

The logo features a stylized letter 'E' composed of three horizontal bars. The top and bottom bars are white, while the middle bar is a vibrant lime green. This 'E' is enclosed within a white square frame that has a slightly offset, layered appearance.

# EUCALYPTUS

**OPEN SOURCE CLOUD COMPUTING SYSTEM**



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# IaaS Platforms

## Commercial:

|                 |                |
|-----------------|----------------|
| Amazon AWS      | IBM Smartcloud |
| Microsoft Azure | HP Cloud       |
| Rackspace cloud | GoGrid         |

## Open Source:

|             |             |
|-------------|-------------|
| Eucalyptus  | Nimbus      |
| Open Nebula | Enomaly     |
| Open Stack  | Cloud Stack |



# 1. Introduction

## Elastic Utility Computing Architecture Linking Your Programs To Useful Systems

- Eucalyptus is open source software for building AWS-compatible private and hybrid clouds.
- Eucalyptus was first developed at the University of California, Santa Barbara in 2007 and has since been adopted by organizations such as NASA, the US Army, and the European Space Agency.
- It provides an Infrastructure-as-a-Service (IaaS) layer that allows users to create and manage virtual machines on their own hardware giving them complete control over their infrastructure and data or in public cloud environments such as Amazon Web Services (AWS).
- Eucalyptus has been used in a variety of high performance computing applications, including scientific computing, big data analytics, and web hosting.



# Eucalyptus 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



## 2. Deployment Models & Services

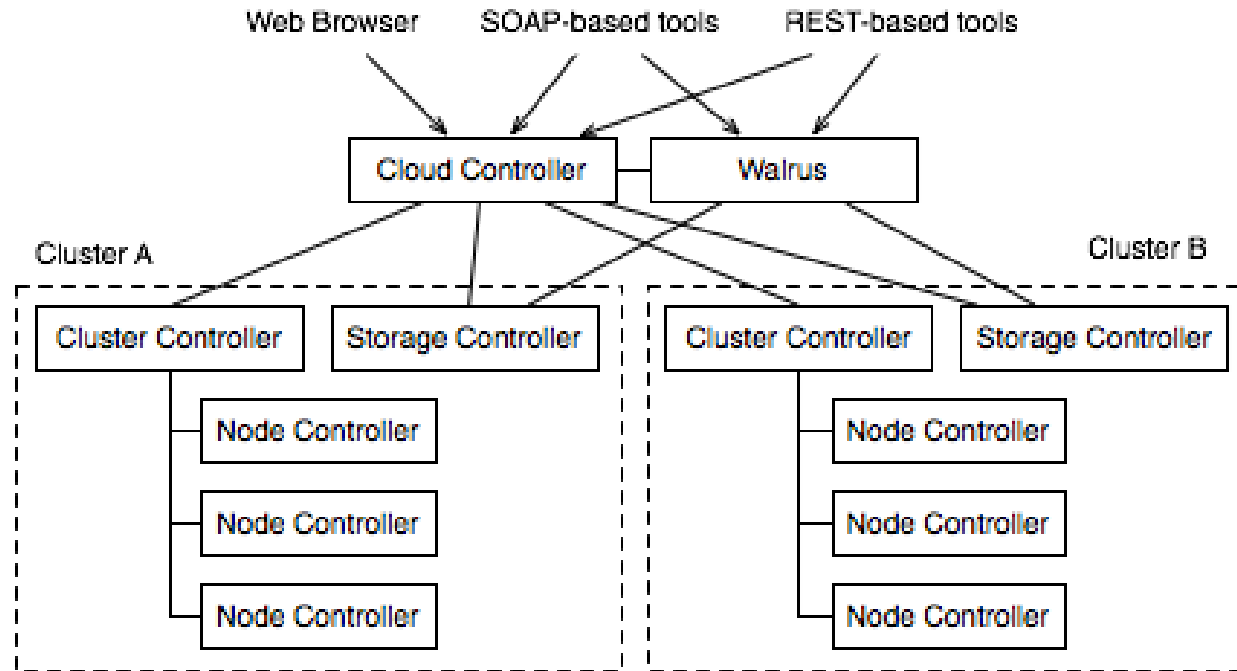
### Deployment Models-

- **Private Cloud:** With Eucalyptus, organizations can create their own private cloud on their own hardware, providing complete control over the infrastructure and data.
- **Public Cloud:** Eucalyptus can be used as a public cloud platform, allowing organizations to provide cloud services to external customers.
- **Hybrid Cloud:** Eucalyptus allows organizations to create a hybrid cloud that spans both private and public cloud environments, giving them the flexibility to use the cloud resources that best suit their needs.

## Services:

- **Elastic Block Storage (EBS):** Eucalyptus offers elastic block storage that allows users to create and manage persistent block storage volumes that can be attached to virtual machines.
- **Object Storage:** Eucalyptus provides object storage that enables users to store and retrieve large amounts of unstructured data.
- **Identity and Access Management (IAM):** Eucalyptus offers IAM services that allow users to manage access to cloud resources.
- **Load Balancing:** Eucalyptus provides load balancing services that enable users to distribute traffic across multiple instances to improve application availability and scalability.
- **Auto Scaling:** Eucalyptus offers auto scaling that allows users to automatically adjust the number of instances based on demand.
- **CloudWatch:** Eucalyptus provides CloudWatch services that allow users to monitor their cloud resources and applications in real-time.

### 3. Architecture



**Modes of operation:** Eucalyptus supports four modes of operation in its networking configuration: static mode, managed mode, managed (noVLAN) mode & system mode.



## 4. Components of Eucalyptus:

- **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.
- **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.
- **Node Controller (NC):** It is the basic component for Nodes. Node controller maintains the life cycle of the instances running on each nodes. Node Controller interacts with the OS, hypervisor and the Cluster Controller simultaneously.
- **Walrus Storage Controller (WS3):** Walrus Storage Controller is a simple file storage system. WS3 stores the the machine images and snapshots. It also stores and serves files using S3 APIs.
- **Storage Controller (SC):** Allows the creation of snapshots of volumes. It provides persistent block storage over AoE or iSCSI to the instances.



## 5. Case Study

**Company:** Tohoku University

**Industry:** Education and Research

**Challenge:** Tohoku University is one of Japan's largest national universities, with over 17,000 students and 6,000 staff members across multiple campuses.

- The university needed a cloud computing platform that would allow researchers to conduct large-scale simulations and analyses while ensuring data security and privacy.

**Solution:** Tohoku University chose Eucalyptus as its cloud computing platform because it offered a private cloud solution that could be hosted on the university's own infrastructure.

- The university deployed Eucalyptus on a cluster of over 300 servers and integrated it with their existing research infrastructure.



## Results:

- Eucalyptus has enabled Tohoku University to provide researchers with a highly scalable, cost-effective, and secure cloud computing platform.
- Researchers can now conduct large-scale simulations and analyses without having to invest in expensive hardware and software.
- Eucalyptus has also improved collaboration between researchers by providing a centralized platform for data sharing and analysis.

Overall, Eucalyptus has helped Tohoku University to accelerate research and innovation while reducing costs and ensuring data security and privacy.



## 6. Advantages & Disadvantages

### Advantages of Eucalyptus:

- **Compatibility with AWS API:** Eucalyptus is fully compatible with the AWS API, which means that existing AWS applications and tools can be used with Eucalyptus without any modifications.
- **Private and Hybrid Cloud Support:** Eucalyptus allows organizations to create their private clouds on their own hardware, giving them complete control over their infrastructure and data.
- **Open-Source:** Eucalyptus is open-source software released under the GNU General Public License (GPL), which means that it is free to use and modify.
- **Scalability:** Eucalyptus is highly scalable and can support thousands of virtual machines and hundreds of physical hosts.
- **Active Community:** Eucalyptus is actively maintained and developed by a community of contributors, making it a reliable and robust cloud computing platform.



## Disadvantages of Eucalyptus:

- **Limited Service Offering:** Eucalyptus provides a limited set of services compared to other cloud platforms like AWS and Azure.
- **Complexity:** Eucalyptus can be complex to set up and manage, especially for organizations without a dedicated IT team or cloud expertise.
- **Compatibility with Non-AWS Platforms:** Although Eucalyptus is compatible with the AWS API, it may not be compatible with other non-AWS cloud platforms, limiting its interoperability.
- **Limited Commercial Support:** Eucalyptus has limited commercial support compared to other cloud platforms, which can be a concern for some organizations.
- **Market Share:** Eucalyptus has a relatively small market share compared to commercial cloud platforms such as AWS and Microsoft Azure. This may limit the availability of support and resources.



## 7. Summary

- Eucalyptus is an open-source cloud computing platform that offers a range of deployment models and services, including private, hybrid, and public clouds, as well as Infrastructure as a Service (IaaS), Elastic Block Storage (EBS), object storage, Identity and Access Management (IAM), load balancing, auto scaling, and CloudWatch.
- Its compatibility with the AWS API and open-source licensing make it an attractive option for organizations looking for a flexible and cost-effective cloud solution.
- However, its limitations in terms of market share, complexity, and service offerings may make it less suitable for some organizations.
- A recent case study of Tohoku University showed how Eucalyptus was able to provide a scalable, cost-effective, and secure cloud computing platform for researchers to conduct large-scale simulations and analyses.