Spring and Hibernate

CS544: Enterprise Architecture

Spring and Hibernate

- In this module we will combine Spring and Hibernate
  - First with Bean Managed Transactions BMT (aka programmer managed transactions)
  - Then with Container Managed Transactions (declarative transactions)

- Even when using BMT spring provides:
  - Single config file for both Spring and Hibernate
  - Using Hibernate with Spring DI

Spring and Hibernate:

BEAN MANAGED TRANSACTIONS (BMT)

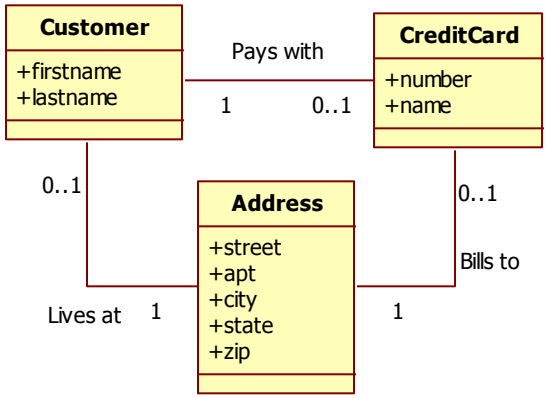
Combined Configuration

- Hibernate can be configured inside Spring
  - One config file for both Spring and Hibernate
  - SessionFactory becomes a Spring Bean singleton
  - Project can then use full Spring feature set
    - Dependency Injection, AOP, Spring Templates
- No longer need HibernateUtil
  - SessionFactory is created by Spring on startup
  - SessionFactory can easily be retrieved from Spring

Example Application

Application Layers

- View Layer:
  - addCustomer.jsp, customer.jsp, customers.jsp, updaCustomer.jsp, error.jsp, OpenSessionFilter
- Control Layer:
  - ViewAllCustomers, ViewCustomer, AddCustomer, ViewUpdCustomer, UpdCustomer
- Service Layer:
  - Customer Service
- Business Layer:
  - Customer, Address, CreditCard
- Persistence Layer:
  - CustomerDAO, AddressDAO, CreditCardDAO



HibernateUtil class no longer included

Spring Configuration 1/2

```
<beans ...>
  <bean id="customerService" class="example.service.CustomerService">
    <property name="addressDAO" ref="addressDao" />
    <property name="creditCardDAO" ref="creditCardDao" />
    <property name="customerDAO" ref="customerDao" />
  </bean>
  <bean id="addressDao" class="example.dao.AddressDAO">
    <property name="sessionFactory" ref="sessionFactory" />
  </bean>
  <bean id="creditCardDao" class="example.dao.CreditCardDAO">
    <property name="sessionFactory" ref="sessionFactory" />
  </bean>
  <bean id="customerDao" class="example.dao.CustomerDAO">
    <property name="sessionFactory" ref="sessionFactory" />
  </bean>

  <bean id="dataSource" class="org.springframework.jdbc.datasource.DriverManagerDataSource">
    <property name="driverClassName" value="com.mysql.jdbc.Driver" />
    <property name="url" value="jdbc:mysql://localhost/cs544" />
    <property name="username" value="root" />
    <property name="password" value="" />
  </bean>

  ...
```

DAO and Service classes become Spring Beans allowing us to use Spring Dependency Injection

Database connection is configured in Spring

Spring Configuration 2/2

```
<bean id="sessionFactory"
    class="org.springframework.orm.hibernate4.LocalSessionFactoryBean">
  <property name="dataSource" ref="dataSource" />
  <property name="hibernateProperties" ref="hibernateProperties" />
  <property name="annotatedClasses">
    <list>
      <value>example.domain.Address</value>
      <value>example.domain.CreditCard</value>
      <value>example.domain.Customer</value>
    </list>
  </property>
</bean>

<bean id="hibernateProperties"
    class="org.springframework.beans.factory.config.PropertiesFactoryBean">
  <property name="properties">
    <props>
      <prop key="hibernate.hbm2ddl.auto">create</prop>
      <prop key="hibernate.dialect">org.hibernate.dialect.MySQL5Dialect</prop>
      <prop key="connection.pool.size">1</prop>
      <prop key="hibernate.show_sql">true</prop>
      <prop key="hibernate.current_session_context_class">thread</prop>
    </props>
  </property>
</bean>

</beans>
```

Basic Hibernate Configuration

You can also specify:
<property name="packagesToScan" value="example.domain" />

Additional Hibernate Property settings

DAO

- Receive the SessionFactory through DI

```
public class AddressDAO {
  private SessionFactory sf;

  public void setSessionFactory(SessionFactory sf) {
    this.sf = sf;
  }

  public void create(Address addr) {
    sf.getCurrentSession().persist(addr);
  }

  public Address get(int id) {
    return (Address) sf.getCurrentSession().get(Address.class, id);
  }

  public void update(Address addr) {
    sf.getCurrentSession().saveOrUpdate(addr);
  }

  public void delete(Address addr) {
    sf.getCurrentSession().delete(addr);
  }
}
```

No longer gets the sessionFactory from HibernateUtil

Spring automatically sets the sf through this setter method (DI)

Methods are exactly the same

Service

- Uses Spring Dependency Injection

```
public class CustomerService {
  private CustomerDAO customerDao;
  private AddressDAO addressDao;
  private CreditCardDAO ccDao;

  public void setCustomerDAO(CustomerDAO customerDao) {
    this.customerDao = customerDao;
  }

  public void setAddressDAO(AddressDAO addressDao) {
    this.addressDao = addressDao;
  }

  public void setCreditCardDAO(CreditCardDAO ccDao) {
    this.ccDao = ccDao;
  }

  ...
```

No longer creates DAO object references

Instead has DAO objects set by Spring through setter methods

OpenSessionInView Filter

```
public class OpenSessionInView implements Filter {
  private SessionFactory sf;

  public void init(FilterConfig config) throws ServletException {
    ServletContext context = config.getServletContext();
    WebApplicationContext applicationContext =
          WebApplicationContextUtils.getWebApplicationContext(context);
    sf = applicationContext.getBean("sessionFactory", SessionFactory.class);
  }
  public void destroy() {}

  public void doFilter(ServletRequest req, ServletResponse resp,
        FilterChain chain) throws IOException, ServletException {
    Transaction tx = null;
    try {
      tx = sf.getCurrentSession().beginTransaction();
      chain.doFilter(req, resp);
      tx.commit();
    } catch(RuntimeException ex) {
      try {
        ex.printStackTrace();
        tx.rollback();
      } catch(RuntimeException rbEx) {
        System.out.println("Could not rollback transaction " + rbEx);
        rbEx.printStackTrace();
      }
      throw ex;
    }
  }
}
```

Gets SessionFactory from Spring instead of HibernateUtil class

Controller

```
public class ViewCustomer extends HttpServlet {
  private static final long serialVersionUID = 1L;

  public void doGet(HttpServletRequest req, HttpServletResponse resp)
                    throws ServletException, IOException {

    int custId = Integer.parseInt(req.getParameter("custId"));

    // get customerService bean from spring
    ServletContext context = getServletContext();
    WebApplicationContext applicationContext =
        WebApplicationContextUtils.getWebApplicationContext(context);
    CustomerService custServ = applicationContext.getBean(
        "customerService", CustomerService.class);

    // make customer available in request, for view rendering
    Customer cust = custServ.getCust(custId);
    req.setAttribute("cust", cust);

    // forward to view customer page
    req.getRequestDispatcher("customer.jsp").forward(req, resp);
  }
}
```

Get customerService from Spring instead of creating a new object

Web.xml

```
<web-app>
  ...

  <filter>
    <filter-name>OpenSessionInView</filter-name>
    <filter-class>example.filter.OpenSessionInView</filter-class>
  </filter>

  <filter-mapping>
    <filter-name>OpenSessionInView</filter-name>
    <url-pattern>/*</url-pattern>
  </filter-mapping>

 <context-param>
    <param-name>contextConfigLocation</param-name>
    <param-value>/WEB-INF/springconfig.xml</param-value>
  </context-param>
  <listener>
    <listener-class>
      org.springframework.web.context.ContextLoaderListener
    </listener-class>
  </listener>

  ...

</web-app>
```

Same as before, our filter

Listener starts the spring context needed by servlets and our custom filter

Spring and Hibernate:

CONTAINER MANAGED TRANSACTIONS (CMT)

Spring and Hibernate

- So far we've only shown basic integration between Spring and Hibernate
  - Our project still has the same transaction issues

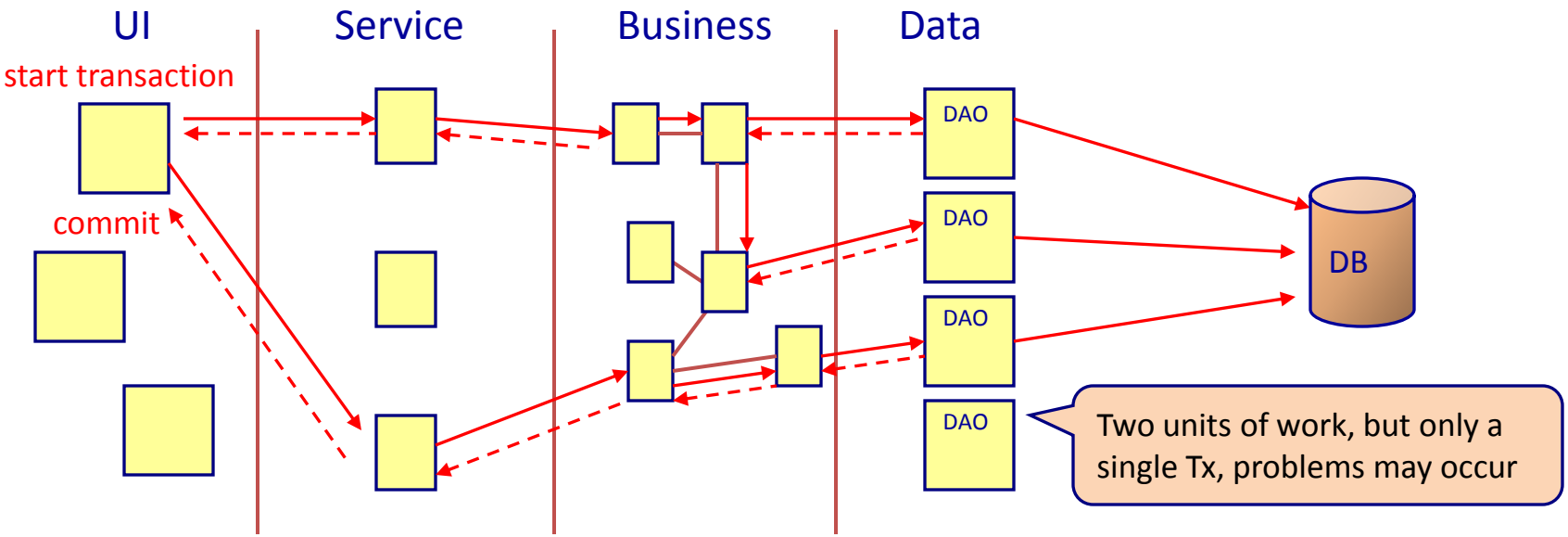
- We haven't yet shown how Spring can really enhance our project
  - Spring managed SessionFactory was a nice bonus
  - Spring Transaction Demarcation will allow us to solve our transaction issues

Spring Transaction Support

- Spring is not a transaction manager
  - We still need a transaction manager
    - JDBC transaction manager
    - Hibernate transaction manager
    - XA transaction manger (JTA)
- Spring provides an abstraction for transaction management
  - You declare how the transactions should be managed
  - Spring works with the underlying transaction manger

UI Transaction

- Because of the OpenSessionInView filter our transaction was demarcated in the UI layer
  - Making it possible for a single transaction to span more than one unit of work



Spring Transactions

- Spring allows us to declaratively specify any transactional requirements for a method
  - Letting us specify that Service level methods should always execute in their own Transaction
  - Thus ensuring that transactions only span a single unit of work, fixing our problem
  - And allowing us to specify that DAO methods always already expect an existing transaction
  - Ensuring that they are never called without a transaction

Web.xml

```
<web-app>
  ...

  <filter>
    <filter-name>SpringOpenSessionInViewFilter</filter-name>
    <filter-class>
      org.springframework.orm.hibernate4.support.OpenSessionInViewFilter
    </filter-class>
 </filter>

  <filter-mapping>
    <filter-name>SpringOpenSessionInViewFilter</filter-name>
    <url-pattern>/*</url-pattern>
  </filter-mapping>

  <context-param>
    <param-name>contextConfigLocation</param-name>
    <param-value>/WEB-INF/springconfig.xml</param-value>
  </context-param>
  <listener>
    <listener-class>
      org.springframework.web.context.ContextLoaderListener
    </listener-class>
  </listener>


  ...

</web-app>
```

Use Spring's open session in view filter instead of our own

Listener starts the spring context needed by the filter

Service 1/2

```
public class CustomerService {
  private CustomerDAO customerDao;
  private AddressDAO addressDao;
  private CreditCardDAO ccDao;

  public CustomerService() {}
  public void setCustomerDAO(CustomerDAO customerDao) { this.customerDao = customerDao; }
  public void setAddressDAO(AddressDAO addressDao) { this.addressDao = addressDao; }
  public void setCreditCardDAO(CreditCardDAO ccDao) { this.ccDao = ccDao; }

  @Transactional(propagation=Propagation.REQUIRES_NEW)
  public void addNewCustomer(Customer cust, Address shipAddr, CreditCard cc,
          Address billAddr) {

    cc.setAddress(billAddr);
    cust.setShipAddress(shipAddr);
    cust.setCreditCard(cc);

    addressDao.create(shipAddr);
    addressDao.create(billAddr);
    ccDao.create(cc);
    customerDao.create(cust);
  }

  ...
```

No default set on the class level

Setter methods have no transactional requirements

All other service level methods are annotated to require a new transaction

Service 2/2

```
...

@Transactional(propagation=Propagation.REQUIRES_NEW, readOnly=true)
  public List<Customer> getAll() {
  return customerDao.getAll();
}

@Transactional(propagation=Propagation.REQUIRES_NEW, readOnly=true)
  public Customer getCust(int custId) {
  return customerDao.get(custId);
}

@Transactional(propagation=Propagation.REQUIRES_NEW)
public void updCustomer(Customer cust, Address shipAddr, CreditCard cc,
          Address billAddr) {
  cc.setAddress(billAddr);
  cust.setShipAddress(shipAddr);
  cust.setCreditCard(cc);

  addressDao.update(billAddr);
  addressDao.update(shipAddr);
  ccDao.update(cc);
  customerDao.update(cust);
}
}
```

Methods that only retrieve can also set to readOnly

DAO

```
@Transactional(propagation=Propagation.MANDATORY)
public class AddressDAO {
  private SessionFactory sf;

  @Transactional(propagation=Propagation.SUPPORTS)
  public void setSessionFactory(SessionFactory sf) {
    this.sf = sf;
  }

  public void create(Address addr) {
    sf.getCurrentSession().persist(addr);
  }

  public Address get(int id) {
    return (Address) sf.getCurrentSession().get(Address.class, id);
  }

  public void update(Address addr) {
    sf.getCurrentSession().saveOrUpdate(addr);
  }

  public void delete(Address addr) {
    sf.getCurrentSession().delete(addr);
  }
}
```

A transaction has to exist (Mandatory) for every method called on this class

Except for setSessionFactory() it can run with or without

Springconfig.xml

```
...

<bean id="hibernateProperties"
      class="org.springframework.beans.factory.config.PropertiesFactoryBean">
  <property name="properties">
    <props>
      <prop key="hibernate.hbm2ddl.auto">create</prop>
      <prop key="hibernate.dialect">org.hibernate.dialect.MySQL5Dialect</prop>
      <prop key="connection.pool.size">1</prop>
      <prop key="hibernate.show_sql">true</prop>

      <!-- Let spring be the session context class
        <prop key="hibernate.current_session_context_class">thread</prop>
      -->
    </props>
  </property>
</bean>

<tx:annotation-driven transaction-manager="txManager" proxy-target-class="true" />
<bean id="txManager" class="org.springframework.orm.hibernate4.HibernateTransactionManager">
  <property name="sessionFactory" ref="sessionFactory"/>
</bean>

</beans>
```

Important: remove thread local, to let Spring manage the TX and the session

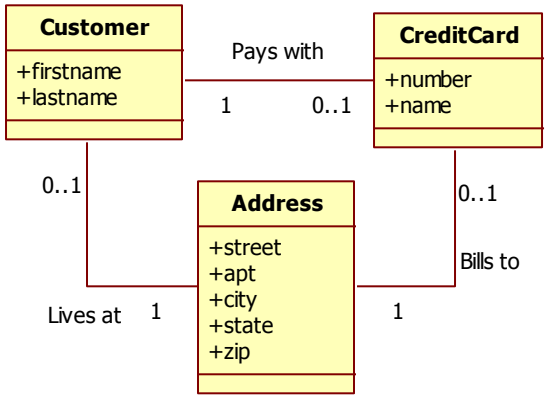
Add configuration for annotation based transaction demarcation

Example Application

Application Layers

- View Layer:
  - addCustomer.jsp, customer.jsp, customers.jsp, updaCustomer.jsp, error.jsp,
- Control Layer:
  - ViewAllCustomers, ViewCustomer, AddCustomer, ViewUpdCustomer, UpdCustomer
- Service Layer:
  - Customer Service
- Business Layer:
  - Customer, Address, CreditCard
- Persistence Layer:
  - CustomerDAO, AddressDAO, CreditCardDAO

OpenSessionFilter class no longer needed



Our application now just contains code related to our application, our previous technology helpers are provided by Spring

Active Learning

- Why don’t we need HibernateUtil when using Spring?

- What are the advantages of Spring’s OpenSessionInView filter?

Module Summary

- In this module we saw how Spring can add to our Hibernate project
  - Spring and Hibernate are easy to configure together
  - Doing so also removes our need for HibernateUtil
- Spring Declarative Transaction Demarcation is powerful and easy to use feature
  - Simply specify the transactional requirements
  - Cleanly provides needed transactional boundaries
  - Switch to Spring's OpenSessionInViewFilter
  - Does create minor Spring Dependency

Main Point

- Spring and Hibernate combine relatively effortlessly, and we can start enjoying Spring features such as DI and AOP, which can give us Container Managed Transactions
- *Science of Consciousness*: The Nature of life is to grow, to greater and greater levels of comfort and ability