

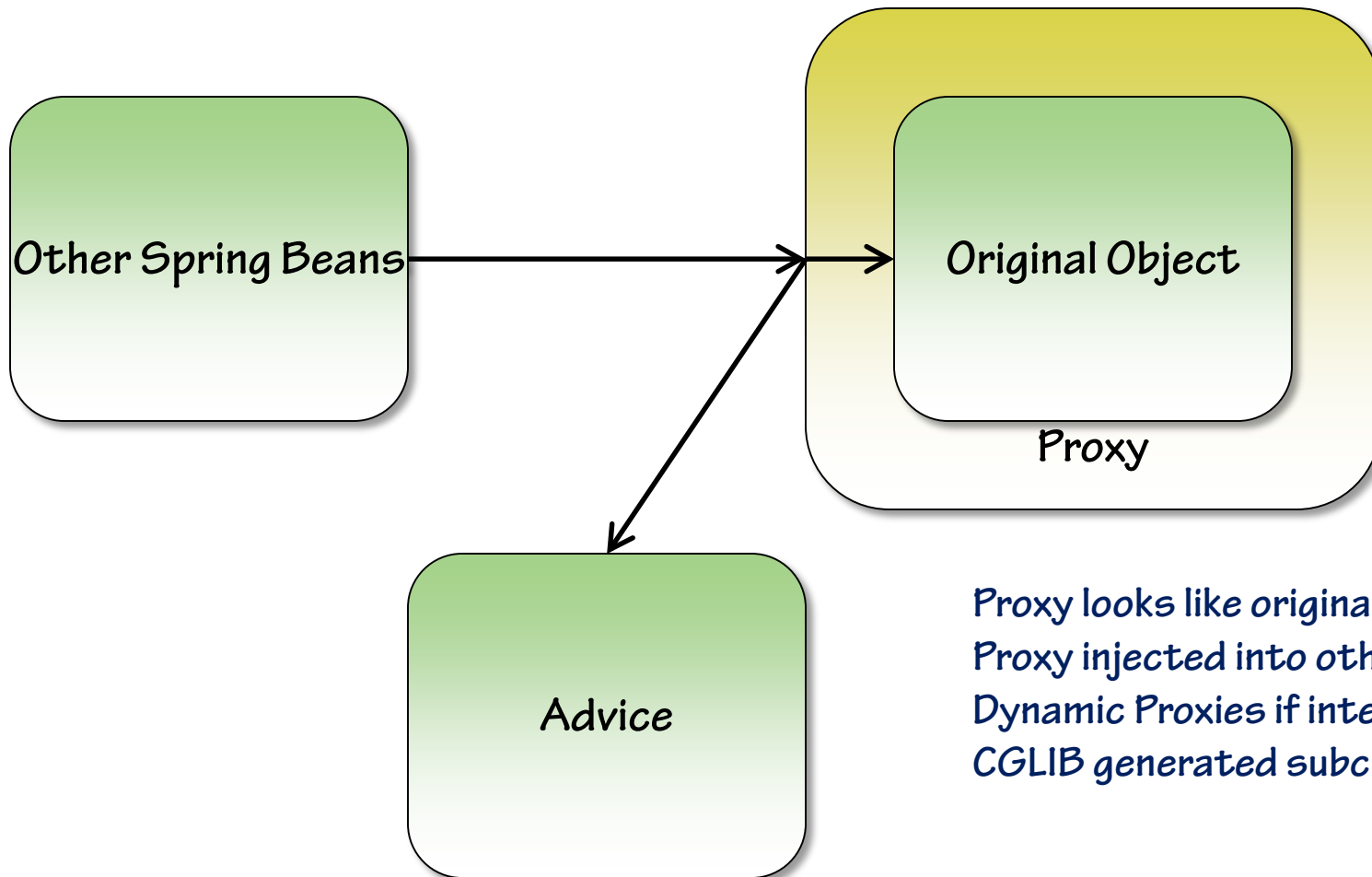
How Aspects are Added to Objects

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How Aspect are Added to Objects



Proxy looks like original objects

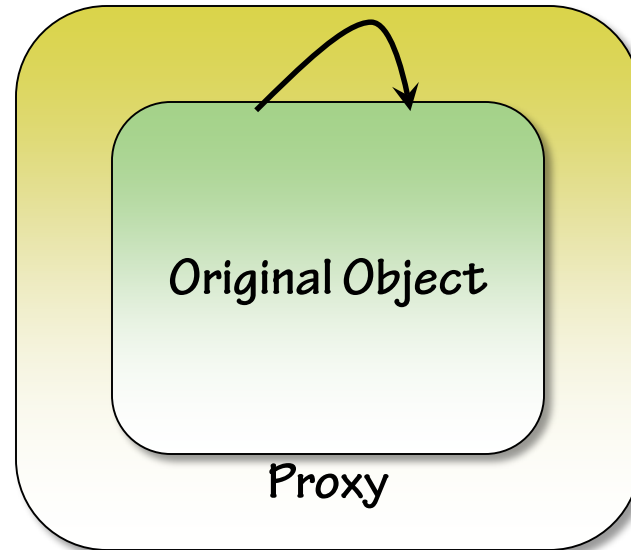
Proxy injected into other Spring Beans

Dynamic Proxies if interfaces are used

CGLIB generated subclasses otherwise

Local Method Calls

*Call never reaches the proxy
And therefore never the advice*



Implications

```
public class TxExample {
```

```
    @Transactional
```

```
    public void transactionalMethod() {  
    }
```

```
    public void callsTransactionalMethod() {  
        transactionalMethod();  
    }
```

*@Transactional is implemented using Spring
AOP*

*@Transactional will not be evaluated in this
case*

Demo: CGLIB vs. Dynamic Proxy

- Introduce an Interface
- Show that Dependency Injection does not work any more
- Fix problem by introducing proxyTargetClass=true

How Proxies are Implemented

- **CGLIB**
 - Subclass dynamically create subclass
 - Subclass implements the proxy
- **Dynamic Proxies**
 - Feature of the JDK
 - Allow dynamic method dispatch
 - For interfaces only
- **CGLIB is used**
 - ...if no interface is implemented
 - ...if proxy-target-class is set to true

What We Saw in the Demo

- Interface introduced
 - Dynamic Proxies instead of CGLIB
 - Proxy implements interface only
 - Test asks for class
 - Dependency injection not possible
-
- Fix: proxy-target-class forces CGLIB
-
- Add all methods to the interface
 - ...and use interface instead of class
 - Proxy implements interface only
 - ...but that is enough

Limits of the Proxy-based AOP Model

- Work only on public methods
- No protected, private
- Works only on methods calls from outside
- Spring Dependency Injection makes it transparent
- What if no Dependency Injection is used?

Spring AOP: Just Another Module

- **Spring is modular**
- **Each part of Spring can be used independently from the other parts**
- **This is also true for Spring AOP**

Summary

- Spring AOP uses proxy based AOP
- Either CGLIB (subclasses)
- ...or Dynamic Proxies (interfaces)
- Dependency Injection makes proxies transparent
- Beware: Call on the local object will not go through the proxy
- Can write code to create proxies