Stay ahead.

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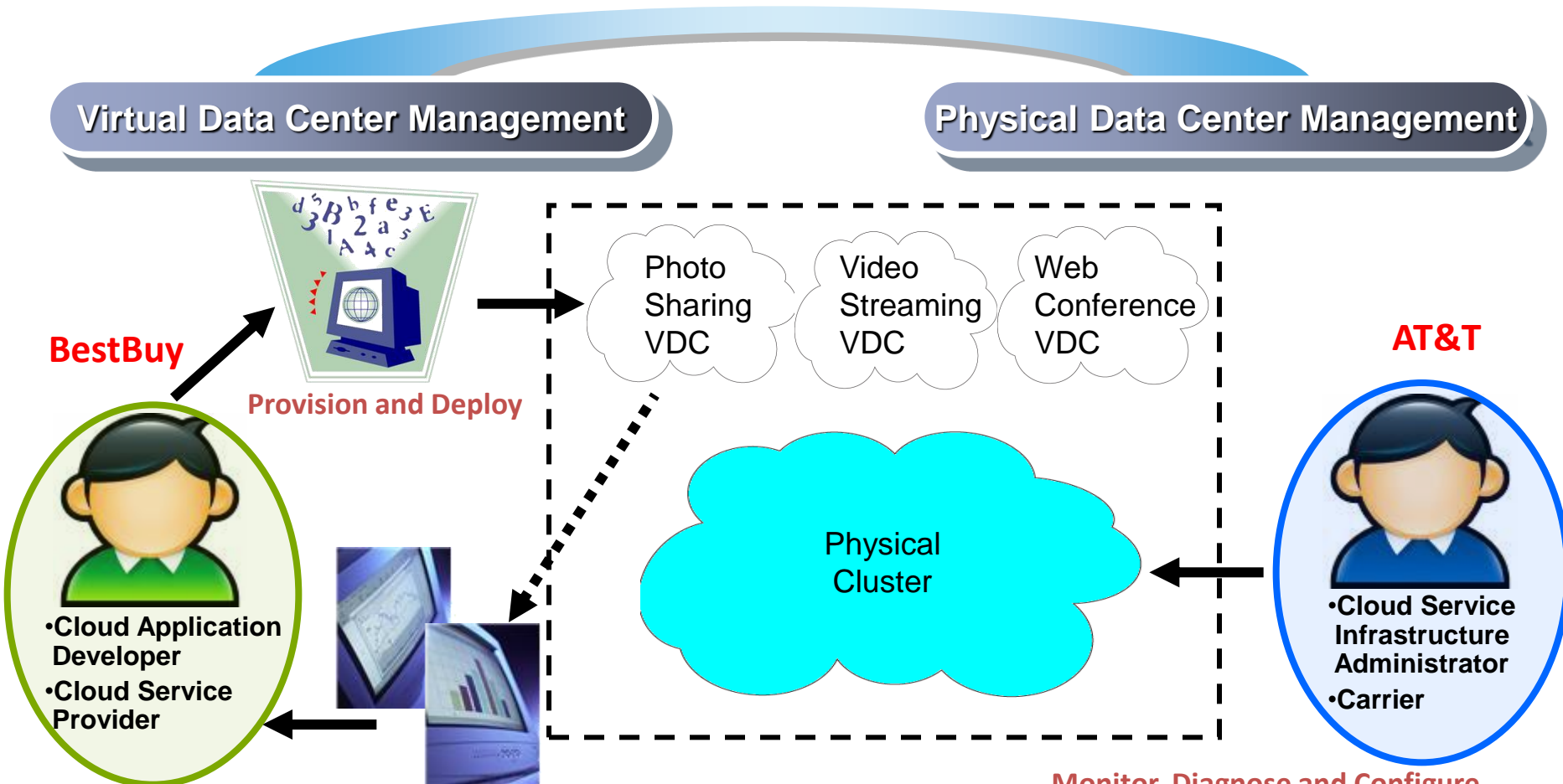# OpenStack: Linux in Cloud Management Software

Dr. Tzi-cker Chiueh

OpenStack Introduction

- An open ecosystem for developing a complete open-source cloud software stack for IaaS

- Target: AWS-EC2 Iike 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

Virtual Data Center Management

Physical Data Center Management

BestBuy

Provision and Deploy

AT&T

Photo Sharing VDC

Video Streaming VDC

Web Conference VDC

Physical Cluster

•Cloud Application Developer
•Cloud Service Provider

•Cloud Service Infrastructure Administrator
•Carrier

Monitor and Configure Virtual Resources

Monitor, Diagnose and Configure Physical Resources

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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 Conceptual View
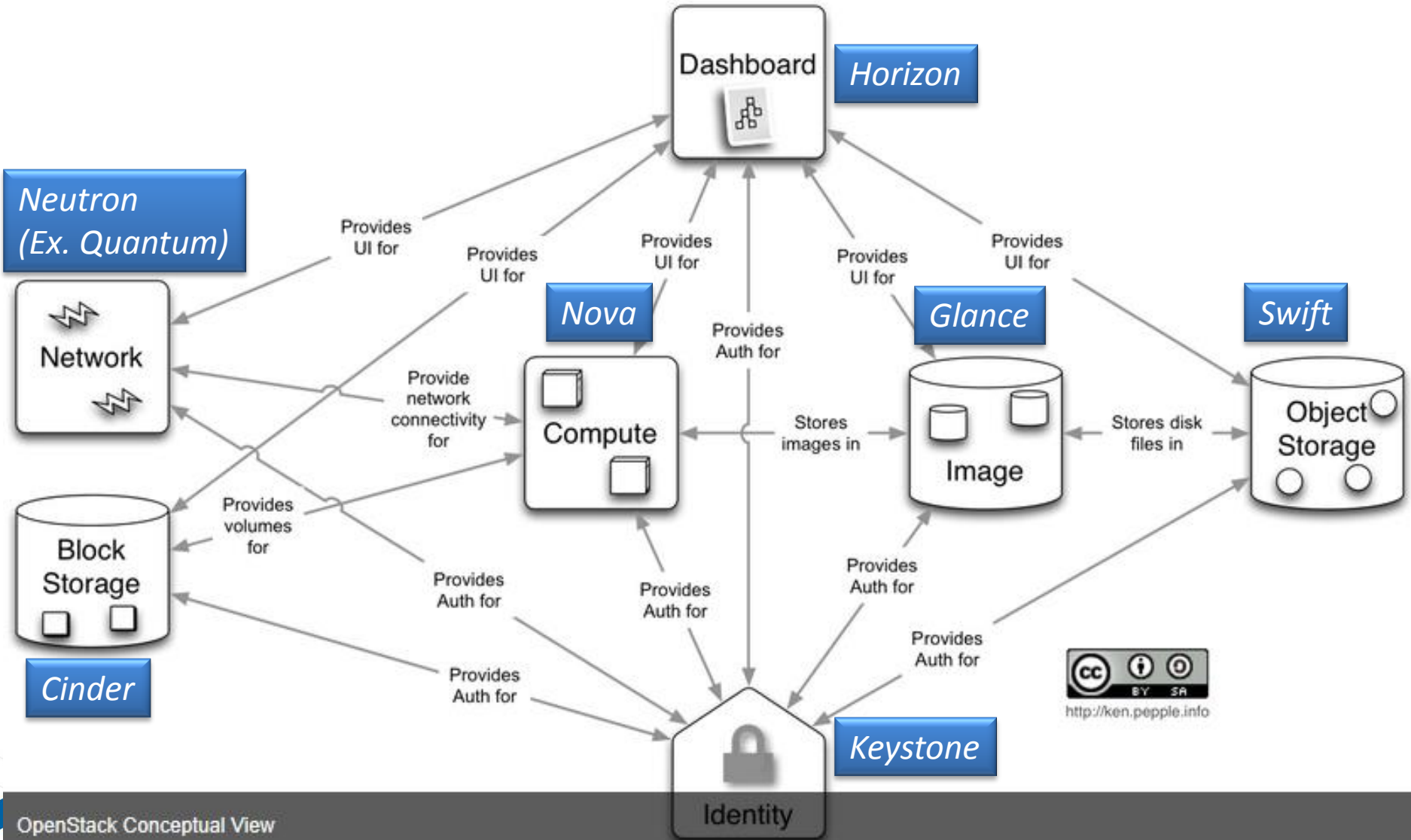
OpenStack Is Fast Evolving

	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

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OpenStack Foundation – Gold

Gold Members

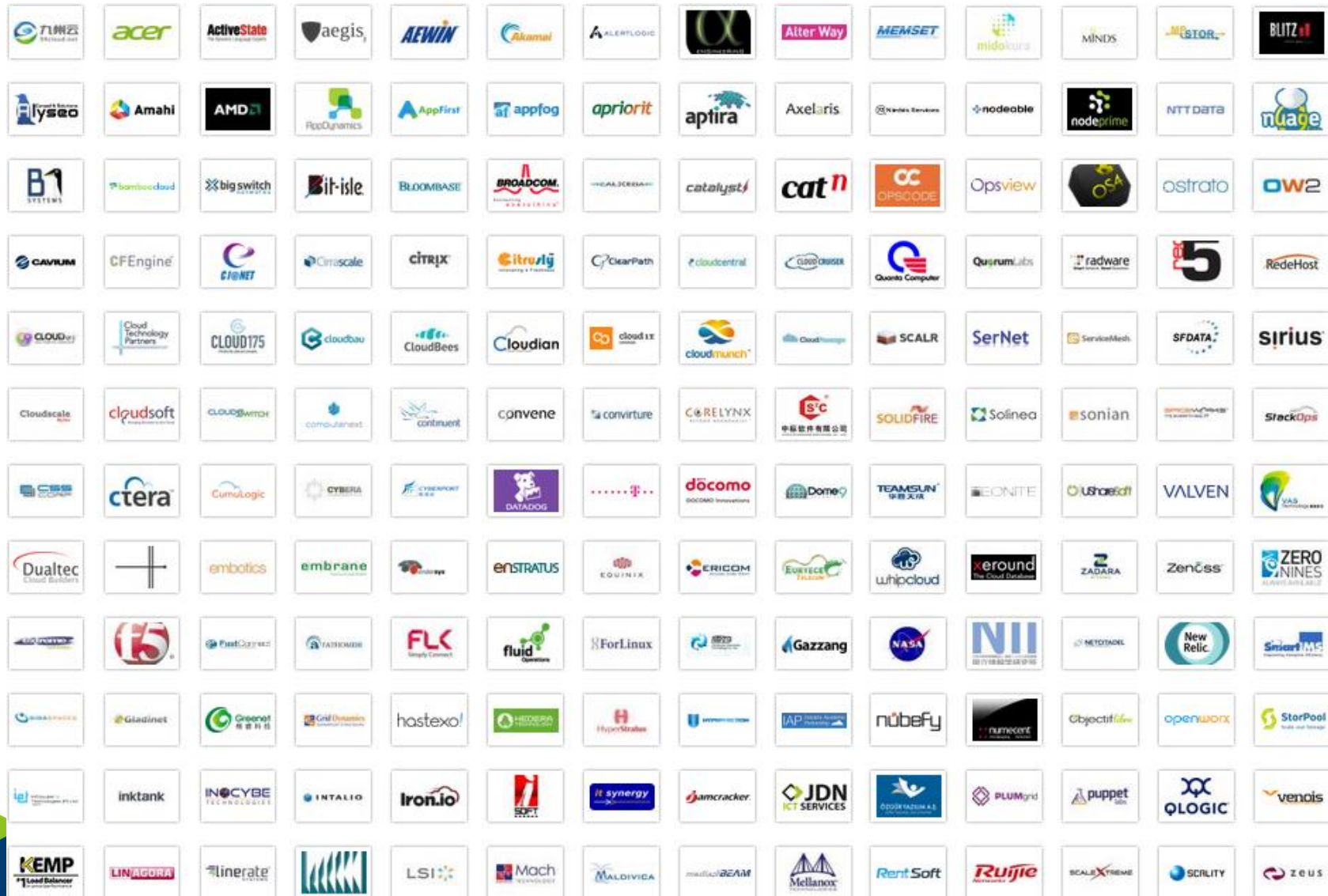|				
CCAT	Cisco	Cloudscaling	Dell	DreamHost
eNovance	Ericsson	Intel	Juniper Networks	Mirantis
Morphlabs	NEC	NetApp	Piston Cloud	VMware
Yahoo!				

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
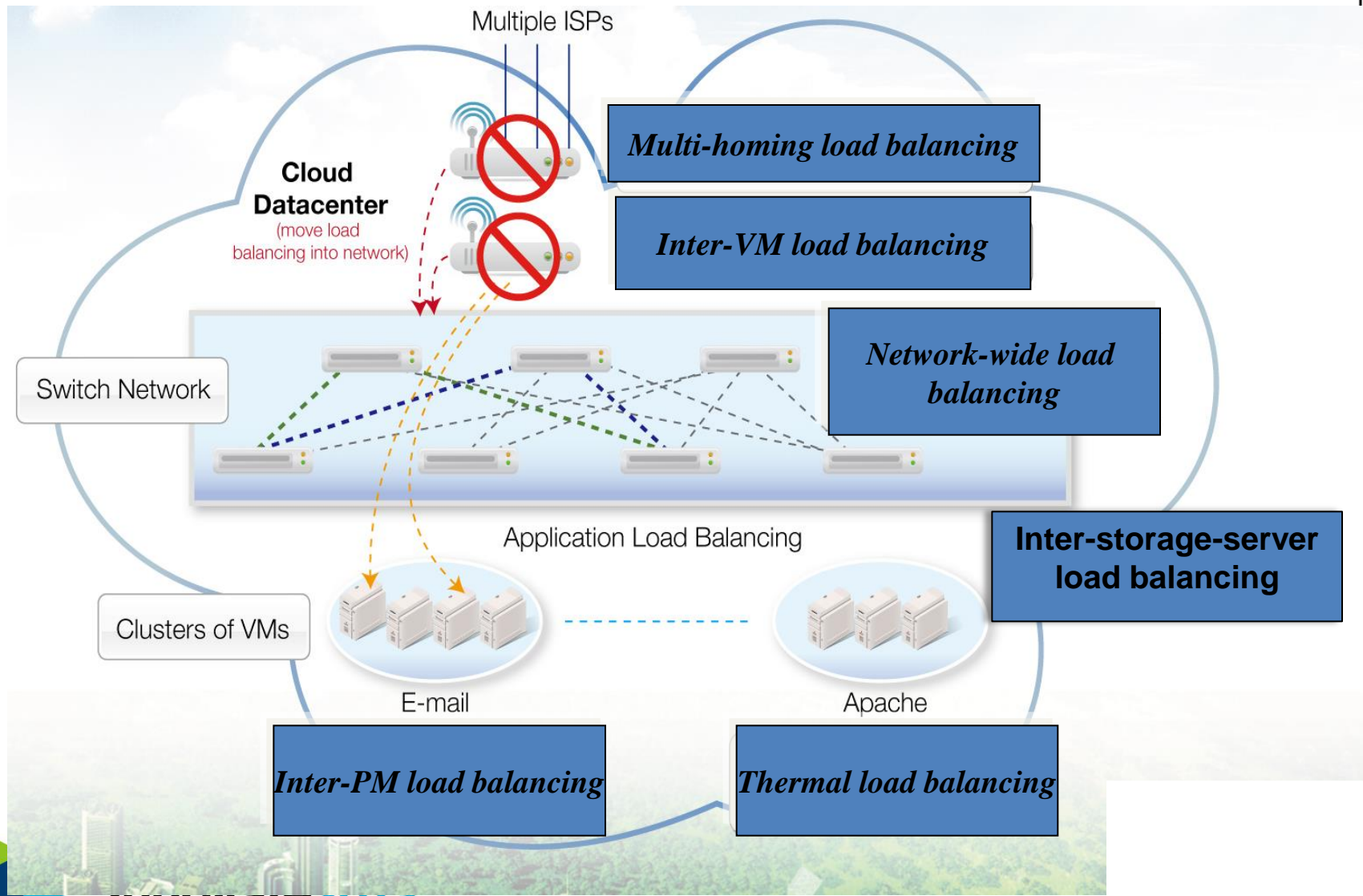- HA support for metadata node: metadata node failure

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

Multiple ISPs

Cloud Datacenter
(move load balancing into network)

Switch Network

Application Load Balancing

Clusters of VMs

E-mail

Apache

Multi-homing load balancing

Inter-VM load balancing

Network-wide load balancing

Inter-storage-server load balancing

Inter-PM load balancing

Thermal load balancing

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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