Oracle Cloud Infrastructure: Network Setup for DBAs

Robert Marz

Databees.

Robert Marz – Independent Consultant

Primary Job Role

Senior Technical Architect
   with database centric view of the world

DOAG
(German Oracle User Group)

Active Member of Database Community
Responsible for Cloud Topics

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Why Networking for DBAs?

After Subscribing to IaaS Cloud Services
You start with an empty virtual Datacenter

Do I have to do it all by myself?

OMG no.
Ask someone who knows this stuff by heart.
(And probably is in Charge for these topics)

Do I realy need to know all this stuff?

Nope.
But Oracle Cloud Infrastructure is network driven.
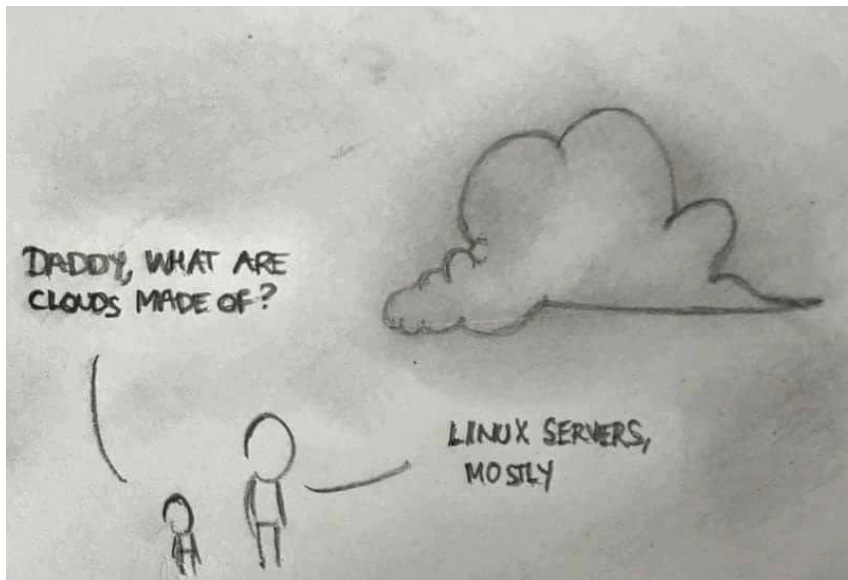**It's the topic of this session - Knowledge never hurts!**

What is it good for?

You can help yourself.
Think about adding DNS-Entries for Scanlisteners

DADDY, WHAT ARE CLOUDS MADE OF?

LINUX SERVERS, MOSTLY

What are Clouds made of?

Linux Servers	Mostly	
Network Components	Other supporting stuff	
Software Defined (SDx)	Everything is Virtual	
	For Cloud-Users	

OCI Basics

Oracle Cloud Infrastructure Overview
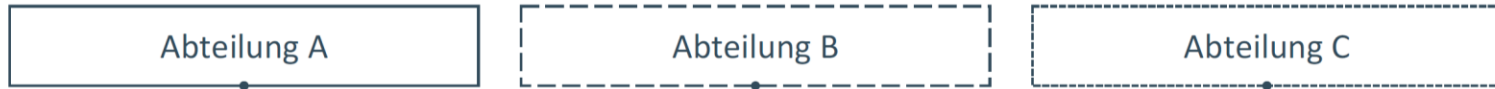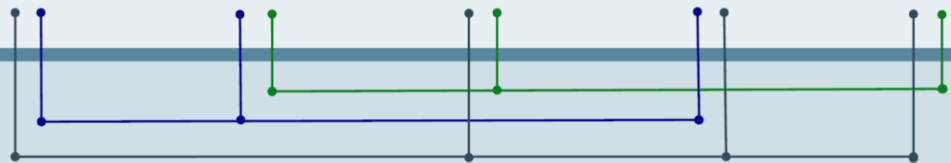
Identity Domains, Tenants & Cloud-Account

ORACLE® Cloud Infrastructure

SIGN IN

Cloud Account

Cloud Account with Identity Cloud Service

robbiedatabee

Next >

Cloud Tenant

Continue

Administrators
- Perform administrative tasks for individual services
- Monitor key metrics and notifications for services
- Manage users and roles for cloud services
- Access the console for services you administer

Users
- Launchpad to all of your applications and services
- Change your identity details and preferences

Notices | Terms of Use | Privacy

Identity Domains, Tenants & Cloud Account

Mean the same thing: Your Cloud Space

Part of your Cloud URLs

Enter your Identity Domain; Login with user & password

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Compartments

Logical Dividers	Namespaces	
	Subdomains	
Separation	Departments	
	Applications	
"New Features"	nestable (6 levels)	*Nov. 1, 2018*
	Renameable	*Sept. 7, 2017*
	Deleteable	*Oct. 18, 2018*
Cloud Resources	Stay in their Compartment (not anymore)	
	See each other	

Virtual Cloud Network Wizard

Virtual Cloud Network Wizard

VCN Wizard

Launched via Menu	Networking > Virtual Cloud Networks > Create Virtual Network
Creates Resources	in one easy step
Start VCN Wizard	VCN with Internet Connectivity … and Site-to-Site VPN Connect
All created resources	can be modified afterwards Exception: VCN IP Range

The Virtual Cloud Network Wizard (Network only)

Create Virtual Cloud Network help cancel

CREATE IN COMPARTMENT

DOAG-DB

robbiedatabee (root)/DOAG-DB

NAME *OPTIONAL*

DOAG-DB Netzwerk

◉ CREATE VIRTUAL CLOUD NETWORK ONLY
○ CREATE VIRTUAL CLOUD NETWORK PLUS RELATED RESOURCES

Creates a Virtual Cloud Network only. You'll still need to set up at least one Subnet, Gateway, and Route Rule to have a working Virtual Cloud Network.

CIDR BLOCK

10.145.120.0/24

Specified IP addresses: 10.145.120.0-10.145.120.255 (256 IP addresses)

DNS RESOLUTION

☑ USE DNS HOSTNAMES IN THIS VCN   ❓

Allows assignment of DNS hostname when launching an Instance

DNS LABEL

doagdb

Only letters and numbers, starting with a letter. 15 characters max.

DNS DOMAIN NAME *(READ-ONLY)*

doagdb.oraclevcn.com

TAGS

Tagging is a metadata system that allows you to organize and track resources within your tenancy. Tags are composed of keys and values that can be attached to resources.

Learn more about tagging

TAG NAMESPACE   TAG KEY   VALUE

None (apply a free-form tag)

+ Additional Tag

☑ VIEW DETAIL PAGE AFTER THIS RESOURCE IS CREATED

Create Virtual Cloud Network

Demo

The Virtual Cloud Network Wizard (Network only) [zoom]

Create Virtual Cloud Network   help   cancel

CREATE IN COMPARTMENT

DOAG-DB

robbiedatabee (root)/DOAG-DB

NAME *OPTIONAL*

DOAG-DB Netzwerk

⦿ CREATE VIRTUAL CLOUD NETWORK ONLY

◯ CREATE VIRTUAL CLOUD NETWORK PLUS RELATED RESOURCES

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CIDR BLOCK

10.145.120.0/24

Specified IP addresses: 10.145.120.0-10.145.120.255 (256 IP addresses)

Demo

Create Virtual Cloud Network

Create Virtual Cloud Network

The Virtual Cloud Network was created: doagdev

Create Internet Gateway

The Internet Gateway "Internet Gateway doagdev" was created

Update Default Route Table

The Route Table was updated: Default Route Table for doagdev

Create Subnet

Public Subnet yFpI:EU-FRANKFURT-1-AD-1 was created

Create Subnet

Public Subnet yFpI:EU-FRANKFURT-1-AD-2 was created

Create Subnet

Public Subnet yFpI:EU-FRANKFURT-1-AD-3 was created

Close

Create Virtual Cloud Ne

CREATE IN COMPARTMENT

DOAG-DEV

robbiedatabee (root)/DOAG-[

NAME *OPTIONAL*

doagdev

◯ CREATE VIRTUAL CLOU

◉ CREATE VIRTUAL CLOU

Automatically sets up a
internet. You can set up firewall rules ai
ingress and egress traffic to your Instan
created in the same Compartment as th

Create S

Name: Public
Security List:
DHCP Option
CIDR: 10.0.2
Route Table:
DNS Label: A

sses)

s)

Demo

The Virtual Cloud Network Wizard (+ related Resources) Results

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Networking in OCI

Networking

VCN	Virtual Cloud Network	**IPv4 only**
	Covers Network Addresses	single, contiguous CIDR block
Subnets	Scope	Regional
		Availability Domain specific
	contain VNICs with same	route table
		security lists
		DHCP Options

Private & Public IPs

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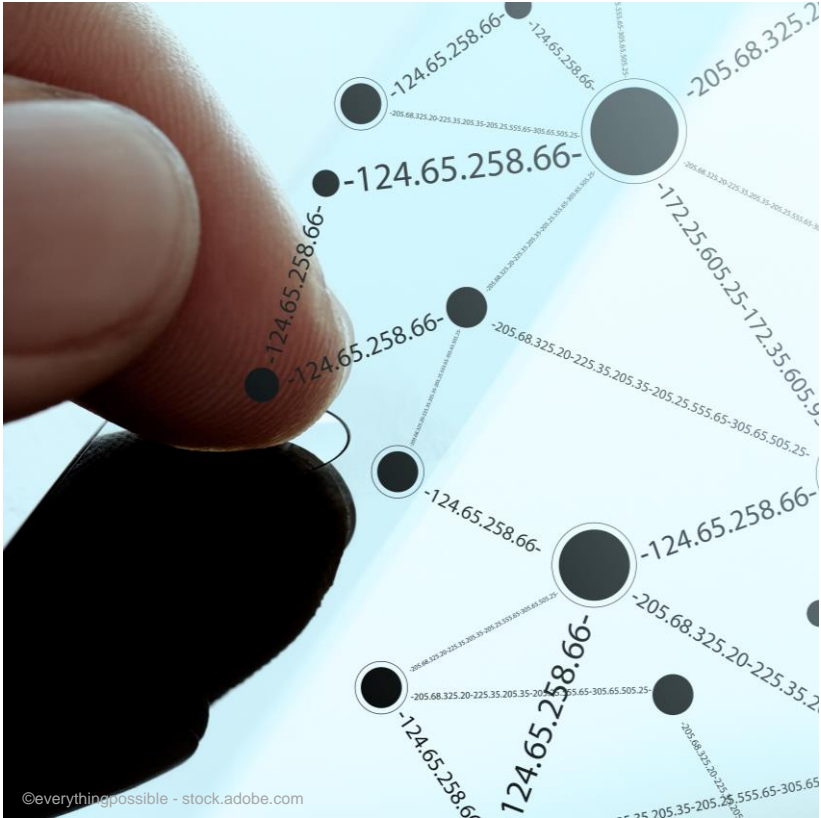
Public IPs are Unique

World Wide

IPv4 Addresses are limited

Not enough unique IPs

Standardized Private IP-Adresses

Used over and over again | Packets with private IP address aren't forwarded into the Internet

Private IP Networks

RFC1918 name	IP address range	number of addresses	largest CIDR block (subnet mask)	classful description
24-bit block	10.0.0.0 – 10.255.255.255	16777216	10.0.0.0/8 (255.0.0.0)	single class A network
20-bit block	172.16.0.0 – 172.31.255.255	1048576	172.16.0.0/12 (255.240.0.0)	16 contiguous class B networks
16-bit block	192.168.0.0 – 192.168.255.255	65536	192.168.0.0/16 (255.255.0.0)	256 contiguous class C networks

https://en.wikipedia.org/wiki/Private_network

IP Subnetworks – Masking & CIDR

IP Addresses in the same Subnet are considered local

no routing required

Subnet Masking

Binary Operation "AND"

Google

"Network Calculator"
"IP Subnet Calculator"

Network	192.168.132.0 mask 255.255.255.0
CIDR	192.168.132.0/**24**

IPv4 Addresses are 4 Bytes	192	168	132	197
Each Byte has 8 Bits, 0-255	1100 0000	1010 1000	1000 0100	1100 0101
Subnet Masks	255	255	255	0
CIDR counts the 1s (3 x 8 = **24**)	1111 1111	1111 1111	1111 1111	0000 0000
Network Adress (logical AND)	192	168	132	0

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Network 192.168.132.197/28
netmask 255.255.255.240

IP	Masked IP
192.168.132.197	192.168.132.`192`

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Network 192.168.132.197/28
netmask 255.255.255.240

IP	Masked IP
192.168.132.197	192.168.132.`192`
192.168.132.190	192.168.132.`176`

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Network 192.168.132.197/28
netmask 255.255.255.240

IP	Masked IP
192.168.132.197	192.168.132.192
192.168.132.190	192.168.132.176
192.168.132.209	192.168.132.208

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Network 192.168.132.197/28
netmask 255.255.255.240

IP	Masked IP
192.168.132.197	192.168.132.`192`
192.168.132.190	192.168.132.`176`
192.168.132.209	192.168.132.`208`
192.168.132.200	192.168.132.`192`

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Examples of IP-Subnets

Network	Low IP Network Adr	High IP Broadcast Adr	# Adrs	Netmask
192.168.132.197/28	192.168.132.193 192.168.132.192	192.168.132.206 192.168.132.207	14	255.255.255.240
172.24.19.100/20	172.24.16.1 172.24.16.0	172.24.19.254 172.24.19.255	4096	255.255.240.0
10.100.0.0/16	10.100.0.1 10.100.0.0	10.100.255.254 10.100.255.255	65534	255.255.0.0

IP Routing – Why planning ahead is important

IP Routing	whenever a Packet has to leave its subnet	"Destination is not on the switch"	
	Addresses in own Subnet are considered local	no routing	
	NEVER OVERLAP	IP-Ranges in Networks	
Plan Ahead	Use only "new" IP-Ranges for Networks	as small as possible	
		as big as necessary	at least 3 Subnets for Availability Domains
	A Cloud Account is a new Datacenter	Chance for a fresh Start	
	Quick and Dirty Trials	Don't let them become productive	
		Destroy and rebuild	

Networking

VNIC	Virtual Network Interface Card	
Private IP	Assigned to each VNIC	primary
		unchanged during lifetime
Public IP	Routable	from Internet
	Optional	Assigned to VNIC 50 static IPs free of charge
	Requirements	Public Subnet, Internet Gateway

Networking

Route Tables	Routes from Subnet to outside VCN	
	Default	empty
Security Lists	Virtual Firewall Rules	Stateful, Stateless; Ingress = inbound; egress = outbound
	Default Set (stateful)	Ingress: allow ssh, icmp type 3+4; Egress: allow any
DHCP Options	Configuration Set	
	Limited Options	DNS Type; Search Domain

OCI Ne

SL

AVAILABLE

Default Security List for DOAG-DB Netzwerk

Edit All Rules **Terminate** **Apply Tag(s)**

| **Security List Information** | **Tags** |

OCID: ...sunwca Show Copy
Created: Sat, 17 Nov 2018 15:34:31 GMT

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

werk

Resources

Ingress Rules (3)

Egress Rules (1)

Ingress Rules

Stateless Rules

No Ingress Rules

There are no stateless Ingress Rules for this Security List.

Stateful Rules

HCP Options

Source: 0.0.0.0/0	**IP Protocol:** TCP	**Source Port Range:** All	**Destination Port Range:** 22	**Allows:** TCP traffic for ports: 22 SSH Remote Login Protocol
Source: 0.0.0.0/0	**IP Protocol:** ICMP	**Type and Code:** 3, 4		**Allows:** ICMP traffic for: 3, 4 Destination Unreachable: Fragmentation Needed and Don't Fragment was Set
Source: 10.145.120.0/24	**IP Protocol:** ICMP	**Type and Code:** 3		**Allows:** ICMP traffic for: 3 Destination Unreachable

Demo

OCI Networking Gateways

Gateways (GW) Virtual Routers

Dynamic Routing GW (DRG)	private Network traffic	
	VCN and on-Premises	
Internet GW	provides direct Internet Access	
NAT GW	Network Address Translation	Connects Cloud resources to Internet without Public IP
Service Gateway	Peers VCN with other Oracle Cloud Services	e.g. Object Storage
Local Peering GW (LPG)	Peer VCNs in **same** Region	
Remote Peering Connection	Peer VCNs in **different** Regions	

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Connecting to the Cloud

Connecting on-Premises to the Cloud

Paths into the Cloud

ssh Tunnel	to public IP	Ends on Compute Server
	Testing and Development only	
Custom Firewall Appliance	Compute Instance	Custom Image
	Custom VPN Setup	e.g. OpenVPN
IPSec VPN	Connect on-Premises VPN to Dynamic Routing Gateway (DRG)	Routing through public Internet
OCI FastConnect	Private Connection	
	Peering	Private Public
	Expensive	+ Provider (leased Line) + Datacenter

Paths into the Cloud: ssh Tunnel

ssh Tunnel

opens Port on local host
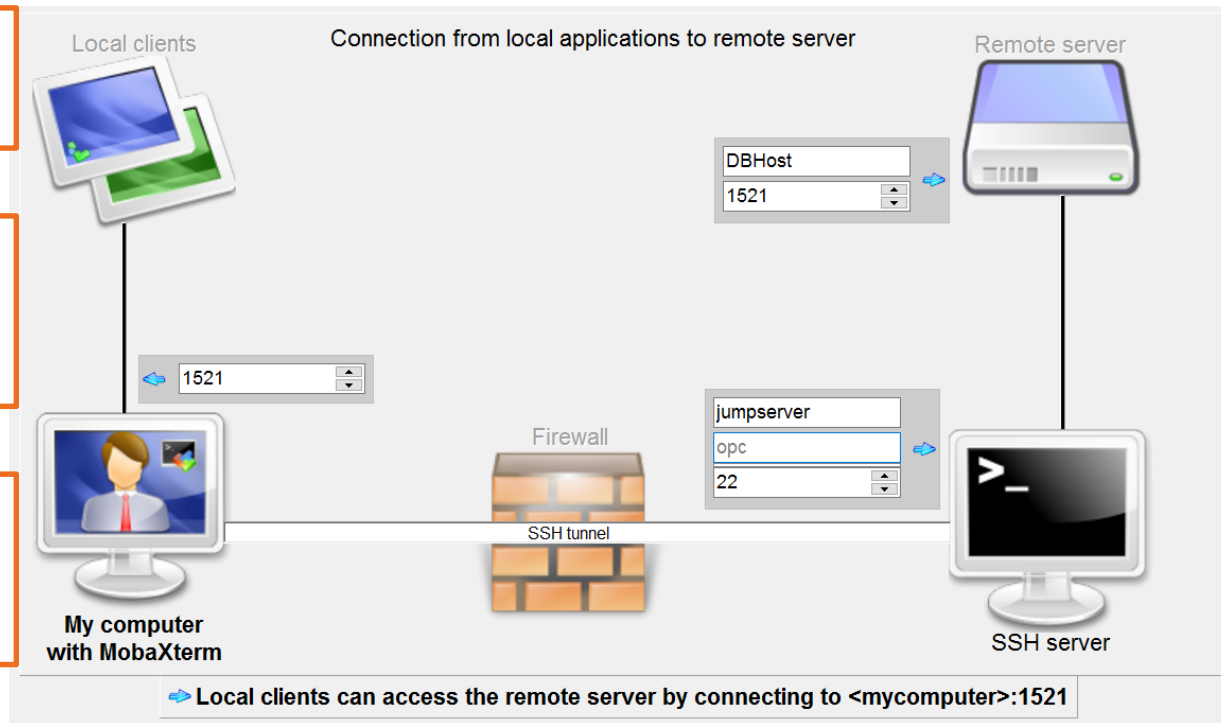
tunnels

IP Packets to ssh-destination „jumpserver"

forwards

IP Packets to any host/port accessible from jumpserver

Connection from local applications to remote server

Local clients

Remote server

DBHost

1521

1521

jumpserver

opc

22

Firewall

SSH tunnel

My computer with MobaXterm

SSH server

Local clients can access the remote server by connecting to <mycomputer>:1521

Paths into the Cloud: Automomous Database

Autonomous DBs

can't have VNICs

Access

encrypted via Internet

Wallet

Download zip-Archive
Import directly to SQL Developer
unzip & configure for SQLNet

Database Connection   help cancel

You will need the client credentials and connection information to connect to your database. The client credentials include the wallet, which is required for all types of connections.

Download Client Credentials (Wallet)

To download your client credentials, click Download, and supply a password for the wallet.

Download

Connection Strings

Use the following connection strings or TNS names for your connections. See the documentation for details.

TNS Name ⓘ	Connection String ⓘ		
ADWFINANCE_HIGH	...2av7afbjbk6bl_adwfinance_high.adwc.oraclecloud.com	Show	Copy
ADWFINANCE_MEDIUM	...v7afbjbk6bl_adwfinance_medium.adwc.oraclecloud.com	Show	Copy
ADWFINANCE_LOW	...g2av7afbjbk6bl_adwfinance_low.adwc.oraclecloud.com	Show	Copy

Showing 3 Item(s)

Close

Next Topic

OCI Networking – Costs EUR - Euro (€)

Networking

Try for Free   Buy Now

Overview   Features   Pricing   Learn More   Documentation

EUR - Euro (€)

Networking

Pricing calculator →

Product	Pay as You Go (GB Outbound Data Transfer Per Month)
Outbound Data Transfer - First 10 TB / Month	Free
Outbound Data Transfer - Over 10 TB / Month	€0.0074
Inbound Data Transfer	Free

https://cloud.oracle.com/networking/pricing as of 01-JAN-2019

Assumptions:
1GBit Connection
1 TB Data transfer
        takes 3h (roughly)

24h x 30 / (3h * TB) ≈ 240 TB
240 TB – 10 TB ≈ 230.000 GB
230.000 * 0,0074€ = 1.702€
max per Month

FastConnect Pricing EUR - Euro (€)

FastConnect

Try for Free   Buy Now

| Overview | Features | Pricing | Providers | Supported Services | Connectivity Models | Learn More | Documentation |

EUR - Euro (€)

FastConnect

Pricing calculator →

Product	Pay as You Go (Port Hour)	Includes
FastConnect 1 Gbps	€0.1845	No separate charges for inbound or outbound data transfer
FastConnect 10 Gbps	€1.107	No separate charges for inbound or outbound data transfer

Note: Pricing shown does not include fees the Network Provider or Datacenter Provider may charge for connectivity. For more details please refer to the "Billing and Pricing" section of the FastConnect FAQ.

24h * 31 = 744h

1 Gbps:
744 * €0,1845 = €137,27

10 Gbps:
744 * €1,107   = €823,61

Additional costs:
+ Network Provider
  (leased line)
+ Datacenter Provider

https://cloud.oracle.com/fastconnect/pricing as of 01-JAN-2019

Oracle Cloud Cost Estimator EUR – Euro (€)

Configuration Options	Pay As You Go	Monthly Flex
⌄ Oracle Cloud Infrastructure - FastConnect	€2,656	€2,656
⌄ ☁ Network	€2,656	€2,656

Utilization

▸ Number of Instances / 1 Instance(s)		
▸ Average Days Usage per Month / 31 day(s)		
▸ Average Hours Usage per Day / 24 hour(s)		

Configuration

	Pay As You Go	Monthly Flex
◢ FastConnect 1 Gbps (B88325) / 1	€137	€137
Port Hour	1	
◢ Outbound Data Transfer (B88327) / 240000	€1,696	€1,696
Gigabyte Outbound Data Transfer Per Month	240000	
◢ FastConnect 10 Gbps (B88326) / 1	€824	€824
Port Hour	1	

https://cloud.oracle.com/en_US/cost-estimator as of 01-JAN-2019

OCI Networking – Costs USD - US-Dollar ($)

Overview   **Networking Cloud Pricing**   Service Gateway

Oracle Networking Cloud Pricing

Cost Estimator

Oracle Cloud infrastructure offers low networking prices that enable customers to move significant quantities of data for less. Inbound data transfer is free, and we offer a high threshold for free outbound data transfer - the first 10TB per month is free for each tenancy. After that, outbound data transfer rates are based on geography.

Product	Pay As You Go	Metric
Inbound Data Transfer	Free	Gigabyte Outbound Data Transfer per Month
Outbound Data Transfer - First 10 TB / Month	Free	Gigabyte Outbound Data Transfer per Month
Outbound Data Transfer - Over 10 TB / Month- Originating in North America and Europe	$0.0085 USD	Gigabyte Outbound Data Transfer per Month
Outbound Data Transfer - Over 10 TB / Month- Originating in APAC, Japan and South America	$0.025 USD	Gigabyte Outbound Data Transfer per Month
Outbound Data Transfer - Over 10 TB / Month- Originating in Middle East and Africa	$0.050 USD	Gigabyte Outbound Data Transfer per Month

Note: VPN Connect is a free service with no port hour charges. Data transfer cost is covered under networking cloud pricing.

Assumptions:
1GBit Connection
1 TB Data transfer
    takes 3h (roughly)

24h x 30 / (3h * TB) ≈ 240 TB
240 TB – 10 TB ≈ 230.000 GB
230.000 * $0.0085 = $1,955.0
max per Month

https://cloud.oracle.com/networking/pricing as of 24-JUN-2020

FastConnect Pricing USD - US-Dollar ($)

FastConnect Cloud Pricing

USD - US Dollar ($)

Cost Estimator

Product	Pay as You Go (Port Hour)	Includes
FastConnect 1 Gbps	$0.2125	No separate charges for inbound or outbound data transfer
FastConnect 10 Gbps	$1.275	No separate charges for inbound or outbound data transfer

Note: Pricing shown does not include fees the network provider or data center provider may charge for connectivity. For more details please refer to the "Billing and Pricing" section of the FastConnect FAQ.

https://www.oracle.com/cloud/networking/fastconnect.html#pricing as of 24-JUN-2020

24h * 31 = 744h

 1 Gbps:
744 * $0.2125 = $158.10

10 Gbps:
744 * $1.275   = $948.60

Additional costs:
+ Network Provider
   (leased line)
+ Datacenter Provider
(+ OCI Outbound Traffic)

Oracle Cloud Cost Estimator – USD - US-Dollar ($)

Configuration Options	Pay As You Go	Monthly Flex
⌄ Oracle Cloud Infrastructure - FastConnect	$3,060	$3,060
⌄ 🌐 Network	$3,060	$3,060

Utilization

▷ Number of Instances / 1 Instance(s)		
▷ Average Days Usage per Month / 31 day(s)		
▷ Average Hours Usage per Day / 24 hour(s)		

Configuration

	Pay As You Go	Monthly Flex
◢ FastConnect 1 Gbps (B88325) / 1	$158	$158
Port Hour	1	
◢ Outbound Data Transfer (B88327) / 240000	$1,953	$1,953
Gigabyte Outbound Data Transfer Per Month	240000	
◢ FastConnect 10 Gbps (B88326) / 1	$949	$949
Port Hour	1	

https://cloud.oracle.com/en_US/cost-estimator as of 24-JUN-2020

OCI Networking – Costs NOK – Norwegian Krone (kr)

Infrastructure > Oracle Cloud Infrastructure > Networking > Pricing

Networking

Try for Free | Buy Now

Overview | Features | Pricing | Learn More | Documentation

NOK - Norwegian Krone (kr)

Networking

Pricing calculator →

Product	Pay as You Go (GB Outbound Data Transfer Per Month)
Outbound Data Transfer - First 10 TB / Month	Free
Outbound Data Transfer - Over 10 TB / Month	kr0.0696
Inbound Data Transfer	Free

Assumptions:
1GBit Connection
1 TB Data transfer
     takes 3h (roughly)

24h x 30 / (3h * TB) ≈ 240 TB
240 TB – 10 TB ≈ 230.000 GB
230.000 * kr0.0696 = kr16,008
max per Month

https://cloud.oracle.com/networking/pricing as of 01-JAN-2019

FastConnect Pricing USD - NOK – Norwegian Krone (kr)

FastConnect

| Try for Free | Buy Now |

Overview   Features   **Pricing**   Providers   Supported Services   Connectivity Models   Learn More   Documentation

NOK - Norwegian Krone (kr) ▼

FastConnect

Pricing calculator →

Product	Pay as You Go (Port Hour)	Includes
FastConnect 1 Gbps	kr1.7406	No separate charges for inbound or outbound data transfer
FastConnect 10 Gbps	kr10.4434	No separate charges for inbound or outbound data transfer

Note: Pricing shown does not include fees the Network Provider or Datacenter Provider may charge for connectivity. For more details please refer to the "Billing and Pricing" section of the FastConnect FAQ.

24h * 31 = 744h

1 Gbps:
744*kr1.7406 = kr1,295.01
10 Gbps:
744*kr10.4434 = kr7,769.89

Additional costs:
+ Network Provider
  (leased line)
+ Datacenter Provider
+ OCI Networking

https://cloud.oracle.com/fastconnect/pricing as of 01-JAN-2019

Oracle Cloud Cost Estimator NOK – Norwegian Krone (kr)

Configuration Options	Pay As You Go	Monthly Flex
⌄ Oracle Cloud Infrastructure - FastConnect	kr25,061	kr25,061
⌄ ☁ Network	kr25,061	kr25,061

Utilization

- ▸ Number of Instances / 1 Instance(s)
- ▸ Average Days Usage per Month / 31 day(s)
- ▸ Average Hours Usage per Day / 24 hour(s)

Configuration

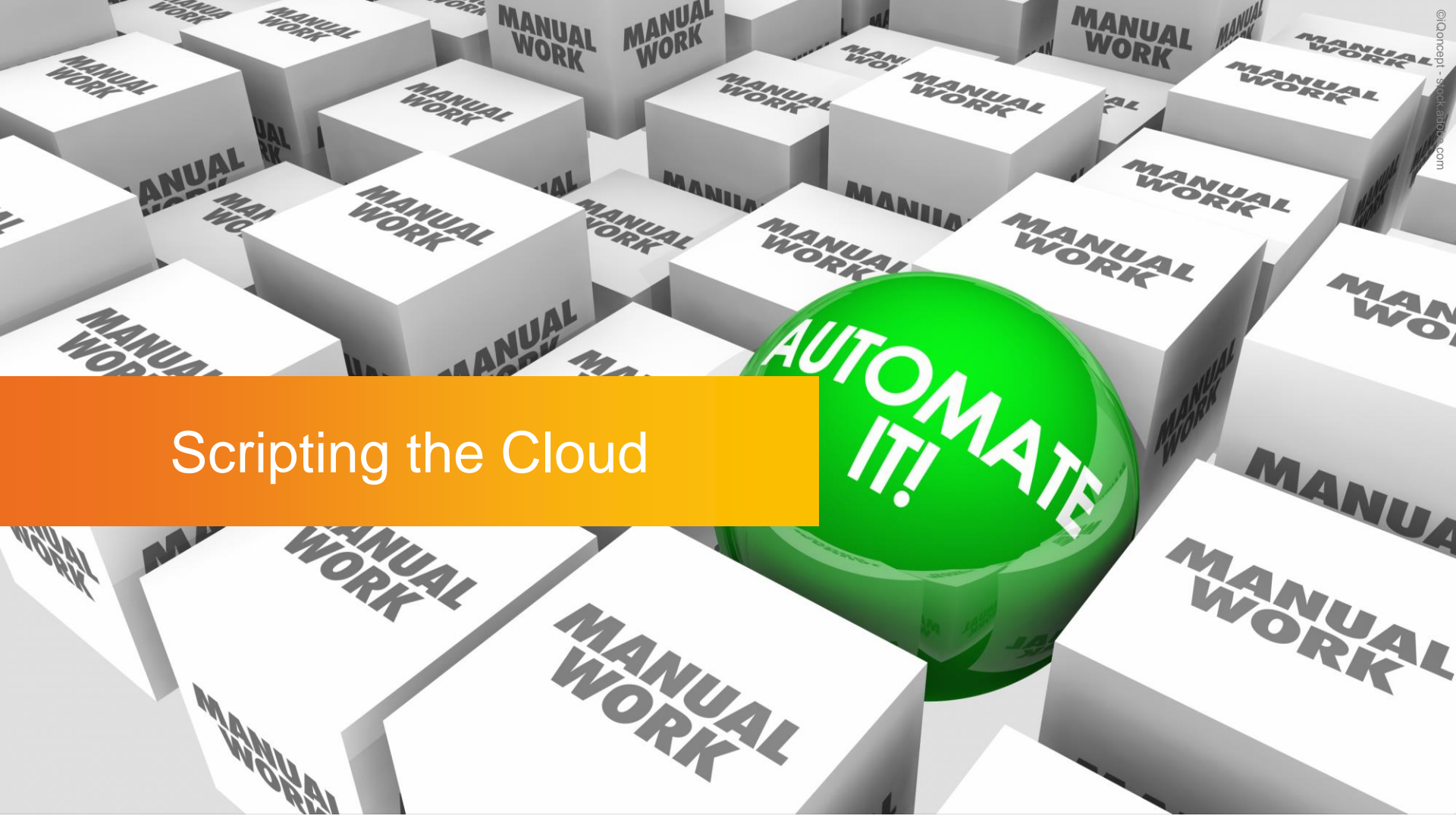|	Pay As You Go	Monthly Flex
◢ FastConnect 1 Gbps (B88325) / 1	kr1,295	kr1,295
Port Hour	1	
◢ Outbound Data Transfer (B88327) / 240000	kr15,997	kr15,997
Gigabyte Outbound Data Transfer Per Month	240000	
◢ FastConnect 10 Gbps (B88326) / 1	kr7,770	kr7,770
Port Hour	1	

https://cloud.oracle.com/en_US/cost-estimator as of 01-JAN-2019

Scripting the Cloud

Scripting means Automation: Infrastructure as Code

Building up and tearing down of virtual environments happens frequently in the Cloud

Some changes can only be made by recreating the resource

Provisioning Cloud Resources
by Clicking the UI is tedious and error prone

Use the Web-UI for Orientation only

Scripting is automation and documentation at the same time: **Software Defined Infrastructure**

Scripting Options – Automate all the Things!

Scripting Options

REST API
- "The Master"
- Provides Access to ALL Resources and Options
- More Programming than Scripting

OCI CLI
- Python Based CLI
- Unix & Windows
- OpenSource Hosted on GitHub

HashiCorp Terraform
- Scripting across all Major IaaS Providers
- Provider by Oracle
- Defacto Standard for Scripting Cloud Resources

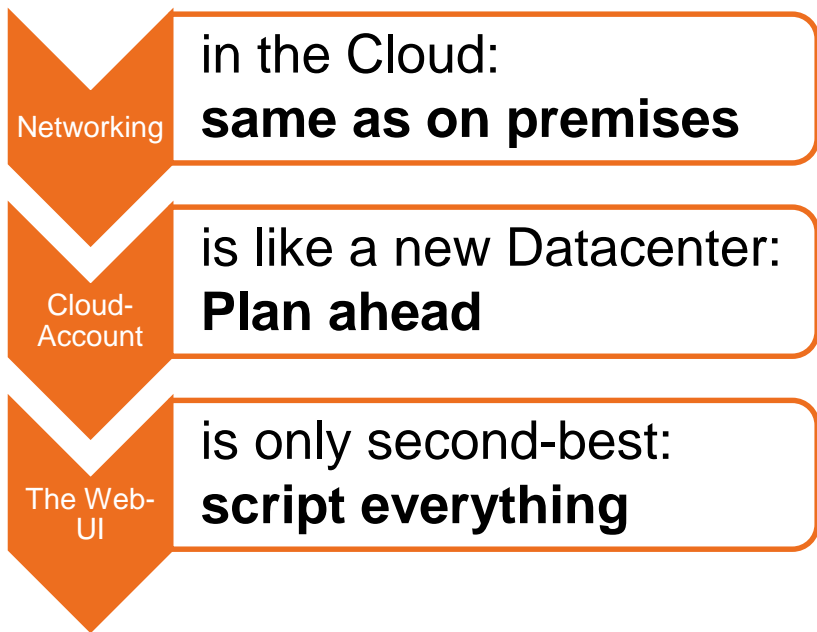### Ansible
- Agentless Orchestration and Automation
- OCI Module provided by Oracle

Conclusion

Automate your Cloud

Networking → in the Cloud:
same as on premises

Cloud-Account → is like a new Datacenter:
Plan ahead

The Web-UI → is only second-best:
script everything

The Sky Cloud is the Limit

PLEASE

DO TRY THIS AT HOME