

# Database in production

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# Agenda

- Setting up database
- MySQL – Workbench
- Object Relational Mapping (ORM) framework – Hibernate
- Project
- Securing database server

# MySQL - Workbench

MySQL Workbench provides DBAs and developers an integrated tools environment for:

- Database Design & Modeling
  - Data modeling: process of documenting a complex software system design as an easily understood diagram, using text and symbols to represent the way data needs to flow.
- SQL Development
- Database Administration
- Database Migration

Reference: <https://dev.mysql.com/downloads/workbench/>

# Setting up database

MySQL installation:

**MAC:**

<https://dev.mysql.com/doc/refman/5.6/en/osx-installation-pkg.html>

**UNIX/ Linux:**

```
sudo apt-get install mysql-server
```

**Windows** installation: (I recommend installing WAMP server which includes MySQL, Maria-DB, PHP, Apache server)

<http://www.wampserver.com/en/#download-wrapper>

If you just want MySQL server follow <https://dev.mysql.com/downloads/mysql/>

# Setting up MySQL Workbench

<https://dev.mysql.com/downloads/workbench/>

**Generally Available (GA) Releases**

## MySQL Workbench 6.3.9


Select Operating System:  
Microsoft Windows

[Looking for previous GA versions?](#)

**Recommended Download:**

**MySQL Installer for Windows**

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



Starting with MySQL 5.6 the MySQL Installer package replaces the standalone MSI packages.

Windows (x86, 32 & 64-bit), MySQL Installer MSI [Go to Download Page >](#)

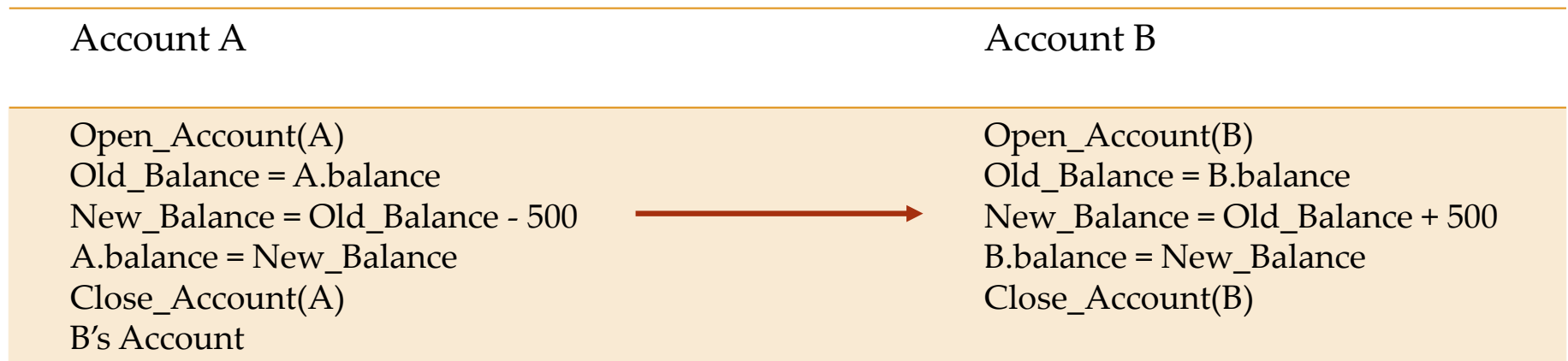
**Other Downloads:**

Windows (x86, 64-bit), MSI Installer	6.3.9	28.3M	<a href="#">Download</a>
<small>(mysql-workbench-community-6.3.9-winx64.msi)</small>			
<small>MD5: 89773c47e3f43d247182a9c0270c2bc5   <a href="#">Signature</a></small>			

# MySQL Workbench Practical

# DBMS - Transaction

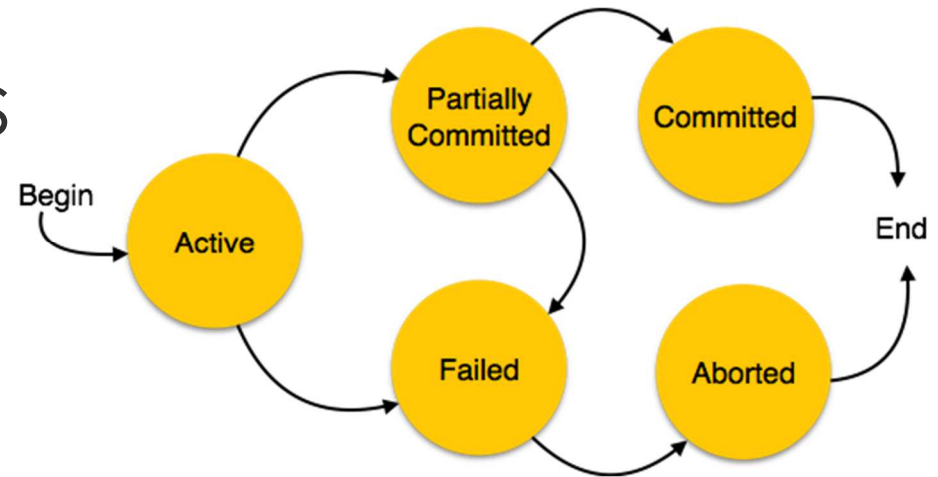
- A transaction can be defined as a group of tasks
- A single task is the minimum processing unit which cannot be divided further
- Example:
  - Transfer \$500 from account "A" to account "B"



- Atomicity, Consistency, Isolation, and Durability (ACID) properties must be satisfied

# States of Transactions

- **Active**
  - Initial state of transaction
- **Partially Committed**
  - Unit operating is in final operation
- **Failed**
  - If any database check fails
  - A failed transaction can no longer proceed further.
- **Aborted**
  - If database is marked failed state.
  - Rollback changes.
    - Restart
    - Kill the transaction
- **Committed**
  - Transaction executed successfully





# Datasource

- An object *might be* containing pool of database connections
- Can be thought of as a factory for connections to a database or multiple database.
- In a basic DataSource implementation, a call to the `getConnection` method returns a connection object that is a physical connection to the data source.

javax.sql

## Interface DataSource

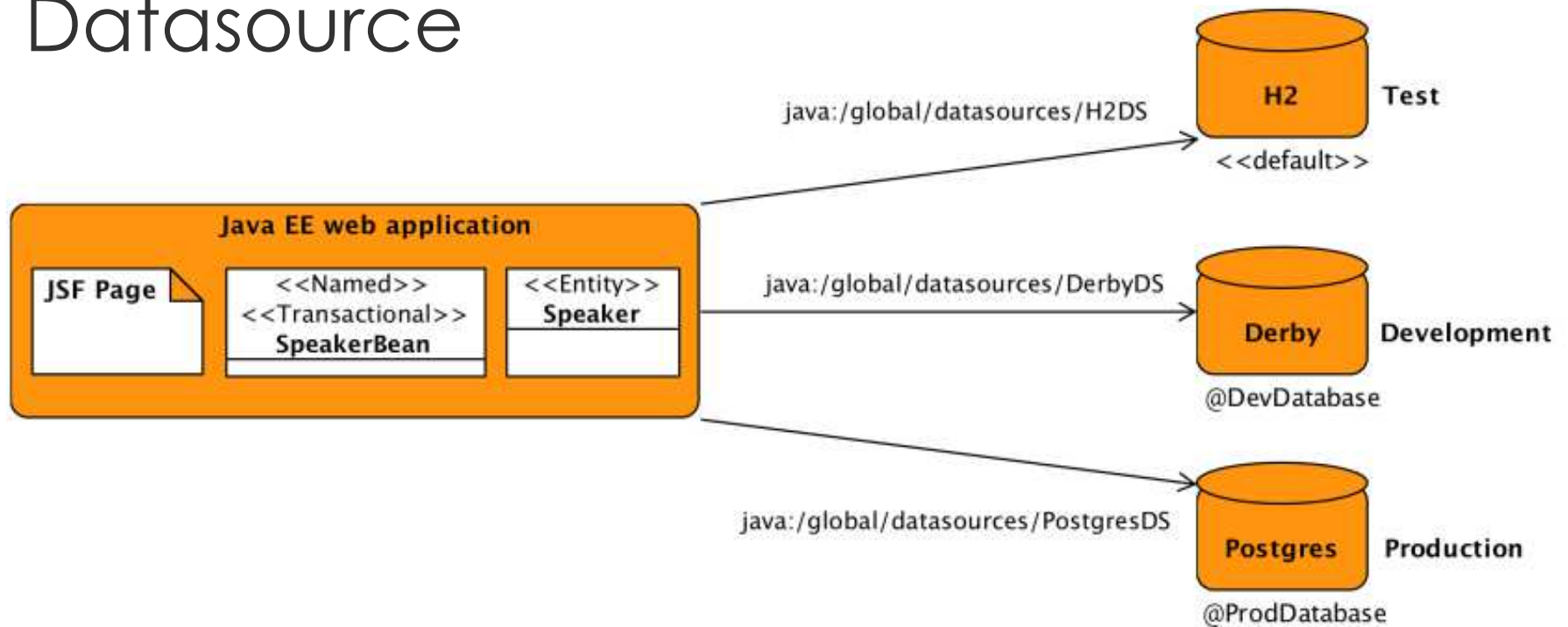
All Superinterfaces:

CommonDataSource, Wrapper

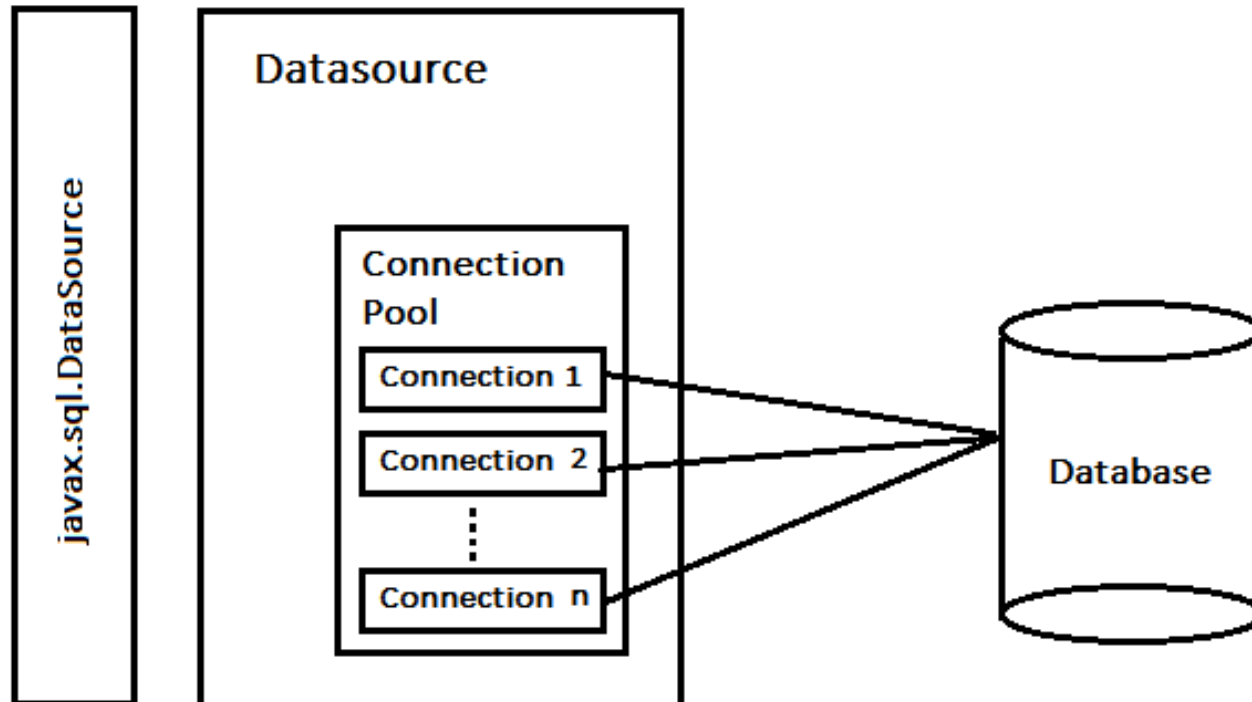
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```
public interface DataSource
extends CommonDataSource, Wrapper
```

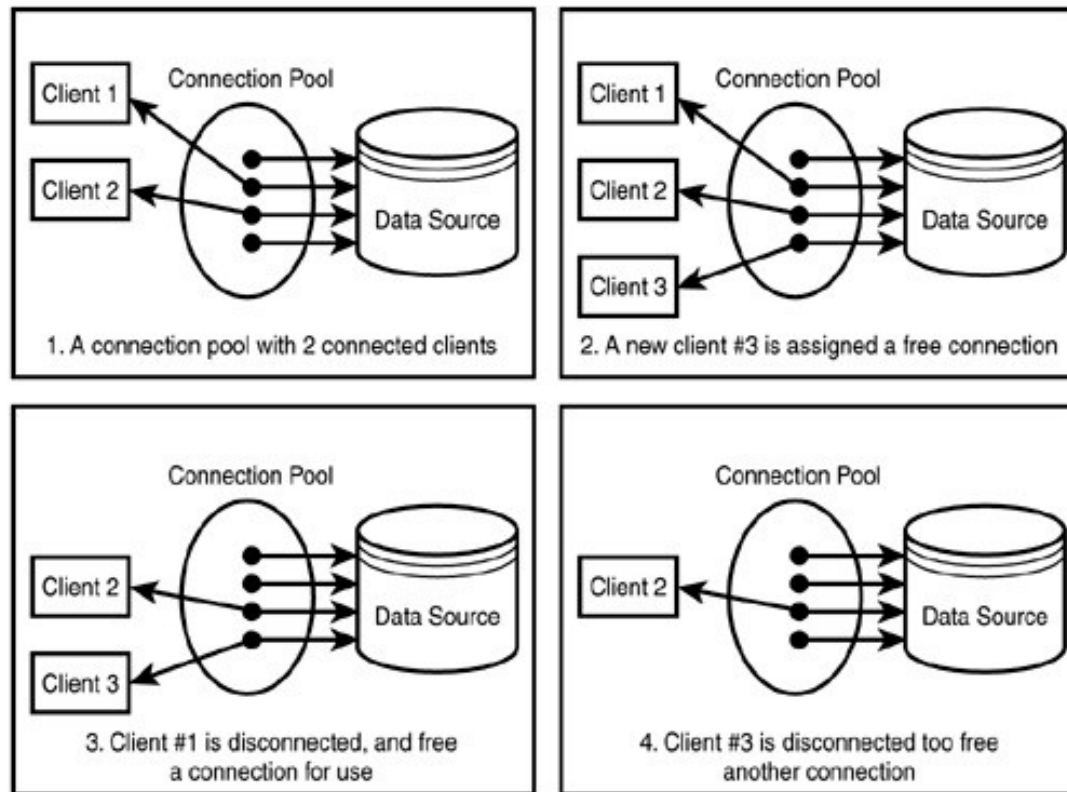
# Datasource



# Connection Pooling



# Connection Pooling



# Why DataSource instead of DriverManager?

## DriverManager

- Application performance is degraded as connection opening and closing is required within class.
- Does not support connection pooling.

## DataSource

- Improves application performance as connections are not created/closed within a class, they are managed by the application server and can be fetched while at runtime.
- It provides a facility creating a pool of connections

### **DriverManager:**

```
Connection conn = DriverManager.getConnection("jdbc:mysql://localhost/db_lecture?" +  
"user=root&password=very_strong_password ;");
```

# ORM – Object Relational Mapping

- Technique for converting data between incompatible type systems using OOP language
- RDBMS represents data in tabular format, whereas object-oriented languages like Java, represent it as an interconnected graph of objects.
- Free (Hibernate for Java) and commercial (QxOrm for C++)
- Or write your own

Reference: [https://en.wikipedia.org/wiki/Object-relational\\_mapping](https://en.wikipedia.org/wiki/Object-relational_mapping)

# Hibernate

- Open source ORM framework
- Implementation of Java Persistence API (JPA), in addition have its own “native” API.
- JPA provides Java developers with an object/relational mapping facility for managing relational data in Java applications.
- High Performance
  - Lazy initialization
  - Eager initialization
  - Better than JDBC
- Caching
  - Session cache (cache object within current session, enabled by default)
  - Second level cache (cache object across sessions, used when object are loaded using primary key)
  - Query cache (cache query result)

# Hibernate Configuration

- Can be done using following approach:
  - XML based
  - Annotation based
- XML is like a boss, it overrides all other configuration, but annotation have its own advantages and XML have its own.
- We will do XML configuration



# Hibernate Project

# Securing database server

# Physical Database Server Security

- Physical machine should be kept in a secured, locked and monitored environment to prevent unauthorized entry, access or theft.
- Never keep application/ web server and database on same machine.

# Firewalls for Database servers

- Use web application firewall (WAF)
  - Application firewall for HTTP(s) applications
  - Applied set of rules to HTTP(s) conversation
  - Generally used for Cross-site scripting and SQL injection
  - Open-source: ModSecurity
- Responsibility of System Administrator and DBAs

# Application Code

- Check for SQL injection (open source: sqlmap)
- Configuration files should be accessible only to required users

# Other measures

- Encrypt files
- Keep current patches
- Enable security control on database
  - DBA is responsible for this
- Enable SSL connection

Further reading: <https://security.berkeley.edu/resources/best-practices-how-articles/database-hardening-best-practices>

**Thank you!**

**For Hearing Me**

# Appendix

<https://dev.mysql.com/doc/refman/5.7/en/resetting-permissions.html>

```
ALTER USER 'root'@'localhost' IDENTIFIED BY 'MyNewPass';
```

Why ORM?

1. Granularity
2. Subtypes (inheritance)
3. Identity
4. Associations
5. Data navigation



- The enhanced entity–relationship (EER) model (or extended entity–relationship model)
- [https://en.wikipedia.org/wiki/Enhanced\\_entity%E2%80%93relationship\\_model](https://en.wikipedia.org/wiki/Enhanced_entity%E2%80%93relationship_model)
- Cross-site scripting (XSS) is a type of computer security vulnerability typically found in web applications. XSS enables attackers to inject client-side scripts into web pages viewed by other users.