BITS Pilani presentation

BITS Pilani
Hyderabad Campus

D. Powar
Lecturer,
BITS-Pilani, Hyderabad Campus

innovate achieve lead

BITS Pilani
Hyderabad Campus

SSZG527

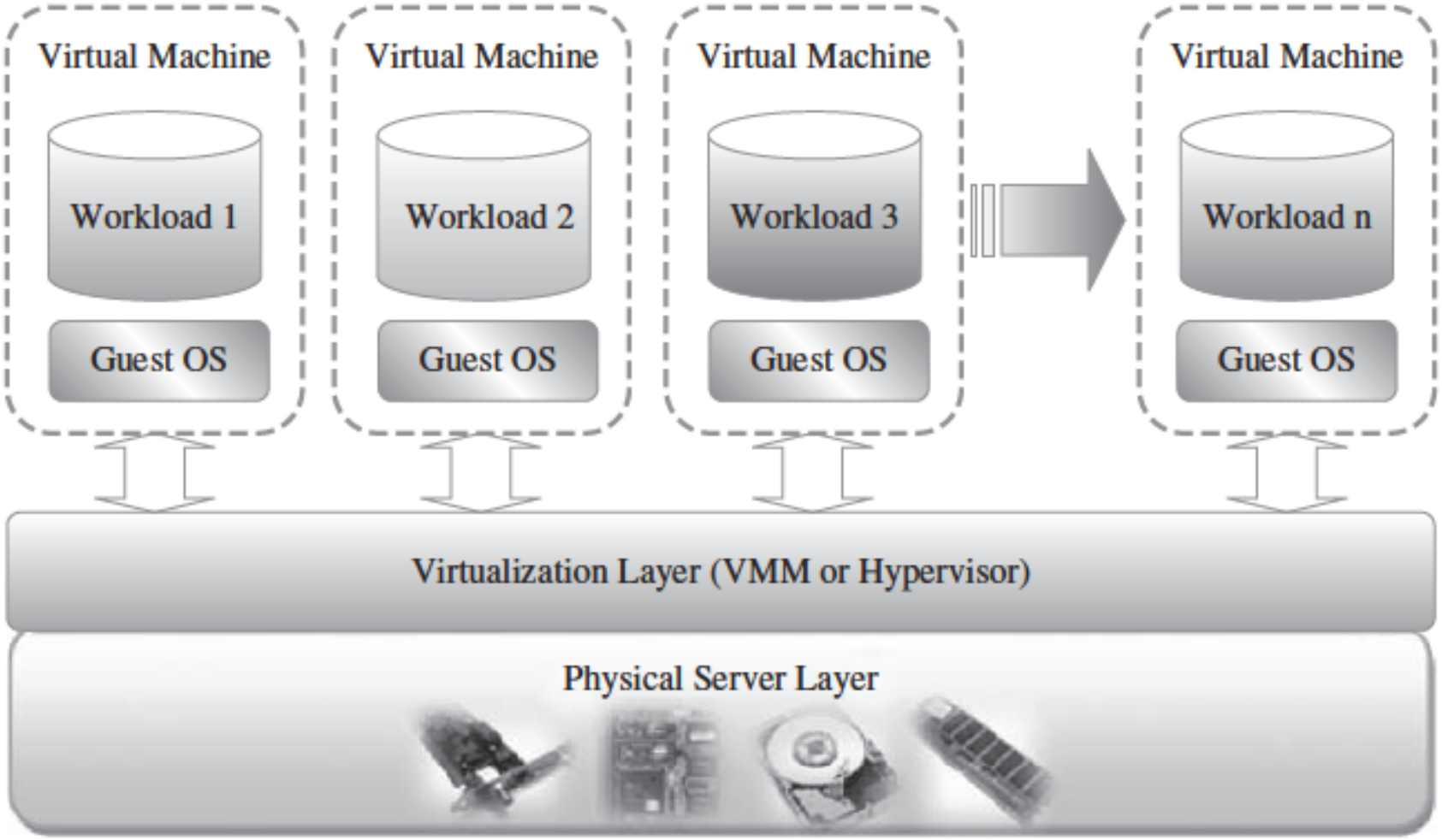
Lecture 8

Cloud Computing

Agenda:

- Preview of last lecture
- Private Cloud Computing deployment
  - ✓ Eucalyptus
  - ✓ OpenStack

Layered Virtualization technology architecture



Migration techniques

	Live migration	Cold migration	Live Storage Migration
1	Needs a shared storage for virtual machines in the server's pool	It does not	It does not
2	Between two hosts, there would be certain CPU compatibility checks to be applied	Compatibility check not required	Compatibility check required

PROVISIONING IN THE CLOUD CONTEXT

- In the cloud context, we shall discuss systems that provide the virtual machine provisioning and migration services
- Amazon EC2 is a widely known example for vendors that provide public cloud services.
- Also Eucalyptus, OpenStack, Open-Nebula, etc. are complementary and enabling technologies for open source cloud tools, which play an invaluable role in infrastructure as a service and in building private and hybrid cloud platforms

Eucalyptus

- Born in Computer Science department of University of California Santa Barbara 2008
- Developed by Professor Rich Wolski and his research group
- **E**lastic **U**tility **C**omputing **A**rchitecture for **L**inking **Y**our **P**rograms **T**o **U**seful **S**ystems
- Current version 4.1.0 (January 29, 2015)
- It is an open-source infrastructure for the implementation of cloud computing on computer clusters.
- It is considered one of the earliest tools developed as a surge computing
- Eucalyptus is a system for implementing on-premise private and hybrid clouds using the hardware and software infrastructure
- The current interface to Eucalyptus is compatible with Amazon's EC2, S3, and EBS interfaces, but the infrastructure is designed to support multiple client-side interfaces

Some of the Eucalyptus features

- ✓ Simple installation and deployment.
- ✓ Support for most Linux distributions (Ubuntu, RHEL, OpenSuse, Debian, Fedora, and CentOS)
- ✓ Support for running VMs that run on top of the Xen, Vmware or KVM hypervisors
- ✓ Secure internal communication using SOAP with WS security
- ✓ Cloud administrator's tool for system's management and user's accounting
- ✓ The ability to configure multiple clusters each with private internal network addresses into a single cloud

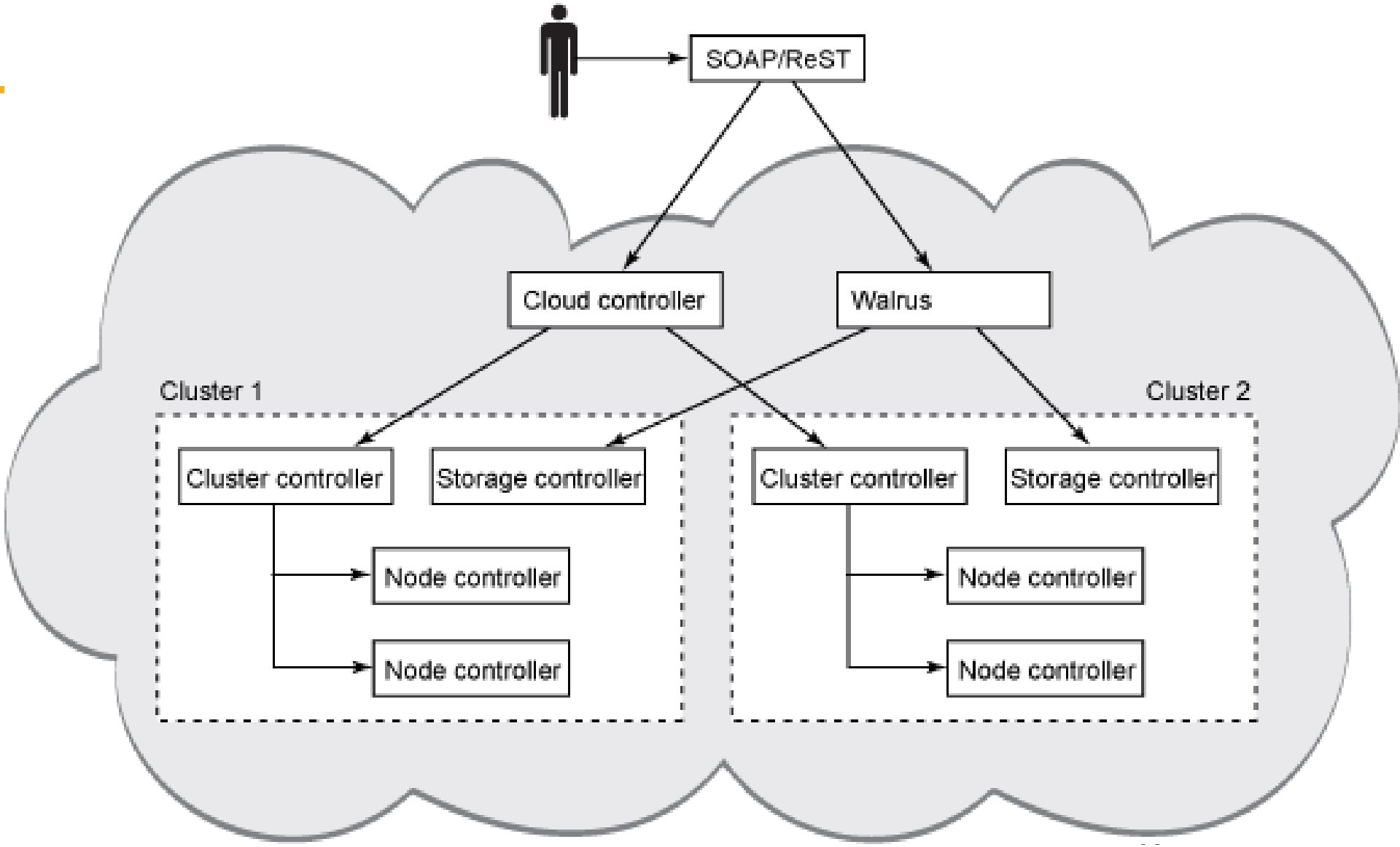
Some of the Eucalyptus features(contd..)

- Open Source
- Modular
- Distributed
- Design to perform
- Flexible
- Compatible
- Hypervisor Agnostic
- Hybrid Cloud

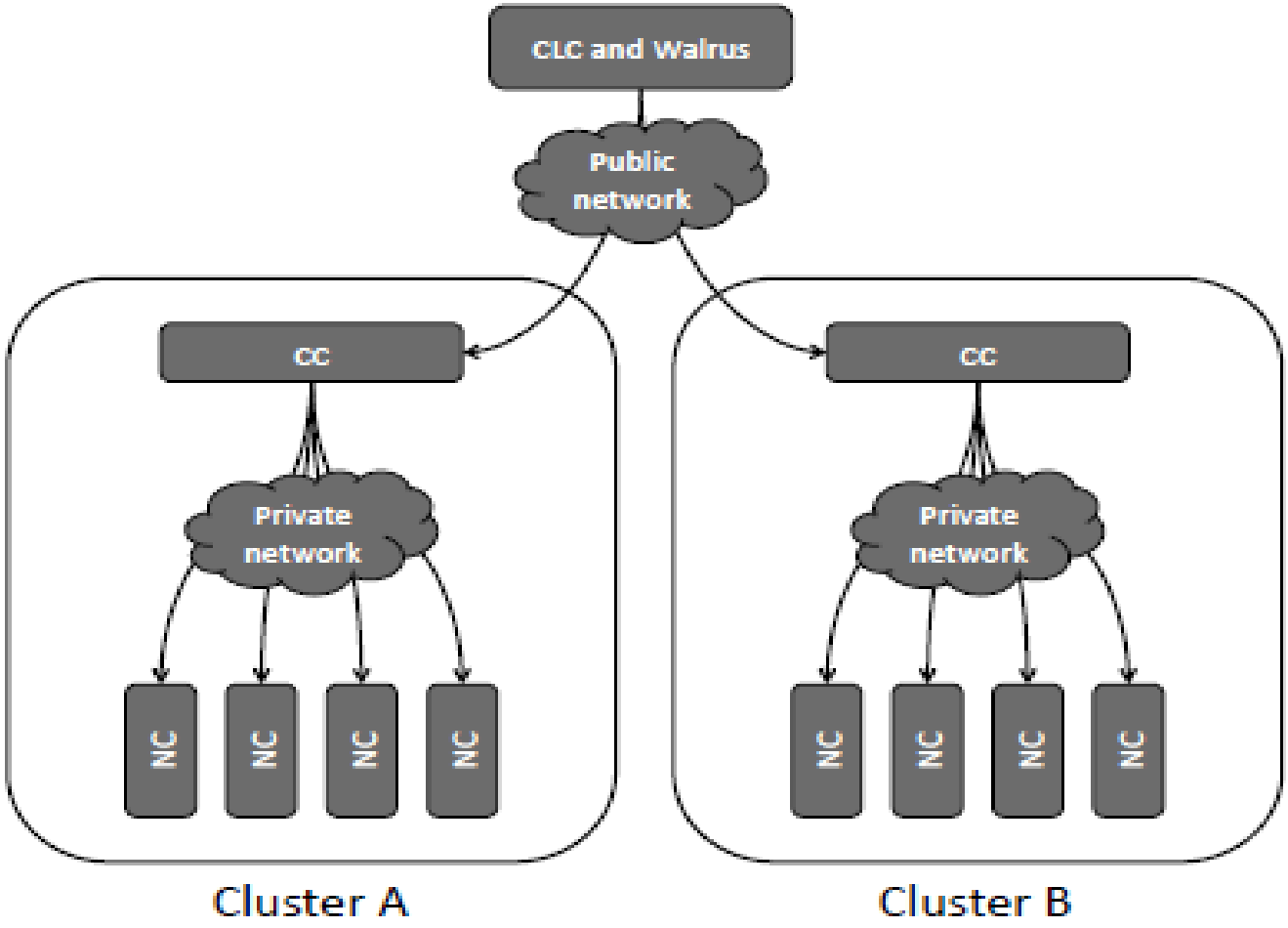
Eucalyptus components

- Eucalyptus is comprised of six components:
  - Cloud Controller (CLC)
  - Walrus (W)
  - Cluster Controller (CC)
  - Storage Controller (SC)
  - Node Controller (NC) and
  - VMware Broker (optional)

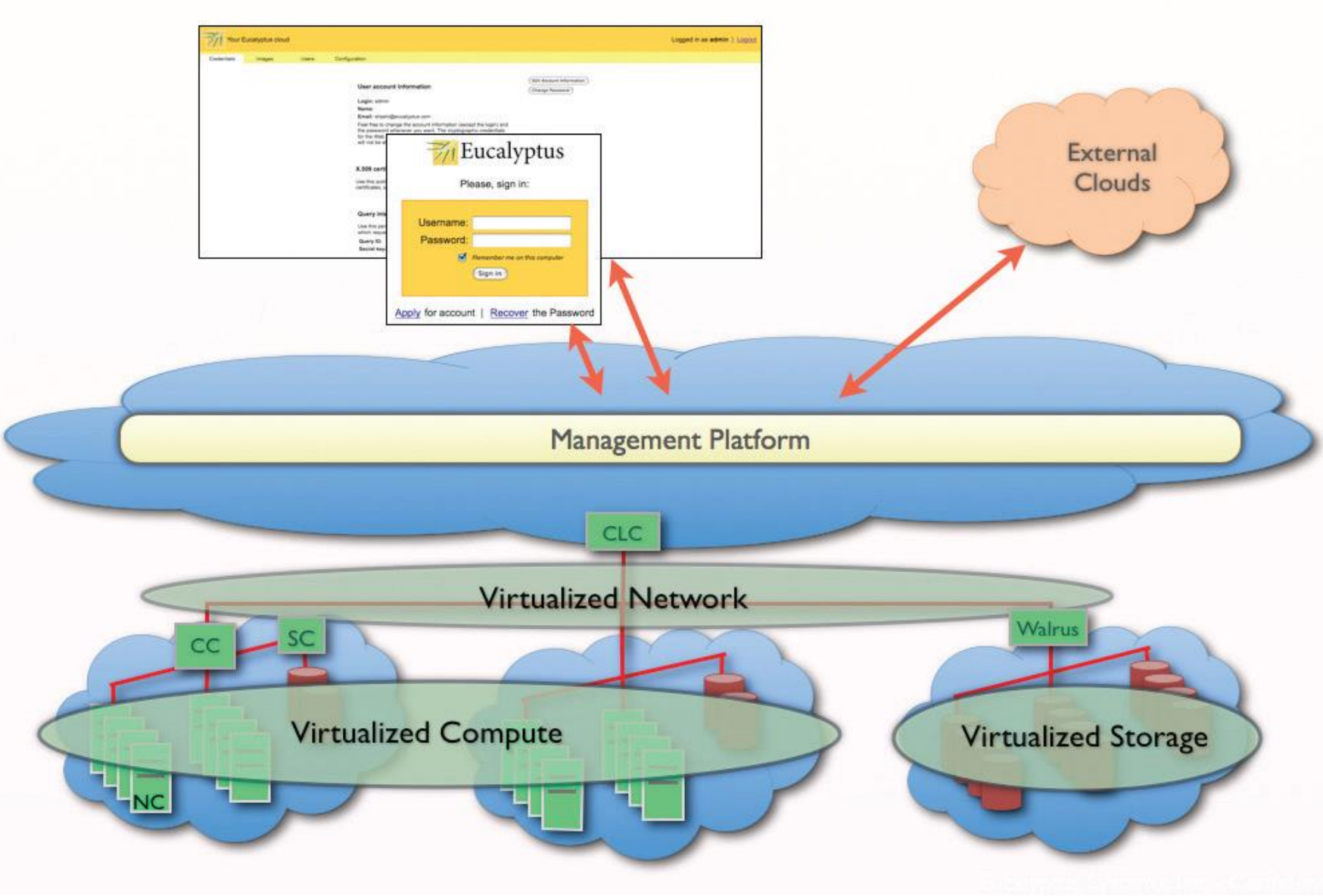
Eucalyptus – Architecture



Eucalyptus Architecture (contd..)



Eucalyptus Architecture (contd..)



Eucalyptus Architecture(Components)

Node Controller (NC):

- It executes on any machine that hosts VM instances
- Controls the execution, inspection, and termination of VM instances on the host where it runs
- It also fetches and maintains a local cache of instance images, and it queries and controls the system software (host OS and the hypervisor) in response to queries and control requests from the CC.
- It is also responsible for the management of the virtual network endpoint

Eucalyptus Architecture(Components)

Cluster Controller (CC):

- Generally executes on a machine that has network connectivity to both the machines running the Node Controllers (NCs) and to the machine running the CLC
- Gathers information about and schedules VM execution on specific node Controllers, as well as manages virtual instance network
- All Node Controllers associated with a single CC must be in the same subnet

Eucalyptus Architecture(Components)

Storage Controller (SC):

- It provides functionality similar to the Amazon Elastic Block Store (Amazon EBS)
- It is a put/get storage service that implements Amazon's S3 interface and provides a way for storing and accessing VM images and user data.
- The SC is capable of interfacing with various storage systems (NFS, iSCSI, SAN devices, etc.)

Eucalyptus Architecture(Components)

Cloud Controller (CLC):

- It is the entry point into the cloud for users and administrators.
- It queries node managers for information about resources, make high-level scheduling decisions, and implements them by making requests to cluster Controllers.
- It is responsible for exposing and managing the underlying virtualized resources (servers, network, and storage)

Eucalyptus Architecture(Components)

Walrus (W):

- Similar to amazon S3
- It manages access to the storage service within Eucalyptus. Requests are communicated to Walrus using the SOAP or REST based interface
- Walrus allows users to store persistent data, organized as buckets and objects.
- Walrus can be accessed by end-users, whether the user is running a client from outside the cloud or from a virtual machine instance running inside the cloud

Eucalyptus Architecture(Components)

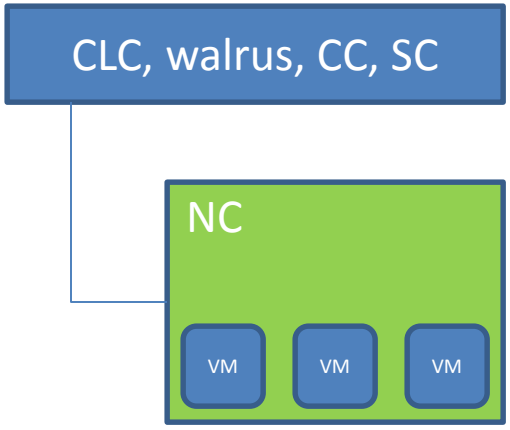
Vmware Broker:

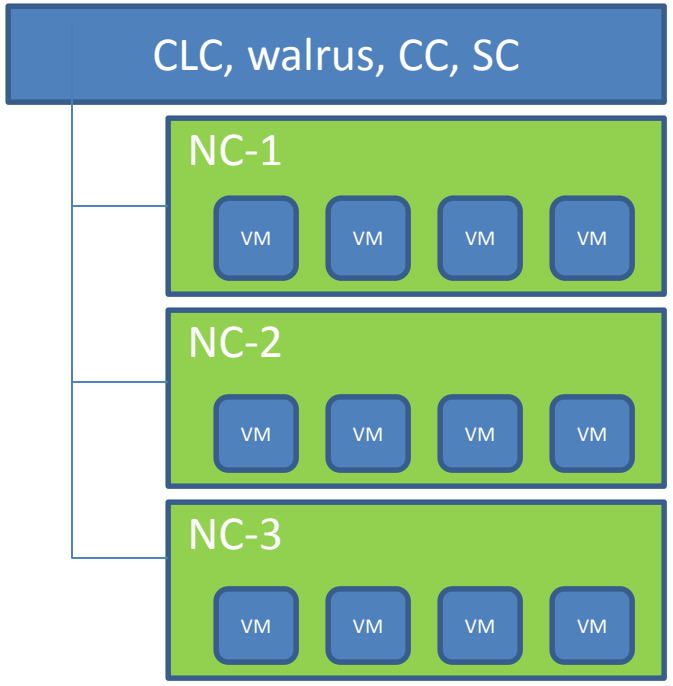
- Vmware Broker (Broker) is an optional Eucalyptus component activated only in versions of Eucalyptus with Vmware support.
- Broker enables Eucalyptus to deploy virtual machines (VMs) on Vmware infrastructure.
- Broker mediates all interactions between the CC and Vmware hypervisors (ESX/ESXi) either directly or through Vmware vCenter

Preparing for Installation

- **A successful installation requires at least two hosts with sufficient resources**
  - Host-A (Front end): running CLC, walrus, CC, Storage controller
  - Host-B : Node controller

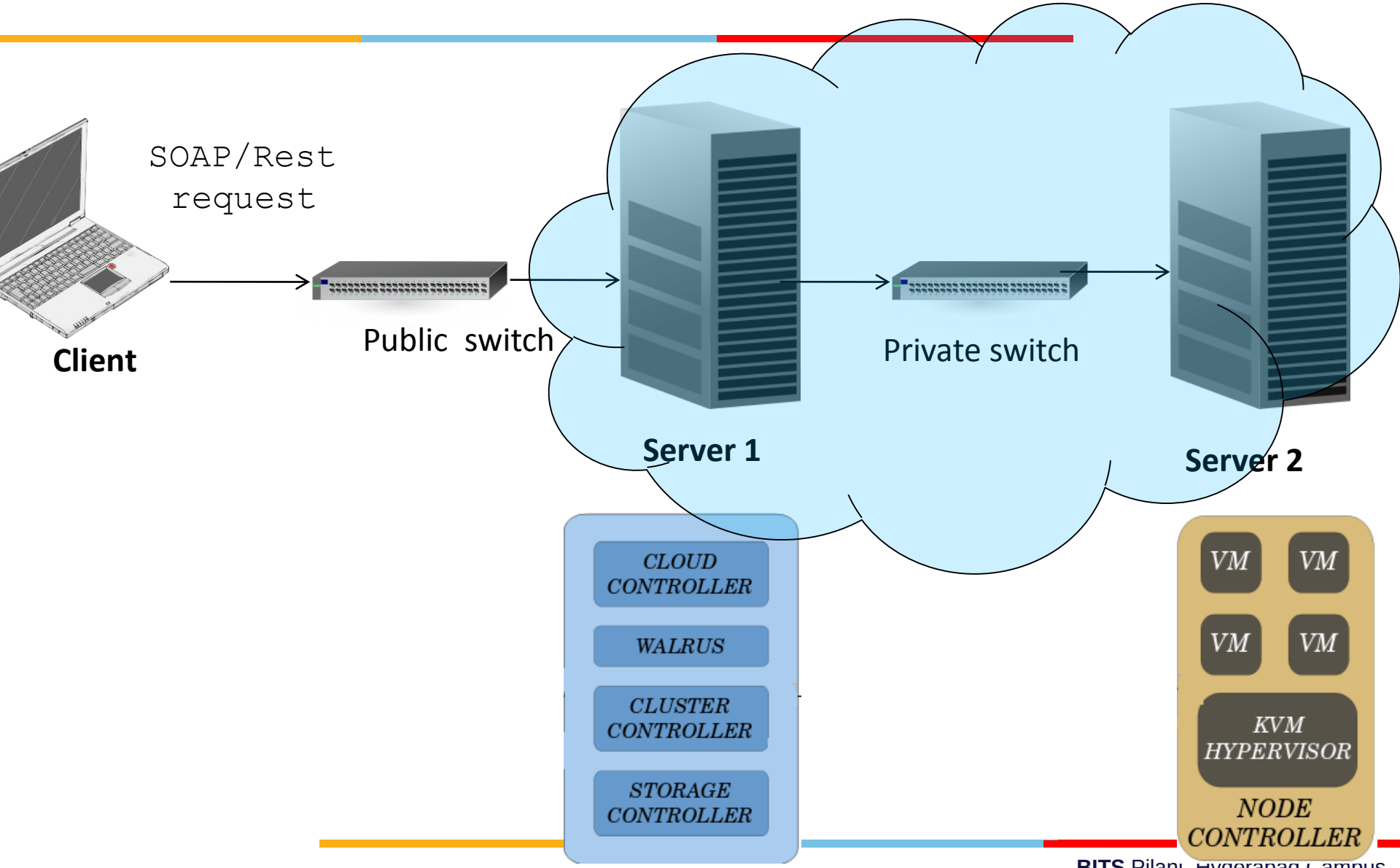
- **You can use additional Node controller hosts in the installation, if you wish**





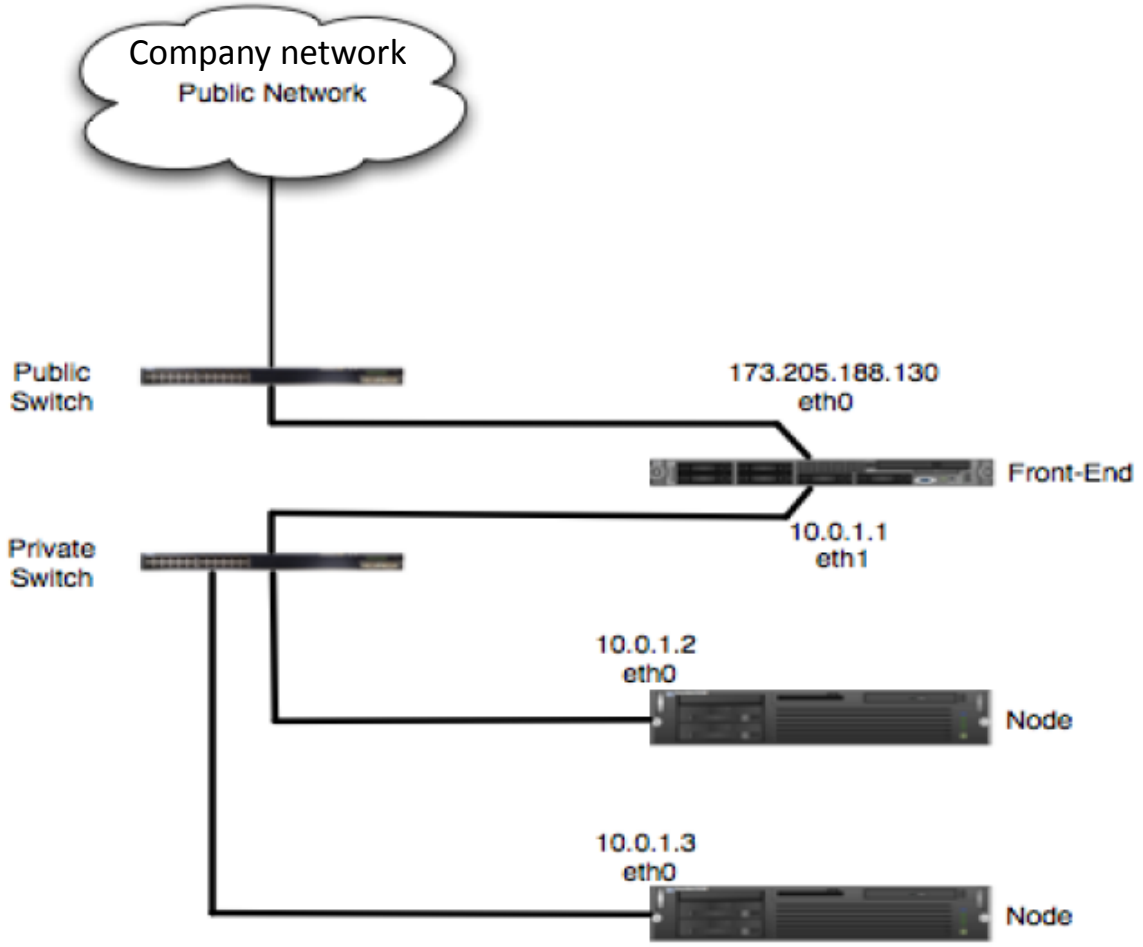
How many VM's can run on NC-1 in parallel?

For experimental purpose



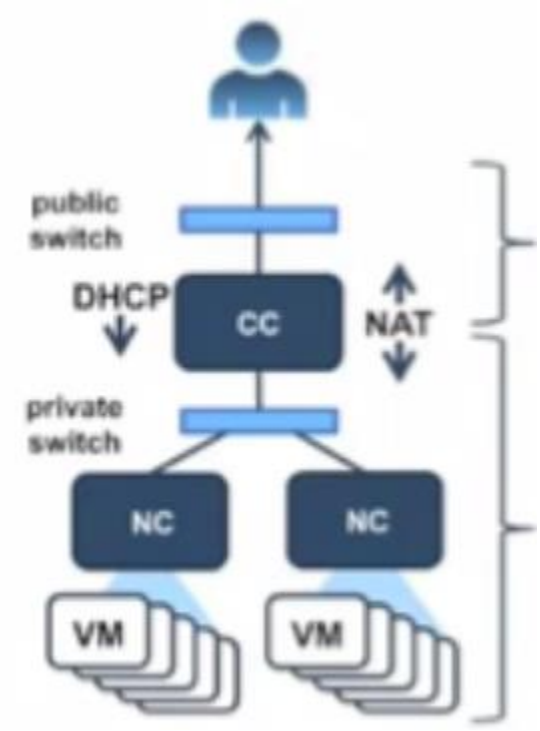
Network interface

- Each host will require at least 1Gb network interface
- The front-end host requires two interfaces (for CC)
- The Node controller host require only a single interface
- CC on front-end host will act as router between VM's and company network



IP address requirements

- The VM's will use two IP addresses, Why?
  - A public IP for cloud - external communication
  - A private IP for VM-to-VM communication
- The CC maps private IP to public IP
  - ✓ Using iptables NAT table
- Eucalyptus Hosts also require IP addresses to communicate

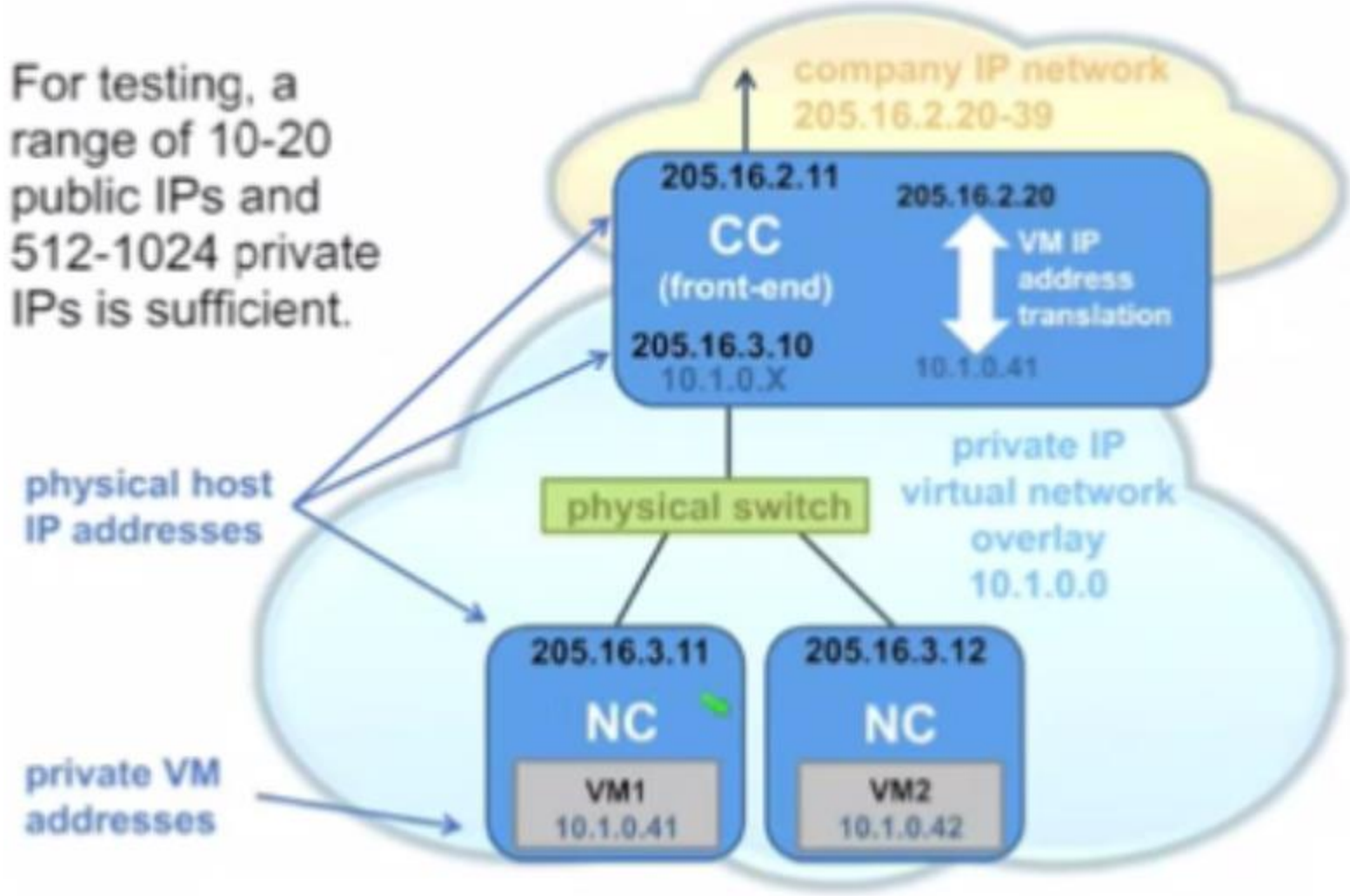


Public IP range:
Available IP addr's in network

Private IP range:
Example: 10.1.0.0 OR 192.168.0.0

Note: Ensure that any existing DHCP server cannot respond to the DHCP requests from the Node controller host(s)

IP addresses illustration

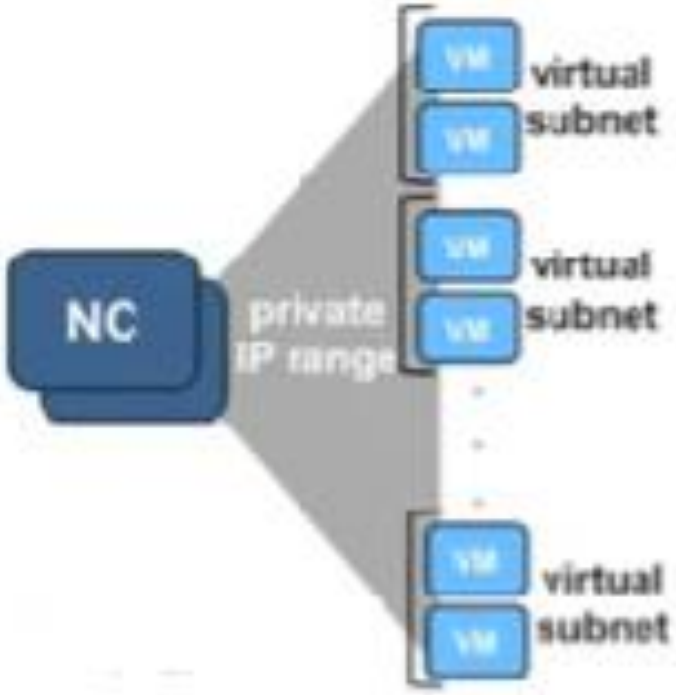


Private IP range

- Private IP range for virtual machines is automatically divided into subnets by Eucalyptus
- Range, No: of subnets, and VM's/subnet configured by parameters in

  /etc/eucalyptus/eucalyptus.conf

- Why?
- Virtual subnet configuration determines:
  - Max no: of security groups (one per subnet)
  - Max no: of instances per security groups (No: of addresses per subnet)



OpenStack – a cloud computing operating system

Cloud Computing : OpenStack

"The OpenStack project has been created with the audacious goal of being the ubiquitous software choice for building cloud infrastructures."

— Ken Pepple, Deploying OpenStack, O'Reilly

"Cloud computing is a computing model, where resources such as computing power, storage, network and software are abstracted and provided as services on the Internet in a remotely accessible fashion. Billing models for these services are generally similar to the ones adopted for public utilities. On-demand availability, ease of provisioning, dynamic and virtually infinite scalability are some of the key attributes of cloud computing."

— docs.openstack.org

Introduction to OpenStack

"OpenStack is a collection of open source software projects that enterprises/service providers can use to setup and run their cloud compute and storage infrastructure."

— docs.openstack.org

The OpenStack Consortium has grown rapidly in the past year:

- NASA
- Rackspace
- Citrix
- Dell
- AMD
- Intel
- Cisco
- HP
- Over 140 others

OpenStack services are available via Amazon's S3 and EC2 APIs. Applications written for Amazon Web Services will work with OpenStack.

Introduction to OpenStack

- Rackspace and NASA are the key initial contributors to the OpenStack.
- Rackspace contributed their "Cloud Files" platform (code) to power the **Object Storage** part of the OpenStack
- NASA contributed their "Nebula“ platform (code) to power the **Compute** part.

7 core components of OpenStack

Nova - Compute Service

Swift - Storage Service

Glance - Imaging Service

Cinder - Block Storage Service

Keystone - Identity Service

Horizon - UI Service

Quantum (Neutron) - Network connectivity Service

>> more

Nova - Compute Service:

- It provides virtual servers upon demand
- Rackspace and HP provide commercial compute services built on Nova and it is used internally at companies like Mercado Libre and NASA (where it originated)
- Nova allows users to create, destroy, and manage virtual machines using user-supplied images
- Corresponds to Amazon's EC2
- Users can use OpenStack API or Amazon's EC2 API
- Uses Python and Web Server Gateway Interface (WSGI)

Horizon - UI Service:

- It provides a modular web-based user interface for all the OpenStack services.
- With this web GUI, you can perform most operations on your cloud like launching an instance, assigning IP addresses, setting access controls, attaching volumes to VM, maintenance, etc.

Storage Services

Glance - Imaging Service:

- It provides a catalog and repository for virtual disk images.
- These disk images are mostly commonly used in OpenStack Compute.
- While this service is technically optional, any cloud of size will require it

Cinder : Block Storage Service:

- It provides persistent block storage to guest VMs

Swift - Storage Service:

- It is basically object storage.
- It allows to store or retrieve files (but not mount directories like a fileserver).
- Several companies provide commercial storage services based on Swift. These include KT, Rackspace (from which Swift originated) and Internap.
- Swift is also used internally at many large companies to store their data

Keystone - Identity Service:

- It provides authentication and authorization for all the OpenStack services. It also provides a service catalog of services within a particular OpenStack cloud.

Quantum (Neutron)- Network connectivity Service:

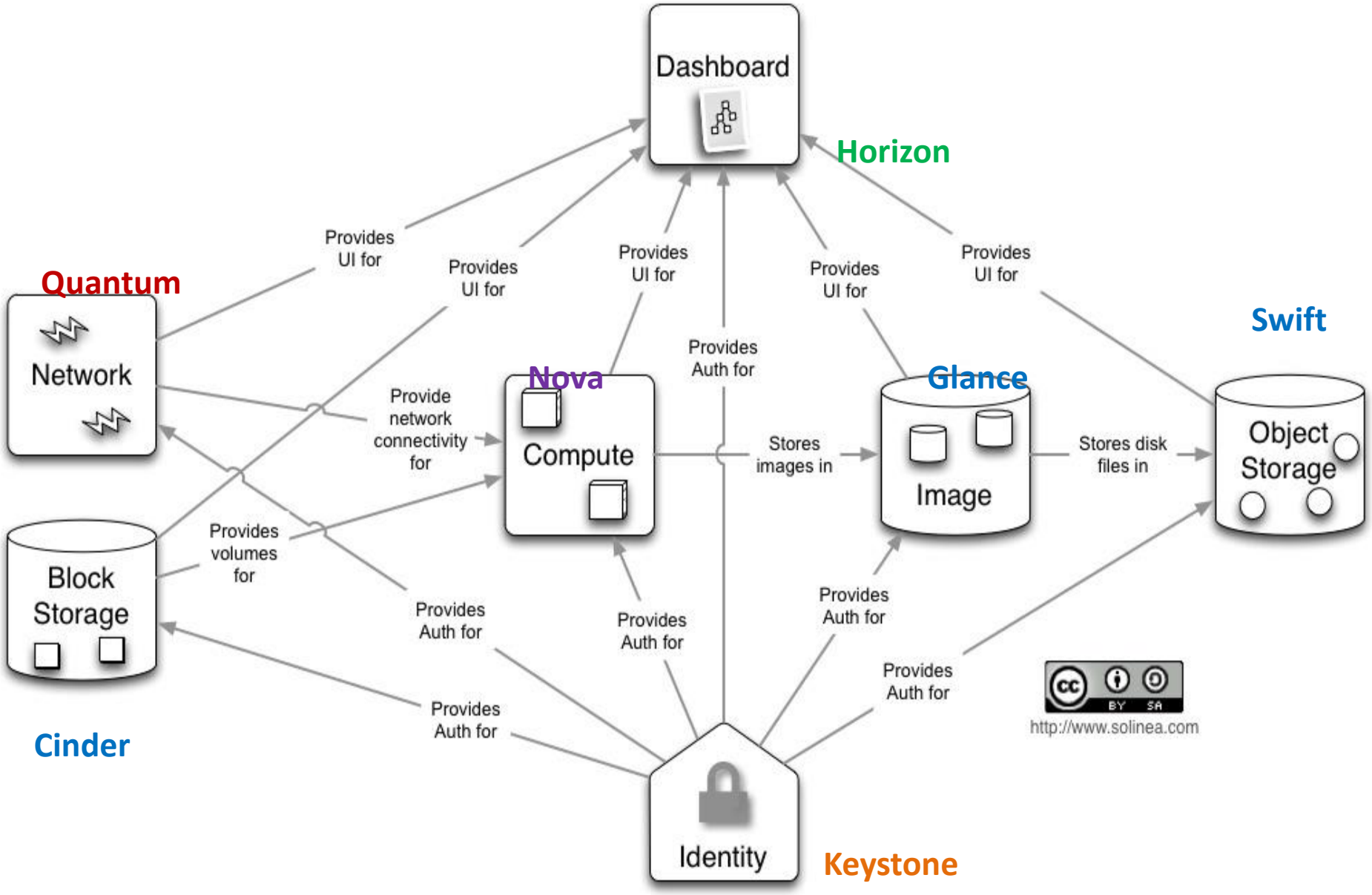
- It provides "network connectivity as a service" between interface devices managed by other OpenStack services (most likely Nova).
- The service works by allowing users to create their own networks and then attach interfaces to them. OpenStack Network has a pluggable architecture to support many popular networking vendors and technologies.

Heat - OpenStack Orchestration

- Used to create a human and machine accessible service for managing the entire lifecycle of infrastructure and applications within OpenStack clouds
- It implements an orchestration engine to launch multiple composite cloud applications based on templates in the form of text files that can be treated like code

- A Heat template describes the infrastructure for a cloud application in a text file that is readable and writable by humans
- Infrastructure resources that can be described include: servers, floating ips, volumes, security groups, users, etc

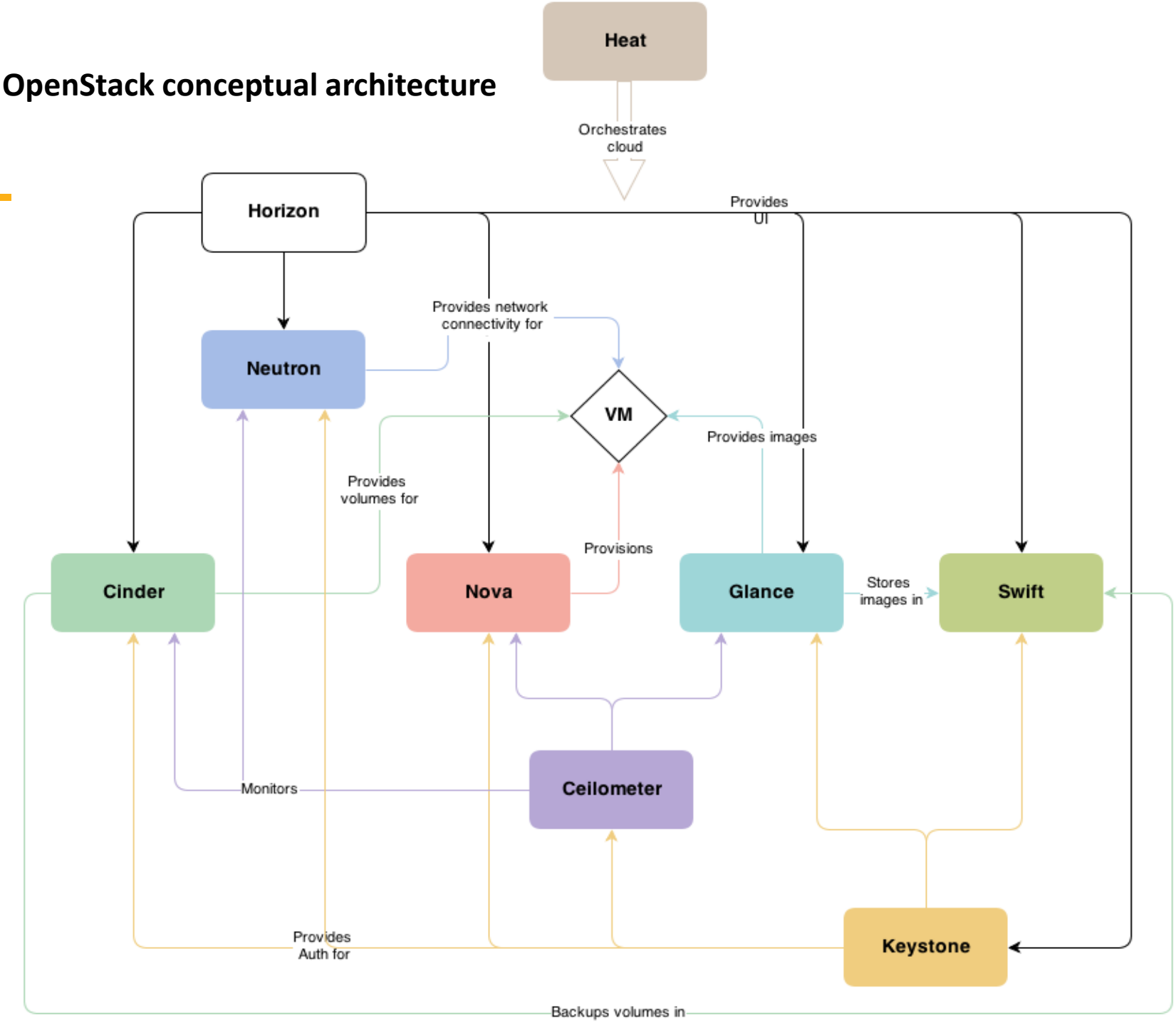
Put together all the components:



OpenStack current services (Juno)		
Service	**Project name**	**Description**
Dashboard	Horizon	Enables users to interact with OpenStack services to launch an instance, assign IP addresses, set access controls, and so on.
Compute	Nova	Provisions and manages large networks of virtual machines on demand.
Networking	Neutron (**Quantum)**	Enables network connectivity as a service among interface devices managed by other OpenStack services, usually Compute. Enables users to create and attach interfaces to networks. Has a pluggable architecture that supports many popular networking vendors and technologies.
Storage		
Object Storage	Swift	Stores and gets files. Does not mount directories like a file server.
Block Storage	Cinder	Provides persistent block storage to guest virtual machines.
Shared services		
Identity Service	Keystone	Provides authentication and authorization for the OpenStack services. Also provides a service catalog within a particular OpenStack cloud.
Image Service	Glance	Provides a registry of virtual machine images. Compute uses it to provision instances.
Metering/Monitoring Service	Ceilometer	Monitors and meters the OpenStack cloud for billing, benchmarking, scalability, and statistics purposes.
Higher-level services		
Orchestration Service	Heat	Orchestrates multiple composite cloud applications by using either the native HOT template format or the AWS CloudFormation template format, through both an OpenStack-native REST API and a CloudFormation-compatible Query API.
Database	Trove	Trove is a database-as-a-service provisioning relational and non-relational database engines

Release name	Release date	Included Component (code names)
Austin	21 October 2010	Nova, Swift
Bexar	3 February 2011	Nova, Glance, Swift
Cactus	15 April 2011	Nova, Glance, Swift
Diablo	22 September 2011	Nova, Glance, Swift
Essex	5 April 2012	Nova, Glance, Swift, Horizon, Keystone
Folsom	27 September 2012	Nova, Glance, Swift, Horizon, Keystone, Quantum, Cinder
Grizzly	4 April 2013	Nova, Glance, Swift, Horizon, Keystone, Quantum, Cinder
Havana	17 October 2013	Nova, Glance, Swift, Horizon, Keystone, Neutron, Cinder, Heat, Ceilometer
Icehouse	17 April 2014	Nova, Glance, Swift, Horizon, Keystone, Neutron, Cinder, Heat, Ceilometer, Trove
Juno	16 October 2014	Nova, Glance, Swift, Horizon, Keystone, Neutron, Cinder, Heat, Ceilometer, Trove
Kilo	April 2015	Nova, Glance, Swift, Horizon, Keystone, Neutron, Cinder, Heat, Ceilometer, Trove, **Ironic, Zaqar, Sahara**

OpenStack conceptual architecture



Summary

- Preview of last lecture
- Private Cloud Computing deployment
  - ✓ Eucalyptus
  - ✓ OpenStack