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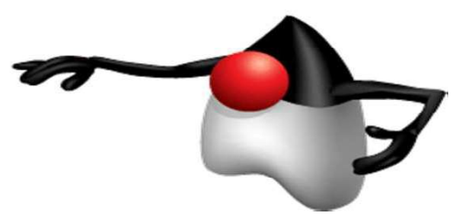
Developing Persistence Layer with JPA Entities

Objectives

After completing this lesson, you should be able to do the following:

- What are JPA Entities?
- Domain Modeling with JPA
- Creating an Entity (a POJO with annotations)
- Specifying Object Relational (OR) Mapping
- Mapping Relationships between Entities
- Inheritance Mapping Strategy (Singe Table, Joined Subclass)



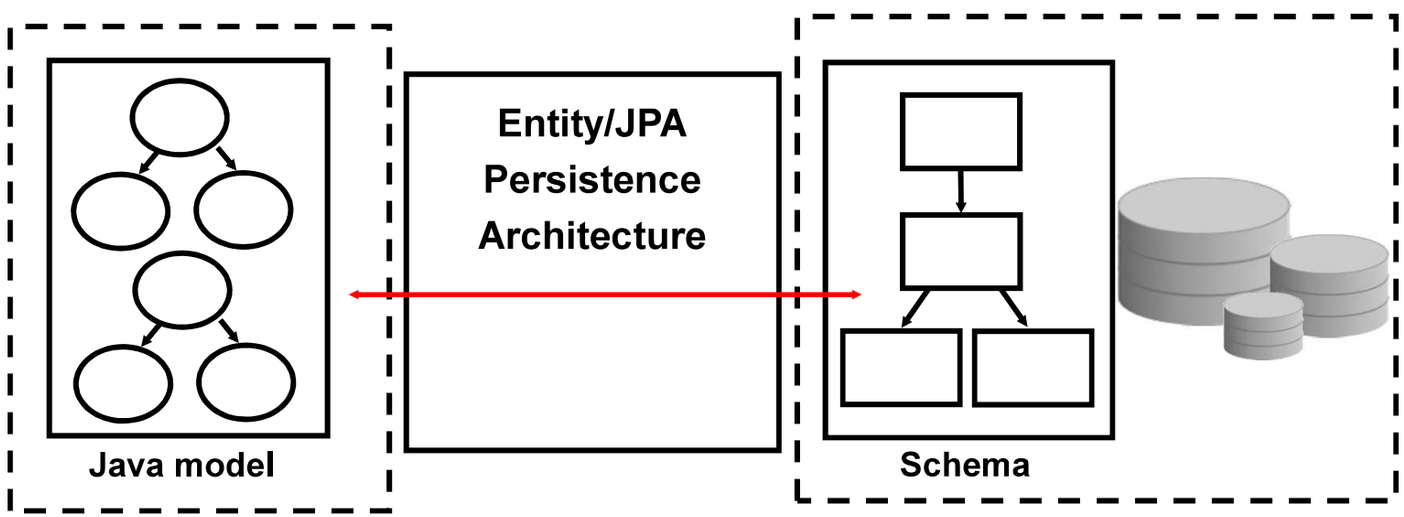
What Is Persistence?

The persistence layer provides mapping between objects and database tables.

- This layer:
  - Enables portability across databases and schemas
  - Supports read, write, and caching capabilities
  - Protects developers from database issues
  - Facilitates change and maintenance
  - Should be used in any application that has an object model

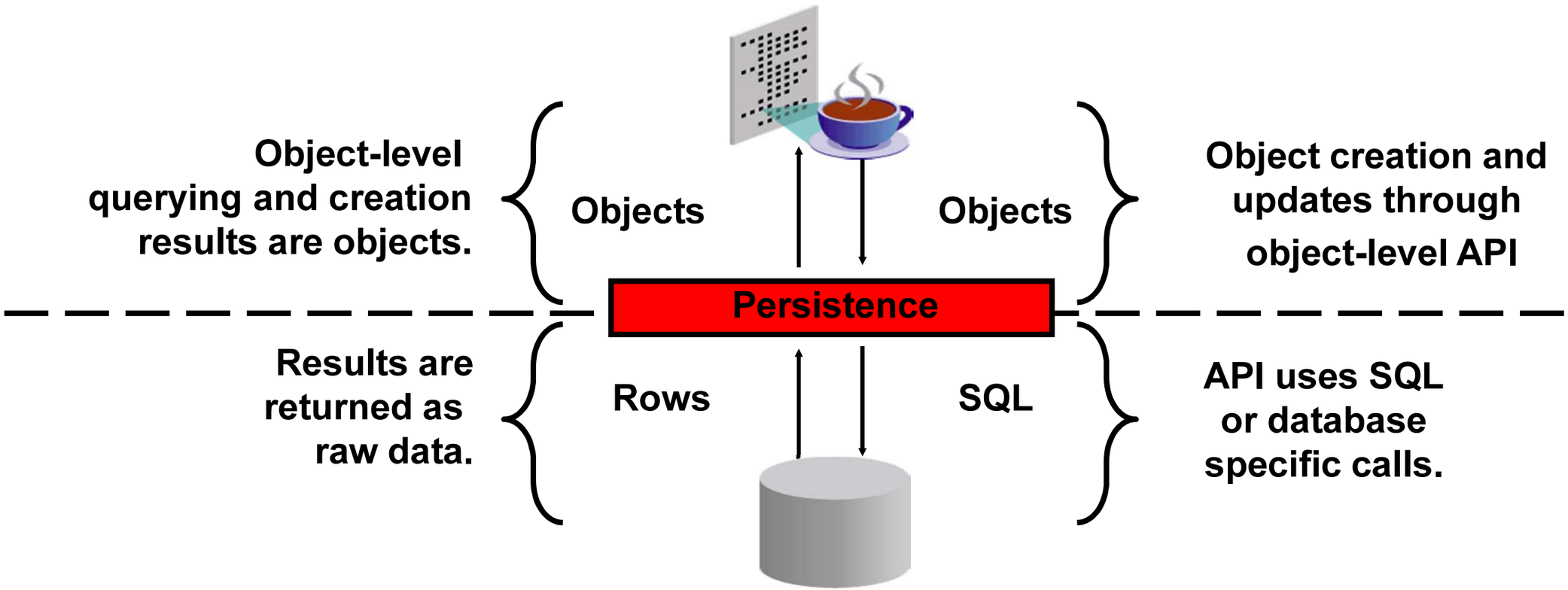
Persistence: Overview

- Mapping relational database objects to Java objects enables easy Java EE application development.
- Frameworks such as EJB 3.0 JPA provide this object-relational mapping.



Persistence Layer

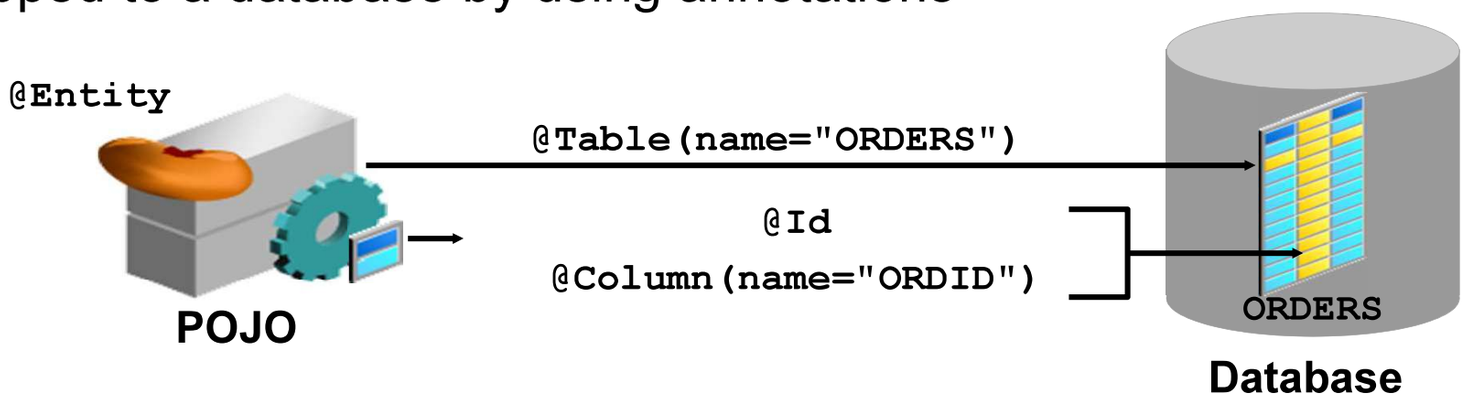
A persistence layer abstracts persistence details from the application layer.



What Are JPA Entities?

A Java Persistence API (JPA) entity is:

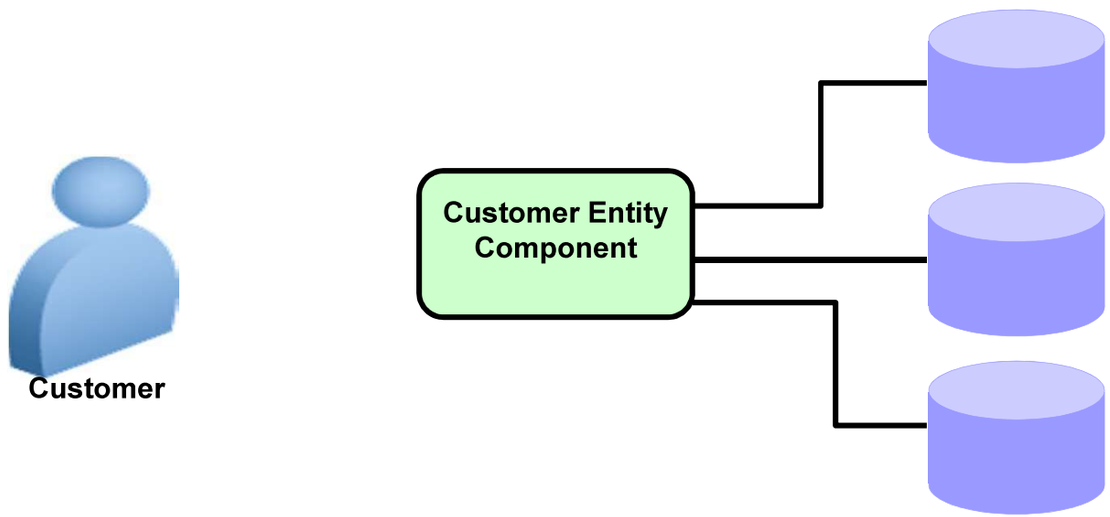
- A lightweight object that manages persistent data
- Defined as a Plain Old Java Object (POJO) marked with the `@Entity` annotation (no interfaces required)
- Not required to implement interfaces
- Mapped to a database by using annotations



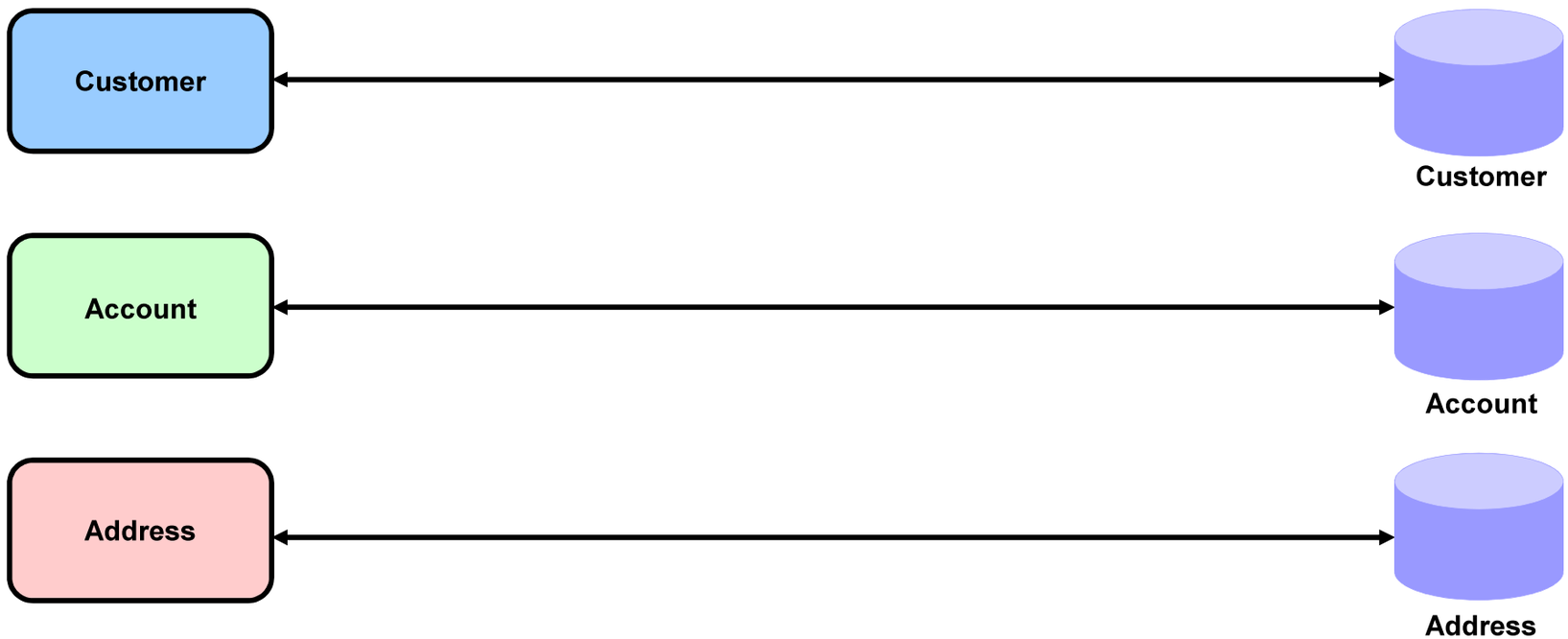
Object Relational Mapping

Object-relational mapping (ORM) software:

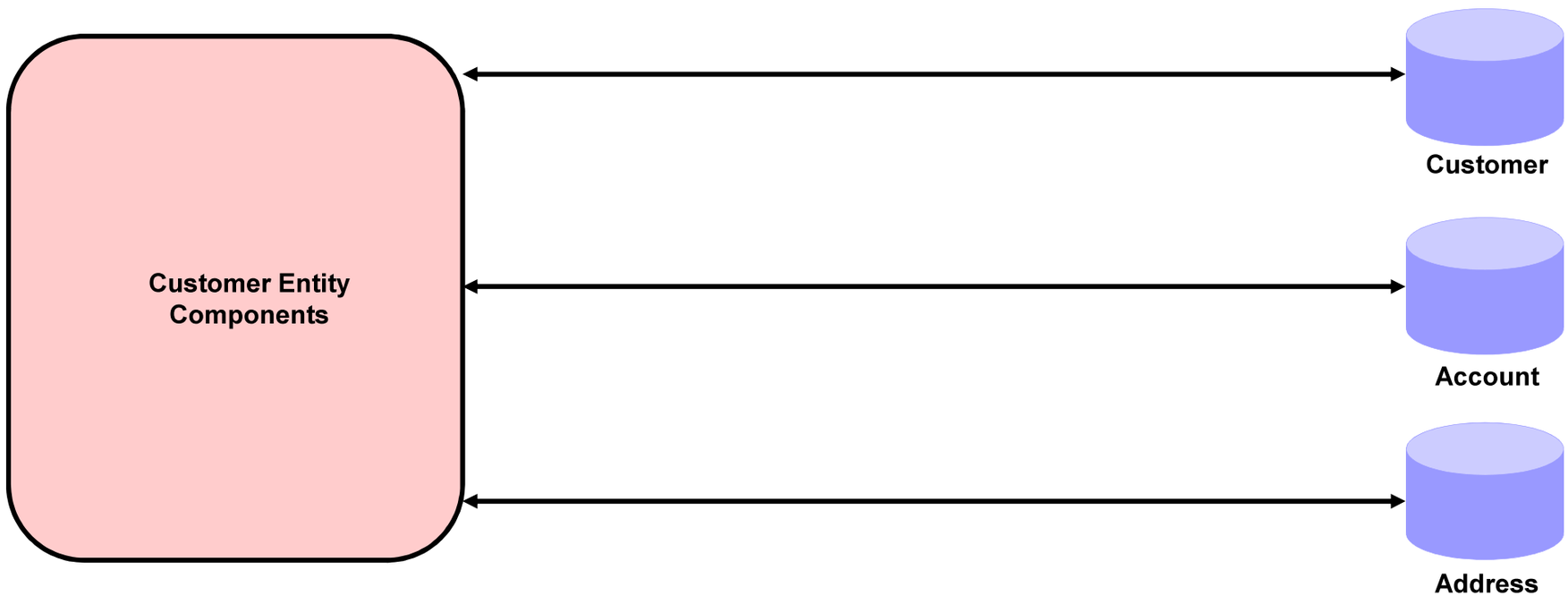
- Provides an object-oriented view of the database
- Examples include EclipseLink and Hibernate



Normalized Data Mapping



Use of an Entity Component Across a Set of Database



JPA entity

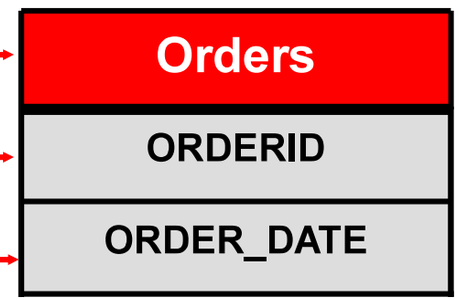
```
@Entity

@Table(name="Orders")

public class Orders {

@Id
@Column(name="ORDERID")
int orderId;

@Column(name="ORDER_DATE")
Date orderDate;
…
}
```



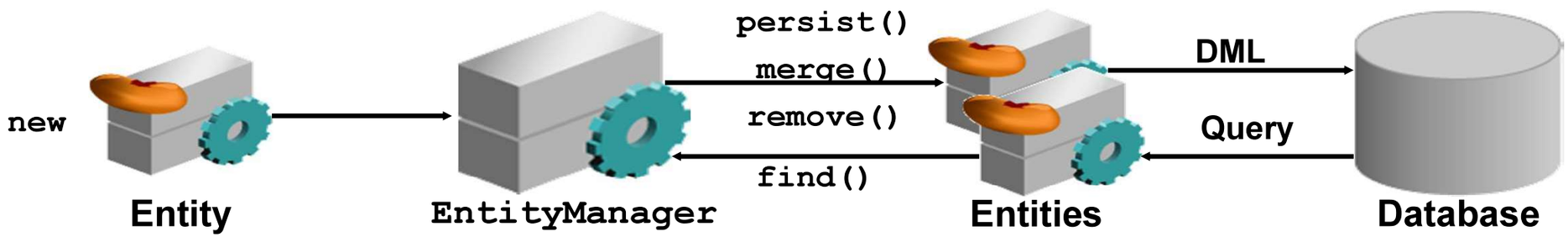
Database table

Domain Modeling with Entities

- Entities support standard object-oriented domain modeling techniques:
  - Inheritance
  - Encapsulation
  - Polymorphic relationships
- Entities can be created with the `new` operator.

Managing Persistence of Entities

- The life cycle of an entity is managed by using the `EntityManager` interface, which is part of the JPA.
- An entity can be created by using:
  - The `new` operator (creates detached instance)
  - The `EntityManager` Query API (synchronized with the database)
- An entity is inserted, updated, or deleted from a database through the `EntityManager` API.



Declaring an Entity

- Declare a new Java class with a no-arg constructor.
- Annotate it with `@Entity`.
- Add fields corresponding to each database column:
  - Add setter and getter methods.
  - Use the `@Id` annotation on the primary key getter method.

```
@Entity                          // annotation
public class Customer implements java.io.Serializable {
  private int customerID;
  private String name;

  public Customer() { ... }  // no-arg constructor
  @Id                            // annotation
  public int getCustomerID() { ... }
  public void setCustomerID(int id) { ... }
  public String getName() { ... }
  public void setName(String n) { ... }
}
```

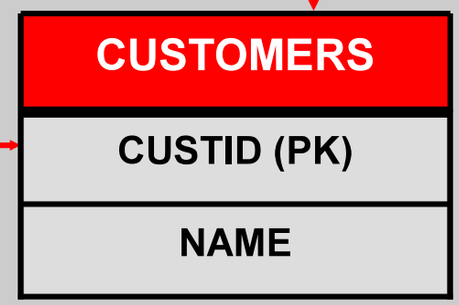
Mapping Entities

Mapping of an entity to a database table is performed:

- By default
- Explicitly using annotations or in an XML deployment descriptor

```
@Entity
@Table(name="CUSTOMERS")
public class Customer implements java.io.Serializable {

  @Id
  @Column(name="CUSTID")
  private int customerID;
  private String name;
  …
  public int getCustomerID() { ... }
  public void setCustomerID(int id) { ... }
  public String getName() { ... }
  public void setName(String n) { ... }
}
```



Quiz

An entity is a lightweight persistence domain object that represents:

1. A relational database
2. A table in a relational database
3. Entity beans in EJB 2.x specification
4. Persistence data in a file

Specifying Entity Identity

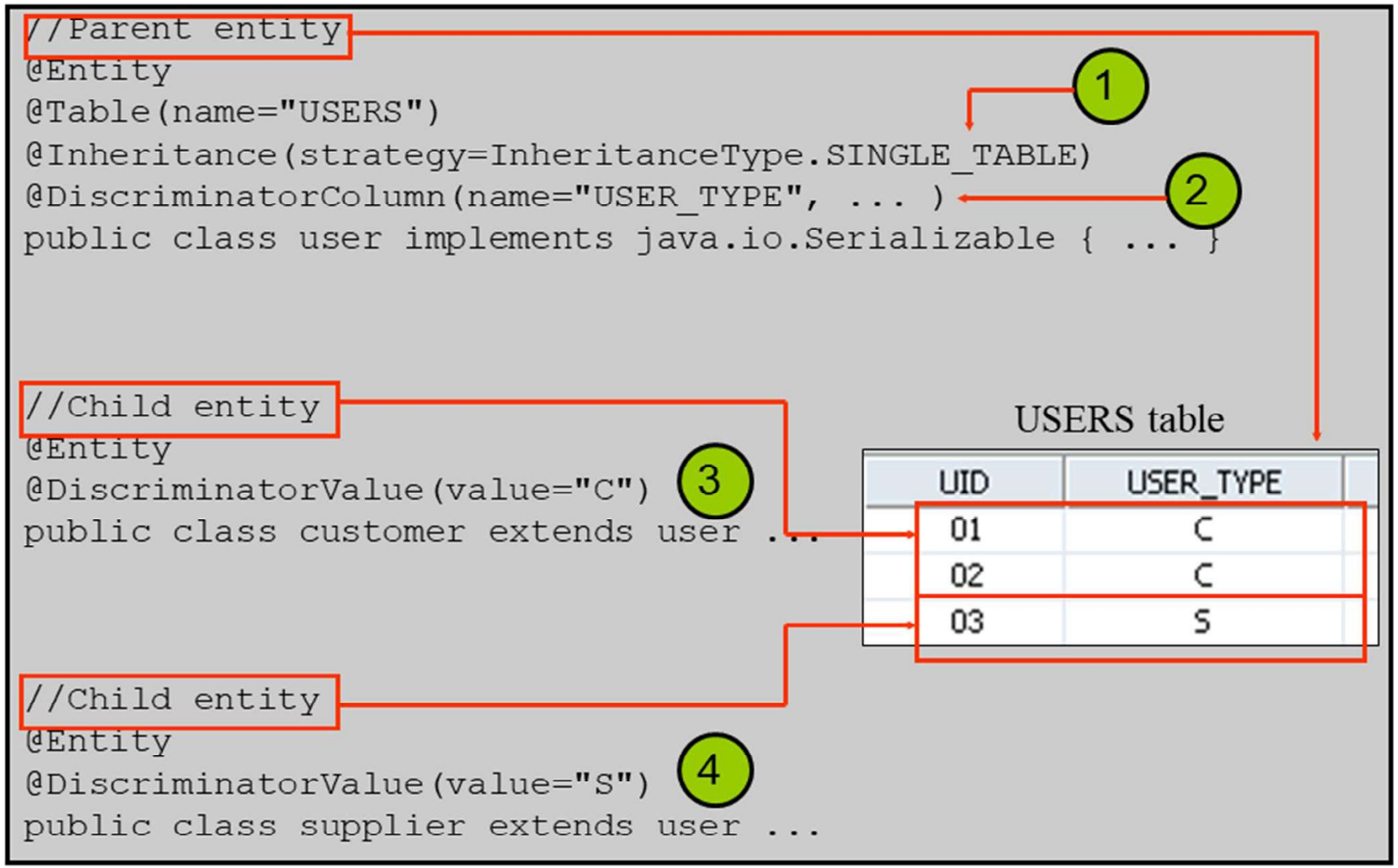
The identity of an entity can be specified by using:

- The `@Id` annotation
- The `@IdClass` annotation

Mapping Inheritance

- Entities can implement inheritance relationships.
- You can use three inheritance mapping strategies to map entity inheritance to database tables:
  - Single-table strategy
  - Joined-tables strategy
  - Table-per-class strategy
- Use the `@Inheritance` annotation.

Single-Table Strategy



Joined-Tables Strategy

```
//Parent entity
@Entity
@Table(name="USERS")
@Inheritance(strategy=InheritanceType.JOINED)
@DiscriminatorColumn(name="USER_TYPE", ... )
public class user ...

//Child entity
@Entity
@Table(name="CUSTOMER")
@DiscriminatorValue(value="C")
@PrimaryKeyJoinColumn(name="UID")
public class customer extends user ...

//Child entity
@Entity
@Table(name="SUPPLIER")
@DiscriminatorValue(value="S")
@PrimaryKeyJoinColumn(name="UID")
public class supplier extends user ...
```

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2

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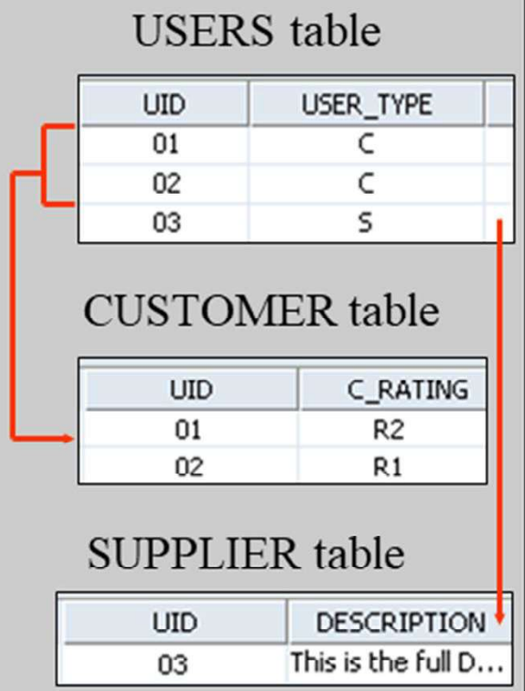
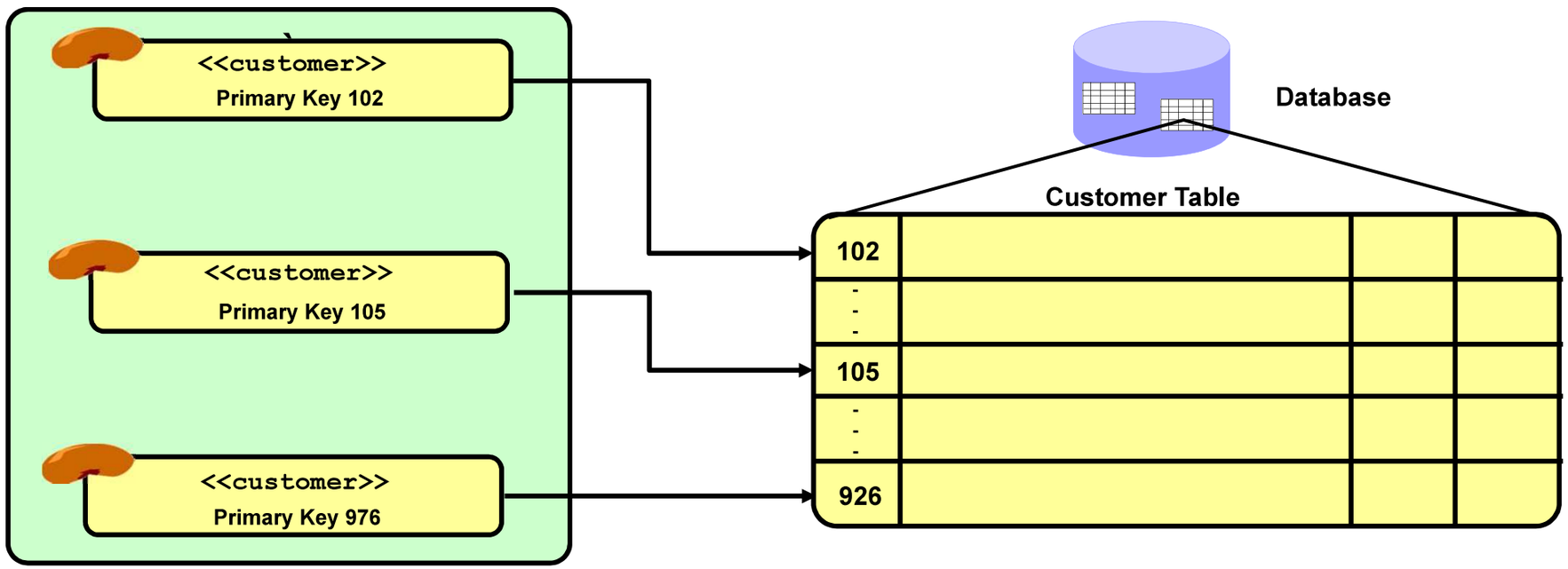


Entity Component Primary Key Association



Generating Primary Key Values

Use the `@GeneratedValue` annotation.

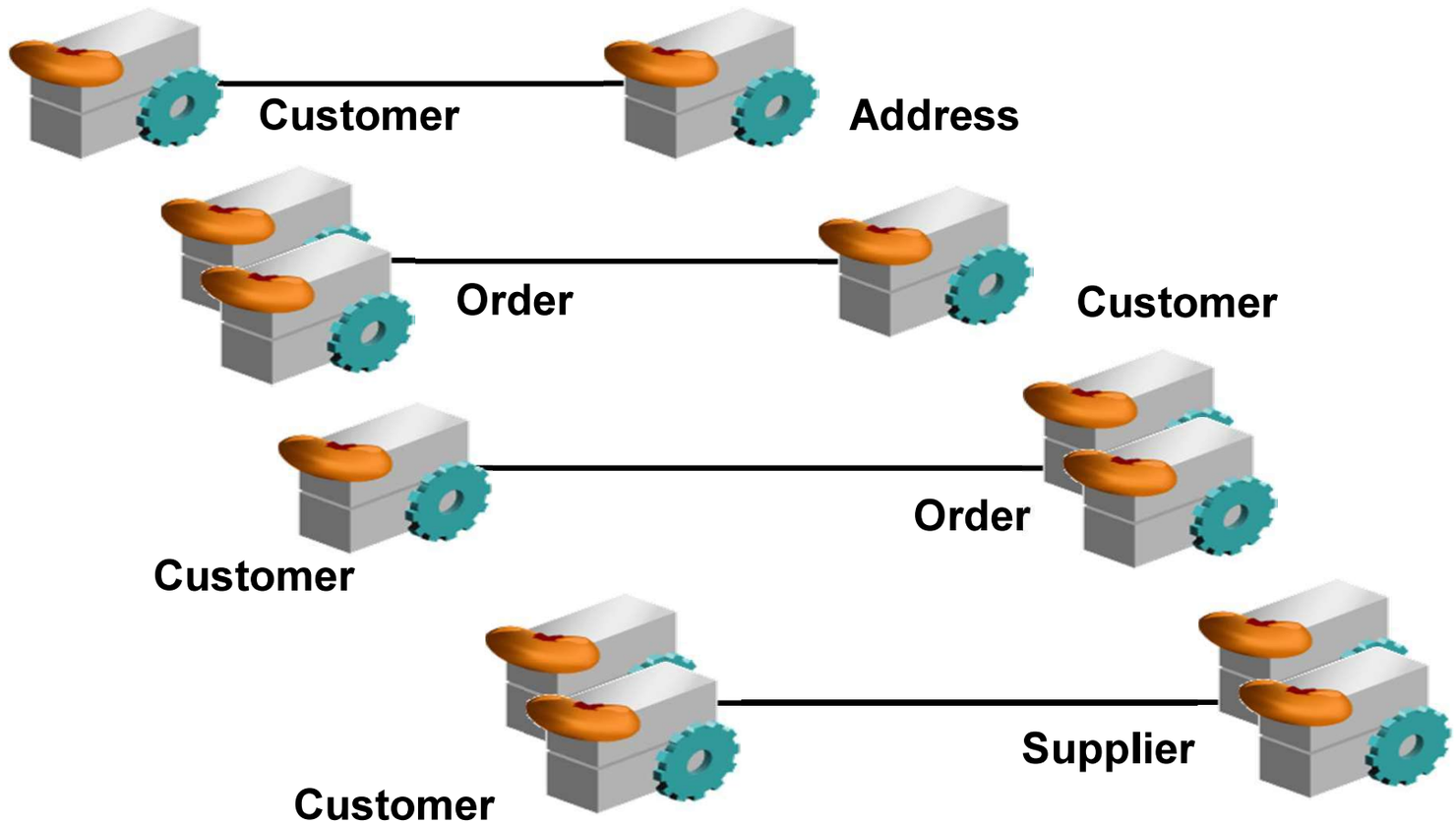
```
@Entity
@Table(name="CUSTOMERS")
public class Customer implements java.io.Serializable {

  @Id
     @SequenceGenerator(name = "CUSTOMER_SEQ_GEN",
          sequenceName = "CUSTOMER_SEQ", initialValue = 1,
                                          allocationSize = 1)
     @GeneratedValue(strategy = GenerationType.SEQUENCE,
                               generator = "CUSTOMER_SEQ_GEN")
     @Column(name = "CUSTID", nullable = false)
      private Long customerId;
   ...
   public int getCustomerID() { ... }
   ...
}
```

1 2 3 4

Mapping Relationships Between Entities

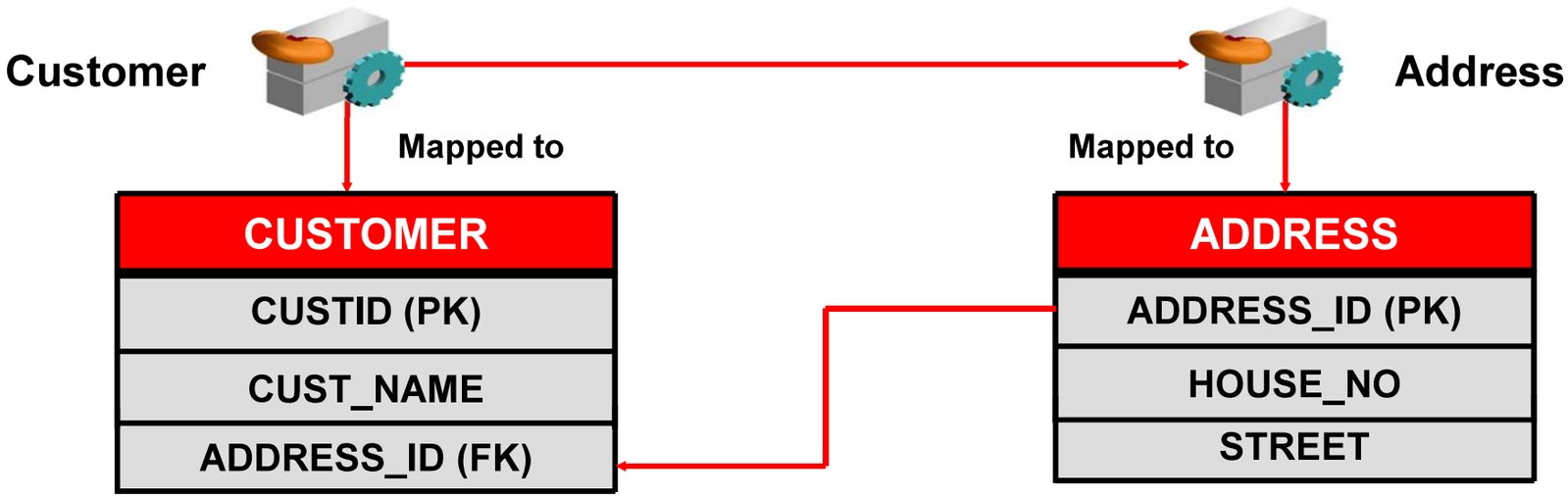
Annotations for entity relationships:

- `@OneToOne`
- `@ManyToOne`
- `@OneToMany`
- `@ManyToMany`



Implementing One-to-One Relationships

- You can map one-to-one relationships by using the `@OneToOne` annotation.
- Depending on the foreign key location, the relationship can be implemented by using:
  - The `@JoinColumn` annotation
  - The `@PrimaryKeyJoinColumn` annotation



Implementing One-to-One Relationships

Example: Mapping a one-to one relationship between the `Customer` class and the `Address` class by using the `@JoinColumn` annotation

```
// In the Customer class:
@Table(name="CUSTOMER")
...
@OneToOne
@JoinColumn(name="ADDRESS_ID",

                    referencedColumnName="ADDRESS_ID")
protected Address address;
...

// In the Address class:
@Table(name="ADDRESS")
...
@column(name="ADDRESS_ID")
...
```

Implementing Many-to-One Relationships

- Mapping a many-to-one relationship:
  - Using the `@ManyToOne` annotation
  - Defines a single-valued association
- Example: Mapping an `Orders` class to a `Customer`

```
// In the Order class
@Entity
@Table(name="ORDER")
public class Order ... {
...
@ManyToOne
@JoinColumn(name="ORDERS_CUSTID_REF",
              referenceColumnName="CUSTID_PK", updatable=false)
protected Customer customer;
...
}
```

Implementing One-to-Many Relationships

Mapping a one-to-many relationship by using the `@OneToMany` annotation.

```
//In the Customer class:
@Table(name="CUSTOMER")
...
@OneToMany(mappedBy="customer")
protected Set<Order> order;
...

// In the Order class:
@Table(name="ORDER")
...
@ManyToOne
@JoinColumn(name="ORDERS_CUSTID_REF",
     referenceColumnName="CUSTID_PK", updatable=false)
protected Customer customer;
...
```

Implementing Many-to-Many Relationships

Mapping a many-to-many relationship by using the `@ManyToMany` annotation.

```
// In the Customer class:
...
@ManyToMany(cascade=PERSIST)
@JoinTable(name="CUST_SUP",
           joinColumns=
         @JoinColumn(name="CUST_ID",referencedColumnName="CID"),
           inverseJoinColumns=
          @JoinColumn(name="SUP_ID", referencedColumnName="SID"))
protected Set<Supplier> suppliers;
...

// In the Supplier class:
...
@ManyToMany(cascade=PERSIST, mappedBy="suppliers")
protected Set<Customer> customers;
...
```

Managing Entities

- Entities are managed by using the `EntityManager` API.
- `EntityManager` performs the following tasks for the entities:
  - Implements the object-relational mapping between Java objects and database
  - Performs the CRUD operations for the entities
  - Manages the life cycle of the entities
  - Manages transactions

Summary

In this lesson, you should have learned how to:

- What are JPA Entities?
- Domain Modeling with JPA
- Creating an Entity (a POJO with annotations)
- Specifying Object Relational (OR) Mapping
- Mapping Relationships between Entities
- Inheritance Mapping Strategy (Singe Table, Joined Subclass)

Practice: Overview

These practice covers the following topics:

- Creating a simple entity bean by coding the bean
- Using the JDeveloper wizards to create a set of entity beans
- Creating and managing a session bean that provides client access to the entity beans
- Creating a test client to invoke the session bean