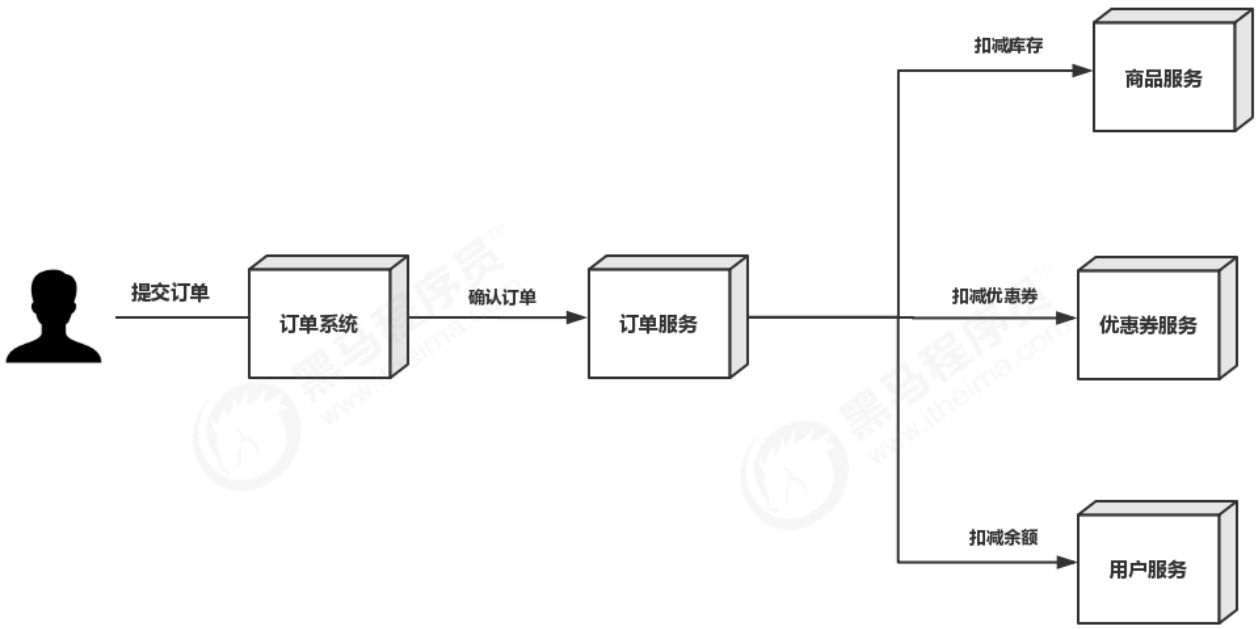
1. 案例介绍

1.1 业务分析

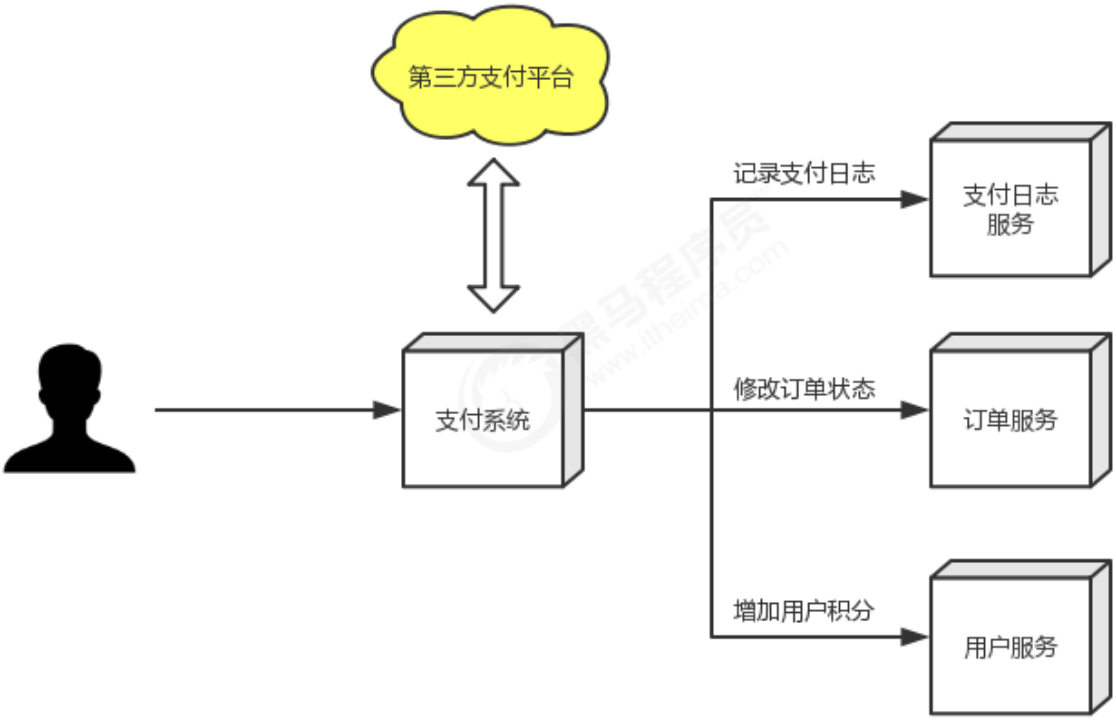
模拟电商网站购物场景中的【下单】和【支付】业务

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



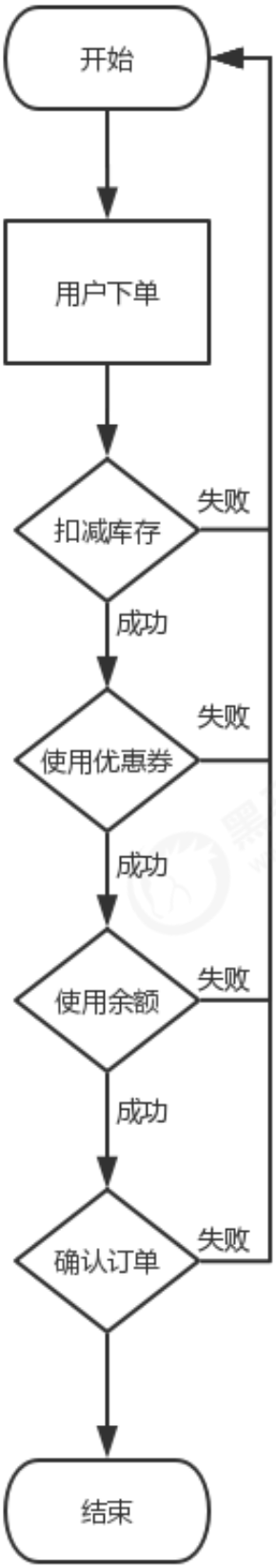
1. 用户请求支付系统
2. 支付系统调用第三方支付平台API进行发起支付流程
3. 用户通过第三方支付平台支付成功后，第三方支付平台回调通知支付系统
4. 支付系统调用订单服务修改订单状态
5. 支付系统调用积分服务添加积分
6. 支付系统调用日志服务记录日志

1.2 问题分析

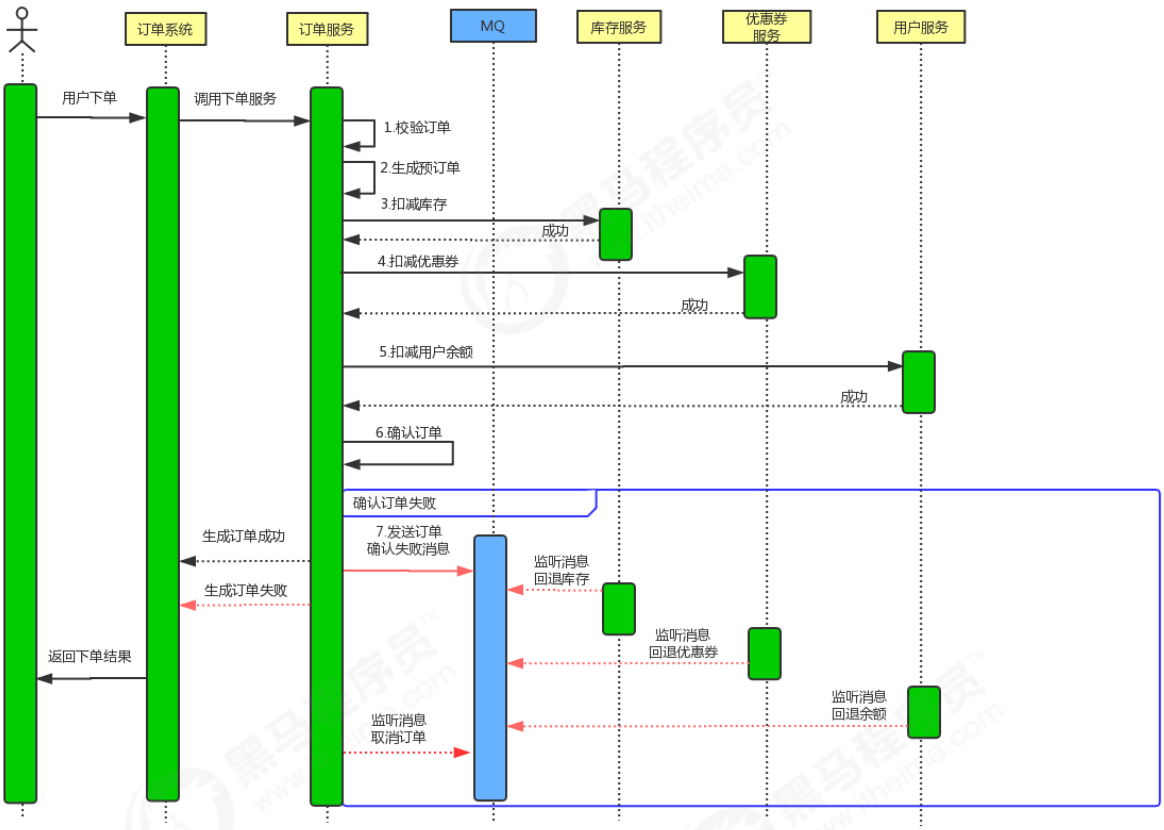
问题1

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？


开始
用户下单
扣减库存
失败
成功
使用优惠券
失败
成功
使用余额
失败
成功
确认订单
失败
结束

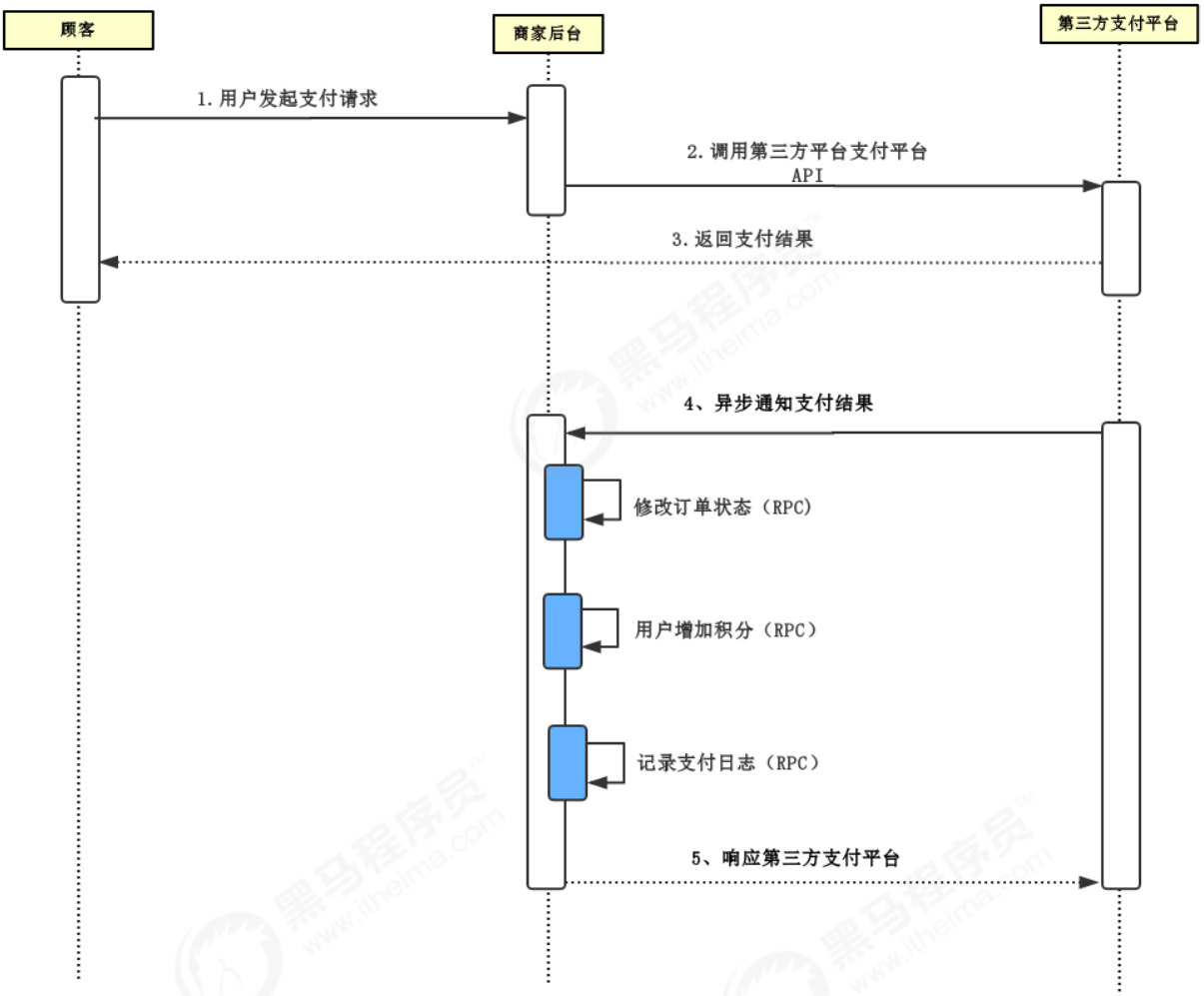
使用MQ保证在下单失败后系统数据的完整性



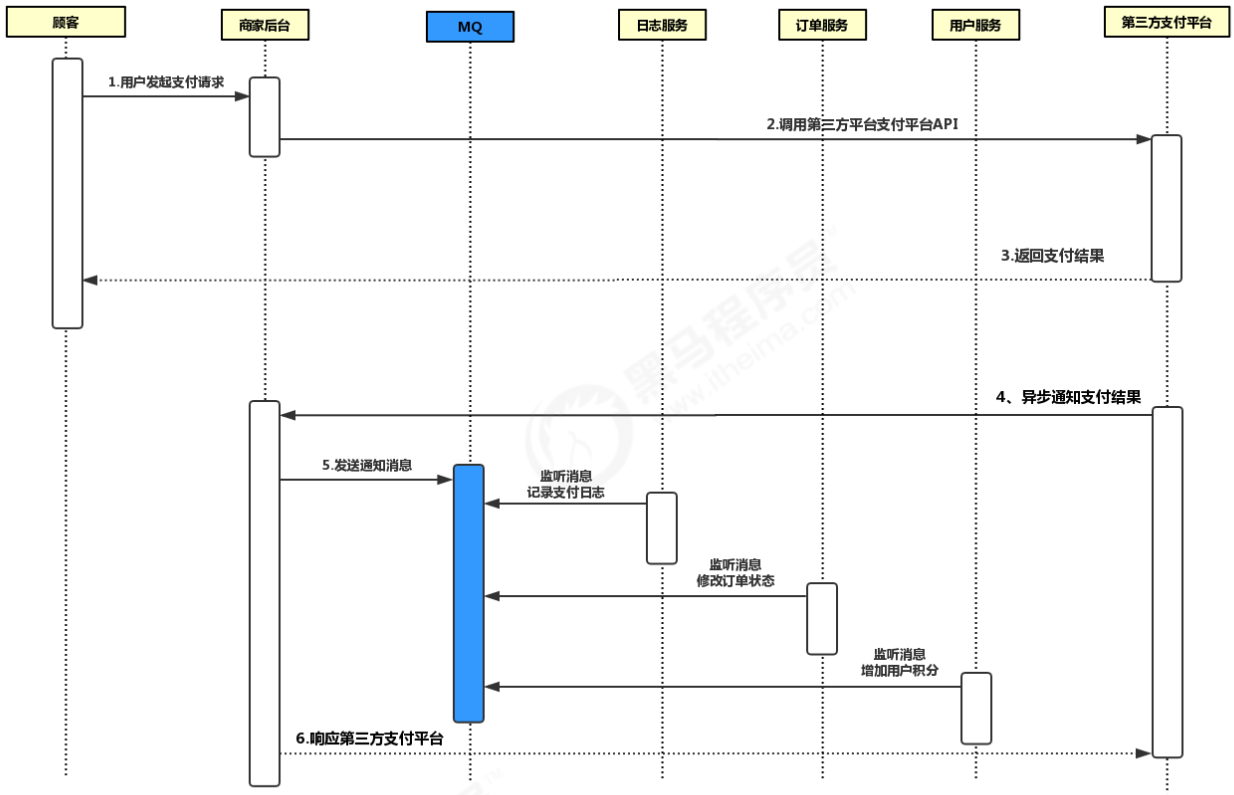
问题2

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？



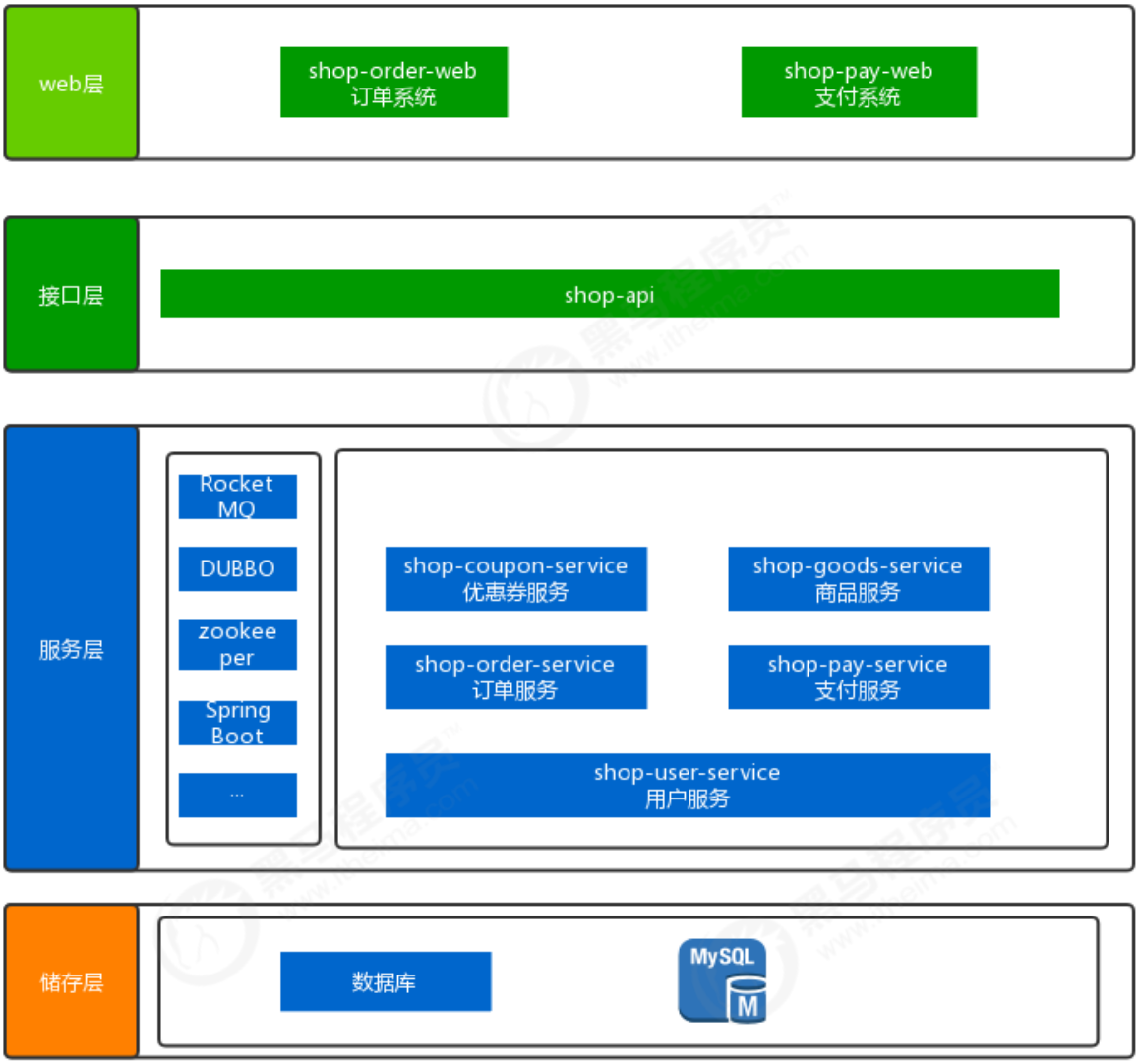
通过MQ进行数据分发，提高系统处理性能



2. 技术分析

2.1 技术选型

- SpringBoot
- Dubbo
- Zookeeper
- RocketMQ
- Mysql



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

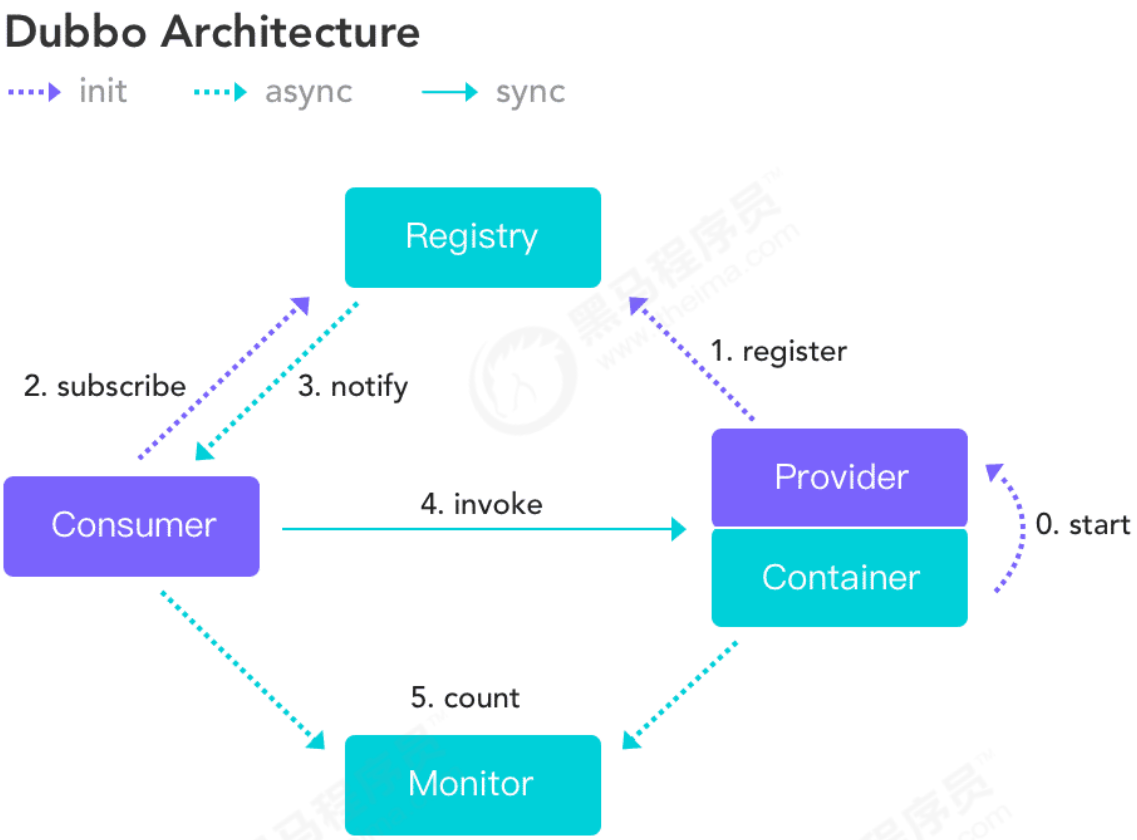
```
@Slf4j
@Component
@RocketMQMessageListener(topic = "springboot-mq",consumerGroup =
"springboot-mq-consumer-1")
public class Consumer implements RocketMQListener<String> {

    @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
```

1. 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-->
    <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-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

```
@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
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

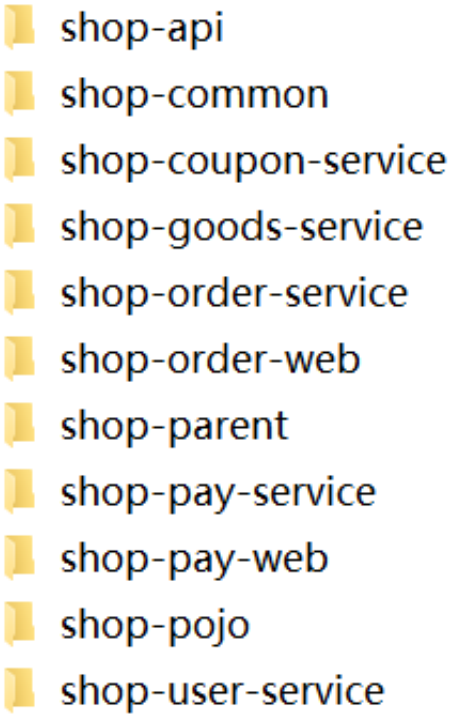
9）MQ消息消费表

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

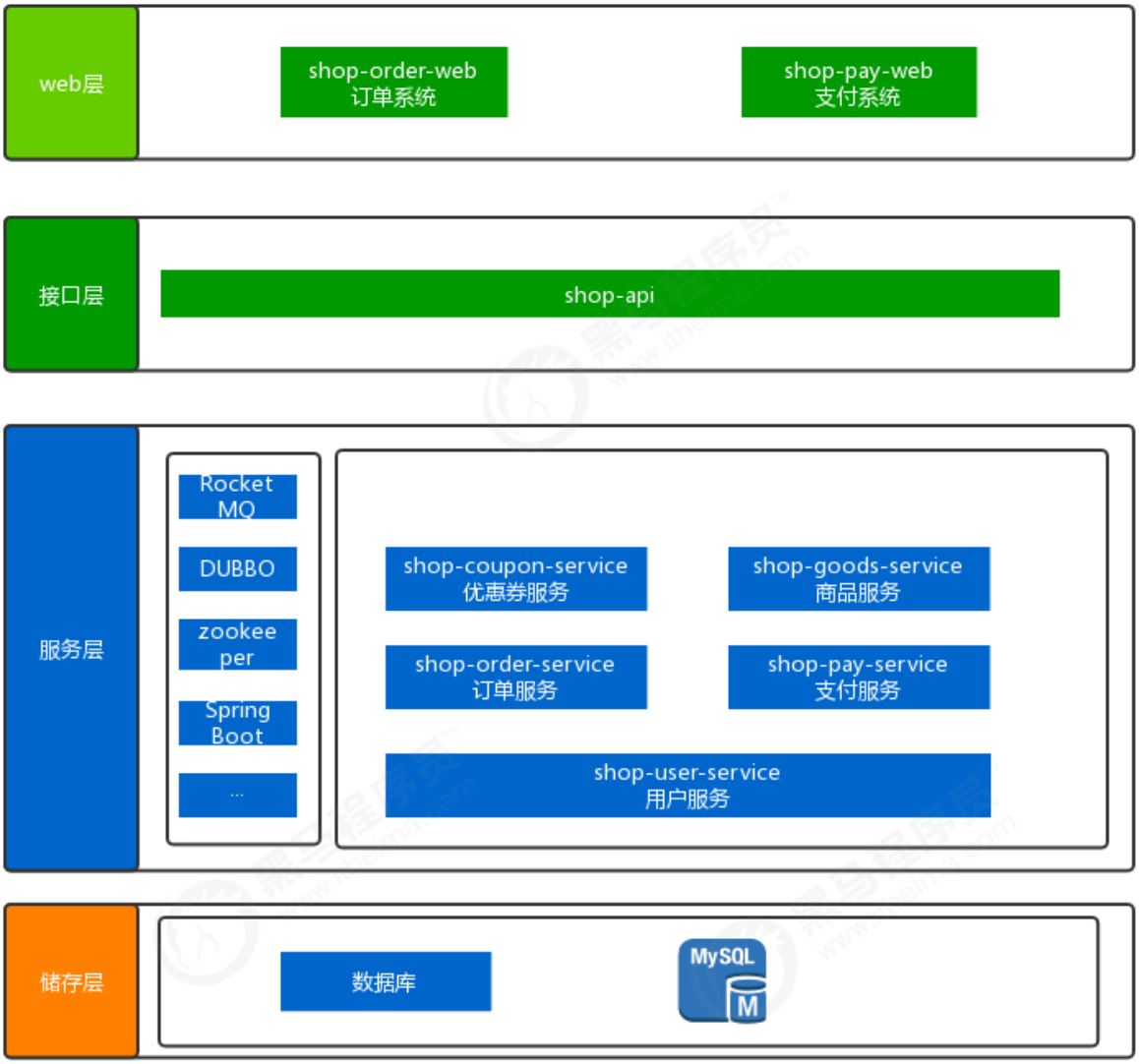
3.1.1 工程浏览



- 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

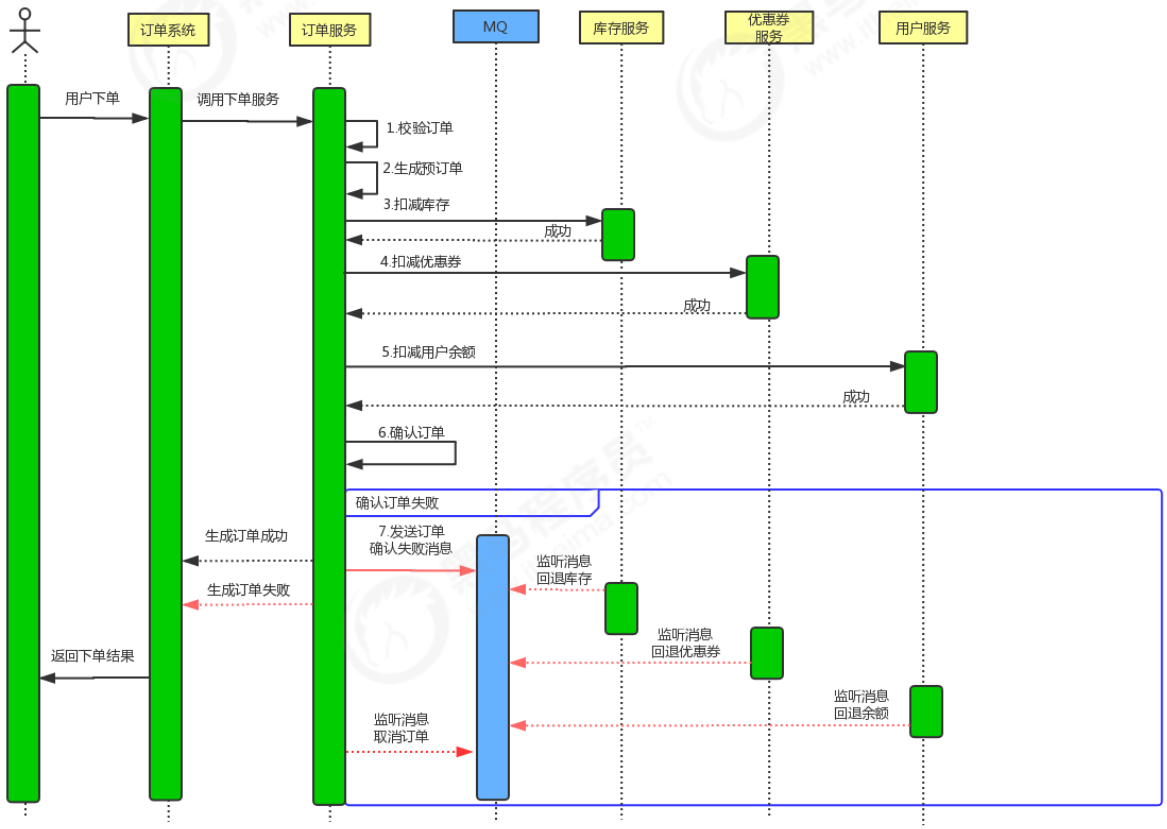
- 常量类

  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

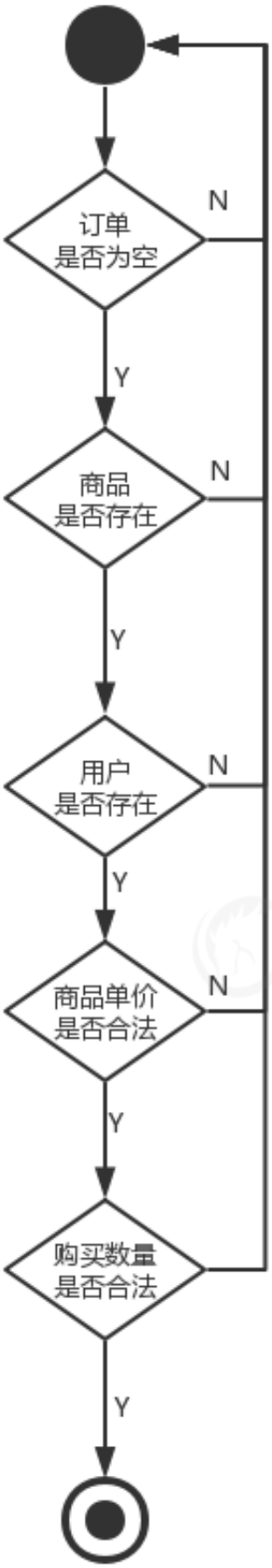
- IOrderService

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

2）业务类实现

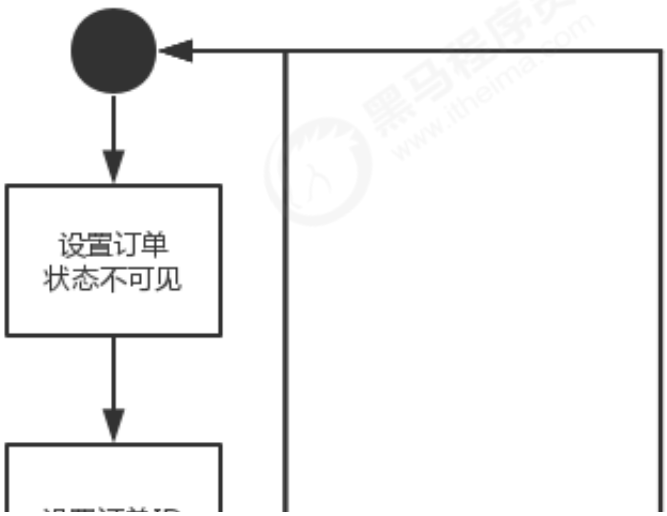
```
@Slf4j
@Component
@Service(interfaceClass = IOrderService.class)
public class OrderServiceImpl implements IOrderService {

    @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
        }

    }
}
```

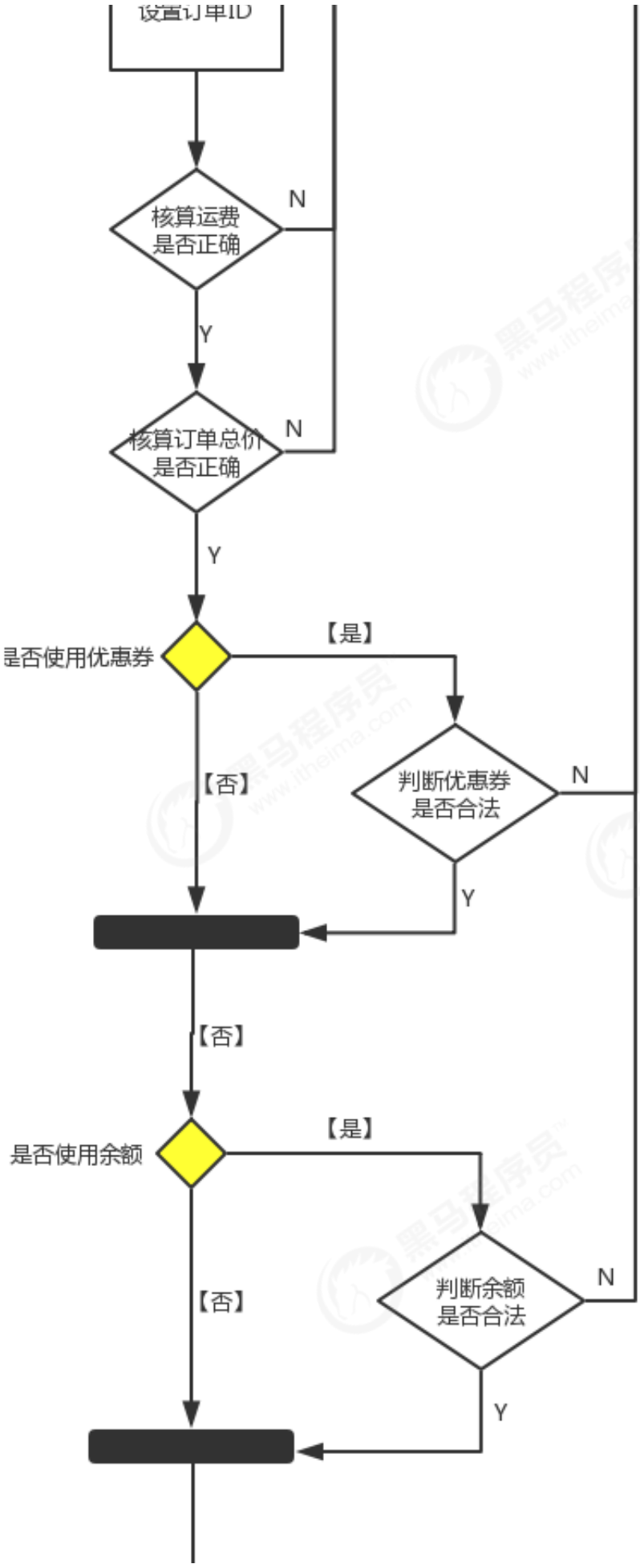
3）校验订单


订单
是否为空
N
Y
商品
是否存在
N
Y
用户
是否存在
N
Y
商品单价
是否合法
N
Y
购买数量
是否合法
Y

```
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】
【否】
判断余额是否合法
N
Y


核算订单总价
设置订单时间
保存订单
到数据库

```
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.getMessag
e());
}
```

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

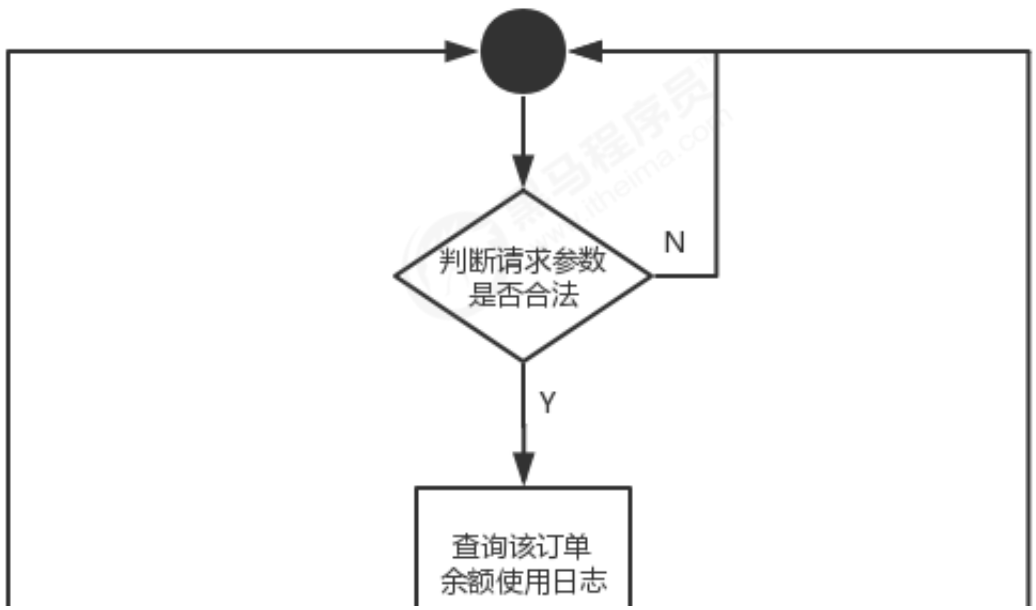
```
@Override
public Result changeCouponStatus(TradeCoupon coupon) {
    try {
        //判断请求参数是否合法
        if (coupon == null || StringUtils.isEmpty(coupon.getCouponId()))
{
            CastException.cast(ShopCode.SHOP_REQUEST_PARAMETER_VALID);
        }
        //更新优惠券状态为已使用
        couponMapper.updateByPrimaryKey(coupon);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

}
```

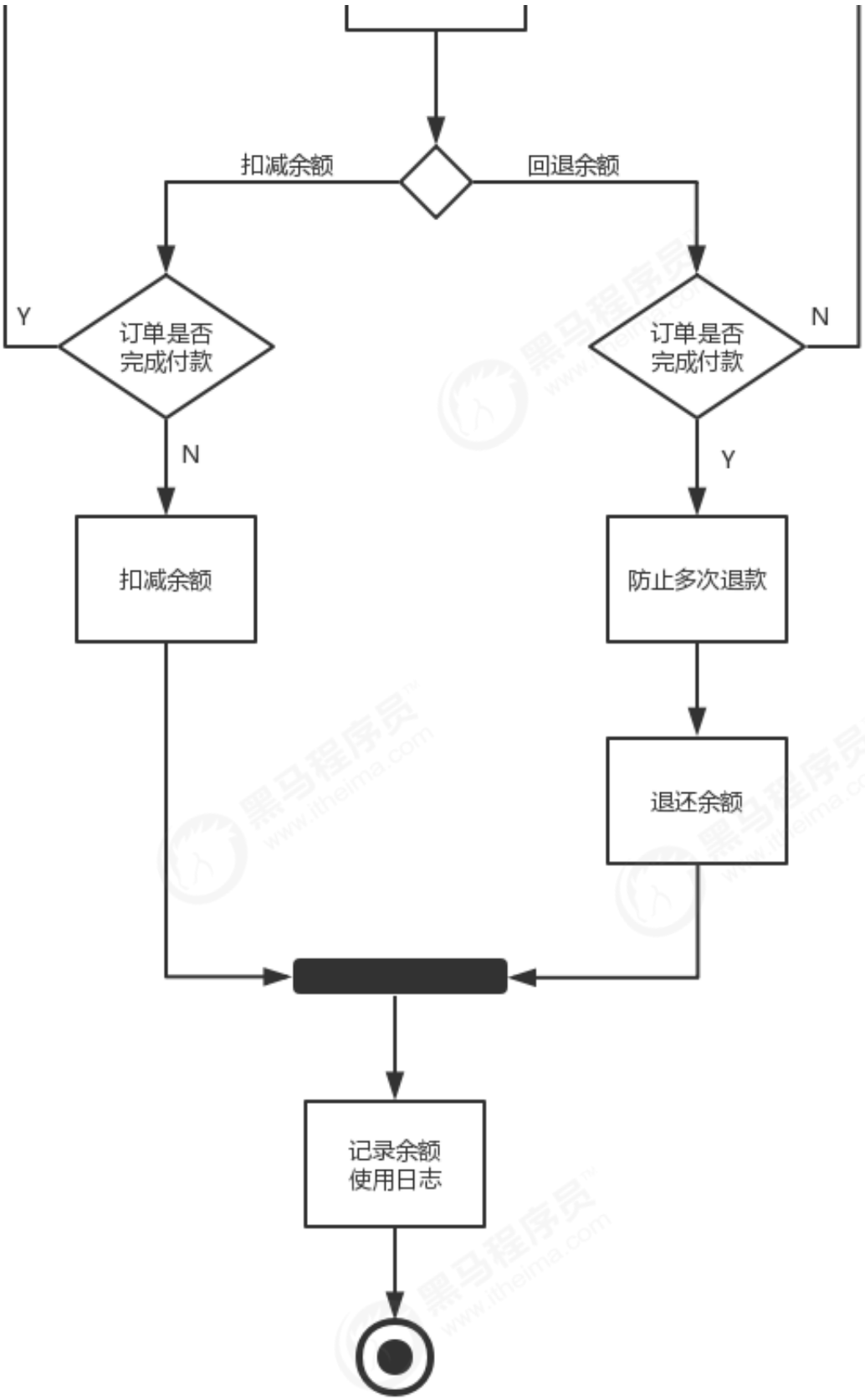
7）扣减用户余额

- 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




扣减余额
回退余额
Y
订单是否
完成付款
N
订单是否
完成付款
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.getC
ode())) {
           //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.ge
tCode())) {

        //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.getMessag
e());
       }
```

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
```