OpenStack

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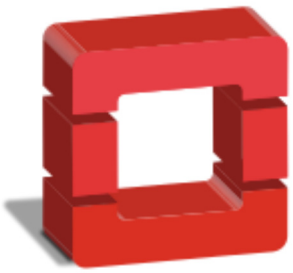
OpenStack is a free and open-source cloud-computing software platform.[2] Users primarily deploy it as an infrastructure-as-a-service (IaaS). The technology consists of a group of interrelated projects that control pools of processing, storage, and networking resources throughout a data center—which users manage through a web-based dashboard, through command-line tools, or through a RESTful API. OpenStack.org released it under the terms of the Apache License.

OpenStack began in 2010 as a joint project of Rackspace Hosting and of NASA. As of 2015 it is managed by the OpenStack Foundation, a non-profit corporate entity established in September 2012[3] to promote OpenStack software and its community.[4] More than 500 companies have joined the project, including AppFormix, Arista Networks, AT&T, AMD, Avaya, Canonical, Cisco, Citrix, Comcast, Dell, Dreamhost, EMC, Ericsson, Fujitsu, Go Daddy, Google, Hewlett-Packard, Hitachi Data Systems, Huawei, IBM, Intel, Internap, Juniper Networks, Mellanox, Mirantis, NEC, NetApp, Nexenta, Oracle, PLUMgrid, Pure Storage, Qosmos, Red Hat, SolidFire, SUSE Linux, VMware, VMTurbo and Yahoo!.[5][6][7][8][9][10][11][12][13] [14]

OpenStack



Stable release	Kilo (2015.1.0)[1] / 30 April 2015
Written in	Python
Operating system	Cross-platform
Type	Cloud computing
License	Apache License 2.0
Website	openstack.org (http://openstack.org/)

The OpenStack community collaborates around a six-month, time-based release cycle with frequent development milestones.[15] During the planning phase of each release, the community gathers for an OpenStack Design Summit to facilitate developer working-sessions and to assemble plans.[16]

Recent OpenStack Summits have taken place in Vancouver in May 2015[17] and in Paris in November 2014.[18] The summit in May 2014 in Atlanta drew 4,500 attendees — a 50% increase from the Hong Kong Summit six months earlier.[19][20]

Contents

History

In July 2010, Rackspace Hosting and NASA jointly launched an open-source cloud-software initiative known as OpenStack. The OpenStack project intended to help organizations offer cloud-computing services running on standard hardware. The community's first official release, code-named Austin, appeared four months later, with plans to release regular updates of the software every few months. The early code came from NASA's Nebula platform as well as from Rackspace's Cloud Files platform.

NASA's Nebula platform

In 2011, developers of the Ubuntu Linux distribution adopted OpenStack[21] with an unsupported technology preview of the OpenStack "Bexar" release for Ubuntu 11.04 "Natty Narwhal".[22] Ubuntu's sponsor Canonical then introduced full support for OpenStack clouds, starting with OpenStack's Cactus release.

OpenStack became available in Debian Sid from the Openstack "Cactus" release in 2011, and the first release of Debian including OpenStack was Debian 7.0 (code name "Wheezy"), including OpenStack 2012.1 (code name: "Essex").[23][24]

In 2012, Red Hat announced a preview of their OpenStack distribution,[25] beginning

with the "Essex" release. After another preview release, Red Hat introduced commercial support for OpenStack with the "Grizzly" release, in July 2013.[26]

In July 2013, NASA released an internal audit citing lack of technical progress and other factors as the agency's primary reason for dropping out as an active developer of the project and instead focus on the use of public clouds.[27] This report is contradicted in part by remarks made by Ames Research Center CIO, Ray Obrien.[28]

In December 2013, Oracle announced it had joined OpenStack as a Sponsor and planned to bring OpenStack to Oracle Solaris, Oracle Linux, and many of its products.[29] It followed by announcing Oracle OpenStack distributions for Oracle Solaris [30][31] and for Oracle Linux using Icehouse on 24 September 2014.[32]

In May 2014, HP announced HP Helion and released a preview of HP Helion OpenStack Community, beginning with the IceHouse release. HP has operated HP Helion Public Cloud on OpenStack since 2012.[33]

At the 2014 Interop and Tech Field Day, software-defined networking was demonstrated by Avaya using Shortest path bridging and OpenStack as an automated campus, extending automation from the data center to the end device, removing manual provisioning from service delivery.[34][35]

As of March 2015, NASA still makes use of OpenStack private cloud[36] and has RFQs out for OpenStack public cloud support.[37]

Components

OpenStack has a modular architecture with various code names for its components.[38]

Cisco Cloud Computing CTO, Cloud Computing on OpenStack and network-as-a-Service

Compute (Nova)

OpenStack Compute (Nova) is a cloud computing fabric controller, which is the main part of an IaaS system. It is designed to manage and automate pools of computer resources and can work with widely available virtualization technologies, as well as bare metal and high-performance computing (HPC) configurations. KVM, VMware, and Xen are available choices for hypervisor technology, together with Hyper-V and Linux container technology such as LXC.[39][40]

It is written in Python and uses many external libraries such as Eventlet (for concurrent programming), Kombu (for AMQP communication), and SQLAlchemy (for database access).[41] Compute's architecture is designed to scale horizontally on standard hardware with no proprietary hardware or software requirements and provide the ability to integrate with legacy systems and third-party technologies.

Image Service (Glance)

OpenStack Image Service (Glance) provides discovery, registration, and delivery services for disk and server images. Stored images can be used as a template. It can also be used to store and catalog an unlimited number of backups. The Image Service can store disk and server images in a variety of back-ends, including OpenStack Object Storage. The Image Service API provides a standard REST interface for querying information about disk images and lets clients stream the images to new servers.

OpenStack.org updates Glance every six months, along with other OpenStack modules. Some of the updates are to catch-up with existing cloud infrastructure services, as OpenStack is comparatively new. Glance adds many enhancements to existing legacy infrastructures. For example, if integrated with VMware, Glance introduces advanced features to the vSphere family such as, vMotion, high availability and dynamic resource scheduling (DRS). vMotion is the live migration of a running VM, from one physical server to another, without service interruption. Thus, it enables a dynamic and automated self-optimizing datacenter, allowing hardware maintenance for the underperforming servers without downtimes.[42][43]

OpenStack's image is an operating system installed on a virtual machine (VM). If a developer adds a variation to an image (as a configuration job) the result is an instance of that image. Subsequently, that instance is an image that developers can add more variations to.

Glance—OpenStack's image service module—is a compute module, as it does not store images, variations, or instances—but rather catalogs them and holds their metadata from Swift or a storage backend datastore. Other modules must communicate with the images metadata through Glance—for example, Heat. Also, Nova can present information about the images, and configure a variation on an image to produce an instance. However, Glance is the only module that can add, delete, share, or duplicate images.[44]

Object Storage (Swift)

OpenStack Object Storage (Swift) is a scalable redundant storage system. Objects and files are written to multiple disk drives spread throughout servers in the data center, with the OpenStack software responsible for ensuring data replication and integrity across the cluster. Storage clusters scale horizontally simply by adding new servers. Should a server or hard drive fail, OpenStack replicates its content from other active nodes to new locations in the cluster. Because OpenStack uses software logic to ensure data replication and distribution across different devices, inexpensive commodity hard drives and servers can be used.

In August 2009, Rackspace started the development of the precursor to OpenStack Object Storage, as a complete replacement for the *Cloud Files* product. The initial development team consisted of nine developers.[45] SwiftStack, an object storage software company, is currently the leading developer for Swift.

Dashboard (Horizon)

OpenStack Dashboard (Horizon) provides administrators and users a graphical interface to access, provision, and automate cloud-based resources. The design accommodates third party products and services, such as billing, monitoring, and additional management tools. The dashboard is also brandable for service providers and other

commercial vendors who want to make use of it. The dashboard is one of several ways users can interact with OpenStack resources. Developers can automate access or build tools to manage resources using the native OpenStack API or the EC2 compatibility API.

Identity Service (Keystone)

OpenStack Identity (Keystone) provides a central directory of users mapped to the OpenStack services they can access. It acts as a common authentication system across the cloud operating system and can integrate with existing backend directory services like LDAP. It supports multiple forms of authentication including standard username and password credentials, token-based systems and AWS-style (i.e. Amazon Web Services) logins. Additionally, the catalog provides a queryable list of all of the services deployed in an OpenStack cloud in a single registry. Users and third-party tools can programmatically determine which resources they can access.

Networking (Neutron)

OpenStack Networking (Neutron, formerly Quantum[46]) is a system for managing networks and IP addresses. OpenStack Networking ensures the network is not a bottleneck or limiting factor in a cloud deployment, and gives users self-service ability, even over network configurations.

OpenStack Networking provides networking models for different applications or user groups. Standard models include flat networks or VLANs that separate servers and traffic. OpenStack Networking manages IP addresses, allowing for dedicated static IP addresses or DHCP. Floating IP addresses let traffic be dynamically rerouted to any resources in the IT infrastructure, so users can redirect traffic during maintenance or in case of a failure.

Users can create their own networks, control traffic, and connect servers and devices to one or more networks. Administrators can use software-defined networking (SDN) technology like OpenFlow to support high levels of multi-tenancy and massive scale. OpenStack Networking provides an extension framework that can deploy and manage additional network services—such as intrusion detection systems (IDS), load balancing, firewalls, and virtual private networks (VPN).

Block Storage (Cinder)

OpenStack Block Storage (Cinder) provides persistent block-level storage devices for use with OpenStack compute instances. The block storage system manages the creation, attaching and detaching of the block devices to servers. Block storage volumes are fully integrated into OpenStack Compute and the Dashboard allowing for cloud users to manage their own storage needs. In addition to local Linux server storage, it can use storage platforms including Ceph, CloudByte, Coraid, EMC (ScaleIO, VMAX and VNX), GlusterFS, Hitachi Data Systems, IBM Storage (Storwize family, SAN Volume Controller, XIV Storage System, and GPFS), Linux LIO, NetApp, Nexenta, Scality, SolidFire, HP (StoreVirtual and 3PAR StoreServ families) and Pure Storage. Block storage is appropriate for performance sensitive scenarios such as database storage, expandable file systems, or providing a server with access to raw block level storage. Snapshot management provides powerful functionality for backing up data stored on block storage volumes. Snapshots can be restored or used to create a new block storage volume.

Orchestration (Heat)

Heat is a service to orchestrate multiple composite cloud applications using templates, through both an OpenStack-native REST API and a CloudFormation-compatible Query API.[47]

Telemetry (Ceilometer)

OpenStack Telemetry Service (Ceilometer) provides a Single Point Of Contact for billing systems, providing all the counters they need to establish customer billing, across all current and future OpenStack components. The delivery of counters is traceable and auditable, the counters must be easily extensible to support new projects, and agents doing data collections should be independent of the overall system.

Database (Trove)

Trove is a database-as-a-service provisioning relational and non-relational database engines.[48]

Elastic Map Reduce (Sahara)

Sahara aims to provide users with simple means to provision Hadoop clusters by specifying several parameters like Hadoop version, cluster topology, nodes hardware details and a few more. After a user fills all the parameters, Sahara deploys the cluster in a few minutes. Sahara also provides means to scale an already-provisioned cluster by adding and removing worker nodes on demand.[49][50]

Bare Metal Provisioning (Ironic)

Ironic is an incubated OpenStack project that aims to provision bare metal machines instead of virtual machines. It was initially forked from the Nova Baremetal driver and has evolved into a separate program. It is best thought of as a bare-metal hypervisor API and a set of plugins that interact with the bare-metal hypervisors. By default, it will use PXE and IPMI in concert to provision and turn on and off machines, but Ironic supports and can be extended with vendor-specific plugins to implement additional functionality.[51][52]

Multiple Tenant Cloud Messaging (Zaqar)

Zaqar is a multi-tenant cloud messaging service for Web developers. It combines the ideas pioneered by Amazon's SQS product with additional semantics to support event broadcasting. The service features a fully RESTful API, which developers can use to send messages between various components of their SaaS and mobile applications by using a variety of communication patterns. Underlying this API is an efficient messaging engine designed with scalability and security in mind. Other OpenStack components can integrate with Zaqar to surface events to end users and to communicate with guest agents that run in the "over-cloud" layer. Cloud operators can leverage Zaqar to provide equivalents of SQS and SNS to their customers. Zaqar was formerly known as Marconi.[53][54]

Shared File System Service (Manila)

OpenStack Shared File System Service (Manila) provides an open API to manage shares in a vendor agnostic framework. Standard primitives include ability to create, delete, and give/deny access to a share and can be used standalone or in a variety of different network environments. Commercial storage appliances from EMC, NetApp, HP, IBM, Oracle, Quobyte, and Hitachi Data Systems are supported as well as filesystem technologies such as Red Hat GlusterFS.[55]

DNSaaS (Designate)

DNS as a Service[56]

Security API (Barbican)

Barbican is a REST API designed for the secure storage, provisioning and management of secrets. It is aimed at being useful for all environments, including large ephemeral Clouds.[57]

Amazon Web Services compatibility

OpenStack APIs are compatible with Amazon EC2 and Amazon S3 and thus client applications written for Amazon Web Services can be used with OpenStack with minimal porting effort.[58][59]

Governance

OpenStack is governed by a non-profit foundation and its board of directors, a technical committee and a user committee. The board of directors is made up of eight members from each of the eight platinum sponsors, eight members from the 24 defined maximum allowed Gold sponsors, and eight members elected by the Foundation individual members.[60]

The current sitting board of directors is:[61]

- Platinum directors:
  - Alan Clark, SUSE, Chairman of the Board
  - Eileen Evans, Hewlett-Packard
  - Van Lindberg, Rackspace
  - Mark McLoughlin, Red Hat
  - Toby Ford, AT&T
  - Todd Moore, IBM
  - Imad Sousou, Intel
- Gold directors:
  - Simon Anderson, DreamHost
  - Robert Esker, NetApp
  - Tristan Goode, Aptira
  - Steven Hallett, Symantec
  - Chris Kemp, Nebula
  - Boris Renski, Mirantis
- Individual directors:
  - Tim Bell, CERN
  - Russell Bryant, Red Hat
  - Alex Freedland, Mirantis
  - Rob Hirschfeld, rackn
  - Vishvananda Ishaya, Nebula
  - Kavit Munshi, Aptira
  - Egle Sigler,

- John Zannos, Canonical
- Sean Roberts, EMC
- Lew Tucker, Cisco, Vice Chairman of the Board
- Rackspace
- Monty Taylor, Hewlett-Packard

- The current technical committee is:[62]
  - James E. Blair, Hewlett-Packard
  - Russell Bryant, Red Hat
  - Thierry Carrez, OpenStack Foundation
  - Sean Dague, Hewlett-Packard
  - Anne Gentle, Rackspace
  - Doug Hellmann, Hewlett-Packard
  - Vishvananda Ishaya, Nebula
  - Mark McClain, Yahoo!
  - Mark McLoughlin, Red Hat
  - Jay Pipes, Mirantis
  - Michael Still, Rackspace
  - Monty Taylor, Hewlett-Packard
  - Devananda van der Veen, Hewlett-Packard
- The current user committee is:[63]
  - Tim Bell, CERN
  - Jon Proulx, MIT
  - Subbu Allamaraju, eBay

The Foundation's stated mission is *[by] providing shared resources to help achieve the OpenStack Mission by Protecting, Empowering, and Promoting OpenStack software and the community around it, including users, developers and the entire ecosystem.* Though, it has little to do with the development of the software, which is managed by the technical committee - *an elected group that represents the contributors to the project, and has oversight on all technical matters.*[64]

Users

OpenStack has a wide variety of users, from a number of different sectors.[65] Notable users include:

- AT&T – joined OpenStack in January 2012[66]
- Alcatel-Lucent
- BBVA[67]
- Bhabha Atomic Research Centre has a private cloud to cater to in house employees' requirements.
- CERN
- BMW
- Deutsche Telekom has created a "Business Marketplace", whose functionality is based on OpenStack[68]
- DreamHost - offers public cloud computing.[69]
- eBay
- HP Converged Cloud, which combines software and cloud services into a unified set of packages and under a single unified architecture.[70]
- HP Public Cloud – runs a variant of Ubuntu Linux[71]
- Intel
- Internap
- iQIYI[72]
- KT (formerly Korea Telecom) - for object storage only[73]
- MercadoLibre.com – MercadoLibre has over 6,000 VMs managed by OpenStack[74]
- NASA
- NSA[75]
- OVH/RunAbove[76]
- PayPal[77]
- Rackspace Cloud[78]
- Sony - online games for PlayStation 4[79]
- SUSE Cloud solution. See SUSE Cloud product description (https://www.suse.com/products/suse-cloud/).
- Wikimedia Labs[80]
- Yahoo!
- Walmart[81]

Deployment models

As the OpenStack project has matured, vendors have pioneered multiple ways for customers to deploy OpenStack:

- OpenStack-based Public Cloud: A vendor provides a public cloud computing system based on the OpenStack project.
- On-premises distribution: In this model, a customer downloads and installs an OpenStack distribution within their internal network. See Distributions.
- Hosted OpenStack Private Cloud: A vendor hosts an OpenStack-based private cloud: including the underlying hardware and the OpenStack software.
- OpenStack-as-a-Service: A vendor hosts OpenStack management software (without any hardware) as a service. Customers sign up for the service and pair it with their internal servers, storage and networks to get a fully operational private cloud.
- Appliance based OpenStack: Nebula was a vendor that sold applicances that could be plugged into a network which spawned a OpenStack deployment.

Distributions

- Cloudscaling[82]

Release history

Release name	Release date	Included Component code names[38]	Notes
Austin	21 October 2010[83][84]	Nova, Swift	Austin Release Notes (https://wiki.openstack.org/wiki/ReleaseNotes/Austin)
Bexar	3 February 2011[85]	Nova, Glance, Swift	Bexar Release Notes (https://wiki.openstack.org/wiki/ReleaseNotes/Bexar)
Cactus	15 April 2011[86]	Nova, Glance, Swift	Cactus Release Notes (https://wiki.openstack.org/wiki/ReleaseNotes/Cactus)
Diablo	22 September 2011[87]	Nova, Glance, Swift	Diablo Release Notes (https://wiki.openstack.org/wiki/ReleaseNotes/Diablo)
Essex	5 April 2012[88]	Nova, Glance, Swift, Horizon, Keystone	Essex Release Notes (https://wiki.openstack.org/wiki/ReleaseNotes/Essex)
Folsom	27 September 2012[89]	Nova, Glance, Swift, Horizon, Keystone, Quantum, Cinder	Folsom Release Notes (https://wiki.openstack.org/wiki/ReleaseNotes/Folsom)
Grizzly	4 April 2013[90]	Nova, Glance, Swift, Horizon, Keystone, Quantum, Cinder	Grizzly Release Notes (https://wiki.openstack.org/wiki/ReleaseNotes/Grizzly)
Havana	17 October 2013[91]	Nova, Glance, Swift, Horizon, Keystone, Neutron, Cinder, Heat, Ceilometer	Havana Release Notes (https://wiki.openstack.org/wiki/ReleaseNotes/Havana)
Icehouse	17 April 2014[92]	Nova, Glance, Swift, Horizon, Keystone, Neutron, Cinder, Heat, Ceilometer, Trove	Icehouse Release Notes (https://wiki.openstack.org/wiki/ReleaseNotes/Icehouse)
Juno	16 October 2014[93]	Nova, Glance, Swift, Horizon, Keystone, Neutron, Cinder, Heat, Ceilometer, Trove, Sahara	Juno Release Notes (https://wiki.openstack.org/wiki/ReleaseNotes/Juno)
Kilo	30 April 2015[94]	Nova, Glance, Swift, Horizon, Keystone, Neutron, Cinder, Heat, Ceilometer, Trove, Sahara, Ironic	Kilo Release Notes (https://wiki.openstack.org/wiki/ReleaseNotes/Kilo)
Liberty	16 October 2015[95]	Nova, Glance, Swift, Horizon, Keystone, Neutron, Cinder, Heat, Ceilometer, Trove, Sahara, Ironic, Zaqar, Manila, Designate,	

		Barbican	
Mitaka	Not Announced[96]	Nova, Glance, Swift, Horizon, Keystone, Neutron, Cinder, Heat, Ceilometer, Trove, Sahara, Ironic, Zaqar, Manila, Designate, Barbican	-

See also

- Cloud computing comparison
- OpenShift

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External links

- Official website (http://www.openstack.org/)

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