DATABASDESIGN FÖR INGENJÖRER - 1DL124

Sommar 2005

En introduktionskurs i databassystem

http://user.it.uu.se/~udbl/dbt-sommar05/
alt. http://www.it.uu.se/edu/course/homepage/dbdesign/st05/

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Database API:s

(Elmasri/Navathe ch. 9)

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Database user interfaces

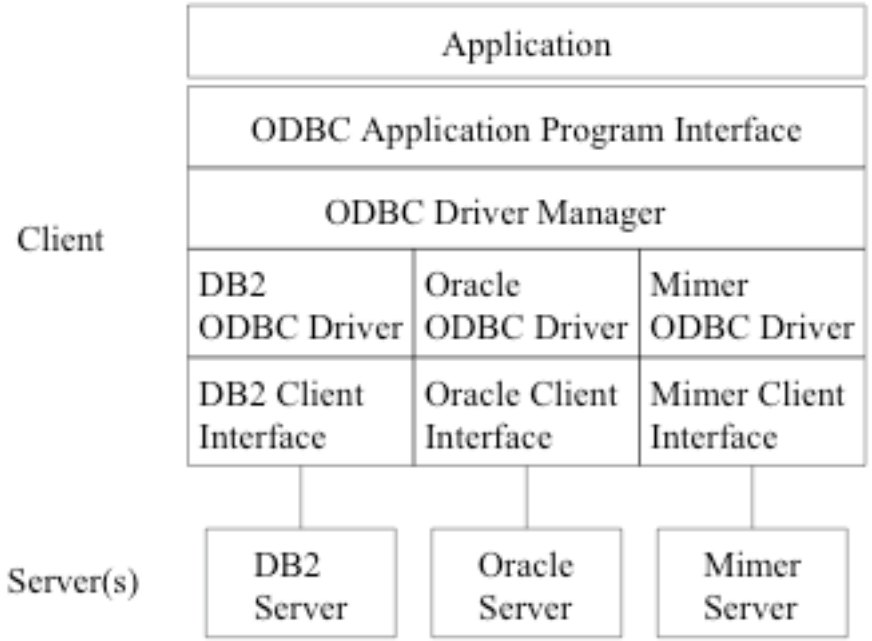
- Textual interfaces
  - Such as BSQL for Mimer
- Graphical interfaces
  - Most well-known is QBE (Query-By-Example) originally developed by IBM. MS Access uses a QBE variant.
- SQL application programming interfaces
  - Requires management of sessions, sql statements and some control of query optimization.
  - Call-level interfaces
  - Embedded SQL

Call-Level Interfaces

- Vendor-specific call-level interfaces
  - An SQL API usually for one or several host languages like C, C++, Java, Fortan, COBOL etc.
  - Support to manage sessions, SQL statements and data conversions
- SQL Call Level Interface (CLI),
  - The Call Level Interface (CLI) is a standard SQL API created by The Open Group. The API is defined for C and COBOL only. ISBN: 1-85912-081-4, X/Open Document Number: C451, 1995.
- SQL/CLI
  - Call-Level Interface (SQL/CLI) is an implementation-independent CLI to access SQL databases. SQL/CLI is an ISO standard ISO/IEC 9075-3:1995 Information technology -- Database languages -- SQL -- Part 3: Call-Level Interface (SQL/CLI). The current SQL/CLI effort is adding support for SQL:1999.
- ODBC
  - (Microsoft) Open Database Connectivity is a standard SQL API. ODBC is based on the Call Level Interface (CLI) specifications from SQL, X/Open (now part of The Open Group), and the ISO/IEC. ODBC was created by the SQL Access Group and released Sept, 1992.
- JDBC - Java Database Connectivity
  - JDBC is an SQL API for Java (to be strictly correct, JDBC is not an acronym).

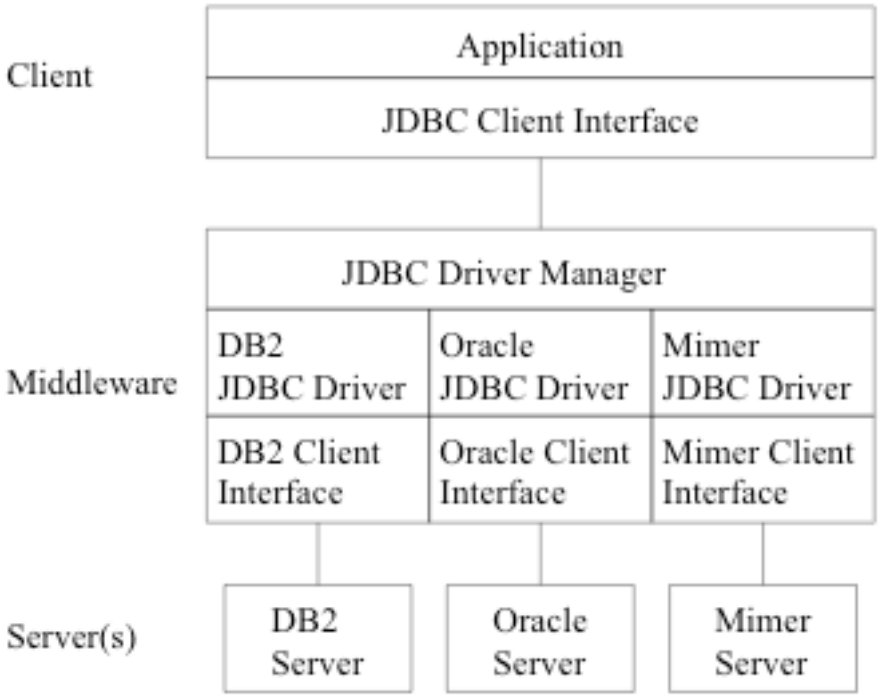
The ODBC architecture

- ODBC API is independent of any one programming language, database system or operating system.



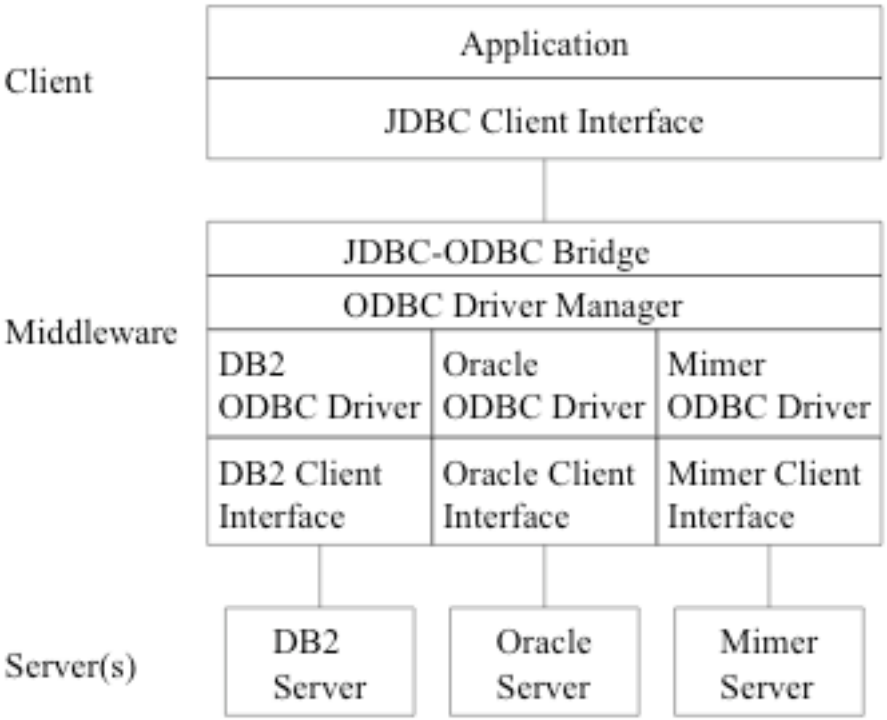
The JDBC architecture

- JDBC API is independent of (relational) DBMS and operating system



Alt. JDBC architecture (JDBC-ODBC bridge)

- Makes ODBC accessible from JDBC such that no special JDBC drivers are required.



Programming with SQL CLI interfaces

- Query: we would like to print the name of all employees that earn more than 100000 in a program using JDBC:
- Source table: `EMPLOYEE(SSN, NAME, INCOME)`

```
{
                    //LoadSUN'sJDBC-ODBCbridge:
    Class.forName("sun.jdbc.odbc.JdbcOdbcDriver");
                    //ConnecttodatabaseserverS:
    Connectioncon = DriverManager.getConnection("jdbc:odbc:S",
                    "myLogin","myPassword");
                    //CreateJDBCstatementholder:
    Statementstmt = con.createStatement();
    Stringquery = "SELECTNAMEFROMEMPLOYEEWHEREINCOME>10000";
    ResultSetrs = stmt.executeQuery(query);
                    //Iterateoverqueryresult:
    while(rs.next())//while tuples in result set do
    {
            Strings=rs.getString("NAME");
            System.out.println(s);
    }
}
```

Programming with SQL CLI interfaces cont.

- In the following code we have a loop that reads the lower income level from the user and prints out all employees that earn more (the `prepareStatement` method comiles and optimizes (prepares) the parameterized query).

```
{
                                // Load SUN's JDBC-ODBC bridge:
        Class.forName("sun.jdbc.odbc.JdbcOdbcDriver");
                                // Connect to database server S:
        Connection con = DriverManager.getConnection("jdbc:odbc:S",
                  "myLogin", "myPassword");
        Statement stmt = con.createStatement();
                                // Parameterized query:
        String query = "SELECT NAME FROM EMPLOYEE WHERE INCOME > ?";
        Int incomeLimit;
                                // Prepare parameterized query:
        PreparedStatement getPersons = con.prepareStatement(query);

        while(....){
                                // Code to read lower income limit into incomeLimit
           ....
                                // Set 1st parameter to incomeLimit:
           getPersons.setInt(1,incomeLimit);
           ResultSet rs = stmt.executeQuery(getPersons);
                                // Iterate over query result:
           while (rs.next()) {
                  String s = rs.getString("NAME");
                  System.out.println(s);
           }
        }
}
```

Embedded SQL

- Host language include embedded and specially marked SQL statements.
- Embedded statements are extracted by preprocessor, translated and replaced by database calls, precompiled (prepared) and stored on server.
- The preprocessed application is then compiled normally
- Supports dynamic recompilation
- Reduces optimization cost and can be somewhat simpler than CLI programming.