PRACTICUM OF ATTACK AND DEFENSE OF NETWORK SECURITY

LECTURE-06 : WEB SECURITY

Spring 2021

Outline

- OWASP TOP 10
- Web vulnerability
  - CSRF, XSS, CRLF injection, SSRF
- Tool
  - Burp, DirBuster
- Privacy & Anonymity
  - VPN, DNS Over HTTPS, TOR

OWASP TOP 10

Open Web Application Security Project

OWASP Top 10

- Most critical security risks to web applications.
- 2003, 2004, 2007, 2010, 2013, and 2017

OWASP Top 10 - 2013	→	OWASP Top 10 - 2017
A1 – Injection	→	A1:2017-Injection
A2 – Broken Authentication and Session Management	→	A2:2017-Broken Authentication
A3 – Cross-Site Scripting (XSS)	↘	A3:2017-Sensitive Data Exposure
A4 – Insecure Direct Object References [Merged+A7]	U	A4:2017-XML External Entities (XXE) [NEW]
A5 – Security Misconfiguration	↘	A5:2017-Broken Access Control [Merged]
A6 – Sensitive Data Exposure	↗	A6:2017-Security Misconfiguration
A7 – Missing Function Level Access Contr [Merged+A4]	U	A7:2017-Cross-Site Scripting (XSS)
A8 – Cross-Site Request Forgery (CSRF)	☒	A8:2017-Insecure Deserialization [NEW, Community]
A9 – Using Components with Known Vulnerabilities	→	A9:2017-Using Components with Known Vulnerabilities
A10 – Unvalidated Redirects and Forwards	☒	A10:2017-Insufficient Logging&Monitoring [NEW,Comm.]

OWASP Top 10 2021 proposal

- Proposal 1. Add SSRF as a new category.
- Proposal 2. Merge XXE and Insecure Deserialization
- Proposal 3. Introduce Overall Risk Score

OWASP Top 10 2021 Statistics-based proposal.

- https://lab.wallarm.com/owasp-top-10-2021-proposal-based-on-a-statistical-data/
- Overall Risk = Avg. CVSS x Amount of Bulletins (https://vulners.com/)

OWASP Top 10 2017		change	OWASP Top 10 2021 proposal	
A1	Injections	**as is**	A1	Injections
A2	Broken Authentication	**as is**	A2	Broken Authentication
A3	Sensitive Data Exposure	**down 1**	A3	Cross-Site Scripting (XSS)
A4	XML eXternal Entities (XXE)	**down 1 + A8**	A4	Sensitive Data Exposure
A5	Broken Access Control	**down 1**	A5	Insecure Deserialization **(merged with XXE)**
A6	Security Misconfiguration	**down 4**	A6	Broken Access Control
A7	Cross-Site Scripting (XSS)	**up 4**	A7	Insufficient Logging & Monitoring
A8	Insecure Deserialization	**up 3 + A4**	A8	**NEW:** Server Side Request Forgery (SSRF)
A9	Known Vulnerabilities	**as is**	A9	Known Vulnerabilities
A10	Insufficient Logging & Monitoring	**up 3**	A10	Security Misconfiguration

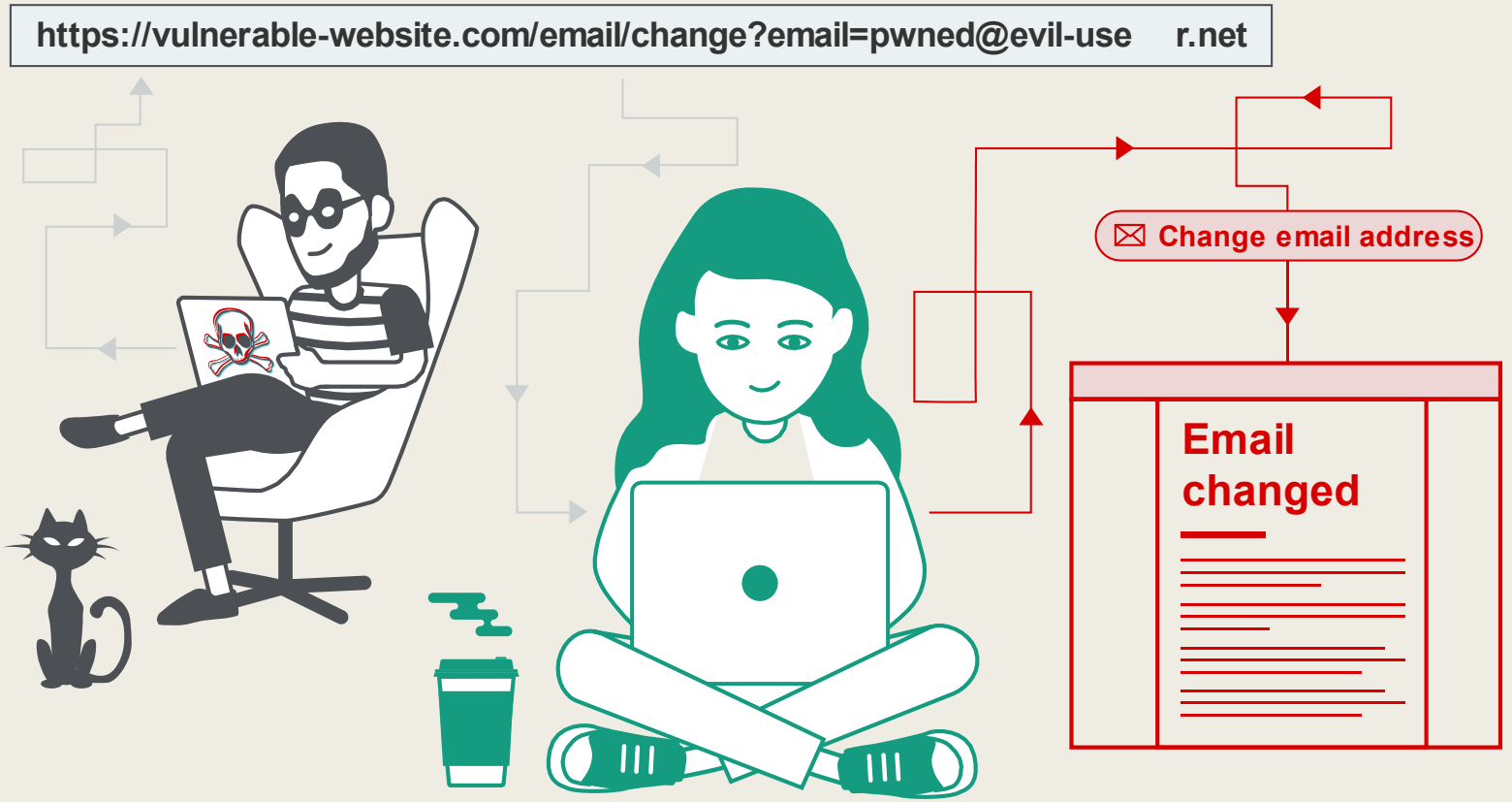
Avg. CVSS	# of bulletins	Overall score
4.83	34061	164514.63
4.08	13735	56038.8
0.1	433353	43335.3
3.55	5990	21264.5
5.33	2985	15910.05
0.72	16967	12216.24
3.35	2309	7735.15
3.8	1139	4328.2
5.38	376	2022.88
2.27	480	1089.6

WEB VULNERABILITY

CSRF
XSS
CRLF injection
SSRF

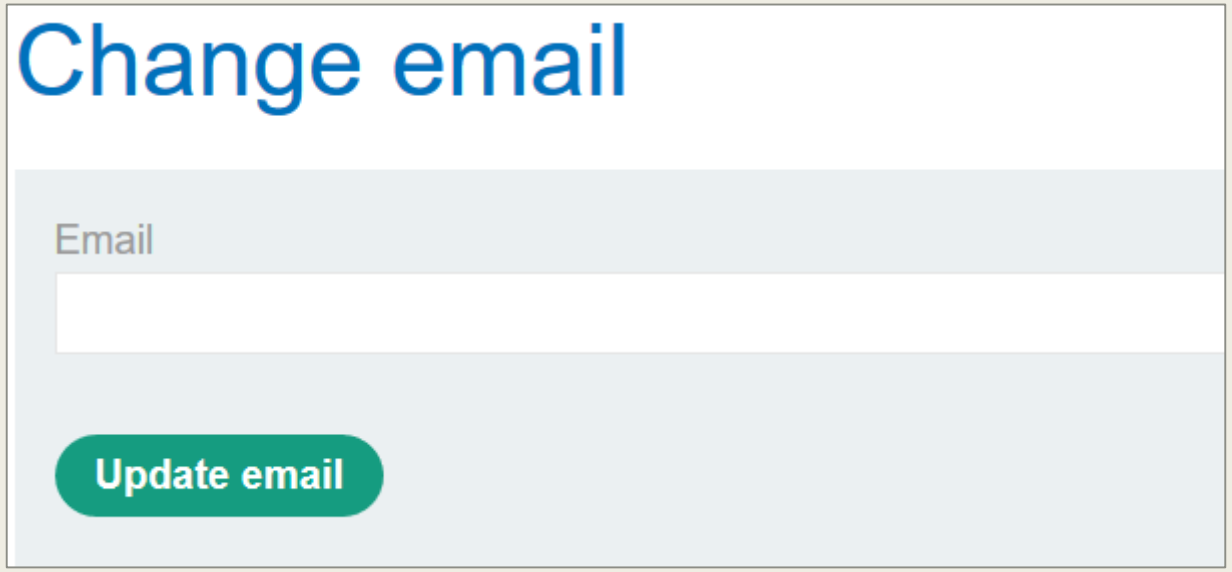
CSRF (Cross-Site Request Forgery)

- 跨站請求偽造
  - 攻擊者讓用戶在當前已登入的網站上，執行非本意操作

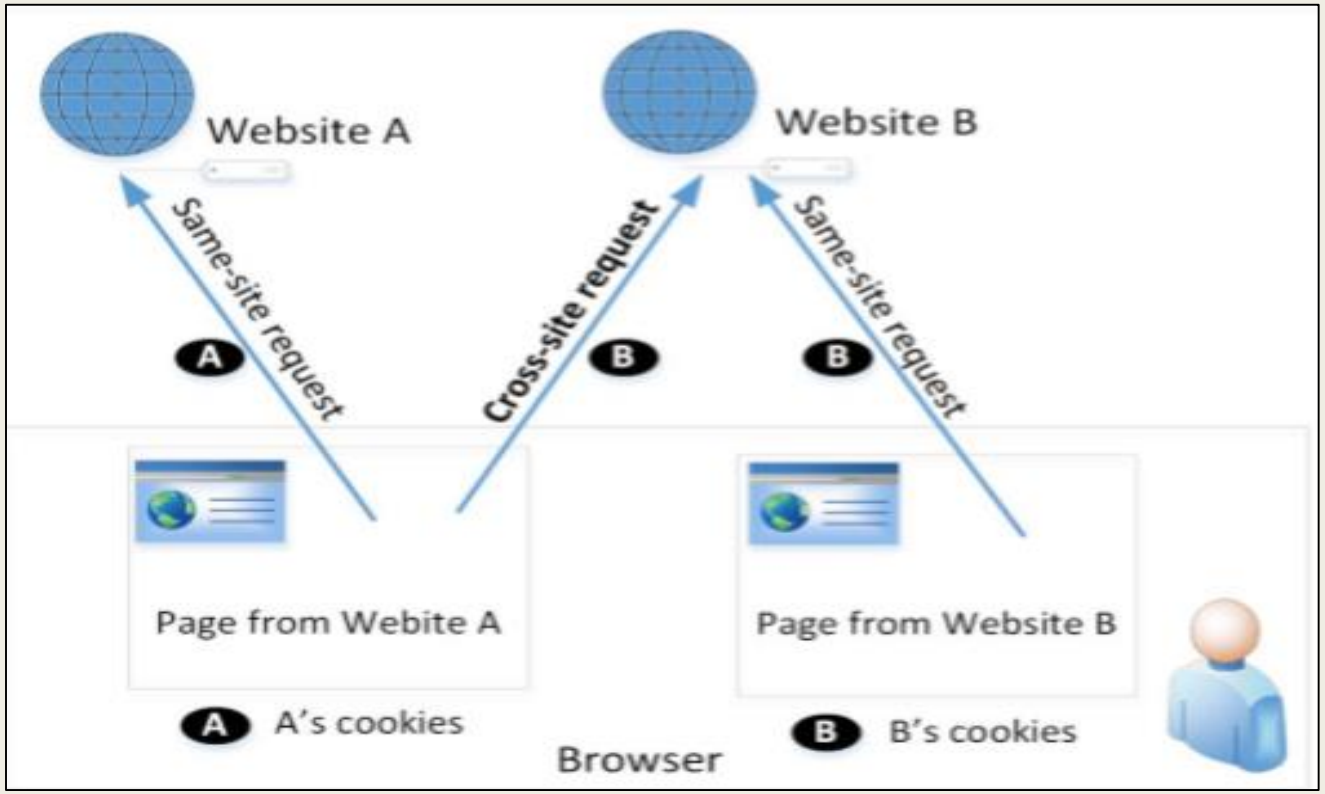


HTML form

```
<h1>Change email</h1>
<section>
    <form class="login-form" action="/email/change-email" method="POST">
        <label>Email</label>
        <input required type="email" name="email" value="">
        <button class='button' type='submit'> Update email </button>
    </form>
</section>
```



Definition:
Cross-Site Requests & Same-Site Request



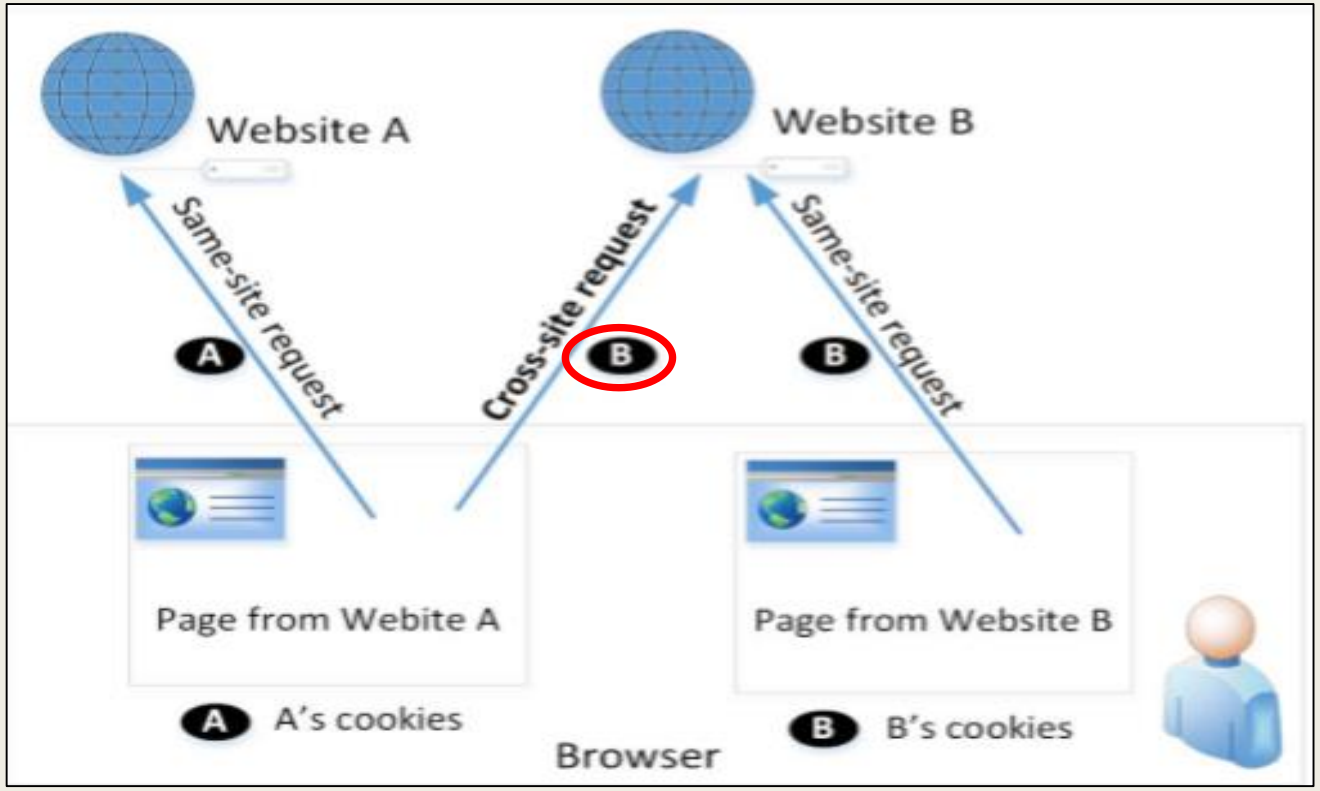
- same-site request:
  一個網站的頁面向自己發送請求

```
action="/email/change-email"
```

- cross-site request:
  A 網站的頁面向 B 網站發送請求

```
action="http://www.example.com/action_post.php" method="post">
```

Cookies in Cross-Site Request

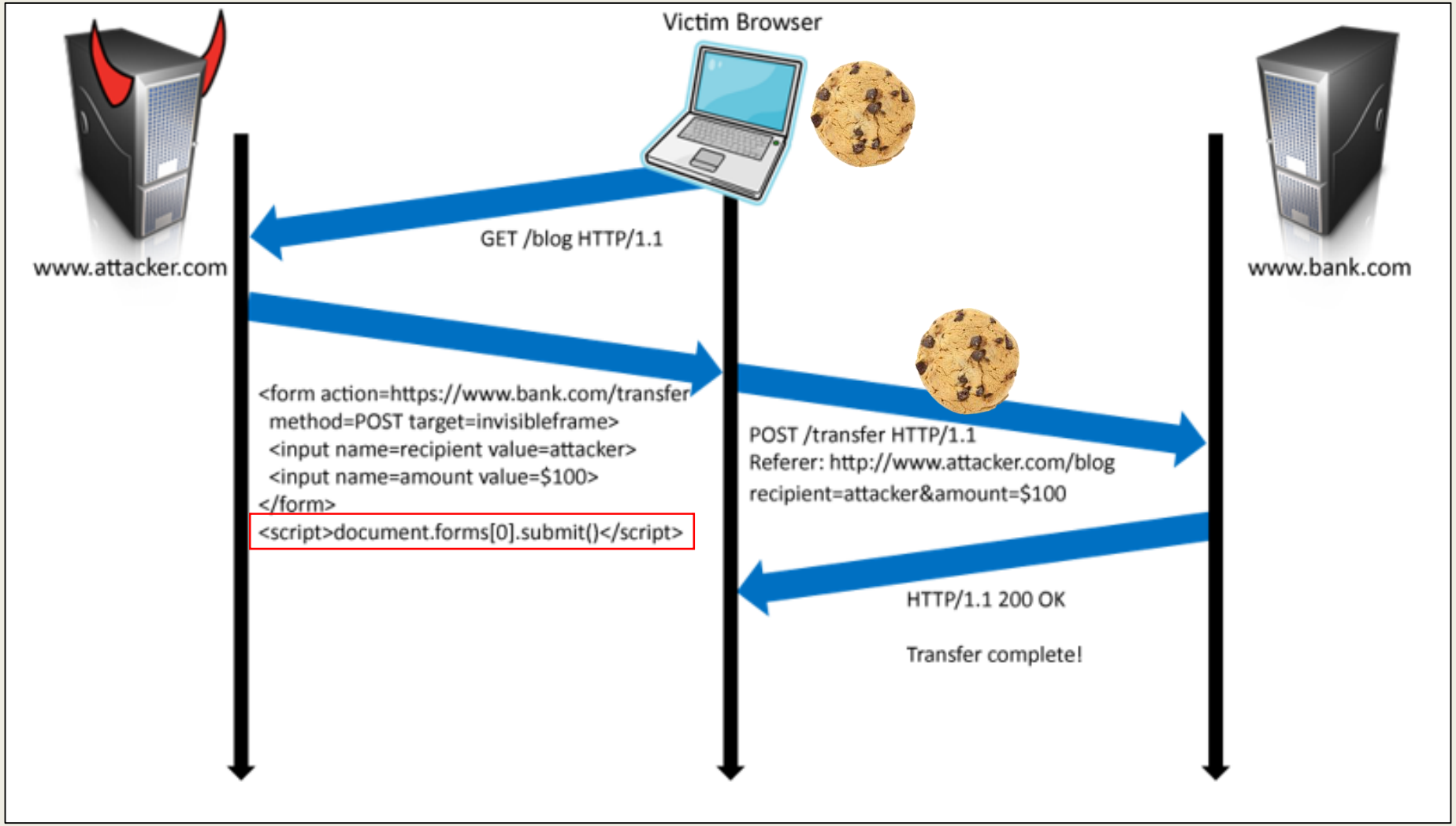


- 當 A.com 的頁面向 A.com 發送請求時，瀏覽器會將 A.com 的 cookies 一併送出

- 當 A.com 的頁面向 B.com 發送請求時，瀏覽器也會將 B.com 的 cookies 送出 (如果cookie沒有SameSite屬性)

```
SameSite=<samesite-value>
```

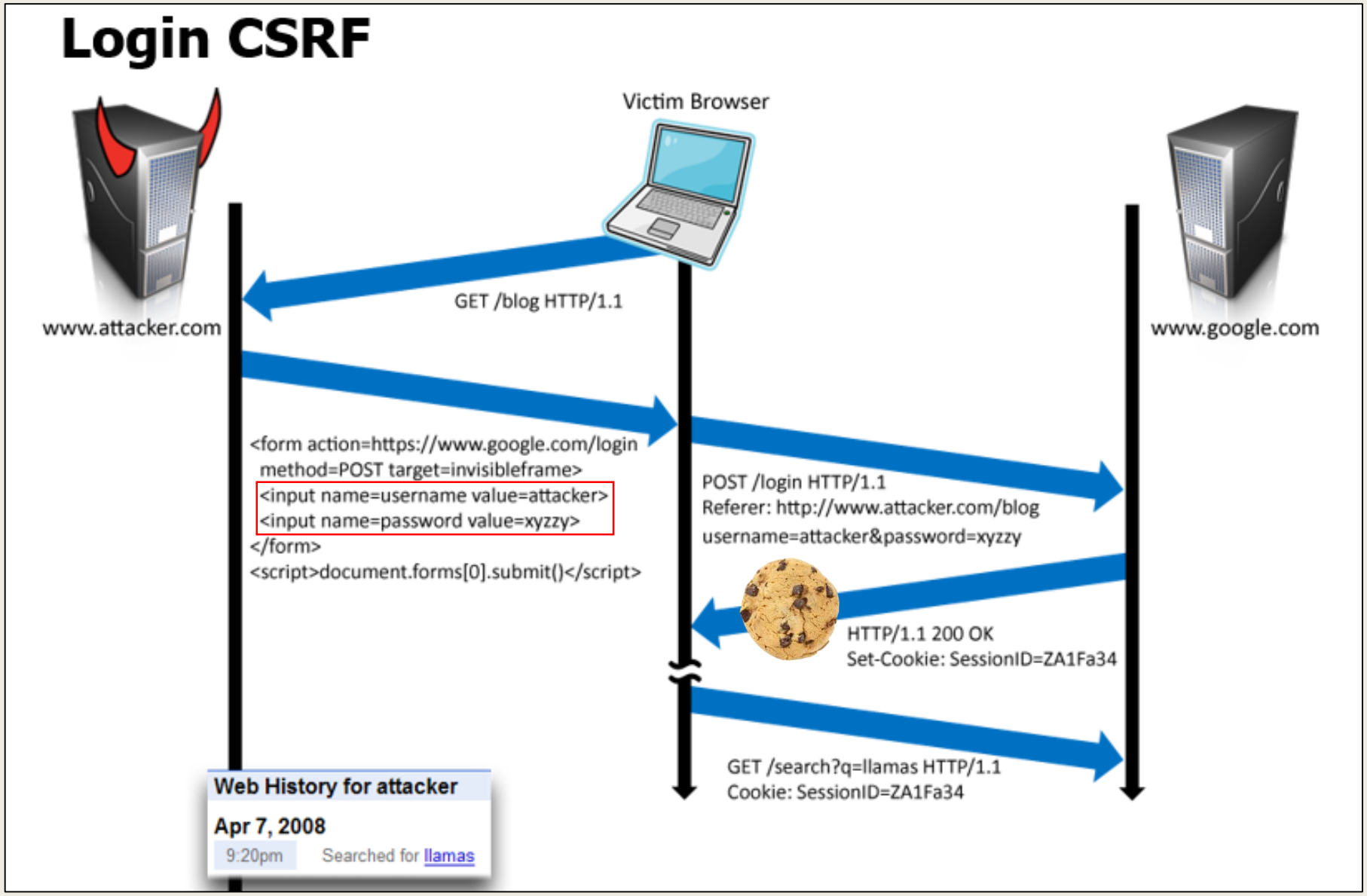
CSRF Attack Flow



CSRF Login Attack

- 攻擊者偽造一個登入請求，使用的是攻擊者自己的帳號密碼
- 目的：攻擊者之後可以登入自己的帳號，查看歷史紀錄，得知受害者做了那些操作或留下哪些資訊

CSRF Login Attack



Trigger request in CSRF

- JavaScript：
  攻擊者可以用 JavaScript 送出請求

```
document.getElementsByName("myForm")[0].submit();
```

- <img> 和 <iframe> tag：
  HTML 的 <img> 和 <iframe> tag 會對 src attribute 所指定的 URL 送出 GET request

```
<img src="http://www.bank32.com/transfer.php?to=3220&amount=500">

<iframe
   src="http://www.bank32.com/transfer.php?to=3220&amount=500">
</iframe>
```

CSRF by GET request

- When you click “Add Friend”

```
http://www.csrflabelgg.com/action/friends/add?friend=40&__elgg_ts=1532750193&__elgg_token=..
```

- The <img> tag will trigger an HTTP GET request.

```
<html>
<head>
<title>
Malicious Web of CSRF Attack
</title>
</head>
<body>
<H1>Congratulation! You have won a grand prize!</H1>

<img src="http://www.csrflabelgg.com/action/friends/add?friend=40" width="1" height="1">

<H2>WebMaster: James Yu</H2>
</body>
</html>
```

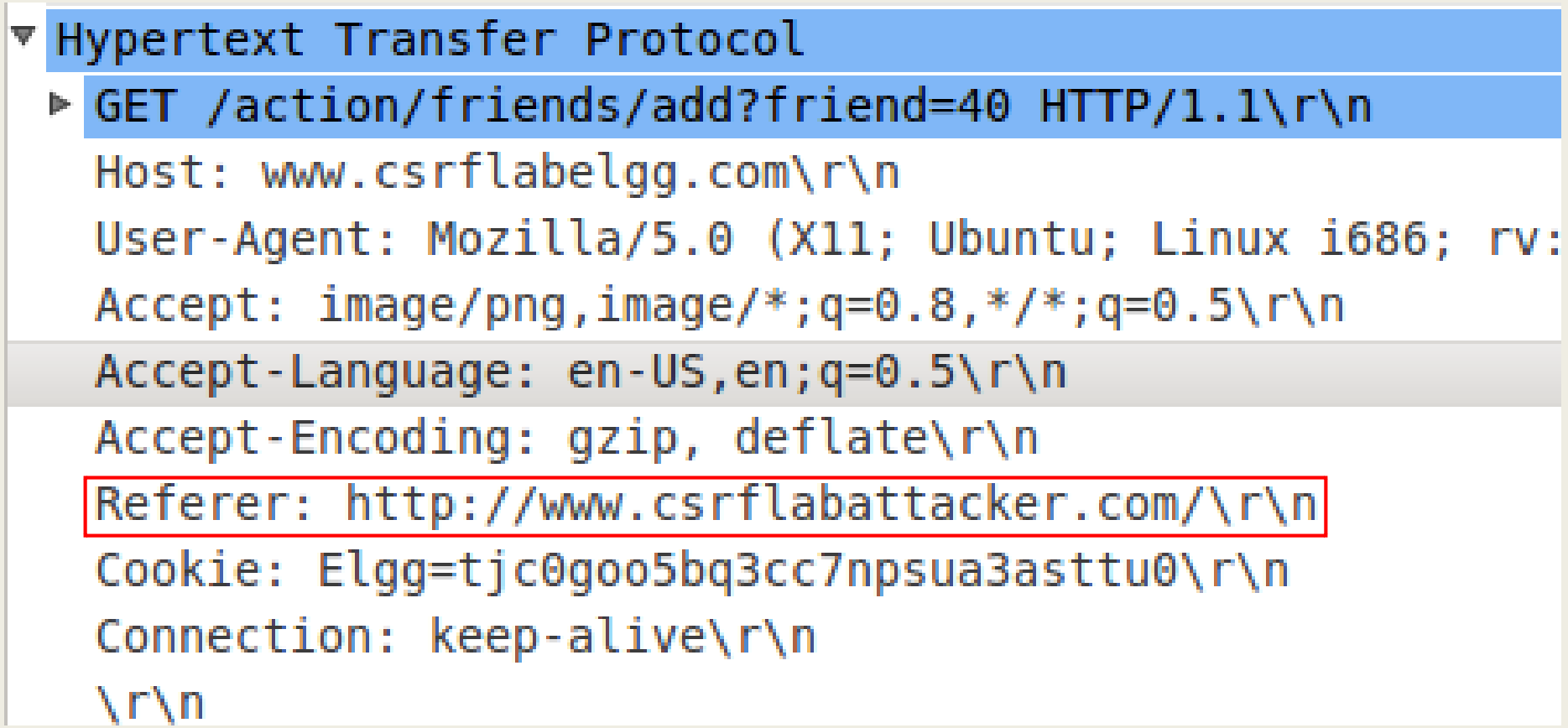
CSRF Countermeasures

- 幫助 server 端分辨 same-site request / cross-site request

1. Referer header (browser's help)
2. Same-site cookie (browser's help)
3. Secret token (the server helps itself)

1. HTTP Referer Header

- HTTP header field identifies the address of the web page from which the request is generated.



1. HTTP Referer Header

- Server 可以確認這個 request 是否源自一個信任的頁面

- 這種方式只能用在暫時性防禦，或者是已知使用者環境的情況下。
  - 有些 proxy為了隱私，會省略 Referer Header
  - 檢查規則容易遺漏或規避，而有些軟體或瀏覽器可以控制傳送或停用 Referer
  - 一個 request 若缺少 Referer header， Server 必須拒絕這個請求

- 可能存在其他漏洞可以達成 Referer spoofing
  - E.g., CRLF injection
  - 瀏覽器本身的漏洞

2. Same-Site Cookies

- 透過 “Set-Cookie” headers
  - *Set-Cookie: NAME=VALUE; expires=DATE; path=PATH; domain=DOMAIN_NAME; Secure; HttpOnly; SameSite=<samesite-value>*

`SameSite=<samesite-value>` | Optional

- `Strict`: The browser sends the cookie only for same-site requests (that is, requests originating from the same site that set the cookie). If the request originated from a different URL than the current one, no cookies with the `SameSite=Strict` attribute are sent.
- `Lax`: The cookie is withheld on cross-site subrequests, such as calls to load images or frames, but is sent when a user navigates to the URL from an external site, such as by following a link.
- `None`: The browser sends the cookie with both cross-site and same-site requests.

3. Secret Token

a) Server 端生成的 CSRF token

b) Server 端生成的 Double Submit Cookie

c) Client 端生成的 Double Submit Cookie

3. Secret Token
a) Server 端生成的 CSRF token

1. 在 form 裡加一個欄位: name='csrftoken' value='<亂碼>'，並將<亂碼>存在 server
2. 收到 request 時比對 form 裡的<亂碼>是否等於 server 端的 <亂碼>

- 產生： Server
- 儲存： Server
- 漏洞：若 csrftoken 不是亂碼，攻擊者可以先發一個 request 取得 csrftoken

3. Secret Token
b) Server 端生成的 Double Submit Cookie

1. 在 form 裡加 CSRF token，同時 set 一個 cookie 的值等於 CSRF token
2. 收到 request 時比對 form 裡的 CSRF token 是否等於 cookie 的值

- 這方法利用的是攻擊者無法取得 cookie 的值，因此偽造的 form 中的 CSRF token 不會和 cookie 裡的值一樣
- 產生： Server
- 儲存： Client
- 漏洞： 攻擊者如果掌握了你底下任何一個 subdomain，就可以幫你來寫 cookie

Weak Integrity of Cookie

- Cookies 對 subdomain 並不具有完整性
- 舉例來說，foo.example.com 可以對 example.com 設置 cookie，而這個有可能把 bar.example.com 對 example.com 設置的 cookie 給蓋掉
- 最糟的情況下，當 bar.example.com 收到這個 cookie 時，區分不出是自己設置的還是別人設置的。foo.example.com 就可以利用這個特性來攻擊 bar.example.com。

3. Secret Token
c) Client 端生成的 Double Submit Cookie

1. 由前端在 form 裡加 CSRF token，同時 set 一個 cookie 的值等於 CSRF token

```
document.cookie = "username=John Doe; expires=Thu, 18 Dec 2013 12:00:00 UTC";
```

2. 收到 request 時比對 form 裡的 CSRF token 是否等於 cookie 的值

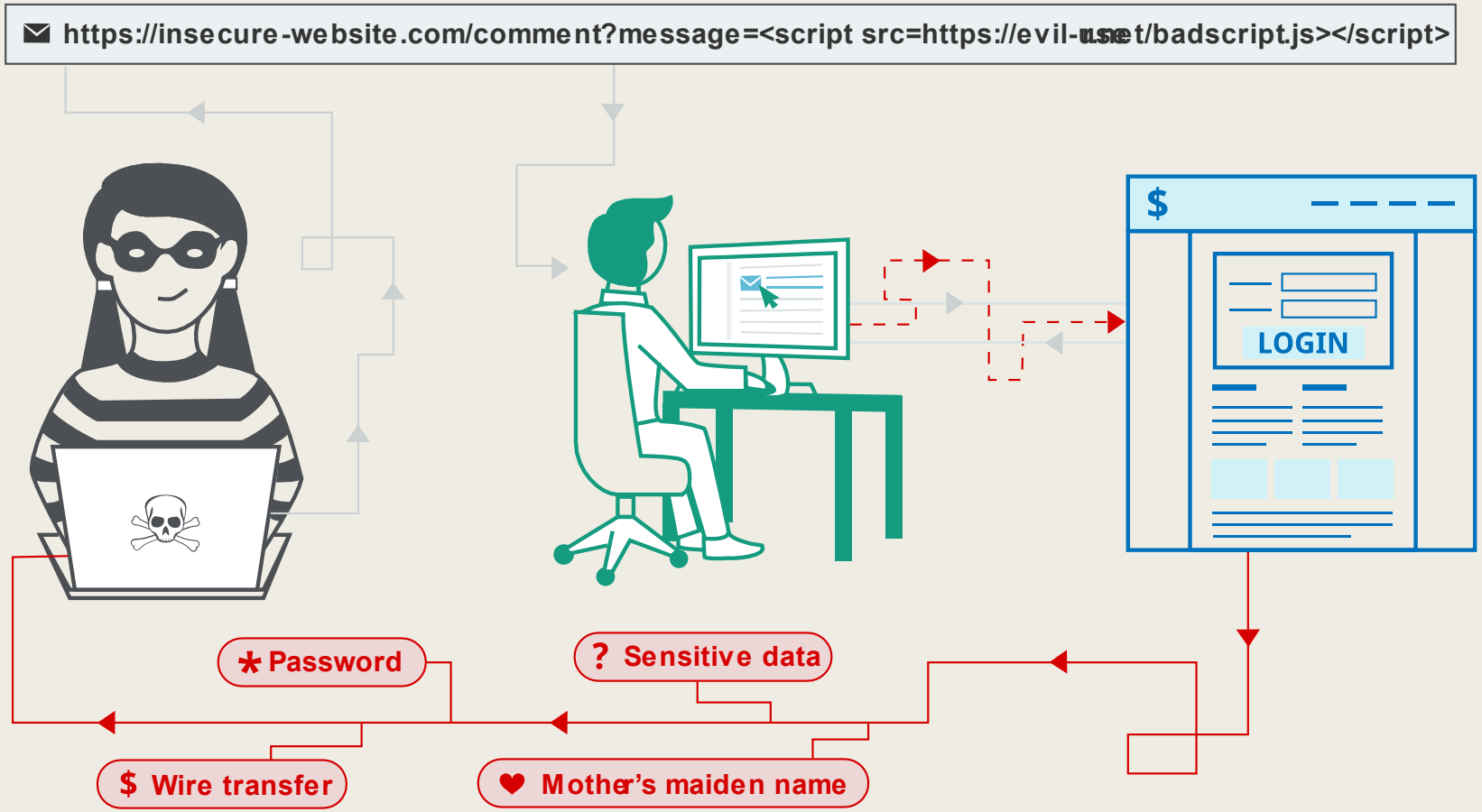
- 單頁應用 (single-page application) 在拿取 CSRF token 會有困難，可以改成 Client 端生成
- 產生： Client
- 儲存： Client

Summary of CSRF

- Cross-site requests vs. Same-site requests
- How does a hacker launch CSRF attack?
- The fundamental cause of the CSRF vulnerability
- Countermeasures against CSRF attack

XSS (Cross-Site Scripting)

- 跨網站指令碼
  - 攻擊者將惡意程式碼注入到受害網頁上，使其他用戶在觀看網頁時執行。



What hackers can do with XSS attacks?

- Forge user requests (even same-site requests)
- Steal cookies (~~HttpOnly~~)
- Man-in-the-browser
  - Get form values / HTML contents
  - Tabnabbing (一種釣魚攻擊的手法)

Types of XSS Attacks

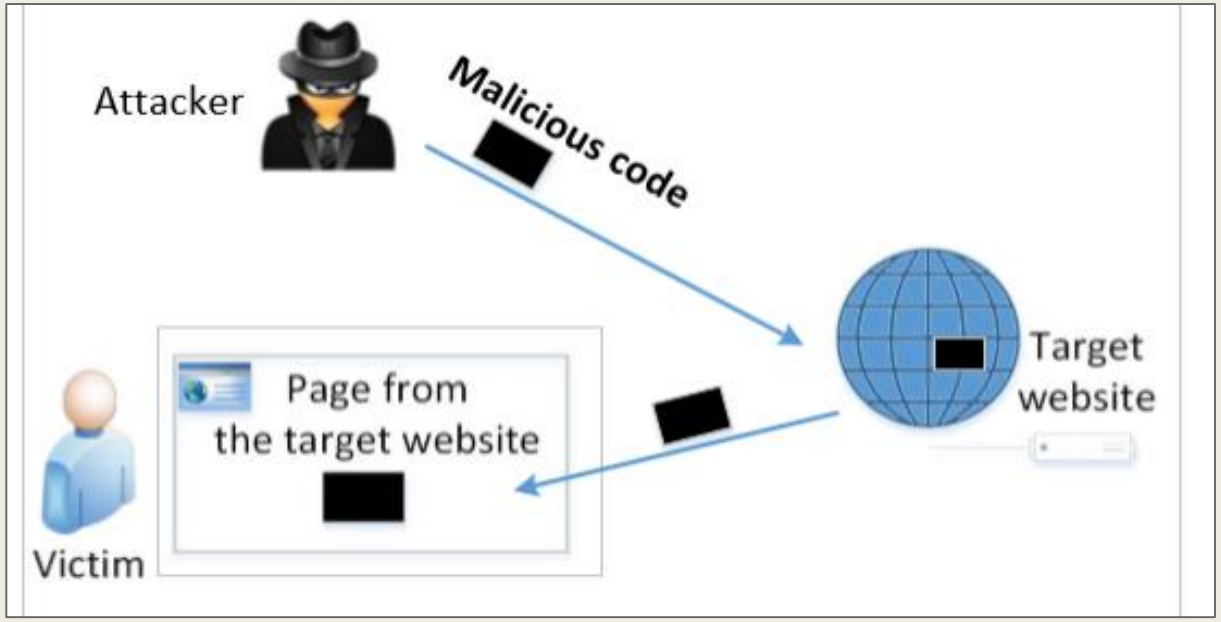
- Stored XSS Attack
- Reflected XSS Attack

Stored XSS Attack

1. 攻擊者將惡意代碼提交到目標網站的資料庫中。

2. 用戶瀏覽受害網站時，Server 將惡意代碼從資料庫取出，拼接在 HTML 中返回給用戶瀏覽器。

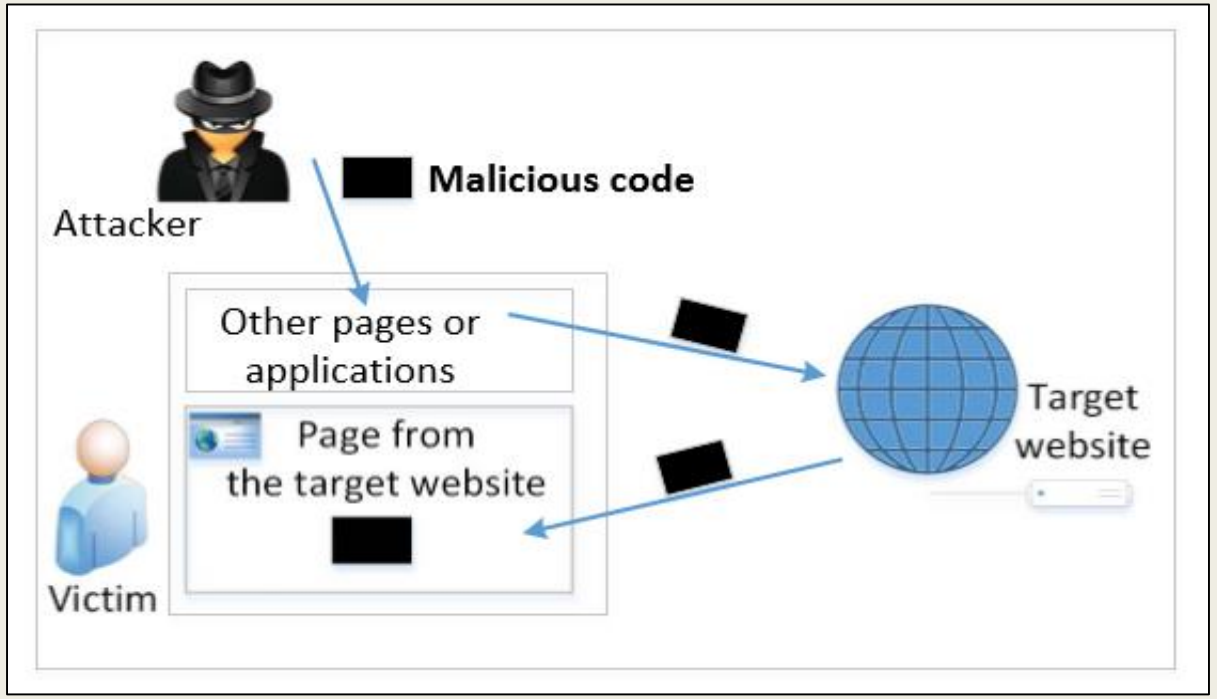
- Example :
  - 社群網站個人頁面
  - 留言



Reflected XSS Attack

1. 攻擊者構造出特殊的 URL，其中包含惡意代碼。

2. 用戶打開帶有惡意代碼的 URL 時，Server 將惡意代碼從 URL 中取出，拼接在 HTML 中返回給瀏覽器。



Example - Reflected XSS Attack

- 有個網站的搜尋使用 GET request
  - http://www.example.com/search?input=word

- 網站回應包含搜尋目標字串

  你搜尋了 **XXX !**

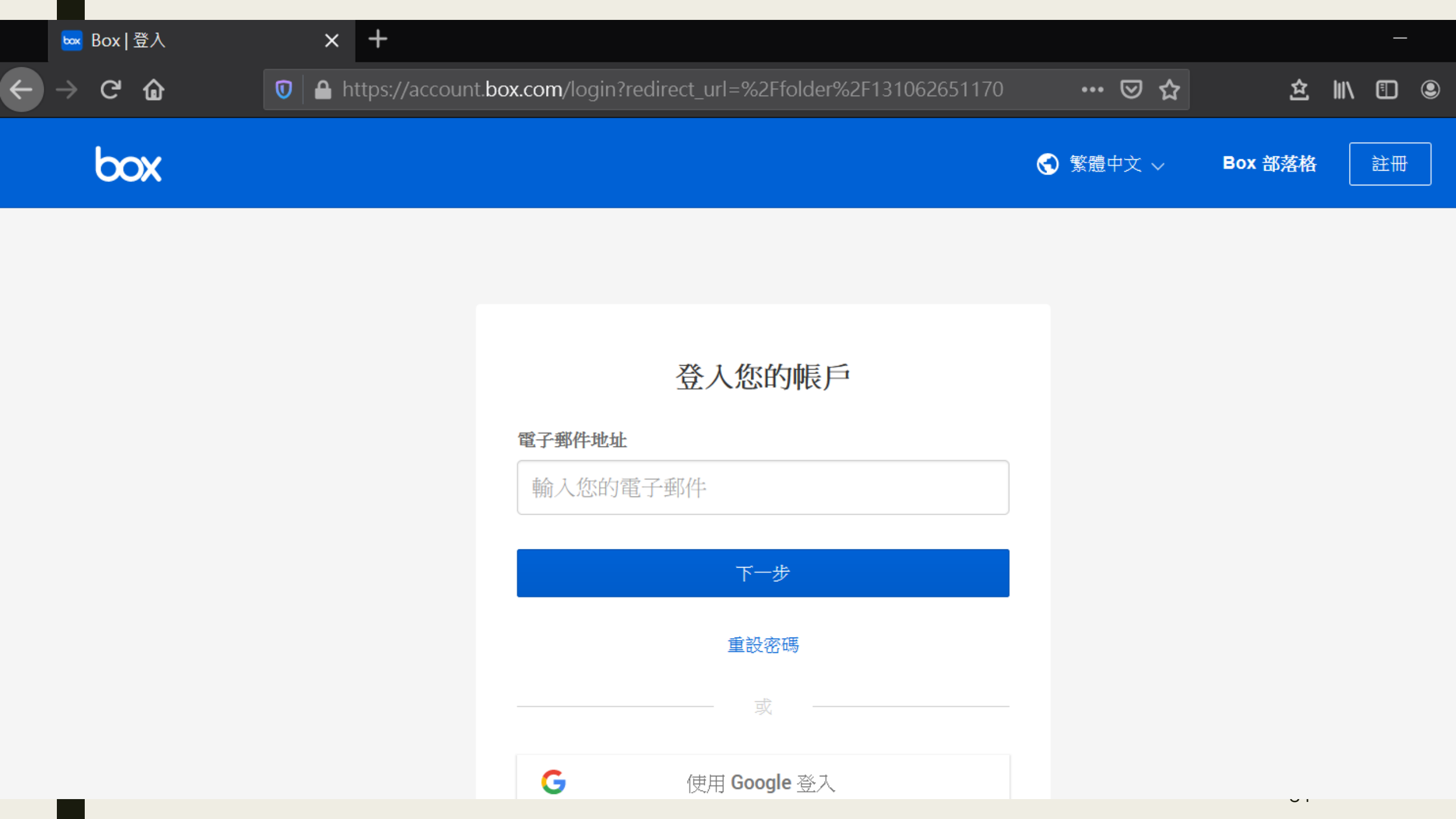
- 攻擊者構造惡意連結
  - http://www.example.com/search?input=<script>alert(1);</script>

Example - Reflected XSS Attack
CRLF injection (HTTP Response Splitting)

- The header of a HTTP response and its body are separated by two CRLF(\r\n\r\n) characters.

```
> Content-Length: 43\r\n
  X-Cache: MISS from 172.19.134.2\r\n
  X-Cache-Lookup: MISS from 172.19.134.2:3128\r\n
  Via: 1.0 172.19.134.2:3128 (squid/2.6.STABLE14)\r\n
  Connection: keep-alive\r\n
  \r\n 回車換行 (Carriage-Return Line-Feed )
```

```
140  61 6c 69 76 65 0d 0a 0d  0a 47 49 46 38 39 61 01   alive··· ·GIF89a·
150  00 01 00 80 00 00 ff ff  ff 00 00 00 21 f9 04 01   ·····••• ••••!···
160  00 00 00 00 2c 00 00 00  00 01 00 01 00 00 02 02   ····,··· ••••••••
170  44 01 00 3b                                        D··;
```


Box | 登入
https://account.box.com/login?redirect_url=%2Ffolder%2F131062651170
box
繁體中文
Box 部落格
註冊
登入您的帳戶
電子郵件地址
輸入您的電子郵件
下一步
重設密碼
或
使用 Google 登入

Example - Reflected XSS Attack
CRLF injection (HTTP Response Splitting)

- Redirect users after successful login:
  - http://localhost/login?page=http%3A%2F%2Flocalhost%2Findex

- HTTP response:

```
HTTP/1.1 302 Moved Temporarily

Date: Tue, 17 Aug 2010 20:00:29 GMT

Server: Apache mod_fcgid/2.3.5 mod_auth_passthrough/2.1
mod_bwlimited/1.4 FrontPage/5.0.2.2635

Location: http://localhost/index
```

Example - Reflected XSS Attack
CRLF injection (HTTP Response Splitting)

- Redirect users after successful login:
  - http://localhost/login?page=http%3A%2F%2Flocalhost%2Fcheckout%0D%0A%0D%0A%3Cscript%3Ealert%28%27hello%27%29%3C%2Fscript%3E

- HTTP response:

```
HTTP/1.1 302 Moved Temporarily

Date: Tue, 17 Aug 2010 20:00:29 GMT

Server: Apache mod_fcgid/2.3.5 mod_auth_passthrough/2.1
mod_bwlimited/1.4 FrontPage/5.0.2.2635

Location: http://localhost/checkout<CRLF>

<CRLF>

<script>alert('hello')</script>
```

Fundamental Causes of XSS

- 使用者提交的 data 包含 HTML tags 和 JavaScript 代碼
- 如果這些 data 沒有經過過濾就傳到 User 的瀏覽器 → XSS attack / CRLF injection
- 瀏覽器無法分辨這些 Script 的來源，認為這就是網站的功能

Countermeasures

1. Filtering approach
2. Encoding approach
3. WAF (Web Application Firewall)

1. Filtering Approach

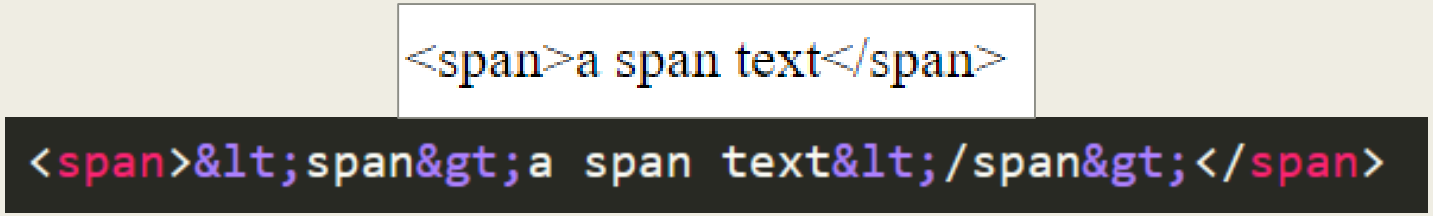
- Input Filtering Approach
  - 移除所有 user input 的 script/code/HTML tags
- Output Filtering Approach
  - 資料庫中保存原始的 user input，輸出到網頁時才做過濾
- 過濾方法可能存在漏洞，除了用 <script> tag 還有別種方法注入代碼

```
<img src="./x.jpg" alt="一張不存在的圖" onerror=alert(1) />
```

- 開發者要處理所有 user input 來源
  - e.g., query parameters, body parameters of POST request, HTTP headers
- 可用 open-source libraries 過濾 JavaScript code
  - e.g., jsoup

2. Encoding Approach

- 將 HTML Markups 換成 HTML Entities

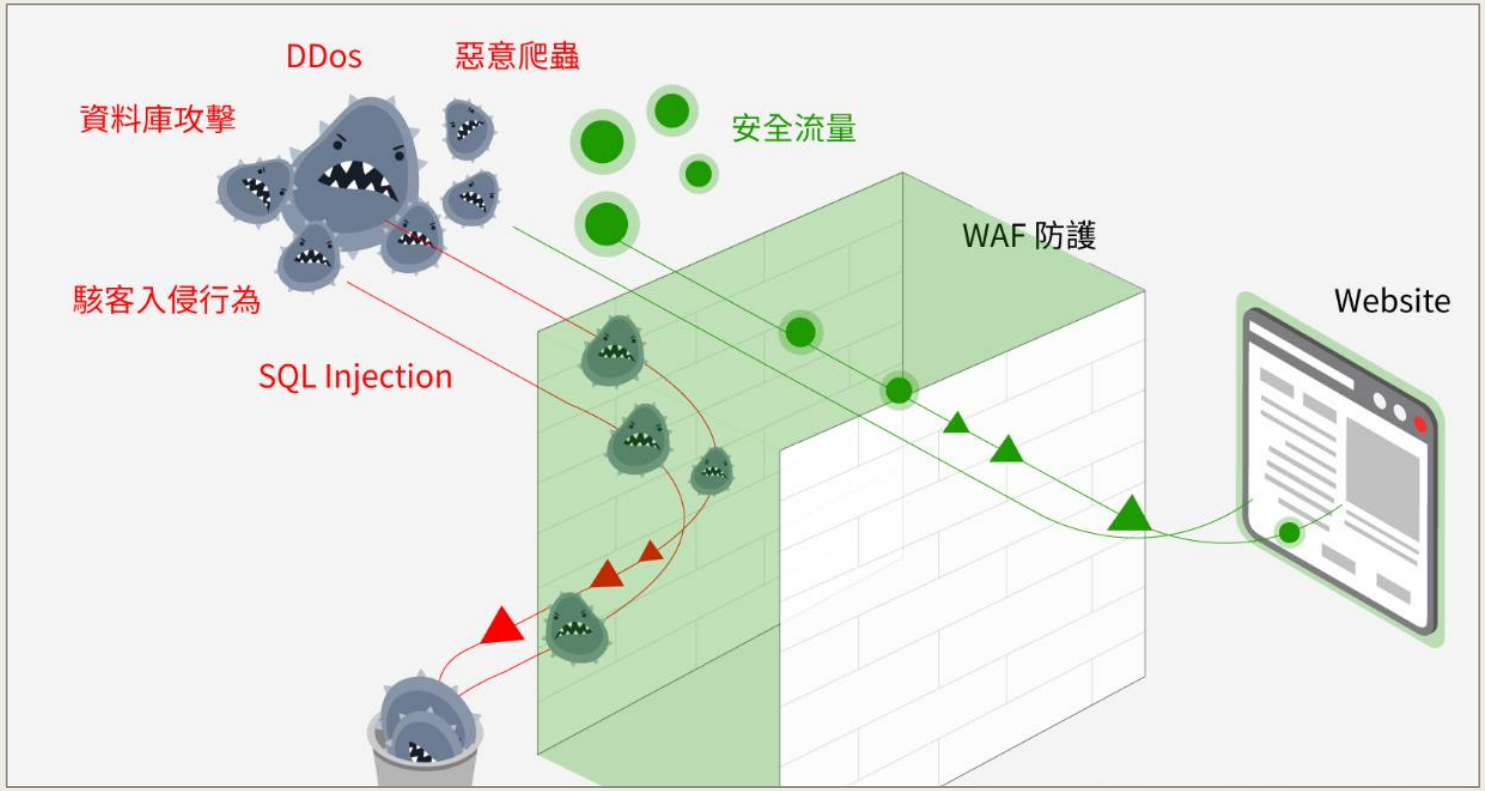


- <script> alert(‘XSS’) </script> → <script>alert(‘XSS’)

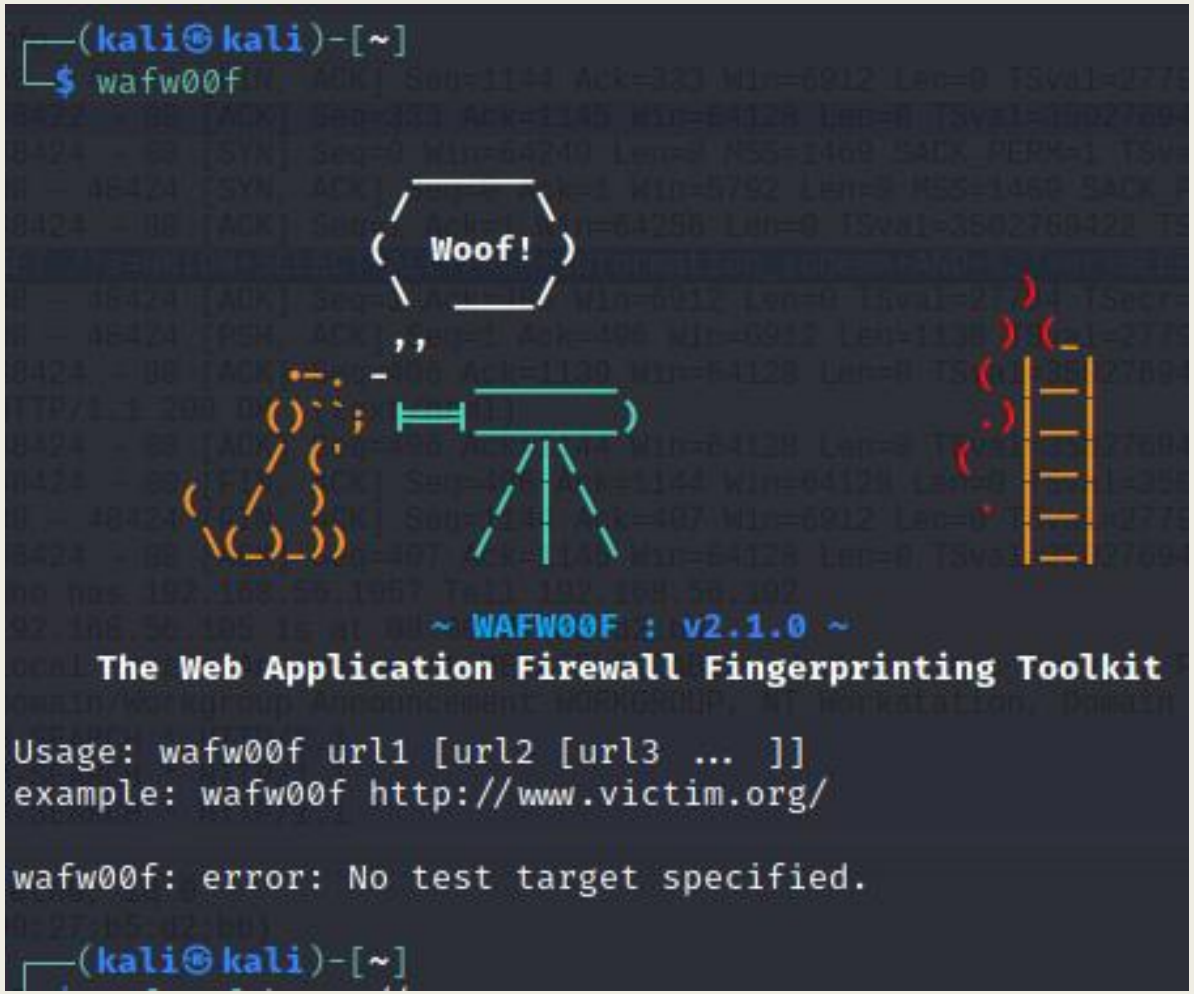
- 這些 JavaScript 被 encode 過後，就會被瀏覽器顯示而不是執行
- 開發者要處理所有 user input 來源
  - e.g., query parameters, body parameters of POST request, HTTP headers

3. WAF (Web Application Firewall)

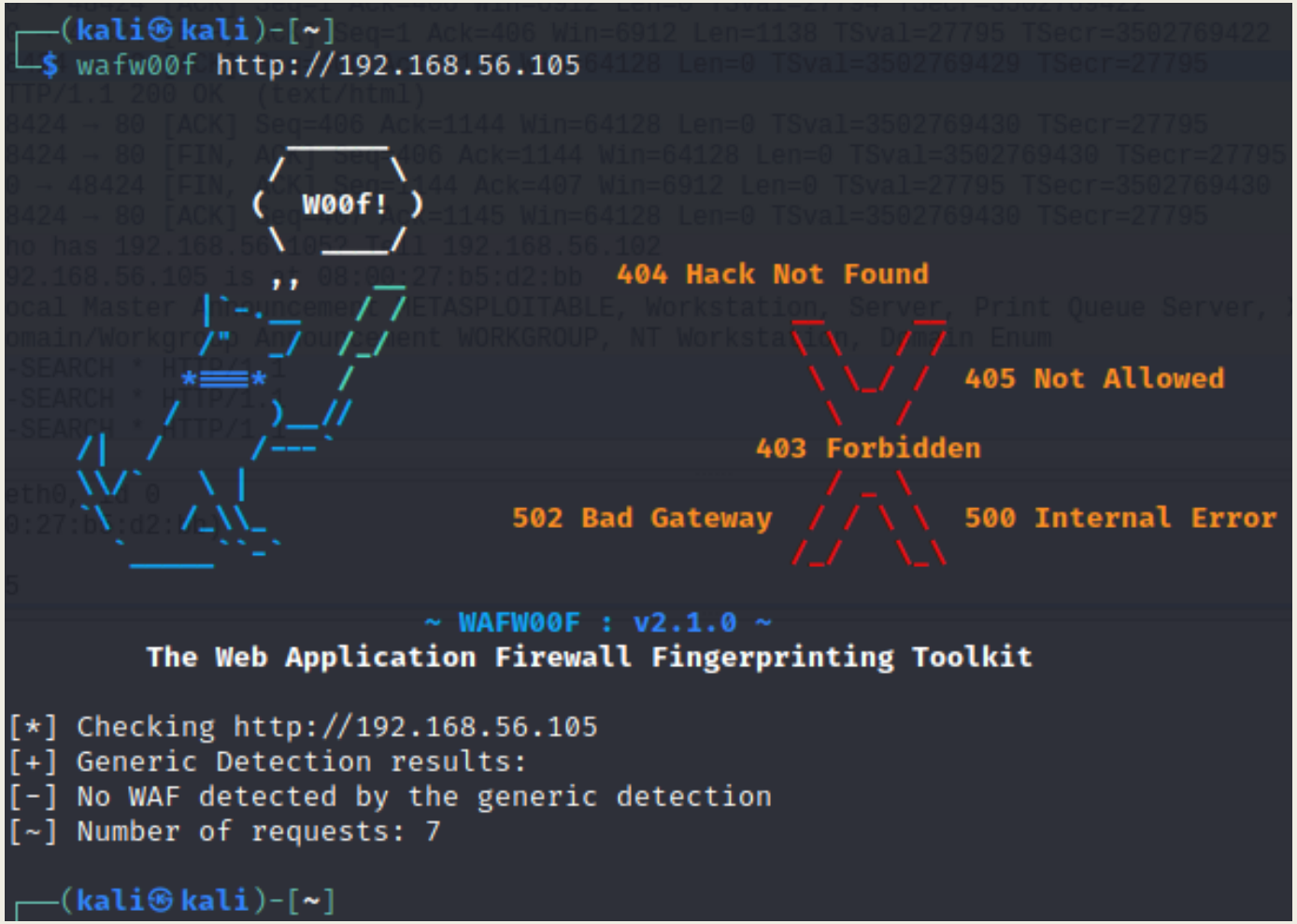
- 網站應用防火牆 (WAF) 會自動過濾惡意的 input，包含惡意的
  - Path, HTTP headers, HTML tag patterns 和 Javascript, SQL patterns



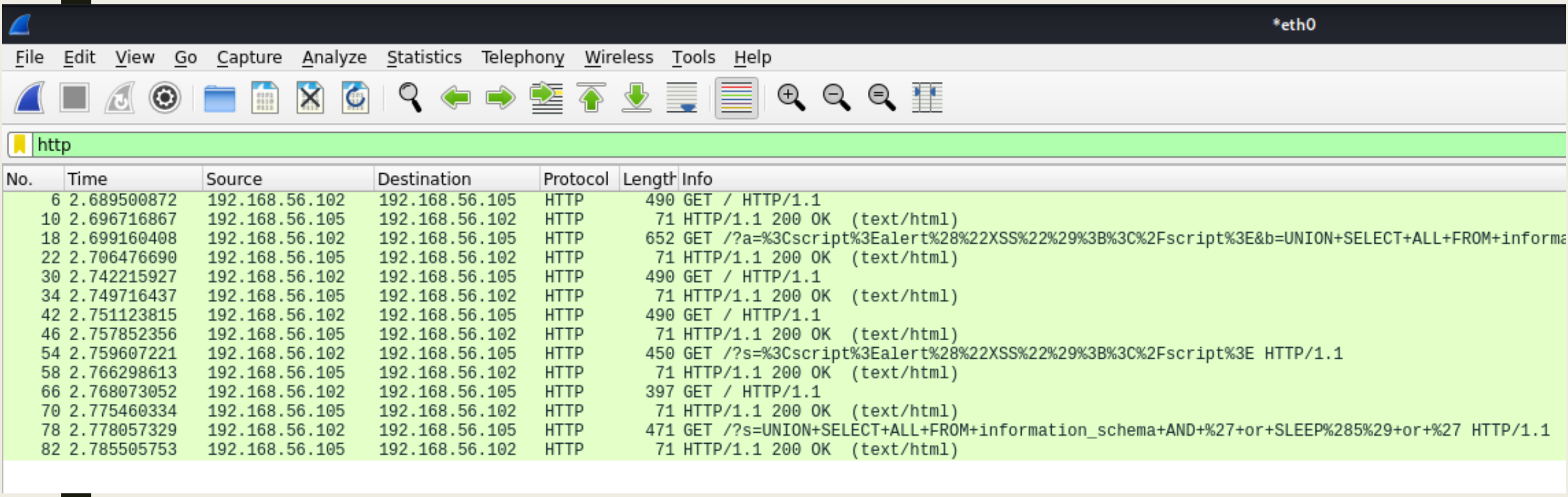
wafw00f


(kali㉿kali)-[~]
$ wafw00f
Woof!
~ WAFW00F : v2.1.0 ~
The Web Application Firewall Fingerprinting Toolkit
Usage: wafw00f url1 [url2 [url3 ...]]
example: wafw00f http://www.victim.org/
wafw00f: error: No test target specified.
(kali㉿kali)-[~]

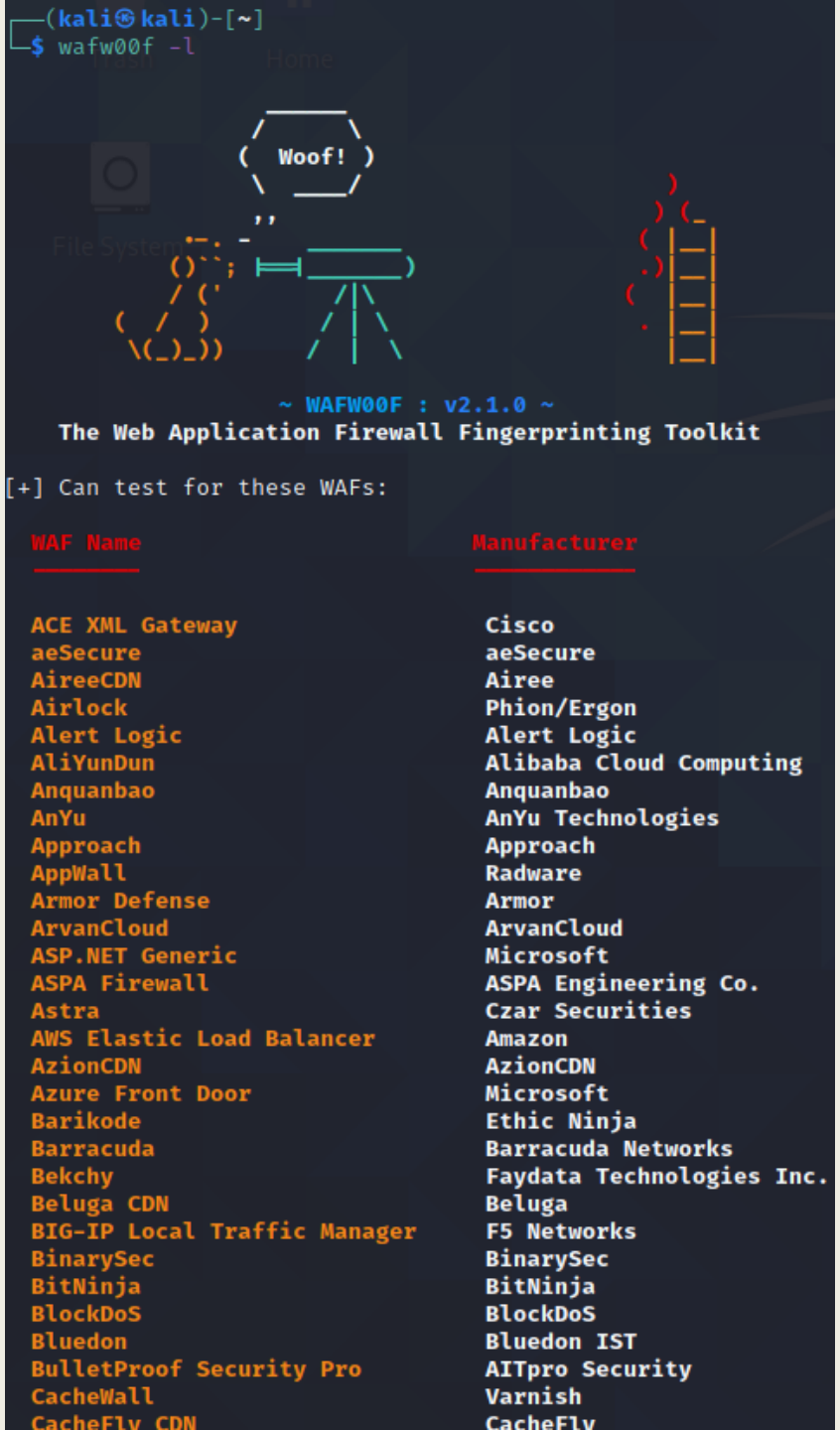
wafw00f


(kali㉿kali)-[~]
$ wafw00f http://192.168.56.105
W00f!
404 Hack Not Found
405 Not Allowed
403 Forbidden
502 Bad Gateway
500 Internal Error
~ WAFW00F : v2.1.0 ~
The Web Application Firewall Fingerprinting Toolkit
[*] Checking http://192.168.56.105
[+] Generic Detection results:
[-] No WAF detected by the generic detection
[~] Number of requests: 7
(kali㉿kali)-[~]

wafw00f

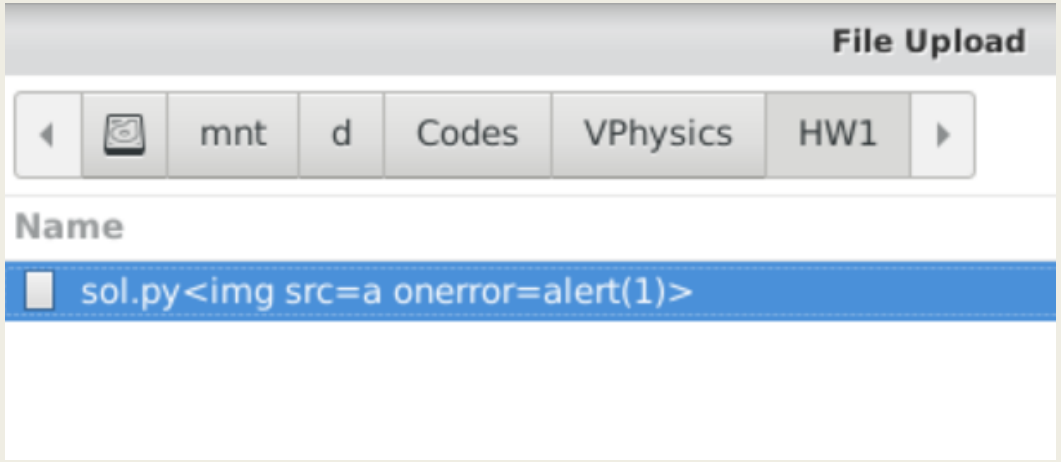

*eth0
File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help
http
No. Time Source Destination Protocol Length Info
6 2.689500872 192.168.56.102 192.168.56.105 HTTP 490 GET / HTTP/1.1
10 2.696716867 192.168.56.105 192.168.56.102 HTTP 71 HTTP/1.1 200 OK (text/html)
18 2.699160408 192.168.56.102 192.168.56.105 HTTP 652 GET /?a=%3Cscript%3Ealert%28%22XSS%22%29%3B%3C%2Fscript%3E&b=UNION+SELECT+ALL+FROM+informa
22 2.706476690 192.168.56.105 192.168.56.102 HTTP 71 HTTP/1.1 200 OK (text/html)
30 2.742215927 192.168.56.102 192.168.56.105 HTTP 490 GET / HTTP/1.1
34 2.749716437 192.168.56.105 192.168.56.102 HTTP 71 HTTP/1.1 200 OK (text/html)
42 2.751123815 192.168.56.102 192.168.56.105 HTTP 490 GET / HTTP/1.1
46 2.757852356 192.168.56.105 192.168.56.102 HTTP 71 HTTP/1.1 200 OK (text/html)
54 2.759607221 192.168.56.102 192.168.56.105 HTTP 450 GET /?s=%3Cscript%3Ealert%28%22XSS%22%29%3B%3C%2Fscript%3E HTTP/1.1
58 2.766298613 192.168.56.105 192.168.56.102 HTTP 71 HTTP/1.1 200 OK (text/html)
66 2.768073052 192.168.56.102 192.168.56.105 HTTP 397 GET / HTTP/1.1
70 2.775460334 192.168.56.105 192.168.56.102 HTTP 71 HTTP/1.1 200 OK (text/html)
78 2.778057329 192.168.56.102 192.168.56.105 HTTP 471 GET /?s=UNION+SELECT+ALL+FROM+information_schema+AND+%27+or+SLEEP%285%29+or+%27 HTTP/1.1
82 2.785505753 192.168.56.105 192.168.56.102 HTTP 71 HTTP/1.1 200 OK (text/html)

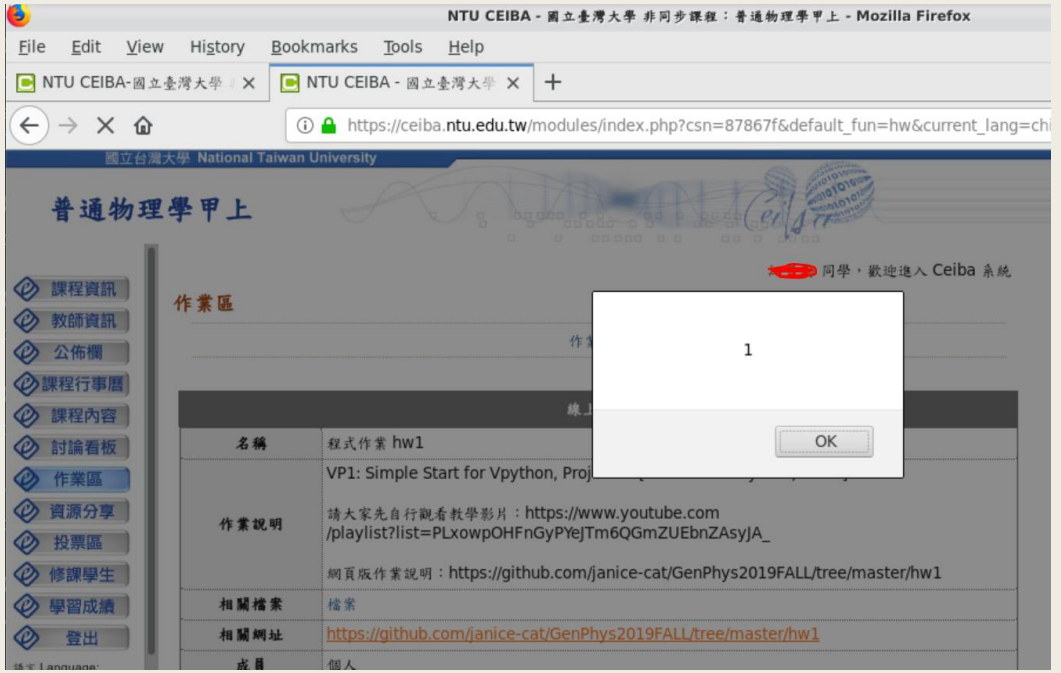
wafw00f


┌──(kali㉿kali)-[~]
└─$ wafw00f -l
Woof!
~ WAFW00F : v2.1.0 ~
The Web Application Firewall Fingerprinting Toolkit
[+] Can test for these WAFs:
WAF Name
Manufacturer
ACE XML Gateway
Cisco
aeSecure
aeSecure
AireeCDN
Airee
Airlock
Phion/Ergon
Alert Logic
Alert Logic
AliYunDun
Alibaba Cloud Computing
Anquanbao
Anquanbao
AnYu
AnYu Technologies
Approach
Approach
AppWall
Radware
Armor Defense
Armor
ArvanCloud
ArvanCloud
ASP.NET Generic
Microsoft
ASPA Firewall
ASPA Engineering Co.
Astra
Czar Securities
AWS Elastic Load Balancer
Amazon
AzionCDN
AzionCDN
Azure Front Door
Microsoft
Barikode
Ethic Ninja
Barracuda
Barracuda Networks
Bekchy
Faydata Technologies Inc.
Beluga CDN
Beluga
BIG-IP Local Traffic Manager
F5 Networks
BinarySec
BinarySec
BitNinja
BitNinja
BlockDoS
BlockDoS
Bluedon
Bluedon IST
BulletProof Security Pro
AITpro Security
CacheWall
Varnish
CacheFly CDN
CacheFly

CEIBA 網站 XSS 漏洞

- 可透過上傳檔案之副檔名達成 XSS 攻擊
- 名稱的部分會被重新命名，但是副檔名並不會被過濾





Summary of XSS

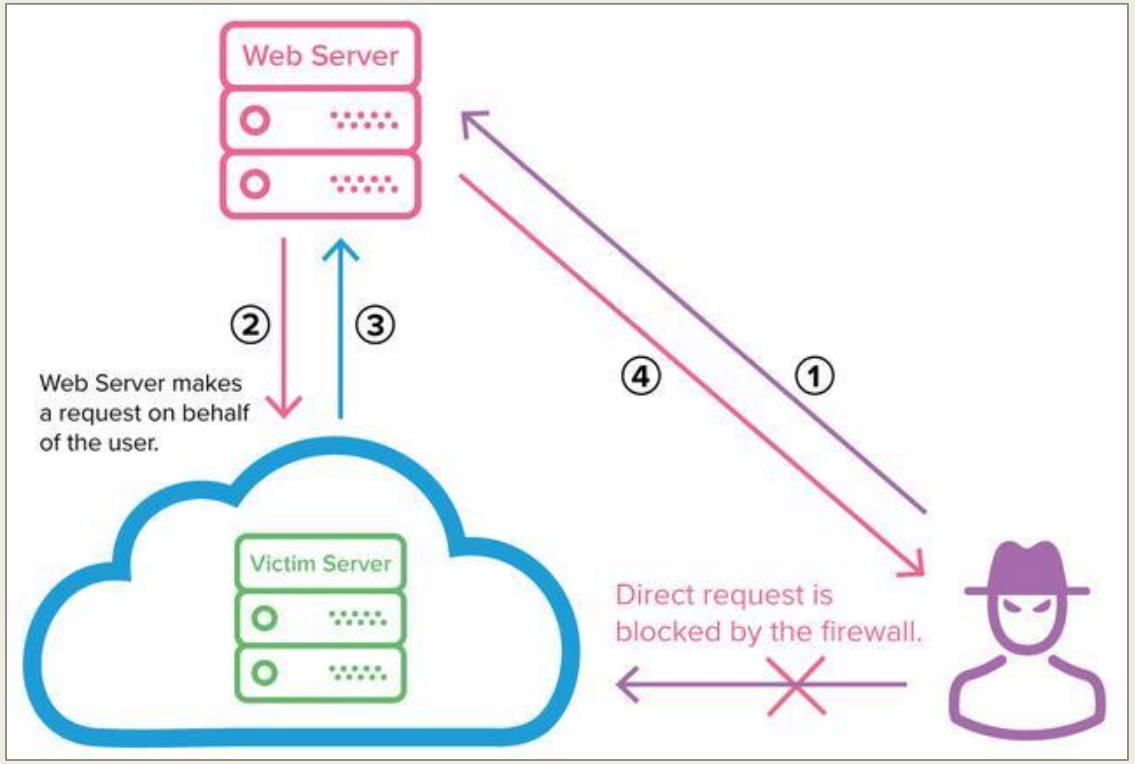
- Two types of XSS attacks
- How to launch XSS attacks
- Countermeasures against XSS attacks

The best defense of XSS?

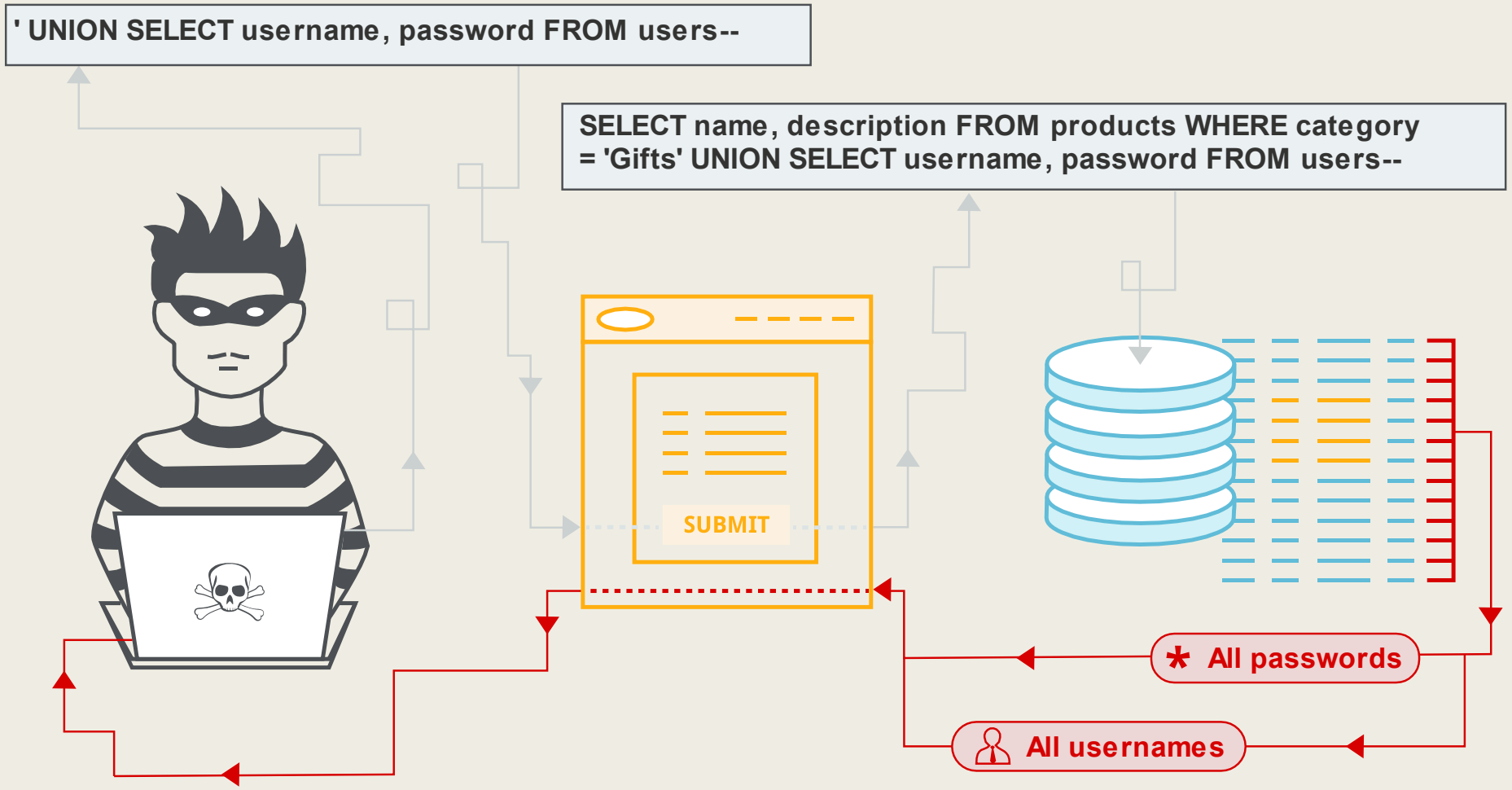
- Define trust boundaries
- Validate and sanitize untrusted data

SSRF (Server-Side Request Forgery)

- 服務器端請求僞造，以伺服器的身份發送一條構造好的請求
- 很多 web 應用都提供了從其他的伺服器上獲取數據的功能
- SSRF 可讓攻擊者的請求重定向到防火牆後的內部網路或本地主機



SSRF (Server-Side Request Forgery)

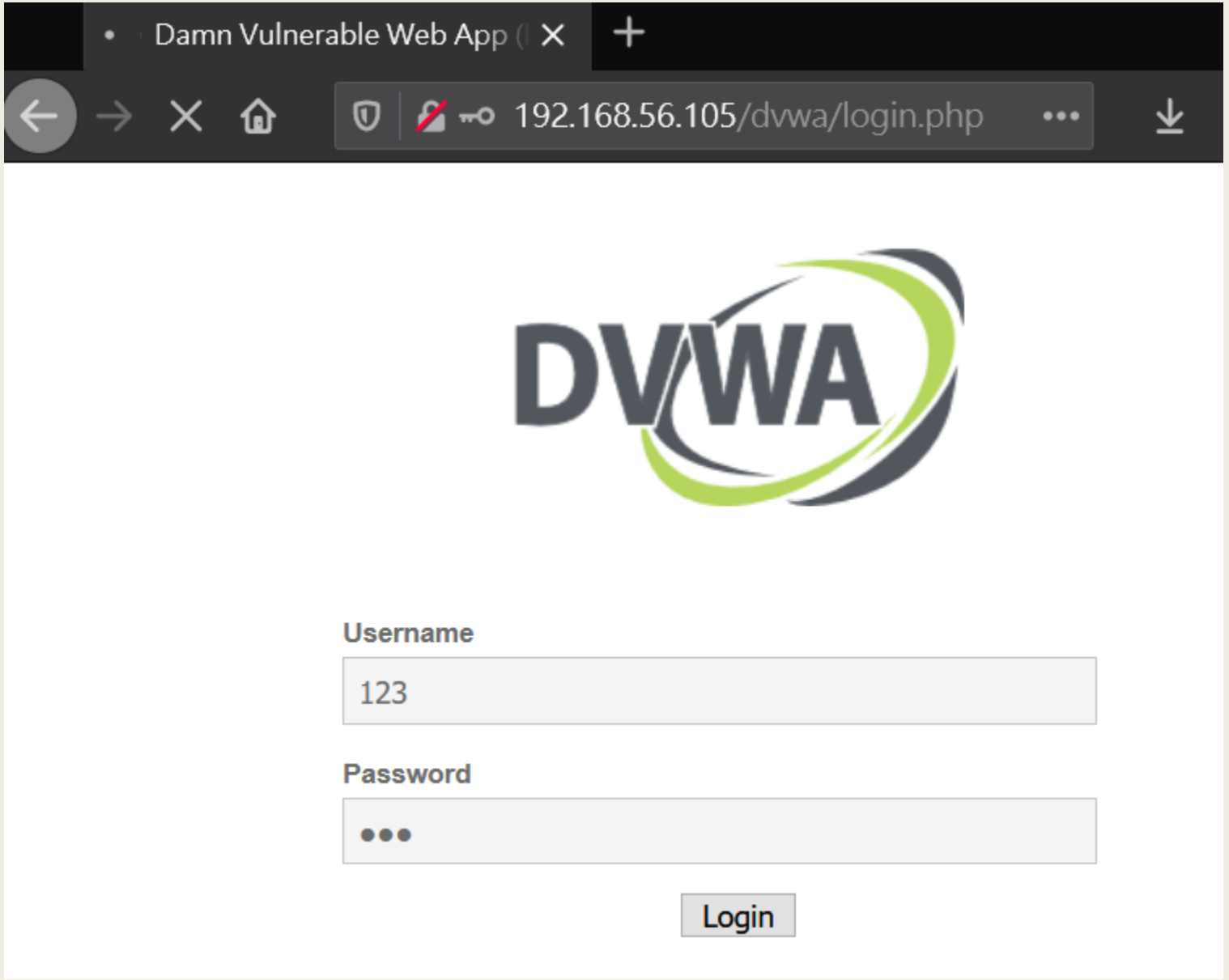


TOOL

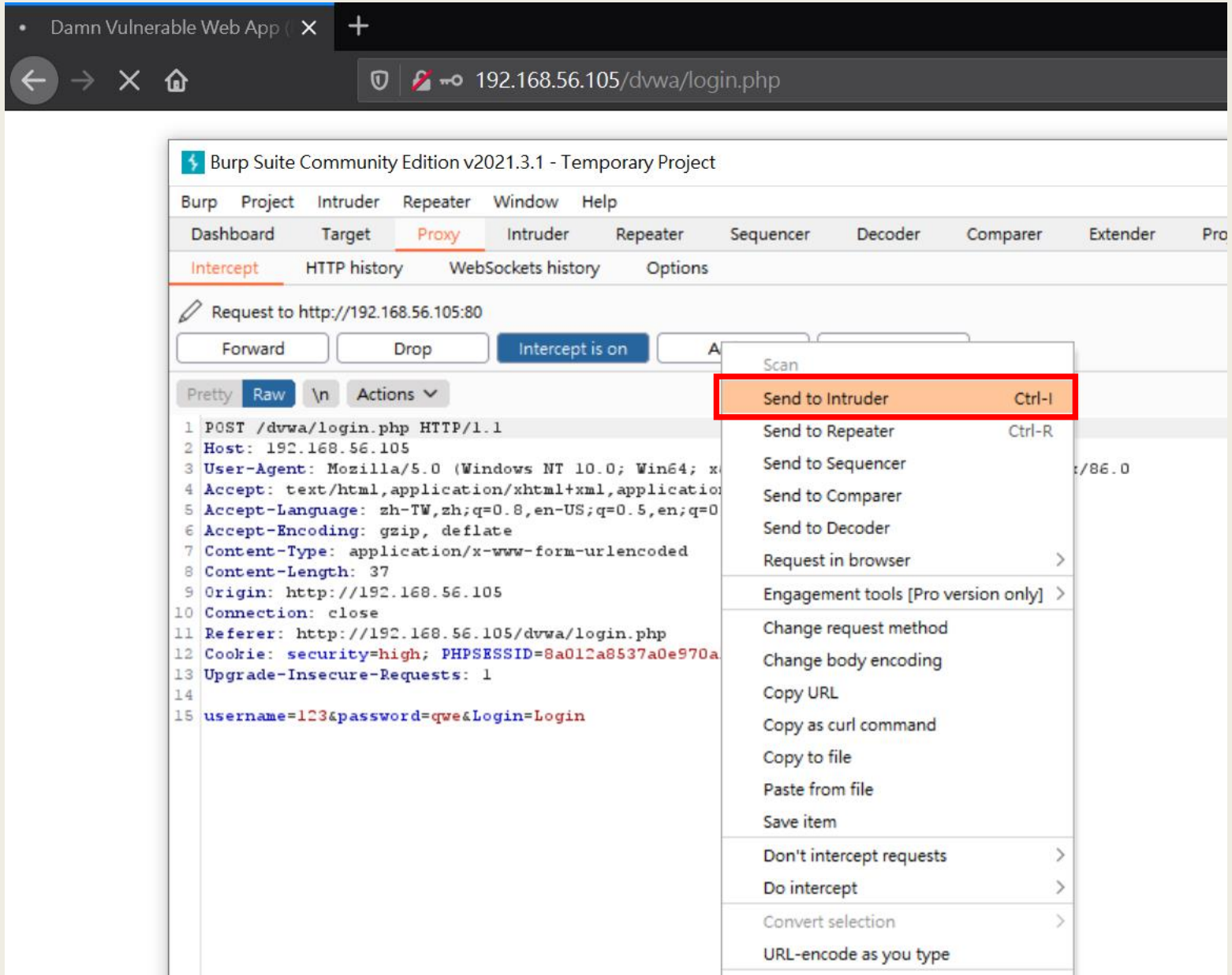
Burp

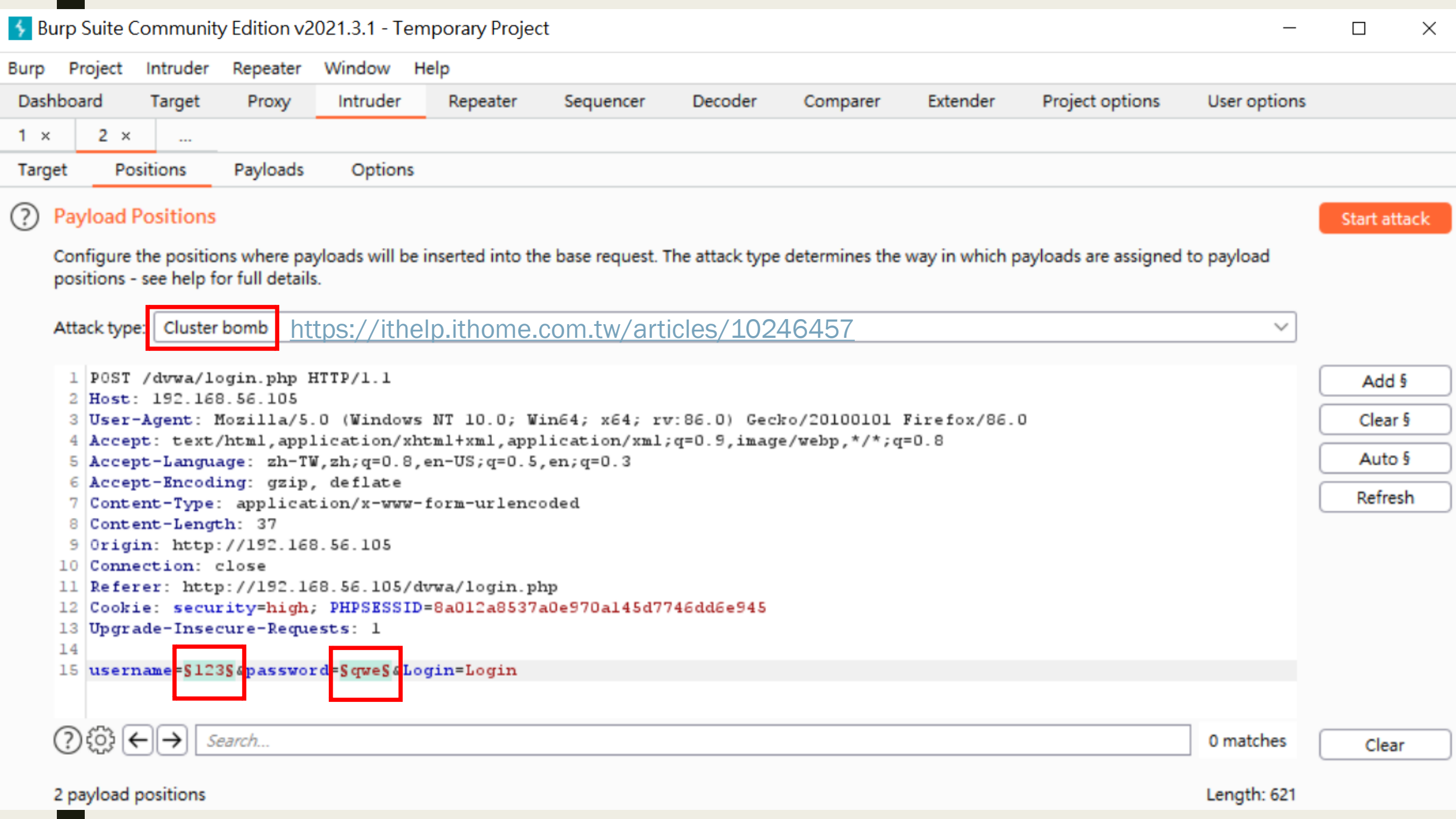
DirBuster

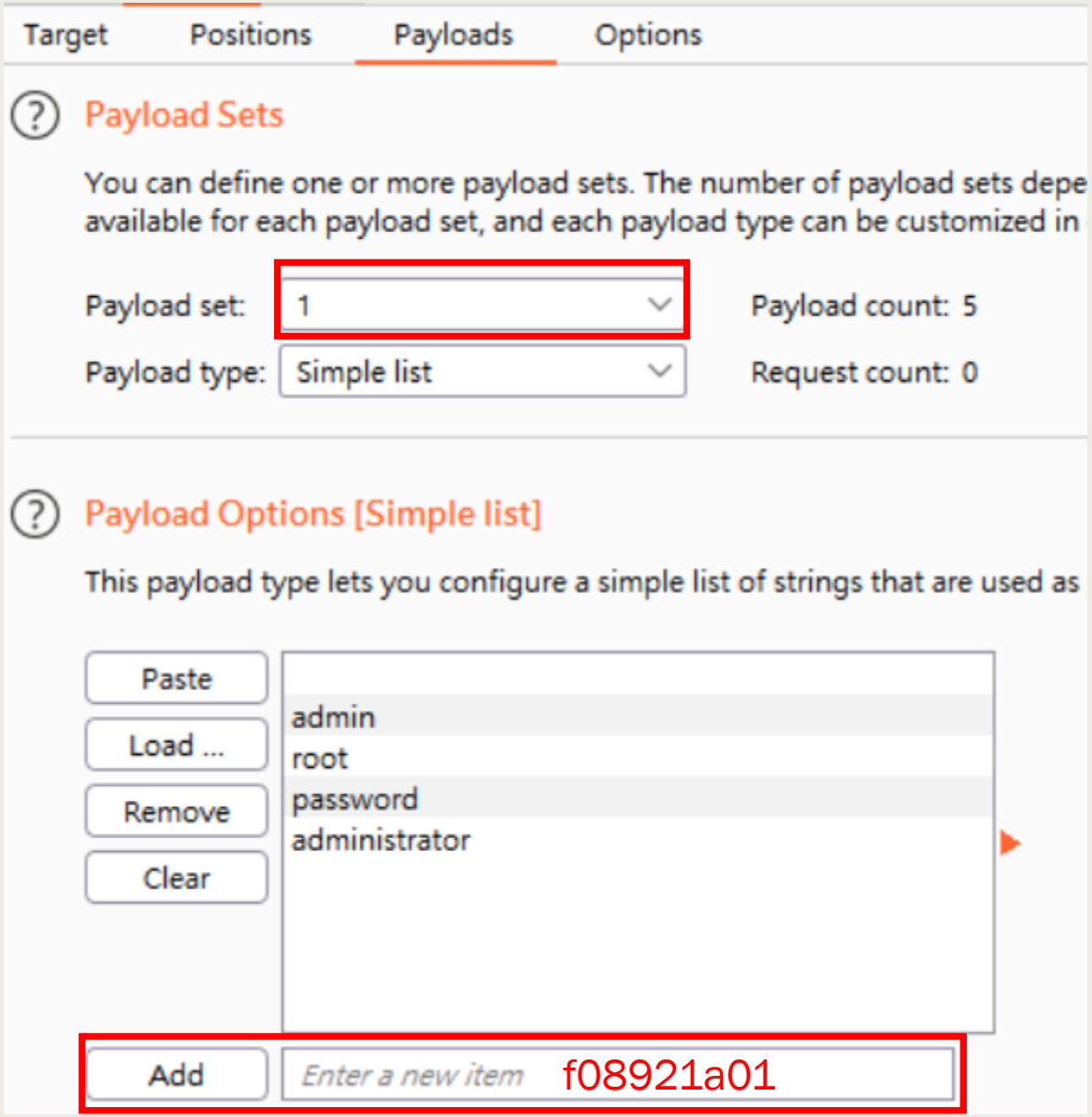
Lab1: Brute Force

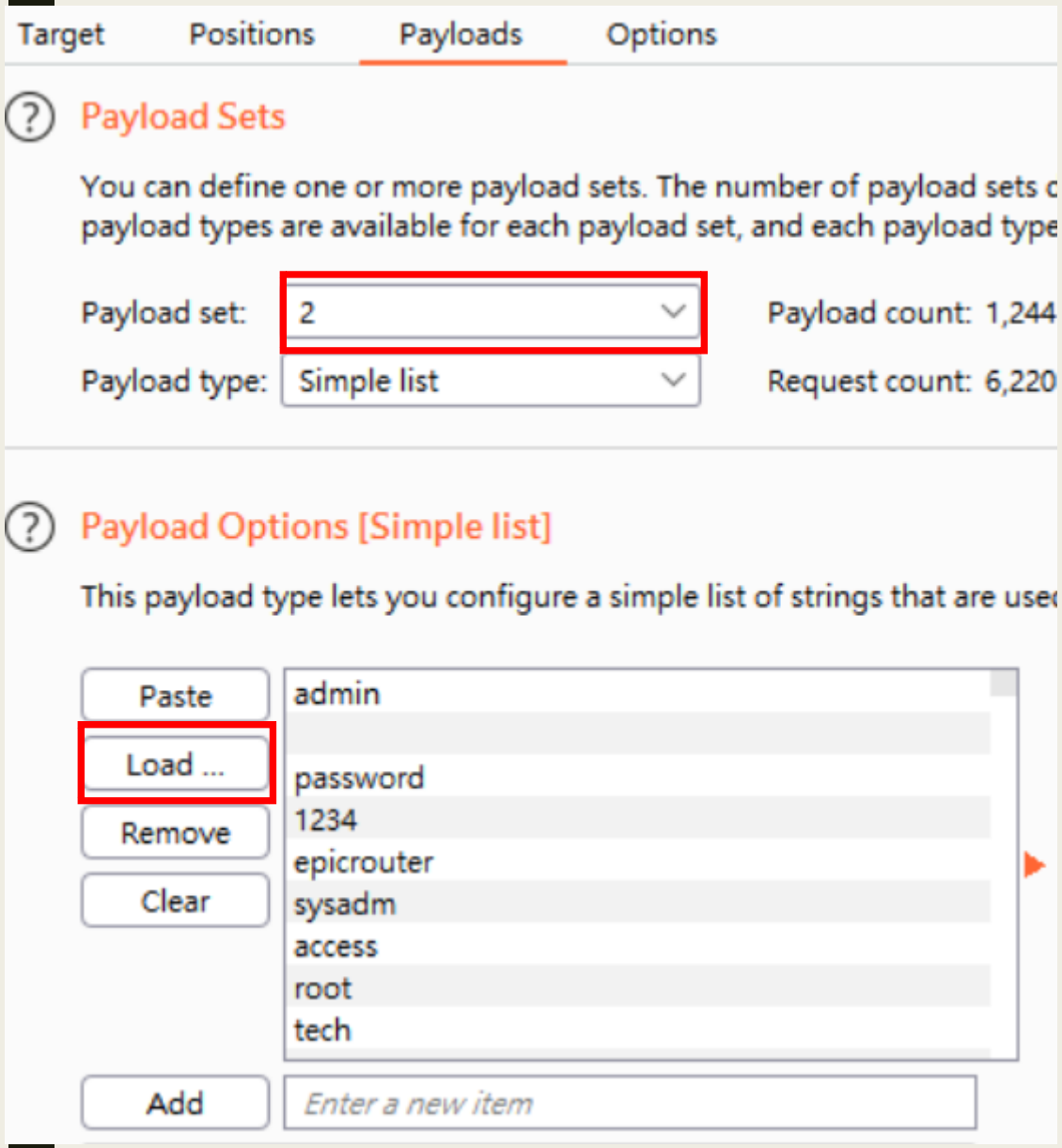


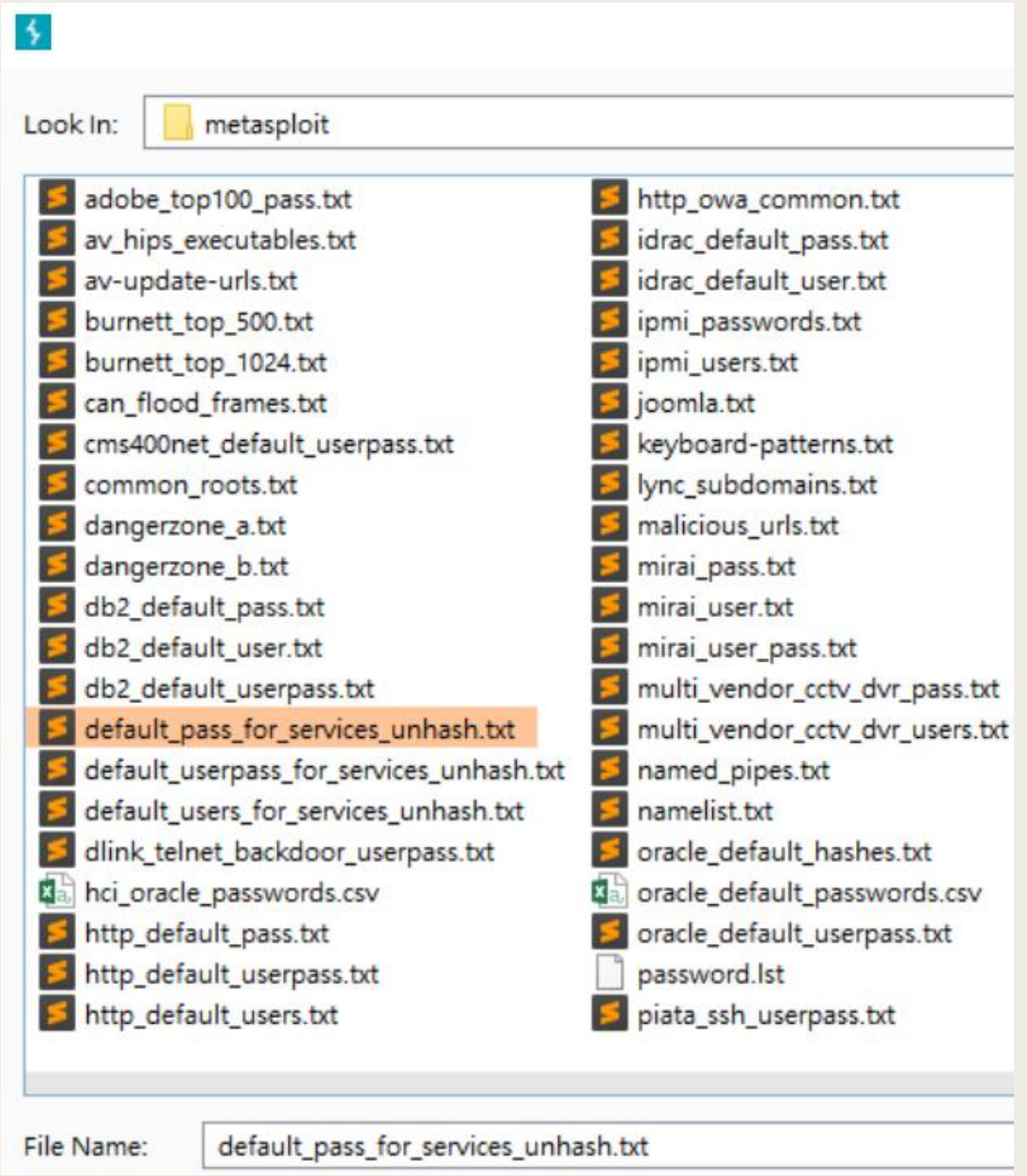
Send the login POST request to Intruder



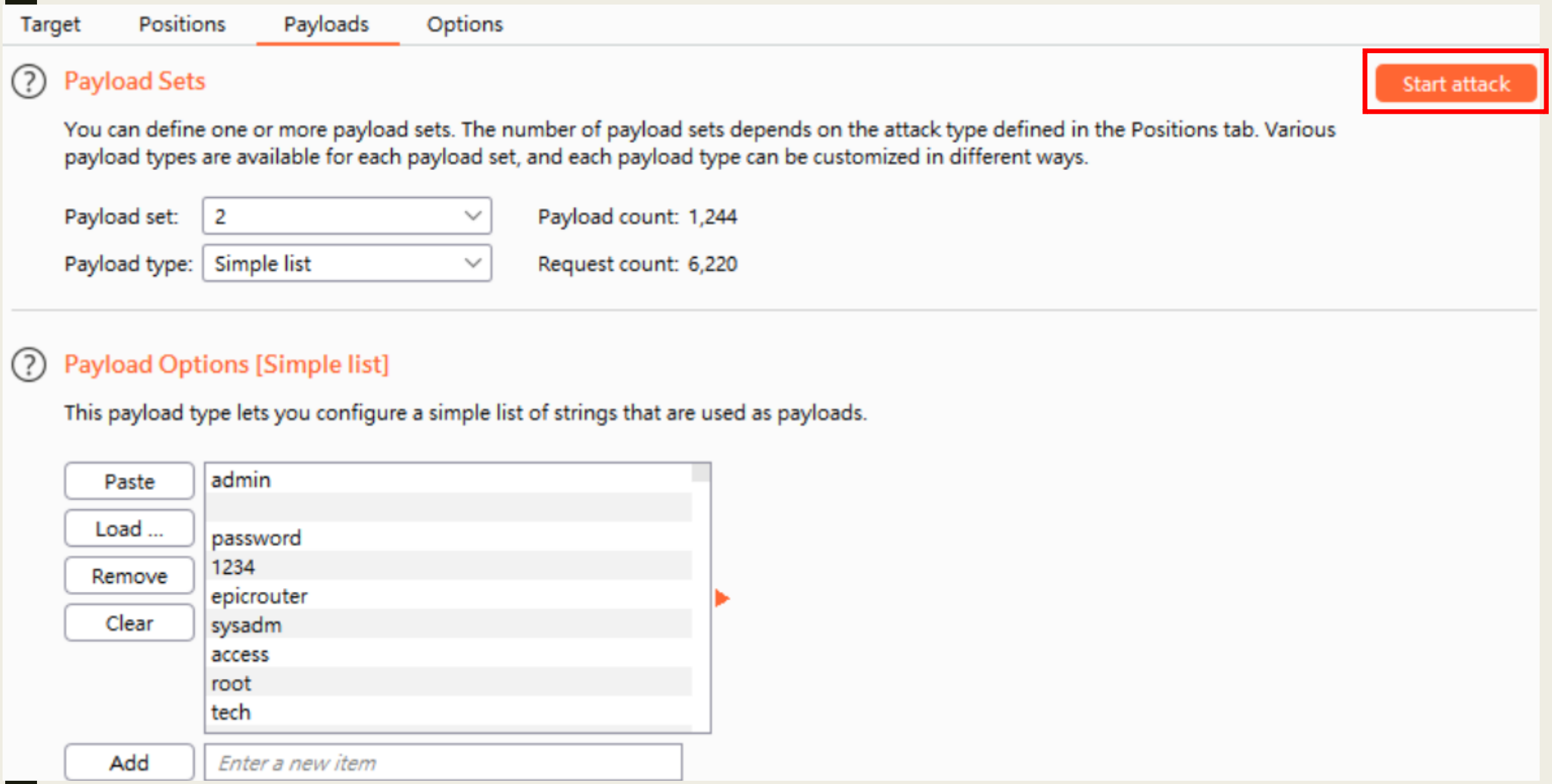

Burp Suite Community Edition v2021.3.1 - Temporary Project
Burp Project Intruder Repeater Window Help
Dashboard Target Proxy Intruder Repeater Sequencer Decoder Comparer Extender Project options User options
1 × 2 × ...
Target Positions Payloads Options
Payload Positions
Start attack
Configure the positions where payloads will be inserted into the base request. The attack type determines the way in which payloads are assigned to payload positions - see help for full details.
Attack type: Cluster bomb
https://ithelp.ithome.com.tw/articles/10246457
1 POST /dvwa/login.php HTTP/1.1
2 Host: 192.168.56.105
3 User-Agent: Mozilla/5.0 (Windows NT 10.0; Win64; x64; rv:86.0) Gecko/20100101 Firefox/86.0
4 Accept: text/html,application/xhtml+xml,application/xml;q=0.9,image/webp,*/*;q=0.8
5 Accept-Language: zh-TW,zh;q=0.8,en-US;q=0.5,en;q=0.3
6 Accept-Encoding: gzip, deflate
7 Content-Type: application/x-www-form-urlencoded
8 Content-Length: 37
9 Origin: http://192.168.56.105
10 Connection: close
11 Referer: http://192.168.56.105/dvwa/login.php
12 Cookie: security=high; PHPSESSID=8a012a8537a0e970a145d7746dd6e945
13 Upgrade-Insecure-Requests: 1
14
15 username=§123§&password=§qwe§&Login=Login
Add §
Clear §
Auto §
Refresh
Search...
0 matches
Clear
2 payload positions
Length: 621


Target
Positions
Payloads
Options
Payload Sets
You can define one or more payload sets. The number of payload sets depe
available for each payload set, and each payload type can be customized in
Payload set:
1
Payload count: 5
Payload type:
Simple list
Request count: 0
Payload Options [Simple list]
This payload type lets you configure a simple list of strings that are used as
Paste
Load ...
Remove
Clear
admin
root
password
administrator
Add
Enter a new item
f08921a01

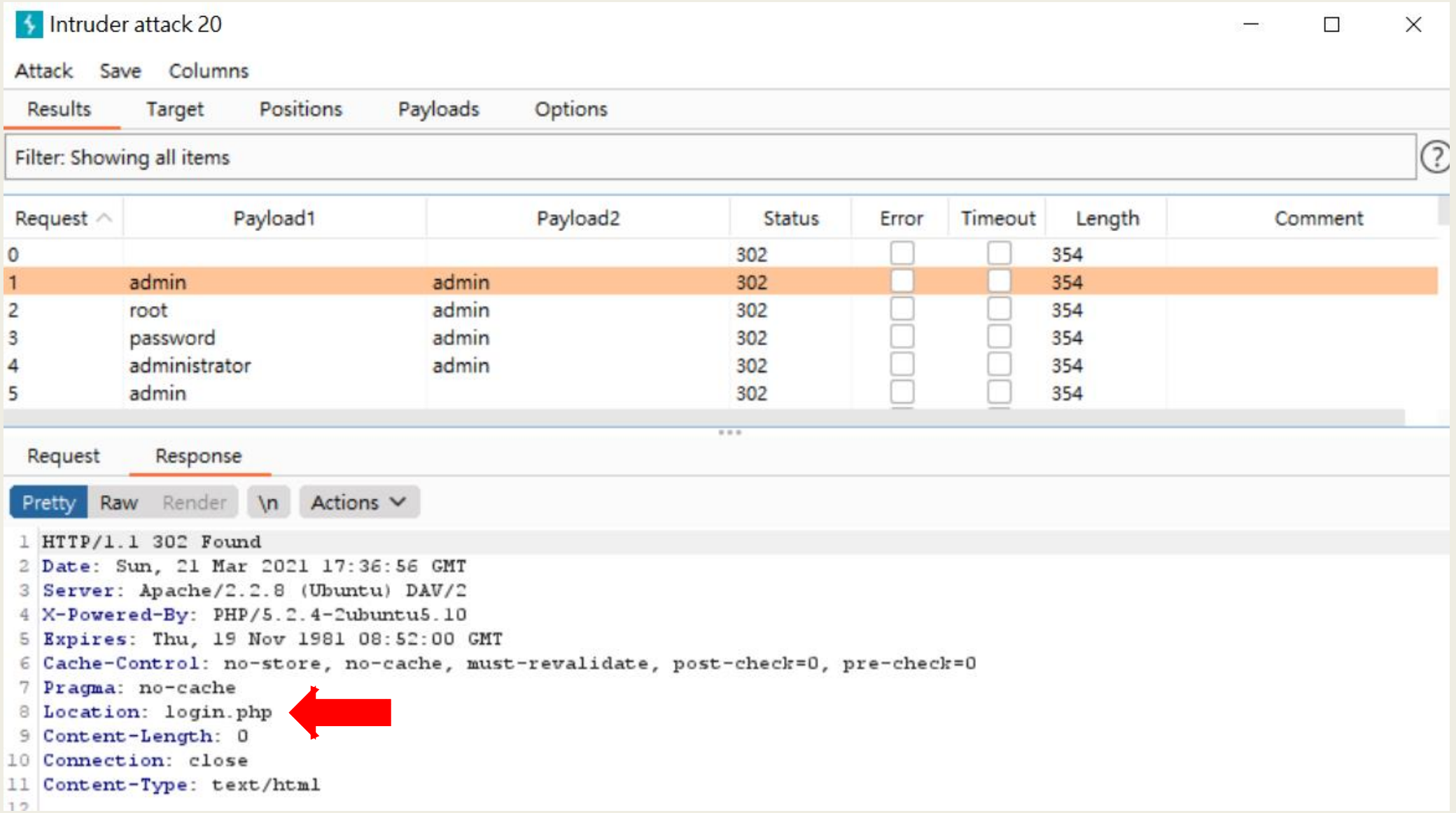


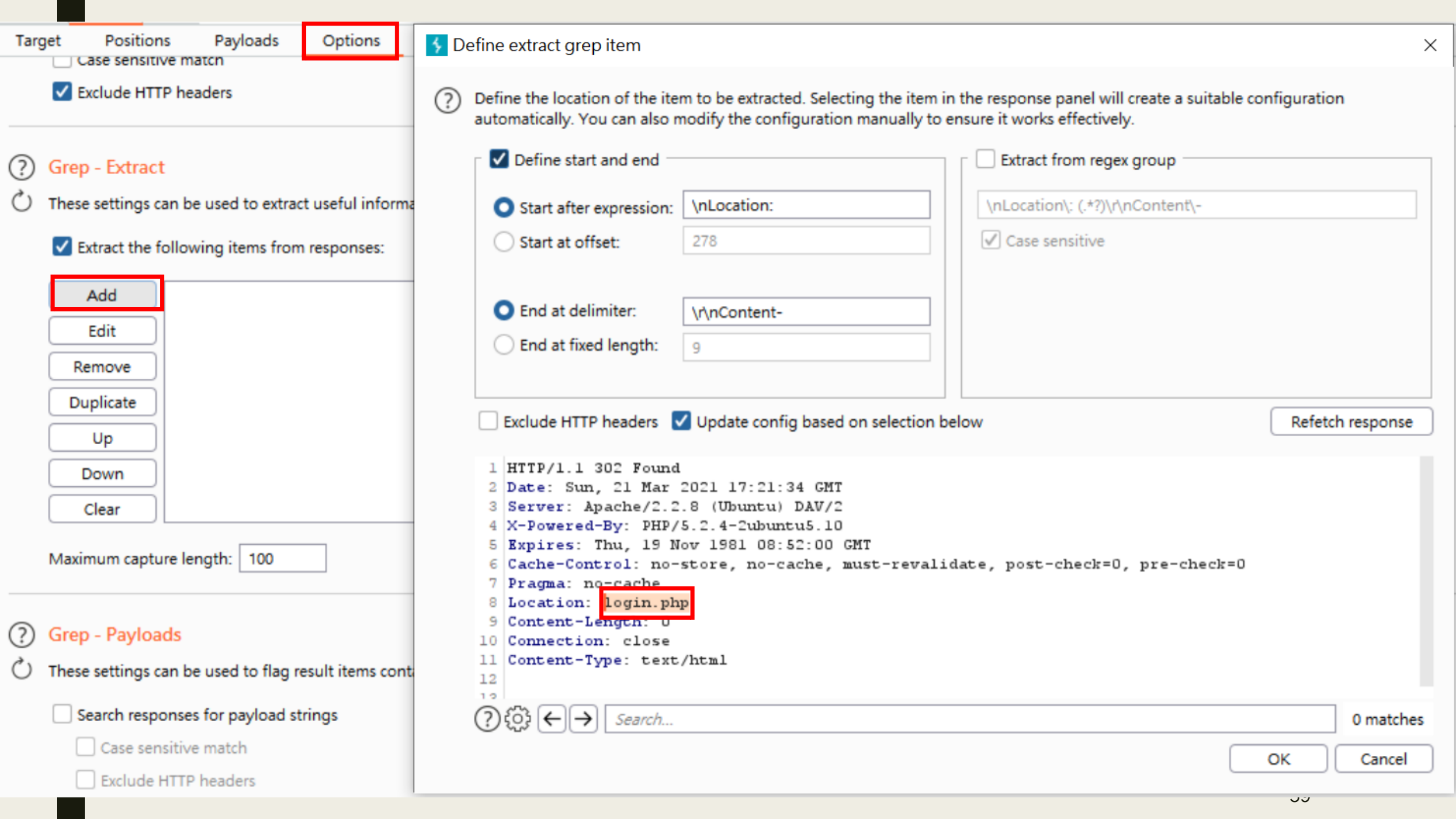



```
┌──(kali㉿kali)-[~]
└─$ sudo cp -Lr /usr/share/wordlists /media/sf_vm_share
```

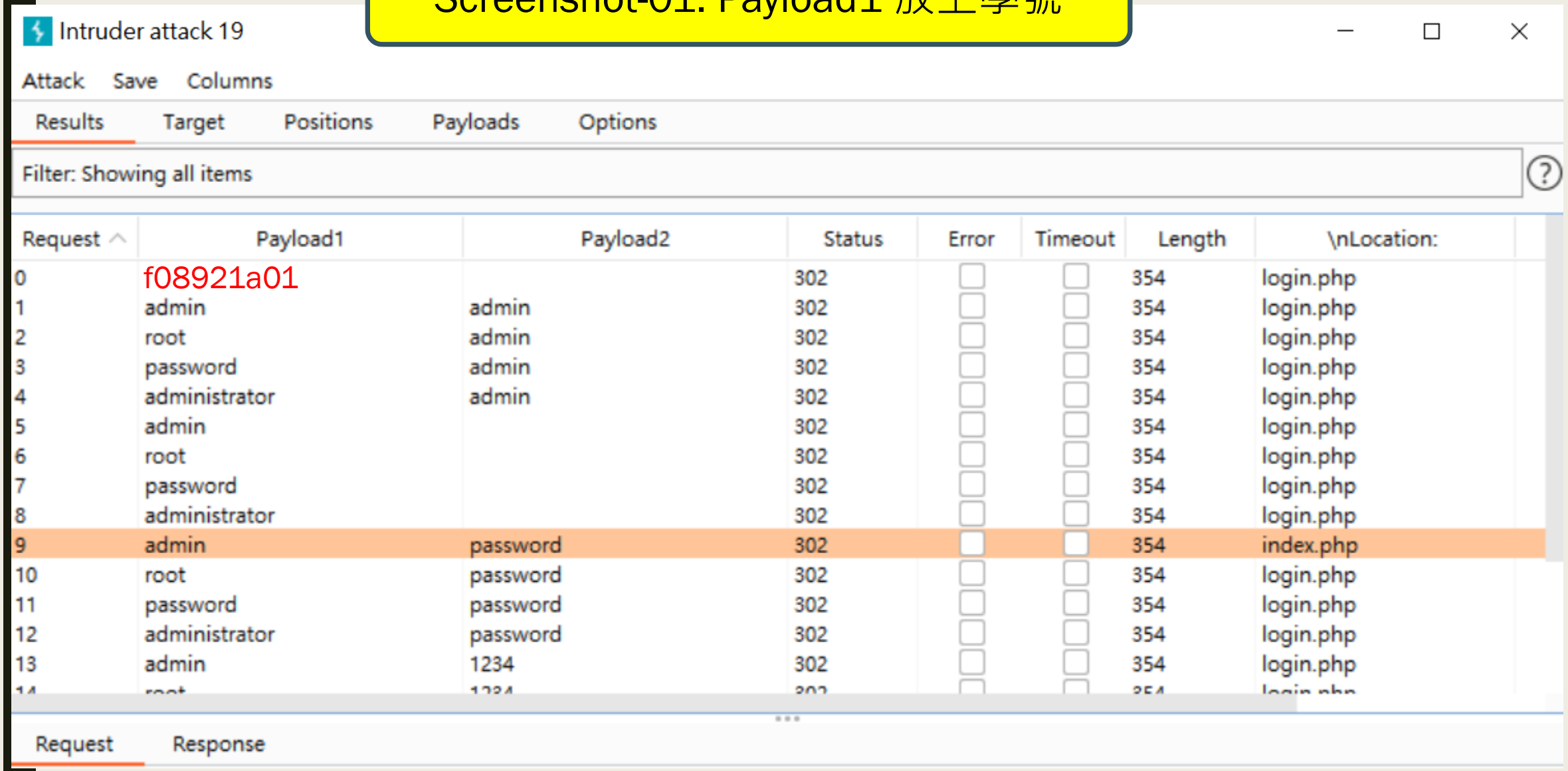

Target
Positions
Payloads
Options
Payload Sets
Start attack
You can define one or more payload sets. The number of payload sets depends on the attack type defined in the Positions tab. Various payload types are available for each payload set, and each payload type can be customized in different ways.
Payload set: 2
Payload count: 1,244
Payload type: Simple list
Request count: 6,220
Payload Options [Simple list]
This payload type lets you configure a simple list of strings that are used as payloads.
Paste
Load ...
Remove
Clear
admin
password
1234
epicrouter
sysadm
access
root
tech
Add
Enter a new item

Fail/Success Responses

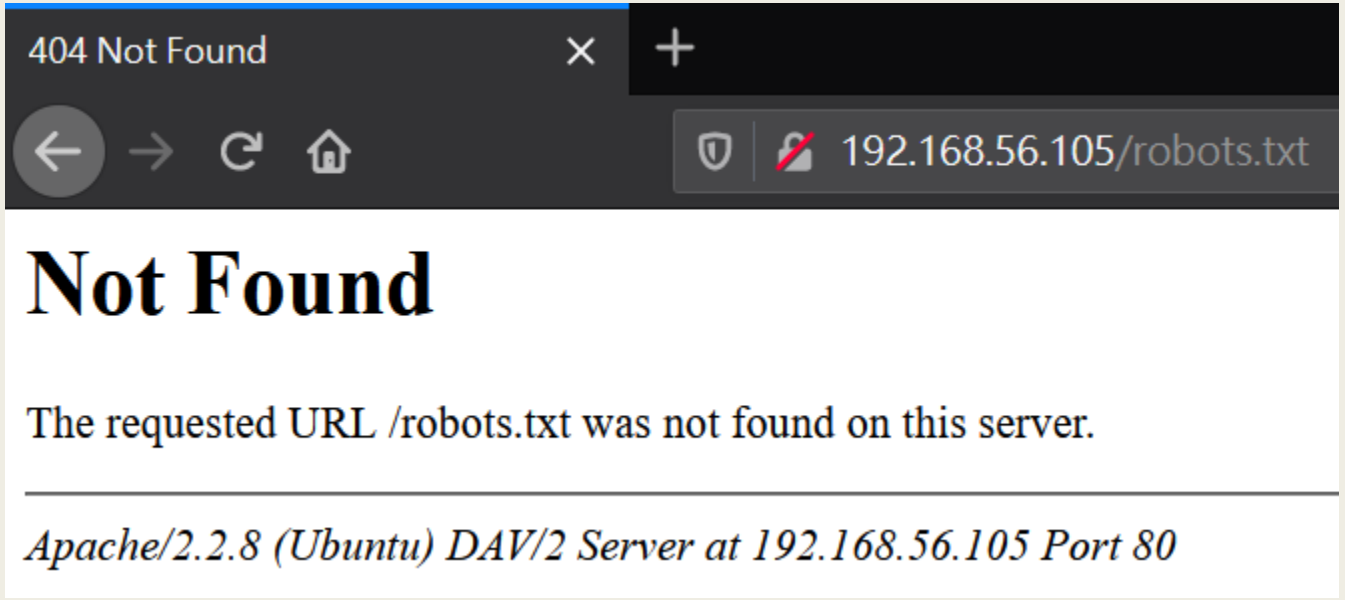


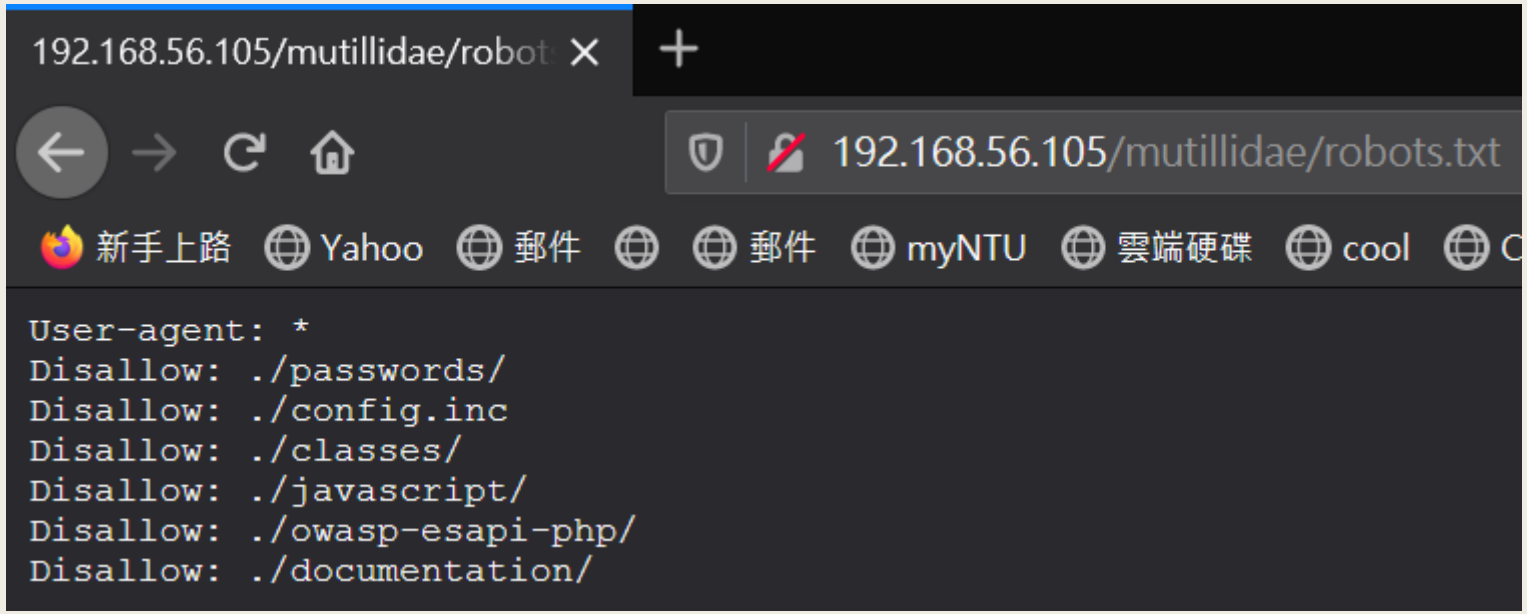

Target
Positions
Payloads
Options
Case sensitive match
Exclude HTTP headers
Grep - Extract
These settings can be used to extract useful informa
Extract the following items from responses:
Add
Edit
Remove
Duplicate
Up
Down
Clear
Maximum capture length: 100
Grep - Payloads
These settings can be used to flag result items cont
Search responses for payload strings
Case sensitive match
Exclude HTTP headers
Define extract grep item
Define the location of the item to be extracted. Selecting the item in the response panel will create a suitable configuration automatically. You can also modify the configuration manually to ensure it works effectively.
Define start and end
Start after expression: \nLocation:
Start at offset: 278
End at delimiter: \r\nContent-
End at fixed length: 9
Extract from regex group
\nLocation\: (.*?)\r\nContent\-
Case sensitive
Exclude HTTP headers
Update config based on selection below
Refetch response
1 HTTP/1.1 302 Found
2 Date: Sun, 21 Mar 2021 17:21:34 GMT
3 Server: Apache/2.2.8 (Ubuntu) DAV/2
4 X-Powered-By: PHP/5.2.4-2ubuntu5.10
5 Expires: Thu, 19 Nov 1981 08:52:00 GMT
6 Cache-Control: no-store, no-cache, must-revalidate, post-check=0, pre-check=0
7 Pragma: no-cache
8 Location: login.php
9 Content-Length: 0
10 Connection: close
11 Content-Type: text/html
12
Search...
0 matches
OK
Cancel

Screenshot-01: Payload1 放上學號



robots.txt

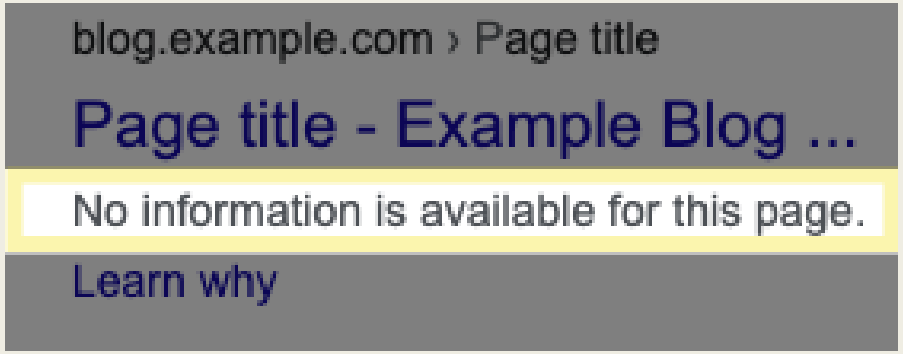

404 Not Found
192.168.56.105/robots.txt
Not Found
The requested URL /robots.txt was not found on this server.
Apache/2.2.8 (Ubuntu) DAV/2 Server at 192.168.56.105 Port 80

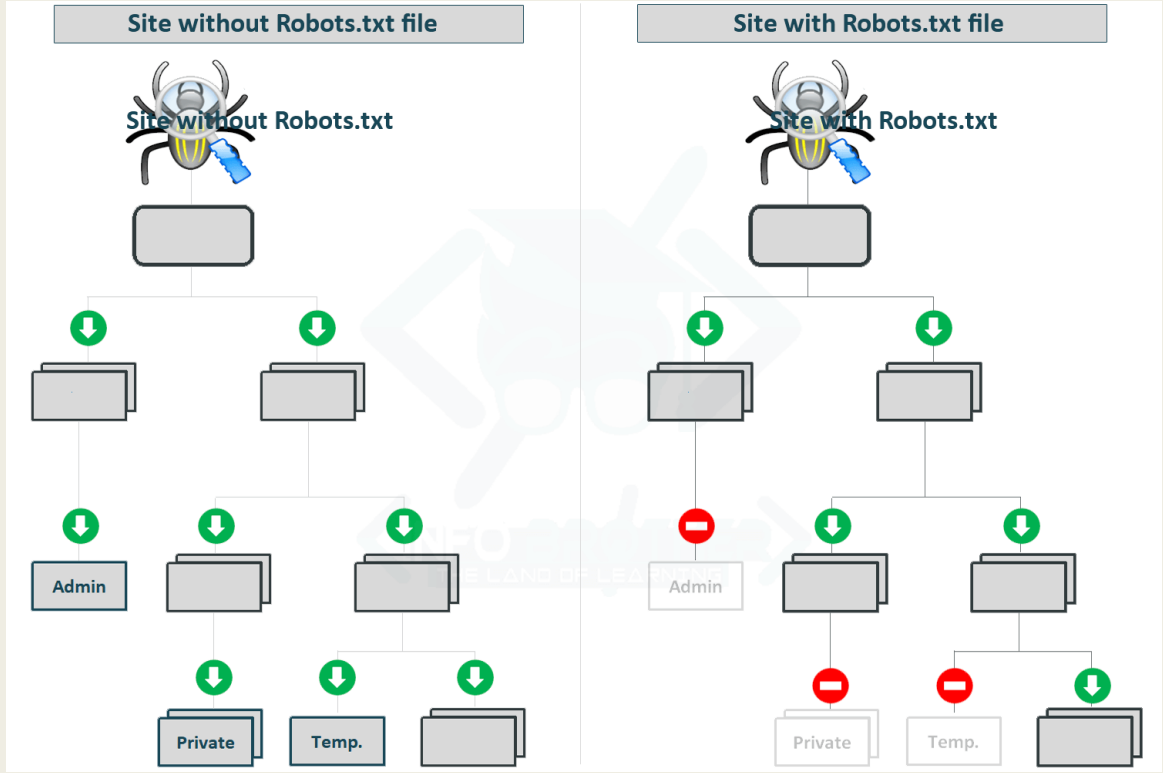

192.168.56.105/mutillidae/robot
192.168.56.105/mutillidae/robots.txt
新手上路
Yahoo
郵件
郵件
myNTU
雲端硬碟
cool
User-agent: *
Disallow: ./passwords/
Disallow: ./config.inc
Disallow: ./classes/
Disallow: ./javascript/
Disallow: ./owasp-esapi-php/
Disallow: ./documentation/

robots.txt

- robots.txt 主要用於管理搜尋引擎檢索器（又稱網路蜘蛛）對網站造成的流量負擔
- 告訴搜尋引擎檢索器，可以或不可以對網站上的哪些網頁或檔案提出要求
- robots.txt 協定
  - 並不是一個規範，而是約定俗成
  - 並不能保證網站的隱私

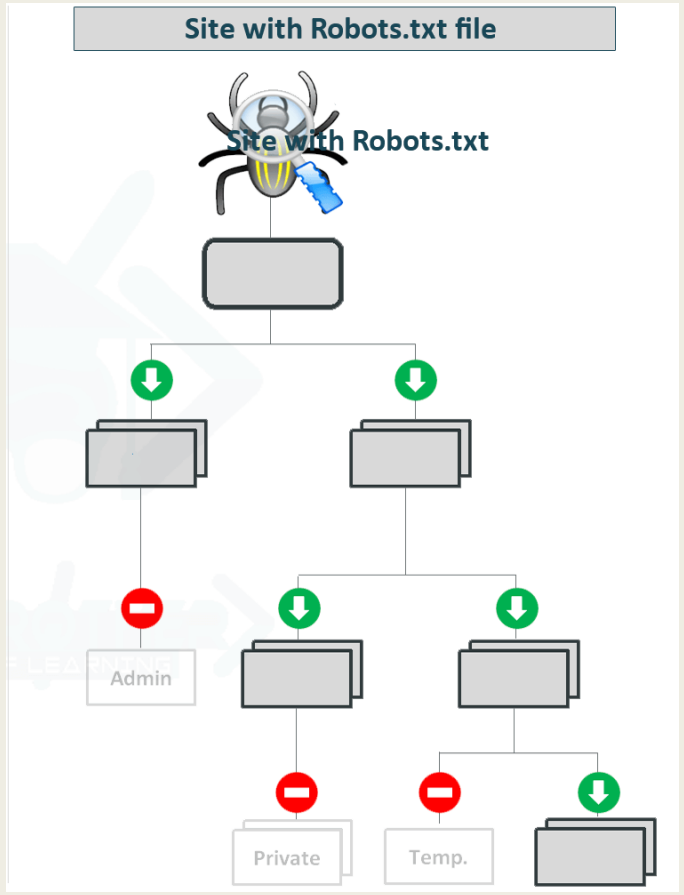
Google:
https://developers.google.com/search/docs/advanced/robots/intro

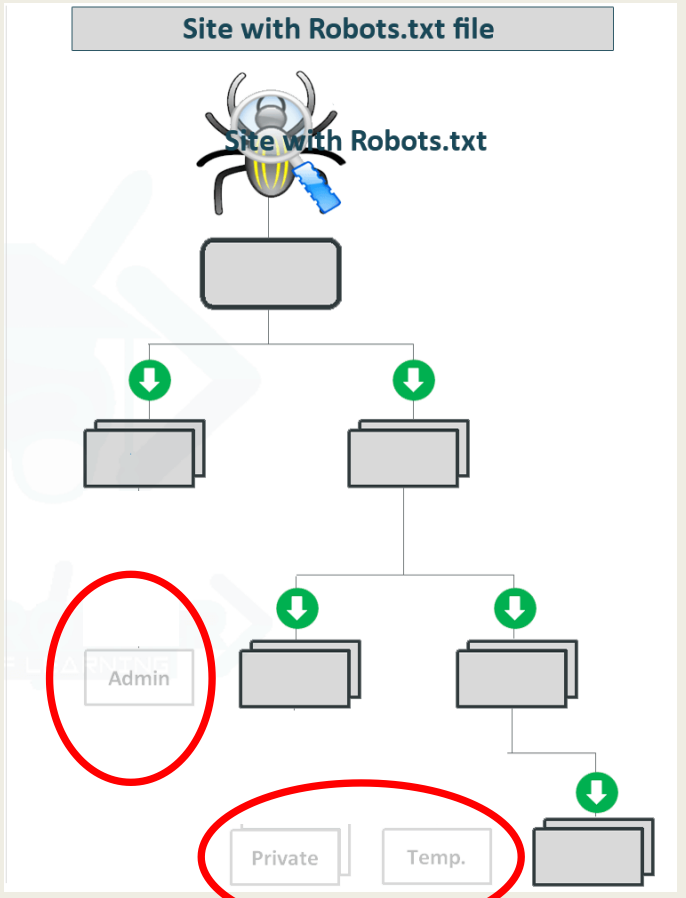




Forceful Browsing

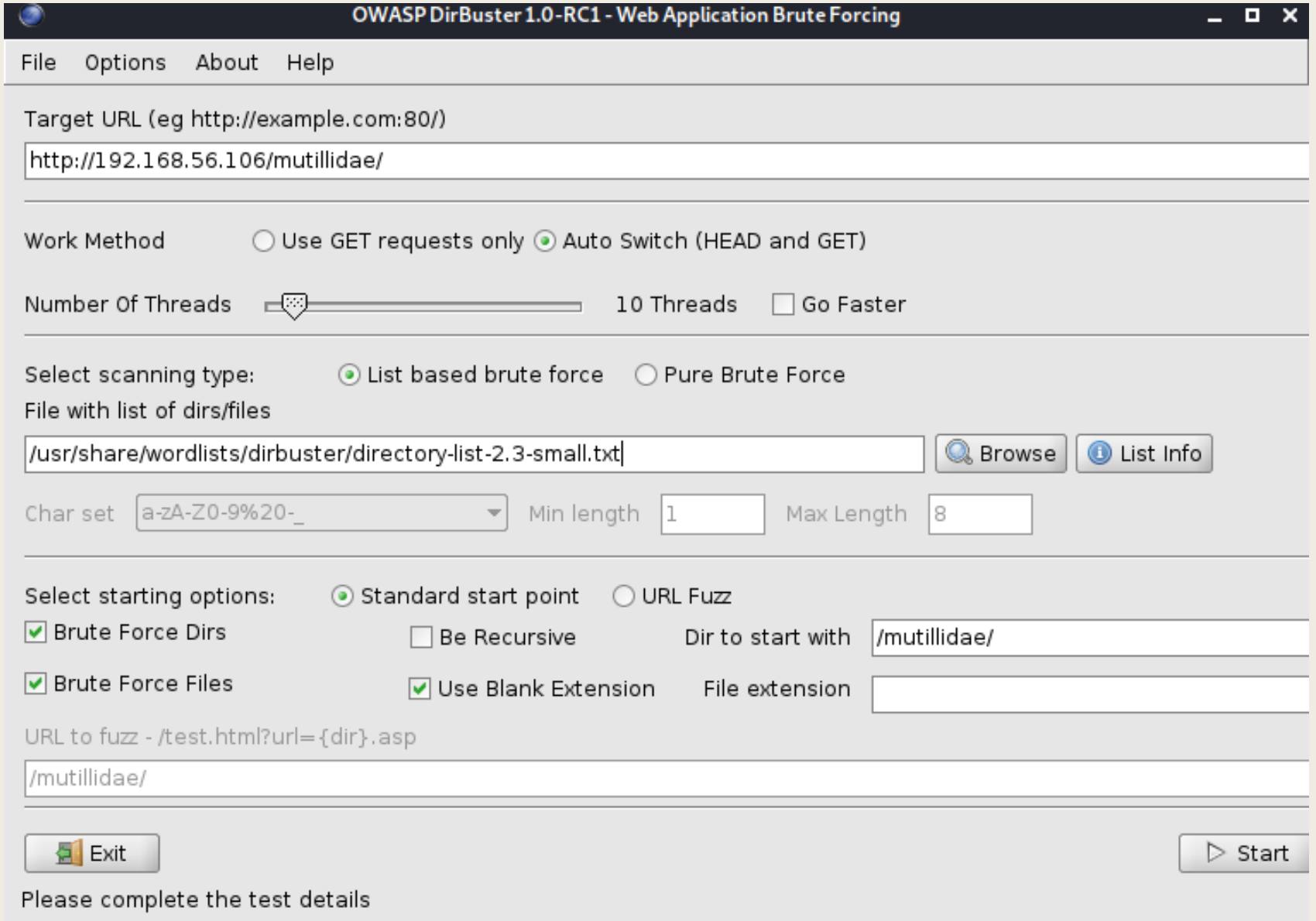
- Forceful browsing (forced browsing) is a brute force attack that aims to enumerate files and gain access to resources that the application does not reference, but can still retrieve.





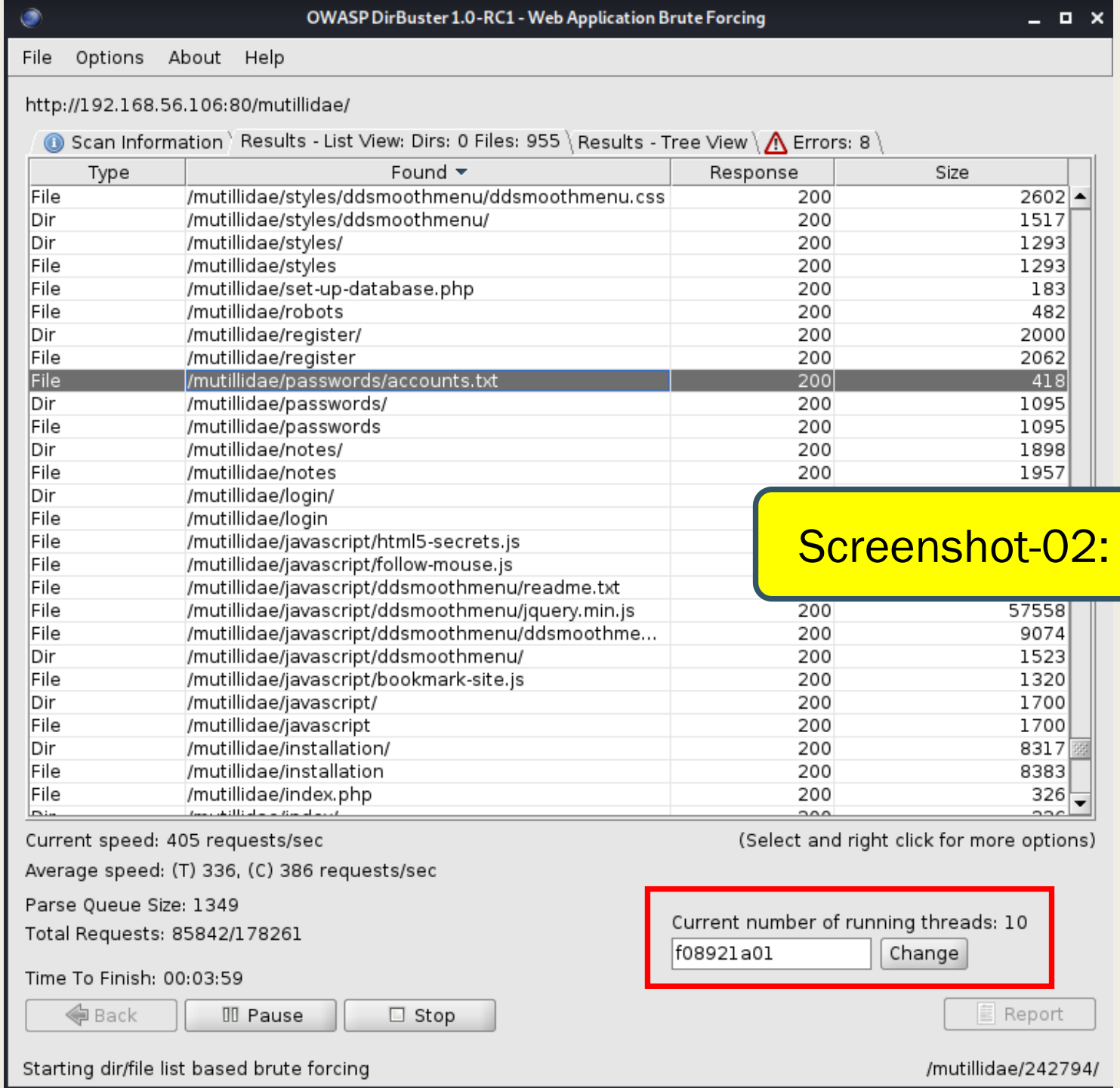
DirBuster


```
┌──(kali㉿kali)-[~]
└─$ dirbuster
Picked up _JAVA_OPTIONS: -Dawt.useSystemAAFontSettings=on -Dswing.aatext=true
Starting OWASP DirBuster 1.0-RC1
```



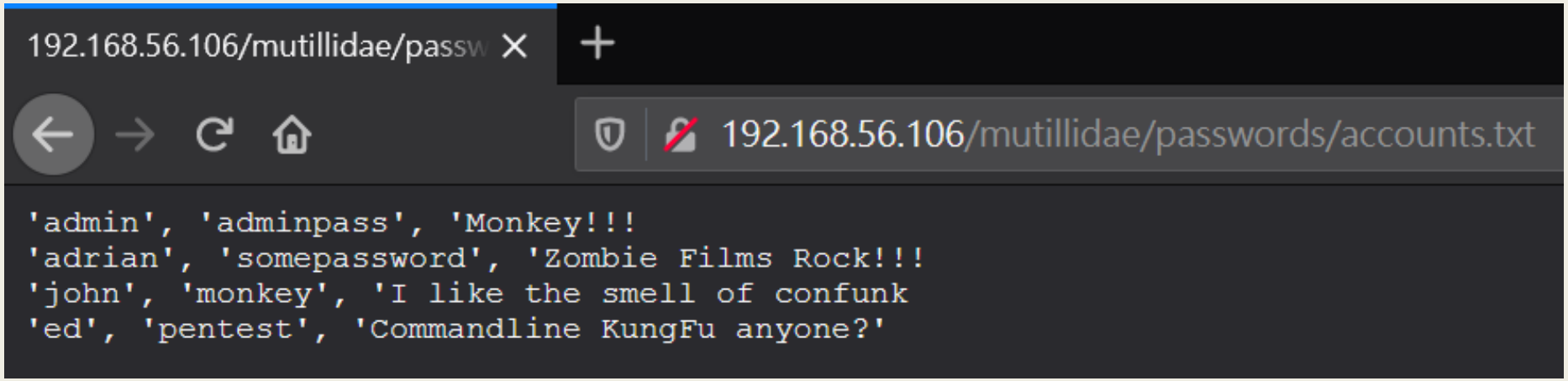
/usr/share/wordlists/dirbuster/directory-list-2.3-medium.txt

/usr/share/wordlists/dirbuster/directory-list-2.3-small.txt



Screenshot-02: Change 欄位放上學號

Hidden resource

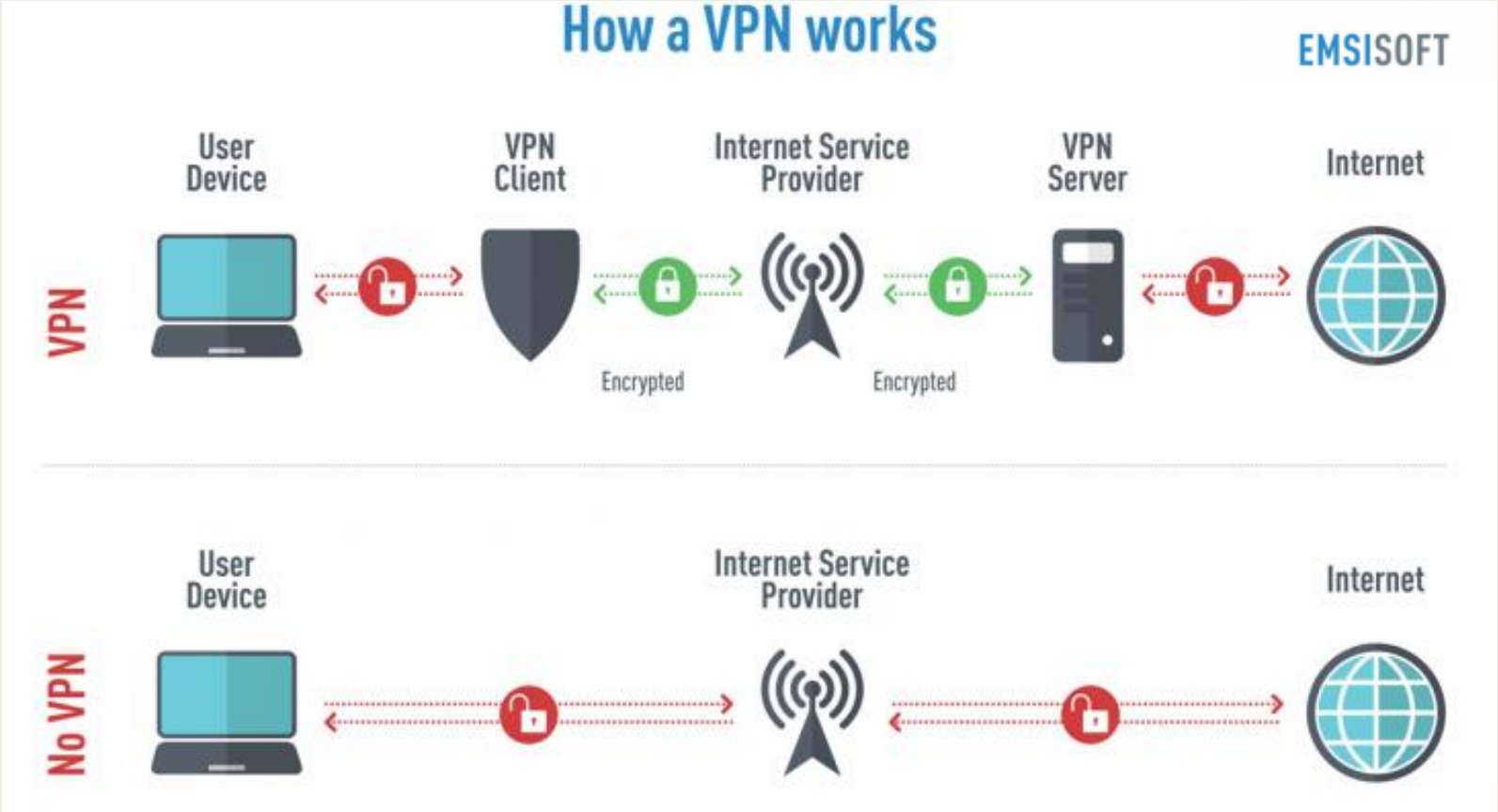


PRIVACY & ANONYMITY

VPN
DNS Over HTTPS
TOR

VPN (Virtual Private Network)

- A type of software that allows you to connect to the internet via an encrypted tunnel.
- It hides your IP address and location using proxy servers.



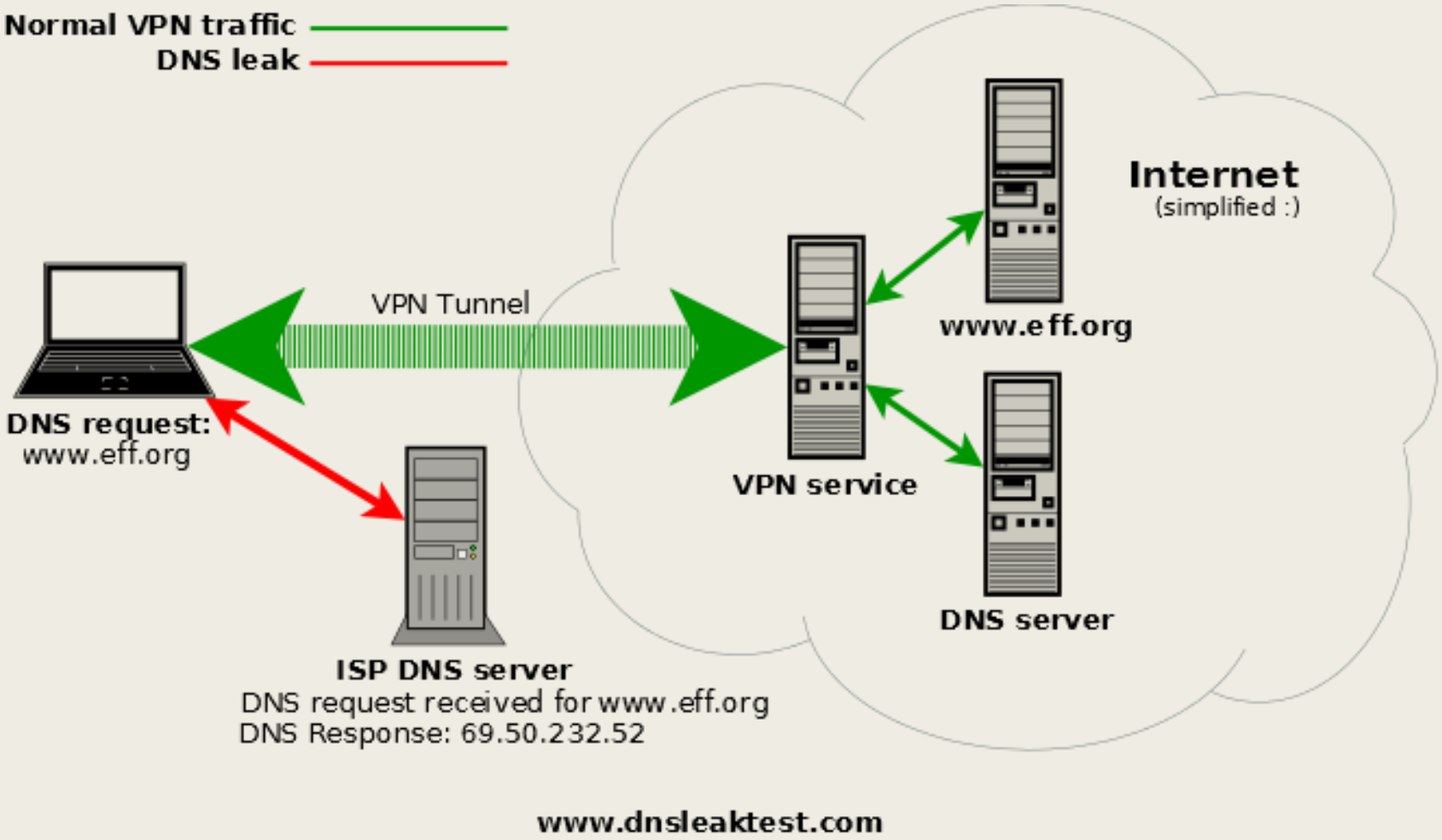
VPN


Pulse Secure
檔案(F)
說明(H)
連線
NTU vpn
已連線
中斷連線
伺服器 URL：sslvpn2.ntu.edu.tw
狀態：已連線
遵從性: 符合安全性政策


How a VPN works
EMSISOFT
User Device
VPN Client
Internet Service Provider
VPN Server
Internet
VPN
Encrypted
Encrypted

DNS leak in VPN

https://www.dnsleaktest.com/



DNS leak Demo

```
wifi0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 172.20.10.8  netmask 255.255.255.240  broadcast 172.20.10.15
```


```
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1350
        inet 140.112.150.27  netmask 255.255.255.255  broadcast 140.112.150.27
```

DNS leak Demo

```
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1350
        inet 140.112.150.27  netmask 255.255.255.255  broadcast 140.112.150.27
```

No.	Time	Source	Destination	Protocol	Length	Source Port	Info
1	0.000000	2404:6800:4008:803:…	2001:288:1001:71:1:…	TCP	86	443	443
2	1.122372	140.112.150.27	13.35.24.84	TCP	55	49232	492
3	1.122434	140.112.150.27	13.35.24.84	TCP	55	49232	[TC
4	1.288341	13.35.24.84	140.112.150.27	TCP	66	443	443

```
wifi0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 172.20.10.8  netmask 255.255.255.240  broadcast 172.20.10.15
```

No.	Time	Source	Destination	Protocol	Length	Source Port	Info
1	0.000000	140.112.2.228	172.20.10.8	TLSv1.2	178	443	App
2	0.041289	172.20.10.8	140.112.2.228	TCP	54	64205	642
3	0.045642	140.112.2.228	172.20.10.8	TCP	54	443	443
4	0.409225	140.112.2.228	172.20.10.8	TLSv1.2	185	443	App

```
└─# nslookup sslvpn2.ntu.edu.tw
Server:         140.112.254.4
Address:        140.112.254.4#53

Name: sslvpn2.ntu.edu.tw
Address: 140.112.2.228
```

DNS leak Demo

```
wifi0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 172.20.10.8  netmask 255.255.255.240  broadcast 172.20.10.15
```

No.	Time	Source	Destination	Protocol	Length	Source Port	Info
1227	4.466633	172.20.10.8	140.112.2.228	TCP	54	64205	64205 → 443 [ACK] Seq=74250 Ack=425820 Win=64755 Len=0
1228	4.466642	140.112.2.228	172.20.10.8	TLSv1.2	496	443	Application Data
1229	4.467371	172.20.10.8	140.112.2.228	TLSv1.2	158	64205	Application Data
1230	4.467466	172.20.10.8	172.20.10.1	DNS	73		Standard query 0x480c AAAA d.pub.network
1231	4.487771	172.20.10.8	140.112.2.228	TLSv1.2	169	64205	Application Data
1232	4.488003	172.20.10.8	172.20.10.1	DNS	84		Standard query 0xc31d A www.google-analytics.com
1233	4.488330	172.20.10.8	140.112.2.228	TLSv1.2	166	64205	Application Data
1234	4.488445	172.20.10.8	172.20.10.1	DNS	81		Standard query 0x5ffa A secure.quantserve.com
1235	4.490027	172.20.10.8	140.112.2.228	TLSv1.2	240	64205	Application Data
1236	4.491052	172.20.10.8	140.112.2.228	TLSv1.2	174	64205	Application Data
1237	4.495871	172.20.10.1	172.20.10.8	DNS	144		Standard query response 0xc31d A www.google-analytics.com CNAME
1238	4.505020	140.112.2.228	172.20.10.8	TLSv1.2	237	443	Application Data
1239	4.506226	172.20.10.1	172.20.10.8	DNS	138		Standard query response 0x480c AAAA d.pub.network SOA anirban.n
1240	4.533163	140.112.2.228	172.20.10.8	TLSv1.2	232	443	Application Data

```
預設閘道 . . . . . : fe80::4d2:5c5d:5820:9bac%17
                                    172.20.10.1
DHCP 伺服器 . . . . . : 172.20.10.1
DHCPv6 IAID . . . . . : 164160101
DHCPv6 用戶端 DUID. . . . . : 00-01-00-01-27-CB-E6-7F-C8-E2-65-FF-32-5F
DNS 伺服器 . . . . . : fe80::4d2:5c5d:5820:9bac%17
                                    172.20.10.1
```

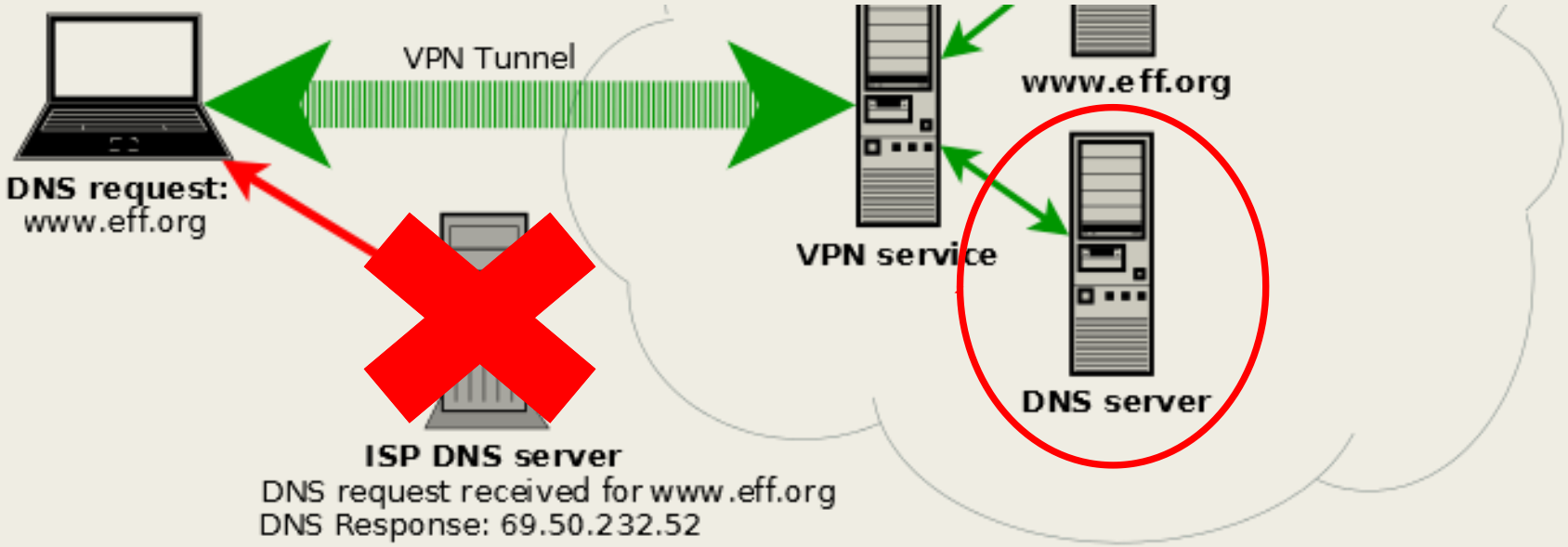
DNS leak Demo

- Leaked DNS queries are done by TWN Broadband

IP	Hostname	ISP	Country
140.112.254.65	ccdns1.cc.ntu.edu.tw.	Taiwan Academic Network	New Taipei, Taiwan
140.112.254.66	ccdns2.cc.ntu.edu.tw.	Taiwan Academic Network	New Taipei, Taiwan
140.112.254.69	ccdns3.cc.ntu.edu.tw.	Taiwan Academic Network	New Taipei, Taiwan
140.112.254.70	ccdns6.cc.ntu.edu.tw.	Taiwan Academic Network	New Taipei, Taiwan
175.96.61.21	dnsr23.tfn.net.tw.	TWN Broadband	Taiwan
175.96.61.22	dnsr24.tfn.net.tw.	TWN Broadband	Taiwan
60.199.22.62	dnsr03.tfn.net.tw.	TWN Broadband	Taiwan

How to fix a DNS leak

- Depends on VPN service
  - Ensure that once connected to the VPN, you are using ONLY the DNS servers provided by the VPN service.

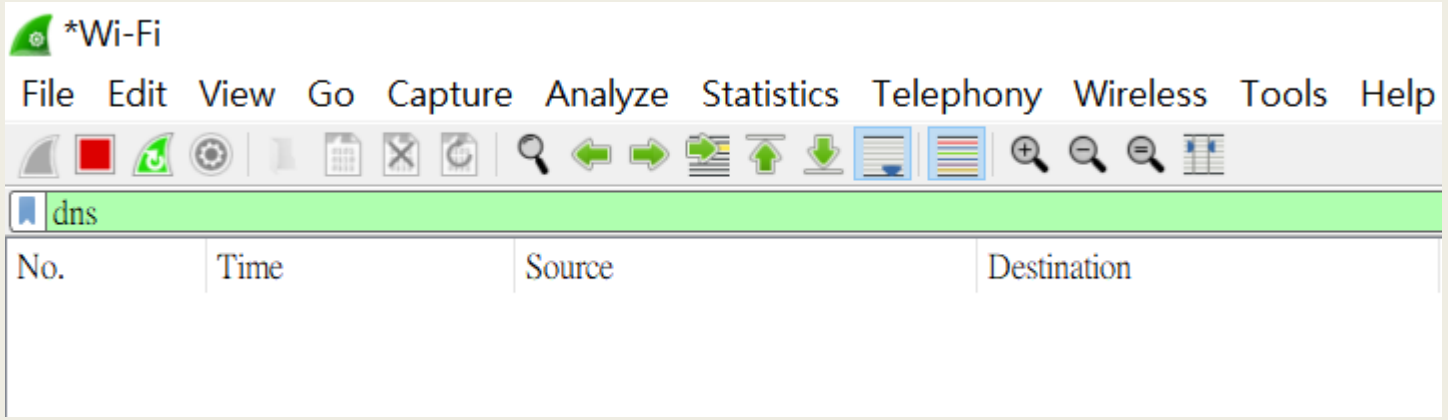


www.dnsleaktest.com

How to fix a DNS leak

- Assign DNS server

- No more DNS leak



DNS Over HTTPS (DoH)

- 傳統 DNS
  - 使用 53 port 向 DNS server 發送明文請求訊息

```
┌──(root💀kali)-[/home/kali]
└─# strace ping google.com -c1 2>&1 | grep '(53)'
connect(5, {sa_family=AF_INET, sin_port=htons(53), sin_addr=inet_addr("140.112.254.4")},
recvfrom(5, "\212\227\201\200\0\1\0\1\0\0\0\0\6google\3com\0\0\1\0\1\300\f\0\1" ... , 2048
recvfrom(5, "\230\221\201\200\0\1\0\1\0\0\0\0\6google\3com\0\0\34\0\1\300\f\0\34" ... , 65
connect(5, {sa_family=AF_INET, sin_port=htons(53), sin_addr=inet_addr("140.112.254.4")},
recvfrom(5, "\316\365\201\200\0\1\0\1\0\0\0\0\00214\00224\003217\003172\7in-ad" ... , 1024

┌──(root💀kali)-[/home/kali]
└─# cat /etc/resolv.conf
# Generated by NetworkManager
search ntu.edu.tw
nameserver 140.112.254.4
```

- DNS Over HTTPS
  - DNS requests will be encapsulated in encrypted HTTPS packets.

DoH deployment scenarios

- Using a DoH implementation within an application
  - Browsers
- Installing a DoH proxy
  - on the name server in the local network
  - on a local system
- Operating systems
  - In May 2020, Microsoft released Windows 10 Insider Preview Build 19628 that included initial support for DoH.
  - Apple's iOS 14 and macOS 11 released in late 2020 support both DoH and DoT protocols.

Enable DoH in Browser

在 Firefox 62 及以上版本中開啟 DNS over HTTPS

1. 在瀏覽器網址列輸入 about:config 然後打開，並同意警告資訊。
2. 搜尋 network.trr
3. 設定 network.trr.mode 值為2
4. 在 network.trr.uri 中填入上表中任一伺服器，例如：https://1.1.1.1/dns-query

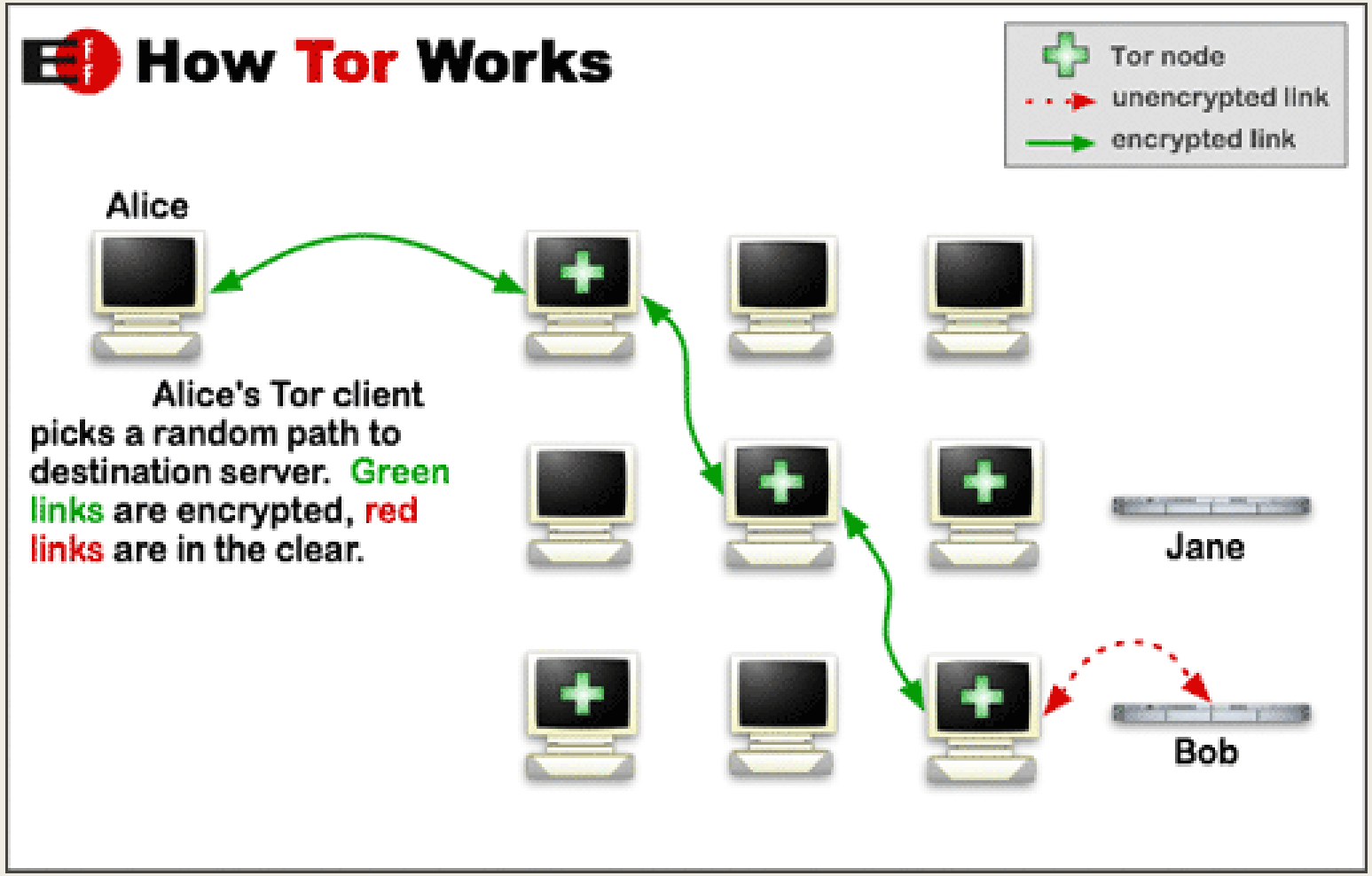
Publicly available DoH servers:
https://github.com/curl/curl/wiki/DNS-over-HTTPS

Test complete

```
Query round     Progress...     Servers found
1               ......          1
```


IP	Hostname	ISP	Country
162.158.241.8	None	Cloudflare	New Taipei, Taiwan

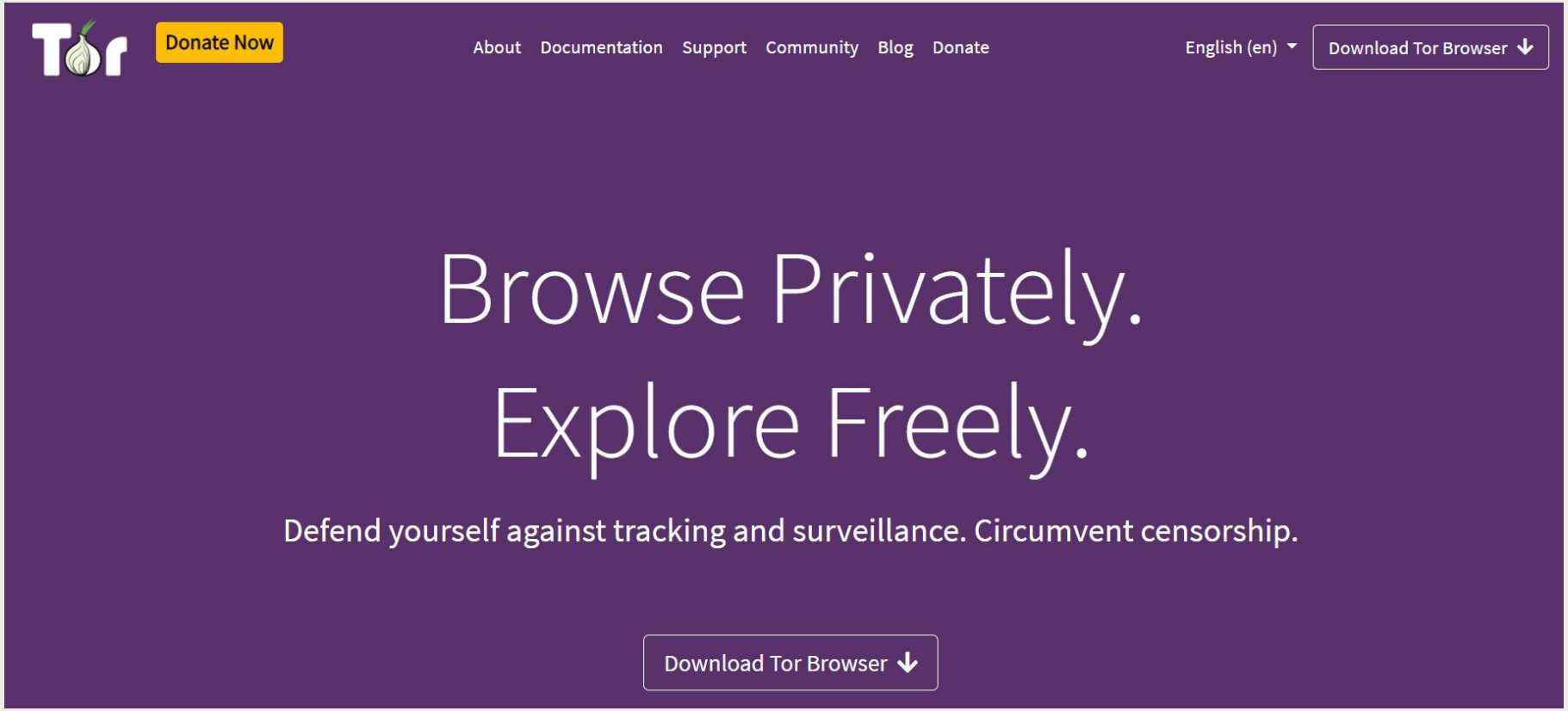
TOR (The Onion Router)



https://www.eff.org/pages/tor-and-https

Tor Browser

- https://www.torproject.org/



setup Tor & Proxychains in Kali

- apt-get install tor proxychains
- locate proxychains

```
┌──(kali㉿kali)-[~]
└─$ locate proxychains
/etc/proxychains4.conf
```

- vim /etc/proxychains4.conf

setup Tor & Proxychains in Kali

- Uncomment
  - *dynamic_chain*
- Comment
  - *strict_chain*

```
dynamic_chain
#
# Dynamic - Each connection will be done via chained proxies
# all proxies chained in the order as they appear in the list
# at least one proxy must be online to play in chain
# (dead proxies are skipped)
# otherwise EINTR is returned to the app
#
#strict_chain
#
# Strict - Each connection will be done via chained proxies
# all proxies chained in the order as they appear in the list
# all proxies must be online to play in chain
# otherwise EINTR is returned to the app
```

- Uncomment
  - *Proxy DNS requests – no leak for DNS data*

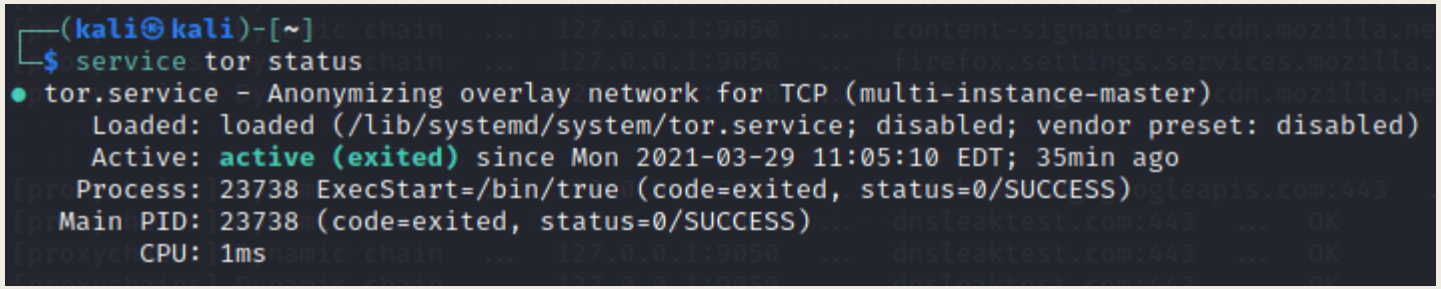
```
# Quiet mode (no output from library)
#quiet_mode

Proxy DNS requests - no leak for DNS data
proxy_dns

# set the class A subnet number to use for
```

- Put socks5 protocol statement on the last line
  - *socks5 127.0.0.1 9050*

```
[ProxyList]
# add proxy here ...
# meanwile
# defaults set to "tor"
socks4  127.0.0.1 9050
socks5  127.0.0.1 9050
```

setup Tor & Proxychains in Kali

- service tor start



- proxychains [program] [argument]
  - *proxychains firefox www.dnsleaktest.com*

- https://attack.mitre.org/techniques/T1090/003/

Name	Description
APT29	A backdoor used by APT29 created a Tor hidden service to forward traffic from the Tor client to local ports 3389 (RDP), 1 enabling full remote access from outside the network.[2]
Attor	Attor has used Tor for C2 communication.[3]
Dok	Dok downloads and installs Tor via homebrew.[4]
FIN4	FIN4 has used Tor to log in to victims' email accounts.[5]
GreyEnergy	GreyEnergy has used Tor relays for Command and Control servers.[6]
Inception	Inception used chains of compromised routers to proxy C2 communications between them and cloud service providers.
Keydnap	Keydnap uses a copy of tor2web proxy for HTTPS communications.[8]

Reference

- HOW TO BECOME ANONYMOUS ONLINE
- Combination of VPN, Tor And ProxyChain For More Anonymity

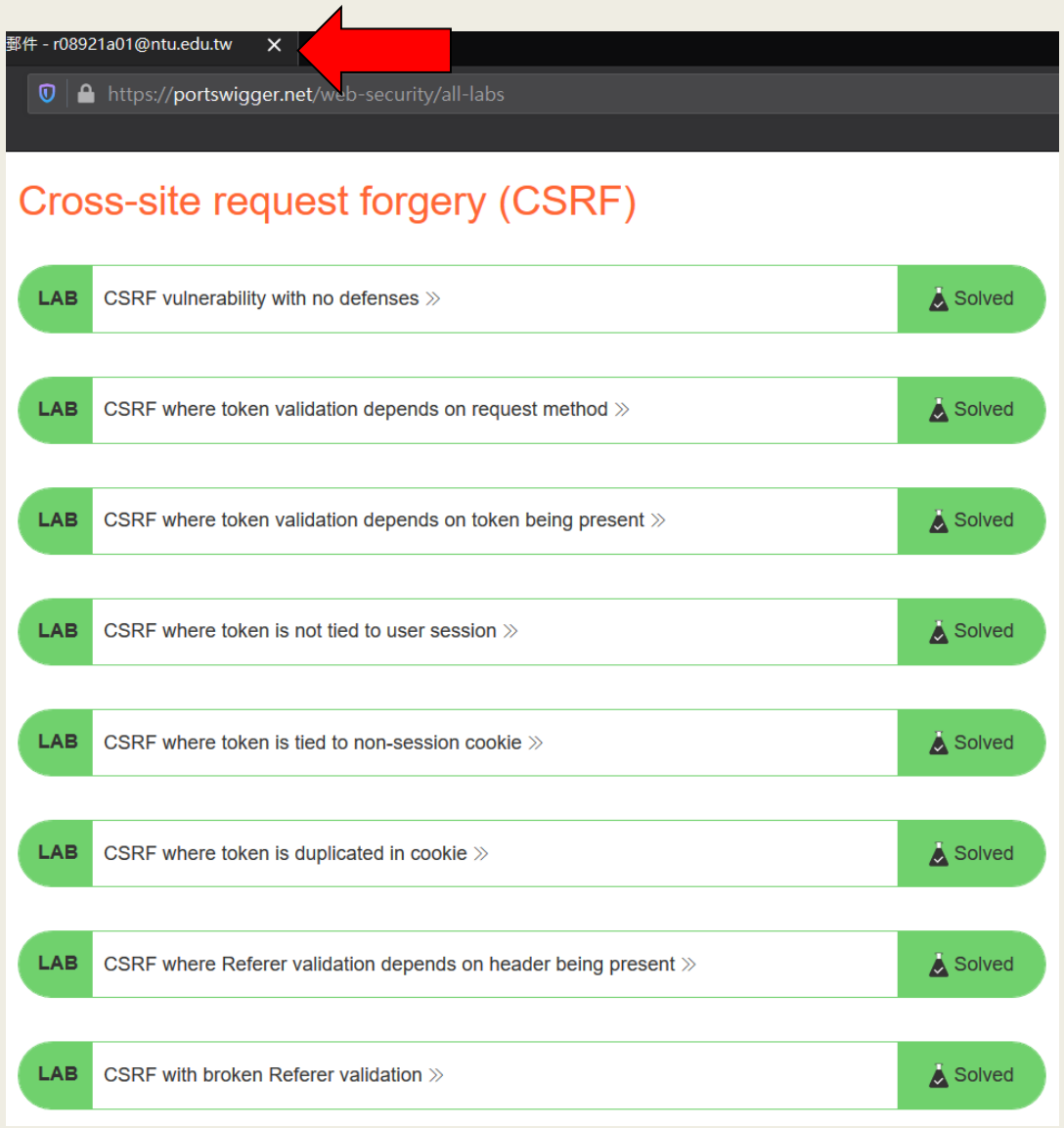
HW

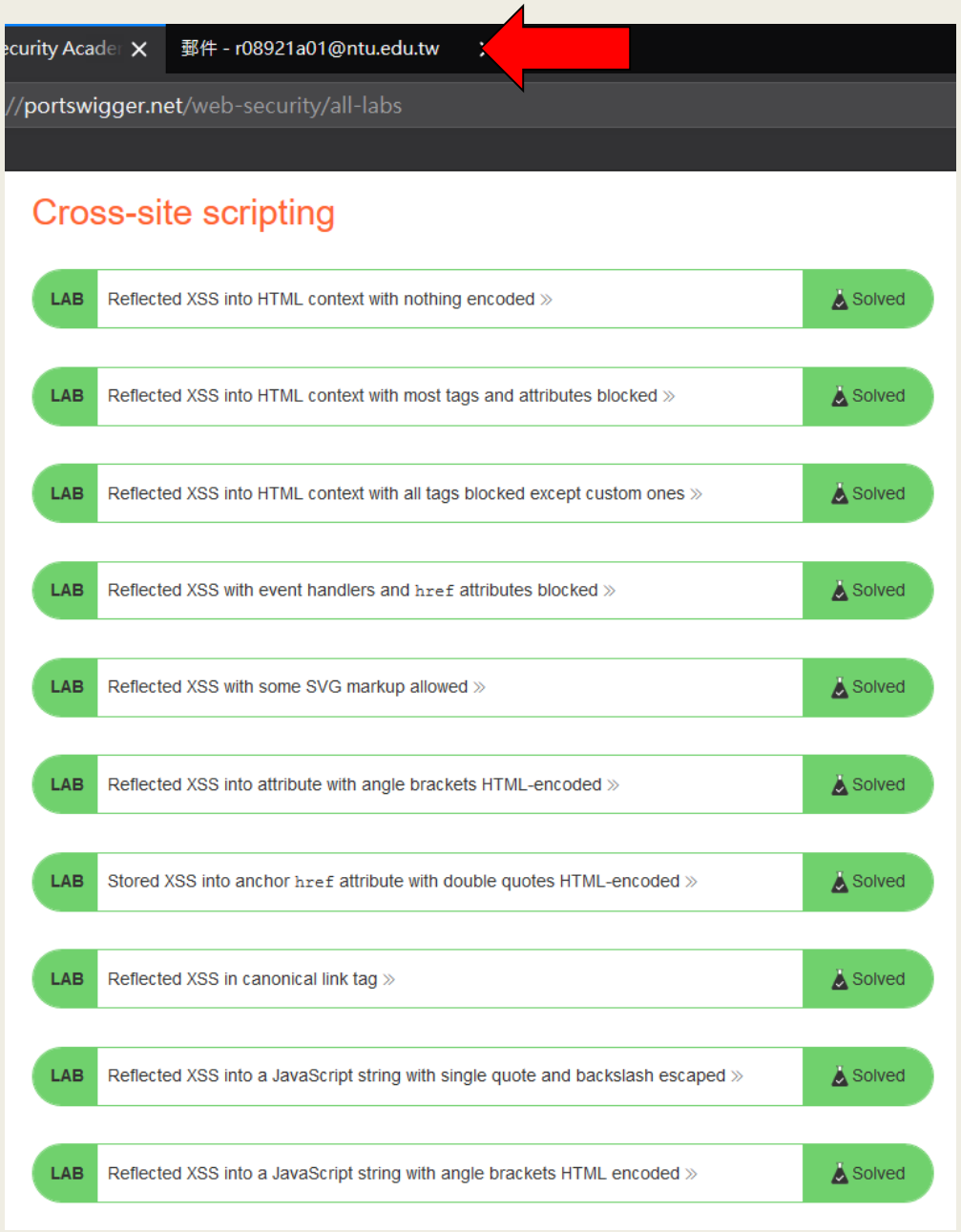
- XSS - 30 labs
  - *https://portswigger.net/web-security/cross-site-scripting*
- CSRF - 8 labs
  - *https://portswigger.net/web-security/csrf*
- SSRF - 7 labs
  - *https://portswigger.net/web-security/ssrf*

HW

- 上傳 pdf 檔，包含:
  - 10pt: Screenshot-01: Payload1 放上學號
  - 10pt: Screenshot-02: Change 欄位放上學號
  - 80pt: Screenshots @ *https://portswigger.net/web-security/all-labs*
- Lab 總共 45 題，解 20 題得 60pt，之後每多一題得 1pt。

With your Email logged in





With your Email logged in