EUCALYPTUS

Elastic Utility Computing Architecture Linking Your Programs To Useful Systems

What is Eucalyptus

- Eucalyptus is open source software for building AWS-compatible private and hybrid clouds.
- It works as an orchestration layer between the hypervisor and the operating system.
- It is written in Java and C
- It can accessed through euca2ools API or Eucalyptus User Console GUI

History

- Started as a research project at University of California, Santa Barbara.
- The company was formed in 2009 with $5.5 million in funding by Benchmark Capital to commercialize the software.
- The co-founders of Eucalyptus were

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Dr. Dan Nurmi, Dr. Neil Soman,

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and Woody Rollins (CEO).

Introduction

- Eucalyptus is an open source cloud implementation for Linux based systems, which provides an EC2-compatible cloud computing platform and S3-compatible cloud storage platform.
- Eucalyptus brings powerful functionalities of Amazon EC2 into open source domain.
- It gives an Infrastructure as a Service (IaaS) solution.
- Eucalyptus was developed to support the high performance computing (HPC).
- Eucalyptus can be deployed without modification on all major Linux OS distributions, including Ubuntu, RHEL/CentOS, openSUSE, and Debian.

Components Of Eucalyptus

- Eucalyptus is comprised of six components:
- Cloud Controller (CLC)
- Walrus
- Cluster Controller (CC)
- Storage Controller (SC)
- Node Controller (NC)
- an optional VMware Broker (Broker or VB).
- Other than the VMware Broker, each component is a stand-alone web service.

Cloud Controller

- The Cloud Controller (CLC) is the entry-point into the cloud for administrators, developers, project managers, and end-users.
- As the interface to the management platform, the CLC is responsible for exposing and managing the underlying virtualized resources (servers, network, and storage).
- Web interfaces for administrators managing an infrastructure (such as images, users, groups, storage, network, and clusters)
- Web services interface (EC2/S3 compliant) for end users (e.g, client tools: euca2ools).

Cloud Controller (CLC) – functions

- It gathers information on the usage and availability of the resources in the cloud.
- It monitors the running instances.
- It monitors the availability of resources on various components of the cloud infrastructure.
- It queries other components for information about resources.
- It makes high level scheduling decisions.
- It makes requests to the cluster controller.

Walrus

- Walrus allows users to store persistent data, organized as buckets and objects.
- You can use Walrus to create, delete, and list buckets, or to put, get, and delete objects, or to set access control policies.
- Walrus equivalent to Amazon's Simple Storage Service (S3), providing a mechanism for storing and accessing virtual machine images and user data.
- **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.**

Cluster Controller

- The 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. A cluster is a collection of machines grouped together in the same network broadcast domain (Ethernet).
- CCs gather information about a set of NCs and schedules virtual machine (VM) execution on specific NCs.
- It provides connectivity to both the nodes running NCs and to the machine running the CLC.
  - Collects information on NCs, report it to CLC
- The CC also manages the virtual machine networks.

Storage Controller

- The Storage Controller (SC) provides functionality similar to the Amazon Elastic Block Store (Amazon EBS).
- The SC is capable of interfacing with various storage systems.
- Elastic block storage exports storage volumes that can be attached by a VM and mounted or accessed as a raw block device.
- EBS volumes persist past VM termination and are commonly used to store persistent data.
- **An EBS volume cannot be shared between VMs and can only be accessed within the same availability zone in which the VM is running.**
- Users can create snapshots from EBS volumes. Snapshots are stored in Walrus and made available across availability zones.

Node Controller

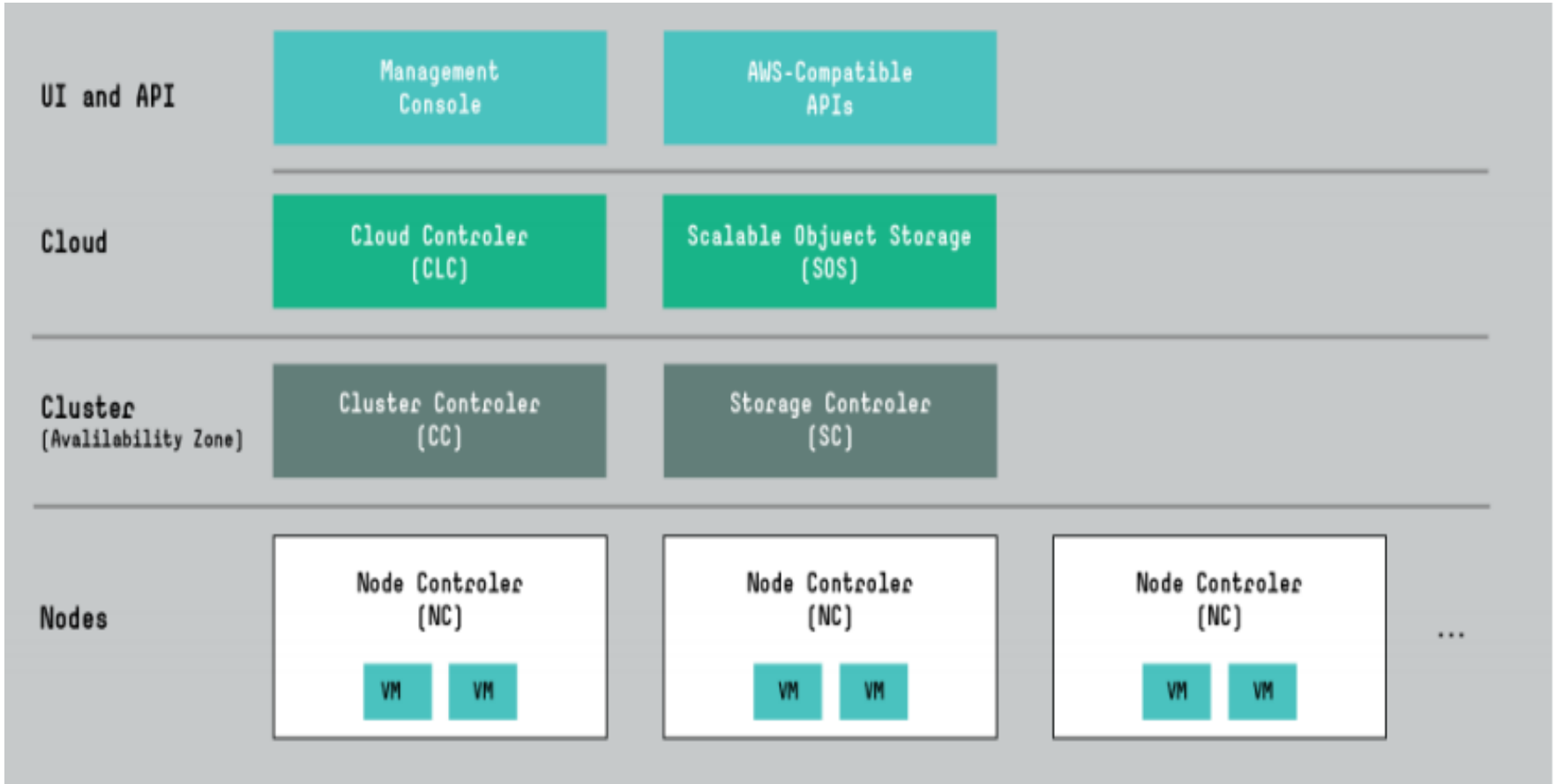
- The Node Controller (NC) executes on any machine that hosts VM instances.
- The NC controls VM activities, including the execution, inspection, and termination of VM instances.
- It also fetches and maintains a local cache of instance images, and it queries and controls the system software (host OS and the hypervisor) in response to queries and control requests from the CC(i.e., resource availability and utilization on the node and reporting the data to CC).
- The NC is also responsible for the management of the virtual network endpoint.

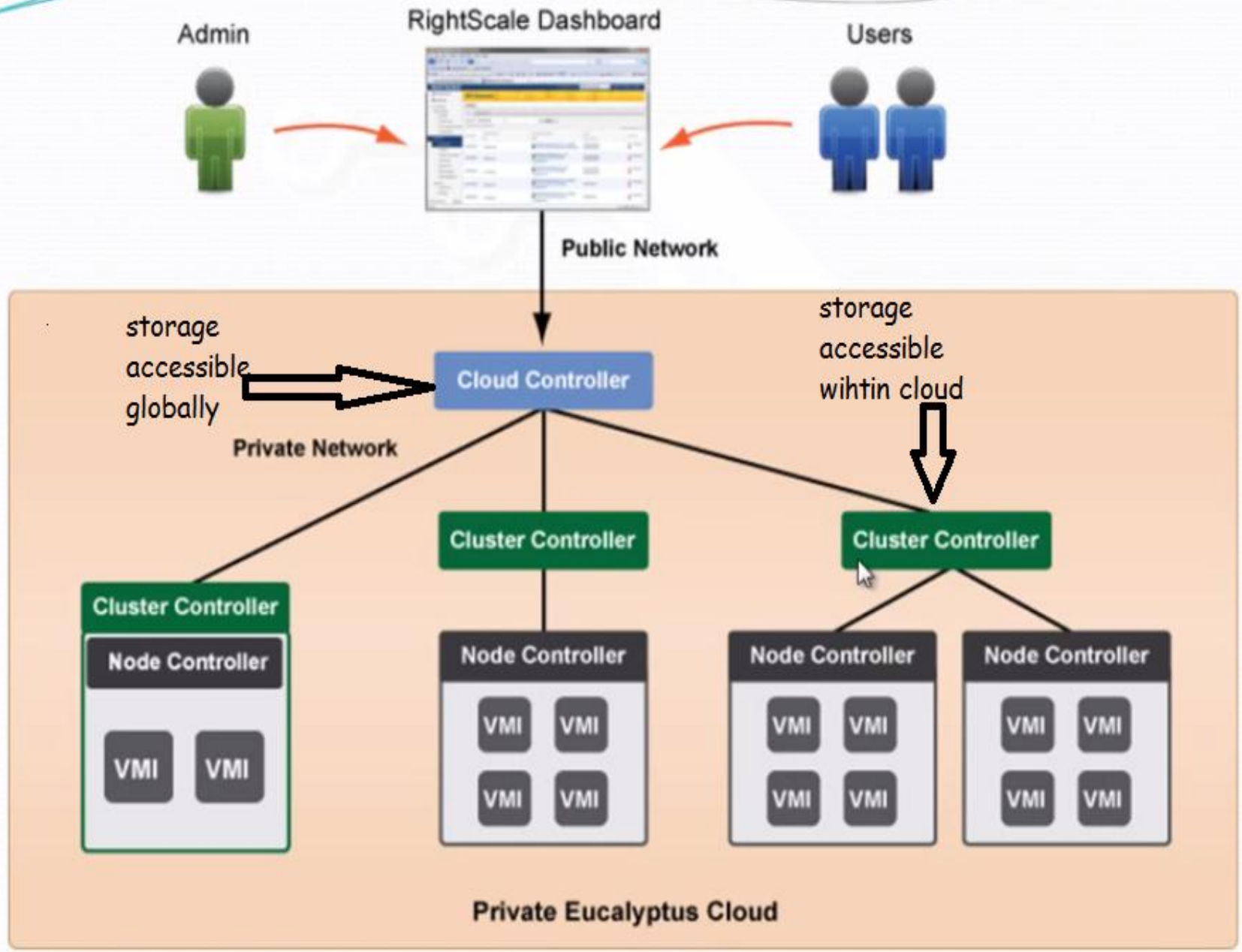
Characteristics

- **Open Source**
  - You can modify it
- **Modular**
  - each component has well-defined interfaces
- **Distributed**
  - Components can be on distributed locations
- **Flexible**
  - Can be installed on a very minimal setup
- **Scalable**
  - Can increase capacity of Cloud
- **Compatible**
  - with Amazon EC2 and S3
- **Supported hypervisors**
  - KVM and XEN

Architecture

- Eucalyptus is a scalable and distributed cloud platform made up of a number of core software components that provide the functionality for the cloud services.

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Public Network
storage
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Cloud Controller
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Private Eucalyptus Cloud

Advantages

- Deliver a self-service provisioning infrastructure to end-users who require instant access to compute and storage resources
- Dynamic resource pooling with built-in elasticity that allows organizations to automatically scale up or scale down virtual compute, network and storage resources based on demand
- Investment protection by integrating with your existing infrastructure
- Integrates into your existing architecture to ensure customer data security and availability
- Eucalyptus supports KVM based virtualization. This allows:
- No modification to guest OS images.
- Use of existing host Linux OS as hypervisor for VMs.

Features

- For implementing, managing and maintaining the virtual machines, network and storage Eucalyptus has variety of features.
- SSH Key Management
- Image Management
- Linux-based VM Management
- IP Address Management
- Security Group Management
- Volume and Snapshot Management
- Automatic virtual Instance Configurations
- Elastic pool of compute entities with fast provisioning

Features..

- Supports both Linux and Windows virtual machines (VMs).
- Application program interface- (API) compatible with Amazon EC2 platform.
- Compatible with Amazon Web Services (AWS) and Simple Storage Service (S3).
- Works with multiple hypervisors including VMware, Xen and KVM.
- Can be installed and deployed from source code and RPM packages.
- Internal processes communications are secured through SOAP and WS-Security.
- Multiple clusters can be virtualized as a single cloud.
- Administrative features such as user and group management and reports.

Advanced Features

- **Auto Scaling:** Allows application developers to scale Eucalyptus resources up or down based on policies defined using Amazon EC2-compatible APIs and tools
- **Elastic Load Balancing:** AWS-compatible service that provides greater fault tolerance for applications
- **Cloud Watch:** An AWS-compatible service that allows users to collect metrics, set alarms, identify trends, and take action to ensure applications run smoothly
- **Resource Tagging**: Fine-grained reporting for showback and chargeback scenarios; allows IT/ DevOps to build reports that show cloud utilization by application, department or user.
- **Expanded Instance Types:** Expanded set of instance types to more closely align to those available in Amazon EC2.
- **Maintenance Mode:** Allows for replication of a virtual machine's hard drive, evacuation of the server node and provides a maintenance window.

Security

- **All Eucalyptus components use WS-security for authentication**
  - Encryption of inter-component communication is not enabled by default
    - Configuration option
- **Ssh key generation and installation ala EC2 is implemented**
  - Cloud controller generates the public/private key pairs and installs them
- **User sign-up is web based**
  - User specifies a password and submits sign-up request
  - Cert. is generated but withheld until admin. approves request
  - User gains access to cert. through password-protected web page
    - Similar to EC2 model without the credit cards

Functionalities

- Eucalyptus commands can manage either Amazon or Eucalyptus instances.
- The Eucalyptus User Console provides an interface for users to self-service provision and configure compute, network, and storage resources.
- Access to virtual instances is available using familiar SSH and RDP mechanisms.
- Virtual instances with application configuration can be stopped and restarted using encrypted boot from EBS capability.
- IaaS service components are configurable as redundant systems that are resilient to multiple types of failures.
- Management state of the cloud machine is preserved and reverted to normal operating conditions in the event of a hardware or software failure.

Functionalities..

- Users can build a library of Eucalyptus Machine Images (EMIs) with application metadata that are decoupled from infrastructure details to allow them to run on Eucalyptus clouds.
- Amazon Machine Images are also compatible with Eucalyptus clouds. VMware Images and vApps can be converted to run on Eucalyptus clouds and AWS public clouds.
- Eucalyptus user identity management can be integrated with existing Microsoft Active Directory or LDAP systems to have fine-grained role based access control over cloud resources.
- Eucalyptus Machine Images can be backed by EBS-like persistent storage volumes, improving the performance of image launch time and enabling fully persistent virtual machine instances.

Applications..

- Eucalyptus supports storage area network devices to take advantage of storage arrays to improve performance and reliability.
- Eucalyptus also supports direct-attached storage.
- Eucalyptus can run multiple versions of Windows and Linux virtual machine images.
- Users can also move instances between a Eucalyptus private cloud and the Amazon Elastic Compute Cloud to create a hybrid cloud.

Amazon Web Services (AWS) and Eucalyptus Partner to Bring Additional Compatibility Between AWS and On-premises IT Environments

- As per the agreement that enables customers to more efficiently migrate workloads between their existing data centers and AWS while using the same management tools and skills across both environments. As part of this agreement, AWS will support Eucalyptus as they continue to extend compatibility with AWS APIs and customer use cases. Customers can run applications in their existing datacenters that are compatible with popular Amazon Web Services such as Amazon Elastic Compute Cloud (Amazon EC2) and Amazon Simple Storage Service (Amazon S3).

Challenges

- **Extensibility**
  - Simple architecture and open internal APIs
- **Client-side interface**
  - modular design so that its compatible with EC2 and other clouds
- **Networking**
  - Virtual private network per cloud
- **Security**
  - Must be compatible with local security policies
- **Packaging, installation, maintenance**
  - system administration staff is an important constituency for uptake

thank you!