Introduction to MySQL as an Open Source Database

Session 1

Objectives

- *List the features of MySQL*
- *State the advantages of MySQL over other RDBMS*
- *Compare MySQL with other RDBMS*
- *State the advantages of PHP in MySQL*
- *Explain open source software licenses*

- A Database Management System (DBMS):
  - Is a software program that stores and manages databases
  - Is responsible for managing the various database operations such as:
    - Adding
    - Accessing
    - Processing of data
  - Helps to manage data in two ways:
    - By providing an interface to manage data
    - By supporting connectivity to other application that can be used to manage data

- DBMS and Relational Database Management System (RDBMS) perform the same task of storing and managing data
- One of the key differences between DBMS and RDBMS is that RDBMS splits large amount of data into smaller tables and establishes relationship between the tables
- DBMS stores large amount of data in a single table. Also, the RDBMS is based on a relational model whereas DBMS is not

The features of MySQL are as follows:

- Technical Features:
  - Is written in C and C++
  - Is tested with different compilers
  - Is compatible with different operating systems
  - Has support for multiple storage engines, both transactional and non-transactional
  - Has Application Programming Interfaces (APIs) for accessing MySQL database available in many languages, including C, C++, Eiffel, Java, Perl, PHP, Python, Ruby and Tcl

Features of MySQL

- Is using multiple kernel threads or processing units, if available, for data processing
- Is using multiple processors where available, boosting performance
- Has ability to divert memory resources from inactive thread to active threads for faster processing
- Has commands and features to retrieve, update and delete data from several tables
- Has support for compatibility to be used as a separate application or as an embedded library

- Column Types:
  - Includes multiple column or data types including numeric, date and time, and string
  - Includes maps of data types from other databases to MySQL data types
  - Includes fixed-length and variable-length strings

- Commands and Functions:
  - Has support for all MySQL operators and functions in the `SELECT` statement and the `WHERE` clause
  - Has support for tables from different databases in one statement
  - Has support displaying information about databases, tables and indexes using the `SHOW` command
  - Has support for displaying query resolution information using the `EXPLAIN` command
  - Has full support `SQL GROUP BY` and `ORDER BY` clauses, group functions, and left and right outer joins
  - Has support for the use of function names as table or column name

- Security:
  - Has support for in-built data encryption and decryption
  - Has support for user account privileges
  - Has support for password encryption

- Scalability and Limits:
  - Handles large databases that have upto 5 billion rows
  - Allows upto 64 indexes per table
  - Allows upto 16 keys per table

- Connectivity:
  - Supports connectivity on any platform to MySQL server using Transmission Control Protocol/Internet Protocol (TCP/IP) sockets
  - Supports connectivity on Windows NT, 2000, XP, 2003, and Vista using named pipes or shared-memory connections
  - Supports connectivity on UNIX systems using UNIX domain sockets files

- Localization:
  - Displays error messages in languages, such as Czech, French, German, Japanese, Korean, Norwegian, Polish and Russian
  - Supports Unicode and various character sets
  - Allows data to be stored, sorted and compared using the chosen character set

- Clients and tools:
  - Provides built-in support to check, optimize and repair tables
  - Provides "`mysql`" tool to execute individual SQL command or SQL commands stored in a file
  - Provides "`mysqlaccess`" tool to check host, user and database privileges
  - Provides "`mysqladmin`" tool to manage the database
  - Provides "`mysqldump`" tool to backup the contents of one or more MySQL database to a file

Features of MySQL

- Provides "`mysqlhotcopy`" tool to backup a single database or table on to the same computer
- Provides "`mysqlimport`" tool to import data into a MySQL table from a file
- Provides "`mysqlshow`" tool to display information about the database, tables and columns
- Provides "`mysqld_safe`" tool that enables safe start up of the MySQL

- **Reliable**: Supports tables that can store and handle large number of records
- **Ease of Use**: Provides a modular and flexible architecture that makes it easy to manage and customize
- **Cross Platform Support**: Supports different operating systems, such as Linux, UNIX, and Microsoft Windows
- **Views:** Supports views where data is copied into temporary or virtual tables during processing. This feature ensures data security

- **Stored Procedures**: Supports stored procedures and functions. This allows to implement business logic at the database level
- **Triggers**: Supports triggers. This feature also enables to implement business logic during data processing

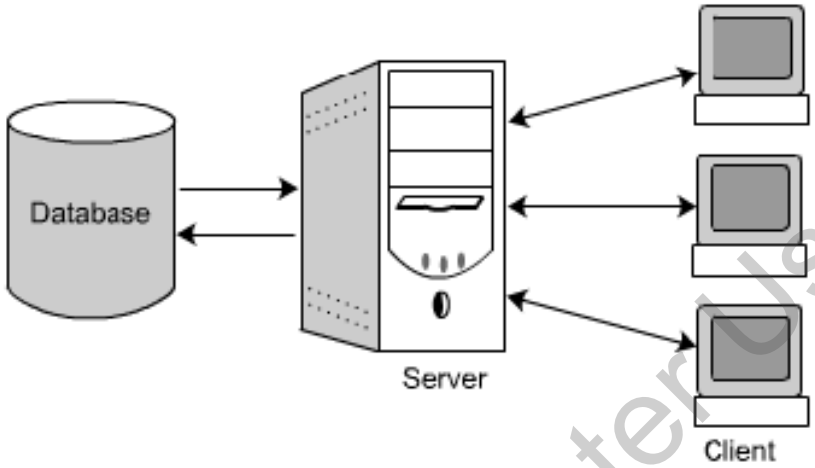
Comparing MySQL With Other RDBMS

- The commercial databases support almost all the features that are present in MySQL, but the performance of MySQL is better
- One drawback in MySQL is that it does not support advanced SQL3 features such as object oriented data types
- PostgresSQL supports advanced SQL3 features and is a better choice as an open-source DBMS
- PostgresSQL has a major disadvantage in its hidden limit of 8K of data per row
- PostgreSQL is more powerful but MySQL is faster

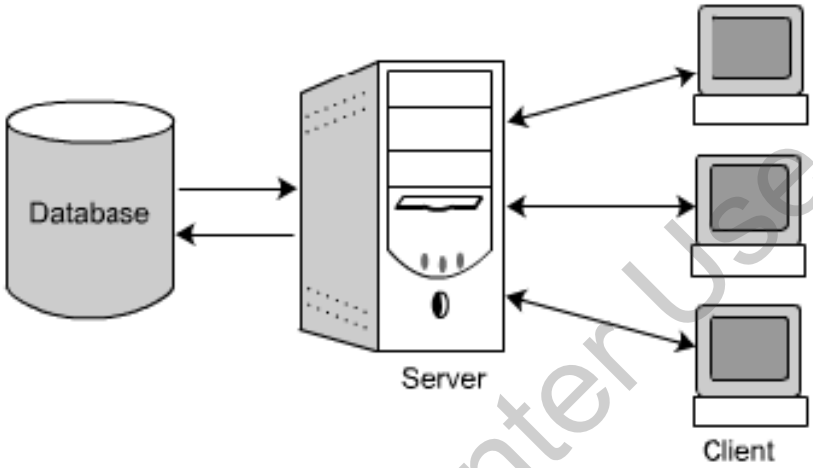
- The latest versions of PostgreSQL and MySQL support features, such as sub-selects, stored procedures, triggers, unions, and views
- Older versions of MySQL did not support all these features. In addition, because these features are new to MySQL, there are some performance issues
- MySQL provides more user-friendly command interface so it is popular among Web developers
- MySQL supports more data types and functions as compared to mSQL
- InstantDB competes well with MySQL when you consider the different features
- MySQL is faster as compared to InstantDB

Advantages of PHP In MySQL Environment

- PHP is a scripting tool designed for Web development
- PHP supports embedding scripts into HTML code
- Developers can use PHP scripts to create HTML Web pages that can read and write data from a database
- PHP is a scripting language that is executed at run-time
- PHP and MySQL can be used together to manage data on the Web
- You can also store and manage information from the database



- Consider a database connected to a server as shown
- The database, server, and client maintain a two-way communication
- If several clients make a request to the server for the same data, then the server will return the data to all the clients and results in slow performance of the system



- The advantage of using PHP is that the database can be accessed directly through a Web page
- In this scenario, the client will request for a PHP file
- The PHP preprocessor will connect to the database, retrieve the data, convert the data into HTML format, and send it to the browser

- Examples of real-world Websites where databases are used:
- **Online Ticket Reservation:**
  - In an online reservation system you can reserve a seat using the Internet
  - Your action updates the backend or the database of this booking system
  - You can access several parts of the database by changing the Uniform Resource Locator (URL)

- **Message Boards**
  - It is an online discussion site where messages can be posted
  - Message boards running on PHP and MySQL are more efficient, as updating one page automatically update other pages.
- **Marketing Websites**
  - Website can be updated using few PHP scripts as the information related to these pages is stored in MySQL database

- **Advertising Banners**
  - Consider a Website where several advertisement banners are present on the site
  - These banners are stored in a database on the server. You can call a PHP script to display each banner
  - In order to insert, modify, or delete a banner you have to access the database
  - A PHP script can be written to select the database from which the banner will be displayed

Requirements of PHP script

- To run a PHP script, you will need to install the following software:
  - Web server
  - PHP
  - MySQL
- PHP supports different operating systems such as Mac OS X, Linux, UNIX, and Windows
- Both PHP and MySQL are open source
- This feature makes them cost effective as compared to other software products

Open Source Software Licensing

- An open-source software license permits users to read, access, change, and reuse the source code of a software product
- Open-source software does not necessarily mean free software
- The advantage of using open-source software is that the developer can customize as per requirements
- There is no limit on the customization and there are various troubleshooting and performance tips freely available on the Internet for open-source software

- Open-source license does not allow you to sell customized software
- You will have to provide the modified source code when you distribute the software
- The source code must be distributed along with the binary
- The software can be modified as required and redistributed under the same terms as the original software
- When the software is used as a part of development of other applications, the software must be redistributed with the application without any royalty or fee

Licensing of MySQL

- MySQL is available under two licensing schemes:
  - **General Public License (GPL)** – Applies to developers who use, and/or distribute open source software under the GPL
  - **Commercial License** – Applies to developers who only use MySQL to develop their own executables and not the source code

Summary

- A database stores data in a structured format. A Database Management System is responsible to store, access, and delete data from a database
- MySQL is an open source RDBMS. It was developed and distributed by MySQL AB, which is now owned by Oracle
- There are many commercial Relational Database Management Systems available, such as Oracle, Microsoft SQL, and Sybase that support most of the data management features
- MySQL works on different operating systems, such as Mac OS X, Linux, UNIX, and Windows

Summary

- Unlike in traditional Database Management Systems that are proprietary, in open source software, you can modify the source code to customize the features
- PHP is a scripting language that enables interaction with a database. You can use PHP and MySQL to store and manage data on the Web
- In order to run a PHP script, you will need to install a Web server, PHP and MySQL
- Open-source software licenses allow you to read, access, change, and reuse the source code of a software product
- MySQL is available under General Public License and Commercial License