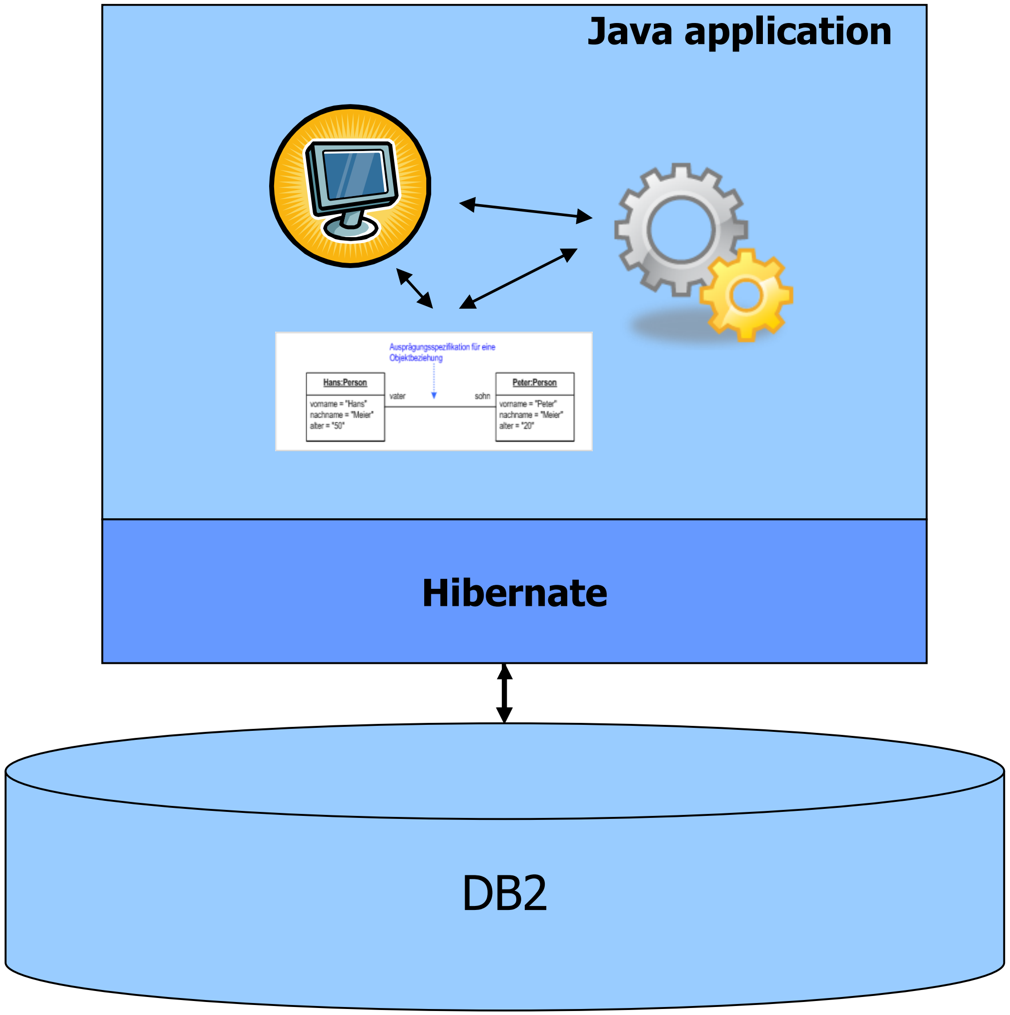
Databases and Information Systems

Object-Relational Mapper: Hibernate

Exercise 3: Overview



Example: Dozent.java

```
public class Dozent {
    private int id;
    private String name;
    private Set vorlesungen = new HashSet();

    public Dozent() {}

    public int getId() { return id; }
    private void setId(int id) {this.id = id; }

    public String getName() { return name; }
    public void setName(String name) { this.name = name; }

    public Set getVorlesungen() { return vorlesungen; }
    public void setVorlesungen(Set vorlesungen) {
        this.vorlesungen = vorlesungen; }

    public boolean equals(Object o) {…}
    public int hashCode() {…}
}
```

unique ID

default constructor

getter/setter for all persistent attributes

equals/hashcode

Example: Dozent.hbm.xml

```xml
<?xml version="1.0"?>
<!DOCTYPE hibernate-mapping PUBLIC
        "-//Hibernate/Hibernate Mapping DTD 3.0//EN"
        "http://hibernate.sourceforge.net/hibernate-mapping-3.0.dtd">

<hibernate-mapping>
    <class name="pkg.Dozent" table="DOZENTEN">
        <id name="id" column="DOZENT_ID">
            <generator class="native"/>
        </id>
        <property name="name" type="string" column="NAME"/>

        <set name="vorlesungen" inverse="true">
             <key column="DOZENT"/>
             <one-to-many class="pkg.Vorlesung"/>
         </set>
    </class>
</hibernate-mapping>
```

Example: How to Use It

```
private static final SessionFactory sessionFactory;
static {
    sessionFactory = new Configuration().configure().buildSessionFactory();
}

public Long erzeugeDozent(String name) {
    Session session = sessionFactory.getCurrentSession();
    session.beginTransaction();
    Dozent dozent = new Dozent();
    Dozent.setName(name);
    Long did = session.save(dozent);
    session.getTransaction().commit();
    return did;
}

public Dozent ladeDozent(Long dozentId) {
    Session session = sessionFactory.getCurrentSession();
    session.beginTransaction();
    Dozent dozent = (Dozent) session.get(Dozent.class, dozentId);
    session.getTransaction().commit();
    return dozent;
}
```

Configuration: hibernate.cfg.xml

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

<hibernate-configuration>
    <session-factory>
        <property name="connection.driver_class">com.ibm.db2.jcc.DB2Driver</property>
        <property name="connection.url">jdbc:db2://vsisls4:50001/VSISP</property>
        <property name="connection.username">vsisp**</property>
        <property name="connection.password">********</property>

        <property name="dialect">org.hibernate.dialect.DB2Dialect</property>
        <property name="current_session_context_class">thread</property>
        <property
name="cache.provider_class">org.hibernate.cache.NoCacheProvider</property>
        <property name="show_sql">true</property>

        <!-- Drop and re-create the database schema on startup -->
        <property name="hbm2ddl.auto">create</property>

        <mapping resource="pkg/Dozent.hbm.xml"/>
        <mapping resource="pkg/Vorlesung.hbm.xml"/>

    </session-factory>
</hibernate-configuration>
```

Mapping: Bidirectional Relations

- many-to-one / one-to-many

```
<class name="pkg.Dozent" table="DOZENTEN">
    <id name="id" column="DOZENT_ID">
        <generator class="native"/>
    </id>
    <property name="name" type="string" column="NAME"/>
    <many-to-one name="fakultät" class="pkg.Fakultät"
        column="FAKULTÄT" not-null="true" />
</class>
```

```
<class name="pkg.Fakultät">
    <id name="id" column="FAKULTÄT_ID">
        <generator class="native"/>
    </id>
    <set name= "dozenten" inverse="true">
        <key column="FAKULTÄT"/>
        <one-to-many class="pkg.Dozent"/>
    </set>
</class>
```

Mapping: Bidirectional Relations

- many-to-many

```
<class name="pkg.Dozent" table="DOZENTEN">
    <id name="id" column="DOZENT_ID">
        <generator class="native"/>
    </id>
    <property name="name" type="string" column="NAME"/>
    <set name="studenten" table="DOZ_STUD" >
        <key column="DOZ_ID"/>
        <many-to-many column="STUD_ID" class="pkg.Student"/>
    </set>
</class>
```

```
<class name="pkg.Student" table="STUDENTEN">
    <id name="id" column="STUDENT_ID">
        <generator class="native"/>
    </id>
    <set name="dozenten" table="DOZ_STUD" >
        <key column="STUD_ID"/>
        <many-to-many column="DOZ_ID" class="pkg.Dozent"/>
    </set>
</class>
```

Mapping: Unidirectional Relations

- many-to-one

```
<class name="pkg.Dozent" table="DOZENTEN">
    <id name="id" column="DOZENT_ID">
        <generator class="native"/>
    </id>
    <property name="name" type="string" column="NAME"/>

    <many-to-one name="fakultät" class="pkg.Fakultät"
        column="FAKULTÄT" not-null="true" />
</class>
```

```
<class name=“pkg.Fakultät">
    <id name="id" column="FAKULTÄT_ID">
        <generator class="native"/>
    </id>
</class>
```

Mapping: Inheritance

- table-per-subclass (vertical partitioning)

```
<class name="UniMitarbeiter" table="MITARBEITER" abstract="true">
    <id name="id" type="long" column="MID">
        <generator class="native"/>
    </id>
    <property name="name" column="NAME"/>
    ...
    <joined-subclass name="Professor" table="PROFESSOR">
        <key column="MID"/>
        <property name="ProfessurTyp" column="PROF_TYP"/>
        ...
    </joined-subclass>
    <joined-subclass name="Wissenschaftler" table="WISSENSCHAFTLER">
        <key column="MID"/>
        ...
    </joined-subclass>
    <joined-subclass name="Techniker" table="TECHNIKER">
        <key column="MID"/>
        ...
    </joined-subclass>
</class>
```

→ 4 tables

Mapping: Inheritance

- table-per-concrete-class (horizontal partitioning)

```
<class name=“UniMitarbeiter“ abstract=“true”>
    <id name="id" type="long" column="PAYMENT_ID">
        <generator class=“sequence"/>
    </id>
    <property name="amount" column="AMOUNT"/>
    ...
    <union-subclass name=“Professor" table=“PROFESSOR">
        <property name=“ProfessurTyp" column=“PROF_TYP"/>
        ...
    </union-subclass>
    <union-subclass name=“Wissenschaftler" table=“WISSENSCHAFTLER">
        ...
    </union-subclass>
    <union-subclass name=“Techniker" table=“TECHNIKER">
        ...
    </union-subclass>
</class>
```

→ 3 tables

Mapping: Inheritance

- table-per-class-hierarchy

```
<class name="UniMitarbeiter" table="MITARBEITER" abstract="true">
    <id name="id" type="long" column="MID">
        <generator class="native"/>
    </id>
    <discriminator column="MITARBEITER_TYP" type="string"/>
    <property name="name" column="NAME"/>
    ...
    <subclass name="Professor" discriminator-value="PROF">
        <property name="ProfessurTyp" column="PROF_TYP"/>
        ...
    </subclass>
    <subclass name="Wissenschfter" discriminator-value="WIMI">
        ...
    </subclass>
    <subclass name="Techniker" discriminator-value="TECH">
        ...
    </subclass>
</class>
```

→ 1 table

Objects

- object states

	transient	persistent	detached
attached to session	✗	✓	✗
represented in DB	✗	✓	✓

- saving an object

```
public Long erzeugeDozent(String name) {
    Dozent dozent = new Dozent(); // dozent is transient
    dozent.setName(name);
    Long did = session.save(dozent); // dozent is persistent
    return did;
}
```

Objects

- load an object

```
Dozent dozent = (Dozent) session.get(Dozent.class, did);
```

- check whether an object exists

```
Dozent dozent = (Dozent) session.get(Dozent.class, did);
if (dozent==null) {
    dozent = new Dozent();
    session.save(dozent, did);
}
```

- refresh an object

```
session.save(dozent);
session.flush(); // force SQL INSERT
session.refresh(dozent); /* now the object also contains values that might
                            for example have been updated by triggers */
```

Objects

- change an object (persistent): flush

```
Dozent dozent = (Dozent) session.get(Dozent.class, did);
dozent.setName(“Müller”);
session.flush();
```

- change an object (detached): update

```
Session session1 = sessionFactory.getCurrentSession();
session1.beginTransaction();
Dozent dozent = (Dozent) session1.get(Dozent.class, did);
Dozent.setName(name);
session1.getTransaction().commit();
session1.close();

[…]
dozent.setFakultät(fak);           //dozent is detached

session session2 = sessionFactory.getCurrentSession();
session2.beginTransaction();
session2.update(dozent);
```

Objects

- delete an object

```
session.delete(dozent);
```

- query objects using HQL

```
List dozenten = session.createQuery(
    "from Dozent as dozent where dozent.alter < ?")
    .setInteger(0, 40)
    .list();

List kittens = session.createQuery(
    "from Dozent as dozent where dozent.fakultät = ?")
    .setEntity(0, fak)
    .list();

Fakultät fak = (Fakultät) session.createQuery(
    "select dozent.fakultät from Dozent as dozent where dozent = ?")
    .setEntity(0, doz)
    .uniqueResult();
```

DB Connections/Transactions

- SessionFactory
  - create sessions
  - administers mapping rules
- Session
  - short-lived
  - creates transactions
  - caches persistent objects
  - bound to the context (thread)
- Transaction
  - atomic units of work
  - require explicit management (begin/commit/rollback)

Java Persistence API Standard (JPA)

- Alternative to proprietary Hibernate API
- Many ORM implementations: Hibernate (>3.2), DataNucleus, EclipseLink, OpenJPA, etc.

```
@Entity
public class Customer {
   @Id
   private String id;
   private String firstName;
   //…
}
EntityManager em = ...
Customer c = new Customer(“John”, “Doe”);
em.getTransaction().begin();
em.persist(c);
//…
c = em.find(Customer.class, <primary key>);
em.getTransaction().commit();
```