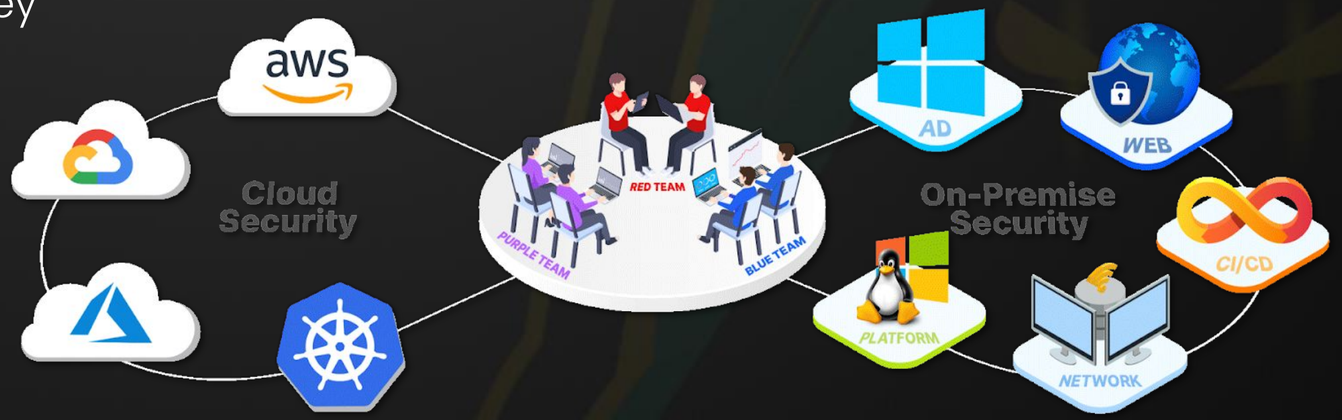
CWL
CyberWarFare Labs

Cyber Defense Strategies for

Combating C2 Based Attacks

About CyberWarFare Labs :

CW Labs is a renowned UK based Ed-tech company specializing in cybersecurity cyber range labs. They provide on-demand educational services and recognize the need for continuous adaptation to evolving threats and client requirements. The company has two primary divisions :



1. Cyber Range Labs

2. Up-Skilling Platform

About Speaker :

Harisuthan S
(Senior Security Engineer)

Is a Blue Team Security researcher, bringing over 3+ years of experience in cyber defence. possesses a deep understanding of Blue Team methodologies including investigation and detection over cyber attacks,

Agenda

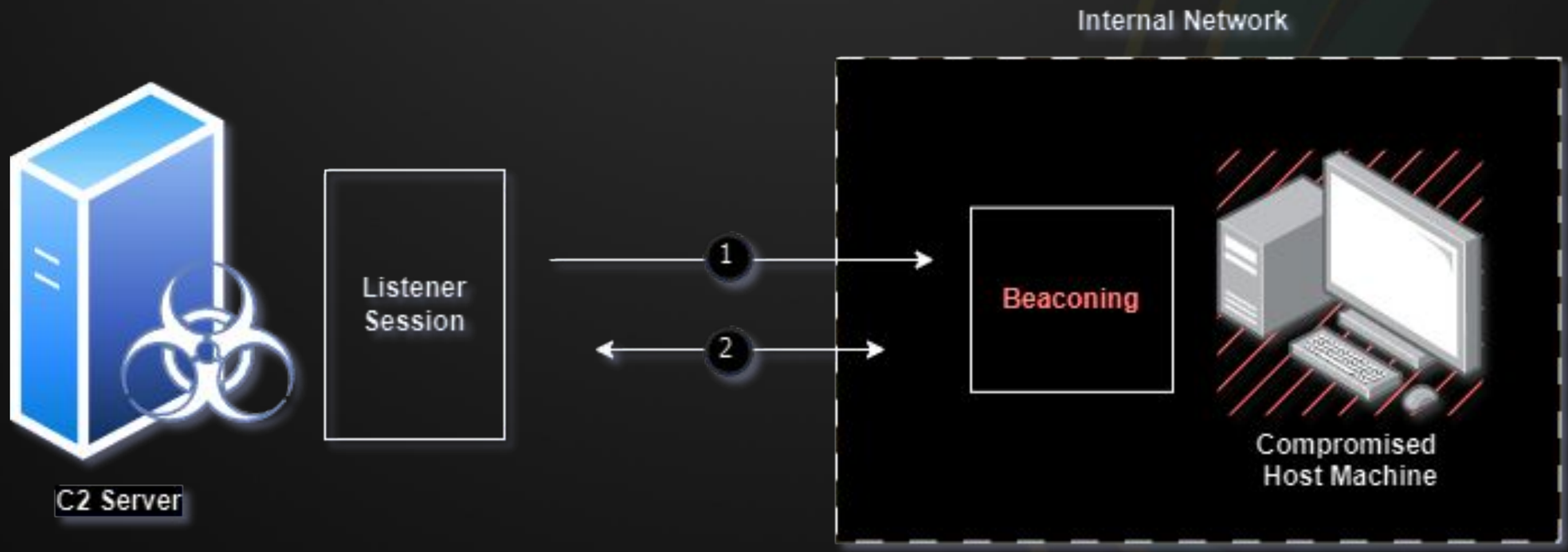
- Working of C2
- Investigating C2 targeted attacks
- JA3 Fingerprinting
- Certified Cyber Defense Analyst : CCDA
- Certification Procedure

Working of Command & Control

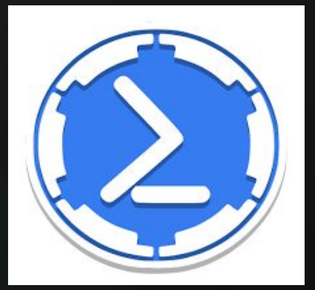
Working of Command & Control

Phase 01	Reconnaissance	Weaponization	
Phase 02	Delivery	Exploitation	Installation
Phase 03	Command and Control (C2)		

General Working Overview



Common C2 Services



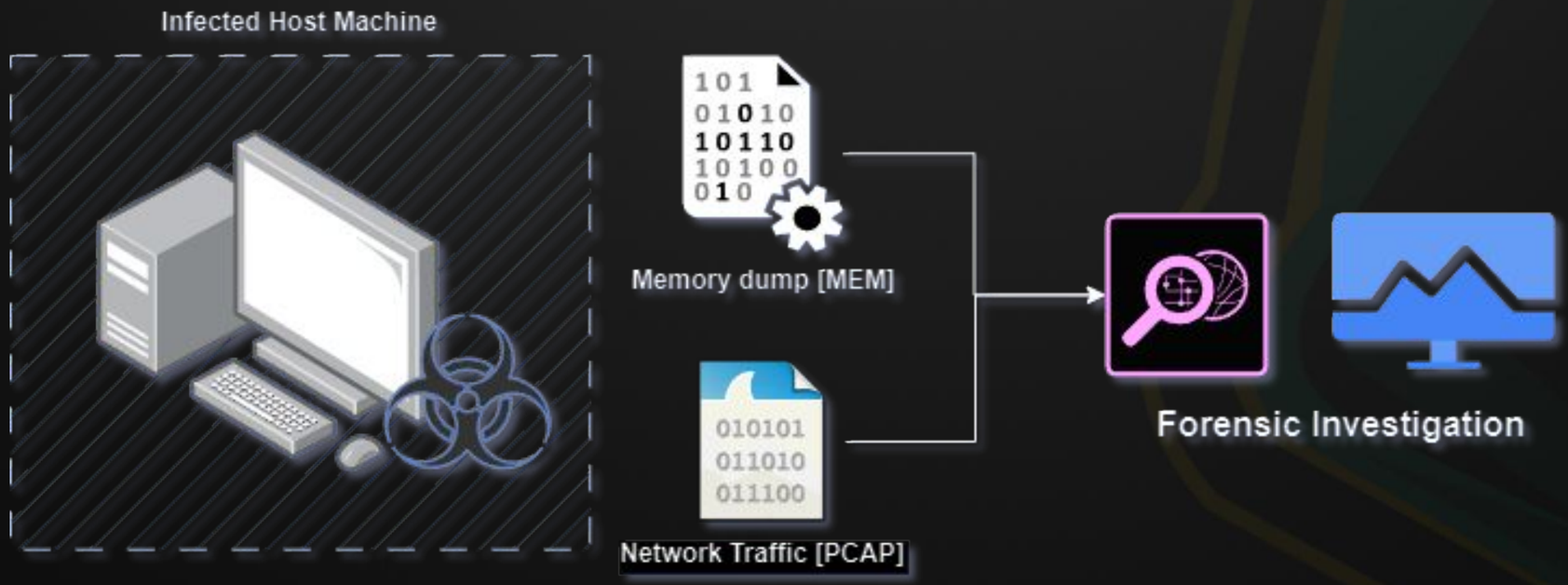
Working Overview

The overall overview of Cyber Defence has been grouped into three categories

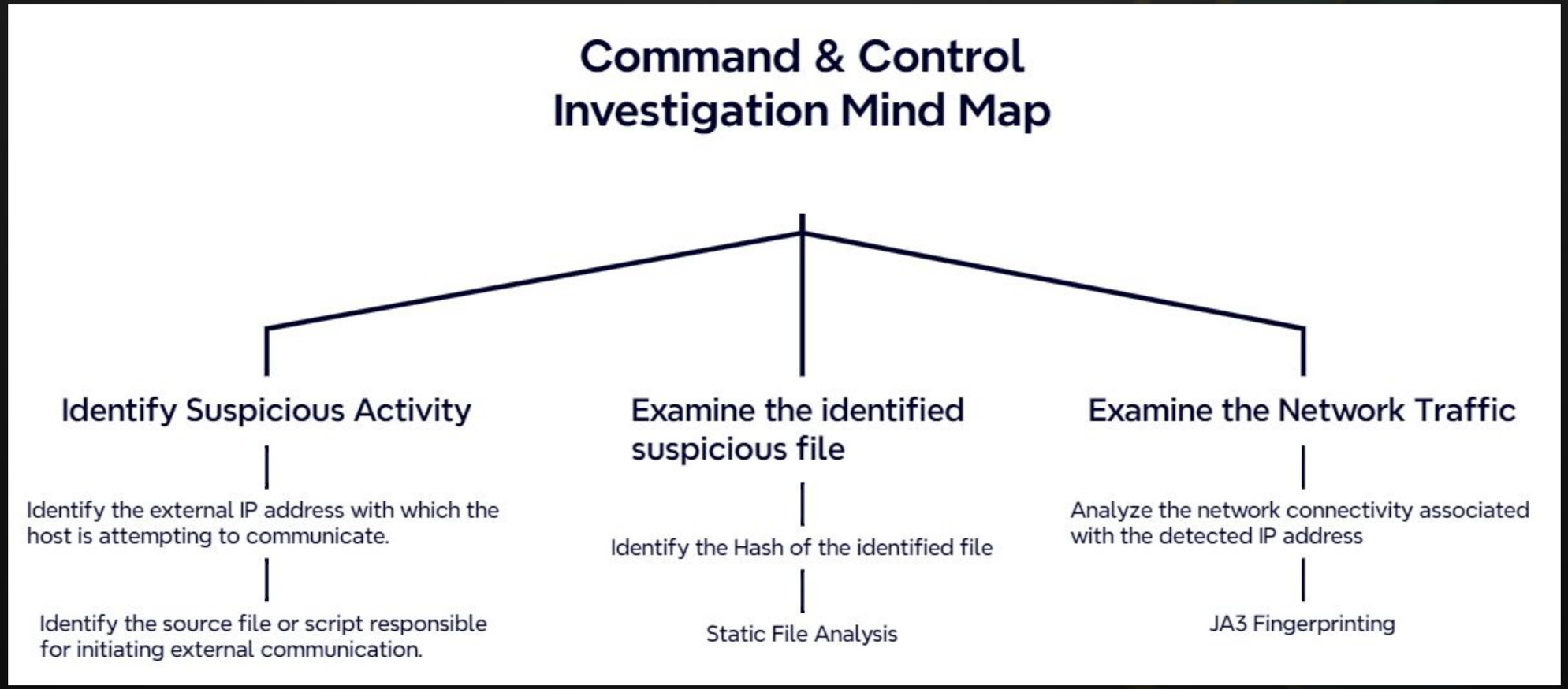
- Malicious File Drop
- Initial Communication
- Handshake
- Command Transmission
- Data Exfiltration
- Beaconing

Investigating C2 targeted attacks

The primary objective is to conduct a thorough investigation into a suspected memory dump [mem] and network dumb [PCAP] with the goal of identifying the source, scope, and impact of the attack.



Investigative Mind Map



Gather the information

The first step of investigation begins by analysing the basic information such as the operating system version, architecture, and system configuration can aid in accurately identifying the system being analysed.

Use the following command to obtain the basic information for the detected image dump.

```
sudo python3 vol.py -f <file_path> windows.info.Info
```

Identify the external IP address and Suspicious file

After gathering the basic information the next step is to identify the the IP which is trying to communicate over the reported port **8888**, Additionally we also identified that the file **AMATEUR_TOOTHB** is been associated with the same activity

```
┌──(kali㉿kali)-[~/Desktop/New Folder/volatility3-2.4.1]
└─$ sudo python3 vol.py -f /home/kali/Downloads/memdump.mem windows.netstat.NetStat
Volatility 3 Framework 2.4.1
Progress:  100.00               PDB scanning finished
Offset  Proto   LocalAddr       LocalPort       ForeignAddr     ForeignPort     State   PID     Owner   Created

0×c18d521ee4e0  TCPv4   192.168.14.238  50355   152.199.39.108  443     CLOSE_WAIT      7636    WWAHost.exe     2024-04-24 14:06:23.000000
0×c18d4c04f4a0  TCPv4   192.168.14.238  50550   192.168.14.202  8888    ESTABLISHED     6236    AMATEUR_TOOTHB  2024-04-24 14:23:20.000000
0×c18d4a8c2460  TCPv4   192.168.14.238  49747   20.198.119.143  443     ESTABLISHED     2944    svchost.exe     2024-04-25 02:17:09.000000
0×c18d4f2b0010  TCPv4   192.168.14.238  50554   20.189.173.1    443     ESTABLISHED     3524    msedge.exe      2024-04-24 14:26:08.000000
0×c18d51dd29b0  TCPv4   192.168.14.238  50356   152.199.39.108  443     CLOSE_WAIT      7636    WWAHost.exe     2024-04-24 14:06:23.000000
0×c18d51ff5b20  TCPv4   192.168.14.238  50353   152.199.39.108  443     CLOSE_WAIT      7636    WWAHost.exe     2024-04-24 14:06:23.000000
0×c18d4f4862a0  TCPv4   192.168.14.238  50555   20.44.10.123    443     ESTABLISHED     3524    msedge.exe      2024-04-24 14:26:09.000000
0×c18d4fbcea20  TCPv4   192.168.14.238  50350   152.195.38.76   80      CLOSE_WAIT      7636    WWAHost.exe     2024-04-24 14:06:23.000000
```

Examine the identified suspicious file

Next step of the investigation is to download the detected suspicious file for further investigation to, using our raw image file we can easily retrieve the file using the PID value associate with it, execute the below mentioned commands and observed the result

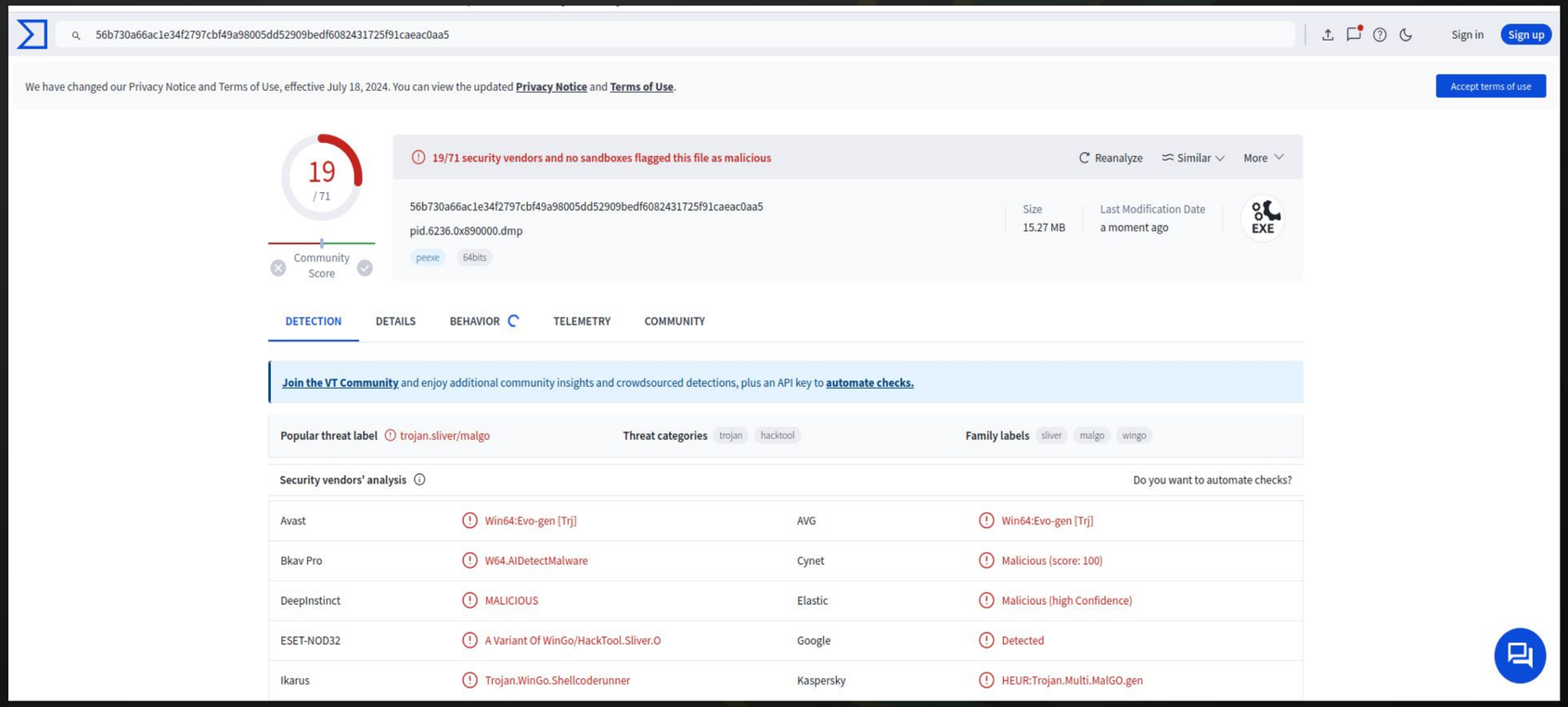
```
sudo python3 vol.py -f <file_path>/suspected.raw windows.pslist --pid 6236 --dump
```

```
┌──(kali㉿kali)-[~/Desktop/New Folder/volatility3-2.4.1]
└─$ sudo python3 vol.py -f /home/kali/Downloads/memdump.mem windows.pslist --pid 6236 --dump
Volatility 3 Framework 2.4.1
Progress:  100.00               PDB scanning finished
PID     PPID    ImageFileName   Offset(V)       Threads Handles SessionId       Wow64   CreateTime      ExitTime        File output

6236    4444    AMATEUR_TOOTHB  0×c18d53262340  9       -       1       False   2024-04-24 14:23:20.000000      N/A     pid.6236.0×890000.dmp
```

Determine the File Repudiation

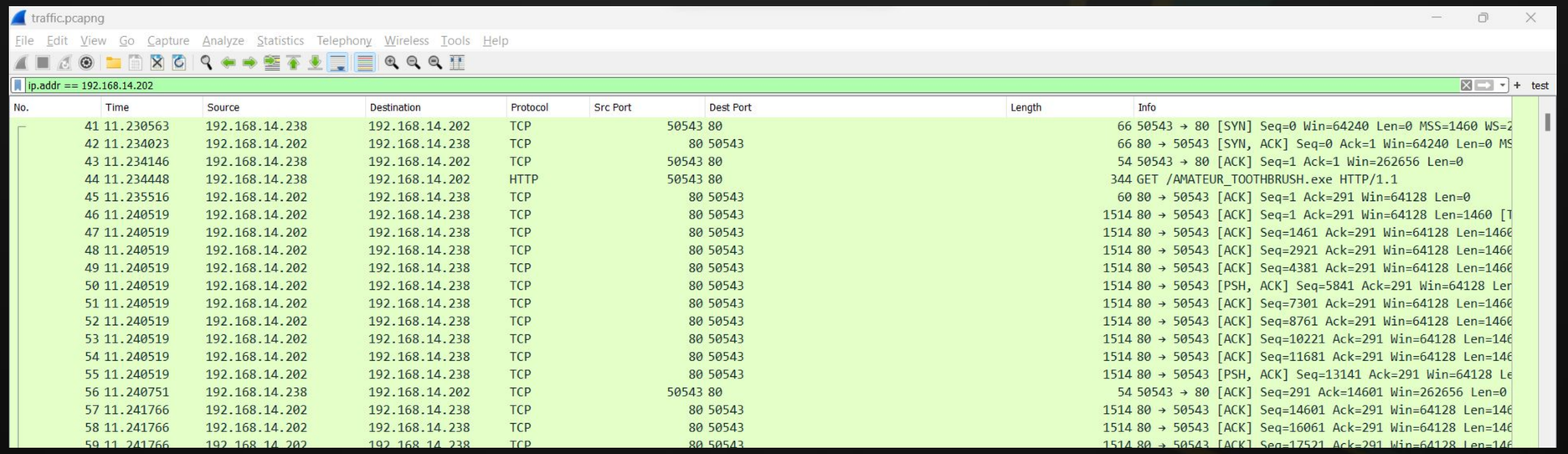
The next step is to analyse the dump via virustotal, upload the extracted dump directly into the virustotal for further analysis



Examine the network traffic

From our previous investigation we identified the IP : **192.168.14.202** which is been associated with the activity, execute the below query to specifically retrieve the activity associated with the IP

```
ip.addr == <IP_Address>
```

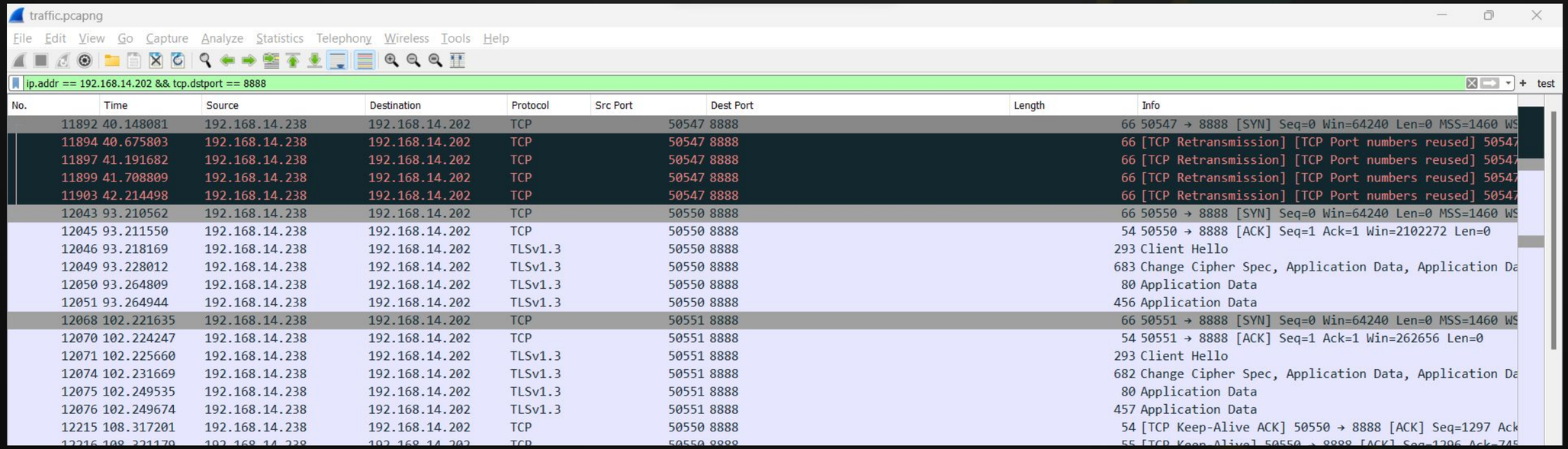


No.	Time	Source	Destination	Protocol	Src Port	Dest Port	Length	Info
41	11.230563	192.168.14.238	192.168.14.202	TCP	50543	80	66	50543 → 80 [SYN] Seq=0 Win=64240 Len=0 MSS=1460 WS=2
42	11.234023	192.168.14.202	192.168.14.238	TCP	80	50543	66	80 → 50543 [SYN, ACK] Seq=0 Ack=1 Win=64240 Len=0 MS
43	11.234146	192.168.14.238	192.168.14.202	TCP	50543	80	54	50543 → 80 [ACK] Seq=1 Ack=1 Win=262656 Len=0
44	11.234448	192.168.14.238	192.168.14.202	HTTP	50543	80	344	GET /AMATEUR_TOOTHBRUSH.exe HTTP/1.1
45	11.235516	192.168.14.202	192.168.14.238	TCP	80	50543	60	80 → 50543 [ACK] Seq=1 Ack=291 Win=64128 Len=0
46	11.240519	192.168.14.202	192.168.14.238	TCP	80	50543	1514	80 → 50543 [ACK] Seq=1 Ack=291 Win=64128 Len=1460 [T
47	11.240519	192.168.14.202	192.168.14.238	TCP	80	50543	1514	80 → 50543 [ACK] Seq=1461 Ack=291 Win=64128 Len=1460
48	11.240519	192.168.14.202	192.168.14.238	TCP	80	50543	1514	80 → 50543 [ACK] Seq=2921 Ack=291 Win=64128 Len=1460
49	11.240519	192.168.14.202	192.168.14.238	TCP	80	50543	1514	80 → 50543 [ACK] Seq=4381 Ack=291 Win=64128 Len=1460
50	11.240519	192.168.14.202	192.168.14.238	TCP	80	50543	1514	80 → 50543 [PSH, ACK] Seq=5841 Ack=291 Win=64128 Ler
51	11.240519	192.168.14.202	192.168.14.238	TCP	80	50543	1514	80 → 50543 [ACK] Seq=7301 Ack=291 Win=64128 Len=1460
52	11.240519	192.168.14.202	192.168.14.238	TCP	80	50543	1514	80 → 50543 [ACK] Seq=8761 Ack=291 Win=64128 Len=1460
53	11.240519	192.168.14.202	192.168.14.238	TCP	80	50543	1514	80 → 50543 [ACK] Seq=10221 Ack=291 Win=64128 Len=146
54	11.240519	192.168.14.202	192.168.14.238	TCP	80	50543	1514	80 → 50543 [ACK] Seq=11681 Ack=291 Win=64128 Len=146
55	11.240519	192.168.14.202	192.168.14.238	TCP	80	50543	1514	80 → 50543 [PSH, ACK] Seq=13141 Ack=291 Win=64128 Le
56	11.240751	192.168.14.238	192.168.14.202	TCP	50543	80	54	50543 → 80 [ACK] Seq=291 Ack=14601 Win=262656 Len=0
57	11.241766	192.168.14.202	192.168.14.238	TCP	80	50543	1514	80 → 50543 [ACK] Seq=14601 Ack=291 Win=64128 Len=146
58	11.241766	192.168.14.202	192.168.14.238	TCP	80	50543	1514	80 → 50543 [ACK] Seq=16061 Ack=291 Win=64128 Len=146
59	11.241766	192.168.14.202	192.168.14.238	TCP	80	50543	1514	80 → 50543 [ACK] Seq=17521 Ack=291 Win=64128 Len=146

Examine the network traffic

After identifying the malicious download request our next step is to retrieve the activity associated with port reported port **8888**, execute the below query and observe the result

```
ip.addr == <IP_Address> && tcp.dstport == <Port>
```



No.	Time	Source	Destination	Protocol	Src Port	Dest Port	Length	Info
11892	40.148081	192.168.14.238	192.168.14.202	TCP	50547	8888	66	50547 → 8888 [SYN] Seq=0 Win=64240 Len=0 MSS=1460 WS
11894	40.675803	192.168.14.238	192.168.14.202	TCP	50547	8888	66	[TCP Retransmission] [TCP Port numbers reused] 50547
11897	41.191682	192.168.14.238	192.168.14.202	TCP	50547	8888	66	[TCP Retransmission] [TCP Port numbers reused] 50547
11899	41.708809	192.168.14.238	192.168.14.202	TCP	50547	8888	66	[TCP Retransmission] [TCP Port numbers reused] 50547
11903	42.214498	192.168.14.238	192.168.14.202	TCP	50547	8888	66	[TCP Retransmission] [TCP Port numbers reused] 50547
12043	93.210562	192.168.14.238	192.168.14.202	TCP	50550	8888	66	50550 → 8888 [SYN] Seq=0 Win=64240 Len=0 MSS=1460 WS
12045	93.211550	192.168.14.238	192.168.14.202	TCP	50550	8888	54	50550 → 8888 [ACK] Seq=1 Ack=1 Win=2102272 Len=0
12046	93.218169	192.168.14.238	192.168.14.202	TLSv1.3	50550	8888	293	Client Hello
12049	93.228012	192.168.14.238	192.168.14.202	TLSv1.3	50550	8888	683	Change Cipher Spec, Application Data, Application Da
12050	93.264809	192.168.14.238	192.168.14.202	TLSv1.3	50550	8888	80	Application Data
12051	93.264944	192.168.14.238	192.168.14.202	TLSv1.3	50550	8888	456	Application Data
12068	102.221635	192.168.14.238	192.168.14.202	TCP	50551	8888	66	50551 → 8888 [SYN] Seq=0 Win=64240 Len=0 MSS=1460 WS
12070	102.224247	192.168.14.238	192.168.14.202	TCP	50551	8888	54	50551 → 8888 [ACK] Seq=1 Ack=1 Win=262656 Len=0
12071	102.225660	192.168.14.238	192.168.14.202	TLSv1.3	50551	8888	293	Client Hello
12074	102.231669	192.168.14.238	192.168.14.202	TLSv1.3	50551	8888	682	Change Cipher Spec, Application Data, Application Da
12075	102.249535	192.168.14.238	192.168.14.202	TLSv1.3	50551	8888	80	Application Data
12076	102.249674	192.168.14.238	192.168.14.202	TLSv1.3	50551	8888	457	Application Data
12215	108.317201	192.168.14.238	192.168.14.202	TCP	50550	8888	54	[TCP Keep-Alive ACK] 50550 → 8888 [ACK] Seq=1297 Ack

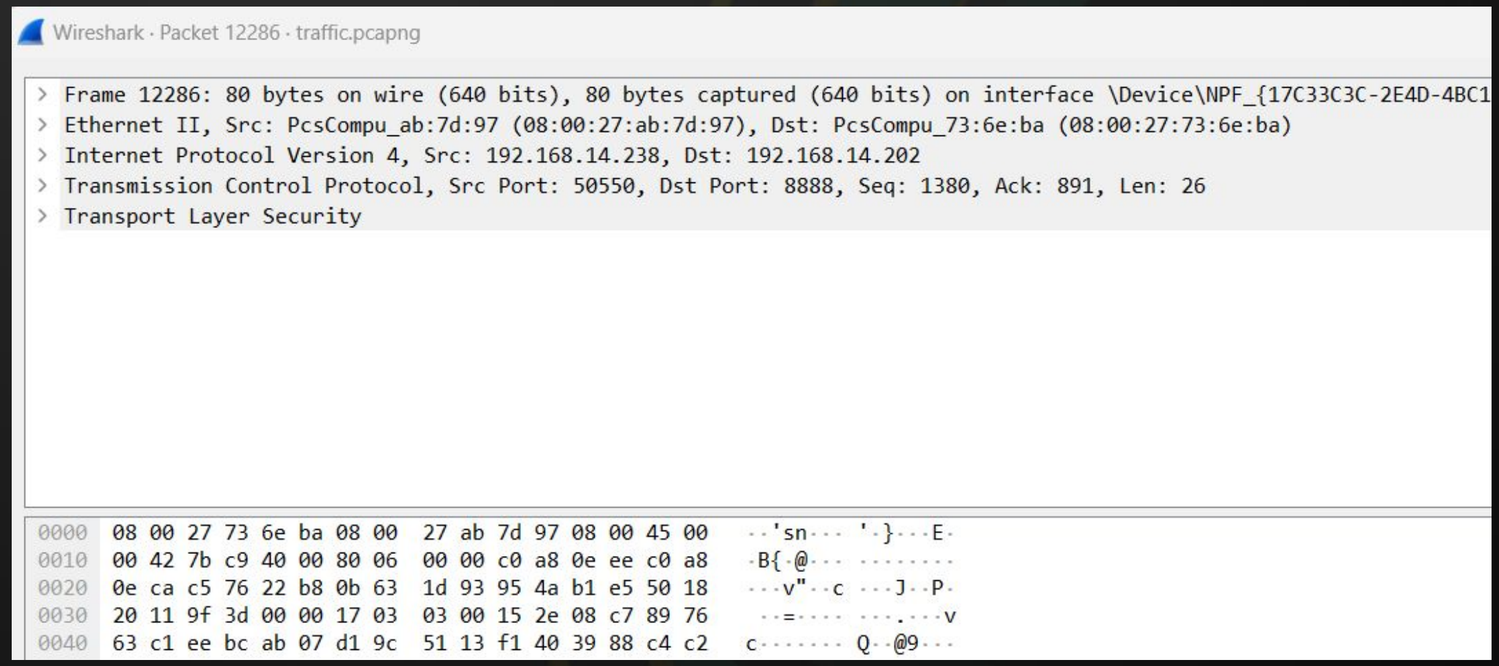
Examine the network traffic

Based on the findings, we've detected TLS communication between the compromised host and the external network. Initially, the requests and responses followed the typical pattern, but in our case, we're observing multiple occurrences of client hello and application data exchanges, which deviate from the norm.

12046	93.218169	192.168.14.238	192.168.14.202	TLSv1.3	50550	8888	293 Client Hello
12049	93.228012	192.168.14.238	192.168.14.202	TLSv1.3	50550	8888	683 Change Cipher Spec, Application Data, Application Data, Application Data
12050	93.264809	192.168.14.238	192.168.14.202	TLSv1.3	50550	8888	80 Application Data
12051	93.264944	192.168.14.238	192.168.14.202	TLSv1.3	50550	8888	456 Application Data
12068	102.221635	192.168.14.238	192.168.14.202	TCP	50551	8888	66 50551 → 8888 [SYN] Seq=0 Win=64240 Len=0 MSS=1460 WS=256 SACK_PERM
12070	102.224247	192.168.14.238	192.168.14.202	TCP	50551	8888	54 50551 → 8888 [ACK] Seq=1 Ack=1 Win=262656 Len=0
12071	102.225660	192.168.14.238	192.168.14.202	TLSv1.3	50551	8888	293 Client Hello
12074	102.231669	192.168.14.238	192.168.14.202	TLSv1.3	50551	8888	682 Change Cipher Spec, Application Data, Application Data, Application Data
12075	102.249535	192.168.14.238	192.168.14.202	TLSv1.3	50551	8888	80 Application Data
12076	102.249674	192.168.14.238	192.168.14.202	TLSv1.3	50551	8888	457 Application Data
12215	108.317201	192.168.14.238	192.168.14.202	TCP	50550	8888	54 [TCP Keep-Alive ACK] 50550 → 8888 [ACK] Seq=1297 Ack=745 Win=2101504 Len=0
12216	108.321179	192.168.14.238	192.168.14.202	TCP	50550	8888	55 [TCP Keep-Alive] 50550 → 8888 [ACK] Seq=1296 Ack=745 Win=2101504 Len=1
12269	117.277616	192.168.14.238	192.168.14.202	TCP	50551	8888	54 [TCP Keep-Alive ACK] 50551 → 8888 [ACK] Seq=1297 Ack=744 Win=261888 Len=0
12270	117.321054	192.168.14.238	192.168.14.202	TCP	50551	8888	55 [TCP Keep-Alive] 50551 → 8888 [ACK] Seq=1296 Ack=744 Win=261888 Len=1
12277	122.402975	192.168.14.238	192.168.14.202	TCP	50550	8888	54 50550 → 8888 [ACK] Seq=1297 Ack=816 Win=2101504 Len=0
12278	122.404923	192.168.14.238	192.168.14.202	TLSv1.3	50550	8888	80 Application Data
12279	122.405047	192.168.14.238	192.168.14.202	TLSv1.3	50550	8888	111 Application Data
12285	127.256792	192.168.14.238	192.168.14.202	TCP	50550	8888	54 50550 → 8888 [ACK] Seq=1380 Ack=891 Win=2101504 Len=0
12286	127.358363	192.168.14.238	192.168.14.202	TLSv1.3	50550	8888	80 Application Data
12287	127.358510	192.168.14.238	192.168.14.202	TLSv1.3	50550	8888	1648 Application Data
12291	132.332387	192.168.14.238	192.168.14.202	TCP	50551	8888	55 [TCP Keep-Alive] 50551 → 8888 [ACK] Seq=1296 Ack=744 Win=261888 Len=1
12298	142.366824	192.168.14.238	192.168.14.202	TCP	50550	8888	55 [TCP Keep-Alive] 50550 → 8888 [ACK] Seq=2999 Ack=891 Win=2101504 Len=1
12300	142.368574	192.168.14.238	192.168.14.202	TCP	50550	8888	54 [TCP Keep-Alive ACK] 50550 → 8888 [ACK] Seq=3000 Ack=891 Win=2101504 Len=0

Examine the network traffic

Typically, these patterns are observed in **C2 communication.** The C2 sends **client hello** requests to check if the targeted host is active and accessible. When the attacker attempts to push malicious commands, they are sent as application data. It's worth noting that even if you attempt to read the packets, the information inside is encrypted and not in a readable format.

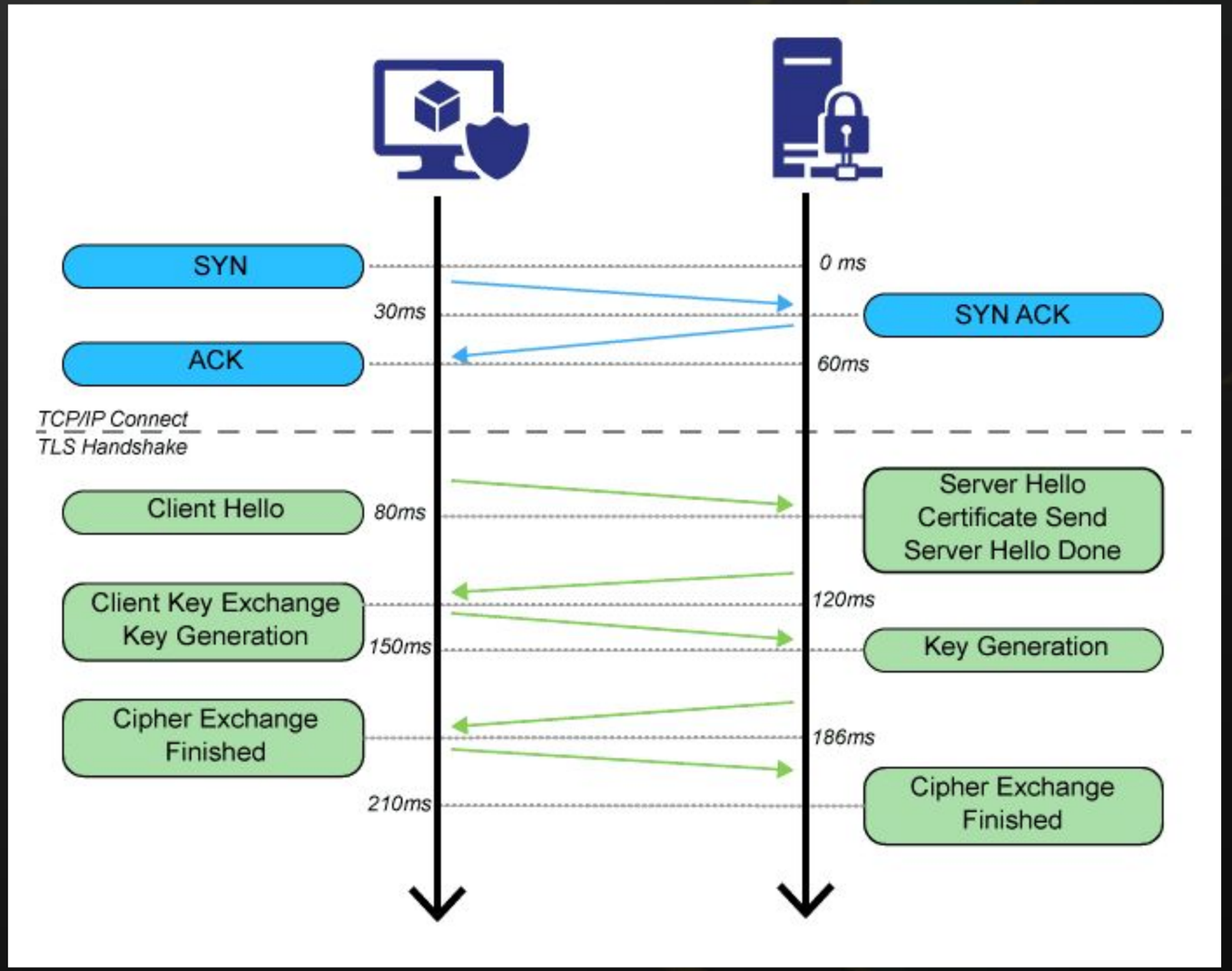


JA3 Fingerprinting

JA3 correlation methodology will help us in identifying and categorizing different types of software or libraries based on their unique fingerprints generated during the handshake process, JA3 typically get generated based on their cryptographic characteristics of the SSL/TLS handshake.

Each unique SSL/TLS handshake will result in unique JA3 fingerprinting.

Working of TLS Handshake

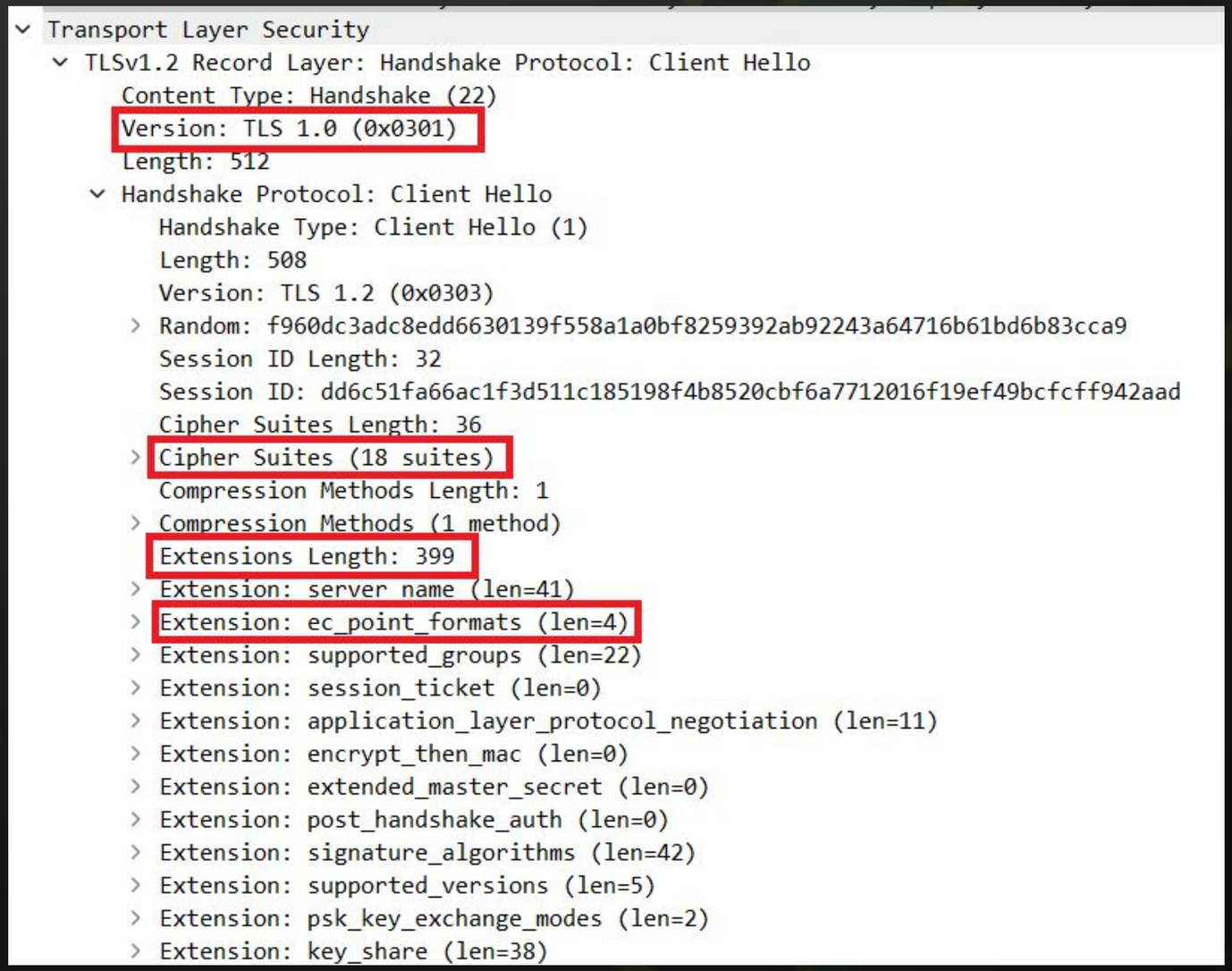


Working of JA3

JA3 fingerprinting value is calculated by collecting the decimal values of the bytes for the following fields.

- Version
- Accepted Ciphers
- List of Extensions
- Elliptic Curves
- Elliptic Curve Formats

The collected decimal values are then hash to MD5 format and resulted with 32 character fingerprints.



Co-relating the JA3

On the Client Hello request we can identify the JA3 section under the Transport Layer Security

This generated JA3 value can be further searched over internet to determine the whether its been associated with any other malicious activity

JA3 Value

19e29534fd49dd27d09234e639c4057e

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Cyber Defence Analyst : CCDA

The Certified Cyber Defence Analyst (CCDA) training offers an investigative approach to Blue Teaming. It's designed to equip participants with the necessary knowledge and skills to become effective in threat detection and investigation as part of a Blue Team.

- Threat Detection & Its Investigation
- Enhance the real time investigation skills
- Hands-on investigations
- Cyber Defence Labs
- Multiple Investigative mind map
- Incident Response Strategies

Cyber Defense Analyst [CCDA]

BTF Lab Overview

- FIM
- Endpoint Monitoring
- Network Monitoring
- SIEM

- Phishing Alert
- Web Targeted Alert
- Network Targeted Alert
- Host Targeted Alert

Cyber Defense Team

Web based Investigation and Analysis

Email Header Analysis

Credential Phishing Investigation

Suspicious Attachment Phishing Investigation

Suspicious Macros Phishing Investigation

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Web based Investigation and Analysis

Admin Page access detected

Subdomain Enumeration

SQL-Map activity detected

File Inclusion activity detected

Command Injection activity detected

Vulnerability Enumeration activity detected

Network based Investigation and Analysis

NMAP Detection

DOS investigation

Suspected Data exfiltration detected

Netcat activity detected

Service brute forcing

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Host Based Attack Investigation Challenges

Suspicious File activity detected

Suspected .SH file detected

Suspicious Scheduled task detected

Suspicious Linpeas activity detected

Multiple Remote Failed Login Detected

Suspicious PowerShell activity detected

Certification Procedure

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Giveaway Alert

5 Certified Cyber Defence Analyst | CCDA

We're giving away Latest Launch "Cyber Defence Analyst [CCDA]"

Thank You

For Professional Red Team / Blue Team / Purple Team / Cloud Cyber Range labs / Trainings, please contact

support@cyberwarfare.live

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