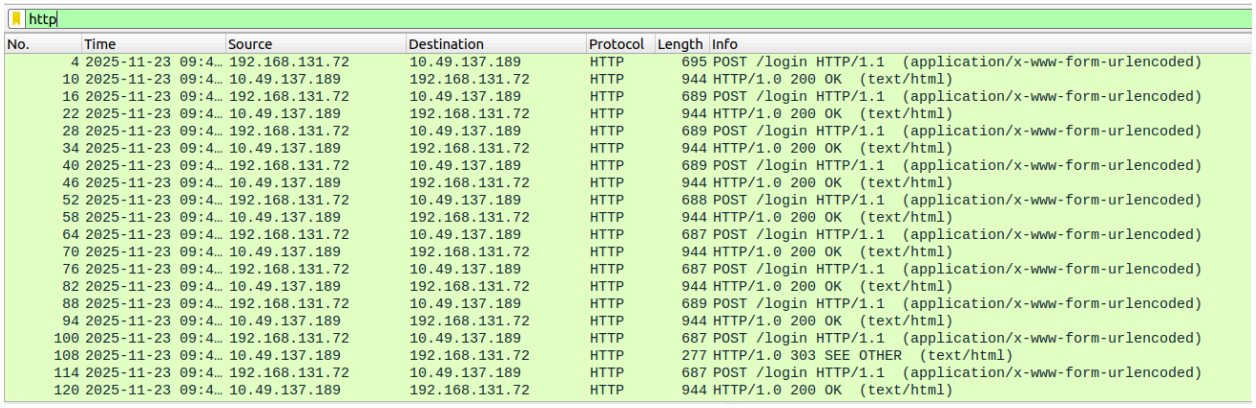
Attack 1

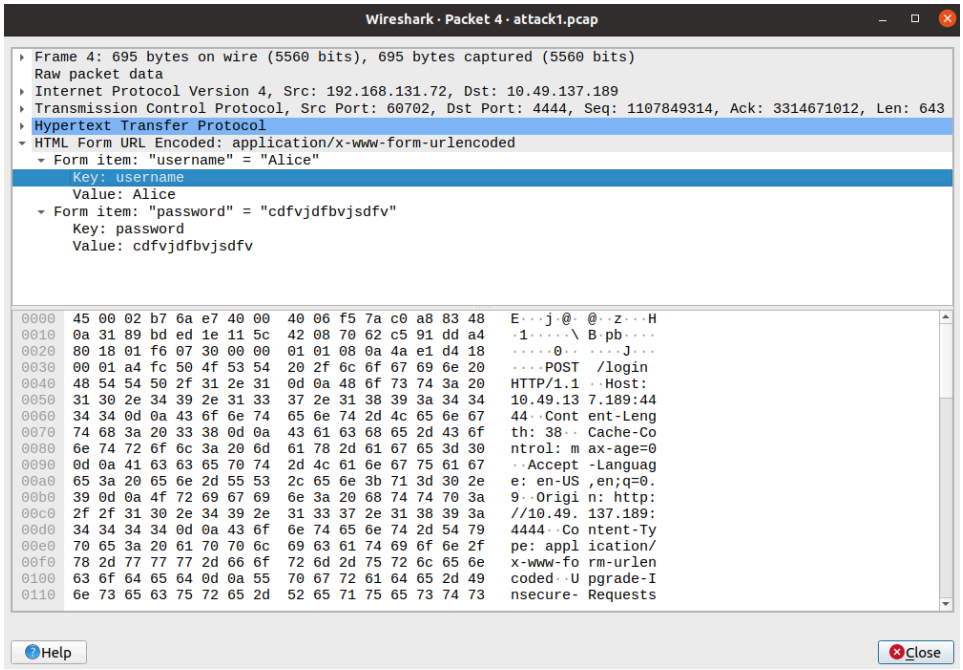
Analysing attack1.pcap, we can see that there are many POST /login requests from 192.168.131.72 to 10.49.137.189.
The image below shows the attack1.pcap in Wireshark with the “http” filter.



http

No.	Time	Source	Destination	Protocol	Length	Info
4	2025-11-23 09:4…	192.168.131.72	10.49.137.189	HTTP	695	POST /login HTTP/1.1 (application/x-www-form-urlencoded)
10	2025-11-23 09:4…	10.49.137.189	192.168.131.72	HTTP	944	HTTP/1.0 200 OK (text/html)
16	2025-11-23 09:4…	192.168.131.72	10.49.137.189	HTTP	689	POST /login HTTP/1.1 (application/x-www-form-urlencoded)
22	2025-11-23 09:4…	10.49.137.189	192.168.131.72	HTTP	944	HTTP/1.0 200 OK (text/html)
28	2025-11-23 09:4…	192.168.131.72	10.49.137.189	HTTP	689	POST /login HTTP/1.1 (application/x-www-form-urlencoded)
34	2025-11-23 09:4…	10.49.137.189	192.168.131.72	HTTP	944	HTTP/1.0 200 OK (text/html)
40	2025-11-23 09:4…	192.168.131.72	10.49.137.189	HTTP	689	POST /login HTTP/1.1 (application/x-www-form-urlencoded)
46	2025-11-23 09:4…	10.49.137.189	192.168.131.72	HTTP	944	HTTP/1.0 200 OK (text/html)
52	2025-11-23 09:4…	192.168.131.72	10.49.137.189	HTTP	688	POST /login HTTP/1.1 (application/x-www-form-urlencoded)
58	2025-11-23 09:4…	10.49.137.189	192.168.131.72	HTTP	944	HTTP/1.0 200 OK (text/html)
64	2025-11-23 09:4…	192.168.131.72	10.49.137.189	HTTP	687	POST /login HTTP/1.1 (application/x-www-form-urlencoded)
70	2025-11-23 09:4…	10.49.137.189	192.168.131.72	HTTP	944	HTTP/1.0 200 OK (text/html)
76	2025-11-23 09:4…	192.168.131.72	10.49.137.189	HTTP	687	POST /login HTTP/1.1 (application/x-www-form-urlencoded)
82	2025-11-23 09:4…	10.49.137.189	192.168.131.72	HTTP	944	HTTP/1.0 200 OK (text/html)
88	2025-11-23 09:4…	192.168.131.72	10.49.137.189	HTTP	689	POST /login HTTP/1.1 (application/x-www-form-urlencoded)
94	2025-11-23 09:4…	10.49.137.189	192.168.131.72	HTTP	944	HTTP/1.0 200 OK (text/html)
100	2025-11-23 09:4…	192.168.131.72	10.49.137.189	HTTP	687	POST /login HTTP/1.1 (application/x-www-form-urlencoded)
108	2025-11-23 09:4…	10.49.137.189	192.168.131.72	HTTP	277	HTTP/1.0 303 SEE OTHER (text/html)
114	2025-11-23 09:4…	192.168.131.72	10.49.137.189	HTTP	687	POST /login HTTP/1.1 (application/x-www-form-urlencoded)
120	2025-11-23 09:4…	10.49.137.189	192.168.131.72	HTTP	944	HTTP/1.0 200 OK (text/html)

Upon taking a closer look at each of the POST requests, we notice that the suspicious user is trying to brute force the password for Alice.



Wireshark · Packet 4 · attack1.pcap

```
▸ Frame 4: 695 bytes on wire (5560 bits), 695 bytes captured (5560 bits)
  Raw packet data
▸ Internet Protocol Version 4, Src: 192.168.131.72, Dst: 10.49.137.189
▸ Transmission Control Protocol, Src Port: 60702, Dst Port: 4444, Seq: 1107849314, Ack: 3314671012, Len: 643
▸ Hypertext Transfer Protocol
▾ HTML Form URL Encoded: application/x-www-form-urlencoded
  ▾ Form item: "username" = "Alice"
      Key: username
      Value: Alice
  ▾ Form item: "password" = "cdfvjdfbvjsdfv"
      Key: password
      Value: cdfvjdfbvjsdfv
```

```
0000  45 00 02 b7 6a e7 40 00  40 06 f5 7a c0 a8 83 48   E···j·@· @··z···H
0010  0a 31 89 bd ed 1e 11 5c  42 08 70 62 c5 91 dd a4   ·1·····\ B·pb····
0020  80 18 01 f6 07 30 00 00  01 01 08 0a 4a e1 d4 18   ·····0·· ····J···
0030  00 01 a4 fc 50 4f 53 54  20 2f 6c 6f 67 69 6e 20   ····POST  /login
0040  48 54 54 50 2f 31 2e 31  0d 0a 48 6f 73 74 3a 20   HTTP/1.1 ··Host:
0050  31 30 2e 34 39 2e 31 33  37 2e 31 38 39 3a 34 34   10.49.13 7.189:44
0060  34 34 0d 0a 43 6f 6e 74  65 6e 74 2d 4c 65 6e 67   44··Cont ent-Leng
0070  74 68 3a 20 33 38 0d 0a  43 61 63 68 65 2d 43 6f   th: 38·· Cache-Co
0080  6e 74 72 6f 6c 3a 20 6d  61 78 2d 61 67 65 3d 30   ntrol: m ax-age=0
0090  0d 0a 41 63 63 65 70 74  2d 4c 61 6e 67 75 61 67   ··Accept -Languag
00a0  65 3a 20 65 6e 2d 55 53  2c 65 6e 3b 71 3d 30 2e   e: en-US ,en;q=0.
00b0  39 0d 0a 4f 72 69 67 69  6e 3a 20 68 74 74 70 3a   9··Origi n: http:
00c0  2f 2f 31 30 2e 34 39 2e  31 33 37 2e 31 38 39 3a   //10.49. 137.189:
00d0  34 34 34 34 0d 0a 43 6f  6e 74 65 6e 74 2d 54 79   4444··Co ntent-Ty
00e0  70 65 3a 20 61 70 70 6c  69 63 61 74 69 6f 6e 2f   pe: appl ication/
00f0  78 2d 77 77 77 2d 66 6f  72 6d 2d 75 72 6c 65 6e   x-www-fo rm-urlen
0100  63 6f 64 65 64 0d 0a 55  70 67 72 61 64 65 2d 49   coded··U pgrade-I
0110  6e 73 65 63 75 72 65 2d  52 65 71 75 65 73 74 73   nsecure- Requests
```

Help Close

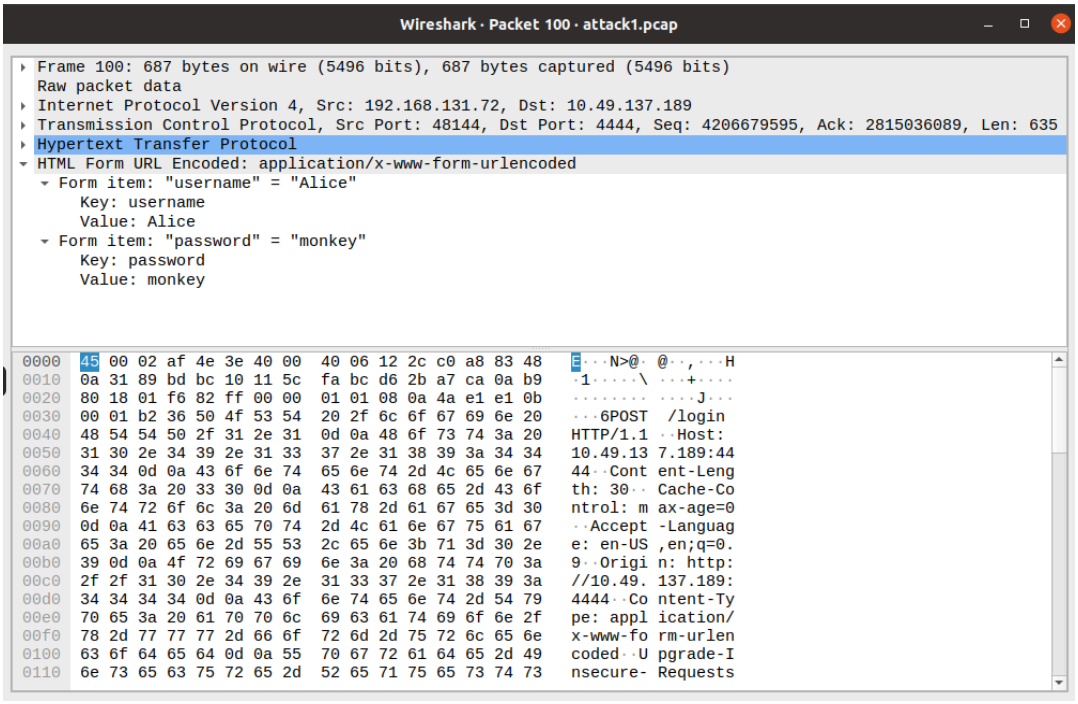
Based on the HTTP packets, we notice that the packet length for a failed password is 944, with HTTP 200 OK. As such, we can use Wireshark to filter the packets with “http and frame.len != 944” rule and the result is shown below.

http and frame.len != 944

No.	Time	Source	Destination	Protocol	Length	Info
4	2025-11-23 09:4…	192.168.131.72	10.49.137.189	HTTP	695	POST /login HTTP/1.1 (application/x-www-form-urlencoded)
16	2025-11-23 09:4…	192.168.131.72	10.49.137.189	HTTP	689	POST /login HTTP/1.1 (application/x-www-form-urlencoded)
28	2025-11-23 09:4…	192.168.131.72	10.49.137.189	HTTP	689	POST /login HTTP/1.1 (application/x-www-form-urlencoded)
40	2025-11-23 09:4…	192.168.131.72	10.49.137.189	HTTP	689	POST /login HTTP/1.1 (application/x-www-form-urlencoded)
52	2025-11-23 09:4…	192.168.131.72	10.49.137.189	HTTP	688	POST /login HTTP/1.1 (application/x-www-form-urlencoded)
64	2025-11-23 09:4…	192.168.131.72	10.49.137.189	HTTP	687	POST /login HTTP/1.1 (application/x-www-form-urlencoded)
76	2025-11-23 09:4…	192.168.131.72	10.49.137.189	HTTP	687	POST /login HTTP/1.1 (application/x-www-form-urlencoded)
88	2025-11-23 09:4…	192.168.131.72	10.49.137.189	HTTP	689	POST /login HTTP/1.1 (application/x-www-form-urlencoded)
100	2025-11-23 09:4…	192.168.131.72	10.49.137.189	HTTP	687	POST /login HTTP/1.1 (application/x-www-form-urlencoded)
108	2025-11-23 09:4…	10.49.137.189	192.168.131.72	HTTP	277	HTTP/1.0 303 SEE OTHER (text/html)
114	2025-11-23 09:4…	192.168.131.72	10.49.137.189	HTTP	687	POST /login HTTP/1.1 (application/x-www-form-urlencoded)
126	2025-11-23 09:4…	192.168.131.72	10.49.137.189	HTTP	688	POST /login HTTP/1.1 (application/x-www-form-urlencoded)
138	2025-11-23 09:4…	192.168.131.72	10.49.137.189	HTTP	688	POST /login HTTP/1.1 (application/x-www-form-urlencoded)
150	2025-11-23 09:4…	192.168.131.72	10.49.137.189	HTTP	687	POST /login HTTP/1.1 (application/x-www-form-urlencoded)
162	2025-11-23 09:4…	192.168.131.72	10.49.137.189	HTTP	687	POST /login HTTP/1.1 (application/x-www-form-urlencoded)
174	2025-11-23 09:4…	192.168.131.72	10.49.137.189	HTTP	687	POST /login HTTP/1.1 (application/x-www-form-urlencoded)
186	2025-11-23 09:4…	192.168.131.72	10.49.137.189	HTTP	689	POST /login HTTP/1.1 (application/x-www-form-urlencoded)
198	2025-11-23 09:4…	192.168.131.72	10.49.137.189	HTTP	687	POST /login HTTP/1.1 (application/x-www-form-urlencoded)
210	2025-11-23 09:4…	192.168.131.72	10.49.137.189	HTTP	689	POST /login HTTP/1.1 (application/x-www-form-urlencoded)
222	2025-11-23 09:4…	192.168.131.72	10.49.137.189	HTTP	690	POST /login HTTP/1.1 (application/x-www-form-urlencoded)

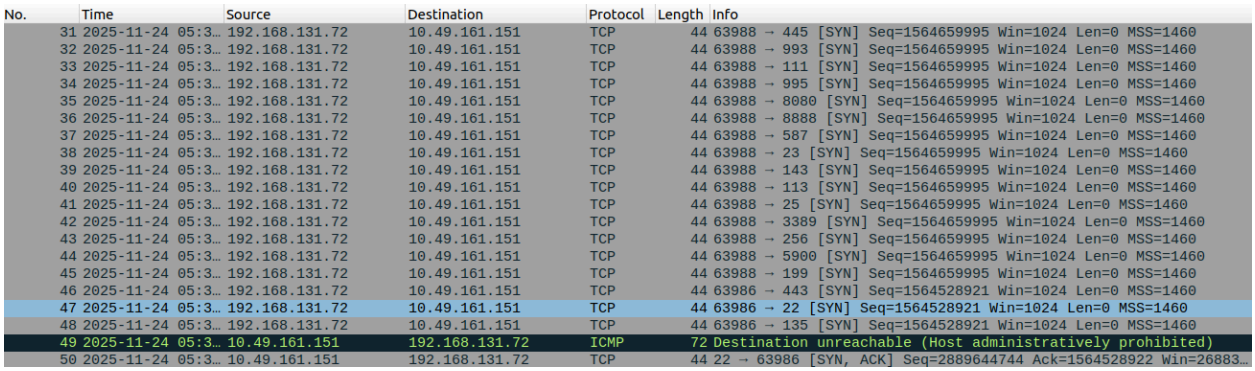
We can see that there is only 1 successful reply, which is captured in packet 108 with the 303 status code. As such, we know that the attacker successfully logged in to the system and gained information.

We know that packet 108 is the result of the HTTP login request on packet 100, so looking at packet 100, we know that the username is Alice and the password is monkey as shown below.



Attack 2

From the image below, attack2.pcap shows many TCP SYN packets being sent from the same IP to the same destination, but to different ports. This resembles reconnaissance through port scanning, to find out which ports are open.



No.	Time	Source	Destination	Protocol	Length	Info
31	2025-11-24 05:3…	192.168.131.72	10.49.161.151	TCP	44	63988 → 445 [SYN] Seq=1564659995 Win=1024 Len=0 MSS=1460
32	2025-11-24 05:3…	192.168.131.72	10.49.161.151	TCP	44	63988 → 993 [SYN] Seq=1564659995 Win=1024 Len=0 MSS=1460
33	2025-11-24 05:3…	192.168.131.72	10.49.161.151	TCP	44	63988 → 111 [SYN] Seq=1564659995 Win=1024 Len=0 MSS=1460
34	2025-11-24 05:3…	192.168.131.72	10.49.161.151	TCP	44	63988 → 995 [SYN] Seq=1564659995 Win=1024 Len=0 MSS=1460
35	2025-11-24 05:3…	192.168.131.72	10.49.161.151	TCP	44	63988 → 8080 [SYN] Seq=1564659995 Win=1024 Len=0 MSS=1460
36	2025-11-24 05:3…	192.168.131.72	10.49.161.151	TCP	44	63988 → 8888 [SYN] Seq=1564659995 Win=1024 Len=0 MSS=1460
37	2025-11-24 05:3…	192.168.131.72	10.49.161.151	TCP	44	63988 → 587 [SYN] Seq=1564659995 Win=1024 Len=0 MSS=1460
38	2025-11-24 05:3…	192.168.131.72	10.49.161.151	TCP	44	63988 → 23 [SYN] Seq=1564659995 Win=1024 Len=0 MSS=1460
39	2025-11-24 05:3…	192.168.131.72	10.49.161.151	TCP	44	63988 → 143 [SYN] Seq=1564659995 Win=1024 Len=0 MSS=1460
40	2025-11-24 05:3…	192.168.131.72	10.49.161.151	TCP	44	63988 → 113 [SYN] Seq=1564659995 Win=1024 Len=0 MSS=1460
41	2025-11-24 05:3…	192.168.131.72	10.49.161.151	TCP	44	63988 → 25 [SYN] Seq=1564659995 Win=1024 Len=0 MSS=1460
42	2025-11-24 05:3…	192.168.131.72	10.49.161.151	TCP	44	63988 → 3389 [SYN] Seq=1564659995 Win=1024 Len=0 MSS=1460
43	2025-11-24 05:3…	192.168.131.72	10.49.161.151	TCP	44	63988 → 256 [SYN] Seq=1564659995 Win=1024 Len=0 MSS=1460
44	2025-11-24 05:3…	192.168.131.72	10.49.161.151	TCP	44	63988 → 5900 [SYN] Seq=1564659995 Win=1024 Len=0 MSS=1460
45	2025-11-24 05:3…	192.168.131.72	10.49.161.151	TCP	44	63988 → 199 [SYN] Seq=1564659995 Win=1024 Len=0 MSS=1460
46	2025-11-24 05:3…	192.168.131.72	10.49.161.151	TCP	44	63986 → 443 [SYN] Seq=1564528921 Win=1024 Len=0 MSS=1460
47	2025-11-24 05:3…	192.168.131.72	10.49.161.151	TCP	44	63986 → 22 [SYN] Seq=1564528921 Win=1024 Len=0 MSS=1460
48	2025-11-24 05:3…	192.168.131.72	10.49.161.151	TCP	44	63986 → 135 [SYN] Seq=1564528921 Win=1024 Len=0 MSS=1460
49	2025-11-24 05:3…	10.49.161.151	192.168.131.72	ICMP	72	Destination unreachable (Host administratively prohibited)
50	2025-11-24 05:3…	10.49.161.151	192.168.131.72	TCP	44	22 → 63986 [SYN, ACK] Seq=2889644744 Ack=1564528922 Win=26883…

As such, I created a rule as shown below to detect TCP SYN port scanning. It checks for SYN flags and will trigger alerts based on threshold, tracked by source. The threshold that I have set is 1000 SYN packets within 5 seconds.

```
# Port Scanning
alert tcp any any -> any any (msg:"Possible TCP SYN port scanning"; flags:S; threshold:type
threshold, track by_src, count 1000, seconds 5; classtype: network-scan; sid:1000021; rev:1;)
```

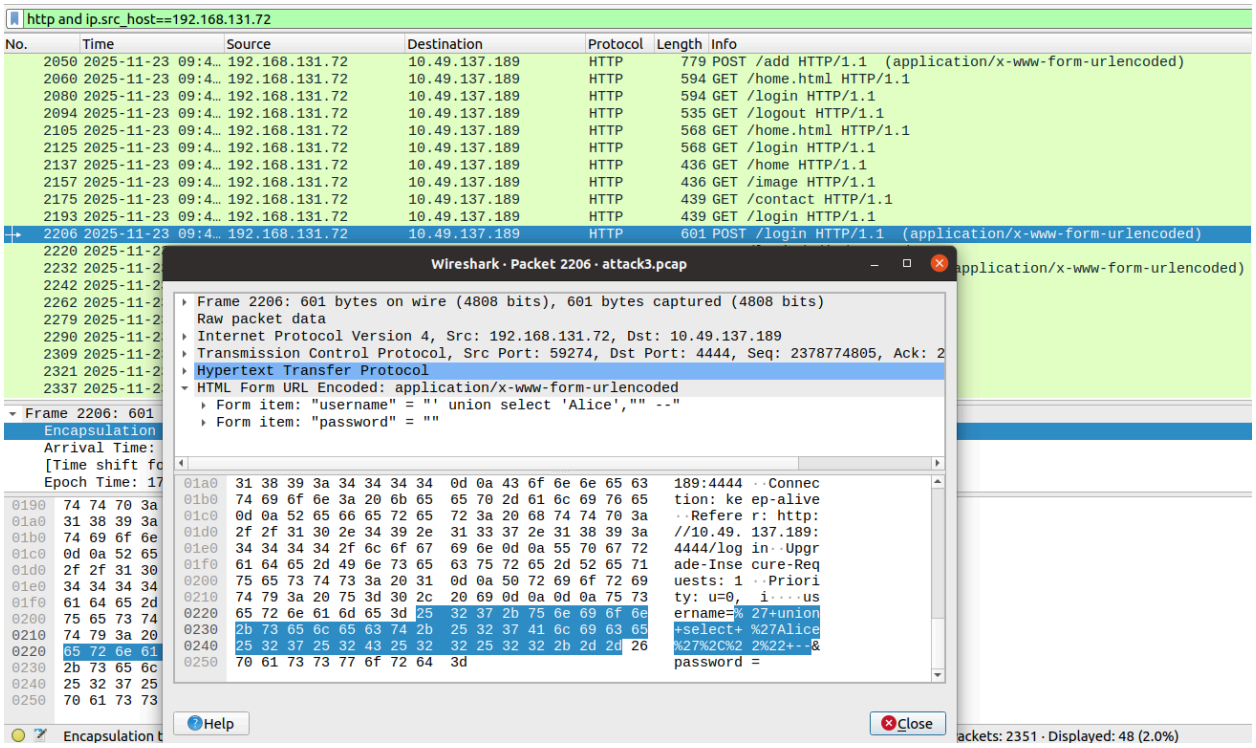
After sending attack2.pcap to suricata, we can see that there is an alert trigger in the logs.

```
root@1006859:/home/seed/Desktop/IDS/PCAPS# cat /var/log/suricata/eve.json |
 grep -a "Possible TCP SYN port scanning"
{"timestamp":"2025-11-24T05:33:15.962767-0500","flow_id":1038831234063638,"
pcap_cnt":1084,"event_type":"alert","src_ip":"192.168.131.72","src_port":63
986,"dest_ip":"10.49.161.151","dest_port":2608,"proto":"TCP","ip_v":4,"pkt_
src":"wire/pcap","alert":{"action":"allowed","gid":1,"signature_id":1000021
,"rev":1,"signature":"Possible TCP SYN port scanning","category":"Detection
 of a Network Scan","severity":3},"direction":"to_server","flow":{"pkts_tos
erver":1,"pkts_toclient":0,"bytes_toserver":44,"bytes_toclient":0,"start":"
2025-11-24T05:33:15.962767-0500","src_ip":"192.168.131.72","dest_ip":"10.49
.161.151","src_port":63986,"dest_port":2608}}
```

Through Wireshark, we know that the attacker is performing SYN port scanning.

Attack 3

From the image below, attack3.pcap contains POST requests with suspicious field content. Upon taking a look at the POST request to /login, I notice that there seems to be a UNION SQL injection, where the attacker uses “union select” to extract additional information from the database.



As such, I created a rule to detect HTTP inputs that contain “union”, followed by “select”, case insensitive as shown below.

```
# UNION SQL Injection
alert http any any -> any any (msg:"Possible UNION SQL injection"; flow:established,to_server;
content:"union"; nocase; content:"select"; nocase; distance:0; classtype:web-application-
attack; sid:1000022; rev:1;)
```

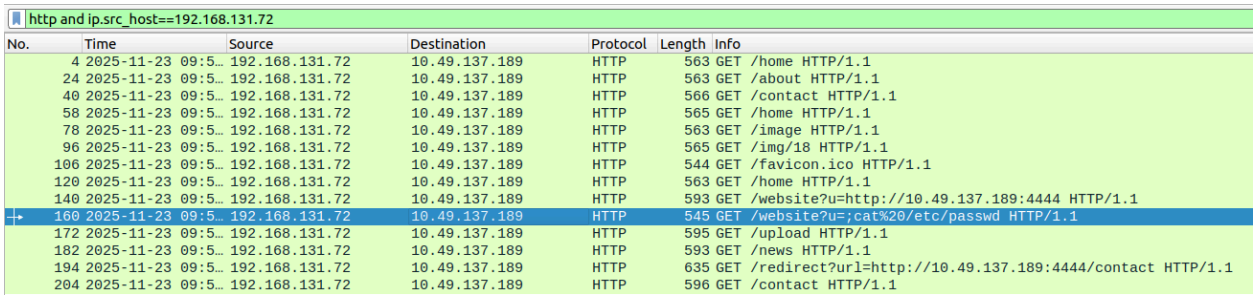
After sending attack3.pcap to suricata, we can see that there is an alert trigger in the logs.

```
root@1006859:/home/seed/Desktop/IDS/PCAPS# cat /var/log/suricata/eve.json |
 grep -a "Possible UNION SQL injection"
{"timestamp":"2025-11-23T09:47:42.237379-0500","flow_id":1798199931839800,"
pcap_cnt":2209,"event_type":"alert","src_ip":"192.168.131.72","src_port":59
274,"dest_ip":"10.49.137.189","dest_port":4444,"proto":"TCP","ip_v":4,"pkt_
src":"wire/pcap","alert":{"action":"allowed","gid":1,"signature_id":1000022
,"rev":1,"signature":"Possible UNION SQL injection","category":"Web Applica
tion Attack","severity":1},"app_proto":"http","direction":"to_server","flow
":{"pkts_toserver":4,"pkts_toclient":3,"bytes_toserver":765,"bytes_toclient
":188,"start":"2025-11-23T09:47:42.090996-0500","src_ip":"192.168.131.72","
dest_ip":"10.49.137.189","src_port":59274,"dest_port":4444}}
```

Through Wireshark, and observing packet 2206, we know that the attacker is performing SQL injection with UNION.

Attack 4

From the image below, attack4.pcap contains HTTP GET requests on different pages. However, we observe that there is a suspicious GET request that seems to inject a command on the server to read /etc/passwd.



http and ip.src_host==192.168.131.72

No.	Time	Source	Destination	Protocol	Length	Info
4	2025-11-23 09:5…	192.168.131.72	10.49.137.189	HTTP	563	GET /home HTTP/1.1
24	2025-11-23 09:5…	192.168.131.72	10.49.137.189	HTTP	563	GET /about HTTP/1.1
40	2025-11-23 09:5…	192.168.131.72	10.49.137.189	HTTP	566	GET /contact HTTP/1.1
58	2025-11-23 09:5…	192.168.131.72	10.49.137.189	HTTP	565	GET /home HTTP/1.1
78	2025-11-23 09:5…	192.168.131.72	10.49.137.189	HTTP	563	GET /image HTTP/1.1
96	2025-11-23 09:5…	192.168.131.72	10.49.137.189	HTTP	565	GET /img/18 HTTP/1.1
106	2025-11-23 09:5…	192.168.131.72	10.49.137.189	HTTP	544	GET /favicon.ico HTTP/1.1
120	2025-11-23 09:5…	192.168.131.72	10.49.137.189	HTTP	563	GET /home HTTP/1.1
140	2025-11-23 09:5…	192.168.131.72	10.49.137.189	HTTP	593	GET /website?u=http://10.49.137.189:4444 HTTP/1.1
160	2025-11-23 09:5…	192.168.131.72	10.49.137.189	HTTP	545	GET /website?u=;cat%20/etc/passwd HTTP/1.1
172	2025-11-23 09:5…	192.168.131.72	10.49.137.189	HTTP	595	GET /upload HTTP/1.1
182	2025-11-23 09:5…	192.168.131.72	10.49.137.189	HTTP	593	GET /news HTTP/1.1
194	2025-11-23 09:5…	192.168.131.72	10.49.137.189	HTTP	635	GET /redirect?url=http://10.49.137.189:4444/contact HTTP/1.1
204	2025-11-23 09:5…	192.168.131.72	10.49.137.189	HTTP	596	GET /contact HTTP/1.1

As such, I created a rule to detect common command injection operators like “;”, “|”, “||”, “&&” as shown below.

```
# Command Injection
alert http any any -> any any (msg:"Possible Command Injection"; flow:established,to_server;
http.uri; pcre:"/(\;|\|\|\||\||&&)/"; classtype:web-application-attack; sid:1000023; rev:1;)
```

After sending attack4.pcap to suricata, we observe that there is an alert trigger in the logs.

```
root@1006859:/home/seed/Desktop/IDS/PCAPS# cat /var/log/suricata/eve.json |
 grep -a "Possible Command Injection"
{"timestamp":"2025-11-23T09:50:59.896698-0500","flow_id":979295079778229,"p
cap_cnt":163,"event_type":"alert","src_ip":"192.168.131.72","src_port":5660
6,"dest_ip":"10.49.137.189","dest_port":4444,"proto":"TCP","ip_v":4,"pkt_sr
c":"wire/pcap","tx_id":0,"alert":{"action":"allowed","gid":1,"signature_id"
:1000023,"rev":1,"signature":"Possible Command Injection","category":"Web A
pplication Attack","severity":1},"ts_progress":"request_complete","tc_progr
ess":"response_headers","http":{"hostname":"10.49.137.189","http_port":4444
,"url":"/website?u=;cat%20/etc/passwd","http_user_agent":"Mozilla/5.0 (X11;
 Linux x86_64; rv:128.0) Gecko/20100101 Firefox/128.0","http_method":"GET",
"protocol":"HTTP/1.1","status":200,"length":0},"app_proto":"http","directio
n":"to_server","flow":{"pkts_toserver":4,"pkts_toclient":3,"bytes_toserver"
:709,"bytes_toclient":181,"start":"2025-11-23T09:50:59.752297-0500","src_ip
":"192.168.131.72","dest_ip":"10.49.137.189","src_port":56606,"dest_port":4
444}}
```

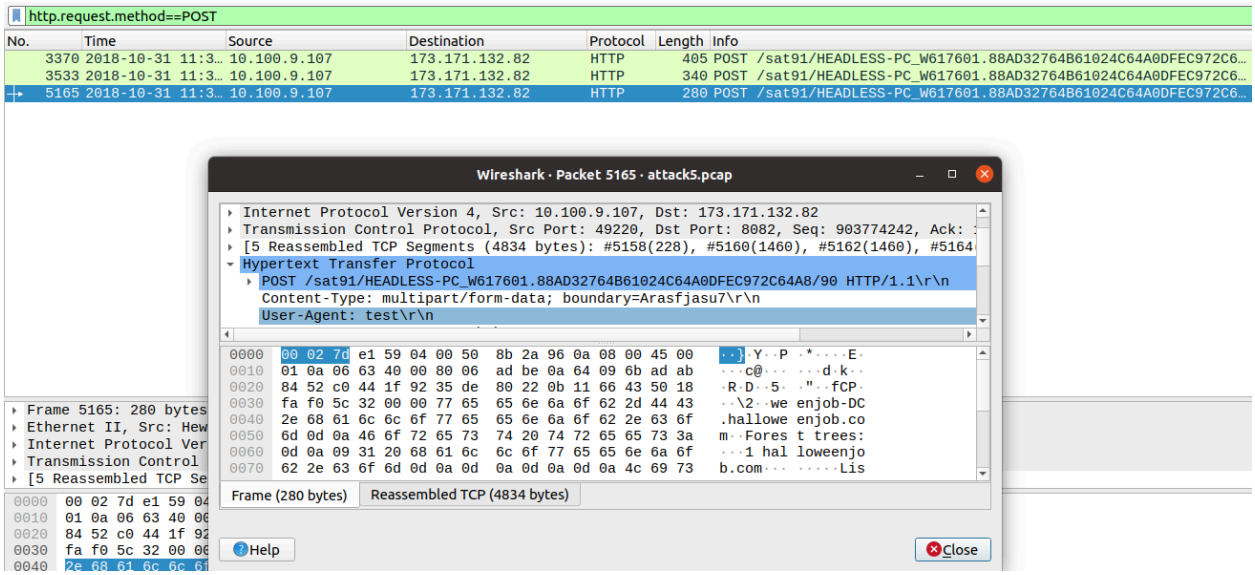
Through Wireshark, we know that the attacker is performing command injection through a GET parameter, u, at /website.

With this attack, the attacker gained read access to /etc/passwd, as shown below.

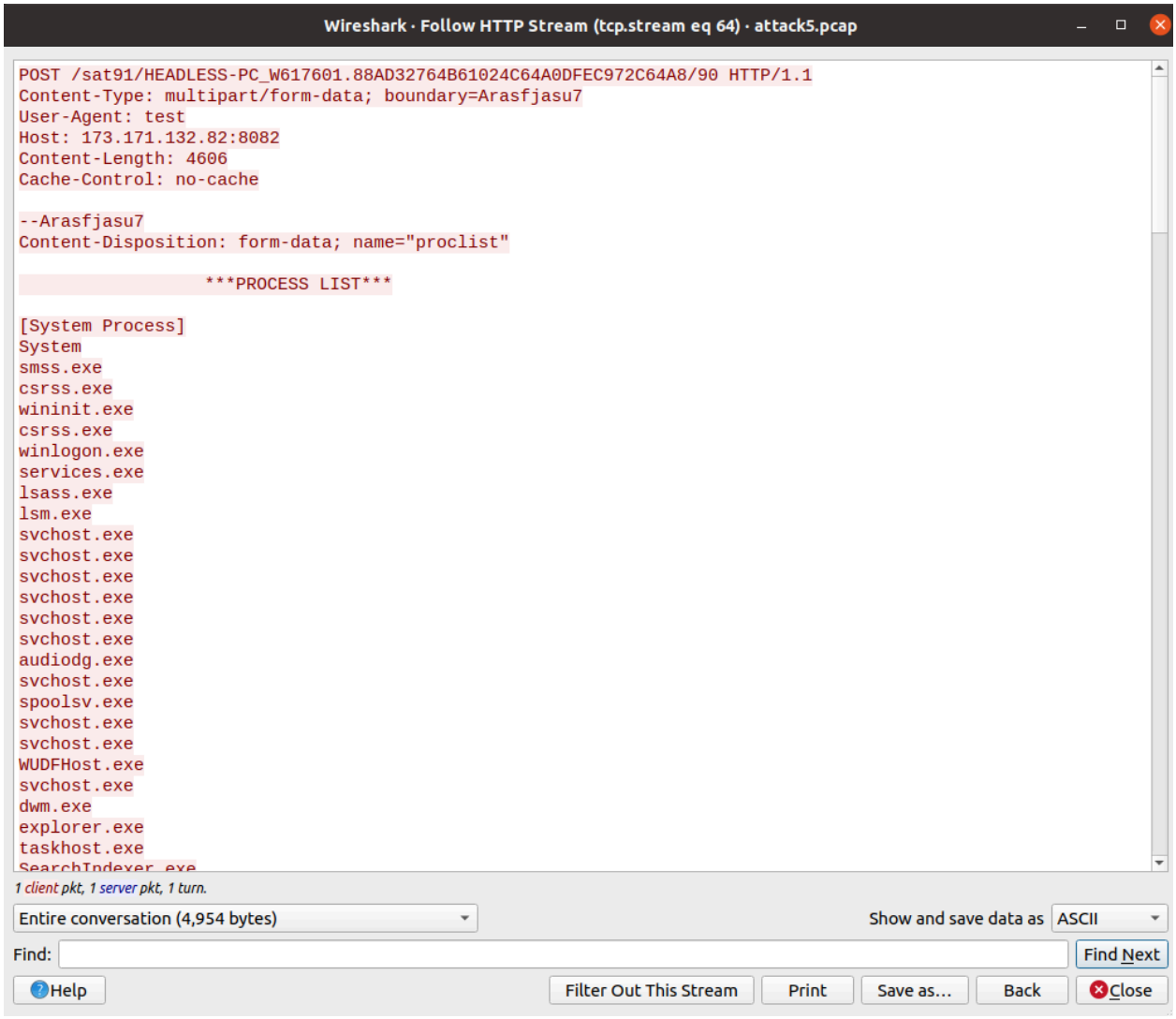
```
HTTP/1.0 200 OK
Content-Type: text/html; charset=utf-8
Content-Length: 1817
Server: Werkzeug/0.12.2 Python/3.4.5
Date: Sun, 23 Nov 2025 14:50:59 GMT

root:x:0:0:root:/root:/bin/bash
bin:x:1:1:bin:/bin:/sbin/nologin
daemon:x:2:2:daemon:/sbin:/sbin/nologin
adm:x:3:4:adm:/var/adm:/sbin/nologin
lp:x:4:7:lp:/var/spool/lpd:/sbin/nologin
sync:x:5:0:sync:/sbin:/bin/sync
shutdown:x:6:0:shutdown:/sbin:/sbin/shutdown
halt:x:7:0:halt:/sbin:/sbin/halt
mail:x:8:12:mail:/var/spool/mail:/sbin/nologin
operator:x:11:0:operator:/root:/sbin/nologin
games:x:12:100:games:/usr/games:/sbin/nologin
ftp:x:14:50:FTP User:/var/ftp:/sbin/nologin
nobody:x:99:99:Nobody:/:/sbin/nologin
systemd-bus-proxy:x:999:998:systemd Bus Proxy:/:/sbin/nologin
systemd-network:x:192:192:systemd Network Management:/:/sbin/nologin
dbus:x:81:81:System message bus:/:/sbin/nologin
polkitd:x:998:997:User for polkitd:/:/sbin/nologin
tss:x:59:59:Account used by the trousers package to sandbox the tcsd daemon:/dev/null:/sbin/nologin
sshd:x:74:74:Privilege-separated SSH:/var/empty/sshd:/sbin/nologin
postfix:x:89:89::/var/spool/postfix:/sbin/nologin
chrony:x:997:995::/var/lib/chrony:/sbin/nologin
apache:x:48:48:Apache:/usr/share/httpd:/sbin/nologin
```

Attack 5

From the image below, attack5.pcap contains various POST requests. The highlighted packet 5165 contained a suspicious POST request, which had “test” as its user-agent field.



Following the HTTP stream of packet 5165, we can see the result below. We can see the data that was being extracted from the infected client, including process list, system information, IP config, etc.



As such, I created a rule to detect HTTP POST requests that sets the User-Agent header to “test”.

```
# Trickbot Trojan
alert http any any -> any any (msg:"Possible Trickbot Exfiltration - User-Agent test";
flow:established,to_server; content:"POST"; http_method; content:"User-Agent: test";
http_header; sid:1000024; rev:1;)
```

Passing attack5.pcap to suricata, we observe from the logs below that there is an alert trigger in the logs due to the “User-Agent: test” header present in a packet.

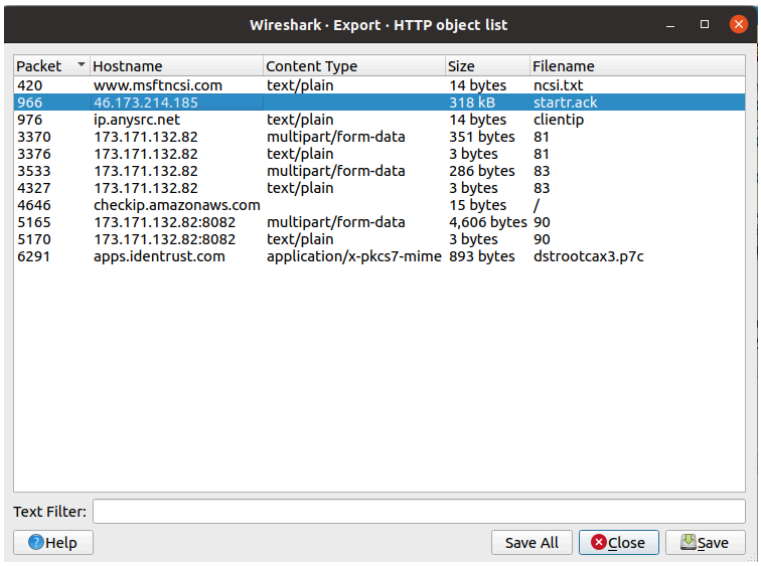
```
root@1006859:/home/seed/Desktop/IDS/PCAPS# cat /var/log/suricata/eve.json |
 grep -a "Possible Trickbot Exfiltration - User-Agent test"
{"timestamp":"2018-10-31T11:36:11.105035-0400","flow_id":783581558290728,"p
cap_cnt":5160,"event_type":"alert","src_ip":"10.100.9.107","src_port":49220
,"dest_ip":"173.171.132.82","dest_port":8082,"proto":"TCP","ip_v":4,"pkt_sr
c":"wire/pcap","tx_id":0,"alert":{"action":"allowed","gid":1,"signature_id"
:1000024,"rev":1,"signature":"Possible Trickbot Exfiltration - User-Agent t
est","category":"","severity":3},"ts_progress":"request_body","tc_progress"
:"response_started","http":{"hostname":"173.171.132.82","http_port":8082,"u
rl":"/sat91/HEADLESS-PC_W617601.88AD32764B61024C64A0DFEC972C64A8/90","http_
user_agent":"test","http_method":"POST","protocol":"HTTP/1.1","length":0},"
app_proto":"http","direction":"to_server","flow":{"pkts_toserver":4,"pkts_t
oclient":2,"bytes_toserver":1916,"bytes_toclient":112,"start":"2018-10-31T1
1:36:10.837801-0400","src_ip":"10.100.9.107","dest_ip":"173.171.132.82","sr
c_port":49220,"dest_port":8082}}
```

The IP address of the infected windows client is 10.100.9.107, which can be found through the source IP address of the POST request with “User-Agent: test”.

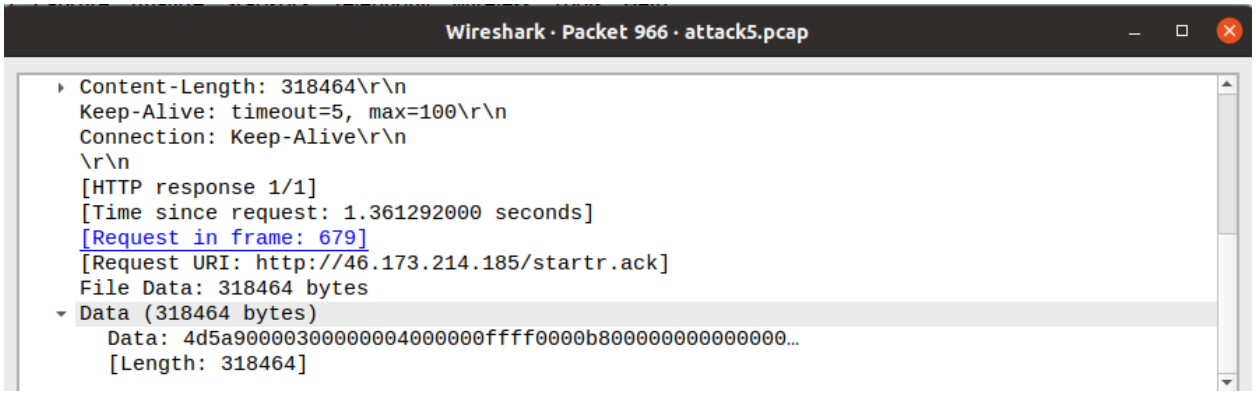
The domain name of the infected windows client is halloweenjob.com as shown below.

```
                ***LOCAL MACHINE DATA***

User name: CN=Ichabod Crane,CN=Users,DC=halloweenjob,DC=com
Computer name: CN=HEADLESS-PC,CN=Computers,DC=halloweenjob,DC=com
Site name: Default-First-Site-Name
Domain shortname: HALLOWEENJOB
Domain name: halloweenjob.com
Forest name: halloweenjob.com
Domain controller: Halloweenjob-DC.halloweenjob.com
Forest trees:
        1 halloweenjob.com
```

To find out the name of the malware, I first exported HTTP objects from the PCAP file and we notice that packet 966 has a file startr.ack and it is a very large file of 318kB.



Taking a closer look at packet 966, we can see that the data section starts with 4d 5a.

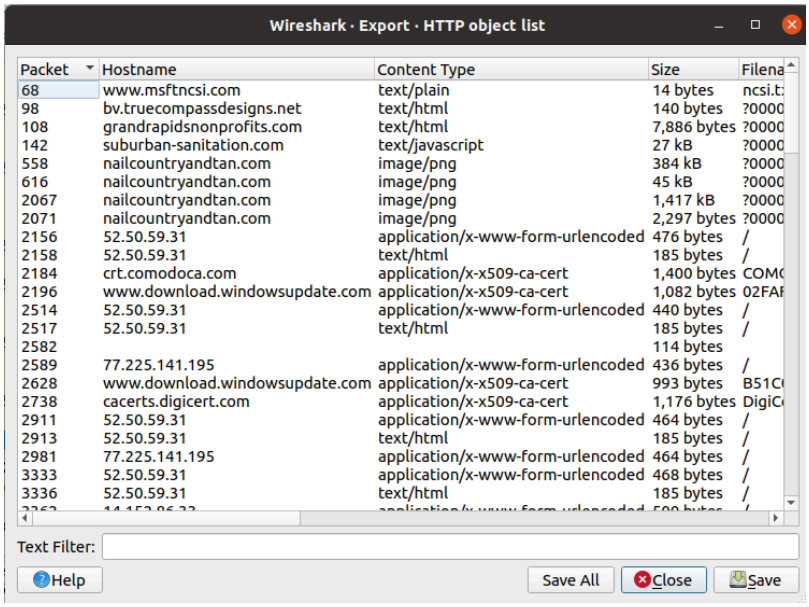


Searching for Windows Executable magic bytes/file signatures, we notice that it matches “0x4D 0x5A” for DOS Executable.

Hence, packet 966 is the packet that transferred the malware.
Therefore, the name of the malware file is startr.ack.

Attack 6

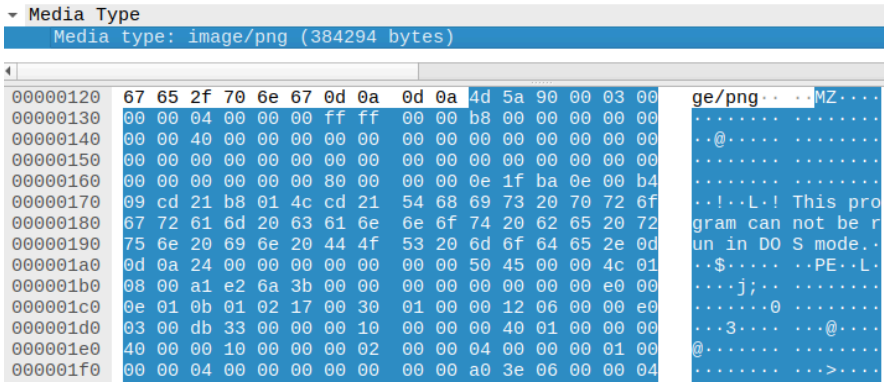
First, I exported the HTTP objects that were in attack6.pcap and I noticed that some packets were unusually huge. In particular, they were packets 142, 558, 616, and 2067.



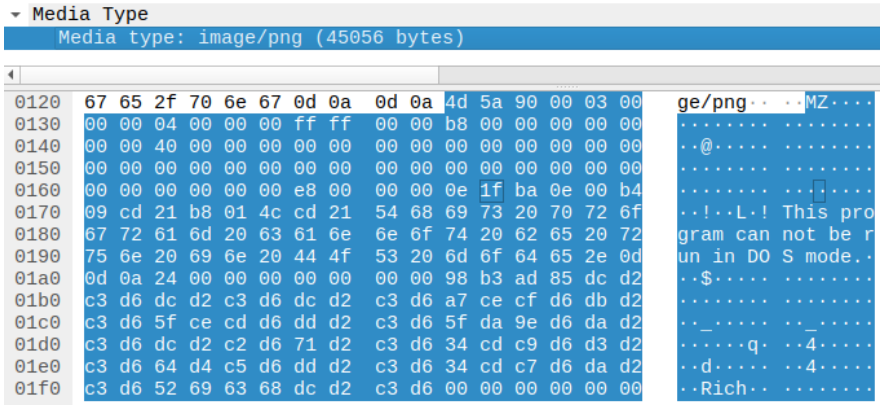
Taking a closer look at packets 558, 616, and 2067, I noticed that even though they had headers “Content-Type: image/png”, they all contained media type that had signatures “0x4d

0x5a", instead of "0x89 0x50 0x4e 0x47" (PNG magic bytes). This means that instead of PNG files, they contained Windows Executable files instead.

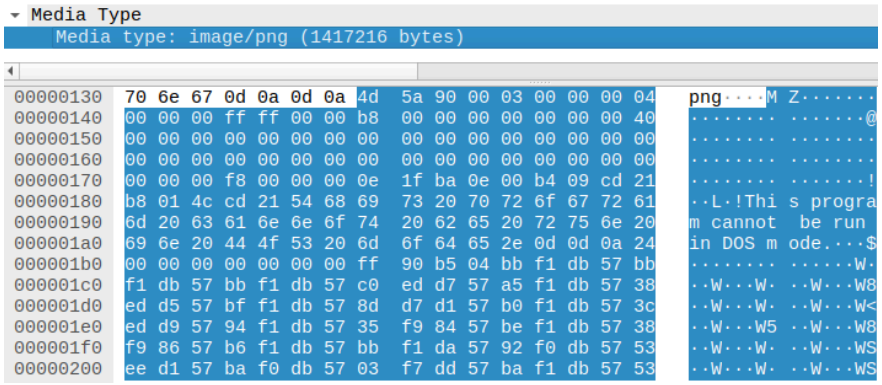
Packet 558:



Packet 616:



Packet 2067:



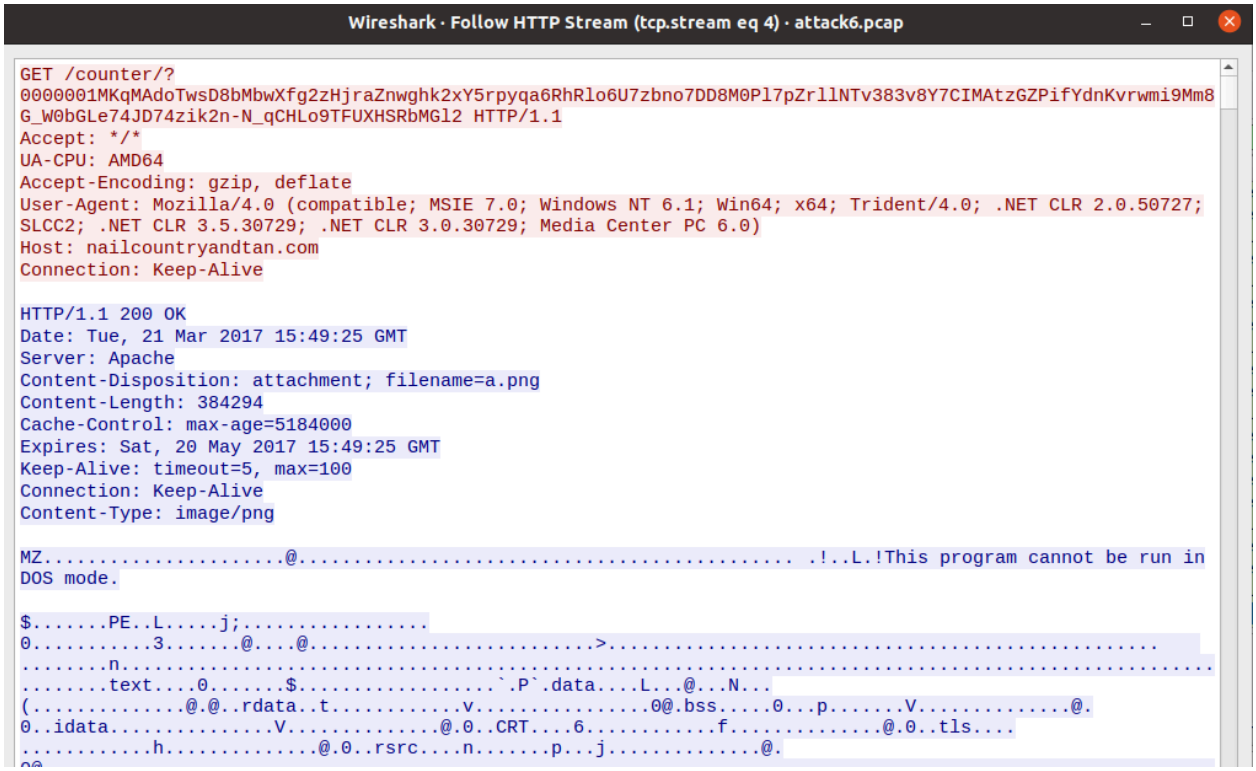
As such, I wrote a rule to detect Windows Executable that are disguised as PNG images. It also checks whether a downloaded file starts with "MZ", which corresponds to "0x4d 0x5a".

```
# Windows Malware Disguised as PNG
alert http any any -> any any (msg:"Windows Malware Disguised as PNG";
flow:established,to_client; content:"MZ"; distance:0; content:"Content-Type: image/png";
http_header; classtype:trojan-activity; sid:1000025; rev:1;)
```

Passing attack6.pcap to suricata, we can observe that there were 3 alert triggers from the logs as shown below, reflecting the 3 packets, 558, 616, and 2067.

```
root@1006859:/home/seed/Desktop/IDS/PCAPS# cat /var/log/suricata/eve.json | grep -a "Windows Malware Disguised as PNG"
{"timestamp":"2017-03-21T11:49:25.125123-0400","flow_id":113104383572826 3,"pcap_cnt":154,"event_type":"alert","src_ip":"50.63.125.1","src_port":80,"dest_ip":"192.168.22.94","dest_port":49161,"proto":"TCP","ip_v":4,"pkt_src":"wire/pcap","tx_id":0,"alert":{"action":"allowed","gid":1,"signature_id":1000025,"rev":1,"signature":"Windows Malware Disguised as PNG","category":"A Network Trojan was detected","severity":1},"ts_progress":"request_complete","tc_progress":"response_body","http":{"hostname":"nailcountryandtan.com","url":"/counter/?0000001MKqMAdoTwsD8bMbwXfg2zHjraZnwghk2xY5rpyqa6RhRlo6U7zbno7DD8M0Pl7pZrllNTv383v8Y7CIMAtzGZPifYdnKvrwmi9Mm8G_W0bGLe74JD74zik2n-N_qCHLo9TFUXHSRbMGl2","http_user_agent":"Mozilla/4.0 (compatible; MSIE 7.0; Windows NT 6.1; Win64; x64; Trident/4.0; .NET CLR 2.0.50727; SLCC2; .NET CLR 3.5.30729; .NET CLR 3.0.30729; Media Center PC 6.0)","http_content_type":"image/png","http_method":"GET","protocol":"HTTP/1.1","status":200,"length":2622},"files":[{"filename":"a.png","gaps":false,"state":"UNKNOWN","stored":false,"size":2622,"tx_id":0}],"app_proto":"http","direction":"to_client","flow":{"pkts_toserver":4,"pkts_toclient":5,"bytes_toserver":705,"bytes_toclient":6118,"start":"2017-03-21T11:49:24.984237-0400","src_ip":"192.168.22.94","dest_ip":"50.63.125.1","src_port":49161,"dest_port":80}}
{"timestamp":"2017-03-21T11:49:25.474991-0400","flow_id":113104383572826 3,"pcap_cnt":564,"event_type":"alert","src_ip":"50.63.125.1","src_port":80,"dest_ip":"192.168.22.94","dest_port":49161,"proto":"TCP","ip_v":4,"pkt_src":"wire/pcap","tx_id":1,"alert":{"action":"allowed","gid":1,"signature_id":1000025,"rev":1,"signature":"Windows Malware Disguised as PNG","category":"A Network Trojan was detected","severity":1},"ts_progress":"request_complete","tc_progress":"response_body","http":{"hostname":"nailcountryandtan.com","url":"/counter/?0000001MKqMAdoTwsD8bMbwXfg2zHjraZnwghk2xY5rpyqa6RhRlo6U7zbno7DD8M0Pl7pZrllNTv383v8Y7CIMAtzGZPifYdnKvrwmi9Mm8G_W0bGLe74JD74zik2n-N_qCHLo9TFUXHSRbMGl3","http_user_agent":"Mozilla/4.0 (compatible; MSIE 7.0; Windows NT 6.1; Win64; x64; Trident/4.0; .NET CLR 2.0.50727; SLCC2; .NET CLR 3.5.30729; .NET CLR 3.0.30729; Media Center PC 6.0)","http_content_type":"image/png","http_method":"GET","protocol":"HTTP/1.1","status":200,"length":2622},"files":[{"filename":"853.png","gaps":false,"state":"UNKNOWN","stored":false,"size":2622,"tx_id":1}],"app_proto":"http","direction":"to_client","flow":{"pkts_toserver":151,"pkts_toclient":268,"bytes_toserver":9984,"bytes_toclient":403452,"start":"2017-03-21T11:49:24.984237-0400","src_ip":"192.168.22.94","dest_ip":"50.63.125.1","src_port":49161,"dest_port":80}}
{"timestamp":"2017-03-21T11:49:25.613384-0400","flow_id":113104383572826 3,"pcap_cnt":623,"event_type":"alert","src_ip":"50.63.125.1","src_port":80,"dest_ip":"192.168.22.94","dest_port":49161,"proto":"TCP","ip_v":4,"pkt_src":"wire/pcap","tx_id":2,"alert":{"action":"allowed","gid":1,"signature_id":1000025,"rev":1,"signature":"Windows Malware Disguised as PNG","category":"A Network Trojan was detected","severity":1},"ts_progress":"request_complete","tc_progress":"response_body","http":{"hostname":"nailcountryandtan.com","url":"/counter/?0000001MKqMAdoTwsD8bMbwXfg2zHjraZnwghk2xY5rpyqa6RhRlo6U7zbno7DD8M0Pl7pZrllNTv383v8Y7CIMAtzGZPifYdnKvrwmi9Mm8G_W0bGLe74JD74zik2n-N_qCHLo9TFUXHSRbMGl4","http_user_agent":"Mozilla/4.0 (compatible; MSIE 7.0; Windows NT 6.1; Win64; x64; Trident/4.0; .NET CLR 2.0.50727; SLCC2; .NET CLR 3.5.30729; .NET CLR 3.0.30729; Media Center PC 6.0)","http_content_type":"image/png","http_method":"GET","protocol":"HTTP/1.1","status":200,"length":4069},"files":[{"filename":"0c1d552cb1d4cb.png","gaps":false,"state":"UNKNOWN","stored":false,"size":4069,"tx_id":2}],"app_proto":"http","direction":"to_client","flow":{"pkts_toserver":176,"pkts_toclient":302,"bytes_toserver":11943,"bytes_toclient":453562,"start":"2017-03-21T11:49:24.984237-0400","src_ip":"192.168.22.94","dest_ip":"50.63.125.1","src_port":49161,"dest_port":80}}
```

From Wireshark, we can tell that the attacker used PNG image files to camouflage it as a normal file even though it was malware. The image below shows that “Content-Type: image/png” header was set, but the payload started with “MZ” instead, which was the file signature for Windows Executables.



Wireshark · Follow HTTP Stream (tcp.stream eq 4) · attack6.pcap

```
GET /counter/?
0000001MKqMAdoTwsD8bMbwXfg2zHjraZnwghk2xY5rpyqa6RhRlo6U7zbno7DD8M0Pl7pZrllNTv383v8Y7CIMAtzGZPifYdnKvrwmi9Mm8
G_W0bGLe74JD74zik2n-N_qCHLo9TFUXHSRbMGl2 HTTP/1.1
Accept: */*
UA-CPU: AMD64
Accept-Encoding: gzip, deflate
User-Agent: Mozilla/4.0 (compatible; MSIE 7.0; Windows NT 6.1; Win64; x64; Trident/4.0; .NET CLR 2.0.50727;
SLCC2; .NET CLR 3.5.30729; .NET CLR 3.0.30729; Media Center PC 6.0)
Host: nailcountryandtan.com
Connection: Keep-Alive

HTTP/1.1 200 OK
Date: Tue, 21 Mar 2017 15:49:25 GMT
Server: Apache
Content-Disposition: attachment; filename=a.png
Content-Length: 384294
Cache-Control: max-age=5184000
Expires: Sat, 20 May 2017 15:49:25 GMT
Keep-Alive: timeout=5, max=100
Connection: Keep-Alive
Content-Type: image/png

MZ.....@..... .!..L.!This program cannot be run in
DOS mode.

$.......PE..L.....j;.................
0...........3.......@....@.........................>.....................................................
........n.....................................................................................................
.......text....0.......$.................`.P`.data....L...@...N...
(..............@.@..rdata..t............v..............0@.bss.....0...p.......V..............@.
0..idata..............V..............@.0..CRT....6............f..............@.0..tls....
............h..............@.0..rsrc....n.......p...j..............@.
```