CS 6304 – Cloud Computing and Big Data Management

Department–Computer Science   Term – Fall, 2019   Credit – 03

Instructor – Dr. Sanjay Madria, madrias@mst.edu, www.mst.edu/~madrias

Time and Location: Thursday, 4 pm to 6.30 pm, room: CS 209

Office Hours: Thursday: 10am – 11am, other times by appointment only

Objective: The objective of this class is to learn different facets of "cloud computing", and "Big Data Management". From Big data perspective, it is about learning big data technology, such as MongoDB, Mahout (Machine learning), Pig, HBase, Hive, MapReduce/Spark and Hadoop. We will study the architectures of different cloud computing models with respect to virtualization, multi-tenancy, privacy, security, data management and indexing, scheduling and cost analysis. From privacy and security point of view, privacy in cloud computing is the ability of user to control what information they reveal about themselves over the cloud or to a cloud service provider, and the ability to control who can access that information. Cloud requires a user-centric access control where every user's request for any provider is accompanied with the user identity and entitlement information. The privacy focus is to provide privacy via a standard system in the form of a middleware agent, which mediates interactions between entities communicating over the cloud. Students are also expected to participate in the class actively by means of in-depth programming HWs, group research project in multiple phases to demonstrate clear understanding, and individual paper presentations (assigned by the instructor) and written critical review of papers and suggestions for improvement. Various software resources will be made available including projects on Ec2/Cloud at S&T from Cloudera.

Course Content:

1. Cloud Computing Architectures
2. MapReduce, Hadoop and Spark for Big Data Computing
3. Big data technology: MongoDB, Pig, Mahout, HBase and Hive
4. Big Data Management and NoSQL Databases
5. Cloud Data Management and Indexing
6. Big Data Privacy and Security Issues
7. Accountability in Cloud
8. Cloud Scale Transaction Management

Grading Policy:

Research Project – 50%

Paper Presentations, Weekly Project Meetings and Class Participation – 10%

5 Programming HWs – 25%

MCQ/Short Q/A Exam – 15%

Background Required

- Strong programming (Java, Python, etc.) experience and hands-on capability
    - Lots of time-consuming system setup, development, debugging, etc..
- Solid data structure and algorithm knowledge
    - Hash Table, B-Tree, etc…
- Self-learning capability for tools use
    - Basic Statistics and Probability, DBMS, Data Mining will help

Course Policy

- Homework is due by 11.59 PM on the due date submitted using Blackboard. Late HWs will be graded with 50% penalty for 1st day.
- Homework and Project will be assigned in a group of maximum of three students. If any student wants to do the assignments and project alone, he can chose to do so, but not allowed later to join any other group.
- I strongly recommend you not to miss the classes and I may take action on being absent more than 5 classes other than due to sickness/Emergency and reserve the right to drop you from the class.
- No make up test/quiz unless under some special cases such as illness with doctor's written advice for rest or under some valid emergency. In any such case, I need to be informed by email with 24 hours and I must agree.

Some important Information:

Title IX
Missouri University of Science and Technology is committed to the safety and well-being of all members of its community. US Federal Law Title IX states that no member of the university community shall, on the basis of sex, be excluded from participation in, or be denied benefits of, or be subjected to discrimination under any education program or activity. Furthermore, in accordance with Title IX guidelines from the US Office of Civil Rights, Missouri S&T requires that all faculty and staff members report, to the Missouri S&T Title IX Coordinator, any notice of sexual harassment, abuse, and/or violence (including personal relational abuse, relational/domestic violence, and stalking) disclosed through communication including but not limited to direct conversation, email, social

media, classroom papers and homework exercises.

Missouri S&T's Title IX Coordinator is interim chief diversity officer Neil Outar. Contact him (naoutar@mst.edu; (573) 341-6038; Temporary Facility A-1200 N. Pine Street) to report Title IX violations. To learn more about Title IX resources and reporting options (confidential and non-confidential) available to Missouri S&T students, staff, and faculty, please visit http://titleix.mst.edu. **Disability Support Services:** http://dss.mst.edu Any student inquiring about academic accommodations because of a disability should be referred to Disability Support Services so that appropriate and reasonable accommodative services can be determined and recommended. Disability Support Services is located in 204 Norwood Hall. Their phone number is 341-4211 and their email is dss@mst.edu. Instructors may consider including the following statement on their course syllabus as a means of informing students about the services offered:

"If you have a documented disability and anticipate needing accommodations in this course, you are strongly encouraged to meet with me early in the semester. You will need to request that the Disability Services staff send a letter to me verifying your disability and specifying the accommodation you will need before I can arrange your accommodation."

Student Honor Code and Academic Integrity:

Please take a few minutes to stress the importance of academic integrity in class. Discuss why it should matter to the student, why it matters to you and your discipline, why it matters to Missouri S&T, and why it matters to future employers. Include a statement on your syllabus about the Honor Code developed and endorsed by the Missouri S&T Student Council: the Honor Code can be found at this link: http://stuco.mst.edu/honor-code/. Encourage students to read and reflect upon the Honor code and its emphasis on HONESTY and RESPECT.

Page 30 of the Student Academic Regulations handbook describes the student standard of conduct relative to the University of Missouri System's Collected Rules and Regulations section 200.010, and offers descriptions of academic dishonesty including cheating, plagiarism or sabotage (http://registrar.mst.edu/academicregs/index.html). Additional guidance for faculty, including the University's Academic Dishonesty Procedures, is available on-line at http://academicsupport.mst.edu. Other informational resources for students regarding ethics and integrity can be found online at http://academicsupport.mst.edu/academicintegrity/studentresources-ai .

S&Tconnect: https://canvas.mst.edu/ (S&Tconnect icon on left toolbar)

S&Tconnect provides an enhanced system that allows students to request appointments with their instructors and advisors via the S&Tconnect calendar, which syncs with the faculty or staff member's Outlook Exchange calendar. S&Tconnect will also facilitate better communication overall to help build student academic success and increase student retention. S&Tconnect Early Alert has replaced the Academic Alert system used by Missouri S&T. If training is needed, please contact Rachel Morris at rachelm@mst.edu or 341-7600.

Classroom Egress Maps:
Faculty should explain where the classroom emergency exits are located. Please include a statement in your course syllabus asking the students to familiarize themselves with the classroom egress maps posted on-line at: http://designconstruction.mst.edu/floorplan/.
• _Accessibility and Accommodations:

It is the university's goal that learning experiences be as accessible as possible. If you anticipate or experience physical or academic barriers based on disability, please contact Disability Support Services at (573) 341-6655, dss@mst.edu, or visit http://dss.mst.edu/ for information, or go to mineraccess.mst.edu to initiate the accommodation process. *Please be aware that any accessible tables and chairs in this room should remain available for students who find that standard classroom seating is not usable.*

• **LEAD Learning Assistance** http://lead.mst.edu

The Learning Enhancement Across Disciplines Program (LEAD) sponsors free learning assistance in a wide range of courses for students who wish to increase their understanding, improve their skills, and validate their mastery of concepts and content in order to achieve their full potential. LEAD assistance starts no later than the third week of classes. Check out the online schedule at http://lead.mst.edu/assist, using zoom buttons to enlarge the view. Look to see what courses you are taking have collaborative LEAD learning centers (bottom half of schedule) and/or Individualized LEAD tutoring (top half of the schedule). For more information, contact the LEAD office at 341-7276 or email lead@mst.edu.

• **The Burns & McDonnell Student Success Center**

The Student Success Center is a centralized location designed for students to visit and feel comfortable about utilizing the campus resources available. The Student Success Center was developed as a campus wide initiative to foster a sense of responsibility and self-directedness to all S&T students by providing peer mentors, caring staff, and approachable faculty and administrators who are student centered and supportive of student success. Visit the B&MSSC at 198 Toomey Hall; 573-341-7596; success@mst.edu; facebook:

www.facebook.com/SandTssc; web: http://studentsuccess.mst.edu/ If you have any questions about the information listed above, please contact the Office of Academic Support at 573-341-7276.