INTRODUCTION TO CLOUD COMPUTING

CIT 3400

LECTURE 4

DR. AMOS CHEGE, PH.D.

LECTURER COMPUTER SCIENCE

CLOUD COMPUTING CHARACTERISTICS

- So what are its characteristics?
  - Described as: On-demand computing, pay as you go, software as a service, utility computing
  - Usually costs, but cost-effective
  - Virtualization
  - Scalable (expand on current hardware)
  - Elastic (dynamically add hardware as needed)
  - Distributed and highly parallel approach
  - Emphasizes availability
  - Replication, replication, replication …

ELASTIC

- Cloud infrastructure used depends on application
  - Only need one server to run small job OR
  - Massive number of servers needed

- ELASTIC – unlimited resources

- Cloud provider keeps adding hardware to satisfy your demand

THE RESULT OF CLOUDS: DIFFERENT COMPUTING MODEL

Software-as-a-Service (SaaS)

Platform-as-a-Service (PaaS)

Infrastructure-as-a-Service (IaaS)

CLOUD SERVICE MODELS

- Software as a Service (SaaS)
  - Applications, management and user interfaces provided over a network

- Platform as a Service (PaaS)
  - Application development frameworks, operating systems and deployment frameworks

- Infrastructure as a Service (IaaS)
  - Virtual computing, storage and network resource that can be provisioned on demand

- Sun white paper:

"Introduction to Cloud Computing Architecture"

IAAS

- Infrastructure as a Service (IaaS) – aka Hardware as a Service (HaaS) and Utility computing
  - **Why buy machines when you can rent resources?**
  - Utility computing billing – based on what used
  - Provides basic storage and compute capabilities as server
    - Servers, storage systems, CPU cycles, switches, routers, etc.

INFRASTRUCTURE-AS-A-SERVICE (IAAS)

- Resource Provisioning
  - Provides the users the capability to provision computing and storage resources.

- Virtual Machines
  - These resources are provided to the users as virtual machine instances and virtual storage. Users can start, stop, configure and manage the virtual machine instances and virtual storage.

- Provider Managers Infrastructure:
  - The cloud service provider manages the underlying infrastructure.

- Pay-per-use/Pay-as-you-go:
  - Virtual resources provisioned by the users are billed based on a pay-per-use/pay-as-you-go paradigm.

IAAS

- Does not provide applications to customers (SaaS and PaaS do)

- Saves cost of purchasing

- Infrastructure can be scaled up or down

- Multiple tenants can use equipment at the same time – called **multitenant**

- Device independence – access systems on different hardware

- Low barriers to entry

IAAS COMPONENTS

- Computer hardware – rented out, provider set up as a grid for scalability
  - Network – hardware for firewalls, routers, etc.
  - Internet connectivity so user can access hardware
- Allows clients to run the VM they want

INFRASTRUCTURE-AS-A-SERVICE (IAAS)

IaaS

Benefits

- Shift focus from IT management to core activities
- No IT infrastructure management costs
- Pay-per-use/pay-per-go pricing
- Guaranteed performance
- Dynamic scaling
- Secure access
- Enterprise grade infrastructure
- Green IT adoption

Characteristics

- Multi-tenancy
- Virtualized hardware
- Management & monitoring tools
- Disaster recovery

Adoption

- Individual users: Low
- Small & medium enterprises: Medium
- Large organizations: High
- Government: High

Examples

- Amazon Elastic Compute Cloud (EC2)
- RackSpace
- Google Compute Engine
- Joyent
- Terremark
- OpSource
- Nimbula
- Enamoly
- Eucalyptus
- Open Stack

QUESTIONS/PROBLEMS

- How do you use this hardware?

- If they provide the hardware and software to use it, is it no longer IaaS?

- If you want to use their servers, do you have to create your own VM? Do they have VMs available?

COMMENT

- If you create your own VMs, etc. This is not easy …

IAAS EXAMPLES

- Ex: Amazon's EC2, e.g. Samba - Connecting to Cloud Storage as a Network Share

- Google Compute Engine

- Windows Azure VMs

SLA

- Service level agreements between provider and client – **SLA**
  - The specific parameters, minimum levels required for each element of the service, remedies for failure to meet requirements.
  - Affirms ownership of data stored on the service provider's system, specifies your rights to get it back.
  - System infrastructure and security standards to be maintained by the service provider, your rights to audit their compliance.
  - Specifies your rights and cost to continue and discontinue using the service.
  - http://www.techradar.com/us/news/internet/cloud-services/four-things-to-know-about-cloud-slas-1157019