

ONAP Deployment Specification for Finance and Operations

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This WIP page will attempt to detail the financial and operations impact of varying ONAP deployments.

NOTE: this is not finished - as I need to do a detailed incoming/outgoing port analysis and some more prototyping - it is a draft for now - mostly as a page to point to when asked questions about cost and security during deployments.

The audience is approving I.T. and Finance personnel.

Up to date content is on [Cloud Native Deployment](#)

Public Cloud Deployment

Executive Summary

ONAP as of 20180131 (Beijing master - pre M2) will deploy (minus DCAEGEN2) and run on a single 64G VM provisioned with a minimal 120G HD and at least 8 vCores. The monthly cost of this deployment will run....

\$246 or 64 US per month (reserved/spot) on AWS EC2

\$365 or 212 US per month (on-demand/reserved) on Microsoft Azure

The security profile for deployment requires outbound access to nexus3.onap.org:10001/10003 as well as [ssh/http/https](https://git.onap.org) access to git.onap.org to do leftover chef pulls and curls in-container for some components (being fixed). The VNF deployment profile currently requires an additional Openstack /Rackspace infrastructure including keystone and CLI/HEAT outbound access for VNF orchestration (in the future cloud-native VNF deployment will be supported).

Marketplace/services Utilization - no use of marketplace services is required in either AWS or Azure. The ONAP deployment brings its own open source software stack to a bare Ubuntu VM. At this time Kubernetes as a Service is also not required and all resiliency/scaling/replication/load-balancing /federation behaviour for HA and Geo-Redundancy is handled natively by the Kubernetes framework.

Beijing release

Corporate Allocation

Beijing requires the following to run: Note there is a 110 pod limit per VM - we currently deploy 175+ pods - hence 2+ VMs for full deployment

- Full production/staging
 - Minimum 2 VMs, 12vCores total, 96G total ram, 100G HD per VM
 - Recommended 3-9 VMs, 24-64 vCores, 128+ total ram, 160G HD per VM + 1 8G/100G kubernetes master VM
- Developer:
 - Minimum 1 VM at 4+ vCores, 16-64G ram, 100G HD - collocated kubernetes master, host and jumpbox (deploys a subset of ONAP)
 - Recommended 3 VMs 1x8G kubernetes master and 2 x 64G hosts

Minimum Deployment costs

Cost is ~\$10/day or \$300/month per 128G deployment – (I happen to have 128G worth of VMs running on the 75% off spot market – including cost effective R4 instances, EBS store and EFS NFS) – 2 deployments and dev cost will run under \$1k US. Based on the level of funding we will go with pure IaaS VMs up to the EKS PaaS for K8s – but that runs over \$20/day. Ideally we should be running 160G+ clusters but 128G is ok for specific VNFs like the vFW - <https://wiki.onap.org/display/DW/Cloud+Native+Deployment#CloudNativeDeployment-AmazonAWS>

Color coded costs are Required, Maximum, Medium, Minimum

[illegible]

Total cost / month - SPOT (medium CD prod cluster - min dev cluster x 1)	\$66 + \$66 + \$66 + \$552 + \$66 + \$354 + \$110 + \$138 = \$1418/month = \$17k/year US (4*)
Total cost / month - SPOT (minimum CD cluster - min dev cluster - collocated host)	\$66 + \$66 + \$66 + \$354 + \$66 + \$276 = \$894/month = \$11K US
Total cost / month - reserved	

Notes:

0 - assumes us-east-1 region (us-east-2 region is cheaper (ohio) but the spot market there is more unstable) - if you use ohio - cut costs by about 40% for spot - ie: r4.2xlarge is 0.13 but 0.07 in ohio)

1 - ONAP is CPU bound - it will peak at over 55 vCores during startup - vCPUs over 8 are required for a stable deployment - we could use C4/C5 compute optimized images - more expensive and get timed out of spot more often - it is the same price and more stable to run an R4.2x/4x instance with twice the ram but the same vCores.

2 - a cluster running the 8 core R4.2xlarge vms will be OK but will be CPU throttled during startup and any during any container under test or rogue container episode.

3 - EBS cost is usually around 45% of the ec2 cost for an R4.large for the average 100G HD

4 - some of these costs are reduced if we use AMI's and cloudformation/cli templates to raise/lower systems (ie: on the weekend off, for CD systems raise for 2 hours test and terminate for 2 hours on 4 hour cycles)

Amsterdam release

Deployment Use Cases

There are several deployment scenarios that include VMs and containers both for ONAP itself and the VNFs that are managed. Container deployments are further segregated by managed kubernetes and Kubernetes as a Service types. We assume that all ONAP components run as Docker containers whether they are managed per VM (HEAT) or managed in a Kubernetes cluster namespace (KaaS or managed).

Type	ONAP(VMs or Containers)	VNF (VMs or Containers)	
	Kubernetes containers on VMs	VM Rackspace/Openstack	

Deployment Example: Full Kubernetes on a VM cluster

This is the RI (Reference implementation) of ONAP Beijing release - it consists of all the ONAP containers 90+ deployed to a particular (dev/stg/prod) namespace ecosystem running on Kubernetes. The Kubernetes implementation is running under any management layer - here Rancher and not on a KaaS. The Kubernetes cluster undercloud can run on 1 or more VMs - in this example we colocate the server and single host on a single VM which currently fits in 55G.

Note: DCAEEN2 is currently being fully containerized and should arrive as a native Kubernetes set of containers by Beijing R2 release. Currently DCAE runs in a 64G VM specifically on a configured Openstack system. There is a reverse proxy mechanism that joins DCAE to the rest of ONAP running in Kubernetes already. DCAE is required for VNF closed loop operations - but not for VNF orchestration. When DCAE is fully refactored for Kubernetes then the memory requirement will jump over the 64G baseline and push it to 96 to 128G depending on the size of the CDAP Hadoop cluster running which is 3-7 containers.

Security Profile

ONAP will require certain ports open by CIDR to several static domain names in order to deploy defined in a security group. At runtime the list is reduced.

Ideally these are all inside a private network.

It looks like we will need a standard public/private network locked down behind a combined ACL/SG for AWS VPC or a NSG for Azure where we only expose what we need outside the private network.

Still working on a list of ports but we should not need any of these exposed if we use a bastion/jumpbox + nat combo inside the network.

Known Security Vulnerabilities

<https://medium.com/handy-tech/analysis-of-a-kubernetes-hack-backdooring-through-kubelet-823be5c3d67c>


<https://github.com/kubernetes/kubernetes/pull/59666> fixed in Kubernetes 1.10




















ONAP Port Profile


ONAP on deployment will require the following incoming and outgoing ports. Note: within ONAP rest calls between components will be handled inside the Kubernetes namespace by the DNS server running as part of K8S.


port	protocol	incoming /outgoing	application	source	destination	Notes
22	ssh		ssh	developer vm	host	
443			tiller	client	host	
8880	http		rancher	client	host	
9090	http		kubernetes		host	
10001	https		nexus3		nexus3.onap.org	
10003	https		nexus3		nexus3.onap.org	
	https		nexus		nexus.onap.org	
	https ssh		git		git.onap.org	
30200-30399	http/https		REST api	developer vm	host	
5005	tcp		java debug port	developer vm	host	
		Lockdown ports				
8080		outgoing				
10249-10255		in/out				Lock these down via VPC or a source CIDR that equals only the server /client IP list https://medium.com/handy-tech/analysis-of-a-kubernetes-hack-backdooring-through-kubelet-823be5c3d67c

Azure

 Search (Ctrl+/)

-  Activity log
-  Access control (IAM)
-  Tags
-  Diagnose and solve problems
- SETTINGS
-  Networking
-  Disks
-  Size
-  Extensions
-  Availability set
-  Configuration
-  Properties
-  Locks
-  Automation script
- OPERATIONS
-  Auto-shutdown
-  Backup
-  Disaster recovery (Preview)
-  Update management (Preview)
-  Inventory (Preview)
-  Change tracking (Preview)

 Attach network interface

 Detach network interface

 Network Interface: onap758

[Effective security rules](#)


[Topology](#) ⓘ

Virtual network/subnet: [onap_lockdown-vnet/default](#)

Public IP: [52.170.238.72](#)






Private IP: [10.0.2.4](#)

INBOUND PORT RULES ⓘ


 Network security group [onap-nsg](#) (attached to network interface: [onap758](#))

Impacts 0 subnets, 1 network interfaces

[Add inbound port](#)






PRIORITY	NAME	PORT	PROTOCOL	SOURCE	DESTINATI...	ACTION	
1000	default-allow-ssh	22	TCP	Any	Any		Allow ...
1010	Port_8880	8880	Any	Any	Any		Allow ...
65000	AllowVnetInBound	Any	Any	VirtualNe...	VirtualNe...		Allow ...
65001	AllowAzureLoadBal...	Any	Any	AzureLoa...	Any		Allow ...
65500	DenyAllInBound	Any	Any	Any	Any		Deny ...

OUTBOUND PORT RULES ⓘ

 Network security group [onap-nsg](#) (attached to network interface: [onap758](#))

Impacts 0 subnets, 1 network interfaces

[Add outbound port](#)

PRIORITY	NAME	PORT	PROTOCOL	SOURCE	DESTINATI...	ACTION	
100	Port_10001	10001	Any	Any	Any		Allow ...
101	Port_10003	10003	Any	Any	Any		Allow ...
65000	AllowVnetOutBound	Any	Any	VirtualNe...	VirtualNe...		Allow ...
65001	AllowInternetOutBo...	Any	Any	Any	Internet		Allow ...
65500	DenyAllOutBound	Any	Any	Any	Any		Deny ...

VPC Dashboard

Filter by VPC:

Select a VPC

Virtual Private Cloud

Your VPCs

Subnets

Route Tables

Internet Gateways

Egress Only Internet Gateways

DHCP Options Sets

Elastic IPs

Endpoints

Endpoint Services

NAT Gateways

Peering Connections

Security

Network ACLs

Security Groups

Resources ↻

Start VPC Wizard

Launch EC2 Instances

Note: Your Instances will launch in the US East (N. Virginia) region.

You are using the following Amazon VPC resources in the US East (N. Virginia) region:

7 VPCs

0 Egress-only Internet Gateways

15 Route Tables

8 Elastic IPs

1 Endpoint

82 Security Groups

0 VPN Connections

0 Customer Gateways

6 Internet Gateways

21 Subnets

7 Network ACLs

0 VPC Peering Connections

0 Nat Gateways

6 Running Instances

0 Virtual Private Gateways

1 DHCP Options Set

VPN Connections

Amazon VPC enables you to use your own isolated resources within the AWS cloud, and then connect those resources directly to your own datacenter using industry-standard encrypted IPsec VPN connections.

Create VPN Connection



Services ▾

Resource Groups ▾



Step 1: Select a VPC Configuration

VPC with a Single Public Subnet

VPC with Public and Private Subnets

VPC with Public and Private Subnets and Hardware VPN Access

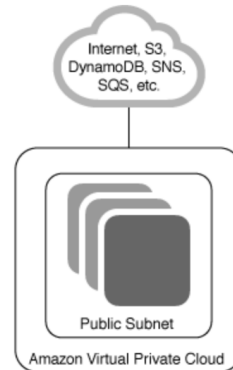
VPC with a Private Subnet Only and Hardware VPN Access

Your instances run in a private, isolated section of the AWS cloud with direct access to the Internet. Network access control lists and security groups can be used to provide strict control over inbound and outbound network traffic to your instances.

Creates:

A /16 network with a /24 subnet. Public subnet instances use Elastic IPs or Public IPs to access the Internet.

Select



Services ▾

Resource Groups ▾



Step 2: VPC with a Single Public Subnet

IPv4 CIDR block:* 10.0.0.0/16 (65531 IP addresses available)

IPv6 CIDR block: ☒ No IPv6 CIDR Block
☐ Amazon provided IPv6 CIDR block

VPC name: k8sVpc

Public subnet's IPv4 CIDR:* 10.0.0.0/24 (251 IP addresses available)

Availability Zone:* No Preference ▾

Subnet name: k8sVpcPub

You can add more subnets after AWS creates the VPC.

Service endpoints

Add Endpoint

Enable DNS hostnames:* ☒ Yes ☐ No

Hardware tenancy:* Default ▾

aws

Services

Resource Groups

F. Michael O'BrienN. VirginiaSupport

VPC Dashboard

Filter by VPC:
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Your VPCs

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Internet Gateways

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DHCP Options Sets

Elastic IPs

Endpoints

Endpoint Services

NAT Gateways

Peering Connections

Create Network ACLDelete

acl-f7a9718d

<< 1 to 1 of 1 Network ACL >>

	Name	Network ACL ID	Associated With	Default	VPC
<input checked="" type="checkbox"/>		acl-f7a9718d	1 Subnet	Yes	vpc-68e8af13 k8sVpc

acl-f7a9718d

SummaryInbound RulesOutbound RulesSubnet AssociationsTags

Allows inbound traffic. Because network ACLs are stateless, you must create inbound and outbound rules.

CancelSave

View: All rules

Rule #	Type	Protocol	Port Range	Source	Allow / Deny	Remove
120	ALL Traffic	ALL	ALL	0.0.0.0/0	ALLOW	
110	Custom TCP Rule	TCP (6)	10249-10255	0.0.0.0/0	DENY	

Add another rule

aws

Services

Resource Groups

F. Michael O'BrienN. VirginiaSupport

VPC Dashboard

Filter by VPC:
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Create Network ACLDelete

acl-f7a9718d

<< 1 to 1 of 1 Network ACL >>

	Name	Network ACL ID	Associated With	Default	VPC
<input checked="" type="checkbox"/>		acl-f7a9718d	1 Subnet	Yes	vpc-68e8af13 k8sVpc

acl-f7a9718d

SummaryInbound RulesOutbound RulesSubnet AssociationsTags

Allows outbound traffic. Because network ACLs are stateless, you must create inbound and outbound rules.

CancelSave

View: All rules

Rule #	Type	Protocol	Port Range	Destination	Allow / Deny	Remove
120	ALL Traffic	ALL	ALL	0.0.0.0/0	ALLOW	
110	Custom TCP Rule	TCP (6)	10249-10255	0.0.0.0/0	DENY	

Add another rule

Software Profile

Rancher 1.6.14

Helm 2.8.0

Kubernetes 1.8.6

Docker 17.03.2

Ubuntu 16.04

The rest of the software versions are specific to the 90+ docker containers running for example MariaDB, Jetty... etc. All of the software is open source and encapsulated in the containers themselves. The containers implement a REST based microservices architecture.

Hardware Profile

[ONAP on Kubernetes#HardwareRequirements](#)

Microsoft Azure

Monthly Cost

Cost \$US	Artifact	Details	
-----------	----------	---------	--

\$365/m at \$0.65 (CAN)/h reduce by 42% for 1 year reserved instances = \$212/month	VM running Ubuntu 16.04 E8s V3	(64g/8vCores) 128G SSD 30G SSD in CA central DC	
\$0 TBD	no extra volume (only 16G VMs have 30G disks)		
	IP		
\$0	image snapshot		
\$0	Cloud Services		
	Total		
\$212/m			

on-demand

Microsoft Azure

New > Create virtual machine > Create

Search resources, services and docs

New

Dashboard

Resource groups

All resources

Recent

App Services

Virtual machines (classic)

Virtual machines

SQL databases

Cloud services (classic)

Security Center

Subscriptions

Azure Active Directory

Monitor

Cost Management + Billing

Help + support

Advisor

More services >

Create virtual machine

1 Basics Done

2 Size Done

3 Settings Done

4 Summary Ubuntu Server 16.04 LTS

Create

Validation passed

Offer details

Prices presented are estimates in your local currency that include only Azure infrastructure costs and any discounts for the subscription and location. The prices don't include any applicable software costs.

Ubuntu Server 16.04 LTS

by Canonical

Terms of use | privacy policy

Pricing details

Standard E8s v3

by Microsoft

Terms of use | privacy policy

0.6469 CAD/hr

Pricing for other VM sizes

Azure resource

You may use your Azure monetary commitment funds or subscription credits for these purchases. Prices presented are retail prices and may not reflect discounts associated with your subscription.

Summary

Basics

Subscription

Pay-As-You-Go

Resource group

(new) onap_lockdown

Location

East US

Terms of use

By clicking "Create", I (a) agree to the legal terms and privacy statement(s) associated with each Marketplace offering above, (b) authorize Microsoft to charge or bill my current payment method for the fees associated with my use of the offering(s), including applicable taxes, with the same billing frequency as my Azure subscription, until I discontinue use of the offering(s), and (c) agree

☐

I give Microsoft permission to use and share my contact information so that Microsoft or the Provider can contact me regarding this product and related products.

Create

Download template and parameters

Reserved

★ Location

Canada Central

★ VM size (View full pricing details)

E8s_v3 (8 vCPUs, 64 GB)

Term

One year

★ Quantity

1

COSTS

Calculate cost

Cost per VM	3,657	CAD
Total VMs	1	Standard_E8s_v3
Reservation cost*	3,657	CAD
Estimated savings*	42%	

Amazon AWS

VM: Minimum EC2 instance of size 61G (ideally 128G) with a 120+GB EBS volume (ideally 1024GB) and at least 8 vCores (ideally 64 vCores), network 1Gbps (ideally 10Gbps).

We can implement proper public/private VPC peering but for this lab environment security will be on the Kubernetes Admin/client-token only.

Example of 2 or 3 network VPC peering setup http://files.meetup.com/18216364/aws_vpc_beanstalk_20150224_post.pdf

Cost

There is an R4.2xlarge instance type that has been the lowest cost instance that can run all of ONAP (except DCAE) and has been demonstrated since Amsterdam on the CD system. The cost on the spot market is between 72 to 89% off the reserved cost at around \$0.14/hour on us-east(N. Virginia DC) and 0.07/hour in us-east(Ohio DC)

Monthly Cost

Cost \$US	Artifact	Details	
\$52/m at \$0.07/h	EC2 spot VM running Ubuntu 16.04	(64g/8vCores)	
	R4.2xlarge	in the ohio DC	
\$12.0/m at \$0.1/m/Gb	EBS volume	120Gb	
\$2.0/m	Elastic EIP		
	AMI image snapshot		
\$0	Cloud Services		
	Total		

\$64/m			
--------	--	--	--

Select instance types

x

☐ Supports dedicated tenancy

Pricing History

Instance type ▾	vCPUs ▾	Memory (GiB) ▾	Storage (GB) ▾	Network ▾	Spot price ▾	Spot savings ▾
All instance types ▾	1 ▾	61	(Any)	Any network ▾		
<input type="checkbox"/> r4.2xlarge	8	61	EBS only	Up to 10 Gigabit	\$0.1274	76%
<input type="checkbox"/> r3.2xlarge	8	61	1 x 160 SSD	High	\$0.1461	78%
<input type="checkbox"/> i3.2xlarge	8	61	1 x 1900 SSD	Up to 10 Gigabit	\$0.1872	70%
<input type="checkbox"/> m4.4xlarge	16	64	EBS only	High	\$0.2407	70%
<input type="checkbox"/> x1e.xlarge	4	122	1 x 120 SSD	Up to 10 Gigabit	\$0.2502	70%
<input type="checkbox"/> r4.xlarge	16	122	EBS only	Up to 10 Gigabit	\$0.2522	76%
<input type="checkbox"/> m5.4xlarge	16	64	EBS only	Up to 10 Gigabit	\$0.2527	67%
<input type="checkbox"/> p2.xlarge	4	61	EBS only	High	\$0.27	70%
<input type="checkbox"/> r3.xlarge	16	122	1 x 320 SSD	High	\$0.2834	79%
<input type="checkbox"/> h1.4xlarge	16	64	2 x 2000	Up to 10 Gigabit	\$0.33	70%

Artifacts

Amazon

Launch template

None

(Default version)

Create launch template

Version description of selected launch template (if any) will display here. Applying a launch template is optional.

AMI ⓘ

Canonical, Ubuntu, 16.04 LTS, amd64 xenial image build on 2017-11-21 (ami-aa2ea6d0)

Search for AMI

Instance type(s) ⓘ

r4.2xlarge (8 vCPU, 61 GiB, EBS only) ⓘ

Select

Select multiple instance types to find the lowest priced instances available

Network ⓘ

vpc-97c256f2 (172.31.0.0/16) (default) | amazon-default

Create new VPC

Availability Zone ⓘ

No preference (launch in cheapest Availability Zone)

EBS volumes ⓘ

Device ⓘ	Snapshot	Size (GiB)	Volume Type	IOPS	Delete ⓘ	Encrypt
Root: /dev/sda1	snap-0dcc947e7c10bed94	120	General Purpose (SSD)		<input checked="" type="checkbox"/>	<input type="checkbox"/>

No additional EBS volumes configured

+ Add new volume

EBS-optimized ⓘ

☐ Launch EBS-optimized instances

Instance store ⓘ

☐ Attach at launch

Monitoring ⓘ

☐ Enable CloudWatch detailed monitoring

Tenancy ⓘ

Default - run a shared hardware instance

Security groups ⓘ

☐ ElasticMapReduce-master
☐ ElasticMapReduce-slave
☒ ONAP_Kubernetes_collocated_lockdown

Create new security group

Spot template

security group

IAM profile

ssh key

EIP

public VPC

Network Interface

EBS Volume

Auto scaling group

Amazon Cloudformation Template

```
SPOT only
{
  "IamFleetRole": "arn:aws:iam::4.....:role/aws-ec2-spot-fleet-tagging-role",
  "AllocationStrategy": "lowestPrice",
  "TargetCapacity": 1,
  "SpotPrice": "0.532",
  "ValidFrom": "2018-01-31T20:31:16Z",
  "ValidUntil": "2019-01-31T20:31:16Z",
  "TerminateInstancesWithExpiration": true,
  "LaunchSpecifications": [
    {
      "ImageId": "ami-aa2ea6d0",
      "InstanceType": "r4.2xlarge",
      "KeyName": "obr...15",
      "SpotPrice": "0.532",
      "BlockDeviceMappings": [
        {
          "DeviceName": "/dev/sda1",
          "Ebs": {
            "DeleteOnTermination": true,
            "VolumeType": "gp2",
            "VolumeSize": 120,
            "SnapshotId": "snap-0dcc947e7c10bed94"
          }
        }
      ]
    },
    {
      "SecurityGroups": [
        {
          "GroupId": "sg-de2185a9"
        }
      ]
    }
  ],
  "Type": "request"
}
```

Microsoft

Azure Resource Manager Template

VM details

```

ubuntu@onap:~$ free
               total        used        free      shared  buff/cache   available
Mem:      65949220      278884    65223112         8812     447224    64947380
Swap:            0           0           0

ubuntu@onap:~$ df
Filesystem      1K-blocks      Used Available Use% Mounted on
udev            32963872          0   32963872    0% /dev
tmpfs           6594924       8788    6586136    1% /run
/dev/sda1       30428648 1328420    29083844    5% /
tmpfs           32974608          0   32974608    0% /dev/shm
tmpfs            5120          0         5120    0% /run/lock
tmpfs           32974608          0   32974608    0% /sys/fs/cgroup
/dev/sdb1       131979684    60988 125191480    1% /mnt
tmpfs           6594924          0    6594924    0% /run/user/1000

```

Sizing

Kubernetes

Openstack

20180202 openlab Integration-SB-01

VMs:

We only need the DCAE and Cloudify-manager VMs when using OOM -the following is the whole set - we will truncate the heat template to bring up half of this

VMs	Flavor	RAM
2	m1.small	2G
4	m1.medium	4G
5	m1.large	8G
17	m1.xlarge	16G
1	m1.xxlarge (cloudify-manager)	64G
29	total	394G

see also discussion on

[OPENLABS-160](#) - Getting issue details...

STATUS

[OPENLABS-161](#) - Getting issue details...

STATUS

[DOC-244](#) - Getting issue details...

STATUS

<https://onap.readthedocs.io/en/latest/guides/onap-developer/settingup/fullonap.html#requirements>

The cns (consul) nodes for example are two sizes larger now at 16G each instead of the documented 4G - I remember mails in the past about memory saturation that caused the bump to m1.xlarge from m1.medium (although consul is already in oom so we should not need these)

[dcaepgvm00](#)

ubuntu-16-04-cloud-amd64

oam_onap_c4Uw

- 10.0.0.26
- 10.12.6.25

[m1.xlarge](#)

onap_key_c4Uw

Active

nova

None

Running

2 weeks, 2 days

[Create Snapshot](#)

[dcaecdap05](#)

ubuntu-16-04-cloud-amd64

oam_onap_c4Uw

- 10.0.0.15
- 10.12.6.22

[m1.xlarge](#)

onap_key_c4Uw

Active

nova

None

Running

2 weeks, 2 days

[Create Snapshot](#)

[dcaecdap03](#)

ubuntu-16-04-cloud-amd64

oam_onap_c4Uw

- 10.0.0.21
- 10.12.6.1

[m1.xlarge](#)

onap_key_c4Uw

Active

nova

None

Running

2 weeks, 2 days

[Create Snapshot](#)

[dcaecdap02](#)

ubuntu-16-04-cloud-amd64

oam_onap_c4Uw

- 10.0.0.11
- 10.12.5.227

[m1.xlarge](#)

onap_key_c4Uw

Active

nova

None

Running

2 weeks, 2 days

[Create Snapshot](#)

[dcaecdap06](#)

ubuntu-16-04-cloud-amd64

oam_onap_c4Uw

- 10.0.0.18
- 10.12.6.8

[m1.xlarge](#)

onap_key_c4Uw

Active

nova

None

Running

2 weeks, 2 days

[Create Snapshot](#)

[dcaecdap01](#)

ubuntu-16-04-cloud-amd64

oam_onap_c4Uw

- 10.0.0.13
- 10.12.5.248

[m1.xlarge](#)

onap_key_c4Uw

Active

nova

None

Running

2 weeks, 2 days

[Create Snapshot](#)

[dcaecdap04](#)

ubuntu-16-04-cloud-amd64

oam_onap_c4Uw

- 10.0.0.3
- 10.12.6.12

[m1.xlarge](#)

onap_key_c4Uw

Active

nova

None

Running

2 weeks, 2 days

[Create Snapshot](#)

[dcaecdap00](#)

ubuntu-16-04-cloud-amd64

oam_onap_c4Uw

- 10.0.0.16
- 10.12.5.92

[m1.xlarge](#)

onap_key_c4Uw

Active

nova

None

Running

2 weeks, 2 days

[Create Snapshot](#)

[dcaedoks00](#)

ubuntu-16-04-cloud-amd64

oam_onap_c4Uw

- 10.0.0.6
- 10.12.5.246

[m1.xlarge](#)

onap_key_c4Uw

Active

nova

None

Running

2 weeks, 2 days

[Create Snapshot](#)

[dcaedokp00](#)

ubuntu-16-04-cloud-amd64

oam_onap_c4Uw

- 10.0.0.17
- 10.12.5.247

[m1.xlarge](#)

onap_key_c4Uw

Active

nova

None

Running

2 weeks, 2 days

[Create Snapshot](#)

[dcaecnsI00](#)

ubuntu-16-04-cloud-amd64

oam_onap_c4Uw

- 10.0.0.12
- 10.12.5.184

[m1.xlarge](#)

onap_key_c4Uw

Active

nova

None

Running

2 weeks, 2 days

[Create Snapshot](#)

[dcaecnsI01](#)

ubuntu-16-04-cloud-amd64

oam_onap_c4Uw

- 10.0.0.14
- 10.12.6.0

[m1.xlarge](#)

onap_key_c4Uw

Active

nova

None

Running

2 weeks, 2 days

[Create Snapshot](#)

[dcaecons102](#)

ubuntu-16-04-cloud-amd64

oam_onap_c4Uw

- 10.0.0.8
- 10.12.5.232

[m1.xlarge](#)

onap_key_c4Uw

Active

nova

None

Running

2 weeks, 2 days

[Create Snapshot](#)

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dcaeorcl00	CentOS-7	oam_onap_c4Uw <ul style="list-style-type: none">• 10.0.0.9• 10.12.5.142	m1.xlarge	onap_key_c4Uw	Active	nova	None	Running	2 weeks, 2 days	Create Snapshot	
	vm1-dcae-bootstrap	ubuntu-16-04-cloud-amd64	oam_onap_c4Uw <ul style="list-style-type: none">• 10.0.4.1• 10.12.5.51	m1.small	onap_key_c4Uw	Active	nova	None	Running	2 weeks, 3 days	Create Snapshot
	vm1-policy	ubuntu-14-04-cloud-amd64	oam_onap_c4Uw <ul style="list-style-type: none">• 10.0.6.1• 10.12.5.178	m1.xlarge	onap_key_c4Uw	Active	nova	None	Running	2 weeks, 3 days	Create Snapshot
	vm1-aai-inst1	ubuntu-14-04-cloud-amd64	oam_onap_c4Uw <ul style="list-style-type: none">• 10.0.1.1• 10.12.5.153	m1.xlarge	onap_key_c4Uw	Active	nova	None	Running	2 weeks, 3 days	Create Snapshot
	vm1-portal	ubuntu-14-04-cloud-amd64	oam_onap_c4Uw <ul style="list-style-type: none">• 10.0.9.1• 10.12.5.159	m1.large	onap_key_c4Uw	Active	nova	None	Running	2 weeks, 3 days	Create Snapshot
	vm1-message-router	ubuntu-14-04-cloud-amd64	oam_onap_c4Uw <ul style="list-style-type: none">• 10.0.11.1• 10.12.5.171	m1.large	onap_key_c4Uw	Active	nova	None	Running	2 weeks, 3 days	Create Snapshot
	vm1-aai-inst2	ubuntu-14-04-cloud-amd64	oam_onap_c4Uw <ul style="list-style-type: none">• 10.0.1.2• 10.12.5.163	m1.xlarge	onap_key_c4Uw	Active	nova	None	Running	2 weeks, 3 days	Create Snapshot
	vm1-appc	ubuntu-14-04-cloud-amd64	oam_onap_c4Uw <ul style="list-style-type: none">• 10.0.2.1• 10.12.5.156	m1.large	onap_key_c4Uw	Active	nova	None	Running	2 weeks, 3 days	Create Snapshot

vm1-robot	ubuntu-16-04-cloud-amd64	oam_onap_c4Uw <ul style="list-style-type: none"> 10.0.10.1 10.12.5.148 	m1.medium	onap_key_c4Uw	Active	nova	None	Running	2 weeks, 3 days	Create Snapshot
vm1-sdc	ubuntu-16-04-cloud-amd64	oam_onap_c4Uw <ul style="list-style-type: none"> 10.0.3.1 10.12.5.2 	m1.xlarge	onap_key_c4Uw	Active	nova	None	Running	2 weeks, 3 days	Create Snapshot
vm1-vid	ubuntu-14-04-cloud-amd64	oam_onap_c4Uw <ul style="list-style-type: none"> 10.0.8.1 10.12.5.116 	m1.medium	onap_key_c4Uw	Active	nova	None	Running	2 weeks, 3 days	Create Snapshot
vm1-so	ubuntu-16-04-cloud-amd64	oam_onap_c4Uw <ul style="list-style-type: none"> 10.0.5.1 10.12.5.38 	m1.large	onap_key_c4Uw	Active	nova	None	Running	2 weeks, 3 days	Create Snapshot
vm1-clamp	ubuntu-16-04-cloud-amd64	oam_onap_c4Uw <ul style="list-style-type: none"> 10.0.12.1 10.12.5.114 	m1.medium	onap_key_c4Uw	Active	nova	None	Running	2 weeks, 3 days	Create Snapshot
vm1-dns-server	ubuntu-14-04-cloud-amd64	oam_onap_c4Uw <ul style="list-style-type: none"> 10.0.100.1 10.12.5.62 	m1.small	onap_key_c4Uw	Active	nova	None	Running	2 weeks, 3 days	Create Snapshot
vm1-sdnc	ubuntu-14-04-cloud-amd64	oam_onap_c4Uw <ul style="list-style-type: none"> 10.0.7.1 10.12.5.173 	m1.large	onap_key_c4Uw	Active	nova	None	Running	2 weeks, 3 days	Create Snapshot
vm1-multi-service	ubuntu-16-04-cloud-amd64	oam_onap_c4Uw <ul style="list-style-type: none"> 10.0.14.1 10.12.5.128 	m1.xlarge	onap_key_c4Uw	Active	nova	None	Running	2 weeks, 3 days	Create Snapshot
nokia_jumphost	(not found)	external <ul style="list-style-type: none"> 10.12.5.134 	m1.medium	nokia_jumphost	Active	nova	None	Running	1 month, 3 weeks	Create Snapshot