



Oracle Cloud Infrastructure: Network Setup for DBAs

Robert Marz



Robert Marz – Independent Consultant



Client

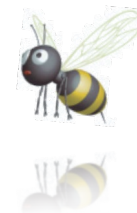
Senior Technical Architect
with database centric view of the world



ORACLE
ACE

its-people

Portfolio Manager Database Technologies
Blog Editor



DOAG (German Oracle User Group)

Active Member of Database Community
Responsible for Cloud Topics



@RobbieDatabee



blog.its-people.de



Robert.Marz
@its-people.de

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 really need to know all this stuff?

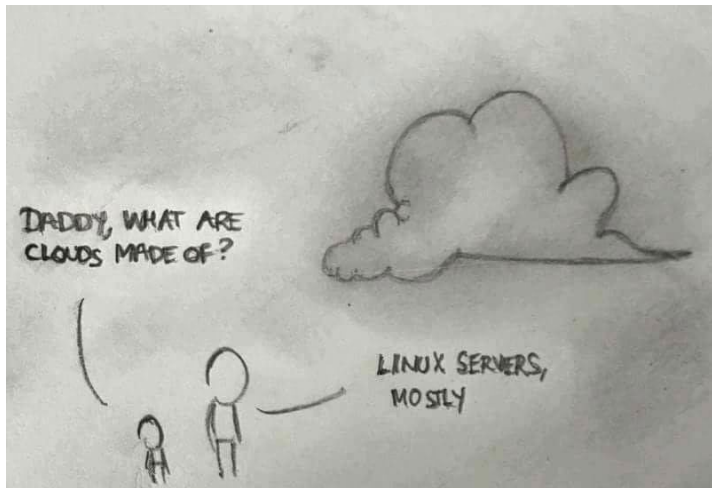
Nope.

**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**



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

Oracle Cloud Infrastructure Overview



GOVERNANCE
(IAM / APIs)



COMPUTE STORAGE DATABASE NETWORK EDGE

Services



Virtuelles Netzwerk



Physikalisches Netzwerk



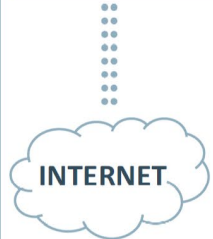
ORACLE
REGION

RECHENZENTREN/
AVAILABILITY DOMAINS

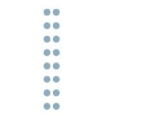


Verbindung - FastConnect/IPSec

ORACLE
REGION *n*



INTERNET



Kunden
RZ

Identity Domains, Tenants & Cloud-Account



ORACLE® Cloud Infrastructure

SIGN IN

Cloud Account with Identity Cloud Service

Cloud Tenant

Continue

[Notices](#) | [Terms of Use](#) | [Privacy](#)



Cloud Account

Cloud Account with Identity Cloud Service

robbiedatabee

Next >

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

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

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

See each other



Virtual Cloud Network Wizard

VCN Wizard

Launched via Menu

Networking
> Virtual Cloud Networks
> Create Virtual Network

Creates Resources

in one easy step

Optional
“with related resources”

But:
less options to configure

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

robbiedatabase (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) <input type="text"/>	<input type="text"/>	<input type="text"/>

VIEW DETAIL PAGE AFTER THIS RESOURCE IS CREATED

Demo

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



Create Virtual Cloud Network

[help](#) [cancel](#)

CREATE IN COMPARTMENT

DOAG-DB



robbiedatabasee (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)

The Virtual Cloud Network Wizard (Network only) - Results



AVAILABLE

DOAG-DB Netzwerk

Terminate Apply Tag(s)

VCN Information Tags

CIDR Block: 10.145.120.0/24 **OCID:** ...fj45ra [Show](#) [Copy](#)
Compartment: robbiedatabase (root)/DOAG-DB **Default Route Table:** [Default Route Table for DOAG-DB Netzwerk](#)
Created: Sat, 17 Nov 2018 15:34:31 GMT **DNS Domain Name:** doagdb... [Show](#) [Copy](#)

Resources

Subnets (0)

Route Tables (0)

Internet Gateways (0)

Dynamic Routing Gateways (0)

Security Lists (0)

DHCP Options (0)

Local Peering Gateways (0)

NAT Gateways (0)

Service Gateways (0)

Subnets *in* robbiedatabase (root) *Compartment*

Create Subnet

Sort by: Created Date (Desc) No Subnets

There are no Subnets in robbiedatabase (root) that match the filter criteria.

Create Subnet



The Virtual Cloud Network



Create Virtual Cloud Network

CREATE IN COMPARTMENT

DOAG-DEV

robbiedatabee (root)/DOAG-DEV

NAME *OPTIONAL*

doagdev

CREATE VIRTUAL CLOUD NETWORK

CREATE VIRTUAL CLOUD NETWORK WITH INTERNET GATEWAY

Automatically sets up a public subnet and an internet gateway. You can set up firewall rules at ingress and egress traffic to your Instance created in the same Compartment as the

Create Subnet

Name: Public Subnet

Security List: Default

DHCP Options: Default

CIDR: 10.0.2.0/24

Route Table: Default

DNS Label: A

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 yFpl:EU-FRANKFURT-1-AD-1 was created

Create Subnet

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

Create Subnet

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

Close

Resources)

resses)

s)

Demo

The Virtual Cloud Network Wizard (Network + related Resources) Results



Networking » Virtual Cloud Networks » Virtual Cloud Network Details



AVAILABLE

doagdev

Terminate Apply Tag(s)

VCN Information Tags

CIDR Block: 10.0.0.0/16
Compartment: robbiedatabase (root)/DOAG-DEV
Created: Sat, 17 Nov 2018 16:33:52 GMT
OCID: ...6ysg4q Show Copy
Default Route Table: [Default Route Table for doagdev](#)
DNS Domain Name: doagdev... Show Copy



Resources

Subnets (3)

Route Tables (1)

Internet Gateways (1)

Dynamic Routing Gateways (0)

Security Lists (1)

DHCP Options (1)

Local Peering Gateways (0)

NAT Gateways (0)

Service Gateways (0)

List Scope

COMPARTMENT

Subnets *in* DOAG-DEV *Compartment*

Create Subnet

Sort by: Created Date (Desc) Displaying 3 Subnets < Page 1 >

	Public Subnet yFpl:EU-FRANKFURT-1-AD-3 OCID: ...pn5egq Show Copy	CIDR Block: 10.0.2.0/24 Virtual Router MAC Address: 00:00:17:75:8F:4D	Availability Domain: yFpl:EU-FRANKFURT-1-AD-3 DNS Domain Name: sub1117163... Show Copy Subnet Access: Public Subnet	Route Table: Default Route Table for doagdev Security Lists: Default Security List for doagdev	DHCP Options: Default DHCP Options for doagdev
	Public Subnet yFpl:EU-FRANKFURT-1-AD-2 OCID: ...2tpbia Show Copy	CIDR Block: 10.0.1.0/24 Virtual Router MAC Address: 00:00:17:75:8F:4D	Availability Domain: yFpl:EU-FRANKFURT-1-AD-2 DNS Domain Name: sub1117163... Show Copy Subnet Access: Public Subnet	Route Table: Default Route Table for doagdev Security Lists: Default Security List for doagdev	DHCP Options: Default DHCP Options for doagdev
	Public Subnet yFpl:EU-FRANKFURT-1-AD-1 OCID: ...cs5ffq Show Copy	CIDR Block: 10.0.0.0/24 Virtual Router MAC Address: 00:00:17:75:8F:4D	Availability Domain: yFpl:EU-FRANKFURT-1-AD-1 DNS Domain Name:	Route Table: Default Route Table for doagdev Security Lists: Default Security List for doagdev	DHCP Options: Default DHCP Options for doagdev



Networking in OCI

Networking

VCN

Virtual Cloud Network

IPv4 only

Covers Network Addresses

single, contiguous CIDR block

Subnets

exists in a single

availability domain

contain VNICs with same

route table
security lists
DHCP Options



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

itspeople

RFC1918 name	IP address range	number of addresses	largest <u>CIDR</u> block (subnet mask)	<u>classful</u> 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

192.168.132.0 mask 255.255.255.0

“Network Calculator”
“IP Subnet Calculator”

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 Address (logical AND)

192

168

132

0

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

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



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

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

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

verkk



ICP Options

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	

Connecting 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

OCI Networking Costs - Currencies



Next Topic

OCI Networking – Costs EUR - Euro (€)



Infrastructure > Oracle Cloud Infrastructure > Networking > Pricing

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

Assumptions:

1Gbit Connection
1 TB Data transfer
takes 3h (roughly)

$24h \times 30 / (3h * TB) \approx 240 TB$
 $240 TB - 10 TB \approx 230.000 GB$
 $230.000 * 0,0074€ = 1.702€$
max per Month

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

FastConnect Pricing EUR - Euro (€)



Infrastructure > FastConnect > Pricing

FastConnect Try for Free Buy Now

[Overview](#) [Features](#) [Pricing](#) [Providers](#) [Supported Services](#) [Connectivity Models](#) [Learn More](#) [Documentation](#)

EUR - Euro (€)

$$24h * 31 = 744h$$

1 Gbps:
 $744 * €0,1845 = €137,27$

10 Gbps:
 $744 * €1,107 = €823,61$

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

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

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](#).

<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

▲ FastConnect 1 Gbps (B88325) / 1

€137

€137

Port Hour

▲ Outbound Data Transfer (B88327) / 240000

€1,696

€1,696

Gigabyte Outbound Data Transfer Per Month

▲ FastConnect 10 Gbps (B88326) / 1

€824

€824

Port Hour

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



Infrastructure > Oracle Cloud Infrastructure > Networking > Pricing

Networking

Try for Free Buy Now

Overview Features **Pricing** Learn More Documentation

USD - US Dollar (\$) -

Assumptions:

1GBit Connection

1 TB Data transfer
takes 3h (roughly)

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	\$0.0085
Inbound Data Transfer	Free

$24h \times 30 / (3h * TB) \approx 240 TB$
 $240 TB - 10 TB \approx 230.000 GB$
 $230.000 * \$0.0085 = \$1,955.0$
max per Month

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

FastConnect Pricing USD - US-Dollar (\$)



Infrastructure > FastConnect > Pricing

FastConnect Try for Free Buy Now

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

USD - US Dollar (\$) ▾

$$24h * 31 = 744h$$

1 Gbps:
 $744 * \$0.2125 = \158.10

10 Gbps:
 $744 * \$1.275 = \948.60

FastConnect

Pricing calculator →

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

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

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](#).

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

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

▲ FastConnect 1 Gbps (B88325) / 1

\$158

\$158

Port Hour

▲ Outbound Data Transfer (B88327) / 240000

\$1,953

\$1,953

Gigabyte Outbound Data Transfer Per Month

▲ FastConnect 10 Gbps (B88326) / 1

\$949

\$949

Port Hour

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

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)

$24h \times 30 / (3h * TB) \approx 240 TB$

$240 TB - 10 TB \approx 230.000 GB$

$230.000 * kr0.0696 = kr16,008$

max per Month

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

FastConnect Pricing USD - NOK – Norwegian Krone (kr)



Infrastructure > FastConnect > Pricing

FastConnect

Try for Free Buy

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

NOK - Norwegian Krone (kr) -

$$24h * 31 = 744h$$

1 Gbps:

$$744 * kr1.7406 = kr1,295.01$$

10 Gbps:

$$744 * kr10.4434 = kr7,769.89$$

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

Additional costs:

+ Network Provider (leased line)

+ Datacenter Provider

+ OCI Networking

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](#).

<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

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

**AUTOMATE
IT!**

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

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

De facto Standard for Scripting Cloud Resources

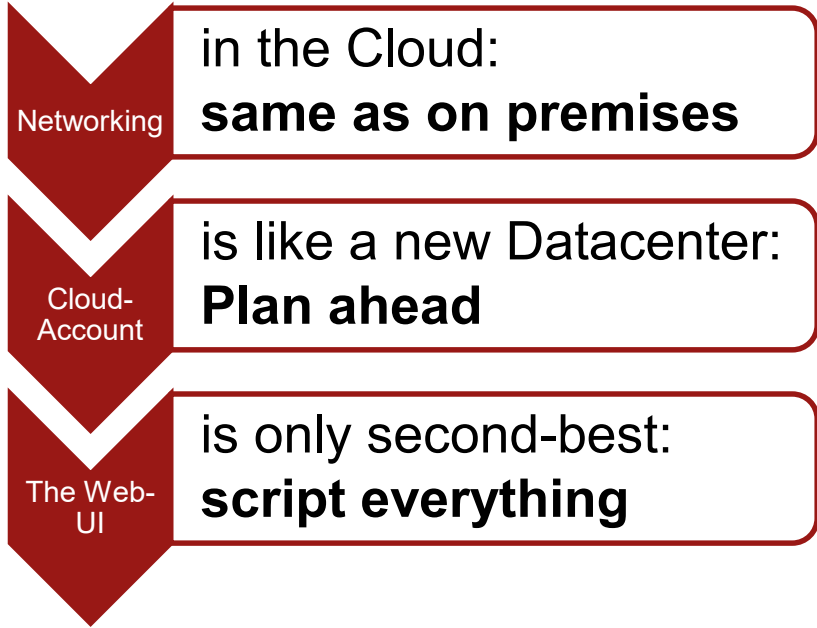
Ansible

Agentless Orchestration and Automation

OCI Module provided by Oracle

Conclusion





The ~~Sky~~ Cloud is the
Limit





Vielen Dank für Ihre
Aufmerksamkeit.