SNS COLLEGE OF TECHNOLOGY

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DEPARTMENT OF COMPUTER APPLICATIONS

COURSE	UNIT IV	TOPIC	Semester
23CAE717 Cloud Computing	**PROGRAMMING MODEL**	Cloud Software Environments -Eucalyptus, Open Nebula, OpenStack, Aneka, CloudSim	II Semester / I MCA


Eucalyptus Overview
The most widely deployed on-premise cloud computing platform

Eucalyptus

- Open-source for building AWS-compatible private and hybrid cloud environment
- Provides an AWS-compliant EC2-based web service interface for cloud service
- Supports cloud programmers in VM image management
- Compute, network, storage and identity resources are accessible as service
- Physical resource management tools interface with hypervisor, storage, and network infrastructure
- AWS Identity and Access Management (IAM) API plus extensions for private clouds
- Eucalyptus stores images in Walrus, the block storage system
- Private and hybrid cloud on heterogeneous architecture

Why Eucalyptus?

- Open-source
- Eucalyptus components have well defined interfaces
- Allows components to be installed close to the needy resources
- Designed to ground up to be scalable and to achieve better performance in diverse environments
- Flexible-minimal step to install
- Compatible with widely used cloud API:Amazon EC2 and S3

Eucalyptus APIs

APIs

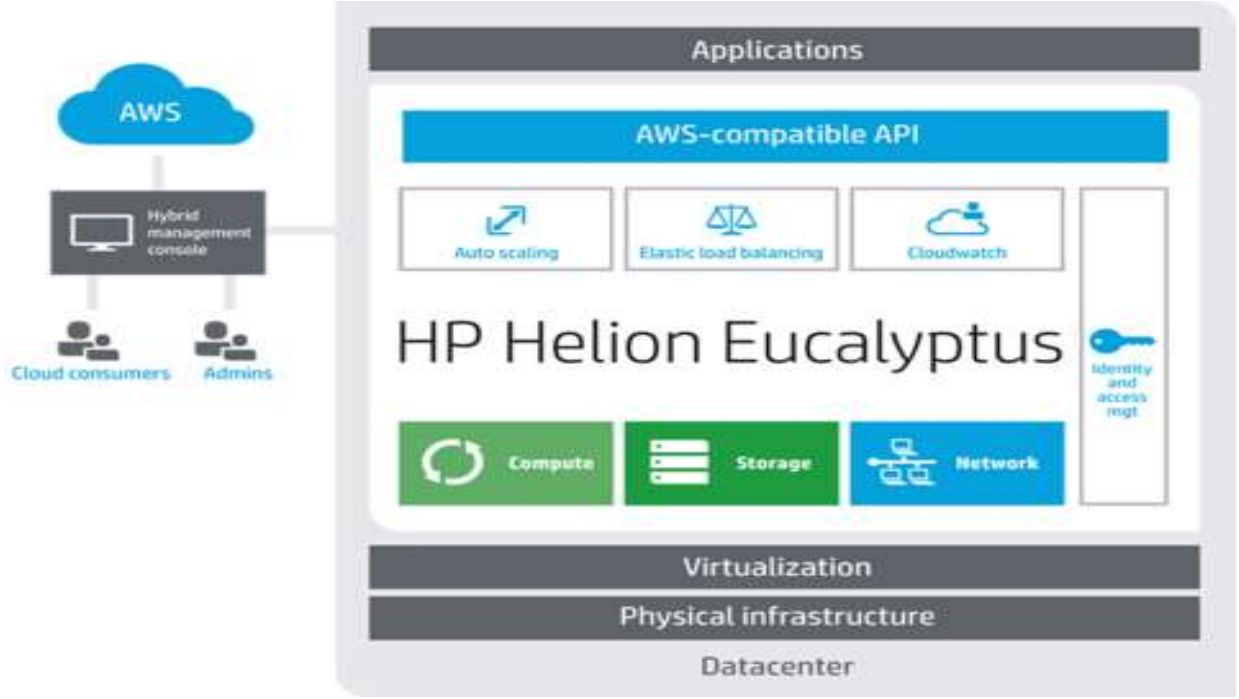
Compute
Run instances with **EC2** and **Auto Scaling / ELB.**

Storage
Use **S3** storage to share data and **EBS** for persistent instance state.

Management
Use **IAM** to manage users and control access, and **Cloud Formation** to manage resources.

Monitoring
Use **CloudWatch** to monitor your compute resources.

Eucalyptus Architecture

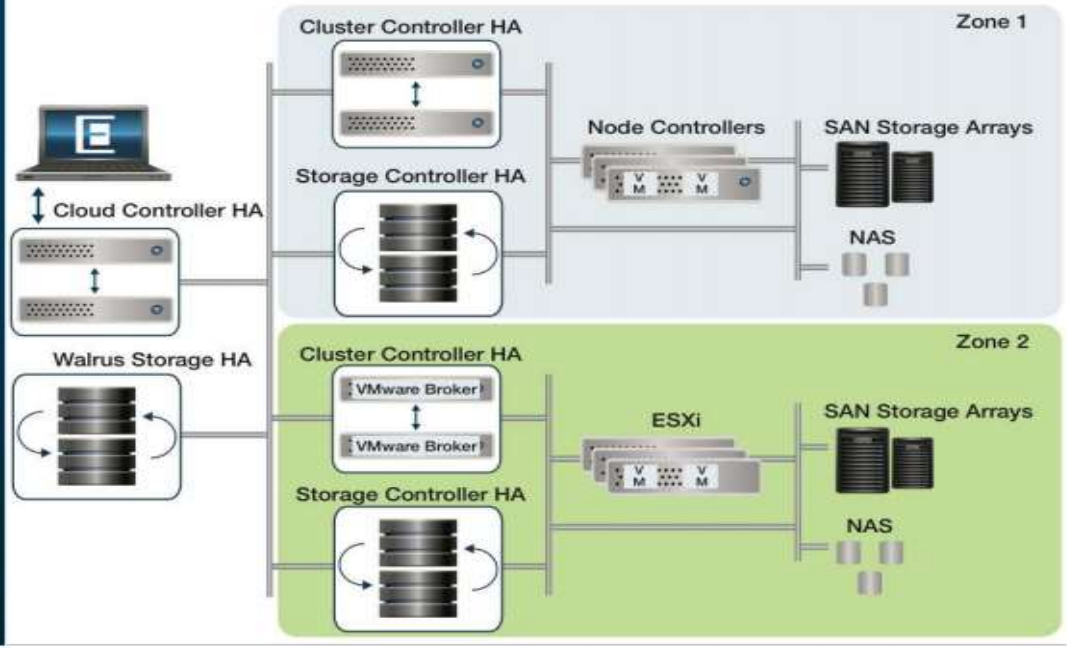


Cloud Controller (CLC)
Walrus –S3
Cluster Controller (CC)
Storage Controller (SC) i-EBS
VMware Broker
Node Controller (NC)

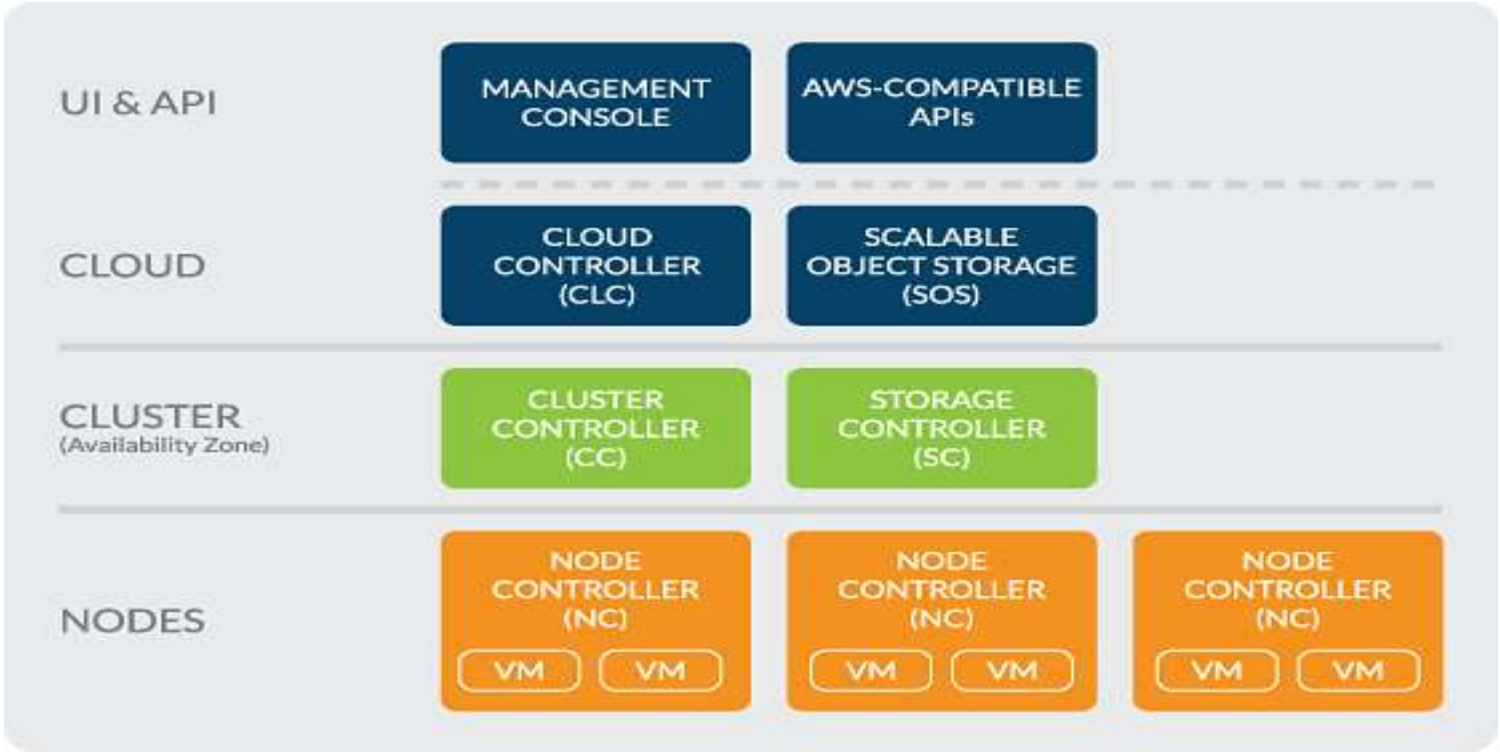
Eucalyptus Architecture

High Availability IaaS

- Prevent single point of failure from disrupting Eucalyptus service
- Detection of service failure(s) with cloud administrator notification
- Automated Eucalyptus service component failure recovery
- No changes required to support applications



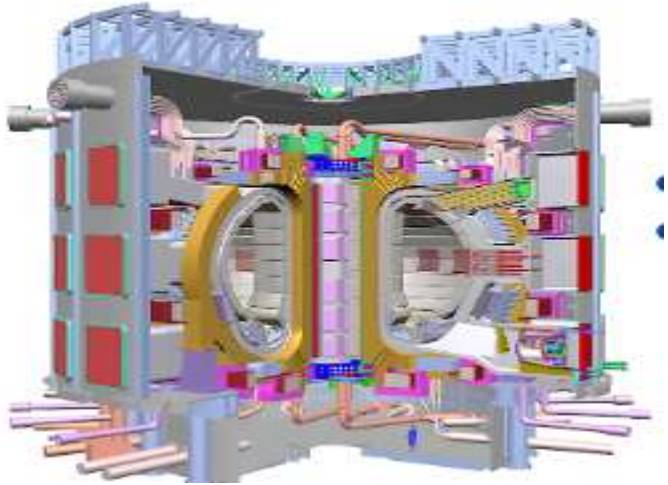
Eucalyptus Architecture




NIMBUS

NIMBUS

- Open source tool (100% free) provide an IaaS solution to scientific community
- EC2/S3-compatible IaaS implementation
- Allows a client to lease remote resources by deploying VMs on those resources and configuring them to represent the environment desired by the user

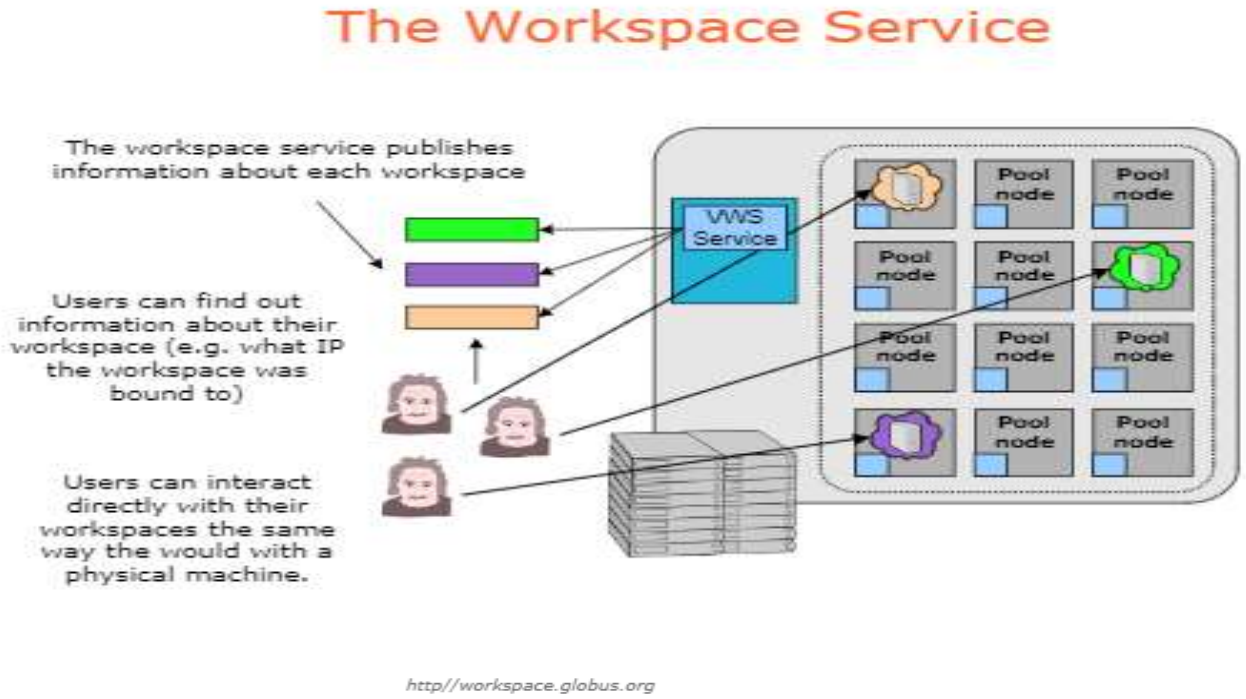


Complex environments

NIMBUS

- Cumulus is storage cloud service that is compatible with the S3 to provide data storage
- Remote deployment and lifecycle management of VMs
- On deployment, the client presents the workspace service with
  - meta-data
  - resource allocation

NIMBUS



- Web based
  - Security
  - Network configuration

NIMBUS

- Supports two resource management strategies:
- In “Resource Pool” mode, the service has direct control of a pool of VM manager nodes and it assumes it can start VMs
- In “Pilot” mode, service makes requests to a cluster’s Local Resource Management System (LRMS) to get a VM manager available to deploy VMs


OpenNebula

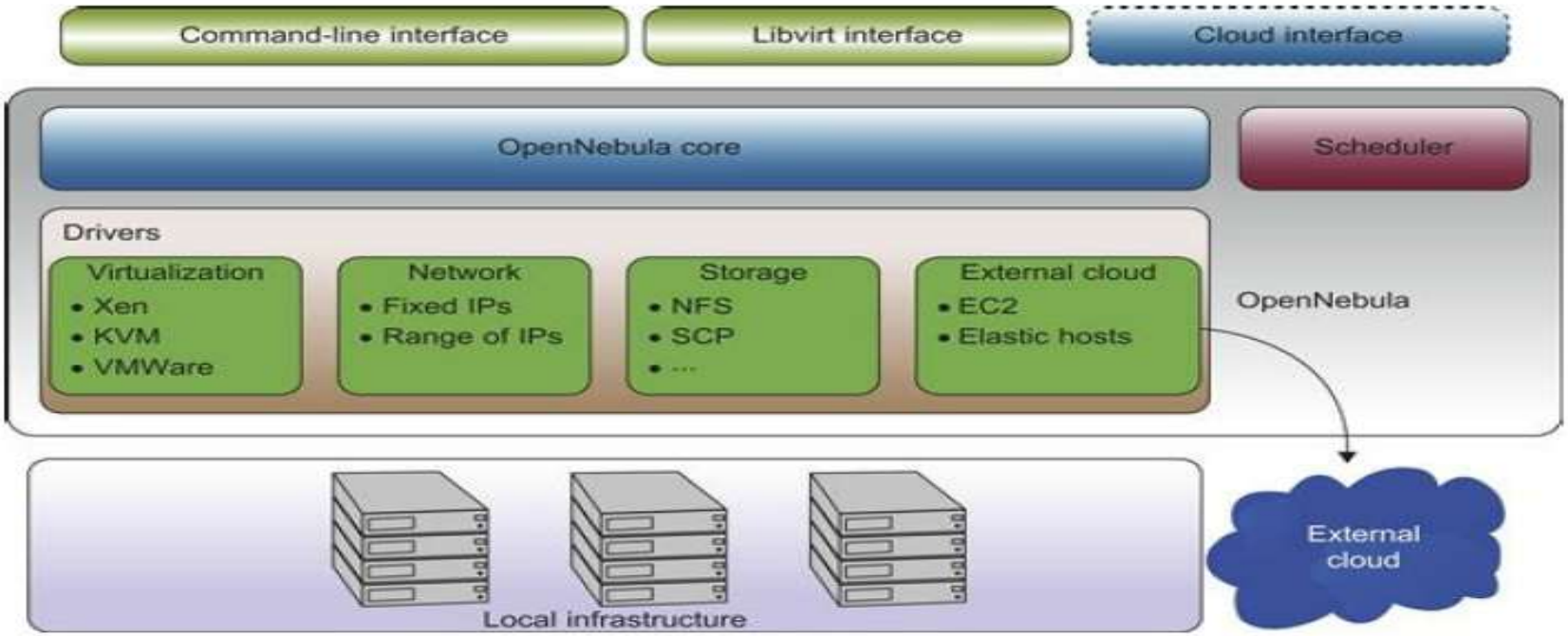
Open Nebula

- European cloud computing platform for managing hetero- geneous distributed data center infrastructures
- manages a data center's virtual infrastructure to build private, public and hybrid implementations of IaaS
- It is used by hosting providers, telecom operators, IT services providers, supercomputing centers, research labs, and international research projects
- core is a centralized component that manages the VM full life cycle

Open Nebula

- Capacity manager /scheduler governs the functionality provided by the core
- Support a hybrid cloud model by using cloud drivers to interface with external clouds when the local resources are insufficient
- Access drivers- They provide an abstraction of the underlying infrastructure to expose the
- Basic functionality of the monitoring, storage, and virtualization services available in the cluster

Open Nebula


Command-line interface
Libvirt interface
Cloud interface
OpenNebula core
Scheduler
Drivers
Virtualization
• Xen
• KVM
• VMWare
Network
• Fixed IPs
• Range of IPs
Storage
• NFS
• SCP
• ...
External cloud
• EC2
• Elastic hosts
OpenNebula
Local infrastructure
External cloud

Open Nebula Benefits

For the Infrastructure Manager

- Centralized management of VM workload and distributed infrastructures
- Support for VM placement policies: balance of workload, server consolidation…
- Dynamic resizing of the infrastructure
- Dynamic partition and isolation of clusters
- Dynamic scaling of private infrastructure to meet fluctuating demands
- Lower infrastructure expenses combining local and remote Cloud resources

Open Nebula Benefits

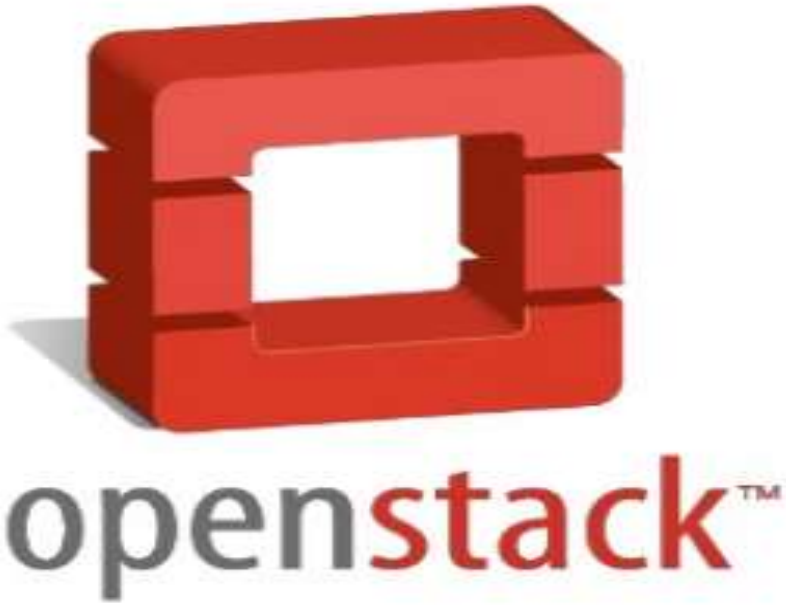
For the Infrastructure user

- ❑ Faster delivery and scalability of services
- ❑ Support for heterogeneous execution environments
- ❑ Full control of the lifecycle of virtualized services management

Open Nebula Benefits

- Faster delivery and scalability of services
- Fits into any existing data center, due to its open, flexible and extensible interfaces, architecture and components
- Builds any type of Cloud deployment
- Open source software, Apache license
- Seamless integration with any product and service in the cloud ecosystem and management tool in the data center, such as
    - cloud providers
    - VM managers
    - virtual image managers
    - service managers
    - management tools

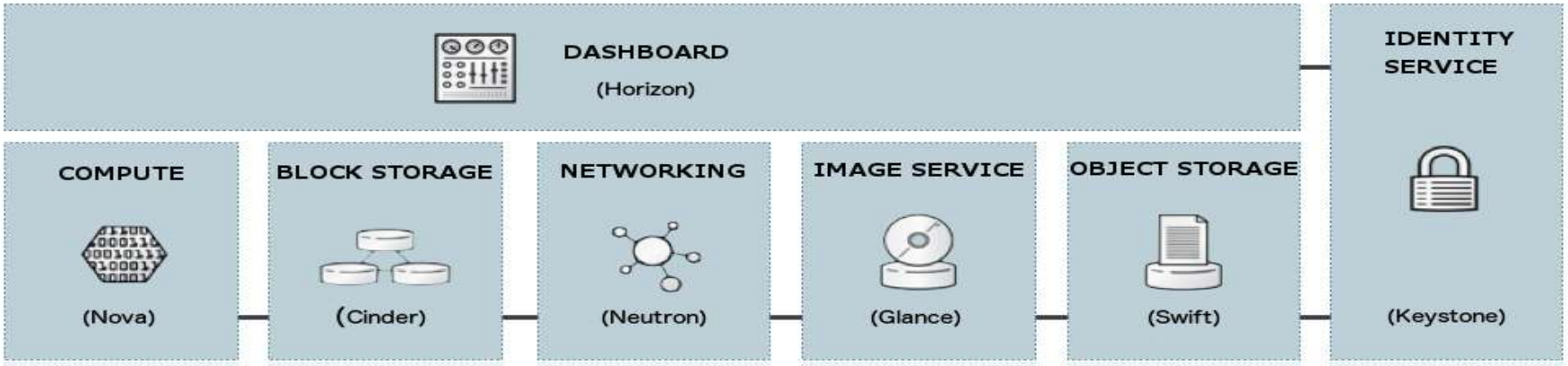
For System Integrators


openstack™

Open Stack

- Cloud OS that controls large pools of compute, storage, and networking resources throughout a datacenter, managed through a dashboard
- focuses on OpenStack Compute and OpenStack Storage solutions
- **OpenStack Compute -** internal fabric of the cloud creating and managing large groups of virtual private servers
- **OpenStack Object Storage** - software for creating redundant, scalable object storage using clusters of commodity servers to store terabytes or even petabytes of data

Open Stack Services



Open Stack Architecture

- Architecture is made up of numerous open source projects
- Six core components

NOVA

Nova is a full management and access tool to OpenStack compute resources—handling scheduling, creation, and deletion.

NEUTRON

Neutron connects the networks across other OpenStack services.

SWIFT

Swift is a highly fault-tolerant object storage service that stores and retrieves unstructured data objects using a RESTful API.

CINDER

Cinder provides persistent block storage accessible through a self-service API.

KEYSTONE

Keystone authenticates and authorizes all OpenStack services. It's also the endpoint catalog for all services.

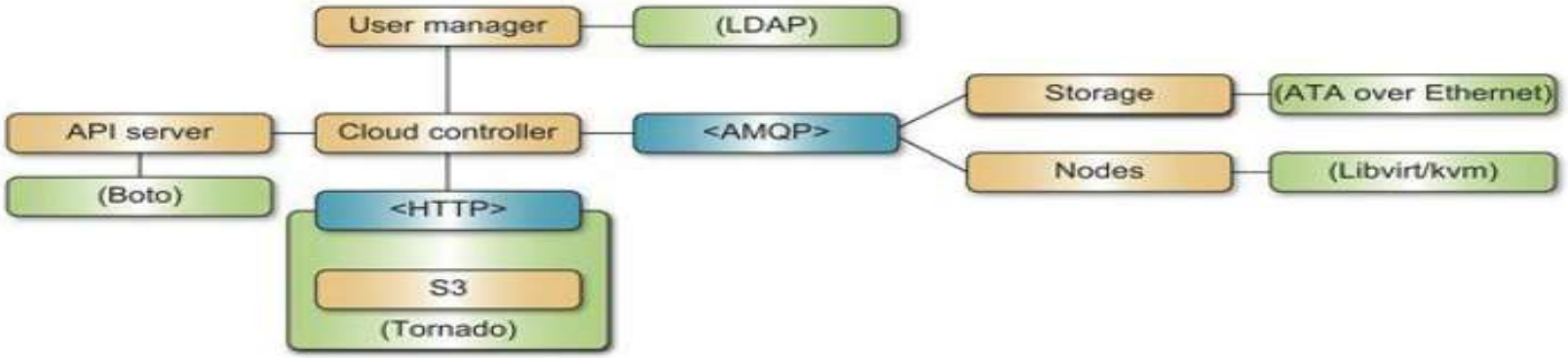
GLANCE

Glance stores and retrieves virtual machine disk images from a variety of locations.

Open Stack - Compute

- A Cloud computing fabric controller, designed to manage and automate pools of computer resources and can work with widely available virtualization technologies
- Architecture for Nova is built on the concepts of shared-nothing and messaging-based information exchange
- API Server receives HTTP requests from boto, converts the commands to and from the API format, and forwards the requests to the cloud controller
- cloud controller maintains the global state of the system, ensures authorization while interacting with the User Manager via Lightweight Directory Access Protocol(LDAP), interacts with the S3 service, and manages nodes
- Additionally, Nova integrates networking components to manage private networks, public IP addressing, VPN and firewall

Open Stack - Compute



- NetworkController manages address and virtual LAN (VLAN) allocations
- RoutingNode governs the NAT (network address translation) conversion of public IPs to private IPs, and enforces firewall rules
- AddressingNode runs Dynamic Host Configuration Protocol (DHCP) services for private networks
- TunnelingNode provides VPN connectivity

Open Stack - Storage

- It built around a number of interacting components and concepts, including a proxy server, a ring, an object server, a container server, an account server, replication, updaters, and auditors
- proxy server is to enable lookups to the accounts, containers, or objects in OpenStack storage rings and route the requests
- A ring represents a mapping between the names of entities stored on disk and their physical locations
- A ring includes the concept of using zones, devices, partitions, and replicas
- Weights can be used to balance the distribution of partitions on drives across the cluster, allowing users to support heterogeneous storage resources
- Objects are stored as binary files with metadata stored in the file's extended attributes

Aneka

- Framework for building customized applications and deploying them on either public or private Clouds
- Acts as a workload distribution and mgt. platform for accelerating applications in both Linux and Microsoft .NET
- All programming models available from within the same container
- SDK containing APIs for multiple programming models and tools
- Runtime Environment for managing application execution management
- Suitable for
  - Development of Enterprise Cloud Applications
  - Cloud enabling legacy applications

Aneka

- Key advantages
  - Support of multiple programming and application environments
  - Simultaneous support of multiple runtime environments
  - Rapid deployment tools and framework
  - Ability to harness multiple virtual and/or physical machines for accelerating application
- offers three types of capabilities for building, accelerating, and managing clouds and their applications

Aneka

Build

Aneka includes a ***Software Development Kit (SDK)*** which includes a combination of ***APIs*** and ***Tools*** to enable you to express your application. Aneka also allows you to build different run-time environments and build new applications.

Accelerate

Aneka supports ***Rapid Development*** and ***Deployment*** of Applications in Multiple Run-Time environments. Aneka uses physical machines as much as possible to achieve maximum utilization in local environment.

Manage

Management includes a Graphical User Interface (GUI) and APIs to set-up, monitor, manage and maintain remote and global Aneka compute clouds. Aneka also has an accounting mechanism and ***manages priorities*** and scalability based on ***SLA/QoS*** which enables ***dynamic provisioning***.

Aneka


Application Development & Management
Management: Tools, Interfaces and APIs
Software Development Kit: APIs & Tools
Middleware - Container
Application Services
Distributed Threads
MapReduce
Bag of Tasks
PSM
Other models...
Foundation Services
Storage
Resource Reservation
Billing & Reporting
Licensing & Accounting
Fabric Services
High-Availability
Resource Provisioning
Hardware Profiling
Membership
Persistence & Security
PAL – Platform Abstraction Layer
Infrastrusture
ECMA 334: .NET or Mono / Windows, Linux, & Mac
Enterprise Desktop Grid
Data Centers
Clusters
Public Cloud

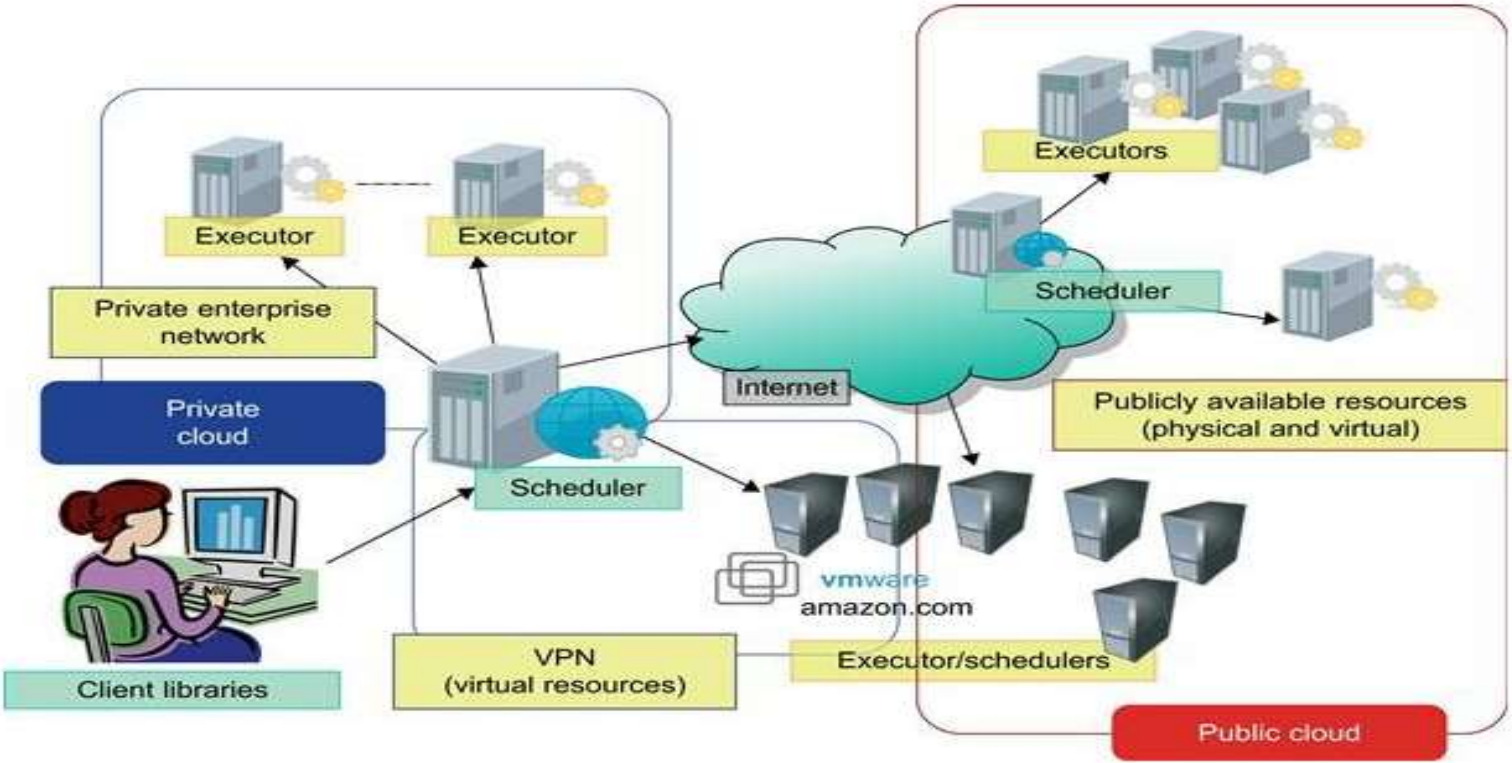
Aneka

- Services are broken up into fabric, foundation, and execution services
- Fabric services directly interact with the node through the Platform Abstraction Layer (PAL) and perform
- Foundation services identify the core system of the Aneka middleware, providing a set of basic features to enable Aneka containers to perform specialized and specific sets of tasks
- Execution services directly deal with the scheduling and execution of applications in the Cloud.

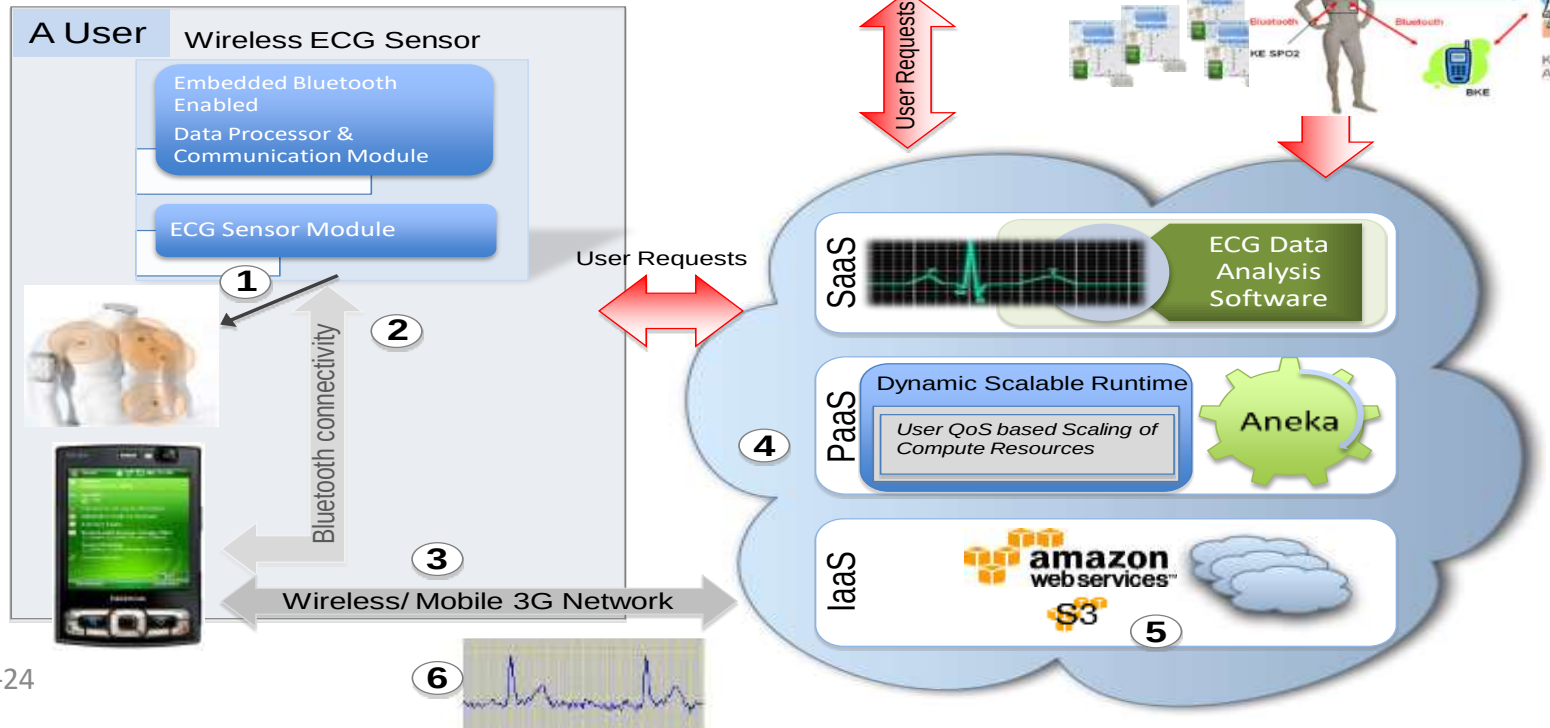
Aneka

- At the application level, a set of different components and tools are provided to:
  1) simplify the development of applications (SDK);
  2) porting existing applications to the Cloud; and
  3) monitoring and managing the Aneka Cloud.

Aneka


Executor
Executor
Private enterprise network
Private cloud
Scheduler
Client libraries
VPN (virtual resources)
Internet
Executors
Scheduler
Publicly available resources (physical and virtual)
vmware
amazon.com
Executor/schedulers
Public cloud

Health Care: SaaS Cloud for ECG Sensor Data Analysis



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ANY
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