Project Report

Project Title – HTTP Host Header Attack and Brute Force Attack

Presented by

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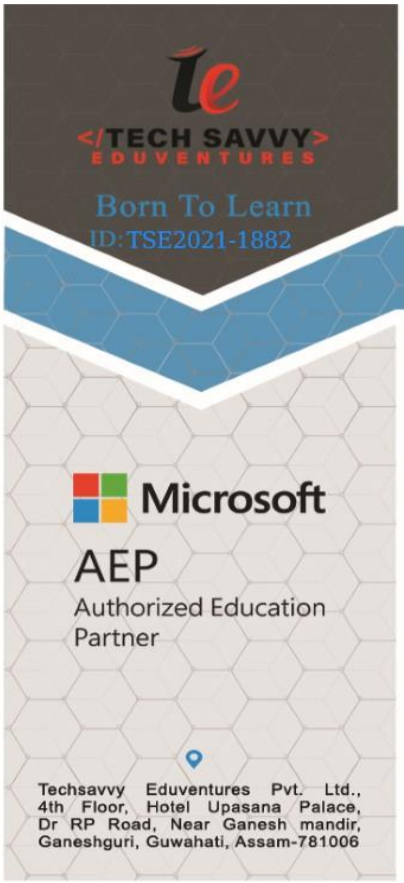
Abstract

A vulnerability assessment simply identifies and reports noted vulnerabilities, whereas penetrations test (Pen Test) attempts to exploit the vulnerabilities to determine whether unauthorized access or other malicious activity is possible. Penetration testing typically includes network penetration testing and application security testing as well as controls and processes around the networks and applications, and should occur from both outside the network trying to come in (external testing) and from inside the network.

In Host Header Attack an attacker can manually divert the code to produce their desired output, simply by editing the host header value. Later we have discussed the full method of this.

A brute force attack is a trial-and-error method used to decode sensitive data. The most common applications for brute force attacks are cracking passwords and cracking encryption keys.

In this project we have done HTTP Host Header Attack and Brute Force Attack. Finally, we found a vulnerable site and exploit it successfully.



Certificate of Completion

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1.Introduction:

1.1 Problem Definition:

- ***What is Penetration testing?***

Penetration testing is a cybersecurity technique organizations use to identify, test and highlight vulnerabilities in their security posture. The challenge is to keep information safe arose as computers gained the ability to share information across communication lines. If a system or any site is not secured, then an attacker can disrupt information or take access to that system or site.

- ***What is website vulnerability?***

A website vulnerability is a misconfiguration in a website or web application code that allows an attacker to gain some level of control of the site, and possibly the hosting server.

Vulnerability in a website makes it prone to attacks. We have used HTTP host header attack to check for the vulnerability of websites or web applications. Vulnerabilities can be leveraged to force software to act in ways it's not intended to, such as stealing information about the current security defenses in place.

- ***What is the HTTP Host Header Attack?***

HTTP Host header attacks exploit vulnerable website that handle the value of the Host header in an unsafeway. If the server implicitly trusts the Host header, andfails to validate or escape it properly, an attacker maybe able to use this input to inject harmful payloadsthat manipulate server-side behavior.

- ***What is Brute Force Attack?***

Brute Force is a hacking technique used to find out the user credentials by trying various possible credentials.

1.2 Project Overview:

In our project we have done penetration testing. It's a security exercise where we try to find and exploit vulnerable websites using HTTP Host Header Attack and Brute Force Attack.

We have used HTTP host header attack to check for the vulnerability of websites of web application and further exploit it using Brute Force Attack.

To test whether a website is vulnerable to HTTP host header attacks, we will need an intercepting proxy tool such as Burp Suite Proxy and manual testing tools like Burp repeater and Burp intruder. We can check it by using three methods which will be further discussed in detail.

After that, we have used Brute Force Attack that uses trial-and-error to guess login info, encryption keys, or find a hidden web page. We have tried to takeover an account of a website by guessing password and username by using Burp Suite. The complete process is further discussed in detail.

1.3 Hardware Specification:

Desktop Configuration:

- **Memory:** 8 GB or 4GB
- **Graphics Card:** Any Graphic Card with 4 GB V Ram
- **CPU:** Any CPU with 4 Core
- **OS:** Windows 8 or 10, Kali Linux, Mac OS X

Laptop Configuration:

- **Processor:** Intel Core i3 or i5 or i7
- **OS :** Windows 8 or 10, Kali Linux, Mac OS X
- **Hard Disk:**500GB ; 8 GB RAM, 500GB / 1 TB ; 16 GB RAM, 256GB; 4 GB

1.4:Software Specification:

Burp Suite, Hashcat, John the Ripper, Thc-Hydra etc.

2. LITERATURE SURVEY:

2.1: Existing system:

When the existing system was studied, it was found having some problems. Existing system was very time-consuming and not very efficient. The drawback of the existing system has lead to the development of new system, which is very user-friendly, consumes less time, and is efficient.

The existing system required the end-user to write codes and manually find out the possible combination of passwords, which was time-consuming. The new system that has been developed has kept all the requirements of end-users into matter. Many drawbacks have been overcome by the newly designed method.[1]

2.2: Proposed System:

New tools have been introduced for testing, such as repeaters, intruders, and intercepting proxy. They generate possible combinations within minutes or hours, depending upon the list. Weak passwords or already hacked passwords are available online, which makes it easier for end-users to make a list. The proposed system is highly efficient, and consumes less-time as they give out the result.

2.3: Feasibility study:

2.3.1: Technical feasibility:

This project is software-based. The tools that were required in this project are-

- BurpSuite (Intruder, Repeater, Proxy)
- Mozilla Firefox
- FoxyProxy

Each of these software or tools are freely available, technically-manageable and need minimum hardware and software requirements that are present in every basic systems, nowadays. From all of these, it is clear that this project is technically feasible.

2.3.2: Resource and legal feasibility:

The resources required in this project are-

- Windows or Linux system (Laptop or Desktop)
- Tools or software (freely available)

The tools mentioned are freely and legally available online. It does not require any payments. Also, it is legal to use for the practice of testers. Hence, it is clear that this project has the required resource and legal feasibility too.

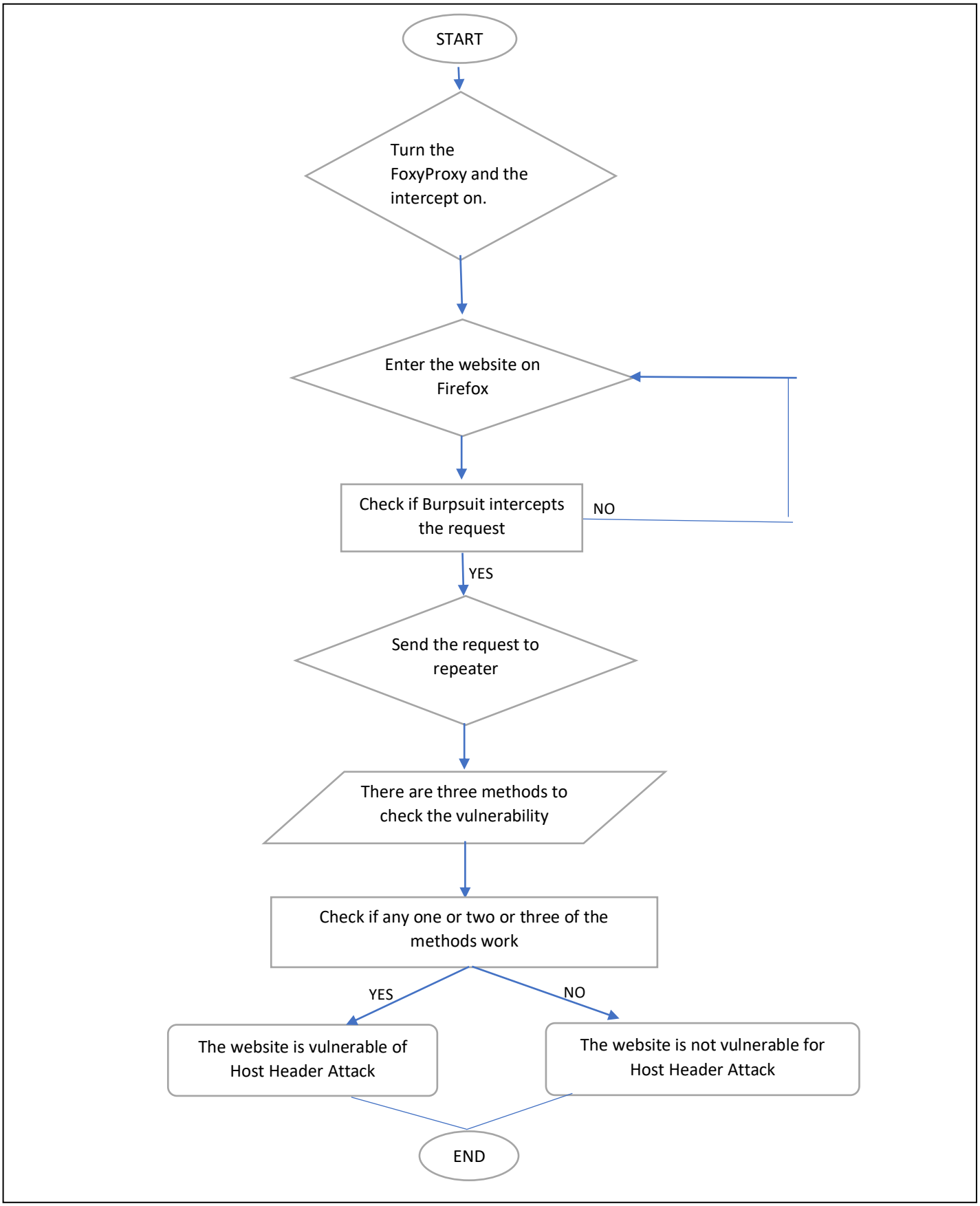
2.3.3: Time feasibility:

Since list of weak passwords are available online and tools are also freely available, which makes it easier for end-users to operate it. Hence, depending upon the list, it takes less-consumable time. Thus, it is confirmed that this project is time feasible.

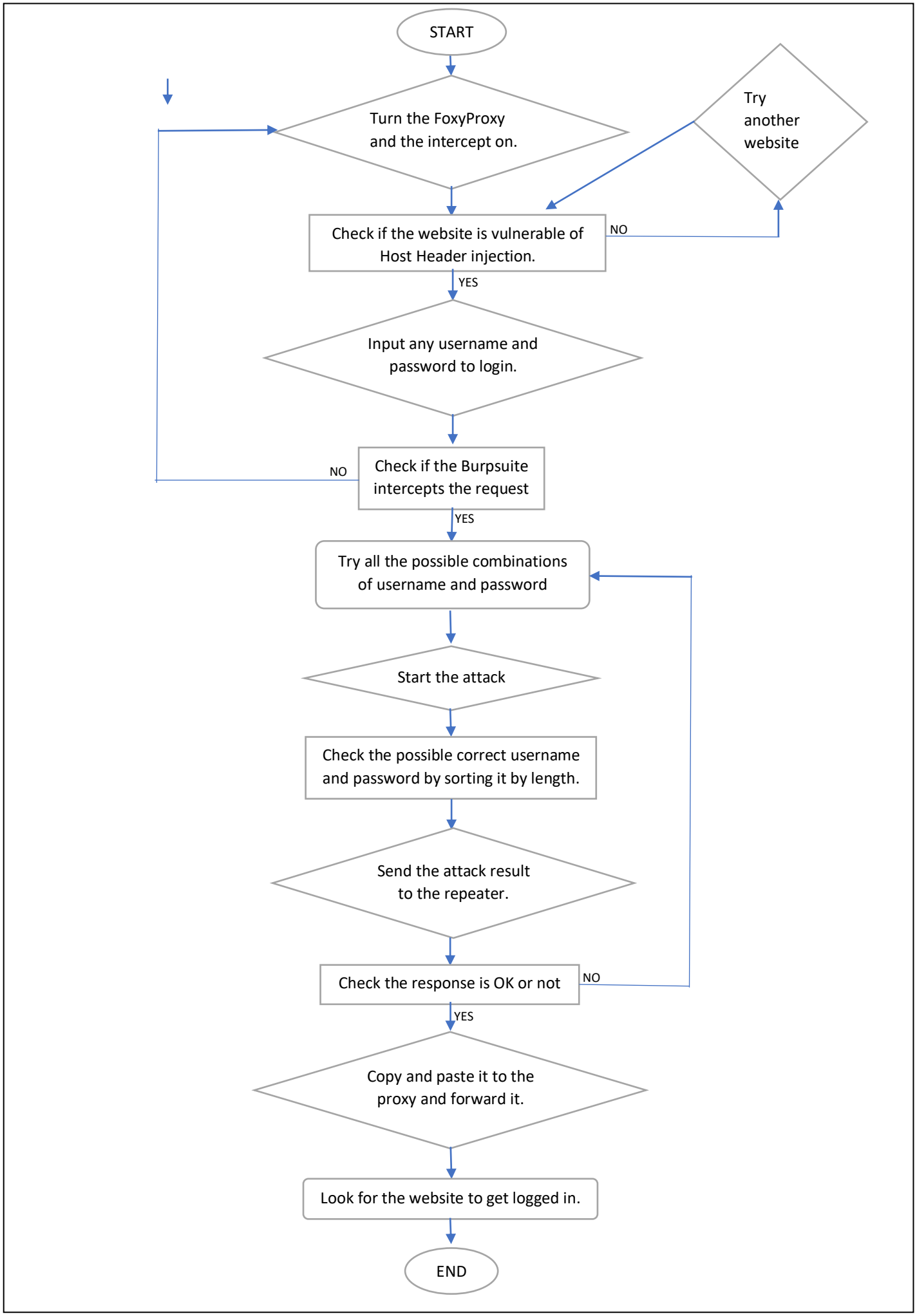
3. System Analysis and Design:

3.1 Flowcharts:

3.1.1 Flowchart of Host Header Injection:



3.1.2 Flowchart of Brute Force Attack:



3.2: Design and Test Steps:

Host Header Attack:

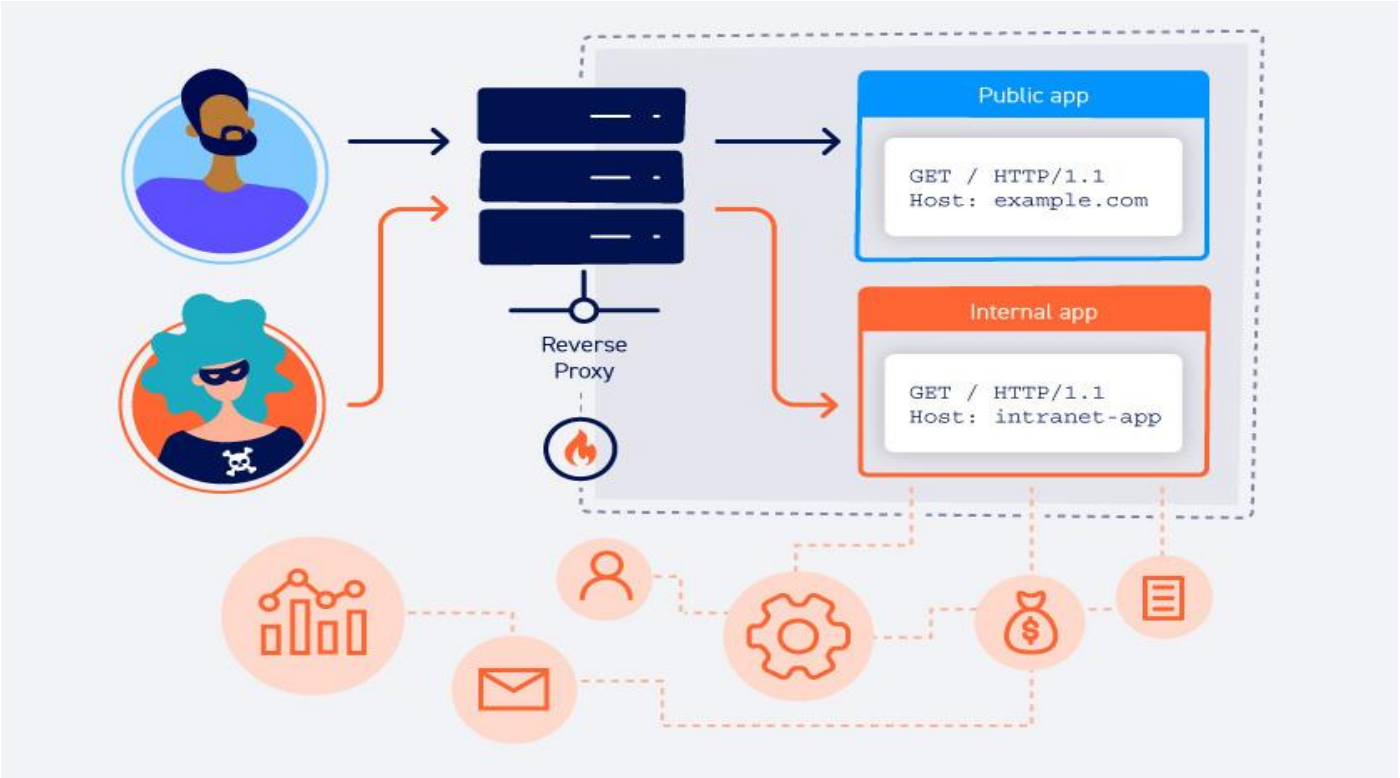


Image1: Design of Host Header Attack[2]

Test Steps:

There are three methods to check if a website is vulnerable of Host Header Attack or not:

▪ **First method**:

1. Change real Host to *bing.com*

▪ **Second method:**

1. Change Host from *real.com* to *bing.com*

2. Set X-Forwarded-Host to *real.com*

▪ **Third method:**

1. Set Host to *real.com*

2. Set X-Forwarded-Host to *bing.com*

Brute Force Attack:

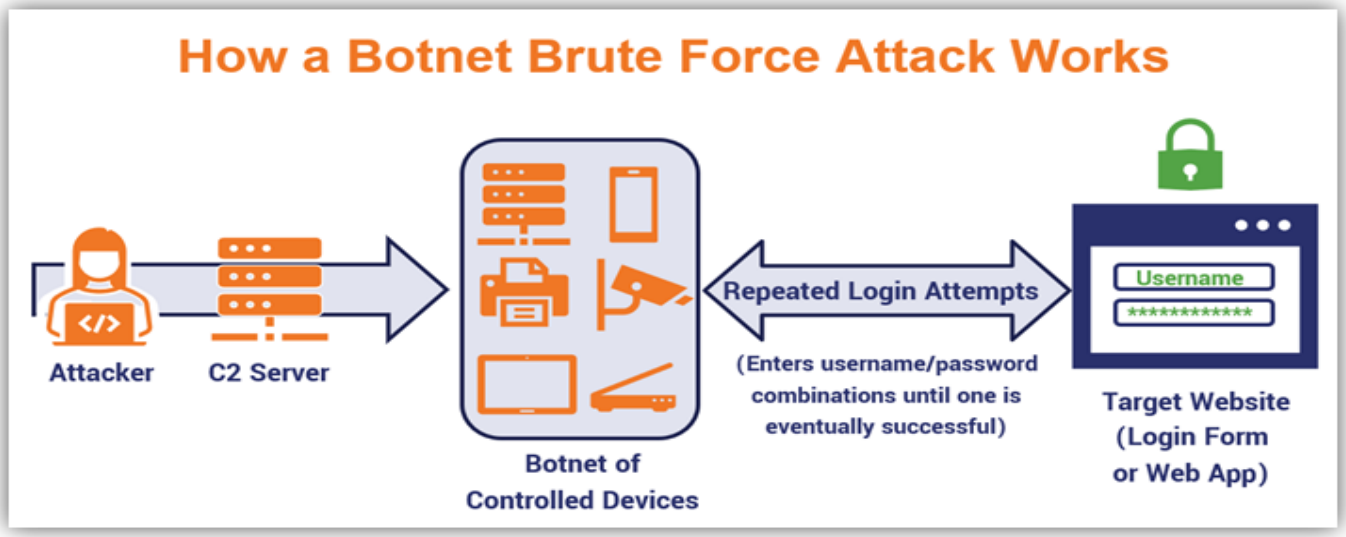


Image2: Design of Brute Force Attack[5]

Test Steps:

There are several steps to do Brute Force Attack on Burpsuite:

1. Turn the FoxyProxy and the intercept on.
2. Input any username and password to login.
3. Send the information to the intruder.
4. Go to the payload position.
5. Brute force the username and password to make combinations.
6. Start the cluster bomb attack.
7. Sorting by length.
8. Send the attack result to the repeater.
9. Copy and paste it to the proxy and forward it.
10. Off the intercept and look for the website to get logged in.

3.3: Algorithm:

3.3.1: Algorithm of Brute Force Attack:

This is the most basic and simplest type of algorithm. A Brute Force Algorithm is the straightforward approach to a problem i.e., the first approach that comes to our mind on seeing the problem. More technically it is just like iterating every possibility available to solve that problem.

When creating a password or an username, the following characters are usually available:

- Numbers (10 different: 0-9)
- Letters (52 different: AZ and az)
- Special characters (32 different).

The number of possible combinations is calculated using the following formula

Possible combinations = possible number of characters$^{\text{Password length}}$

For example, consider a password containing 5 characters(3 lower case characters and two numbers).

Now the possible number of characters will be 26(since there are 26 lower case characters)+10(since there are 10 numbers)=36. And Password length will be 5.

So, the possible combinations will be 36^5=60,466,176.

Let, a generation of 2 billion keys per second is expected, since this corresponds approximately to the speed of a very strong single computer.

So, the time required to decrypt the password will be 60,466,176 /2,000,000,000 =
0.03 seconds

3.4: Testing Process:

Testing process of Host Header Attack:

Initial testing is as simple as supplying another domain (i.e.`attacker.com`) into the Host header field. It is how the web server processes the header value that dictates the impact. The attack is valid when the web server processes the input to send the request to an attacker-controlled host that resides at the supplied domain, and not to an internal virtual host that resides on the web server.[3]

```
GET / HTTP/1.1
Host: www.attacker.com
[...]
```

In the simplest case, this may cause a 302 redirect to the supplied domain.

```
HTTP/1.1 302 Found
[...]
Location: http://www.attacker.com/login.php
```

X-Forwarded Host Header Bypass

In the event that Host header injection is mitigated by checking for invalid input injected via the Host header, you can supply the value to the `X-Forwarded-Host` header.[3]

```
GET / HTTP/1.1
Host: www.example.com
X-Forwarded-Host: www.attacker.com
...
```

OR, supply the invalid input to Host header and supply the main website to `X-Forwarded-Host` header.

```
GET / HTTP/1.1
Host:www.attacker.com
X-Forwarded-Host: www.example.com
...
```

Practically, there is a possibility that two of the methods may fail, and the third one may hunt down the site. Thus, in accordance, we have to perform all the three methods, in case, the first two methods do not work.[3]

Testing process of Brute Force Attack:

Brute force attacks focus at defeating a cryptographic algorithm by attempting to predict a valid key from a large number of possibilities. During this attack, an attacker produces a large number of keys by performing an exhaustive search over the key space (all possible keys) and uses each of the predicted keys in an attempt of decrypting a cipher text.[4]

Steps to test for key brute force bugs:

- Step 1: Search a Host Header injection vulnerable site.
- Step 2: Make combinations of usernames and passwords.
- Step 3: Execute test cases

Step 1: Search a Host Header injection vulnerable site:

The first step in testing for brute force attacks is to find a site which is vulnerable of Host Header injection.

Test for Host Header injection we can do it by the above method.

Step2: Make combinations of usernames and passwords:

- The attacker discovers an application functionality that performs authentication based on a key value.
- The attacker produces combinations of usernames and passwords.
- The attacker attempts to authenticate using combinations predicted in the previous step.

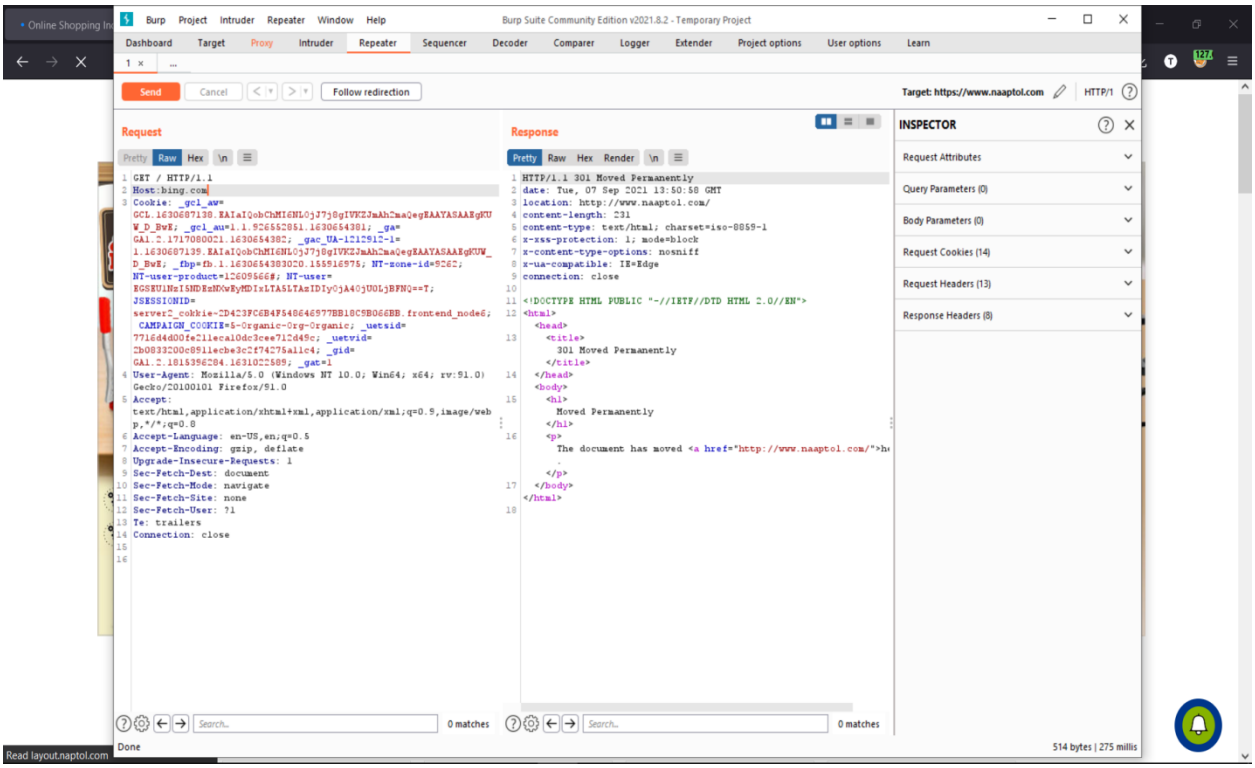
Step 3: Execute test cases:

- Check the possible right username and password combination by sorting the list.
- Check if the response is OK.
- Copy and paste it to the proxy and forward it.
- Look for the website to get logged in.

4. Proof Of Concept & Steps to reproduce HTTP Host Header Attack:

- ***First method to find host header injection:***

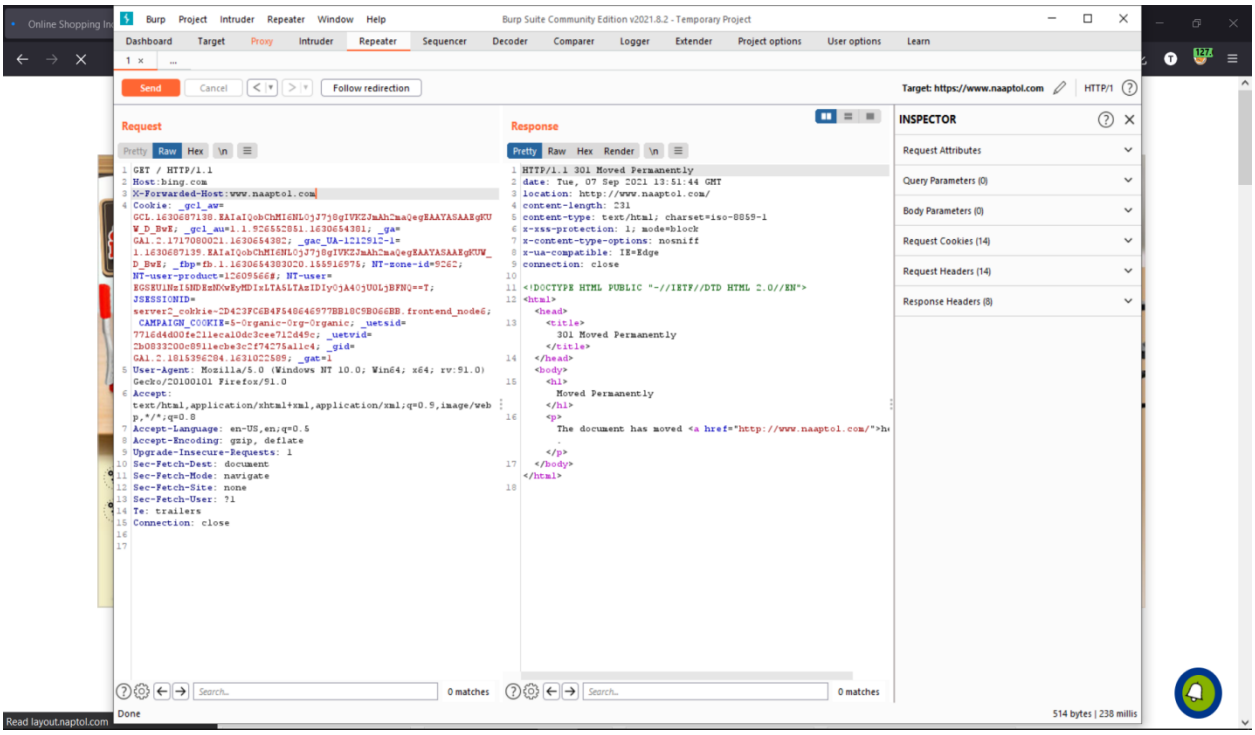
  1. ***Change real Host to bing.com***



- ***Second method to find host header injection:***

  1. ***Change Host from real.com to bing.com***

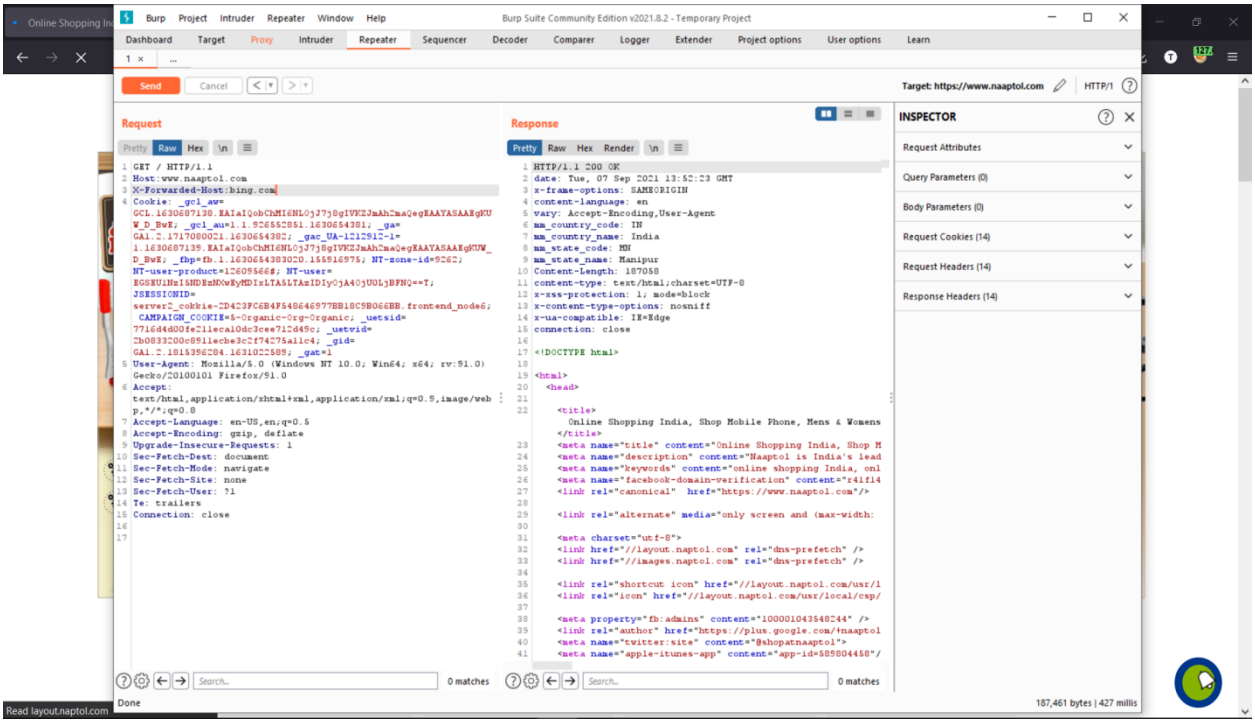
  2. ***Set X-Forwarded-Host to real.com***



- ***Third method to find host header injection:***

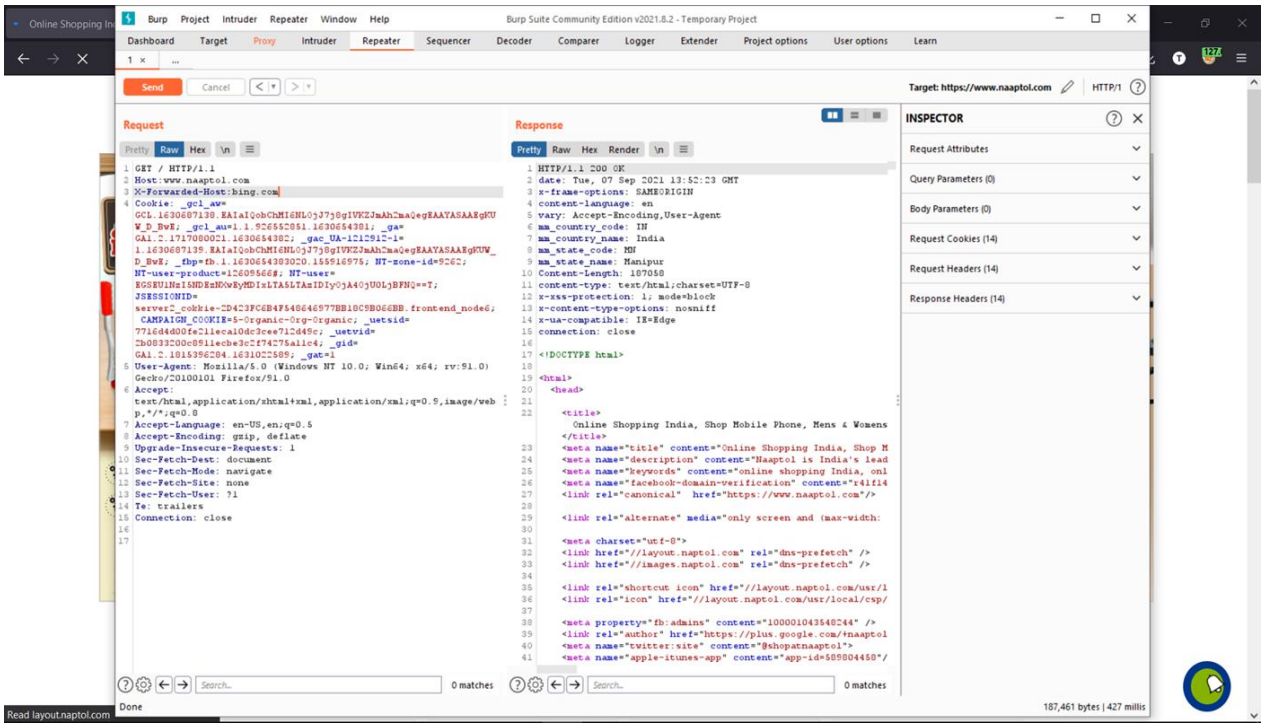
  1. Set Host to real.com

  2. Set X-Forwarded-Host to bing.com



Result of HTTP Host Header Attack:

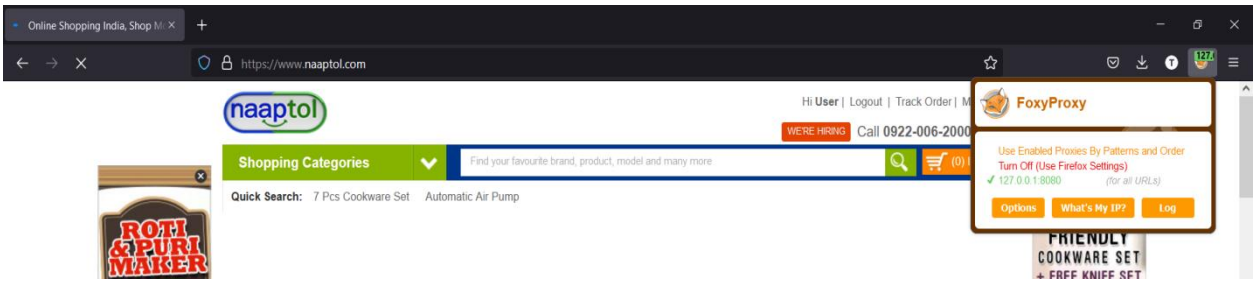
We find a Host Header Attack vulnerable site i.e.***www.naaptol.com.***

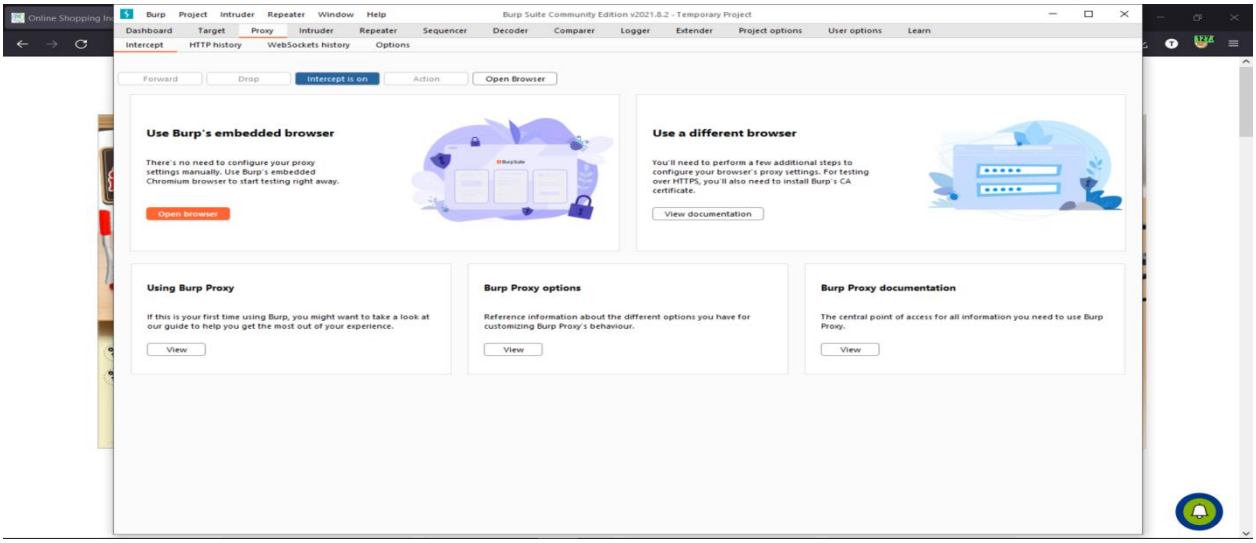


In the picture we can see that we got 200 OK in the response section. So, that means this site is vulnerable of Host Header Injection.

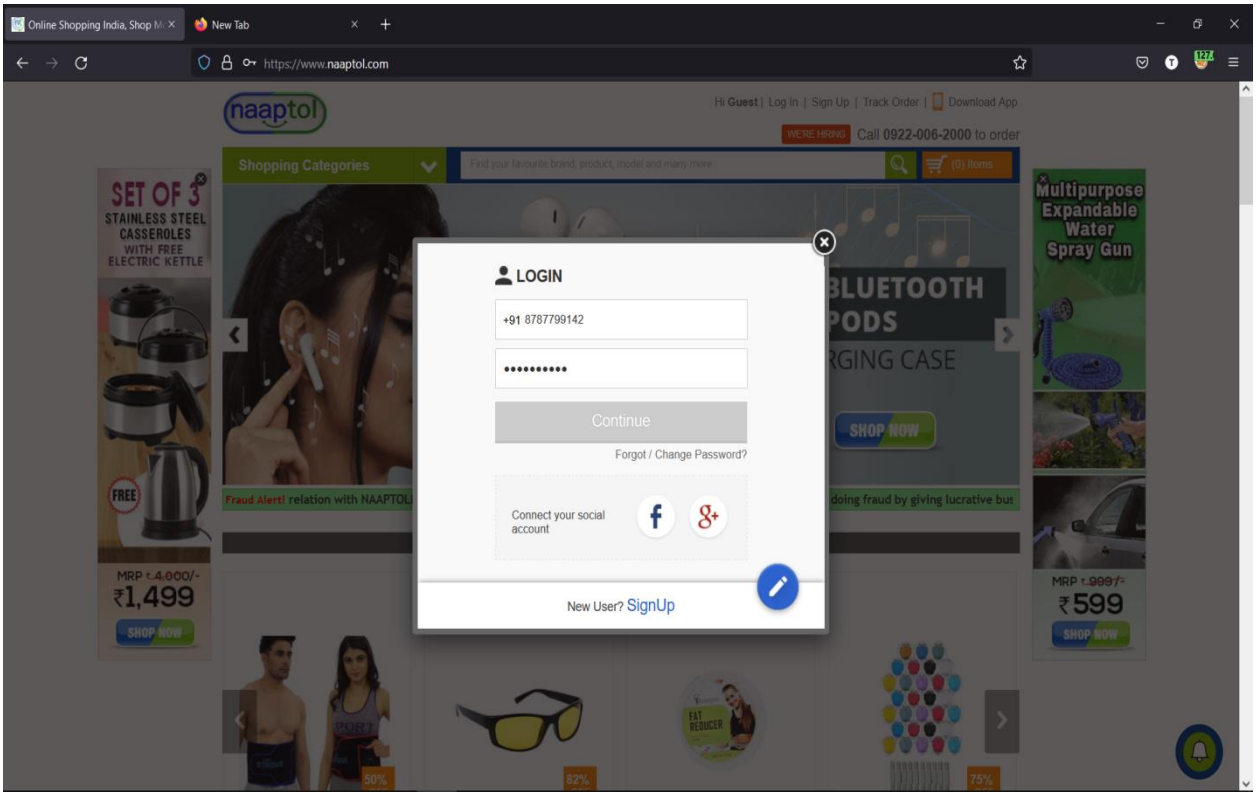
5. Proof Of Concept & Steps to reproduce Brute Force Attack:

1. ***Turn the FoxyProxy and the intercept on.***

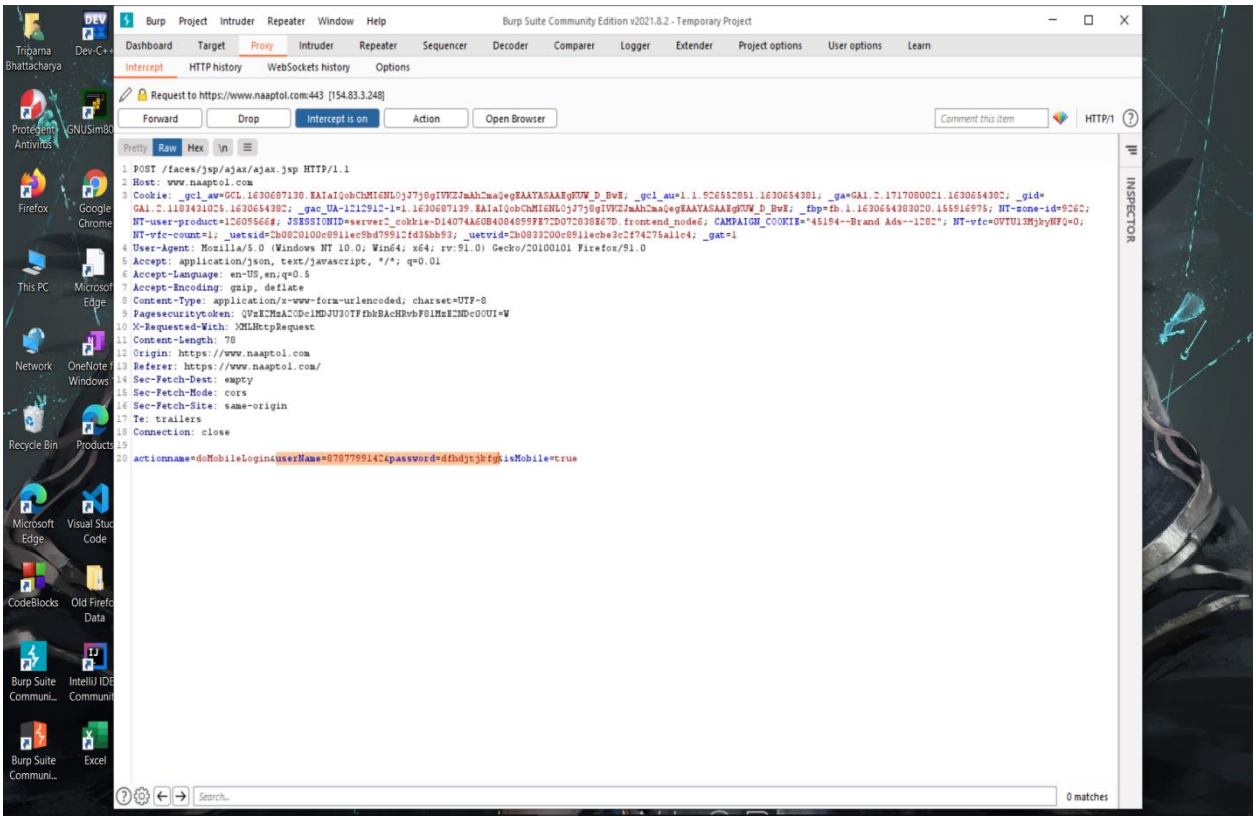




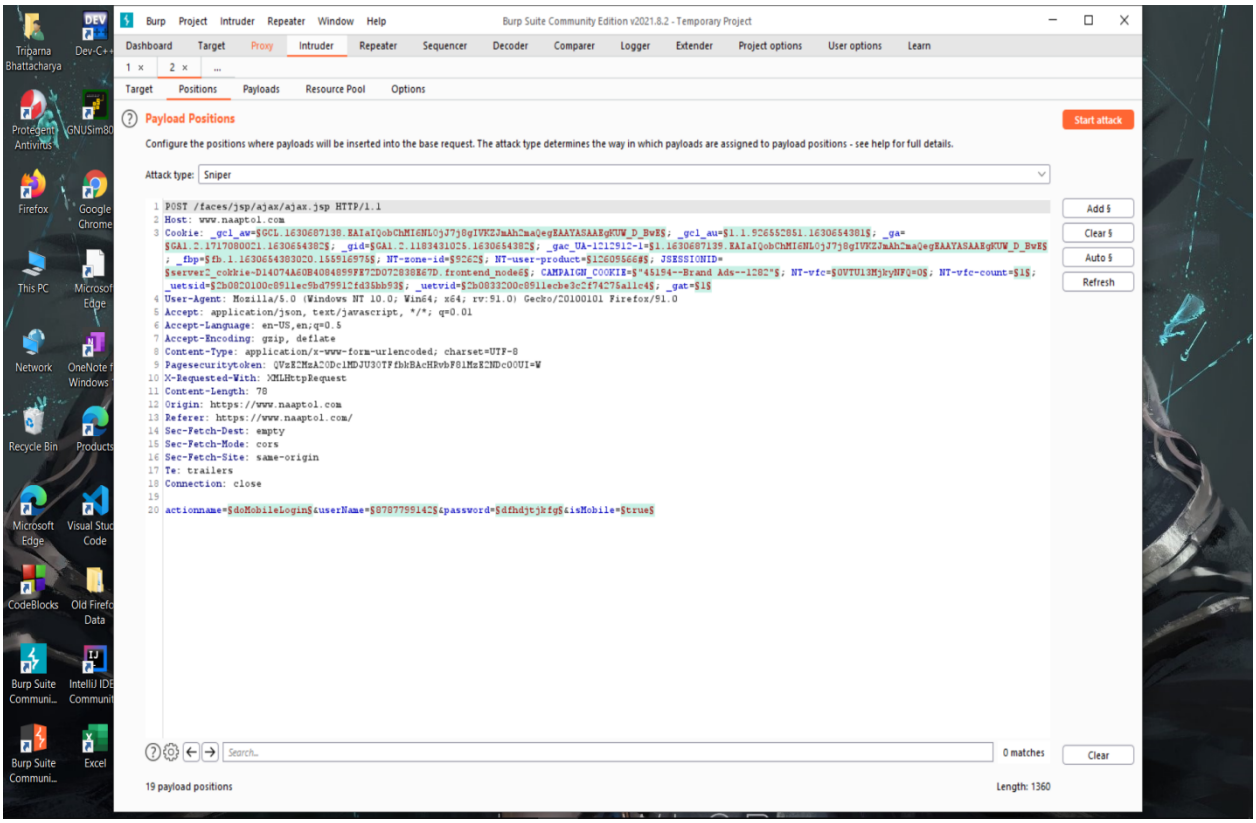
2. ***Input any username and password to login.***



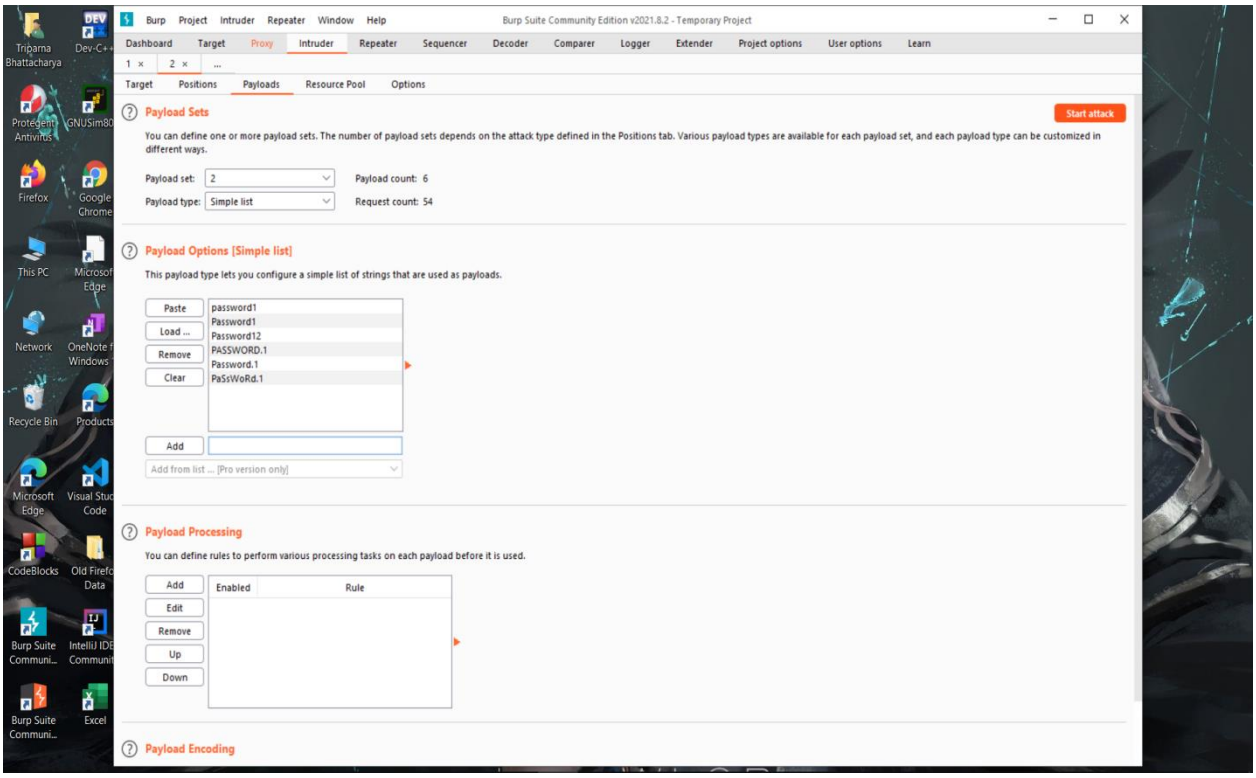
3. *Send the information to the intruder.*



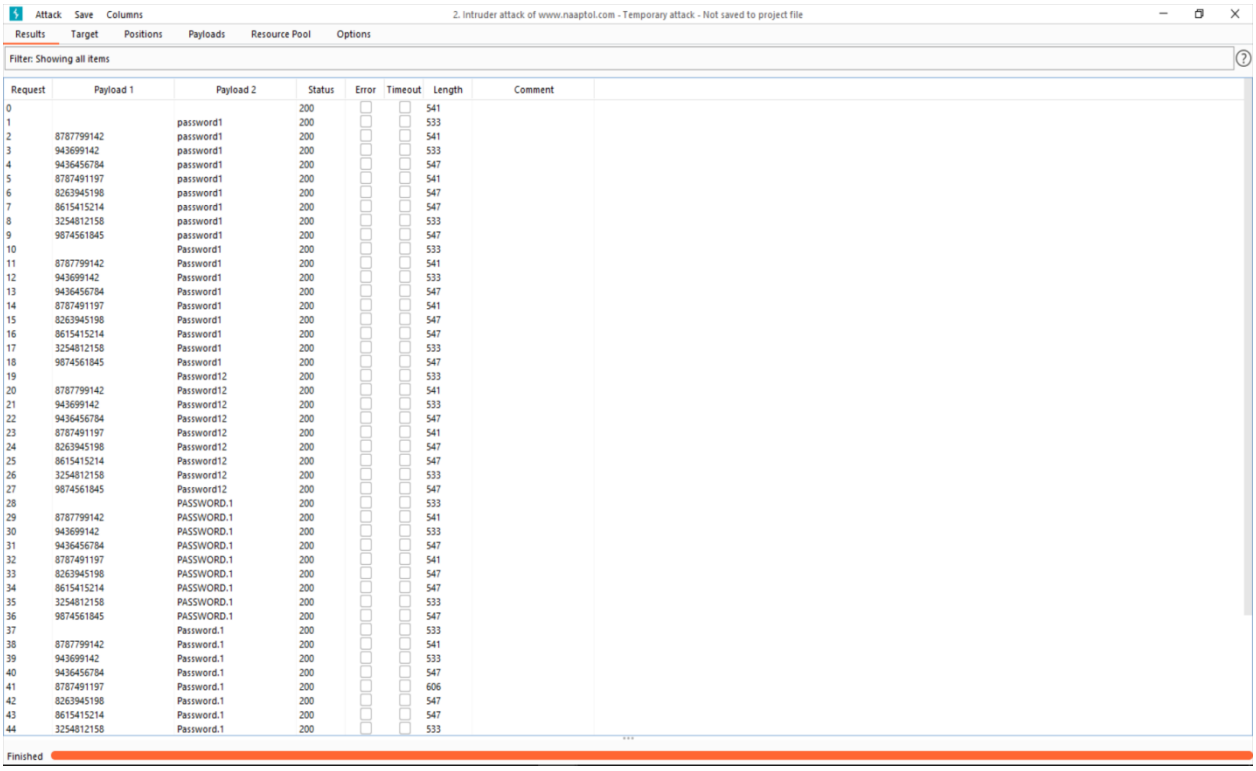
4. *Go to the payload position.*



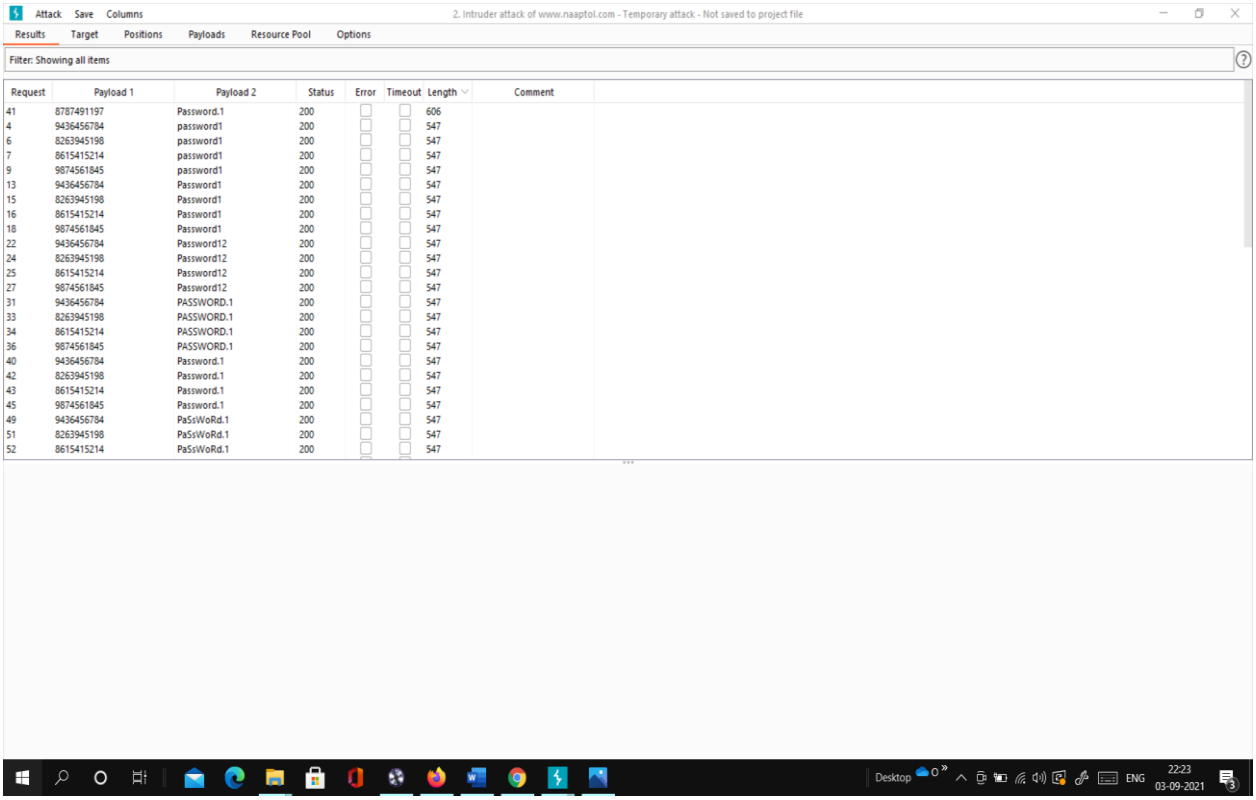
5. *Brute force the username and password to make combinations.*



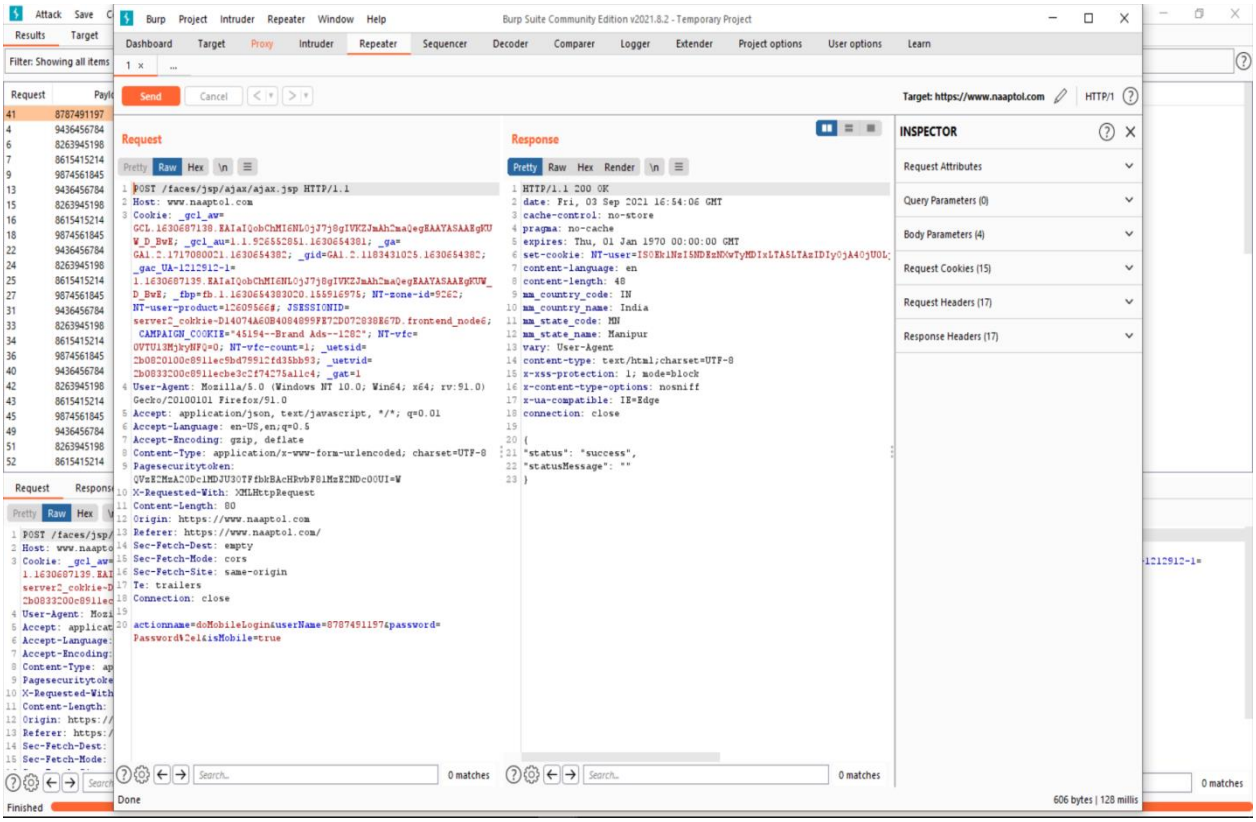
6. *Start the attack.*



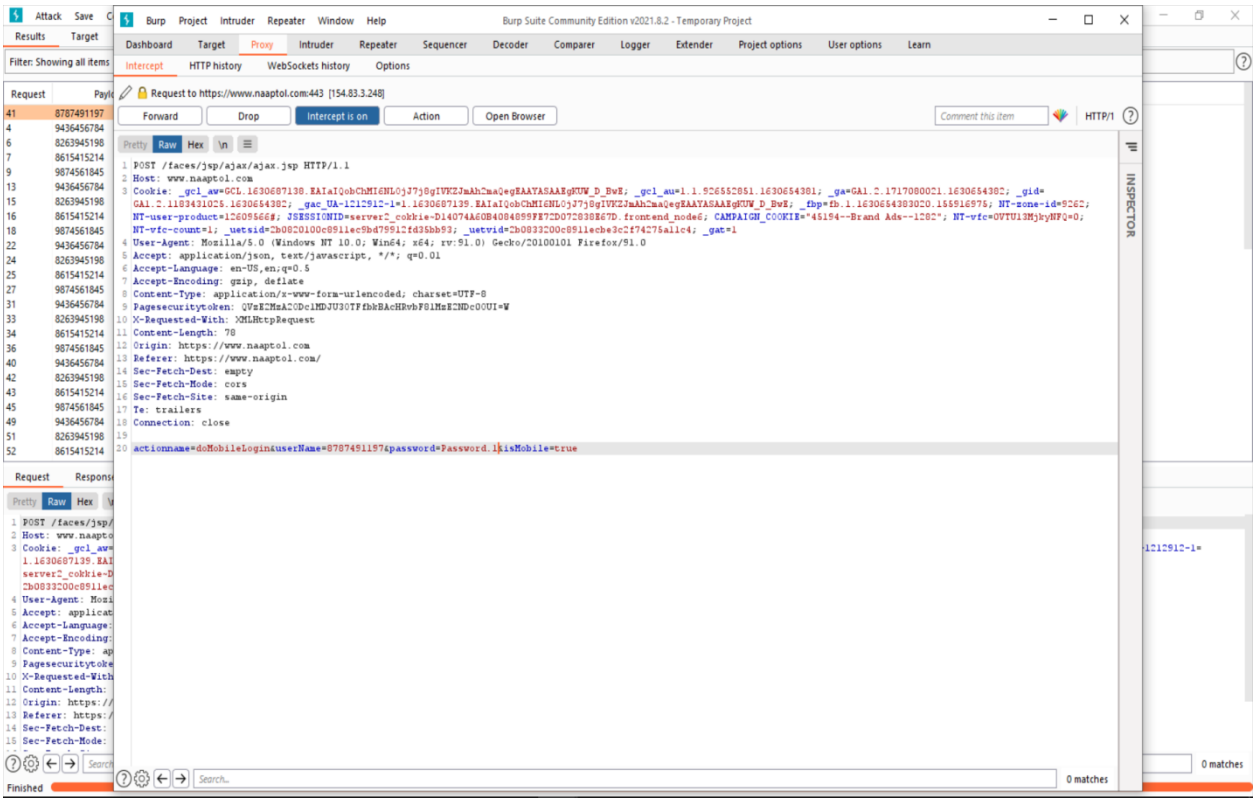
7. *Sorting by length.*



8. *Send the attack result to the repeater.*

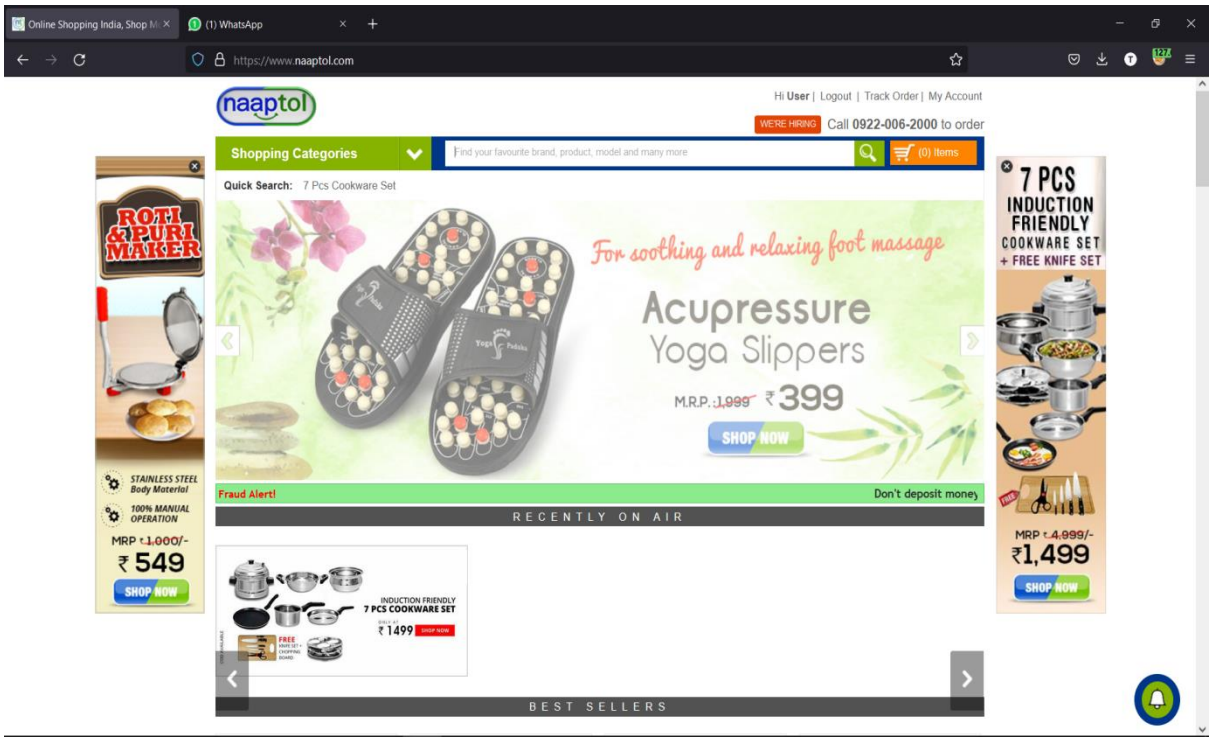


9. Copy and paste the request to the proxy and forward it.



10. Result of Brute Force Attack:

We have done Brute Force Attack on***www.naptol.com***.



In the above picture we can see that we have successfully logged in as an user.So, this site is vulnerable for Brute Force Attack

5. Conclusions /Recommendations:

There are both advantages & disadvantages of pentesting. One can perform attacks to ensure the security of their websites. On the other hand, attackers can illegally attack websites to steal information or inject malicious ads.

However, good security practices should be adopted in order to secure the websites or web applications. Enable Two-Factor Authentication, captcha and other protections to avoid attacks.

Monitor your site closely or purchase hosting with a managed cloud provider to handle monitoring for you. Ensure that the support includes proactive monitoring so that someone is at the helm to protect the site.

6. References:

Help from the internet, following websites links have been used in completion of this project：

- [1]: Slideshare, https://www.slideshare.net/
- [2]: Portswigger,https://portswigger.net/web-security/host-header
- [3]: OWASP,https://owasp.org/www-project-web-security-testing-guide/latest/4-Web_Application_Security_Testing/07-Input_Validation_Testing/17-Testing_for_Host_Header_Injection
- [4]: SECURITY INNOVATION,https://blog.securityinnovation.com/blog/2011/07/how-to-test-for-brute-force-vulnerabilities.html
- [5]: hashedout, https://www.thesslstore.com/blog/brute-force-attack-definition-how-brute-force-works/
- GitHub,https://github.com/scipag/password-list