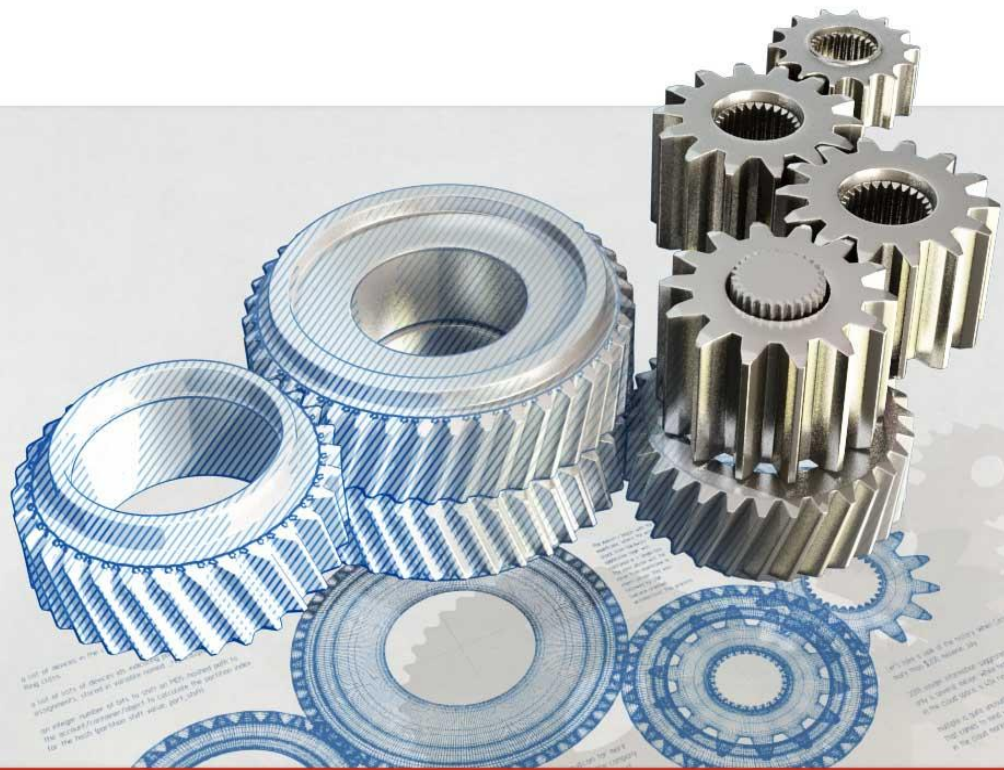# Hadoop on OpenStack Cloud

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Dmitry Mescheryakov
Software Engineer, @MirantisIT

Agenda

- OpenStack
- Sahara
- Demo
- Hadoop Performance on Cloud
- Conclusion

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OpenStack

Open source cloud computing platform

17,209 commits by 1202 people for Icehouse release* (6 month dev cycle)

Top 20 contributing companies include Red Hat, IBM, HP, Rackspace, VMWare, Intel, Samsung and others*

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* data taken from OpenStack Icehouse Release Bitergia Technical Report

OpenStack

- OpenSource from the very beginning (Apache 2.0)
- All pythonic, services exposed via REST API
- Is split into a number of projects

- Scalable
- Supports various deployment modes
- Flexibility in choice of underlying technologies
  - There is always an open source choice available

OpenStack Identity Service

- Authenticates / Authorizes users
- Provides multi-tenancy
- Provides interface for managing users & tenants
- Single entry point for OpenStack users. To use OpenStack you need to know:
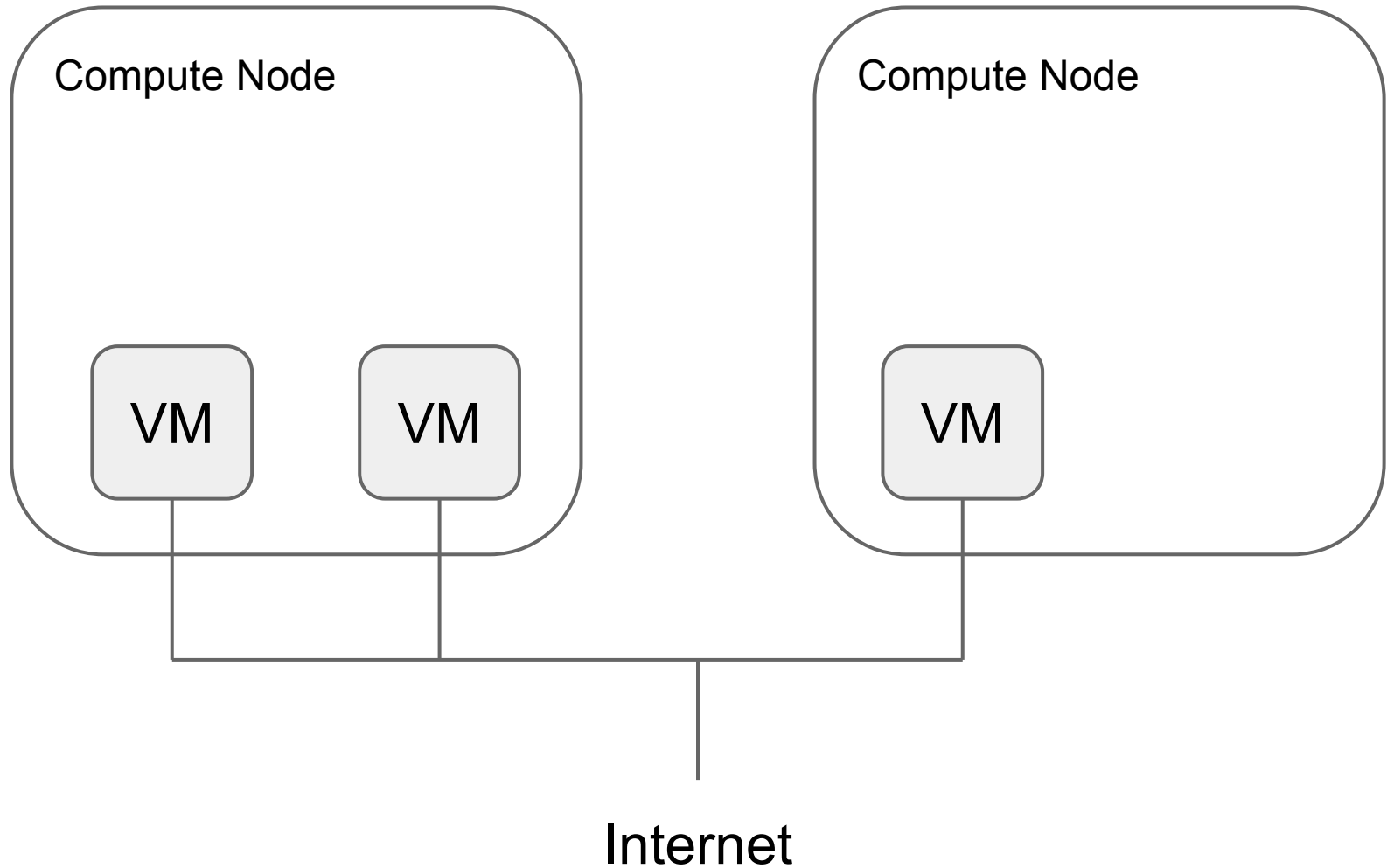 - username
  - password
  - tenant name
  - Identity API URL

OpenStack Compute

Compute Node

VM   VM

Compute Node

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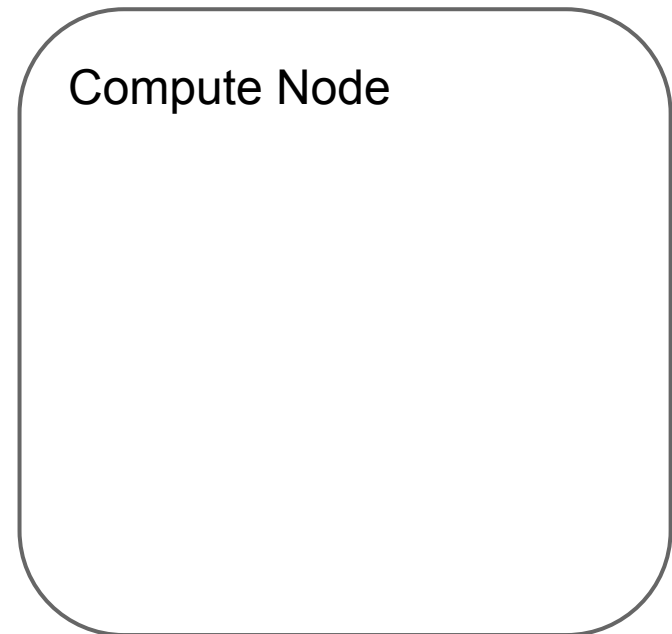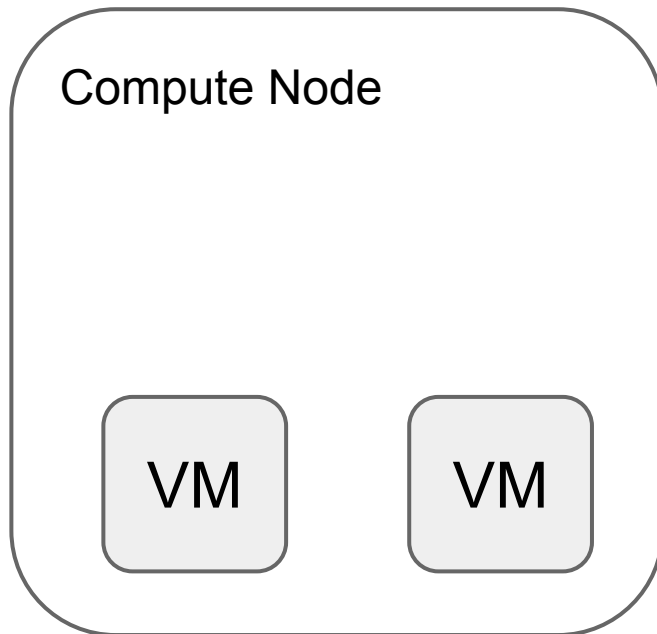
OpenStack Compute

- Virtual Machines lifecycle management
- Supported hypervisors:
  - QEMU/KVM
  - Xen
  - LXC
  - Hyper-V
  - VMWare

OpenStack Networking

Compute Node

VM

VM

Compute Node

VM

Internet

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OpenStack Networking

- Provides networking for VMs using two concepts:
  - virtual network
  - virtual router
- Networking plugin:
  - Open vSwitch
  - Cisco
  - Brocade
  - BigSwitch
  - And many more...

OpenStack Image Service

- Image catalog for Compute
- Supported backends:
  - Local FS
  - OpenStack Object Storage
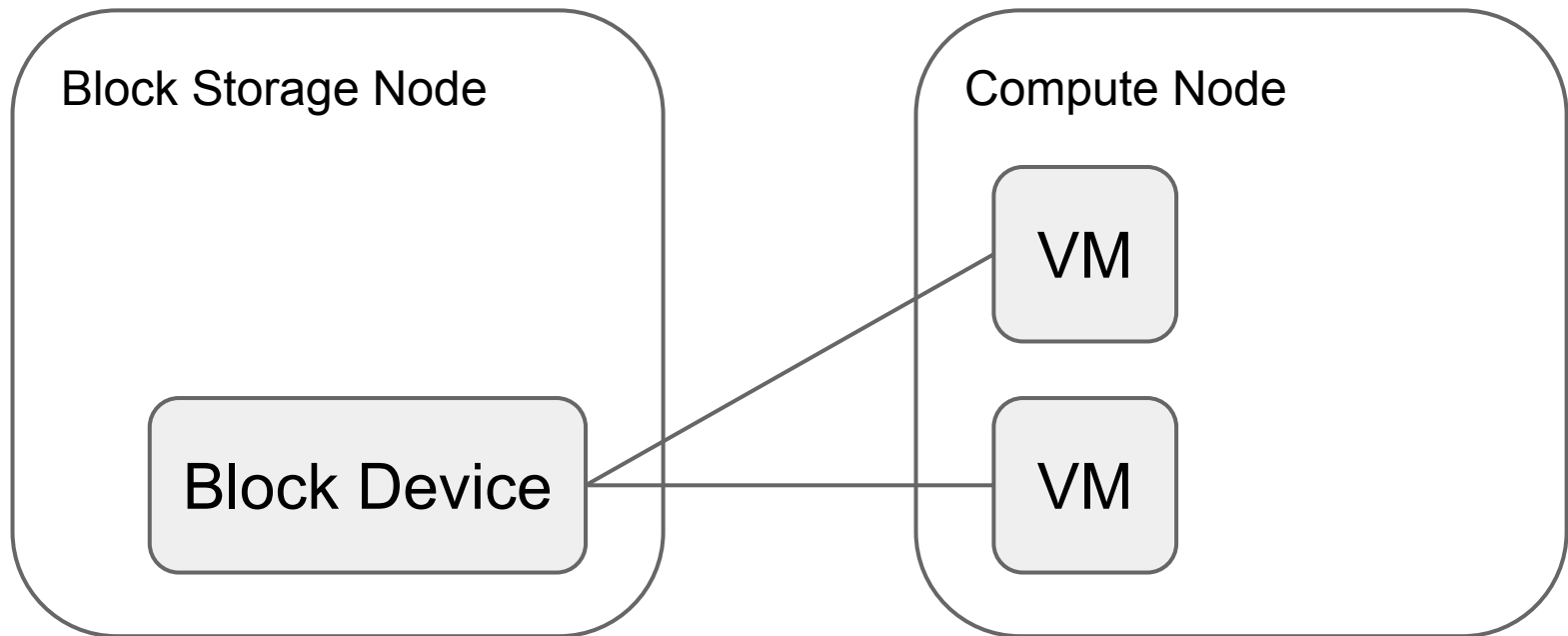 - GridFS
  - Ceph RBD
  - And some more...

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OpenStack Object Storage

Server

Compute Node

Object Storage

HTTP POST

VM

HTTP GET

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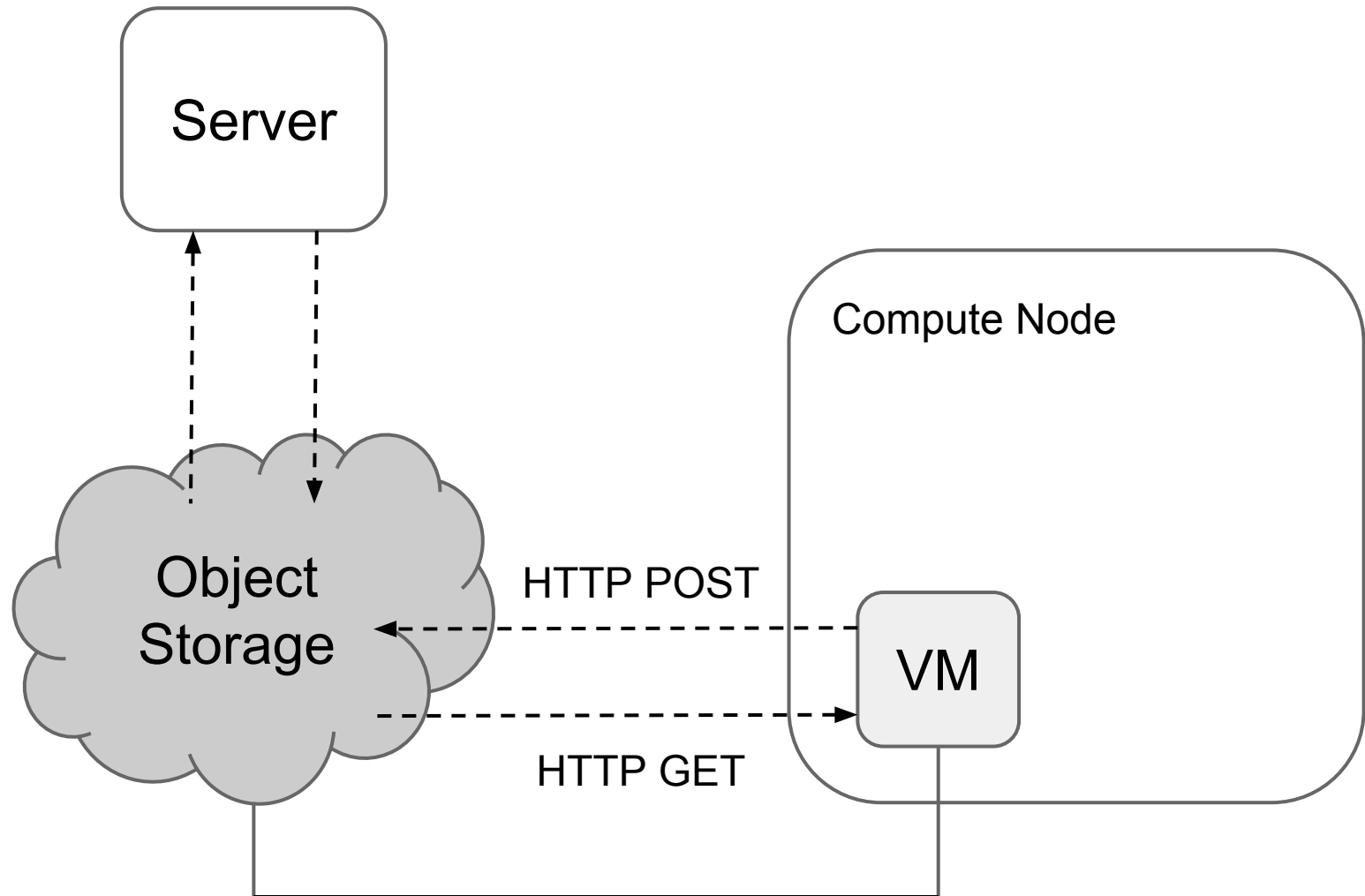
OpenStack Object Storage

- Storage of unstructured data
- Swift, could be replaced with Ceph

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OpenStack Block Storage

OpenStack Block Storage

- Provides persistent block storage (plug your SAN here)
- Storage plugins:
  - LVM
  - Ceph RADOS
  - Coraid AoE
  - Dell EqualLogic
  - And many more ...

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OpenStack Dashboard

- OpenStack Web UI

AWS vs OpenStack

Amazon	OpenStack
	Compute
EC2	Networking
	Image Service
Identity & Access Manager	Identity Service
S3	Object Storage
Elastic Block Storage	Block Storage
Web UI	Dashboard

OpenStack API

http://127.0.0.1:8774/v2/1e2afda0.../servers

X-Auth-Token: 2c1ecf5...

```
{"server": {"name": "my-instance",
            "imageRef": "fe35ee17-...",
            "key_name": "my-keypair",
            "flavorRef": "2",
            "networks": [{"uuid":"bb80cc75-..."}]}}
```

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OpenStack CLI Clients

```
nova boot  \
    --image ubuntu-14.04  \
    --key-name my-keypair  \
    --flavor m1.small  \
    --nic net-id=bb80cc75-...  \
    my-instance
```

OS_USERNAME, OS_PASSWORD, OS_TENANT_NAME, OS_AUTH_URL environment variables must be defined

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OpenStack Python Bindings

```
from novaclient import client

nova = client.Client('2', 'admin', 'nova', 'admin', 'http://127.
0.0.1:5000/v2.0/')

nova.servers.create('my-instance',
                    image='fefbee17-...',
                    flavor='2',
                    key_name='my-keypair',
                    nics=[{"net-id": 'bb80cc75-...'}])
```
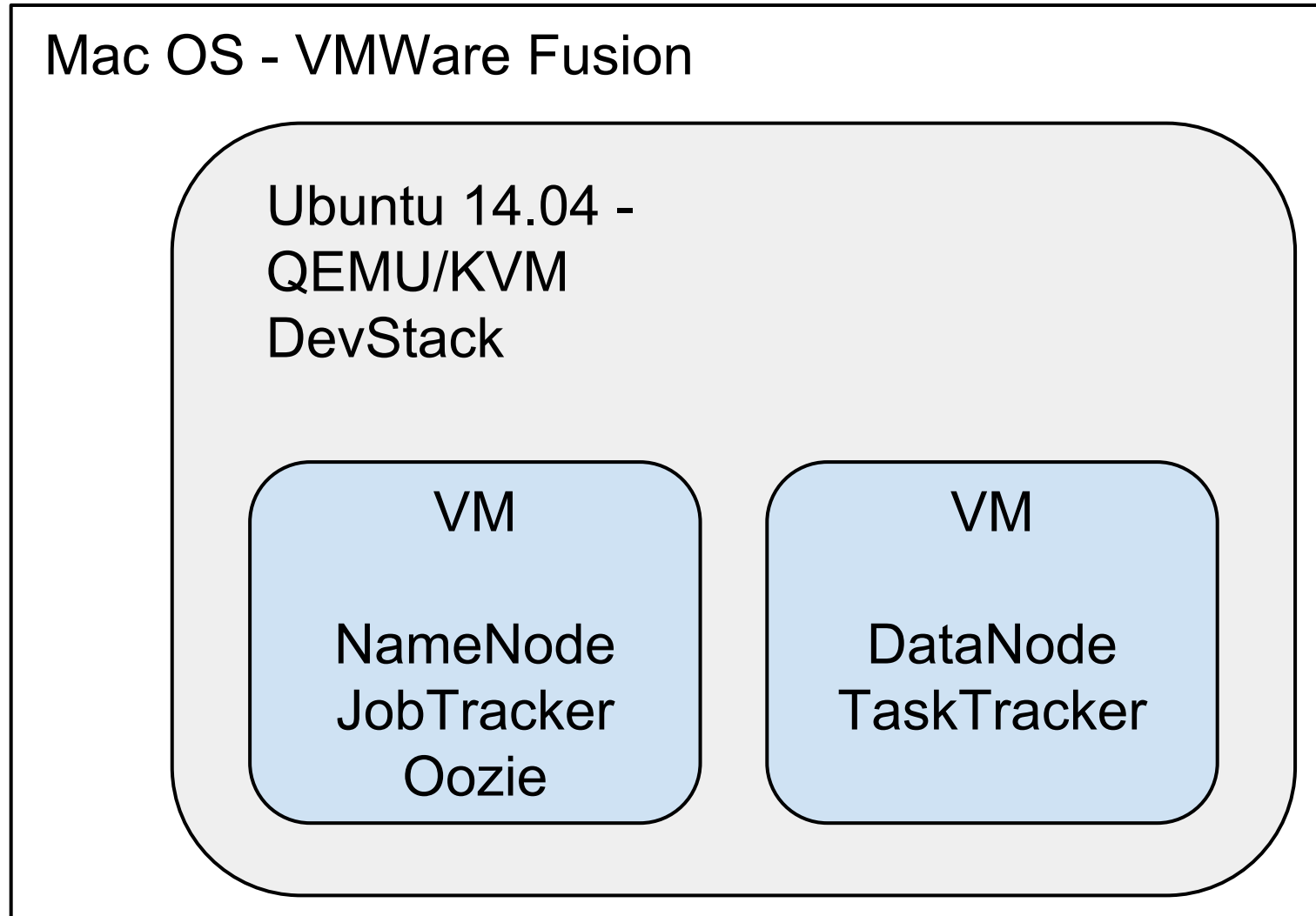
DevStack

All-in-one OpenStack installation for dev and demo purposes

http://devstack.org, and follow instructions

To enable Sahara:

http://docs.openstack.org/developer/sahara/devref/devstack.html

DevStack Demo Environment

Mac OS - VMWare Fusion

Ubuntu 14.04 -
QEMU/KVM
DevStack

VM

NameNode
JobTracker
Oozie

VM

DataNode
TaskTracker

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DevStack on VM: a tip

Host hypervisor should pass through hardware virtualization: QEMU/KVM for Linux, VMWare Fusion for Mac OS X.

VT-x (vmx) for Intel, AMD-V (svm) for AMD

Without it, nested VMs will be very slow. To check:
 cat /proc/cpuinfo | grep --color "vmx\|svm"

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Sahara (ex. Savanna): OpenStack Data Processing

Simplify running Hadoop on OpenStack

Started a year ago and currently major contributors include Mirantis, Red Hat and Hortonworks

Will be integrated project in OpenStack Juno release (October 2014)

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Sahara Overview

- template based cluster provisioning
- different distributions via plugins:
  - Vanilla Hadoop
  - HDP
  - CDH (in progress)
- Each plugin supports several versions

Supported Hadoop Ecosystem Projects

- HDFS
- MapReduce
- YARN
- Oozie
- Hive

Sahara Functionality

- Bringing up cluster
- Configure it along the way
- Scale cluster
- Terminate cluster
- Job execution (Elastic Data Processing)

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Integration with Object Storage

Work with Object Storage like with HDFS

- swift://test-container.sahara/my_file
- username
- password
- tenant name

Prepared Images

- Take cloud image (Ubuntu, Fedora, CentOS) as a base
- Install Hadoop, Java and other stuff on it
- Enjoy much faster cluster provisioning

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Data Locality

Sahara can provide data locality info, if configured properly

Works for both HDFS and Object Storage

VMs running on the same hardware machines are 'close', and Sahara knows that

Other Stuff

- REST API
- CLI client
- Python bindings
- UI

Hadoop in the Cloud: Performance

- Mirantis OpenStack Express cluster
- 20 nodes
- CPU: 24 x 2.10 GHz (2 x Intel Xeon CPU E5-2620)
- Memory: 8 x 4.0 GB, 32.0 GB total
- Disk: 1 drive, 0.9 TB (WDC WD1003FBYX-0)
- Network: 2 x 1 GbE

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Performance tests

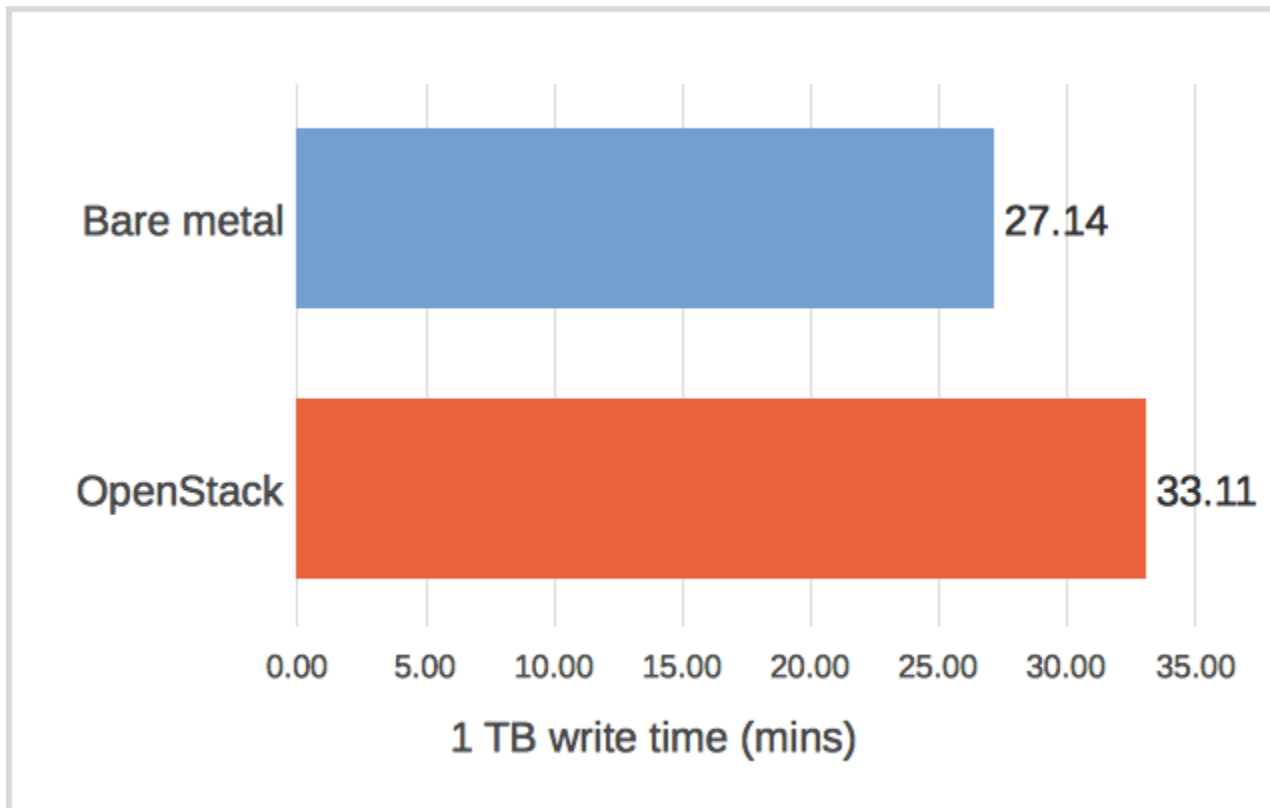- disk read/write
- network throughput
- cpu
- composite test
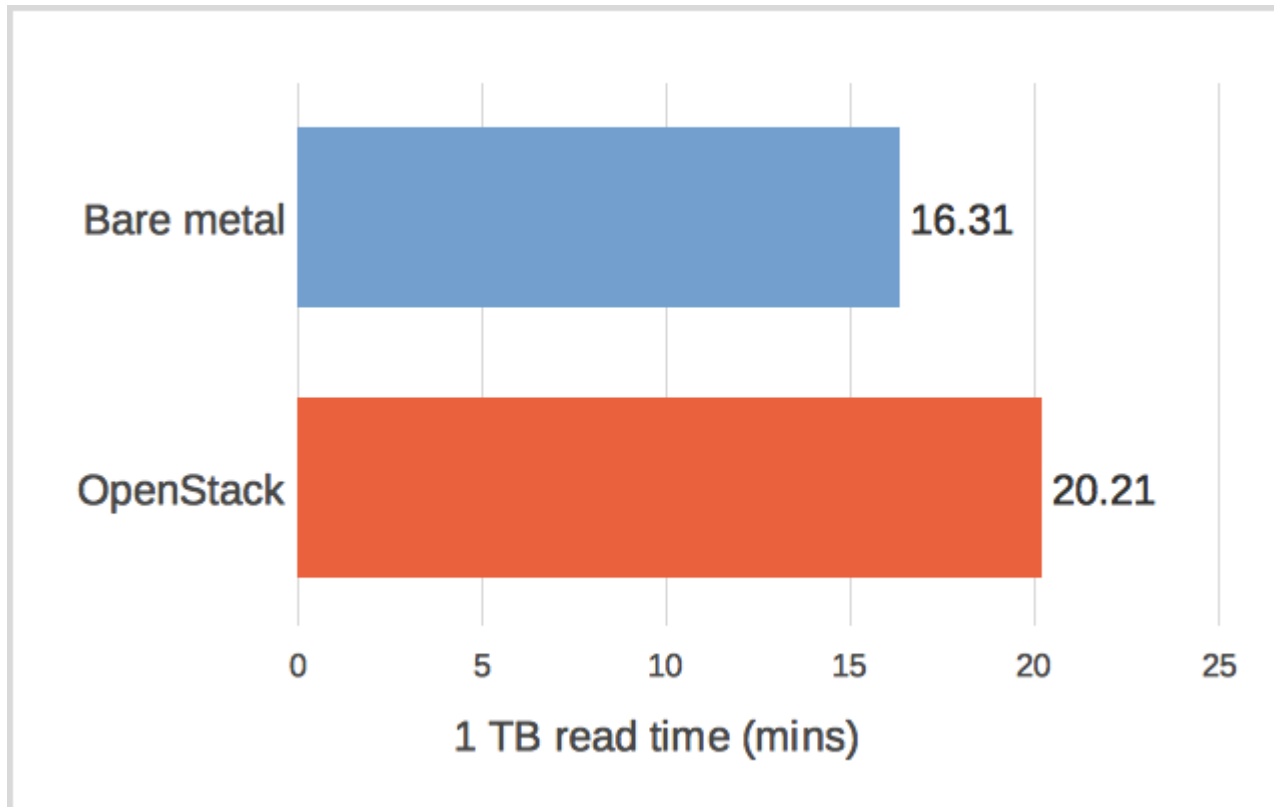
Disk Read/Write

TestDFSIO - built-in hadoop I/O test

- 1000 files of 1GB (1 TB total)
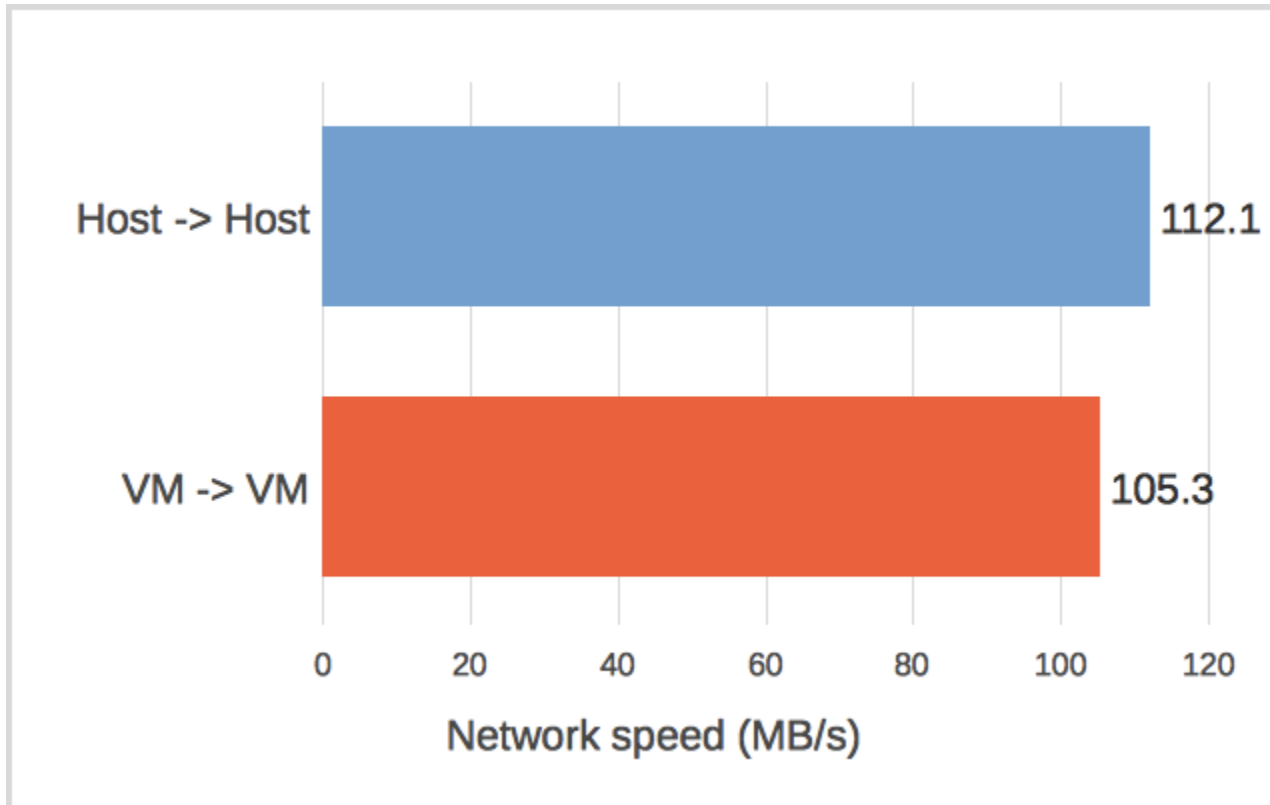
Disk Write

*less is better

Disk Read

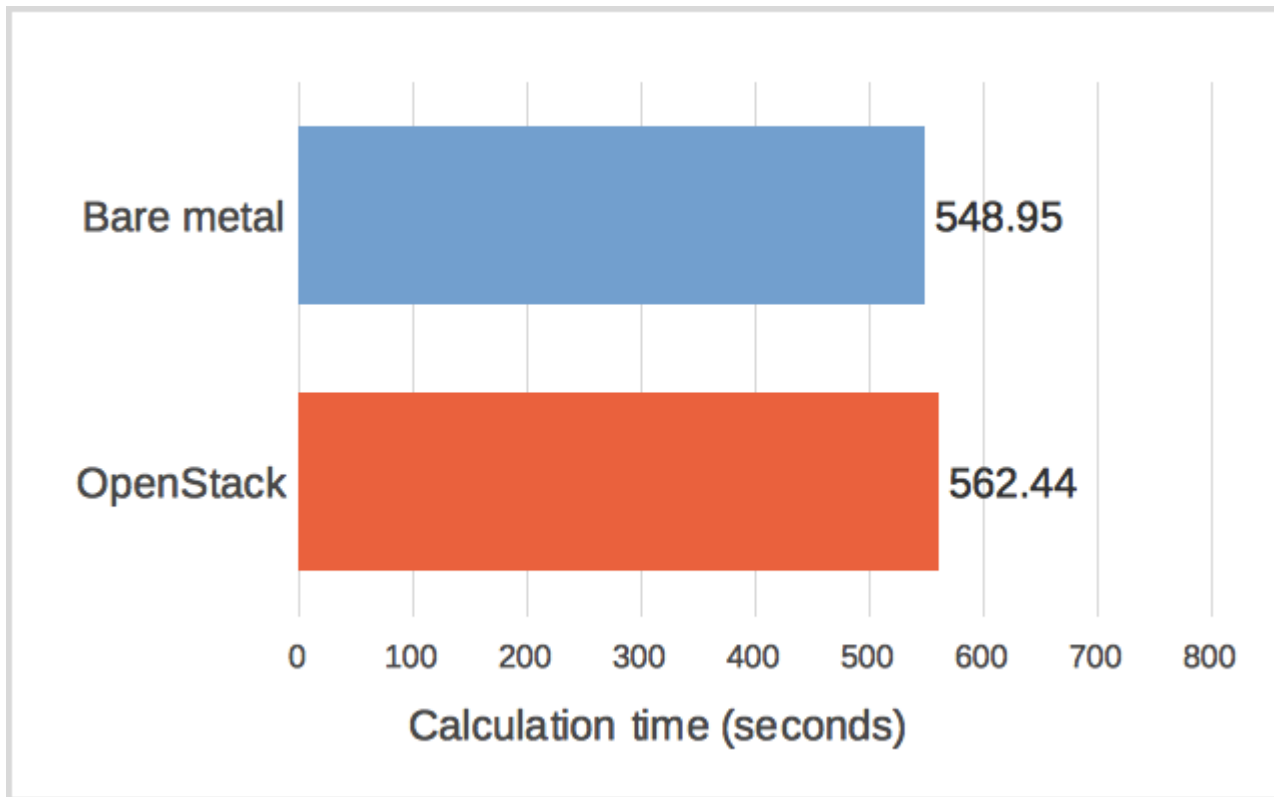
*less is better

Network

time + nc

Network

*greater is better

CPU

PI - built-in hadoop test, depends mostly on CPU

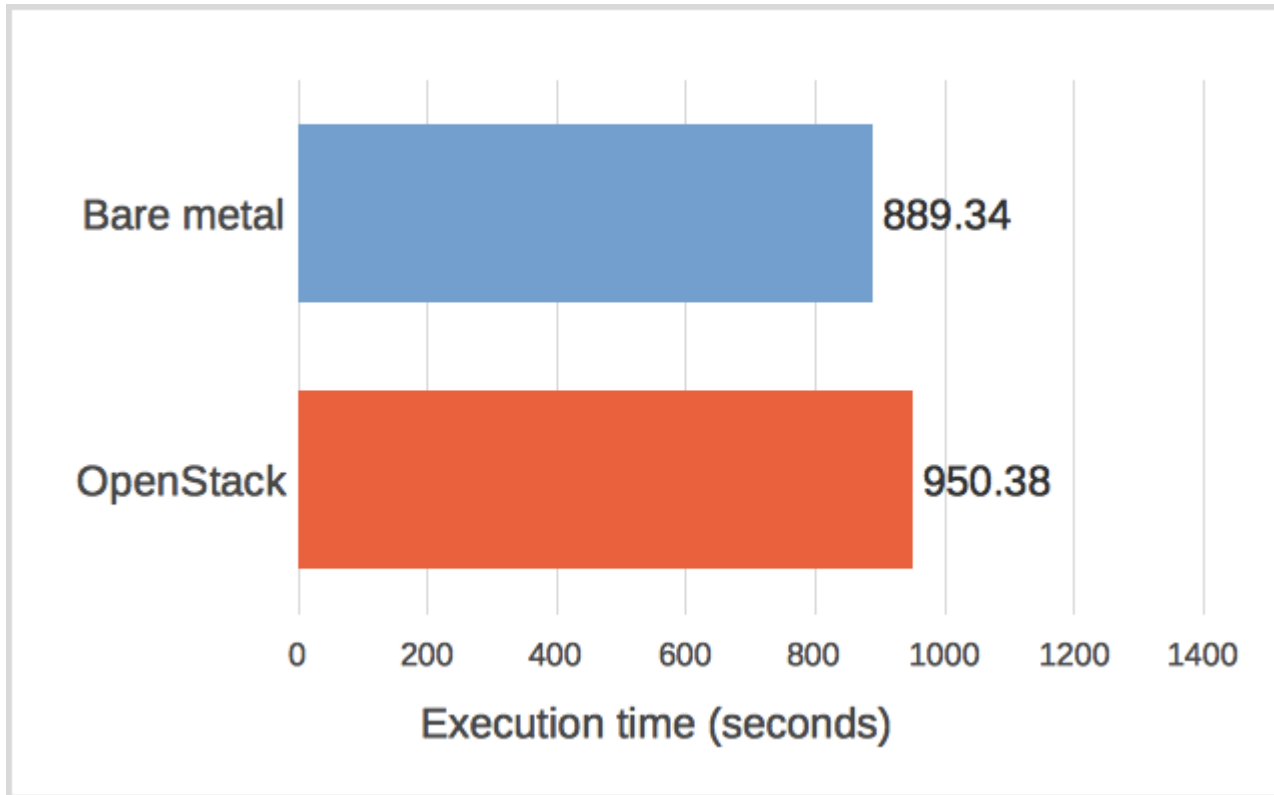- 50 series of 10,000,000,000 probes

CPU

*less is better

Composite Text

Terasort - built-in hadoop test

- 200,000,000 of 100-byte entries (20 GB)

Terasort

*less is better

Performance Testing Results

Virtualized Hadoop 24% slower than Bare Metal one in the worst case (disk read)

It is only 6% slower with the composite test (Terasort)

More details in talk "Performance of Hadoop on OpenStack" by Andrew Lazarev (find it on youtube)

Why Sahara

- agility
- self-service
- multi-tenancy
- pay as you go

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Q&A