INTRODUCTION TO CLOUD COMPUTING

CIT 3400

LECTURE 7

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TYPES OF CLOUDS

- Public, Private, Hybrid Clouds
- Names do not necessarily dictate location
- Type may depend on whether temporary or permanent

BENEFITS

- Scalability
- Simplicity – don't have to configure new equipment
- Knowledgeable vendors
- More internal resources – *hire less people*
- Security – strict privacy policies, employ proven cryptographic methods

LIMITATIONS

- Certain applications not ready
  - Needs lot of bandwidth to communicate (expensive)
  - Effort to integrate with other applications
  - Mashup
  - May not be compatible with variety browsers and operate using SSL
  - Cannot communicate securely
  - SECURITY

THE SAME OLD THINGS OR NEW CONTRIBUTIONS?

- Can use own data center or clouds
- Illusion resources are infinite
- Predominant model – Infrastructure as a service IaaS
- Builds on established trends driving cost of delivery
- Increases speed and agility for sketching application architecture to actual deployment
- Virtualization, on-demand deployment, internet delivery of services and open source software

DIFFERENT VIEW ON WHAT IS NEW ABOUT CLOUDS

- **Build on established practices, but changes how we**
  - **Invent, develop, deploy, scale, update, maintain and pay for application and infrastructure**

- See if you agree with this at the end of the semester

CAN YOU CREATE YOUR OWN LOCAL/PRIVATE CLOUD?

- IaaS
- Local – if stored in-house
- Private – only used by enterprise or organization
- Everyone wants to be compatible with AWS EC2 (most popular public cloud)
- APIs consistent with AWS API so can reuse tools, images and scripts

- **Some "private clouds" aren't really clouds at all**

OPEN-SOURCE CLOUDS

- Open-source cloud wars -
- Why do they all have “stack” in their name?
  - Because are moving up the stack from layer 1 (physical) to layer 5 (applications) of the OSI (Open Systems Interconnection) model
- So how do they make money?
- All of them use hypervisors

OPEN-SOURCE CLOUD - HYPERVISORS

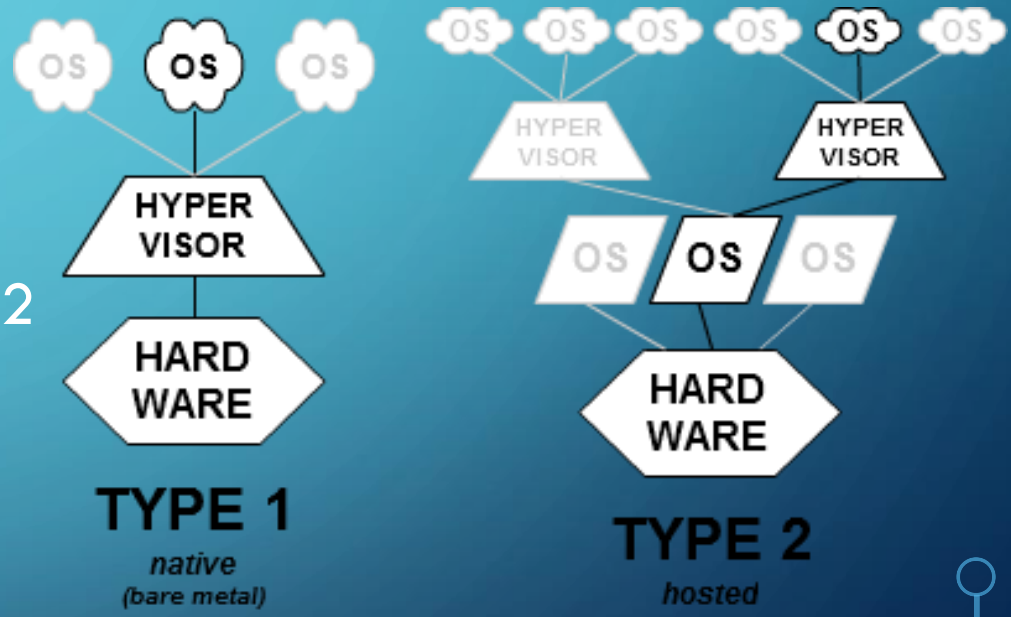
- Hypervisors
  - KVM, Xen, Vmware, Oracle VM
- Run on a host OS, but can emulate using virtualization many guest OSs
  - E.g. KVM host must be Linux, but supports guest OSs Linux, Windows, Solaris, BSD

OPEN-SOURCE CLOUD - HYPERVISORS

- KVM: host OS has to be Linux
  - Can't use in older CPUs before virtualization extensions
- Xen: been around a lot longer
  - Can use on machines that don't have virtualization extensions
  - Currently better performance
  - EC2 uses Xen
- VMware
  - Geared towards performance

TYPE 1 VS TYPE 2 HYPERVISORS

- XenServer, HyperV Server are type 1,
- VMware workstation and VirtualBox are type 2



OPEN-SOURCE CLOUDS

- OpenStack
  - Started by Rackspace (storage files) and NASA in 2010
  - Both Ubuntu and Red Hat distributions
  - Hypervisors: KVM, Xen and VMware

OPEN-SOURCE CLOUDS

- OpenStack Components:
  - Firewall
    - Switches and load balancers on the public facing network connections
  - Controller Service
    - Support services for cloud resources
    - High availability
  - Compute Nodes
    - Running hypervisors
  - Block Storage
    - For use by VMs.
  - Object Storage
    - Storage for serving static objects, such as VM images

OPEN-SOURCE CLOUDS

- CloudStack being revived under Apache
  - OpenStack owner (Citrix) now own CloudStack (2009) and dropped OpenStack
  - More “Amazon like”
  - Hypervisors: KVM, vSphere, XenServer, Oracle VM
  - Better for enterprises

OPEN-SOURCE CLOUDS

- CloudStack Components:
  - Regions
    - A collection of one ore more zones controlled by management servers
  - Zones
    - Equivalent to a single datacenter. Consists of one or more pods and secondary storage.
  - Pods
    - Switches and one or more clusters
  - Cluster
    - Homogenous hosts and primary storage
  - Host
    - A single compute node within a cluster
  - Primary Storage
    - Storage resources provided to a single cluster for running VMs
  - Secondary Storage
    - A zone-wide storage resource that stores disk templates, ISO images, and VM snapshots

OPEN-SOURCE CLOUDS

- Eucalyptus

"Elastic Utility Computing Architecture for Linking Your Programs To Useful Systems"

  - Developed 2008
  - VMware, Xen, KVM
  - Ubuntu, Red Hat, RHEL, CentOS, Fedora, other flavors of Linux
  - Only project based on GPL (GNU general SW license) and not ASL (Apache SW license)
  - Implement AWS API on top of Eucalyptus
  - AWS agrees to support Eucalyptus, users can migrate workloads between the two, applications compatible with both

OPEN-SOURCE CLOUDS

- Eucalyptus Components
  - Cloud Controller
    - Manages cluster controller(s), user information, and cloud resource administration
  - Cluster Controller
    - One or more clusters of compute and storage nodes. Cluster controller manages network for VM and physical machines, load balancing/consolidation, and identification of compute and storage resources
  - Compute Node(s)
    - Hosts VMs by using Hypervisors
  - Storage Node(s)
    - Persistent data storage

OPEN-SOURCE CLOUDS

- OpenNebula
  - Developed 2008 – European
  - Xen, KVM, Vmware
  - Interfaces: EC2, OGF OCCI, vCloud

OPEN-SOURCE CLOUDS

- Nimbus
  - Developed 2009
  - EC2/S2 compatible
  - Xen, KVM
  - Combine with OpenStack, Amazon, others

PAPER TO READ

- A Survey on Open-source Cloud Computing Solutions