Cloud Comparison

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El Centro College
public iaaS

- Amazon Web Services
- CloudStack
- Eucalyptus
- OpenStack

private iaaS
<table>
<thead>
<tr>
<th>Feature</th>
<th>CloudStack</th>
<th>Eucalyptus</th>
<th>OpenStack</th>
</tr>
</thead>
<tbody>
<tr>
<td>Architecture</td>
<td>Monolithic</td>
<td>5 part, AWS</td>
<td>Fragments</td>
</tr>
<tr>
<td>Installation</td>
<td>Medium</td>
<td>Medium</td>
<td>Difficult</td>
</tr>
<tr>
<td>Administration</td>
<td>UI, EC2 CLI</td>
<td>EC2 CLI</td>
<td>Multi CLI</td>
</tr>
<tr>
<td>Security</td>
<td>Baseline</td>
<td>Registered</td>
<td>Keystone</td>
</tr>
<tr>
<td>High Availability</td>
<td>LB multi</td>
<td>2x failover</td>
<td>Swift only</td>
</tr>
</tbody>
</table>
Openstack: is an Open Source solution where all of it's components are either core components or formerly incubated then integrated as part of the official product.

These components perform different functions at various levels such as compute, controller, dashboard, networking, and so forth.

It's modular design allows for third parties to provide other components which can perform functionalities outside of the core functionalities.
OpenStack installation

Build physical network, storage nodes, hypervisors

KEYSTONE setup
Install keystone, reconfigure from sqlite to mysql
Manually create keystore database, init the service
Define tenants, users, roles; run keystone-init.py
Define swift filter in keystone.conf
Populate keystore service catalog from database
Verify keystore with openssl

GLANCE setup
Install glance, reconfigure from sqlite to mysql
Manually create glance database
Configure glance-api-paste.ini, glance-registry.conf
Populate glance database, restart services
Verify glance by uploading a test image

NOVA setup
Install nova and dependencies
Manually create nova database
Configure hypervisor, database, keystone in nova.conf
Populate nova database, restart services
Create nova network bridge interface for guest vms
Configure opensrc file with CLI credentials
Download real vm image, upload to glance registry
Define security group, keypair, start an instance

SWIFT STORAGE setup
Do the following for each storage node.
Install swift account, container, object
Make XFS filesystem on each disk partition
Configure rsysq
Configure swift account, container, object servers
Start storage services

SWIFT PROXY setup
Install swift proxy
Create SSL certificate
Configure memcached to listen on proxy local ip address
Configure keystone admin token
Create proxy server.conf
Run swift ring builder for account, container, object
Enumerate storage devices on each ring
Verify and rebalance the rings
Start proxy services

HORIZON setup
Install apache and horizon dashboard
Manually create horizon database
Populate horizon database
Restart services
Networking in OpenStack ...

I DON'T ALWAYS USE SDN

BUT WHEN I DO, I USE IT WITH NEUTRON
Along Came Neutron
1. OpenStack has the largest total population, followed by Eucalyptus, CloudStack, and OpenNebula;

2. OpenStack has the largest active population during the past quarter, followed by CloudStack, Eucalyptus, and OpenNebula;

3. OpenStack has the largest active population during the past month, followed by CloudStack, Eucalyptus, and OpenNebula.
IBM SmartCloud delivered by public, private or hybrid models

Cloud services and workloads
- Software as a Service (SaaS)
- Platform as a Service (PaaS)
- Infrastructure as a Service (IaaS)

Cloud management
- Provision, monitor, schedule, track and bill.

Virtualization
- Hypervisors, virtual servers and virtual networking.

Physical hardware
- Servers, storage and networking.

Strategy, security, design and implementation consulting
OpenStack services

horizon

rabbit-mq
- nova-api
- nova-compute
- nova-volume
- nova-network
- nova-scheduler

rdbms

hypervisor
- VM
- swift-account
- VM
- swift-container
- VM
- swift-object
- VM
- swift-proxy
- VM
- glance-control
- VM
- glance-registry

keystone: identity, token, catalog, policy
OpenNebula:

A solution that is designed to be an Open Source alternative to VMWare's VCenter and targeted at enterprise users.

Unlike Openstack, all of its components comes as a single unit akin to that VCenter.
Service Model

- Pets are given names like `pussinboots.cern.ch`
- They are unique, lovingly hand raised and cared for
- When they get ill, you nurse them back to health

- Cattle are given numbers like `vm0042.cern.ch`
- They are almost identical to other cattle
- When they get ill, you get another one

- Future application architectures should use Cattle but Pets with strong configuration management are viable and still needed
OpenStack has been the poster child for open source cloud computing for more than a year now but the bandwagon has some challenges.
Openstack has the biggest momentum currently because of the large number of vendor participation.

While OpenNebula is an open-source effort focused on user needs, OpenStack is a vendor-driven effort.
A Look To the Future

OpenStack to further fragment into more vendor specific “stacks”

with narrow test matrices and extended proprietary features that lock customers in and don’t interoperate well. OpenStack’s biggest success is marketing. These vendor “stacks” and cloud providers will continue marketing “OpenStack” as the primary and, in most cases only, differentiator.
OpenStack penetration in the market is relatively small compared with the investment made by vendors and Vcs.

These vendor specific “stacks” are not only competing with OpenNebula, other open-source cloud management platforms like CloudStack and Eucalyptus, and proprietary incumbents, they are also competing between them and with the open source community itself.
Any organization interested in using OpenStack, and requiring commercial support and enterprise maturity, is recommended (by the vendors running the project) to deploy any of the several enterprise distributions.
CloudStack high availability
DevStack

Devstack, like openstack, is a living breathing project and like most projects undergoing active development, it has bugs and issues.

You can always run the latest and greatest devstack code (the ‘master’ branch) but you risk encountering whatever issues the Openstack developers just ran into. Running from a stable branch makes sense for most cases.
From architecture perspective, Cloudstack is a monolithic application, whereas Eucalyptus and Openstack is split into multiple smaller application pieces.

For example, Openstack is split into Compute(Nova), Object storage(Swift), Network(Quantum), Authentication(Keystone), Image management(Glance), front-end(Horizon).
CloudStack installation

Build physical network, storage nodes, hypervisors

Unzip cloudstack .tar.gz, run install.sh
(yum install cloudstack mysql)

Cloud-bridge RPM

Set up NFS shares (primary/secondary storage)

Download system & user templates

Database schema setup

UI-based cloud launch

See also http://www.bizalgo.com/2012/07/08/making-cloudstack-quick-install-quicker/
CloudBridge (awsapi) -> CloudStack REST API

ec2 API script

```
ec2-add-keypair mykey
ec2-add-group grp1
ec2-authorize grp1 -P tcp -p 22 -s 0.0.0.0/0
ec2-run-instances ami-123456 --instance-count 1
    --instance-type m1.small --key mykey --group grp1
```

CloudStack REST API commands:

```
?comand=createSSHKeyPair&name=mykey
?comand=createSecurityGroup&name=grp1
?comand=authorizeSecurityGroupIngress
    &securitygroupname=grp1
    &startport=22&endpoint=22&cidrList=0.0.0.0/0
?comand=deployVirtualMachine
    &serviceofferingid=m1smallid&templateid=ami123456id
    &zoneid=1&keypair=mykey&group=grp1
```
<table>
<thead>
<tr>
<th></th>
<th>CloudStack</th>
</tr>
</thead>
<tbody>
<tr>
<td>Architecture</td>
<td>Monolithic controller. Datacenter model, not object storage.</td>
</tr>
<tr>
<td>Installation</td>
<td>Fewest parts to install. RPM needed.</td>
</tr>
<tr>
<td>Administration</td>
<td>Good web UI; a belated script CLI</td>
</tr>
<tr>
<td>Security</td>
<td>Baseline vlan/firewall vm protection</td>
</tr>
<tr>
<td>High Availability</td>
<td>Load-balanced multi-node controller</td>
</tr>
</tbody>
</table>
CloudStack high availability
OpenNebula is made for users by users,

OpenStack is made for vendors by vendors.
ec2 API script

CloudBridge (awsapi)

CloudStack REST API

```
ec2-add-keypair mykey
ec2-add-group grp1
ec2-authorize grp1 -P tcp -p 22 -s 0.0.0.0/0
ec2-run-instances ami-123456 --instance-count 1
--instance-type m1.small --key mykey --group grp1

?command=createSSHKeyPair&name=mykey
?command=createSecurityGroup&name=grp1
?command=authorizeSecurityGroupIngress
&securitygroupname=grp1
&startport=22&endport=22&cidrList=0.0.0.0/0
?command=deployVirtualMachine
&serviceofferingid=m1smallid&templateid=ami123456id
&zoneid=1&keypair=mykey&group=grp1
```
Roadmap Definition

OpenNebula roadmap is completely driven by users needs with features that meet real demands, and not features that result from an agreement among the different vendors participating in the management board of the project.
**Internal Organization.** While OpenStack comprises many different subprojects (14 at the time of writing this post) aimed at building the different subsystems in a cloud infrastructure, OpenNebula offers a single integrated, comprehensive management platform for all cloud subsystems.
<table>
<thead>
<tr>
<th>Orchestration-based</th>
<th>Policy-based</th>
<th>Design for Fail</th>
</tr>
</thead>
<tbody>
<tr>
<td>PaaS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IaaS</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Cloud Foundry
- Heroku
- Azure
- Amazon Web Services
- vCloud Director
- OpenStack
- BmcSoftware
- Hp
- Microsoft System Center
- Nimbula
there is room in the market for several open-source CMPs that, addressing different cloud niches, will fit together into a broad open cloud ecosystem.
OpenStack and OpenNebula:

Open-source Project Models

Both projects release code under the liberal Apache 2.0 license, follow a transparent development process with a public roadmap, and have the same license agreement for new contributions.
OpenNebula is made for users by users,
OpenStack is made for vendors by vendors.
OpenNebula Users in Technology
Different Cloud Models
Although there are as many ways to understand cloud computing as there are organizations planning to build a cloud, they mostly fall between two extreme cloud models:
Enterprise Cloud Model
(Datacenter Virtualization): On one side, there are businesses that understand cloud as an extension of virtualization in the datacenter; hence looking for a VMware vCloud-like infrastructure automation tool to orchestrate and simplify the management of the virtualized resources.
Public Cloud Model
(Infrastructure Provision): On the other side, there are businesses that understand cloud as an AWS-like cloud on-premise; hence looking for a provisioning tool to supply virtualized resources on-demand.
OpenNebula:

... is a single enterprise-ready open-source product, easy to install and operate, with a single installing and updating process, a one-stop community and a long-term commercial support.

Any organization can use the open-source distribution to build a production cloud, and receive best-effort support through the community mailing list. Additionally, any organization can purchase commercial support directly from the developers.
OpenStack comprises many subprojects with different levels maturity that require complex integration to achieve a functional cloud infrastructure. No update path is provided if you want to install a new version, and there is not commercial support.
A growing number of components and subprojects is making even more difficult their integration and coordination, and the delivery of a single coherent solution.
CloudStack high availability

Load balanced multi-node Management Server

Replicated database for disaster recovery
Eucalyptus tries to mimic AWS api as much as possible. Amazon and Eucalyptus have partnership agreement as well.

Folks going to Eucalyptus have advantage of moving to hybrid clouds easily since same api/cli can work both in Eucalyptus private cloud and AWS public cloud.

Cloudstack also has a conversion layer to convert AWS api to cloudstack api.
Eucalyptus high availability

Failover, NOT load balancing
Eight controller machines at cloud/cluster level
Storage redundancy relies on SAN vendor
Arbitrators monitor connectivity to CLC, Walrus, CC
Web UI does NOT control guest instances!

Use euca2ools CLI instead.

(Or RightScale/enStratus)
<table>
<thead>
<tr>
<th></th>
<th>Eucalyptus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Architecture</td>
<td>Five main components. AWS clone</td>
</tr>
<tr>
<td>Installation</td>
<td>Nice RPM/DEB, still medium effort</td>
</tr>
<tr>
<td>Administration</td>
<td>Strong CLI compatible with EC2 API</td>
</tr>
<tr>
<td>Security</td>
<td>Baseline + component registration</td>
</tr>
<tr>
<td>High Availability</td>
<td>Primary/secondary component failover</td>
</tr>
</tbody>
</table>
Eucalyptus FastStart

The One-Line Install
Run this command on your CentOS 6.5 minimal server
bash <(curl -Ls eucalyptus.com/install)
Version 4.0.2 (Released: 2014-10-20)
Increase the size of your cloud. Just run this command on
additional CentOS 6.5 minimal servers
bash <(curl -Ls eucalyptus.com/install-nc)
Version 4.0.2 (Released: 2014-10-20)
With Eucalyptus, quickly bring products to production and realize an immediate return on investment.
Eucalyptus installation

Build physical network, storage nodes, hypervisors

Open firewall ports on cloud component nodes
  (CLC to Walrus, CC to NC, etc)

Setup yum/dpkg repositories (eucalyptus.repo)

RPM/apt-get installation of eucalyptus components

Configure eucalyptus.conf

euca_conf: create postgres db

Register components and arbitrators

HA: configure DRBD
Eucalyptus high availability

Primary/secondary CLC, Walrus, SC, CC

NC and VM instances are disposable
Eucalyptus security

The CloudStack baseline
(VLAN, API PKI, VM SSH)

...and...

Component registration
(since not monolithic)
<table>
<thead>
<tr>
<th>Storage Type</th>
<th>Eucalyptus Feature</th>
<th>AWS Feature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Object storage</td>
<td>Walrus</td>
<td>S3</td>
</tr>
<tr>
<td>Block storage</td>
<td>Storage Controller (SC)</td>
<td>Elastic Block Storage (EBS)</td>
</tr>
<tr>
<td>Command line scripts</td>
<td>euca2ools</td>
<td>EC2 API tools</td>
</tr>
</tbody>
</table>
Eucalyptus high availability

Primary/secondary CLC, Walrus, SC, CC

LDAP / AD

CLC

Walrus

SAN / NAS

SAN / NAS

SC

CC

NC

NC

NC

NC

VM

VM

VM

NC and VM instances are disposable

BUSINESS ALGORITHMS
OwnCloud / Demo

- Private cloud file storage system
- Keeps your files in sync between all of your computers
- Remote / mobile access to your internal file servers
- Share files with your co-workers for customers
- Cloud that is secure, private and owned by you
- Open-Source = no software licenses to buy
- Works with iPhone, Android, iPad, PC & Mac
Stack Wars