Cloud Computing 1

CSCI 4850/5850 High-Performance Computing

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Tae-Hyuk (Ted) Ahn
Department of Computer Science
Program of Bioinformatics and Computational Biology
Saint Louis University
Learning Objectives

- You will learn how to use Amazon Web Service (AWS) that is a cloud platform
Setting up an AWS for HPC course

- Three options:
  - Signup AWS (need credit card) – Then, apply AWS Educate Credit ($100)
  - Just signup AWS Educate without creditcard (limited)
  - Use my course account credential (I will forward the info at class)
What is Cloud Computing?

- **Cloud computing** is the on-demand delivery of IT resources and applications via the Internet with pay-as-you-go pricing.
- With cloud computing, you don’t need to make large upfront investments in hardware and spend a lot of time managing that hardware.
- Cloud computing provides a simple way to access servers, storage, databases, and a broad set of application services over the Internet.
Why Call It the Cloud?

- Internet traditionally represented as the cloud
- CC allows for running applications remotely in the Internet

→ Cloud Computing
Six Advantages of Cloud Computing

- Trade capital expense for variable expense
- Benefit from massive economies of scale
- Stop guessing about capacity
- Increase speed and agility
- Stop spending money running and maintaining data centers
- Go global in minutes
Cloud security is job zero in cloud computing providers.
- Providers usually provide security-specific tools and features across network security, configuration management, access control, and data encryption.

Cloud Compliance enables customers to understand the robust controls in place to maintain security and data protection in the cloud.
- This helps customers to establish and operate a security control environment.
History: The pioneers

- Jul 2002: Amazon Web Services launched
  - Third-party sites can search and display products from Amazon's web site, add items to Amazon shopping carts
  - Available through XML and SOAP
- Mar 2006: Amazon S3 launched
  - Innovative 'pay-per-use' pricing model, which is now the standard in cloud computing
  - Cheaper than many small/medium storage solutions: $0.15/GB/month of storage, $0.20/GB/month for traffic
  - Amazon no longer a pure retailer, entering technology space
- Aug 2006: EC2 launched
  - Core computing infrastructure becomes available
History: Wide-spread adoption

- Apr 2008: Google App Engine launched
  - Same building blocks Google uses for its own applications: Bigtable and GFS for storage, automatic scaling and load balancing, ...

- Nov 2009: Windows Azure Beta launched
  - Becomes generally available in 21 countries in Feb 2010
  - Microsoft’s online services are gradually transitioned to Azure

- Dec 2013: Google Compute Engine launches
  - Provides lower level support vs. App Engine; full set of services
  - Dramatically lower prices, quickly matched by AWS and Azure
What is Amazon AWS?

- Amazon Web Services (AWS) provides a number of different services, including:
  - Amazon Elastic Compute Cloud (EC2)
    Virtual machines for running custom software
  - Amazon Simple Storage Service (S3)
    Simple key-value store, accessible as a web service
  - Amazon DynamoDB
    Distributed NoSQL database, one of several in AWS
  - Amazon Elastic MapReduce
    Scalable MapReduce computation
  - Amazon Mechanical Turk (MTurk)
    A 'marketplace for work'
  - Amazon SimpleDB
    Simple NoSQL database
AWS credentials

- Sign-in credentials
  - AWS web site and management console
  - Command-line tools
  - REST APIs
  - Many different types of credentials

- EC2 key pairs
  - Access keys
  - X.509 certificates
  - SOAP APIs

- Signing in to AWS
  - AWS website and management console
  - Command-line tools
  - REST APIs

- Connecting to an instance (e.g., via ssh)

AWS documentation:
The AWS management console

- Used to control many AWS services:
  - For example, start/stop EC2 instances, create S3 buckets...
What is Amazon EC2?

- Infrastructure-as-a-Service (IaaS)
  - You can rent various types of virtual machines by the hour
  - In your VMs, you can run your own (Linux/Windows) programs
    - Examples: Web server, search engine, movie renderer, ...

[Table showing EC2 instance types and pricing]

- 1 GB memory
- 1 virtual core
- (ECU variable)
- Storage: EBS only

244 GB memory
36 virtual cores
(116 ECU)
24x2TB HDD

http://aws.amazon.com/ec2/#pricing (9/10/2015)
Amazon Machine Images

● When I launch an instance, what software will be installed on it?
  ▪ Software is taken from an Amazon Machine Image (AMI)
  ▪ Selected when you launch an instance
  ▪ Essentially a file system that contains the operating system, applications, and potentially other data

● How do I get an AMI?
  ▪ Amazon provides several generic ones, e.g., Amazon Linux, Fedora Core, Windows Server, ...
  ▪ You can make your own
    • You can even run your own custom kernel (with some restrictions)
Online Tutorial & Certification

https://www.aws.training/
Getting Started

https://aws.amazon.com/getting-started/

Today:
- Launch a Linux Virtual Machine
- Launch a WordPress Website
- Store and Retrieve a File
What Is Amazon EC2?

Amazon Elastic Compute Cloud (Amazon EC2) provides scalable computing capacity in the Amazon Web Services (AWS) cloud. Using Amazon EC2 eliminates your need to invest in hardware upfront, so you can develop and deploy applications faster. You can use Amazon EC2 to launch as many or as few virtual servers as you need, configure security and networking, and manage storage. Amazon EC2 enables you to scale up or down to handle changes in requirements or spikes in popularity, reducing your need to forecast traffic.

For more information about cloud computing, see What is Cloud Computing?

Features of Amazon EC2

Amazon EC2 provides the following features:

- Virtual computing environments, known as `instances`
- Preconfigured templates for your instances, known as `Amazon Machine Images (AMIs)`, that package the bits you need for your server (including the operating system and additional software)
- Various configurations of CPU, memory, storage, and networking capacity for your instances, known as `instance types`
- Secure login information for your instances using `key pairs` (AWS stores the public key, and you store the private key in a secure place)
- Storage volumes for temporary data that's deleted when you stop or terminate your instance, known as `instance store volumes`
- Persistent storage volumes for your data using Amazon Elastic Block Store (Amazon EBS), known as `Amazon EBS volumes`
- Multiple physical locations for your resources, such as instances and Amazon EBS volumes, known as `regions` and `Availability Zones`