ANISH ADNANI
D17B 101

ASSIGNMENT 1

1. Following are the characteristics of cloud computing

> On-demand self-service

Cloud computing resources can be provisioned without human interaction from the service provider. In other words, a manufacturing organization can provision additional computing resources as needed without going through the cloud service provider. This can be a storage space, virtual machine instances, database instances, and so on.

> Broad network access

Cloud computing resources are available over the network and can be accessed by diverse customer platforms. In other words, cloud services are available over a network - ideally high broadband communication link - such as the internet, or in the case of a private clouds it could be a local area network (LAN)

> Multi-tenancy and resource pooling

Cloud computing resources are designed to support a multi-tenant model. Multi-tenancy allows multiple customers to share the same applications or the same physical infrastructure while retaining privacy and security over their information. It's similar to people living in an apartment building, sharing the same building infrastructure but they

still have their own apartments and privacy within that infrastructure

> Rapid elasticity and scalability
One of the great things about cloud computing is the ability to quickly provision resources in the cloud as manufacturing organizations need them. And then to remove them when they don't need them. Cloud computing resources can scale up or down rapidly and, in some cases, automatically, in response to business demands.

> Measured service
Cloud computing resources usage is metered and manufacturing organizations pay accordingly for what they have used. Resource utilization can be optimized by leveraging charge-per-use capabilities. This means they have used cloud resources - whether virtual servers instances that are running on storage in cloud - gets monitored, measured and reported by the cloud service provider.

2) There are mainly 5 types of virtualization mentioned as follows
i) Desktop virtualization: The virtualization of desktop, which sometimes is referred to as virtual Desktop Infrastructure (VDI), is where a

desktop operating system, such as Windows 7, will run as a virtual machine on a physical server with other virtual desktops. The processing of multiple virtual desktops occurs on one or a few physical servers, typically at the centralized data center.

ii) Application virtualization

Application virtualization uses software to package an application into a "single executable and run anywhere" type of application. The software application is seperated from the operating system and runs in what is referred to as a "sandbox". Virtualizing the application allows things like registry and configuration changes to appear to run in the underlying operating system, although they really are running in a sandbox. There are two types of application virtualization: remote and streaming of applications

iii) Server virtualization

Server virtualization allows for many virtual machines to run on one physical server. The virtual servers share the resources of the physical server, which leads to better utilization of the physical servers resources. The resources that the virtual machines share are CPU, memory, storage, and networking. All of these resources are provided to the virtual machines through the hypervisor of the physical server.

iv) Storage virtualization

Storage virtualization is the process of grouping physical storage using software to represent what appears to be a single storage device in a virtual format. Correlations are made between storage virtualization and traditional virtual machines, since both take physical hardware and resources and abstract access to them.

v) Network virtualization

Network virtualization is using software to perform network functionality by decoupling the virtual networks from the underlying network hardware. Once you start using network virtualization, the physical network is only used for packet forwarding, so all of the management is done using the virtual or software-based switches.

3) Following are the different modes of operation of Eucalyptus

i) Managed mode

managed mode is the most feature rich mode offered by Eucalyptus. In this mode, the Eucalyptus administrator defines large network from which VM instances will draw their IP addresses. As with static mode, CC will maintain a DHCP server with static mappings for each instance

that is raised and allocated the right IPs at the time of requesting an NC to raise the instance. Managed mode implements 'security groups' for ingress filtering and isolation of instances. The user specifies a security group to which the new instance should be associated with, at the time of requesting a new instance.

ii) System

In system mode, CC generates and assigns a random MAC address to the VM instance while requesting NC to bring up the instance. NC attaches the VM instance's virtual NIC to the physical NIC on the node through a bridge. This mode requires that the nodes are connected to the enterprise network directly. Instances obtain an IP address using DHCP, just as physical machines on the network do.

iii) Static

Static mode offers the Eucalyptus administrator more control over VM IP address assignment that System mode does. In this mode, the administrator configures Eucalyptus with a 'map' of MAC address/IP address pairs on CC.

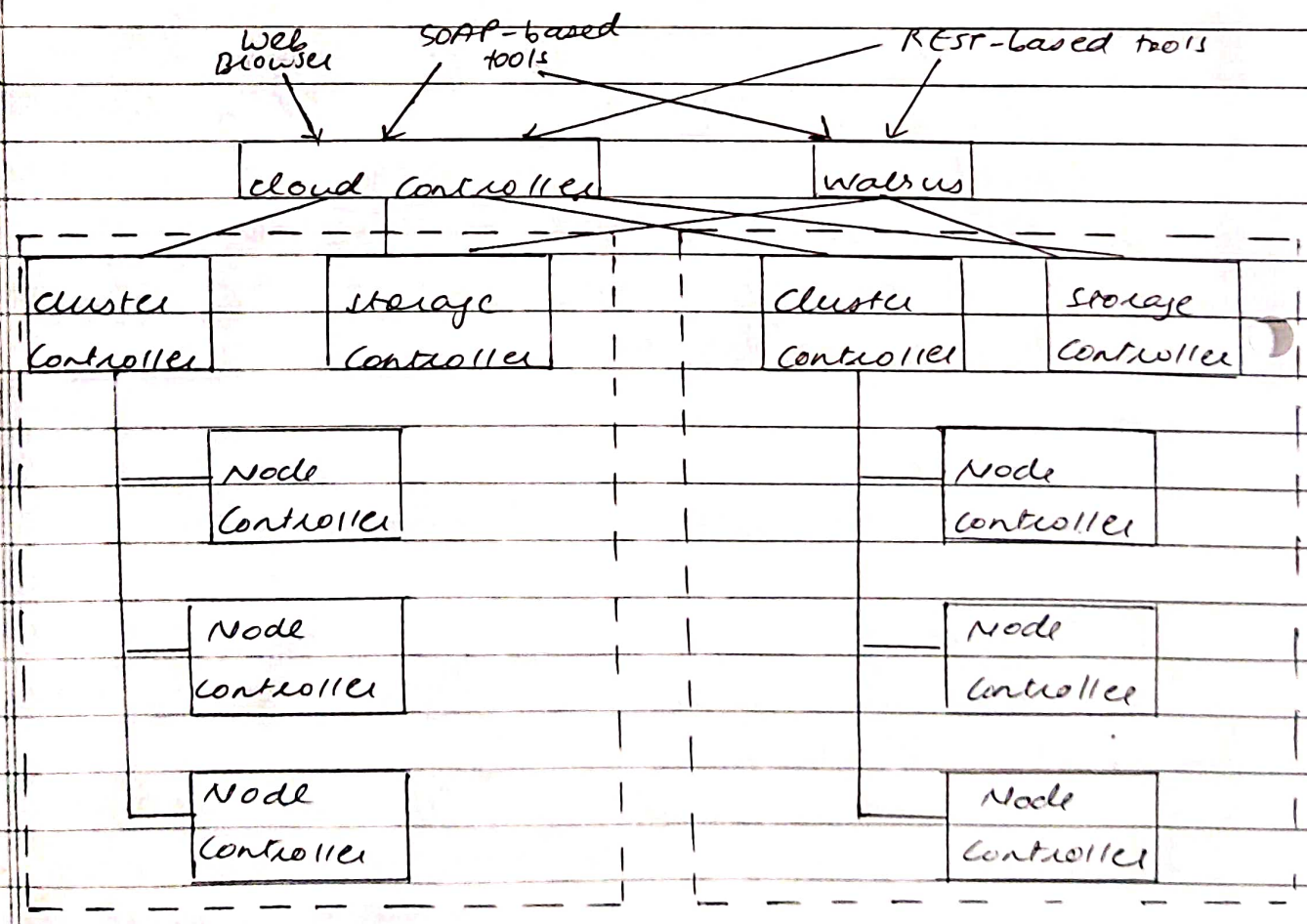
This mode is similar to "Bridged Networking" that hypervisors like VMware, VirtualBox etc. offer or like "tap" networking offered by

KVM / Qemu.

(iv) Managed NOVLAN

This mode is identical to MANAGED mode in terms of features (dynamic IPs and security groups), but does not provide VM network isolation. Eucalyptus administrators who want dynamic assignable IPs and the security groups, but are not in a position to run on a network that allows VLAN tagged packets or those who do not have a need for VM network isolation can use this mode.

4)



Eucalyptus Fundamental Architecture

Components of Eucalyptus

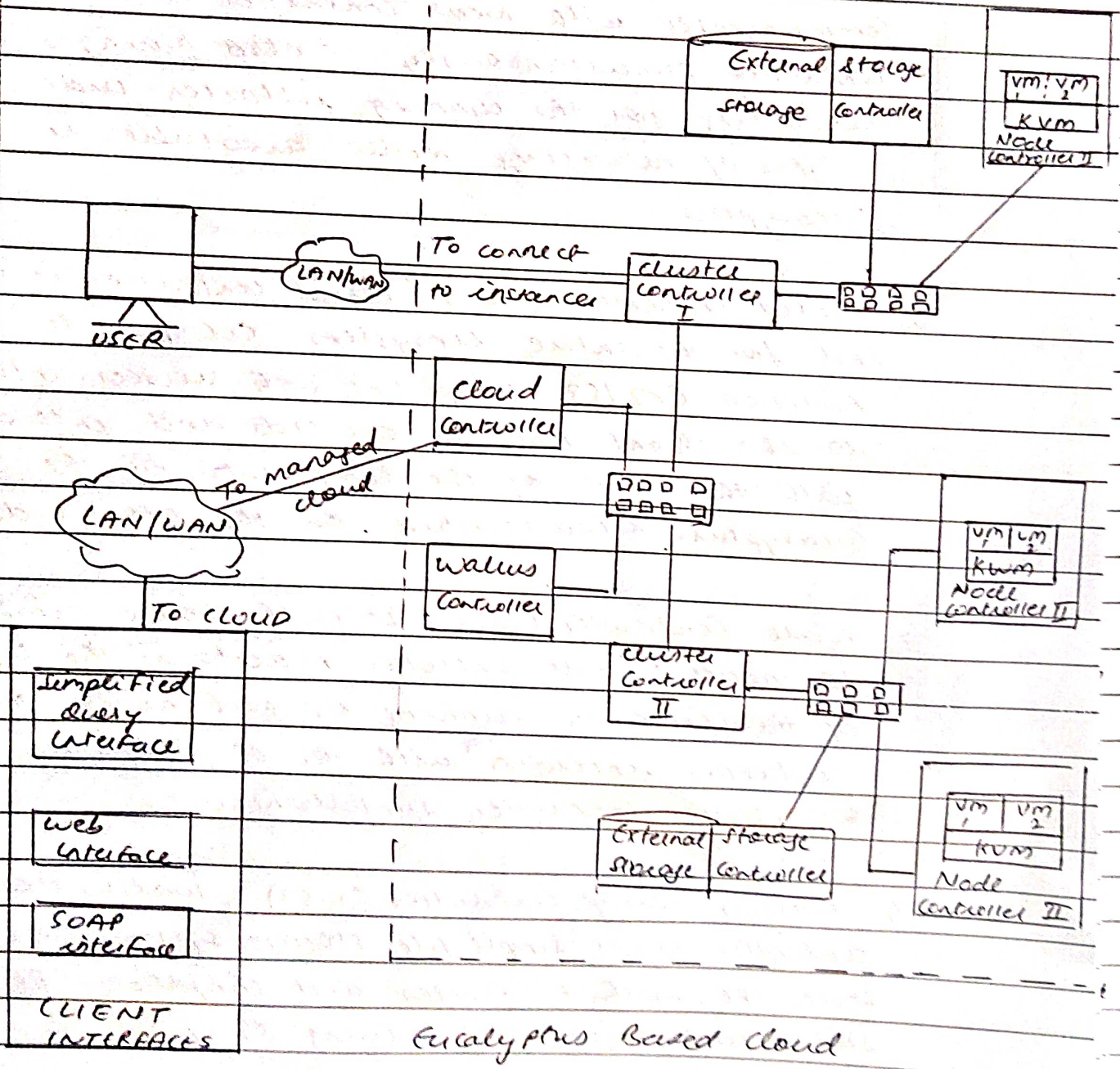
1. Cluster Controller (CC) : Cluster Controller manages the one or more Node Controller and responsible for deploying and managing instances on them. It communicates with Node Controller and Cloud Controller simultaneously. CC also manages the networking for the running instances under certain types of networking modes available in Eucalyptus.

2. Cloud Controller (CLC): Cloud controller is front end for the entire ecosystem. CLC provides an Amazon EC2/S3 compliant web services interface to the client tools on one side and interacts with the rest of the components of the Eucalyptus infrastructure on the other side.

3. Node Controller (NC) : It is the basic component for nodes. Node controller maintains the lifecycle of the instances running on each nodes. Node controller interacts with the OS, hypervisor and the cluster controller simultaneously.

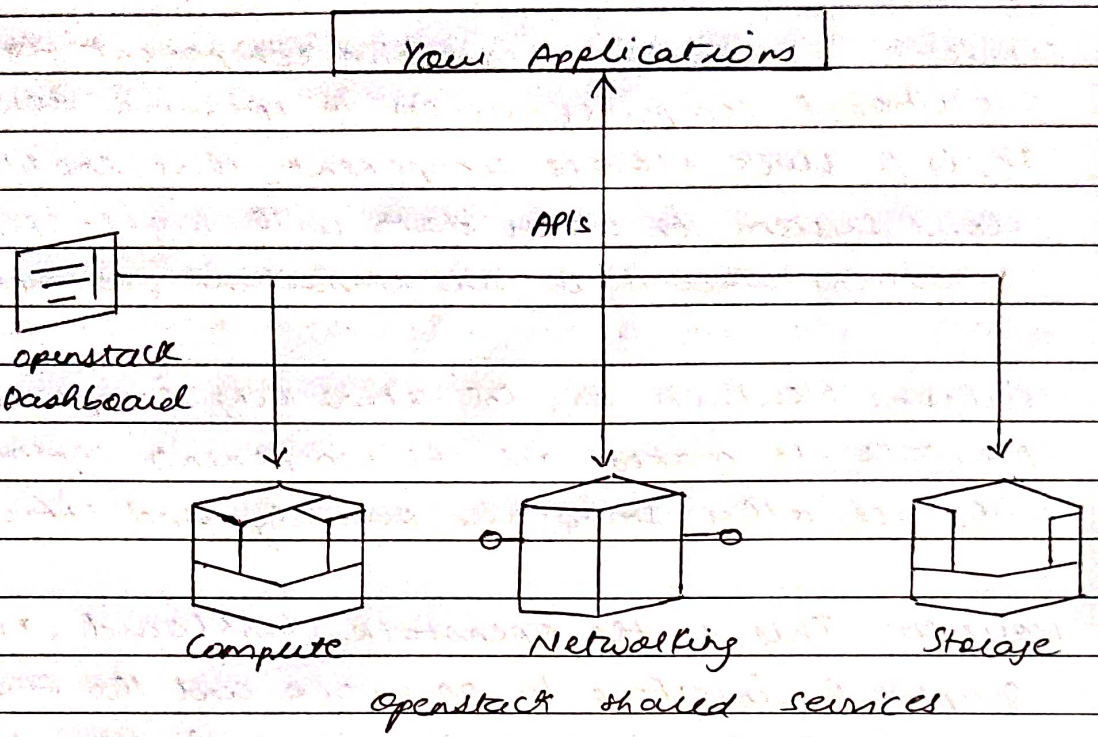
4. Walrus storage Controller (WS3) : Walrus storage controller is a simple file storage system. WS3 stores the machine images and snapshots. It also stores and serves files using S3 APIs

5. Storage controller (SC) allows the creation of snapshots of volumes. It provides persistent block storage over AoE or iSCSI to the instances.



Eucalyptus Based Cloud

5)



Following are the core components of Openstack

(1) Nova: This is the primary computing engine behind Openstack. This allows deploying and managing virtual machines and other instances to handle computing tasks

(2) Swift: The storage system for objects and files is referred to as swift. In the traditional storage systems, files are referred to a location on the disk drive, whereas in openstack swift files are referred to by a unique identifier and the swift is in charge where to store the files

(3) Cinder: This is the respective component to the traditional computer access to specific disc locations. It is a block storage component that enables the cloud system to access data with higher speed in situations when it is an important feature

(4) Neutron: Neutron is the networking component of openstack. It makes all the components communicate with each other smoothly, quickly and efficiently.

(5) Horizon: This is the openstack dashboard. It's the graphical interface to openstack and the first component that users starting with openstack will see.

(6) Glance: This is the component that provides image services or virtual copies of hard disks. Glance allows these images to be used as templates when deploying new virtual machine instances.

(7) Keystone: This is the component that provides identity services for openstack. Basically, this is a centralized list of all the users and their permissions for the services they use in the openstack cloud

(8) Ceilometer: Ceilometer provides data measurement services, thus enabling the cloud to offer billing services to individual users of the cloud. It measures system

usage by each user for each of the components of cloud and make reporting available

(9) Heat: Heat is the orchestration component of openstack, which allows developers to store the requirements of a cloud application in a file that defines what resources are necessary for that application. In this way, it helps to manage the infrastructure needed for a cloud service to run.

6)

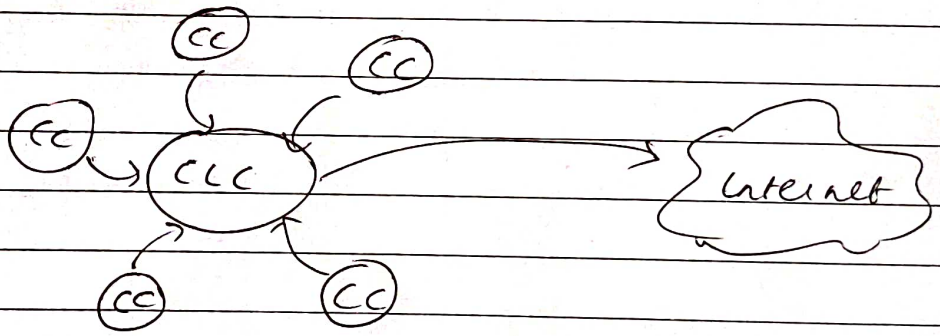
Eucalyptus cloud	Openstack cloud
- Eucalyptus is open source software for building private, AWS-compatible IT, QA, and developer clouds. It makes it easy to deliver cloud computing, just like AWS, from within your data center	- Openstack is a cloud operating system that controls large pools of compute, storage, and networking resources throughout a datacenter, all managed through a dashboard that gives administrators control while empowering their users to provision resources through a web interface
- Integrable tools with Eucalyptus are Amazon S3,	- Integrable tools with openstack cloud are Ansible, Terraform,

Amazon EC2, Amazon Route 53, Amazon DynamoDB etc	Rancher, Docker, Packer, Spinnaker, etc.
- Eucalyptus cloud was initially released on May 29, 2008 with stable version achieved on 30 Apr, 2018	- openstack was released on 21 Oct, 2010 with better stability
- Eucalyptus was written in Java, C	- openstack was written in Python
- Eucalyptus is open source for building private, AWS-compatible clouds	- openstack is open source software for building private and public clouds
- Companies using Eucalyptus include Sony, AppDynamics, etc	- Companies using Openstack include Hubspot, Wikipedia, surveymonkey, etc
- Eucalyptus is a smaller community	- Openstack has much larger community as compared to Eucalyptus

7) There are two modes of operation of openstack

Single Host Mode

- Network service based on a cluster controller
- cluster controller receives traffic from all compute nodes.
- cluster controller on receiving traffic forwards the traffic to internet
- Floating IPs and security groups are being hosted on cluster controller.



Limitations

Single point of failure: unavailability of cloud controller will stop the instances communicating on the network

Multi Host Mode

- A copy of the network is run on each of the compute nodes and these nodes are used as internet gateways
- Consumed by the instances that are running on each individual nodes

- Floating IPs and security groups are also hosted on those compute nodes for each instances.

Limitations

- Requires nodes to have public IP address for communicating over the internet. If not available unable to operate on this mode.