

1. Course Code

2245

2. Course Title

G3e:Advanced Software Developments (Cloud Computing)

3. Teacher

WANNOUS, Muhammad

4. Term

Spring 2

5. Course Requirements (Courses / Knowledge prerequisite for this course)

Courses:

[1] Fundamentals of Information Networks (2201)

[2] Web application development (2249)

Skills:

[1] Mastering of the command-line and IDE

[2] Mastering software installation and setup

[3] Mastering the basics of computer networks and addressing

A previous architectural knowledge of Cloud Computing is NOT required.

6. Course Overview and Objectives

This course serves as an introduction to Cloud Computing environment. It starts with a brief covering for the different technologies that are used in to construct and manage the cloud computing environment and then continues to show one scenario for utilizing resources in it. By attending this course, the students will have the opportunity to act as a service provider and consumer. This course utilizes cloud services provided by Google Cloud Platform, so students attending it need to have accounts in Google.

7. Course Outline

- 1 Course orientation, definition and characteristics of cloud computing.
Demonstration
- 2 Cloud services, deployment models, and applications
- 3 Cloud concepts and technologies -Virtualization-
- 4 Cloud concepts and technologies -Networking within virtualization-
- 5 Cloud concepts and technologies -Load balancing- & cloud services
- 6 Open source private cloud software
- 7 Developing applications for the cloud (local environment setup)
- 8 Developing applications for the cloud (creating a project)
- 9 Developing applications for the cloud (coding)
- 10 Developing applications for the cloud (deployment)
- 11 Cloud application benchmarking (concepts)
- 12 Cloud application benchmarking (jMeter)
- 13 Cloud application security (concepts)
- 14 Cloud application security (checking)
- 15 Final project
- 16 Final exam

8. Textbooks (Required Books for this course)

For this course, a set of lecture slides, handouts, and other resources will be distributed in a timely manner.

9. Reference Books (optional books for further study)

[1] Cloud Computing: A hands-on Approach, ISBN-13: 978-1494435141

[2] Learning Openstack, ISBN-13: 978-1783986965

10. Course Goals (Attainment Targets)

- (1) Define Cloud Computing.
- (2) Describe the infrastructure of the cloud.
- (3) Explain the different service models of the cloud and compare them
- (4) Experiment with a simple system to provide cloud services.
- (5) Experiment with one of the public cloud service providers.
- (6) Practice designing and deploying a sample web application in the cloud.
- (7)
- (8)

11. Correspondence relationship between Educational goals and Course goals

Educational goals of the school		Course Goals	
High level ICT skills	Basic academic skills	(1) (2) (3)	
	Specialized knowledge and literacy	(4) (5) (6)	
Human skill (Tankyu skill)	Ability to continually improve own strengths		
	Ability to discover and resolve the problem in society	Problem setting	
		Hypothesis planning	
		Hypothesis testing	
		Practice	
	Fundamental Competencies for Working Persons	Ability to step forward	
Ability to think through			
Ability to work in a team			
Professional ethics			

12. Evaluation

Goals	Evaluation method & point allocation					
	examination	Quiz	Reports	Presentation	Deliverables	Other
(1)	○	○				
(2)	○	○				
(3)	○	○				
(4)	○				○	
(5)	○				○	
(6)	○				○	
(7)						
(8)						
Allocation	40	30			30	

13. Evaluation Criteria

Examination	A final exam is intended to assess students' overall understanding and application of the course goals. This is an open-book exam that allows students to locate answers in the subject materials/external resources. The exam consists of several questions of different types, simple answer, multiple choices, space-filling, ...etc. and one exercise to design a web application in the cloud.
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Quiz	This course will include up to three quizzes. Each quiz consists of several questions of different types, simple answer, multiple choices, space-filling, ...etc. The questions are to verify the knowledge a student has acquired regarding specific lectures. The quiz is limited in time, but a student can try it twice.	
Reports		
Presentation		
Deliverables	The course has several exercises and two projects. The exercises cover the following topics: 1) using a virtualization hypervisor to build a virtual machine, 2) networking two or more virtual machines, 3) demonstrating one way to achieve load balancing, 4) the construction of a tiny cloud and managing it, 5) showing the way to deploy a web application in the cloud, and 6) application testing and debugging. The instructor will provide the information related to each exercise promptly. The first project covers the virtualization technology, and the final project involves developing an application and deploying it in the cloud. Exercises in this course are not graded, but the projects are. For the first project, each student should submit a report detailing the steps to complete the exercise, while for the final project each student is required to deploy a web application in the cloud and provide a link to it. The grade of the final project considers the functions of the application that utilize cloud service.	
Other		
14. Active Learning		
Hourly percentage of active learning within the whole class time		70%
1	Active learning such as problem solving assignment using the knowledge and skills acquired in class.	All the time
2	Active learning such as group works and discussions.	Sometimes
3	Outcome presentations and feedbacks.	Not at all
4	Students actively make decisions on how the class should be conducted.	Not at all

15. Notes

This course contains both theoretical and practical parts. Be prepared for using the shell interface and for coding (in Java).

Quizzes and projects have deadlines and they won't be postponed unless a serious issue occurs.

16. Course plan

(Notice) This plan is tentative and might be changed at the time of delivery

Lesson 1: (Course orientation, Definition and characteristics of Cloud Computing)

Discussion and Lecture 45 minutes, Demonstration, 45 minutes)

[1] Course syllabus

[2] Grading

[3] Definition and characteristics of Cloud Computing

- + An overview of Cloud Computing and its characteristics.

- + Demonstration of deploying a sample project in Google App Engine.

Lesson 2: (Cloud services, deployment models, and applications)

(Lecture, 90 minutes)

[1] Service models.

- + SaaS

- + PaaS

- + IaaS).

[2] Deployment models

- + Public

- + Private

- + Hybrid

- + Community

[3] Control over resources within the service models.

Lesson 3: (Cloud concepts and technologies-virtualization-)

(Lecture 30 minutes, Practice, 60 minutes)

[1] An overview of the technologies utilized for Cloud Computing

- + Virtualization

- + Load balancing

- + Replication

- + SDN...

[2] Exercise-1

- + Installing a virtual-machine in VirtualBox

- + Remote access to a virtual-machine

Lesson 4: (Cloud concepts and technologies -networking within virtualization-)

(Lecture 30 minutes, Practice, 60 minutes)

[1] Networking scenarios offered by the virtualization hypervisor

- + Host-only
- + Bridged
- + NAT

[1] Exercise-2:

- + Creating a host-only network in VirtualBox
 - + Connecting two virtual machines to a host-only/NAT/Bridged network
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Lesson 5: (Cloud concepts and technologies -load balancing- & cloud services)

(Lecture 30 minutes, Practice, 60 minutes)

[1] Load balancing

[2] Exercise-3:

- + Configure one load balancer to distribute load among two web servers

[3] An overview of the Cloud services

- + Compute
 - + Storage
 - + Database
 - + Application
 - + Contents delivery...etc.
-

Lesson 6: (Open source private cloud software)

(Lecture 30 minutes, Practice, 60 minutes)

[1] An overview of open source software used for managing clouds

- + CloudStack
- + OpenStack

[2] Exercise-4:

- + Importing a virtual machine containing OpenStack in VirtualBox
 - + Running OpenStack and configuring a new image and network
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Lesson 7: (Developing for the cloud -environment setup)

(Lecture 30 minutes, Practice, 60 minutes)

[1] Cloud application design considerations

[2] Google App Engine development environment setup

- + Java Development Kit (JDK)
 - + NetBeans IDE
 - + Google Cloud SDK
 - + Maven
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Lesson 8: (Developing applications for the cloud - creating a (Practice, 90 minutes)

[1] Preparing the hosting environment

- + Create a project in Google App Engine
- + Enabling services
- + Logs and settings

Lesson 9 : (Developing applications for the cloud - coding) (Practice, 90 minutes)

[1] Exercise-5:

- + Create a sample application in NetBeans
- + Accessing services in the cloud via Java Servlets

Lesson 10 : (Developing applications for the cloud - (Practice, 90 minutes)

[1] Exercise-5:

- + Deploying the sample application to Google App Engine

Lesson 11 : (Cloud application benchmarking -concepts) (Practice 90 minutes)

[1] Benchmarking of web applications.

- + Types of tests

Lesson 12 : (Cloud application benchmarking -jMeter)

(Lecture 30 minutes, Practice, 60 minutes)

[1] Apache jMeter

- + Installation

[2] Exercise-6:

- + Benchmarking the sample application with jMeter

Lesson 13 : (Cloud application security-concepts)

(Lecture 30 minutes, Practice, 60 minutes)

[1] Securing applications in the cloud

- + Enabling SSL for applications
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Lesson 14 : (Cloud Application Security (checking))

(Lecture 30 minutes, Practice, 60 minutes)

[1] Checking the security status of an application in the cloud

+ Security scanner in Google App Engine

Lesson 15 : (Final project)

(Lecture 30 minutes, Practice 60 minutes)

This session is dedicated to discussing the details of the final project and answering any questions on it. The project is about converting the image repository application we created in a previous course to a cloud application.

Lesson 16: (Final Exam)

(Final Exam 90 minutes)

This is an open-book exam that allows students to locate answers in the subject materials/external resources. The exam consists of several questions of different types, simple answer, multiple choices, space-filling, ...etc. and one exercise to design a web application in the cloud.
