

Introduction to SQL

Introduction to SQL

- A standard language used in most DBMS.
- Both as a DDL and DML language.
 - **DDL** (Data Definition Language): define the schema of the database.
 - **DML** (Data Manipulation Language): provides commands to manipulate the database (query, insert, update, delete).

SQL Continued

- *Based* on relational algebra, but not entirely identical.
 - Relations \Leftrightarrow Tables
 - Tuples \Leftrightarrow Rows
 - Attributes \Leftrightarrow Columns

Basic DDL Commands in SQL

- **CREATE**: to define new tables (to define relation schemas)
- **DROP**: to delete table definitions (to delete relation schemas)
- **ALTER**: to change the definitions of existing tables (to change relation schema)
- Other features as DDL
 - Specify referential integrity constraints (FKs)
 - Specify user-defined attributes constraints

Basic DML Commands in SQL

- **INSERT**: to add new rows to table
- **UPDATE**: to change the “state” (the value) of rows.
- **DELETE**: to remove rows
- **SELECT**: a query command that uses relation algebra *like* expressions
- Various options available to handle the enforcement/violation of integrity constraints

Platforms of This Course

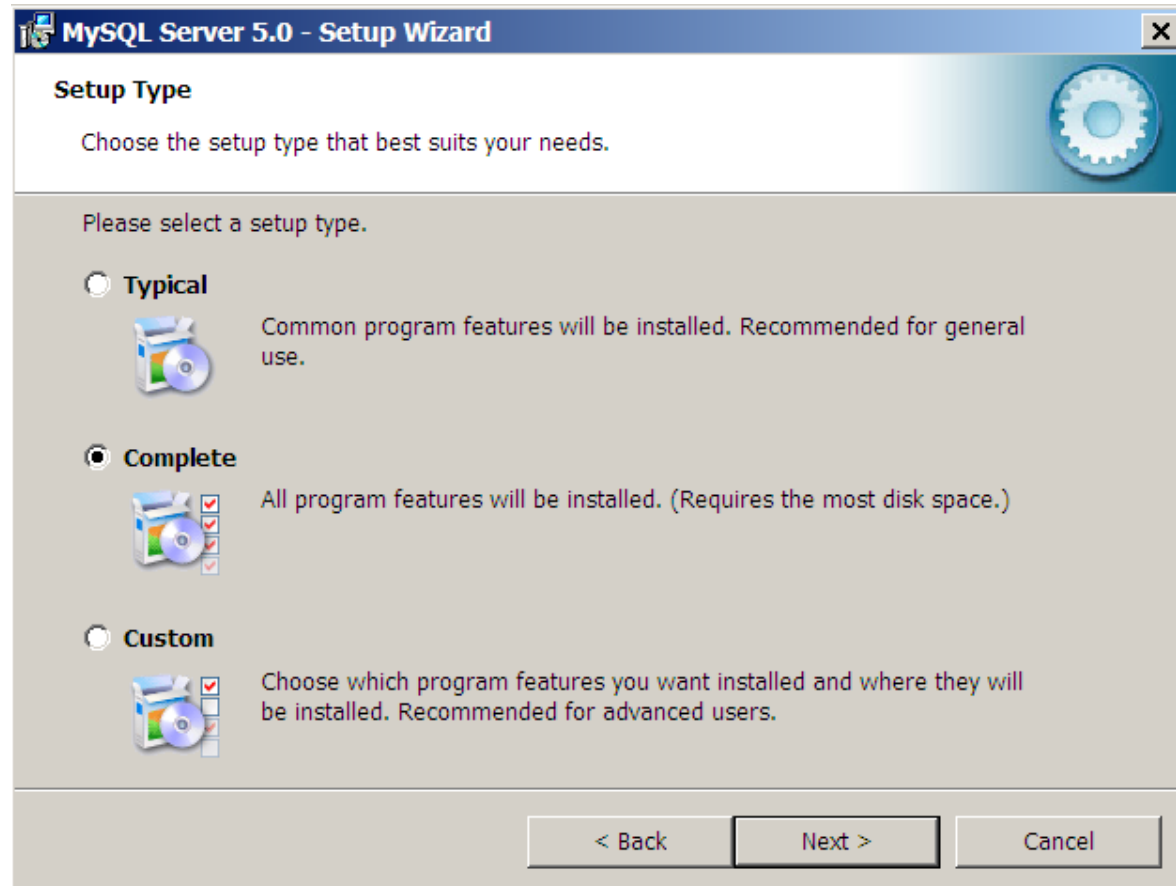
- Platform 1: MySQL
 - Open source, free software
 - Available on Windows and Linux.
 - Easily installed on your own PC.
- Platform 2: Oracle 10g Enterprise Edition
 - Available through IT&E labs
 - Proprietary, popular DBMS
 - Please see http://labs.ite.gmu.edu/reference/faq_oracle.htm for details.

MySQL

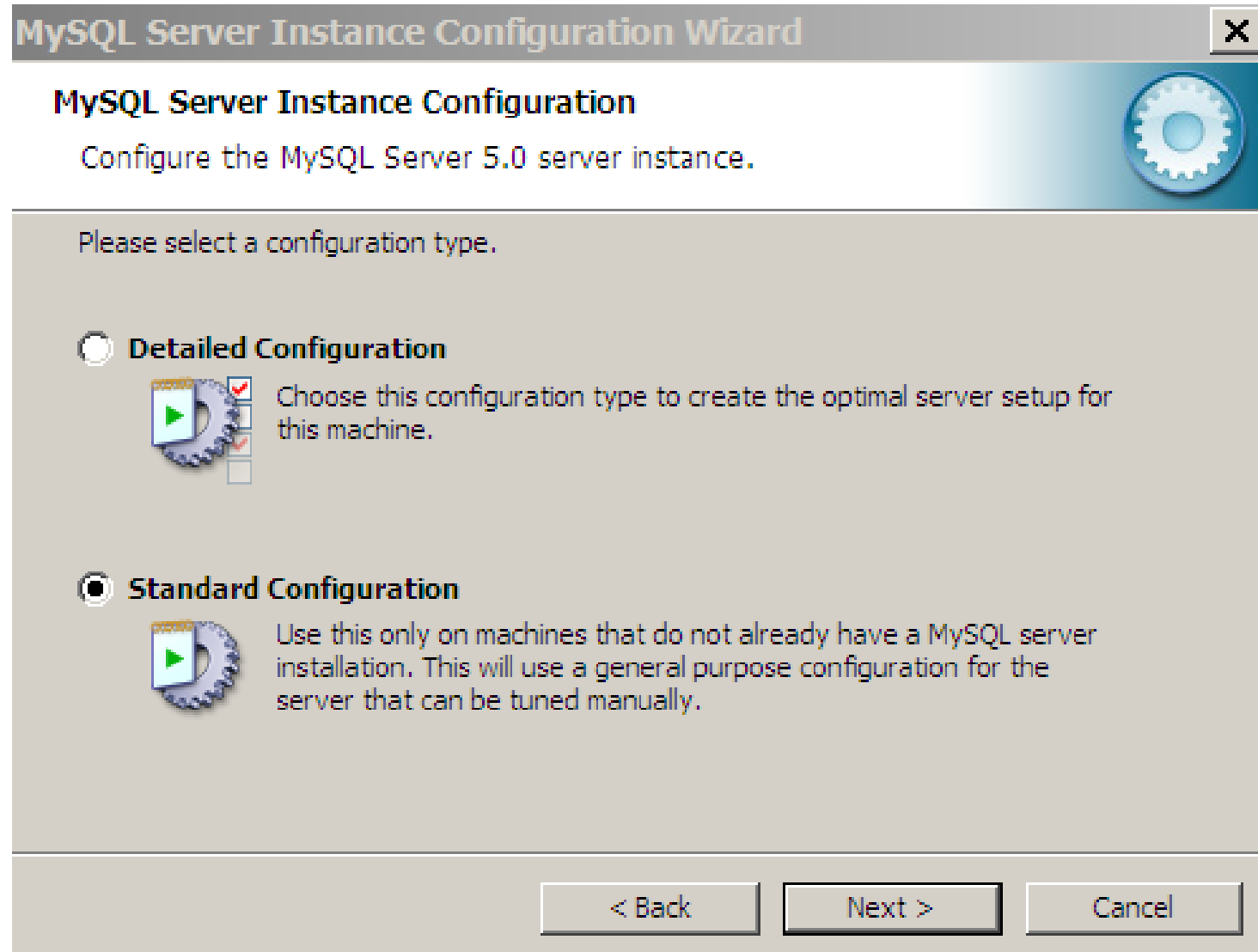
- Open source and free
- Generally not as powerful as Oracle
- Still, it is an industrial strength package.
 - Users include Amazon, NASA, Google, Yahoo ...
- A commercial edition is also available (MySQL Enterprise) --- You are paying for the services.

Installation on Windows

- Download the Essential Version of MySQL 5.0 from mysql.com
- Click on the .exe file to start installation.
- In Setup Type, Choose “Complete”



Use Standard Configuration



Install As Windows Service




The image shows a screenshot of the 'MySQL Server Instance Configuration Wizard' window. The title bar reads 'MySQL Server Instance Configuration Wizard' with a close button. The main heading is 'MySQL Server Instance Configuration' with a subtext 'Configure the MySQL Server 5.0 server instance.' and a gear icon. The instruction says 'Please set the Windows options.' There are two main sections. The first section, 'Install As Windows Service', is checked and includes a gear icon, a description 'This is the recommended way to run the MySQL server on Windows.', a 'Service Name' dropdown menu set to 'MySQL', and a checked checkbox for 'Launch the MySQL Server automatically'. The second section, 'Include Bin Directory in Windows PATH', is also checked and includes a small MySQL logo icon and a description 'Check this option to include the directory containing the server / client executables in the Windows PATH variable so they can be called from the command line.' At the bottom are three buttons: '< Back', 'Next >', and 'Cancel'.

MySQL Server Instance Configuration Wizard

MySQL Server Instance Configuration
Configure the MySQL Server 5.0 server instance.

Please set the Windows options.

☒ **Install As Windows Service**

 This is the recommended way to run the MySQL server on Windows.

Service Name:

☒ Launch the MySQL Server automatically

☒ **Include Bin Directory in Windows PATH**

 Check this option to include the directory containing the server / client executables in the Windows PATH variable so they can be called from the command line.

< Back Next > Cancel

Set Root Password

MySQL Server Instance Configuration Wizard [X]

MySQL Server Instance Configuration [Gear Icon]

Configure the MySQL Server 5.0 server instance.

Please set the security options.

☒ **Modify Security Settings**

 New root password: Enter the root password.

 Confirm: Retype the password.

☐ Enable root access from remote machines

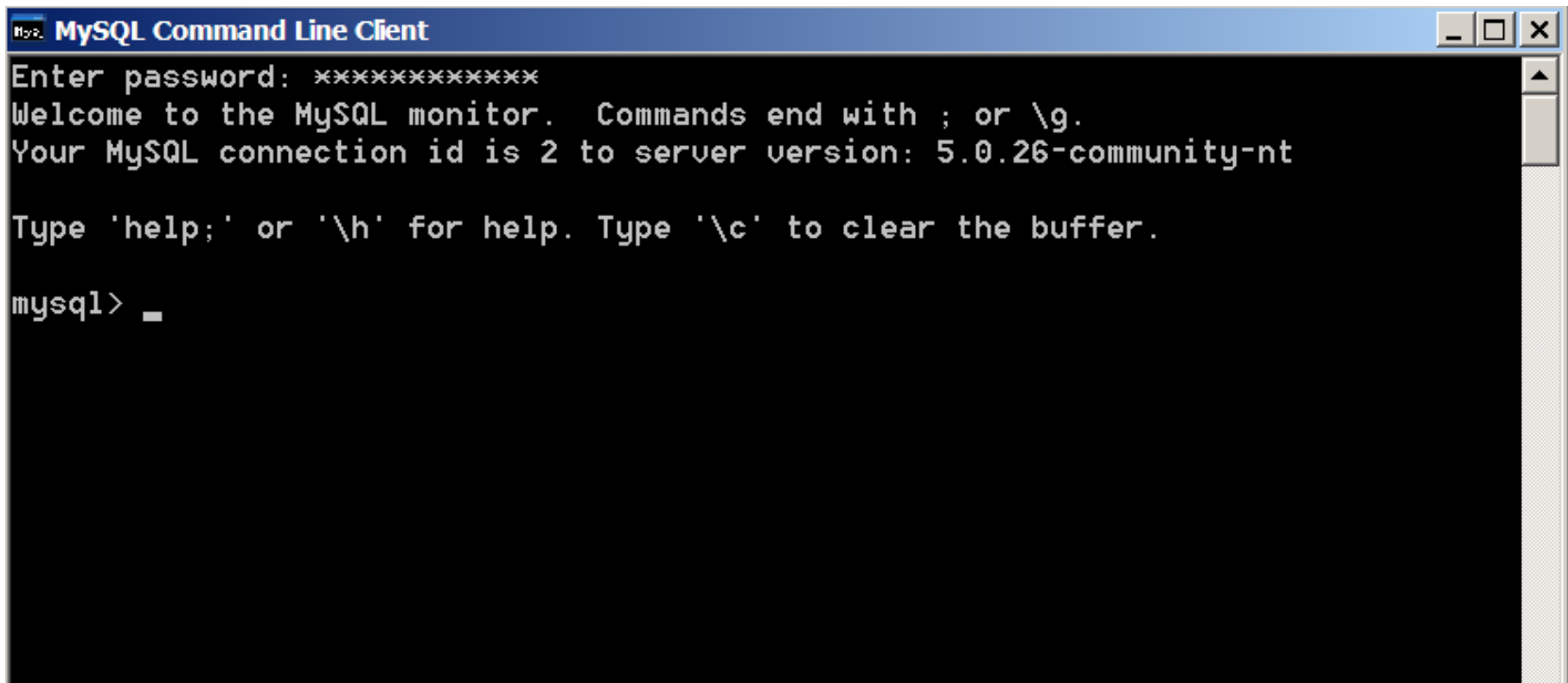
☐ **Create An Anonymous Account**

 This option will create an anonymous account on this server. Please note that this can lead to an insecure system.

< Back Next > Cancel

Launch MySQL

- Use the Start menu to launch the “MySQL Command Line Client”
- Enter the root password

A screenshot of the MySQL Command Line Client window. The title bar reads "MySQL Command Line Client". The window has a black background with white text. The text inside the window reads: "Enter password: *****", "Welcome to the MySQL monitor. Commands end with ; or \g.", "Your MySQL connection id is 2 to server version: 5.0.26-community-nt", "Type 'help;' or '\h' for help. Type '\c' to clear the buffer.", and "mysql> _".

```
MySQL Command Line Client
Enter password: *****
Welcome to the MySQL monitor.  Commands end with ; or \g.
Your MySQL connection id is 2 to server version: 5.0.26-community-nt

Type 'help;' or '\h' for help. Type '\c' to clear the buffer.

mysql> _
```

EMPLOYEE

Fname	Minit	Lname	<u>Ssn</u>	Bdate	Address	Sex	Salary	Super_ssn	Dno
-------	-------	-------	------------	-------	---------	-----	--------	-----------	-----

DEPARTMENT

Dname	<u>Dnumber</u>	Mgr_ssn	Mgr_start_date
-------	----------------	---------	----------------

DEPT_LOCATIONS

<u>Dnumber</u>	<u>Dlocation</u>
----------------	------------------

PROJECT

Pname	<u>Pnumber</u>	Plocation	Dnum
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WORKS_ON

<u>Essn</u>	<u>Pno</u>	Hours
-------------	------------	-------

DEPENDENT

<u>Essn</u>	<u>Dependent_name</u>	Sex	Bdate	Relationship
-------------	-----------------------	-----	-------	--------------

The
COMPANY
Database

Create the COMPANY Database

- To create
`create database COMPANY;`
- To use (or switch to) the database
`use COMPANY;`
- Subsequent commands will operate on the COMPANY database by default.

CREATE TABLE

```
CREATE TABLE DEPARTMENT (  
Dname      VARCHAR(10) NOT NULL,  
Dnumber    INTEGER  Default 0,  
Mgr_ssn    CHAR(9),  
Mgr_Sartdate CHAR(9),  
PRIMARY KEY (Dnumber),  
UNIQUE      (Dname),  
FOREIGN KEY (Mgr_ssn)  
            REFERENCES EMPLOYEE (Ssn));
```

- The “UNIQUE” clause specifies secondary keys.
- EMPLOYEE) has to be created first for the FK Mgr_ssn to refer to it.

Additional Data Types

- **DATE:**
 - Made up of year-month-day in the format yyyy-mm-dd
- **TIME:**
 - Made up of hour:minute:second in the format hh:mm:ss
- **TIMESTAMP:**
 - Has both DATE and TIME components
- **Decimal (i,j):**
 - i : total number of digits
 - j : the number of digits after the decimal point
- Others: Boolean, Float, Double Precision

Adding the Dno FK to EMPLOYEE

- If “create table EMPLOYEE” is issued first, we cannot specify Dno as a FK in that create command.
- An ALTER command must be used to change the schema of EMPLOYEE, after the “create table DEPARTMENT,” to add a FK.

```
alter table EMPLOYEE  
add constraint  
foreign key (Dno)  
references DEPARTMENT (Dnumber);
```

The Check Clause

- Used to specify user-defined constraints
- Assume that dept. numbers are from 0 to 99.

```
create table DEPARTMENT (  
    ...  
    Dnumber INTEGER Default 0  
        check (Dnumber>=0 AND Dumber<=99),  
    ...);
```

- “Check” can also be a clause of the entire table.

```
create table DEPARTMENT (  
    ...  
    Dept_create_date date,  
    Mgr_start_date    date,  
    check (Dept_create_date <= Mgr_start_date)  
);
```

Add Columns to Existing Tables

- To add spouse SSN (S_ssn) to EMPLOYEE

```
alter table EMPLOYEE add column S_ssn char(9);
```

- The new attribute will have NULLs in all the tuples of the relation right after the command is executed

- Alternatively, we can set a default value.

```
alter table EMPLOYEE add column S_ssn char(9)  
    default "0000000000";
```

Delete Columns from Existing Tables

- To delete column S_ssn
`alter table EMPLOYEE drop column S_ssn;`
- **Reminder:** changing relation schemas typically indicates ill-executed design phase of the database.

Referential Integrity Options

- **Causes** of referential integrity violation for a foreign key FK (consider the Mgr_ssn of DEPARTMENT).
 - **On Delete:** when deleting the foreign tuple
 - What to do when deleting the manager tuple in EMPLOYEE ?
 - **On Update:** when updating the foreign tuple
 - What to do when updating/changing the SSN of the manager tuple in EMPLOYEE is changed ?
- **Actions** when the above two causes occur.
 - **Set Null:** the Mgr_ssn is set to null.
 - **Set Default:** the Mgr_ssn is set to the default value.
 - **Cascade:** the Mgr_ssn is updated accordingly
 - If the manager is deleted, the department is also deleted.

The Mgr_ssn Example

```
CREATE TABLE DEPARTMENT (  
    ...  
    Mgr_ssn    CHAR(9),  
    ...  
    FOREIGN KEY (Mgr_ssn)  
        REFERENCES EMPLOYEE (Ssn)  
        ON DELETE    ???  
        ON UPDATE    ???  
);
```

Another Example

Create table EMP(

```
...  
ESSN          CHAR(9),  
DNO           INTEGER  DEFAULT 1,  
SUPERSSN      CHAR(9),  
PRIMARY KEY (ESSN),  
FOREIGN KEY (DNO) REFERENCES DEPT  
ON DELETE SET DEFAULT  
ON UPDATE CASCADE,  
FOREIGN KEY (SUPERSSN) REFERENCES EMP  
ON DELETE SET NULL  
ON UPDATE CASCADE);
```

Another Example

Create table EMP(

```
...  
ESSN          CHAR(9),  
DNO           INTEGER  DEFAULT 1,  
SUPERSSN      CHAR(9),  
PRIMARY KEY (ESSN),  
FOREIGN KEY (DNO) REFERENCES DEPT  
ON DELETE SET DEFAULT  
ON UPDATE CASCADE,  
FOREIGN KEY (SUPERSSN) REFERENCES EMP  
ON DELETE SET NULL  
ON UPDATE CASCADE);
```


Miscellaneous Commands

- `show databases;`
 - Show all the databases on the server
- `show tables;`
 - Show all the tables of the present database
- `show columns from table EMPLOYEE;`
- `drop table t_name;`
 - Delete the entire table *t_name*
- `drop database db_name;`
 - Delete the entire database *db_name*
- `load data infile f_name into table t_name;`
 - To be discussed with the next homework.