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FORENSICS CYBER-SECURITY

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Wireshark Tutorial

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Introduction

This guide aims to provide some examples of techniques that you are expected to use when analyzing traffic in Wireshark. For the third assignment of CSF, it is extremely important that you understand and are comfortable with the basic filtering capabilities of Wireshark, so that you can purposefully search for the information you want to find.

It is also very important for you to be able to identify what details might be suspicious in certain protocols, not only so that you can notice them when you see them, but also so that you can purposefully search for them.

1 Setting up the SSL Key log file

To be able to inspect the contents of the SSL/TLS packets in our capture, you must first set up the SSL key log file that was generated during the capture. To do this, you may follow the following steps:

1. Open Wireshark.
2. On top of the window, go to **Edit**, followed by **Preferences**.
3. Expand **Protocols** and search for **TLS** in the list of protocols.
4. Finally, find the field **(Pre)-Master-Secret log filename** and type there the path to the SSL key log file.

2 Time Shift

Wireshark provides users with a tool that may be useful to convert the times shown in the whole capture to different timezones. This tool is called **Time Shift**, and it can be accessed by going to the top of the window to **Edit**, followed by **Time Shift...**

Figure 1 shows the Time Shift window and its options. In this specific example, we are shifting all packets 14 days back in time.

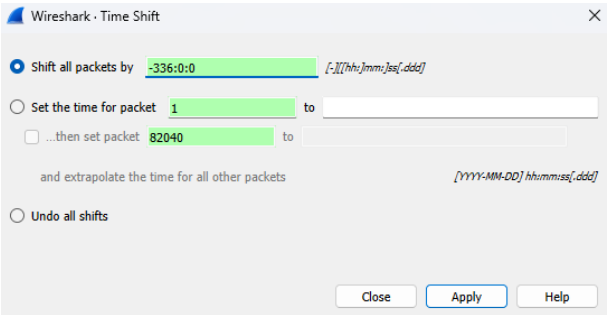


Figure 1: Time Shift Window

After using the Time Shift tool, if you ever want to revert and recover the original times, you may simply go back to the Time Shift window and select **Undo all shifts**.

3 Name Resolution

During your analysis, it might sometimes be useful to search for a specific domain name, such as `www.google.com` instead of its corresponding address, which is usually not recognizable. For this purpose, Wireshark provides options for name resolution. To access these options, you simply have to go to the top of the window to **View**, followed by **Name Resolution**, as shown in Figure 2.

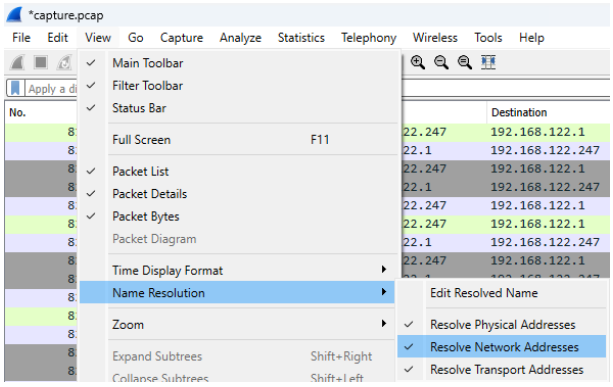


Figure 2: How to access the Name Resolution options

Here you have three options:

- **Resolve Physical Addresses:** Wireshark will attempt to translate MAC addresses to their respective names, for example, by identifying the name of the vendor to which the Organizationally Unique Identifier (OUI) belongs to.
- **Resolve Network Addresses:** Wireshark will use DNS servers to attempt to convert IP addresses to the hostnames associated with them.
- **Resolve Transport Addresses:** Wireshark will convert TCP and UDP ports to their well-known names, if they exist. For example, port 80 will be identified as HTTP.

Furthermore, while performing your analysis, you may have trouble keeping track of who each address belongs to. To help with this, you may right-click on an address you want to give a name to, and select **Edit Resolved Name**. After doing so, a text box will appear at the top of the packet list where you can type your desired name and press **Ok** to apply it. From then on, all instances of that IP address in the packet list will be replaced with your chosen name, making it easier for you to identify the entities involved in the various communications.

4 Find Tool

The find tool is present in various applications and Wireshark is no different. As is common, you can access this tool by pressing the `CTRL + F` key combination, or by going to **Edit -> Find Packet...**

However, before you can start accurately searching for what you desire, you must select where your search will be performed. As you may have noticed, Wireshark is divided into three **Panes**, the Packet List, the Packet Details, and the Packet Bytes. Figure 3 shows each of these panes, together with their names.

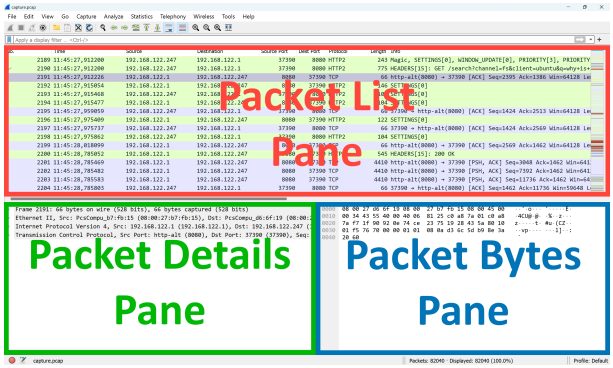


Figure 3: Wireshark panes

When performing a search using the find tool, you must specify in which of the three panes the search should be made. Additionally, you must also specify what type of data you would like to search for: Hex Value, String or Regular Expression. If you are searching for a string, you may also specify whether the search should be case-sensitive or not, and what character encoding(s) to use in the search.

5 Export Packet Bytes

One very useful thing that Wireshark allows you to do is export specific parts of a packet's data to a file. Some specific cases in which this can be helpful are to export plaintext data, HTML data, JSON data, etc.

You can do this by simply right-clicking on what you want to extract in the **Packet details Pane**, followed by **Export Packet Bytes...**

Figure 4 shows how you can export, for example, JSON data from an HTTP request.

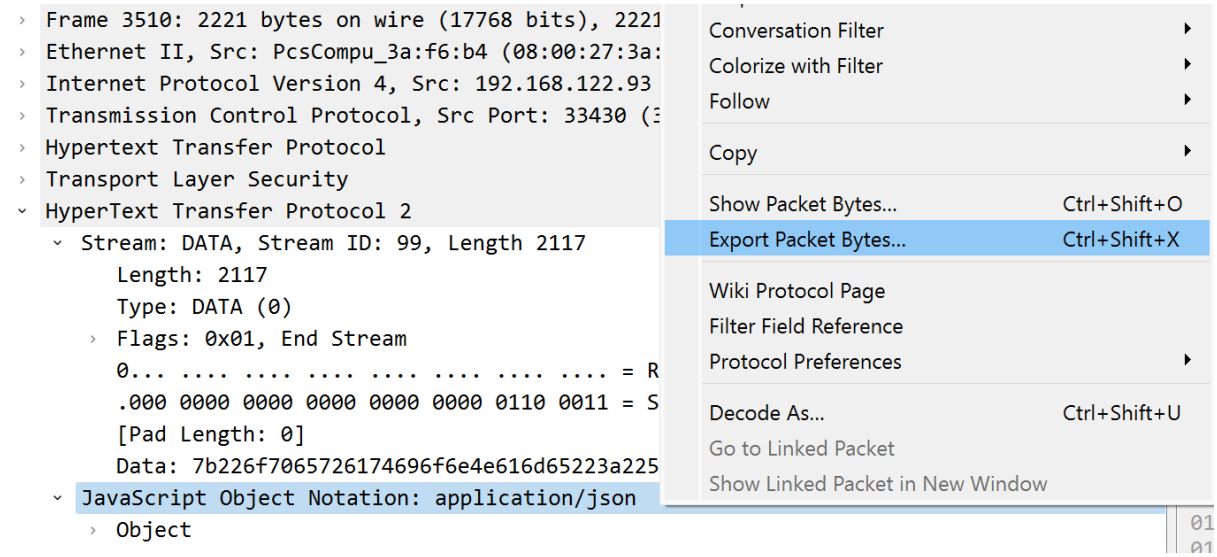


Figure 4: Exporting JSON data from an HTTP response

6 Follow Stream

In some cases, such as with HTTP connections, it might be useful to see the contents of a whole "conversation" that spans multiple packets. To do this, you may use the "Follow _ Stream" tool, which allows you to see the whole conversation to which a packet belongs. There are multiple options of streams to follow: TCP, UDP, TLS, HTTP, HTTP/2, etc.

Figure 5 shows how to access this tool for a certain packet.

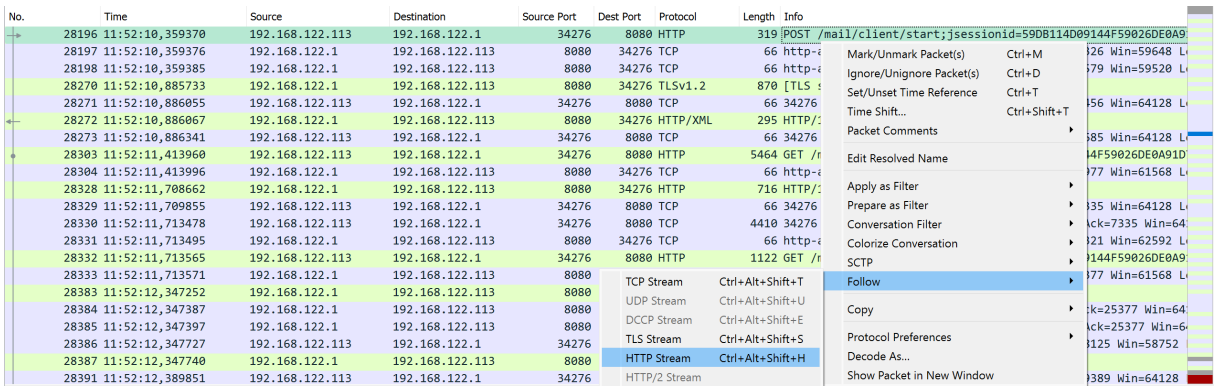


Figure 5: Following an HTTP Stream

A simple example is an HTTP conversation, which allows you to see the sequence of requests and their respective responses. Figure 6 shows an example of the window that appears when you follow a stream.

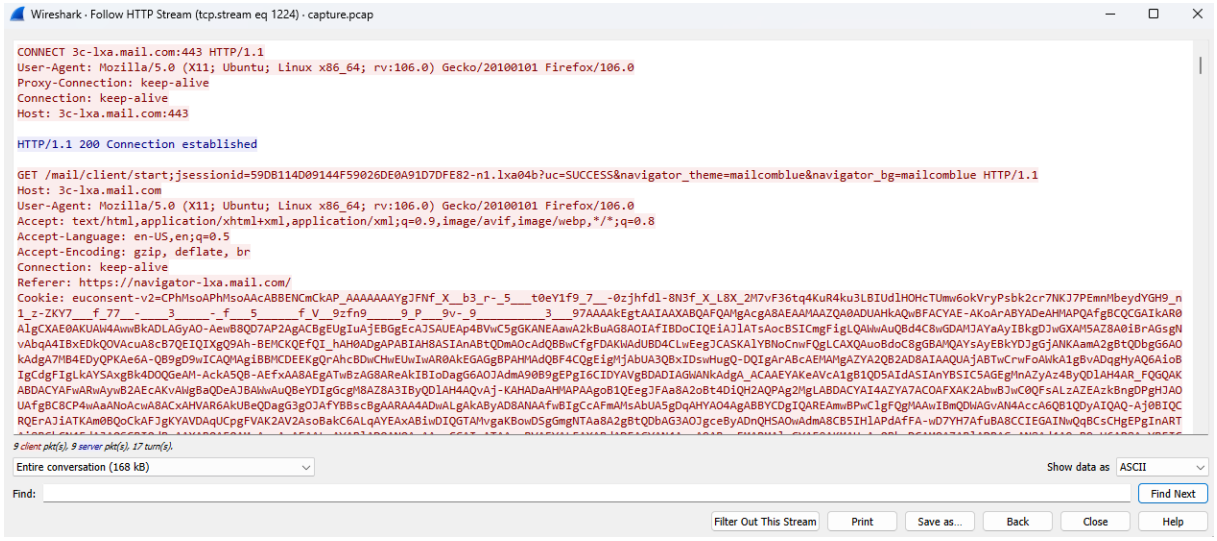


Figure 6: Example of an HTTP conversation seen when following an HTTP stream

On the bottom of the follow stream window, you are provided with some useful options, such as the direction specifier, which allows you to specify whether to show the whole conversation or just the packets going in one direction, and the data presentation mode, which allows you to specify how the data should be shown, for example, as **Raw** data, as an **Hex Dump**, decoded as **ASCII**, etc.

Finally, you can also export the currently shown contents of this window to a file by using the **Save as...** button. Pay attention to the fact that the data is exported based on your current presentation mode, so, for example, if you have selected the data to be shown as a Hex Dump, the exported file will be formatted as a Hex Dump.

7 Export Objects

Another way to export files found in a capture is the Export Objects Tool. To use it, you simply have to go to the top of the window to **File**, followed by **Export Objects** and choose the protocol for which you want to search for and extract objects. Figure 7 shows an example of a list of HTTP objects found by Wireshark through this tool.

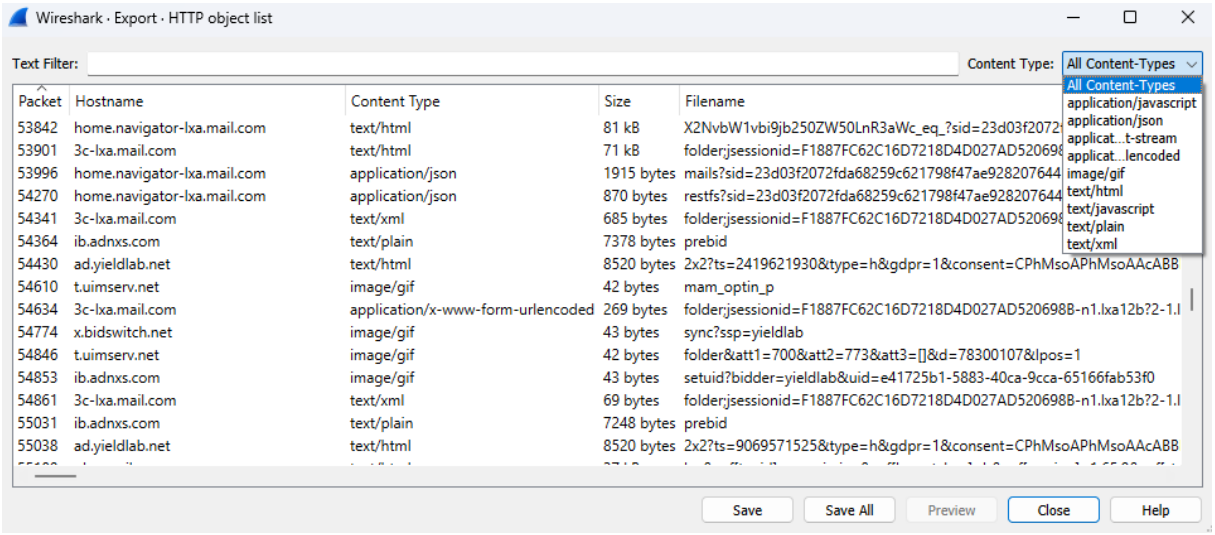


Figure 7: Example of a list of HTTP objects

From this list, you can either export just specific objects or export all objects shown. Additionally, you can also filter only certain types of objects and export those.

8 Statistics

Wireshark offers various statistical views that aid in the detection of unusual patterns within network traffic. These views analyze packet flow rates, protocol distribution, and conversation patterns, providing insights on network behavior and potential issues in the captured data.

8.1 Number of packets per unit time

You can create a graph that plots the number of packets per unit of time by clicking on **Statistics -> I/O Graphs**. You can then identify the periods with highest activity in terms of number of packets sent/received, and click directly on the peaks to get a closer look at what is causing that unusual behavior.

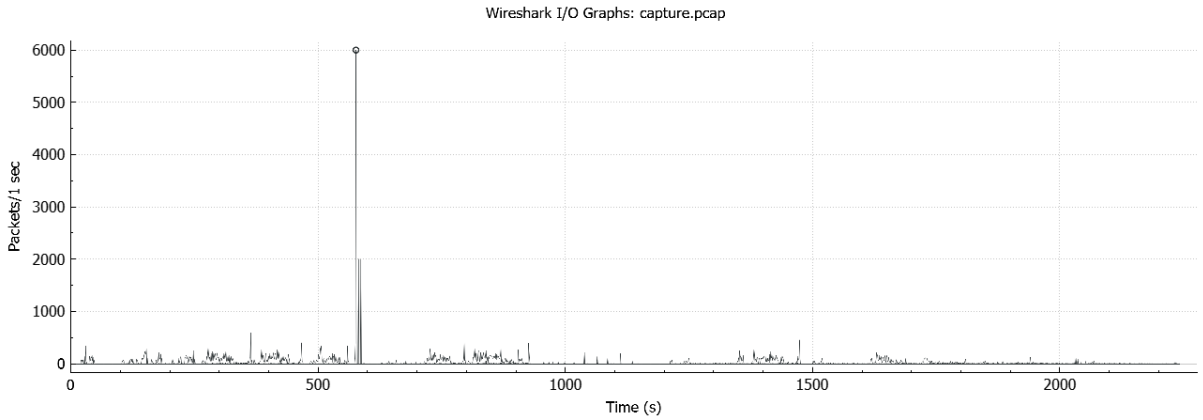


Figure 8: Example of an I/O Graph with a suspicious peak

8.2 Statistics on endpoints

Wireshark also provides a range of statistics on the amount of data (packets, bytes) sent/received by the different endpoints present on the capture. You can access this by clicking on **Statistics -> Endpoints**. This allows you to get a better idea of which hosts are more active in the capture (Figure 9), and which ports were used the most to transfer the largest amount of data (Figure 10). This can provide useful information if there are unusual ports gathering large volumes of data. Knowing this information can help narrow the search by applying the specific host and port as filters.

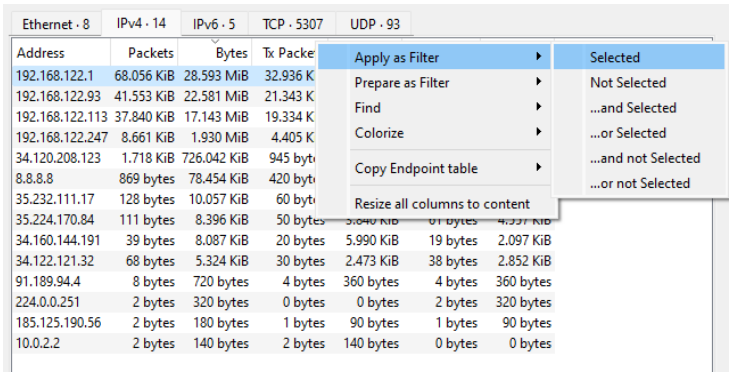


Figure 9: Example of statistics per host

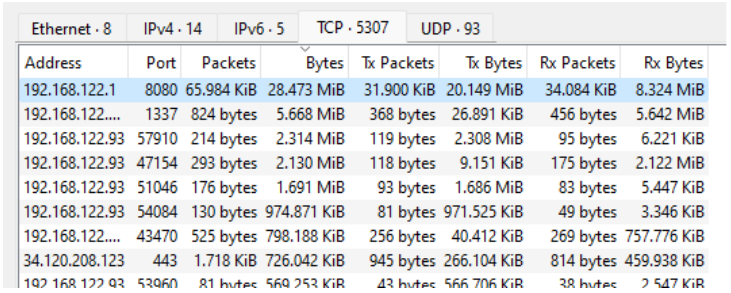


Figure 10: Example of statistics per host and port

9 Filter Examples

Finally, the most versatile tool and the main method for finding information in a network capture is the **Display Filters**. To help you understand what types of things you may be able to find using this tool, this section provides you with some examples of filters and their resulting packet lists, as well as some questions related to those results.

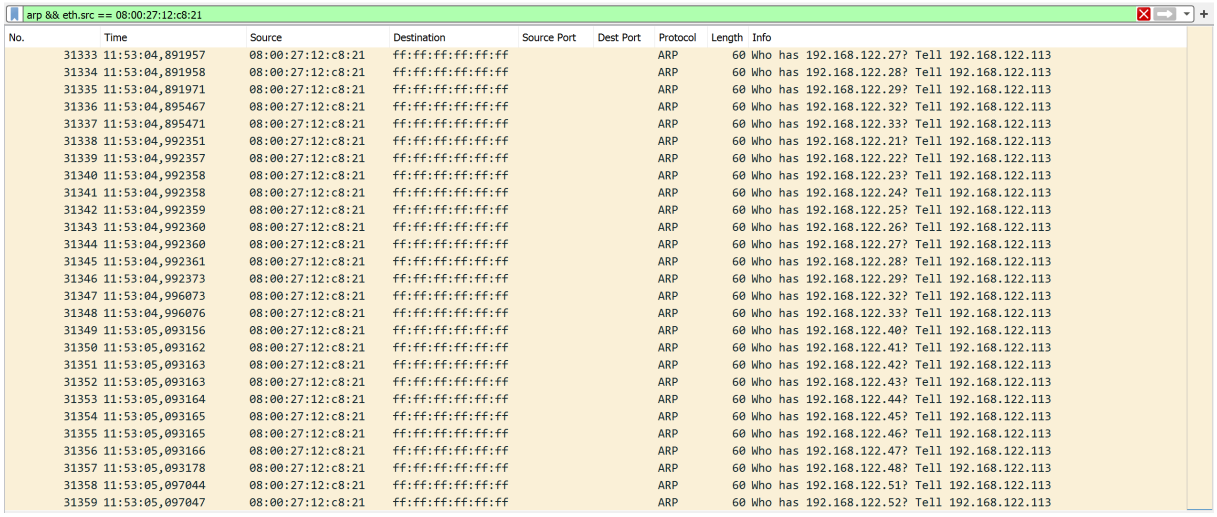
Most of these examples focus on a user whose computer has the MAC address `08:00:27:12:c8:21` and the IP address `192.168.122.113`.

Try to answer the questions related to each example to the best of your ability so that you can understand the purpose of each filter. Remember to use Google to search for any concept you may not fully understand.

9.1 ARP Example

Figure 11 shows the result of using the following filter(s):

- `arp`, which shows only packets corresponding to the Address Resolution Protocol (ARP).
- `eth.src == 08:00:27:12:c8:21` which shows only packets where the source MAC address is the specified one.



arp && eth.src == 08:00:27:12:c8:21

No.	Time	Source	Destination	Source Port	Dest Port	Protocol	Length	Info
31333	11:53:04,891957	08:00:27:12:c8:21	ff:ff:ff:ff:ff:ff			ARP	60	Who has 192.168.122.27? Tell 192.168.122.113
31334	11:53:04,891958	08:00:27:12:c8:21	ff:ff:ff:ff:ff:ff			ARP	60	Who has 192.168.122.28? Tell 192.168.122.113
31335	11:53:04,891971	08:00:27:12:c8:21	ff:ff:ff:ff:ff:ff			ARP	60	Who has 192.168.122.29? Tell 192.168.122.113
31336	11:53:04,895467	08:00:27:12:c8:21	ff:ff:ff:ff:ff:ff			ARP	60	Who has 192.168.122.32? Tell 192.168.122.113
31337	11:53:04,895471	08:00:27:12:c8:21	ff:ff:ff:ff:ff:ff			ARP	60	Who has 192.168.122.33? Tell 192.168.122.113
31338	11:53:04,992351	08:00:27:12:c8:21	ff:ff:ff:ff:ff:ff			ARP	60	Who has 192.168.122.21? Tell 192.168.122.113
31339	11:53:04,992357	08:00:27:12:c8:21	ff:ff:ff:ff:ff:ff			ARP	60	Who has 192.168.122.22? Tell 192.168.122.113
31340	11:53:04,992358	08:00:27:12:c8:21	ff:ff:ff:ff:ff:ff			ARP	60	Who has 192.168.122.23? Tell 192.168.122.113
31341	11:53:04,992358	08:00:27:12:c8:21	ff:ff:ff:ff:ff:ff			ARP	60	Who has 192.168.122.24? Tell 192.168.122.113
31342	11:53:04,992359	08:00:27:12:c8:21	ff:ff:ff:ff:ff:ff			ARP	60	Who has 192.168.122.25? Tell 192.168.122.113
31343	11:53:04,992360	08:00:27:12:c8:21	ff:ff:ff:ff:ff:ff			ARP	60	Who has 192.168.122.26? Tell 192.168.122.113
31344	11:53:04,992360	08:00:27:12:c8:21	ff:ff:ff:ff:ff:ff			ARP	60	Who has 192.168.122.27? Tell 192.168.122.113
31345	11:53:04,992361	08:00:27:12:c8:21	ff:ff:ff:ff:ff:ff			ARP	60	Who has 192.168.122.28? Tell 192.168.122.113
31346	11:53:04,992373	08:00:27:12:c8:21	ff:ff:ff:ff:ff:ff			ARP	60	Who has 192.168.122.29? Tell 192.168.122.113
31347	11:53:04,996073	08:00:27:12:c8:21	ff:ff:ff:ff:ff:ff			ARP	60	Who has 192.168.122.32? Tell 192.168.122.113
31348	11:53:04,996076	08:00:27:12:c8:21	ff:ff:ff:ff:ff:ff			ARP	60	Who has 192.168.122.33? Tell 192.168.122.113
31349	11:53:05,093156	08:00:27:12:c8:21	ff:ff:ff:ff:ff:ff			ARP	60	Who has 192.168.122.40? Tell 192.168.122.113
31350	11:53:05,093162	08:00:27:12:c8:21	ff:ff:ff:ff:ff:ff			ARP	60	Who has 192.168.122.41? Tell 192.168.122.113
31351	11:53:05,093163	08:00:27:12:c8:21	ff:ff:ff:ff:ff:ff			ARP	60	Who has 192.168.122.42? Tell 192.168.122.113
31352	11:53:05,093163	08:00:27:12:c8:21	ff:ff:ff:ff:ff:ff			ARP	60	Who has 192.168.122.43? Tell 192.168.122.113
31353	11:53:05,093164	08:00:27:12:c8:21	ff:ff:ff:ff:ff:ff			ARP	60	Who has 192.168.122.44? Tell 192.168.122.113
31354	11:53:05,093165	08:00:27:12:c8:21	ff:ff:ff:ff:ff:ff			ARP	60	Who has 192.168.122.45? Tell 192.168.122.113
31355	11:53:05,093165	08:00:27:12:c8:21	ff:ff:ff:ff:ff:ff			ARP	60	Who has 192.168.122.46? Tell 192.168.122.113
31356	11:53:05,093166	08:00:27:12:c8:21	ff:ff:ff:ff:ff:ff			ARP	60	Who has 192.168.122.47? Tell 192.168.122.113
31357	11:53:05,093178	08:00:27:12:c8:21	ff:ff:ff:ff:ff:ff			ARP	60	Who has 192.168.122.48? Tell 192.168.122.113
31358	11:53:05,097044	08:00:27:12:c8:21	ff:ff:ff:ff:ff:ff			ARP	60	Who has 192.168.122.51? Tell 192.168.122.113
31359	11:53:05,097047	08:00:27:12:c8:21	ff:ff:ff:ff:ff:ff			ARP	60	Who has 192.168.122.52? Tell 192.168.122.113

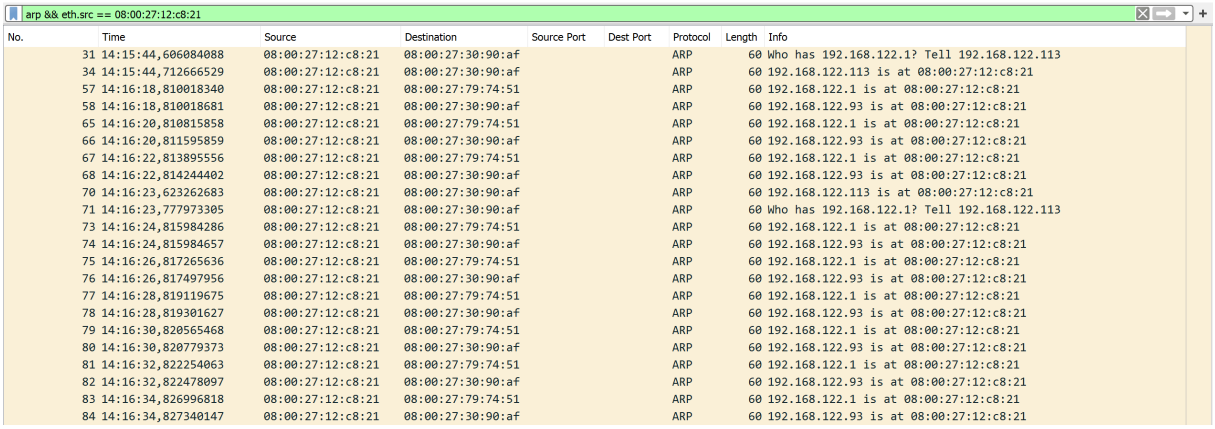
Figure 11: ARP Example

1. Is the resulting list of packets normal, or do you find anything suspicious about it?
2. What kinds of user actions may such a filter be used to identify?

9.2 Another ARP Example

Figure 12 shows the result of using the same filters as the previous example, but in a different capture:

- `arp`, which shows only packets corresponding to the Address Resolution Protocol (ARP).
- `eth.src == 08:00:27:12:c8:21` which shows only packets where the source MAC address is the specified one.



arp && eth.src == 08:00:27:12:c8:21

No.	Time	Source	Destination	Source Port	Dest Port	Protocol	Length	Info
31	14:15:44,606084088	08:00:27:12:c8:21	08:00:27:30:90:af			ARP	60	Who has 192.168.122.1? Tell 192.168.122.113
34	14:15:44,712666529	08:00:27:12:c8:21	08:00:27:30:90:af			ARP	60	192.168.122.113 is at 08:00:27:12:c8:21
57	14:16:18,810018340	08:00:27:12:c8:21	08:00:27:79:74:51			ARP	60	192.168.122.1 is at 08:00:27:12:c8:21
58	14:16:18,810018681	08:00:27:12:c8:21	08:00:27:30:90:af			ARP	60	192.168.122.93 is at 08:00:27:12:c8:21
65	14:16:20,810815858	08:00:27:12:c8:21	08:00:27:79:74:51			ARP	60	192.168.122.1 is at 08:00:27:12:c8:21
66	14:16:20,811595859	08:00:27:12:c8:21	08:00:27:30:90:af			ARP	60	192.168.122.93 is at 08:00:27:12:c8:21
67	14:16:22,813895556	08:00:27:12:c8:21	08:00:27:79:74:51			ARP	60	192.168.122.1 is at 08:00:27:12:c8:21
68	14:16:22,814244402	08:00:27:12:c8:21	08:00:27:30:90:af			ARP	60	192.168.122.93 is at 08:00:27:12:c8:21
70	14:16:23,623262683	08:00:27:12:c8:21	08:00:27:30:90:af			ARP	60	192.168.122.113 is at 08:00:27:12:c8:21
71	14:16:23,777973305	08:00:27:12:c8:21	08:00:27:30:90:af			ARP	60	Who has 192.168.122.1? Tell 192.168.122.113
73	14:16:24,815984286	08:00:27:12:c8:21	08:00:27:79:74:51			ARP	60	192.168.122.1 is at 08:00:27:12:c8:21
74	14:16:24,815984657	08:00:27:12:c8:21	08:00:27:30:90:af			ARP	60	192.168.122.93 is at 08:00:27:12:c8:21
75	14:16:26,817265636	08:00:27:12:c8:21	08:00:27:79:74:51			ARP	60	192.168.122.1 is at 08:00:27:12:c8:21
76	14:16:26,817497956	08:00:27:12:c8:21	08:00:27:30:90:af			ARP	60	192.168.122.93 is at 08:00:27:12:c8:21
77	14:16:28,819119675	08:00:27:12:c8:21	08:00:27:79:74:51			ARP	60	192.168.122.1 is at 08:00:27:12:c8:21
78	14:16:28,819301627	08:00:27:12:c8:21	08:00:27:30:90:af			ARP	60	192.168.122.93 is at 08:00:27:12:c8:21
79	14:16:30,820565468	08:00:27:12:c8:21	08:00:27:79:74:51			ARP	60	192.168.122.1 is at 08:00:27:12:c8:21
80	14:16:30,820779373	08:00:27:12:c8:21	08:00:27:30:90:af			ARP	60	192.168.122.93 is at 08:00:27:12:c8:21
81	14:16:32,822254063	08:00:27:12:c8:21	08:00:27:79:74:51			ARP	60	192.168.122.1 is at 08:00:27:12:c8:21
82	14:16:32,822478097	08:00:27:12:c8:21	08:00:27:30:90:af			ARP	60	192.168.122.93 is at 08:00:27:12:c8:21
83	14:16:34,826996818	08:00:27:12:c8:21	08:00:27:79:74:51			ARP	60	192.168.122.1 is at 08:00:27:12:c8:21
84	14:16:34,827340147	08:00:27:12:c8:21	08:00:27:30:90:af			ARP	60	192.168.122.93 is at 08:00:27:12:c8:21

Figure 12: Another ARP Example

1. Is the resulting list of packets normal, or do you find anything suspicious about it?
2. Can you identify what type of attack may have been performed during this capture? If so, who performed it and what might be the objective of the attack?

9.3 SSH Example

Figure 13 shows the result of using the following filter(s):

- `ssh`, which shows only packets corresponding to the Secure Shell (SSH) protocol.

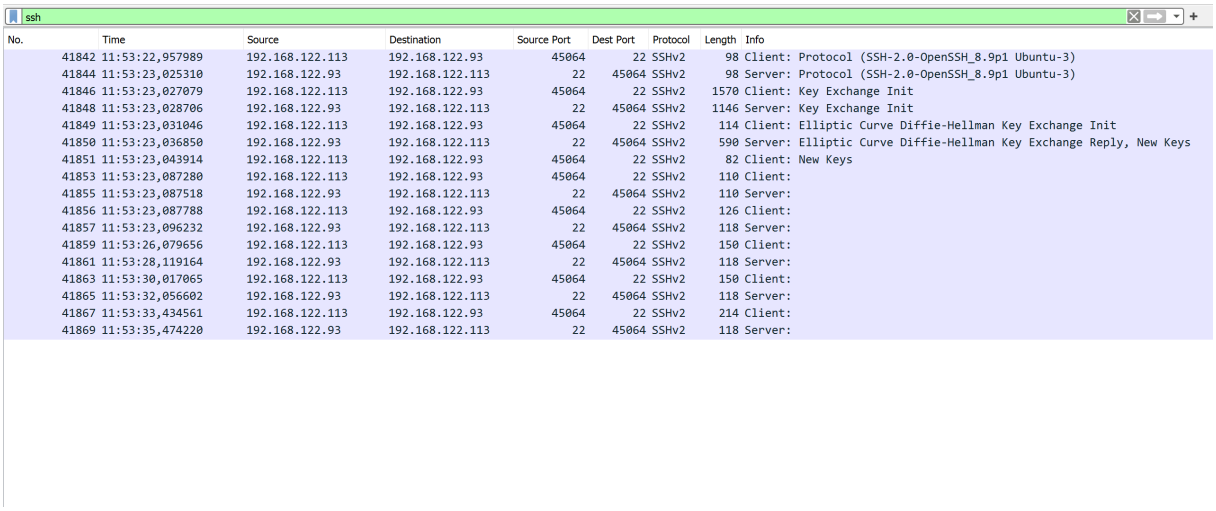


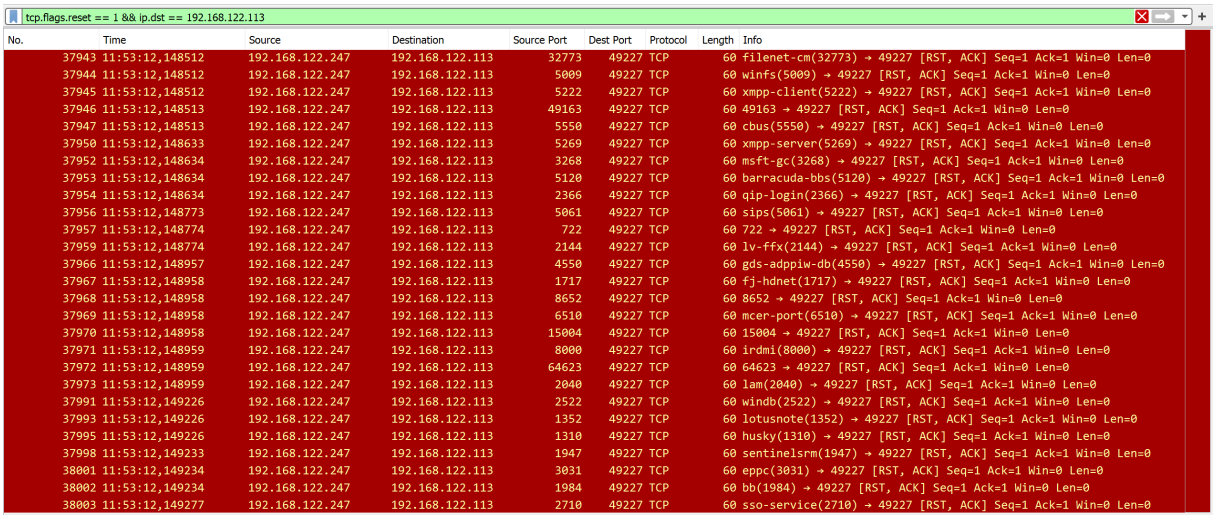
Figure 13: SSH Example

1. Is it usual to see SSH traffic in a capture? Could it have been generated automatically by a device?
2. Can you obtain any information just from this capture, even though it is encrypted?
3. Do you have any hypotheses related to what may have been done by the user? What method could you use to confirm your hypotheses?

9.4 TCP Reset Flag Example

Figure 14 shows the result of using the following filter(s):

- `tcp.flags.reset == 1`, which shows only packets with the TCP reset flag set.
- `ip.dst == 192.168.122.113` which shows only packets where the destination IP address is the specified one.



tcp.flags.reset == 1 && ip.dst == 192.168.122.113

No.	Time	Source	Destination	Source Port	Dest Port	Protocol	Length	Info
37943	11:53:12,148512	192.168.122.247	192.168.122.113	32773	49227	TCP	60	filenet-cm(32773) → 49227 [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
37944	11:53:12,148512	192.168.122.247	192.168.122.113	5009	49227	TCP	60	winfs(5009) → 49227 [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
37945	11:53:12,148512	192.168.122.247	192.168.122.113	5222	49227	TCP	60	xmpp-client(5222) → 49227 [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
37946	11:53:12,148513	192.168.122.247	192.168.122.113	49163	49227	TCP	60	49163 → 49227 [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
37947	11:53:12,148513	192.168.122.247	192.168.122.113	5550	49227	TCP	60	cbus(5550) → 49227 [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
37950	11:53:12,148633	192.168.122.247	192.168.122.113	5269	49227	TCP	60	xmpp-server(5269) → 49227 [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
37952	11:53:12,148634	192.168.122.247	192.168.122.113	3268	49227	TCP	60	msft-gc(3268) → 49227 [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
37953	11:53:12,148634	192.168.122.247	192.168.122.113	5120	49227	TCP	60	barracuda-bbs(5120) → 49227 [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
37954	11:53:12,148634	192.168.122.247	192.168.122.113	2366	49227	TCP	60	qip-login(2366) → 49227 [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
37956	11:53:12,148773	192.168.122.247	192.168.122.113	5061	49227	TCP	60	sips(5061) → 49227 [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
37957	11:53:12,148774	192.168.122.247	192.168.122.113	722	49227	TCP	60	722 → 49227 [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
37959	11:53:12,148774	192.168.122.247	192.168.122.113	2144	49227	TCP	60	lv-ffx(2144) → 49227 [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
37966	11:53:12,148957	192.168.122.247	192.168.122.113	4550	49227	TCP	60	gds-adppiw-db(4550) → 49227 [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
37967	11:53:12,148958	192.168.122.247	192.168.122.113	1717	49227	TCP	60	fj-hdnet(1717) → 49227 [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
37968	11:53:12,148958	192.168.122.247	192.168.122.113	8652	49227	TCP	60	8652 → 49227 [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
37969	11:53:12,148958	192.168.122.247	192.168.122.113	6510	49227	TCP	60	mcer-port(6510) → 49227 [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
37970	11:53:12,148958	192.168.122.247	192.168.122.113	15004	49227	TCP	60	15004 → 49227 [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
37971	11:53:12,148959	192.168.122.247	192.168.122.113	8000	49227	TCP	60	irdmi(8000) → 49227 [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
37972	11:53:12,148959	192.168.122.247	192.168.122.113	64623	49227	TCP	60	64623 → 49227 [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
37973	11:53:12,148959	192.168.122.247	192.168.122.113	2040	49227	TCP	60	lam(2040) → 49227 [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
37991	11:53:12,149226	192.168.122.247	192.168.122.113	2522	49227	TCP	60	windb(2522) → 49227 [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
37993	11:53:12,149226	192.168.122.247	192.168.122.113	1352	49227	TCP	60	lotusnote(1352) → 49227 [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
37995	11:53:12,149226	192.168.122.247	192.168.122.113	1310	49227	TCP	60	husky(1310) → 49227 [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
37998	11:53:12,149233	192.168.122.247	192.168.122.113	1947	49227	TCP	60	sentinelsrm(1947) → 49227 [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
38001	11:53:12,149234	192.168.122.247	192.168.122.113	3031	49227	TCP	60	eppc(3031) → 49227 [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
38002	11:53:12,149234	192.168.122.247	192.168.122.113	1984	49227	TCP	60	bb(1984) → 49227 [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
38003	11:53:12,149277	192.168.122.247	192.168.122.113	2710	49227	TCP	60	sso-service(2710) → 49227 [RST, ACK] Seq=1 Ack=1 Win=0 Len=0

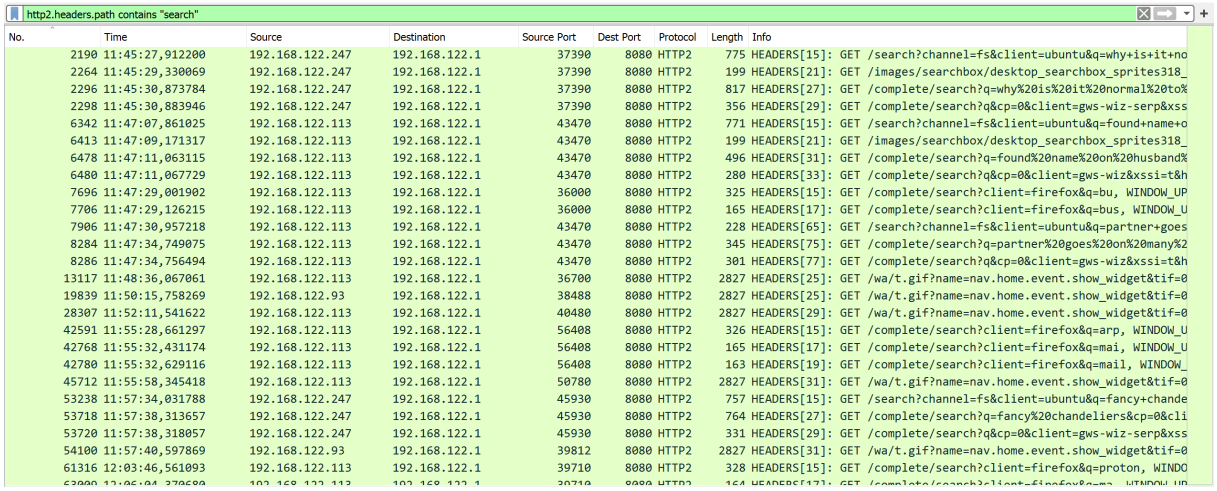
Figure 14: TCP Reset Example

1. What do you think is the objective of such a filter? Explain in simple terms what you think the filter is looking for.
2. Is the resulting packet list normal or do you find anything suspicious about it?

9.5 HTTP Path Example

Figure 15 shows the result of using the following filter(s):

- `http2.headers.path contains "search"`, which shows only packets whose HTTP/2 path contains the string “search”.



http2.headers.path contains "search"

No.	Time	Source	Destination	Source Port	Dest Port	Protocol	Length	Info
2190	11:45:27,912200	192.168.122.247	192.168.122.1	37390	8080	HTTP2	775	HEADERS[15]: GET /search?channel=fs&client=ubuntu&q=why+is+it+no
2264	11:45:29,330069	192.168.122.247	192.168.122.1	37390	8080	HTTP2	199	HEADERS[21]: GET /images/searchbox/desktop_searchbox_sprites318_
2296	11:45:30,873784	192.168.122.247	192.168.122.1	37390	8080	HTTP2	817	HEADERS[27]: GET /complete/search?q=why%20is%20it%20normal%20to%
2298	11:45:30,883946	192.168.122.247	192.168.122.1	37390	8080	HTTP2	356	HEADERS[29]: GET /complete/search?q&cp=0&client=gws-wiz-serp&xss
6342	11:47:07,861025	192.168.122.113	192.168.122.1	43470	8080	HTTP2	771	HEADERS[15]: GET /search?channel=fs&client=ubuntu&q=found+name+o
6413	11:47:09,171317	192.168.122.113	192.168.122.1	43470	8080	HTTP2	199	HEADERS[21]: GET /images/searchbox/desktop_searchbox_sprites318_
6478	11:47:11,063115	192.168.122.113	192.168.122.1	43470	8080	HTTP2	496	HEADERS[31]: GET /complete/search?q=found%20name%20on%20husband%
6480	11:47:11,067729	192.168.122.113	192.168.122.1	43470	8080	HTTP2	280	HEADERS[33]: GET /complete/search?q&cp=0&client=gws-wiz&xssi=t&h
7696	11:47:29,001902	192.168.122.113	192.168.122.1	36000	8080	HTTP2	325	HEADERS[15]: GET /complete/search?client=firefox&q=bu, WINDOW_UP
7706	11:47:29,126215	192.168.122.113	192.168.122.1	36000	8080	HTTP2	165	HEADERS[17]: GET /complete/search?client=firefox&q=bus, WINDOW_U
7906	11:47:30,957218	192.168.122.113	192.168.122.1	43470	8080	HTTP2	228	HEADERS[65]: GET /search?channel=fs&client=ubuntu&q=partner+goes
8284	11:47:34,749075	192.168.122.113	192.168.122.1	43470	8080	HTTP2	345	HEADERS[75]: GET /complete/search?q=partner%20goes%20on%20many%2
8286	11:47:34,756494	192.168.122.113	192.168.122.1	43470	8080	HTTP2	301	HEADERS[77]: GET /complete/search?q&cp=0&client=gws-wiz&xssi=t&h
13117	11:48:36,067061	192.168.122.113	192.168.122.1	36700	8080	HTTP2	2827	HEADERS[25]: GET /wa/t.gif?name=nav.home.event.show_widget&tif=0
19839	11:50:15,758269	192.168.122.93	192.168.122.1	38488	8080	HTTP2	2827	HEADERS[25]: GET /wa/t.gif?name=nav.home.event.show_widget&tif=0
28307	11:52:11,541622	192.168.122.113	192.168.122.1	40480	8080	HTTP2	2827	HEADERS[29]: GET /wa/t.gif?name=nav.home.event.show_widget&tif=0
42591	11:55:28,661297	192.168.122.113	192.168.122.1	56408	8080	HTTP2	326	HEADERS[15]: GET /complete/search?client=firefox&q=arp, WINDOW_U
42768	11:55:32,431174	192.168.122.113	192.168.122.1	56408	8080	HTTP2	165	HEADERS[17]: GET /complete/search?client=firefox&q=mai, WINDOW_U
42780	11:55:32,629116	192.168.122.113	192.168.122.1	56408	8080	HTTP2	163	HEADERS[19]: GET /complete/search?client=firefox&q=mail, WINDOW_
45712	11:55:58,345418	192.168.122.113	192.168.122.1	50780	8080	HTTP2	2827	HEADERS[31]: GET /wa/t.gif?name=nav.home.event.show_widget&tif=0
53238	11:57:34,031788	192.168.122.247	192.168.122.1	45930	8080	HTTP2	757	HEADERS[15]: GET /search?channel=fs&client=ubuntu&q=fancy+chande
53718	11:57:38,313657	192.168.122.247	192.168.122.1	45930	8080	HTTP2	764	HEADERS[27]: GET /complete/search?q=fancy%20chandeliers&cp=0&cli
53720	11:57:38,318057	192.168.122.247	192.168.122.1	45930	8080	HTTP2	331	HEADERS[29]: GET /complete/search?q&cp=0&client=gws-wiz-serp&xss
54100	11:57:40,597869	192.168.122.93	192.168.122.1	39812	8080	HTTP2	2827	HEADERS[31]: GET /wa/t.gif?name=nav.home.event.show_widget&tif=0
61316	12:03:46,561093	192.168.122.113	192.168.122.1	39710	8080	HTTP2	328	HEADERS[15]: GET /complete/search?client=firefox&q=proton, WINDO

Figure 15: HTTP Path Example

1. What do you think is the objective of such a filter? Explain what you think the filter is looking for.
2. From what you can see in this list, can you give an example of a piece of information that you can learn?

9.6 HTTP File Data Example

Figure 16 shows the result of using the following filter(s):

- `http.file_data contains "mail"`, which shows only packets that contain the string "mail" in the data of a file transported by the HTTP protocol.

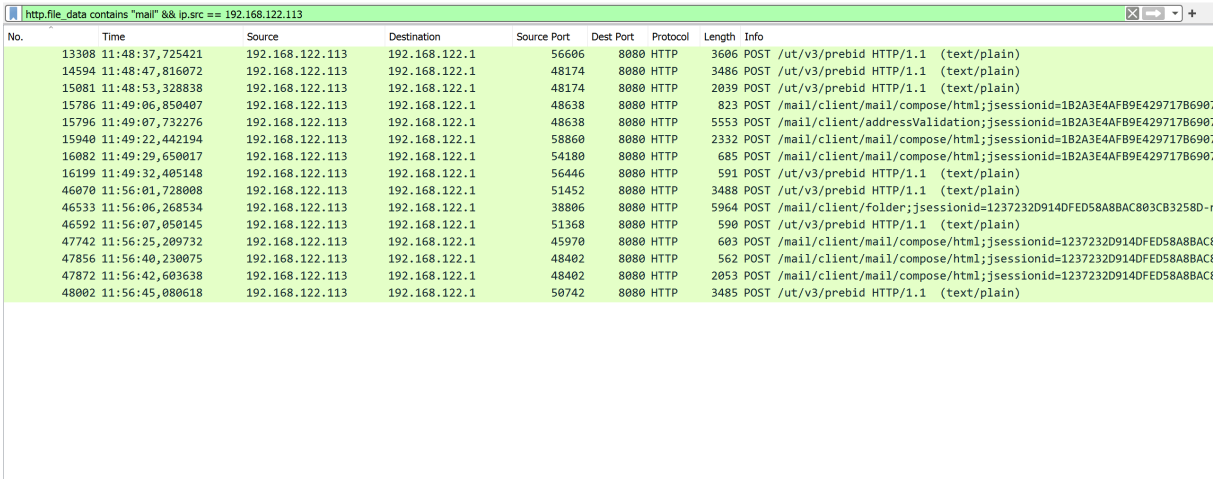


Figure 16: HTTP File Data Example

1. What do you think is the objective of such a filter? Explain what you think the filter is looking for.
2. How can you modify the filter to perform a more targeted search?

9.7 TCP Syn Flag Example

Figure 17 shows the result of using the following filter(s):

- `tcp.flags.syn == 1`, which shows only packets with the TCP syn flag set.
- `tcp.flags.ack == 0`, which shows only packets with the TCP ack flag unset.
- `ip.dst == 192.168.122.113`, which shows only packets where the destination IP address is the specified one.

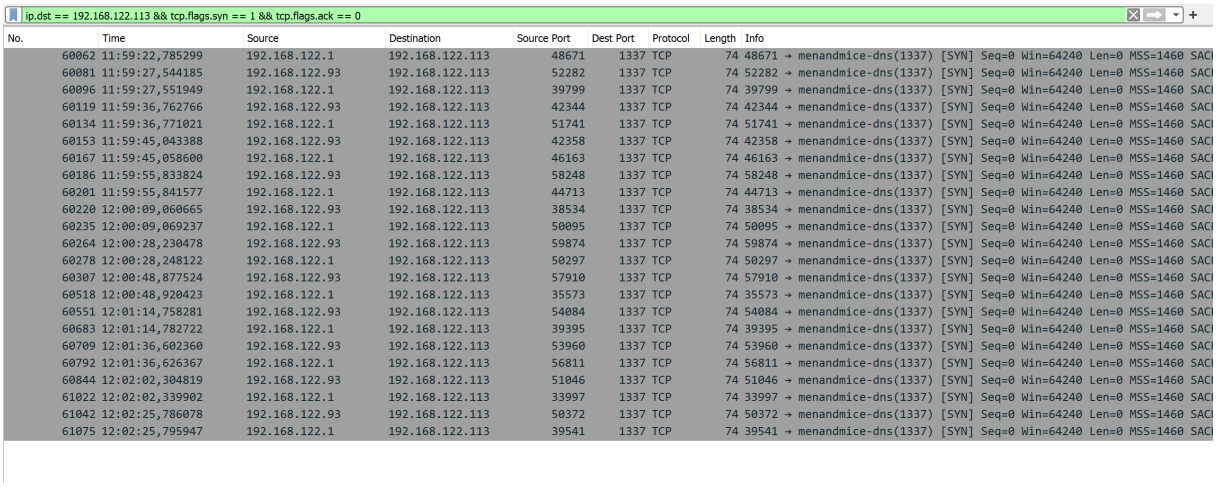


Figure 17: TCP Syn Flag Example

1. Is the resulting list of packets normal, or do you find anything suspicious about it?
2. What kind of packet does the combination `tcp.flags.syn == 1 && tcp.flags.ack == 0` filter for? Explain in simple terms.
3. Why would it be relevant to perform such a search with the user's computer as destination?