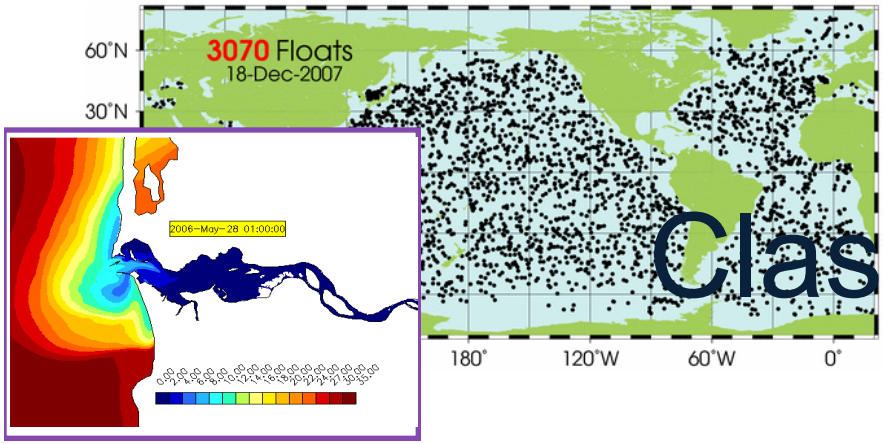
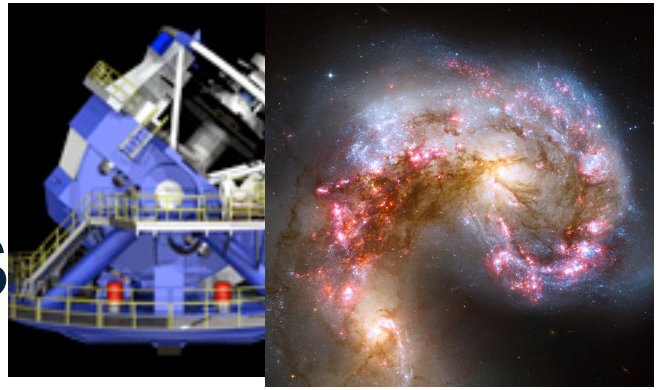
Introduction to Data Management
CSE 344

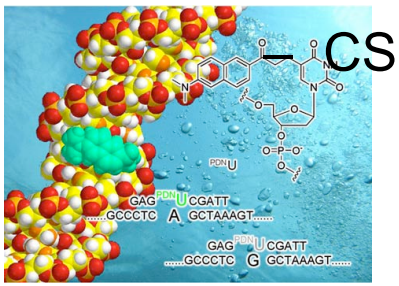
Lecture 1: Introduction

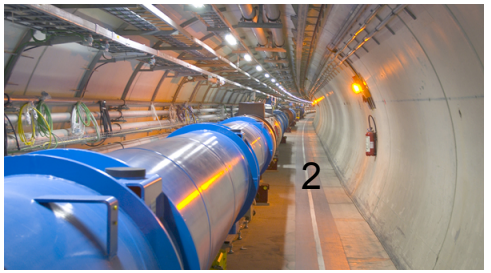


Class Goals



- The world is drowning in data!
- Need computer scientists to help manage this data
  - Help domain scientists achieve new discoveries
  - Help companies provide better services (e.g. Facebook)
  - Help governments become more efficient
- Welcome to 344: Introduction to Data Management
  - Existing tools PLUS data management principles
- Next steps:
  - CSE 444: build data management systems
  - CSE 446: learn interesting facts from data





Staff

- Instructor: Hal Perkins
  - perkins@cs.washington.edu
  - Office CSE 548: tbd + when door is open
- TAs:
  - Siena Dumas Ang
  - Srini Iyer
  - Dan Radion
  - Shengliang Xu

  Office hours will be posted on the course calendar shortly – fill out the doodle to help us figure out good ones!

- Contacting staff:
  - Discussion board for most things, but email to cse344-staff@cs if needed

Course Format

- Lectures MWF, 1:30-2:20 pm
- Sections: Th 9:30, 10:30, 11:30
  - Content: exercises, tutorials, questions
  - Locations: see web
- 8 Homework assignments:
- 7 Web quizzes
- Midterm and final

Communications

- Web page: http://www.cs.washington.edu/344
  - Syllabus is there
  - Lectures will be available there (see calendar)
  - Homework assignments will be available there
  - Link to web quizzes is there
- Mailing list
  - Announcements (low traffic – must read)
  - Registered students automatically subscribed
- Discussion board
  - Great place to ask course-related questions
  - Post a message today (so it'll track new ones for you)

Textbook

Main textbook, available at the bookstore:

- *Database Systems: The Complete Book*,
  Hector Garcia-Molina,
  Jeffrey Ullman,
  Jennifer Widom

  Second edition.

Most important: COME TO CLASS ! ASK QUESTIONS !

Other Texts

Available at the Engineering Library
(some on reserve):

- *Database Management Systems*, Ramakrishnan
- *XQuery from the Experts*, Katz, Ed.
- *Fundamentals of Database Systems*, Elmasri, Navathe
- *Foundations of Databases*, Abiteboul, Hull, Vianu
- *Data on the Web,* Abiteboul, Buneman, Suciu

Grading

- Homeworks 30%
- Web quizzes 20%
- Midterm 20%
- Final 30%

Eight Homework Assignments

H1&H2: Basic SQL with SQLite

H3: Advanced SQL with SQL Server

H4: Relational algebra, Datalog

H5: XML and XQuery with Saxon

H6: Conceptual Design

H7: SQL in Java (JDBC)

H8: Parallel processing with MapReduce

Most due Thursday nights 11 pm – submit via dropbox!

About the Assignments

- Homework assignments will take time but most time should be spent *learning*
- Do them on your own
- Very practical assignments
- Put everything on your resume!!!
  - SQL, SQLite, SQL Server, SQL Azure JDBC, XML, XQuery, Saxon, Amazon Elastic MapReduce, Hadoop, Pig Latin, …

Deadlines and Late Days

- Assignments are expected to be done on time, but things happen, so…
- You have up to 4 late days to use during the quarter on homework only
  - No more than 2 on any one assignment
  - Use in 24-hour chunks
- Late days = safety net, not convenience!
  - You should not plan on using them
  - If you use all 4 you are doing it wrong

Academic Integrity

- Anything you submit for credit is expected to be your own work
  - Of course you should exchange ideas with others – but not detailed solutions
  - We all know the difference between appropriate collaboration and cheating
  - If you attempt to gain credit for work you did not do, or help others do so, it's misconduct
- I trust you implicitly, but will come down hard on any violations of that trust

Seven Web Quizzes

- Class token on the white board: write it down
- Short online tests
- Can take many times: best score counts!
- No late days – closes at 11:00 deadline
  - Will drop lowest score
- Provide explanations for wrong answers
- Will help you
  - Test your knowledge
  - Stay in synch with class
  - Get ready for homeworks

Web quizzes generally due Tuesday nights

Exams

- Midterm (tbd) and Final (Mon. 12/8, 2:30)
  - Midterm preferences? Fri. 10/31 or Mon. 11/3?
- Open book, no notes, computers, etc.!
- Check course website for dates
- Location: in class

Outline of Today's Lecture

- Overview of database management systems
  - Why they are helpful
  - What are some of their key features
  - What are some of their key concepts

- Course content

Database

What is a database ?

Give examples of databases

Database

What is a database ?

- A collection of files storing related data

Give examples of databases

- Accounts database; payroll database; UW's students database; Amazon's products database; airline reservation database

Database Management System

What is a DBMS ?

Give examples of DBMSs

Database Management System

What is a DBMS ?

- *A big program written by someone else that allows us to manage efficiently a large database and allows it to persist over long periods of time*

Give examples of DBMSs

- Oracle, IBM (DB2, Informix), Microsoft (SQL Server, Access)
- Sybase
- Open source: MySQL (Sun/Oracle), PostgreSQL
- Open source library: SQLite

We will focus on relational DBMSs most quarter

An Example: Online Bookseller

- What data do we need?
  -
  -
  -
- What capabilities on the data do we need?
  -
  -
  -

An Example: Online Bookseller

- What data do we need?
  - Data about books, customers, pending orders, order histories, trends, preferences, etc.
  - Data about sessions (clicks, pages, searches)
  - Note: data must be persistent! Outlive application
- What capabilities on the data do we need?
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An Example: Online Bookseller

- What data do we need?
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  - Note: data must be persistent! Outlive application
- What capabilities on the data do we need?
  - Insert/remove books, find books by author/title/ category/price, create order history, sales
  - Find popular books; recommend books
  - Note: data must be accessed efficiently, by many users

Multi-user discussion

- Jane and John both have ID number for gift certificate (credit) of $200 they got as a wedding gift
  - Jane @ her office orders "The Selfish Gene, R. Dawkins" ($80)
  - John @ his office orders "Guns and Steel, J. Diamond" ($100)

- Questions:
  - What is the ending credit?
  - What if second book costs $130?
  - What if system crashes?

Discussion

- Did you ever encounter a data management problem?
  - Experimental data from a homework?
  - Personal data?
  - Other data?
- How did you manage your data?

DBMS Benefits

- Expensive to implement all these features inside the application
- DBMS provides these features (and more)
- DBMS simplifies application development

Client/Server Architecture

- One *server* that stores the database (DBMS):
  - Usually a beefy system
  - But can be your own desktop…
  - … or a huge cluster running a parallel DBMS
- Many *clients* run apps and connect to DBMS
  - E.g. Microsoft's Management Studio
  - Or psql (for PostgreSQL)
  - Or some Java/C++ program (very typical)
- Clients "talk" to server using JDBC protocol

People

- **DB application developer**: writes programs that query and modify data (344)
- **DB designer**: establishes schema (344)
- **DB administrator**: loads data, tunes system, keeps whole thing running (344, 444)
- **Data analyst**: data mining, data integration (344, 446)
- **DBMS implementor**: builds the DBMS (444)

Key Data Mngmt Concepts

- **Data models**: how to describe real-world data
  - Relational, XML, graph data (RDF)
- **Schema v.s. data**
- **Declarative query language**
  - Say what you want not how to get it
- **Data independence**
  - Physical independence: Can change how data is stored on disk without maintenance to applications
  - Logical independence: can change schema w/o affecting apps
- **Query optimizer** and compiler
- **Transactions**: isolation and atomicity

What This Course Contains

- **Focus: Using DBMSs**
- Relational Data Model
  - SQL, Relational Algebra, Relational Calculus, datalog
- Semistructured Data Model
  - XML, XPath, and XQuery
- Conceptual design
  - E/R diagrams, Views, and Database normalization
- Transactions
- Parallel databases, MapReduce, and Pig-Latin
- Data integration and data cleaning

What to Do Now

http://www.cs.washington.edu/344

- Webquiz 1 is open
  - Create account at http://newgradiance.com/
  - Use course token
  - Webquiz due next Tuesday, 11 pm
- Homework 1 is posted
  - Simple queries in SQL Lite
  - Homework due next Thursday, 11 pm
- Sign overload sheet if you're still trying to register
- Post a reply to the "hello" discussion board msg
- Bring a laptop to section tomorrow!!
  - With sqlite ready to run if you can!