OPENSTACK INTRODUCTION AND ARCHITECTURE

Virtualization Group - Boston
October 16, 2014
Beth Cohen
The implications of a DIY approach are profound, organizations won’t see the impact of their choice for months, or years. There are a growing number of IT organizations that embrace risk in a new way and reject the established approach to enterprise software.”

Alessandro Perilli
Gartner
Theme: Architecture Design Considerations

• “To reap the benefits of OpenStack, you should plan, design, and architect your cloud properly, taking user's needs into account and understanding the use cases.”

Introduction
Architecture Design Guide
Agenda

- What is OpenStack?
  - A brief history
  - The OpenStack Foundation
- What is a Design Guide?
- Guide methodology
- How to use
- Typical Architectures

OpenStack looks more attractive than most commercial solutions due to its inherent capability to mix and match different modules and deeply tweak the resulting cloud infrastructure stack.
What is OpenStack?

Quick Start for the Terminally Busy…

- Open Source Cloud software
- Launched by NASA and Rackspace in 2010
- Massively scalable
- Managed by the OpenStack Foundation
- Rapidly taking over the Cloud world!
What is OpenStack?

A Brief History

• Jointly founded in July 2010 by Rackspace and NASA with merger of two projects:
  • Swift object storage based on Rackspace's Cloud Files platform
  • Nova based on Nebula compute platform

• Fastest growing Open Source project to date!

• Strong Community Support
  • Contributions by engineer
  • More Stats: http://stackalytics.com/
Strong Community Support

**Contribution by companies**

- HP: 24%
- Red Hat: 21%
- IBM: 8%
- Mirantis: 8%
- Rackspace: 7%
- "Independent": 8%
- SUSE: 17%
- "others": 8%

**Contribution by modules**

- nova: 56%
- config: 10%
- project-config: 5%
- neutron: 5%
- openstack-manuals: 4%
- heat: 4%
- horizon: 3%
- tempest: 3%
- "others": 2%
What is OpenStack

By the numbers

- 1,202 contributors
- Samsung, Yahoo!, Comcast among Top 20 users
- 350 new features
- 53 3rd party CI
- 2,902 bug fixes
- Top Companies committing code:
  - RedHat
  - IBM
  - HP
  - RackSpace
  - Mirantis
  - SUSE
  - OpenStack Foundation
  - eNovance
  - VMWare
  - Intel
- 32% increase
- 16 languages
What is OpenStack?

An Open Source Foundation

Technical Committee

Board of Directors

User Committee

**MEET THE**

TECH COMMITTEE

SOFTWARE DEVELOPMENT & DIRECTION

13 TOTAL MEMBERS
(ELECTED BY ACTIVE TECH CONTRIBUTORS)

DETERMINES CROSS-PROGRAM ISSUES

OpenStack Technical Committee members define and steward the technical direction of OpenStack software, including cross-program issues. The committee of 13 is fully elected by the project’s Active Technical Contributors.

BOARD of DIRECTORS

PROTECT, PROMOTE, & EMPOWER

8 PLATINUM
Appointed by Members

8 GOLD
Elected by Member Class

8 INDIVIDUAL
Elected by Individual Members

The Board of Directors provides strategic and financial oversight of Foundation resources and staff. Alan Clark, Director of Industry Initiatives, Emerging Standards and Open Source at SUSE, was elected Chairman of the Board, and Lew Tucker, Vice President and CTO of Cloud Computing at Cisco, was elected Vice Chairman of the Board.

USER COMMITTEE

USER ADVOCACY AND FEEDBACK

REPRESENTING
75 +

GLOBAL USER GROUPS

Tim Bell, Operating Systems and Infrastructure Services Group Leader at CERN, was appointed by the Board of Directors to help establish a new User Committee, created to represent a broad set of enterprise, academic and service provider users with the Technical Committee and Board of Directors.
What is OpenStack?

An Open Source Foundation

- Independent home for the OpenStack project
- Uses the Apache licensing model
- Serves developers, users, and the entire ecosystem by providing:
  - Shared resources
  - Enable technology vendors targeting the platform
- **Individual membership** is free and accessible to anyone

Join our global community of technologists, developers, researchers, corporations and cloud computing experts.

19052 PEOPLE
143 COUNTRIES
What is OpenStack?

Open Source Cloud Platform

• Open source software for building private and public clouds
  • Designed for flexibility and many different use cases
  • Mix and match components
  • Kit of administrative tools
• Enables multi-tenancy
  • Quota for different users
  • Users can be associated with multiple tenants
• Provides virtual machines (VM) on demand
  • Self service provisioning
  • Snapshotting capability
• Storage volumes
  • Block storage for VM images
  • Object storage for VM images and arbitrary files
High Level Architecture - Icehouse

Adapted from: http://26a0ff8ca8ba32139f7d-db711c577a50b6bdc946ea71aaca027d.r97.cf1.rackcdn.com/openstack-conceptual-arch-folsom.jpg
OpenStack Project Release History

Six Month Cycle – Currently working on Juno

- Releases are timed to correspond with the developer Summit meeting
- Still no reliable upgrade paths between releases
- Expect large deltas between releases for the next year or so as new features and core functionality are added

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Icehouse Official Projects

- Integrated Projects (Icehouse release)
  - OpenStack Compute (nova): [https://launchpad.net/nova](https://launchpad.net/nova)
  - OpenStack Object Storage (swift): [https://launchpad.net/swift](https://launchpad.net/swift)
  - OpenStack Image Service (glance): [https://launchpad.net/glance](https://launchpad.net/glance)
  - OpenStack Identity (keystone): [https://launchpad.net/keystone](https://launchpad.net/keystone)
  - OpenStack Dashboard (horizon): [https://launchpad.net/horizon](https://launchpad.net/horizon)
  - OpenStack Networking (Neutron): [https://launchpad.net/Neutron](https://launchpad.net/Neutron)
  - OpenStack Block Storage service (cinder): [https://launchpad.net/cinder](https://launchpad.net/cinder)
  - Ceilometer: [https://launchpad.net/ceilometer](https://launchpad.net/ceilometer)
  - Heat: [https://launchpad.net/heat](https://launchpad.net/heat)
OpenStack Icehouse Roadmap Highlights

- **Database Service (Trove)** - Scalable and reliable Cloud Database as a Service provisioning functionality for both relational and non-relational database engines
- **Bare Metal (Ironic)** - Provides an API for management and provisioning of physical machines.
- **Queue Service (Marconi)** - message queueing API and service for distributed application messaging
- **Data Processing (Savannah)** – Hadoop on OpenStack

DESIGNING OPENSTACK ARCHITECTURES
What the Heck is a Design Guide?

Is not...
- Explicit instructions for building a Cloud
- A hardware specification
- Instructions for how to operate a Cloud
- Security mandates

Is...
- Important considerations for common cloud use cases
- Business objectives
- Technology constraints
- Organization requirements
12 People, 5 Days, 1 Book

- How we did it
- Used an Extreme Agile approach

Five days
The Team

- Kenneth Hui (EMC)
- Alexandra Settle (Rackspace)
- Anthony Veiga (Comcast)
- Beth Cohen (Verizon)
- Kevin Jackson (Rackspace)
- Maish Saidel-Keesing (Cisco)
- Nick Chase (Mirantis) @NickChase
- Scott Lowe (VMware)
- Sean Collins (Comcast) @sc68cal
- Sean Winn (Cloudscaling)
- Sebastian Gutierrez (Red Hat)
- Stephen Gordon (Red Hat)
- Vinny Valdez (Red Hat)
High Level Logical Architecture

But Pretty Pictures are Not Enough!
OpenStack Architecture Evolution

Onion Model
- Users & Community
- Ecosystem & Vendors
- Incubated
- Integrated
- Core
- OpenStack™
- Products
  - Managed by Board
- OpenStack™
  - Managed by Technical Committee

Integrated Model
- Integrated Release
  - OpenStack Project
  - OpenStack Project
  - OpenStack Project
  - OpenStack Project
  - OpenStack Project
  - OpenStack Project
OpenStack DefCore Project

- Committee working on OpenStack standardization and shared coding library
- Finally some adults in the room

**Diagram:**

- **Shows Proven Usage**
  - Widely Deployed
  - Used by Tools
  - Used by Clients

- **Aligns with Technical Direction**
  - Future Direction
  - Complete
  - Stable

- **Takes a System View**
  - Foundational
  - Atomic
  - Proximity

- **Plays Well with Others**
  - Discoverable
  - Documented
  - Core in Last Release
General Principles and Methodology

- A process for capturing requirements and building use cases
- Incorporate the requirements to design the cloud architecture
High Level Requirements

Overall business objectives

• Develop clear definition of business goals and requirements
• Increase project support and engagement with business, customers and end users.

Technology

• Coordinate the OpenStack architecture across the project and leverage OpenStack community efforts more effectively.
• Architect for automation as much as possible to speed development and deployment.
• Use the appropriate tools for the development effort.
• Create better and more test metrics and test harnesses to support continuous and integrated development, test processes and automation.

Organization

• Better messaging of management support of team efforts
• Develop better cultural understanding of Open Source, cloud architectures, Agile methodologies, continuous development, test and integration, overall development concepts in general
Different Architectures for Different Purposes

- **General purpose**: A cloud built with common components that should address 80% of common use cases.
- **Compute focused**: A cloud designed to address compute intensive workloads such as high performance computing (HPC).
- **Storage focused**: A cloud focused on storage intensive workloads such as data analytics with parallel file systems.
- **Network focused**: A cloud depending on high performance and reliable networking, such as a content delivery network (CDN).
Different Architectures for Different Purposes

- **Multi-site**: A cloud built with multiple sites available for application deployments for geographical, reliability or data locality reasons.
- **Hybrid cloud**: An architecture where multiple disparate clouds are connected either for failover, hybrid cloud bursting, or availability.
- **Massively scalable**: An architecture that is intended for cloud service providers or other extremely large installations.
- **Specialized cases**
General purpose

- Most common
- Base for all other specialized architectures
- No predefined use, so need to support all potential cases
- Balanced loads across all Cloud components
Compute focused

- High performance computing (HPC)
- Big data analytics using Hadoop or other distributed data stores
- Continuous integration/continuous deployment (CI/CD)
- Platform-as-a-Service (PaaS)
- Signal processing for network function virtualization (NFV)
Storage focused

- Active archive, backups and hierarchical storage management.
- General content storage and synchronization.
- Data analytics with parallel file systems.
- Unstructured data store for services.
- Persistent block storage.
- Operating system and application image store.
- Media streaming.
- Databases.
- Content distribution.
- Cloud storage peering.
Network focused

- Content delivery network
- Network service offerings
- High speed and high volume transactional systems
- Virtual desktop infrastructure (VDI)
- Voice over IP (VoIP)
- Video Conference or web conference
- High performance computing (HPC)
Multi-site

- An organization with a diverse geographic footprint.
- Geo-location sensitive data.
- Data locality, in which specific data or functionality should be close to users.
Hybrid cloud

- Bursting from a private cloud to a public cloud
- Disaster recovery
- Development and testing
- Federated cloud, enabling users to choose resources from multiple providers
- Hybrid clouds built to support legacy systems as they transition to cloud
Hybrid cloud
Massively scalable
Specialized Cases

- **Specialized Networking**: This describes running networking-oriented software that may involve reading packets directly from the wire or participating in routing protocols.
- **Software-defined networking (SDN)**: This use case details both running an SDN controller from within OpenStack as well as participating in a software-defined network.
- **Desktop-as-a-Service**: This is for organizations that want to run a virtualized desktop environment on a cloud. This can apply to private or public clouds.
- **OpenStack on OpenStack**: Some organizations are finding that it makes technical sense to build a multi-tiered cloud by running OpenStack on top of an OpenStack installation.
- **Specialized hardware**: Some highly specialized situations will require the use of specialized hardware devices from within the OpenStack environment.
Specialized – Multi-Hypervisor
Specialized – SDN
Specialized – Desktop as a Service

• Boot storms: What happens when hundreds or thousands of users log in during shift changes, affects the storage design.
• The performance of the applications running in these virtual desktops
• Operating system and compatibility with the OpenStack hypervisor
Specialized – OpenStack on OpenStack
Specialized Hardware
OPENSTACK
INTRODUCTION AND ARCHITECTURE

Questions?
OpenStack Additional Resources

- [http://www.openstack.org/](http://www.openstack.org/) - Main site
- [http://docs.openstack.org/trunk/openstack-compute/admin/content/ch_getting-started-with-openstack.html](http://docs.openstack.org/trunk/openstack-compute/admin/content/ch_getting-started-with-openstack.html)
  OpenStack Cloud Computing Cookbook
- [http://www.openstack.org/blog/tag/training/](http://www.openstack.org/blog/tag/training/) - Tag: Training
Cloud Architecture Additional Resources

- OpenStack Architecture Design Guide

- Blogs and Articles
  - Five Days + Twelve Writers + One Book Sprint = One Excellent Book on OpenStack Architecture
  - OpenStack Architecture Design Guide—Now Available for Download
  - The OpenStack Architecture Design Guide Story
  - OpenStack Architecture and Design Book Sprint
  - The OpenStack Architecture Design Guide Book Sprint