**Northeastern University – Silicon Valley**

CS 6620 Cloud Computing

**Homework Set #1** [100 points]

***INSTRUCTIONS: Please provide clear explanations in your own sentences, directly answering the question, demonstrating your understanding of the question and its solution, in depth, with sufficient detail. Submit your solutions [PDF preferred]. Include your full name. Do not email the solutions.***

**PART I: Concepts and Theory, Algorithms**

Study Chapters 1 and 2 of Bhagga & Madisetti, and Ch. 1 from Buyya. [100 points].

Answer the below questions from **Buyya**, in your own words (1 – 2 small paras each; Diagrams as needed).

Buyya page 27

Review questions  
1. What is the innovative characteristic of cloud computing?  
2. Which are the technologies on which cloud computing relies?  
3. Provide a brief characterization of a distributed system.  
4. Define cloud computing and identify its core features.  
5. What are the major distributed computing technologies that led to cloud computing?  
6. What is virtualization?  
7. What is the major revolution introduced by Web 2.0?  
8. Give some examples of Web 2.0 applications.  
9. Describe the main characteristics of a service orientation.  
12. Briefly summarize the Cloud Computing Reference Model.  
13. What is the major advantage of cloud computing?  
14. Briefly summarize the challenges still open in cloud computing.  
15. How is cloud development different from traditional software development?

**PART II: LAB (Programming in AWS Cloud)**

Study **Ch. 2** from this book python AWS Cookbook (O’Reilly). This is the Lab part.

Obtain your student AWS free account and confirm with screnshots. Dos ome basic operations.

Complete the lab exercise (Ch 2 Bagga) from page 76 to page 81. this should include completing the following setup. show screenshots in your answer, and submit working code. please see instructions from tiie on how to submit code and how it will be graded. Use Consol to code.

Set up and launch an EC2 instance (p. 76 – 80)

EC2 auto scaling (p. 82 – 84)

Creating an application load balancer (see from page 84 onwards)

Creating a VPC instance

***Answer (Qichen An)***

Part1 Concepts and understanding

1. What is the innovative characteristic of cloud computing?

According to the content of the class and relevant book slides, the innovative characteristic of cloud computing take advantage of both cloud service consumers and cloud service providers containing On-demand self-service, broad network access, resource pooling, rapid elasticity, measured service, performance, reduced costs, outsourced management, reliability and multi-tenancy.

2. Which are the technologies on which cloud computing relies?

Basically, cloud computing relies on lots of concepts and technologies. Some of these technologies will be taught in the rest of the class such as virtualization. A well-considered answer about the full technologies which cloud computing relies are virtualization, distributed computing, load balancing, Web 2.0, service orientation, scalability and elasticity, deployment, replication, monitoring, identity and access management, service level agreements and billing.

3. Provide a brief characterization of a distributed system.

Based on my understanding, a distributed system contains a group of some independent computers. And the group of computers are considered as a single coherent system for users. In the distributed system, multiple independent computers split up the massive and complex work and coordinate to complete the full job more efficiently. In this kind of environment, the system handles massive work that a single computer cannot handle alone, and also offers additional advantages over traditional computing environments for reducing the risks involved with having a single point of failure, bolstering reliability and fault tolerance.

4. Define cloud computing and identify its core features.

Basically, could computing means an Internet-centric way of computing. In different institute and organizations, the definition of cloud computing is not exactly the same. For example, by Armbrust, cloud computing is defined as both applications delivered as services over the Internet and the hardware and system software in the datacenters that provide those services. In my view, a perfect definition could be as follows by the complement of NIST’ definition. Cloud computing is both applications delivered as services and the hardware and system software that provide those services, enabling ubiquitous, convenient, on-demand network access that can be rapidly provisioned and released with minimal management effort or service provider interaction.

For its cloud computing, on-demand self-service, broad network access, resource-pooling, rapid elasticity, and measured service could be considered as its core features.

5. What are the major distributed computing technologies that led to cloud computing?

According to the content of the class and relevant book slides, three major milestones of distributed computing technologies have led to cloud computing. They are mainframe computing, cluster computing, and grid computing.

Mainframe computing is the first example of large computational facilities leveraging multiple processing units. And for the second technology, cluster computing start as a low-cost alternative to the use of mainframes and supercomputers. What’s more, for the last one, grid computing can be considered as an evolution of cluster computing.

6. What is virtualization?

For cloud computing, virtualization is a core technology. It is a fundamental element of cloud computing because it provides IT infrastructure on demand. It envelops a collection of solutions permitting the deliberation of a few of the basic components for computing. It benefits the component of hardware, runtime situations, storage, and networking.

7. What is the major revolution introduced by Web 2.0?

Web 2.0 is another core technology enabling the provisioning of cloud services. The Web is the essential interface through which cloud computing delivers its administrations.

For the major revolution, the Web envelops a set of innovations and administrations that encourage intelligently data sharing, collaboration, user-centered plan, and application composition. This advancement has changed the Web into a rich platform for application advancement.

8. Give some examples of Web 2.0 applications.

Directly for the relevant slides of the first class, examples of Web 2.0 applications are Google Documents, Google Maps, Facebook, Twitter, YouTube and Wikipedia.

Social networking Websites take the biggest advantage of Web 2.0. The level of interaction in Websites such as Facebook or Flickr would not have been possible without the support of AJAX, Really Simple Syndication (RSS), and other tools that make the user experience incredibly interactive. Moreover, community Websites harness the collective intelligence of the community, which provides content to the applications themselves: Flickr provides advanced services for storing digital pictures and videos, Facebook is a social networking site that leverages user activity to provide content, and Blogger, like any other blogging site, provides an online diary that is fed by users

9. Describe the main characteristics of a service orientation.

Directly for the relevant slides of the first class, Service-oriented computing (SOC) supports the development of rapid, low-cost, flexible, interoperable, and evolvable applications and systems.

12. Briefly summarize the Cloud Computing Reference Model.

The reference model for cloud computing is an abstract model that characterizes and standardizes a cloud computing environment by partitioning it into abstraction layers and cross-layer functions.

Graphical user interface, text, application

Description automatically generated

In above image, Cloud Computing services can be classified into three major categories as:

a. Infrastructure-as-a-Service (IaaS)

Infrastructure-as-a-Service solutions deliver infrastructure on demand in the form of virtual hardware, storage, and networking.

b. Platform-as-a-Service (PaaS)

For PaaS, the solutions deliver scalable and elastic runtime environments on demand and host the execution of applications.

c. Software-as-a-Service (SaaS)

Software-as-a-Service solutions provide applications and services on demand.

These categories are related to each other and provide an organic view of cloud computing.

13. What is the major advantage of cloud computing?

The most evident benefit from the use of cloud computing systems and technologies is the increased economical return due to the reduced maintenance costs and operational costs related to IT software and infrastructure.

What’s more, in detail, increased agility Increased agility in defining and structuring software systems is another significant benefit of cloud computing. And end users can benefit from cloud computing by having their data and the capability of operating on it always available, from anywhere, at any time, and through multiple devices. Finally, service orientation and on-demand access create new opportunities for composing systems and applications with a flexibility not possible before cloud computing.

14. Briefly summarize the challenges still open in cloud computing.

The challenges still open in cloud computing can be summarized as IT practitioners, managers, governments, and regulators.

15. How is cloud development different from traditional software development?

In my views, the main difference is that advancement of a cloud computing application happens by leveraging stages and frameworks that give distinctive sorts of administrations. It’s from the bare-metal framework to customizable applications serving particular purposes.

Part 2 Lab

*1. Set up and launch an EC2 instance*

Step 1: choose an Amazon Machine Image (AMI)

I select the Amazon Linux 2 AMI.

Graphical user interface, text, application, email

Description automatically generated

Step 2: choose an instance type

I select the type ‘t2.micro’.

Table

Description automatically generated

Step 3: configure instance details.

A screenshot of a computer

Description automatically generated

Step 4: add storage.

Graphical user interface, text, application, email

Description automatically generated

Step 5: add tags

A screenshot of a computer

Description automatically generated

Step 6: configure security group

A screenshot of a computer

Description automatically generated

Final result

A screenshot of a computer

Description automatically generated

*2.EC2 auto scaling*

Step 1: create a launch template

Graphical user interface, text

Description automatically generated

Graphical user interface, text, application

Description automatically generated

Step 2: create auto scaling group

Launch the template that first step created.

A screenshot of a computer

Description automatically generated

Configure settings.

A screenshot of a computer

Description automatically generated

Configure advanced options and add tags.

A screenshot of a computer

Description automatically generated

A screenshot of a computer

Description automatically generated

Final result

Graphical user interface, text, application

Description automatically generated

*3. Creating an application load balancer*

Step 1: create target group

Configure settings.

Graphical user interface, text, application

Description automatically generated

Register targets.

Graphical user interface, text, application, email

Description automatically generated

Result

Graphical user interface, text, application, email

Description automatically generated

Step 2: create load balancer

Create load balancer type. I select the application load balancer.

Graphical user interface, website

Description automatically generated

Configure.

Graphical user interface, text, application

Description automatically generated

Final result

A screenshot of a computer

Description automatically generated

*4. Creating a VPC instance*

Graphical user interface, text, application, email

Description automatically generated

Launch EC2 instances

Step 1: choose AMI

Similarly, I choose Amazon Linux 2 AMI.

A screenshot of a computer

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Step 2: choose an instance type

Similarly, I select t2.micro.

A screenshot of a computer

Description automatically generated

Step 3: configure

A screenshot of a computer

Description automatically generated

Step 4: add storage

Graphical user interface, text, application, email

Description automatically generated

Step 5: add tags

Graphical user interface, text, email

Description automatically generated

Step 6: configure security group

A screenshot of a computer

Description automatically generated

Final result

Graphical user interface, text, application, email

Description automatically generated