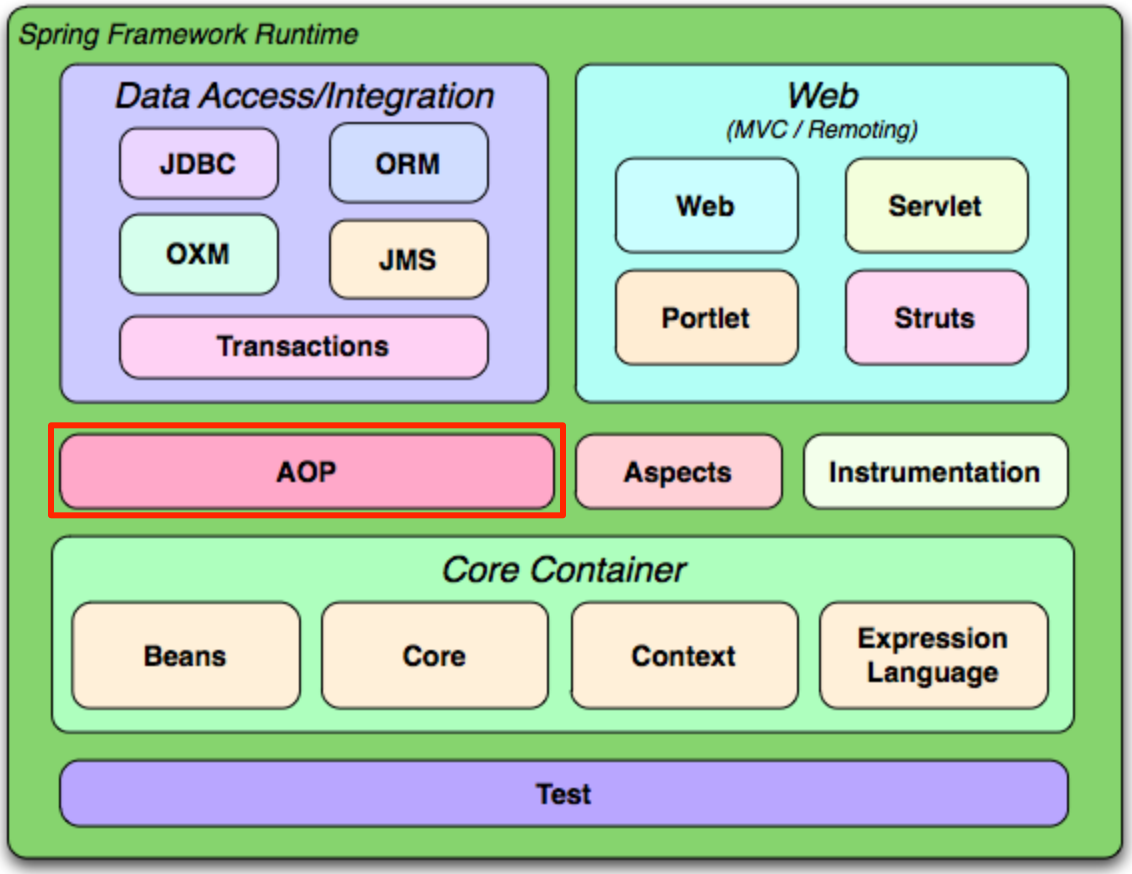
CS5220 Advanced Topics in Web Programming

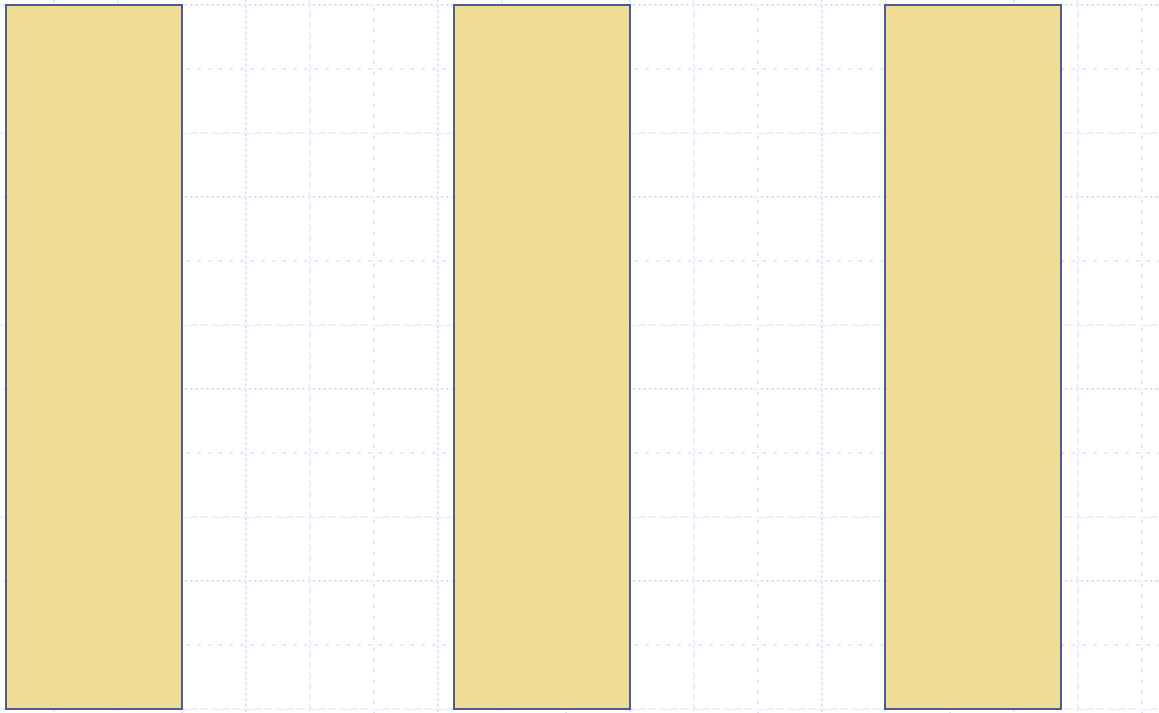
Spring – Aspect Oriented Programming

Chengyu Sun
California State University, Los Angeles

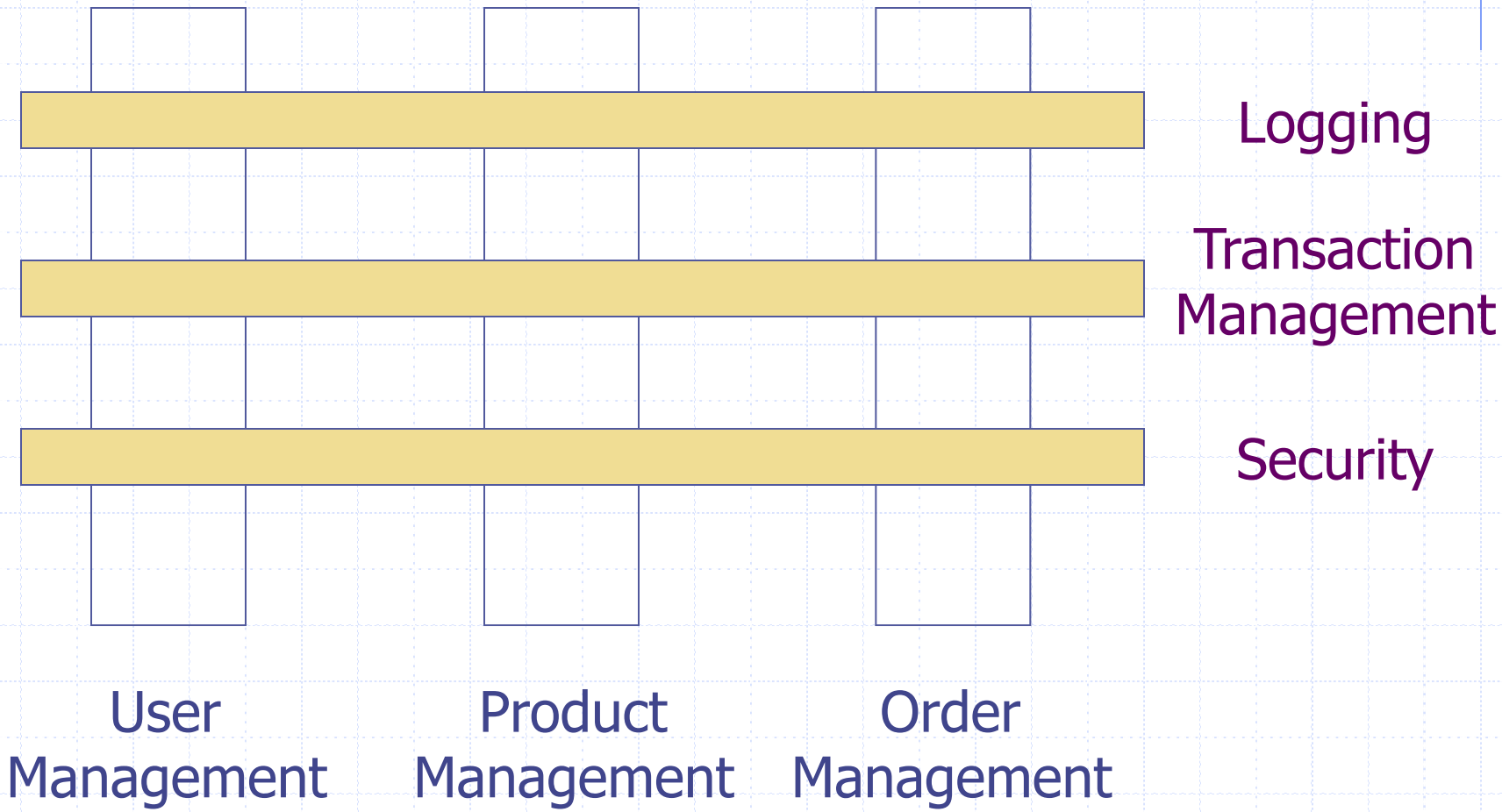
Spring Framework



Concerns



Cross-Cutting Concerns



An Example of Transaction Rollback

```
catch( SQLException e ) {
    System.err.println( e.getMessage() );
    if( c != null ) {
        try {
            c.rollback();
          } catch( SQLException ex ) {
            System.err.println( ex.getMessage() );
        }
    }
}
```

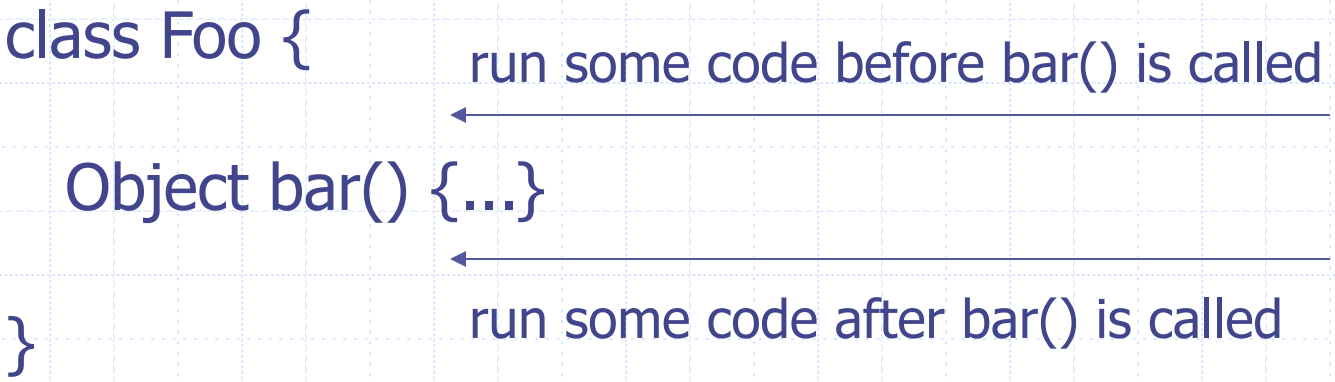
Aspect Oriented Programming

- Separate out cross-cutting concern code into their own classes or modules, called aspects.

Example: Logging

- `LoggedTask1` and `LoggedTask2`
  - Both implement `LoggedTask` interface
  - `LoggedTask1` – mixes application code and logging code
  - `LoggedTask2` – only has application code

How Does it Work?



Proxy – Subclass

```
class Foo1 extends Foo {

    Object bar()
    {
        // some code before super.bar()
        ...
        O o = super.bar();
        // some code after super.bar();
        ...
        return o;
    }

}
```

Proxy – Wrapper Class

```
class Foo2 {

    private Foo foo;

    Object bar()
    {
        // some code before super.bar()
        ...
        Object o = foo.bar();
        // some code after super.bar();
        ...
        return o;
    }

}
```

Some AOP Terminology

- Target
- Proxy
- Proxy Interface
- Advice

Create Proxies Automatically - ProxyFactoryBean

```
<bean id="loggedTask2" class="cs520.spring.aop.LoggedTask2" />

<bean id="loggedTask2WithAdvice"
        class="org.springframework.aop.framework.ProxyFactoryBean">
    <property name="proxyInterfaces">
        <list>
            <value>cs520.spring.log.LoggedTask</value>
        </list>
    </property>
    <property name="target" ref="loggedTask2" />
    <property name="interceptorNames">
        <list>
            <value>loggingAdvice</value>
        </list>
    </property>
</bean>
```

More AOP Terminology

- Join point: a point in the execution of the application where the advice can be plugged in
- Pointcut: A predicate that determines join points
- Introduction: adding new methods and/or fields to existing classes
- Weaving
  - *Compile time*, *class load time*, or *runtime*

Spring AOP

- Advices are written in Java
- Pointcuts are defined in XML or annotation
- Supports only method join points
- Aspects are woven in at runtime
- Advisor = Advice + Pointcuts

Advice Types

Type	Interface
Around	org.aopalliance.intercept.MethodInterceptor
Before	org.springframework.aop.MethodBeforeAdvice
After	org.springframework.aop.AfterReturningAdvice
Throws	org.springframework.aop.ThrowsAdvice

Use Interceptor

```
public class LoggingInterceptor implements MethodInterceptor {

    public Object invoke( MethodInvocation invocation ) throws Throwable
    {
        // do something before method invocation
        …

        Object result = invocation.proceed();

        // do something after method invocation
        …

        return result;
    }
}
```

Configure Pointcuts

- NameMatchMethodPointcutAdvisor
- RegExpPointcutAdvisor

```
<bean id="loggingAdvisor"
   class="org.springframework.aop.support.NameMatchMethodPointcutAdvisor">
      <property name="mappedName" value="doSomething*" />
      <property name="advice" ref="loggingInterceptor" />
</bean>
```

AOP Annotations

- Spring Framework – Core
  - Chapter 5. Aspect Oriented Programming with Spring

About AOP

- Good??
- Bad??