Introduction to Database Systems CSE 444

Lecture #1

March 31, 2008

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Staff

- Instructor: Hal Perkins
  - CSE 548, perkins at cs
    Office hours: Mon 4-4:30+, Wed 4:30-5:00+,
    CSE006 lab + dropins + appointments
- TAs:
  - Huei-hun Elizabeth Tseng, lachesis at cs
  - Zackary Allred, jaerys at cs
  - Office hours tbd

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Communications

- Web site: www.cs.washington.edu/444
  - Lectures available here (usually the morning before class)
  - Homework posted here (HW0 & HW1 are posted now)
  - The project description is also here (Project phases 0 and 1 are posted!)
- Discussion board
  - Will be linked from web site
  - Please watch, contribute
- Mailing list
  - Everyone automatically subscribed
  - Mainly for announcements from course staff, etc.

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Textbook(s)

Main textbook, available at the bookstore:

- *Database Systems: The Complete Book,* Hector Garcia-Molina, Jeffrey Ullman, Jennifer Widom
  - Most chapters are good. Some are not as great (functional dependencies).
- COME TO CLASS ! ASK QUESTIONS ! READ SLIDES !

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Other Texts

Available at the Engineering Library (not on reserve):

- *Database Management Systems*, Ramakrishnan
- *Xquery*, Walmsley
- *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

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Outline of Today's Lecture

1. Overview of DBMS
2. DBMS through an example
3. Course outline
4. Homeworks 0 & 1, Project phases 0 & 1

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Database

What is a database ?

Give examples of databases

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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

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Database Management System

What is a DBMS ?

Give examples of DBMS

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Database Management System

What is a DBMS ?

- *A big C/C++ 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 DBMS

- DB2 (IBM), SQL Server (MS), Oracle, Sybase
- MySQL, Postgres, …

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RDBMS Market Shares

In 2006, www.gartner.com

- Oracle: 47% market share, $7.2BN in sales
- IBM: 21% market share with $3.2BN in sales
- Microsoft: 17% market with $2.6BN in sales

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An Example

The Internet Movie Database
http://www.imdb.com

- Entities:
  Actors (800k), Movies (400k), Directors, …
- Relationships:
  who played where, who directed what, …

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Tables

Directors:

id	fName	lName
15901	Francis Ford	Coppola
. . .		

Movie_Directors:

id	mid
15901	130128
. . .	

Movies:

mid	Title	Year
130128	The Godfather	1972
. . .		

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What the Database Systems Does

1. Create/store large datasets
2. Search/query/update
3. Change the structure
4. Concurrent access to many user
5. Recover from crashes
6. Security

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Possible Organizations

- Files
- Spreadsheets
- DBMS

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1. Create/store Large Datasets

- Files — Yes, but…
- Spreadsheets — Not really…
- DBMS — Yes

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2. Search/Query/Update

- Files
- Spreadsheets
- DBMS

Simple queries (grep); Updates are difficult

Simple queries; Simple updates

All

Updates: generally OK

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3. Change the Structure

Add *Address* to each Actor

- Files
- Spreadsheets
- DBMS

Very hard

Yes

Yes

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4. Concurrent Access

Multiple users access/update the data concurrently

Lost updates; inconsistent reads,…

- What can go wrong ?
- How do we protect against that in OS ?
- This is insufficient in databases; why ?

locks

A logical action consists of multiple updates

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5. Recover from crashes

- Transfer $100 from account #4662 to #7199:

```
X = Read(Account, #4662);
X.amount = X.amount - 100;
Write(Account, #4662, X);

Y = Read(Account, #7199);
Y.amount = Y.amount + 100;
Write(Account, #7199, Y);
```

CRASH !

What is the problem ?

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6. Security

- Files
- Spreadsheets
- DBMS

File-level access control

Same [?]

Table/attribute-level access control

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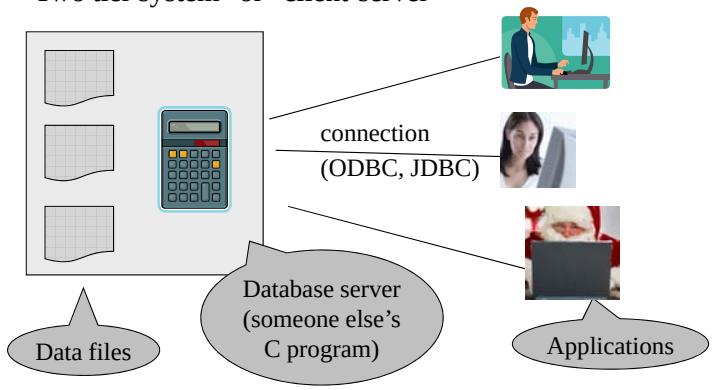
Enters a DMBS

"Two tier system" or "client-server"



Data Independence

Logical view

Directors:

id	fName	lName
15901	Francis Ford	Coppola
. . .		

Movie_Directors:

id	mid
15901	130128
. . .	

Movies:

mid	Title	Year
130128	The Godfather	1972
. . .		

Directors_file **Moviews_title_index_file**

Directors_fname_index_file **Movies_file**

Physical view

What the Database Systems Does

1. Create/store large datasets
2. Search/query/update
3. Change the structure
4. Concurrent access to many user
5. Recover from crashes
6. Security

SQL DML

SQL DDL

Transactions ACID

Grant, Revoke, Roles

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Course Outline - TENTATIVE !!

1. 3/31: SQL
2. 4/7: Views, Constraints, SQL in C#
3. 4/14: Database Design: E/R, NF
4. 4/21: XML/XPath/XQuery
5. 4/28: Midterm, security
6. 5/5: Transactions, recovery, concurrency
7. 5/19: Database storage, indexes, query execution
8. 5/28: Physical operators, optimization

- Calendar on web site – updated as we go

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Grading (TENTATIVE)

- Homework 30%
- Project 25%
- Midterm 15%
- Final 25%
- Intangibles: 5%

Late days: Up to 4 total per quarter, at most 2 on any particular assignment/project phase. Otherwise **no late assignments accepted**

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Reading Assignment

- Reading assignment for Fri, Sept.28
  - **Introduction** from **SQL for Web Nerds,** by Philip Greenspun, http://philip.greenspun.com/sql/ (link on the course web)
- This is a one-time assignment, no grading, BUT *very* instructive and lots of fun reading

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Homework

- Homework 0:
  - Due this Friday! (Don't panic – page with your name/picture/etc.)
- Homework 1:
  - SQL Queries
  - Due Friday, April 11
  - It is posted already!
- Homework 2:
  - Conceptual design: E/R diagrams, Normal Forms
  - Due Friday, April 25
- Homework 3:
  - XML/Xquery
  - Due Friday, May 9
- Homework 4:
  - Transactions: concurrency control and recovery
  - Due Friday, May 23

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The Project: Boutique Online Store

- Phase 0:
  - Partner details; due middle of next week
- Phase 1:
  - Design a Database Schema, Build Related Data Logic
  - Due Friday, April 18
- Phase 2:
  - Import data, Web Inventory Data Logic
  - Due Friday, May 2
- Phase 3:
  - Checkout Logic
  - Due Friday, May 16
- Phase 4:
  - Database Tuning
  - Due Friday, May 30

Project

SQL Server, C#, ASP.NET

- Supported
- Will provide starter code in C#, ASP.NET
- The import data is in SQL/XML on SQL Server

Alternative technologies: MySQL, postgres, PHPs

- Technically possible
- Not support or encouraged. Talk to instructor if you think you have a compelling reason for even considering this.
  - Religious commitment to LAMP is not a compelling reason

Accessing SQL Server – Today!

SQL Server Management Studio

- Server Type = Database Engine
- Server Name = IISQLSRV
- Authentication = SQL Server Authentication
  - Login = your UW CSE login id
  - Password = 2008#cse444
  - Change your password on first login (must be "secure")
- Details on the course web

Then play with IMDB, start thinking about HW1

Until Next Time…

- Homework 0
- Log on to SQL server – let us know *immediately* if you have problems
- Find a partner for the project (all quarter)
- Look at homework 1
- Start reading about SQL online and in the book