Spring Framework Explained

What Makes The Magic Work

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Introduction

- Bean/BeanDefinition
- BeanFactory
- ApplicationContext
- ClassPathBeanDefinitionScanner
- BeanPostProcessor
- Proxies
- Bean Lifecycle

Bean and BeanDefinition

- Bean
  - An Object that is managed by the container
  - Often a singleton, but not always
  - Often instantiated by the container, but not always
- BeanDefinition
  - A set of metadata indicating how to create a bean
  - getName()
  - getBeanClassName()
  - getFactoryMethodName()

BeanFactory

- “the root interface for accessing a Spring container” (javadoc)

```
public interface BeanFactory {
  <T> T getBean(String name, Class<T> requiredType) throws BeansException;
  // ...
}
```

- Related interfaces
  - SingletonBeanRegistry
  - ListableBeanRegistry
  - BeanDefinitionRegistry
- Implementations
  - DefaultListableBeanFactory
  - SimpleJndiBeanFactory

```java
@Data static class MyBeanRequiresInjection {
    private MyInjectedBean myField;
}

static class MyInjectedBean {
    @Getter private final String myValue = "myInjectedProperty";
}

@Test void test() {
    BeanFactory beanFactory = new DefaultListableBeanFactory();

    ((BeanDefinitionRegistry) beanFactory).registerBeanDefinition( beanName: "myInjectedBean",
        BeanDefinitionBuilder
            .genericBeanDefinition(MyInjectedBean.class)
            .getBeanDefinition());

    ((BeanDefinitionRegistry) beanFactory).registerBeanDefinition( beanName: "myBean",
        BeanDefinitionBuilder
            .genericBeanDefinition(MyBeanRequiresInjection.class)
            .addAutowiredProperty("myField")
            .getBeanDefinition());

    MyBeanRequiresInjection myPojo = beanFactory.getBean( name: "myBean", MyBeanRequiresInjection.class);
    System.out.println(myPojo.getMyField().getMyValue()); // myInjectedProperty
}
```

Demo!

Inspecting the BeanFactory

ApplicationContext

Manages the BeanFactory	• Controls the BeanFactory lifecycle • Provides extension points • Initializes singletons eagerly
Adds Enterprise features	• Events • Profiles and Properties • Resources • Messages and i18n
AnnotationConfigApplicationContext (and variations)	• Uses a ClassPathBeanDefinitionScanner to register bean definitions

ClassPathBeanDefinitionScanner

- Registers BeanDefinitions with the BeanFactory
- Detects @Component, @Service, @Repository, @ManagedBean, @Named
- Parses classes in bytecode, without loading them

```
private void scan(String... basePackages) {
    for (String basePackage : basePackages) {
        Set<BeanDefinition> candidates = findCandidateComponents(basePackage);

        for (BeanDefinition candidate : candidates) {
            // augment BeanDefinition with metadata from component class

            registerBeanDefinition(candidate, beanDefinitionRegistry);
        }
    }
}
```

BeanPostProcessor

- “Factory hook that allows for custom modification of new bean instances — for example, checking for marker interfaces of wrapping beans with proxies.”

```
public interface BeanPostProcessor {
    Object postProcessBeforeInitialization(Object bean, String beanName) throws BeansException;
    Object postProcessAfterInitialization(Object bean, String beanName) throws BeansException;
}
```

- Some implementations
  - ConfigurationPropertiesBindingPostProcessor (@ConfigurationProperties)
  - AutowiredAnnotationBeanPostProcessor (@Autowired, @Value, @Inject, @Lookup)
  - MethodValidationPostProcessor (@Valid, @NotNull, @NotEmpty)

Proxies

- JDK Proxy
  - Interfaces only
  - Part of JDK
- CGLIB
  - Classes and interfaces

```
Person person = new Person();
person.setName("Mikaël");

Person personProxy = (Person) Enhancer.create(
        Person.class,
        (MethodInterceptor) (_, method, args, _) -> {

            if (method.getReturnType().equals(String.class)) {
                String result = (String) method.invoke(person, args);
                return result.toUpperCase();
            }

            return method.invoke(person, args);
        });

System.out.println(personProxy.getName()); // MIKAËL
```

Demo!

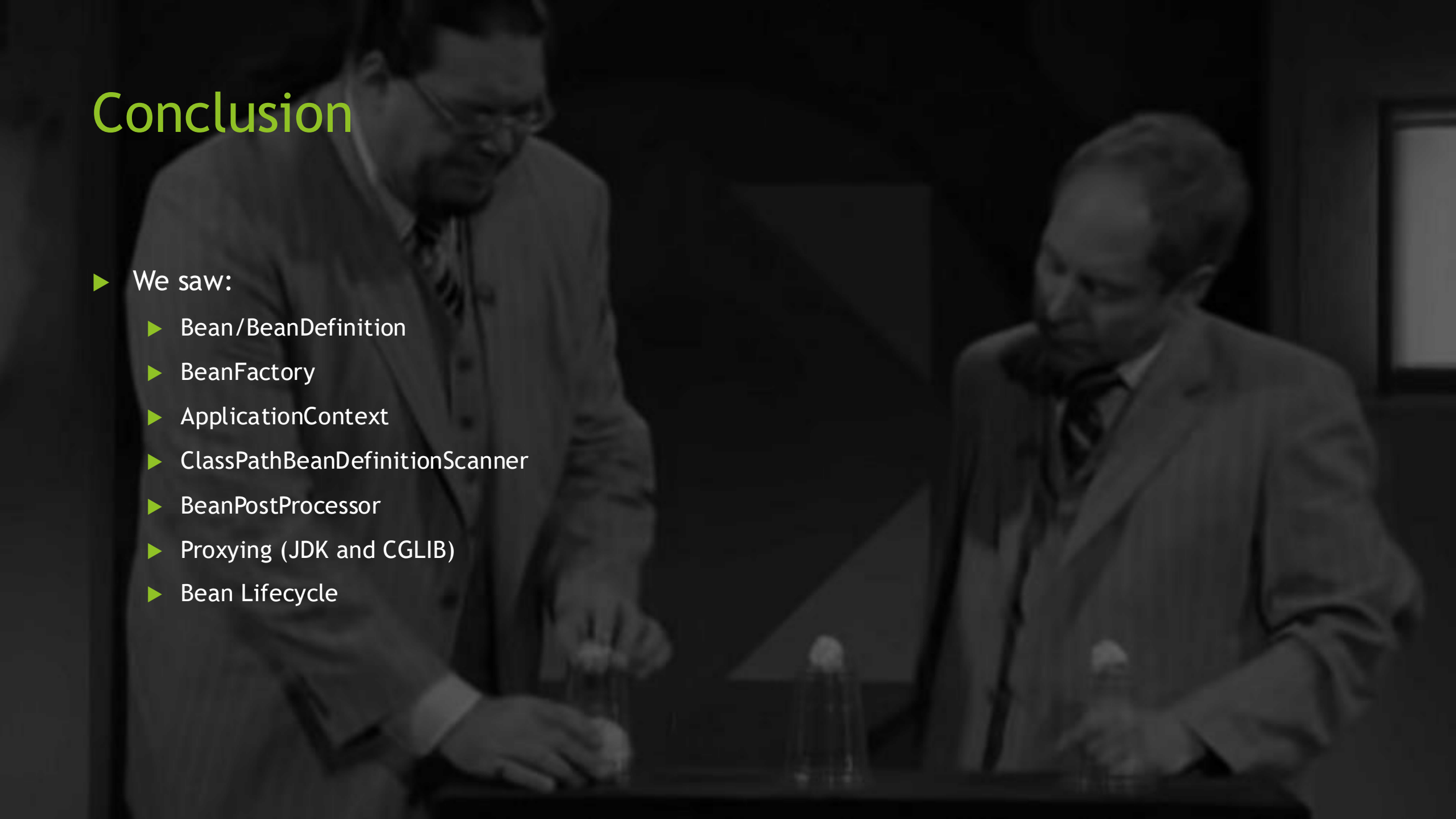
- Inspecting proxies
- Proxy errors
- Caching proxy

Bean Lifecycle

- Once per BeanFactory
  - Parse BeanDefinitions
  - Invoke BeanFactoryProcessors
- Once per Bean
  1. Instantiate Beans
  2. Inject properties (@Autowired, @Value, @Resource, @Inject)
  3. ApplicationContextAware, BeanFactoryAware, BeanNameAware, EnvironmentAware, ApplicationEventPublisherAware...
  4. BeanProcessors 1st time (postProcessBeforeInitialization)
  5. @PostConstruct, InitializingBean, @Bean(initMethod = "...")
  6. BeanPostProcessor 2nd time (postProcessAfterInitialization)

} Through BeanPostProcessors

Conclusion



- We saw:
  - Bean/BeanDefinition
  - BeanFactory
  - ApplicationContext
  - ClassPathBeanDefinitionScanner
  - BeanPostProcessor
  - Proxying (JDK and CGLIB)
  - Bean Lifecycle