Cloud

- Public Cloud
- Private Cloud
- Hybrid Cloud
- Community Cloud
What is a cloud?

Collection of computational resources (hardware and software) delivered over a network, usually the Internet.

3 distinct aspects makes something a “cloud”:

- Resources are usually metered (pay-per-use).
- Resources can be provisioned on-demand.
- Resources can be manipulated via API.
Desktop as a service (DaaS), backend as a service (BaaS), and information technology management as a service (ITMaaS).
Service Models

Software as a service (SaaS) is a software licensing and delivery model in which software is licensed on a subscription basis and is centrally hosted, also know as "software on-demand".

Platform as a service (PaaS) provides computing platforms and solution stacks as service.

Infrastructure as a service (IAAS) provides computing facility as a service.
Examples

Image from http://thegadgetsquare.com/1552/what-is-cloud-computing/
Shared Hosting

- Share same hardware and OS.
- Low cost.
  - HostGator starts at $3.96/mo
  - GoDaddy starts at $1.99/mo
- Fewer options and less flexibility.
- Less performant. Frequent outages.
- Security implications.
Dedicated Hosting

• Leased dedicated hardware (servers, network switches, etc...).
• High Cost.
  • Typical monthly fee starts at $200/mo.
• Greater flexibility and options.
• Higher performance.
• Long contracts (typically 1 year, but can be upwards of 3 years).
Dedicated Hosting

- Servers
- Operating System
- Hardware
- Network
- Data
  - Database
  - Storage
Co-location

• Purchase and host your own hardware.
• High Initial Cost (CAPEX).
  • A good server can cost upwards of $10k.
• Monthly fees for power, network, cooling.
• Long contracts (typically 1 year, but can be upwards of 3 years).
Virtual private server (VPS)

- Best compromise between price and performance.
- Utilized primitive incarnations of virtualization.
- Pay monthly fee for VPS ($40-$100/mo).
- Security implications.
Virtual private server (VPS)
Which option do I choose?
Something’s missing...

Diagram showing layers of computer systems:
- **Your Application**
- **Operating Systems**
  - Distributions
  - Packages
  - Configuration Files
  - Services
  - Patching
- **Networks**
  - Switches
  - Routers
  - IPs
  - VLANS
  - Firewalls
  - Bandwidth
- **Servers**
  - RAM
  - CPUs
  - Disk
  - Network Adapters
  - Fans
- **Datacentres**
  - Power
  - Cooling
  - Racks
  - Physical Security
I just want to deploy code...
Hire a System Admin

- Due to complexity, the only option available was to hire a system admin that knew how to navigate that world.

- Sys. Admin would prepare the environment, and deploy your code on your behalf since they know the system best.

- This leads to System Admin vs. Developer wars.
The Glory of the Cloud

Simplified cloud infrastructure
The Cloud...

- Abstracts away the complication of running a proper server environment.
- Controlled through an API so you can “deploy” infrastructure.
- Entire environments can be deployed in minutes.
Amazon Web Services cloud
What’s it made of?

Anatomy of a cloud
Compute Nodes

- Physical servers running virtualization software.
- Provided CPU and Memory resources.
- Usually don’t store any permanent data.
- Connected to multiple networks.
Virtualization

- Virtualization allows you to run multiple operating systems on a single server.
- Virtualization usually refers to the Hypervisor.
- Motivation for virtualization - most hardware is under-utilized.
- Virtualization increases utilization to get the most out of expensive hardware.
Anatomy continues...
Network Layers

• One network sits in front of Compute Nodes to provide Internet access.

• One network sits in the back of Compute Nodes to provide access to Storage layer.

• Usually Ethernet and Fibre Optic based.

• Not uncommon to see 10GigE switches.
Storage Layer

- Use of Storage Area Networks (SANs), Network Attached Storage (NAS), Direct Attached Storage (DAS).
- Usually in the form of specialized commercial hardware with lots and lots of drives.
- Very Expensive.
- Failures can be catastrophic.
- You usually have to buy 2 for redundancy.
Failure example

• On April 20, 2011, some parts of Amazon Web Services suffered a major outage.

• A portion of volumes utilizing the Elastic Block Store (EBS) service became "stuck" and were unable to fulfill read/write requests.

• It took at least five days for service to be fully restored.
Advantage and disadvantages

Cloud Computing

- Scale and Cost
- Security
- Lock-in
- Choice and Agility
- Encapsulated Change Management
- Next-Generation Architectures
- Lack of Control
- Reliability

+ [Advantages]
- [Disadvantages]
The Future...

• A WSJ article cites “cloud computing” market to explode to $241B by 2020 (up from $41B in 2011).

• Dec 2010 - Heroku was acquired by Salesforce.com for $212M!

• https://aws.amazon.com/solutions/case-studies/ lists hundreds of major websites using AWS, and that’s just Amazon’s list.
The Future...

• Openstack.org is supported by more then hundred “corporate” contributes, with individual contributors in the thousands.

• Data locality will continue to be a big concern for all players (providers, end users, government bodies) as more legislation is passed.

• The US EPA estimates that servers and data centers are responsible for up to 1.5% of the total US electricity consumption.
References