



Spring Workshop II

Persistenz und ORM einfach gemacht / Spring Data

https://github.com/Michaeli71/AMTC_Spring_Workshop

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Speaker Intro



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- ~8 ¼ Jahre SSE bei Heidelberger Druckmaschinen AG in Kiel
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Kurse: Bitte sprecht mich an!





Agenda

Workshop Contents



- **PART 1: Einführung**
 - Überblick: JDBC / JPA
 - ORM
 - DAO Pattern
 - In Memory DB
 - **PART 2: JdbcTemplate**
-

Workshop Contents



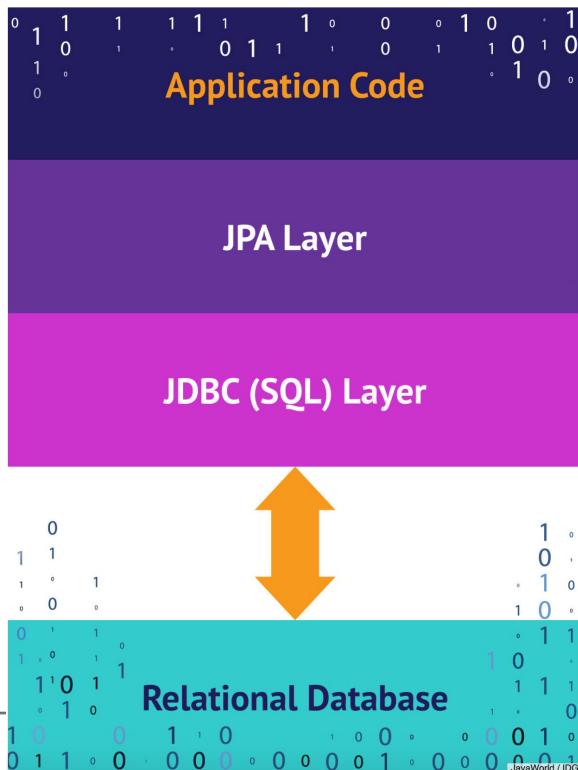
- **PART 3: Spring Data**
 - Einführung
 - Spring Data JPA Grundlagen
 - Spring Data Repositories
 - Spring Data Mongo DB
 - **PART 4: Validierung**
 - **PART 5: MapStruct**
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PART 1: Einführung

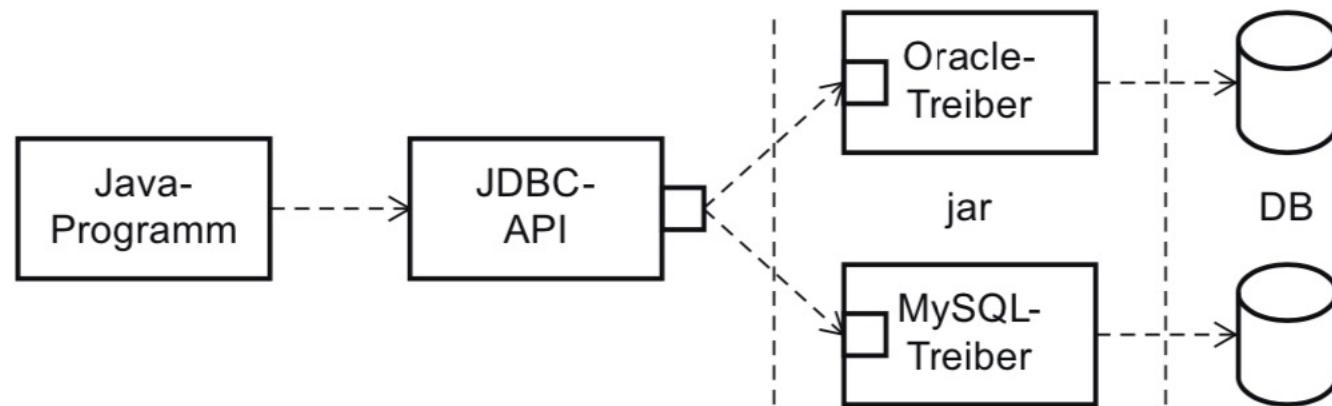


- Java Persistence API (JPA) ist eine Sammlung von Klassen und Interfaces zur Verwaltung von Daten in einer Datenbank
- JPA "vermittelt" zwischen Application / Domain Model und Datenbanken (RDBMS)





- **JDBC = Java Database Connectivity**
- **Definiert einen Standard zum Zugriff auf relationale Datenbanken**

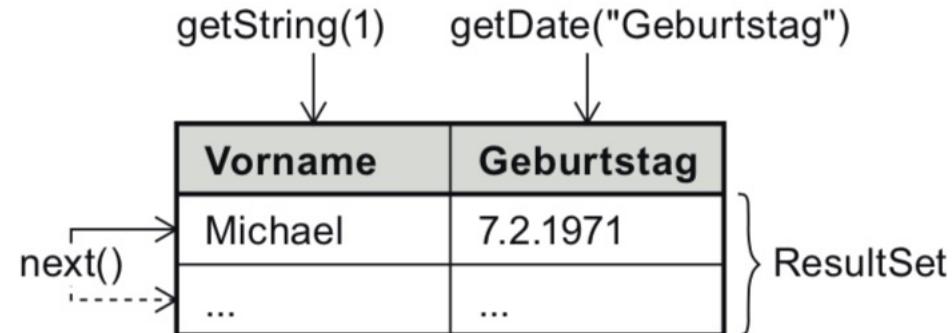


- **javax.sql.DataSource repräsentiert eine abstrakte Fabrik für Verbindungen zu Datenbanken**



- **java.sql.Connection** repräsentiert eine Verbindung zu Datenbank und erzeugt u.a. Statements und steuert Transaktionen usw.
- **java.sql.Statement / PreparedStatement** repräsentiert eine Anweisung, die ausgeführt werden soll
- **java.sql.ResultSet** repräsentiert Ergebnisse von Abfragen

SELECT Vorname, Geburtstag FROM Personen;





- **JPA deutlich mehr high-level als JDBC**
 - Keine JDBC/SQL-Anweisungen durch Entwickler mehr nötig
 - Viele JDBC/SQL-Kommandos werden automatisch durch JPA generiert
 - JPA ist datenbankunabhängig, passt das SQL dann datenbankspezifisch an
 - Für Abfragen SQL ähnliche Sprache (JPQL)
 - Datenbank scheint zwar durch, aber viel mehr Abstraktion
- **JPA dient zum Object/Relational Mapping (ORM)**
 - Applikation arbeitet mit Objekten und dem Konzept der Entities
 - Entities werden auf Datenbanktabellen abgebildet
 - Kommandos und Aktionen als Methoden und nicht SQL-Befehle
 - Assoziationen und Vererbung lassen sich ohne Tricks realisieren



- JPA gleicht mögliche Änderungen am Objekt-/Entity-Zustand automatisch mit der Datenbank ab (am Transaktionsende)
 - Benutzer ändert also im Objektmodell und dies wird gleich in der Datenbank abgebildet, keine zusätzlichen SQL-Befehle nötig
 - Selbst anspruchsvolle Dinge wie Assoziationen und Vererbung werden problemlos unterstützt:
 - Automatischen Laden von referenzierten Objekten möglich
 - Automatisches Löschen von referenzierten Objekten möglich
 - JPA verwaltet die Entities und speichert diese zwischen (1st Level Caching)
-



- JPA ist (nur) eine Spezifikation (keine Implementation)
- JPA Funktionalität wird durch verschiedene Provider implementiert
 - Hibernate
 - EclipseLink / TopLink
 - ObjectDB

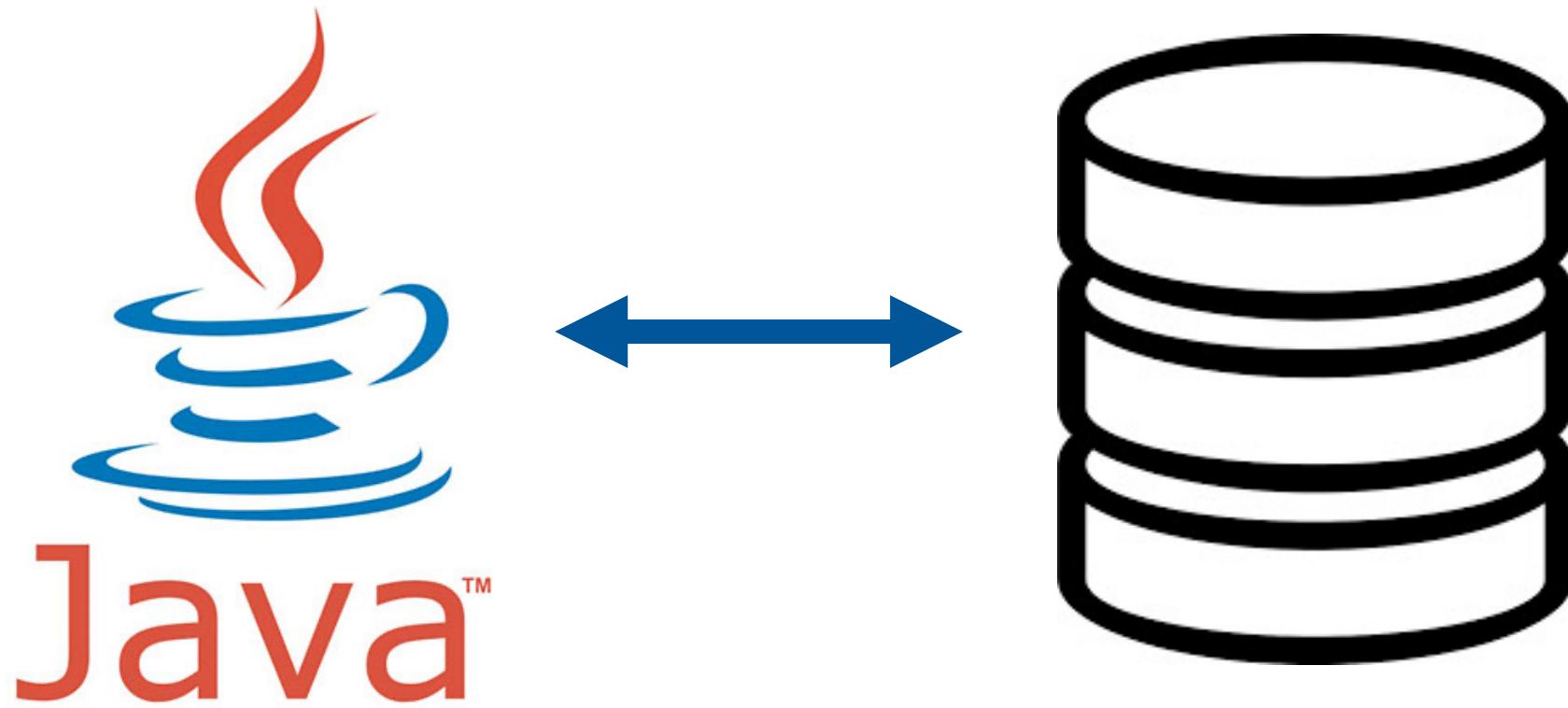


ORM Intro

ORM = Object-Relational Mapping



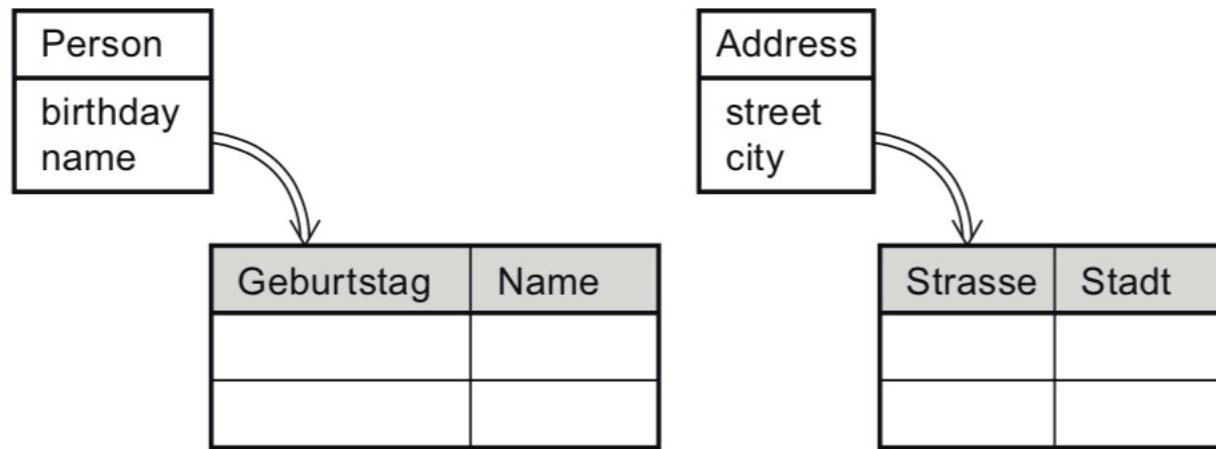
- **ORM = Object-Relational Mapping**
- **Abbildung vom objektorientierten Modell auf das Datenbankmodell**



ORM = Object-Relational Mapping



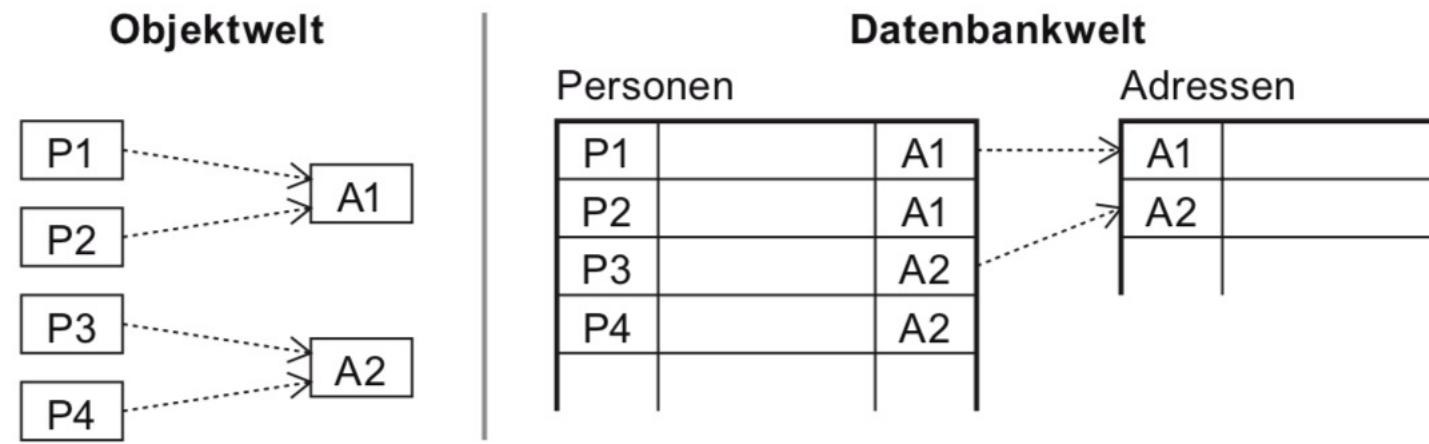
- Objekte auf Tabellen einer Datenbank abbilden:
 - Objekte in DB speichern



- Objekte aus DB rekonstruieren



- Objekte auf Tabellen einer Datenbank abbilden:
 - Beziehungen



- Vererbung
- ORM lässt sich mit etwas Mühe selbst programmieren.
- Wird aber doch mitunter komplex und herausfordernd (vor allem Assoziationen und Vererbung)



- **ORM mit «purem» JDBC ist recht aufwendig**
 - umso komplexer, aufwendiger und fehleranfälliger, je verzweigter der Objektgraph und je mehr Objekte und Assoziationen sowie Vererbungsbeziehungen existieren.
- **JPA erleichtert dies ungemein**
 - SQL-Anweisungen werden durch JPA automatisch generiert
 - Manchmal sind die generierten SQL-Kommandos suboptimal
 - Performance leidet, wenn viele referenzierte Daten verwaltet werden
- **Convention over Configuration**
 - Entitäten sind Java-Klassen mit Attributen und Annotations
 - In der Datenbank gibt es korrespondierende Tabellen und Spalten
 - **Implizite Abbildung erfolgt über Namen**
 - Explizite Abbildung erfolgt über Annotationen möglich (oder XML)

Beispiel Entity Variante Annotations an den Methoden



```
@Entity  
@Table(name = "PersonenJPA")  
public class Person implements Serializable  
{  
    private Long id;  
    private String firstName;  
    private String lastName;  
    private LocalDate birthday;  
  
    @Id  
    @GeneratedValue  
    public Long getId() // read only  
    {  
        return id;  
    }  
  
    @Column(name = "Vorname")  
    public String getFirstName()  
    {  
        return firstName;  
    }  
  
    ...  
}
```



Beispiel Entity Annotations an den Attributen



```
@Entity  
@Table(name = "PersonenJPA")  
public class Person implements Serializable  
{  
    @Id  
    @GeneratedValue  
    private Long id;  
  
    @Column(name = "Vorname")  
    private String firstName;  
  
    @Column(name = "Name")  
    private String lastName;  
  
    @Column(name = "Geburtstag")  
    private LocalDate birthday;  
  
    ...  
}
```

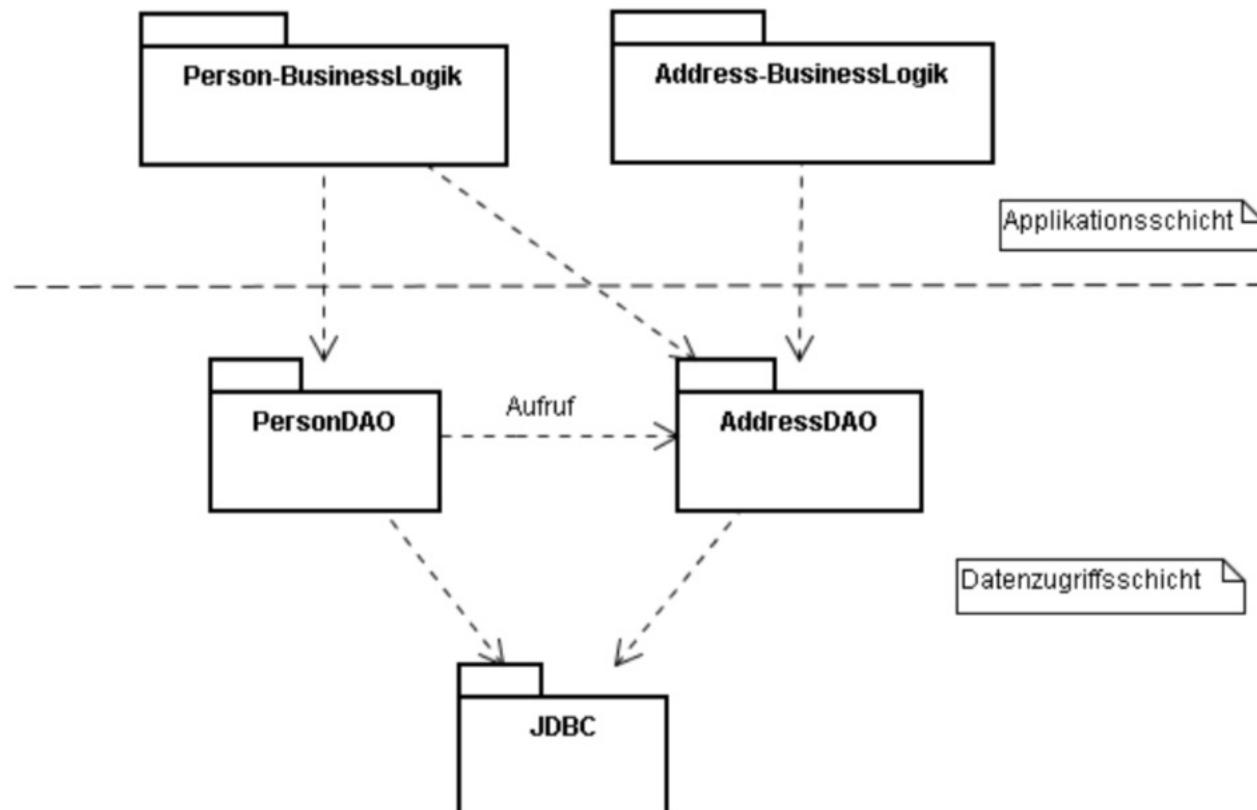




DAOs und Repositories



- Das Data Access Object (DAO)-Muster ist ein Strukturmuster
- Es ermöglicht, die Anwendungs-/Geschäftsschicht von der Persistenzschicht mithilfe einer abstrakten API zu isolieren.





- **DAO verbirgt alle Komplexitäten, die mit der Durchführung von CRUD-Operationen verbunden sind, vor der Anwendung.**
 - **DAO führt zu loser Kopplung: Bestandteile der Applikation können sich leichter getrennt voneinander weiterentwickeln**
 - **Eng verwandt mit dem Repository Pattern (DAO wird manchmal auch als Repository bezeichnet)**
 - **Idealerweise erfolgen alle Datenbankzugriffe im System über ein DAO, um eine gute Kapselung zu erreichen.**
-



- Jede DAO-Instanz ist für eine Entität zuständig, insbesondere die CRUD-Operationen: Anlegen, Lesen (nach Primärschlüssel), Aktualisieren und Löschen (CRUD) des Domänenobjekts verantwortlich

```
public interface IPersonDAO
{
    // CRUD-Funktionalität
    List<Person> getAllPersons() throws DataAccessException;
    long addPerson(Person person) throws DataAccessException;
    void updateFromOther(long personId, Person otherPerson) throws DataAccessException;
    void removePerson(long personId) throws DataAccessException;
}
```

- DAO kann weitere Aktionen ermöglichen, etwa spezielle Abfragen
- DAO ist nicht für die Handhabung von Transaktionen, Session oder Connections verantwortlich - diese werden außerhalb der DAO behandelt

```
private static void executeStatements(final EntityManager entityManager)
{
    // DAO erzeugen
    final IPersonDAO dao = new PersonDAO(entityManager);

    // Einfügeoperationen ausführen und das Resultat prüfen
    final Person michael = new Person("Micha-DAO", "Inden", new Date(71, 1, 7));
    final Person michael2 = new Person("Micha-DAO", "Inden", new Date(71, 1, 7));
    final Person werner = new Person("Werner-DAO", "Inden", new Date(40, 0, 31));

    final long michaelId = dao.createPerson(michael);
    final long michaelId2 = dao.createPerson(michael2);
    final long wernerId = dao.createPerson(werner);

    final List<Person> persons2 = dao.findAllPersons();
    persons2.forEach(System.out::println);

    // Änderungen ausführen und das Resultat prüfen
    dao.deletePersonById(michaelId);
    werner.setFirstName("Dr. h.c. Werner");

    final List<Person> persons = dao.findAllPersons();
    persons.forEach(System.out::println);
}
```

Allgemeineres DAO Pattern



- Rudimentäres Interface für einen generischen DAO
 - **save() ist für «create» und «update» zuständig bzw. «update» geschieht durch Attributänderungen**

```
import java.util.List;
import java.util.Optional;

public interface Dao<T>
{
    T save(T t);

    T get(long id);
    List<T> getAll();

    void delete(T t);
}
```

```
import java.util.List;
import java.util.Optional;

public interface Dao<T>
{
    T save(T t);

    Optional<T> get(long id);
    List<T> getAll();

    void delete(T t);
}
```

Allgemeineres DAO Pattern mit JPA



- **Verschiedene Typen für Keys**
- **Implementierung und Anbindung an EntityManager**

```
public final class GenericDAO<T, K>
{
    private final EntityManager entityManager;
    private final Class<T> clazz;

    GenericDAO(final EntityManager entityManager, final Class<T> clazz)
    {
        this.entityManager = entityManager;
        this.clazz = clazz;
    }

    // C -- CREATE
    public T save(final T newObject)
    {
        entityManager.persist(newObject);
        return newObject;
    }
}
```

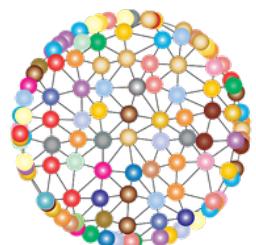
Allgemeineres DAO Pattern



```
// R -- READ
public T findById(final K id)
{
    return entityManager.find(clazz, id);
}

// R -- READ
public List<T> findAll()
{
    final TypedQuery<T> query = entityManager.createQuery("FROM " + clazz.getSimpleName(),
                                                          clazz);
    return query.getResultList();
}

// D -- DELETE
public void deleteById(final K id)
{
    final T objectInDb = findById(id);
    if (objectInDb != null)
    {
        entityManager.remove(objectInDb);
    }
}
```



**Das ist schon gut. Wäre es
nicht super, wenn man das
noch kürzer und mächtiger
machen könnte?**

Spring Data Repositories



- **Data Access Object (DAO) vereinfachen den Datenzugriff in der Regel enorm**
- **Besser noch sind die Spring Data Repositories, die von Hause aus bereits eine Sammlung sehr nützlicher Methoden mit bringen**
- **Es können ganz leicht eigene Abfragen definiert werden**

```
public interface IFooDAO extends JpaRepository<Foo, Long> {  
  
    Foo findByName(String name);  
  
}
```

- **Später mehr ...**



Experimente mit In-Memory-DB

H2 In-Memory-DB



- H2 ist eine der beliebtesten In-Memory-Datenbanken. Spring Boot bietet eine sehr gute Integration für H2.
 - H2 ist ein in Java geschriebenes relationales Datenbankmanagementsystem. Es kann in Java-Anwendungen eingebettet oder im Client-Server-Modus ausgeführt werden.
 - H2 unterstützt eine (wesentliche) Teilmenge des SQL-Standards.
 - H2 bietet auch eine Web-Konsole für die Verwaltung der Datenbank.
 - <http://www.h2database.com/html/features.html>
-

Additional H2 Dependencies



Maven

```
<dependency>
    <groupId>com.h2database</groupId>
    <artifactId>h2</artifactId>
    <version>1.4.200</version>
</dependency>
```

Gradle

```
implementation group: 'com.h2database', name: 'h2', version: '1.4.200'
```

H2 Login



English ▾ Preferences Tools Help

Login

Saved Settings:

Setting Name:

Driver Class:

JDBC URL:

User Name:

Password:



H2 Screen

jdbc:h2:mem:test
+ PEOPLE
+ INFORMATION_SCHEMA
+ Users
i H2 1.4.200 (2019-10-14)

Run Run Selected Auto complete Clear SQL statement:

SELECT * FROM PEOPLE |



Important Commands

	Displays this Help Page
	Shows the Command History
	Ctrl+Enter Executes the current SQL statement
	Shift+Enter Executes the SQL statement defined by the text selection
	Ctrl+Space Auto complete
	Disconnects from the database

Sample SQL Script

Delete the table if it exists	DROP TABLE IF EXISTS TEST;
Create a new table with ID and NAME columns	CREATE TABLE TEST(ID INT PRIMARY KEY, NAME VARCHAR(255));
Add a new row	INSERT INTO TEST VALUES(1, 'Hello');
Add another row	INSERT INTO TEST VALUES(2, 'World');
Query the table	SELECT * FROM TEST ORDER BY ID;
Change data in a row	UPDATE TEST SET NAME='Hi' WHERE ID=1;
Remove a row	DELETE FROM TEST WHERE ID=2;
Help	HELP ...

H2 Abfrage



SQL toolbar: Auto commit checked, Max rows: 1000, Auto complete Off, Auto select On.

Database tree: jdbc:h2:mem:test, PEOPLE, INFORMATION_SCHEMA, Users, H2 1.4.200 (2019-10-14).

SQL statement: `SELECT * FROM PEOPLE`

Execution result:

```
SELECT * FROM PEOPLE;
```

ID	FIRST_NAME	LAST_NAME	AGE
1	Michael	Inden	50
2	Tim	Boetzmeyer	50
3	Heinz	Mustermann	32
4	James	Bond	44

(4 rows, 43 ms)

Edit

H2 InMemoryDB Interessante Links



- <https://howtodoinjava.com/spring-boot2/h2-database-example/>
 - <https://www.linkedin.com/pulse/unit-testing-using-h2-in-memory-db-raghunandan-gupta/>
 - <https://phauer.com/2017/dont-use-in-memory-databases-tests-h2/>
-



PART 2: JdbcTemplate



Einführung JdbcTemplate

- JdbcTemplate kümmert sich um die Erstellung und Freigabe von Ressourcen wie das Erstellen und Schließen von Verbindungsobjekten usw.
- Also: Kein lästiges „Daraufachten“, die die Verbindung in jedem Fall wieder zu schließen
- JdbcTemplate kümmert sich auch um Exceptions und liefert informative Fehlermeldungen
- Mit Hilfe der Klasse JdbcTemplate können wir alle Datenbankoperationen wie Einfügen, Aktualisieren, Löschen und Abrufen von Daten aus der Datenbank durchführen.

```
jdbcTemplate.execute("DROP TABLE customers IF EXISTS");
jdbcTemplate.execute("CREATE TABLE customers(" + "id SERIAL, first_name VARCHAR(255),
last_name VARCHAR(255))");

jdbcTemplate.query("SELECT id, first_name, last_name FROM customers WHERE first_name = ?",
new Object[] { "Josh" },
```

- <https://spring.io/guides/gs relational-data-access/>
-



1. `int update(String query)` ermöglicht es, Datensätze einzufügen, zu aktualisieren und zu löschen.
 2. `int update(String query, Object... args)` dient zum Einfügen, Aktualisieren und Löschen von Datensätzen mit PreparedStatement unter Verwendung der angegebenen Argumente.
 3. `void execute(String query)` wird verwendet, um eine DDL-Abfrage auszuführen.
 4. `List query(String sql, RowMapper rm)` wird verwendet, um Datensätze mit RowMapper aus den Daten zu extrahieren.
 5. `T query(String sql, ResultSetExtractor rse)` dient dazu, Datensätze mit Hilfe von ResultSetExtractor abzurufen.
-



Beispiel: Verwaltung von Employee-Daten

```
create table EMPLOYEE (
    id integer not null primary key,
    name varchar(20) not null,
    salary float not null
);

public class Employee {
    private int id;
    private String name;
    private float salary;

    public Employee() {
    }

    public Employee(int id, String name, float salary) {
        this.id = id;
        this.name = name;
        this.salary = salary;
    }
}
```



DAO mit JdbcTemplate

```
public class EmployeeDao {  
    private JdbcTemplate jdbcTemplate;  
  
    public void setJdbcTemplate(JdbcTemplate jdbcTemplate) {  
        this.jdbcTemplate = jdbcTemplate;  
    }  
  
    public int saveEmployee(Employee e) {  
        String sql = "insert into employee values('" + e.getId() + "', '" +  
                    e.getName() + "', '" + e.getSalary() + "')";  
        return jdbcTemplate.update(sql);  
    }  
  
    public int getEmployeeCount() {  
        String sql = "select count(*) from employee";  
        return jdbcTemplate.queryForObject(sql, Integer.class, new Object[] {});  
    }  
  
    ...
```

DAO mit JdbcTemplate



...

```
public int deleteEmployee(Employee e) {  
    String sql = "delete from employee where id=''" + e.getId() + "'";  
    return jdbcTemplate.update(sql);  
}  
  
// Erweiterungen  
public Employee getEmployeeById(int id) {  
    // Fieser Fehler: String sql = "select * from employee where id = " + id;  
    String sql = "select * from employee where id = ?";  
    return jdbcTemplate.queryForObject(sql, new EmployeeRowMapper(),  
                                     new Object[] { id });  
}  
  
public List<Employee> getAllEmployees() {  
    String sql = "select * from employee";  
    return jdbcTemplate.query(sql, new EmployeeRowMapper());  
}
```



Datenextraktion mit RowMapper

```
public class EmployeeRowMapper implements RowMapper<Employee> {  
    @Override  
    public Employee mapRow(ResultSet resultSet, int i) throws SQLException  
    {  
        Employee person = new Employee();  
  
        person.setId(resultSet.getInt(1));  
        // long id = resultSet.getInt("id")  
        person.setName(resultSet.getString(2));  
        person.setSalary(resultSet.getFloat(3));  
  
        return person;  
        // return new Employee(rs.getInt(1), rs.getString(2), rs.getFloat(3));  
    }  
}
```



DAO im Einsatz

```
var ctx = new ClassPathXmlApplicationContext("applicationContext.xml");

EmployeeDao dao = (EmployeeDao) ctx.getBean("employeeDao");
System.out.println("employee count: " + dao.getEmployeeCount());

int status = dao.saveEmployee(new Employee(4711, "Michael", 12345.0f));
System.out.println(status);
System.out.println("employee count: " + dao.getEmployeeCount());

System.out.println(dao.getAllEmployees());
System.out.println(dao.getEmployeeById(1));
System.out.println(dao.getEmployeeById(4711));
```



Konfiguration in Plain Spring für JdbcTemplate

```
<?xml version="1.0" encoding="UTF-8"?>
<beans ...>

    <jdbc:initialize-database data-source="dataSource">
        <jdbc:script location="classpath:scripts/schema.sql" />
        <jdbc:script location="classpath:scripts/data-h2.sql" />
    </jdbc:initialize-database>

    <bean id="dataSource" class="org.springframework.jdbc.datasource.DriverManagerDataSource">
        <property name="driverClassName" value="org.h2.Driver" />
        <property name="url" value="jdbc:h2:mem:testdb;DB_CLOSE_DELAY=-1" />
        <property name="username" value="sa" />
        <property name="password" value="" />
    </bean>

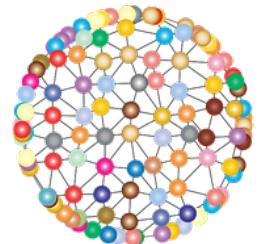
    <bean id="jdbcTemplate" class="org.springframework.jdbc.core.JdbcTemplate">
        <property name="dataSource" ref="dataSource"></property>
    </bean>

    <bean id="employeeDao" class="springjdbc.dao.EmployeeDao">
        <property name="jdbcTemplate" ref="jdbcTemplate"></property>
    </bean>
</beans>
```



DEMO

»spring-jdbc-intro«
»spring-jdbc-with-spring-boot-1«
»spring-jdbc-with-spring-boot-2-web«



**Das ist schon eine gute
Hilfe, aber: Was ist daran
unschön?**



Part 3:

Spring Data

- Einführung
 - Spring Data JPA Grundlagen
 - Spring Data Repositories
 - Spring Data Mongo DB
-



Einführung





- provide a **familiar** and **consistent**, Spring-based programming model for **data access**
- makes it **easy** to use **relational** and **non-relational databases**, and **cloud-based data** services.
- **umbrella project** which contains **many subprojects** that are specific to a given database.

Spring Data Main Modules



- **Spring Data Commons** - Core Spring concepts underpinning every Spring Data project.
 - **Spring Data JPA** - Makes it easy to implement JPA-based repositories.
 - **Spring Data MongoDB** - Spring based, object-document support and repositories for MongoDB.
 - ...
-

Gleich und doch verschieden



JPA	MongoDB	Neo4j
<pre>@Entity @Table(name="TUSR") public class User { @Id private String id; @Column(name="fn") private String name; private Date lastLogin; ... }</pre>	<pre>@Document(collection="usr") public class User { @Id private String id; @Field("fn") private String name; private Date lastLogin; ... }</pre>	<pre>@NodeEntity public class User { @GraphId Long id; private String name; private Date lastLogin; ... }</pre>



Spring Data Grundlagen

JPA Example



Getting Started — Maven Dependencies



```
<parent>
    <groupId>org.springframework.boot</groupId>
    <artifactId>spring-boot-starter-parent</artifactId>
    <version>2.5.6</version>
</parent>

<dependencies>
    <dependency>
        <groupId>org.springframework.boot</groupId>
        <artifactId>spring-boot-starter-data-jpa</artifactId>
    </dependency>
    ...

```

Getting Started — Gradle Dependencies



```
plugins {  
    id "org.springframework.boot" version "2.5.6"  
}  
  
apply plugin: 'java'  
apply plugin: 'eclipse'  
  
repositories {  
    mavenCentral()  
}  
  
sourceCompatibility = 11  
targetCompatibility = 11  
  
dependencies {  
  
    implementation 'org.springframework.boot:spring-boot-starter-data-jpa:2.5.6'  
    testImplementation 'org.springframework.boot:spring-boot-starter-test:2.5.6'
```

First Spring Boot Application Example



```
import org.springframework.boot.SpringApplication;
import org.springframework.boot.autoconfigure.SpringBootApplication;

@SpringBootApplication
public class MyApp {

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

First Entity Example



```
import javax.persistence.Entity;
import javax.persistence.GeneratedValue;
import javax.persistence.Id;

@Entity
public class SimpleEmployee
{
    @Id
    @GeneratedValue
    private Long id;
    private String firstName, lastName, description;

    private SimpleEmployee()
    {
    }

    public SimpleEmployee(String firstName, String lastName, String description)
    {
        this.firstName = firstName;
        this.lastName = lastName;
        this.description = description;
    }

    ...
}
```

First Repository Example



- Datenbankabfragen folgen dem **DAO Pattern**
- Diese sind durch sogenannte **Repositories** beschrieben
- In Spring sind das einfache **Interfaces (POJI)** => **Deklarative Programmierung**

```
import java.util.List;  
  
import org.springframework.data.repository.CrudRepository;  
  
public interface SimpleEmployeeRepository extends CrudRepository<SimpleEmployee, Long>  
{  
    SimpleEmployee findByFirstName(String firstName);  
  
    List<SimpleEmployee> findByLastName(String lastName);  
}
```

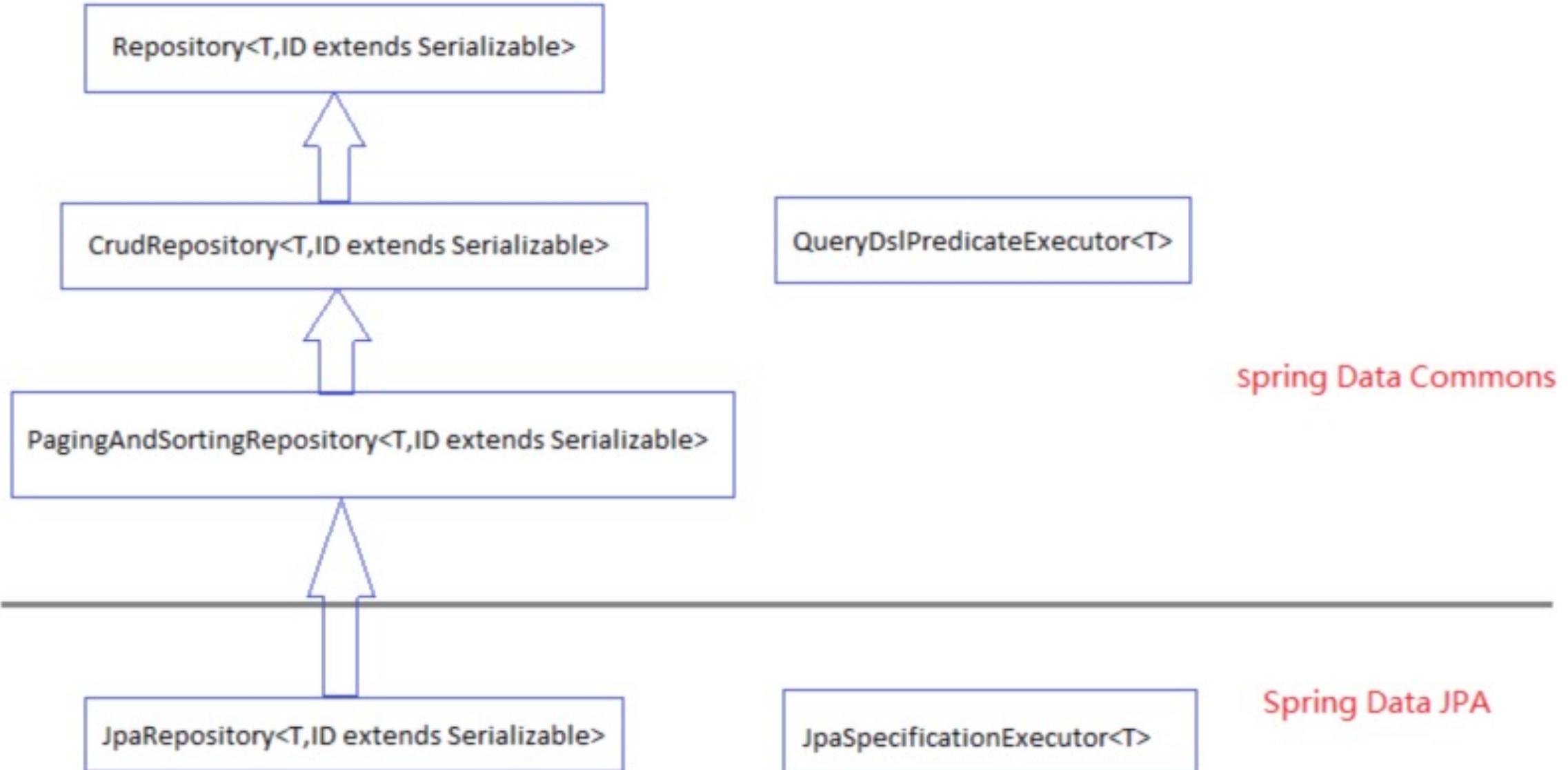
- **Datenbankzugriffe werden basierend auf findXyz() automatisch generiert**

Basis Spring CRUD Repository — Standardfunktionalität



```
public interface CrudRepository<T, ID extends Serializable> extends Repository<T, ID> {  
  
    <S extends T> S save(S entity);  
  
    Optional<T> findById(ID primaryKey);  
  
    Iterable<T> findAll();  
  
    long count();  
  
    void delete(T entity);  
  
    boolean existsById(ID primaryKey);  
  
    // ...  
}
```

Basis Spring Repositories



First Example



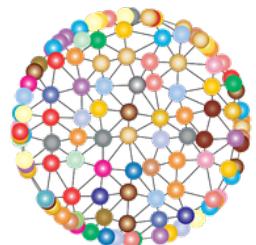
Starten wir einfach mal ...

```
@SpringBootApplication  
public class MyApp {  
  
    public static void main(String[] args) {  
        SpringApplication.run(MyApp.class, args);  
    }  
}
```

```
*****  
APPLICATION FAILED TO START  
*****
```

Description:

Cannot determine embedded database driver class for database type NONE



Wie binden wir eine DB ein?

H2 und Spring Boot



- Die Konfiguration der H2-Datenbank mit Spring Boot ist sehr einfach: **Einfach die H2-Abhängigkeit zur POM hinzufügen:**
- Spring Boot erstellt automatisch die Datenbank, richtet alle JDBC-Objekte der Datenbank ein und konfiguriert Hibernate standardmäßig in einem Create-Drop-Modus.
- Wenn Hibernate startet, scannt es die JPA-kommentierten Klassen und generiert automatisch den SQL-Code, der für die Erstellung der Datenbanktabellen erforderlich ist, und führt ihn aus.

RECAP: Additional H2 Dependencies



Maven

```
<dependency>
    <groupId>com.h2database</groupId>
    <artifactId>h2</artifactId>
    <version>1.4.200</version>
</dependency>
```

Gradle

```
implementation group: 'com.h2database', name: 'h2', version: '1.4.200'
```

Applikation starten



Maven

```
mvn clean package  
mvn spring-boot:run
```

```
<plugin>  
  <groupId>org.springframework.boot</groupId>  
  <artifactId>spring-boot-maven-plugin</artifactId>  
</plugin>
```

Gradle

```
gradle clean assemble  
gradle bootRun
```

```
plugins { id 'org.springframework.boot' version '2.6.0' }
```

Kommandozeile

```
mvn clean package spring-boot:repackage  
java -jar target/ex21-spring-boot-person-datajpa-app-1.0.0.jar
```

Applikation starten



Maven

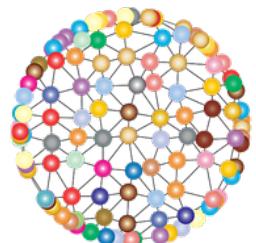
```
mvn clean package  
mvn spring-boot:run
```

Gradle

```
gradle clean assemble  
gradle bootRun
```

Kommandozeile

```
mvn clean package spring-boot:repackage  
java -jar target/ex21-spring-boot-person-datajpa-app-1.0.0.jar
```



**Wie arbeiten wir
mit der DB?**

Datenbank befüllen — CommandLineRunner (oder Skripte)



```
@SpringBootApplication
public class Application implements CommandLineRunner
{
    @Autowired
    private SimpleEmployeeRepository repository;

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

    public void run(String... args) throws Exception
    {
        ...
    }
}
```

Datenbank befüllen — CommandLineRunner



```
public void run(String... args) throws Exception
{
    Employee emp1 = new Employee("Michael", "Inden", "Team Lead");
    Employee emp2 = new Employee("Karthi", "Bolu Ganesh", "Lead Engineer");
    Employee emp3 = new Employee("Marcello", "Fluri", "Senior SW Engineer");

    System.out.println("Employees: " + repository.count());
    repository.save(emp1);
    repository.save(emp2);
    repository.save(emp3);
    System.out.println("Employees: " + repository.count());
    System.out.println("Employees: " + repository.findAll());

    // Find + Delete
    repository.delete(repository.findByFirstName("Marcello"));
    System.out.println("Employees: " + repository.count());
    System.out.println("Employees: " + repository.findAll());
}
```

Datenbank befüllen — CommandLineRunner



```
Employees: 0
```

```
Employees: 3
```

```
Employees: [SimpleEmployee [id=6, firstName=Michael, lastName=Inden, description=Team Lead],  
SimpleEmployee [id=7, firstName=Karthi, lastName=Bollu Ganesh, description=Lead Engineer],  
SimpleEmployee [id=8, firstName=Marcello, lastName=Fluri, description=Senior SW Engineer]]
```

```
Employees: 2
```

```
Employees: [SimpleEmployee [id=6, firstName=Michael, lastName=Inden, description=Team Lead],  
SimpleEmployee [id=7, firstName=Karthi, lastName=Bollu Ganesh, description=Lead Engineer]]
```



Spring Data Repositories

Spring Data Repositories: Abfrage-Varianten über Methodennamen



```
public interface MovieRepository extends JpaRepository<Movie, Long>
{
    List<Movie> findByTitleIgnoringCase(String title);
}
```

- **findBy, readBy, getBy, countBy, queryBy**
- **GreaterThan, LessThan, Between**
- **Like, In**

- **Sortierung: OrderBy...Asc / Desc**
- **Eindeutigkeit: Distinct**
- **Einschränkungen / Paging: Top / First, etwa Top10**



Mögliche Varianten

- **And, Or**
 - `findByLastnameAndFirstname()` / `findByLastnameOrFirstname()`
 - ... where `x.lastname = ?1 and (or) x.firstname = ?2`
- **Is, Equals**
 - `findByFirstnameIs()` / `findByFirstnameEquals()` / `findByFirstname()`
 - ... where `x.firstname = ?1`
- **Between**
 - `findByStartDateBetween()`
 - ... where `x.startDate between ?1 and ?2`
- **LessThan, GreaterThan**
 - `findByAgeLessThan()` / `findByAgeGreaterThan()`
 - ... where `x.age < ?1` / ... where `x.age > ?1`



Mögliche Varianten

- `After`, `Before`
- `IsNull`, `IsNotNull`, `NotNull`
- `Like` / `NotLike`
- `Containing`
- `OrderBy`
- `True` / `False`
- `In` / `NotIn`
- `Not`
- `IgnoreCase`
- `Asc` / `Desc`
- **Begrenzung der Ergebnisgröße einer Abfrage**
 - `findFirst10ByLastnameAsc`

Schlüsselwörter



Keyword	Sample	JPQL snippet
And	findByLastnameAndFirstname	... where x.lastname = ?1 and x.firstname = ?2
Or	findByLastnameOrFirstname	... where x.lastname = ?1 or x.firstname = ?2
Is, Equals	findByFirstname, findByFirstnameIs, findByFirstnameEquals	... where x.firstname = ?1?
Between	findByStartDateBetween	... where x.startDate between ?1 and ?2
LessThan	findByAgeLessThan	... where x.age < ?1
LessThanEqual	findByAgeLessThanEqual	... where x.age <= ?1
GreaterThan	findByAgeGreaterThan	... where x.age > ?1
GreaterThanOrEqual	findByAgeGreaterThanOrEqual	... where x.age >= ?1
After	findByStartDateAfter	... where x.startDate > ?1
Before	findByStartDateBefore	... where x.startDate < ?1
IsNull	findByAgeIsNull	... where x.age is null
IsNotNull, NotNull	findByAge(Is)NotNull	... where x.age not null
Like	findByFirstnameLike	... where x.firstname like ?1
NotLike	findByFirstnameNotLike	... where x.firstname not like ?1
StartingWith	findByFirstnameStartingWith	... where x.firstname like ?1 (parameter bound with appended %)
EndingWith	findByFirstnameEndingWith	... where x.firstname like ?1 (parameter bound with prepended %)
Containing	findByFirstnameContaining	... where x.firstname like ?1 (parameter bound wrapped in %)
OrderBy	findByAgeOrderByLastnameDesc	... where x.age = ?1 order by x.lastname desc
Not	findByLastnameNot	... where x.lastname <> ?1
In	findByAgeIn(Collection<Age> ages)	... where x.age in ?1
NotIn	findByAgeNotIn(Collection<Age> age)	... where x.age not in ?1

Repository Example



Repository Example



```
Employee emp1 = new Employee("Michael", "Inden", "Team Lead", 47);
Employee emp2 = new Employee("Karthi", "Bollu Ganesh", "Lead Engineer", 33);
Employee emp3 = new Employee("Marcello", "Fluri", "Senior SW Engineer", 52);
Employee emp4 = new Employee("Marco", "Sonderegger", "SW Engineer", 30);
Employee emp5 = new Employee("Numa", "Trezzini", "SW Engineer", 30);
Employee emp6 = new Employee("Martin", "Dorta", "Senior SW Engineer", 50);

employeeRepository.save(emp1);
employeeRepository.save(emp2);
employeeRepository.save(emp3);
employeeRepository.save(emp4);
employeeRepository.save(emp5);
employeeRepository.save(emp6);
```

Repository Example



```
System.out.println("Employees 40-50: " + employeeRepository.findByAgeBetween(40, 50));
System.out.println("#Employees 40-50: " + employeeRepository.countByAgeBetween(40, 50));

System.out.println("Employees > 40: " + employeeRepository.findByAgeGreaterThan(40));
System.out.println("Employees < 50 Top 3: " + employeeRepository.findTop3ByAgeLessThan(50));
System.out.println("Employees: " + employeeRepository.findByAgeLessThanOrderByNameAsc(35));
System.out.println("Employees: " + employeeRepository.getFirstNameLike("Ma"));
System.out.println("Employees: " + employeeRepository.findByFirstNameOrLastName("Michael",
                                            "Fluri"));
```

Repository Example



```
System.out.println("Employees 40-50: " + repository.findByAgeBetween(40, 50));
System.out.println("#Employees 40-50: " + repository.countByAgeBetween(40, 50));

System.out.println("Employees > 40: " + repository.findByAgeGreaterThan(40));
System.out.println("Employees < 50 Top 3: " + repository.findTop3ByAgeLessThan(50));
System.out.println("Employees: " + repository.findByAgeLessThanOrderByNameAsc(35));

System.out.println("Employees: " + repository.getFirstNameLike("Ma"));
```

```
Employees 40-50: [Employee [id=1, firstName=Michael, lastName=Inden, description=Team Lead, age=47],
                  Employee [id=6, firstName=Martin, lastName=Dorta, description=Senior SW Engineer, age=50]]
#Employees 40-50: 2
Employees > 40: [Employee [id=1, firstName=Michael, lastName=Inden, description=Team Lead, age=47],
                  Employee [id=3, firstName=Marcello, lastName=Fluri, description=Senior SW Engineer, age=52],
                  Employee [id=6, firstName=Martin, lastName=Dorta, description=Senior SW Engineer, age=50]]
Employees < 50 Top 3: [Employee [id=1, firstName=Michael, lastName=Inden, description=Team Lead, age=47],
                       Employee [id=2, firstName=Karthi, lastName=Bollu Ganesh, description=Lead Engineer, age=33],
                       Employee [id=4, firstName=Marco, lastName=Sonderegger, description=SW Engineer, age=30]]
Employees: [Employee [id=2, firstName=Karthi, lastName=Bollu Ganesh, description=Lead Engineer, age=33],
            Employee [id=4, firstName=Marco, lastName=Sonderegger, description=SW Engineer, age=30],
            Employee [id=5, firstName=Numa, lastName=Trezzini, description=SW Engineer, age=30]]
Employees: [Employee [id=3, firstName=Marcello, lastName=Fluri, description=Senior SW Engineer, age=52],
            Employee [id=4, firstName=Marco, lastName=Sonderegger, description=SW Engineer, age=30],
            Employee [id=6, firstName=Martin, lastName=Dorta, description=Senior SW Engineer, age=50]]
```



DEMO

«spring-data-slides-examples»

Spring Data Repositories



- Mit Spring Data Repositories können nicht nur eigene Abfragen basierend auf Methodenname, sondern auch spezielle SQL-artige definiert werden:

- ```
@Query("SELECT u FROM User u WHERE u.status = 1")
Collection<User> findAllActiveUsers();
```

```
@Query("SELECT u FROM User u WHERE u.status = ?1 and u.name = ?2")
User findUserByStatusAndName(Integer status, String name);
```

- ```
@Query(  
    value = "SELECT * FROM USERS u WHERE u.status = 1",  
    nativeQuery = true)  
Collection<User> findAllActiveUsersNative();
```

Spring Data Repositories



• Weitere Möglichkeiten

```
@Query(value = "SELECT u FROM User u WHERE u.name IN :names")
List<User> findUserByNameList(@Param("names") Collection<String> names);
```



Exercises 21 – 22

https://github.com/Michaeli71/AMTC_Spring_Workshop





Spring Data MongoDB Example

Repository Example



```
import org.springframework.data.annotation.Id;  
  
import org.springframework.data.mongodb.core.mapping.Document;  
  
@Document  
public class Employee  
{  
    @Id  
    private String id;  
  
    ...  
}
```

Repository Example



Repository Example



```
System.out.println("Employees 40-50: " + repository.findByAgeBetween(40, 50));
System.out.println("#Employees 40-50: " + repository.countByAgeBetween(40, 50));

System.out.println("Employees > 40: " + repository.findByAgeGreaterThan(40));
System.out.println("Employees < 50 Top 3: " + repository.findTop3ByAgeLessThan(50));
System.out.println("Employees: " + repository.findByAgeLessThanOrderByFirstNameAsc(35));

System.out.println("Employees: " + repository.getFirstNameLike("Ma"));
```

```
Employees 40-50: [Employee [id=5aa84d265131b00b822c12cc, firstName=Michael, lastName=Inden, description=Team Lead, age=47]]
#Employees < 50: 1
Employees > 40: [Employee [id=5aa84d265131b00b822c12cc, firstName=Michael, lastName=Inden, description=Team Lead, age=47],
Employee [id=5aa84d265131b00b822c12ce, firstName=Marcello, lastName=Fluri, description=Senior SW Engineer, age=52],
Employee [id=5aa84d265131b00b822c12d1, firstName=Martin, lastName=Dorta, description=Senior SW Engineer, age=50]]
Employees < 50 Top 3:
[Employee [id=5aa84d265131b00b822c12cc, firstName=Michael, lastName=Inden, description=Team Lead, age=47],
Employee [id=5aa84d265131b00b822c12cd, firstName=Karthi, lastName=Bollu Ganesh, description=Lead Engineer, age=33],
Employee [id=5aa84d265131b00b822c12cf, firstName=Marco, lastName=Sonderegger, description=SW Engineer, age=30]]
Employees:
[Employee [id=5aa84d265131b00b822c12cd, firstName=Karthi, lastName=Bollu Ganesh, description=Lead Engineer, age=33],
Employee [id=5aa84d265131b00b822c12cf, firstName=Marco, lastName=Sonderegger, description=SW Engineer, age=30],
Employee [id=5aa84d265131b00b822c12d0, firstName=Numa, lastName=Trezzini, description=SW Engineer, age=30]]
Employees:
[Employee [id=5aa84d265131b00b822c12ce, firstName=Marcello, lastName=Fluri, description=Senior SW Engineer, age=52],
Employee [id=5aa84d265131b00b822c12cf, firstName=Marco, lastName=Sonderegger, description=SW Engineer, age=30],
Employee [id=5aa84d265131b00b822c12d1, firstName=Martin, lastName=Dorta, description=Senior SW Engineer, age=50]]
Employees: [Employee [id=5aa84d265131b00b822c12cc, firstName=Michael, lastName=Inden, description=Team Lead, age=47],
Employee [id=5aa84d265131b00b822c12ce, firstName=Marcello, lastName=Fluri, description=Senior SW Engineer, age=52]]
```

Repository Example



MongoDB: BETWEEN: lower < x < upper

```
Employees 40-50: [Employee [id=5aa84d265131b00b822c12cc, firstName=Michael, lastName=Inden, description=Team Lead, age=47]]  
#Employees 40-50: 1  
Employees > 40: [Employee [id=5aa84d265131b00b822c12cc, firstName=Michael, lastName=Inden, description=Team Lead, age=47],  
                  Employee [id=5aa84d265131b00b822c12ce, firstName=Marcello, lastName=Fluri, description=Senior SW Engineer, age=52],  
                  Employee [id=5aa84d265131b00b822c12d1, firstName=Martin, lastName=Dorta, description=Senior SW Engineer, age=50]]  
Employees < 50 Top 3:  
[Employee [id=5aa84d265131b00b822c12cc, firstName=Michael, lastName=Inden, description=Team Lead, age=47],  
         Employee [id=5aa84d265131b00b822c12cd, firstName=Karthi, lastName=Bollu Ganesh, description=Lead Engineer, age=33],  
         Employee [id=5aa84d265131b00b822c12cf, firstName=Marco, lastName=Sonderegger, description=SW Engineer, age=30]]  
Employees:  
[Employee [id=5aa84d265131b00b822c12cd, firstName=Karthi, lastName=Bollu Ganesh, description=Lead Engineer, age=33],  
         Employee [id=5aa84d265131b00b822c12cf, firstName=Marco, lastName=Sonderegger, description=SW Engineer, age=30],  
         Employee [id=5aa84d265131b00b822c12d0, firstName=Numa, lastName=Trezzini, description=SW Engineer, age=30]]  
Employees:  
[Employee [id=5aa84d265131b00b822c12ce, firstName=Marcello, lastName=Fluri, description=Senior SW Engineer, age=52],  
         Employee [id=5aa84d265131b00b822c12cf, firstName=Marco, lastName=Sonderegger, description=SW Engineer, age=30],  
         Employee [id=5aa84d265131b00b822c12d1, firstName=Martin, lastName=Dorta, description=Senior SW Engineer, age=50]]
```

JPA: BETWEEN: lower <= x <= upper

```
Employees 40-50: [Employee [id=1, firstName=Michael, lastName=Inden, description=Team Lead, age=47],  
                  Employee [id=6, firstName=Martin, lastName=Dorta, description=Senior SW Engineer, age=50]]  
#Employees 40-50: 2  
Employees > 40: [Employee [id=1, firstName=Michael, lastName=Inden, description=Team Lead, age=47],  
                  Employee [id=3, firstName=Marcello, lastName=Fluri, description=Senior SW Engineer, age=52],  
                  Employee [id=6, firstName=Martin, lastName=Dorta, description=Senior SW Engineer, age=50]]  
Employees < 50 Top 3: [Employee [id=1, firstName=Michael, lastName=Inden, description=Team Lead, age=47],  
                         Employee [id=2, firstName=Karthi, lastName=Bollu Ganesh, description=Lead Engineer, age=33],  
                         Employee [id=4, firstName=Marco, lastName=Sonderegger, description=SW Engineer, age=30]]  
Employees: [Employee [id=2, firstName=Karthi, lastName=Bollu Ganesh, description=Lead Engineer, age=33],  
           Employee [id=4, firstName=Marco, lastName=Sonderegger, description=SW Engineer, age=30],  
           Employee [id=5, firstName=Numa, lastName=Trezzini, description=SW Engineer, age=30]]  
Employees: [Employee [id=3, firstName=Marcello, lastName=Fluri, description=Senior SW Engineer, age=52],  
           Employee [id=4, firstName=Marco, lastName=Sonderegger, description=SW Engineer, age=30],  
           Employee [id=6, firstName=Martin, lastName=Dorta, description=Senior SW Engineer, age=50]]
```

Repository Example



Names-Postfix	Operation als JSON
GreaterThan	{ "age" : { "\$gt" : <value> } }
LessThan	{ "age" : { "\$lt" : <value> } }
Between	{ "age" : { "\$gt" : from, "\$lt" : to } }
IsNotNull, NotNull	{ "age" : { "\$ne" : null } }
IsNull, Null	{ "age" : null }
-/-	{ "age" : <value> }
Not	{ "age" : { "\$ne" : <value> } }

MongoDB Compass



<https://docs.mongodb.com/compass/master/install/>

MongoDB Compass Community - localhost:27017/codingsession.persons

localhost:27017 STANDALONE MongoDB 3.6.2 Community

My Cluster

C 7 DBS 10 COLLECTIONS

filter

admin

codingsession

databases

employees

persons

students

config

crud_example

karthi

local

test

codingsession.persons

DOCUMENTS 3 TOTAL SIZE 239B AVG. SIZE 80B INDEXES 1 TOTAL SIZE 16.0KB AVG. SIZE 16.0KB

Documents Explain Plan Indexes

FILTER { field: 'value' } OPTIONS FIND

INSERT DOCUMENT VIEW LIST TABLE

Displaying documents 1 - 3 of 3

	_id ObjectId	name String	nationality String	age Int32
1	Saa3e8b0bd0c9a4476d06f60	"Beat"	"swiss"	35
2	Saa3e8b0bd0c9a4476d06f61	"Peter"	"german"	29
3	Saa3e8b0bd0c9a4476d06f62	"Tim"	No field	No field

NoSQL Booster Query Tool



<https://nosqlbooster.com/downloads>

NoSQLBooster for MongoDB

Connect Open Save Import Export Mongotop Mongostat Test Data Schema Run Stop Theme

Connection Tree

- localhost
 - admin
 - codingsession
 - databases (2)
 - employees (2)
 - `_id_ (16.0 KIB)`
 - persons (3)
 - students (2)
 - config
 - crud_example
 - karthi
 - local
 - test

codingsession:employees x codingsession:persons x

localhost:27017 (v3.6.2) codingsession

1 db.persons.find({})

persons 0.015 s 3 Docs

	<code>_id</code>	name	nationality	age	info	info.x
1	ObjectId("5aa3e8b0bd0c9a4476d06f60")	Beat	swiss	35	{ 2 fields }	203
2	ObjectId("5aa3e8b0bd0c9a4476d06f61")	Peter	german	29		
3	ObjectId("5aa3e8b0bd0c9a4476d06f62")	Tim				

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Feedback/Support Show Log 03:51:41 pm



DEMO

«spring-data-slides-mongo-examples»



Exercises 23 – 25

https://github.com/Michaeli71/AMTC_Spring_Workshop





Part 4: Validation



Dependencies



```
<dependency>
<groupId>org.hibernate.validator</groupId>
<artifactId>hibernate-validator</artifactId>
<version>6.0.22.Final</version>
</dependency>
```

Validation



```
import javax.validation.constraints.AssertTrue;
import javax.validation.constraints.Email;
import javax.validation.constraints.Max;
import javax.validation.constraints.Min;
import javax.validation.constraints.NotNull;
import javax.validation.constraints.Size;

public class User
{
    @NotNull(message = "Name cannot be null")
    private String name;

    @AssertTrue
    private boolean working;

    // ...
}
```

Validation „pur“



```
public class User
{
    @NotNull(message = "Name cannot be null")
    private String name;

    @AssertTrue
    private boolean working;

    @Size(min = 10, max = 200,
          message = "About Me must be between 10 and 200 characters")
    private String aboutMe;

    @Min(value = 18, message = "Age should not be less than 18")
    @Max(value = 150, message = "Age should not be greater than 150")
    private int age;

    @Email(message = "Email should be valid")
    private String email;

    // standard setters and getters
}
```

Validation „pur“



```
public class ProgrammaticValidationExample
{
    public static void main(final String[] args)
    {
        UserWithValidation user = new UserWithValidation();
        user.setWorking(false);
        user.setAboutMe("No info about me!");
        user.setAge(11);

        try (ValidatorFactory factory = Validation.buildDefaultValidatorFactory())
        {
            Validator validator = factory.getValidator();
            Set<ConstraintViolation<UserWithValidation>> violations = validator.validate(user);
            for (ConstraintViolation<UserWithValidation> violation : violations)
            {
                System.err.println(violation.getMessage());
            }
        }
    }
}
```

Name cannot be null
muss wahr sein
Age should not be less than 18

Validation in JPA



```
@Entity
public class UserWithValidation
{
    @Id @GeneratedValue
    private Long id;

    @NotNull(message = "Name cannot be null")
    private String name;

    @AssertTrue
    private boolean working;

    @Size(min = 10, max = 200,
          message = "About Me must be between 10 and 200 characters")
    private String aboutMe;

    @Min(value = 18, message = "Age should not be less than 18")
    @Max(value = 150, message = "Age should not be greater than 150")
    private int age;

    // ...
    // standard setters and getters
}
```

Validation in JPA



```
private static void executeStatements(final EntityManager entityManager)
{
    UserWithValidation user = new UserWithValidation();
    user.setWorking(false);
    user.setAboutMe("No info about me!");
    user.setAge(11);

    entityManager.persist(user);
    System.out.println(user);
}

ConstraintViolationImpl{interpolatedMessage='Age should not be less than 18',
propertyPath=age, rootBeanClass=class t_validation.UserWithValidation,
messageTemplate='Age should not be less than 18'}
ConstraintViolationImpl{interpolatedMessage='muss wahr sein', propertyPath=working,
rootBeanClass=class t_validation.UserWithValidation,
messageTemplate='{javax.validation.constraints.AssertTrue.message}'}
ConstraintViolationImpl{interpolatedMessage='Name cannot be null', propertyPath=name,
rootBeanClass=class t_validation.UserWithValidation, messageTemplate='Name cannot be
null'}
```



DEMO

ProgrammaticValidationExample.java

Validation -- Annotations



- **@NotBlank** kann nur auf Textwerte angewendet werden und validiert, dass die Eigenschaft nicht Null oder Leerzeichen ist.
- **@Positive & @PositiveOrZero** werden auf numerische Werte angewendet und prüfen, ob diese positiv oder positiv einschließlich 0 sind.
- **@Negative & @NegativeOrZero** gelten für numerische Werte und bestätigen, dass sie negativ oder negativ, einschließlich 0, sind.
- **@Past & @PastOrPresent** prüfen, ob ein Datumswert in der Vergangenheit oder in der Vergangenheit einschließlich der Gegenwart liegt; für alle Datumstypen einschließlich der in Java 8
- **@Future & @FutureOrPresent** fordern, dass ein Datumswert in der Zukunft oder in der Zukunft einschließlich der Gegenwart liegt.

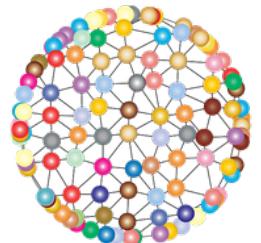


* Anpassungen in Persistence Unit

<validation-mode>AUT0</validation-mode>

<validation-mode>CALLBACK</validation-mode>

- Fallstricke Versionen Hibernate & Hibernate-Validator sowie javax.validation / jakarta.validation
 - **Hibernate-Validator 7.x ⇔ / jakarta.validation**
 - **Hibernate-Validator 6.x ⇔ / javax.validation**
- Nur ältere Variante läuft in Persistence Unit sauber, ansonsten Versions- und Initialisierungsprobleme
- Standalone geht beides problemlos



Wie kann man eigene Validatoren bauen?

Eigene Validatoren in JPA



```
@Target({ElementType.FIELD})
@Retention(RetentionPolicy.RUNTIME)
@Constraint(validatedBy = CheckEnumValidator.class)
public @interface CheckEnum
{
    String message() default "Please enter a valid enum value for this field.";
    Class<?> type();

    // für Constraint
    Class<?>[] groups() default {};
    Class<?extends Payload>[] payload() default {};
}
```

Eigene Validatoren in JPA



```
public class CheckEnumValidator implements ConstraintValidator<CheckEnum, String>
{
    Class<?> type;

    @Override
    public void initialize(CheckEnum constraintAnnotation)
    {
        type = constraintAnnotation.type();
        if (!type.isEnum())
            throw new IllegalArgumentException("type is not an enum");
    }

    @Override
    public boolean isValid(String value, ConstraintValidatorContext context)
    {
        ...
    }
}
```

Eigene Validatoren in JPA



```
public class CheckEnumValidator implements ConstraintValidator<CheckEnum, String>
{
    ...

    @Override
    public boolean isValid(String value, ConstraintValidatorContext context)
    {
        if (value == null)
            return true;

        Enum<?>[] enumValues = (Enum<?>[])type.getEnumConstants();
        for (Enum<?> enumValue : enumValues)
        {
            if (enumValue.name().equals(value.trim()))
                return true;
        }
        return false;
    }
}
```

Eigene Validatoren in JPA



```
public class ValidatedDomainClass
{
    @NotNull(message = "Deposit Date is required.")
    @CheckLocalDate(dateFormat = { "yyyy-MM-dd" })
    String depositDate;

    @CheckLocalDate(dateFormat = "dd.MM.yyyy")
    String publicationDate;
    @CheckLocalDate(dateFormat = { "dd.MM.yyyy", "dd.MM.yy" })
    String collectionDate;

    // Enum-Validator für Legacy
    @CheckEnum(type = Seasons.class)
    String season;
    @CheckEnum(type = SpecialColors.class)
    String color;
    @CheckListOfValues(allowedValues = { "Anne", "Will", "Peter", "Lustig" })
    String value;
}
```



DEMO

CustomValidatorsExample.java



Validation in Spring



Dependencies



```
<dependency>
<groupId>org.springframework.boot</groupId>
<artifactId>spring-boot-starter-validation</artifactId>
</dependency>
```

<https://reflectoring.io/bean-validation-with-spring-boot/>

Validation



```
import javax.validation.constraints.Max;
import javax.validation.constraints.Min;
import javax.validation.constraints.Pattern;

public class Input {

    @Min(1)
    @Max(10)
    private int numberBetweenOneAndTen;

    @Pattern(regexp = "[0-9]{1,3}\\. [0-9]{1,3}\\. [0-9]{1,3}\\. [0-9]{1,3}$")
    private String ipAddress;

    // ...
}
```

Validation



```
@RestController
class ValidateRequestBodyController {

    @PostMapping("/validateBody")
    ResponseEntity<String> validateBody(@Valid @RequestBody Input input) {
        return ResponseEntity.ok("valid");
    }
}
```

Validation



```
@RestController
@Validated
class ValidateParametersController {

    @GetMapping("/validatePathVariable/{id}")
    ResponseEntity<String> validatePathVariable(@PathVariable("id") @Min(5) int id) {
        return ResponseEntity.ok("valid");
    }

    @GetMapping("/validateRequestParam")
    ResponseEntity<String> validateRequestParam(@RequestParam("param") @Min(5) int param)
    {
        return ResponseEntity.ok("valid");
    }

    @ExceptionHandler(ConstraintViolationException.class)
    @ResponseStatus(HttpStatus.BAD_REQUEST)
    ResponseEntity<String> handleConstraintViolationException(ConstraintViolationException e)
    {
        return new ResponseEntity<>("not valid due to validation error: " + e.getMessage(),
            HttpStatus.BAD_REQUEST);
    }
}
```



DEMO

«spring-validation-slides-examples»



DEMO / Hands On

<https://spring.io/guides/gs/validating-form-input/>



Exercise 26

https://github.com/Michaeli71/AMTC_Spring_Workshop





Part 5: Mappings mit MapStruct



Mapping



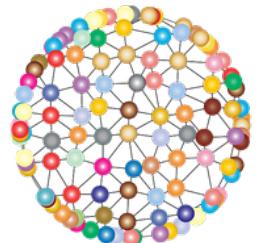
```
public class Car {  
  
    private String make;  
    private int number0fSeats;  
    private CarType type;  
  
    public Car(String make, int number0fSeats,  
              CarType type) {  
        this.make = make;  
        this.number0fSeats = number0fSeats;  
        this.type = type;  
    }  
    ...  
  
    public enum CarType {  
        PLAIN, PICKUP, SUV, TRUCK  
    }  
}
```



```
public class CarDto {  
  
    private String make;  
    private int seatCount;  
    private String type;
```



**Sollen wir etwa jedes
einzelne Attribut von
Hand übertragen?**





Zum Einbinden und Aktivieren von MapStruct muss die POM wie folgt ergänzt werden:

```
<dependency>
    <groupId>org.mapstruct</groupId>
    <artifactId>mapstruct</artifactId>
    <version>1.4.2.Final</version>
</dependency>

<plugin>
    <groupId>org.apache.maven.plugins</groupId>
    <artifactId>maven-compiler-plugin</artifactId>
    <version>3.8.1</version>
    <configuration>
        <release>11</release>
        <annotationProcessorPaths>
            <path>
                <groupId>org.mapstruct</groupId>
                <artifactId>mapstruct-processor</artifactId>
                <version>1.4.2.Final</version>
            </path>
        </annotationProcessorPaths>
    </configuration>
</plugin>
```

Mapping mit MapStruct



```
public class SimpleSource {  
    private String name;  
    private String description;  
  
    public String getName() {  
        return name;  
    }  
  
    public void setName(String name) {  
        this.name = name;  
    }  
  
    ...  
}
```



```
public class SimpleDestination {  
    private String name;  
    private String description;  
  
    public String getName() {  
        return name;  
    }  
  
    public void setName(String name) {  
        this.name = name;  
    }  
  
    ...  
}
```

```
@Mapper  
public interface SimpleSourceDestinationMapper {  
    SimpleDestination sourceToDestination(SimpleSource source);  
    SimpleSource destinationToSource(SimpleDestination destination);  
}
```

Mapping mit MapStruct



```
public class SimpleSourceDestinationMapperTest {  
    private SimpleSourceDestinationMapper mapper =  
        Mappers.getMapper(SimpleSourceDestinationMapper.class);  
  
    @Test  
    public void sourceToDestinationMapsCorrect() {  
        SimpleSource simpleSource = new SimpleSource();  
        simpleSource.setName("SourceName");  
        simpleSource.setDescription("SourceDescription");  
  
        SimpleDestination destination = mapper.sourceToDestination(simpleSource);  
  
        assertEquals(simpleSource.getName(), destination.getName());  
        assertEquals(simpleSource.getDescription(), destination.getDescription());  
    }  
  
    ...  
}
```

Mapping mit MapStruct



...

```
@Test  
public void destinationToSourceMapsCorrect() {  
    SimpleDestination destination = new SimpleDestination();  
    destination.setName("DestinationName");  
    destination.setDescription("DestinationDescription");  
  
    SimpleSource source = mapper.destinationToSource(destination);  
  
    assertEquals(destination.getName(), source.getName());  
    assertEquals(destination.getDescription(), source.getDescription());  
}  
}
```

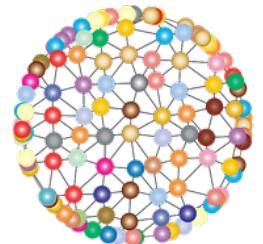
Mapping



```
public class Car {  
  
    private String make;  
    private int number0fSeats;  
    private CarType type;  
  
    public Car(String make, int number0fSeats,  
              CarType type) {  
        this.make = make;  
        this.number0fSeats = number0fSeats;  
        this.type = type;  
    }  
    ...  
  
    public enum CarType {  
        PLAIN, PICKUP, SUV, TRUCK  
    }  
}
```



```
public class CarDto {  
  
    private String make;  
    private int seatCount;  
    private String type;
```



**Wie können wir
steuernd eingreifen?**

Mapping mit MapStruct

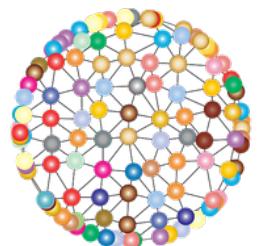


```
@Mapper
public interface CarMapper {
    CarMapper INSTANCE = Mappers.getMapper( CarMapper.class );
    @Mapping(source = "numberOfSeats", target = "seatCount")
    CarDto toDto(Car car);
    @Mapping(source = "seatCount", target = "numberOfSeats")
    Car toCar(CarDto dto);
}
```

Mapping mit MapStruct



```
public class CarMapperTest {  
  
    @Test  
    public void shouldMapCarToDto() {  
        // given  
        Car car = new Car("FORD", 5, CarType.PICKUP);  
  
        // when  
        CarDto carDto = CarMapper.INSTANCE.toDto(car);  
  
        // then  
        assertNotNull(carDto);  
        assertEquals("FORD", carDto.getMake());  
        assertEquals(5, carDto.getSeatCount());  
        assertEquals("PICKUP", carDto.getType());  
    }  
  
    ...  
}
```



**Wie nutzt man das im
Kontext von Spring?**

Mapping mit MapStruct



```
@Mapper(componentModel = "spring")
public interface ProductMapper {
    ProductDTO toProductDTO(Product product);
    List<ProductDTO> toProductDTOs(List<Product> products);

    Product toProduct(ProductDTO productDTO);
}
```

```
@Entity
public class Product {
    @Id
    @GeneratedValue
    private Long id;

    private String name;
    private String description;
    private BigDecimal price;

    private Date createdAt;
    private Date updatedAt;
```

```
public class ProductDTO {
    private String name;
    private String description;
    private BigDecimal price;
```

Mapping mit MapStruct



```
@RestController
@RequestMapping("/api/products")
public class ProductAPI {
    private final ProductService productService;
    private final ProductMapper productMapper;

    public ProductAPI(ProductService productService,
                      ProductMapper productMapper) {
        this.productService = productService;
        this.productMapper = productMapper;
    }

    @GetMapping
    @ResponseStatus(HttpStatus.OK)
    public List<ProductDTO> findAll() {
        List<Product> results = productService.findAll();
        return productMapper.toProductDTOs(results);
    }
}
```

Mapping mit MapStruct



...

```
@PostMapping  
@ResponseStatus(HttpStatus.CREATED)  
public ProductDTO create(@RequestBody ProductDTO productDTO) {  
    Product entity = productMapper.toProduct(productDTO);  
    productService.save(entity);  
  
    return productDTO;  
}  
  
@GetMapping("/{id}")  
public ResponseEntity<ProductDTO> findById(@PathVariable Long id) {  
    Optional<Product> optProduct = productService.findById(id);  
  
    if (optProduct.isEmpty())  
        return ResponseEntity.notFound().build();  
    ProductDTO dto = productMapper.toProductDTO(optProduct.get());  
    return ResponseEntity.ok(dto);  
}
```



DEMO

«spring-mapstruct-slides-examples»



Exercise 27

[https://github.com/Michaeli71/AMTC Spring Workshop](https://github.com/Michaeli71/AMTC_Spring_Workshop)

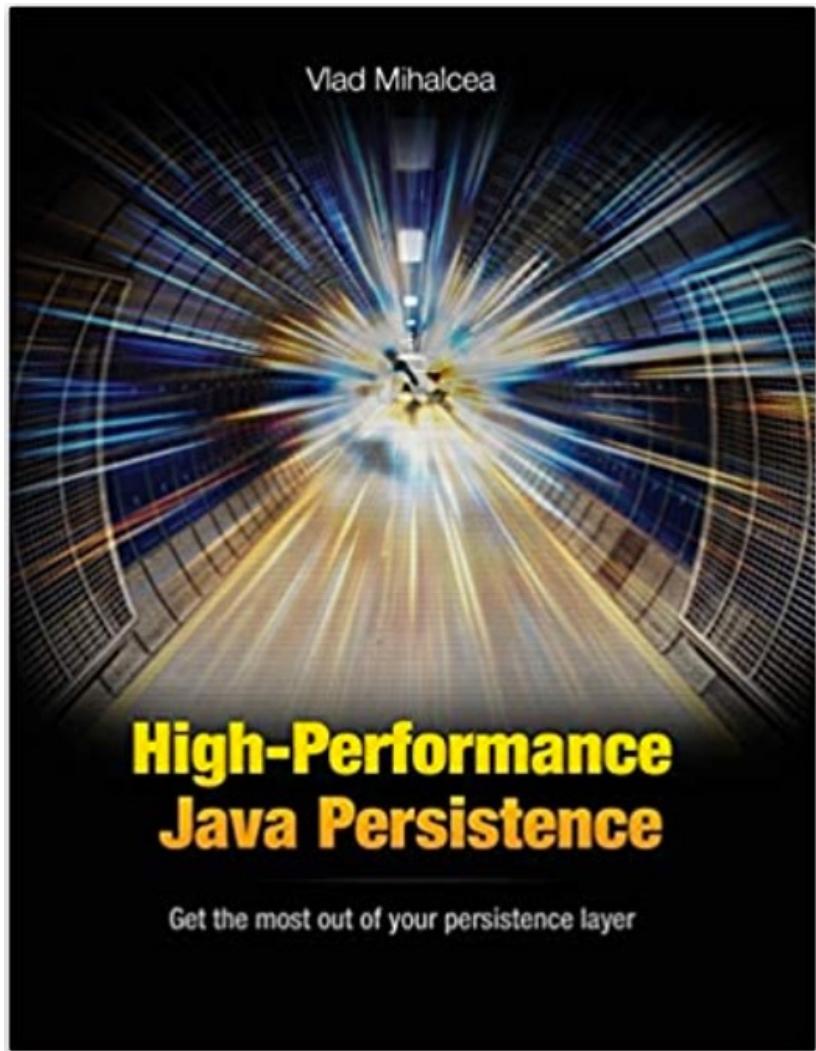
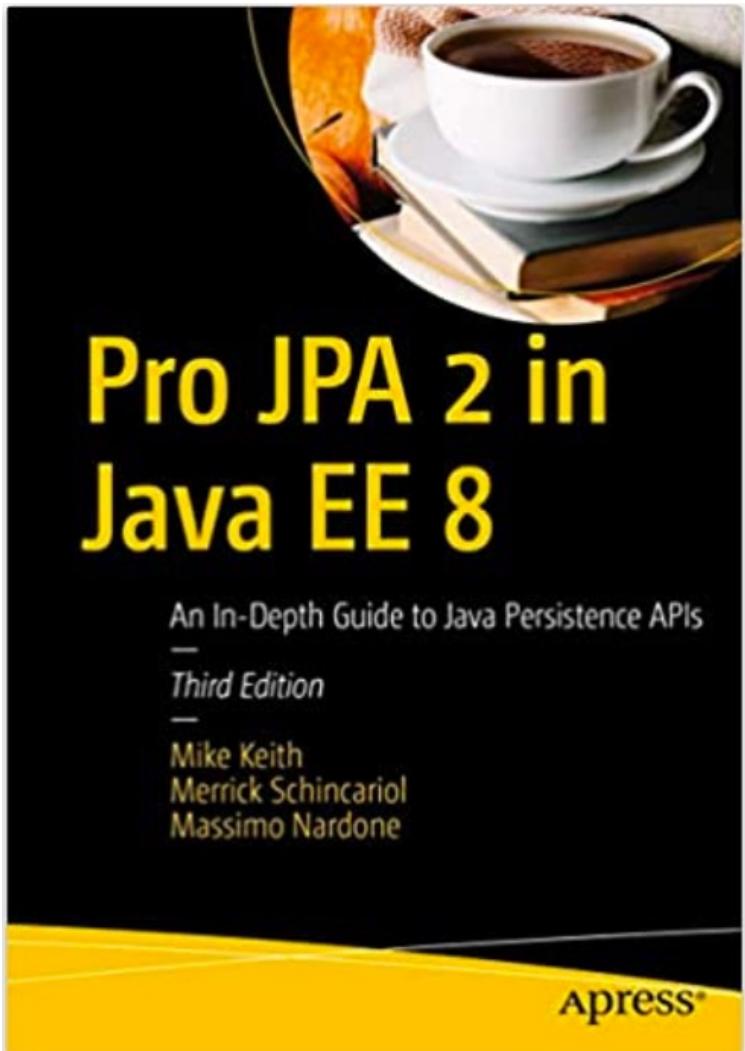




Questions?



Empfehlenswerte Bücher



Weitere Infos / Quellen



- **ORM**

- <https://thorben-janssen.com/jpa-generate-primary-keys/>
 - <https://www.objectdb.com/java/jpa/entity/generated>
 - <https://vladmirhalcea.com/orphanremoval-jpa-hibernate/>
 - <https://www.baeldung.com/jpa-one-to-one>
 - <https://www.baeldung.com/jpa-cascade-remove-vs-orphanremoval>
 - <https://www.baeldung.com/hibernate-inheritance>
 - <https://thorben-janssen.com/complete-guide-inheritance-strategies-jpa-hibernate/>
 - <https://www.objectdb.com/api/java/jpa/MappedSuperclass>
 - <https://www.logicbig.com/tutorials/java-ee-tutorial/jpa/mapped-super-class.html>
 - <https://vladmirhalcea.com/the-best-way-to-map-a-onetoone-relationship-with-jpa-and-hibernate/>
 - <https://www.baeldung.com/jpa-many-to-many>
 - <https://vladmirhalcea.com/the-best-way-to-use-the-manytomany-annotation-with-jpa-and-hibernate/>
 - <https://stackabuse.com/a-guide-to-jpa-with-hibernate-relationship-mapping/>
 - <https://thorben-janssen.com/best-practices-for-many-to-many-associations-with-hibernate-and-jpa/>
-



- **Validation**
 - <https://www.baeldung.com/javax-validation>
 - https://docs.jboss.org/hibernate/stable/validator/reference/en-US/html_single/
- **MapStruct**
 - <https://mapstruct.org/>
 - <https://www.baeldung.com/mapstruct>
 - <https://stackabuse.com/guide-to-mapstruct-in-java-advanced-mapping-library/>
 - <https://www.tutorialspoint.com/mapstruct/index.htm>
 - <https://auth0.com/blog/how-to-automatically-map-jpa-entities-into-dtos-in-spring-boot-using-mapstruct/>
 - https://www.jug.ch/events/slides/190827_Get_smart_with_MapStruct.pdf
 - <https://hellokoding.com/mapping-jpa-hibernate-entity-and-dto-with-mapstruct/>



Thank You