Table of Contents *generated with DocToc*

- 基本
  - ClassPathXmlApplicationContext
    - 构造器
    - 设置配置文件路径
      - Environment接口
        - Profile
        - Property
      - Environment构造器
        - PropertySources接口
        - PropertySource接口
      - 路径Placeholder处理
        - PropertyResolver接口
        - 解析
  - refresh
    - prepareRefresh
      - 属性校验
    - BeanFactory创建
      - BeanFactory接口
      - BeanFactory定制
      - Bean加载
        - EntityResolver
        - BeanDefinitionReader
        - 路径解析(Ant)
        - 配置文件加载
        - Bean解析
      - 默认命名空间解析
        - import
        - alias
        - bean
          - id & name处理
          - beanName生成
          - bean解析
          - Bean装饰
          - Bean注册
          - BeanDefiniton数据结构
        - beans
      - 其它命名空间解析
        - NamespaceHandler继承体系

            - init
            - BeanFactory数据结构
        - prepareBeanFactory
            - BeanExpressionResolver
            - PropertyEditorRegistrar
            - 环境注入
            - 依赖解析忽略
            - bean伪装
            - LoadTimeWeaver
            - 注册环境
        - postProcessBeanFactory
        - invokeBeanFactoryPostProcessors
        - BeanPostProcessor注册
        - MessageSource
        - 事件驱动
            - 事件
            - 发布者
                - ApplicationEventPublisher
                - ApplicationEventMulticaster
            - 监听器
            - 初始化
            - 事件发布
                - 监听器获取
                - 同步/异步
                    - 全局
                    - 注解
        - onRefresh
        - ApplicationListener注册
        - singleton初始化
            - ConversionService
            - StringValueResolver
            - LoadTimeWeaverAware
            - 初始化
- getBean
    - beanName转化
    - 手动注册bean检测
    - 检查父容器
    - 依赖初始化
    - Singleton初始化
        - getSingleton方法
            - 是否存在

            - bean创建
                - lookup-method检测
                - InstantiationAwareBeanPostProcessor触发
                - doCreateBean
                    - 创建(createBeanInstance)
                    - MergedBeanDefinitionPostProcessor
                    - 属性解析
                    - 属性设置
                    - 初始化
        - getObjectForBeanInstance
    - Prototype初始化
        - beforePrototypeCreation
        - createBean
        - afterPrototypeCreation
        - 总结
    - 其它Scope初始化

基本

本部分从最基本的Spring开始。配置文件:

```
<?xml version="1.0" encoding="UTF-8"?>
<beans>
    <bean class="base.SimpleBean"></bean>
</beans>
```

启动代码:

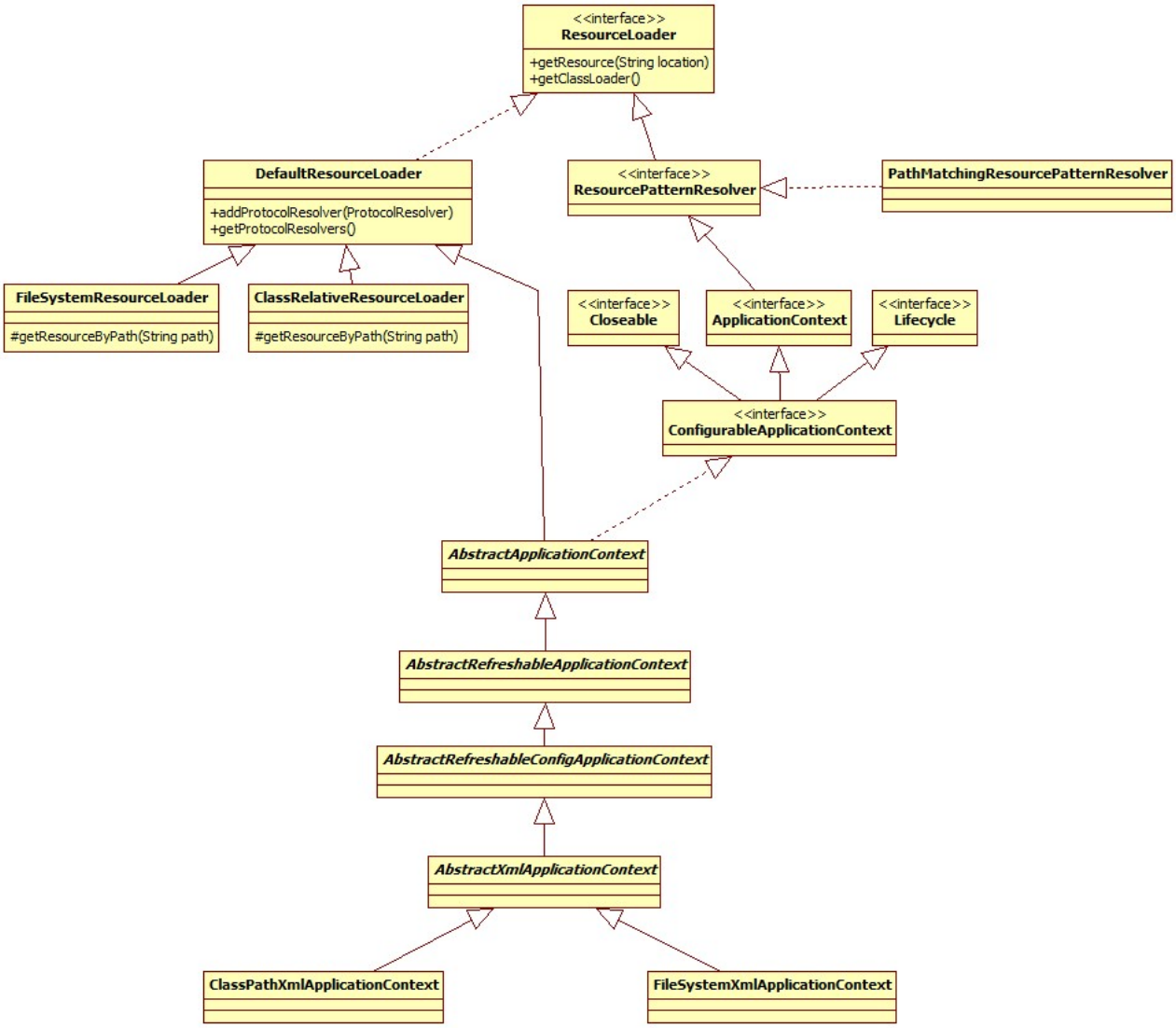
```
public static void main(String[] args) {
    ClassPathXmlApplicationContext context = new
ClassPathXmlApplicationContext("config.xml");
    SimpleBean bean = context.getBean(SimpleBean.class);
    bean.send();
    context.close();
}
```

SimpleBean:

```
public class SimpleBean {
    public void send() {
        System.out.println("I am send method from SimpleBean!");
    }
}
```

ClassPathXmlApplicationContext

整个继承体系如下:



ResourceLoader代表了**加载资源的一种方式，正是策略模式的实现。**

构造器源码:

```
public ClassPathXmlApplicationContext(String[] configLocations, boolean refresh,
ApplicationContext              parent) {
    //null
    super(parent);
    setConfigLocations(configLocations);
    //默认true
    if (refresh) {
        refresh();
    }
}
```

构造器

首先看父类构造器，沿着继承体系一直向上调用，直到AbstractApplicationContext:

```
public AbstractApplicationContext(ApplicationContext parent) {
    this();
    setParent(parent);
}
public AbstractApplicationContext() {
    this.resourcePatternResolver = getResourcePatternResolver();
}
```

getResourcePatternResolver:

```
protected ResourcePatternResolver getResourcePatternResolver() {
    return new PathMatchingResourcePatternResolver(this);
}
```

PathMatchingResourcePatternResolver支持Ant风格的路径解析。

设置配置文件路径

即AbstractRefreshableConfigApplicationContext.setConfigLocations:

```
public void setConfigLocations(String... locations) {
    if (locations != null) {
        Assert.noNullElements(locations, "Config locations must not be null");
        this.configLocations = new String[locations.length];
        for (int i = 0; i < locations.length; i++) {
            this.configLocations[i] = resolvePath(locations[i]).trim();
        }
    } else {
        this.configLocations = null;
    }
}
```

resolvePath:

```
protected String resolvePath(String path) {
    return getEnvironment().resolveRequiredPlaceholders(path);
}
```

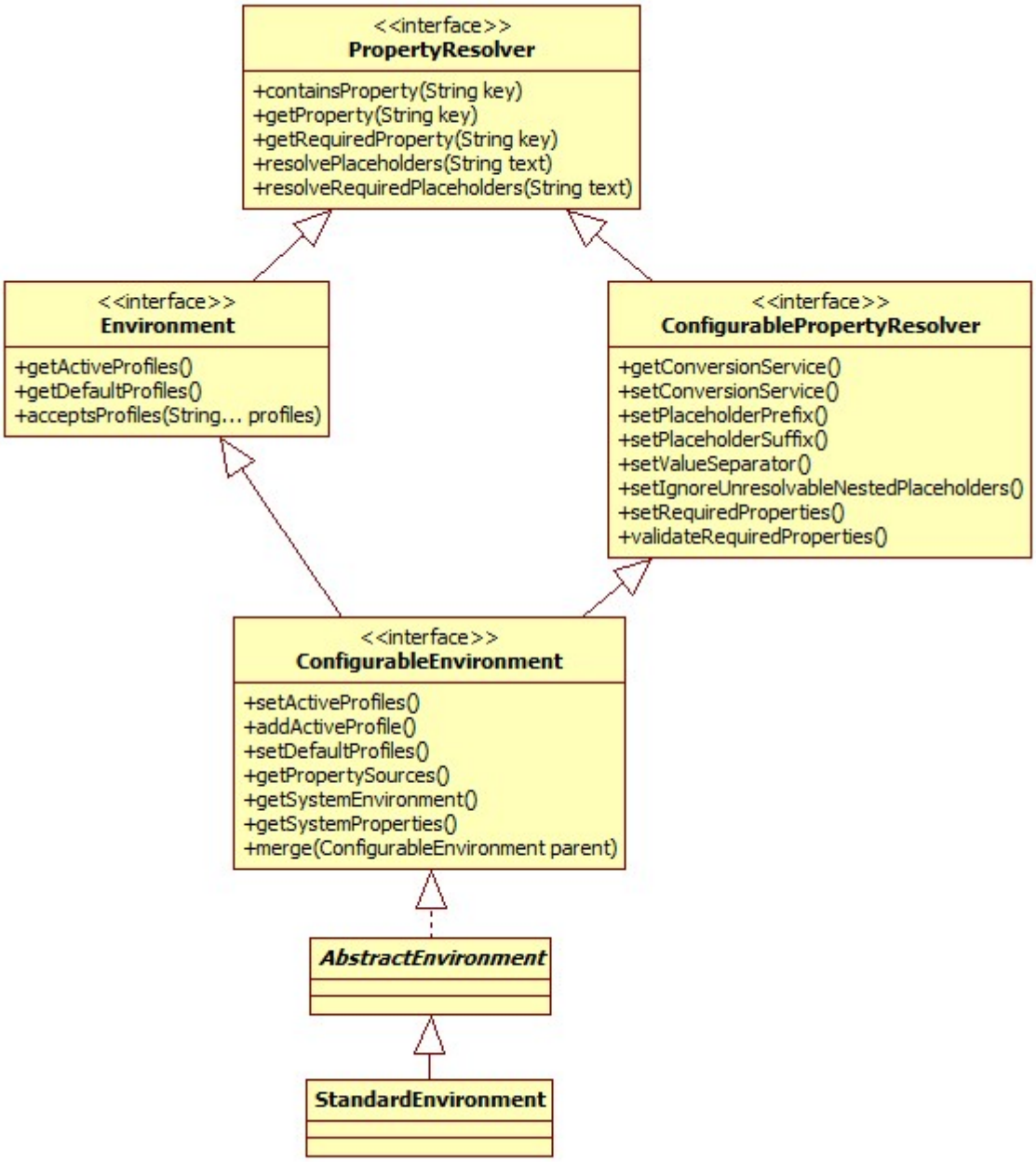
此方法的目的在于将占位符(placeholder)解析成实际的地址。比如可以这么写: `new ClassPathXmlApplicationContext("classpath:config.xml");` 那么classpath:就是需要被解析的。

getEnvironment方法来自于ConfigurableApplicationContext接口，源码很简单，如果为空就调用createEnvironment创建一个。AbstractApplicationContext.createEnvironment:

```
protected ConfigurableEnvironment createEnvironment() {
    return new StandardEnvironment();
}
```

Environment接口

继承体系:



Environmen接口**代表了当前应用所处的环境。**从此接口的方法可以看出，其主要和profile、Property相关。

Profile

Spring Profile特性是从3.1开始的，其主要是为了解决这样一种问题: 线上环境和测试环境使用不同的配置或是数据库或是其它。有了Profile便可以在 不同环境之间无缝切换。**Spring容器管理的所有bean都是和一个profile绑定在一起的。**使用了Profile的配置文件示例:

```
<beans profile="develop">
    <context:property-placeholder location="classpath*:jdbc-develop.properties"/>
</beans>
<beans profile="production">
    <context:property-placeholder location="classpath*:jdbc-production.properties"/>
</beans>
<beans profile="test">
    <context:property-placeholder location="classpath*:jdbc-test.properties"/>
</beans>
```

在启动代码中可以用如下代码设置活跃(当前使用的)Profile:

```
context.getEnvironment().setActiveProfiles("dev");
```

当然使用的方式还有很多(比如注解)，参考:

spring3.1 profile 配置不同的环境

Spring Profiles example

Property

这里的Property指的是程序运行时的一些参数，引用注释:

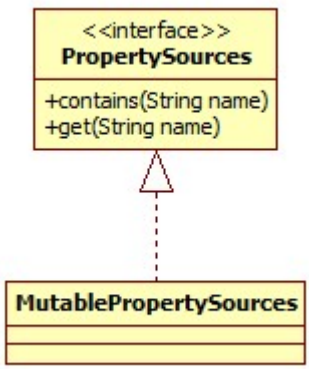
> properties files, JVM system properties, system environment variables, JNDI, servlet context parameters, ad-hoc Properties objects,Maps, and so on.

Environment构造器

```
private final MutablePropertySources propertySources = new
MutablePropertySources(this.logger);
public AbstractEnvironment() {
    customizePropertySources(this.propertySources);
}
```

PropertySources接口

继承体系:



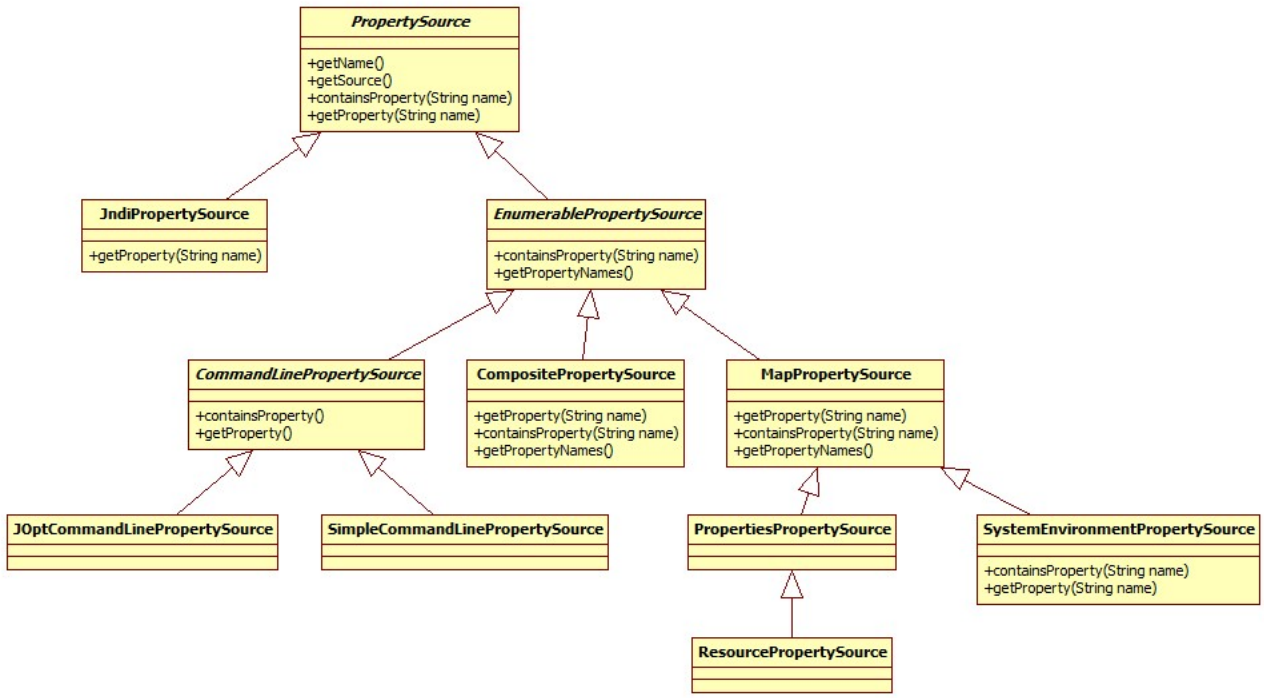
此接口实际上是PropertySource的容器，默认的MutablePropertySources实现内部含有一个CopyOnWriteArrayList作为存储载体。

StandardEnvironment.customizePropertySources:

```
/** System environment property source name: {@value} */
public static final String SYSTEM_ENVIRONMENT_PROPERTY_SOURCE_NAME =
"systemEnvironment";
/** JVM system properties property source name: {@value} */
public static final String SYSTEM_PROPERTIES_PROPERTY_SOURCE_NAME = "systemProperties";
@Override
protected void customizePropertySources(MutablePropertySources propertySources) {
    propertySources.addLast(new MapPropertySource
        (SYSTEM_PROPERTIES_PROPERTY_SOURCE_NAME, getSystemProperties()));
    propertySources.addLast(new SystemEnvironmentPropertySource
        (SYSTEM_ENVIRONMENT_PROPERTY_SOURCE_NAME, getSystemEnvironment()));
}
```

PropertySource接口

PropertySource接口代表了键值对的Property来源。继承体系：



AbstractEnvironment.getSystemProperties:

```
@Override
public Map<String, Object> getSystemProperties() {
    try {
        return (Map) System.getProperties();
    }
    catch (AccessControlException ex) {
        return (Map) new ReadOnlySystemAttributesMap() {
            @Override
```

```
            protected String getSystemAttribute(String attributeName) {
                try {
                    return System.getProperty(attributeName);
                }
                catch (AccessControlException ex) {
                    if (logger.isInfoEnabled()) {
                        logger.info(format("Caught AccessControlException when
accessing system " +
                                "property [%s]; its value will be returned [null].
Reason: %s",
                                attributeName, ex.getMessage()));
                    }
                    return null;
                }
            }
        };
    }
}
```

这里的实现很有意思，如果安全管理器阻止获取全部的系统属性，那么会尝试获取单个属性的可能性，如果还不行就抛异常了。

getSystemEnvironment方法也是一个套路，不过最终调用的是System.getenv，可以获取jvm和OS的一些版本信息。

路径Placeholder处理

AbstractEnvironment.resolveRequiredPlaceholders:

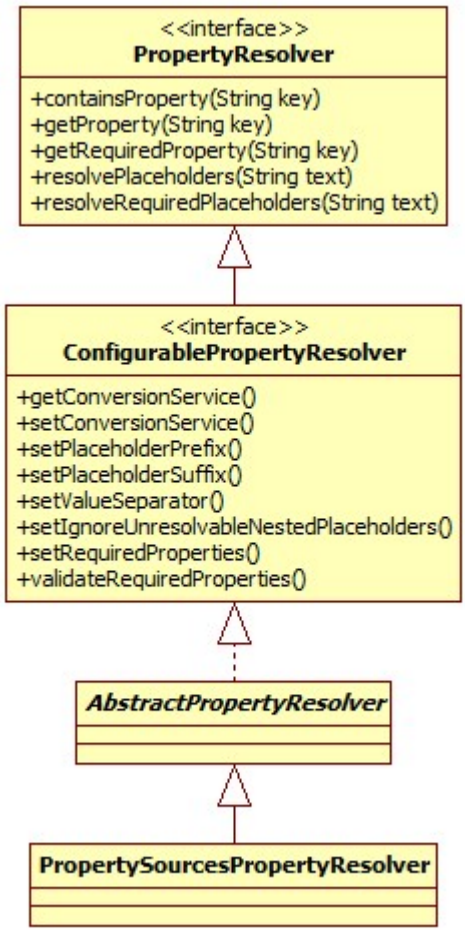
```
@Override
public String resolveRequiredPlaceholders(String text) throws IllegalArgumentException
{
    //text即配置文件路径，比如classpath:config.xml
    return this.propertyResolver.resolveRequiredPlaceholders(text);
}
```

propertyResolver是一个PropertySourcesPropertyResolver对象:

```
private final ConfigurablePropertyResolver propertyResolver =
            new PropertySourcesPropertyResolver(this.propertySources);
```

PropertyResolver接口

PropertyResolver继承体系(排除Environment分支):



此接口正是用来解析PropertyResource。

解析

AbstractPropertyResolver.resolveRequiredPlaceholders:

```
@Override
public String resolveRequiredPlaceholders(String text) throws IllegalArgumentException
{
    if (this.strictHelper == null) {
        this.strictHelper = createPlaceholderHelper(false);
    }
    return doResolvePlaceholders(text, this.strictHelper);
}
```

```
private PropertyPlaceholderHelper createPlaceholderHelper(boolean
ignoreUnresolvablePlaceholders) {
    //三个参数分别是${, }, :
    return new PropertyPlaceholderHelper(this.placeholderPrefix,
this.placeholderSuffix,
        this.valueSeparator, ignoreUnresolvablePlaceholders);
}
```

doResolvePlaceholders:

```
private String doResolvePlaceholders(String text, PropertyPlaceholderHelper helper) {
    //PlaceholderResolver接口依然是策略模式的体现
    return helper.replacePlaceholders(text, new
PropertyPlaceholderHelper.PlaceholderResolver() {
        @Override
        public String resolvePlaceholder(String placeholderName) {
            return getPropertyAsRawString(placeholderName);
        }
    });
}
```

其实代码执行到这里的时候还没有进行xml配置文件的解析，那么这里的解析placeHolder是什么意思呢，原因在于可以这么写:

```
System.setProperty("spring", "classpath");
ClassPathXmlApplicationContext context = new
ClassPathXmlApplicationContext("${spring}:config.xml");
SimpleBean bean = context.getBean(SimpleBean.class);
```

这样就可以正确解析。placeholder的替换其实就是字符串操作，这里只说一下正确的属性是怎么来的。实现的关键在于PropertySourcesPropertyResolver.getProperty:

```
@Override
protected String getPropertyAsRawString(String key) {
    return getProperty(key, String.class, false);
}
protected <T> T getProperty(String key, Class<T> targetValueType, boolean
resolveNestedPlaceholders) {
    if (this.propertySources != null) {
        for (PropertySource<?> propertySource : this.propertySources) {
            Object value = propertySource.getProperty(key);
            return value;
        }
    }
    return null;
}
```

很明显了，就是从System.getProperty和System.getenv获取，但是由于环境变量是无法自定义的，所以其实此处只能通过System.setProperty指定。

注意，classpath:XXX这种写法的classpath前缀到目前为止还没有被处理。

refresh

Spring bean解析就在此方法，所以单独提出来。

AbstractApplicationContext.refresh:

```
@Override
public void refresh() throws BeansException, IllegalStateException {
    synchronized (this.startupShutdownMonitor) {
```

```
            // Prepare this context for refreshing.
            prepareRefresh();
            // Tell the subclass to refresh the internal bean factory.
            ConfigurableListableBeanFactory beanFactory = obtainFreshBeanFactory();
            // Prepare the bean factory for use in this context.
            prepareBeanFactory(beanFactory);
            try {
                // Allows post-processing of the bean factory in context subclasses.
                postProcessBeanFactory(beanFactory);
                // Invoke factory processors registered as beans in the context.
                invokeBeanFactoryPostProcessors(beanFactory);
                // Register bean processors that intercept bean creation.
                registerBeanPostProcessors(beanFactory);
                // Initialize message source for this context.
                initMessageSource();
                // Initialize event multicaster for this context.
                initApplicationEventMulticaster();
                // Initialize other special beans in specific context subclasses.
                onRefresh();
                // Check for listener beans and register them.
                registerListeners();
                // Instantiate all remaining (non-lazy-init) singletons.
                finishBeanFactoryInitialization(beanFactory);
                // Last step: publish corresponding event.
                finishRefresh();
            } catch (BeansException ex) {
                // Destroy already created singletons to avoid dangling resources.
                destroyBeans();
                // Reset 'active' flag.
                cancelRefresh(ex);
                // Propagate exception to caller.
                throw ex;
            } finally {
                // Reset common introspection caches in Spring's core, since we
                // might not ever need metadata for singleton beans anymore...
                resetCommonCaches();
            }
        }
    }
```

prepareRefresh

```
protected void prepareRefresh() {
    this.startupDate = System.currentTimeMillis();
    this.closed.set(false);
    this.active.set(true);
    // Initialize any placeholder property sources in the context environment
    //空实现
    initPropertySources();
    // Validate that all properties marked as required are resolvable
    // see ConfigurablePropertyResolver#setRequiredProperties
    getEnvironment().validateRequiredProperties();
```

```
    // Allow for the collection of early ApplicationEvents,
    // to be published once the multicaster is available...
    this.earlyApplicationEvents = new LinkedHashSet<ApplicationEvent>();
}
```

属性校验

AbstractEnvironment.validateRequiredProperties:

```
@Override
public void validateRequiredProperties() throws MissingRequiredPropertiesException {
    this.propertyResolver.validateRequiredProperties();
}
```

AbstractPropertyResolver.validateRequiredProperties:

```
@Override
public void validateRequiredProperties() {
    MissingRequiredPropertiesException ex = new MissingRequiredPropertiesException();
    for (String key : this.requiredProperties) {
        if (this.getProperty(key) == null) {
            ex.addMissingRequiredProperty(key);
        }
    }
    if (!ex.getMissingRequiredProperties().isEmpty()) {
        throw ex;
    }
}
```

requiredProperties是通过setRequiredProperties方法设置的，保存在一个list里面，默认是空的，也就是不需要校验任何属性。

BeanFactory创建

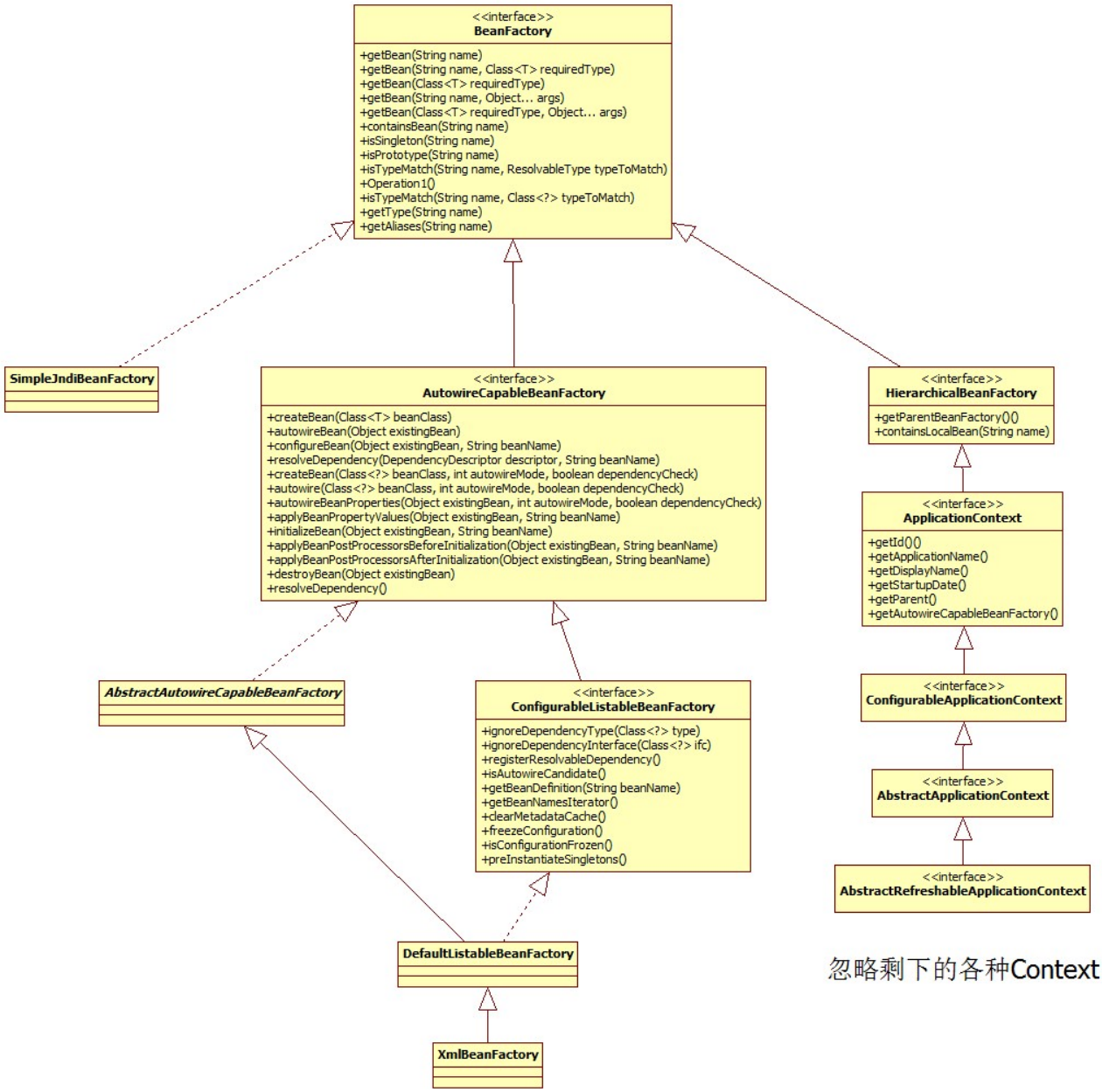
由obtainFreshBeanFactory调用AbstractRefreshableApplicationContext.refreshBeanFactory:

```
@Override
protected final void refreshBeanFactory() throws BeansException {
    //如果已经存在，那么销毁之前的
    if (hasBeanFactory()) {
        destroyBeans();
        closeBeanFactory();
    }
    //创建了一个DefaultListableBeanFactory对象
    DefaultListableBeanFactory beanFactory = createBeanFactory();
    beanFactory.setSerializationId(getId());
    customizeBeanFactory(beanFactory);
    loadBeanDefinitions(beanFactory);
    synchronized (this.beanFactoryMonitor) {
        this.beanFactory = beanFactory;
    }
```

```
}
```

BeanFactory接口

此接口实际上就是Bean容器，其继承体系:



BeanFactory定制

AbstractRefreshableApplicationContext.customizeBeanFactory方法用于给子类提供一个自由配置的机会，默认实现:

```
protected void customizeBeanFactory(DefaultListableBeanFactory beanFactory) {
    if (this.allowBeanDefinitionOverriding != null) {
        //默认false，不允许覆盖

 beanFactory.setAllowBeanDefinitionOverriding(this.allowBeanDefinitionOverriding);
    }
    if (this.allowCircularReferences != null) {
        //默认false，不允许循环引用
        beanFactory.setAllowCircularReferences(this.allowCircularReferences);
    }
}
```

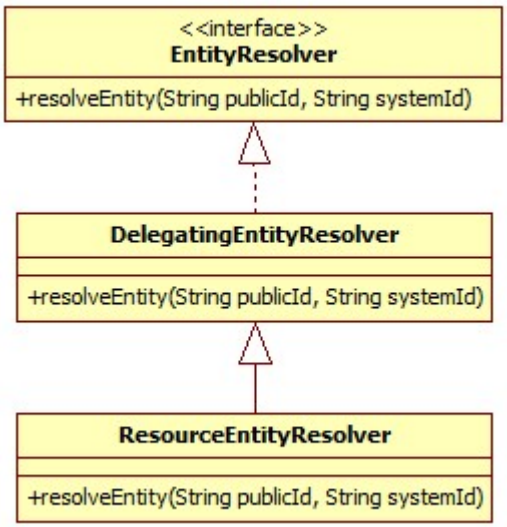
Bean加载

AbstractXmlApplicationContext.loadBeanDefinitions，这个便是核心的bean加载了:

```
@Override
protected void loadBeanDefinitions(DefaultListableBeanFactory beanFactory) {
    // Create a new XmlBeanDefinitionReader for the given BeanFactory.
    XmlBeanDefinitionReader beanDefinitionReader = new
XmlBeanDefinitionReader(beanFactory);
    // Configure the bean definition reader with this context's
    // resource loading environment.
    beanDefinitionReader.setEnvironment(this.getEnvironment());
    beanDefinitionReader.setResourceLoader(this);
    beanDefinitionReader.setEntityResolver(new ResourceEntityResolver(this));
    // Allow a subclass to provide custom initialization of the reader,
    // then proceed with actually loading the bean definitions.
    //默认空实现
    initBeanDefinitionReader(beanDefinitionReader);
    loadBeanDefinitions(beanDefinitionReader);
}
```

EntityResolver

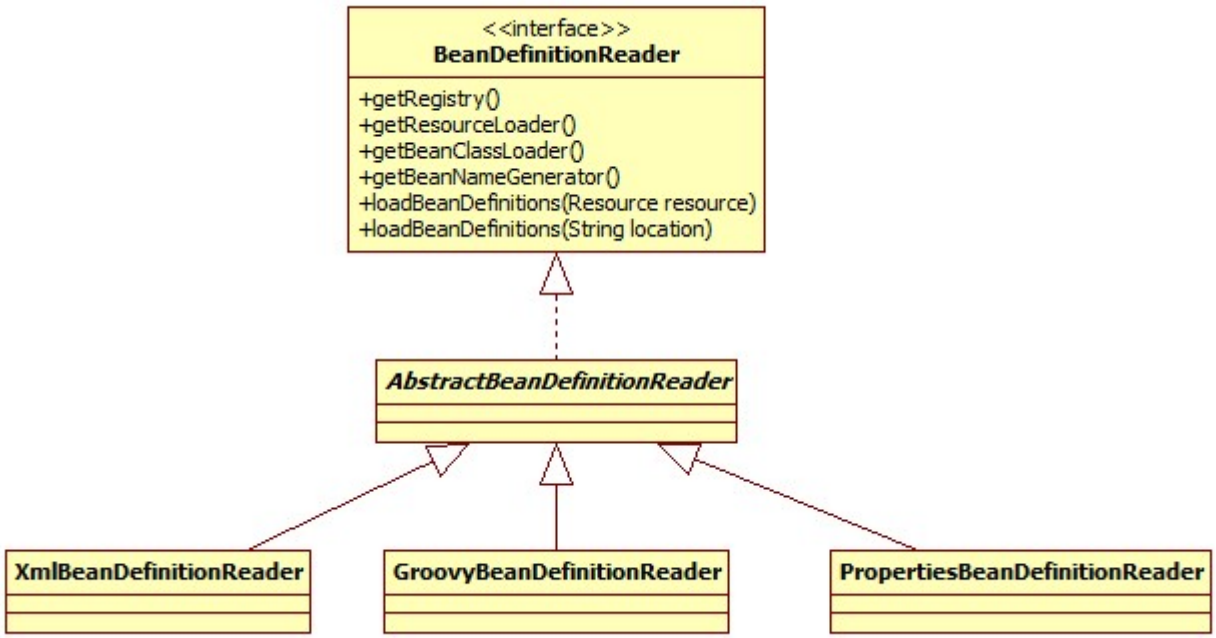
此处只说明用到的部分继承体系:



EntityResolver接口在org.xml.sax中定义。DelegatingEntityResolver用于schema和dtd的解析。

BeanDefinitionReader

继承体系:



路径解析(Ant)

```
protected void loadBeanDefinitions(XmlBeanDefinitionReader reader) {
    Resource[] configResources = getConfigResources();
    if (configResources != null) {
        reader.loadBeanDefinitions(configResources);
    }
    String[] configLocations = getConfigLocations();
    //here
    if (configLocations != null) {
        reader.loadBeanDefinitions(configLocations);
    }
}
```

AbstractBeanDefinitionReader.loadBeanDefinitions:

```
@Override
public int loadBeanDefinitions(String... locations) throws BeanDefinitionStoreException
{
    Assert.notNull(locations, "Location array must not be null");
    int counter = 0;
    for (String location : locations) {
        counter += loadBeanDefinitions(location);
    }
    return counter;
}
```

之后调用:

```
//第二个参数为空
public int loadBeanDefinitions(String location, Set<Resource> actualResources) {
    ResourceLoader resourceLoader = getResourceLoader();
    //参见ResourceLoader类图，ClassPathXmlApplicationContext实现了此接口
    if (resourceLoader instanceof ResourcePatternResolver) {
        // Resource pattern matching available.
        try {
            Resource[] resources = ((ResourcePatternResolver)
resourceLoader).getResources(location);
            int loadCount = loadBeanDefinitions(resources);
            if (actualResources != null) {
                for (Resource resource : resources) {
                    actualResources.add(resource);
                }
            }
            return loadCount;
        }
        catch (IOException ex) {
            throw new BeanDefinitionStoreException(
                    "Could not resolve bean definition resource pattern [" + location +
"]", ex);
        }
    }
    else {
        // Can only load single resources by absolute URL.
```

```
            Resource resource = resourceLoader.getResource(location);
            int loadCount = loadBeanDefinitions(resource);
            if (actualResources != null) {
                actualResources.add(resource);
            }
            return loadCount;
        }
    }
```

getResource的实现在AbstractApplicationContext：

```
    @Override
    public Resource[] getResources(String locationPattern) throws IOException {
        //构造器中初始化，PathMatchingResourcePatternResolver对象
        return this.resourcePatternResolver.getResources(locationPattern);
    }
```

PathMatchingResourcePatternResolver是ResourceLoader继承体系的一部分。

```
    @Override
    public Resource[] getResources(String locationPattern) throws IOException {
        Assert.notNull(locationPattern, "Location pattern must not be null");
        //classpath:
        if (locationPattern.startsWith(CLASSPATH_ALL_URL_PREFIX)) {
            // a class path resource (multiple resources for same name possible)
            //matcher是一个AntPathMatcher对象
            if (getPathMatcher().isPattern(locationPattern
                .substring(CLASSPATH_ALL_URL_PREFIX.length()))) {
                // a class path resource pattern
                return findPathMatchingResources(locationPattern);
            } else {
                // all class path resources with the given name
                return findAllClassPathResources(locationPattern
                    .substring(CLASSPATH_ALL_URL_PREFIX.length()));
            }
        } else {
            // Only look for a pattern after a prefix here
            // (to not get fooled by a pattern symbol in a strange prefix).
            int prefixEnd = locationPattern.indexOf(":") + 1;
            if (getPathMatcher().isPattern(locationPattern.substring(prefixEnd))) {
                // a file pattern
                return findPathMatchingResources(locationPattern);
            }
            else {
                // a single resource with the given name
                return new Resource[] {getResourceLoader().getResource(locationPattern)};
            }
        }
    }
```

isPattern:

```
@Override
public boolean isPattern(String path) {
    return (path.indexOf('*') != -1 || path.indexOf('?') != -1);
}
```

可以看出配置文件路径是支持ant风格的，也就是可以这么写:

```
new ClassPathXmlApplicationContext("con*.xml");
```

具体怎么解析ant风格的就不写了。

配置文件加载

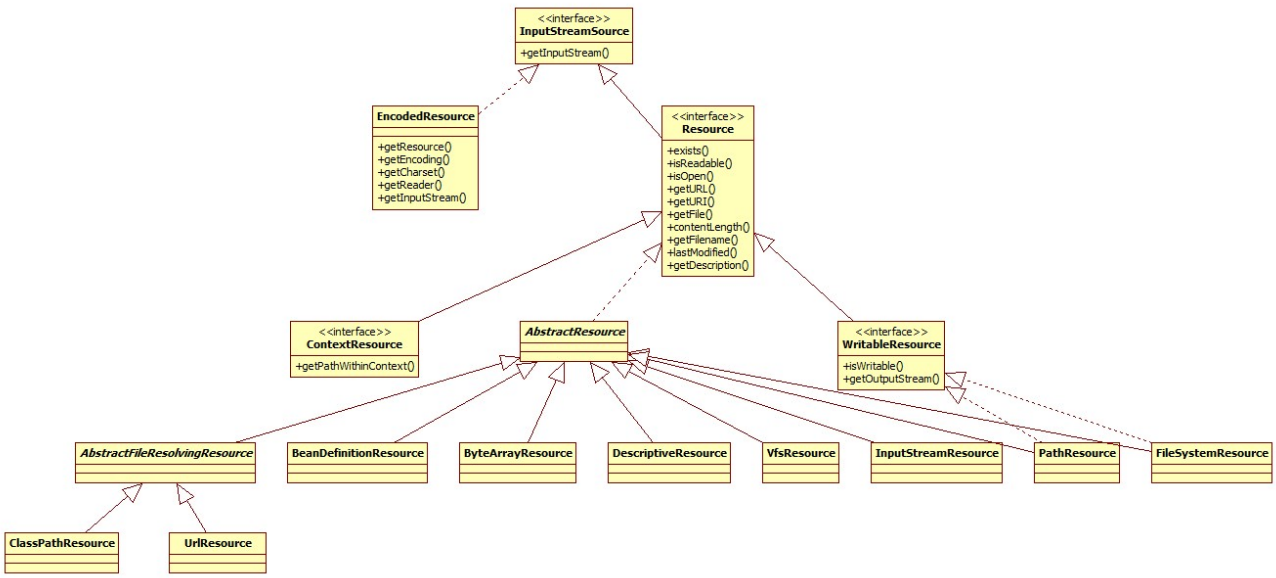
入口方法在AbstractBeanDefinitionReader的217行:

```
//加载
Resource[] resources = ((ResourcePatternResolver)
resourceLoader).getResources(location);
//解析
int loadCount = loadBeanDefinitions(resources);
```

最终逐个调用XmlBeanDefinitionReader的loadBeanDefinitions方法:

```
@Override
public int loadBeanDefinitions(Resource resource) {
    return loadBeanDefinitions(new EncodedResource(resource));
}
```

Resource是代表一种资源的接口，其类图:



EncodedResource扮演的其实是一个装饰器的模式，为InputStreamSource添加了字符编码(虽然默认为null)。这样为我们自定义xml配置文件的编码方式提供了机会。

之后关键的源码只有两行:

```
public int loadBeanDefinitions(EncodedResource encodedResource) throws
BeanDefinitionStoreException {
    InputStream inputStream = encodedResource.getResource().getInputStream();
    InputSource inputSource = new InputSource(inputStream);
    return doLoadBeanDefinitions(inputSource, encodedResource.getResource());
}
```

InputSource是org.xml.sax的类。

doLoadBeanDefinitions：

```
protected int doLoadBeanDefinitions(InputSource inputSource, Resource resource) {
    Document doc = doLoadDocument(inputSource, resource);
    return registerBeanDefinitions(doc, resource);
}
```

doLoadDocument:

```
protected Document doLoadDocument(InputSource inputSource, Resource resource) {
    return this.documentLoader.loadDocument(inputSource, getEntityResolver(),
this.errorHandler,
        getValidationModeForResource(resource), isNamespaceAware());
}
```

documentLoader是一个DefaultDocumentLoader对象，此类是DocumentLoader接口的唯一实现。getEntityResolver方法返回ResourceEntityResolver，上面说过了。errorHandler是一个SimpleSaxErrorHandler对象。

校验模型其实就是确定xml文件使用xsd方式还是dtd方式来校验，忘了的话左转度娘。Spring会通过读取xml文件的方式判断应该采用哪种。

NamespaceAware默认false，因为默认配置了校验为true。

DefaultDocumentLoader.loadDocument:

```
@Override
public Document loadDocument(InputSource inputSource, EntityResolver entityResolver,
    ErrorHandler errorHandler, int validationMode, boolean namespaceAware) {
    //这里就是老套路了，可以看出，Spring还是使用了dom的方式解析，即一次全部load到内存
    DocumentBuilderFactory factory = createDocumentBuilderFactory(validationMode,
namespaceAware);
    DocumentBuilder builder = createDocumentBuilder(factory, entityResolver,
errorHandler);
    return builder.parse(inputSource);
}
```

createDocumentBuilderFactory比较有意思:

```
protected DocumentBuilderFactory createDocumentBuilderFactory(int validationMode,
boolean namespaceAware{
    DocumentBuilderFactory factory = DocumentBuilderFactory.newInstance();
```

```
    factory.setNamespaceAware(namespaceAware);
    if (validationMode != XmlValidationModeDetector.VALIDATION_NONE) {
        //此方法设为true仅对dtd有效，xsd(schema)无效
        factory.setValidating(true);
        if (validationMode == XmlValidationModeDetector.VALIDATION_XSD) {
            // Enforce namespace aware for XSD...
             //开启xsd(schema)支持
            factory.setNamespaceAware(true);
             //这个也是Java支持Schema的套路，可以问度娘
            factory.setAttribute(SCHEMA_LANGUAGE_ATTRIBUTE, XSD_SCHEMA_LANGUAGE);
        }
    }
    return factory;
}
```

Bean解析

XmlBeanDefinitionReader.registerBeanDefinitions:

```
public int registerBeanDefinitions(Document doc, Resource resource) {
    BeanDefinitionDocumentReader documentReader = createBeanDefinitionDocumentReader();
    int countBefore = getRegistry().getBeanDefinitionCount();
    documentReader.registerBeanDefinitions(doc, createReaderContext(resource));
    return getRegistry().getBeanDefinitionCount() - countBefore;
}
```

createBeanDefinitionDocumentReader:

```
protected BeanDefinitionDocumentReader createBeanDefinitionDocumentReader() {
    return BeanDefinitionDocumentReader.class.cast
      //反射
      (BeanUtils.instantiateClass(this.documentReaderClass));
}
```

documentReaderClass默认是DefaultBeanDefinitionDocumentReader，这其实也是策略模式，通过setter方法可以更换其实现。

注意cast方法，代替了强转。

createReaderContext：

```
public XmlReaderContext createReaderContext(Resource resource) {
    return new XmlReaderContext(resource, this.problemReporter, this.eventListener,
        this.sourceExtractor, this, getNamespaceHandlerResolver());
}
```

problemReporter是一个FailFastProblemReporter对象。

eventListener是EmptyReaderEventListener对象，此类里的方法都是空实现。

sourceExtractor是NullSourceExtractor对象，直接返回空，也是空实现。

getNamespaceHandlerResolver默认返回DefaultNamespaceHandlerResolver对象，用来获取xsd对应的处理器。

XmlReaderContext的作用感觉就是这一堆参数的容器，糅合到一起传给DocumentReader，并美其名为Context。可以看出，Spring中到处都是策略模式，大量操作被抽象成接口。

DefaultBeanDefinitionDocumentReader.registerBeanDefinitions:

```
@Override
public void registerBeanDefinitions(Document doc, XmlReaderContext readerContext) {
    this.readerContext = readerContext;
    Element root = doc.getDocumentElement();
    doRegisterBeanDefinitions(root);
}
```

doRegisterBeanDefinitions:

```
protected void doRegisterBeanDefinitions(Element root) {
    BeanDefinitionParserDelegate parent = this.delegate;
    this.delegate = createDelegate(getReaderContext(), root, parent);
    //默认的命名空间即
    //http://www.springframework.org/schema/beans
    if (this.delegate.isDefaultNamespace(root)) {
        //检查profile属性
        String profileSpec = root.getAttribute(PROFILE_ATTRIBUTE);
        if (StringUtils.hasText(profileSpec)) {
            //profile属性可以以,分割
            String[] specifiedProfiles = StringUtils.tokenizeToStringArray(
                    profileSpec,
BeanDefinitionParserDelegate.MULTI_VALUE_ATTRIBUTE_DELIMITERS);
            if
(!getReaderContext().getEnvironment().acceptsProfiles(specifiedProfiles)) {
                return;
            }
        }
    }
    preProcessXml(root);
    parseBeanDefinitions(root, this.delegate);
    postProcessXml(root);
    this.delegate = parent;
}
```

delegate的作用在于处理beans标签的嵌套，其实Spring配置文件是可以写成这样的:

```
<?xml version="1.0" encoding="UTF-8"?>
<beans>
    <bean class="base.SimpleBean"></bean>
    <beans>
        <bean class="java.lang.Object"></bean>
    </beans>
</beans>
```

xml(schema)的命名空间其实类似于java的报名，命名空间采用URL，比如Spring的是这样:

```
<?xml version="1.0" encoding="UTF-8"?>
<beans xmlns="http://www.springframework.org/schema/beans"></beans>
```

xmlns属性就是xml规范定义的用来设置命名空间的。这样设置了之后其实里面的bean元素全名就相当于http://www.springframework.org/schema/beans:bean，可以有效的防止命名冲突。命名空间可以通过规范定义的org.w3c.dom.Node.getNamespaceURI方法获得。

注意一下profile的检查, AbstractEnvironment.acceptsProfiles:

```
@Override
public boolean acceptsProfiles(String... profiles) {
    Assert.notEmpty(profiles, "Must specify at least one profile");
    for (String profile : profiles) {
        if (StringUtils.hasLength(profile) && profile.charAt(0) == '!') {
            if (!isProfileActive(profile.substring(1))) {
                return true;
            }
        } else if (isProfileActive(profile)) {
            return true;
        }
    }
    return false;
}
```

原理很简单，注意从源码可以看出，**profile属性支持!取反。**

preProcessXml方法是个空实现，供子类去覆盖，**目的在于给子类一个把我们自定义的标签转为Spring标准标签的机会**, 想的真周到。

DefaultBeanDefinitionDocumentReader.parseBeanDefinitions:

```
protected void parseBeanDefinitions(Element root, BeanDefinitionParserDelegate
delegate) {
    if (delegate.isDefaultNamespace(root)) {
        NodeList nl = root.getChildNodes();
        for (int i = 0; i < nl.getLength(); i++) {
            Node node = nl.item(i);
            if (node instanceof Element) {
                Element ele = (Element) node;
                if (delegate.isDefaultNamespace(ele)) {
                    parseDefaultElement(ele, delegate);
                } else {
                    delegate.parseCustomElement(ele);
                }
            }
        }
    } else {
        delegate.parseCustomElement(root);
    }
}
```

可见，对于非默认命名空间的元素交由delegate处理。

默认命名空间解析

即import, alias, bean, 嵌套的beans四种元素。parseDefaultElement:

```
private void parseDefaultElement(Element ele, BeanDefinitionParserDelegate delegate) {
    //"import"
    if (delegate.nodeNameEquals(ele, IMPORT_ELEMENT)) {
        importBeanDefinitionResource(ele);
    }
    else if (delegate.nodeNameEquals(ele, ALIAS_ELEMENT)) {
        processAliasRegistration(ele);
    }
    else if (delegate.nodeNameEquals(ele, BEAN_ELEMENT)) {
        processBeanDefinition(ele, delegate);
    }
    else if (delegate.nodeNameEquals(ele, NESTED_BEANS_ELEMENT)) {
        // recurse
        doRegisterBeanDefinitions(ele);
    }
}
```

import

写法示例:

```
<import resource="CTIContext.xml" />
<import resource="customerContext.xml" />
```

importBeanDefinitionResource套路和之前的配置文件加载完全一样，不过注意被import进来的文件是先于当前文件 被解析的。

alias

加入有一个bean名为componentA-dataSource，但是另一个组件想以componentB-dataSource的名字使用，就可以这样定义:

```
<alias name="componentA-dataSource" alias="componentB-dataSource"/>
```

processAliasRegistration核心源码:

```
protected void processAliasRegistration(Element ele) {
    String name = ele.getAttribute(NAME_ATTRIBUTE);
    String alias = ele.getAttribute(ALIAS_ATTRIBUTE);
    getReaderContext().getRegistry().registerAlias(name, alias);
    getReaderContext().fireAliasRegistered(name, alias, extractSource(ele));
}
```

从前面的源码可以发现，registry其实就是DefaultListableBeanFactory，它实现了BeanDefinitionRegistry接口。registerAlias方法的实现在SimpleAliasRegistry:

```
@Override
public void registerAlias(String name, String alias) {
    Assert.hasText(name, "'name' must not be empty");
    Assert.hasText(alias, "'alias' must not be empty");
    //名字和别名一样
    if (alias.equals(name)) {
        //ConcurrentHashMap
        this.aliasMap.remove(alias);
    } else {
        String registeredName = this.aliasMap.get(alias);
        if (registeredName != null) {
            if (registeredName.equals(name)) {
                // An existing alias - no need to re-register
                return;
            }
            if (!allowAliasOverriding()) {
                throw new IllegalStateException
                    ("Cannot register alias '" + alias + "' for name '" +
                    name + "': It is already registered for name '" + registeredName +
"'.");
            }
        }
        checkForAliasCircle(name, alias);
        this.aliasMap.put(alias, name);
    }
}
```

所以别名关系的保存使用Map完成，key为别名，value为本来的名字。

bean

bean节点是Spring最最常见的节点了。

DefaultBeanDefinitionDocumentReader.processBeanDefinition:

```
protected void processBeanDefinition(Element ele, BeanDefinitionParserDelegate
delegate) {
    BeanDefinitionHolder bdHolder = delegate.parseBeanDefinitionElement(ele);
    if (bdHolder != null) {
        bdHolder = delegate.decorateBeanDefinitionIfRequired(ele, bdHolder);
        try {
            // Register the final decorated instance.
            BeanDefinitionReaderUtils.registerBeanDefinition
                (bdHolder, getReaderContext().getRegistry());
        }
        catch (BeanDefinitionStoreException ex) {
            getReaderContext().error("Failed to register bean definition with name '" +
                    bdHolder.getBeanName() + "'", ele, ex);
        }
        // Send registration event.
        getReaderContext().fireComponentRegistered(new
BeanComponentDefinition(bdHolder));
    }
```

```
}
```

id & name处理

最终调用BeanDefinitionParserDelegate.parseBeanDefinitionElement(Element ele, BeanDefinition containingBean)，源码较长，分部分说明。

首先获取到id和name属性，**name属性支持配置多个，以逗号分隔，如果没有指定id，那么将以第一个name属性值代替。id必须是唯一的，name属性其实是alias的角色，可以和其它的bean重复，如果name也没有配置，那么其实什么也没做。**

```
String id = ele.getAttribute(ID_ATTRIBUTE);
String nameAttr = ele.getAttribute(NAME_ATTRIBUTE);
List<String> aliases = new ArrayList<String>();
if (StringUtils.hasLength(nameAttr)) {
    //按,分隔
    String[] nameArr = StringUtils.tokenizeToStringArray
        (nameAttr, MULTI_VALUE_ATTRIBUTE_DELIMITERS);
    aliases.addAll(Arrays.asList(nameArr));
}
String beanName = id;
if (!StringUtils.hasText(beanName) && !aliases.isEmpty()) {
    //name的第一个值作为id
    beanName = aliases.remove(0);
}
//默认null
if (containingBean == null) {
    //校验id是否已重复，如果重复直接抛异常
    //校验是通过内部一个HashSet完成的，出现过的id都会保存进此Set
    checkNameUniqueness(beanName, aliases, ele);
}
```

beanName生成

如果name和id属性都没有指定，那么Spring会自己生成一个，BeanDefinitionParserDelegate.parseBeanDefinitionElement:

```
beanName = this.readerContext.generateBeanName(beanDefinition);
String beanClassName = beanDefinition.getBeanClassName();
aliases.add(beanClassName);
```

可见，Spring同时会把类名作为其别名。

最终调用的是BeanDefinitionReaderUtils.generateBeanName:

```
public static String generateBeanName(
        BeanDefinition definition, BeanDefinitionRegistry registry, boolean
isInnerBean) {
    String generatedBeanName = definition.getBeanClassName();
    if (generatedBeanName == null) {
        if (definition.getParentName() != null) {
            generatedBeanName = definition.getParentName() + "$child";
```

```
                //工厂方法产生的bean
            } else if (definition.getFactoryBeanName() != null) {
                generatedBeanName = definition.getFactoryBeanName() + "$created";
            }
        }
        String id = generatedBeanName;
        if (isInnerBean) {
            // Inner bean: generate identity hashcode suffix.
            id = generatedBeanName + GENERATED_BEAN_NAME_SEPARATOR +
                ObjectUtils.getIdentityHexString(definition);
        } else {
            // Top-level bean: use plain class name.
            // Increase counter until the id is unique.
            int counter = -1;
             //用类名#自增的数字命名
            while (counter == -1 || registry.containsBeanDefinition(id)) {
                counter++;
                id = generatedBeanName + GENERATED_BEAN_NAME_SEPARATOR + counter;
            }
        }
        return id;
    }
```

bean解析

还是分部分说明(parseBeanDefinitionElement)。

首先获取到bean的class属性和parent属性，配置了parent之后，当前bean会继承父bean的属性。之后根据class和parent创建BeanDefinition对象。

```
String className = null;
if (ele.hasAttribute(CLASS_ATTRIBUTE)) {
    className = ele.getAttribute(CLASS_ATTRIBUTE).trim();
}
String parent = null;
if (ele.hasAttribute(PARENT_ATTRIBUTE)) {
    parent = ele.getAttribute(PARENT_ATTRIBUTE);
}
AbstractBeanDefinition bd = createBeanDefinition(className, parent);
```

BeanDefinition的创建在BeanDefinitionReaderUtils.createBeanDefinition:

```
public static AbstractBeanDefinition createBeanDefinition(
        String parentName, String className, ClassLoader classLoader) {
    GenericBeanDefinition bd = new GenericBeanDefinition();
    bd.setParentName(parentName);
    if (className != null) {
        if (classLoader != null) {
            bd.setBeanClass(ClassUtils.forName(className, classLoader));
        }
        else {
            bd.setBeanClassName(className);
        }
```

```
        }
        return bd;
    }
```

之后是解析bean的其它属性，其实就是读取其配置，调用相应的setter方法保存在BeanDefinition中:

```
parseBeanDefinitionAttributes(ele, beanName, containingBean, bd);
```

之后解析bean的decription子元素:

```
<bean id="b" name="one, two" class="base.SimpleBean">
    <description>SimpleBean</description>
</bean>
```

就仅仅是个描述。

然后是meta子元素的解析，meta元素在xml配置文件里是这样的:

```
<bean id="b" name="one, two" class="base.SimpleBean">
    <meta key="name" value="skywalker"/>
</bean>
```

注释上说，这样可以将任意的元数据附到对应的bean definition上。解析过程源码:

```
public void parseMetaElements(Element ele, BeanMetadataAttributeAccessor
attributeAccessor) {
    NodeList nl = ele.getChildNodes();
    for (int i = 0; i < nl.getLength(); i++) {
        Node node = nl.item(i);
        if (isCandidateElement(node) && nodeNameEquals(node, META_ELEMENT)) {
            Element metaElement = (Element) node;
            String key = metaElement.getAttribute(KEY_ATTRIBUTE);
            String value = metaElement.getAttribute(VALUE_ATTRIBUTE);
             //就是一个key, value的载体，无他
            BeanMetadataAttribute attribute = new BeanMetadataAttribute(key, value);
             //sourceExtractor默认是NullSourceExtractor，返回的是空
            attribute.setSource(extractSource(metaElement));
            attributeAccessor.addMetadataAttribute(attribute);
        }
    }
}
```

AbstractBeanDefinition继承自BeanMetadataAttributeAccessor类，底层使用了一个LinkedHashMap保存metadata。这个metadata具体是做什么暂时还不知道。

lookup-method解析:

此标签的作用在于当一个bean的某个方法被设置为lookup-method后，**每次调用此方法时，都会返回一个新的指定bean的对象**。用法示例:

```
<bean id="apple" class="cn.com.willchen.test.di.Apple" scope="prototype"/>
<!--水果盘-->
<bean id="fruitPlate" class="cn.com.willchen.test.di.FruitPlate">
    <lookup-method name="getFruit" bean="apple"/>
</bean>
```

数据保存在Set中，对应的类是MethodOverrides。可以参考:

Spring - lookup-method方式实现依赖注入

replace-mothod解析:

此标签用于替换bean里面的特定的方法实现，替换者必须实现Spring的MethodReplacer接口，有点像aop的意思。

配置文件示例:

```
<bean name="replacer" class="springroad.deomo.chap4.MethodReplace" />
<bean name="testBean" class="springroad.deomo.chap4.LookupMethodBean">
    <replaced-method name="test" replacer="replacer">
        <arg-type match="String" />
    </replaced-method>
</bean>
```

arg-type的作用是指定替换方法的参数类型，因为接口的定义参数都是Object的。参考: SPRING.NET 1.3.2 学习20--方法注入之替换方法注入

解析之后将数据放在ReplaceOverride对象中，里面有一个LinkedList专门用于保存arg-type。

构造参数(constructor-arg)解析:

作用一目了然，使用示例:

```
<bean class="base.SimpleBean">
    <constructor-arg>
        <value type="java.lang.String">Cat</value>
    </constructor-arg>
</bean>
```

type一般不需要指定，除了泛型集合那种。除此之外，constructor-arg还支持name, index, ref等属性，可以具体的指定参数的位置等。构造参数解析后保存在BeanDefinition内部一个ConstructorArgumentValues对象中。如果设置了index属性，那么以Map<Integer, ValueHolder>的形式保存，反之，以List的形式保存。

property解析:

非常常用的标签，用以为bean的属性赋值，支持value和ref两种形式，示例:

```
<bean class="base.SimpleBean">
    <property name="name" value="skywalker" />
</bean>
```

value和ref属性不能同时出现，如果是ref，那么将其值保存在不可变的RuntimeBeanReference对象中，其实现了BeanReference接口，此接口只有一个getBeanName方法。如果是value，那么将其值保存在TypedStringValue对象中。最终将对象保存在BeanDefinition内部一个MutablePropertyValues对象中(内部以ArrayList实现)。

qualifier解析:

配置示例:

```
<bean class="base.Student">
    <property name="name" value="skywalker"></property>
    <property name="age" value="12"></property>
    <qualifier type="org.springframework.beans.factory.annotation.Qualifier"
value="student" />
</bean>
<bean class="base.Student">
    <property name="name" value="seaswalker"></property>
    <property name="age" value="15"></property>
    <qualifier value="student_2"></qualifier>
</bean>
<bean class="base.SimpleBean" />
```

SimpleBean部分源码:

```
@Autowired
@Qualifier("student")
private Student student;
```

此标签和@Qualifier, @Autowired两个注解一起使用才有作用。@Autowired注解采用按类型查找的方式进行注入，如果找到多个需要类型的bean便会报错，有了@Qualifier标签就可以再按照此注解指定的名称查找。两者结合相当于实现了按类型+名称注入。type属性可以不指定，因为默认就是那个。qualifier标签可以有attribute子元素，比如:

```
<qualifier type="org.springframework.beans.factory.annotation.Qualifier"
value="student">
    <attribute key="id" value="1"/>
</qualifier>
```

貌似是用来在qualifier也区分不开的时候使用。attribute键值对保存在BeanMetadataAttribute对象中。整个qualifier保存在AutowireCandidateQualifier对象中。

Bean装饰

这部分是针对其它schema的属性以及子节点，比如:

```
<bean class="base.Student" primary="true">
    <context:property-override />
</bean>
```

没见过这种用法，留个坑。

Bean注册

BeanDefinitionReaderUtils.registerBeanDefinition:

```
public static void registerBeanDefinition(
    BeanDefinitionHolder definitionHolder, BeanDefinitionRegistry registry) {
    // Register bean definition under primary name.
    String beanName = definitionHolder.getBeanName();
    registry.registerBeanDefinition(beanName, definitionHolder.getBeanDefinition());
    // Register aliases for bean name, if any.
    String[] aliases = definitionHolder.getAliases();
    if (aliases != null) {
        for (String alias : aliases) {
            registry.registerAlias(beanName, alias);
        }
    }
}
```

registry其实就是DefaultListableBeanFactory对象，registerBeanDefinition方法主要就干了这么两件事:

```
@Override
public void registerBeanDefinition(String beanName, BeanDefinition beanDefinition) {
    this.beanDefinitionMap.put(beanName, beanDefinition);
    this.beanDefinitionNames.add(beanName);
}
```

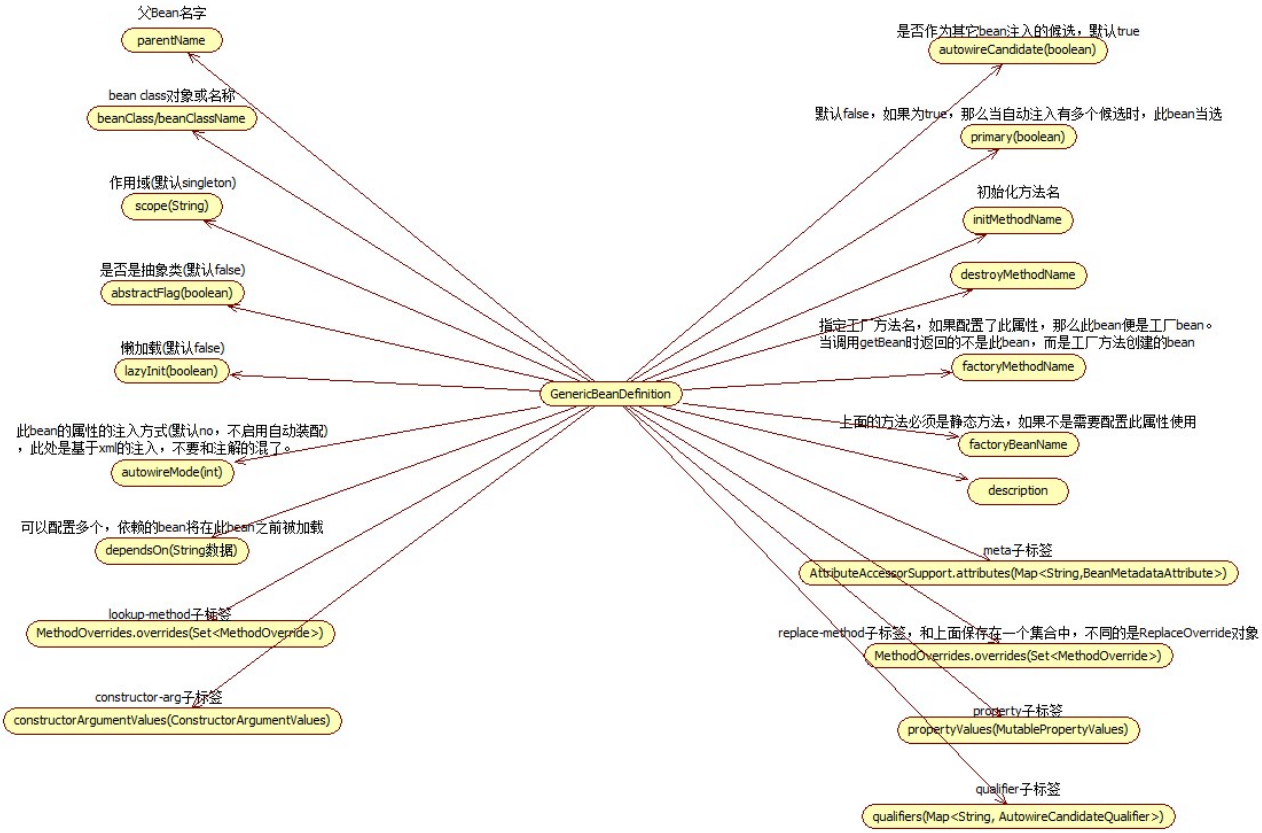
一个是Map，另一个是List，一目了然。registerAlias方法的实现在其父类SimpleAliasRegistry，就是把键值对放在了一个ConcurrentHashMap里。

ComponentRegistered事件触发:

默认是个空实现，前面说过了。

BeanDefiniton数据结构

BeanDefiniton数据结构如下图:



beans

beans元素的嵌套直接递归调用DefaultBeanDefinitionDocumentReader.parseBeanDefinitions。

其它命名空间解析

入口在DefaultBeanDefinitionDocumentReader.parseBeanDefinitions->BeanDefinitionParserDelegate.parseCustomElement(第二个参数为空):

```
public BeanDefinition parseCustomElement(Element ele, BeanDefinition containingBd) {
    String namespaceUri = getNamespaceURI(ele);
    NamespaceHandler handler =
this.readerContext.getNamespaceHandlerResolver().resolve(namespaceUri);
    return handler.parse(ele, new ParserContext(this.readerContext, this,
containingBd));
}
```

NamespaceHandlerResolver由XmlBeanDefinitionReader初始化，是一个DefaultNamespaceHandlerResolver对象，也是NamespaceHandlerResolver接口的唯一实现。

其resolve方法:

```
@Override
public NamespaceHandler resolve(String namespaceUri) {
    Map<String, Object> handlerMappings = getHandlerMappings();
    Object handlerOrClassName = handlerMappings.get(namespaceUri);
    if (handlerOrClassName == null) {
        return null;
```

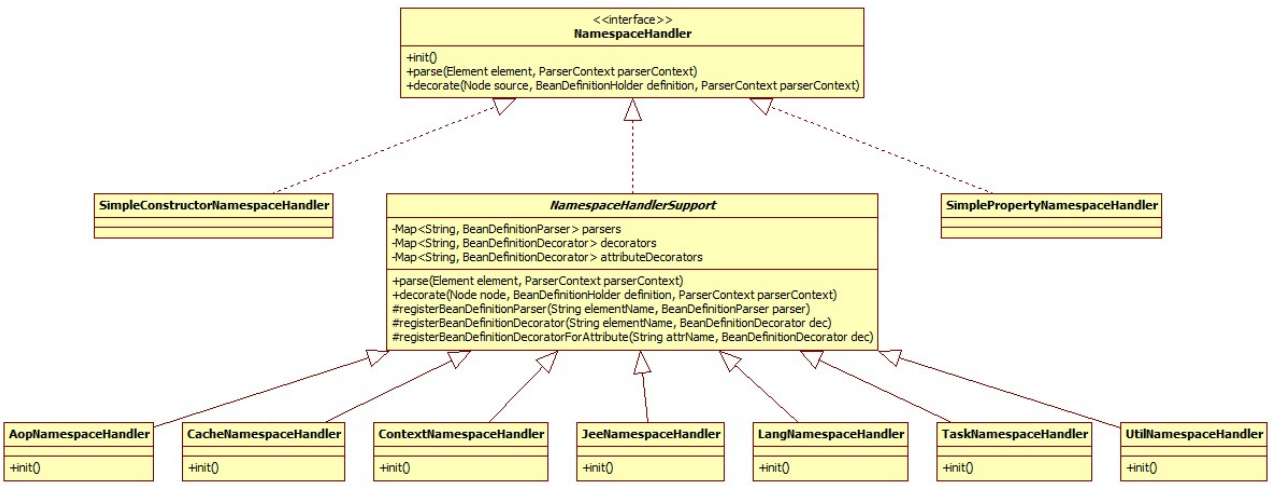
```
    } else if (handlerOrClassName instanceof NamespaceHandler) {
        return (NamespaceHandler) handlerOrClassName;
    } else {
        String className = (String) handlerOrClassName;
        Class<?> handlerClass = ClassUtils.forName(className, this.classLoader);
        NamespaceHandler namespaceHandler = (NamespaceHandler)
BeanUtils.instantiateClass(handlerClass);
        namespaceHandler.init();
        handlerMappings.put(namespaceUri, namespaceHandler);
        return namespaceHandler;
    }
}
```

容易看出，Spring其实使用了一个Map了保存其映射关系，key就是命名空间的uri，value是**NamespaceHandler对象或是Class完整名，如果发现是类名，那么用反射的方法进行初始化，如果是NamespaceHandler对象，那么直接返回。**

NamespaceHandler映射关系来自于各个Spring jar包下的META-INF/spring.handlers文件，以spring-context包为例:

```
http\://www.springframework.org/schema/context=org.springframework.context.config.Conte
xtNamespaceHandler
http\://www.springframework.org/schema/jee=org.springframework.ejb.config.JeeNamespaceH
andler
http\://www.springframework.org/schema/lang=org.springframework.scripting.config.LangNa
mespaceHandler
http\://www.springframework.org/schema/task=org.springframework.scheduling.config.TaskN
amespaceHandler
http\://www.springframework.org/schema/cache=org.springframework.cache.config.CacheName
spaceHandler
```

NamespaceHandler继承体系



init

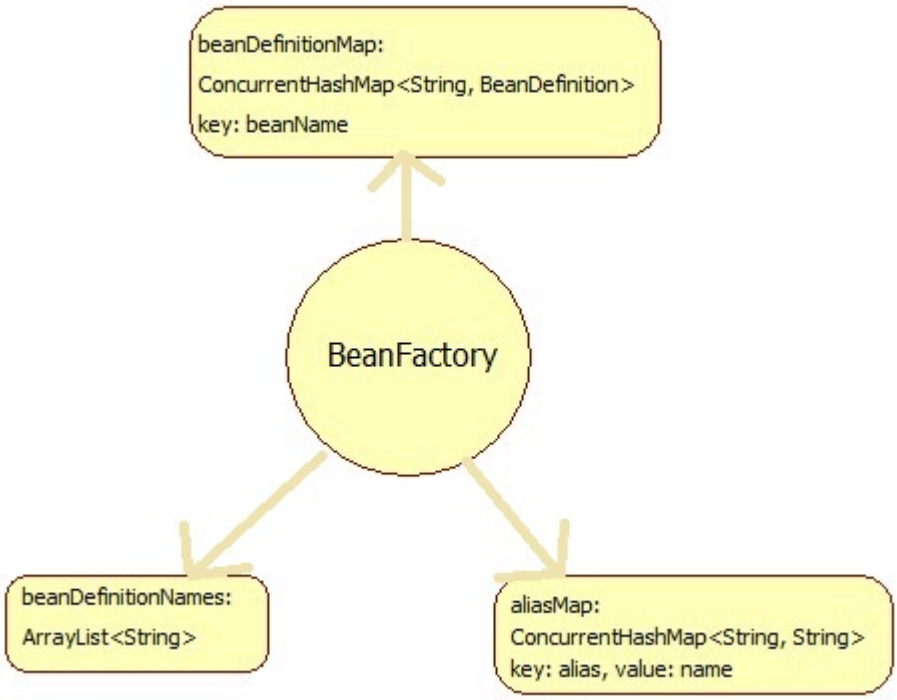
resolve中调用了其init方法，此方法用以向NamespaceHandler对象注册BeanDefinitionParser对象。**此接口用以解析顶层(beans下)的非默认命名空间元素，比如** `<context:annotation-config />` **。**

所以这样逻辑就很容易理解了: **每种子标签的解析仍是策略模式的体现，init负责向父类NamespaceHandlerSupport注册不同的策略，由父类的NamespaceHandlerSupport.parse方法根据具体的子标签调用相应的策略完成解析的过程。**

此部分较为重要，所以重新开始大纲。

BeanFactory数据结构

BeanDefinition在BeanFactory中的主要数据结构如下图:



prepareBeanFactory

此方法负责对BeanFactory进行一些特征的设置工作，"特征"包含这么几个方面:

BeanExpressionResolver

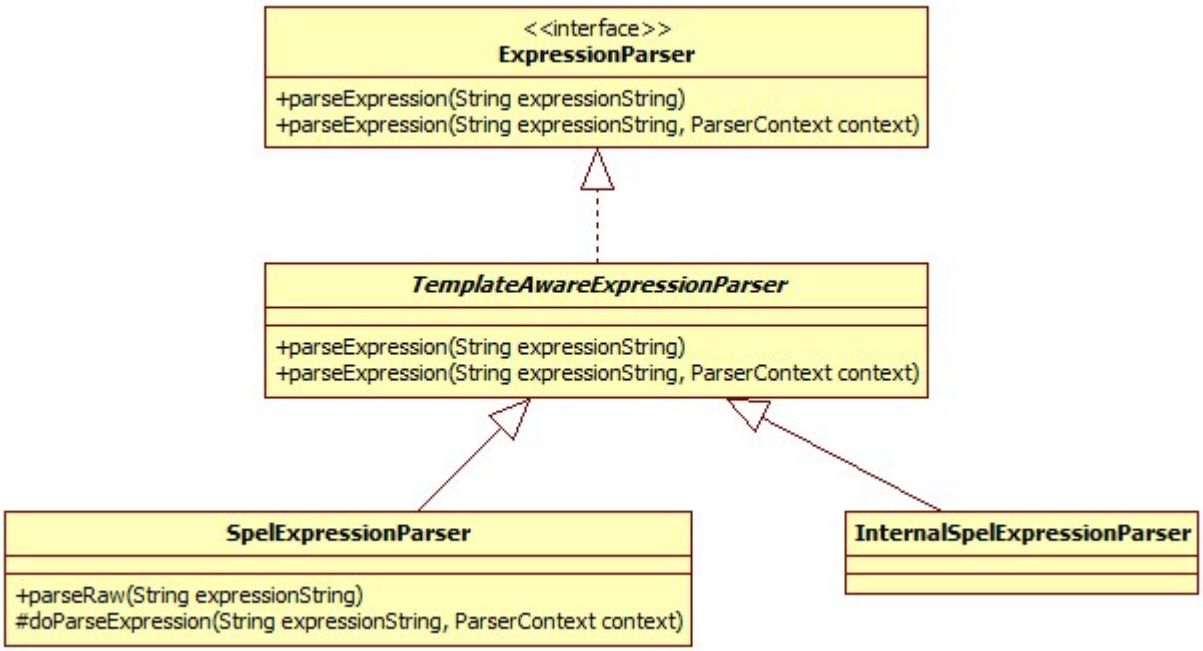
此接口只有一个实现: StandardBeanExpressionResolver。接口只含有一个方法:

```
Object evaluate(String value, BeanExpressionContext evalContext)
```

prepareBeanFactory将一个此对象放入BeanFactory:

```
beanFactory.setBeanExpressionResolver(new
StandardBeanExpressionResolver(beanFactory.getBeanClassLoader()));
```

StandardBeanExpressionResolver对象内部有一个关键的成员: SpelExpressionParser,其整个类图:



这便是Spring3.0开始出现的Spel表达式的解释器。

PropertyEditorRegistrar

此接口用于向Spring注册java.beans.PropertyEditor，只有一个方法:

```
registerCustomEditors(PropertyEditorRegistry registry)
```

实现也只有一个: ResourceEditorRegistrar。

在编写xml配置时，我们设置的值都是字符串形式，所以在使用时肯定需要转为我们需要的类型，PropertyEditor接口正是定义了这么个东西。

prepareBeanFactory:

```
beanFactory.addPropertyEditorRegistrar(new ResourceEditorRegistrar(this,
getEnvironment()));
```

BeanFactory也暴露了registerCustomEditors方法用以添加自定义的转换器，所以这个地方是组合模式的体现。

我们有两种方式可以添加自定义PropertyEditor:

- 通过`context.getBeanFactory().registerCustomEditor`
- 通过Spring配置文件:

```
<bean class="org.springframework.beans.factory.config.CustomEditorConfigurer">
  <property name="customEditors">
          <map>
              <entry key="base.Cat" value="base.CatEditor" />
      </map>
  </property>
</bean>
```

参考: 深入理解JavaBean(2)：属性编辑器PropertyEditor

环境注入

在Spring中我们自己的bean可以通过实现EnvironmentAware等一系列Aware接口获取到Spring内部的一些对象。prepareBeanFactory:

```
beanFactory.addBeanPostProcessor(new ApplicationContextAwareProcessor(this));
```

ApplicationContextAwareProcessor核心的invokeAwareInterfaces方法:

```
private void invokeAwareInterfaces(Object bean) {
    if (bean instanceof Aware) {
        if (bean instanceof EnvironmentAware) {
            ((EnvironmentAware)
bean).setEnvironment(this.applicationContext.getEnvironment());
        }
        if (bean instanceof EmbeddedValueResolverAware) {
            ((EmbeddedValueResolverAware)
bean).setEmbeddedValueResolver(this.embeddedValueResolver);
        }
        //....
    }
}
```

依赖解析忽略

此部分设置哪些接口在进行依赖注入的时候应该被忽略:

```
beanFactory.ignoreDependencyInterface(ResourceLoaderAware.class);
beanFactory.ignoreDependencyInterface(ApplicationEventPublisherAware.class);
beanFactory.ignoreDependencyInterface(MessageSourceAware.class);
beanFactory.ignoreDependencyInterface(ApplicationContextAware.class);
beanFactory.ignoreDependencyInterface(EnvironmentAware.class);
```

bean伪装

有些对象并不在BeanFactory中，但是我们依然想让它们可以被装配，这就需要伪装一下:

```
beanFactory.registerResolvableDependency(BeanFactory.class, beanFactory);
beanFactory.registerResolvableDependency(ResourceLoader.class, this);
beanFactory.registerResolvableDependency(ApplicationEventPublisher.class, this);
beanFactory.registerResolvableDependency(ApplicationContext.class, this);
```

伪装关系保存在一个Map<Class<?>, Object>里。

LoadTimeWeaver

如果配置了此bean，那么:

```
if (beanFactory.containsBean(LOAD_TIME_WEAVER_BEAN_NAME)) {
    beanFactory.addBeanPostProcessor(new LoadTimeWeaverAwareProcessor(beanFactory));
    // Set a temporary ClassLoader for type matching.
    beanFactory.setTempClassLoader(new
ContextTypeMatchClassLoader(beanFactory.getBeanClassLoader()));
}
```

这个东西具体是干什么的在后面context:load-time-weaver中说明。

注册环境

源码:

```
if (!beanFactory.containsLocalBean(ENVIRONMENT_BEAN_NAME)) {
    beanFactory.registerSingleton(ENVIRONMENT_BEAN_NAME, getEnvironment());
}
if (!beanFactory.containsLocalBean(SYSTEM_PROPERTIES_BEAN_NAME)) {
    beanFactory.registerSingleton(SYSTEM_PROPERTIES_BEAN_NAME,
getEnvironment().getSystemProperties());
}
if (!beanFactory.containsLocalBean(SYSTEM_ENVIRONMENT_BEAN_NAME)) {
    beanFactory.registerSingleton(SYSTEM_ENVIRONMENT_BEAN_NAME, getEnvironment().
        getSystemEnvironment());
}
```

containsLocalBean特殊之处在于不会去父BeanFactory寻找。

postProcessBeanFactory

此方法允许子类在所有的bean尚未初始化之前注册BeanPostProcessor。空实现且没有子类覆盖。

invokeBeanFactoryPostProcessors

BeanFactoryPostProcessor接口允许我们在bean正是初始化之前改变其值。此接口只有一个方法:

```
void postProcessBeanFactory(ConfigurableListableBeanFactory beanFactory);
```

有两种方式可以向Spring添加此对象:

- 通过代码的方式:

  ```
  context.addBeanFactoryPostProcessor
  ```

- 通过xml配置的方式:

  ```
  <bean class="base.SimpleBeanFactoryPostProcessor" />
  ```

注意此时尚未进行bean的初始化工作，初始化是在后面的finishBeanFactoryInitialization进行的，所以在BeanFactoryPostProcessor对象中获取bean会导致提前初始化。

此方法的关键源码:

```
protected void invokeBeanFactoryPostProcessors(ConfigurableListableBeanFactory
beanFactory) {
    PostProcessorRegistrationDelegate.invokeBeanFactoryPostProcessors(beanFactory,
        getBeanFactoryPostProcessors());
}
```

getBeanFactoryPostProcessors获取的就是AbstractApplicationContext的成员beanFactoryPostProcessors(ArrayList)，但是很有意思，**只有通过context.addBeanFactoryPostProcessor这种方式添加的才会出现在这个List里，所以对于xml配置方式，此List其实没有任何元素。玄机就在PostProcessorRegistrationDelegate里。**

核心思想就是使用BeanFactory的getBeanNamesForType方法获取相应的BeanDefinition的name数组，之后逐一调用getBean方法获取到bean(初始化)，getBean方法后面再说。

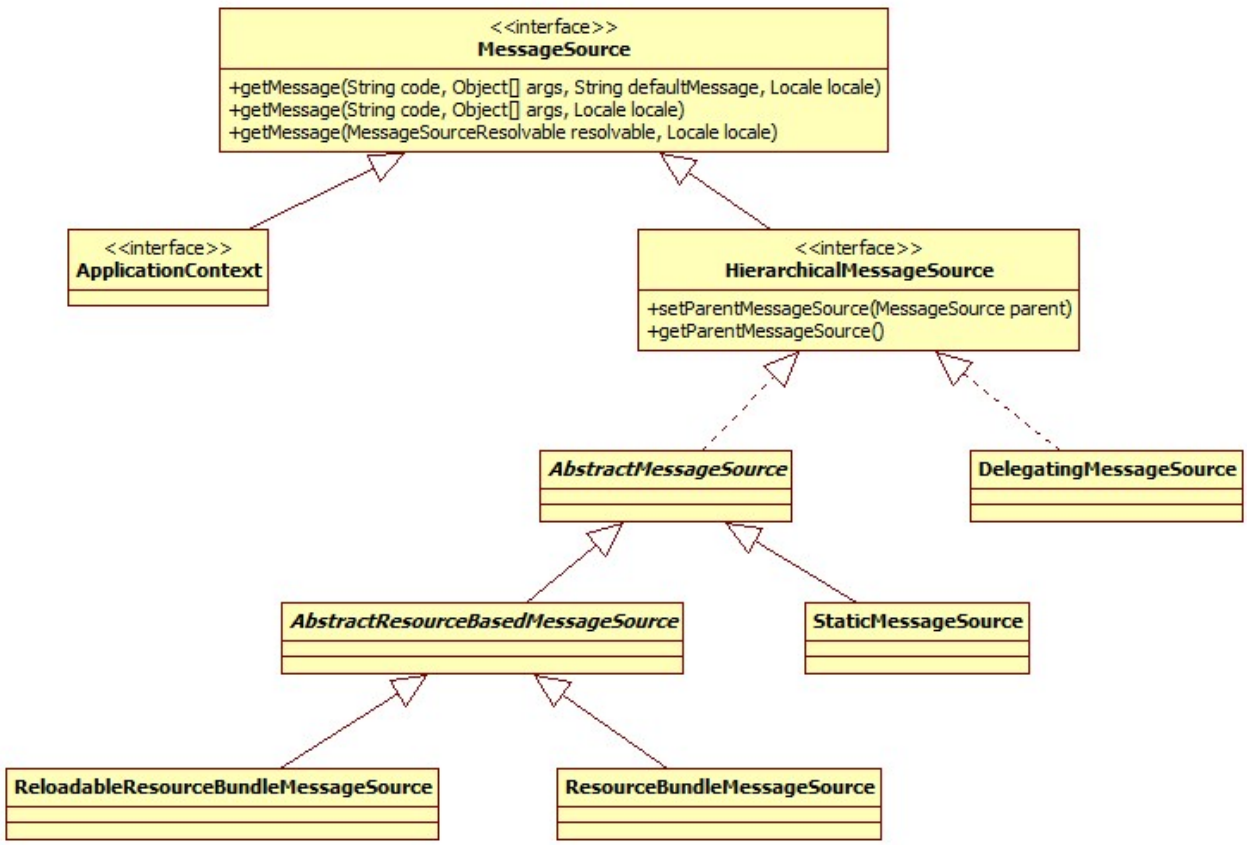
注意此处有一个优先级的概念，如果你的BeanFactoryPostProcessor同时实现了Ordered或者是PriorityOrdered接口，那么会被首先执行。

BeanPostProcessor注册

此部分实质上是在BeanDefinitions中寻找BeanPostProcessor，之后调用BeanFactory.addBeanPostProcessor方法保存在一个List中，注意添加时仍然有优先级的概念，优先级高的在前面。

MessageSource

此接口用以支持Spring国际化。继承体系如下:



AbstractApplicationContext的initMessageSource()方法就是在BeanFactory中查找MessageSource的bean，如果配置了此bean，那么调用getBean方法完成其初始化并将其保存在AbstractApplicationContext内部messageSource成员变量中，用以处理ApplicationContext的getMessage调用，因为从继承体系上来看，ApplicationContext是MessageSource的子类，此处是委托模式的体现。如果没有配置此bean，那么初始化一个DelegatingMessageSource对象，此类是一个空实现，同样用以处理getMessage调用请求。

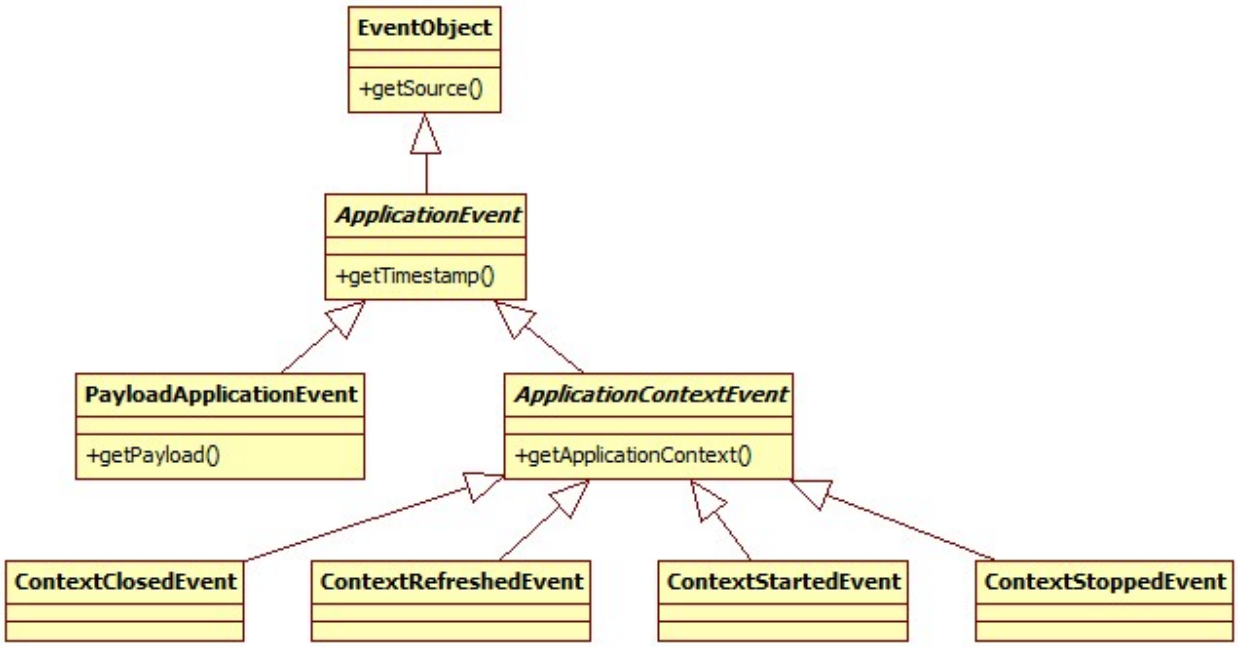
参考: 学习Spring必学的Java基础知识(8)----国际化信息

事件驱动

此接口代表了Spring的事件驱动(监听器)模式。一个事件驱动包含三部分:

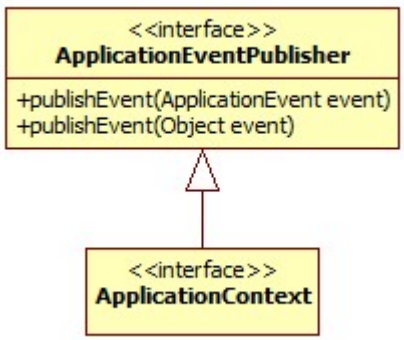
事件

java的所有事件对象一般都是java.util.EventObject的子类，Spring的整个继承体系如下:



发布者

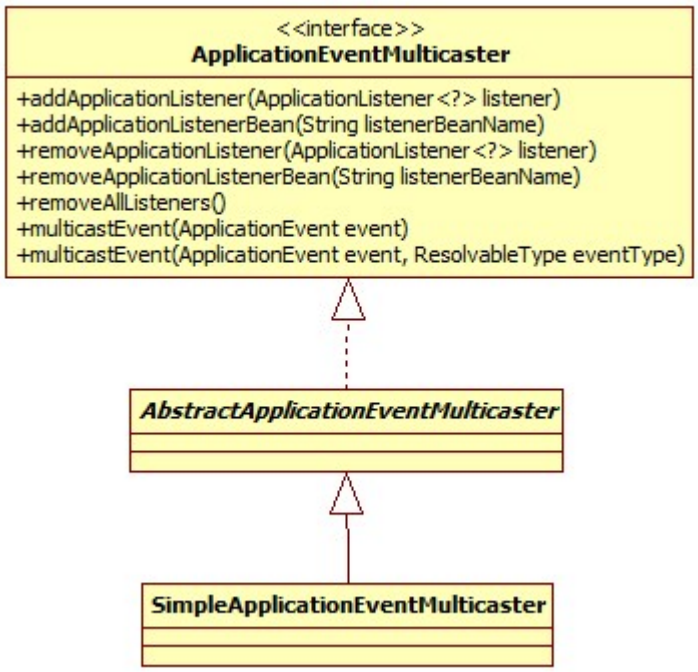
ApplicationEventPublisher



一目了然。

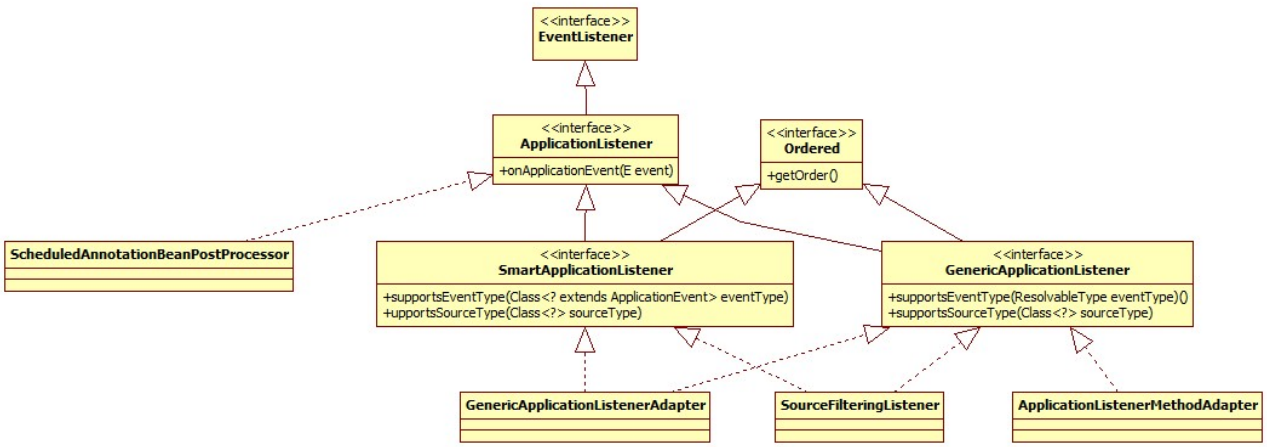
ApplicationEventMulticaster

ApplicationEventPublisher实际上正是将请求委托给ApplicationEventMulticaster来实现的。其继承体系:



监听器

所有的监听器是jdk EventListener的子类，这是一个mark接口。继承体系:



可以看出SmartApplicationListener和GenericApplicationListener是高度相似的，都提供了事件类型检测和顺序机制，而后者是从Spring4.2加入的，Spring官方文档推荐使用后者代替前者。

初始化

前面说过ApplicationEventPublisher是通过委托给ApplicationEventMulticaster实现的，所以refresh方法中完成的是对ApplicationEventMulticaster的初始化:

```
// Initialize event multicaster for this context.
initApplicationEventMulticaster();
```

initApplicationEventMulticaster则首先在BeanFactory中寻找ApplicationEventMulticaster的bean，如果找到，那么调用getBean方法将其初始化，如果找不到那么使用SimpleApplicationEventMulticaster。

事件发布

AbstractApplicationContext.publishEvent核心代码:

```
protected void publishEvent(Object event, ResolvableType eventType) {
    getApplicationEventMulticaster().multicastEvent(applicationEvent, eventType);
}
```

SimpleApplicationEventMulticaster.multicastEvent:

```
@Override
public void multicastEvent(final ApplicationEvent event, ResolvableType eventType) {
    ResolvableType type = (eventType != null ? eventType :
resolveDefaultEventType(event));
    for (final ApplicationListener<?> listener : getApplicationListeners(event, type))
{
        Executor executor = getTaskExecutor();
        if (executor != null) {
            executor.execute(new Runnable() {
                @Override
                public void run() {
                    invokeListener(listener, event);
                }
            });
        } else {
            invokeListener(listener, event);
        }
    }
}
```

监听器获取

获取当然还是通过beanFactory的getBean来完成的，值得注意的是Spring在此处使用了缓存(ConcurrentHashMap)来加速查找的过程。

同步/异步

可以看出，如果executor不为空，那么监听器的执行实际上是异步的。那么如何配置同步/异步呢?

全局

```
<task:executor id="multicasterExecutor" pool-size="3"/>
<bean class="org.springframework.context.event.SimpleApplicationEventMulticaster">
    <property name="taskExecutor" ref="multicasterExecutor"></property>
</bean>
```

task schema是Spring从3.0开始加入的，使我们可以不再依赖于Quartz实现定时任务，源码在org.springframework.core.task包下，使用需要引入schema：

```
xmlns:task="http://www.springframework.org/schema/task"
xsi:schemaLocation="http://www.springframework.org/schema/task
http://www.springframework.org/schema/task/spring-task-4.0.xsd"
```

可以参考: Spring定时任务的几种实现

注解

开启注解支持:

```
<!-- 开启@AspectJ AOP代理 -->
<aop:aspectj-autoproxy proxy-target-class="true"/>
<!-- 任务调度器 -->
<task:scheduler id="scheduler" pool-size="10"/>
<!-- 任务执行器 -->
<task:executor id="executor" pool-size="10"/>
<!--开启注解调度支持 @Async @Scheduled-->
<task:annotation-driven executor="executor" scheduler="scheduler" proxy-target-
class="true"/>
```

在代码中使用示例:

```
@Component
public class EmailRegisterListener implements ApplicationListener<RegisterEvent> {
    @Async
    @Override
    public void onApplicationEvent(final RegisterEvent event) {
        System.out.println("注册成功，发送确认邮件给：" +
((User)event.getSource()).getUsername());
    }
}
```

参考: 详解Spring事件驱动模型

onRefresh

这又是一个模版方法，允许子类在进行bean初始化之前进行一些定制操作。默认空实现。

ApplicationListener注册

registerListeners方法干的，没什么好说的。

singleton初始化

finishBeanFactoryInitialization：

```
protected void finishBeanFactoryInitialization(ConfigurableListableBeanFactory
beanFactory) {
    if (beanFactory.containsBean(CONVERSION_SERVICE_BEAN_NAME) &&
            beanFactory.isTypeMatch(CONVERSION_SERVICE_BEAN_NAME,
ConversionService.class)) {
```

```
        beanFactory.setConversionService(
                beanFactory.getBean(CONVERSION_SERVICE_BEAN_NAME,
ConversionService.class));
    }
    if (!beanFactory.hasEmbeddedValueResolver()) {
        beanFactory.addEmbeddedValueResolver(new StringValueResolver() {
            @Override
            public String resolveStringValue(String strVal) {
                return getEnvironment().resolvePlaceholders(strVal);
            }
        });
    }
    String[] weaverAwareNames = beanFactory.getBeanNamesForType
        (LoadTimeWeaverAware.class, false, false);
    for (String weaverAwareName : weaverAwareNames) {
        getBean(weaverAwareName);
    }
    // Allow for caching all bean definition metadata, not expecting further changes.
    beanFactory.freezeConfiguration();
    // Instantiate all remaining (non-lazy-init) singletons.
    beanFactory.preInstantiateSingletons();
}
```

分部分说明。

ConversionService

此接口用于类型之间的转换，在Spring里其实就是把配置文件中的String转为其它类型，从3.0开始出现，目的和jdk的PropertyEditor接口是一样的，参考ConfigurableBeanFactory.setConversionService注释:

> Specify a Spring 3.0 ConversionService to use for converting property values, as an alternative to JavaBeans PropertyEditors. @since 3.0

StringValueResolver

用于解析注解的值。接口只定义了一个方法:

```
String resolveStringValue(String strVal);
```

LoadTimeWeaverAware

实现了此接口的bean可以得到LoadTimeWeaver，此处仅仅初始化。

初始化

DefaultListableBeanFactory.preInstantiateSingletons:

```
@Override
public void preInstantiateSingletons() throws BeansException {
    List<String> beanNames = new ArrayList<String>(this.beanDefinitionNames);
    for (String beanName : beanNames) {
        RootBeanDefinition bd = getMergedLocalBeanDefinition(beanName);
        if (!bd.isAbstract() && bd.isSingleton() && !bd.isLazyInit()) {
```

```
            if (isFactoryBean(beanName)) {
                final FactoryBean<?> factory = (FactoryBean<?>)
getBean(FACTORY_BEAN_PREFIX
                    + beanName);
                boolean isEagerInit;
                if (System.getSecurityManager() != null && factory instanceof
SmartFactoryBean) {
                    isEagerInit = AccessController.doPrivileged(new
PrivilegedAction<Boolean>() {
                        @Override
                        public Boolean run() {
                            return ((SmartFactoryBean<?>) factory).isEagerInit();
                        }
                    }, getAccessControlContext());
                }
                else {
                    isEagerInit = (factory instanceof SmartFactoryBean &&
                            ((SmartFactoryBean<?>) factory).isEagerInit());
                }
                if (isEagerInit) {
                    getBean(beanName);
                }
            }
            else {
                getBean(beanName);
            }
        }
    }

    // Trigger post-initialization callback for all applicable beans...
    for (String beanName : beanNames) {
        Object singletonInstance = getSingleton(beanName);
        if (singletonInstance instanceof SmartInitializingSingleton) {
            final SmartInitializingSingleton smartSingleton =
                (SmartInitializingSingleton) singletonInstance;
            if (System.getSecurityManager() != null) {
                AccessController.doPrivileged(new PrivilegedAction<Object>() {
                    @Override
                    public Object run() {
                        smartSingleton.afterSingletonsInstantiated();
                        return null;
                    }
                }, getAccessControlContext());
            }
            else {
                smartSingleton.afterSingletonsInstantiated();
            }
        }
    }
}
```

首先进行Singleton的初始化，其中如果bean是FactoryBean类型(注意，只定义了factory-method属性的普通bean并不是FactoryBean)，并且还是SmartFactoryBean类型，那么需要判断是否需要eagerInit(isEagerInit是此接口定义的方法)。

getBean

这里便是bean初始化的核心逻辑。源码比较复杂，分开说。以getBean(String name)为例。
AbstractBeanFactory.getBean:

```
@Override
public Object getBean(String name) throws BeansException {
    return doGetBean(name, null, null, false);
}
```

第二个参数表示bean的Class类型，第三个表示创建bean需要的参数，最后一个表示不需要进行类型检查。

beanName转化

```
final String beanName = transformedBeanName(name);
```

这里是将FactoryBean的前缀去掉以及将别名转为真实的名字。

手动注册bean检测

前面注册环境一节说过，Spring其实手动注册了一些单例bean。这一步就是检测是不是这些bean。如果是，那么再检测是不是工厂bean，如果是返回其工厂方法返回的实例，如果不是返回bean本身。

```
Object sharedInstance = getSingleton(beanName);
if (sharedInstance != null && args == null) {
    bean = getObjectForBeanInstance(sharedInstance, name, beanName, null);
}
```

检查父容器

如果父容器存在并且存在此bean定义，那么交由其父容器初始化:

```
BeanFactory parentBeanFactory = getParentBeanFactory();
if (parentBeanFactory != null && !containsBeanDefinition(beanName)) {
    // Not found -> check parent.
    //此方法其实是做了前面beanName转化的逆操作，因为父容器同样会进行转化操作
    String nameToLookup = originalBeanName(name);
    if (args != null) {
        // Delegation to parent with explicit args.
        return (T) parentBeanFactory.getBean(nameToLookup, args);
    } else {
        // No args -> delegate to standard getBean method.
        return parentBeanFactory.getBean(nameToLookup, requiredType);
    }
}
```

依赖初始化

bean可以由depends-on属性配置依赖的bean。Spring会首先初始化依赖的bean。

```
String[] dependsOn = mbd.getDependsOn();
if (dependsOn != null) {
    for (String dependsOnBean : dependsOn) {
         //检测是否存在循环依赖
        if (isDependent(beanName, dependsOnBean)) {
            throw new BeanCreationException(mbd.getResourceDescription(), beanName,
            "Circular depends-on relationship between '" + beanName + "' and '" +
dependsOnBean + "'");
        }
        registerDependentBean(dependsOnBean, beanName);
        getBean(dependsOnBean);
    }
}
```

registerDependentBean进行了依赖关系的注册，这么做的原因是Spring在即进行bean销毁的时候会首先销毁被依赖的bean。依赖关系的保存是通过一个ConcurrentHashMap<String, Set>完成的，key是bean的真实名字。

Singleton初始化

虽然这里大纲是Singleton初始化，但是getBean方法本身是包括所有scope的初始化，在这里一次说明了。

```
if (mbd.isSingleton()) {
    sharedInstance = getSingleton(beanName, new ObjectFactory<Object>() {
        @Override
        public Object getObject() throws BeansException {
            return createBean(beanName, mbd, args);
        }
    });
    bean = getObjectForBeanInstance(sharedInstance, name, beanName, mbd);
}
```

getSingleton方法

是否存在

首先会检测是否已经存在，如果存在，直接返回:

```
synchronized (this.singletonObjects) {
    Object singletonObject = this.singletonObjects.get(beanName);
}
```

所有的单例bean都保存在这样的数据结构中: `ConcurrentHashMap<String, Object>`。

bean创建

源码位于AbstractAutowireCapableBeanFactory.createBean，主要分为几个部分:

lookup-method检测

此部分用于检测lookup-method标签配置的方法是否存在:

```
RootBeanDefinition mbdToUse = mbd;
mbdToUse.prepareMethodOverrides();
```

prepareMethodOverrides:

```
public void prepareMethodOverrides() throws BeanDefinitionValidationException {
    // Check that lookup methods exists.
    MethodOverrides methodOverrides = getMethodOverrides();
    if (!methodOverrides.isEmpty()) {
        Set<MethodOverride> overrides = methodOverrides.getOverrides();
        synchronized (overrides) {
            for (MethodOverride mo : overrides) {
                prepareMethodOverride(mo);
            }
        }
    }
}
```

prepareMethodOverride:

```
protected void prepareMethodOverride(MethodOverride mo)  {
    int count = ClassUtils.getMethodCountForName(getBeanClass(), mo.getMethodName());
    if (count == 0) {
        throw new BeanDefinitionValidationException(
                "Invalid method override: no method with name '" + mo.getMethodName() +
                "' on class [" + getBeanClassName() + "]");
    } else if (count == 1) {
        // Mark override as not overloaded, to avoid the overhead of arg type checking.
        mo.setOverloaded(false);
    }
}
```

InstantiationAwareBeanPostProcessor触发

在这里触发的是其postProcessBeforeInitialization和postProcessAfterInstantiation方法。

```
Object bean = resolveBeforeInstantiation(beanName, mbdToUse);
if (bean != null) {
    return bean;
}
Object beanInstance = doCreateBean(beanName, mbdToUse, args);
return beanInstance;
```

继续:

```
protected Object resolveBeforeInstantiation(String beanName, RootBeanDefinition mbd) {
    Object bean = null;
    if (!Boolean.FALSE.equals(mbd.beforeInstantiationResolved)) {
        // Make sure bean class is actually resolved at this point.
        if (!mbd.isSynthetic() && hasInstantiationAwareBeanPostProcessors()) {
            Class<?> targetType = determineTargetType(beanName, mbd);
            if (targetType != null) {
                bean = applyBeanPostProcessorsBeforeInstantiation(targetType,
beanName);
                if (bean != null) {
                    bean = applyBeanPostProcessorsAfterInitialization(bean, beanName);
                }
            }
        }
        mbd.beforeInstantiationResolved = (bean != null);
    }
    return bean;
}
```

从这里可以看出，**如果InstantiationAwareBeanPostProcessor返回的不是空，那么将不会继续执行剩下的Spring初始化流程，此接口用于初始化自定义的bean，主要是在Spring内部使用。**

doCreateBean

同样分为几部分。

创建(createBeanInstance)

关键代码:

```
BeanWrapper instanceWrapper = null;
if (instanceWrapper == null) {
    instanceWrapper = createBeanInstance(beanName, mbd, args);
}
```

createBeanInstance的创建过程又分为以下几种情况:

- 工厂bean:

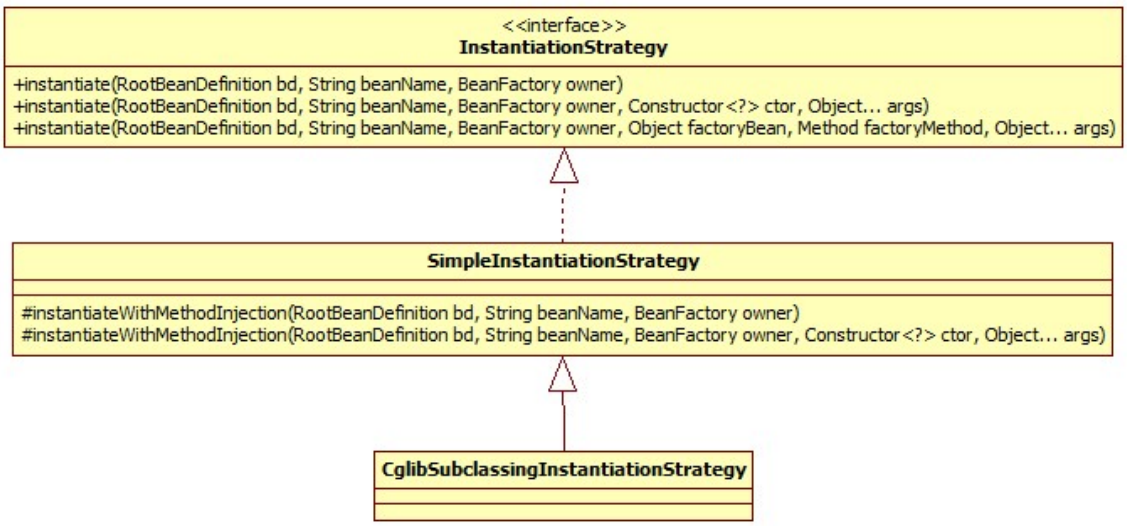
  调用instantiateUsingFactoryMethod方法:

```
protected BeanWrapper instantiateUsingFactoryMethod(
  String beanName, RootBeanDefinition mbd, Object[] explicitArgs) {
  return new ConstructorResolver(this).instantiateUsingFactoryMethod(beanName, mbd,
explicitArgs);
}
```

注意，此处的工厂bean指的是配置了factory-bean/factory-method属性的bean，不是实现了FacrotyBean接口的bean。如果没有配置factory-bean属性，那么factory-method指向的方法必须是静态的。此方法主要做了这么几件事:

- 初始化一个BeanWrapperImpl对象。
- 根据设置的参数列表使用反射的方法寻找相应的方法对象。
- InstantiationStrategy:

  bean的初始化在此处又抽成了策略模式，类图:



  instantiateUsingFactoryMethod部分源码:

```
beanInstance = this.beanFactory.getInstantiationStrategy().instantiate(
    mbd, beanName, this.beanFactory, factoryBean, factoryMethodToUse,
argsToUse);
```

  getInstantiationStrategy返回的是CglibSubclassingInstantiationStrategy对象。此处instantiate实现也很简单，就是调用工厂方法的Method对象反射调用其invoke即可得到对象，SimpleInstantiationStrategy.

  instantiate核心源码:

```
@Override
public Object instantiate(RootBeanDefinition bd, String beanName, BeanFactory
owner,
    Object factoryBean, final Method factoryMethod, Object... args) {
    return factoryMethod.invoke(factoryBean, args);
}
```

- 构造器自动装配

  createBeanInstance部分源码:

```
// Need to determine the constructor...
Constructor<?>[] ctors = determineConstructorsFromBeanPostProcessors(beanClass,
beanName);
if (ctors != null ||
  mbd.getResolvedAutowireMode() == RootBeanDefinition.AUTOWIRE_CONSTRUCTOR ||
    //配置了<constructor-arg>子元素
  mbd.hasConstructorArgumentValues() || !ObjectUtils.isEmpty(args))  {
  return autowireConstructor(beanName, mbd, ctors, args);
}
```

  determineConstructorsFromBeanPostProcessors源码:

```
protected Constructor<?>[] determineConstructorsFromBeanPostProcessors(Class<?>
beanClass, String beanName) {
  if (beanClass != null && hasInstantiationAwareBeanPostProcessors()) {
      for (BeanPostProcessor bp : getBeanPostProcessors()) {
          if (bp instanceof SmartInstantiationAwareBeanPostProcessor) {
              SmartInstantiationAwareBeanPostProcessor ibp =
                  (SmartInstantiationAwareBeanPostProcessor) bp;
              Constructor<?>[] ctors =
ibp.determineCandidateConstructors(beanClass, beanName);
              if (ctors != null) {
                  return ctors;
              }
          }
      }
  }
  return null;
}
```

  可见是由SmartInstantiationAwareBeanPostProcessor决定的，默认是没有配置这种东西的。

  之后就是判断bean的自动装配模式，可以通过如下方式配置:

```
<bean id="student" class="base.Student" primary="true" autowire="default" />
```

  autowire共有以下几种选项:

  - no: 默认的，不进行自动装配。在这种情况下，只能通过ref方式引用其它bean。
  - byName: 根据bean里面属性的名字在BeanFactory中进行查找并装配。
  - byType: 按类型。
  - constructor: 以byType的方式查找bean的构造参数列表。
  - default: 由父bean决定。

  参考: Spring - bean的autowire属性(自动装配)

  autowireConstructor调用的是ConstructorResolver.autowireConstructor，此方法主要做了两件事:

  - 得到合适的构造器对象。
  - 根据构造器参数的类型去BeanFactory查找相应的bean:

入口方法在ConstructorResolver.resolveAutowiredArgument:

```
protected Object resolveAutowiredArgument(
        MethodParameter param, String beanName, Set<String>
autowiredBeanNames,
        TypeConverter typeConverter) {
    return this.beanFactory.resolveDependency(
            new DependencyDescriptor(param, true), beanName,
            autowiredBeanNames, typeConverter);
}
```

最终调用的还是CglibSubclassingInstantiationStrategy.instantiate方法，关键源码:

```
@Override
public Object instantiate(RootBeanDefinition bd, String beanName, BeanFactory
owner,
      final Constructor<?> ctor, Object... args) {
  if (bd.getMethodOverrides().isEmpty()) {
          //反射调用
      return BeanUtils.instantiateClass(ctor, args);
  } else {
      return instantiateWithMethodInjection(bd, beanName, owner, ctor, args);
  }
}
```

可以看出，如果配置了lookup-method标签，**得到的实际上是用Cglib生成的目标类的代理子类。**

CglibSubclassingInstantiationStrategy.instantiateWithMethodInjection:

```
@Override
protected Object instantiateWithMethodInjection(RootBeanDefinition bd, String
beanName, BeanFactory     owner,Constructor<?> ctor, Object... args) {
  // Must generate CGLIB subclass...
  return new CglibSubclassCreator(bd, owner).instantiate(ctor, args);
}
```

- 默认构造器

  一行代码，很简单:

```
// No special handling: simply use no-arg constructor.
return instantiateBean(beanName, mbd);
```

MergedBeanDefinitionPostProcessor

触发源码:

```
synchronized (mbd.postProcessingLock) {
    if (!mbd.postProcessed) {
        applyMergedBeanDefinitionPostProcessors(mbd, beanType, beanName);
        mbd.postProcessed = true;
    }
}
```

此接口也是Spring内部使用的，不管它了。

属性解析

入口方法: AbstractAutowireCapableBeanFactory.populateBean，它的作用是: 根据autowire类型进行autowire by name，by type 或者是直接进行设置，简略后的源码:

```
protected void populateBean(String beanName, RootBeanDefinition mbd, BeanWrapper bw) {
    //所有<property>的值
    PropertyValues pvs = mbd.getPropertyValues();

    if (mbd.getResolvedAutowireMode() == RootBeanDefinition.AUTOWIRE_BY_NAME ||
            mbd.getResolvedAutowireMode() == RootBeanDefinition.AUTOWIRE_BY_TYPE) {
        MutablePropertyValues newPvs = new MutablePropertyValues(pvs);

        // Add property values based on autowire by name if applicable.
        if (mbd.getResolvedAutowireMode() == RootBeanDefinition.AUTOWIRE_BY_NAME) {
            autowireByName(beanName, mbd, bw, newPvs);
        }

        // Add property values based on autowire by type if applicable.
        if (mbd.getResolvedAutowireMode() == RootBeanDefinition.AUTOWIRE_BY_TYPE) {
            autowireByType(beanName, mbd, bw, newPvs);
        }

        pvs = newPvs;
    }
    //设值
    applyPropertyValues(beanName, mbd, bw, pvs);
}
```

autowireByName源码:

```
protected void autowireByName(
        String beanName, AbstractBeanDefinition mbd, BeanWrapper bw,
MutablePropertyValues pvs) {
    //返回所有引用(ref="XXX")的bean名称
    String[] propertyNames = unsatisfiedNonSimpleProperties(mbd, bw);
    for (String propertyName : propertyNames) {
        if (containsBean(propertyName)) {
             //从BeanFactory获取
            Object bean = getBean(propertyName);
            pvs.add(propertyName, bean);
            registerDependentBean(propertyName, beanName);
        }
    }
}
```

autowireByType也是同样的套路，所以可以得出结论: **autowireByName和autowireByType方法只是先获取到引用的bean，真正的设值是在applyPropertyValues中进行的。**

属性设置

Spring判断一个属性可不可以被设置(存不存在)是通过java bean的内省操作来完成的，也就是说，属性可以被设置的条件是**此属性拥有public的setter方法，并且注入时的属性名应该是setter的名字。**

初始化

此处的初始化指的是bean已经构造完成，执行诸如调用其init方法的操作。相关源码:

```
// Initialize the bean instance.
Object exposedObject = bean;
try {
    populateBean(beanName, mbd, instanceWrapper);
    if (exposedObject != null) {
        exposedObject = initializeBean(beanName, exposedObject, mbd);
    }
}
```

initializeBean:

```
protected Object initializeBean(final String beanName, final Object bean,
RootBeanDefinition mbd) {
    if (System.getSecurityManager() != null) {
        AccessController.doPrivileged(new PrivilegedAction<Object>() {
            @Override
            public Object run() {
                invokeAwareMethods(beanName, bean);
                return null;
            }
        }, getAccessControlContext());
    }
    else {
        invokeAwareMethods(beanName, bean);
    }
```

```
    Object wrappedBean = bean;
    if (mbd == null || !mbd.isSynthetic()) {
        wrappedBean = applyBeanPostProcessorsBeforeInitialization(wrappedBean,
beanName);
    }

    invokeInitMethods(beanName, wrappedBean, mbd);

    if (mbd == null || !mbd.isSynthetic()) {
        wrappedBean = applyBeanPostProcessorsAfterInitialization(wrappedBean,
beanName);
    }
    return wrappedBean;
}
```

主要的操作步骤一目了然。

- Aware方法触发:

  我们的bean有可能实现了一些XXXAware接口，此处就是负责调用它们:

  ```
  private void invokeAwareMethods(final String beanName, final Object bean) {
    if (bean instanceof Aware) {
        if (bean instanceof BeanNameAware) {
            ((BeanNameAware) bean).setBeanName(beanName);
        }
        if (bean instanceof BeanClassLoaderAware) {
            ((BeanClassLoaderAware) bean).setBeanClassLoader(getBeanClassLoader());
        }
        if (bean instanceof BeanFactoryAware) {
            ((BeanFactoryAware)
  bean).setBeanFactory(AbstractAutowireCapableBeanFactory.this);
        }
    }
  }
  ```

- BeanPostProcessor触发，没什么好说的
- 调用init方法:

  在XML配置中，bean可以有一个init-method属性来指定初始化时调用的方法。从原理来说，其实就是一个反射调用。不过注意这里有一个InitializingBean的概念。

  此接口只有一个方法:

  ```
  void afterPropertiesSet() throws Exception;
  ```

  如果我们的bean实现了此接口，那么此方法会首先被调用。此接口的意义在于: 当此bean的所有属性都被设置(注入)后，给bean一个利用现有属性重新组织或是检查属性的机会。感觉和init方法有些冲突，不过此接口在Spring被广泛使用。

getObjectForBeanInstance

位于AbstractBeanFactory，此方法的目的在于如果bean是FactoryBean，那么返回其工厂方法创建的bean，而不是自身。

Prototype初始化

AbstractBeanFactory.doGetBean相关源码:

```
else if (mbd.isPrototype()) {
    // It's a prototype -> create a new instance.
    Object prototypeInstance = null;
    try {
        beforePrototypeCreation(beanName);
        prototypeInstance = createBean(beanName, mbd, args);
    }
    finally {
        afterPrototypeCreation(beanName);
    }
    bean = getObjectForBeanInstance(prototypeInstance, name, beanName, mbd);
}
```

beforePrototypeCreation

此方法用于确保在同一时刻只能有一个此bean在初始化。

createBean

和单例的是一样的，不在赘述。

afterPrototypeCreation

和beforePrototypeCreation对应的，你懂的。

总结

可以看出，初始化其实和单例是一样的，只不过单例多了一个是否已经存在的检查。

其它Scope初始化

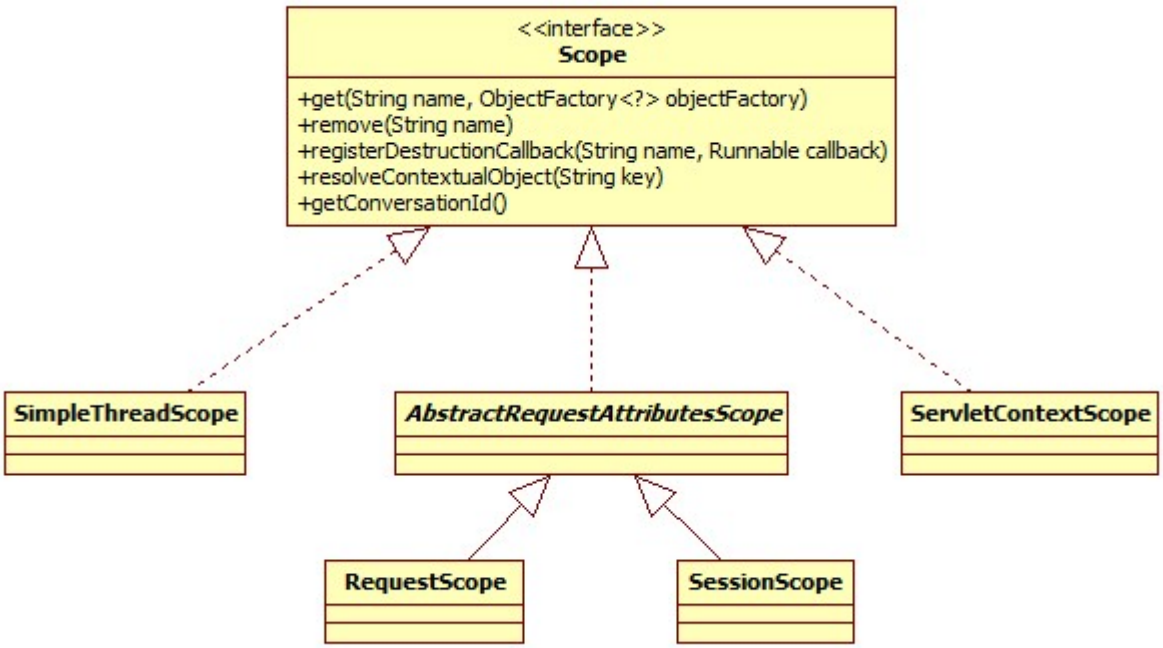
其它就指的是request、session。此部分源码:

```
else {
    String scopeName = mbd.getScope();
    final Scope scope = this.scopes.get(scopeName);
    if (scope == null) {
        throw new IllegalStateException("No Scope registered for scope name '" +
scopeName + "'");
    }
    Object scopedInstance = scope.get(beanName, new ObjectFactory<Object>() {
        @Override
        public Object getObject() throws BeansException {
            beforePrototypeCreation(beanName);
```

```
                try {
                    return createBean(beanName, mbd, args);
                }
                finally {
                    afterPrototypeCreation(beanName);
                }
            }
        });
        bean = getObjectForBeanInstance(scopedInstance, name, beanName, mbd);
    }
```

scopes是一个LinkedHashMap<String, Scope>，可以调用 ConfigurableBeanFactory定义的registerScope方法注册其值。

Scope接口继承体系:



根据socpe.get的注释，此方法如果找到了叫做beanName的bean，那么返回，如果没有，将调用ObjectFactory创建之。Scope的实现参考类图。