

# Uebung04 vesys

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# Inhaltsverzeichnis

# 1 Beschreibung

## 1.1 Architektur

Die Bank wird als REST Service implementiert, wobei GET, POST, PUT, HEAD und DELETE Anfragen für die accounts Ressource angeboten werden.

Transfers werden in einer separaten Ressource verwaltet, damit sie am Stück ausgeführt werden.

## 2 Code

### 2.1 Transfer Types

Listing 1: AccountURLs

```
1 package bank.types;

import java.util.ArrayList;
import java.util.List;

6 import javax.xml.bind.annotation.XmlRootElement;

@XmlRootElement
public class AccountURLs {
    private List<String> url;
11     public List<String> getUrl() {
        return url;
    }

16     public void setUrl(List<String> url) {
        this.url = url;
    }

    public AccountURLs() {
21         url = new ArrayList<String>();
    }
}
```

Listing 2: AccountData

```
package bank.types;

2 import javax.xml.bind.annotation.XmlRootElement;

@XmlRootElement(name = "account")
public class AccountData {
7     private String number;
    private String owner;
    private double balance;
    private boolean active;
    private int modified;
12     public String getNumber() {
        return number;
    }
    public void setNumber(String number) {
17         this.number = number;
    }
    public String getOwner() {
        return owner;
    }
22     public void setOwner(String owner) {
        this.owner = owner;
    }
}
```

```

        public double getBalance() {
            return balance;
27    }
        public void setBalance(double balance) {
            this.balance = balance;
        }
        public boolean isActive() {
32    return active;
        }
        public void setActive(boolean active) {
            this.active = active;
        }
37    public int getModified() {
        return modified;
    }
        public void setModified(int modified) {
            this.modified = modified;
42    }
    }
}

```

---

### Listing 3: TransactionData

```

package bank.types;

import javax.xml.bind.annotation.XmlRootElement;

5 @XmlRootElement(name = "TransactionData")
public class TransactionData {
    private double fromAmount;
    private double toAmount;
    private String fromNumber, toNumber, fromETag, toETag;
10    public double getFromAmount() {
        return fromAmount;
    }
    public void setFromAmount(double fromAmount) {
        this.fromAmount = fromAmount;
15    }
    public double getToAmount() {
        return toAmount;
    }
    public void setToAmount(double toAmount) {
20    this.toAmount = toAmount;
    }
    public String getFromNumber() {
        return fromNumber;
    }
25    public void setFromNumber(String fromNumber) {
        this.fromNumber = fromNumber;
    }
    public String getToNumber() {
        return toNumber;
30    }
    public void setToNumber(String toNumber) {
        this.toNumber = toNumber;
    }
    public String getFromETag() {
35    return fromETag;
    }
    public void setFromETag(String fromETag) {
        this.fromETag = fromETag;
    }
40    public String getToETag() {
        return toETag;
    }
    public void setToETag(String toETag) {
        this.toETag = toETag;
45    }
}

```

## 2.2 Server

### 2.2.1 Ressourcen

Listing 4: Accounts

```
package bank.resources;

import javax.ws.rs.Consumes;
4 import javax.ws.rs.DELETE;
import javax.ws.rs.GET;
import javax.ws.rs.HEAD;
import javax.ws.rs.POST;
import javax.ws.rs.PUT;
9 import javax.ws.rs.Path;
import javax.ws.rs.PathParam;
import javax.ws.rs.Produces;
import javax.ws.rs.core.Context;
import javax.ws.rs.core.EntityTag;
14 import javax.ws.rs.core.MediaType;
import javax.ws.rs.core.Request;
import javax.ws.rs.core.Response;
import javax.ws.rs.core.Response.ResponseBuilder;
import javax.ws.rs.core.Response.Status;
19 import javax.ws.rs.core.UriInfo;

import bank.implementation.Account;
import bank.implementation.Bank;
import bank.types.AccountURLs;

24 import com.sun.jersey.spi.resource.Singleton;

@Path("/accounts")
@Singleton
29 public class Accounts {

    @GET
    @Produces(MediaType.APPLICATION_XML)
34 public Response getAccountURLs(@Context Request request, @Context UriInfo uri) {
    EntityTag modified = new EntityTag(String.valueOf(Bank.modified));

    ResponseBuilder builder = request.evaluatePreconditions(modified);
    if (builder != null) {
39         return builder.build();
    }

    AccountURLs urls = new AccountURLs();
    for (Account account : Bank.accounts.values()) {
44         if (account.isActive()) {
            urls.getUrl().add(uri.getRequestUri().toString() + "/" + account.getNumber());
        }
    }

49     builder = Response.ok(urls);
    builder.tag(modified);
    return builder.build();
}

54 @POST
@Consumes("text/plain")
public Response createAccount(@Context UriInfo uri, String owner) {
    Account account = new Account(owner);
    Bank.modified++;
59     Bank.accounts.put(account.getNumber(), account);
    ResponseBuilder builder;
    builder = Response.created(uri.getRequestUri().resolve(account.getNumber()));
    return builder.build();
}

64 @GET
```

```

@Path("/{id}")
public Response getAccount(@PathParam("id") String number) {
    Account account = Bank.accounts.get(number);

69     if (account==null) {
        return Response.status(Status.NOT_FOUND).build();
    }

74     else return Response.ok(account.getAccountData()).build();
}

@DELETE
@Path("/{id}")
79 public Response deleteAccount(@Context Request request, @PathParam("id") String number) {
    Account account = Bank.accounts.get(number);

    if (account==null) {
        return Response.status(Status.NOT_FOUND).build();
84     }
    synchronized(account) {
        if (account.getBalance() <= 0.0) {
            account.setActive(false);
            Bank.modified++;
89         } else {
            return Response.status(Status.CONFLICT).entity("Balance is not 0").build();
        }
    }

94     return Response.status(Status.NO_CONTENT).build();
}

@HEAD
@Path("/{id}")
99 public Response isActive(@PathParam("id") String number) {
    Account account = Bank.accounts.get(number);

    if (account==null) {
        return Response.status(Status.NOT_FOUND).build();
104     }

    if (account.isActive()) {
        return Response.ok().build();
    } else {
109     return Response.status(Status.GONE).build();
    }
}

@PUT
114 @Path("/{id}")
@Consumes("text/plain")
public Response setBalance(@Context Request request, @PathParam("id") String number,
    String sAmount) {

    double amount;

119     amount = Double.parseDouble(sAmount);

    Account account = Bank.accounts.get(number);

    if (account==null) {
        return Response.status(Status.NOT_FOUND).build();
124     }

    synchronized (account) {
129     ResponseBuilder builder = request.evaluatePreconditions(new EntityTag(String.valueOf(
        account.getModified())));
        if (builder != null) {
            builder.build();
        }

134     account.setBalance(amount);
    }
}

```

```

        return Response.status(Status.NO_CONTENT).build();
    }
139 }

```

## Listing 5: Transfer

```

1 package bank.resources;

import javax.ws.rs.POST;
import javax.ws.rs.Path;
import javax.ws.rs.core.Context;
6 import javax.ws.rs.core.Response;
import javax.ws.rs.core.Response.Status;
import javax.ws.rs.core.UriInfo;

import bank.implementation.Account;
11 import bank.implementation.Bank;
import bank.types.TransactionData;

import com.sun.jersey.spi.resource.Singleton;

16 @Path("/transfer")
@Singleton
public class Transfer {

    @POST
21 public Response doTransfer(@Context UriInfo uri, TransactionData data) {
    Account fromAccount = Bank.accounts.get(data.getFromNumber());
    Account toAccount = Bank.accounts.get(data.getToNumber());

    if (fromAccount==null || toAccount==null) {
26         return Response.status(Status.NOT_FOUND).build();
    } else {
        Account a;
        Account b;
        if (fromAccount.getNumber().compareTo(toAccount.getNumber())> 0) {
31             a = fromAccount;
            b = toAccount;
        } else {
            b = fromAccount;
            a = toAccount;
36        }

        synchronized (a) {
            synchronized (b) {
                if (!String.valueOf(fromAccount.getModified()).equals(data.getFromETag()) ||
41                    !String.valueOf(toAccount.getModified()).equals(data.getToETag())) {
                    return Response.status(Status.CONFLICT).build();
                }

                fromAccount.setBalance(data.getFromAmount());
                toAccount.setBalance(data.getToAmount());
46
                return Response.noContent().build();
            }
        }
51    }
}
}

```

## 2.2.2 Implementierung

### Listing 6: Bank

```

1 package bank.implementation;

```

```

import java.util.concurrent.ConcurrentHashMap;

public class Bank {
6   public static ConcurrentHashMap<String, Account> accounts = new ConcurrentHashMap<>();
   public static volatile int modified = 0;
}

```

#### Listing 7: Account

```

package bank.implementation;
2
import java.util.UUID;

import bank.types.AccountData;

7 public final class Account {
   private final String number;
   private final String owner;
   private volatile double balance;
   private volatile boolean active = true;
12  private volatile int modified;

   public Account(final String owner) {
       this.owner = owner;
       this.number = UUID.randomUUID().toString();
17      this.modified = 0;
   }

   public double getBalance() {
       return balance;
22  }

   public String getOwner() {
       return owner;
   }
27

   public String getNumber() {
       return number;
   }

32  public int getModified() {
       return modified;
   }

   public boolean isActive() {
37      return active;
   }

   public synchronized void setActive(final boolean active) {
       this.modified++;
42      this.active = active;
   }

   public synchronized void setBalance(final double amount) {
47      if (amount < 0) {
           throw new IllegalArgumentException("Amount can't be negative!");
       }

       this.modified++;
52      this.balance = amount;
   }

   public synchronized AccountData getAccountData() {
       AccountData data = new AccountData();
57      data.setNumber(number);
       data.setOwner(owner);
       data.setBalance(balance);
       data.setActive(active);
       data.setModified(modified);

```



```

62     return data;
    }
}

```

## 2.3 Client

Listing 8: Driver

```

package bank.rest;

import java.io.IOException;
4 import java.util.HashSet;
import java.util.Set;

import javax.ws.rs.core.EntityTag;
import javax.ws.rs.core.MediaType;
9
import bank.InactiveException;
import bank.OverdrawException;
import bank.types.AccountData;
import bank.types.AccountURLs;
14 import bank.types.TransactionData;

import com.sun.jersey.api.client.Client;
import com.sun.jersey.api.client.ClientResponse;
import com.sun.jersey.api.client.WebResource;
19
public class Driver implements bank.BankDriver {
    private String url;
    private Bank bank;

24    @Override
    public void connect(String[] args) throws IOException {
        url = args[0];
        bank = new Bank(url);
    }
29
    @Override
    public void disconnect() throws IOException {
        bank = null;
    }
34
    @Override
    public Bank getBank() {
        return bank;
    }
39
    static class Bank implements bank.Bank {
        private String url;
        Client c;
        WebResource r;
44        WebResource rTransfer;
        private Set<String> accountNumbers;
        private EntityTag modified;

        public Bank(String url) {
49            this.url = url;
            c = Client.create();
            r = c.resource(url + "accounts/");
            rTransfer = c.resource(url + "transfer/");
        }
54
        @Override
        public Set<String> getAccountNumbers() throws IOException {

            ClientResponse response;
59            if (accountNumbers==null) {
                response = r.get(ClientResponse.class);
            } else {
                response = r.header("If-None-Match", modified).get(ClientResponse.class);

```

```

    }

64
    switch(response.getClientResponseStatus()) {
        case OK:
            accountNumbers = new HashSet<String>();
69            for (String url : response.getEntity(AccountURLs.class).getUrl()) {
                accountNumbers.add(url.substring(url.lastIndexOf('/')+1));
            }
            modified = response.getEntityTag();
            return accountNumbers;
74        case NOT_MODIFIED:
            return accountNumbers;
        default:
            throw new IOException("Error connecting to the server");
    }
79
}

@Override
public String createAccount(String owner) throws IOException {
84    ClientResponse response = r.type(MediaType.TEXT_PLAIN).post(ClientResponse.class,
        owner);
    if (response.getClientResponseStatus() == ClientResponse.Status.CREATED) {
        String accUrl = response.getLocation().toString();
        return accUrl.substring(accUrl.lastIndexOf('/')+1);
    } else {
89        throw new IOException(response.getClientResponseStatus().getReasonPhrase());
    }
}

@Override
94 public boolean closeAccount(String number) throws IOException {
    WebResource r = c.resource(url + "accounts/" + number);
    ClientResponse response = r.delete(ClientResponse.class);
    switch (response.getClientResponseStatus()) {
        case OK:
        case NO_CONTENT:
99         return true;
        case CONFLICT:
            return false;
        default:
104         throw new IOException(response.getClientResponseStatus().getReasonPhrase());
    }
}

@Override
109 public bank.Account getAccount(String number) throws IOException {
    if (number.length() > 0) {
        WebResource r = c.resource(url + "accounts/" + number);
        ClientResponse response = r.get(ClientResponse.class);
114        switch (response.getClientResponseStatus()) {
            case OK:
                return new Account(response.getEntity(AccountData.class), r);
            case NOT_FOUND:
                return null;
119            default:
                throw new IOException("Error connecting to the server");
        }
    } else {
        return null;
124    }
}

@Override
public void transfer(bank.Account fromAcc, bank.Account toAcc, double amount)
129     throws IOException, InactiveException, OverdrawException {
    Account from = (Account)fromAcc;
    Account to = (Account)toAcc;

    boolean pending = true;

```

```

134         if (amount < 0) {
            throw new IllegalArgumentException();
        }

139         while (pending) {
            from.update();
            to.update();

            if (!from.isActive() || !to.isActive()) {
144                 throw new InactiveException();
            }

            if (amount > from.getBalance()) {
149                 throw new OverdrawException();
            }

            TransactionData data = new TransactionData();
            data.setFromETag(from.modified);
            data.setFromAmount(from.balance - amount);
154             data.setFromNumber(from.number);
            data.setToETag(to.modified);
            data.setToAmount(to.balance + amount);
            data.setToNumber(to.number);

159             ClientResponse response = rTransfer.post(ClientResponse.class, data);

            switch(response.getClientResponseStatus()) {
                case NO_CONTENT:
                    pending=false;
164                     break;
                case CONFLICT:
                    pending=true;
                    break;
                default:
169                     throw new IOException(response.getClientResponseStatus().getReasonPhrase());
            }
        }
    }
}

174 static class Account implements bank.Account {
    private final String number;
    private final String owner;
    private volatile double balance;
179     private volatile boolean active = true;
    private volatile String modified;
    private WebResource r;

    public Account(AccountData entity, WebResource r) {
184         this.number = entity.getNumber();
        this.owner = entity.getOwner();
        this.balance = entity.getBalance();
        this.active = entity.isActive();
        this.modified = String.valueOf(entity.getModified());
189         this.r = r;
    }

    public synchronized void update() throws IOException {
        ClientResponse response = r.get(ClientResponse.class);
194         switch (response.getClientResponseStatus()) {
            case OK:
                AccountData acc = response.getEntity(AccountData.class);
                this.active = acc.isActive();
                this.balance = acc.getBalance();
199                 this.modified = String.valueOf(acc.getModified());
                break;
            default:
                throw new IOException(response.getClientResponseStatus().getReasonPhrase());
        }
    }
204 }

```

```

    public String getModified() {
        return modified;
    }

209
    @Override
    public double getBalance() throws IOException {
        update();
        return balance;
214
    }

    @Override
    public String getOwner() {
        return owner;
219
    }

    @Override
    public String getNumber() {
        return number;
224
    }

    @Override
    public boolean isActive() throws IOException {
        update();
        return active;
229
    }

    @Override
    public synchronized void deposit(double amount) throws InactiveException,
        IllegalArgumentException, IOException {
234
        boolean committed = false;
        while (!committed) {
            update();

            if (!this.active) {
239
                throw new InactiveException("Account is closed!");
            }

            if (amount < 0) {
                throw new IllegalArgumentException("Amount can't be negative!");
244
            }

            ClientResponse response = r.header("If-Match", new EntityTag(modified)).put(
                ClientResponse.class, String.valueOf(balance+amount));

            switch(response.getClientResponseStatus()) {
249
                case NO_CONTENT:
                    committed=true;
                    break;
                case PRECONDITION_FAILED:
                    committed=false;
254
                    break;
                default:
                    throw new IOException(response.getClientResponseStatus().getReasonPhrase());
            }
        }
259
    }

    @Override
    public void withdraw(double amount) throws InactiveException, OverdrawException,
        IllegalArgumentException, IOException {
264
        boolean committed = false;
        while (!committed) {
            update();

            if (!this.active) {
269
                throw new InactiveException("Account is closed!");
            }

            if (amount < 0) {
                throw new IllegalArgumentException("Amount can't be negative!");
274
            }

```

```

        if (amount > balance) {
            throw new OverdrawException("Not enough money on account!");
        }

279     ClientResponse response = r.header("If-Match", new EntityTag(modified)).put(
            ClientResponse.class, String.valueOf(balance-amount));

        switch(response.getClientResponseStatus()) {
            case NO_CONTENT:
                committed=true;
284             break;
            case PRECONDITION_FAILED:
                committed=false;
                break;
            default:
289             throw new IOException(response.getClientResponseStatus().getReasonPhrase());
        }
    }
}

294 }

}

```

---