COS 598: Cloud Computing

Course Description The National Institute of Stands and Technology (NIST) defines cloud computing as "a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction." This course will study the technologies underpinning the rapid expansion of this new computing paradigm, the new problem-solving capabilities enabled by the cloud, and provide the student with hands-on experience in utilizing cloud services for scientific research. It will focus on the virtualization of computational resources, cloud storage models, distributed computing in the cloud, and important applications areas such as big data analytics.

Prerequisites COS 331 or equivalent.

Expectations This is a 500-level computer science course designed for graduate students and advanced undergraduates. As such, regular class attendance and *participation* is expected. Assigned work should be completed within the allotted time. You are encouraged to bring laptop to class for in-class work, but not for surfing the Web, sharing funny videos, or working on assignments from other classes. You are expected to do more of your own learning, problem solving, and topic exploration. You will also present material to the class on commonly used (supportive) cloud technologies.

Place and Time Monday, Wednesday, and Friday 1:00 – 1: 50, room 136 Boardman Hall.

Instructor Dr. Phillip Dickens, Associate Professor, School of Computing and Information Sciences.

Contact Information Office: 226 East Annex
e-mail: dickens@umcs.maine.edu

Office Hours TBD

Required Software You will need to download and install several software products for this class. It is recommended that you download Python from Continuum Analytics (https://www.anaconda.com). You will also need to install Jupyter notebook (can download it with Python), a Github account, and access to Amazon Web Services (through class account and hopefully through your own free-tier account).

Papers: Students will be asked to read and present papers on various aspects of cloud computing. Paper presentations will be counted as part of in-class work.

Grading:

In-class work (graded):		30%
Homework:	30%	
Project:		30%
Final:	10%	

Textbook: *Cloud Computing for Science and Engineering* by Ian Foster and Dennis Gannon. An on-line version of the book is available for free from https://cloud4scieng.org/chapters.

Course Management: The course will use the Bright Space Course Management System as its homepage. All class material, including the syllabus, homework assignments, project descriptions, copies of class slides, and course announcements will be maintained on this System.

URL: https://courses.maine.edu

Assignments: Unless otherwise announced, all assignments, including written homework, programming assignments, project source code and supporting documentation, are to be submitted on Blackboard ONLY. The time by which the assignment must be uploaded to Blackboard will vary but will be specified.

NOTE:. Please keep track of your grades as posted on Blackboard! If you have an issue with an assignment grade you must bring it to my attention within one week after the grade is posted.

Required Statements:

Academic Honesty Statement: Academic honesty is very important. It is dishonest to cheat on exams, to copy term papers, to submit papers written by another person, to fake experimental results, or to copy or reword parts of books or articles into your own papers without appropriately citing the source. Students committing or aiding in any of these violations may be given failing grades for an assignment or for an entire course, at the discretion of the instructor. In addition to any academic action taken by an instructor, these violations are also subject to action under the University of Maine Student Conduct Code. The maximum possible sanction under the student conduct code is dismissal from the University.

Course Schedule Disclaimer (Disruption Clause):

In the event of an extended disruption of normal classroom activities, the format for this course may be modified to enable its completion within its programmed time frame. In that event, you will be provided an addendum to the syllabus that will supersede this version.

Observance of Religious Holidays/Events: The University of Maine recognizes that when students are observing significant religious holidays, some may be unable to attend classes or labs, study, take tests, or work on other assignments. If they provide adequate notice (at least one week and longer if at all possible),

these students are allowed to make up course requirements as long as this effort does not create an unreasonable burden upon the instructor, department or University. At the discretion of the instructor, such coursework could be due before or after the examination or assignment. No adverse or prejudicial effects shall result to a student's grade for the examination, study, or course requirement on the day of religious observance. The student shall not be marked absent from the class due to observing a significant religious holiday. In the case of an internship or clinical, students should refer to the applicable policy in place by the employer or site.

Sexual Discrimination Reporting

The University of Maine is committed to making campus a safe place for students. Because of this commitment, if you tell a teacher about an experience of sexual assault, sexual harassment, stalking, relationship abuse (dating violence and domestic violence), sexual misconduct or any form of gender discrimination involving members of the campus, your teacher is required to report this information to the campus Office of Sexual Assault & Violence Prevention or the Office of Equal Opportunity.

If you want to talk in confidence to someone about an experience of sexual discrimination, please contact these resources:

For confidential resources on campus: Counseling Center: 207-581-1392 or Cutler Health Center: at 207-581-4000.

For confidential resources off campus: Rape Response Services: 1-800-310-0000 or Partners for Peace: 1-800-863-9909.

Other resources: The resources listed below can offer support but may have to report the incident to others who can help:

For support services on campus: Office of Sexual Assault & Violence Prevention: 207-581-1406, Office of Community Standards: 207-581-1409, University of Maine Police: 207-581-4040 or 911. Or see the OSAVP website for a complete list of services at http://www.umaine.edu/osavp/

Topics: We will cover a number of topics including the definition of cloud computing, the technological path leading to cloud computing, cloud service/deployment models, virtualization, virtual machines, containers, container orchestration mechanisms, cloud-based storage systems, and scalable cloud technologies (e.g., Spark, Hadoop, map/reduce computational paradigm, elastic file systems, and micro-services architectures). The schedule from Spring 2020 is provided below.

Week	Main Topics Covered
1	Defining Cloud Computing, Cloud Providers, Cloud Infrastructure
2	Technologies enabling Cloud computing, Parallel/Distributed programming models, cluster computing, Grid computing, Web services
3	Cloud Storage Models
4	Umaine ACG Open Stack Cloud
5	Virtualization, Virtual Machines,Containers
5	Computing in the Cloud: Message Passing Interface
6	Computing in the Cloud: Pthreads
7	Docker Compose
8	Microservices Architecture, DockerCoins Example
9	Docker Swarm
10	Student Presentations: SQLite, Flask, Cloud Storage

11	Student Presentations: Building container services, Docker Swarm networking, Nginx
12	Example adding new service to microservices application
13	Python multithreading, Container Communication
14	Scaling Applications in the Cloud