

Introduction to MySQL

Database Systems

Agenda

- × Bureaucracy...
- × Database architecture overview
- × SSH Tunneling
- × Intro to MySQL
- × Comments on homework

Homework #1

- ✗ Submission date is on the website.. (No late arrivals will be accepted)
- ✗ Work should be done in pairs
- ✗ Submission is done via moodle, by one of the partners.
- ✗ Submit a zip file, with
 - + an answers pdf that contains the full names and IDs of both partners on top of the page
 - + A .sql file for every query
- ✗ Use the format described in the assignment

Project

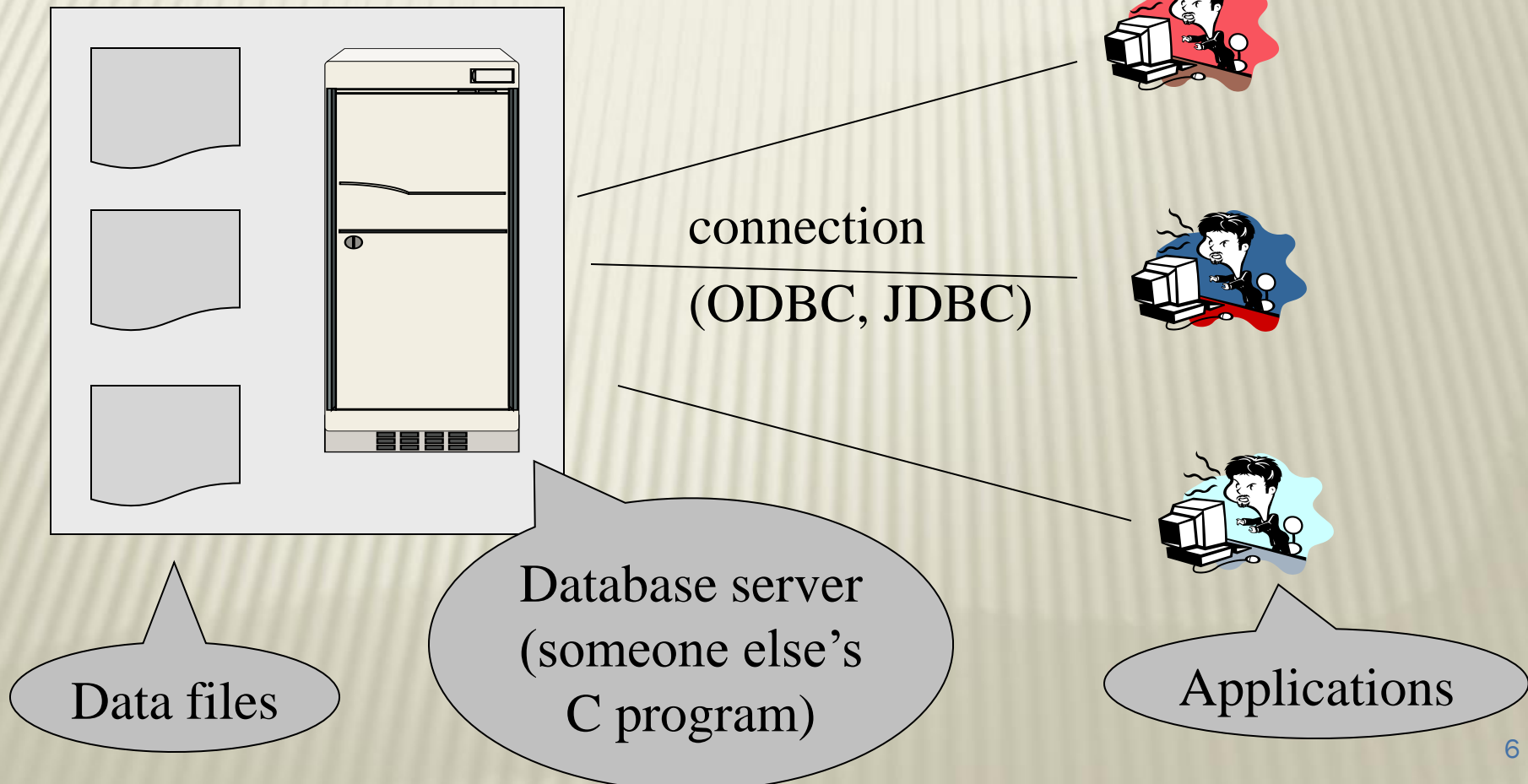
- ✖ Hard work, but practical.
- ✖ Work in groups of 4
- ✖ Project goal: to tackle and resolve **real-life** DB related development issues
- ✖ One stage, with a check point in ~the middle
- ✖ Use JAVA (SWT)
- ✖ Thinking out of the box will be rewarded

Agenda

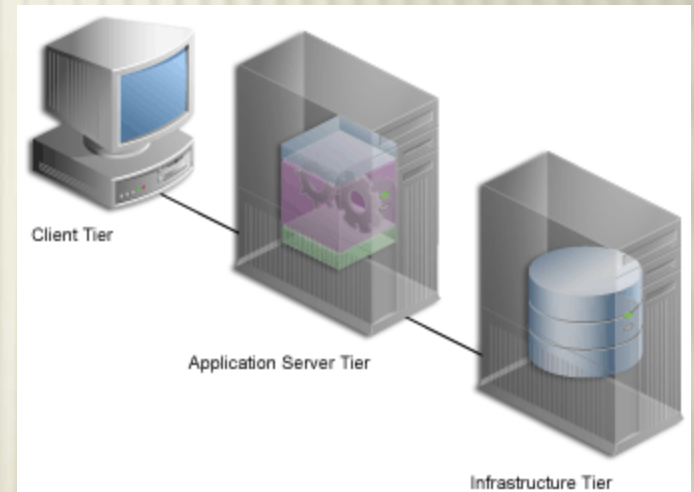
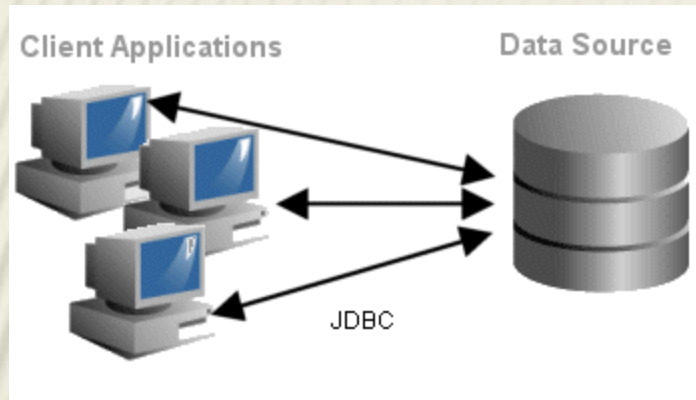
- × Bureaucracy...
- × Database architecture overview
- × SSH Tunneling
- × Intro to MySQL
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DB System from lecture #1

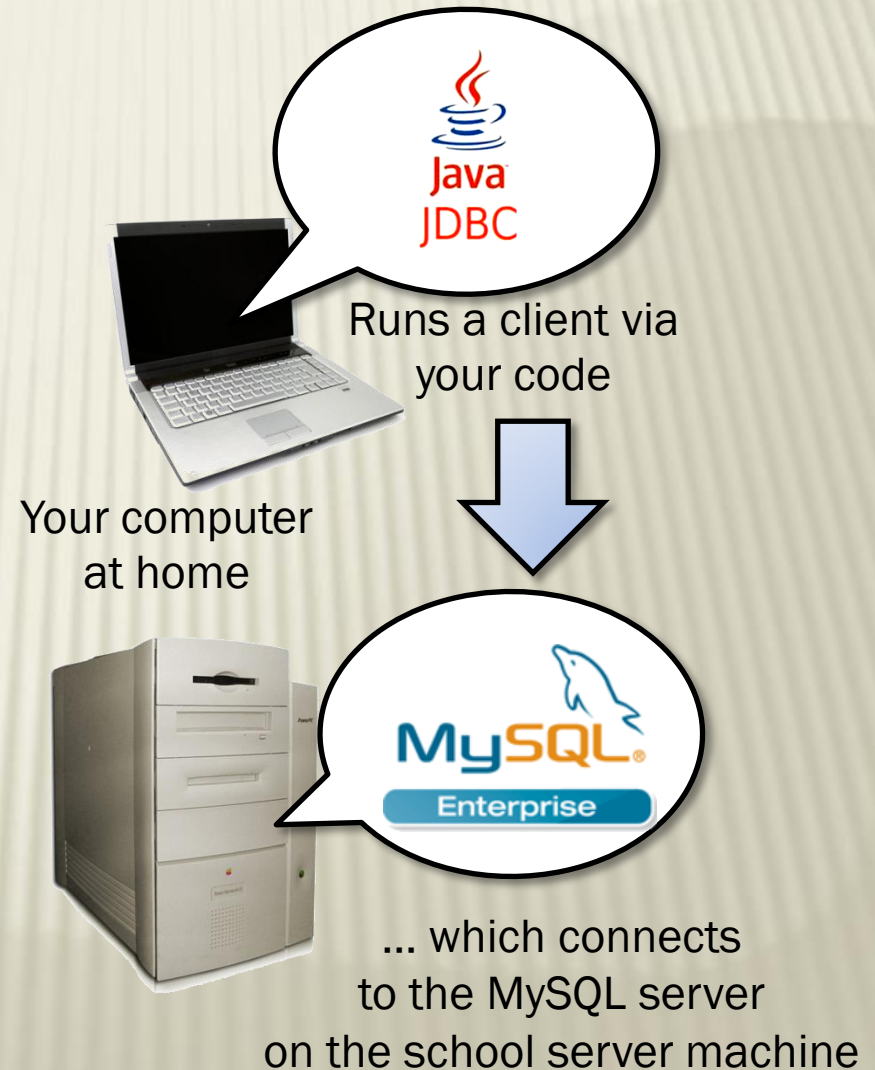
“Two tier database system”



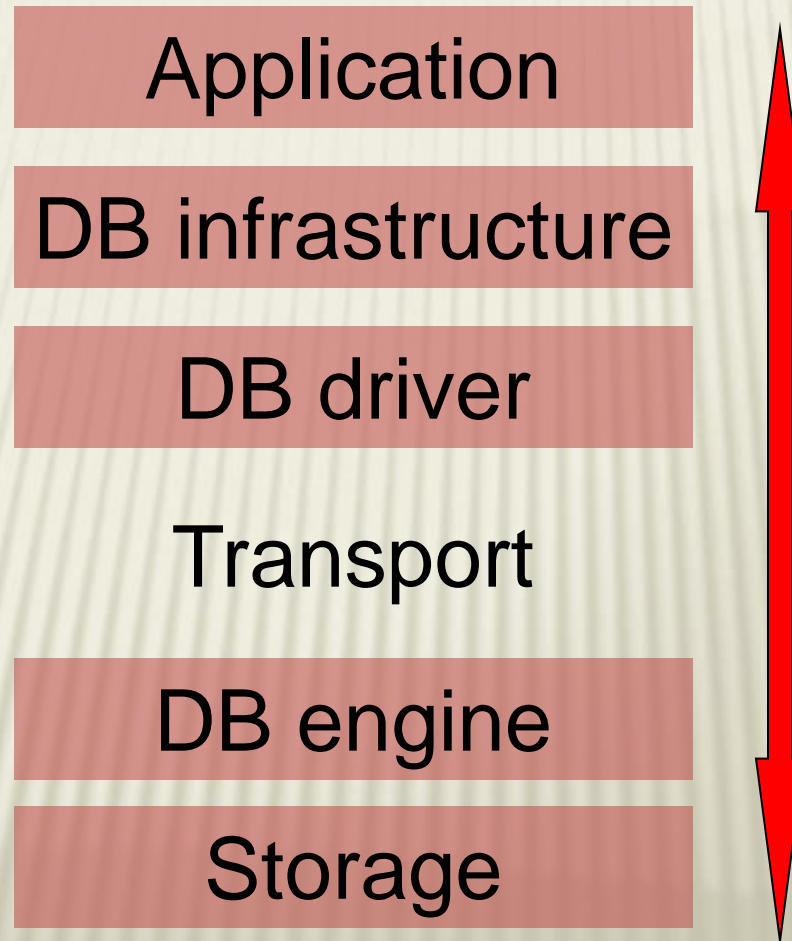
1,2,3 tiers



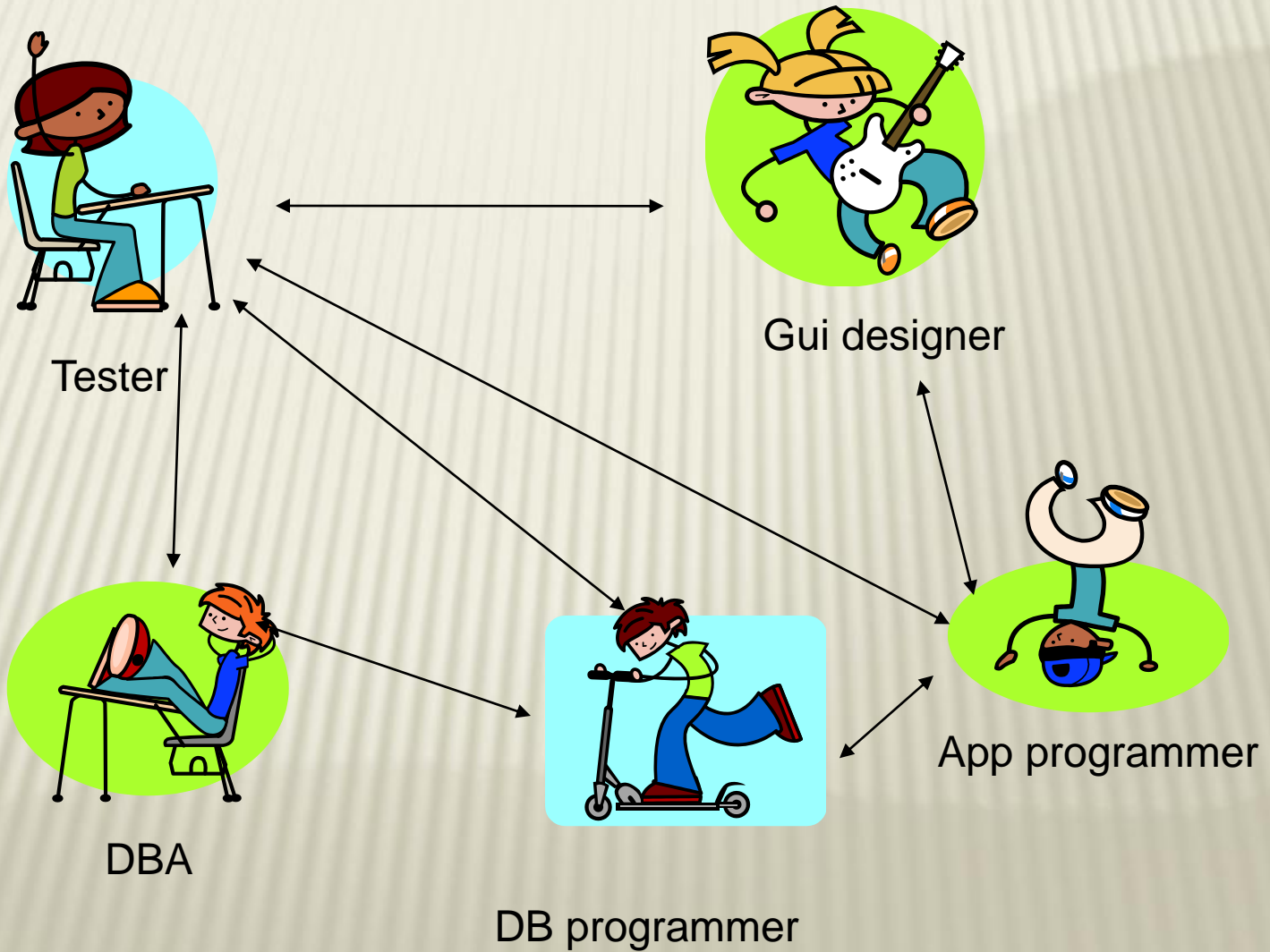
Examples in this course



Abstractly (DB) system layers may include



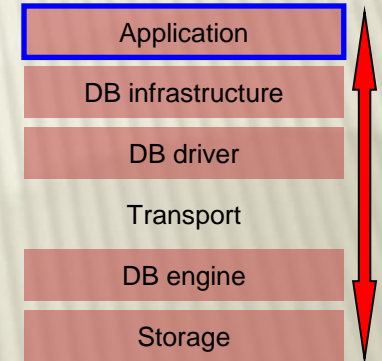
Why?



Application layer

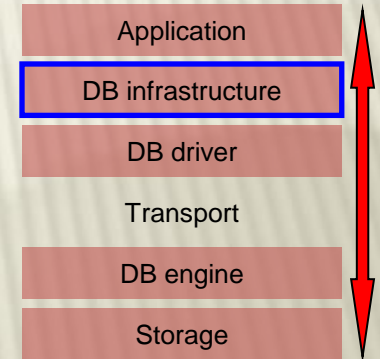
✖ Why should it actually use database?

- + Persistence layer
- + Access data storage
- + Interfacing between systems
- + Large volumes
- + Scalability
- + Redundancy



Infrastructure layer

- × Goals:
 - + Database “hiding”
 - + Schema abstraction
 - + Encapsulation of db mechanisms
- × How: (In two words)



Model Abstraction

- × Could be a part of your application – or an external package
 - + E.g., hibernate

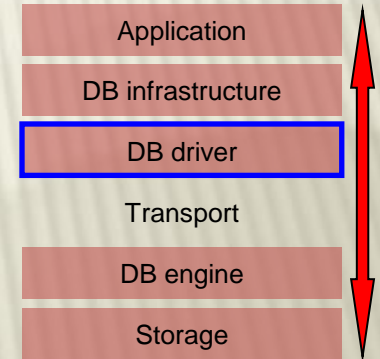
DB driver / bridge

× Used for:

- + API for database connectivity
- + Protocol converter
- + Performance improvements
- + Transaction management

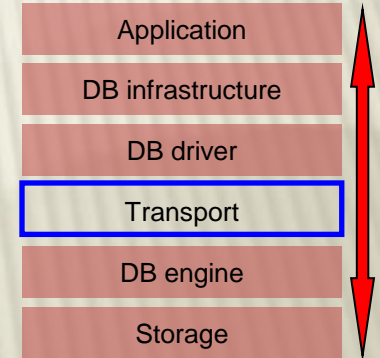
× Examples:

- + In a minute...



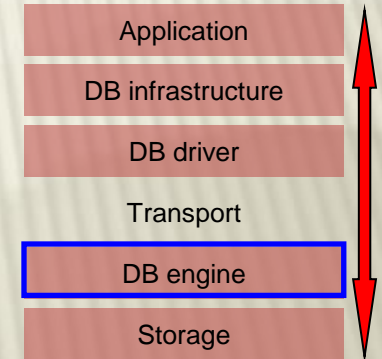
Transport

- ✖ Mainly TCP but not only
- ✖ Secure
- ✖ Efficient
- ✖ Fast (but not fast enough)



DB engine

- ✖ Total management of the DB environment including
 - + Security
 - + Scalability
 - + Fault tolerant (disaster management)
 - + Monitoring
 - + Services
- ✖ Large DB engines include Microsoft SQL Server, Oracle, SyBase, MySQL, etc.



DB engine (2)

DB engine management includes:

- + Databases/Tables/Fields

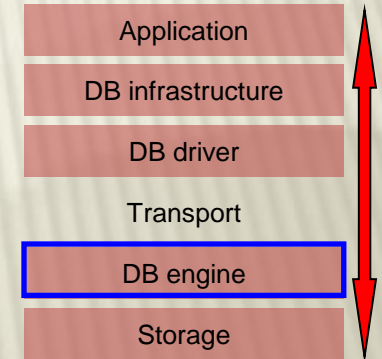
Creation/removal/modification/
optimization

- + Connections/Users/Roles

Security/monitoring/logging

- + Jobs/Processes/Threads

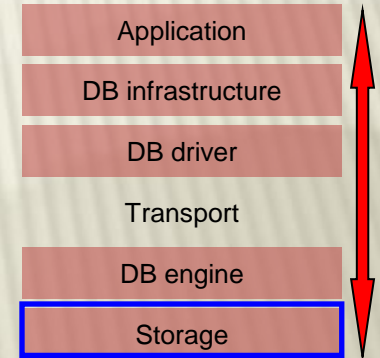
Scheduling/balancing/managing



Storage

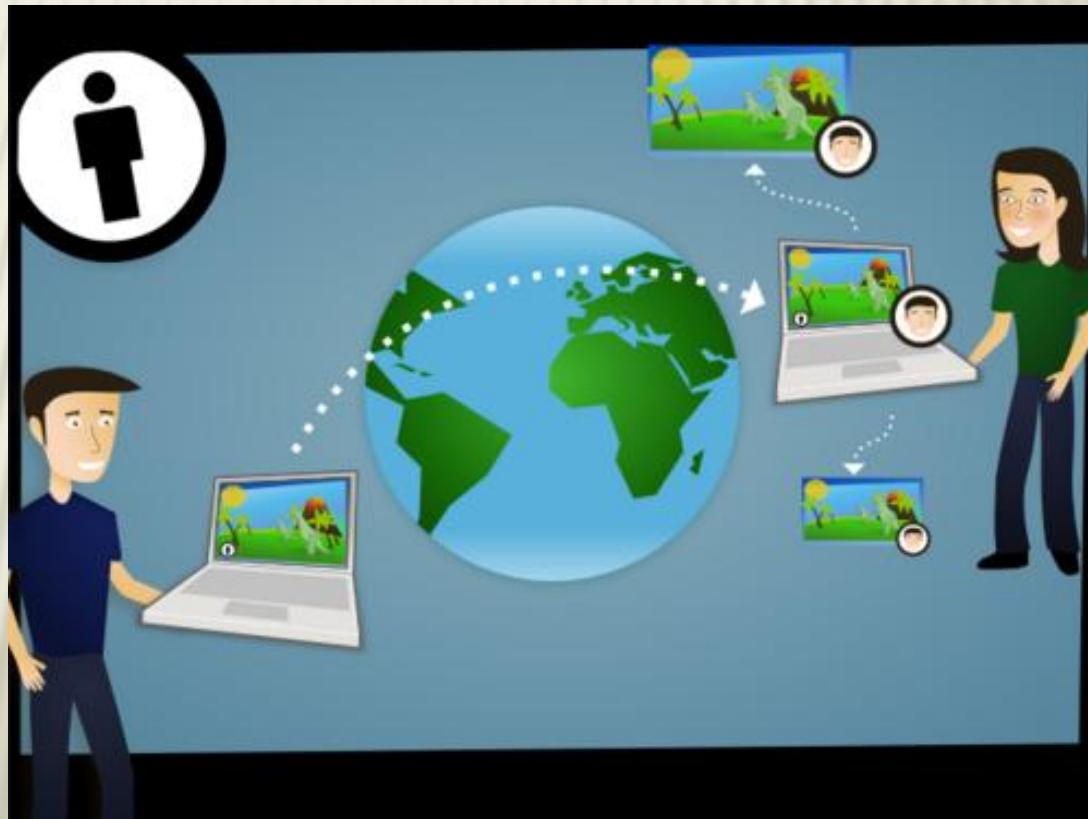
× NAS/SAN, Raid and other stuff

- + We are interested in the storage-engine interface



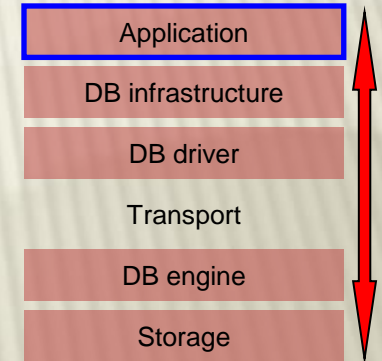
A real-life example

- ✖ We want to build an image sharing Website
- ✖ What is our data?



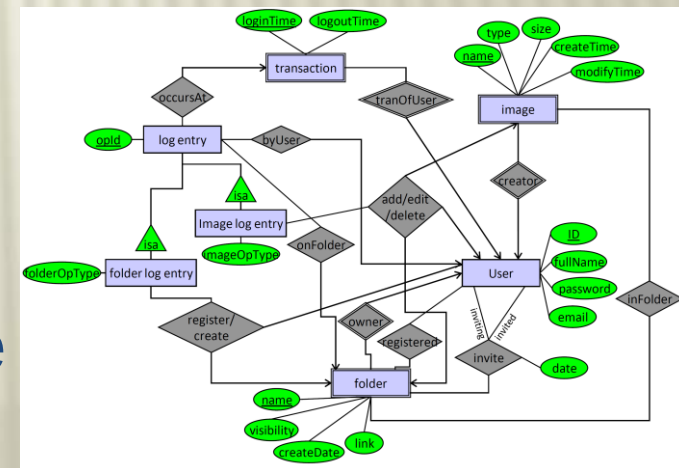
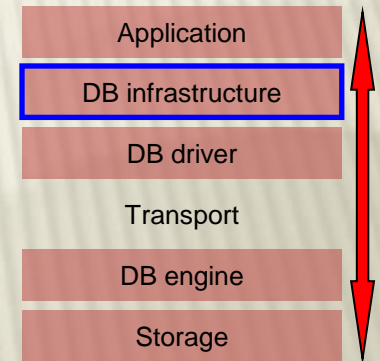
The application

- ✗ GUI
 - ✗ Application-User Management
 - + Do not confuse with DB users!
 - ✗ Image processing
 - ✗ And so on...
-
- ✗ The application needs storage for the images, albums, users, tags...
 - ✗ Runs on the application server
 - + E.g., your computer at home



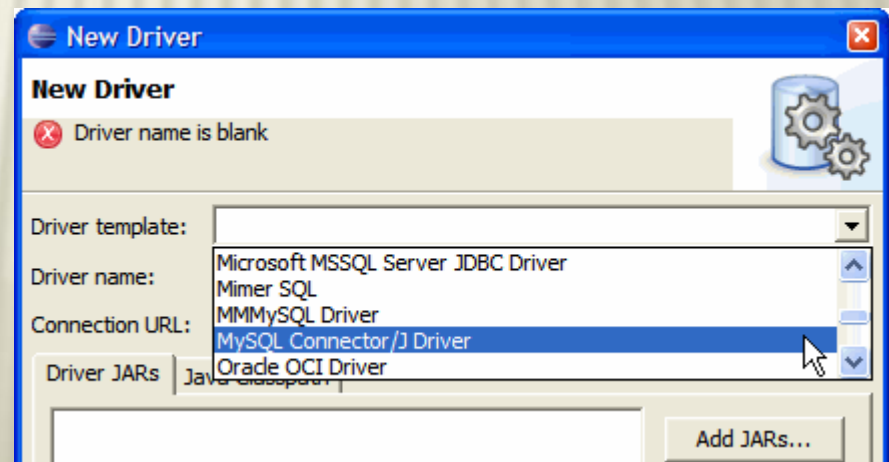
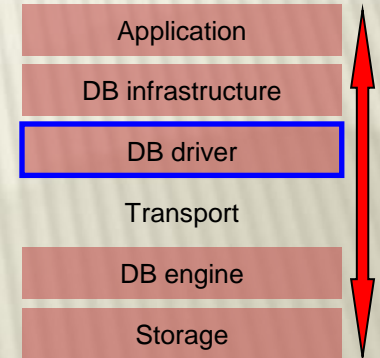
Infrastructure

- ✖ This layer wraps
 - + Entities in our application (Images, users,...)
 - + Relations between entities (Image creator, followers,...)
 - + Common operations (upload/edit/delete image,...)
- ✖ Some of these may be created by an automatic process
- ✖ Still on the application machine



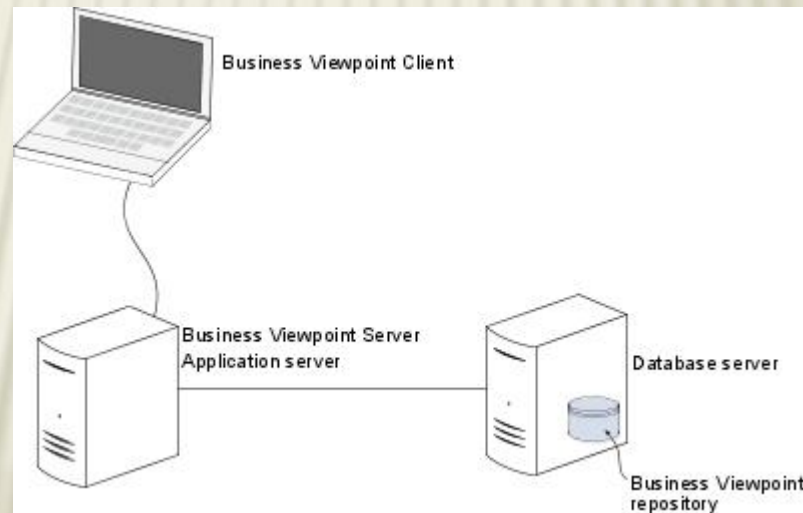
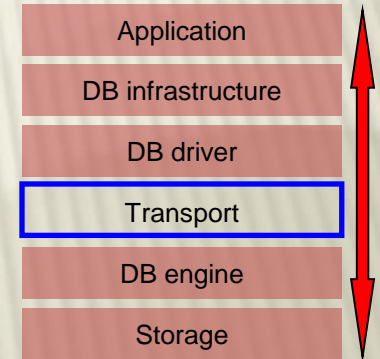
DB driver / bridge

- ✗ Not written by us, e.g., J connector
- ✗ Used by the infrastructure
- ✗ E.g., to upload an image we use an insert command to the image table (and perhaps others)
- ✗ We want the type of DB used to be configurable



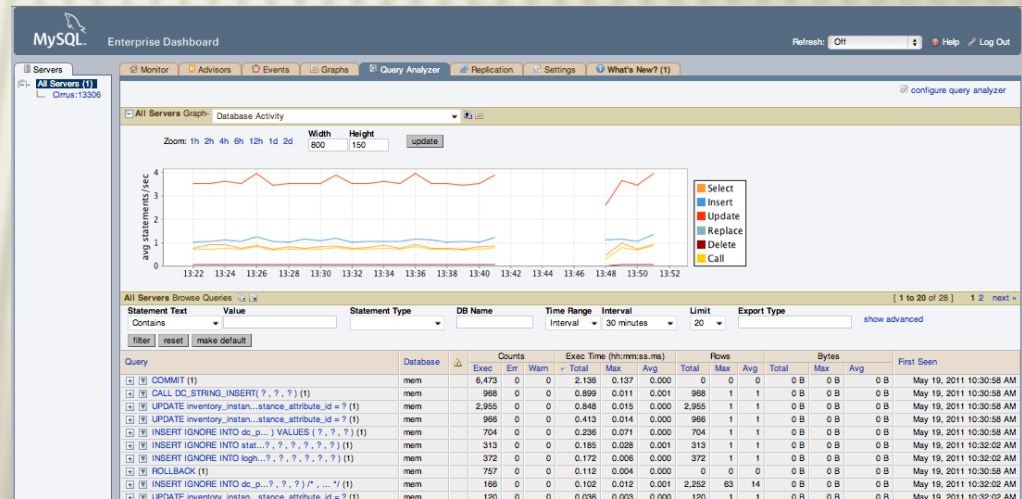
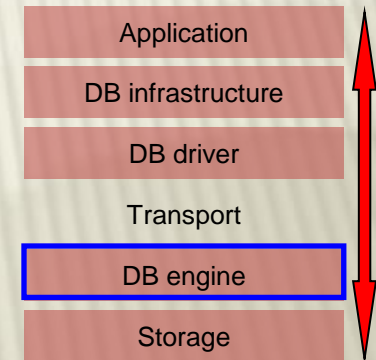
Transport

- ✖ Our application connects to the database server
- ✖ Over TCP/IP



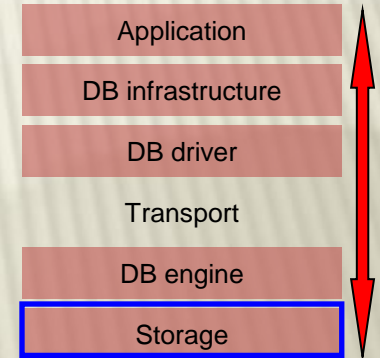
DB engine

- ✗ E.g., MySQL Community Server
- ✗ The db stores
 - + Our tables with the data (Images, users, etc.)
 - + Optimization components (Indexes, triggers)
 - + Predefined operations (procedures, functions)
- ✗ Executes the requests we sent
 - + E.g., insert an image



Storage

✖ E.g., the school MySQL server stores data on the school machines



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Connecting...

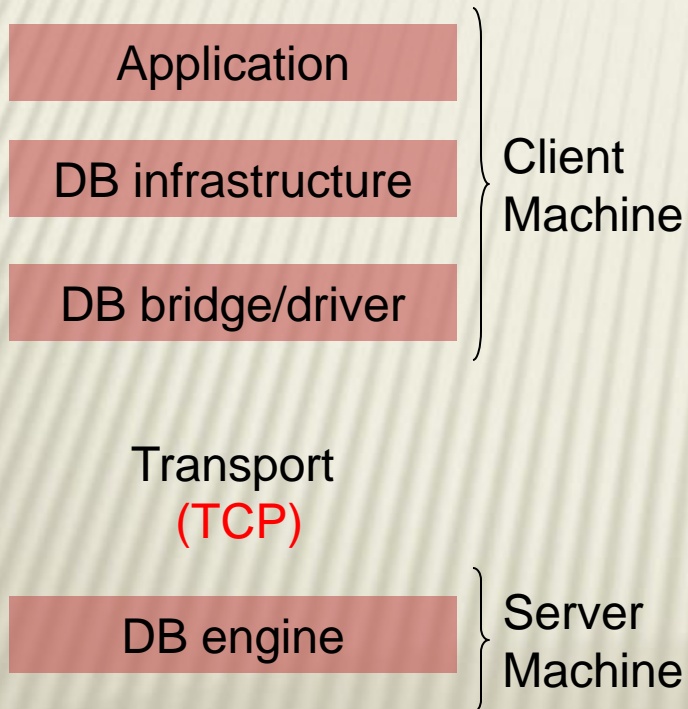
You need:

- × Host IP/ name
 - × Port
 - × Home install: host=localhost
TAU's server: host=mysqlsrv.cs.tau.ac.il
 - × MySQL default port is 3306
- is it really that easy??

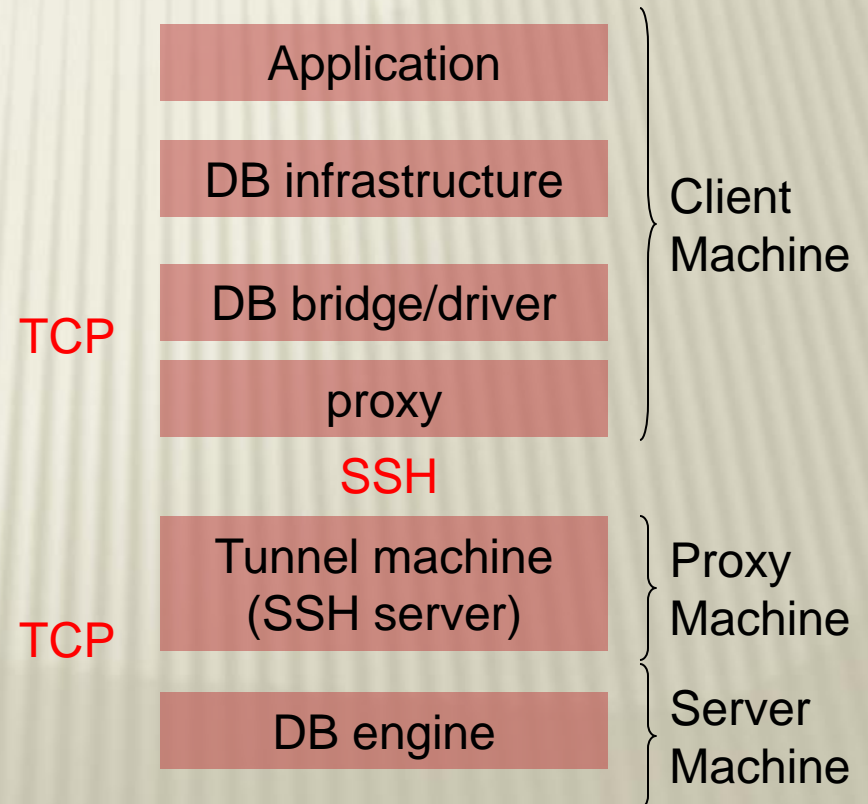
Welcome to

The travels of a queen

Standard way



Using Tunnel



SSH in TAU

Application

DB infrastructure

Db bridge/driver

proxy

YOUR MACHINE
define DB at localhost, port 3305

Putty connects to nova and
forward local port 3305 to
mysqlsrv.cs.tau.ac.il port 3306

Tunnel machine
(SSH server)

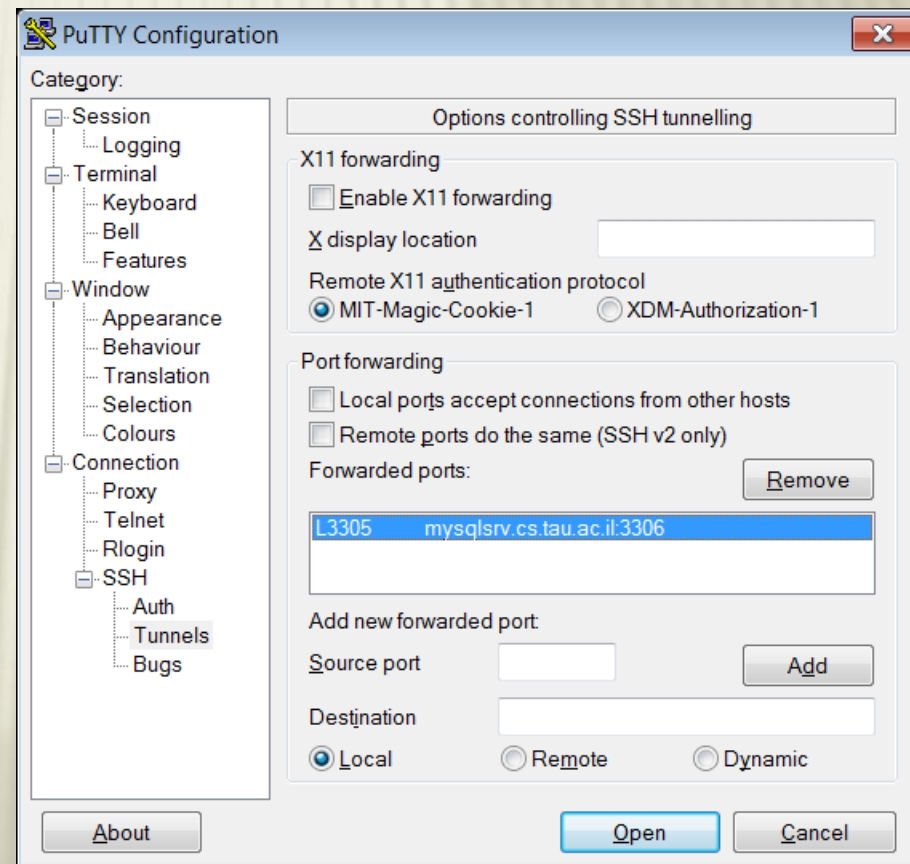
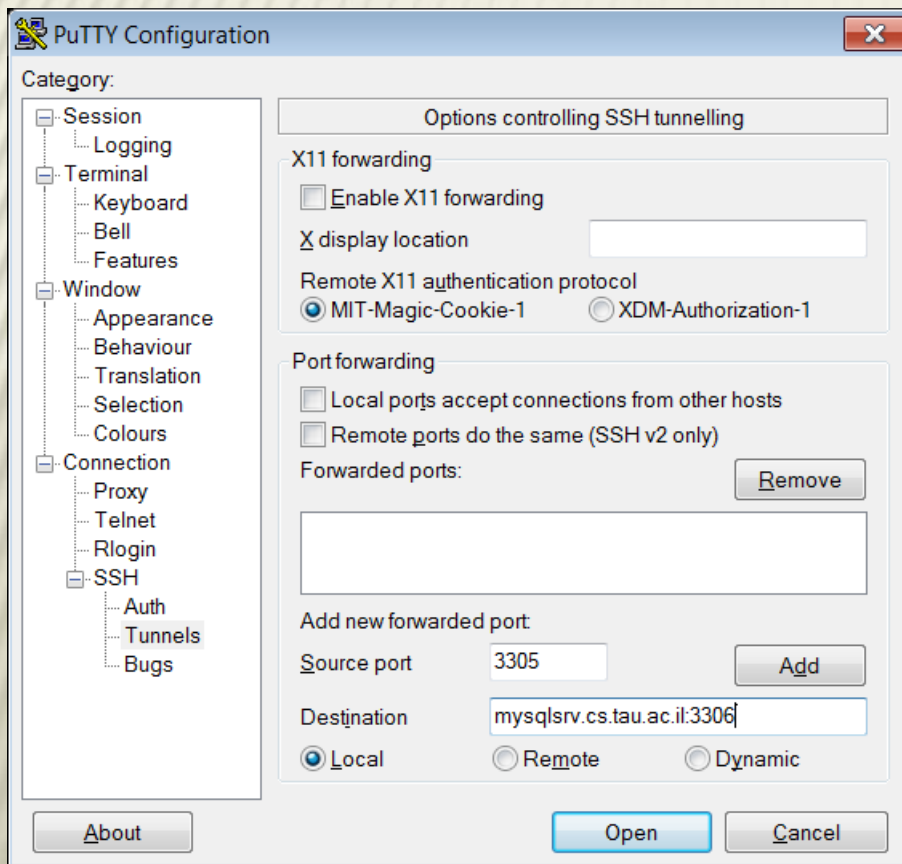
Nova.cs.tau.ac.il

DB engine

mysqlsrv.cs.tau.ac.il

SSH in TAU

× Putty



Don't forget to

- × CHECK THE CONNECTION GUIDE!!
(course website next to these slides)

Agenda

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Products we will be using

- ✖ MySQL (Community Server – Home)
- ✖ MySQL (Enterprise Edition – TAU)
- ✖ MySQL Workbench (GUI Tool..)
- ✖ MySQL Connector (J) – In two weeks...

Free to download on www.mysql.com



TAU Server settings..

- ✖ You can create your own user (schema) by following the connection guide link (course website..)
- ✖ For the project, each group will get a dedicated user+schema

“Sakila” Schema (For hw1)

- ✖ We will use the “Sakila” schema

<http://dev.mysql.com/doc/sakila/en/>

- ✖ Install and download from

<http://dev.mysql.com/doc/index-other.html>

Can be installed
with the other
MySQL products

- ✖ Already installed on TAU’s server:

username: *sakila*

password: *sakila*

schema: *sakila*

Schema: a set of
tables (and views) in
a database.
Each schema has its
own permissions

MySQL Command

- ✖ In the TAU System website:

http://www.cs.tau.ac.il/system/searchview?search_api_views_fulltext=+mysql

- ✖ How to run:

<http://www.cs.tau.ac.il/system/MySQLConn>

→ `mysql -u sakila -h mysqlsrv.cs.tau.ac.il sakila -p`

- ✖ Common commands:

- “show databases;”
- “show tables;”
- “select.. ;”

→ Don't forget the ;

Install MySQL at Home

✖ MySQL Community Server

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

MySQL Community Server 5.6.22

Select Platform:

Microsoft Windows ▼

Recommended Download:

MySQL Installer 5.6 for Windows

**All MySQL Products. For All Windows Platforms.
In One Package.**

Starting with MySQL 5.6 the MySQL Installer package replaces the server-only MSI packages.



Windows (x86, 64-bit), MySQL Installer MSI

Download

Registration is Optional

Begin Your Download - mysql-installer-community-5.6.22.0.msi

Login Now or Sign Up for a free account.

An Oracle Web Account provides you with the following advantages:

- Fast access to MySQL software downloads
- Download technical White Papers and Presentations
- Post messages in the MySQL Discussion Forums
- Report and track bugs in the MySQL bug system
- Comment in the MySQL Documentation

Login »

using my Oracle Web account

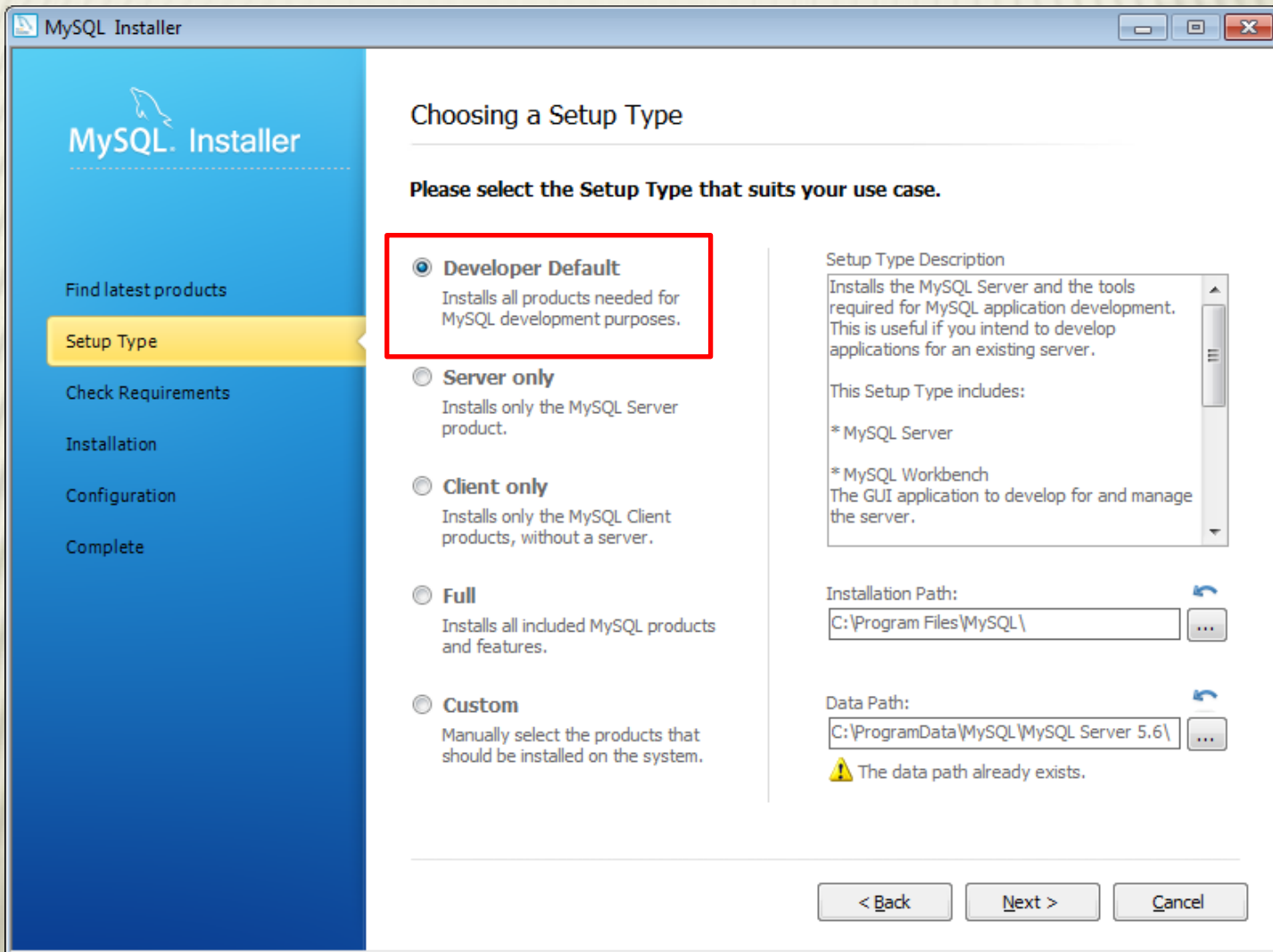
Sign Up »

for an Oracle Web account

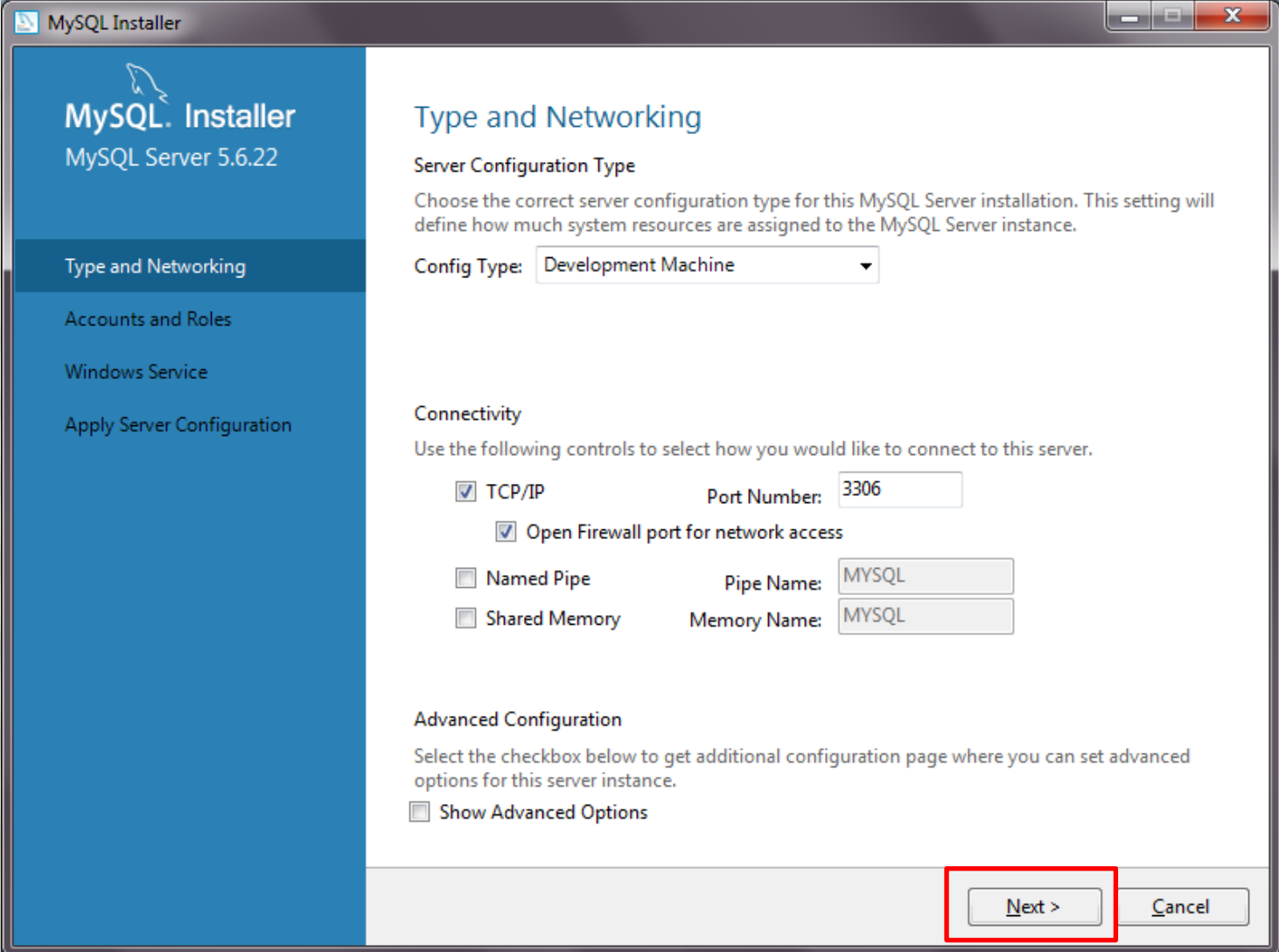
MySQL.com is using Oracle SSO for authentication. If you already have an Oracle Web account, click the Login link. Otherwise, link and following the instructions.

No thanks, just start my download.

Installation using an Installer



Configuration



The image shows a screenshot of the MySQL Installer window for MySQL Server 5.6.22. The window has a blue sidebar on the left with the following menu items: 'Type and Networking' (selected), 'Accounts and Roles', 'Windows Service', and 'Apply Server Configuration'. The main area is titled 'Type and Networking' and contains the following sections:

- Server Configuration Type**
Choose the correct server configuration type for this MySQL Server installation. This setting will define how much system resources are assigned to the MySQL Server instance.
Config Type:
- Connectivity**
Use the following controls to select how you would like to connect to this server.
 - ☒ TCP/IP Port Number:
 - ☒ Open Firewall port for network access
 - ☐ Named Pipe Pipe Name:
 - ☐ Shared Memory Memory Name:
- Advanced Configuration**
Select the checkbox below to get additional configuration page where you can set advanced options for this server instance.
 - ☐ Show Advanced Options

At the bottom right, there are two buttons: 'Next >' (highlighted with a red rectangle) and 'Cancel'.

Installation using an Installer

MySQL Installer

MySQL Server Configuration 2 / 3

Root Account Password

Enter the password for the root account. Please remember to store this password in a secure place.

Current Root Password:

MySQL Root Password:

Repeat Password:

Password Strength: Strong

MySQL User Accounts

Create MySQL user accounts for your users and applications. Assign a role to the user that consists of a set of privileges.

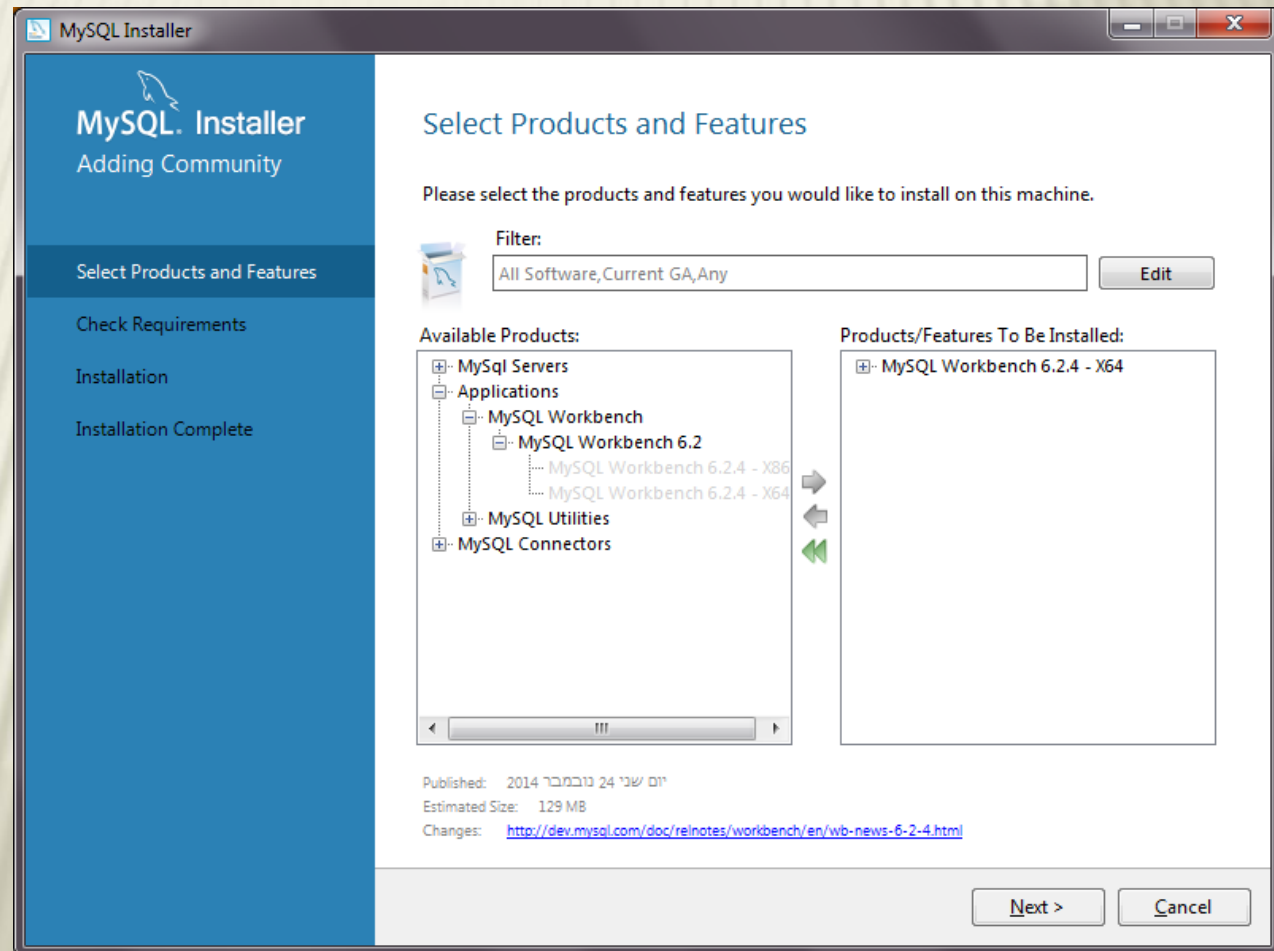
MySQL Username	Host	User Role
----------------	------	-----------

Add User Edit User Delete User

< Back Next > Cancel

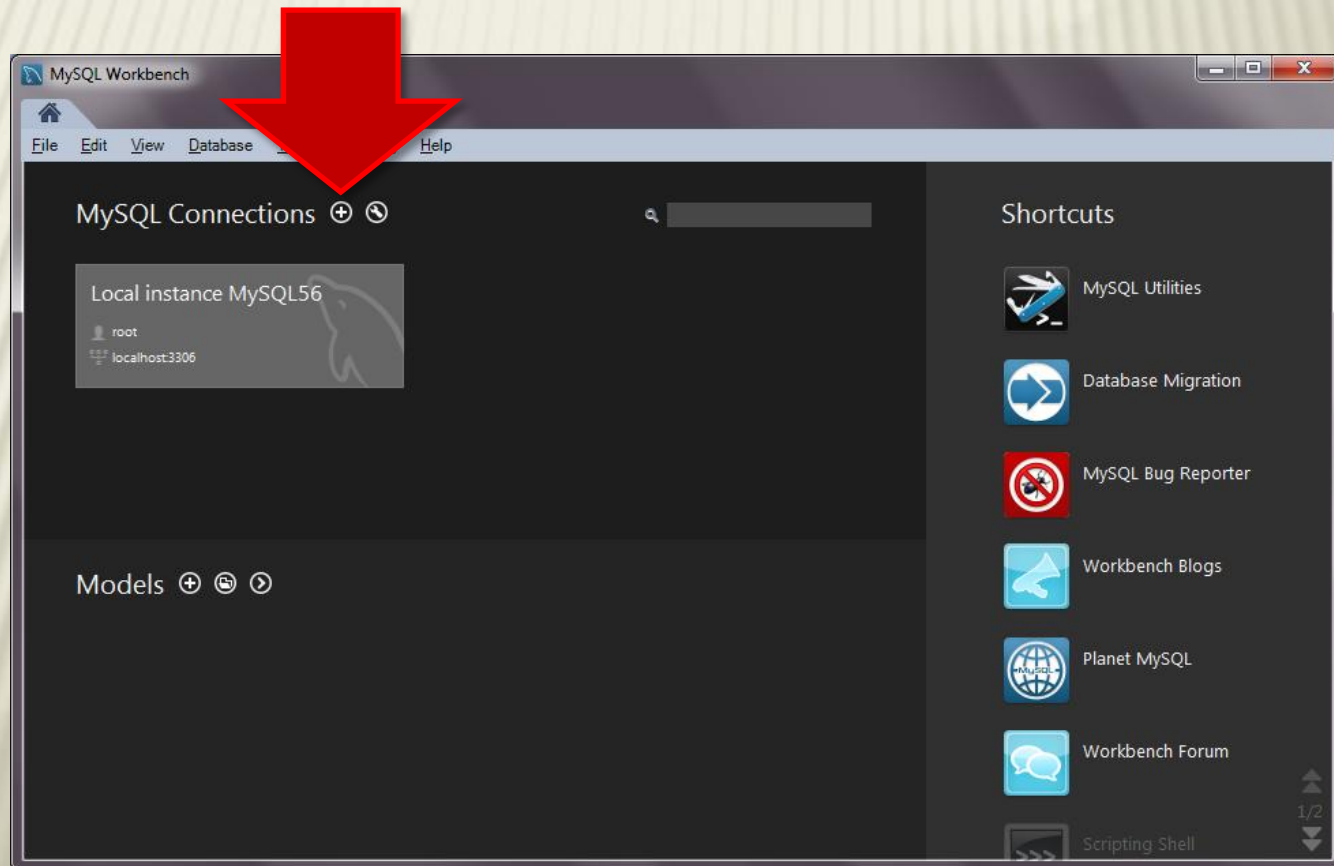
MySQL Workbench

- ✖ Make sure to install server, workbench and examples



Example: connecting to school server

- ✗ Open the tunnel!
- ✗ Then open workbench and create new connection



Configure the connection

Setup New Connection

Connection Name: Type a name for the connection

Connection Method: Method to use to connect to the RDBMS

Parameters

Hostname: Port: Name or IP address of the server host, - and TCP/IP port.

Username: Name of the user to connect with.

Password: The user's password. Will be requested later if it's not set.

Default Schema: The schema to use as default schema. Leave blank to select it later.

Support old authentication protocol

Setup New Connection

Connection Name: Type a name for the connection

Connection Method: Method to use to connect to the RDBMS

Parameters SSL **Advanced**

☐ Use compression protocol. Select this option for WAN connections.

☐ Use ANSI quotes to quote identifiers. If enabled this option overwrites the serverside settings.

☐ Enable Cleartext Authentication Plugin. Send user password in cleartext. Required for some authentication methods.

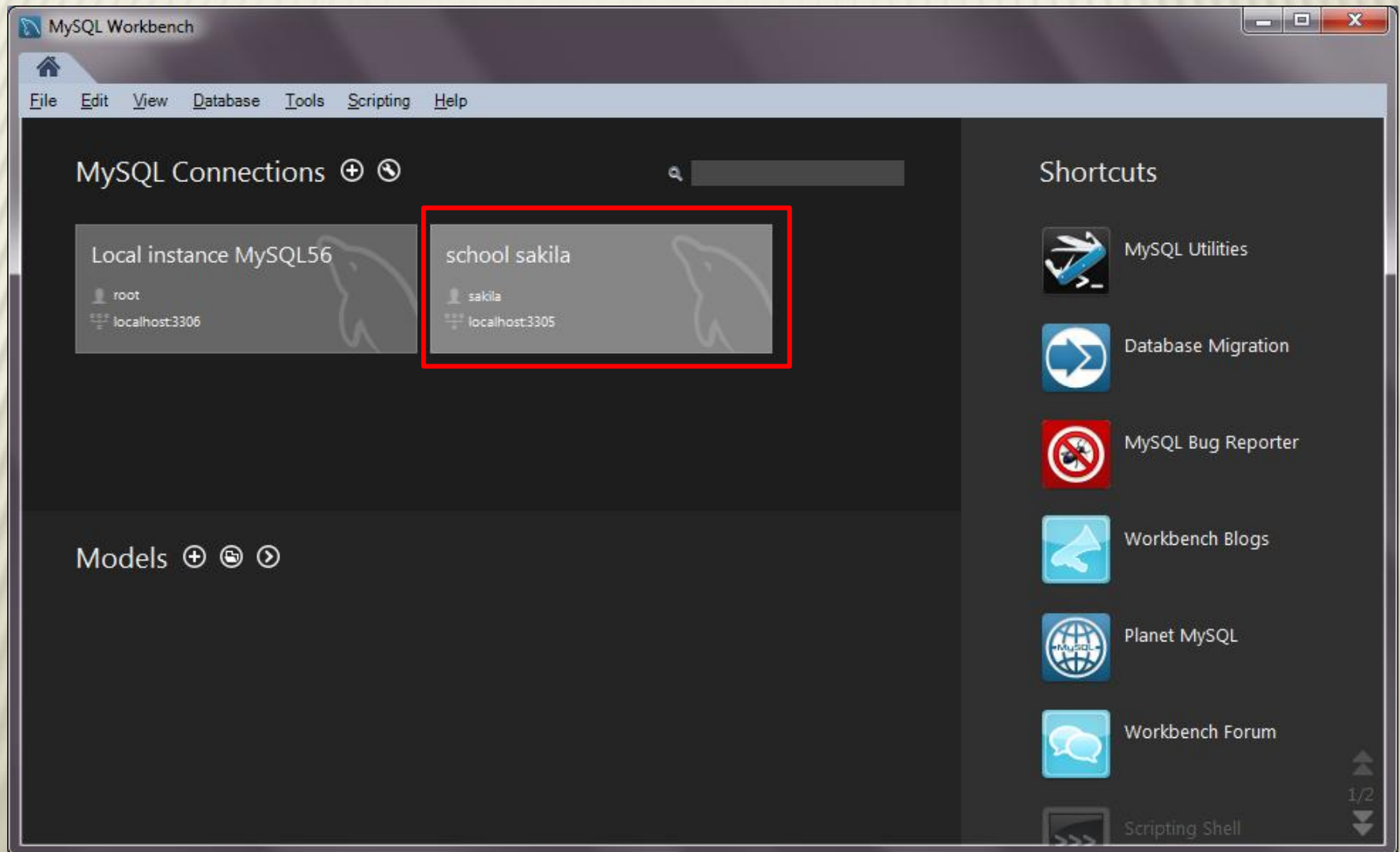
☒ Use the old authentication protocol. This option disables Connector/C++'s secure_auth option.

SQL_MODE: Override the default SQL_MODE used by the server.

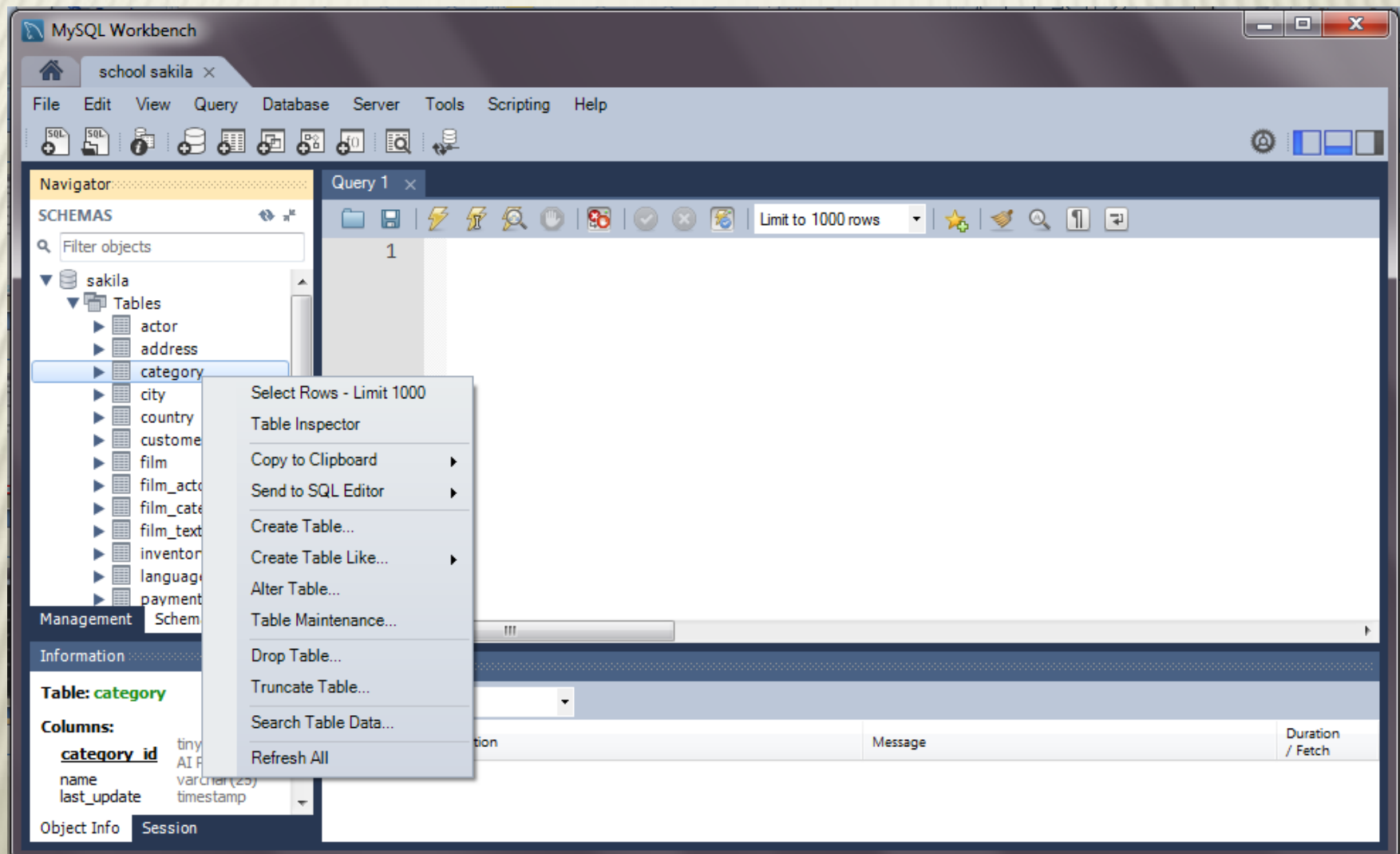
Others: Other options for Connector/C++ as option=value pairs, one per line.

Configure Server Management... **Test Connection** Cancel **OK**

Open the new connection



Now you can query the SQL data



... and the result

The screenshot shows the MySQL Workbench interface with the 'sakila' database selected. The 'Navigator' pane on the left displays the database schema, with the 'category' table highlighted. The 'Information' pane at the bottom left shows the details of the 'category' table, including its columns: 'category_id' (tinyint(3) UNSIGNED, Primary Key), 'name' (varchar(25)), and 'last_update' (timestamp).

The 'Query' pane in the center shows the following SQL query:

```
1 • SELECT * FROM sakila.category;
```

The 'Result Grid' pane at the bottom displays the results of the query, showing 10 rows of data. The columns are 'category_id', 'name', and 'last_update'.

category_id	name	last_update
1	Action	2006-02-15 04:46:27
2	Animation	2006-02-15 04:46:27
3	Children	2006-02-15 04:46:27
4	Classics	2006-02-15 04:46:27
5	Comedy	2006-02-15 04:46:27
6	Documentary	2006-02-15 04:46:27
7	Drama	2006-02-15 04:46:27
8	Family	2006-02-15 04:46:27
9	Foreign	2006-02-15 04:46:27
10	Games	2006-02-15 04:46:27

Demo Time ☺

DEMO TIME ☺

✕ Startup the Server..

Demo Time ☺

- × Server Administration
 - run the local instance
 - create users
 - export/import

Demo Time 😊

- × SQL Development
 - browse the schema
 - create/alter tables
 - run queries
 - export results

Demo Time ☺

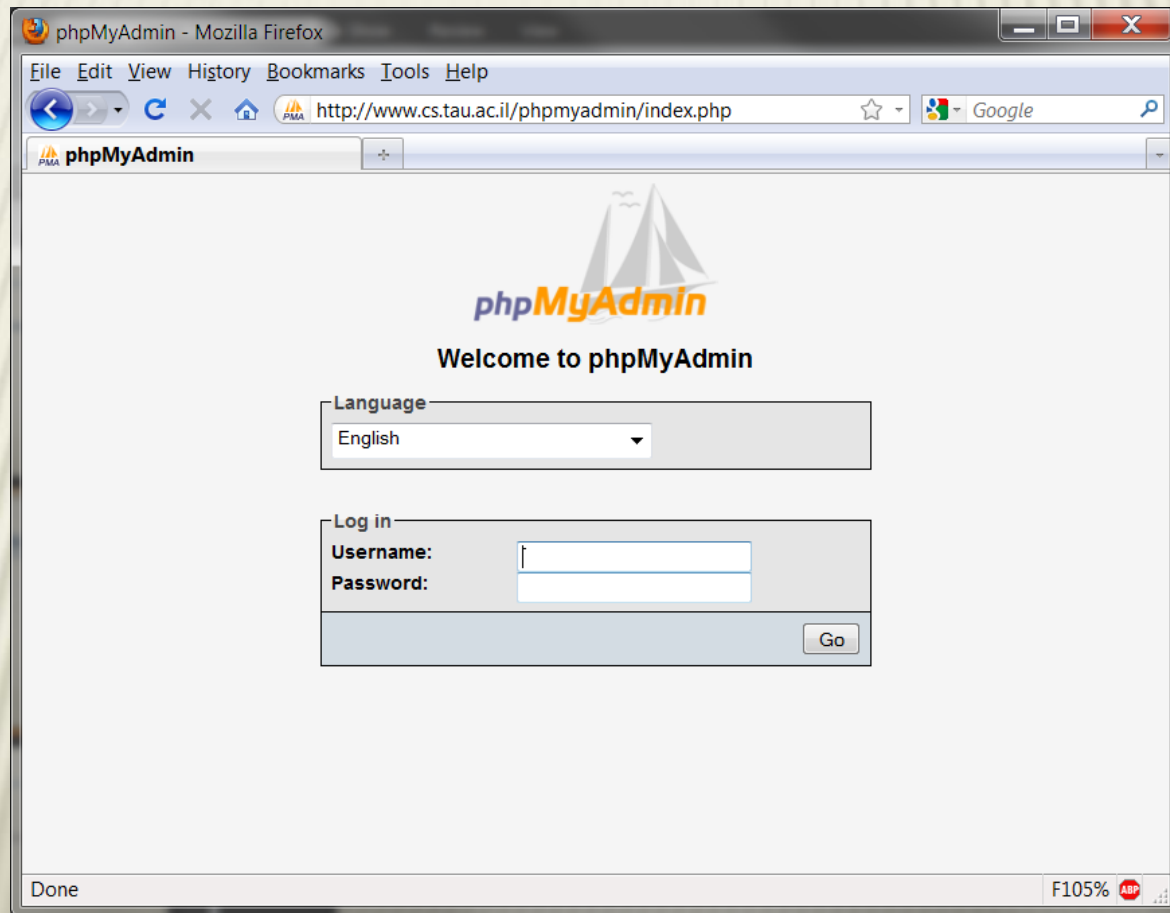
Demo Time ☺

- ✕ Install the “sakila” schema

Demo Time ☺

- × Data Modeling
 - browse / alter the schema

phpMyAdmin



phpMyAdmin

- ✖ Another tool for managing MySQL
- ✖ Installed on tau, and reachable from home without a tunnel!

<https://www.cs.tau.ac.il/phpmyadmin/index.php>
(note the *https*)

- ✖ To install at home, download from:
<http://www.phpmyadmin.net/>
(requires php server so its not recommended unless you are familiar with these stuff...)

phpMyAdmin

Database


































































































































































sakila (23)

sakila (23)

- actor
- actor_info
- address
- category
- city
- country
- customer
- customer_list
- film
- film_actor
- film_category
- film_list
- film_text
- inventory
- language
- nicer_but_slower_film_list
- payment
- rental
- sales_by_film_category
- sales_by_store
- staff
- staff_list
- store

Server: mysqlsrv.cs.tau.ac.il Database: sakila

Structure SQL Search Query Export Import Operations

Table	Action	Records ¹	Type	Collation	Size	Overhead
<input type="checkbox"/> actor	      	200	InnoDB	utf8_general_ci	32.0 KiB	-
<input type="checkbox"/> actor_info	      	~0 ²	View	---	-	-
<input type="checkbox"/> address	      	603	InnoDB	utf8_general_ci	96.0 KiB	-
<input type="checkbox"/> category	      	16	InnoDB	utf8_general_ci	16.0 KiB	-
<input type="checkbox"/> city	      	600	InnoDB	utf8_general_ci	64.0 KiB	-
<input type="checkbox"/> country	      	109	InnoDB	utf8_general_ci	16.0 KiB	-
<input type="checkbox"/> customer	      	599	InnoDB	utf8_general_ci	128.0 KiB	-
<input type="checkbox"/> customer_list	      	~0 ²	View	---	-	-
<input type="checkbox"/> film	      	1,000	InnoDB	utf8_general_ci	272.0 KiB	-
<input type="checkbox"/> film_actor	      	5,462	InnoDB	utf8_general_ci	272.0 KiB	-
<input type="checkbox"/> film_category	      	1,000	InnoDB	utf8_general_ci	80.0 KiB	-
<input type="checkbox"/> film_list	      	~0 ²	View	---	-	-
<input type="checkbox"/> film_text	      	1,000	MyISAM	utf8_general_ci	317.8 KiB	-
<input type="checkbox"/> inventory	      	4,581	InnoDB	utf8_general_ci	368.0 KiB	-
<input type="checkbox"/> language	      	6	InnoDB	utf8_general_ci	16.0 KiB	-
<input type="checkbox"/> nicer_but_slower_film_list	      	~0 ²	View	---	-	-
<input type="checkbox"/> payment	      	16,049	InnoDB	utf8_general_ci	2.1 MiB	-
<input type="checkbox"/> rental	      	16,044	InnoDB	utf8_general_ci	2.7 MiB	-
<input type="checkbox"/> sales_by_film_category	      	~0 ²	View	---	-	-
<input type="checkbox"/> sales_by_store	      	~0 ²	View	---	-	-
<input type="checkbox"/> staff	      	2	InnoDB	utf8_general_ci	96.0 KiB	-
<input type="checkbox"/> staff_list	      	~0 ²	View	---	-	-
<input type="checkbox"/> store	      	2	InnoDB	utf8_general_ci	48.0 KiB	-
23 table(s)	Sum	~47,273	MyISAM	latin1_swedish_ci	6.6 MiB	0 B

Check All / Uncheck All

With selected: ▾

Print view Data Dictionary

Create new table on database sakila

Agenda

- × Bureaucracy...
- × Database architecture overview
- × SSH Tunneling
- × Intro to MySQL
- × Comments on Homework

“Sakila” Schema

- ✖ We will use the “Sakila” schema
<http://dev.mysql.com/doc/sakila/en/>
- ✖ Installed as an example with the community server
- ✖ Already installed on TAU’s server:
username: *sakila*
password: *sakila*
schema: *sakila*

Homework Notes

- × SQL functions and arithmetic conditions.
- × 'strings'
- × LIKE (%), LOWER
- × Use the Syntax help in Query browser
- × MAX, MIN
- × IN

MySQL Queries

- ✗ For now, only general SQL queries
- ✗ Not everything we discussed is enabled in MySQL!
- ✗ Manual
 - + <http://dev.mysql.com/doc/refman/5.6/en/index.html>



Thank you 😊