The OpenStack Cloud Computing Framework and Ecosystem

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#ICCLab / ZHAW
www.cloudcomp.ch

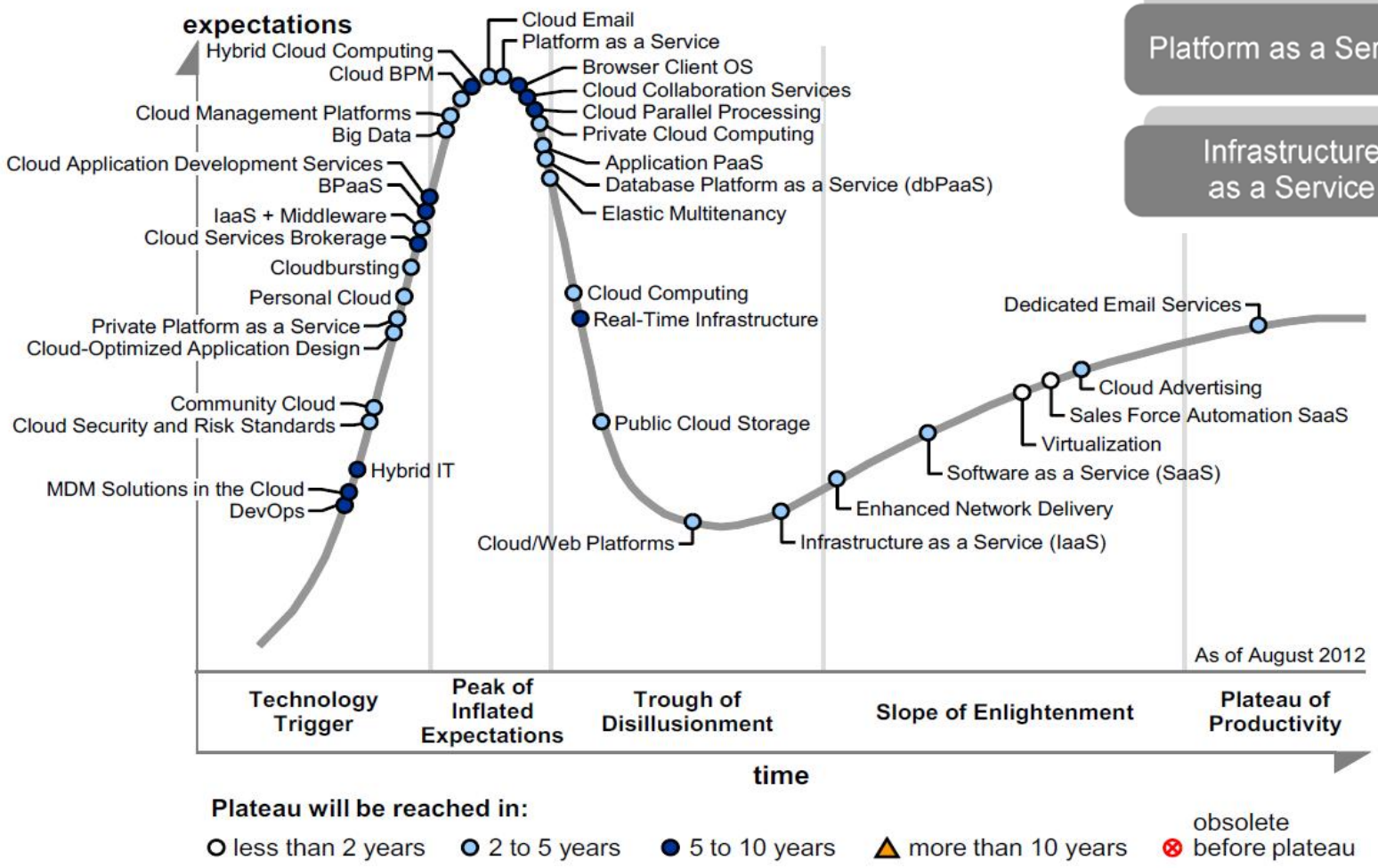
A Reality

Software as a Service

Platform as a Service

Infrastructure as a Service

Figure 1. Hype Cycle for Cloud Computing, 2012



Source: Gartner (August 2012)

A Business

Gartner Says Worldwide Public Cloud Services Market to Total $131 Billion (Ed. in 2013)

IaaS Continues as Fastest-Growing Market Segment

The public cloud services market is forecast to grow 18.5 percent in 2013 to total $131 billion worldwide, up from $111 billion in 2012, according to Gartner, Inc. Infrastructure as a service (IaaS), including cloud compute, storage and print services, continued as the fastest-growing segment of the market, growing 42.4 percent in 2012 to $6.1 billion and expected to grow 47.3 percent in 2013 to $9 billion.

"Although forecast growth is generally high across all regions, the adoption of cloud services varies significantly by country. Providers should not assume that a generic strategy applied to specific countries or regions of the world will produce the same outcome when applied to other countries, even countries with similar market characteristics," said Mr. Anderson. "Local economic factors, regulatory issues, the local political climate, the diverse landscape of global and local providers, including noncloud providers, and other country-specific factors ensure a unique marketplace in each country and region."

North America is the largest region in the cloud services market, accounting for 59 percent of all new spending on cloud services from 2013 through 2016. Western Europe, despite the growth challenges in the region, remains the second-largest region and will account for 24 percent of all new spending during the same time period. However, the highest growth rates for cloud services continue to come from the emerging regions of Emerging Asia/Pacific (led by Indonesia and India), Greater China and Latin America (led by Argentina, Mexico and Brazil).

"IT services providers, particularly those focused on delivering cloud services offerings or related services, must consider these disproportionately large mature markets if they want to play a leading role in cloud services growth worldwide," Mr. Anderson said. "Similarly, markets in Emerging Asia/Pacific, Greater China and Latin America should also be important considerations for IT services providers that want to capitalize on the high growth of these regions, particularly Latin America and Greater China."

Additional information is available in the report "Forecast Overview: Public Cloud Services, Worldwide, 2011-2016, 4Q12 Update." The report is available on Gartner's website at http://www.gartner.com/resId=2332215.

Options

Google App Engine

amazon web services™

Joyent

CloudSigma

Los Angeles Hong Kong Miami Expanding Dallas St Louis Seattle Tokyo Washington DC the Dublin London New York City Frankfurt San Francisco Amsterdam Cloud

the rackspace cloud

hp Cloud Services

Consequences

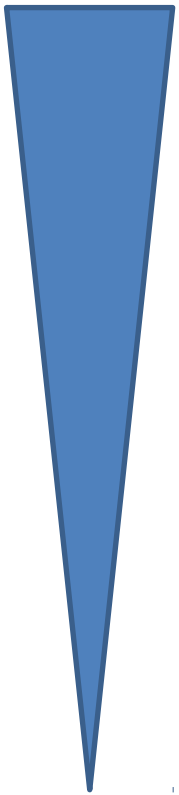
Lock-in

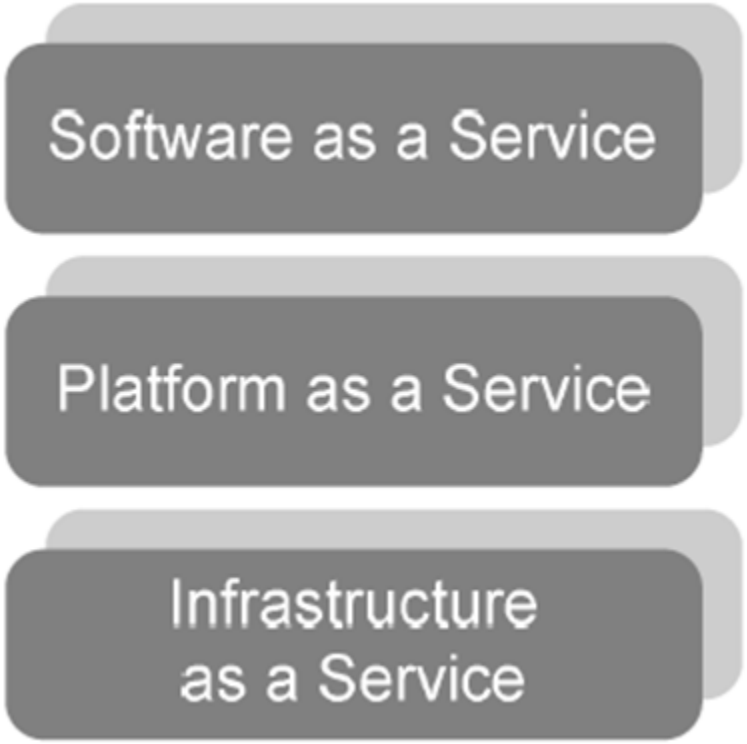
Alternatives

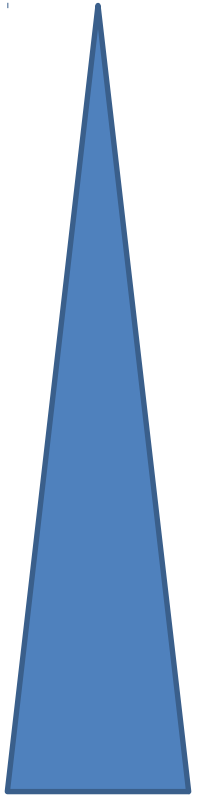
Open Source
&
Open Standards

Challenges

Diversity







Availability

Cloud Computing Enablement

Open Source

- Xen, Xen Cloud Platform (XCP)
- KVM – Kernel-based Virtualization
- VirtualBox - Oracle supported Virtualization Solutions
- OpenVZ - Container-based, Similar to Solaris Containers or BSD Zones
- LXC – User-space chroot’ed installs

Open Source Software-as-a-Service

Very fuzzy ...

Open Source Platform-as-a-Service

	Year Started	Sponsors	Supported Plattforms
CLOUD FOUNDRY	2011	VMware	Java/Spring, Node.js, Grails, Ruby/Rails, Ruby/Sinatra, *)
OPENSHIFT	2011	RedHat	JavaEE6/JBoss, Ruby, PHP, Python, Perl, Node.js
WSO2 Stratos	2010	WSO2	JavaEE6, JBoss
SmartOS	2011	Joyent	Node.js

*) some derived products (AppFog, Stackato,...) also support PHP, Perl, Python, Erlang, Scala, Clojure, .Net

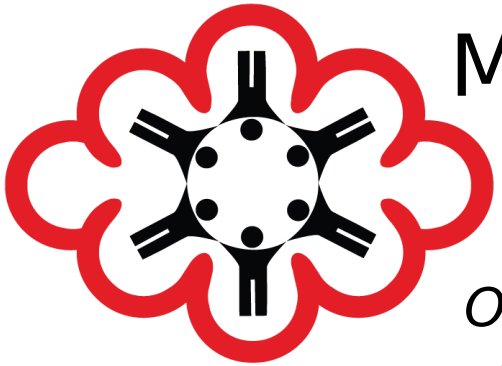
Open Source Infrastructure-as-a-Service

	Year Started	License	Supported Hypervisors
EUCALYPTUS	2006	GPL	Xen, KVM, VMware*
cloudstack open source cloud computing	2008	Apache 2 (since 2012)	Xen, KVM, VMware, OracleVM
OpenNebula	2008	Apache 2	Xen, KVM, VMware
openstack™	2010	Apache 2	Xen, KVM, VMware, VirtualBox, Hyper-V, qcow2

*) not in OpenSource Version

Open Cloud Computing Interface

Protocol and API for Management Of Cloud Service Resources.



OCCI was originally initiated to create a remote management API for IaaS, PaaS model based Services

OCCI is inclusive of an evolving world of cloud resources

OGF

NIST
National Institute of Standards and Technology

siena
Standards and Interoperability for eInfrastructure implemeNtation initiAtive

CabinetOffice

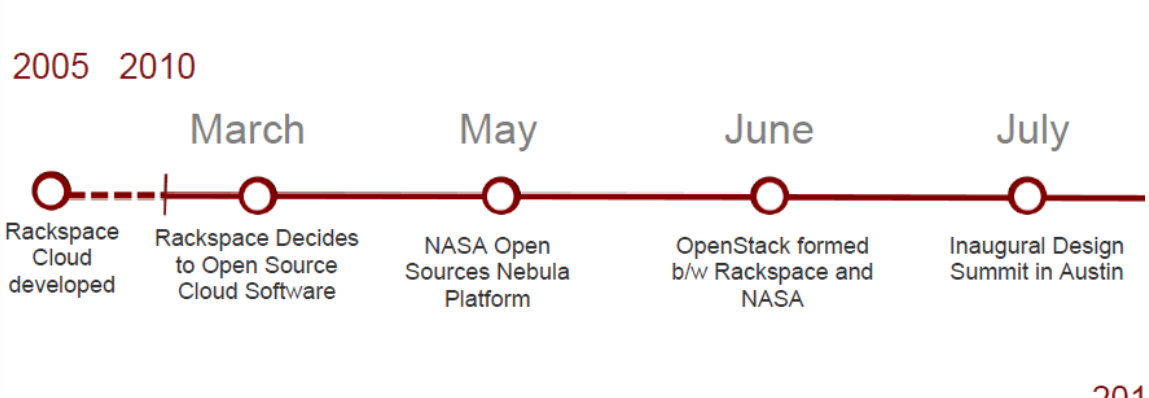
Bundesministerium für Wirtschaft und Technologie

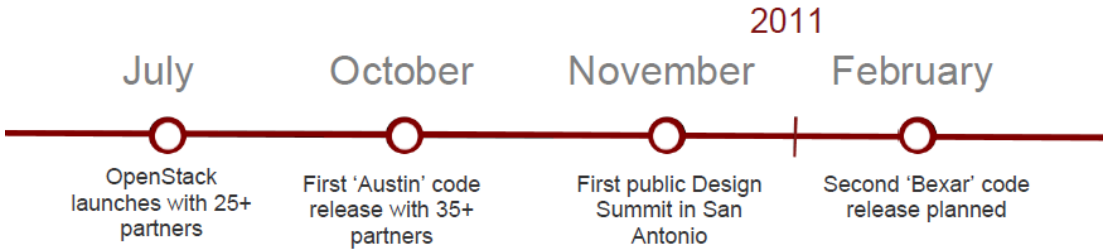
WIRTSCHAFT. WACHSTUM. WOHLSTAND.

egi

Future Grid

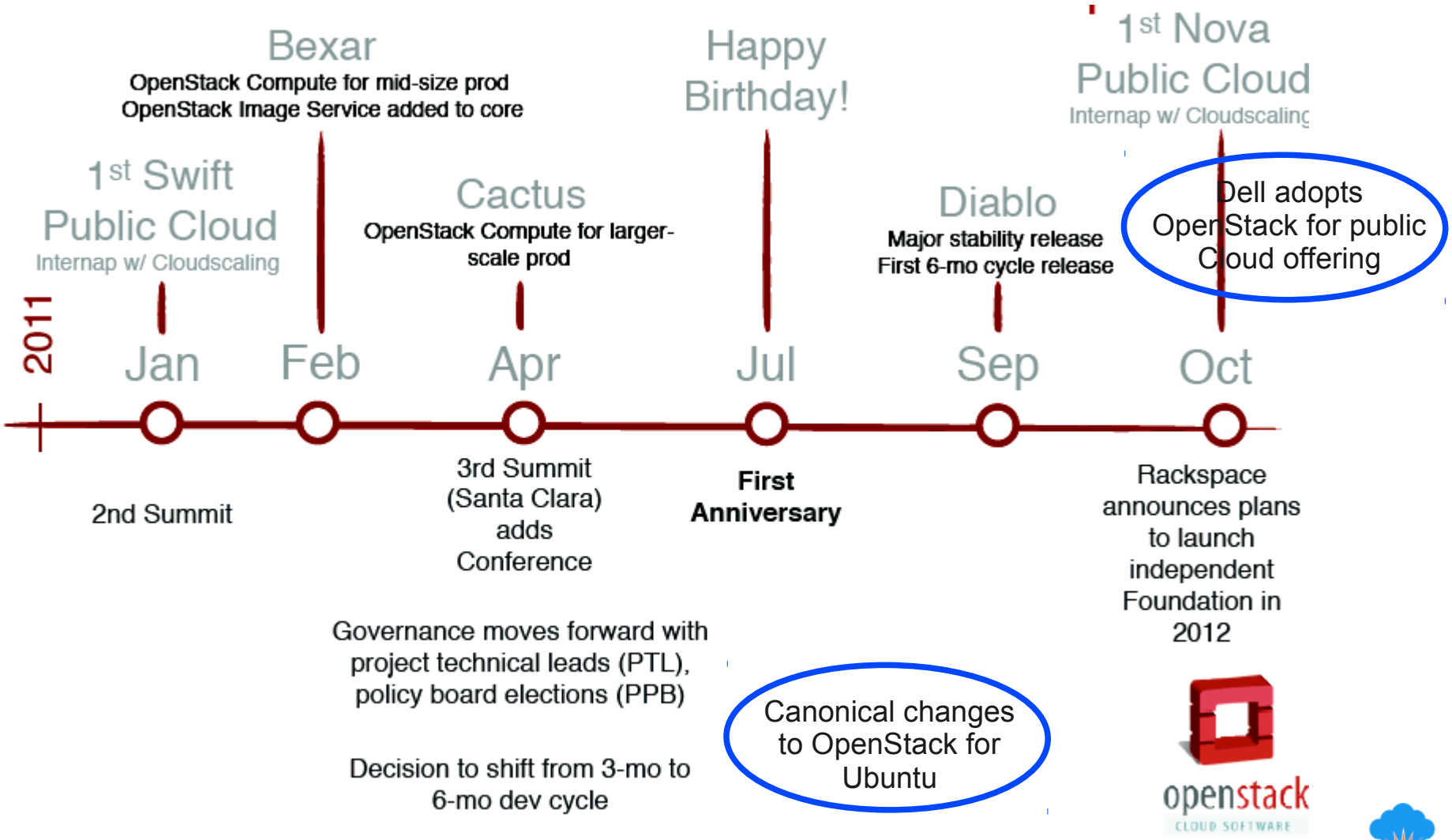
Genesis of OpenStack



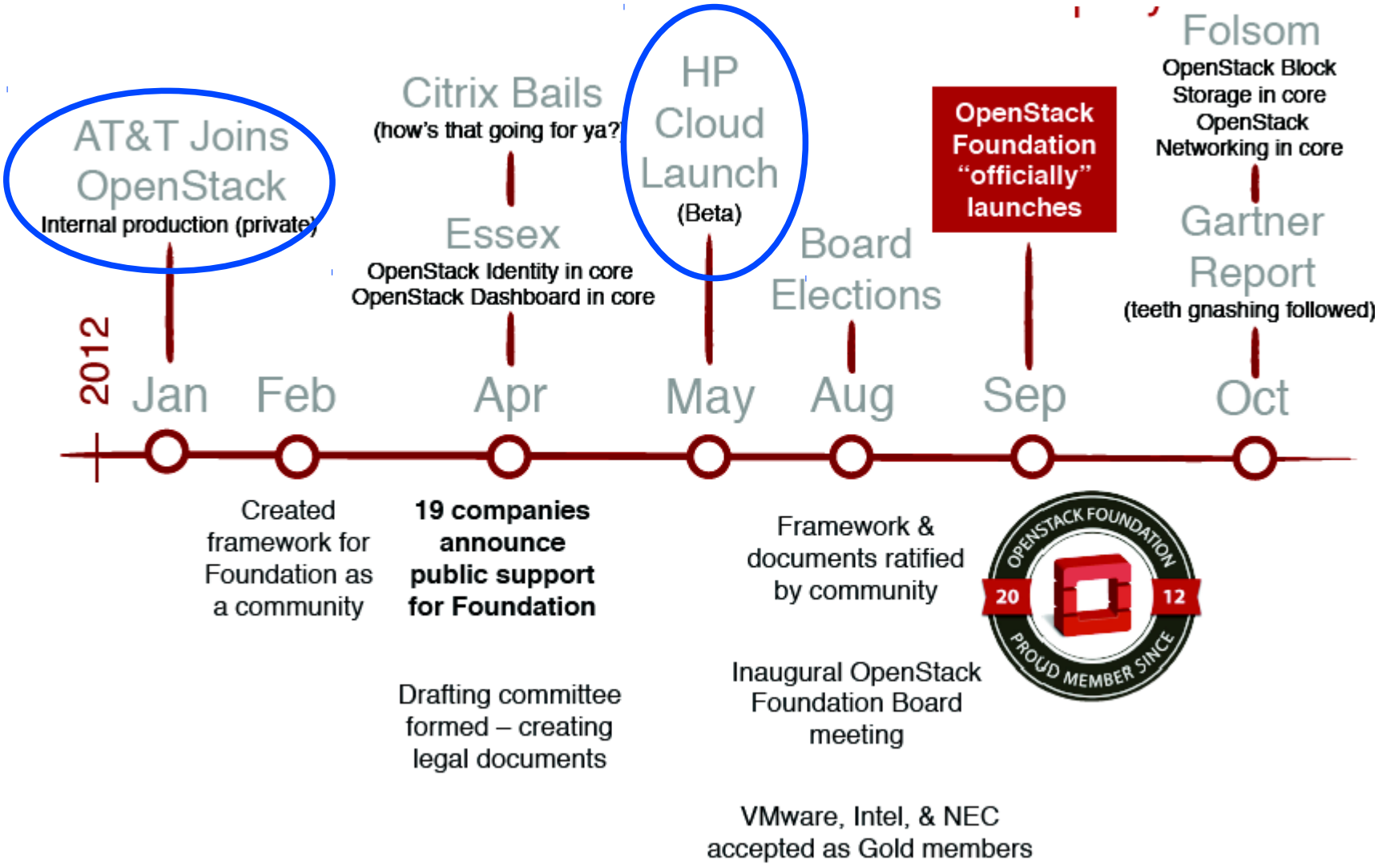


Quo Vadis?

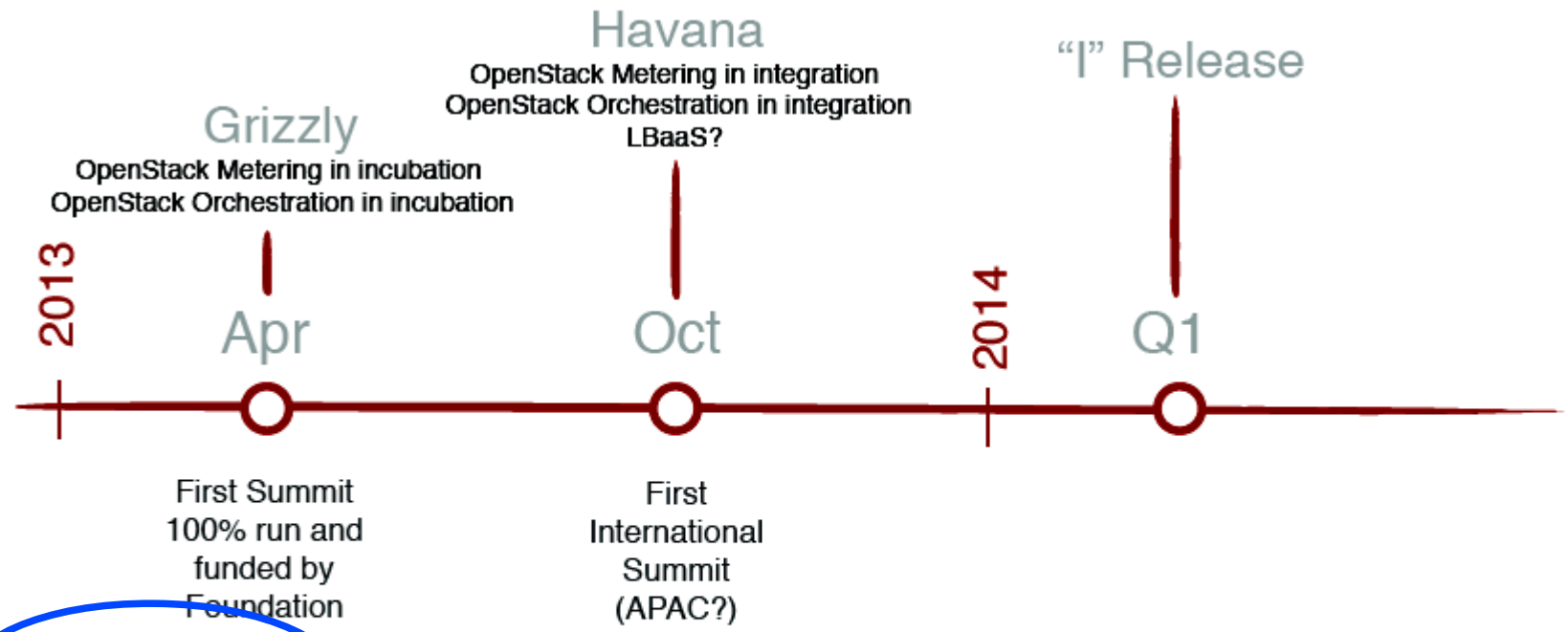
Genesis of OpenStack



Building Momentum

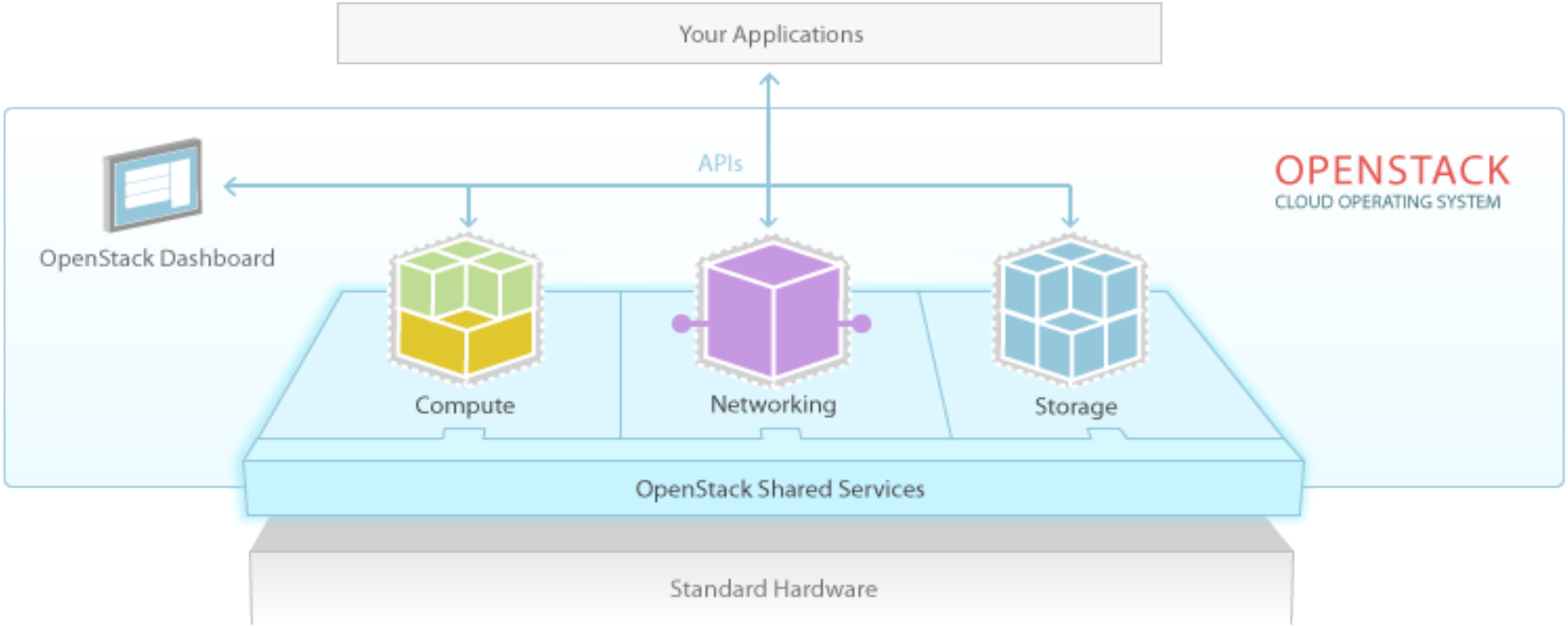


Achieving Enterprise Grade

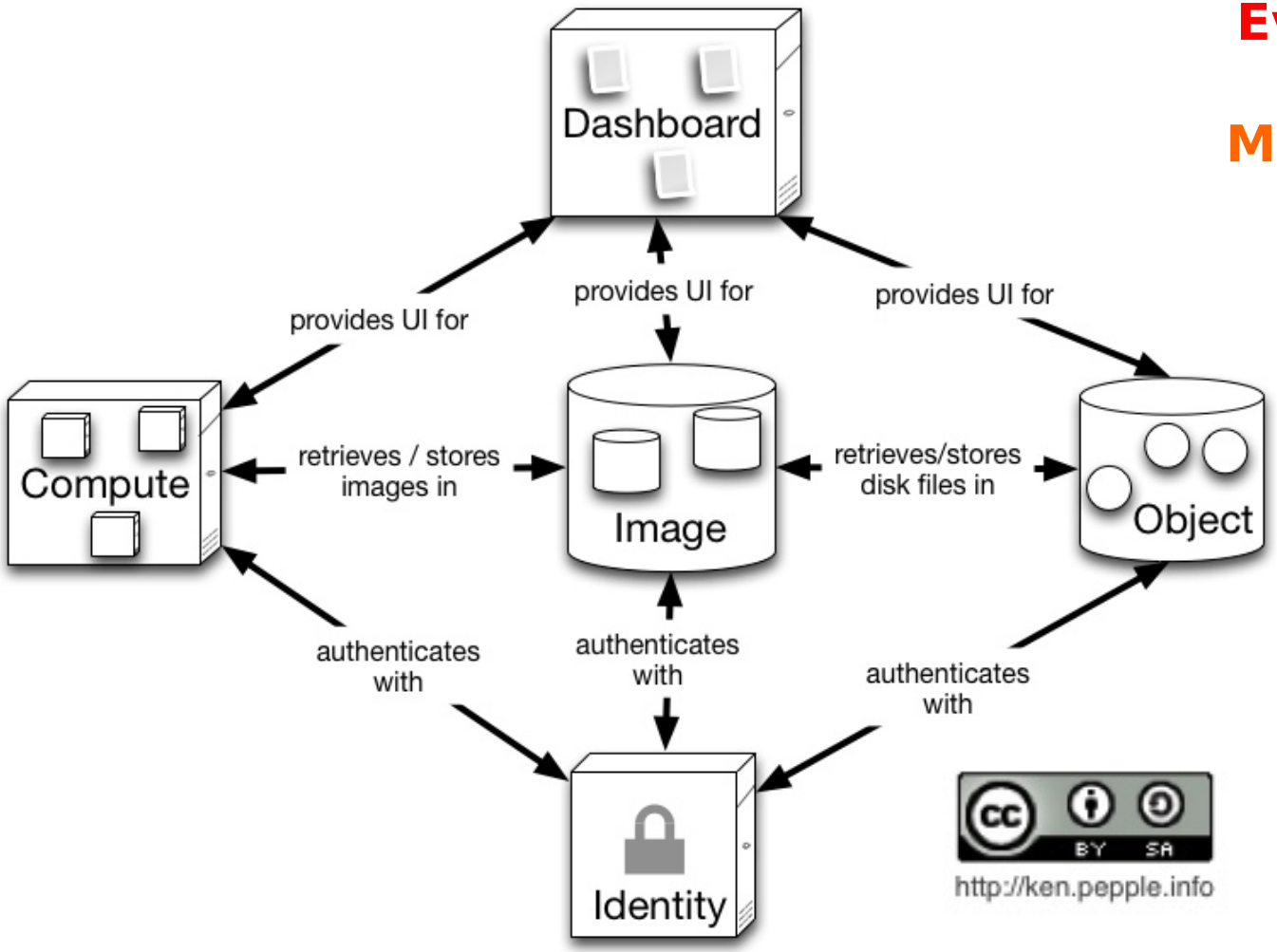


IBM Makes a Big Bet on OpenStack

OpenStack Service Model



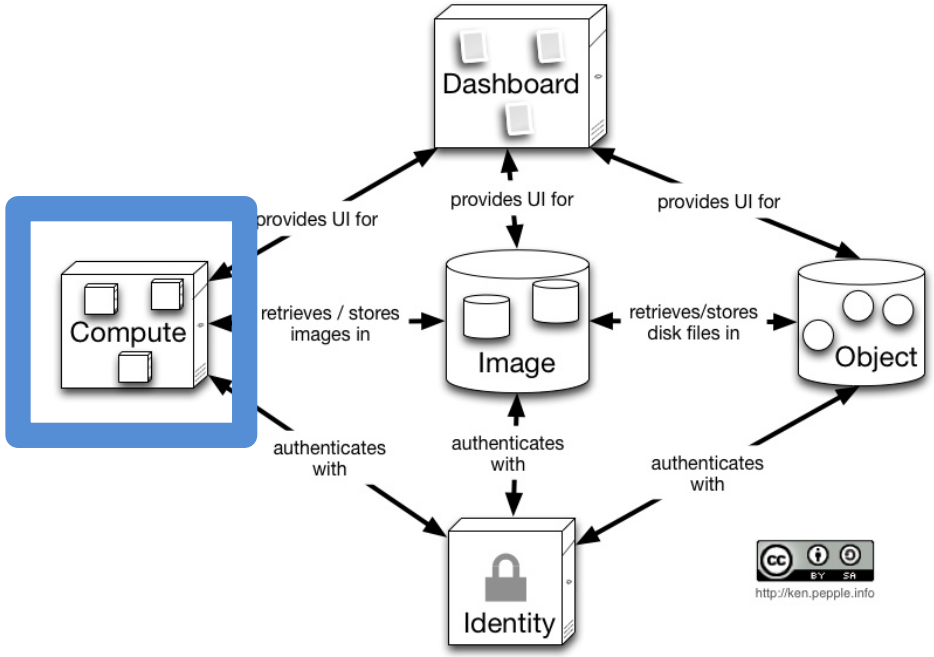
OpenStack High-Level Architecture



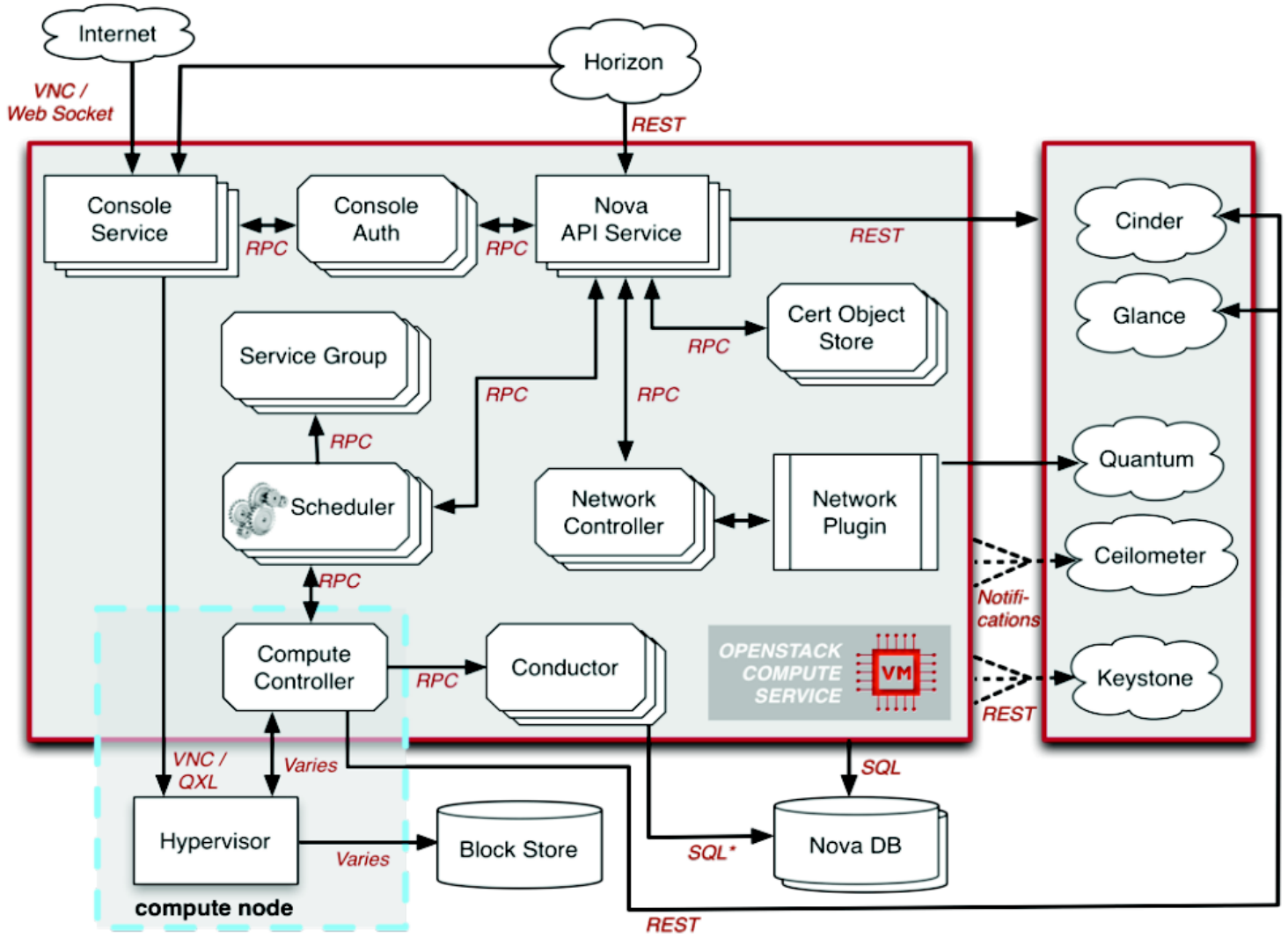
Everything has an API
Message based
Discrete
Pluggable
Components

Key Component: Compute

- **Nova:** Provides virtual servers on demand
  - KVM, Xen, VMware, HyperV, VirtualBox,LXC
- Looks after scheduling, networking & Block Storage
  - Future componentisation via Cinder and Quantum



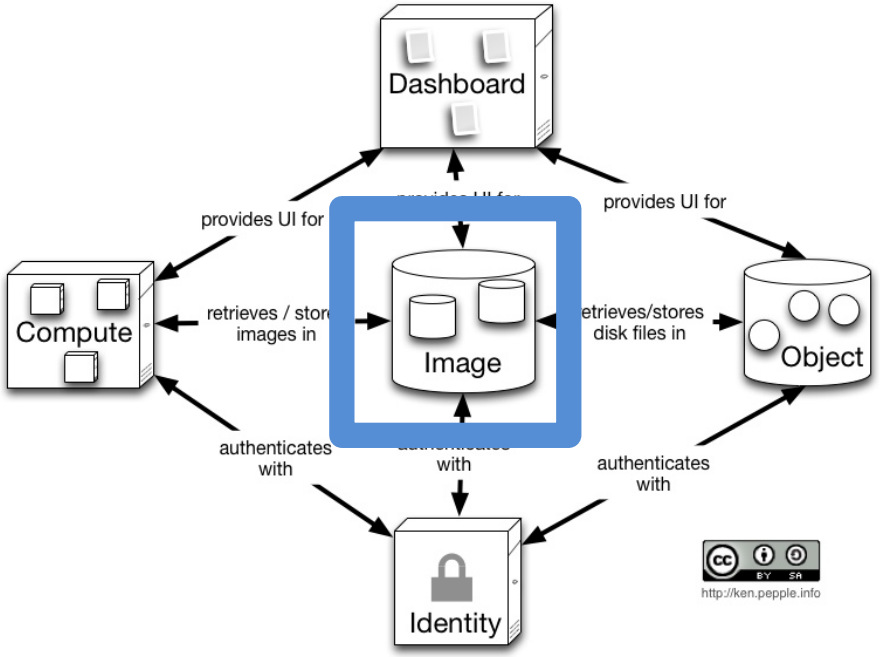
Key Component: Compute



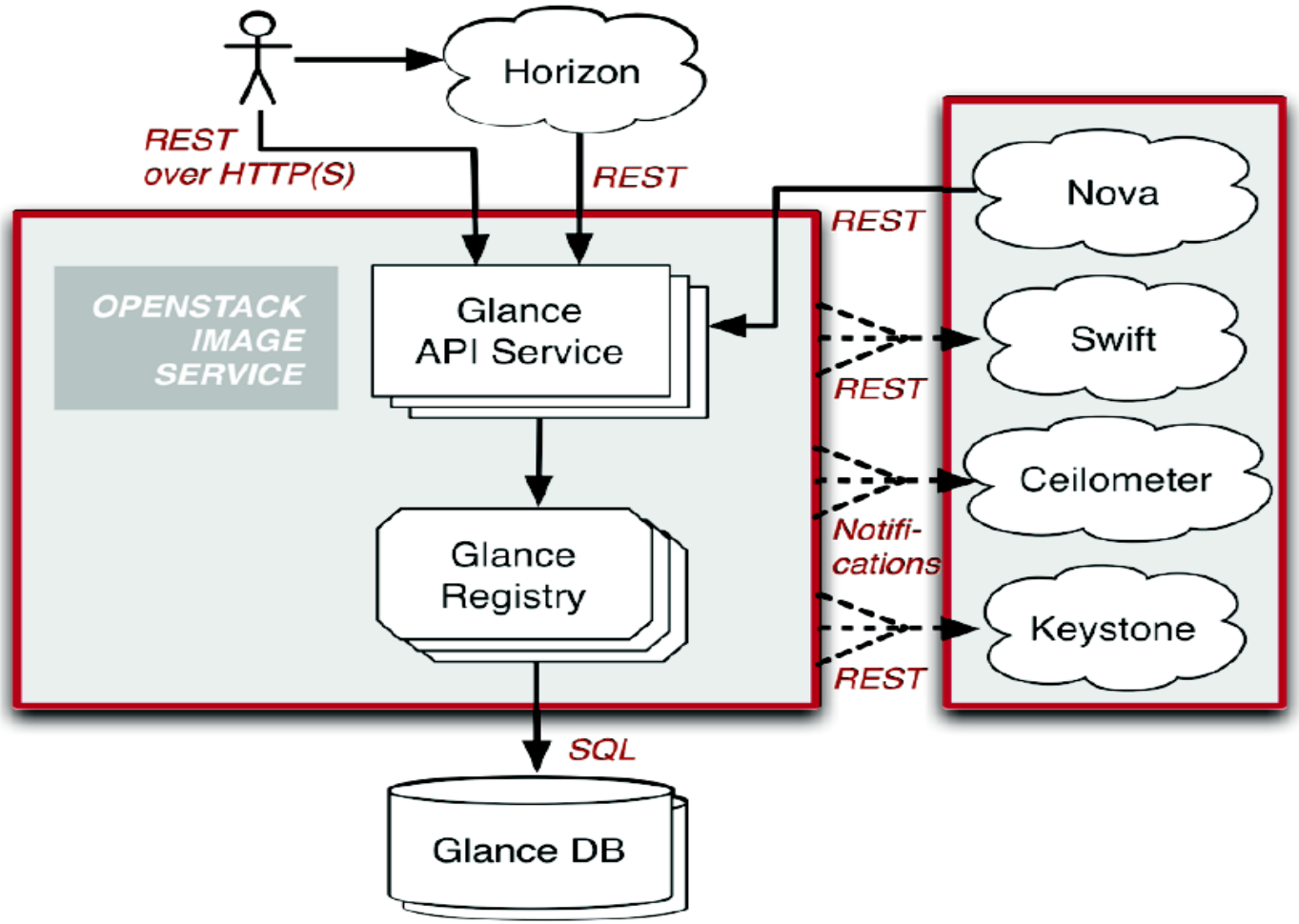
Source: R. Bias, OpenStack Summit April 2013: The State of the Stack

Key Component: Image

- **Glance:** Virtual Machine Image Registration and Storage
  - Storage via pluggable backends



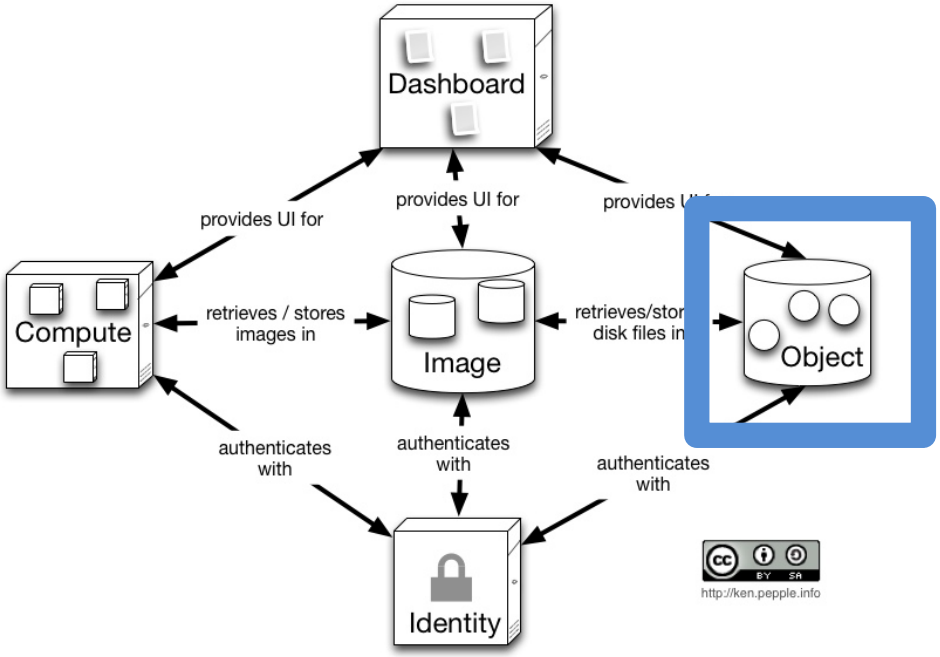
Key Component: Image



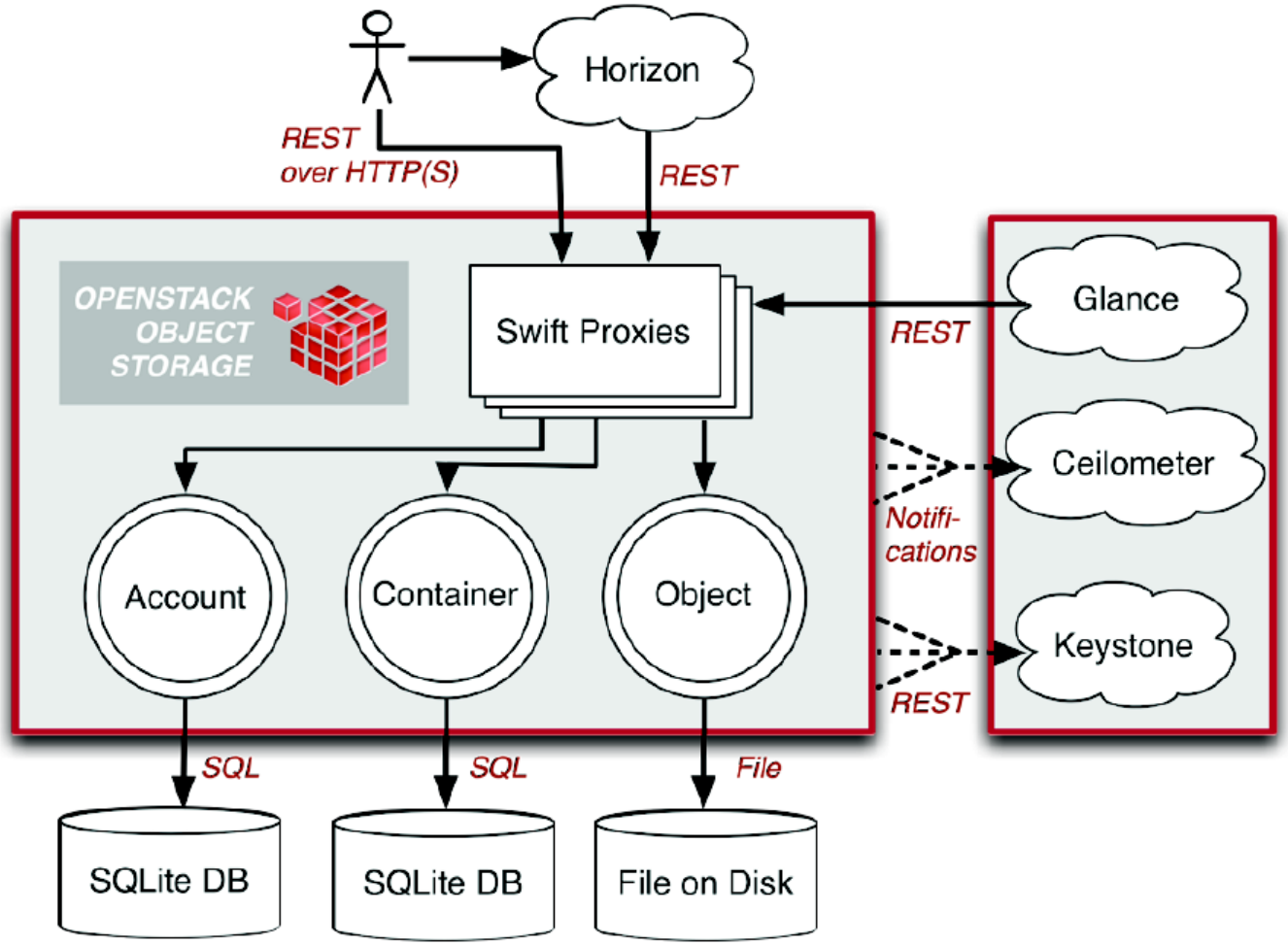
Source: R. Bias, OpenStack Summit April 2013: The State of the Stack

Key Component: Object Storage

- **Swift:** Store & Retrieve data
- Data (*objects*) are stored in buckets (*containers*)
- Eventually consistent design



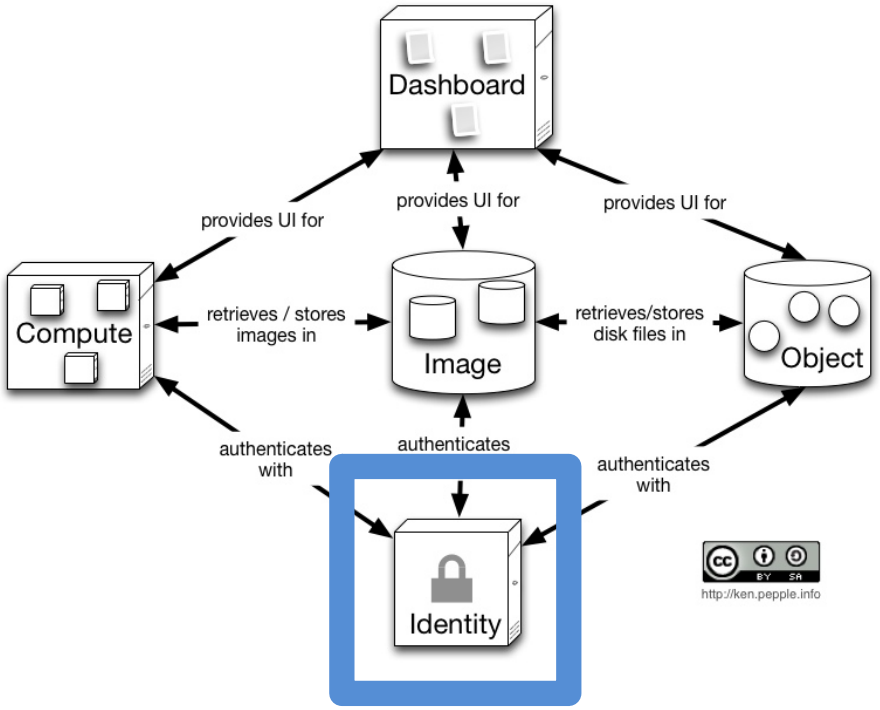
Key Component: Object Storage



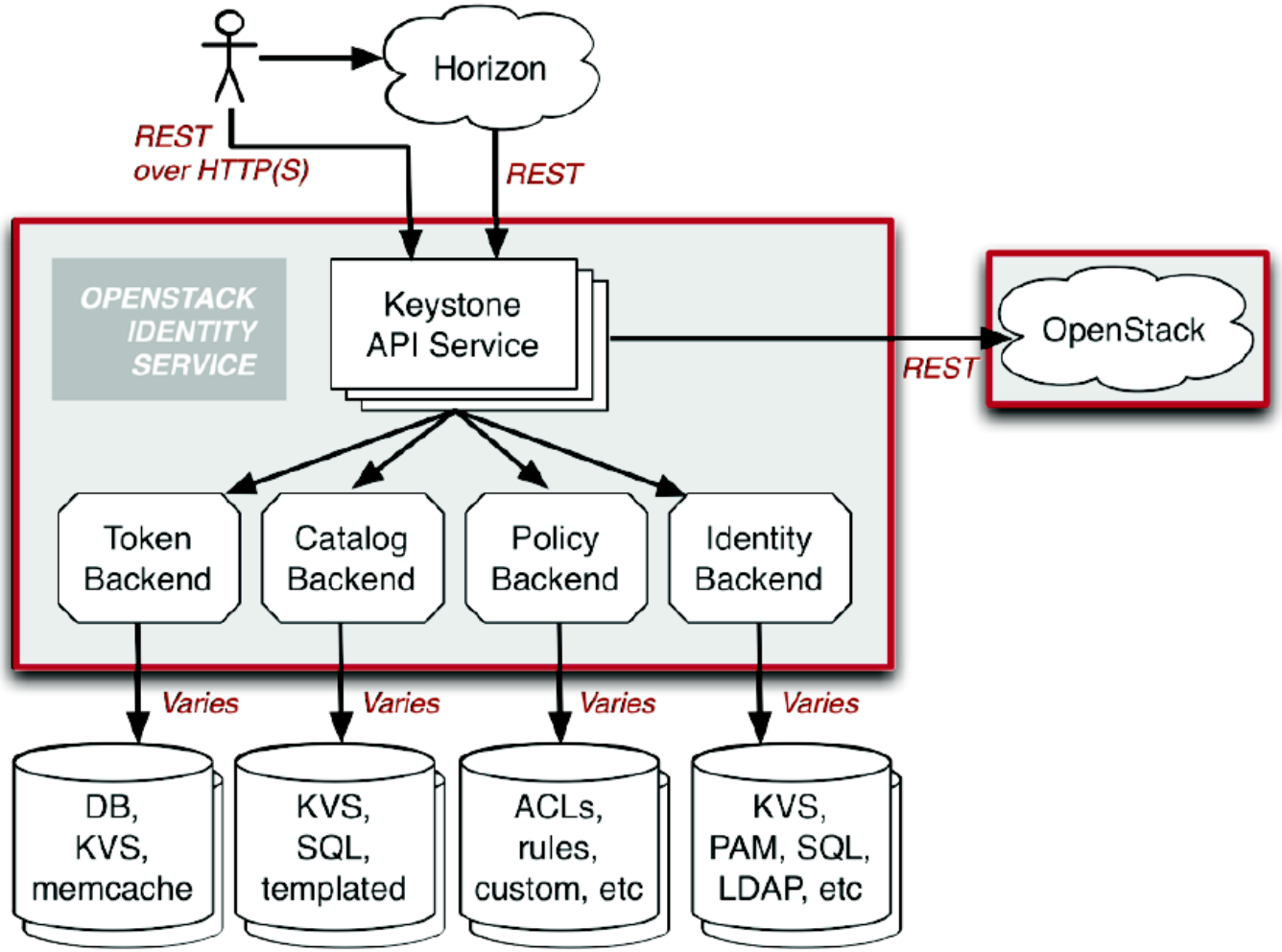
Source: R. Bias, OpenStack Summit April 2013: The State of the Stack

Key Component: Identity

- **Keystone:** authentication and authorization
  - all the OpenStack services.
- Service type catalog of services.
- Pluggable front and back ends



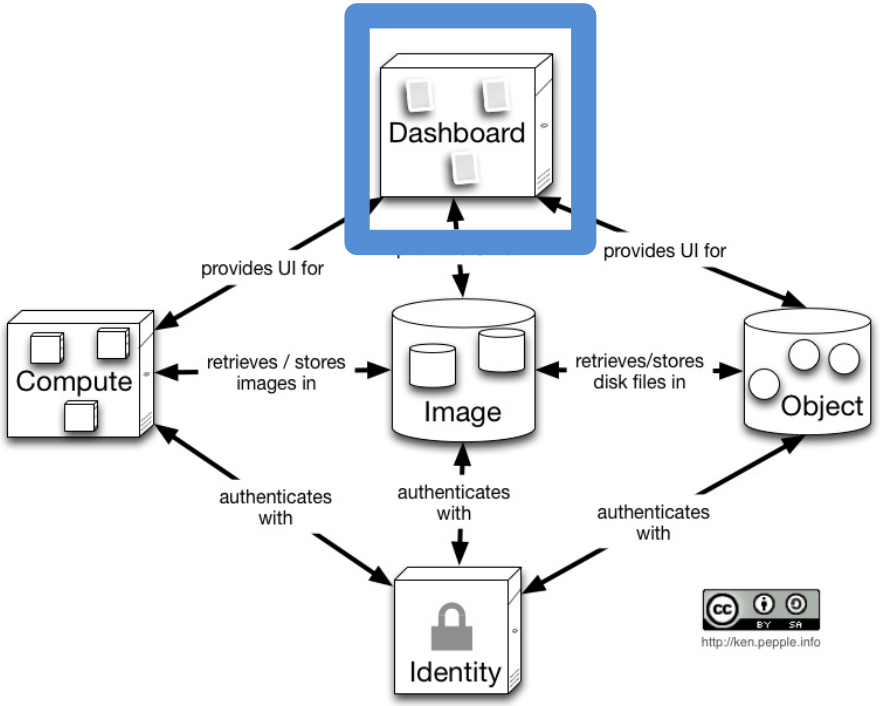
Key Component: Identity



Source: R. Bias, OpenStack Summit April 2013: The State of the Stack

Key Component: Dashboard

- **Horizon:** A modular web-based user interface for all the OpenStack services
- Core functionality
  - Other via cmd. line



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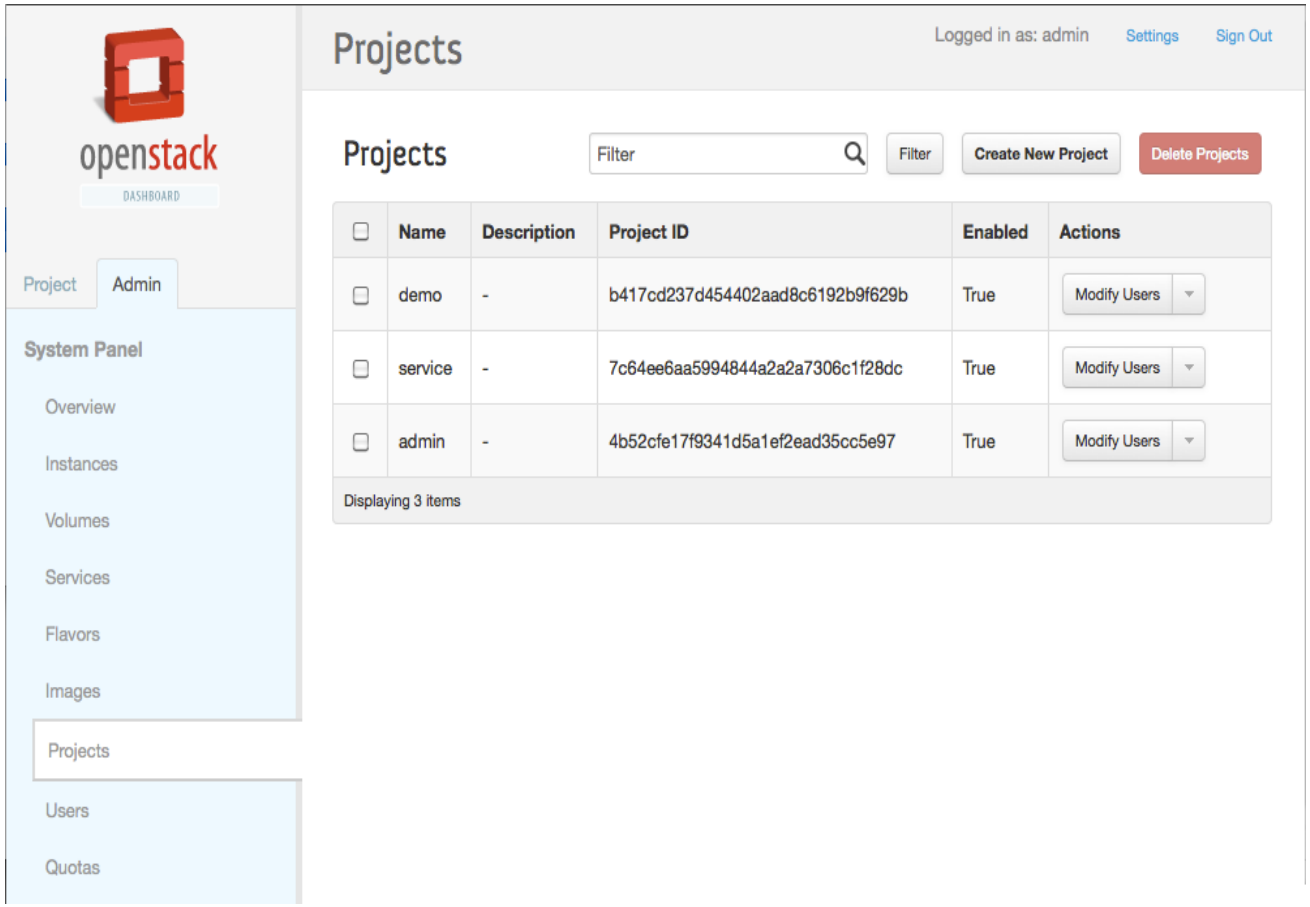
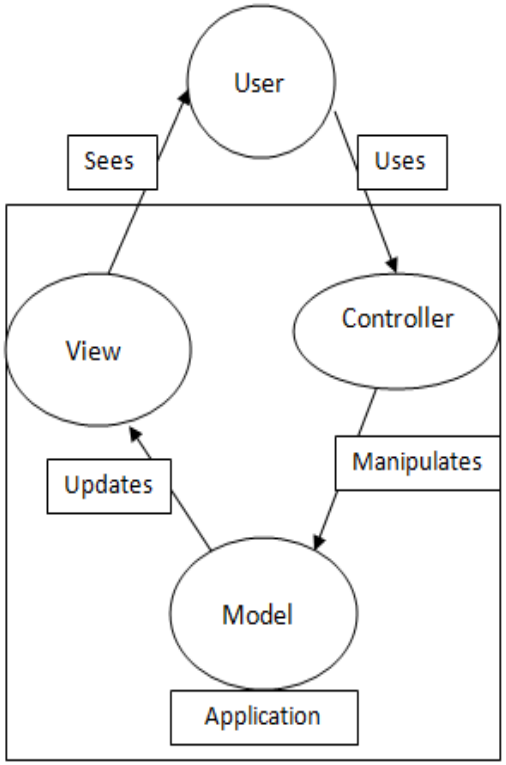
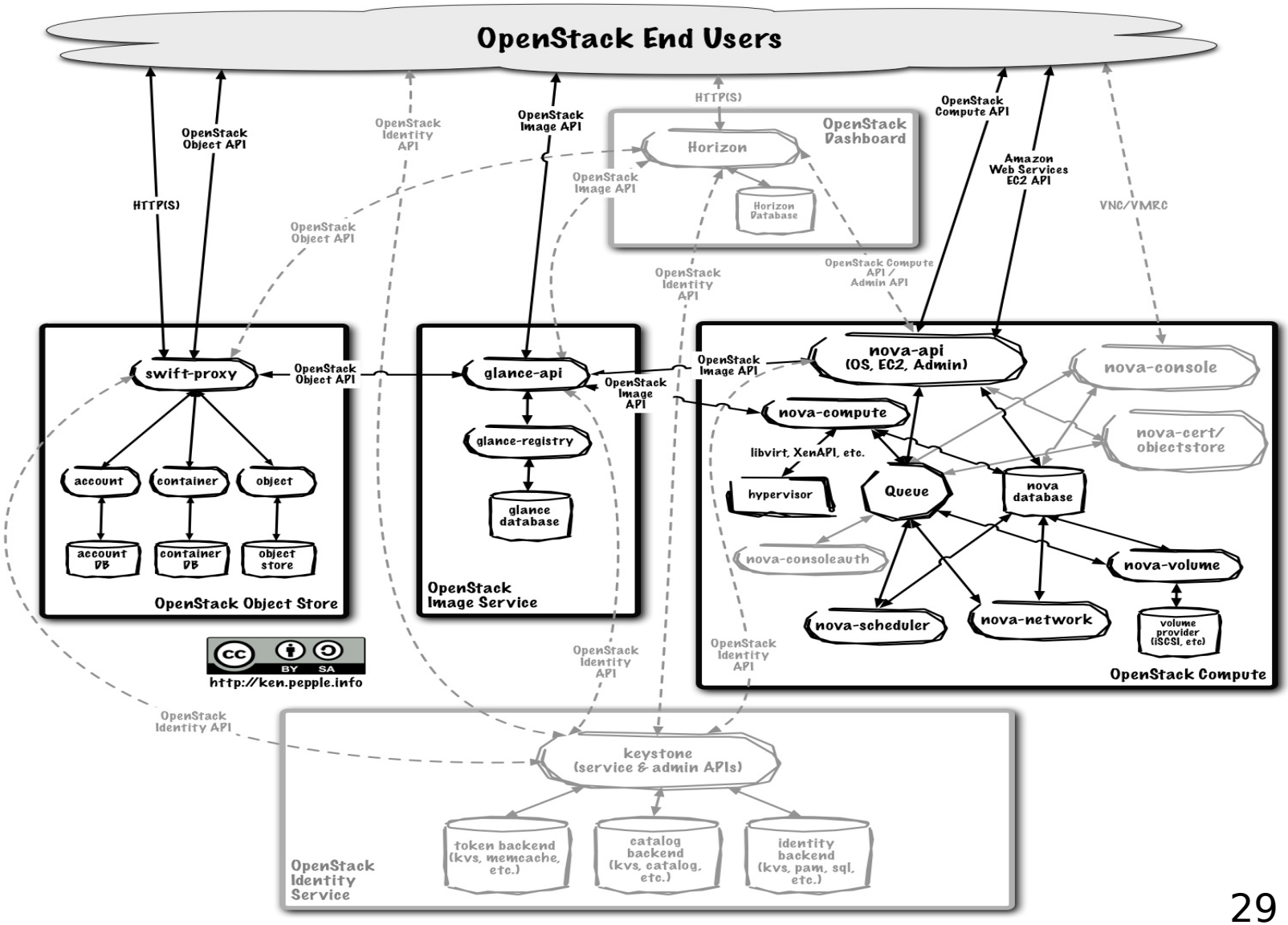




http://upload.wikimedia.org/wikipedia/commons/archive/f/fd/20100511010238%21MVC-Process.png

OpenStack Architecture: The Big Picture



OpenStack Grizzly Release

OpenStack official projects

Integrated Projects (Grizzly release)

- OpenStack Compute (nova): https://launchpad.net/nova
- OpenStack Object Storage (swift): https://launchpad.net/swift
- OpenStack Image Service (glance): https://launchpad.net/glance
- OpenStack Identity (keystone): https://launchpad.net/keystone
- OpenStack Dashboard (horizon): https://launchpad.net/horizon
- OpenStack Networking (quantum): https://launchpad.net/quantum
- OpenStack Block Storage service (cinder): https://launchpad.net/cinder

Recent, important, cool

Incubated Projects (Grizzly release)

- Ceilometer: https://launchpad.net/ceilometer
- Heat: https://launchpad.net/heat

Even newer, important, cool

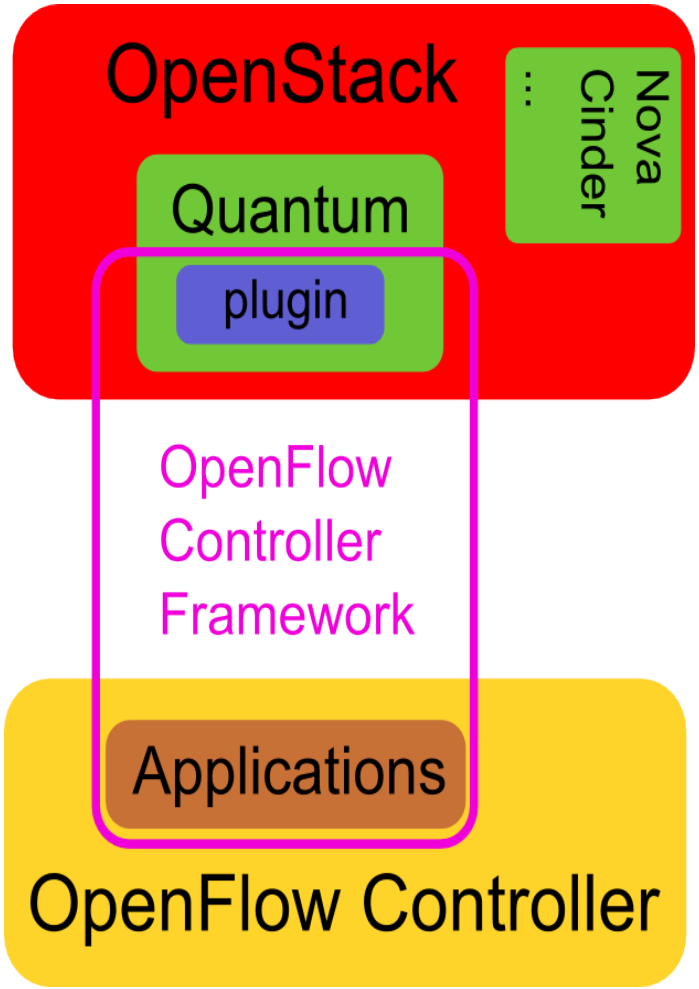
- Python ceilometer client library: https://launchpad.net/python-ceilometerclient
- Python heat client library: https://launchpad.net/python-heatclient

Library Projects

- OpenStack common library: https://launchpad.net/oslo
- Python nova client library: https://launchpad.net/python-novaclient
- Python swift client library: https://launchpad.net/python-swiftclient
- Python glance client library: https://launchpad.net/python-glanceclient
- Python keystone client library: https://launchpad.net/python-keystoneclient
- Python quantum client library: https://launchpad.net/python-quantumclient
- Python cinder client library: https://launchpad.net/python-cinderclient

Recent Component: Quantum

- **Quantum:** Quantum is an **SDN-based** project to provide "networking as a service" between interface devices (e.g., vNICs) managed by other Openstack services (e.g., nova).



Recent Component: Quantum

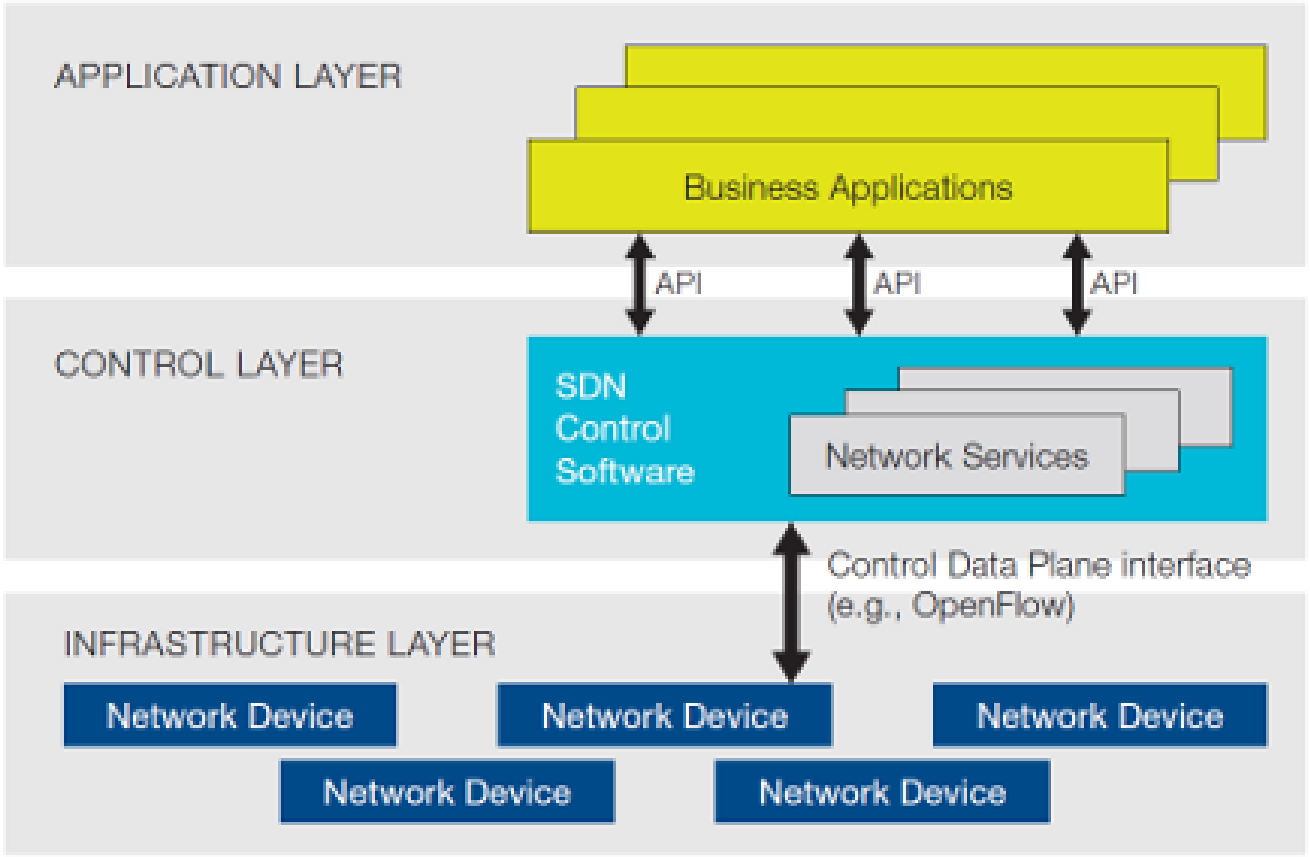
	Nova	Quantum
*-as-a-service	Compute	Network
Major API abstractions	“virtual servers”: represents a host with CPU, memory, disk, and NICs.	“virtual networks”: A basic L2 network segment. “virtual ports”: Attachment point for devices connecting to virtual networks.
Interactions with other OpenStack services.	virtual servers use “virtual images” from Glance.	virtual ports are linked to vNICs on “virtual servers”.
Supports different back-end technologies	“virt-drivers” for KVM, XenServer, Hyper-V, VMWare ESX	“plugins” for Open vSwitch Cisco UCS, Linux Bridge, Nicira NVP, Ryu Controller.
API Extensibility for new or back-end specific features.	keypairs, instance rescue, volumes, etc.	quality-of-service, port statistics, security groups, etc.

Source: Dan Wendlandt – Quantum Hacker & PTL

Recent Component: Quantum

But what is SDN?

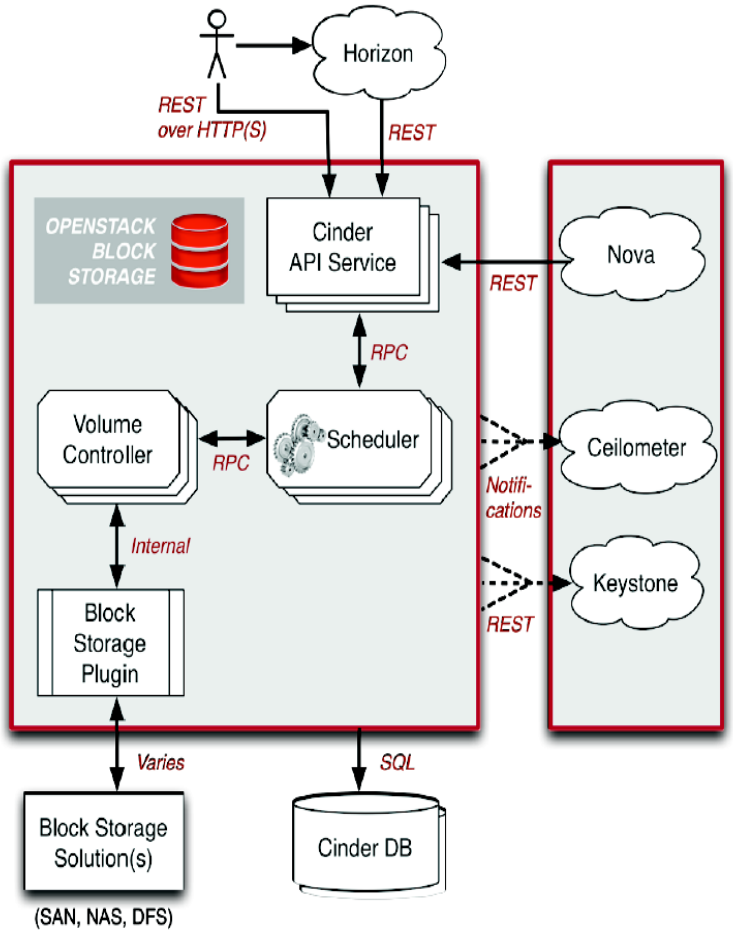
Recent Component: Quantum



But what is SDN? A revolution

Recent Component: Cinder

- **Cinder:** The goal of the Cinder project is to **separate the existing nova-volume block service** into its own project.



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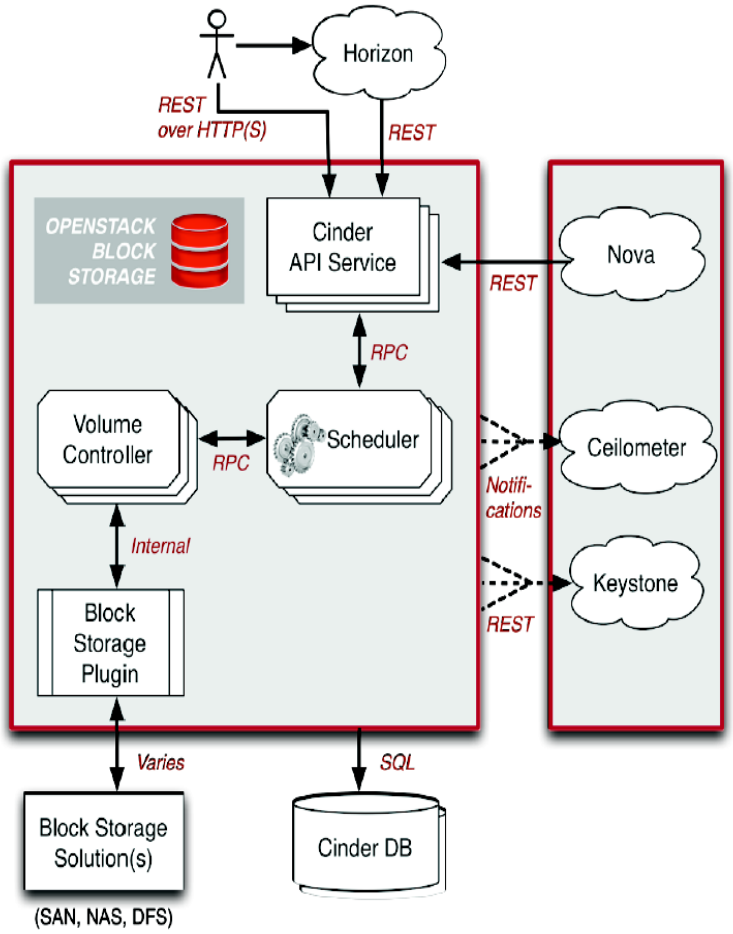
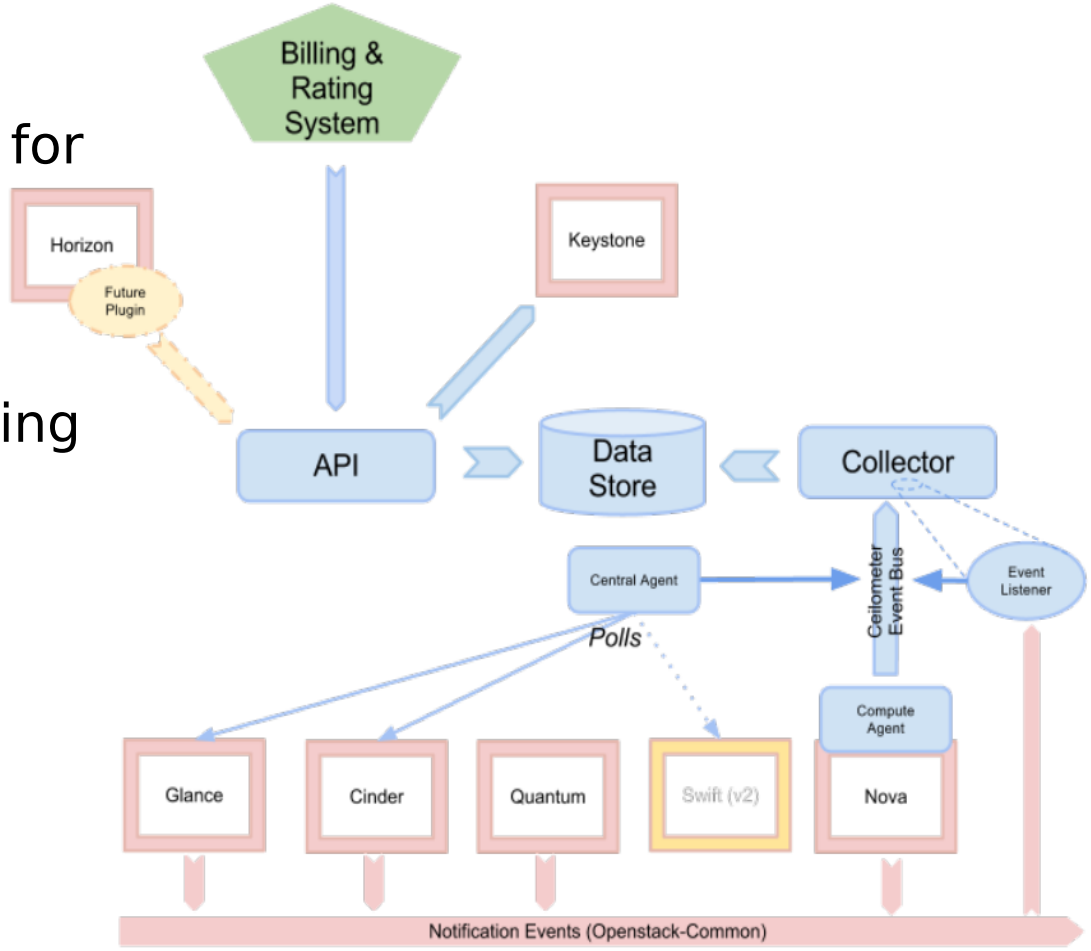


Source: R. Bias, OpenStack Summit April 2013: The State of the Stack

Recent Component: Ceilometer

- **Ceilometer:** Complete monitoring environment for services, resources, and hardware infrastructure
  - Build-in support for Rating, Charging, Billing



Source: OpenStack Ceilometer

Technology scope, okay, but what about Enterprise grade?...

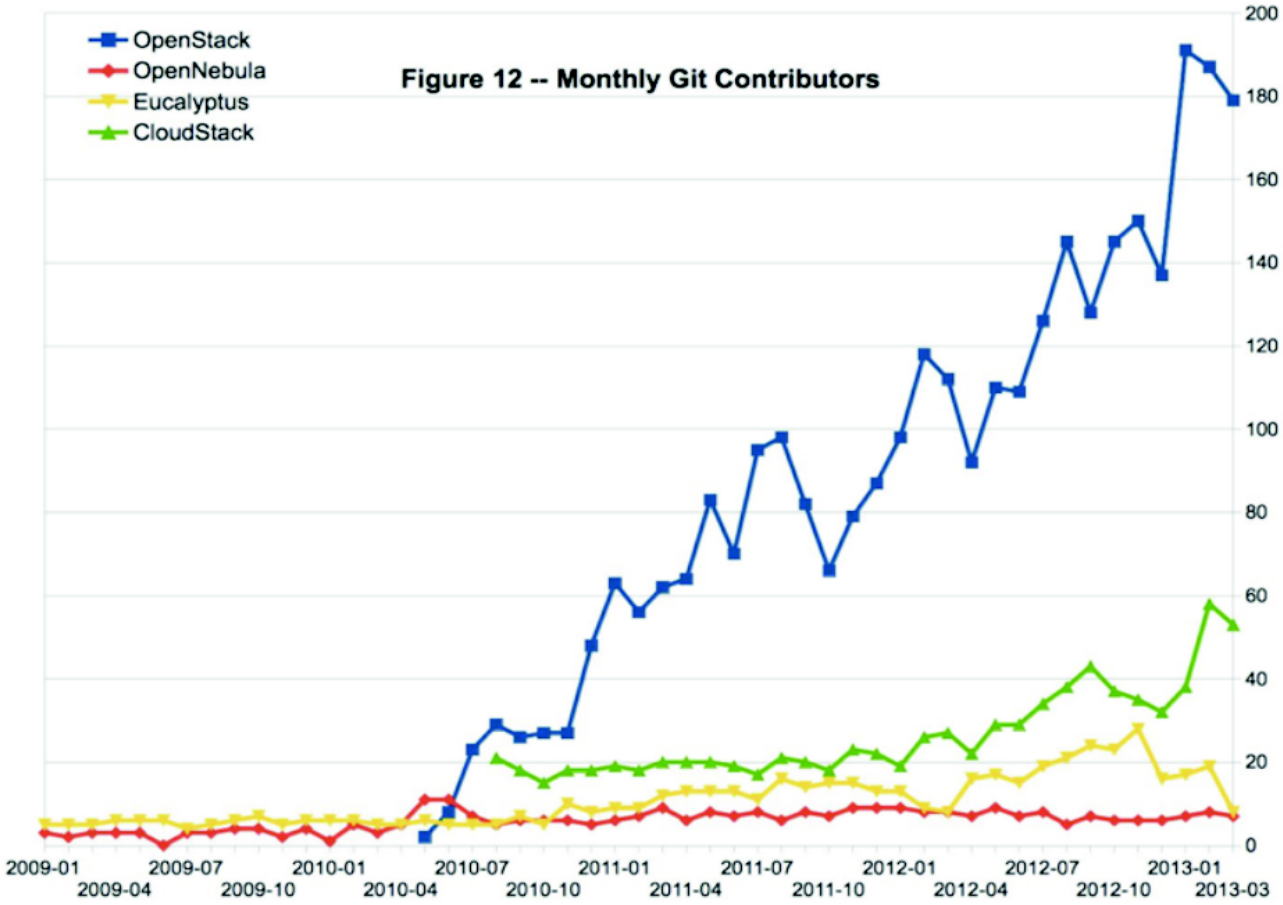
What about: momentum, sustainability, support, maturity, accountability, ...?

Technology scope, okay, but what about Enterprise grade?...

Developer Growth	Over **517 contributors** to Grizzly; a **56% increase** from Folsom release
Top Contributors by Employer	Red Hat, Rackspace, IBM, HP, Nebula, Intel, eNovance, Canonical, VMware, Cloudscaling, DreamHost and SINA
Total Number of Features	Approximately **230 new features**; a 35% increase in the total lines of code from September to March
Attracting New Plugins & Drivers	**5** new Networking plugins and **10** new Block Storage drivers`
Patches Merged	Approximately **7,620 patches merged**
Testing	On average, deploying an OpenStack cloud for testing **700 times per day**

Source: Overview of the OpenStack Grizzly release.

Technology scope, okay, but what about Enterprise grade?...



Qingye Jiang (John) - Open Source IaaS Community Analysis CY13 - Q1

http://www.qyjohn.net/?p=3120

Source: R. Bias, OpenStack Summit April 2013: The State of the Stack

Enterprise grade: The Foundation

- Open Source Software Projects can be quite “challenging”.
- They live or die alongside of the motivation of the committed developers.
- Motivation in a non-commercial environment is largely based by recognition
- Recognition by technical merit, … links to ego … strong opinions …
- How to build trust without loosing the commitment of contributors?
  - Balance between control and creative liberty
- Proven tool: OSS Foundations

Enterprise grade: The Foundation

Mission:

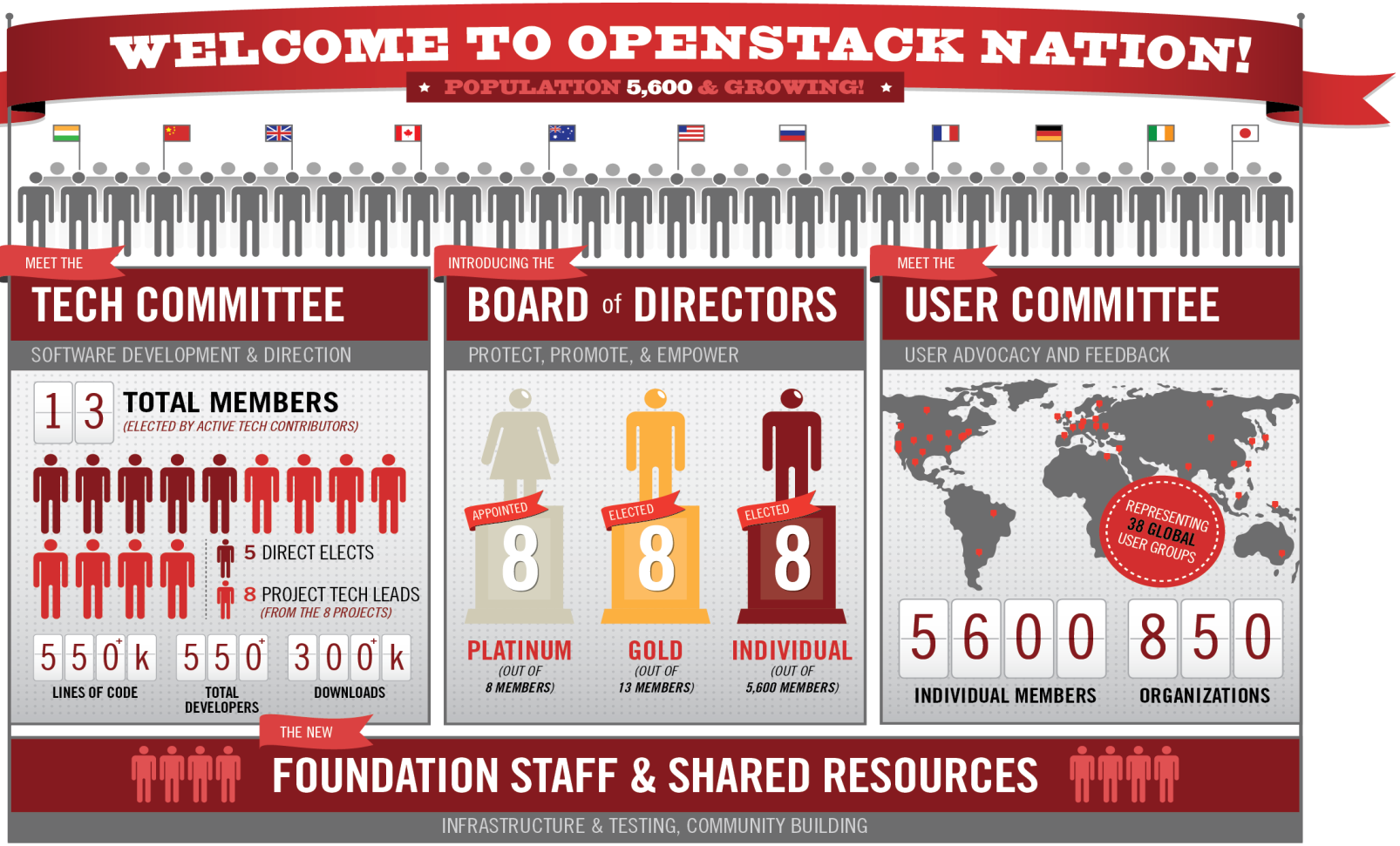
“The OpenStack Foundation is an independent body providing shared resources to help achieve the OpenStack Mission by **Protecting**, **Empowering**, and **Promoting** OpenStack software and the community around it, including users, developers and the entire ecosystem.“

Latest: http://wiki.openstack.org/Governance/Foundation/Mission

Source: OpenStack Foundation.

Enterprise grade: The Foundation

openstack™
CLOUD SOFTWARE



Source: OpenStack Foundation.

Enterprise grade: The Foundation

Project Technical Leads

- Elected by core code contributors every 6 months prior to Design Summits
- Set technical direction for the project they lead
- Make tough calls when needed
- **Net:** Most of the technical decisions made on a day-to-day basis are made by this person, who is elected by the technical community

Actual PTL

openstack™
CLOUD SOFTWARE

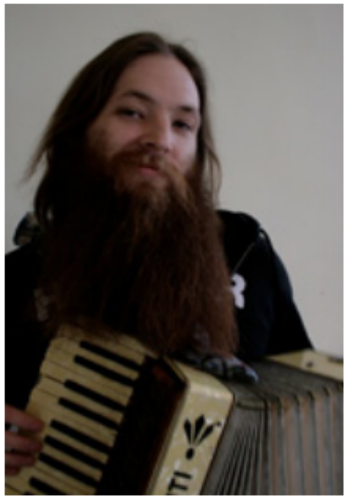
Source: OpenStack Foundation.

Enterprise grade: The Foundation

Technical Committee

Responsibilities

- Artist formerly known as the Project Policy Board (PPB)
- Set technical policies that cross projects, work with PTLs
- Determine which new projects are “incubated”



Actual OpenStack developer

openstack™
CLOUD SOFTWARE

Source: OpenStack Foundation.

Enterprise grade: The Foundation

Board of Directors

Responsibilities

- Oversees Foundation operations
- Sets overall budget & goals & hires Executive Director
- Advocates for the Foundation and the entire OpenStack community

Membership

- Individual Members elect 1/3 of the seats
- Gold Members elect 1/3 of the seats
- Platinum Members appoint 1/3 of the seats
- Members must follow a code of conduct, committing to advancing OpenStack, staying active in the community, and performing their duties with integrity

Not an actual Board Member

openstack
CLOUD SOFTWARE

Source: OpenStack Foundation.

Enterprise grade: The Foundation

Membership of the Foundation: Three types

"Individual Members" who participate on their own or as part of their paid employment. It's free to join as an Individual Member and Individual Members have the right to run for, and vote for, a number of leadership positions.

"Platinum Members" (was called "Strategic") are companies which make a significant strategic commitment to OpenStack in funding and resources. Platinum Members each appoint a representative to the Board of Directors

"Gold Members" (was called "Associate") are companies which provide funding and resources, but at a lower level than Platinum Members. Associate Members as a class elect representatives to the Board of Directors.

Source: OpenStack Foundation.

Enterprise grade: The Foundation

Funding Sources

Platinum Member Fees

- $500,000 per year (paid annually) with a three-year commitment.
- Contributing resources equivalent to 2 FTEs
- AT&T, Canonical, HP, IBM, Nebula, Rackspace, Red Hat, and SUSE

Gold Member Fees

- Total company revenue times 0.025%, minimum of $50,000, maximum of $200,000.
- Cisco, ClearPath Networks, Cloudscaling, Dell, DreamHost, ITRI, Mirantis, Morphlabs, NetApp, Piston Cloud Computing and Yahoo!

Corporate Sponsorships

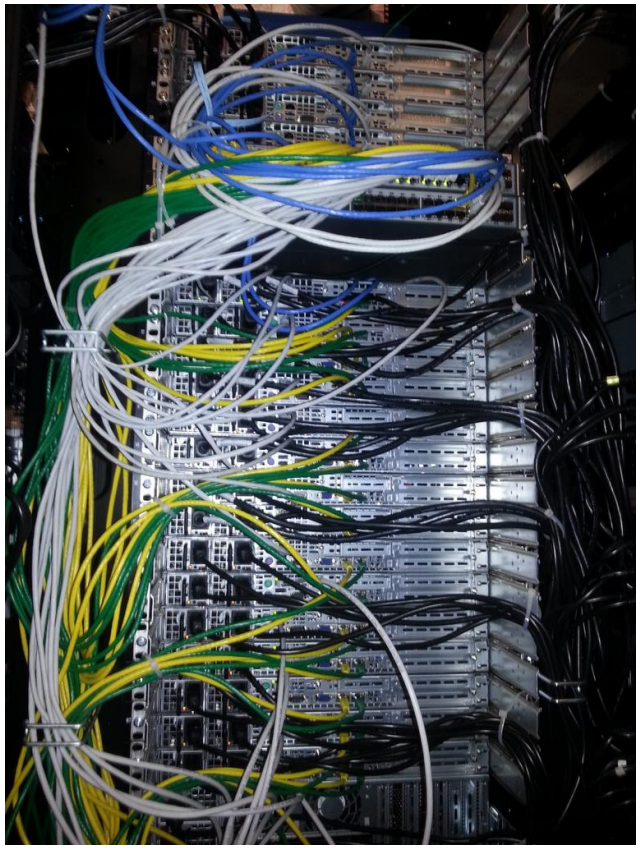
- Other companies can support the OpenStack foundation at a lower cost by becoming a Corporate Sponsor
- Additional funds will be raised through event sponsorships, like the OpenStack Design Summit & Conference, industry conferences and regional events

openstack™
CLOUD SOFTWARE

Source: OpenStack Foundation.

OpenStack@ICCLab

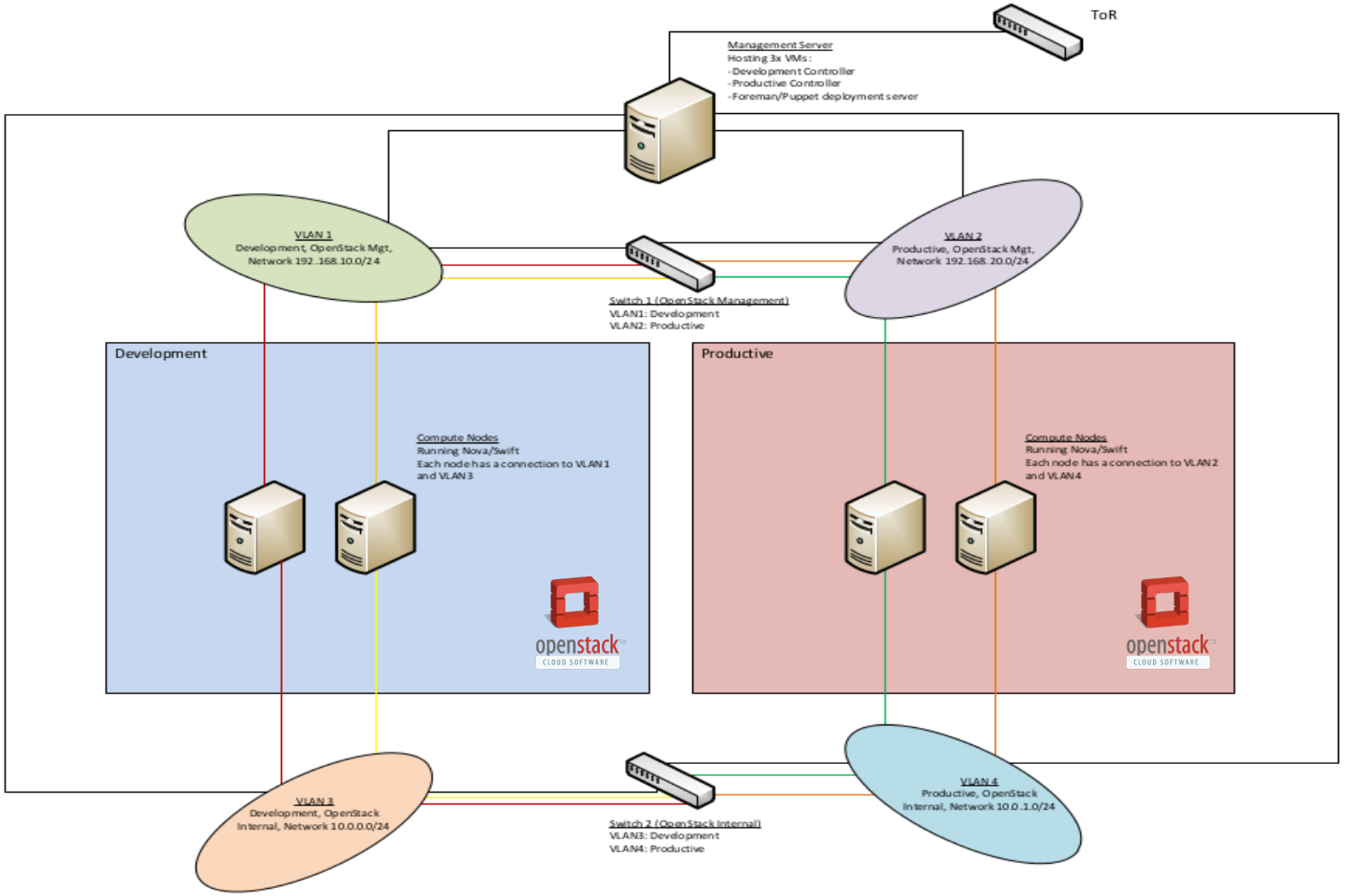
Second public SWISS OpenStack Proof-of-Concept (next to CERN)
Fully operational Cloud (IaaS)
25 Computing units, 8×2.4 Ghz Cores, 64GB RAM and 4×1TB local storage per unit.
12TB NFS or iSCSI Storage
10Gbit Ethernet (data) 1Gbit (ctrl)



- Hadoop as a Service
- Open Cloud Computing Interface
- Cloud Monitoring
- SDN-ready
- SmartOS for OpenStack

OpenStack @ ICCLab

ICCLab – Development / Productive Environment



How can **YOU** take part?

Swiss OpenStack User Group!

Meet-up soon to be announced

@openstackch

http://linkd.in/os-ugch

Join in!