Spring Databases

Module 2
Spring ORM

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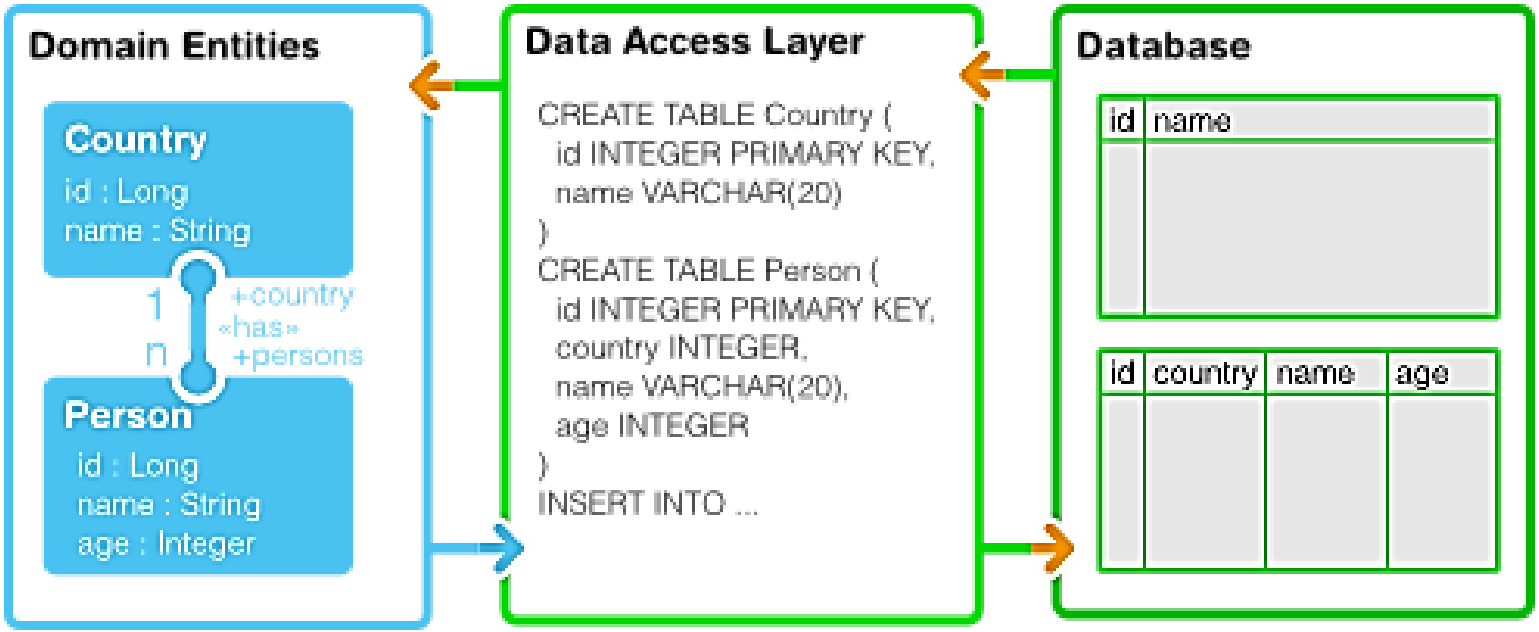
Spring :: ORM

ORM - Object-relational mapping

• connects the concepts of relational database and object-oriented system

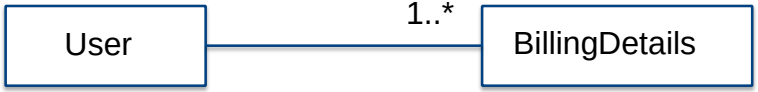


Spring :: ORM

Paradigm mismatch

Spring :: ORM

Paradigm mismatch




```java
public class User {
    String username;
    String address;
    Set billingDetails;
}

public class BillingDetails {
    String account;
    String bankname;
    User user;

}
```

```
create table USERS (
    USERNAME varchar(15) primary key,
    ADDRESS varchar(255) not null

);
create table BILLINGDETAILS (
    ACCOUNT varchar(15) primary key,
    BANKNAME varchar(255) not null,
    USERNAME varchar(15) not null,
    foreign key (USERNAME) references USERS

);
```

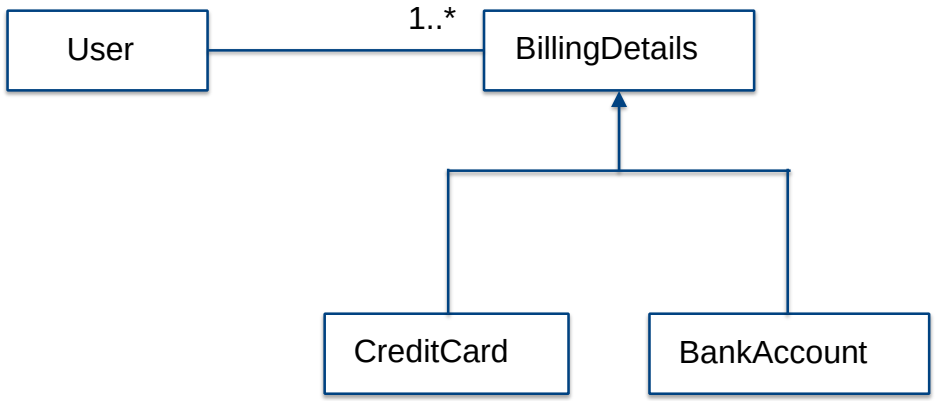
Paradigm mismatch

- The problem of granularity.


```
create table USERS (
   USERNAME varchar(15) primary key,
   ADDRESS_STREET varchar(255),
   ADDRESS_ZIPCODE varchar(5),
   ADDRESS_CITY varchar(255)
);
```

Paradigm mismatch

- The problem of granularity.
- The problem of subtypes.



Paradigm mismatch

- The problem of granularity.
- The problem of subtypes.
- The problem of identity.

```
create table USERS (
    ID bigint not null primary key,
    USERNAME varchar(15) not null unique,
    ...

);
create table BILLINGDETAILS (
    ID bigint not null primary key,
    ACCOUNT varchar(15) not null,
    BANKNAME varchar(255) not null,
    USER_ID bigint not null,
    foreign key (USER_ID) references USERS

);
```

Paradigm mismatch

- The problem of granularity.
- The problem of subtypes.
- The problem of identity.
- Problems relating to associations.

```
public class User {
    Set billingDetails;

}
public class BillingDetails {
    User user;

}
```

Paradigm mismatch

- Problems relating to associations.

```
public class User {
    Set billingDetails;

}
public class BillingDetails {
    Set users;

}
```

Paradigm mismatch

- Problems relating to associations.

```
public class User {
    Set billingDetails;

}
public class BillingDetails {
    Set users;

}

create table USER_BILLINGDETAILS (
     USER_ID bigint,
     BILLINGDETAILS_ID bigint,
     primary key (USER_ID, BILLINGDETAILS_ID),
     foreign key (USER_ID) references USERS,
     foreign key (BILLINGDETAILS_ID)
     references BILLINGDETAILS

);
```

Paradigm mismatch

- The problem of granularity.
- The problem of subtypes.
- The problem of identity.
- Problems relating to associations.
- The problem of data navigation.

```
someUser.getBillingDetails().iterator().next()
```

Paradigm mismatch

- The problem of granularity.
- The problem of subtypes.
- The problem of identity.
- Problems relating to associations.
- The problem of data navigation.

```
someUser.getBillingDetails().iterator().next()
```

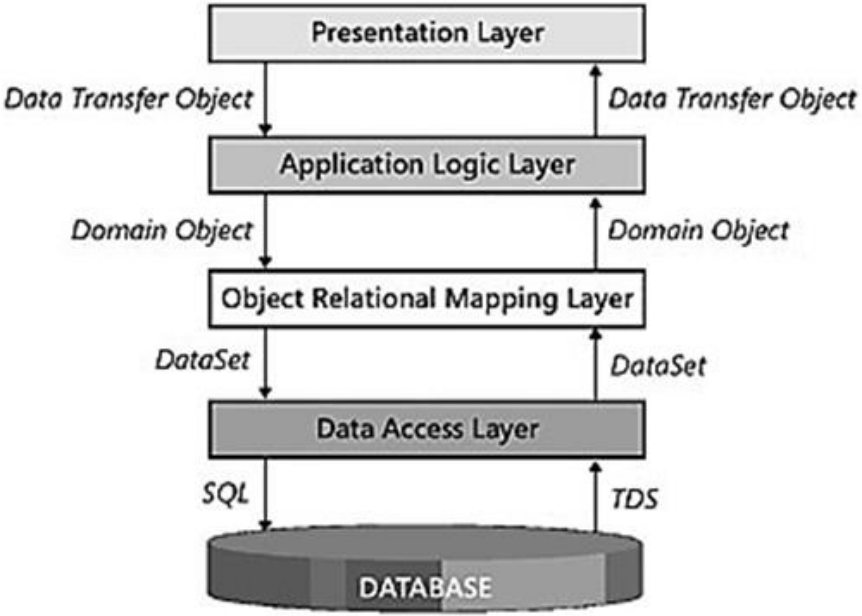
```
select * from USERS u
left outer join BILLINGDETAILS bd on bd.USER_ID =
u.ID
where u.ID = 123;
```

Spring :: Overview of ORM module

- org.springframework.orm.hibernate5
- org.springframework.orm.ibatis
- org.springframework.orm.jpa

Spring :: ORM

ORM - Object-relational mapping



Data flow when using object relational mapping

Spring :: Benefits of Working with ORM

- Speeding development
- Making data access more abstract and portable
- Cache management
- Generating boilerplate code for basic CRUD operations (Create, Read, Update, Delete)

Spring :: ORM :: Example

```
public interface BookDao {
    public Book getById(int id);
    public List<Book> getAll();
    public void insert(Book book);
    public void update(int id, String title);
    public void delete(Book book);
    public Book findByTitle(String bookTitle);
}
```

BOOK

ID: integer
TITLE : varchar
DATE_RELEASE : timestamp

Spring :: ORM :: Example

Implementation with the use of Spring JDBC

```
public void setDataSource(DataSource dataSource) {
   this.dataSource = dataSource;
   jdbcTemplate = new JdbcTemplate(this.dataSource);
}


@Override
public void insert(Book book) {
   String sql = "INSERT INTO BOOK (TITLE, DATE_RELEASE) VALUES (?, ?)";
   jdbcTemplate.update(sql, getPreparedStatementSetter(book));
}
```

Spring :: ORM :: Example

```java
@Entity
@Table(name = "BOOK")
public class Book {
    private int id;
    private String title;
    private Date dateRelease;

    @Id
    @GeneratedValue
    public int getId() {
        return id;
    }

    public void setId(int id) {
        this.id = id;
    }
```

```java
@Column(name = "TITLE")
public String getTitle() {
    return title;
}

public void setTitle(String title) {
    this.title = title;
}
```

BOOK

ID: integer
TITLE : varchar
DATE_RELEASE : timestamp

Spring :: ORM :: Example

`Session` is the main runtime interface between a Java application and Hibernate. This is the central API class abstracting the notion of a persistence service.

The main function of the **`Session`** is to offer create, read and delete operations for instances of mapped entity classes.

Instances may exist in one of three states:

- *transient*: never persistent, not associated with any **`Session`**
- *persistent*: associated with a unique **`Session`**
- *detached*: previously persistent, not associated with any **`Session`**

Spring :: ORM :: Example

```
@Repository
public class BookDaoImpl implements BookDao {
    private SessionFactory sessionFactory;

    private Session session;

    public void setSessionFactory(SessionFactory sessionFactory) {
        this.sessionFactory = sessionFactory;
        session = this.sessionFactory.openSession();
    }

    @Override
    public void insert(Book book) {
        Transaction tx = session.beginTransaction();
        session.save(book);
        tx.commit();
    }
```

In order to persist a transient object, you need to do it within a transaction and to commit it.

ex.9

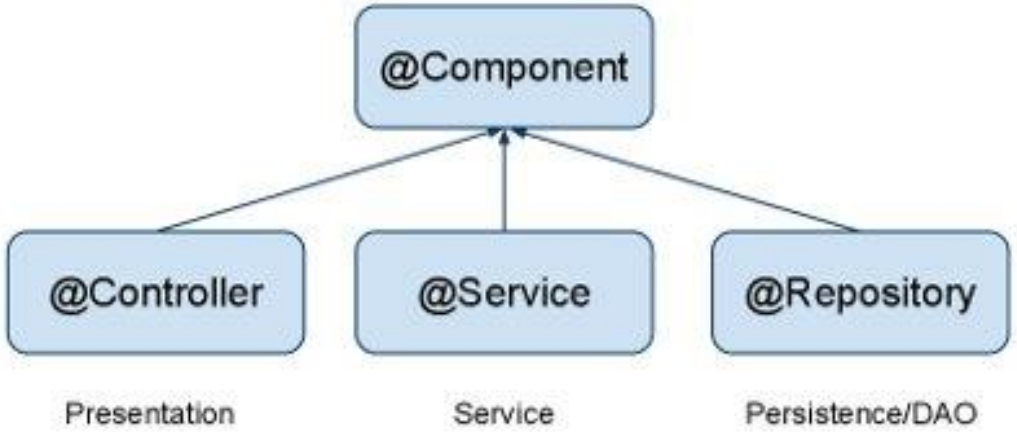
Spring :: ORM :: Example

- Transient instances may be made persistent by calling **`save()`** or **`saveOrUpdate()`**.
- Persistent instances may be made transient by calling **`delete()`**.
- Any instance returned by a **`get()`** or **`load()`** method is persistent.
- Detached instances may be made persistent by calling **`update()`** or **`saveOrUpdate()`**.

- **`save()`** and **`persist()`** result in an SQL INSERT
- **`delete()`** results in an SQL DELETE
- **`update()`** results in an SQL UPDATE

Spring :: ORM :: Stereotypes

- **Stereotype** is a marker annotation denoting the role of the bean in the overall architecture (at a conceptual, rather than implementation, level).



@Repository – for DAO beans, translates checked exceptions to **DataAccessException** hierarchy
@Service – for business logic beans
@Controller – for controllers

Spring :: ORM :: Example

```
<bean
class="org.springframework.dao.annotation.
       PersistenceExceptionTranslationPostProcessor" />

<bean id="sessionFactory"
class="org.springframework.orm.hibernate5.LocalSessionFactoryBean">
   <property name="dataSource" ref="dataSource" />

   <property name="hibernateProperties">
     <props>
        <prop key="hibernate.dialect">org.hibernate.dialect.MySQLDialect</prop>
        <prop key="hibernate.show_sql">true</prop>
        <prop key="hibernate.hbm2ddl.auto">create</prop>
     </props>
   </property>
```

Spring :: ORM :: Example

```
  <property name="annotatedClasses">
     <list>
      <value> com.luxoft.springdb.example9.Book</value>
     </list>
  </property>
</bean>

<jdbc:embedded-database id="dataSource" />
   <jdbc:script location="classpath:db-schema.sql" />
<jdbc:embedded-database />
```

Spring :: ORM :: Example with HibernateDaoSupport

```
@Repository
public class BookDaoImpl extends HibernateDaoSupport implements BookDao {
  @Override
  @Transactional(readOnly=false)
  public void insert(Book book) {
      getHibernateTemplate().save(book);
  }

  @Override
  public Book getById(int id) {
      return (Book) getHibernateTemplate().get(Book.class, id);
  }
```

Insert/update/delete operations need to be transactional. The **`@Transactional`** annotation, to be discussed into the transactions module.

Spring :: ORM :: Example with HibernateDaoSupport

```
<tx:annotation-driven/>

<bean id="transactionManager"
class="org.springframework.orm.hibernate5.HibernateTransactionManager">
    <property name="sessionFactory" ref="sessionFactory"/>
</bean>
```

Need to enable the configuration of transactional behavior based on annotations using **`<tx:annotation-driven/>`** and to create a **`HibernateTransactionManager`** bean.

Spring :: ORM :: Universal DAO

```
public interface Dao<T> {
   public void insert(final T entity);
   public void delete(final T entity);
   public void update(int id, String property);
   public T findByProperty(String propertyValue);
   public T getById(int id);
   public List<T> getAll();
}
```

Spring :: ORM :: Universal DAO

```
@Repository
public abstract class AbstractHibernateDao<T> extends HibernateDaoSupport implements Dao<T> {

    private Class<T> clazz;

    public void setClazz(final Class<T> clazzToSet) {
        this.clazz = clazzToSet;
    }

    @Override
    public T getById(final int id) {
        return (T) getHibernateTemplate().get(clazz, id);
    }

    @Override
    @SuppressWarnings("unchecked")
    public List<T> getAll() {
        return (List<T>)getHibernateTemplate().find("from " + clazz.getName());
    }
```

Spring :: ORM :: Universal DAO

```
@Repository
public class BookDaoImpl extends AbstractHibernateDao<Book>  {

    public BookDaoImpl() {
        setClazz(Book.class);
    }

    @Transactional(readOnly=false)
    public void update(int id, String title) {
        Book book =
(Book)getHibernateTemplate().getSessionFactory().openSession()
                                        .get(Book.class, id);
        book.setTitle(title);
        getHibernateTemplate().update(book);
    }
```

ex.11

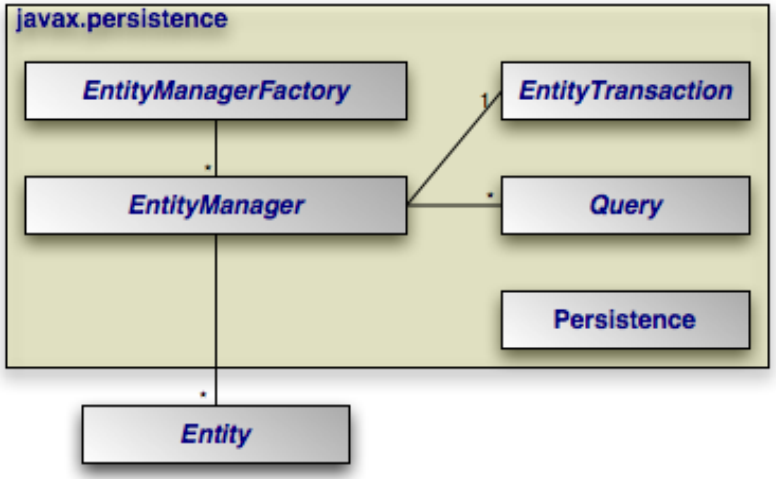
Practice here

Spring :: ORM :: JPA

Java Persistence API (JPA) — API included to Java SE and Java EE since Java 5

Support of the persistency of JPA covers these areas:

- API, defined in package javax.persistence
- Java Persistence Query Language
- Meta-information
- Generation of DDL for entities



Spring :: ORM :: JPA

```
public interface BookDao {
   public Book getById(int id);
   public List<Book> getAll();
   public void insert(Book book);
   public void update(int id, String title);
   public void delete(Book book);
   public Book findByTitle(String bookTitle);
}

public abstract class AbstractJpaDao {

   protected EntityManagerFactory entityManagerFactory;

   @PersistenceUnit
   public void setEntityManagerFactory(EntityManagerFactory entityManagerFactory) {
        this.entityManagerFactory = entityManagerFactory;
   }
}
```

Spring :: ORM :: JPA

```
@Repository
public class BookJpaDaoImpl extends AbstractJpaDao implements BookDao {

   @Override
   public void insert(Book book) {
      EntityManager entityManager = entityManagerFactory.createEntityManager();

      entityManager.getTransaction().begin();
      entityManager.persist(book);
      entityManager.getTransaction().commit();

      if (entityManager != null) {
         entityManager.close();
      }
   }
```

Spring :: ORM :: JPA

```
<context:annotation-config />

<context:component-scan base-package="com.luxoft.springdb.ormjpa.model, com.luxoft.springdb.ormjpa.dao"
/>

<jdbc:embedded-database id="dataSource"/>

<bean id="localContainerEntityManagerFactory"
class="org.springframework.orm.jpa.LocalContainerEntityManagerFactoryBean">
   <property name="persistenceUnitName" value="springframework.lab.orm.jpa"/>

   <property name="dataSource" ref="dataSource"/>
   <property name="persistenceProviderClass" value="org.hibernate.jpa.HibernatePersistenceProvider"/>
</bean>

<bean id="bookDaoImpl" class="com.luxoft.springdb.ormjpa.dao.jpa.BookJpaDaoImpl" />
```

Spring :: ORM :: JPA

```
<persistence xmlns="http://java.sun.com/xml/ns/persistence"
             xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
             xsi:schemaLocation="http://java.sun.com/xml/ns/persistence
             http://java.sun.com/xml/ns/persistence/persistence_2_0.xsd"
             version="2.0">
    <persistence-unit name="springframework.lab.orm.jpa">

        <class>com.luxoft.jva010.orm.model.Book</class>

        <properties>
            <property name="hibernate.show_sql" value="true" />
            <property name="hibernate.hbm2ddl.auto" value="create" />
        </properties>
    </persistence-unit>
</persistence>
```

Spring :: ORM :: JPA - generified

```
public interface Dao<T> {
  public void insert(T entity);
  public void delete(final T entity);
  public void update(int id, String property);
  public T findByProperty(String propertyValue);
  public T getById(int id);
  public List<T> getAll();
}
```

Spring :: ORM :: JPA - generified

```
public abstract class AbstractJpaDao<T> implements Dao<T> {

  protected Class<T> clazz;
  protected EntityManagerFactory entityManagerFactory;

  public void setClazz(final Class<T> clazzToSet) {
      this.clazz = clazzToSet;
  }

  @PersistenceUnit
  public void setEntityManagerFactory(EntityManagerFactory
                                      entityManagerFactory) {
      this.entityManagerFactory = entityManagerFactory;
  }
```

Spring :: ORM :: JPA - generified

```
@Override
public void insert(final T entity) {
  EntityManager entityManager =
entityManagerFactory.createEntityManager();

  entityManager.getTransaction().begin();
  entityManager.persist(entity);
  entityManager.getTransaction().commit();

  if (entityManager != null) {
      entityManager.close();
  }
}
```

Spring :: ORM :: JPA - generified

```
@Repository
public class BookJpaDaoImpl extends AbstractJpaDao<Book> {
   public BookJpaDaoImpl() {
      setClazz(Book.class);
   }

   @Override
   public Book findByProperty(String propertyValue) {
       EntityManager entityManager = entityManagerFactory.createEntityManager();
       Book book = (Book) entityManager
                   .createQuery("SELECT c FROM " + clazz.getName() +
                                " c WHERE c.title LIKE :title")
                    .setParameter("title", propertyValue).getSingleResult();
      if (entityManager != null) {
         entityManager.close();
      }
      return book;
   }
```

orm-jpa-gen

Spring :: JPA initialization

Since Spring 3.1+ we can avoid defining of persistence.xml by turning on the auto-scanning of all classes of package **packagesToScan:**

```
<bean id="localContainerEntityManagerFactory"
class="org.springframework.orm.jpa.LocalContainerEntityManagerFactoryBean">
        <property name="dataSource" ref="dataSource"/>
    <property name="packagesToScan" value="com.luxoft"/>
    <property name="jpaVendorAdapter">
        <bean class="org.springframework.orm.jpa.vendor.HibernateJpaVendorAdapter">
           <property name="showSql" value="true"/>
               <property name="generateDdl" value="true"/>
               <property name="databasePlatform"
                         value="org.hibernate.dialect.HSQLDialect"/>
        </bean>
    </property>
</bean>
```

Exercise

Lab guide:

- Exercise 2