Syllabus, Course Requirements, and Policies

Prerequisite: CS 520 or equivalent (an undergraduate or graduate course on modern operating systems)

COURSE REQUIREMENTS

Attendance: Required by Stevens.

Participation: Overall, I want the "lectures" to be interactive discussions rather than monologues.If there is a question, please do not hesitate to ask it right away.

Homework: All homework is individual. In the (unlikely, I hope) case where identical copies of the homework are submitted, **all students** who have submitted it get zero points, and the final grade will automatically move one letter down. All Stevens policies concerning plagiarism will also apply. Note that the Graduate **Student Code of Academic Integrity** forbids **both** copying the work of others and making your own work available to others. It is your responsibility to safeguard your work. Never visit websites (e.g., CourseHero, Chegg, or StackOverflow) where homework are posted (possibly, illegally) and **never** post any of your homeowrk solutions to any website.

Quizzes: Can pop up at any time.

COURSE DESCRIPTION

Cloud Computing is still a new and fast-growing field, which can be greatly influenced by individual research. As part of the overarching study of the field, the course will present and familiarize you with the range of open problems, from which they can choose the ones to tackle in your own research. Some of the development is taking place in the open source communities, and you will be familiarized with this work and be prepared to contribute to it.

For those of you who plan to work in the industry, the course will provide the present snapshot of the field and its essential technical and business background. At the moment, every IT organization needs to make decisions on what to outsource to cloud and what to keep in the enterprise. In addition, cloud service providers (whose number and make-up will grow as telecommunications companies are planning to enter the field) need new professionals to grow their business.

This course provides the background relevant to working on either side of cloud computing industry.

Here is the **required text book**, which will be supplemented by the **lecture slides** reflecting the industry state of the art.

The book should be available at the Stevens Campus Bookstore and also on Amazon and major booksellers.

For those who want to learn the security of **Network Function Virtualization (NFV)** in depth and understand more of my work in the industry, I *recommend* a new book, in which I have co-authored an invited chapter:

Please note that this course is about understanding the underlying *technologies* (as in the "Stevens Institute of Technology").

As far as this class is concerned, the Amazon experiments, which will make a lion's share of the lab work, are merely illustrations of how to use these technologies. To this end, the class materials and the advice of our esteemed CAs will be sufficient for completing the lab work.

You will also have full access to *all* AWS Academy resources *free of charge*. Again, this is a bonus, but not part of class requirements although in class you will learn *how* this stuff works. If you would like to prepare for the AWS certification, you will have all the materials one needs.

In the past, there were some problems with the labs there. Our Course Assistants will do their best to help you in such cases, but our abilities are limited. Again, studying in the AWS Academy is not an objective of this course but rather the resources of the Academy are given to you as a bonus to pursue extra-curricular professional development.

In what follows, I explain the grading policies and the approximate breakdown of the topics.

Grading Policies

The grade will be determined based on the performance: First, it will be determined who (if anyone) has indeed excelled, and those will be graded "A"; then those who have failed (I hope there will be none) will be graded "F"; and the rest will be graded "B" or "C," depending, *partly,* on the breakpoints of the cumulative grade distribution. With that, if you actively participate in class so that I am confident that you know the subject, I might ignore the numbers.

Judging strictly from number, the final grade will depend on the cumulative average grade you receive for the homework (*20%*), Midterm (*30%*), and the IdM Quiz and the Course Project (*50%*).

The penalty for handing in the homework one week late is 20% of the overall score; two weeks late—50%; anything later than that—*100%*. In order to get a non-failing grade, you must submit all homework assignments (even if you submit them late and get *0* points).

And please remember: we are not grading *you as a person*—we are grading *your knowledge of the material* for this particular course. The process of grading is inherently imperfect.
You can help me greatly by being active in class. (By the way, because of the US Government requirements, Stevens Institute of Technology require that I take Title IV attendance, which Canvas reports to the Deans. The attendance is mandatory.)

I want to make sure you understand everything—when something is unclear, just ask! There is no such thing as a bad or wrong question; on the contrary, when something is unclear, I need an immediate feedback, so that I can change the pace of the course if necessary. You will never be penalized for asking a question, but you may penalize yourself if you don't ask it and thus miss a chance to understand and to learn!

It is to your advantage to miss none of the lectures—some of the material will be discussed only in class, and you won't find it in the notes or in the book. My experience has demonstrated that those who missed more than 30% of the lectures invariably get very low grades on the Final and often fail the class. With that, the solutions to homework problems and exams will be presented and discussed only in class; they will not be distributed in any form because of the copyright- and ethical issues.

Every homework is an individual assignment. You may use web materials, papers, etc., but you need to indicate the source for each piece of material you use. While it is always a good idea to study in a team, in the end you have to write your submission alone. If two--or more homework submission--are identical, those who have submitted them will get a grade of 0 automatically. There are also substantial penalties instituted by the school, which are described below. (In short, never copy your homework and never make your homework available to others. You are responsible for securing your homework.)

Breakdown of topics by date (approximate)

Week	Topic	Reading materials
Weeks 1-2	Definition of the basic concepts, business issues, NIST documents, and the topic overview	Lecture slides, refere Book Chapters 1-2
Weeks 3-4	Virtualization: hypervisors, paravirtualization, with the case study of Xen, KVM, and VMware (and possibly others), I/O MMU, security issues in virtualization.	Lecture slides, Book (References to the b Xen, and the docum on the KVM in Linux Foundation as well a VMWare product pag
Week 5	Introduction to IP networks. Enterprise LANs and WANs.	Lecture slides, Book references to IETF RI

Week 6	**Midterm** (open-book)* The Midterm may move a week or two later	
Weeks 7-9	QoS parameters for "Network as a Service" with the examples of*diffserv, RSVP,* and *MPLS*. Security protocols. Introduction to SDN.	Lecture slides, Book 4., references to the RFC and the ONF sit
Weeks 9-11	Network appliances: DNS, and Firewalls.	Lecture slides. Book 5, and references to IETF standards.
Week 12	Cloud storage and the structure of the modern data center.	Lecture slides, Book
Weeks 13-14	Service life cycle, orchestration and management in the Cloud, Web architecture and REST API, Microservices, Amazon Cloud Formation service template.	Lecture slides, Book
Week 15	Introduction to *OpenStack*. Review of the orchestration: *Heat*and *Ceilometer* projects. TOSCA as the orchestration specification language. Identity Management in the Cloud. Overview of OpenStack *Keystone* and token-based mechanisms (OpenID and OAuth). Open Source Software for *Big Data* (review of Hadoop and Cassandra)	Book, Ch 7 and Appe
Final Quiz and selected student projects review	The last day of the class	

Important: Please review these outcomes as ultimately they will determine your grade.

CS 524 Course Outcomes

Cloud: Explain the economics of outsourcing IT to the cloud.

Virtual Machines: Explain how hypervisors solve the problems of distributing a CPU among virtual machines.

Web Applications: Explain the structure of the Web as a client-server system.

Network as a Service: Explain how QoS technologies are used to provide "data pipes" between data centers.

Security and Identity Management: Explain major security and privacy problems in the cloud and how they are addressed with the security mechanisms.

Servers: Describe the architecture of the modern data center and the mechanisms of service orchestration.

Discovery: Explain how DNS works, and how it can be used for service discovery and content distribution.