

A graphic illustration of a white cloud floating in a blue sky. On the cloud are several colorful icons: a blue music note, a red envelope, an orange document, and a green server rack. Colorful lines swirl around the cloud, suggesting connectivity and data flow.

Cloud System Administration using OpenStack

Md. Mahedi Hasan

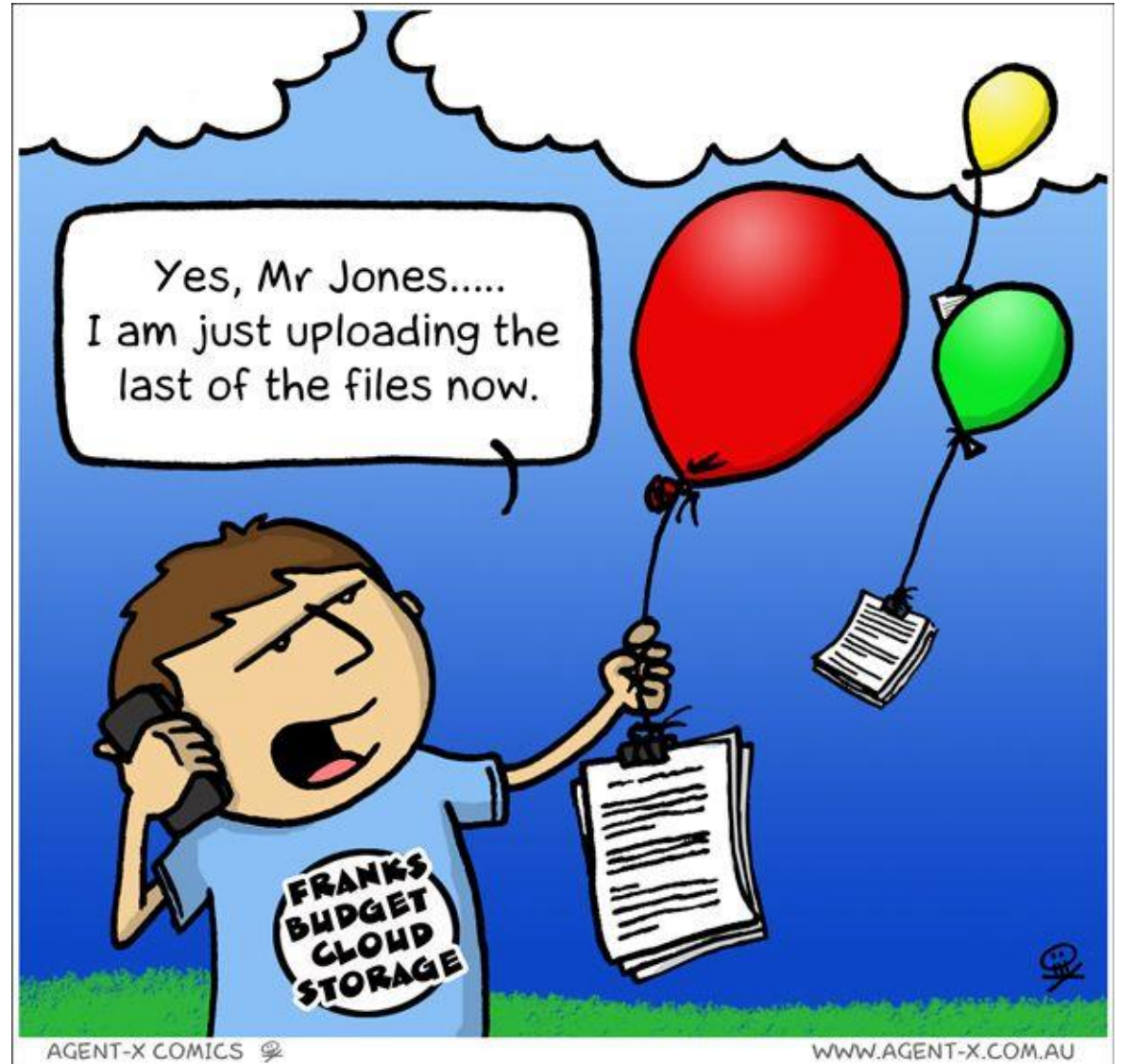
Sr. System Engineer (BdREN)

 mahedi@bdren.net.bd |  www.Mahedi.me

 [/in/mahedicse/](https://www.linkedin.com/in/mahedicse/) |  [/mahedi.cse](https://www.facebook.com/mahedi.cse)

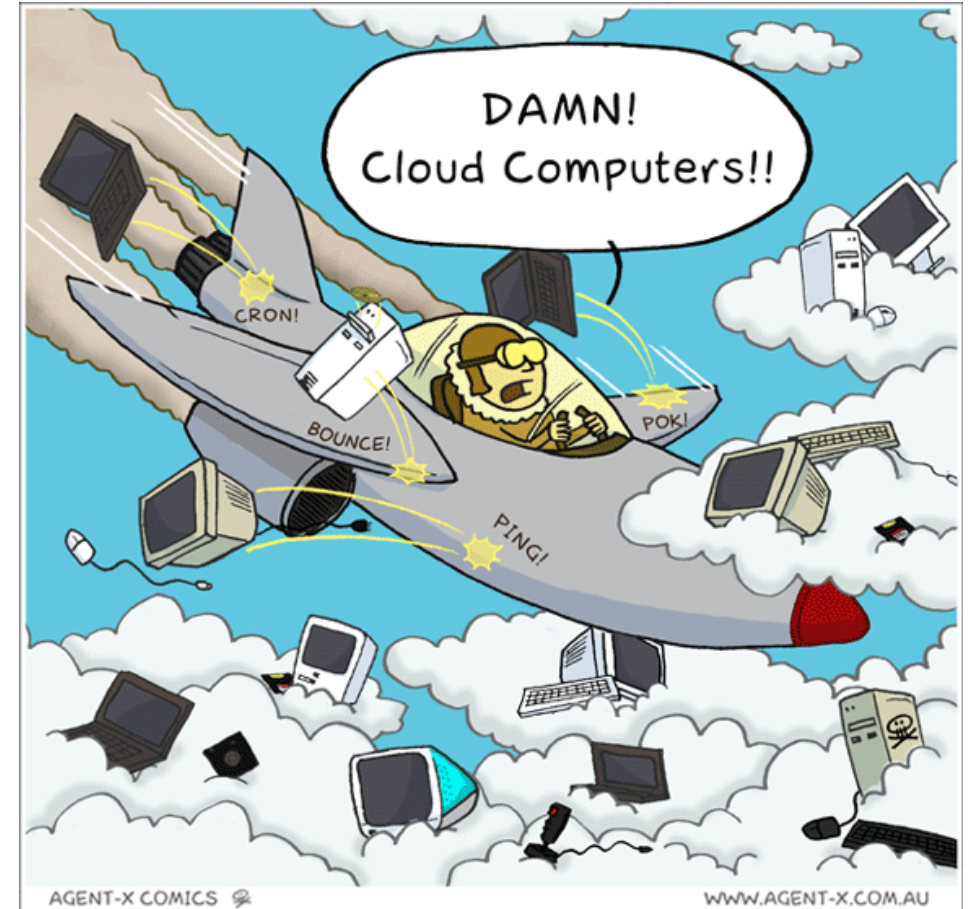
What is Cloud Computing ?

- ☁ Is it's a Standard?
- ☁ Is it's a Hardware?
- ☁ Is it's a Software?
- ☁ So What is actually it?



Introduction to Cloud Computing

- ☁ Today's the modern technology of computing is cloud computing that can provide mobility and massive scalability of computing.
- ☁ It's can be integrated all of the computing services in a single umbrella.
- ☁ Cloud Computing is actually nothing except a concept of computing that integrate the generic computing via Internet or Intranet (e.g.: office online, g-drive, VPSs etc.)



Definition of Cloud Computing ?

The NIST Definition of Cloud Computing: Cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction.



Essential Characteristics:

On-demand self-service:

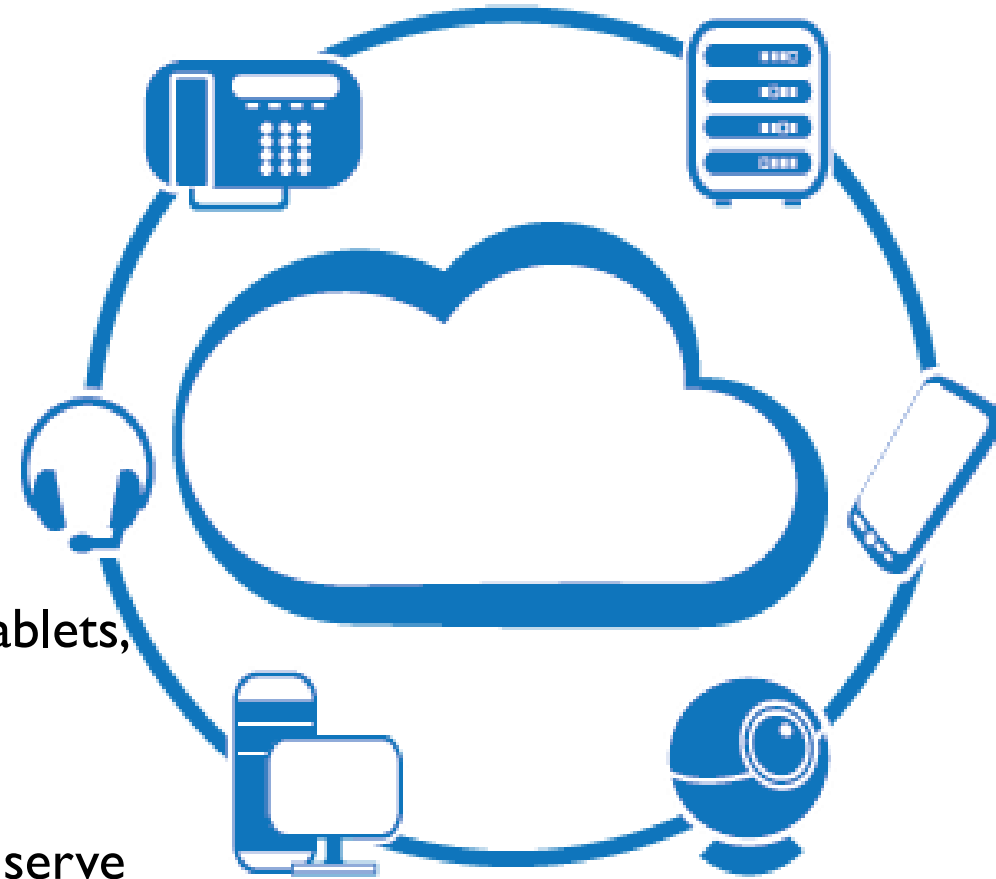
- It's provided recourses to user's on demand
- User operate their services by their self
- No user interaction required with physical systems

Broad network access:

- High speed network capacity to operate all the services
- Accessible from via Internet or Intranet or Both
- Support thin and thick client (e.g., mobile phones, tablets, laptops, and workstations).

Resource pooling:

- The provider's computing resources are pooled to serve multiple consumers using a multi-tenant model
- Different physical and virtual resources dynamically assigned and reassigned according to consumer demand (e.g.: storage, processing, memory, and network bandwidth.)



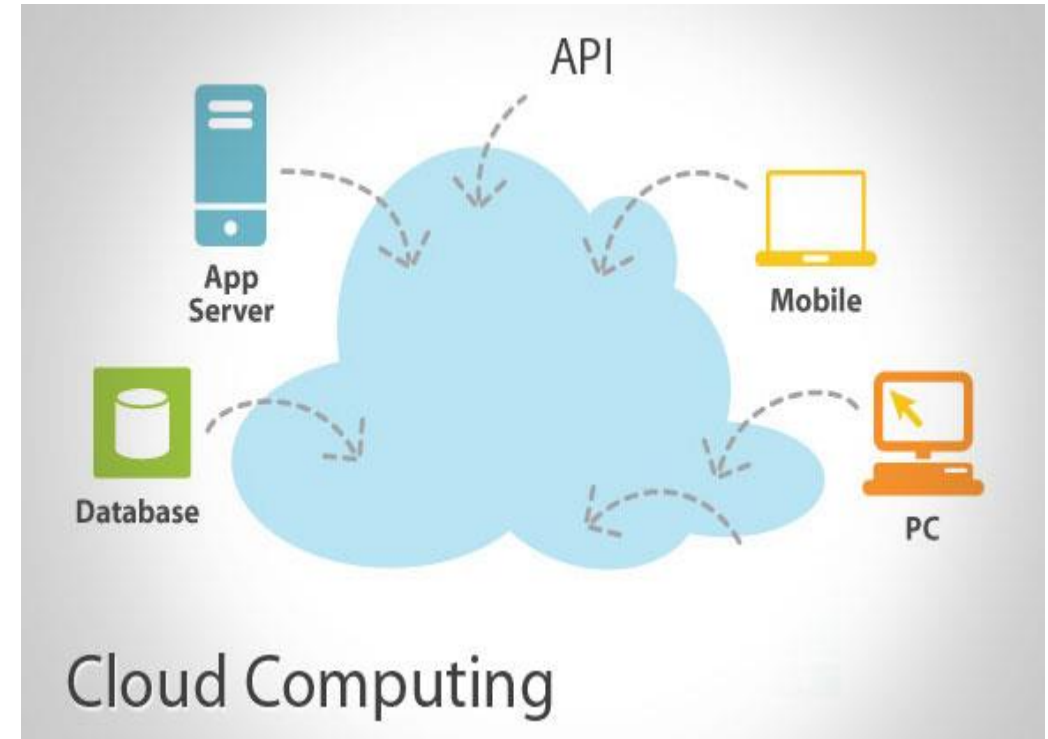
Essential Characteristics (Cont.):

☁ **Rapid elasticity:**

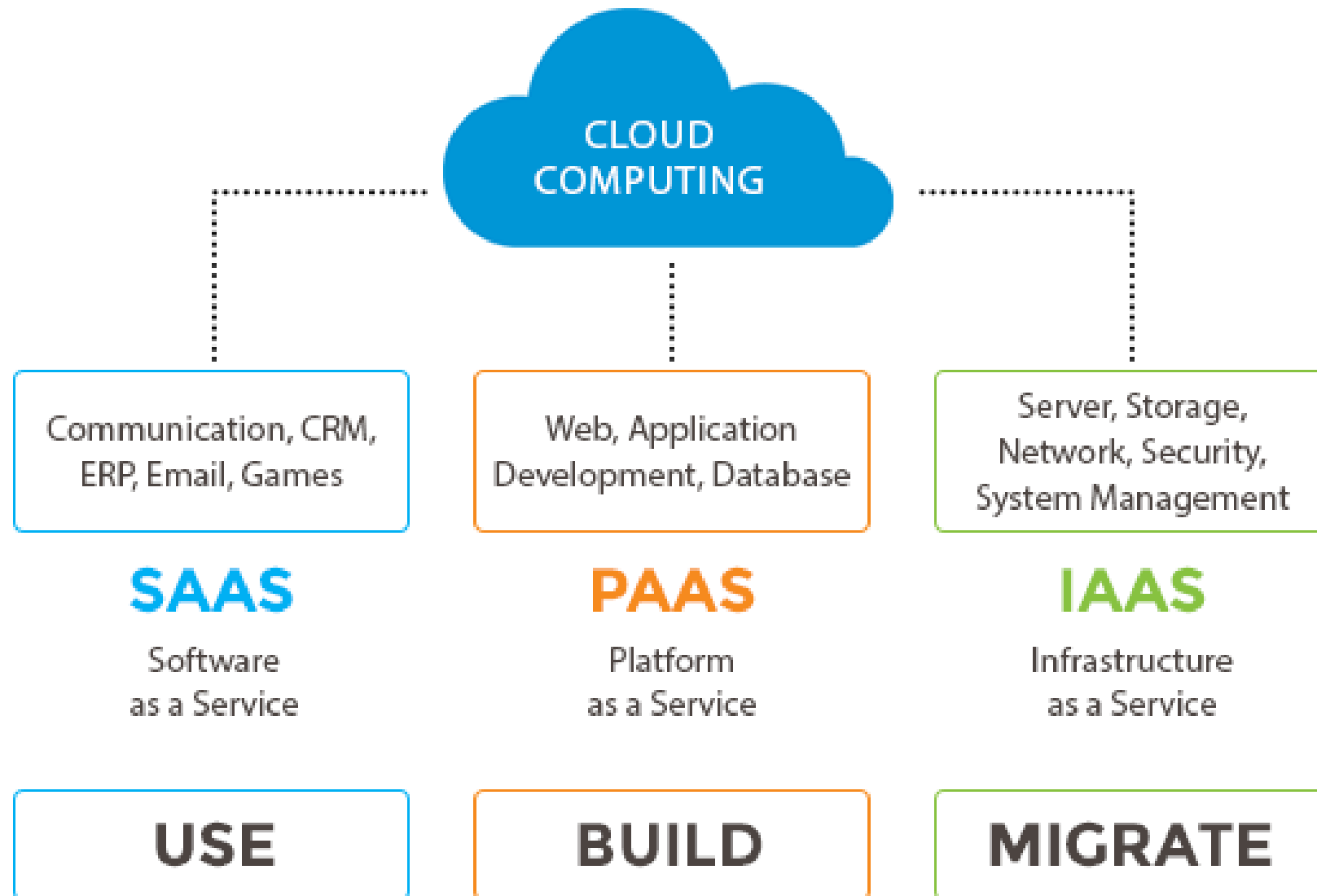
- ☁ Capabilities can be elastically provisioned and released, in some cases automatically.
- ☁ To the customer, the capabilities available for provisioning often appear to be unlimited and can be appropriated in any quantity at any time.

☁ **Measured service:**

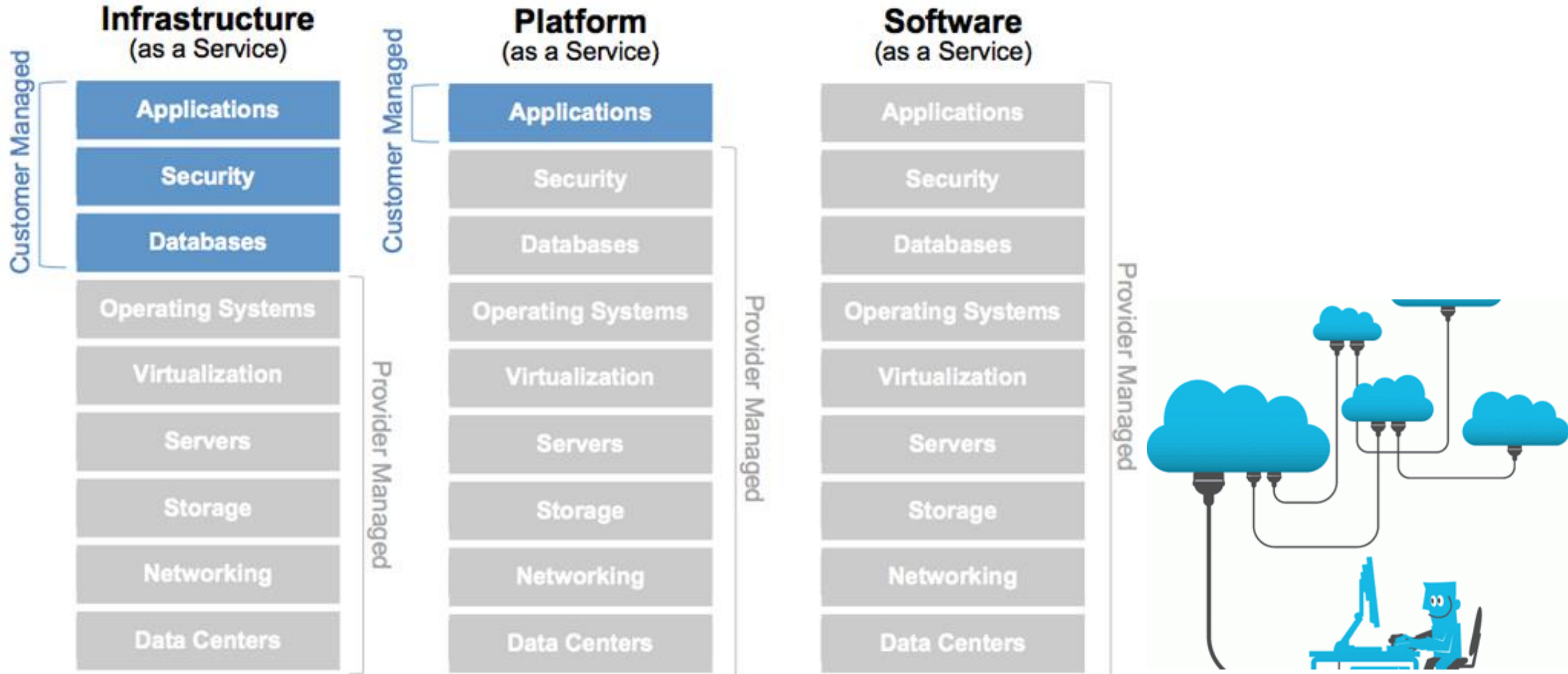
- ☁ Cloud systems automatically control and optimize resource (e.g., storage, processing, bandwidth, and active user accounts).
- ☁ Resource usage can be monitored, controlled, and reported, providing transparency for both the provider and customer of the utilized service.



Service Model



Cloud Provider vs. Customer Roles for Managing Cloud Services



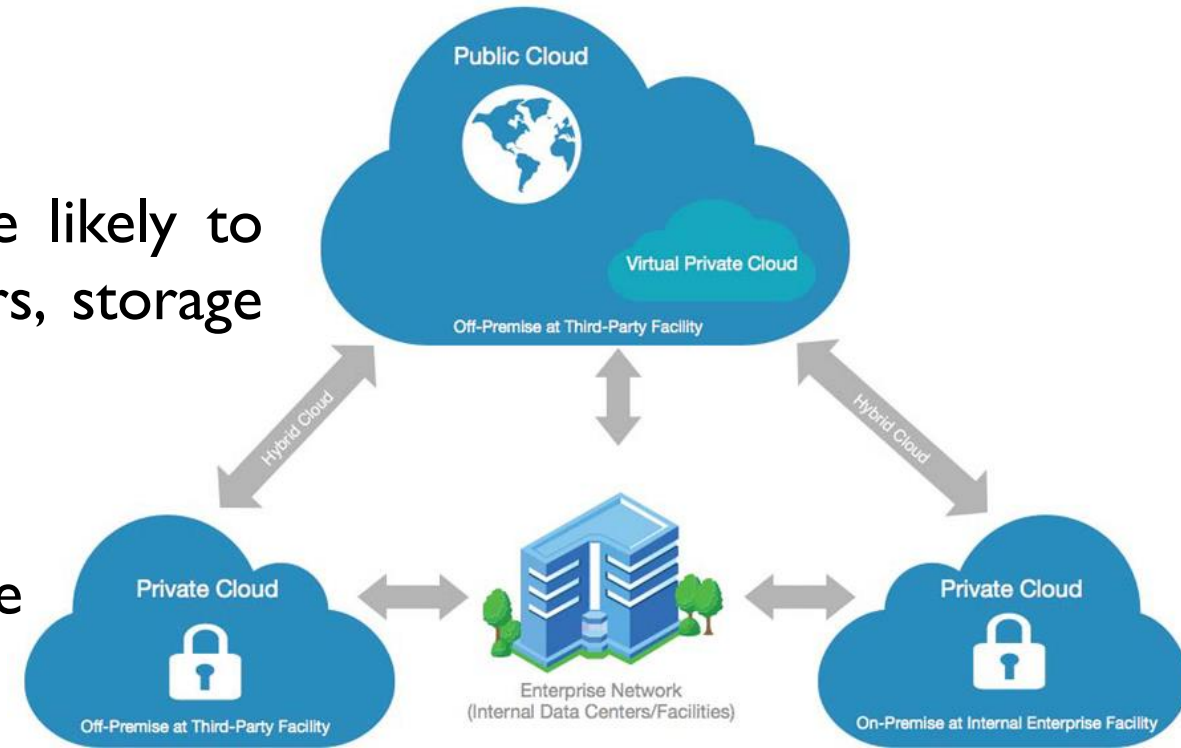
Deployment Model

Public Cloud:

- Public clouds are run by third parties
- Applications from different customers are likely to be mixed together on the cloud's servers, storage systems, and networks.

Private Cloud:

- Private clouds are built for the exclusive use by a single organization.
- Providing the control over data, security, and quality of service
- The company owns the infrastructure and has control over how applications are deployed on it



Deployment Model (Cont.)

• **Hybrid Cloud:**

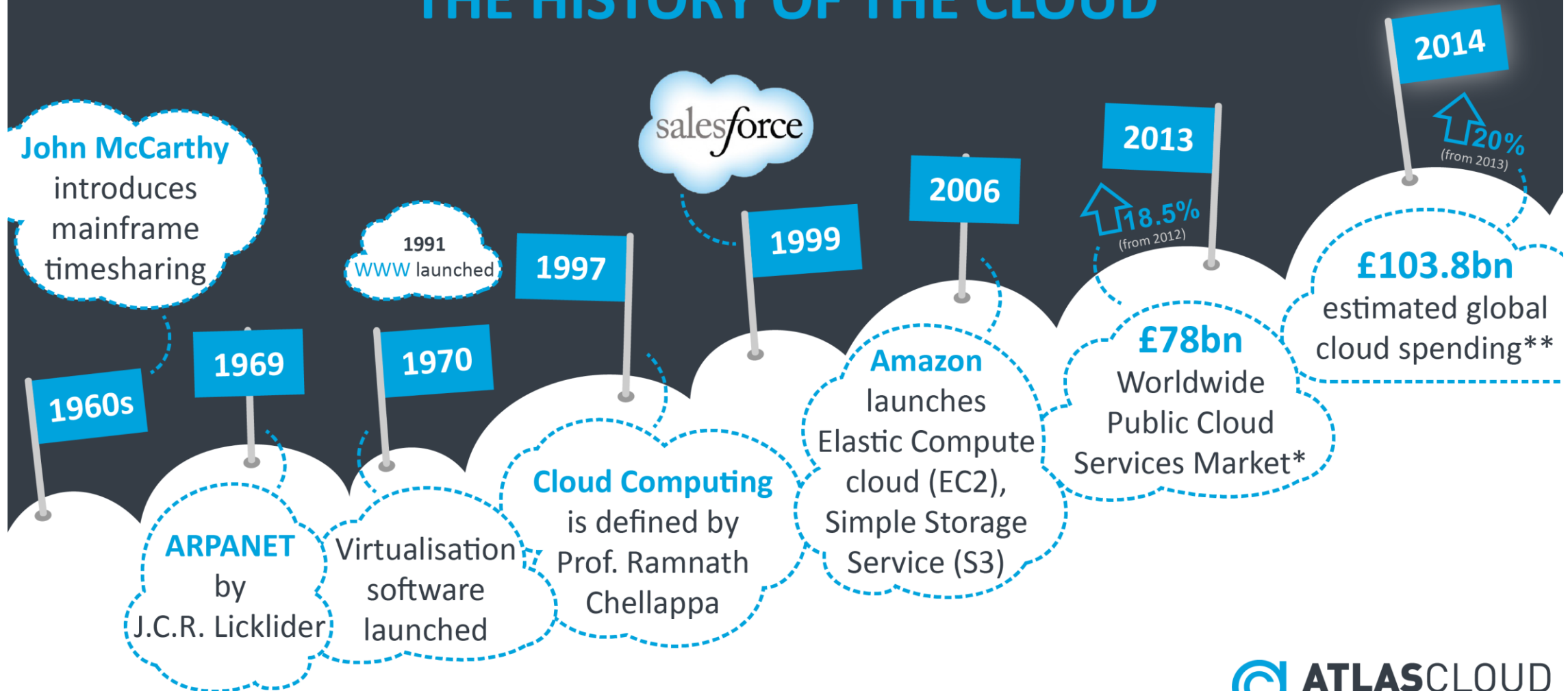
- Hybrid clouds combine both public and private cloud models.
- They can help to provide on-demand, externally provisioned scale.
- The ability to expand a private cloud with the resources of a public cloud

• **Community Cloud:**

- A cloud service that provides for a community of users or organizations with shared interests/concerns.
- The system is managed by one or more of the organizations, by a central provider, or a combination.
- Organizations utilizing this cloud service have shared missions, governance, security requirements, and policies.
- Cloud services can be hosted within the consumer organization's premises, at peer organization facilities.

History and Evaluation of Cloud

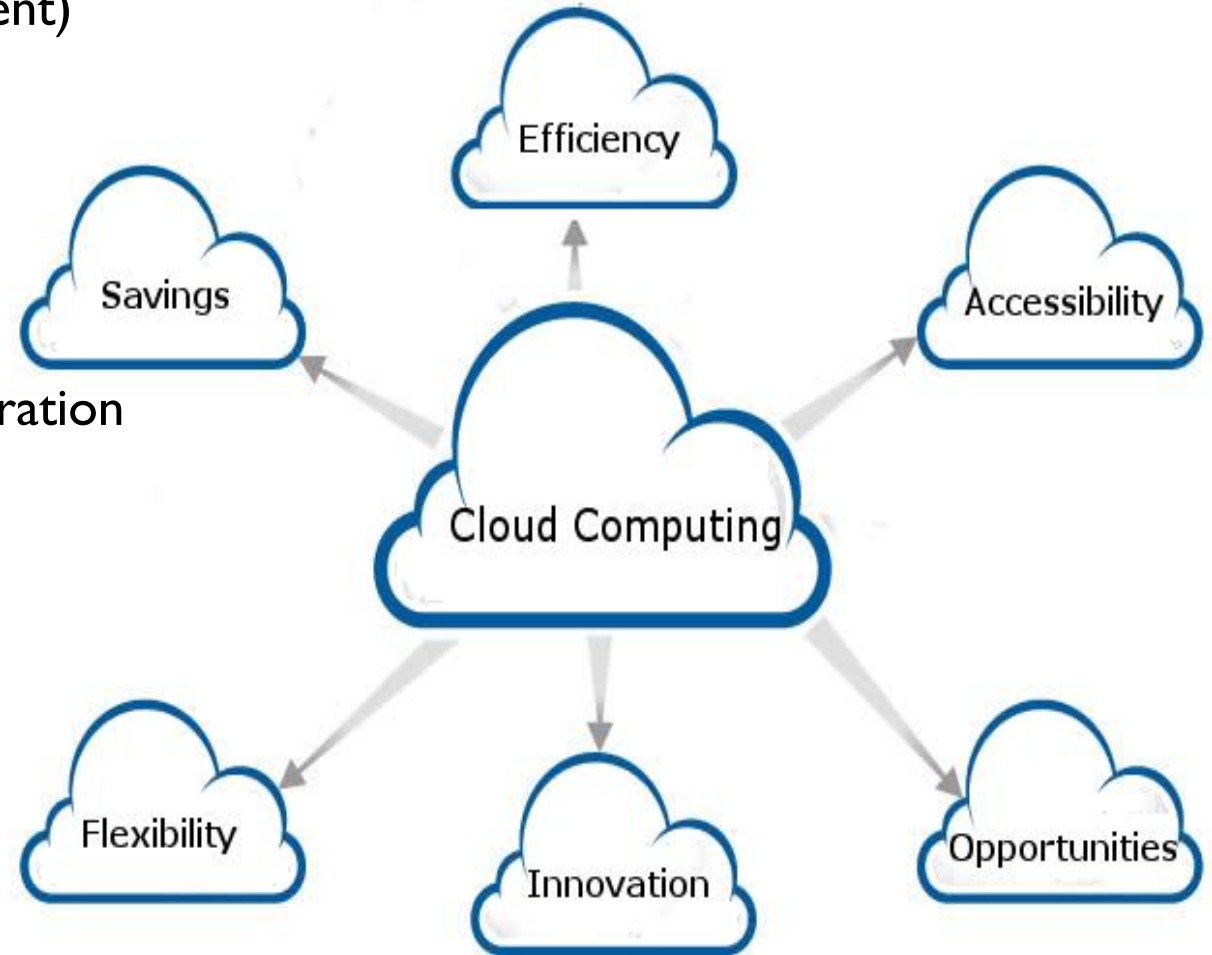
THE HISTORY OF THE CLOUD



* Gartner, ** Constellation Research







Advantage of Cloud Computing

- ☁ **Accessibility:** It's provide easy to access via internet or intranet used various type of application (e.g.: portal, ssh, apps, api etc.). Real-time statistics, monitoring, and metering of services (transparency into the cloud environment)
- ☁ **Efficiency:**
 - ☁ Self-service management
 - ☁ Reduce run time and response time
 - ☁ Data reliability & High Availability
 - ☁ Role-based security for multi-level administration
- ☁ **Saving:**
 - ☁ Minimize infrastructure risk
 - ☁ Lower cost of entry
 - ☁ Saving Energy
 - ☁ Pay per use
- ☁ **Increased pace of innovation:**
- ☁ **Portability/Flexibility and Opportunities**








Pros and Cons

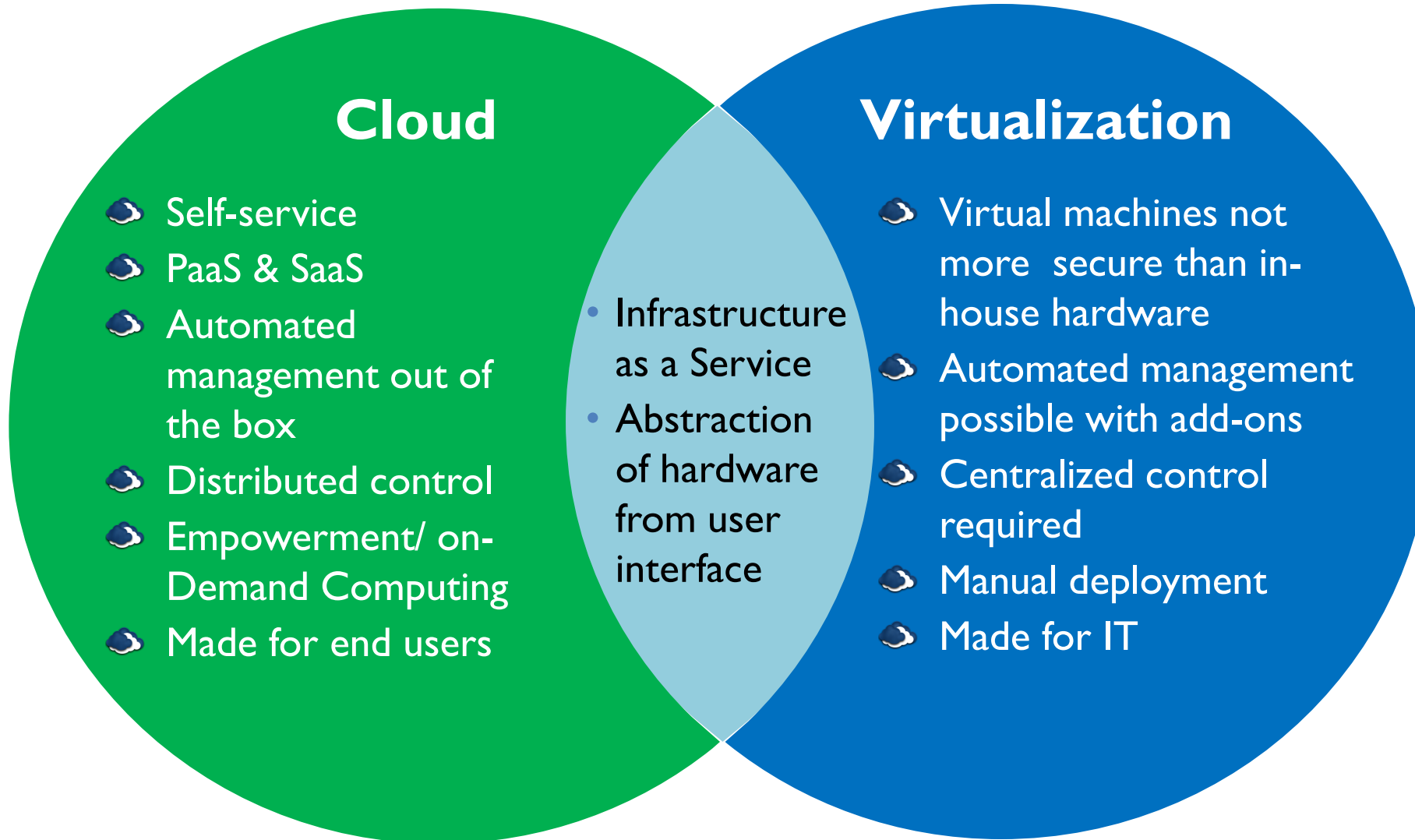
Pros:

-  *Reduces cost*
-  *Pure maintenance cost*
-  *Increases in computing power*
-  *Universal Access*
-  *Up to date software*
-  *Disaster recovery*

Cons :

-  *Security, Privacy*
-  *Vendor lock in*
-  *Limited control*
-  *Technical issue*
-  *Server breakdown*

Cloud Computing Vs. Virtualization

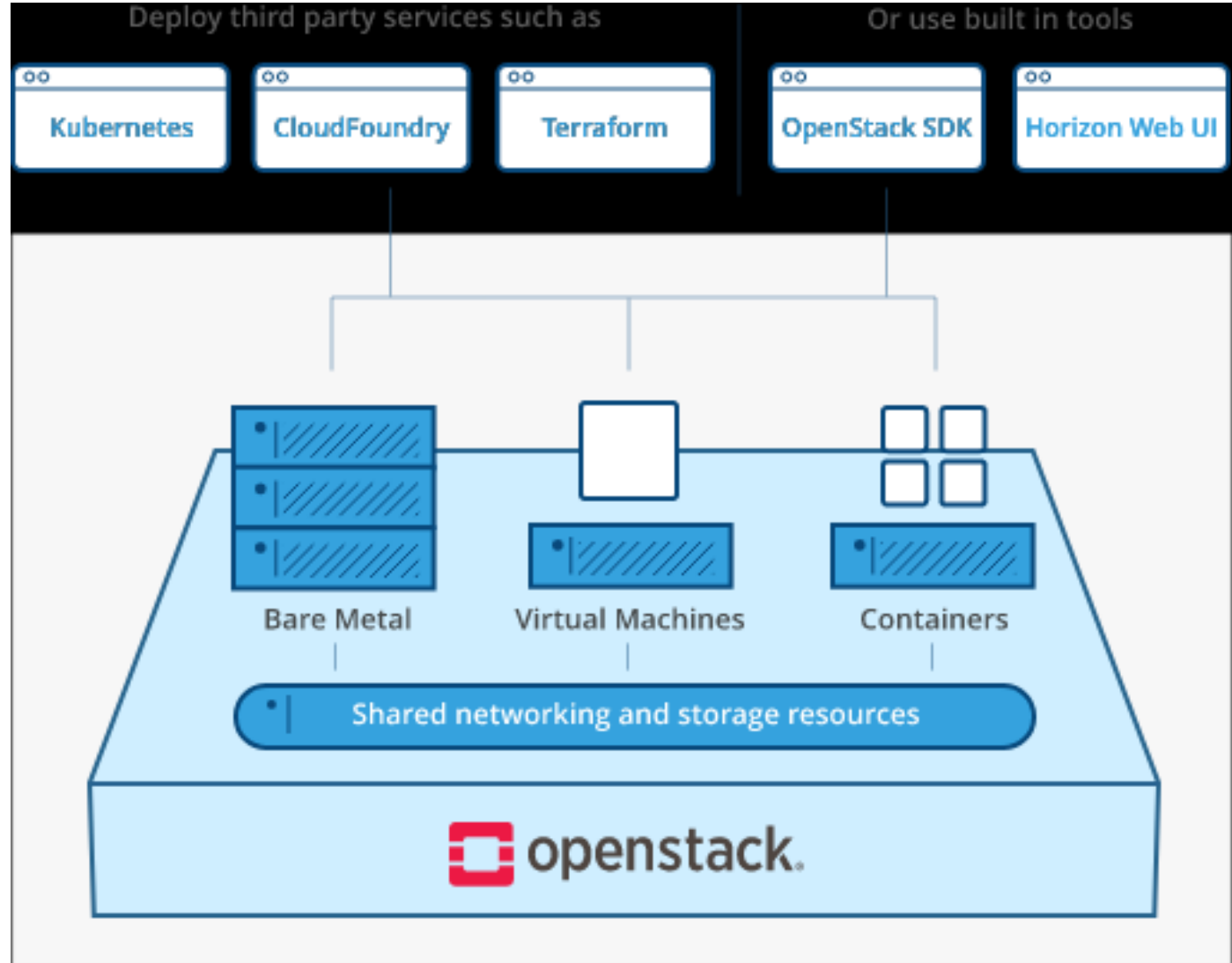


Cloud Computing Vs. Grid Computing

	Cloud Computing	Grid Computing
What?	Cloud enable access to leased computing power and storage from client's devices	Grid enable access to shared computing power and storage capacity from terminal.
Who Provide the service?	Large individual companies	Research institutes and universities federate their services around the world
Who use the service?	Normal user to commercial business	Research collaboration
Where are the computing resources ?	In the provider's private data centers, which is often centralized	In computing centers distributed across different sites, countries and continents.
Why are the useful for?	Clouds best support long-term support and on demand self service.	Grids were designed to handle large set of limited duration jobs that produce or use huge amount of data.

What is OpenStack ?

- ☁️ OpenStack is a Cloud management software
- ☁️ It's Open Source
- ☁️ A rich of feature of Cloud Services
- ☁️ Renowned vendor work on it (NASA, Rackspace, Wal-Mart, HP, Red Hat etc.)
- ☁️ A large number of community
- ☁️ Strong Documentation
- ☁️ Huge opportunity for developer
- ☁️ Fully configurable by developer
- ☁️ Support RESTFul API



OpenStack Service Catalog

IaaS Services

Service	Project name	Description
Dashboard	Horizon	Provides a web-based self-service portal to interact with underlying OpenStack services, such as launching an instance, assigning IP addresses and configuring access controls.
Compute	Nova	Manages the lifecycle of compute instances in an OpenStack environment. Responsibilities include spawning, scheduling and decommissioning of virtual machines on demand.
Networking	Neutron	Enables Network-Connectivity-as-a-Service for other OpenStack services, such as OpenStack Compute. Provides an API for users to define networks and the attachments into them. Has a pluggable architecture that supports many popular networking vendors and technologies.

OpenStack Service Catalog Cont.

Storage

Service	Project name	Description
Object Storage	Swift	Stores and retrieves arbitrary unstructured data objects via a RESTful, HTTP based API. It is highly fault tolerant with its data replication and scale out architecture. Its implementation is not like a file server with mountable directories.
Block Storage	Cinder	Provides persistent block storage to running instances. Its pluggable driver architecture facilitates the creation and management of block storage devices.

Shared services

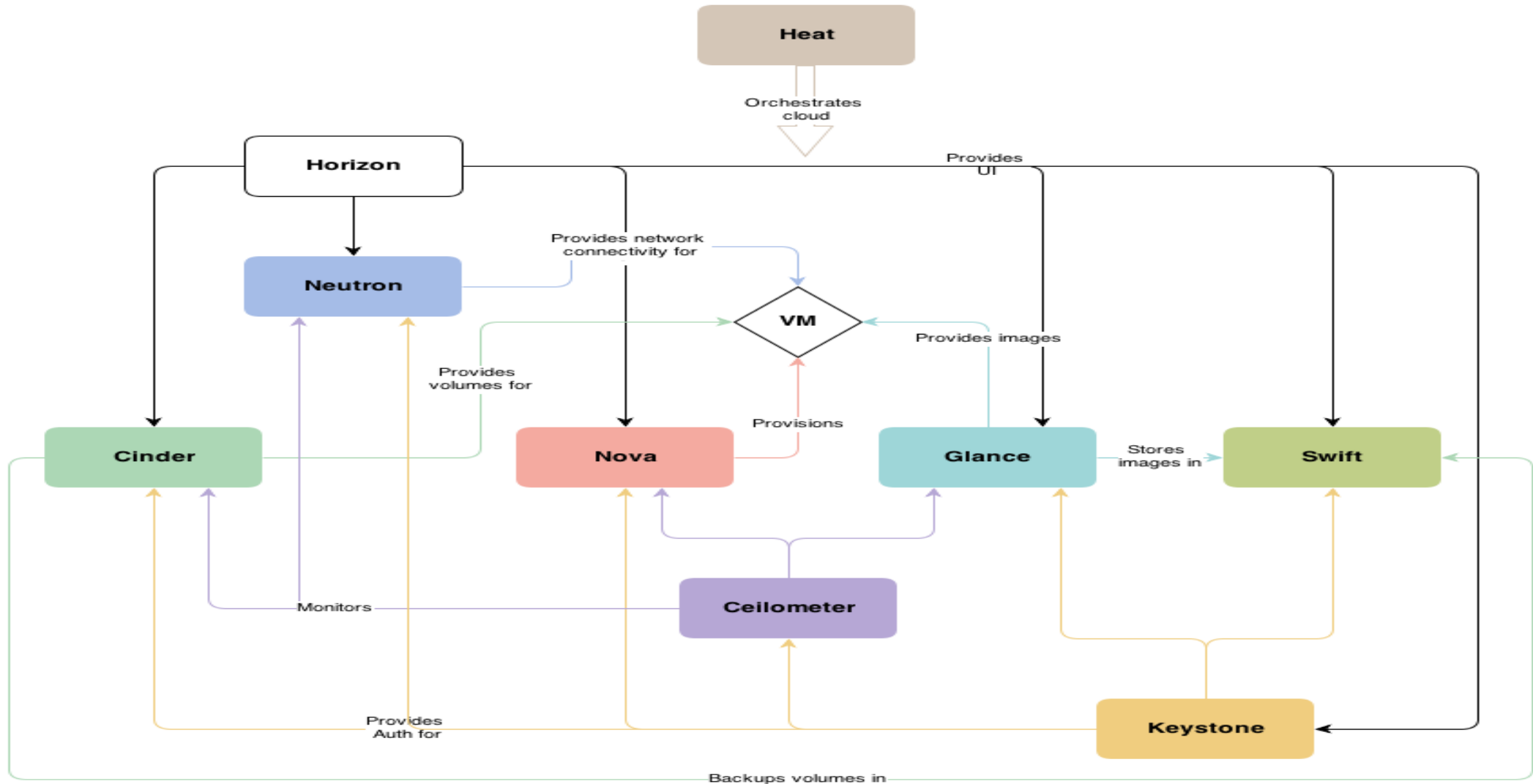
Identity service	Keystone	Provides an authentication and authorization service for other OpenStack services. Provides a catalog of endpoints for all OpenStack services.
Image Service	Glance	Stores and retrieves virtual machine disk images. OpenStack Compute makes use of this during instance provisioning.
Telemetry	Ceilometer	Monitors and meters the OpenStack cloud for billing, benchmarking, scalability, and statistical purposes.

OpenStack Service Catalog Cont.

Higher-level services

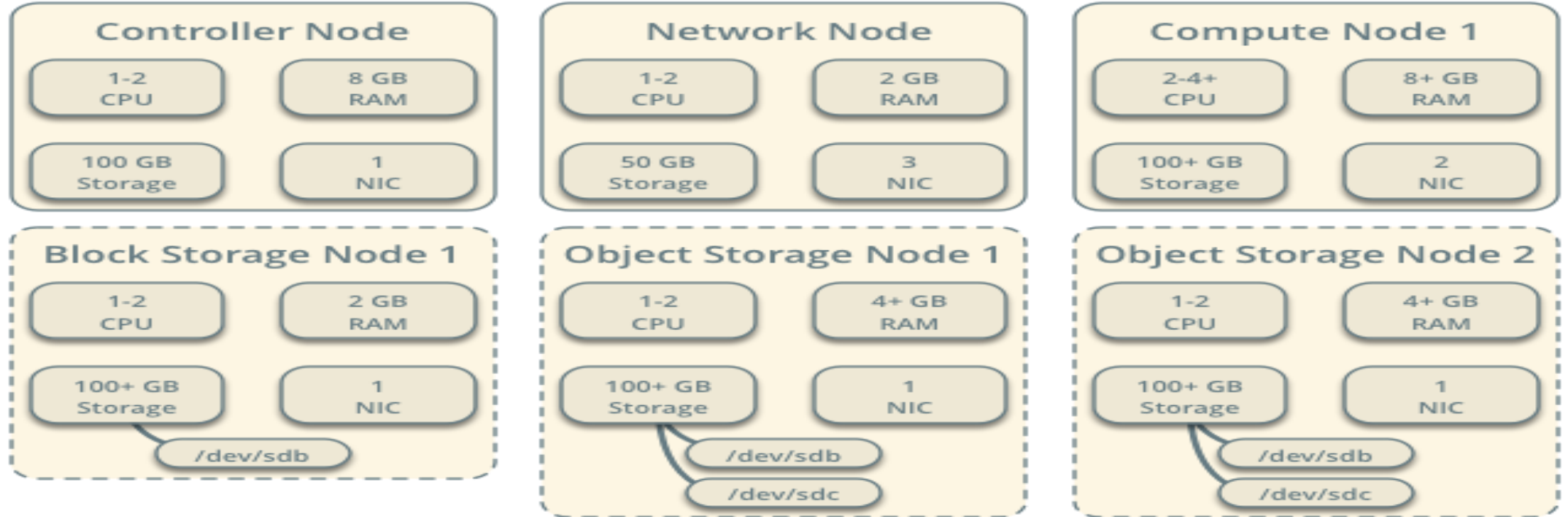
Service	Project name	Description
Orchestration	Heat	Orchestrates multiple composite cloud applications by using either the native HOT template format or the AWS Cloud Formation template format, through both an OpenStack-native REST API and a Cloud Formation-compatible Query API.
Database Service	Trove	Provides scalable and reliable Cloud Database-as-a-Service functionality for both relational and non-relational database engines.

OpenStack Architecture



OpenStack Architecture Cont.

Minimal Architecture Example - Hardware Requirements OpenStack Networking (neutron)

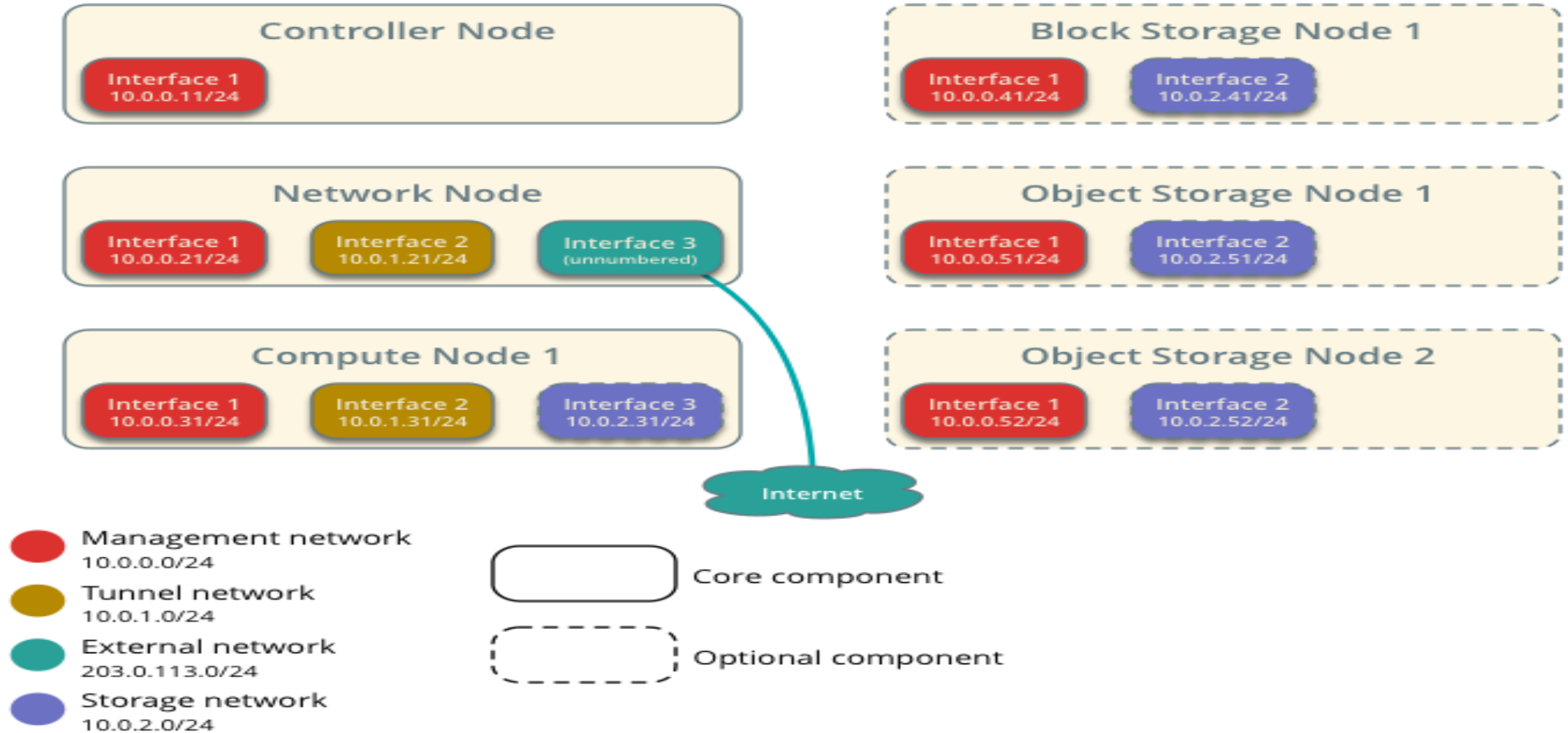


 Core component

 Optional component

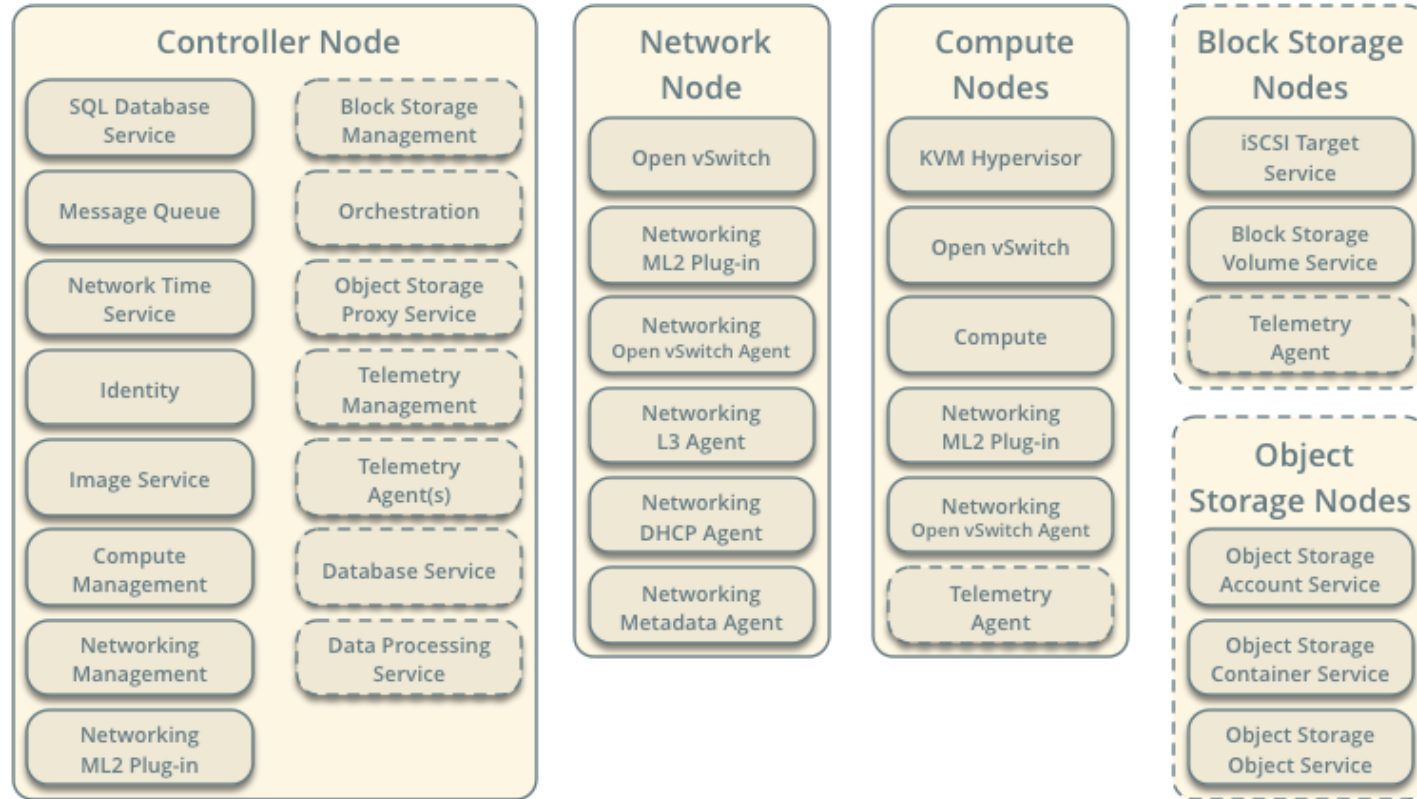
OpenStack Architecture Cont.

Minimal Architecture Example - Network Layout OpenStack Networking (neutron)



OpenStack Architecture Cont. (Service Layout)

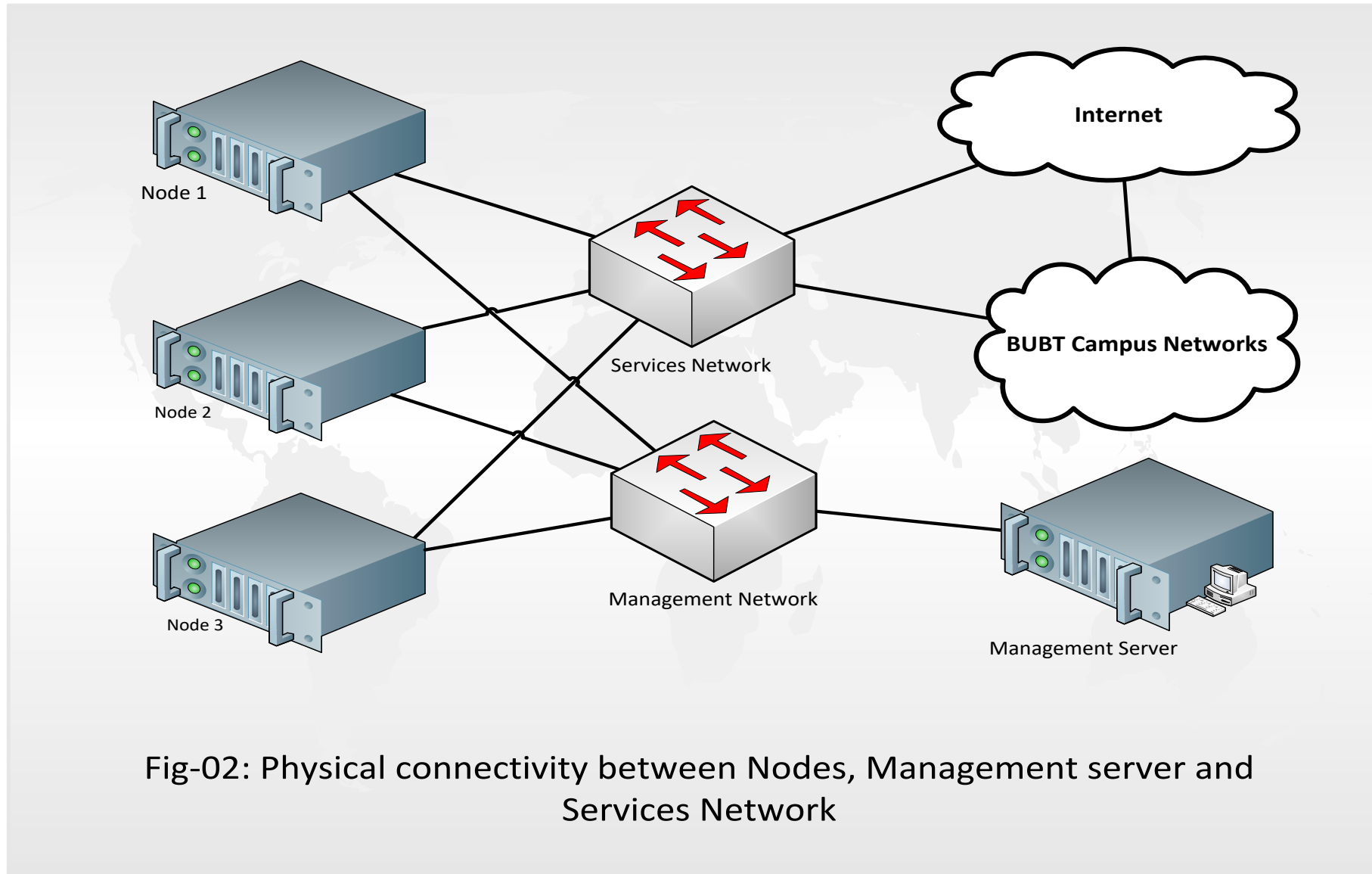
Minimal Architecture Example - Service Layout OpenStack Networking (neutron)



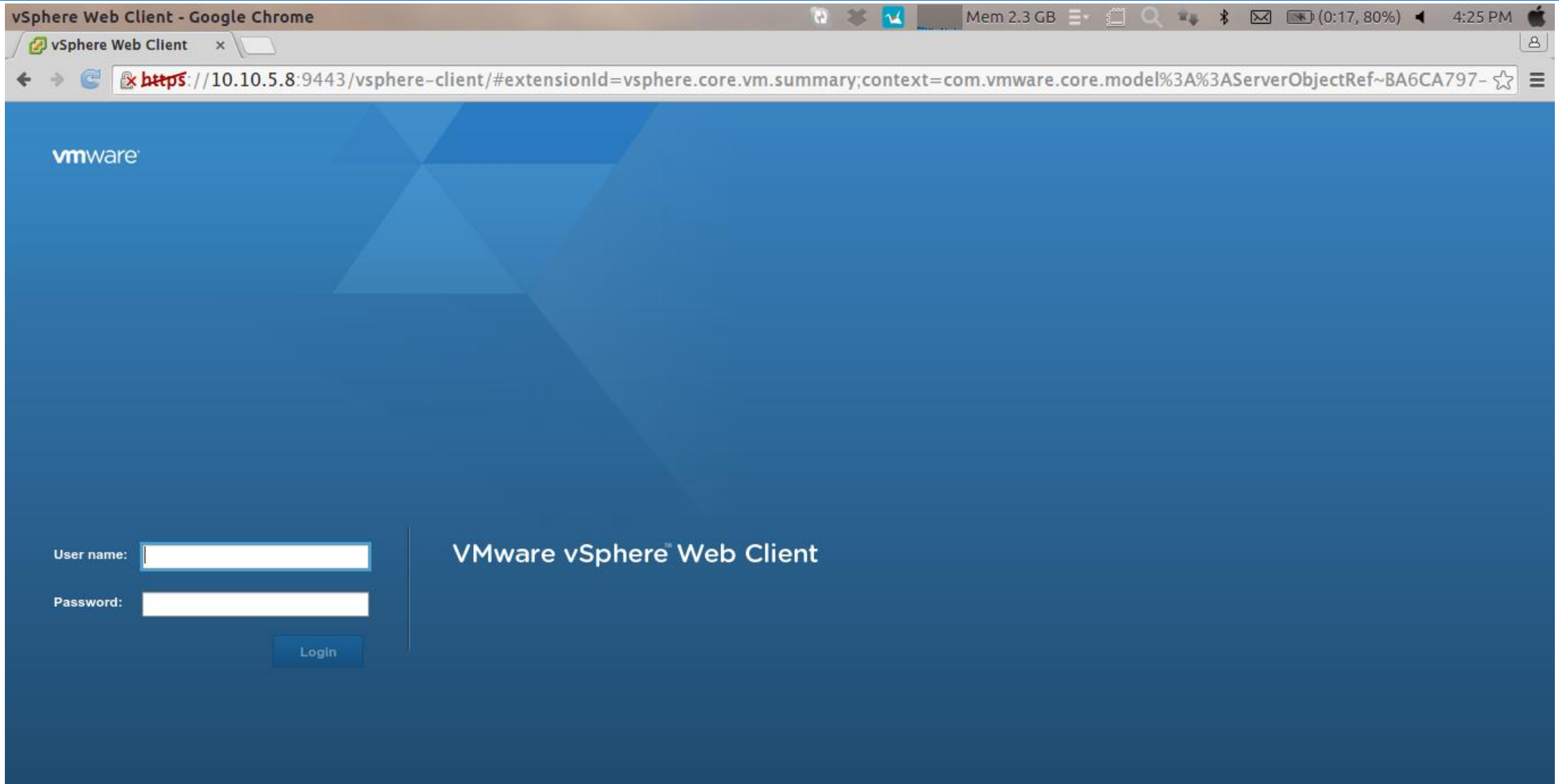
 Core component

 Optional component

Conceptual Diagram of a private cloud



Demonstrations of a Private Cloud



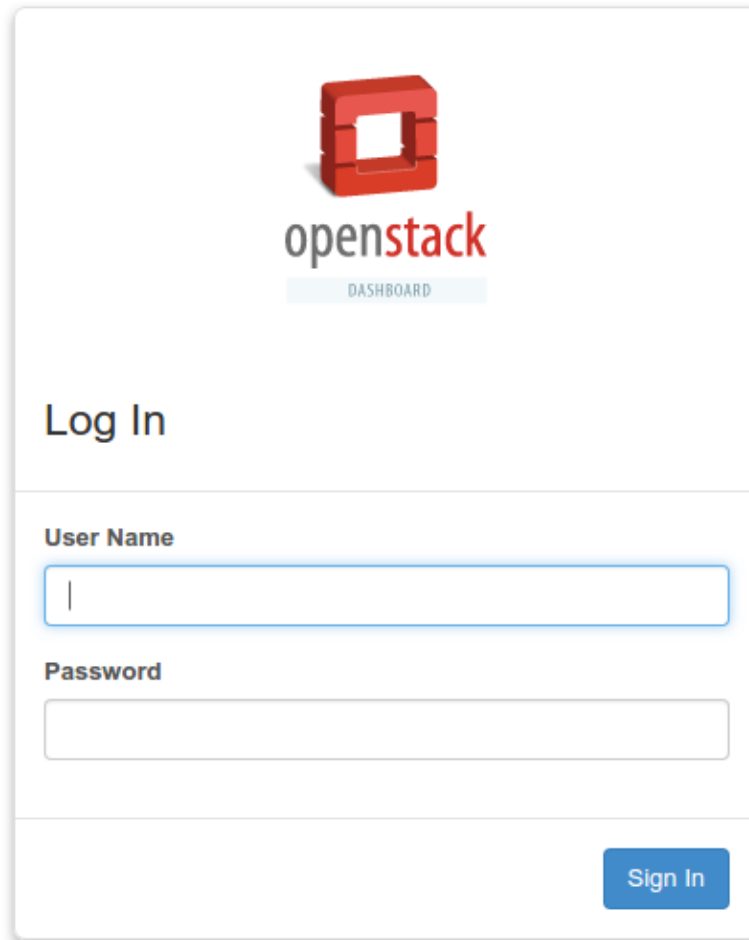
Demonstrations of a Private Cloud

The screenshot displays the vSphere Web Client interface in a Google Chrome browser. The address bar shows the URL: `https://10.10.5.8:9443/vsphere-client/#extensionId=vsphere.core.folder.related;cor`. The page title is "vmware vSphere Web Client".

The interface is divided into several sections:

- Left Navigation Pane:** Shows a tree view under "VCENTERSERVER". The "BUBT_CLOUD" folder is expanded, revealing sub-objects: "OpenStack" (with a warning icon), "10.10.5.2", "10.10.5.3", "10.10.5.4", "10.10.5.5", "block", "Compute", "compute-ubuntu64", "controller-ubuntu64-14.0", "network-ubuntu64-14.04", "object1", "object2", and "Windows_Server2008R2". A "PublicCloud" folder is also visible at the bottom of the tree.
- Top Navigation:** Includes "VCENTERSERVER" and "Actions" menus. Below them are tabs for "Getting Started", "Summary", "Monitor", "Manage", and "Related Objects".
- Sub-Navigation:** A secondary set of tabs includes "Top Level Objects", "Datacenters", "Clusters", "Hosts", "Virtual Machines", "VM Templates", and "vApps".
- Content Area:** Displays a list of objects under the "Name" header. The "BUBT_CLOUD" object is selected and highlighted in blue, with "PublicCloud" listed below it.

Demonstrations of a Private Cloud



The image shows a screenshot of the OpenStack Dashboard login interface. At the top center is the OpenStack logo, which consists of a red 3D cube with a square hole in the center, and the text "openstack" below it. Underneath the logo is a light blue button labeled "DASHBOARD". Below this is the heading "Log In". The form contains two input fields: "User Name" and "Password". The "User Name" field has a vertical cursor at the beginning. At the bottom right of the form is a blue button labeled "Sign In".

openstack
DASHBOARD

Log In

User Name

Password

Sign In

Demonstrations of a Private Cloud

The screenshot shows the OpenStack dashboard interface. At the top left is the OpenStack logo. The top right shows the user 'admin' in 'regionOne' with a 'Sign Out' button. A left-hand navigation menu includes 'Project', 'Admin', 'System', 'Overview', 'Hypervisors', 'Host Aggregates', 'Instances', 'Volumes', 'Flavors', 'Images', 'Networks', 'Routers', 'Defaults', and 'System Information'. The main content area is titled 'Overview' and contains a 'Usage Summary' section. This section prompts the user to 'Select a period of time to query its usage:' with input fields for 'From: 2015-07-01' and 'To: 2015-07-24', and a 'Submit' button. Below the date selection, it displays usage statistics: 'Active Instances: 2 Active RAM: 1GB This Period's VCPU-Hours: 1087.64 This Period's GB-Hours: 11607.96'. A 'Download CSV Summary' button is located to the right. Below the statistics is a table with the following data:

Project Name	VCPU	Disk	RAM	VCPU Hours	Disk GB Hours
demo	2	21GB	1GB	1087.64	11607.96

Below the table, it indicates 'Displaying 1 item'.

Demonstrations of a Private Cloud

The screenshot shows the OpenStack Horizon Admin Dashboard in Mozilla Firefox. The browser address bar shows the URL `controller/horizon/admin/info/`. The dashboard header includes the OpenStack logo, the user `admin` in `regionOne`, and a `Sign Out` button. The left sidebar contains a navigation menu with categories: **Project**, **Admin**, and **System**. Under **System**, the following items are listed: Overview, Hypervisors, Host Aggregates, Instances, Volumes, Flavors, Images, Networks, Routers, and Defaults. The main content area is titled **System Info** and has tabs for **Services**, **Compute Services** (selected), **Block Storage Services**, and **Network Agents**. The **Compute Services** section features a table with a search filter and a list of services. The table has columns for Name, Host, Zone, Status, State, and Last Updated. Five services are listed, all with a status of 'Enabled' and a state of 'Up'. The last updated time for all is '0 minutes'. A footer note indicates 'Displaying 5 items'. The version number 'Version: 2014.2.3' is shown in the bottom right corner of the dashboard area.

Name	Host	Zone	Status	State	Last Updated
nova-cert	controller	internal	Enabled	Up	0 minutes
nova-consoleauth	controller	internal	Enabled	Up	0 minutes
nova-scheduler	controller	internal	Enabled	Up	0 minutes
nova-conductor	controller	internal	Enabled	Up	0 minutes
nova-compute	compute	nova	Enabled	Up	0 minutes

Version: 2014.2.3

Demonstrations of a Private Cloud

The screenshot shows the OpenStack Horizon admin interface. The browser address bar displays `controller/horizon/admin/info/`. The page title is "System Info - OpenStack Dashboard - Mozilla Firefox". The user is logged in as "admin" in "regionOne". The left sidebar shows a navigation menu with "System" selected. The main content area is titled "System Info" and has tabs for "Services", "Compute Services", "Block Storage Services", and "Network Agents". The "Block Storage Services" tab is active, showing a table with the following data:

Name	Host	Zone	Status	State	Last Updated
cinder-scheduler	controller	nova	Enabled	Up	0 minutes
cinder-volume	block	nova	Enabled	Up	0 minutes

Below the table, it says "Displaying 2 items". There are two "Filter" buttons on the right side of the table. The version number "Version: 2014.2.3" is visible in the bottom right corner of the dashboard content.

Demonstrations of a Private Cloud

System Info - OpenStack Dashboard - Mozilla Firefox

System Info - OpenS... x

controller/horizon/admin/info/

openstack admin . regionOne Sign Out

Project Admin System

Overview Hypervisors Host Aggregates Instances Volumes Flavors Images Networks Routers Defaults

System Info

Services Compute Services Block Storage Services Network Agents

Network Agents

Filter Filter

Type	Name	Host	Status	State	Last Updated
L3 agent	neutron-l3-agent	network	Enabled	Up	0 minutes
Open vSwitch agent	neutron-openvswitch-agent	compute	Enabled	Up	0 minutes
Metadata agent	neutron-metadata-agent	network	Enabled	Up	0 minutes
Open vSwitch agent	neutron-openvswitch-agent	network	Enabled	Up	0 minutes
DHCP agent	neutron-dhcp-agent	network	Enabled	Up	0 minutes

Displaying 5 items

Version: 2014.2.3

controller/horizon/admin/info/?tab=system_info_network_agents

Demonstrations of a Private Cloud

openstack demo . regionOne Sign Out

Project Compute Overview Instances Volumes Images Access & Security Network Identity

Overview

Limit Summary

Resource	Used	Limit
Instances	2 of 10	10
VCPUs	2 of 20	20
RAM	1.5GB of 50GB	50GB
Floating IPs	5 of 50	50
Security Groups	1 of 10	10
Volumes	1 of 10	10
Volume Storage	1GB of 1000GB	1000GB

Usage Summary

Select a period of time to query its usage:

From: To: The date should be in YYYY-mm-dd format.

Active Instances: 2 Active RAM: 1GB This Period's VCPU-Hours: 1087.87 This Period's GB-Hours: 11610.37

Demonstrations of a Private Cloud

The screenshot shows the OpenStack dashboard interface. The top header includes the OpenStack logo, the user 'demo', and a 'Sign Out' button. The left sidebar contains navigation options: Project, Compute, Overview, Instances (highlighted), Volumes, Images, Access & Security, Network, and Identity. The main content area is titled 'Instances' and features a search bar with 'Instance Name' and 'Filter' options. Below the search bar are three buttons: 'Launch Instance', 'Soft Reboot Instances', and 'Terminate Instances'. The main table displays two instances:

<input type="checkbox"/>	Instance Name	Image Name	IP Address	Size	Key Pair	Status	Availability Zone	Task	Power State	Time since created	Actions
<input type="checkbox"/>	Ubuntu-Server_14.04-x86_64	Ubuntu-Server_14.04-x86_64	192.168.100.26 192.168.10.206	small	cloudkey	Shutoff	nova	None	Shut Down	2 weeks, 6 days	Start Instance
<input type="checkbox"/>	cirros-0.3.4-x86_64	cirros-0.3.4-x86_64	192.168.100.25 192.168.10.209	m1.tiny	cloudkey	Active	nova	None	Running	2 weeks, 6 days	Create Snapshot

Displaying 2 items

Demonstrations of a Private Cloud

The screenshot displays the OpenStack dashboard interface. At the top left is the OpenStack logo. The top right shows the user 'demo' and a 'Sign Out' button. The left sidebar contains a navigation menu with 'Project' selected, and sub-items for 'Compute', 'Overview', 'Instances', 'Volumes' (highlighted), 'Images', 'Access & Security', 'Network', and 'Identity'. The main content area is titled 'Volumes' and has two tabs: 'Volumes' (active) and 'Volume Snapshots'. Below the tabs are search and filter controls, a '+ Create Volume' button, and a 'Delete Volumes' button. A table lists the volumes:

<input type="checkbox"/>	Name	Description	Size	Status	Type	Attached To	Availability Zone	Bootable	Encrypted	Actions
<input type="checkbox"/>	demo-volume1		1GB	Available	-		nova	No	No	Edit Volume

Below the table, it indicates 'Displaying 1 item'.

Demonstrations of a Private Cloud

Network Topology - OpenStack Dashboard - Mozilla Firefox (Private Browsing)

Network Topology - ... x cirros-0.3.4-x86_64(... x)

controller/horizon/project/network_topology/

Project

- Compute
- Network
- Network Topology
- Networks
- Routers

Identity

Network Topology

Small Normal

Launch Instance Create Network Create Router

The diagram illustrates a network topology. On the left, a vertical blue bar represents the external network 'ext-net' with the IP address '192.168.10.0/24'. A horizontal line connects this network to a 'Router' box labeled 'demo-rout..' with IP '192.168.100.1'. From the router, a vertical orange bar represents the private network 'demo-net' with the IP address '192.168.100.0/24'. Two instances are connected to the private network: 'Ubuntu-Se.. Instance' with IP '192.168.100.26' and 'cirros-0... Instance' with IP '192.168.100.25'.

Demonstrations of a Private Cloud

The screenshot shows the OpenStack dashboard interface. The top header includes the OpenStack logo, the user 'demo', and a 'Sign Out' button. The left sidebar contains navigation options: Project, Compute, Overview, Instances, Volumes, Images (highlighted), Access & Security, Network, and Identity. The main content area is titled 'Images' and features a table of five images. Above the table are filters for 'Project (0)', 'Shared with Me (0)', and 'Public (5)', along with buttons for '+ Create Image' and 'Delete Images'. The table columns are Image Name, Type, Status, Public, Protected, Format, Size, and Actions. Each image has a 'Launch' button in the Actions column.

<input type="checkbox"/>	Image Name	Type	Status	Public	Protected	Format	Size	Actions
<input type="checkbox"/>	Ubuntu-Server_14.04-x86_64	Image	Active	Yes	No	QCOW2	246.5 MB	Launch ▾
<input type="checkbox"/>	Ubuntu-14.04-x86_64	Image	Active	Yes	No	QCOW2	244.8 MB	Launch ▾
<input type="checkbox"/>	Fedora-22-x86_64	Image	Active	Yes	No	QCOW2	218.0 MB	Launch ▾
<input type="checkbox"/>	cirros-0.3.4-i386	Image	Active	Yes	No	QCOW2	11.9 MB	Launch ▾
<input type="checkbox"/>	cirros-0.3.4.-x86_64	Image	Active	Yes	No	QCOW2	12.7 MB	Launch ▾

Displaying 5 items

Demonstrations of a Private Cloud

The screenshot shows the OpenStack dashboard interface. At the top left is the OpenStack logo. The top right shows the user 'demo' in the 'regionOne' region, with a 'Sign Out' button. A left-hand navigation menu includes 'Project', 'Compute', 'Overview', 'Instances', 'Volumes', 'Images', 'Access & Security', 'Network', and 'Identity'. The main content area is titled 'Instance Details: cirros-0.3.4.-x86_64'. Below the title are tabs for 'Overview', 'Log', 'Console', and 'Action Log'. The 'Log' tab is active, displaying the 'Instance Console Log'. The log content includes system information, disk details, and network configuration. The log length is 35, and there are 'Go' and 'View Full Log' buttons.

failed to get instance-id of datasource
Starting dropbear sshd: OK
=== system information ===
Platform: OpenStack Foundation OpenStack Nova
Container: none
Arch: x86_64
CPU(s): 1 @ 3192.606 MHz
Cores/Sockets/Threads: 1/1/1
Virt-type: VT-x
RAM Size: 491MB
Disks:
NAME MAJ:MIN SIZE LABEL MOUNTPOINT
vda 253:0 1073741824
vdal 253:1 1061061120 cirros-rootfs /
=== sshd host keys ===
-----BEGIN SSH HOST KEY KEYS-----
ssh-rsa AAAAB3NzaC1yc2EAAAADAQABAAQgCD0q+qu7pX53nudZDsXJ4qhprEozEMlnKaWZBJxShJUZn84AB2DPeJ4/1HELuUSTJEgOY+FhbY1JoG+walqXNUYZkBPgDHaOih8iPJr5zpj
ssh-dss AAAAB3NzaC1kc3MAAACBAO4RQiJpMZOOA+Avu3iKrsxghrcHboXDsJICR2KOxcw6I10mi7AHYSocGPKdA218vYOSfPoZGF5o+kvWV17NJoVuIscfQglmlwsX1eRTuaJzzja4gWDr
-----END SSH HOST KEY KEYS-----
=== network info ===
if-info: lo,up,127.0.0.1,8,::1
if-info: eth0,up,192.168.100.25,24,fe80::f816:3eff:fee3:c4aa
ip-route:default via 192.168.100.1 dev eth0
ip-route:192.168.100.0/24 dev eth0 src 192.168.100.25
=== datasource: None None ===
=== cirros: current=0.3.4 uptime=45.27 ===

Demonstrations of a Private Cloud

Connected (unencrypted) to: QEMU (instance-0000001c)

Send CtrlAltDel

```
login as 'cirros' user. default password: 'cubswin:'). use 'sudo' for root.
cirros login:
login as 'cirros' user. default password: 'cubswin:'). use 'sudo' for root.
cirros login: cirros
Password:
$ ifconfig
eth0      Link encap:Ethernet  HWaddr FA:16:3E:E3:C4:AA
          inet addr:192.168.100.25  Bcast:192.168.100.255  Mask:255.255.255.0
          inet6 addr: fe80::f816:3eff:fee3:c4aa/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1454  Metric:1
          RX packets:367 errors:0 dropped:0 overruns:0 frame:0
          TX packets:296 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:43765 (42.7 KiB)  TX bytes:32136 (31.3 KiB)

lo        Link encap:Local Loopback
          inet addr:127.0.0.1  Mask:255.0.0.0
          inet6 addr: ::1/128 Scope:Host
          UP LOOPBACK RUNNING  MTU:16436  Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:0
          RX bytes:0 (0.0 B)  TX bytes:0 (0.0 B)

$
```

Demonstrations of a Private Cloud

```
mahedi@Mahedi-Ubuntu: ~  
mahedi@Mahedi-Ubuntu:~$ ping 192.168.10.209  
PING 192.168.10.209 (192.168.10.209) 56(84) bytes of data.  
64 bytes from 192.168.10.209: icmp_seq=1 ttl=63 time=4.99 ms  
64 bytes from 192.168.10.209: icmp_seq=2 ttl=63 time=2.06 ms  
64 bytes from 192.168.10.209: icmp_seq=3 ttl=63 time=1.79 ms  
64 bytes from 192.168.10.209: icmp_seq=4 ttl=63 time=1.97 ms  
64 bytes from 192.168.10.209: icmp_seq=5 ttl=63 time=1.98 ms  
64 bytes from 192.168.10.209: icmp_seq=6 ttl=63 time=2.12 ms  
64 bytes from 192.168.10.209: icmp_seq=7 ttl=63 time=2.06 ms  
^C  
--- 192.168.10.209 ping statistics ---  
7 packets transmitted, 7 received, 0% packet loss, time 6007ms  
rtt min/avg/max/mdev = 1.793/2.428/4.991/1.050 ms  
mahedi@Mahedi-Ubuntu:~$ ssh cirros@192.168.10.209  
The authenticity of host '192.168.10.209 (192.168.10.209)' can't be established.  
RSA key fingerprint is 92:42:2b:12:18:24:35:05:34:c4:e4:7f:14:a8:b0:b4.  
Are you sure you want to continue connecting (yes/no)? yes  
Warning: Permanently added '192.168.10.209' (RSA) to the list of known hosts.  
cirros@192.168.10.209's password:  
$ █
```

Challenges

- ☁ Clear concept is required to implement cloud system (e.g.: Services, Multi tenant model and network tropology of cloud system etc.)
- ☁ Huge configuration is needed for implementation each services manually.
- ☁ Need to understand communication between different services.
- ☁ Need to handle multiple databases and remember a number password set.
- ☁ Good knowledge works in Linux/Unix system.

Live Demonstrations

[Lab: https://github.com/mahedicse/microstack](https://github.com/mahedicse/microstack)

<http://openstack-lab-xy.bdren.net.bd/>



