CIT 581-CLD Cloud Computing

(last updated February 19, 2015)

I. Catalog Description:

This course provides an introduction in the techniques and technologies used in cloud computing. It consists of independent and intensive hands on labs. Topics covered in this course focus on the characteristics of cloud computing, cloud delivery models, and deployment models, anatomy, security and case studies. The course will emphasize on architecture and the development of web services that can scale on cloud infrastructure. We cover practical deployments ranging from OpenStack, Containers, Ceph etc. to virtualization layers KVM, VMware products, and the use of AWS. The students learn how to develop application against common PaaS. Finally, we also cover some theoretical parts such as the CAP theorem, Paxos, BASE vs ACID etc. Below we show some of the modules offered in this course.

II. Organization and Schedule

Semester	*Meeting Type*	*Days*	*Time*	*Location*
Fall '14	Lecture	W	2:30-5:20	EE 005
	EXAM 1	TBA	2:30-5:20	EE 005
	EXAM 2	TBA	2:30-5:20	EE 005
	FINAL EXAM	TBD	per Purdue	EE 005
	Semester project		to be announced	
	Last day to drop	Sep 8	without a grade	
	Last day to drop	Sep 22	w/ W in transcripts	

III. Prerequisites

Undergraduate course in Operating Systems or Unix/Linux (equivalent to CNIT 34000) from Purdue or other institution, or appropriate permission by the instructor.

IV. Course Audience

The instructors normally do not permit course audits, due to the limited number resources on the VMware vCenter platform, and Amazon Web Service (AWS) credits. However, you are allowed to participate in the class as long as there an available seat in the auditorium.

V. Lab

The labs are based on the thin client paradigm. You will not have access to a physical hardware and everything will be virtualized. To access our infrastructure will need VPN access. The credentials will be provided by the instructor in the beginning on the class on Blackboard.

Other labs on Amazon AWS and Microsoft Azure do not require access to the lab.

VI. Course Instructor

Name	*Office*	*Phone*	*Email Address*	*Office Hours*
Ioannis Papapanagiotou	Knoy 213	494-4677	ipapapan@purdue.edu	
	Office hours:			M 1:30-2:30pm

VII. Recommended Textbooks, Lab Manuals, and Supplies

The instructor will provide the appropriate notes from the course. Additional articles and papers to read will be posted on Blackboard. However, if you insist in acquiring a book the following is recommended:

Distributed and Cloud Computing: From Parallel Processing to the Internet of Things, By K. Hwang et al., Elsevier 2012.

VIII. Topics Covered

- Introduction to Cloud Computing (standardization and automation, rapid elasticity, flexibility and pricing)
- Architecture (Service and Delivery Models, Virtualization, Hypervisors)
- Amazon AWS, OpenStack, Google Cloud and Microsoft Azure
- Anatomy of the Cloud (Cloud tiers, Sharding, CAP Theorem, ACID/Base, Web Services)
- Replication and Consistency
- 2 and 3 Phase Commits (Logical and Vector Clocks, Chandy/Lamport)
- Paxos (Byzantine Failure, Quorums)
- Case Study: The Amazon Dynamo and Cassandra (Eventual Consistency)
- IaaS Cloud Storage (Ephemeral, Block and Object storage)

- PaaS Cloud Storage (BLOB, NoSQL, Queueing Services)
- Micro Services and Containers (Linux Containers, Control Groups, Namespaces, Docker)
- Network Virtualization (OpenStack Neutron, Software Defined Networks, OpenFlow)
- Security (security integration model, threads, Economic Denial of Sustainability, threat mitigation, Google Case Study)

IX. Instructor Objectives

Your instructor's goal is to maximize the educational experience of those students who bring an appropriate and sincere effort and serious interest in the subject matter to the classroom.

X. Course Outline (Subject to change)

Week 1	Introduction and Motivation for Cloud Computing and SOA	Week 9	Case Study: The Amazon Dynamo and Cassandra (Eventual Consistency)
Week 2	Service and Delivery Models, Virtualization, Hypervisors	Week 10	Break
Week 3	Major Cloud IaaS: Amazon AWS, OpenStack, Google Cloud and Microsoft Azure	Week 11	IaaS and PaaS Cloud Storage
Week 4	Cloud tiers, Sharding, CAP Theorem, ACID/Base, Web Services	Week 12	Linux Containers, Control Groups, Namespaces, Docker
Week 5	Cloud tiers, Sharding, CAP Theorem, ACID/Base, Web Services	Week 13	Network Virtualization
Week 6	Replication and Consistency	Week 14	Security
Week 7	2 and 3 Phase Commits	Week 15	Security
Week 8	Paxos, Byzantine Failure, Quorums	Week 16	Project Presentation

XI. How Final Grades will be Determined (subject to change with notice)

A. Points and/or Weights

Grading Criteria	**Weight Toward Final Grade**
Quizzes	10 %

Midterm Exam	20%
Final Exam	10 %
Hands on Labs	30 %
Industry based Projects	30
Attendance and Class Participation	0 %
Extra Credit	(given as part of homework)

B. Grading Scale

Grade	*Scale*	*Notes or Prior Term's Distribution*
A+	97 - 100 %	% of total points possible
A	94 - 96 %	% of total points possible
A-	90 - 93 %	% of total points possible
B+	87 - 89 %	% of total points possible
B	84 - 86 %	% of total points possible
B-	80 - 83 %	% of total points possible
C	70 - 79 %	% of total points possible
D	60 - 69 %	% of total points possible
E	not applicable	given only under very extenuating circumstances
F	0 - 59 %	% of total points possible
I		See policy.
W/WF		See policy.

C. Miscellaneous Notes and Comments

1. Receiving 89.4% of the total points is not an A- you will receive a grade of B+. The final course grades are rounded up to two decimal places. For example, 89.5% would be an A-.
2. Incompletes will only be given under extenuating circumstances that caused the student to be absent for an extended period of time. Extended absences must be documented through the Dean of Students Office and will be validated by the instructor. Project-based incompletes will be penalized a minimum of one letter grade for the course.

XII. Course Policies

A. Attendance, Preparation, and Courtesy Expectations and Policies

1. You are expected to be present for every meeting of the course. Your success in the course will heavily depend on your attendance and

participation in the classroom. The instructor or his secretary must be notified in advance for an excused absence. Even if the absence is excused, you are fully responsible for any homework or lessons that were assigned or covered in the missed classes.

2. In the event of an extended absence (usually five days or longer), you should contact the Dean of Students Office to report the absence and receive advice on how to proceed. Upon your return to campus, you must promptly contact your instructor to determine if and how missed work will be made up.
3. In the event of an excused or unexcused absence, you alone are responsible for promptly discovering what you missed.
4. Some handouts will be distributed only in class. Students who notify the instructor of an absence prior to class can receive handouts from the Professor. Remaining copies of handouts are promptly recycled.

B. Add/Drop Expectations and Policies

1. According to CIT educational policy, this course may not be added to any student's academic schedule after the third week of a Fall or Spring semester (or equivalent for a Summer semester) except under very extenuating circumstances to be approved by the Assistant Department Head of Computer Technology.
2. According to CIT educational policy, no independent study course can be substituted for this course.
3. You may drop this course without a failing grade so long as you do so before the published University deadline for dropping the course.

C. Quiz and Exam Policies

1. Quizzes will be unannounced.
2. There are **no makeups** for quizzes regardless of an excused absence. The lowest quiz score will be dropped from the student's final score at the end of the semester.
3. Makeup examinations will only be given under extenuating and unavoidable circumstances. The burden of proof of said circumstances is on the student. Makeup examinations will usually differ from the original exam, and may be essay or oral.
4. The graded final examination will not be returned. The department for possible future use in testouts is retaining it. However, you may review your final examination results by making an appointment with your instructor.

D. Homework Policies and Quality Expectations

1. All homework assignments, by default, are to be treated as an individual effort unless otherwise stated.
2. All homework submissions must include the completed, computerized version of the CIT Office Submission Form template.
3. Homework and projects not submitted through Blackboard must be submitted for grading to the CIT Main Office in Knoy 255. All

submissions will be dated and time-stamped. The office closes promptly at 5:00 PM; therefore all materials must be submitted by 4:30 PM to be considered "on time." The instructor **will not** accept homework in class or in his office.

4. **LATE WORK**: Late homework will be **penalized 50% per day**, excluding weekends, University holidays, and University vacation periods.
5. Always check your assignments for spelling and grammar. Points will be subtracted for mistakes.
6. Points will be subtracted for submitting poorly or improperly organized work, or for not following instructions.
7. Points will be subtracted for misspelled words or misused words.

E. Re-Grading Policies

1. Any student wishing to appeal any score must return his or her paper, quiz, or exam with a written statement explaining the appeal. An appeal must be submitted no later than one week after the original scores were returned.
2. Any work submitted for re-grade may be totally re-graded. Do not assume the instructor will only regrade those portions that the student wishes to be re-graded.
3. According to University regulations, only final course grades can be "appealed." There is a formal School of Technology and University timetable and process for grade appeals. Questions about grade appeals should be directed to the Assistant Department Head of Computer Technology or the Chair of the School of Technology Grade Appeals Committee.

F. Lab Policies and Expectations

1. If you use CPT laboratories, you are responsible for any and all laboratory policies – including the security policies that govern your account. Policies do change from time to time; therefore, you should review the CPTnet and Laboratory Policies at the beginning of each semester. Accounts can be temporarily or permanently suspended for policy violations.
2. In the event that your account is suspended for any laboratory or network policy violation, this course will not extend deadlines or eliminate late penalties for assignments that could not be completed because of the suspension.
3. You will be assigned the equipment necessary for you to work on your labs. Do not borrow parts or interfere with any other student's lab setup. If you have problems with your equipment, or suspect tampering, immediately contact the instructor (ipapapan@purdue.edu).

G. Academic Dishonesty ("Cheating") Policies

1. Any form of cheating on any examination in the course may result in an "F" grade for the course, and the case will be forwarded to the Office of the Dean of Students for appropriate disciplinary action.

2. Any form of cheating on a homework or project submission will result in both a zero score for the assignment, and a one-letter grade penalty in the course. Also, the case will be forwarded to the Office of the Dean of Students for appropriate disciplinary action.
3. Any form of cheating on a quiz will result in a zero score for that quiz, and the case will be forwarded to the Office of the Dean of Students for appropriate disciplinary action.
4. Cheating, or helping another student to cheat, are considered equal cases of academic dishonesty and will be dealt with as noted above.
5. Giving another student access to your computer account, or negligently permitting another student to access your computer account constitutes cheating on your part if that other student copies any files that become implicated in a cheating case. Protect your account as if your academic career depends on it!

H. Disabling Conditions

1. Any student who, because of a disabling condition, may require special arrangements in order to meet course requirements should contact the instructor by the third week of class in order to make necessary accommodations. Students who do not contact the instructor by the third week of class, or as soon as they know they have a disabling condition, forfeit their rights to special accommodations. Students must work with the Dean of Students Office in order to receive special accommodations for this class.