

410.712.81
Advanced Practical Computer Concepts
For Bioinformatics

Topic: MySQL

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We have already reviewed general databases and SQL, including basic principles of data modeling and normalization. This lecture will extend this into the realm of the practical by first discussing a particular RDBMS vendor (MySQL) and then discussing its basic features.

There's even one cartoon.

There is a wide variety of database vendors in modern use – these vary greatly in cost and feature sets. Empirical usage comparisons between them are difficult because some are commercial, with well-tracked install base statistics, while others are open-source and more difficult to track since they are not distributed from a single source. Some of the more popular include:

DB2, MySQL, Oracle, PostgreSQL, Sybase

So why are we using MySQL? It is a popular choice for developers of web applications because:

- It's free
- It has a relatively low overhead
- Integrates well with Linux, Apache, Perl/PHP/Python
- Commercial support is available for paying customers
- Many high-profile sites use it:
 - Flickr, Google, YouTube, Facebook, Wikipedia

Oracle currently owns MySQL after acquiring Sun, the previous backer, in 2009.

Most developers have a few advanced favorite features they rely on and will harshly judge a new RDBMS if they aren't present. So, here's the neat stuff MySQL can do:

- Partitioned tables and database clustering
- Query caching
- Sub-select queries
- Cursors, triggers and stored procedures
- Updatable views (but not materialized views)
- Cross-platform support (Windows, OS X, Linux, etc.)
- Full text indexing
- Customizable storage engines
- Transactions

Null hypothesis



Getting MySQL

The free version of MySQL is known as the MySQL Community Server.

The screenshot shows the MySQL.com website. The header includes the MySQL logo, the tagline "The world's most popular open source database", and navigation links for "MySQL.com", "Downloads (GA)", and "Customer Login". A search bar and "Login | Register" links are also present. The main navigation menu includes "Home", "Products", "Services", "Partners", "Customers", "Why MySQL?", "News & Events", and "How to Buy". The left sidebar contains links for "MySQL Enterprise Edition Trial", "MySQL Enterprise Edition", "Free Web Seminars", "MySQL Training", "White Papers", "Buy Now", and "Contact Us". The main content area is titled "Download MySQL Community Server" and describes the MySQL Community Edition as a freely downloadable version of the world's most popular open source database. It also mentions the MySQL Cluster Community Edition. A section for "Important Platform Support Updates" is visible. The "Generally Available (GA) Releases" section shows the "MySQL Community Server 5.5.14" download page. A "Select Platform:" dropdown menu is set to "Linux - Generic". Below this, a table lists three download options for Linux - Generic 2.6 (x86, 64-bit), RPM Package: MySQL Server (49.1M), Development Libraries (6.2M), and another set of Development Libraries (6.0M). Each option has a "Download" button and an MD5 checksum.

MySQL.com

The world's most popular open source database

Downloads (GA) Customer Login

Home Products Services Partners Customers Why MySQL? News & Events How to Buy

Download MySQL Community Server

MySQL Community Edition is a freely downloadable version of the world's most popular open source database that is supported by an active community of open source developers and enthusiasts.

MySQL Cluster Community Edition is available as a separate download. The reason for this change is so that MySQL Cluster can provide more frequent updates and support using the latest sources of MySQL Cluster Carrier Grade Edition.

MySQL open source software is provided under the GPL License.

OEMs, ISVs and VARs can purchase commercial licenses.

Important Platform Support Updates

MySQL Community Server 5.5.14

Looking for previous GA versions?

Select Platform:

Linux - Generic Select

Linux - Generic 2.6 (x86, 64-bit), RPM Package MySQL Server (MySQL-server-5.5.14-1.linux2.6.x86_64.rpm)	5.5.14	49.1M	Download	MD5: 2d38539e67891243276e423b90689470
Linux - Generic 2.6 (x86, 64-bit), RPM Package Development Libraries (MySQL-devel-5.5.14-1.linux2.6.x86_64.rpm)	5.5.14	6.2M	Download	MD5: f0004979d102c7fd93cc2591a9967d48
Linux - Generic 2.6 (x86, 32-bit), RPM Package Development Libraries	5.5.14	6.0M	Download	

<http://www.mysql.com/downloads/mysql/>

MySQL is already set up on the class server, but you can go here if you'd like to install it on your own machine.

Our specific server information was given in the Introduction sent at the beginning of the semester, but generically, you connect to a MySQL server with the following simple command:

```
mysql -u jsmith -h localhost -p
```

It will then prompt you for your password. Once logged in, you'll see the MySQL terminal, where you can enter commands and SQL statements.

Note that you cannot just connect to ANY computer running a MySQL server. The server must first have the external port open that the MySQL daemon listens on. This is 3306 by default, but can be changed by the server administrator. If changed, you can specify the custom port by adding the `-P` option to your connection string.

SQL was covered in a previous lecture, so I'm only going to cover MySQL-specific commands here. Some of the most common:

`mysql> show databases`

Shows a list of all databases on the system you have permission to use.

`mysql> use database`

Changes you command context to operate within a specific database.

`mysql> show tables`

Lists all the tables within your current database.

`mysql> describe table`

Lists all the columns in a table, their datatypes, and more.

`mysql> create database database`

Creates an empty database with the passed name.

MySQL has a quick database exporting tool called 'mysqldump'. Depending on the options you use it can do a complete dump of the data and object definitions. This can be used to back up a database or just send a copy to someone else. A simple example backs up a database called 'annotation' into a file called 'annotation.sql'

```
$ mysqldump -u jorvis -h localhost -p annotation > annotation.sql
```

Notice that the output is a plain-text SQL file. This can be imported easily into other MySQL server instances (see next slide.)

The mysqldump command has a great many options controlling what is exported, the format used, etc. Please read the manpage for more information.

If you have a text file of MySQL commands there are two primary ways to import it into your database. The first is to use the *source* command from the mysql terminal and providing the path to your SQL file:

```
mysql> source /home/jorvis/somefile.sql
```

That will execute all SQL in the file but should carry a warning: as each statement is executed there is a bit of feedback on the command line showing you that the command was either successful or failed. It scrolls by very quickly, so if there are failures they will be hard to see.

The other method is to redirect standard input into the mysql client, specifying the database on the command line. Here's an example:

```
$ mysql -u jorvis -h localhost -p < somefile.sql
```

This would restore the contents of a mysqldump. If you had regular SQL statements that you wanted executed this way but *within* a database you'd just need to add the -D parameter.

For these examples let's assume you have a database called 'annotation'. The MySQL GRANT command allows you to specify the exact permissions any user from any host can have on any database object. Its generic syntax is:

```
GRANT priv list ON database.table TO user@'host' IDENTIFIED BY 'password';
```

If we had just created our annotation database and I wanted to grant full permissions for myself from any host I'd do this:

```
GRANT ALL PRIVILEGES ON annotation.* to jorvis@'%' IDENTIFIED BY 'foo';
```

If I wanted to grant another power user the ability to read and modify data within my tables, I could do something like this:

```
GRANT SELECT,INSERT,UPDATE,DELETE ON annotation.* to shenson@'%';
```

Notice I left off the password definition there, since I knew she was already a user in the system. The '%' sign means 'all hosts' and the '*' means 'all tables'.

For a full list of the grantable rights and all possible options, see the official documentation here:

<http://dev.mysql.com/doc/refman/5.1/en/grant.html>

One very nice feature of MySQL is that you can choose a different back-end storage engine for each different table in your database (see the CREATE TABLE documentation). Here are a few of note:

MyISAM: This is the default engine and is optimized for relatively quick read access and has support for full text searches.

InnoDB: Best for transactional databases, this engine has support for commits, rollbacks, crash recovery and foreign key constraints.

Memory: Fastest engine for reads, since MySQL keeps data for all tables of this type in memory.

There is an excellent page here that describes more of the engines and has a feature comparison chart between them.

<http://dev.mysql.com/doc/refman/5.1/en/storage-engines.html>

phpMyAdmin

I believe that you should always start with a new technology getting as close as you can to it, avoiding any tools or shortcuts that prevent you from really learning the system.

However, this tool is so very popular that it deserves a mention here. It can be used to completely manage your databases with a web-based point and click interface.

It is well designed and documented, but I believe you should spend the time first creating and adding tables, etc. manually and then, once you're a pro, occasionally use a tool like phpMyAdmin to save time.

phpMyAdmin

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About

phpMyAdmin is a free software tool written in [PHP](#) intended to handle the administration of [MySQL](#) over the World Wide Web. phpMyAdmin supports a wide range of operations with MySQL. The most frequently used operations are supported by the user interface (managing databases, tables, fields, relations, indexes, users, permissions, etc), while you still have the ability to directly execute any SQL statement.



phpMyAdmin comes with a wide range of [documentation](#) and users are welcome to update [our wiki pages](#) to share ideas and howtos for various operations. The [phpMyAdmin team](#) will try to help you if you face any problem, you can use [variety of support channels](#) to get help.

phpMyAdmin is also very deeply documented in a book written by one of developers - [Mastering phpMyAdmin for Effective MySQL Management](#), which is available in English, Czech, German and Spanish.

To ease usage to a wide range of people, phpMyAdmin is translated into [62 languages](#) and supports both LTR and RTL languages.

Since version 3.0.0, phpMyAdmin joined the [GoPHP5 initiative](#) and dropped compatibility code for older PHP and MySQL versions; version 3 and later requires at least PHP 5.2 and MySQL 5.

phpMyAdmin has won several [awards](#). Among others, it was chosen as the best PHP application in various awards and every year wins the SourceForge.net Community Choice Awards as "Best Tool or Utility for SysAdmins".

phpMyAdmin is a more than ten years old project with stable and flexible code base, to find out more about the project and its history see [separate page](#).

Features

- Intuitive web interface
- Support for most MySQL features:
 - browse and drop databases, tables, views, fields and indexes
 - create, copy, drop, rename and alter databases, tables, fields and indexes
 - maintenance server, databases and tables, with proposals on server configuration
 - execute, edit and bookmark any [SQL](#)-statement, even batch-queries
 - manage MySQL users and privileges
 - manage stored procedures and triggers

Download 3.4.3.1:
[.gz](#) [.zip](#) [notes](#) ...

Try [phpMyAdmin](#)

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Further reading

Comparison of relational database management systems

http://en.wikipedia.org/wiki/Comparison_of_relational_database_management_systems

Google Code University introduction to databases and MySQL

<http://code.google.com/edu/tools101/mysql.html>