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OpenStack: Linux in Cloud Management Software

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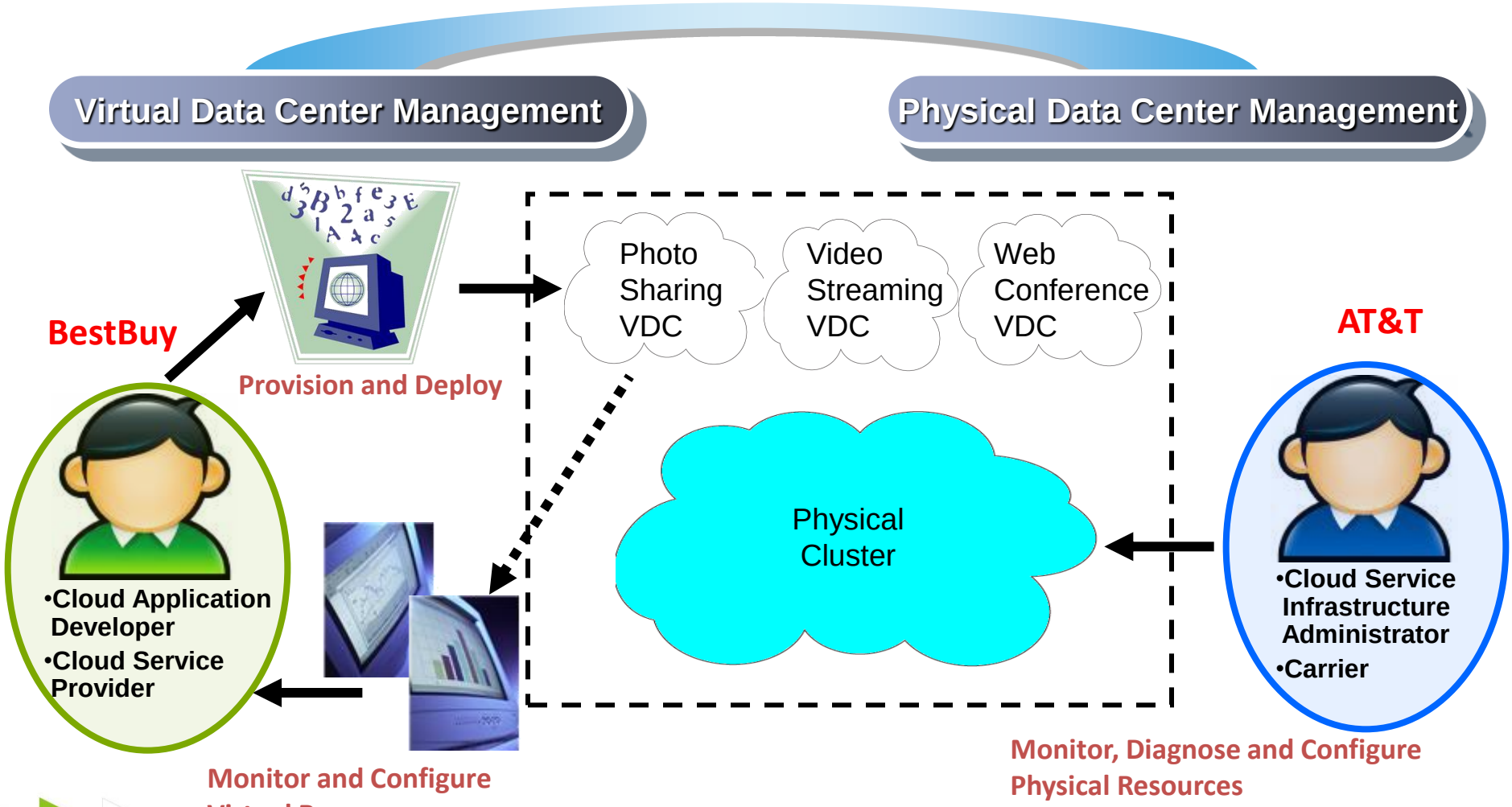
OpenStack Introduction

- An open ecosystem for developing a complete open-source cloud software stack for IaaS
- Target: AWS-EC2 like IaaS
- Consists of (a) an open-source OpenStack core, and (b) a set of APIs that interfaces the core with third-party plugins
- Commercial significance:
  - Provides a platform that enables open competition for third-party component solutions
  - Gives cloud service providers the ability to avoid lock-ins

Data Center Virtualization



IaaS Service Model

- Multiple virtual data centers or tenants on a single physical data center
- Virtual Data Center specification
  - No. of VM instances each with CPU performance and memory size requirement
  - Per-VM storage space requirement
  - External network bandwidth requirement
  - Security policy
  - Backup policy
  - Traffic shaping policy
  - Load balancing and auto-scaling policy
  - Network configuration: public IP address and private IP address range
  - OS image and application image

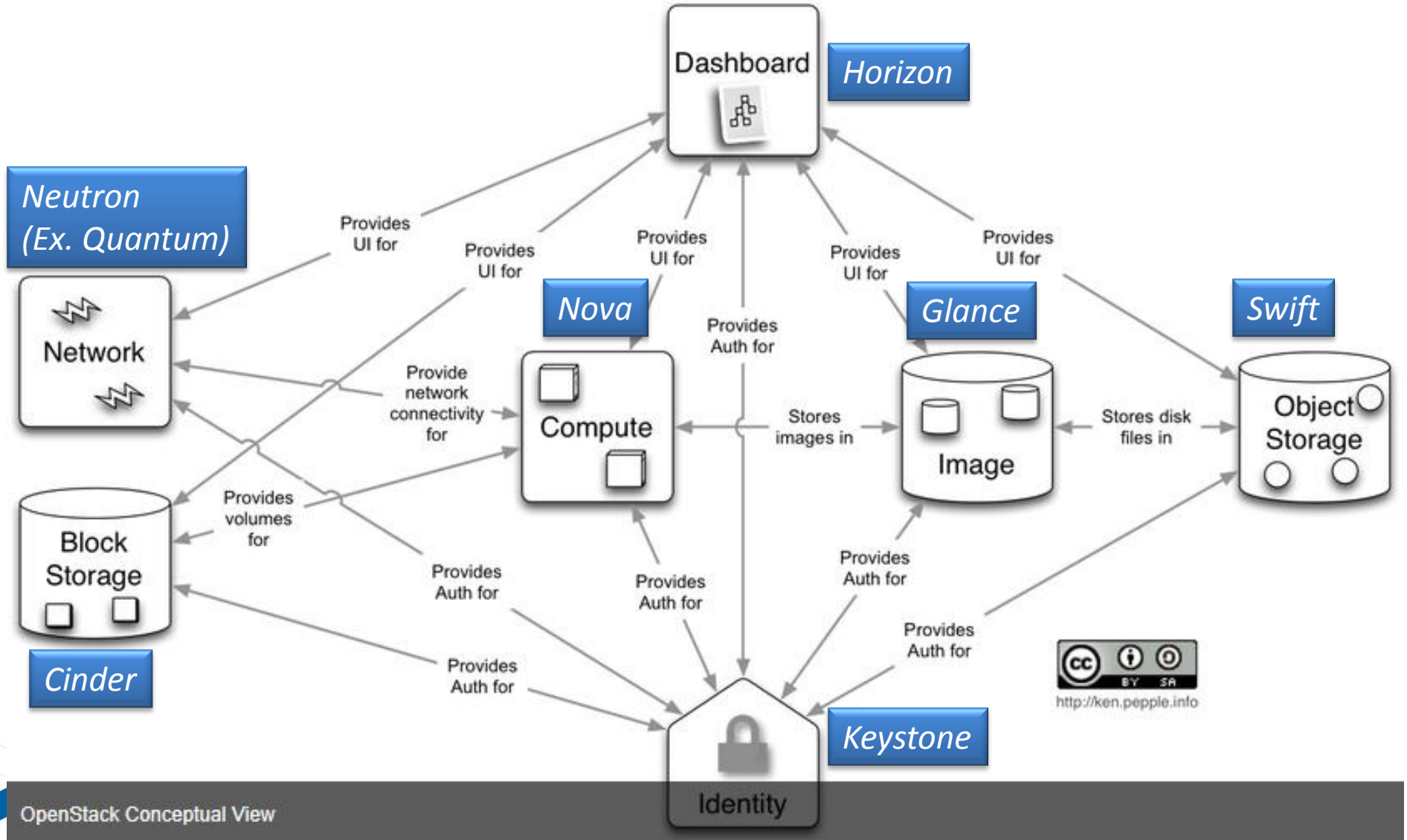
OpenStack Technologies

- Server virtualization: Nova
- Storage virtualization: Cinder
- Network virtualization: Quantum
- Management virtualization: Horizon and Ceilometer
- Security: Keystone
- Support: Glance, Swift and Heat

Network Virtualization

- Multiple virtual networks run on a single physical network
- Each VDC has its own virtual network
  - VMs in a VDC could be organized into one or multiple IP subnets
  - A full private IP address price (i.e. 10.x.x.x)
  - A set of public IP addresses as service entry points
  - L3-VPN connects VDCs that share the same IP address space
  - Per-VC firewall, server load balancing and traffic shaping policy
  - Inter-VDC connections through public IP addresses but local routers
- Support for private IP address reuse: a private IP address such as 10.1.2.5 could be used in multiple VDCs simultaneously

OpenStack Conceptual View



OpenStack Is Fast Evolving

	Austin	Bexar	Cactus	Diablo	Essex	Folsom	Greezly	Havana
	Nov-10	Feb-11	Apr-11	Oct-11	Apr-12	Oct-12	Apr-13	Oct-13
OpenStack Compute (Nova)								
OpenStack Object Storage (Swift)								
OpenStack Image Service (Glance)								
OpenStack Identity (Keystone)								
OpenStack Dashboard (Horizon)								
OpenStack Networking								
OpenStack Block Storage (Cinder)								
Metering (Ceilometer)								
Basic Cloud Orchestration & Service Definition (Heat)								
Python libraries (Oslo)								

OpenStack Foundation – Platinum

Platinum Members

AT&T

Canonical

HP

IBM

Nebula

Rackspace

Red Hat, Inc.

SUSE

OpenStack Foundation – Gold

Gold Members

CCAT

Cisco

Cloudscaling

Dell

DreamHost

eNovance

Ericsson

Intel

Juniper Networks

Mirantis

Morphlabs

NEC

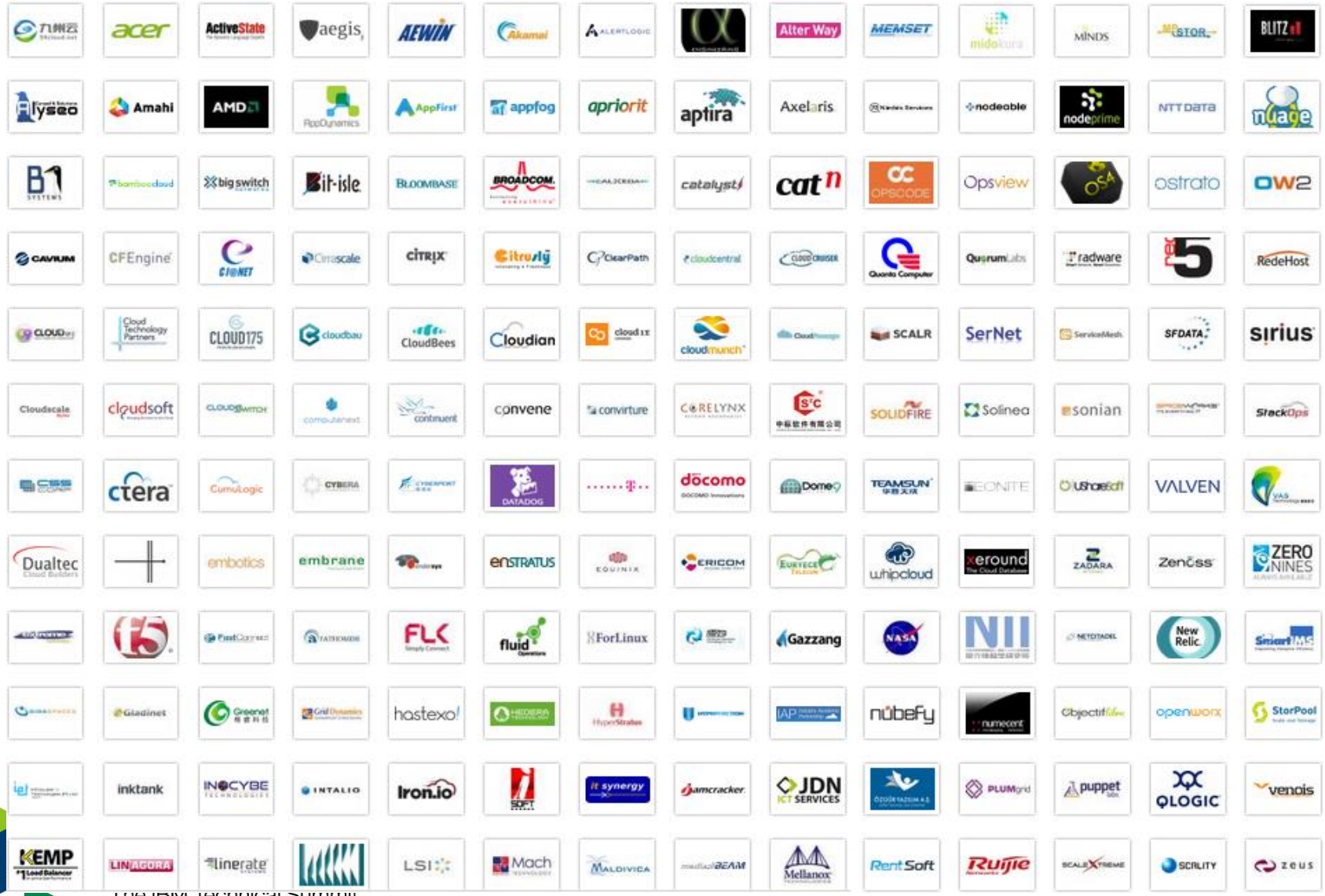
NetApp

Piston Cloud

VMware

Yahoo!

OpenStack Foundation – more…



OpenStack Ecosystem

- OpenStack core + API: OpenStack Foundation
- OpenStack plugin provider
  - Cinder: ITRI, Zadara
  - Neutron: ITRI/Pica8, Midokura, bigSwitch
  - Object storage: Swiftstack
- OpenStack solution provider
  - ITRI, IBM, HP, Ubuntu, Redhat, Rackspace
- OpenStack system integrator
  - Cloudscaling, MorphLabs, Dell, HP, IBM, Piston computing
- OpenStack user: Rackspace, KT, AT&T, HP, Metacloud

Current Status

- > 10,000 members over 125 countries
- 860+ code contributors
- 50 summit sponsors
- 2500+ summit attendees
- OpenStack Summit at Hong Kong: Nov. 5-8, 2013
- Taiwan OpenStack user group (TWOSUG)
  - Founded in December 2011 in ITRI
  - 7 meetups, 1 workshop and +500 participants

To-do Items for OpenStack

- More commercially ready network virtualization (Neutron) and storage virtualization (Cinder) plugin
- Management virtualization
- Disaster recovery support
- High availability support
- Scalability support
  - Dynamic optimizations for server virtualization

ITRI Cloud OS

- Deployment:
  - Bare metal asset discovery, and installation of hypervisor and Cloud OS
- Server virtualization: built on Nova
  - Static provisioning: virtual machine, virtual disk, virtual network and security
  - Dynamic resource management: power consolidation, inter-PM load balancing
- Storage virtualization: based on Cinder API
  - Comprehensive data protection with low performance overhead
  - Scalable metadata management
- Network virtualization: based on Quantum API
  - Private IP address space reuse with multiple IP subnets
  - VDC-specific auto-scaling, server load balancing, traffic shaping, VPN and NAT
- Management virtualization:
  - Separation of physical from virtual data center administration
  - Application performance reporting
  - Real-time CPU/memory/disk/network resource usage metering
- Security:
  - Centralized L3/L4 Firewall
  - Distributed L4/L7 and Web Application Firewall
  - Inter-VDC isolation: VMs in one VDC cannot ping VMs in another VDC

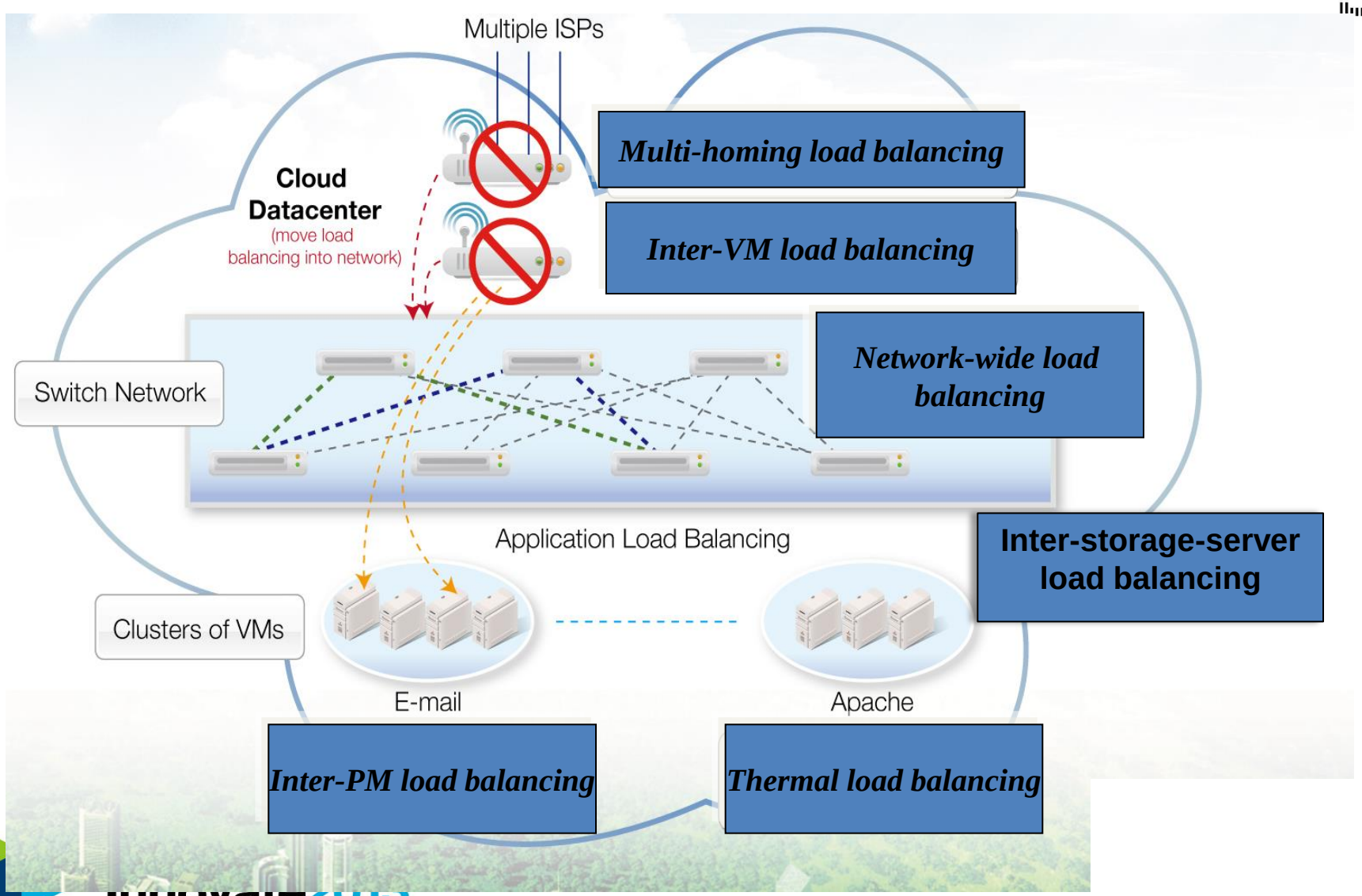
Comprehensive Data Protection

- Storage hardware: JBOJBOD, or just a bunch of JBOD servers
  - Centralized metadata node with HA support and distributed data nodes
- SW/HW RAID: disk failure
- Inter-data-node replication: disk, controller, data node, and network switch failures
- Local data backup: manual error
  - Zero data copying
  - Scalable Disk de-duplication
  - Scalable garbage collection
- Wide-area data backup: site failure
- HA support for metadata node: metadata node failure

High Availability Support

- Cloud OS components
  - Active-passive
    - Logging + Log replication + DRBD + Heartbeat
  - Active-active:
    - Clustering
- User VMs
  - Disk state-preserving fail-over for application VMs running inside VDCs
    - Shared persistent state + VM restart + take-over
  - Memory state-preserving fail-over for application VMs running inside VDCs
    - Shared persistent state + Continuous VM state migration + take-over

Multi-Dimensional Load Balancing



System Management/Administration

- Separation of physical from virtual data center administration
  - Multi-tenancy aware
- Comprehensive monitoring
  - Health and usage data for servers, switches, and disks
  - Health of cloud management software components
- Multi-tenancy-aware virtual to physical resource mapping
  - Virtual Machines ➔ Physical Machines
  - Virtual Volumes ➔ Physical Disks
  - Virtual Network Links ➔ Physical Network Links
- Unified log collection, filtering and access
- Integration with trouble ticketing

Summary

- OpenStack is coming! OpenStack is coming!
- OpenStack is not just another open-source cloud management software distribution, but an open ecosystem that allows everybody to play
- Existing open-source OpenStack distribution is not complete and may take another 12 to 18 months to mature
- ITRI Cloud OS is three years in the making and is going to be compatible with the Grizzly distribution by the end of 2013
- The current version of ITRI Cloud OS is already more functional than the current OpenStack roadmap

Thank You!

Questions and Comments?

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Please check out ITRI Cloud OS Demo in OpenStack Booth