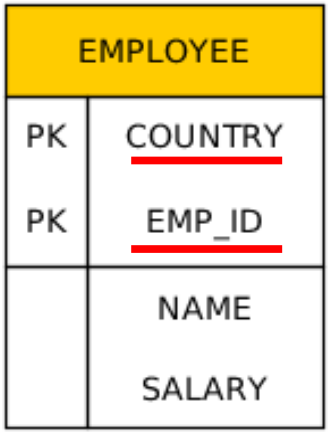
Compound primary keys

Id Class



No setters. Once created, can not be changed.

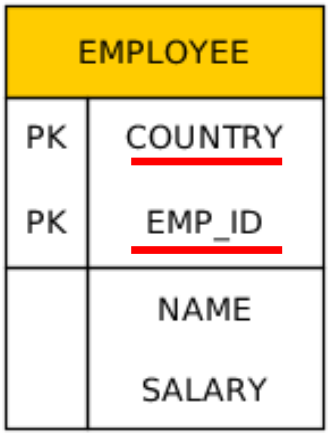
```
public class EmployeeId
                implements Serializable {
    private String country;
    private int id;

    public EmployeeId() {}
    public EmployeeId(String country,
                      int id) {
        this.country = country;
        this.id = id;
    }

    public String getCountry() {...};
    public int getId() {...}

    public boolean equals(Object o) {...}

    public int hashCode() {
        Return country.hashCode() + id;
    }
```

```
@Entity
@IdClass(EmployeeId.class)
public class Emlpoyee {
    @Id private String country;
    @Id
    @Column(name="EMP_ID")
    private int id;
    private String name;
    private long salary;
    // …
}
```

```
EmployeeId id = new Employee(country, id);
Employee emp = em.find(Employee.class, id);
```

Compound primary keys

Embedded Id Class

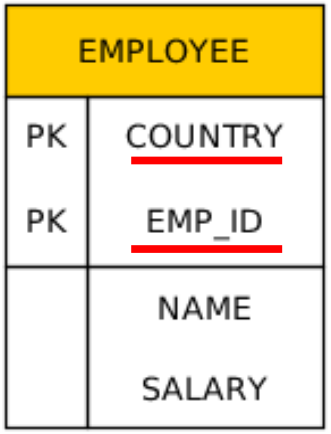



```
@Embeddable
public class EmployeeId
    private String country;
    @Column(name="EMP_ID")
    private int id;

    public EmployeeId() {}
    public EmployeeId(String country,
                      int id) {
        this.country = country;
        this.id = id;
    }
    // ...
}
```

```
@Entity
public class Emlpoyee {
    @EmbeddedId private EmployeeId id;
    private String name;
    private long salary;
    // …
    public String getCountry() {return id.getCountry();}
    Public int getId() {return id.getId();}
    // …
}
```

Compound primary keys

Embedded Id Class




```
@Embeddable
public class EmployeeId
    private String country;
    @Column(name="EMP_ID")
    private int id;

    public EmployeeId() {}
    public EmployeeId(String country,
                      int id) {
        this.country = country;
        this.id = id;
    }
```

Referencing an embedded IdClass in a query:

```
em.createQuery("SELECT e FROM Employee e " +
               "WHERE e.id.country = ?1 AND e.id.id = @2")
      .setParameter(1, country)
      .setParameter(2, id)
      .getSingleResult();
```

Shared Primary Key

Bidirectional one-to-one relationship between Employee and EmployeeHistory

```
@Entity
public class EmployeeHistory
    // ...
    @Id
    @OneToOne
    @JoinColumn(name="EMP_ID")
    private Employee employee;
    // ...
}
```

The primary key type of EmployeeHistory is the same as primary key of Employee.

- If <pk> of Emloyee is integer, <pk> of EmployeeHistory will be also integer.
- If Employee has a compound <pk>, either with an id class or an embedded id class, then EmployeeHistory will share the same id class and should also be annotated
- @IdClass.

The rule is that a primary key attribute corresponds to a relationship attribute. However, the relationship attribute is missing in this case (the id class is shared between both parent and dependententities). Hence, this is an exception from the above mentioned rule.

Shared Primary Key

Bidirectional one-to-one relationship between Employee and EmployeeHistory

```
@Entity
public class EmployeeHistory
    // ...
    @Id
    int empId;

    @MapsId
    @OneToOne
    @JoinColumn(name="EMP_ID")
    private Employee employee;
    // ...
}
```

On the provious slide, the relationship attribute was missing.

In this case, the EmployeeHistory class contains both a primary key attribute as well as the relationship attribute. Both attributes are mapped to the same foreign key column in the table.

@MapsId annotates the relationship attribute to indicate that it is mapping the id attribute as well (**read-only mapping**!). Updates/inserts to the foreign key column will only occur through the relationship attribute.

=> YOU MUST ALWAYS SET THE PARENT RELATIONSHIPS BEFORE TRYING TO PERSIST A DEPENDENT ENTITY.

Read-only mappings

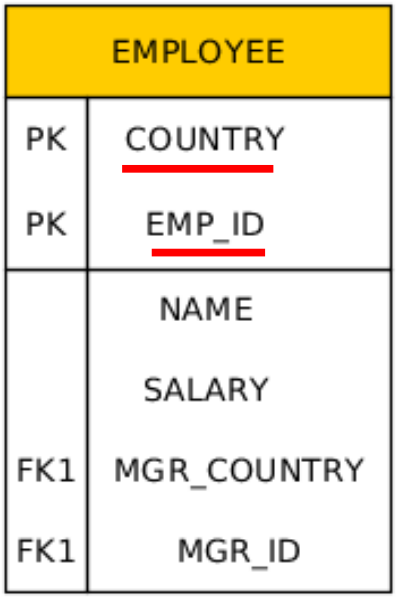
The constrains are checked on commit!
Hence, the constrained properties can be Modified in memory.

```
@Entity
public class Employee
    @Id
    @Column(insertable=false)
    private int id;

    @Column(insertable=false, updatable=false)
    private String name;

    @Column(insertable=false, updatable=false)
    private long salary;

    @ManyToOne
    @JoinColumn(name="DEPT_ID", insertable=false, updatable=false)
    private Department department;
    // ...
}
```

Optionality

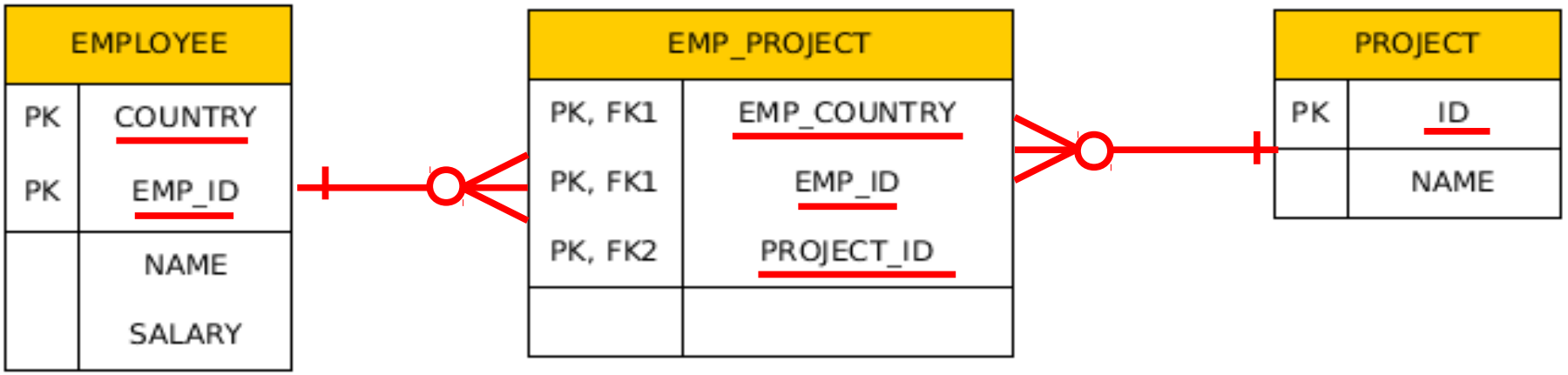
```
@Entity
public class Employee
    // ...

    @ManyToOne(optional=false)
    @JoinColumn(name="DEPT_ID", insertable=false, updatable=false)
    private Department department;
    // ...
}
```

Compound Join Columns




```
@Entity
@IdClass(EmployeeId.class)
public class Employee {
    @Id private String country;
    @Id
    @Column name="EMP_ID")
    private int id;

    @ManyToOne
    @JoinColumns({
        @JoinColumn(name="MGR_COUNTRY",
                    referencedColumnName="COUNTRY"),
        @JoinColumn(name="MGR_ID",
                    referencedColumnName="EMP_ID")
    })
    private Employee manager;

    @OneToMany(mappedBy="manager")
    private Collection<Employee> directs;
    // …
}
```

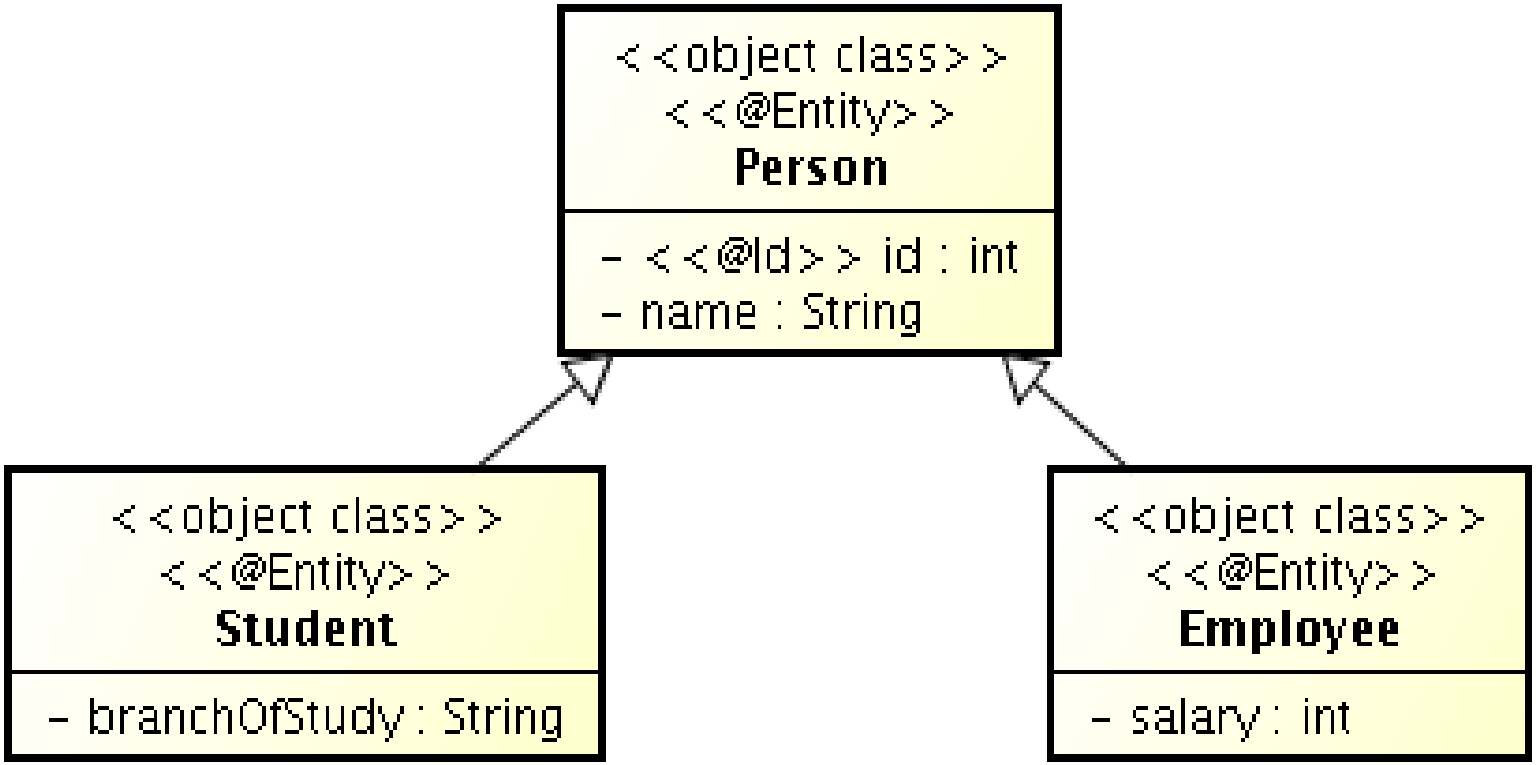
Compound Join Columns




```
@Entity
@IdClass(EmployeeId.class)
public class Employee
    @Id private String country;
    @Id
    @Column(name="EMP_ID")
    private int id;
    @ManyToMany
    @JoinTable(
        name="EMP_PROJECT",
        joinColumns={
            @JoinColumn(name="EMP_COUNTRY", referencedColumnName="COUNTRY"),
            @JoinColumn(name="EMP_ID", referencedColumnName="EMP_ID")},
        inverseJoinColumns=@JoinColumn(name="PROJECT_ID"))
    private Collection<Project> projects;
}
```

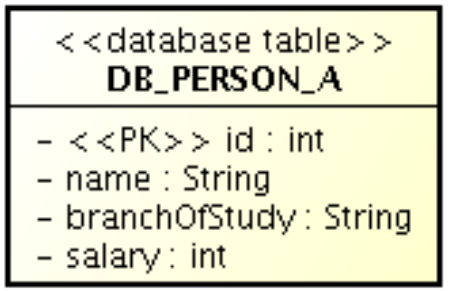
Inheritance

- How to map inheritance into RDBMS ?

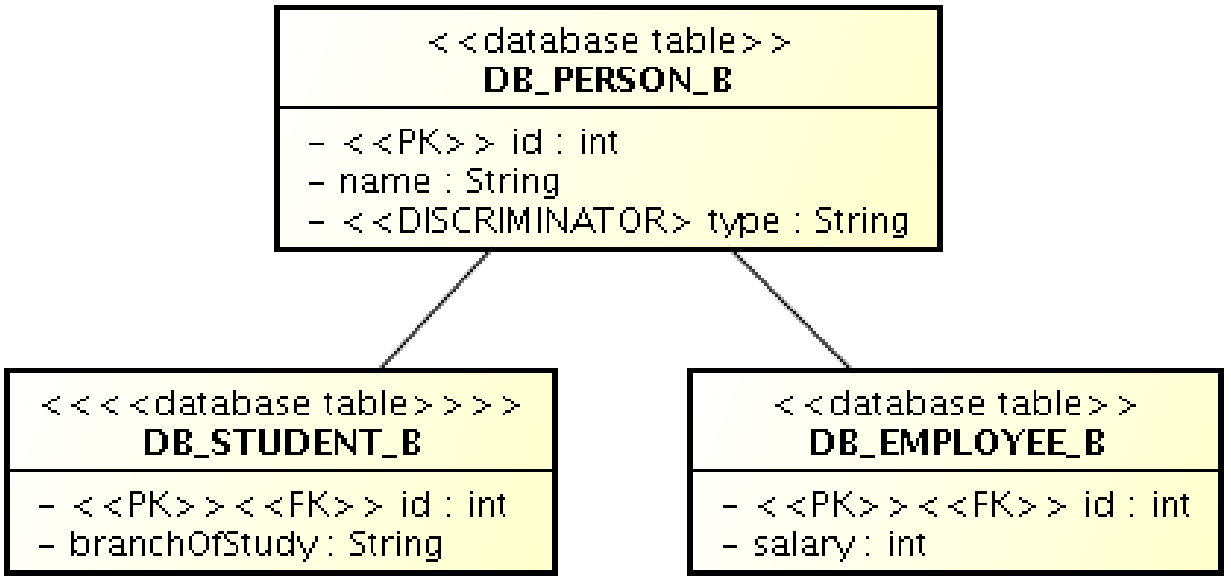


Strategies for inheritance mapping

- Single table

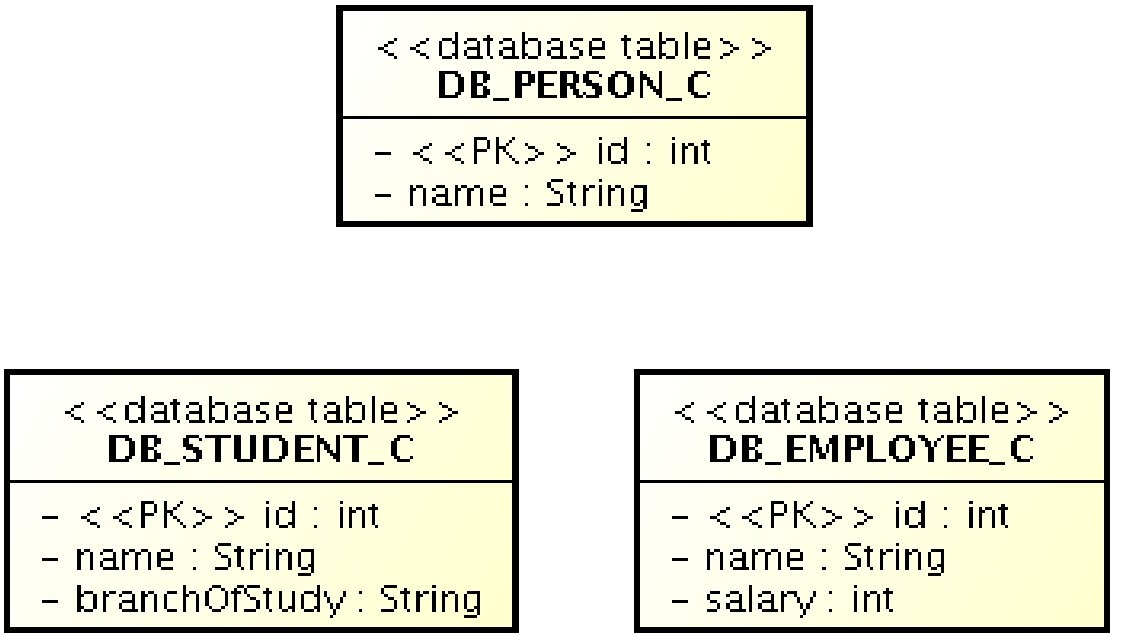


- Joined



Strategies for inheritance mapping

- Table-per-concrete-class



Inheritance mapping
single-table strategy

```
@Entity
@Table(name="DB_PERSON_C")
@Inheritance  //same as @Inheritance(strategy=InheritanceType.SINGLE_TABLE)
@DiscriminationColumn(name="EMP_TYPE")
public abstract class Person { …}

@Entity
@DiscriminatorValue("Emp")
Public class Employee extends Person {…}

@Entity
@DiscriminatorValue("Stud")
Public class Student extends Person {...}
```

Inheritance mapping
joined strategy

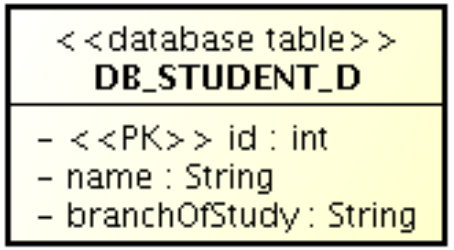
```
@Entity
@Table(name="DB_PERSON_C")
@Inheritance(strategy=InheritanceType.JOINED)
@DiscriminationColumn(name="EMP_TYPE",
                      discriminatorType=discriminatorType.INTEGER)
public abstract class Person { …}

@Entity
@Table(name="DB_EMPLOYEE_C")
@DiscriminatorValue("1")
public class Employee extends Person {…}

@Entity
@Table(name="DB_STUDENT_C")
@DiscriminatorValue("2")
public class Student extends Person {...}
```

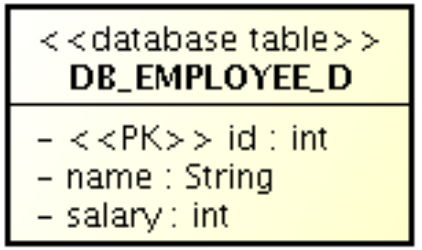
Inheritance mapping
table-per-concrete-class strategy

```
@Entity
@Table(name="DB_PERSON_C")
public abstract class Person { …}

@Entity
@Table(name="DB_EMPLOYEE_C")
@AttributeOverride(name="name", column=@Column(name="FULLNAME"))
@DiscriminatorValue("1")
public class Employee extends Person {…}

@Entity
@Table(name="DB_STUDENT_C")
@DiscriminatorValue("2")
public class Student extends Person {...}
```

Strategies for inheritance mapping

- If Person is not an `@Entity`, but a `@MappedSuperClass`





- If `Person` is not an `@Entity`, neither `@MappedSuperClass`, the deploy fails as the `@Id` is in the `Person` (non-entity) class.

Queries

- JPQL (Java Persistence Query Language)
- Native queries (SQL)

JPQL

JPQL very similar to SQL (especially in JPA 2.0)

```
SELECT p.number
FROM Employee e JOIN e.phones p
WHERE e.department.name = 'NA42' AND p.type = 'CELL'
```

Conditions do not stick on values of database columns, but on entities and their properties.

```
SELECT d, COUNT(e), MAX(e.salary), AVG(e.salary)
FROM Department d JOIN d.employees e
GROUP BY d
HAVING COUNT(e) >= 5
```

JPQL – query parameters

- positional

```
SELECT e
FROM Employee e
WHERE e.department = ?1 AND e.salary > ?2
```

- named

```
SELECT e
FROM Employee e
WHERE e.department = :dept AND salary > :base
```

JPQL – defining a query dynamically

```
@Stateless
public class QueryServiceBean implements QueruService {
   @PersistenceContext(unitName="DynamicQueries")
   EntityManager em;

   public long queryEmpSalary(String deptName, String empName)
   {
      String query = "SELECT e.salary FROM Employee e " +
                     "WHERE e.department.name = '" + deptName +
                     "' AND e.name = '" + empName + "'";
      return em.createQuery(query, Long.class)
                                          .getSingleResult();
   }
```

JPQL – using parameters

```
String QUERY = “SELECT e.salary FROM Employee e “ +
                    “WHERE e.department.name = :deptName “ +
                    “AND e.name = :empName“;

public long queryEmpSalary(String deptName, String empName) {
   return em.createQuery(QUERY, Long.class)
               .setParameter(“deptName“, deptName)
               .setParameter(“empName“, empName)
               .getSingleResult();
}
```

JPQL – named queries

```
@NamedQuery(name="Employee.findByName",
            query="SELECT e FROM Employee e " +
                  "WHERE e.name = :name")
```

```
public Employee findEmployeeByName(String name)  {
   return em.createNamedQuery("Employee.findByName",
                              Employee.class)
                                   .setParameter(„name", name)
                                   .getSingleResult();
}
```

JPQL – named queries

```
@NamedQuery(name="Employee.findByDept",
            query="SELECT e FROM Employee e " +
                  "WHERE e.department = ?1")
```

```
public void printEmployeesForDepartment(String dept)  {
   List<Employee> result =
       em.createNamedQuery("Employee.findByDept",
                           Employee.class)
           .setParameter(1, dept)
           .getResultList();
   int count = 0;
   for (Employee e: result) {
      System.out.println(++count + ":" + e.getName);
   }
}
```

JPQL – pagination

```
private long pageSize    = 800;
private long currentPage = 0;

public List getCurrentResults()  {
   return em.createNamedQuery("Employee.findByDept",
                              Employee.class)
            .setFirstResult(currentPage * pageSize)
            .setMaxResults(pageSize)
            .getResultList();
}

public void next() {
   currentPage++;
}
```

JPQL – bulk updates

Modifications of entities not only by em.persist() or em.remove();

```
em.createQuery("UPDATE Employee e SET e.manager = ?1 " +
                        "WHERE e.department = ?2)
                    .setParameter(1, manager)
                    .setParameter(2, dept)
                    .executeUpdate();
```

```
em.createQuery("DELETE FROM Project p „ +
                  "WHERE p.employees IS EMPTY")
                    .executeUpdate();
```

If REMOVE cascade option is set fro a relationship, cascading remove occurs.

Native SQL update and delete operations should not be applied to tables mapped by an entity (transaction, cascading).

Native (SQL) queries

```
@NamedNativeQuery(
   name="getStructureReportingTo",
   query = "SELECT emp_id, name, salary, manager_id,"+
                  "dept_id, address_id " +
                  "FROM emp ",
   resultClass = Employee.class
)
```

Mapping is straightforward

Native (SQL) queries

```
@NamedNativeQuery(
   name="getEmployeeAddress",
   query = "SELECT emp_id, name, salary, manager_id,"+
                  "dept_id, address_id, id, street, city, " +
                  "state, zip " +
                  "FROM emp JOIN address "
                              "ON emp.address_id = address.id)"
)
```

Mapping less straightforward

```
@SqlResultSetMapping(
   name="EmployeeWithAddress",
   entities={@EntityResult(entityClass=Employee.class),
             @EntityResult(entityClass=Address.class)}
```

Native (SQL) queries

```
Query q = em.createNativeQuery(
        "SELECT o.id AS order_id, " +
            "o.quantity AS order_quantity, " +
            "o.item AS order_item, " +
            "i.name AS item_name, " +
        "FROM Order o, Item i " +
        "WHERE (order_quantity > 25) AND (order_item = i.id)",
    "OrderResults");

    @SqlResultSetMapping(name="OrderResults",
        entities={
            @EntityResult(entityClass=com.acme.Order.class,
        fields={
                @FieldResult(name="id", column="order_id"),
                @FieldResult(name="quantity",
                             column="order_quantity"),
                @FieldResult(name="item",
                             column="order_item")})},
        columns={
            @ColumnResult(name="item_name")}
    )
```