Hibernate (JPA) Code First Entity Relations

Advanced Mapping

SoftUni Team

Technical Trainers

Software University

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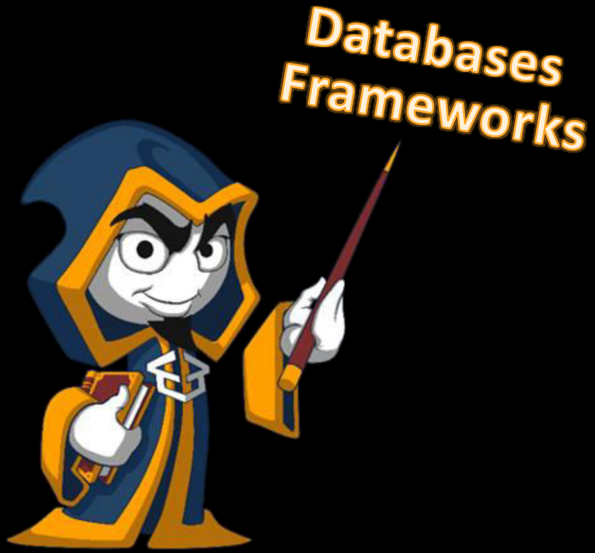

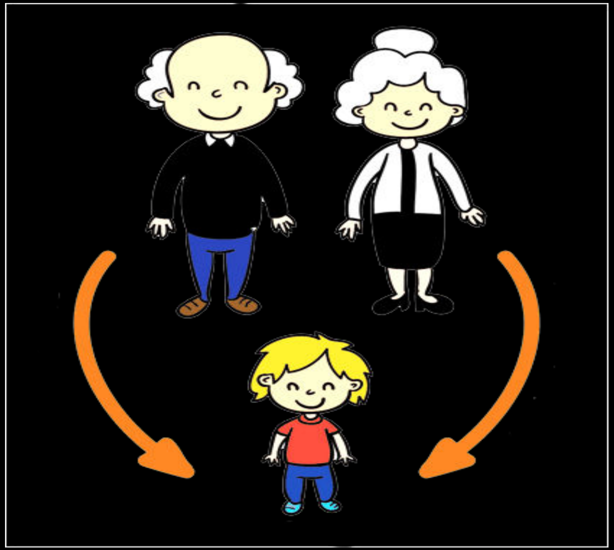

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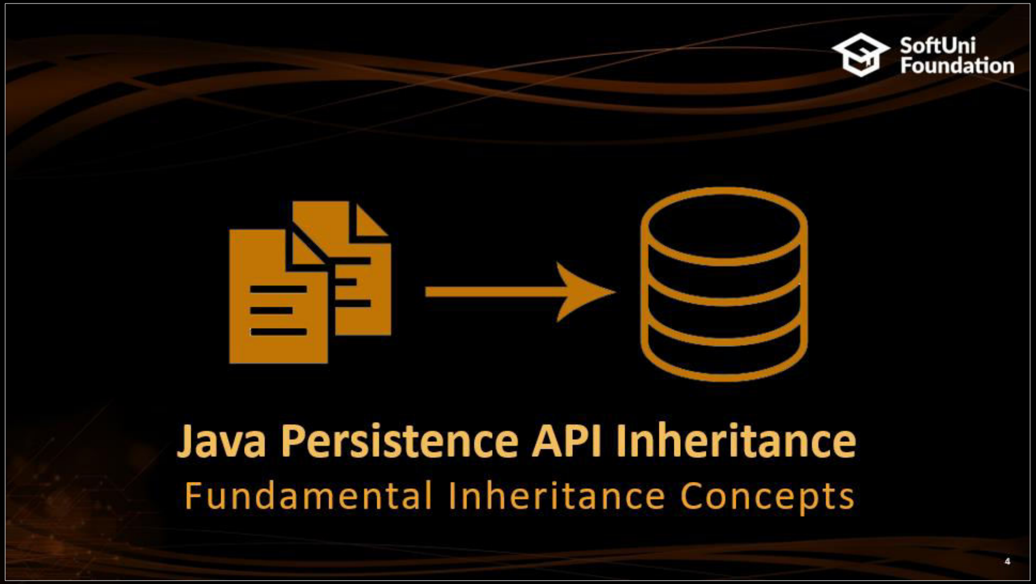

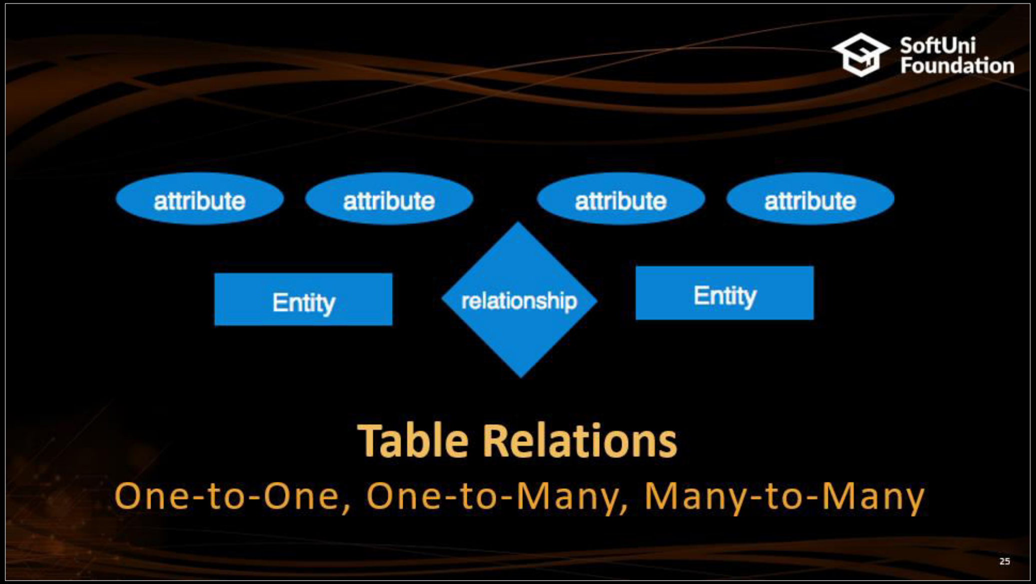

Questions

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#JavaDB

Java Persistence API Inheritance

Fundamental Inheritance Concepts

Inheritance

- Inheritance is a fundamental concept in most programming languages
  - SQL does not support this kind of relationships
- Implemented by any JPA framework by inheriting and mapping Entities

JPA Inheritance Strategies

- Implemented by the `javax.persistence.Inheritance` annotation
- The following mapping strategies are used to map the entity data to the underlying database:
  - A single table per class hierarchy
  - A table per concrete entity class
  - "Join" strategy – mapping common fields in a single table

Table Per Class

- Table creation for each entity
  - A table defined for each concrete class in the inheritance
  - Allows inheritance to be used in the object model, when it does not exist in the data model
- Querying root or branch classes can be very difficult and inefficient

Table Per Class strategy: Example

Vehicle.java

```
@Entity
@Inheritance(strategy =
InheritanceType.TABLE_PER_CLASS)
public abstract class Vehicle {
    @Id
    @GeneratedValue(strategy = GenerationType.TABLE)
    private int id;

    @Basic
    private String model;

    protected Vehicle() {}
    protected Vehicle(String model) {
        this.model = model;
    }
}
```

Inheritance type

A table generator is used for each table

Table Per Class strategy: Example (2)

Bike.java

```
@Entity
@Table(name = "bikes")
public class Bike extends Vehicle {
    private final static String model = "BIKE";
    public Bike(){
        super(model);
    }
}
```

Table Name

Car.java

```
@Entity
@Table(name = "cars")
public class Car extends Vehicle {
    private final static String model = "CAR";
    public Car(){
        super(model);
    }
}
```

Table Name

Table Per Class strategy: Example (3)

Main.java

```
..
Vehicle bike = new Bike();
Vehicle car = new Car();

em.persist(bike);
em.persist(car);
```

- Result:

bikes	
id	type
1	"BIKE"

cars	
id	type
1	"CAR"

Table Per Class strategy: Conclusion

- Disadvantages:
  - Repeating information in each table
  - Changes in super class involves changes in all subclass tables
  - No foreign keys involved (unrelated tables)
- Advantages:
  - No NULL values – no unneeded fields
  - Simple style to implement inheritance mapping

Table Per Class: Joined

- Table is defined for each class in the inheritance hierarchy
  - Storing of that class only the local attributes
  - Each table must store object's primary key

Table Per Class strategy: Example

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Vehicle.java

```
@Entity
@Table(name = "vehicles")
@Inheritance(strategy = InheritanceType.JOINED)
public abstract class Vehicle {
    @Id
    @GeneratedValue(strategy = GenerationType.TABLE)
    private int id;

    @Basic
    private String model;

    protected Vehicle() {}
    protected Vehicle(String model) {
        this.model = model;
    }
}
```

Inheritance type

A table generator is used for each table

Table Per Class strategy: Example (2)

TransportationVehicle.java

```
@MappedSuperclass
public abstract class TransportationVehicle extends Vehicle {
    private int loadCapacity;

    // Getters and setters
}
```

Table Per Class strategy: Example (2)

PassengerVehicle.java

```
@MappedSuperclass
public abstract class PassengerVehicle extends Vehicle
{

    private int noOfpassengers;

    public PassengerVehicle(String model) {
        super(model);
    }

    // Getters and setters
}
```

Table Per Class strategy: Example (3)

Truck.java

```java
@Entity
public class Truck extends TransportationVehicle {
    private final static String model = "CAR";
    private int noOfContainers;
    // Getters and setters
}
```

Car.java

```java
@Entity
public class Car extends PassengerVehicle {
    private final static String model = "CAR";
    public Car(){
        super(model);
    }
}
```

Results - Joined strategy

- After persist:

vehicles	
id	model
1	CAR
2	TRUCK

cars	
id	noOfPassengers
1	2

trucks		
id	noOfContainers	loadCapacity
1	2	5

Results - Joined strategy

- Disadvantages:
  - Multiple JOINS - for deep hierarchies it may give poor performance
- Advantages:
  - No NULL values
  - No repeating information
  - Foreign keys involved
  - Reduced changes in schema on superclass changes

Table Per Class: Single Table

- Simplest and typically the best performing and best solution
  - A single table is used to store all of the instances of the entire inheritance hierarchy
  - A column for every attribute of every class
  - A discriminator column is used to determine which class the particular row belongs to

Table Per Class strategy: Example

Vehicle.java

```
@Entity
@Table(name = "vehicles")
@Inheritance(strategy = InheritanceType.SINGLE_TABLE)
@DiscriminatorColumn(name = "type")
public abstract class Vehicle {
    @Id
    @GeneratedValue(strategy = GenerationType.TABLE)
    private int id;

    @Basic
    private String model;

    protected Vehicle() {}
    protected Vehicle(String model) {
        this.model = model;
    }
}
```

Inheritance type

A table generator is used for each table

Table Per Class strategy: Example (2)

TransportationVehicle.java

```java
@MappedSuperclass
public abstract class TransportationVehicle extends Vehicle {
    private int loadCapacity;

    // Getters and setters
}
```

Table Per Class strategy: Example (2)

PassengerVehicle.java

```
@MappedSuperclass
public abstract class PassengerVehicle extends Vehicle {

    private int noOfpassengers;

    public PassengerVehicle(String model) {
        super(model);
    }

    // Getters and setters
}
```

Table Per Class strategy: Example (3)

Truck.java

```
@Entity
@DiscriminatorValue(values = "truck")
public class Truck extends TransportationVehicle {
    private final static String model = "TRUCK";
    private int noOfContainers;
    // Getters and setters
}
```

Car.java

```
@Entity
@DiscriminatorValue(values = "car")
public class Car extends PassengerVehicle {
    private final static String model = "CAR";
    public Car(){
        super(model);
    }
}
```

Results - Joined strategy

- After persist:

vehicles				
id	type	loadCapacity	noOfPassengers	noOfContainers
1	truck	…	…	…
2	car	…	…	…

Discriminator column

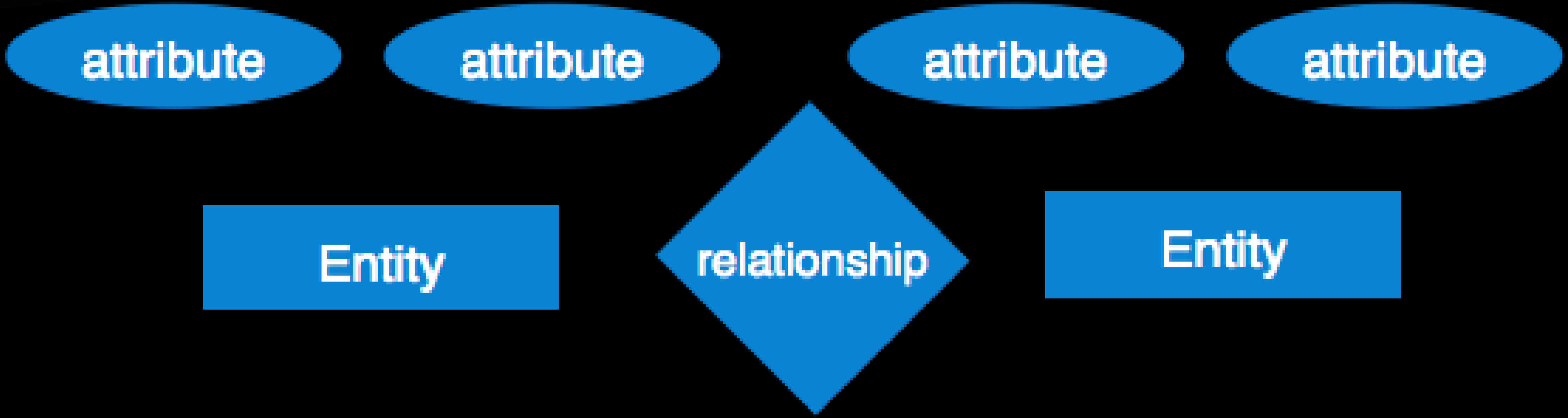


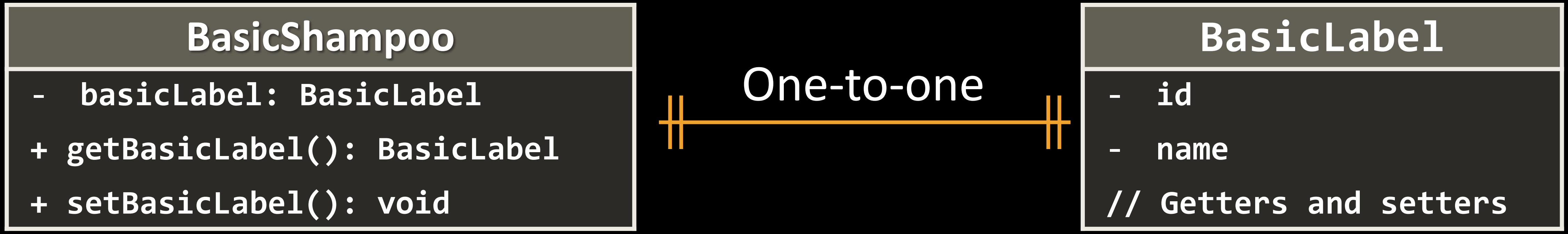
Table Relations

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

Database Relationships

- There are several types of database relationships:
  - One to One Relationships
  - One to Many and Many to One Relationships
  - Many to Many Relationships
  - Self Referencing Relationships

One-To-One - Unidirectional



One-To-One - Unidirectional

BasicShampoo.java

```
@Entity
@Table(name = "shampoos")
@Inheritance(strategy = InheritanceType.SINGLE_TABLE)
public abstract class BasicShampoo implements Shampoo {

//…

    @OneToOne(optional = false)
    @JoinColumn(name = "label_id",
    referencedColumnName = "id")
    private BasicLabel label;

//…
}
```

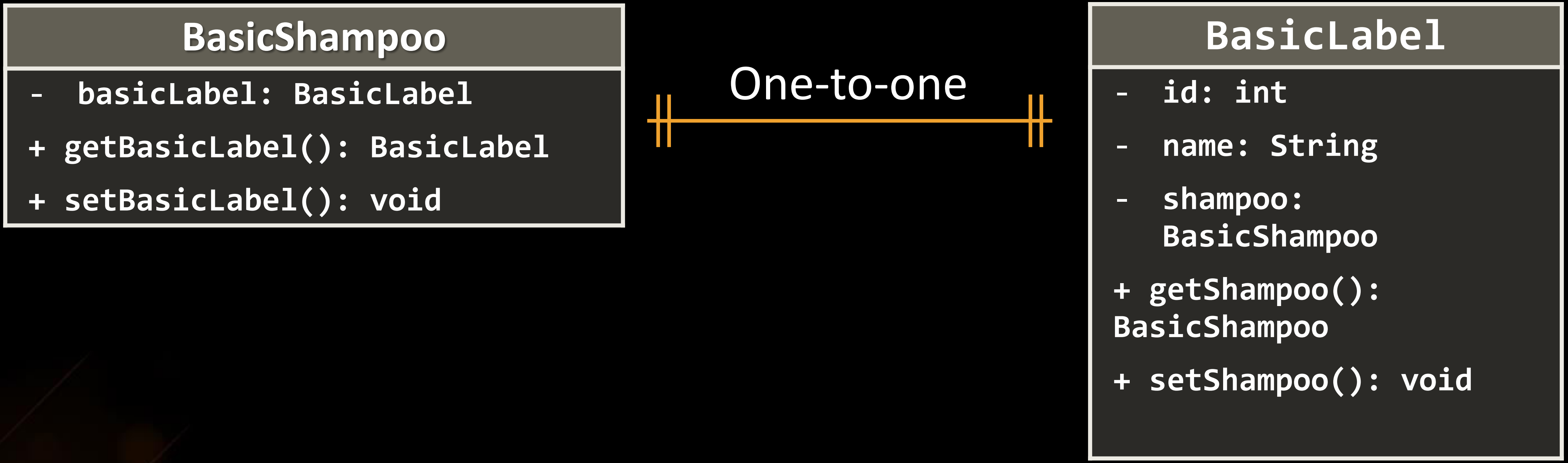
One-To-One relationship

Runtime evaluation

Column name in table labels

Column name in table shampoos

One-To-One - Bidirectional



One-To-One - Bidirectional

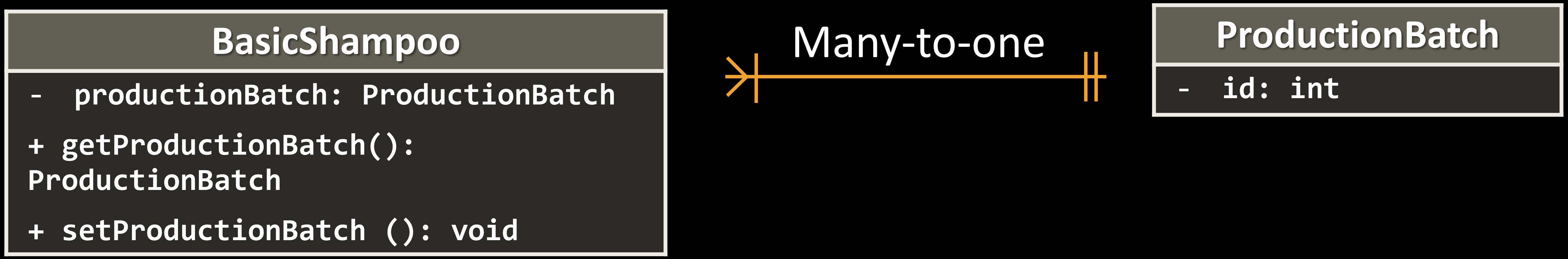
BasicLabel.java

```java
@Entity
@Table(name = "labels")
public class BasicLabel implements Label{
//…

    @OneToOne(mappedBy = "label",
    targetEntity = BasicShampoo.class)
    private BasicShampoo basicShampoo;

//…
}
```

Field in entity BasicShampoo

Entity for the mapping

Many-To-One - Unidirectional


BasicShampoo
- productionBatch: ProductionBatch
+ getProductionBatch(): ProductionBatch
+ setProductionBatch (): void
Many-to-one
ProductionBatch
- id: int

Many-To-One - Unidirectional

BasicShampoo.java

```
@Entity
@Table(name = "shampoos")
@Inheritance(strategy = InheritanceType.SINGLE_TABLE)
public abstract class BasicShampoo implements Shampoo {

//…

    @ManyToOne(optional = false)
    @JoinColumn(name = "batch_id", referencedColumnName = "id")
    private ProductionBatch batch;
//…
}
```

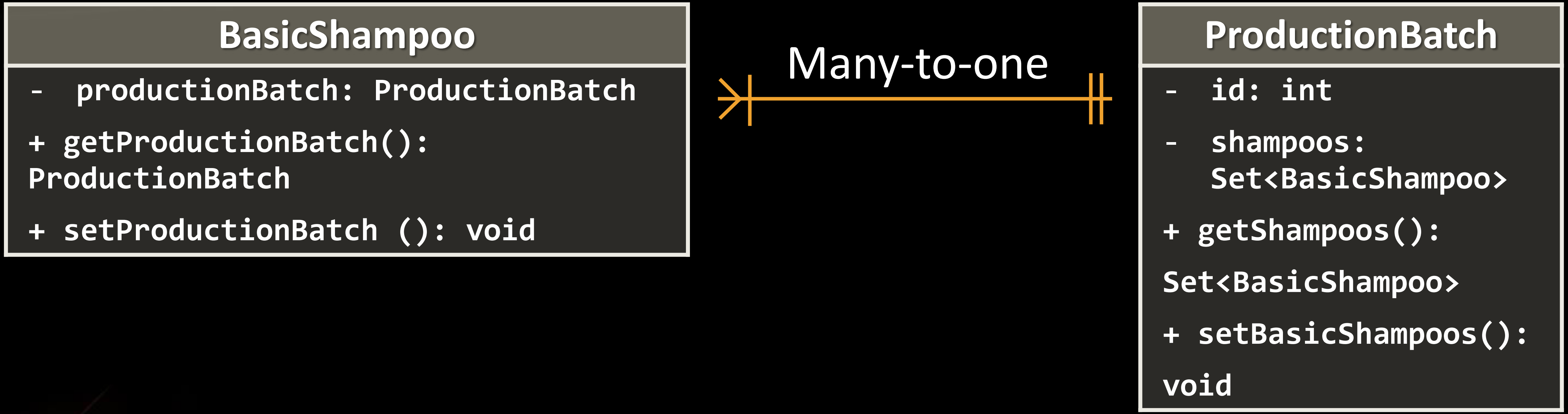
Many-To-One relationship

Runtime evaluation

Column name in table shampoos

Column name in table batches

One-To-Many - Bidirectional


BasicShampoo
- productionBatch: ProductionBatch
+ getProductionBatch(): ProductionBatch
+ setProductionBatch (): void
Many-to-one
ProductionBatch
- id: int
- shampoos: Set<BasicShampoo>
+ getShampoos(): Set<BasicShampoo>
+ setBasicShampoos(): void

One-To-Many - Bidirectional

ProductionBatch.java

```
@Entity
@Table(name = "batches")
public class ProductionBatch implements Batch {
//…

    @OneToMany(mappedBy = "batch", targetEntity = BasicShampoo.class,
               fetch = FetchType.LAZY, cascade = CascadeType.ALL)
    private Set<Shampoo> shampoos;

//…
}
```

Field in entity BasicShampoo

Entity for the mapping

Fetching type

Cascade type

Many-To-Many - Unidirectional

BasicShampoo.java

```
@Entity
@Table(name = "shampoos")
@Inheritance(strategy = InheritanceType.SINGLE_TABLE)
public abstract class BasicShampoo implements Shampoo {

//…

    @ManyToMany
    @JoinTable(name = "shampoos_ingredients",
    joinColumns = @JoinColumn(name = "shampoo_id", referencedColumnName = "id"),
    inverseJoinColumns = @JoinColumn(name = "ingredient_id", referencedColumnName
= "id"))
    private Set<BasicIngredient> ingredients;
//…
}
```

Many-To-Many relationship

Mapping table

Column in shampoos

Column in ingredients

Column in mapping table

Many-To-Many - Bidirectional

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BasicIngredient.java

```
@Entity
@Table(name = "ingredients")
@Inheritance(strategy = InheritanceType.SINGLE_TABLE)
@DiscriminatorColumn(name = "type", discriminatorType =
DiscriminatorType.STRING)
public abstract class BasicIngredient implements Ingredient {
//…

    @ManyToMany(mappedBy = "ingredients", targetEntity =
BasicShampoo.class)
    private Set<BasicShampoo> shampoos;

//…
}
```

Field in entity BasicShampoo

Entity for the mapping

Lazy Loading - Fetch Types

- Fetching – retrieve objects from the database
  - Fetched entities are stored in the Persistence Context as cache
- Retrieval of an entity object might cause automatic retrieval of additional entity objects

Fetching Strategies

- Fetching Strategies
  - EAGER – retrieves all entity objects reachable through fetched entity
    - Can cause slowdown when used with a big data source
  - LAZY – retrieves all reachable entity objects only when fetched entity's getter method is called

```
University university = em.find((long) 1); // this.students = null

// The collection holding the students is populated when the getter is called
university.getStudents();
```

Cascading

- JPA translates entity state transitions to database DML statements
  - This behavior is configured through the CascadeType mappings
- `CascadeType.PERSIST`: means that save() or persist() operations cascade to related entities
- `CascadeType.MERGE`: means that related entities are merged into managed state when the owning entity is merged
- `CascadeType.REFRESH`: does the same thing for the refresh() operation

Cascading (2)

- **CascadeType.REMOVE**: removes all related entities association with this setting when the owning entity is deleted
- **CascadeType.DETACH**: detaches all related entities if a “manual detach” occurs
- **CascadeType.ALL**: is shorthand for all of the above cascade operations

Summary

- Relational databases don't support inheritance
  - It is implemented by JPA:
    - SINGLE_TABLE
    - TABLE_PER_CLASS
    - JOINED
- Table relations are Un/Bidirectional
  - One-to-One
  - Many-to-One
  - Many-to-Many

Hibernate (JPA) Code First Entity Relations

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