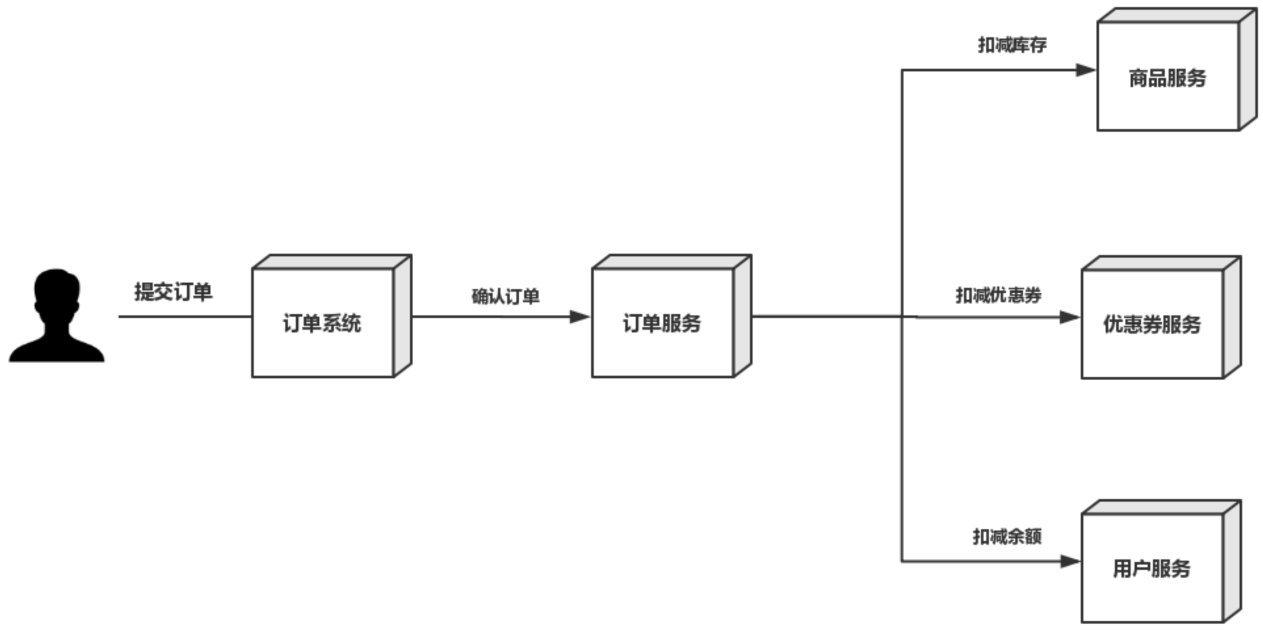
1. 案例介绍

1.1 业务分析

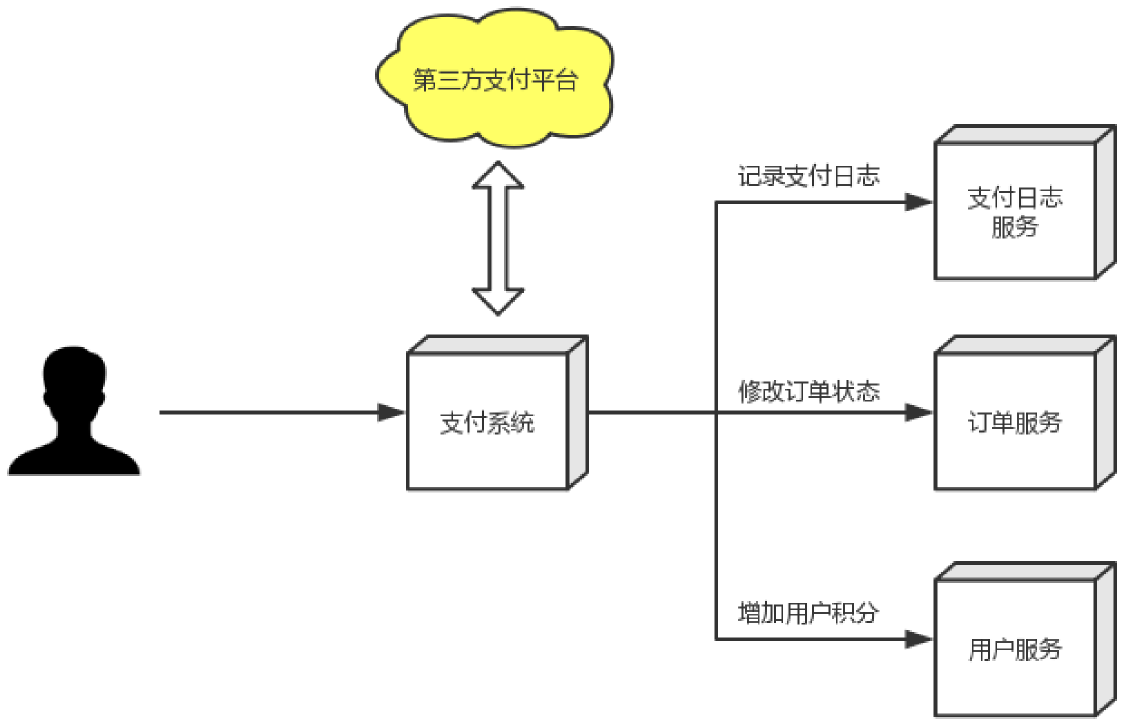
模拟电商网站购物场景中的【下单】和【支付】业务

###1）下单



1. 用户请求订单系统下单
2. 订单系统通过RPC调用订单服务下单
3. 订单服务调用优惠券服务，扣减优惠券
4. 订单服务调用调用库存服务，校验并扣减库存
5. 订单服务调用用户服务，扣减用户余额
6. 订单服务完成确认订单

###2）支付



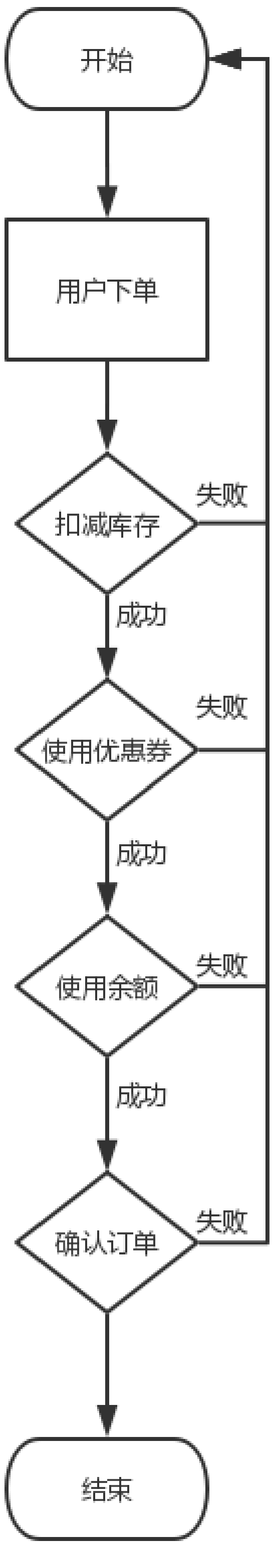
1. 用户请求支付系统
2. 支付系统调用第三方支付平台API进行发起支付流程
3. 用户通过第三方支付平台支付成功后，第三方支付平台回调通知支付系统
4. 支付系统调用用订单服务修改订单状态
5. 支付系统调用积分服务添加积分
6. 支付系统调用日志服务记录日志

1.2 问题分析

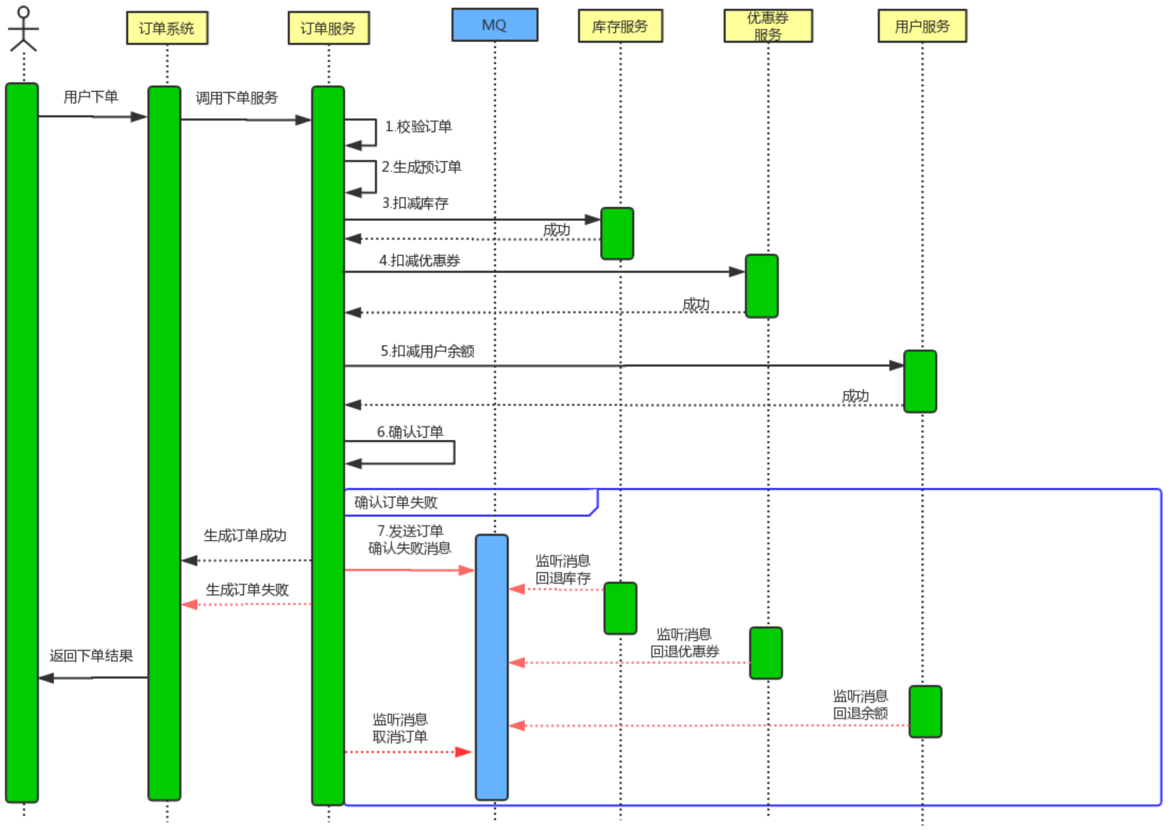
问题1

用户提交订单后，扣减库存成功、扣减优惠券成功、使用余额成功，但是在确认订单操作失败，需要对库存、库存、余额进行回退。

如何保证数据的完整性？



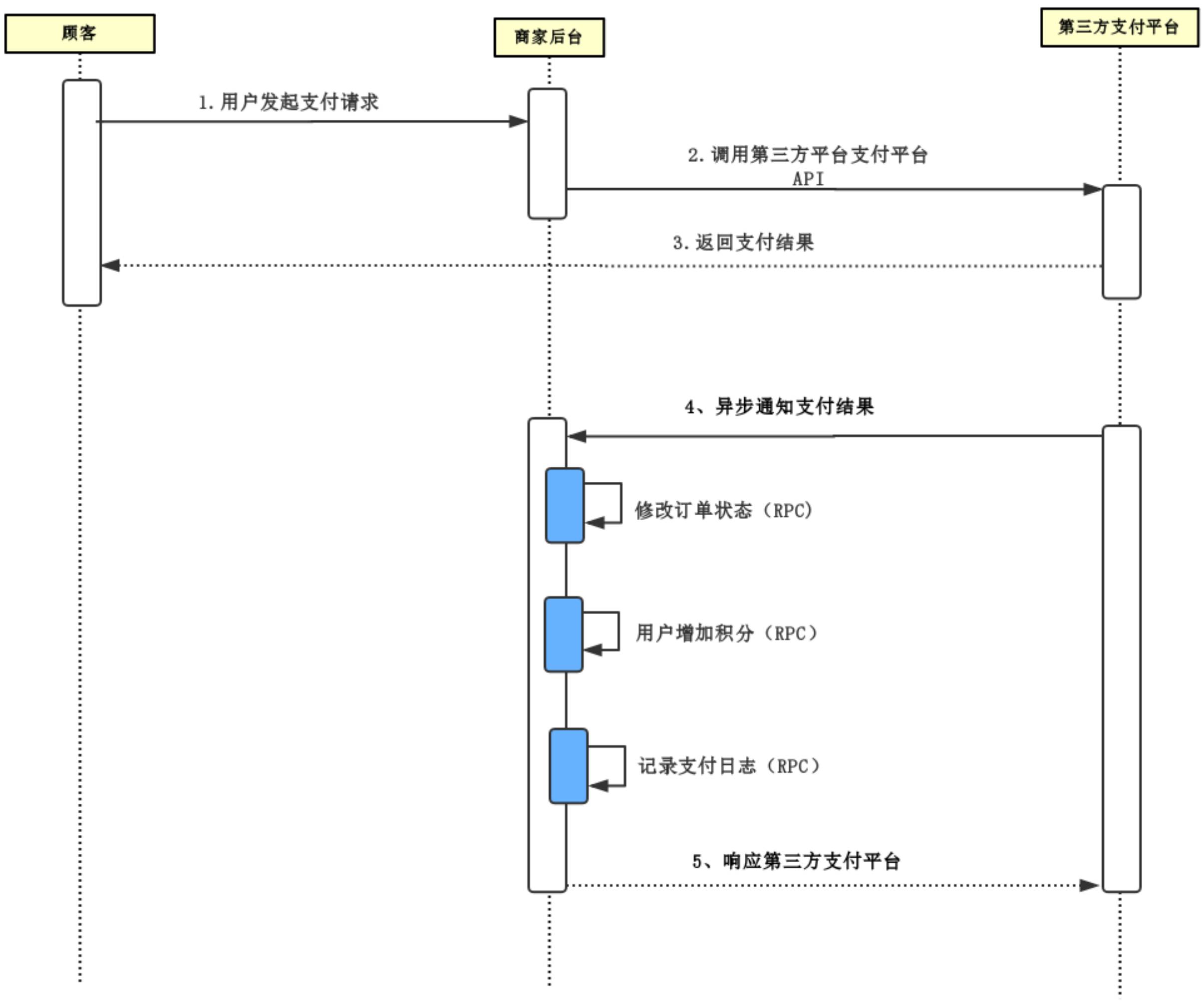
使用MQ保证在下单失败后系统数据的完整性



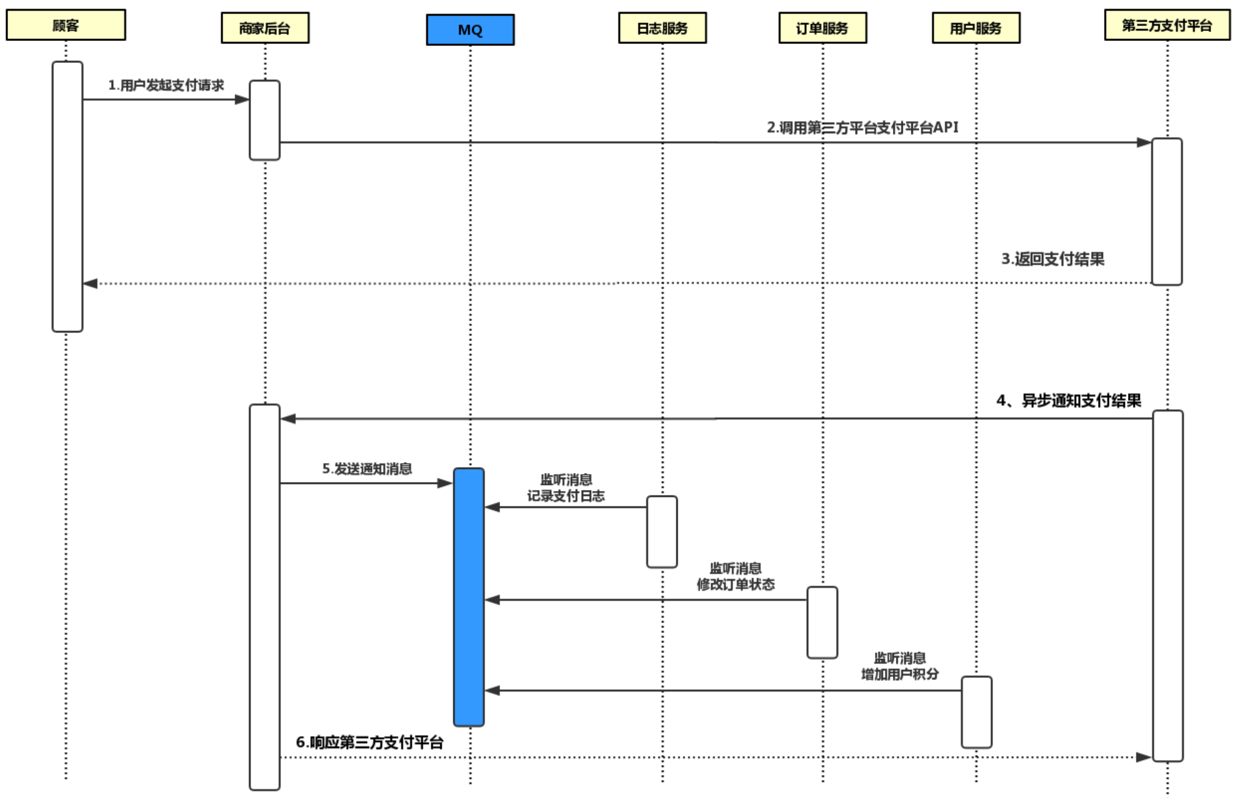
###问题2

用户通过第三方支付平台（支付宝、微信）支付成功后，第三方支付平台要通过回调API异步通知商家支付系统用户支付结果，支付系统根据支付结果修改订单状态、记录支付日志和给用户增加积分。

商家支付系统如何保证在收到第三方支付平台的异步通知时，如何快速给第三方支付凭条做出回应？



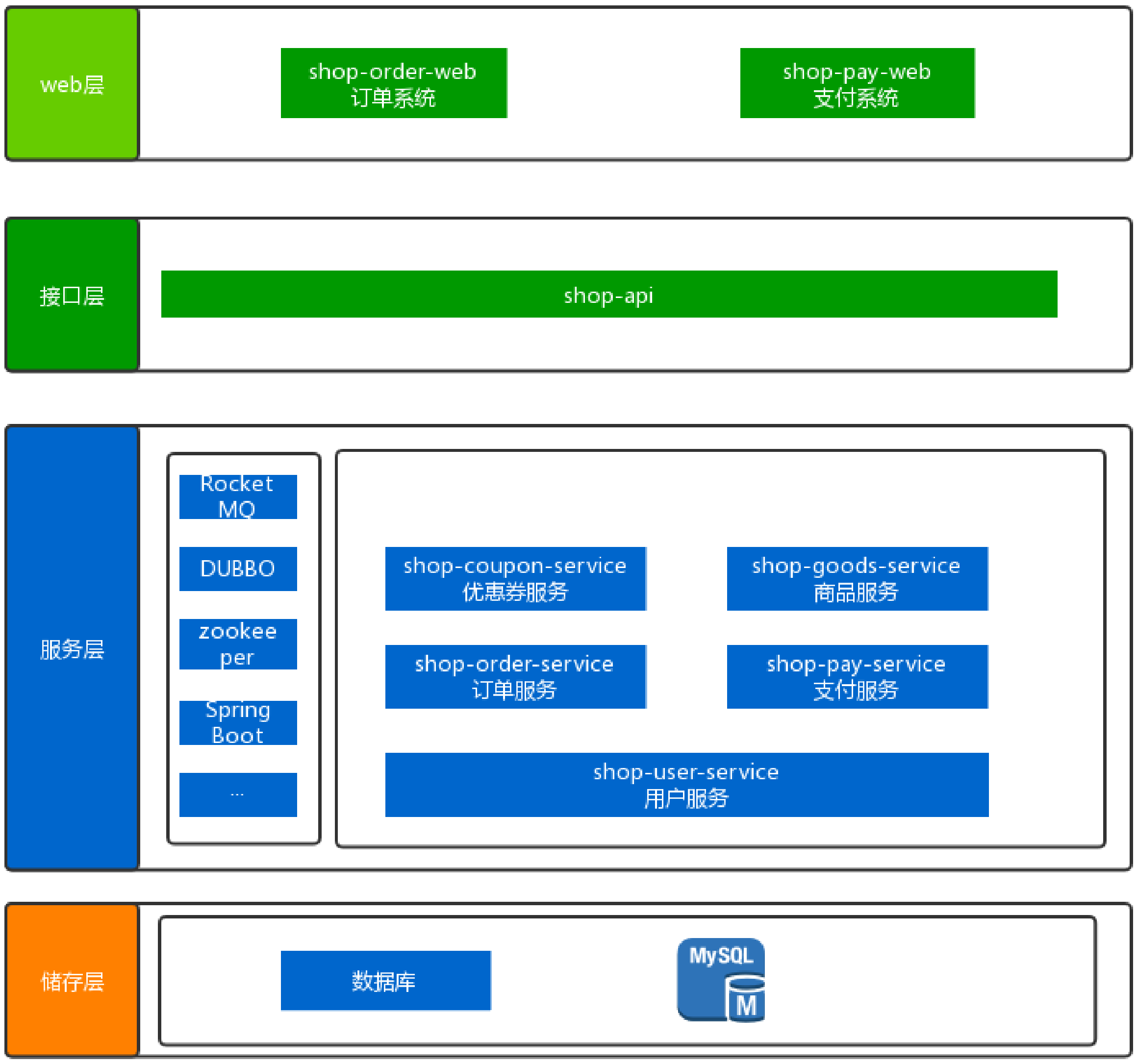
通过MQ进行数据分发，提高系统处理性能



2. 技术分析

2.1 技术选型

- SpringBoot
- Dubbo
- Zookeeper
- RocketMQ
- Mysql


web层
shop-order-web 订单系统
shop-pay-web 支付系统
接口层
shop-api
服务层
Rocket MQ
DUBBO
zookeeper
Spring Boot
...
shop-coupon-service 优惠券服务
shop-goods-service 商品服务
shop-order-service 订单服务
shop-pay-service 支付服务
shop-user-service 用户服务
储存层
数据库
MySQL

2.2 SpringBoot整合RocketMQ

下载rocketmq-spring项目

将rocketmq-spring安装到本地仓库

```
mvn install -Dmaven.skip.test=true
```

2.2.1 消息生产者

1）添加依赖

```
<parent>
    <groupId>org.springframework.boot</groupId>
    <artifactId>spring-boot-starter-parent</artifactId>
    <version>2.0.1.RELEASE</version>
</parent>

<properties>
```

```
    <rocketmq-spring-boot-starter-version>2.0.3</rocketmq-spring-boot-starter-version>
</properties>

<dependencies>
    <dependency>
        <groupId>org.apache.rocketmq</groupId>
        <artifactId>rocketmq-spring-boot-starter</artifactId>
        <version>${rocketmq-spring-boot-starter-version}</version>
    </dependency>
    <dependency>
        <groupId>org.projectlombok</groupId>
        <artifactId>lombok</artifactId>
        <version>1.18.6</version>
    </dependency>
    <dependency>
        <groupId>org.springframework.boot</groupId>
        <artifactId>spring-boot-starter-test</artifactId>
        <scope>test</scope>
    </dependency>

</dependencies>
```

2）配置文件

```
# application.properties
rocketmq.name-server=192.168.25.135:9876;192.168.25.138:9876
rocketmq.producer.group=my-group
```

3）启动类

```
@SpringBootApplication
public class MQProducerApplication {
    public static void main(String[] args) {
        SpringApplication.run(MQSpringBootApplication.class);
    }
}
```

4）测试类

```
@RunWith(SpringRunner.class)
@SpringBootTest(classes = {MQSpringBootApplication.class})
public class ProducerTest {

    @Autowired
    private RocketMQTemplate rocketMQTemplate;

    @Test
    public void test1(){
        rocketMQTemplate.convertAndSend("springboot-mq","hello springboot rocketmq");
    }
}
```

2.2.2 消息消费者

1）添加依赖

同消息生产者

2）配置文件

同消息生产者

3）启动类

```
@SpringBootApplication
public class MQConsumerApplication {
    public static void main(String[] args) {
        SpringApplication.run(MQSpringBootApplication.class);
    }
}
```

4）消息监听器

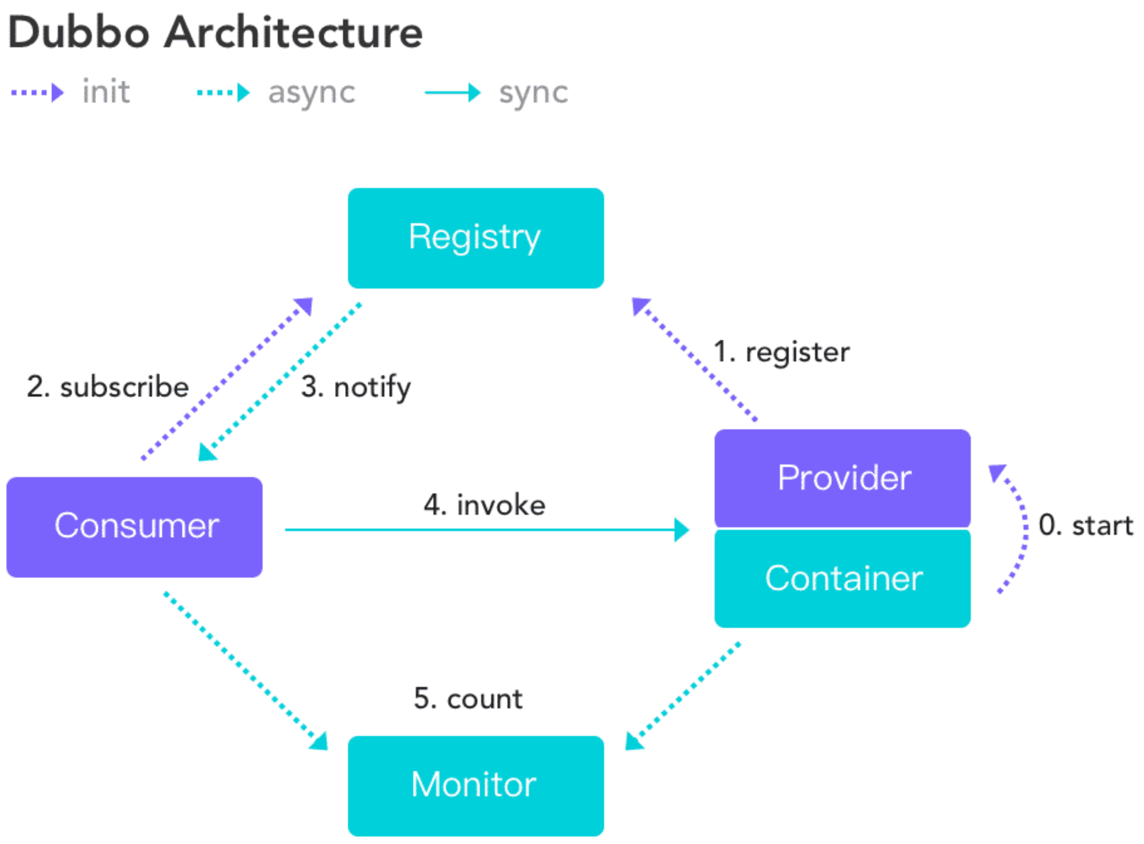
```
@Slf4j
@Component
@RocketMQMessageListener(topic = "springboot-mq",consumerGroup = "springboot-mq-consumer-1")
public class Consumer implements RocketMQListener<String> {

    @Override
    public void onMessage(String message) {
        log.info("Receive message: "+message);
    }
}
```

2.3 SpringBoot整合Dubbo

下载dubbo-spring-boot-starter依赖包

将dubbo-spring-boot-starter安装到本地仓库

```
mvn install -Dmaven.skip.test=true
```



2.3.1 搭建Zookeeper集群

1）准备工作

1. 安装JDK
2. 将Zookeeper上传到服务器
3. 解压Zookeeper，并创建data目录，将conf下的zoo_sample.cfg文件改名为zoo.cfg
4. 建立`/user/local/zookeeper-cluster`,将解压后的Zookeeper复制到以下三个目录

```
/usr/local/zookeeper-cluster/zookeeper-1
/usr/local/zookeeper-cluster/zookeeper-2
/usr/local/zookeeper-cluster/zookeeper-3
```

5. 配置每一个 Zookeeper 的 dataDir（zoo.cfg） clientPort 分别为 2181 2182 2183

   修改`/usr/local/zookeeper-cluster/zookeeper-1/conf/zoo.cfg`

```
clientPort=2181
dataDir=/usr/local/zookeeper-cluster/zookeeper-1/data
```

修改/usr/local/zookeeper-cluster/zookeeper-2/conf/zoo.cfg

```
clientPort=2182
dataDir=/usr/local/zookeeper-cluster/zookeeper-2/data
```

修改/usr/local/zookeeper-cluster/zookeeper-3/conf/zoo.cfg

```
clientPort=2183
dataDir=/usr/local/zookeeper-cluster/zookeeper-3/data
```

2）配置集群

1. 在每个 zookeeper 的 data 目录下创建一个 myid 文件，内容分别是 1、2、3 。这个文件就是记录每个服务器的 ID
2. 在每一个 zookeeper 的 zoo.cfg 配置客户端访问端口（clientPort）和集群服务器 IP 列表。

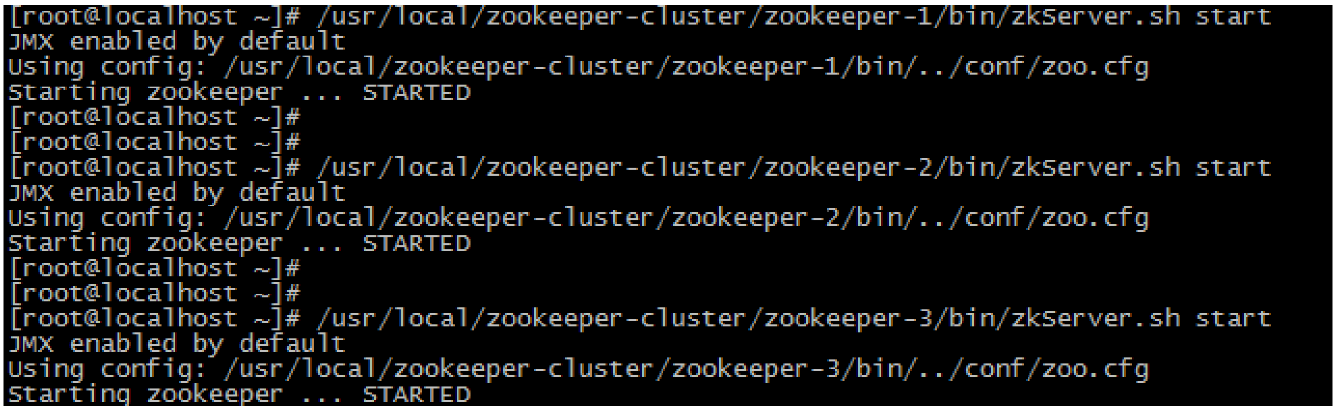
   集群服务器 IP 列表如下

```
server.1=192.168.25.140:2881:3881
server.2=192.168.25.140:2882:3882
server.3=192.168.25.140:2883:3883
```

解释：server.服务器 ID=服务器 IP 地址：服务器之间通信端口：服务器之间投票选举端口

3）启动集群

启动集群就是分别启动每个实例。



```
[root@localhost ~]# /usr/local/zookeeper-cluster/zookeeper-1/bin/zkServer.sh start
JMX enabled by default
Using config: /usr/local/zookeeper-cluster/zookeeper-1/bin/../conf/zoo.cfg
Starting zookeeper ... STARTED
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]# /usr/local/zookeeper-cluster/zookeeper-2/bin/zkServer.sh start
JMX enabled by default
Using config: /usr/local/zookeeper-cluster/zookeeper-2/bin/../conf/zoo.cfg
Starting zookeeper ... STARTED
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]# /usr/local/zookeeper-cluster/zookeeper-3/bin/zkServer.sh start
JMX enabled by default
Using config: /usr/local/zookeeper-cluster/zookeeper-3/bin/../conf/zoo.cfg
Starting zookeeper ... STARTED
```

2.3.2 RPC服务接口

```
public interface IUserService {
    public String sayHello(String name);
}
```

2.3.3 服务提供者

1）添加依赖

```
<parent>
    <groupId>org.springframework.boot</groupId>
    <artifactId>spring-boot-starter-parent</artifactId>
    <version>2.0.1.RELEASE</version>
</parent>

<dependencies>
    <!--dubbo-->
    <dependency>
        <groupId>com.alibaba.spring.boot</groupId>
        <artifactId>dubbo-spring-boot-starter</artifactId>
        <version>2.0.0</version>
    </dependency>
        <!--spring-boot-stater-->
    <dependency>
        <groupId>org.springframework.boot</groupId>
        <artifactId>spring-boot-starter</artifactId>
        <exclusions>
            <exclusion>
                <artifactId>log4j-to-slf4j</artifactId>
                <groupId>org.apache.logging.log4j</groupId>
            </exclusion>
        </exclusions>
    </dependency>
        <!--zookeeper-->
    <dependency>
        <groupId>org.apache.zookeeper</groupId>
        <artifactId>zookeeper</artifactId>
        <version>3.4.10</version>
        <exclusions>
            <exclusion>
                <groupId>org.slf4j</groupId>
                <artifactId>slf4j-log4j12</artifactId>
            </exclusion>
            <exclusion>
                <groupId>log4j</groupId>
                <artifactId>log4j</artifactId>
            </exclusion>
        </exclusions>
    </dependency>

    <dependency>
        <groupId>com.101tec</groupId>
        <artifactId>zkclient</artifactId>
        <version>0.9</version>
        <exclusions>
            <exclusion>
                <artifactId>slf4j-log4j12</artifactId>
                <groupId>org.slf4j</groupId>
            </exclusion>
        </exclusions>
    </dependency>
        <!--API-->
    <dependency>
        <groupId>com.itheima.demo</groupId>
        <artifactId>dubbo-api</artifactId>
        <version>1.0-SNAPSHOT</version>
    </dependency>

</dependencies>
```

2）配置文件

```
# application.properties
spring.application.name=dubbo-demo-provider
spring.dubbo.application.id=dubbo-demo-provider
spring.dubbo.application.name=dubbo-demo-provider
spring.dubbo.registry.address=zookeeper://192.168.25.140:2181;zookeeper://192.168.25.140:2182;
zookeeper://192.168.25.140:2183
spring.dubbo.server=true
spring.dubbo.protocol.name=dubbo
spring.dubbo.protocol.port=20880
```

3）启动类

```
@EnableDubboConfiguration
@SpringBootApplication
public class ProviderBootstrap {

    public static void main(String[] args) throws IOException {
        SpringApplication.run(ProviderBootstrap.class,args);
    }

}
```

4）服务实现

```
@Component
@Service(interfaceClass = IUserService.class)
public class UserServiceImpl implements IUserService{
    @Override
    public String sayHello(String name) {
        return "hello:"+name;
    }
}
```

2.3.4 服务消费者

1）添加依赖

```
<parent>
        <groupId>org.springframework.boot</groupId>
        <artifactId>spring-boot-starter-parent</artifactId>
        <version>2.0.1.RELEASE</version>
    </parent>

<dependencies>

    <dependency>
        <groupId>org.springframework.boot</groupId>
        <artifactId>spring-boot-starter-web</artifactId>
    </dependency>

    <!--dubbo-->
    <dependency>
        <groupId>com.alibaba.spring.boot</groupId>
        <artifactId>dubbo-spring-boot-starter</artifactId>
        <version>2.0.0</version>
    </dependency>

    <dependency>
        <groupId>org.springframework.boot</groupId>
        <artifactId>spring-boot-starter</artifactId>
        <exclusions>
            <exclusion>
                <artifactId>log4j-to-slf4j</artifactId>
                <groupId>org.apache.logging.log4j</groupId>
            </exclusion>
        </exclusions>
    </dependency>

    <!--zookeeper-->
```

```xml
    <dependency>
        <groupId>org.apache.zookeeper</groupId>
        <artifactId>zookeeper</artifactId>
        <version>3.4.10</version>
        <exclusions>
            <exclusion>
                <groupId>org.slf4j</groupId>
                <artifactId>slf4j-log4j12</artifactId>
            </exclusion>
            <exclusion>
                <groupId>log4j</groupId>
                <artifactId>log4j</artifactId>
            </exclusion>
        </exclusions>
    </dependency>

    <dependency>
        <groupId>com.101tec</groupId>
        <artifactId>zkclient</artifactId>
        <version>0.9</version>
        <exclusions>
            <exclusion>
                <artifactId>slf4j-log4j12</artifactId>
                <groupId>org.slf4j</groupId>
            </exclusion>
        </exclusions>
    </dependency>

    <!--API-->
    <dependency>
        <groupId>com.itheima.demo</groupId>
        <artifactId>dubbo-api</artifactId>
        <version>1.0-SNAPSHOT</version>
    </dependency>

</dependencies>
```

2）配置文件

```properties
# application.properties
spring.application.name=dubbo-demo-consumer
spring.dubbo.application.name=dubbo-demo-consumer
spring.dubbo.application.id=dubbo-demo-consumer

spring.dubbo.registry.address=zookeeper://192.168.25.140:2181;zookeeper://192.168.25.140:2182;
zookeeper://192.168.25.140:2183
```

3）启动类

```java
@EnableDubboConfiguration
@SpringBootApplication
public class ConsumerBootstrap {
    public static void main(String[] args) {
        SpringApplication.run(ConsumerBootstrap.class);
    }
}
```

4）Controller

```
@RestController
@RequestMapping("/user")
public class UserController {

    @Reference
    private IUserService userService;

    @RequestMapping("/sayHello")
    public String sayHello(String name){
        return userService.sayHello(name);
    }

}
```

3. 环境搭建

3.1 数据库

1）优惠券表

Field	Type	Comment
coupon_id	bigint(50) NOT NULL	优惠券ID
coupon_price	decimal(10,2) NULL	优惠券金额
user_id	bigint(50) NULL	用户ID
order_id	bigint(32) NULL	订单ID
is_used	int(1) NULL	是否使用 0未使用 1已使用
used_time	timestamp NULL	使用时间

2）商品表

Field	Type	Comment
goods_id	bigint(50) NOT NULL	主键
goods_name	varchar(255) NULL	商品名称
goods_number	int(11) NULL	商品库存
goods_price	decimal(10,2) NULL	商品价格
goods_desc	varchar(255) NULL	商品描述
add_time	timestamp NULL	添加时间

3）订单表

Field	Type	Comment
order_id	bigint(50) NOT NULL	订单ID
user_id	bigint(50) NULL	用户ID
order_status	int(1) NULL	订单状态 0未确认 1已确认 2已取消 3无效 4退款
pay_status	int(1) NULL	支付状态 0未支付 1支付中 2已支付
shipping_status	int(1) NULL	发货状态 0未发货 1已发货 2已退货
address	varchar(255) NULL	收货地址
consignee	varchar(255) NULL	收货人
goods_id	bigint(50) NULL	商品ID
goods_number	int(11) NULL	商品数量

Field	Type	Comment
goods_price	decimal(10,2) NULL	商品价格
goods_amount	decimal(10,0) NULL	商品总价
shipping_fee	decimal(10,2) NULL	运费
order_amount	decimal(10,2) NULL	订单价格
coupon_id	bigint(50) NULL	优惠券ID
coupon_paid	decimal(10,2) NULL	优惠券
money_paid	decimal(10,2) NULL	已付金额
pay_amount	decimal(10,2) NULL	支付金额
add_time	timestamp NULL	创建时间
confirm_time	timestamp NULL	订单确认时间
pay_time	timestamp NULL	支付时间

4）订单商品日志表

Field	Type	Comment
goods_id	int(11) NOT NULL	商品ID
order_id	varchar(32) NOT NULL	订单ID
goods_number	int(11) NULL	库存数量
log_time	datetime NULL	记录时间

5）用户表

Field	Type	Comment
user_id	bigint(50) NOT NULL	用户ID
user_name	varchar(255) NULL	用户姓名
user_password	varchar(255) NULL	用户密码
user_mobile	varchar(255) NULL	手机号
user_score	int(11) NULL	积分
user_reg_time	timestamp NULL	注册时间
user_money	decimal(10,0) NULL	用户余额

6）用户余额日志表

Field	Type	Comment
user_id	bigint(50) NOT NULL	用户ID
order_id	bigint(50) NOT NULL	订单ID
money_log_type	int(1) NOT NULL	日志类型 1订单付款 2 订单退款
use_money	decimal(10,2) NULL	操作金额
create_time	timestamp NULL	日志时间

7）订单支付表

Field	Type	Comment
pay_id	bigint(50) NOT NULL	支付编号
order_id	bigint(50) NULL	订单编号
pay_amount	decimal(10,2) NULL	支付金额
is_paid	int(1) NULL	是否已支付 1否 2是

8）MQ消息生产表

Field	Type	Comment
id	varchar(100) NOT NULL	主键
group_name	varchar(100) NULL	生产者组名
msg_topic	varchar(100) NULL	消息主题
msg_tag	varchar(100) NULL	Tag
msg_key	varchar(100) NULL	Key
msg_body	varchar(500) NULL	消息内容
msg_status	int(1) NULL	0:未处理;1:已经处理
create_time	timestamp NOT NULL	记录时间

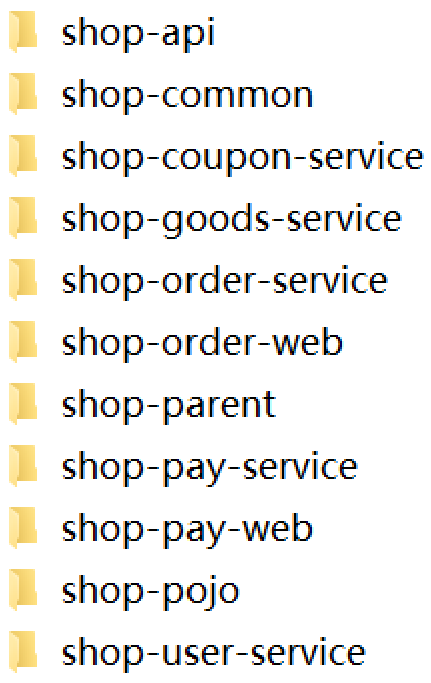
###9）MQ消息消费表

Field	Type	Comment
msg_id	varchar(50) NULL	消息ID
group_name	varchar(100) NOT NULL	消费者组名
msg_tag	varchar(100) NOT NULL	Tag
msg_key	varchar(100) NOT NULL	Key
msg_body	varchar(500) NULL	消息体
consumer_status	int(1) NULL	0:正在处理;1:处理成功;2:处理失败
consumer_times	int(1) NULL	消费次数
consumer_timestamp	timestamp NULL	消费时间
remark	varchar(500) NULL	备注

3.2 项目初始化

shop系统基于Maven进行项目管理

3.1.1 工程浏览

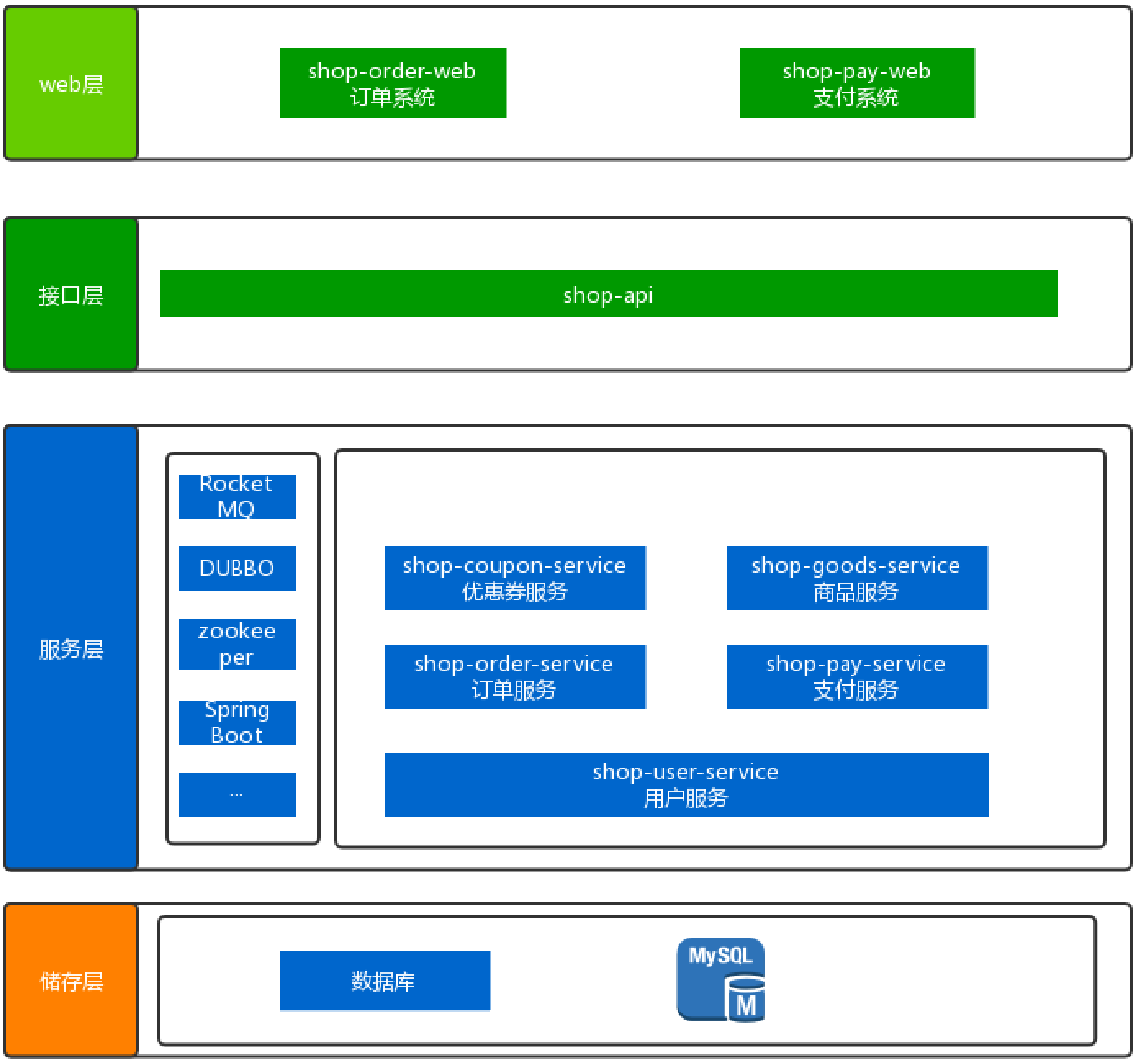


shop-api
shop-common
shop-coupon-service
shop-goods-service
shop-order-service
shop-order-web
shop-parent
shop-pay-service
shop-pay-web
shop-pojo
shop-user-service

- 父工程：shop-parent
- 订单系统：shop-order-web
- 支付系统：shop-pay-web
- 优惠券服务：shop-coupon-service
- 订单服务：shop-order-service
- 支付服务：shop-pay-service
- 商品服务：shop-goods-service
- 用户服务：shop-user-service
- 实体类：shop-pojo
- 持久层：shop-dao
- 接口层：shop-api
- 工具工程：shop-common

共12个系统

3.1.2 工程关系



3.3 Mybatis逆向工程使用

1）代码生成

使用Mybatis逆向工程针对数据表生成CURD持久层代码

###2）代码导入

- 将实体类导入到shop-pojo工程
- 在服务层工程中导入对应的Mapper类和对应配置文件

3.4 公共类介绍

- ID生成器

  IDWorker：Twitter雪花算法

- 异常处理类

  CustomerException：自定义异常类

  CastException：异常抛出类

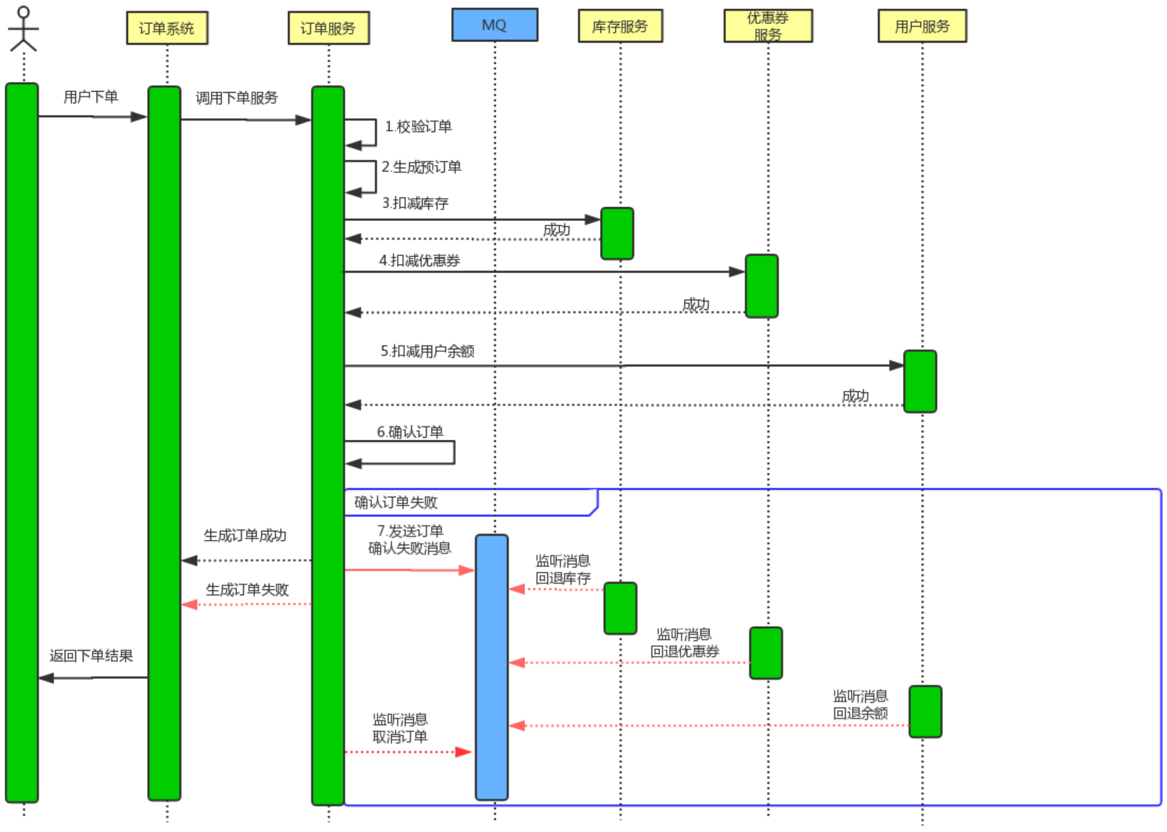
- 常量类

  ShopCode：系统状态类

- 响应实体类

  Result：封装响应状态和响应信息

4. 下单业务



4.1 下单基本流程

1）接口定义

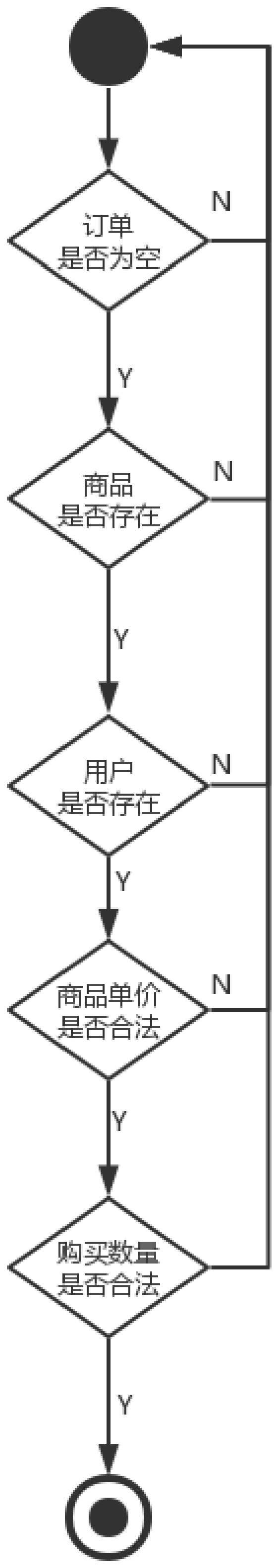
- IOrderService

```
public interface IOrderService {
    /**
     * 确认订单
     * @param order
     * @return Result
     */
    Result confirmOrder(TradeOrder order);
}
```

###2）业务类实现

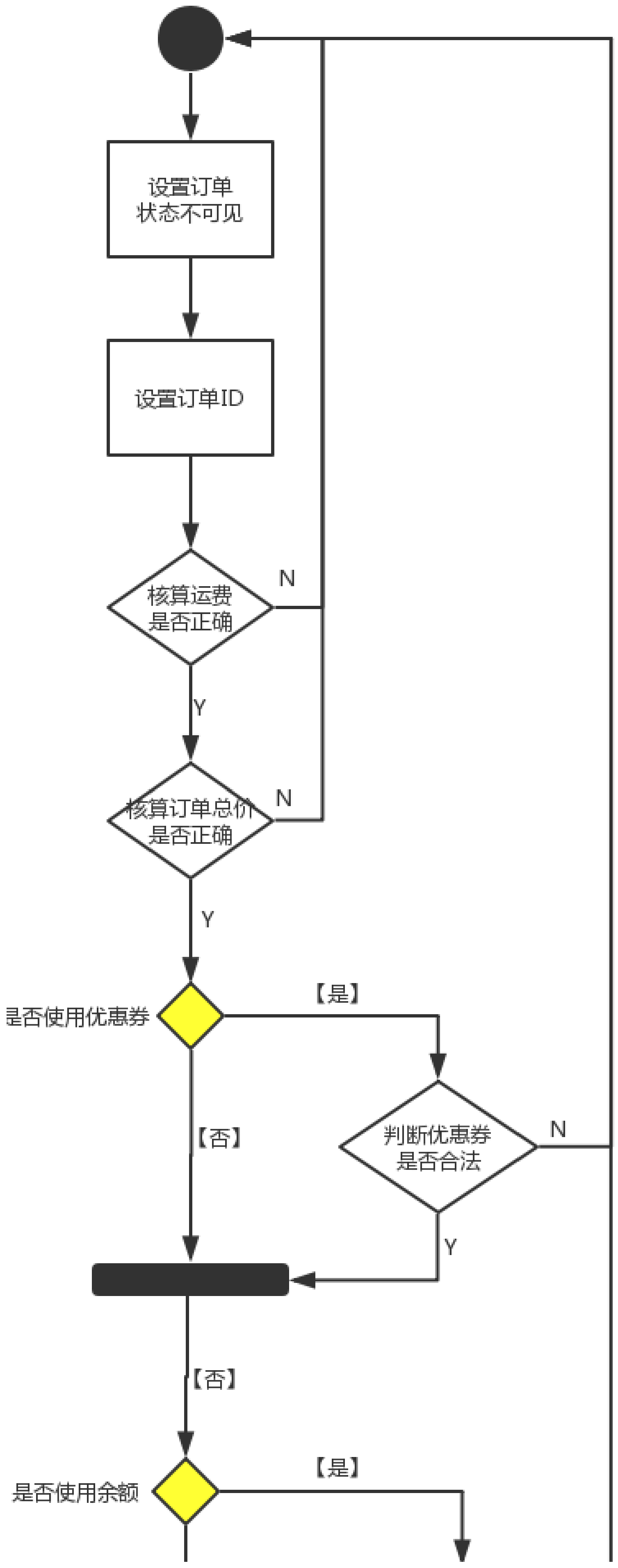
```
@Slf4j
@Component
@Service(interfaceClass = IOrderService.class)
public class OrderServiceImpl implements IOrderService {

    @Override
    public Result confirmOrder(TradeOrder order) {
        //1.校验订单

        //2.生成预订单
        try {
            //3.扣减库存

            //4.扣减优惠券

            //5.使用余额

            //6.确认订单

            //7.返回成功状态

        } catch (Exception e) {
            //1.确认订单失败,发送消息

            //2.返回失败状态
        }

    }
}
```

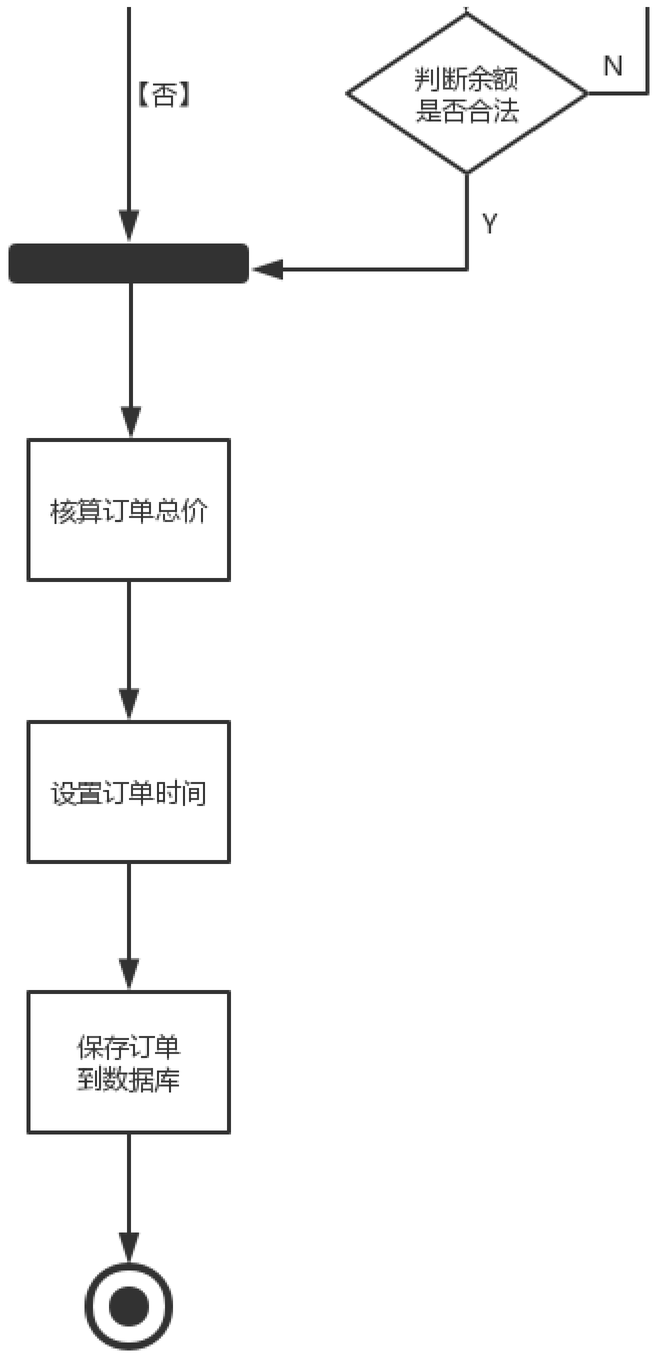
###3) 校验订单



```
private void checkOrder(TradeOrder order) {
        //1.校验订单是否存在
        if(order==null){
            CastException.cast(ShopCode.SHOP_ORDER_INVALID);
        }
        //2.校验订单中的商品是否存在
        TradeGoods goods = goodsService.findOne(order.getGoodsId());
        if(goods==null){
            CastException.cast(ShopCode.SHOP_GOODS_NO_EXIST);
        }
        //3.校验下单用户是否存在
        TradeUser user = userService.findOne(order.getUserId());
        if(user==null){
            CastException.cast(ShopCode.SHOP_USER_NO_EXIST);
        }
        //4.校验商品单价是否合法
        if(order.getGoodsPrice().compareTo(goods.getGoodsPrice())!=0){
            CastException.cast(ShopCode.SHOP_GOODS_PRICE_INVALID);
        }
        //5.校验订单商品数量是否合法
        if(order.getGoodsNumber()>=goods.getGoodsNumber()){
            CastException.cast(ShopCode.SHOP_GOODS_NUM_NOT_ENOUGH);
        }

        log.info("校验订单通过");
}
```

###4) 生成预订单


设置订单
状态不可见
设置订单ID
核算运费
是否正确
N
Y
核算订单总价
是否正确
N
Y
是否使用优惠券
【是】
【否】
判断优惠券
是否合法
N
Y
【否】
是否使用余额
【是】



```
private Long savePreOrder(TradeOrder order) {
        //1.设置订单状态为不可见
        order.setOrderStatus(ShopCode.SHOP_ORDER_NO_CONFIRM.getCode());
        //2.订单ID
        order.setOrderId(idWorker.nextId());
        //核算运费是否正确
        BigDecimal shippingFee = calculateShippingFee(order.getOrderAmount());
        if (order.getShippingFee().compareTo(shippingFee) != 0) {
            CastException.cast(ShopCode.SHOP_ORDER_SHIPPINGFEE_INVALID);
        }
        //3.计算订单总价格是否正确
        BigDecimal orderAmount = order.getGoodsPrice().multiply(new
BigDecimal(order.getGoodsNumber()));
        orderAmount.add(shippingFee);
        if (orderAmount.compareTo(order.getOrderAmount()) != 0) {
            CastException.cast(ShopCode.SHOP_ORDERAMOUNT_INVALID);
        }

        //4.判断优惠券信息是否合法
        Long couponId = order.getCouponId();
        if (couponId != null) {
            TradeCoupon coupon = couponService.findOne(couponId);
            //优惠券不存在
            if (coupon == null) {
                CastException.cast(ShopCode.SHOP_COUPON_NO_EXIST);
            }
            //优惠券已经使用
            if ((ShopCode.SHOP_COUPON_ISUSED.getCode().toString())
                .equals(coupon.getIsUsed().toString())) {
                CastException.cast(ShopCode.SHOP_COUPON_INVALIED);
            }
            order.setCouponPaid(coupon.getCouponPrice());
        } else {
            order.setCouponPaid(BigDecimal.ZERO);
        }

        //5.判断余额是否正确
        BigDecimal moneyPaid = order.getMoneyPaid();
        if (moneyPaid != null) {
            //比较余额是否大于0
            int r = order.getMoneyPaid().compareTo(BigDecimal.ZERO);
            //余额小于0
            if (r == -1) {
                CastException.cast(ShopCode.SHOP_MONEY_PAID_LESS_ZERO);
            }
            //余额大于0
            if (r == 1) {
                //查询用户信息
                TradeUser user = userService.findOne(order.getUserId());
                if (user == null) {
                    CastException.cast(ShopCode.SHOP_USER_NO_EXIST);
                }
            //比较余额是否大于用户账户余额
            if (user.getUserMoney().compareTo(order.getMoneyPaid().longValue()) == -1) {
                CastException.cast(ShopCode.SHOP_MONEY_PAID_INVALID);
            }
            order.setMoneyPaid(order.getMoneyPaid());
        }
    } else {
        order.setMoneyPaid(BigDecimal.ZERO);
    }
    //计算订单支付总价
    order.setPayAmount(orderAmount.subtract(order.getCouponPaid())
                       .subtract(order.getMoneyPaid()));
    //设置订单添加时间
    order.setAddTime(new Date());

    //保存预订单
    int r = orderMapper.insert(order);
    if (ShopCode.SHOP_SUCCESS.getCode() != r) {
        CastException.cast(ShopCode.SHOP_ORDER_SAVE_ERROR);
    }
    log.info("订单:["+order.getOrderId()+"]预订单生成成功");
    return order.getOrderId();
}
```

###5）扣减库存

- 通过dubbo调用商品服务完成扣减库存

```
private void reduceGoodsNum(TradeOrder order) {
        TradeGoodsNumberLog goodsNumberLog = new TradeGoodsNumberLog();
        goodsNumberLog.setGoodsId(order.getGoodsId());
        goodsNumberLog.setOrderId(order.getOrderId());
        goodsNumberLog.setGoodsNumber(order.getGoodsNumber());
        Result result = goodsService.reduceGoodsNum(goodsNumberLog);
        if (result.getSuccess().equals(ShopCode.SHOP_FAIL.getSuccess())) {
            CastException.cast(ShopCode.SHOP_REDUCE_GOODS_NUM_FAIL);
        }
        log.info("订单:["+order.getOrderId()+"]扣减库存["+order.getGoodsNumber()+"个]成功");
    }
```

- 商品服务GoodsService扣减库存

```
@Override
public Result reduceGoodsNum(TradeGoodsNumberLog goodsNumberLog) {
    if (goodsNumberLog == null ||
            goodsNumberLog.getGoodsNumber() == null ||
            goodsNumberLog.getOrderId() == null ||
            goodsNumberLog.getGoodsNumber() == null ||
            goodsNumberLog.getGoodsNumber().intValue() <= 0) {
        CastException.cast(ShopCode.SHOP_REQUEST_PARAMETER_VALID);
    }
    TradeGoods goods = goodsMapper.selectByPrimaryKey(goodsNumberLog.getGoodsId());
    if(goods.getGoodsNumber()<goodsNumberLog.getGoodsNumber()){
        //库存不足
        CastException.cast(ShopCode.SHOP_GOODS_NUM_NOT_ENOUGH);
    }
    //减库存
    goods.setGoodsNumber(goods.getGoodsNumber()-goodsNumberLog.getGoodsNumber());
    goodsMapper.updateByPrimaryKey(goods);


    //记录库存操作日志
    goodsNumberLog.setGoodsNumber(-(goodsNumberLog.getGoodsNumber()));
    goodsNumberLog.setLogTime(new Date());
    goodsNumberLogMapper.insert(goodsNumberLog);

    return new Result(ShopCode.SHOP_SUCCESS.getSuccess(),ShopCode.SHOP_SUCCESS.getMessage());
}
```

###6）扣减优惠券

- 通过dubbo完成扣减优惠券

```
private void changeCoponStatus(TradeOrder order) {
    //判断用户是否使用优惠券
    if (!StringUtils.isEmpty(order.getCouponId())) {
        //封装优惠券对象
        TradeCoupon coupon = couponService.findOne(order.getCouponId());
        coupon.setIsUsed(ShopCode.SHOP_COUPON_ISUSED.getCode());
        coupon.setUsedTime(new Date());
        coupon.setOrderId(order.getOrderId());
        Result result = couponService.changeCouponStatus(coupon);
        //判断执行结果
        if (result.getSuccess().equals(ShopCode.SHOP_FAIL.getSuccess())) {
            //优惠券使用失败
            CastException.cast(ShopCode.SHOP_COUPON_USE_FAIL);
        }
        log.info("订单:["+order.getOrderId()+"]使用扣减优惠券["+coupon.getCouponPrice()+"元]成
功");
    }

}
```

- 优惠券服务CouponService更改优惠券状态

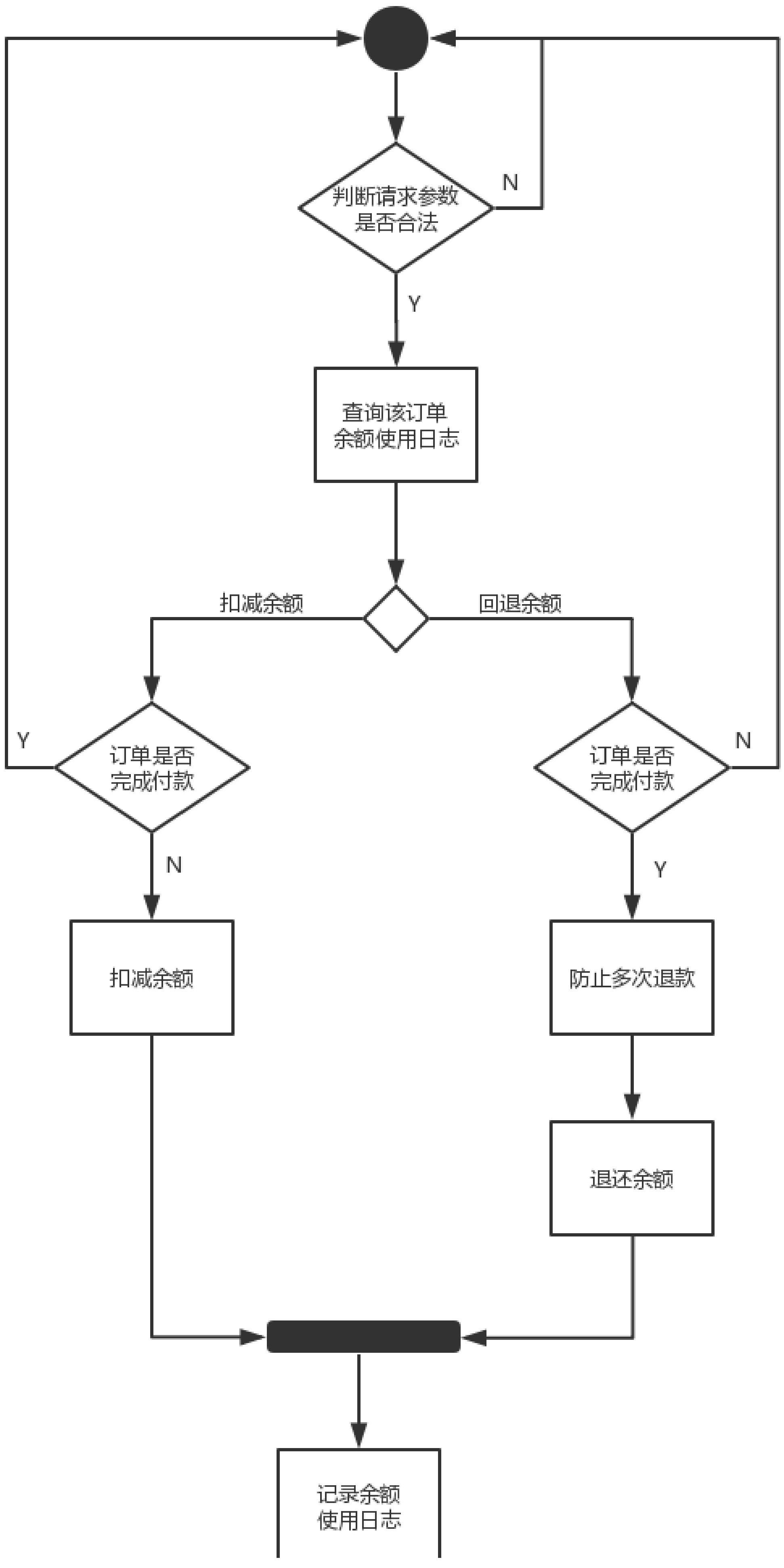
```
@Override
public Result changeCouponStatus(TradeCoupon coupon) {
    try {
        //判断请求参数是否合法
        if (coupon == null || StringUtils.isEmpty(coupon.getCouponId())) {
            CastException.cast(ShopCode.SHOP_REQUEST_PARAMETER_VALID);
        }
                //更新优惠券状态为已使用
        couponMapper.updateByPrimaryKey(coupon);
        return new Result(ShopCode.SHOP_SUCCESS.getSuccess(),
ShopCode.SHOP_SUCCESS.getMessage());
    } catch (Exception e) {
        return new Result(ShopCode.SHOP_FAIL.getSuccess(), ShopCode.SHOP_FAIL.getMessage());
    }
}
```

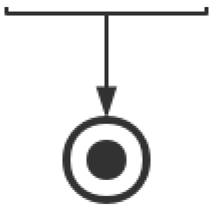
###7）扣减用户余额

- 通过用户服务完成扣减余额

```
private void reduceMoneyPaid(TradeOrder order) {
    //判断订单中使用的余额是否合法
    if (order.getMoneyPaid() != null && order.getMoneyPaid().compareTo(BigDecimal.ZERO) == 1)
{
        TradeUserMoneyLog userMoneyLog = new TradeUserMoneyLog();
        userMoneyLog.setOrderId(order.getOrderId());
        userMoneyLog.setUserId(order.getUserId());
        userMoneyLog.setUseMoney(order.getMoneyPaid());
        userMoneyLog.setMoneyLogType(ShopCode.SHOP_USER_MONEY_PAID.getCode());
        //扣减余额
        Result result = userService.changeUserMoney(userMoneyLog);
        if (result.getSuccess().equals(ShopCode.SHOP_FAIL.getSuccess())) {
            CastException.cast(ShopCode.SHOP_USER_MONEY_REDUCE_FAIL);
        }
        log.info("订单:["+order.getOrderId()+"扣减余额["+order.getMoneyPaid()+"元]成功]");
    }
}
```

- 用户服务UserService,更新余额


判断请求参数
是否合法
N
Y
查询该订单
余额使用日志
扣减余额
回退余额
Y
订单是否
完成付款
订单是否
完成付款
N
N
Y
扣减余额
防止多次退款
退还余额
记录余额
使用日志



```
@Override
public Result changeUserMoney(TradeUserMoneyLog userMoneyLog) {
    //判断请求参数是否合法
    if (userMoneyLog == null
            || userMoneyLog.getUserId() == null
            || userMoneyLog.getUseMoney() == null
            || userMoneyLog.getOrderId() == null
            || userMoneyLog.getUseMoney().compareTo(BigDecimal.ZERO) <= 0) {
        CastException.cast(ShopCode.SHOP_REQUEST_PARAMETER_VALID);
    }

    //查询该订单是否存在付款记录
    TradeUserMoneyLogExample userMoneyLogExample = new TradeUserMoneyLogExample();
    userMoneyLogExample.createCriteria()
            .andUserIdEqualTo(userMoneyLog.getUserId())
            .andOrderIdEqualTo(userMoneyLog.getOrderId());
   int count = userMoneyLogMapper.countByExample(userMoneyLogExample);
   TradeUser tradeUser = new TradeUser();
   tradeUser.setUserId(userMoneyLog.getUserId());
   tradeUser.setUserMoney(userMoneyLog.getUseMoney().longValue());
   //判断余额操作行为
   //【付款操作】
   if (userMoneyLog.getMoneyLogType().equals(ShopCode.SHOP_USER_MONEY_PAID.getCode())) {
           //订单已经付款，则抛异常
           if (count > 0) {
                CastException.cast(ShopCode.SHOP_ORDER_PAY_STATUS_IS_PAY);
            }
           //用户账户扣减余额
           userMapper.reduceUserMoney(tradeUser);
       }
    //【退款操作】
    if (userMoneyLog.getMoneyLogType().equals(ShopCode.SHOP_USER_MONEY_REFUND.getCode())) {
         //如果订单未付款,则不能退款,抛异常
         if (count == 0) {
         CastException.cast(ShopCode.SHOP_ORDER_PAY_STATUS_NO_PAY);
     }
     //防止多次退款
     userMoneyLogExample = new TradeUserMoneyLogExample();
     userMoneyLogExample.createCriteria()
             .andUserIdEqualTo(userMoneyLog.getUserId())
                .andOrderIdEqualTo(userMoneyLog.getOrderId())
                .andMoneyLogTypeEqualTo(ShopCode.SHOP_USER_MONEY_REFUND.getCode());
     count = userMoneyLogMapper.countByExample(userMoneyLogExample);
     if (count > 0) {
         CastException.cast(ShopCode.SHOP_USER_MONEY_REFUND_ALREADY);
     }
        //用户账户添加余额
        userMapper.addUserMoney(tradeUser);
    }


    //记录用户使用余额日志
    userMoneyLog.setCreateTime(new Date());
    userMoneyLogMapper.insert(userMoneyLog);
    return new Result(ShopCode.SHOP_SUCCESS.getSuccess(),ShopCode.SHOP_SUCCESS.getMessage());
}
```

###8）确认订单

```
private void updateOrderStatus(TradeOrder order) {
    order.setOrderStatus(ShopCode.SHOP_ORDER_CONFIRM.getCode());
    order.setPayStatus(ShopCode.SHOP_ORDER_PAY_STATUS_NO_PAY.getCode());
    order.setConfirmTime(new Date());
    int r = orderMapper.updateByPrimaryKey(order);
    if (r <= 0) {
        CastException.cast(ShopCode.SHOP_ORDER_CONFIRM_FAIL);
    }
    log.info("订单:["+order.getOrderId()+"]状态修改成功");
}
```

9）小结

```
@Override
public Result confirmOrder(TradeOrder order) {
    //1.校验订单
    checkOrder(order);
    //2.生成预订单
    Long orderId = savePreOrder(order);
    order.setOrderId(orderId);
    try {
        //3.扣减库存
        reduceGoodsNum(order);
        //4.扣减优惠券
        changeCoponStatus(order);
        //5.使用余额
        reduceMoneyPaid(order);
        //6.确认订单
        updateOrderStatus(order);
        log.info("订单:["+orderId+"]确认成功");
        return new Result(ShopCode.SHOP_SUCCESS.getSuccess(),
ShopCode.SHOP_SUCCESS.getMessage());
    } catch (Exception e) {
        //确认订单失败,发送消息
        ...
        return new Result(ShopCode.SHOP_FAIL.getSuccess(), ShopCode.SHOP_FAIL.getMessage());
    }
}
```

4.2 失败补偿机制

4.2.1 消息发送方

- 配置RocketMQ属性值

```
rocketmq.name-server=192.168.25.135:9876;192.168.25.138:9876
rocketmq.producer.group=orderProducerGroup

mq.order.consumer.group.name=order_orderTopic_cancel_group
mq.order.topic=orderTopic
mq.order.tag.confirm=order_confirm
mq.order.tag.cancel=order_cancel
```

- 注入模板类和属性值信息

```
@Autowired
private RocketMQTemplate rocketMQTemplate;

@Value("${mq.order.topic}")
private String topic;

@Value("${mq.order.tag.cancel}")
private String cancelTag;
```

- 发送下单失败消息

```
@Override
public Result confirmOrder(TradeOrder order) {
    //1.校验订单
    //2.生成预订
    try {
        //3.扣减库存
        //4.扣减优惠券
        //5.使用余额
        //6.确认订单
    } catch (Exception e) {
        //确认订单失败,发送消息
        CancelOrderMQ cancelOrderMQ = new CancelOrderMQ();
        cancelOrderMQ.setOrderId(order.getOrderId());
        cancelOrderMQ.setCouponId(order.getCouponId());
        cancelOrderMQ.setGoodsId(order.getGoodsId());
        cancelOrderMQ.setGoodsNumber(order.getGoodsNumber());
        cancelOrderMQ.setUserId(order.getUserId());
        cancelOrderMQ.setUserMoney(order.getMoneyPaid());
        try {
            sendMessage(topic,
                        cancelTag,
                        cancelOrderMQ.getOrderId().toString(),
                    JSON.toJSONString(cancelOrderMQ));
    } catch (Exception e1) {
        e1.printStackTrace();
            CastException.cast(ShopCode.SHOP_MQ_SEND_MESSAGE_FAIL);
        }
        return new Result(ShopCode.SHOP_FAIL.getSuccess(), ShopCode.SHOP_FAIL.getMessage());
    }
}

private void sendMessage(String topic, String tags, String keys, String body) throws Exception
{
    //判断Topic是否为空
    if (StringUtils.isEmpty(topic)) {
        CastException.cast(ShopCode.SHOP_MQ_TOPIC_IS_EMPTY);
    }
    //判断消息内容是否为空
    if (StringUtils.isEmpty(body)) {
        CastException.cast(ShopCode.SHOP_MQ_MESSAGE_BODY_IS_EMPTY);
    }
    //消息体
    Message message = new Message(topic, tags, keys, body.getBytes());
    //发送消息
    rocketMQTemplate.getProducer().send(message);
}
```

4.2.2 消费接收方

- 配置RocketMQ属性值

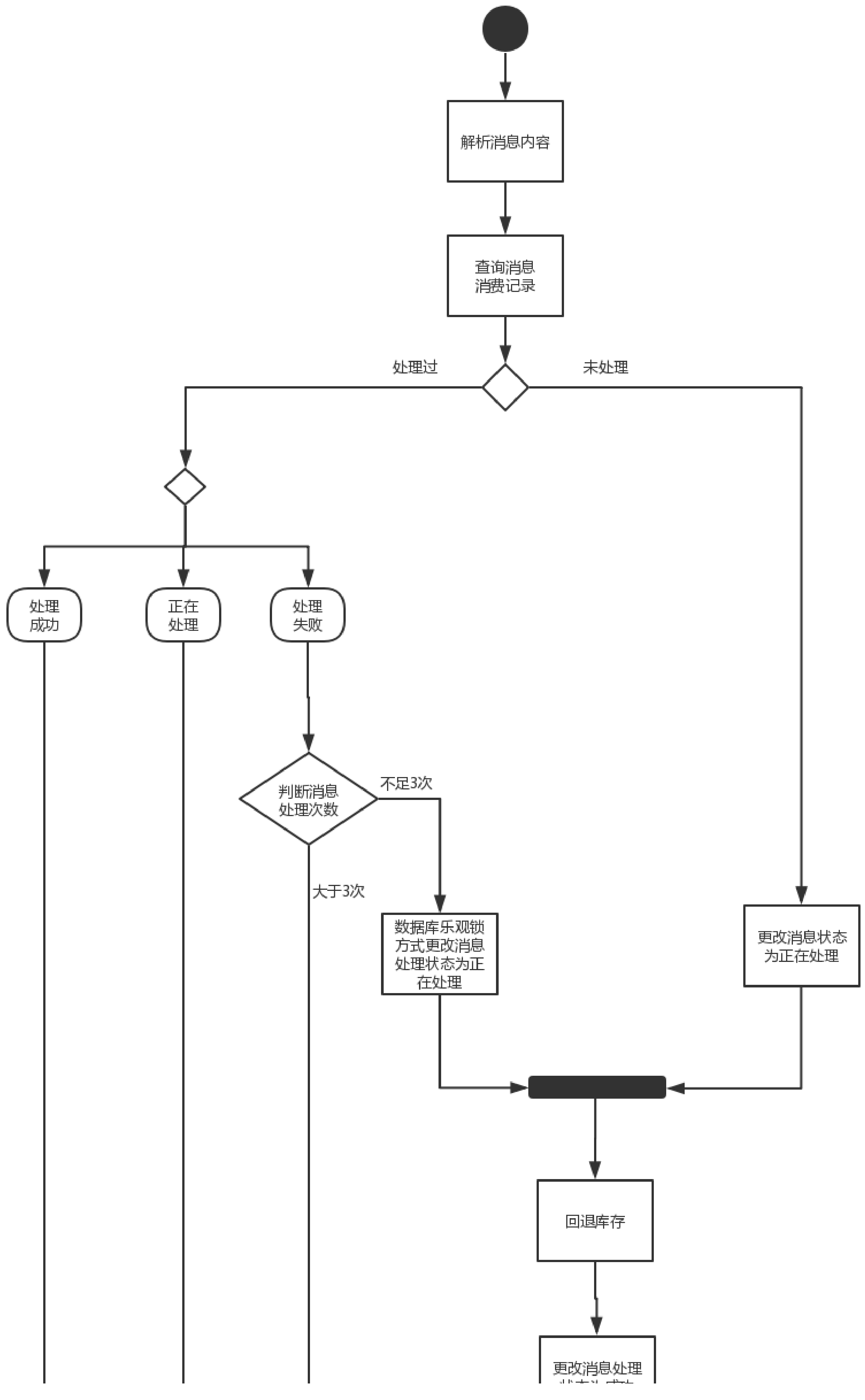
```
rocketmq.name-server=192.168.25.135:9876;192.168.25.138:9876
mq.order.consumer.group.name=order_orderTopic_cancel_group
mq.order.topic=orderTopic
```

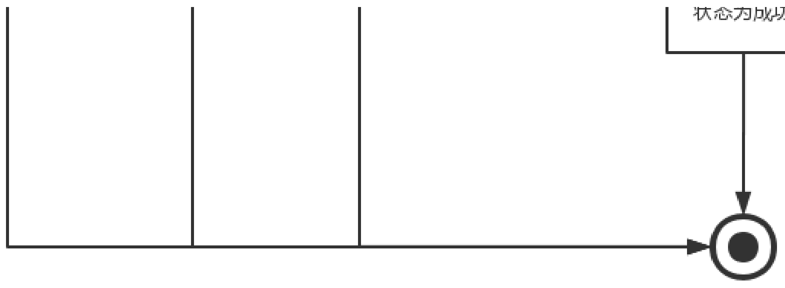
- 创建监听类，消费消息

```
@Slf4j
@Component
@RocketMQMessageListener(topic = "${mq.order.topic}",
                         consumerGroup = "${mq.order.consumer.group.name}",
                         messageModel = MessageModel.BROADCASTING)
public class CancelOrderConsumer implements RocketMQListener<MessageExt>{

    @Override
    public void onMessage(MessageExt messageExt) {
        ...
    }
}
```

1）回退库存

- 流程分析


解析消息内容
查询消息消费记录
处理过
未处理
处理成功
正在处理
处理失败
判断消息处理次数
不足3次
大于3次
数据库乐观锁方式更改消息处理状态为正在处理
更改消息状态为正在处理
回退库存
更改消息处理



- 消息消费者

```
@Slf4j
@Component
@RocketMQMessageListener(topic = "${mq.order.topic}",consumerGroup =
"${mq.order.consumer.group.name}",messageModel = MessageModel.BROADCASTING )
public class CancelMQListener implements RocketMQListener<MessageExt>{


    @Value("${mq.order.consumer.group.name}")
    private String groupName;

    @Autowired
    private TradeGoodsMapper goodsMapper;

    @Autowired
    private TradeMqConsumerLogMapper mqConsumerLogMapper;

    @Autowired
    private TradeGoodsNumberLogMapper goodsNumberLogMapper;

    @Override
    public void onMessage(MessageExt messageExt) {
        String msgId=null;
        String tags=null;
        String keys=null;
        String body=null;
        try {
            //1. 解析消息内容
            msgId = messageExt.getMsgId();
            tags= messageExt.getTags();
            keys= messageExt.getKeys();
            body= new String(messageExt.getBody(),"UTF-8");

            log.info("接受消息成功");

            //2. 查询消息消费记录
            TradeMqConsumerLogKey primaryKey = new TradeMqConsumerLogKey();
            primaryKey.setMsgTag(tags);
            primaryKey.setMsgKey(keys);
            primaryKey.setGroupName(groupName);
            TradeMqConsumerLog mqConsumerLog =
mqConsumerLogMapper.selectByPrimaryKey(primaryKey);

            if(mqConsumerLog!=null){
                //3. 判断如果消费过...
                //3.1 获得消息处理状态
                Integer status = mqConsumerLog.getConsumerStatus();
                //处理过...返回

if(ShopCode.SHOP_MQ_MESSAGE_STATUS_SUCCESS.getCode().intValue()==status.intValue()){
                    log.info("消息:"+msgId+",已经处理过");
                    return;
                }

                //正在处理...返回

if(ShopCode.SHOP_MQ_MESSAGE_STATUS_PROCESSING.getCode().intValue()==status.intValue()){
                    log.info("消息:"+msgId+",正在处理");
                    return;
                }

                //处理失败

if(ShopCode.SHOP_MQ_MESSAGE_STATUS_FAIL.getCode().intValue()==status.intValue()){
                    //获得消息处理次数
                    Integer times = mqConsumerLog.getConsumerTimes();
                    if(times>3){
                        log.info("消息:"+msgId+",消息处理超过3次,不能再进行处理了");
                        return;
                    }

mqConsumerLog.setConsumerStatus(ShopCode.SHOP_MQ_MESSAGE_STATUS_PROCESSING.getCode());

                    //使用数据库乐观锁更新
                    TradeMqConsumerLogExample example = new TradeMqConsumerLogExample();
                    TradeMqConsumerLogExample.Criteria criteria = example.createCriteria();
                    criteria.andMsgTagEqualTo(mqConsumerLog.getMsgTag());
                    criteria.andMsgKeyEqualTo(mqConsumerLog.getMsgKey());
                    criteria.andGroupNameEqualTo(groupName);
                    criteria.andConsumerTimesEqualTo(mqConsumerLog.getConsumerTimes());
                    int r = mqConsumerLogMapper.updateByExampleSelective(mqConsumerLog,
example);
                    if(r<=0){
                        //未修改成功,其他线程并发修改
                        log.info("并发修改,稍后处理");
                    }
                }

            }else{
                //4. 判断如果没有消费过...
                mqConsumerLog = new TradeMqConsumerLog();
                mqConsumerLog.setMsgTag(tags);
                mqConsumerLog.setMsgKey(keys);

mqConsumerLog.setConsumerStatus(ShopCode.SHOP_MQ_MESSAGE_STATUS_PROCESSING.getCode());
                mqConsumerLog.setMsgBody(body);
                mqConsumerLog.setMsgId(msgId);
                mqConsumerLog.setConsumerTimes(0);

                //将消息处理信息添加到数据库
                mqConsumerLogMapper.insert(mqConsumerLog);
            }
            //5. 回退库存
            MQEntity mqEntity = JSON.parseObject(body, MQEntity.class);
            Long goodsId = mqEntity.getGoodsId();
            TradeGoods goods = goodsMapper.selectByPrimaryKey(goodsId);
            goods.setGoodsNumber(goods.getGoodsNumber()+mqEntity.getGoodsNum());
            goodsMapper.updateByPrimaryKey(goods);

            //记录库存操作日志
            TradeGoodsNumberLog goodsNumberLog = new TradeGoodsNumberLog();
            goodsNumberLog.setOrderId(mqEntity.getOrderId());
            goodsNumberLog.setGoodsId(goodsId);
            goodsNumberLog.setGoodsNumber(mqEntity.getGoodsNum());
            goodsNumberLog.setLogTime(new Date());
            goodsNumberLogMapper.insert(goodsNumberLog);

            //6. 将消息的处理状态改为成功

mqConsumerLog.setConsumerStatus(ShopCode.SHOP_MQ_MESSAGE_STATUS_SUCCESS.getCode());
            mqConsumerLog.setConsumerTimestamp(new Date());
            mqConsumerLogMapper.updateByPrimaryKey(mqConsumerLog);
            log.info("回退库存成功");
        } catch (Exception e) {
            e.printStackTrace();
            TradeMqConsumerLogKey primaryKey = new TradeMqConsumerLogKey();
            primaryKey.setMsgTag(tags);
            primaryKey.setMsgKey(keys);
            primaryKey.setGroupName(groupName);
            TradeMqConsumerLog mqConsumerLog =
mqConsumerLogMapper.selectByPrimaryKey(primaryKey);
            if(mqConsumerLog==null){
                //数据库未有记录
                mqConsumerLog = new TradeMqConsumerLog();
                mqConsumerLog.setMsgTag(tags);
                mqConsumerLog.setMsgKey(keys);

mqConsumerLog.setConsumerStatus(ShopCode.SHOP_MQ_MESSAGE_STATUS_FAIL.getCode());
                mqConsumerLog.setMsgBody(body);
                mqConsumerLog.setMsgId(msgId);
                mqConsumerLog.setConsumerTimes(1);
                mqConsumerLogMapper.insert(mqConsumerLog);
            }else{
                mqConsumerLog.setConsumerTimes(mqConsumerLog.getConsumerTimes()+1);
                mqConsumerLogMapper.updateByPrimaryKeySelective(mqConsumerLog);
            }
        }

    }
}
```

2）回退优惠券

```
@Slf4j
@Component
@RocketMQMessageListener(topic = "${mq.order.topic}",consumerGroup =
"${mq.order.consumer.group.name}",messageModel = MessageModel.BROADCASTING )
public class CancelMQListener implements RocketMQListener<MessageExt>{


    @Autowired
    private TradeCouponMapper couponMapper;

    @Override
    public void onMessage(MessageExt message) {

        try {
            //1. 解析消息内容
            String body = new String(message.getBody(), "UTF-8");
            MQEntity mqEntity = JSON.parseObject(body, MQEntity.class);
            log.info("接收到消息");
            //2. 查询优惠券信息
            TradeCoupon coupon = couponMapper.selectByPrimaryKey(mqEntity.getCouponId());
            //3.更改优惠券状态
            coupon.setUsedTime(null);
            coupon.setIsUsed(ShopCode.SHOP_COUPON_UNUSED.getCode());
            coupon.setOrderId(null);
            couponMapper.updateByPrimaryKey(coupon);
            log.info("回退优惠券成功");
        } catch (UnsupportedEncodingException e) {
            e.printStackTrace();
            log.error("回退优惠券失败");
        }

    }
}
```

3）回退余额

```
@Slf4j
@Component
@RocketMQMessageListener(topic = "${mq.order.topic}",consumerGroup =
"${mq.order.consumer.group.name}",messageModel = MessageModel.BROADCASTING )
public class CancelMQListener implements RocketMQListener<MessageExt>{


    @Autowired
    private IUserService userService;

    @Override
    public void onMessage(MessageExt messageExt) {

        try {
            //1.解析消息
            String body = new String(messageExt.getBody(), "UTF-8");
            MQEntity mqEntity = JSON.parseObject(body, MQEntity.class);
            log.info("接收到消息");
            if(mqEntity.getUserMoney()!=null &&
mqEntity.getUserMoney().compareTo(BigDecimal.ZERO)>0){
                //2.调用业务层,进行余额修改
                TradeUserMoneyLog userMoneyLog = new TradeUserMoneyLog();
                userMoneyLog.setUseMoney(mqEntity.getUserMoney());
                userMoneyLog.setMoneyLogType(ShopCode.SHOP_USER_MONEY_REFUND.getCode());
                userMoneyLog.setUserId(mqEntity.getUserId());
                userMoneyLog.setOrderId(mqEntity.getOrderId());
                userService.updateMoneyPaid(userMoneyLog);
                log.info("余额回退成功");
            }
        } catch (UnsupportedEncodingException e) {
            e.printStackTrace();
            log.error("余额回退失败");
        }

    }
}
```

4）取消订单

```
@Override
    public void onMessage(MessageExt messageExt) {
        String body = new String(messageExt.getBody(), "UTF-8");
        String msgId = messageExt.getMsgId();
        String tags = messageExt.getTags();
        String keys = messageExt.getKeys();
        log.info("CancelOrderProcessor receive message:"+messageExt);
        CancelOrderMQ cancelOrderMQ = JSON.parseObject(body, CancelOrderMQ.class);
        TradeOrder order = orderService.findOne(cancelOrderMQ.getOrderId());
                order.setOrderStatus(ShopCode.SHOP_ORDER_CANCEL.getCode());
        orderService.changeOrderStatus(order);
        log.info("订单:["+order.getOrderId()+"]状态设置为取消");
        return order;
    }
```

4.3 测试

1）准备测试环境

```
@RunWith(SpringRunner.class)
@SpringBootTest(classes = ShopOrderServiceApplication.class)
public class OrderTest {

    @Autowired
    private IOrderService orderService;
}
```

###1）准备测试数据

- 用户数据
- 商品数据
- 优惠券数据

###2）测试下单成功流程

```
@Test
public void add(){
    Long goodsId=XXXL;
    Long userId=XXXL;
    Long couponId=XXXL;

    TradeOrder order = new TradeOrder();
    order.setGoodsId(goodsId);
    order.setUserId(userId);
    order.setGoodsNumber(1);
    order.setAddress("北京");
    order.setGoodsPrice(new BigDecimal("5000"));
    order.setOrderAmount(new BigDecimal("5000"));
    order.setMoneyPaid(new BigDecimal("100"));
    order.setCouponId(couponId);
    order.setShippingFee(new BigDecimal(0));
    orderService.confirmOrder(order);
}
```

执行完毕后,查看数据库中用户的余额、优惠券数据，及订单的状态数据

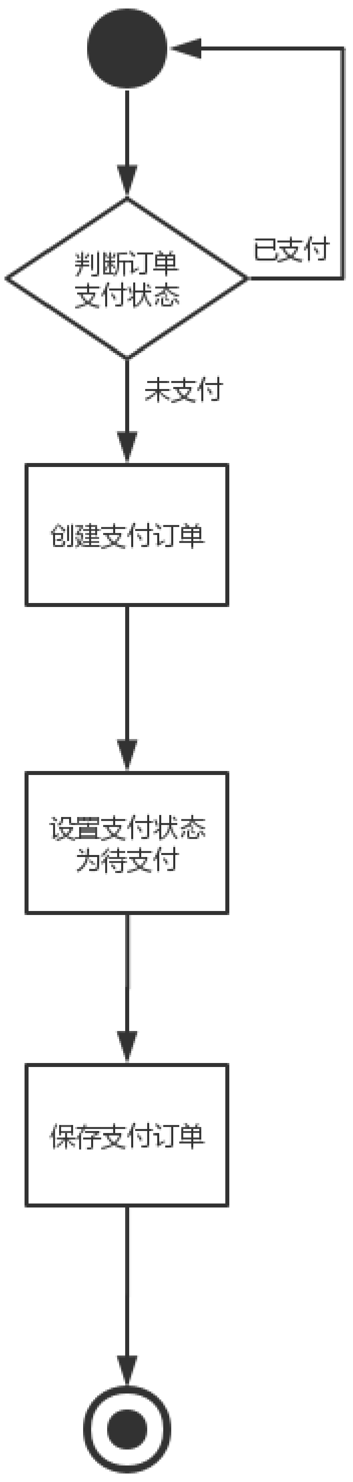
###3）测试下单失败流程

代码同上。

执行完毕后，查看用户的余额、优惠券数据是否发生更改，订单的状态是否为取消。

5. 支付业务

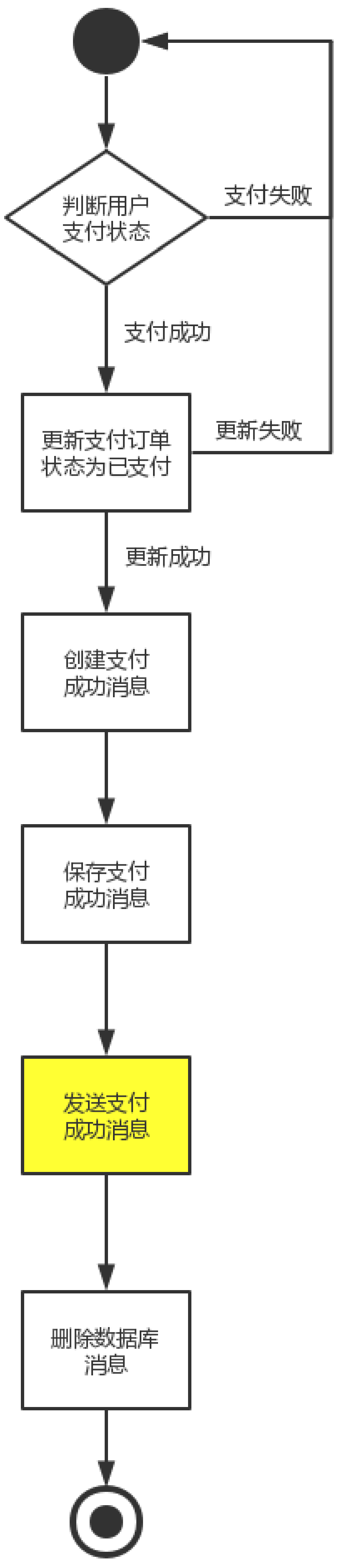
5.1 创建支付订单



```
public Result createPayment(TradePay tradePay) {
    //查询订单支付状态
    try {
        TradePayExample payExample = new TradePayExample();
        TradePayExample.Criteria criteria = payExample.createCriteria();
        criteria.andOrderIdEqualTo(tradePay.getOrderId());
        criteria.andIsPaidEqualTo(ShopCode.SHOP_ORDER_PAY_STATUS_IS_PAY.getCode());
        int count = tradePayMapper.countByExample(payExample);
        if (count > 0) {
            CastException.cast(ShopCode.SHOP_ORDER_PAY_STATUS_IS_PAY);
        }

        long payId = idWorker.nextId();
        tradePay.setPayId(payId);
        tradePay.setIsPaid(ShopCode.SHOP_ORDER_PAY_STATUS_NO_PAY.getCode());
        tradePayMapper.insert(tradePay);
        log.info("创建支付订单成功:" + payId);
    } catch (Exception e) {
        return new Result(ShopCode.SHOP_FAIL.getSuccess(), ShopCode.SHOP_FAIL.getMessage());
    }
    return new Result(ShopCode.SHOP_SUCCESS.getSuccess(), ShopCode.SHOP_SUCCESS.getMessage());
}
```

5.2 支付回调

5.2.1 流程分析


判断用户支付状态
支付失败
支付成功
更新支付订单状态为已支付
更新失败
更新成功
创建支付成功消息
保存支付成功消息
发送支付成功消息
删除数据库消息

5.2.2 代码实现

```
public Result callbackPayment(TradePay tradePay) {

    if (tradePay.getIsPaid().equals(ShopCode.SHOP_ORDER_PAY_STATUS_IS_PAY.getCode())) {
        tradePay = tradePayMapper.selectByPrimaryKey(tradePay.getPayId());
        if (tradePay == null) {
            CastException.cast(ShopCode.SHOP_PAYMENT_NOT_FOUND);
        }
        tradePay.setIsPaid(ShopCode.SHOP_ORDER_PAY_STATUS_IS_PAY.getCode());
        int i = tradePayMapper.updateByPrimaryKeySelective(tradePay);
        //更新成功代表支付成功
        if (i == 1) {
            TradeMqProducerTemp mqProducerTemp = new TradeMqProducerTemp();
            mqProducerTemp.setId(String.valueOf(idWorker.nextId()));
            mqProducerTemp.setGroupName("payProducerGroup");
            mqProducerTemp.setMsgKey(String.valueOf(tradePay.getPayId()));
            mqProducerTemp.setMsgTag(topic);
            mqProducerTemp.setMsgBody(JSON.toJSONString(tradePay));
            mqProducerTemp.setCreateTime(new Date());
            mqProducerTempMapper.insert(mqProducerTemp);
            TradePay finalTradePay = tradePay;
            executorService.submit(new Runnable() {
                @Override
                public void run() {
                    try {
                        SendResult sendResult = sendMessage(topic,
                                                            tag,
                                                            finalTradePay.getPayId(),
                                                            JSON.toJSONString(finalTradePay));
                        log.info(JSON.toJSONString(sendResult));
                        if (SendStatus.SEND_OK.equals(sendResult.getSendStatus())) {
                            mqProducerTempMapper.deleteByPrimaryKey(mqProducerTemp.getId());
                            System.out.println("删除消息表成功");
                        }
                    } catch (Exception e) {
                        e.printStackTrace();
                    }
                }
            });
        } else {
            CastException.cast(ShopCode.SHOP_PAYMENT_IS_PAID);
        }
    }
    return new Result(ShopCode.SHOP_SUCCESS.getSuccess(), ShopCode.SHOP_SUCCESS.getMessage());
}
```

线程池优化消息发送逻辑

- 创建线程池对象

```
@Bean
public ThreadPoolTaskExecutor getThreadPool() {

    ThreadPoolTaskExecutor executor = new ThreadPoolTaskExecutor();

    executor.setCorePoolSize(4);

    executor.setMaxPoolSize(8);
    executor.setQueueCapacity(100);

    executor.setKeepAliveSeconds(60);

    executor.setThreadNamePrefix("Pool-A");

    executor.setRejectedExecutionHandler(new ThreadPoolExecutor.CallerRunsPolicy());

    executor.initialize();

    return executor;

}
```

- 使用线程池

```
@Autowired
private ThreadPoolTaskExecutor executorService;

executorService.submit(new Runnable() {
    @Override
    public void run() {
        try {
            SendResult sendResult = sendMessage(topic, tag, finalTradePay.getPayId(),
JSON.toJSONString(finalTradePay));
            log.info(JSON.toJSONString(sendResult));
            if (SendStatus.SEND_OK.equals(sendResult.getSendStatus())) {
                mqProducerTempMapper.deleteByPrimaryKey(mqProducerTemp.getId());
                System.out.println("删除消息表成功");
            }
        } catch (Exception e) {
            e.printStackTrace();
        }
    }
});
```

5.2.3

处理消息

支付成功后，支付服务payService发送MQ消息，订单服务、用户服务、日志服务需要订阅消息进行处理

1. 订单服务修改订单状态为已支付
2. 日志服务记录支付日志
3. 用户服务负责给用户增加积分

以下用订单服务为例说明消息的处理情况

1）配置RocketMQ属性值

```
mq.pay.topic=payTopic
mq.pay.consumer.group.name=pay_payTopic_group
```

2）消费消息

- 在订单服务中，配置公共的消息处理类

```
public class BaseConsumer {

    public TradeOrder handleMessage(IOrderService
                                    orderService,
                                    MessageExt messageExt,Integer code) throws Exception {
        //解析消息内容
        String body = new String(messageExt.getBody(), "UTF-8");
        String msgId = messageExt.getMsgId();
        String tags = messageExt.getTags();
        String keys = messageExt.getKeys();
        OrderMQ orderMq = JSON.parseObject(body, OrderMQ.class);

        //查询
        TradeOrder order = orderService.findOne(orderMq.getOrderId());

        if(ShopCode.SHOP_ORDER_MESSAGE_STATUS_CANCEL.getCode().equals(code)){
            order.setOrderStatus(ShopCode.SHOP_ORDER_CANCEL.getCode());
        }

        if(ShopCode.SHOP_ORDER_MESSAGE_STATUS_ISPAID.getCode().equals(code)){
            order.setPayStatus(ShopCode.SHOP_ORDER_PAY_STATUS_IS_PAY.getCode());
        }
        orderService.changeOrderStatus(order);
        return order;
    }

}
```

- 接受订单支付成功消息

```
@Slf4j
@Component
@RocketMQMessageListener(topic = "${mq.pay.topic}",
                         consumerGroup = "${mq.pay.consumer.group.name}")
public class PayConsumer extends BaseConsumer implements RocketMQListener<MessageExt> {

    @Autowired
    private IOrderService orderService;

    @Override
    public void onMessage(MessageExt messageExt) {
        try {
            log.info("CancelOrderProcessor receive message:"+messageExt);
            TradeOrder order = handleMessage(orderService,
                                             messageExt,

ShopCode.SHOP_ORDER_MESSAGE_STATUS_ISPAID.getCode());
            log.info("订单:["+order.getOrderId()+"]支付成功");
        } catch (Exception e) {
            e.printStackTrace();
            log.error("订单支付失败");
        }
    }
}
```

6. 整体联调

通过Rest客户端请求shop-order-web和shop-pay-web完成下单和支付操作

6.1 准备工作

1）配置RestTemplate类

```
@Configuration
public class RestTemplateConfig {

    @Bean
    @ConditionalOnMissingBean({ RestOperations.class, RestTemplate.class })
    public RestTemplate restTemplate(ClientHttpRequestFactory factory) {

        RestTemplate restTemplate = new RestTemplate(factory);

        // 使用 utf-8 编码集的 conver 替换默认的 conver（默认的 string conver 的编码集为"ISO-8859-
1"）
        List<HttpMessageConverter<?>> messageConverters = restTemplate.getMessageConverters();
        Iterator<HttpMessageConverter<?>> iterator = messageConverters.iterator();
        while (iterator.hasNext()) {
            HttpMessageConverter<?> converter = iterator.next();
            if (converter instanceof StringHttpMessageConverter) {
                iterator.remove();
            }
        }
        messageConverters.add(new StringHttpMessageConverter(Charset.forName("UTF-8")));

        return restTemplate;
    }

    @Bean
    @ConditionalOnMissingBean({ClientHttpRequestFactory.class})
    public ClientHttpRequestFactory simpleClientHttpRequestFactory() {
        SimpleClientHttpRequestFactory factory = new SimpleClientHttpRequestFactory();
        // ms
        factory.setReadTimeout(15000);
        // ms
        factory.setConnectTimeout(15000);
        return factory;
    }
}
```

2）配置请求地址

- 订单系统

```
server.host=http://localhost
server.servlet.path=/order-web
server.port=8080
shop.order.baseURI=${server.host}:${server.port}${server.servlet.path}
shop.order.confirm=/order/confirm
```

- 支付系统

```
server.host=http://localhost
server.servlet.path=/pay-web
server.port=9090
shop.pay.baseURI=${server.host}:${server.port}${server.servlet.path}
shop.pay.createPayment=/pay/createPayment
shop.pay.callbackPayment=/pay/callbackPayment
```

6.2 下单测试

```
@RunWith(SpringRunner.class)
@ContextConfiguration(classes = ShopOrderWebApplication.class)
@TestPropertySource("classpath:application.properties")
public class OrderTest {

    @Autowired
    private RestTemplate restTemplate;

    @Value("${shop.order.baseURI}")
    private String baseURI;

    @Value("${shop.order.confirm}")
    private String confirmOrderPath;

    @Autowired
    private IDWorker idWorker;

   /**
     * 下单
     */
    @Test
    public void confirmOrder(){
        Long goodsId=XXXL;
        Long userId=XXXL;
        Long couponId=XXXL;

        TradeOrder order = new TradeOrder();
        order.setGoodsId(goodsId);
        order.setUserId(userId);
        order.setGoodsNumber(1);
        order.setAddress("北京");
        order.setGoodsPrice(new BigDecimal("5000"));
        order.setOrderAmount(new BigDecimal("5000"));
        order.setMoneyPaid(new BigDecimal("100"));
        order.setCouponId(couponId);
        order.setShippingFee(new BigDecimal(0));

        Result result = restTemplate.postForEntity(baseURI + confirmOrderPath, order,
Result.class).getBody();
        System.out.println(result);
    }

}
```

6.3 支付测试

```
@RunWith(SpringRunner.class)
@ContextConfiguration(classes = ShopPayWebApplication.class)
@TestPropertySource("classpath:application.properties")
public class PayTest {

    @Autowired
    private RestTemplate restTemplate;

    @Value("${shop.pay.baseURI}")
    private String baseURI;
    @Value("${shop.pay.createPayment}")
    private String createPaymentPath;

    @Value("${shop.pay.callbackPayment}")
    private String callbackPaymentPath;

    @Autowired
    private IDWorker idWorker;

   /**
     * 创建支付订单
     */
    @Test
    public void createPayment(){

        Long orderId = 346321587315814400L;
        TradePay pay = new TradePay();
        pay.setOrderId(orderId);
        pay.setPayAmount(new BigDecimal(4800));

        Result result = restTemplate.postForEntity(baseURI + createPaymentPath, pay,
Result.class).getBody();
        System.out.println(result);
    }

    /**
     * 支付回调
     */
    @Test
    public void callbackPayment(){
        Long payId = 346321891507720192L;
        TradePay pay = new TradePay();
        pay.setPayId(payId);
        pay.setIsPaid(ShopCode.SHOP_ORDER_PAY_STATUS_IS_PAY.getCode());
        Result result = restTemplate.postForEntity(baseURI + callbackPaymentPath, pay,
Result.class).getBody();
        System.out.println(result);

    }

}
```