Tutorial 1: Ping, Traceroute, Wireshark

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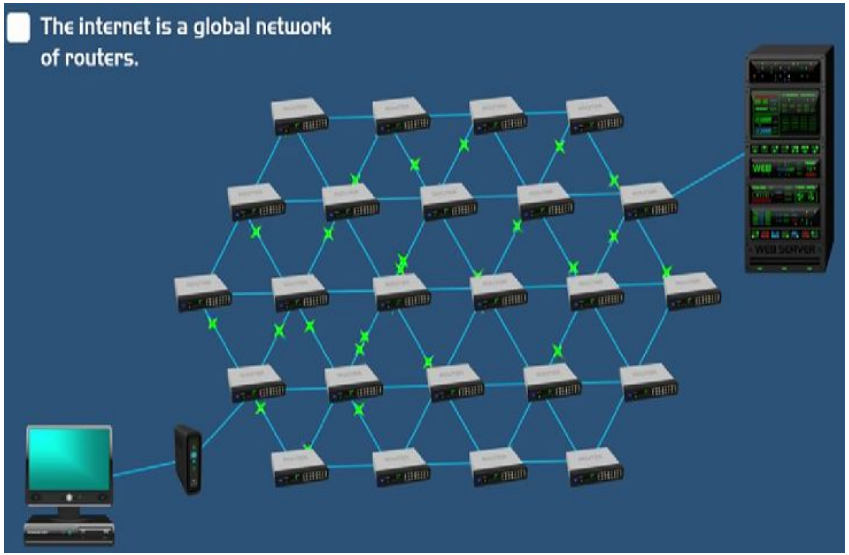
Topics

- Ping
- Traceroute (Tracert)
- Wireshark

Internet: A global network



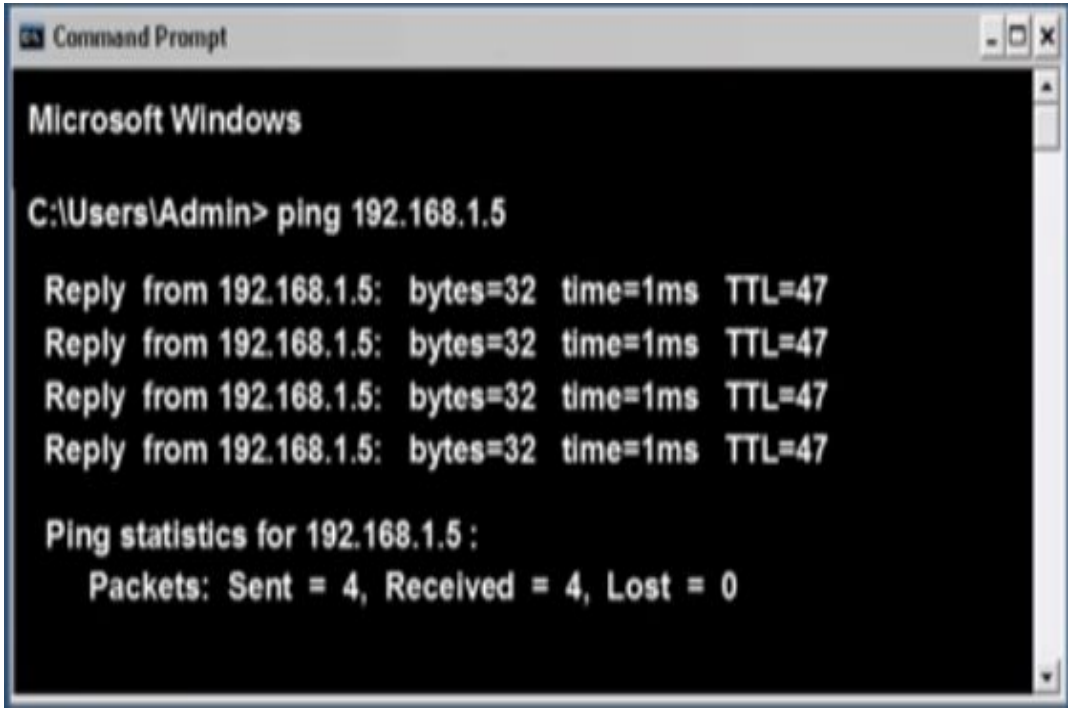
Ping

https://youtu.be/IIicPE38O-s?si=yQLviipmIXEqaFVt

Ping

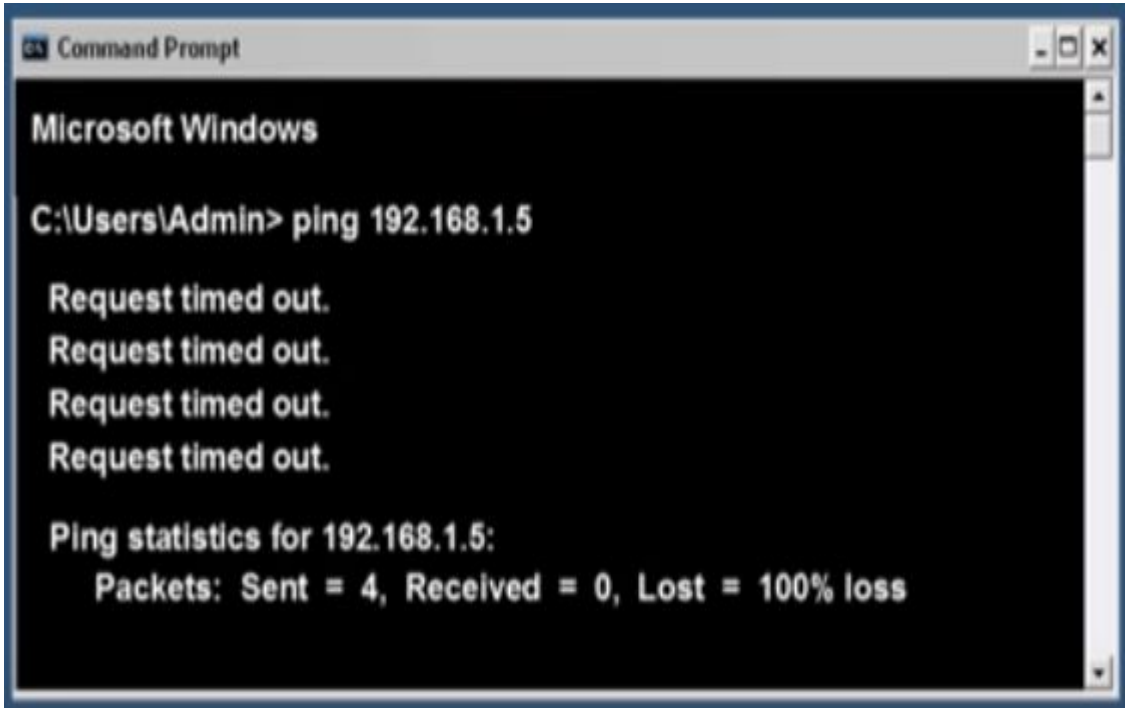
- A tool for troubleshooting network issues, such as:
  - Test network connectivity (local network, Internet)
  - Test network Interface card
- Available in Windows, Linux, MacOS
- The sender sends 4 packets to the destination and waits for reply
- **RTT(Round-Trip-Time)**: the time between the transmission of a packet from the transmitter until the reply from the receiver returns

Ping



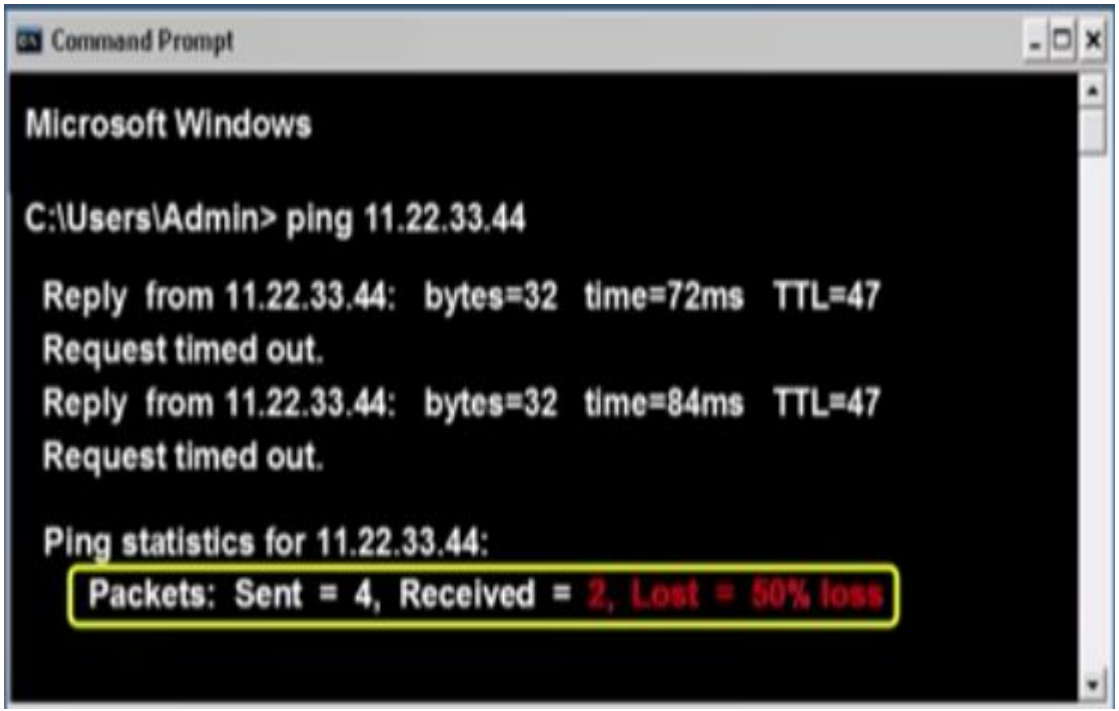
- There is connectivity between two hosts, without packet losses
- 4 packets were sent, 4 replies were received
- You can ping an IP address or a server name

Ping



- No reply
- There isn’t connectivity between two hosts
- 4 packets were sent, 0 packets were received
- Possible reasons:
  - The receiver is power down
  - Firewall

Ping

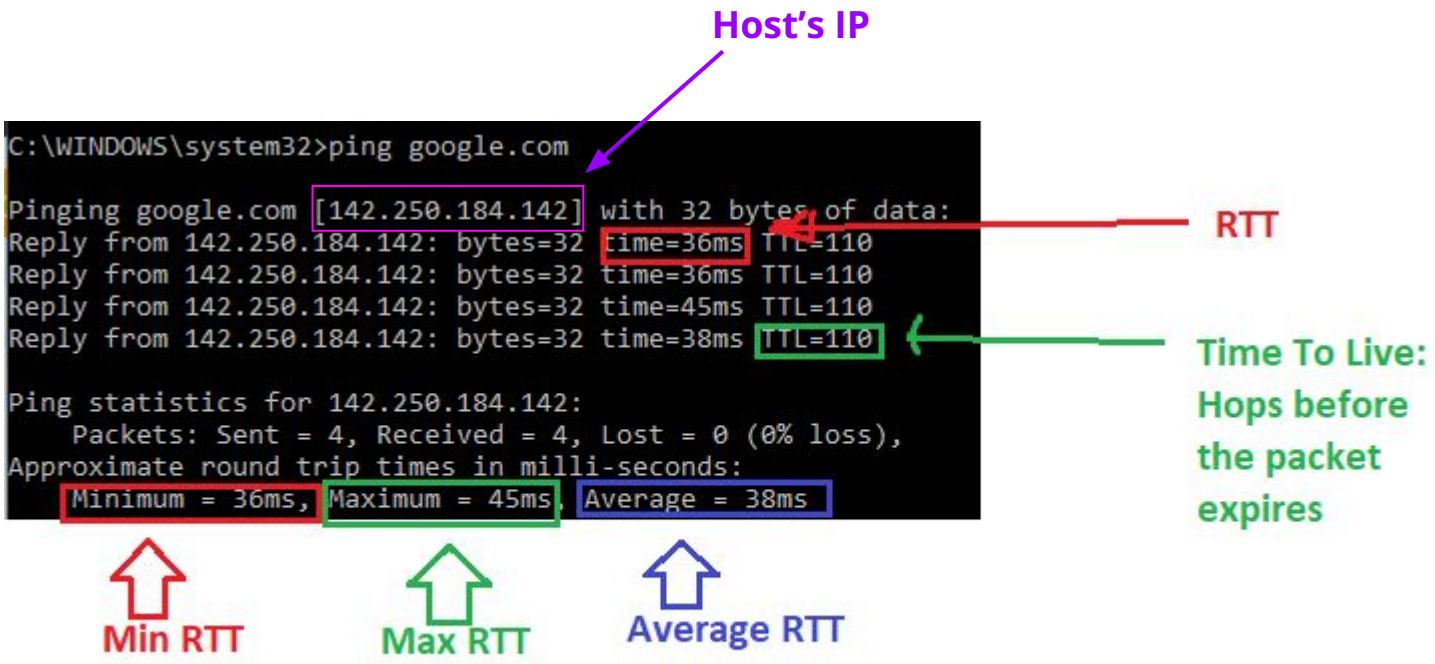


- Not all the data packets reply back to the sender
- **Packet loss**
- Possible reasons:
  - Network congestion
  - Faulty hardware (cables, wiring, network card, modem)

Ping

- The route to the destination cannot be found
- A router doesn’t have any information on how to route data to the destination
- The destination is disconnecting from the Internet

Ping


Host's IP
C:\WINDOWS\system32>ping google.com
Pinging google.com [142.250.184.142] with 32 bytes of data:
Reply from 142.250.184.142: bytes=32 time=36ms TTL=110
Reply from 142.250.184.142: bytes=32 time=36ms TTL=110
Reply from 142.250.184.142: bytes=32 time=45ms TTL=110
Reply from 142.250.184.142: bytes=32 time=38ms TTL=110
Ping statistics for 142.250.184.142:
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
Minimum = 36ms, Maximum = 45ms, Average = 38ms
RTT
Time To Live: Hops before the packet expires
Min RTT
Max RTT
Average RTT

Traceroute (tracert)

https://youtu.be/up3bcBLZS74?si=3zoCpaYqv6qA1ALu

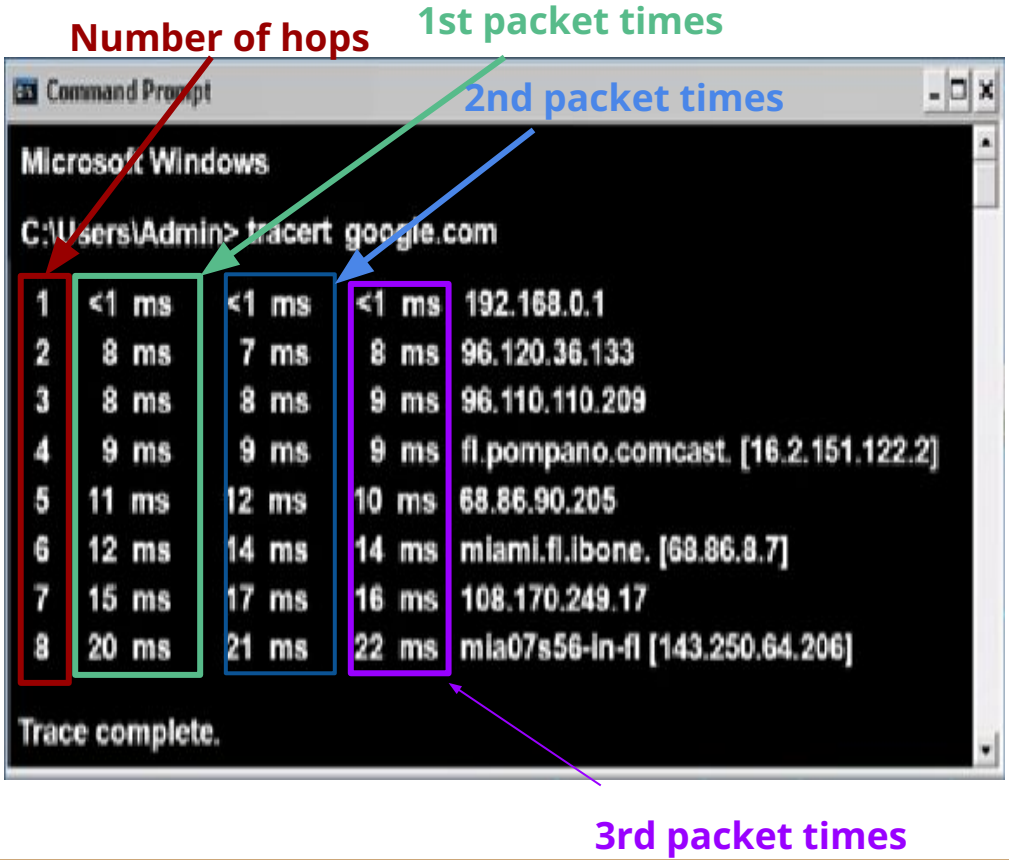
Traceroute

- Used to show the route that the data packets take
- A tool that is used to find the exact path a data packet is taken from the sender to the receiver
- Available in Windows (tracert), UNIX and MacOS
- Pings every router in the path
- Sends three packets and measures the RTTs that the data packet took from each router and the destination

Traceroute

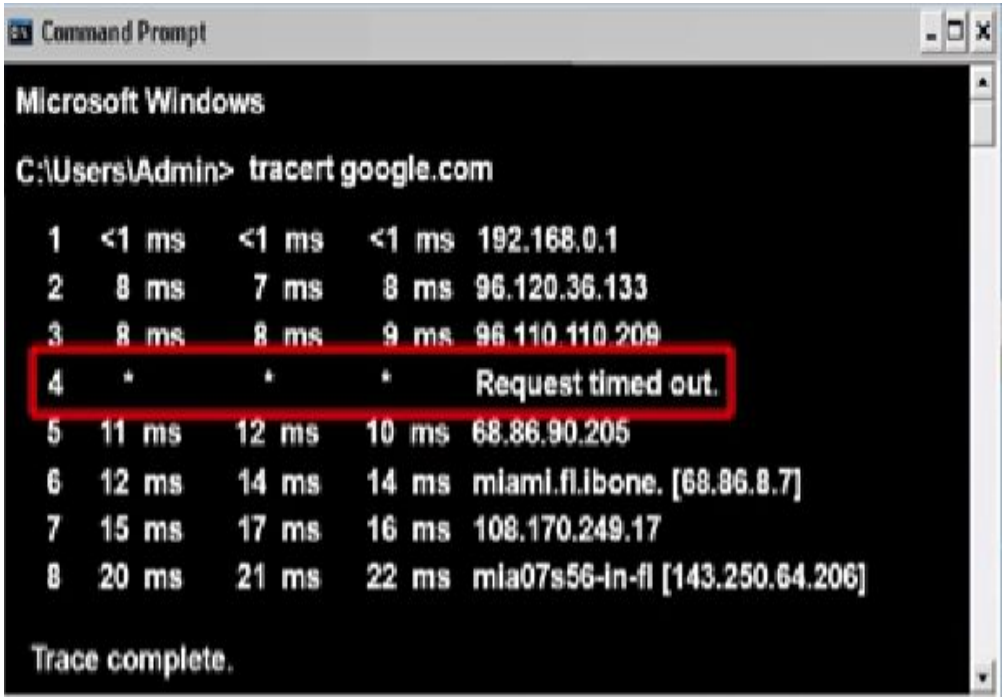
- **TTL(Time-to-Live)**: how long the packet can live before it discarded, the maximum number of hops that packet can cross until it returns
- Every time a packet passes through a router, the router decreases the TTL by 1
- If TTL=0, the router drops the packet and a reply is transmitted to the sender that identifies the router

Traceroute



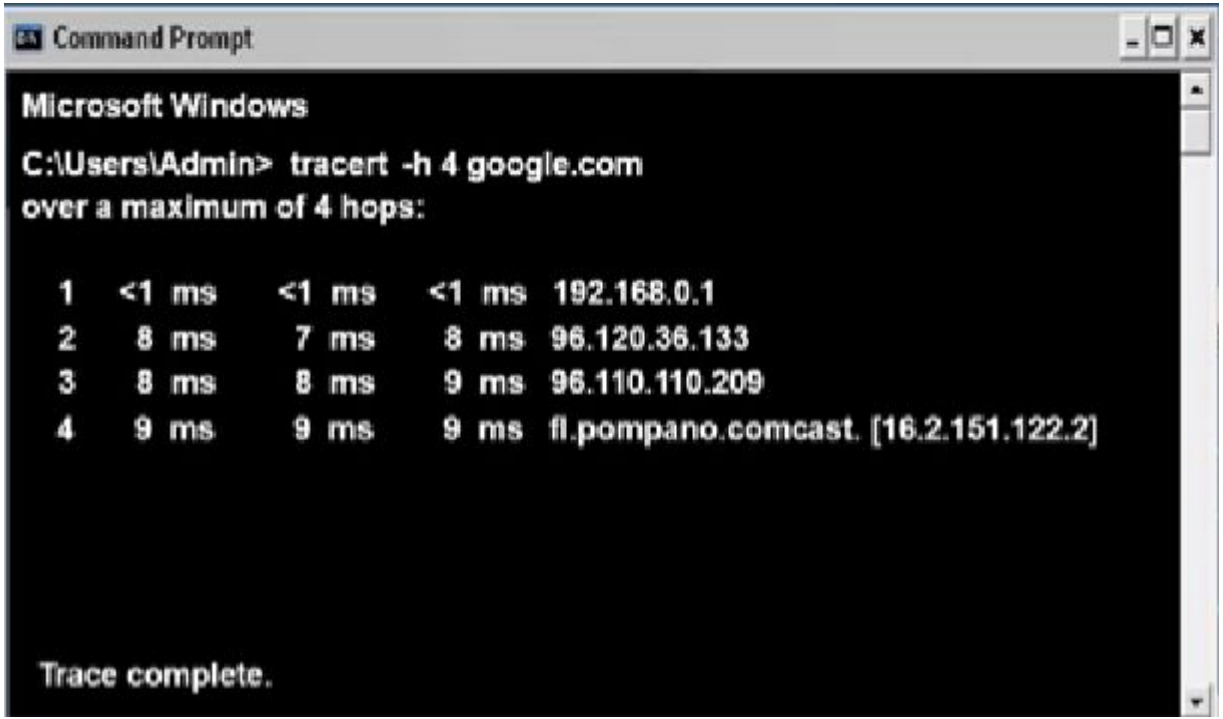
- The RTT of each of three packets from the sender to each router and the destination

Traceroute



- possible reasons:
  - problem with the specific router
  - not configured to return traceroute replies
- The packets passed to the next router

Traceroute



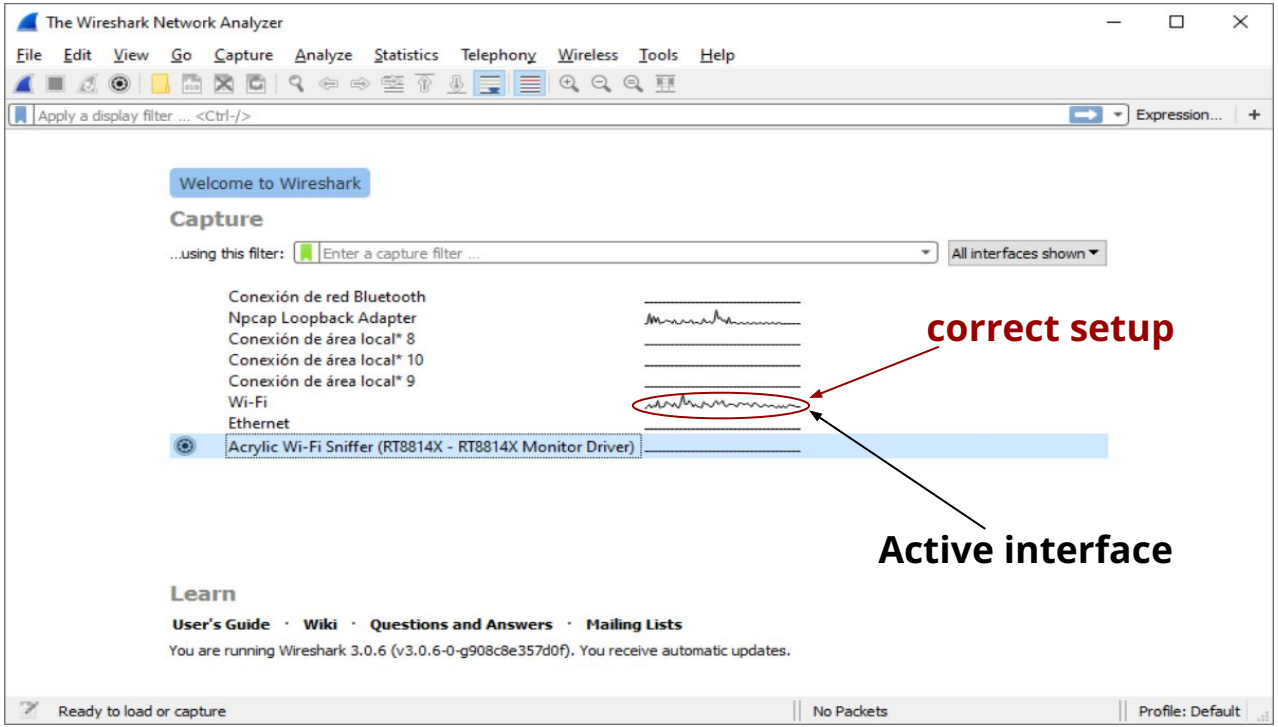
- Sets the TTL=4
- When the packet traverses 4 hops,it is dropped

Wireshark

Wireshark

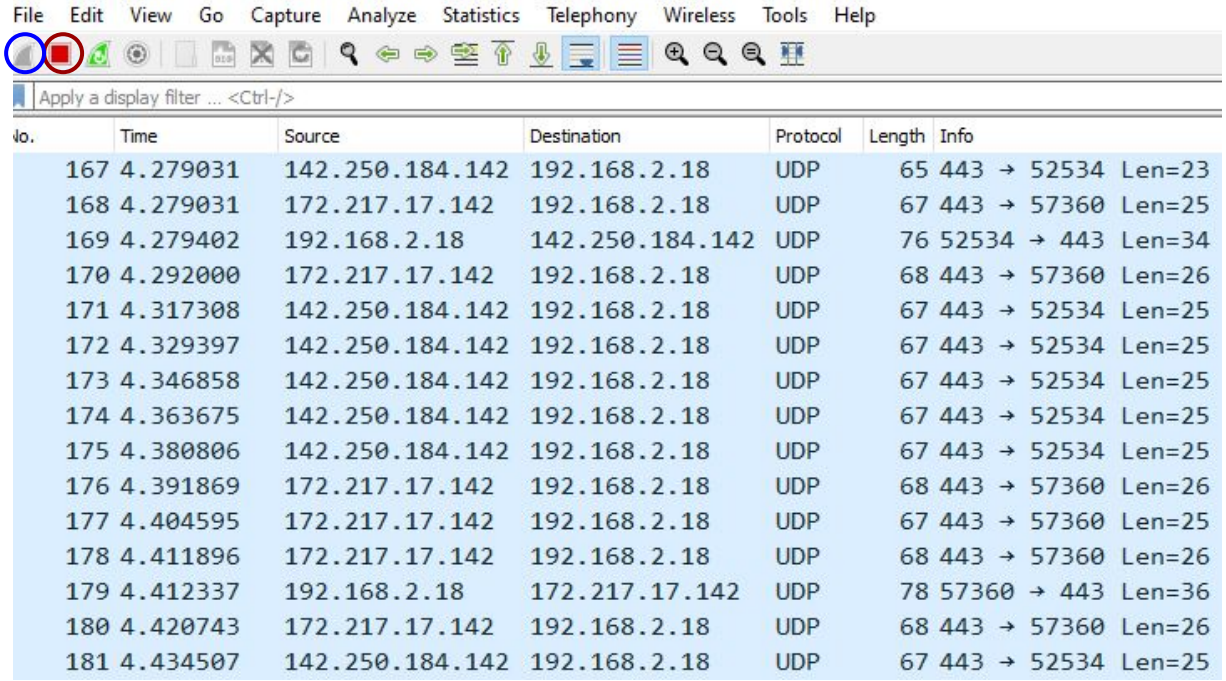
- Packet sniffer: tool used for capturing network packets
- Download:
  - Windows and Macos:
    - https://www.wireshark.org/download.html
    - In windows run the Wireshark as administrator
  - Linux:
    - https://linuxhint.com/install_configure_wireshark_ubuntu/

Wireshark: Setup



- **Run** the Wireshark **as administrator**
- Select an active interface

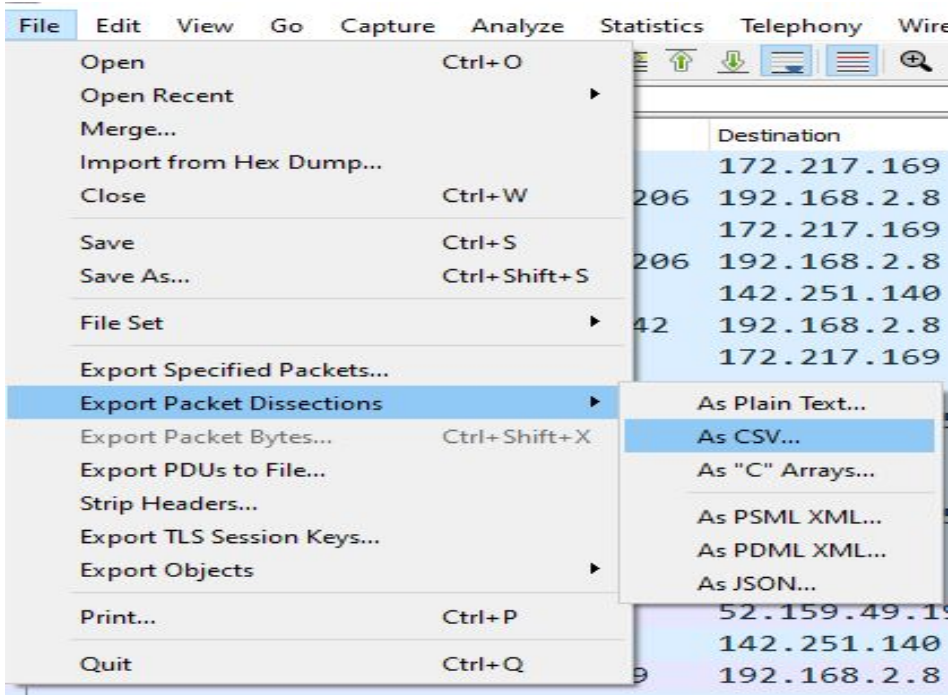
Wireshark: Capturing



No.	Time	Source	Destination	Protocol	Length	Info
167	4.279031	142.250.184.142	192.168.2.18	UDP	65	443 → 52534 Len=23
168	4.279031	172.217.17.142	192.168.2.18	UDP	67	443 → 57360 Len=25
169	4.279402	192.168.2.18	142.250.184.142	UDP	76	52534 → 443 Len=34
170	4.292000	172.217.17.142	192.168.2.18	UDP	68	443 → 57360 Len=26
171	4.317308	142.250.184.142	192.168.2.18	UDP	67	443 → 52534 Len=25
172	4.329397	142.250.184.142	192.168.2.18	UDP	67	443 → 52534 Len=25
173	4.346858	142.250.184.142	192.168.2.18	UDP	67	443 → 52534 Len=25
174	4.363675	142.250.184.142	192.168.2.18	UDP	67	443 → 52534 Len=25
175	4.380806	142.250.184.142	192.168.2.18	UDP	67	443 → 52534 Len=25
176	4.391869	172.217.17.142	192.168.2.18	UDP	68	443 → 57360 Len=26
177	4.404595	172.217.17.142	192.168.2.18	UDP	67	443 → 57360 Len=25
178	4.411896	172.217.17.142	192.168.2.18	UDP	68	443 → 57360 Len=26
179	4.412337	192.168.2.18	172.217.17.142	UDP	78	57360 → 443 Len=36
180	4.420743	172.217.17.142	192.168.2.18	UDP	68	443 → 57360 Len=26
181	4.434507	142.250.184.142	192.168.2.18	UDP	67	443 → 52534 Len=25

- Start capturing packets
- Stop capturing

Wireshark: Export files



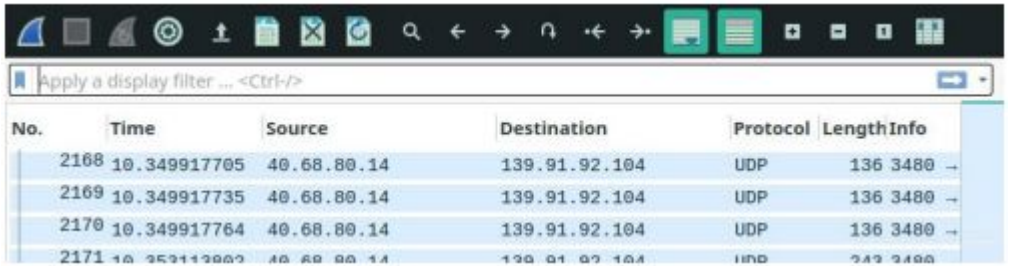
- File > Export Packet Dissections > AS CSV...

Wireshark

No.	Time	Source	Destination	Protocol	Length	Info
88	8.506952	192.168.2.8	185.125.188.55	TLSv…	134	Change Cipher Spec, Application Data
89	8.506982	192.168.2.8	185.125.188.55	TLSv…	1262	Application Data
90	8.507001	192.168.2.8	185.125.188.55	TCP	1514	51134 → 443 [PSH, ACK] Seq=1553 Ack=3554 Win=130560
91	8.507015	192.168.2.8	185.125.188.55	TLSv…	1514	Application Data
92	8.508394	192.168.2.8	185.125.188.55	TLSv…	1108	Application Data, Application Data
93	8.575764	185.125.188.55	192.168.2.8	TLSv…	133	Application Data
94	8.575764	185.125.188.55	192.168.2.8	TLSv…	133	Application Data
95	8.575852	192.168.2.8	185.125.188.55	TCP	54	51134 → 443 [ACK] Seq=5527 Ack=3712 Win=130560 Len=
96	8.585799	185.125.188.55	192.168.2.8	TCP	60	443 → 51134 [ACK] Seq=3712 Ack=2997 Win=59520 Len=0
97	8.592751	185.125.188.55	192.168.2.8	TCP	60	443 → 51134 [ACK] Seq=3712 Ack=4473 Win=58112 Len=0
98	8.640895	185.125.188.55	192.168.2.8	TCP	60	443 → 51134 [ACK] Seq=3712 Ack=5527 Win=57088 Len=0
99	8.757826	185.125.188.55	192.168.2.8	TCP	1498	443 → 51134 [ACK] Seq=3712 Ack=5527 Win=57088 Len=1
100	8.760040	185.125.188.55	192.168.2.8	TCP	1498	443 → 51134 [PSH, ACK] Seq=5156 Ack=5527 Win=57088
101	8.760040	185.125.188.55	192.168.2.8	TCP	1498	443 → 51134 [ACK] Seq=6600 Ack=5527 Win=57088 Len=1
102	8.760077	192.168.2.8	185.125.188.55	TCP	54	51134 → 443 [ACK] Seq=5527 Ack=8044 Win=131328 Len=
103	8.763258	185.125.188.55	192.168.2.8	TCP	1498	443 → 51134 [PSH, ACK] Seq=8044 Ack=5527 Win=57088
104	8.763285	192.168.2.8	185.125.188.55	TCP	54	51134 → 443 [ACK] Seq=5527 Ack=9488 Win=131328 Len=
105	8.764356	185.125.188.55	192.168.2.8	TCP	1498	443 → 51134 [ACK] Seq=9488 Ack=5527 Win=57088 Len=1

- **No**.: the serial number of the packet
- **Time**: the time of the transmission/receiving of the packet (starts from 0, the moment that the capturing started) in seconds
- **Source**: the source IP address
- **Destination**: the destination IP address
- **Protocol**: the protocol used
- **Length**: the length of the packets in bytes
- **Info**: extra information about the packet (header fields, flags etc)

Wireshark: Filtering

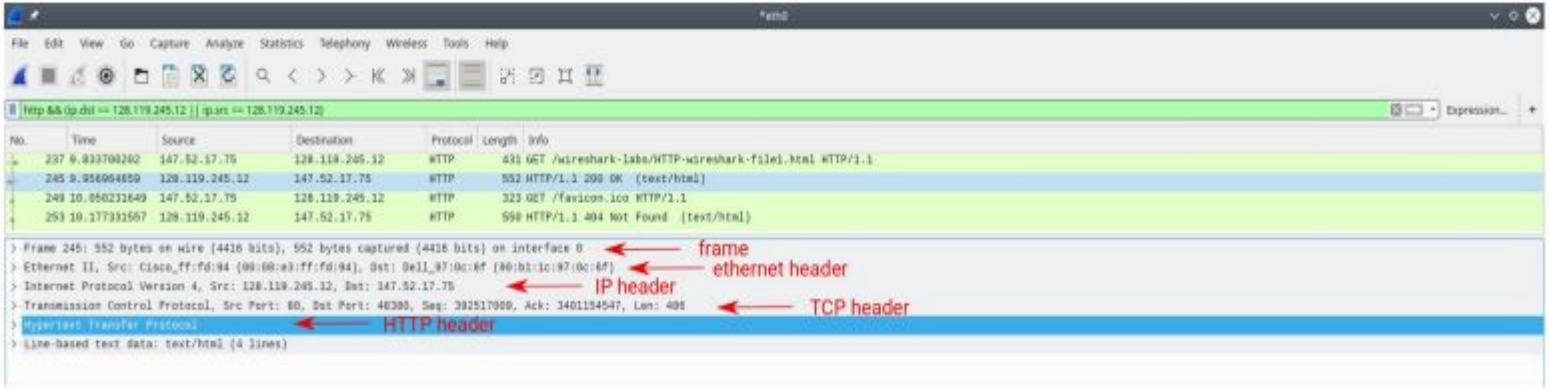


- You can filter with:
  - Transfer protocol name (tcp,udp etc)
  - Source IP, destination IP (ip.src==192.168.0.0, ip.dst==192.168.0.0)
- You can use logical operators:
  - and,or
  - && ,||,!
- Examples:
  - ip.src != 10.43.54.65 or ip.dst != 10.43.54.65
  - tcp
  - udp

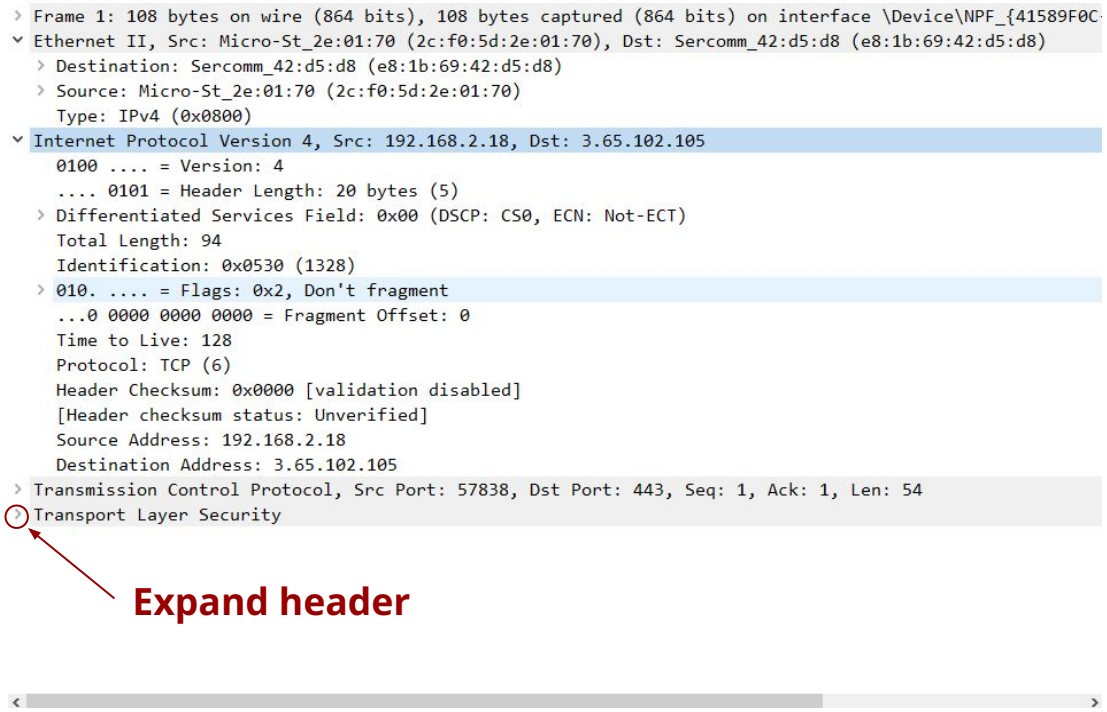
https://wiki.wireshark.org/DisplayFilters

Wireshark: Encapsulation

- Encapsulation allows us to use different protocols in all levels of the TCP/IP stack.
- Wireshark shows us the headers of all these levels (e.g. an HTTP packet)



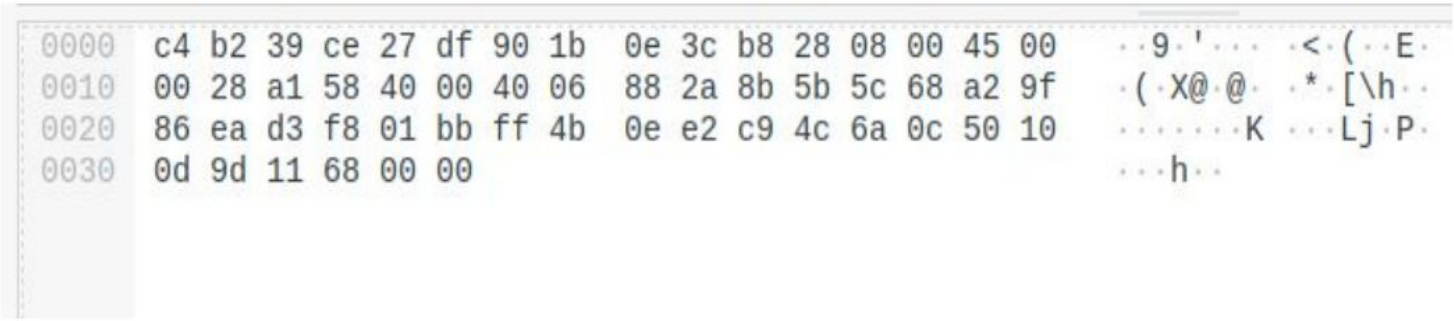
Wireshark: Encapsulation



- Five headers (Physical layer, Link layer, Network layer, Transport layer, App layer)

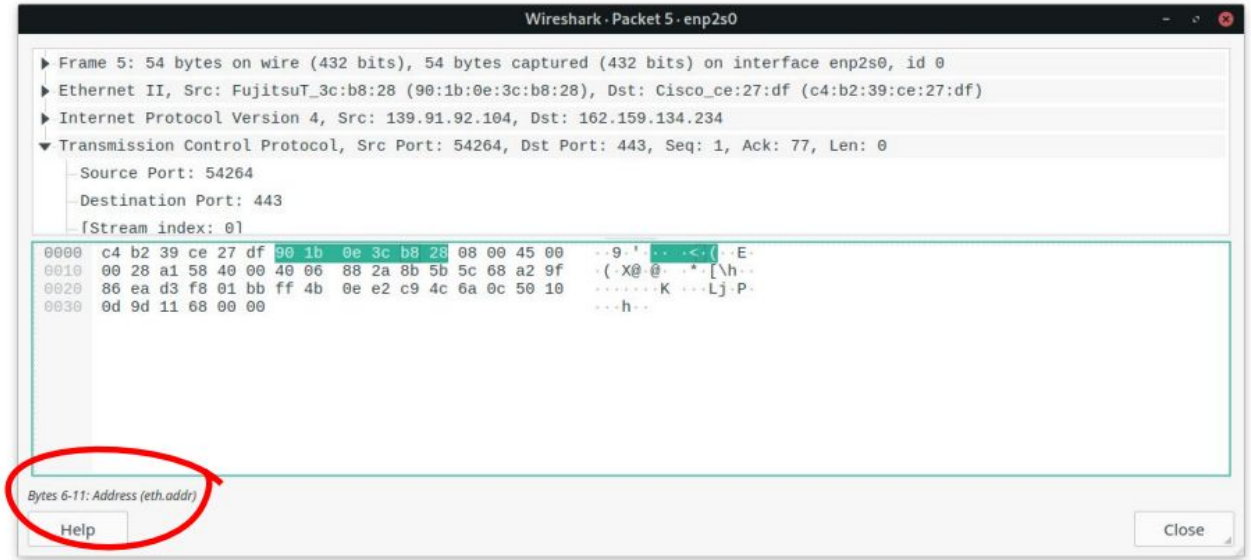
Wireshark: Packet details

As mentioned, you can see the details of each package by clicking on it. You can double-click to open it in a new window. There you can see the packet's details, as they're shown on the previous slide.
You can also see the hex format of the packet:



Wireshark: Packet details

You can hover over the bytes and see what they represent (see bottom left corner):




MY FACE AFTER
RUNNING WIRESHARK FOR THE FIRST TIME