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TOMORROW starts here.

Cisco Connect

OpenStack Deployment in the Enterprise

Session ID T-DC-19-I

Josh Kaya, TSA

Mike Perron, CSE

House Keeping Notes

Thank you for attending Cisco Connect Toronto 2014, here are a few housekeeping notes to ensure we all enjoy the session today.

- Please ensure your cellphones are set on silent to ensure no one is disturbed during the session
- Please hold all questions until the end of these session to ensure all material is covered

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Give us your feedback and you could win 1 of 2 fabulous prizes in a random draw.

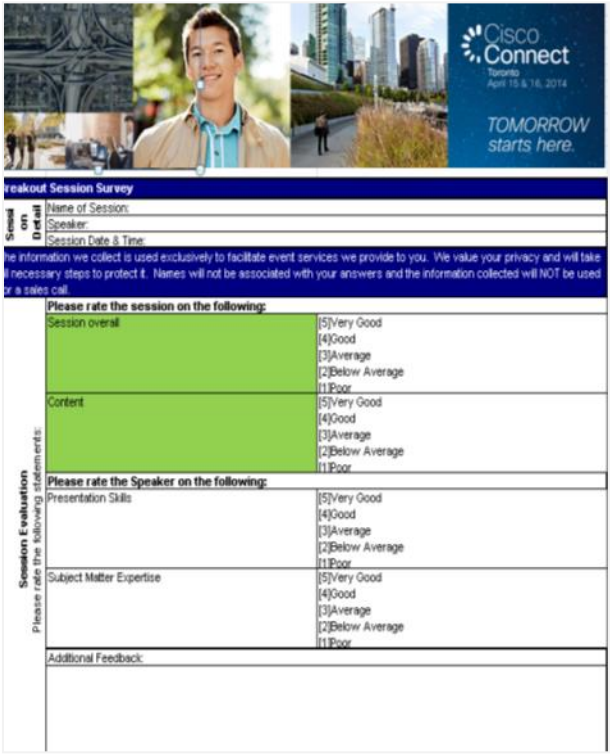
Complete and return your paper evaluation form to the Room Attendant at the end of the session.

Winners will be announced today at the end of the session. *You must be present to win!*

Please visit the Concierge desk to pick up your prize redemption slip.

plantronics

Visit them at BOOTH# 407



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Agenda

- Intro to OpenStack (30 minutes)
- Networking in OpenStack (30 minutes)
- OpenStack integration with ACI
- Demo - (30 Minutes)
- final thoughts - Openstack user group

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Agenda – Intro to OpenStack

- Review: Amazon AWS
- OpenStack Intro
- OpenStack Community and Distributions
- OpenStack Architecture
- OpenStack Terminology
- OpenStack Projects
- OpenStack and Cisco

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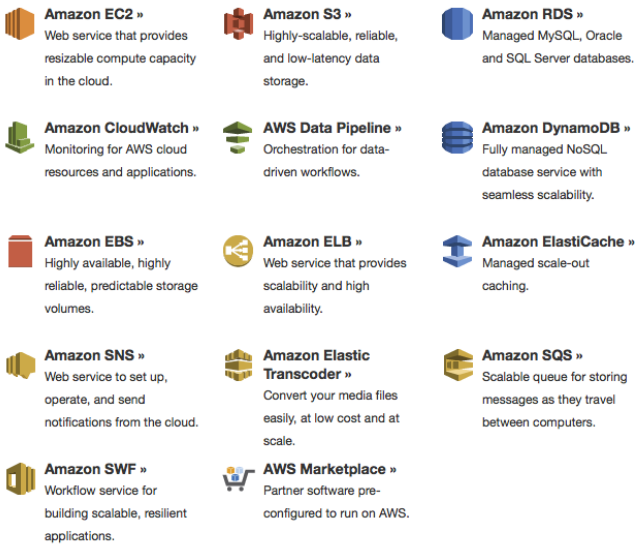
Review – Amazon AWS



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Amazon AWS

- AWS is Amazon's umbrella description of all of their web-based technology services

- Mainly infrastructure services:
  - Amazon Elastic Compute Cloud (EC2)
  - Amazon Simple Storage Service (S3)
  - Amazon Simple Queue Service (SQS)
  - Amazon CloudFront
  - Amazon SimpleDB

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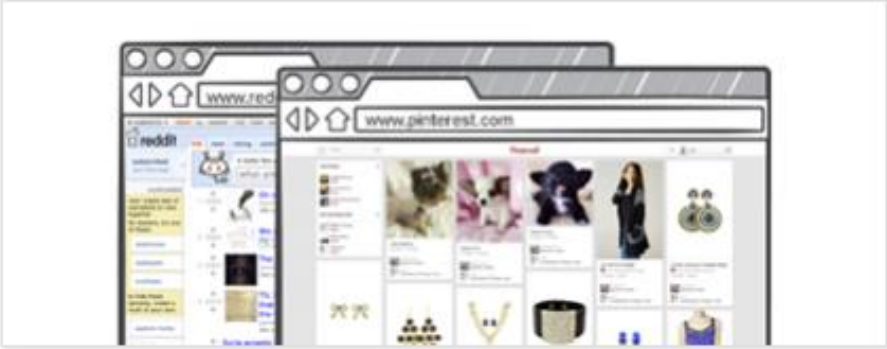
Amazon EC2 Is…



- A Web service that provides resizable compute capacity in the cloud.
- Designed to make Web-scale computing easier for developers.
- A simple Web service interface that provides complete control of your computing resources

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Amazon EC2 Benefits You Because It

- Reduces the time required to obtain and boot new server instances to minutes
- Quickly scales capacity, both up and down, as your computing requirements change
- Changes the economics of computing:
  - Pay only for capacity that you actually use
  - *a* + *bc* becomes just *bc*

  - No start-up, monthly, or fixed costs
  - $0.10 per CPU hour
  - $0.20 per GB transferred across Net
  - No cost to transfer data between Amazon S3 and Amazon EC2

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Amazon Storage

- EC2 Instance Store : disappears with the instance (transient)
- S3 is independent of an instance: for archival purposes: vault: store it now and retrieve it at a later date
- Elastic Block Storage: SAN-like, persists across time
- SimpleDB: Relational database better than MySQL or Oracle for reliability.

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Amazon S3 API: Web/Object Storage

Amazon web services S3 API supports the ability to:

- Find buckets and objects
- Discover their meta data
- Create new buckets
- Upload new objects
- Delete existing buckets and objects
- When manipulating the buckets you can optionally specify where they should be stored.
- Use REST API preferably something that abstracts out even that: Jets3t; s3cmd (command line)
- BitTorrent access to S3 is also available

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Intro

- “OpenStack is a collection of open source technologies delivering a massively scalable cloud operating system” - openstack.org
- OpenStack is a cloud operating system that controls large pools of compute, storage, and networking resources throughout a data center, all managed through a dashboard that gives administrators control while empowering users to provision resources through a web interface.
- OpenStack is an Open Source software for building private and public clouds.
- OpenStack is backed up by a global of community technologists, developers, researchers, corporations and computing experts.
- OpenStack enables developers to build cloud-aware applications via APIs

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OpenStack Community

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OpenStack Distributions

- RedHat - Based on the same model of Fedora and Red Hat Enterprise Linux, OpenStack from Red Hat is available in two flavors
  - Red Hat Distribution of OpenStack (RDO)
  - Red Hat Enterprise Linux OpenStack Platform.
- Mirantis – provides OpenStack software, training and consulting
- RackSpace - provides OpenStack software, hosting, training and consulting
- Canonical – bundles OpenStack with their server (Ubuntu based) including fully scriptable API
- Cloudscaling – provides customized OpenStack to meet enterprise needs
- Piston OpenStack -includes a number of proprietary technologies that automate the configuration, deployment and management of OpenStack

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OpenStack Conceptual Architecture

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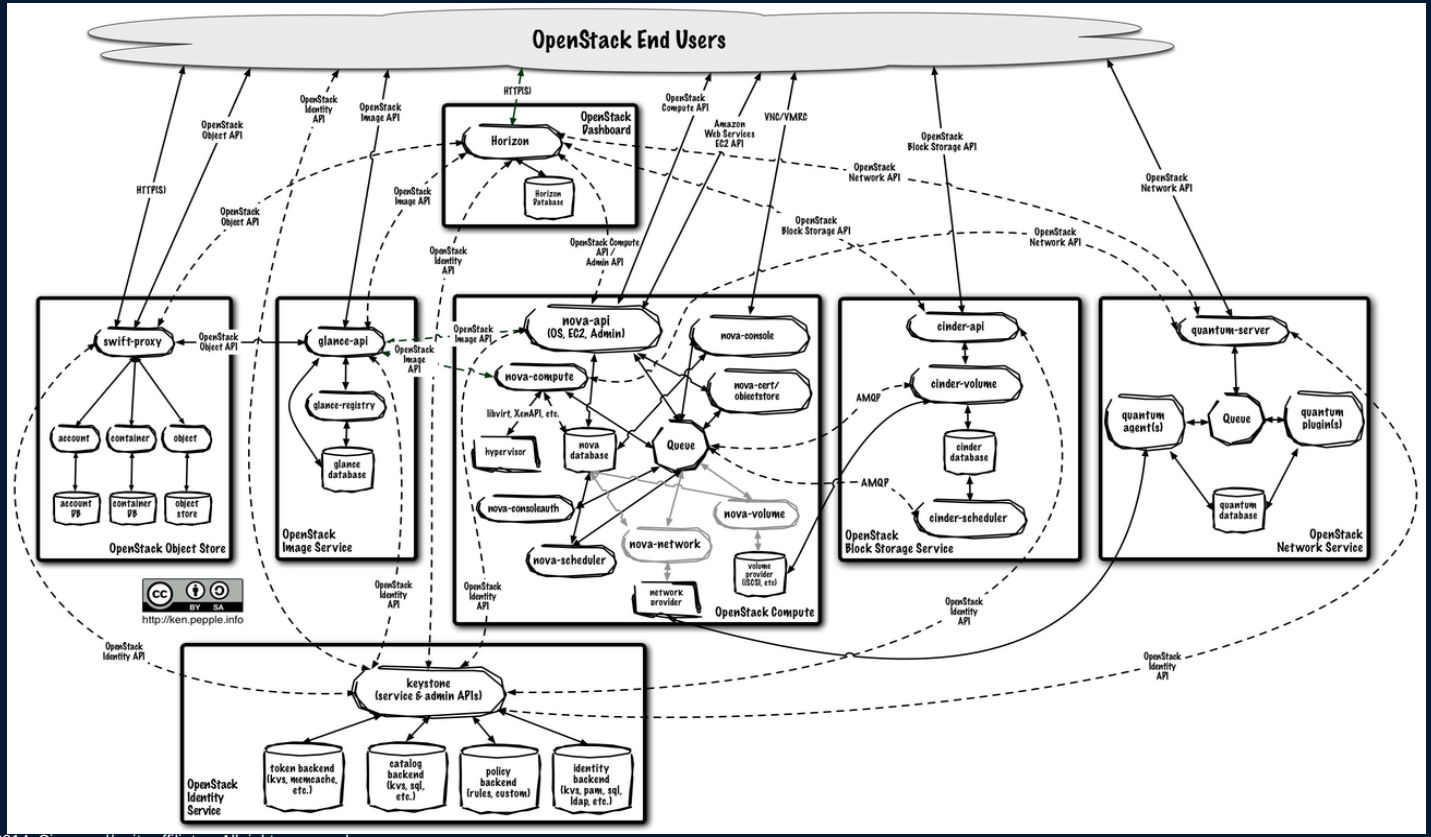
OpenStack Logical Architecture



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OpenStack Terminology

- Instance- Running virtual machine
- Image- Non-running virtual machine, multiple formats (AMI, OVF, etc.)
- Application Programming Interface (API)- Interface for computer programs
- Message Queue- Acts as a hub for passing messages between daemons
- Volume- Provides persistent block storage to instances
- Project- aka Tenants, provides logical separation among cloud users
- Flavors- Pre-created bundles of compute resources
- Fixed IP- Associated to an instance on start-up, internal only
- Floating IP- Public facing IP address

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OpenStack Releases

Release Name	Release Date	Included Components
Austin	21 Oct 2010	Nova, Swift
Bexar	3 Feb 2011	Nova, Glance, Swift
Cactus	15 Apr 2011	Nova, Glance, Swift
Diablo	22 Sept 2011	Nova, Glance, Swift
Essex	5 Apr 2012	Nova, Glance, Swift, Horizon, Keystone
Folsom	27 Sept 2012	Nova, Glance, Swift, Horizon, Keystone, Quantum, Cinder
Grizzly	4 Apr 2013	Nova, Glance, Swift, Horizon, Keystone, Quantum, Cinder
Havana	17 Oct 2013	Nova, Glance, Swift, Horizon, Keystone, Neutron, Cinder
Icehouse	Apr 2014	Nova, Glance, Swift, Horizon, Keystone, Neutron, Cinder …

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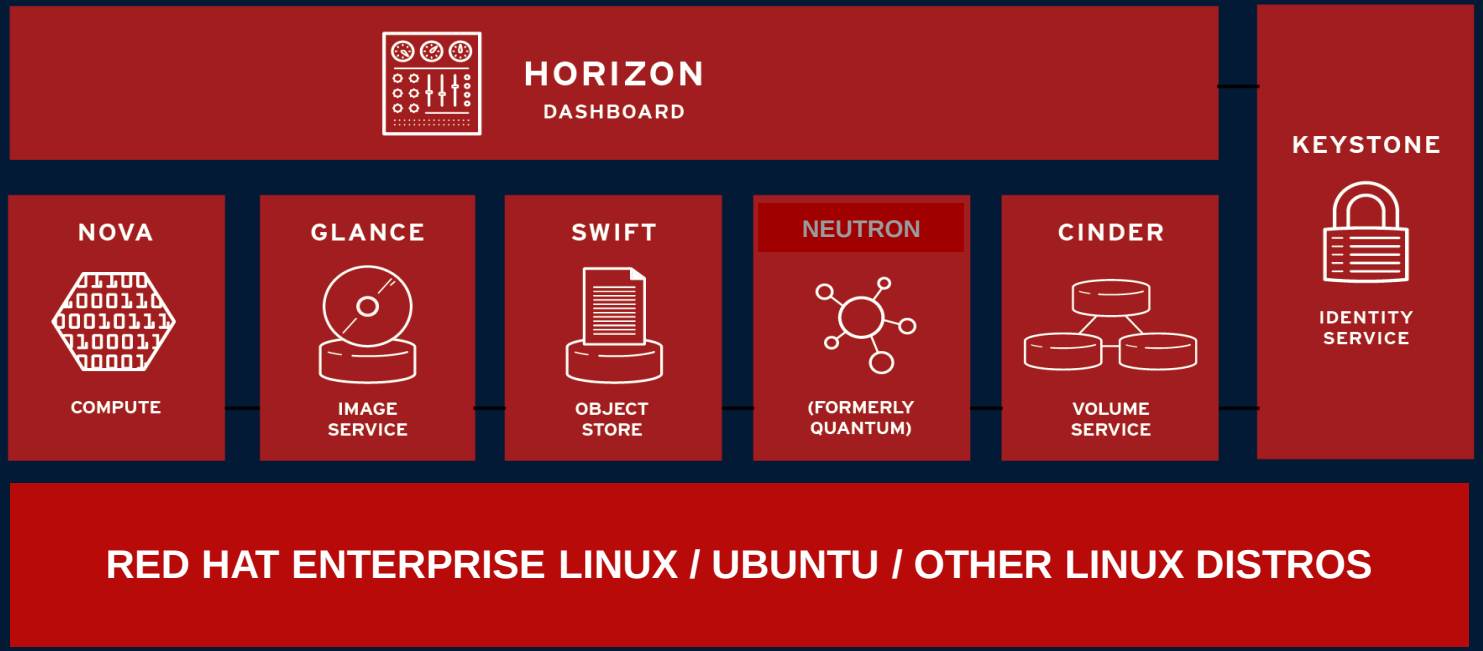
OpenStack Projects



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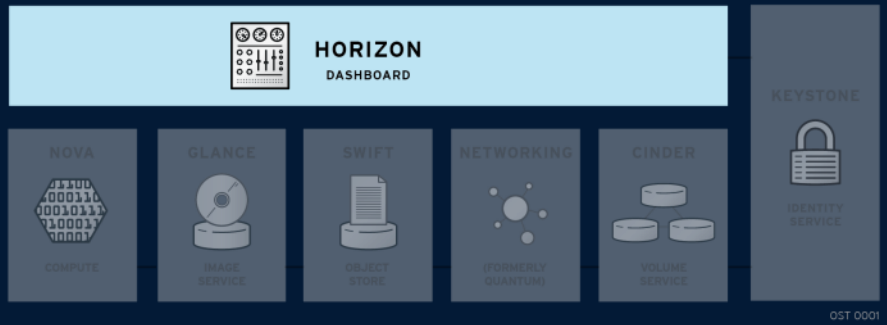
OpenStack Projects - HORIZON



OpenStack Dashboard (HORIZON)

- Dashboard
- Provides simple self service UI for end-users
- Basic cloud administrator functions
  - Define users, tenants and quotas
  - No infrastructure management

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OpenStack Projects - KEYSTONE

OpenStack Identity (KEYSTONE)

- Identity Service
- Common authorization framework
- Manages users, tenants and roles
- Pluggable backends (SQL, PAM, LDAP, etc)

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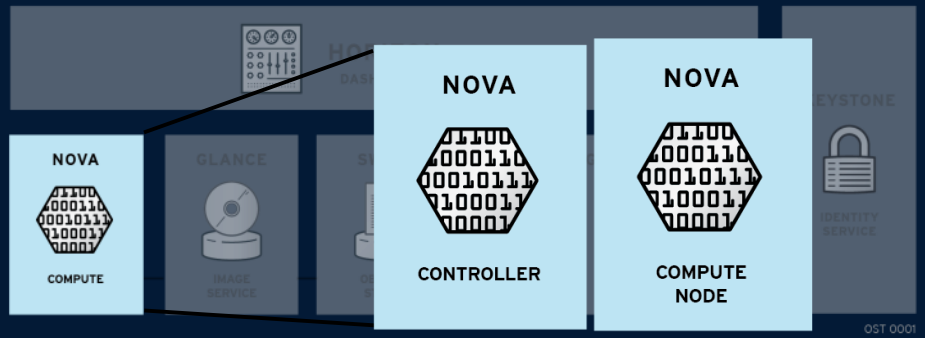
OpenStack Projects - NOVA



OpenStack Compute (NOVA)

- Core compute service comprised of
  - Compute Nodes – hypervisors that run virtual machines
    - Supports multiple hypervisors KVM, Xen, LXC, Hyper-V and ESX
  - Distributed controllers that handle scheduling, API calls, etc
    - Native OpenStack API and Amazon EC2 compatible API

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OpenStack Projects - GLANCE

OpenStack Image (GLANCE)

- Image service
- Stores and retrieves disk images (virtual machine templates)
- Supports Raw, QCOW, VMDK, VHD, ISO, OVF & AMI/AKI
- Backend storage : Filesystem, Swift, Amazon S3

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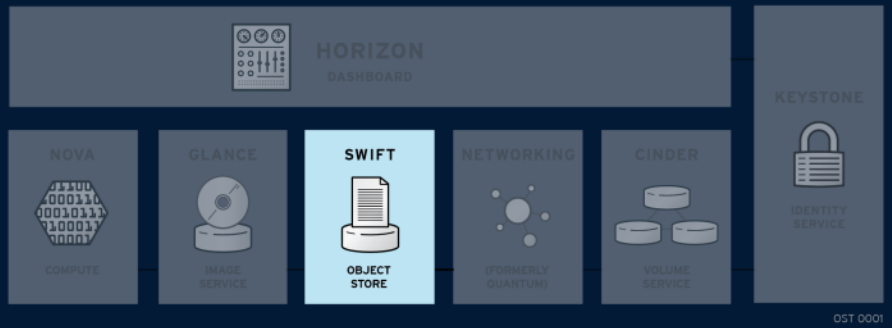
OpenStack Projects - SWIFT



OpenStack Object Storage (SWIFT)

- Object Storage service
- Modeled after Amazon's S3 service
- Provides simple service for storing and retrieving arbitrary data
- Native API and S3 compatible API

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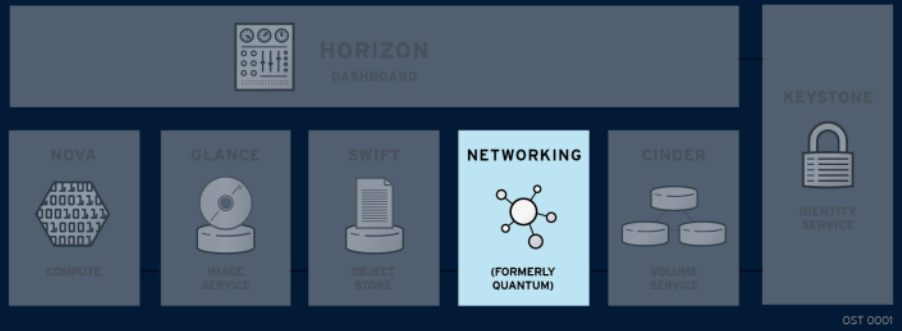
OpenStack Projects - NEUTRON



OpenStack Networking (NEUTRON formerly QUANTUM)

- Network Service
- Provides framework for Software Defined Network (SDN)
- Plugin architecture
  - Allows integration of hardware and software based network solutions

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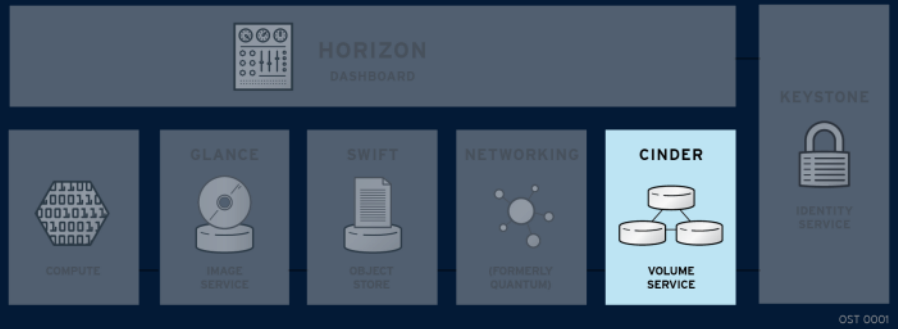
OpenStack Projects - CINDER



OpenStack Block Storage (CINDER)

- Block Storage (Volume) Service
- Provides block storage for virtual machines (persistent disks)
- Similar to Amazon EBS service
- Plugin architecture for vendor extensions
  - eg. NetApp driver for Cinder

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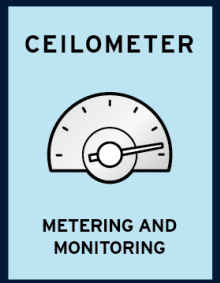
OpenStack Incubating Projects

OpenStack Orchestration (HEAT)

- Goal: Provides AWS CloudFormation implementation for OpenStack
- Deploys composite cloud applications to OpenStack



OpenStack Monitoring and Metering (CEILOMETER)

- Goal: To provide a single infrastructure to collect measurements from an entire OpenStack infrastructure; eliminate need for multiple agents attaching to multiple OpenStack projects
- Primary targets metering and monitoring; provides extensibility

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OpenStack at Cisco

Community Participation

- OpenStack Foundation Board member
- Code Contributions across Core services
- Second most prolific contributor for Completed Blueprints
- One of the leading contributors of code to the Neutron project
- Expanding beyond Neutron

Cisco Engineering

- Neutron Plug-ins for Cisco Nexus
  - ACI APIC plug-ins
  - VLAN Programing
  - N1KV portfolio for KVM
- Cisco OpenStack Tools
  - Cisco UCS OpenStack Installer
  - UCS One-touch provisioning tool
- Cisco UCS OpenStack CVD
- Cisco UCS Accelerator Paks
- Adoption in Products (VIRL)

Customers and Partners

- Cisco OpenStack Advanced Services
- Drive innovation through real-world use cases
- Comcast, WebEx, Paypal, Best Buy, large SPs, Photobucket

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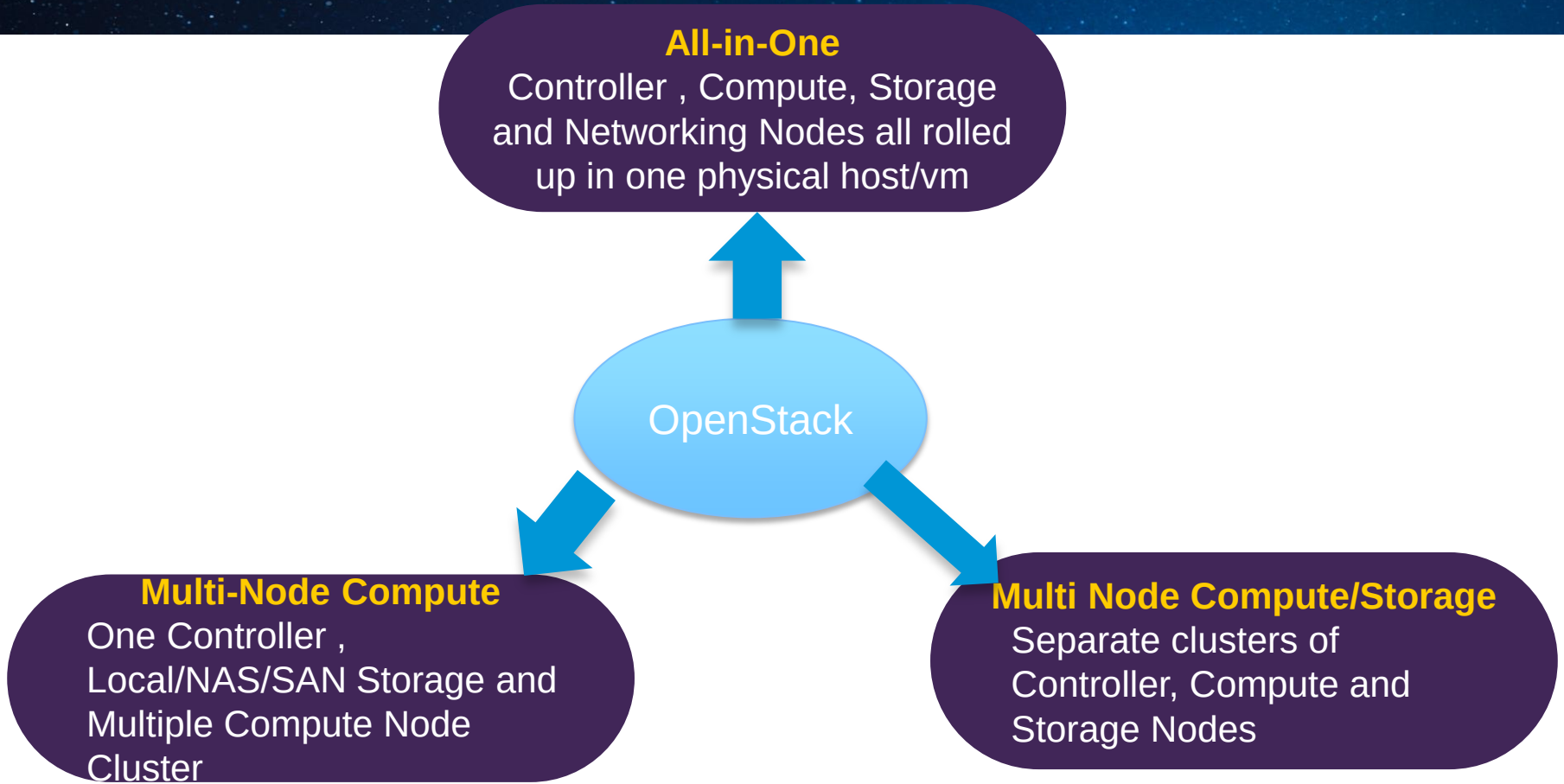
OpenStack Deployment Models



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OpenStack – Scripted Install on UCS

Pre-configure UCS

- Hostname / IP address
- Logical credentials
- Resource allocation preferences
- Only Point of User Touch

Provision UCS Servers

- Chassis/Server Discovery
- Service Profile Association
- PXE boot devices deployed

Register Nodes

- Cobbler database update

Event Listener

- Updates the newly added node info in puppet
- Puppet apply
- Add hosts/system in OpenStack

Host OS Install

- PXE boot for initial OS install
- RHEL 6.4 installation on bare-metal servers
- Sync all the plugins from Puppet Master

OpenStack Handover

- Inventory of nova nodes on controller
- VM Provisioning
- OpenStack Services Deployment

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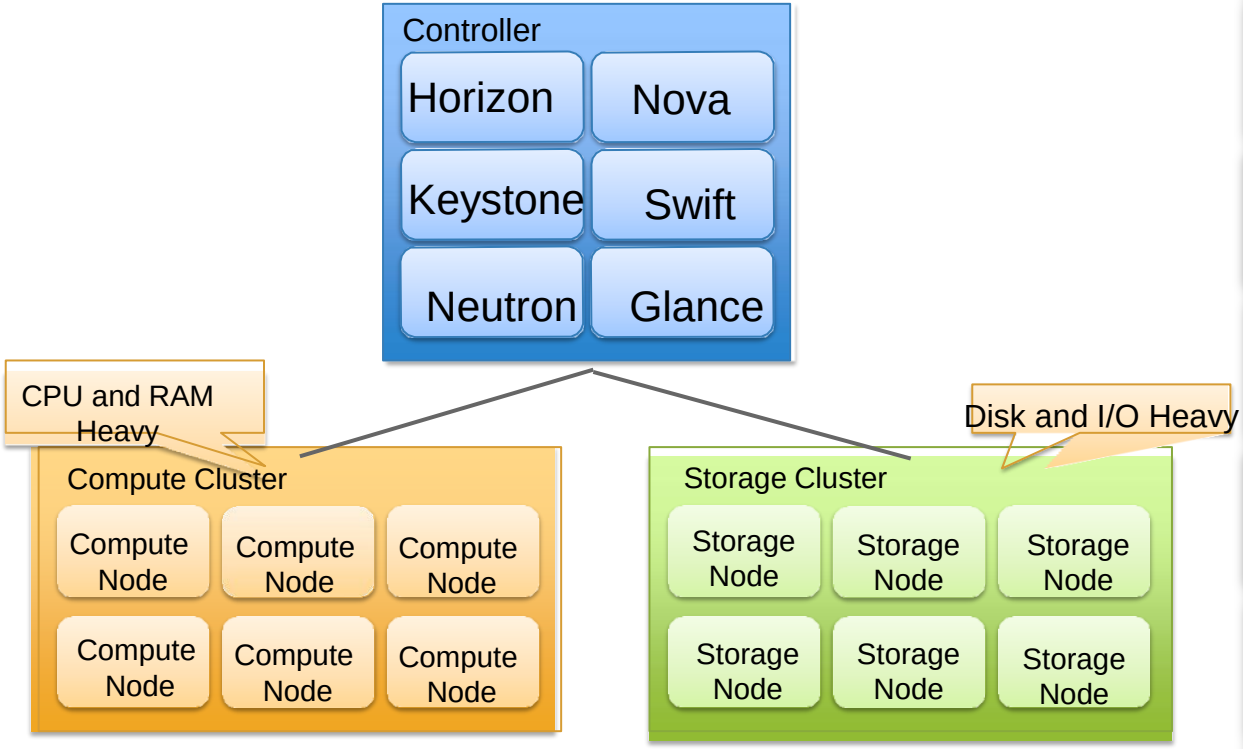
Typical OpenStack Deployment



Controller	2 x C220 M3 or 2 x B200 M3
Compute	N x C220 M3 or N x B200 M3
Swift Proxy	N x C220 M3 or N x B200 M3
Swift Storage	N x C240 M3
Ceph Storage	N x C240 M3

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Real Life OpenStack Deployment Looks Like This !

- Controller Node

  Intel E5-2660, ≤ 256 Gb, ≤ 2 TB HDD

  B200 M3; C220 M3

- Compute Nodes

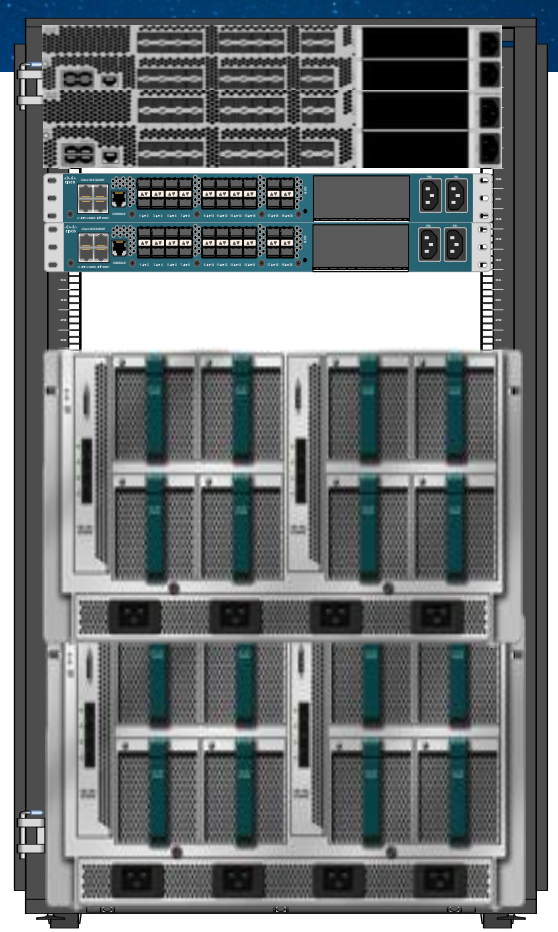
  Intel E5-2660, 768 Gb – 1 TB RAM, 2 TB HDD

  B200 M3, B250 M2; B440 M2; C220 M3

- Storage Nodes

  Intel E5-2660, 32 Gb RAM, ≤ 24 TB HDD

  C240 M3



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Getting Started

- Try/Dev/Demo:
  - http://devstack.org/
  - http://www.stackops.com/
  - http://trystack.org/
- Many, many, many blogs on setting up OpenStack on every virtual platform imaginable
- Grizzly:
  - http://docwiki.cisco.com/wiki/OpenStack:Grizzly:All-In-One
  - http://docwiki.cisco.com/wiki/OpenStack:Grizzly-Multinode
- Havana:
  - http://docwiki.cisco.com/wiki/Openstack:Havana-Openstack-Installer
  - http://docwiki.cisco.com/wiki/OpenStack_Havana_Release:_High-Availability_Manual_Deployment_Guide

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OpenStack - Resources

OpenStack at Cisco:

http://www.cisco.com/web/solutions/openstack/index.html

OpenStack Cisco Validated Designs:

http://www.cisco.com/c/en/us/td/docs/unified_computing/ucs/UCS_CVDs/ucs_rhos.html

Cisco Nexus Plug-in for OpenStack

http://www.cisco.com/c/en/us/products/collateral/switches/nexus-3000-series-switches/data_sheet_c78-727737.html

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OpenStack Networking

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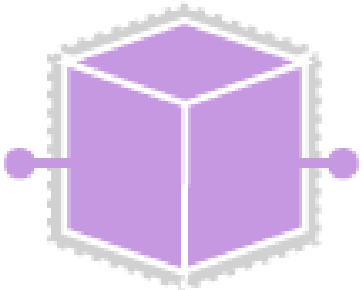
Neutron Introduction



Neutron

OpenStack Network Service (Neutron)

Provides “network connectivity as a service” between devices managed by other OpenStack services

- Provides abstractions and functionality needed for cloud networking
- Why Neutron?
  - Current networking under Nova is limited
  - Provide tenants an API to build rich networking topologies
  - Foster innovation through plug-ins

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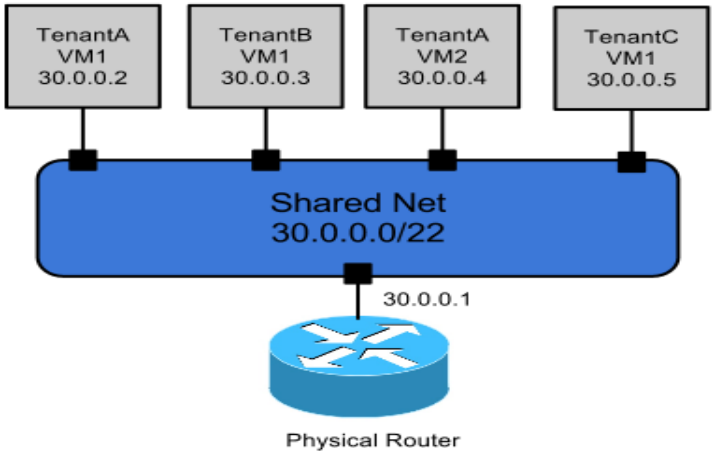
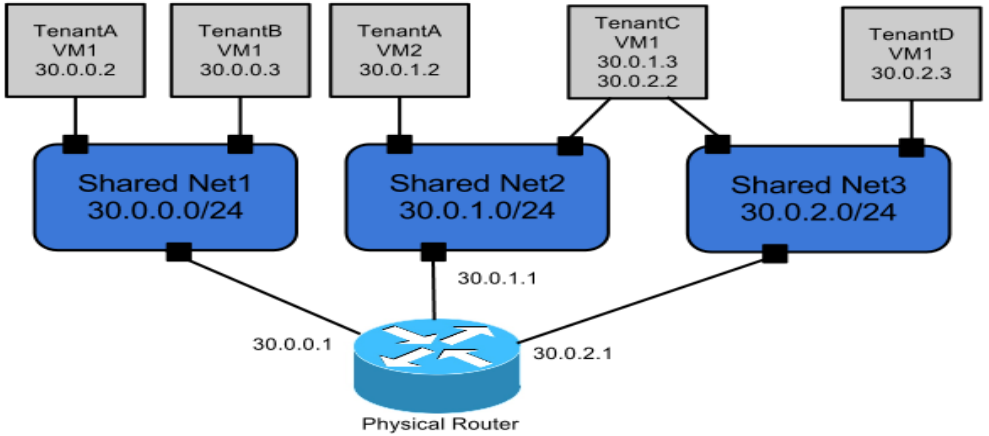
OpenStack Network Topologies



Single Flat Network



Multiple Flat Networks

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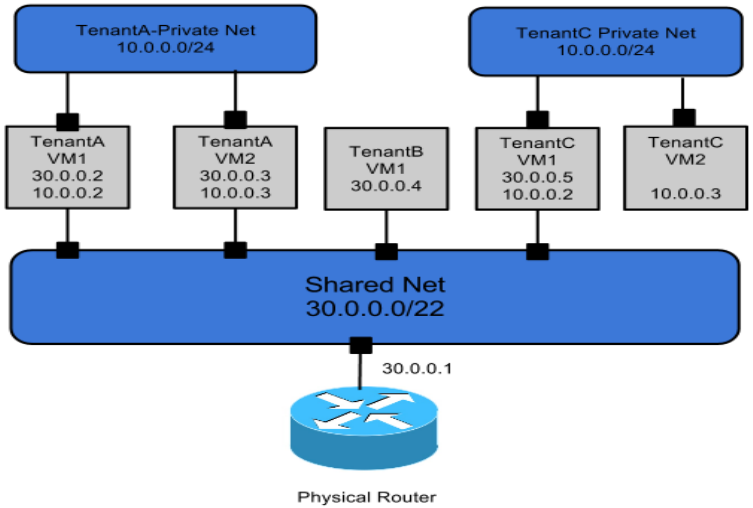
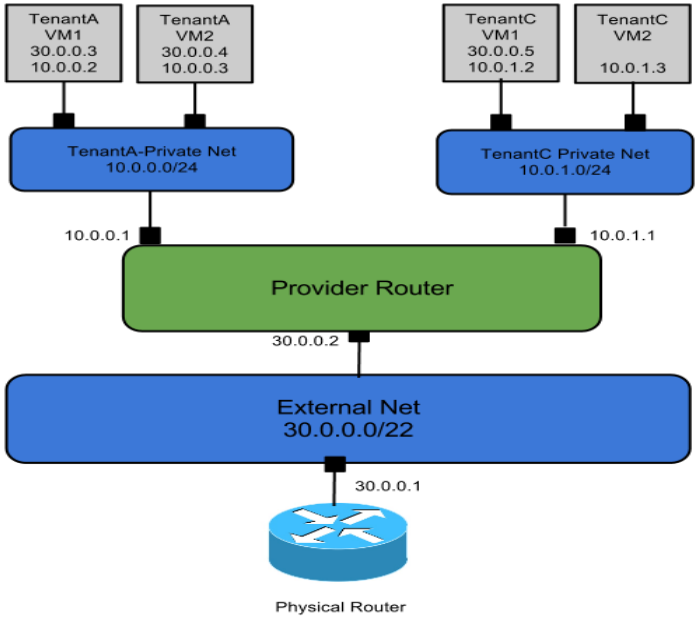
OpenStack Network Topologies



Mixed Flat and Private Network



Provider and Tenant Networks

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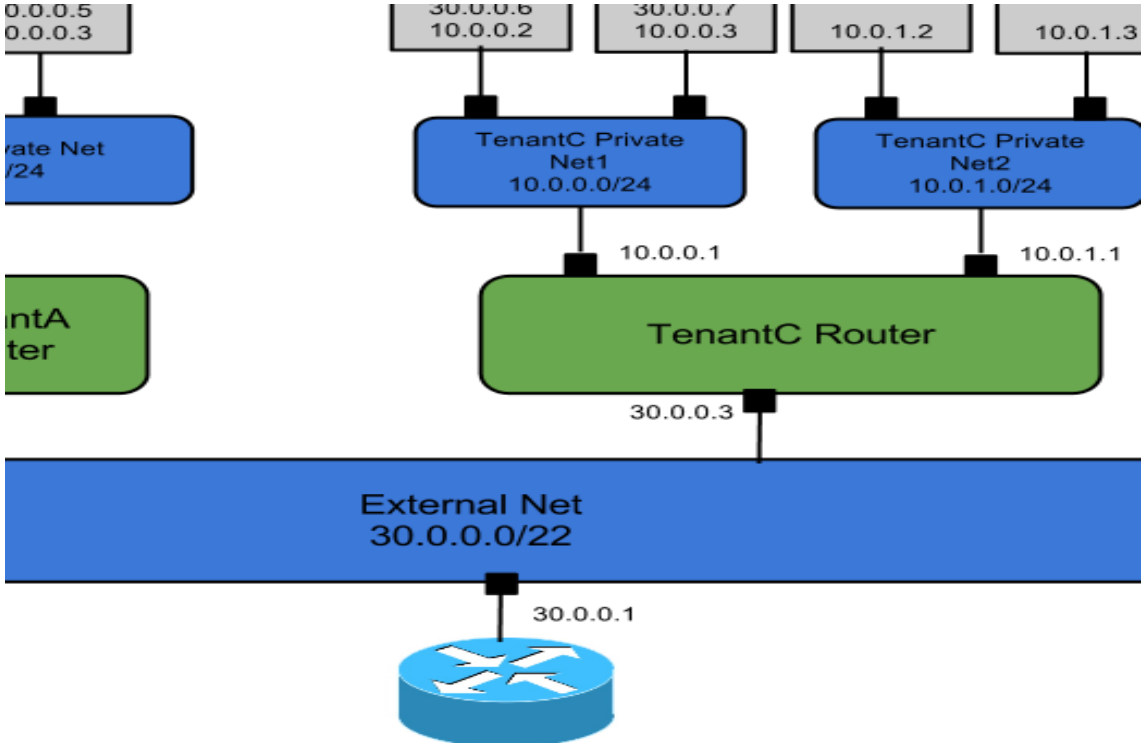
OpenStack Network Topologies



Tenant Routers and Private Networks

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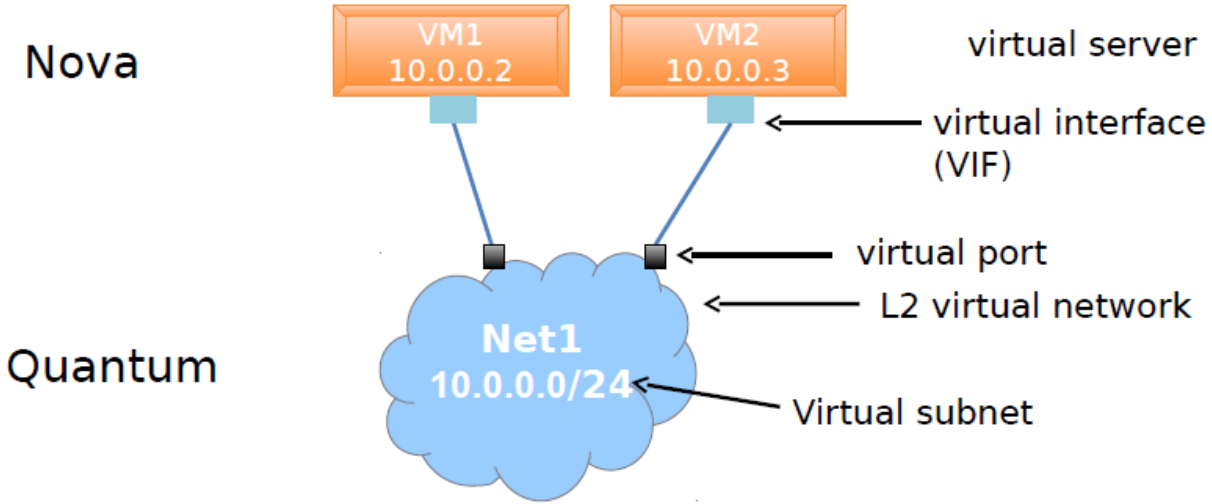
Basic Neutron API Abstractions (Quantum Derived)



"virtual networks" and virtual subnets are fundamentally multi-tenant, just like virtual servers (e.g., overlapping IP's can be used on different networks)

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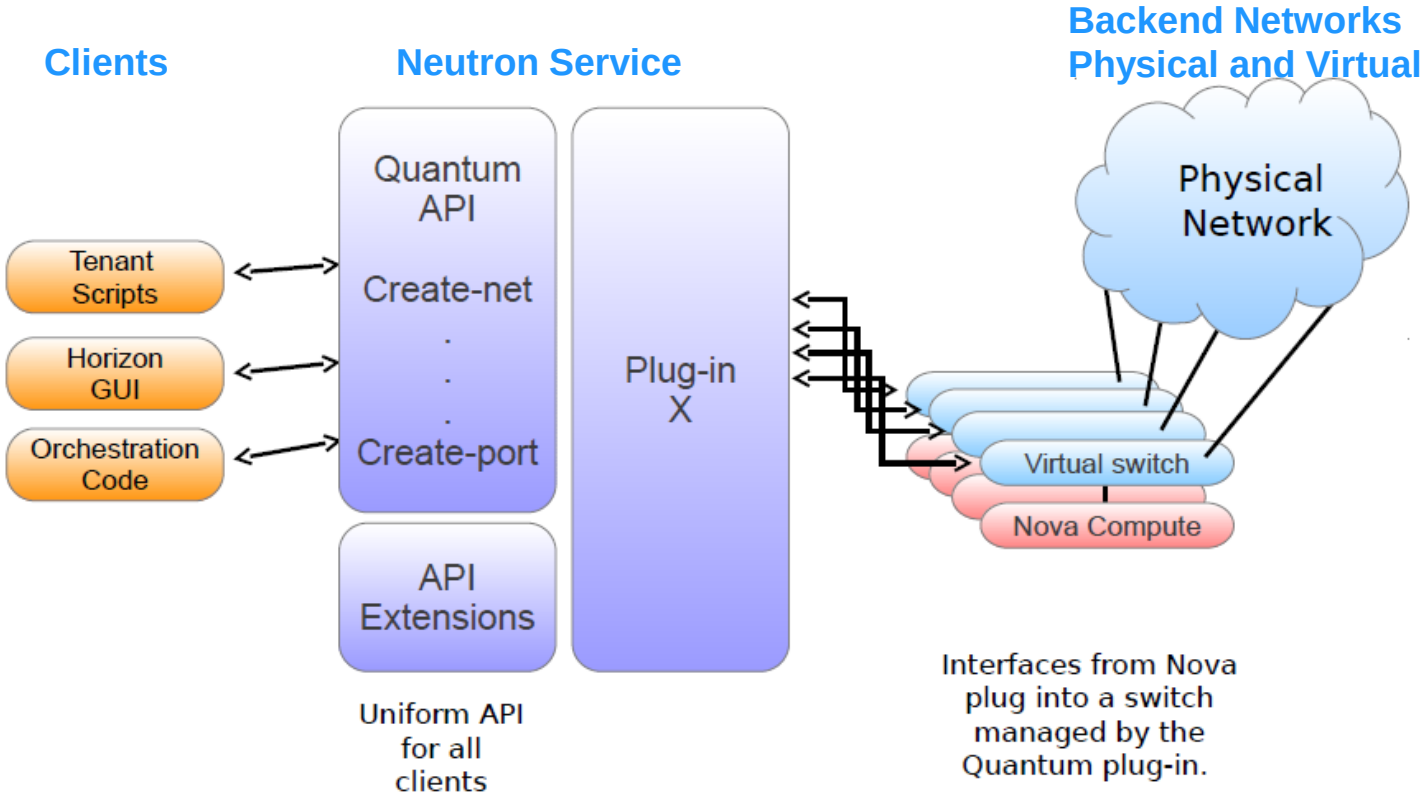
Neutron Architecture



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Neutron API Extensions

Neutron Base API v2.0

- **Networks**
  - Create, Delete, Update
  - List, Show
- **Subnets**
  - Create, Delete, Update
  - List, Show
- **Ports**
  - Create, Delete, Update
  - List, Show

Neutron API Extensions

- **Routers**

  Create, Delete, Update, List, Show
- **FloatingIP**

  Create, Delete, Update, List, Show
- ***QoS, ACLs, LBaaS***
- ***Security Filter Policies***
- ***Netflow***
- ***Port Profiles/Statistics***

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OpenStack Neutron Grizzly Additions

- **Multiple network nodes running L3-agents and DHCP-agents**
- Allows L3-L4 packet filtering for security policies
- **Load-balancing-as-a-Service (LBaaS)**
- **Metadata improvements, allow overlapping IP address ranges**
- Horizon GUI support for Routers + Loadbalancers
- Support for XML API
- **New vendor plugins and improvements to existing plugins**
- Seamless upgrade from Folsom to Grizzly

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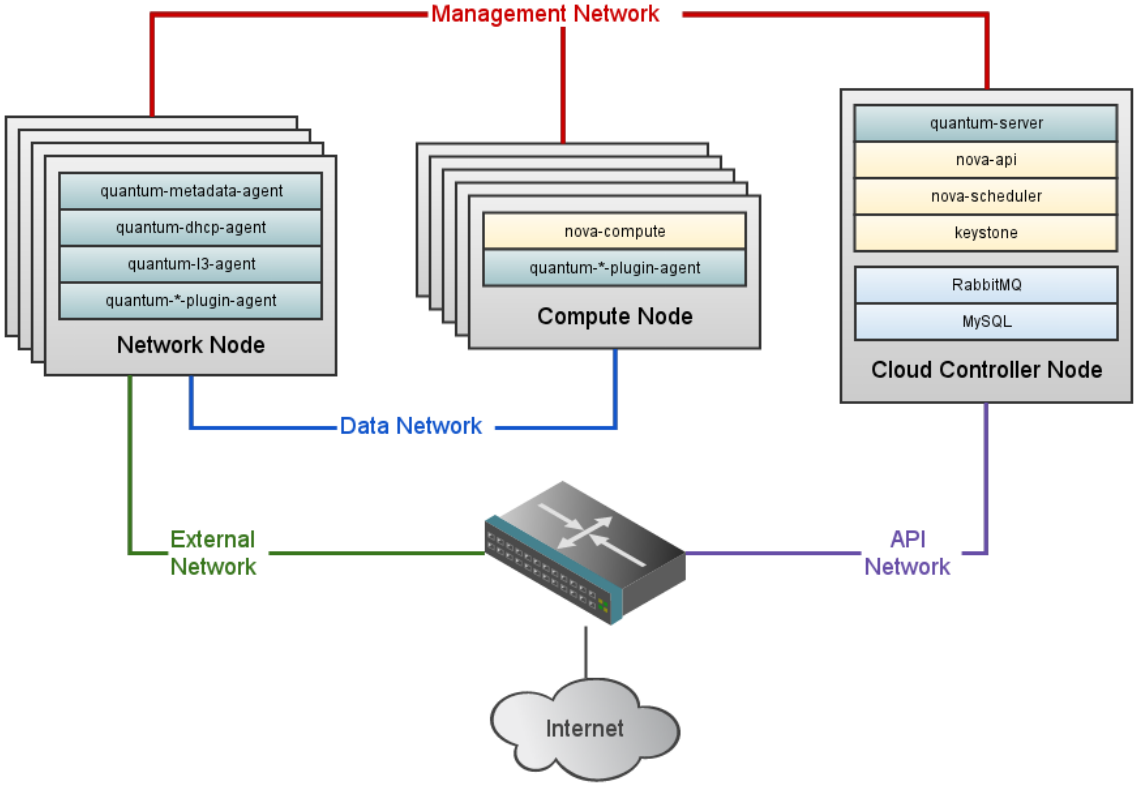
Network Connectivity for Physical Hosts



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What is Modular Layer 2?

A new Neutron core plugin in Havana

- Modular
  - Drivers for layer 2 network types and mechanisms - interface with agents, hardware, controllers, ...
  - Service plugins and their drivers for layer 3+
- Works with existing L2 agents
  - openvswitch
  - linuxbridge
  - hyperv
- Deprecates existing monolithic plugins
  - openvswitch
  - linuxbridge

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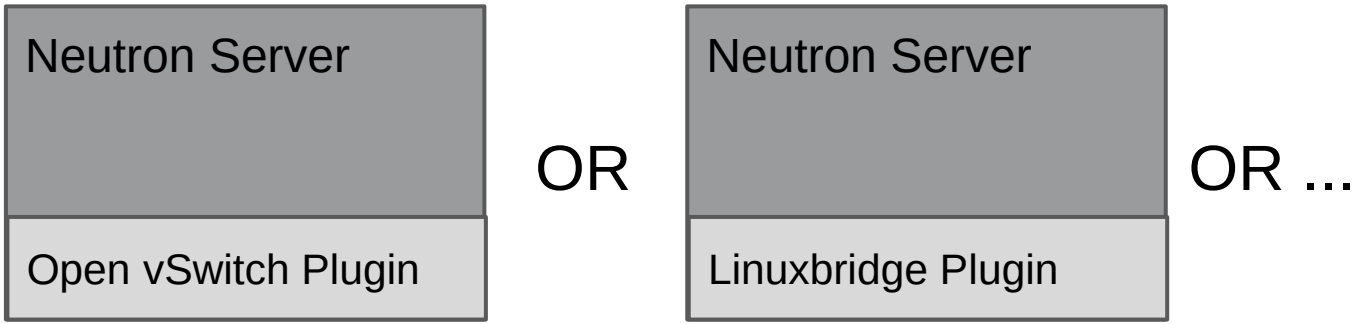
Before Modular Layer 2 ...



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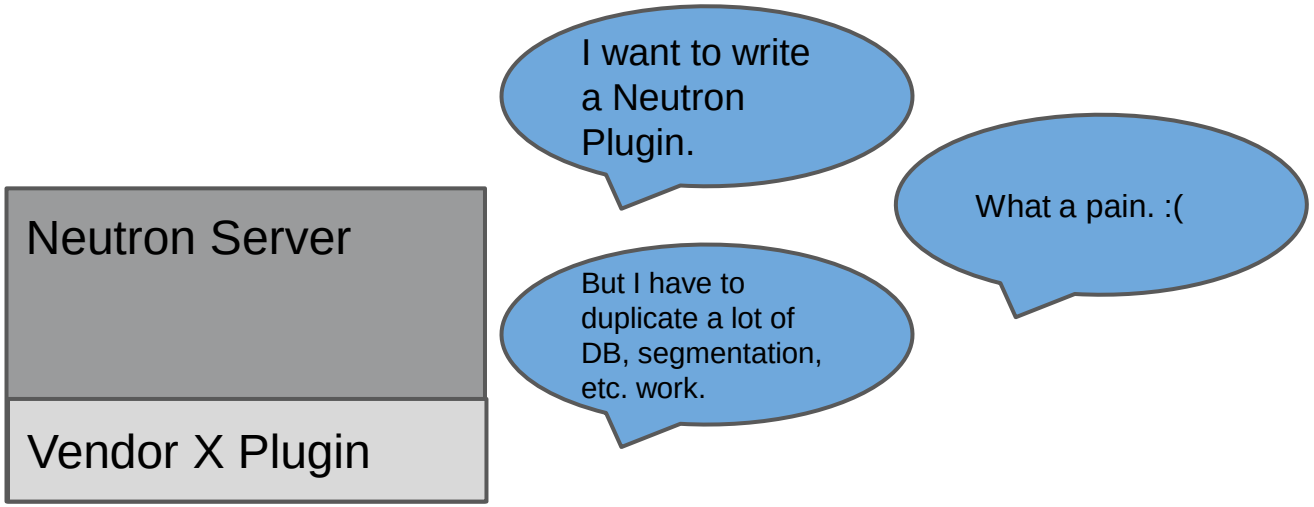
Before Modular Layer 2 ...



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Modular Layer 2 (ML2) Plugin

The Modular Layer 2 (ML2) Plugin is a framework allowing OpenStack Neutron to simultaneously utilize the variety of layer 2 networking technologies found in complex real-world data centers.

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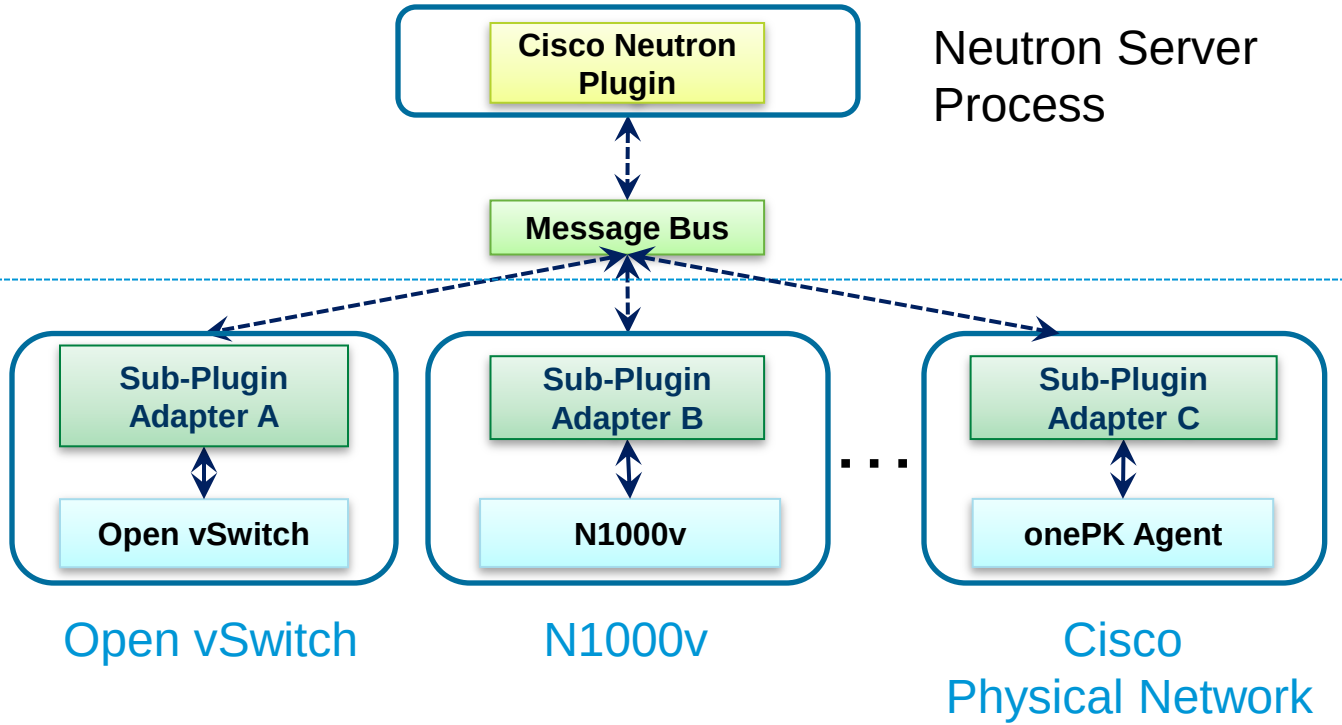
Neutron Multi-plugin Support



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ML2 Use Cases

- Replace existing monolithic plugins
  - Eliminate redundant code
  - Reduce development & maintenance effort
- New features
  - Top-of-Rack switch control
  - Avoid tunnel flooding via L2 population
  - Many more to come...
- Heterogeneous deployments
  - Specialized hypervisor nodes with distinct network mechanisms
  - Integrate *aaS appliances
  - Roll new technologies into existing deployments

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What’s Similar?

ML2 is functionally a superset of the monolithic openvswitch, linuxbridge, and hyperv plugins:

- Based on NeutronDBPluginV2
- Models networks in terms of provider attributes
- RPC interface to L2 agents
- Extension APIs

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What’s Different?

ML2 introduces several innovations to achieve its goals:

- Cleanly separates management of network types from the mechanisms for accessing those networks
  - Makes types and mechanisms pluggable via drivers
  - Allows multiple mechanism drivers to access same network simultaneously
  - Optional features packaged as mechanism drivers
- Supports multi-segment networks
- Flexible port binding
- L3 router extension integrated as a service plugin

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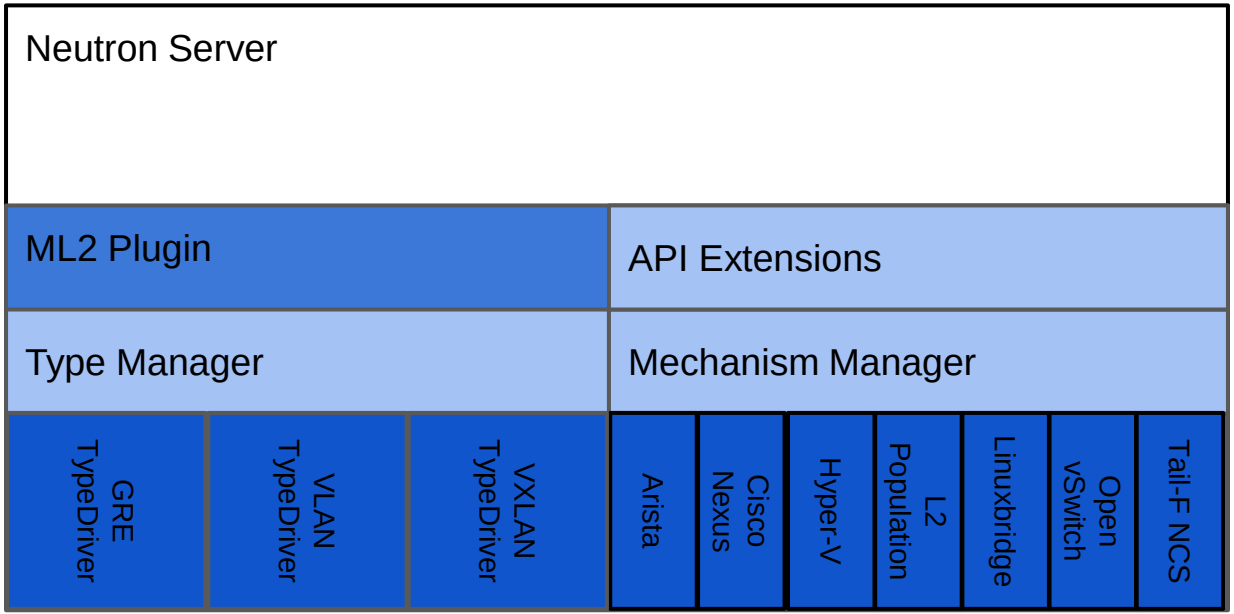
ML2 Architecture Diagram



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Type Drivers in Havana

The following are supported segmentation types in ML2 for the Havana release:

- local
- flat
- VLAN
- GRE
- VXLAN

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Mechanism Drivers in Havana

The following ML2 MechanismDrivers exist in Havana:

- Arista
- Cisco Nexus
- Hyper-V Agent
- L2 Population
- Linuxbridge Agent
- Open vSwitch Agent
- Tail-f NCS

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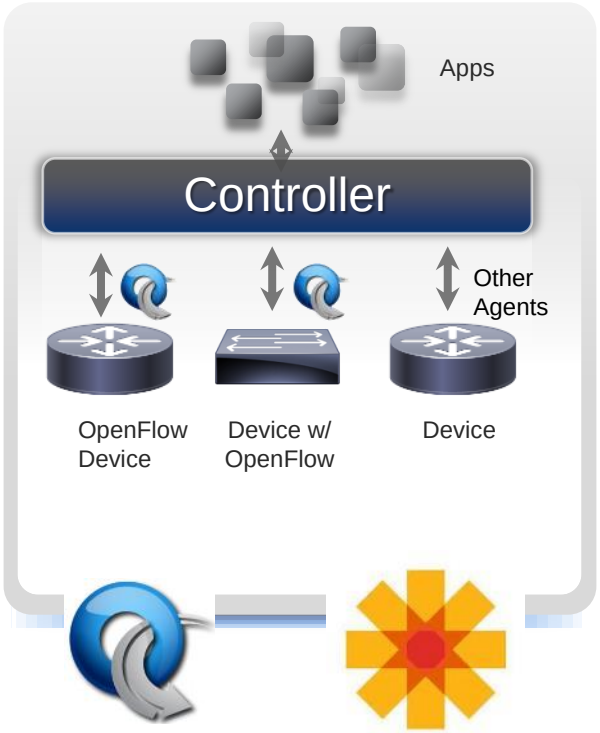
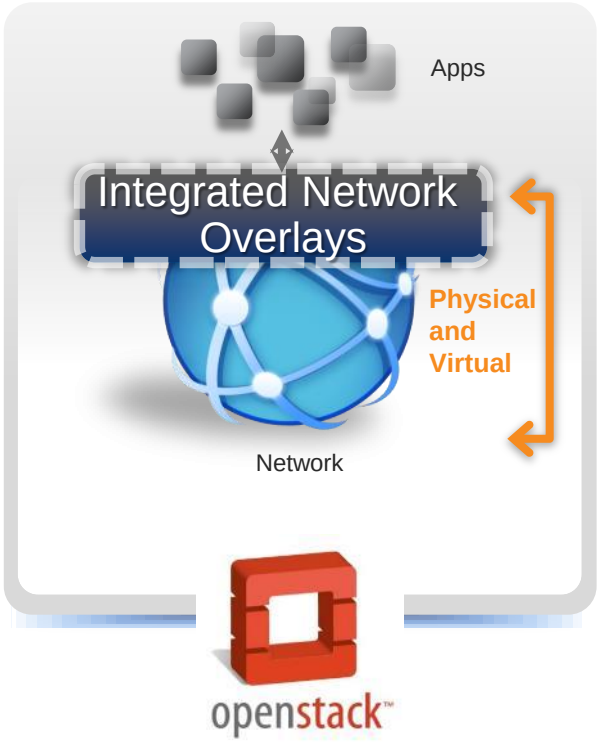
SDN & Cisco Open Network Environment (ONE)





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Cisco OpenStack Plugins & Initiatives (More to Come!)

- Nexus 1000V Neutron Plugin
- Nexus 1000V VXLAN Gateway Neutron Plugin
- Nexus 1000V Cloud Services Router Neutron Plugin
- Nexus Dynamic Fabric Automation (DFA) Neutron Plugin
- Nexus L3 Neutron Plugin
- OpenDaylight Neutron Plugin
- Cisco Validated Design
- OpenStack UCS Installer

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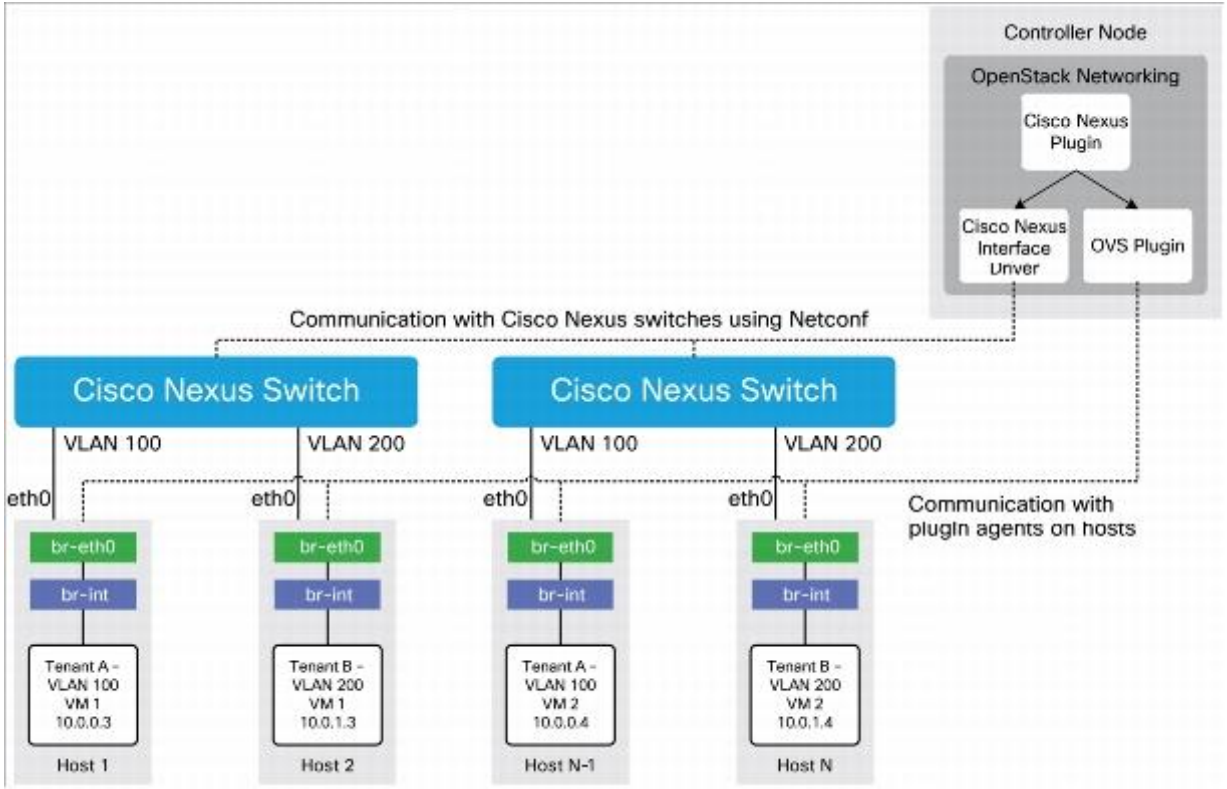
Cisco OpenStack Nexus 1000V Plugin



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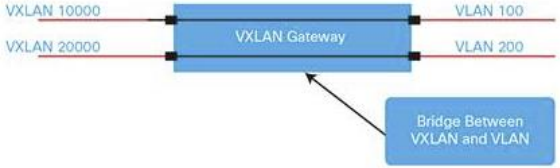
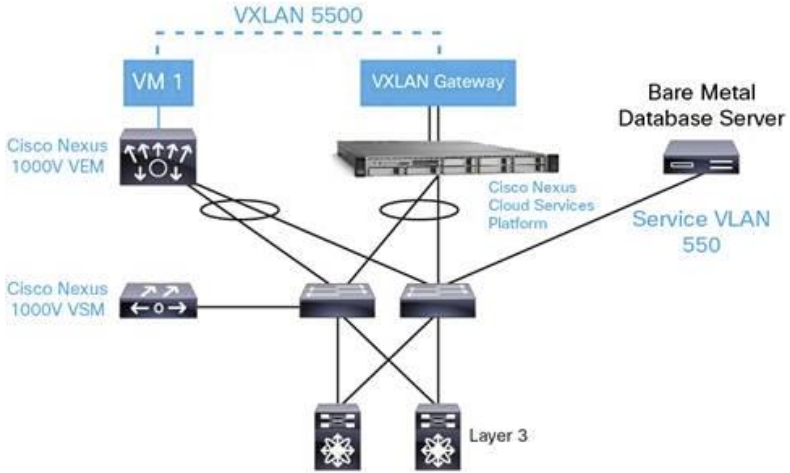
Nexus 1000V VXLAN Gateway



VXLAN is a Layer 2 network isolation technology that uses a 24-bit segment identifier to scale beyond the 4000-address limitations of VLANs. VXLAN technology creates LAN segments by using an overlay approach with MAC-in-IP encapsulation. The Cisco Nexus 1000V VEM encapsulates the original Layer 2 frame leaving the virtual machine.

The initial support for VXLAN extended to virtual switches that run in a hypervisor environment, and the only endpoints that could be on VXLANs were virtual machinesrespectively. Physical servers and traditional service nodes will continue to be used on traditional VLAN interfaces. To connect workloads with some components on a VXLAN interface and others on a VLAN interface, or to apply hardware-based services to a VXLAN network, an interconnection such as VXLAN gateway is employed.



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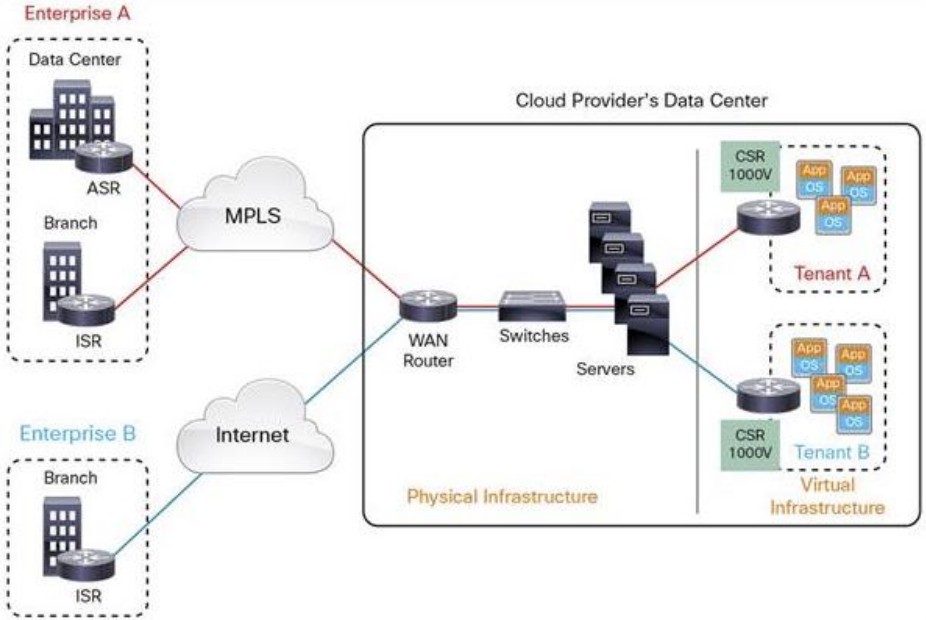
Nexus 1000V Cloud Services Router

The Cisco® Cloud Services Router 1000V (CSR 1000V) is a single-tenant router in virtual form-factor that delivers comprehensive WAN gateway functions to multitenant provider-hosted clouds. Using familiar, industry-leading Cisco IOS® Software networking capabilities, the CSR 1000V enables enterprises to extend their WANs transparently into external provider-hosted clouds and cloud providers to offer their tenants enterprise-class networking services.

The Cisco CSR 1000V contains the same operating system, Cisco IOS XE Software, which runs inside the Cisco ASR 1000 product line. Providing control- and data-plane separation, multicore forwarding, and a modular architecture that allows for smooth insertion of networking features, Cisco IOS XE Software is well-suited for dynamic cloud environments. The software is based on the stable, robust, and feature-rich Cisco IOS Software that has powered Cisco ISRs and other hardware routers in demanding enterprise, service provider, and government networks for more than two decades.



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APPLICATION CENTRIC INFRASTRUCTURE

Physical Networking

Nexus 7K

Nexus 2K

Hypervisors and Virtual Networking

cisco

Microsoft

vmware

Xen

Compute

L4–L7 Services

cisco

CITRIX

f5

SOURCEfire

Storage

EMC²

NetApp

Multi DC WAN and Cloud

Integrated WAN Edge

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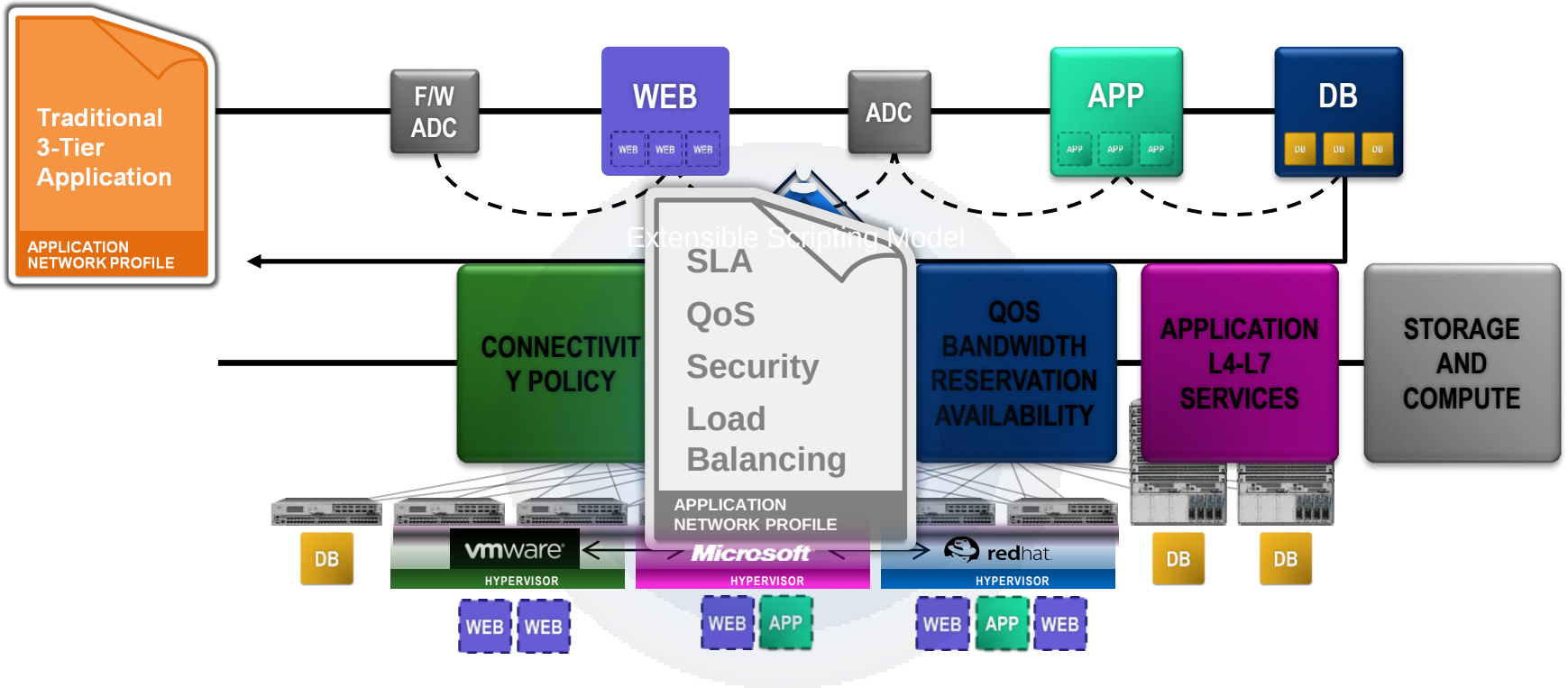
AGILITY: ANY APPLICATION, ANYWHERE—PHYSICAL AND VIRTUAL
COMMON APPLICATION NETWORK PROFILE



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Solution: Integrating Cisco ACI fabric with Red Hat OpenStack

Cisco's ACI Fabric combines ACI-ready Nexus 9000 switches with application policy, enabling applications to drive networking behavior, not the other way around. Pre-defined application requirements and descriptions automate the provisioning of the network, application services, security policies, tenant subnets and workload placement. Automating the provisioning of the complete application network reduces IT costs, reduces errors, accelerates deployment and makes the business more agile.

Cisco and Red Hat have collaborated to build a joint solution on RHEL OpenStack Platform through integration with existing OpenStack Neutron APIs, Open vSwitch, and the Cisco Application Policy Infrastructure Controller (APIC).

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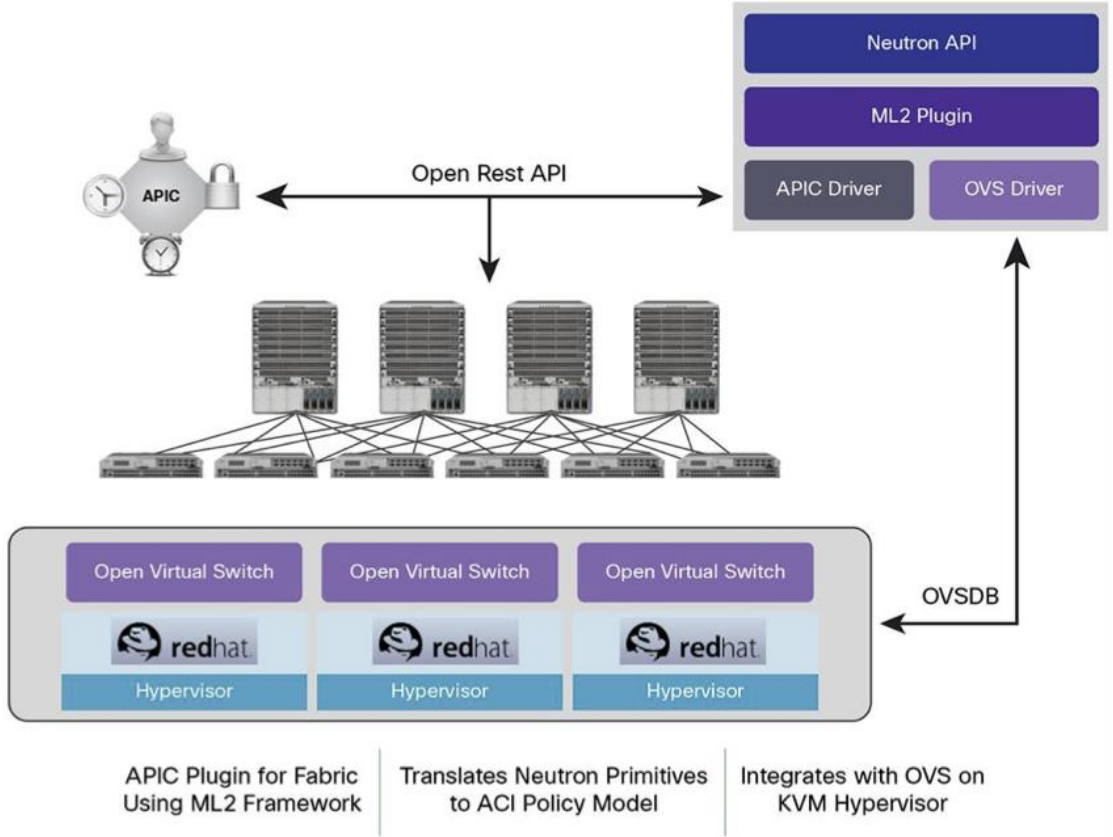
Cisco APIC Integration with RHEL OpenStack Platform



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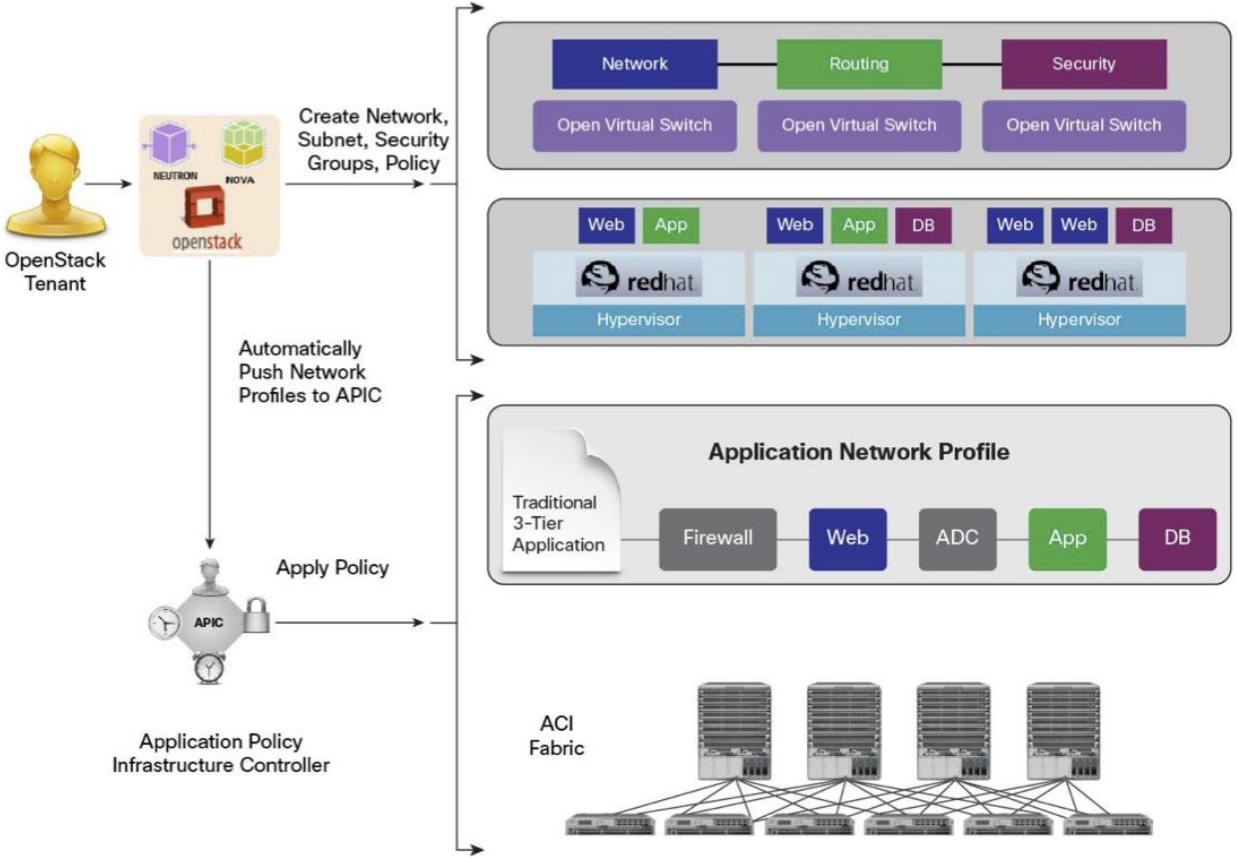
Cisco ACI Integration with RHEL OpenStack Platform



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Cisco ACI Integration with RHEL OpenStack Platform Solution Benefits:

- Provides certified, supported, integrated, and deployable solution for running RHEL OpenStack Platform on application centric networking infrastructure
- Simplifies and accelerates deployment and management of applications and infrastructure in private, public, and hybrid clouds using OpenStack
- Enables scalability, performance, and agility in cloud environments by combining the flexibility of software (RHEL OpenStack Platform and Cisco ACI) with the performance of hardware (Cisco ACI)
- Provides the capability to build comprehensive application-based network policies in the cloud
- Benefits the open source community through the evolution of network concepts using extensions to the
- OpenStack Neutron model to achieve a more application centric infrastructure
- Provides enhanced automation and programmability capabilities through open APIs to enable a broader ecosystem

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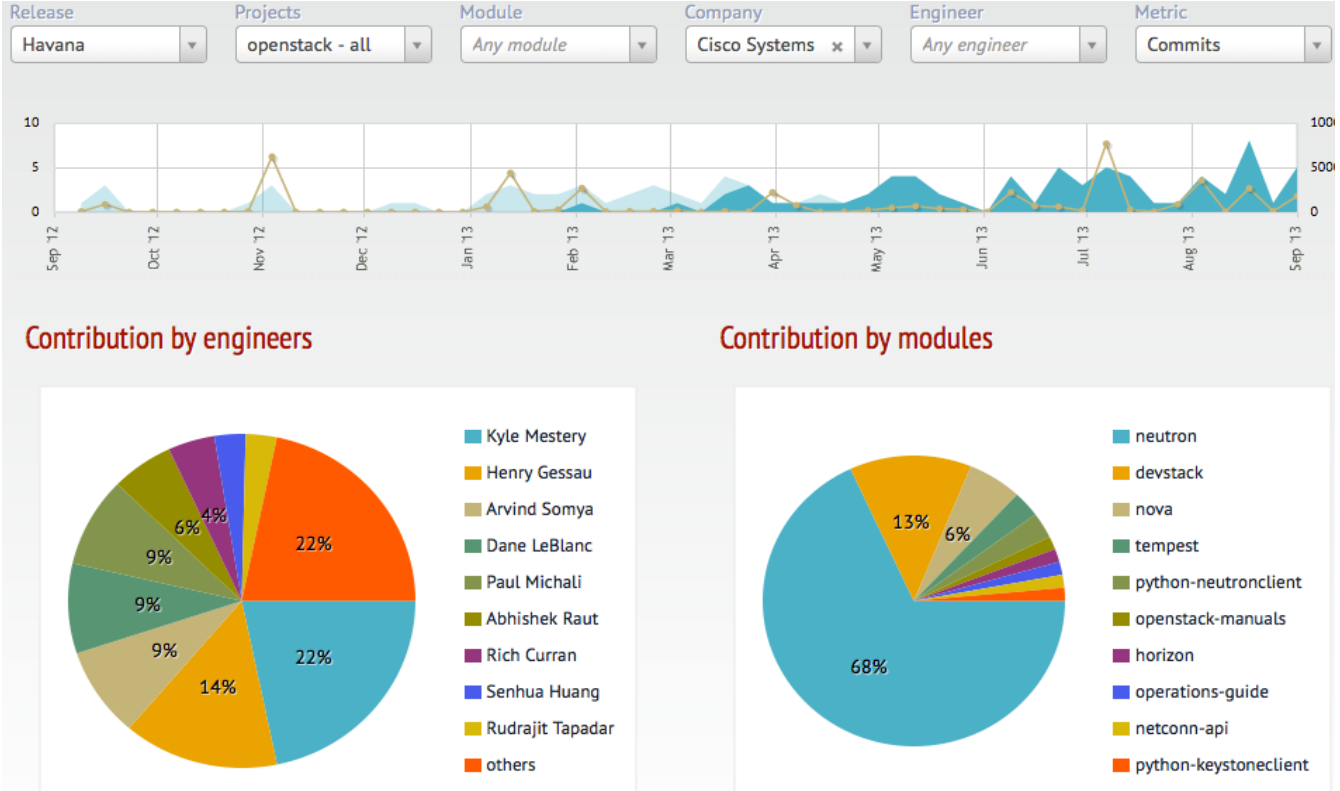
Cisco OpenStack Code Contributions



http://stackalytics.com/

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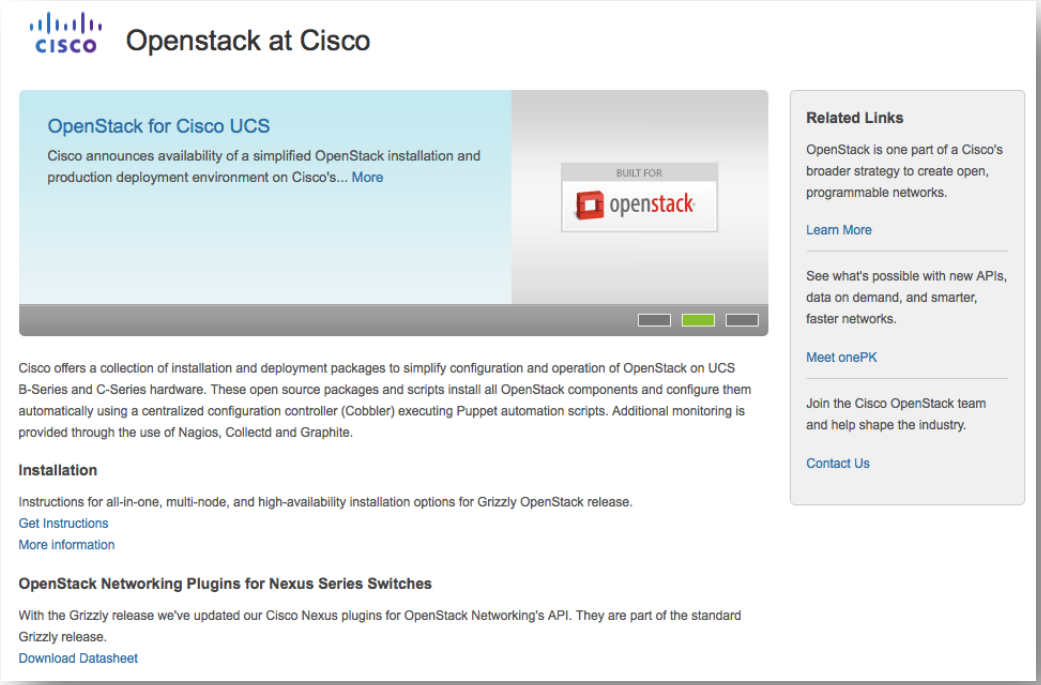
Cisco Openstack Installer – Opening The Cloud



Openstack at Cisco

OpenStack for Cisco UCS

Cisco announces availability of a simplified OpenStack installation and production deployment environment on Cisco's... More

BUILT FOR openstack

Related Links

OpenStack is one part of a Cisco's broader strategy to create open, programmable networks.

Learn More

See what's possible with new APIs, data on demand, and smarter, faster networks.

Meet onePK

Join the Cisco OpenStack team and help shape the industry.

Contact Us

Cisco offers a collection of installation and deployment packages to simplify configuration and operation of OpenStack on UCS B-Series and C-Series hardware. These open source packages and scripts install all OpenStack components and configure them automatically using a centralized configuration controller (Cobbler) executing Puppet automation scripts. Additional monitoring is provided through the use of Nagios, Collectd and Graphite.

Installation

Instructions for all-in-one, multi-node, and high-availability installation options for Grizzly OpenStack release.
Get Instructions
More information

OpenStack Networking Plugins for Nexus Series Switches

With the Grizzly release we've updated our Cisco Nexus plugins for OpenStack Networking's API. They are part of the standard Grizzly release.
Download Datasheet

Simplified installer for the suite of Openstack modules

Works with UCS C-Series and Nexus switches

http://docwiki.cisco.com/wiki/OpenStack#Introduction

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How to get started with OpenStack?

A documented shell script to build complete OpenStack development environments.

Created by Rackspace Cloud Builders, Maintained by the OpenStack developer community.

Setup a fresh supported Linux installation.

Clone devstack from devstack.

```
git clone https://github.com/openstack-dev/devstack.git
```

Deploy your OpenStack Cloud

```
cd devstack && ./stack.sh
```


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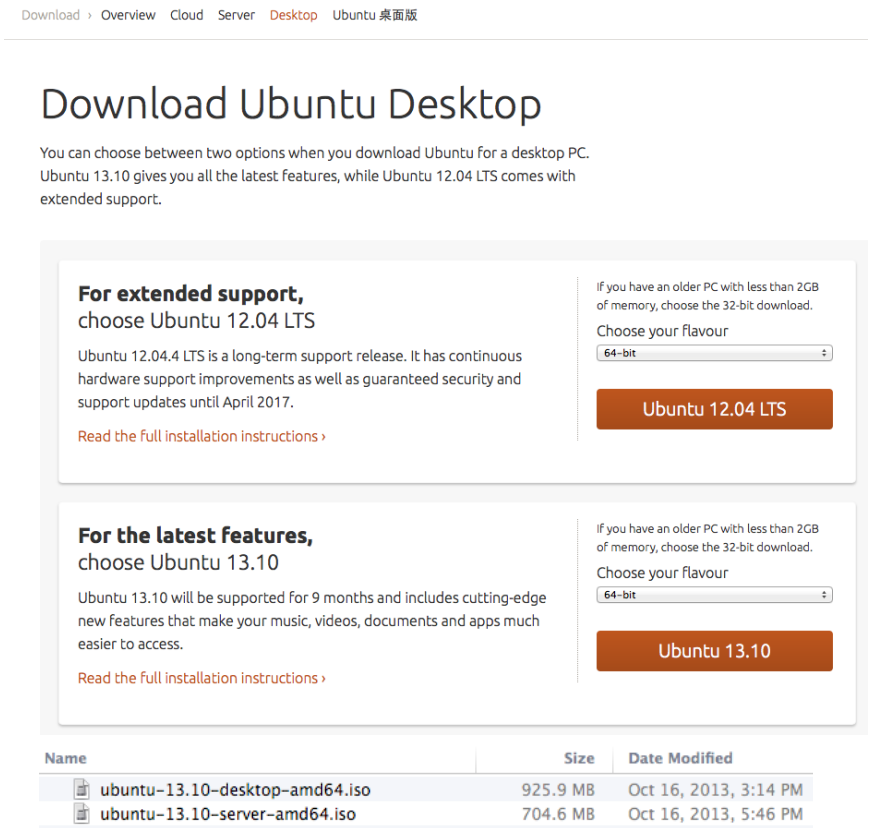
OpenStack – Devstack Install (stable/havana)

Download Ubuntu:

- 13.10 Desktop (GUI)
- 13.10 Server (Console/SSH)



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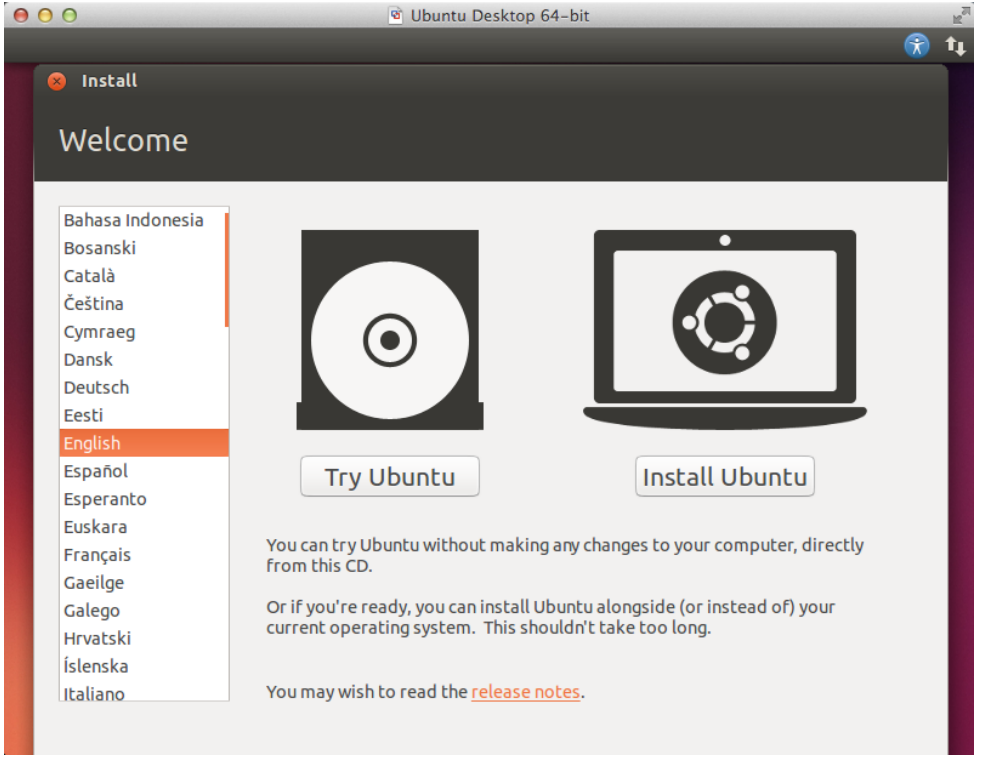
OpenStack – Devstack Install (stable/havana)

Install Ubuntu:

- Bare Metal
- VM



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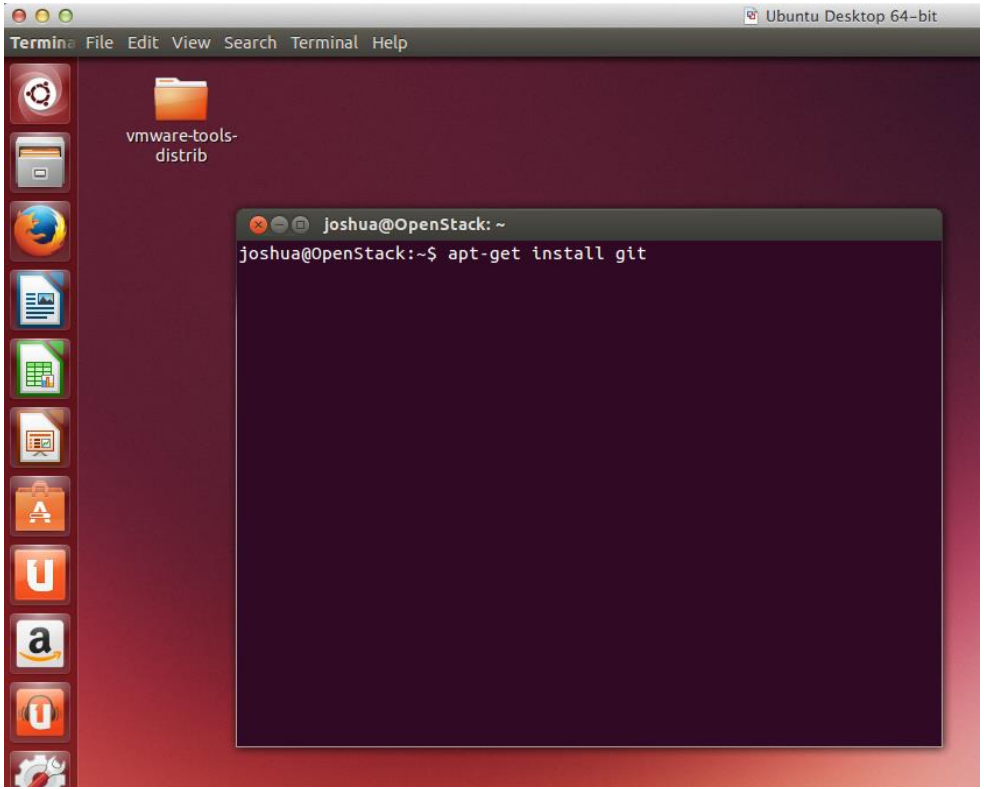
OpenStack – Devstack Install (stable/havana)



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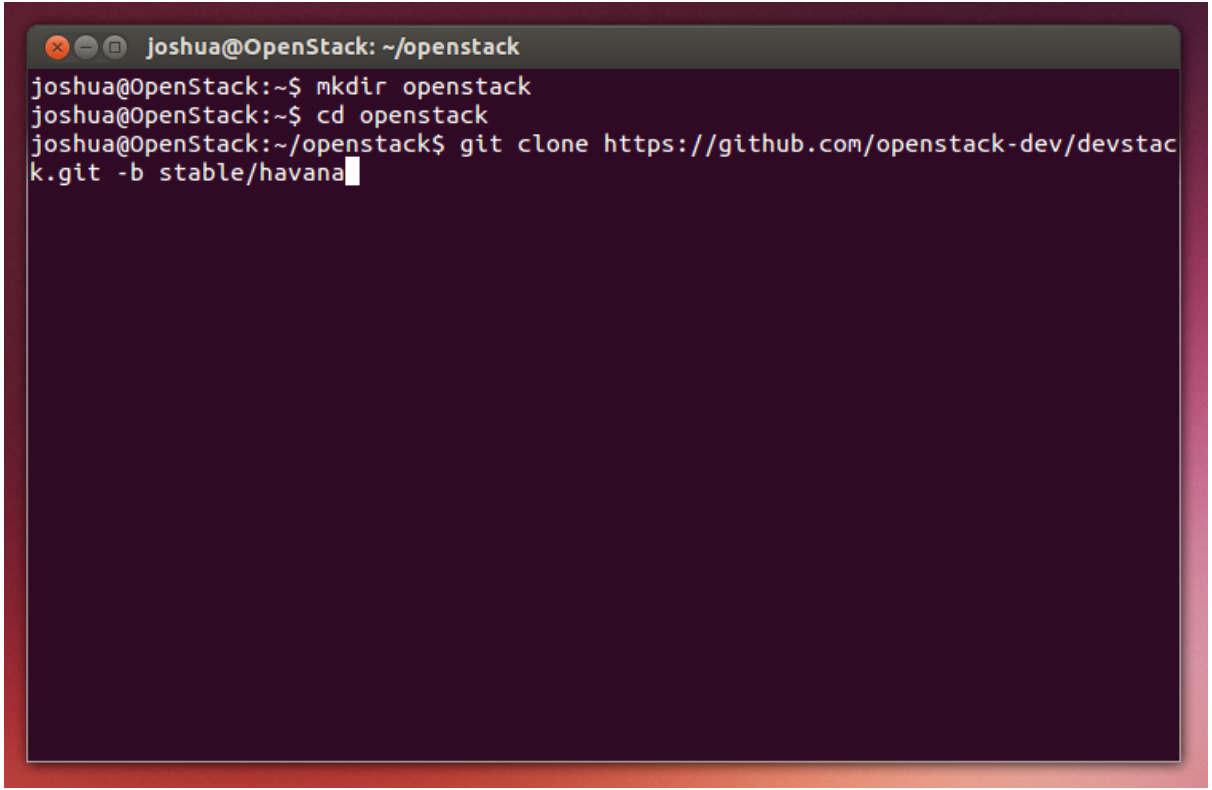
OpenStack – Devstack Install (stable/havana)



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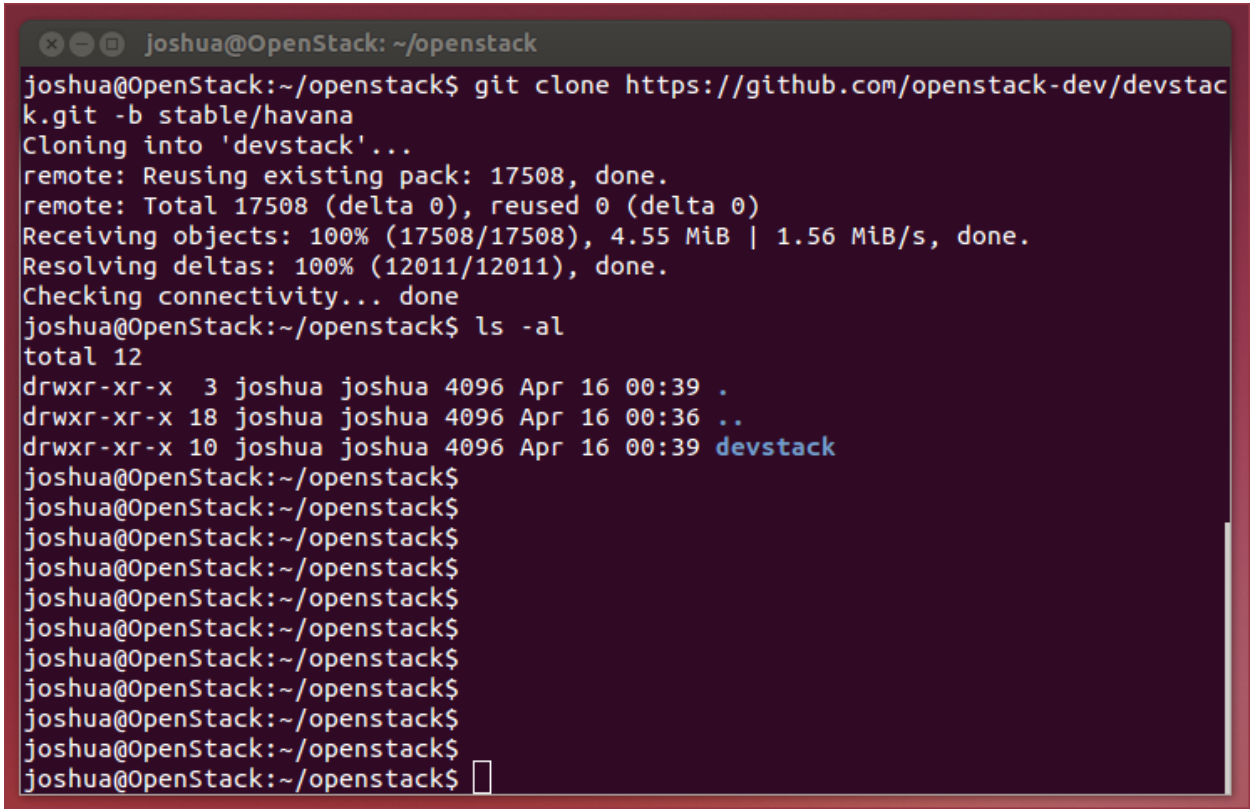
OpenStack – Devstack Install (stable/havana)



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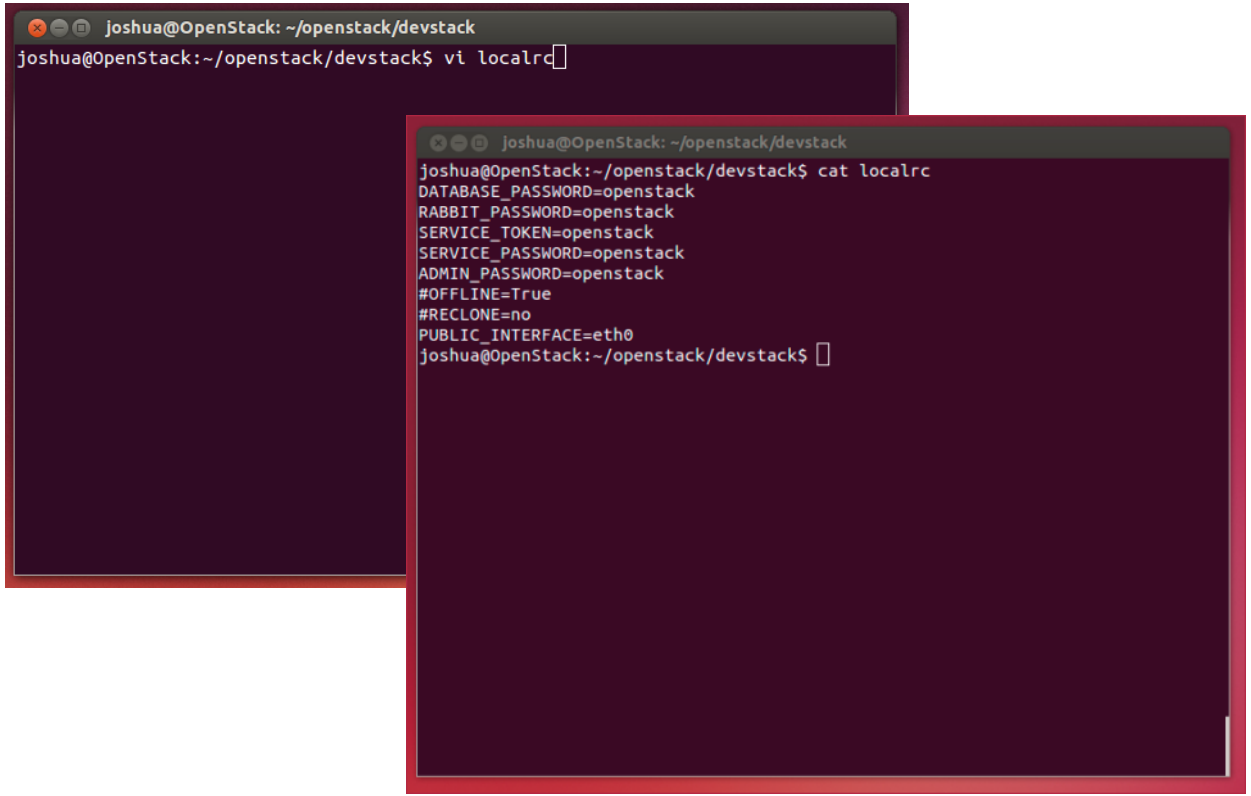
OpenStack – Devstack Install (stable/havana)

Create installrc file:

- OFFLINE and RECLONE can be uncommented after install as needed
- Note: In this example the password for user “admin” is being set to “openstack”



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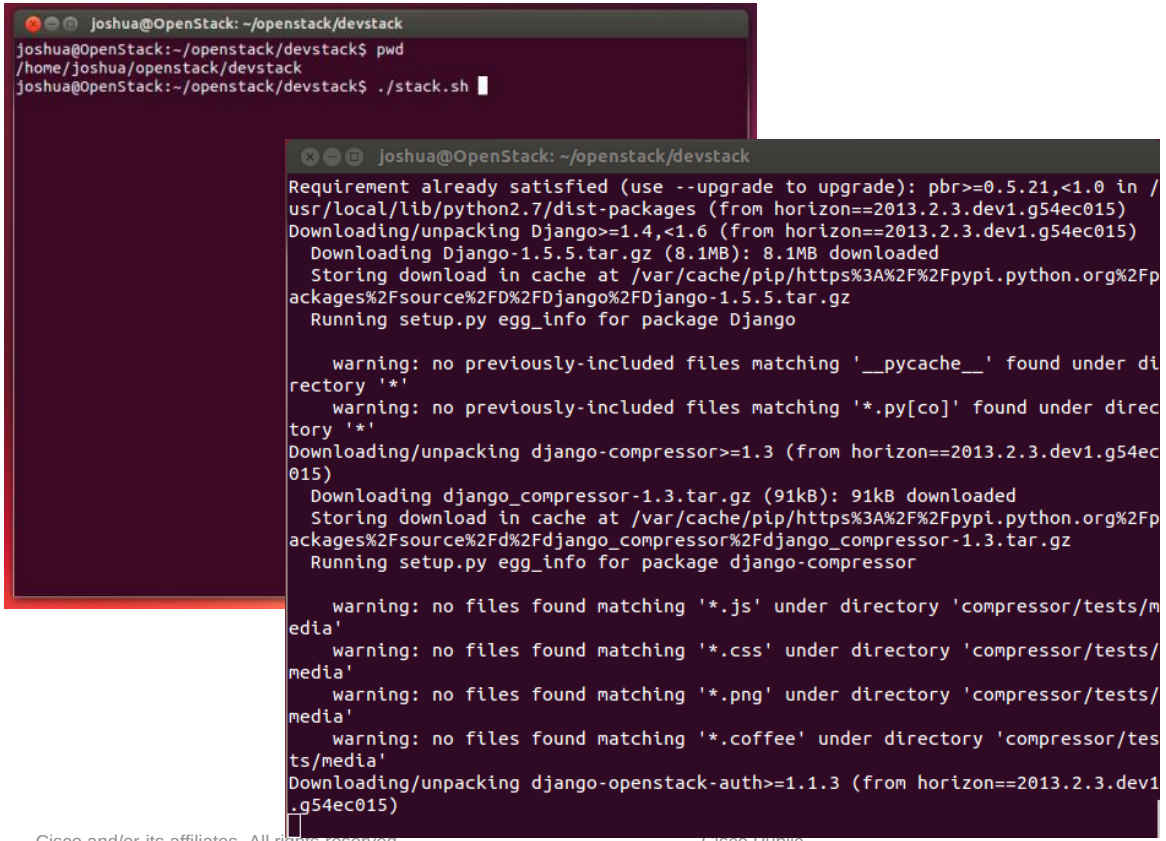
OpenStack – Devstack Install (stable/havana)

Wait…

- Install time will vary by VM resources and WAN bandwidth (>5min typically)



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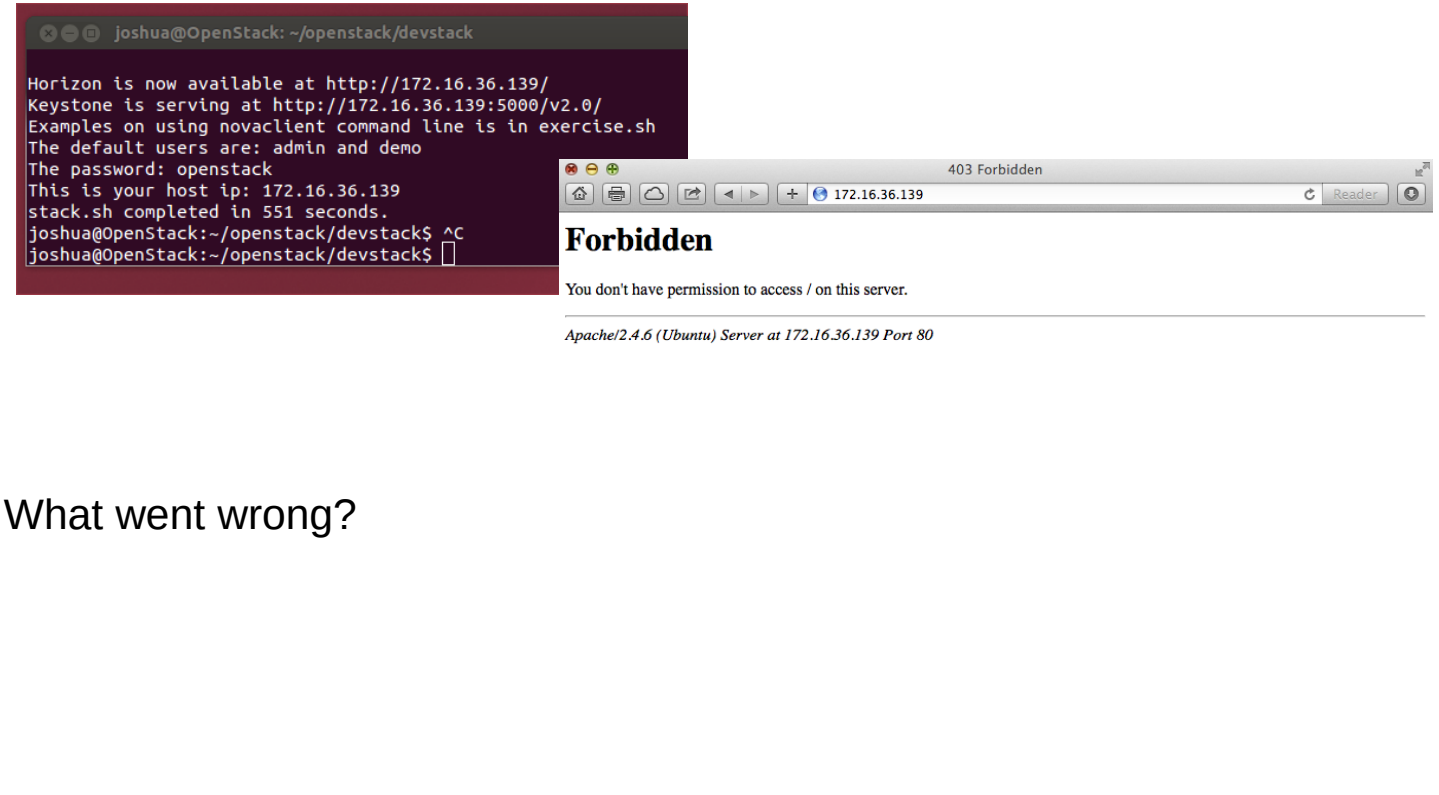
OpenStack – Devstack Install (stable/havana)



What went wrong?

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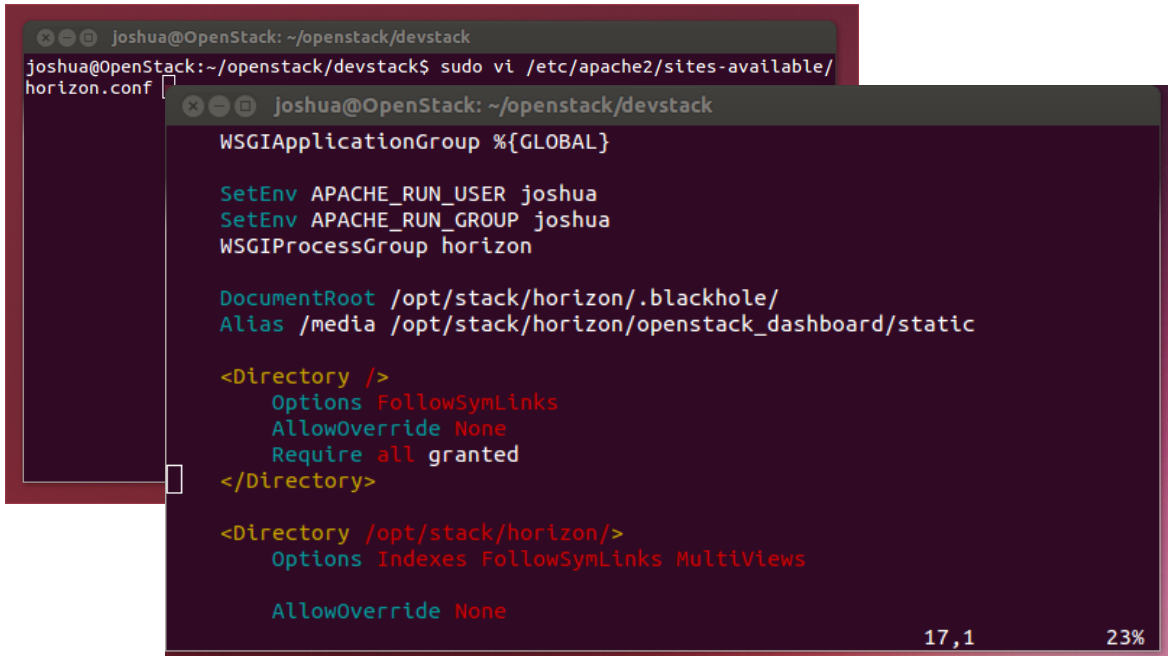
OpenStack – Devstack Install (stable/havana)



Patch:

- Add “Require all granted” to the root directory config

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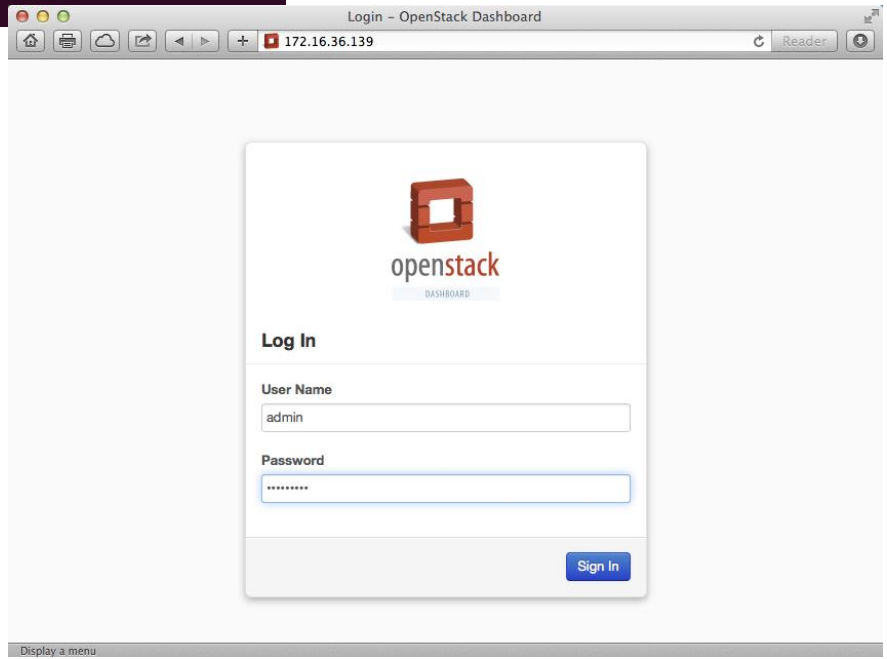
OpenStack – Devstack Install (stable/havana)

```
joshua@OpenStack: ~/openstack/devstack
joshua@OpenStack:~/openstack/devstack$ sudo service apache2 restart
 * Restarting web server apache2
AH00558: apache2: Could not reliably determine the server's fully qualified
domain name, using 127.0.1.1. Set the 'ServerName' directive globally to sup
press this message
                                                                    [ OK ]
joshua@OpenStack:~/openstack/devstack$
```

Restart Apache



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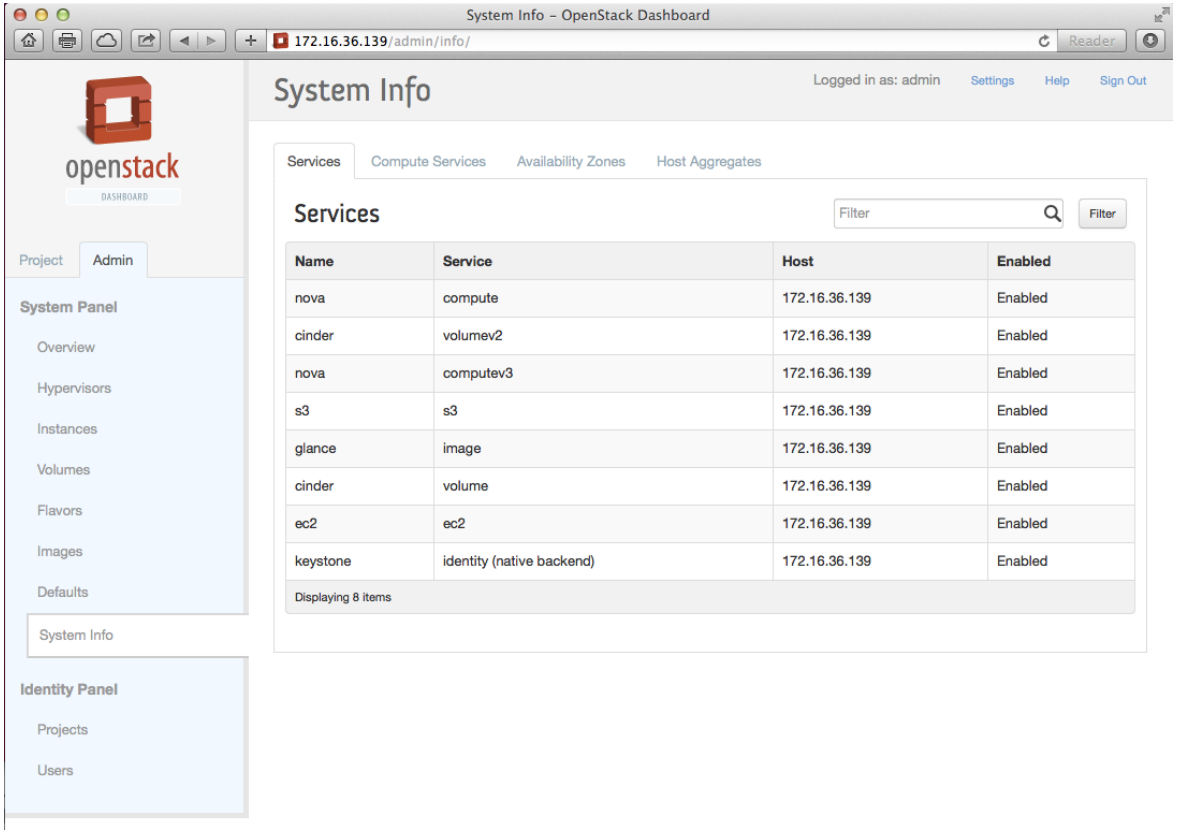
OpenStack – Devstack Install (stable/havana)



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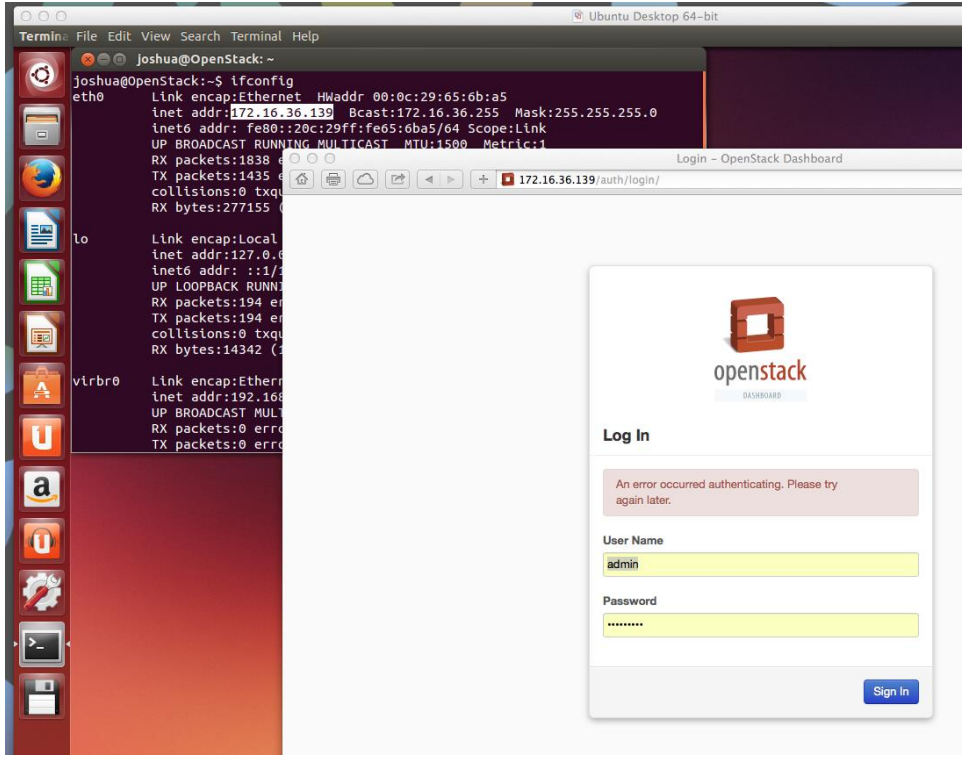
OpenStack – Devstack Install (stable/havana)

After rebooting:

- Devstack does not start all services automatically!

```
joshua@OpenStack: ~/openstack/devstack
joshua@OpenStack:~$ cd openstack/devstack/
joshua@OpenStack:~/openstack/devstack$ sudo ./rejoin-stack.sh
```



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OpenStack References

OpenStack Architecture

http://wiki.openstack.org/

https://github.com/CiscoSystems/cisco-openstack-docs

http://wiki.openstack.org/Neutron

http://devstack.org/

http://cisco.com/go/openstack

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Final Thoughts/OpenStack Toronto User's Group

Mission Statement:

OpenTech Toronto is comprised of individuals who are interested in exploring the Open Technology platforms being developed today (Storage, Computer, Network and Dev/Ops).

Our goal is to educate and provide a open forum for IT Professionals in Toronto to explore Openstack, Open Daylights and the concepts of SDN as core concepts.

We are meeting during the business day within the Downtown Toronto core to provide access for all interested individuals.

The group has conducted two meeting shave been held thus far in February and April of this year.

Contact details:

Please contact Nicholas Laine at nlaine@esitechnologies.com to be added to our Group mailing list for our next meeting scheduled for late May.

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Expert Suggestions on Creating Slides

- Animations on a slide can result in key information being covered when the file is saved as a PDF. It is best to split up a series of animations over several slides.
- If you include log files in your slides, please make sure they come from a lab system – not a customer production system that could contain sensitive customer information.
- Keep text to the key or important data, with a minimum font size of 14 pt.
- If you have a number of text slides in a row, try to keep the same size text across all the slides to make it easier to read in the flow.

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Expert Suggestions on Creating Slides

- The most valuable tools in PowerPoint for ensuring use of correct fonts, bullets, and text are the Layout and the Reset Tools on the Home Menu.
  - Ensure every slide you work on is connected to the correct Layout
  - Use Home/Layout or Reset; or right click and Layout or Reset Slide
- Home/Replace allows you to replace fonts or text globally.
- Control Shift C and V copies and pastes formatting.
- Optional fix: http://blog.cgeier.at/convert-a-43-ppt-slide-deck-into-a-169-aspect offers a fix to convert your current presentation into widescreen. You will still need to convert this presentation into the correct template and resize/reorient all the graphics to the wider screen. This fix however does resolve the issue of stretching the graphics.

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This is a Title and Subtitle Slide/Size 26

Subtitle: Size 18, Left Aligned

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3 Column Slide/Title Case/Size 26

- Arial—Only font used in presentation
- Body copy uses size 16 when using multiple columns, left aligned
- Use a color when emphasizing words, do not italicize

- Arial—Only font used in presentation
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Layout: Title and Subtitle for Heavy Graphics

To be used for large network diagrams

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Layout: Title Only for Heavy Graphics

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Color Palette

R: 154 G: 155 B: 156	R: 89 G: 89 B: 89	R: 0 G: 101 B: 189	R: 63 G: 156 B: 53	R: 130 G: 75 B: 176	R: 5 G: 52 B: 108	R: 127 G: 195 B: 255	R: 146 G: 4 B: 129

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Callout Example

Callout Leader Line

This is body text that
can further describe this

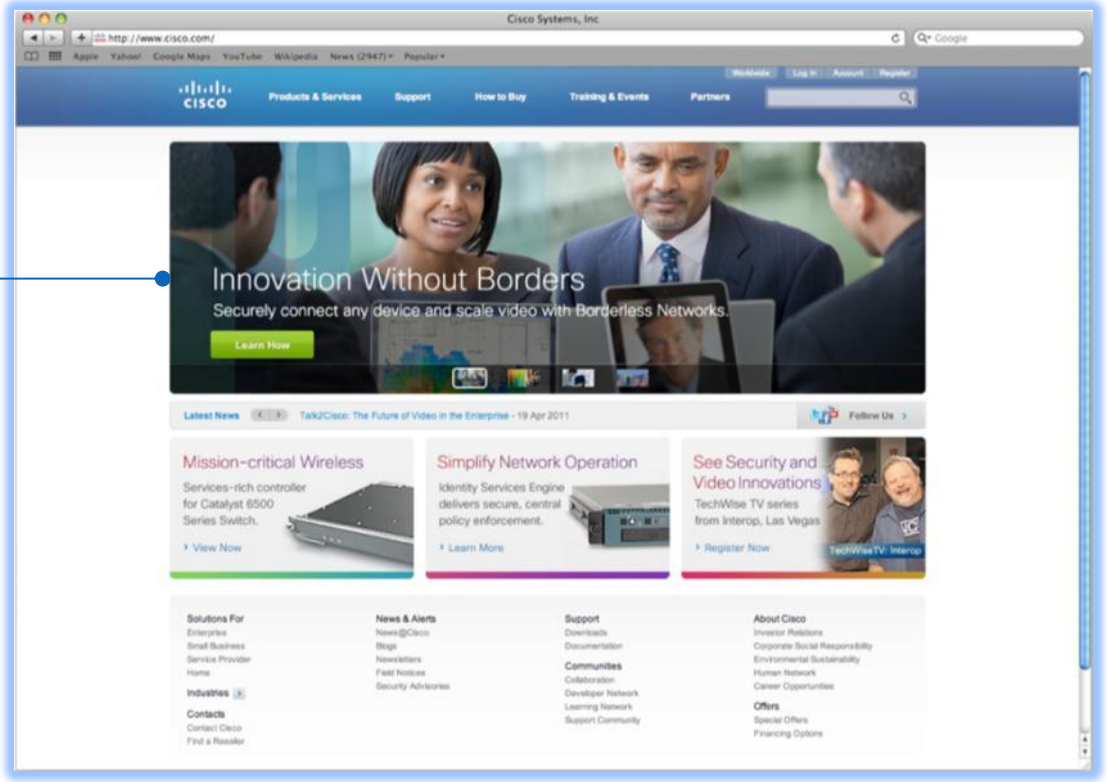

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Table Example

Header	Header	Header	Header	Header
Data	500	400	300	200
Data	100	200	300	400
Data	80	70	60	50
Data	5000	300	400	2000
Data	20	20	20	20
TOTAL	**5700**	**990**	**1080**	**2470**

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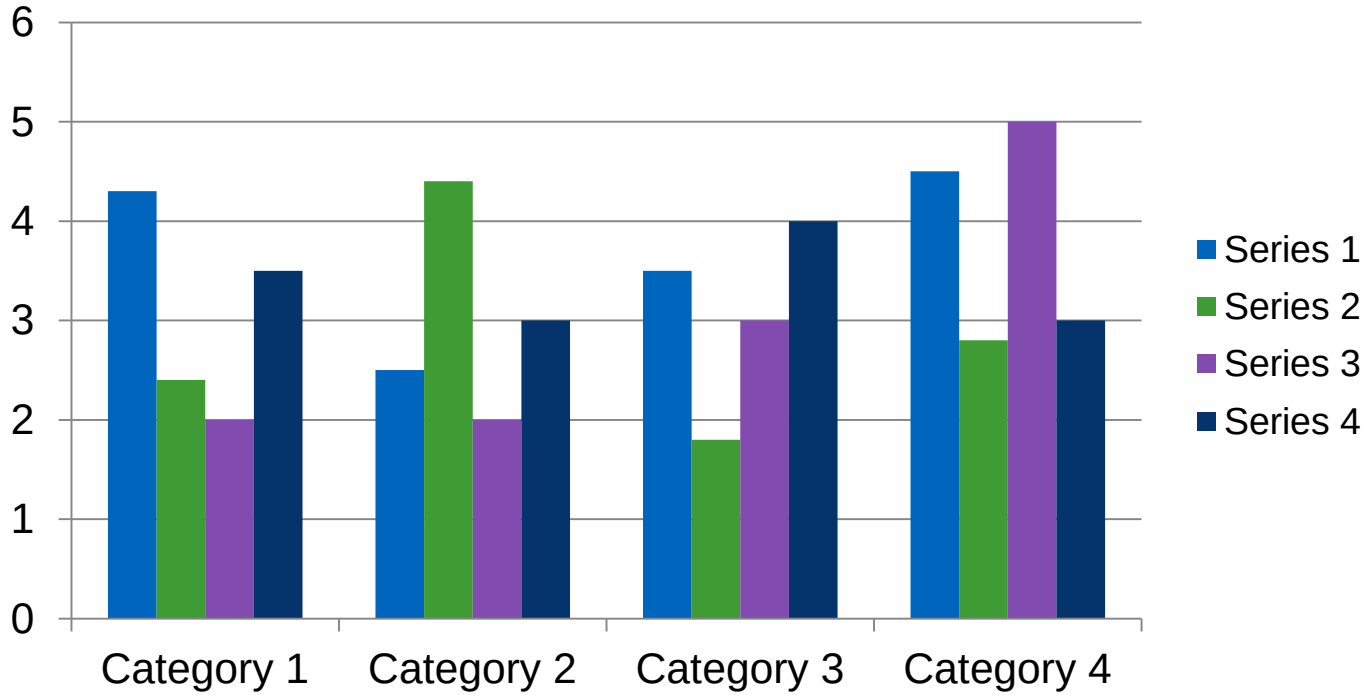
Bar Chart Example



Source: Placeholder for Notes is 16 points

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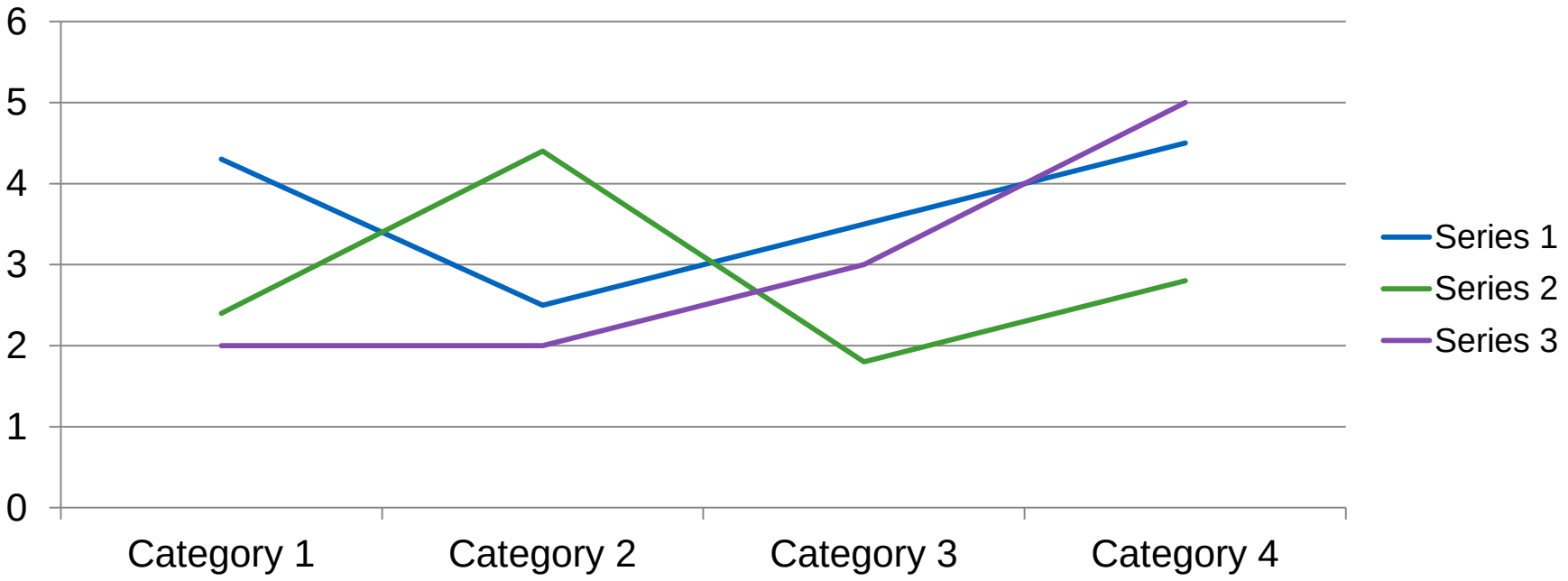
Line Chart Example



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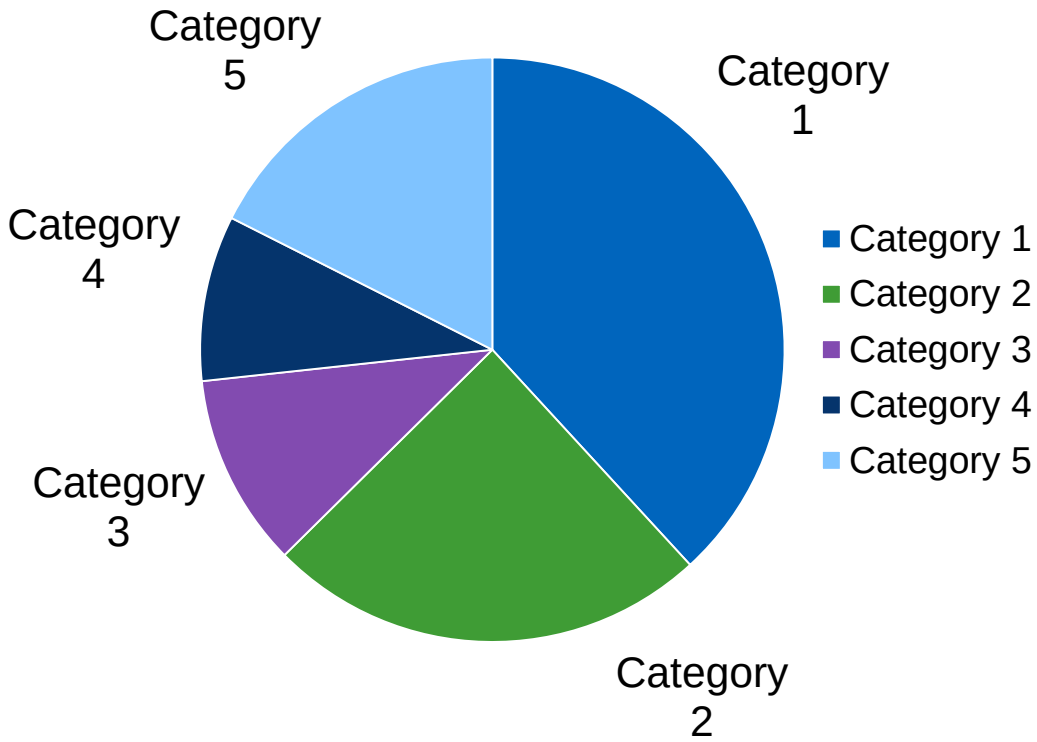
Pie Chart Example



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