



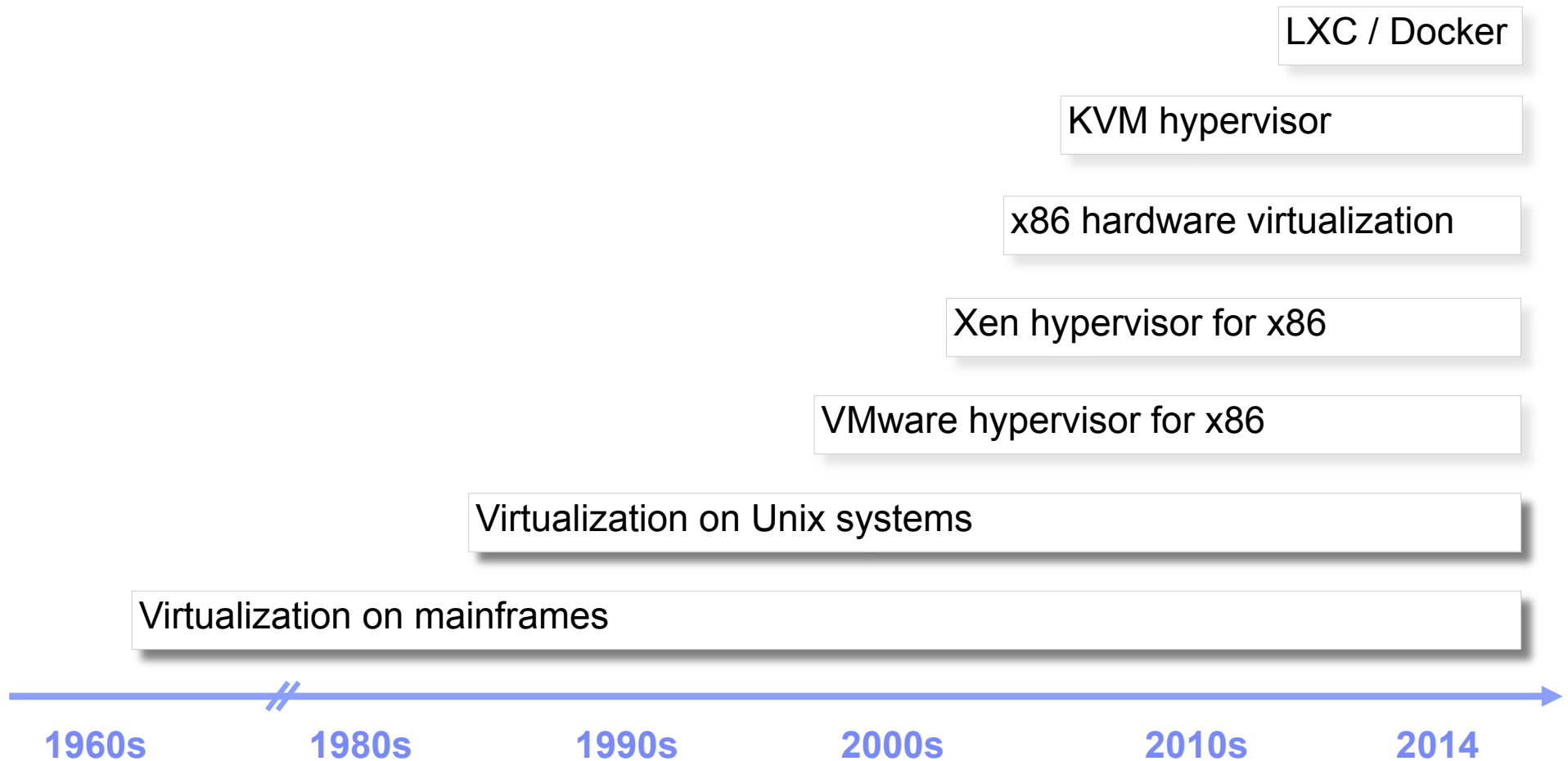
KVM, OpenStack, and the Open Cloud

Adam Jollans, IBM & Mike Kadera, Intel
CloudOpen Europe - October 13, 2014

Agenda

- A Brief History of Virtualization
- KVM Architecture
- Building Open Clouds
- OpenStack Architecture
- KVM and OpenStack
- Case Study of OpenStack & KVM Cloud – Intel IT
- Futures
- Additional Sessions and Resources

A Brief History of Virtualization

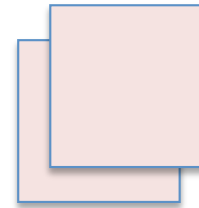


Conceptual Framework

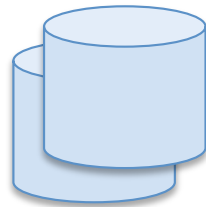
User Interface



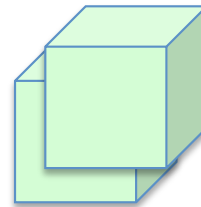
Applications



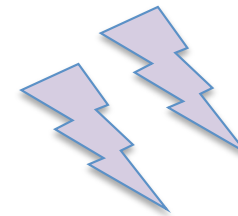
Management Tools



Storage

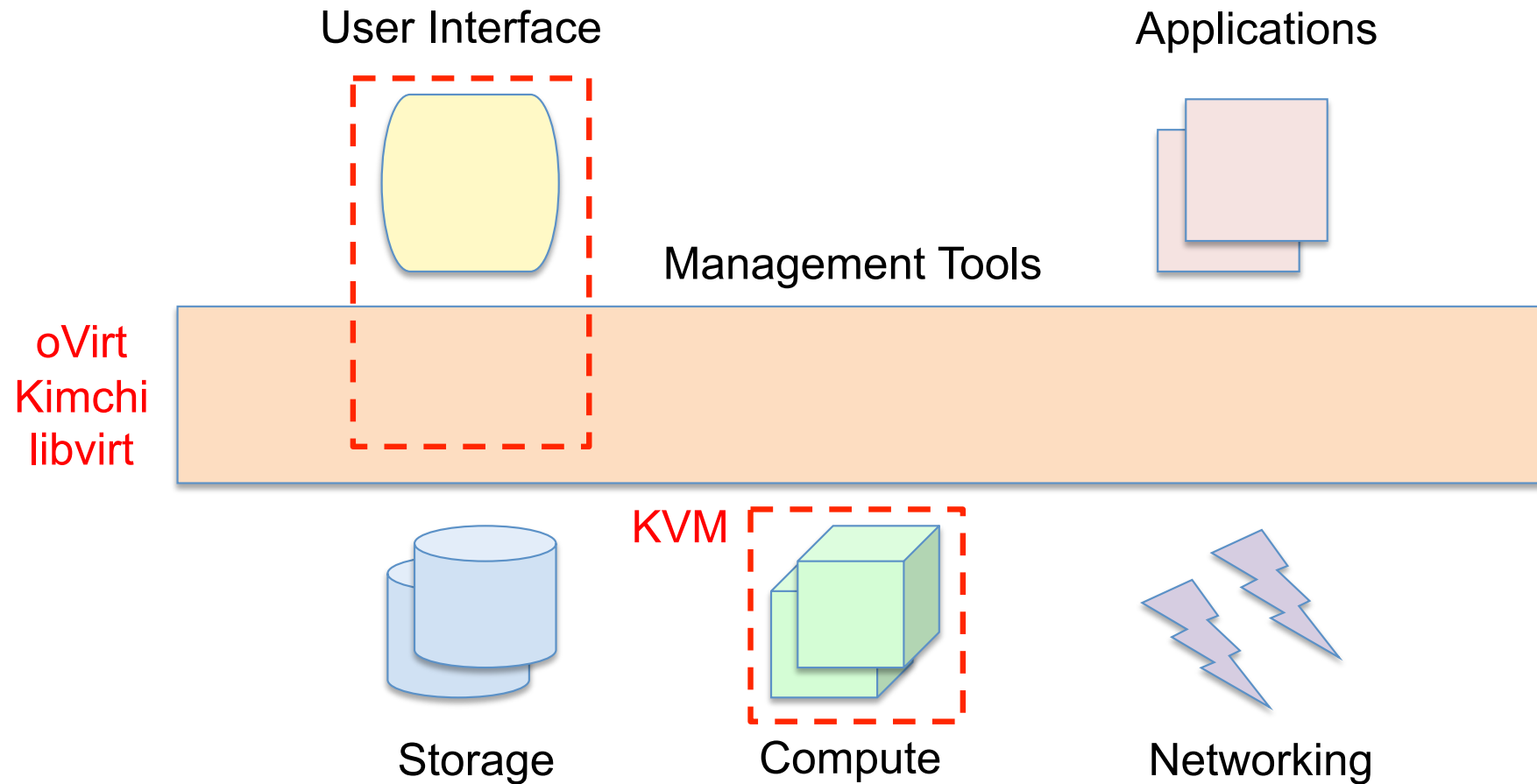


Compute

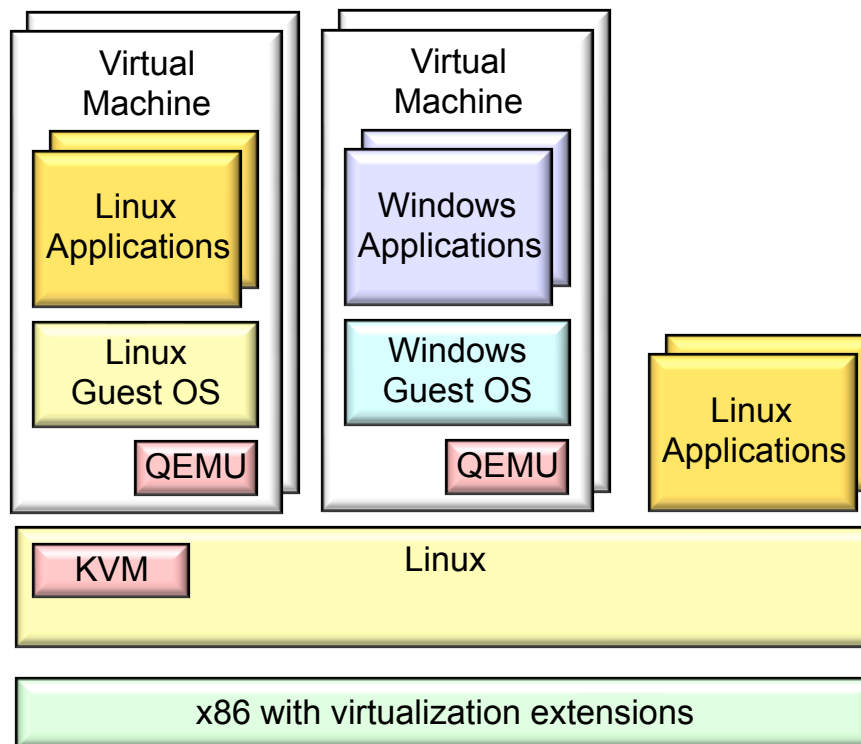


Networking

Introduction to KVM



KVM Architecture



Open source hypervisor based on Linux

KVM

- Kernel module that turns Linux into a Virtual Machine Monitor
- Merged into the Linux kernel

QEMU

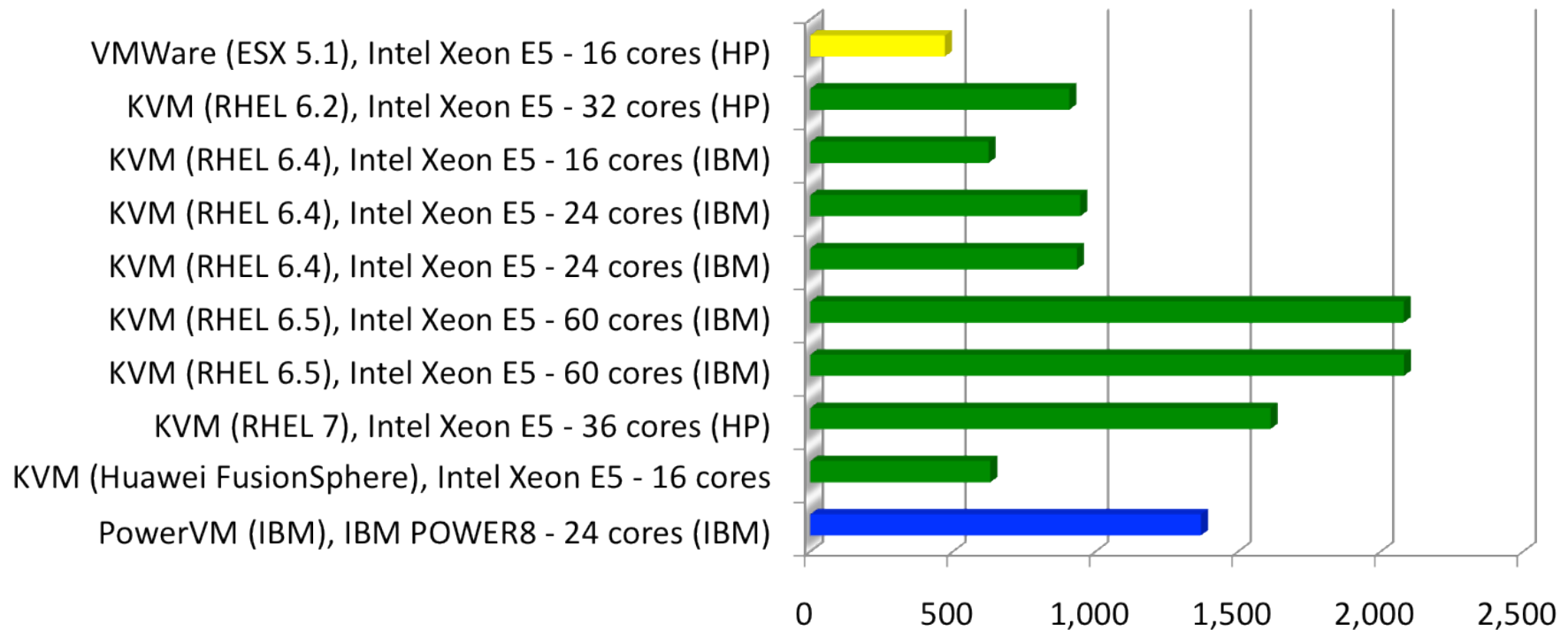
- Emulator used for I/O device virtualization

x86 virtualization extensions

- Intel VT-x
- AMD (AMD-V)

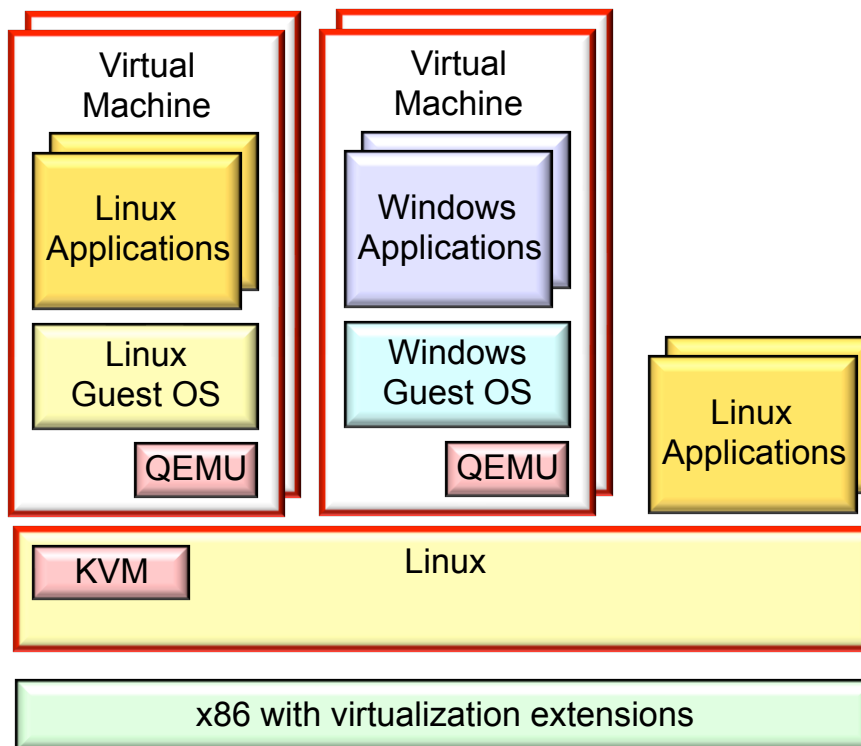
KVM Performance

SPECvirt_sc2013



Source: SPECvirt_2013 Published Results - http://www.spec.org/virt_sc2013/results/specvirt_sc2013_perf.html

KVM Security



SELinux

- Mandatory Access Control (MAC) integrated into Linux
- Provides “need to know” security between processes

sVirt

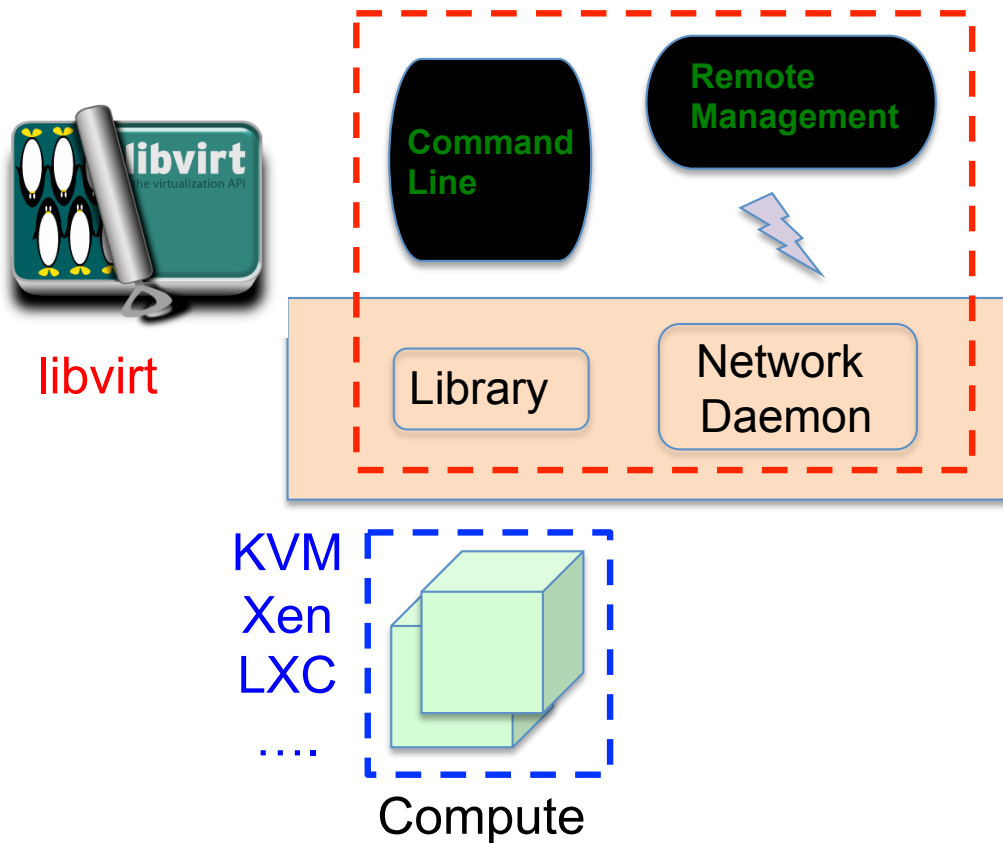
- Combines SELinux and KVM
- Delivers “need to know” security between virtual machines

Certifications

- EAL4+ certification for KVM in RHEL 6 and SLES 11 SP 2 on various x86 64-bit Intel and AMD64-based hardware from Dell, HP, IBM and SGI

KVM Management - libvirt

User Interface



Library

- Open Source project
- Manages multiple hypervisors

Command Line

- Powerful
- Complex to use

Network Daemon

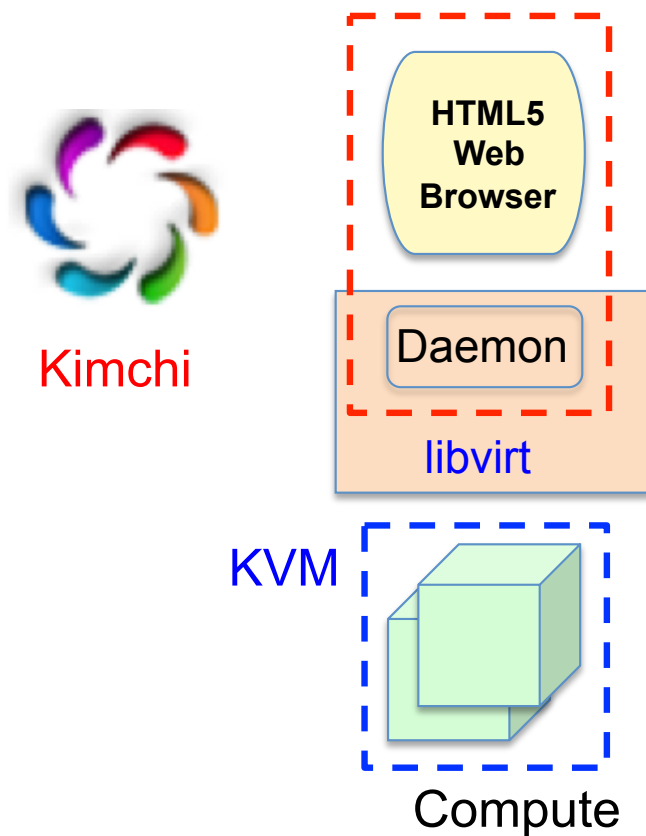
- Enables remote management

Base for other management tools

- virt-manager, Kimchi, oVirt
- OpenStack

KVM Management - Kimchi

User Interface



Kimchi

- Open Source project
- Manages KVM on x86, Power

User Interface

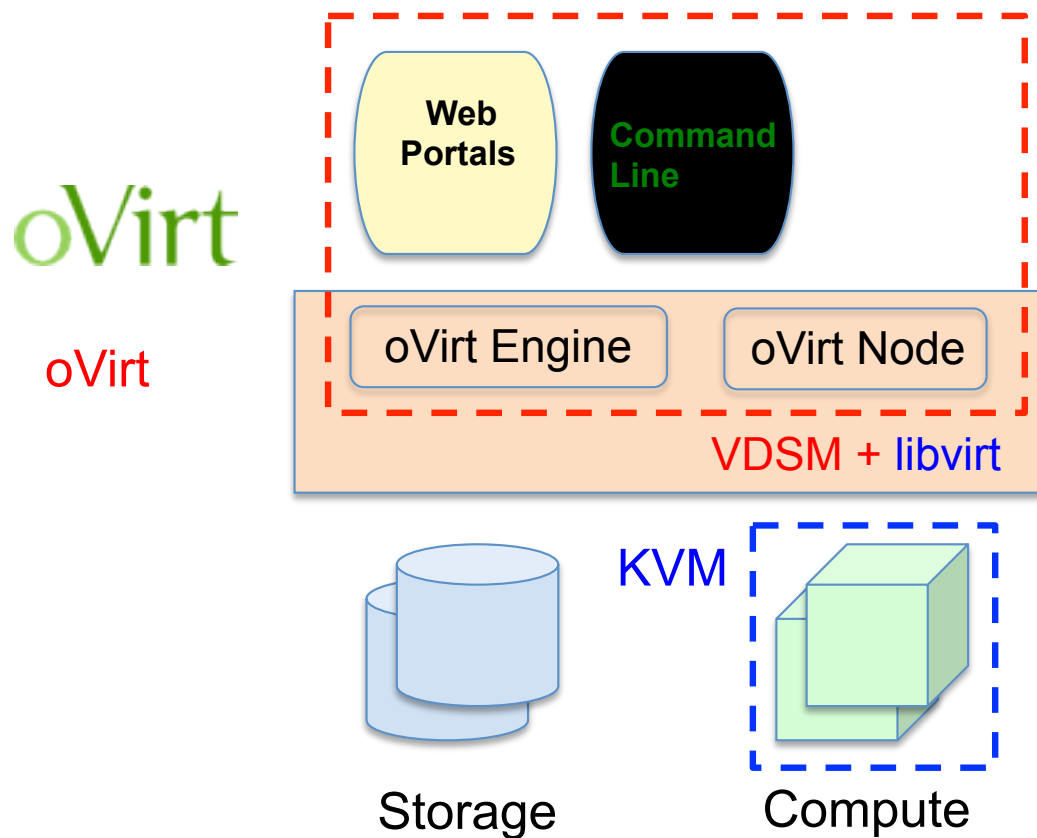
- Easy to use
- Access from HTML5 web browser

Servers managed

- Single digits

KVM Management - oVirt

User Interface



oVirt

- Open Source project
- Manages KVM on x86

User Interface

- Web portals
- Command line, API

oVirt Engine

- Manages VMs
- Configures storage, network

oVirt Nodes

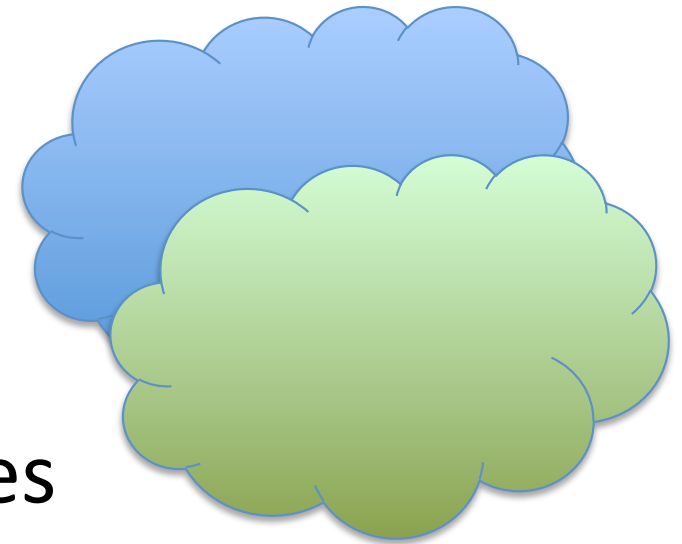
- Run virtual machines

Servers managed

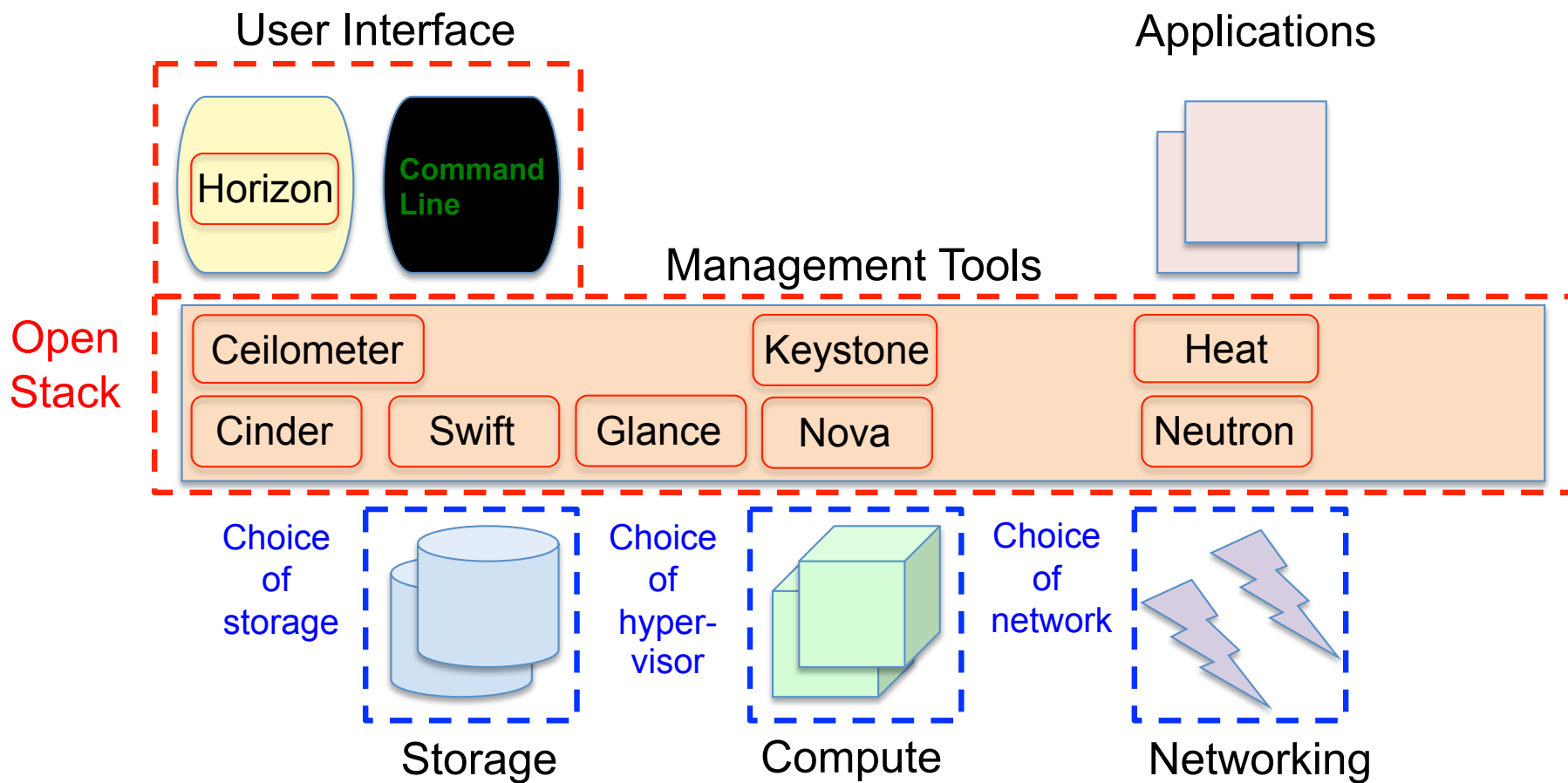
- Tens to hundreds

Building Open Clouds

- Security
- Resilience
- Performance
- Scalability – thousands of nodes
- Heterogeneity
- Interoperability

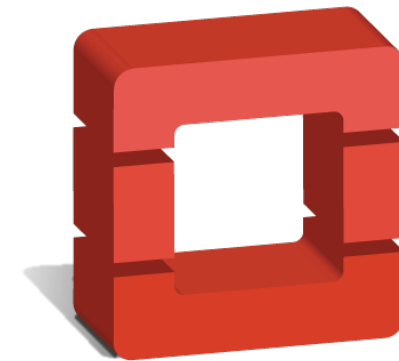


Introduction to OpenStack



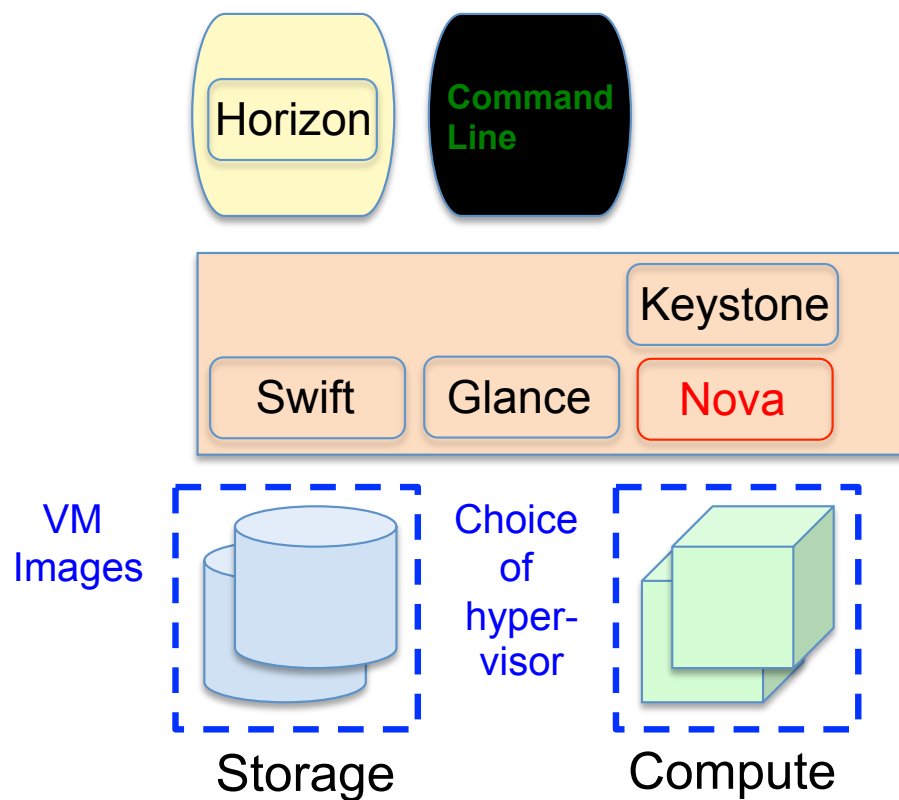
OpenStack Design Principles

- Open
 - Open Development Model
 - Open Design Process
 - Open Community
- General Purpose
 - Balancing Compute, Storage, Network
- Massively Scalable
- Multi-site
- Resilient and recoverable



openstack™
CLOUD SOFTWARE

Nova – Compute Service



Manages VM lifecycle

- Starting and stopping VMs
- Scheduling and monitoring VMs

Key Components

- API
- Database
- Scheduler
- Compute node and plug-ins

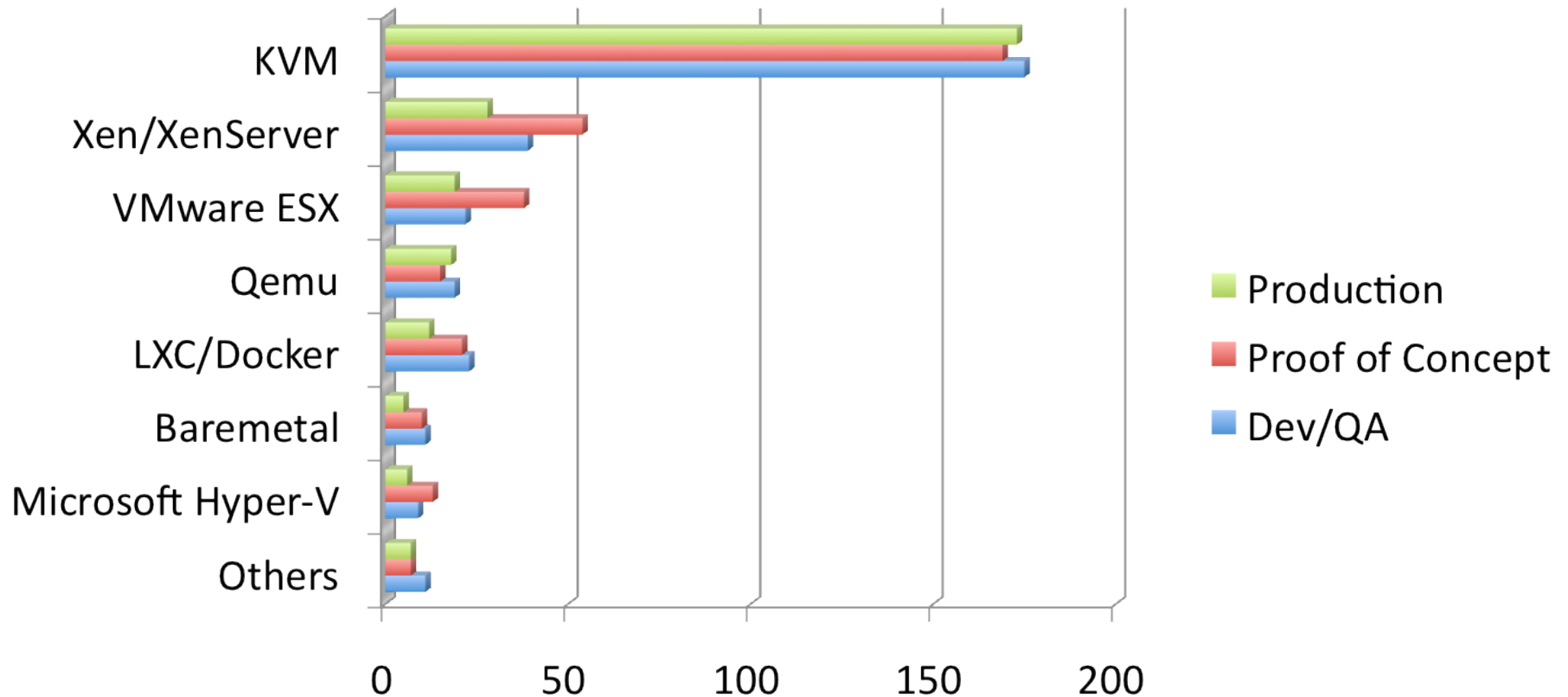
Authentication

- Keystone

Access to VM images

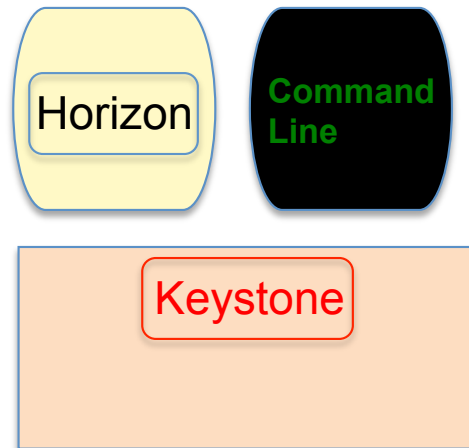
- Glance
- Swift

OpenStack and Hypervisor Usage



Source: OpenStack User Survey May2014 - <http://www.slideshare.net/ryan-lane/openstack-atlanta-user-survey>

Keystone – Authentication Service



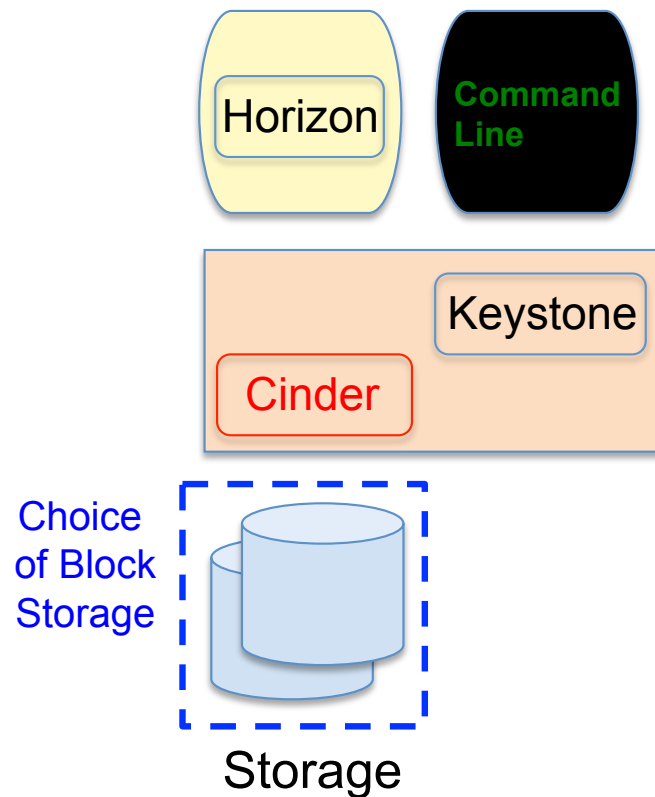
Manages security

- Service for all other modules
- Authentication
- Authorization

Key components

- API
- Backends
 - Token
 - Catalog
 - Policy
 - Identity

Cinder – Block Storage Service



Manages persistent block storage

- Provides volumes to running instances
- Pluggable driver architecture
- High Availability

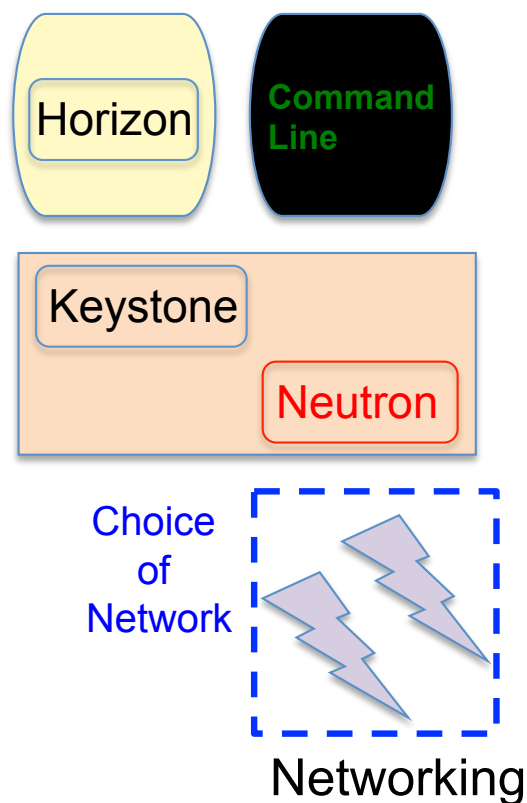
Key components

- API
- Queue
- Database
- Scheduler
- Storage plug-ins

Authentication

- Keystone

Neutron – Networking Service



Manages networking connectivity

- Provides volumes to running instances
- Pluggable driver architecture
- Support for range of networking technologies

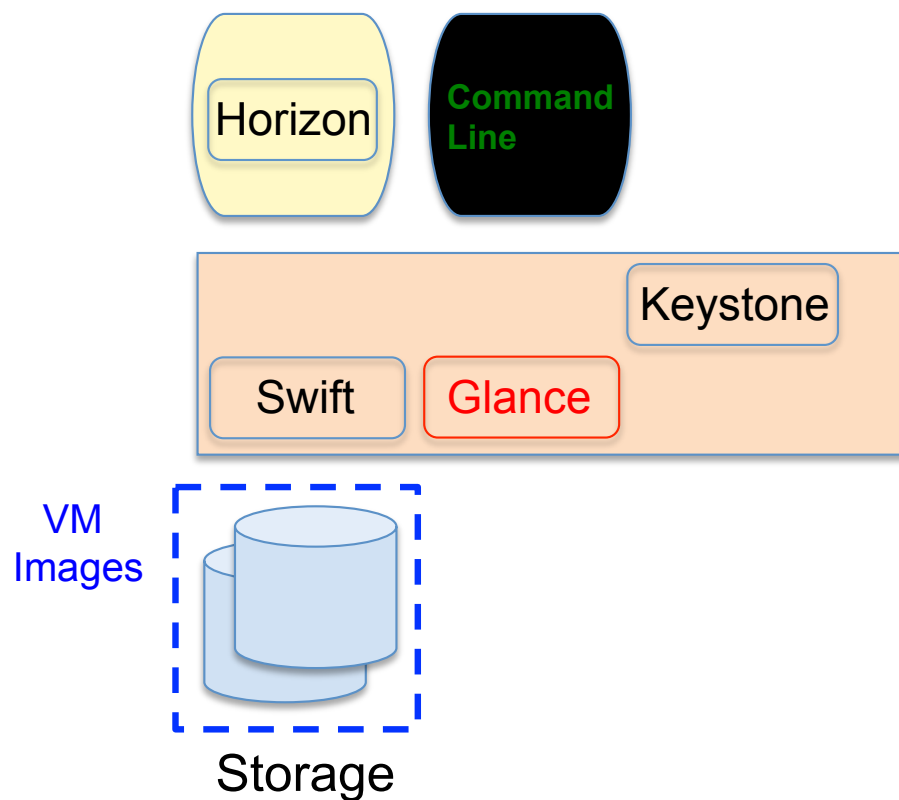
Key components

- API
- Queue
- Database
- Scheduler
- Agent
- Networking plug-ins

Authentication

- Keystone

Glance – Image Service



Manages VM images

- Catalog of images
- Search and registration
- Fetch and delivery

Key components

- API
- Registry
- Database

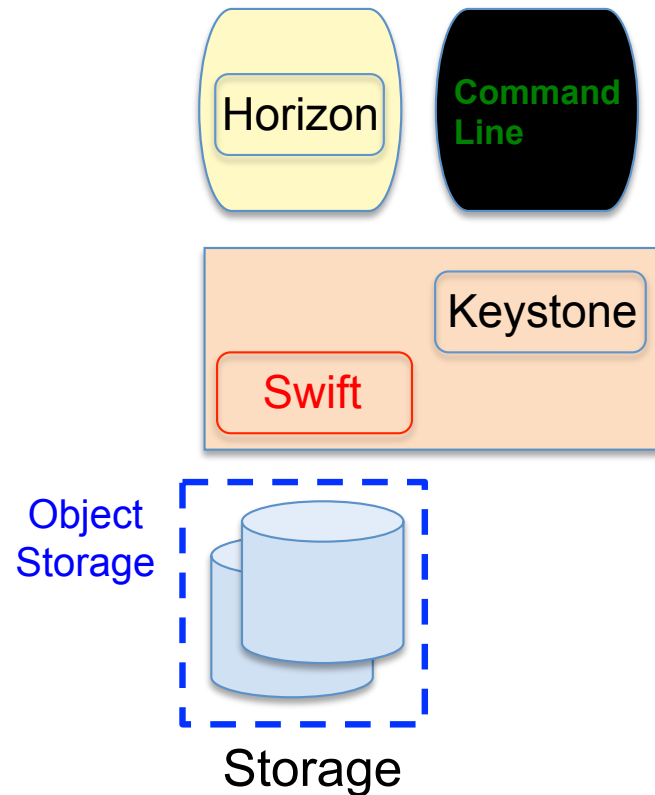
Authentication

- Keystone

Storage of VM images

- Swift
- Local file system

Swift – Object Storage Service



Manages unstructured object storage

- Highly scalable
- Durable – three times replication
- Distributed

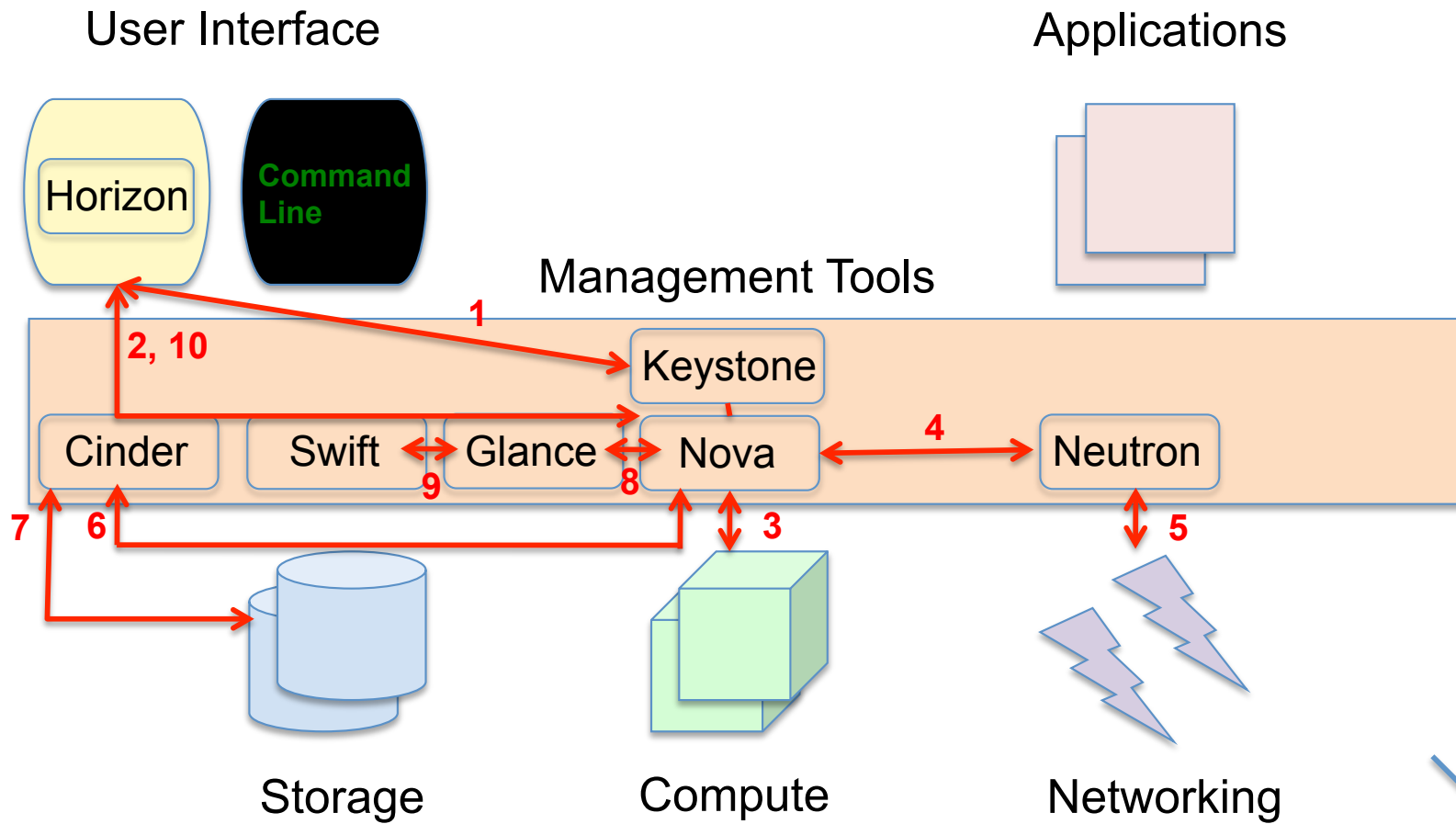
Key components

- Proxy / API
- Rings
 - Accounts
 - Containers
 - Objects
- Data stores

Authentication

- Keystone

Provisioning a VM



KVM and OpenStack

- KVM excels at choice criteria for Hypervisor
 - Cost
 - Scale & Performance
 - Security
 - Interoperability
- Development Affinity
 - Both open source projects
 - KVM is default hypervisor for OpenStack development
- Deployment Affinity
 - KVM is best supported, easiest to deploy, with most full-featured driver



Intel IT's Cloud Goals



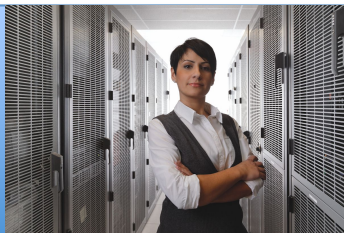
80% Effective
Utilization
Efficiency through Federation

- Pervasive Virtualization (75%)
 - Enterprise App Virtualization
 - Secure Virtualization
- Larger Pools in Fewer Data Centers



Velocity Increase
Agility through Automation & Self
Service

- On-Demand Self Service the Norm
- Provision VMs within minutes
- Innovative Idea to Production <day
- External Cloud for Burst Demand



Zero Business Impact

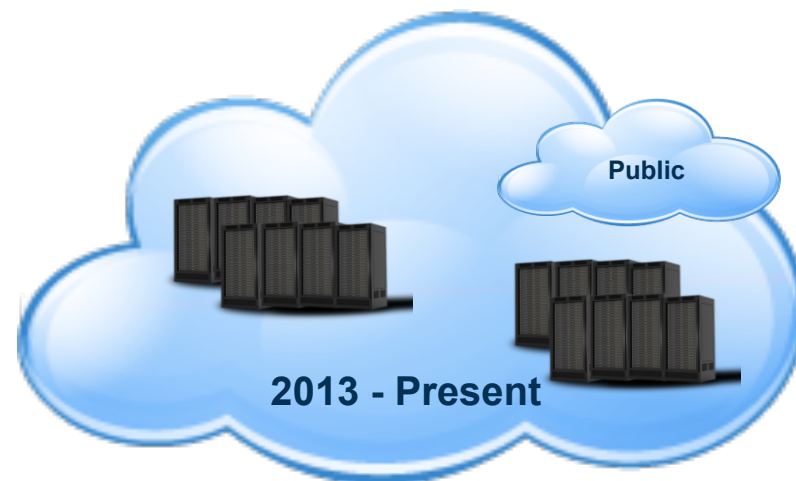
- Reduce MTTR
- App Design for Failure
- Increase Availability

Intel IT & OpenStack/KVM

Deployment History



- OpenStack Essex
- ~1000 virtual instances for external services
- qemu-system-x86_64 1.0



- OpenStack Grizzly
- ~3500 instances for multiple services (~40:1, ~100 vCPU)
- qemu-system-x86_64 1.4.2

Intel IT & OpenStack/KVM

KVM Benefits

Performance

- 2012 Study on 'standard' cloud workloads (database)
 - Par or better vs. marketplace
- HV realm is seemingly near-stable on straight performance

Stability

- Open Source, tight OpenStack and Linux kernel integration
- Hypervisor efficiency
- Drinking our own champagne - we've got a few KVM devs :-)

KVM Lessons Learned

Performance

- Check flags – lots of features/options
- Windows guest updates
- Keep your images current

Stability

- Oversubscribing & big multi-vCPU instances
- Windows guest can be sensitive IO interruptions

Intel & OpenStack/KVM

Future Direction

IT

- It's not just the hypervisor... it's how they are managed within the stack
- OpenStack enabled [Single Control Plane](#) to simplify hosting multiple environments

Intel in the community

- Expose optimized hardware features to KVM and OpenStack schedulers
- EG: Cache QoS monitoring, chipset features (AVX2, Intel® AES-NI, etc.), VMCS Shadowing, APIC virtualization

See how you can accelerate your applications with features like Intel® AVX in your OpenStack VMs at our booth (#19 - #21)

KVM Futures

- Heterogeneous processor support
 - ARM
 - POWER
 - System z
 - GPUs
- Network Function Virtualization
- Additional Performance Improvements
 - Minimizing locks
 - Multi-threaded device model
- Nested Virtualization



OpenStack Futures – Juno

- Keystone
 - LDAP Integration
- Heat
 - Templates
- Nova
 - Network Function Virtualization
- Glance
 - Additional artifacts beyond just images
- Marconi
 - Messaging and Queuing System



Additional Resources

- LinuxCon Europe
 - “Linux: Where are we Going”
 - Weds 15Oct14, 9:40am
 - “What’s Coming up in OpenStack Juno”
 - Weds 15Oct14, 4:30pm
- KVM Forum
 - Tues-Thurs 14-16Oct14
- OpenStack Summit, Paris
 - Mon-Fri 3-7Nov14
- Open Virtualization Alliance
 - <https://openvirtualizationalliance.org>
- Forthcoming IDC White Paper
 - “KVM – Open Source Virtualization for the Enterprise and OpenStack Clouds”
- New Linux Foundation Training Course
 - LFS540 – “Linux KVM Virtualization”

