NETWORK & MULTIMEDIA LAB

WEB SECURITY

Spring 2021

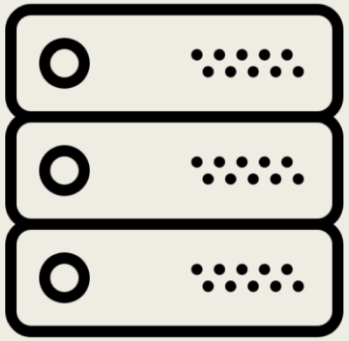
Outline

- Web Basics
  - HTTP Protocols
  - Cookie and Session
- 3 Attacks
  - CSRF
  - XSS
  - SSRF
- 2 Tools
  - Burp
  - DirBuster

前端/後端

- 瀏覽器
- Chrome, Firefox, Safari
- UI 介面
- HTML, CSS, JS

- 伺服器
- Apache, Nginx
- 提供網頁、處理使用者請求
- JS, Python, PHP, Ruby, Go ...



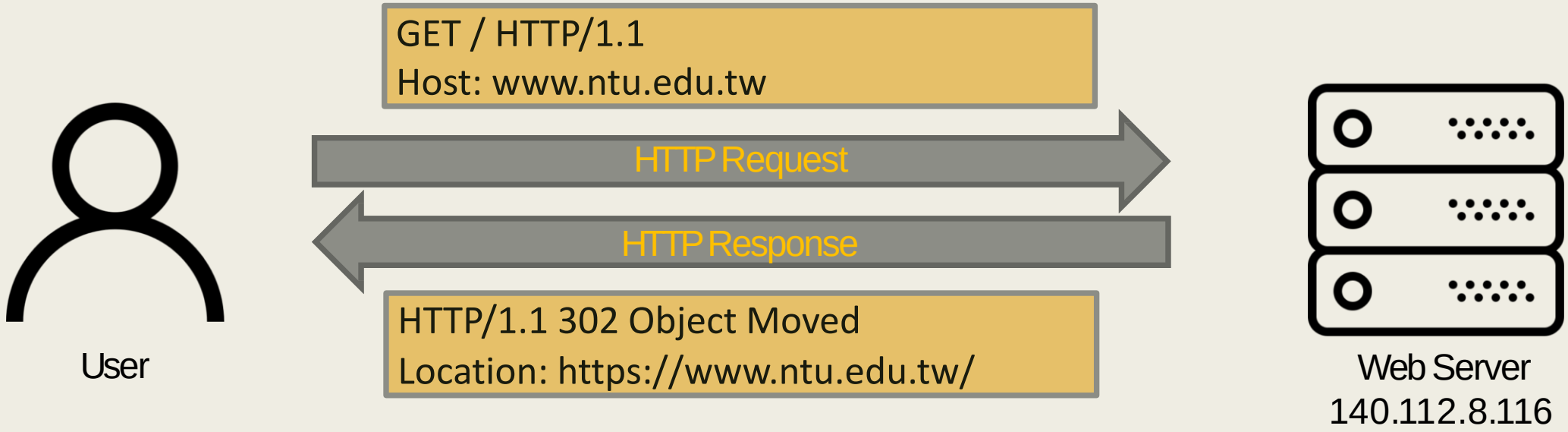
Protocols

當使用者在瀏覽網頁時，瀏覽器通常會使用以下幾種通訊協定跟網頁伺服器傳輸資料

- HTTP
  - 以明文的方式傳送與接收 HTML 等網頁資料，預設是以 TCP 80 Port 進行傳輸
- HTTPS
  - 原則上與 HTTP 相同，但是會以 TLS/SSL 協定將傳輸資料加密，預設是以 TCP 443 Port 進行傳輸
- WebSocket
  - 在使用者與伺服器之間提供一個全雙工(Full-Duplex)的通道，讓伺服器可以主動對使用者進行訊息推播

HTTP

- 瀏覽 http://www.ntu.edu.tw 時傳輸的 HTTP 內容

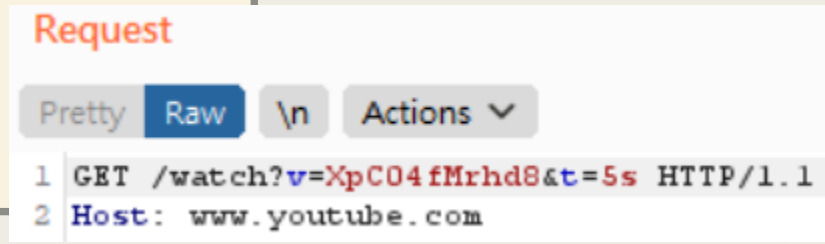


URL (Uniform Resource Locator)

- 統一資源定位符
- 格式：scheme:[//authority]path[?query][#fragment]
- authority = [userinfo@]host[:port]

- 例如：https://www.youtube.com/watch?v=XpC04fMrhd8&t=5s#16w8

scheme → https
authority → www.youtube.com
path → watch
query → v=XpC04fMrhd8&t=5s
fragment → 16w8 (不會被傳送至伺服器, 只提供瀏覽器來使用)



HTTP Request

- 架構
  - Request Line
  - Request Header
  - Empty Line
  - Request Body (Optional)

```
POST /cgi-bin/cbdic/gsweb.cgi HTTP/1.1
Host: dict.revised.moe.edu.tw
Connection: keep-alive
Content-Length: 81
Cache-Control: max-age=0
Origin: http://dict.revised.moe.edu.tw
Upgrade-Insecure-Requests: 1
Content-Type: application/x-www-form-urlencoded
User-Agent: Mozilla/5.0 (Macintosh; Intel Mac OS X 10_15_
Accept: text/html,application/xhtml+xml,application/xml;q=
Referer: http://dict.revised.moe.edu.tw/cgi-bin/cbdic/gswe
Accept-Encoding: gzip, deflate
Accept-Language: zh-TW,zh;q=0.9,en-US;q=0.8,en;q=0.7,zh-CN
Cookie: LB_new_revised=52588428.20480.0000; _ga=GA1.3.1889

o=e0&ccd=h1YUAg&sec=sec1&qs0=123&clscan=&selectmode=mode1&
```

HTTP Request

- Request Line
  - Request Method: GET, POST, ...
  - https://developer.mozilla.org/en-US/docs/Web/HTTP/Methods

- Request Header
  - Host: 網域名稱
  - Content-Length: Body 的長度
  - Content-Type: Body 的格式
  - User-Agent: 使用者的 OS、瀏覽器資訊
  - Cookie: 存在使用者瀏覽器中的資料

```
POST /cgi-bin/cbdic/gsweb.cgi HTTP/1.1
Host: dict.revised.moe.edu.tw
Connection: keep-alive
Content-Length: 81
Cache-Control: max-age=0
Origin: http://dict.revised.moe.edu.tw
Upgrade-Insecure-Requests: 1
Content-Type: application/x-www-form-urlencoded
User-Agent: Mozilla/5.0 (Macintosh; Intel Mac OS X 10_15_3
Accept: text/html,application/xhtml+xml,application/xml;q=
Referer: http://dict.revised.moe.edu.tw/cgi-bin/cbdic/gswe
Accept-Encoding: gzip, deflate
Accept-Language: zh-TW,zh;q=0.9,en-US;q=0.8,en;q=0.7,zh-CN
Cookie: LB_new_revised=52588428.20480.0000; _ga=GA1.3.1889

o=e0&ccd=h1YUAg&sec=sec1&qs0=123&clscan=&selectmode=mode1&
```

HTTP Response

- 架構
  - Status Line
  - Response Header
  - Empty Line
  - Message Body (Optional)

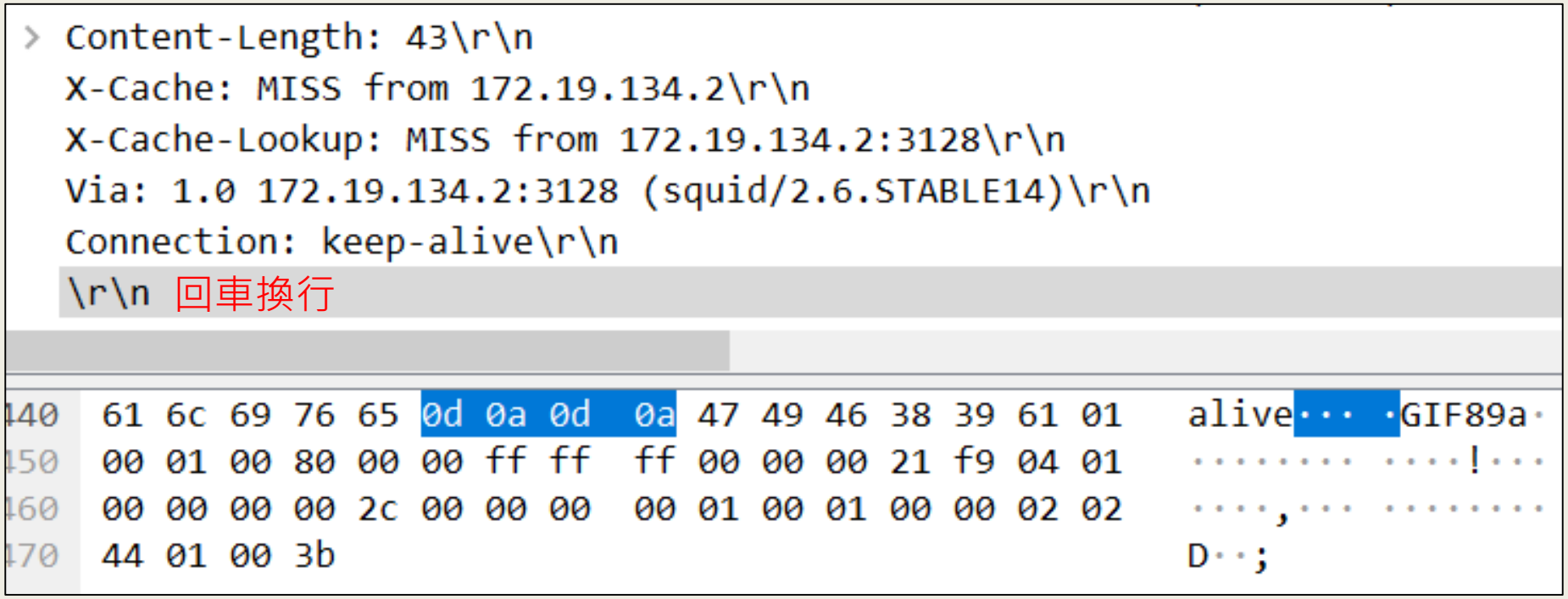
HTTP Response

- Status Codes
  - 1XX: Client 需要繼續處理 (較少見)
  - 2XX: 成功
  - 3XX: 重新導向
  - 4XX: 客戶端錯誤
  - 5XX: 伺服器錯誤

```
HTTP/1.1 200 OK
Date: Sat, 14 Mar 2020 07:47:01 GMT
Server: Apache
X-Frame-Options: http://140.111.34.3, ht
Vary: Accept-Encoding
Content-Encoding: gzip
Content-Length: 247
Connection: close
Content-Type: text/html; charset=utf-8

<html>
<head><meta http-equiv="Pragma" content=
<body>

    <table border="0" cellpadding="0" c
      <tbody><tr>
        <td width="423" background="/cb
      </tr>
    </tbody></table>
    <br>

no message
</body>
</html>
```

HTTP Response Splitting
CRLF injection (Carriage-Return Line-Feed)

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



HTTP Response Splitting
CRLF injection (Carriage-Return Line-Feed)

- 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
```

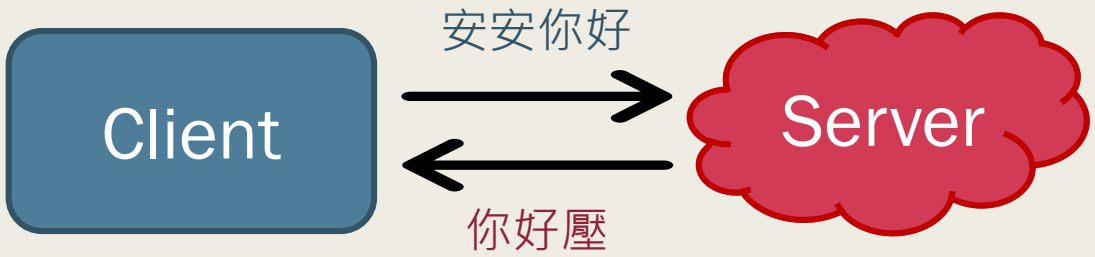
HTTP Response Splitting
CRLF injection (Carriage-Return Line-Feed)

- 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:

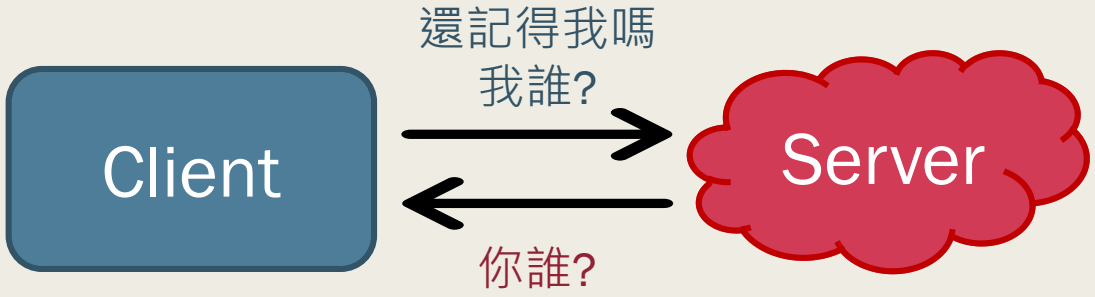
```
HTTP/1.1 302 Moved Temporarily

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>
```

Cookie and Session

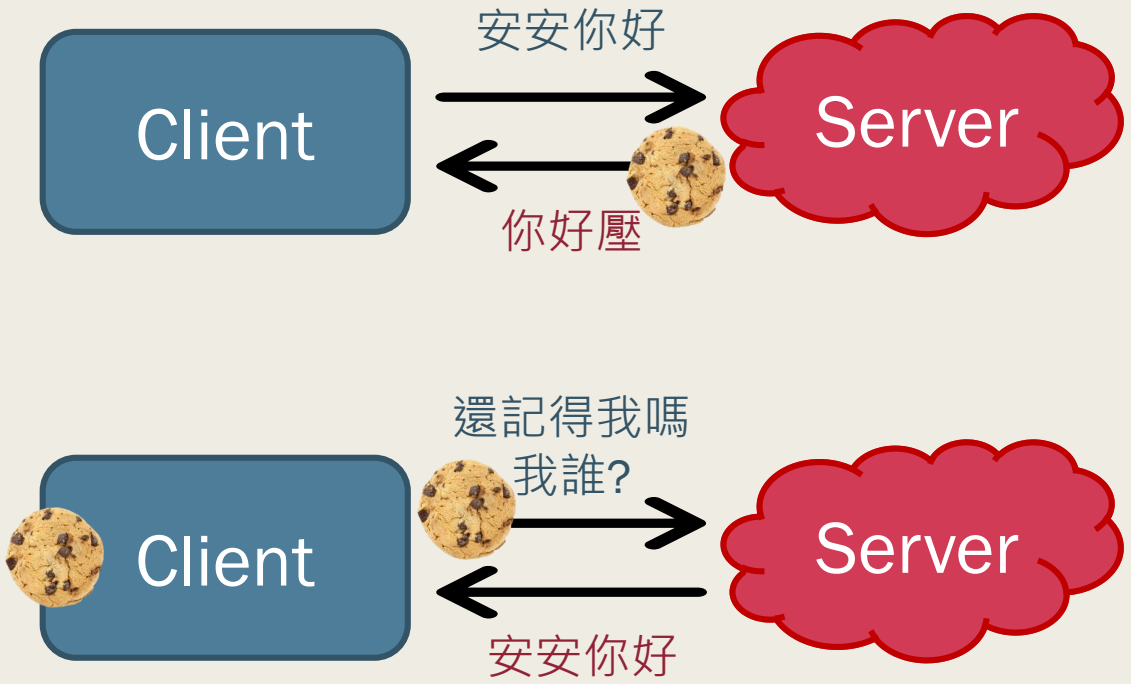
- HTTP 協定是無狀態的 (Stateless protocol)
  - 伺服器不會知道用戶上一次做了什麼



- Server
  - 如何判斷請求是來自哪個使用者？
  - 如何判斷使用者已經登入？
  - 如何避免使用者 A 假冒成使用者 B？



Cookie and Session



Cookie and Session

- Cookie 存放 ID
- Session 存放 ID 與對應的資料

Name	Value
SESSIONID	hGjrFF

Client (Cookie)

ID	Data
3ij4Ah	...
0g9XvX	...
hGjrFF	user=foo, login=True
o2AiHk	...

Server (Session)

Pretty Raw Render \n Actions

```
4 X-XSS-Protection: 1;mode=block
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 Vary: Accept-Encoding
9 Set-Cookie: PHPSESSID=541e64be3f14c19d2174558cc1293fef; path=/; secure;
```

Cookie-based Session

- 把 Session 放在 Cookie 裡
  - Data 經過加密 (算法 & Key 未知，難以竄改)

- 優點:
  - 降低 Server 的負擔

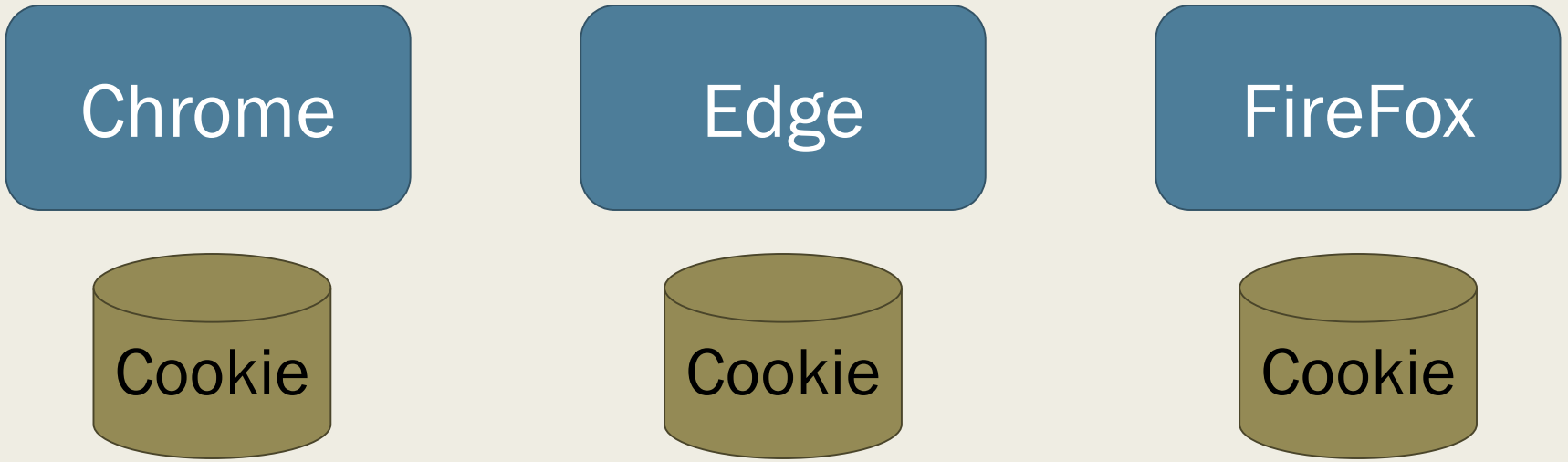
- 缺點:
  - Cookie 會被附加在每個 HTTP 請求中，所以無形中增加了流量
  - Cookie 的大小限制在 4KB 左右

Cookie-based Session

```
7 Referer: https://github.com/login
8 Connection: close
9 Cookie: _gh_sess=
hLBIFh7T4fjMx0KIalAaKrsYU71gJ%2B1gbMGeuT%2BiBv3k4aIKjh12hciXQIFXM3UPWzk8Ctck0mGksf
zqo7B3p40NCIzeoY%2FDzI%2Byom%2F31FnteVWp3QQHsjMLQwEpI0DX10UI%2B5KXKw%2FLQtJIrTQC3P
gAKzX4b9TLt0Vsh1I95%2BNAgGP%2BGXo0DCIZGx9MPBE7nUbzzga%2BVo%2F8aU0cWW2TYSJMPGgBRymJ
%2B0xp0C4Fs2HZJG4hRLPxdq3KRse5MTp0tWe5XqTkQr5zeJsDbx0ku54HhSNYH%2FZII2ZGkwnb0%2BJu
ms00P5i6DqrogHLGiYyx6a%2By6WUp7CjyloQLdEDmbeAf9a3upB1AC7uxL5yivtt2CA5v4CDc%2B0msyH
RlyA%2B3PkHw8xN4wNiS%2Brv%2FluxUkXeMzg0PjpGuqXMQysYg4IRw2jqDXKWS8tb0PxA1AYe11Kca%2
FrfAwCLMA0VUqtWTAB4YjuYwFFGtQ0SS1izWP5wiD0jWrUCCBcNFKKhgv0QDi%2FrzR8iKtTQwx%2FqWly
JnA50plowUDEFz0ERkqR9A%2Bawtk%2Fc0xdjY29fgDs%2F611YBza6xia09qL10PP650ZFAD11azho7J9
vvKNUMKCvssHhFT111wibfskPJXxrYUboIGjPYM6KfCjHwpR9ZrYnH2tyTyHb1RxnlXM3hBXuGzEJLQ%2
FtHsghrDRx1tGnP6RbJJzmw187SG0eVjBHJXbfN9N89FMt91CBqQvRMEbupWSe54Xan8yVoQyCEYSrxt6m
0Nz7IPARQkW04FUoEUbYBgC3VCmWKuQuG%2BhSF%2FcwdCqf%2F89gNJRI1VVyToLGmwrfnbnVIrii6Bdi
M%2Fs%2BJYFYUzfQWmNYf4PtE1ZPrWtnK5F%2FP9w3JoS%2Bf4NT7qaI4VsR4bK9fMb1rEn0CPs%2FVqkA
2%2FpNMovPM%2F%2FXDh4A8RuwnCnBK2%2B2b%2FH5U1FJ7CC3RMh0WPotXg%3D%3D--H0RergUryjCdwA
77--VmMguP1wkaaPJFLUU%2B28dA%3D%3D; _octo=GH1.1.458315067.1616567046; logged_in=
```

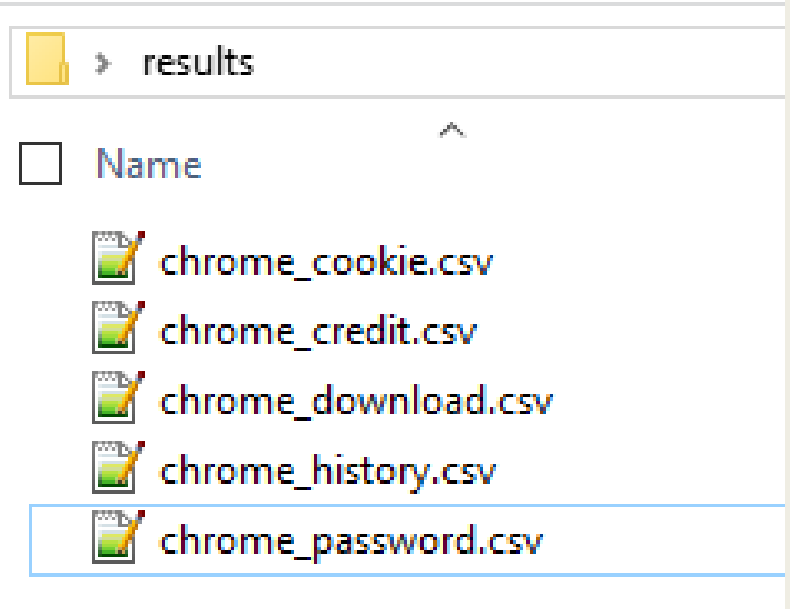
Cookie and Browser

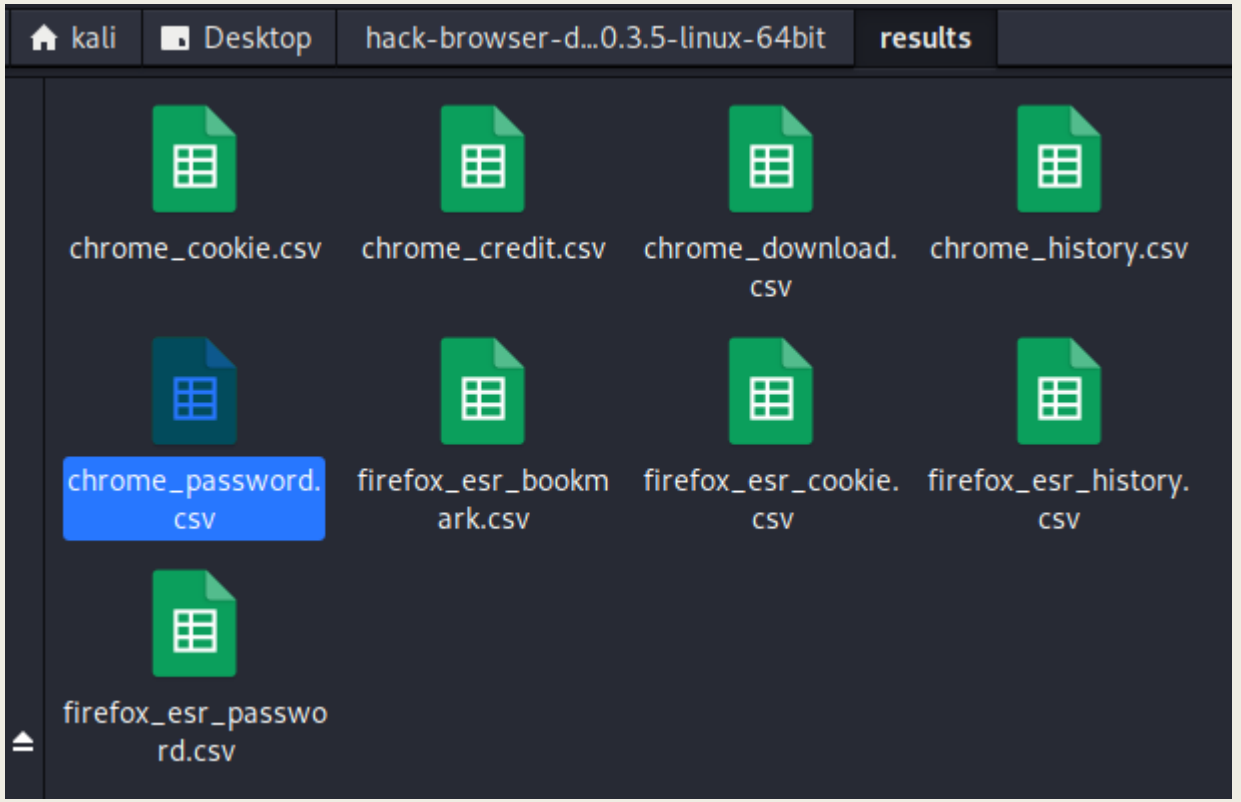
- 每個瀏覽器存放 Cookie 的空間是獨立的



Data and Browser

https://github.com/moonD4rk/HackBrowserData

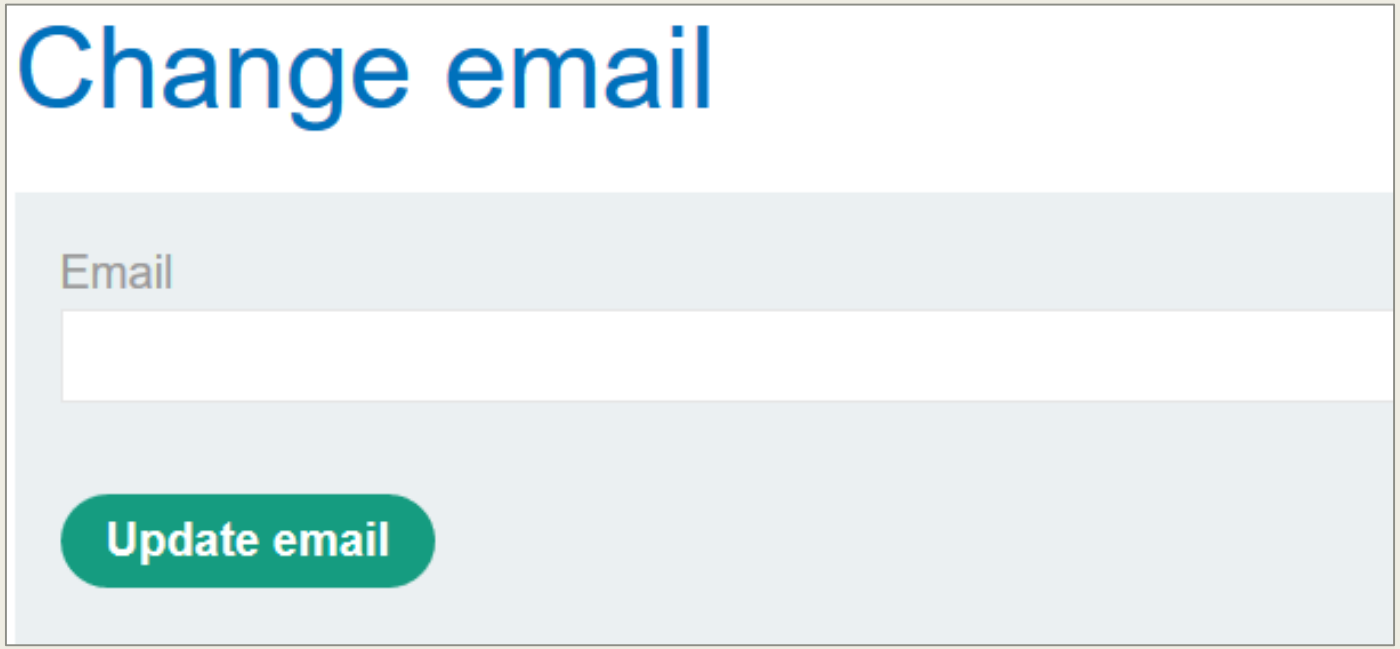




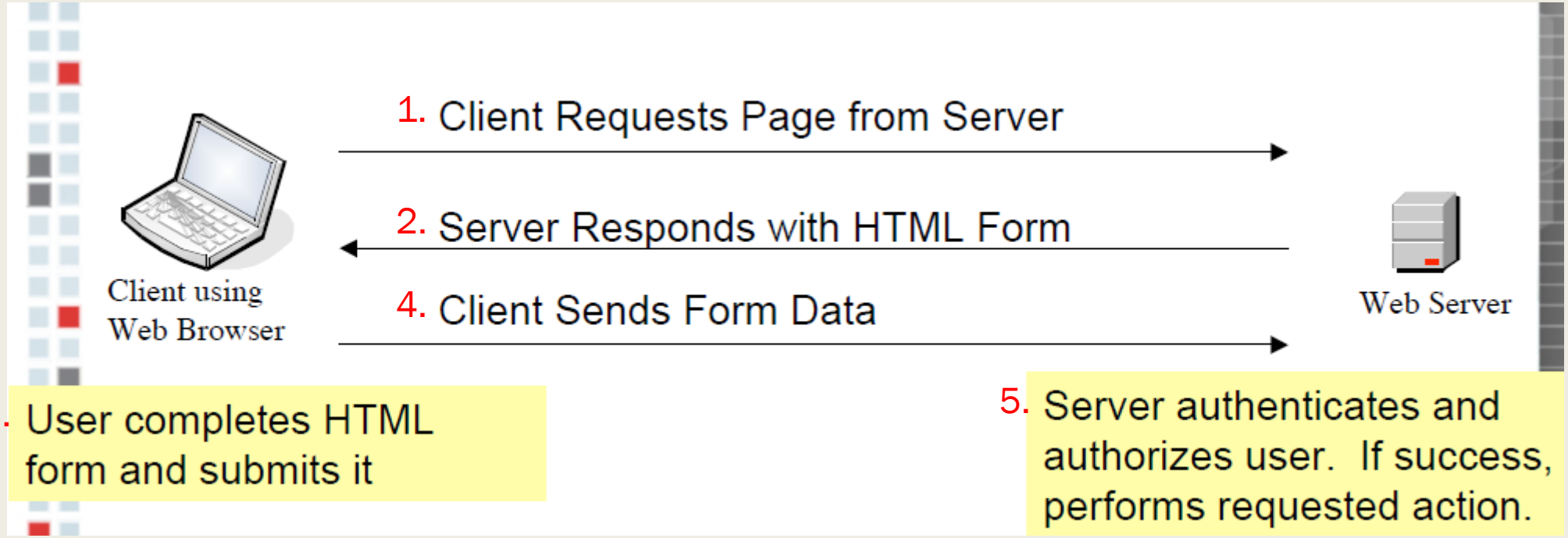
CSRF (Cross-Site Request Forgery)

- 跨站請求偽造
- 一種讓用戶在當前已登入的網站上，執行非本意操作的攻擊手法

HTTP request

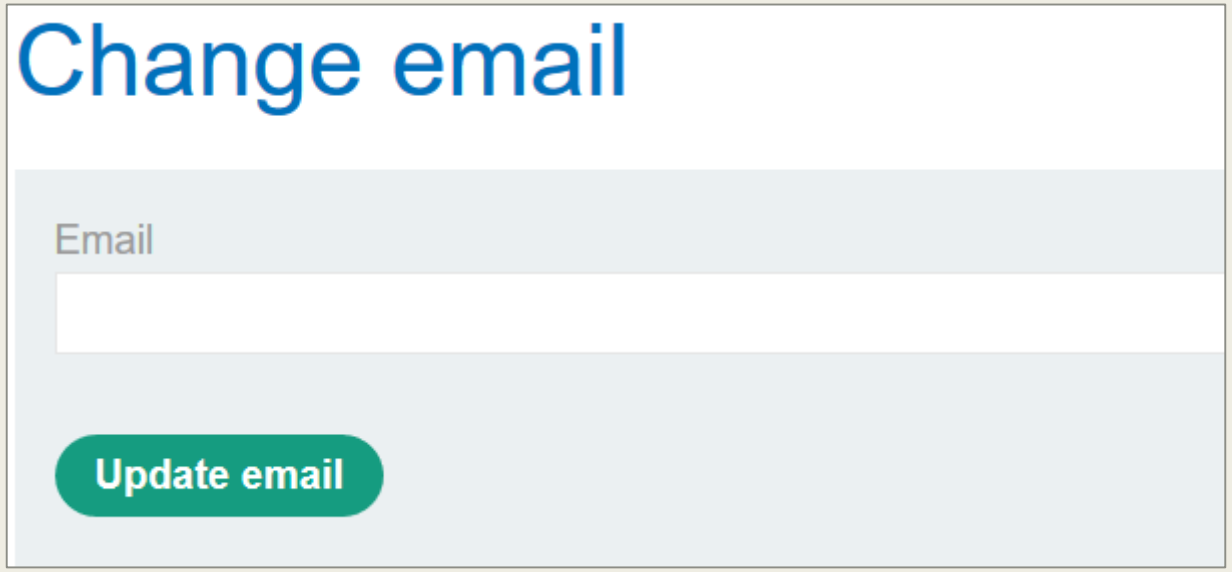


HTTP request

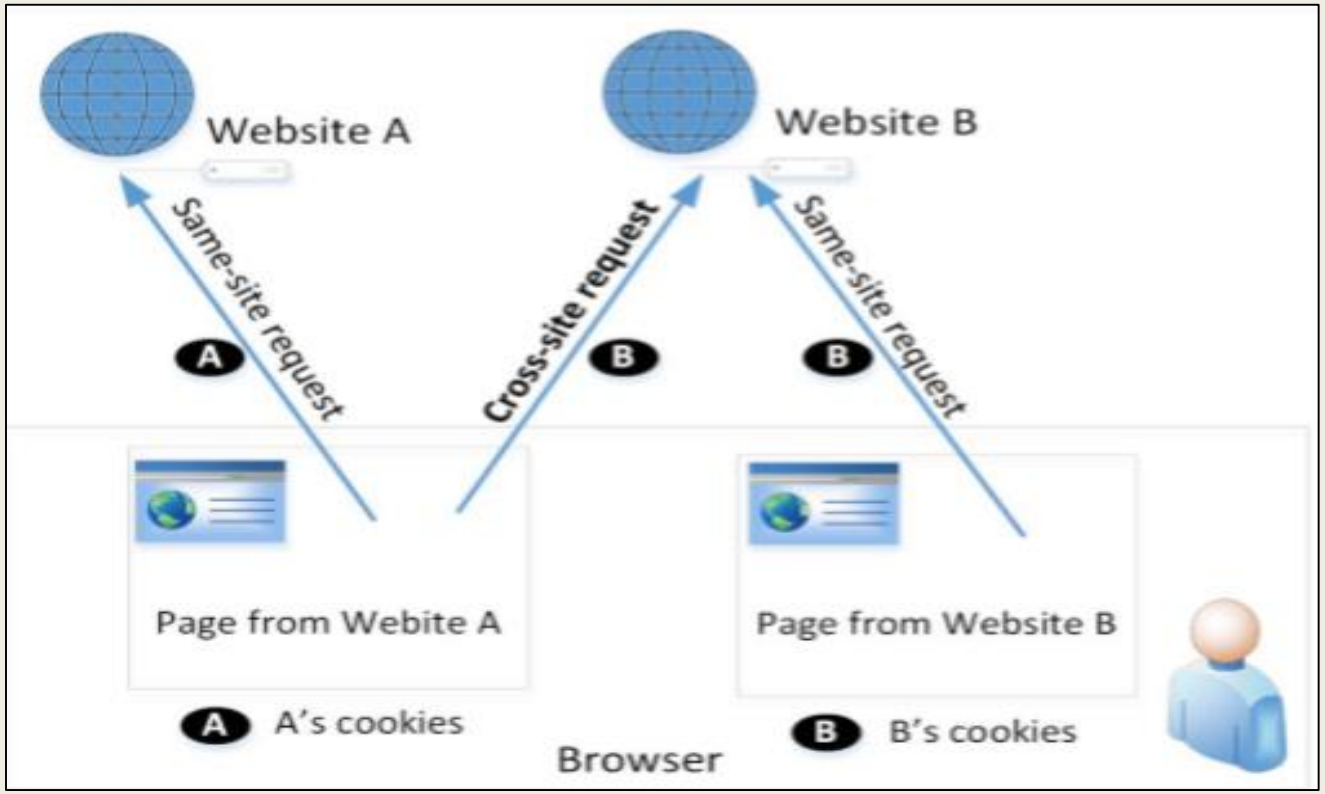


HTML form

```
<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



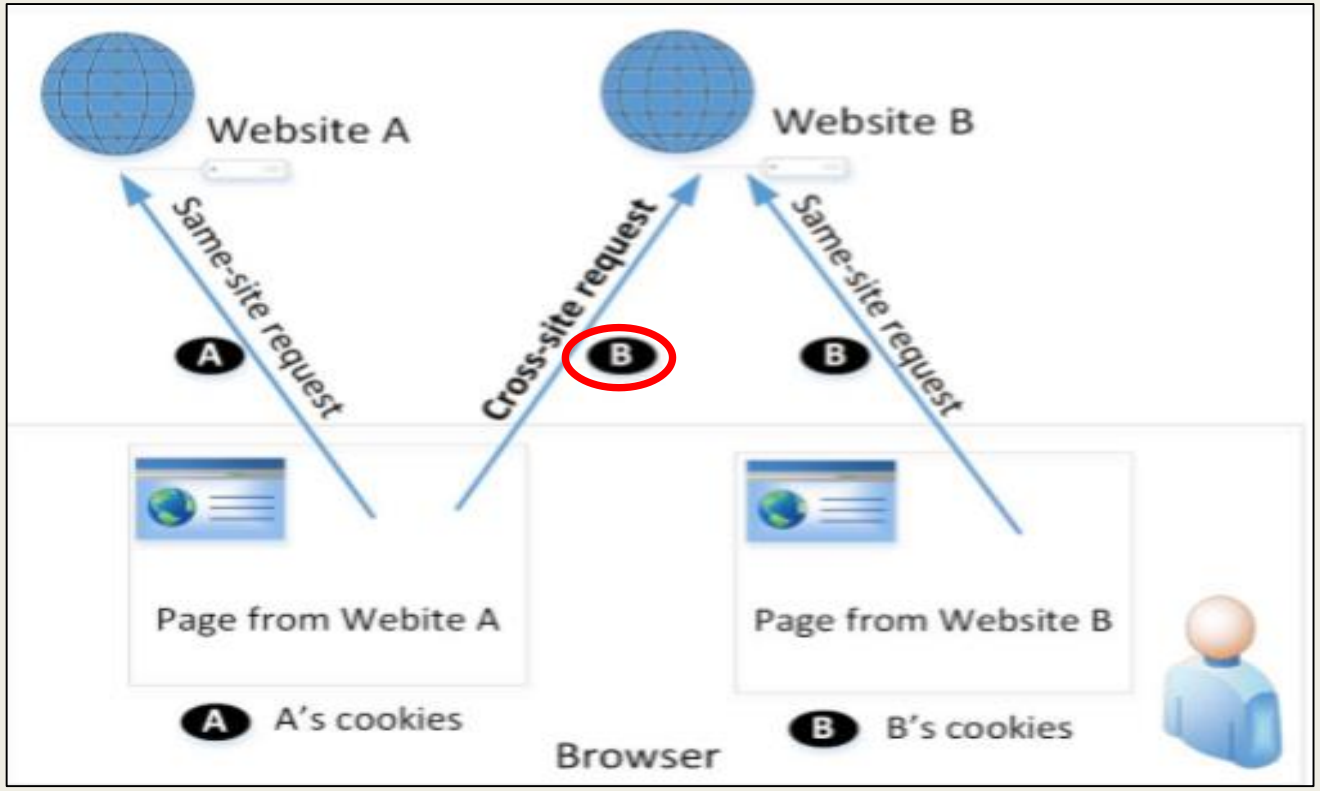
- same-site request:
  一個網站的頁面向自己發送請求

```
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">
```

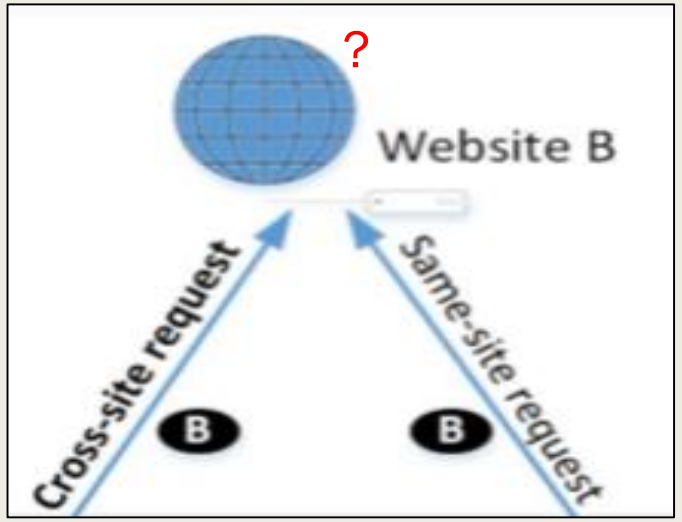
Cookies in Cross-Site Request



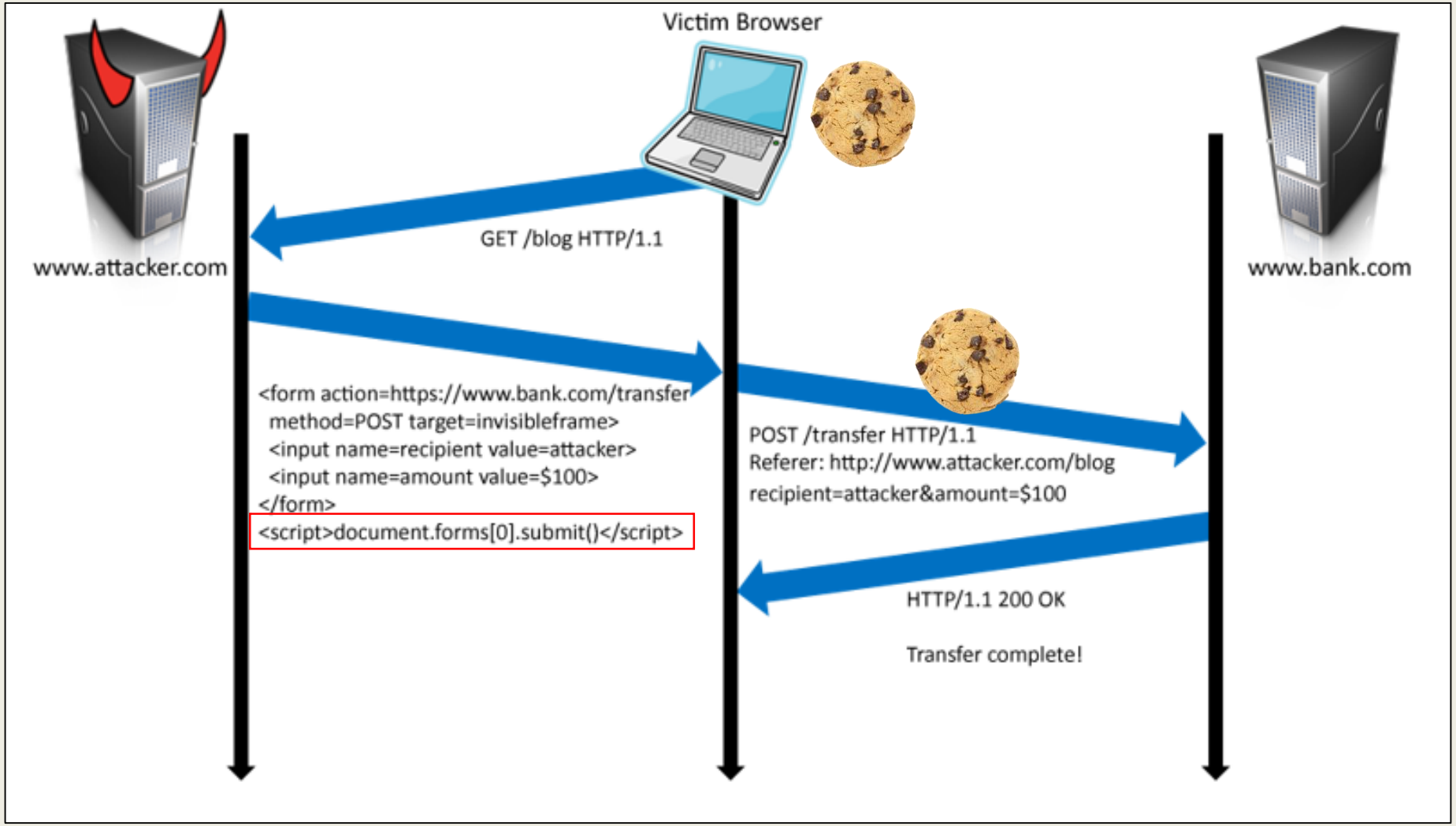
- 當 A.com 的頁面向 A.com 發送請求時，瀏覽器會將 A.com 的 cookies 一併送出
- 當 A.com 的頁面向 B.com 發送請求時，瀏覽器也會將 B.com 的 cookies 送出

Problems of Cross-Site Requests

- 因為 cross-site cookie 的特性， server 端無法分辨一個 request 是 same-site request 還是 cross-site request
- 第三方網站可以偽造一個跨站請求，若瀏覽器附上 cross-site cookie，受害網站便會認為這是使用者所發出的請求
- 因此這種攻擊手法稱為 CSRF



CSRF Attack Flow



Attacking Scenario

- 受害者必須已經在受害網站上取得授權
  (已登入並取得 cookie)

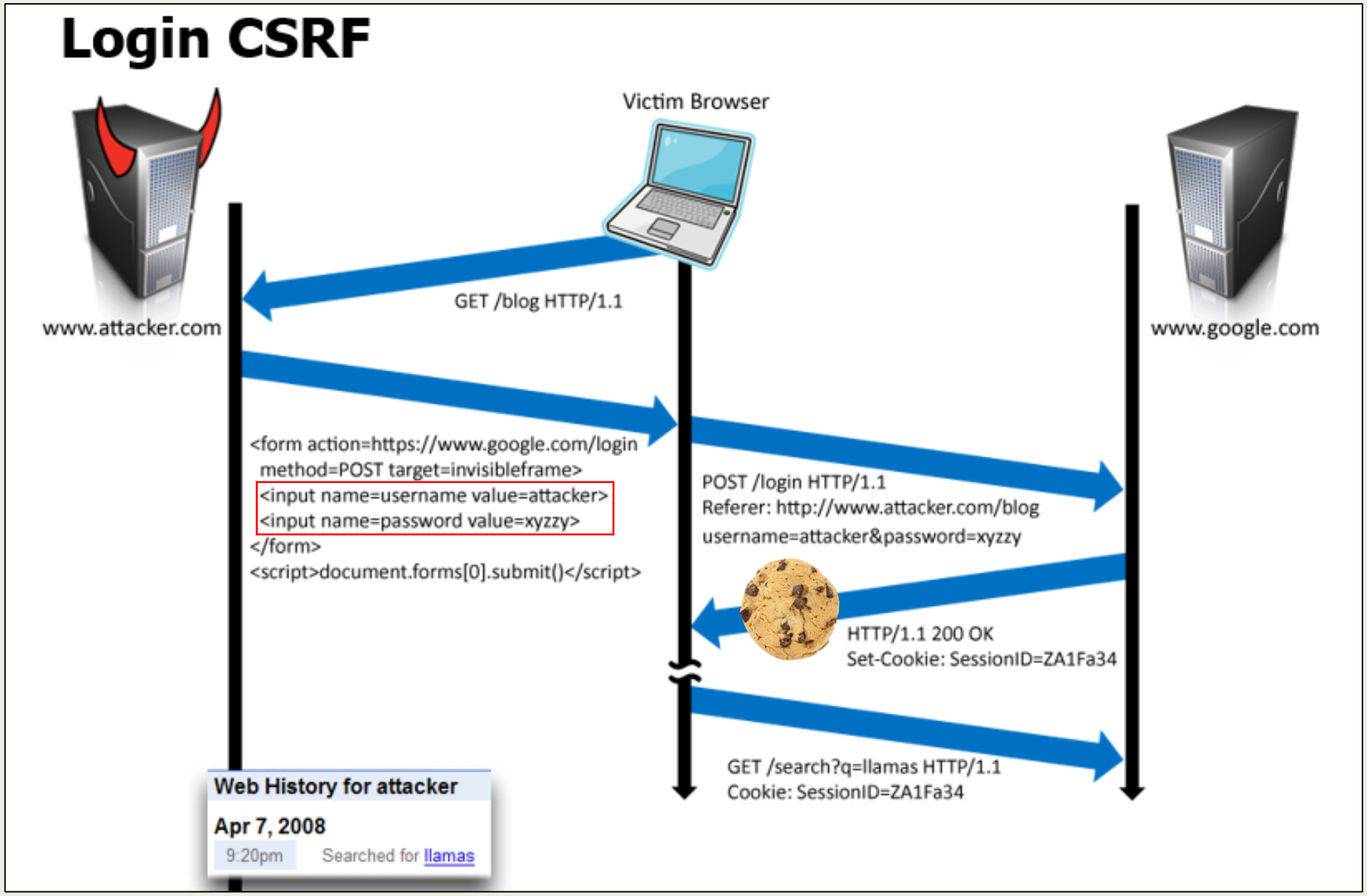
- 攻擊者要想辦法讓受害者造訪惡意網頁
  - a discussion forum
  - HTML email body or attachment
  - or any location that a victim is likely to click while logged into the target site

- 這個惡意網頁包含了偽造的請求，並自動發送給受害網站

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



CSRF Attack Methods (trigger request)

- 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 Attacks on HTTP GET Service

- 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>
```

Implementation of Cookies

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

Implementation of Cookies

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

`Secure` Optional

A secure cookie is only sent to the server when a request is made with the `https:` scheme. (However, confidential information should never be stored in HTTP Cookies, as the entire mechanism is inherently insecure and doesn't encrypt any information.)

`HttpOnly` Optional

<script>alert(document.cookie)</script>

Forbids JavaScript from accessing the cookie, for example, through the `Document.cookie` property. Note that a cookie that has been created with HttpOnly will still be sent with JavaScript-initiated requests, e.g. when calling `XMLHttpRequest.send()` or `fetch()`. This mitigates attacks against cross-site scripting (XSS).

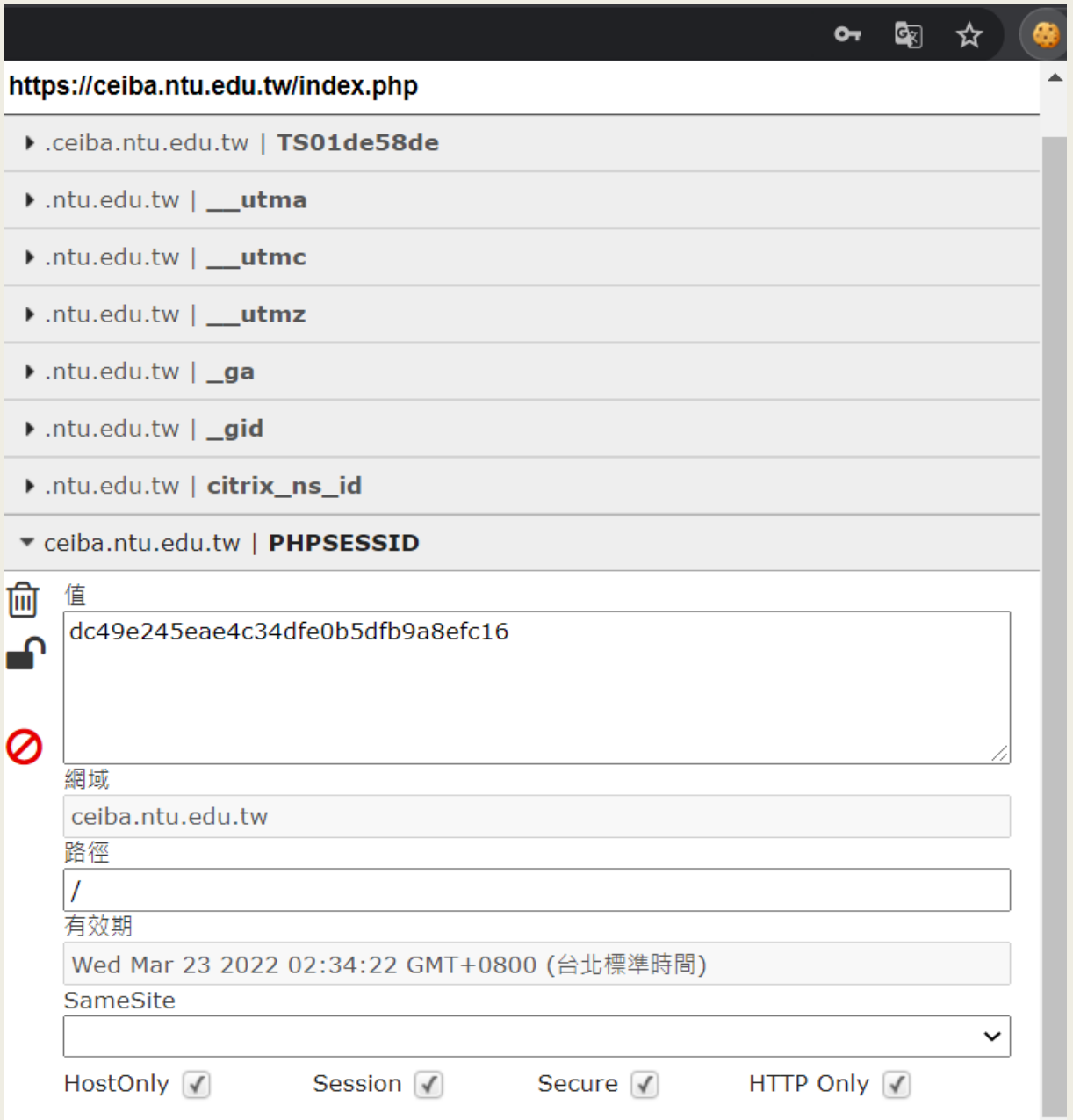
Implementation of Cookies

- 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.

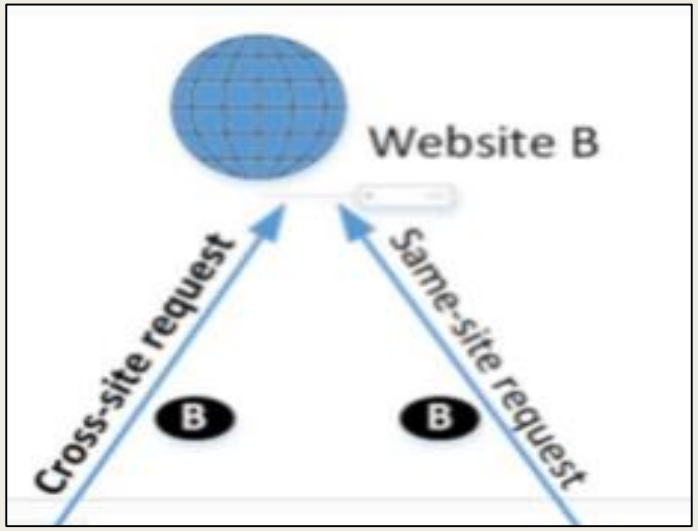
Implementation of Cookies



Fundamental Causes of CSRF

- server 端無法分辨一個 request 是 same-site request (Trusted) 還是 cross-site request (Not Trusted)

- 然而，瀏覽器知道一個 request 是 same-site 還是 cross-site



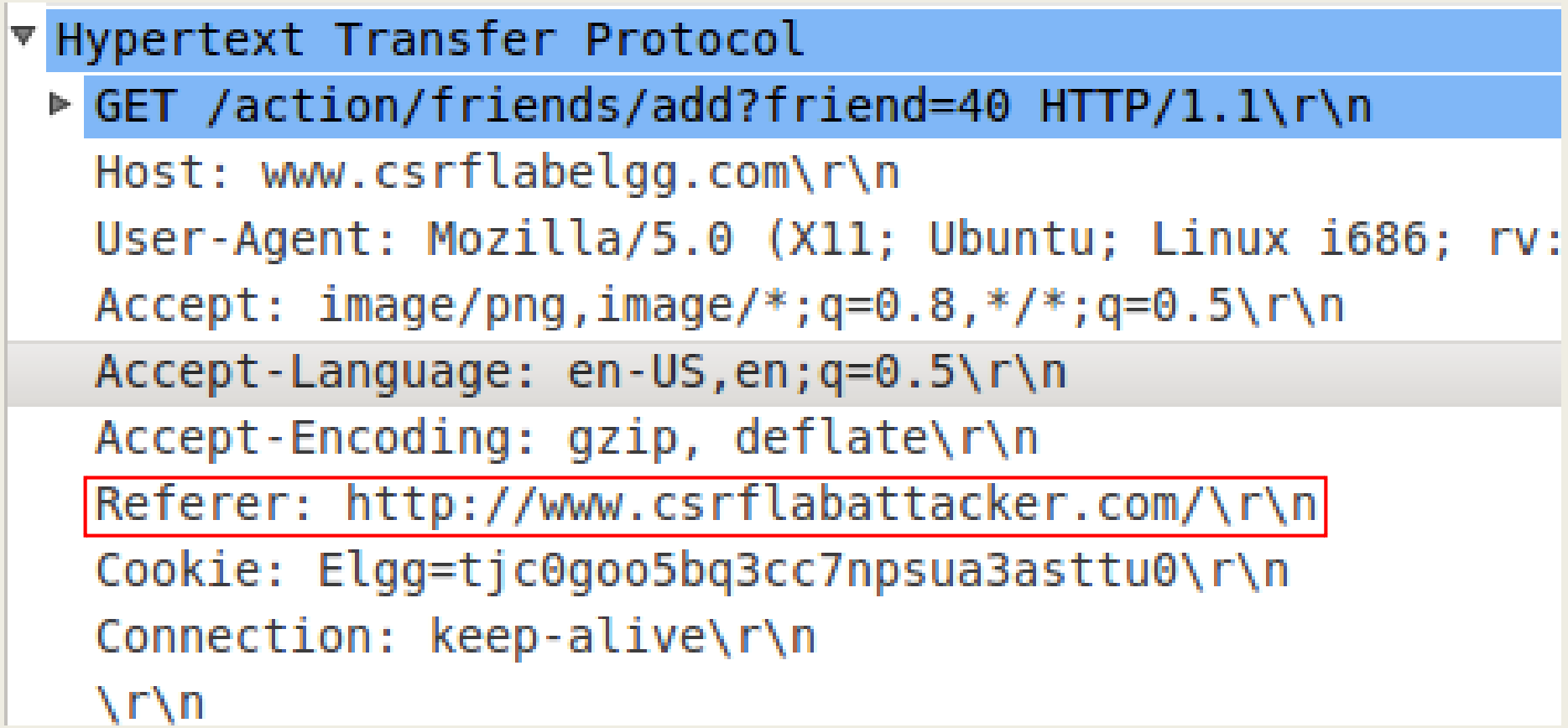
Countermeasures

- 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)*

Countermeasures
1. HTTP Referer Header

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



Countermeasures
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

Countermeasures
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.

Countermeasures
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

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

- 產生： Server
- 儲存： Server

- 在 form 裡新增一個 name='csrftoken' value='<亂碼>'，比對 Server 端的 <亂碼>

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

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

- 產生： Server
- 儲存： Client

- 一樣在表單放 CSRF token，但這次參照值不是存在 Server 裡，而是存在 cookie 裡
- 這方法利用的是攻擊者無法取得 cookie 的值，因此偽造的表單中的 CSRF token 不會和 cookie 裡的值一樣

- 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。

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

- 產生： Client
- 儲存： Client

- 前面提的 Double Submit Cookie，是由 Server 產生、存在 Client 的 Cookie
- 但由於單頁應用 (single-page application) 在拿取 CSRF token 會有困難，可以改成 Client 端生成
- 此 cookie 只是要確保攻擊者無法取得，沒有包含任何敏感資訊，所以不避擔心安全性考量

Summary of CSRF

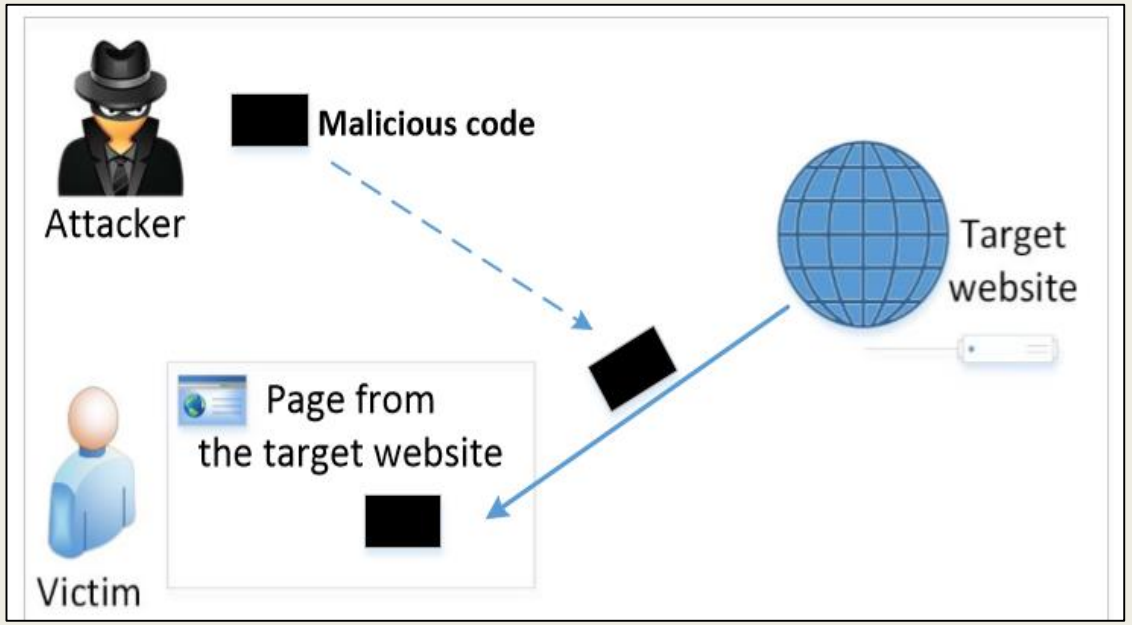
- Cross-site requests vs. Same-site requests
- How does a hacker launch CSRF attack?
- The fundamental cause of the CSRF vulnerability
- Countermeasures against CSRF attack

XSS (Cross-Site Scripting)

- 跨網站指令碼，屬於代碼注入的一種

Definition: XSS

- 它允許惡意使用者將程式碼注入到網頁上，使其他使用者在觀看網頁時受到影響(執行程式碼)



What hackers can do with XSS attacks?

- Forge user requests
- Steal cookies
- Play a sound
- Get user-agent string
- Man-in-the-browser
- Get form values / HTML contents
- Fake notifications
- Tabnabbing (一種釣魚攻擊的手法)

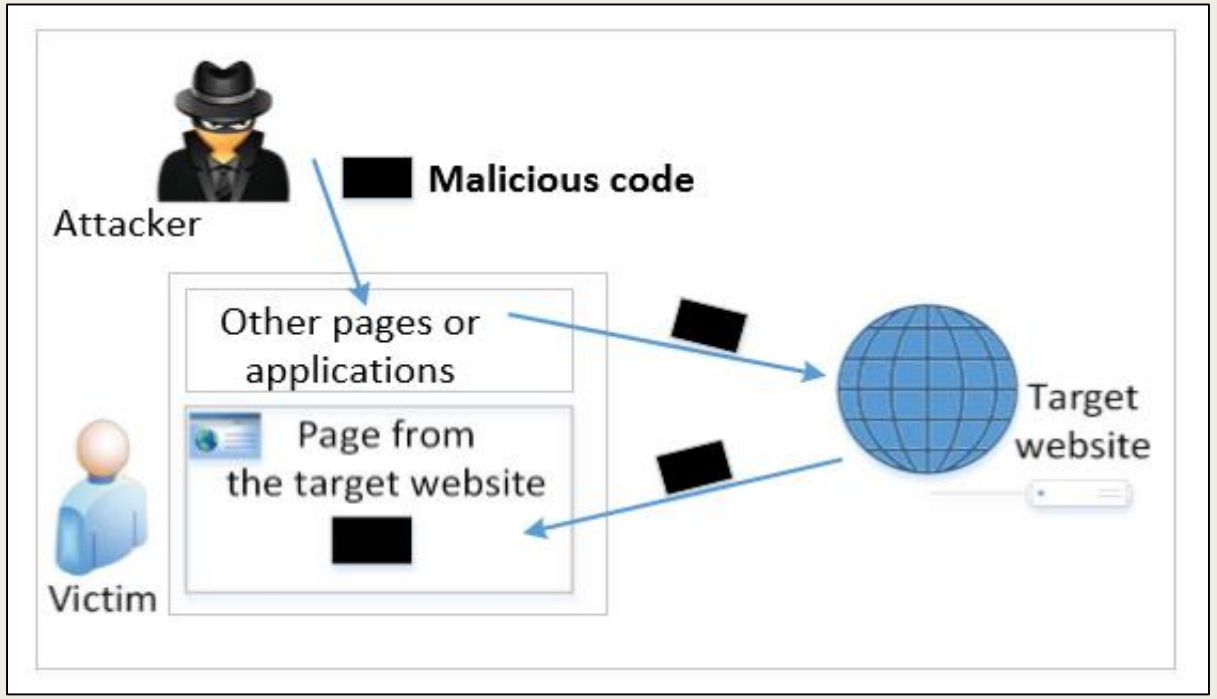
Types of XSS Attacks

- Reflected XSS Attack
  - *Non-persistent*
- Stored XSS Attack
  - *Persistent*

Reflected XSS Attack

- 攻擊者構造出特殊的 URL，其中包含惡意代碼。

- 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。



Reflected XSS Attack

- Assume a vulnerable service on the website : http://www.example.com/search?input=word , where word is provided by the users.

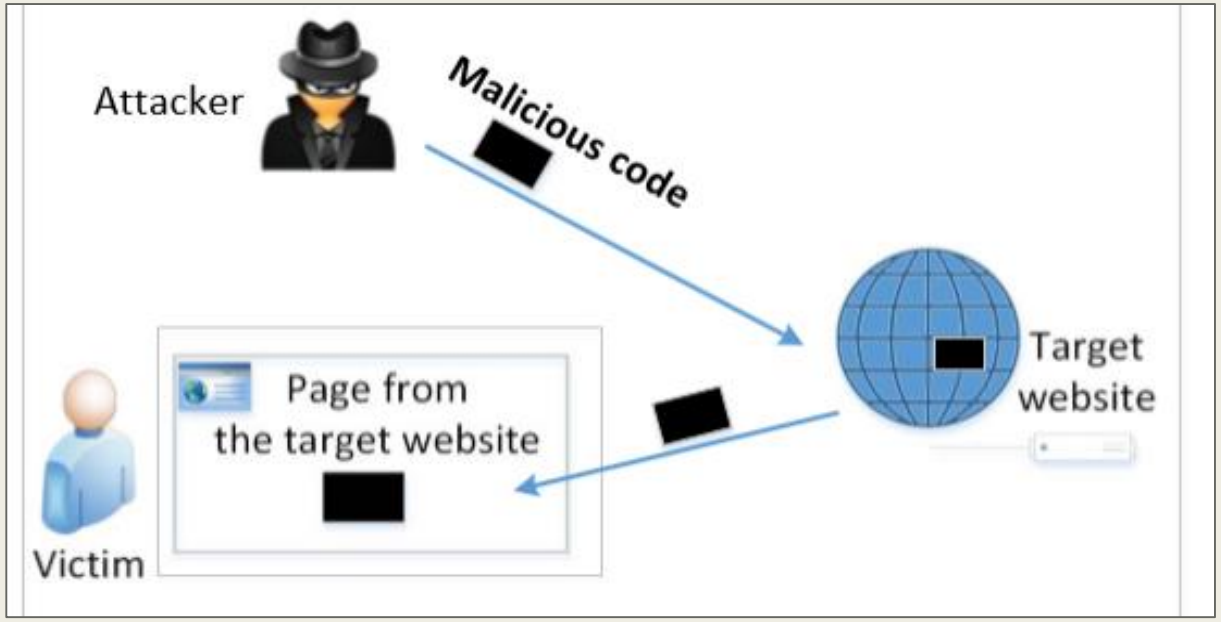
你搜尋了 **xxx !**

- Now the attacker sends the following URL to the victim and tricks him to click the link: http://www.example.com/search?input=<script>alert(1);</script>

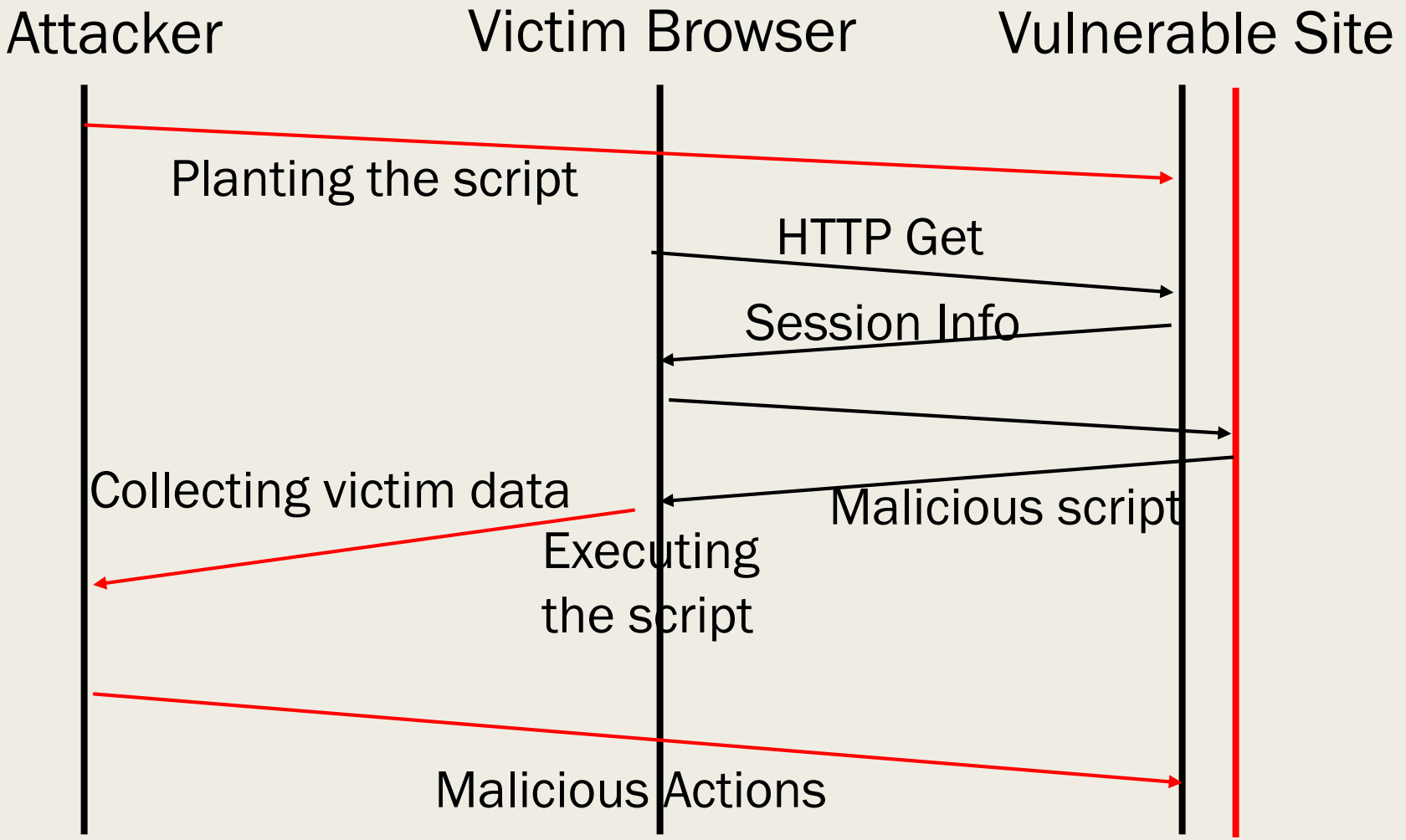
Stored XSS Attack

- 攻擊用戶打開目標網站時，網站服務端將惡意代碼從資料庫取出，拼接在 HTML 中返回給瀏覽器。
- 者將惡意代碼提交到目標網站的資料庫中。

- Example :
  - 社群網站個人頁面
  - 留言



Stored XSS Attack Flow



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
- 瀏覽器無法分辨這些 Script 的來源，認為這就是原網站的功能

Countermeasures

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

1. Input Filtering Approach

- 移除所有 user input 的 script/code
- 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) />
```

- 用 open-source libraries 過濾 JavaScript code
  - *Example: jsoup*

2. Output Filtering Approach

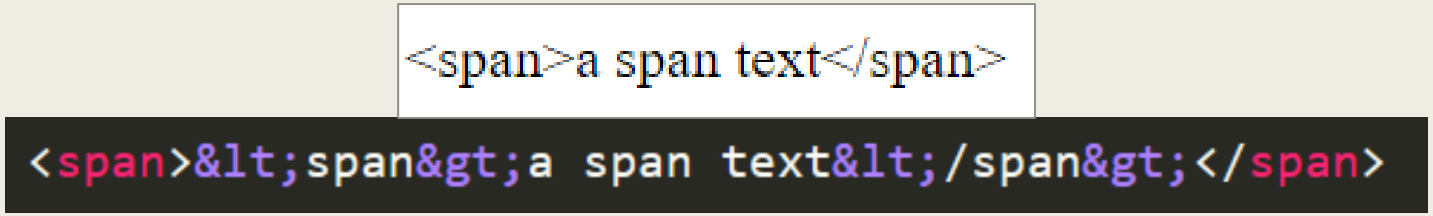
- 移除所有 user input 的 script/code
- 資料庫中保存原始的 user input，輸出到網頁時才做過濾

Notes about Filtering Approach

- 這種方法要開發者處理所有 user input 來源
  (query parameters, body parameters of POST request, HTTP headers)

3. Encoding Approach

- 將 HTML Markups 換成 HTML Entities

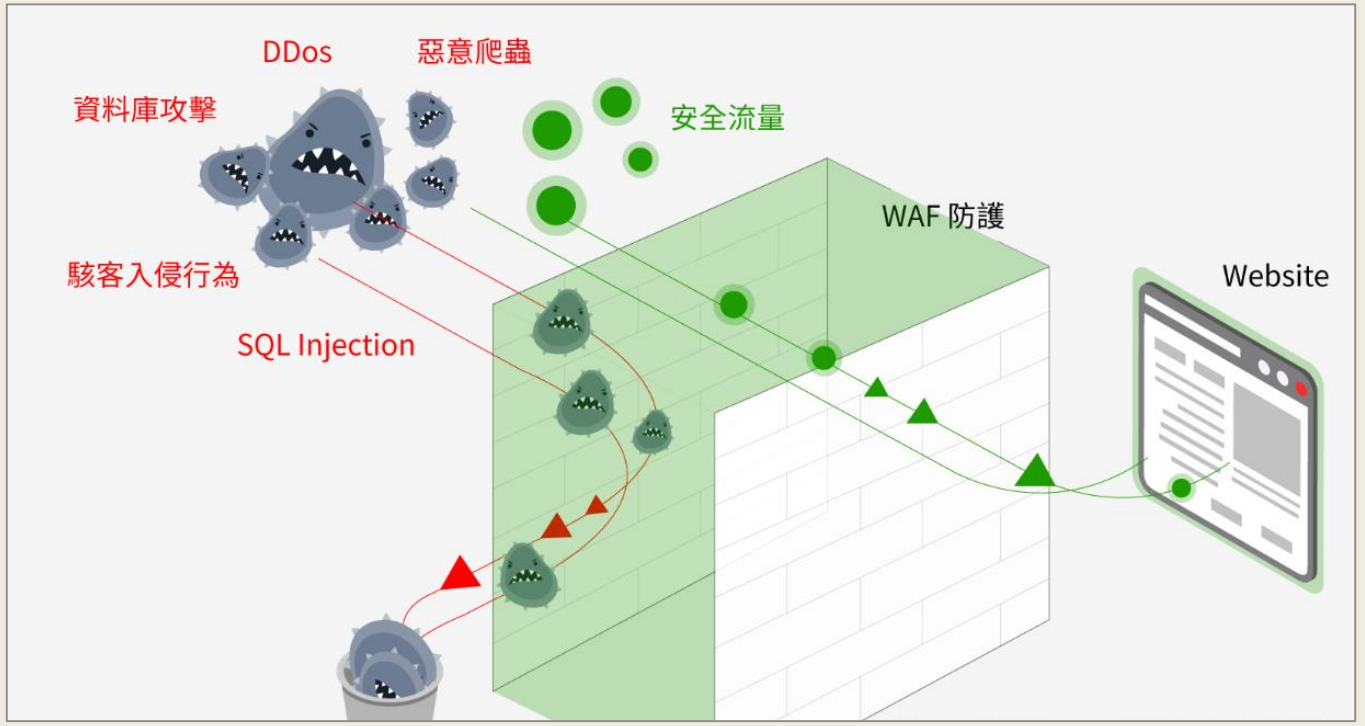


- <script> alert(‘XSS’) </script> → <script>alert(‘XSS’)

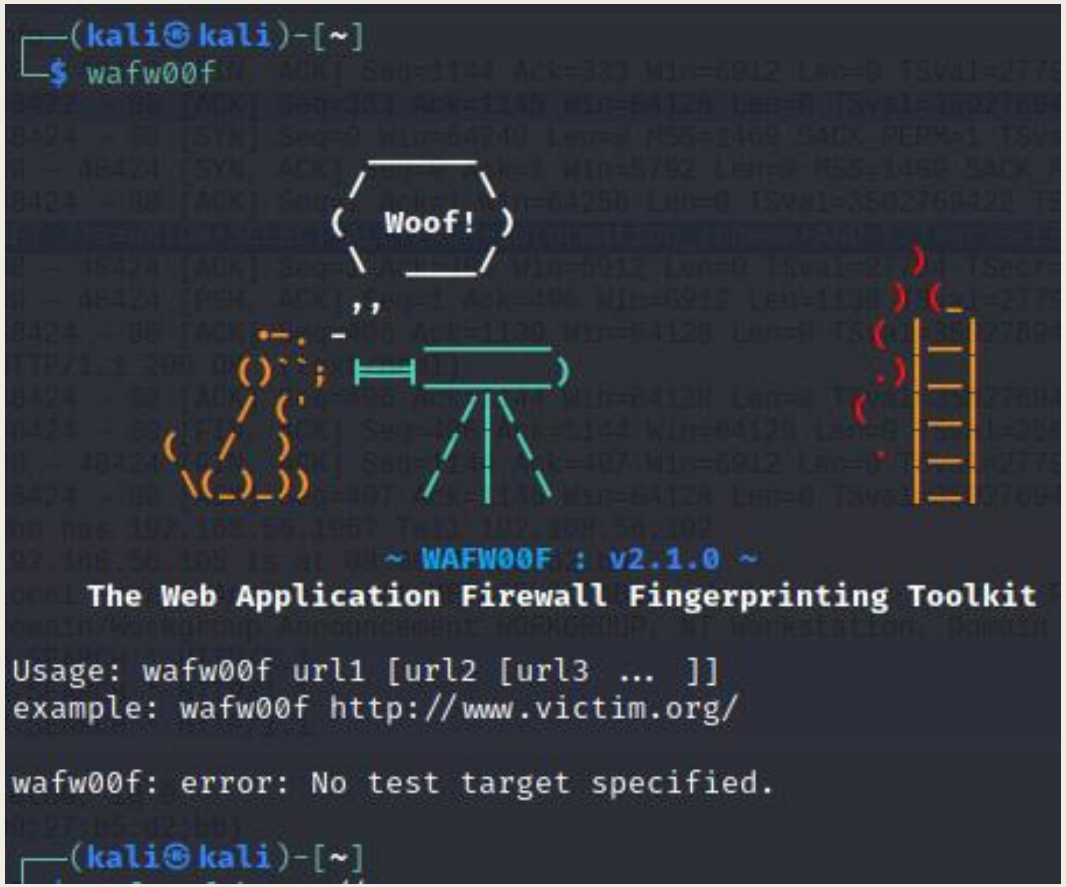
- 這些 JavaScript 被 encode 過後，就會被瀏覽器顯示而不是執行

4. Web Application Firewall (WAF)

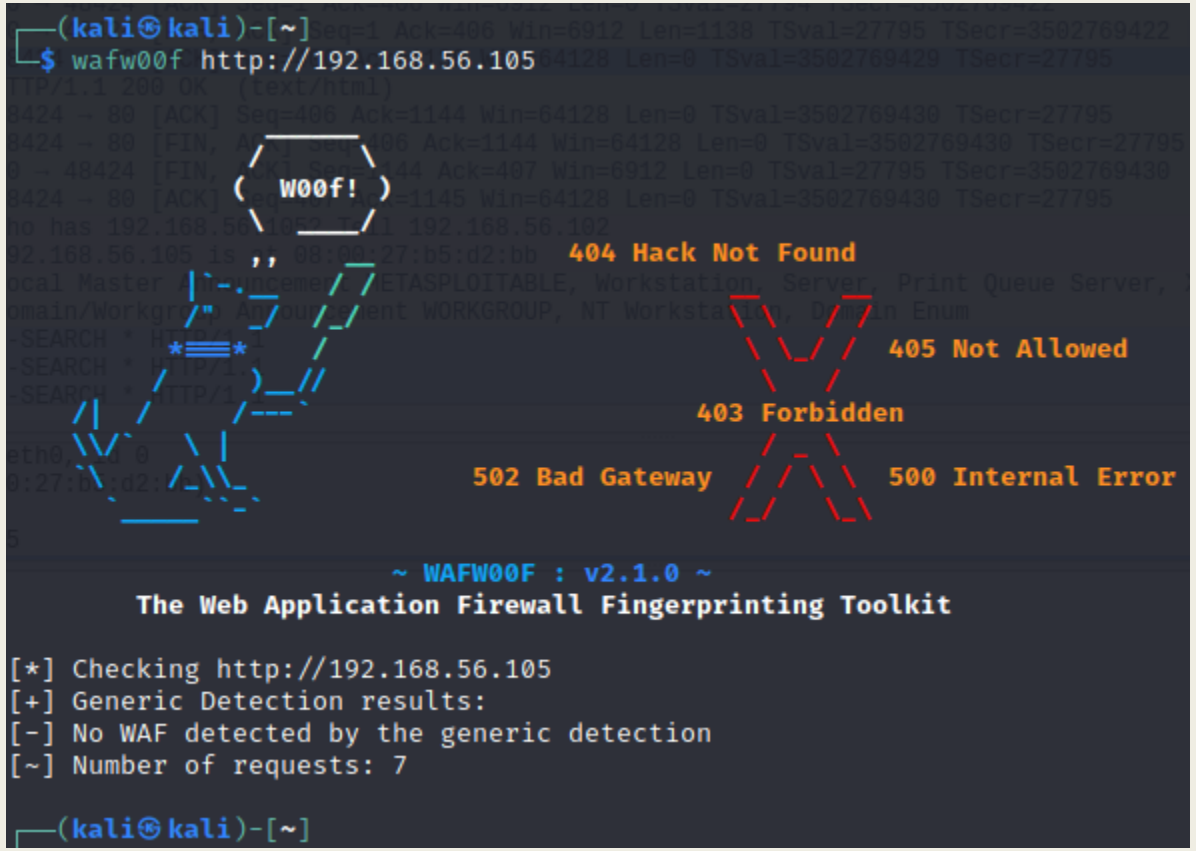
- 網站應用防火牆 (WAF) 會自動幫你過濾惡意的 input
  (包含 path, HTTP headers, HTML tag patterns 和 Javascript, SQL patterns)



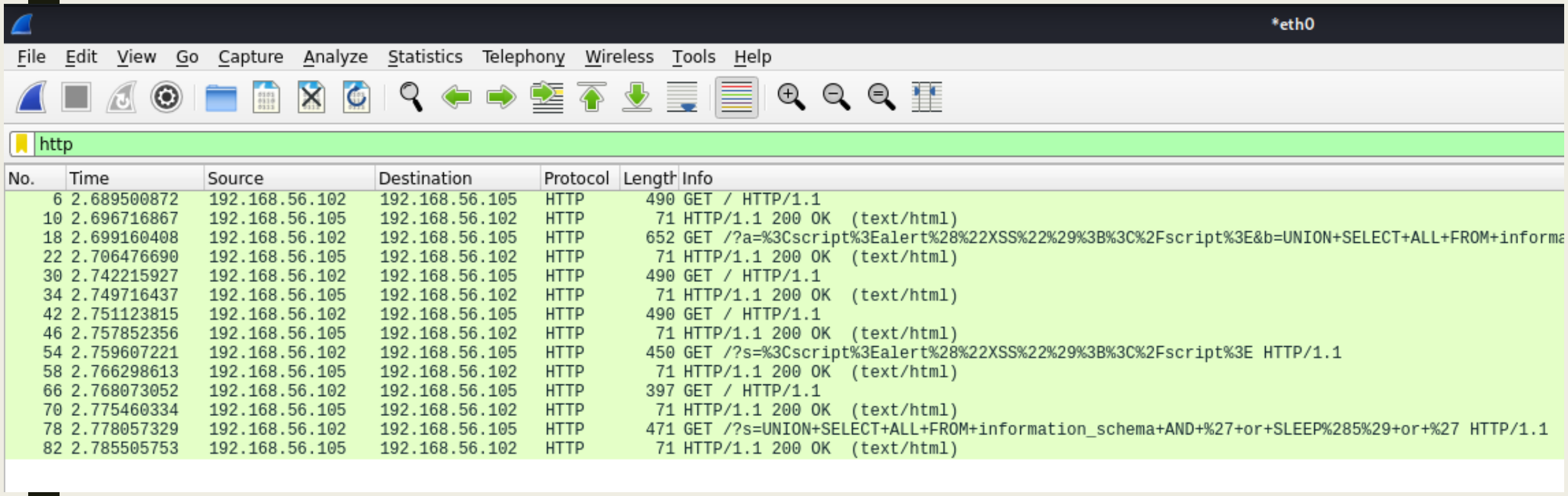
wafw00f


(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)-[~]

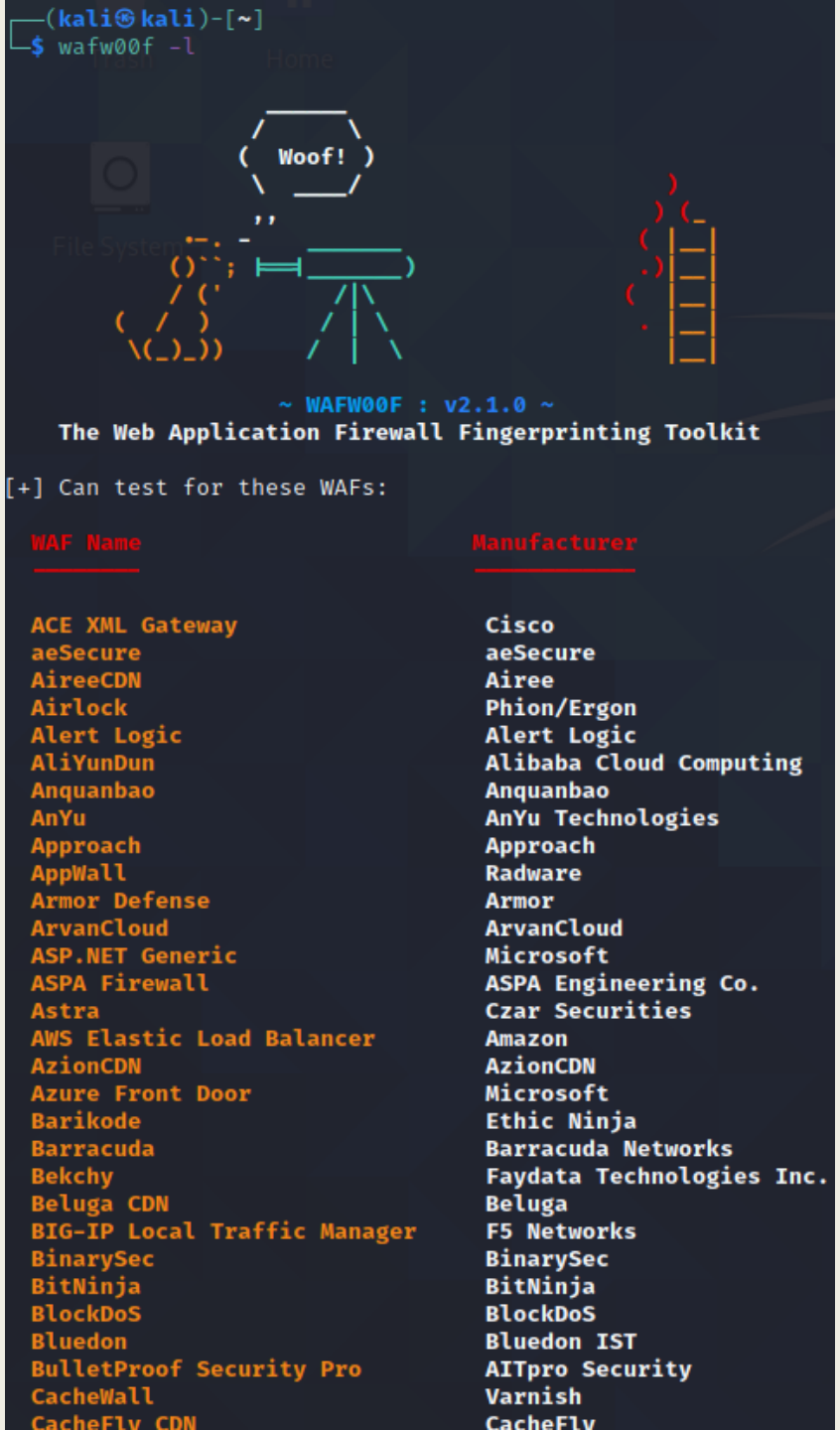
wafw00f


(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

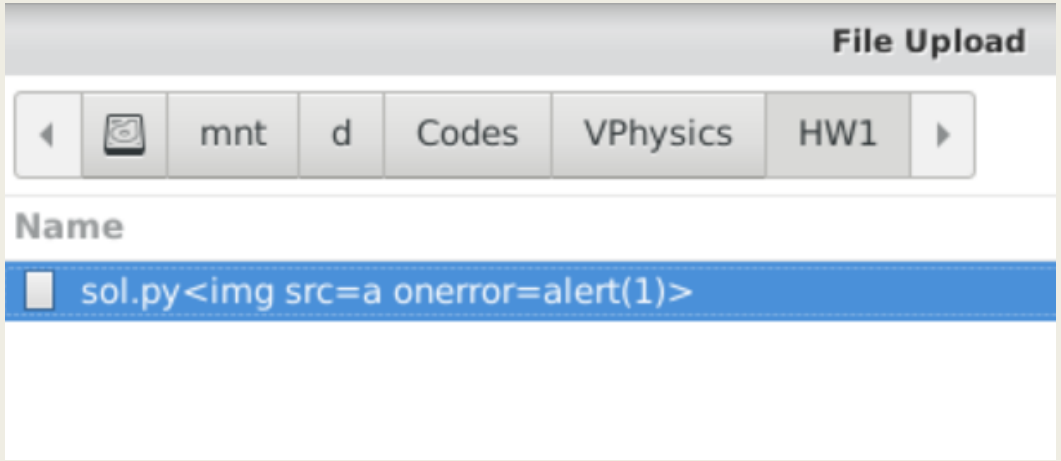

*eth0
File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help
http
No. Time Source Destination Protocol Length Info
6 2.689500872 192.168.56.102 192.168.56.105 HTTP 490 GET / HTTP/1.1
10 2.696716867 192.168.56.105 192.168.56.102 HTTP 71 HTTP/1.1 200 OK (text/html)
18 2.699160408 192.168.56.102 192.168.56.105 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)

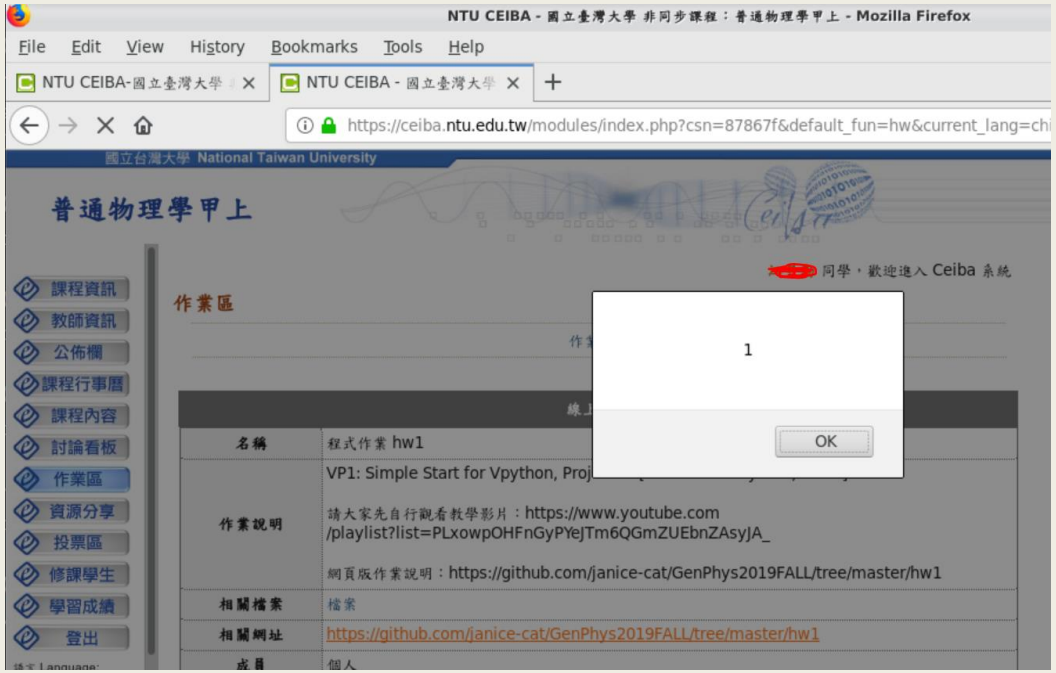
wafw00f


┌──(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

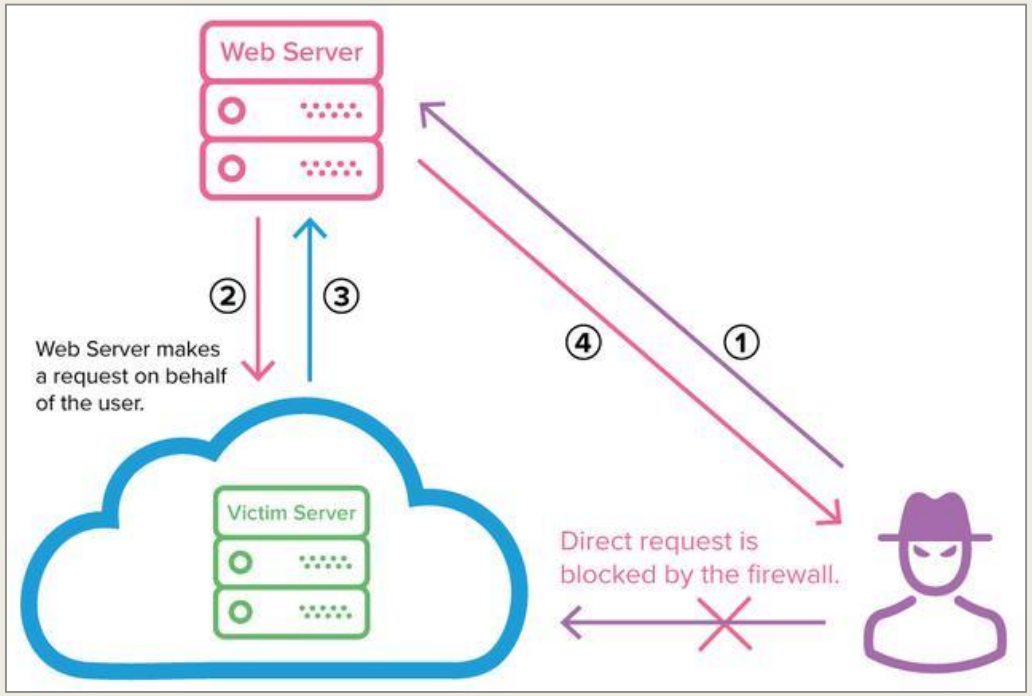
- Two types of XSS attacks
- How to launch XSS attacks
- Countermeasures against XSS attacks

The best defense of XSS?

- Define trust boundaries
- Validate and sanitize untrusted data

Server-Side Request Forgery (SSRF)

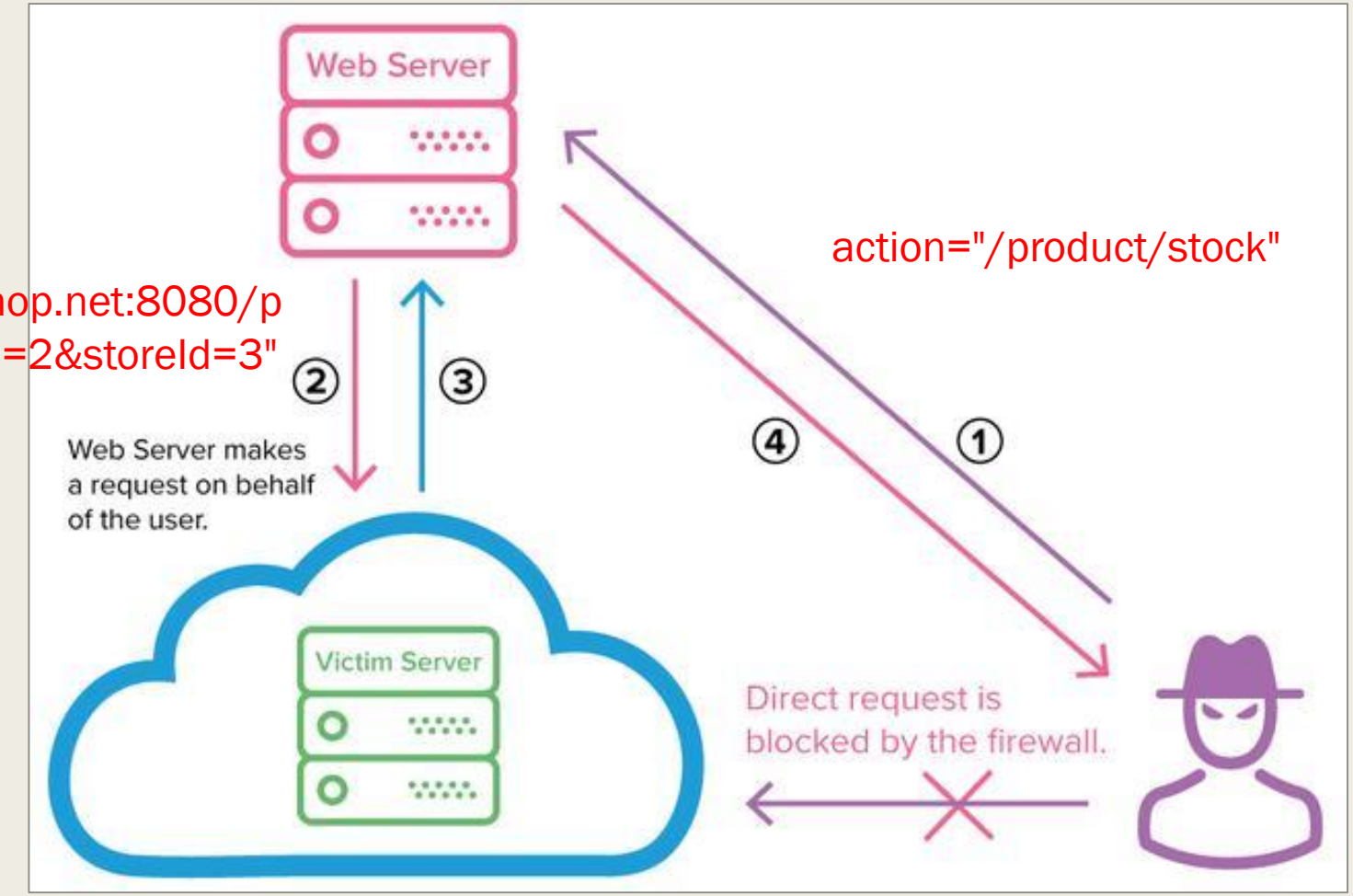
- 服務器端請求僞造，以伺服器的身份發送一條構造好的請求
- 很多 web 應用都提供了從其他的伺服器上獲取數據的功能
- SSRF 可讓攻擊者的請求重定向到防火牆後的內部網路或本地主機



https://portswigger.net/web-security/ssrf/lab-basic-ssrf-against-localhost

Server-Side Request Forgery (SSRF)

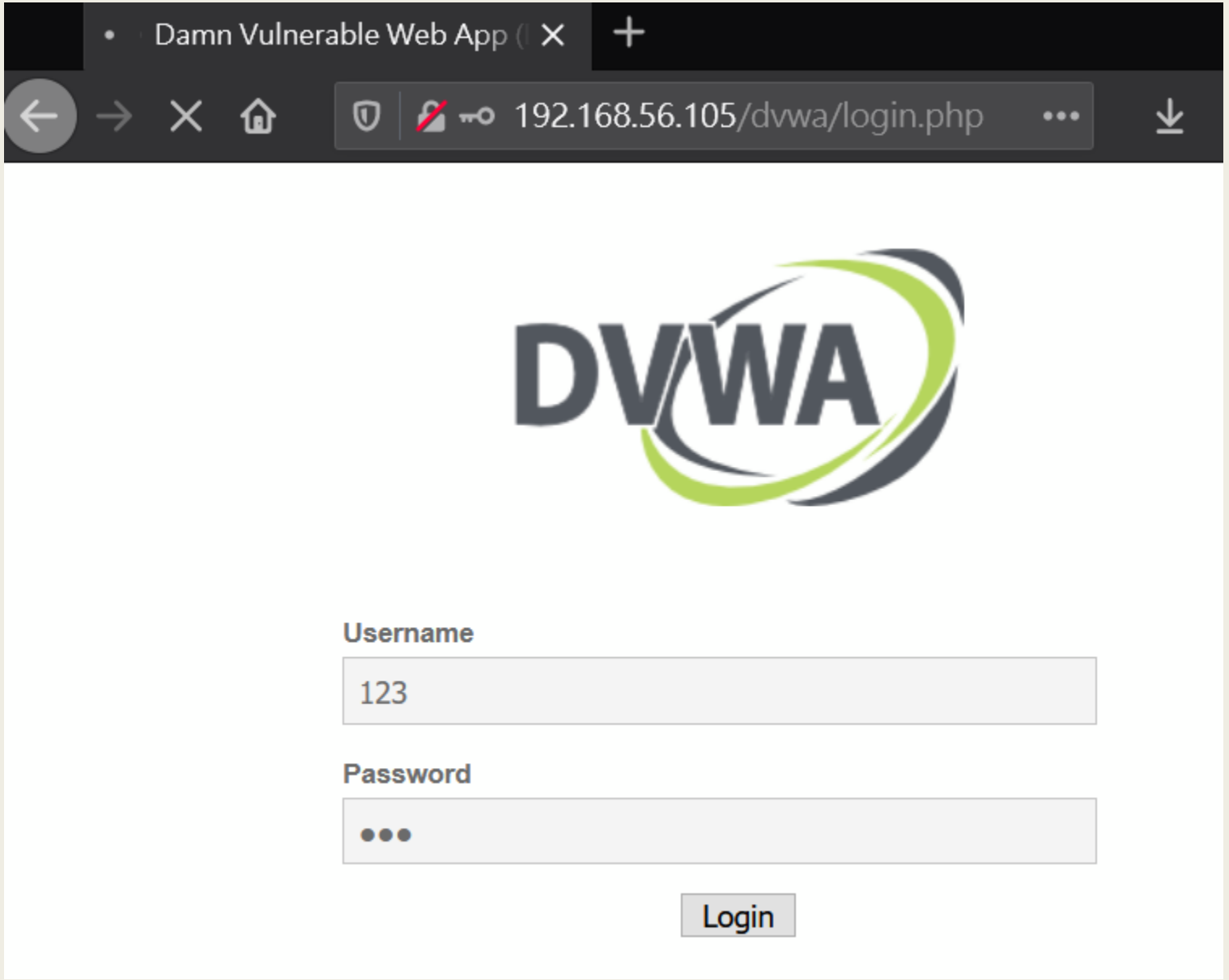
value="http://stock.weliketoshop.net:8080/product/stock/check?productId=2&storeId=3"



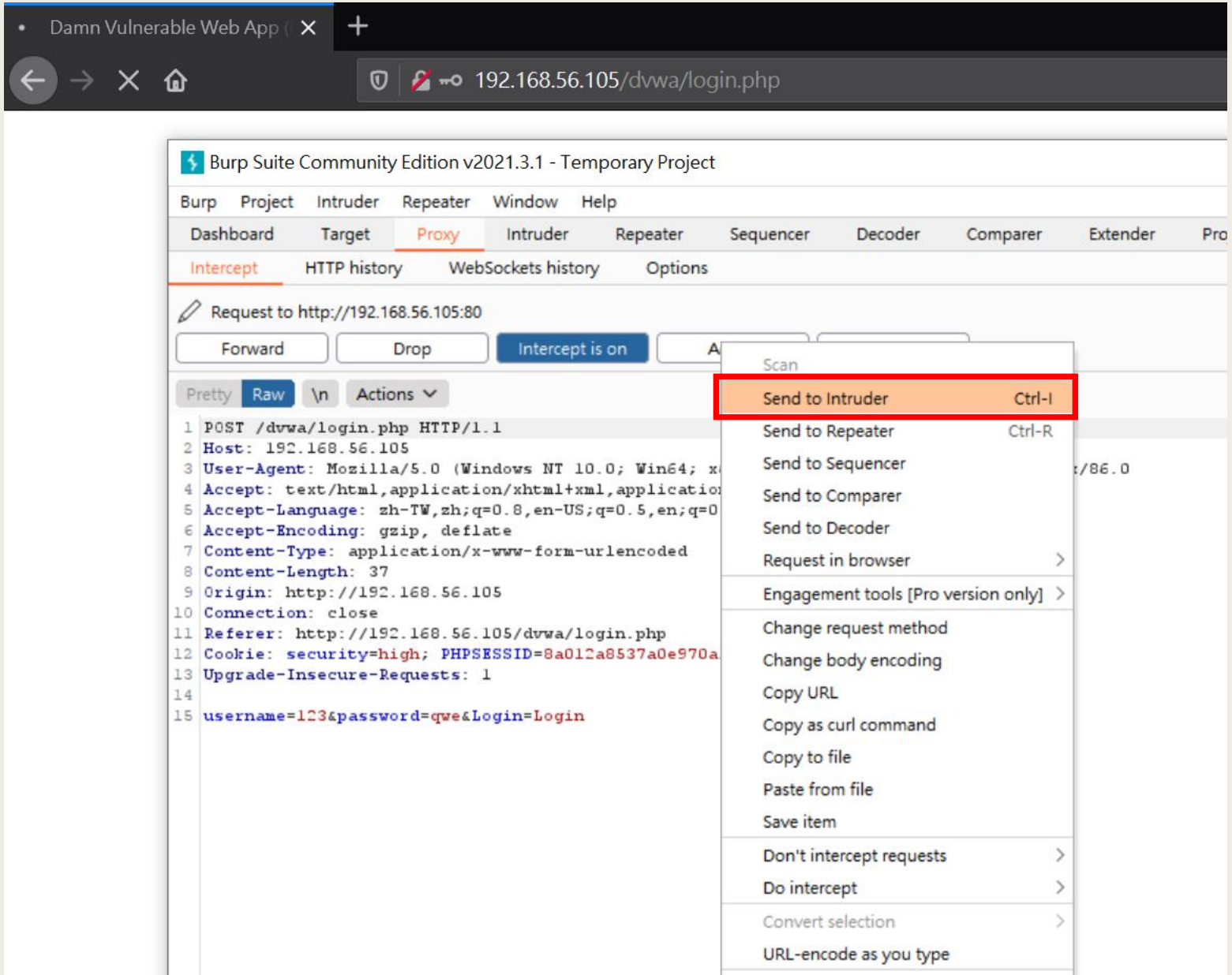
METASPLOITABLE 2

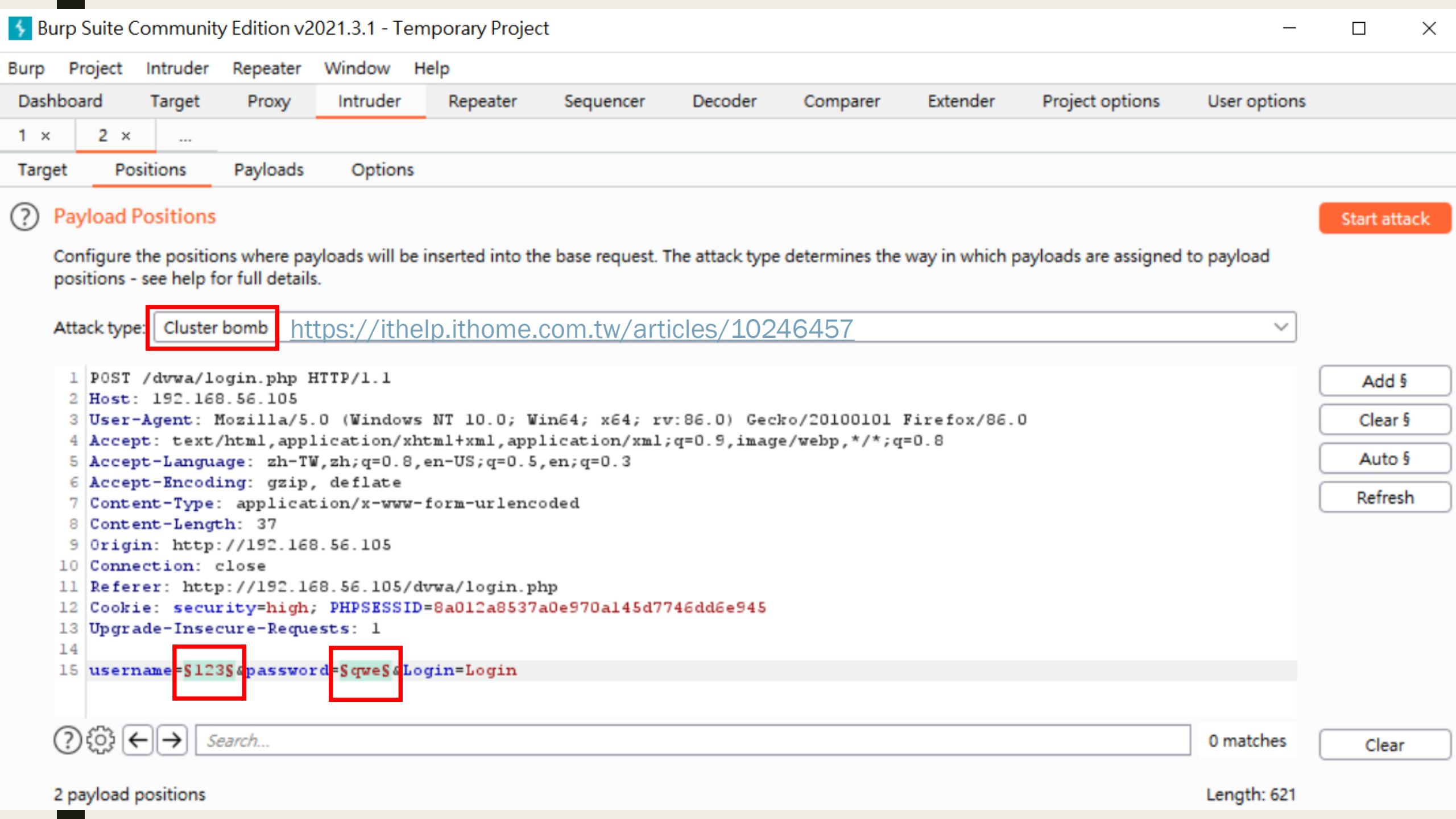
DVWA - Damn Vulnerable Web Application

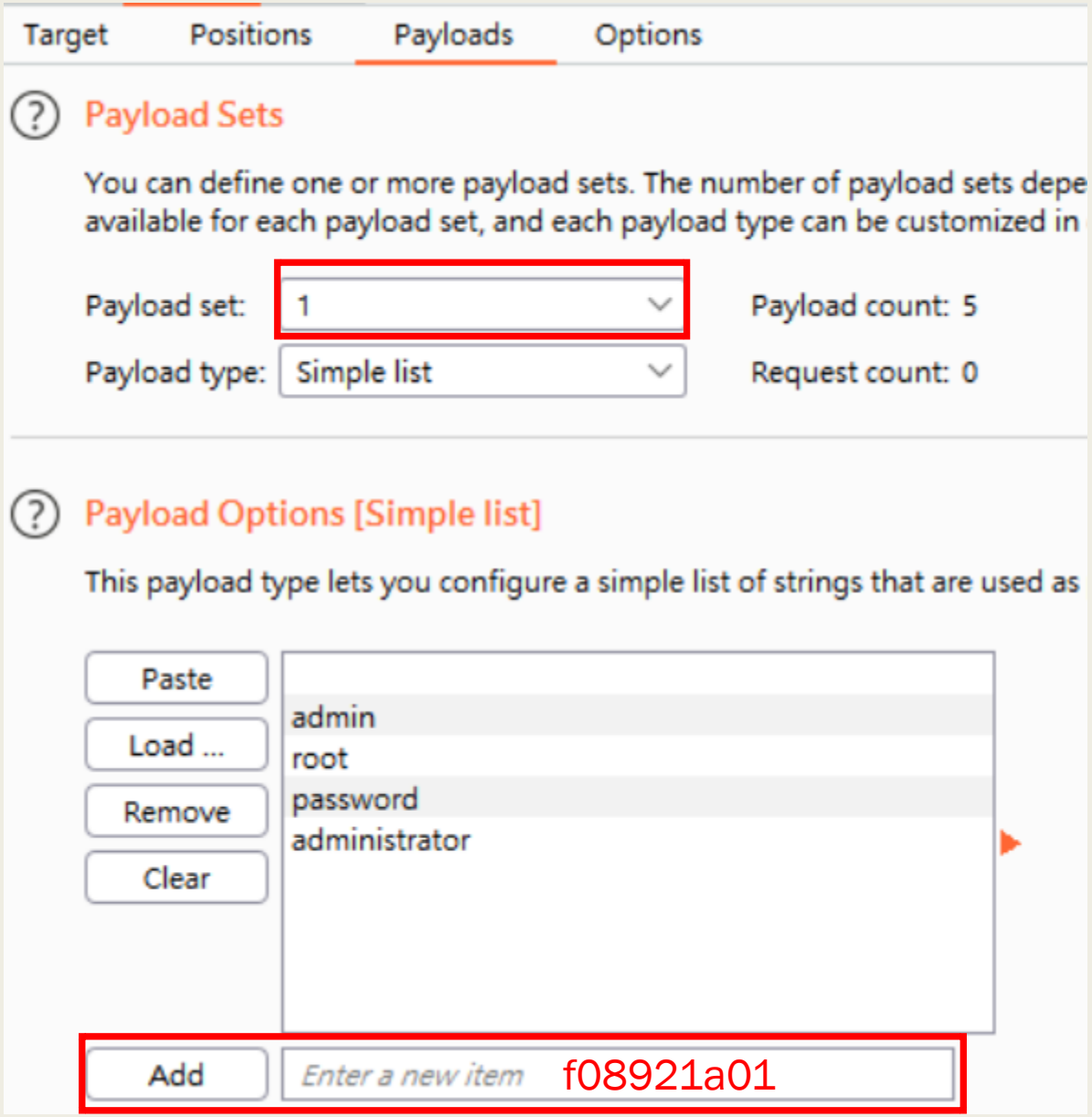
Lab1: Brute Force

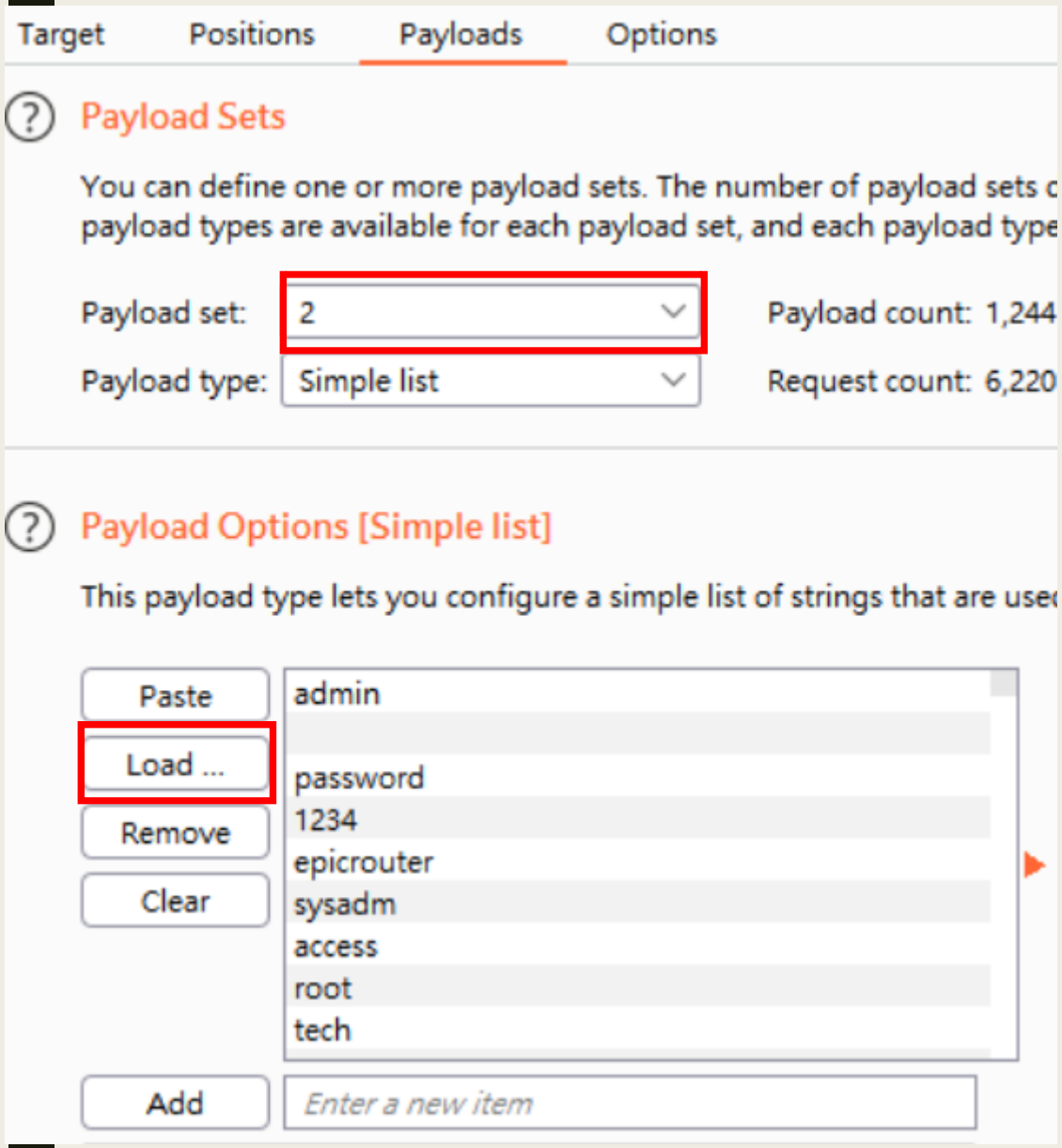


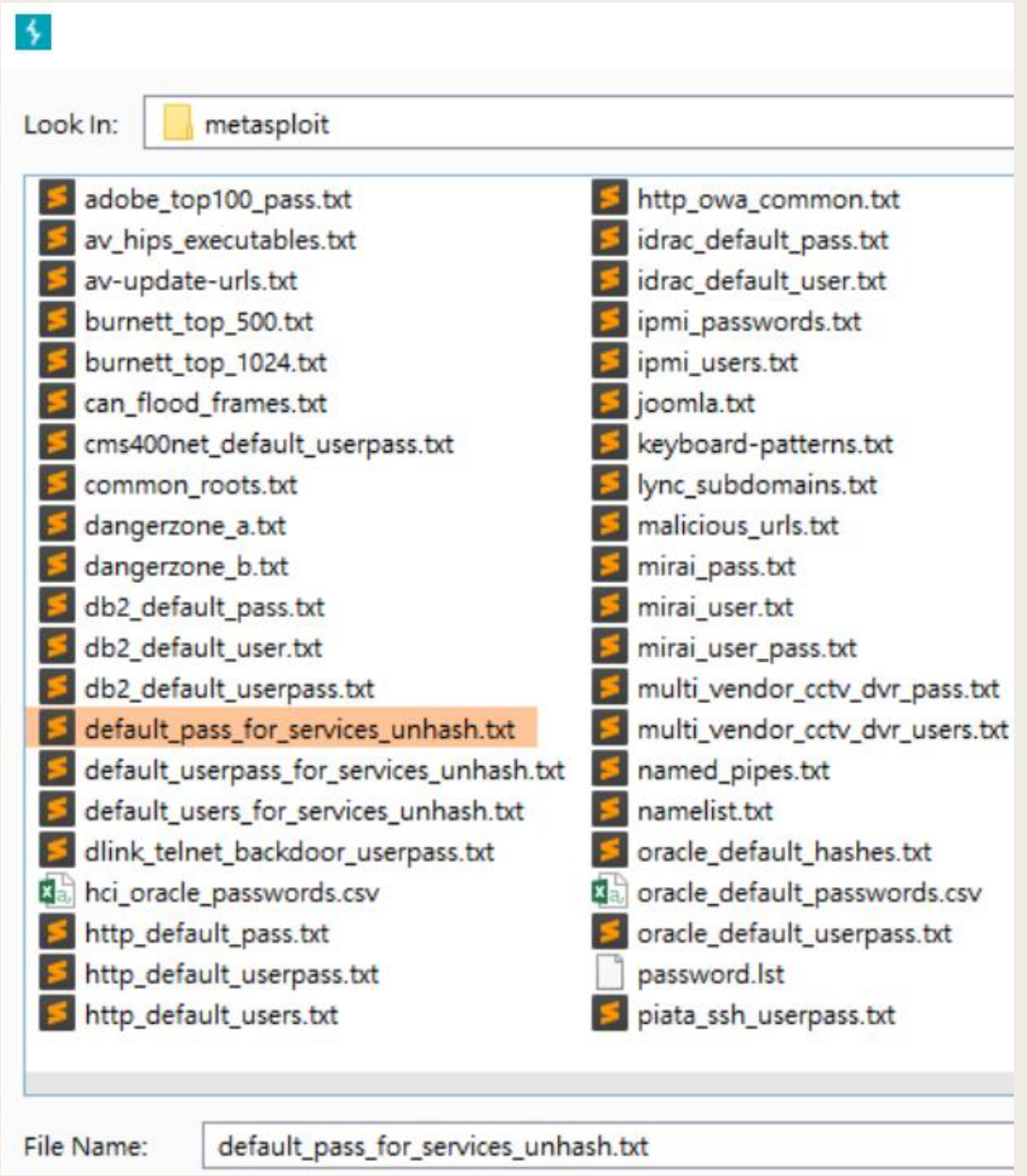
Send the login POST request to Intruder



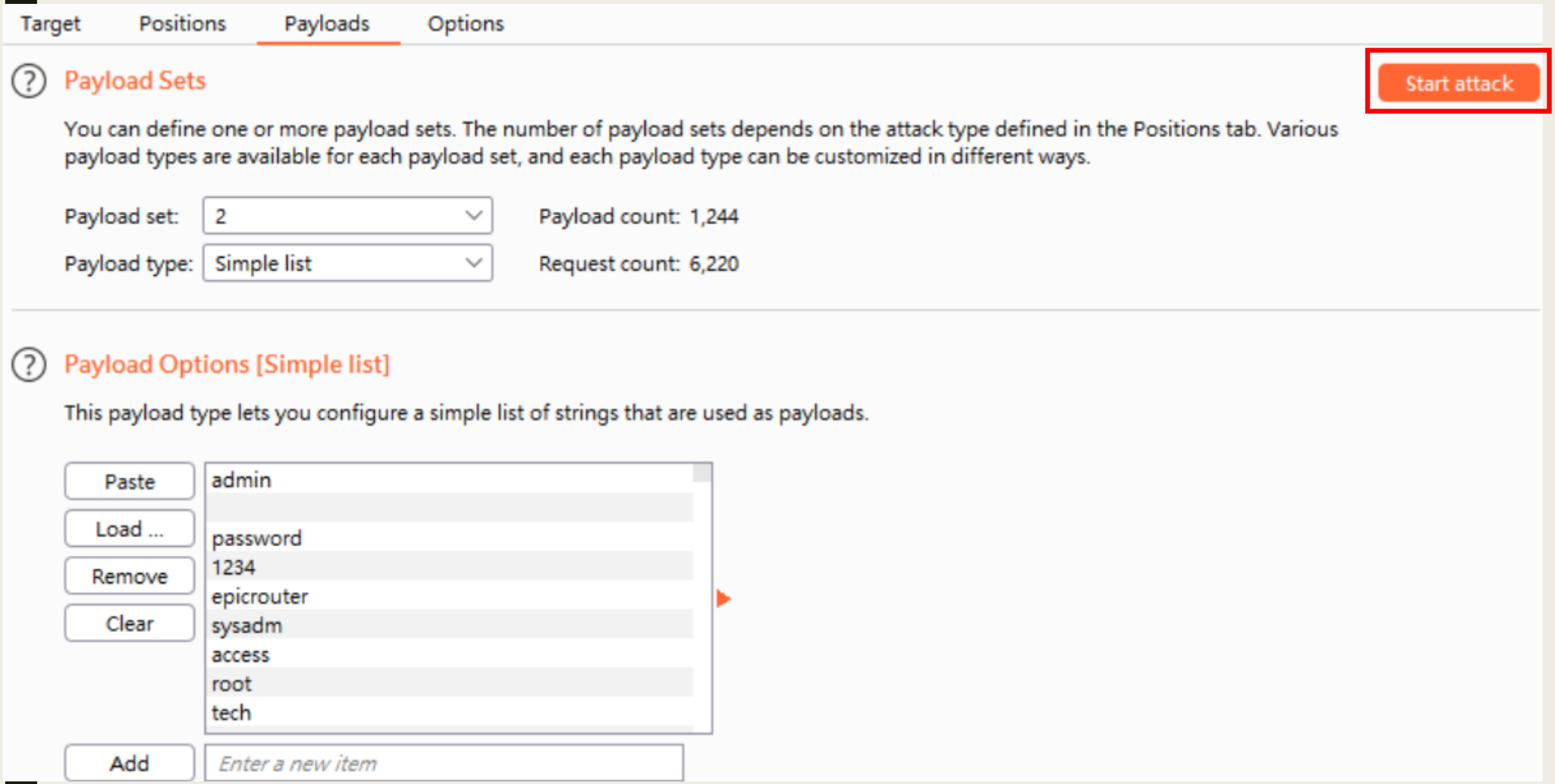

Burp Suite Community Edition v2021.3.1 - Temporary Project
Burp Project Intruder Repeater Window Help
Dashboard Target Proxy Intruder Repeater Sequencer Decoder Comparer Extender Project options User options
1 × 2 × ...
Target Positions Payloads Options
Payload Positions
Start attack
Configure the positions 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

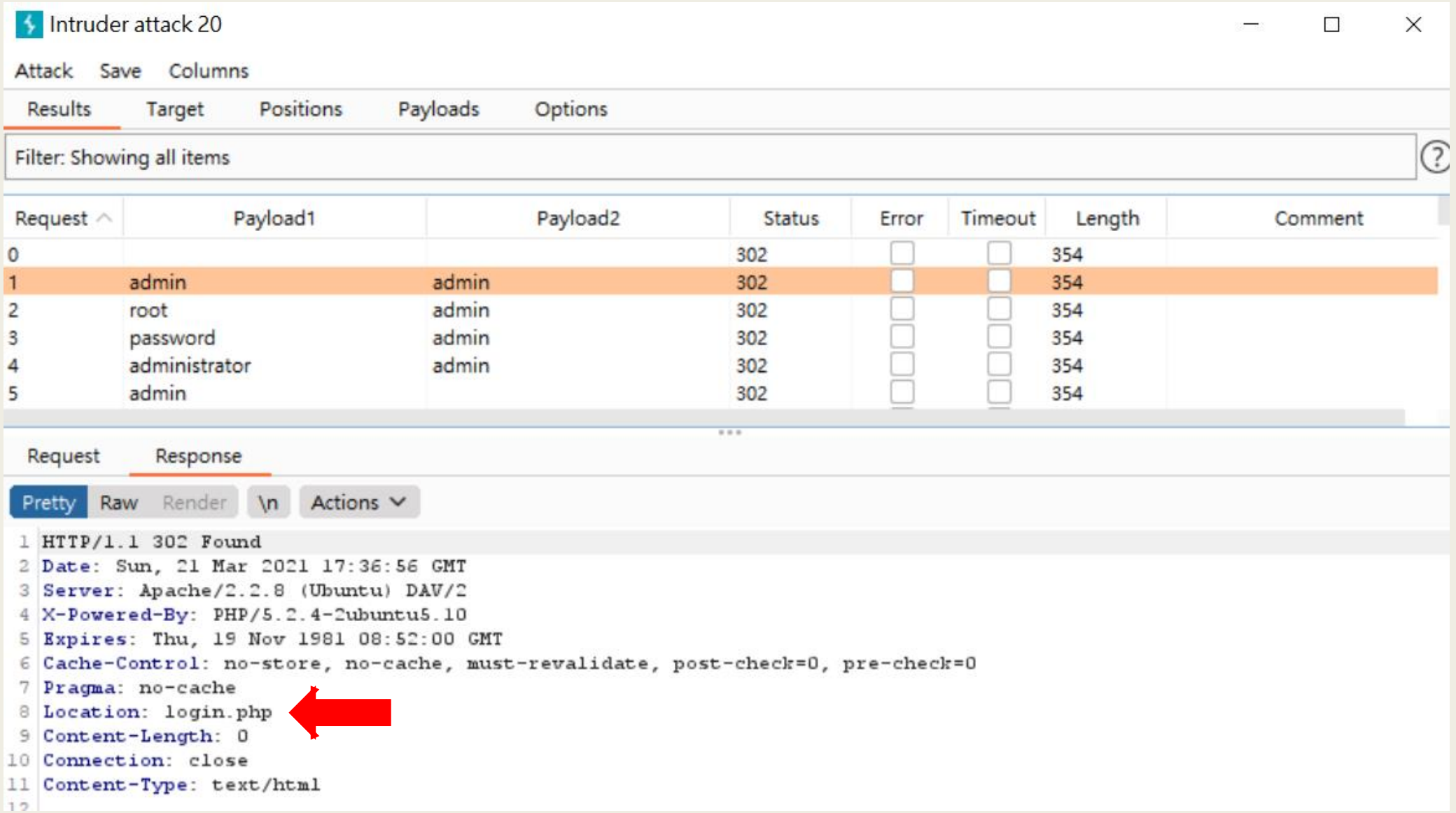


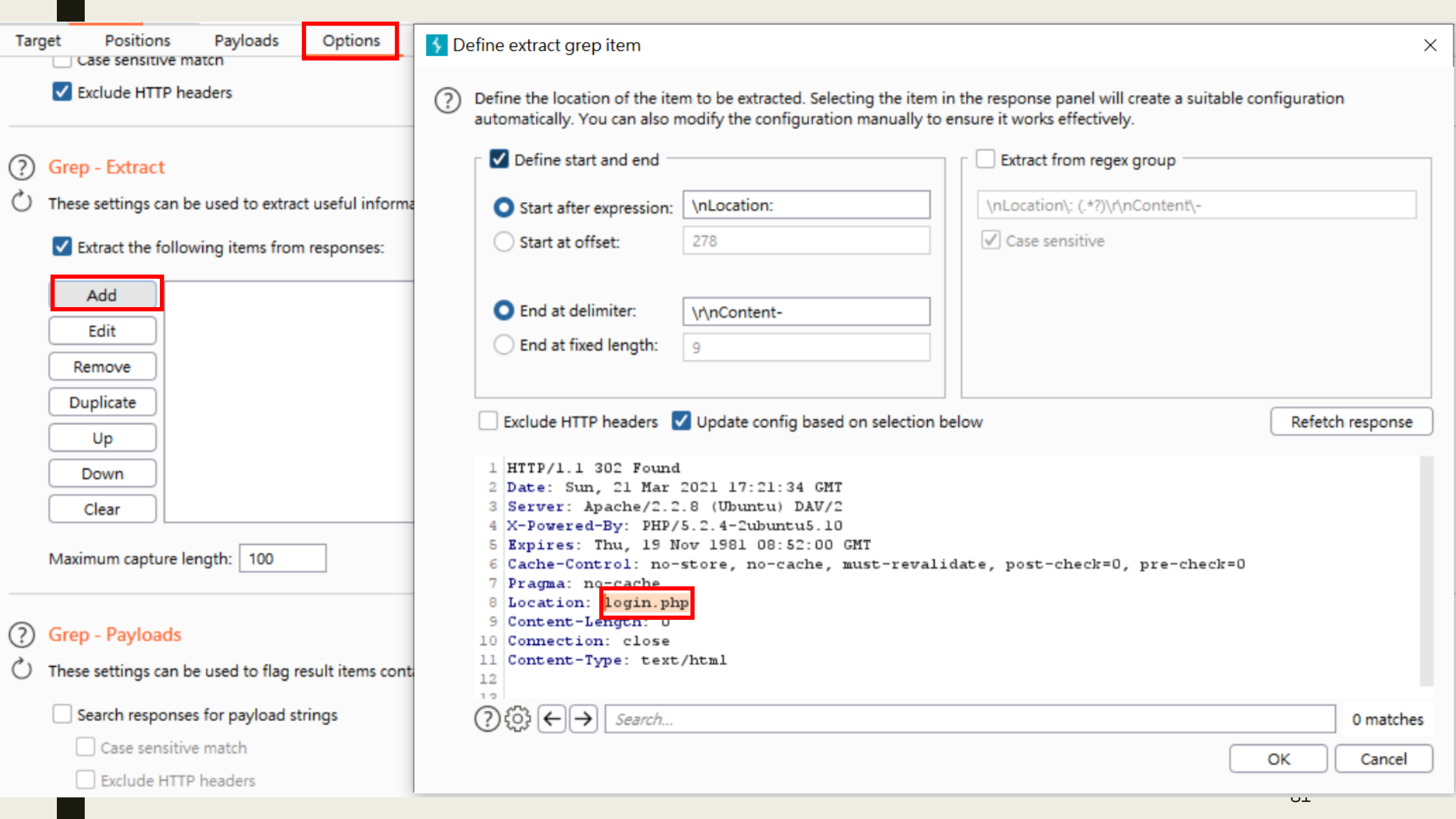



```
┌──(kali㉿kali)-[~]
└─$ sudo cp -Lr /usr/share/wordlists /media/sf_vm_share
```

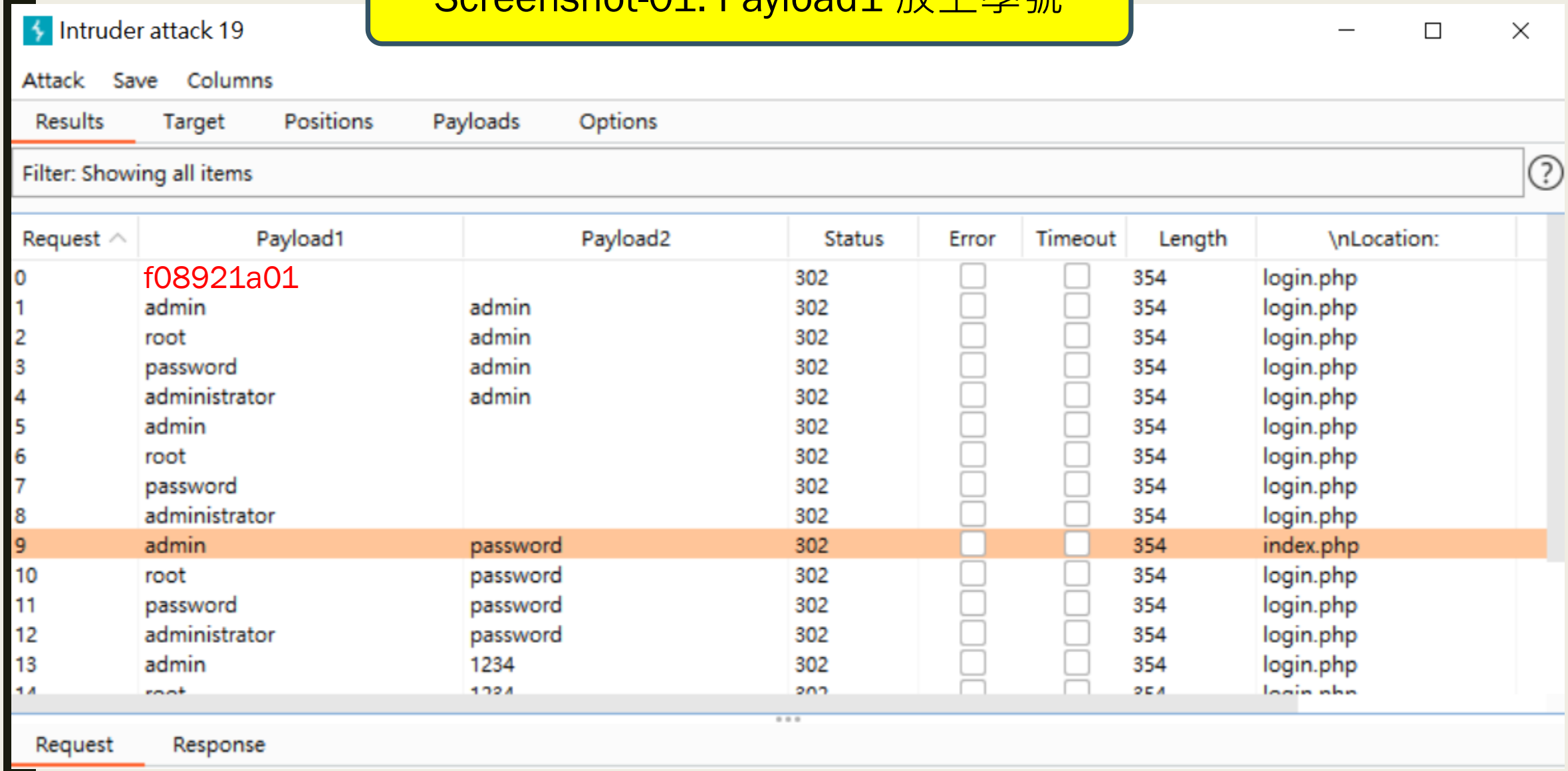

Target
Positions
Payloads
Options
Payload Sets
Start attack
You can define one or more payload sets. The number of payload sets depends on the attack type defined in the Positions tab. Various payload types are available for each payload set, and each payload type can be customized in different ways.
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

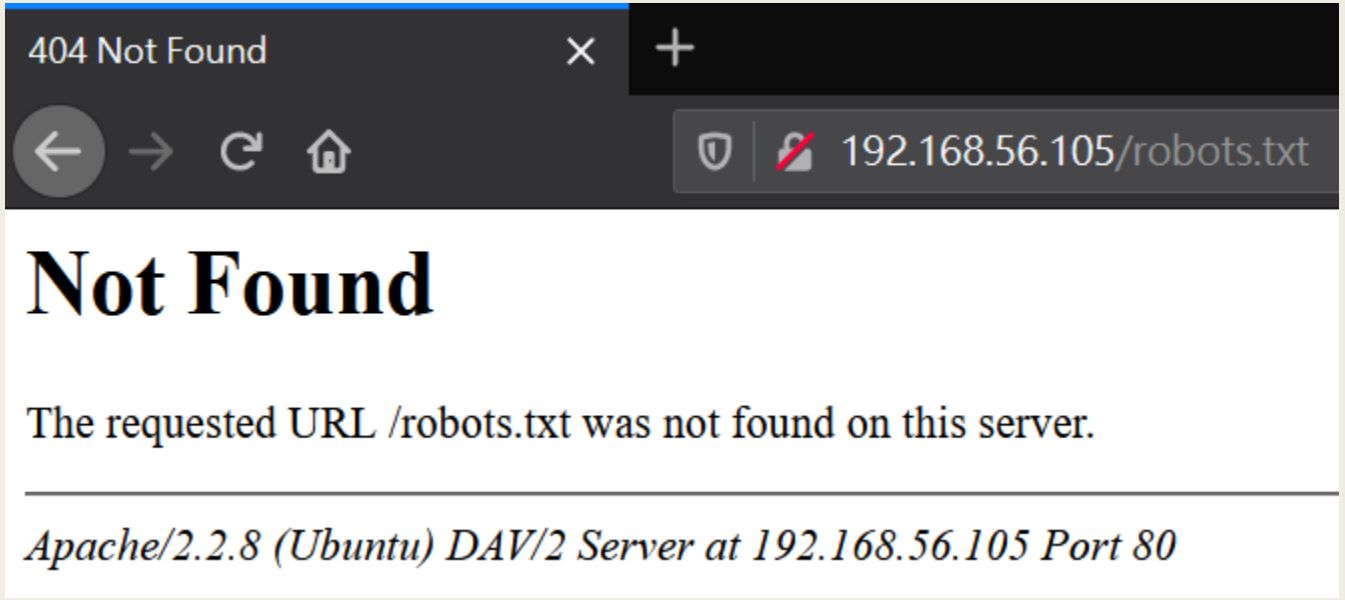


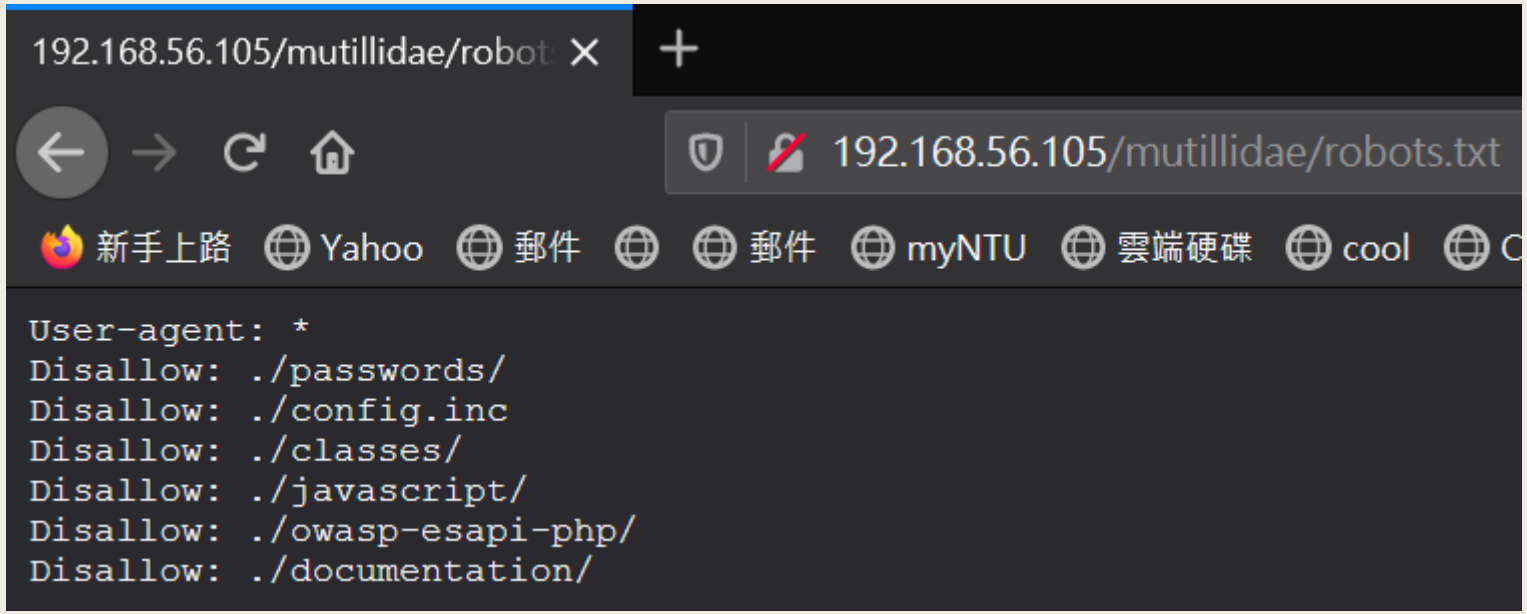

Target
Positions
Payloads
Options
Case sensitive match
Exclude HTTP headers
Grep - Extract
These settings can be used to extract useful informa
Extract the following items from responses:
Add
Edit
Remove
Duplicate
Up
Down
Clear
Maximum capture length: 100
Grep - Payloads
These settings can be used to 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

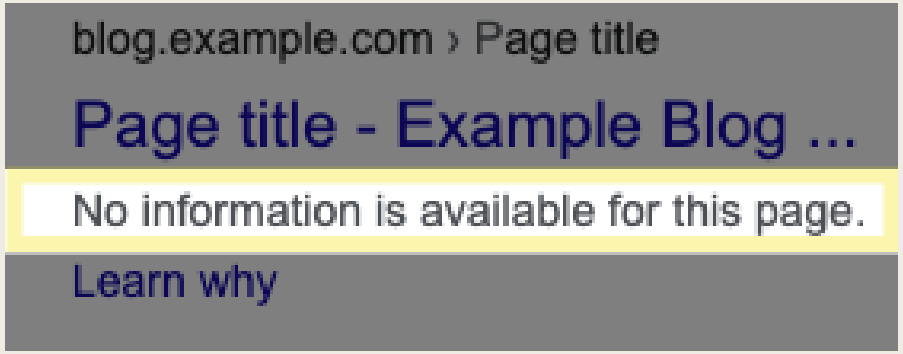

404 Not Found
192.168.56.105/robots.txt
Not Found
The requested URL /robots.txt was not found on this server.
Apache/2.2.8 (Ubuntu) DAV/2 Server at 192.168.56.105 Port 80

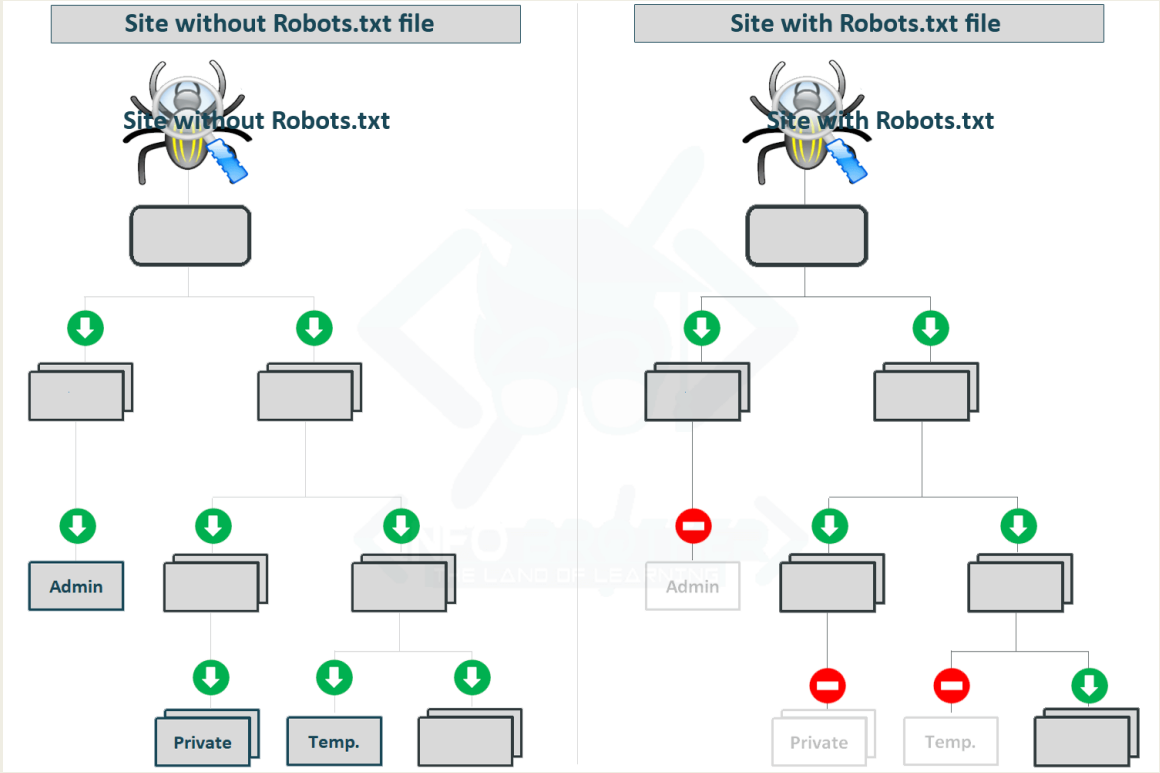

192.168.56.105/mutillidae/robot
192.168.56.105/mutillidae/robots.txt
新手上路
Yahoo
郵件
郵件
myNTU
雲端硬碟
cool
User-agent: *
Disallow: ./passwords/
Disallow: ./config.inc
Disallow: ./classes/
Disallow: ./javascript/
Disallow: ./owasp-esapi-php/
Disallow: ./documentation/

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

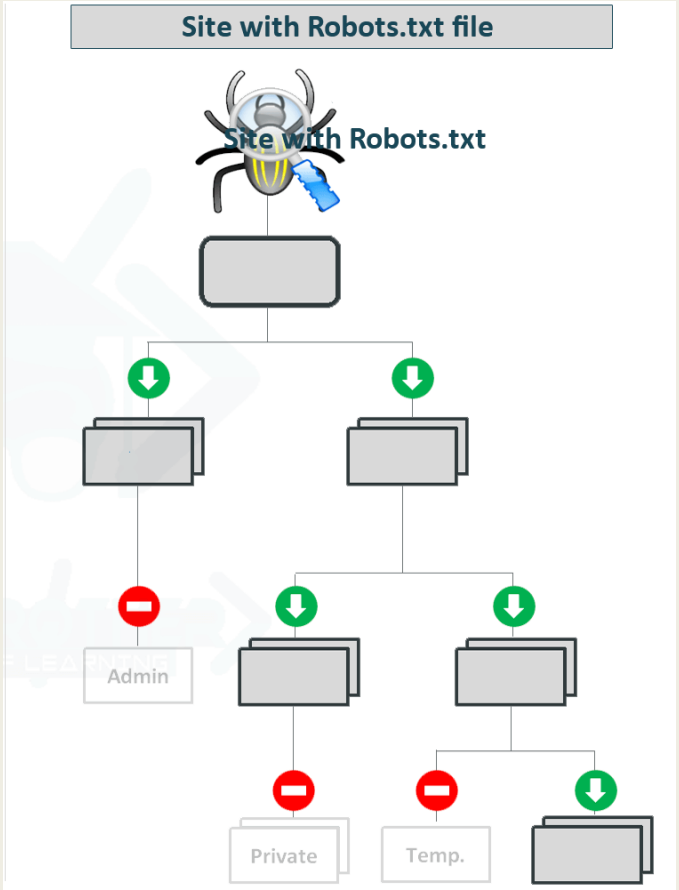
Google:
https://developers.google.com/search/docs/advanced/robots/intro

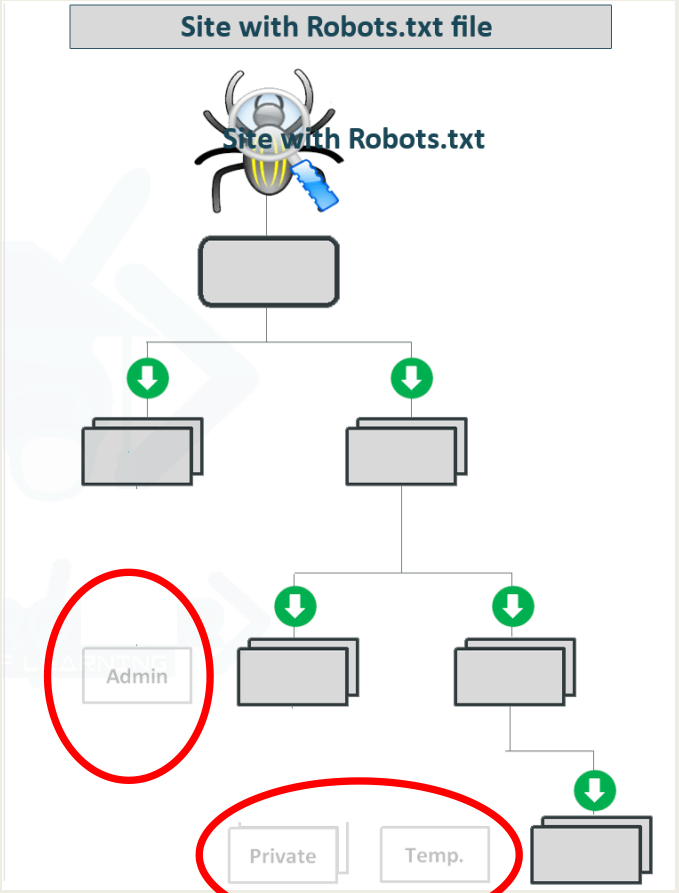




Forceful Browsing

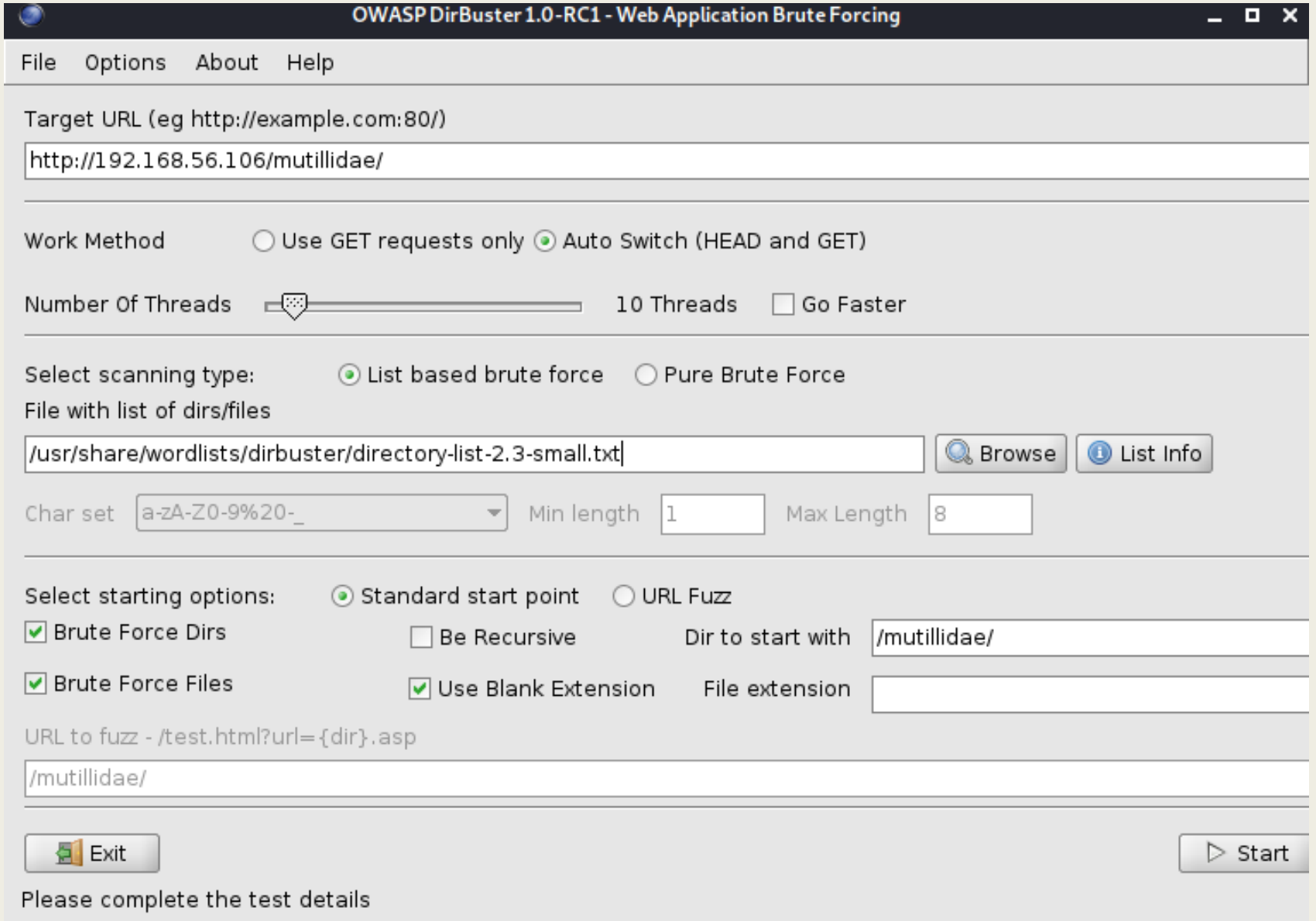
- Forceful browsing (forced browsing) is a brute force attack that aims to enumerate files and gain access to resources that the application does not reference, but can still retrieve.





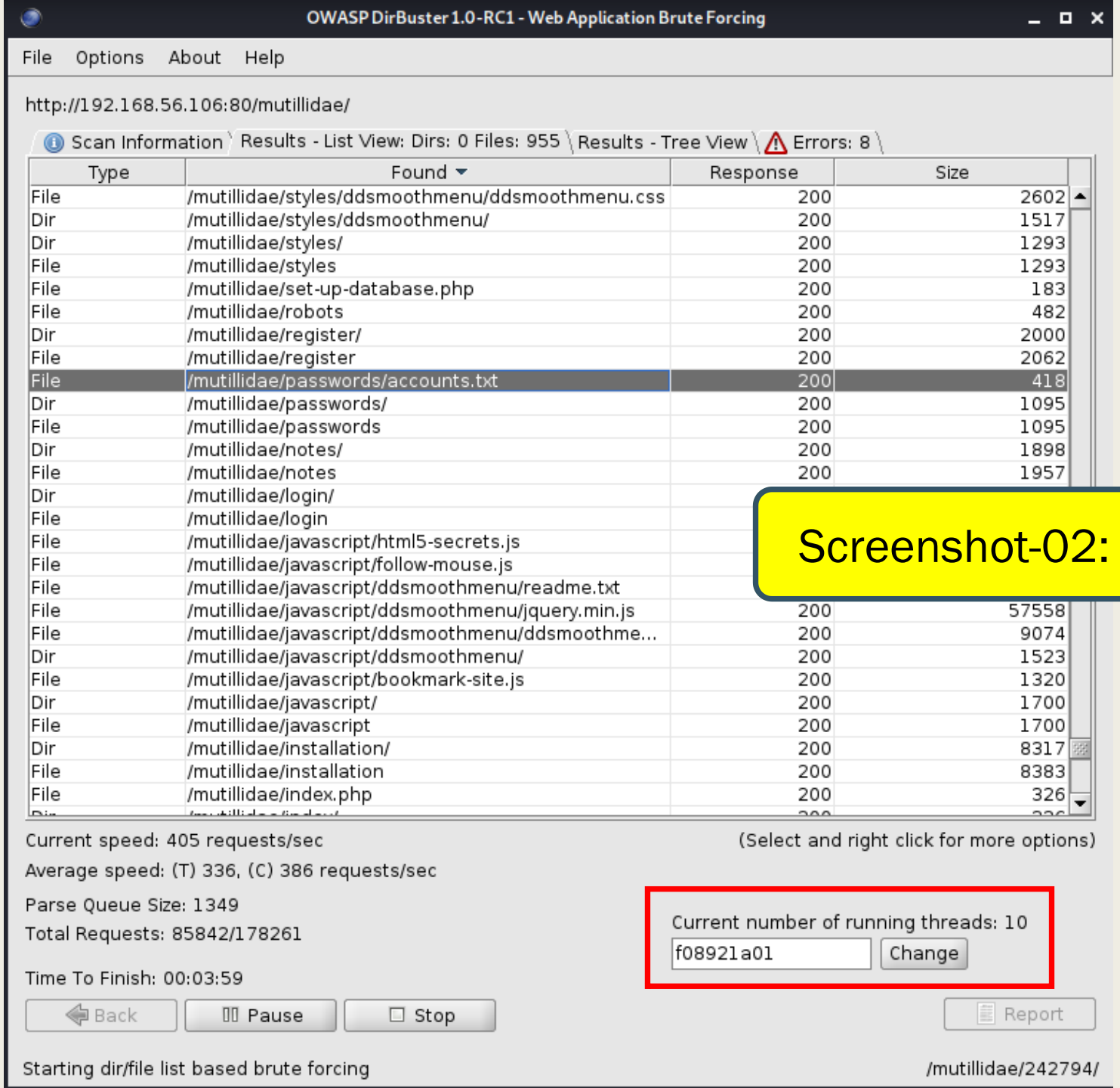
DirBuster


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



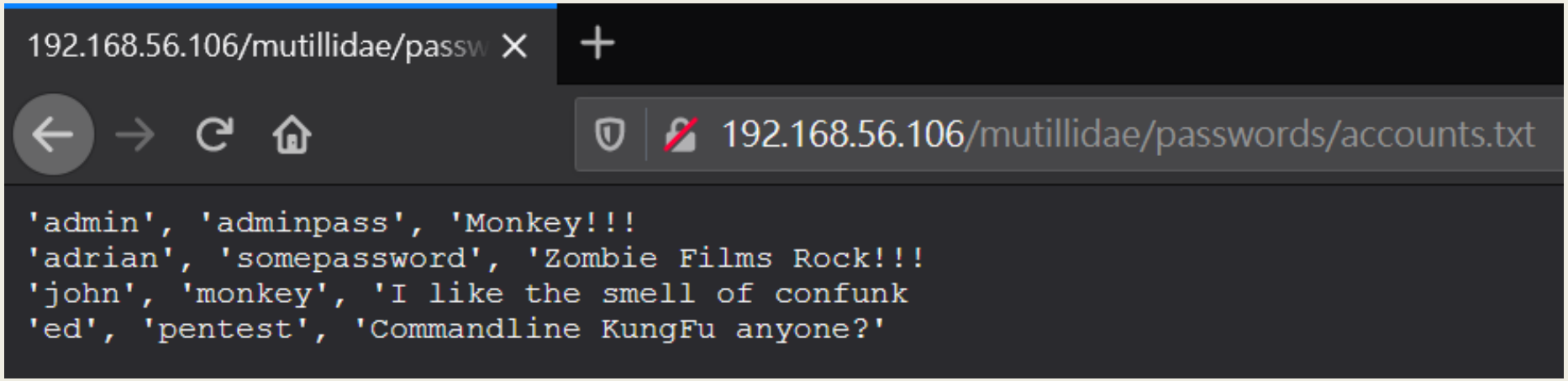
/usr/share/wordlists/dirbuster/directory-list-2.3-medium.txt

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

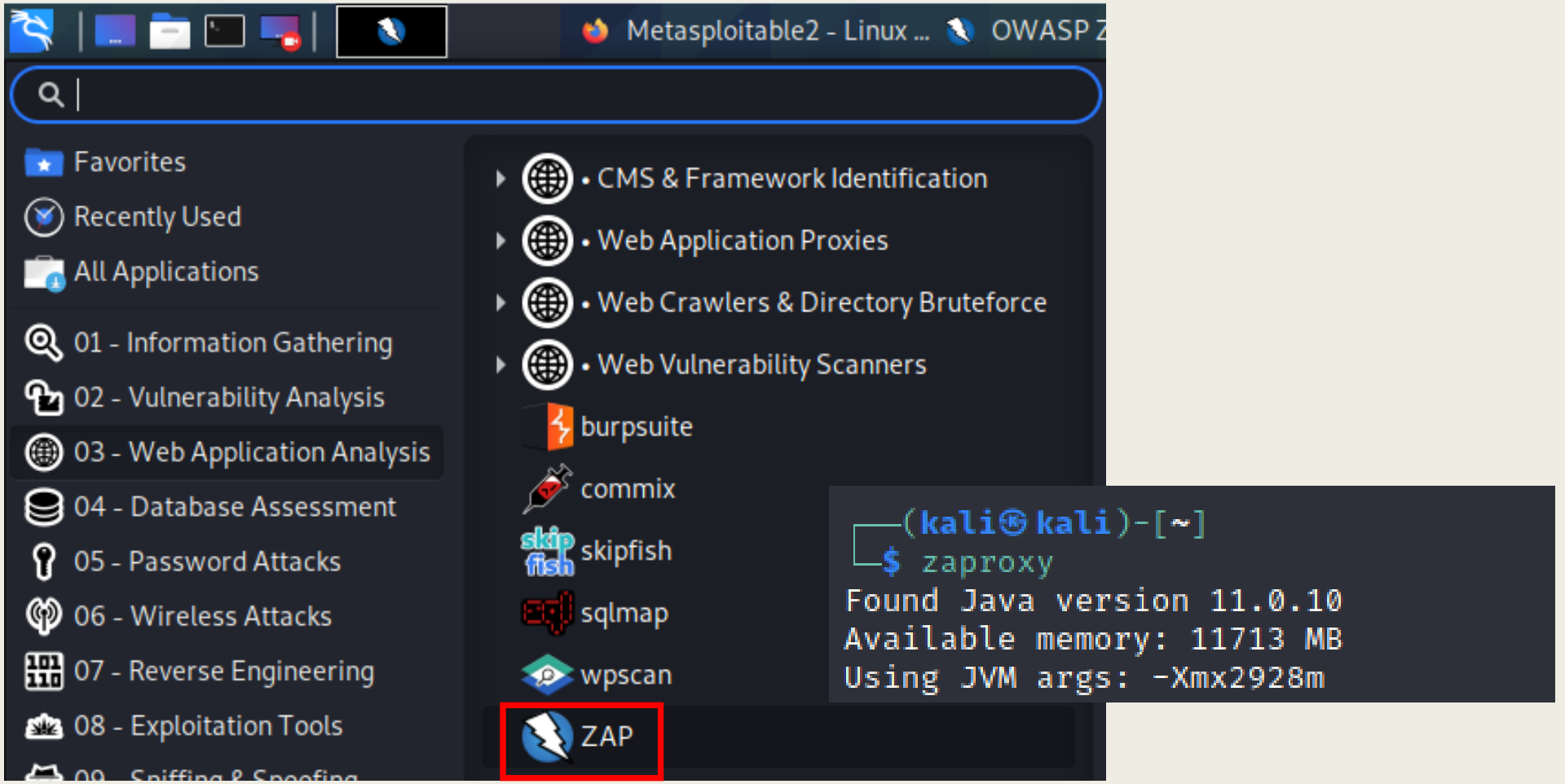


Screenshot-02: Change 欄位放上學號

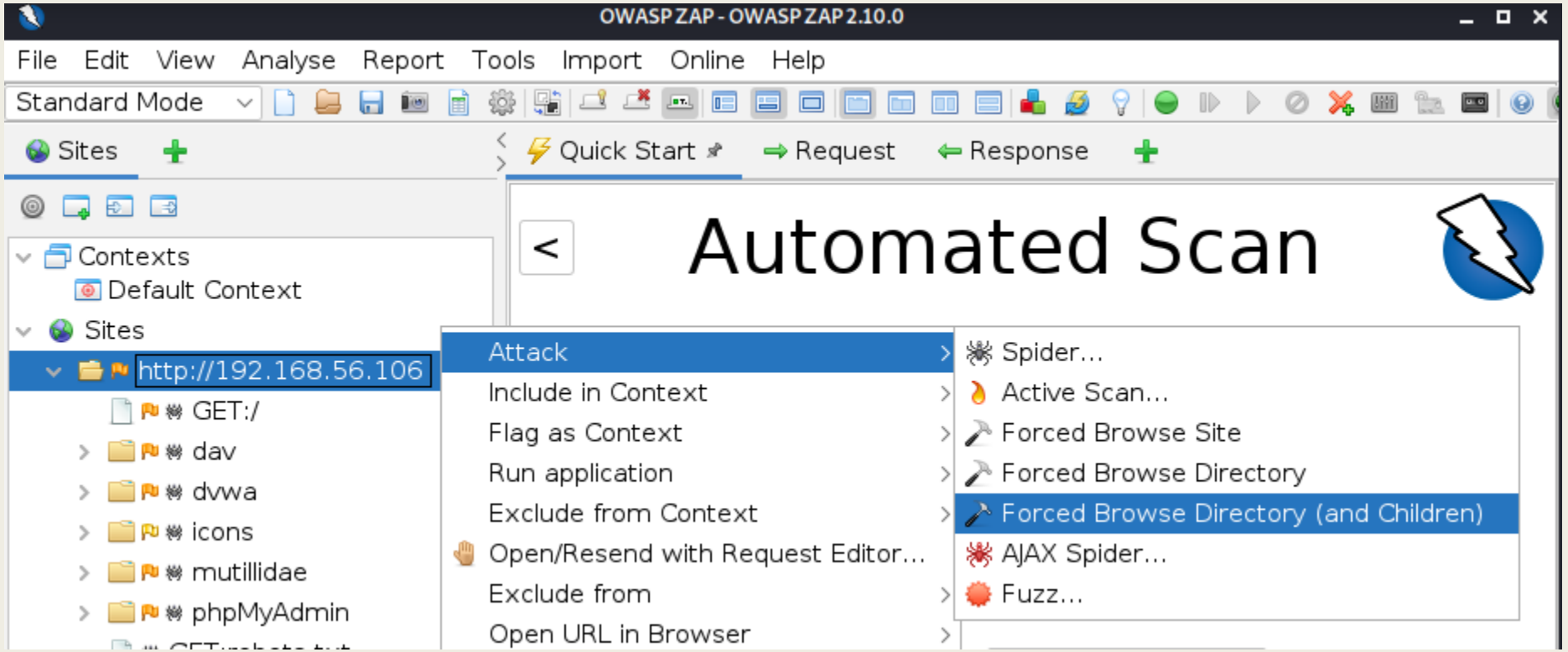
Hidden resource



ZAP (Zed Attack Proxy)



ZAP (Zed Attack Proxy)



Information Disclosure

- Backup files
  - backup.zip
  - www.tar.gz
  - index.php.bak
- Temporary files
  - .index.php.swp
  - index.php~
  - #index.php#
- Log Files
  - *.log

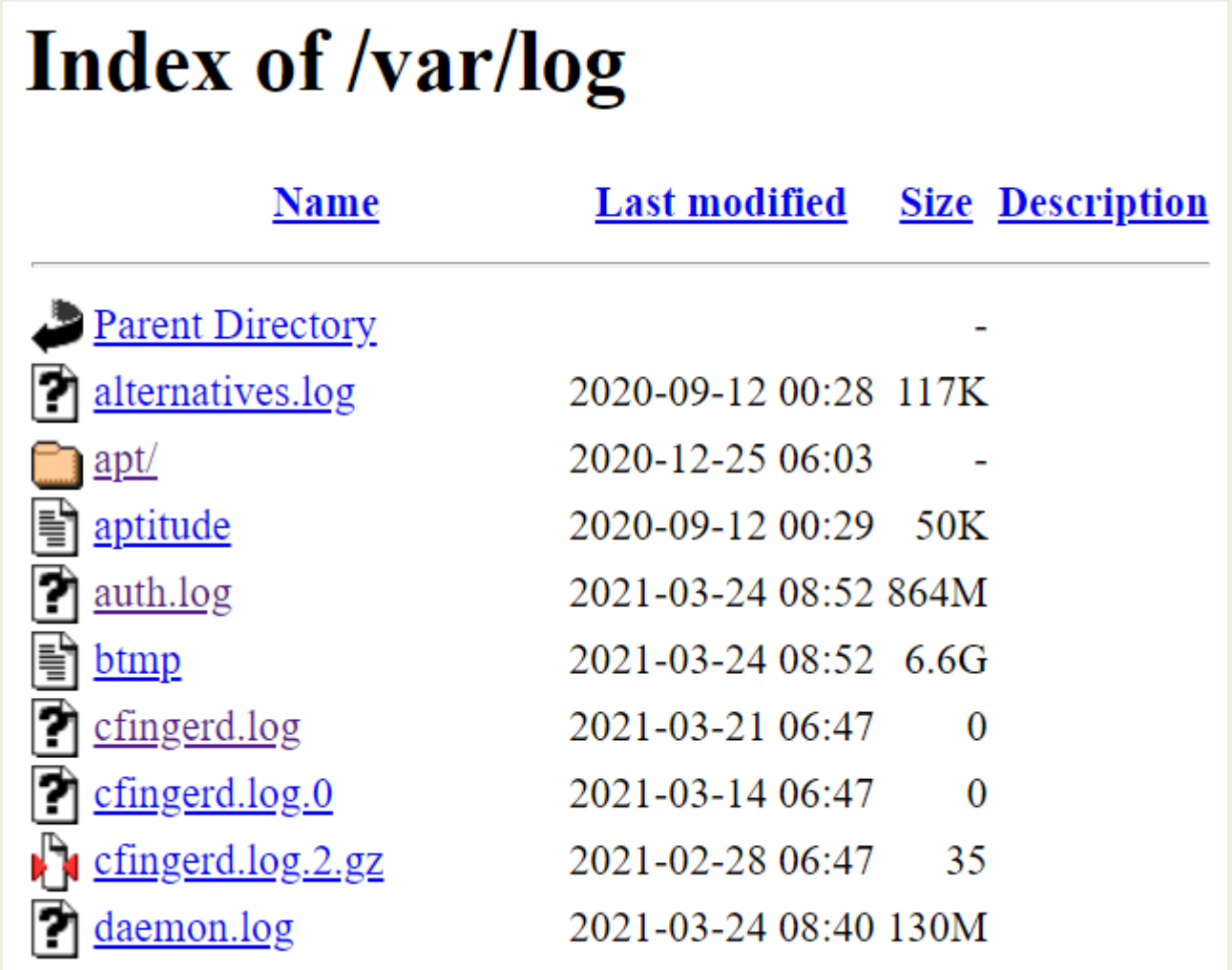
- Version Control Systems
  - .git / .svn / .hg
  - Tools (可還原 Source Code)
    - github.com/denny0223/scrabble
    - github.com/lijiejie/GitHack

- Google Hacking Database
  - *https://www.exploit-db.com/google-hacking-database*

Information Disclosure

- intitle:"index of" “auth.log“

- Logging sensitive data
  - db password
  - user password
  - secret key
  - …

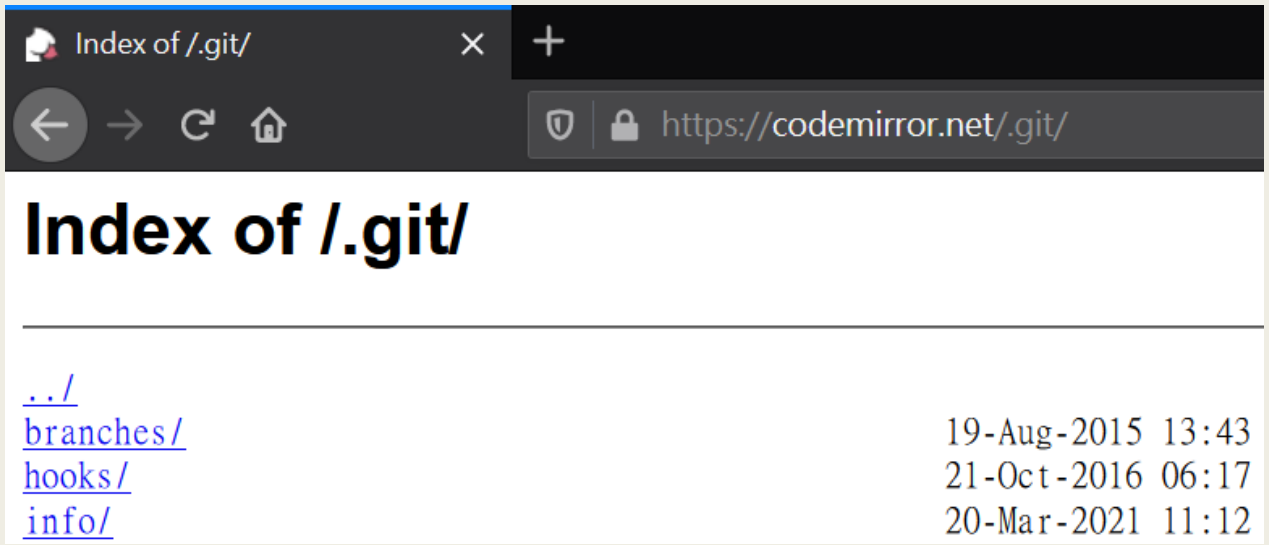


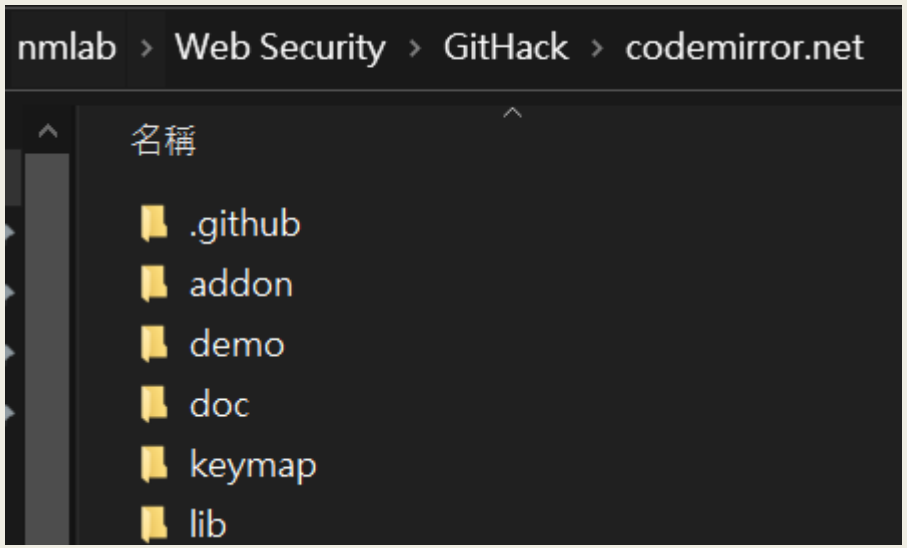
Index of /var/log

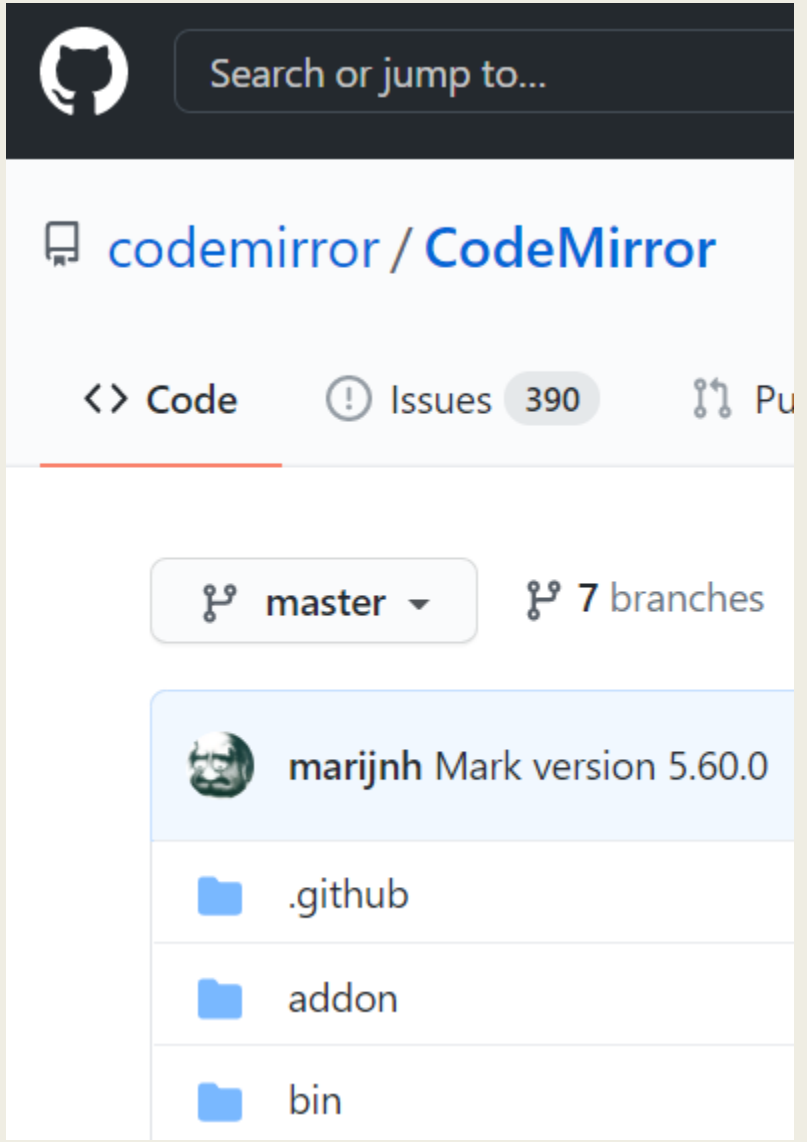
Name	Last modified	Size	Description
Parent Directory		-	
alternatives.log	2020-09-12 00:28	117K	
apt/	2020-12-25 06:03	-	
aptitude	2020-09-12 00:29	50K	
auth.log	2021-03-24 08:52	864M	
btmp	2021-03-24 08:52	6.6G	
cfingerd.log	2021-03-21 06:47	0	
cfingerd.log.0	2021-03-14 06:47	0	
cfingerd.log.2.gz	2021-02-28 06:47	35	
daemon.log	2021-03-24 08:40	130M	

Information Disclosure

- inurl: /.git







https://github.com/codemirror/CodeMirror

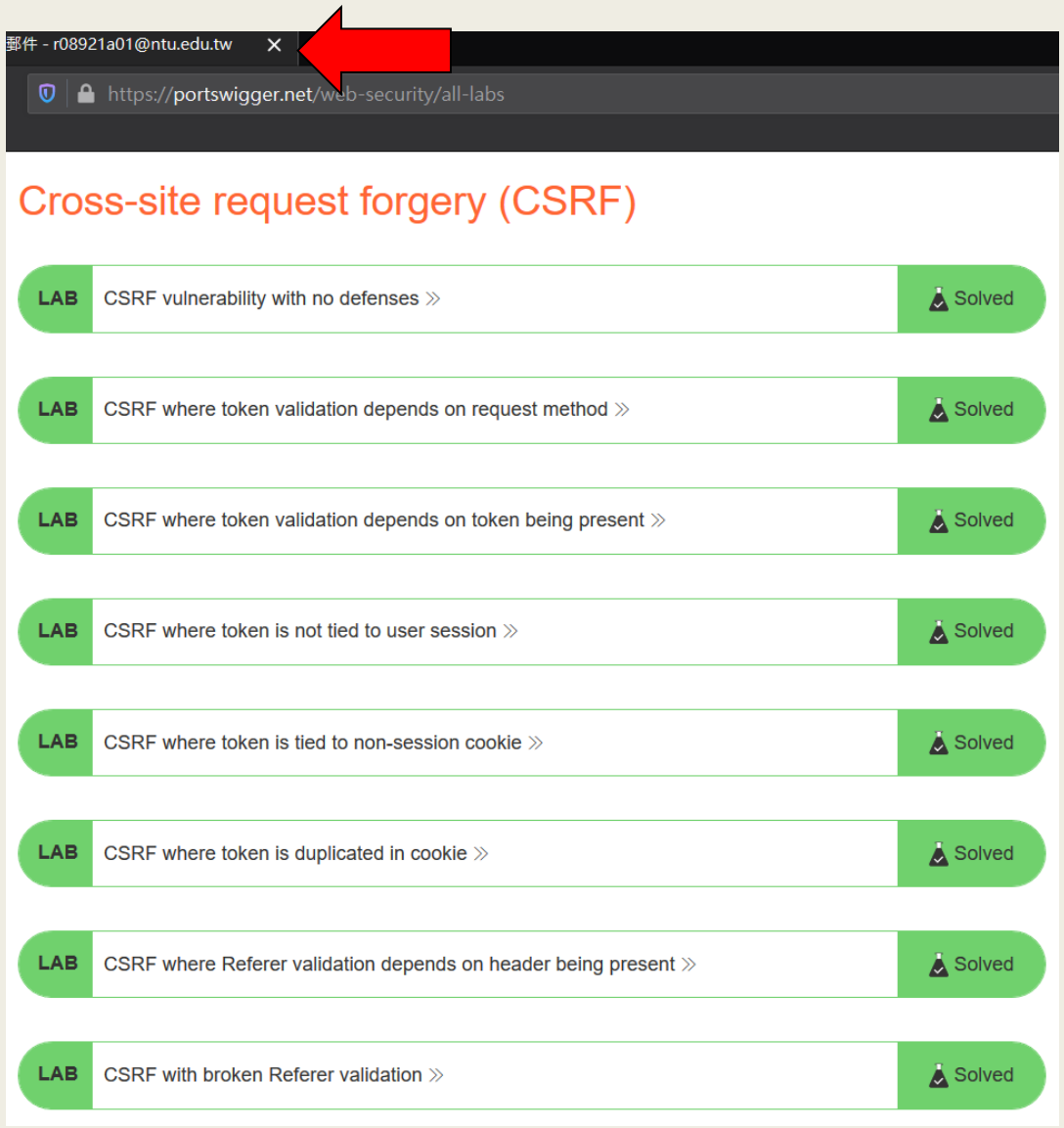
HW

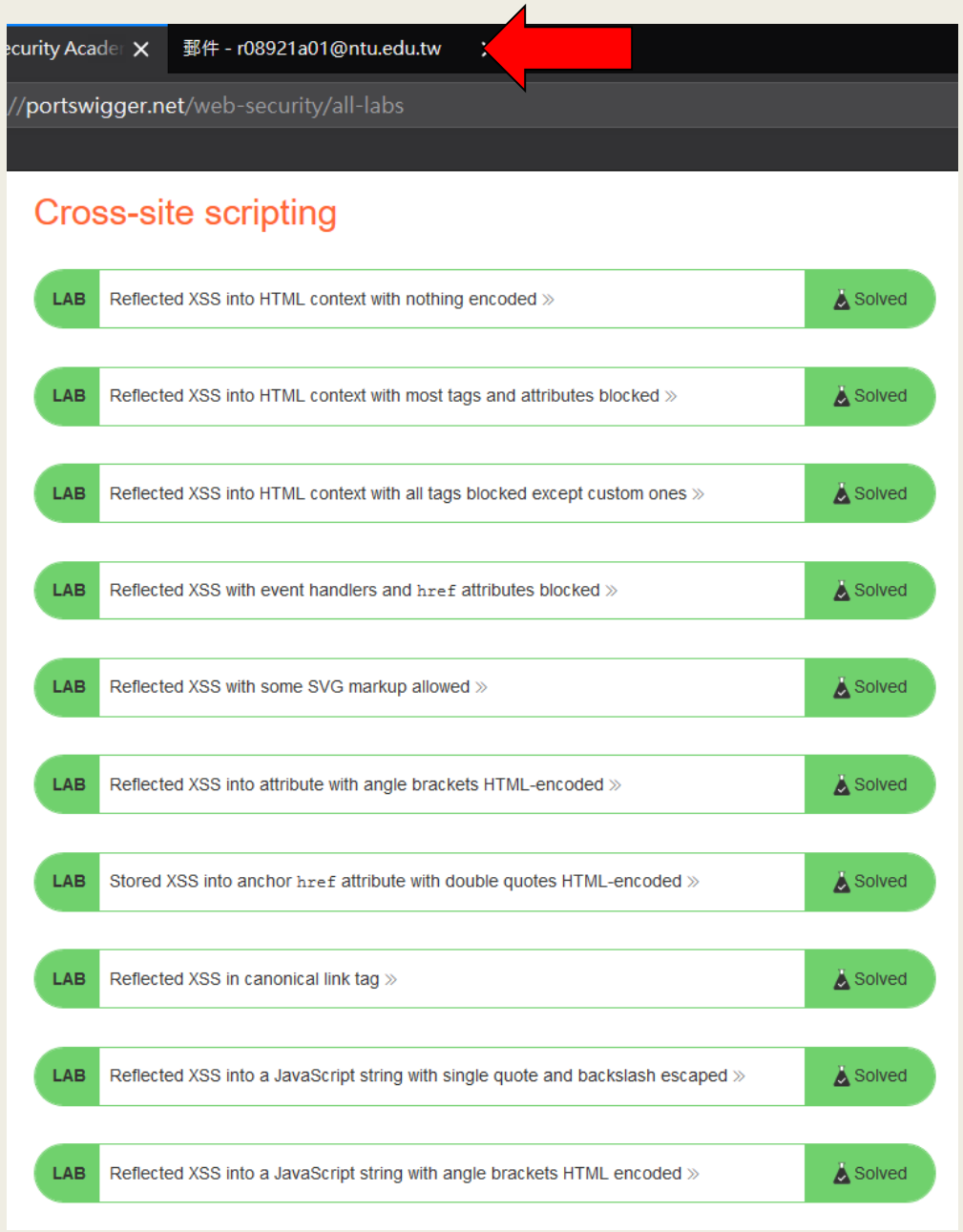
- 10 Labs in XSS:
  - *https://portswigger.net/web-security/cross-site-scripting*
- 8 Labs in CSRF:
  - *https://portswigger.net/web-security/csrf*
- 5 Labs in SSRF (First 5):
  - *https://portswigger.net/web-security/ssrf*

HW

- 上傳 .pdf 檔，包含:
  - 1. Screenshot-01: Payload1 放上學號
  - 2. Screenshot-02: Change 欄位放上學號
  - 3~5. (XSS, CSRF, SSRF) @ *https://portswigger.net/web-security/all-labs*
  - 6. Lab reflection

With your Email logged in





With your Email logged in