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

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- Database architecture overview
- SSH Tunneling
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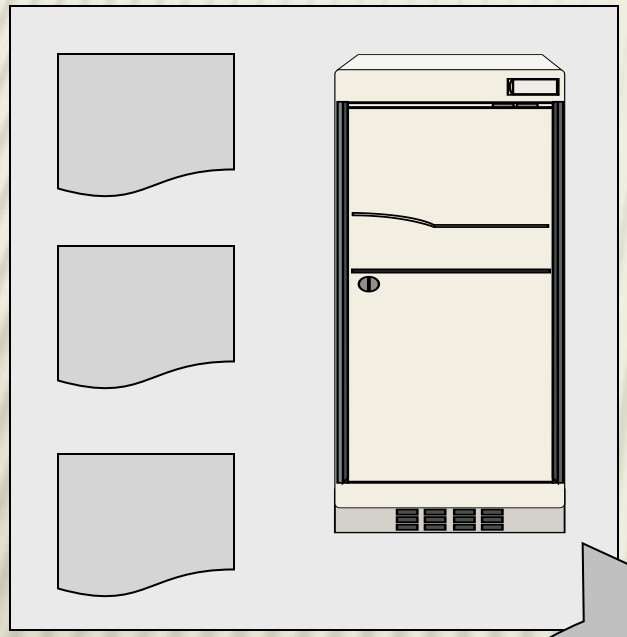
DB System from lecture #1

"Two tier database system"



connection

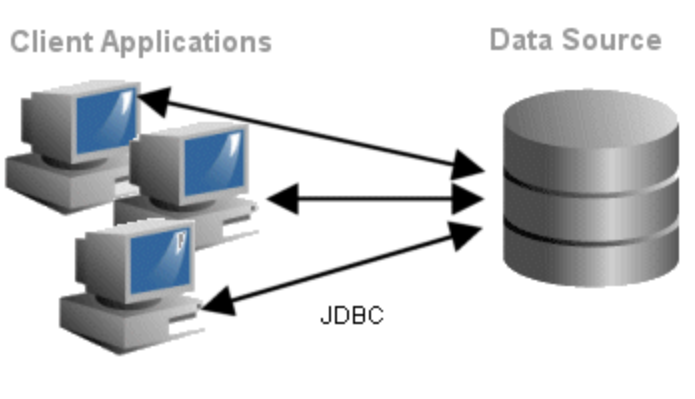
(ODBC, JDBC)

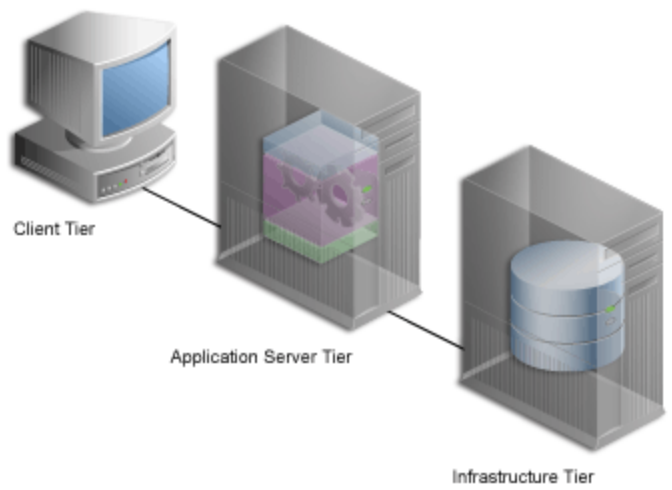
Data files

Database server (someone else's C program)

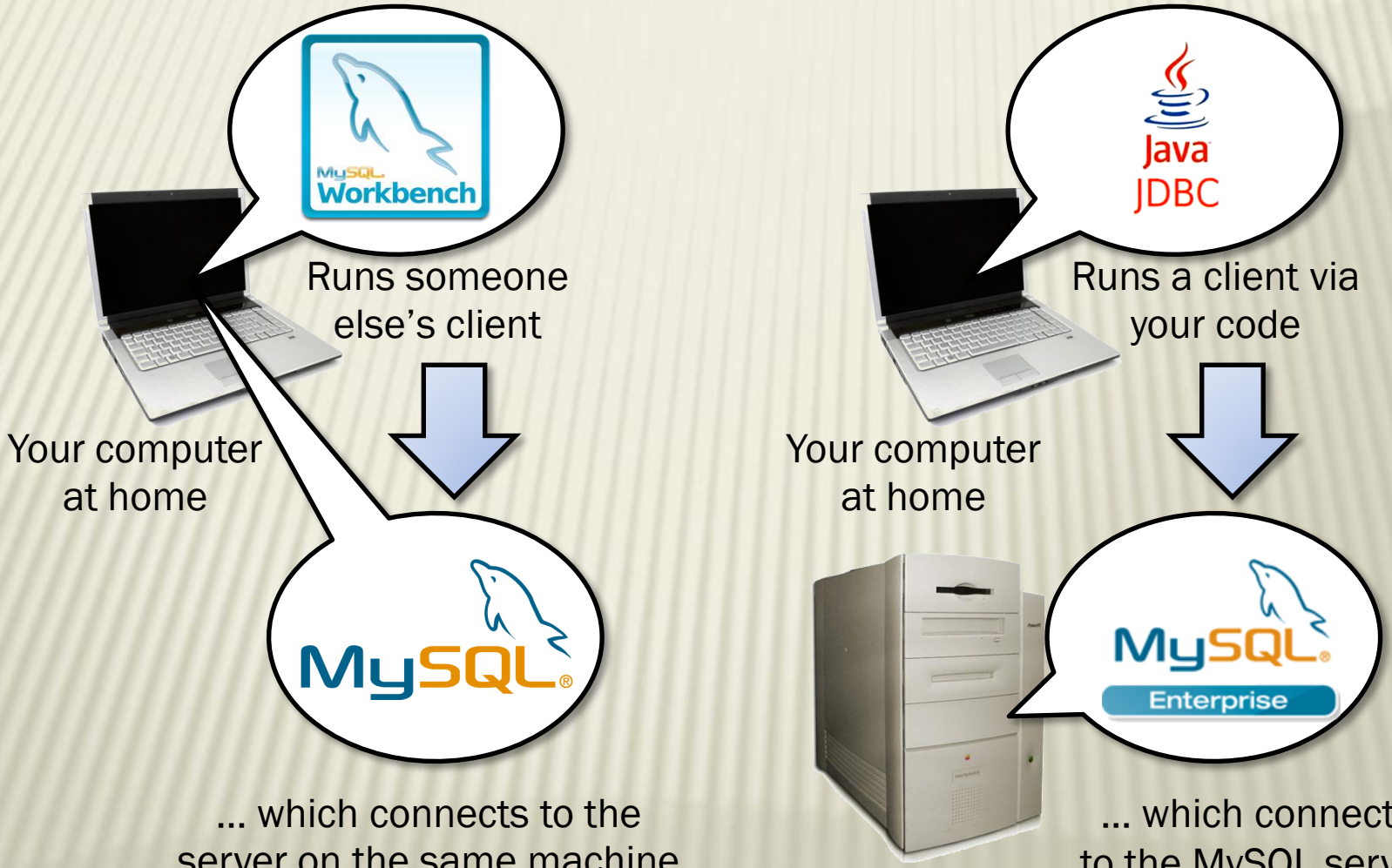
Applications

1,2,3 tiers

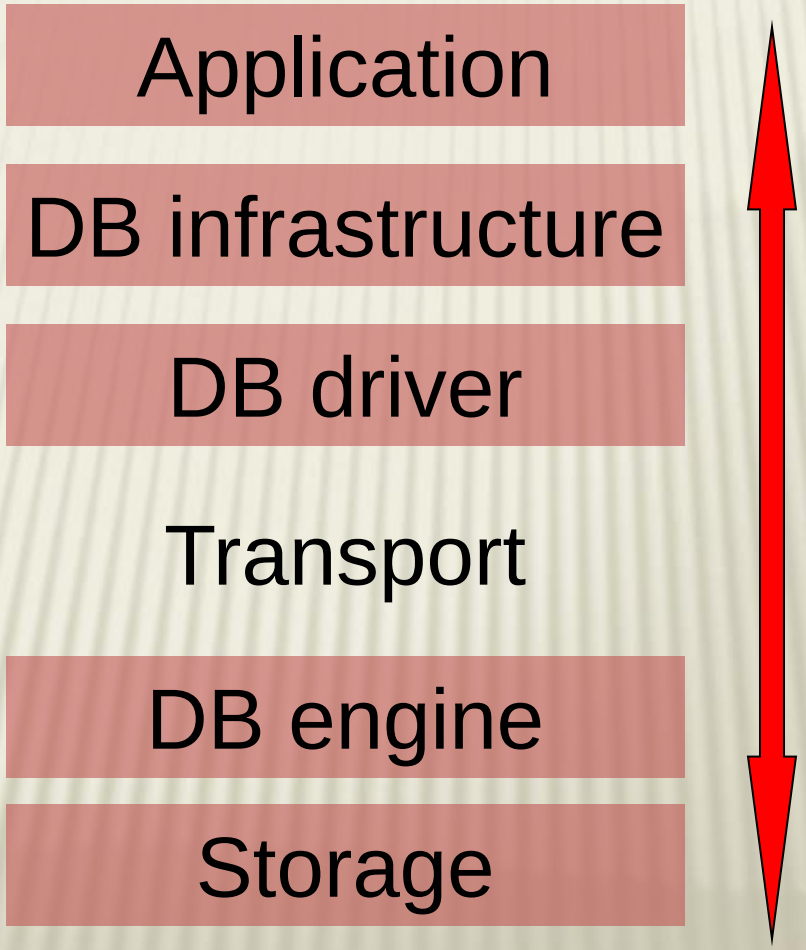

Client Applications
Data Source
JDBC


Client Tier
Application Server Tier
Infrastructure Tier

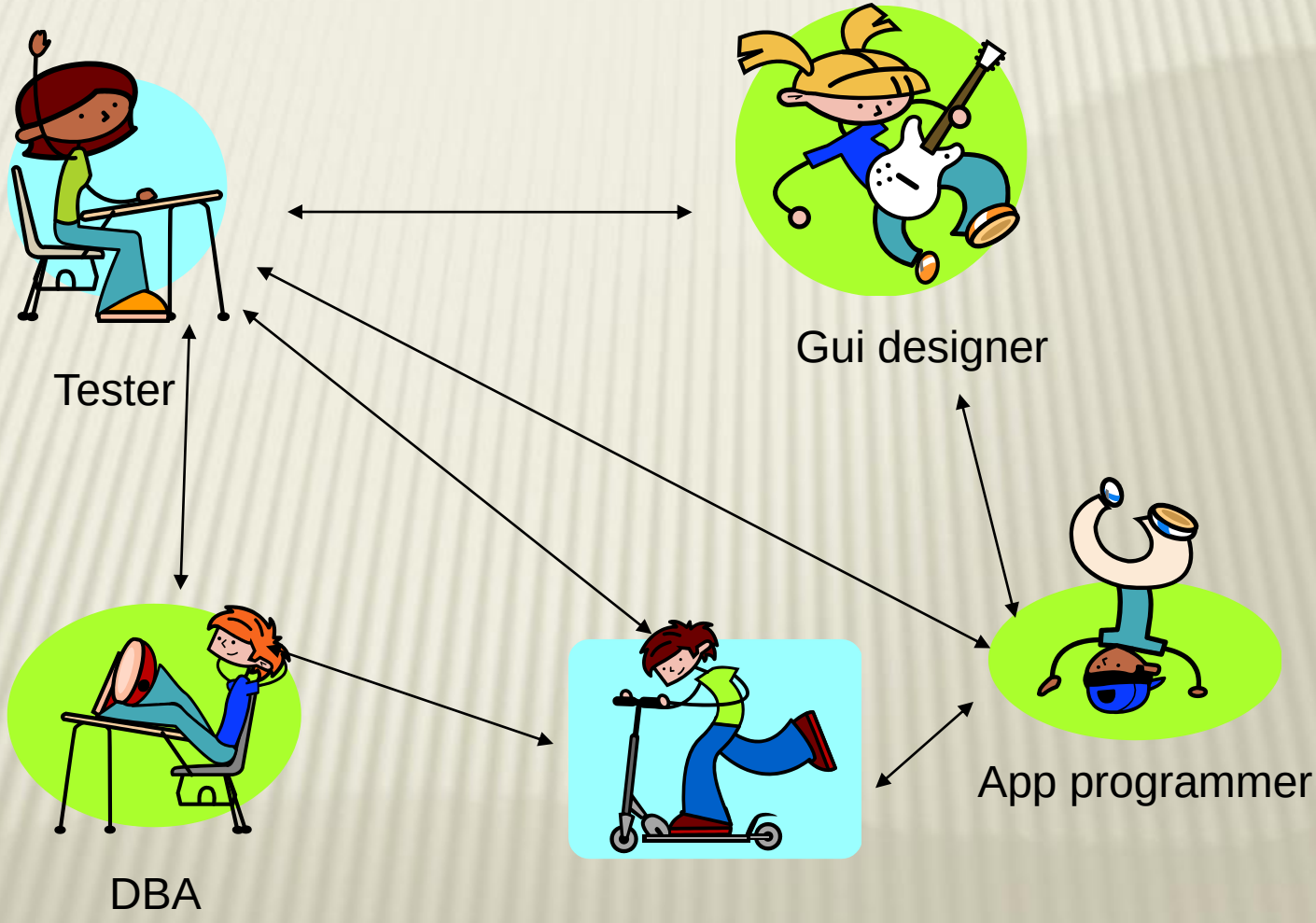
Examples in this course



Abstractly (DB) system layers may include

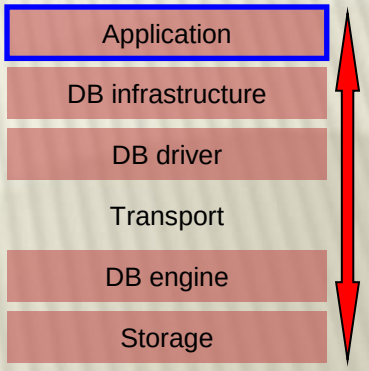


Why?

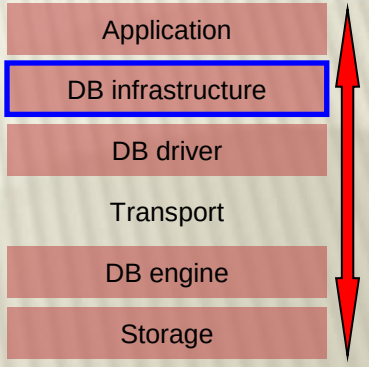


Application layer

- Why should it actually use database?
  - Persistence layer
  - Access data storage
  - Interfacing between systems
  - Large volumes
  - Scalability
  - Redundancy



Infrastructure layer



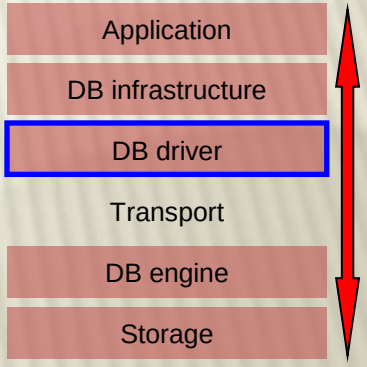
- Goals:
  - Database “hiding”
  - Schema abstraction
  - Encapsulation of db mechanisms
- How: (In two words)

Model Abstraction

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

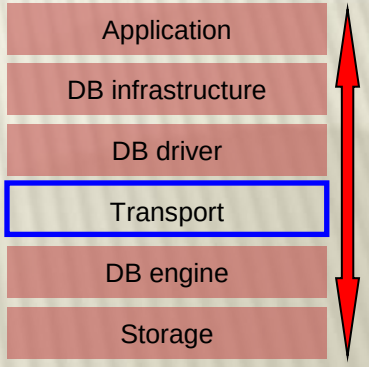
DB driver / bridge

- Used for:
  - API for database connectivity
  - Protocol converter
  - Performance improvements
  - Transaction management
- Examples:
  - In a minute…



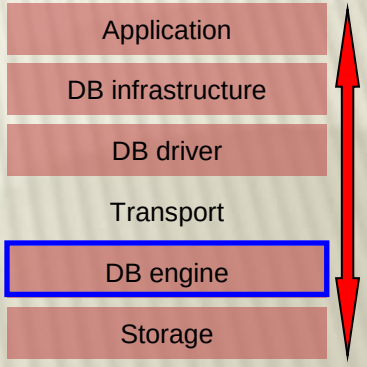
Transport

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



DB engine

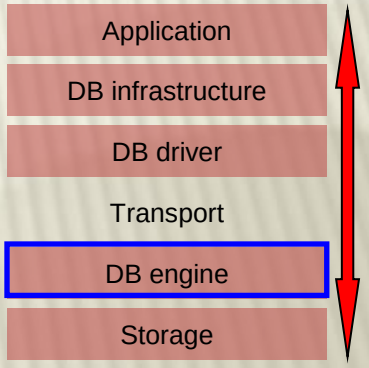
- Total management of the DB environment including
  - Security
  - Scalability
  - Fault tolerant (disaster management)
  - Monitoring
  - Services
- Large DB engines include Microsoft SQL Server, Oracle, SyBase, MySQL, etc.



DB engine (2)

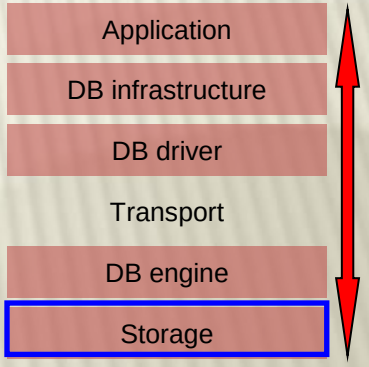
DB engine management includes:

- + Databases/Tables/Fields
- Creation/removal/modification/optimization
- + Connections/Users/Roles
- Security/monitoring/logging
- + Jobs/Processes/Threads
- Scheduling/balancing/managing



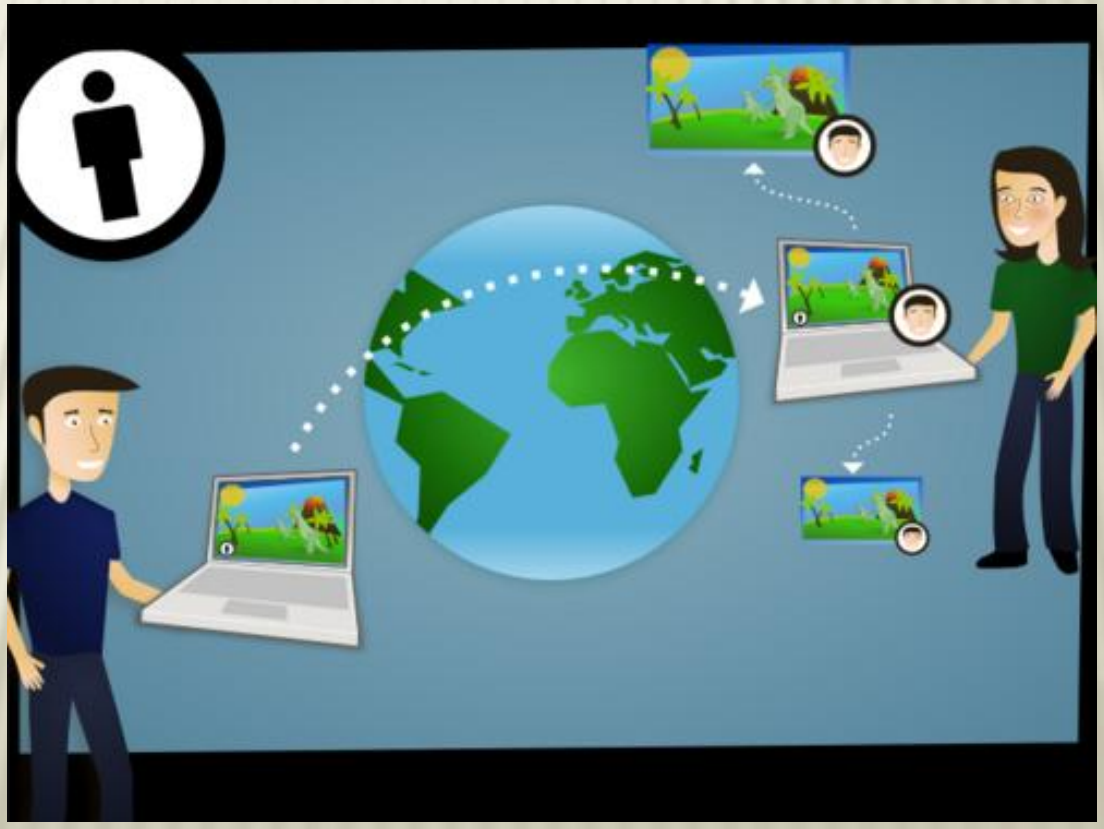
Storage

- NAS/SAN, Raid and other stuff
  - We are interested in the storage-engine interface



A real-life example

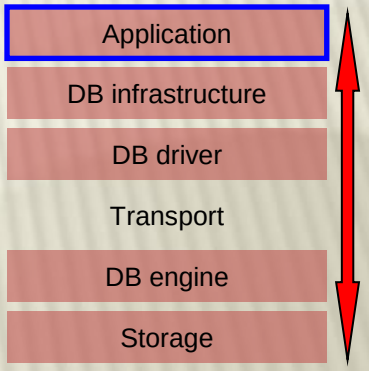
- We want to build an image sharing Website
- What is our data?



The application

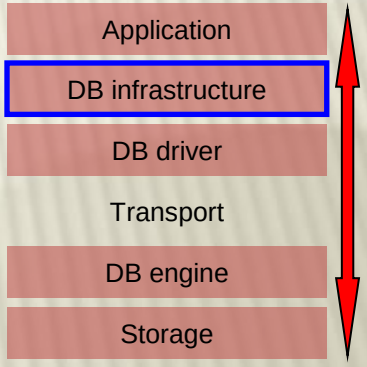
- GUI
- Application-User Management
  - Do not confuse with DB users!
- Image processing
- And so on…

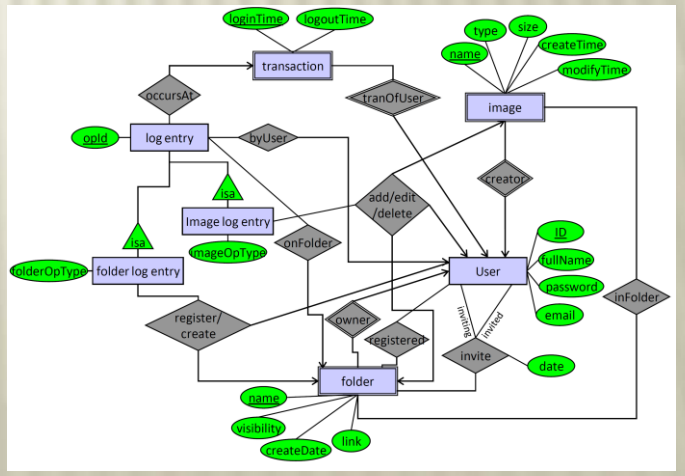
- The application needs storage for the images, albums, users, tags…
- Runs on the application server
  - E.g., your computer at home



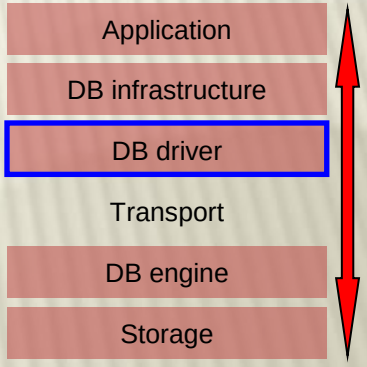
Infrastructure

- 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

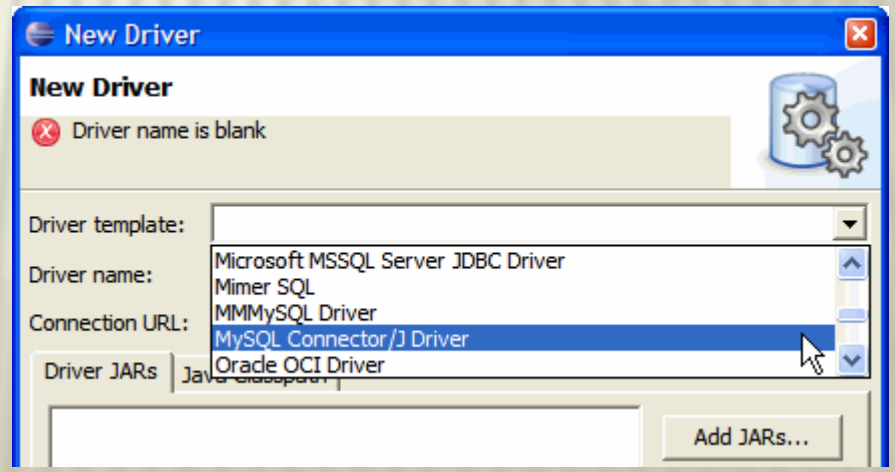




DB driver / bridge

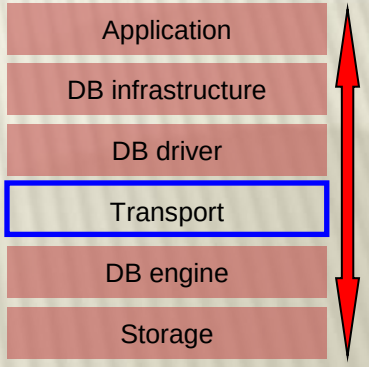


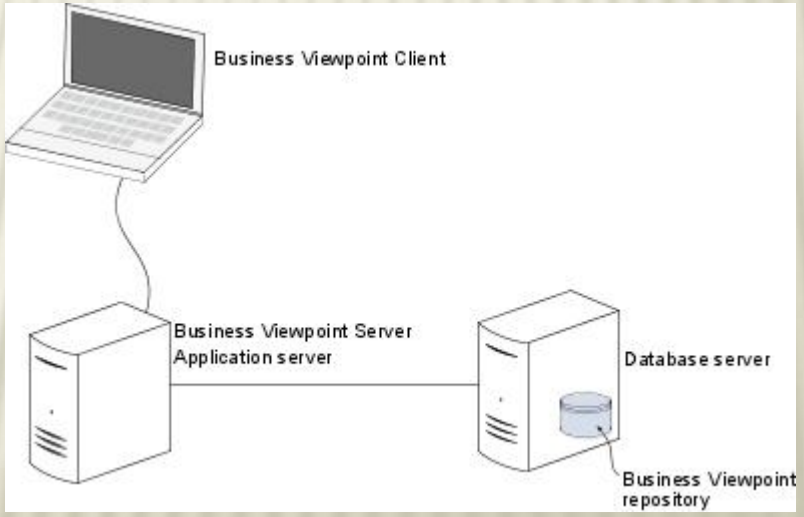
- Not written by us, e.g., J connector
- Used by the infrastructure
- E.g., to upload an image we use an insert command to the image table (and perhaps others)
- We want the type of DB used to be configurable



Transport

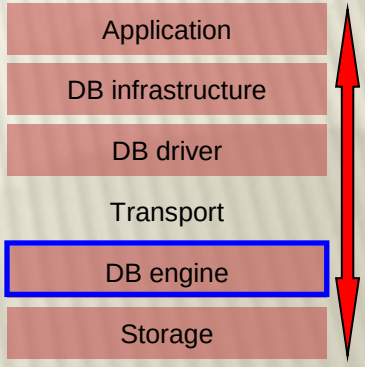
- Our application connects to the database server
- Over TCP/IP

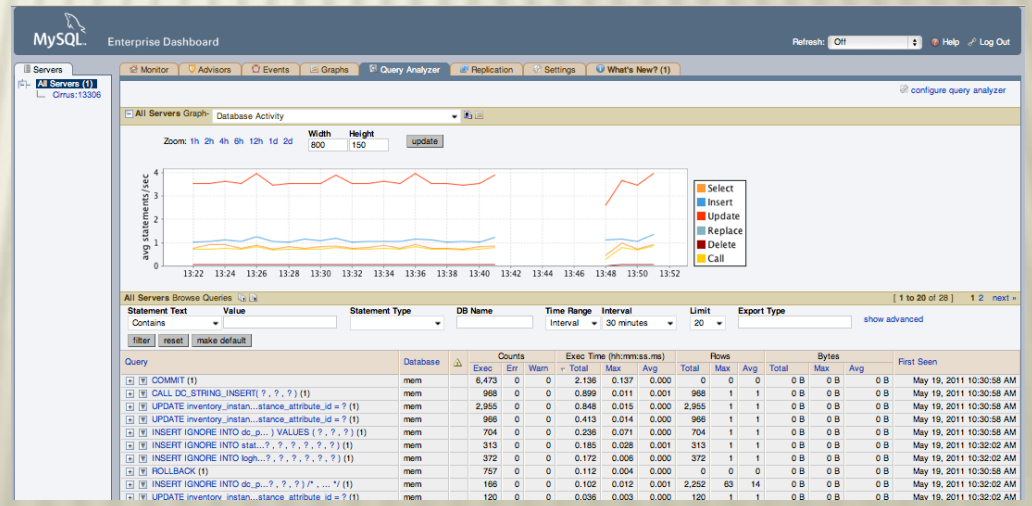




DB engine

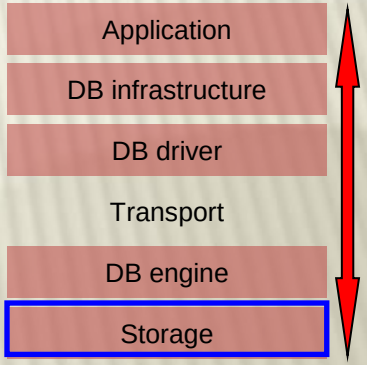
- E.g., MySQL Community Server
- The db stores
  - Our tables with the data (Images, users, etc.)
  - Optimization components (Indexes, triggers)
  - Predefined operations (procedures, functions)
- Executes the requests we sent
  - E.g., insert an image





Storage

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



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Connecting…

You need:

- **Host IP/ name**
- **Port**

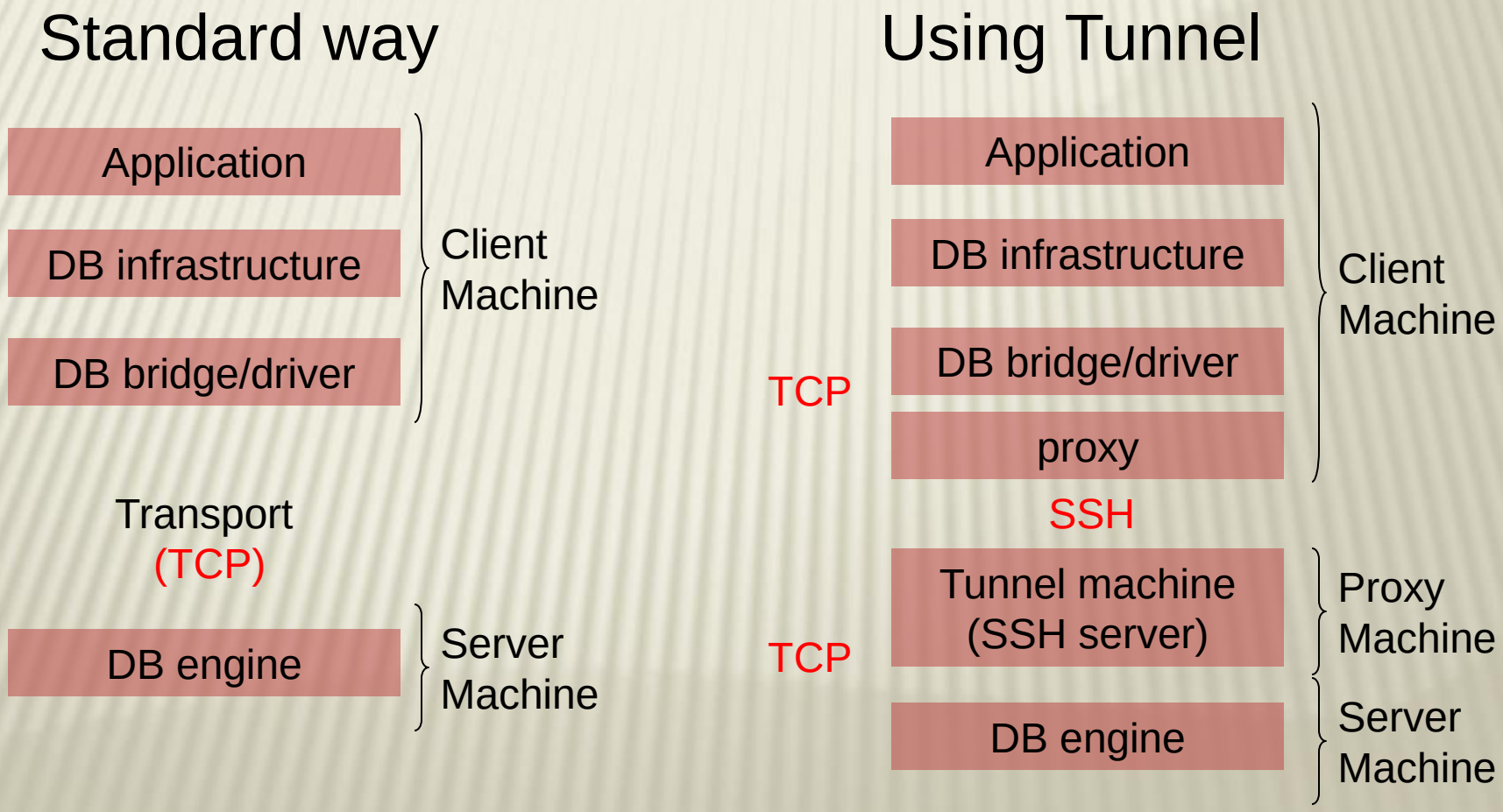
- Home install: host=localhost
  TAU's server: host=mysqlsrv.cs.tau.ac.il

- MySQL default port is 3306

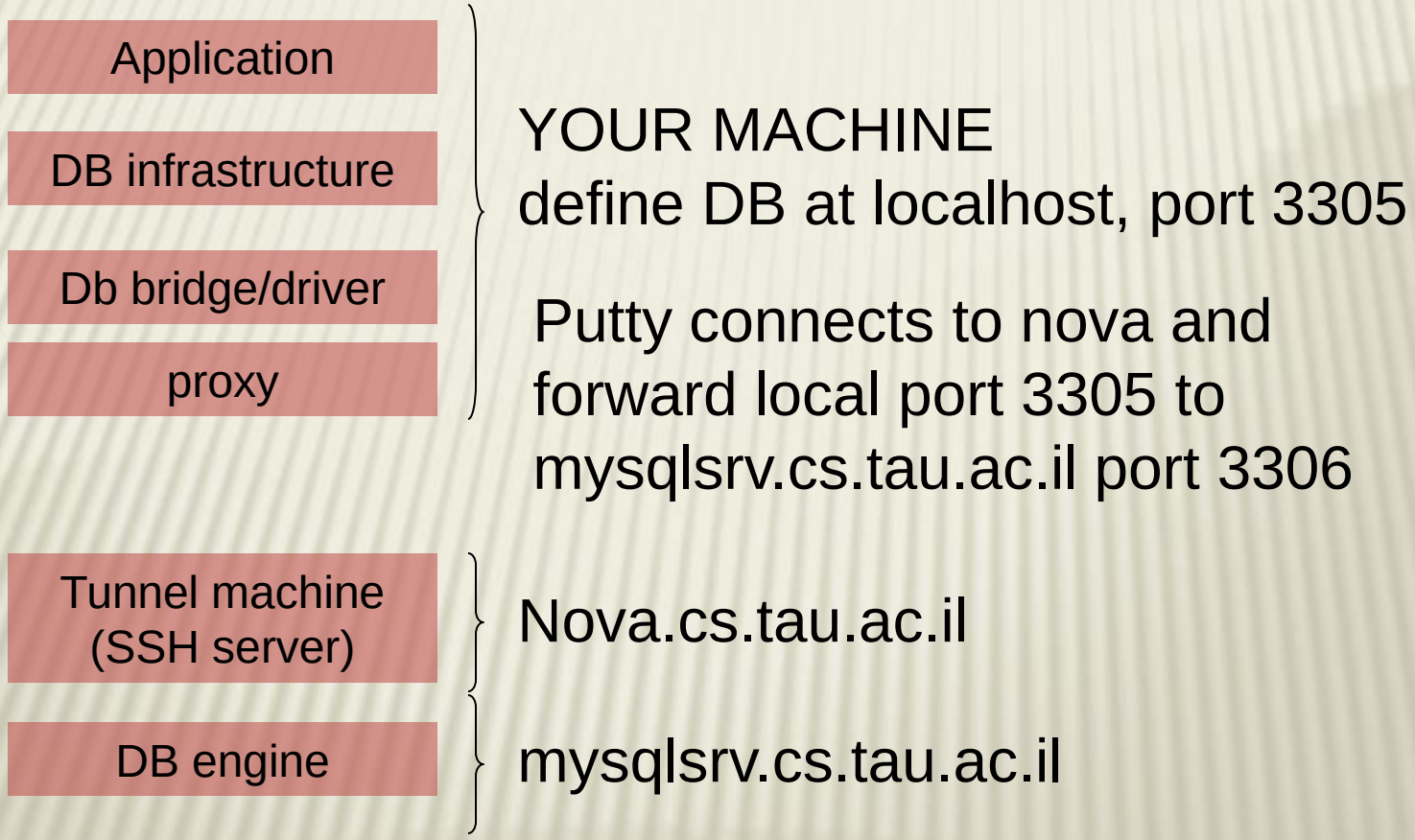
is it really that easy??

Welcome to

SSH

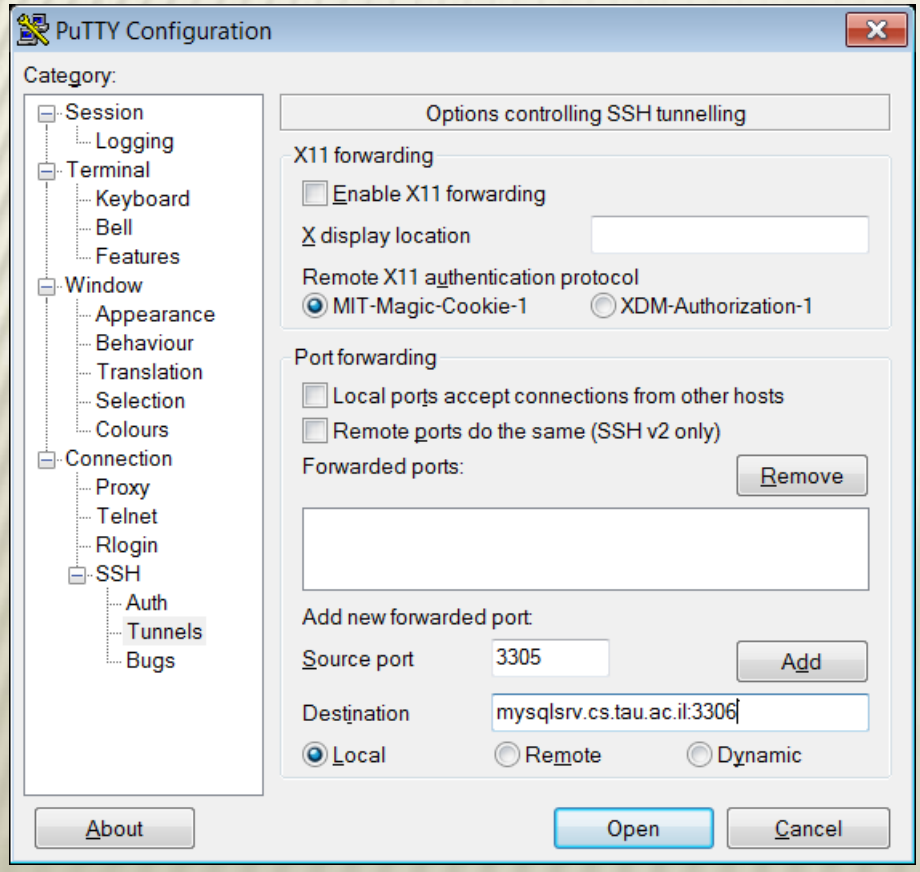

Standard way
Application
DB infrastructure
DB bridge/driver
Client Machine
Transport (TCP)
DB engine
Server Machine
Using Tunnel
Application
DB infrastructure
DB bridge/driver
proxy
Client Machine
TCP
SSH
Tunnel machine (SSH server)
Proxy Machine
TCP
DB engine
Server Machine

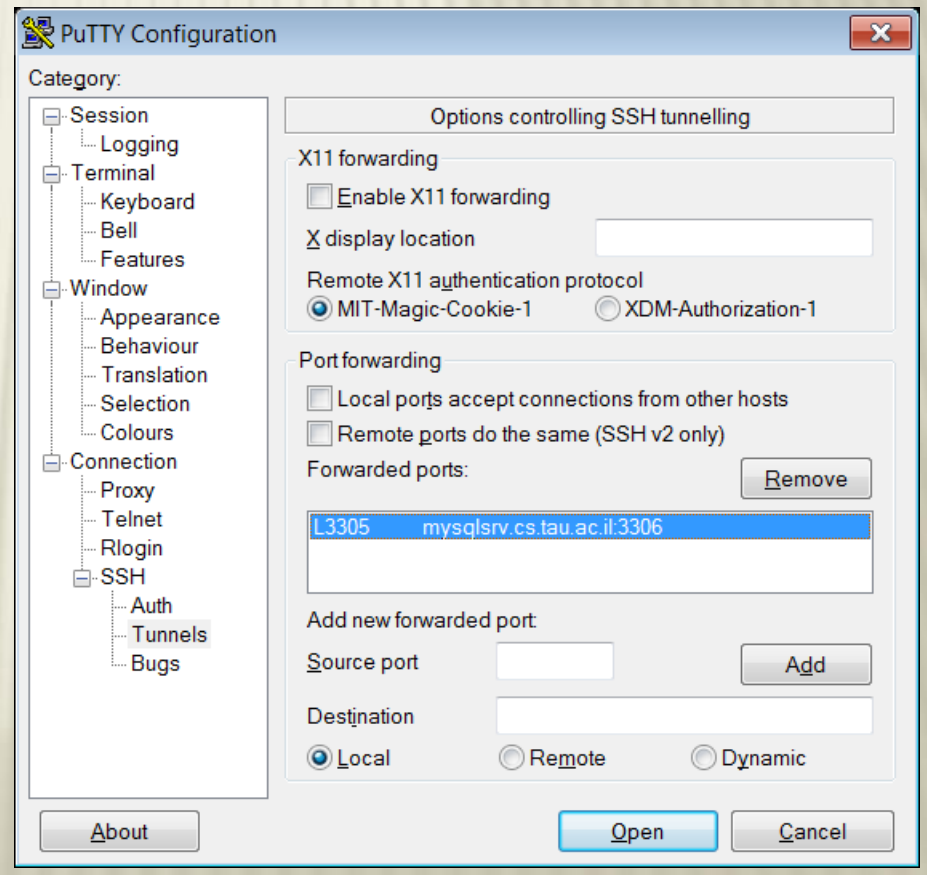
SSH in TAU


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

- Bureaucracy…
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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

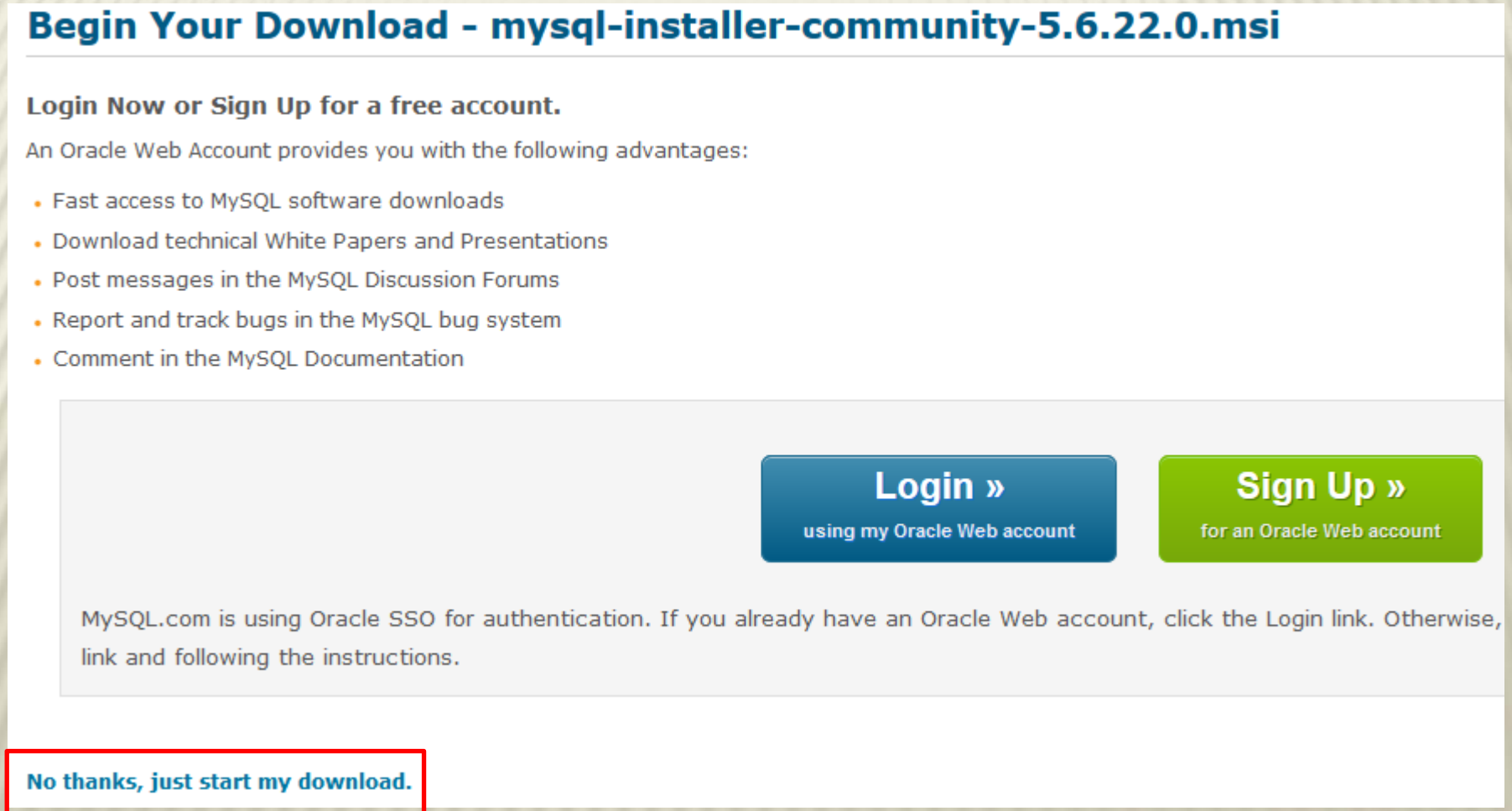
- Common commands:
  - "show databases;"
  - "show tables;"
  - "select.. ;"

→ Don't forget the ;

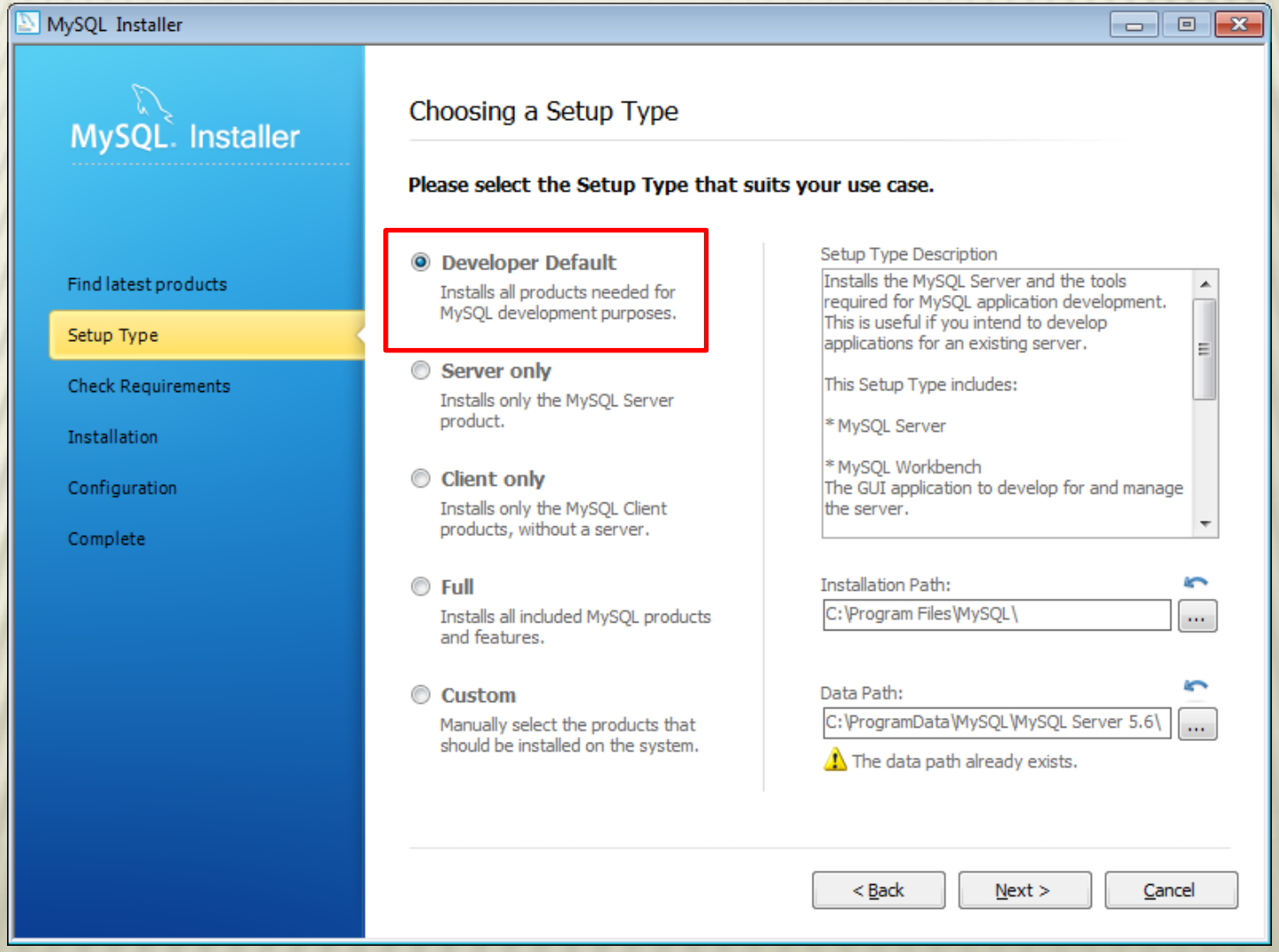
Install MySQL at Home

- MySQL Community Server
  http://www.mysql.com/downloads/mysql/

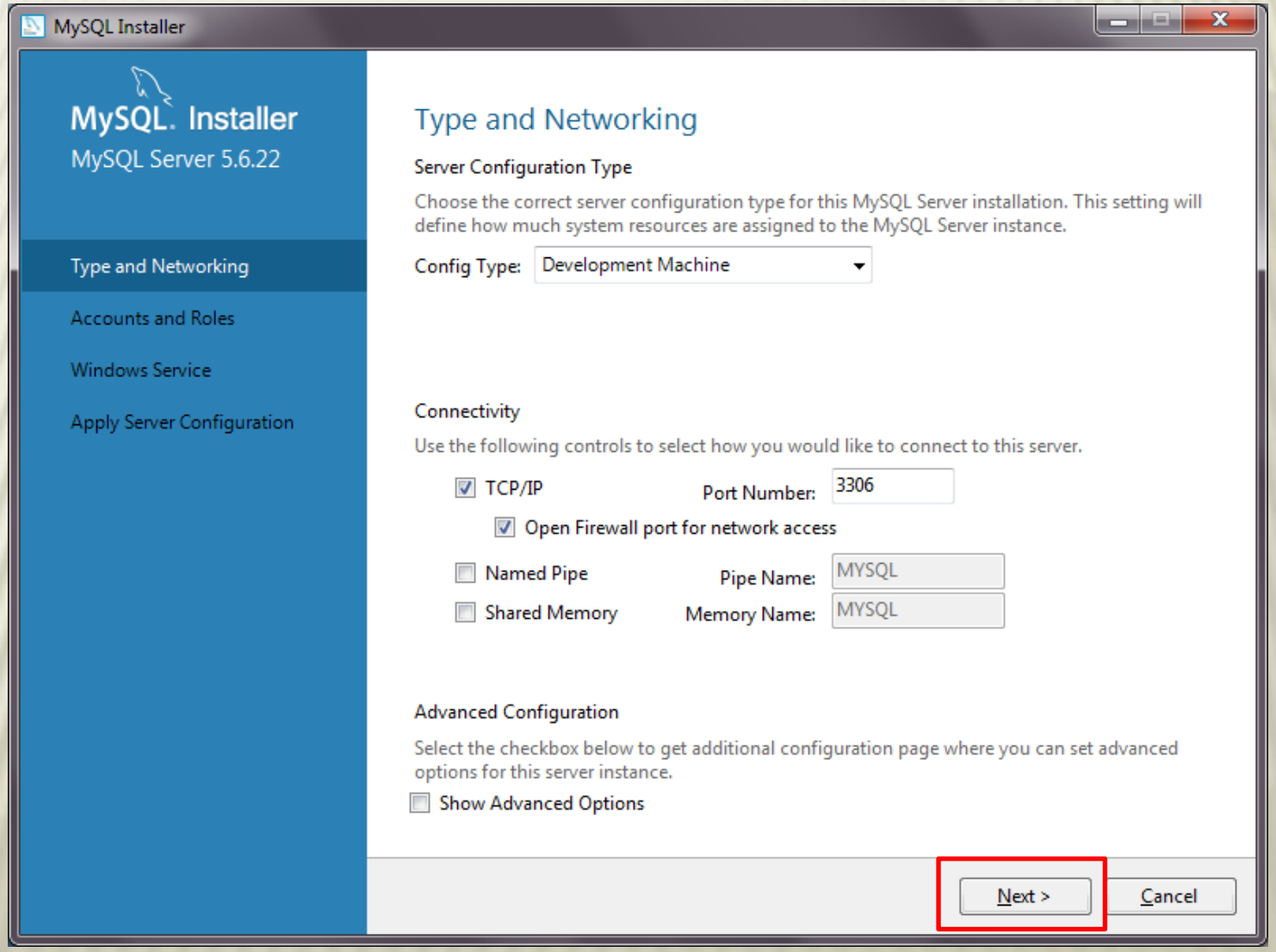
Registration is Optional



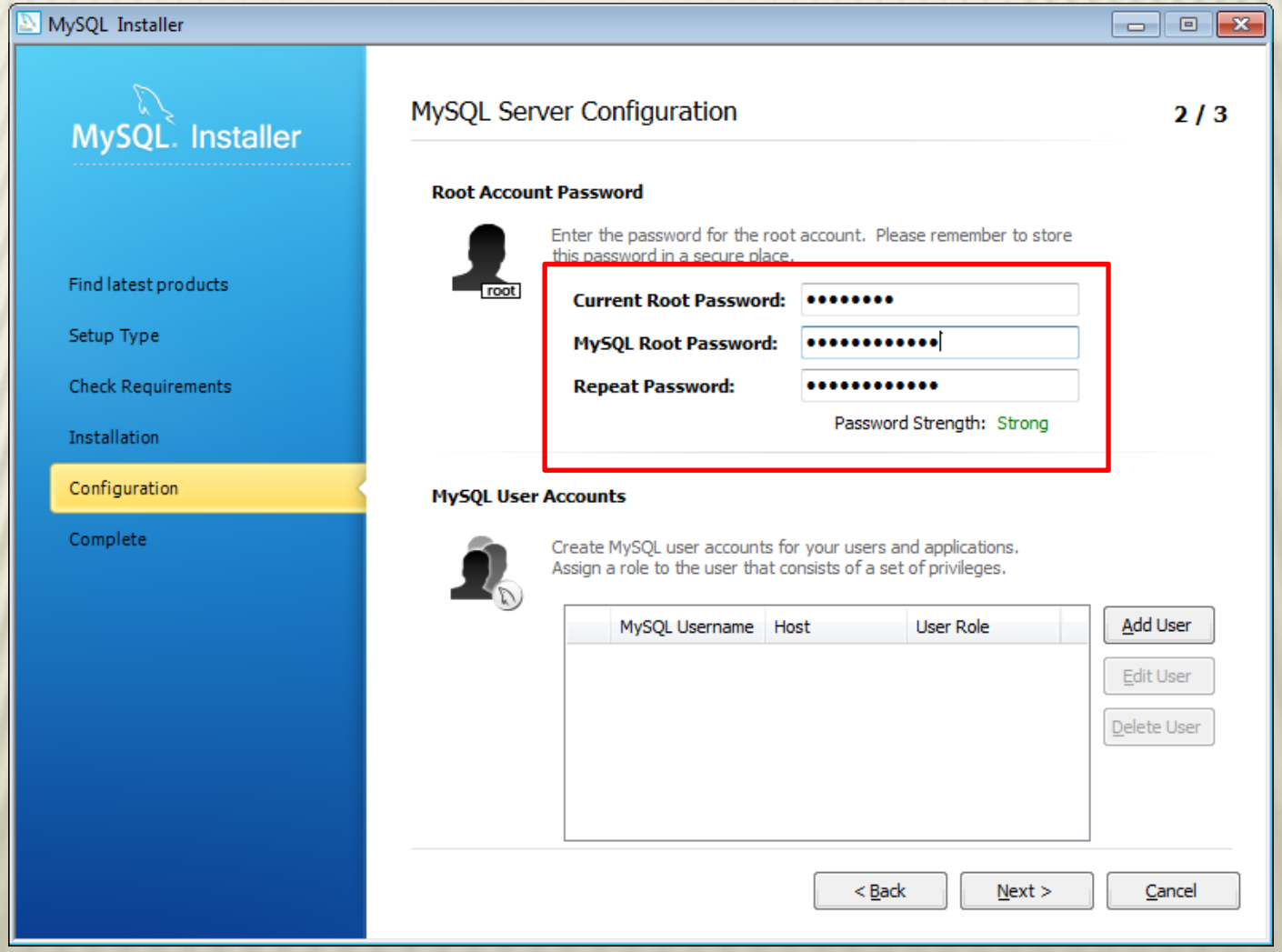
Installation using an Installer



Configuration

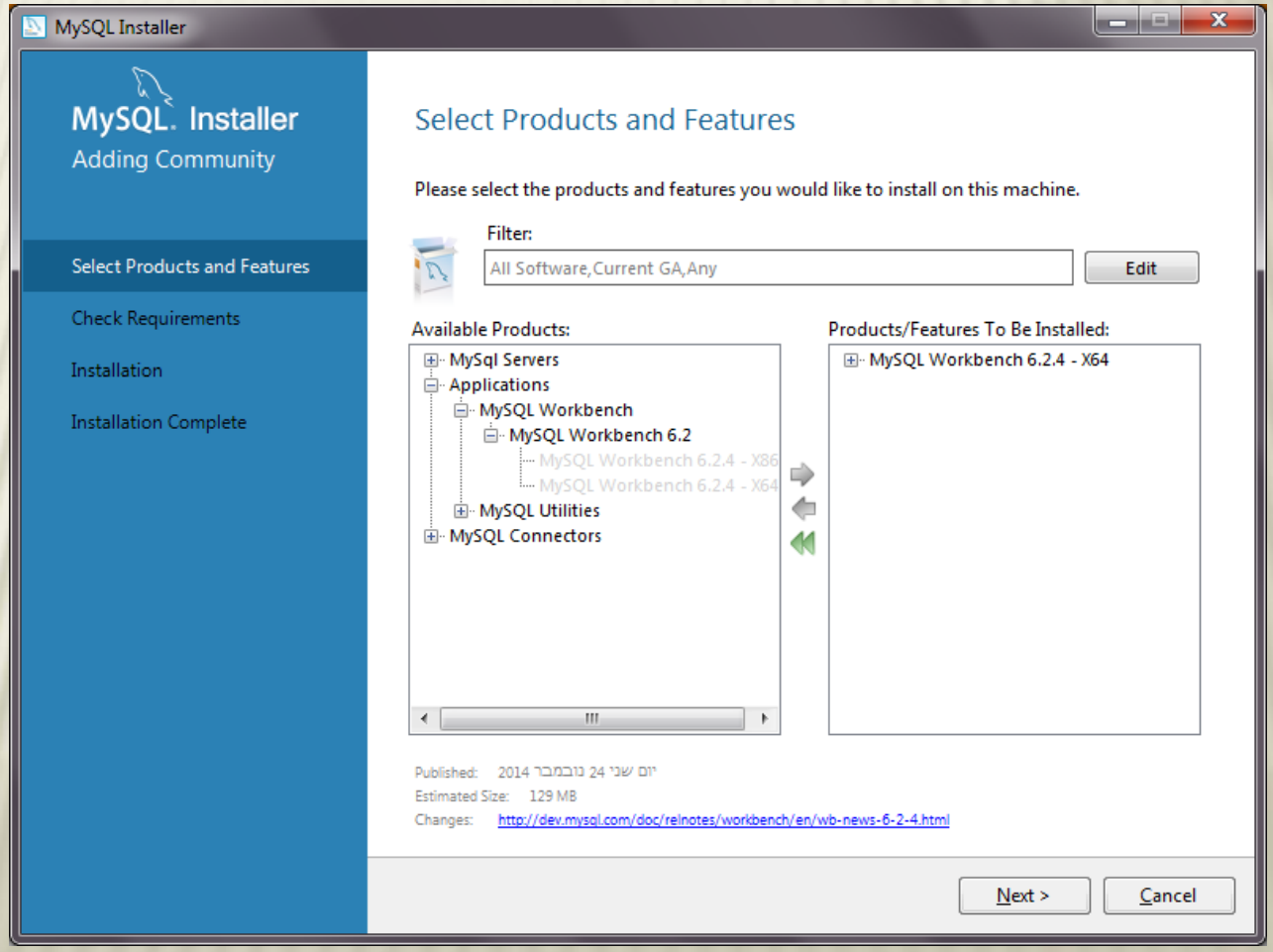


Installation using an Installer



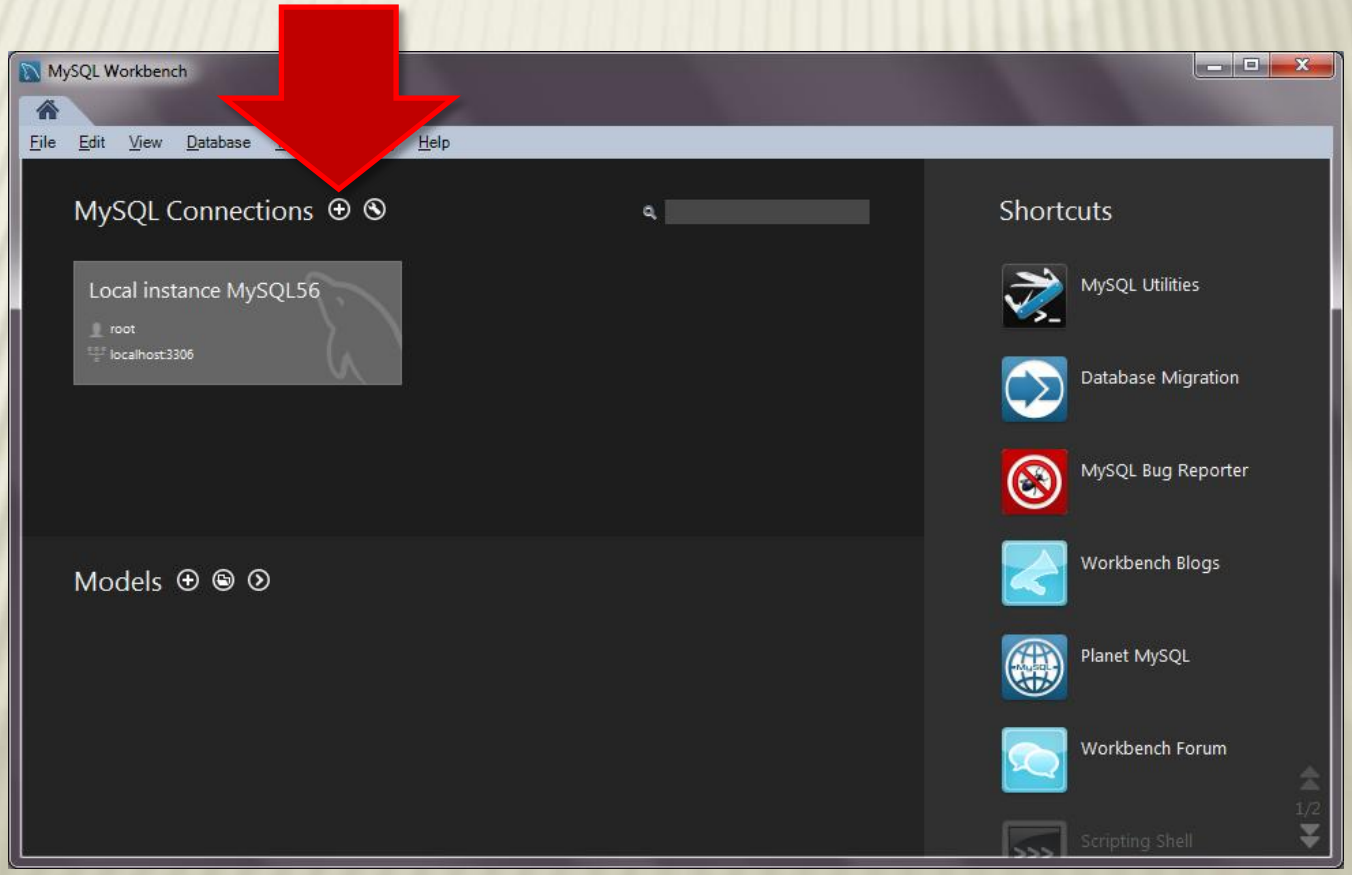
MySQL Workbench

- Make sure to install server, workbench and examples

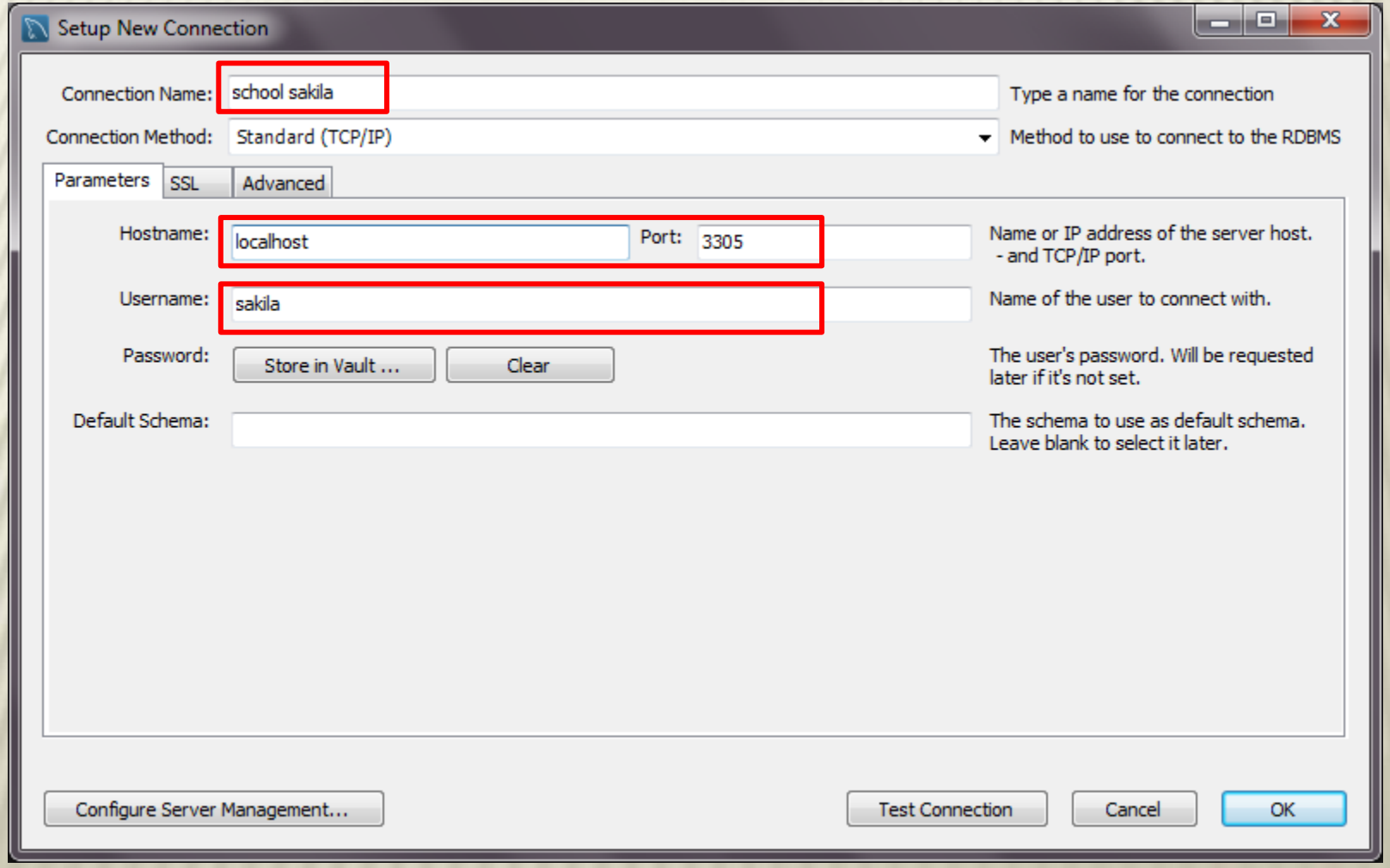


Example: connecting to school server

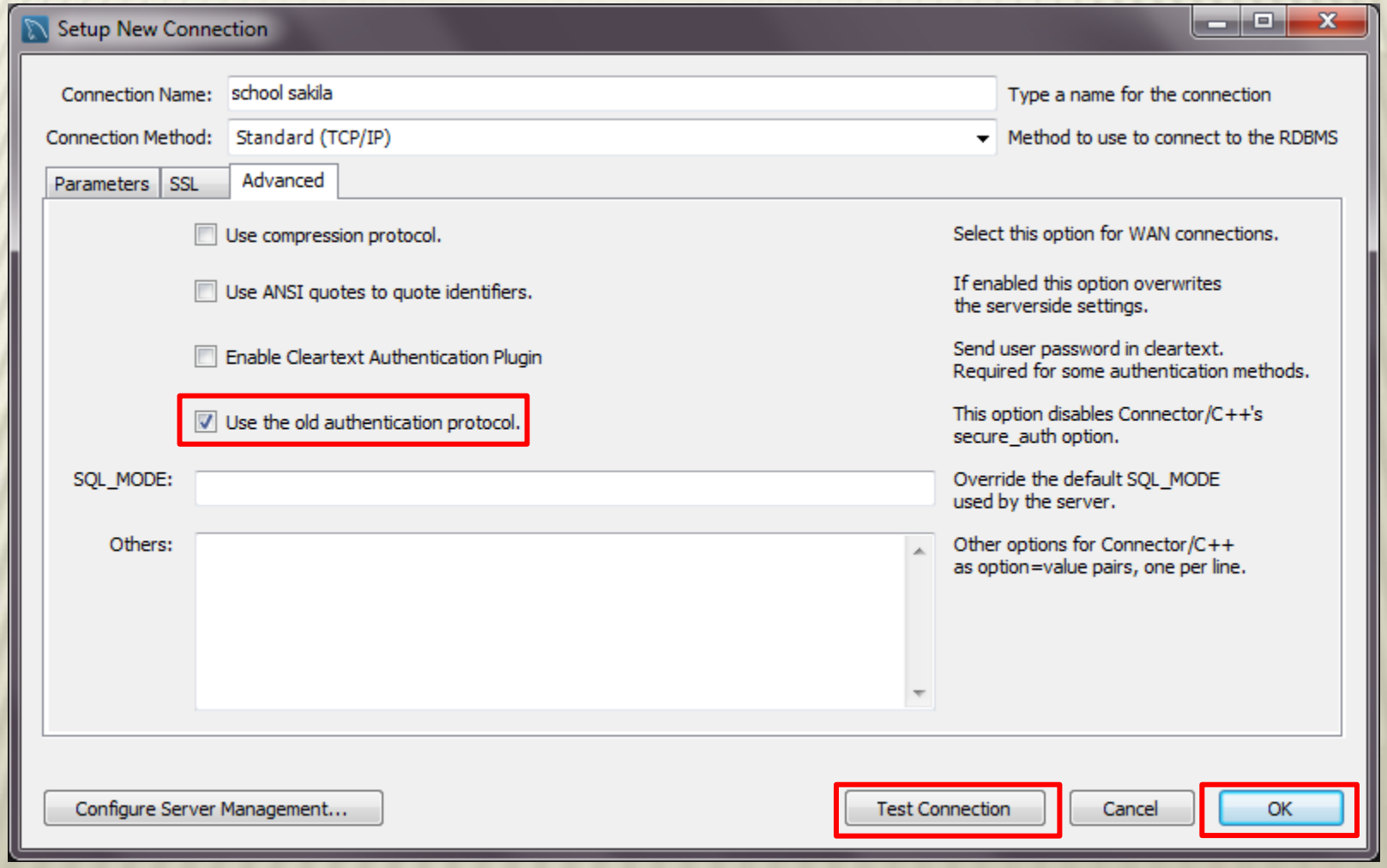
- Open the tunnel!
- Then open workbench and create new connection



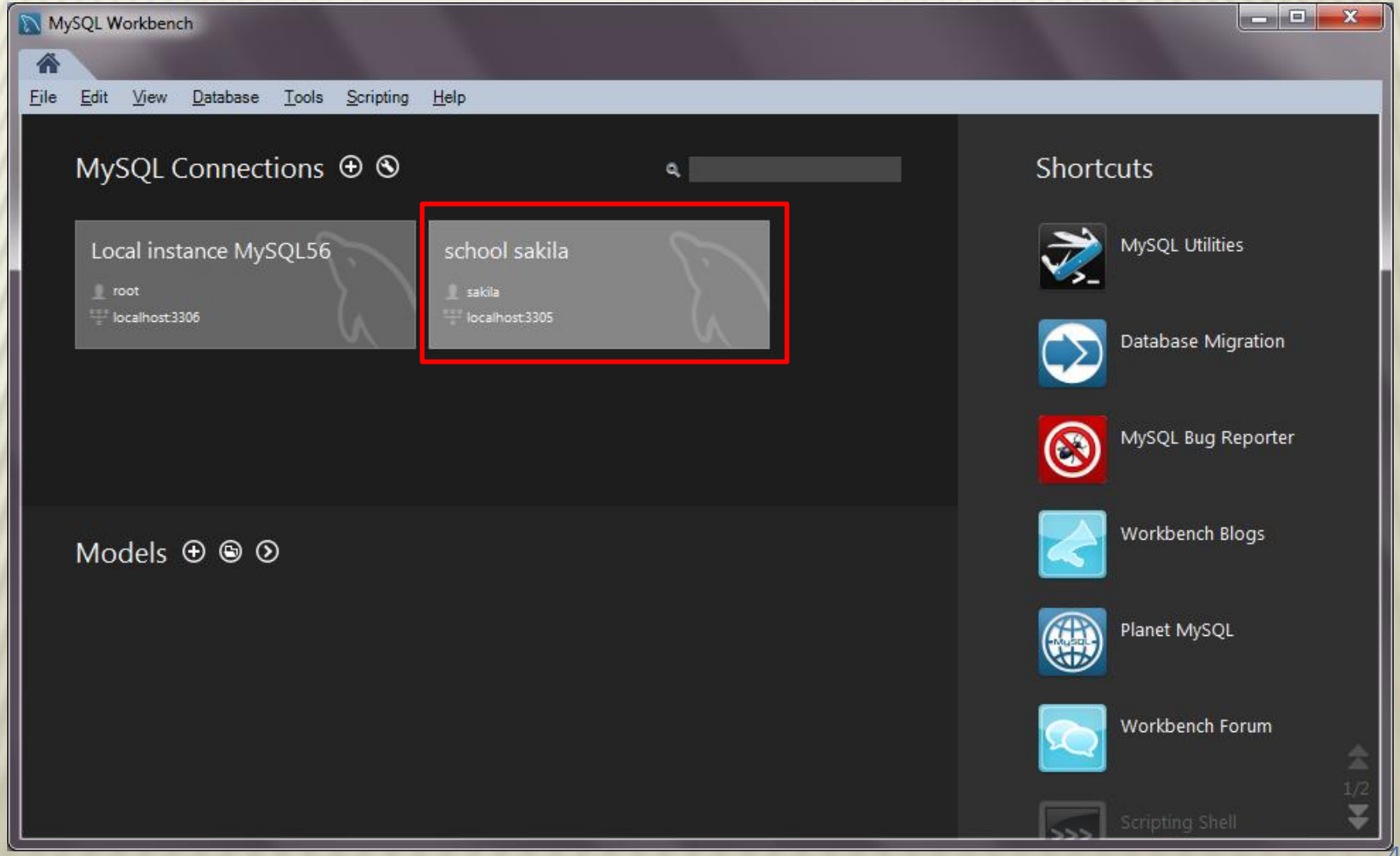
Configure the connection



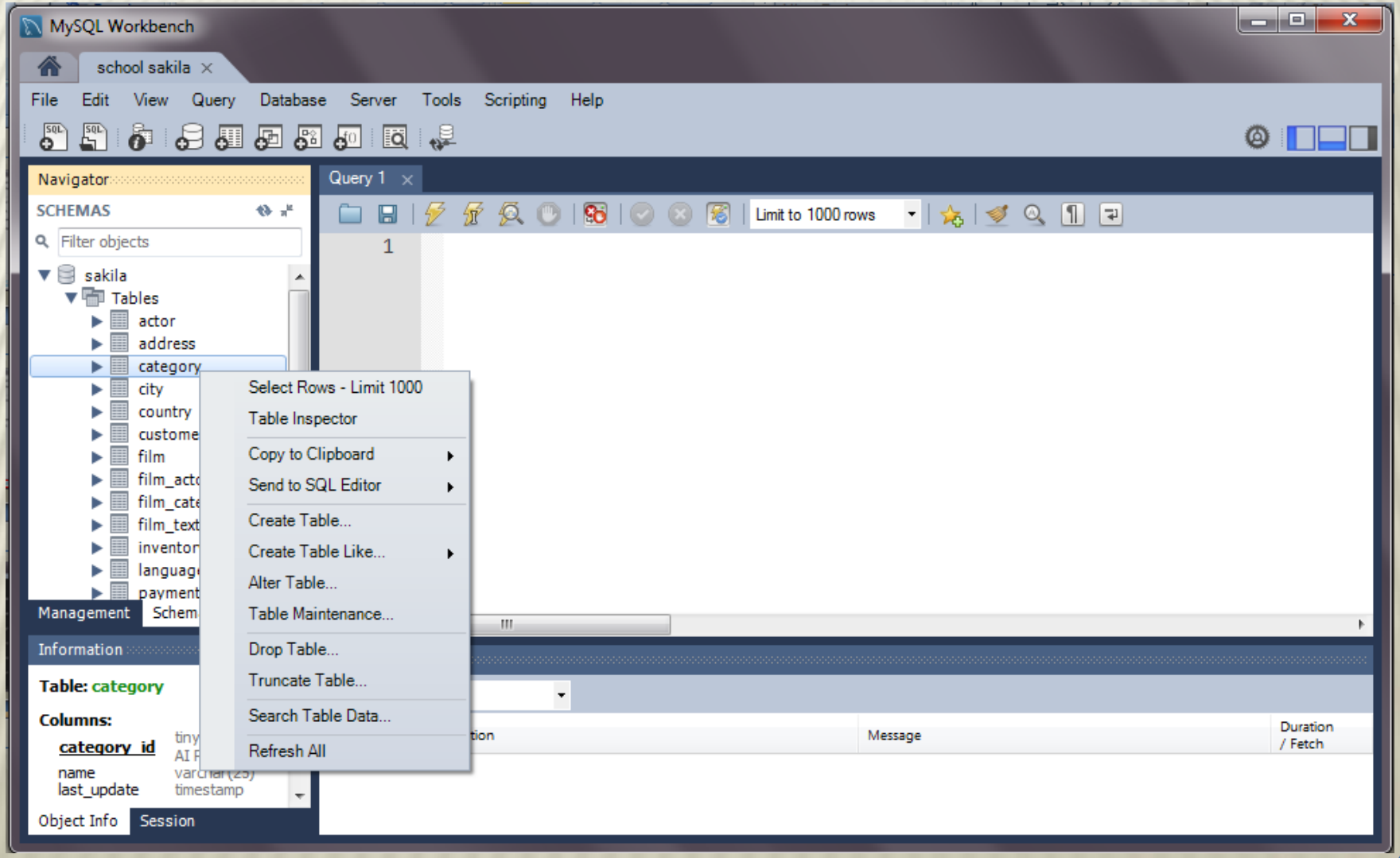
Support old authentication protocol



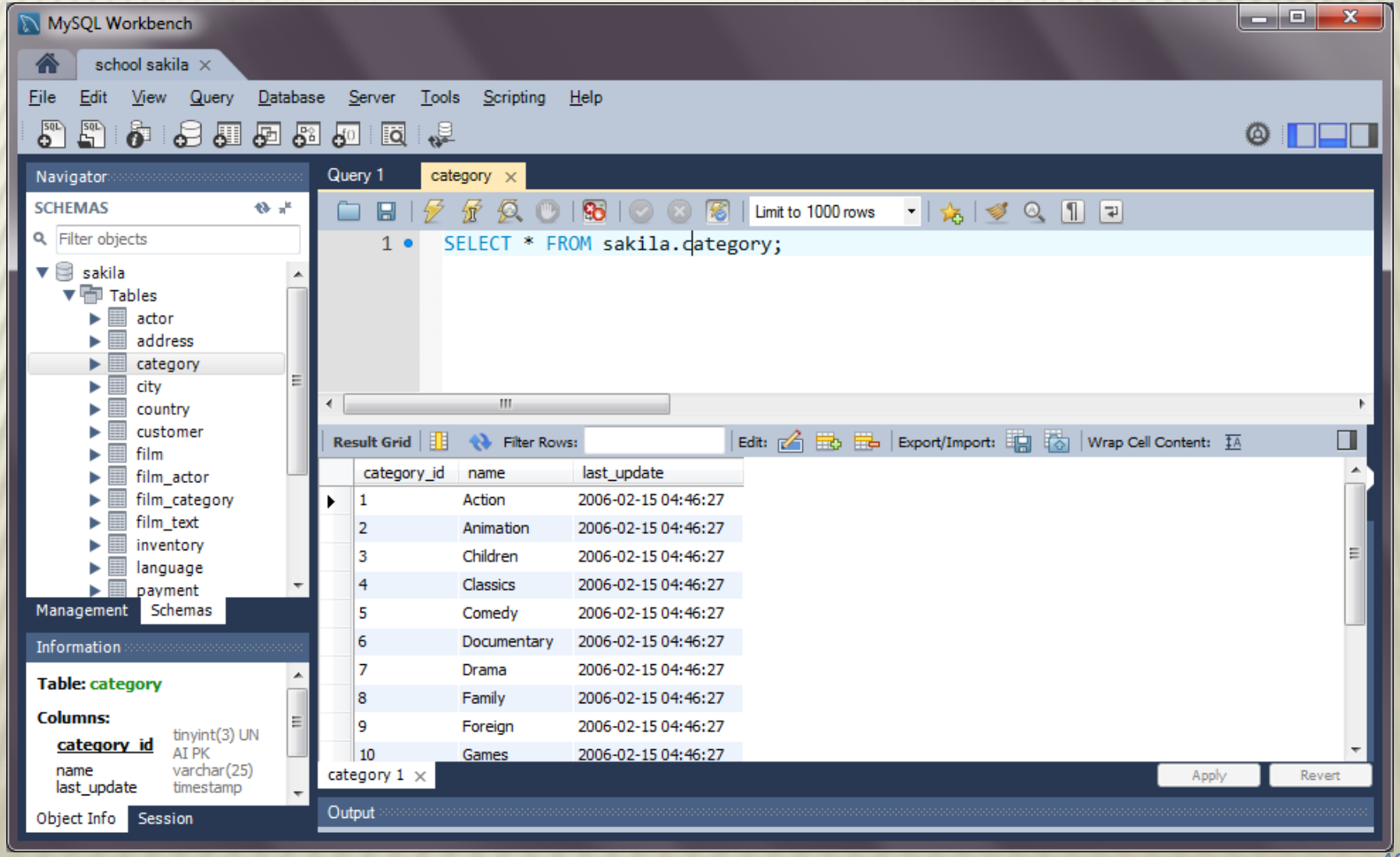
Open the new connection



Now you can query the SQL data



... and the result



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

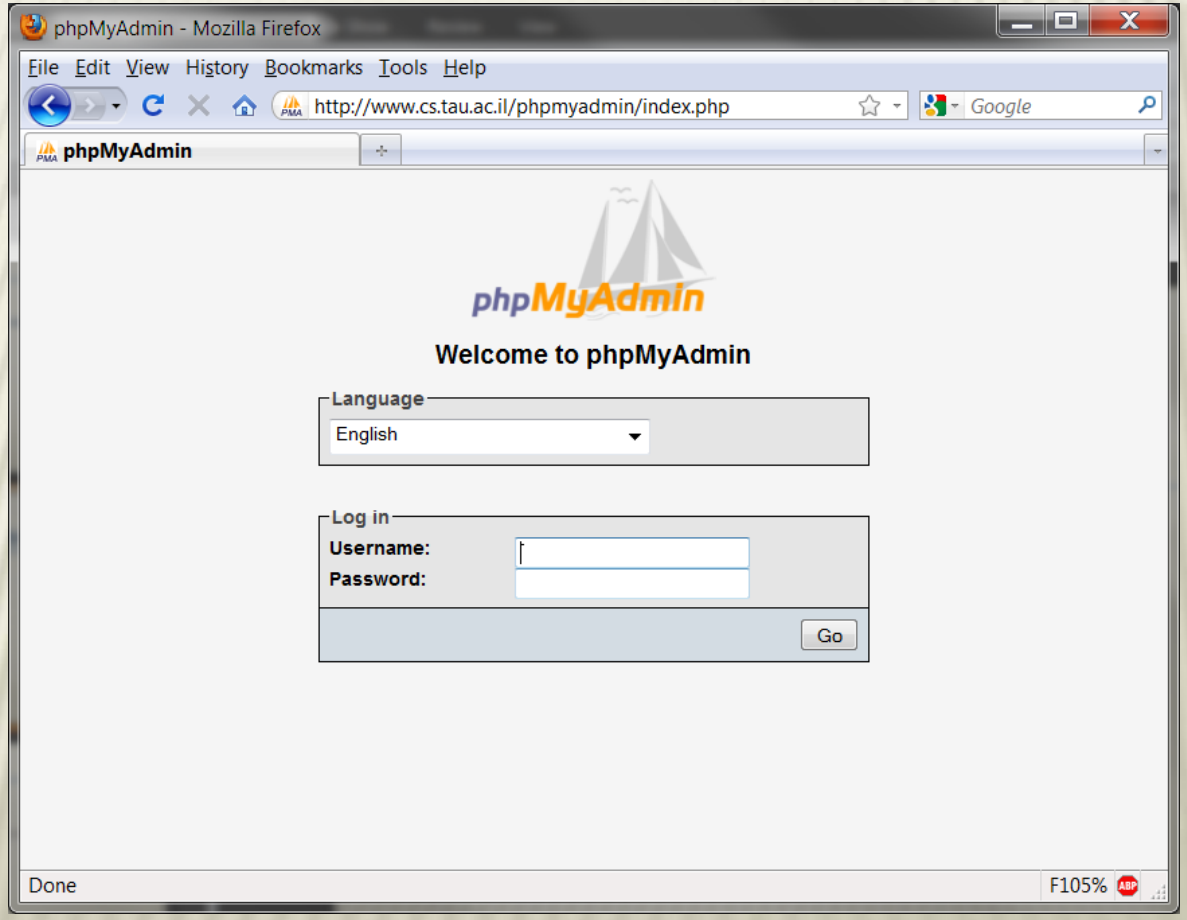
Demo Time ☺

- Install the “sakila” schema

Demo Time ☺

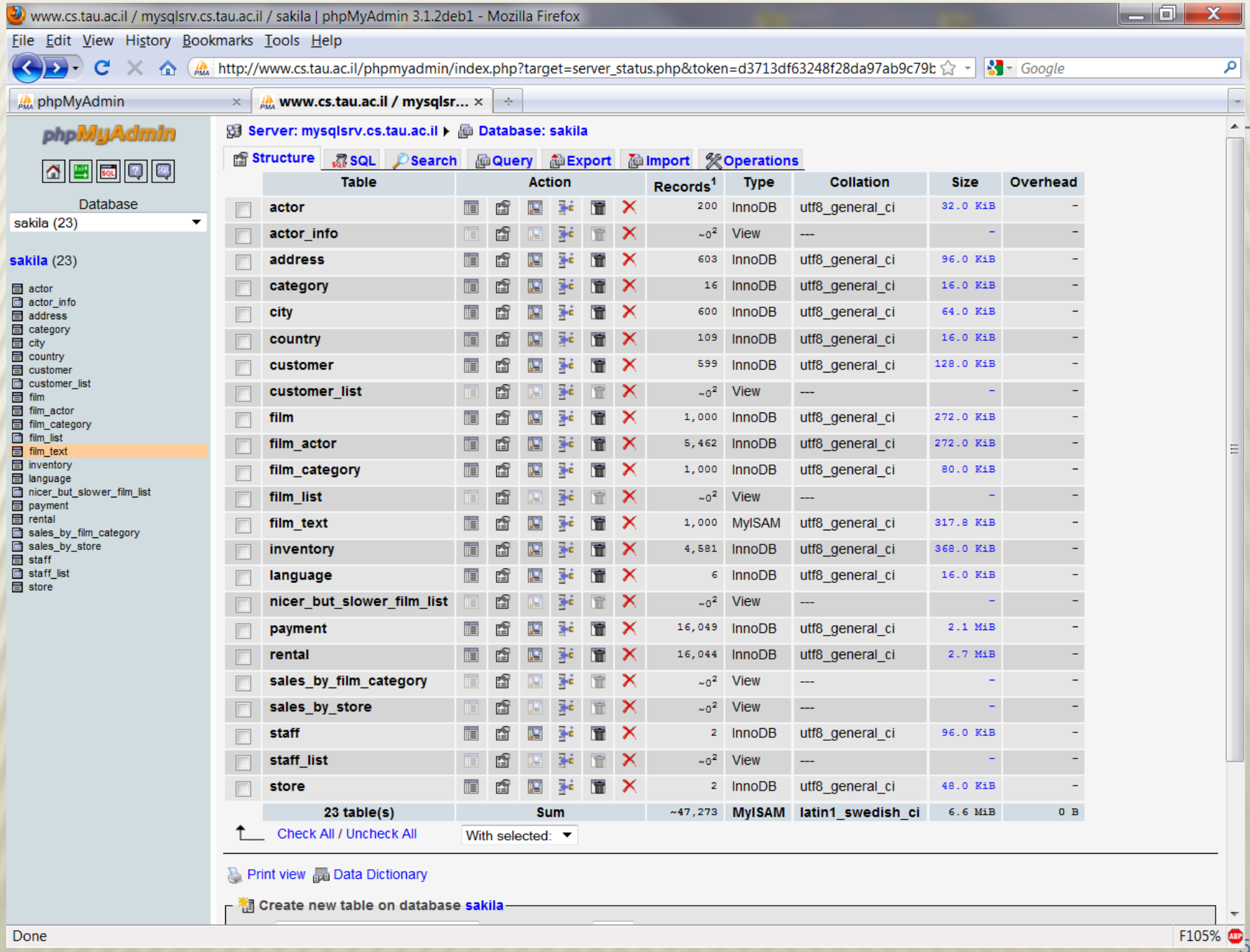
- Data Modeling
  → browse / alter the schema

phpMyAdmin


phpMyAdmin - Mozilla Firefox
File Edit View History Bookmarks Tools Help
http://www.cs.tau.ac.il/phpmyadmin/index.php
Google
phpMyAdmin
phpMyAdmin
Welcome to phpMyAdmin
Language
English
Log in
Username:
Password:
Go
Done
F105%

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…)


www.cs.tau.ac.il / mysqlsrv.cs.tau.ac.il / sakila | phpMyAdmin 3.1.2deb1 - Mozilla Firefox
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phpMyAdmin
Database
sakila (23)
sakila (23)
actor
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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
actor 200 InnoDB utf8_general_ci 32.0 KiB -
actor_info ~0[2] View --- - -
address 603 InnoDB utf8_general_ci 96.0 KiB -
category 16 InnoDB utf8_general_ci 16.0 KiB -
city 600 InnoDB utf8_general_ci 64.0 KiB -
country 109 InnoDB utf8_general_ci 16.0 KiB -
customer 599 InnoDB utf8_general_ci 128.0 KiB -
customer_list ~0[2] View --- - -
film 1,000 InnoDB utf8_general_ci 272.0 KiB -
film_actor 5,462 InnoDB utf8_general_ci 272.0 KiB -
film_category 1,000 InnoDB utf8_general_ci 80.0 KiB -
film_list ~0[2] View --- - -
film_text 1,000 MyISAM utf8_general_ci 317.8 KiB -
inventory 4,581 InnoDB utf8_general_ci 368.0 KiB -
language 6 InnoDB utf8_general_ci 16.0 KiB -
nicer_but_slower_film_list ~0[2] View --- - -
payment 16,049 InnoDB utf8_general_ci 2.1 MiB -
rental 16,044 InnoDB utf8_general_ci 2.7 MiB -
sales_by_film_category ~0[2] View --- - -
sales_by_store ~0[2] View --- - -
staff 2 InnoDB utf8_general_ci 96.0 KiB -
staff_list ~0[2] View --- - -
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
Done
F105%

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 ☺