Hibernate Introduction

Maven, Hibernate, Configuration, JPA, Annotations

SoftUni Team

Technical Trainers

Software University

Software University

https://softuni.bg

Table of Contents

Questions

Software University

sli.do

#Java-DB

Maven

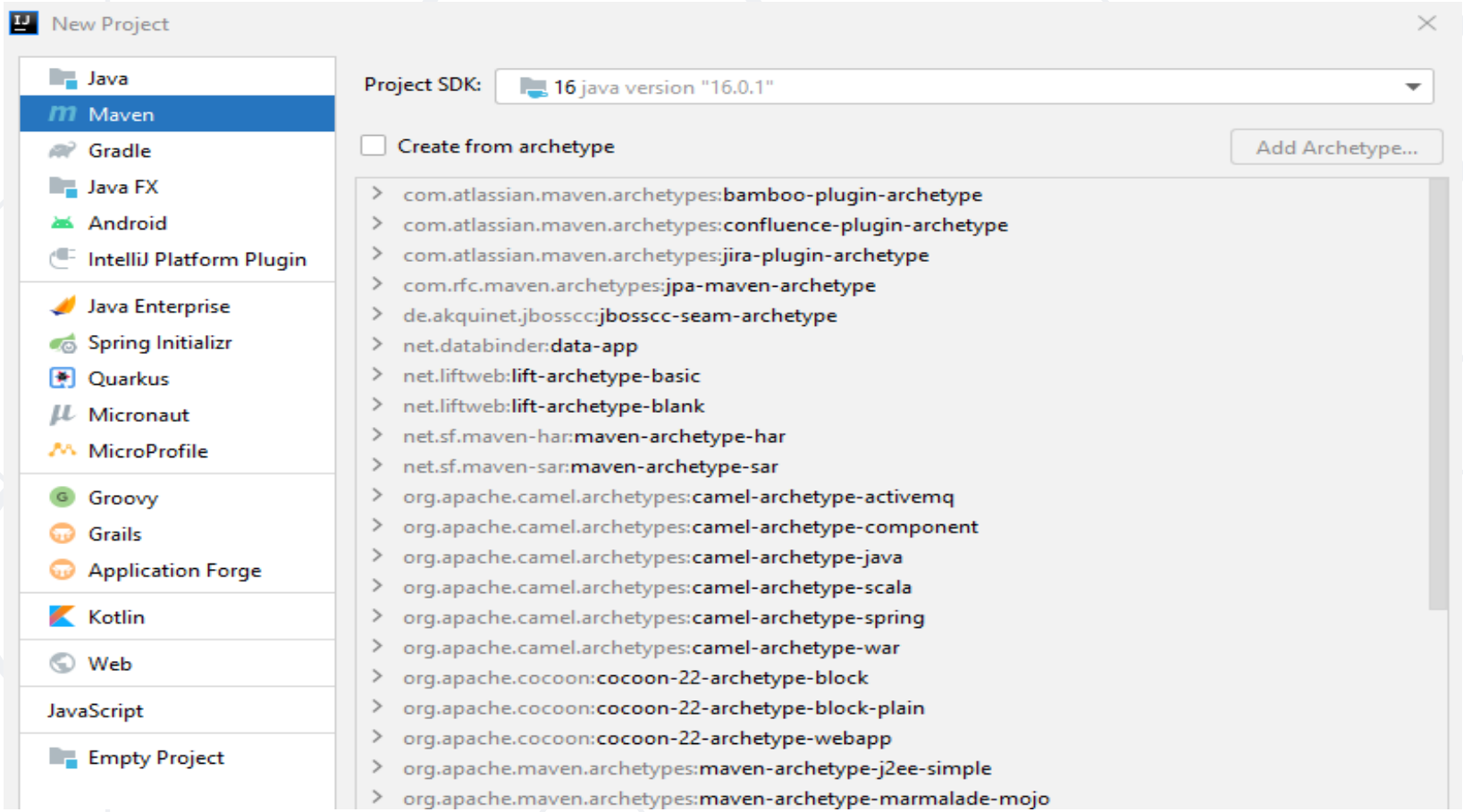
Project Management and Comprehension

Maven Overview

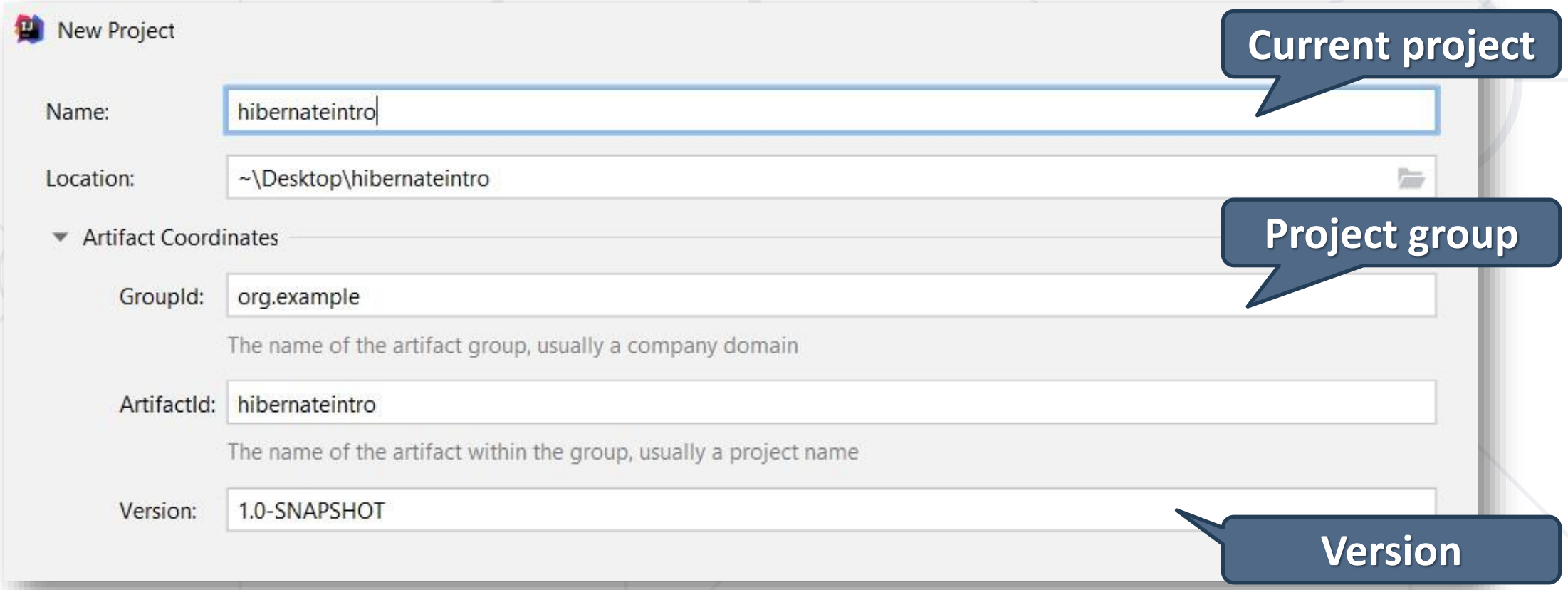
- Maven is a built automation tool.
  - Describes how software is built and its dependencies
  - Uses XML files
- Dynamically downloads **Java libraries** and **Maven plug-ins**
  - Projects are configured using a **P**roject **O**bject **M**odel, which is stored in a **pom.xml** file

Setup – Creating a Maven Project (1)

- Select "Maven" project from the new project panel:

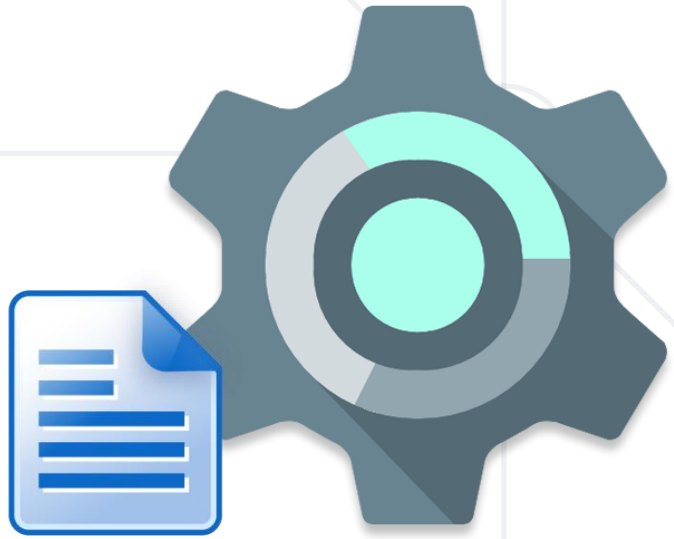


Setup (2)


New Project
Name:
hibernateintro
Location:
~\Desktop\hibernateintro
Artifact Coordinates
GroupId:
org.example
The name of the artifact group, usually a company domain
ArtifactId:
hibernateintro
The name of the artifact within the group, usually a project name
Version:
1.0-SNAPSHOT
Current project
Project group
Version

Maven Configurations

- A **P**roject **O**bject **M**odel(**POM**) is the fundamental unit of work in Maven
- **Configurations** are held in the **pom.xml** file
  - When executing a task or goal, Maven looks for the POM file in the current directory



POM Model

Software University

pom.xml

```
<build>
    <plugins>
        <plugin>
            <groupId>org.apache.maven.plugins</groupId>
            <artifactId>maven-compiler-plugin</artifactId>
            <configuration>
                <source>16</source>
                <target>16</target>
            </configuration>
        </plugin>
    </plugins>
</build>
```

Java compile version

Dependencies

- Dependencies are set with the **<dependency>** tag:

pom.xml

```
<dependencies>
        <dependency>
            <groupId>org.hibernate</groupId>
            <artifactId>hibernate-core</artifactId>
        </dependency>
        <dependency>
            <groupId>mysql</groupId>
            <artifactId>mysql-connector-java</artifactId>
        </dependency>
</dependencies>
```

Dependency 1

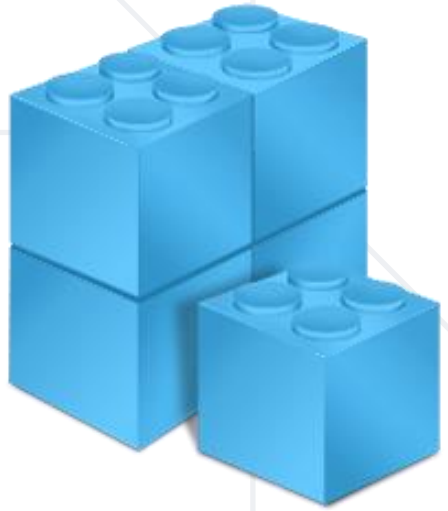
Dependency 2

Hibernate Framework

Mapping Java Classes to Database Tables

Hibernate Framework

- Hibernate is a Java ORM framework
  - Mapping an object-oriented model to a relational database
    - It is implemented by the configuration of an **XML file** or by using **Java Annotations**
  - Maintain the database schema



Java ORM Approaches

- Different approaches to **Java ORM**:
  - POJO (Plain Old Java Objects) + XML mappings
    - A bit old-fashioned, but very powerful
    - Implemented in the "classical" Hibernate
  - Annotated Java classes (**POJO**) mapped to DB tables
    - Based on Java annotations and XML
    - Easier to implement and maintain
  - Code generation - tools

Hibernate Configuration (1)

- Pom.xml explain

pom.xml

```
…
 <dependencies>
        <dependency>
            <groupId>org.hibernate</groupId>
            <artifactId>hibernate-core</artifactId>
            <version>5.4.30.Final</version>
        </dependency>
        <dependency>
            <groupId>mysql</groupId>
            <artifactId>mysql-connector-java</artifactId>
        </dependency>
</dependencies>
…
```

Hibernate

MySQL connector

Hibernate Configuration (2)

Software University

hibernate.cfg.xml

```
<?xml version='1.0' encoding='utf-8'?>
<!DOCTYPE hibernate-configuration
        PUBLIC "-//Hibernate/Hibernate Configuration DTD//EN"
        "http://www.hibernate.org/dtd/hibernate-configuration-
3.0.dtd">

<hibernate-configuration>
    <session-factory>
        <property name="hibernate.dialect">
            org.hibernate.dialect.MySQL8Dialect
        </property>
        <property name="hibernate.connection.driver_class">
            com.mysql.cj.jdbc.Driver
        </property>
```

Configuration

SQL Dialect

Driver

Hibernate Configuration (3)

Software University

hibernate.cfg.xml

```
        <!-- Connection Settings -->
        <property name="hibernate.connection.url">
jdbc:mysql://localhost:3306/school?createDatabaseIfNotExist=true
        </property>
        <property name="hibernate.connection.username">
            root
        </property>
        <property name="hibernate.connection.password">
            1234
        </property>
        <property name="hbm2ddl.auto">
            update
        </property>
```

Connection string

User

Pass

Auto strategy

Hibernate Configuration (4)

Software University

hibernate.cfg.xml

```
    …
        <!-- List of XML mapping files -->
        <mapping resource="student.hbm.xml"/>
    </session-factory>
</hibernate-configuration>
```

Mapping files

Hibernate Implementation Example

Software University

POJO (Plain Old Java Objects) + XML mappings

```
public class Student {
  private long id;
  private String name;

  public Student() {
  }
  // Getters and setters
}
```

Hibernate Mapping (1)

Software University

student.hbm.xml

```
<?xml version="1.0" encoding="utf-8"?>
<!DOCTYPE hibernate-mapping PUBLIC
        "-//Hibernate/Hibernate Mapping DTD//EN"
        "http://www.hibernate.org/dtd/hibernate-mapping-3.0.dtd">

<hibernate-mapping>
    <class name="entities.Student" table="students">
        <id name="id" column="id">
            <generator class="identity" />
        </id>
      …
```

Mapping file

Class mapping

Field mapping

Hibernate Mapping (2)

student.hbm.xml

Field mapping

```
…
      <property name="name" column="first_name" />
    </class>
</hibernate-mapping>
```

Hibernate Sessions

Main.java

```
public class Main {
    public static void main(String[] args) {
        Configuration cfg = new Configuration();
        cfg.configure();
        SessionFactory sessionFactory =
                cfg.buildSessionFactory();
        Session session = sessionFactory.openSession();
        session.beginTransaction();

        // Your Code Here
        session.getTransaction().commit();
        session.close();
    }
}
```

Service Registry

Session

Transaction commit

Hibernate Save Data

Main.java

```
public static void main(String[] args) {
        //…
        session.beginTransaction();

        Student example = new Student();
        session.save(example);

        session.getTransaction().commit();
                session.close();
    }
}
```

Save object

Hibernate Retrieve Data by Get

Main.java

```
public static void main(String[] args) {
      …

      Student student = session.get(Student.class, 1L);

         session.close();
    }
}
```

Get object

Hibernate Retrieve Data by Query

Main.java

```
public static void main(String[] args) {
      // …
        session.beginTransaction();

      List<Student> studentList =
      session.createQuery("FROM Student " ,
                                  Student.class).list();
        for (Student student : studentList) {
            System.out.println(student.getId());
        }
        session.getTransaction().commit();
        session.close();
    }
}
```

Get list of objects

Hibernate Querying Language – HQL

SELECT

```
"FROM Student"
```

SELECT + WHERE

```
"FROM Student WHERE name = 'John'"
```

SELECT + JOIN

```
"FROM Student AS s
JOIN s.major AS major"
```

Hibernate Retrieve Data by Criteria

Main.java

```
public static void main(String[] args) {
       //…
         session.beginTransaction();
       CriteriaBuilder builder = session.getCriteriaBuilder();
       CriteriaQuery criteria = builder.createQuery();
       Root<Student> r = criteria.from(Student.class);
       criteria.select(r).where(builder.like(r.get("name"),"P%"));
       List<Student> studentList =
       session.createQuery(criteria).getResultList();
         for (Student student : studentList) {
             System.out.println(student.getName());
         }

         session.getTransaction().commit();
         session.close();
    }
```

Get list of objects by criteria

Java Persistence API

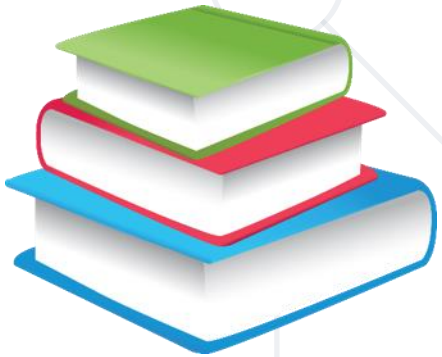
ORM Fundamentals

About JPA (1)

- What is Java Persistence API (JPA)?
  - Database persistence technology for Java (**official standard**)
    - Object-relational mapping (ORM) technology
    - Operates with POJO entities with annotations or XML mappings
    - Implemented by many **ORM engines**:
      Hibernate, **EclipseLink**, etc.

About JPA (2)

- JPA maps Java classes to database tables
  - Maps relationships between tables as associations between classes
- Provides **CRUD** functionality and queries
  - Create, read, update, delete + queries



Entities in JPA

- A JPA entity is just a POJO class
  - Abstract or concrete **top level** Java class
  - Non-final fields/properties, no-arguments constructor
  - No required interfaces
  - Direct field or property-based access
- Getter/setter can contain logic (e.g., validation)

Entity Class: Student

Software University

Student.java

```
@Entity @Table(name = "students")
public class Student {
    @Id
    @GeneratedValue(strategy = GenerationType.IDENTITY)
    @Column(name = "id")
    private long id;
    @Column(name = "name", length = 50)
    private String name;

    // Getters and setters
}
```

Set table name

Primary key

Identity

Column name

Column name and length

Column name

Annotations (1)

- **@Entity** - Declares the class as an entity or a table
- **@Table** - Declares table name
- **@Basic** - Specifies non-constraint fields explicitly
- **@Transient** - Specifies the property that is not persistent, i.e.,
  the value is never stored in the database

Annotations (2)

- **@Id** - Specifies the property, use for identity (primary key of a table) of the class
  - **@GeneratedValue** - specifies how the identity attribute can be initialized
    - Automatic, manual, or value taken from a sequence table
- **@Column** -Specifies the column attribute for the persistence property

JPA Configuration (1)

Software University

pom.xml

```
<project xmlns="http://maven.apache.org/POM/4.0.0"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"

xsi:schemaLocation="http://maven.apache.org/POM/4.0.0
      http://maven.apache.org/maven-v4_0_0.xsd">
    <modelVersion>4.0.0</modelVersion>
          <groupId>com.javawebtutor</groupId>
          <artifactId>JPAMavenExample</artifactId>
          <packaging>jar</packaging>
          <version>1.0-SNAPSHOT</version>
          <name>JPAMavenExample</name>
          <url>http://maven.apache.org</url>
      …
```

JPA Configuration (2)

Software University

pom.xml

```
…
<dependencies>
        <dependency>
            <groupId>javax.persistence</groupId>
            <artifactId>javax.persistence-api</artifactId>
            <version>2.2</version>
        </dependency>
        <dependency>
            <groupId>org.hibernate</groupId>
            <artifactId>hibernate-core</artifactId>
            <version>5.4.30.Final</version>
        </dependency>
…
```

JPA Configuration (3)

Software University

pom.xml

```
…
        <dependency>
            <groupId>mysql</groupId>
            <artifactId>mysql-connector-java</artifactId>
            <version>8.0.25</version>
        </dependency>
    </dependencies>
</project>
```

JPA Configuration (4)

- Create new directory **META-INF** in **resources** folder. After that place persistence.xml in it

persistence.xml

```
<?xml version="1.0" encoding="UTF-8"?>
<persistence xmlns="http://java.sun.com/xml/ns/persistence" version="2.0">
    <persistence-unit name="school">
        <properties> <property name = "hibernate.connection.url"
value="jdbc:mysql://localhost:3306/school?createDatabaseIfNotExist=true"/>
            <property name = "hibernate.connection.driver_class"
value="com.mysql.jdbc.Driver"/>
            …
```

JPA Configuration (5)

Software University

persistence.xml

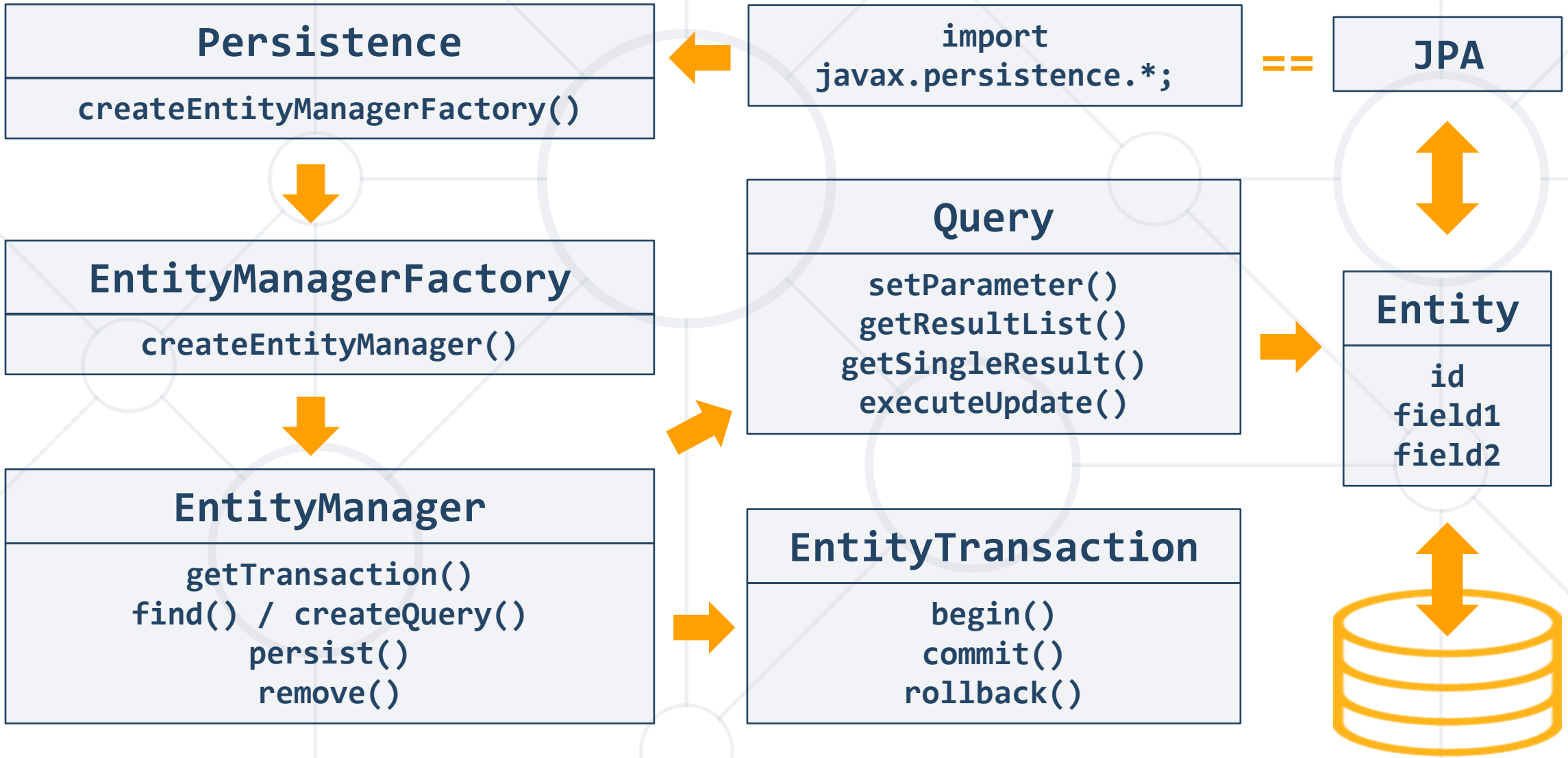
```
            …
        <property name = "hibernate.connection.username" value="root"/>
        <property name = "hibernate.connection.password" value="1234"/>
        <property name = "hibernate.dialect"
value="org.hibernate.dialect.MySQL8Dialect"/>
        <property name = "hibernate.hbm2ddl.auto" value="update"/>
        <property name = "hibernate.show_sql" value = "true" />
      </properties>
   </persistence-unit>
</persistence>
```

JPA Save Objects

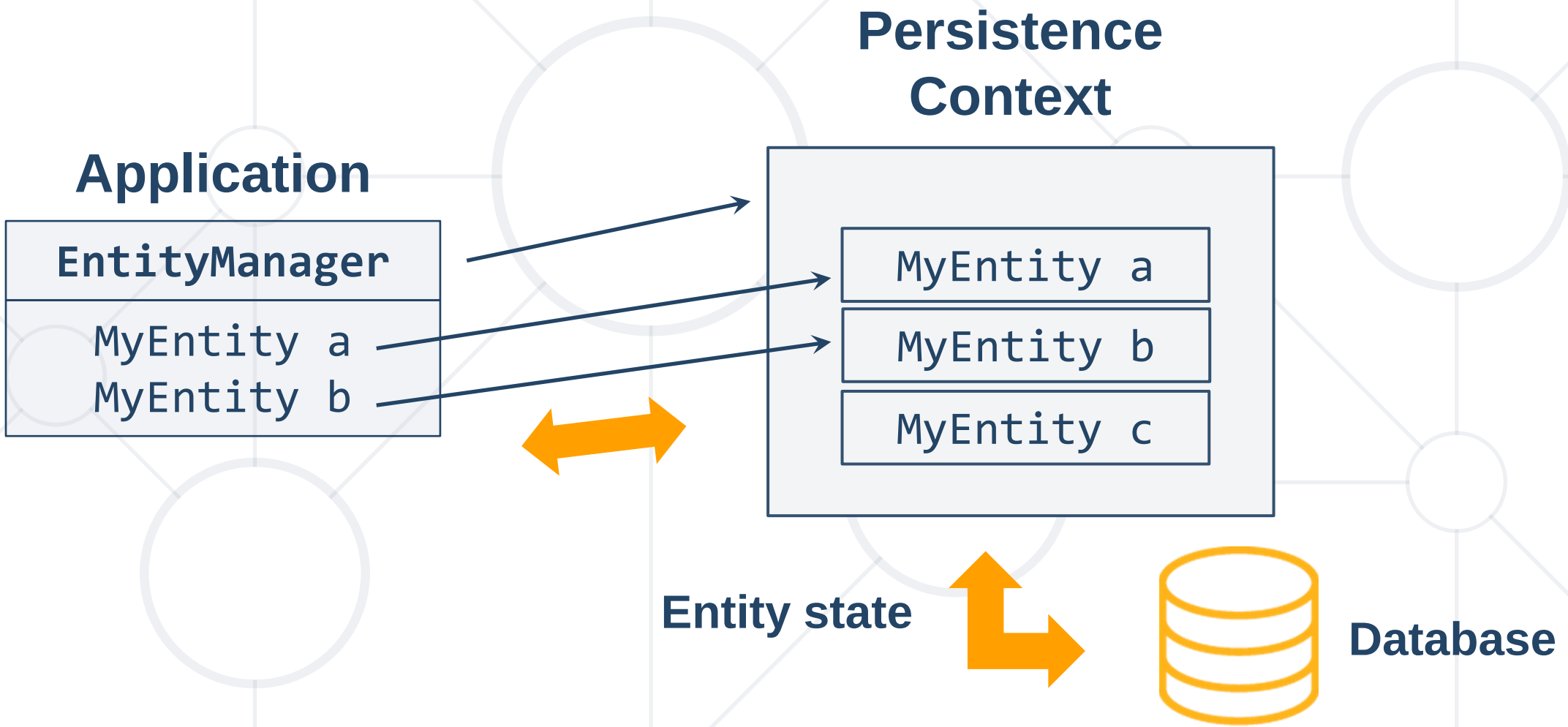
Main.java

```
public static void main(String[] args) {
        EntityManagerFactory emf =
Persistence.createEntityManagerFactory("school");
        EntityManager em = emf.createEntityManager();
        em.getTransaction().begin();
        Student student = new Student("Teo");
        em.persist(student);
        em.getTransaction().commit();
    }
}
```

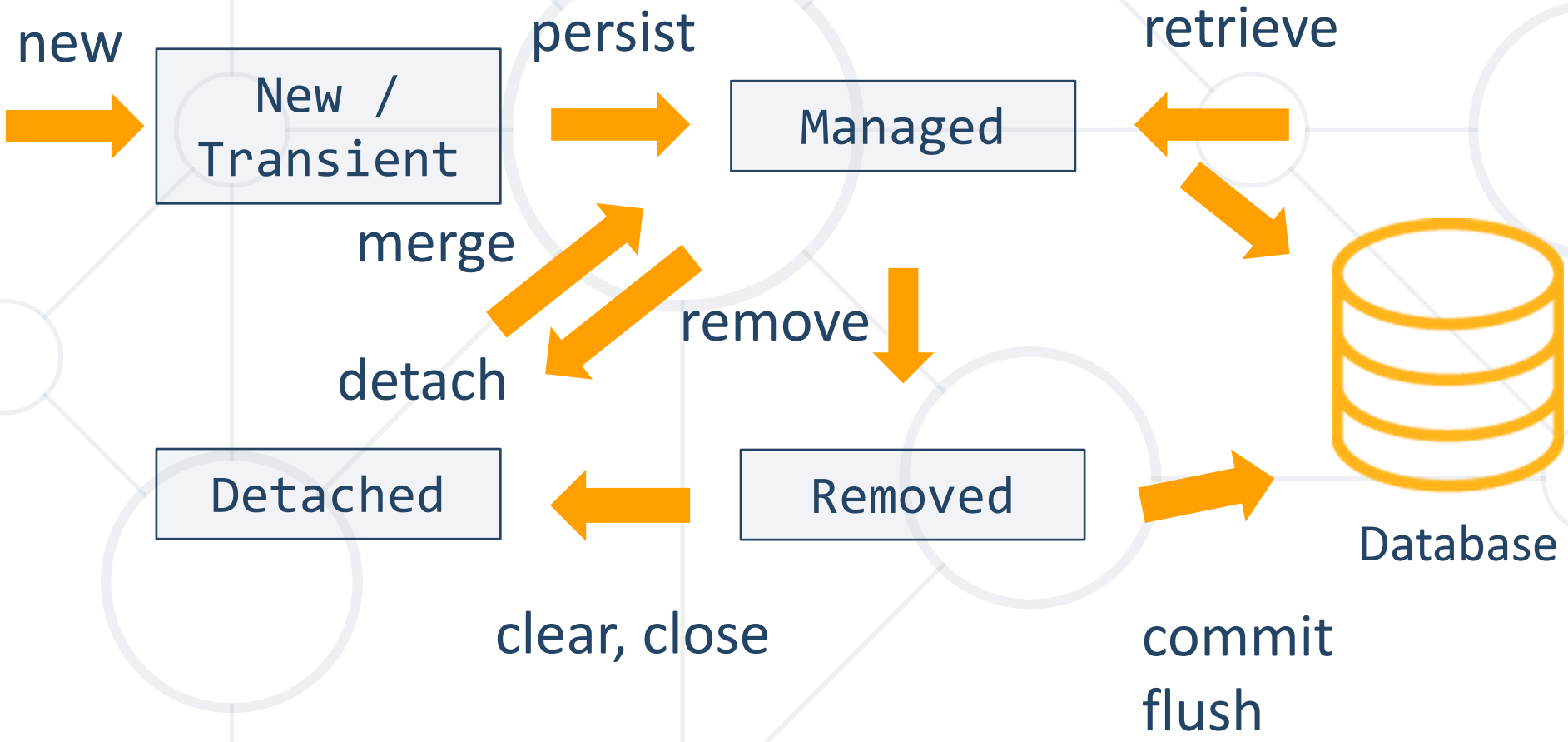
JPA – Java Persistence API



Persistence Context (PC) and Entities



Entity Object Life Cycle



JPA Write Data Methods (1)

- **persist()** – persists given entity object into the DB (SQL INSERT)
- **remove()** – deletes given entity into the DB (SQL DELETE by primary key)
- **refresh()** – reloads given entity from the DB (SQL SELECT by primary key)

JPA Write Data Methods (2)

- **detach()** – removes the object from the persistence context(PC)
- **merge()** – synchronize the state of detached entity with the PC
- **contains()** - determine if given entity is managed by the PC
- **flush()** – writes the changes from PC in the database

JPA Read Data Methods

- **find()** - execute a simple Select query by primary key

Main.java

```
public static void main(String[] args) {
        EntityManagerFactory emf =
Persistence.createEntityManagerFactory("school");

        EntityManager em = emf.createEntityManager();
        em.getTransaction().begin();
        em.find(Student.class,1)
        em.getTransaction().commit();
    }
```

Get object

JPA Delete Objects

Main.java

```
public static void main(String[] args) {
        EntityManagerFactory emf =
Persistence.createEntityManagerFactory("school");
        EntityManager em = emf.createEntityManager();
        em.getTransaction().begin();
        Student student = em.find(Student.class,1);
        em.remove(student);
        em.getTransaction().commit();
    }
}
```

Remove object

JPA Merge Objects

- Merges the state of **detached** entity into a **managed copy** of the detached entity.
  - Returned entity has a different Java identity than the detached one

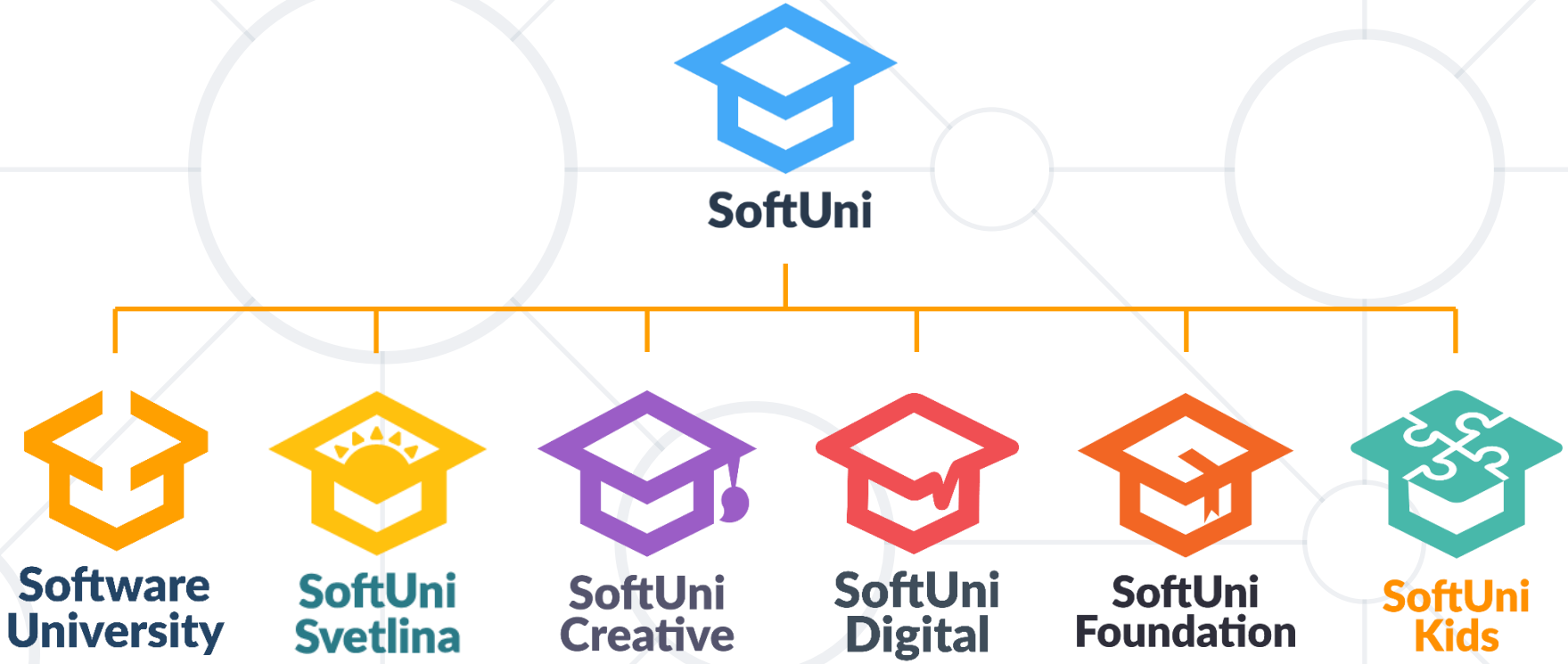
```
public Student storeUpdatedStudent(Student student) {
  return entityManager.merge(student);
}
```

- May invoke SQL SELECT

Summary

- Maven helps us build our project easily
  - Easy dependency import by XMLs
- Java Persistence API (JPA) is an official standard for Java ORMs
- Hibernate is a widely used Java ORM
  - Implements JPA

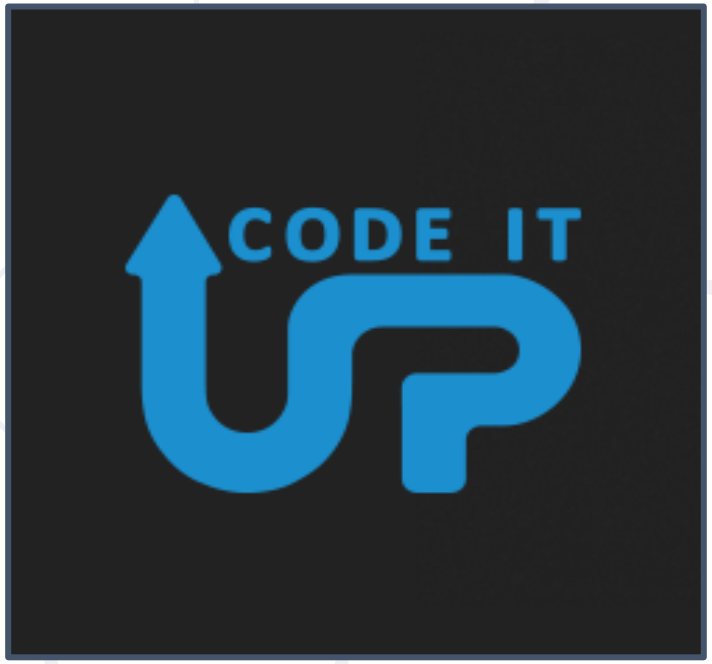
Questions?



SoftUni Diamond Partners

Software University

Educational Partners



VIRTUAL RACING SCHOOL

Trainings @ Software University (SoftUni)

- Software University – High-Quality Education, Profession and Job for Software Developers
  - softuni.bg, about.softuni.bg
- Software University Foundation
  - softuni.foundation
- Software University @ Facebook
  - facebook.com/SoftwareUniversity
- Software University Forums
  - forum.softuni.bg

License

- This course (slides, examples, demos, exercises, homework, documents, videos and other assets) is **copyrighted content**
- Unauthorized copy, reproduction or use is illegal
- © SoftUni – https://about.softuni.bg/
- © Software University – https://softuni.bg