University of Maine, School of Computing and Information Science

SIE558 Real-time Sensor Data Streams

Silvia Nittel

Contact Information:

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Office Hours:
Office hours for this course will be announced at the beginning of the semester.
Alternatively, contact me.

Credits: 3
Prerequisite:Graduate standing, SIE 555, programming experience in Java,
C++, or C

Catalog description
This course is an introduction into the technology of sensor data stream
management. This data management technology is driven by computing through
sensors and other smart devices that are embedded in the environment and
attached to the internet, constantly streaming sensed information. With streams
everywhere, Data Stream Engines (DSE) have emerged aiming to provide
generic software technology similar to that of database systems for analyzing
streaming data with simple queries in real-time. Sensor streams are ultimately
stored in databases and analyzed using scalable cloud technologies.

Topics covered:
• Introduction to sensor data stream management systems
• Data stream engine software
• Data model and query language concepts
• Stream query processing
• Stream query optimization techniques
• Adaptive stream query processing techniques
• Real-time sensor data stream management
• Historic sensor stream management in the cloud

Course outline

Week	Topic
week 1	*Organizational meeting* *Literature Search* Introduction to Sensor Stream Management.
week 2	Visions and Overviews. Prototype Stream Systems.
week 3	Stream Data Model Languages..
week 4	Query Languages. Semantics and Stream Query Processing.
week 5	Stream Query Processing Stream Query Operators
week 6	Stream Query Processing Query Optimization
week 7	Query Processing and Constraints Adaptive Query Processing/Migration
week 8	Scheduling of Operators and Queries Approximation/Sampling/Estimation
week 9	Sensor Data Management Sensor Applications
week 10	The Field as Data Type for Big Spatial Data I The Field as Data Type for Big Spatial Data II
week 11	THANKSGIVING BREAK
week 12	Big Sensor Data Management in the Cloud I Big Sensor Data Management in the Cloud II
week 13	Integrating live Sensor Streams with Historic Streams
week 14	FINAL PROJECTS

Textbooks:
Real-Time Analytics: Techniques to Analyze and Visualize Streaming Data, Bryon Ellis, Wiley 2014
Data Stream Management (Synthesis Lectures on Data Management), Lukasz Golab, M. Tamer Ozsu, Morgan & Claypool Publishers (2010)

Software:

We will use the Apache Storm data stream engine platform.

Course Goals and Objectives

- Introduce students to central concepts of data stream management concepts, applications, and programming
- Develop an understanding of data stream processing and optimization
- Learn in particular new advances in the subject areas of sensor and stream data management systems.

- Develop skills needed to critically analyze technical literature.
- Get practice designing a research or application project related to stream or sensor data management.
- Practice skills to communicate your ideas to an audience in a presentation or a scientific discussion.

Learning outcomes:

Upon completion of this course, students should be able to:

- Explain the differences and similarities between traditional database systems and stream engines.
- Describe the different components, including their underlying principles and algorithms, of a stream engine.
- Design and develop a stream- or sensor-related database project.
- Gain skills in understanding, programming and applying data stream engine technology.

Grading, Class Policies and Course Expectations

As a graduate level course, you are expected to exhibit high quality work that demonstrates sound understanding of the concepts and their complexity. Earning an "A" represents oral and written work that is of exceptionally high quality and demonstrates superb understanding of the course material. A "B" grade represents oral and written work that is of good quality and demonstrates a sound understanding of course material. A "C" grade represents a minimally adequate completion of assignments and participation demonstrating a limited understanding of course material.

Grading criteria:

Homework assignments (programming, paper presentations) – 50%

Class participation– 10%

Final Project (programming project and presentation)– 40%

Academic honesty

Academic honesty is expected. Plagiarism—one form of academic dishonesty—is the handing in of work not substantially the student's own. It is usually done without reference, but is unacceptable even in the guise of acknowledged copying. It is not cheating, however, to discuss ideas and approaches to a problem, nor is it cheating to seek or accept help with a program or with writing a paper. Indeed, a moderate form of collaboration is encouraged as a useful part of any educational process. Nevertheless, good judgment must be used, and

students are expected to present the results of their own thinking and writing. Plagiarism is unacceptable in this course and will result in a failing grade.

Students with disabilities:

If you have a disability for which you may be requesting an accommodation, please contact Ann Smith, Coordinator of Services for Students with Disabilities (Onward Building, 581-2319), as early as possible in the term.

Extended disruption:

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.

UMaine's 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: 207-581-4000.
- For confidential resources on campus: Rape Response Services: 1-800-310-0000 or Spruce Run: 1-800-863-9909.
- The following resources on campus can offer support but may have to report the incident to others who can help: 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.

See the OSAVP website for a complete list of services at
http://www.umaine.edu/osavp/