JPA with Hibernate 3.0

Association and Mapping

Lesson Objectives

After completing this lesson, participants will be able to understand:

- What is entity association?
- Different types of entity associations
- What are class inheritance mappings?
- Implementing associations and mapping using JPA

What is Entity Association?

Association represents relationship between entities.

A Java class can contain an object of another class or a set of objects of another class.

There is no directionality involved in relational world, its just a matter of writing a query. But there is notion of directionality which is possible in java.

Hence associations are classified as

- unidirectional
- bidirectional.

6.1: Associations

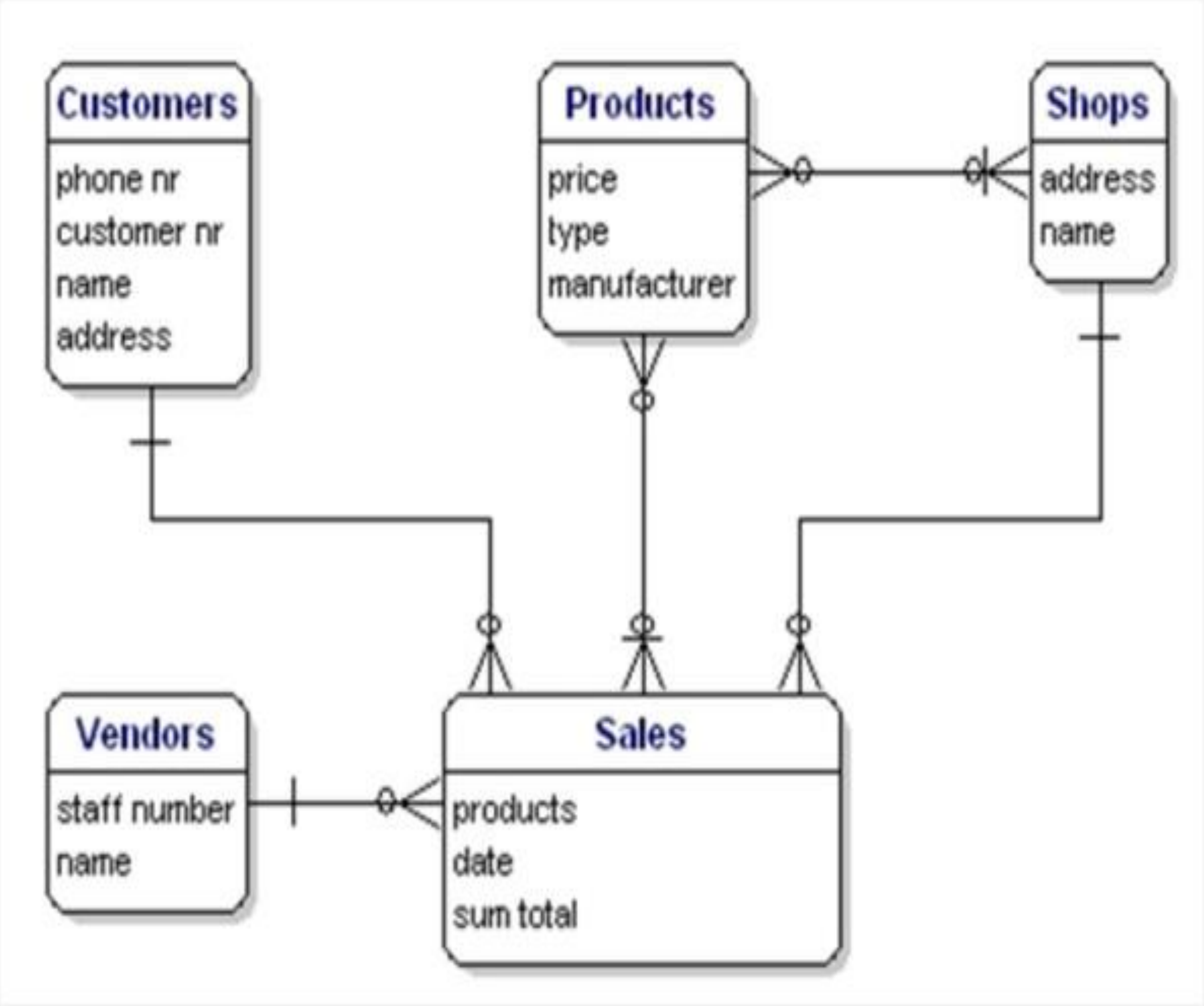
Different types of associations

Unidirectional

- One to One
- One to Many
- Many to Many

Bidirectional

- One to One
- One to Many/Many to One
  - Without Join Table
  - With Join Table

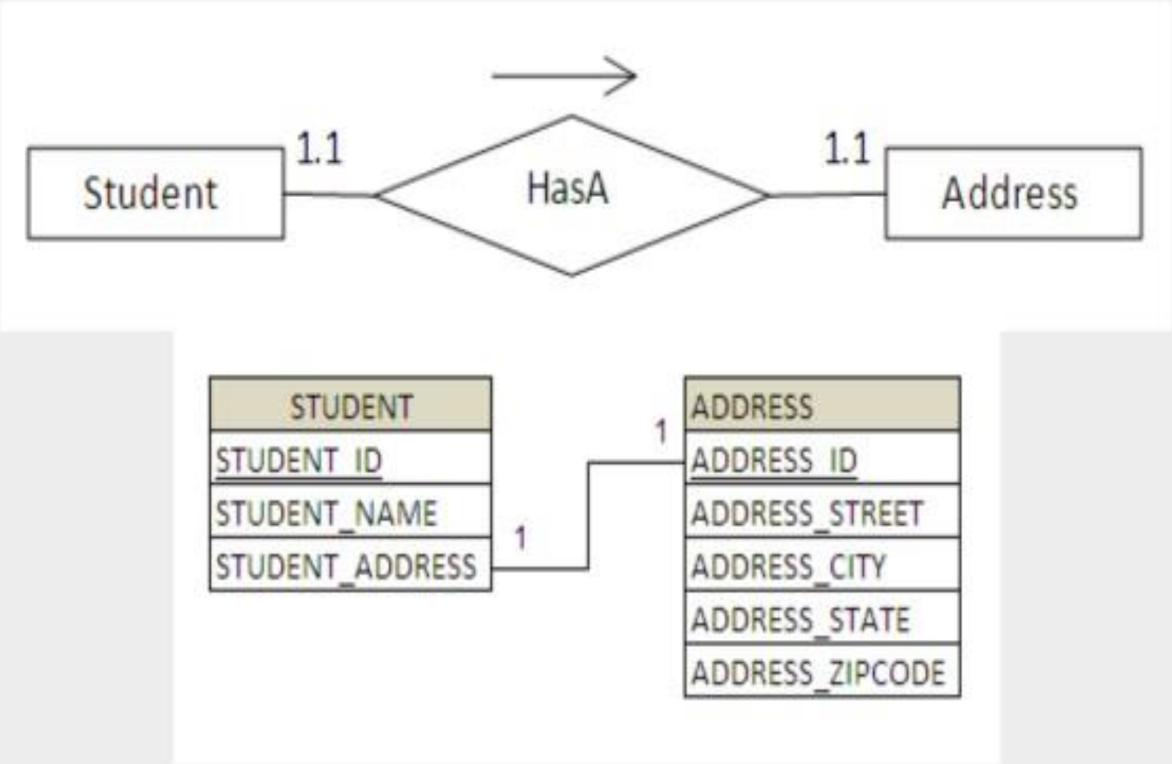


6.1: Associations

Unidirectional one to one

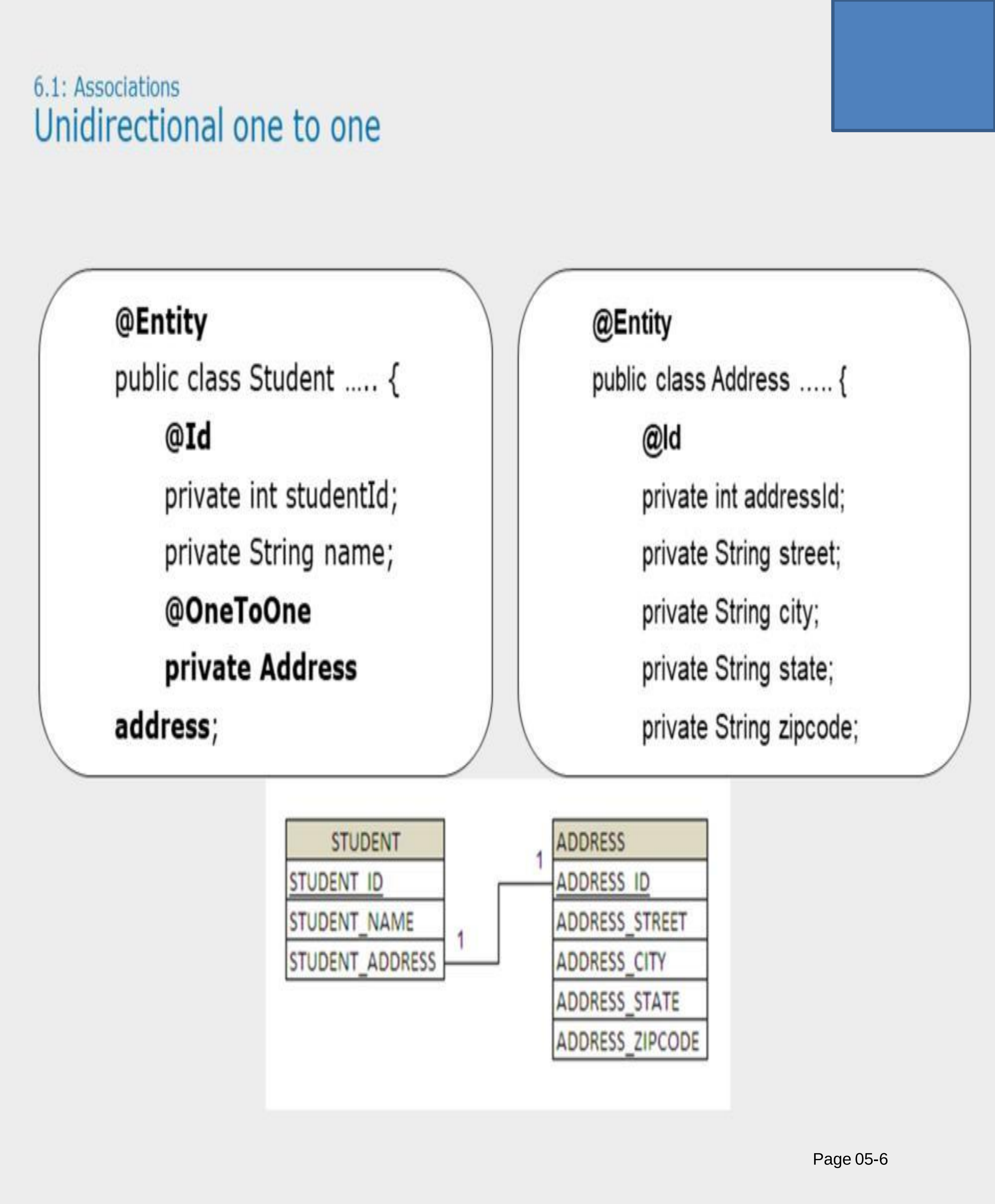
Consider the relationship between Student and his/her permanent address According to the relationship each student should have a unique permanent address.

To create this relationship you need to have a STUDENT and ADDRESS table. The relational model is shown below.



Instructor Notes:

Explain the need of using @JoinColumn in case of associations. Usually, while configuring JPA using annotations, most of the time JPA derives column names based on tables in association.
This may conflict if you have some other column name. For example, If we want to store address reference in student table as address_id, then the @JoinColumn annotation will help.



6.1: Associations

Unidirectional one to one

```
@Entity
public class Student ..... {
    @Id
    private int studentId;
    private String name;
    @OneToOne
    private Address
address;
```

```
@Entity
public class Address ..... {
    @Id
    private int addressId;
    private String street;
    private String city;
    private String state;
    private String zipcode;
```

@OneToOne

Defines a single-valued association to another entity that has one-to-one multiplicity. This annotations can have following optional attributes:

1. **cascade (Optional):** The operations that must be cascaded to the target of the association. i.e. It indicates JPA operations on associated entity along with owner of association.
2. **fetch (Optional)** : Whether the association should be lazily loaded or must be eagerly fetched. i.e. When you fetch Student entity, if you want to load the associated entity (Address) immediately, then you have to mention this attribute with ‘EAGER’. Default is LAZY, means the associated entity (Address) will be loaded when required.

Note: In case of relationship, most of the times associated column name (for example, STUDENT_ADDRESS in STUDENT table) is different and creates confits, to avoid this, JPA provides @JoinColumn annotation.

6.1: Associations

Cascading associated Entities

Cascade attribute is mandatory, whenever we apply relationship between objects, cascade attribute transfers operations done on one object onto its related child objects.

This attribute indicates JPA operations on associated entity along with owner of association. It may take one of the value represented by CascadeType enumeration.

- PERSIST
- MERGE
- REMOVE
- ALL

Cascade Types :

ALL : All cascade operations will be applied to the parent entity’s related entity. All is equivalent to specifying cascade={DETACH, MERGE, PERSIST, REFRESH, REMOVE}

DETACH : If the parent entity is detached from the persistence context, the related entity will also be detached.

MERGE : If the parent entity is merged into the persistence context, the related entity will also be merged.

PERSIST : If the parent entity is persisted into the persistence context, the related entity will also be persisted.

REFRESH :If the parent entity is refreshed in the current persistence context,
the related entity will also be refreshed.

REMOVE :If the parent entity is removed from the current persistence context, the related entity will also be removed.

6.1: Associations

Demo

JPAOneToOneUni

Bidirectional one to one

In this example, one employee can have one address and one address belongs to one employee only. Here, we are using bidirectional association.

In such case, a foreign key is created in the primary table.

Consider the following classes:

```
@Entity
public class Student ..... {
    @Id
    private int studentId;
    private String name;
    @OneToOne
    private Address address;
```

```
@Entity
public class Address ..... {
    @Id
    private int addressId;
    private String street;
    private String zipcode;
    @OneToOne(mappedBy="address")
    private Student student;
```

The direction of a relationship can be either bidirectional or unidirectional. A bidirectional relationship has both an **owning side** and an **inverse side**. A unidirectional relationship has only an owning side. The owning side of a relationship determines how the Persistence runtime makes updates to the relationship in the database.

In a bidirectional relationship, each entity has a relationship field or property that refers to the other entity. Through the relationship field or property, an entity class's code can access its related object. If an entity has a related field, the entity is said to "know" about its related object. Such relationship field must be marked with **mappedBy** attribute.

The inverse side of a bidirectional relationship must refer to its owning side by using the mappedBy element of the @OneToOne, @OneToMany, or @ManyToMany annotation.

Demo

JPAOneToOneBI

6.1: Associations

Bidirectional one to many

In a one to many/many to one association, a one class contains a collection of other class object and the second class has an object of the first.

Consider following classes:

```
@Entity
public class Employee ….. {
        @Id
        private int id;
        private String name;
        @ManyToOne
        @JoinColumn(name="dept_
no")
        private Department
department ;
```

```
@Entity
public class Department ….. {
        @Id
        private int id;
        private String name;
        @OneToMany(mappedBy="departme
nt")
        private Set<Employee>  employees;
```

Slide example shows association between Department and its Employees. As one department can have many employees, we need to use @OneToMany annotation to represent this relationship. Therefore we need to use any type of collection as per given requirement. As department cannot have duplicate employees, so slide example uses Set<Employee> collection to store employees.

Note: The many side of many-to-one bidirectional relationships must not define the mappedBy element. The many side is always the owning side of the relationship. As shown in the slide, the Employee is owning side of the relationship.

6.1: Associations

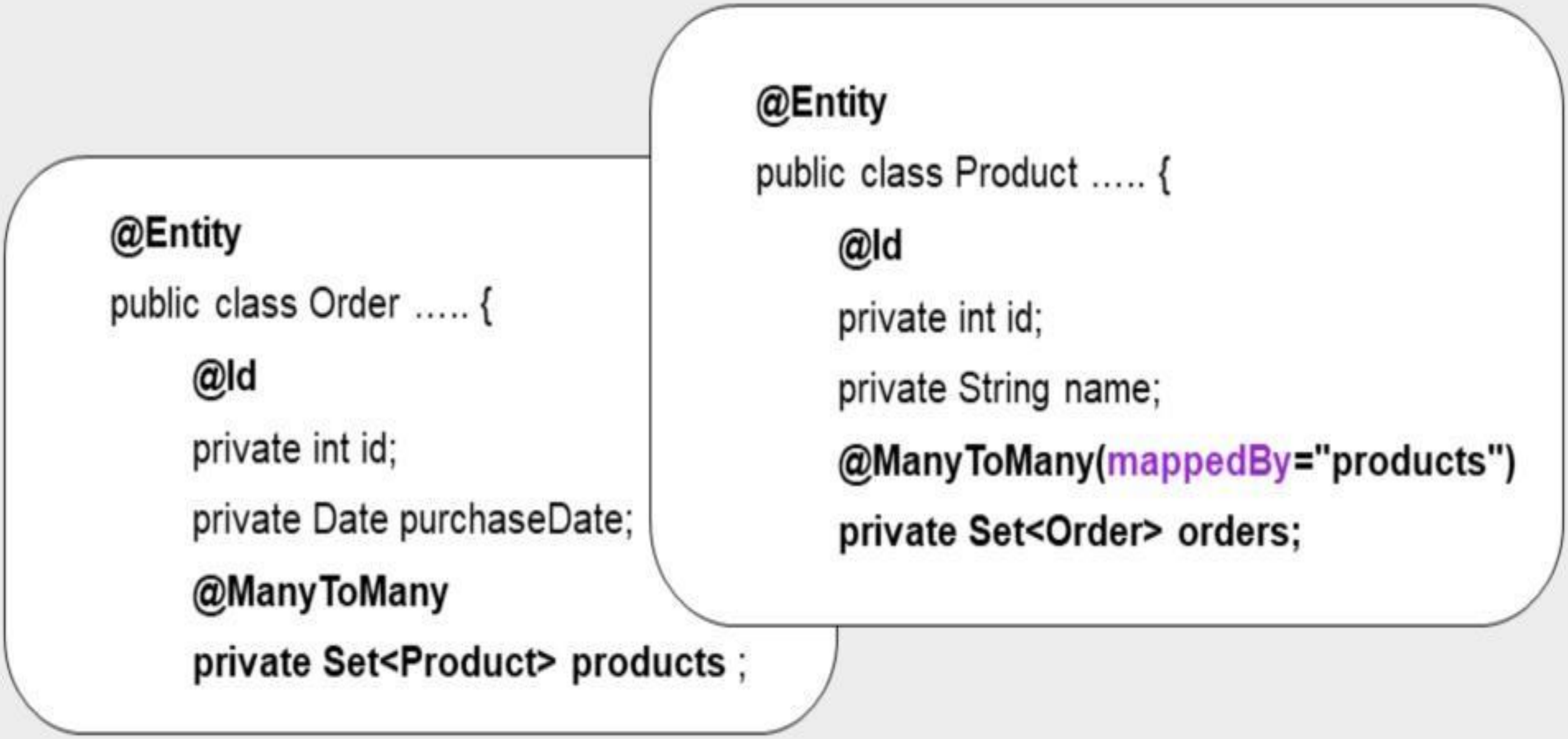
Demo

JPAOneToManyBI

6.1: Associations

Bidirectional Many to many using Join Table

In the below example, an order can have any number of products and also product can be part of multiple orders.



```
@Entity
public class Order ..... {
        @Id
        private int id;
        private Date purchaseDate;
        @ManyToMany
        private Set<Product> products ;
```

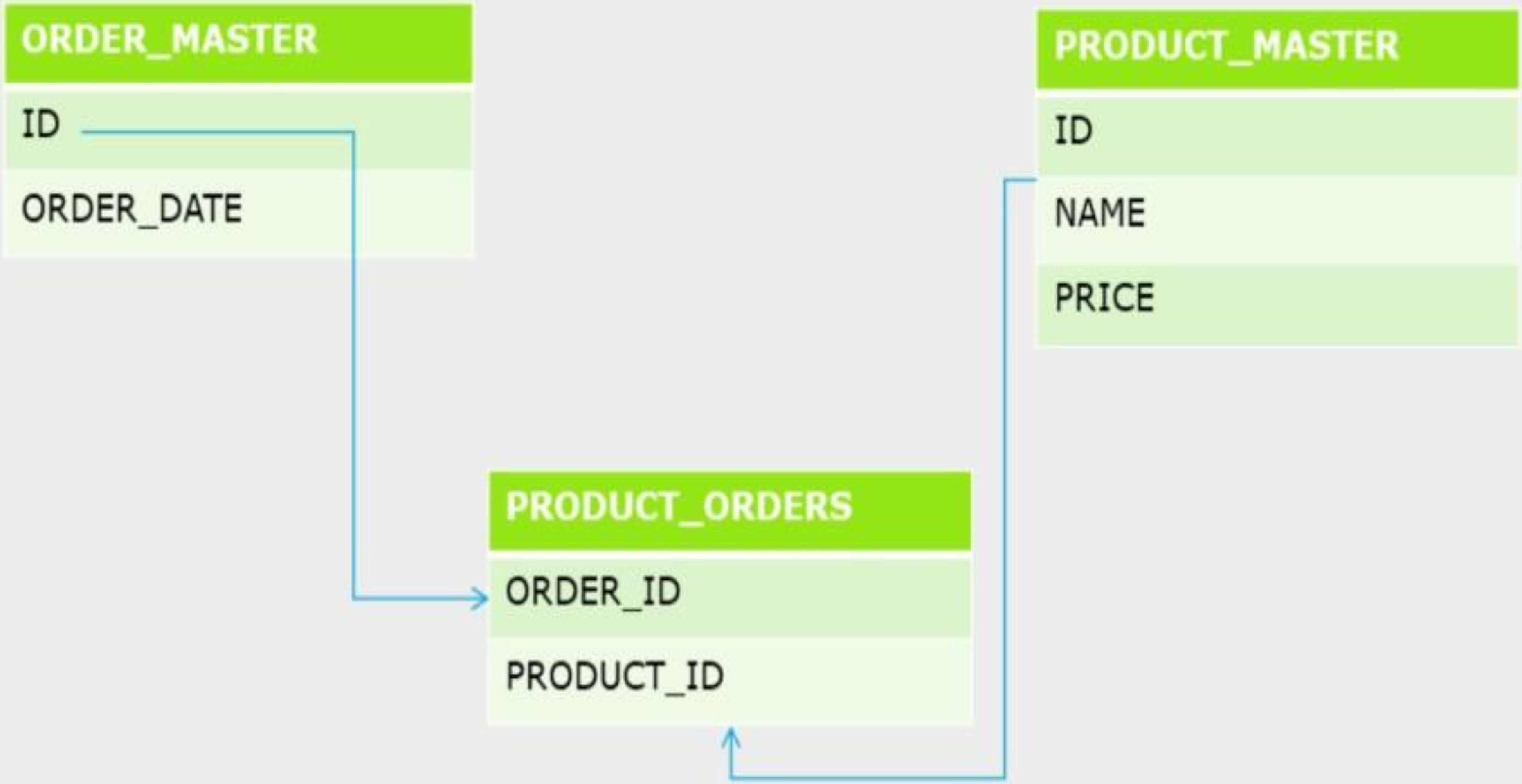
```
@Entity
public class Product ..... {
        @Id
        private int id;
        private String name;
        @ManyToMany(mappedBy="products")
        private Set<Order> orders;
```

For many-to-many bidirectional relationships, either side may be the owning side. For the given example, Order acts as owning side of the relationship.

6.1: Associations

Bidirectional Many to many using Join Table

In database data of products and orders can be stored using Join table.



ORDER_MASTER
- ID
- ORDER_DATE

PRODUCT_MASTER
- ID
- NAME
- PRICE

PRODUCT_ORDERS
- ORDER_ID
- PRODUCT_ID

To store data of many to many relationship, join table can be used. As shown in slide, the orders stored in ORDER_MASTER table, products stored in PRODUCT_MASTER and there association is stored in PRODUCT_ORDERS.

To implement the above relationship with join table, JPA allows owning side of relationship to describe join table using @JoinTable annotation. For example,

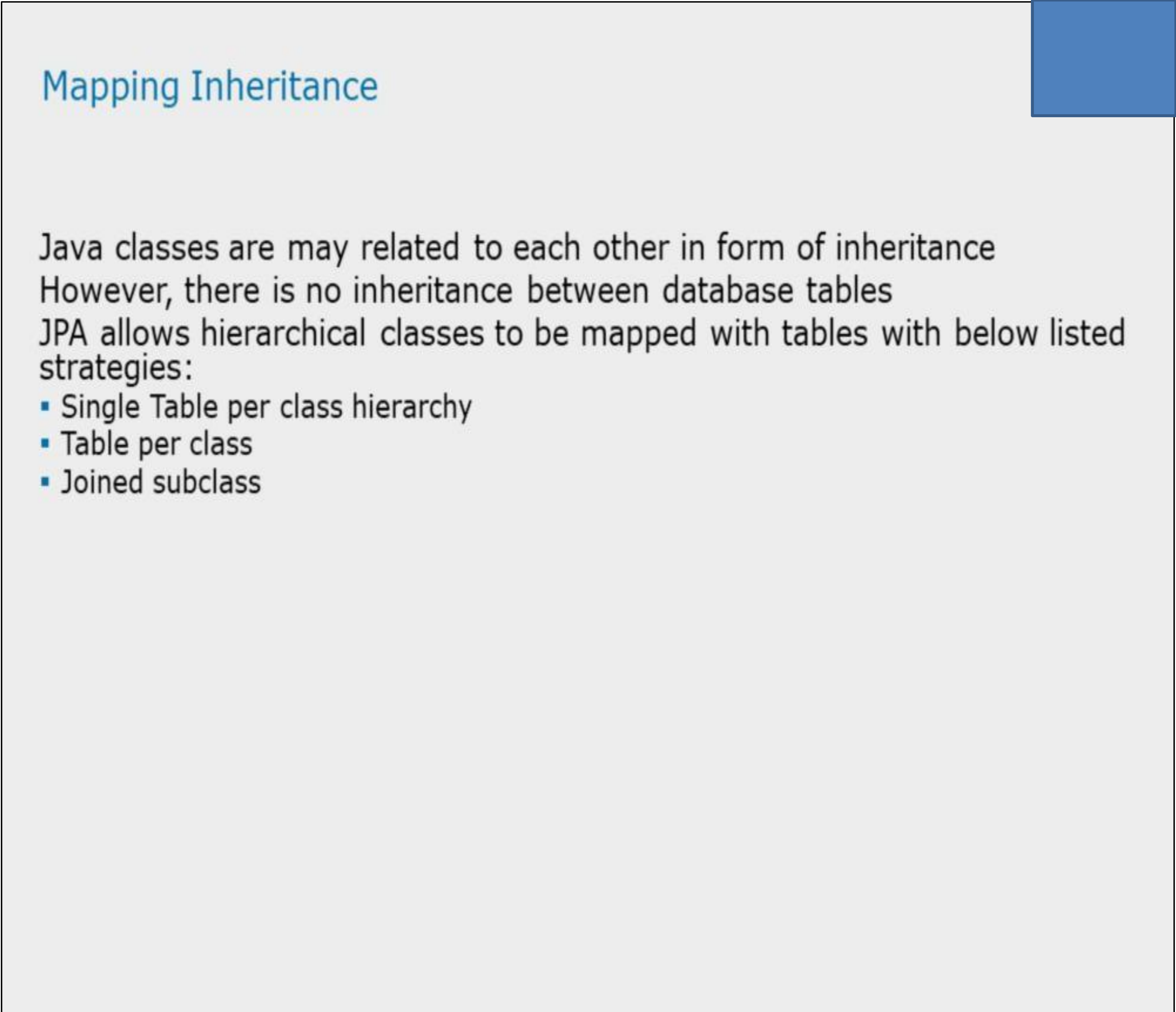
```
@ManyToMany(cascade = CascadeType.ALL)
@JoinTable(name = "product_orders",
            joinColumns = { @JoinColumn(name = "order_id") },
            inverseJoinColumns = { @JoinColumn(name =
"product_id") } )
private Set<Product> products = new HashSet<>();
```

@JoinTable: This annotation is used to describe join table properties. It has three attributes:

1. **name:** Name of the join table
2. **joinColumns:** Join column name for owning side i.e. order table
3. **inverseColumns:** Join column name for inverse side. i.e. product table.

Demo

JPAManyToManyBI



Mapping Inheritance

Java classes are may related to each other in form of inheritance

However, there is no inheritance between database tables

JPA allows hierarchical classes to be mapped with tables with below listed strategies:

- Single Table per class hierarchy
- Table per class
- Joined subclass

Three ways of handling inheritance

1.Single table per class hierarchy
(InheritanceType.SINGLE_TABLE)

2.Table per concrete entity class
(InheritanceType.TABLE_PER_CLASS)

3.“join” strategy, where fields or properties that are specific to a subclass are mapped to a different table than the fields or properties that are common to the parent class (InheritanceType.JOINED)

Let us explore each in detail.

6.2: Inheritance

Single Table per Class Hierarchy

In this strategy, a single table is created for all classes in the inheritance hierarchy.

It uses additional column called discriminator to distinguish the object of child classes

The value in discriminator column is used to identify rows belonging to subclasses

Single Table per Class Hierarchy:

In this strategy, only one database table is created for all subclasses. It is de- normalized table has columns for all attributes.

JPA Mapping Configuration:

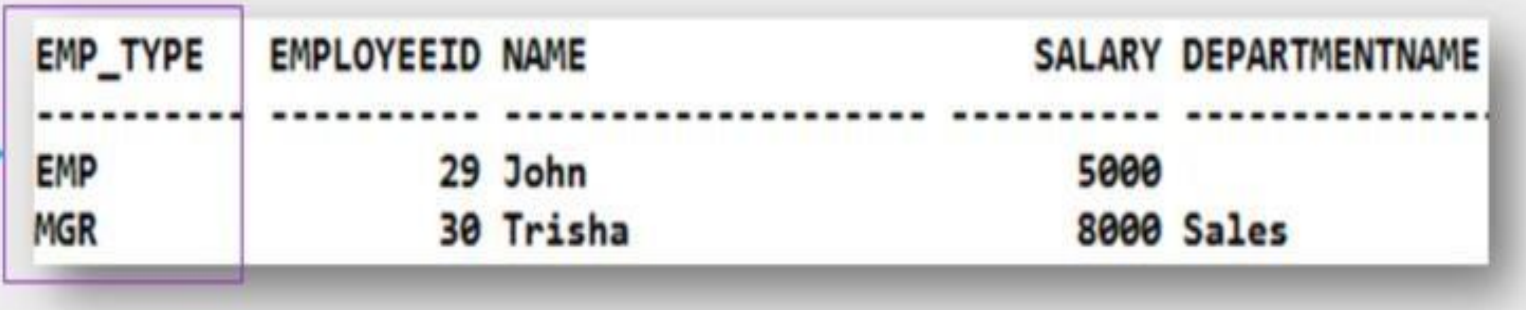
Single annotation @Inheritance with InheritanceType strategy required only on superclass. Also use '@DiscriminatorColumn' to define discriminator column and it data type, which later will be used to differentiate parent and child rows.

Note: Each class in hierarchy can provide optional discriminator value for its own objects rows. This is done by using @DiscriminatorValue annotation.

Single Table per Class Hierarchy

```
@Entity
@Inheritance(strategy=InheritanceType.SINGLE_TABLE)
public class Employee ..... {
    @Id
    private int id;
    private String name;
    private double salary;
```

```
@Entity
public class Manager extends Employee {
    private String departmentName;
```



```
EMP_TYPE  EMPLOYEEID NAME                   SALARY DEPARTMENTNAME
--------- ---------- -------------------- ---------- --------------
EMP               29 John                     5000
MGR               30 Trisha                   8000 Sales
```

Discriminator Column

Advantages

1. It is the fastest of all inheritance models
2. Since it does not requires a join to retrieve a persistent instance from the database.
3. Persisting or Updating a persistent instance requires only a single INSERT
or UPDATE statement.

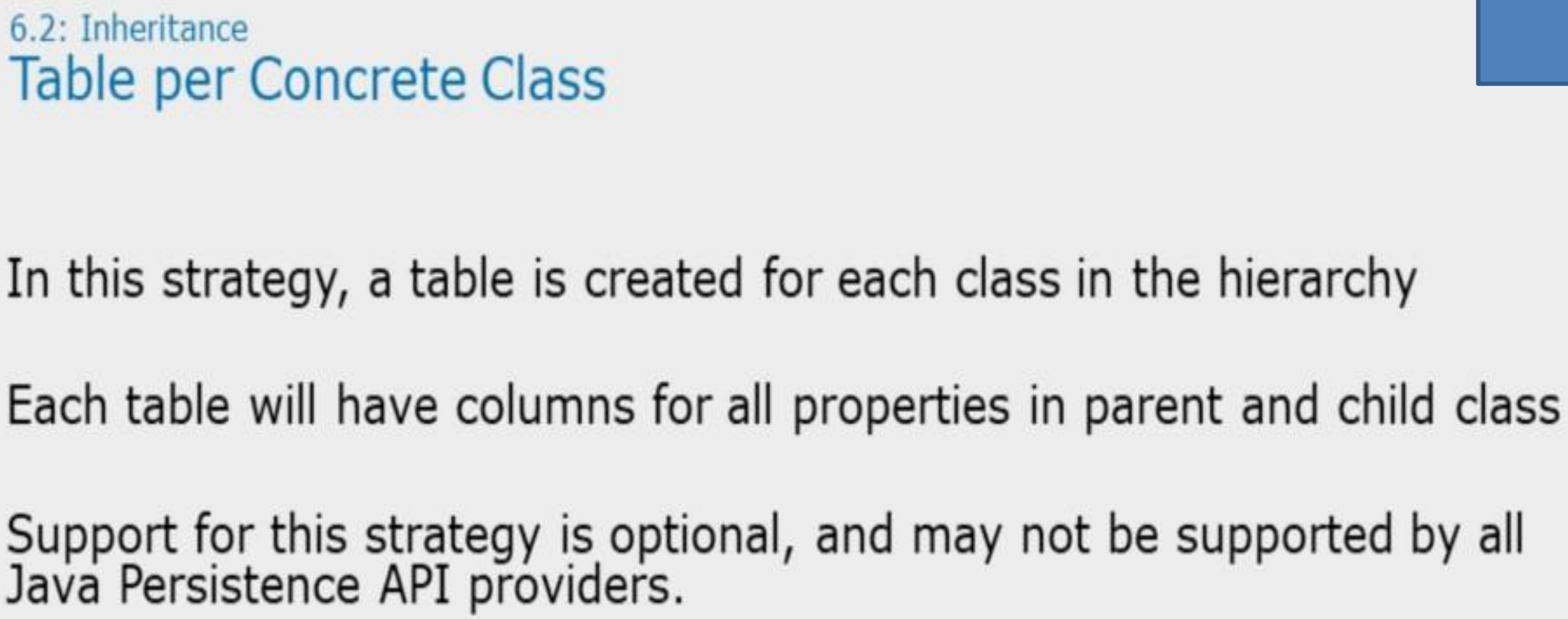
Disadvantages

1. The larger the inheritance model gets, the "wider" the mapped table gets, in that for every field in the entire inheritance hierarchy, a column must exist in the mapped table. This may have undesirable consequence on the database size, since a wide or deep inheritance hierarchy will result in tables with many mostly-empty columns.

6.2: Inheritance

Demo

JPASTInheritance



6.2: Inheritance

Table per Concrete Class

In this strategy, a table is created for each class in the hierarchy

Each table will have columns for all properties in parent and child class

Support for this strategy is optional, and may not be supported by all Java Persistence API providers.

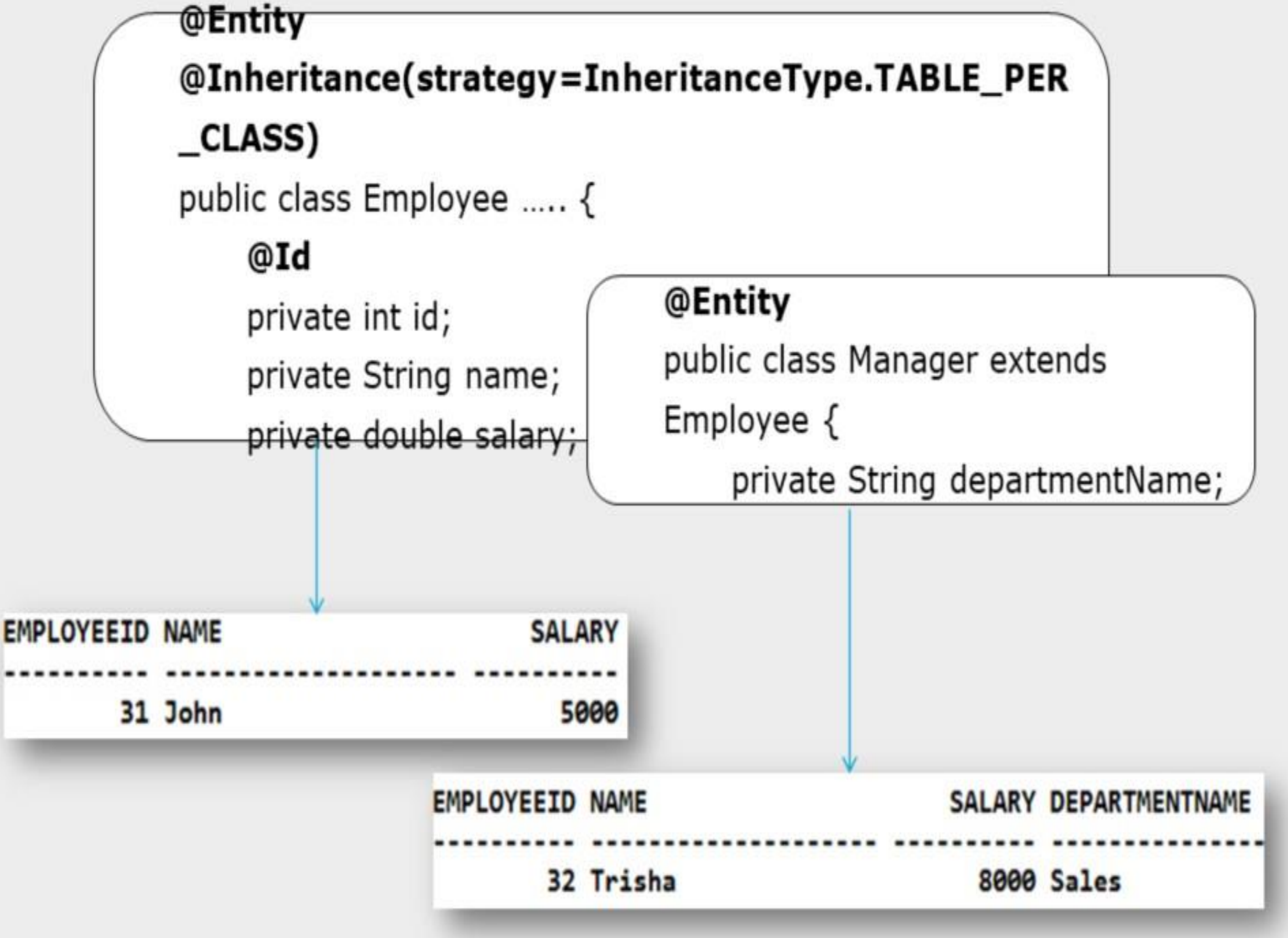
Table per concrete class:

In this inheritance strategy, one database table will be created for the superclass AND one per subclass.

Subclass tables have their object-specific columns along with shared columns from superclass table.

6.2: Inheritance

Table per Concrete Class



```
@Entity
@Inheritance(strategy=InheritanceType.TABLE_PER
_CLASS)
public class Employee ….. {
    @Id
    private int id;
    private String name;
    private double salary;
```

```
@Entity
public class Manager extends
Employee {
    private String departmentName;
```

```
EMPLOYEEID NAME                    SALARY
---------- ------------------ ----------
        31 John                     5000
```

```
EMPLOYEEID NAME                    SALARY DEPARTMENTNAME
---------- ------------------ ---------- --------------
        32 Trisha                   8000 Sales
```

Advantages:

1. This is the easiest method of Inheritance mapping to implement.

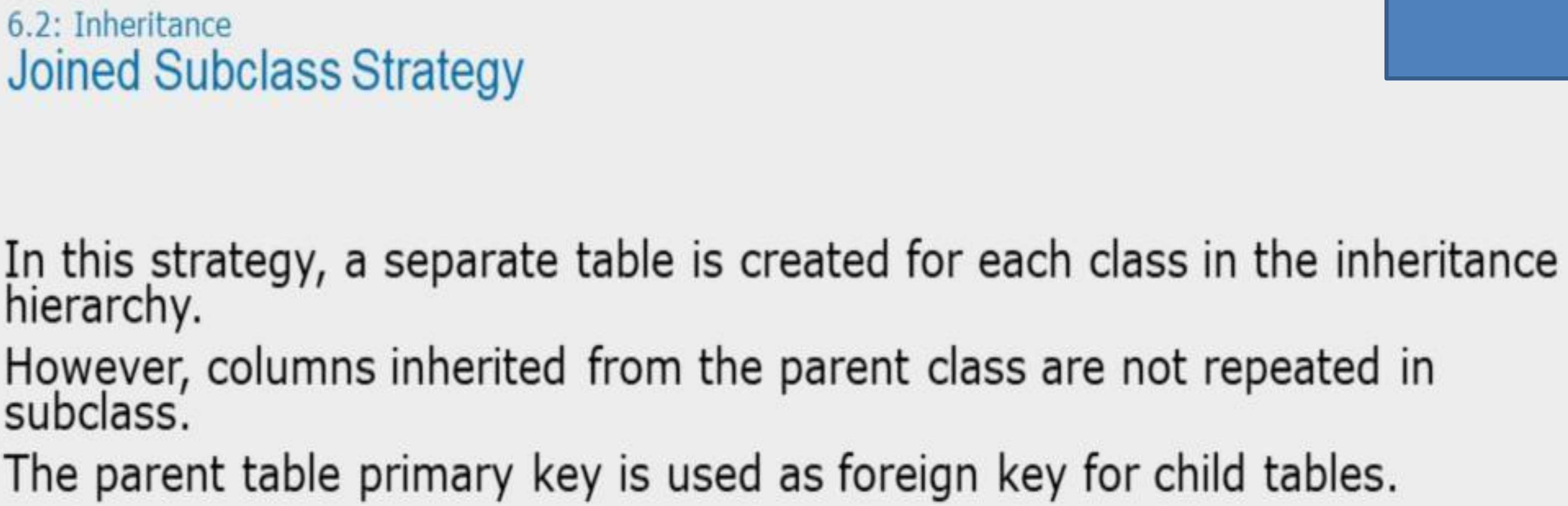
Disadvantages:

1. Data that belongs to a parent class is scattered across a number of subclass tables, which represents concrete classes.
2. This hierarchy is not recommended for most cases.
3. Changes to a parent class is reflected to large number of tables
4. A query couched in terms of parent class is likely to cause a large number of select operations

6.2: Inheritance

Demo

JPATPCInheritance



6.2: Inheritance

Joined Subclass Strategy

In this strategy, a separate table is created for each class in the inheritance hierarchy.

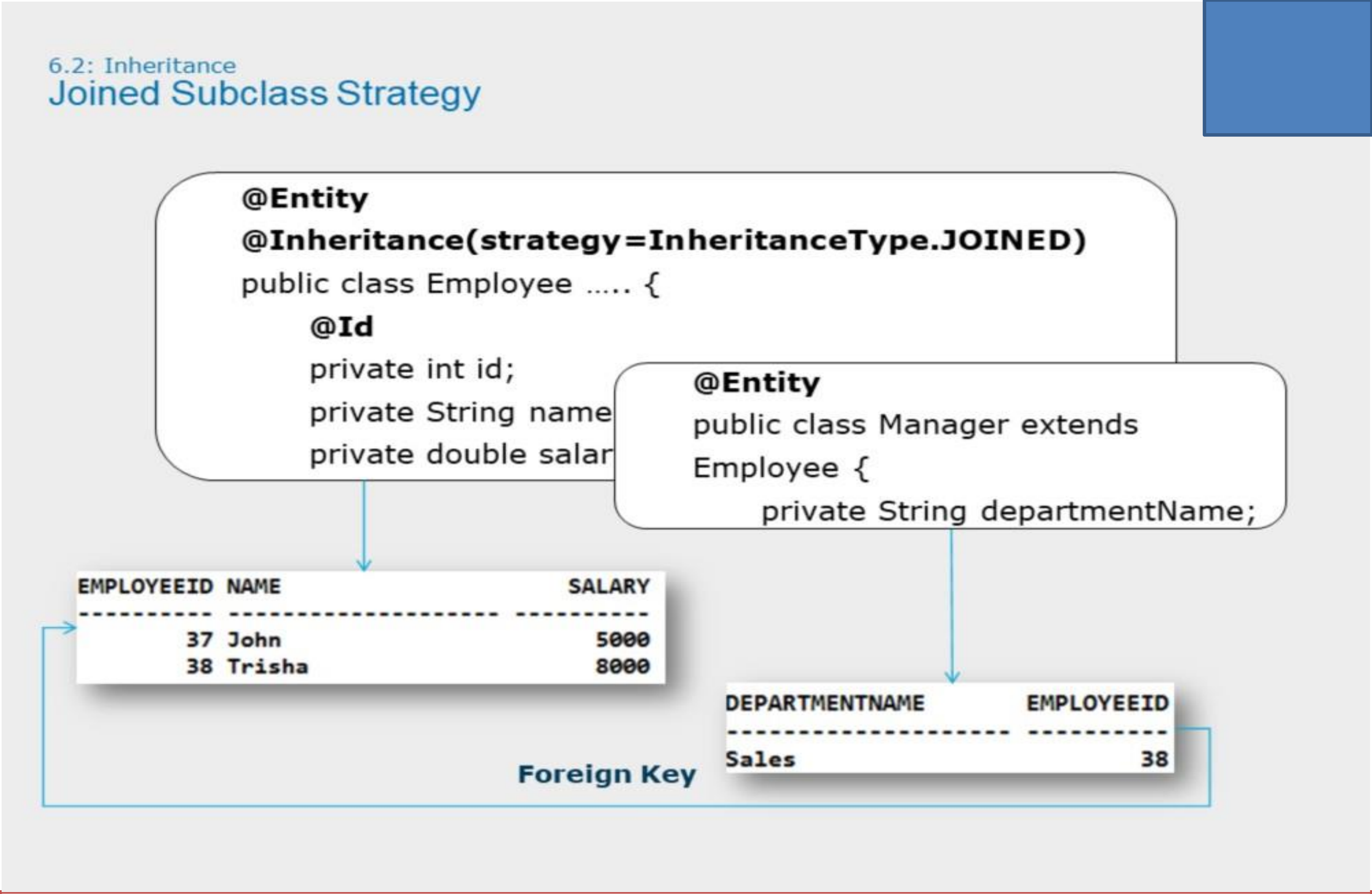
However, columns inherited from the parent class are not repeated in subclass.

The parent table primary key is used as foreign key for child tables.

Joined Subclass Hierarchy:

In this inheritance strategy, one database table will be created for the superclass AND one per subclass.

Subclass tables have their object-specific columns along with a foreign key column referring primary key of Superclass.



6.2: Inheritance

Joined Subclass Strategy

```
@Entity
@Inheritance(strategy=InheritanceType.JOINED)
public class Employee ….. {
    @Id
    private int id;
    private String name
    private double salar
```

```
@Entity
public class Manager extends
Employee {
    private String departmentName;
```

```
EMPLOYEEID NAME                     SALARY
---------- -------------------- ----------
        37 John                       5000
        38 Trisha                     8000
```

```
DEPARTMENTNAME       EMPLOYEEID
-------------------- ----------
Sales                        38
```

Advantages

1. Using joined subclass tables results in the most normalized database schema, meaning the schema with the least spurious or redundant data.

Disadvantages

1. Retrieving any subclass requires one or more database joins, and storing subclasses requires multiple INSERT or UPDATE statements.

6.2: Inheritance

Demo

JPAJSInheritance

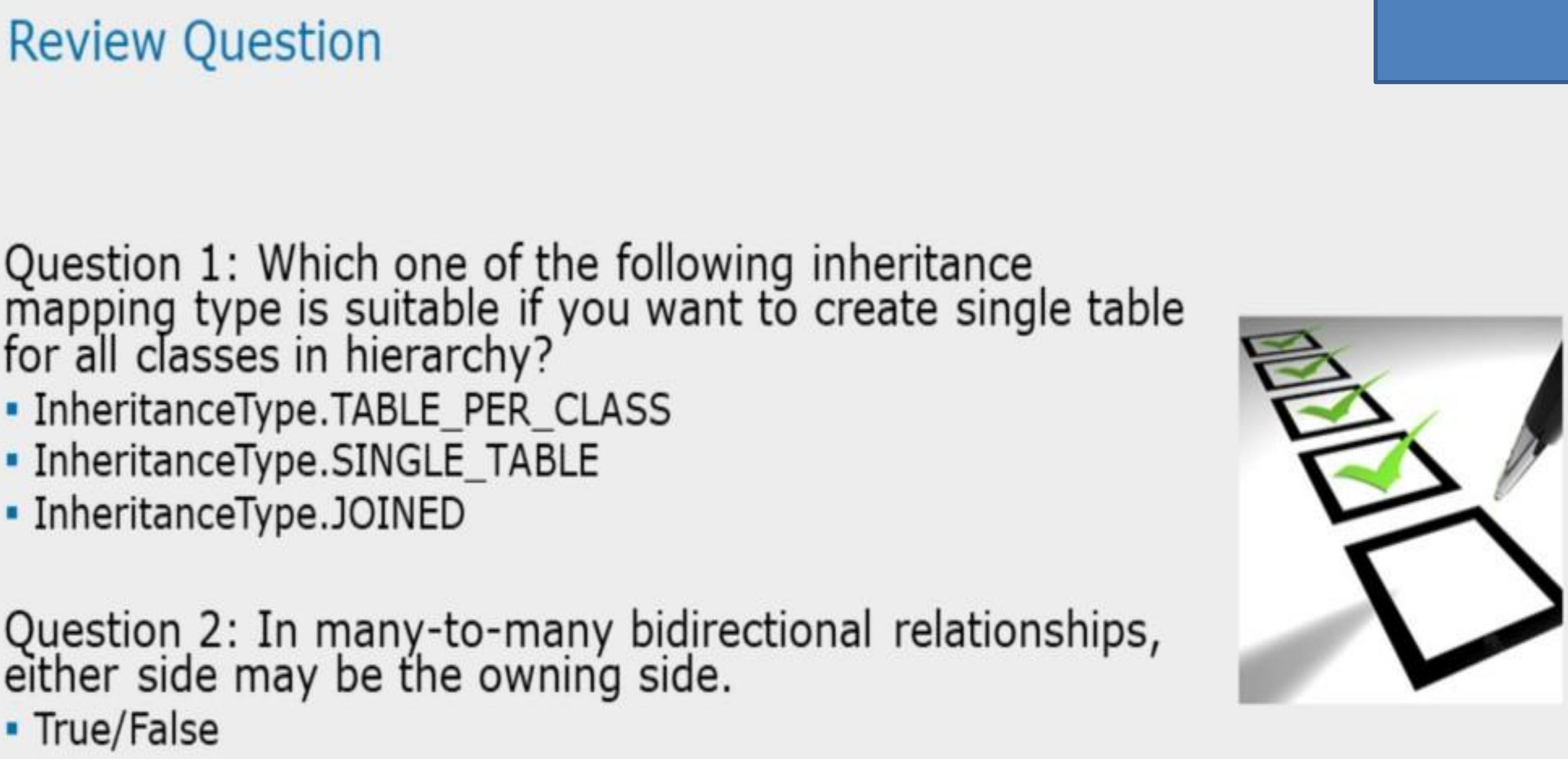
Lab

Associations and Mapping

Summary

In this lesson, you have learnt:

- Entity associations and inheritance mapping
- Implementing associations and inheritance using JPA



Review Question

Question 1: Which one of the following inheritance mapping type is suitable if you want to create single table for all classes in hierarchy?

- InheritanceType.TABLE_PER_CLASS
- InheritanceType.SINGLE_TABLE
- InheritanceType.JOINED

Question 2: In many-to-many bidirectional relationships, either side may be the owning side.

- True/False

Answers:

1.InheritanceType.SINGLE_TABLE

2. True