CS4843: Cloud Computing, Fall 2018

Time : MW 7:30pm -- 8:45pm

Instructor: Palden Lama

Office: NPB 3.210

Office hours: Monday and Wednesday 10 am – 11:30 am

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Course Description This course encompasses a comprehensive study of the system architecture, enabling technologies, software environment, and innovative applications of cloud computing. The course will give students an overview of the inner-workings of the open source cloud operating system (OpenStack), virtualization techniques and provide hands-on training on the automation of cloud operations, cloud performance benchmarking, and processing big data in the cloud using parallel programming models such as MapReduce and Spark.

Tentative Course topics

- Cloud Computing :
  - History of Cloud Computing
  - Current & future trends
  - Virtualization
  - Benchmarking HPC cluster in the Cloud (using OpenMPI)
- OpenStack :
  - OpenStack Architecture and components
  - OpenStack Command Line Interface (CLI)
  - OpenStack APIs
- Big Data with Hadoop :
  - Hadoop Architecture
  - Hadoop Distributed File System (HDFS)
  - MapReduce Programming
- Spark : In-Memory Cluster Computing
  - Resilient Distributed Datasets (RDD)
  - Spark Programming
  - Performance Evaluation
- Container:
  - Docker
  - Container Orchestration

Lab Assignments There will be four to five lab assignments, and they will be posted on the blackboard. Each student group (3 students) will work on the assignments together, and submit the deliverables using the blackboard. Late homework/project submissions in general will only be accepted one additional week and, will be penalized 10%, except under non-academic circumstances, such as illness and University-sanctioned events.

Python Programming Basics The students will be required to complete an online course on Python programming and submit a proof of course completion on the blackboard. Since most of the lab assignments require basic skills in Python, students are encouraged to complete the online course as early as possible, but no later than October 1st. The details of the online course will be provided on blackboard.

Final Term Project Each student group will work on a final project in the area of cloud computing. The student groups will propose their project idea, and get them approved by the instructor before working on them. A one or two page project proposal must be submitted by October 5, 2017. The final project report must be submitted by December 5, 2018. Each group will also give a project presentation and demo in class.

Few Examples of Final Projects

Study of OpenStack Swift (Cloud Object Storage)
Analyzing Twitter Data with Hadoop
Comparing the provisioning time for Docker Container and Virtual Machines
Machine learning in the Cloud
Image Processing in the Cloud
Performance Comparison MapReduce vs. Spark Computation models on Hadoop 2.0
A Study of MapReduce Query Language and Interactive Analysis of Big Data using Hive and Pig.
Container Orchestration with Kubernetes
Benchmarking Docker Container Performance

Reference Books

Distributed and Cloud Computing, From Parallel Processing to the Internet of Things, by Kai Hwang, Geoffrey C. Fox, Jack J. Dongarra (any edition will be ok).

Hadoop: The Definitive Guide, by Tom White (any edition will be ok).

Python for Everybody: Exploring Data in Python 3 (Publisher: Amazon) - By Charles Severance and Sue Blumenberg.

Required Background

- Prerequisite: CS 3423 Systems Programming
- Knowledge of UNIX systems and strong programming skills (Python is the preferred language).

Grading

The final grade will be composed of

- **Class Participation** 5%
- **Online Python Course Completion** 5%
- **Midterm (take home exam)** 20%
- **Lab Assignments** 40%
- **Final Project, Presentation+Demo** 30%

Grades will be assigned as follows:

$90 \leq \{A\}$; $87 \leq \{A-\} < 90$

$84 \leq \{B+\} < 87$; $80 \leq \{B\} < 84$;

$75 \leq \{C+\} < 80$; $70 \leq \{C\} < 75$;

$65 \leq \{D+\} < 70$; $60 \leq \{D\} < 65$

E/F: below 60

Important Dates

Online Python Course Completion Due 10/1
Final Project Proposal Due 10/5
Midterm (take home) 10/8
Final Project Presentations 11/26, 11/28, 12/3, 12/5
Final Project Report Submission Due 12/5

Course Policies

- Class attendance is required to receive credit for participation. Students who are observing a religious holy day or are participating in a University-sanctioned event may be excused, when prior notice is given to the instructor.
- Students are strongly encouraged to provide course evaluation at the end of the semester. Student feedback in the course evaluations will be used by professors to improve their teaching and it is used by the University as one factor in evaluating the instructor's effectiveness.
- Late homework/project submissions in general will only be accepted one additional week and, will be penalized 10%, except under non-academic circumstances, such as illness and University-sanctioned events.

University Policies and General Information

http://utsa.edu/syllabus
Note: The syllabus is subject to minor changes.