

# 面向对象分析与设计

## Object Oriented Analysis and Design

——详细设计

Detail Design

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# 1. 对象设计

**Object Design**



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# 1.1 软件设计的目标

## Software Design Goals

- 为什么要做软件设计?
  - 是解决软件复杂性的必要手段
    - 将软件分为不同的部分，分而治之。
    - 是团队分工协作的前提
  - 是降低开发成本，提高软件质量的必要手段
    - 提高软件的重用性
    - 增强软件的扩展性

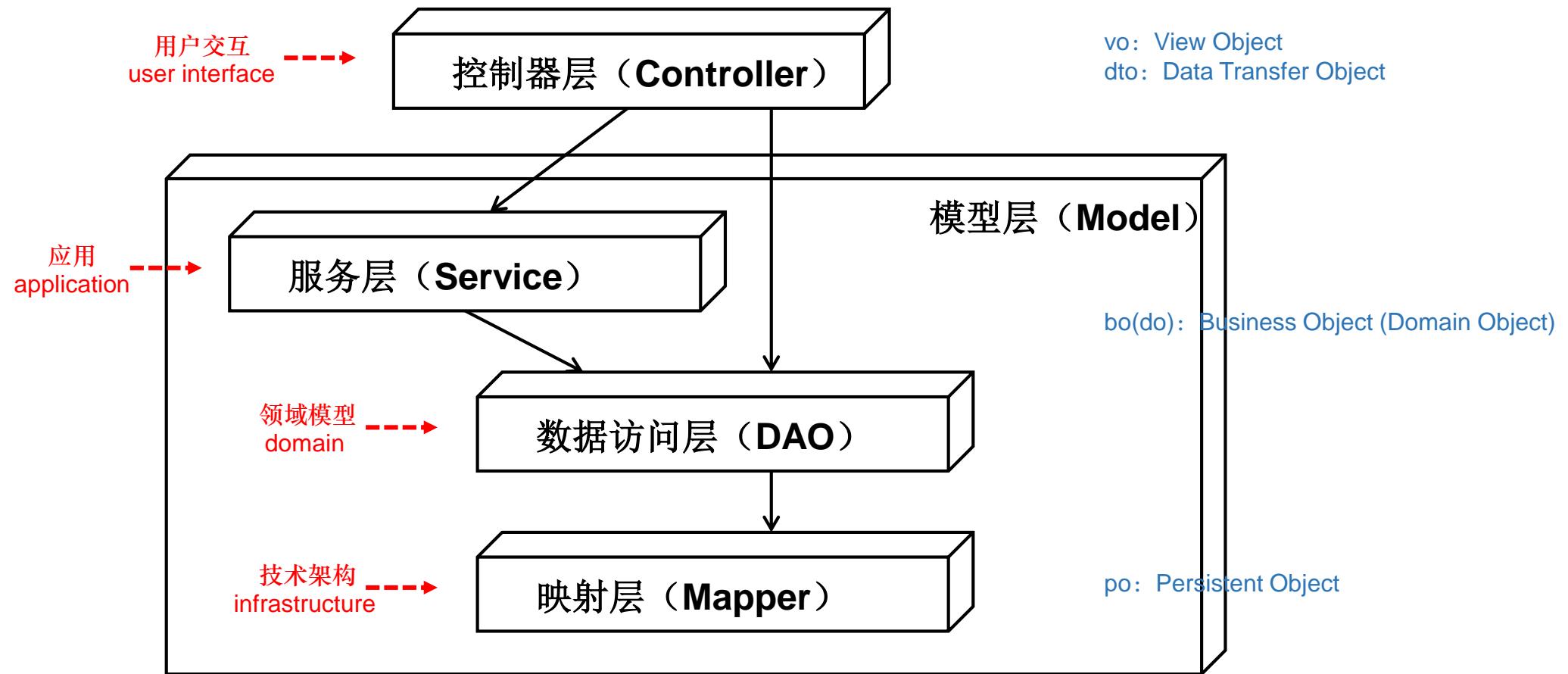
我们虽然无法找到一个绝对理想的圆，但这并不妨碍我们理解什么是圆。

--- 源自罗翔的《圆圈正义》



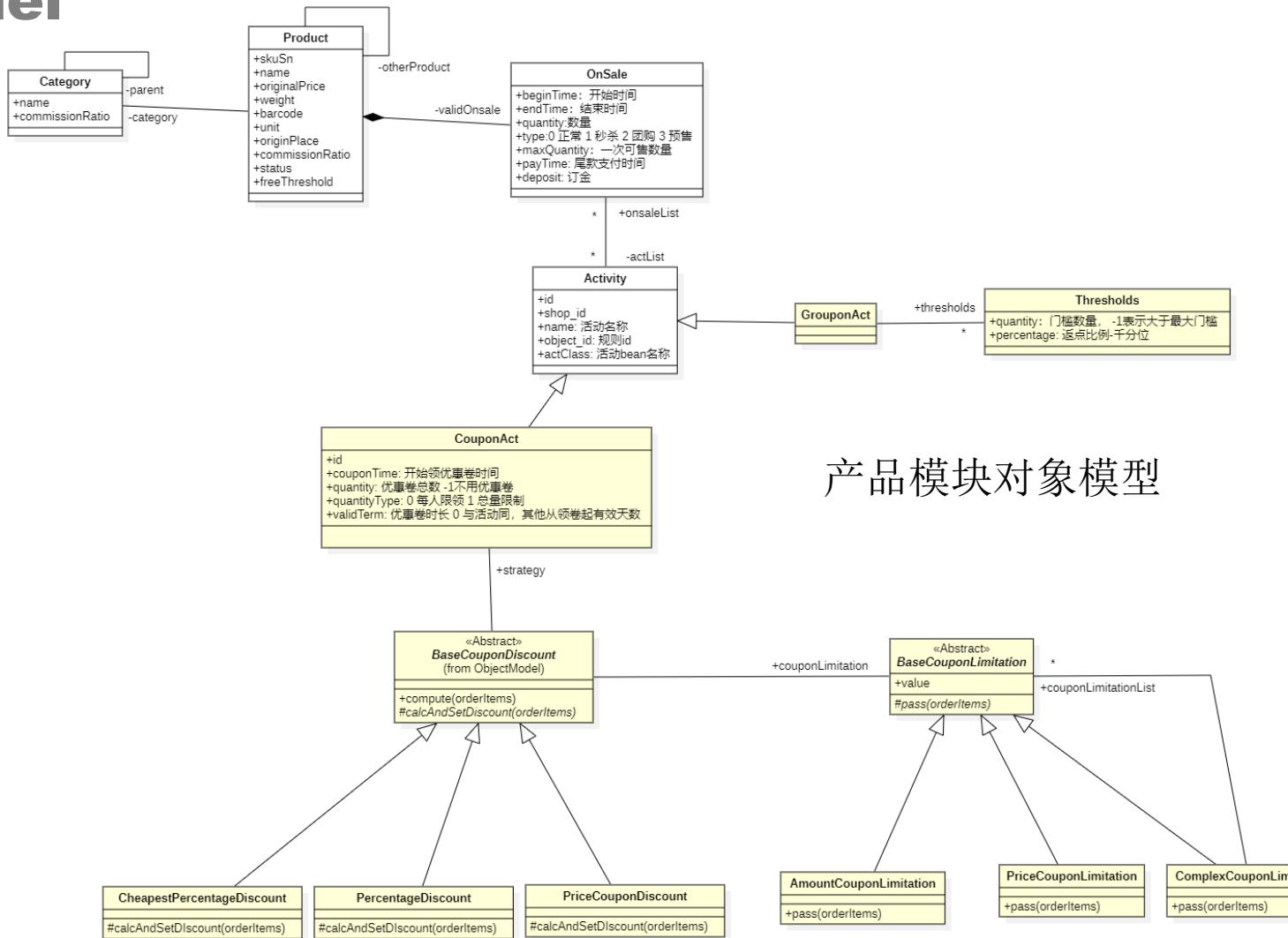
# 1.2 对象模型

## Object Model



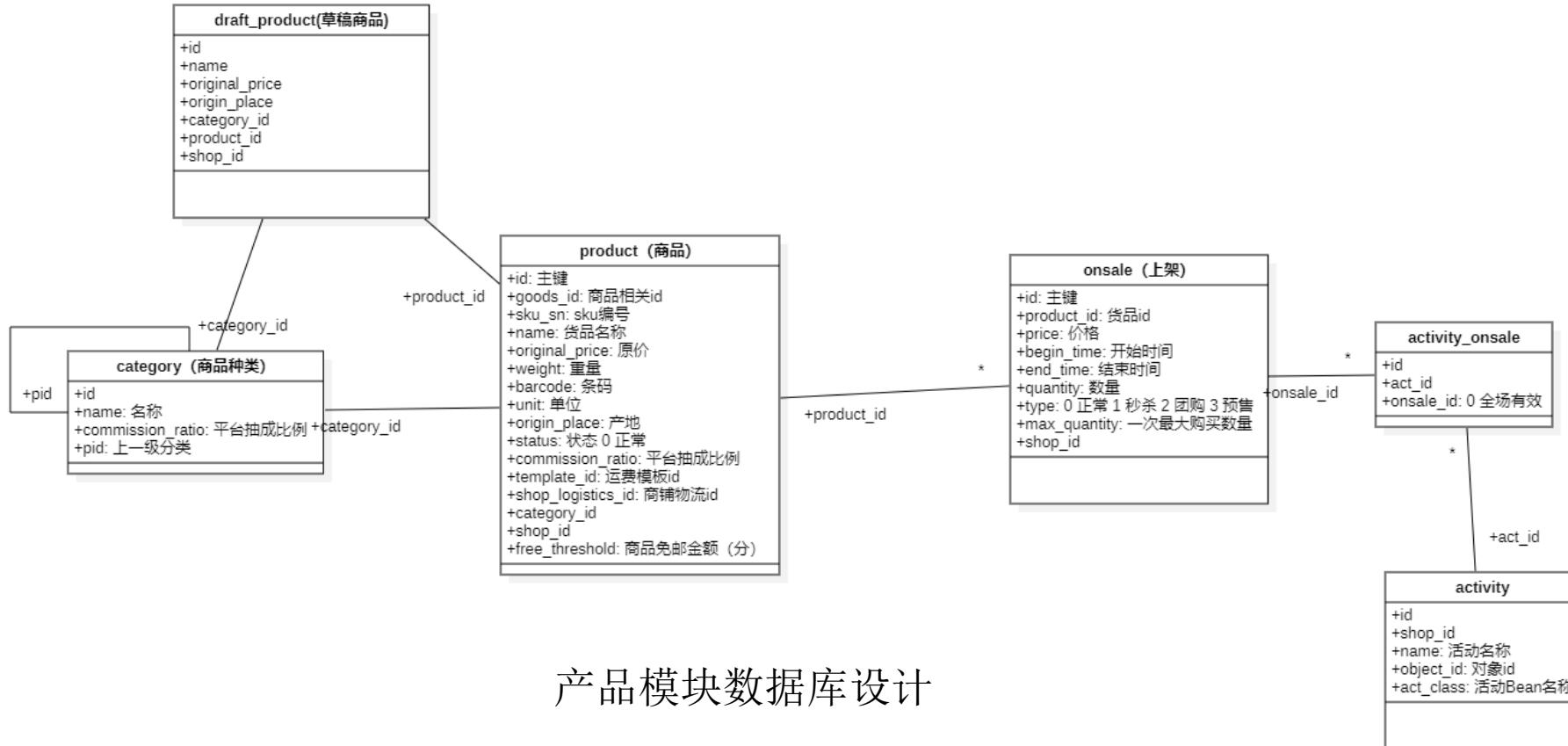
# 1.2 对象模型

## Object Model



# 1.2 对象模型

## Object Model



# 1.2 对象模型

## Object Model

- 贫血模型 (Anemic Model)
  - 对象模型只有getter和setter方法，没有任何业务逻辑
  - 所有的逻辑都在Service层和Dao层，同getter和setter方法访问对象模型



# 1.2 对象模型 Object Model

- 2021年取消团购

```
@Data
@AllArgsConstructor
@NoArgsConstructor
public class GroupOnActivity implements Serializable {

    private Long id;
    private String name;
    private Long shopId;
    private String shopName;
    private List<GroupOnStrategyVo> strategy;
    private ZonedDateTime beginTime;
    private ZonedDateTime endTime;
    private Long creatorId;
    private String creatorName;
    private Long modifierId;
    private String modifierName;
    private ZonedDateTime gmtCreate;
    private ZonedDateTime gmtModified;
    private Byte state;

    public GroupOnState getState() {
        return GroupOnState.valueOf(state);
    }

    public void setState(GroupOnState state) {
        this.state = state.getCode().byteValue();
    }
}
```

```
@Service
public class GroupOnActivityService {

    @Autowired
    private GroupActivityDao groupActivityDao;

    @Autowired
    private GoodsService goodsService;

    @Transactional(rollbackFor = Exception.class)
    public ReturnObject offlineGroupOnActivity(long id, long shopId, long loginUser, String loginUsername) {
        ReturnObject<GroupOnActivity> findObj = groupActivityDao.getGroupOnActivity(id);
        if(!findObj.getCode().equals(ReturnNo.OK))
        {
            return findObj;
        }
        if(findObj.getData()==null)
        {
            return new ReturnObject(ReturnNo.RESOURCE_ID_NOTEEXIST);
        }
        if(findObj.getData().getState().equals(GroupOnState.OFFLINE))
        {
            return new ReturnObject(ReturnNo.STATENOTALLOW);
        }

        GroupOnActivity groupOnActivity = new GroupOnActivity();
        setPoModifiedFields(groupOnActivity,loginUser,loginUsername);
        groupOnActivity.setId(id);
        groupOnActivity.setState(GroupOnState.OFFLINE);

        ReturnObject obj = groupActivityDao.modifyGroupOnActivity(groupOnActivity);
        if(!obj.getCode().equals(ReturnNo.OK))
        {
            return obj;
        }

        InternalReturnObject result = goodsService.offlineOnsale(id,shopId);
        if(result.getErrno()!=0){
            obj=new ReturnObject(ReturnNo.getByCode(result.getErrno()),result.getErrMsg());
        }else{
            obj=new ReturnObject();
        }
        return obj;
    }
}
```



# 1.2 对象模型 Object Model

- 2021年取消团购

```
@Repository
public class GroupActivityDao {
    private Logger logger = LoggerFactory.getLogger(GroupActivityDao.class);
    @Autowired
    private GroupOnActivityPoMapper groupOnActivityPoMapper;

    public ReturnObject<GroupOnActivity> getGroupOnActivity(long id){
        GroupOnActivityPo g1;
        try {
            g1 = groupOnActivityPoMapper.selectByPrimaryKey(id);
        }
        catch(Exception e) {
            logger.error(e.getMessage());
            return new ReturnObject<>(ReturnNo.INTERNAL_SERVER_ERR,e.getMessage());
        }
        if(g1==null)
        {
            return new ReturnObject<>(ReturnNo.RESOURCE_ID_NOTEXIST);
        }
        GroupOnActivity groupOnActivity = (GroupOnActivity) cloneVo(g1,GroupOnActivity.class);
        return new ReturnObject<GroupOnActivity>(groupOnActivity);
    }

    public ReturnObject modifyGroupOnActivity(GroupOnActivity groupOnActivity)
    {
        ReturnObject retObj;
        GroupOnActivityPo groupOnActivityPo = (GroupOnActivityPo) cloneVo(groupOnActivity,GroupOnActivityPo.class);
        setPoModifiedFields(groupOnActivityPo,groupOnActivity.getModifierId(),groupOnActivity.getModifierName());
        int ret;
        try
        {
            ret = groupOnActivityPoMapper.updateByPrimaryKeySelective(groupOnActivityPo);
        }
        catch(Exception e)
        {
            logger.error(e.getMessage());
            return new ReturnObject(ReturnNo.INTERNAL_SERVER_ERR,e.getMessage());
        }
        if (ret == 0){
            retObj = new ReturnObject(ReturnNo.RESOURCE_ID_NOTEXIST);
        } else {
            retObj = new ReturnObject(ReturnNo.OK);
        }
        return retObj;
    }
}
```



# 1.2 对象模型

## Object Model

- 2021年取消团购

```
public ReturnObject onlineOrOfflineOnSaleAct(Long actId, Long userId, String userName, OnSale.State cntState, OnSale.State finalState) {
    try {
        OnSalePoExample oe = new OnSalePoExample();
        OnSalePoExample.Criteria cr = oe.createCriteria();
        cr.andActivityIdEqualTo(actId);
        Byte s1 = cntState.getCode().byteValue();
        cr.andStateEqualTo(s1);

        Byte s2 = finalState.getCode().byteValue();
        List<OnSalePo> pos = onSalePoMapper.selectByExample(oe);

        for (OnSalePo po : pos) {
            po.setState(s2);
            setPoModifiedFields(po, userId, userName);

            if (finalState == OnSale.State.OFFLINE) {
                //如果结束时间晚于当前时间且开始时间早于当前时间，修改结束时间为当前时间
                if (po.getEndTime().isAfter(LocalDateTime.now()) && po.getBeginTime().isBefore(LocalDateTime.now())) {
                    po.setEndTime(LocalDateTime.now());
                }
            } else if (finalState == OnSale.State.ONLINE) {
                //如果开始时间早于当前时间且结束时间晚于当前时间，修改开始时间为当前时间
                if (po.getBeginTime().isBefore(LocalDateTime.now()) && po.getEndTime().isAfter(LocalDateTime.now())) {
                    po.setBeginTime(LocalDateTime.now());
                }
            }

            onSalePoMapper.updateByPrimaryKeySelective(po);
        }
        return new ReturnObject();
    } catch (Exception e) {
        logger.error(e.getMessage());
        return new ReturnObject(ReturnNo.INTERNAL_SERVER_ERR, e.getMessage());
    }
}
```



# 1.2 对象模型

## Object Model

- 充血模型 (Fat Model)
  - 数据和对应的业务逻辑被封装到同一个类中, 满足面向对象的封装特性
  - 逻辑被分配到Service层, Dao层和bo对象中



# 1.2 对象模型

## Object Model

- 2023年取消团购

```
@Service
@Transactional(propagation = Propagation.REQUIRED)
public class GrouponActService {

    private Logger logger = LoggerFactory.getLogger(GrouponActService.class);

    private RedisUtil redisUtil;

    private ProductDao productDao;

    private OnsaleDao onsaleDao;

    private ActivityDao activityDao;

    @Autowired
    public GrouponActService(RedisUtil redisUtil, OnsaleDao onsaleDao, ActivityDao activityDao, ProductDao productDao) {
        this.redisUtil = redisUtil;
        this.onsaleDao = onsaleDao;
        this.activityDao = activityDao;
        this.productDao = productDao;
    }

    public void cancel(Long shopId, Long id, UserDto user) {
        GrouponAct activity = this.activityDao.findById(id, shopId, GrouponAct.ACTCLASS);
        List<String> keys = activity.cancel(user);
        this.redisUtil.del(keys.toArray(new String[keys.size()]));
    }
}
```



# 1.2 对象模型

## Object Model

```
@Repository
public class ActivityDao {

    public <T extends Activity> T findById(Long id, Long shopId, String actClass) throws RuntimeException {
        assert(null != id && null != shopId) : "ActivityDao.findById: activity id and shopId can not be null";
        String key = String.format(KEY, id);
        if (redisUtil.hasKey(key)){
            Activity act = (Activity) redisUtil.get(key);
            if (!shopId.equals(act.getShopId()) && PLATFORM != shopId){
                throw new BusinessException(ReturnNo.RESOURCE_ID_OUTSCOPE, String.format(ReturnNo.RESOURCE_ID_OUTSCOPE.getMessage(), "活动", id, shopId));
            }
            if (act.getActClass().equals(actClass)){
                setBo(act);
                return (T) act;
            } else {
                throw new BusinessException(ReturnNo.RESOURCE_ID_NOTEXIST, String.format(ReturnNo.RESOURCE_ID_NOTEXIST.getMessage(), "活动", id));
            }
        }

        Optional<ActivityPo> ret = this.activityPoMapper.findById(id);
        if (ret.isPresent()){
            ActivityPo po = ret.get();
            if (!shopId.equals(po.getShopId()) && PLATFORM != shopId){
                throw new BusinessException(ReturnNo.RESOURCE_ID_OUTSCOPE, String.format(ReturnNo.RESOURCE_ID_OUTSCOPE.getMessage(), "活动", id, shopId));
            }
            if (po.getActClass().equals(actClass)){
                return (T) this.getBo(po, Optional.ofNullable(key));
            }else{
                throw new BusinessException(ReturnNo.RESOURCE_ID_NOTEXIST, String.format(ReturnNo.RESOURCE_ID_NOTEXIST.getMessage(), "活动", id));
            }
        }else{
            throw new BusinessException(ReturnNo.RESOURCE_ID_NOTEXIST, String.format(ReturnNo.RESOURCE_ID_NOTEXIST.getMessage(), "活动", id));
        }
    }
}
```

# 1.2 对象模型

## Object Model

```
@AllArgsConstructor
@JsonInclude(JsonInclude.Include.NON_NULL)
@ToString(callSuper = true)
@CopyFrom({GrouponActVo.class, GrouponActModVo.class, GrouponActPo.class, ActivityPo.class})
public class GrouponAct extends Activity{

    public static final String ACTCLASS = "grouponActDao";

    private List<Threshold> thresholds;

    public GrouponAct() {
        super();
        this.actClass = ACTCLASS;
    }

    public List<String> cancel(UserDto user){
        List<Onsale> onsaleList = this.getOnsaleList();
        LocalDateTime now = LocalDateTime.now();
        List<String> keys = new ArrayList<>(onsaleList.size());
        for (Onsale obj : onsaleList){
            Onsale updateObj = obj.cancel(now);
            if (null != updateObj) {
                keys.add(this.onsaleDao.save(updateObj, user));
            }
        }
        return keys;
    }
}
```



# 1.2 对象模型

## Object Model

```
@Repository
@Repository
public class OnsaleDao {

    private void hasConflictOnsale(Onsale onsale) throws BusinessException{
        logger.debug("hasConflictOnsale: onsale = {}", onsale);
        if ( null == onsale.getProductId() && null == onsale.getBeginTime() && null == onsale.getEndTime()){
            throw new IllegalArgumentException("OnsaleDao.hasConflictOnsale: onsale's productId, beginTime and endTime can not be null");
        }

        PageRequest pageable = PageRequest.of(0,MAX_RETURN, Sort.by(Sort.Direction.ASC, "beginTime"));
        List<OnsalePo> poList = this.onsalePoMapper.findOverlap(onsale.getProductId(), onsale.getBeginTime(), onsale.getEndTime(), pageable);
        if ( poList.size() > 0){
            logger.debug("hasConflictOnsale: poList Size = {}, onsale's id = {}",poList.size(), onsale.getId());
            if (null != onsale.getId()){
                //修改的目标onsale不计算在重复范围内
                poList = poList.stream().filter(o -> !onsale.getId().equals(o.getId())).collect(Collectors.toList());
            }

            if (poList.size() > 0){
                throw new BusinessException(ReturnNo.GOODS_ONSALE_CONFLICT, String.format(ReturnNo.GOODS_ONSALE_CONFLICT.getMessage(), poList.get(0).getId()));
            }
        }
    }

    public String save(Onsale onsale, UserDto user) throws BusinessException{
        logger.debug("save: onsale={}",onsale);
        this.hasConflictOnsale(onsale);
        onsale.setModifier(user);
        onsale.setGmtModified(LocalDateTime.now());
        OnsalePo onsalePo = CloneFactory.copy(new OnsalePo(), onsale);
        OnsalePo newPo = this.onsalePoMapper.save(onsalePo);
        if (Onsale.NOTEEXIST == newPo.getId()){
            throw new BusinessException(ReturnNo.RESOURCE_ID_NOTEEXIST, String.format(ReturnNo.RESOURCE_ID_NOTEEXIST.getMessage(), "销售", onsalePo.getId()));
        }
        return String.format(KEY,newPo.getId());
    }
}
```

# 1.3 静态建模和动态建模

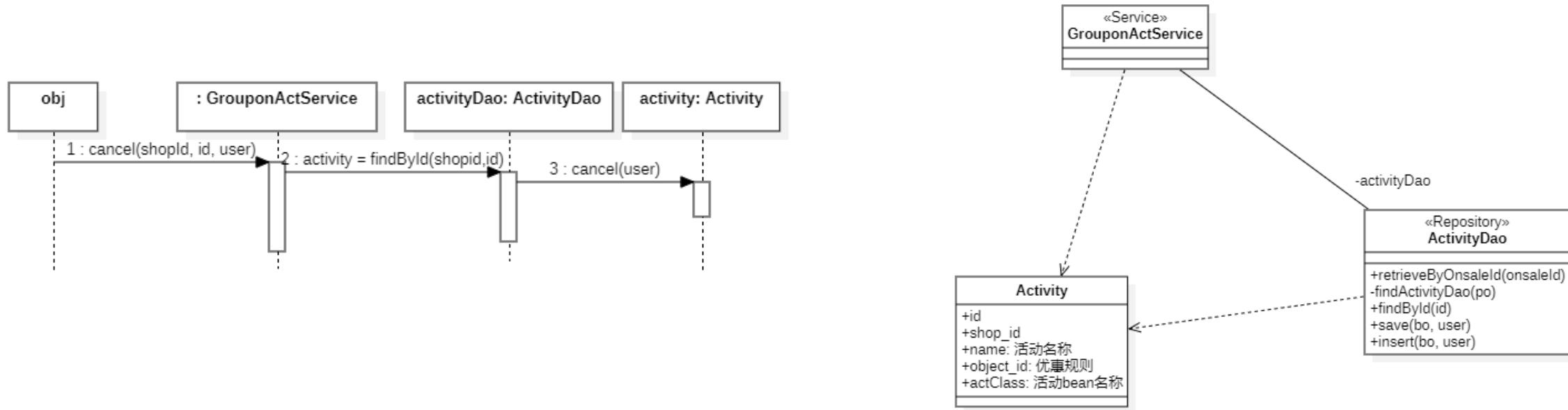
## Static Modeling and Dynamic Modeling

- 动态建模：使用GRASP原则，设计代码的行为，业务逻辑
  - UML 交互图（Interaction Diagram）
    - 顺序图（Sequence Diagram）和沟通图（Communication Diagram）
  - 状态机图（State Machine Diagram）
  - 活动图（Activity Diagram）
- 静态建模：设计系统的结构，包括包结构，类，属性和方法定义
  - UML 类图（Class Diagram）
  - 部署图（Deployment Diagram）
  - 组件图（Component Diagram）



# 1.3 静态建模和动态建模

## Static Modeling and Dynamic Modeling



静态建模和动态建模是同步进行的



# 1.3 静态建模和动态建模

## Static Modeling and Dynamic Modeling

- 动态建模
  - 思考对象交互的细节，描述实现逻辑的方式。
  - 是真正面向对象设计的细节。“rubber hits the road”



# 2. UML交互图

**Interaction Diagram**

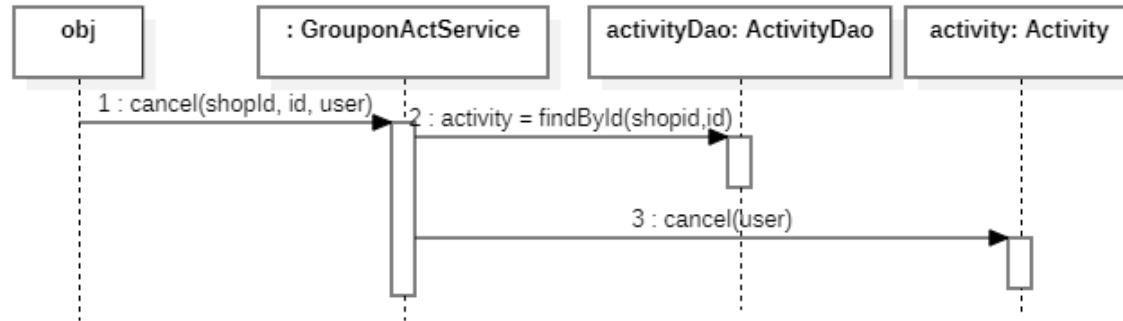


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# 2.1顺序图和通信图

## Sequence Diagram and Communication Diagram

- 顺序图 (Sequence Diagram)
  - 用于藩篱格式描述对象之间的交互



```
@Service
@Transactional(propagation = Propagation.REQUIRED)
public class GrouponActService {

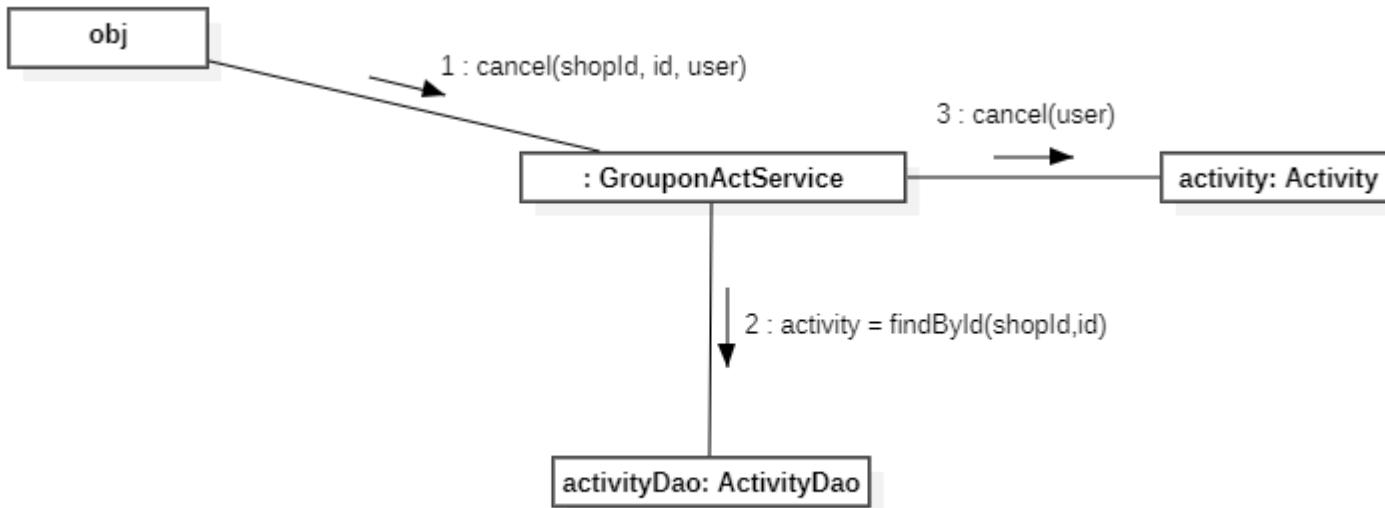
    public void cancel(Long shoId, Long id, UserDto user) {
        GrouponAct activity = this.activityDao.findByd(id, shoId, GrouponAct.ACTCLASS);
        List<String> keys = activity.cancel(user);
        this.redisUtil.del(keys.toArray(new String[keys.size()]));
    }
}
```



# 2.1顺序图和通信图

## Sequence Diagram and Communication Diagram

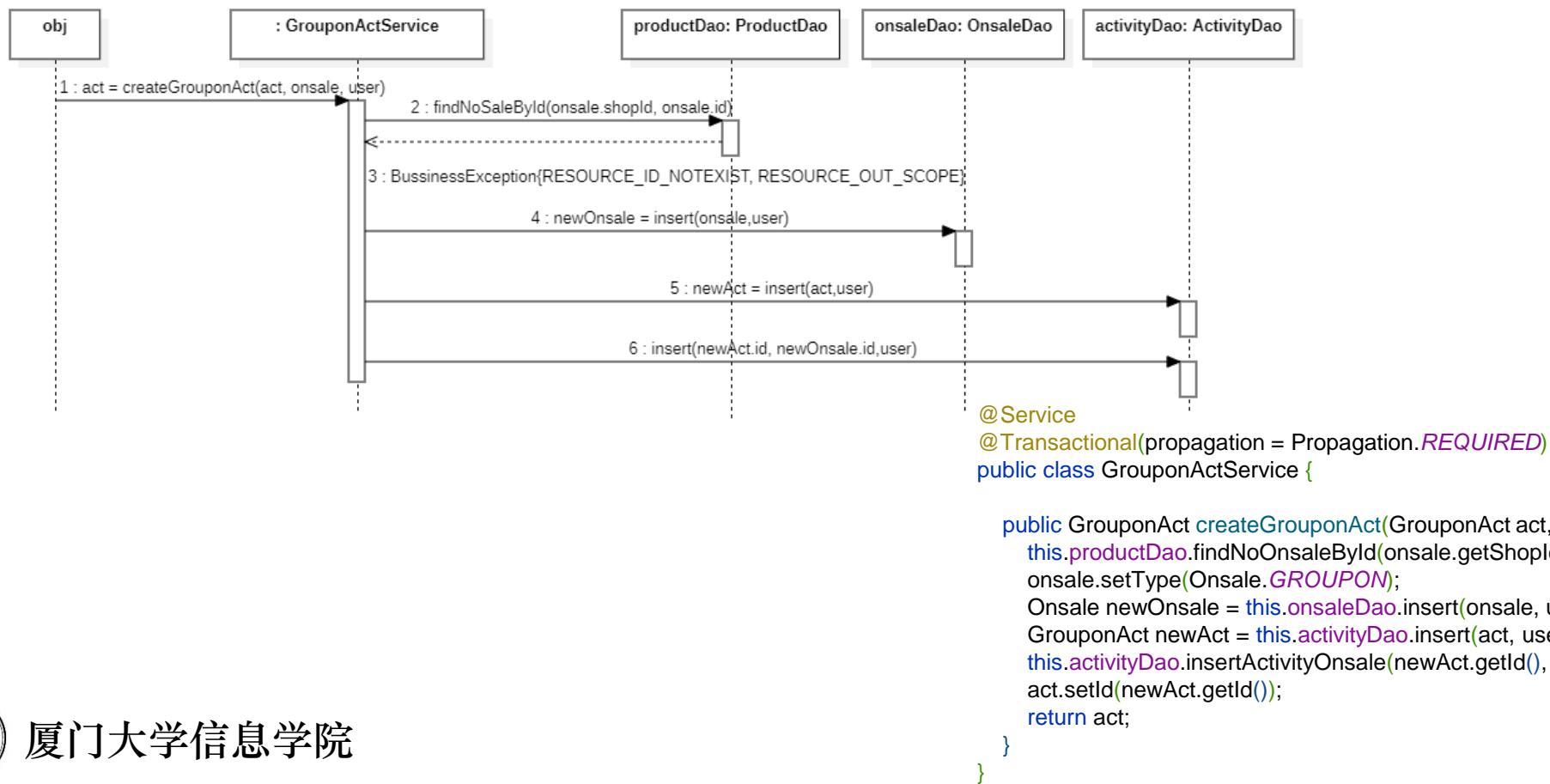
- 通信图（Communication Diagram）
  - 用网络图的格式描述对象之间的交互



# 2.1顺序图和通信图

## Sequence Diagram and Communication Diagram

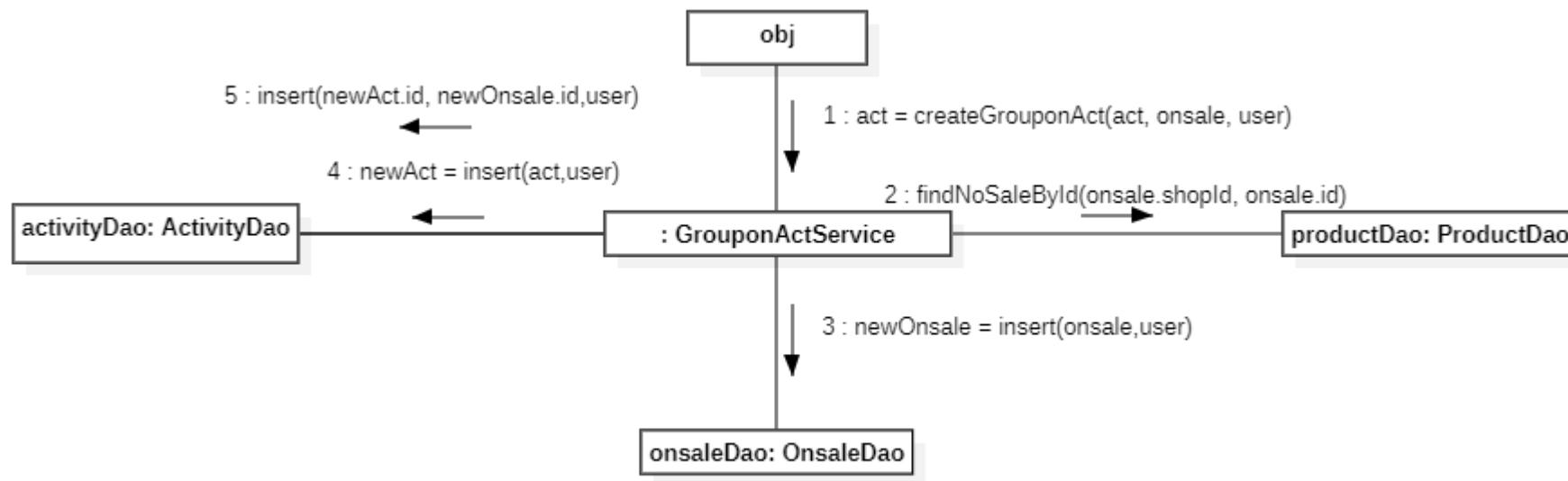
- 顺序图 (Sequence Diagram)



# 2.1顺序图和通信图

## Sequence Diagram and Communication Diagram

- 通信图 (Communication Diagram)



# 2.1顺序图和通信图

## Sequence Diagram and Communication Diagram

- 顺序图与通信图的区别

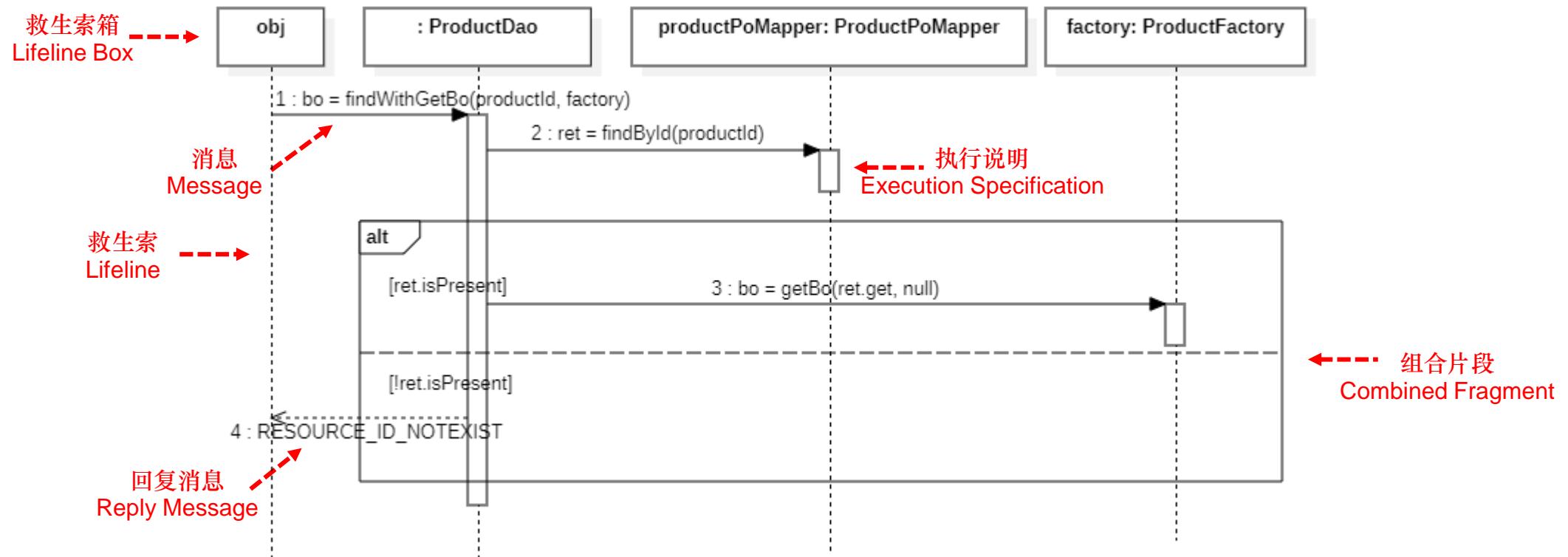
顺序图	清晰描述消息的顺序	需从左至右描述，特别在交互对象较多时比较占版面
通信图	节省版面	难以区分消息的顺序



## 2.2 顺序图

### Sequence Diagram

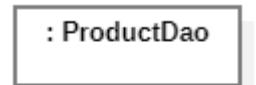
- 顺序图的符号



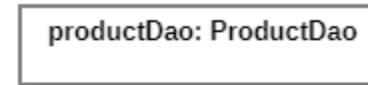
## 2.2 顺序图

### Sequence Diagram

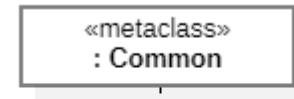
- 用Lifeline Box描述对象



匿名ProductDao对象



变量名为productDao的ProductDao对象



Common的静态类



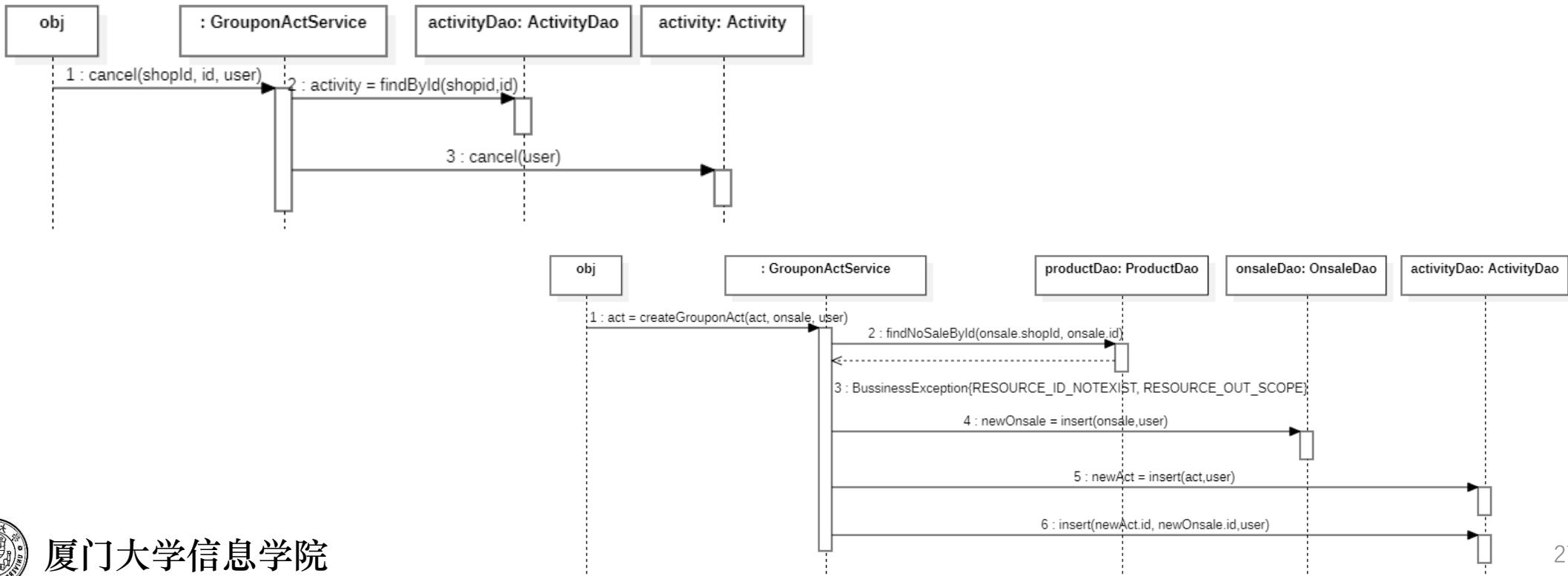
actList集合中的一个Activity对象



## 2.2 顺序图

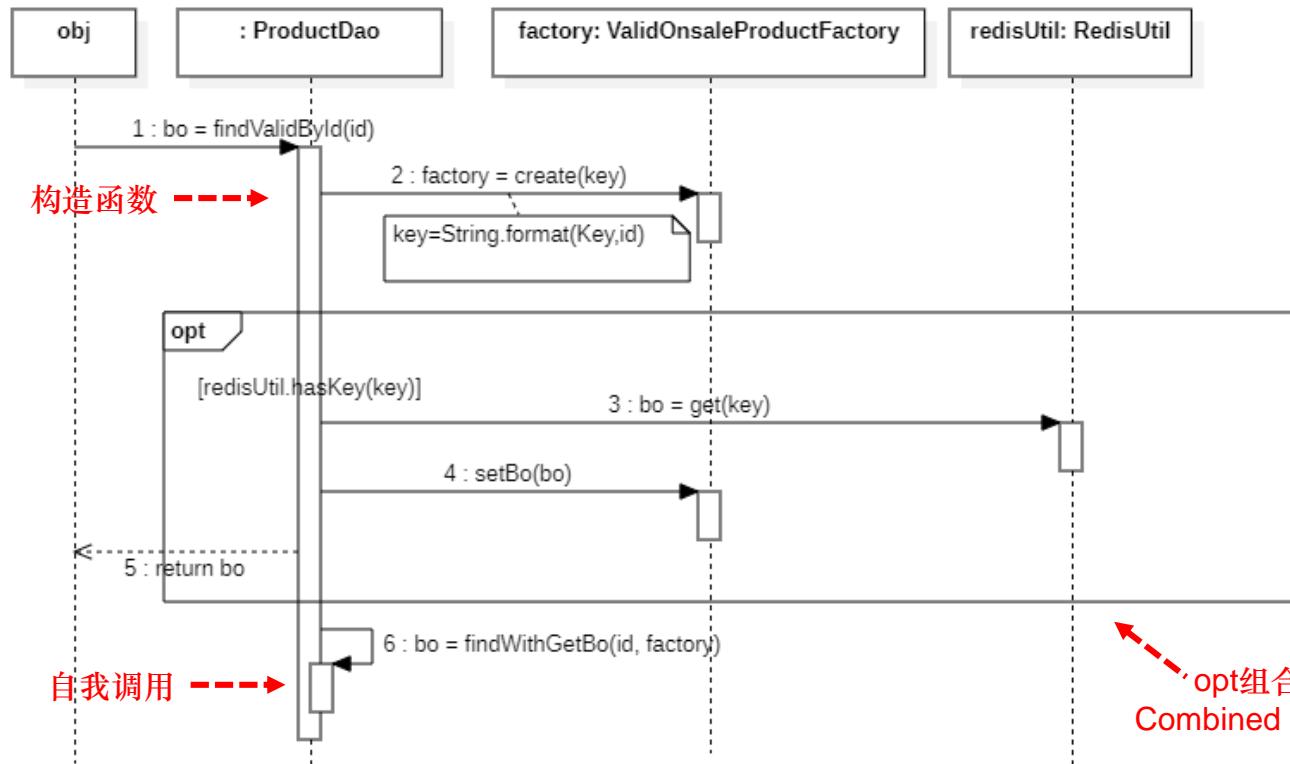
### Sequence Diagram

- 消息格式
  - `return = message(parameter : parameterType) : returnType`



## 2.2 顺序图

### Sequence Diagram



```
@Repository  
@RefreshScope  
public class ProductDao {  
  
    private final static Logger logger = LoggerFactory.getLogger(ProductDao.class);  
  
    private RedisUtil redisUtil;  
  
    public Product findValidById(Long id) throws RuntimeException {  
        logger.debug("findValidById: id = {}", id);  
        String key = String.format(KEY, id);  
        ValidOnsaleProductFactory factory = new ValidOnsaleProductFactory(id);  
        if (this.redisUtil.hasKey(key)) {  
            Product bo = (Product) redisUtil.get(key);  
            factory.setBo(bo);  
            return bo;  
        }  
        return this.findWithGetBo(platform, id, factory, true);  
    }  
}
```



## 2.2 顺序图

### Sequence Diagram

- 组合片段

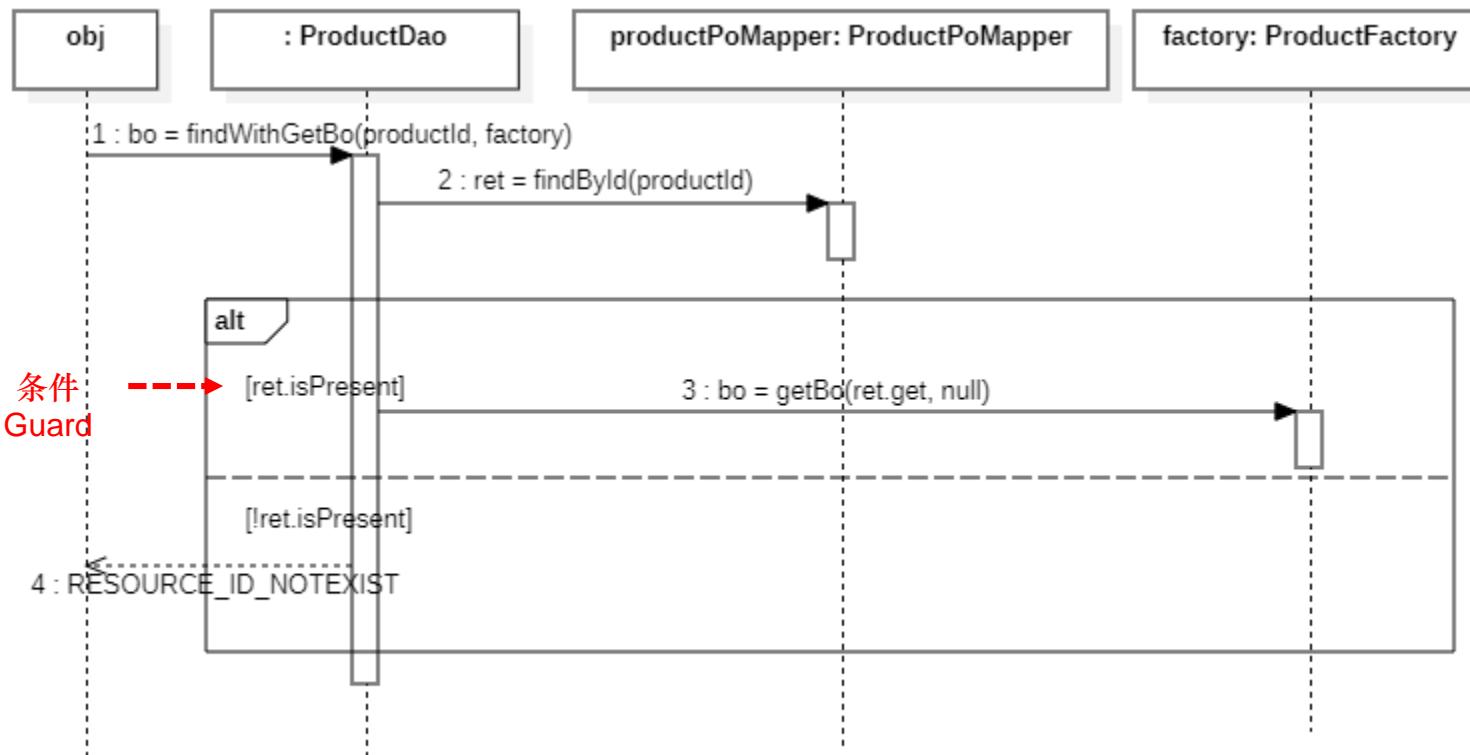
类型	解释
alt	if ... else
loop	循环
opt	if
region	关键区
par	并行代码区



## 2.2 顺序图

### Sequence Diagram

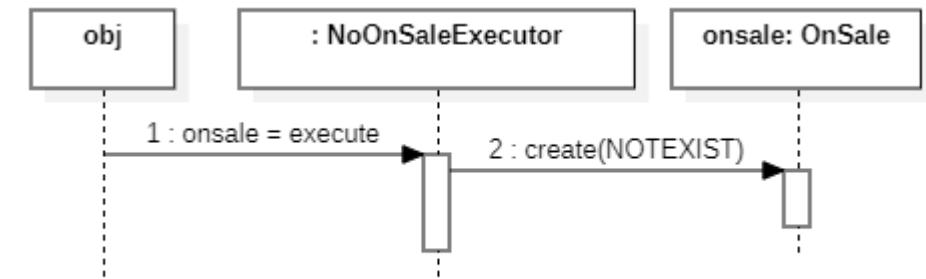
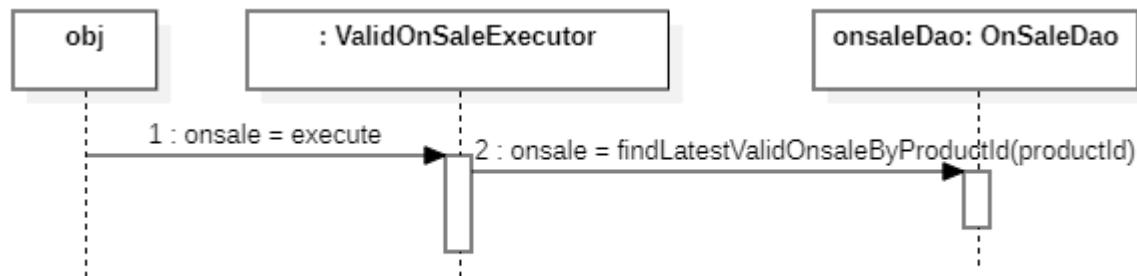
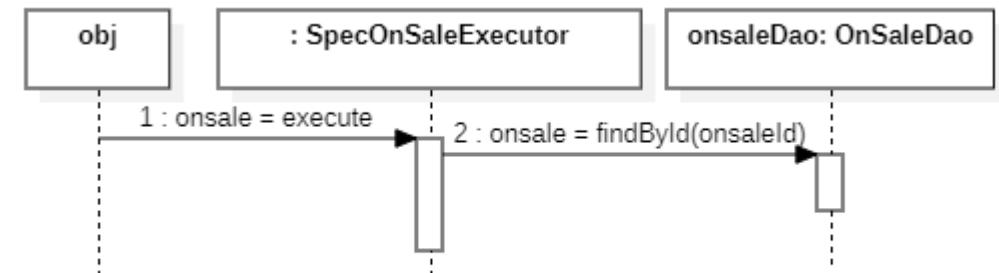
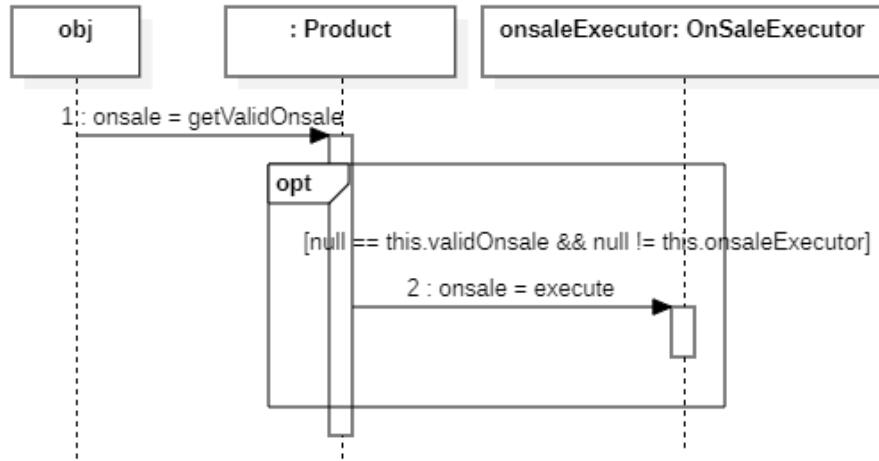
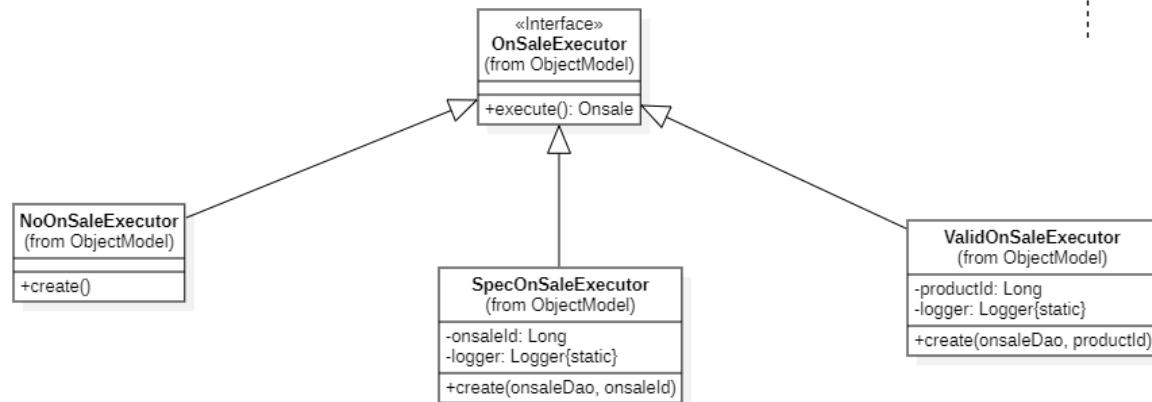
- 组合片段



# 2.2 顺序图

## Sequence Diagram

- 多态



# 3. UML 状态图

**UML State Machine Diagram**



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# 3.1 对象状态建模

## Object State Modeling

- 系统中的对象可以分为两类
  - 状态无关的对象：始终保持相同的行为特性.
  - 状态有关的对象：在不同状态下行为特性不同



## 3.2 状态机图

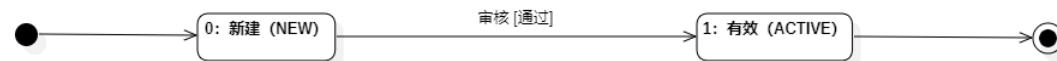
### State Machine Diagram

- 事件 (Event )
  - 事件指的是发生在时间和空间上的对状态机来讲有意义的那些事情。事件通常会引起状态的变迁，促使对象从一种状态切换到另一种状态
- 状态 (State)
  - 状态指的是对象在其生命周期中的一种状况.
- 转换 (Transition)
  - 是两个不同状态之间的迁移关系，表明处于某个状态的对象由某个事件触发并且在满足某个特定条件下进入一个新的状态。

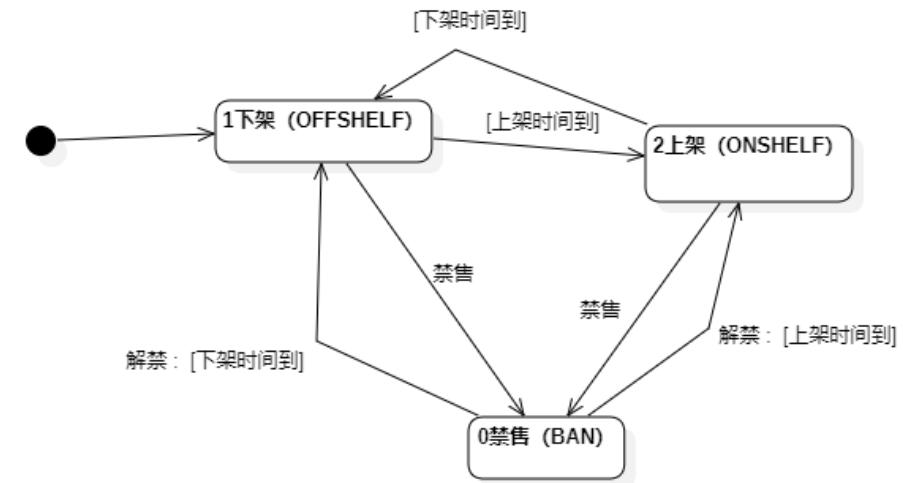


## 3.2 状态机图

### State Machine Diagram



活动状态图



产品状态图



# 4. GRASP: 职责驱动的设计

**GRASP: Designing Objects With Responsibilities**



## 4.1 职责驱动的设计

### Response-Driven Design

- 职责 (Responsibilities)
- 角色 (Roles)
- 协作 (Collaborations)

General Responsibility Assignment Software Patterns



# 4.1 职责驱动的设计

## Response-Driven Design

- GRASP方法
  - 创建者 (Creator)
  - 信息专家 (Information Expert)
  - 低耦合 (Low Coupling)
  - 高内聚 (High Cohesion)
  - 多态 (Polymorphism)
  - 间接 (Indirection)
  - 虚构 (Pure Fabrication)

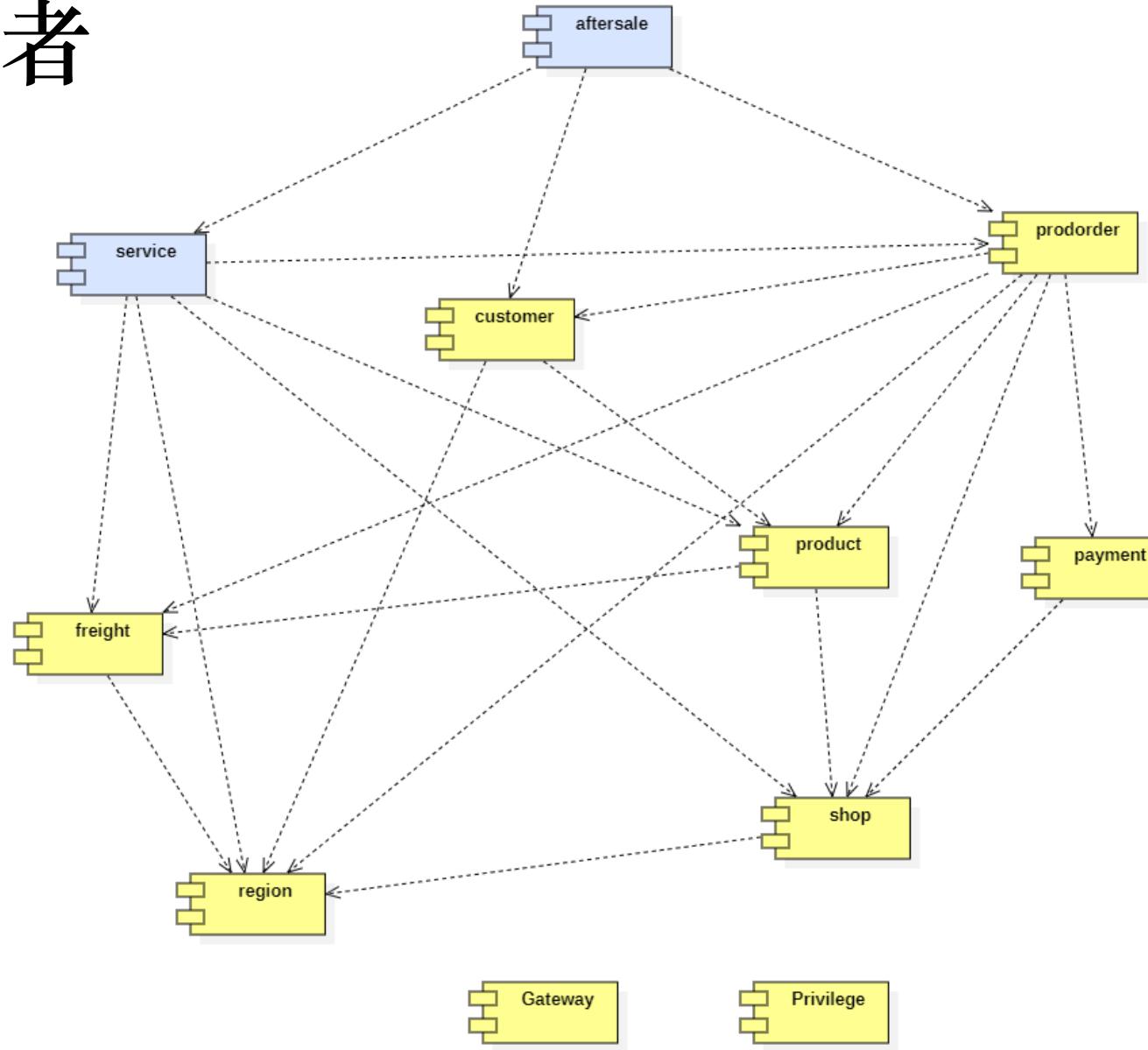


## 4.2 创建者 Creator

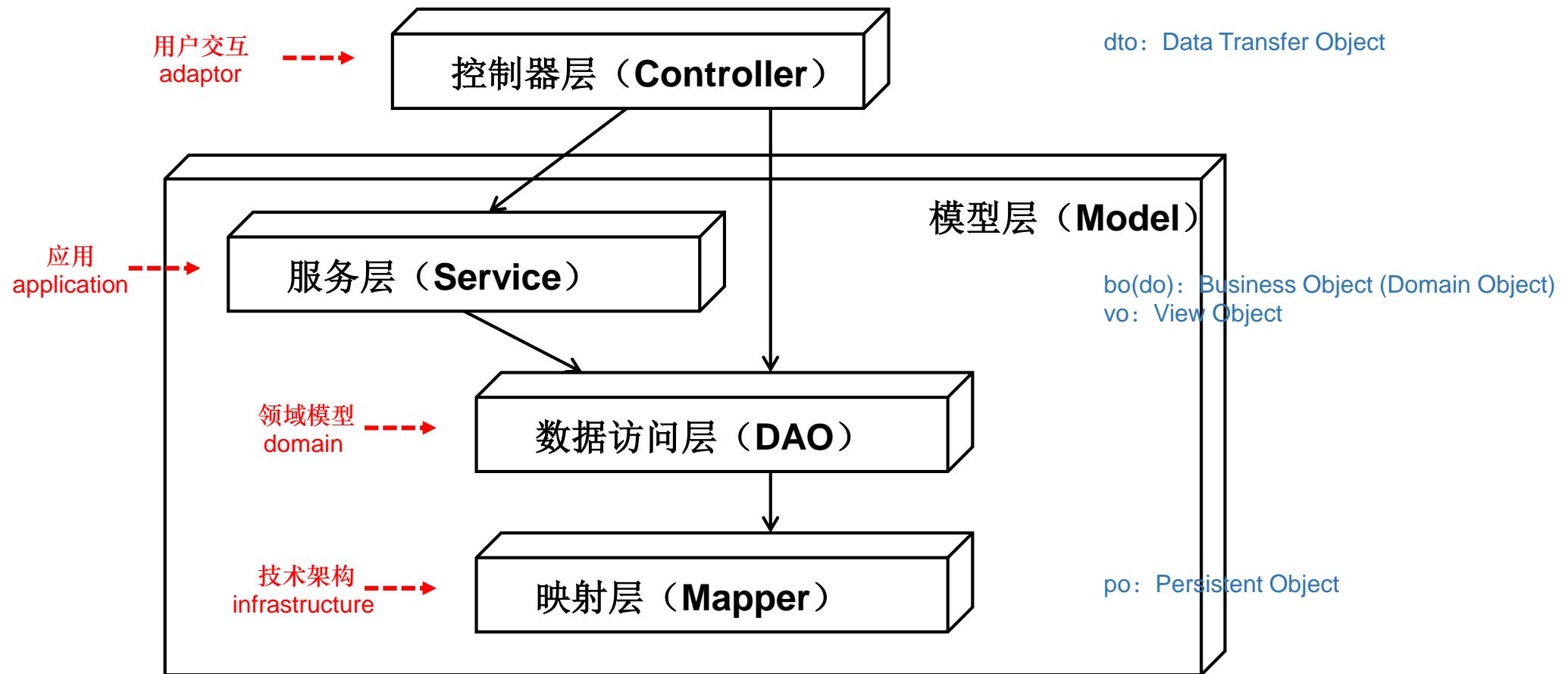
- 问题：对象A由谁创建？
- 方案：如果对象B符合以下条件，则由B对象创建对象A：
  - B 包含 A - 整体和局部的关系。
  - B 记录 A - 关联关系。
  - B 用到 A - 依赖关系。
  - B 有 A的初始化数据。



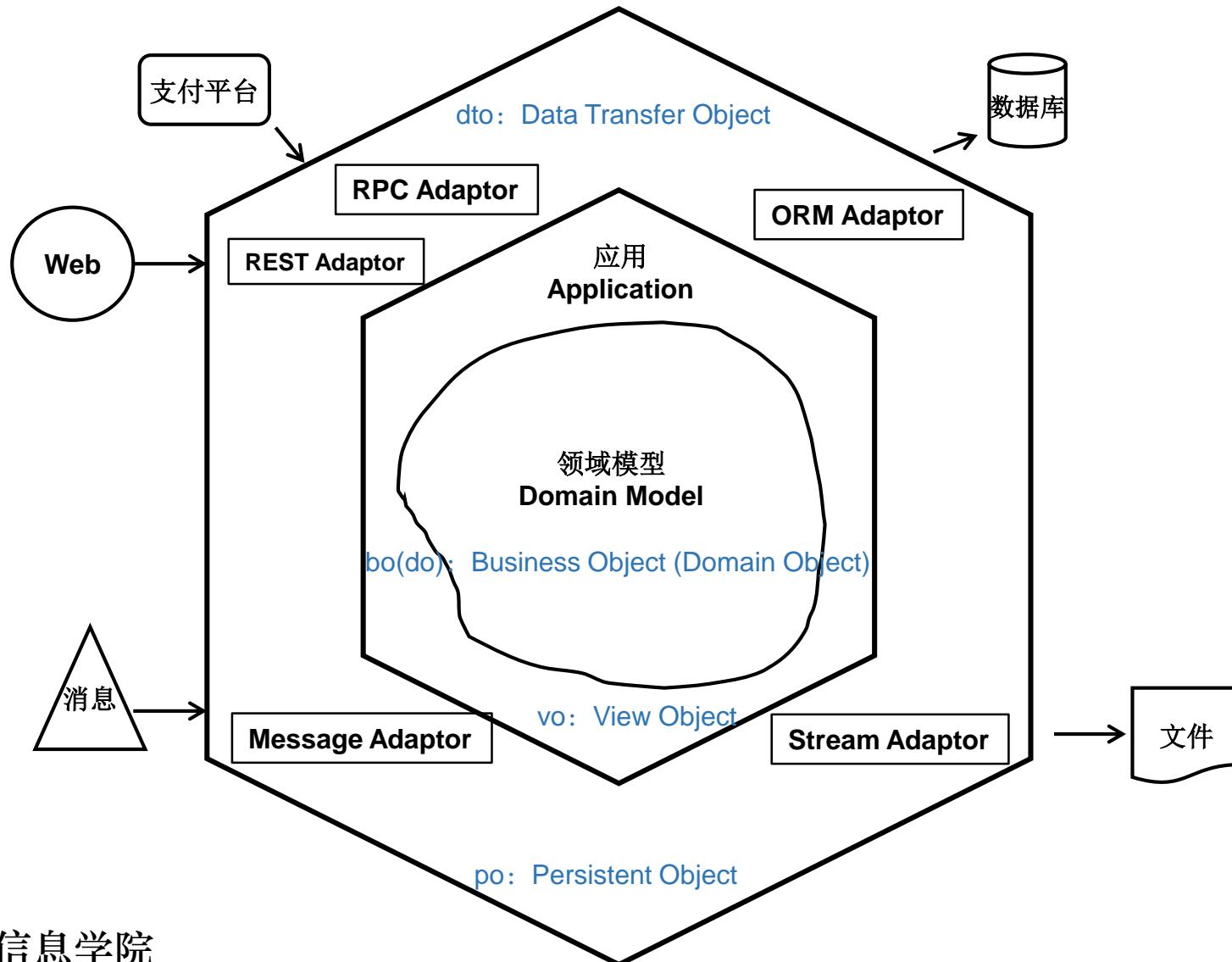
## 4.2 创建者 Creator



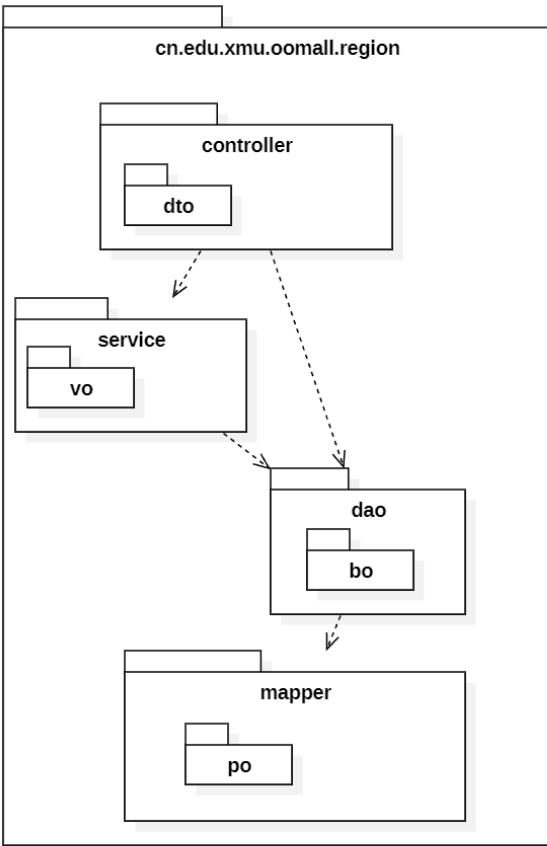
## 4.2 创建者 Creator



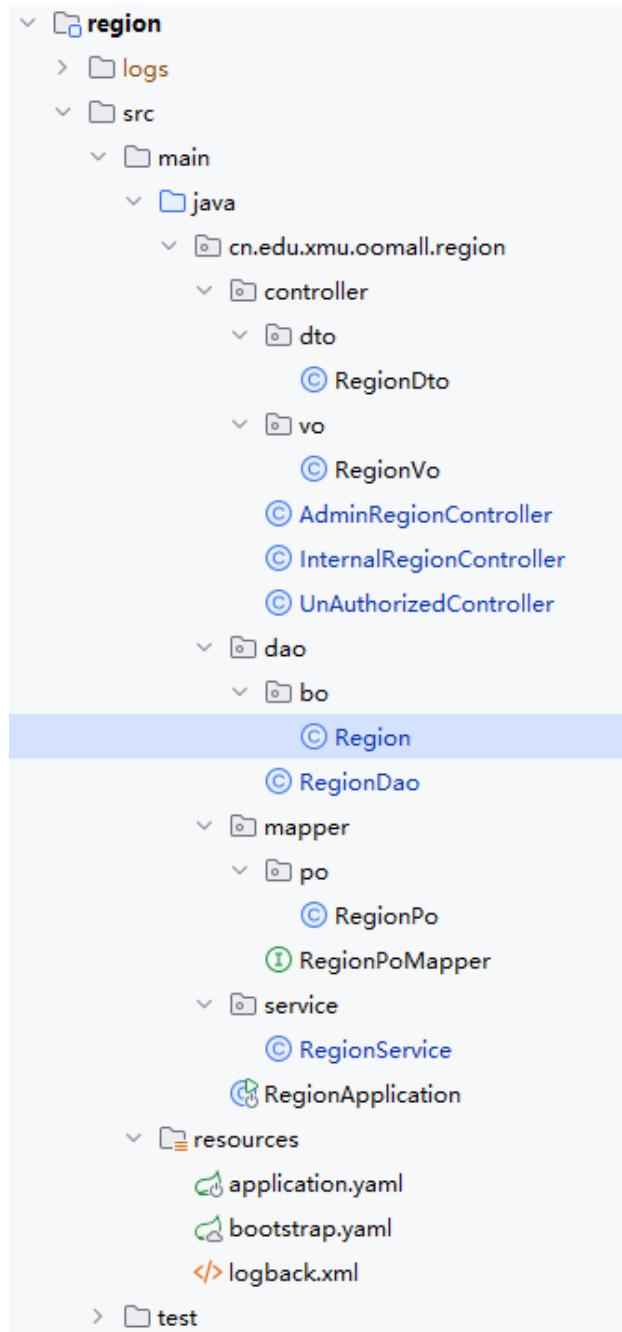
## 4.2 创建者 Creator



# 4.2 创建者 Creator

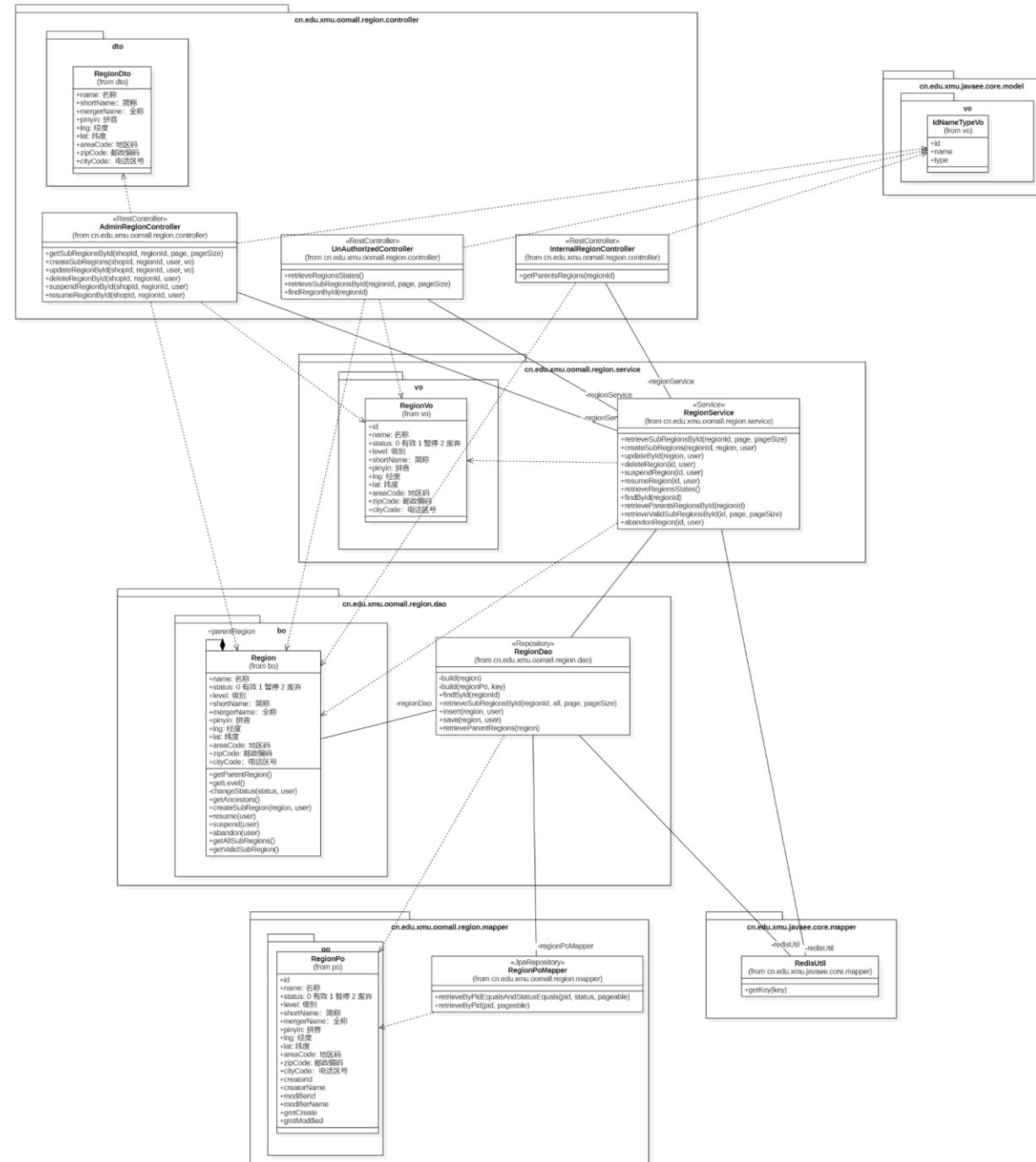


## Region模块包图

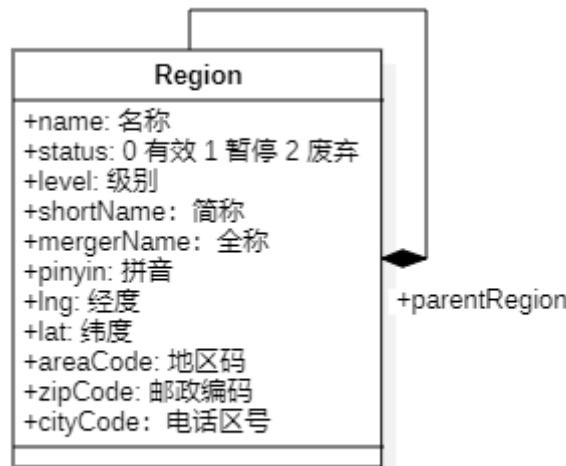


# 4.2 创建者 Creator

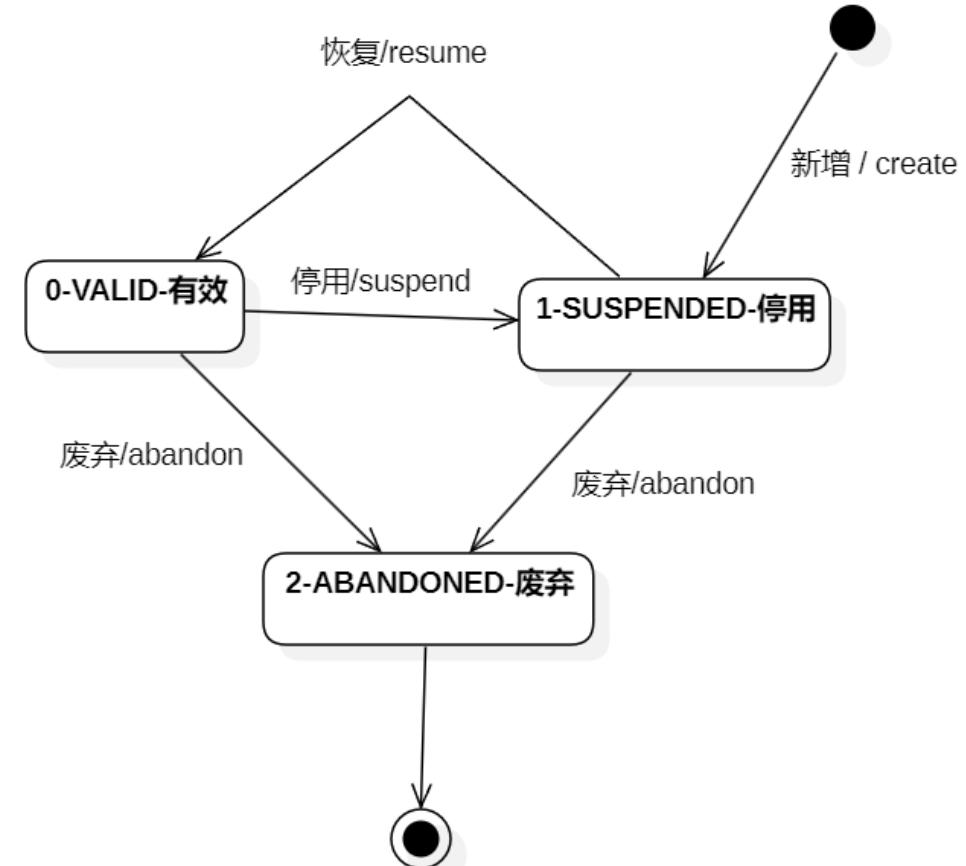
地区模块类图



## 4.2 创建者 Creator



Region模块对象模型



Region对象状态图



# 4.2 创建者 Creator

region

## 管理员在地区下新增子地区

POST /platforms/{did}/regions/{id}/subregions

▶ 调试 Run in Apifox

- 新的子地区是suspend状态

### 请求参数

#### Path 参数

did integer <int64>	必需
只能为0.否则出17错误	
id integer 地区id	必需

#### Header 参数

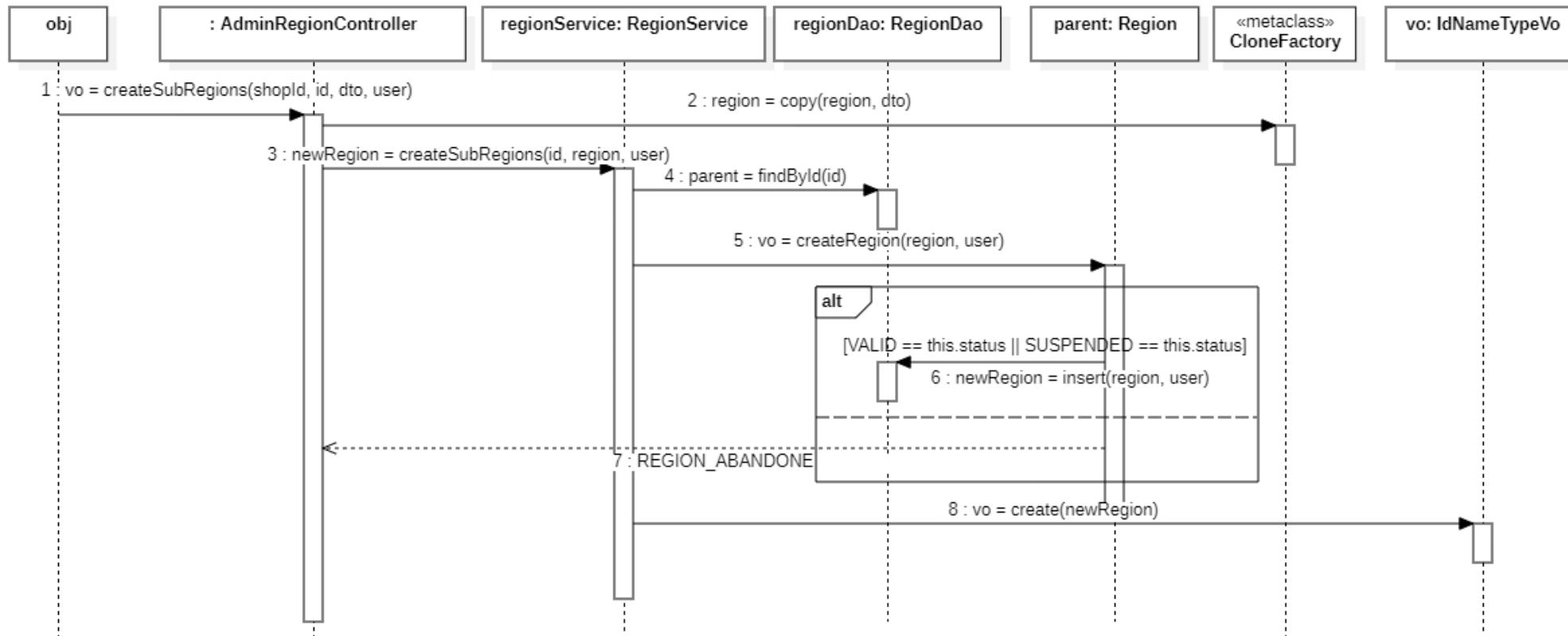
authorization string 用户token	必需
------------------------------	----

#### Body 参数 application/json 必填

参数	类型	描述	可选	示例
name	string		可选	{ "name": "string", "shortName": "string", "mergerName": "string", "pinyin": "string", "lng": "string", "lat": "string", "areaCode": "string", "zipCode": "string", "cityCode": "string" }
shortName	string	简称	可选	
mergerName	string	全称	可选	
pinyin	string	拼音	可选	
lng	string	经度	可选	
lat	string	纬度	可选	
areaCode	string	地区码	可选	
zipCode	string	邮政编码	可选	
cityCode	string	电话区号	可选	



# 4.2 创建者 Creator



创建下级地区顺序图



## 4.3 信息专家

### Information Expert

- 问题：分配职责给对象的基本原则是什么？
- 方案：“知者为之” - 谁具备完成职责所需的信息，就由谁来承担职责



## 4.3 信息专家

### Information Expert

- 问题：分配职责给对象的基本原则是什么？
- 方案：“知者为之” - 谁具备完成职责所需的信息，就由谁来承担职责



# 4.3 信息专家

## Information Expert

region

### 管理员停用某个地区

PUT /platforms/{did}/regions/{id}/suspend

▶ 调试 Run in Apifox

• 下级地区一并停用

#### 请求参数

Path 参数

`did` integer <int64> 必需 只能为0,否则出17错误

`id` integer 地区id 必需

Header 参数

`authorization` string 用户token 必需

#### 请求示例代码

Shell JavaScript Java Swift Go PHP Python HTTP C C# Objective-C Ruby OCaml Dart F

#### 返回响应

200 成功

application/json

成功

Body

`errno` integer  
示例值: 0

`errmsg` string  
示例值: 成功

示例

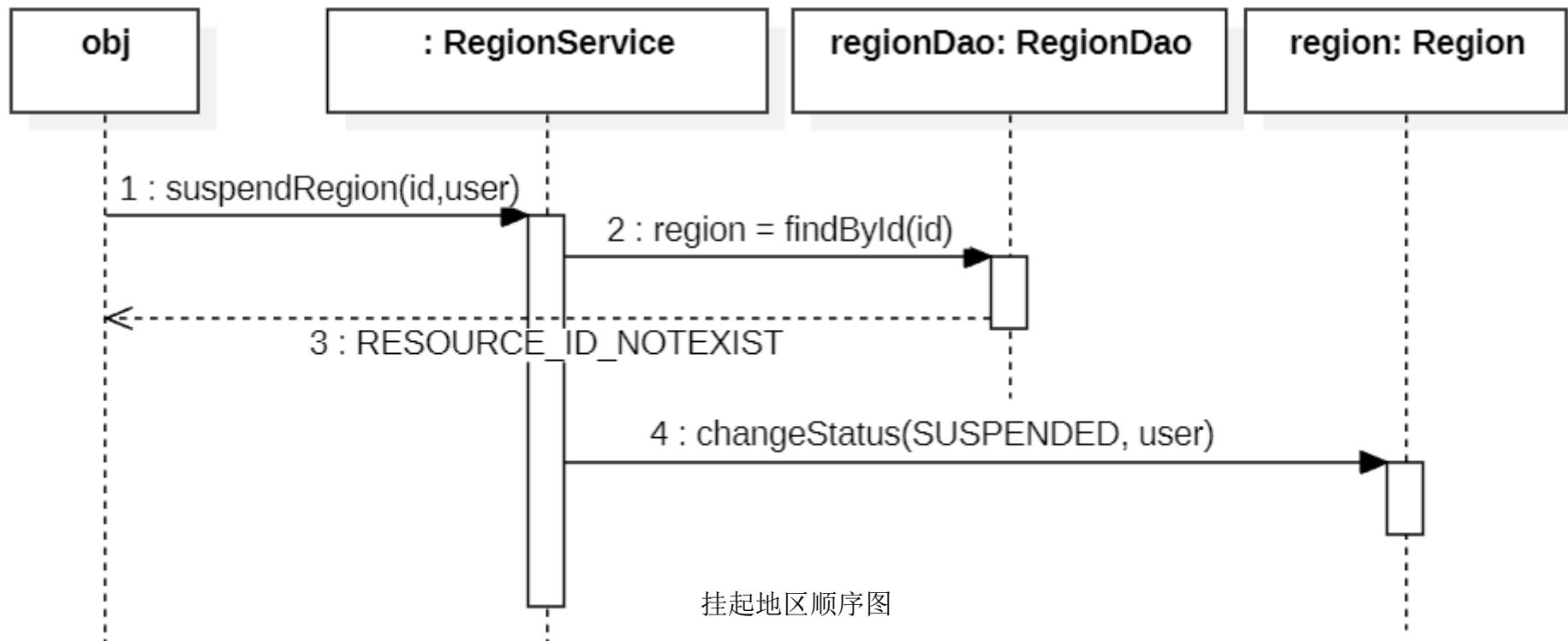
```
{  
  "errno": 0,  
  "errmsg": "成功"  
}
```

停用某个地区 (<https://qbcgzdds.jf.apifox.cn/361366669e0>)



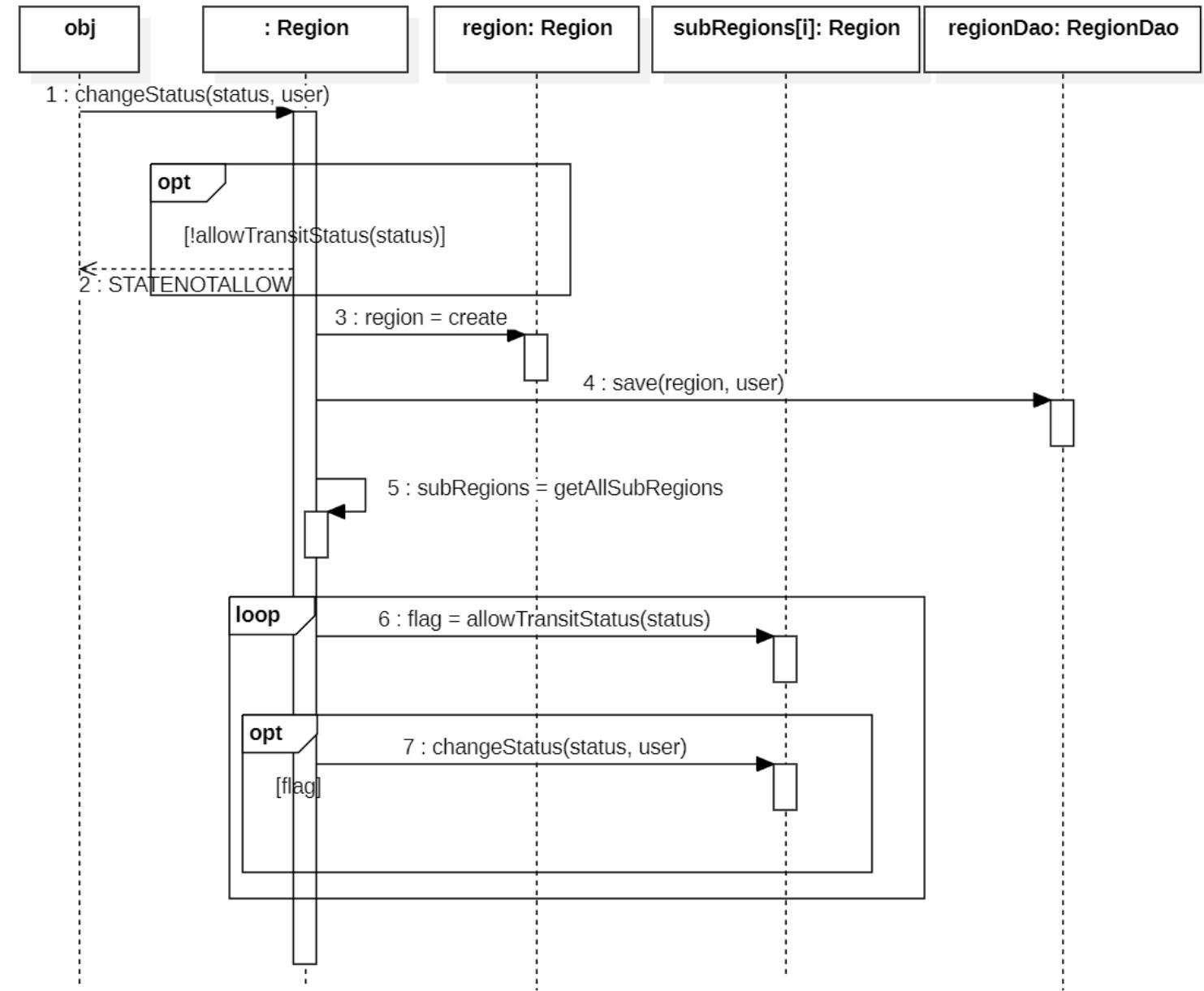
# 4.3 信息专家

## Information Expert



# 4.3 信息专家

## Information Expert



修改地区状态顺序图



# 4.3 信息专家

## Information Expert

region

管理员废弃某个地区

DELETE /platforms/{did}/regions/{id}

▶ 调试 ▶ Run in Apifox

下级地区一并废弃

请求参数

Path 参数

did integer <int64> 必需  
只能为0,否则出17错误

id integer 地区id 必需

Header 参数

authorization string 用户token 必需

请求示例代码

Shell JavaScript Java Swift Go PHP Python HTTP C C# Objective-C Ruby OCaml Dart F

返回响应

200 成功

application/json

成功

Body

errno integer  
示例值: 0 可选

errmsg string  
示例值: 成功 可选

示例

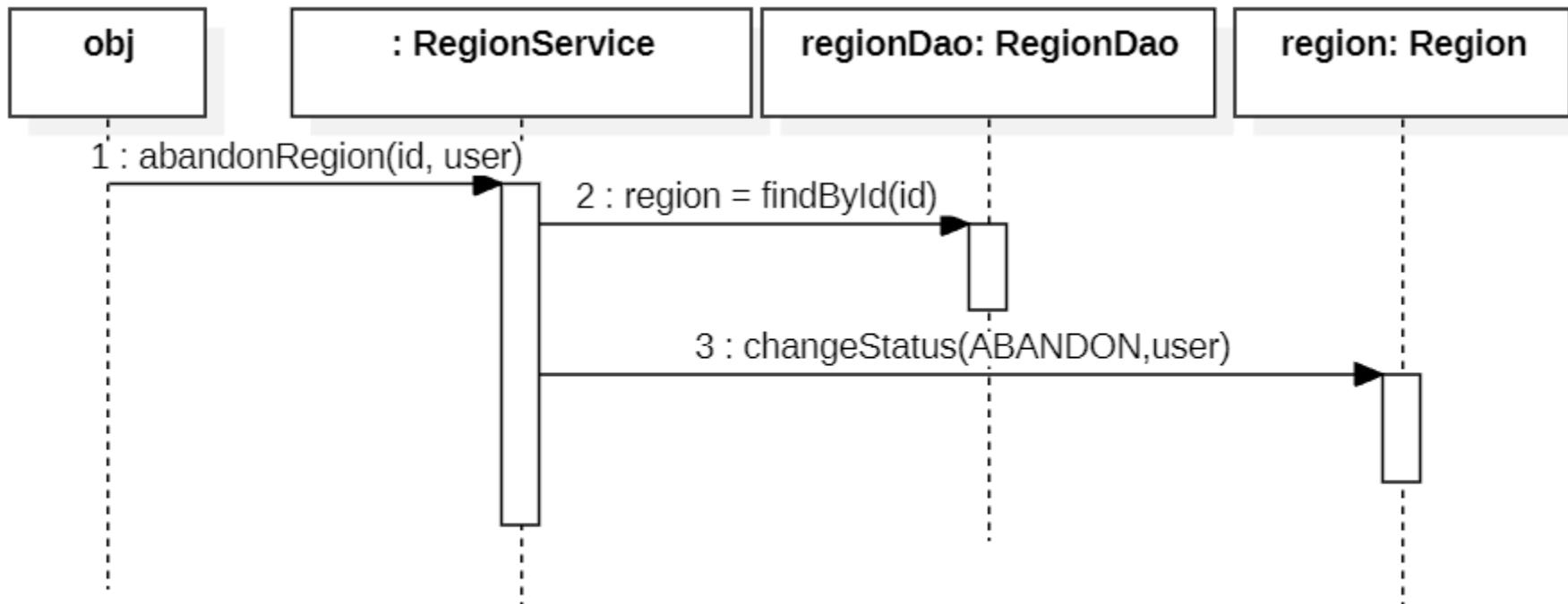
```
{  
    "errno": 0,  
    "errmsg": "成功"  
}
```

废弃某个地区 (<https://qbcgzdds.jf.apifox.cn/361366668e0>)



# 4.3 信息专家

## Information Expert



废弃地区顺序图



# 4.3 信息专家

## Information Expert

region

### 管理员恢复某个地区

PUT /platforms/{did}/regions/{id}/resume

▶ 调试 Run in Apifox

- 上级地区需都是valid状态
- 下级地区一并恢复

#### 请求参数

##### Path 参数

did integer <int64> 必需  
只能为0,否则出17错误

id integer 地区id 必需

##### Header 参数

authorization string 用户token 必需

#### 请求示例代码

Shell JavaScript Java Swift Go PHP Python HTTP C C# Objective-C Ruby OCaml Dart F

#### 返回响应

200 成功

application/json

成功

Body

errno integer 可选  
示例值: 0

errmsg string 可选  
示例值: 成功

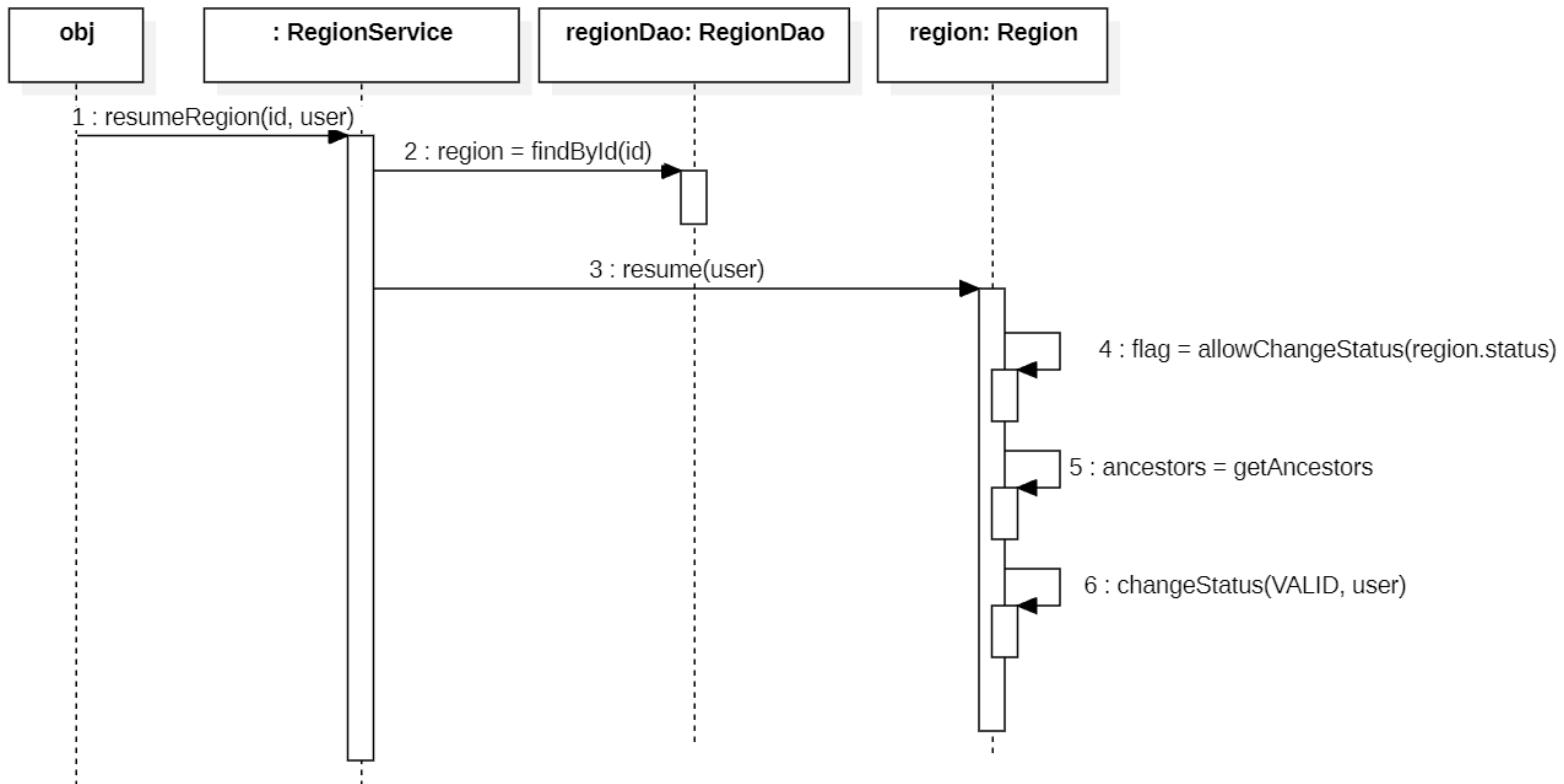
示例

```
{  
  "errno": 0,  
  "errmsg": "成功"  
}
```



# 4.3 信息专家

## Information Expert



恢复地区状态顺序图



# 4.4 非面向对象设计

## None object-oriented design

The screenshot shows the Apifox API documentation for a 'region' endpoint. The title is '查询地区的上级地区' (Query Parent Regions). The URL is `/internal/regions/{id}/parents`. The method is GET. There are two buttons at the top right: '调试' (Debug) and 'Run in Apifox'. Below the URL, there's a note: '无需登录' (No login required), '从最近到最远按序返回最多返回10条' (Return from nearest to farthest in sequence, up to 10 items), and '需要缓存' (Cache required). The '请求参数' (Request Parameters) section shows a 'Path 参数' (Path Parameter) named 'id' of type integer, which is required. Below that is a '请求示例代码' (Request Example Code) section with icons for various programming languages: Shell, JavaScript, Java, Swift, Go, PHP, Python, HTTP, C, C#, Objective-C, Ruby, OCaml, Dart, and F#. The '返回响应' (Return Response) section shows a successful 200 response with a status message '成功' (Success). The response body schema is defined as follows:

```
application/json  
成功  
Body  
  errno integer  
  示例值: 0  
  errmsg string  
  示例值: 成功  
  data array<object>  
    可选  
    id integer <int64>  
    Product ID  
    name string  
    名称
```

示例

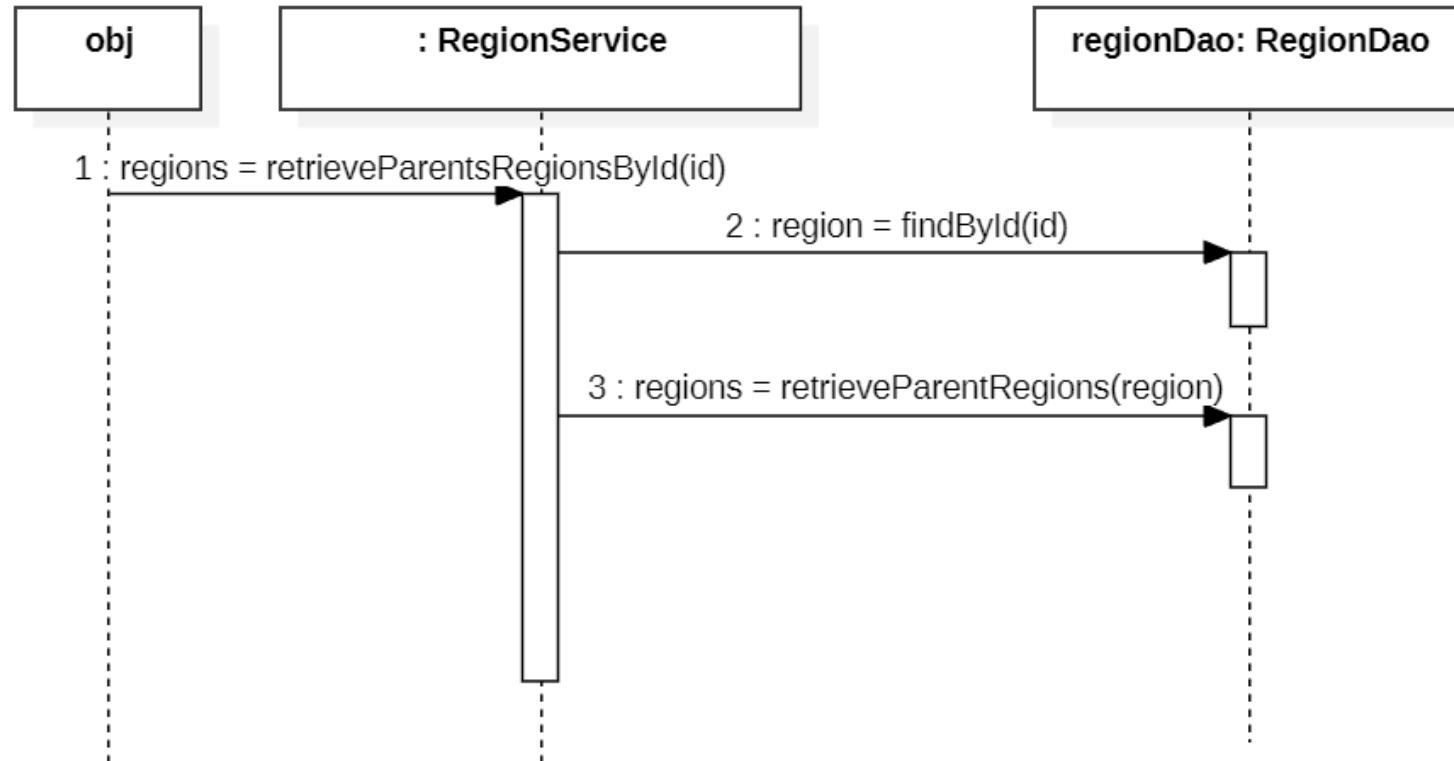
```
{  
  "errno": 0,  
  "errmsg": "成功",  
  "data": [  
    {  
      "id": 0,  
      "name": "string"  
    }  
  ]  
}
```

查询上级地区 (<https://qbcgzdds.jf.apifox.cn/361366671e0>)



## 4.4 非面向对象设计

### None object-oriented design



查询上级地区顺序图



# 4.4 非面向对象设计

## None object-oriented design

region

### 查询在地区下的子地区

GET /regions/{id}/subregions

▶ 调试 Run in Apifox

- 只显示非废弃状态的地区
- 无需登录
- 需要缓存

#### 请求参数

Path 参数

`id` integer 地区id 必需

Query 参数

`page` integer 页码 可选  
`pageSize` integer 每页数目 可选

#### 请求示例代码

Shell JavaScript Java Swift Go PHP Python HTTP C C# Objective-C Ruby OCaml Dart F

#### 返回响应

200 成功

application/json

成功

Body

`errno` integer 可选  
示例值: 0

`errmsg` string 可选  
示例值: 成功

`data` object 可选

`page` integer 页码 可选  
示例值: 0

`pageSize` integer 每页数目 可选  
示例值: 10

`list` array[object ({IDName})] 可选

示例

```
{  
  "errno": 0,  
  "errmsg": "成功",  
  "data": {  
    "page": 0,  
    "pageSize": 0,  
    "list": [  
      {  
        "id": 0,  
        "name": "string"  
      }  
    ]  
  }  
}
```

901 901

查询子地区 (<https://qbcgzdds.jf.apifox.cn/361366665e0>)



# 4.4 非面向对象设计

## None object-oriented design

region

管理员查询在地区下的子地区

GET /platforms/{did}/regions/{id}/subregions

▶ 调试 Run in Apifox

废弃的地区也会返回

请求参数

Path 参数

did integer <int64> 只能为0,否则出17错误 必需

id integer 地区id 必需

Query 参数

page integer 页码 可选

pageSize integer 每页数目 可选

Header 参数

authorization string 用户token 必需

请求示例代码

Shell JavaScript Java Swift Go PHP Python HTTP C C# Objective-C Ruby OCaml Dart F

返回响应

200 成功

application/json

成功

Body

errno integer  
示例值: 0 可选

errmsg string  
示例值: 成功 可选

data object  
page integer 页码 可选

pageSize integer 每页数目 可选

list array[object {DName}] 可选

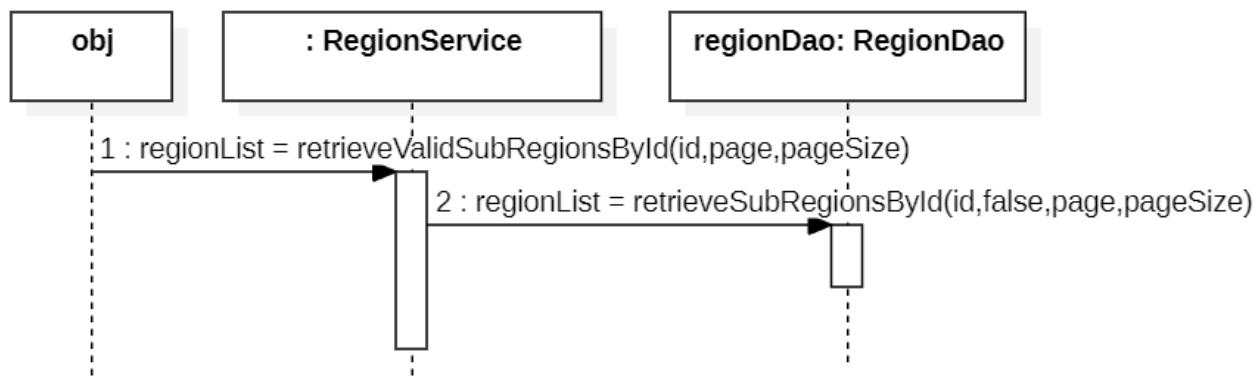
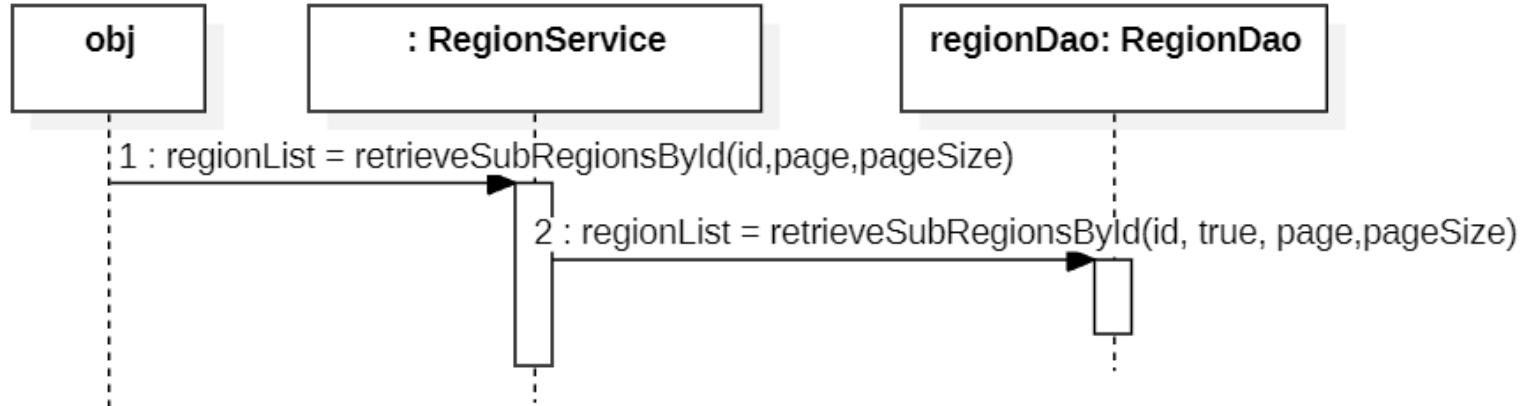
示例

```
{  
    "errno": 0,  
    "errmsg": "成功",  
    "data": {  
        "page": 0,  
        "pageSize": 0,  
        "list": [  
            {  
                "id": 0,  
                "name": "string"  
            }  
        ]  
    }  
}
```



# 4.4 非面向对象设计

## None object-oriented design

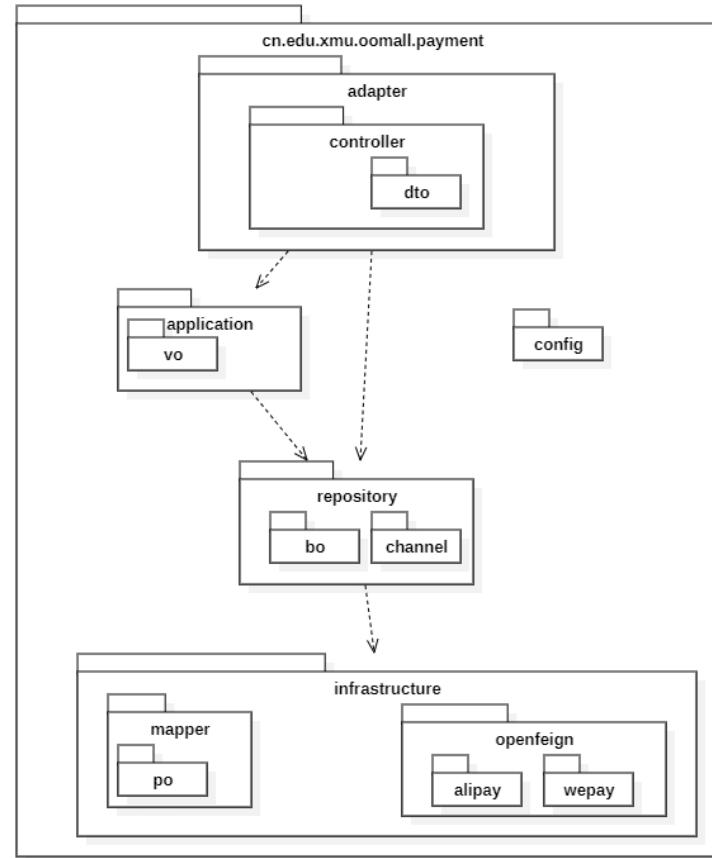


顾客获得下级地区顺序图



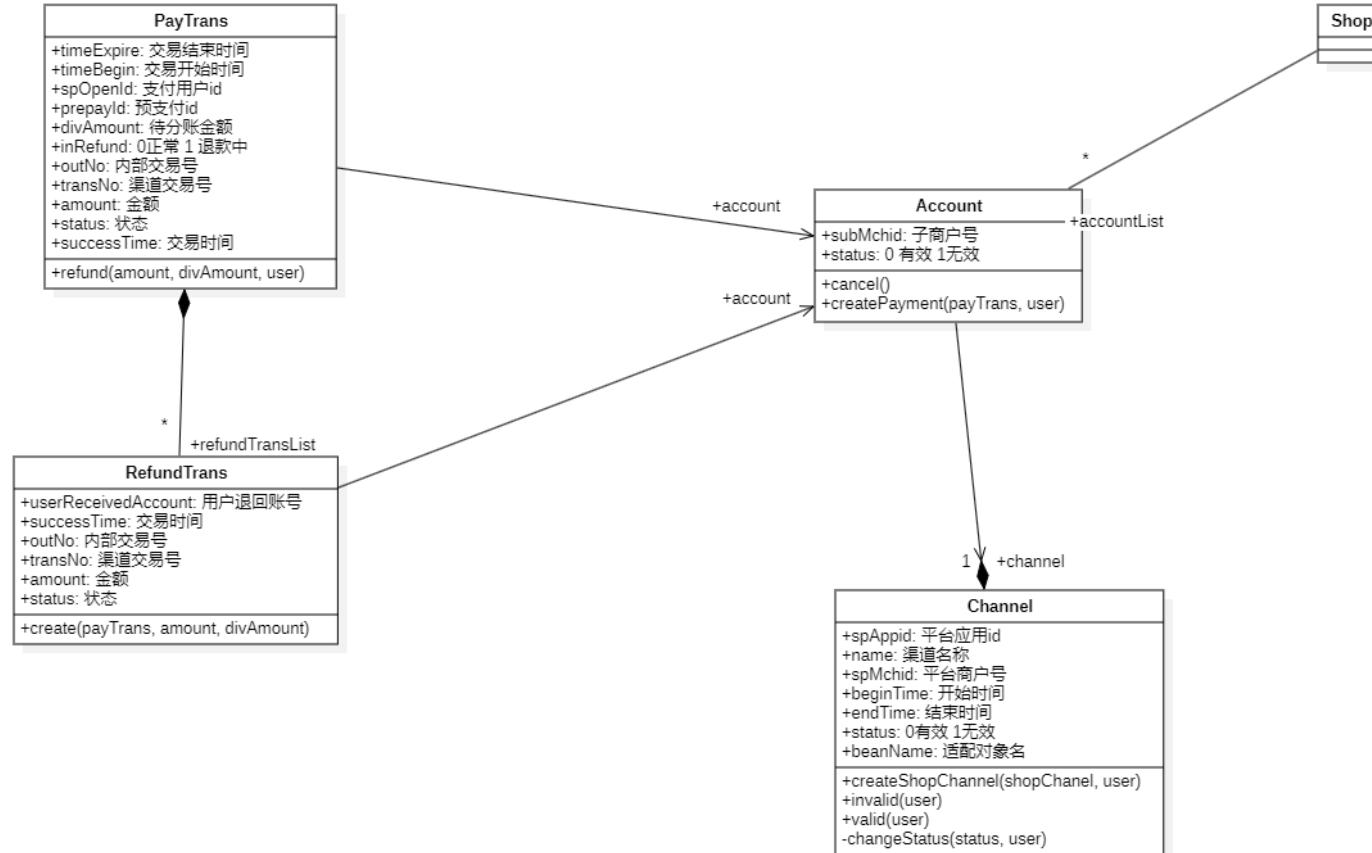
# 4.5 创建者和信息专家-支付模块

## Creator and Information Expert in Payment Module



# 4.5 创建者和信息专家-支付模块

## Creator and Information Expert in Payment Module

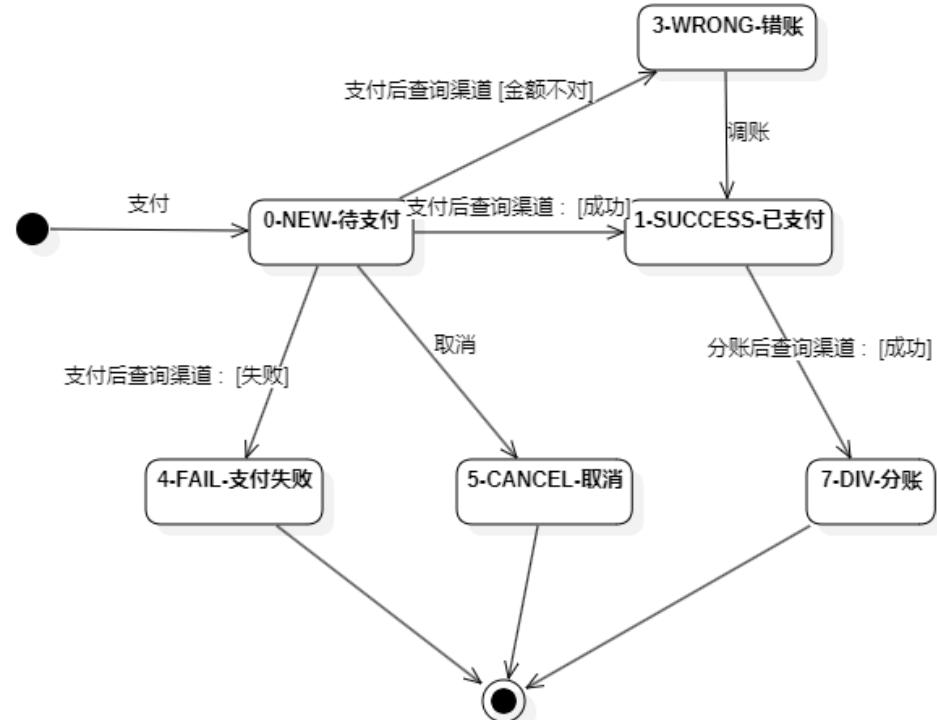


支付对象模型

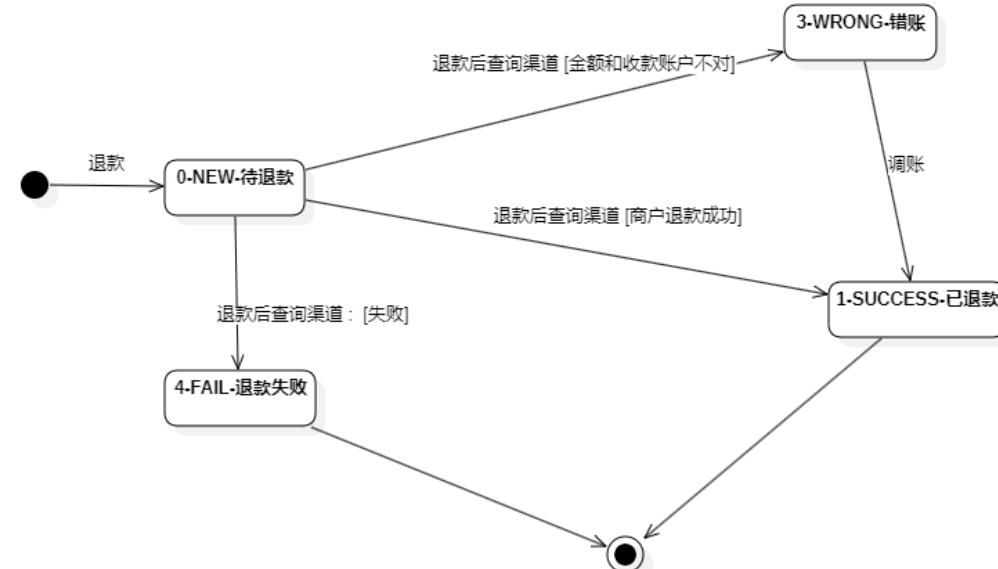


# 4.5 创建者和信息专家-支付模块

## Creator and Information Expert in Payment Module



支付对象状态图



退款对象状态图



# 4.5 创建者和信息专家-支付模块

## Creator and Information Expert in Payment Module

The screenshot shows the Apifox API documentation for the 'payment' module's '签约收款账户' (Sign up Collection Account) endpoint. The endpoint is a POST request to `/shops/{shopId}/channels/{id}/accounts`. The interface includes sections for '请求参数' (Request Parameters), '请求示例代码' (Request Example Code), and '返回响应' (Return Response). The '请求参数' section details Path parameters (`shopId`, `id`), Header parameters (`authorization`), and Body parameters (`subMchid`). The '请求示例代码' section provides code examples for various languages. The '返回响应' section shows a successful response (200 OK) with a status message and a detailed JSON schema for the response body.

支付  
签约收款账户

POST /shops/{shopId}/channels/{id}/accounts

复制页面

建好为无效态

请求参数

Path 参数

<code>shopId</code> integer <int64> 店铺id	必需
<code>id</code> integer <int64> 支付渠道id	必需

Header 参数

<code>authorization</code> string 用户token	必需
---	----

Body 参数 application/json 必填

<code>subMchid</code> string 子商户号	可选	示例
{ "subMchid": "string" }		

请求示例代码

Shell JavaScript Java Swift Go PHP Python HTTP C C# Objective-C Ruby OCaml Dart JSON

返回响应

103 早期提示

200 成功

application/json

成功

Body

`errno` integer  
示例值: 0

`errmsg` string  
示例值: 成功

`data` object (SimpleAccount) SimpleAccount

`id` integer <int64>

`subMchid` integer 子商户号

`status` integer 状态

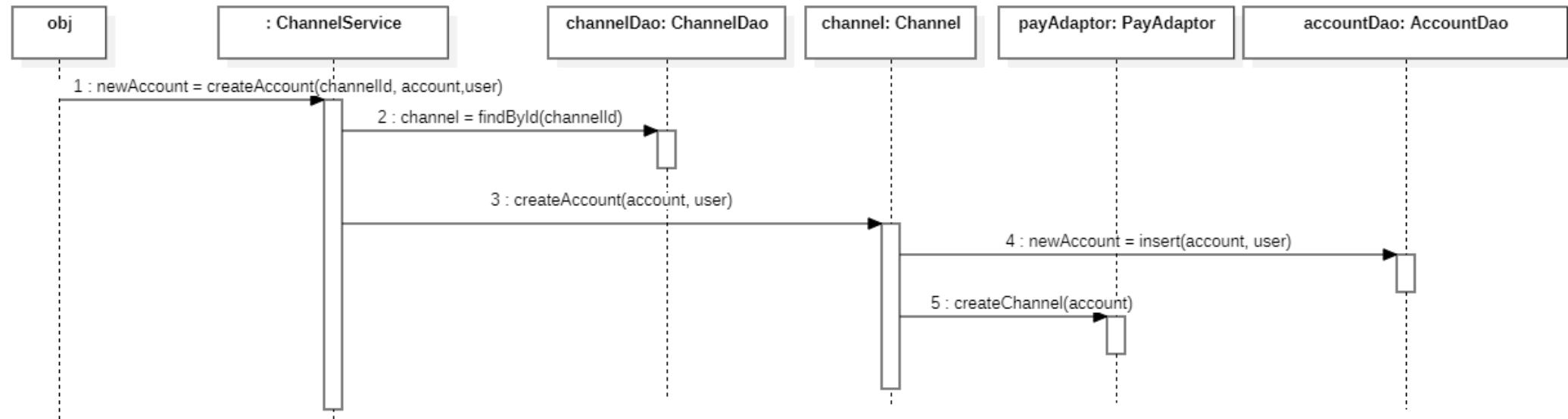
示例

```
{  
    "errno": 0,  
    "errmsg": "成功",  
    "data": {  
        "id": 0,  
        "subMchid": 0,  
        "status": 0  
    }  
}
```



# 4.5 创建者和信息专家-支付模块

## Creator and Information Expert in Payment Module



签约账户的顺序图



# 4.5 创建者和信息专家-支付模块

## Creator and Information Expert in Payment Module

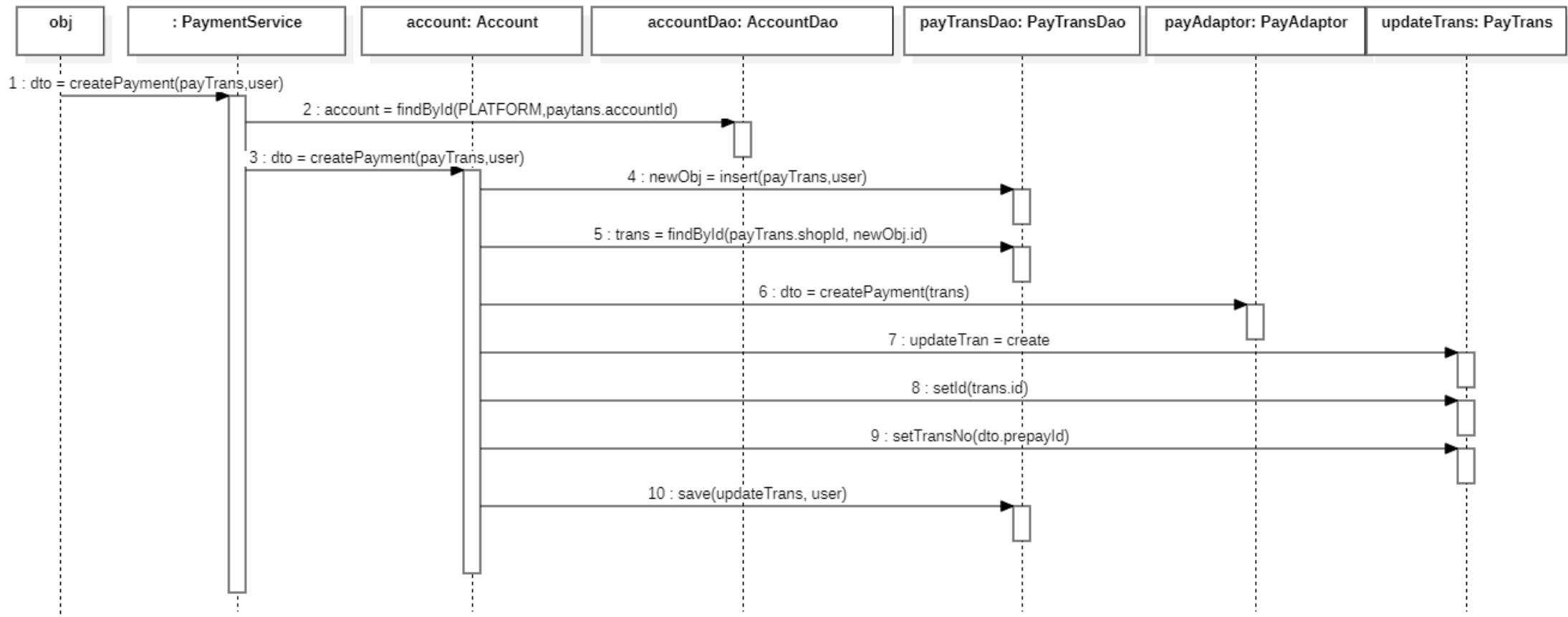
The screenshot shows the Apifox API documentation for the 'Create payment order' endpoint. It includes:

- 请求参数 (Request Parameters):**
  - Path 参数 (Path Parameters):** id (integer, 必填) - 商户收款账户id
  - Header 参数 (Header Parameters):** authorization (string, 必填) - 用户token
- Body 参数 (Body Parameters):** application/json (必填)
  - outTradeNo (string, 可选) - alipay.out\_trade\_no 商户网站唯一订单号, wepay.out\_trade\_no 商户系统的内部订单号, 只能是数字、大小写字母, \*只在一个商户号下唯一。
  - description (string, 可选) - alipay.subject 订单标题, wepay.description 商品描述
  - timeExpire (string, 可选) - 结束支付时间
  - timeBegin (string, 可选) - 开始支付时间
  - amount (integer, 可选) - 付款金额
  - divAmount (integer, 可选) - 付款分账金额
- 请求示例代码 (Request Examples):** Shell, JavaScript, Java, Swift, Go, PHP, Python, HTTP, C, C++, Objective-C, Ruby, OCaml, Dart, Golang
- 返回响应 (Response Examples):**
  - 200 成功 (Success):** application/json
    - Body:
      - errno (integer, 可选) - 错误码: 0
      - errmsg (string, 可选) - 错误信息
      - data (object (PayResponse))
        - id (integer, 可选) - 支付单id
        - outTradeNo (string, 可选) - alipay.out\_trade\_no 商户网站唯一订单号
        - prepayId (string, 可选) - wepay.prepay\_id 支付宝单号 alipay.trade\_no 该交易在支付宝系统中的交易流水号, 最长64位。
        - totalAmount (integer, 可选) - alipay.total\_amount 该笔订单的总金额, 单位为人民币 (分)
        - sellerId (string, 可选) - alipay.seller\_id 收款支付宝账号对应的支付宝唯一用户名
        - merchantOrderNo (string, 可选) - alipay.merchant\_order\_no 商户原始订单号



# 4.5 创建者和信息专家-支付模块

## Creator and Information Expert in Payment Module



创建支付单顺序图



# 4.5 创建者和信息专家-支付模块

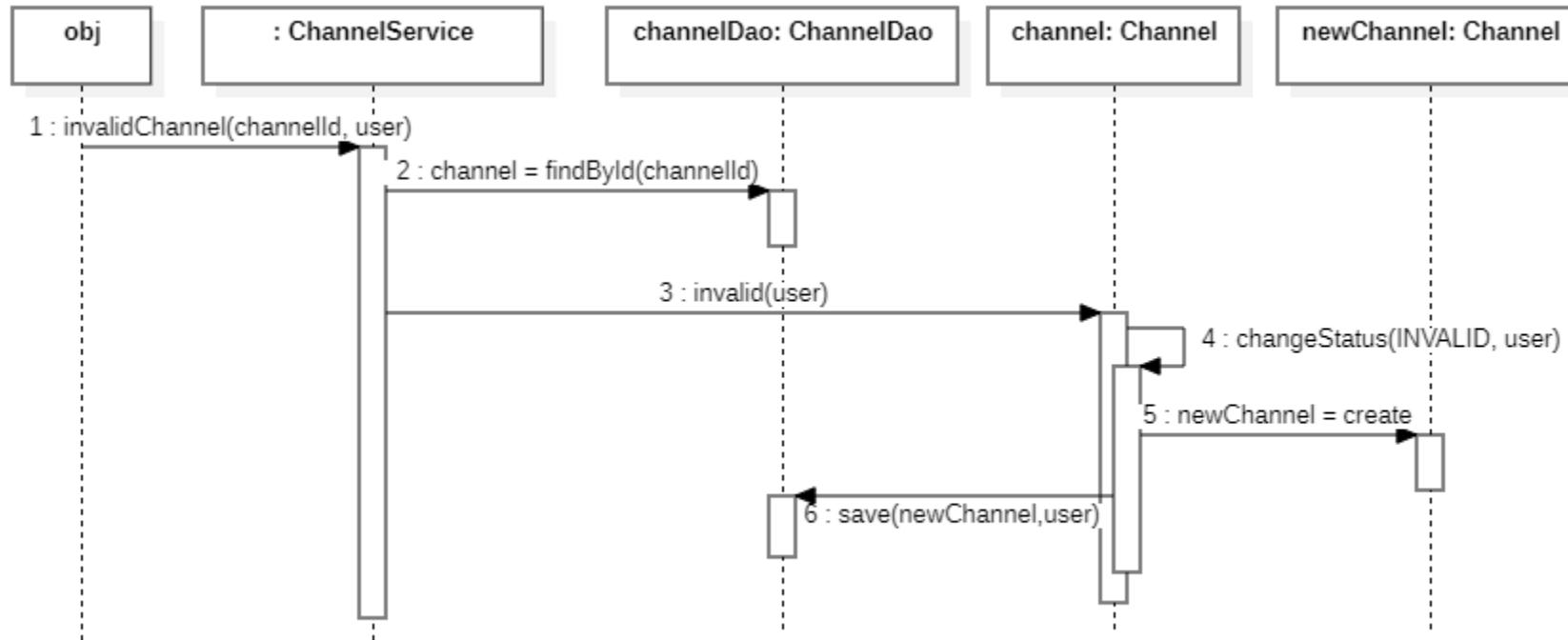
## Creator and Information Expert in Payment Module

The screenshot shows the Apifox interface for the 'payment' module. The endpoint is `PUT /platforms/{shopId}/channels/{id}/invalid`. The description indicates that the effective status is set to invalid, and all stores corresponding payment channels are invalid. The request parameters section details path parameters (`shopId` and `id`), header parameters (`authorization`), and query parameters. Below this, there's an example code section with icons for various programming languages like Shell, JavaScript, Java, Swift, Go, PHP, Python, HTTP, C, C#, Objective-C, Ruby, OCaml, Dart, and F#. Finally, the response section shows a successful 200 status with a JSON schema for the body, which includes `errno` (integer, optional, value 0) and `errmsg` (string, optional, value "成功").



# 4.5 创建者和信息专家-支付模块

## Creator and Information Expert in Payment Module



# 4.5 创建者和信息专家-支付模块

## Creator and Information Expert in Payment Module

The screenshot shows the Apifox interface for the payment module's accounts endpoint. At the top, it says "顾客获得商户的收款账号" (Customer Gets Merchant Collection Account). Below that, there are sections for "请求参数" (Request Parameters) and "Header 参数" (Header Parameters). Under "请求参数", there are three Query parameters: "shopId" (店铺id), "page" (页码), and "pageSize" (每页数目). Under "Header 参数", there is one parameter: "authorization" (用户token). Below these, there is a section for "请求示例代码" (Request Example Code) with icons for various programming languages like Shell, JavaScript, Java, Swift, Go, PHP, Python, HTTP, C, C++, Objective-C, Ruby, OCaml, Dart, and F#. At the bottom, there is a "返回响应" (Return Response) section showing a successful 200 response in application/json format. The response body includes fields like "erno", "errmsg", "data" (with "page", "pageSize", and "list" sub-fields), and "channel" (with "id", "subMchId", "status", and "beginTime", "endTime", "status" sub-fields), along with "creator", "gmtCreate", "gmtModified", and "modifier" objects.



# 4.5 创建者和信息专家-支付模块

## Creator and Information Expert in Payment Module

```
public List<Account> retrieveValidAccount(Long shopId, Integer page, Integer pageSize){  
    //获得所有的Account, 再判断Account和Channel的状态是否都有效  
    List<Account> accounts = this.accountDao.retrieveByShopId(shopId, page, pageSize);  
    return accounts.stream()  
        .filter(account -> account.getStatus().equals(Account.VALID) && account.getChannel().getStatus().equals(Channel.VALID))  
        .collect(Collectors.toList());  
}
```



## 4.6 高内聚和低耦合

### High Cohesion and Low Coupling

- 高内聚 (High Cohesion)
  - 如何让对象易理解，好管理？
- 低耦合 (Low Coupling)
  - 如何减轻变更的影响范围？



# 4.6 高内聚和低耦合

## High Cohesion and Low Coupling

@Transactional

```
public PayTransDto createPayment(LocalDateTime timeBegin, LocalDateTime timeExpire, String spOpenid, Long shopChannelId, Long amount,
Long divAmount, UserDto user) throws BusinessException {
    ShopChannel shopChannel = this.shopChannelDao.findById(shopChannelId);
    Channel channel = shopChannel.getChannel();
    logger.debug("createPayment: shop = {}", shopChannel);
    if (ShopChannel.INVALID == shopChannel.getStatus() || Channel.INVALID == channel.getStatus()) {
        throw new BusinessException(ReturnNo.PAY_CHANNEL_INVALID, String.format(ReturnNo.PAY_CHANNEL_INVALID.getMessage(),
channel.getName()));
    }

    PayTrans newObj = new PayTrans(timeBegin, timeExpire, spOpenid, amount, divAmount, shopChannel);
    payTransDao.save(newObj, user);
    newObj = payTransDao.findById(newObj.getId());

    PayAdaptor payChannel = this.factory.createPayAdaptor(shopChannel);
    logger.debug("createPayment: payChannel = {}, newObj = {}", payChannel, newObj);

    PostPayTransAdaptorDto adaptorDto = payChannel.createPayment(newObj);
    newObj.setPrepayId(adaptorDto.getPrepayId());
    clearFields(newObj, "id", "prepayId");
    try {
        payTransDao.saveById(newObj, null);
    }catch (BusinessException e){
        if (ReturnNo.RESOURCE_ID_NOTEXIST == e.getErrno()){
            logger.error("createPayment: 回写支付对象失败。");
            throw new BusinessException(ReturnNo.INTERNAL_SERVER_ERR);
        }else{
            throw e;
        }
    }

    PayTransDto dto = cloneObj(newObj, PayTransDto.class);
    logger.debug("createPayment: dto = {}", dto);
    return dto;
}
```

```
public PostPayTransAdaptorVo createPayment(PayTrans payTrans, UserDto user) throws BusinessException {
    Account account = this.accountDao.findById(PLATFORM, payTrans.getAccountID());
    logger.debug("createPayment: shop = {}", account);
    return account.createPayment(payTrans, user);
}
```



# 4.6 高内聚和低耦合

## High Cohesion and Low Coupling

payment

管理员创建退款信息，需检查Payment是否是此商铺的payment

POST /internal/shops/{shopId}/payments/{id}/refunds ▶ 调试

此API为模拟API，即时返回支付成功，生成paysn

请求参数

Path 参数

shopId	integer <int64>	店铺id	必需
id	integer	支付id	必需

Header 参数

authorization	string	用户token	必需
---------------	--------	---------	----

Body 参数 application/json 必填

amount	integer	退款金额	可选	示例
divAmount	integer	退回分账金额	可选	{ "amount": 0, "divAmount": 0 }

请求示例代码

Shell, JavaScript, Java, Swift, Go, PHP, Python, HTTP, C, C#, Objective-C, Ruby, OCaml, Delphi

返回响应

200 成功

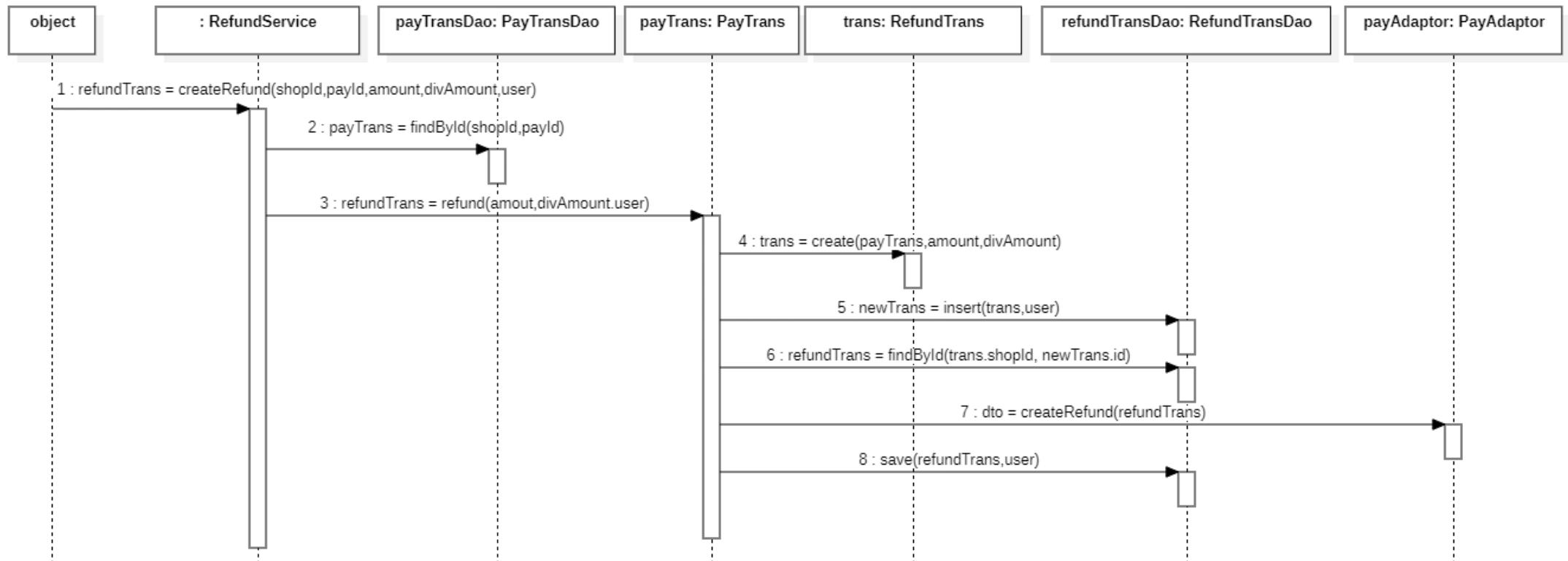
application/json

errno	integer	示例值: 0	可选	示例
errmsg	string	示例值: 成功	可选	{ "errno": 0, "errmsg": "成功", "data": { "id": 0, "outNo": "string", "transNo": "string", "amount": 0, "successTime": "string", "channel": { "id": 0, "name": "string" }, "status": 0, "adjustor": { "id": 0, "name": "string" }, "adjustTime": "string", "ledger": { "amount": 0, "status": 0 } } }



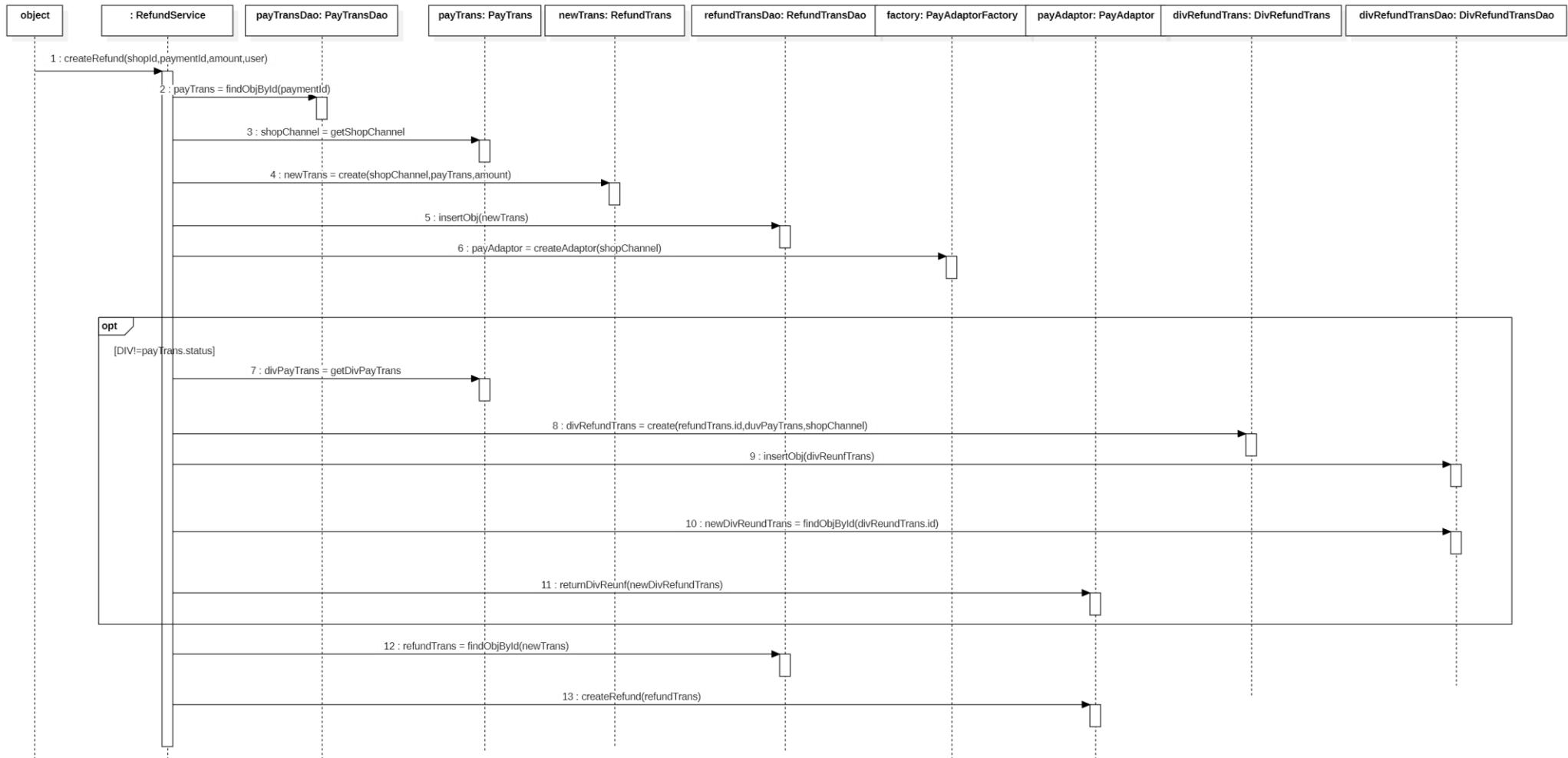
# 4.6 高内聚和低耦合

## High Cohesion and Low Coupling



# 4.6 高内聚和低耦合

## High Cohesion and Low Coupling

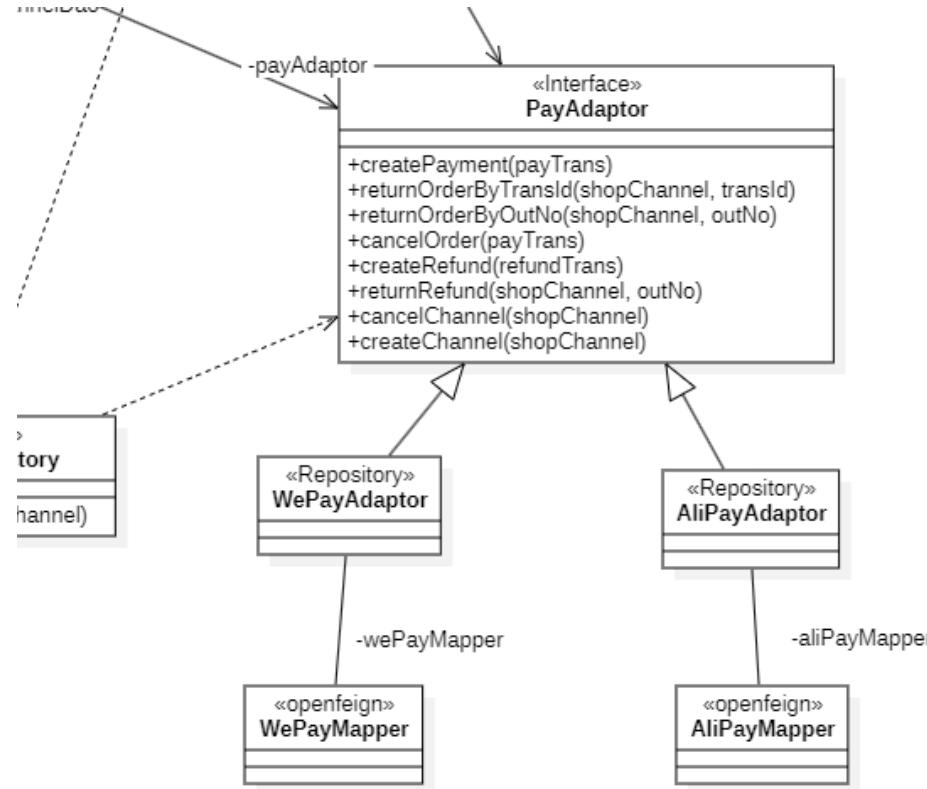


## 4.7 多态 Polymorphism

- 问题
  - 支付平台需要支持不同的支付渠道，如支付宝、云闪付、微信支付等
  - 这些类型有共性的逻辑
  - 如何处理多种类型？
- 方案
  - 使用多态实现不同的类型行为



# 4.7 多态 Polymorphism



## 4.8 间接 Indirection

- 问题
  - 支付模块中需要集成多个支付渠道，这些支付渠道会逐步增加，且API会发生变化
  - 如何避免支付模块与这些支付渠道的直接耦合？
- 方案
  - 我不用你，我通过其他对象用你



# 4.8 间接 Indirection

payment

## 签约收款账户

POST /shops/{shopId}/channels/{id}/accounts

调试 Run in Apifox

• 建好为无效态

请求参数

Path 参数

shopId	integer <int64> 店铺id	必需
id	integer <int64> 支付渠道id	必需

Header 参数

authorization	string 用户token	必需
---------------	----------------	----

Body 参数 application/json 必填

subMchid	string 子商户号	可选	示例
		{ "subMchid": "string" }	

请求示例代码

Shell JavaScript Java Swift Go PHP Python HTTP C C# Objective-C Ruby OCaml Dart F#

返回响应

103 早期提示

200 成功

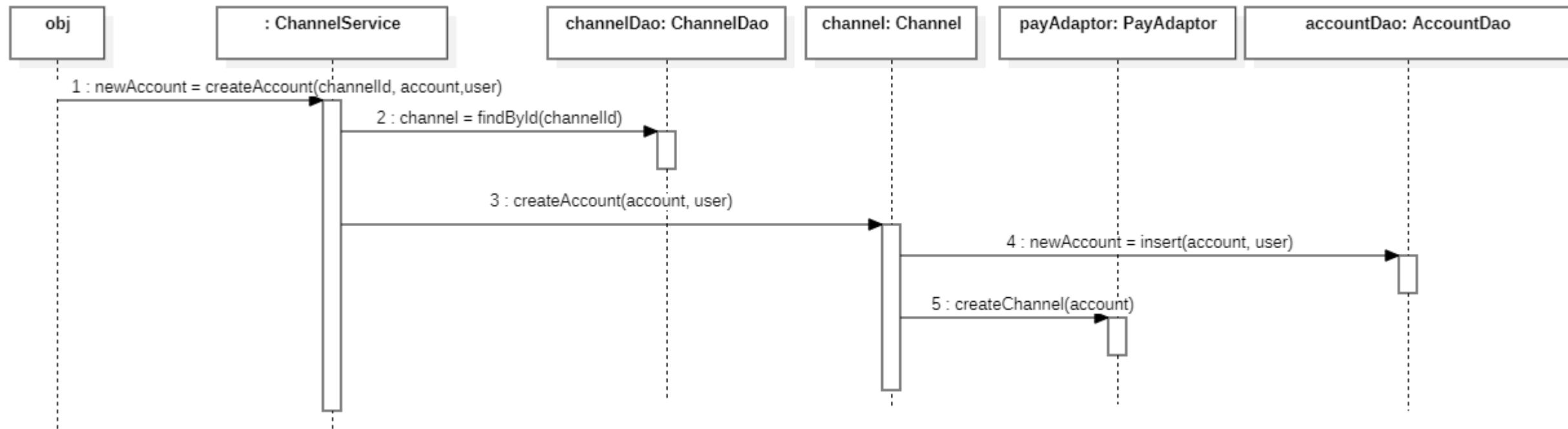
application/json

成功	示例
Body	
errno	integer 可选
示例值:	0
errmsg	string 可选
示例值:	成功
data	object (SimpleAccount) SimpleAccount 可选
id	integer <int64> 可选
subMchid	integer 子商户号 可选
status	integer 状态 可选

{  
  "errno": 0,  
  "errmsg": "成功",  
  "data": {  
    "id": 0,  
    "subMchid": 0,  
    "status": 0  
  }  
}

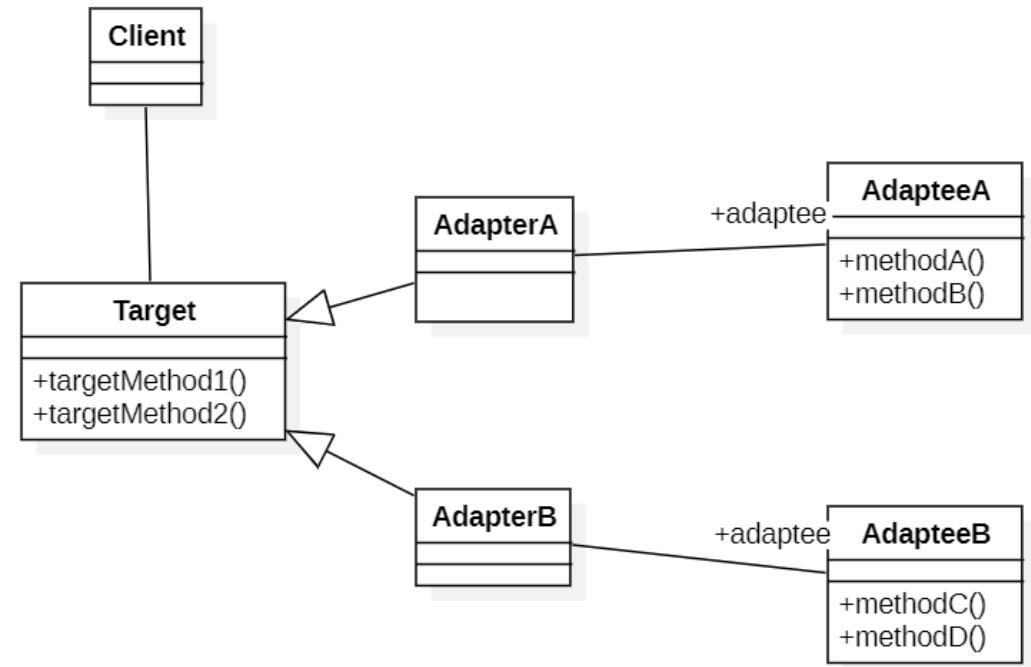


# 4.8 间接 Indirection

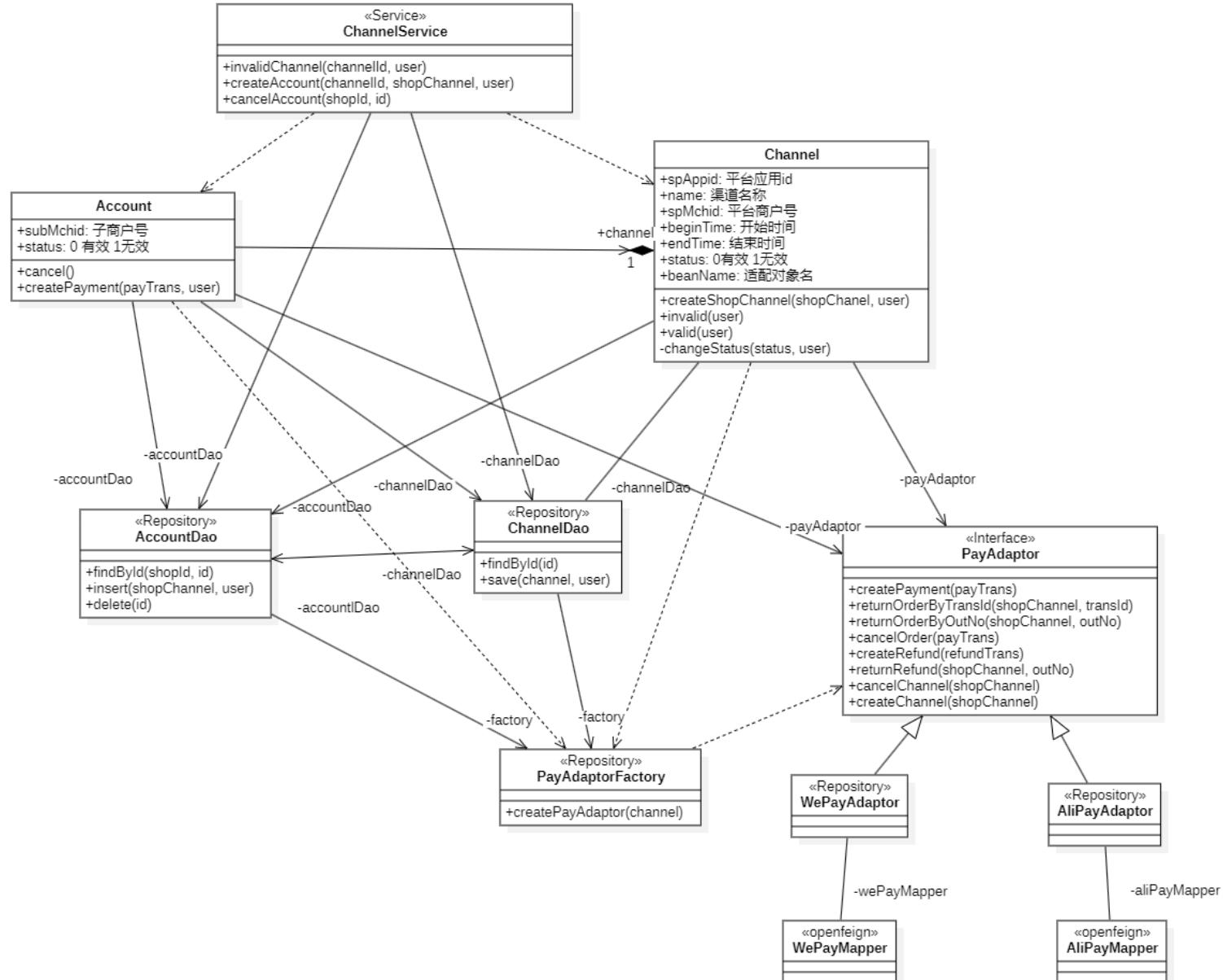


## 4.8 间接 Indirection

- 适配器模式 (Adaptor)
  - 将一个类的接口转换成客户希望的另外一个接口。 Adapter模式使得原本由于接口不兼容而不能一起工作的那些类可以一起工作。



# 4.8 间接 Indirection



# 4.8 间接 Indirection

payment

## 创建支付单

POST /internal/accounts/{id}/payments

此 API 为模拟 API，即时返回支付成功，生成 payasn

### 请求参数

Path 参数

`id` integer 商户收款账户id 必填

Header 参数

`authorization` string 用户token 必填

Body 参数 application/json 必填

`outNo` string 可选  
alipay.out\_trade\_no 商户网站唯一订单号, weipay.out\_trade\_no 商户系统内部订单号，只能是数字、大小写字母、\*且在同一个商户号下唯一。

`description` string 可选  
alipay:subject 订单标题, weipay:description 商品描述

`timeExpire` string 可选  
结束支付时间

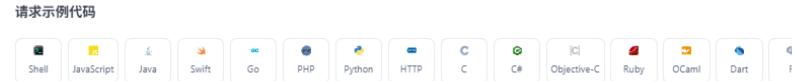
`timeBegin` string 可选  
开始支付时间

`amount` integer 可选  
付款金额

`divAmount` integer 可选  
付款分账金额

示例

```
{  
    "outNo": "string",  
    "description": "string",  
    "timeExpire": "string",  
    "timeBegin": null,  
    "amount": 0,  
    "divAmount": 0  
}
```



### 返回响应

200 成功

application/json

成功

Body

`errno` integer 可选  
示例值: 0

`errmsg` string 可选  
示例值: 成功

`data` object (PayResponse) PayResponse 可选

`id` integer 支付单id 可选

`outTradeNo` string 可选  
alipay.out\_trade\_no 商户网站唯一订单号

`prepayId` string 可选  
weipay:prepay\_id 预支付单号 alipay.trade\_no 该交易在支付宝系统中的交易流水号。最长64位。

`totalAmount` integer 可选  
alipay:total\_amount 该笔订单的资金总额，单位为人民币(分)

`sellerId` string 可选  
alipay:seller\_id 收款支付宝账号对应的支付宝唯一用户号

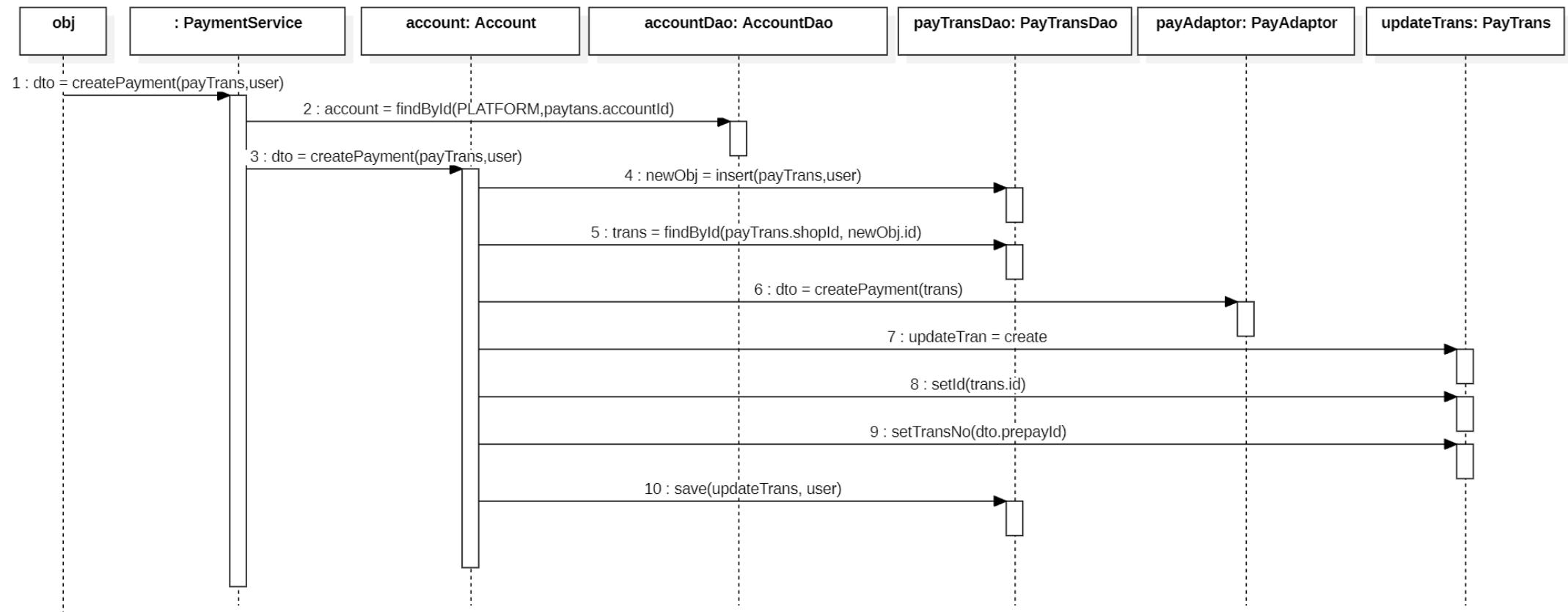
`merchantOrderNo` string 可选  
alipay:merchant\_order\_no 商户原始订单号

示例

```
{  
    "errno": 0,  
    "errmsg": "成功",  
    "data": {  
        "id": 0,  
        "outTradeNo": "string",  
        "prepayId": "string",  
        "totalAmount": 0,  
        "sellerId": "string",  
        "merchantOrderNo": "string"  
    }  
}
```



# 4.8 间接 Indirection



# 4.8 间接 Indirection

payment  
解约店铺的账户

DELETE /shops/{shopId}/accounts/{id} ▶ 调试

无效状态才能删除

请求参数

Path 参数

shopId	integer 店铺id	必需
id	integer 商铺支付渠道id	必需

Header 参数

authorization	string 用户token	必需
---------------	----------------	----

请求示例代码

Shell JavaScript Java Swift Go PHP Python HTTP C C# Objective-C Ruby OCaml

返回响应

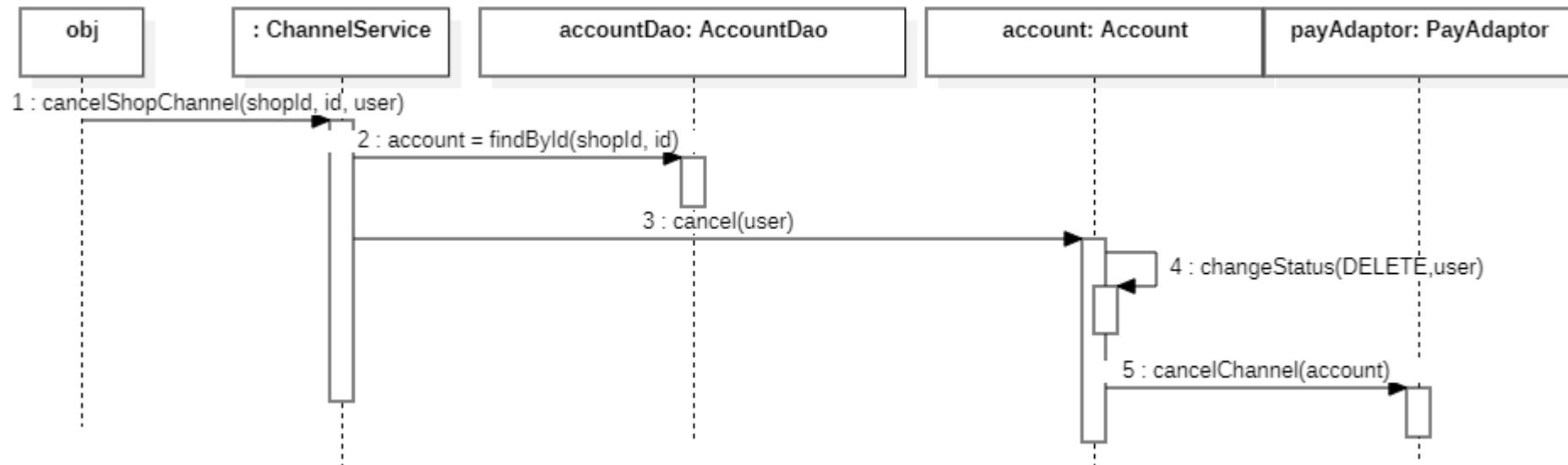
200 成功

application/json

成功	示例
Body	{ "errno": 0, "errmsg": "成功" }
errno integer 示例值: 0	可选
errmsg string 示例值: 成功	可选



## 4.8 间接 Indirection



# 4.9 虚构

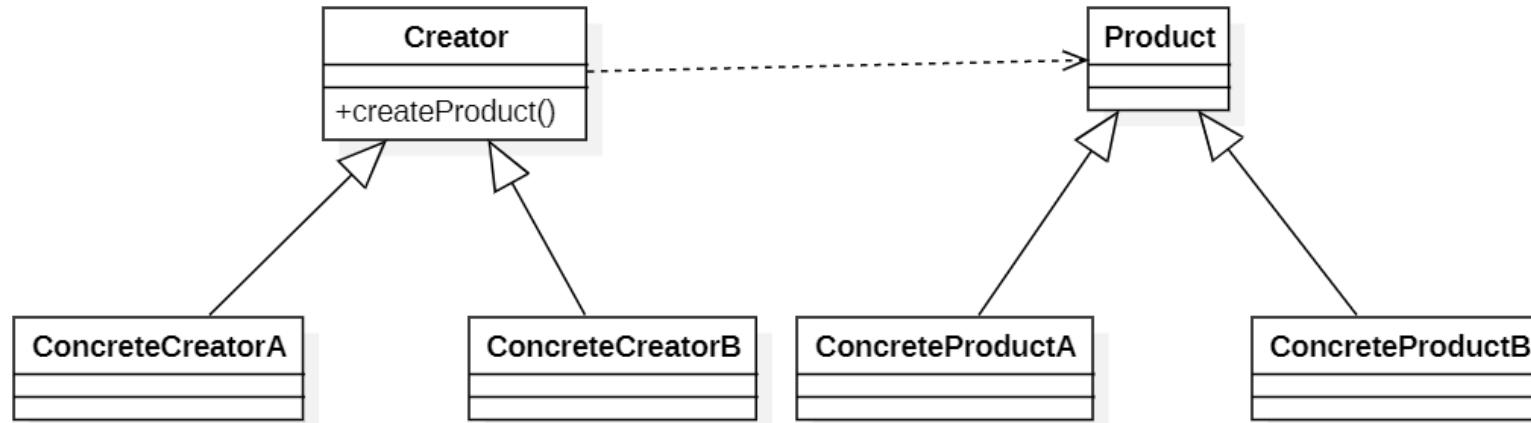
## Pure Fabrication

- 问题
  - 如何创建支付渠道的适配器？
  - 当没有两全之策时
- 方案
  - 可以考虑专门虚构一个对象来创建适配器



## 4.9 虚构 Pure Fabrication

- 工厂方法 (Factory Method)
  - 负责生产一个对象。
  - 定义一个创建对象的接口，让子类决定实例化哪个类，使得一个类的实例化延迟到其子类。



# 4.9 虚构 Pure Fabrication

```
@Repository
@RequiredArgsConstructor
public class PayAdaptorFactory {

    private static final Logger logger = LoggerFactory.getLogger(PayAdaptorFactory.class);

    private final ApplicationContext context;

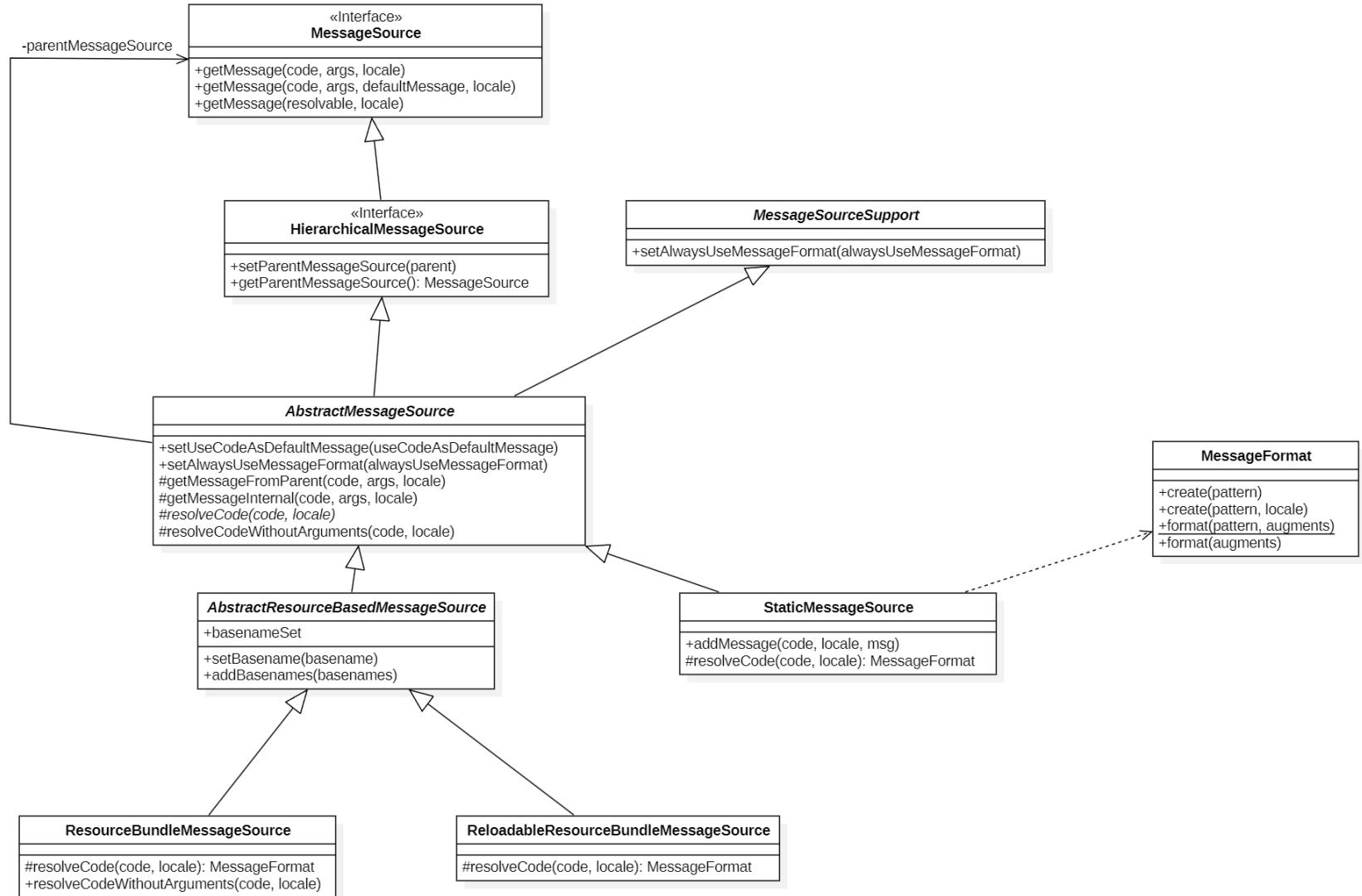
    /**
     * 返回商铺的支付渠道服务
     * 简单工厂模式
     *
     * @param channel 支付渠道
     * @return
     * @author Ming Qiu
     * <p>
     * date: 2022-11-06 18:05
     */
    public PayAdaptor createPayAdaptor(Channel channel) {
        logger.debug("createPayAdaptor: channel = {}", channel);
        return (PayAdaptor) context.getBean(channel.getBeanName());
    }

    public void setPayAdaptor(PayAdaptorFactory factory){
        this.payAdaptor = factory.createPayAdaptor(this.getChannel());
    }
}
```



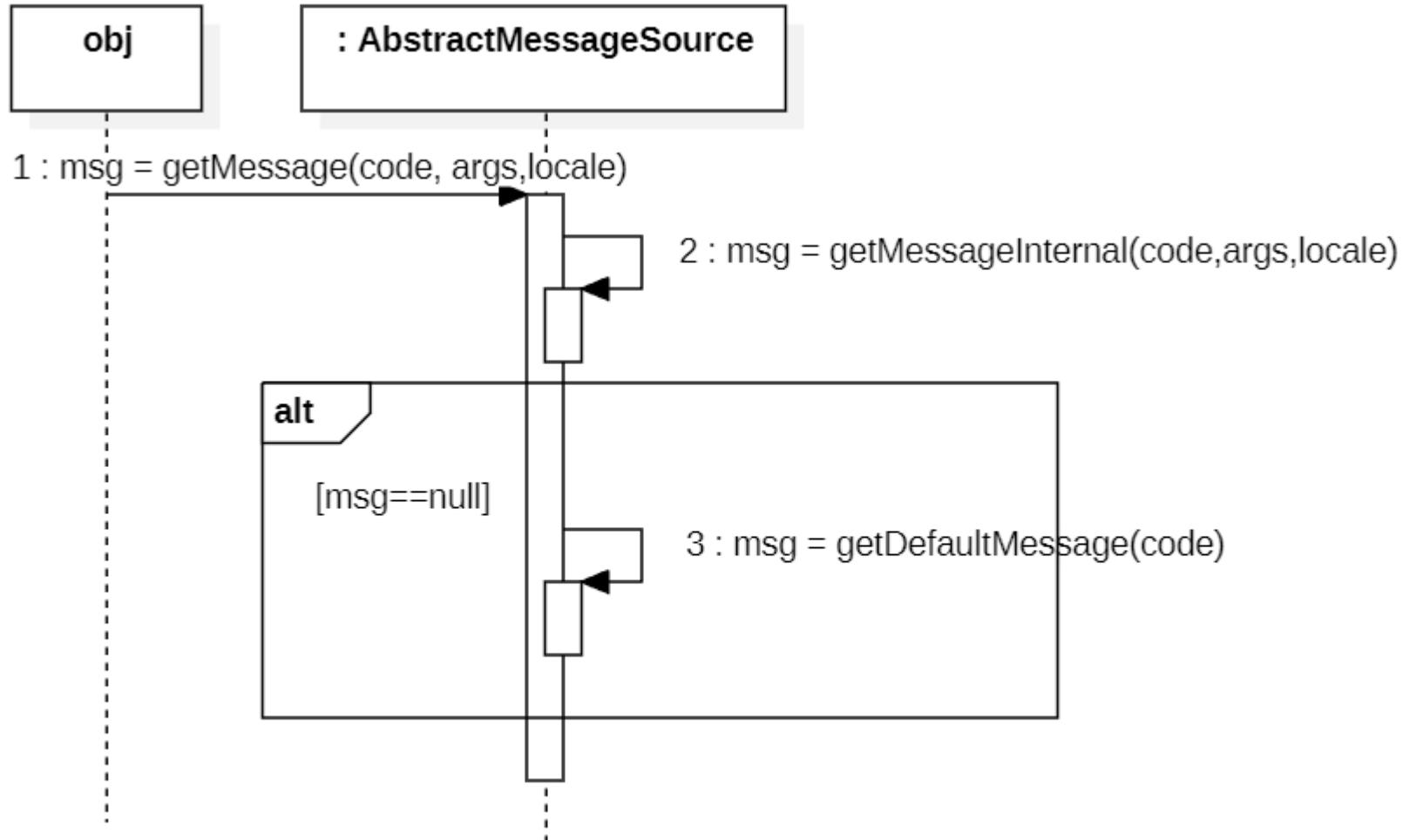
# 4.10 Spring国际化的设计

## Design of Spring Internationalization



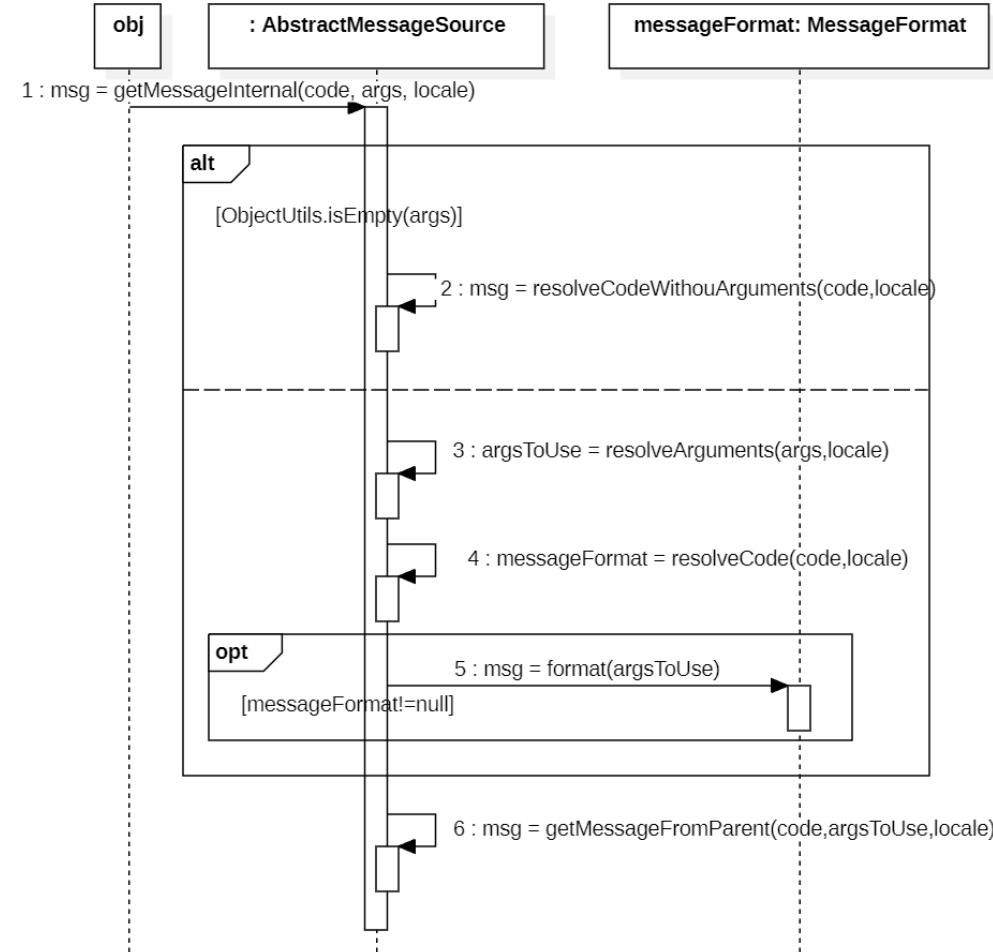
# 4.10 Spring国际化的设计

## Design of Spring Internationalization



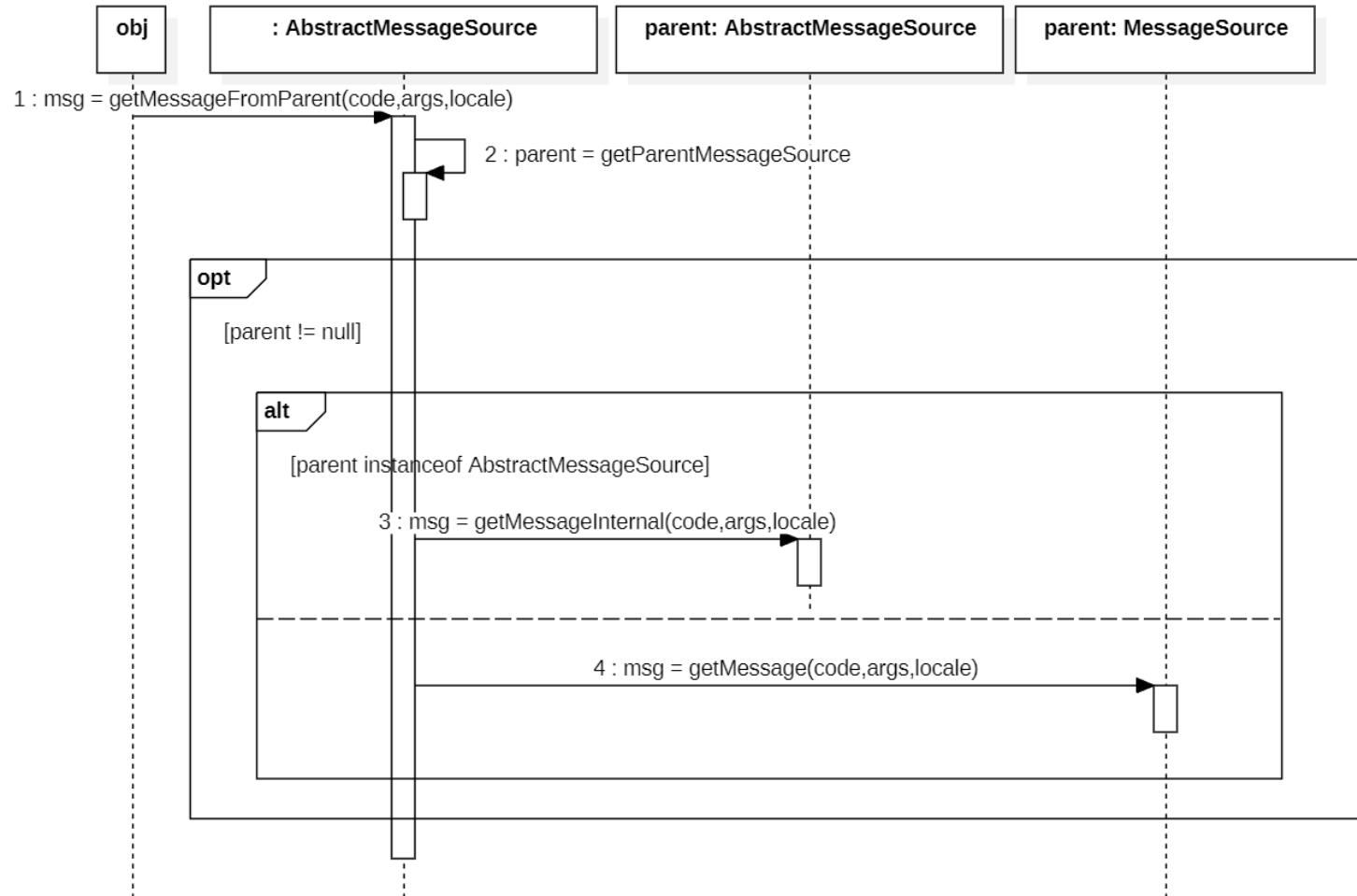
# 4.10 Spring国际化的设计

## Design of Spring Internationalization



# 4.10 Spring国际化的设计

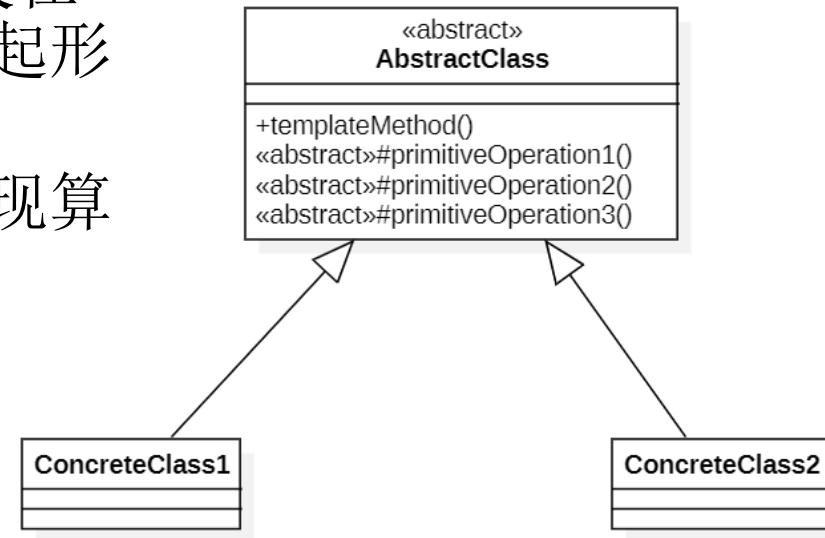
## Design of Spring Internationalization



## 4.10 Spring国际化的设计

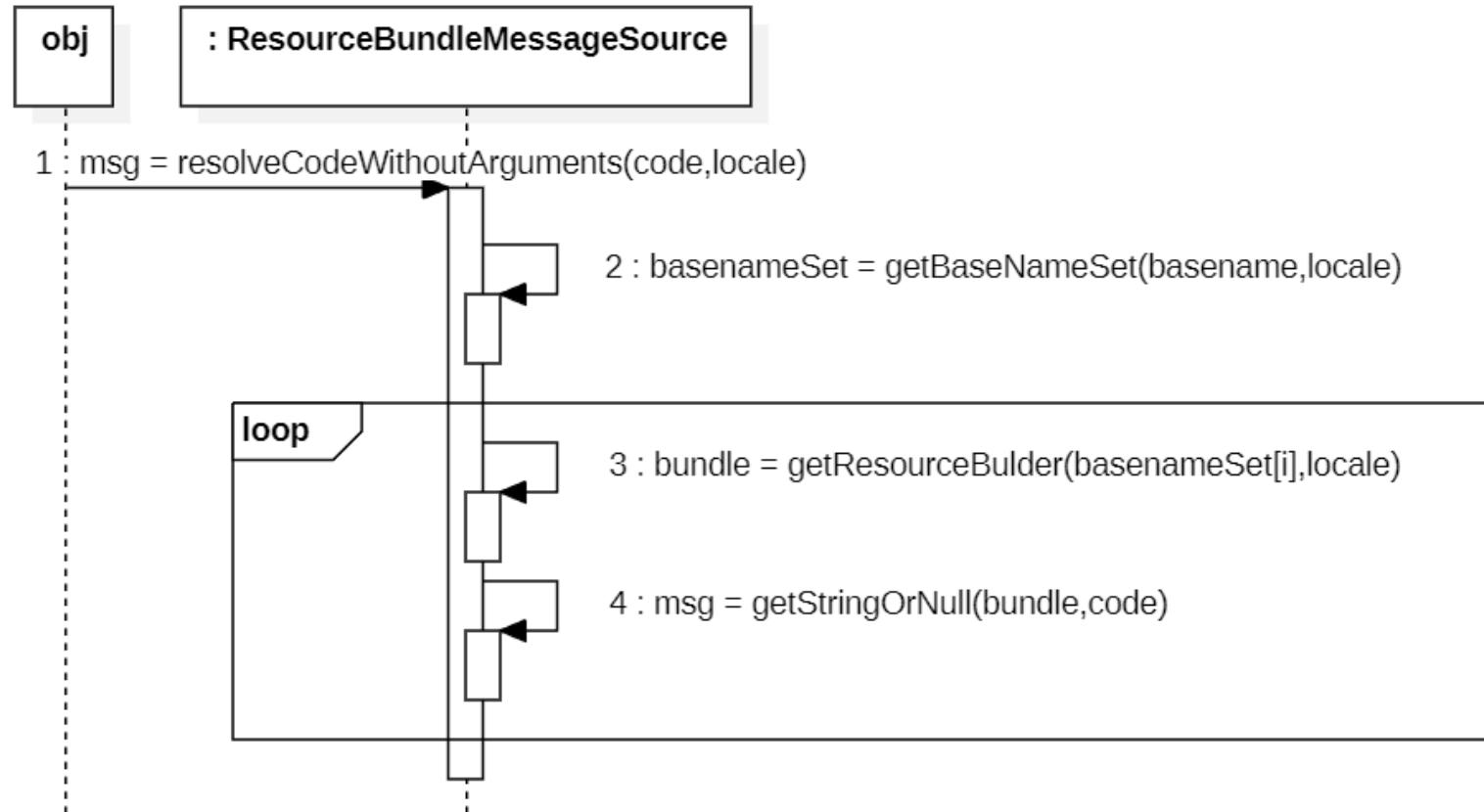
### Design of Spring Internationalization

- 模板方式设计模式（Template Method）
  - 模板方法（Template Method）是定义在抽象类中的、把基本操作方法组合在一起形成一个总算法或一个总行为的方法。
  - 基本方法（Primitive Method）是实现算法各个步骤的方法。



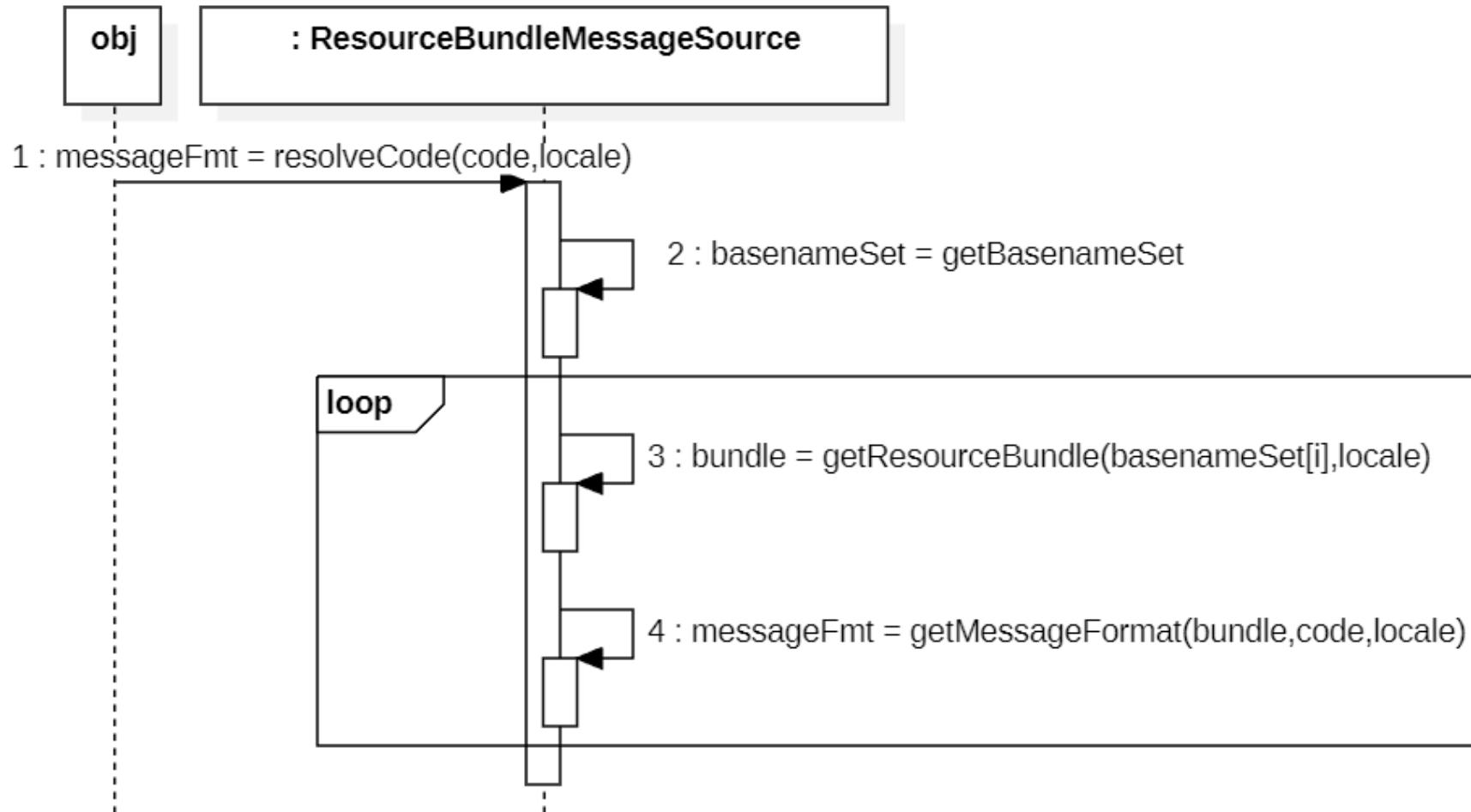
# 4.10 Spring国际化的设计

## Design of Spring Internationalization



# 4.10 Spring国际化的设计

## Design of Spring Internationalization



## 4.11 软件设计的七大原则

### Seven Principles in Software Design

- 开闭原则 (Open Closed Principle, OCP)
  - 由勃兰特·梅耶 (Bertrand Meyer) 在 1988 年的著作《面向对象软件构造》 (Object Oriented Software Construction) 中提出:
  - 软件实体应当对扩展开放, 对修改关闭 (Software entities should be open for extension, but closed for modification)。



## 4.11 软件设计的七大原则

### Seven Principles in Software Design

- 开闭原则是面向对象程序设计的终极目标，它使软件实体拥有一定的适应性和灵活性的同时具备稳定性和延续性。
  - 对软件测试的影响 -- 软件遵守开闭原则的话，软件测试时只需要对扩展的代码进行测试就可以了，因为原有的测试代码仍然能够正常运行。
  - 可以提高代码的可复用性 -- 粒度越小，被复用的可能性就越大；
  - 可以提高软件的可维护性 -- 遵守开闭原则的软件，其稳定性高和延续性强，从而易于扩展和维护。
- 通过“抽象约束、封装变化”来实现开闭原则
  - 即通过接口或者抽象类为软件实体定义一个相对稳定的抽象层，而将相同的可变因素封装在具体实现类中。



## 4.11 软件设计的七大原则

### Seven Principles in Software Design

- Liskov替换原则 (Liskov Substitution Principle, LSP)
  - 由麻省理工学院计算机科学实验室的里斯科夫 (Liskov) 女士在 1987 年的“面向对象技术的高峰会议” (OOPSLA) 上发表的一篇文章《数据抽象和层次》 (Data Abstraction and Hierarchy) 里提出
  - 继承必须确保超类所拥有的性质在子类中仍然成立 (Inheritance should ensure that any property proved about supertype objects also holds for subtype objects)。



## 4.11 软件设计的七大原则

### Seven Principles in Software Design

- Liskov替换原则是实现开闭原则的重要方式之一。
  - 它克服了继承中重写父类造成的可复用性变差的缺点。
  - 它是动作正确性的保证。即类的扩展不会给已有的系统引入新的错误，降低了代码出错的可能性。
  - 加强程序的健壮性，同时变更时可以做到非常好的兼容性，提高程序的维护性、可扩展性，降低需求变更时引入的风险。



## 4.11 软件设计的七大原则

### Seven Principles in Software Design

- 依赖倒置原则 (Dependence Inversion Principle, DIP)
  - 由Object Mentor 公司总裁罗伯特·马丁 (Robert C. Martin) 于 1996 年在 C++ Report 上发表的文章中提出：高层模块不应该依赖低层模块，两者都应该依赖其抽象；抽象不应该依赖细节，细节应该依赖抽象  
(High level modules should not depend upon low level modules. Both should depend upon abstractions. Abstractions should not depend upon details. Details should depend upon abstractions)。
  - 其核心思想是：要面向接口编程，不要面向实现编程。



## 4.11 软件设计的七大原则

### Seven Principles in Software Design

- 单一职责原则 (Single Responsibility Principle, SRP)
  - 由罗伯特·C. 马丁 (Robert C. Martin) 于《敏捷软件开发：原则、模式和实践》一书中提出的。
  - 单一职责原则规定一个类应该有且仅有一个引起它变化的原因，否则类应该被拆分 (There should never be more than one reason for a class to change)



## 4.11 软件设计的七大原则

### Seven Principles in Software Design

- 单一职责原则的核心就是控制类的粒度大小、将对象解耦、提高其内聚性。如果遵循单一职责原则将有以下优点。
  - 降低类的复杂度。一个类只负责一项职责，其逻辑肯定要比负责多项职责简单得多。
  - 提高类的可读性。复杂性降低，自然其可读性会提高。
  - 提高系统的可维护性。可读性提高，那自然更容易维护了。
  - 变更引起的风险降低。变更是必然的，如果单一职责原则遵守得好，当修改一个功能时，可以显著降低对其他功能的影响。



## 4.11 软件设计的七大原则

### Seven Principles in Software Design

- 接口隔离原则 (Interface Segregation Principle, ISP)
  - 客户端不应该被迫依赖于它不使用的方法 (Clients should not be forced to depend on methods they do not use)。
  - 一个类对另一个类的依赖应该建立在最小的接口上 (The dependency of one class to another one should depend on the smallest possible interface)。



## 4.11 软件设计的七大原则

### Seven Principles in Software Design

- 迪米特法则 (Law of Demeter, LoD) /最少知识原则 (Least Knowledge Principle, LKP)
  - 由伊恩·荷兰 (Ian Holland) 提出，被 UML 创始者之一的布奇 (Booch) 普及，后来又因为在经典著作《程序员修炼之道》 (The Pragmatic Programmer) 提及而广为人知。
  - 只与你的直接朋友交谈，不跟“陌生人”说话 (Talk only to your immediate friends and not to strangers)。
  - 如果两个软件实体无须直接通信，那么就不应当发生直接的相互调用，可以通过第三方转发该调用。其目的是降低类之间的耦合度，提高模块的相对独立性。



## 4.11 软件设计的七大原则

### Seven Principles in Software Design

- 合成复用原则 (Composite Reuse Principle, CRP) /组合/聚合复用原则 (Composition/Aggregate Reuse Principle, CARP)
  - 在软件复用时，要尽量先使用组合或者聚合等关联关系来实现，其次才考虑使用继承关系来实现。



## 4.11 软件设计的七大原则

### Seven Principles in Software Design

设计原则	内容	目的
开闭原则	对扩展开放，对修改关闭	降低维护带来的新风险
依赖倒置原则	高层不应该依赖低层，要面向接口编程	更利于代码结构的升级扩展
单一职责原则	一个类只干一件事，实现类要单一	便于理解，提高代码的可读性
接口隔离原则	一个接口只干一件事，接口要精简单一	功能解耦，高聚合、低耦合
迪米特法则	不该知道的不要知道，一个类应该保持对其它对象最少的了解，降低耦合度	只和朋友交流，不和陌生人说话，减少代码臃肿
Liskov替换原则	不要破坏继承体系，子类重写方法功能发生改变，不应该影响父类方法的含义	防止继承泛滥
合成复用原则	尽量使用组合或者聚合关系实现代码复用，少使用继承	降低代码耦合



# 4.12 支付模块中的例子

## Examples in Payment Module

The screenshot shows the Apifox interface for a payment module endpoint. The title is "查看支付单的详情信息". The method is "GET /shops/{shopId}/payments/{id}". The description says: "如果状态不是最终状态, 需要查询渠道api获取最新状态".  
Request Parameters:

- Path Parameters:
  - shopId: integer <int64> 店铺id (必填)
  - id: integer <int64> 支付单id (必填)
- Header Parameters:
  - authorization: string 用户token (必填)

  
Request Examples: Icons for various programming languages: Shell, JavaScript, Java, Swift, Go, PHP, Python, HTTP, C, C#, Objective-C, Ruby, OCaml, Dart.  
Response:

200 成功

application/json

成功

Body

schema object

- errno: integer 可选
- errmsg: string 可选
- data: object (PayTrans) PayTrans 可选

示例

```
{  
  "schema": {  
    "errno": 0,  
    "errmsg": "string",  
    "data": {  
      "id": 0,  
      "outNo": "string",  
      "transNo": "string",  
      "amount": 0,  
      "divAmount": 0,  
      "successTime": "string",  
      "prepayId": "string",  
    }  
  }  
}
```



# 4.12 支付模块中的例子

## Examples in Payment Module

