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Oracle Cloud Infrastructure Multicloud Architect Professional (2025)

Student Guide
S1110202GC10

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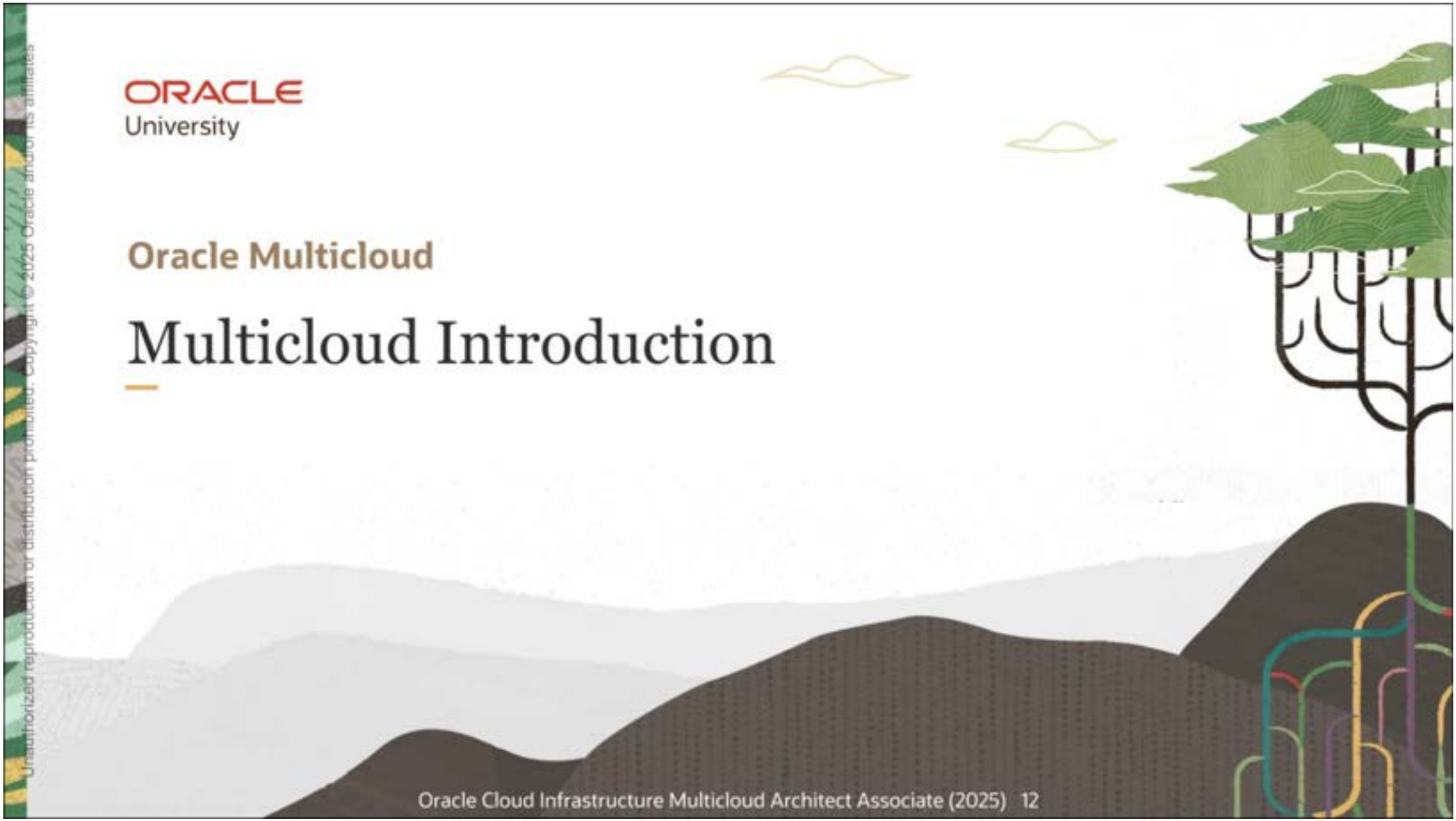
Oracle Multicloud

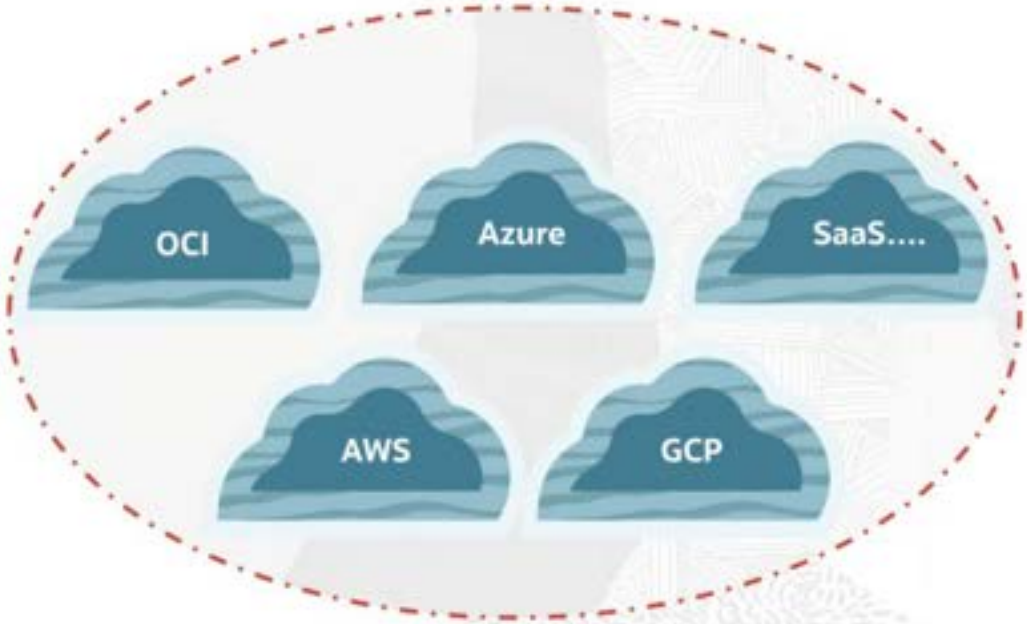
Multicloud Introduction



Multicloud – The New Normal

Multicloud is the coordinated use of cloud services from more than one provider

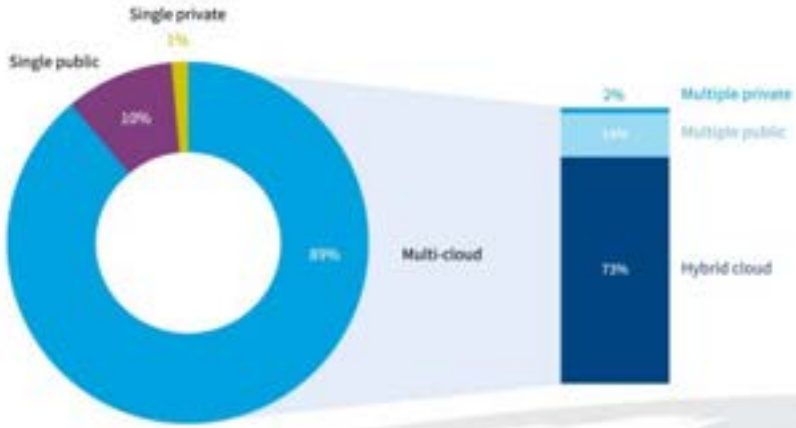
- Top drivers of multicloud adoption include data sovereignty and cost optimization.
- Other drivers include business agility, best of breed cloud services and mitigating vendor lock-in concerns.
- Multicloud enables organizations more control over where and how data is stored and used, while also controlling costs by adjusting which services they use from different providers.



Multicloud is the *"New Normal"*.

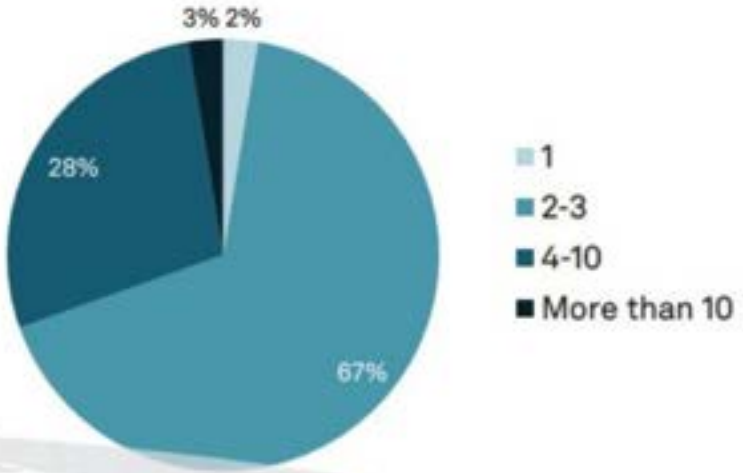
Multicloud remains the de facto standard for all organizations.

Organizations embrace multi-cloud



Flexera 2024 State of the Cloud Report

Number of Cloud Providers used in organizations



451 Research commissioned by Oracle, Q3 2022

Drivers for using multiple clouds?

451 Research commissioned by Oracle, Q3 2022

Multiple clouds helped advance your company's business goals?

HashiCorp 2023 State of Cloud Strategy Survey

OCI Distributed Cloud offers exceptional flexibility and choice

Multicloud

Our products work with your other providers, including Oracle Database Service at Azure, Oracle Database Service for Azure, Oracle Interconnect with Azure, and Oracle MySQL Heatwave on AWS

Hybrid cloud

We bring cloud services to you, including Oracle Exadata Cloud@Customer, Oracle Roving Edge Infrastructure, OCI Observability and Management, and Oracle Database

Public cloud

Access cloud services in 45+ global locations including Commercial, US Government, UK Government, US National Security Regions, and EU Sovereign (2024)

Dedicated cloud

We build a cloud just for you, with all 100+ OCI services running in customer data centers, including OCI Dedicated Region and Oracle Alloy

OCI-Azure Interconnect

Highly optimized, secure, and unified cross-cloud experience

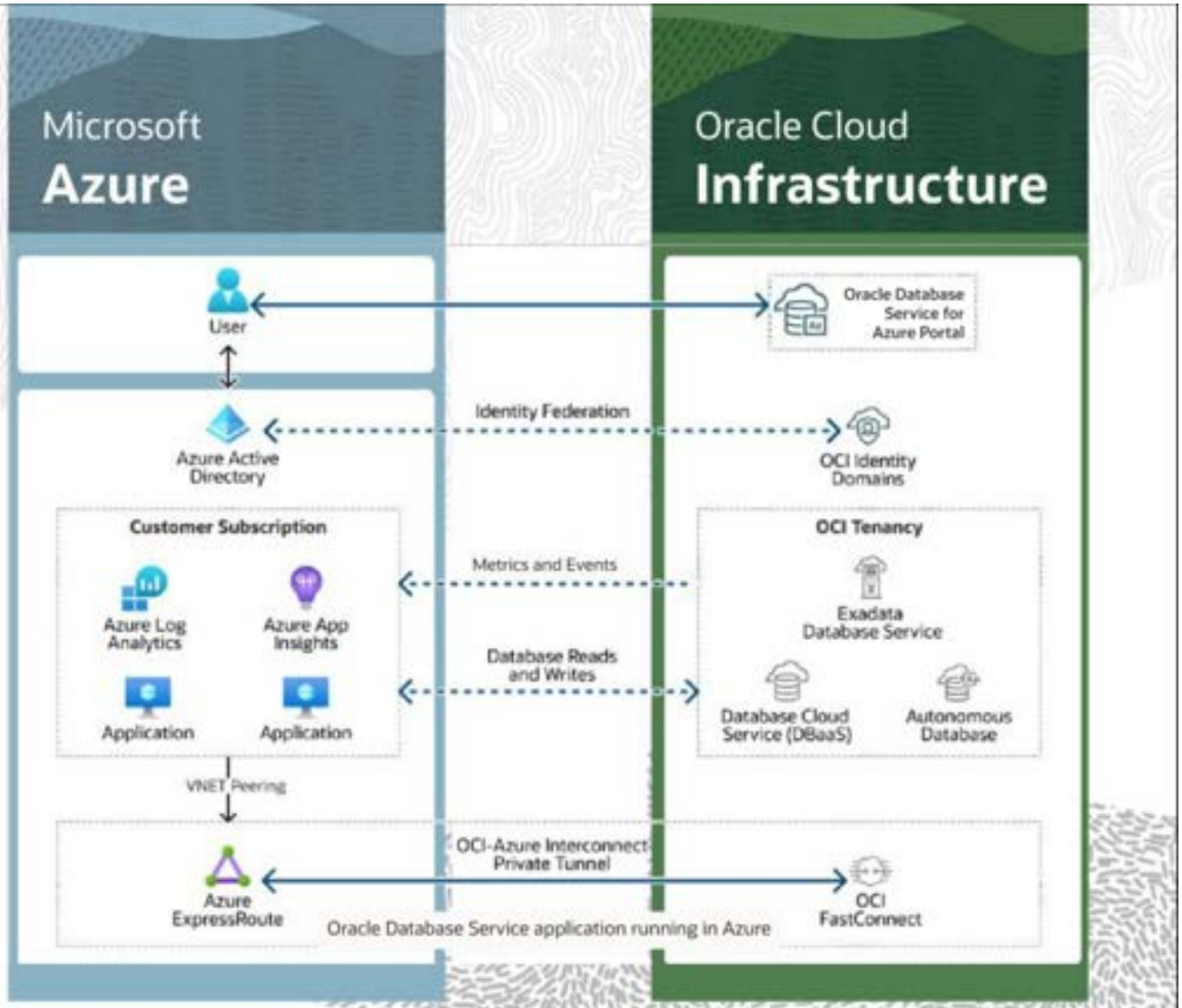
12 Azure Interconnect regions

< 2 millisecond latency private interconnection

No egress or ingress charges for data

Oracle Database Service for Azure

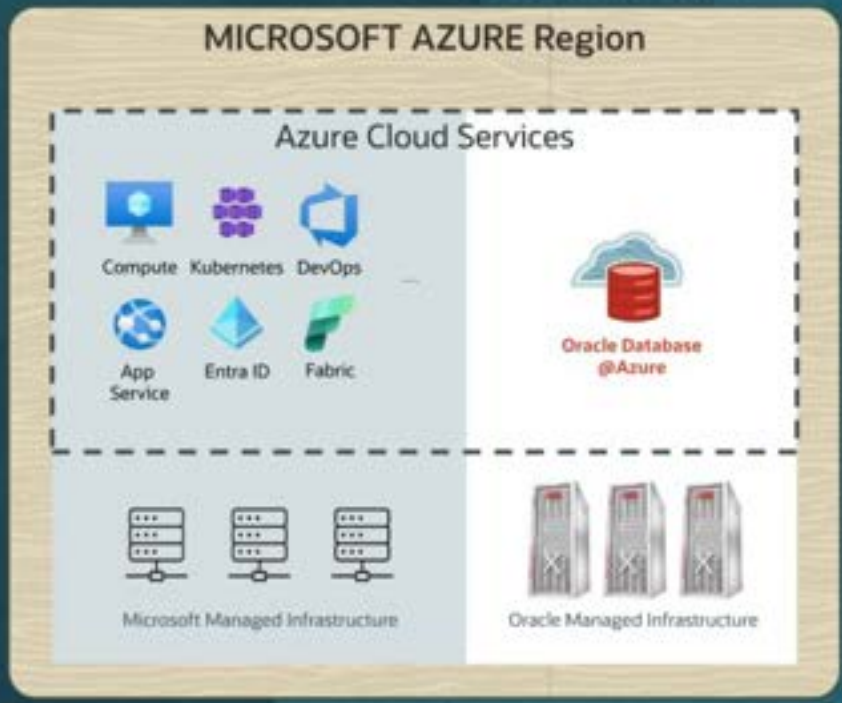
- Familiar Azure-native user experience
- Automated identity, networking, and monitoring integration
- < 2 MS latency private interconnect
- No additional cost



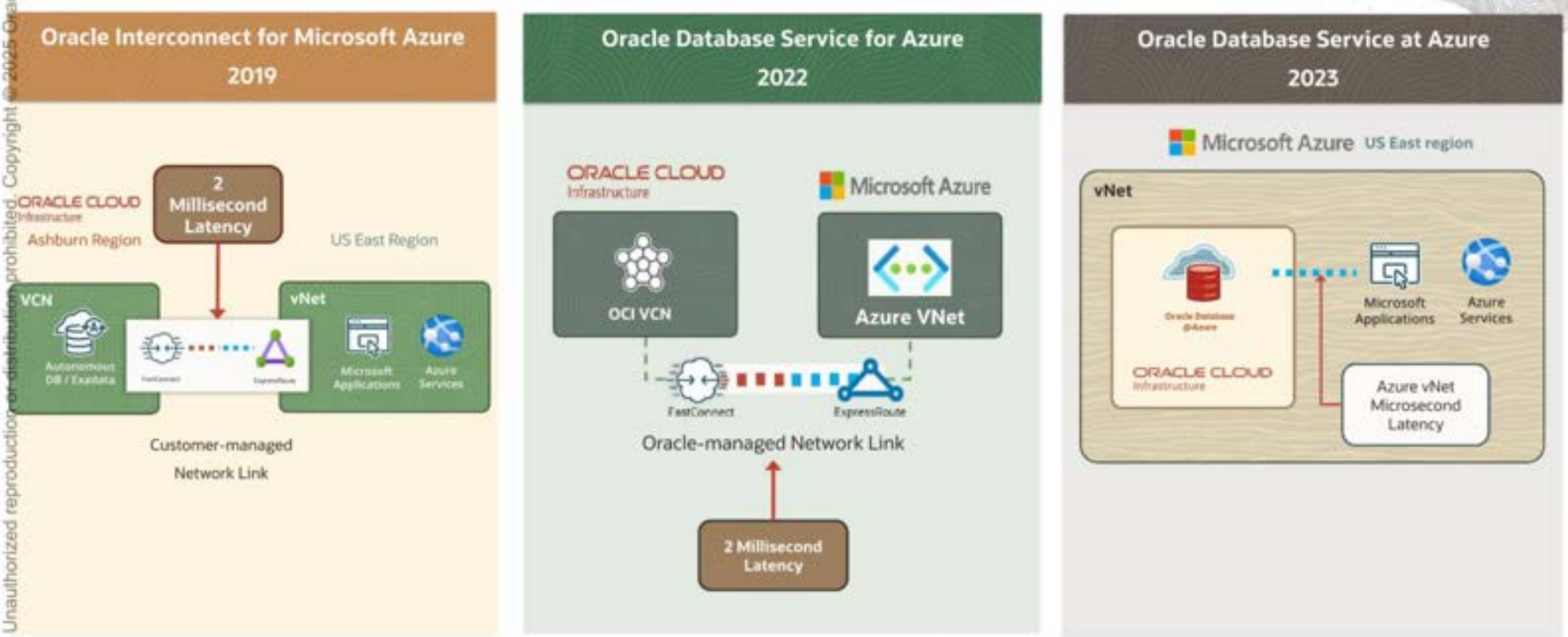
Oracle Database@Azure

Oracle and Microsoft deliver Oracle database services on OCI in Microsoft Azure datacenters

ORACLE | Microsoft



OCI- Azure Interoperability



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Oracle Multicloud

Multicloud Announcements

ORACLE CLOUD Infrastructure

Milestones

Multicloud – Major Announcements

Oracle Interconnect for Google Cloud

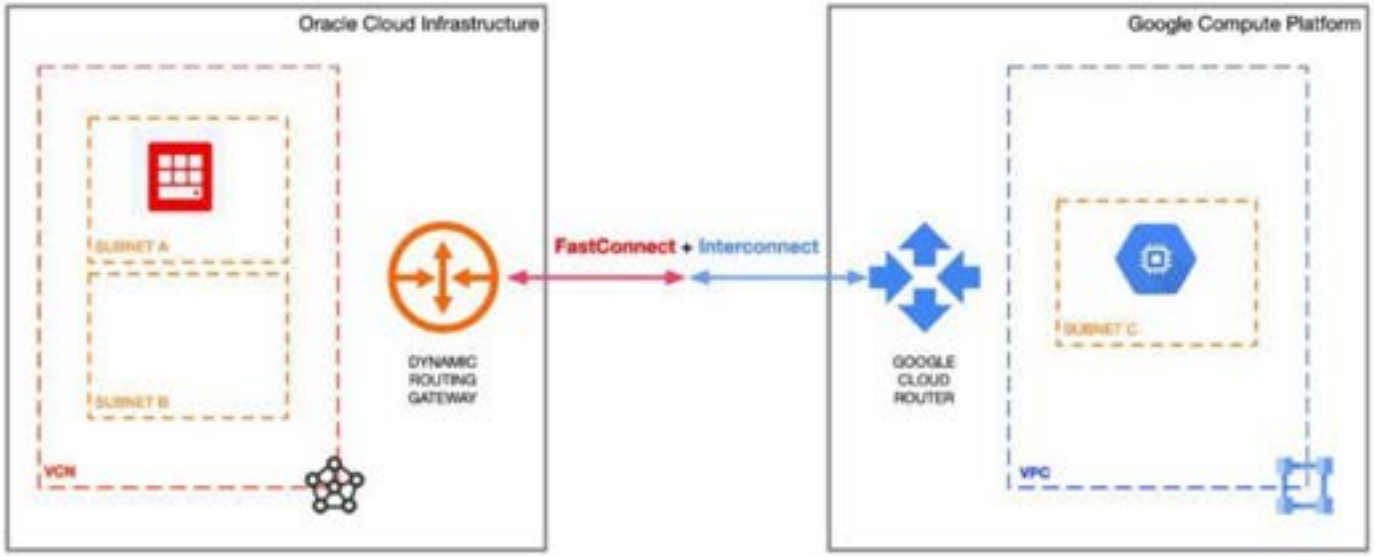
Highly optimized, secure, and unified cross-cloud experience

11 Google Cloud Interconnect regions

< 2 millisecond latency private interconnection

No egress or ingress charges for data

Oracle Interconnect for Google Cloud



With the **Oracle Interconnect for Google Cloud**, Oracle and Google have created an integrated cloud experience using OCI FastConnect and Google Cloud Interconnect.

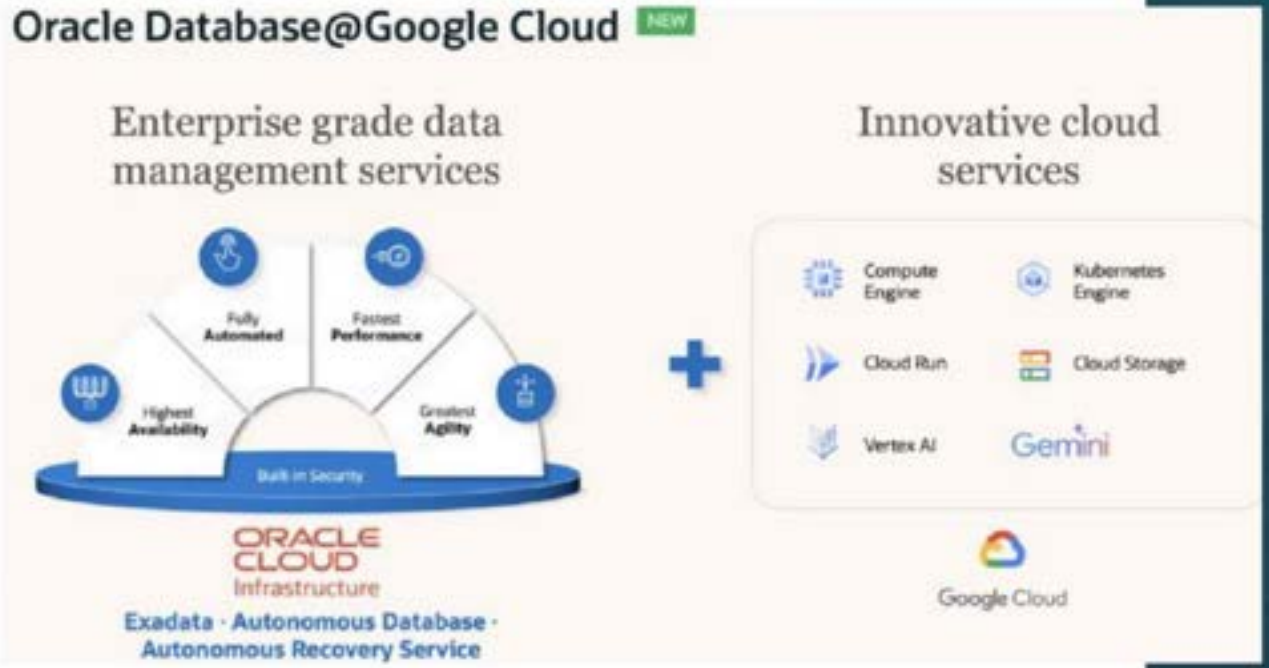
This multicloud interconnection allows you to run mission-critical enterprise workloads across your Google Cloud and OCI environments and access the best-in-class services of each cloud provider, using a dedicated, low-latency private connection.

Oracle Interconnect for Google Cloud is available in the following regions:

OCI region	Google Cloud region
US East (Ashburn)	us-east4 (Ashburn)
Canada Southeast (Montreal)	northamerica-northeast1 (Montreal)
Germany Central (Frankfurt)	europe-west3 (Frankfurt)
Spain Central (Madrid)	europe-southwest1 (Madrid)
UK South (London)	europe-west2 (London)
Australia East (Sydney)	australia-southeast1 (Sydney)
Australia Southeast (Melbourne)	australia-southeast2 (Melbourne)
India West (Mumbai)	asia-south1 (Mumbai)
Japan East (Tokyo)	asia-northeast1 (Tokyo)
Singapore	asia-southeast1 (Singapore)
Brazil East (Sao Paulo)	southamerica-east1 (Sao Paulo)

OCI location	Azure ExpressRoute location
Canada Southeast (Toronto) - YYZ	Toronto and Toronto2
US East (Ashburn) - IAD	Washington DC and Washington DC2
US West (Phoenix) - PHX	Phoenix
US West (San Jose) - SJC	Silicon Valley
Japan East (Tokyo) NRT	Tokyo
Singapore (Singapore) - SIN	Singapore
South Korea Central (Seoul) - ICN	Seoul
Brazil Southeast (Vinhedo) - VCP	Campinas
Germany Central (Frankfurt) - FRA	Frankfurt and Frankfurt2
Netherlands Northwest (Amsterdam) - AMS	Amersterdam2
UK South (London) - LHR	London
South Africa Central (Johannesburg) - JNB	Johannesburg

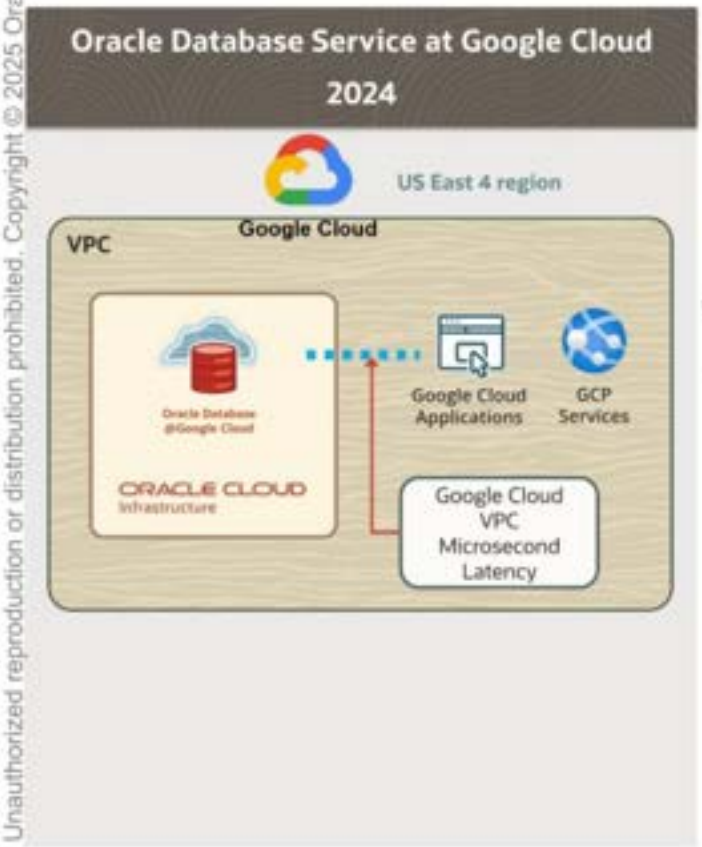
Oracle Database@Google Cloud

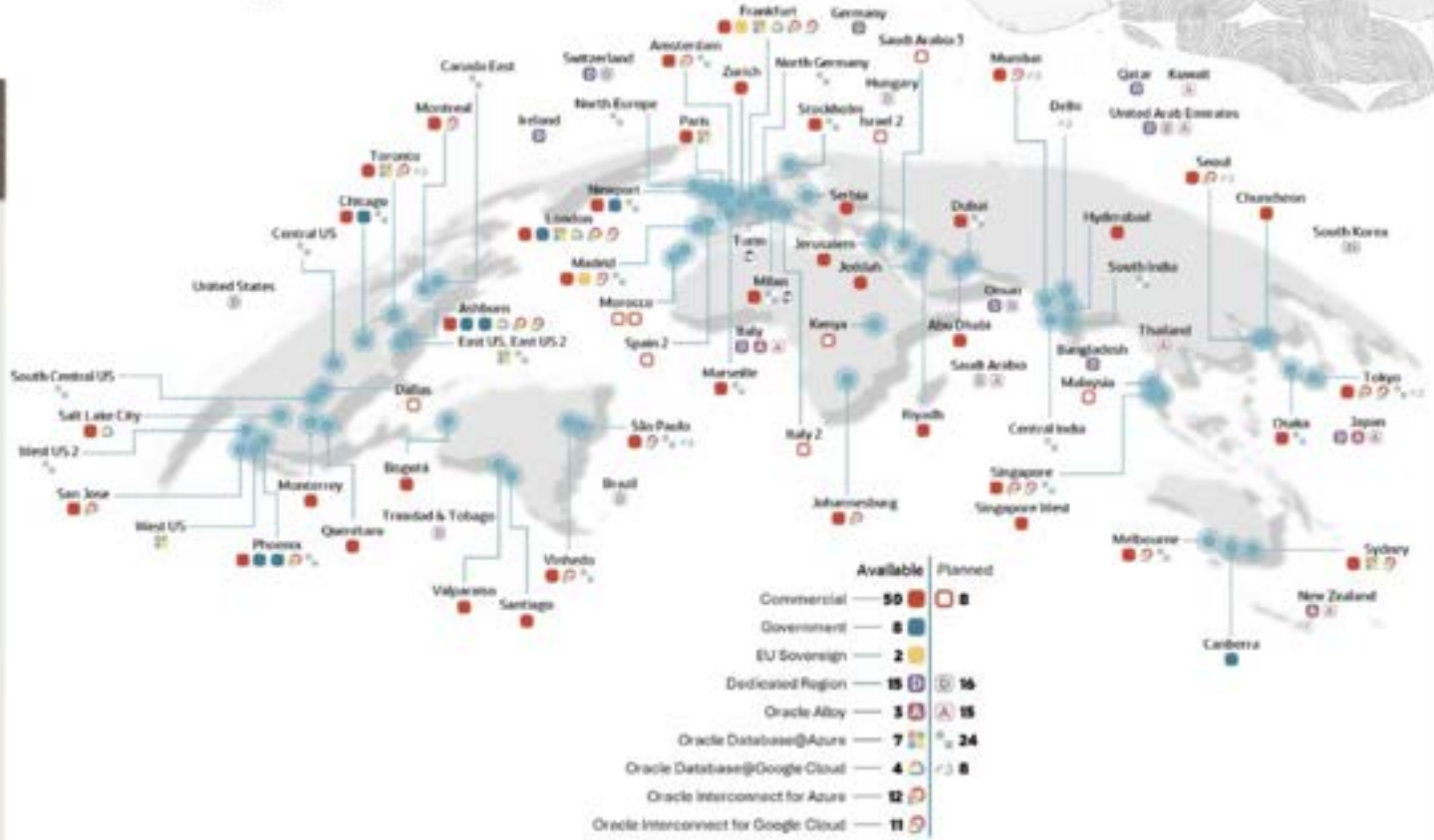


Oracle and Google Cloud deliver Oracle database services on OCI in Google Cloud datacenters

ORACLE | Google Cloud

OCI- GCP Interoperability





Oracle Database@AWS

Oracle and Amazon Web Services deliver Oracle database services on OCI in AWS datacenters

Oracle and AWS are partnering together to provide a unified experience for collaborative support, purchasing, management, and operations. You can pay for Oracle Database services using your existing AWS Private Pricing Agreements, and use your existing Oracle license benefits and discount programs

Oracle Cloud Migrations can now migrate AWS EC2 instances to OCI

Compute

Amazon
EC2

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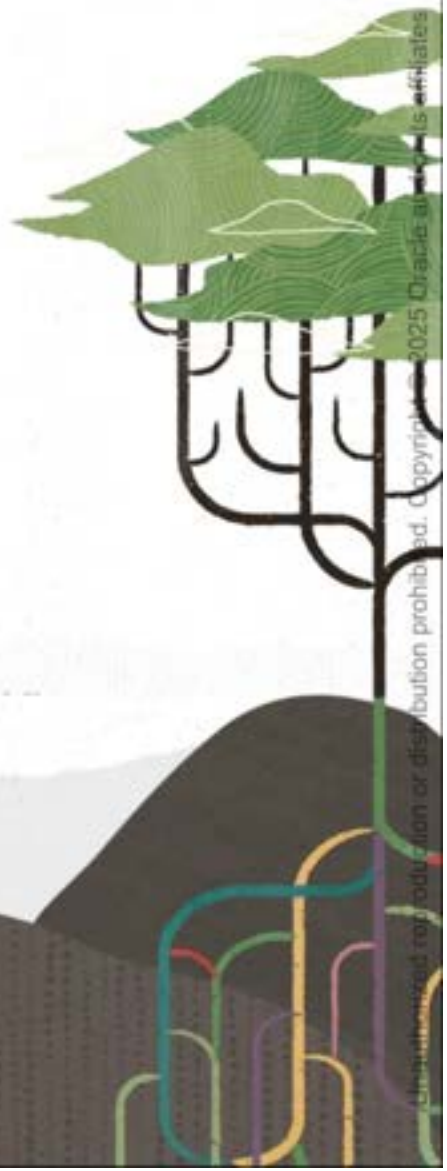
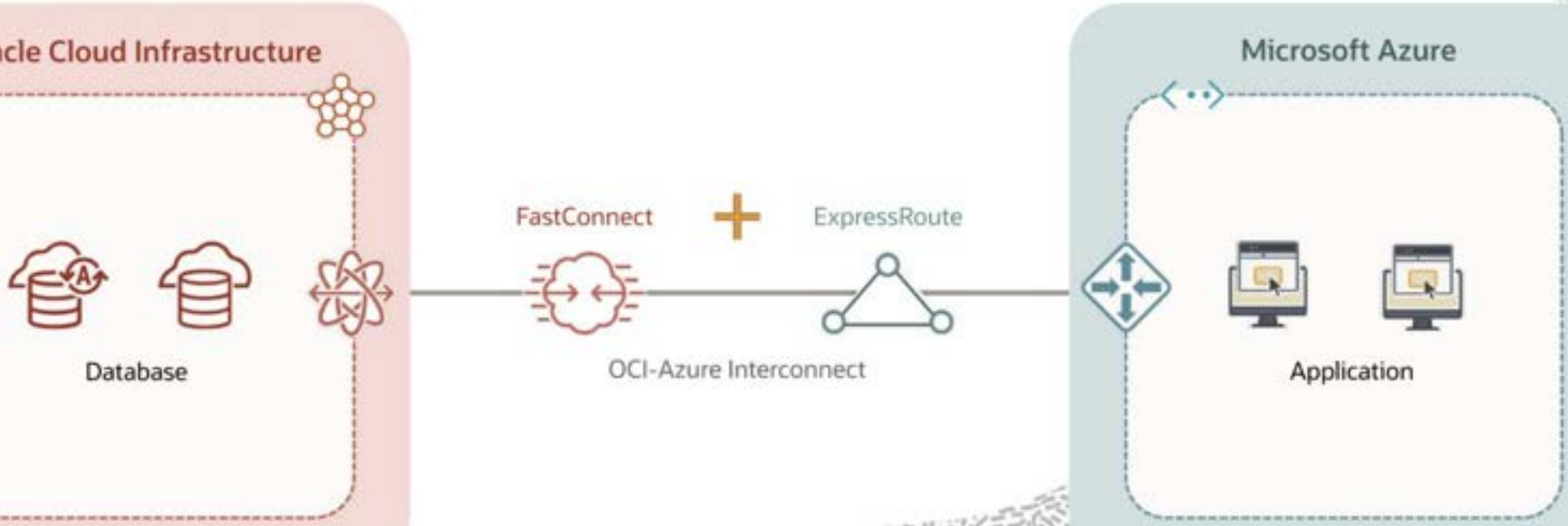
Oracle Cloud Infrastructure

OCI Multicloud Use Cases

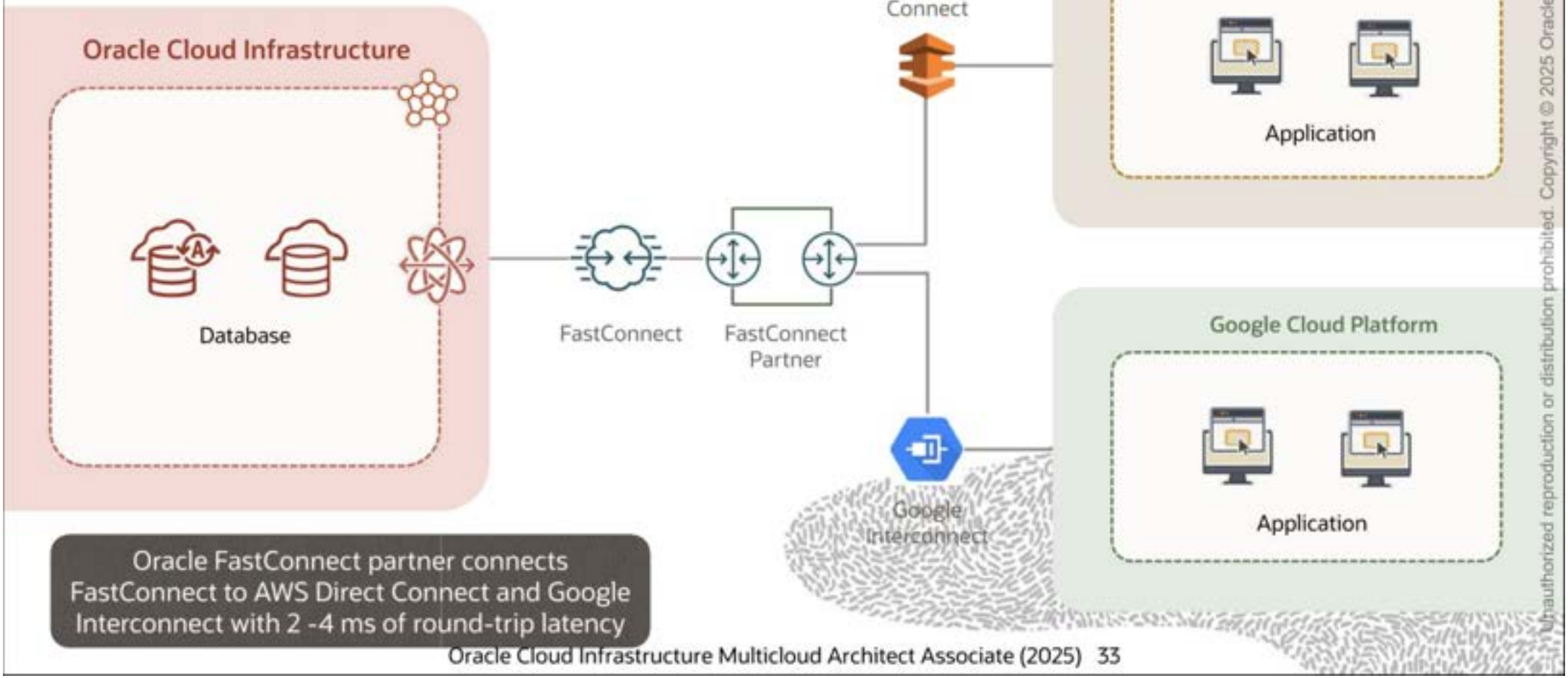


Split Stack Architecture



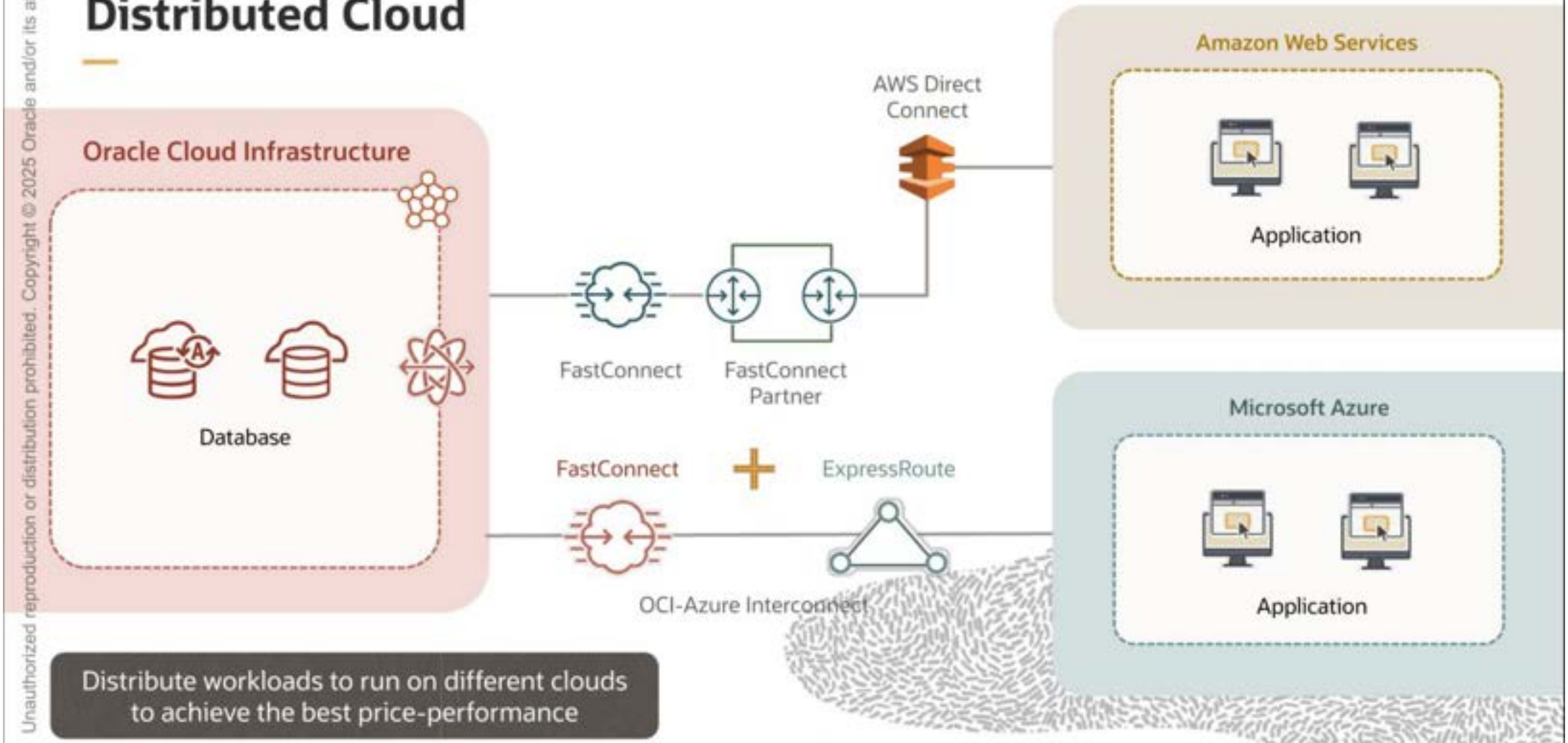
Direct connection with ~ 2ms round trip latency between clouds
– no intermediate connectivity provider is required

Split Stack Architecture



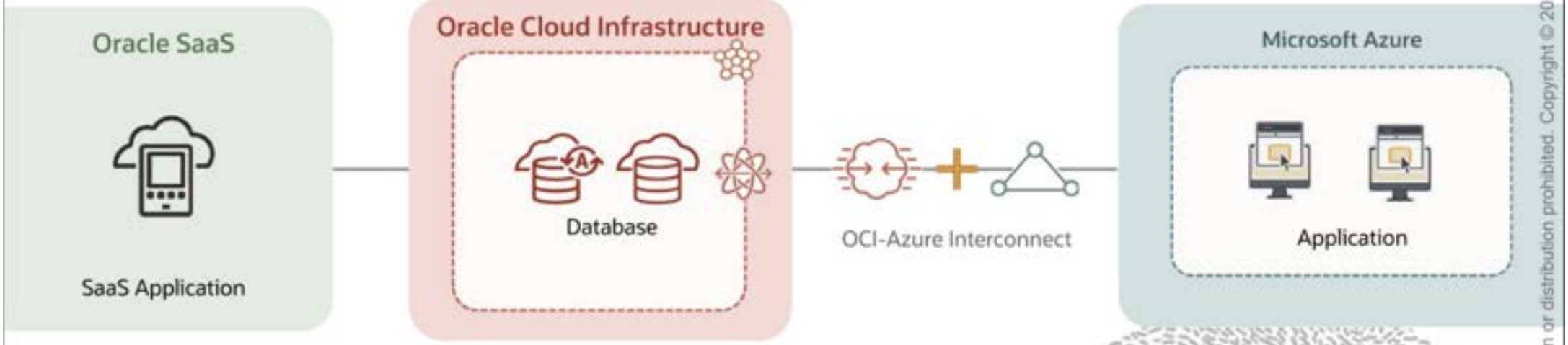
Oracle FastConnect partner connects FastConnect to AWS Direct Connect and Google Interconnect with 2 -4 ms of round-trip latency

Distributed Cloud



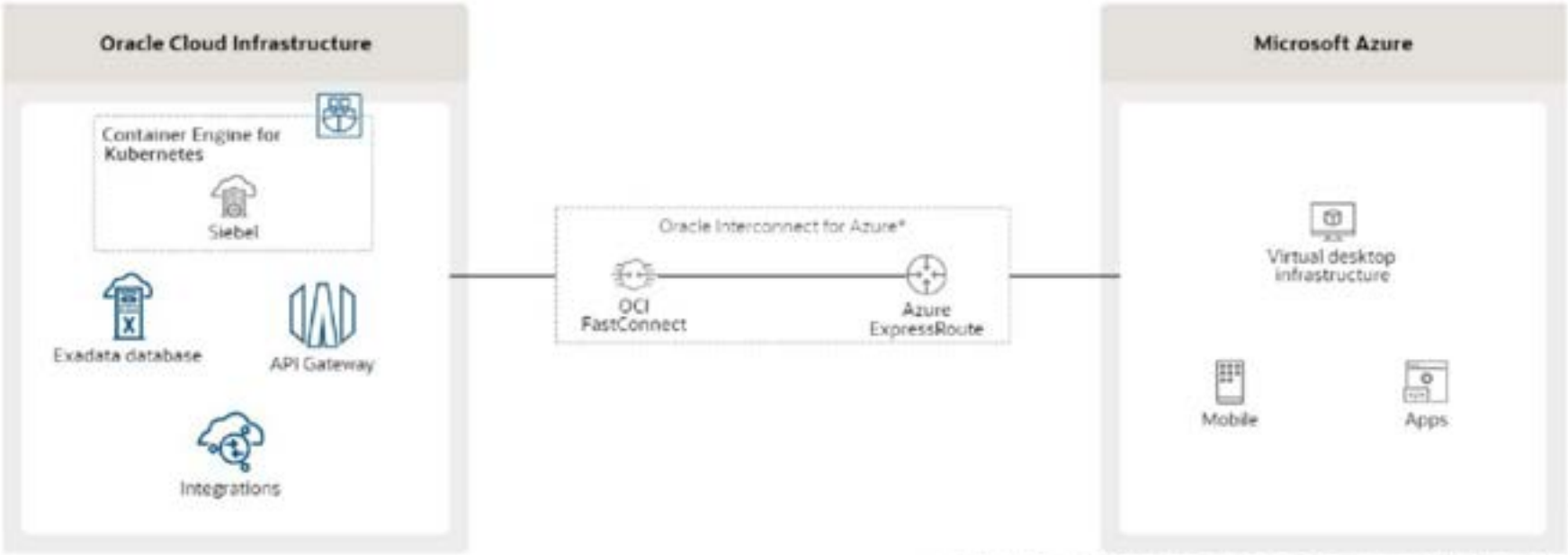
Distribute workloads to run on different clouds to achieve the best price-performance

SaaS Integration



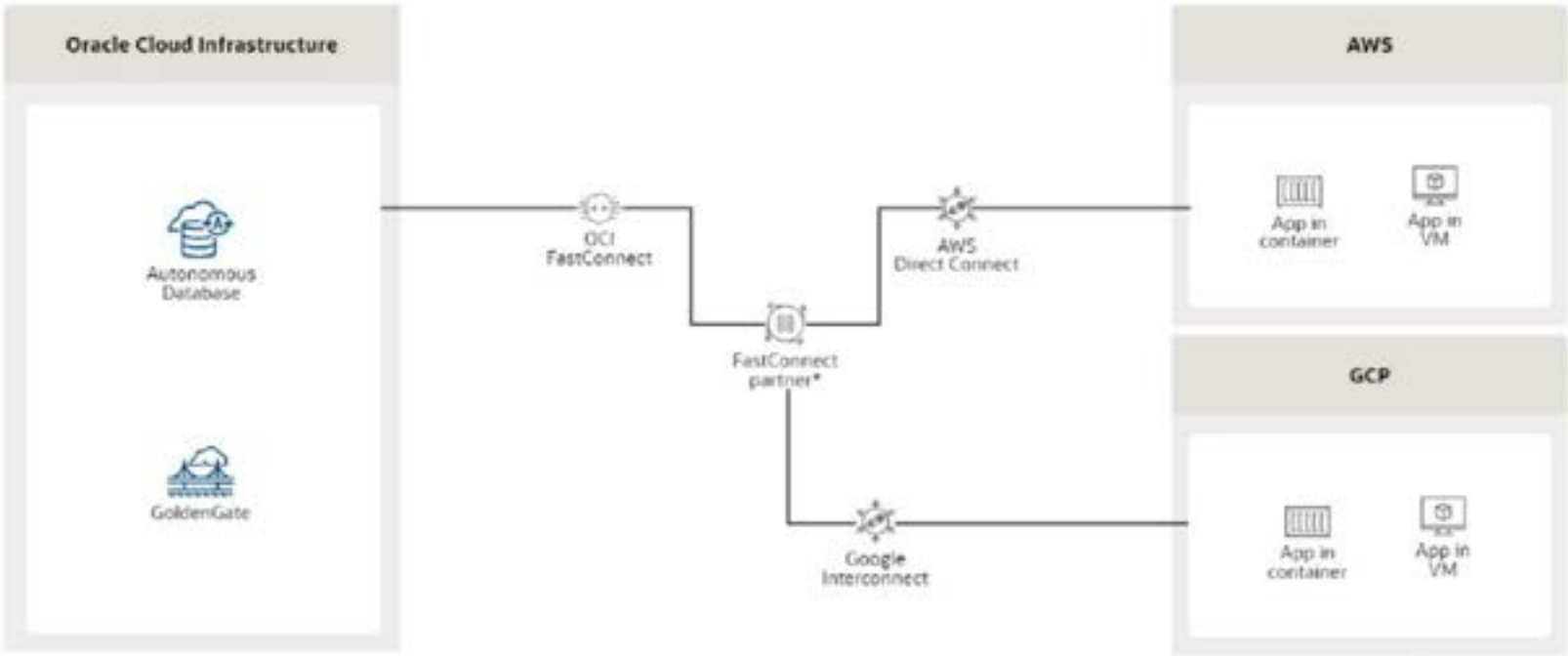
Integrate SaaS applications with applications on different clouds to achieve business agility and innovation.

Split Stack



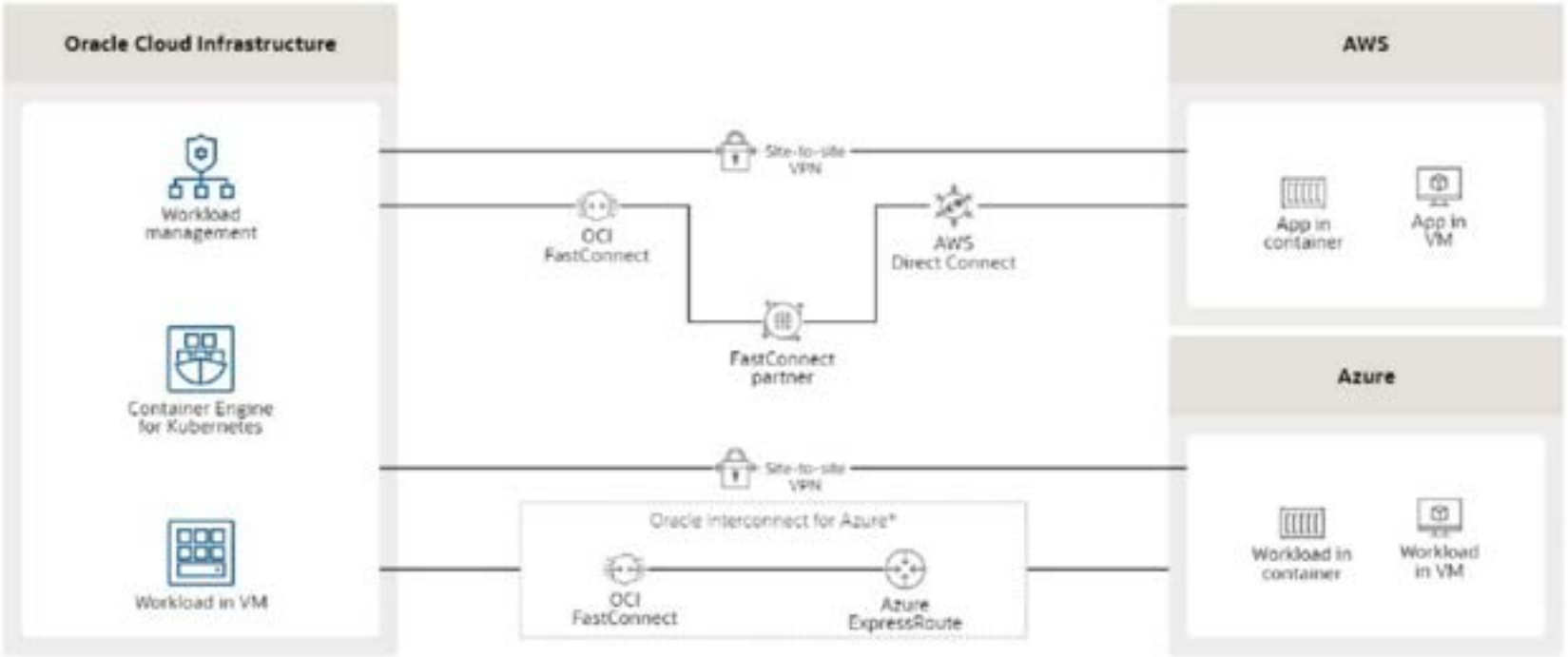
Direct connection with ~ 2ms round trip latency between clouds – no intermediate connectivity provider is required

Split Stack Architecture



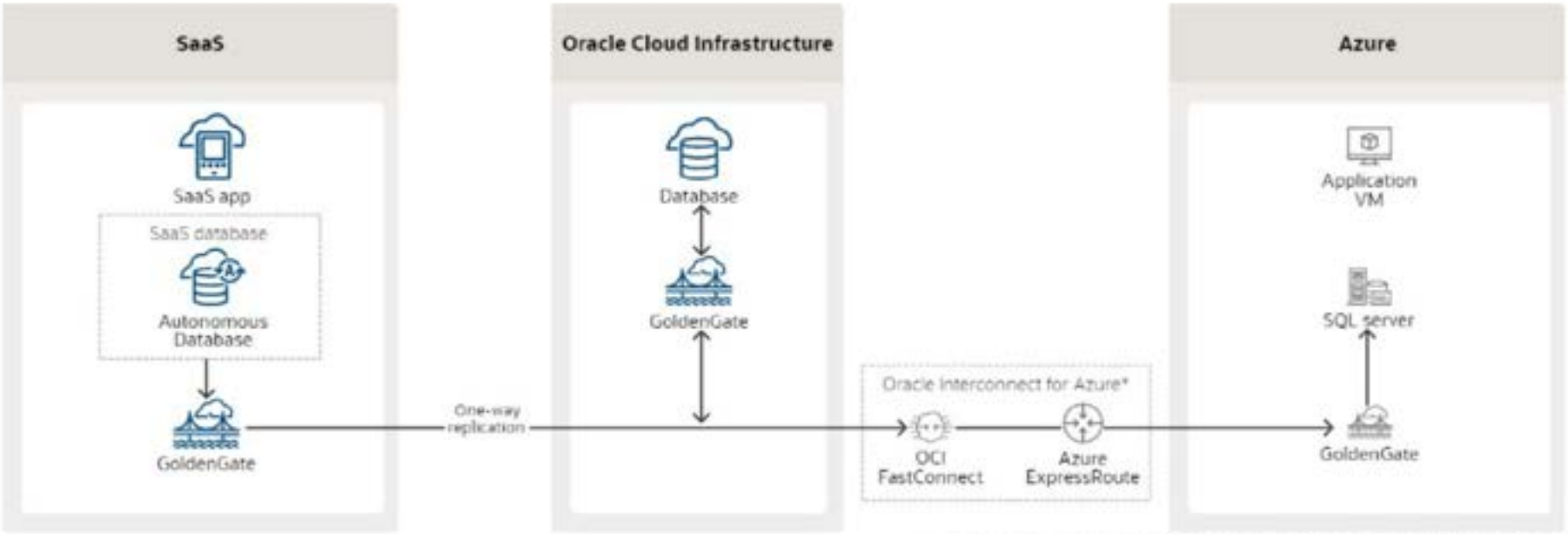
OCI FastConnect partner connects FastConnect to AWS Direct Connect and Google Interconnect with two to four milliseconds of round-trip latency

Distributed Cloud



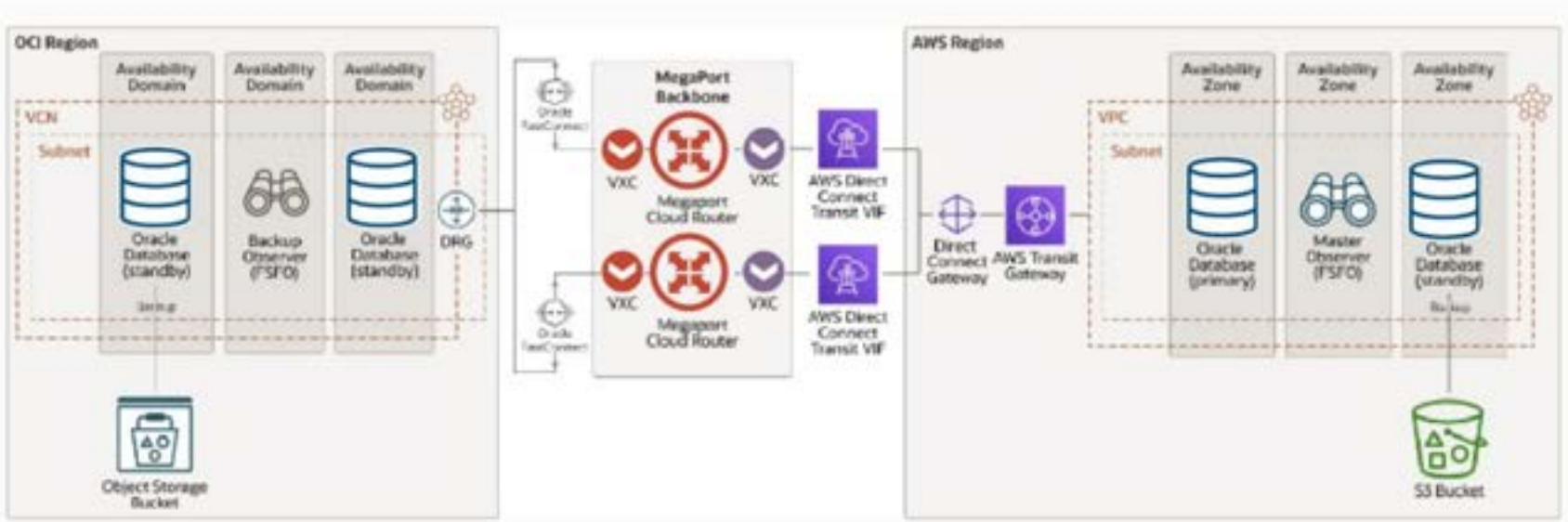
Distribute workloads to run on different clouds to achieve the best price-performance

SaaS Integration



Integrate SaaS applications with applications on different clouds to achieve business agility and innovation

High Availability and Data Protection



This architecture provides reliable failover for key databases in a multicloud environment

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OCI Multicloud Architect

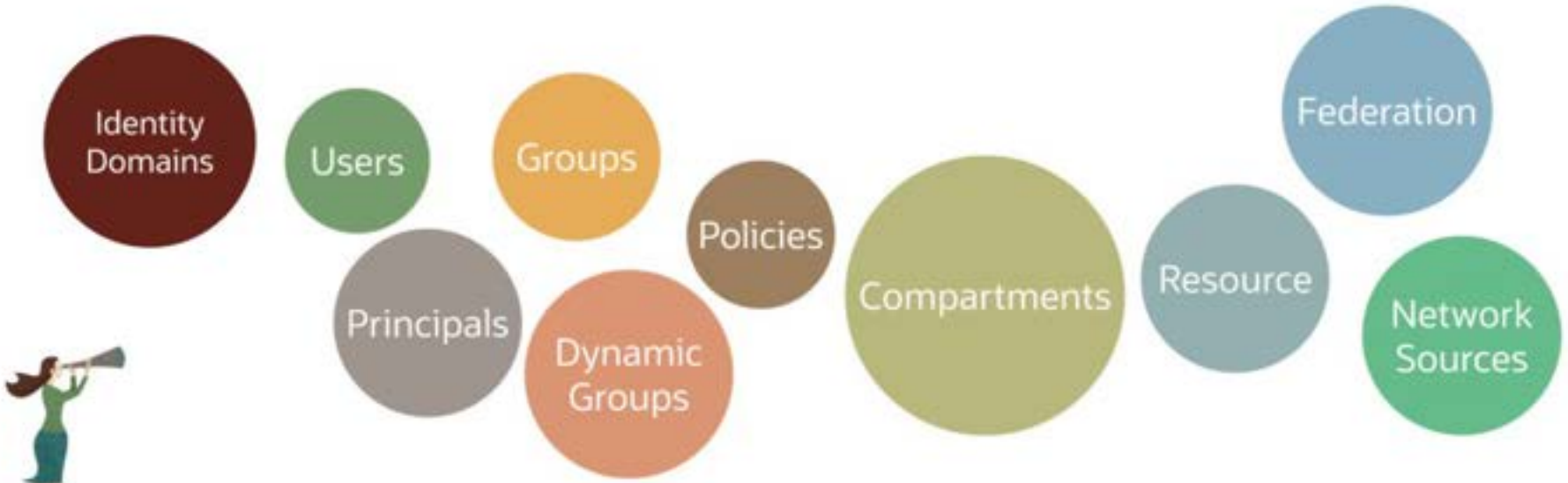
OCI IAM Basics

OCI Identity and Access Management

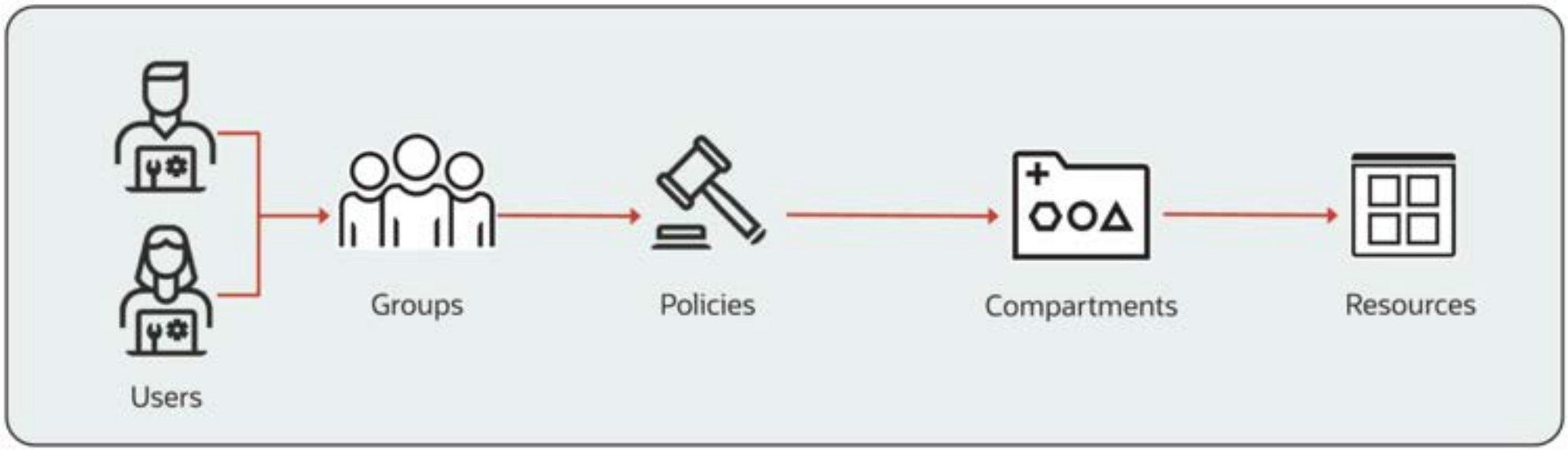
What is OCI IAM?

- IAM = Identity and Access Management Service
- Fine-grained Access Control
- AuthN – Who are you?
- AuthZ – What permissions do you have?

OCI Identity Concepts



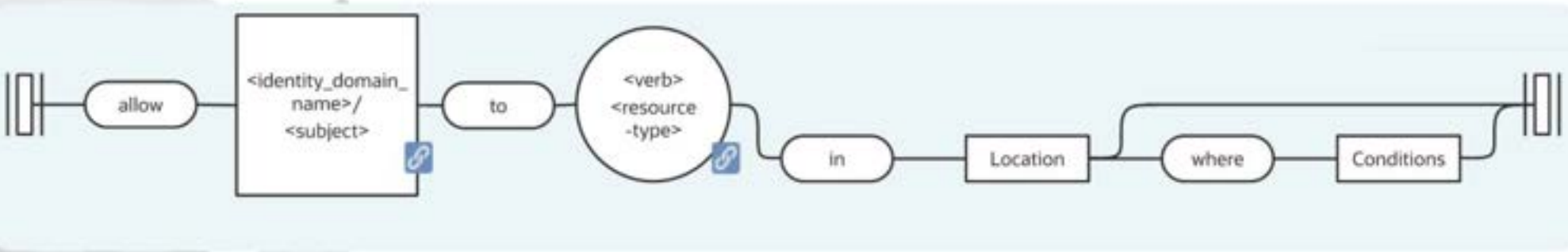
OCI Identity Concepts



AuthZ

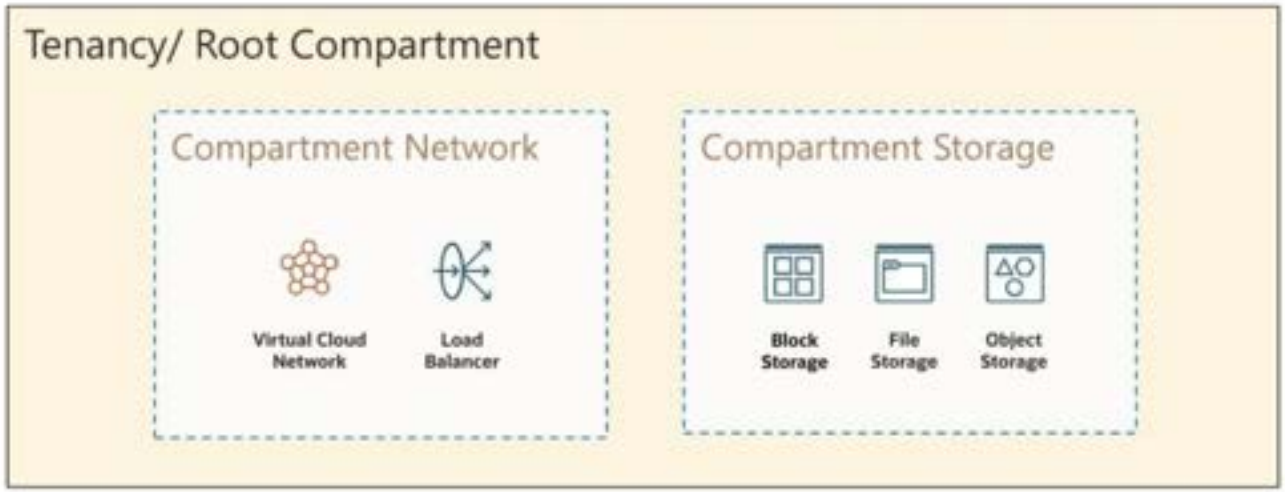
What permissions do you have?

AuthZ in OCI – IAM Policies



Compartment

Collection of related resources



Isolate and control access

Root Compartment can hold all the cloud resources

Best practice: Create dedicated compartments to isolate resources.

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OCI Multicloud Architect

Identity Domain

OCI Identity and Access Management

A user population in OCI and associated configurations and security settings.

Identity Domain Types

- **Free**
- **Premium**
- **Oracle Apps**
- **External User**
- **Oracle Apps Premium**

Each account includes a default identity domain allowing customers to manage access to OCI resources. Customers can elect to create additional identity domains based on their specific needs.

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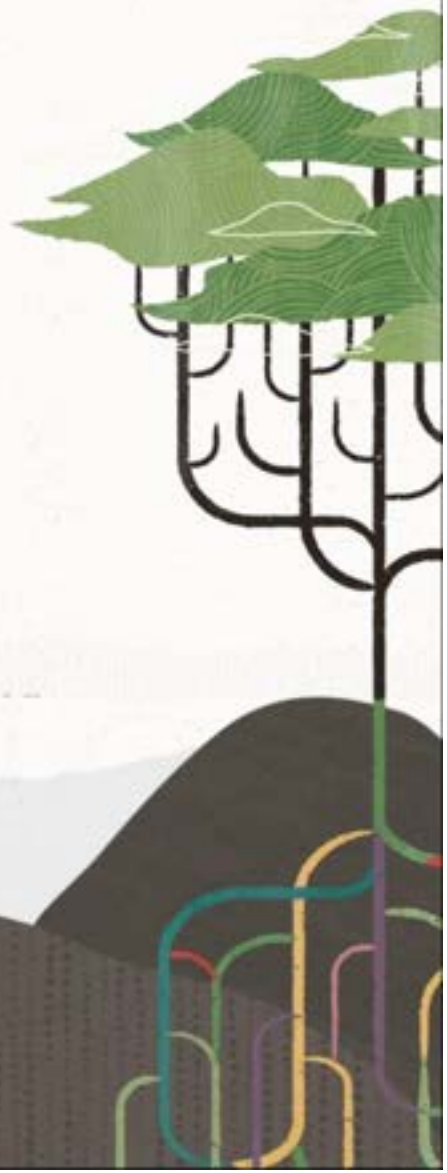
OCI Multicloud Architect

Federation Concepts

OCI Identity and Access Management



Identity Federation

Identity Provider

Entity that creates and manages identities of users

Service Provider

Entity that provides Web Services.

Calls upon an IdP to authenticate users

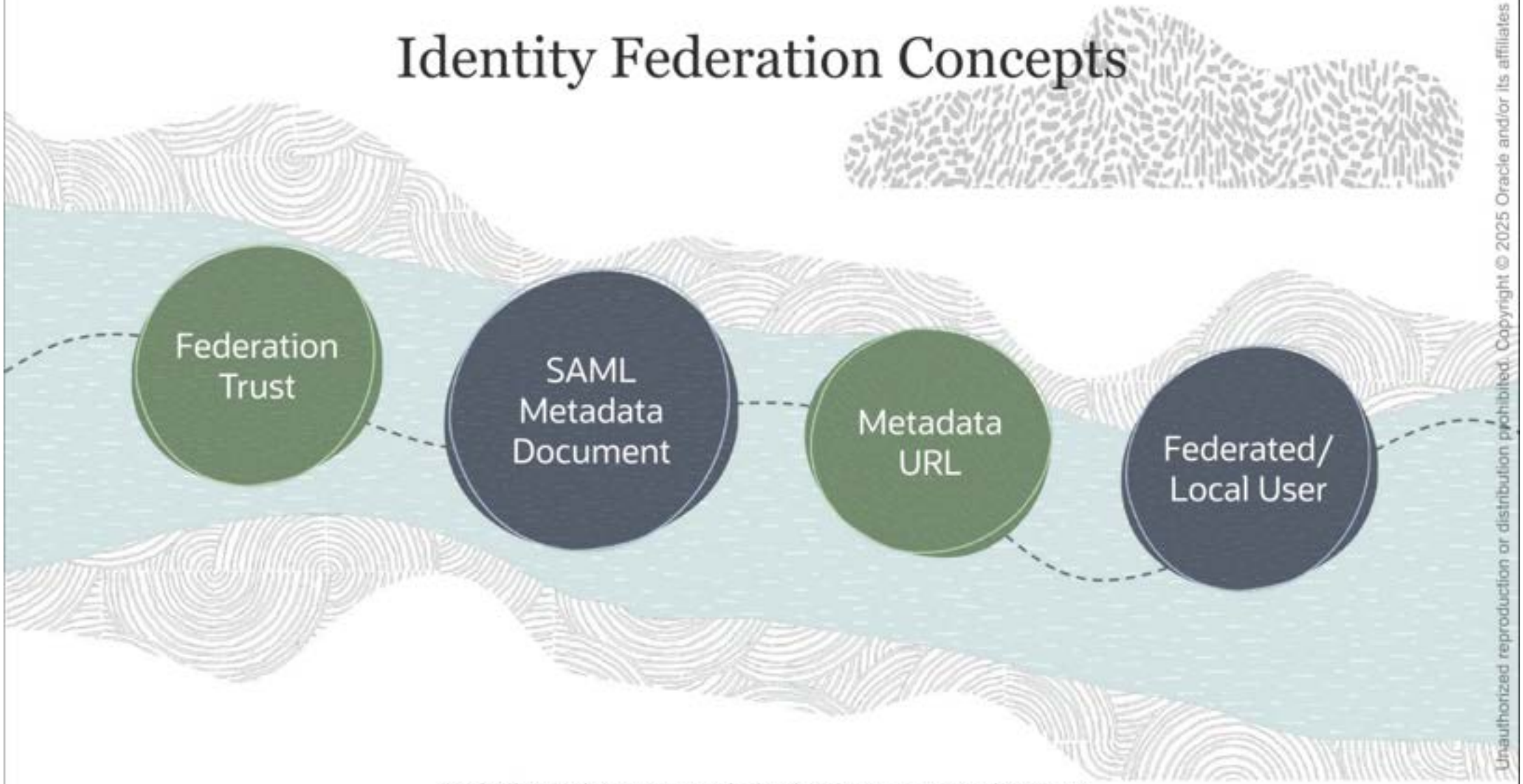
What is Identity Federation?

Relationship built between the identity provider and service provider

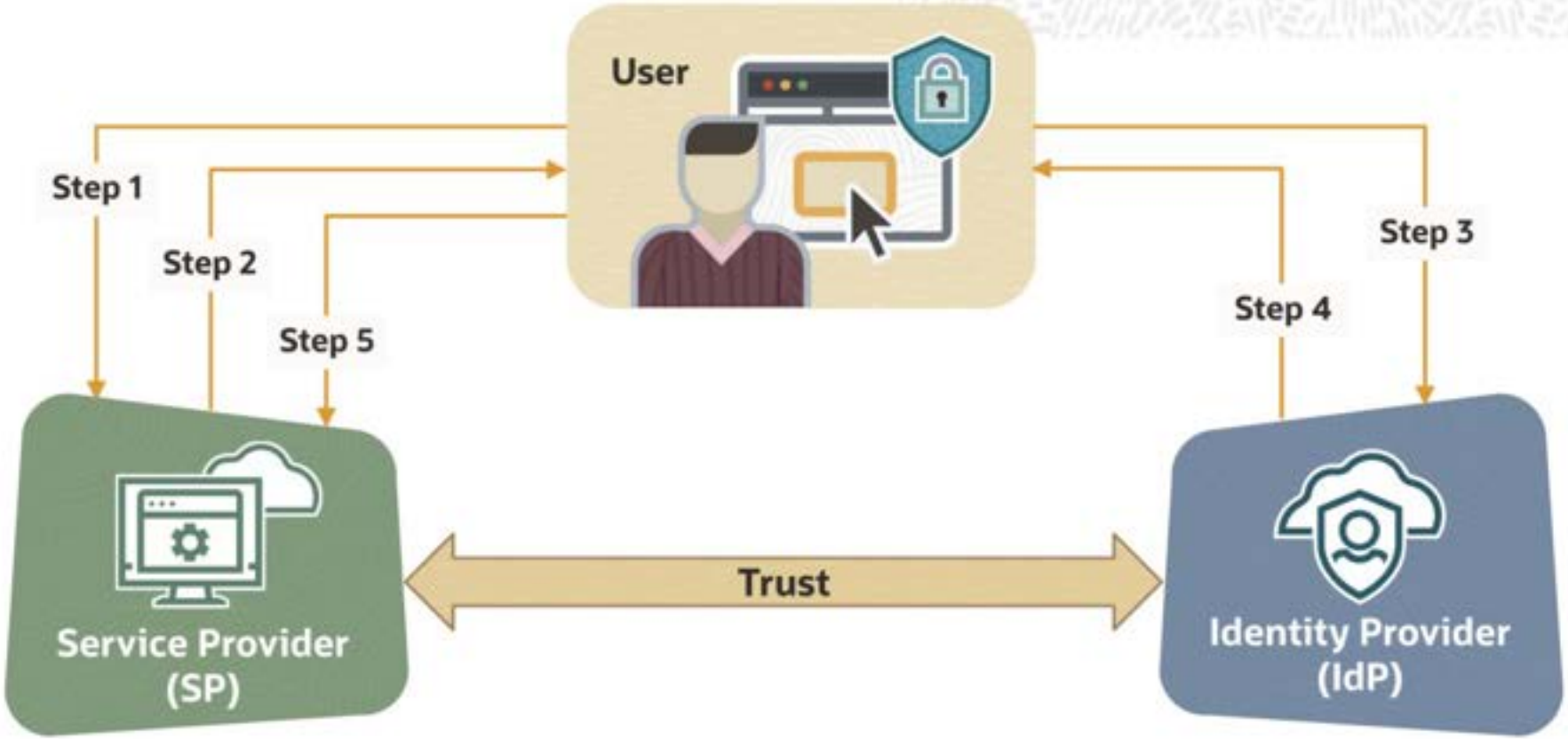
Delegate authentication responsibility to a trusted external party

Oracle Cloud Infrastructure (OCI) can be federated with any IdP that supports the Security Assertion Markup Language (SAML) 2.0 protocol.

Identity Federation Concepts



How does Identity Federation work?



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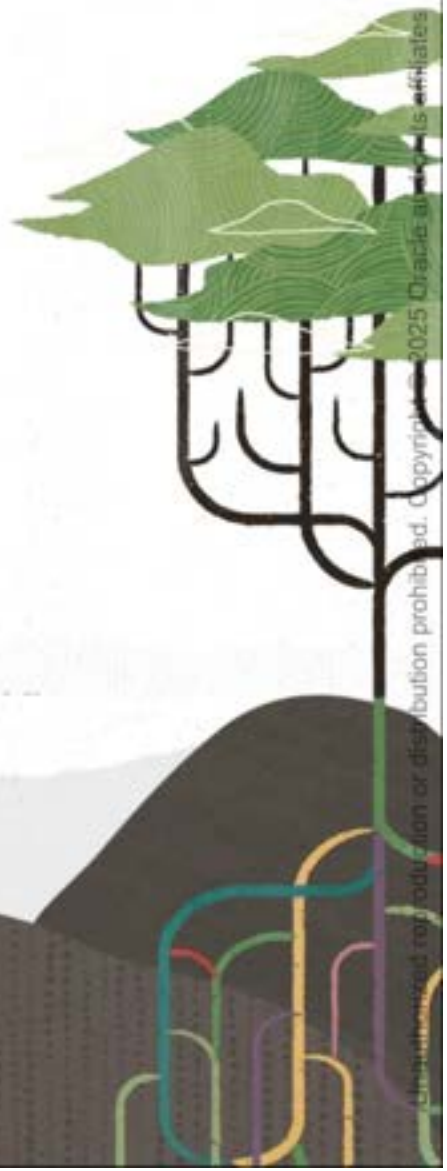
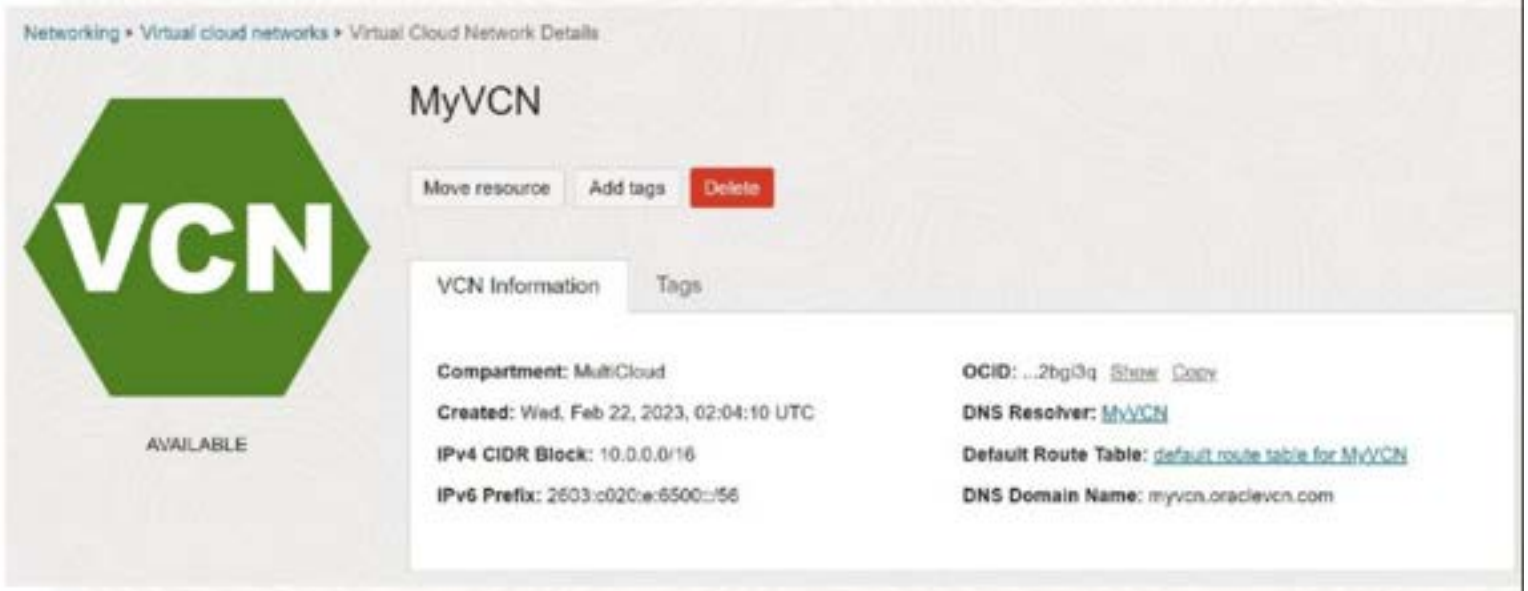
Oracle Cloud Infrastructure

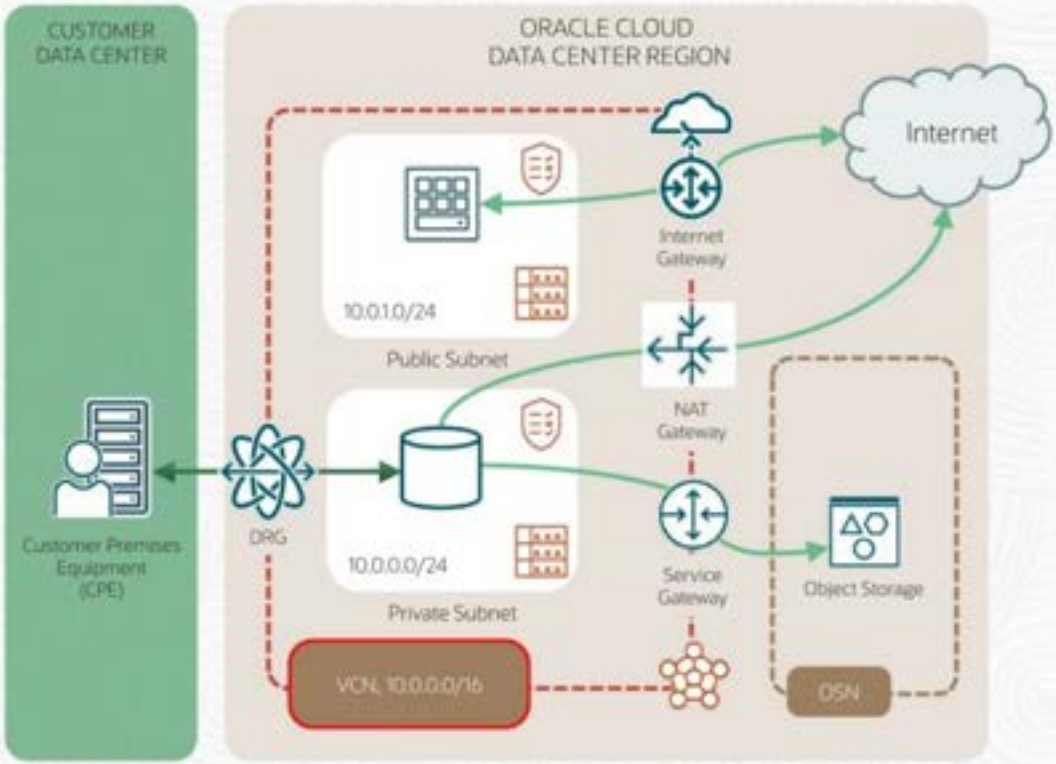
Getting started with OCI Virtual Networks



Virtual Cloud Network



Virtual Cloud Network



Resides in a single region

Can have more than one IPv4 CIDR range

CIDR blocks can be modified after VCNs are created

IP address range for your VCN

Avoid CIDR overlaps

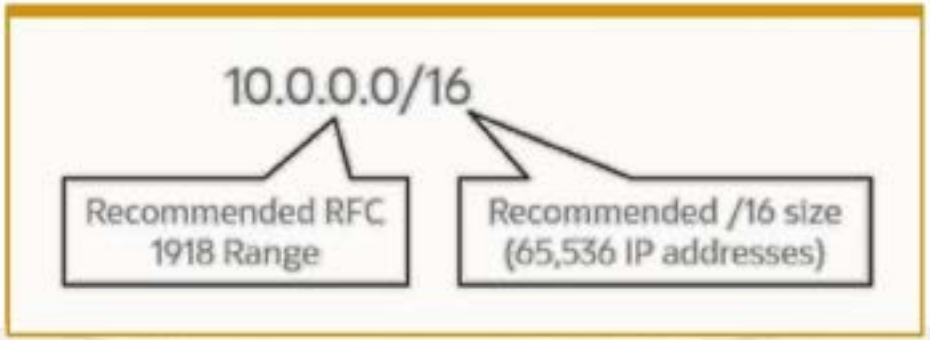
RFC 1918

Use private IP address ranges specified in RFC 1918.

VCN size range

Allowable OCI VCN CIDR range is from /16 to /30

VCN reserves three IP addresses



IPv6

You can have up to 5 IPv6 prefixes per VCN

Of which one is assigned by Oracle Cloud Infrastructure

You can import BYoIP IPv6 prefixes

Up to four

You can permit or prohibit Internet access to a subnet

by specifying the "public/private" subnet level flag

VCN Subnet

Networking > Virtual cloud networks > MyVCN > Subnet Details > IPv6 Prefixes > Subnet Details

S

AVAILABLE

public subnet-MyVCN

Edit | Move resource | Add tags | Terminate

Subnet Information | Tags

OCID: ...ag5i4a Show Copy
IPv4 CIDR Block: 10.0.0.0/24
IPv6 Prefix: 2603:c020:000e:657e:0000:0000:0000:0000/64
Virtual Router Mac Address: 00:00:17:E0:3A:E5
Subnet Type: Regional

Compartment: MultiCloud
DNS Domain Name: sub02220204080... Show Copy
Subnet Access: Public Subnet
DHCP Options: Default DHCP Options for MyVCN
Route Table: default route table for MyVCN

Subnet

VCNs are divided into subnets

Instances are placed in subnets.

Subnets are designated either Private or Public

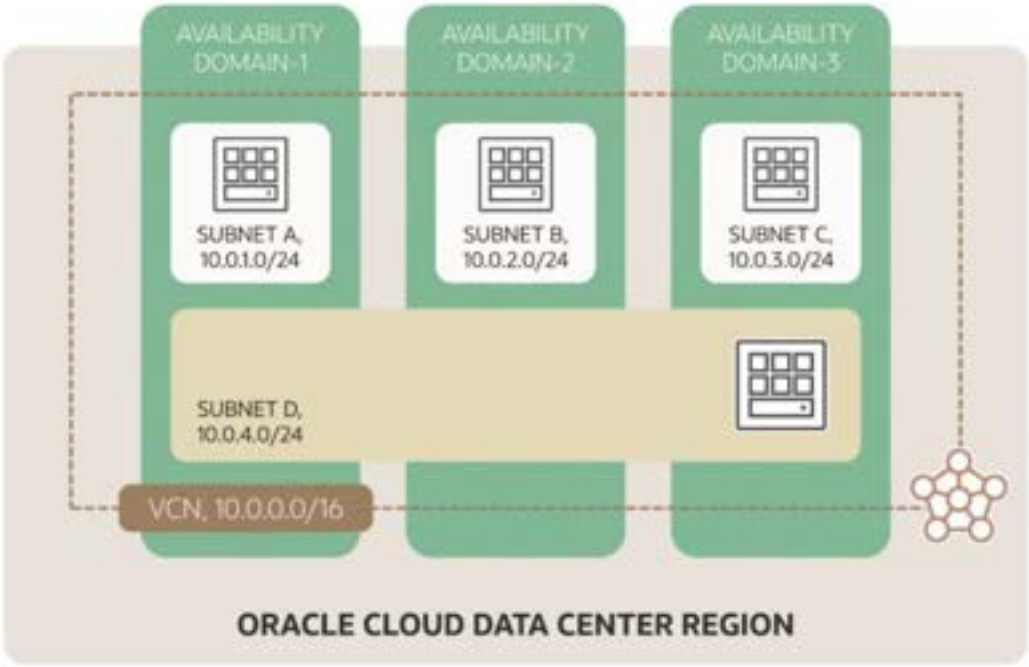
Subnets are either regional or AD Specific

Subnet

A subnet can grow or shrink after creation

Instances draw their internal IP address and network configuration from their subnet.

The Virtual Network Interface Card (vNIC) determines how the instance connects with endpoints inside and outside the VCN



VCN Security

Networking • Virtual cloud networks • MyVCN • Security List Details

SL

AVAILABLE

Default Security List for MyVCN

Instance traffic is controlled by firewall rules on each instance in addition to this Security List

Move resource | Add tags | Terminate

Security List Information | Tags

OCID: ...zgh9q Show Copy

Compartment: MultiCloud

Created: Wed, Feb 22, 2023, 02:04:10 UTC

Resources

- Ingress Rules (3)
- Egress Rules (1)

Ingress Rules

Add Ingress Rules | Edit | Remove

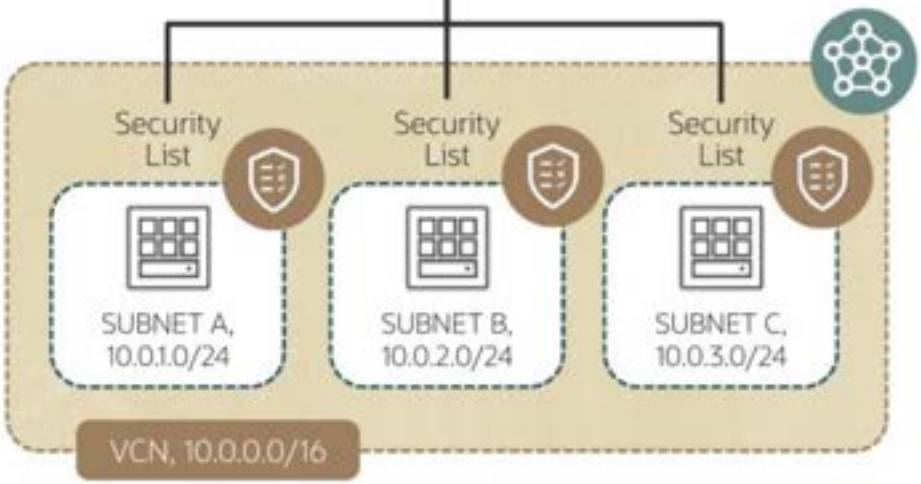
Stateless	Source	IP Protocol	Source Port Range	Destination Port Range	Type and Code	Allows	Description
No	0.0.0.0/0	TCP	All	22		TCP traffic for ports: 22 SSH Remote Login Protocol	

Security list

A security list is a common set of firewall rules associated with a subnet and applied to instances launched inside the subnet

Choose whether a given rule is stateful or stateless

	Direction	CIDR	Protocol	Source Port	Dest Port
Stateful	Ingress	0.0.0.0/0	TCP	All	80
Stateful	Egress	10.0.2.0/24	TCP	All	1521

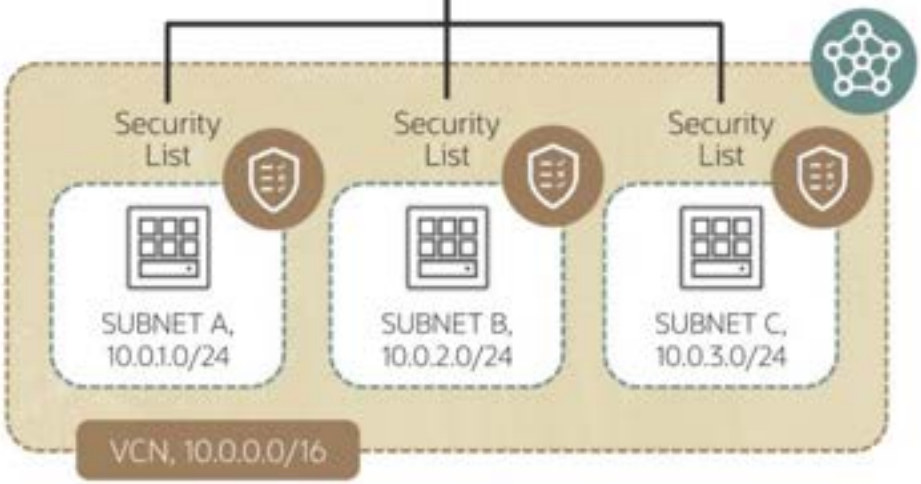


Security list

A security list:

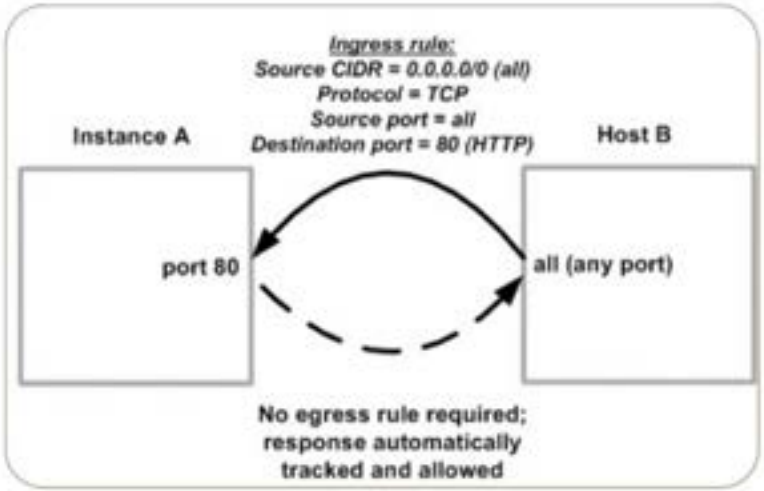
- Is enforced at the vNIC level
- Consists of rules that specify the types of traffic allowed in and out of the subnet
- Is associated with the subnet either during or after subnet creation
- Applies to a given instance, whether it's talking with another instance in the VCN or a host outside the VCN

	Direction	CIDR	Protocol	Source Port	Dest Port
Stateful	Ingress	0.0.0.0/0	TCP	All	80
Stateful	Egress	10.0.2.0/24	TCP	All	1521



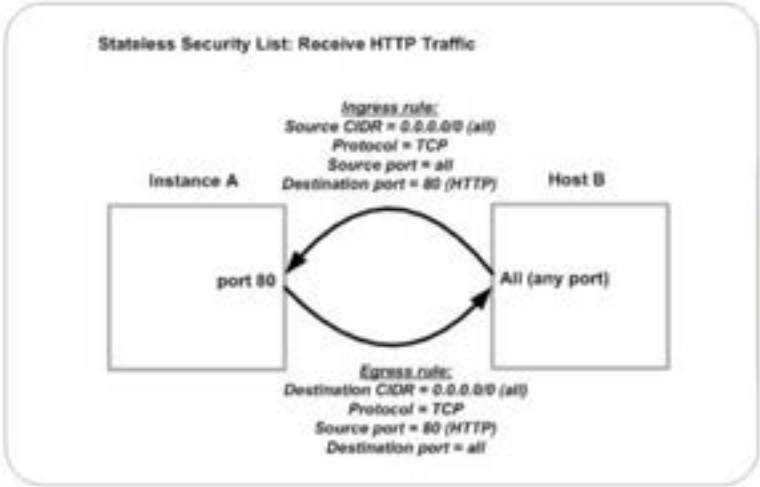
Stateful security rules

- **Connection Tracking:** When an instance receives traffic matching the stateful ingress rule, the response is tracked and automatically allowed regardless of any egress rules; similar to sending traffic from the host.
- Default security list rules are stateful.



Stateless security rules

- Response traffic is not automatically allowed.
- To allow response traffic, create a corresponding stateless egress rule.
- If you add a stateless rule to a security list, it indicates that you do NOT want to use connection tracking for any traffic that matches that rule.
- Better for scenarios with large numbers of connections (Load Balancing, Big Data).



Security list

- Some protocols, like ICMP, require an egress rule regardless of the state option.
- IPv6 is supported and requires a protocol-specific rule (that is, an ICMP rule for IPv4 will not include support for IPv6).

Ingress Rules

Add Ingress Rules | Edit | Remove

Stateless	Source	IP Protocol	Source Port Range	Destination Port Range	Type and Code	Allows	Description
No	0.0.0.0/0	ICMP			8	ICMP traffic for: 8 Echo	
No	::/0	IPv6-ICMP			All	IPv6-ICMP traffic for: All	

0 Selected — Showing 2 Items — 1 of 1

Network security groups

NSG

Provides a virtual firewall for a set of cloud resources that all have the same security posture

NSG

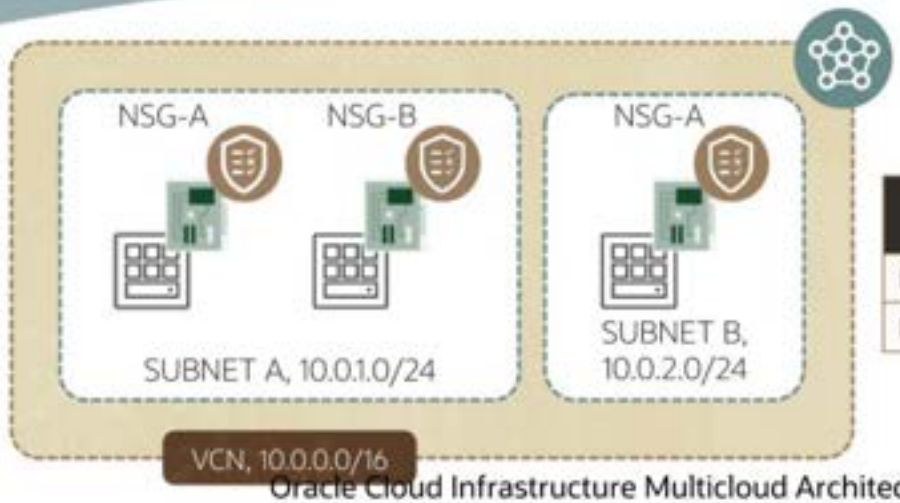
Consists of rules that apply only to a set of vNICs of your choice in a single VCN

NSG

Maximum five NSGs per vNIC

NSG

Supports resources such as compute instances, load balancers, DB systems, Autonomous DBs, and Mount targets



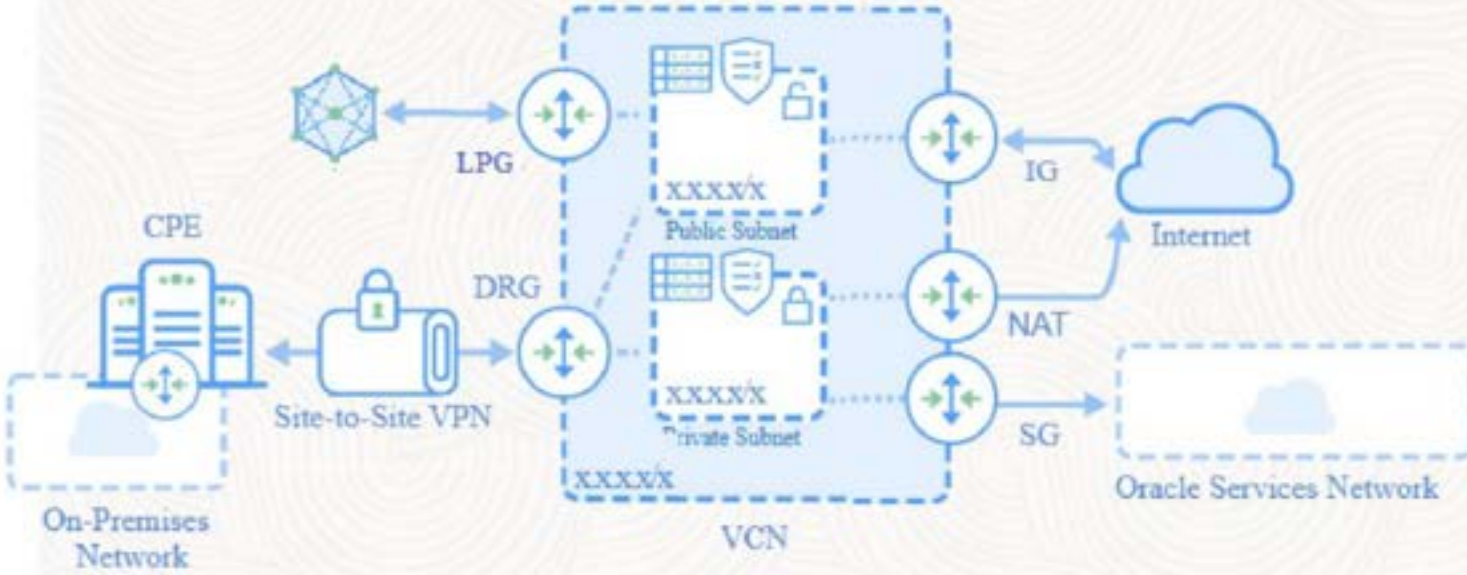
		Direction	CIDR	Protocol	Source Port	Dest Port
NSG-A	Stateful	Ingress	0.0.0.0/0	TCP	All	80
NSG-B	Stateful	Ingress	0.0.0.0/0	TCP	All	22

Security list + network security groups

Use SLs alone, NSGs alone, or both together

	Security List	Network Security Groups
A packet in question is allowed if any rule in any of the relevant lists and groups allows the traffic	To enforce security rules for all vNICs in a VCN, put the rules in one SL, and then associate that SL with all the subnets in the VCN	NSG can allow you to create exceptions for a giving instance in a subnet by adding permissions in additions to those in a SL
Oracle recommends using NSGs instead of SLs because NSGs let you separate the VCN's subnet architecture from your application's security requirements.	Specify a CIDR as the source or destination	Specify an NSG as the source of traffic (for ingress rules) or the traffic's destination (for egress rules)

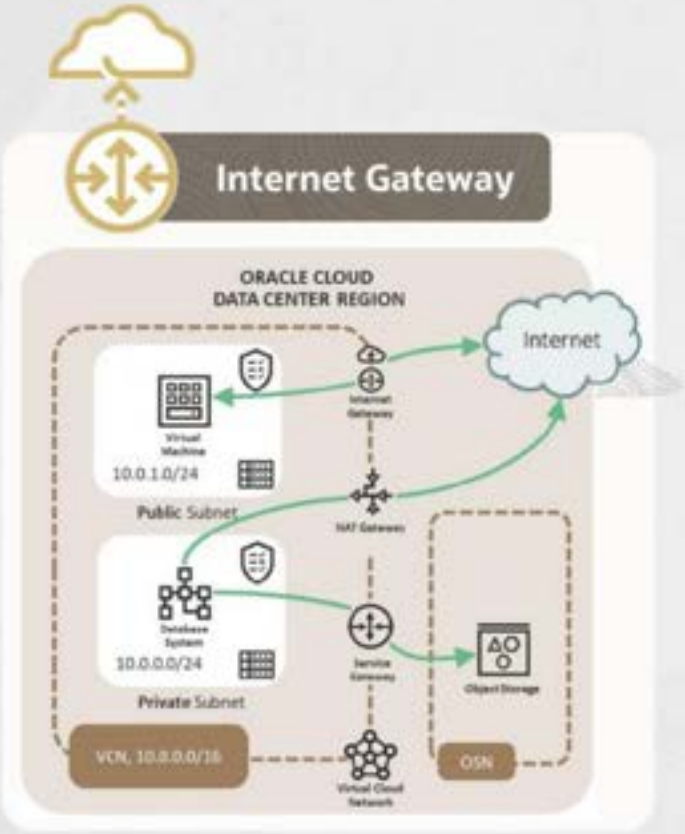
VCN Gateways



Internet Gateway

- Is an optional virtual router you can add to your VCN to enable direct connectivity to the internet
- Supports connections initiated from within the VCN (egress) and from the internet (ingress)
- Requires resources that use it for internet access to be in a public subnet and have public IP addresses
- Requires each public subnet that uses it to have a route table rule specifying the gateway as the target

Internet Gateway



Use security rules to control the types of traffic allowed in and out of resources in that subnet.

An internet gateway can be used only by resources in the gateway's VCN, not by hosts in the connected on-premises network or in a peered VCN.

You can't add or move an internet gateway to a VCN within a security zone. Security zones do not permit public subnets.

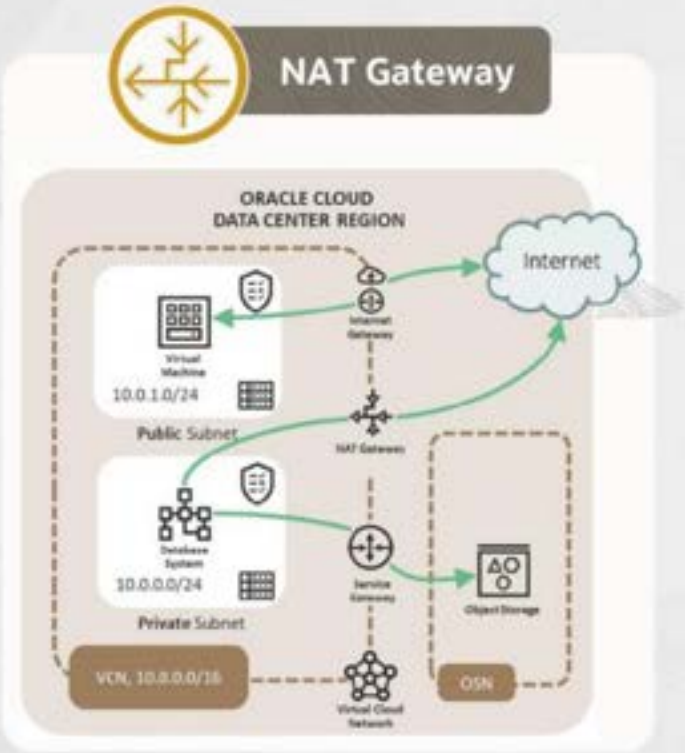
NAT Gateway

Instances in a private subnet don't have public IP addresses.

Add a NAT gateway to your VCN to give instances in a private subnet access to the internet.

NAT gateways are highly available and support TCP, UDP, and ICMP ping traffic.

NAT Gateway



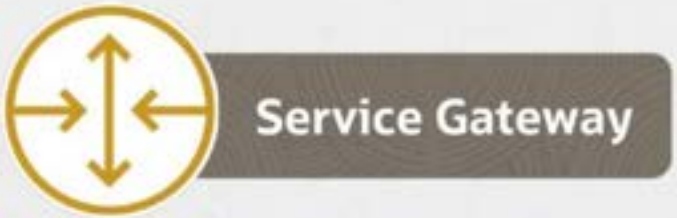
Supports a maximum of 20,000 concurrent connections to a single destination address and port

Can use an Ephemeral or Reserved IP address

Has a limit on the number of NAT gateways per VCN

Can be used only by resources within the VCN. VCN peering does not provide access to it. Nor does DRG connectivity to on-premises.

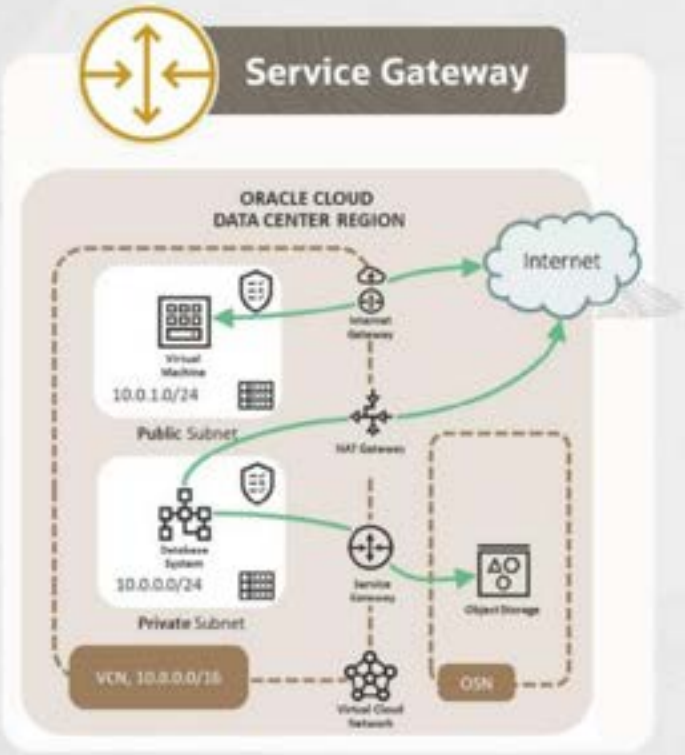
Service Gateway



Provides a secure, private path for network traffic between your VCN and Oracle Services Network to reach services like Object Storage, bypassing the internet

The Oracle Services Network is a conceptual network in Oracle Cloud Infrastructure that is reserved for Oracle services. These services have public IP addresses that you typically reach over the internet. However, you can access the Oracle Services Network without the traffic going over the internet. There are different ways of doing this, depending on which of your hosts need access.

Service Gateway



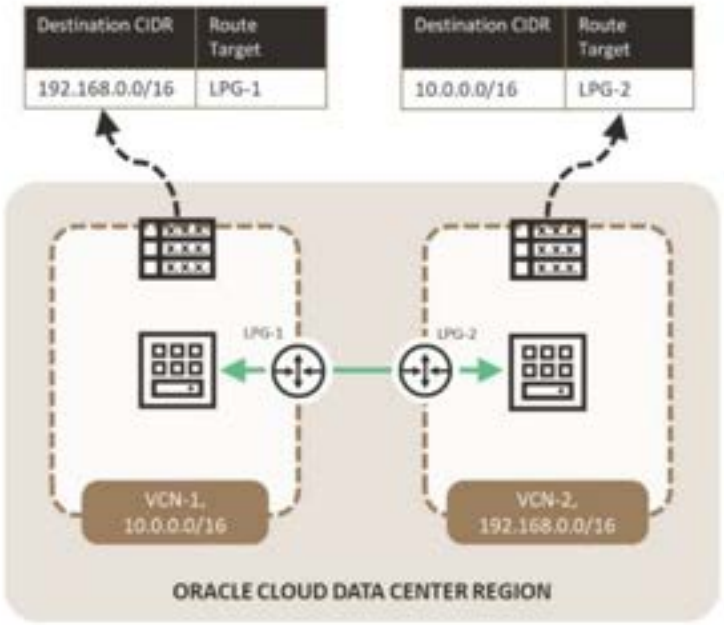
Hosts in your on-premises network:

- Private access through a VCN with FastConnect private peering or Site-to-Site VPN: Use private IP addresses and reach the Oracle Services Network by way of the VCN and the VCN's service gateway.
- Public access with FastConnect public peering: Use public IP addresses.

A service gateway is regional and enables access only to supported Oracle services *in the same region* as the VCN.

VCN Peering

Local peering (within regions)



Local Peering Gateway

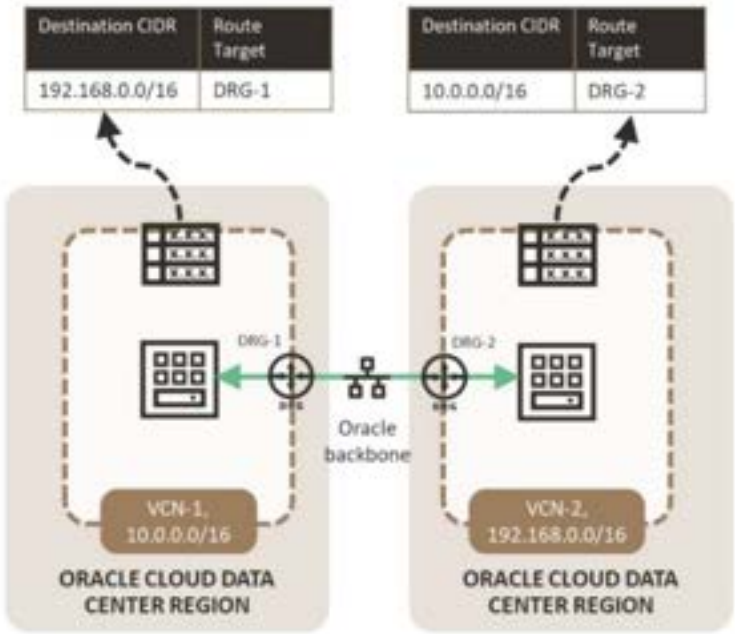
Local VCN peering (within region)

A typical local peering includes:

- Two VCNs with nonoverlapping CIDRs in the same region
- An LPG on each VCN in the peering relationship
- A connection between those two LPGs
- Supporting route rules to enable traffic to flow over the connection, and only to and from select subnets in the respective VCNs (if desired)
- Supporting security rules to control the types of traffic allowed to and from the instances in the subnets that need to communicate with the other VCN

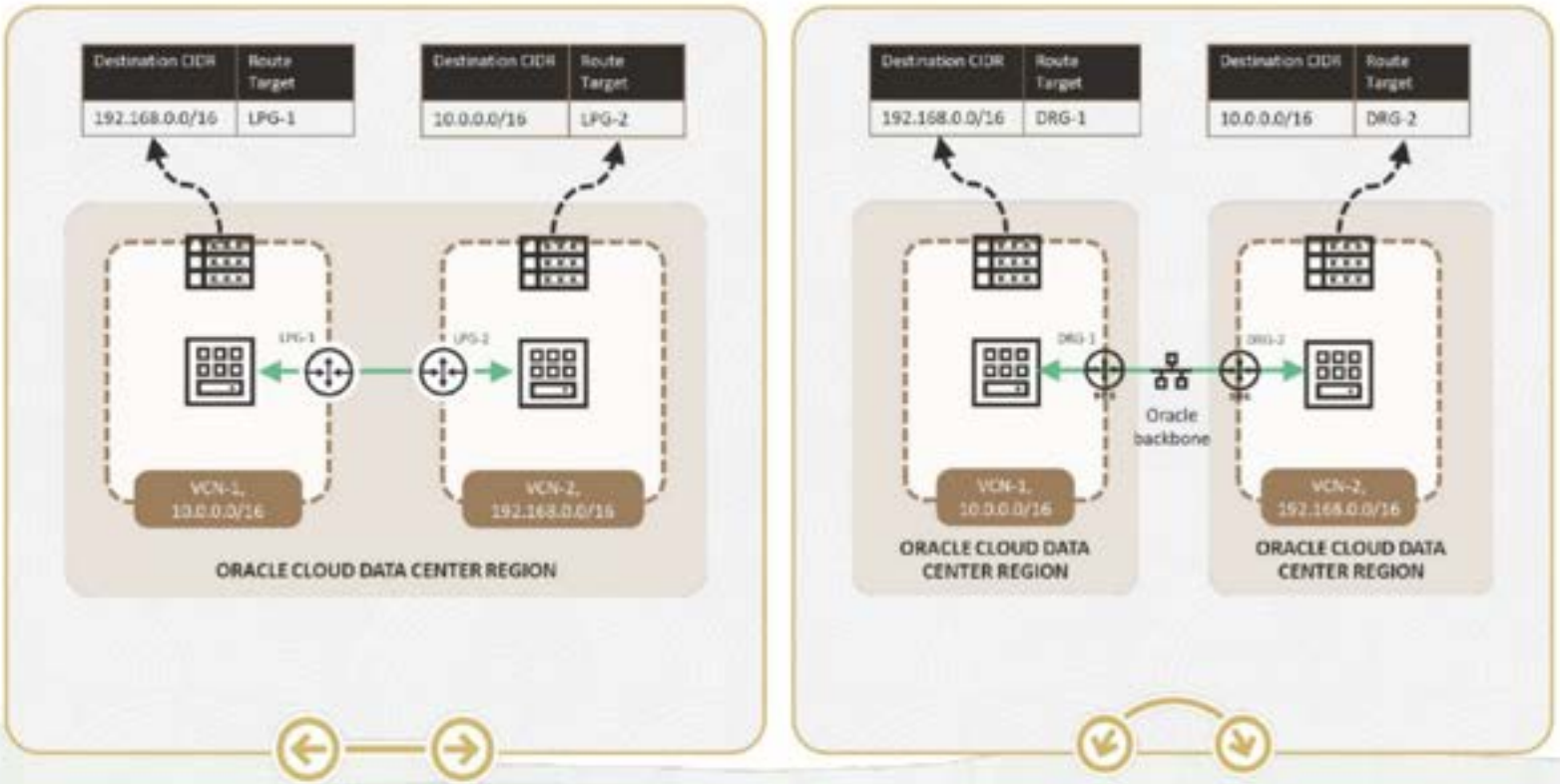
Dynamic Routing Gateway

Remote peering (across regions)



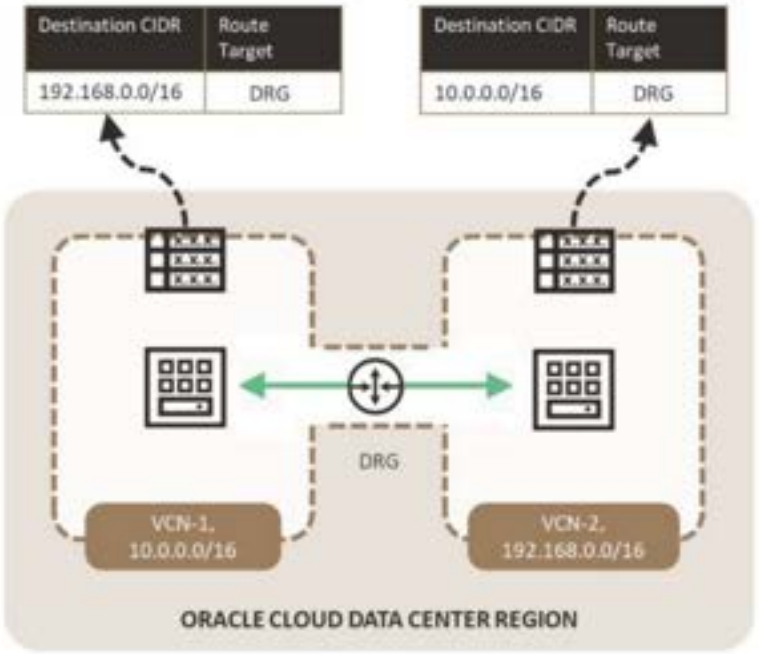
VCN gateways

Local peering vs. remote peering



Dynamic Routing Gateway

DRG with VCN attachments



VCN Routing

Networking • Virtual cloud networks • MyVCN • Route Table Details

RT

AVAILABLE

route table for private subnet-MyVCN

More resource | Add tags | Terminate

Route Table Information | Tags

OCID: ...tzveyq Show Copy

Created: Wed, Feb 22, 2023, 02:04:12 UTC

Compartment: MultiCloud

Resources

Route Rules (2)

Route Rules

Traffic within the VCN is handled by the VCN's local routing by default. Intra-VCN routing allows you more control over routing between subnets. Learn more

Add Route Rules | Edit | Remove

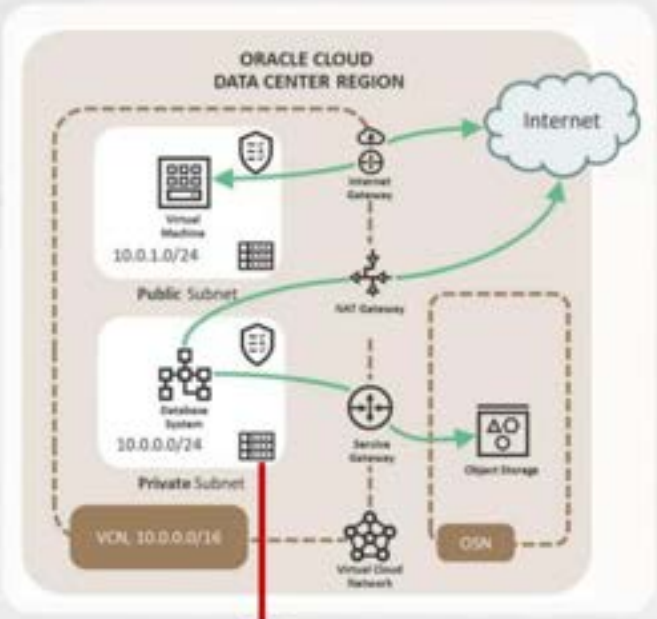
Destination	Target Type	Target	Route Type	Description
0.0.0.0/0	NAT Gateway	NAT gateway-MyVCN	Static	
All PHX Services in Oracle Services Network	Service Gateway	Service gateway-MyVCN	Static	

0 Selected — Showing 2 items — 1 of 1

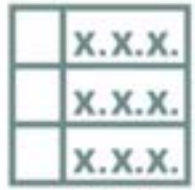
Route table

- The primary routing scenario is for sending a subnet's traffic to destinations outside the VCN.
- Traffic within the VCN's subnets is automatically handled by the VCN local routing.
- If a route table has overlapping rules, Oracle uses the most specific rule in the table to route the traffic.
- If there is no route rule that matches the network traffic you intend to route outside the VCN, the traffic is dropped.
- IPv6 addressing is supported for all commercial and government regions.

Route table



Destination CIDR	Route Target
0.0.0.0/0	NAT Gateway
Object Storage	Service Gateway



Used to send traffic out of the VCN

Consists of a set of route rules; each rule specifies the:

- Destination CIDR block
- Route target (the next hop) for traffic that matches that CIDR

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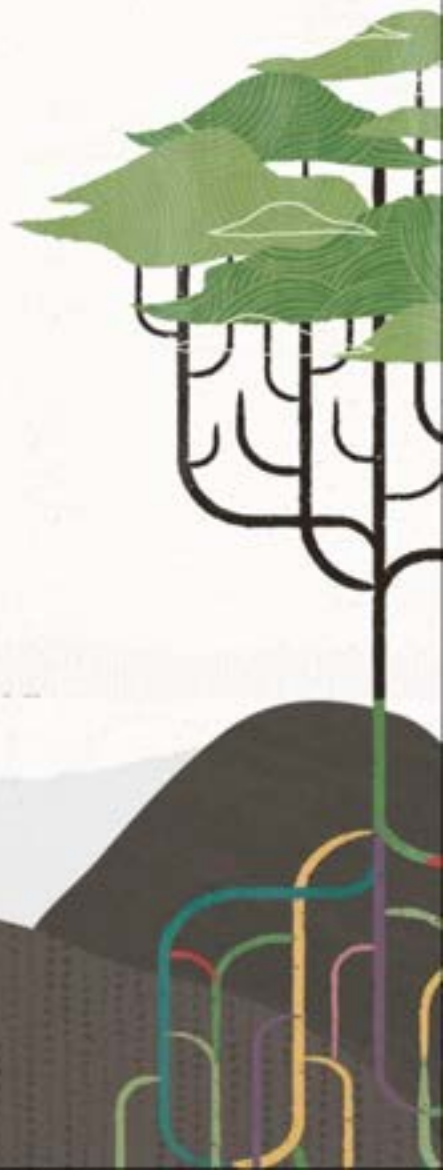
Oracle Multicloud

Multicloud Network Connectivity



Multicloud Connectivity Options

Site-to-Site VPN

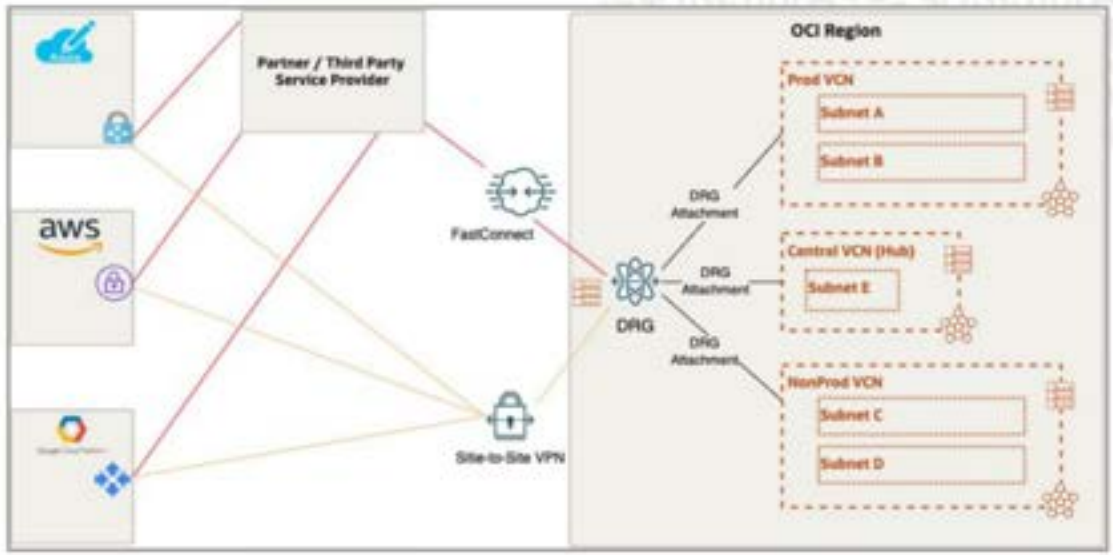
FastConnect

OCI-Azure Interconnect

Oracle Database Service for Azure

Site-to-Site VPN and FastConnect

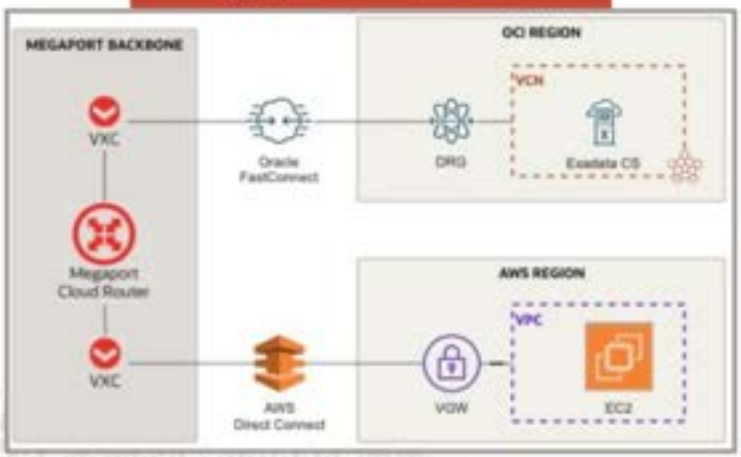
- Site-to-site VPN
  - Uses public Internet for connectivity
  - Connection consists of multiple redundant IPSec tunnels
  - Bandwidth/latency can vary
- FastConnect
  - Uses dedicated connection
  - Fixed bandwidth/latency
  - Supports Private and Public Peering



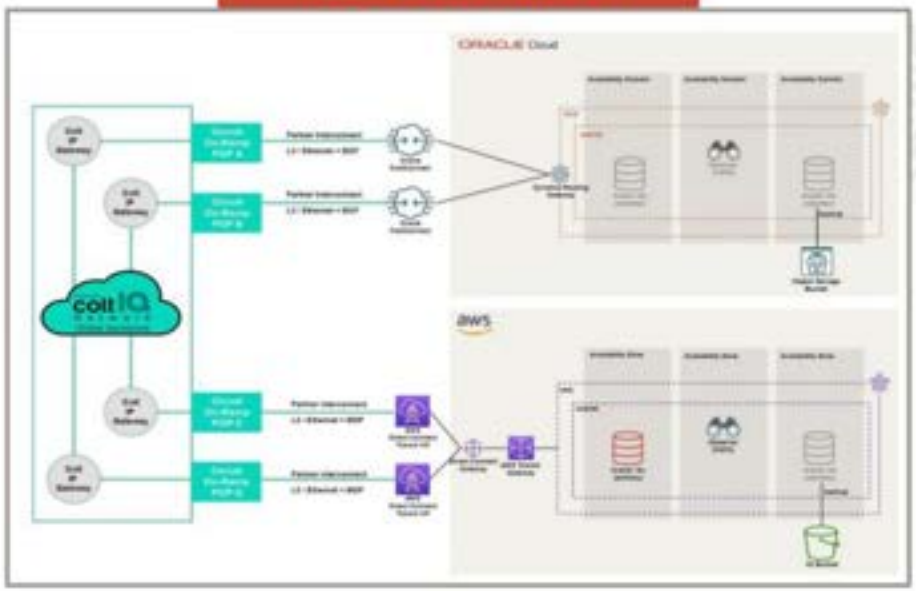
FastConnect Partners

Equinix Multicloud

Megaport Multicloud



Colt Multicloud



In the diagrams, few of our largest connectivity partners are shown: Equinix, Megaport, and Colt

Connections to other clouds from OCI is quick and easy to establish through Oracle FastConnect partners.




	Site-to-Site VPN	FastConnect	OCI-Azure Interconnect	Oracle DB for Azure
Connectivity	Public Internet	Private Connection	Private Connection	Private Connection
Encryption	IPsec	Can be added	Can be added	Can be added
Latency	Depends on distance	Depends on distance	Low latency	Low latency
Bandwidth	Usually low	High	High	High
Availability	Broad geographic reach	Broad geographic reach	12 regions globally	12 regions globally
Requires 3rd party providers	No	Yes	No	No
Set-up	Easy and quick	Depends on 3rd party provider	Easy, quick and automated	Oracle managed
Reliability	Depends on public internet	Reliable	Reliable	Reliable
SLA	No	Depends on 3rd party provider	FastConnect and ExpressRoute independent SLAs	No (SLO coming soon)
Support	No	Oracle and 3rd party provider	Oracle and Microsoft (collaborative)	Oracle and Microsoft
Connecting Clouds	Any Clouds	Oracle to any Cloud	Oracle to Azure	Oracle to Azure
FastConnect Port charges	No	Yes	Yes	No
Egress Traffic cost	Yes	No	No	No

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Oracle Multicloud

Site-to-Site VPN

Site-to-Site VPN: Overview

- Offers a simple and secure way to connect your corporate network to Oracle Cloud Infrastructure over your existing internet connection
- Encrypts your data and tunnels it through the public internet for enhanced security and privacy with an IPSec VPN connection

Features
Site-to-site VPN for a secure connection between your network and the Oracle Cloud
High availability with two tunnels connected to redundant Oracle routers
Industry-standard Internet Key Exchange version 1 (IKEv1 and IKEv2) protocol

Site-to-Site VPN: Use Cases

Use for Proof of Concept

No contracts or commitment. Build as many VPN tunnels to Oracle Cloud Infrastructure as desired and decide how long you want them active.

Connect multiple locations to the cloud

Connect your headquarters, branch locations, and private datacenters to the Oracle Cloud so all of your offices can access applications.

Securely connect your existing infrastructure to the cloud

Securely connect your existing infrastructure to the cloud or connect multiple clouds.

Build redundant connectivity for Oracle FastConnect

Already have Oracle FastConnect? Site-to-Site VPN can provide a redundant connection to Oracle Cloud Infrastructure.

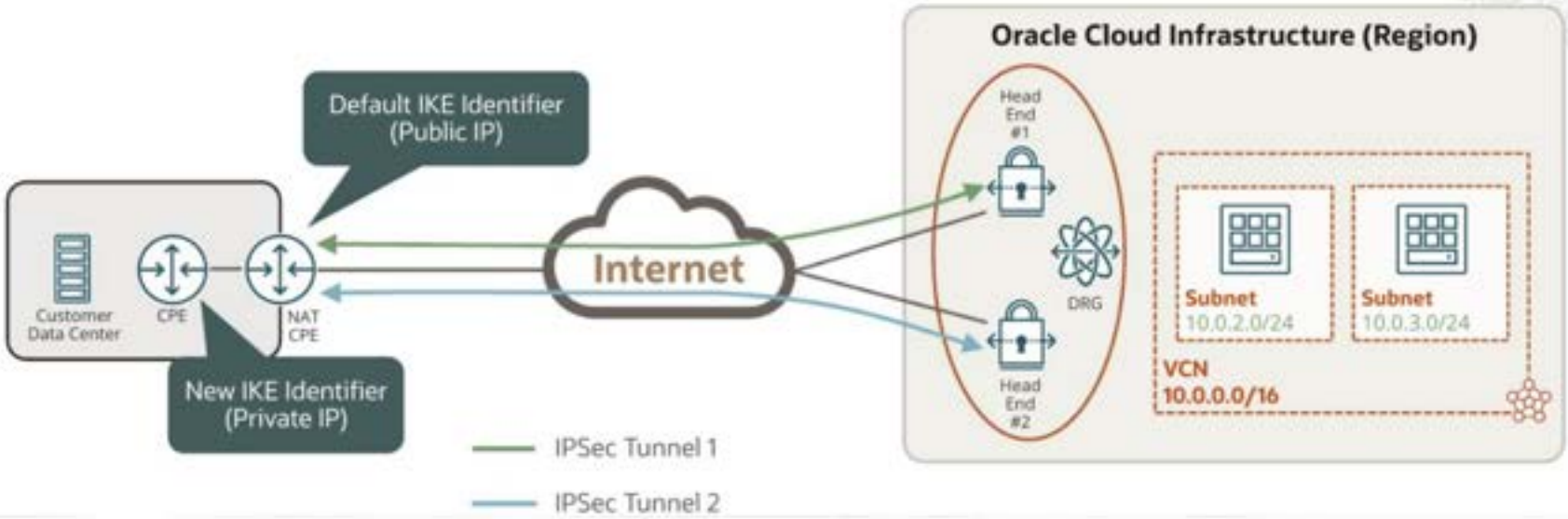
Site-to-Site VPN Setup

- Supports IKEv1 and IKEv2
- Dynamic Routing Gateway (DRG) - VPN headend at OCI end of the Site-to-Site VPN
- Customer Premise Equipment (CPE)
  - Actual VPN router in your on-premises network (hardware or software)
  - When setting up the VPN, you create a **virtual representation** of your on-premises router, which is known as CPE object.
  - To create a CPE Object – Name, Outside Public IP address
- IPSec Connection
  - After creating the CPE object and DRG, you connect them by creating an IPSec connection, which results in two redundant IPSec tunnels.
  - Static Routing and BGP Routing Supported

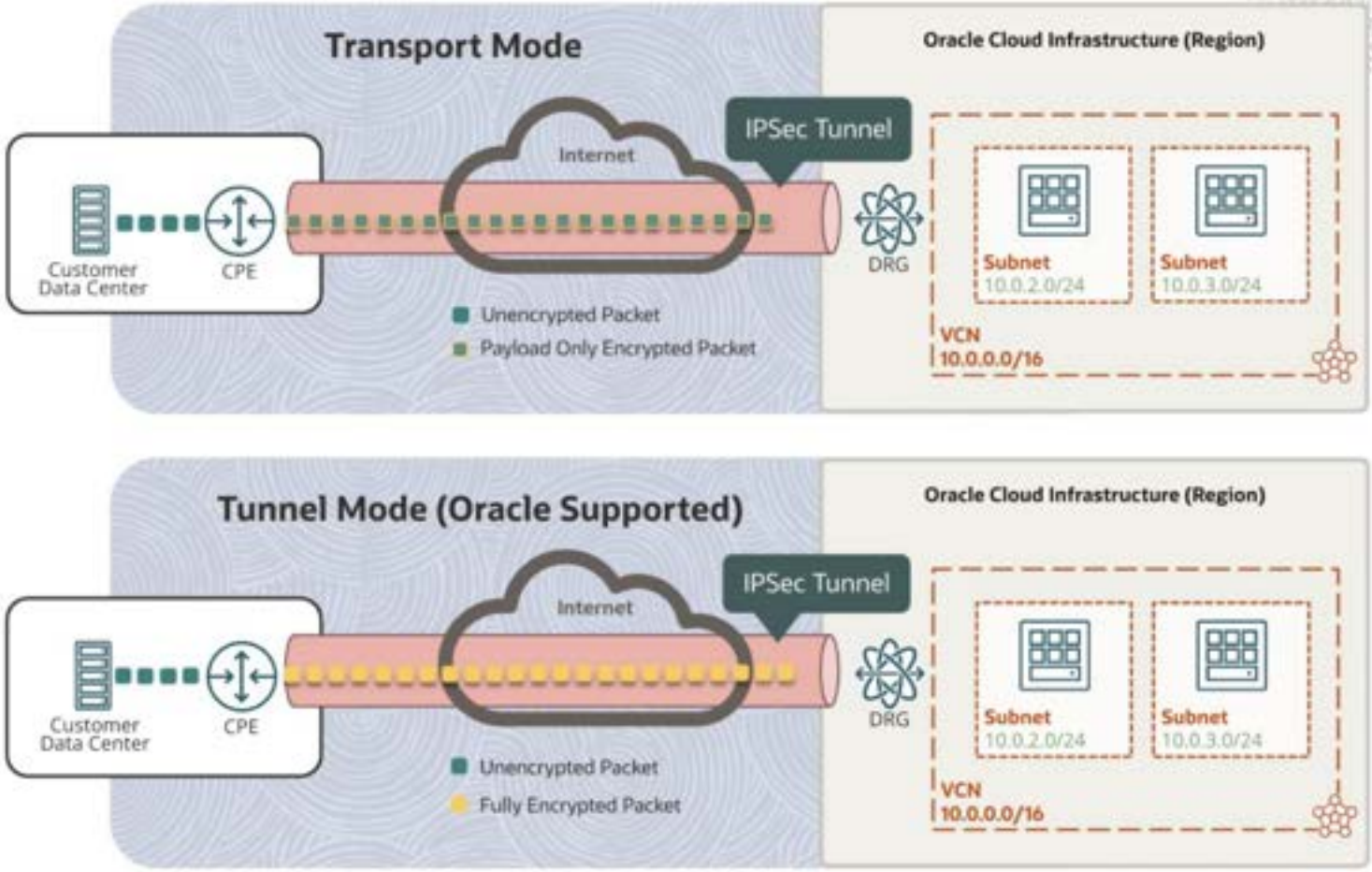
Site-to-Site VPN: Equipment on Customer Premises

- Oracle Cloud Infrastructure uses standard-based IPSec encryption.
- Verified Equipment Vendors
  - Check Point
  - Cisco
  - FortiGate
  - Juniper
  - Libreswan (or Openswan)
  - Palo Alto
  - WatchGuard
  - Yamaha

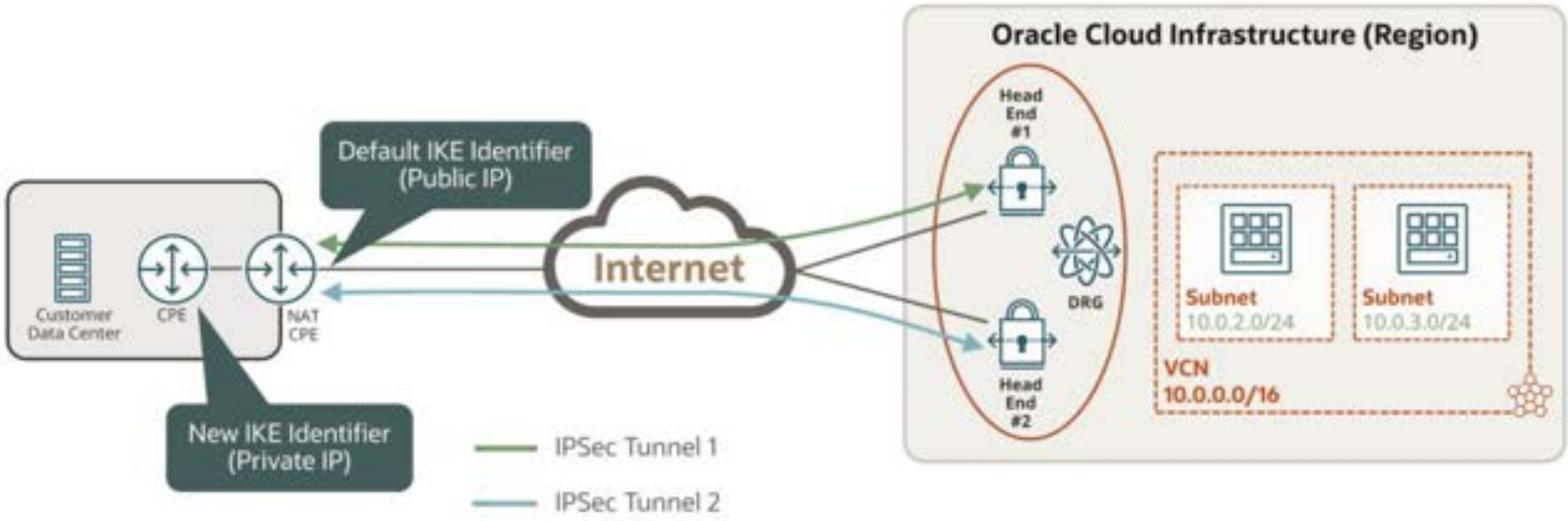
Site-to-Site VPN: Overview



Site-to-Site VPN: Tunnel Mode



Site-to-Site VPN: CPE Behind a NAT Device



Do we need this slide? looks the same as the VPN overview slide

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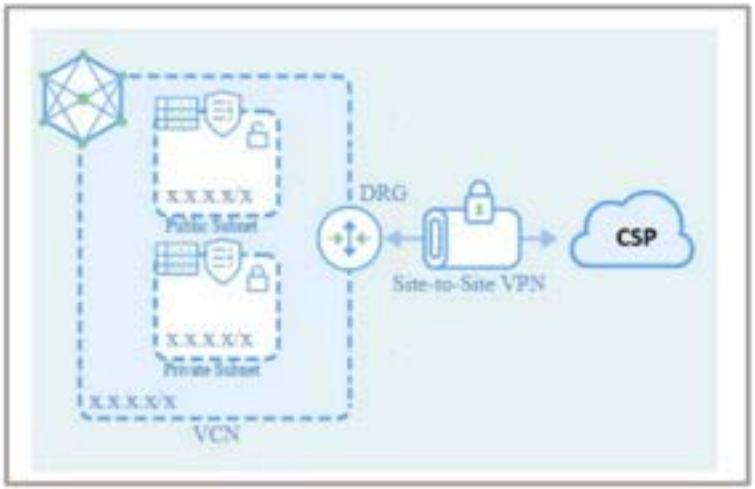
Oracle Multicloud

Multicloud Site-to-Site VPN

Multicloud VPN

- The Oracle Cloud Infrastructure (OCI) Site-to-Site VPN service offers a secure IPSec connection between your on-premises network and a virtual cloud network (VCN).
- You can also use Site-to-Site VPN to connect OCI resources to other cloud service providers.

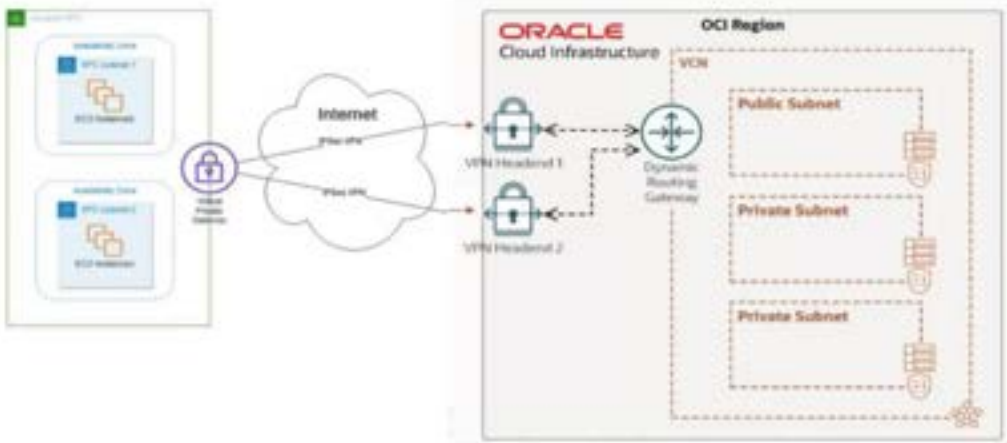
Oracle Multicloud VPN Guides
Site-to-site VPN between OCI and AWS
Site-to-site VPN between OCI and Azure
Site-to-site VPN between OCI and GCP



Site-to-Site VPN: AWS

Configuration Process

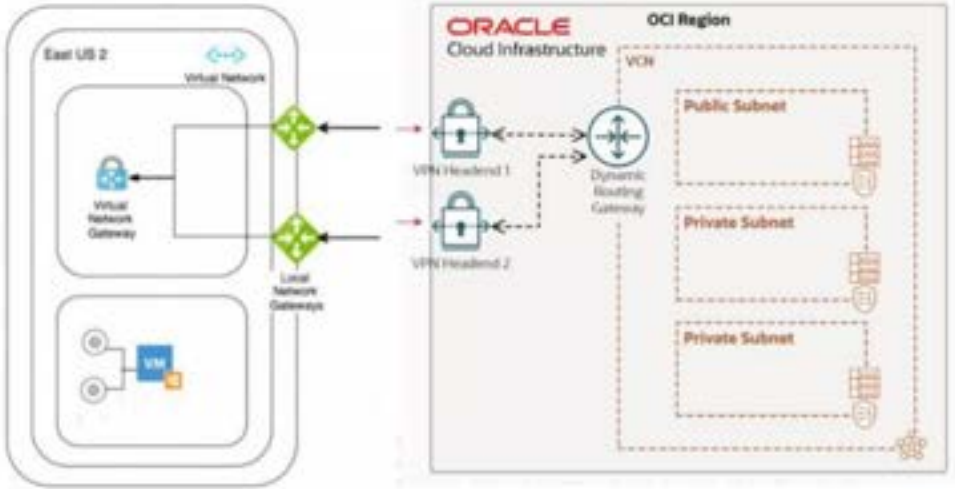
- AWS - Create Temporary Customer Gateway
- AWS - Create and Attach Virtual Private Gateway
- AWS - Create VPN Connection
- AWS - Download Configuration
- OCI - Create CPE Object
- OCI - Create IPSec Connection
- AWS - Create New Customer Gateway
- AWS - Modify VPN Connection for New Customer Gateway
- Verification



Site-to-Site VPN: Azure

Configuration Process

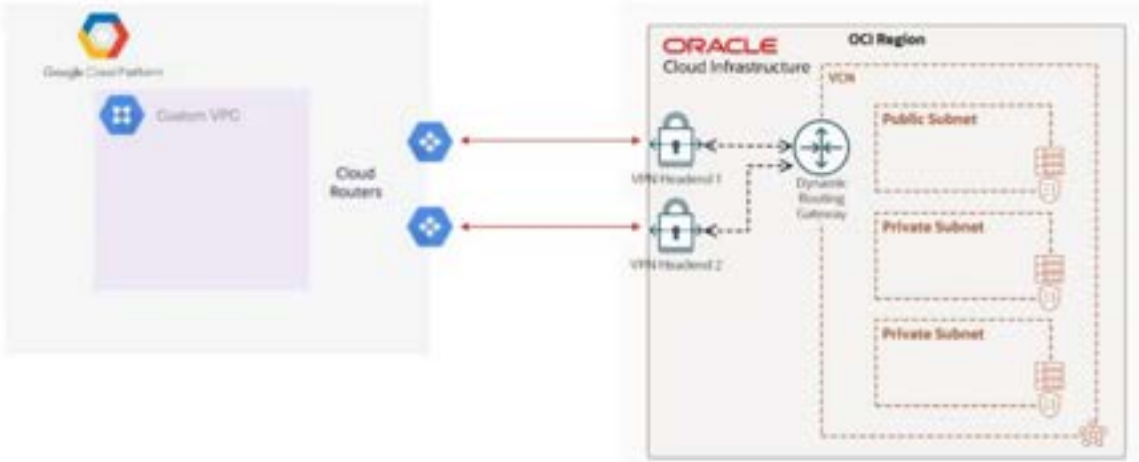
- Azure - Create VPN Gateway
- OCI - Create CPE Object
- OCI - Create IPSec Connection
- OCI - Open Oracle Service Request to Change PFS
- OCI - Save Site-to-Site VPN IP Address and Shared Secret
- Azure - Create a VPN Connection



Site-to-Site VPN: GCP

Configuration Process

- GCP - Start VPN Configuration
- OCI - Create CPE Object
- OCI - Create IPSec Connection
- OCI - Save Oracle VPN IP Address and Shared Secret
- GCP - Create a VPN Peer Gateway
- GCP - Create a Cloud Router
- GCP - Complete configuring VPN Tunnel
- GCP - Configure BGP Sessions
- Verification



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Oracle Cloud Infrastructure

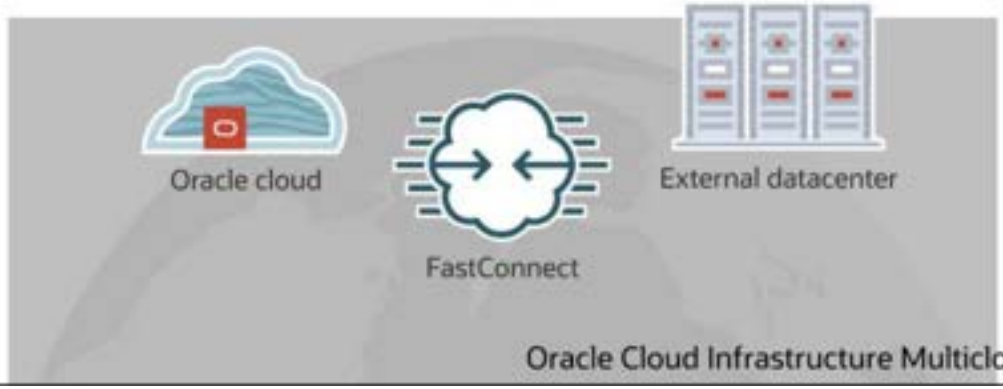
FastConnect

Design Considerations

Overview

With FastConnect, enterprises can create high-speed, low-latency, private connections between Oracle cloud and their external datacenter deployment for consistent and predictable performance.

High Availability **Elasticity and Scalability**



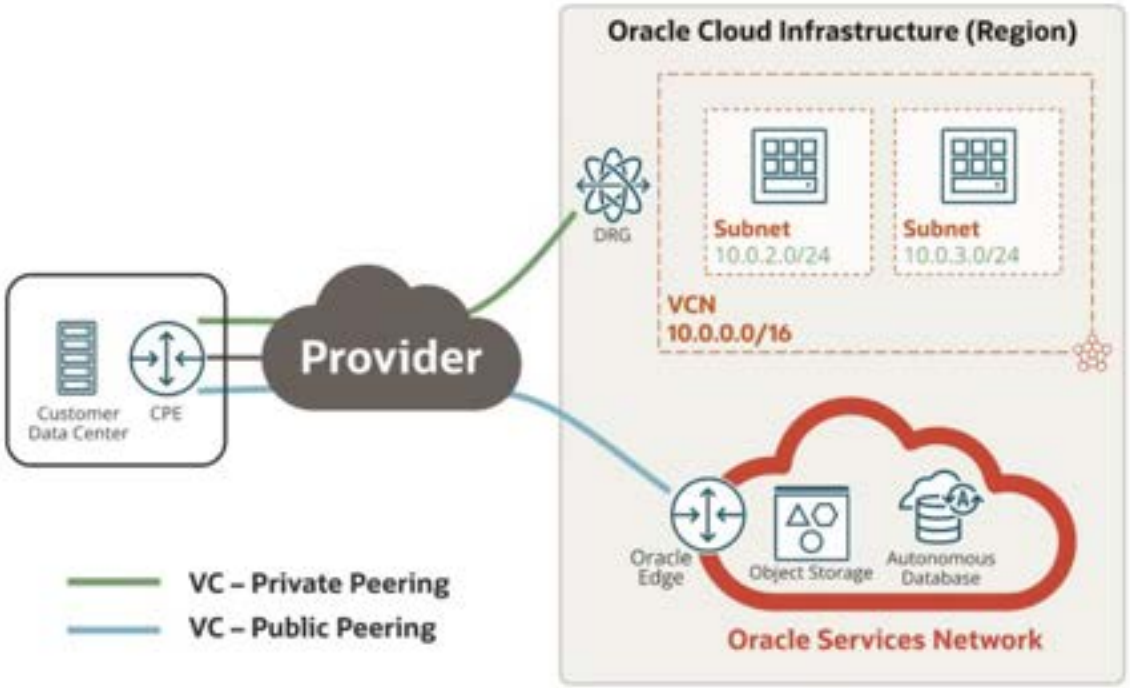
- Connect to OCI directly or via pre-integrated Network Partners
- 1 Gbps, 10 Gbps, and 100 Gbps* ports
- Extend remote datacenters into Oracle ("Private peering") or connect to Public resources ("Public peering")
- Supported Services

No data transfer charges

Use Cases for Low-Latency, Dedicated Connectivity

ORACLE Applications, ORACLE E-Business Suite, ORACLE JD Edwards, ORACLE PeopleSoft, ORACLE Siebel, ORACLE Hyperion	HPC, hadoop, Altair, slurm, Spark		
Latency-sensitive enterprise applications	**Big Data & High-Performance Computing with data-transfer needs**	**Sensitive data that cannot traverse the public internet**	**Lift-and-shift to Cloud**
Applications with relational database back-ends are especially vulnerable to latency and require predictable performance.	Large data transfer, high performance and low latency are a must.	Applications that contain sensitive data benefit from an extra level of privacy and isolation.	Moving Web-App-DB tiers to Oracle Cloud needs dedicated network connectivity.

Virtual Circuit



- A virtual circuit is an isolated network path that runs over one or more physical network connections to provide a single, logical connection between the customer's CPE and the DRG.
- Each virtual circuit is made up of information shared between the customer, Oracle, and a provider.
- The customer could have multiple virtual circuits to isolate traffic from different parts of their organization (e.g. one virtual circuit for 10.0.1.0/24; another for 172.16.0.0/16), or to provide redundancy.
- FastConnect uses Border Gateway Protocol (BGP) to exchange routing information between the various autonomous systems involved in the connection.
- Virtual circuits can be for Private Peering and Public Peering.

FastConnect and IPv6

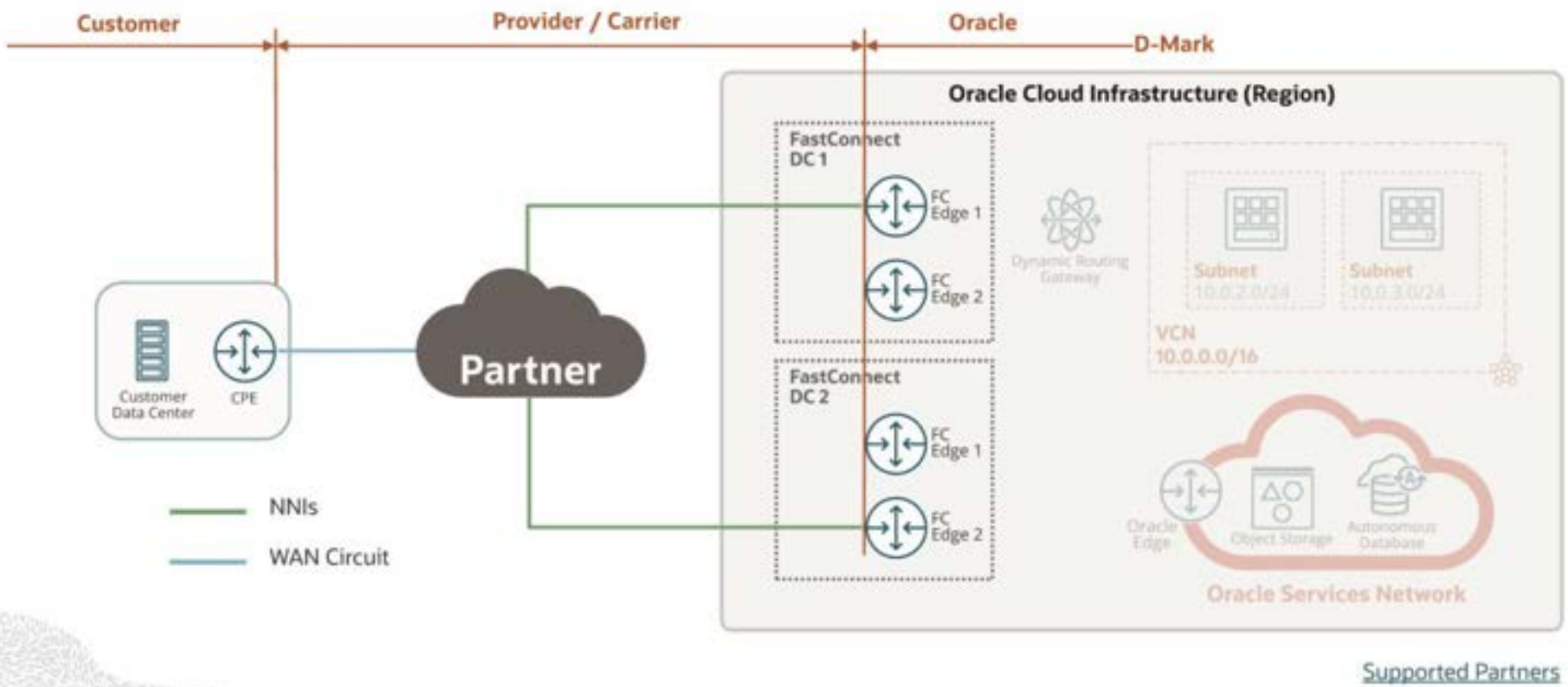
- The on-premises hosts with IPv6 addresses can communicate with an IPv6-enabled VCN over FastConnect.
- The FastConnect virtual circuit needs to have IPv6 BGP addresses.

- When you specify the BGP address pair, you must include a subnet mask that contains both addresses:
- Allowed subnet masks are: /64, /96, /126, /127

FastConnect Connectivity Options

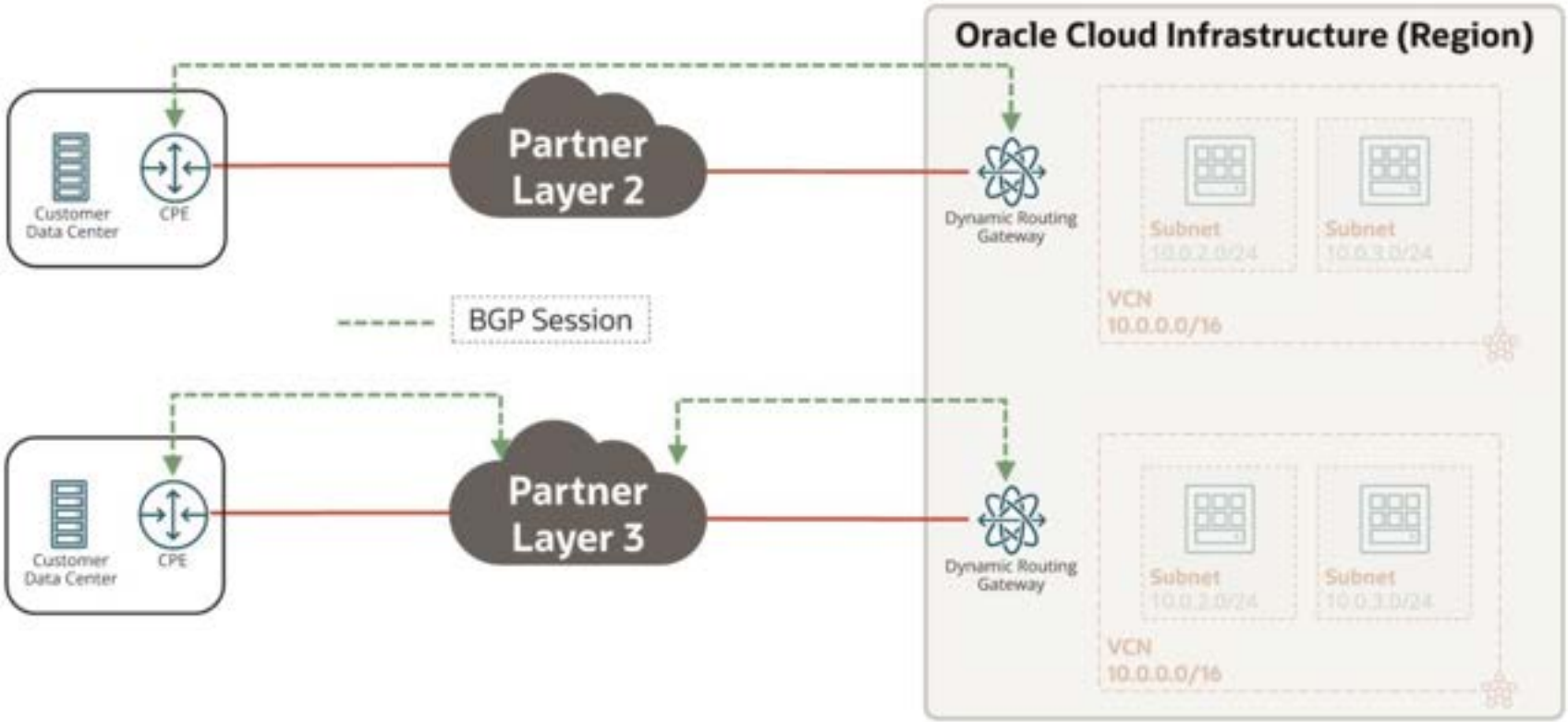
FastConnect Option	Implementation Time	Complexity	Carrier Virtual Circuit Charge	Carrier Charge
1. With an Oracle Partner	Quick	Easy	$	$$
2. With a Third-Party Provider	Long	Complex	Included	$$$
3. Colocation with Oracle	Short	Easy	Included	$

Option 1 - FastConnect with an Oracle Partner

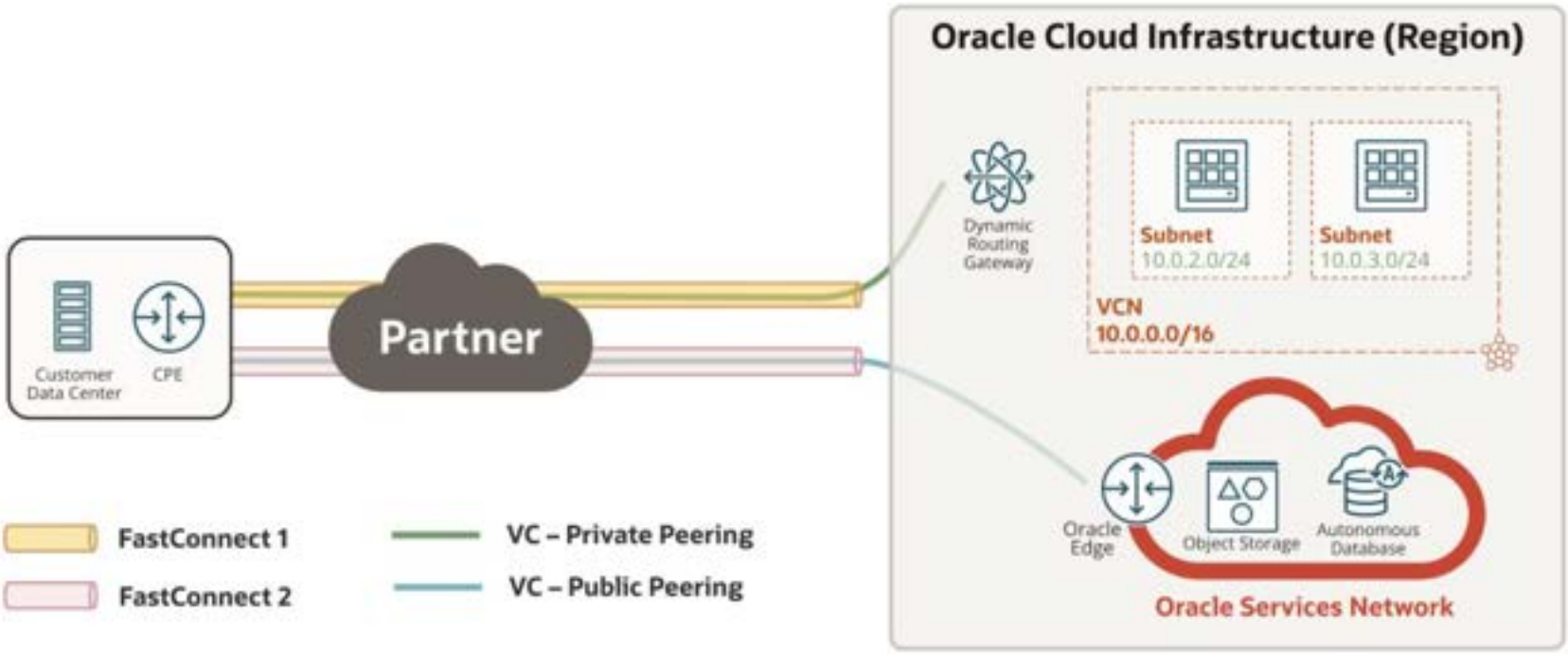


Supported Partners

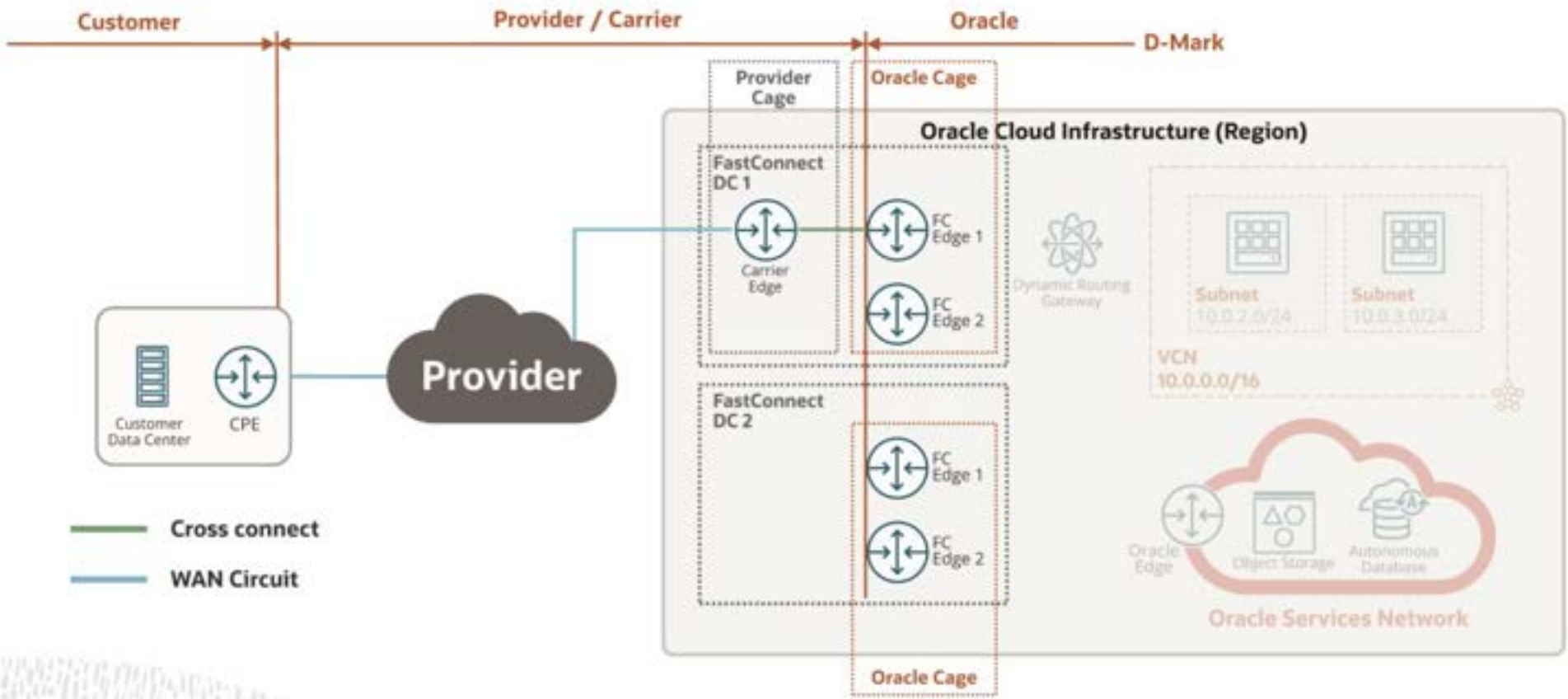
Option 1 - FastConnect with an Oracle Partner - Layer 2 and Layer 3



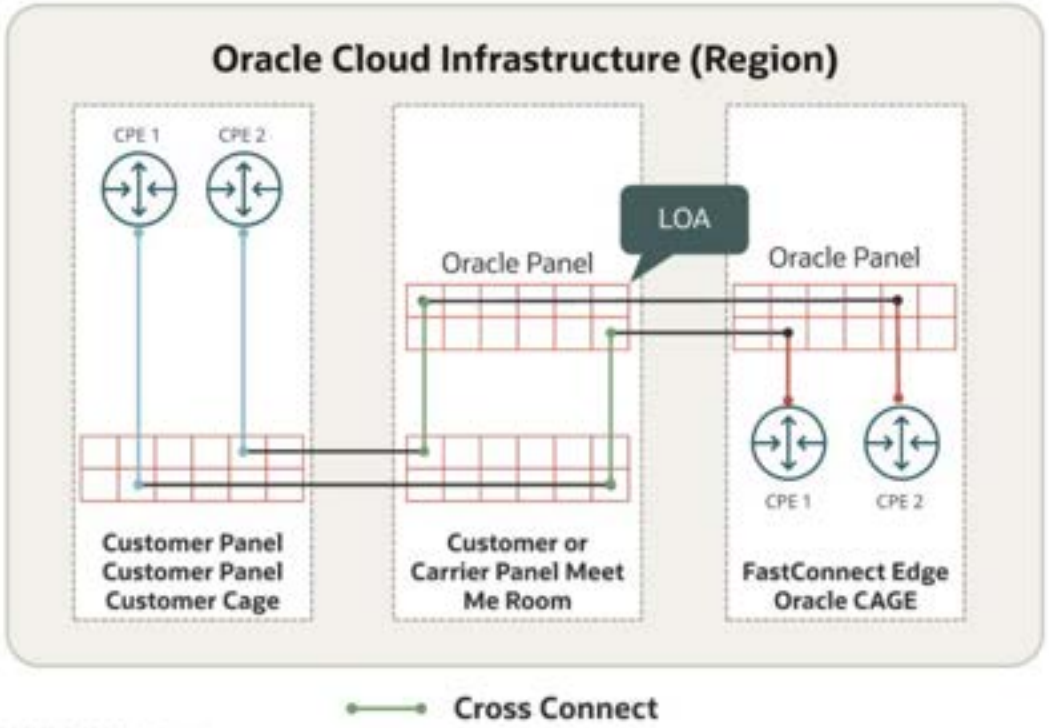
Option 2 - FastConnect with a Third-Party Provider



Option 2 - FastConnect with a Third-Party Provider

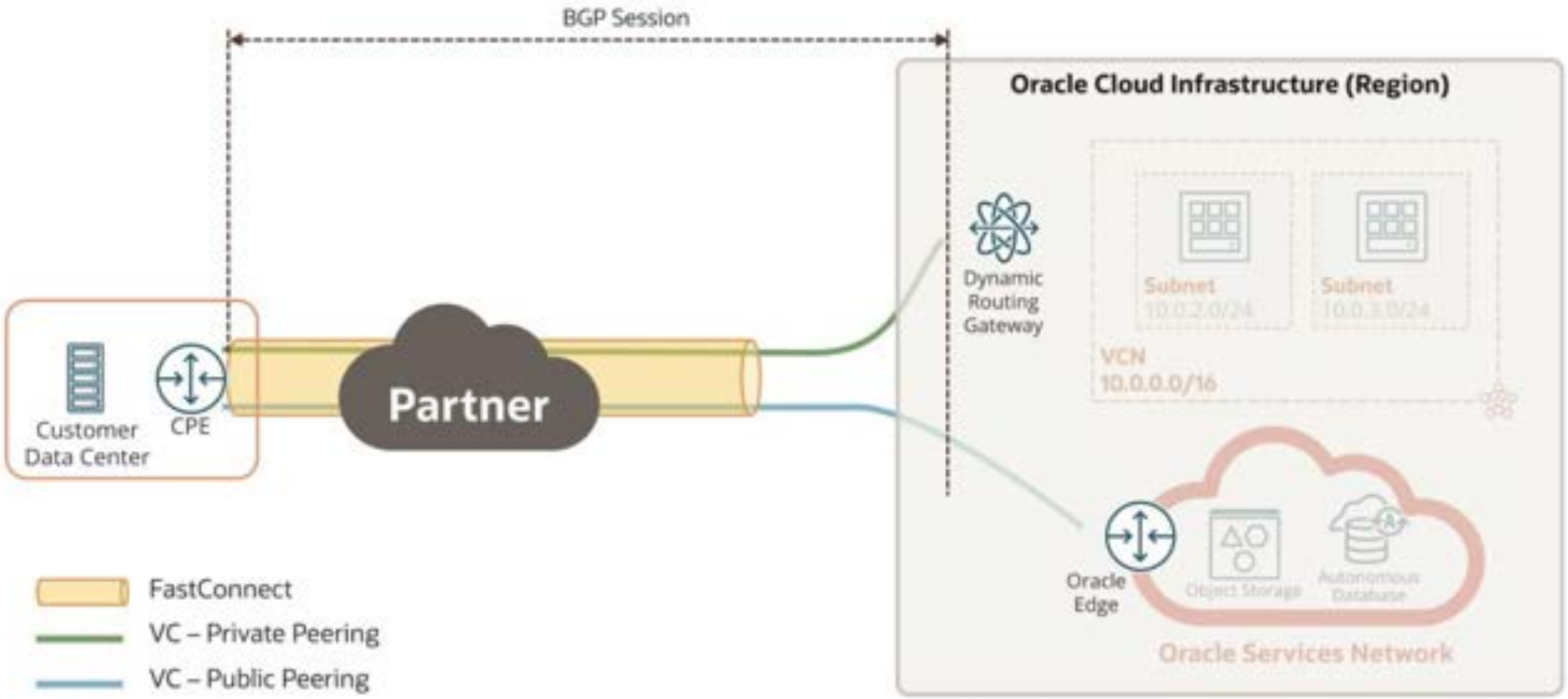


FastConnect with a Third-Party Provider or Colocation with Oracle Cross Connect - Meet Me Room

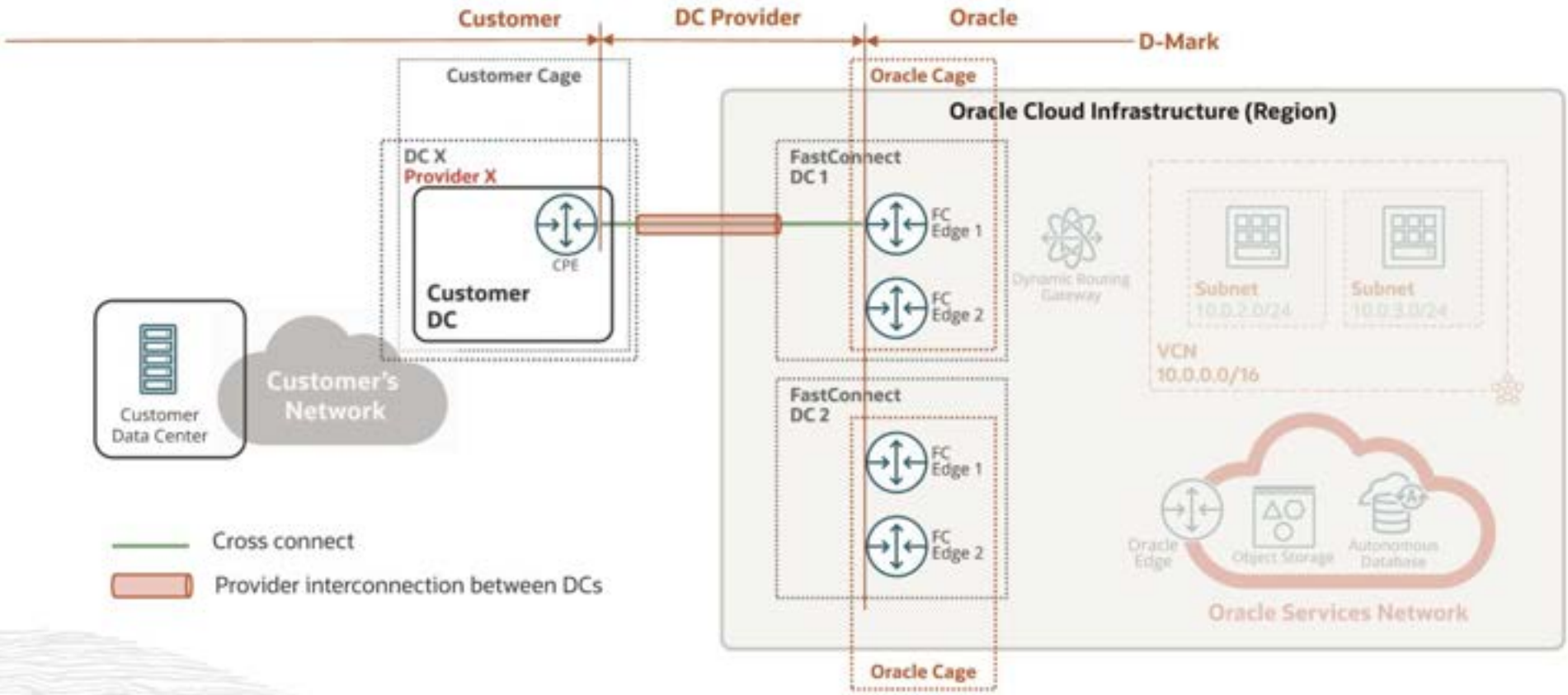


- Customer submits cross connect order to Colocation provider such as Coresite
- Coresite patches from Customer Panel to Oracle Panel
- Bulk cable runs are pre-ran from Oracle Panel in OCI Cage to Meet Me Room
- Customer may need Colo to run a fiber from the Customer Cage to Meet Me Room
- **Third-Party provider should have capability to order cross connect with the colocation provider**

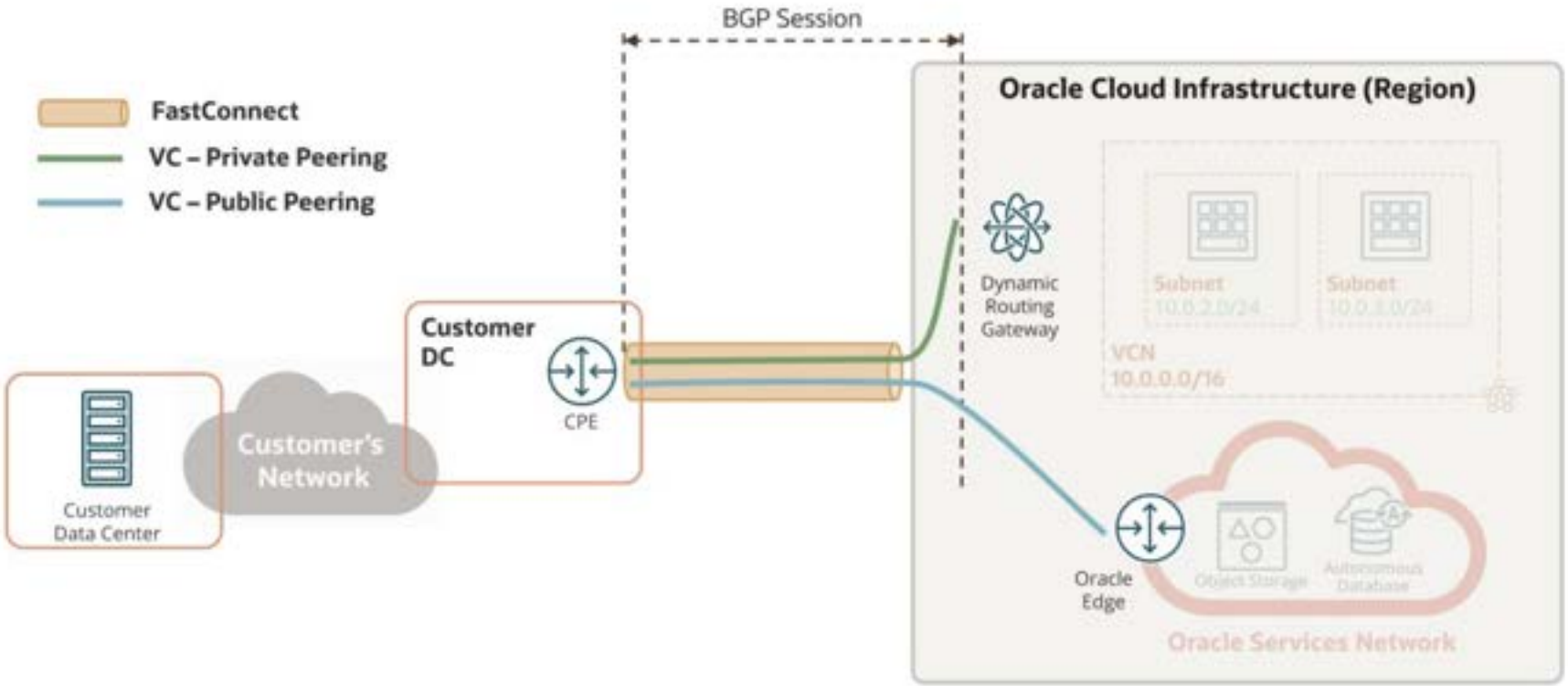
Option 2 - FastConnect with a Third-Party Provider - Virtual Circuits



Option 3 - FastConnect Colocation with Oracle - Multiple DCs same Provider



Option 3 - FastConnect Colocation with Oracle - Virtual Circuits



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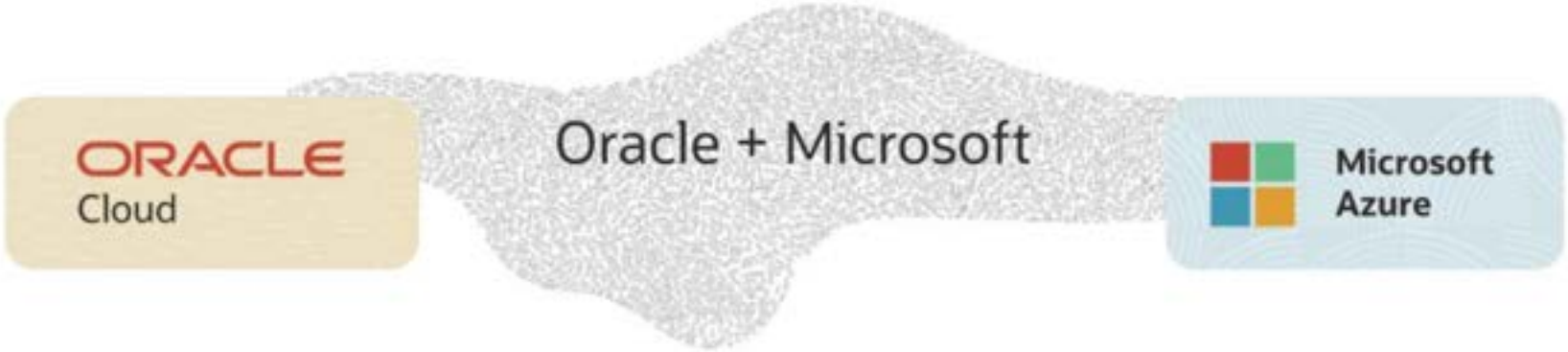
OCI-Azure Interconnect Introduction

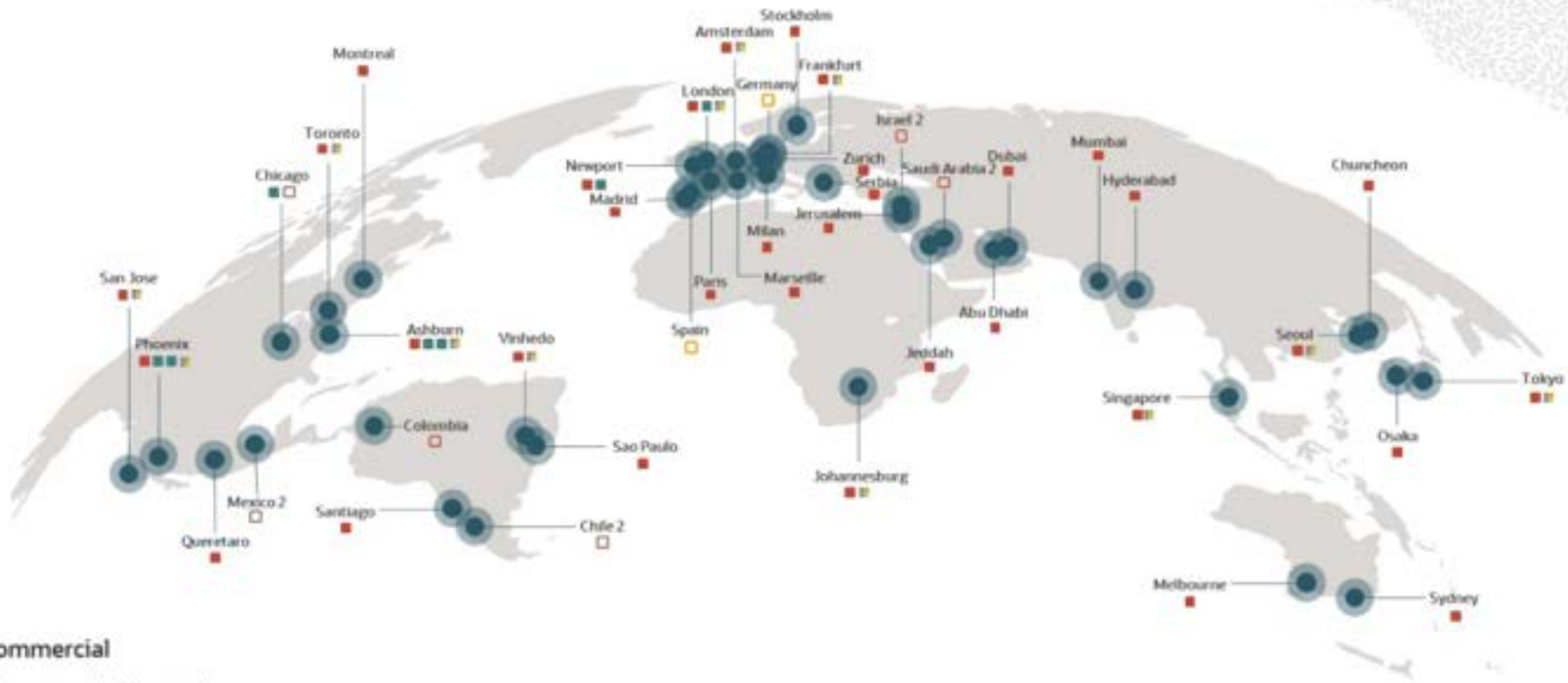
OCI-Azure Interconnect



Cross-cloud connection

- One time setup without the need for any intermediate network provider.
- Migrate and run mission-critical enterprise workloads across Microsoft Azure and Oracle Cloud.
- Consistent network performance (~2 ms latency)
- Provide single sign-on access to resources deployed in Oracle Cloud and Microsoft Azure.
- Gain a highly optimized, secure, and unified cloud experience.

OCI-Azure Interconnect Regions



- Commercial
- Commercial Planned
- Sovereign Planned
- Government
- Microsoft Interconnect Azure

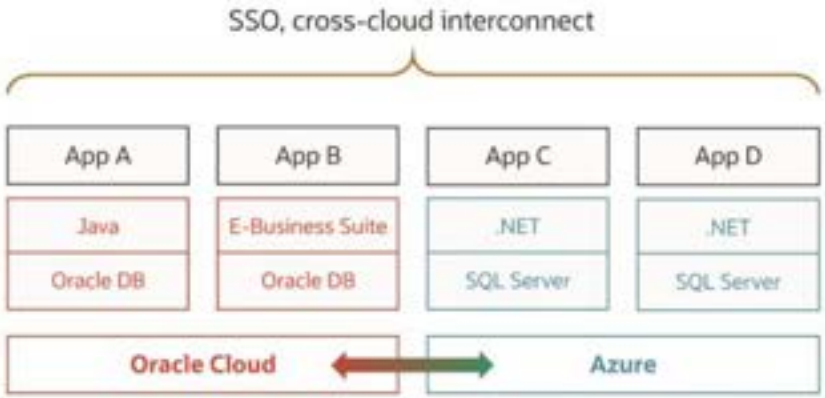
12 Azure Interconnect Regions

41 OCI Public Regions; 9 more planned

Architecture

OCI-Azure Interconnect

Common Use Cases



Supported Deployments:

Full stack Oracle or custom apps on Oracle Database on OCI and full stack apps on Azure that interoperate and share data

Oracle Apps (PSFT, JDE) on Azure using Oracle Database on OCI

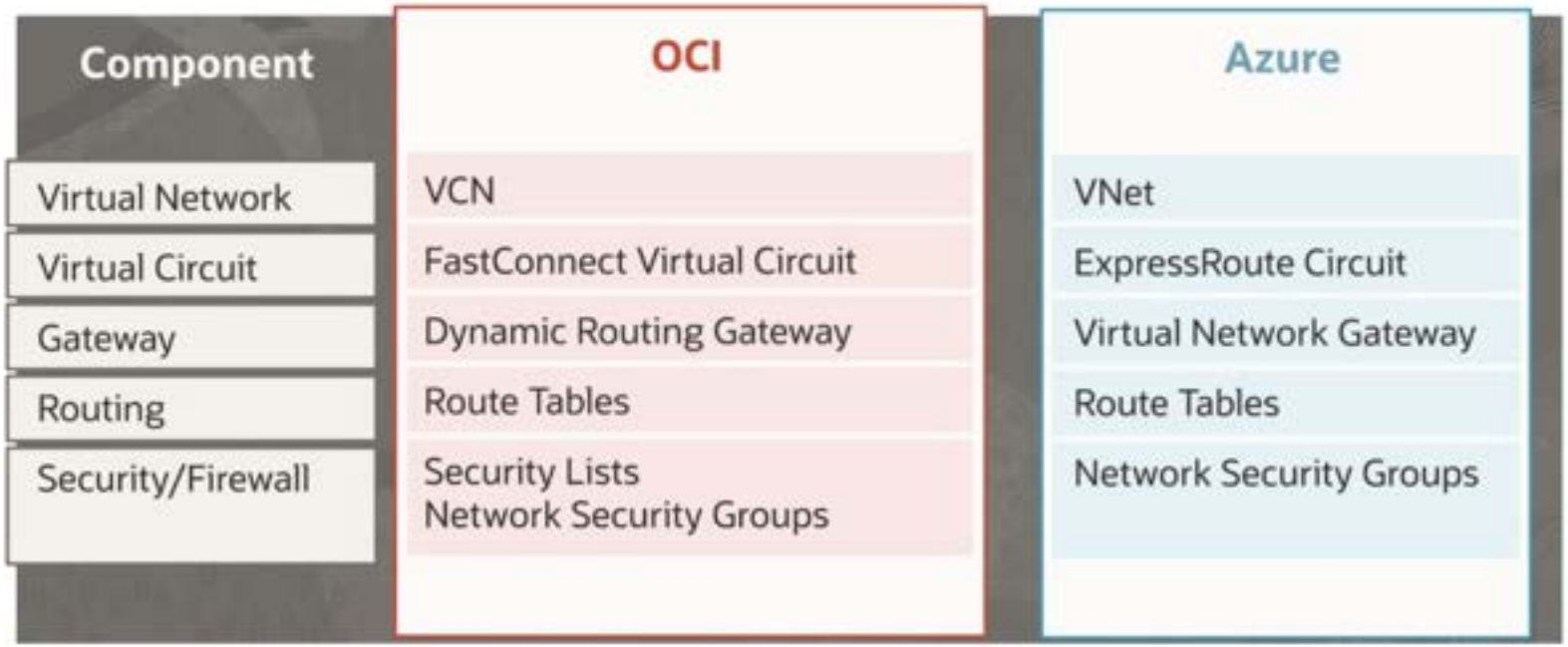
Custom .NET applications on Azure using Oracle Database on OCI

Custom Cloud Native apps on Azure using Oracle Autonomous DB

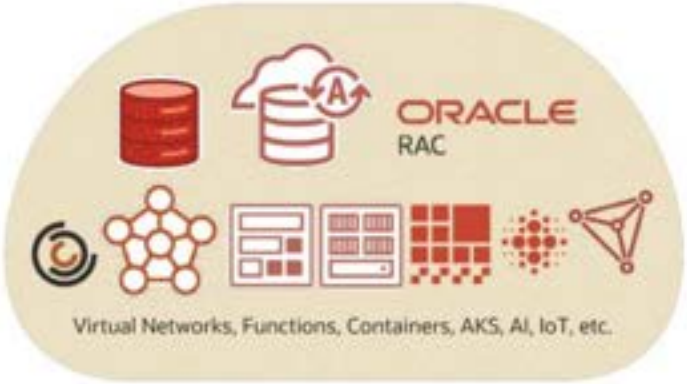
Applications/Oracle Database in OCI, Azure Data Lake for analytics, and Cognitive Services for AI

SQL Azure, SQL Server, SQL DW on Azure and Oracle Analytics Cloud, and Data Science service on OCI

Building Blocks



Partnership Benefits



Innovate across clouds

Run enterprise-grade, multi cloud applications between Oracle Cloud and Azure.

Enjoy a choice of services

Access a one-stop shop for all database and cloud service needs.

Leverage existing investments

Migrate on-premises apps and databases to the cloud without re-architecting technology.

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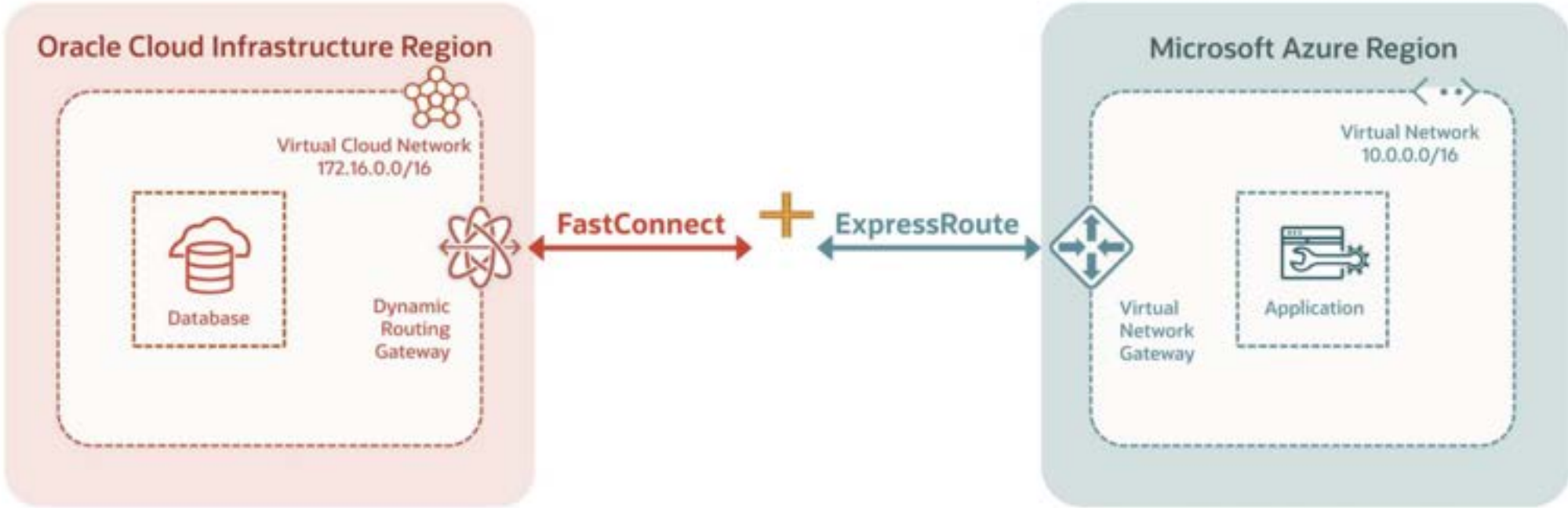
Oracle Cloud Infrastructure

OCI-Azure Interconnect Scenarios

OCI-Azure Interconnect Scenarios

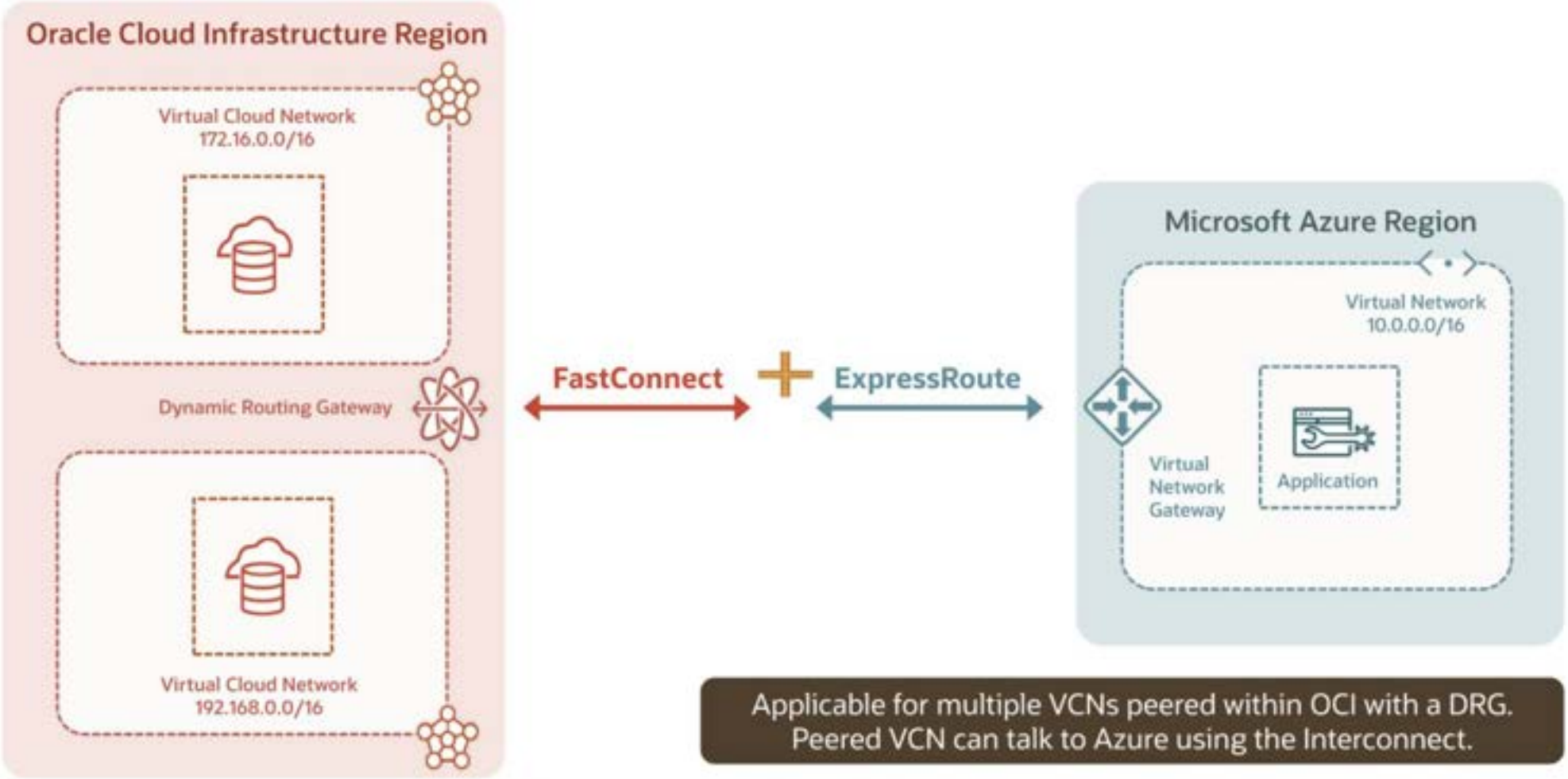
Scenarios	Supported
Connect OCI VCN to Azure VNET (Basic Deployment)	Yes
Connect peered OCI VCNs in the same region to Azure	Yes
Connect peered OCI VCNs in different regions to Azure	Yes
Connect services in Oracle Services Network to Azure	Yes
Connect on-premises environments to Azure via OCI VCN (and vice versa)	No

Connect OCI VCN to Azure VNet



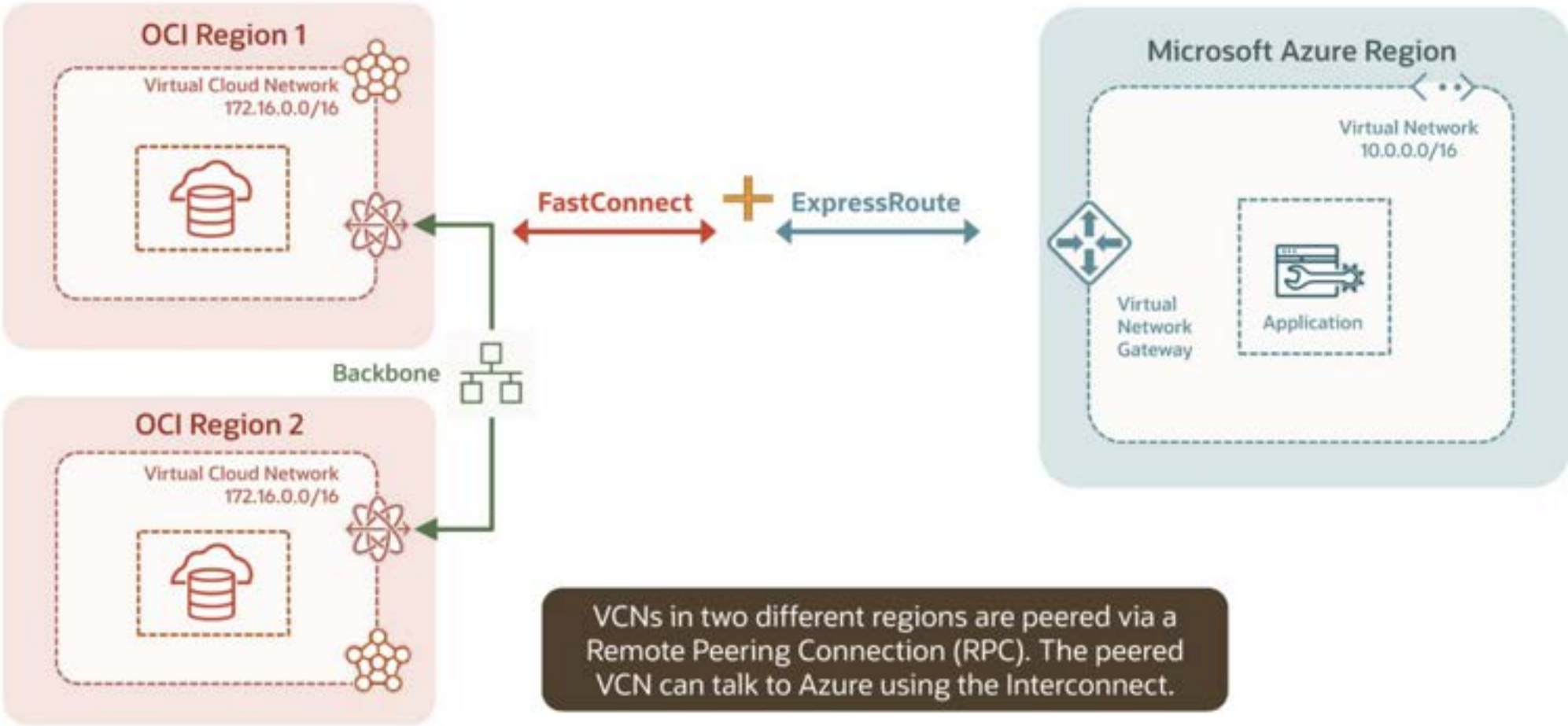
This is the basic configuration of the Interconnect from the Oracle Console and the Azure Portal to create a private path between Oracle VCN and Azure VNET

Connect Peered OCI VCNs in the same OCI Region to Azure



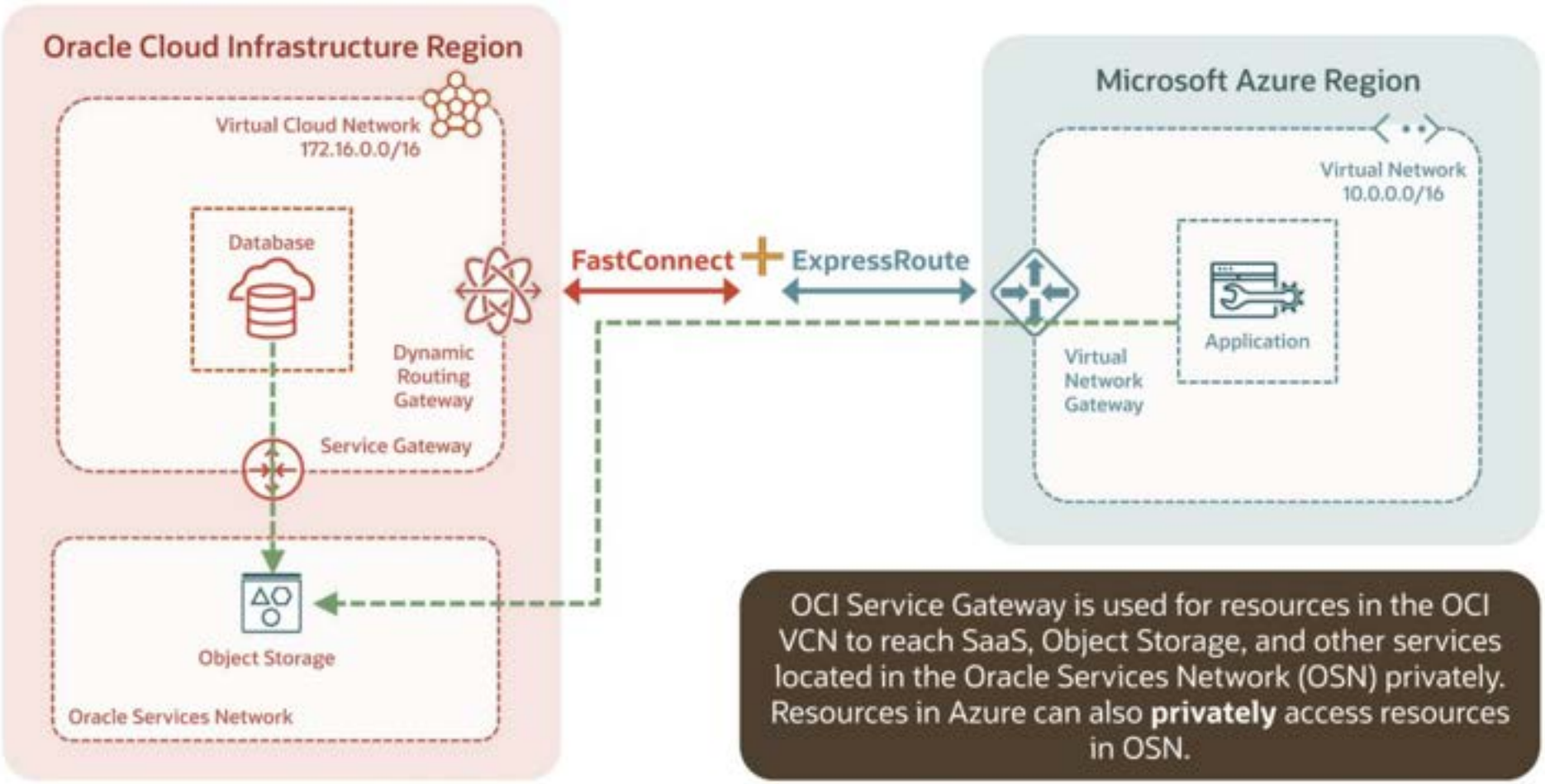
Applicable for multiple VCNs peered within OCI with a DRG. Peered VCN can talk to Azure using the Interconnect.

Connect Peered OCI VCNs in different OCI Regions to Azure



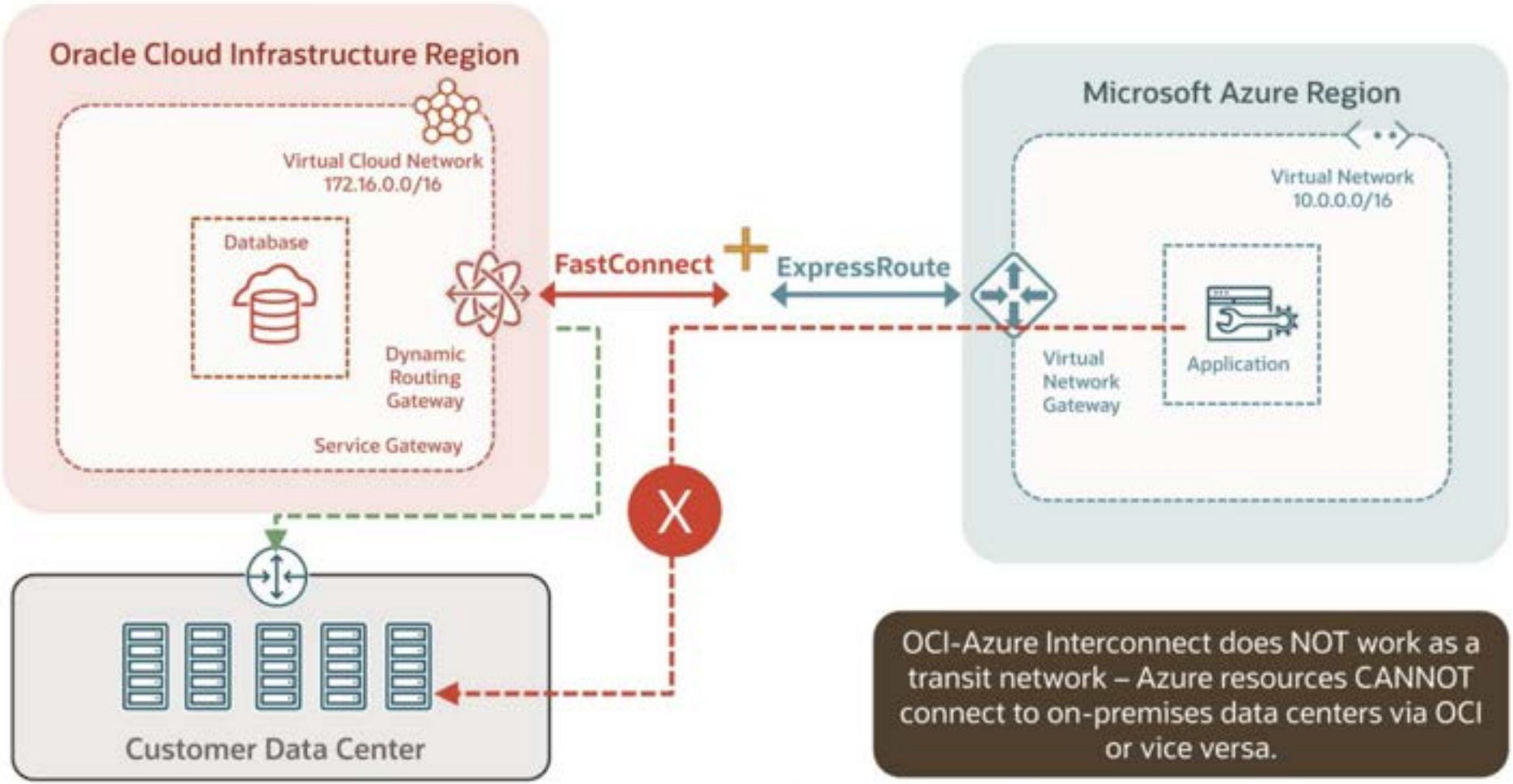
VCNs in two different regions are peered via a Remote Peering Connection (RPC). The peered VCN can talk to Azure using the Interconnect.

Connect services in Oracle Services Network to Azure



OCI Service Gateway is used for resources in the OCI VCN to reach SaaS, Object Storage, and other services located in the Oracle Services Network (OSN) privately. Resources in Azure can also **privately** access resources in OSN.

On-prem Private Connectivity to OCI



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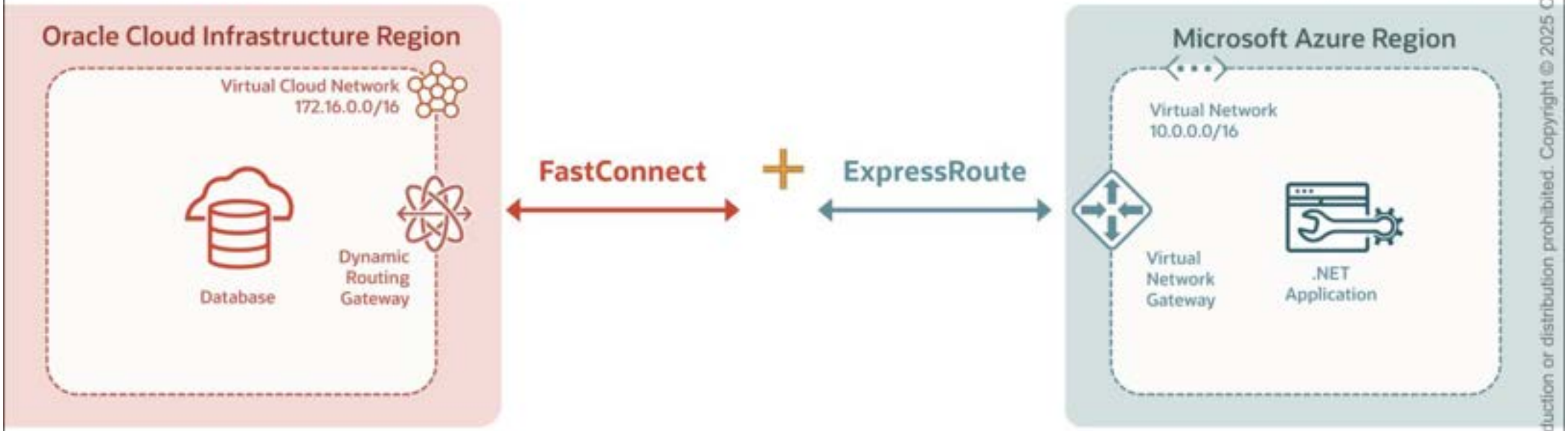
Oracle Cloud Infrastructure

OCI-Azure Interconnect Setup

OCI-Azure Interconnect



Interconnect Setup Process

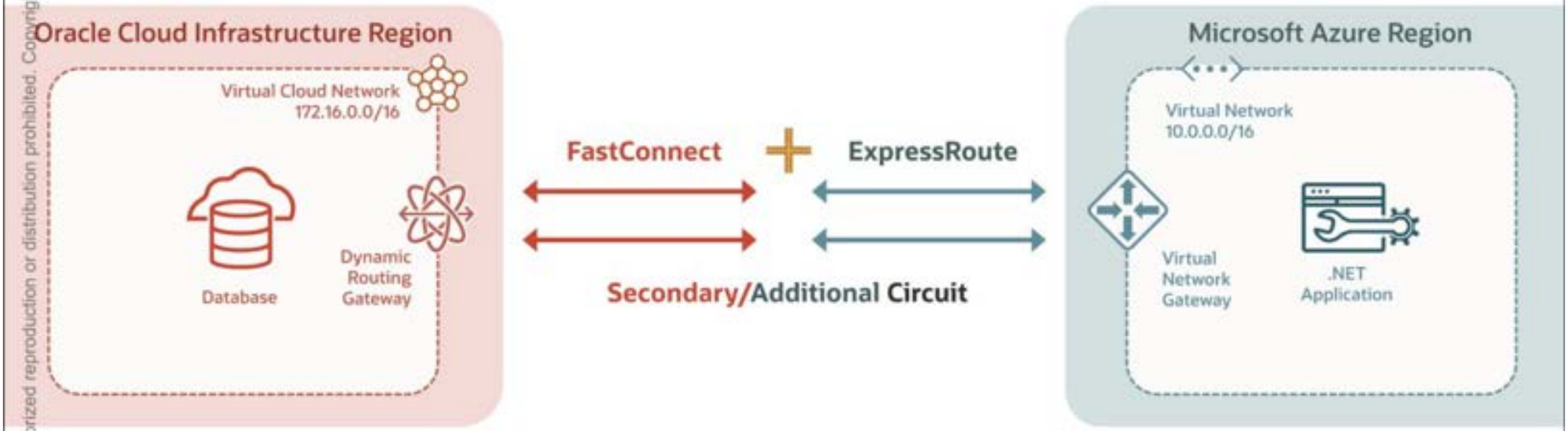
Tasks	Oracle Cloud Infrastructure	Microsoft Azure
Task 1	Configure VCN Security List	Configure VNET Security Group
Task 2		Setup Azure ExpressRoute circuit
Task 3	Setup Oracle Fastconnect Virtual circuit	
Task 4	Confirm circuits are provisioned	Confirm circuits are provisioned
Task 5	Configure routing for VCN	Configure routing for VNET
Task 6	Test the connection	Test the connection

BGP Requirements

- The connection between the Azure VNet and OCI VCN uses BGP dynamic routing
- The connection is redundant; therefore, two BGP sessions are required
- Administrators are required to provide IP ranges for the BGP advertising to use:
  - A primary pair of BGP addresses (one IP address each for OCI and Azure)
  - A separate, secondary pair of BGP addresses (one IP address each for OCI and Azure)
- For each pair, you must provide a separate block of addresses with a subnet mask from /28 to /31

Redundancy and High Availability

The connection is self-redundant, with two circuits and BGP sessions running in the background. However, admins may still deploy multiple circuits, Interconnect or IPSEC, as additional redundancy.



Bandwidth and Cost Considerations

- The cost of Oracle FastConnect is the same across all the Oracle Cloud Infrastructure regions. There are no separate ingress or egress data charges.
- Azure has more than one SKU available for ExpressRoute, with different options and pricing. Pricing also varies from region to region.
- FastConnect is available in 1, 2, 5 or 10 Gbps, so a proper sizing exercise and planning is recommended.
- Azure ExpressRoute supports up to 10 Gbps bandwidth
- It is recommended to match bandwidth allocation on both ends.

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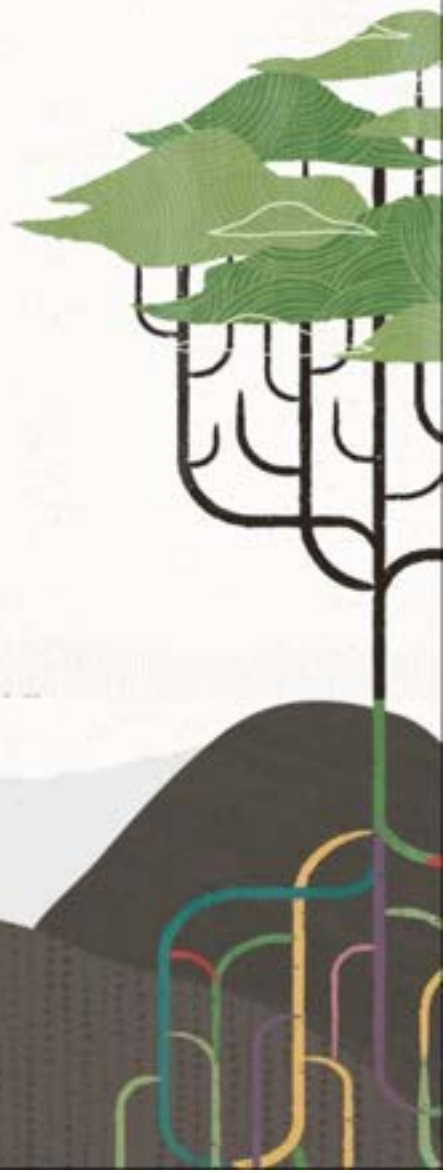
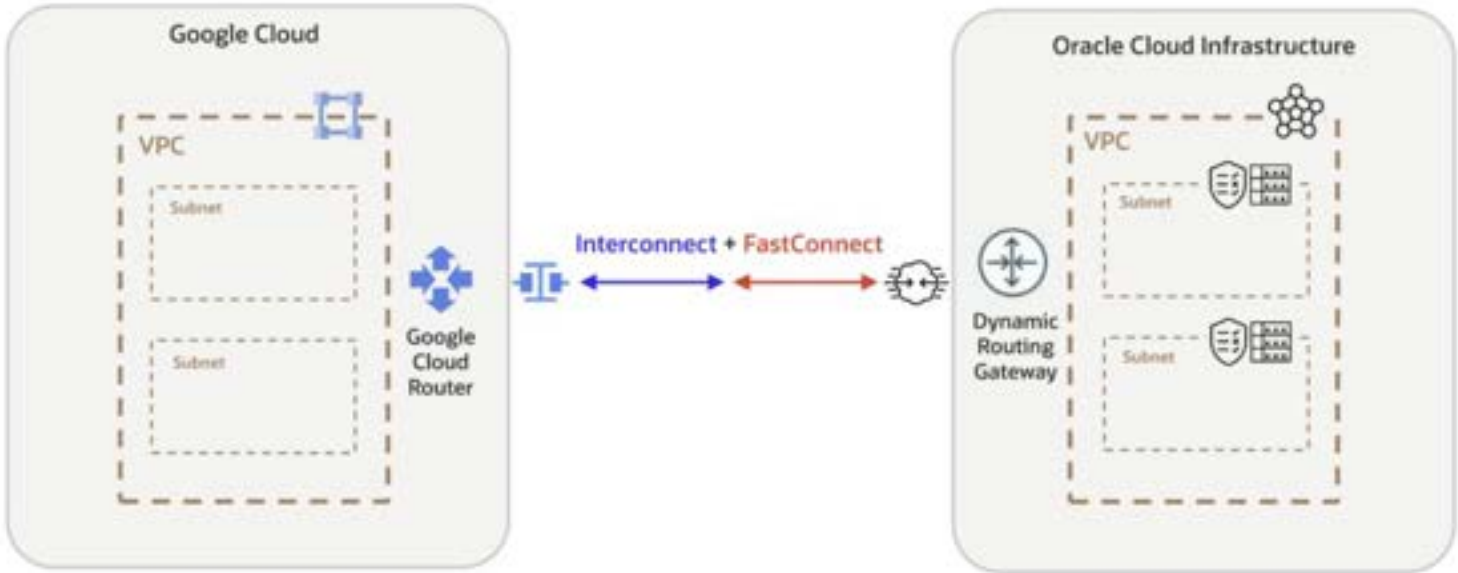
Oracle Cloud Infrastructure

Oracle Interconnect for Google Cloud

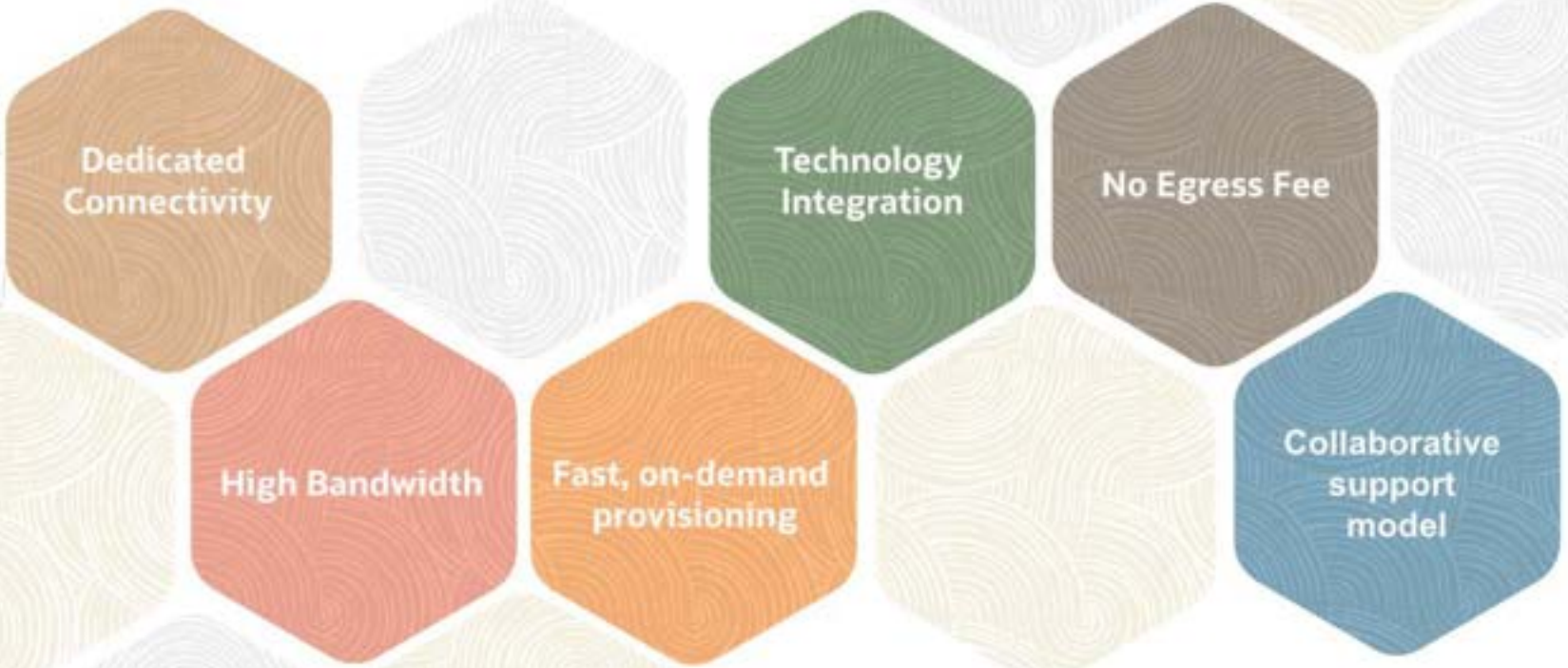


Oracle Interconnect for Google Cloud Overview



A dedicated, private interconnection service

Benefits

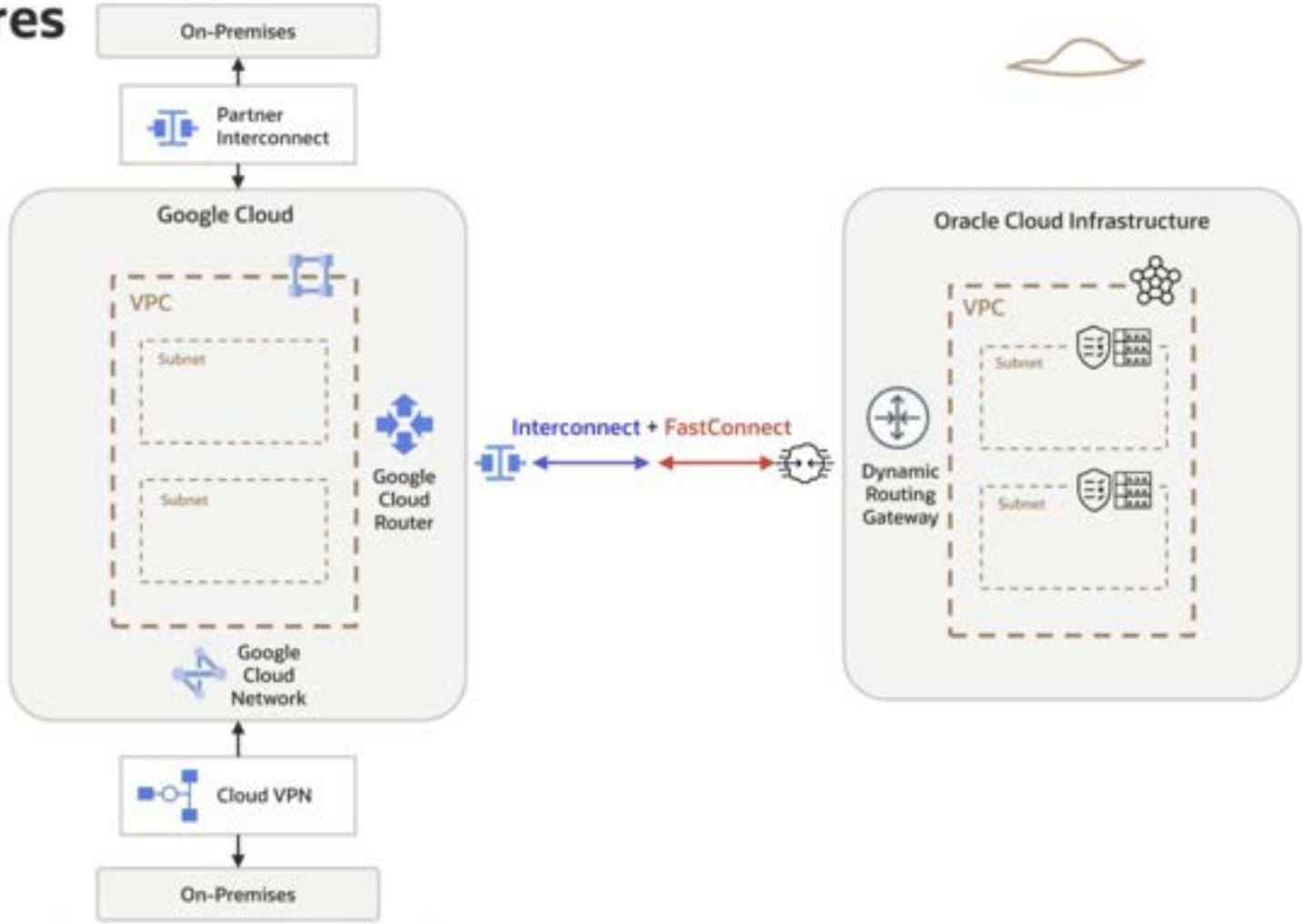


Oracle Interconnect for Google Cloud Regions

Google Cloud region	Paired Oracle Cloud Infrastructure region
asia-northeast1	ap-tokyo-1
asia-south1	ap-mumbai-1
asia-southeast1	ap-singapore-1
australia-southeast1	ap-sydney-1
australia-southeast2	ap-melbourne-1
europe-southwest1	eu-madrid-1
europe-west2	uk-london-1
europe-west3	eu-frankfurt-1
northamerica-northeast1	ca-montreal-1
southamerica-east1	sa-saopaulo-1
us-east4	us-ashburn-1

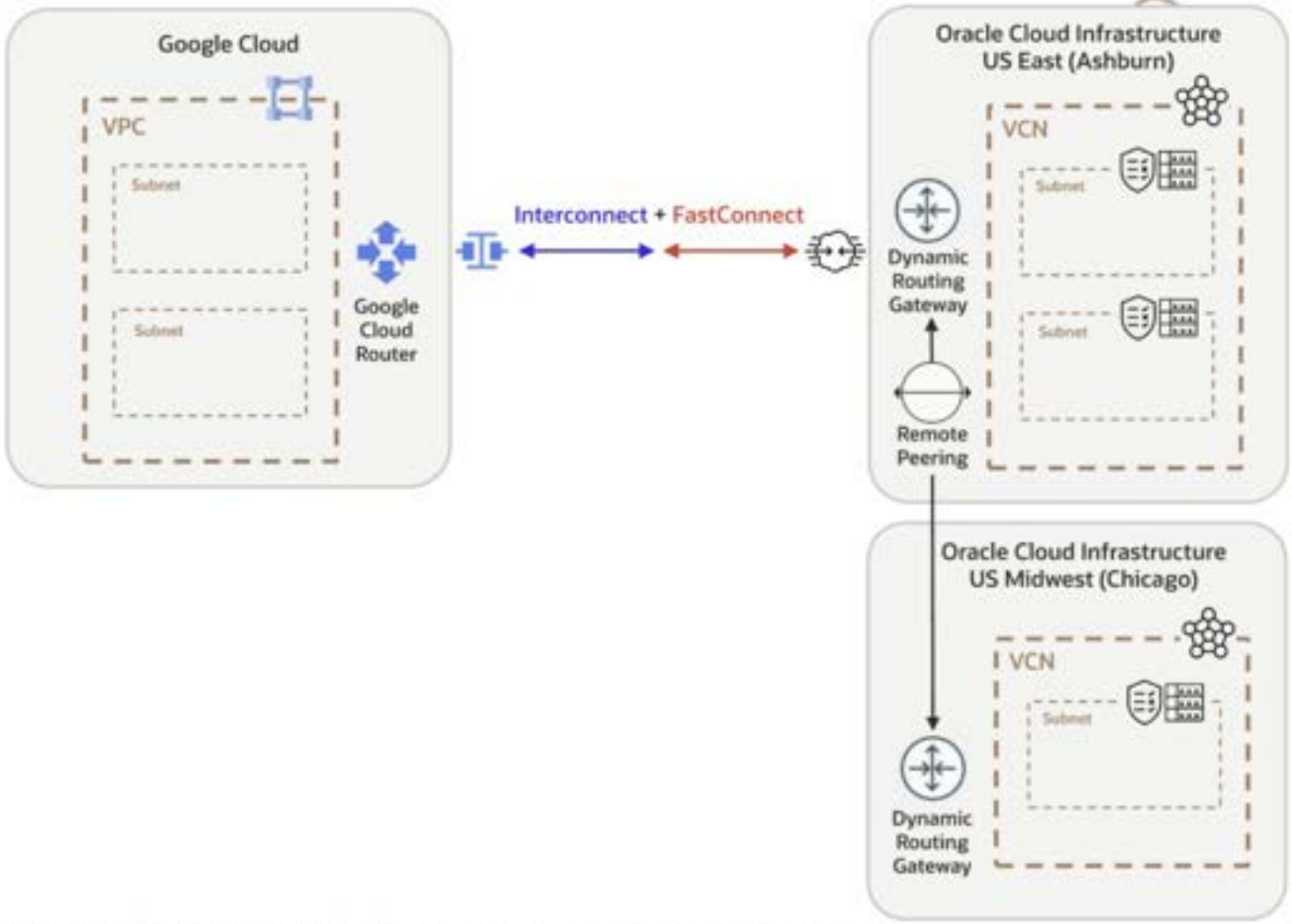
Common Architectures

Extend the Oracle Interconnect for Google Cloud with Network Connectivity Center

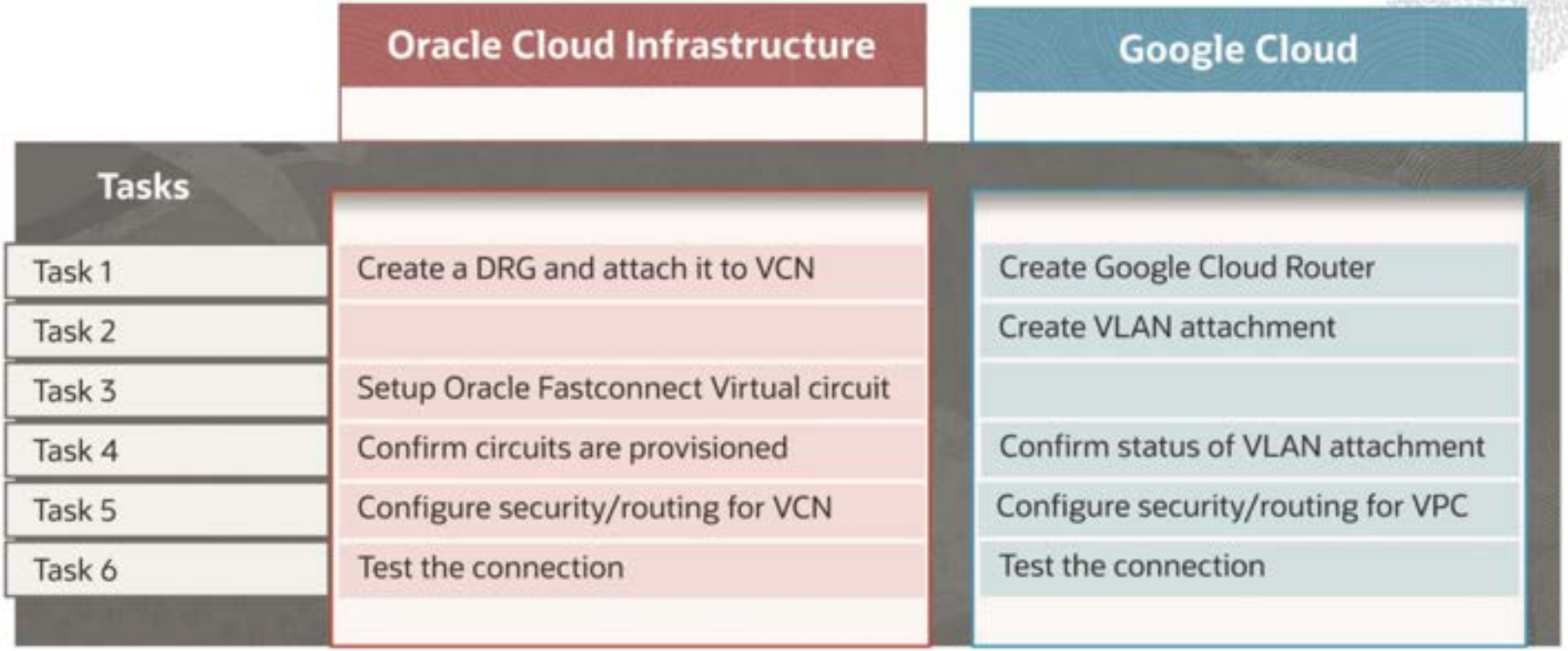


Common Architectures

Enable remote on-ramp to other regions using the Oracle backbone

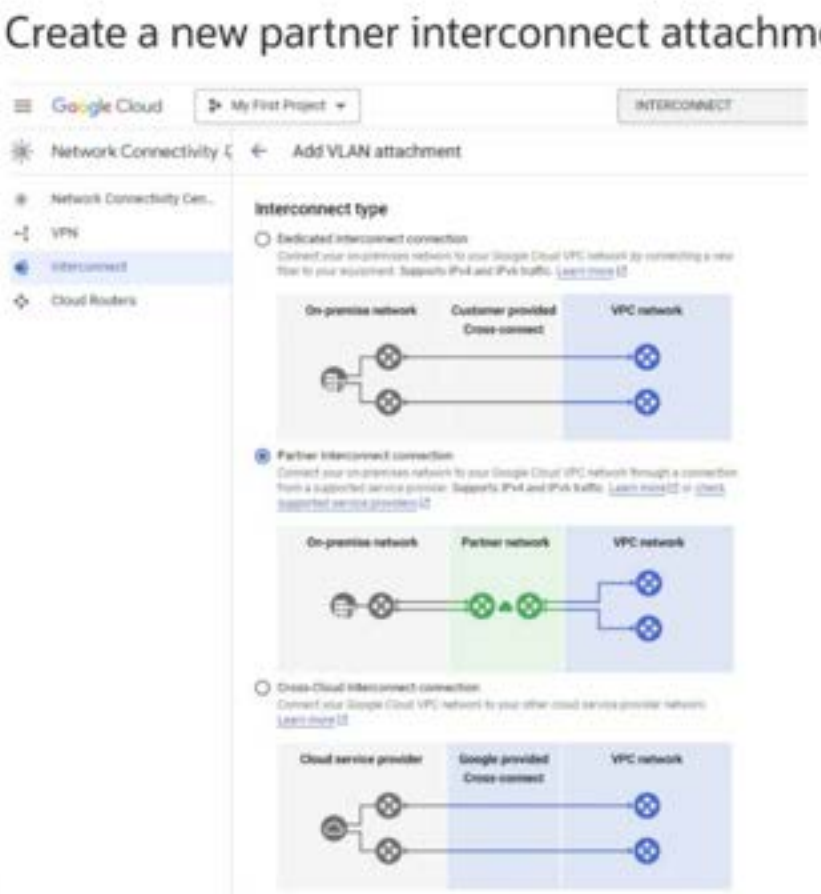


Interconnect Setup Process



Provisioning Workflow (GCP)

Add VLAN attachment

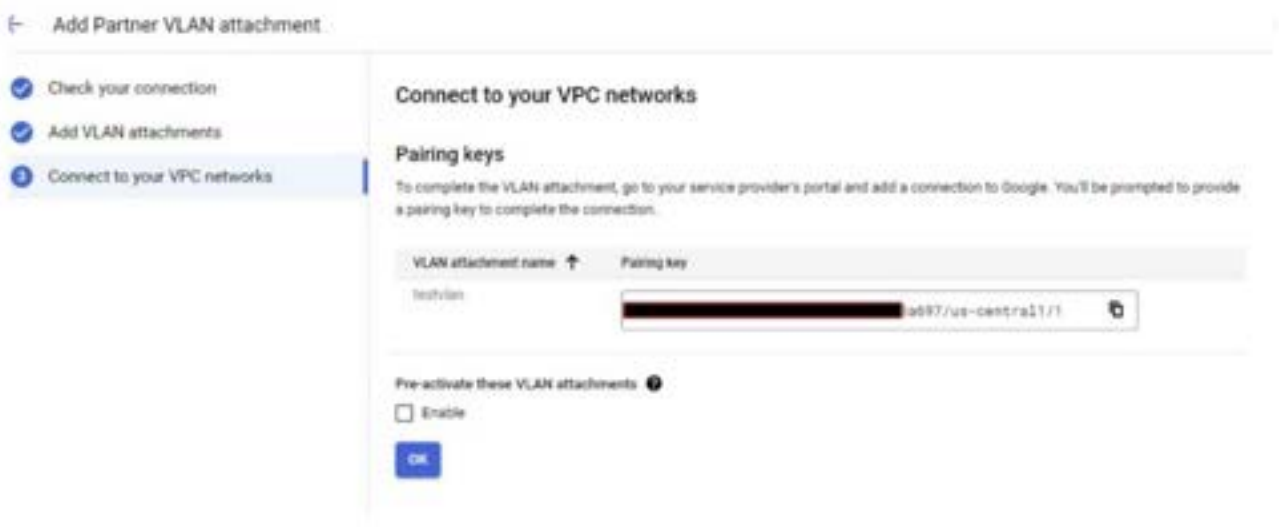


Provisioning Workflow (GCP)

Pairing Keys

To complete the VLAN attachment, go to OCI and add a connection to Google.

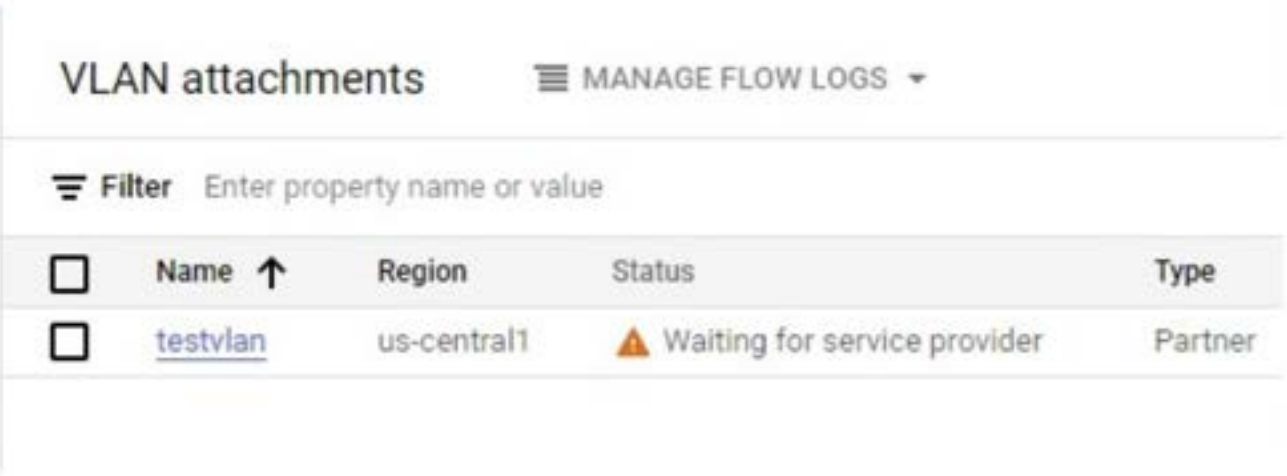
You will be prompted to provide a pairing key



Provisioning Workflow (GCP)

Activate the connection

Activate the connection after completing the configuration on OCI



Provisioning Workflow (OCI)

Connection Type

Create a new FastConnect connection of the type “FastConnect partner”

Provisioning Workflow (OCI)

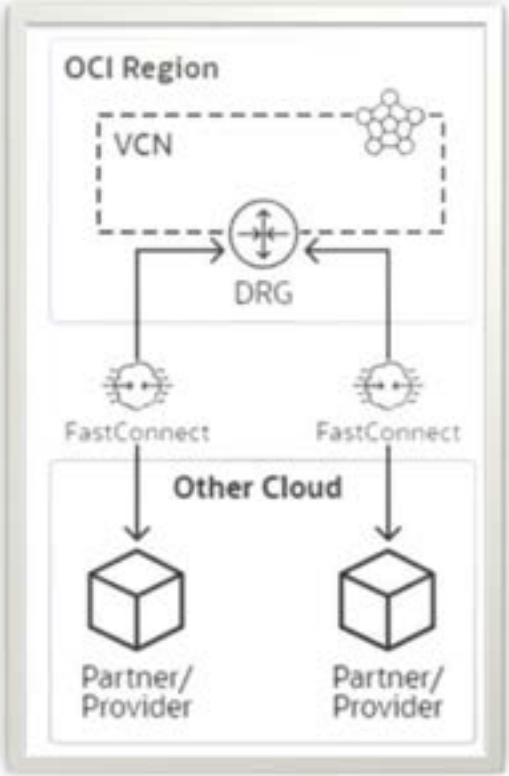
Create Connection

Select DRG, Provisioned bandwidth, MTU and pairing key (from GCP)

Provisioning Workflow (OCI)

Repeat for resiliency

Create a new FastConnect partner connection to Google Cloud



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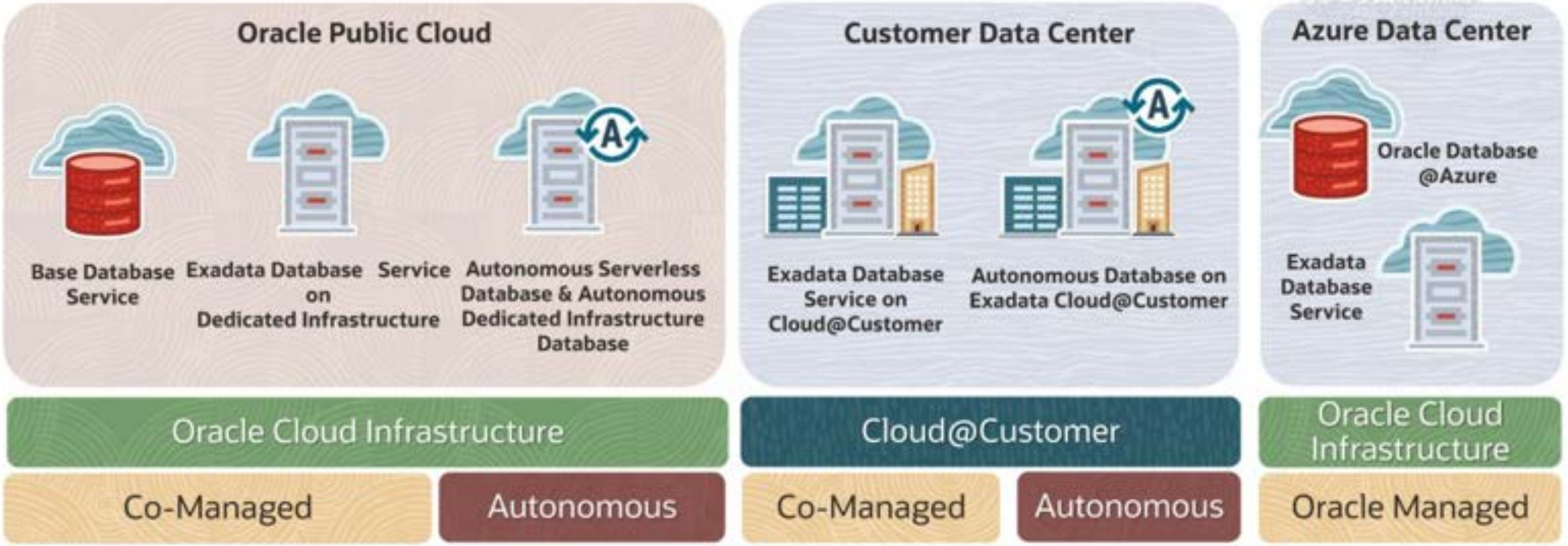
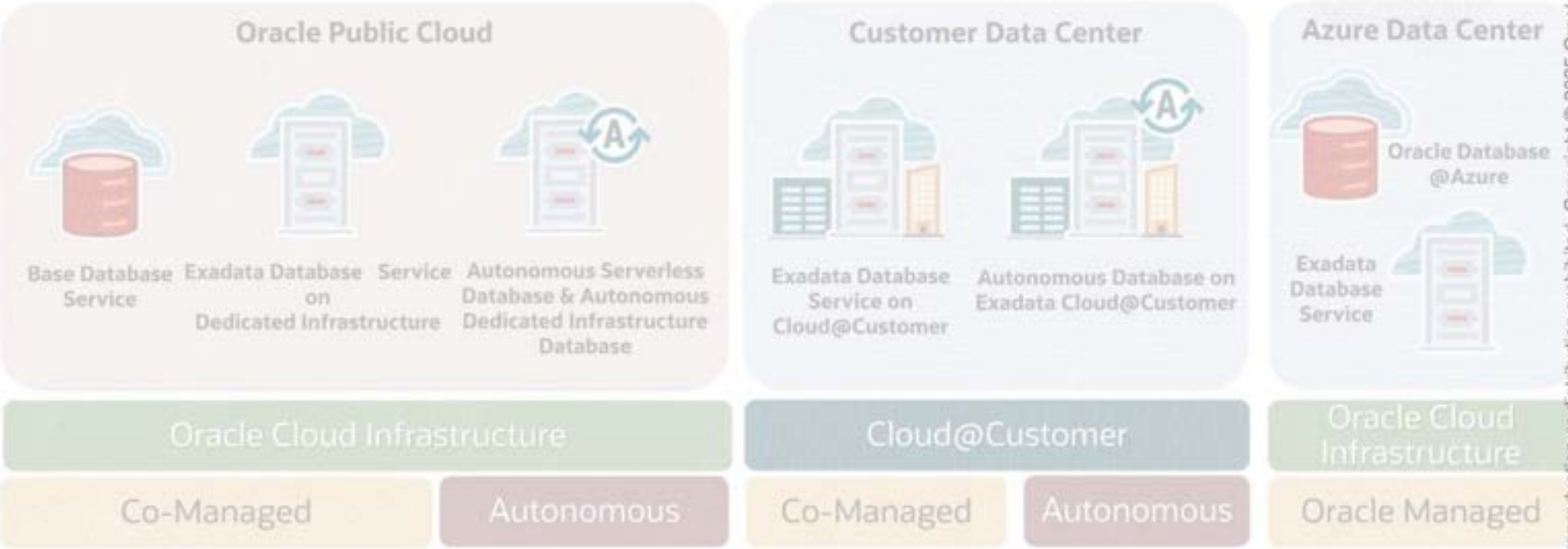
Oracle Multicloud

OCI Database Services Introduction

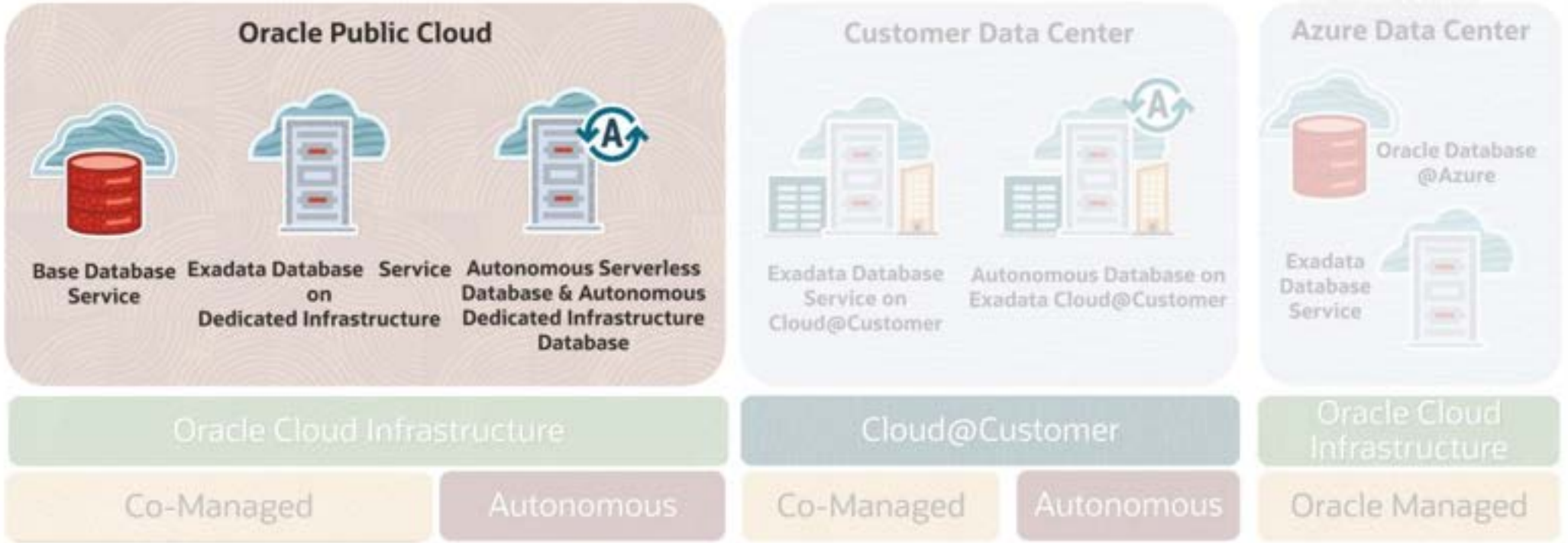
Database Services in Oracle Cloud



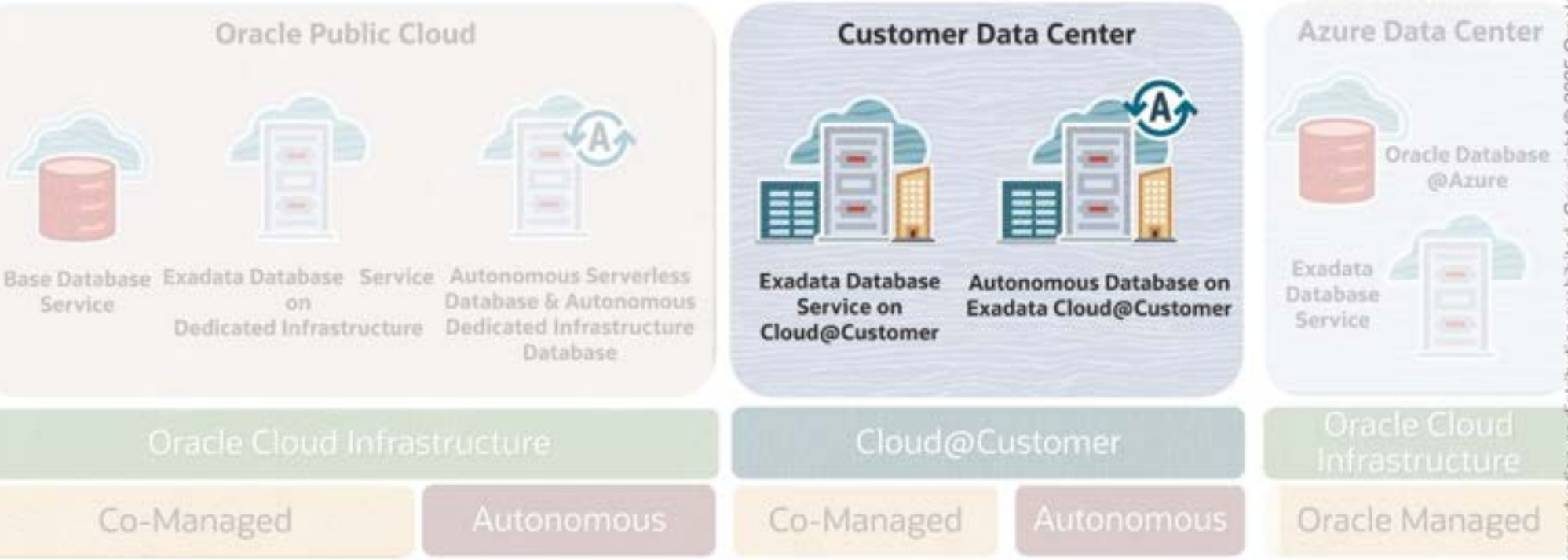
Database Services in Oracle Cloud



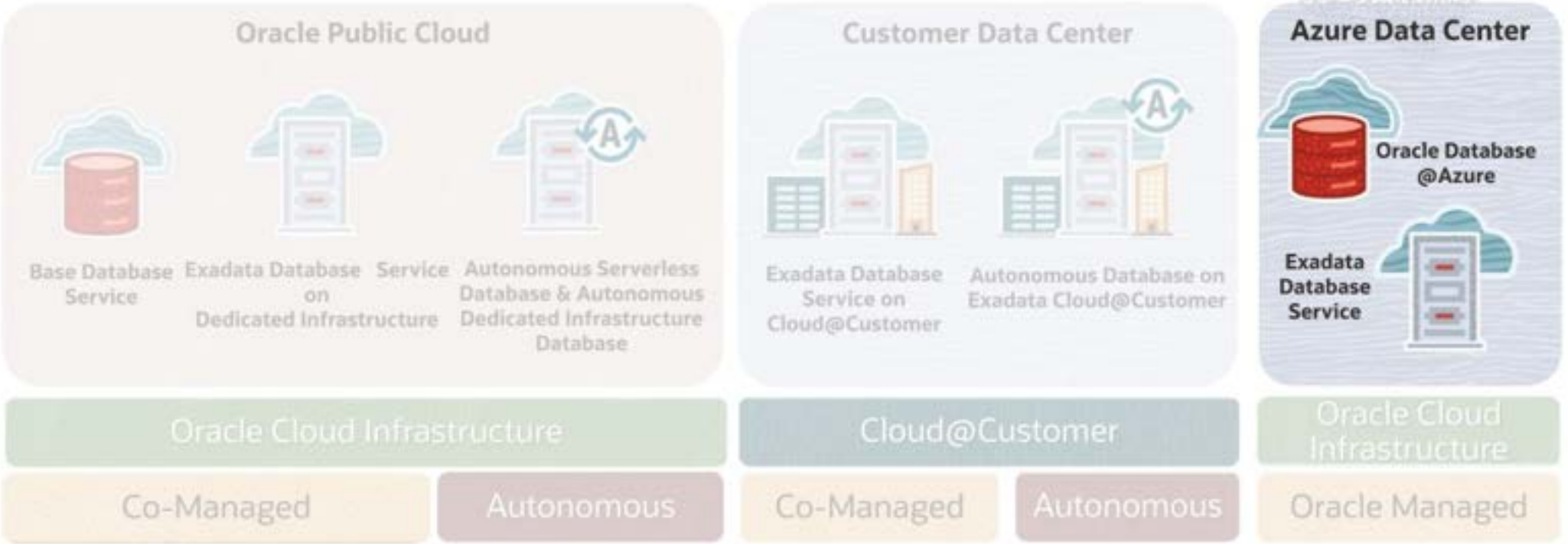
Database Services in Oracle Cloud



Database Services in Oracle Cloud



Database Services in Oracle Cloud



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Oracle MultiCloud

Oracle Base Database Service

Virtual Machine DB Systems

Oracle Base Database Service

Efficiently run and manage database workloads

- Single-instance or 2-node RAC Virtual Machines
- Cloud automation under customer control—provisioning, patching, backup, disaster recovery
- 4 tiers of Oracle Database License Included options or Bring Your Own License
- Runs all supported Oracle database versions

Faster time to production

Improved Availability with RAC

Secure isolated environments

License-Included Oracle Database Options

4 licensing tiers of functionality to meet application-specific requirements

Enterprise Edition Extreme Performance

- Database In-Memory
- Active Data Guard
- Real Application Clusters
- Application Continuity*

Enterprise Edition High Performance

- Partitioning & Multitenant
- Advanced Compression
- Advanced Security
- Life Cycle and Cloud Management Packs

Enterprise Edition

- Data Guard
- Real Application Testing
- Data Masking and Subsetting Pack
- Tuning Pack and Diagnostic Packs

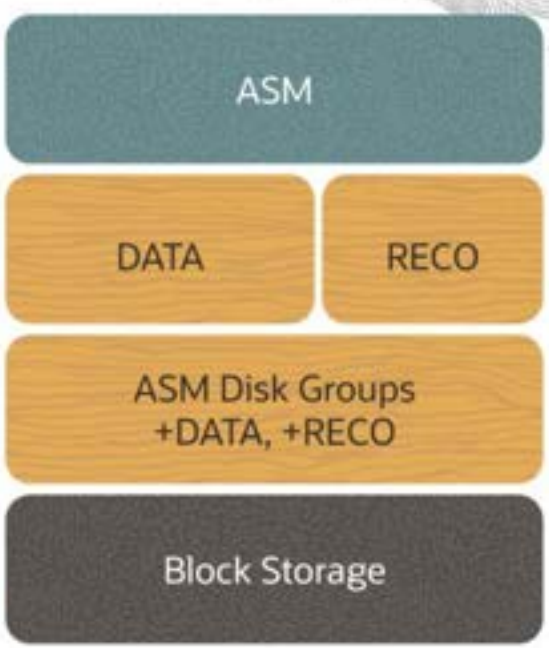
Standard Edition 2

- Transparent Data Encryption (TDE)
- Multitenant with 3 PDB
- Machine Learning
- Spatial and Graph

* Requires the Oracle Active Data Guard or the Oracle Real Application Clusters option

VM DB Systems Storage Architecture

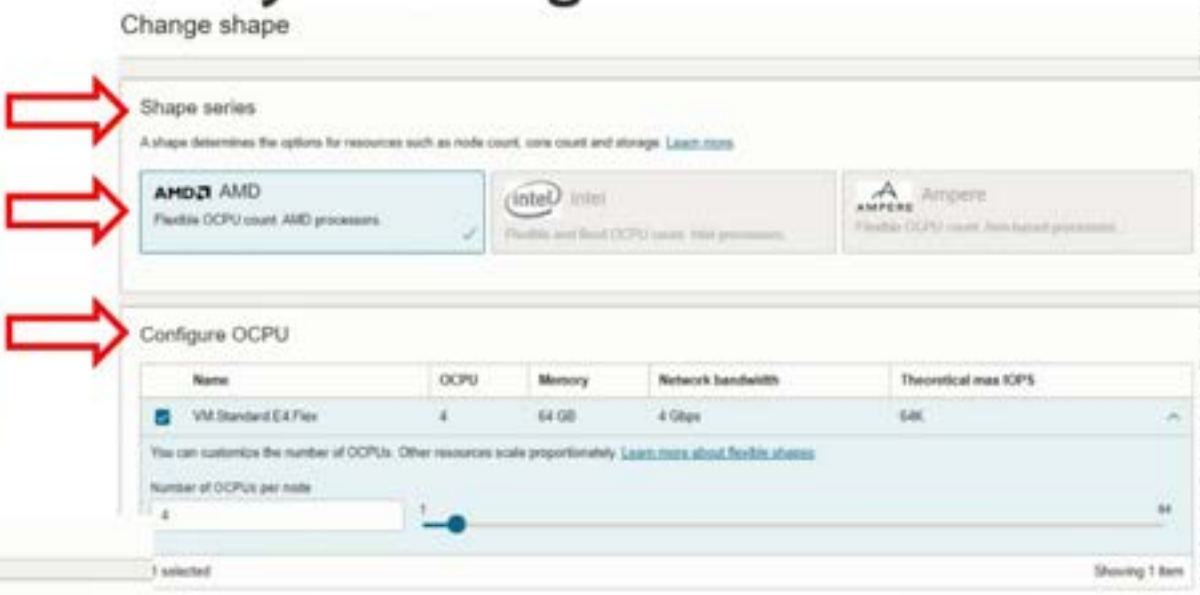
- There is a choice of LVM or Grid Infrastructure (ASM) storage management.
- ASM uses DATA and RECO disk groups.
- Block Storage provides triple mirroring of data.
- ASM redundancy is set to external.
- DB System clones are also supported.



Cloud Automation for Life Cycle Management

Oracle Cloud Web-based UI, REST APIs, SDK, CLI

- Scale OCPUs
- Scale up storage



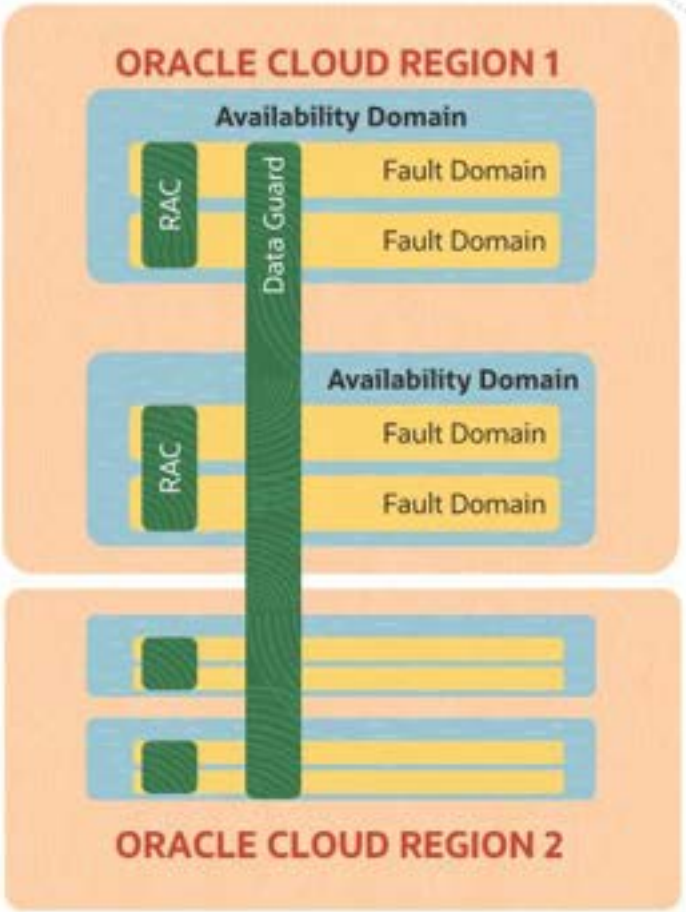
Cloud Automation for Life Cycle Management

Oracle Cloud Web-based UI, REST APIs, SDK, and CLI

- Enable Data Guard
- Backup and recovery

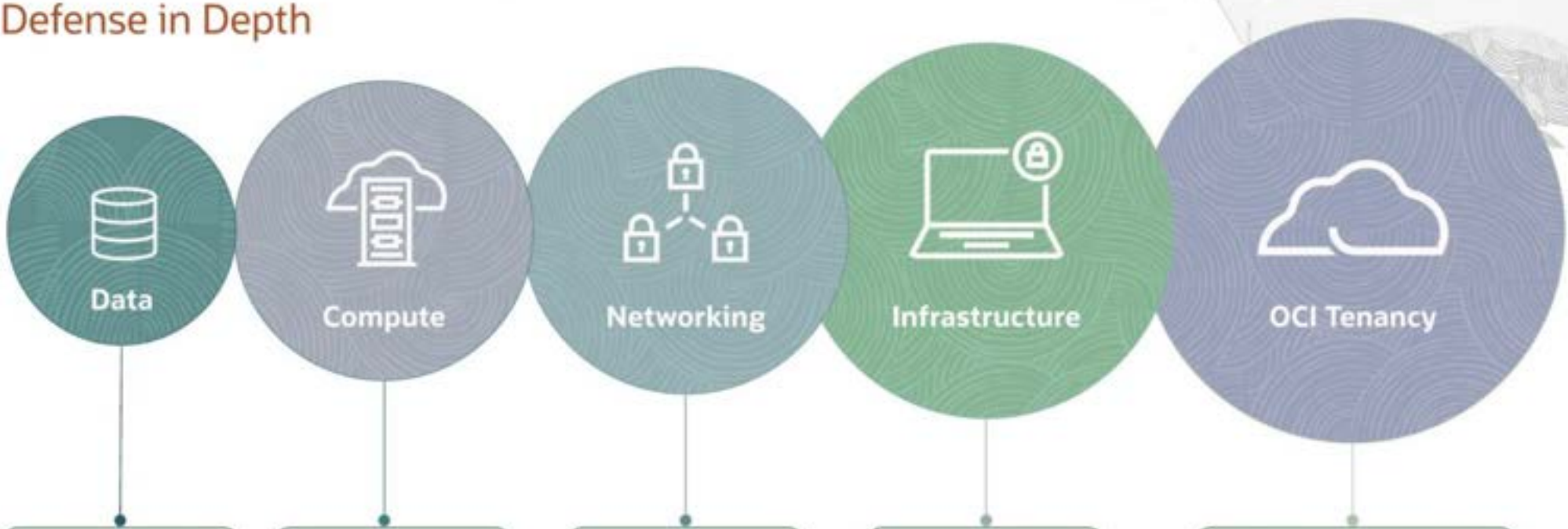
High Availability and Disaster Recovery

- Real Application Clusters (RAC) across Fault Domains provides database instance fault isolation.
- Data Guard deployed across availability domains within a region provides high availability.
- Data Guard deployed across regions provides geographic isolation for disaster recovery.



Integrated Security from Data to Identity

Defense in Depth



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Oracle Multicloud

Autonomous Databases

Autonomous Services Automatically Secure, Tune, and Scale Your Apps

Automatic provisioning

Automatic configuration

Automatic encryption

Automatic online patching and updating

Automatic elastic scaling

Automatic tuning

- Eliminates human labor
- Eliminates human error
- Eliminates down time
- Eliminates scaling complexity
- Eliminates performanc e tuning complexity

Autonomous Database

Types

Fully managed database with two workload types

Fully managed database with two development environments

Autonomous Database

Deployment options

Serverless

It allows provision and management of only the Autonomous DB.

Oracle handles Exadata infrastructure deployment and management.

Dedicated

It allows exclusive use of the Exadata hardware.

Fully managed database with two workload types

Autonomous Transaction Processing

Autonomous Data Warehouse

Autonomous – Serverless

Autonomous – Dedicated

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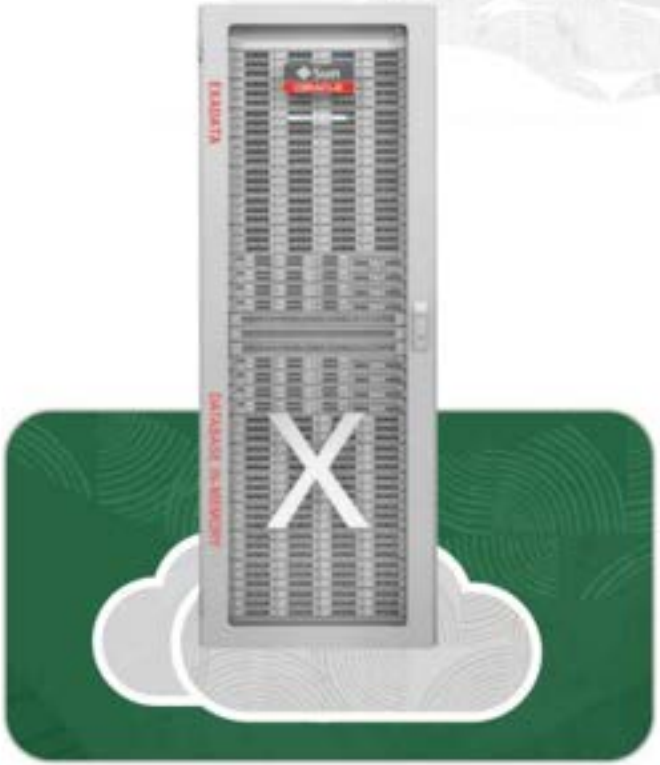
Exadata Database Service

What Is Exadata Database Service?

- **Oracle Database offering with all features and options:**
  - Industry-leading Oracle database for mission-critical OLTP and Analytics workloads
- **On Exadata Database Machine:**
  - The fastest and most available Oracle Database platform
  - Ideally suited for cloud computing
- **In the Oracle Cloud:**
  - Monthly subscription, no capital expenditure
  - Oracle deploys and manages the infrastructure
  - Simple, fast, web-driven service provisioning
  - Complete service isolation with no over-provisioning
  - 100% compatibility with on-premises applications and Oracle database



Database Services on Exadata in Oracle Cloud

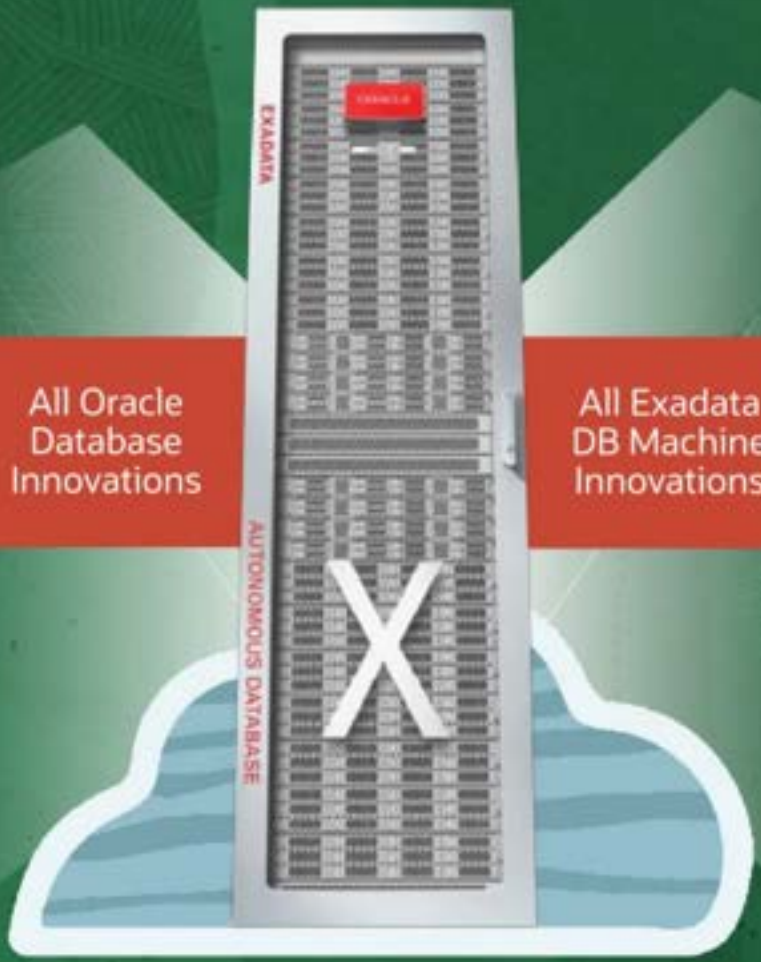
Data Center	**Public Cloud (Oracle Cloud Infrastructure)**		**Customer Data Center**		**Azure Data Center**
Deployment	**Exadata Cloud Infrastructure**		**Exadata Cloud@Customer**		**Exadata Cloud Infrastructure**
Management Model	Co-managed*	Autonomous	Co-managed*	Autonomous	Oracle Managed
Database Service	 Exadata Database Service on Dedicated Infrastructure	 Autonomous Database on Dedicated Exadata Infrastructure	 Exadata Database Service on Cloud@Customer	 Autonomous Database on Exadata Cloud@Customer	 Oracle Database@Azure

❖ **Co-managed*: Oracle-managed infrastructure, customer-managed virtual machines and databases**

Exadata in Oracle Cloud: Most Complete Database Service Available

- Multitenant
- In-Memory DB
- Real Application Clusters
- Active Data Guard
- Partitioning
- Advanced Compression
- Advanced Security, Label Security, DB Vault
- Real Application Testing
- Advanced Analytics, Spatial and Graph
- Management Packs for Oracle Database

All Oracle Database Innovations



All Exadata DB Machine Innovations

- Offload SQL to Storage
- RoCE Fabric
- PMEM Commit and Data Accelerators
- Smart Flash Cache
- Storage Indexes
- Columnar Flash Cache
- Hybrid Columnar Compression
- I/O Resource Management
- Network Resource Management
- In-Memory Fault Tolerance
- Exafusion Direct-to-Wire Protocol

OCPU Scaling Options for Exadata Database Service

Exadata OCPUs can be scaled within exiting servers as follows:

- **OCPUs can be scaled up or down online** symmetrically in multiples of the number of database servers currently provisioned for the Exadata VM cluster.
  - You can scale the Exadata Database Service instance down to zero enabled OCPUs.
  - **With zero-enabled OCPUs**, you are billed only for the infrastructure until you scale up the system.

Exadata OCPUs can also be scaled beyond exiting servers as follows:

- **For X8M/X9M Flexible Infrastructure systems** can simply add Compute servers as required.
- **For X6,X7, X8 Fixed-shape systems** will need to change to a larger shape.

Cost-Effective Software Licensing Models

Subscribe to infrastructure and choose Licensing Model

License Included Pricing

Ideal for organizations with new workloads and dynamic utilization

- **Includes Oracle Database Enterprise Edition, Options and Management Packs** at one low price
- Pay-per-use pricing for software and active OCPUs, all paid for with Universal Credits

Bring Your Own License Pricing

Ideal for organizations moving existing workloads with consistent usage to the cloud

- Utilize **existing on-premises licenses** and Save on existing software support
- Includes Transparent Data Encryption, Data Safe, Oracle Machine Learning, and select management packs at no additional cost

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Oracle Cloud Infrastructure

MySQL Database Service

Oracle University

MySQL

World's best opensource database

Most popular opensource database of choice

Very efficient for OLTP across many industry (e-commerce, social media, tech, finance, manufacturing)

Social media | ECommerce | FinTech | Manufacturing

High-performance, highly reliable

Available with free and enterprise grade edition

MySQL Database Service

Transition from self-managed to fully managed

- Fully managed MySQL database in Oracle Cloud Infrastructure
- OCI native
- Beats on-premises deployment complexity
- Enterprise rich features – backup and recovery, patching, security, high-availability
- Full automation benefits
- Easy adoption for enterprises using application in on-premises MySQL DB

MySQL Database Service

A glance into the fully managed features

- Provisioning
  - choose your required compute shape,
  - MySQL Server Enterprise Edition 8.0
  - select your VCN
  - choose storage size for high performance block storage
  - choose Standalone/High Availability/HeatWave configuration
- Edit DB system shape, configuration, monitor and increase storage from console

MySQL Database Service

A glance into the fully managed features

- Connect to DB System endpoints using Compute, VPN, Bastion, Cloud Shell and OCI SQL worksheet
- Create, edit and monitor Read Replicas with Load Balancer
- Create full and incremental backup with point-in-time restore capability
- Migrate from on-premises to OCI MySQL DB Service using MySQL Shell `dumpX` and `loadDump` utilities
- Inbound and outbound Replication

Note: Only MySQL HeatWave and Standalone configuration is supported with ODSA provisioning of MySQL database service

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MySQL Database Service – High Availability Configuration

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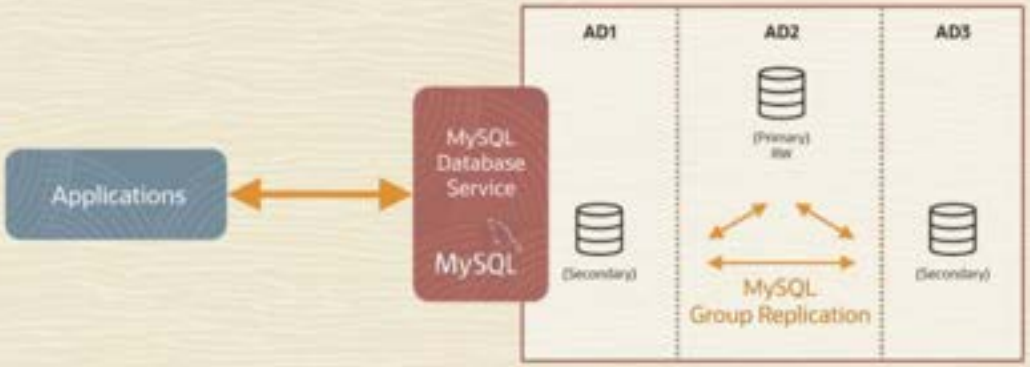
MySQL Database Service

Increase application uptime with **High Availability** configuration

Zero Data Loss

Automatic Failover

Multi-AD region



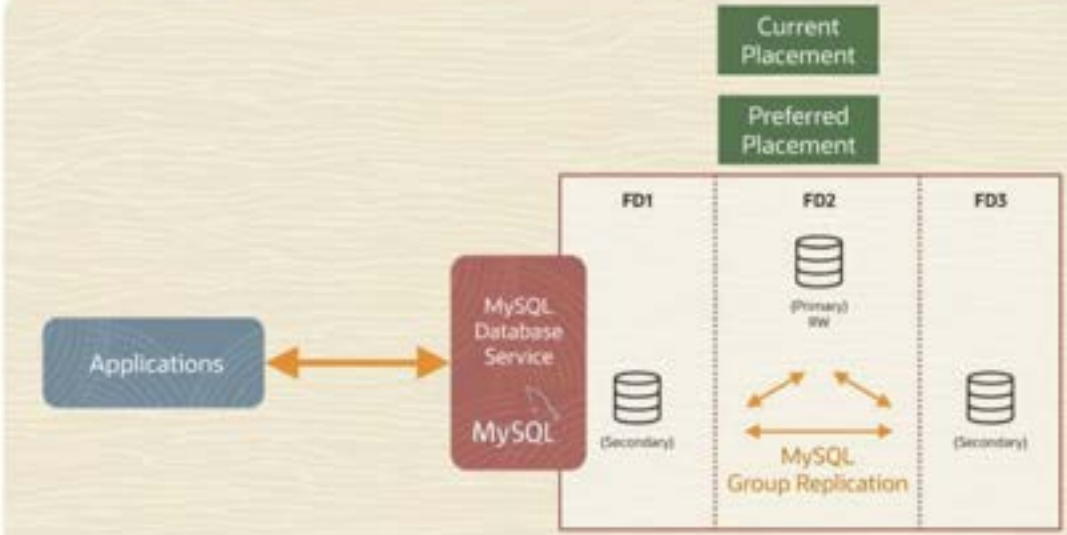
- One primary (RW mode) and two secondary
- Deployed across multiple availability domains or Fault domains
- Uses Native MySQL Group Replication
- Replicated over secured and managed internal network
- Prerequisite: Define Primary Keys on tables

Note:
Not available for provisioning with ODSA currently

Supported Version of MySQL : 8.0.24

MySQL Database Service

High Availability Automatic Failover (Single AD region/Subnet within Single AD)



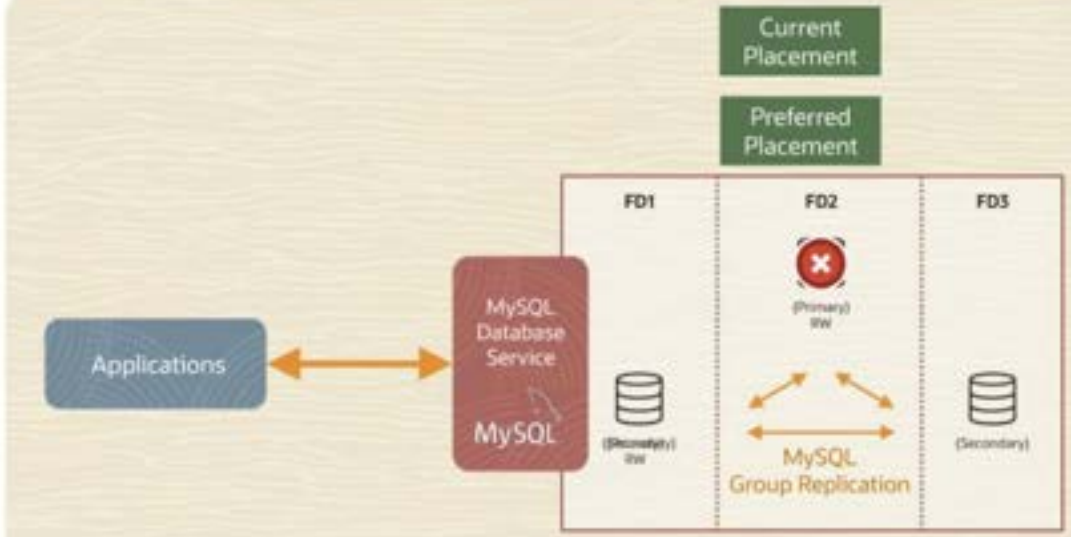
MySQL instance are placed in different fault domains if it is:

- Single AD Region
- Multiple AD region but with AD specific subnet

Note:
Same principle of automatic failover applies even in a multi AD region

MySQL Database Service

High Availability Automatic Failover (Single AD region/Subnet within Single AD)

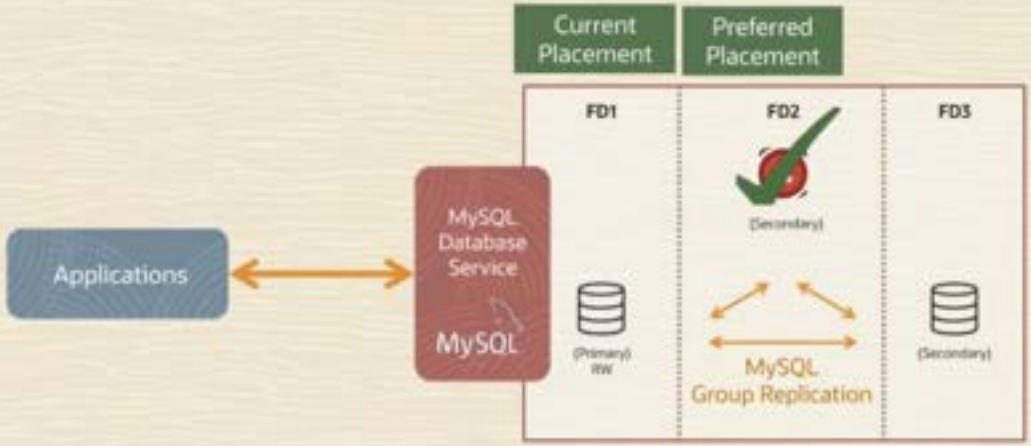


- Automatic Failover
  - RPO = 0
  - RTO in minutes
- No change to DB endpoint during automatic failover or switchover

Message on DB Systems Details page:
Current placement (<DomainName>) differs from preferred placement, due to failover or maintenance activity.

MySQL Database Service

High Availability Automatic Failover (Single AD region/Subnet within Single AD)



- Manual Switchover from Current to Preferred Placement
- Switchover to Preferred Placement can happen when DB system restarts during maintenance
- No change to DB endpoint during automatic failover or switchover

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MySQL Database Service – HeatWave Overview

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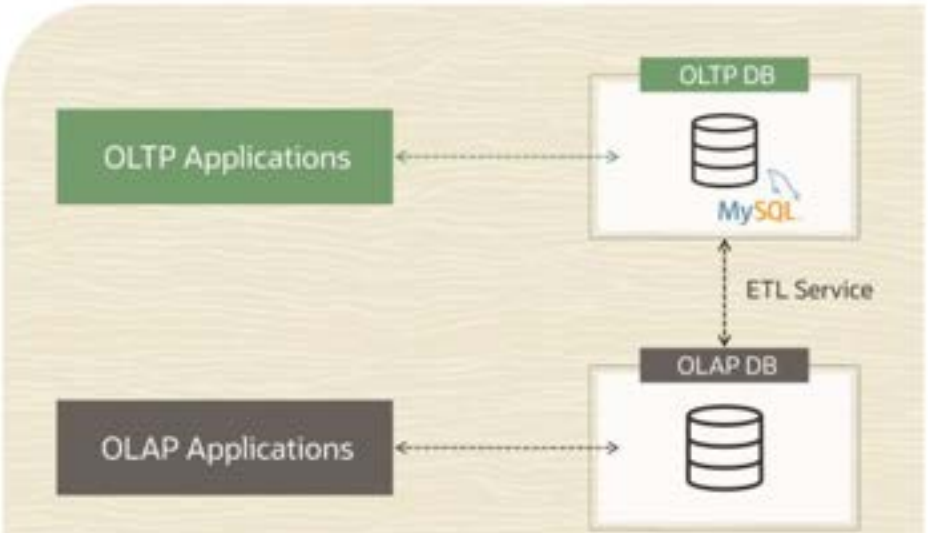
MySQL Database Service

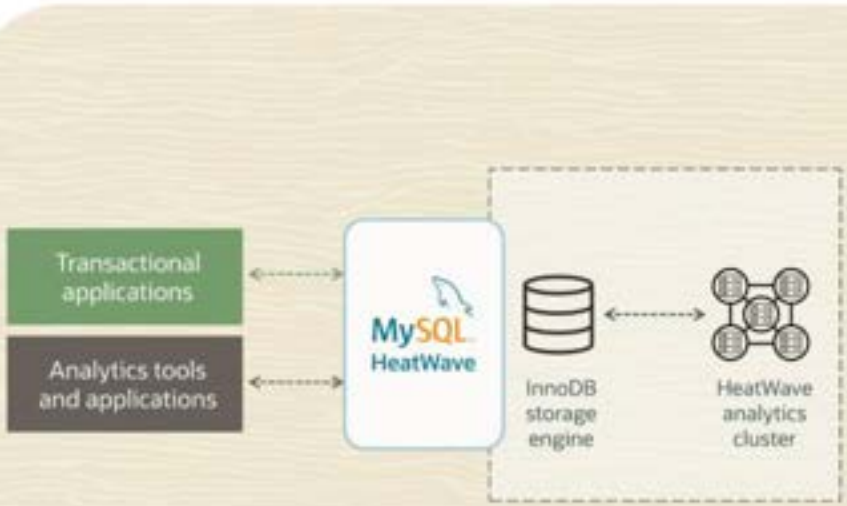
Operating OLTP and OLAP workloads in MySQL Database Service



- Manage two separate databases
- Add ETL step for loading into OLAP database
- Lacks real time analytics
- Maintain dual compliance with security standards
- Billed for two databases and ETL software license

MySQL Database Service

MySQL HeatWave configuration– bring your OLTP and OLAP together

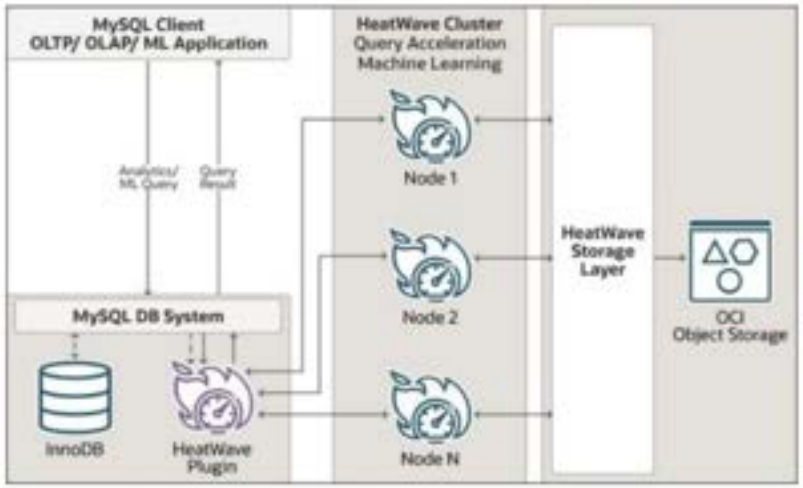


- Single database service for OLTP and OLAP
- No need of ETL processing
- Enables real time analytics
- No application changes needed
- Massively parallel query processing architecture
- Improves security with built-in security features
- Comparatively higher price-performance
- Integrated with OCI native and 3rd party tools

Supported with **ODSA** DB service provisioning

MySQL Database Service

HeatWave configuration



- Comprises of the MySQL DB System and HeatWave cluster nodes
- Distributed, scalable, shared-nothing architecture
- In-memory hybrid columnar query processing engine (RAPID)
- Scale-out Heatwave storage layer persists node data onto OCI Object Storage
- Data transmission between analytics nodes and OCI object storage is encrypted by default
- Faster automated recovery during cluster or node failure/maintenance

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MySQL Database Service – HeatWave Features

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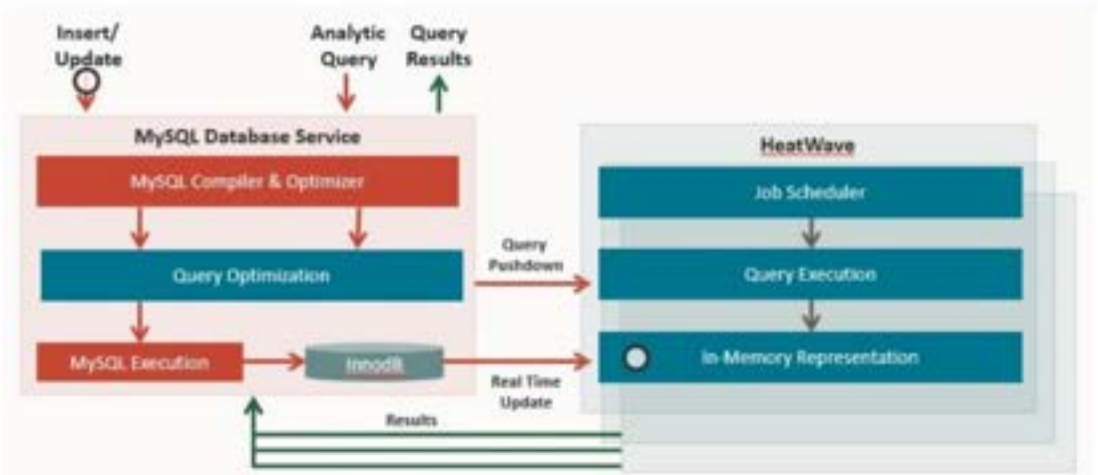
MySQL Database Service

HeatWave configuration: single interface for OLAP, OLTP or Mixed workloads

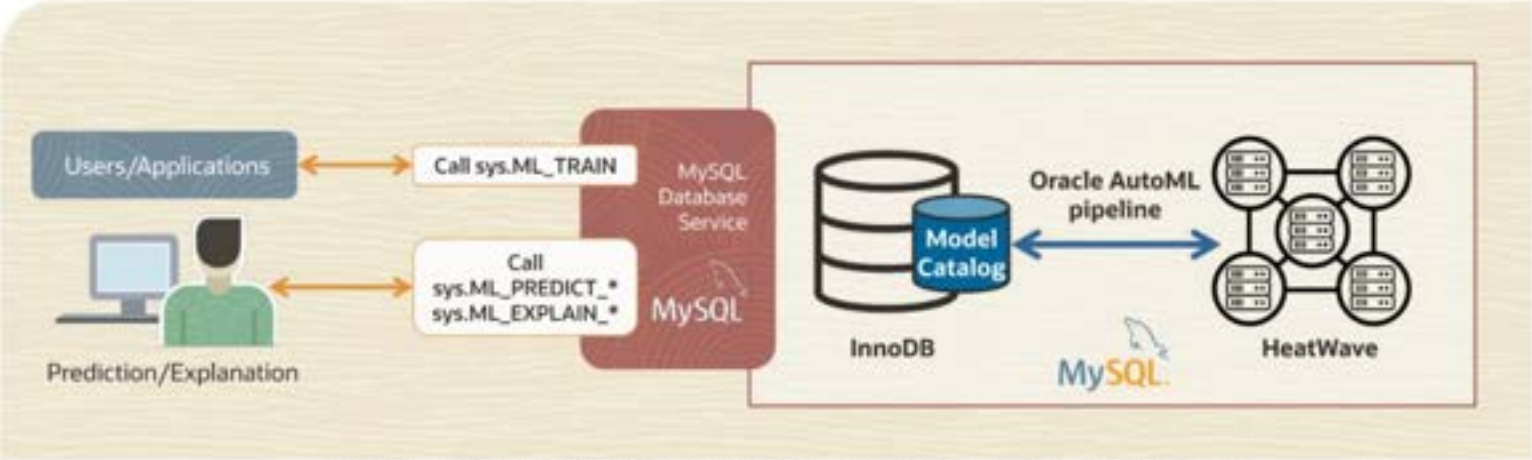


- No change to MySQL syntax
- Transparent Query Push down
- Automatic change propagation to Heatwave nodes

MySQL Database Service

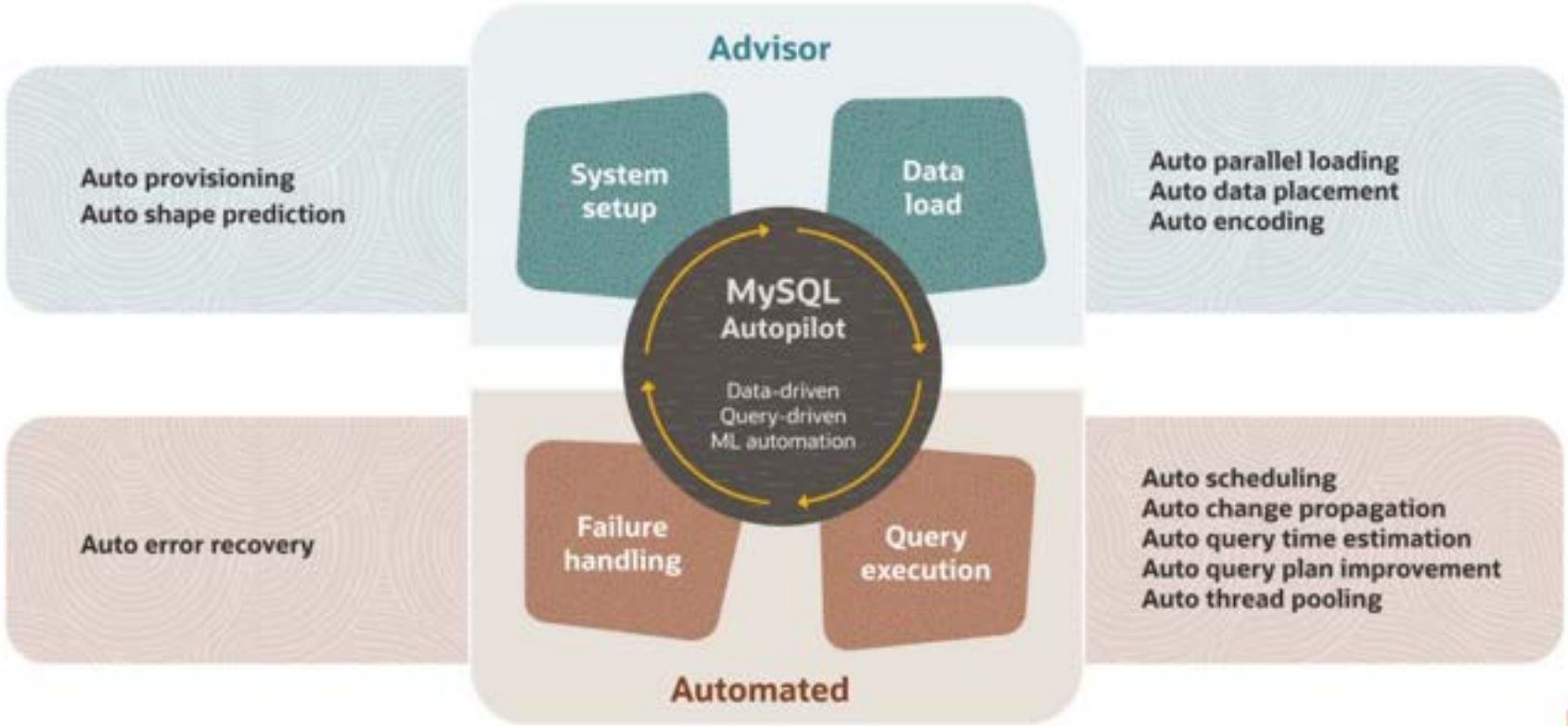
In-database HeatWave AutoML with MySQL HeatWave configuration

- Natively available ML feature in MySQL HeatWave
- Ease of use – no ML/tool/algorithm expertise is needed
- Pre-created ML routines can be invoked as SQL call
- ML_TRAIN routine leverages Oracle AutoML technology



MySQL Database Service

MySQL Autopilot with MySQL **HeatWave** configuration



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Oracle Cloud Infrastructure

Introduction to Oracle Database@Azure

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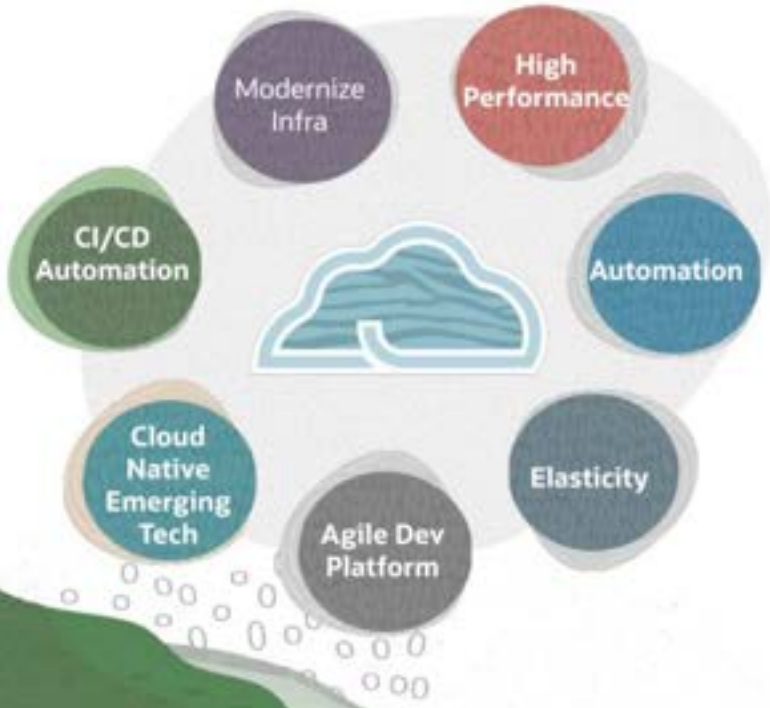
Multicloud

Single Cloud Deployment



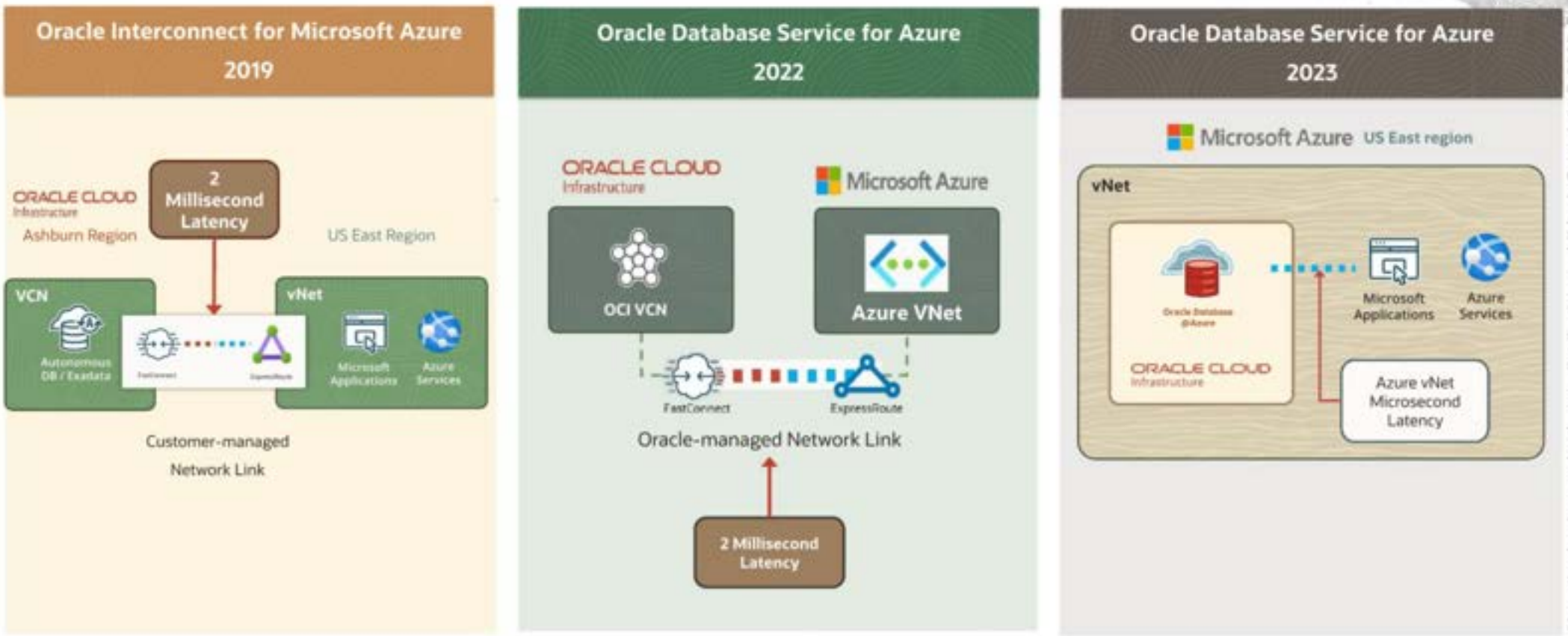
Multicloud Deployment

98% Enterprises use or plan to use two or more clouds

Key Drivers

- Specific Workload Support
- Higher Performance, Security and Compliance
- Business Continuity
- Avoid Vendor Lock-in
- Cost Optimization
- Data Residency
- Business Agility and Innovations

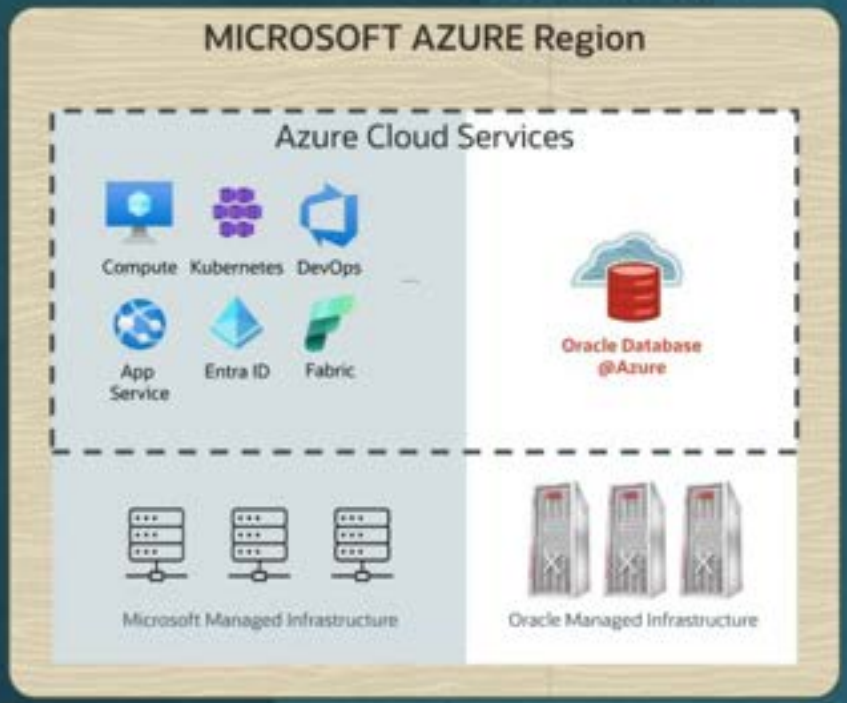
OCI- Azure Interoperability



Oracle Database@Azure

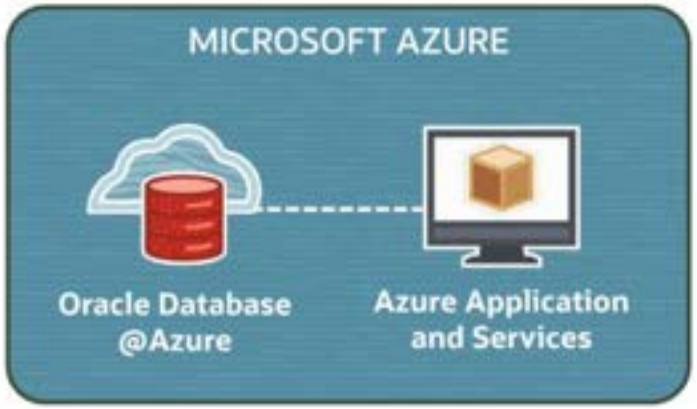
Oracle and Microsoft deliver Oracle database services on OCI in Microsoft Azure datacenters

ORACLE | Microsoft



Oracle Database@Azure Service Overview

- Colocated with Microsoft Azure Data Center
- Native Integration between Azure and OCI resources
- No manual configuration of private interconnect between the providers
- Get Microseconds Latency
- OCI native Exadata Database Service
- Gain the highest level of oracle database performance, scalability, security and availability
- Collaborative technical support from Microsoft and Oracle

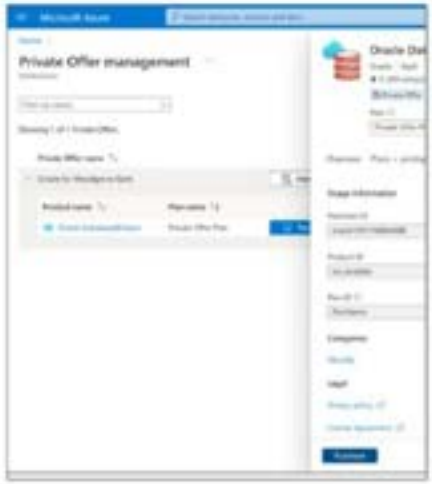


Oracle Database@Azure Easy Adoption

Purchase in Azure Marketplace and parity with OCI

Deploy, manage, and monitor through Azure Portal and APIs

Combine with your choice of Azure services



Oracle Database@Azure Operational Responsibilities

Oracle

⇒ Manage Exadata Database Service Infrastructure running in Azure

⇒ Service Software Updates

⇒ Service Infrastructure updates

⇒ Support Oracle Database@Azure Issues

Azure Customers

⇒ Provision Exadata Database Service Infrastructure

⇒ Manage the Provisioned Databases in the service

⇒ Operate and Monitor Infrastructure and Database

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Oracle Database@Azure – Use Case Scenarios

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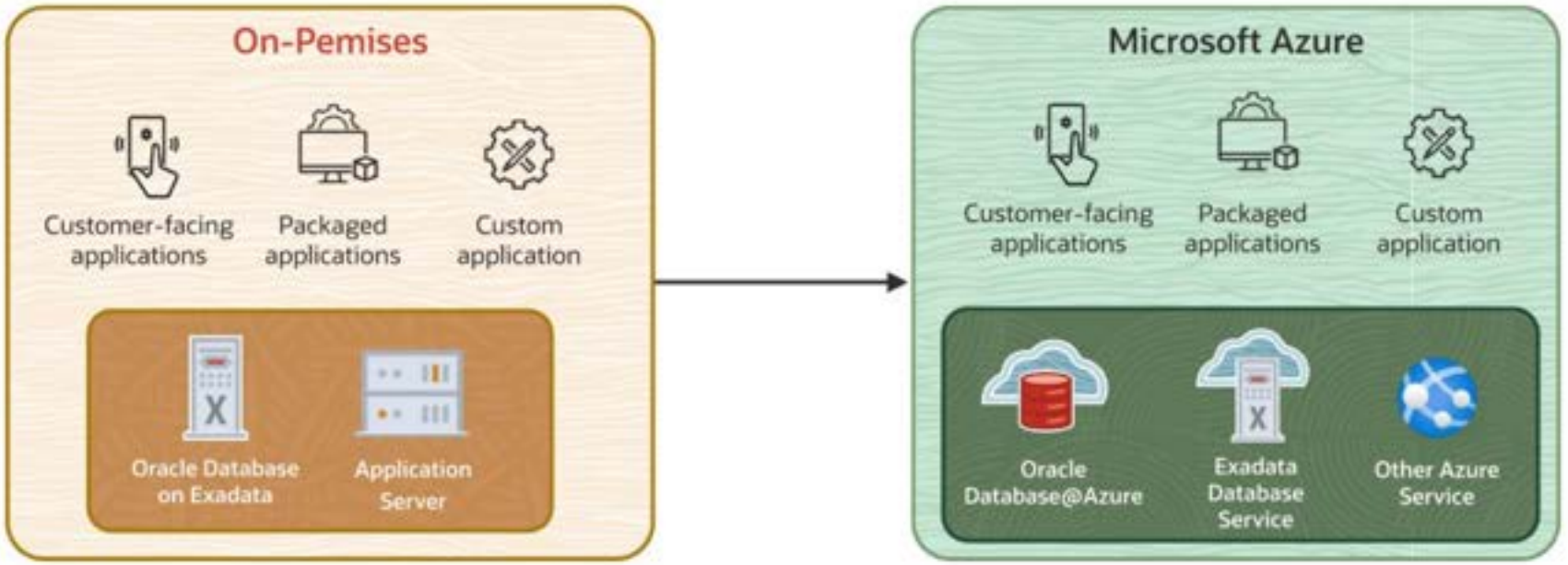
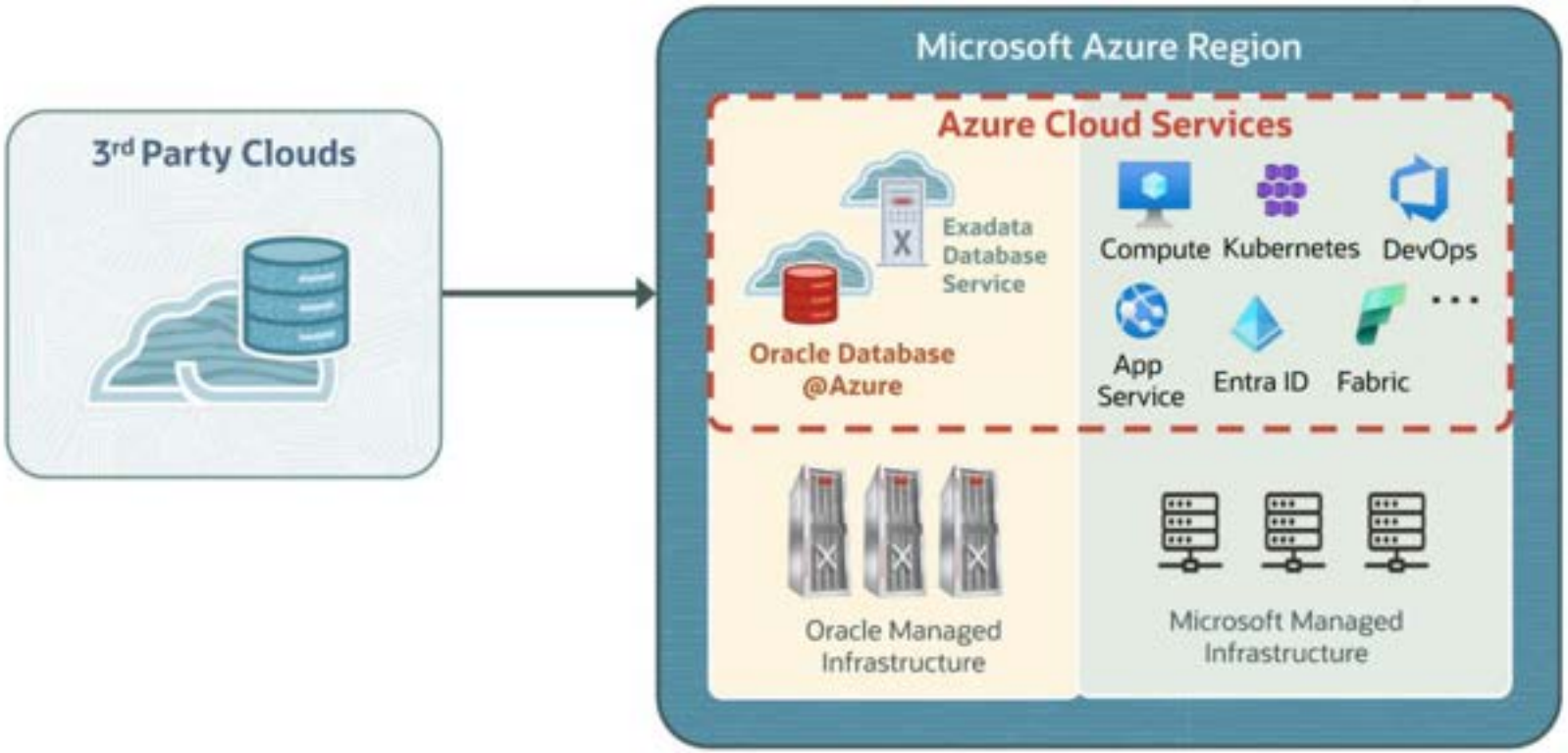
Migrate Workloads from On-Premises



1. Deploy Exadata Database Service in your Vnet
2. Provision and migrate databases to Exadata Database Service
3. Migrate business applications and connect to databases on Exadata Database Service

Migrate Database Workloads from Non-Oracle Cloud



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Oracle Database@Azure - Architecture

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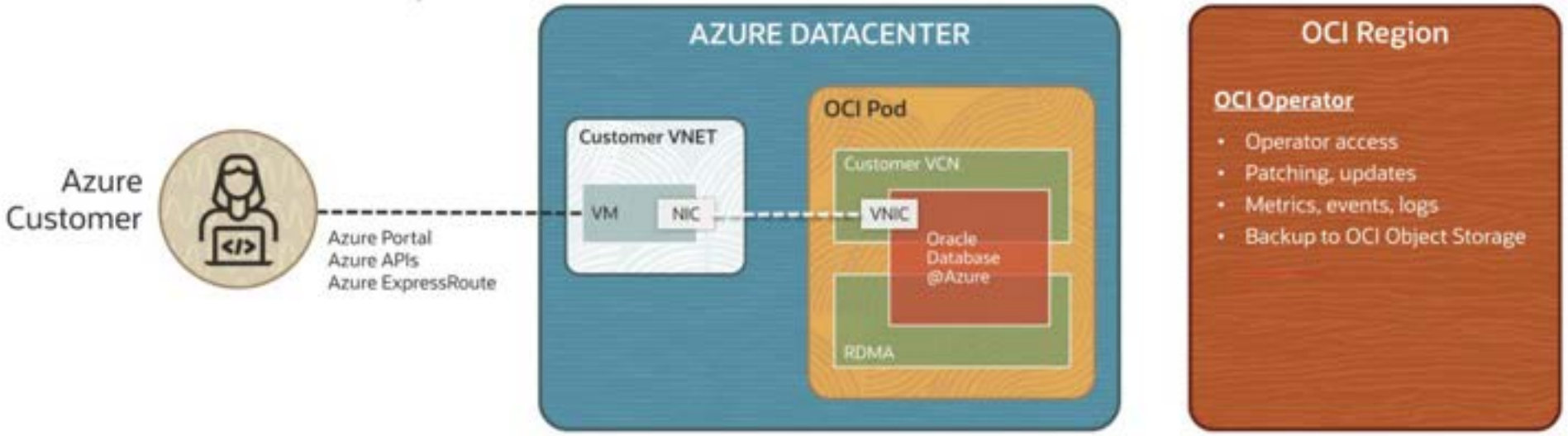
Physical Data Center Level Architecture

Video Content to be replaced from below Link:

https://blogs.oracle.com/cloud-infrastructure/post/first-principles-powering-applications-with-oracle-database-at-azure

Time: 04:08 - 08:34 -- architecture
09:40 - 0941 – thank you..



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Oracle Database@Azure - Onboarding

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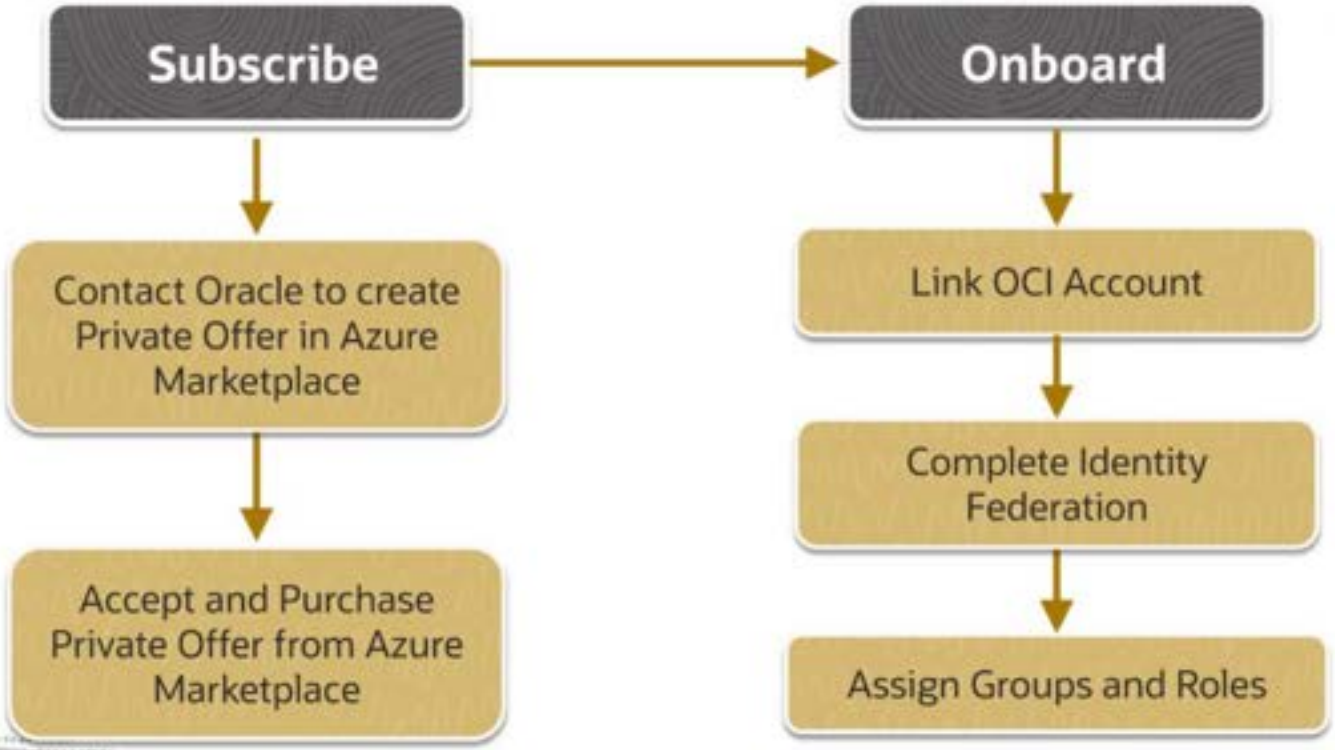
Subscribe and Onboard Oracle Database@Azure

Requires Active Azure Subscription

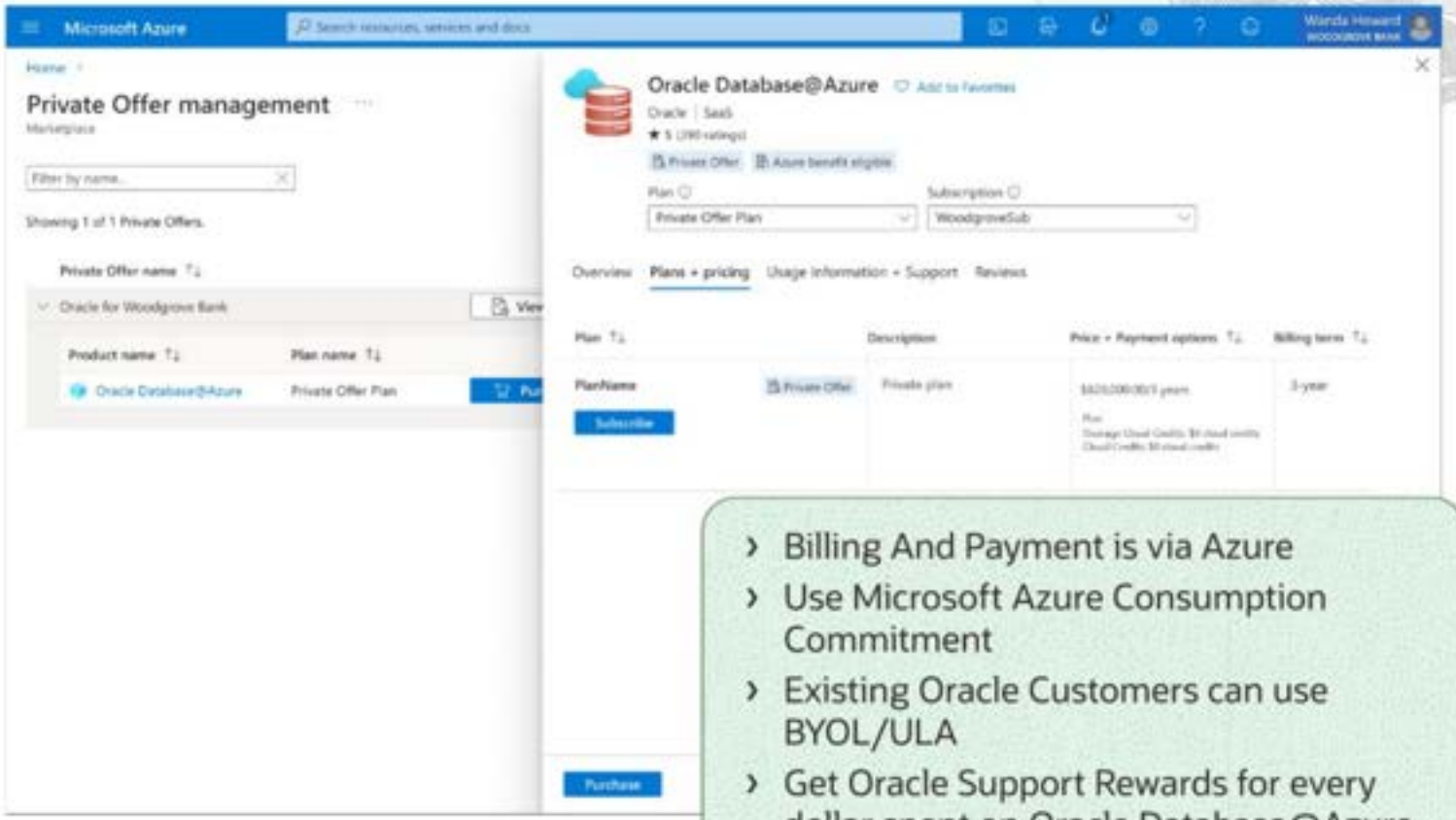


Subscribe To Oracle Database@Azure

Subscribe

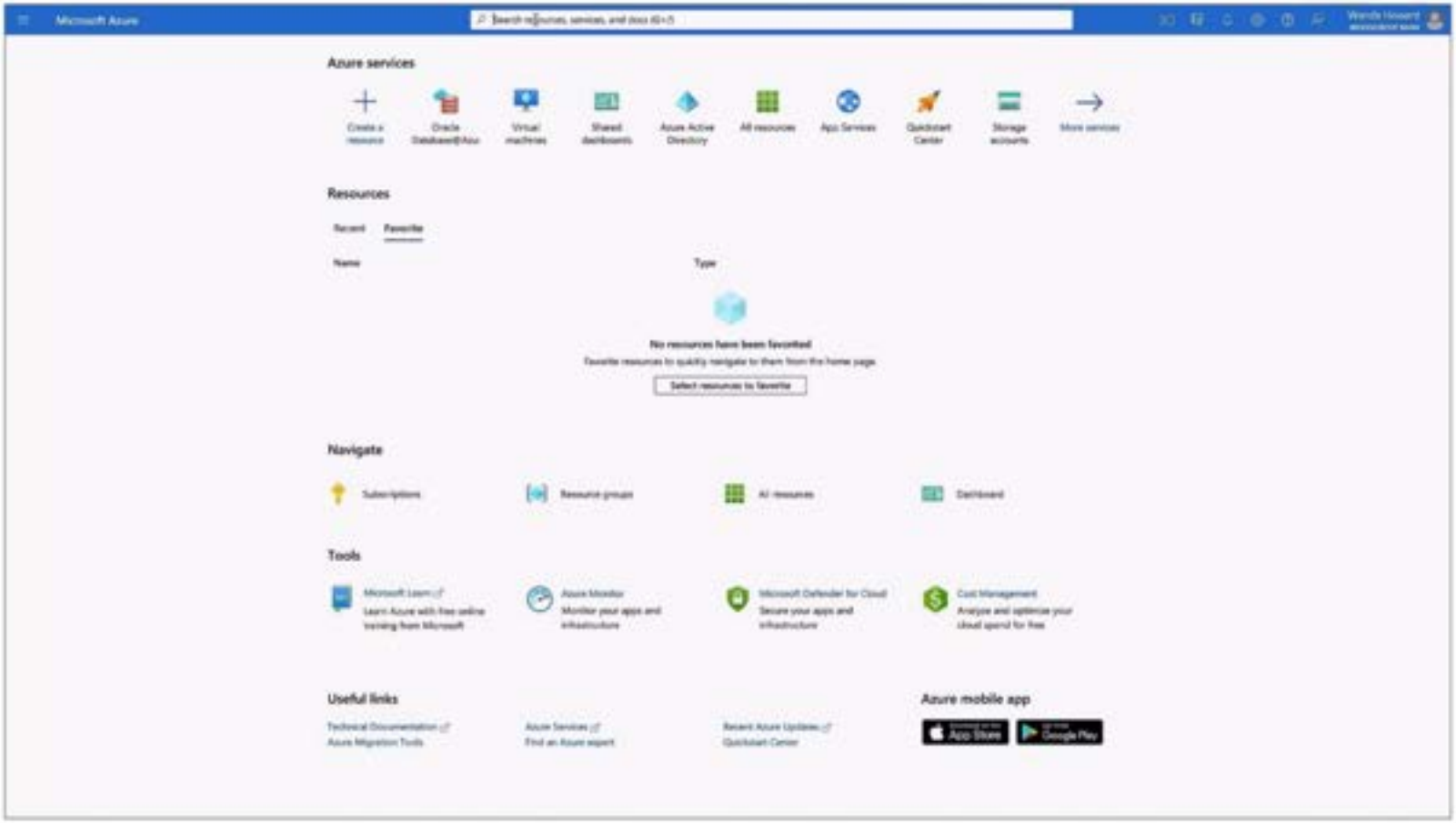
Contact Oracle to create Private Offer in Azure Marketplace

Accept and Purchase Private Offer from Azure Marketplace

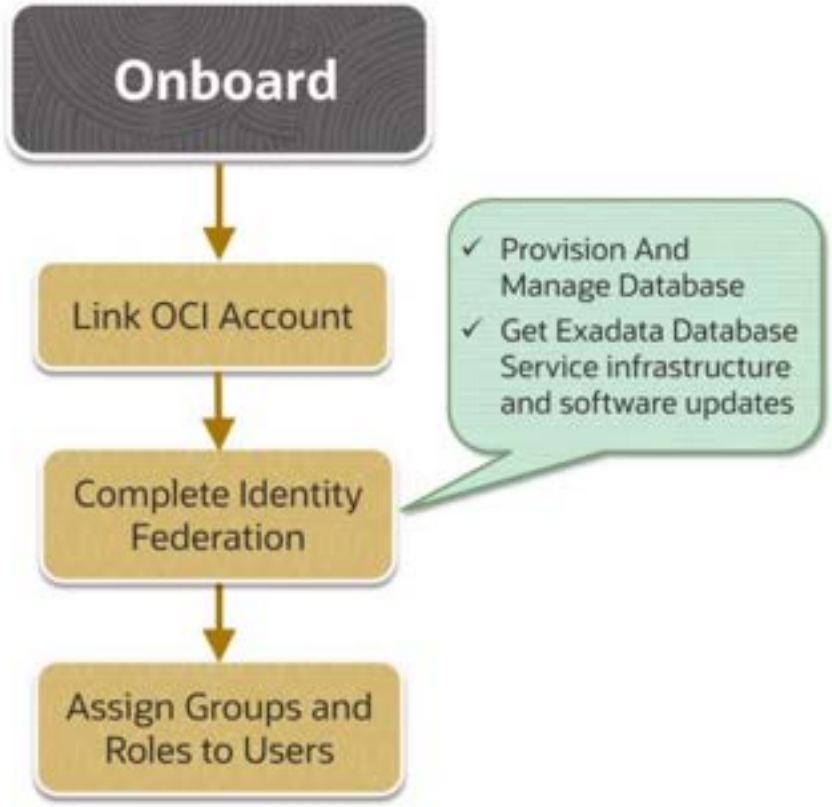


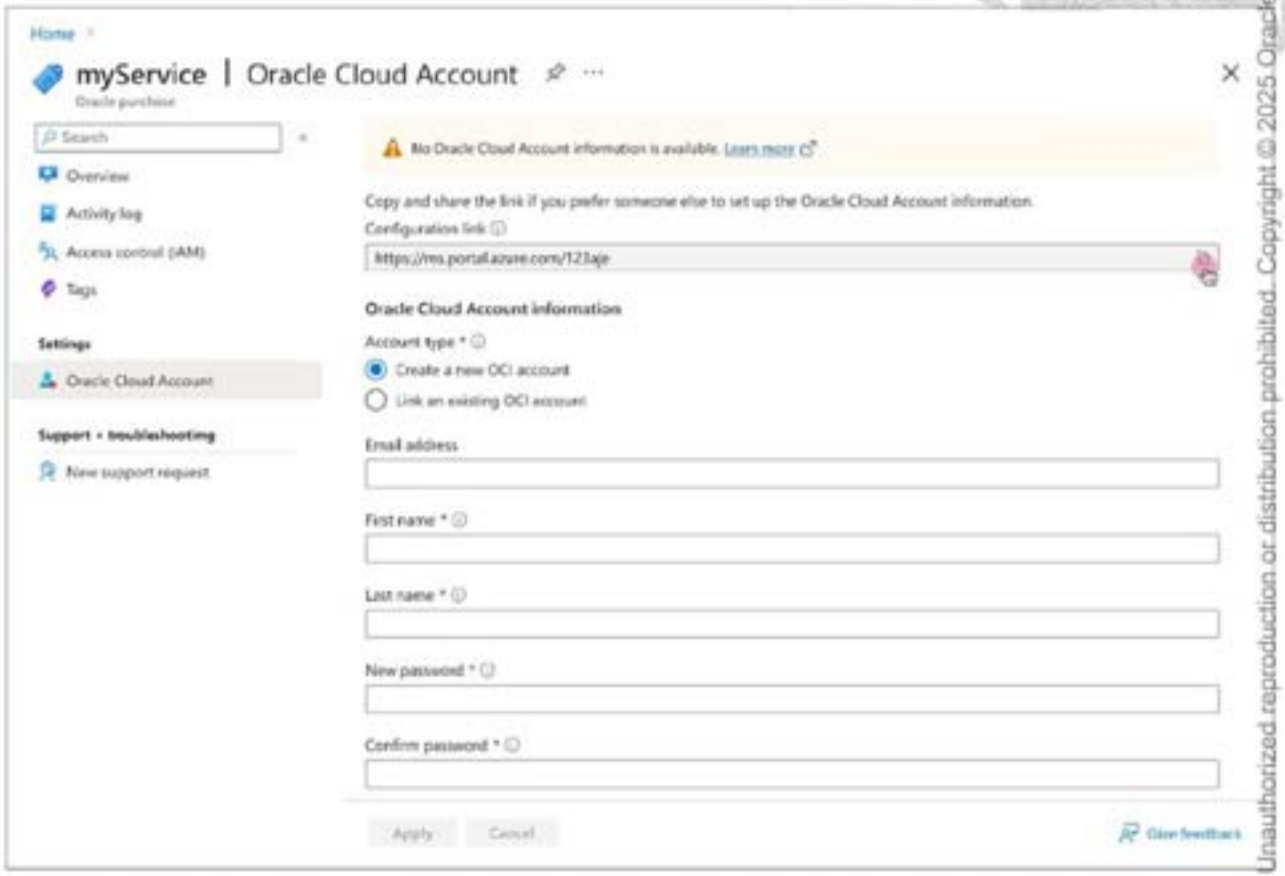
- Billing And Payment is via Azure
- Use Microsoft Azure Consumption Commitment
- Existing Oracle Customers can use BYOL/ULA
- Get Oracle Support Rewards for every dollar spent on Oracle Database@Azure

Oracle Database@Azure Resource



Onboard Oracle Database@Azure





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Oracle Cloud Infrastructure

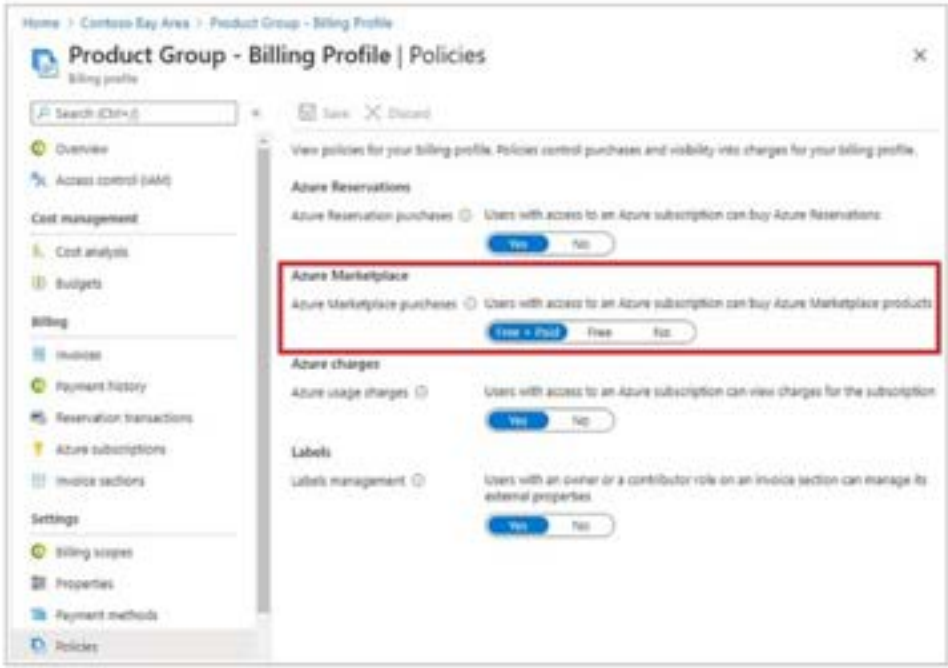
Oracle Database@Azure Identity

Oracle Database@Azure

Identity – Azure Roles

Azure permissions that allows to accept "Free + Paid" offers in Azure Marketplace

Agreement type	Permissions to accept offer	Permissions to purchase or subscribe
Microsoft Customer Agreement (MCA)	Billing account owner or contributor	Subscription owner or subscription contributor
Enterprise Agreement (EA)	Enterprise administrator	Subscription owner or subscription contributor



Groups and Roles in Azure

Group name	Azure role assigned	Description
odbaa-exa-infra-administrators	Light to medium	Manage all Oracle Exadata Database Service resources in Azure
odbaa-vm-cluster-administrators	Single or multiple (at a small scale)	Administer VM cluster resources in Azure
odbaa-db-family-administrators	Not applicable	This group is replicated in OCI during the optional identity federation process
odbaa-db-family-readers	Not applicable	This group is replicated in OCI during the optional identity federation process.
odbaa-exa-cdb-administrators	Not applicable	This group is replicated in OCI during the optional identity federation process.
odbaa-exa-pdb-administrators	Not applicable	This group is replicated in OCI during the optional identity federation process

Groups and Roles in OCI

Group name	Description
odbaa-db-family-administrators	Manage DB family actions
odbaa-db-family-readers	Read DB family actions
odbaa-exa-cdb-administrators	Manage Oracle Container Database (CDB) actions
odbaa-exa-pdb-administrators	Manage Oracle Pluggable Database (PDB) actions

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Oracle Cloud Infrastructure

Oracle Database@Azure Networking

Oracle Database@Azure

Oracle Database@Azure network requirements

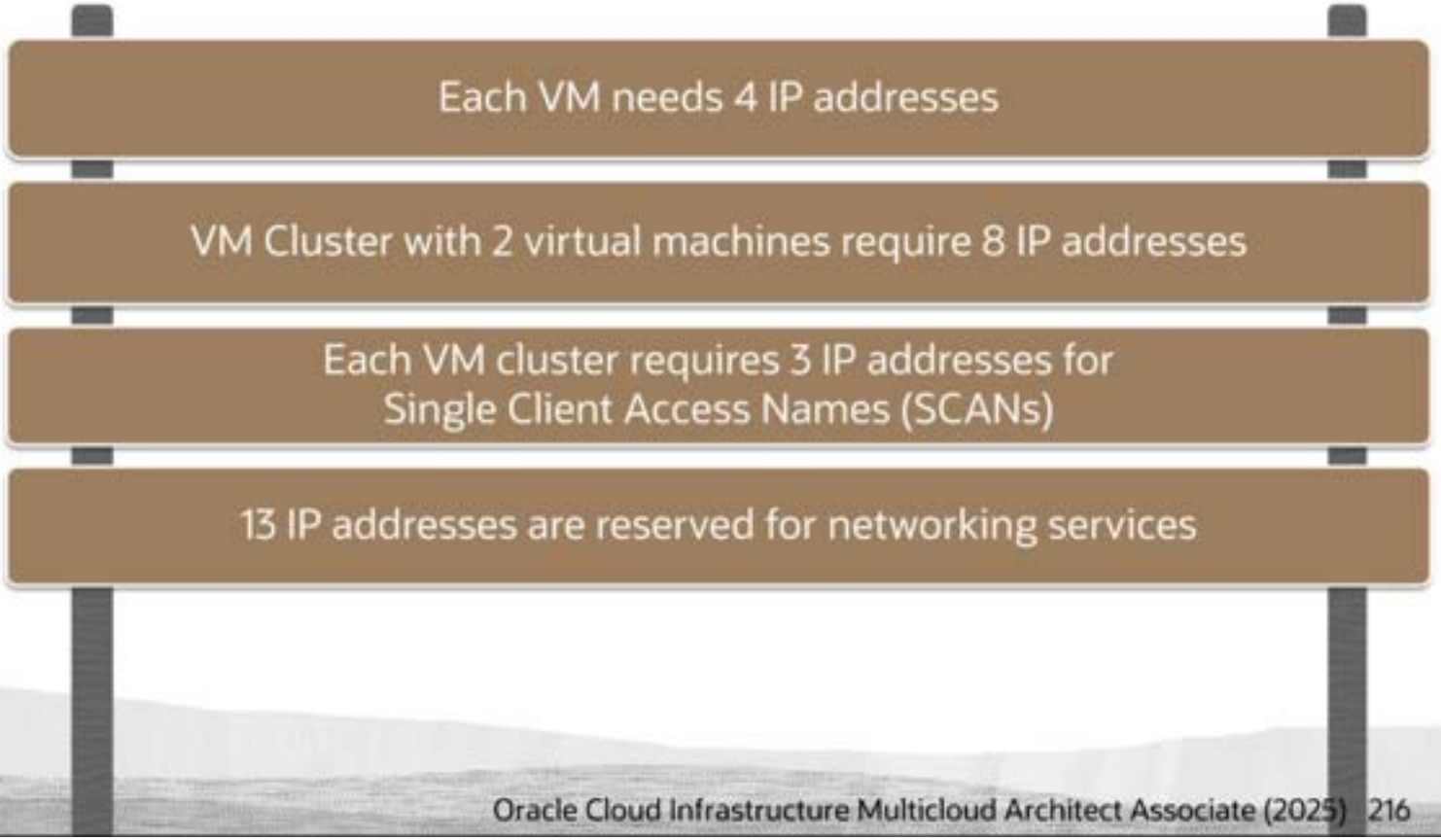
An Azure Virtual Network to create Oracle Exadata VM Clusters

Two Subnets – For database client and database backup

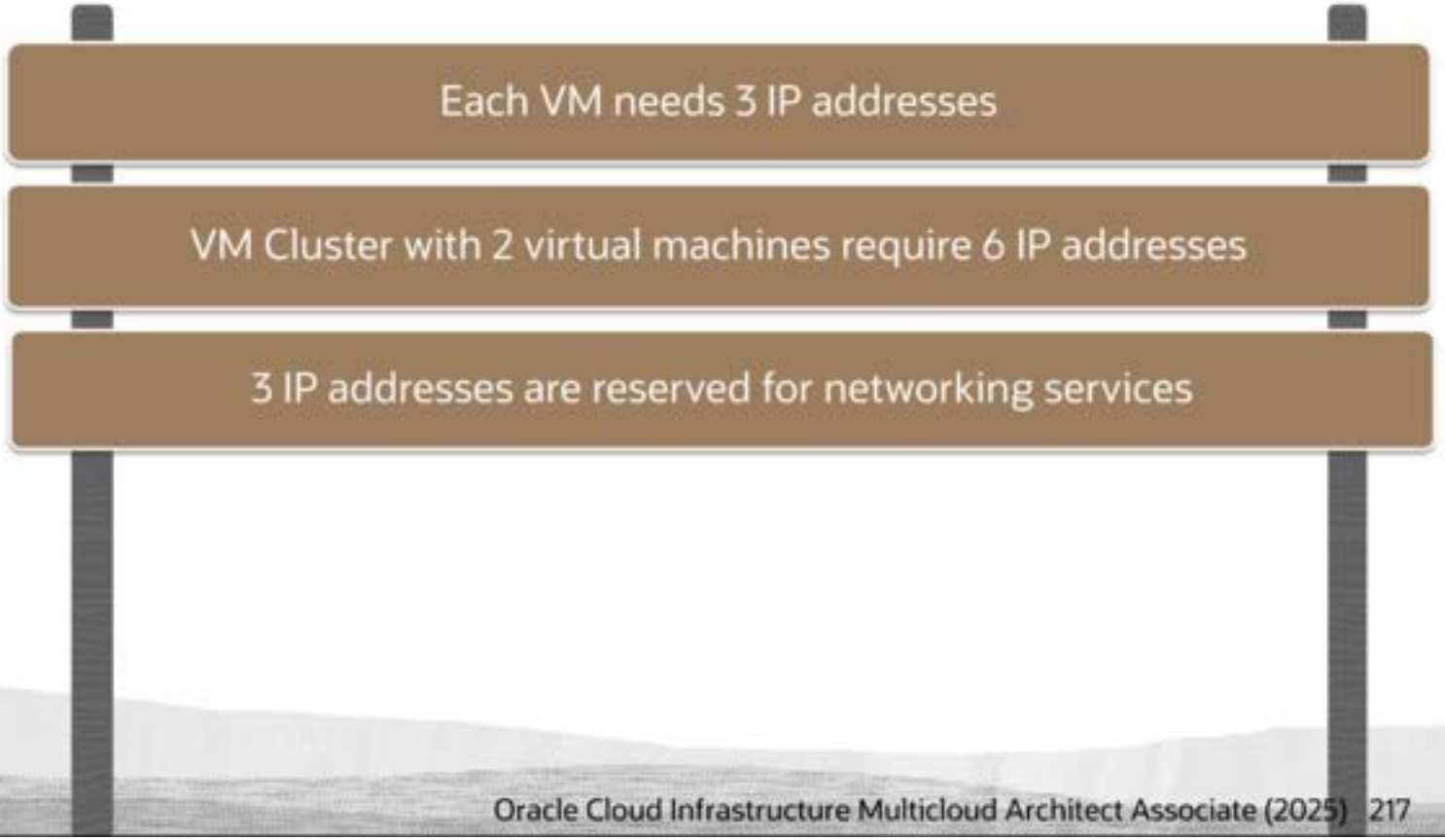
Enable subnet delegation for the subnets to Oracle database@Azure

IP addresses 100.106.0.0/16 and 100.107.0.0/16 are reserved for the interconnect

Client Subnet IP address requirements



Backup Subnet IP address requirements



Usable IPs for Client & Backup subnets by CIDR size

Subnet CIDR	Reserved Networking IPs for Client Subnet	Usable IPs for Client Subnet (Virtual Machines and SCANs)	Reserved Networking IPs for Backup Subnet	Usable IPs for Backup Subnet (Virtual Machines and SCANs)
28	13	3 (2^4 - 13)	3	13 (2^4 - 3)
/27	13	19 (2^5 - 13)	3	29 (2^5 - 3)
/26	13	51 (2^6 - 13)	3	61 (2^6 - 3)
/25	13	115 (2^7 - 13)	3	125 (2^7 - 3)
/24	13	243 (2^8 - 13)	3	253 (2^8 - 3)
/23	13	499 (2^9 - 13)	3	509 (2^9 - 3)
/22	13	1011 (2^10 - 13)	3	1021 (2^10 - 3)

Subnet Delegation in Azure VNet

Enable Subnet Delegation for Client and Backup Subnets to Oracle Database@Azure

Oracle.Database/networkAttachments

Subnet Delegation Benefits

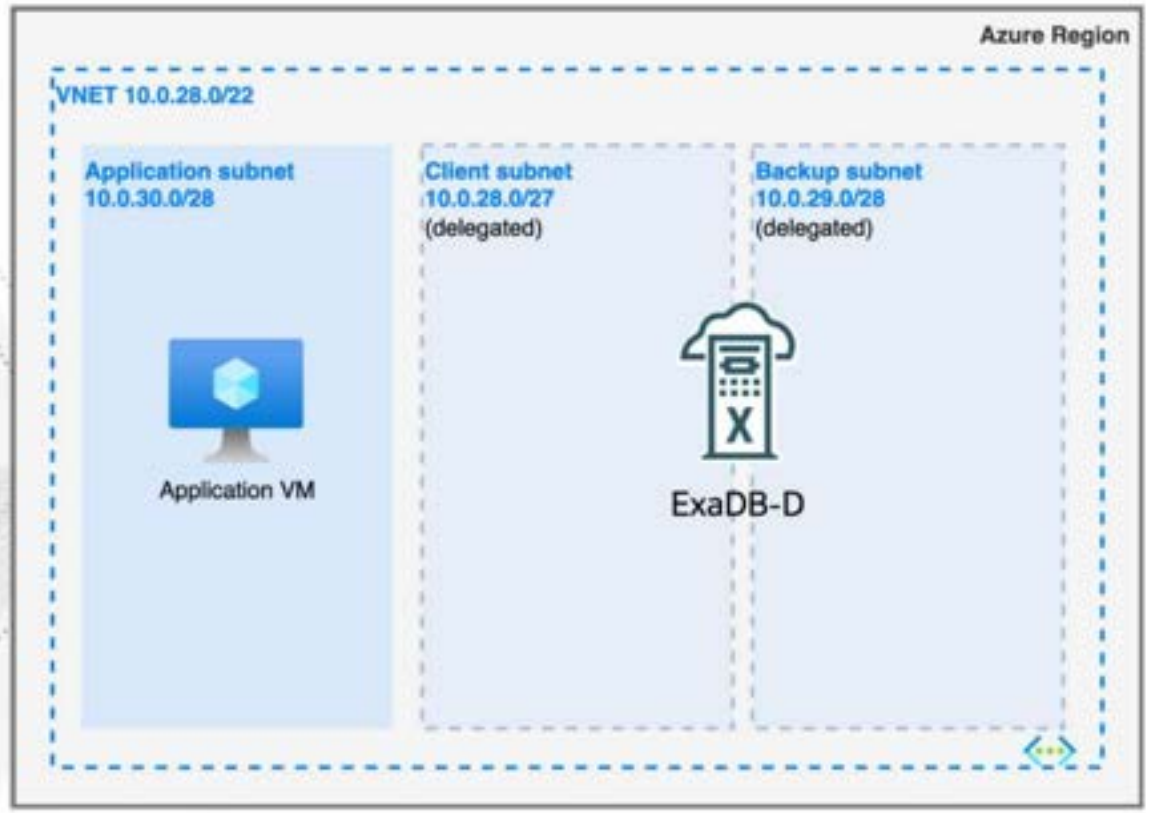
Simplified network management

Increases flexibility

Improves network security

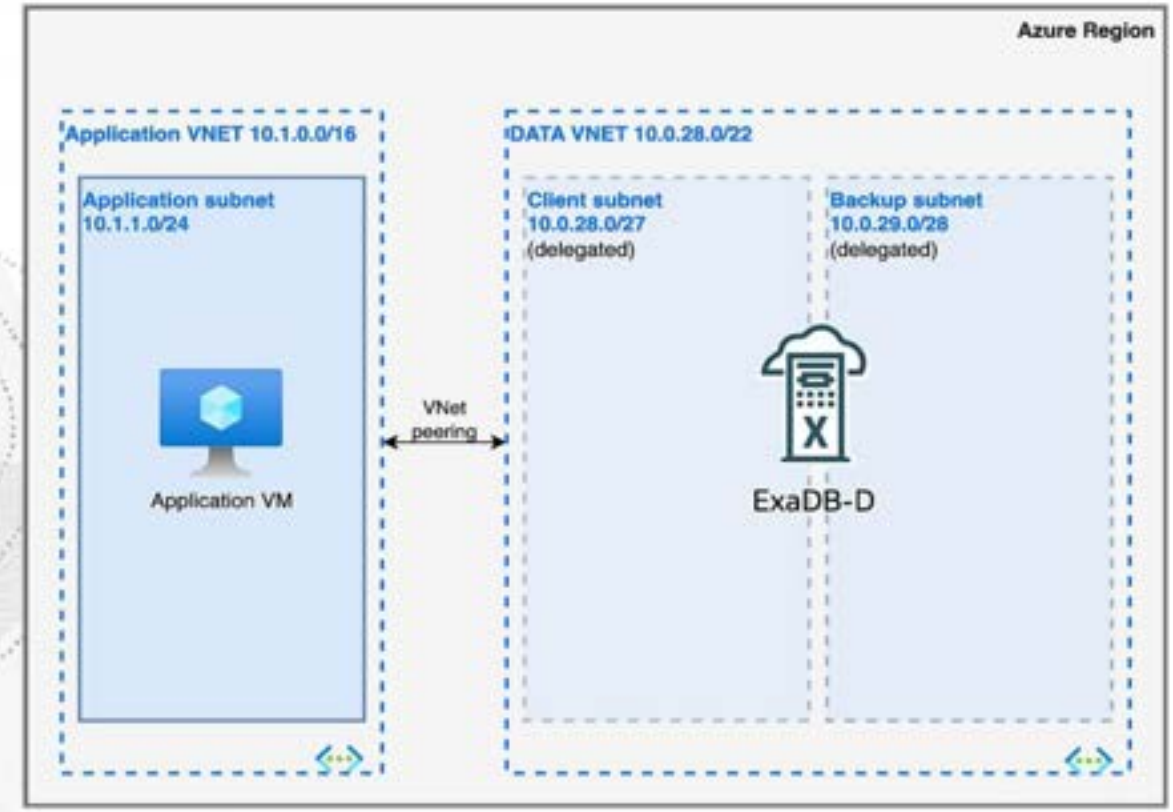
Enhances performance

Local VNet Topology



- Apps connect to Database in the same VNet
- Lowest network latency
- No ingress/egress costs

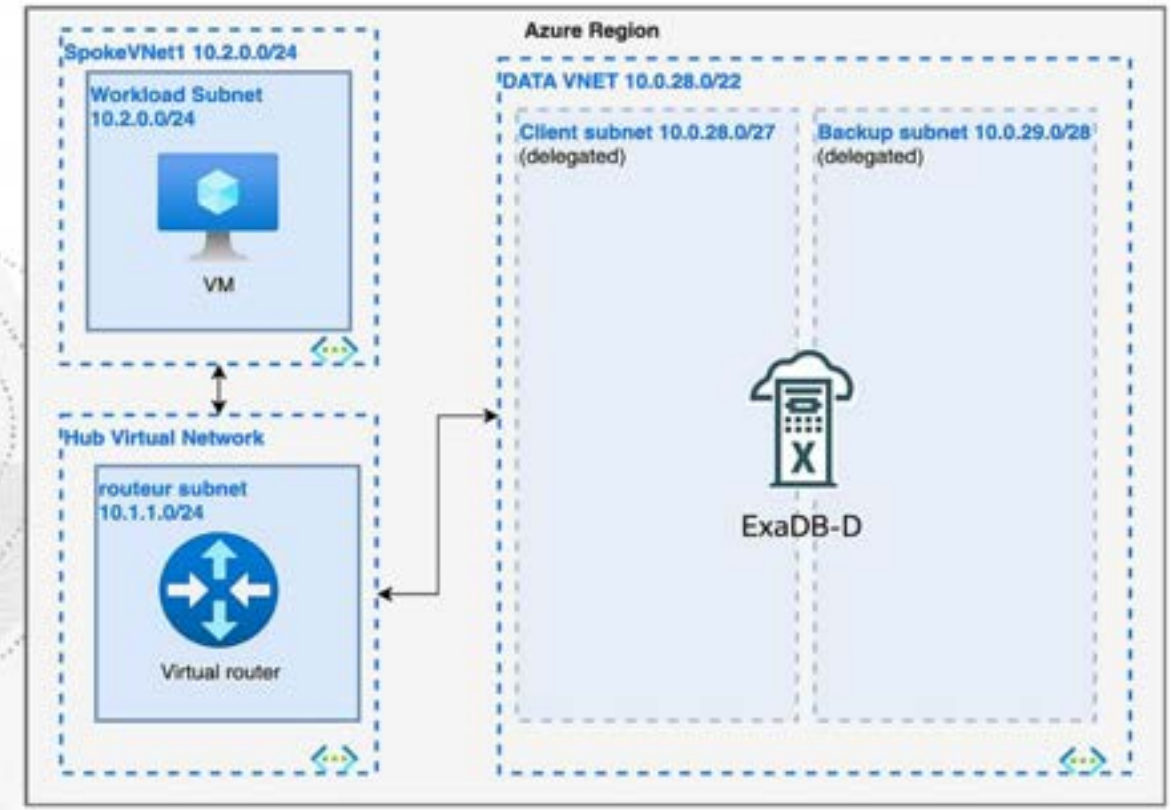
VNet Peering Topology



Use local VNet peering to connect apps in a VNet to database VNet in the same region

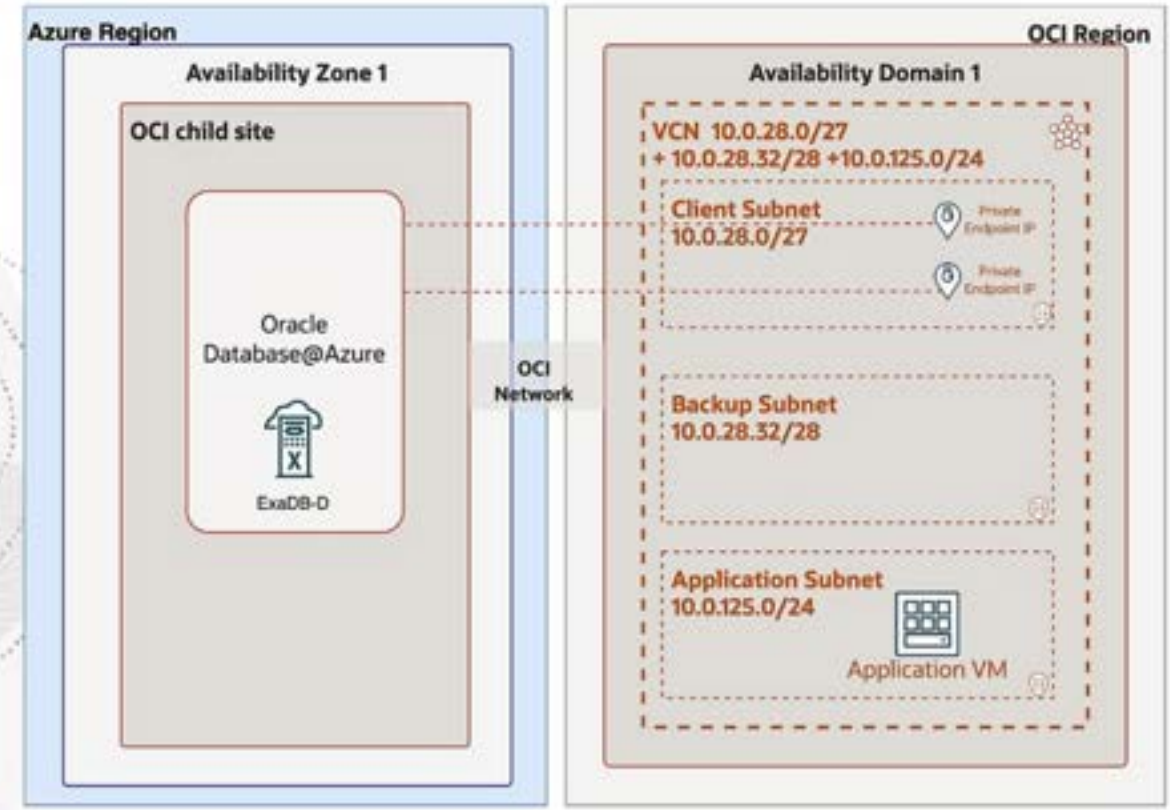
Incurs ingress/egress costs

Hub-spoke VNet Peering topology



- The hub VNet is a central point of connectivity between apps and database
- The spoke VNets peer with the hub
- Incurs ingress/egress costs
- Not recommended for latency sensitive apps

Connect OCI application or service in same VCN



Create an additional subnet in the OCI shadow VCN

Deploy the application or service in the new subnet

Connect the application or service to the private endpoint of the database

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Oracle Database@Azure - Provisioning

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Operational Interfaces

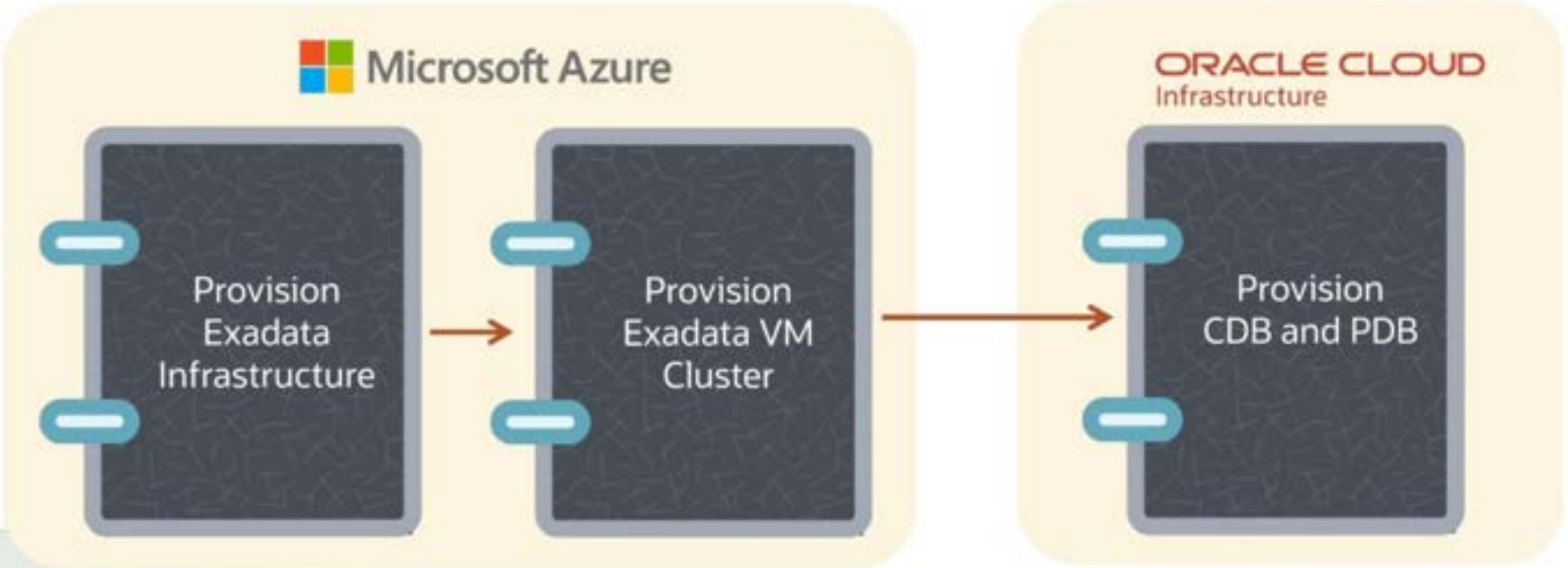
Microsoft Azure

- Provision Exadata Infrastructure and Exadata VM cluster using Azure portal, Azure APIs, SDKs and Terraform.
- Manage the provisioned Oracle Exadata Database Service resources (scale Servers, OCPUs, maintenance)
- Monitor infrastructure and database metrics, events and logs

ORACLE CLOUD Infrastructure

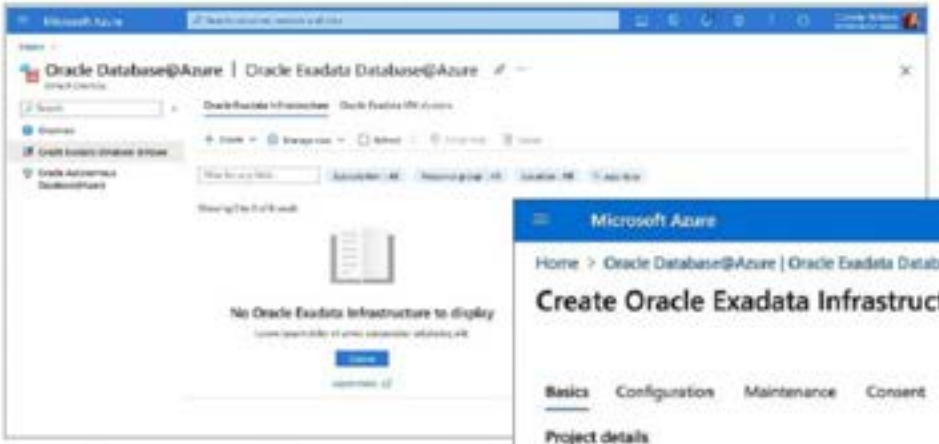
- Provision Database Homes
- Provision Container and pluggable databases
- Manage the databases (Data Guard, Automatic Backup configuration, updates to GI, OS, Databases)
- Migrate to the provisioned databases in Exadata Database Service

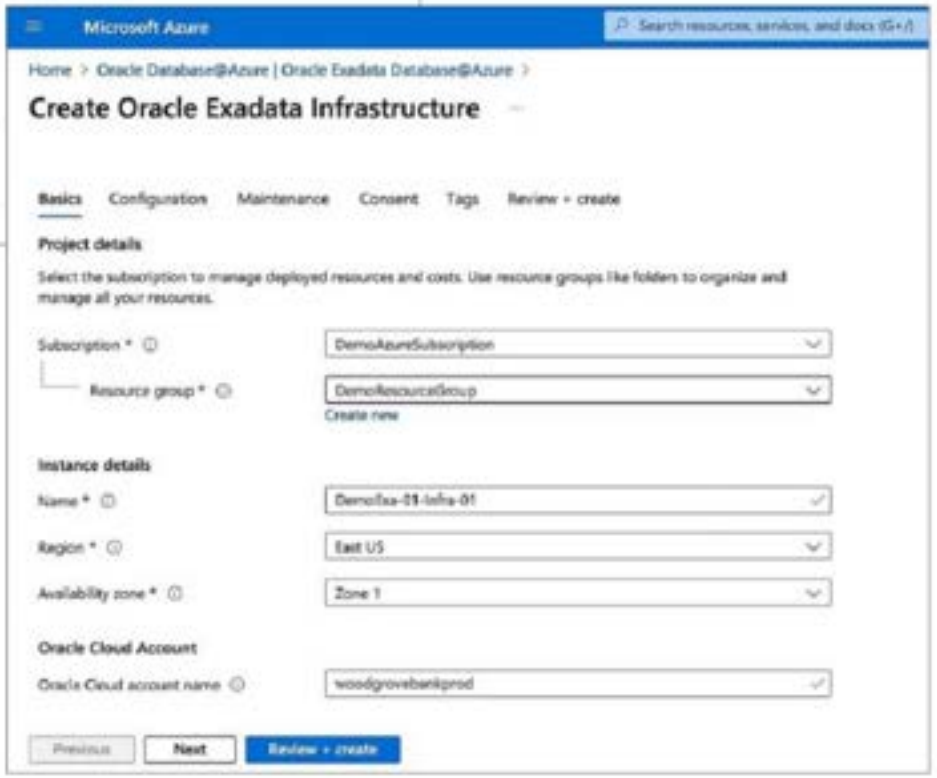
Provision Oracle Database@Azure Resources



Provision Oracle Exadata Infrastructure

User must be member of Oracle Database@Azure Infrastructure admin group





Creating Oracle Exadata Infrastructure Resource:

- Azure Subscription and Resource Group name
- Instance Name, Region, AZ, OCI account name
- Infrastructure model name
- Number of Database Servers
- Number of Storage Servers
- Maintenance method and Select Schedule

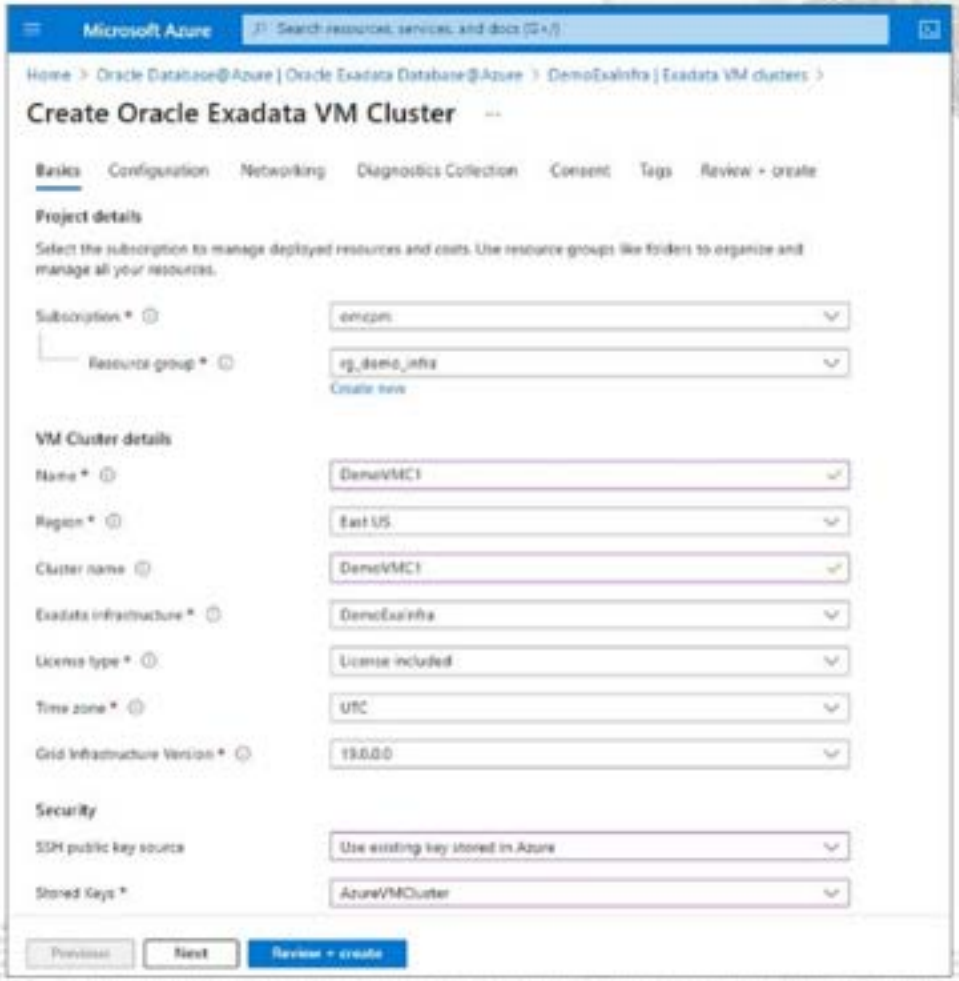
Provision Oracle Exadata VM Cluster

User must be member of Oracle Database@Azure VM Cluster admin group

Create an Azure VNet with two Delegated Subnets

Creating Oracle Exadata VM Cluster: Basic tab

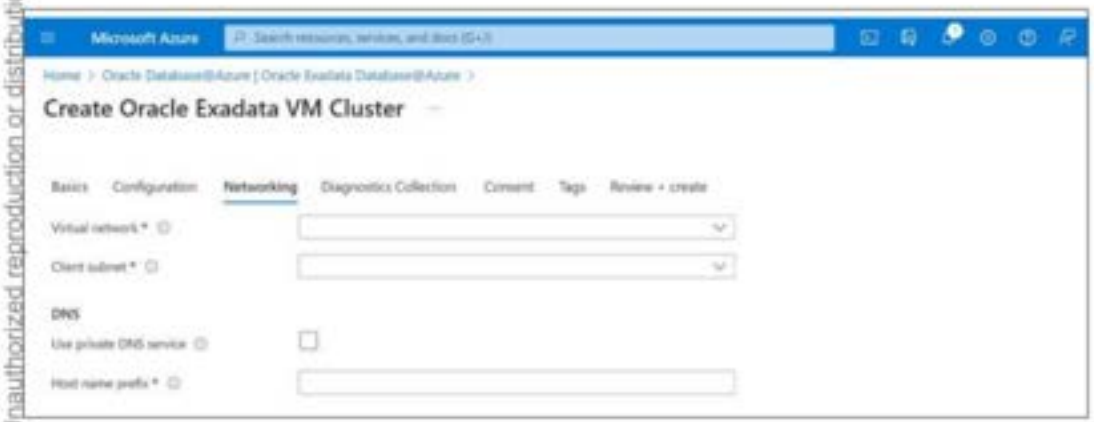
- Azure Subscription and Resource Group name
- Name, Region, Cluster Name, License Type
- Grid Infrastructure version, SSH public Key, TZ

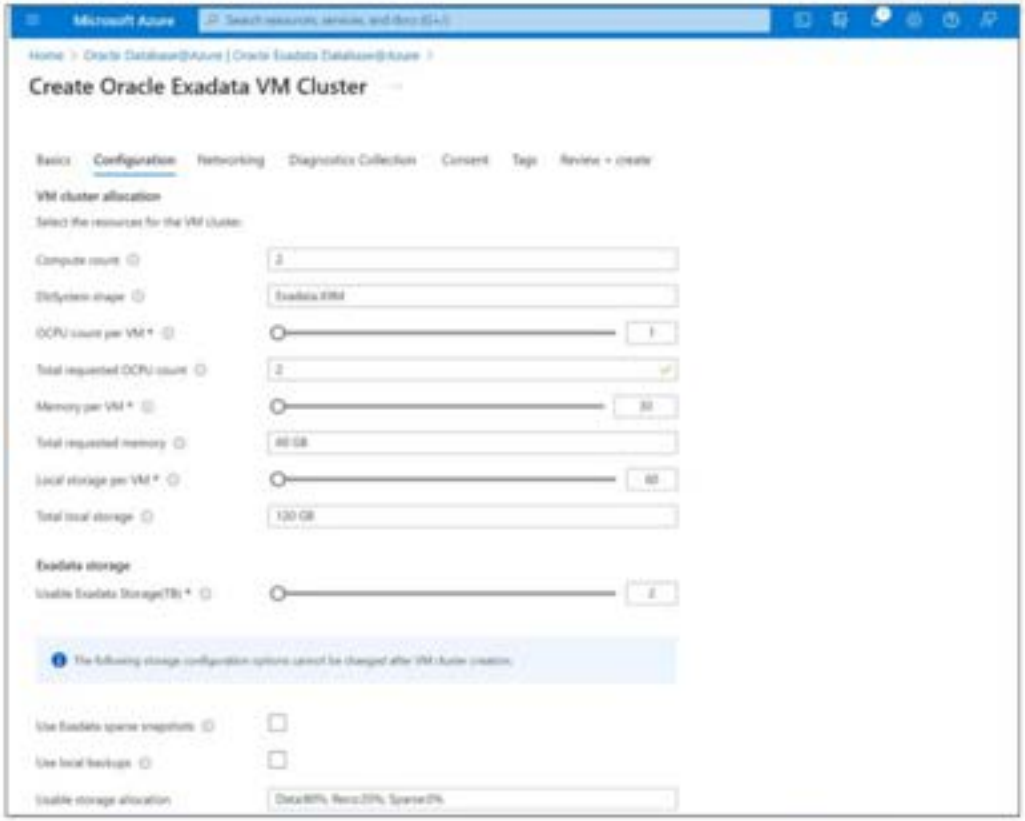


Provision Oracle Exadata VM Cluster

Creating Oracle Exadata VM Cluster: Configuration & Networking Tabs

- VM Cluster configuration (Compute count, shape, OCPU/VM,memory/VM,local storage/VM, Exadata Storage)
- Optionally, enable sparse snapshots, local backups and distribution
- Provide delegated subnets for client and backup



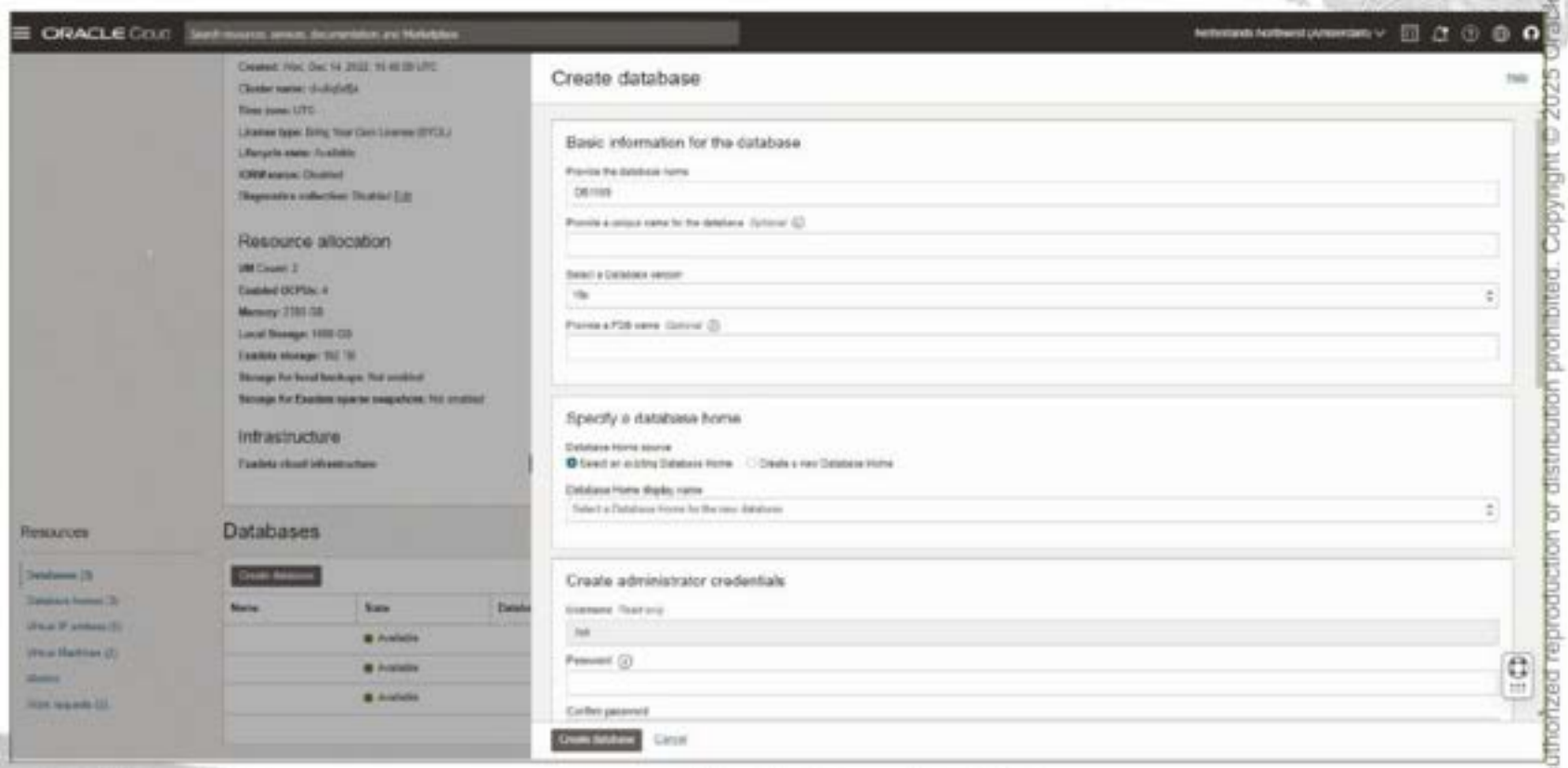


Provision Oracle Exadata Database

User must be member of Oracle Database@Azure CDB or PDB admin group

Click on *Go To OCI* under OCI Database URL in Exadata VM Cluster Overview page

In OCI Console, provision database home and databases (CDB and PDB)



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Oracle Cloud Infrastructure

Oracle Database@Azure - Operations

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Operational Resources

	Azure	OCI
Resource & Lifecycle Management	**Exadata instance management** (Infra. & VM cluster) scaling, maintenance	**DB management** DB CRUD, backup, keys, Database connection string information
Observability	Infrastructure logs, metrics, & events database logs and metrics	Database logs and metrics
Billing, Costs & Usage	Invoice cost management	Detailed usage reporting

Monitoring Resources in Azure

Oracle Database@Azure is natively integrated into Azure Monitor

Monitor Exadata VM Metrics

Monitor Database Metrics, Logs and Events

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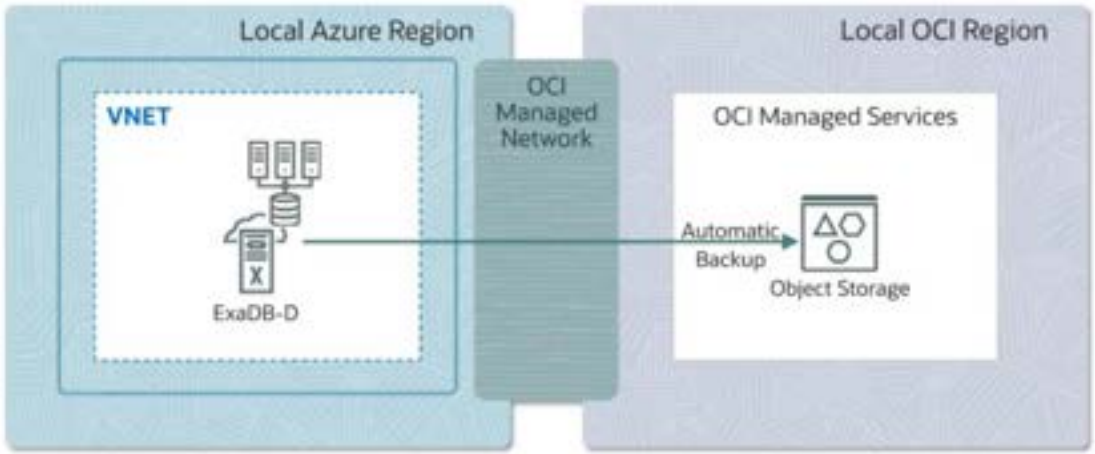
High Availability & Disaster Recovery with Oracle Database@Azure

Objectives

- Automatic Backup with Oracle Database@Azure
- Disaster Recovery Configurations
- Automatic Data Guard Deployments
- Hybrid Data Guard with Oracle Database @Azure

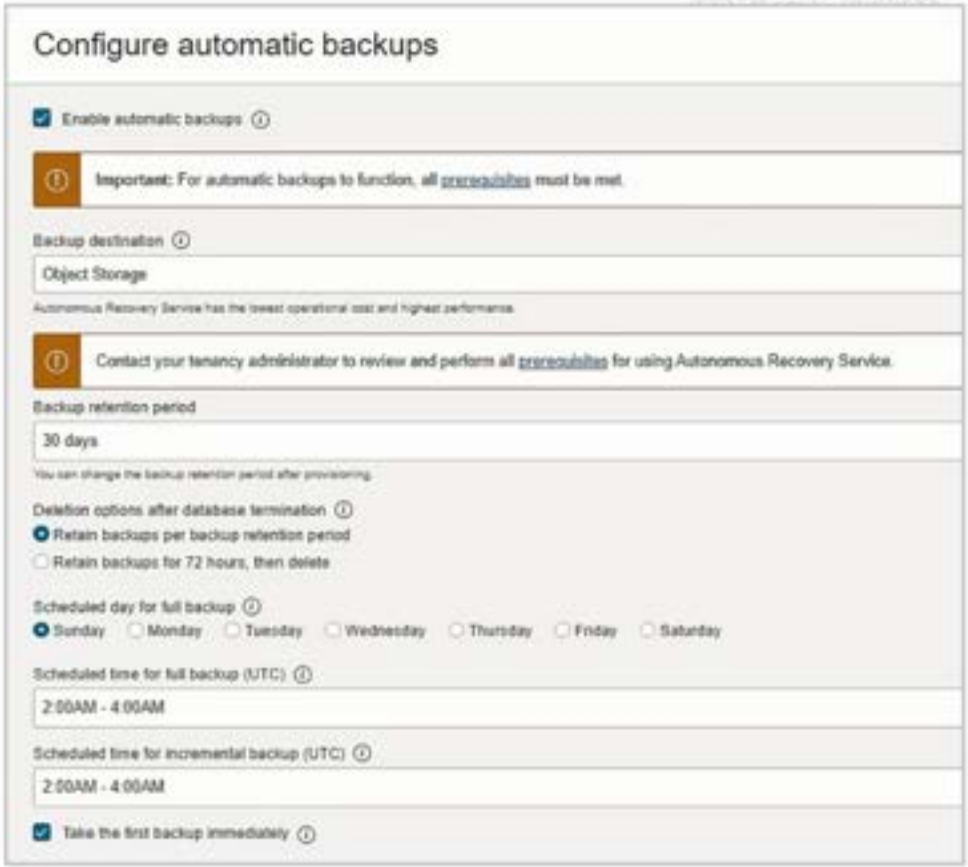
Automatic Backup to OCI Object Storage

- Automated one-click setup
- Built-in MAA best practices and backup validation
- Backup runs independently of node availability
- Backup on primary and/or standby
- Three-way mirrored backup
- Network traffic through the backup subnet

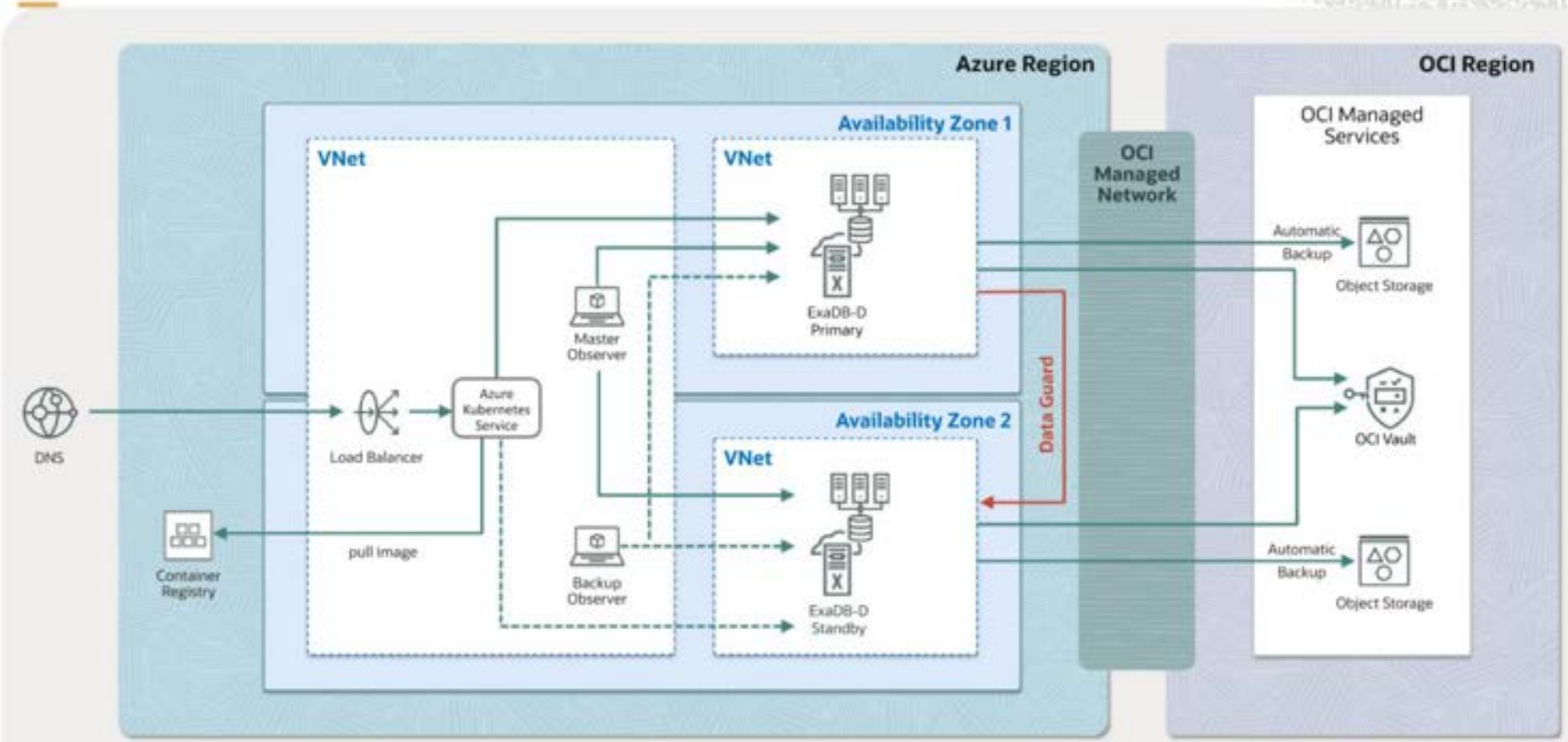


Configure Automatic Backup in OCI Console

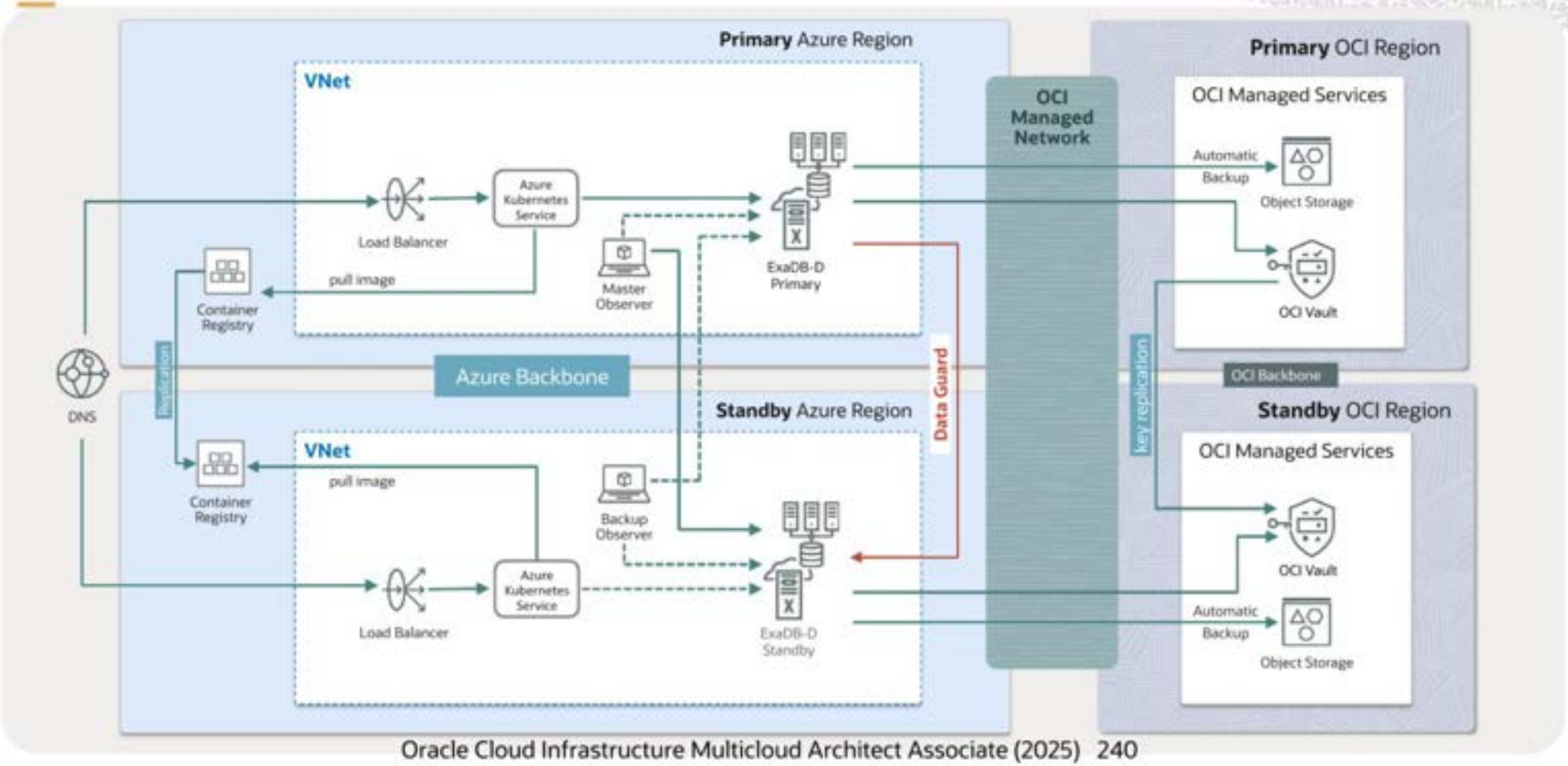
- Backup stored in Oracle-managed Standard Bucket
- Provides the option to choose weekday for full backups
- Provides the option to change backup time
- Runs automatic archivelog backup
  - Via cron job every 30 minutes
- Backup retention for 7, 15, 30, or 60 days
- Restores CDB capabilities:
  - Restores PDB via `dbaascli` commands
- Charging only for Object Storage space
  - Not for the number of requests or the backup module



Disaster Recovery - Configuring Local Standby

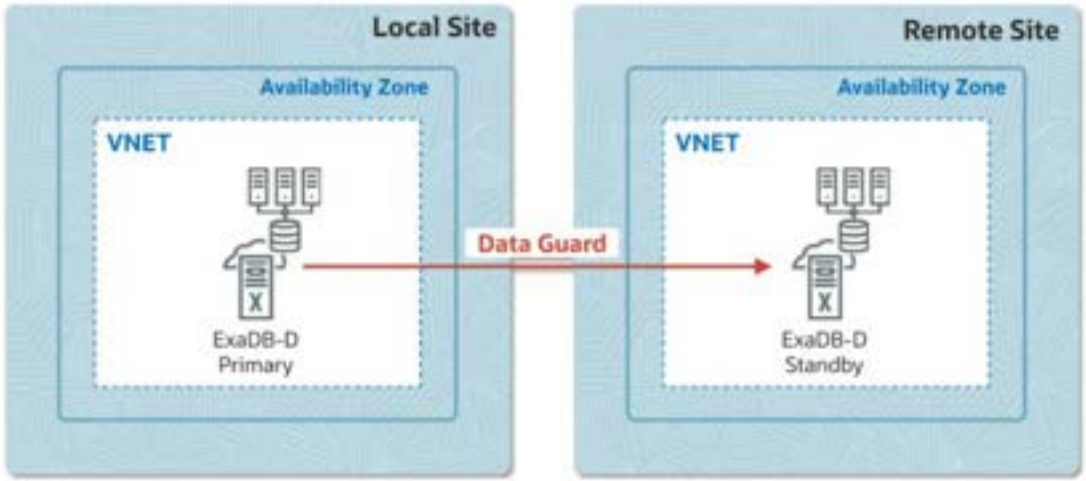


Disaster Recovery - Configuring Remote Standby

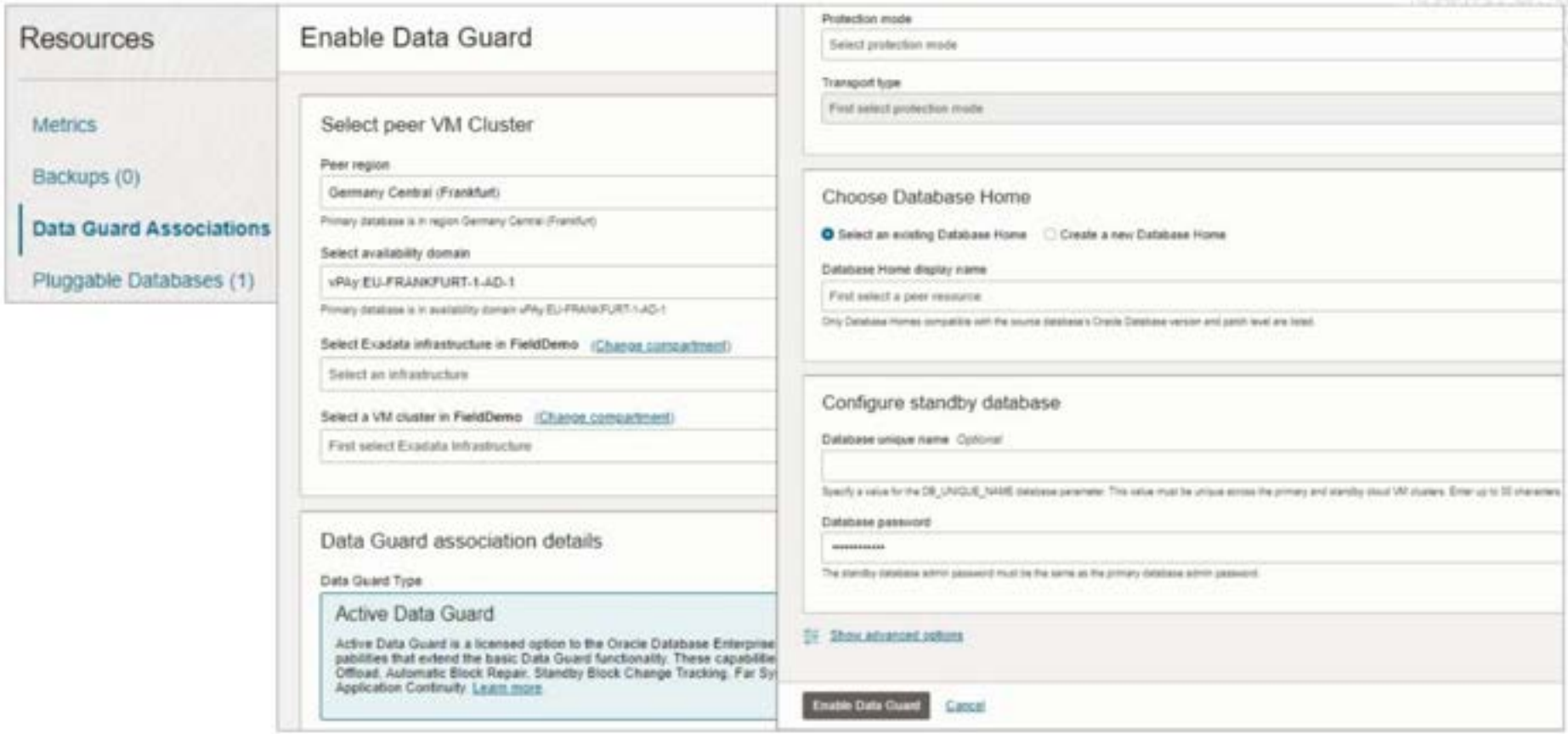


Automated Data Guard Deployment

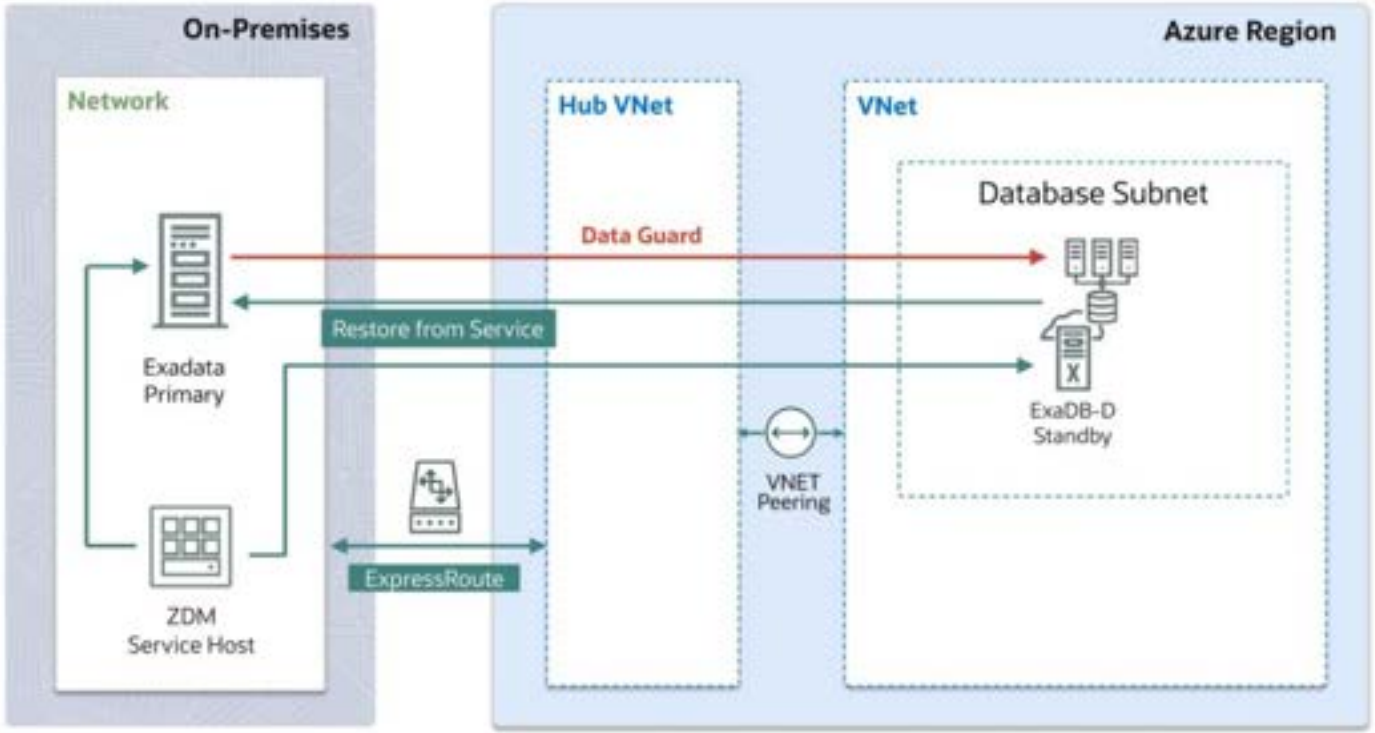
- Involves an automated one-click setup
- Cross-AZs or cross-region configuration
- MAA best practices incorporated by default
- Supports failover and switchover operations
- Creates one standby database:
  - Multiple standby databases can be created manually.
- Choose Active Data Guard (open read-only) for additional data protection and read-only benefits.
- Alternatively, choose Data Guard (mounted standby).



Configure Data Guard or Active Data Guard in OCI Console



Configure Hybrid Data Guard with Oracle Database@Azure



- Physical online migration without downtime
- Automated target encryption
- MAA compliant
- Simple and free
- Extensive pre- and post-checks
- Customizable workflow
- Jobs framework
- Resumable
- And more ...

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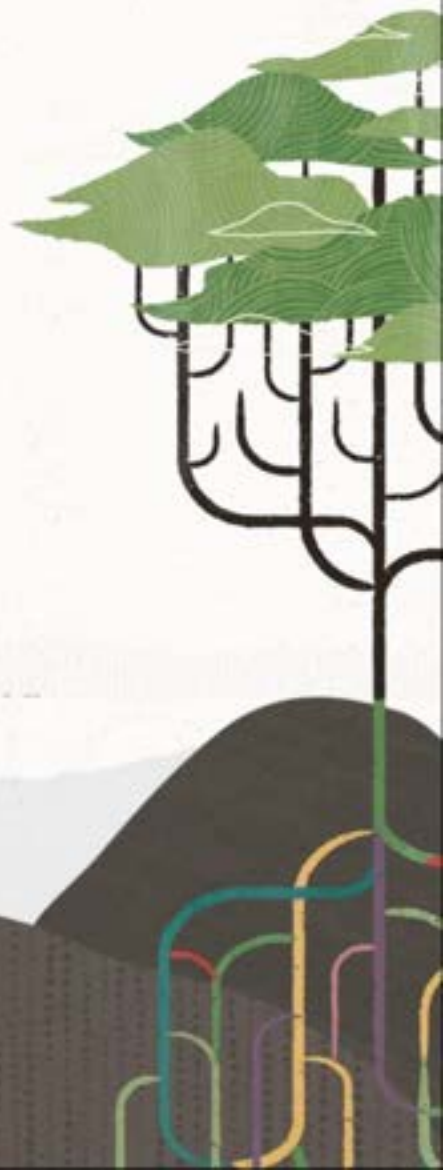
Oracle Cloud Infrastructure

Introduction to Oracle Database@Google Cloud

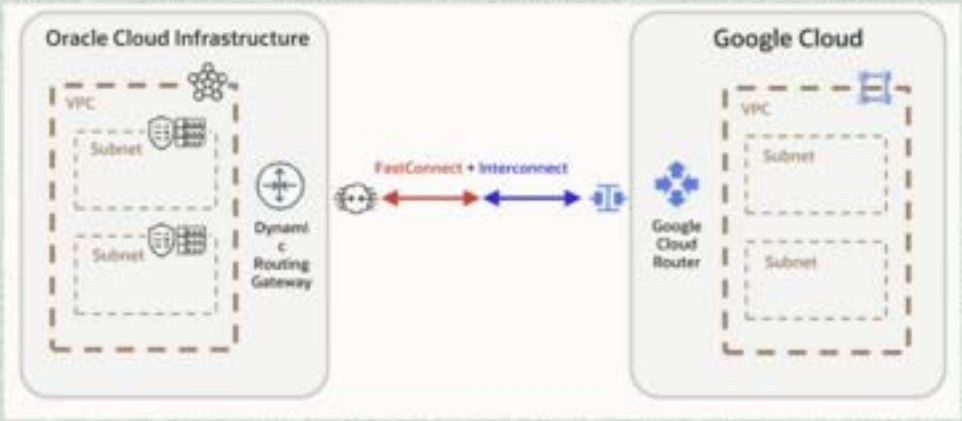


Oracle And Google Cloud Partnership

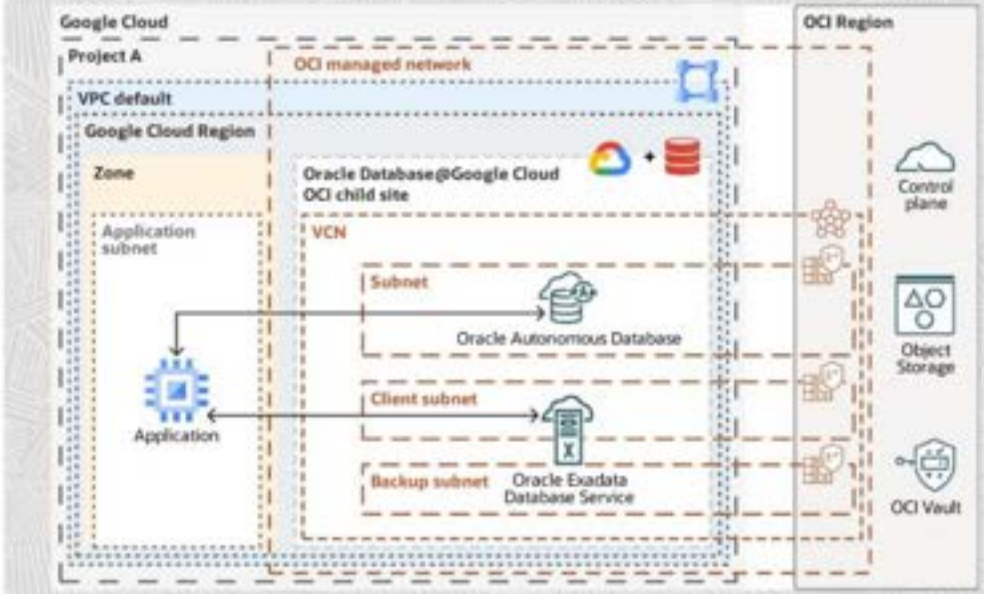
- Extends customers multi-cloud strategy
- Eases integration of technologies across both providers
- Saves on cost
- Collaborative Support Model
- Enables business continuity

Oracle and Google Cloud Partnership Offering

Oracle Interconnect For Google Cloud
June 2024



Oracle Database@Google Cloud
2024



Oracle Database@Google Cloud

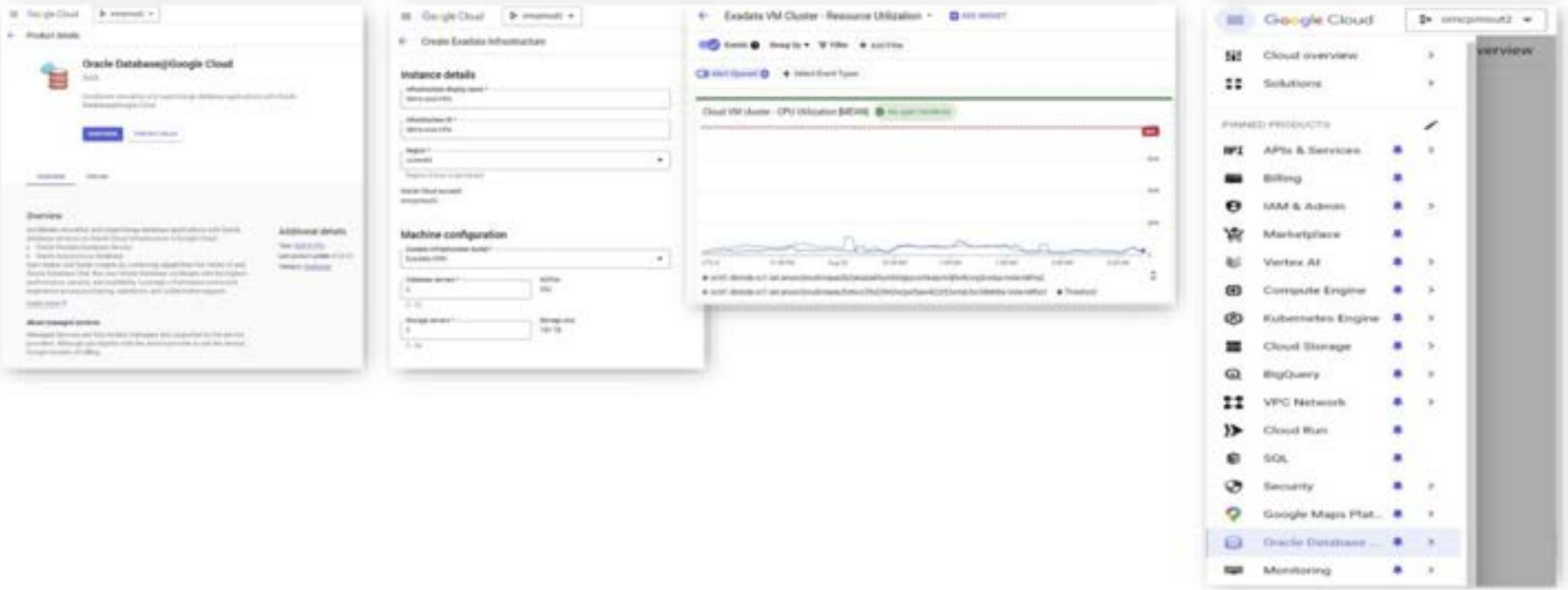
- OCI native oracle database services running in Google cloud datacenter
- Runs on OCI infrastructure managed by Oracle Cloud operation experts
- Simple, secured and low latency operating environment
- High performance, scalability and availability
- Manage using Google cloud console or the tools
- Integrated with Google networking
- Simplified purchasing and operations
- Collaborative Support from Oracle and Google

Oracle Database@Google Cloud Easy Adoption

Purchase in Google Cloud Marketplace

Deploy, manage, and monitor through Google Cloud Console and APIs

Combine with your choice of Google Cloud services



Operational Responsibilities

Oracle

- Manage Database Service Infrastructure running in Google Cloud
- Service Software Updates
- Service Infrastructure updates
- Support customer's database service Issues

Google Cloud Customers

- Provision Database Service
- Manage the provisioned databases from google and oracle cloud console
- Operate and Monitor Infrastructure and Database

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Oracle Cloud Infrastructure

Oracle Database@Google Cloud – Architecture

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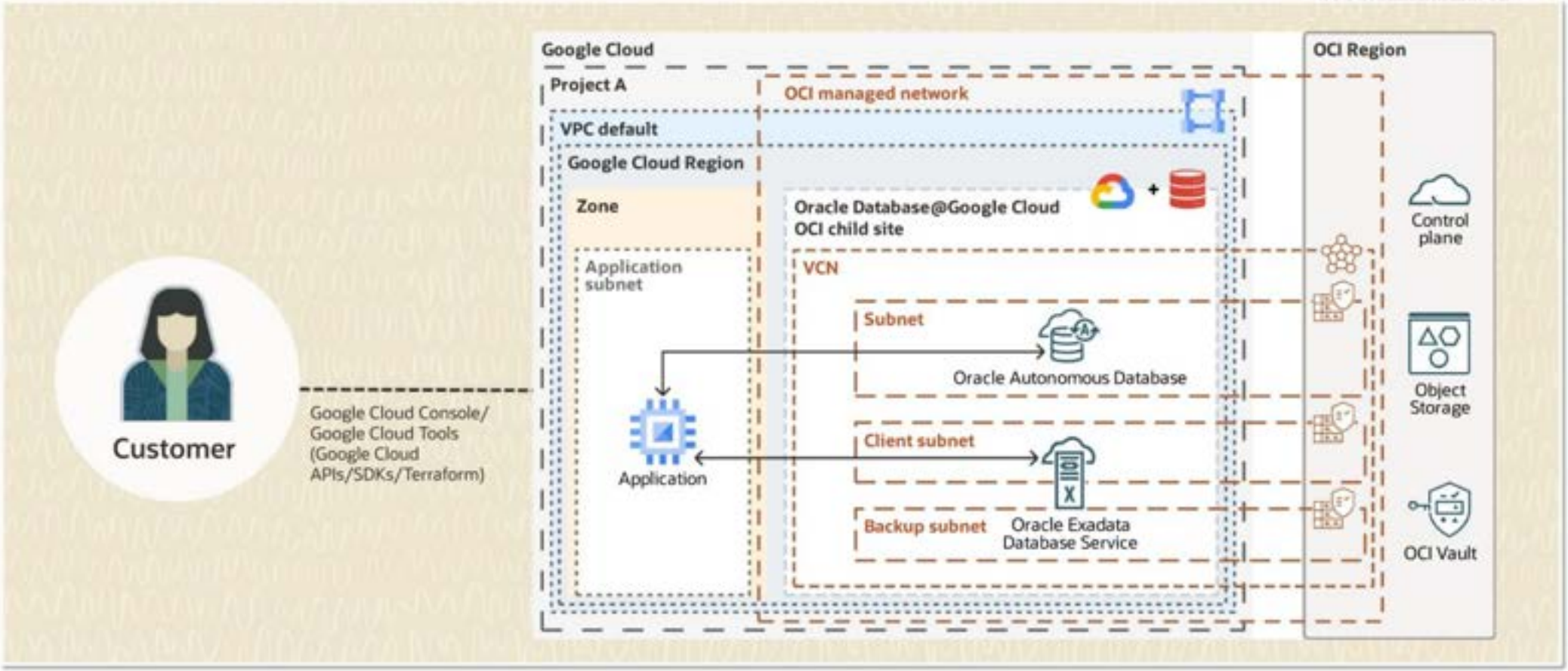
Deployment Architecture in Google Cloud Zone



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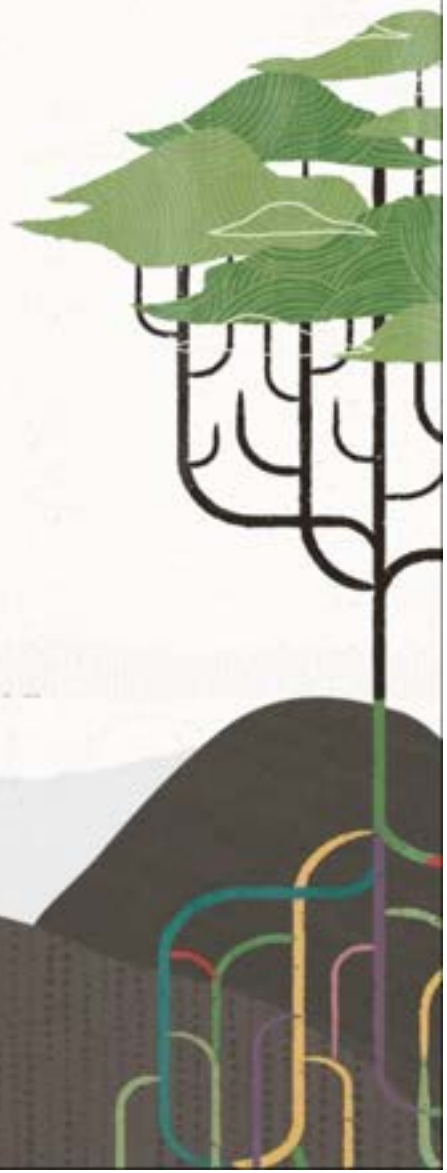
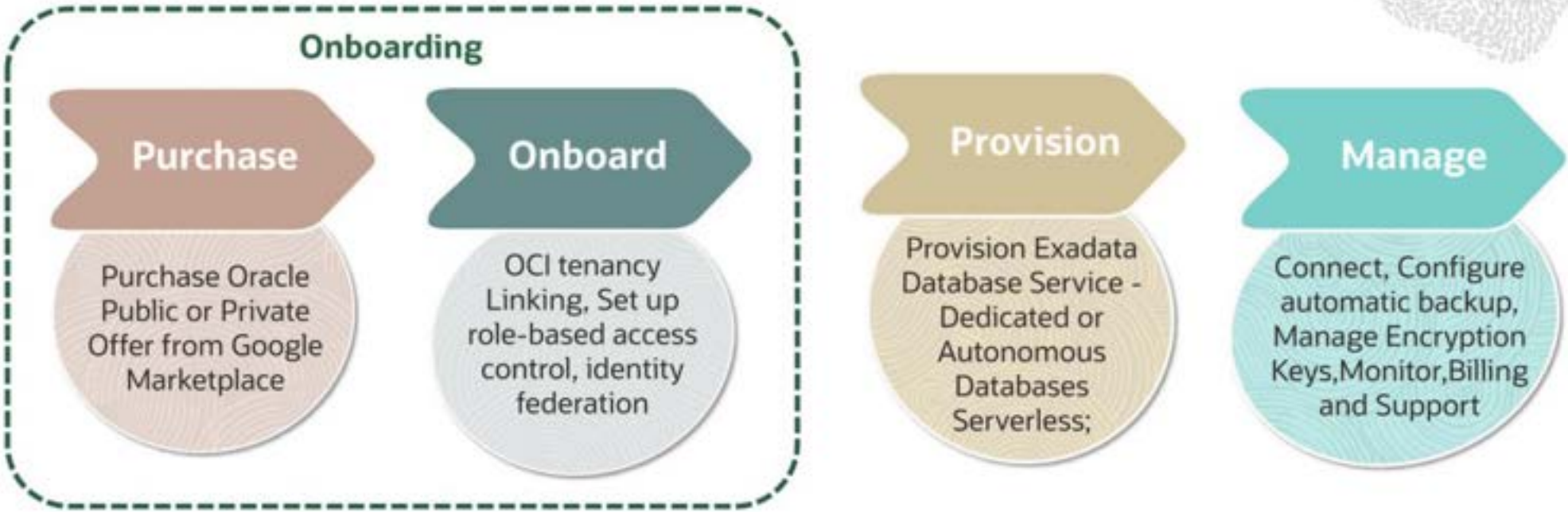
Oracle Database@Google Cloud - User Journey



User Journey



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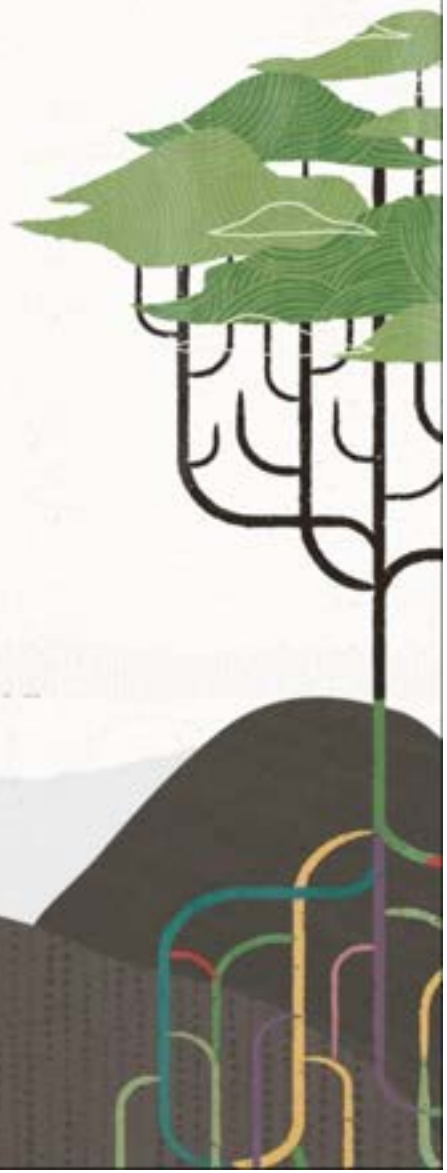
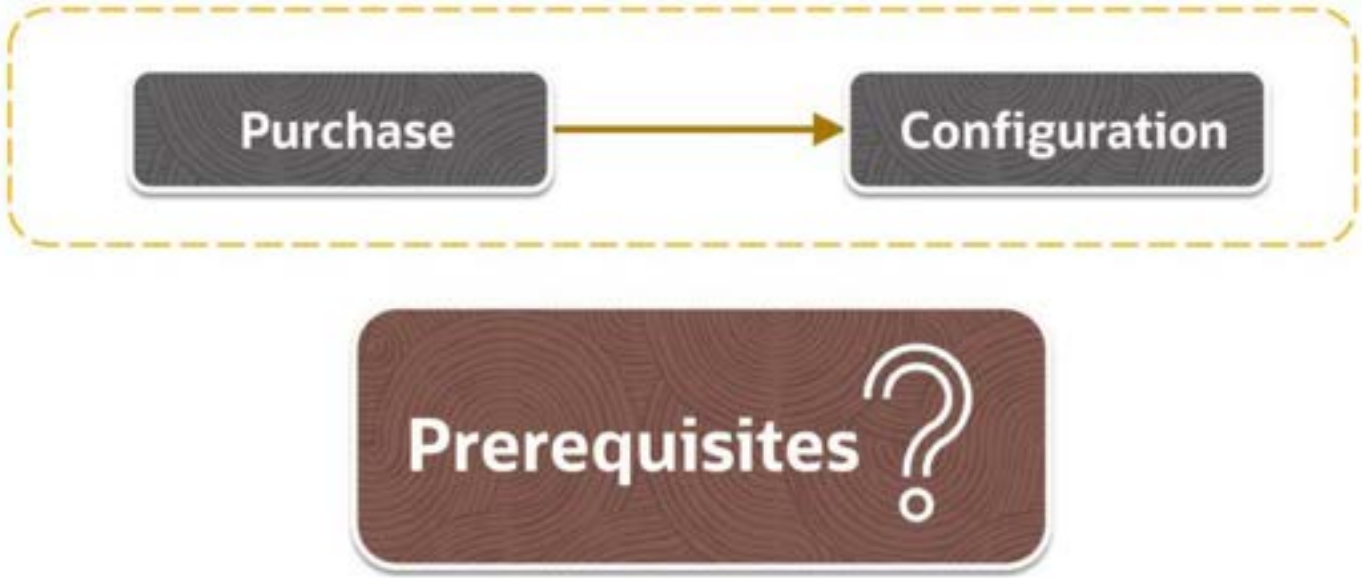
Oracle Database@Google Cloud – Onboarding



Onboarding Oracle Database@Google Cloud

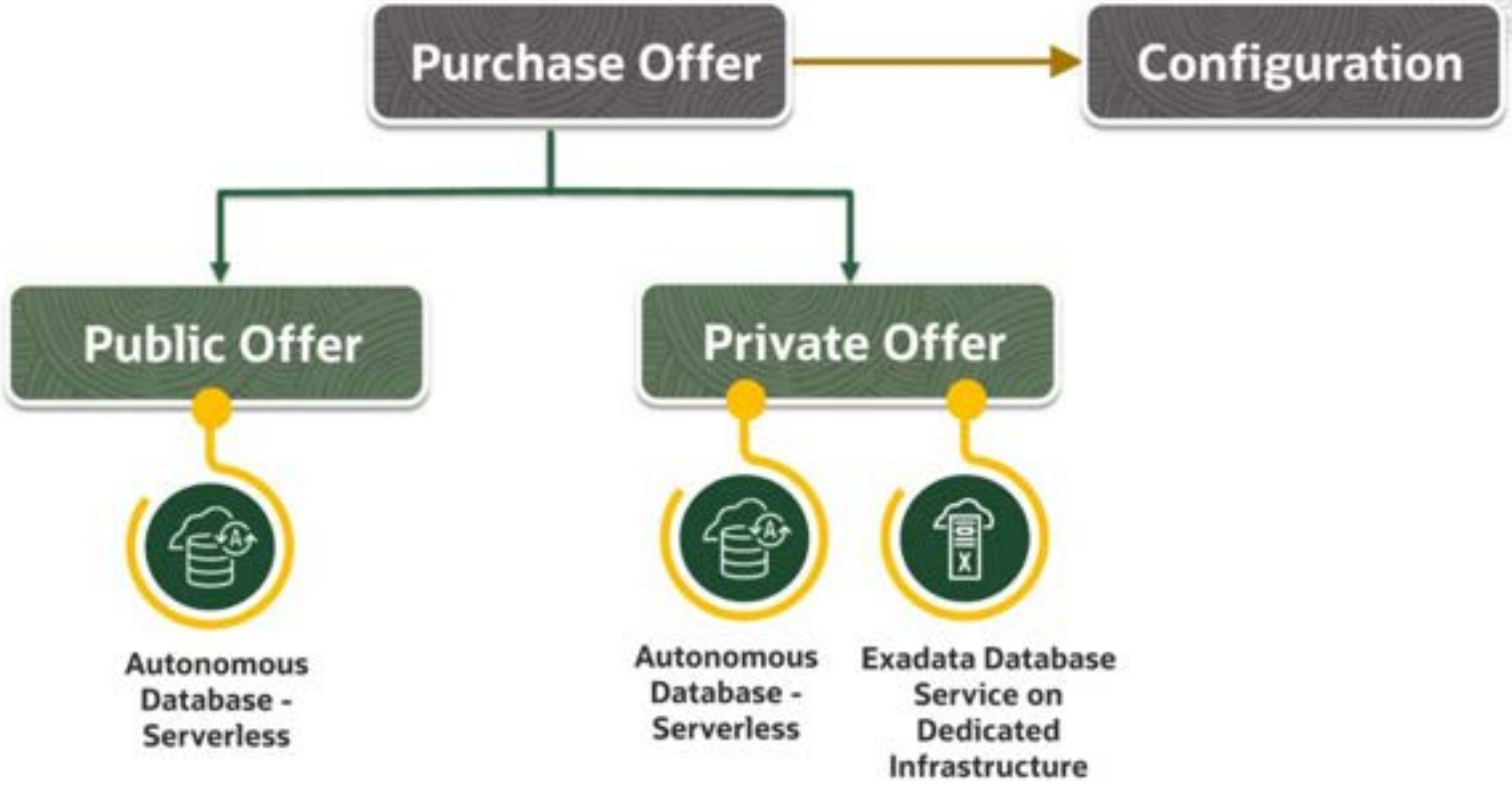


Onboarding Prerequisites

- Permissions for Onboarding task
- Google Cloud Project & Google Billing Account
- OCI account for linking

Cloud Env	Task	Permission
Google Cloud	Private Offer Purchase	Project Owner or Contributor
Google Cloud	Public Offer Purchase	Billing Account Owner, Contributor
OCI and Google Cloud	Account Linking	OCI Administrator, OCI Account Owner, GCP: Project Owner or Editor
Google Cloud	Identity Federation	External Identity Provider Administrator, Groups Administrator, User Administrator
OCI	Identity Federation	OCI Identity Domain Administrator
OCI	Register with My Oracle Support	OCI Support Owner

Onboarding Oracle Database@Google Cloud



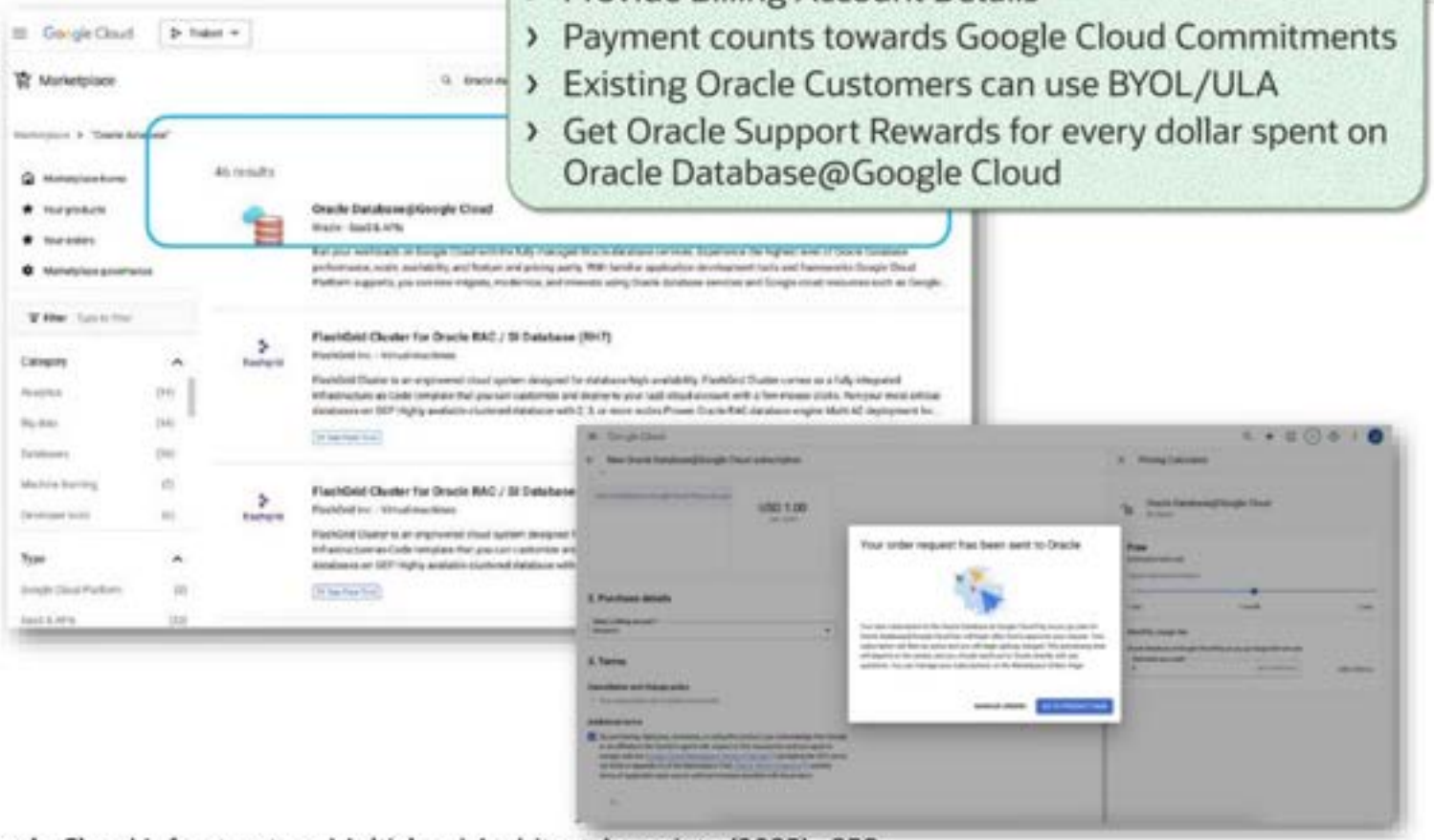
Purchase - Public Offer

Google Cloud Console

Google Cloud Marketplace

Subscribe Oracle Database@Google Cloud

- No need to contact Oracle Sales
- Select Pay As You Go Plan
- Provide Billing Account Details
- Payment counts towards Google Cloud Commitments
- Existing Oracle Customers can use BYOL/ULA
- Get Oracle Support Rewards for every dollar spent on Oracle Database@Google Cloud



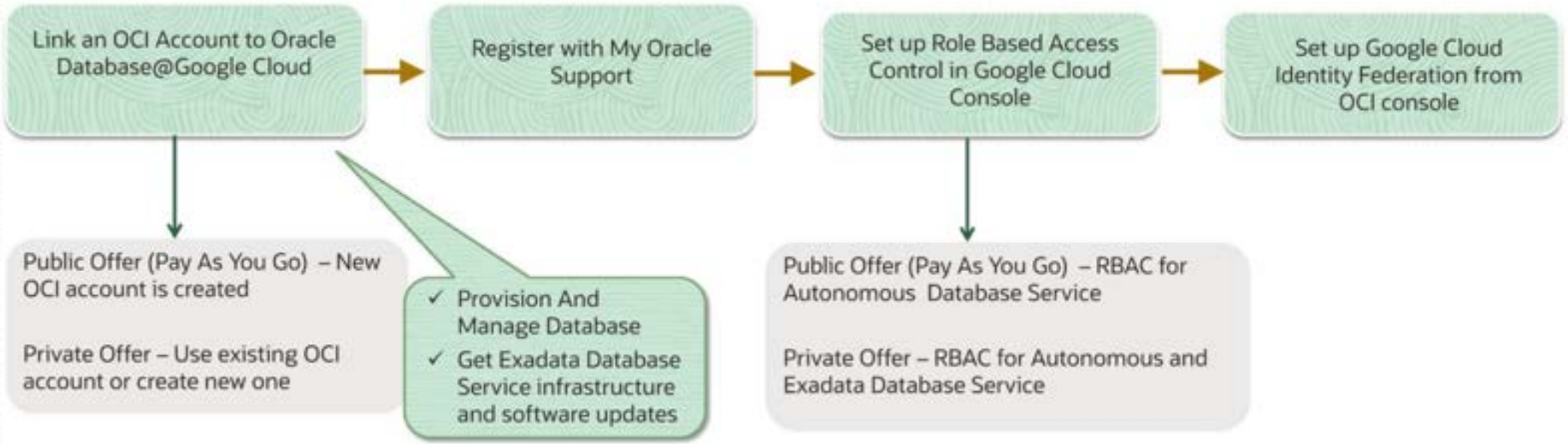
Purchase - Private Offer

- Provide Billing Account Details
- Payment counts towards Google Cloud Commitments
- Existing Oracle Customers can use BYOL/ULA
- Get Oracle Support Rewards for every dollar spent on Oracle Database@Google Cloud

Contact Oracle Sales to create Private Offer in Google Cloud Marketplace

Review and accept private offer in Google Cloud Marketplace

Configuration



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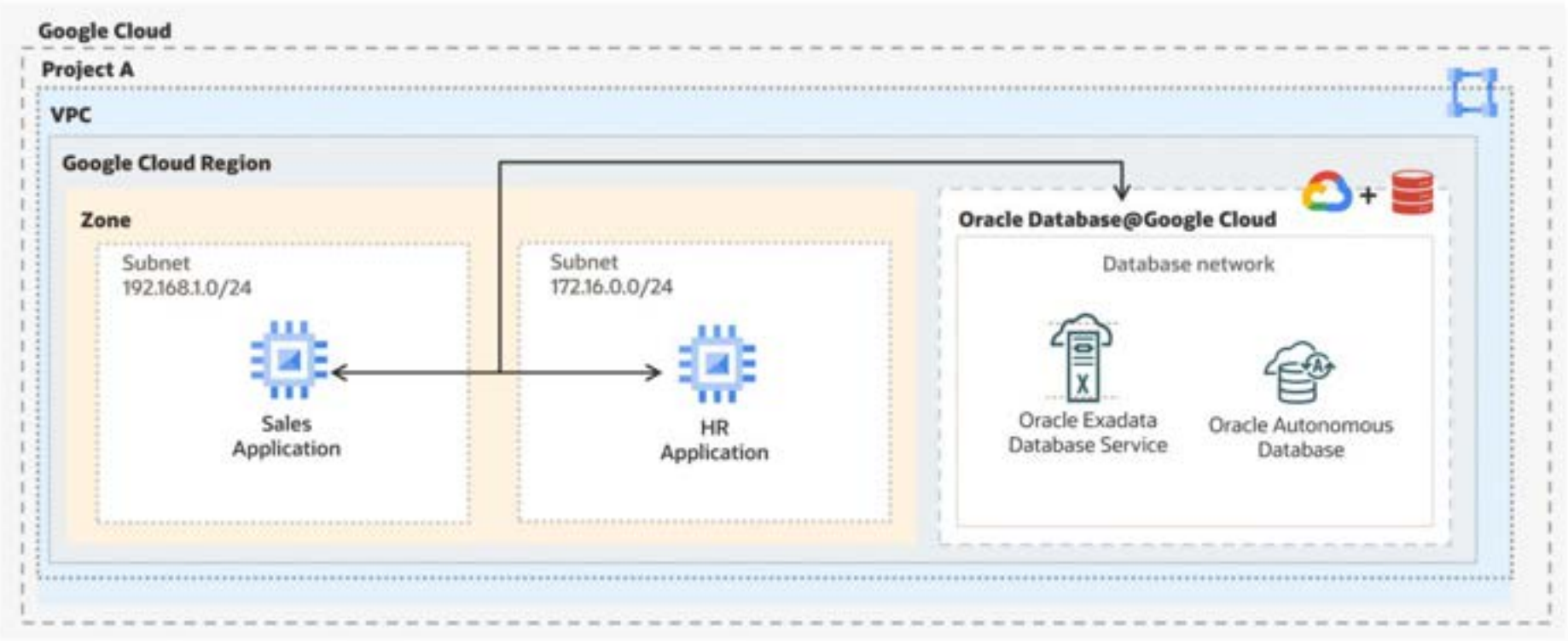
Oracle Cloud Infrastructure

Oracle Database@Google Cloud - Networking Topologies

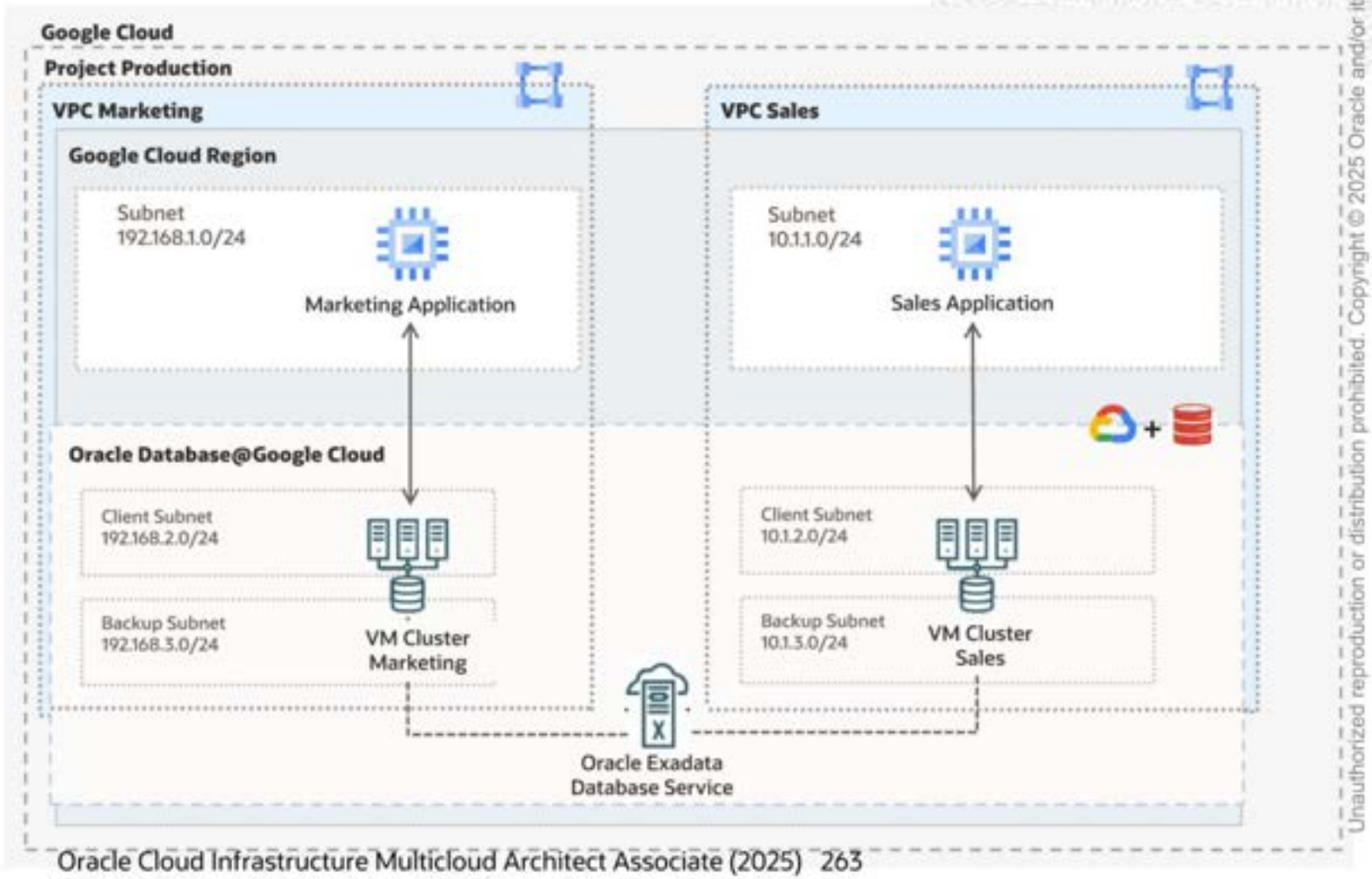
Single VPC - Multiples Subnets

- Oracle Databases subnets and application subnets are part of the same Google Cloud Region, VPC, Project
- Subnets in the same VPC has access to the ExaDB-D and ADB-S
- Firewall rules are defined at the OCI Network Security Group (NSG)



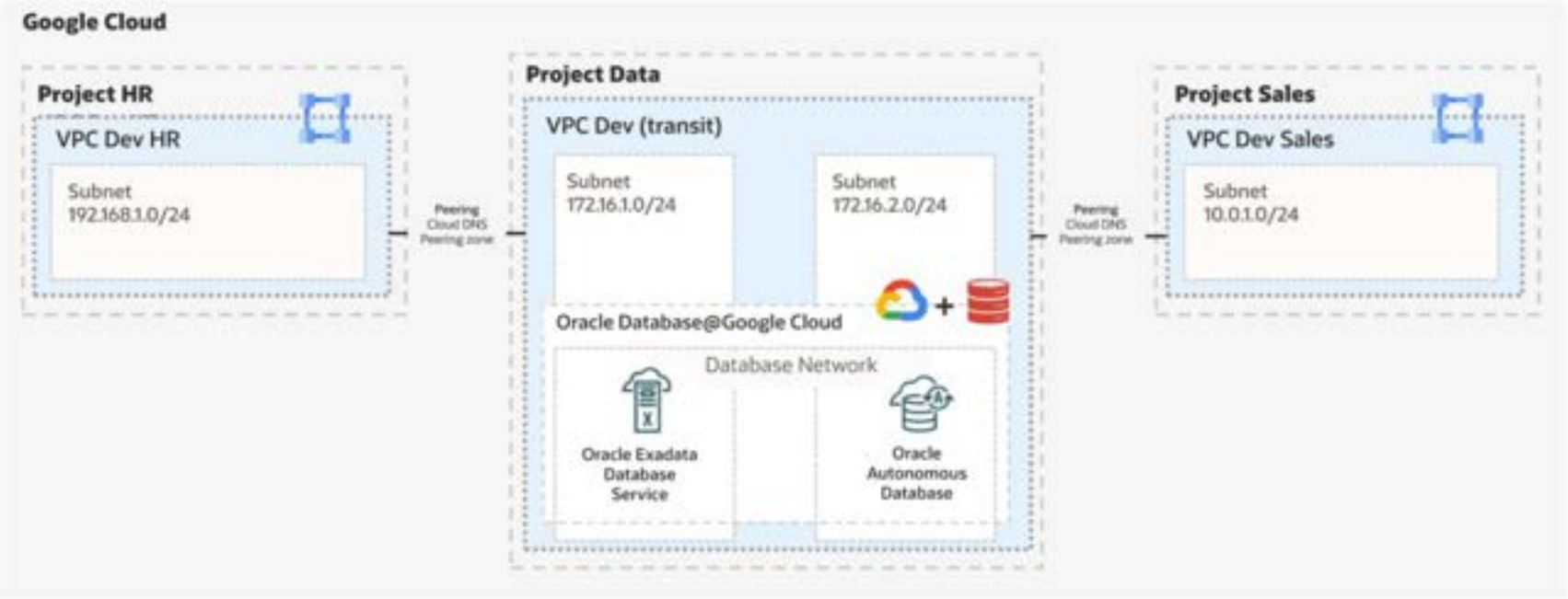
Multiple VPC

- Each VM Cluster is connected to a different VPC
- Multiple VM Cluster share the same Exadata Infrastructure
- Exadata Infra and VM Cluster are part of the same project



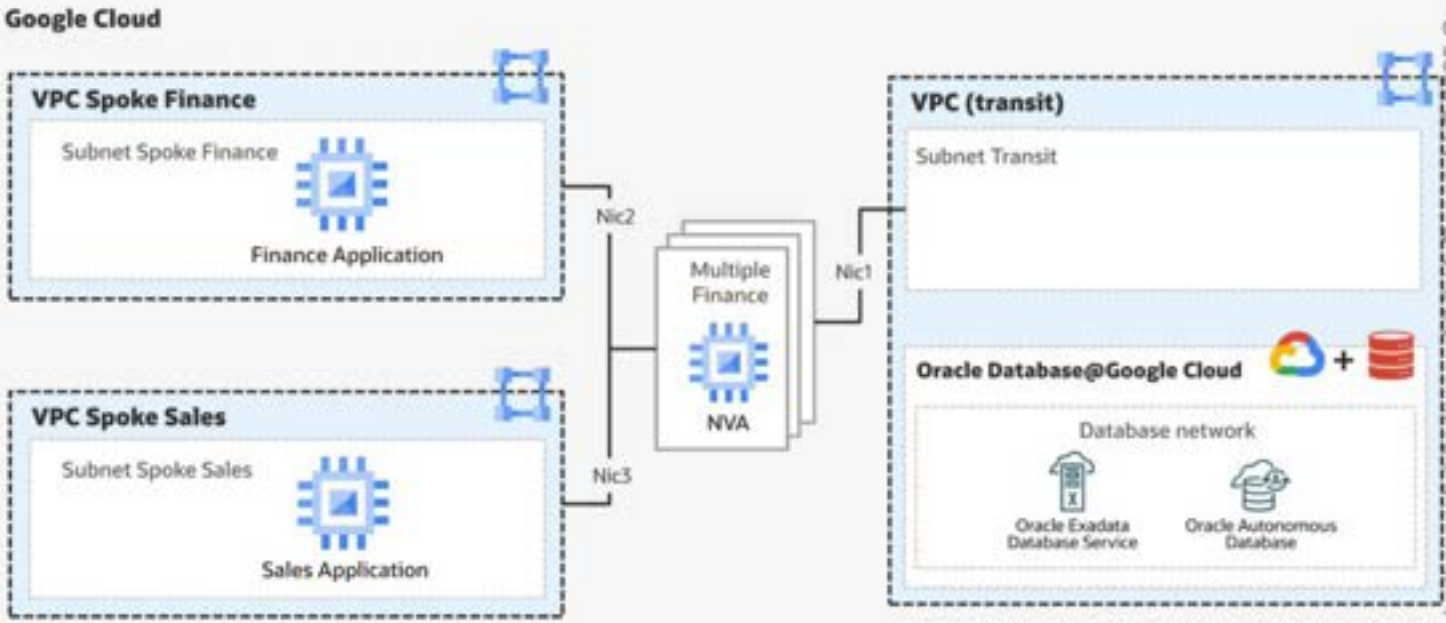
VPC Peering

- Oracle Database@Google Cloud created in the VPC transit.
- The DB is accessible from multiple VPC by peering.
- VPC transit is peered with other VPC of the same or different projects and or organizations.



Hub-and-Spoke network virtual appliance (NVA)

- Hub NVA has multiple VNICs in each spoke subnet.
- Hub NVA support routing.
- VNIC for Oracle Database@GoogleCloud is created in transit subnet
- Oracle Database@GoogleCloud, as a spoke to the NVA by the Partner Interconnect.



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Oracle Cloud Infrastructure

Oracle Database@Google Cloud – Provisioning

Role Based Access Grants for OD@GCP

Control user access to Oracle Database@ Google Cloud with role based access control

Google Cloud Groups and Roles for Autonomous Database – Serverless (ADB-S)

Group Name	Role Name	Purpose of Group
odbg-adbs-db-administrators	Oracle Database@Google Cloud Autonomous Database Admin	Manages all ADB resources in Google Cloud
odbg-db-family-administrators	Oracle Database@Google Cloud admin	Manage all oracle database resources in OCI; replicated to OCI during Identify Federation
odbg-network-administrators	-	Manages network resources in OCI; replicated to OCI during Identify Federation

Google Cloud Groups and Roles for Exadata Service – Dedicated (ExaDB –D)

Group Name	Role Name	Purpose of Group
odbg-exa-infra-administrators	Oracle Database@Google Cloud Exadata Infrastructure Admin	Manages all Exadata database service resources in Google Cloud
odbg-vm-cluster-administrators	Oracle Database@Google Cloud VM Cluster Admin	Manage VM cluster resources in Google Cloud
odbg-network-administrators	-	Manages network resources in OCI; replicated to OCI during Identify Federation
odbg-exa-cdb-administrators		Manage all CDB resources in OCI; replicated to OCI during Identify Federation
odbg-exa-pdb-administrators		Manage all PDB resources in OCI; replicated to OCI during Identify Federation

Network Requirement for Database Service in OD@GCP

Autonomous Database :
Minimum CIDR size is /27
(non-overlapping)

Exadata Database Service :

Minimum CIDR size : /27 (non-overlapping)
Interconnect IPs for Exadata X9M :100.106.0.0/16 and
100.107.0.0/16

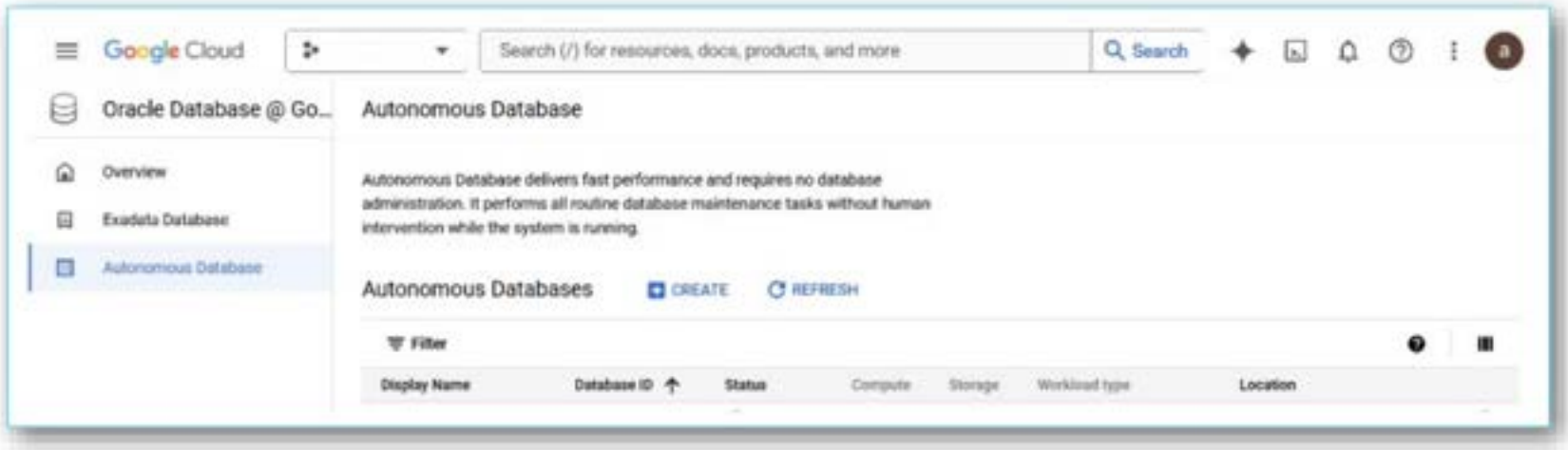
Client Subnet:
4 IPs address for each VM in cluster
3 IPs per cluster for SCAN
Reserved IPs per cluster with minimum size of 2 VMs = 11

Backup Subnet:
3 IPs per VM
Reserved IPs per cluster with minimum size of 2 VMs = 6

Provision Oracle ADB-S in OD@GCP

Prerequisite

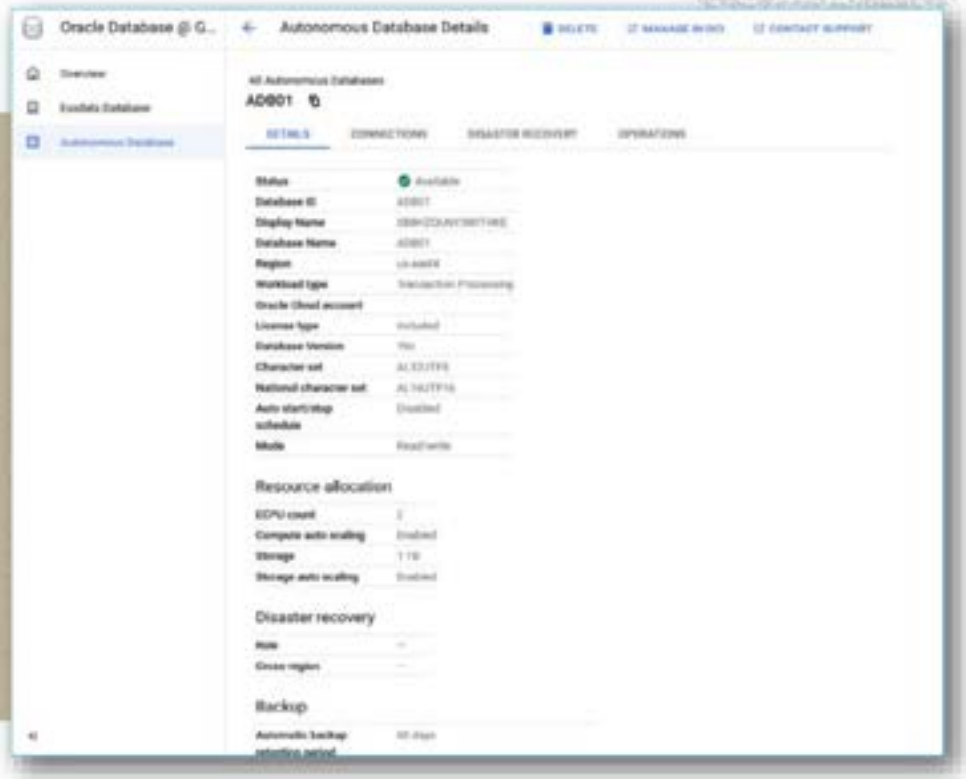
- Google Cloud Project
- Google Virtual Cloud Network (VPC)



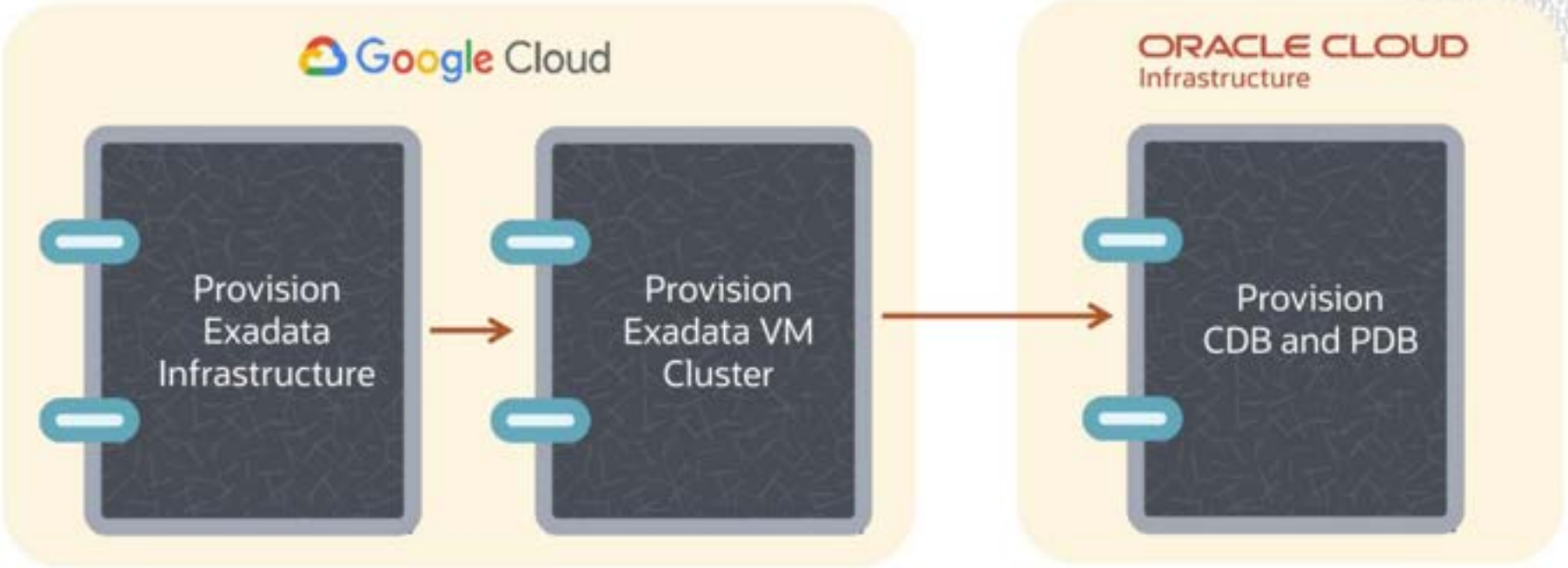
Provision Oracle ADB-S in OD@GCP

Configuration Parameters

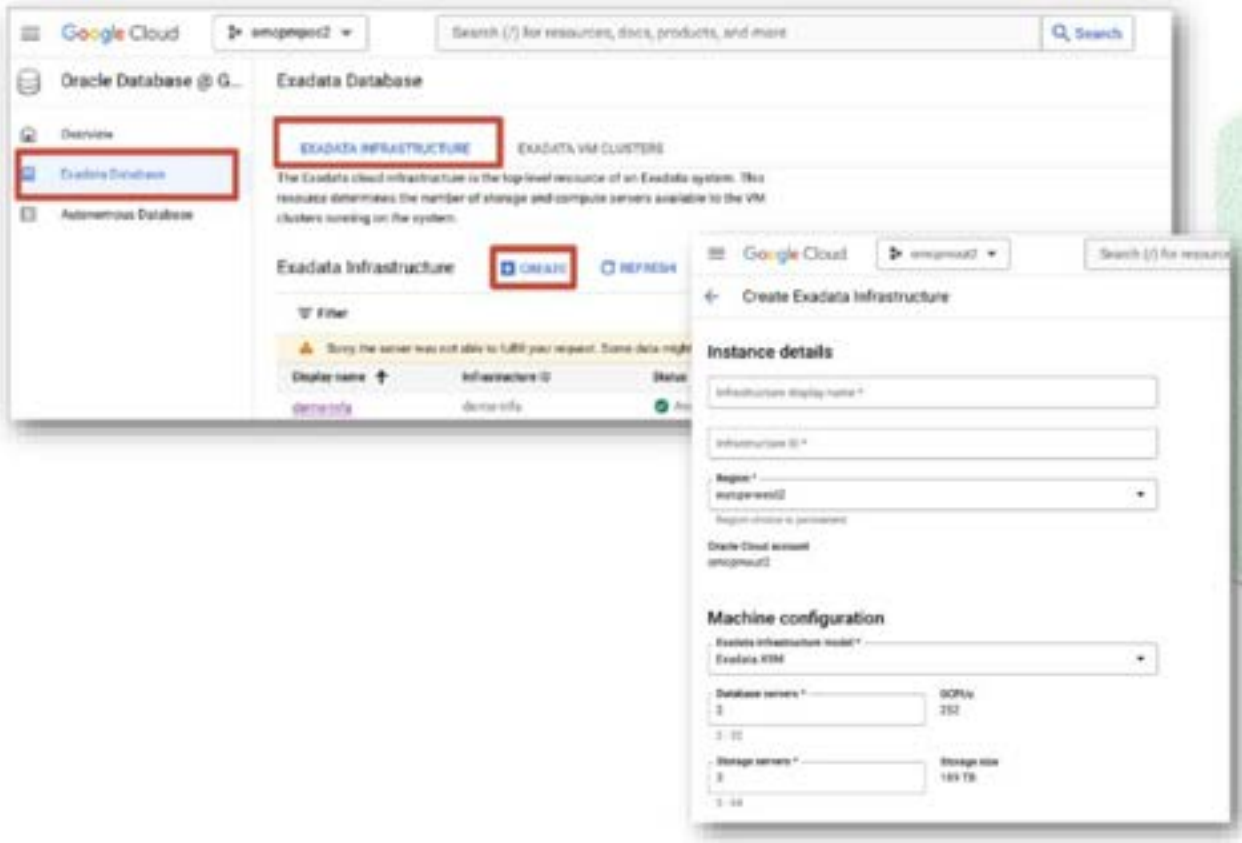
- Instance Details: ID, Name, Display Name, Region
- Workload type – ATP, ADW, JSON, APEX
- License Type – License Included or BYOL
- Compute – ECPU and Storage size and optionally enable auto scale
- Networking – Provide VPC, non overlapping Subnet CIDR, private IP and TLS option
- Others – Backup retention period, admin credentials, character set, contacts for notification, patch apply preference, etc.



Provision ExaDB –D in OD@GCP

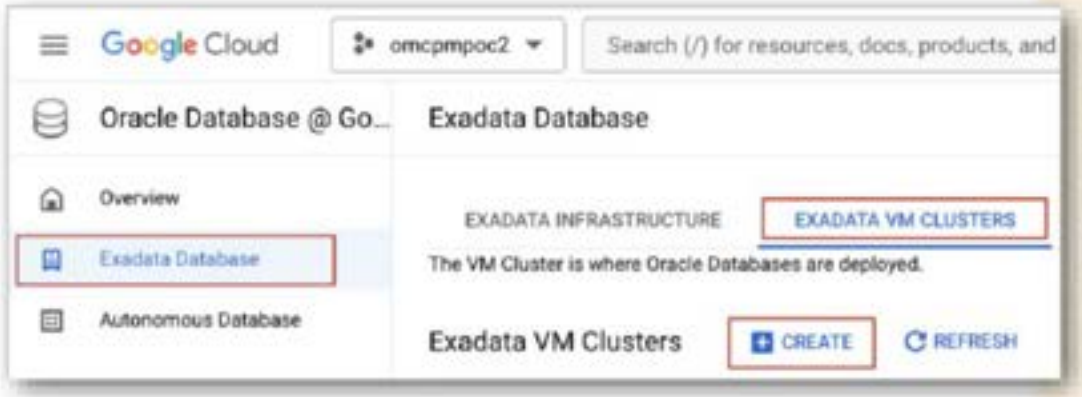


Provision Oracle Exadata Infrastructure



- Exadata Infrastructure ID, Display name, region; linked OCI account
- Infrastructure model, number of DB servers and storage servers
- Maintenance method and schedule, contacts

Provision Oracle Exadata VM Cluster



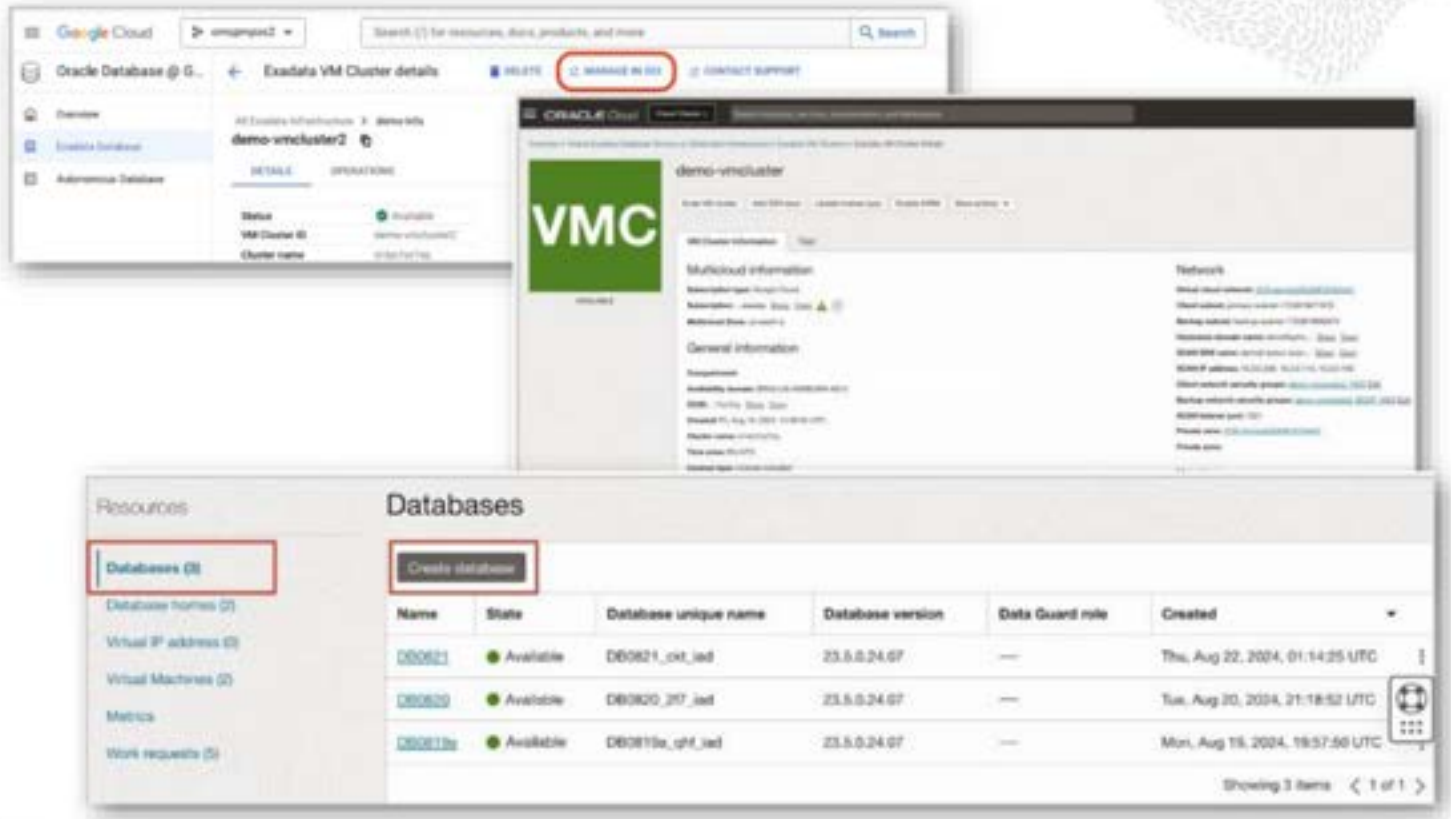
- VM Cluster name, Cluster ID and Grid Infrastructure version
- Cluster VM OCPU (min 2), Memory (min 30GB) and Local storage (min 60GB)
- Exadata Storage (min 2 TB) – opt for sparse snapshots and local backups
- Networking range for client and backup IP (192.168.16.16/28 reserved for interconnect)
- Optionally enable diagnostic collection for events, health metrics, incident logs and trace
- SSH keys, License type, timezone, SCAN listener port

Provision Oracle Exadata Database

Click on MANAGE IN OCI link in Exadata VM Cluster Overview page to switch from Google Cloud to OCI console

Create Database Home and provision Container and pluggable database in OCI console

Manage operations not enabled with Oracle Database@Google Cloud service



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Oracle Cloud Infrastructure

Oracle Database@Google Cloud - Manage

Operations And Interfaces

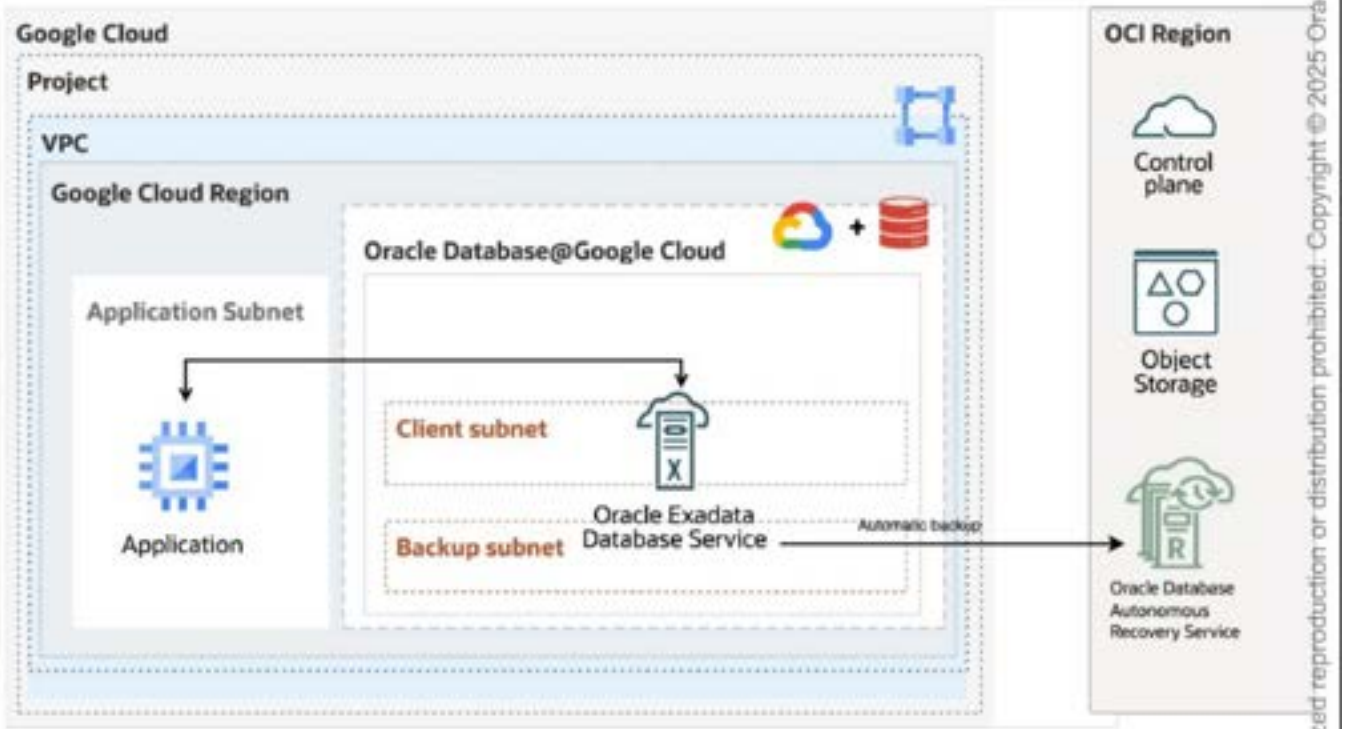
	Google Cloud Console	OCI Console
Resource & Lifecycle Management	**Provision and Delete Autonomous Database Service, Exadata Database Service resource** (Infra. & VM cluster)	Create and manage CDB, PBD of ExaDB Service, DB backup, Encryption keys, Database connection string and test connection
Observability	Infrastructure logs, metrics, & events database logs and metrics	Database logs and metrics
Billing, Costs & Usage	Invoice cost management and payment	Detailed usage reporting

Google Cloud APIs, SDKs and Terraform can also be used for performing operations on Oracle Database@Google Cloud

Configure Backup for Exadata Database Service

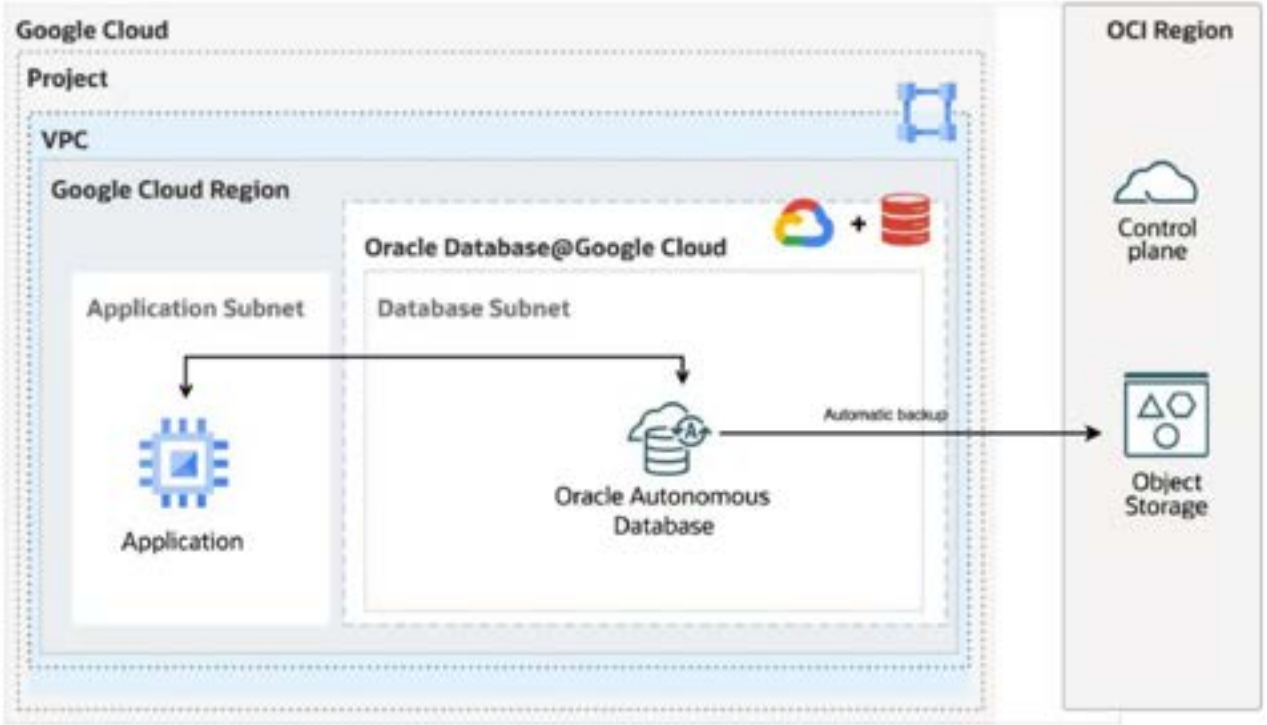
- OCI Object Storage (default)
- Autonomous Recovery Service - RCV (recommended)

- ✓ Automated one-click setup
- ✓ Option for real-time data protection
- ✓ Backup immutability
- ✓ Mandatory and automatic encryption
- ✓ Incremental forever backups
  - ✓ Higher operational efficiency
  - ✓ Faster recovery
- ✓ Backup on primary and/or standby
- ✓ MAA Backup/Restore Practices and Performance Observations
- ✓ RCV can run in OCI or Google Cloud



Configure Backup for Autonomous Database Service

- OCI Object Storage
- Automated and Manual



Monitoring Resources in Google Cloud

Simplified Monitoring Using Google Cloud Monitor

Monitor Exadata VM Metrics

Monitor Database Metrics, Logs and Events