

O/R Mapping 实践

认识 Spring Data JPA

对象与关系的范式不匹配

	Object	RDBMS
粒度	类	表
继承	有	没有
唯一性	<code>a == b</code> <code>a.equals(b)</code>	主键
关联	引用	外键
数据访问	逐级访问	SQL 数量要少

Hibernate

- 一款开源的对象关系映射（Object / Relational Mapping）框架
- 将开发者从 95% 的常见数据持久化工作中解放出来
- 屏蔽了底层数据库的各种细节

Hibernate 发展历程

- 2001年, Gavin King 发布第一个版本
- 2003年, Hibernate 开发团队加入 JBoss
- 2006年, Hibernate 3.2 成为 JPA 实现

Java Persistence API

JPA 为对象关系映射提供了一种基于 POJO 的持久化模型

- 简化数据持久化代码的开发工作
- 为 Java 社区屏蔽不同持久化 API 的差异

2006 年, *JPA 1.0* 作为 *JSR 220* 的一部分正式发布

Spring Data

在保留底层存储特性的同时，提供相对一致的、基于 **Spring** 的编程模型

主要模块

- Spring Data Commons
- Spring Data JDBC
- **Spring Data JPA**
- Spring Data Redis
-

```
<dependencyManagement>
  <dependencies>
    <dependency>
      <groupId>org.springframework.data</groupId>
      <artifactId>spring-data-releasetrain</artifactId>
      <version>Lovelace-SR4</version>
      <scope>import</scope>
      <type>pom</type>
    </dependency>
  </dependencies>
</dependencyManagement>
```

```
<dependency>
  <groupId>org.springframework.boot</groupId>
  <artifactId>spring-boot-starter-data-jpa</artifactId>
</dependency>
```

定义 JPA 实体对象

常用 JPA 注解

实体

- @Entity、@MappedSuperclass
- @Table(name)

主键

- @Id
 - @GeneratedValue(strategy, generator)
 - @SequenceGenerator(name, sequenceName)

常用 JPA 注解

```
@Entity(name = "Product")
public static class Product {

    @Id
    @GeneratedValue(
        strategy = GenerationType.SEQUENCE,
        generator = "sequence-generator"
    )
    @SequenceGenerator(
        name = "sequence-generator",
        sequenceName = "product_sequence"
    )
    private Long id;

    @Column(name = "product_name")
    private String name;

    //Getters and setters are omitted for brevity

}
```

常用 JPA 注解

映射

- `@Column(name, nullable, length, insertable, updatable)`
- `@JoinTable(name)`、`@JoinColumn(name)`

关系

- `@OneToOne`、`@OneToMany`、`@ManyToOne`、`@ManyToMany`
- `@OrderBy`

Project Lombok

Project Lombok 能够自动嵌入 IDE 和构建工具，提升开发效率

常用功能

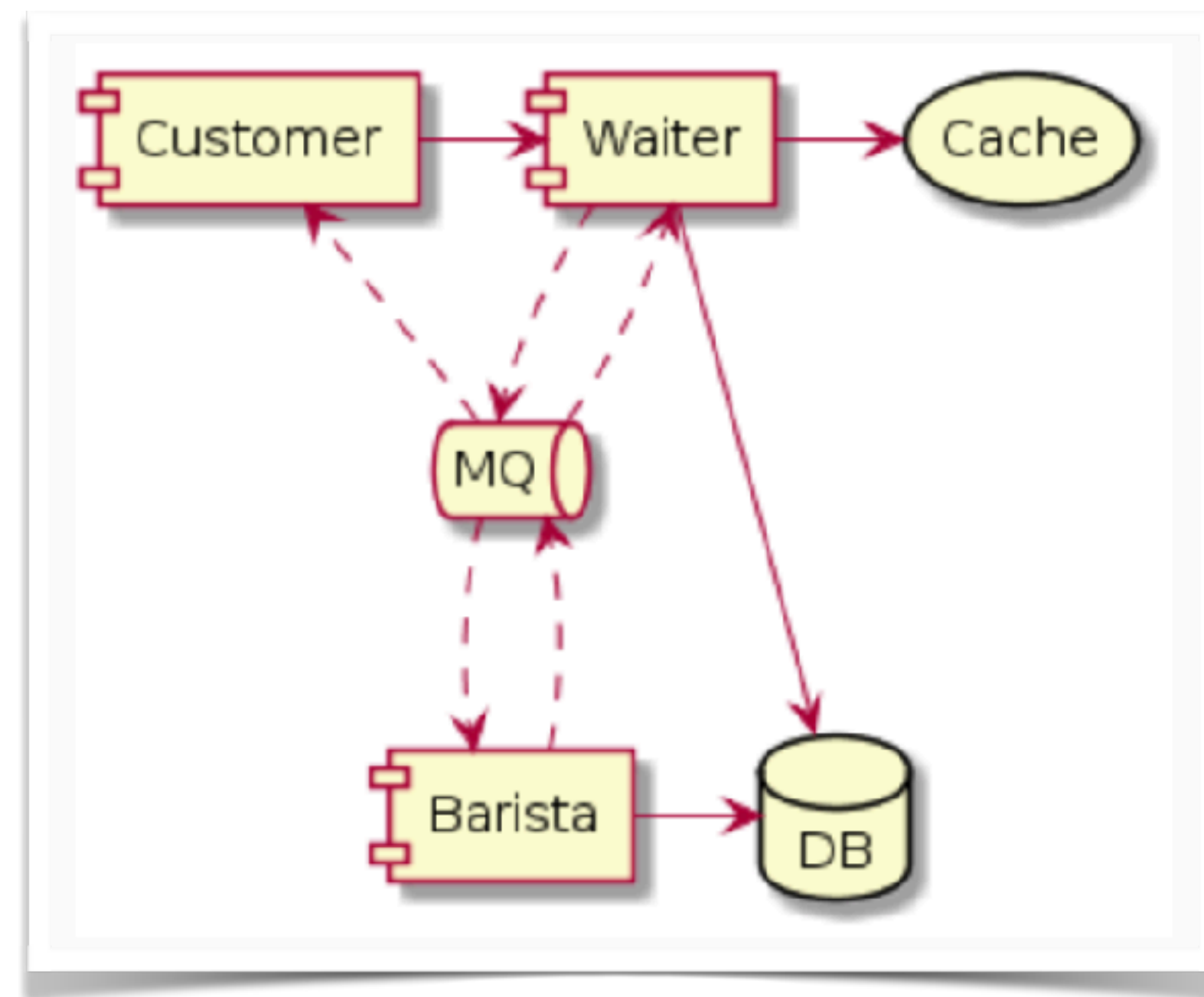
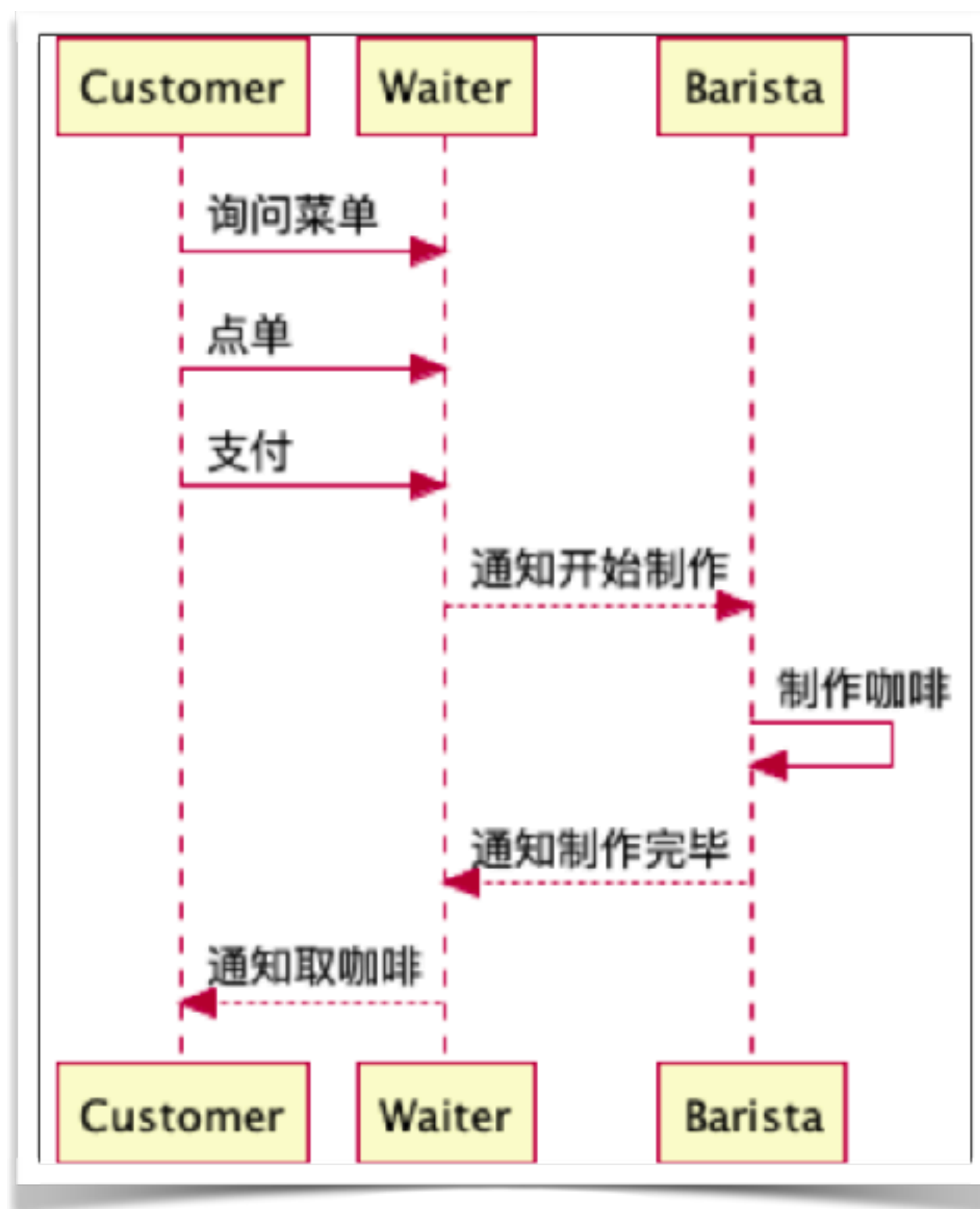
- @Getter / @Setter
- @ToString
- @NoArgsConstructor / @RequiredArgsConstructor / @AllArgsConstructor
- @Data
- @Builder
- @Slf4j / @CommonsLog / @Log4j2

线上咖啡馆实战项目

SpringBucks

项目目标

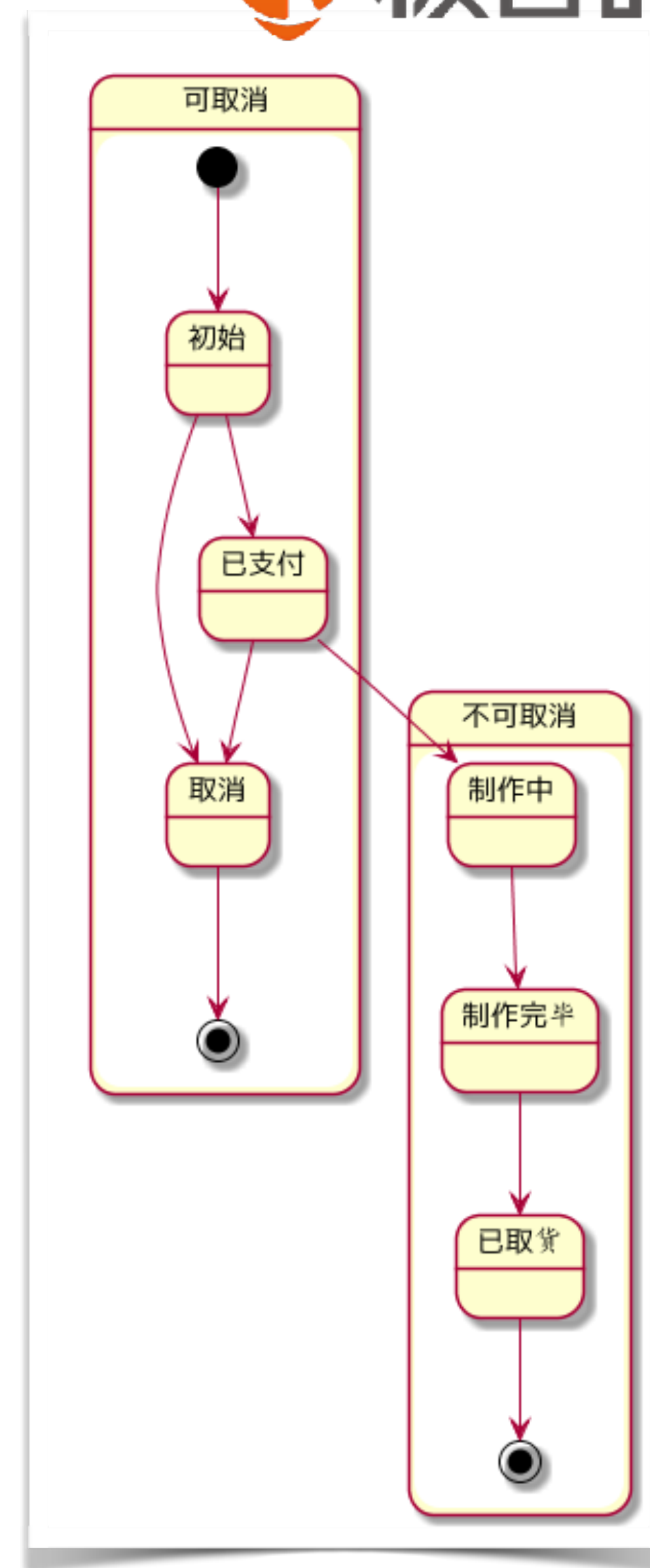
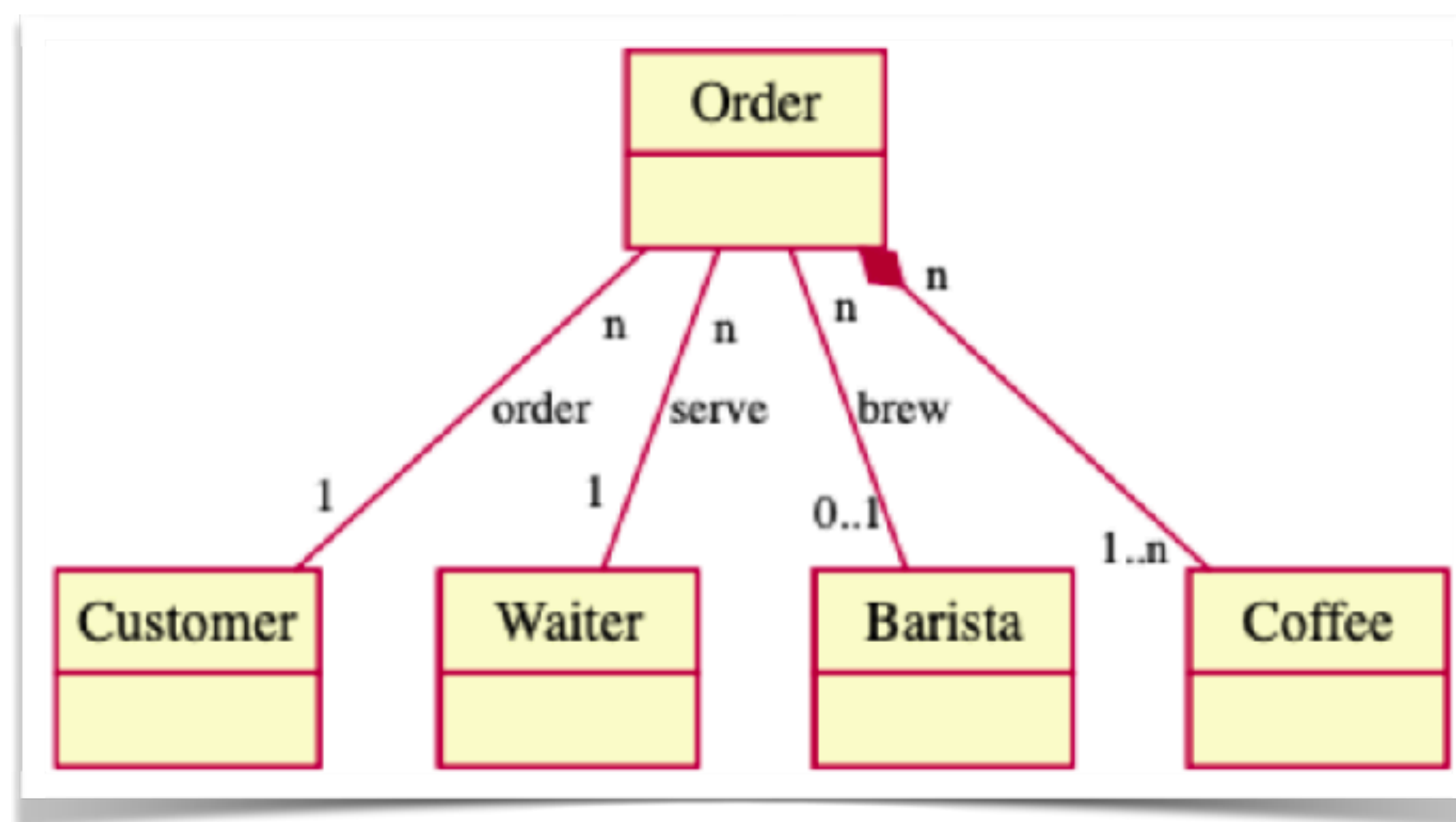
通过一个完整的例子演示 Spring 全家桶各主要成员的用法



项目中的对象实体

实体

- 咖啡、订单、顾客、服务员、咖啡师



实体定义

```
<dependency>  
    <groupId>org.springframework.boot</groupId>  
    <artifactId>spring-boot-starter-data-jpa</artifactId>  
</dependency>
```

```
<dependency>  
    <groupId>org.joda</groupId>  
    <artifactId>joda-money</artifactId>  
    <version>1.0.1</version>  
</dependency>
```

```
<dependency>  
    <groupId>org.jadira.usertype</groupId>  
    <artifactId>usertype.core</artifactId>  
    <version>6.0.1.GA</version>  
</dependency>
```

```
<dependency>  
    <groupId>org.projectlombok</groupId>  
    <artifactId>lombok</artifactId>  
    <optional>true</optional>  
</dependency>
```


实体定义

```
@Entity
@Table(name = "T_MENU")
@Builder
@Data
@NoArgsConstructor
@AllArgsConstructor
public class Coffee implements Serializable {
    @Id
    @GeneratedValue
    private Long id;
    private String name;
    @Column
    @Type(type = "org.jadira.usertype.moneyandcurrency.joda.PersistentMoneyAmount",
        parameters = {@org.hibernate.annotations.Parameter(name = "currencyCode", value = "CNY")})
    private Money price;
    @Column(updatable = false)
    @CreationTimestamp
    private Date createTime;
    @UpdateTimestamp
    private Date updateTime;
}
```

实体定义

```
@Entity
@Table(name = "T_ORDER")
@Data
@NoArgsConstructor
@AllArgsConstructor
@Builder
public class CoffeeOrder implements Serializable {
    @Id
    @GeneratedValue
    private Long id;
    private String customer;
    @ManyToMany
    @JoinTable(name = "T_ORDER_COFFEE")
    private List<Coffee> items;
    @Column(nullable = false)
    private Integer state;
    @Column(updatable = false)
    @CreationTimestamp
    private Date createTime;
    @UpdateTimestamp
    private Date updateTime;
}
```

“Talk is cheap, show me the code.”

Chapter 3 / jpa-demo

实体定义

```
@MappedSuperclass
@Data
@NoArgsConstructor
@AllArgsConstructor
public class BaseEntity implements Serializable {
    @Id
    @GeneratedValue
    private Long id;
    @Column(updatable = false)
    @CreationTimestamp
    private Date createTime;
    @UpdateTimestamp
    private Date updateTime;
}
```

实体定义

```
@Entity
@Table(name = "T_MENU")
@Builder
@Data
@ToString(callSuper = true)
@NoArgsConstructor
@AllArgsConstructor
public class Coffee extends BaseEntity implements Serializable {
    private String name;
    @Type(type = "org.jadira.usertype.moneyandcurrency.joda.PersistentMoneyAmount",
        parameters = {@org.hibernate.annotations.Parameter(name = "currencyCode", value = "CNY")})
    private Money price;
}
```

实体定义

```
@Entity
@Table(name = "T_ORDER")
@Data
@ToString(callSuper = true)
@NoArgsConstructor
@AllArgsConstructor
@Builder
public class CoffeeOrder extends BaseEntity implements Serializable {
    private String customer;
    @ManyToMany
    @JoinTable(name = "T_ORDER_COFFEE")
    @OrderBy("id")
    private List<Coffee> items;
    @Enumerated
    @Column(nullable = false)
    private OrderState state;
}

public enum OrderState {
    INIT, PAID, BREWING, BREWED, TAKEN, CANCELLED
}
```

“Talk is cheap, show me the code.”

Chapter 3 / jpa-complex-demo

通过 Spring Data JPA 操作数据库

Repository

@EnableJpaRepositories

Repository<T, ID> 接口

- CrudRepository<T, ID>
- PagingAndSortingRepository<T, ID>
- JpaRepository<T, ID>

定义查询

根据方法名定义查询

- `find...By...` / `read...By...` / `query...By...` / `get...By...`
- `count...By...`
- `...OrderBy...[Asc / Desc]`
- `And` / `Or` / `IgnoreCase`
- `Top` / `First` / `Distinct`

分页查询

分页查询

- `PagingAndSortingRepository<T, ID>`
- `Pageable` / `Sort`
- `Slice<T>` / `Page<T>`

保存实体

```
Coffee espresso = Coffee.builder().name("espresso")
    .price(Money.of(CurrencyUnit.of("CNY"), 20.0))
    .build();
coffeeRepository.save(espresso);
log.info("Coffee: {}", espresso);

Coffee latte = Coffee.builder().name("latte")
    .price(Money.of(CurrencyUnit.of("CNY"), 30.0))
    .build();
coffeeRepository.save(latte);
log.info("Coffee: {}", latte);
```

保存实体

```
order = CoffeeOrder.builder()  
    .customer("Li Lei")  
    .items(Arrays.asList(espresso, latte))  
    .state(0)  
    .build();  
orderRepository.save(order);  
log.info("Order: {}", order);
```

“Talk is cheap, show me the code.”

Chapter 3 / jpa-demo

查询实体

```
@NoRepositoryBean
public interface BaseRepository<T, Long> extends PagingAndSortingRepository<T, Long> {
    List<T> findTop3ByOrderByUpdateTimeDescIdAsc();
}
```

```
public interface CoffeeOrderRepository extends BaseRepository<CoffeeOrder, Long> {
    List<CoffeeOrder> findByCustomerOrderById(String customer);
    List<CoffeeOrder> findByItems_Name(String name);
}
```

查询实体

```
coffeeRepository
    .findAll(Sort.by(Sort.Direction.DESC, "id"))
    .forEach(c -> log.info("Loading {}", c));

List<CoffeeOrder> list = orderRepository.findTop3ByOrderByUpdateTimeDescIdAsc();
log.info("findTop3ByOrderByUpdateTimeDescIdAsc: {}", getJoinedOrderId(list));

list = orderRepository.findByCustomerId("Li Lei");
log.info("findByCustomerId: {}", getJoinedOrderId(list));

// 不开启事务会因为没Session而报LazyInitializationException
list.forEach(o -> {
    log.info("Order {}", o.getId());
    o.getItems().forEach(i -> log.info("  Item {}", i));
});

list = orderRepository.findByItems_Name("latte");
log.info("findByItems_Name: {}", getJoinedOrderId(list));
```


“Talk is cheap, show me the code.”

Chapter 3 / jpa-complex-demo

Repository 是怎么从接口变成 Bean 的

Repository Bean 是如何创建的

JpaRepositoriesRegistrar

- 激活了 @EnableJpaRepositories
- 返回了 JpaRepositoryConfigExtension

RepositoryBeanDefinitionRegistrarSupport.registerBeanDefinitions

- 注册 Repository Bean (类型是 JpaRepositoryFactoryBean)

RepositoryConfigurationExtensionSupport.getRepositoryConfigurations

- 取得 Repository 配置

JpaRepositoryFactory.getTargetRepository

- 创建了 Repository

接口中的方法是如何被解释的

RepositoryFactorySupport.getRepository 添加了Advice

- DefaultMethodInvokingMethodInterceptor
- QueryExecutorMethodInterceptor

AbstractJpaQuery.execute 执行具体的查询

语法解析在 Part 中

通过 MyBatis 操作数据库

认识 MyBatis

MyBatis (<https://github.com/mybatis/mybatis-3>)

- 一款优秀的持久层框架
- 支持定制化 SQL、存储过程和高级映射

在 Spring 中使用 MyBatis

- MyBatis Spring Adapter (<https://github.com/mybatis/spring>)
- MyBatis Spring-Boot-Starter (<https://github.com/mybatis/spring-boot-starter>)

简单配置

- `mybatis.mapper-locations = classpath*:mapper/**/*.xml`
- `mybatis.type-aliases-package = 类型别名的包名`
- `mybatis.type-handlers-package = TypeHandler扫描包名`
- `mybatis.configuration.map-underscore-to-camel-case = true`

Mapper 的定义与扫描

- @MapperScan 配置扫描位置
- @Mapper 定义接口
- 映射的定义—— XML 与注解

Mapper 的定义与扫描

```
@Mapper
public interface CoffeeMapper {
    @Insert("insert into t_coffee (name, price, create_time, update_time)"
            + "values ({name}, {price}, now(), now())")
    @Options(useGeneratedKeys = true)
    Long save(Coffee coffee);

    @Select("select * from t_coffee where id = #{id}")
    @Results({
        @Result(id = true, column = "id", property = "id"),
        @Result(column = "create_time", property = "createTime"),
        // map-underscore-to-camel-case = true 可以实现一样的效果
        // @Result(column = "update_time", property = "updateTime"),
    })
    Coffee findById(@Param("id") Long id);
}
```

“Talk is cheap, show me the code.”

Chapter 3 / mybatis-demo

让 MyBatis 更好用的那些工具

MyBatis Generator

认识 MyBatis Generator

MyBatis Generator (<http://www.mybatis.org/generator/>)

- MyBatis 代码生成器
- 根据数据库表生成相关代码
 - POJO
 - Mapper 接口
 - SQL Map XML

运行 MyBatis Generator

命令行

- `java -jar mybatis-generator-core-x.x.x.jar -configfile generatorConfig.xml`

Maven Plugin (mybatis-generator-maven-plugin)

- `mvn mybatis-generator:generate`
- `${basedir}/src/main/resources/generatorConfig.xml`

Eclipse Plugin

Java 程序

Ant Task

配置 MyBatis Generator

generatorConfiguration

context

- jdbcConnection
- javaModelGenerator
- sqlMapGenerator
- javaClientGenerator (ANNOTATEDMAPPER / XMLMAPPER / MIXEDMAPPER)
- table

生成时可以使用插件

内置插件都在 `org.mybatis.generator.plugins` 包中

- `FluentBuilderMethodsPlugin`
- `ToStringPlugin`
- `SerializablePlugin`
- `RowBoundsPlugin`
-

使用生成的对象

- 简单操作，直接使用生成的 xxxMapper 的方法
- 复杂查询，使用生成的 xxxExample 对象

使用生成的对象

```
Coffee latte = new Coffee()
    .withName("latte")
    .withPrice(Money.of(CurrencyUnit.of("CNY"), 30.0))
    .withCreateTime(new Date())
    .withUpdateTime(new Date());
coffeeMapper.insert(latte);

Coffee s = coffeeMapper.selectByPrimaryKey(1L);
log.info("Coffee {}", s);

CoffeeExample example = new CoffeeExample();
example.createCriteria().andNameEqualTo("latte");
List<Coffee> list = coffeeMapper.selectByExample(example);
list.forEach(e -> log.info("selectByExample: {}", e));
```

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Chapter 3 / mybatis-generator-demo

让 MyBatis 更好用的那些工具

MyBatis PageHelper

认识 MyBatis PageHelper

MyBatis PageHelper (<https://pagehelper.github.io>)

- 支持多种数据库
- 支持多种分页方式
- SpringBoot 支持 (<https://github.com/pagehelper/pagehelper-spring-boot>)
 - pagehelper-spring-boot-starter

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Chapter 3 / mybatis-pagehelper-demo

SpringBucks 进度小结

本章小结

- 简单了解了 Java Persistence API 的背景
- 学习了 JPA 的常用注解
- 学习了 Lombok 的用法
- 学习了 Spring Data JPA 的基本用法
- 学习了 MyBatis 及其相关工具的基本用法

SpringBucks 进度小结

- 概述性地了解了 SpringBucks 的需求
- 通过 JPA 定义并实现了 SpringBucks 中的一些实体
- 通过 Spring Data JPA 定义了一些简单的 Repository

“Talk is cheap, show me the code.”

Chapter 3 / springbucks