DNS Sinkhole & RPZ 運作原理與實際應用

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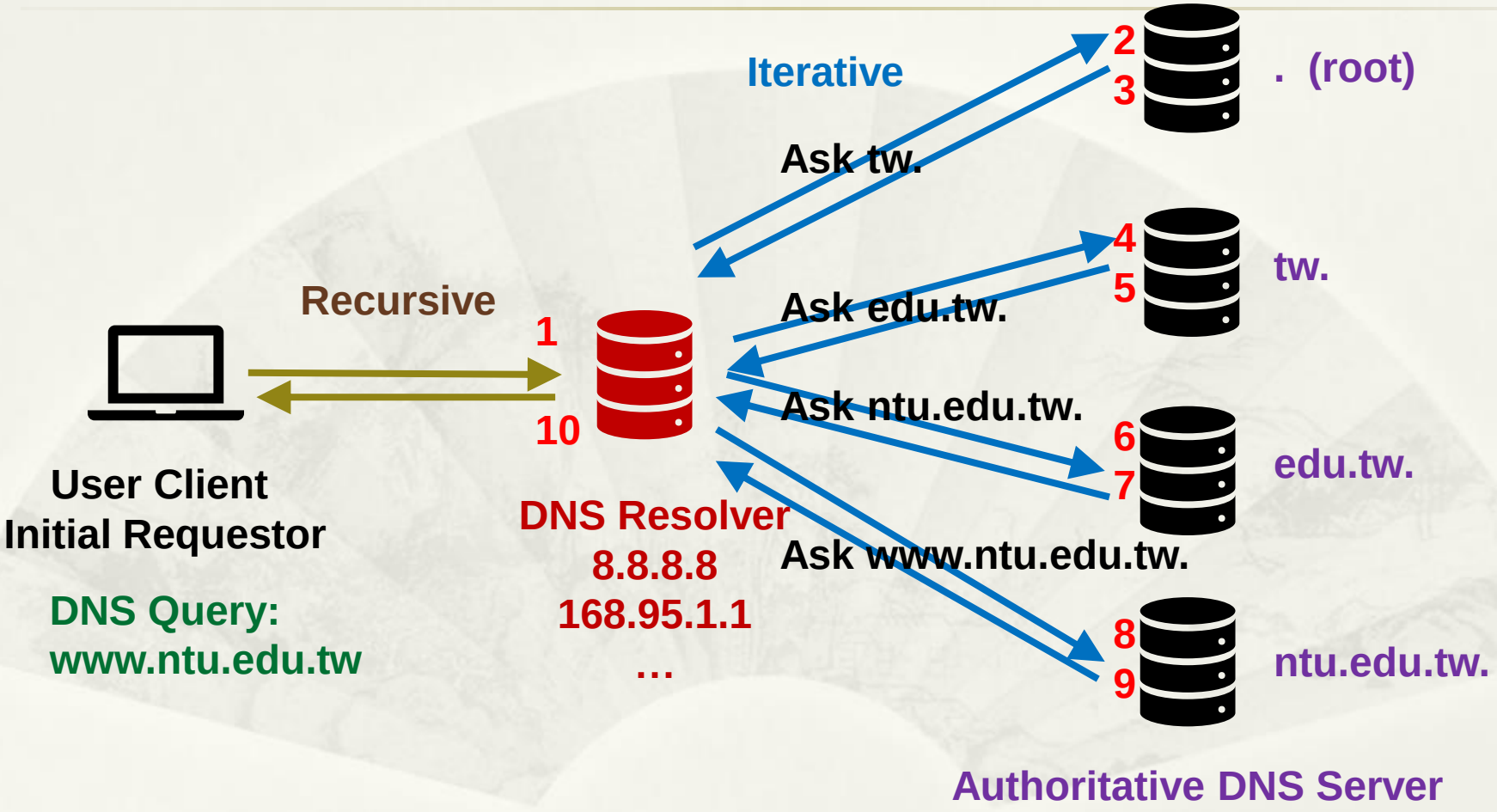
大綱

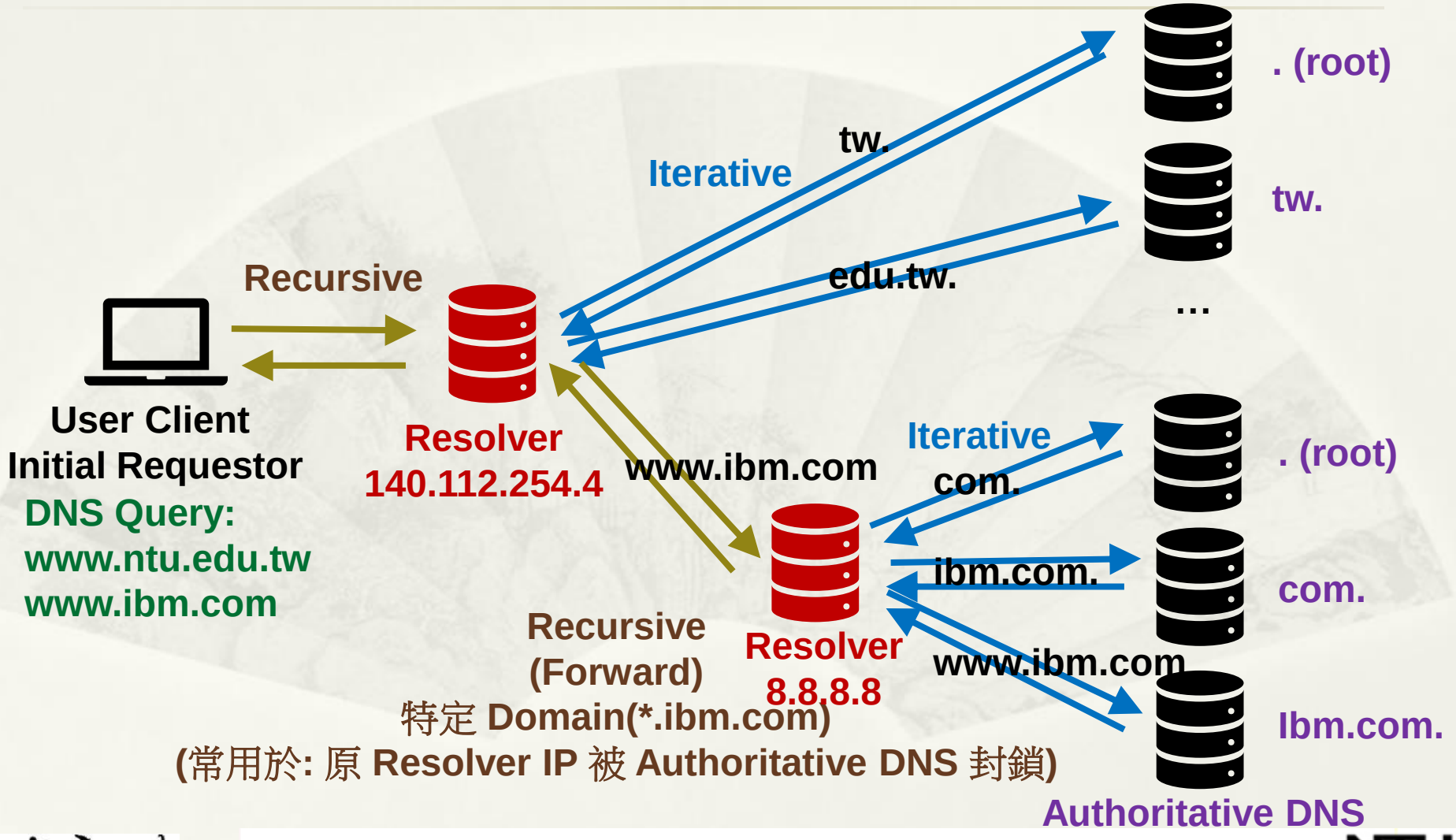
- DNS 架構與運作原理
- DNS Sinkhole
- DNS RPZ

DNS 運作架構

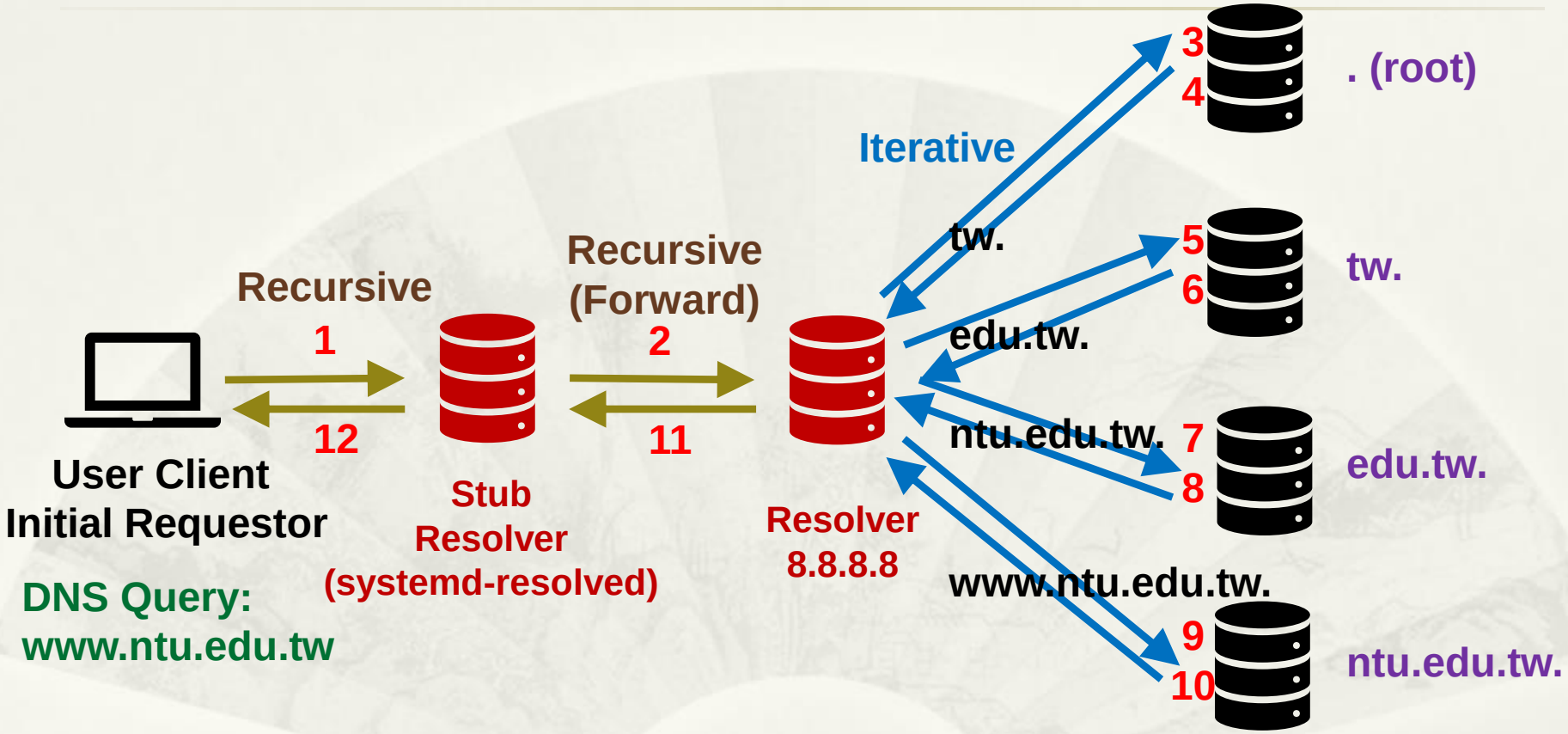
DNS 運作架構


Iterative
2
3
. (root)
Ask tw.
4
5
tw.
Recursive
Ask edu.tw.
1
10
Ask ntu.edu.tw.
6
7
edu.tw.
User Client
Initial Requestor
DNS Resolver
8.8.8.8
168.95.1.1
…
Ask www.ntu.edu.tw.
8
9
ntu.edu.tw.
DNS Query:
www.ntu.edu.tw
Authoritative DNS Server

Partial Forward



Stub Resolver (All Forward)



※新版 Linux 幾乎預設皆有 Stub Resolver
目的: 提供 DNS Cache 功能

DNS Sinkhole

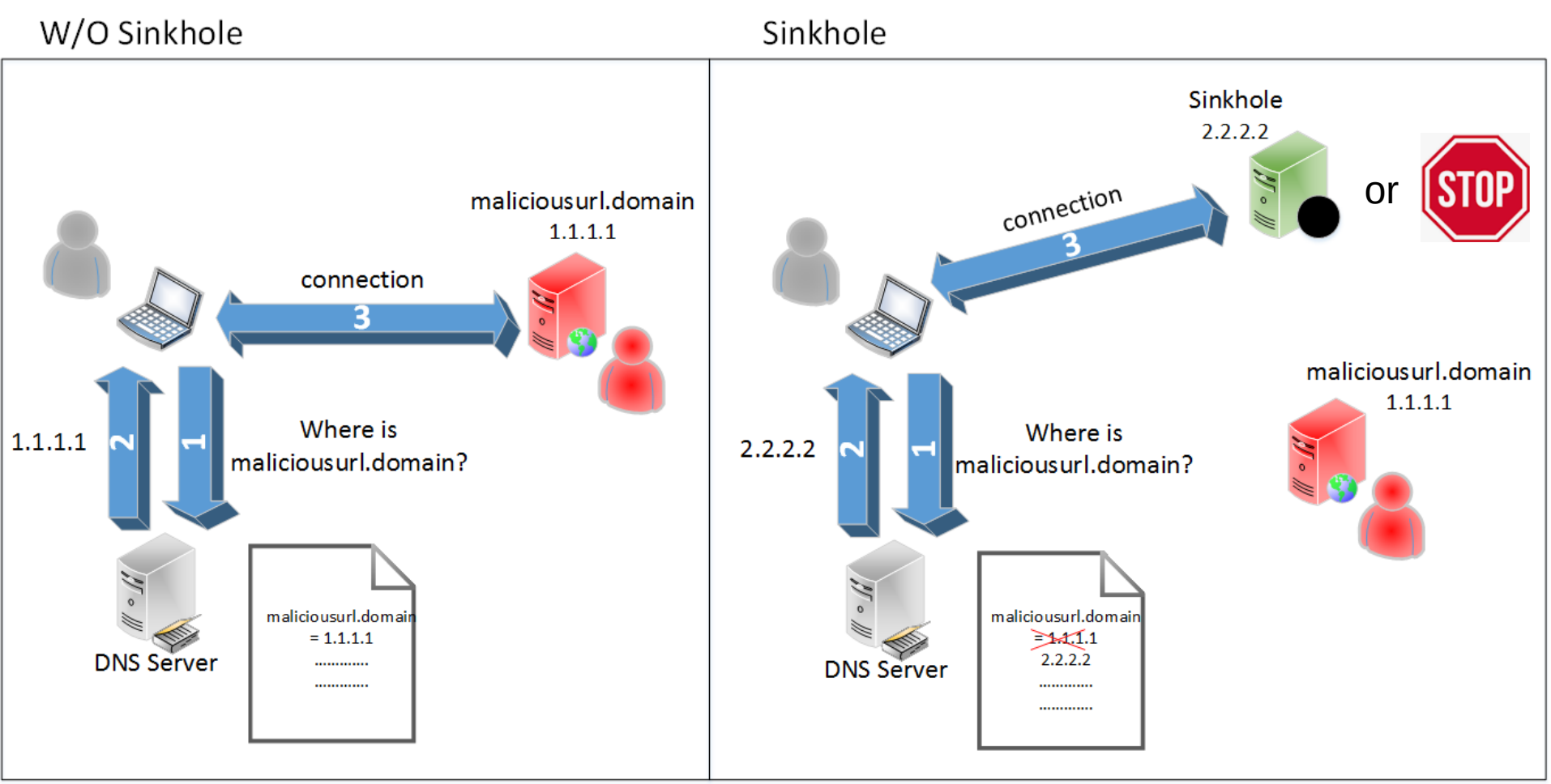
大綱

* 事前阻擋: DNS Sinkhole
  * DNS Authoritative Server: 正解 and 反解
  * 資安設備阻擋 or Redirect
  * Local Hosts File
  * DNS Resolver: DNS RPZ
* 事後分析
  * 資安情資資料庫

事前阻擋 vs. 事後分析

- 事前阻擋: DNS Sinkhole
- 事後分析: 分析 DNS Query Log 是否出現於 DNS 黑名單

DNS Sinkhole
運作方式



https://www.enisa.europa.eu/topics/incident-response/glossary/dns-sinkhole

DNS Sinkhole

- Protect users by intercepting DNS request attempting to connect to known malicious domains.
- 目的: Return NXDOMAIN or False IP
- 作法:
  - DNS Authoritative Server: 正解 and 反解
  - 資安設備阻擋 or Redirect
  - Local Hosts File

    Linux: /etc/hosts

    Windows: C:\Windows\System32\drivers\etc\hosts
  - DNS Resolver: DNS Firewalls、DNS RPZ

DNS Sinkhole
use DNS Authoritative Server

方法 1

DNS Authoritative Server

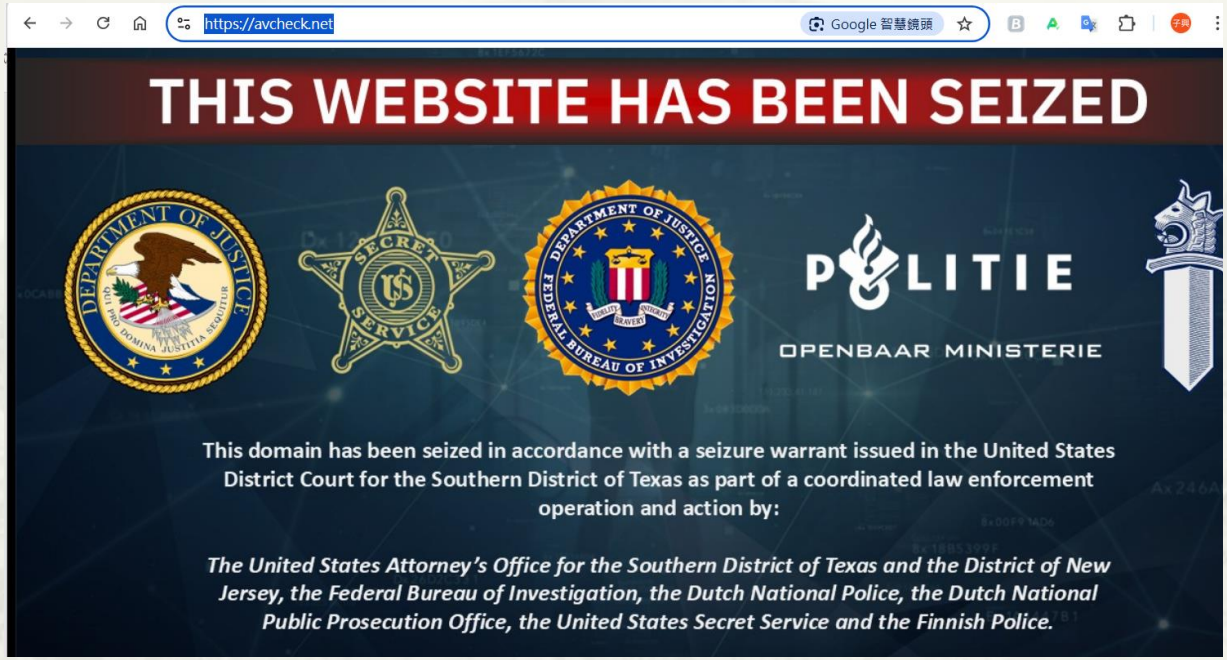
- 前提: Botnets have been compromised by Up-level domain.
- 案例1: 2022年4月7日
  - 微軟接管了駭客 Fancy Bear（亦稱 APT28、Strontium）用以攻擊烏克蘭的7個網域，並將流量導向微軟控制的 Sinkhole
  - 此駭客組織在烏克蘭戰爭中，曾鎖定烏克蘭入口網站 Ukr.net 用戶下手，發動網釣攻擊。
    - Ref. https://www.ithome.com.tw/news/150323

DNS Authoritative Server

* 案例2: 2022年4月22日
  * 微軟成功接管 ZLoader 殭屍網路超過 400 個網域，使其暫時在網絡上消失。
  * ZLoader 是惡名昭彰大型殭屍網路之一，最初以金融木馬程式姿態出現，後來逐漸擴充成惡意軟體即服務供應商，與 Ryuk、DarkSide 和 BlackMatter 等勒索軟體分享網路，受害者遍布全球。
  * Ref. https://technews.tw/2022/04/22/microsoft-successfully-takes-over-zloader-botnet/

DNS Authoritative Server

* 案例3: https://avcheck.net/



* 2025-06-02 國際警方關閉被駭客用來對抗防毒軟體的 AVCheck
  * Ref. https://www.ithome.com.tw/news/169290

如何知道網址已經是 DNS Sinkhole？ (Identify Compromised Hosts)

* 方法1 : Domain 正解
  * http://網址/ ，內容顯示 sinkholed by xxxx

* 方法2: IP addr 反解(PTR)
  * 出現 Sinkhole 字串

方法1 : Domain 正解

* 內容顯示 sinkholed by xxxx
* 案例: WannaCry 勒索病毒運作檢查網址
  https://www.iuqerfsodp9ifjaposdfjhgosurijfaewrwergwea.com
  https://iuqerfsodp9ifjaposdfjhgosurijfaewrwergwea.com

WannaCry 勒索病毒運作檢查網址

* https://applealmond.com/posts/5224

勒索病毒已停止擴散？WannaCry 2.0 更新版釋出，威脅尚未解除

2017 年 5 月 14 日 / 多頻發送

就在昨天肆虐全台的 WannaCry 勒索病毒，被一名化名 MalwareTech 的資安研究人員發現，WannaCry 會透過一個未被註冊的網域名稱：iuqerfsodp9ifjaposdfjhgosurijfaewrwergwea.com 作為判斷是否擴散的依據，只要該網域不存在，病毒就會繼續擴散。因此這名研究人員把網域註冊起來，意外地阻止了 WannaCry 的擴散。

方法1 : Domain 正解

- Snort Rules 封包內容出現 “sinkhole” 關鍵字

  alert tcp $EXTERNAL_NET $HTTP_PORTS -> $HOME_NET any (msg:"INDICATOR-COMPROMISE Connection to malware sinkhole - CERT.PL"; flow:to_client,established; content:"Content-Length: 24|0D 0A|"; http_header; content:"Sinkholed by CERT.PL
";

  alert tcp $EXTERNAL_NET $HTTP_PORTS -> $HOME_NET any (msg:"INDICATOR-COMPROMISE connection to zeus malware sinkhole"; flow:to_client,established; content:"X-Sinkhole|3A| Malware GameOverZeus sinkhole";

  alert tcp $EXTERNAL_NET any -> $HOME_NET any (msg:"MALWARE-OTHER connection to malware sinkhole"; flow:to_client,established; isdataat:21; isdataat:!22; content:"Sinkholed by abuse.ch|0A|";

  alert tcp $EXTERNAL_NET any -> $HOME_NET any (msg:"MALWARE-OTHER Sinkhole reply - irc-sinkhole.cert.pl"; flow:to_client,established; content:"|3A|irc|2D|sinkhole|2E|cert|2E|pl";

  alert tcp $EXTERNAL_NET $HTTP_PORTS -> $HOME_NET any (msg:"MALWARE-OTHER connection to malware sinkhole"; flow:to_client,established; content:"X-Sinkhole|3A| Malware";

  alert tcp $EXTERNAL_NET $HTTP_PORTS -> $HOME_NET any (msg:"MALWARE-OTHER connection to malware sinkhole"; flow:to_client,established; content:"malware-sinkhole|0D 0A|";

方法2: IP addr 反解(PTR) 出現 Sinkhole 字串

- 案例: ET TROJAN Ransom.Win32.Birele.gsg
  - 清大資工所網路安全課程期末惡意程式分析作業
    - https://www.sharecourse.net/sharecourse/upload/assign/51/submit/f1d72b40f5527b1f2a46eba2788115c6.pdf

- 惡意網址: mkkuei4dsz.com
- DNS 正解 IP: 166.78.144.80
- 166.78.144.80 反解(PTR) :

  C:\> nslookup 166.78.144.80

  名稱: so1.snkhole.mal-ware.susp-nded.domain

  Address: 166.78.144.80

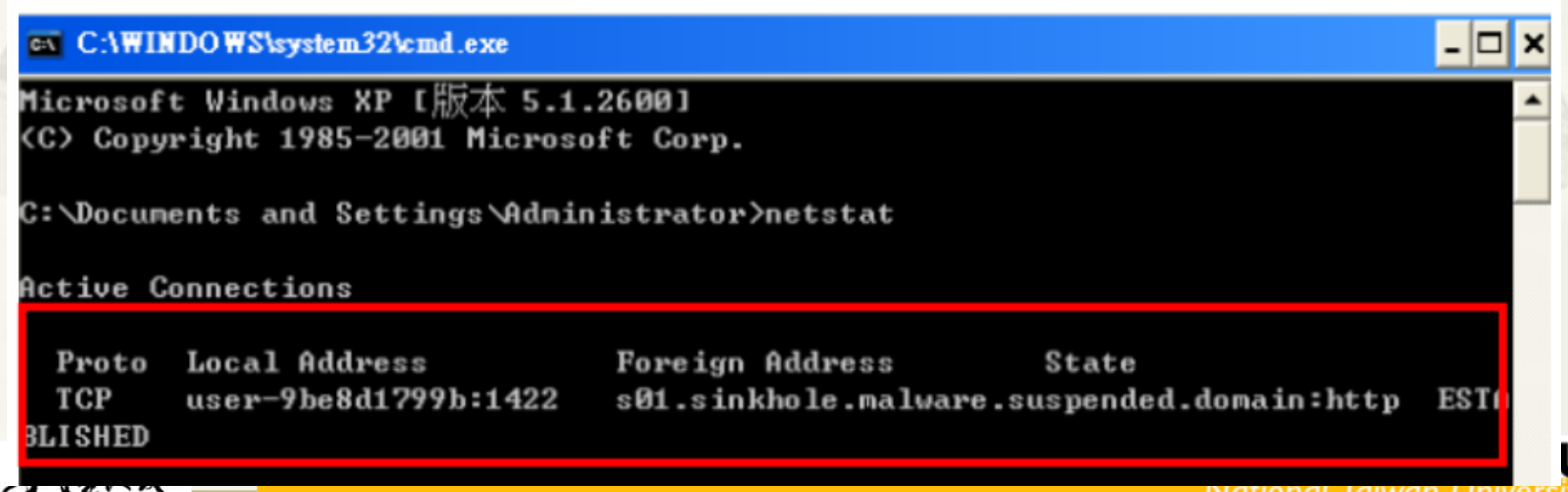
  - 補充: sinkhole domain name 無正解 IP 或 無特別意義
    - C:\Users\user>nslookup so1.snkhole.mal-ware.susp-nded.domain
    - 找不到 so1.snkhole.mal-ware.susp-nded.domain: Non-existent domain

方法2: IP addr 反解(PTR) 出現 sinkhole 字串

* 清大資工所網路安全課程期末惡意程式分析作業
* 封包側錄

101	47.0964890	192.168.113.128	192.168.113.2	DNS	75 Standard query 0x340a A mkkuei4kdsz.com
102	47.3791150	192.168.113.2	192.168.113.128	DNS	91 Standard query response 0x340a A 166.78.144.80
103	47.3805360	192.168.113.128	166.78.144.80	TCP	62 interhdl-elmd > http [SYN] Seq=0 Win=64240 Len=0 MSS=1460 SACK_PERM=1
104	47.3809450	166.78.144.80	192.168.113.128	TCP	60 http > interhdl-elmd [SYN, ACK] Seq=0 Ack=1 Win=64240 Len=0 MSS=1460
105	47.3809470	192.168.113.128	166.78.144.80	TCP	54 interhdl-elmd > http [ACK] Seq=1 Ack=1 Win=64240 Len=0
106	47.3811850	192.168.113.128	166.78.144.80	HTTP	245 GET /683/411.html HTTP/1.1
107	47.3814540	166.78.144.80	192.168.113.128	TCP	60 http > interhdl-elmd [ACK] Seq=1 Ack=192 Win=64240 Len=0

* 連線觀察 netstat



方法2: IP addr 反解(PTR) 出現 sinkhole 字串

* 思考:
  * 所有對外連線 IP 進行 DNS 反解後搜尋是否有 sinkhole 字串

DNS Sinkhole
資安設備阻擋 or Redirect

方法 2

資安設備阻擋
Cisco IPS

- DNS Query 網址為已知之網域黑名單
- Snort Rule
  - alert **udp $HOME_NET any -> any 53** (msg:"INDICATOR-COMPROMISE DNS request for known malware sinkhole domain iuqerfsodp9ifjaposdfjhgosurijfaewrwergwea.com - WannaCry"; flow:to_server; byte_test:1,!&,0xF8,2; content:"|29|iuqerfsodp9ifjaposdfjhgosurijfaewrwergwea|03|com|00
  - alert **udp $EXTERNAL_NET 53 -> $HOME_NET any** (msg:"INDICATOR-COMPROMISE DNS response points to sinkholed domain"; flow:to_client,established; content:"|00 02 00 01|"; content:"honeybot|02|us";
  - alert **udp $HOME_NET any -> any 53** (msg:“MALWARE-CNC Torpig bot sinkhole server DNS lookup”; flow:to_server; byte_test:1,!&,0xF8,2; content:“torpig-sinkhole|03|org”; (待釐清)

待釐清

torpig-sinkhole.org 為 DNS Sinkhole ?

* https://otx.alienvault.com/indicator/domain/torpig-sinkhole.org
* https://www.virustotal.com/gui/domain/torpig-sinkhole.org
* https://www.virustotal.com/gui/domain/mx2.torpig-sinkhole.org

資安設備 Redirect
PaloAlto 使用 CNAME

* 案例1: nslookup dgs.ltedu.com.tw

  未經授權的回答:

  名稱: sinkhole.paloaltonetworks.com

  Address: 72.5.65.111

  Aliases: dgs.ltedu.com.tw

  * PA 將該 Domain 列入 spyware 威脅類別

* 案例2: 2024isme.skyces.org

```
Non-authoritative answer:
2024isme.skyces.org     canonical name = sinkhole.paloaltonetworks.com.
Name:   sinkhole.paloaltonetworks.com
Address: 72.5.65.111
>
```

資安設備 Redirect
With Secure 更改 DNS query 結果

* 2024isme.skyces.org

* With Secure: EDR Solution
  * https://www.withsecure.com/en/home

DNS Sinkhole
use Local Hosts File

方法 3

Local Hosts File

* Steven Black
  * https://github.com/StevenBlack/hosts
  * 下載後直接放於 Local Hosts File

    Linux: /etc/hosts

    Windows: C:\Windows\System32\drivers\etc\hosts

Host file recipe	Readme	Raw hosts	Unique domains
Unified hosts = (adware + malware)	Readme	link	165,872
Unified hosts + fakenews	Readme	link	168,066
fakenews	Readme	link	2,194
Unified hosts + gambling	Readme	link	172,368
gambling	Readme	link	6,508
Unified hosts + porn	Readme	link	240,534
porn	Readme	link	75,364
Unified hosts + social	Readme	link	169,060
social	Readme	link	3,217

```
#=====================================
# Title: Hosts contributed by Steven Black
# http://stevenblack.com

0.0.0.0 ad-assets.futurecdn.net
0.0.0.0 ck.getcookiestxt.com
0.0.0.0 eu1.clevertap-prod.com
0.0.0.0 wizhumpgyros.com
0.0.0.0 coccyxwickimp.com
0.0.0.0 webmail-who-int.000webhostapp.com
0.0.0.0 010sec.com
0.0.0.0 01mspmd5yalky8.com
0.0.0.0 0byv9mgbn0.com
0.0.0.0 ns6.0pendns.org
0.0.0.0 dns.0pengl.com
0.0.0.0 12724.xyz
0.0.0.0 21736.xyz
0.0.0.0 www.analytics.247sports.com
0.0.0.0 2no.co
0.0.0.0 www.2no.co
0.0.0.0 logitechlogitechglobal.112.2o7.net
```

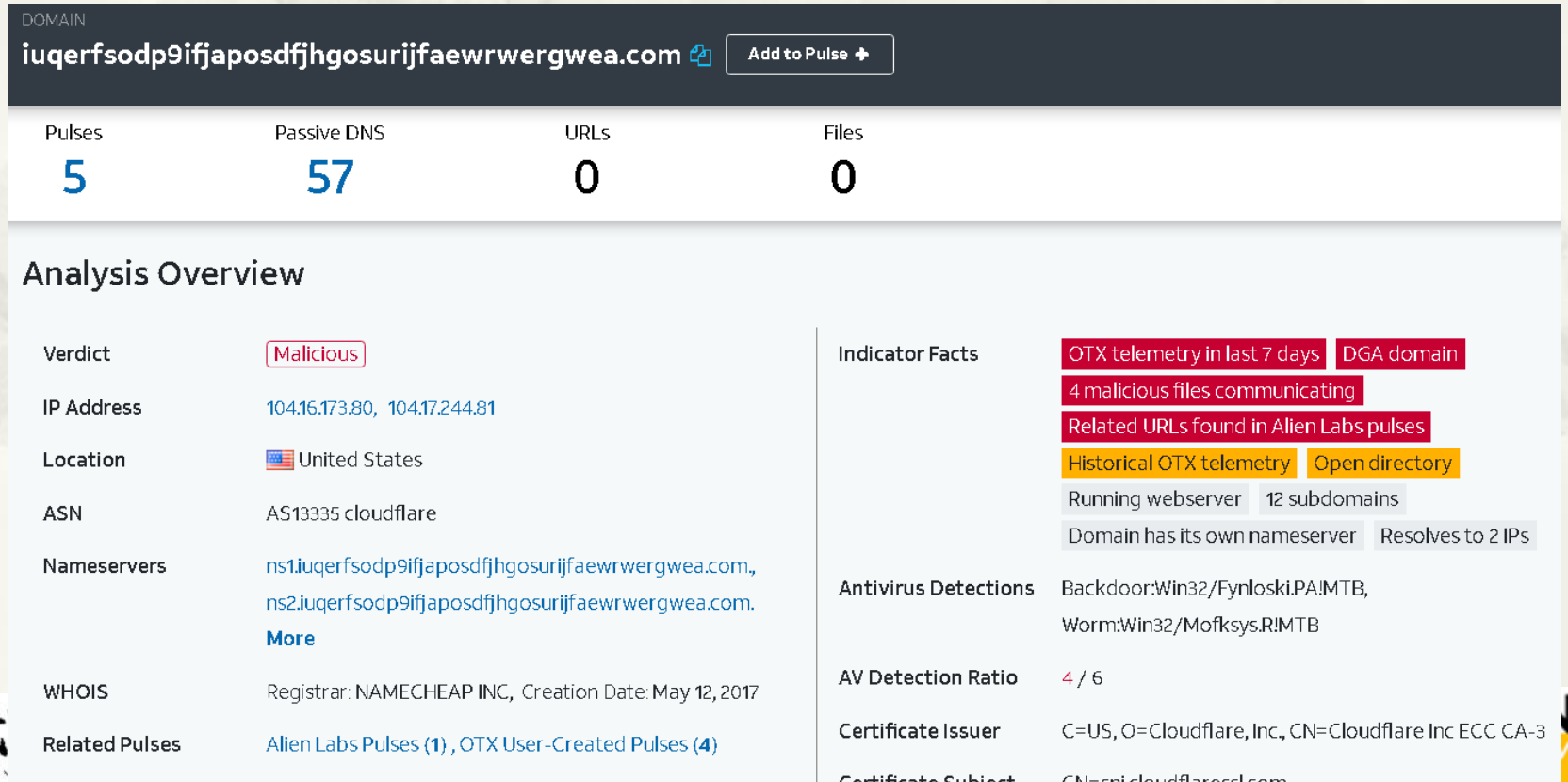
事後分析

事後分析

- 分析 DNS Query Log 是否出現於DNS 黑名單
- 資安情資資料庫
  - Open Threat Intelligence Community
    - https://otx.alienvault.com/

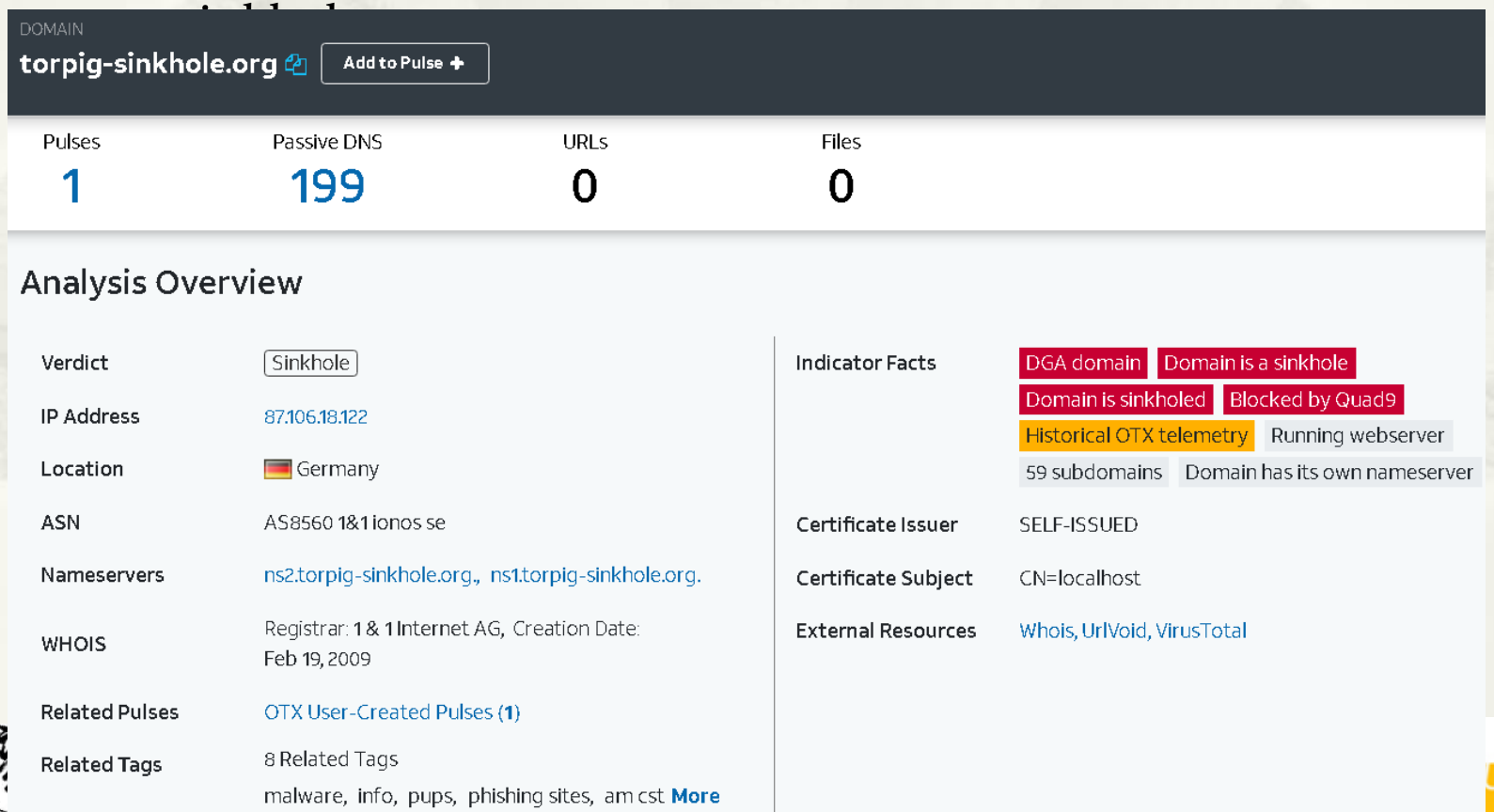
如何知道某網址已經是 DNS Sinkhole ?

* 範例: Domain Name (FQDN)
  * iuqerfsodp9ifjaposdfjhgosurijfaewrwergwea.com
  * https://otx.alienvault.com/indicator/domain/iuqerfsodp9ifjaposdfjhgosurijfaewrwergwea.com



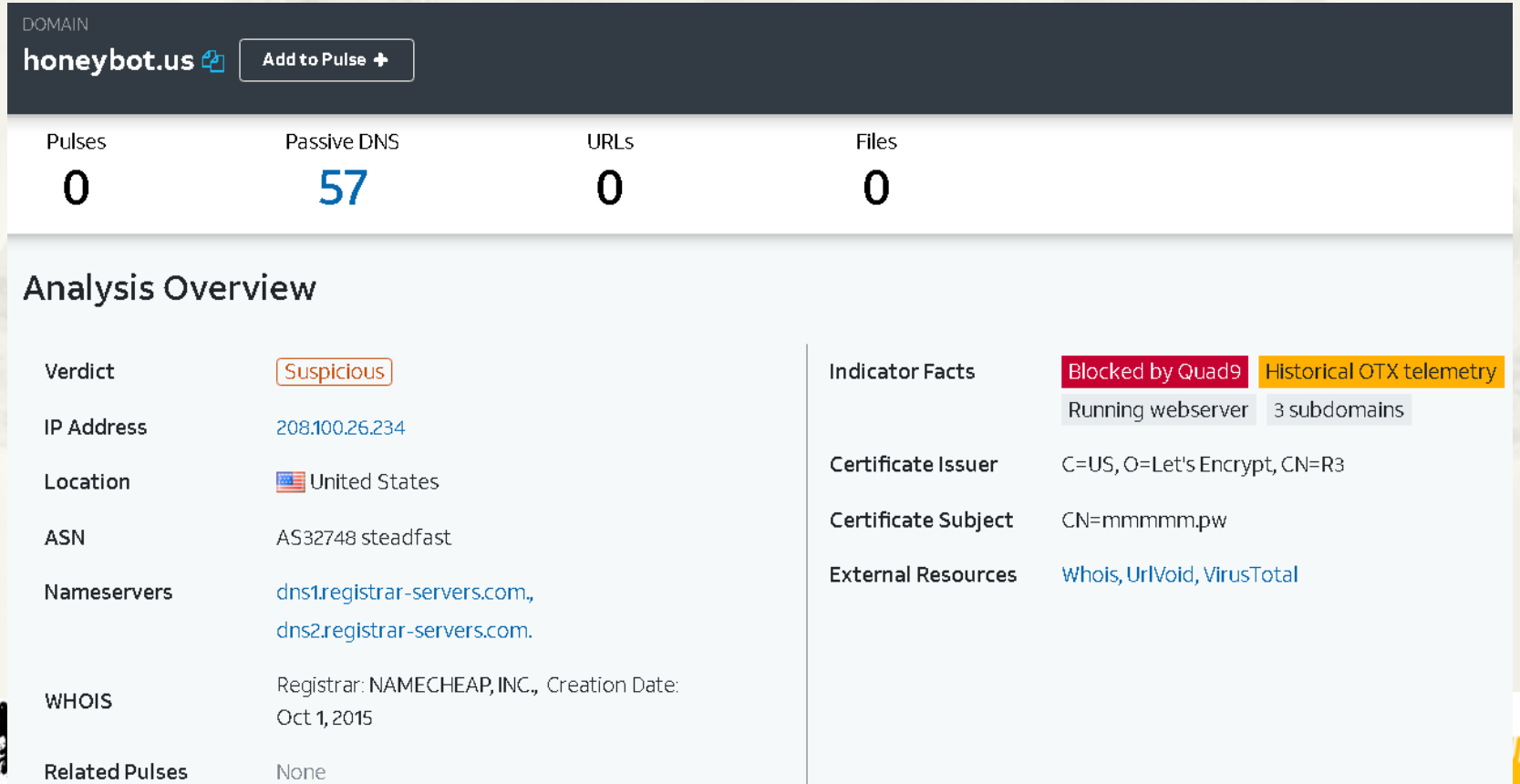
如何知道某網址已經是 DNS Sinkhole ?

* 範例: Domain Name (FQDN)
  * torpig-sinkhole.org
    * https://otx.alienvault.com/indicator/domain/torpig-



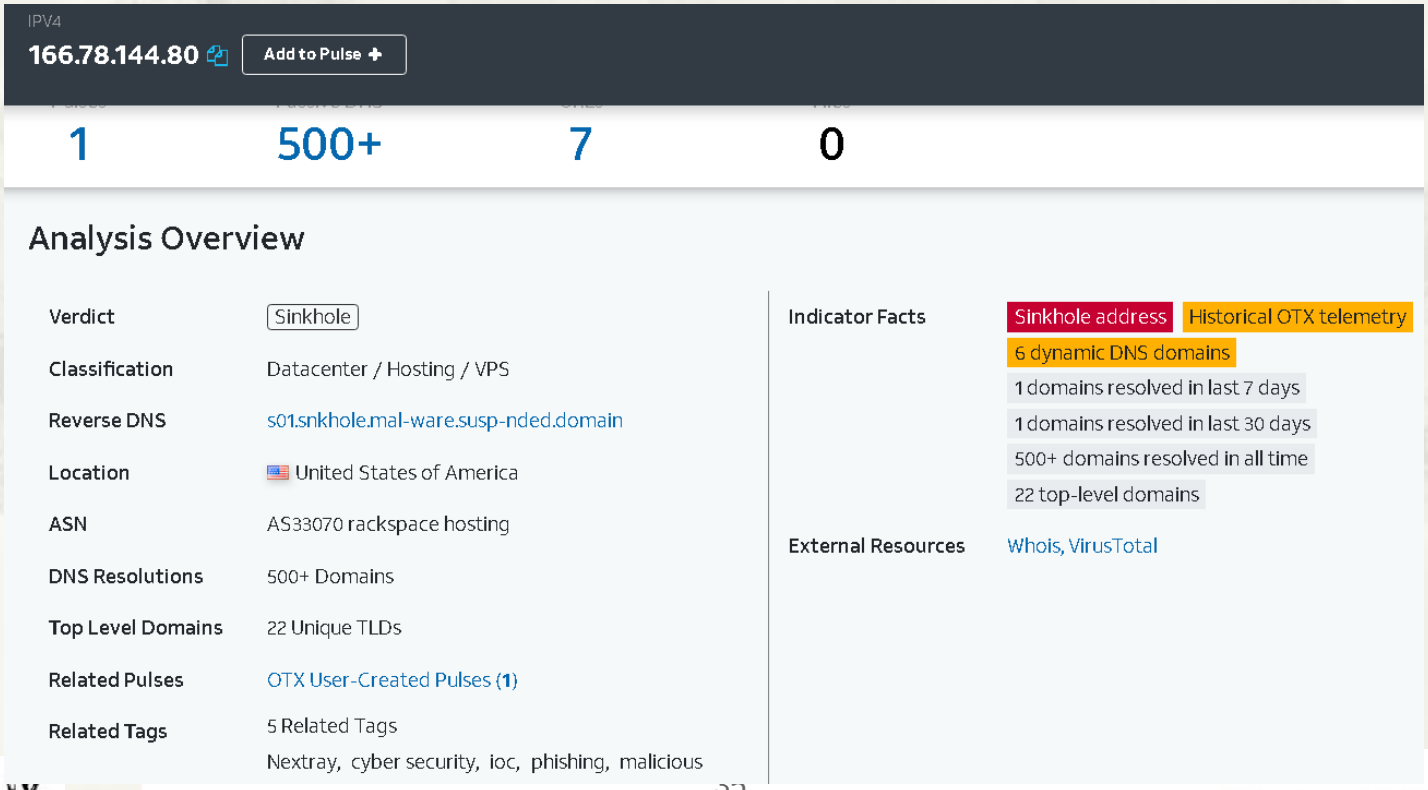
如何知道某網址已經是 DNS Sinkhole ?

* 範例: Domain Name (FQDN)
  * honeybot.us
  * https://otx.alienvault.com/indicator/domain/honeybot.us



如何知道 IP 已經是 DNS Sinkhole ?

* 範例: IP
  * 166.78.144.80
  * https://otx.alienvault.com/indicator/ip/166.78.144.80



DNS Sinkhole
use DNS Resolver
(DNS Firewalls、DNS RPZ)

大綱

- 傳統 DNS Sinkhole 作法
- 回應政策區域 Response Policy Zone (RPZ)
- RPZ 現有聯防案例
- RPZ 語法介紹
- RPZ 是否與 DNSSEC 衝突?
- RPZ Redirect to 警告頁面受 HSTS 限制

傳統 DNS Sinkhole 作法

不支援 RPZ 之替代方法

傳統 DNS Sinkhole 作法 (不支援 RPZ 之替代方法)

- 直接將惡意 FQDN 建立單獨的 Zone，並共用一個 Zone File.
- BIND
  - named.conf

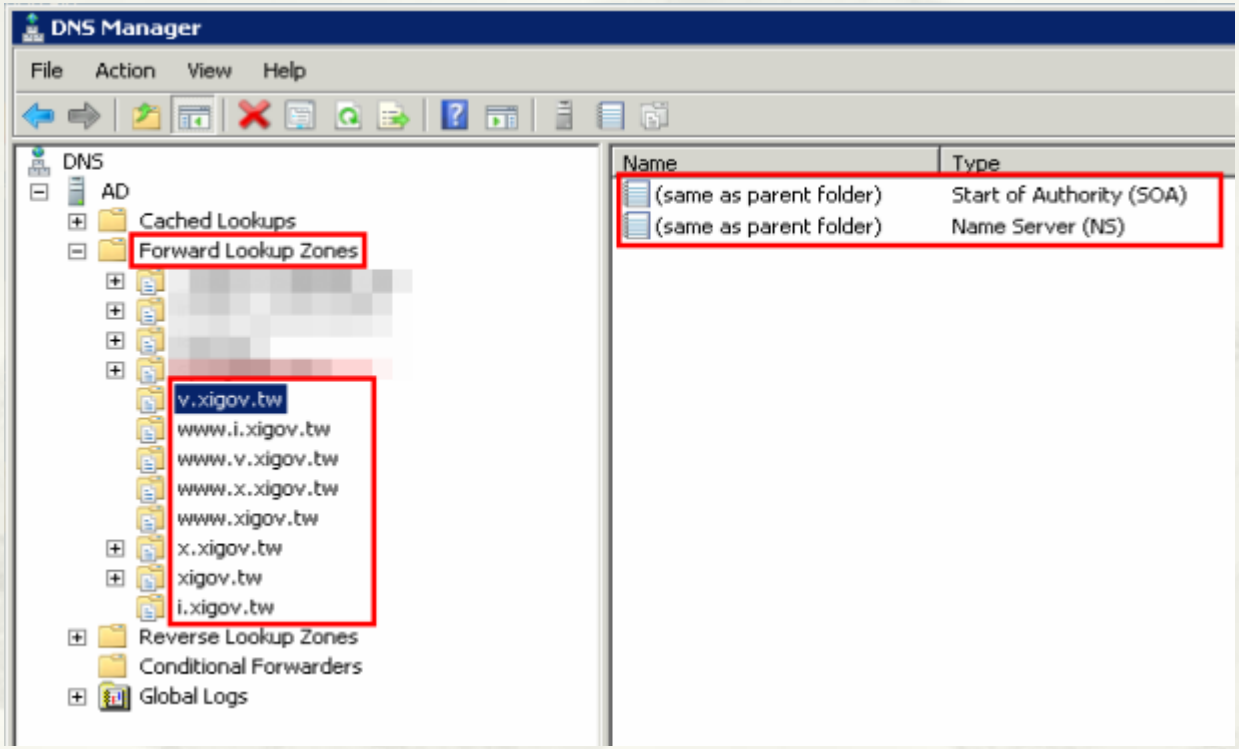
```
zone "onedrive.hayraet.com" IN { type master; file "redirect.nowhere"; };
zone "cathaylife.garfeas.com" IN { type master; file "redirect.nowhere"; };
zone "ntu-web.weebly.com." IN { type master; file "redirect.nowhere"; };
zone "eud.tw." IN { type master; file “redirect.nowhere"; };
....
```

  - Zone File: redirect.nowhere

```
@   1D IN SOA   localhost root ( 20210830  3H   15M  1W  1D )
    1D IN NS    @
    5  IN A     192.168.1.1
```

Windows DNS 黑名單

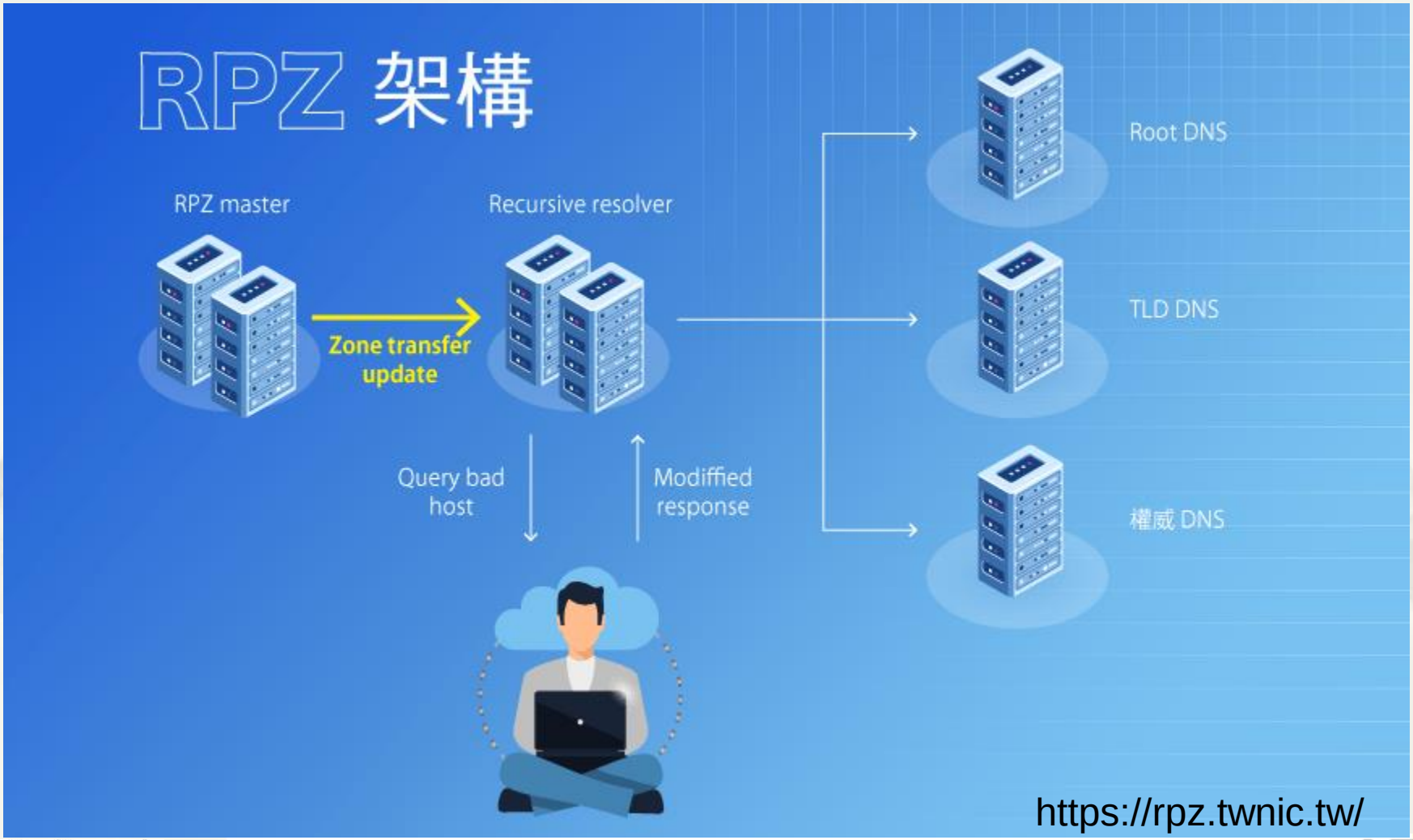
* 直接將惡意 FQDN 建立單獨的 Zone



* Ref. https://hackmd.io/@farmer87/infoblox_local_rpz_rules

回應政策區域
Response Policy Zone (RPZ)

RPZ 架構


RPZ 架構
RPZ master
Recursive resolver
Zone transfer update
Root DNS
TLD DNS
權威 DNS
Query bad host
Modiffied response
https://rpz.twnic.tw/

RPZ

- 回應政策區域 (Response Policy Zone, RPZ)
  - DNS Resolver 提供的功能，也可稱為DNS防火牆
- Support
  - BIND v9.8+ support up to 64 Response Policy Zones
    - https://bind9.readthedocs.io/en/latest/chapter6.html#dns-firewalls-and-response-policy-zones
  - Unbound
    - https://unbound.docs.nlnetlabs.nl/en/latest/topics/filtering/rpz.html
  - PowerDNS Recursor v4+
- Not Support
  - Windows DNS Server

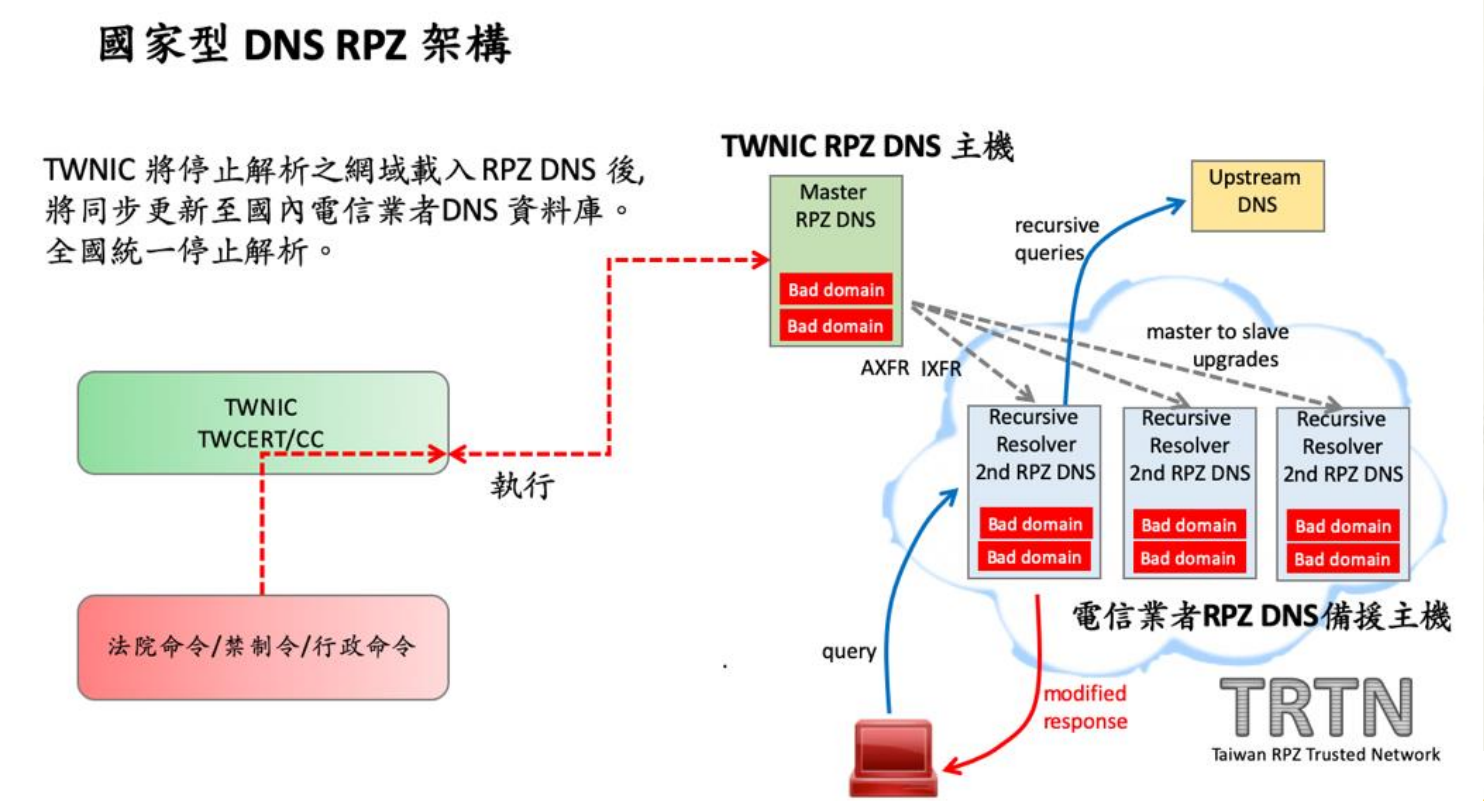
RPZ 之限制與使用疑慮

- 使用類似 DNS Spoof 方式變更原查詢結果
  - 破壞 DNSSEC Chain of Trust 信任架構
  - 無法提供合法 HTTPS 憑證，Redirect to 警告頁面會顯示不安全
    - 若原網站有啟用 HSTS 限制，將無法 Redirect to 警告頁面
- 使用 Zone Transfer 方式傳輸 RPZ Zone File
  - 雙方未認證且使用明碼傳輸，可能遭受 Man-in-the-Middle 中間人攻擊 .
  - 來源 Primary DNS Server 若遭駭客攻陷，可能派送惡意資料，將正常網站導向駭客網站.
- 約 20% 連線單位使用 Windows DNS Server，但不支援 RPZ.

教育體系
現有 RPZ 聯防案例

TWNIC RPZ

- https://rpz.twnic.tw/
- 使用方式: DNS Zone Transfer
- 缺點: 加入單位，會收到許多 RPZ 清單異動公文



TWNIC RPZ 清單案例

rpztw. 300 IN SOA localhost. This.is.an.infringing.website.rpztw. 1740707761 60 60 86400 60

rpztw.	300 IN NS localhost.
tw21.joom.ac.rpztw.	300 IN A 34.102.218.71
*.tw21.joom.ac.rpztw.	300 IN A 34.102.218.71
tw22.joom.ac.rpztw.	300 IN A 34.102.218.71
*.tw22.joom.ac.rpztw.	300 IN A 34.102.218.71
tw23.joom.ac.rpztw.	300 IN A 34.102.218.71
*.tw23.joom.ac.rpztw.	300 IN A 34.102.218.71

....

資安院 RPZ

* 使用方式
  * 使用 Web URL 搭配 Token ID 下載
  * https://ironcloak.nics.nat.gov.tw/api/get_linux_blacklist_dn/<Token-ID>
* 缺點
  * 需自行設定 Cron Job 才能自動下載 RPZ Zone File

* Zone File 案例

```
$TTL 30
@   SOA rpz.nics.nat.gov.tw. hostmaster.nics.nat.gov.tw. 2024091815 300 1800 604800 30
    NS  localhost.
360photo.oss-cn-hongkong.aliyuncs.com CNAME .
ab27.ciscosrv.com                     CNAME .
administrators.ga                     CNAME .
adobe-flash-player.live               CNAME .
amazon.panasocin.com                  CNAME .
ap21.ilvsmail.com                     CNAME .
ap97.cksogo.com                       CNAME .
...
```

教育部 RPZ BIND Config

```
options {
  response-policy {
    zone "rpztw";
    zone "rpzmoe";
  };
};
zone "rpztw" {
  type slave;
  file "rpztw";
  masters {
    140.111.12.87;
  };
  allow-query {
    localhost;
  };
};
```

```
zone "rpzmoe" {
  type slave;
  file "rpzmoe";
  masters {
    140.111.12.87;
  };
  allow-query {
    localhost;
  };
};
```

Zone File: rpztw

```
rpztw.  300 IN SOA  localhost. This.is.an.infringing.website.rpztw. 1746667741 60 60 86400 60
rpztw.  300 IN NS   localhost.
twa11.joom.ac.rpztw.          300   IN   A   34.102.218.71
*.twa11.joom.ac.rpztw.        300   IN   A   34.102.218.71
twshop15.joom.ac.rpztw.       300   IN   A   34.102.218.71
*.twshop15.joom.ac.rpztw.     300   IN   A   34.102.218.71
twshop26.joom.ac.rpztw.       300   IN   A   34.102.218.71
*.twshop26.joom.ac.rpztw.     300   IN   A   34.102.218.71
twshop28.joom.ac.rpztw.       300   IN   A   34.102.218.71
*.twshop28.joom.ac.rpztw.     300   IN   A   34.102.218.71
twshop39.joom.ac.rpztw.       300   IN   A   34.102.218.71
*.twshop39.joom.ac.rpztw.     300   IN   A   34.102.218.71
twshop45.joom.ac.rpztw.       300   IN   A   34.102.218.71
*.twshop45.joom.ac.rpztw.     300   IN   A   34.102.218.71
twshop5.joom.ac.rpztw.        300   IN   A   34.102.218.71
*.twshop5.joom.ac.rpztw.      300   IN   A   34.102.218.71
okex.ac.rpztw.                300   IN   A   182.173.0.181
*.okex.ac.rpztw.              300   IN   A   182.173.0.181
....
www.methe.shop.rpztw.         300   IN   A   34.102.218.71
....
```

Zone File: rpzmoe

```
rpzmoe.  300  IN  SOA  localhost. root.localhost. 2025031001 3600 900 604800 3600
rpzmoe.  300  IN  NS   localhost.
testrpzblock.edu.tw.rpzmoe. 300 IN      CNAME   .
```

Convert Zone File Format

- raw to text

  ~# named-compilezone -f raw -F text -o example.com.text example.com example.com.raw

- text to raw

  ~# named-compilezone -f text -F raw -o example.com.raw example.com example.com.text

教育部 RPZ

* Zone Transfer
  ~# dig axfr rpztw @140.111.12.87
  ~# dig axfr rpzmoe @140.111.12.87

* 人工網頁下載(待更新)
  * https://noc.tanet.edu.tw/index.php/download/ip/1435-4

黑名單測試
www.methe.shop

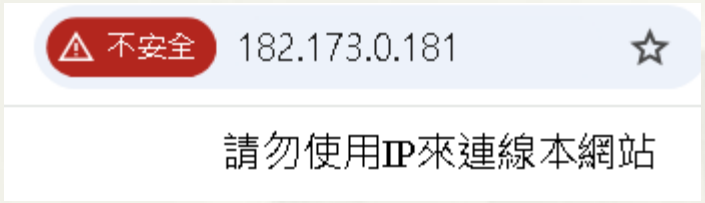
```
C:\Users\user>nslookup
預設伺服器:  dns.google
Address:  8.8.8.8

> www.methe.shop
伺服器:  dns.google
Address:  8.8.8.8

未經授權的回答:
名稱:    methe.shop
Address:  20.239.70.103
Aliases:  www.methe.shop

> server 140.112.254.65
預設伺服器:  ccdns1.cc.ntu.edu.tw
Address:  140.112.254.65

> www.methe.shop
伺服器:  ccdns1.cc.ntu.edu.tw
Address:  140.112.254.65

未經授權的回答:
名稱:    www.methe.shop
Address:  34.102.218.71
```

原始記錄

RPZ 記錄

Redirect to 警告頁面

Redirect to 警告頁面



Redirect to 警告頁面

RPZ 語法介紹

7 Types of Actions

- Redirect to specific IP or Domain with a warning page.
  - A 192.168.10.100
  - CNAME www.drop.com
- CNAME .
  - Return NXDOMAIN
- CNAME *.
  - Return NODATA (empty NOERROR)
- CNAME *.badrpz.com.
  - Redirect to prepend subdomain
- CNAME rpz-passthru.
  - PASSTHRU RPZ(跳過 RPZ 檢查)
- CNAME rpz-drop.
  - DROP Action
- CNAME rpz-tcp-only.
  - Change to use TCP that require DNS client to responses with TCP.

NXDOMAIN vs. NODATA(empty NOERROR)

- NXDOMAIN
  - dig xyz.google.com @8.8.8.8
  - dig xyz.edu.com @8.8.8.8

```
;; ->>HEADER<<- opcode: QUERY, status: NXDOMAIN, id: 37586
;; flags: qr rd ra; QUERY: 1, ANSWER: 0, AUTHORITY: 1, ADDITIONAL: 1

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 512
;; QUESTION SECTION:
;xyz.edu.com.                   IN      A

;; AUTHORITY SECTION:
edu.com.                600     IN      SOA     ns37.domaincontrol.com.
```

- NODATA(empty NOERROR)
  - dig xyz.ibm.com @8.8.8.8
  - dig xyz.apple.com @8.8.8.8

```
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 9534
;; flags: qr rd ra; QUERY: 1, ANSWER: 0, AUTHORITY: 1, ADDITIONAL: 1

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 512
;; QUESTION SECTION:
;xyz.apple.com.                 IN      A

;; AUTHORITY SECTION:
apple.com.              300     IN      SOA     ns-ext-prod.jackfruit.apple.com.
```

CNAME rpz-tcp-only.

- dig tcp.tesla.com @127.0.0.1

```
root@ubuntu24-BIND:~# dig tcp.tesla.com @127.0.0.1
;; Truncated, retrying in TCP mode.

; <<>> DiG 9.18.30-0ubuntu0.24.04.2-Ubuntu <<>> tcp.tesla.com @127.0.0.1
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NXDOMAIN, id: 31525
;; flags: qr rd ra; QUERY: 1, ANSWER: 0, AUTHORITY: 1, ADDITIONAL: 1

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 1232
; COOKIE: 5f8653de62fd2e4001000000068216391dbf6142b5ce3a7fb (good)
;; QUESTION SECTION:
;tcp.tesla.com.                 IN      A

;; AUTHORITY SECTION:
tesla.com.              10800   IN      SOA     edns69.ultradns.com. noc.

;; Query time: 331 msec
;; SERVER: 127.0.0.1#53(127.0.0.1) (TCP)
;; WHEN: Mon May 12 10:57:21 CST 2025
;; MSG SIZE  rcvd: 144
```

CNAME *.badrpz.com.

- dig prepend.tesla.com @127.0.0.1

```
root@ubuntu24-BIND:~# dig prepend.tesla.com @127.0.0.1

; <<>> DiG 9.18.30-0ubuntu0.24.04.2-Ubuntu <<>> prepend.tesla.com @127.0.0.1
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 57880
;; flags: qr rd ra; QUERY: 1, ANSWER: 2, AUTHORITY: 0, ADDITIONAL: 2

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 1232
; COOKIE: b03185a46c53c7c9010000000682164a32a0317069a100093 (good)
;; QUESTION SECTION:
;prepend.tesla.com.             IN      A

;; ANSWER SECTION:
prepend.tesla.com.      5       IN      CNAME   prepend.tesla.com.badrpz.com.
prepend.tesla.com.badrpz.com. 1800 IN   A       192.168.10.10

;; ADDITIONAL SECTION:
my.rpz.                 1800    IN      SOA     localhost. root.localhost. 100 86400 7200 604800 3600
```

CNAME rpz-passthru.
CNAME rpz-drop.

* dig passthru.tesla.com @127.0.0.1

```
root@ubuntu24-BIND:~# dig passthru.tesla.com @127.0.0.1

; <<>> DiG 9.18.30-0ubuntu0.24.04.2-Ubuntu <<>> passthru.tesla.com @127.0.0.1
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NXDOMAIN, id: 13155
;; flags: qr rd ra; QUERY: 1, ANSWER: 0, AUTHORITY: 1, ADDITIONAL: 1

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 1232
; COOKIE: 8d1629f3997e6a67010000006821656aa32b94ccf562621b (good)
;; QUESTION SECTION:
;passthru.tesla.com.            IN      A

;; AUTHORITY SECTION:
tesla.com.              10800   IN      SOA     edns69.ultradns.com. noc.teslamotors.com.
```

* dig drop.tesla.com @127.0.0.1

```
root@ubuntu24-BIND:~# dig drop.tesla.com @127.0.0.1
;; communications error to 127.0.0.1#53: timed out
;; communications error to 127.0.0.1#53: timed out
;; communications error to 127.0.0.1#53: timed out
```

5 Types of Trigger

- Query name
  - www.tesla.com.my.rpz. A 1.1.1.1
  - web.tesla.com A 1.1.1.1 ; .my.rpz. 可省略
  - *.apple.com A 1.1.1.1
  - wildcard 作用於目前 domain, sub-domain, sub-sub-domain, ..., 但仍以 specific RR 記錄優先.
- Authoritative DNS Server IP
  - 32.1.11.117.140.rpz-nsip CNAME .
    - IP 140.117.11.1/32
  - 24.0.11.117.140.rpz-nsip CNAME .
    - IP 140.117.11.0/24
- FQDN of Authoritative DNS Server
  - nsbackup.ntut.edu.tw.rpz-nsdname CNAME .
  - *.ntut.edu.tw.rpz-nsdname CNAME .
- User Client IP
  - 8.0.0.0.10.rpz-client-ip CNAME .
    - IP 10.0.0.0/8
- DNS Answer: A record(IP addr)
  - 32.102.8.112.140.rpz-ip CNAME .

Authoritative DNS Server IP

* 需先查詢 NS 記錄
* ~# dig ns nsysu.edu.tw

```
;; ANSWER SECTION:
nsysu.edu.tw.           300     IN      NS      dns.nsysu.edu.tw.
nsysu.edu.tw.           300     IN      NS      dns2.nsysu.edu.tw.

;; ADDITIONAL SECTION:
dns.nsysu.edu.tw.       300     IN      A       140.117.11.1
dns2.nsysu.edu.tw.      300     IN      A       140.117.11.11
dns.nsysu.edu.tw.       300     IN      AAAA    2001:288:8001:11::11
```

32.1.11.117.140.rpz-nsip CNAME .

32.11.11.117.140.rpz-nsip CNAME .

or

24.0.11.117.140.rpz-nsip CNAME .

FQDN of Authoritative DNS Server

* 需先查詢 NS 記錄
* ~# dig ns ntut.edu.tw @168.95.1.1

```
;; ANSWER SECTION:
ntut.edu.tw.            600     IN      NS      nsbackup.ntut.edu.tw.
ntut.edu.tw.            600     IN      NS      galaxy.cc.ntut.edu.tw.
```

nsbackup.ntut.edu.tw.rpz-nsdname CNAME .

galaxy.cc.ntut.edu.tw.rpz-nsdname CNAME .

or

*.ntut.edu.tw.rpz-nsdname CNAME *.badrpz.com.

DNS Answer: A record (IP addr)

* 阻擋 www.cc.ntu.edu.tw
  * 32.102.8.112.140.rpz-ip CNAME .

```
> www.cc.ntu.edu.tw
伺服器:  [8.8.8.8]
Address:  8.8.8.8

未經授權的回答:
名稱:    www.cc.ntu.edu.tw
Address:  140.112.8.102
```

* 阻擋 www.aaa.com (有 cname)
  * 32.121.66.60.45.rpz-ip CNAME .

```
> www.aaa.com
伺服器:  [8.8.8.8]
Address:  8.8.8.8

未經授權的回答:
名稱:    ayv797h.impervadns.net
Address:  45.60.66.121
Aliases:  www.aaa.com
```

```
root@ubuntu24-BIND:~# dig www.aaa.com @127.0.0.1

; <<>> DiG 9.18.30-0ubuntu0.24.04.2-Ubuntu <<>> www.aaa.com @127.0.0.1
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NXDOMAIN, id: 26895
;; flags: qr rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 0, ADDITIONAL: 2

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 1232
; COOKIE: 1d808e3ca441666f01000000680b597fac0672610e389be3 (good)
;; QUESTION SECTION:
;www.aaa.com.                   IN      A

;; ANSWER SECTION:
www.aaa.com.            180     IN      CNAME   ayv797h.impervadns.net.

;; ADDITIONAL SECTION:
my.rpz.                 1800    IN      SOA     localhost. root.localhost. 100 86400 7200 604800 3600
```

RPZ 是否與 DNSSEC 衝突?

RPZ 是否與 DNSSEC 衝突?

~# dig log.twnic.net.tw @127.0.0.1

```
;; ANSWER SECTION:
log.twnic.net.tw.       5       IN      A       2.2.2.2

;; ADDITIONAL SECTION:
my.rpz.                 1800    IN      SOA     localhost.
```

~# dig +dnssec log.twnic.net.tw @127.0.0.1

```
;; ANSWER SECTION:
log.twnic.net.tw.       3009    IN      A       211.72.210.212
log.twnic.net.tw.       3009    IN      RRSIG   A 8 4 3600 20250604071126 20250505071126
IaiYB16 rEJGg+WK4cZruoXSxOISy9Bq9YcTB1I0g1Tum23wN+1hdcfxCfiBQMUL 8LsKp4sniWCM2pj0km3uuwQA
```

* 結果不同

RPZ 是否與 DNSSEC 衝突?

* 解決方法

~# nano /etc/bind/named.conf.options

response-policy { zone my.rpz; } break-dnssec yes;

~# systemctl restart bind9

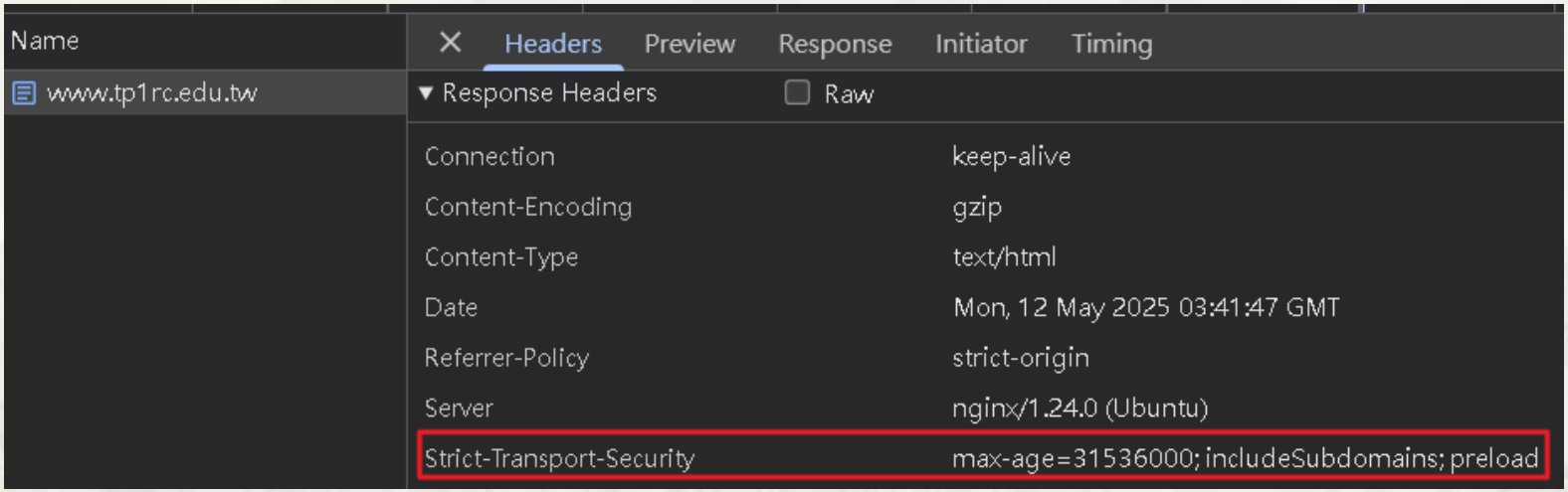
~# dig +dnssec log.twnic.net.tw @127.0.0.1

```
;; ANSWER SECTION:
log.twnic.net.tw.       5       IN      A       2.2.2.2

;; ADDITIONAL SECTION:
my.rpz.                 1800    IN      SOA     localhost. root.localhost.
```

RPZ Redirect to 警告頁面
受 HSTS 限制

HSTS
HTTP Strict Transport Security

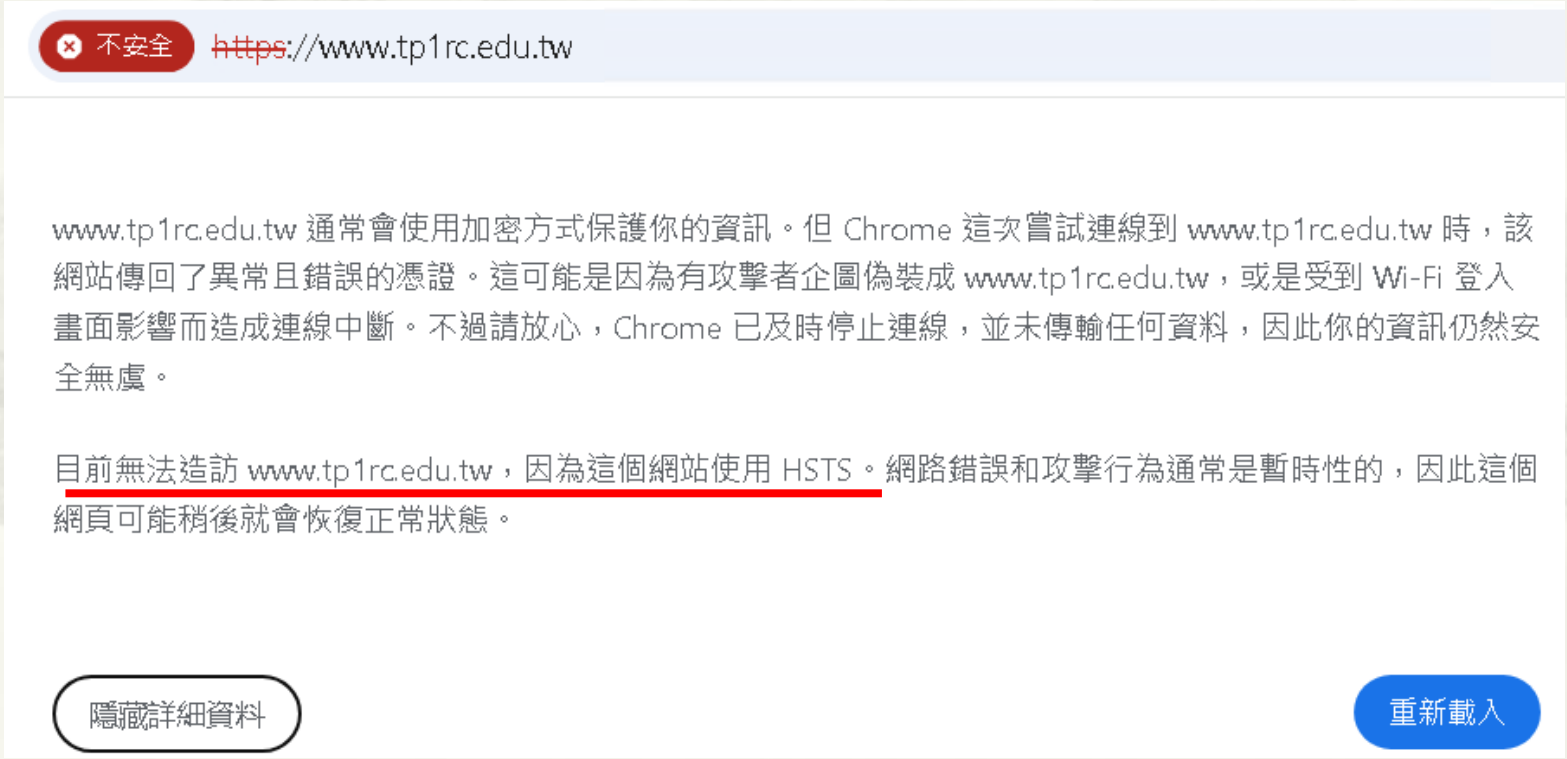
* www.tp1rc.edu.tw
  * Chrome F12



  * 在 31536000秒（365天）中，需使用 HTTPS 連線，且若網頁憑證無效，不能忽略警告繼續存取網站。
  * includeSubdomains; preload -- 子域名網站也適用

HSTS
HTTP Strict Transport Security

* 因 HSTS 限制，https://www.tp1rc.edu.tw 無法 Redirect to 警告頁面



Convert to RPZ Format

- a command-line tool written in Go for converting a list of domain names and IP into a RPZ file format.
  - https://github.com/pure-dns/easyrpz
- 語法

```
easyrpz \
  -i inputFile1.hosts \
  -i http://example.com/inputFile2.hosts \
  -e excludeFile1.txt \
  -e http://example.com/excludeFile2.txt \
  -o outputFile.rpz
```

Ref.

- https://dnsrpz.info/
- https://www.isc.org/rpz/
- https://www.ietf.org/archive/id/draft-vixie-dnsop-dns-rpz-00.txt
- https://rpz-block-list.readthedocs.io/en/latest/indexTOC.html
- https://www.zytrax.com/books/dns/ch7/rpz.html

簡報完畢
謝謝