

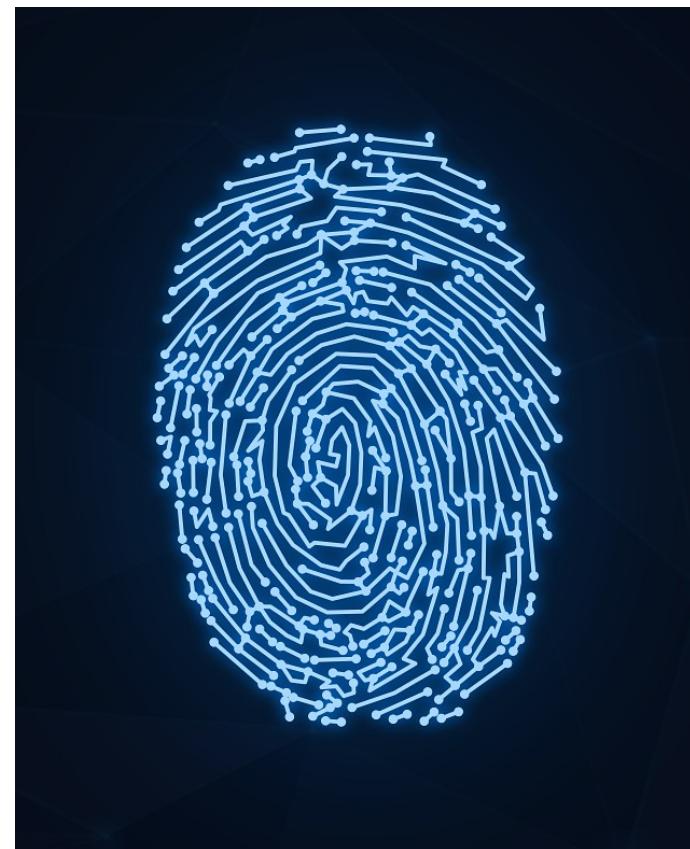
# HackerFrogs Afterschool Digital Forensics: Network Traffic

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Digital Forensics

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Special Requirements:  
Registered account at  
[tryhackme.com](https://tryhackme.com)

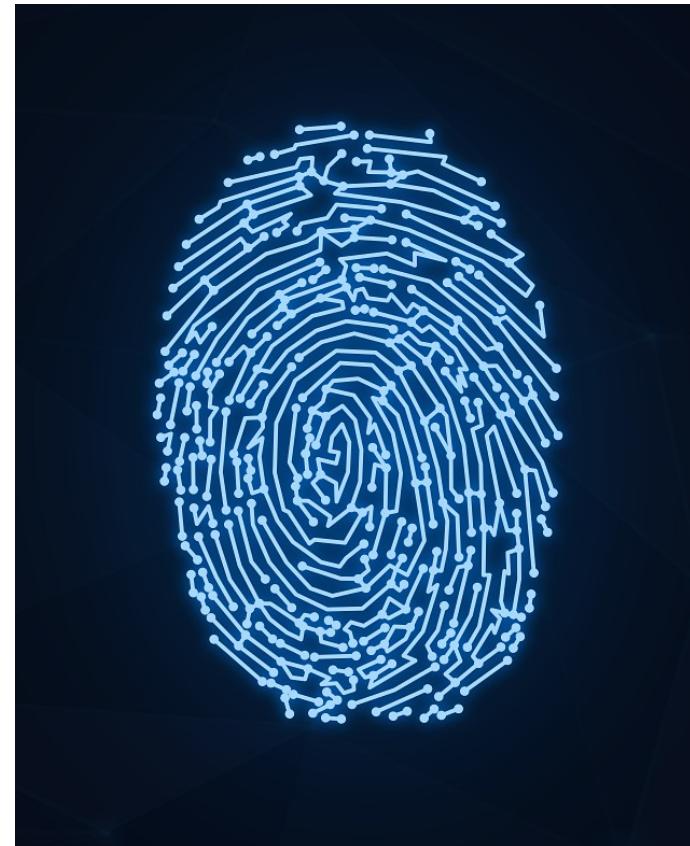


# Welcome to HackerFrogs Afterschool!

Hey there HackerFrogs!

This is the third intro to  
Digital Forensics workshop.

In the previous workshop  
we learned about the  
following Digital Forensic  
concepts:



# Steganography

Steganography is the process of hiding information in another medium. E.g., hiding a hidden message in a picture



# Steganography

When dealing with digital files, steganography can be used to embed files or messages into different media files, like pictures, videos, and audio files



# Steghide



Steghide is a program which can be used to embed files into certain types of picture and audio files

# Steghide



Embedding files with Steghide can use password protection, for added security

# This Workshop's Topics

- network logs
- packet capture files
- Wireshark

# Network Traffic



This workshop's topic is computer networking log forensics.

# Network Traffic



Any time a network device sends data from one device to another, network traffic is generated as network packets are sent back and forth

# What is a Network Device?



What is a network device? Any device that connects to a computer network: PCs, phones, tablets, cars, other IoT devices, etc, etc.

# Network Packets and Traffic

No.	Time	Source	Destination	Protocol	Length
3866	1440.683657	10.10.10.4	143.204.215.126	TCP	5
3867	1440.692645	10.10.10.4	143.204.215.126	TLSv1.3	45
3868	1440.703264	143.204.215.126	10.10.10.4	TCP	148
3869	1440.703282	10.10.10.4	143.204.215.126	TCP	5
3870	1440.703412	143.204.215.126	10.10.10.4	TCP	148
3871	1440.703421	10.10.10.4	143.204.215.126	TCP	5

- ▶ Frame 1: 62 bytes on wire (496 bits), 62 bytes captured (496 bits)
- ▶ Ethernet II, Src: PcsCompu\_43:73:bc (08:00:27:43:73:bc), Dst: IPv6mcast\_02
- ▶ Internet Protocol Version 6, Src: fe80::a00:27ff:fe43:73bc, Dst: ff02::2
- ▶ Internet Control Message Protocol v6

Network packets contain a number of elements, such as...

# Network Packets and Traffic

Source	Destination
10.10.10.4	143.204.215.126
10.10.10.4	143.204.215.126
143.204.215.126	10.10.10.4
10.10.10.4	143.204.215.126

**Source and Destination:** the network addresses of both the source and destination devices (IP address)

# Network Traffic

```
<html>\n  <head>\n    <title>[Simple Login Page! TryHackMe]</title>\n    <link rel="stylesheet" media="screen" href="css/bootstrap.css"\n    <link rel="stylesheet" media="screen" href="css/tryhackme.css"\n</head>\n
```

**The “payload”:** the actual data being sent

# Network Traffic

- ▼ Ethernet II, Src: PcsCompu\_a2:07:27 (08:00:27:a2:07:27),
  - ▶ Destination: PcsCompu\_43:73:bc (08:00:27:43:73:bc)
  - ▶ Source: PcsCompu\_a2:07:27 (08:00:27:a2:07:27)
  - Type: IPv4 (0x0800)

**Header info:** essential data for routing and processing the packet

# Network Traffic

## Hypertext Transfer Protocol

▶ HTTP/1.1 302 Found\r\n

Date: Mon, 08 Nov 2021 17:37:38 GMT\r\n

Server: Apache/2.4.43 (Debian)\r\n

Expires: Thu, 19 Nov 1981 08:52:00 GMT\r\n

**Protocol info:** depending on the type of data packet (TCP, UDP, HTTP, etc), protocol-specific data can also be included in the packet

# PCAP Files

No.	Time	Source	Destination	Protocol	Length	Info
3893	74.009209782	192.168.0.5	198.35.26.96	TCP	86	[TCP Window Update] 49426 → 443 [ACK]
3894	74.009619550	198.35.26.96	192.168.0.5	TCP	1414	443 → 49426 [ACK] Seq=957494 Ack=16680
3895	74.009628076	192.168.0.5	198.35.26.96	TCP	86	[TCP Window Update] 49426 → 443 [ACK]
3896	74.010017906	198.35.26.96	192.168.0.5	TLSv1.3	1414	Application Data, Application Data
3897	74.010021713	192.168.0.5	198.35.26.96	TCP	86	[TCP Window Update] 49426 → 443 [ACK]
3898	74.012261319	198.35.26.96	192.168.0.5	TCP	1414	443 → 49426 [ACK] Seq=960190 Ack=16680
3899	74.012265176	192.168.0.5	198.35.26.96	TCP	86	[TCP Window Update] 49426 → 443 [ACK]
3900	74.012686034	198.35.26.96	192.168.0.5	TCP	2762	443 → 49426 [ACK] Seq=961538 Ack=16680
3901	74.012689801	192.168.0.5	198.35.26.96	TCP	86	[TCP Window Update] 49426 → 443 [ACK]
3902	74.013239191	198.35.26.96	192.168.0.5	TCP	1414	443 → 49426 [ACK] Seq=964234 Ack=16680
3903	74.013242156	192.168.0.5	198.35.26.96	TCP	86	[TCP Window Update] 49426 → 443 [ACK]
3904	74.013513344	198.35.26.96	192.168.0.5	TLSv1.3	884	Application Data
3905	74.013516600	192.168.0.5	198.35.26.96	TCP	86	[TCP Window Update] 49426 → 443 [ACK]

Files which contain a collection of network traffic are called packet capture (PCAP) files, and one specialty of digital forensics is the analysis of network traffic and PCAP files.

# Wireshark



Wireshark is a program which is widely used for network traffic analysis, and we'll learn to use it to analyze PCAP files.

# Wireshark

We'll learn Wireshark through an interactive module on the TryHackMe website. Please navigate to the following URL:

<https://tryhackme.com/r/room/adventofcyber3>

# Networking Basics: The OSI Model



Before we dive into how to use Wireshark, let's review the OSI model, which Wireshark uses to organize PCAP contents

# The OSI Model



The OSI model a system for organizing computer networking data into abstract layers. There are 7 layers in the OSI model:

# The OSI Layers

Layer 1 – Physical

Layer 2 – Data Link

Layer 3 – Network

Layer 4 – Transport

Layer 5 – Session

Layer 6 – Presentation

Layer 7 – Application

# OSI Layer 1: Physical



OSI Layer 1 is the **Physical** layer, which represents the physical connection between devices and the sending / receiving of raw data bits over a physical medium

# OSI Layer 1: Physical



Examples of things that transmit data over OSI layer 1 include cables, connectors, network interface cards (NICs), and modems.

# OSI Layer 2: Data Link



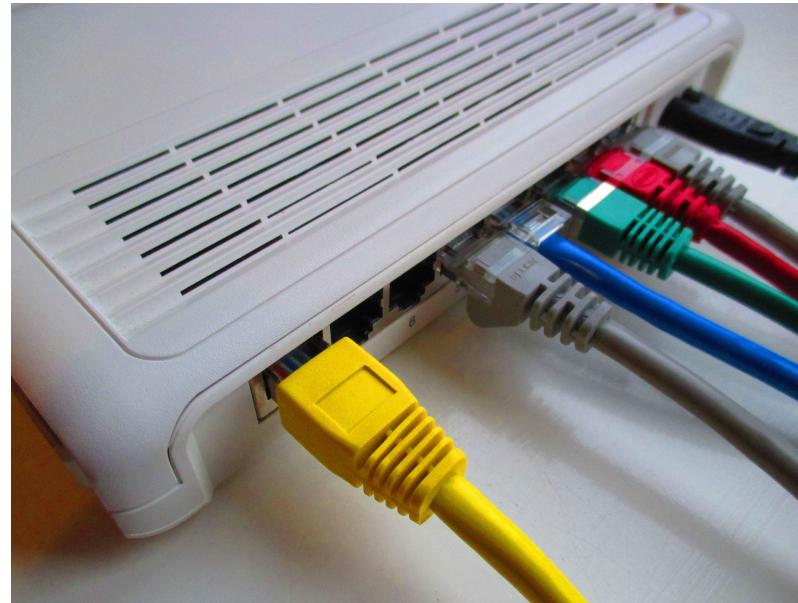
OSI Layer 2 is the **Data Link** layer, which provides reliable communication between directly connected nodes on a network. Data transmitted over the Data Link layer are called frames

# OSI Layer 2: Data Link



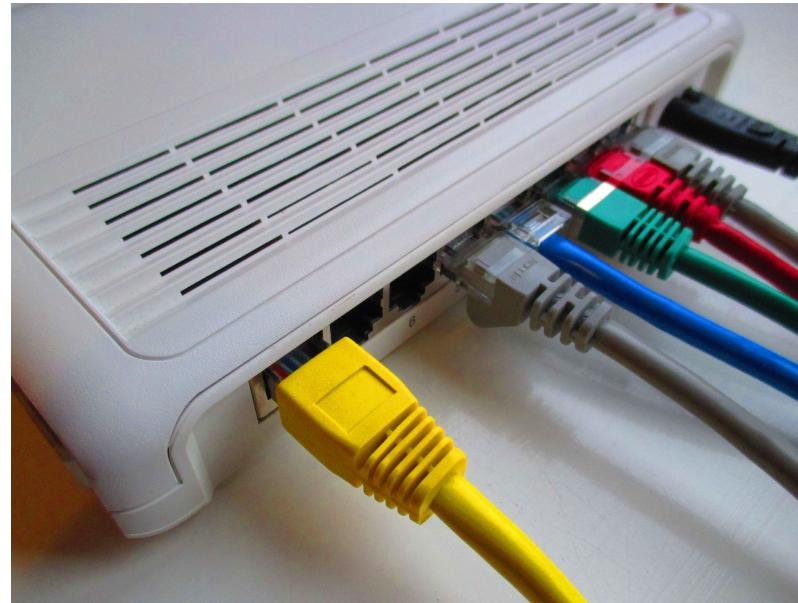
Examples of things that transmit data over OSI layer 2 include ethernet switches, wireless access points (WAPs), virtual LANs (VLANs), and MAC addresses

# OSI Layer 3: Network



OSI Layer 3 is the **Network** layer, which covers logical addressing, routing, creation, and forwarding of packets between devices across different networks. Data transmitted over the Network layer are called packets

# OSI Layer 3: Network



Examples of things that transmit data over OSI layer 3 are Firewalls, IPv4 / IPv6, ICMP, Network Address Translation (NAT) devices, and routers

# OSI Layer 4: Transport



OSI Layer 4 is the **Transport** layer, which handles end-to-end communication, error detection / correction, and flow control in a network. Data transmitted over the Transport layer are called segments

# OSI Layer 4: Transport



Examples of things that transmit data over OSI layer 4 are Transmission Control Protocol (TCP), User Datagram Protocol (UDP), port numbers, multiplexing, and socket programming

# OSI Layer 5: Session



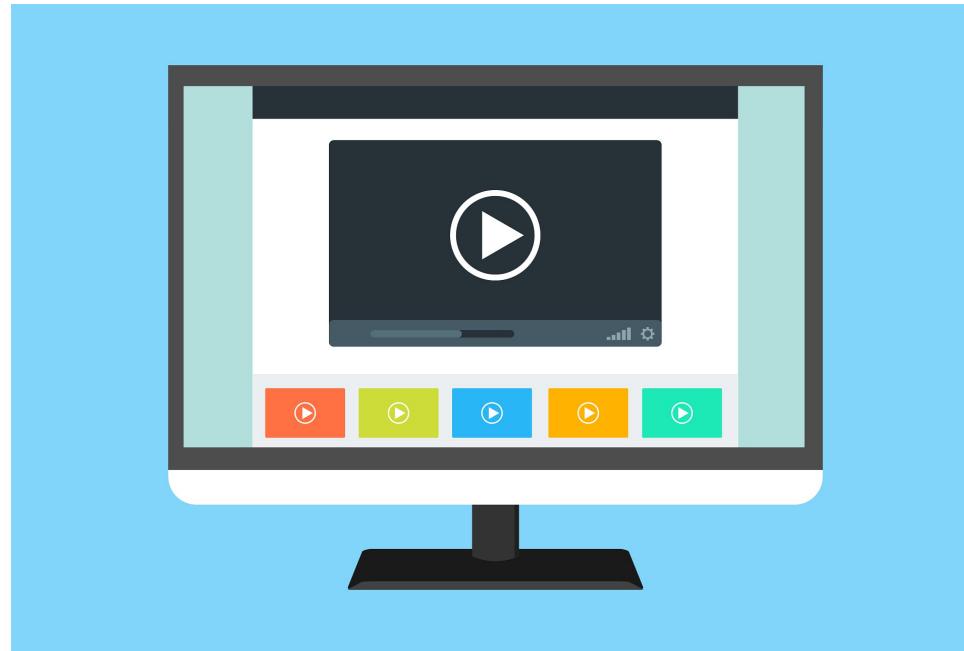
OSI Layer 5 is the **Session** layer, which manages communication sessions, and the orderly exchange of data between devices. Data transmitted over the Session layer is called data units or session data

# OSI Layer 5: Session



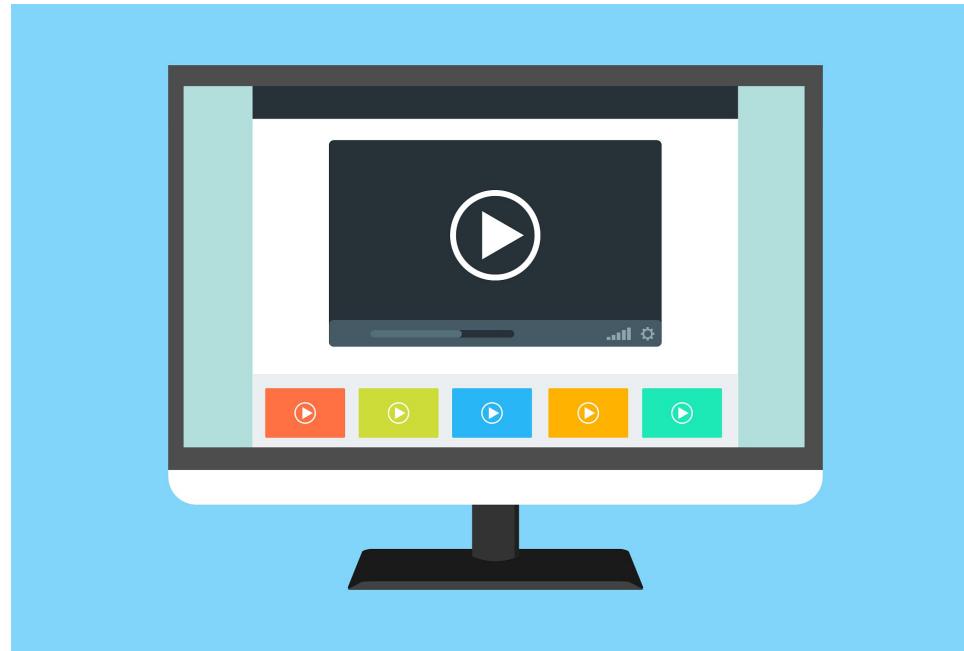
Examples of things that transmit data over OSI layer 5 are web browsers / web servers, remote desktop protocol (RDP), and network printing

# OSI Layer 6: Presentation



OSI Layer 6 is the **Presentation** layer, and deals with encryption, character encoding, data compression, and format conversion. Data transmitted over the Presentation layer is called data units or presentation data

# OSI Layer 6: Presentation



Examples of things that transmit data over OSI layer 6 are media players, transport layer security (TLS) protocols, file format converters, encoding libraries, and encryption / decryption software.

# OSI Layer 7: Application



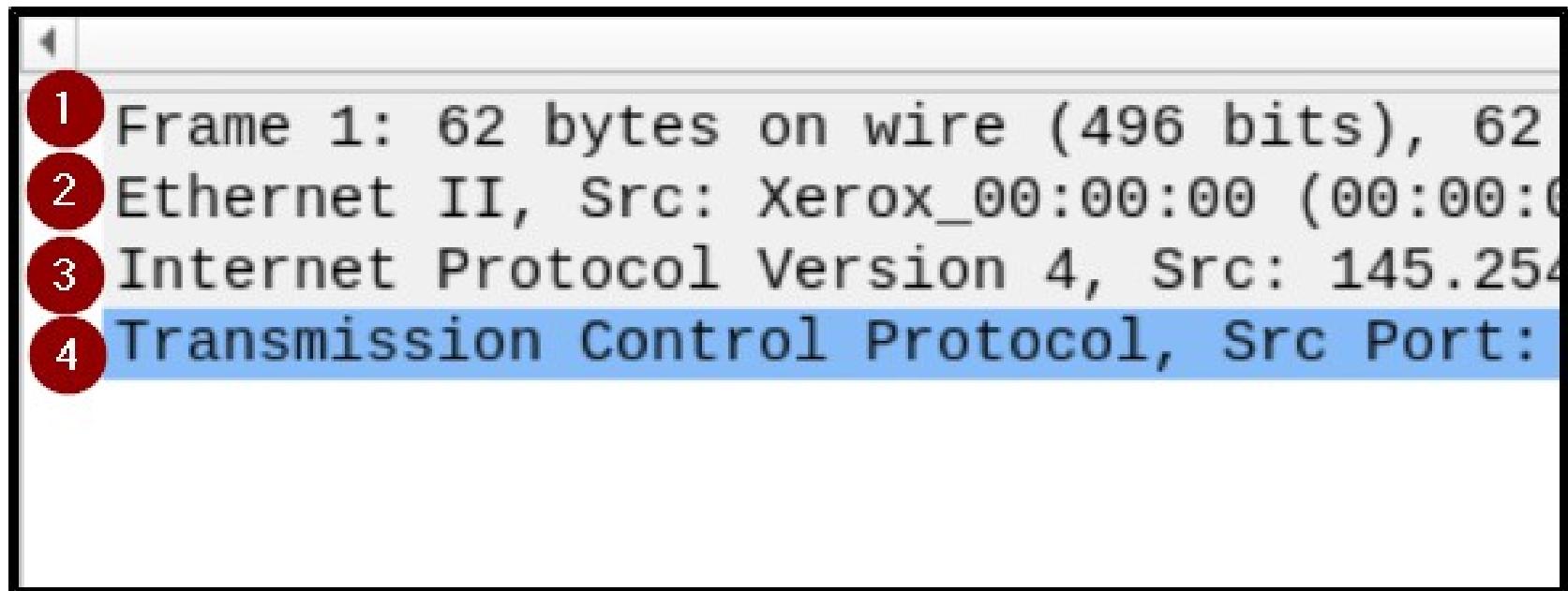
OSI Layer 7 is the **Application** layer, deals with end-user applications and offers a standardized interface for diverse apps across a network. Data transmitted over the Application layer is called application data, or messages

# OSI Layer 7: Application



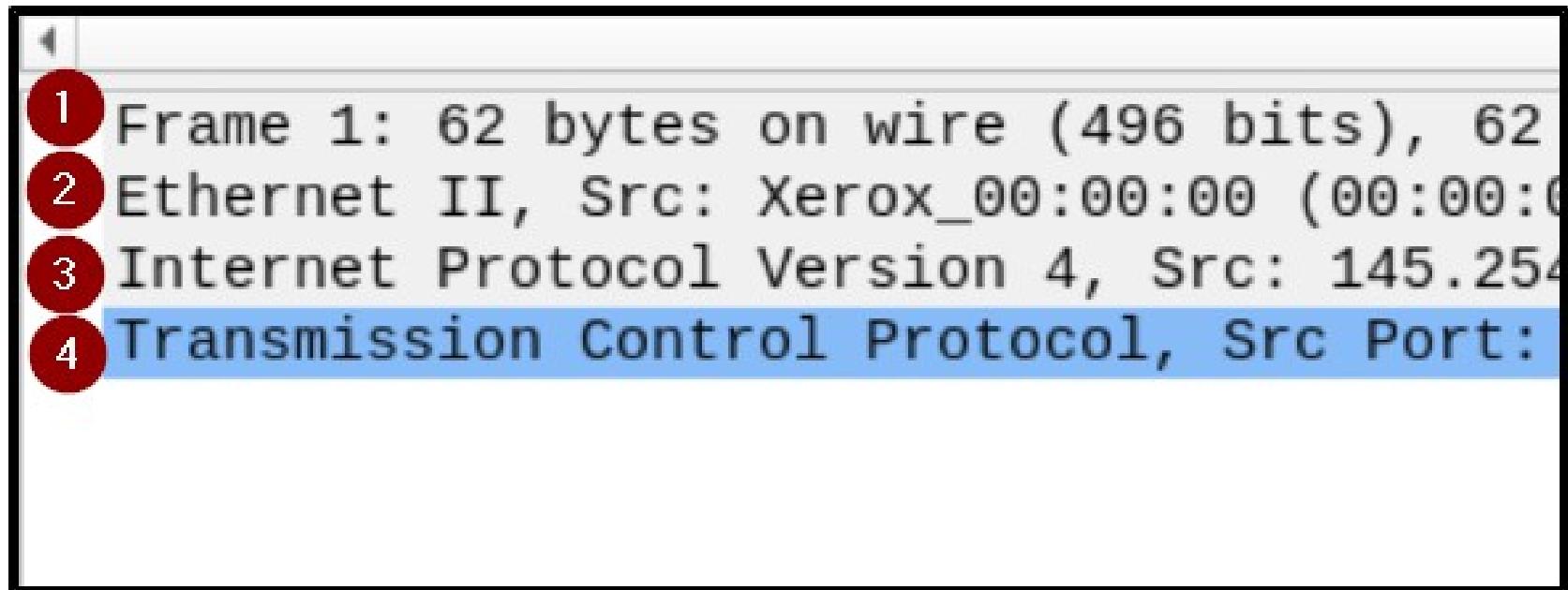
Examples of things that transmit data over OSI layer 7 are web browsers, HTTP, email clients, messaging apps, DNS, and database management systems (DBMS)

# Wireshark and the OSI Model



The Wireshark packet details pane organizes its expandable tabs according to OSI layers. Note that not all packets will contain layers in a sequence.

# Wireshark and the OSI Model

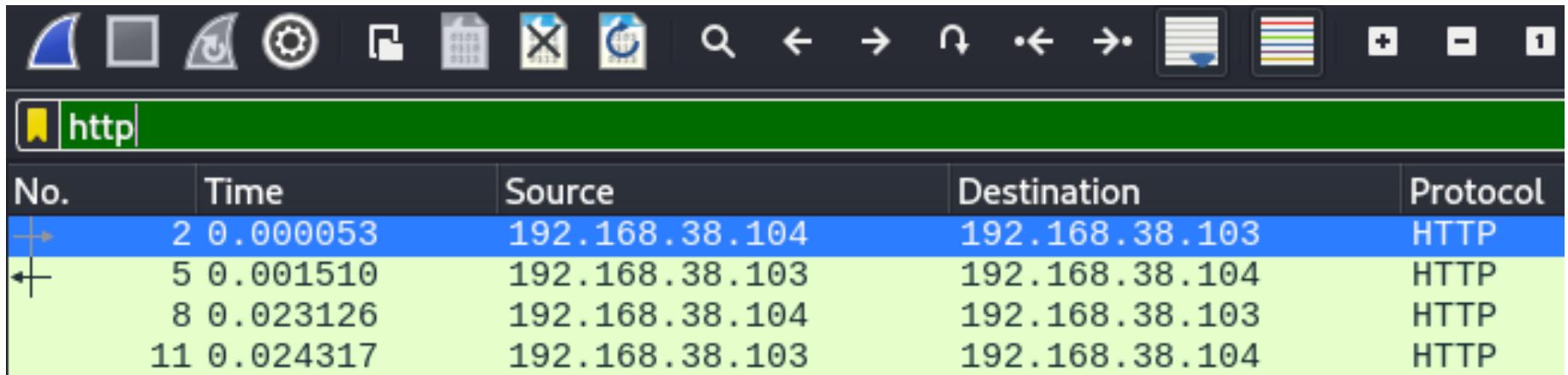


The screenshot shows a Wireshark interface with a single packet selected. Four red circles with white numbers are overlaid on the left side of the packet details:

- 1 Frame 1: 62 bytes on wire (496 bits), 62 bytes captured (496 bits), 62 bytes selected (496 bits)
- 2 Ethernet II, Src: Xerox\_00:00:00 (00:00:00:00:00:00), Dst: 00:0c:29:4f:00:00 (00:0c:29:4f:00:00)
- 3 Internet Protocol Version 4, Src: 145.254.1.100 (145.254.1.100), Dst: 145.254.1.1 (145.254.1.1)
- 4 Transmission Control Protocol, Src Port: 5353 (5353), Dst Port: 53 (53)

But most packets will contain data for OSI layers  
1, 2, and 3.

# Display Filter

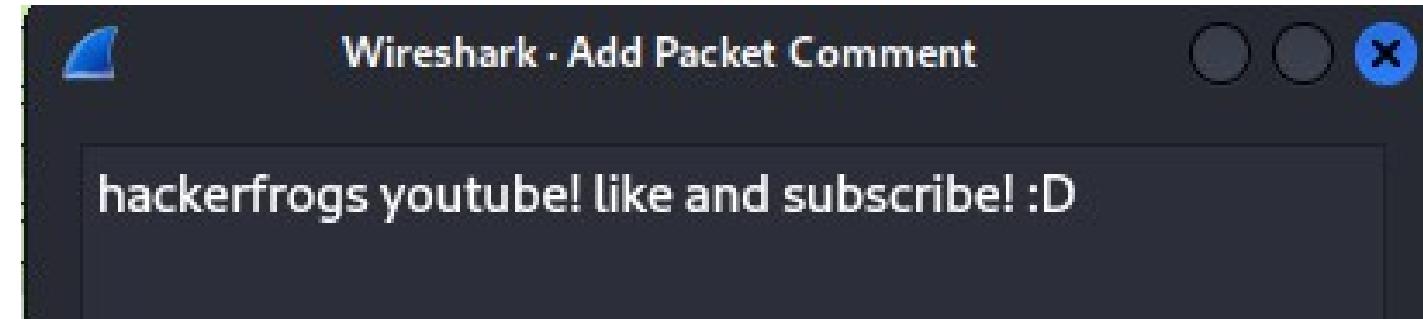


The screenshot shows the Wireshark interface with a display filter set to "http". The packet list view displays four HTTP packets. The first packet (No. 2) is selected, highlighted in blue. The other three packets (No. 5, 8, and 11) are shown in green, indicating they are part of the same conversation or selected as related packets.

No.	Time	Source	Destination	Protocol
2	0.000053	192.168.38.104	192.168.38.103	HTTP
5	0.001510	192.168.38.103	192.168.38.104	HTTP
8	0.023126	192.168.38.104	192.168.38.103	HTTP
11	0.024317	192.168.38.103	192.168.38.104	HTTP

The display filter is an important tool for managing large numbers of packets, and can be fine-tuned to display only packets with specific properties.

# Packet Comments



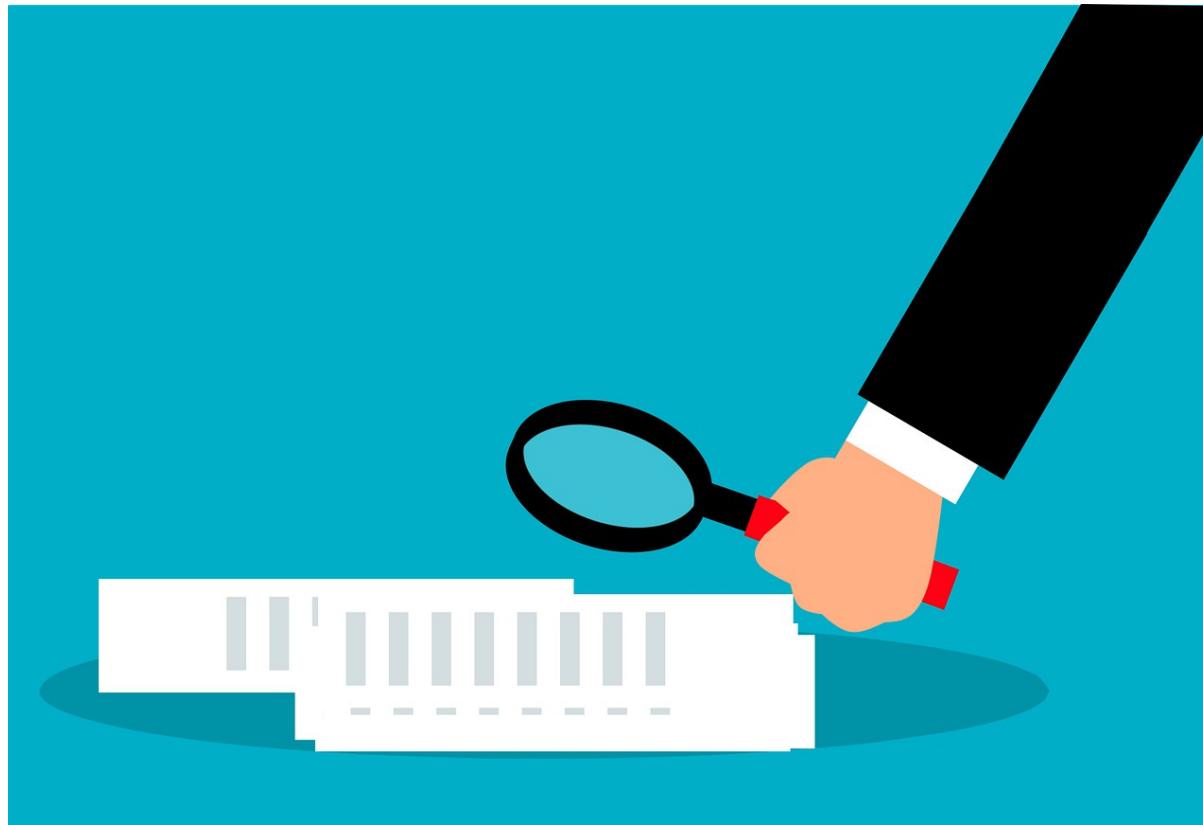
Packet comments are a way for analysts to attach notes to specific packets. The keyboard shortcut for packet comments is **Ctrl+Alt+C**.

# Packet Comments

pkt_comment		
No.	Time	Source
+	2 0.000053	192.168.38.104

We can also filter packets by only those containing comments with the Display Filter “pkt\_comment”

# Summary



Let's review the digital forensics concepts we learned in this workshop:

# Network Traffic



Any time a network device sends data from one device to another, network traffic is generated as network packets are sent back and forth

# PCAP Files

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Files which contain a collection of network traffic are called packet capture (PCAP) files, and one specialty of digital forensics is the analysis of network traffic and PCAP files.

# Wireshark



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# What's Next?

In the next digital forensics workshop, we'll practice more network traffic analysis with the TryHackMe platform



# Extra Credit

Looking for more study material on this workshop's topics?

See this video's description for links to supplemental documents and exercises!



# Until Next Time, HackerFrogs!

