
TOMORROW
starts here.
CISCO
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OpenStack for Service Providers and Enterprise

BRKSPG-2644

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#clmel

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Agenda

- Enterprise Cloud Trends (listen up Cloud providers ;-))
- What is OpenStack?
- OpenStack Participation
- What are Enterprise/SPs doing with OpenStack?
- OpenStack Deployment
- Cisco Product Integration
- Conclusion

Enterprise Cloud Trends

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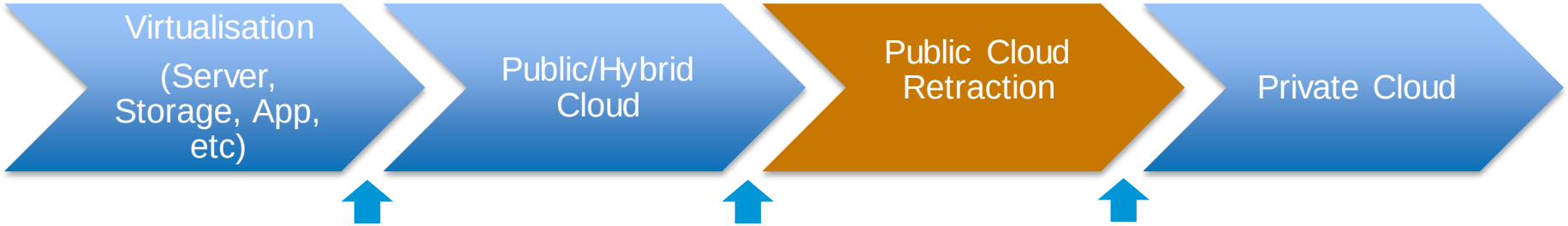
Enterprise Trends – Cloud



Cost driven
Horrible mistake

Missed expectations:
- Cost
- HA
- Performance
- Ops

Cloud done their way:
- Self-service
- Reset cost expectations
- Elastic
- Understand Cloud HA
- Multi-tenancy
- IT meet DevOps

Enterprise Trends – Cont.

- Learned lots of stuff:
- Hypervisors
- Multi-DC
- Virtual networking
- etc..

- OpenStack
  - KVM
  - Zen
  - ESXi
  - Hyper-V
- Eucalyptus
- Cloudstack

- OpenStack
  - Docker
- It's about the App, stupid
  - Docker + stuff
  - CoreOS
  - Kubernetes
  - Mezos
  - etc..

Insanity = Doing the Same Thing Over and Over Expecting a Different Result

- Cool and exciting technologies are borderline useless if IT process & change control don't adapt
- Elastic, self-service, FastIT, are all the enemy of legacy IT models

Changing technology hoping for different results when IT policies don't change to meet new requirements

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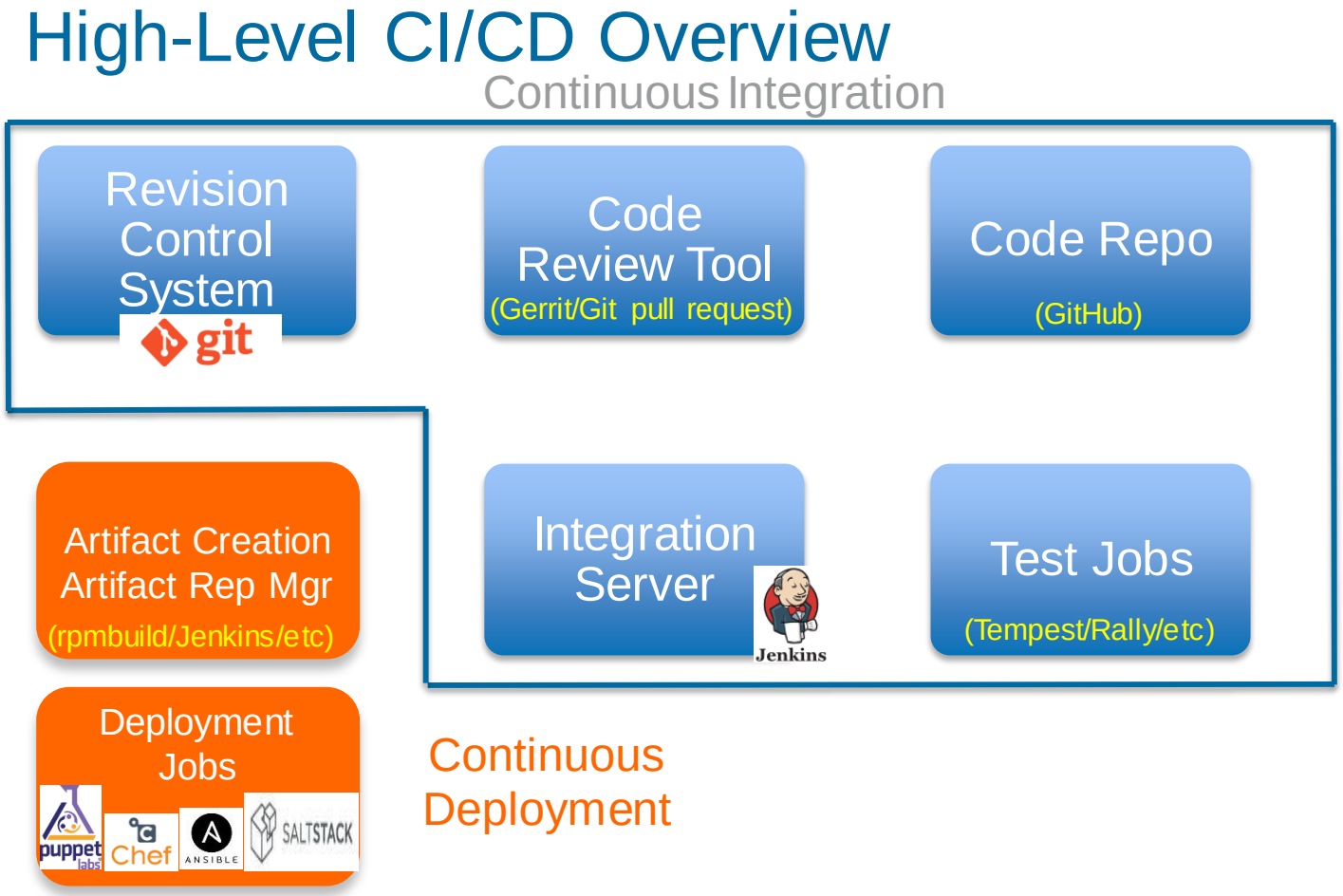
CI/CD as a Prereq to OpenStack

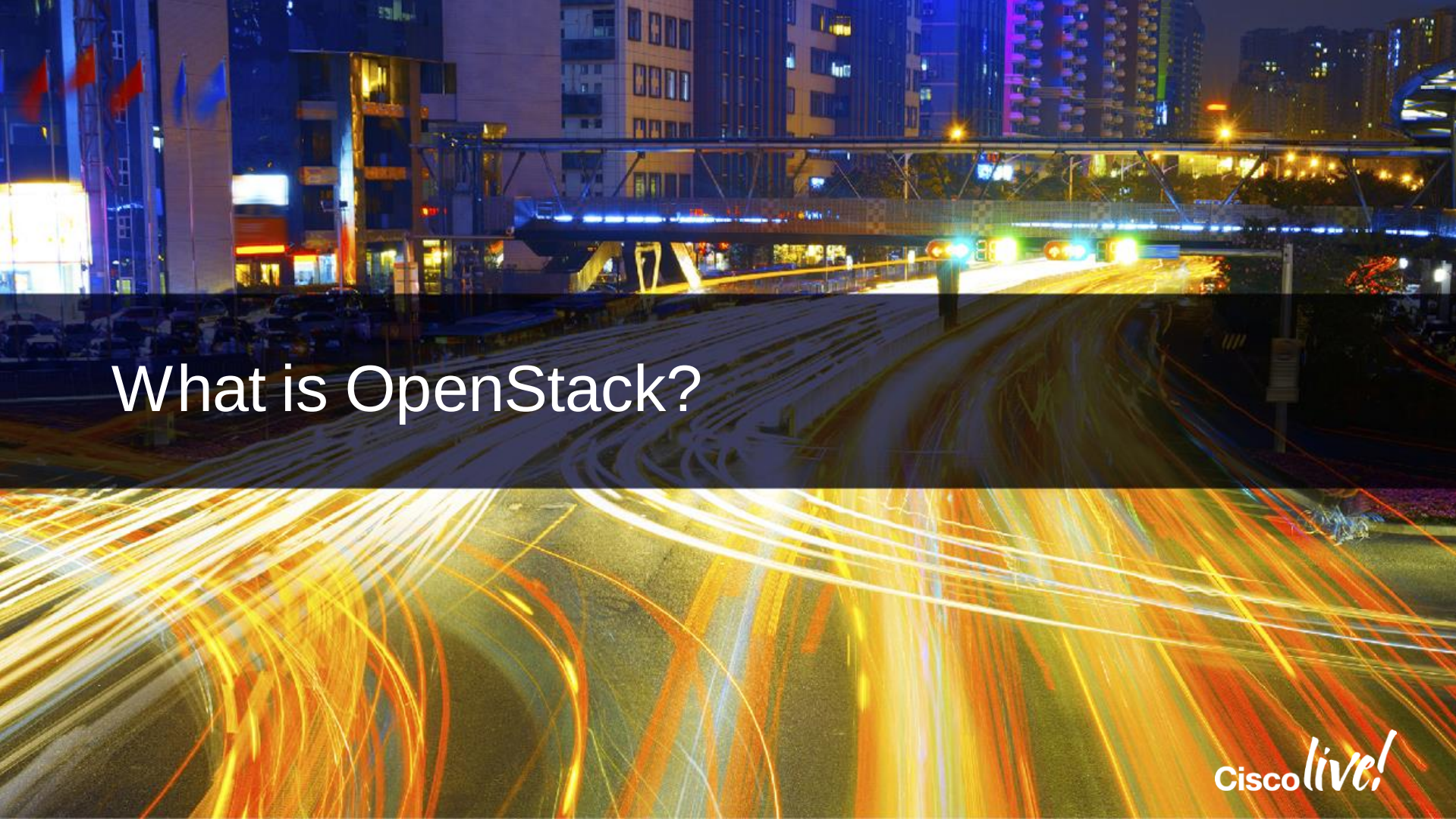
- The biggest issue with OpenStack is actually not OpenStack itself but the operational processes that surround it
- DevOps – Learn it, Live it, Love it: http://www.jedi.be/blog/2012/05/12/codifying-devops-area-practices/
- CI/CD – The make or break process that your customer has to understand
- Build the processes BEFORE building the OpenStack environment
- Remember, OpenStack was built for modern-day distributed web applications that are driven by developers

High-Level CI/CD Overview



- RCS: Subversion, Mercurial, CVS, Bazaar, Perforce, ClearCase, etc..
- Code Review: Gerrit, Git pull request, Phabricator, Barkeep, Gitlab, etc..
- Code Repo: GitHub, BitBucket, BitKeeper, Gitorious, etc..
- Integration Server: Jenkins/Hudson, Zuul, CloudBees, Go, Maven, etc..
- Test Jobs: Tempest, Rally, puppet-rspec, tox, etc..
- Artifacts: rpmbuild, Jenkins, Artifactory, Apache Archiva, etc..

*See notes for logo credits



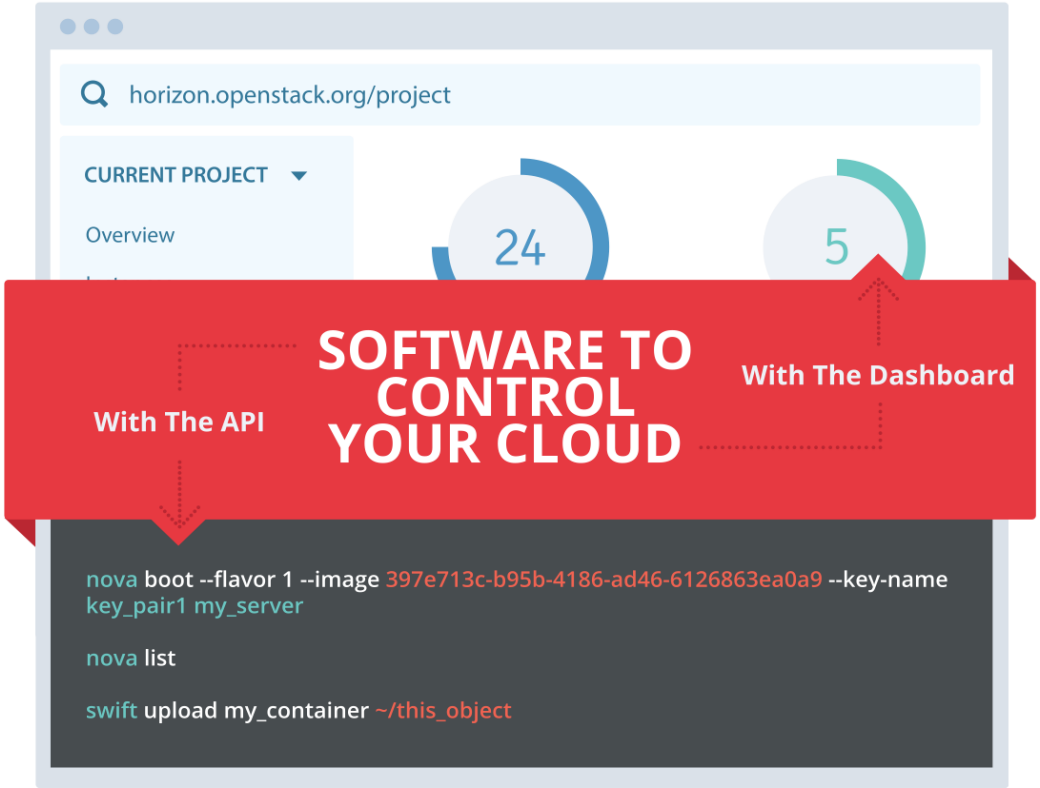
What is OpenStack?

“OpenStack is a collection of open source technologies delivering a massively scalable cloud operating system”

- openstack.org

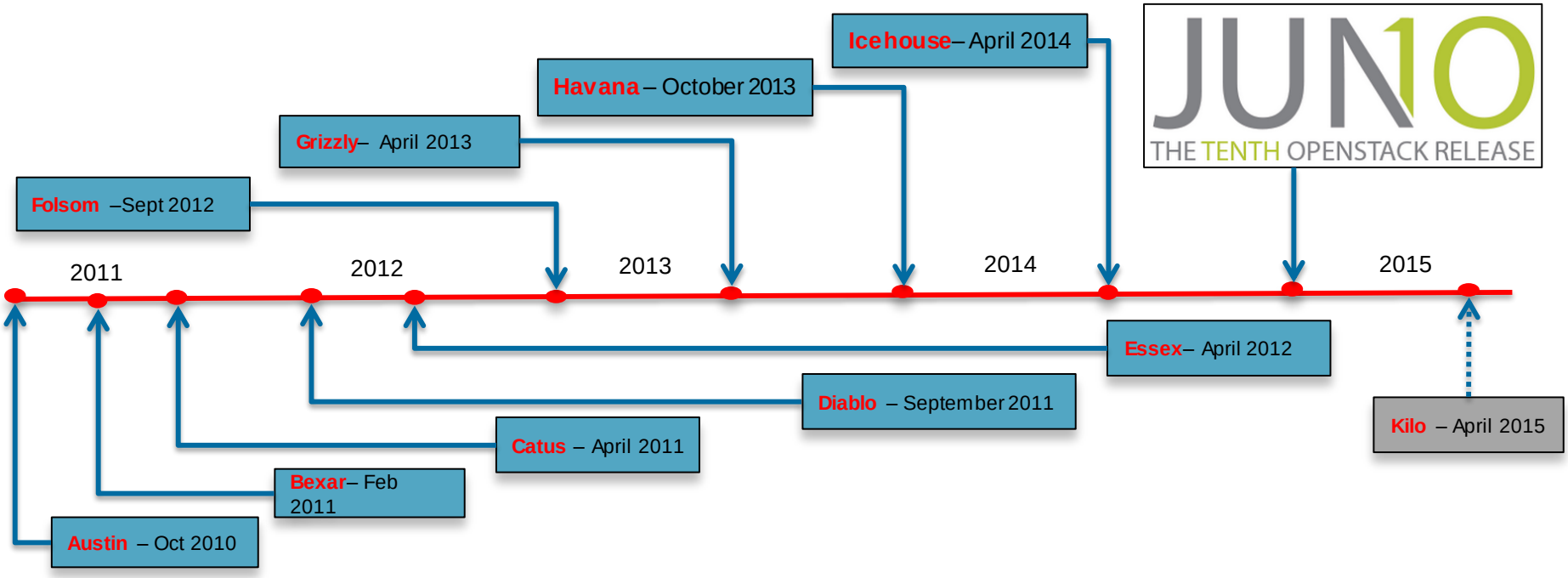
OpenStack Cloud Computing Software

- Freely available, open source software allowing anyone to build their own private or public clouds.
- Open source and open APIs allows the customer to avoid being locked ir to a single vendor
- Built by a growing community of contributors
- Opportunities for vendors to develop their own solutions and services



http://www.openstack.org/assets/welcome-guide/OpenStackWelcomeGuide.pdf

OpenStack Releases



OpenStack is “Project” Based

Core Projects Shown

Compute

“Nova”

- Houses VMs
- API driven
- Support for multi-hypervisors

Storage

Image, Object, Block

“Glance, Swift, Cinder”

- Instance/VM image storage
- Cloud object storage
- Persistent block level storage

Dashboard

“Horizon”

- Web app for controlling OpenStack resources
- Self-service portal

Identity

“Keystone”

- Centralised policies
- Tenant mgmt.
- RBAC
- Ext. integration (LDAP)

Networking

“Neutron”

- Networking as a service
- Multiple models
- IP address mgmt.
- Plugins to external HW

Telemetry

“Ceilometer”

- Central collection point
- Metering and monitoring

Orchestration

“Heat”

- Template-based orchestration engine
- More rapid deployment of applications

Database

“Trove”

-DBaaS

-Single-tenant DB within instance

Data Processing

“Sahara”

- Fast provisioning of Hadoop clusters

New!

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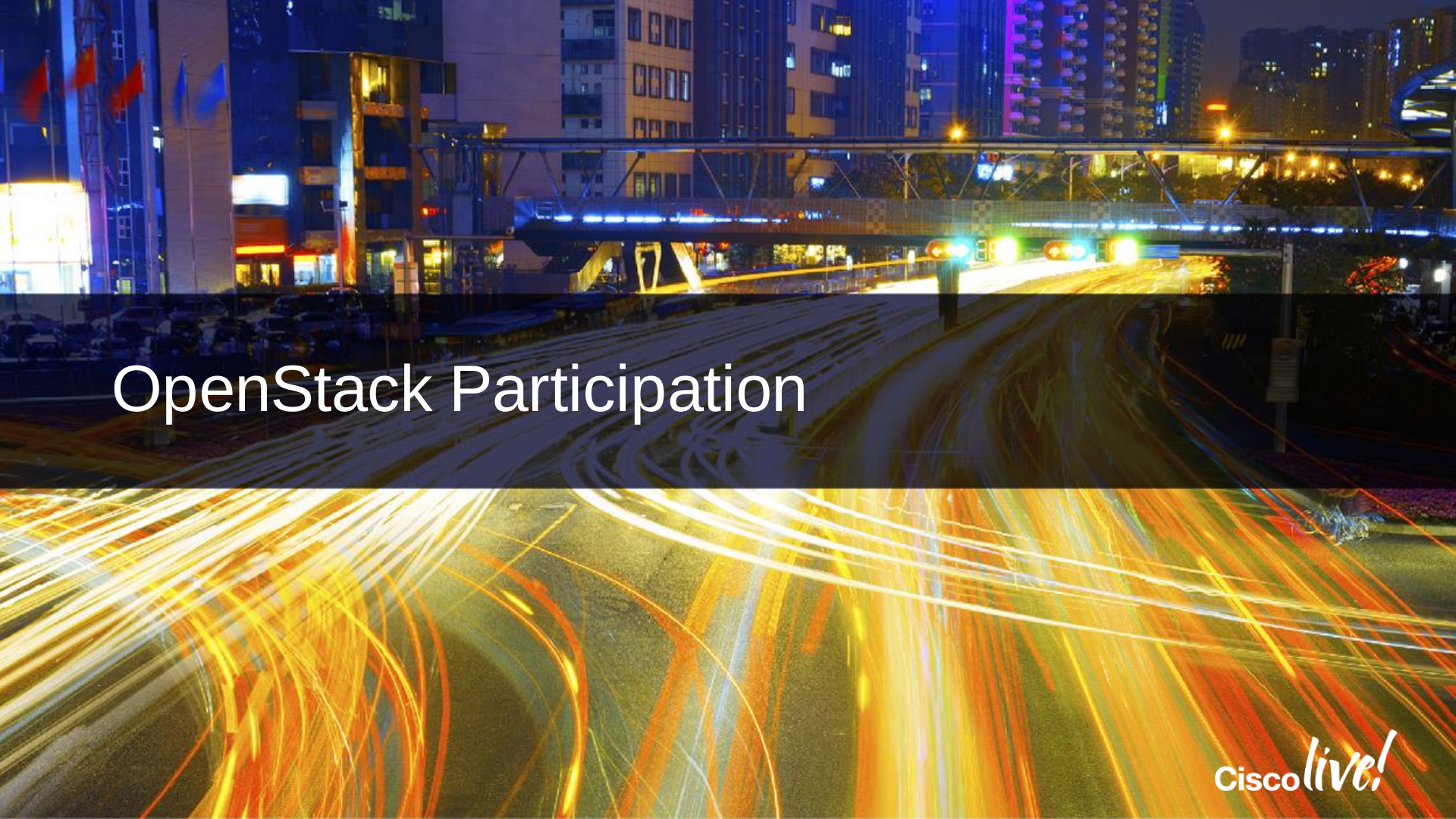
Reference

What's New in Juno

- PTL Juno Summary: https://www.youtube.com/playlist?list=PLKqaoAnDyfgqpX5f3PCuOgsDm-_UJu2aU
- Nova
  - NFV
  - Improvements in live upgrades (introduced in Icehouse)
  - http://blog.russellbryant.net/2014/07/07/juno-preview-for-openstack-compute-nova/
- Heat
  - Rollback
  - non-Admin resource creation
  - http://www.zerobanana.com/archive/2014/07/10#heat-juno-update
- Neutron
  - Distributed Virtual Router
  - L3 HA
  - New LBaaS API


OpenStack Participation
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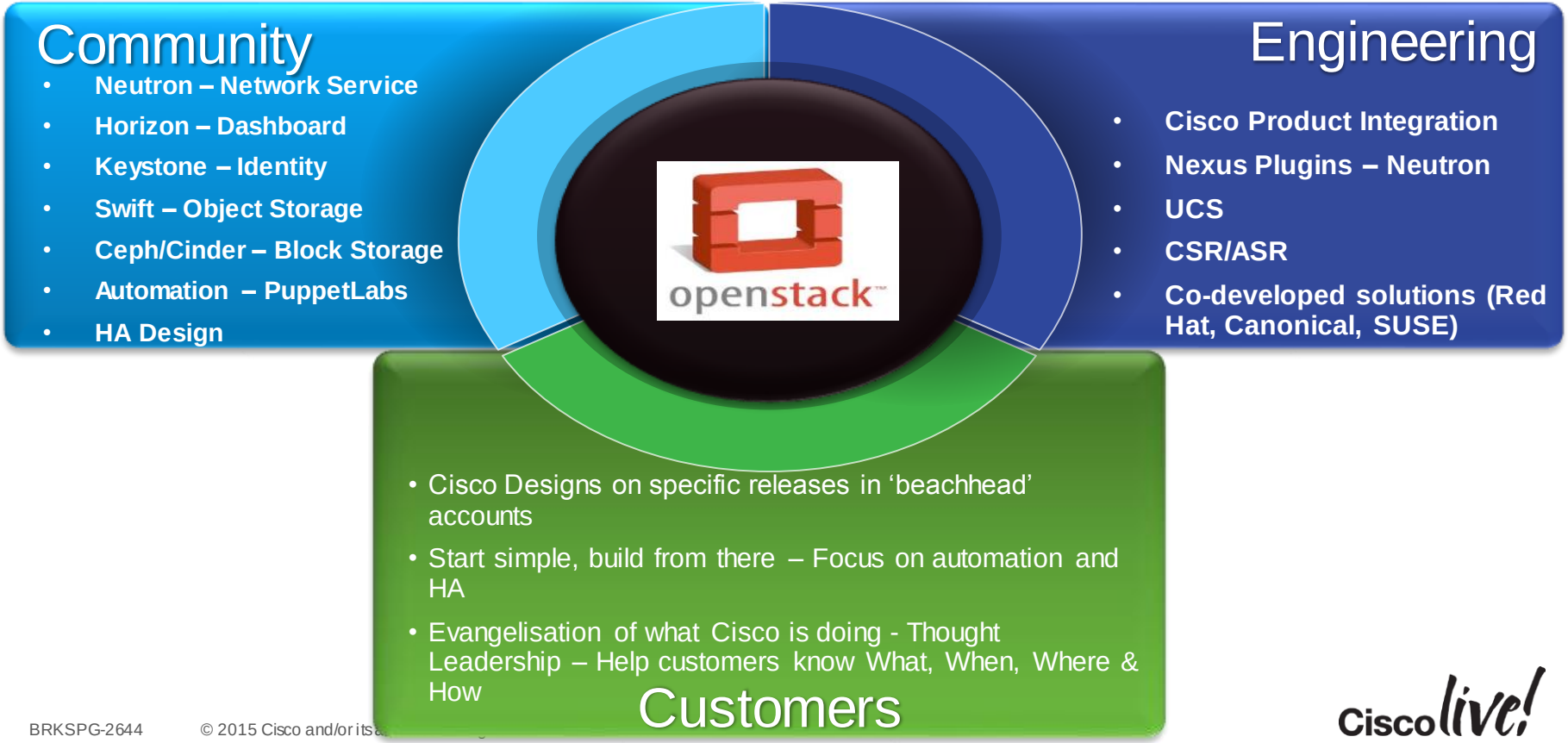
Why Does OpenStack Matter?

- Choice
  - There is no one-size fits all option for cloud computing – *Amazon is cool but not the be all/end all solution*
  - There is no single vendor who can fill all needs of a cloud stack – You will likely engage with multiple partners
- Community
  - Open Source
  - Community driven – Individual, organisational
  - Better time-to-market and faster feature velocity
- Commercialisation
  - Start with the 'baseline' OpenStack components
  - Vendor opportunities for value-add integration on top of OpenStack baseline
    - Design, deployment, automation, operation, high-availability, applications, etc…

Who is Involved in OpenStack?

- You name it – Compute, Storage, Networking vendors, Universities, Gov't, massive pile of OpenStack-specific startups
- Traditional HW vendors – Cisco, HP, Dell, etc…
- Providers – Rackspace, AT&T, Comcast, etc…
- Startups – PistonCloud, SwiftStack and many, many more…
- Distributions & Support – Red Hat, Canonical, SUSE
- Some are focused on only small parts of OpenStack such as driving object storage features (SwiftStack), or automated deployment and support (PistonCloud) or networking and compute pull-thru as well as project leadership (Cisco – Nexus, UCS, services, Neutron)

Cisco's Focus on OpenStack - Today



Reference

Cisco + Other Distributions/Vendors

- Cisco.com OpenStack: http://www.cisco.com/web/solutions/openstack/index.html
- Red Hat:
  - UCSO: http://www.cisco.com/c/en/us/td/docs/solutions/Enterprise/Data_Center/OpenStack/UCSO/Starter/1-0/UCSO.pdf
  - http://www.cisco.com/c/en/us/td/docs/solutions/Enterprise/Data_Center/OpenStack/RHEL-UCS/Red-Hat-Openstack-Platform-UCS.pdf
  - http://www.cisco.com/c/dam/en/us/td/docs/unified_computing/ucs/UCS_CVDs/ucs_rhos.pdf
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  - http://www.cisco.com/c/dam/en/us/solutions/collateral/data-center-virtualization/unified-fabric/solution-brief-c22-729865.pdf
- Ubuntu: http://www.cisco.com/c/dam/en/us/td/docs/unified_computing/ucs/UCS_CVDs/ucs_ubuntu.pdf
- FlexPod: http://nt-ap.com/IfgPlx
- Solution Accelerator Paks: http://www.cisco.com/web/solutions/openstack/le_sb_open.pdf

Reference

Distro/Vendor Supported Installers

- Red Hat OpenStack (RHOS/RDO) – PackStack and Foreman:
  http://www.redhat.com/openstack/
  http://openstack.redhat.com/Main_Page
- Canonical/Ubuntu – MAAS and JuJu: http://www.ubuntu.com/cloud
- SUSE: https://www.suse.com/products/suse-cloud/features/
- Mirantis Fuel: http://software.mirantis.com/main/
- Piston Cloud: http://www.pistoncloud.com/
- Others …

Red Hat - Packstack

- Meant for single/few host deployments in NON-production deployments :https://access.redhat.com/documentation/en-US/Red_Hat_Enterprise_Linux_OpenStack_Platform/5/html/Getting_Started_Guide/index.html
  - https://openstack.redhat.com/Main_Page
- Install Packstack:

```
yum install -y openstack-packstack
```

- Generate SSH keys (or let Packstack do it):

```
ssh-keygen
```

- Generate an answer file (or just run 'packstack' and follow the prompts):

```
packstack --gen-answer-file=~/answers.cfg
```

- Run the answer file:

```
packstack --answer-file=~/answers.cfg
```

Installer Demo

What are Enterprise/SPs Doing with OpenStack?

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Common Enterprise Use Cases

- OpenStack, at least today, is targeted at hosting modern day distributed applications written for the cloud – This isn't your grandpa's server virtualisation platform built for individual VM HA/Mobility
- Sandbox environments
  - A place to research, learn and test CI/CD processes
  - PoC web applications along with 'practicing' the new DevOps methodology
  - A place to learn the whole cloud deployment framework, document, train, move to production
- Development environments
  - Using the lessons learned in the sandbox phase:
    - Build Dev, QA and production environments
    - Apply CI/CD processes
    - Slow-role Web application deployment either on 'standard' OpenStack or in conjunction with a PaaS deployment
- Data Processing environments – Big Data clusters, etc..
- Training systems – Cheap and fast to build and tear down for each class
- Revenue generating applications – Vertical applications

Telco's are Turning to OpenStack for NFV


DNS


EPC


CDN


DPI


Carrier Grade NAT


PE Router

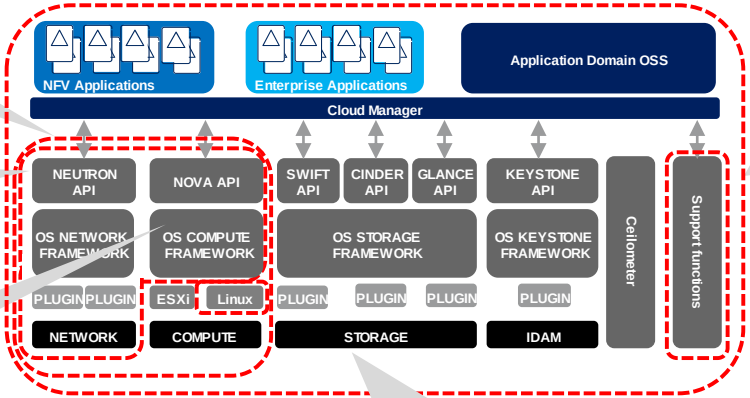

Session Border Controller


WAN Acceleration


Firewall

- **Resource Allocation & Optimisation**
- **Resource Isolation**

- **Networking**
  - WAN orchestration
  - VNF provisioning



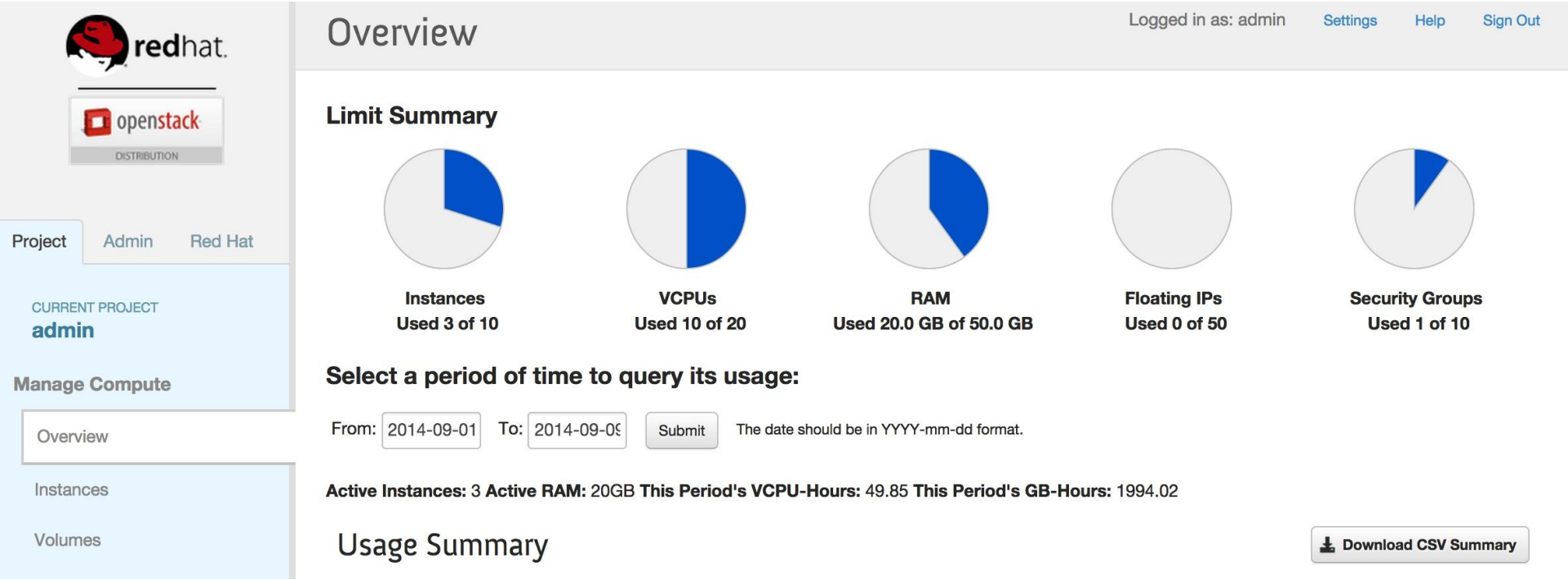
- **Real Time Response**
  - Interrupt servicing
  - OVS latency

- **High Availability**
  - Mitigation of failures
  - Fault monitoring and heath check

- **Carrier Grade Security**
  - Multi-tenancy with end-to-end isolation
- **Software Management and Upgrade Support**
  - Hitless & automated upgrades
- **Backup and Restore**
  - Automatic backup
- **Audit and Trouble Shooting**
  - Audit log, monitor
- **Assurance:**

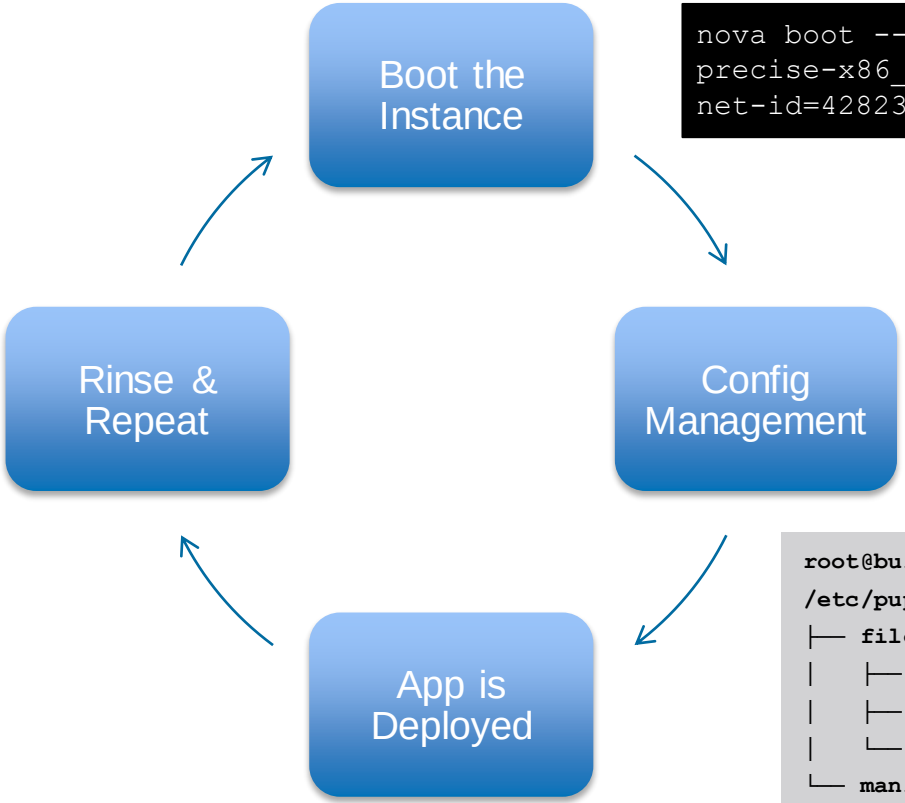
https://wiki.openstack.org/wiki/Teams/NFV

Shock-and-Awe: Dashboard is Not Where Tenants Do Their Work



Cloud Apps Deployment – Automate it

http://docs.openstack.org/user-guide/content/user-data.html




```
nova boot --user-data ./cloud-config-puppet.txt --image
precise-x86_64 --flavor m1.tiny --key_name ctrl-key --nic
net-id=42823c88-bb86-4e9a-9f7b-ef1c0631ee5e sales-web-01
```

- Cloud-init for Puppet/Chef/etc..
- Image already has agent/script

```
# Nodes for web server instances
node 'sales-web-01' {
    include lamp
}
```

```
root@build-server:~# tree /etc/puppet/modules/lamp/
/etc/puppet/modules/lamp/
├── files
│   ├── apache2.conf
│   ├── index.php
│   └── php5.conf
└── manifests
    └── init.pp
```

live!

Cloud Apps Deployment - Heat

- Growing interest in Heat-based deployments
- Today, Heat orchestrates resources inside a tenant space
- https://wiki.openstack.org/wiki/Heat
- http://docwiki.cisco.com/wiki/OpenShift_Origin_Heat_Deployment_Guide
- http://blog.scottlowe.org/2014/05/01/an-introduction-to-openstack-heat/

Heat Demo

https://github.com/shmcfarl/my-heat-templates

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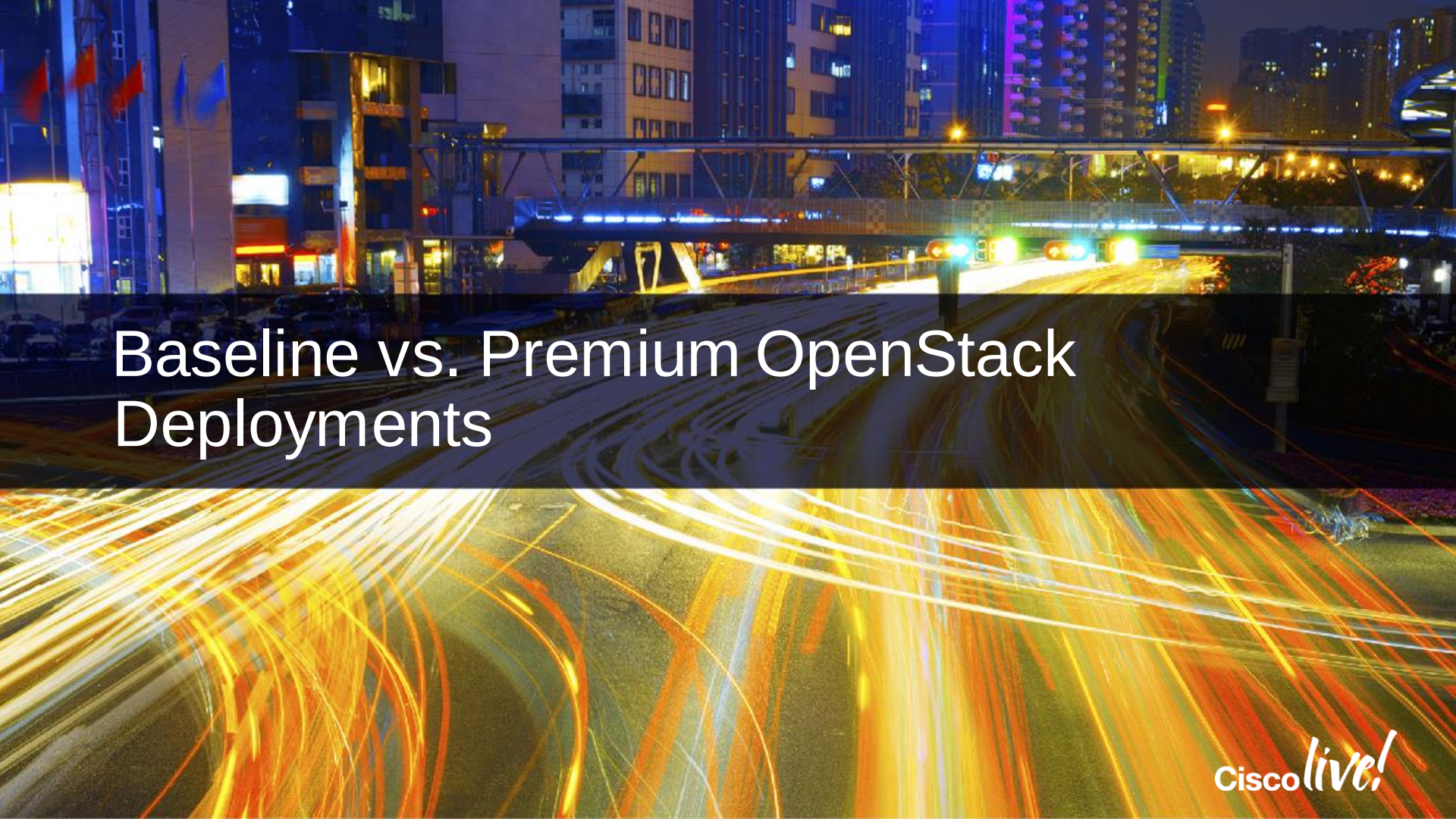

Baseline vs. Premium OpenStack Deployments

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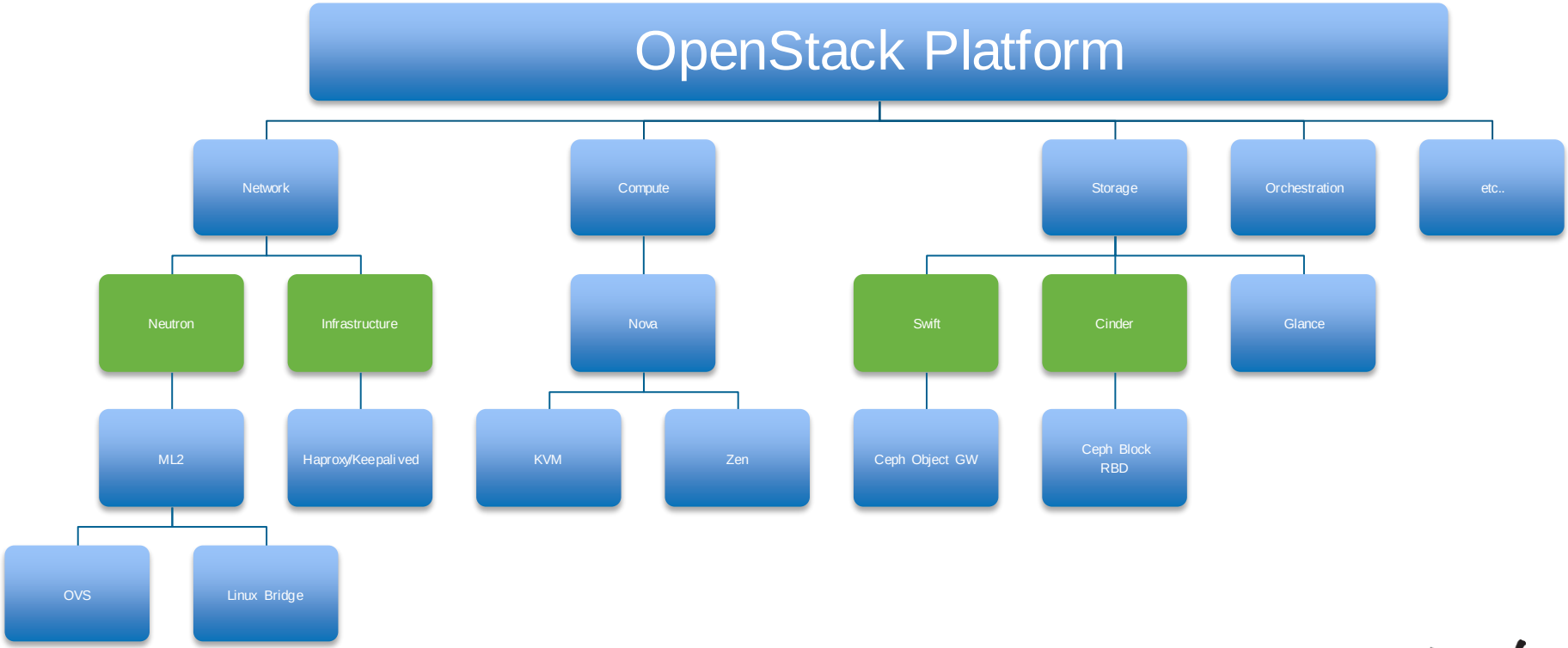
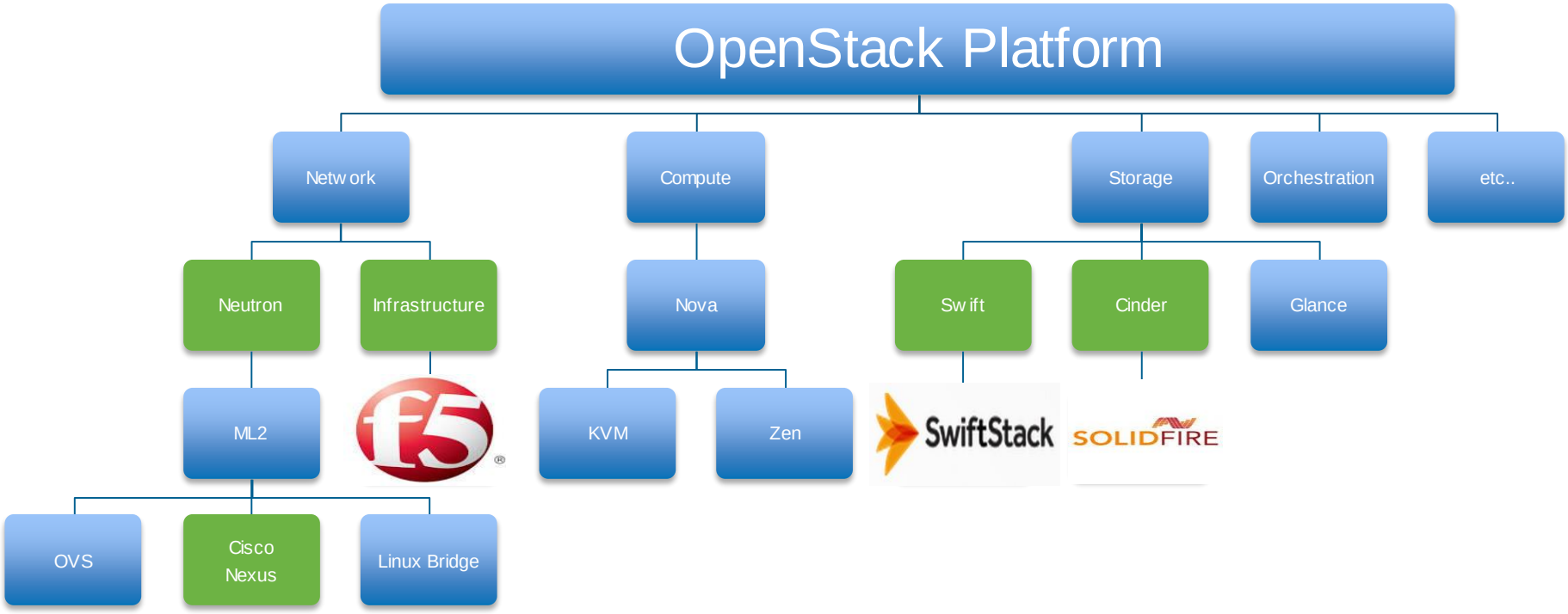
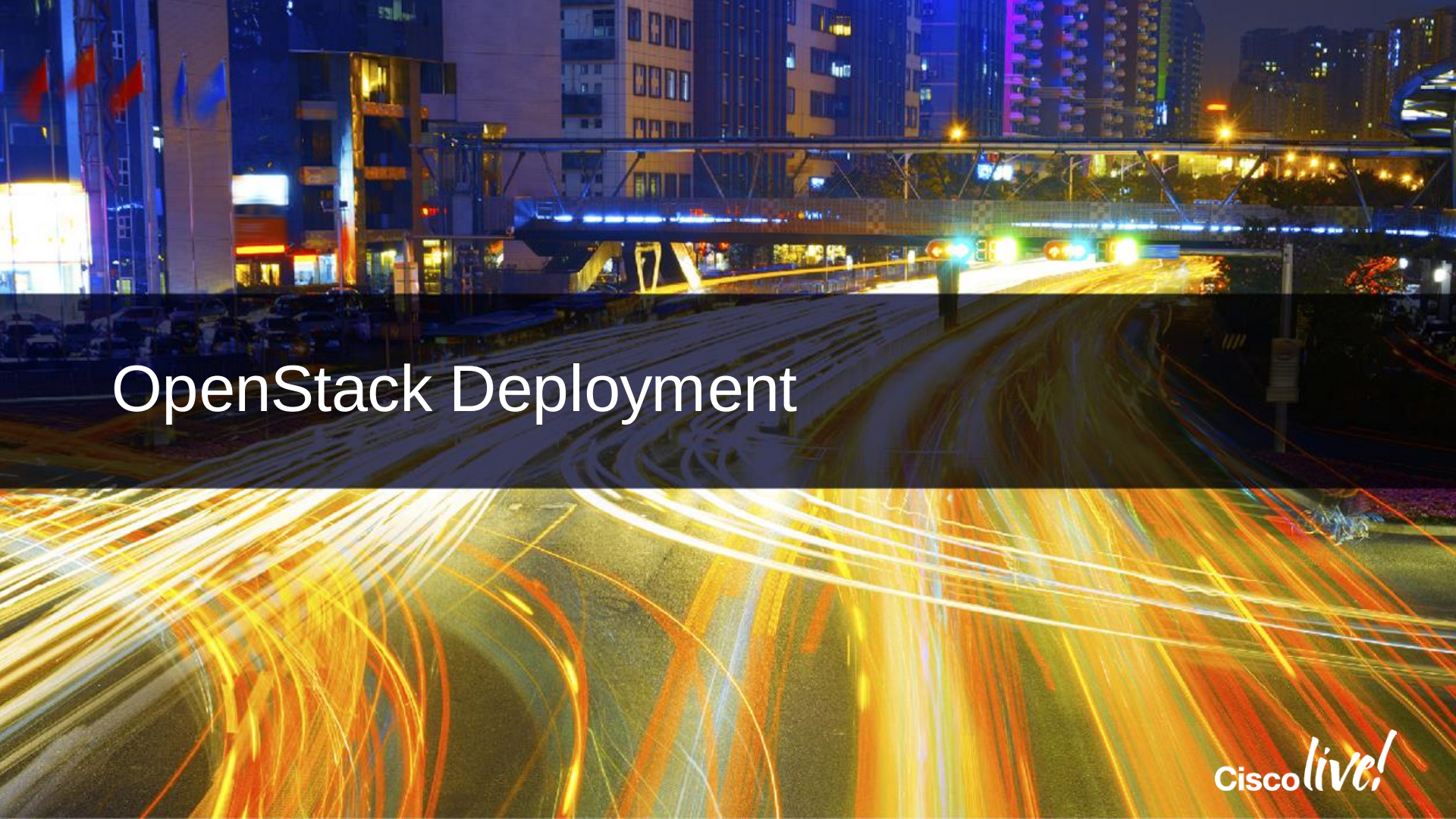
Common Baseline Components - Example



Common Premium Components - Example




OpenStack Deployment
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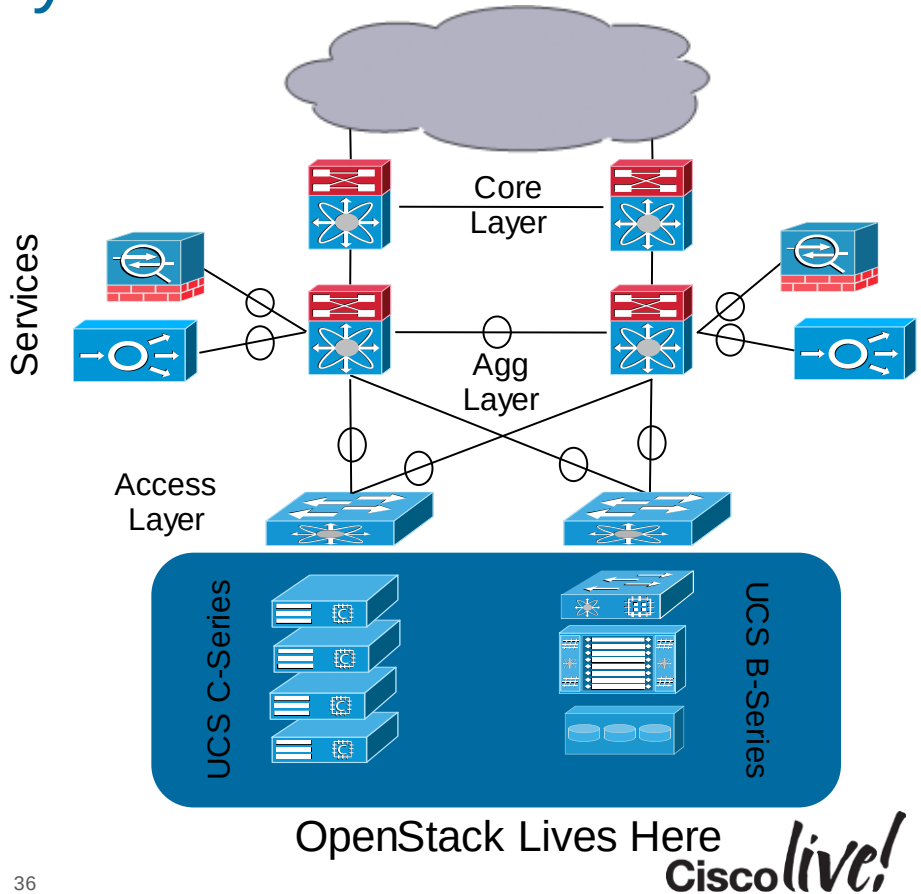
What Really Changes in My Data Centre?

- OpenStack components live South of the Top-of-Rack switch
- Your existing DC, Internet Edge and BN architecture stays the same
- It's about the compute, storage and orchestration/management tiers
- Your apps go largely unchanged



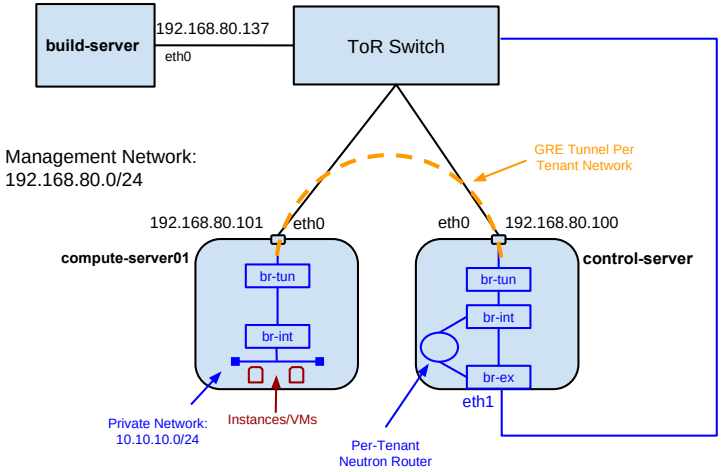
To Automate or Not and How Much to Automate

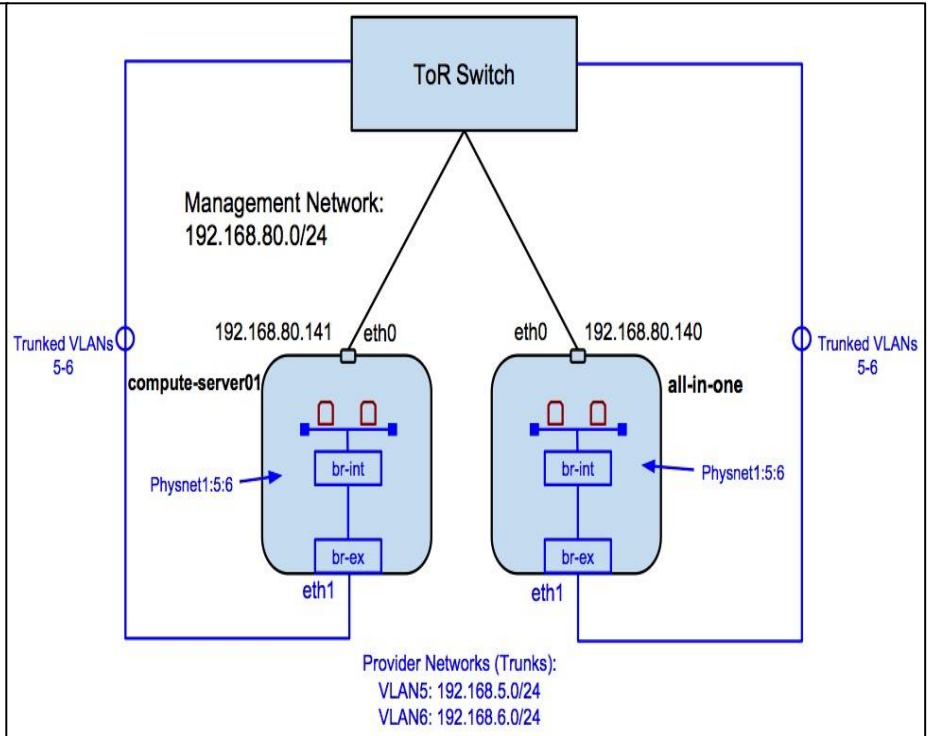
- Single Shot – Manually setup everything:
  - Deep appreciation for what installers do
  - Best way to learn how the components of OpenStack communicate
- Semi-Automatic – Use automation for 'some' of the setup and maintain/modify manually:
  - See slide on installers
- Automatic – Install > Operate > Upgrade
  - CI/CD a huge part of this flow

Network Decisions

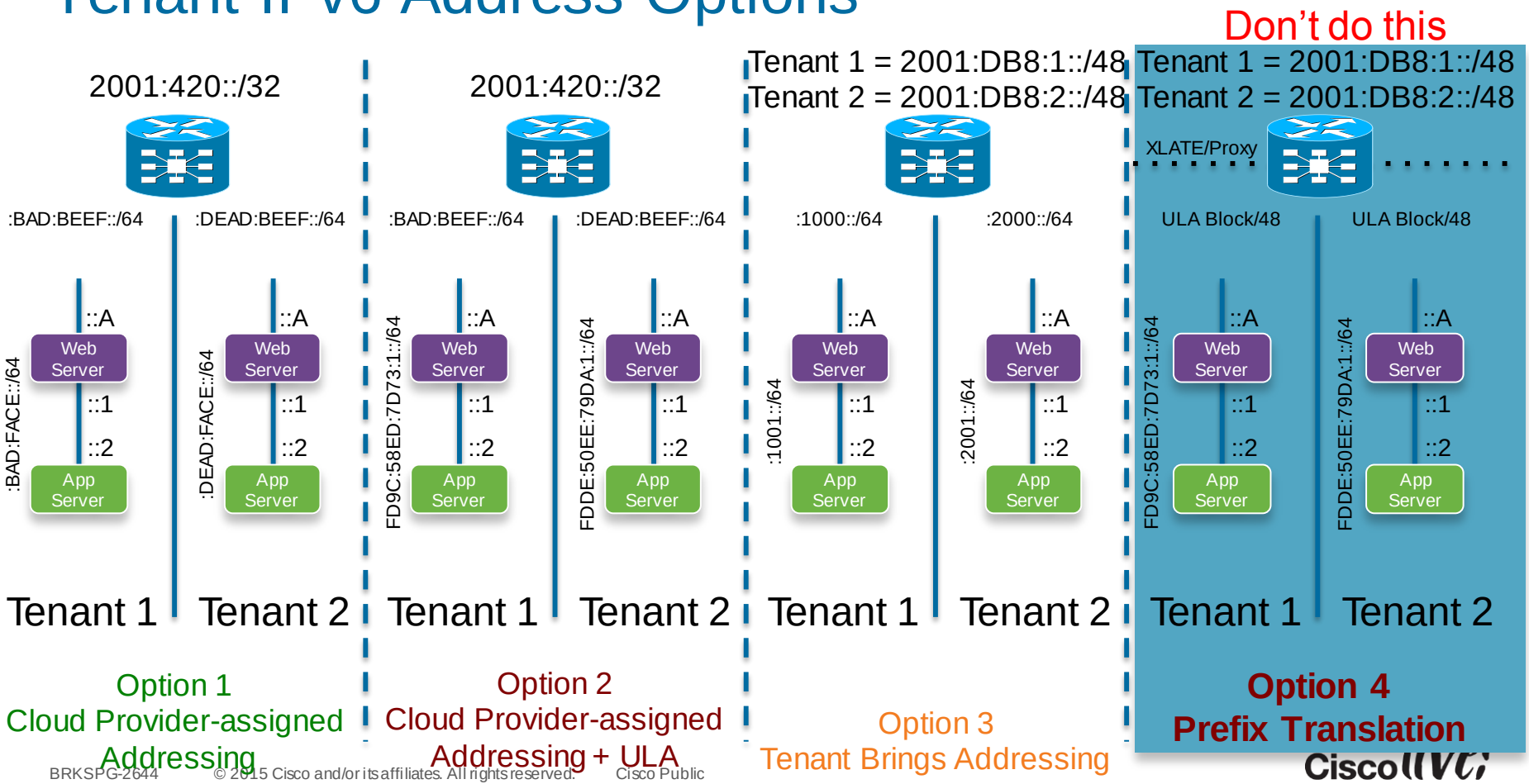
- OpenStack Networking
  - http://docs.openstack.org/admin-guide-cloud/content/section_networking-scenarios.html
  - Many vendor plugins (ML2/OVS, Ryu, etc..)
  - Flat, Routers with NAT, VLAN Trunking, GRE, VXLAN
- Scale
  - VLAN number limitations for large tenant + networking environments
  - GRE/VXLAN – Throughput impact, especially on older releases
  - Service scale – i.e. VPNaaS mesh
- IPv6 – Minimally useable in Juno (without patches), MUCH better in Kilo
- Network Tuning – Linux kernel, networking and vSwitch-specific (OVS) tuning is critical:
  - vhost-net ('**modprobe vhost-net**'): http://www.linux-kvm.com/content/how-maximize-virtio-net-performance-vhost-net https://ask.openstack.org/en/question/6140/quantum-neutron-gre-slow-performance/
  - Test Offload settings: '**ethtool -K eth1 gro off**' - http://www.linuxcommand.org/man_pages/ethtool8.html

Network Topologies – Overlays (GRE, VXLAN, etc) and VLANs





Tenant IPv6 Address Options

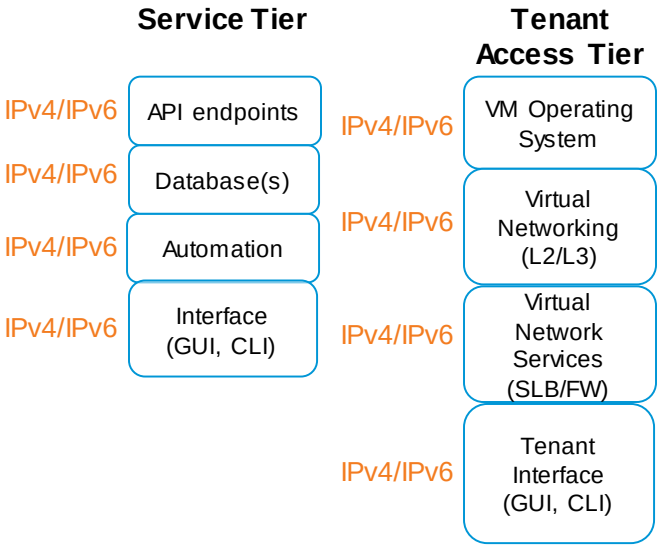


The Hard Stuff – IPv6 + Cloud

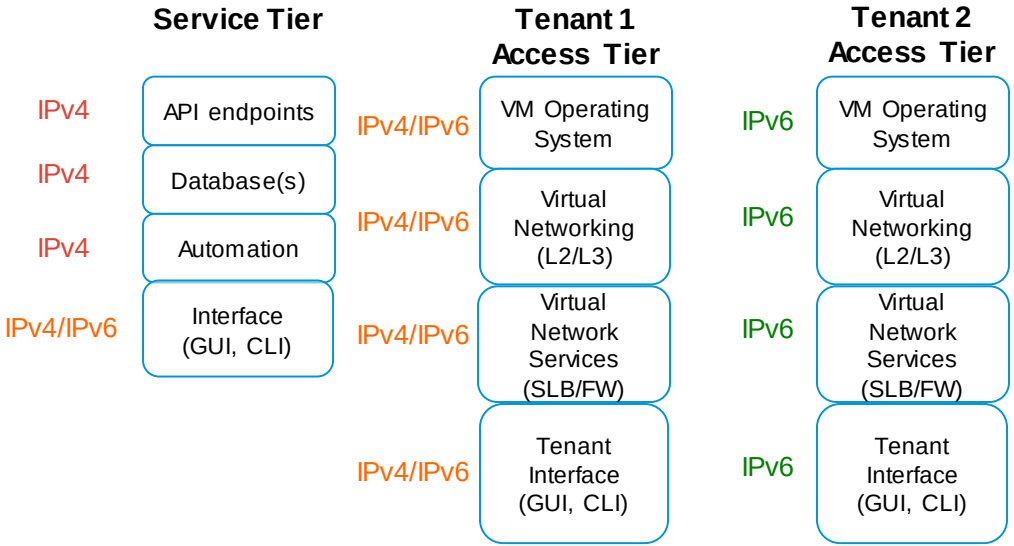
- If you look at most of the private cloud infrastructure components – most of the 'magic' occurs South of the ToR
- North of the ToR is mostly plain-Jane networking (L2/L3, SLB, Security)
- Inside of a private cloud stack you have a lot of moving parts and they all ride on IP:
  - API endpoints
  - Provisioning, Orchestration and Management services
  - Boatload of protocols and databases and high-availability components
  - Virtual networking services <> Physical networking
- Two common approaches for IPv6 support:
  - Dual-Stack everything (Service Tier + Tenant Access Tier [Tenant management interface along with VM network access])
  - Conditional Dual stack (Tenant Access Tier only – API endpoints & DBs are still IPv4)

Cloud Stack – IP Version Options

Dual-Stack Everything



Conditional Dual-Stack

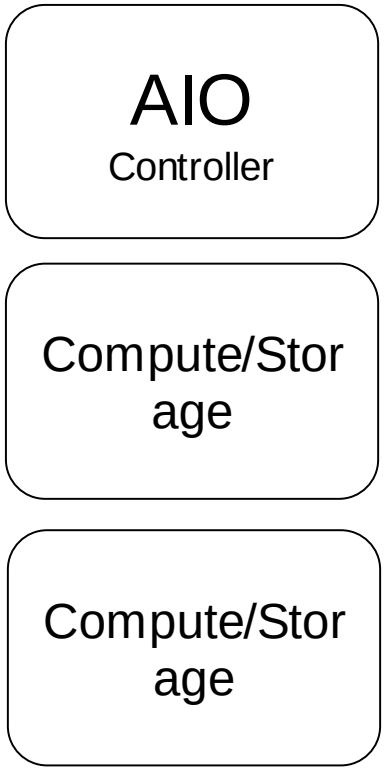


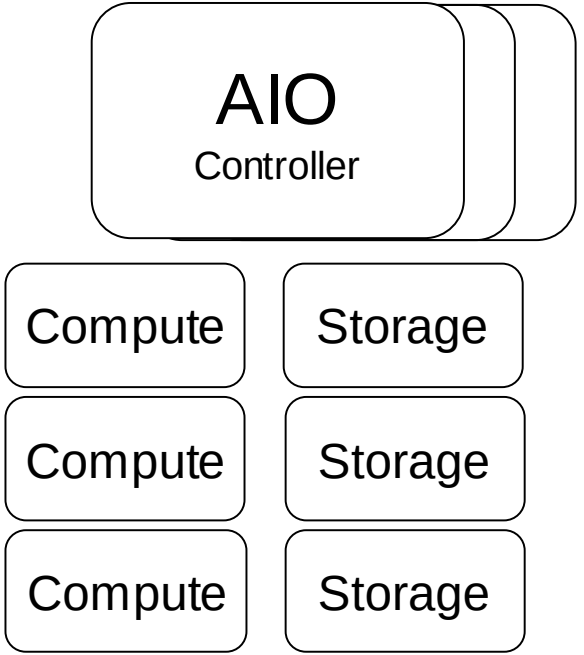
High Availability Decisions

- Know what you don't know
- Pick your release – HA matures on every release: Folsom (sucked for HA) -> Grizzly (getting better) -> Havana (Making progress) –> Icehouse (you get the idea) - You may have to use other open source tools to get a complete system highly available
- Many components are:
  - Databases: Options include MySQL-WSREP and Galera
  - Message Queue: RabbitMQ Clustering and RabbitMQ Mirrored Queues
  - API/Web services: HAProxy, Keepalived, traditional SLB
  - Swift proxy nodes: HAProxy, Keepalived, traditional SLB
  - Swift nodes: Architecturally designed to be available (i.e. multiple copies of objects)
  - Compute node: Nothing directly HA, but can use Migration for planned maintenance windows
- Puppet HA: Search "puppet master redundancy" or "masterless puppet" – you will land plenty of reading choices ;-)

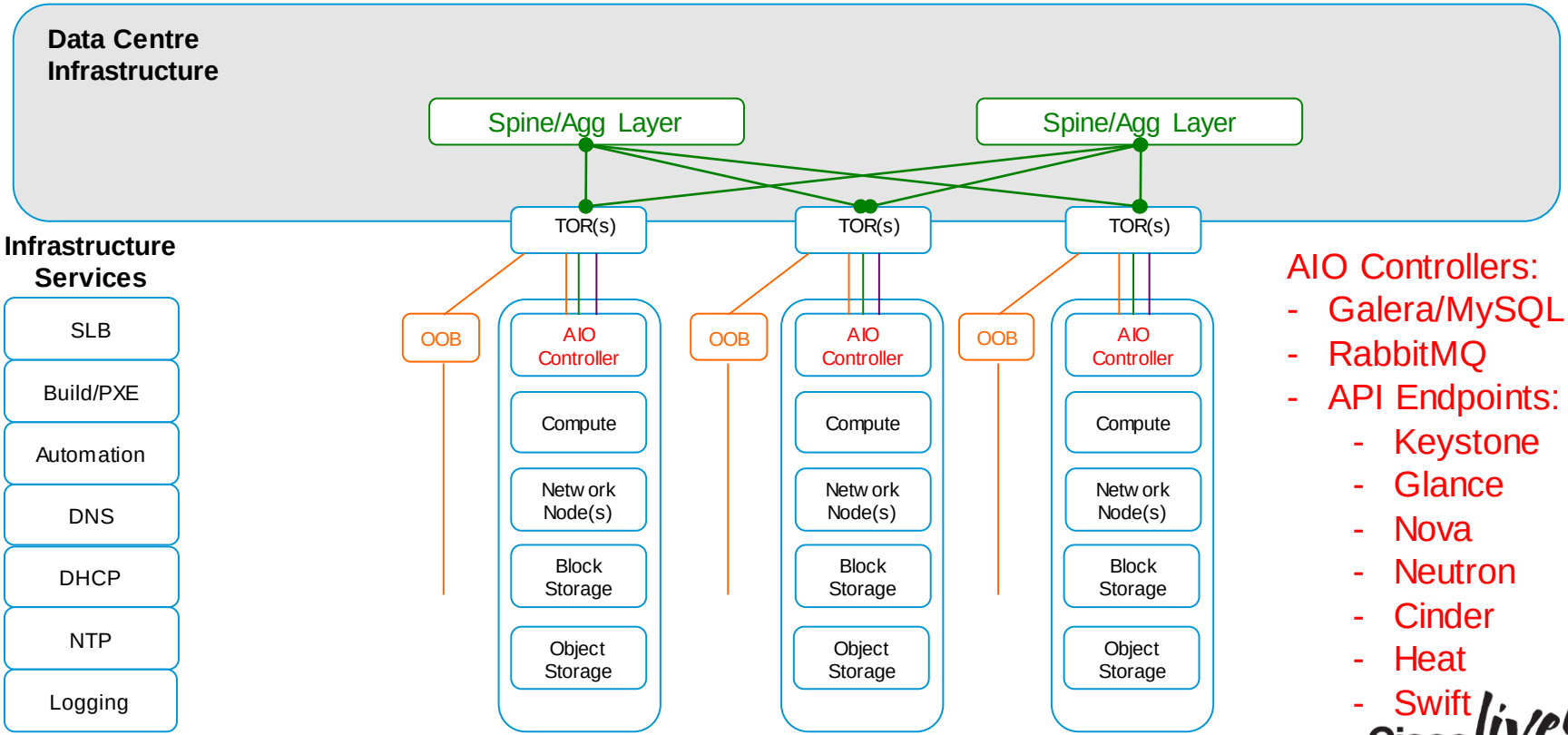
All-in-One (AIO) – Getting Started

AIO Controller:
- MySQL, MariaDB, etc
- RabbitMQ, Qpid, etc..
- API Endpoints:
  - Keystone
  - Glance
  - Nova
  - Neutron
  - Cinder
  - Heat
  - Swift



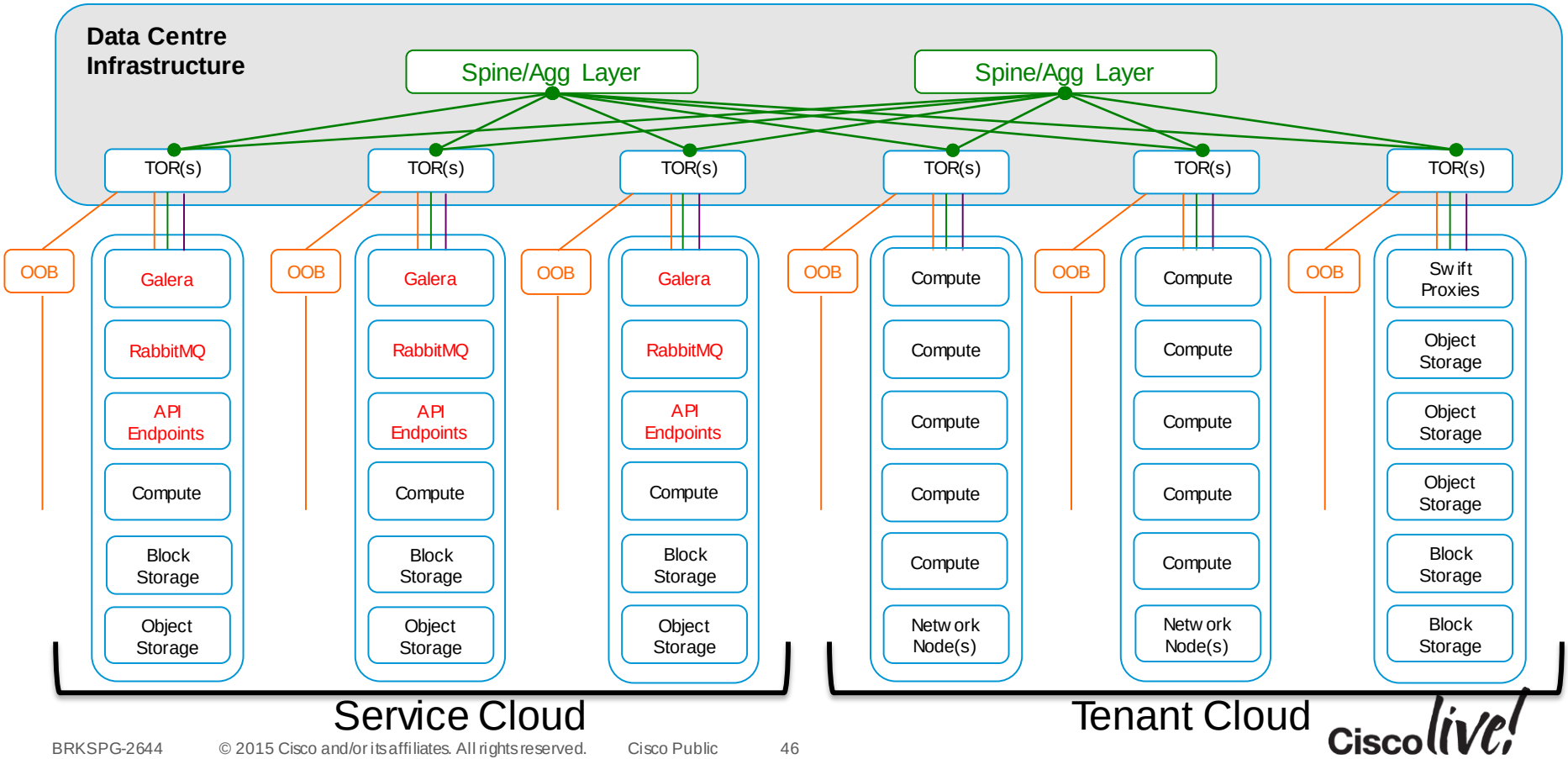


All-in-One (AIO) Compressed HA



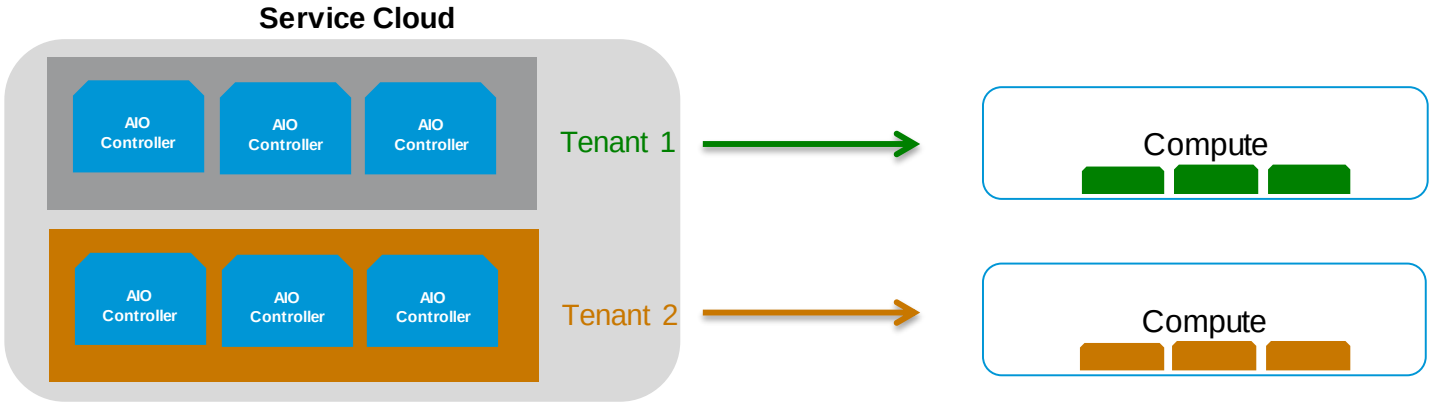
AIO Controllers:
- Galera/MySQL
- RabbitMQ
- API Endpoints:
  - Keystone
  - Glance
  - Nova
  - Neutron
  - Cinder
  - Heat
  - Swift

Service Cloud + Tenant Cloud



What's a Service Cloud?

- It's the 'under cloud'
- Used as a hosting platform for tenant cloud services – usually in a large cloud (1000s of instances with 100-1000s of tenants)
- It is an OpenStack deployment that will host (virtually) the OpenStack control functions used by each tenant




Services

LBaaS

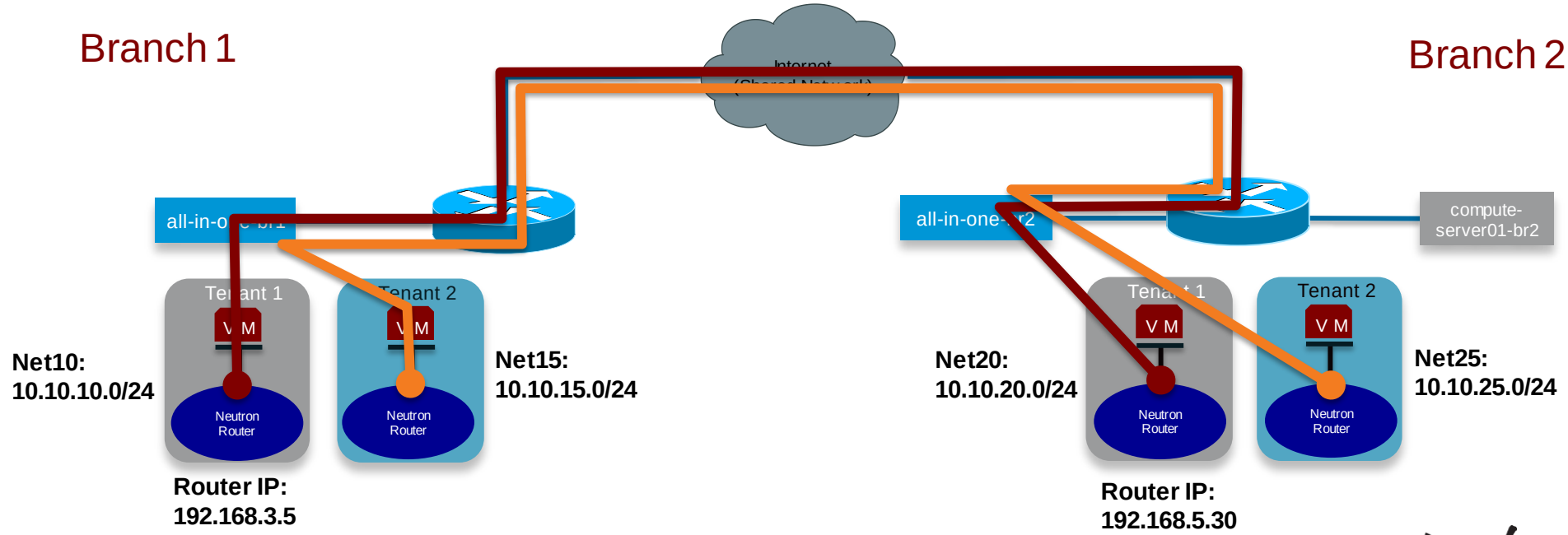
- A service to provide basic load-balancing of VMs/Instances within the OpenStack cluster
- The default LB provider is HAProxy
- Can leverage plugins for LBaaS to control external virtual or physical load-balancers (i.e. F5, A10, Citrix)

LBaaS Demo

VPNaaS

- A service to provide IPsec VPN connectivity on a per-router/per-tenant basis
- Manual configuration via CLI or OpenStack Dashboard
- As with any IPsec site-to-site VPN, large deployments with lots of sites/tenants will require a lot of configuration due to mesh-type connectivity
- Cisco provides CSR as a means of deploying VPN

VPN Topology

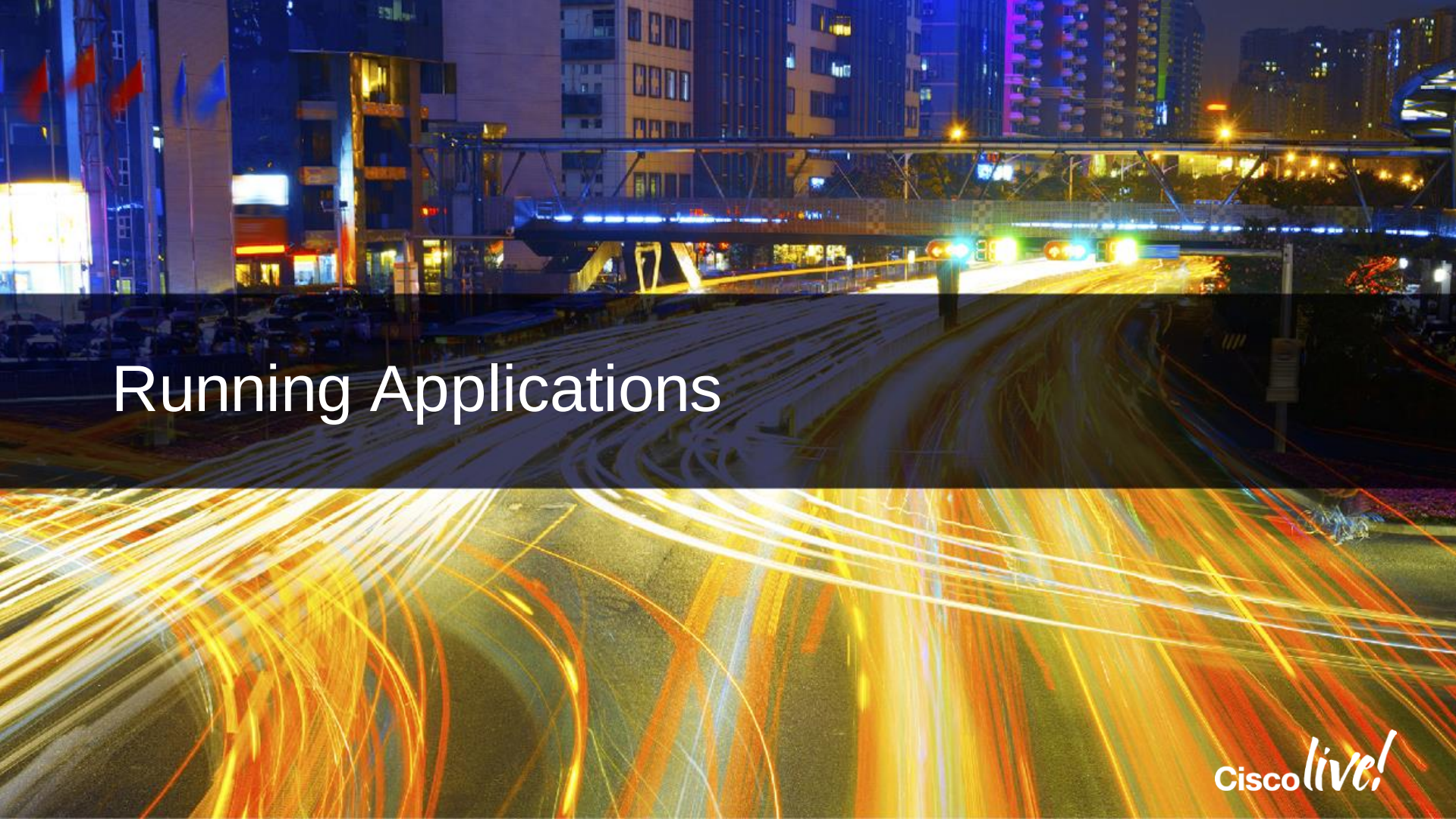



Storage

References for Storage Info

Reference

- OpenStack Storage: https://www.openstack.org/software/openstack-storage/
- Block Storage: http://docs.openstack.org/havana/config-reference/content/ch_configuring-openstack-block-storage.html
- Object Storage:http://docs.openstack.org/havana/config-reference/content/ch_configuring-object-storage.html
- Cinder How-to:http://docwiki.cisco.com/wiki/OpenStack:Havana:Cinder-Volume-Test
- Cinder Deep Dive (Grizzly): https://wiki.openstack.org/wiki/File:Cinder-grizzly-deep-dive-pub.pdf
- CEPH Storage: http://ceph.com/docs/master/rados/
  - http://www.inktank.com/resource/type/presentations/
  - http://www.slideshare.net/Inktank_Ceph/scaling-ceph-at-cern


Running Applications
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Multiple Paths to Managing Images/Apps

Reference

- Docker:
  - http://www.docker.io/
  - https://wiki.openstack.org/wiki/Docker
- VMBuilder:
  - http://docwiki.cisco.com/wiki/OpenStack:VM_Build
  - https://launchpad.net/vmbuilder
  - https://help.ubuntu.com/12.04/serverguide/jeos-and-vmbuilder.html
- Disk Image Builder:
  - https://github.com/stackforge/diskimage-builder
- Heat – Template based orchestration engine :
  - https://wiki.openstack.org/wiki/Heat
  - https://github.com/openstack/heat
- Salt Cloud
  - https://github.com/saltstack/salt-cloud
- Baseline images + automated application deployment (scripts, Puppet, Chef)
- Template images – Prebuilt with apps installed and deployed from Glance

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Cisco Integration

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Product Integration Overview

- Nexus 1000v: http://www.cisco.com/c/en/us/products/switches/nexus-1000v-kvm/index.html
- Nexus 3000 and Higher: http://www.cisco.com/en/US/prod/collateral/switches/ps9441/ps11541/data_sheet_c78-727737.html
- Cisco Nexus + OpenStack Deployment: http://docwiki.cisco.com/wiki/OpenStack:_Havana:_2-Role_Nexus
- Cisco CSR 1000v: http://www.cisco.com/c/en/us/td/docs/routers/csr1000/software/configuration/csr1000Vswcfg/installkvm.html
- Cisco ACI with OpenStack: http://www.cisco.com/c/dam/en/us/solutions/collateral/data-center-virtualization/unified-fabric/solution-brief-c22-729865.pdf
- Cisco APIC driver for OpenStack Neutron ML2: http://www.cisco.com/c/en/us/solutions/collateral/data-center-virtualization/application-centric-infrastructure/guide-c07-732454.html

Support

- Community model is like any other open source community support model
  - http://docs.openstack.org/grizzly/openstack-compute/admin/content/community-support.html
  - http://ask.openstack.org
- Cisco AS - Assessments, plans, design, implement, support & optimise
- Cisco + Partnerships
- Channel Partners – Build a practice now!!

Conclusion

- Next time: Scale, HA, apps, network design impact and some new breakouts (OpenStack storage session)
- OpenStack is for real and maturing at a rapid pace
- Many different players involved and it is evolving rapidly
- Align yourself with market leaders who have strong partnerships
- There is still a lot of focus on getting OpenStack Deployed, but we are progressing rapidly towards true operational issues:
  - Scale
  - Application deployment
  - Upgrades
- Start now!
- Get involved in the community – open source enjoys the major advantage of feature velocity


Q & A
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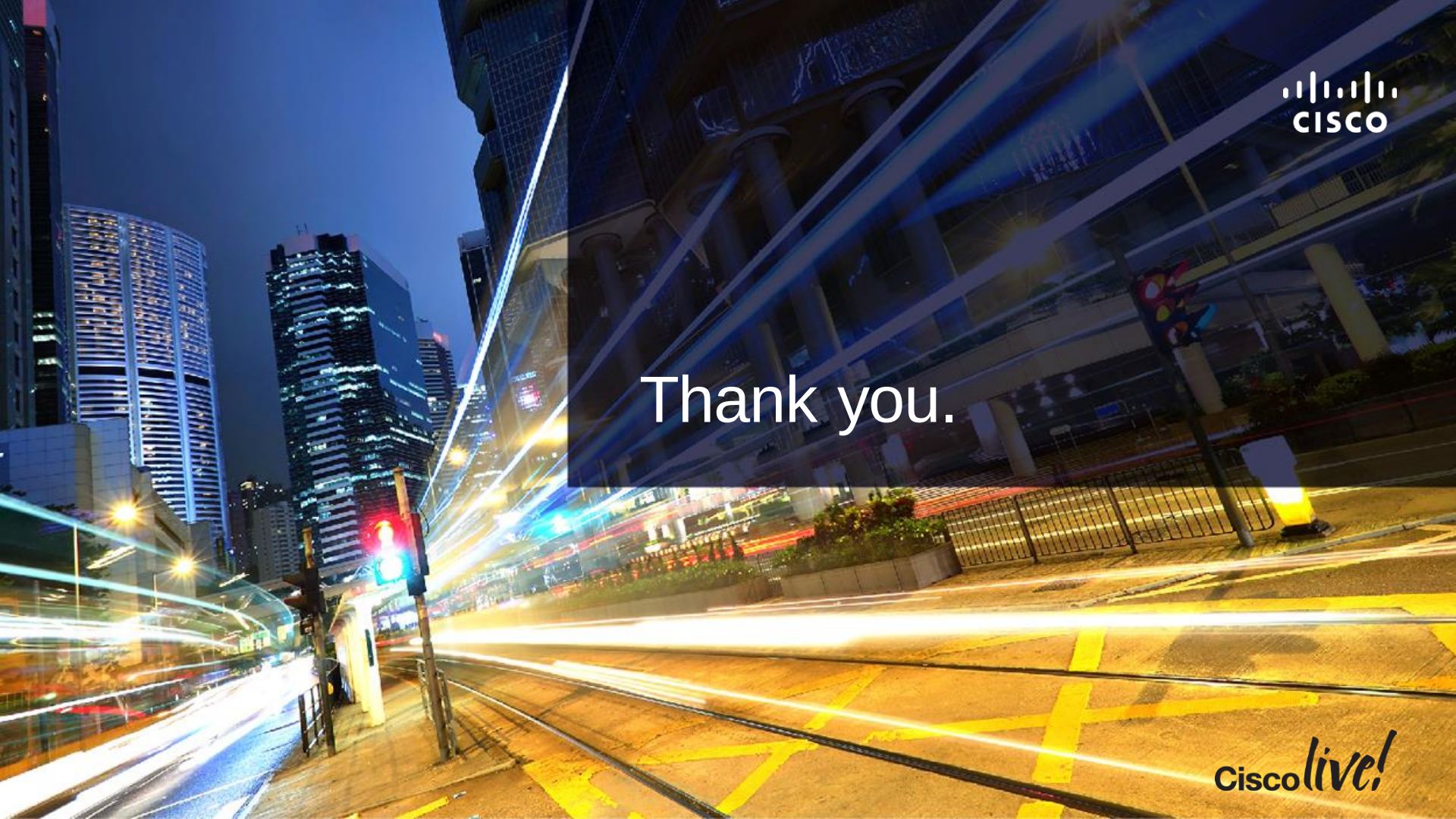
Thank you.
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Reference Slides


Understanding Neutron + OVS for example.com
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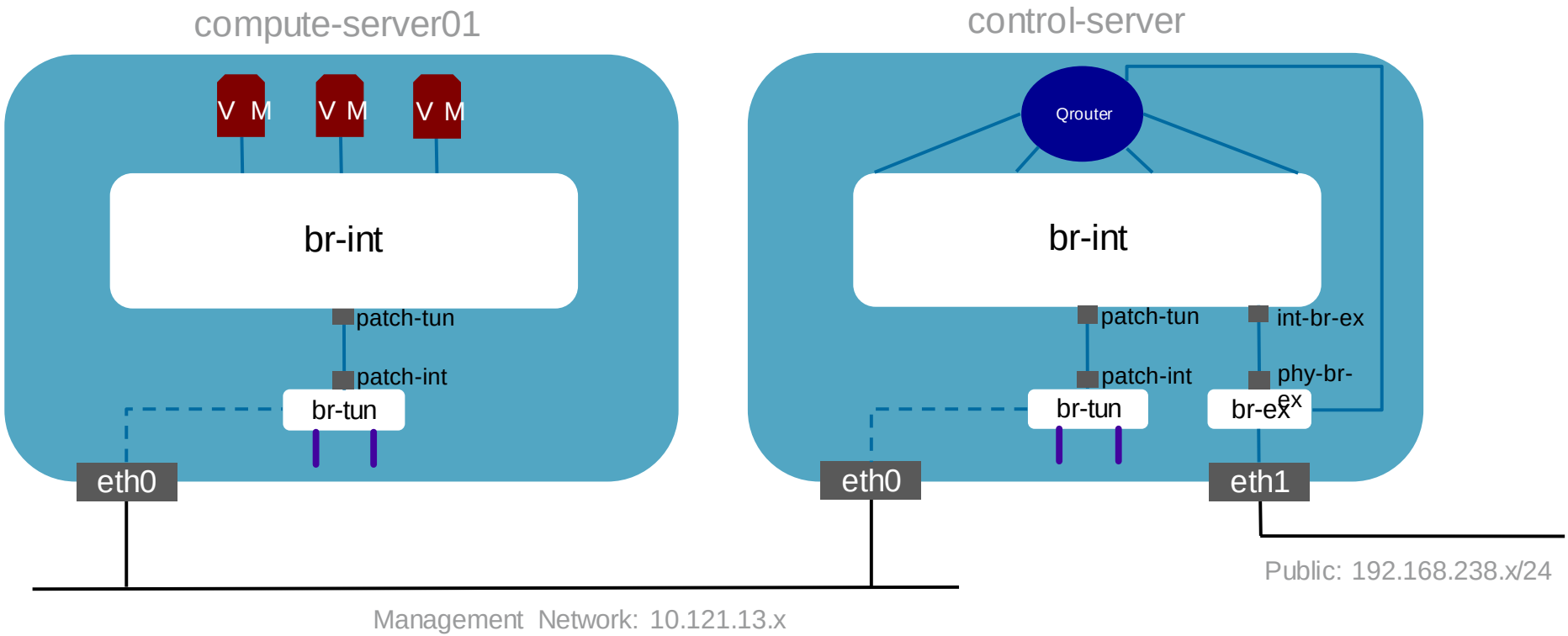
Example – Network Layout

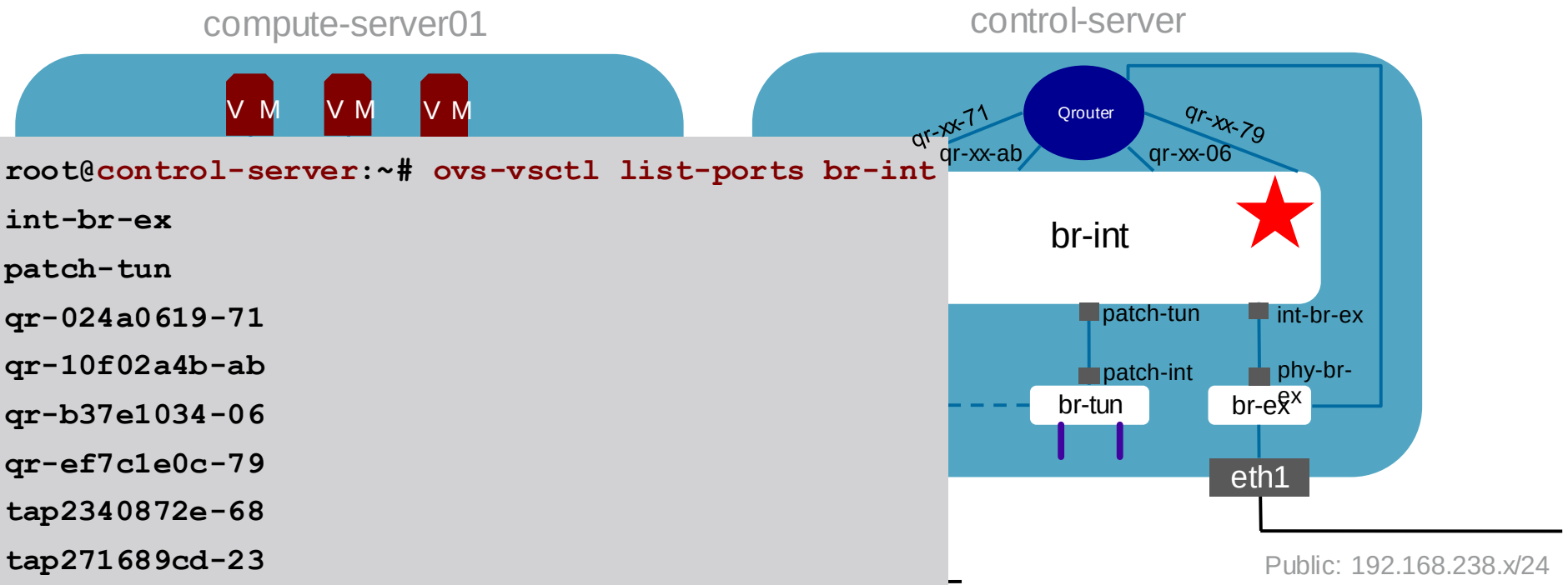
Host View



Example – OVS Bridge/Neutron Router

"br-int" view

```
root@control-server:~# ovs-vsctl list-ports br-int
int-br-ex
patch-tun
qr-024a0619-71
qr-10f02a4b-ab
qr-b37e1034-06
qr-ef7c1e0c-79
tap2340872e-68
tap271689cd-23
tap3fe91abf-c8
tap60a25081-14
tap6d3911a5-44
```



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Example – OVS Bridge/Neutron Router

"br-int" view qr-xx & tapxx

compute-server01

control-server

```
root@control-server:~# ovs-vsctl list-ports br-int
int-br-ex
patch-tun
qr-024a0619-71
qr-10f02a4b-ab
qr-b37e1034-06
qr-ef7c1e0c-79
tap2340872e-68
tap271689cd-23
tap3fe91abf-c8
tap60a25081-14
tap6d3911a5-44
```

bridge-to-router
1 for each tenant

A tap interface for each network used for DHCP service:

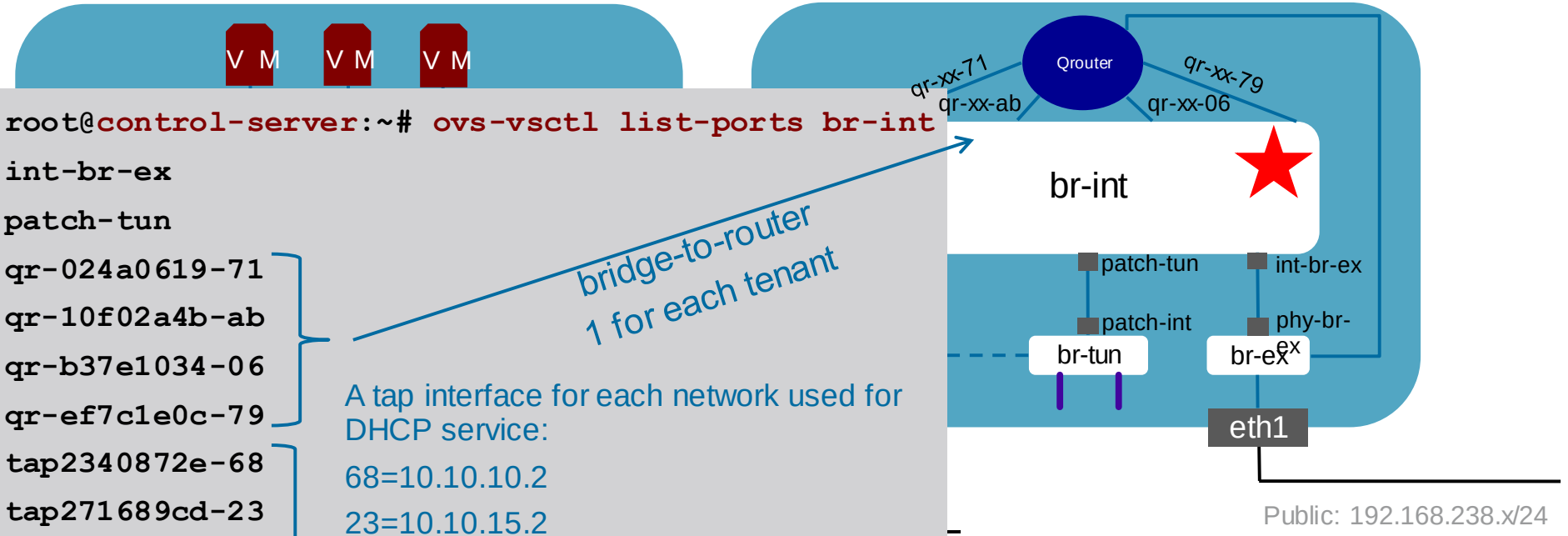
68=10.10.10.2

23=10.10.15.2

c8=192.168.238.5

14=10.10.20.2

44=10.10.25.2



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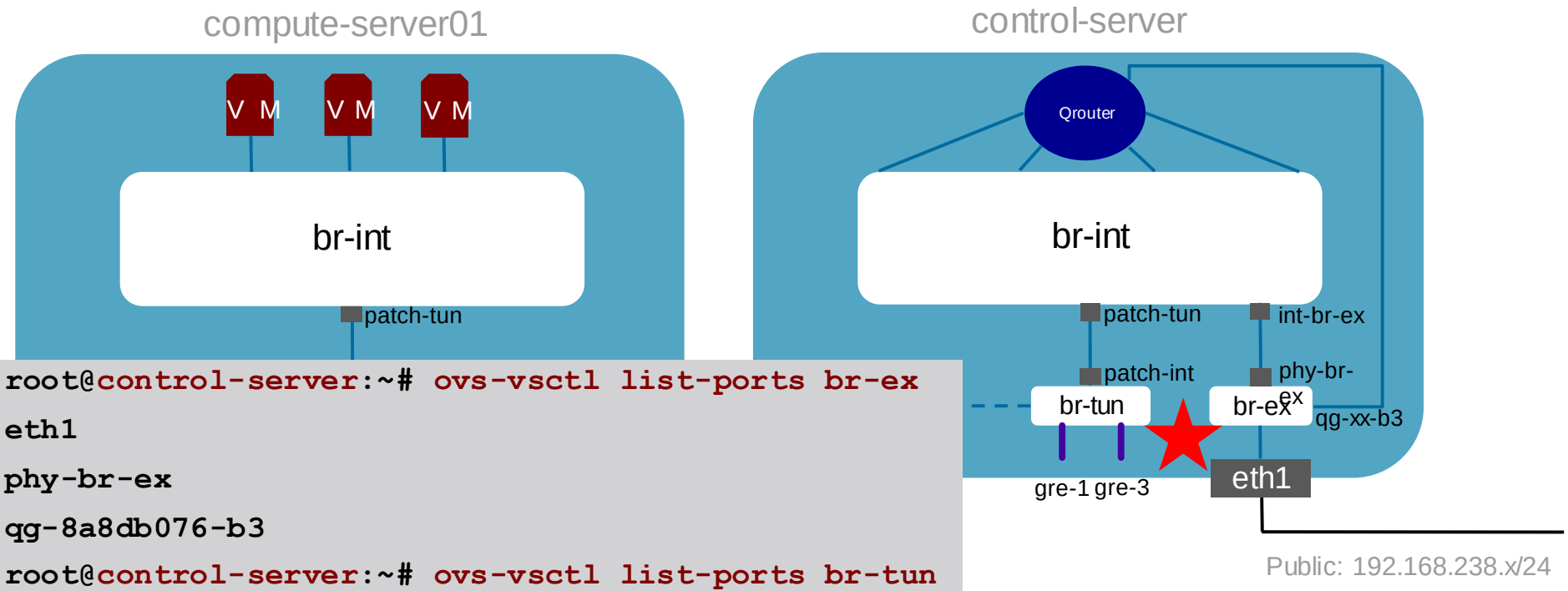
Example – OVS Bridge/Neutron Router

"br-ex" & br-tun view




```
root@control-server:~# ovs-vsctl list-ports br-ex
eth1
phy-br-ex
qg-8a8db076-b3
root@control-server:~# ovs-vsctl list-ports br-tun
gre-1
gre-3
patch-int
```

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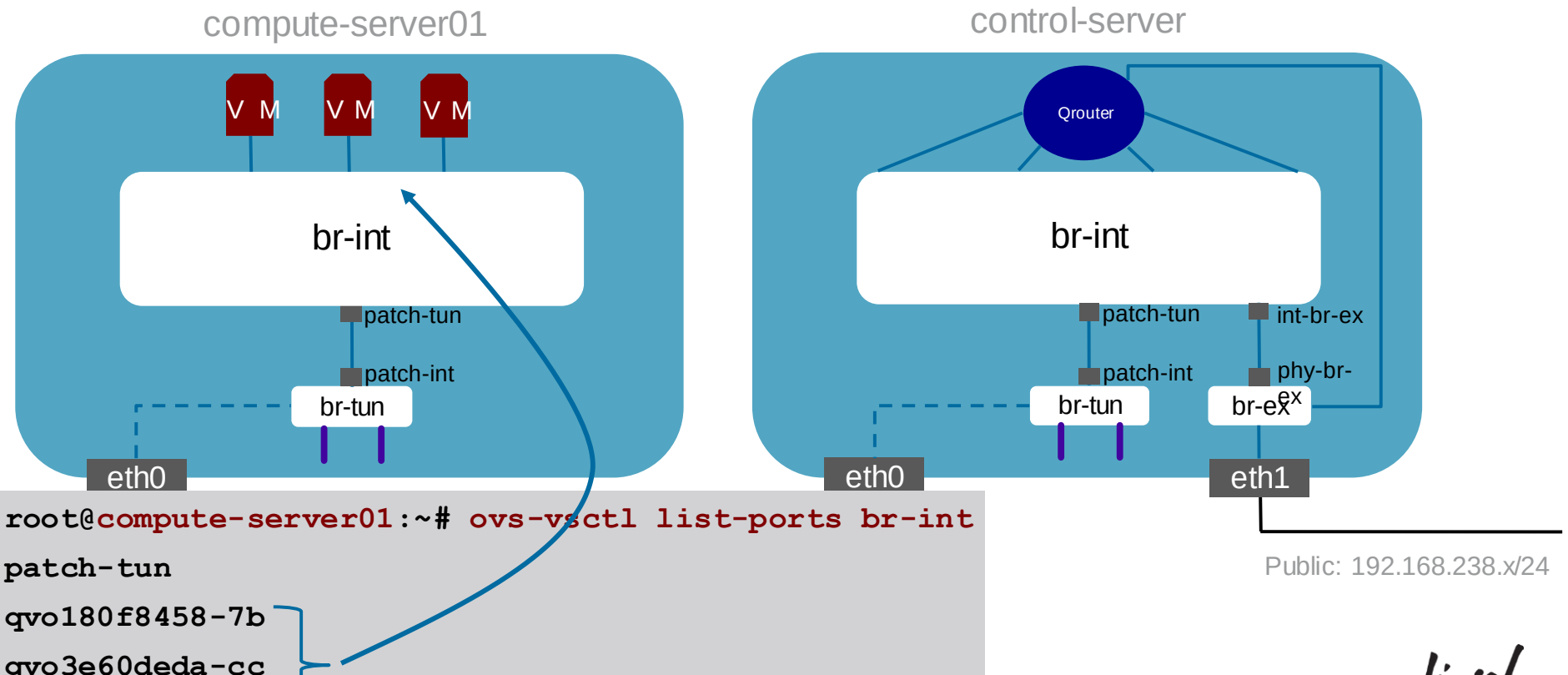
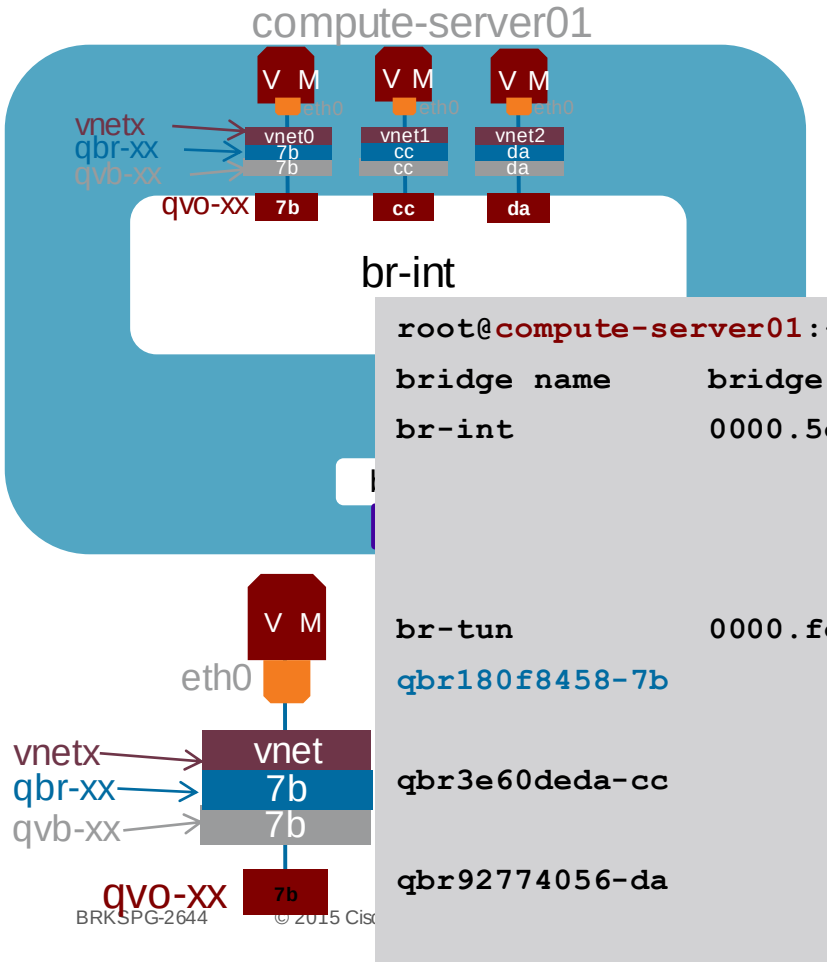
Example – OVS Bridge/Neutron Router

compute-server01 “br-int” view




```
root@compute-server01:~# ovs-vsctl list-ports br-int
patch-tun
qvo180f8458-7b
qvo3e60deda-cc
qvo92774056-da
```

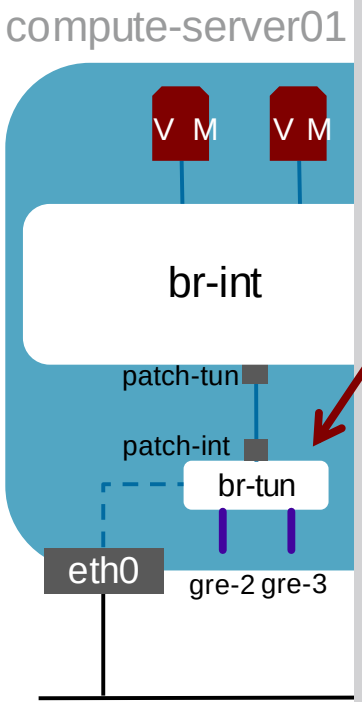
Example – OVS Bridge/Neutron Router



*Thanks to Etsuji Nakai for the original detailed overview of OVS/Neutron ports : http://www.slideshare.net/enakai/how-quantum-configures-virtual-networks-under-the-hood

```
root@compute-server01:~# brctl show
bridge name     bridge id               STP enabled     interfaces
br-int          0000.5e15d719a548       no              int-br-ex
                                                        qvo180f8458-7b
                                                        qvo3e60deda-cc
                                                        qvo92774056-da
br-tun          0000.febc48d02540       no
qbr180f8458-7b          8000.1a425eeda354       no              qvb180f8458-7b
                                                                vnet0
qbr3e60deda-cc          8000.8a70b498c8ce       no              qvb3e60deda-cc
                                                                vnet2
qbr92774056-da          8000.3e21bdf7dd5b       no              qvb92774056-da
                                                                vnet1
```

Example – OVS Bridge/Neutron Router



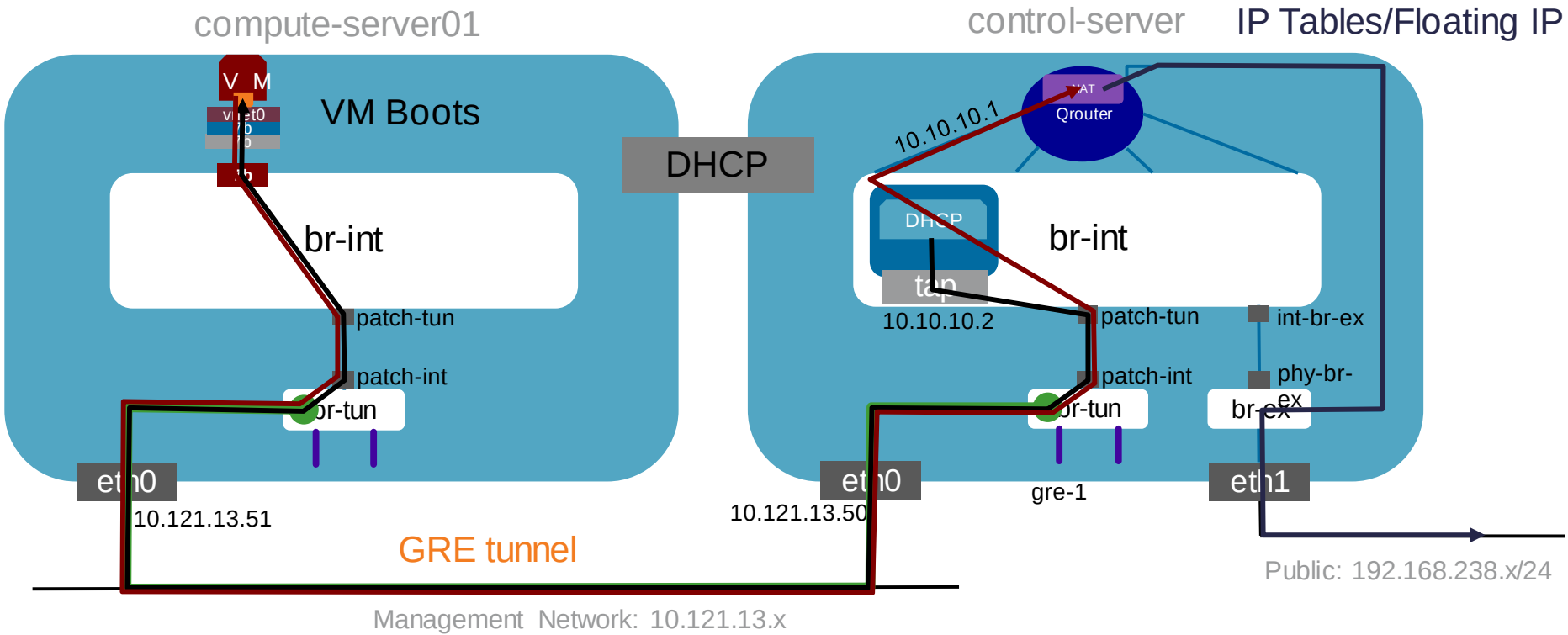

```
root@compute-server01:~# ovs-vsctl show
ac44a899-5f10-4ff9-8dad-902fa7c10e5e
...
Bridge br-tun
        Port "gre-2"
            Interface "gre-2"
                type: gre
                options: {in_key=flow, out_key=flow, remote_ip="10.121.13.50"}
        Port patch-int
            Interface patch-int
                type: patch
                options: {peer=patch-tun}
        Port "gre-3"
            Interface "gre-3"
                type: gre
                options: {in_key=flow, out_key=flow, remote_ip="10.121.13.52"}
        Port br-tun
            Interface br-tun
                type: internal
```

control-server

compute-server02

Example – Basic VM Traffic Flow

High-Level Walk-Thru




Monitoring

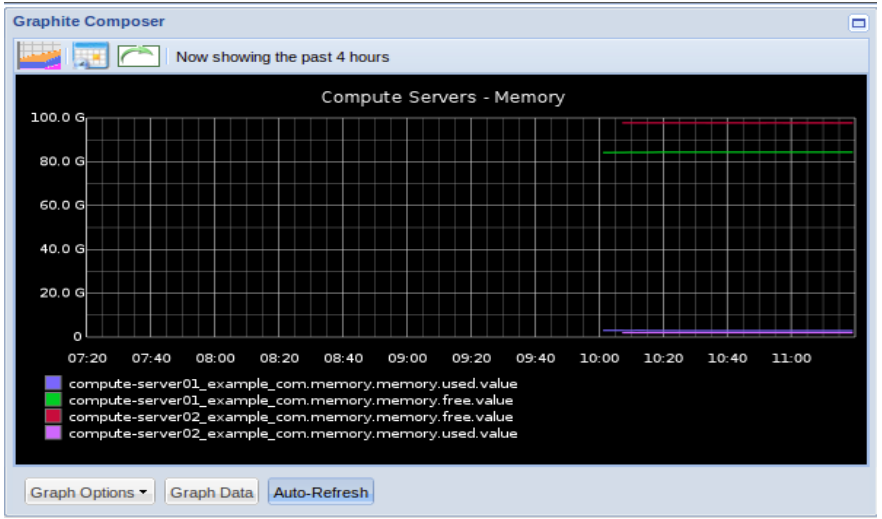
Basic Monitoring is Available

Nagios/Graphite/Collectd

- http://<build-server>/nagios3 - Health monitoring of OpenStack nodes

Host	Status	Last Check	Duration	Status Information
compute-server01	UP	2013-03-19 12:03:47	4d 1h 29m 7s	PING OK - Packet loss = 0%, RTA = 0.27 ms
compute-server02	UP	2013-03-19 12:04:57	4d 1h 28m 57s	PING OK - Packet loss = 0%, RTA = 0.31 ms
control-server	UP	2013-03-19 12:05:47	0d 1h 9m 8s	PING OK - Packet loss = 0%, RTA = 0.30 ms

- http://<build-server>:8190 – Main Graphite performance console
- http://<build-server>:8190/dashboard/ - User/Self-service performance console
- http://www.nagios.org/
- http://graphite.wikidot.com/
- http://collectd.org/

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