SECTION 4

January 27th, 2011

Today

- Database Updates
- Java Database Connectivity (JDBC)
- Transactions in SQL

Modifying the database

Three kinds of modifications in SQL:

- insertions
- updates
- deletions

Sometimes they are all called “updates”

Insertions

General form:

INSERT INTO R(A1,…., An) **VALUES** (v1,…., vn)

Insertions

Product (name, listPrice, category)
Purchase (buyer, seller, product, price)

Example: Insert a new purchase to the database:

```
INSERT INTO Purchase (buyer, seller, product, price)
       VALUES ('Joe', 'Fred', 'wakeup-clock-espresso-machine',
                199.99)
```

Missing attributes → NULL.
May drop attribute names if you give them in order.

Inserting results of a query

```
INSERT   INTO   Product (name)

     SELECT  DISTINCT Purchase.product
     FROM      Purchase
     WHERE   Purchase.date > "10/26/01";
```

The query replaces the VALUES keyword.
Here we insert *many* tuples into Product

Updates

Example:

```
UPDATE   Product
SET    price = price/2
WHERE  Product.name  IN
                (SELECT product
                  FROM    Purchase
                  WHERE  Date ='Oct, 25,1999');
```

WHERE works the same as in a query (SELECT).
It chooses the tuples whose values are to be updated

Deletions

Similar to UPDATE but without the SET clause:

```
DELETE    FROM    Purchase

WHERE     seller = 'Joe'   AND
                   product = 'Brooklyn Bridge'
```

Always specify a WHERE clause (in fact, write it first!)
Otherwise, *every tuple* will be deleted!

JDBC AND PROJECT 2

Project 2

- Movie Rental Business
  - Movies from imdb (iisqlsrv – sql server)
  - Customer Information from personal database (local – postgres)

JDBC (Java Database Connectivity)

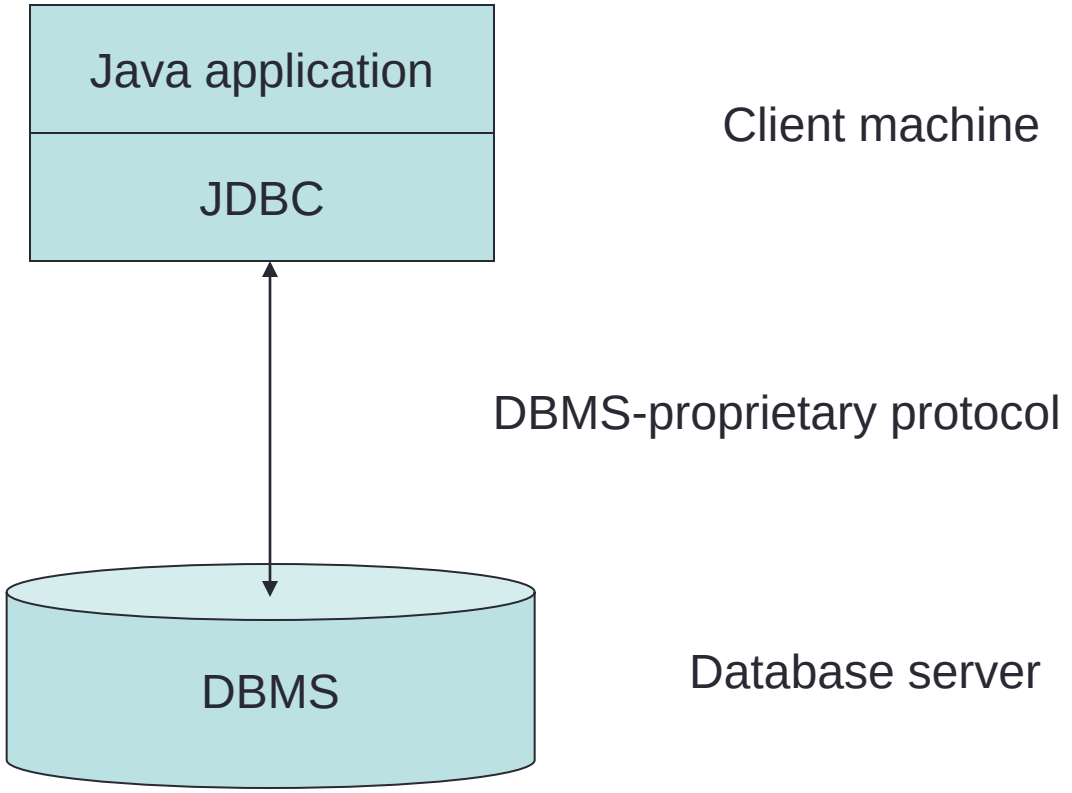
A Java API to access a database:

- Connect to a data source
- Send queries and update statements
- Retrieve and process results

Documentation:

http://java.sun.com/javase/6/docs/technotes/guides/jdbc/

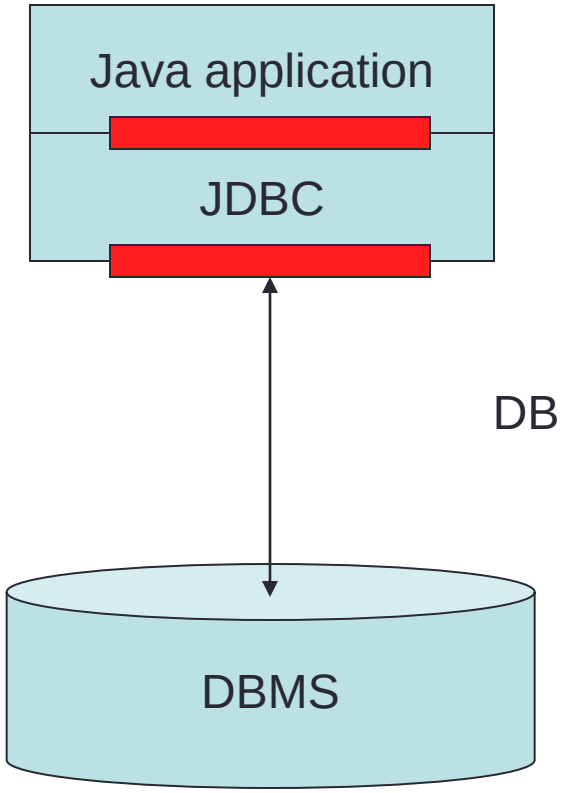
JDBC lets Java talk to your database



DBMS vendors make JDBC drivers…

JDBC API for apps

JDBC API for drivers

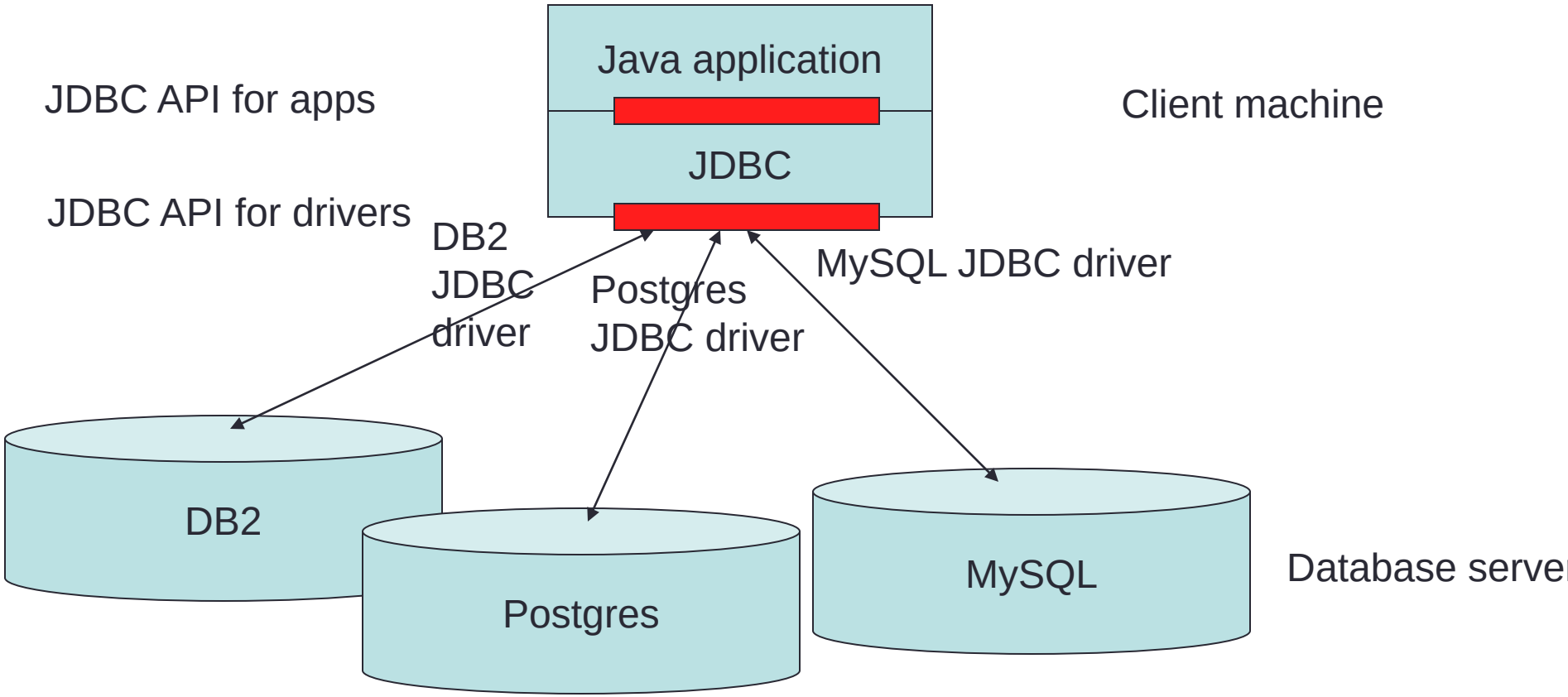


Client machine

DBMS-proprietary protocol

Database server

… letting JDBC talk to *any* database



First, load the driver

- For Project 2 look in project2.tar.gz:
  - SQL Server driver
    sqljdbc4.jar
  - PostgreSQL driver
    postgresql-8.4-701.jdbc4.jar
  - Already installed on Lab PCs (use 444shell.cmd)

- Put on class path, then tell Java to load it

```
Class.forName("com.microsoft.sqlserver.jdbc.SQLServerDriver");
Class.forName ("org.postgresql.Driver");
```

  - Class.forName() optional in current versions of Java

JDBC example

```
Connection conn = DriverManager.getConnection
      ("jdbc:sqlserver://iisqlsrv;database=username",
       "username", "password");

Statement stmt = conn.createStatement();

ResultSet rs = stmt.executeQuery
      ("SELECT a, b, c FROM Table1");

while (rs.next()) {
      int x = rs.getInt(“a”)
      String s = rs.getString(“b”)
      float f = rs.getFloat(“c”)
}
```

Close all JDBC objects when done

```
Connection conn = DriverManager.getConnection(...);
Statement stmt = conn.createStatement();
ResultSet rs = stmt.executeQuery
      ("SELECT a, b, c FROM Table1");

// do work with rs...

rs.close();
stmt.close();
conn.close();
```

```
Class.forName
  ("com.microsoft.sqlserver.jdbc.SQLServerDriver");

Connection conn = null;

try {
      conn = DriverManager.getConnection( … );


      …


} catch (Exception e) {
      e.printStackTrace();
} finally {
      conn.close();
}
```

Modifying the database

Use Statement.executeUpdate():

```
Statement stmt = conn.createStatement();

int rowsUpdated = stmt.executeUpdate (
   "UPDATE hw1_data " +
   "SET name = 'jane''s super gizmo' " +
   "WHERE name = 'gizmo3' "
);
```

- Works with any database modification, not just UPDATE
- Warning – will throw exception if you run it with a query! (it expects as output an int for rows affected, not a result set)

Update example in Java

```
// Change product "gizmo3"'s name to "jane's super gizmo“

static void runUpdate (Connection conn) throws SQLException
{
        // Our code goes here
        // Execute update
        // examine results
        // properly close connection
}
```

Parameterized queries - PreparedStatement

```
PreparedStatement pstmt = conn.prepareStatement
    ("SELECT * from hw1_data WHERE month = ? ");
…
pstmt.setString(1, "may");
ResultSet rs1 = pstmt.executeQuery();
…

pstmt.setString(1, "aug");
ResultSet rs2 = pstmt.executeQuery();

…
```

Parameterized queries - PreparedStatement

No need to worry about quotes ‘, “

```
PreparedStatement pstmt = conn.prepareStatement
    ("SELECT website FROM shops " +
        "WHERE name = ? OR owner = ? ");
…
pstmt.setString(1, "George's");
pstmt.setString(2, "Oh \"wow\"!");
…
```

Parameterized queries - PreparedStatement

No need to worry about quotes ‘, “

```
PreparedStatement pstmt = conn.prepareStatement
    ("SELECT website FROM shops " +
        "WHERE name = ? OR owner = ? ");
…
pstmt.setString(1, "George's");
pstmt.setString(2, "Oh \"wow\"!");
…
```

Single quotes without escaping!
Parameterizing lets plan be cached

```
Statement stmt = conn.createStatement();
ResultSet rs = stmt.executeQuery
      ("SELECT website FROM shops "
      + "WHERE name = 'George''s' OR …");
```

Must escape single quotes.
What if this came from user?

Parameterized query example in Java

```
// List all the sales in April, May, and June
// (separately for each month)
static void runParamQ (Connection conn) throws SQLException
{
        // Our code goes here
        pstmt = conn.prepareStatement (
                "SELECT name, discount, price " +
                "FROM hw1_data " +
                "WHERE month = ? “);
        // Our code goes here
}
```

TRANSACTIONS

Transactions

2 reasons to put related actions in a transaction:

- *Recovery:* either everything happens, or nothing does
- *Concurrency control:* make sure unrelated actions don't interfere with each other

In project 2, we mostly need the latter

SQL transaction syntax

Start a transaction:

- Standard/Postgres: `START TRANSACTION;`
- Postgres/SQL Server: `BEGIN TRANSACTION;`

Commit the transaction:

```
COMMIT;
```

Abort the transaction:

```
ROLLBACK;
```

By default: “auto-commit” (no transaction used)

Transactions in JDBC

```
String s1 = “BEGIN TRANSACTION READ ONLY”;
String s2 = “BEGIN TRANSACTION READ WRITE”;
String s3 = “COMMIT TRANSACTION”;
String s4 = “ROLLBACK TRANSACTION”;

PreparedStatement p1 = con.prepareStatement(s1);
PreparedStatement p2 = con.prepareStatement(s2);
PreparedStatement p3 = con.prepareStatement(s3);
PreparedStatement p4 = con.prepareStatement(s4);


…
p1.executeUpdate();
// transaction started
…

if (ok) p3.executeUpdate();
else p4.executeUpdate();
// transaction finished or reverted
```

Transactions in JDBC – option 2

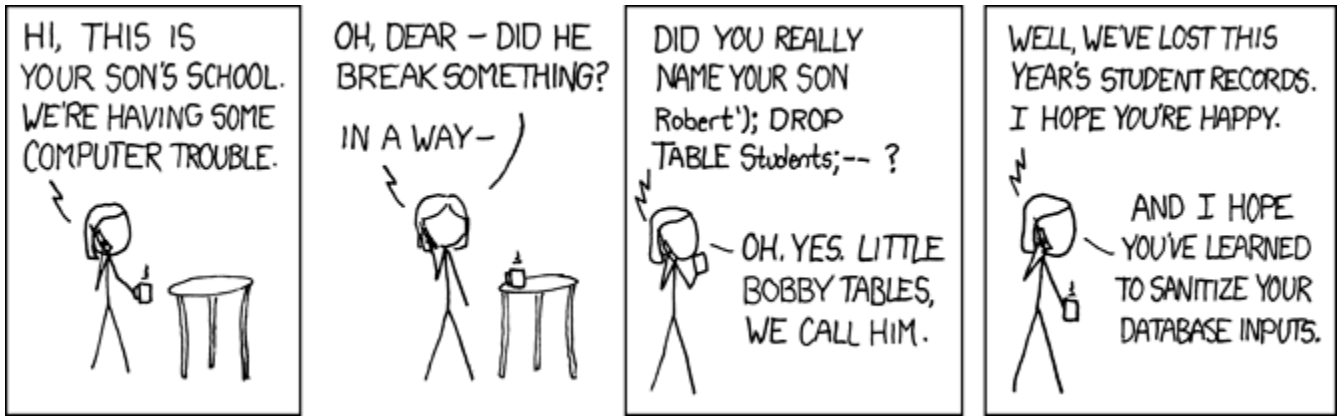
Use JDBC methods to work with transactions:

```
conn.setAutoCommit(false);
// From now on, everything is in a transaction
…

if (ok) conn.commit();
else conn.rollback();
// Old transaction done/reverted, new one started
…

conn.setAutoCommit(true);
// Now each statement executes by itself again
```

That's all!



SQL injection -- http://xkcd.com/327/