Java Programming 3

Week 7 - JDBC - JdbcTemplate - Profiles

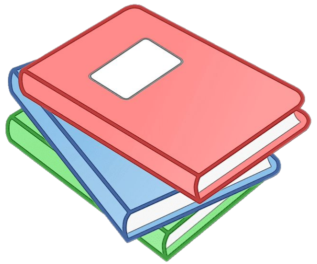
KdG

Agenda this week

JDBC
Implementing the repository
JdbcTemplate
Spring profiles

Tutorials

- JDBC: http://tutorials.jenkov.com/jdbc/index.html
- JDBC and Spring: https://www.baeldung.com/spring-jdbc-jdbctemplate
- Spring JDBC Reference: https://docs.spring.io/spring-framework/docs/1.2.2/reference/jdbc.html
- Spring Profiles: https://www.baeldung.com/spring-profiles
- Spring JDBC Guide: https://spring.io/guides/gs/relational-data-access/

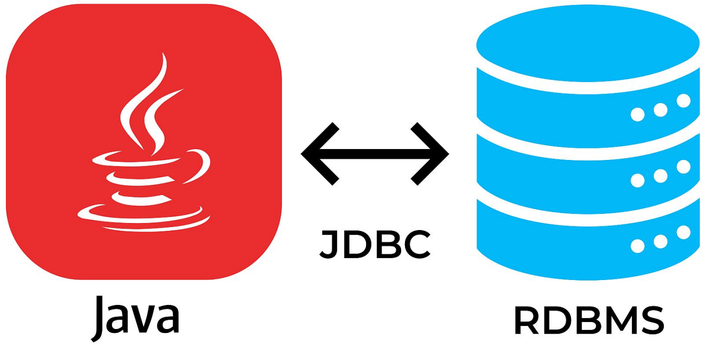


Agenda this week

JDBC
Implementing the repository
JdbcTemplate
Spring profiles

JDBC

- API that allows a Java program to communicate with a relational database
- Independent of the vendor
- Access using SQL Queries
- Part of standard Java (java.sql.*)



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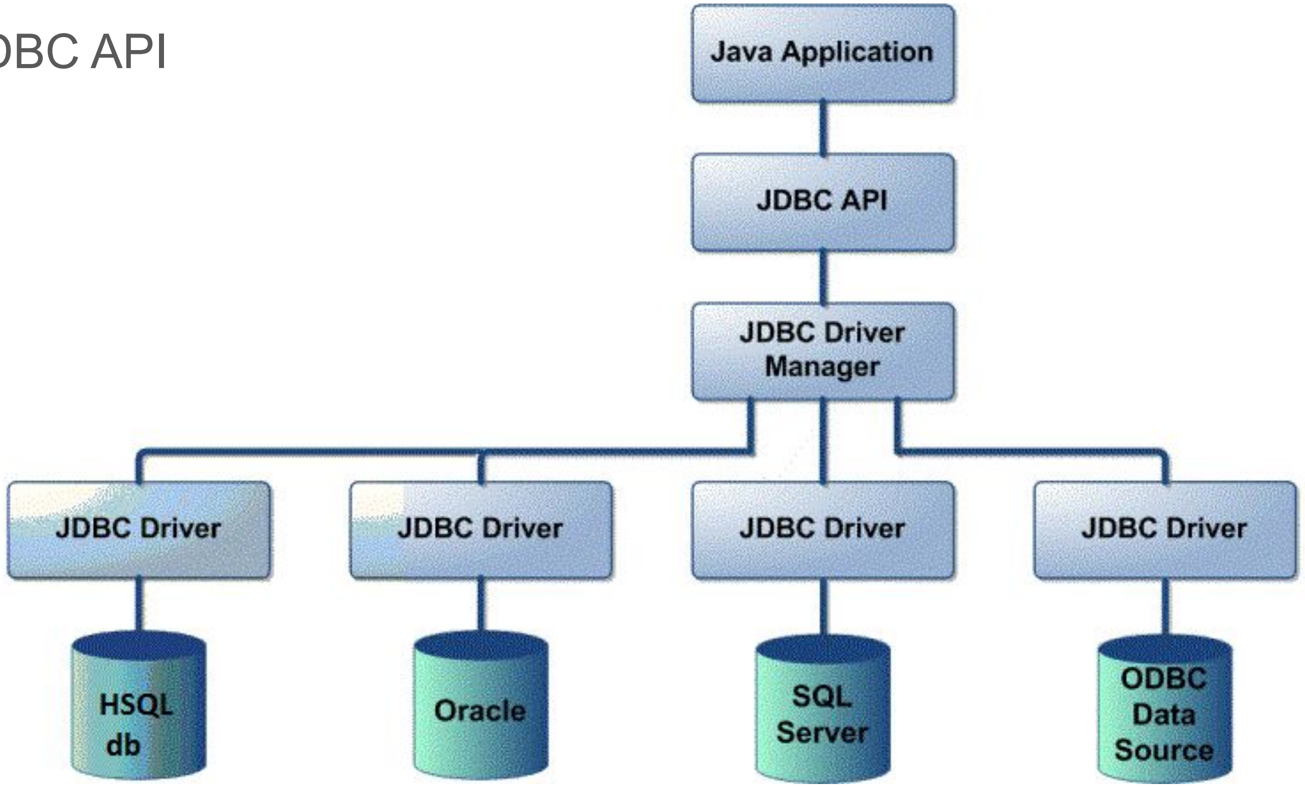
JDBC Driver

- Implements the JDBC API
- Vendor specific

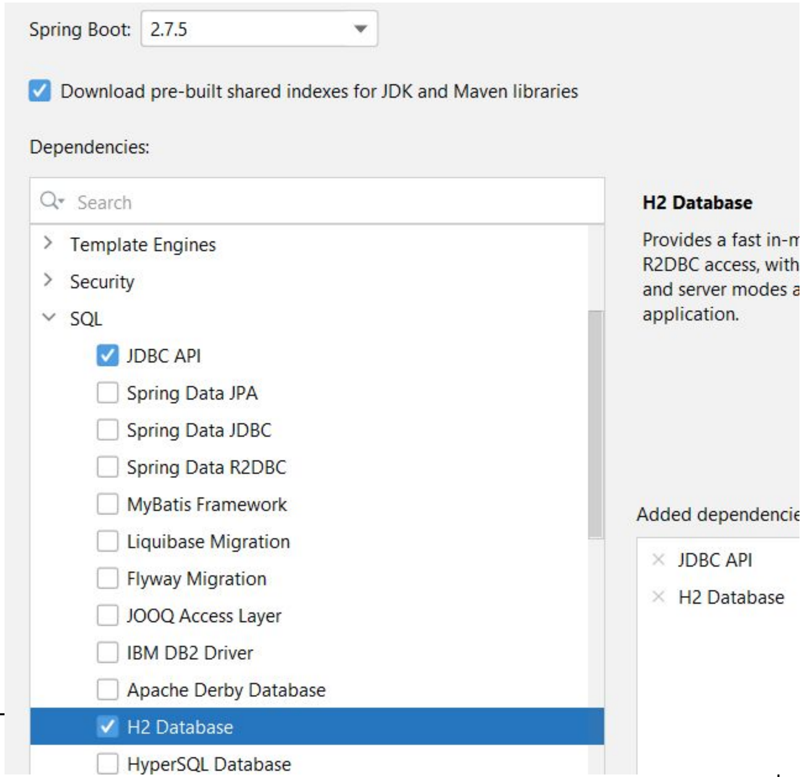


H2Database

- We will use H2 DB in the examples
  - Lightweight, small, fast, in memory
  - Perfect for development and testing
  - Not suitable for production: you will use PostgreSQL instead
- We will have to add the driver to the gradle dependency!

Create new Spring project

- Add 2 dependencies
  - JDBC API
  - H2 Database


Spring Boot: 2.7.5

[✓] Download pre-built shared indexes for JDK and Maven libraries

Dependencies:

- [✓] JDBC API
- [ ] Spring Data JPA
- [ ] Spring Data JDBC
- [ ] Spring Data R2DBC
- [ ] MyBatis Framework
- [ ] Liquibase Migration
- [ ] Flyway Migration
- [ ] JOOQ Access Layer
- [ ] IBM DB2 Driver
- [ ] Apache Derby Database
- [✓] H2 Database
- [ ] HyperSQL Database

H2 Database

Provides a fast in-m
R2DBC access, with
and server modes a
application.

Added dependencie

- JDBC API
- H2 Database

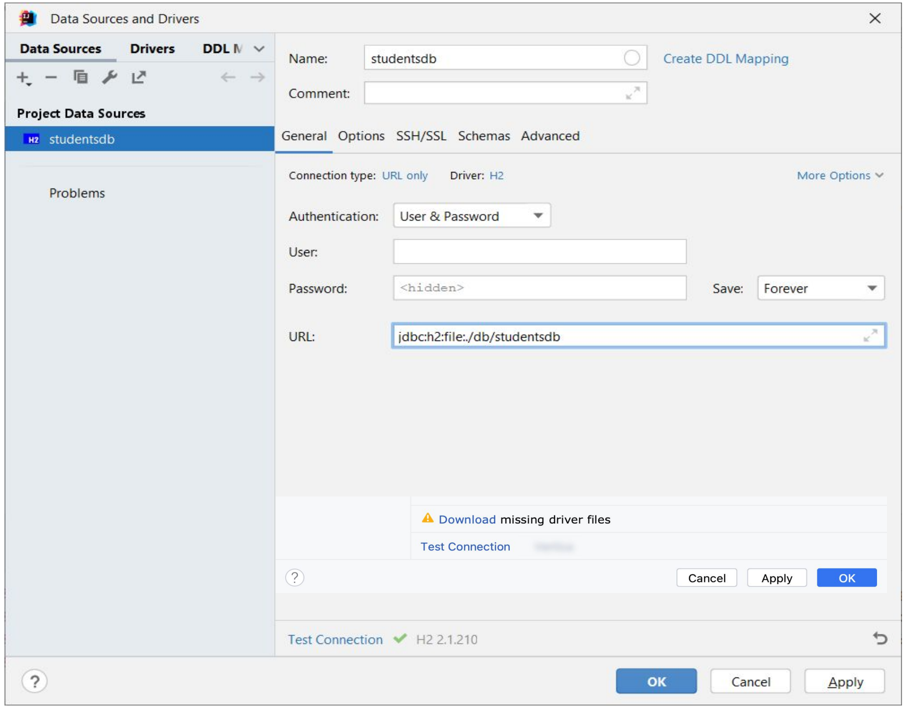
```
dependencies {
   //…
   implementation ("org.springframework.boot:spring-boot-starter-jdbc")
   runtimeOnly ("com.h2database:h2")
}
```

Create DB first: IntelliJ Database View

- Connection Type: URL Only
- URL: **jdbc:h2:file:./db/studentsdb**

  → Creates DB in ./db folder

  - If intellij proposes to download missing driver files, do so.



studentsdb

Name: studentsdb

Comment:

Connection type: URL only Driver: H2

Authentication: User & Password

User:

Password: <hidden> Save: Forever

URL: jdbc:h2:file:./db/studentsdb

⚠ Download missing driver files

Test Connection ✓ H2 2.1.210

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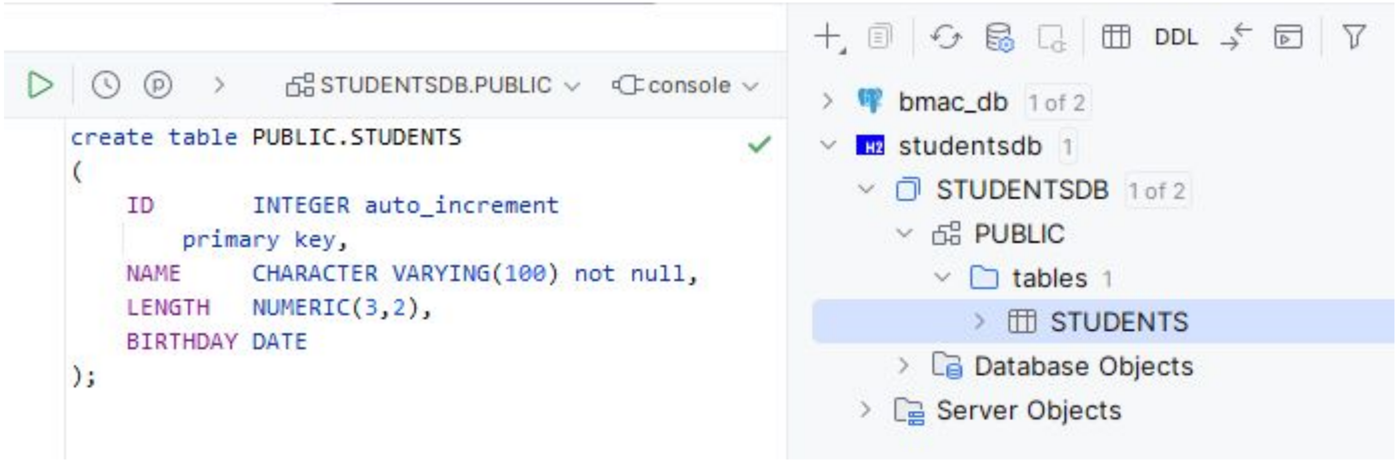
Create table STUDENT

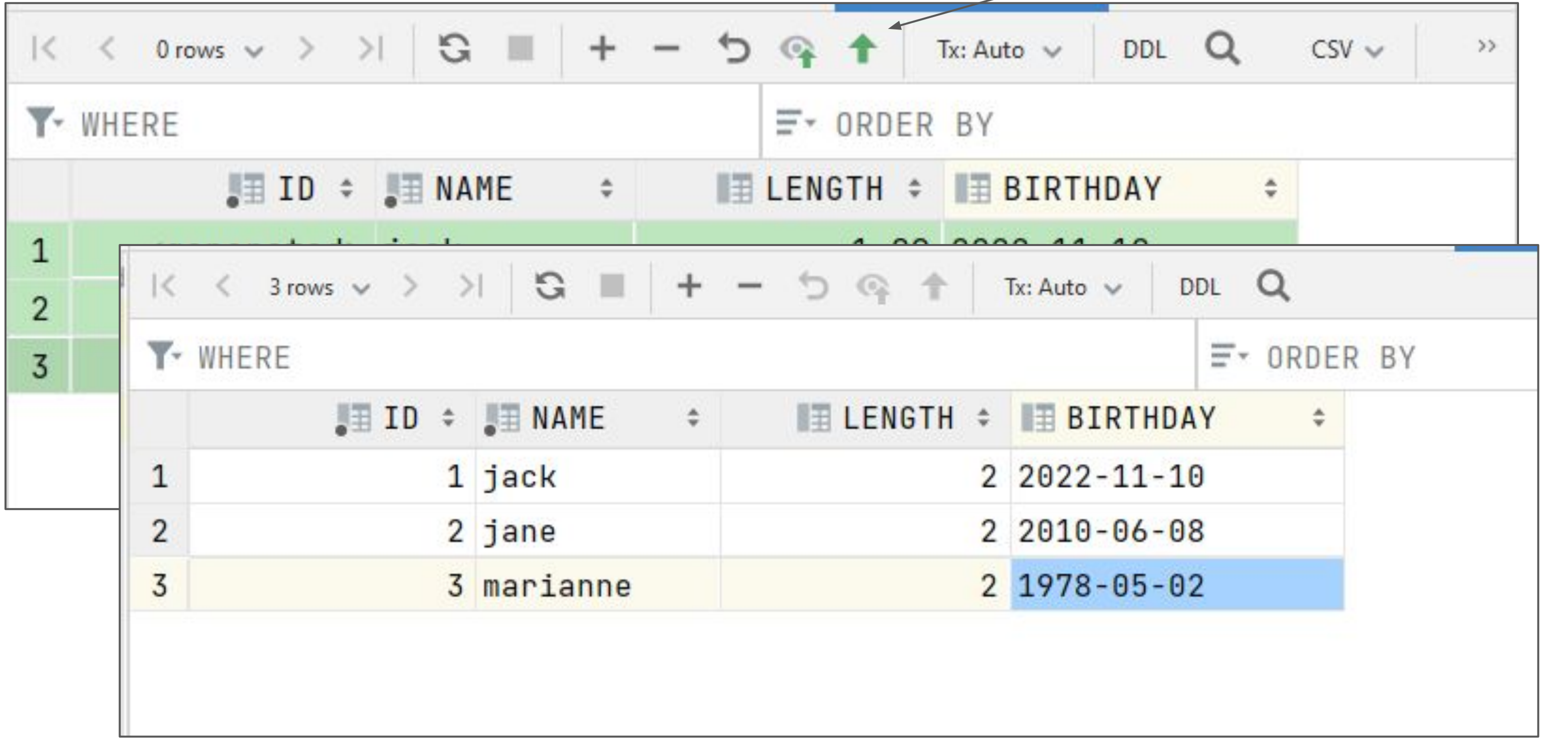
- Use the DB View
- Create columns ID (PK, auto_increment), NAME, LENGTH, BIRTHDAY



```
create table PUBLIC.STUDENTS
(
    ID       INTEGER auto_increment
        primary key,
    NAME     CHARACTER VARYING(100) not null,
    LENGTH   NUMERIC(3,2),
    BIRTHDAY DATE
);
```

Add some records…

Don't forget to push Submit…



	ID	NAME	LENGTH	BIRTHDAY
1	1	jack	2	2022-11-10
2	2	jane	2	2010-06-08
3	3	marianne	2	1978-05-02

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JDBC: basic steps

1. Add JDBC Driver
2. Create a `Connection` to the database
3. Create a `Statement` (or `PreparedStatement`)
4. Perform query
5. Process the result (`ResultSet`)
6. Close `ResultSet` - `Statement` - `Connection`

Slides code

Create a CommandLineRunner

```
When a bean implementing
CommandLineRunner is loaded,
It's run method is executed
```

```java
@SpringBootApplication
public class JdbcApplication implements CommandLineRunner{

 public static void main(String[] args) {
  SpringApplication.run(JdbcApplication.class, args);
 }

 @Override
 public void run(String... args) throws Exception {
  Connection connection = DriverManager.getConnection("jdbc:h2:file:./db/studentsdb");
  Statement statement = connection.createStatement();
  ResultSet resultSet = statement.executeQuery("SELECT * FROM STUDENTS");
  while (resultSet.next()) {
   System.out.println(resultSet.getString("ID") + " " + resultSet.getString("NAME"));
  }
  resultSet.close();
  statement.close();
  connection.close();
 }
}
```

```
1 jack
2 jane
3 marianne
```

```
A file can only be opened by one process, deactivate the
database in your IntelliJ tool window before running this.
(This problem does not occur with network databases)
```

Connection

- You create a connection to the Database via **`DriverManager.`*`getConnection(..)`***
  - You can provide username and password as extra parameters

```
public void run(String... args) throws Exception {
   Connection connection = DriverManager.getConnection("jdbc:h2:file:./db/studentsdb");
   Statement statement = connection.createStatement();
   ResultSet resultSet = statement.executeQuery("SELECT * FROM STUDENTS");
   while (resultSet.next()) {
       System.out.println(resultSet.getString("ID") + " " + resultSet.getString("NAME"));
   }
   resultSet.close();
   statement.close();
   connection.close();
}
```

Closing the connection

- You should close the connection if it is no longer used!
  - Typically the DB can only serve a limited number of connections at the same time…
- Use try (*with resources)* to be sure → will automatically close connection
  - You can open multiple resources in one try (with; resources)

```
public void run(String... args) throws Exception {
 try (Connection connection = DriverManager.getConnection("jdbc:h2:file:./db/studentsdb");
      Statement statement = connection.createStatement();
 ) {
  try (ResultSet resultSet = statement.executeQuery("SELECT * FROM STUDENTS")) {
   while (resultSet.next()) {
    System.out.println(resultSet.getString("ID") + " " + resultSet.getString("NAME"));
   }
  }
 }
}
```

Statement

- You create a Statement to perform a query on the database
- Statements should also be closed (eg using try with resources)!

```
public void run(String... args) throws Exception {
 try (Connection connection = DriverManager.getConnection("jdbc:h2:file:./db/studentsdb");
      Statement statement = connection.createStatement();
 ) {
  try (ResultSet resultSet = statement.executeQuery("SELECT * FROM STUDENTS")) {
   while (resultSet.next()) {
    System.out.println(resultSet.getString("ID") + " " + resultSet.getString("NAME"));
   }
  }
 }
}
```

ResultSet

- The executeQuery method returns a ResultSet. Via the ResultSet you can retrieve the rows returned by the query…
- ResultSet should also be closed after use…

```java
public void run(String... args) throws Exception {
 try (Connection connection = DriverManager.getConnection("jdbc:h2:file:./db/studentsdb");
      Statement statement = connection.createStatement();
 ) {
  try (ResultSet resultSet = statement.executeQuery("SELECT * FROM STUDENTS")) {
   while (resultSet.next()) {
    System.out.println(resultSet.getString("ID") + " " + resultSet.getString("NAME"));
   }
  }
 }
}
```

ResultSet

- The next() method moves the cursor to the next row
- It returns true if there is a new row, false otherwise
- Perfect in combination with a while loop…

```
public void run(String... args) throws Exception {
 try (Connection connection = DriverManager.getConnection("jdbc:h2:file:./db/studentsdb");
      Statement statement = connection.createStatement();
 ) {
  try (ResultSet resultSet = statement.executeQuery("SELECT * FROM STUDENTS")) {
   while (resultSet.next()) {
    System.out.println(resultSet.getString("ID") + " " + resultSet.getString("NAME"));
   }
  }
 }
}
```

ResultSet

- Once you are on a row, you can retrieve values of different columns using the column name or the column index (starts from 1)
    - Using name is preferred over index…

```
public void run(String... args) throws Exception {
   try (Connection connection = DriverManager.getConnection("jdbc:h2:file:./db/studentsdb")){
       try (Statement statement = connection.createStatement()) {
           try (ResultSet resultSet = statement.executeQuery("SELECT * FROM STUDENTS")) {
              while (resultSet.next()) {
                  System.out.println(resultSet.getString("ID") + " " + resultSet.getString("NAME"));
                  System.out.println(resultSet.getString(1) + " " + resultSet.getString(2));
              }
           }
       }
   }
}
```

ResultSet get…: what SQL types?

- getString(...): for character based types (char, varchar, varchar2, …)
  - Works on any type (does a toString)
- getInt(...), getLong(...): integer types (smallint, int, …)
- getFloat(...), getDouble(...): decimal types (decimal, real, double precision, …)
- getBoolean(...): boolean types
- getDate(...): for dates
  - Returns java.sql.Date object → convert it to LocalDate for use in Java…
- …

```
Date birthDay = resultSet.getDate("BIRTHDAY");
LocalDate localDate = birthDay.toLocalDate();
```

Insert or delete data?

```
try (Connection connection = DriverManagergetConnection("jdbc:h2:file:./db/studentsdb")) {
   try (Statement statement = connection.createStatement()) {
       int result = statement.executeUpdate("INSERT INTO STUDENTS(NAME, LENGTH, BIRTHDAY) " +
                                              "VALUES('AN',1.65,'1967-3-12')");
       Sy
   }
}
```

```
try (Connection connection = DriverManagergetConnection("jdbc:h2:file:./db/studentsdb")) {
   try (Statement statement = connection.createStatement()) {
       int result = statement.executeUpdate("DELETE FROM STUDENTS WHERE NAME = 'AN'");
       System.out.println(result + "row(s) updated");
   }
}
```

- Use executeUpdate method to do updates (inserts, deletes) to the database
- Returns number of rows affected (1 in the above cases)

Exercise:

- Create new Spring application
  - Add JDBC and H2 dependencies
- Use the Database view in IntelliJ to:
  - Create table STUDENTS: a user has an id, name, length and birthday
  - Add some data
- Write a small application (commandlinerunner) that shows all STUDENTS sorted by birthday
- Perform some updates and deletes on the data
- What happens if you keep the connection open on the IntelliJ Database tool?

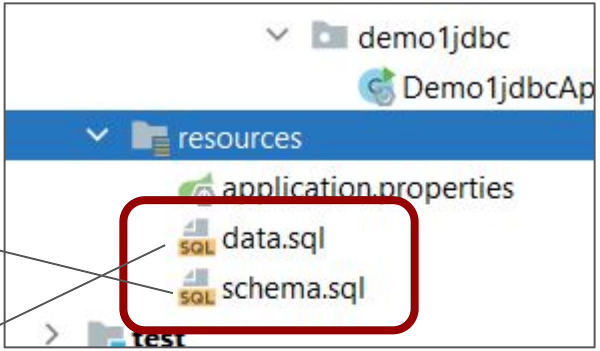
Creating the database tables and loading initial data?

- You can do this in database tool, or using Java code
- Or: you can add a `schema.sql` and `data.sql` to the resources folder
- Spring will run the .sql files once when the application starts...

```sql
DROP TABLE IF EXISTS PERSONS; -- not needed for in memory DB

CREATE TABLE PERSONS(
   ID INTEGER AUTO_INCREMENT PRIMARY KEY,
   NAME CHARACTER VARYING(100) NOT NULL,
   FIRSTNAME CHARACTER VARYING(50)  NOT NULL,
   REMARK CHARACTER VARYING(256)
);
```

```sql
INSERT INTO PERSONS(NAME, FIRSTNAME,REMARK)
VALUES ('JONES', 'JACK','of all trades'),
      ('POTTER', 'JACK','Lilly''s dad'),
      ('POTTER', 'MIA','Lilly''s mum'),
      ('REED', 'JACK','union');
```



Configure the datasource in Spring...

- Spring needs to know where to connect: you can add this info in the `application.properties`

```
spring.datasource.url=jdbc:h2:mem:personsdb
spring.datasource.username=sa
spring.datasource.password=
spring.sql.init.mode=always
```

We use a H2 memory database now: it will only exist in memory. Ideal for developing and testing…

If not using a memory database Spring does not run the schema.sql and data.sql, you need to add this last line...

[Slides code: persons_datasource](#) DataSourceRunner

Exercise:

- Create a small Spring application (no Spring MVC, just a commandlinerunner) that loads 10 students (name, length, birthday) into a H2 memory database at startup:
  - Configure in the application.properties
  - use schema.sql and data.sql to create the table and load the data
- The application asks for the name via the console
- The application shows all records that match the name
- Use this query: `"SELECT * FROM STUDENTS WHERE NAME = '" + name + "'"`

Exercise:

- Create a small Spring application (no Spring MVC, just a commandlinerunner) that loads 10 students (name, length, birthday) into a H2 memory database at startup:
  - Configure in the application.properties
  - use schema.sql and data.sql to create the table and load the data
- The application asks for the name via the console
- The application shows all records that match the name
- Use this query: `"SELECT * FROM STUDENTS WHERE NAME = '" + name + "'"`

→ Try using `JACK' OR '1'='1` as name, what happens?

→ Example of SQL Injection!

PreparedStatement

The values are inserted at the ? in the PreparedStatement.
The prepared statement can execute the SAME statement multiple times with DIFFERENT parameters

- You can *prepare* an SQL statement:
  - It will be precompiled → you can prepare it beforehand
  - You can change the parameters
  - It is a good protection against SQL injection...

```
try (PreparedStatement statement = connection.prepareStatement("INSERT INTO STUDENTS(NAME, LENGTH, BIRTHDAY)
VALUES(?,?,?)")) {
   for (int i=0;i<10;i++) {
       statement.setString(1, "An" + i);
       statement.setDouble(2, 1.78);
       statement.setDate(3, Date.valueOf(LocalDate.of(1987, 1 + i, 23)));
       int result = statement.executeUpdate();
       System.out.println(result);
   }
}
```

Slides code: preparedStatement

Exercise:

- Use a PreparedStatement in the previous exercise: does it solve the SQL Injection problem?

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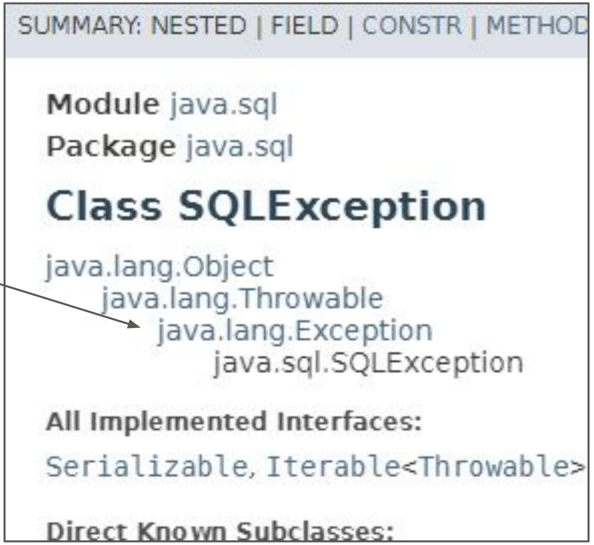
SQLExceptions

- If something goes wrong, JDBC throws an SQLException
  - Example: DB offline, wrong table, column does not exist, …
  - It is a *checked* exception: you have to write exception handling code for it…
  - Not very fine-grained: you get an SQLException for all kinds of problems

```
Extract from the Java 17 API Documentation:
SQLException inherits from Exception so it
is a checked exception…
```



SUMMARY: NESTED | FIELD | CONSTR | METHOD

Module java.sql

Package java.sql

Class SQLException

```
java.lang.Object
    java.lang.Throwable
        java.lang.Exception
            java.sql.SQLException
```

All Implemented Interfaces:

`Serializable`, `Iterable<Throwable>`

Direct Known Subclasses:

Transactions in JDBC

- Sometimes you need to perform more than one query together.
- Example: transfer money to other account
  - Query one: remove money from the first account
  - Query two: add money to the second account
    - If for some reason the second query does not succeed, the first one should roll back!
- In a relational database you use transactions for this
- You can also perform transactions using JDBC

Transactions in JDBC

```
try (Connection connection = DriverManager.getConnection("jdbc:h2:mem:personsdb","sa","")) {
 connection.setAutoCommit(false);
 try (Statement statement = connection.createStatement()) {
  try {
   statement.executeUpdate("""
    INSERT INTO PERSONS(NAME, FIRSTNAME, REMARK)
    VALUES('Truus','Trampoline','Lastly through a hogshead of real fire!')
    """);
   statement.executeUpdate("DELETE FROM PERSONS WHERE FIRSTNAME LIKE '%ER'");
   if (new Random().nextBoolean()) throw new SQLException("Problem!");
   System.out.println("No problem, inserting and deleting...");
   connection.commit();
  } catch (SQLException e) {
   System.out.println("Problem, rolling back delete and insert!");
   connection.rollback();
  }
}
```

We mimic an SQLException here, just for the demo. If the exception is thrown, the transaction will rollback and BOTH the insert and delete will not happen!

Slides code: persons_datasource TransactionRunner

Agenda this week

JDBC
Implementing the repository
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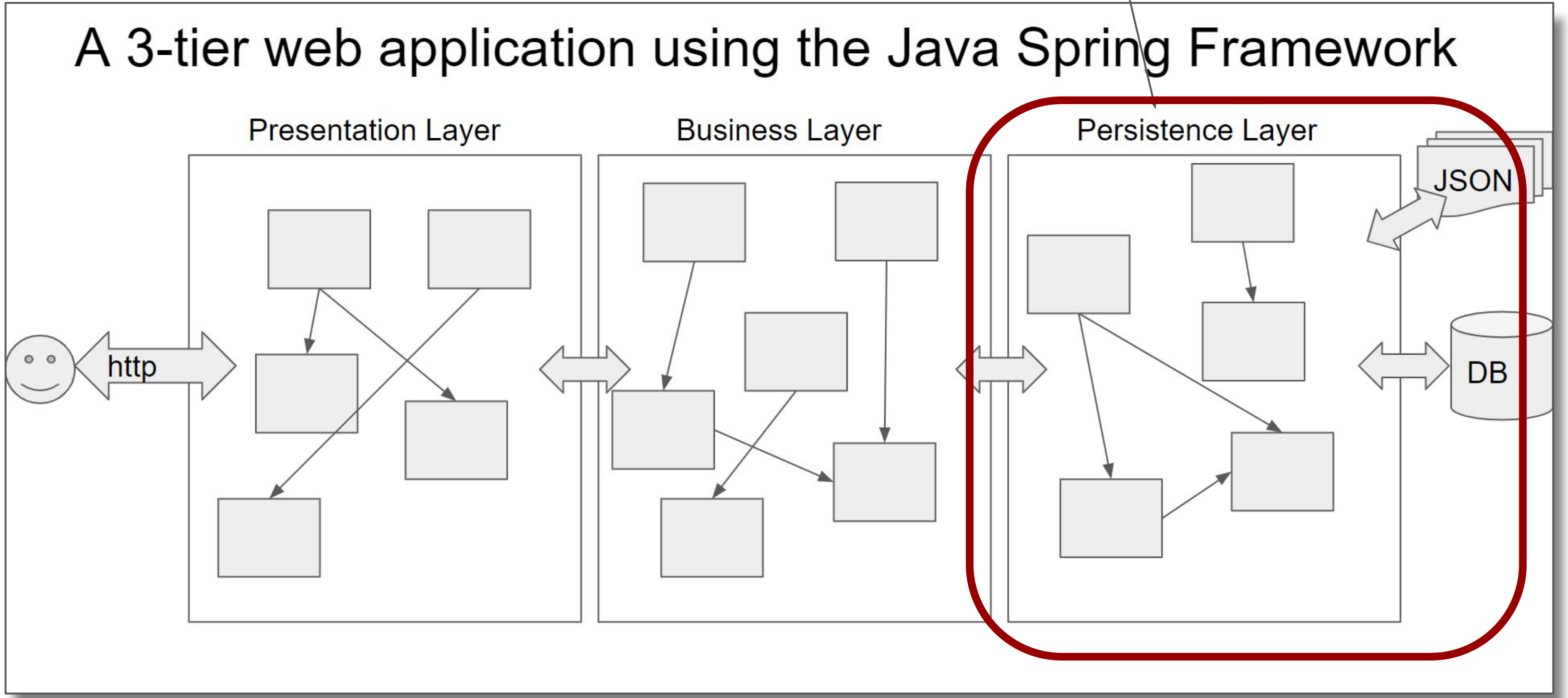
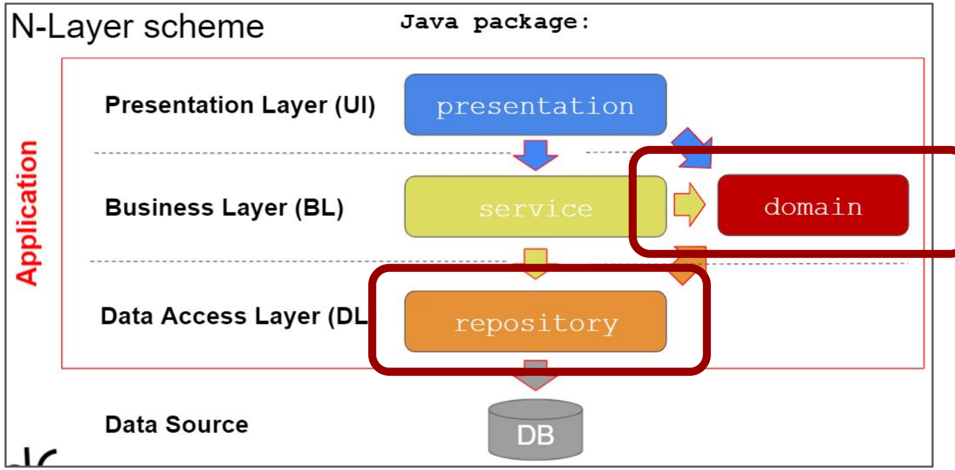
The persistence layer

We will use JDBC in the Persistence Layer.
We will create Repository classes for it...



Remember: Domain and Repository

- Domain classes map to database tables (“entities”)
- They have an ID to contain the PK of the record
- We create Repository classes for each entity.
- Annotate with @Repository (= a Spring Component)
- The Repository classes will contain the JDBC code
- Repository has methods to
  - Query entities (findBy…)
  - Create entities (create…)
  - Update entities (update…)
  - Delete entities (delete…)



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Exercise: create the StudentJdbcRepository(1/6)

- Create the domain class Student (id, name, length, birthday)
- Configure your project with a database with some Students
  - Use application.properties - schema.sql - data.sql
- Create the StudentRepository interface:

```
public interface StudentRepository {
   List<Student> findAll();
   Student createStudent(Student student);
   void updateStudent(Student student);
   void deleteStudent(int id);
}
```

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Exercise: create the StudentJdbcRepository(2/6)

- Create the StudentJdbcRepository(implements StudentRepository)
- Implement the findAll() method
  - You need the database URL, username and password to create the connection → values from the application.properties files can be retrieved as follows:

```java
public StudentJdbcRepository(@Value("${spring.datasource.url}") String dbURL,
 @Value("${spring.datasource.username}") String user,
 @Value("${spring.datasource.password}:''") String password) {
 this.dbURL = dbURL;
 this.user = user;
 this.password = password;
}
```

```
:'' default value
(if property is not found)
is an empty string
```

Exercise: create the StudentJdbcRepository(3/6)

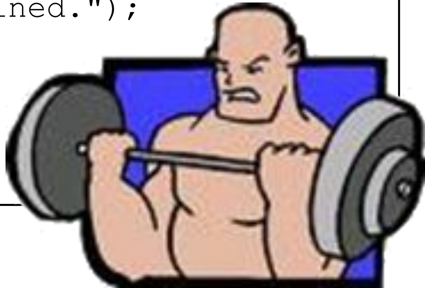
- Create the presentation class StudentMenu
  - The StudentRepository is injected (*we will skip the service layer for this exercise…*)
  - We will show a small console menu like this:
- Test findAll!

```
Welcome to the Student Management System
========================================
1) List students
2) Add student
3) Update student
4) Delete student
Make a choice:
```

Exercise: create the StudentJdbcRepository(4/6)

- Implement the createStudent() method
- You need the ID of the newly created Student. How?

```
try (PreparedStatement statement
  = connection.prepareStatement("INSERT INTO STUDENTS(..)"= Statement.RETURN_GENERATED_KEYS)){
   //…
   int result = statement.executeUpdate();
   if (result != 0) {
       try (ResultSet generatedKeys = statement.getGeneratedKeys()) {
           if (generatedKeys.next()) {
               createdStudent.setId(generatedKeys.getInt(1));
           }
           else {
               throw new SQLException("Creating student failed, no ID obtained.");
           }
       }
   }
}
```



Exercise: create the StudentJdbcRepository(5/6)

- Implement the updateStudent() and deleteStudent() methods
- Example run:

```
Welcome to the Student Management System
========================================
1) List students
2) Add student
3) Update student
4) Delete student
Make a choice:3
Student{id=1, name='jane', length=1.87, birthday=2010-06-08}
Student{id=2, name='marianne', length=1.23, birthday=1978-05-02}
Student{id=3, name='Truus', length=2.0, birthday=1954-03-12}
Student{id=4, name='An', length=1.67, birthday=1987-02-23}
Which student (id)?4
new name:Jef
new length:1.87
new birthday (mm-dd-yyyy):02-23-1987
```

Exercise: create the StudentJdbcRepository(6/6)

- What about those SQLExceptions?
- We don’t want the repository to throw SQLExceptions to the higher layers
    - Create an unchecked exception class DatabaseException
    - Wrap the SQLException in it and throw to higher layers
    - Catch in the presentation layer and show a message…

JdbcTemplate: removes the boilerplate code

```
@Component
public class JdbcTemplateRunner implements CommandLineRunner {
 private JdbcTemplate jdbcTemplate;

 public JdbcTemplateRunner(JdbcTemplate jdbcTemplate) {
  this.jdbcTemplate = jdbcTemplate;
 }

 @Override
 public void run(String... args) throws Exception {
  //Query the database
  jdbcTemplate.query("SELECT * FROM PERSONS",
   (RowCallbackHandler) rs ->
    System.out.println(rs.getString("ID") + " " + rs.getString("NAME")));
 }
}
```

Spring provides JdbcTemplate.
It handles connections, statement, closing, exceptions etc behind the scenes,
taking parameters (url, user, password) from application.properties

RowCallbackHandler is executed for each resultset row

Old JDBC Code:

```
public void run(String... args) throws Exception {
   try (Connection connection = DriverManager.getConnection("jdbc:h2:mem:peronsdb","sa","")){
       try (Statement statement = connection.createStatement()) {
           try (ResultSet resultSet = statement.executeQuery("SELECT * FROM STUDENTS")) {
               while (resultSet.next()) {
                   System.out.println(resultSet.getString("ID") + " " + resultSet.getString("NAME"));
               }
           }
```

Slides code: persons_datasource JdbcTemplateRunner

Other JdbcTemplate methods

- `query`: execute a query. A lot of overloaded methods here, see docs.
- `queryForObject`: executes a Query, returns a domain object.
- `update`: perform an update
- `batchUpdate`: perform a batch of updates in one go

https://docs.spring.io/spring-framework/docs/current/javadoc-api/org/springframework/jdbc/core/JdbcTemplate.html

Example: convert ResultSet to List of domain objects

```
public List<Person> findByName(String name){
 return jdbcTemplate.query("SELECT * FROM PERSONS WHERE NAME = ?",
   (rs, rowNum) -> new Person(rs.getInt("id"),
     rs.getString("name"),
     rs.getString("firstname"),
     rs.getString("remark")),
   name);
}
```

The second parameter is a RowMapper implementation (here a lambda). It provides code to convert the ResultSet into a domain Object. JdbcTemplate will apply it to all records in the ResultSet and returns a List!

Subsequent parameters are for the PreparedStatement...

The `RowMapper`

- You can pass a `RowMapper` to the `query` or `queryForObject` methods. It maps a row in the `ResultSet` to the Domain object. It can be done in different ways:
  - Implement a `RowMapper` (using class, a lambda expression, referencing a method from the repository…)
  - Using a `BeanPropertyRowMapper` to generate the `RowMapper` based on the Domain object

`The domain object needs a default constructor for this to work…!`

`Slides code: persons_datasource` `RowMapperRunner`

Example: queryForObject

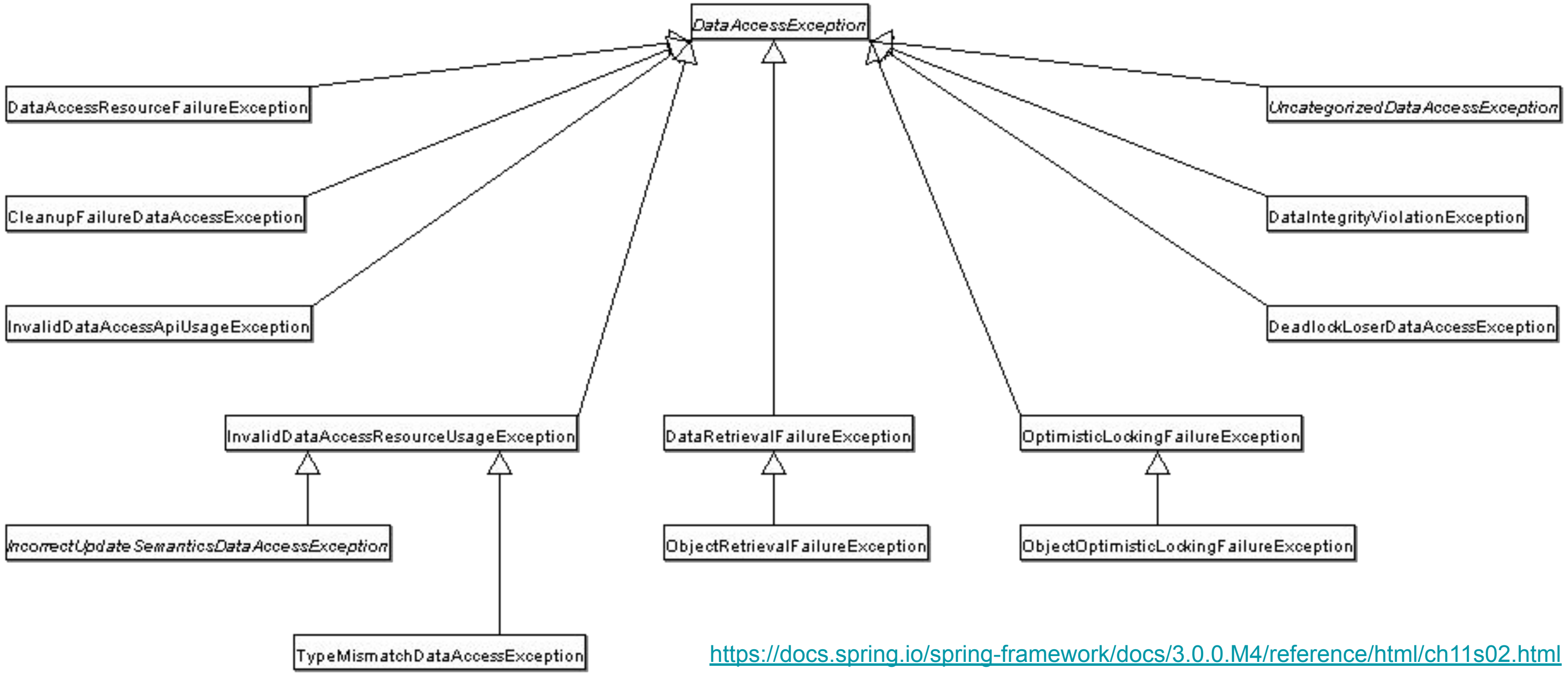
```
public Person findById(int id) {
 return jdbcTemplate.queryForObject("SELECT * FROM PERSONS WHERE ID = ?",
   this::mapRow,
   id);
}

private Person mapRow(ResultSet rs, int i) throws SQLException {
 return new Person(rs.getInt("id"),
   rs.getString("name"),
   rs.getString("firstname"),
   rs.getString("remark"));
}
```

The mapRow method reference does the same as the lambda in the previous example, but can be reused in other queries returning Person(s)

And the SQLException?

Spring provides more fine-grained exceptions so you can write better exception handling.
The exceptions are unchecked: you don't need to handle them!

- It is replaced by a hierarchy of `DataAccessExceptions`


DataAccessException
DataAccessResourceFailureException
CleanupFailureDataAccessException
InvalidDataAccessApiUsageException
InvalidDataAccessResourceUsageException
DataRetrievalFailureException
OptimisticLockingFailureException
UncategorizedDataAccessException
DataIntegrityViolationException
DeadlockLoserDataAccessException
IncorrectUpdateSemanticsDataAccessException
TypeMismatchDataAccessException
ObjectRetrievalFailureException
ObjectOptimisticLockingFailureException

https://docs.spring.io/spring-framework/docs/3.0.0.M4/reference/html/ch11s02.html

KdG

Exercise: walk through this spring.io guide

- This small tutorial walks you through using JdbcTemplate to access a relational database: https://spring.io/guides/gs/relational-data-access/

KdG

Saving entities to the database

- How is the retrieving of the ID implemented?

```
public Person save(Person person) {
 jdbcTemplate.update("INSERT INTO PERSONS (NAME, FIRSTNAME, REMARK) VALUES (?, ?, ?)",
  person.getName(),
  person.getFirstName(),
  person.getRemark());
 // set Person id??
 return person;
}
```

Using a SimpleJdbcInsert object

```
private SimpleJdbcInsert personInserter;

public PersonJdbcTemplateRepository(JdbcTemplate jdbcTemplate) {
 this.jdbcTemplate = jdbcTemplate;
 personInserter = new SimpleJdbcInsert(jdbcTemplate).withTableName("PERSONS")
  .usingGeneratedKeyColumns("ID");
}
//...
public Person save(Person person) {
 int personId = personInserter.executeAndReturnKey(Map.of(
  "NAME", person.getName(),
  "FIRSTNAME", person.getFirstName(),
  "REMARK", person.getRemark())
 ).intValue();
 person.setId(personId);
 return person;
}
```

Exercise:

- Create a second implementation of the StudentRepository, this time using JdbcTemplate!
  - Inject the JdbcTemplate
  - Use a private mapRow method to map a ResultSet entry to a Student
  - Use SimpleJdbcInsert to retrieve the id when creating a new Student
  - Think about the exception handling…
- Test this implementation…

Agenda this week

JDBC
Implementing the repository
JdbcTemplate
Spring profiles

Spring profiles

- https://www.baeldung.com/spring-profiles
- If you like to use another DB technology for development versus testing or production?
  - Spring provides the possibility to define *profiles*
    - You can select the active profile in `application.properties`:
      - `spring.profiles.active=prod`
    - You can create separate `application-dev.properties`, `application-prod.properties, …`
  - In your code: using the `@Profile` annotation you can map beans to different profiles

Development
Testing/QA
Production

KdG

Example: H2 for development - PostgreSQL for production

- Make sure `org.postgresql:postgresql` dependency is in build.gradle.kts
- Put PostgreSql attributes into application-prod.properties

```
spring.datasource.url=jdbc:postgresql:personsdb
spring.datasource.username=postgres
spring.datasource.password=student_1234
spring.sql.init.mode=always
spring.sql.init.schema-locations=classpath:schema-prod.sql
spring.sql.init.data-locations=classpath:data-prod.sql
```

Normally you will not reinitialise your production db, and only use the schema and data files for development.

- PostgreSql dialect may differ

```
DROP TABLE IF EXISTS PERSONS;
CREATE TABLE PERSONS(
   ID  SERIAL PRIMARY KEY,
   NAME CHARACTER VARYING(100) NOT NULL,
   FIRSTNAME CHARACTER VARYING(50)  NOT NULL,
   REMARK CHARACTER VARYING(256)
);
```

Or: Configure the database from code with @Profile

- Annotating beans with @Profile(“dev”) and @Profile(“prod”), will only activate them for these profiles
- Create two @Configuration classes H2DatabaseConfig and PostgreSqlDatabaseConfig

dev

```
@Bean
public DataSource dataSource(){
   DataSource dataSource = DataSourceBuilder
.create()
       .driverClassName("org.h2.Driver")
           .url("jdbc:h2:mem:studentdb")
           .username("sa")
           .password("")
           .build();
   return dataSource;
}
```

prod

```
@Bean
public DataSource dataSource(){
   DataSource dataSource = DataSourceBuilder
.create()

.driverClassName("org.postgresql.Driver")
           .url("jdbc:postgresql:pro3_db")
           .username("postgres")
           .password("student_1234")
           .build();
   return dataSource;
}
```

Slides code: profiles_code

Configuring @Profile from code

- Add `H2LoadData` and `PostgresLoadData` class (annotate with `@Component` and `@Profile`)
- Add `@PostConstruct` method in each class:

dev

```
@PostConstruct
public void loadData(){
  jdbcTemplate.update("DROP TABLE IF EXISTS
PERSONS");
  jdbcTemplate.update("""
    CREATE TABLE PERSONS(
      ID INTEGER AUTO_INCREMENT PRIMARY KEY,
      NAME CHARACTER VARYING(100) NOT NULL,
      FIRSTNAME CHARACTER VARYING(50)  NOT NULL,
      REMARK CHARACTER VARYING(256)
   );
""");
   jdbcTemplate.update("""
 INSERT INTO PERSONS(NAME, FIRSTNAME,REMARK)
VALUES ('JONES', 'JACK','of all trades'),
      ('POTTER', 'JACK','Lilly''s dad'),
      ('POTTER', 'MIA','Lilly''s mum'),
      ('REED', 'JACK','union');
      """);
}
```

prod

```
@PostConstruct
public void loadData(){
  jdbcTemplate.update("DROP TABLE IF EXISTS
PERSONS");
  jdbcTemplate.update("""
    CREATE TABLE PERSONS(
      ID INTEGER SERIALPRIMARY KEY,
      NAME CHARACTER VARYING(100) NOT NULL,
      FIRSTNAME CHARACTER VARYING(50)  NOT NULL,
      REMARK CHARACTER VARYING(256)
   );
""");
   jdbcTemplate.update("""
 INSERT INTO PERSONS(NAME, FIRSTNAME,REMARK)
VALUES ('JONES', 'JACK','of all trades'),
      ('POTTER', 'JACK','Lilly''s dad'),
      ('POTTER', 'MIA','Lilly''s mum'),
      ('REED', 'JACK','union');
      """);
}
```

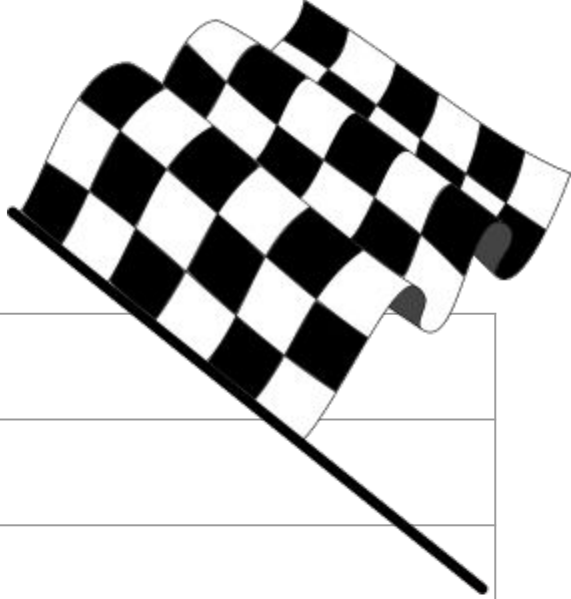
Profiles: there’s more…

- Profiles can be configured in many other ways and can be used for many other purposes, we only look at a small example
- For more info, check the tutorial: https://www.baeldung.com/spring-profiles

Exercise: using profiles

- Install the PostgreSQL database system on your platform
- Create a database using PostgreSQL tooling
- Try to connect using the IntelliJ Database tooling
- Walk through the previous slides and try to create 2 profiles, switch between the two and test your application.
    - Try to configure the databases using 2 application.properties files
    - Try to configure the databases from code using the @Profile annotation

Agenda this week



JDBC
Implementing the repository
JdbcTemplate
Spring profiles

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Project

- Implement the Repository of your 2 main entities using Spring JDBC (JdbcTemplates) in combination with a H2B
- Use a schema.sql and data.sql to load initial data.
- Use profiles to be able to switch between the old implementation (using Java Collections) and the new implementation (using JDBC)