USING WIRESHARK TO CAPTURE AND ANALYZE NETWORK DATA

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The content of these slides are taken from CPSC 526 TUTORIAL by Nashd Safa
(Extended and partially modified)

WIRESHARK

- **Wireshark** (Originally named Ethereal)is a free and open-source packet analyzer
- It is used for network troubleshooting, analysis, software and communication protocol development, and education.
- It has a graphical front-end, and many more information sorting and filtering options.

FEATURES AND FUNCTIONALITIES OF WIRESHARK

- Wireshark is software that "understands" the structure of different networking protocols. Thus, it is able to display the encapsulation and the fields along with their meanings of different packets specified by different networking protocols.

- Live data can be read from a number of types of network, including Ethernet, IEEE 802.11, PPP…

- Data display can be refined using a display filter.

INSTALLING WIRESHARK

- Download Wireshark from
  http://www.wireshark.org/download.html
- Choose appropriate version according to your operating system
- (For Windows), during installation agree to install **winpcap** as well.
  - **pcap** (packet capture) is an application programming interface (API) for capturing network traffic. Unix-like systems implement pcap in the libpcap library. Windows uses a port of libpcap known as **WinPcap**.
- http://wiki.wireshark.org/CaptureSetup

  Provides a good tutorial on how to capture data using WireShark

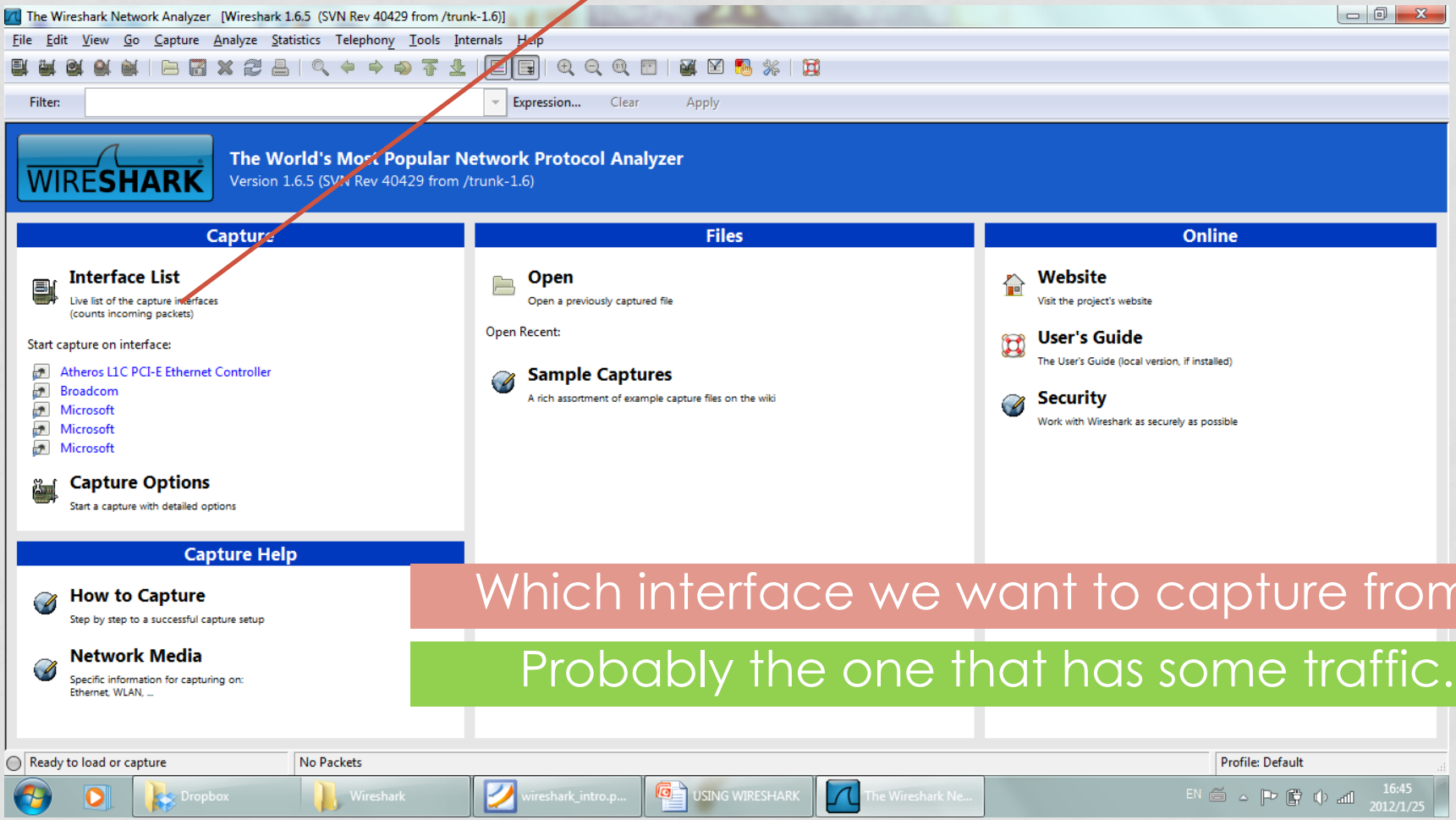
BEFORE CAPTURING DATA

- **Are you allowed to do this?**
- Ensure that you have the permission to capture packets from the network you are connected with. (Corporate policies or applicable law might prohibit capturing data from the network)

- **General Setup**
- Operating system must support packet capturing, e.g. capture support is enabled
- You must have sufficient privileges to capture packets, e.g. root / Administrator privileges
- Your computer's time and time zone settings should be correct

CAPTURING DATA

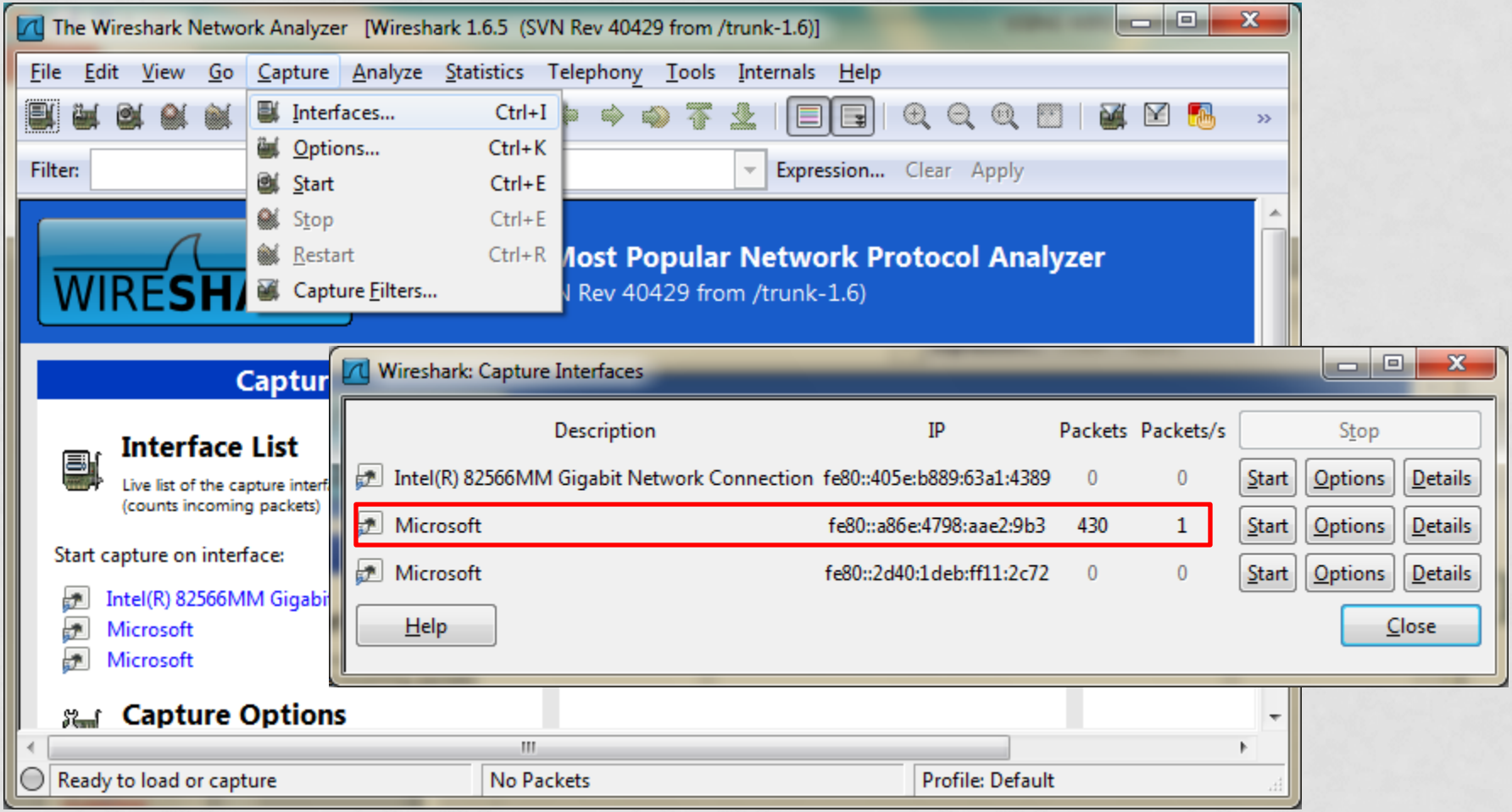
- The available network interfaces are listed here.



Which interface we want to capture from?

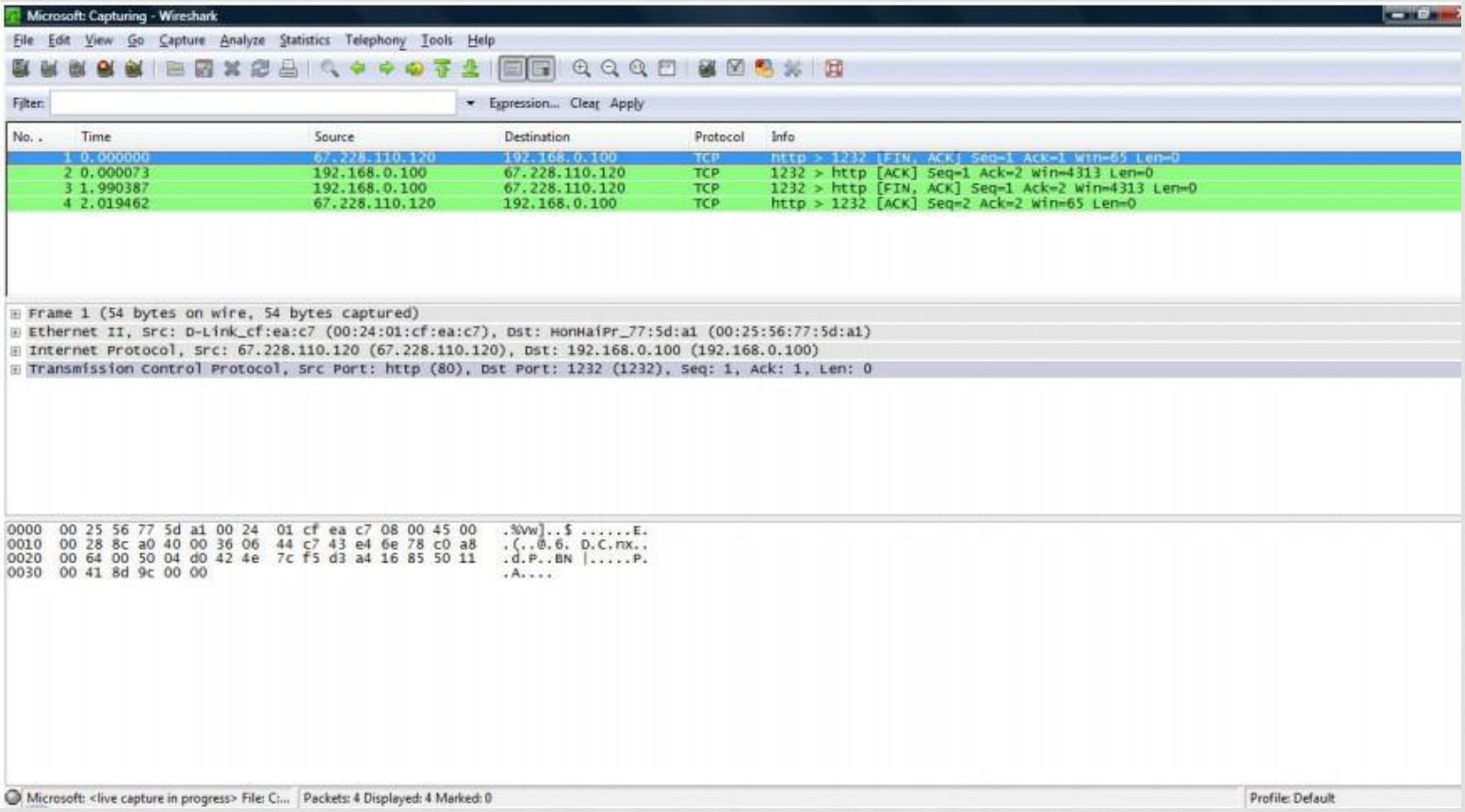
Probably the one that has some traffic.

CHOOSING THE INTERFACE



CAPTURING DATA

- Click on the specific interface you want to capture traffic from.



ANALYZING CAPTURED DATA

Filter: Expression... Clear Apply

No.	Time	Source	Destination	Protocol	Info
154	97.805307	192.168.0.100	174.129.27.168	TLSv1	Application Data, Application Data, Application Data,
155	97.805312	192.168.0.100	174.129.27.168	TLSv1	Application Data,
156	97.848793	174.129.27.168	192.168.0.100	TCP	https > bvcontrol [ACK] Seq=1414 Ack=3545 Win=16896 Len=0
157	97.848865	192.168.0.100	174.129.27.168	TLSv1	Application Data, Application Data, Application Data,
158	97.848872	192.168.0.100	174.129.27.168	TLSv1	Application Data, Application Data, Application Data,
159	97.890781	174.129.27.168	192.168.0.100	TCP	https > bvcontrol [ACK] Seq=1414 Ack=4993 Win=19968 Len=0
160	97.890856	192.168.0.100	174.129.27.168	TCP	[TCP segment of a reassembled PDU]
161	97.890864	192.168.0.100	174.129.27.168	TCP	[TCP segment of a reassembled PDU]
162	97.897797	174.129.27.168	192.168.0.100	TCP	https > bvcontrol [ACK] Seq=1414 Ack=6441 Win=23040 Len=0
163	97.897850	192.168.0.100	174.129.27.168	TCP	[TCP segment of a reassembled PDU]

Time of capturing the packet

Source IP

Destination IP

Protocol Name

Brief description of the packet data

ANALYZING CAPTURED DATA

No.	Time	Source	Destination	Protocol	Info
154	97.805307	192.168.0.100	174.129.27.168	TLSv1	Application Data, Application
155	97.805312	192.168.0.100	174.129.27.168	TLSv1	Application Data,
156	97.848793	174.129.27.168	192.168.0.100	TCP	https > bvcontrol [ACK] Seq=14
157	97.848865	192.168.0.100	174.129.27.168	TLSv1	Application Data, Application
158	97.848872	192.168.0.100	174.129.27.168	TLSv1	Application Data, Application
159	97.890781	174.129.27.168	192.168.0.100	TCP	https > bvcontrol [ACK] Seq=14
160	97.890856	192.168.0.100	174.129.27.168	TCP	[TCP segment of a reassembled
161	97.890864	192.168.0.100	174.129.27.168	TCP	[TCP segment of a reassembled
162	97.897797	174.129.27.168	192.168.0.100	TCP	https > bvcontrol [ACK] Seq=14
163	97.897850	192.168.0.100	174.129.27.168	TCP	[TCP segment of a reassembled

```
⊞ Frame 159 (54 bytes on wire, 54 bytes captured)
⊞ Ethernet II, Src: D-Link_cf:ea:c7 (00:24:01:cf:ea:c7), Dst: HonHaiPr_77:5d:a1 (00:25:56:77:5d:a1)
⊞ Internet Protocol, Src: 174.129.27.168 (174.129.27.168), Dst: 192.168.0.100 (192.168.0.100)
⊞ Transmission Control Protocol, Src Port: https (443), Dst Port: bvcontrol (1236), Seq: 1414, Ack: 4993, Len: 0
```

Hierarchical View → Frame (Bottom Layer)
Ethernet
IP
TCP (Top Layer)

- Note: The hierarchical display here is upside down compared to the Internet protocol stack that you have seen in the lectures.

ANALYZING CAPTURED DATA

Microsoft (src net 192.168.1.6) [Wireshark 1.6.5 (SVN Rev 40429 from /trunk-1.6)]

File Edit View Go Capture Analyze Statistics Telephony Tools Internals Help

Filter: http.request.version=="HTTP/1.1" Expression... Clear Apply

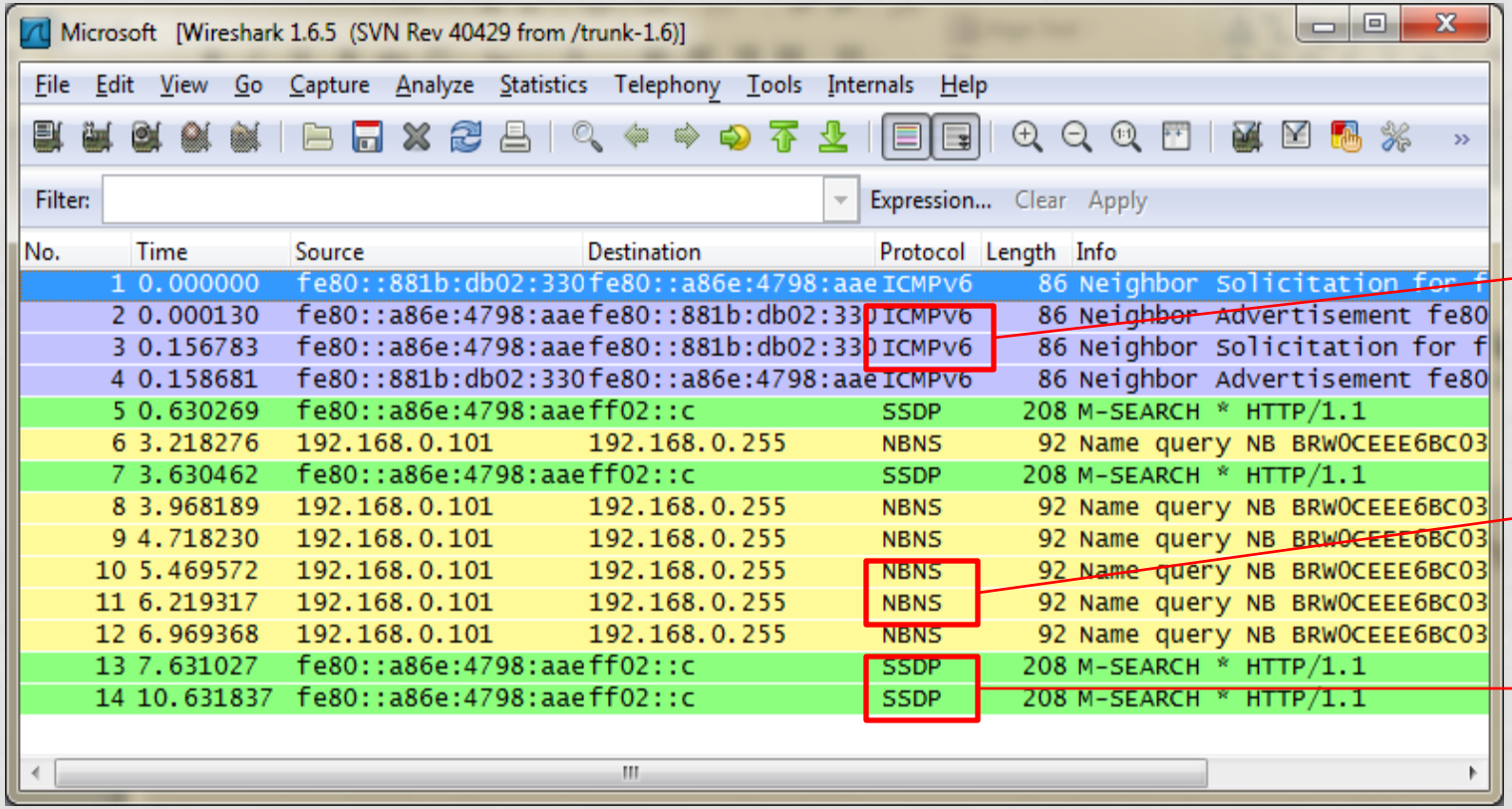
No.	Time	Source	Destination	Protocol	Length	Info
686	12.794845	192.168.1.6	174.35.52.133	HTTP	462	GET /thumbnail/76d800a7jw1dpgsbd8ja6j.jpg HTTP/1.1
688	12.797284	192.168.1.6	174.35.52.133	HTTP	462	GET /thumbnail/69abd30bjw1dpgt36vcuvj.jpg HTTP/1.1
694	12.812058	192.168.1.6	174.35.52.142	HTTP	462	GET /thumbnail/7f1ef208jw1dpgu7nx3awj.jpg HTTP/1.1
729	13.007040	192.168.1.6	174.35.52.142	HTTP	462	GET /thumbnail/5f75ec4agw1dpgsmyhfinj.jpg HTTP/1.1
733	13.011754	192.168.1.6	174.35.52.142	HTTP	462	GET /thumbnail/93831636jw1dpg6jjkmzvj.jpg HTTP/1.1
734	13.012022	192.168.1.6	174.35.52.142	HTTP	462	GET /thumbnail/4711809ejw1dpgu2cd15rj.jpg HTTP/1.1
735	13.012321	192.168.1.6	174.35.52.142	HTTP	462	GET /thumbnail/7069fcb4jw1dpgrdksra2j.jpg HTTP/1.1
750	13.068017	192.168.1.6	174.35.52.142	HTTP	460	GET /bmiddle/5f75ec4agw1dpgsmyhfinj.jpg HTTP/1.1

```
⊞ Frame 686: 462 bytes on wire (3696 bits), 462 bytes captured (3696 bits)
⊞ Ethernet II, Src: LiteonTe_14:fc:f9 (68:a3:c4:14:fc:f9), Dst: Netgear_2f:8b:49 (74:44:01:2f:8b:49)
⊞ Internet Protocol Version 4, Src: 192.168.1.6 (192.168.1.6), Dst: 174.35.52.133 (174.35.52.133)
⊞ Transmission Control Protocol, Src Port: 51529 (51529), Dst Port: http (80), Seq: 1, Ack: 1, Len: 408
⊟ Hypertext Transfer Protocol
  ⊞ GET /thumbnail/76d800a7jw1dpgsbd8ja6j.jpg HTTP/1.1\r\n
    Host: ww1.sinaimg.cn\r\n
    Connection: keep-alive\r\n
    User-Agent: Mozilla/5.0 (Windows NT 6.1; WOW64) AppleWebKit/535.7 (KHTML, like Gecko) Chrome/16.0.912.77 Safari/535.7\r\n
    Accept: */*\r\n
    Referer: http://www.weibo.com/u/1740944337?wvr=3.6&lf=reg\r\n
    Accept-Encoding: gzip,deflate,sdch\r\n
    Accept-Language: en-US,en;q=0.8\r\n
    Accept-Charset: ISO-8859-1,utf-8;q=0.7,*;q=0.3\r\n
    \r\n
    [Full request URI: http://ww1.sinaimg.cn/thumbnail/76d800a7jw1dpgsbd8ja6j.jpg]
```

- HTTP header

SO MANY STRANGE PACKETS!

- Wireshark captures everything that is sent/recived on the chosen interface. You need to filter what you want.



Control Messages

NetBIOS Packets

Discovery Packets

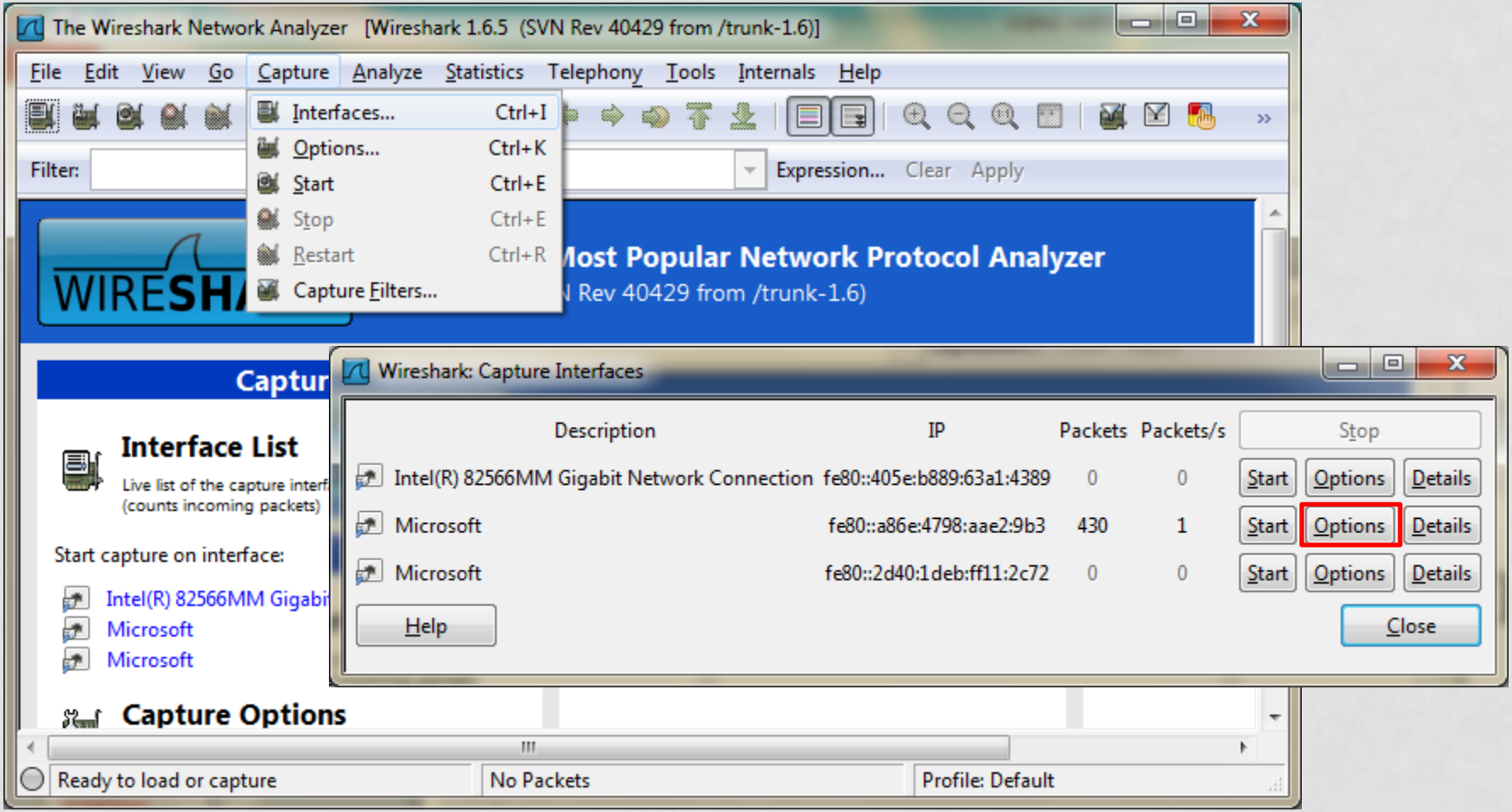
WIRESHARK FILTERS

- **Two types of filters:**
- Capture Filters
- Display Filters

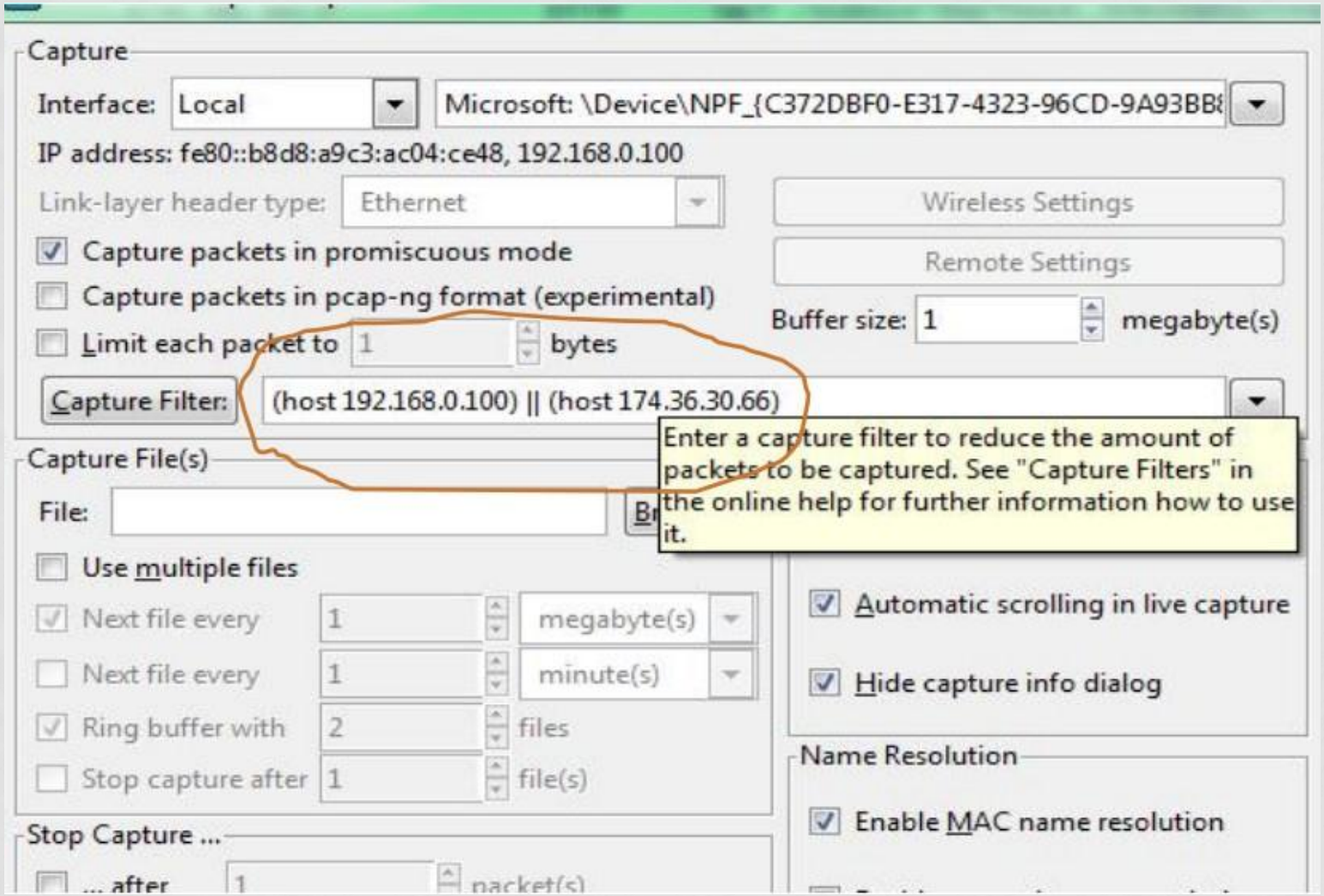
- Wireshark contains a powerful **capture** filter engine that helps remove unwanted packets from a packet trace and only retrieves the packets of our interest.

- **Display** filters let you compare the fields within a protocol against a specific value, compare fields against fields, and check the existence of specified fields or protocols

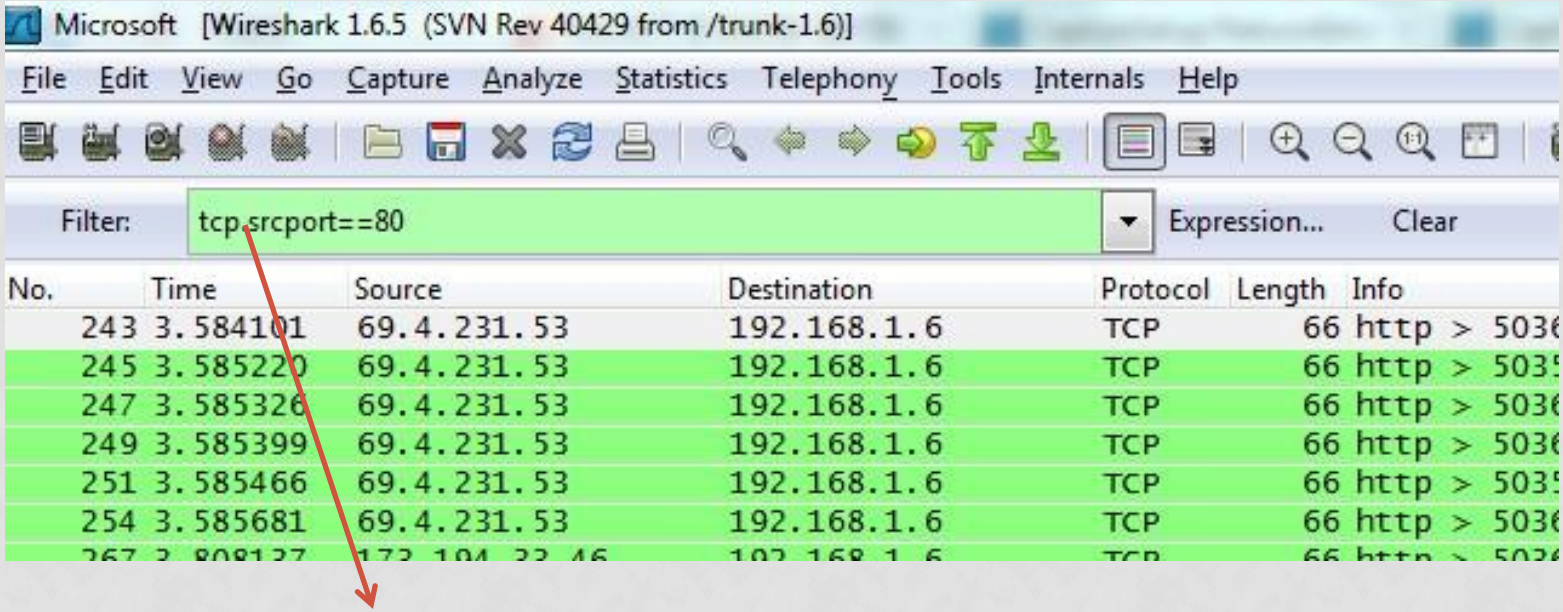
CAPTURE OPTIONS



EXAMPLE OF A CAPTURE FILTER



EXAMPLE OF A DISPLAY FILTER



- Display filter separates the packets to be displayed (In this case, only packets with source port 80 are displayed)

WIRESHARK FILTERS

- **Comparison operators**
- Fields can also be compared against values. The comparison operators can be expressed either through English-like abbreviations or through C-like symbols:
- eq, == Equal
- ne, != Not Equal
- gt, > Greater Than
- lt, < Less Than
- ge, >= Greater than or Equal to
- le, <= Less than or Equal to

WIRESHARK FILTERS

- **Logical Expressions**

  Tests can be combined using logical expressions. These too are expressible in C-like syntax or with English-like abbreviations:

  and, && Logical AND

  or, | | Logical OR

  not, ! Logical NOT

- Some Valid Display Filters
- tcp.port == 80 and ip.src == 192.168.2.1
- http and frame[100-199] contains "wireshark"

WIRESHARK FILTERS

- **The Slice Operator**
- You can take a slice of a field if the field is a text string or a byte array. For example, you can filter the HTTP header fields . Here the header "location" indicates the REDIRECTION happens.

  http.location[0:12]=="http://pages"

- Another example is:

  http.content_type[0:4] == "text"

CAPTURE FILTERS

Syntax	Protocol	Direction	Host(s)	Logical Op.	Other Express.
Example	tcp	dst	136.159.5.20	and	host 136.159.5.6

- **Protocol:**
- *Values*: ether, fddi, ip, arp, rarp, decnet, lat, sca, moprc, mopdl, tcp and udp.
- If no protocol is specified, all the protocols are used.

- **Direction:**
- Values: src, dst, src and dst, src or dst
- If no source or destination is specified, the "src or dst" keywords are applied.
- For example, “host 136.159.5.20" is equivalent to "src or dst host 136.159.5.20".

CAPTURE FILTERS

- **Host(s):**
- Values: net, port, host, portrange.
- If no host(s) is specified, the "host" keyword is used.
- For example, "src 136.159.5.20" is equivalent to "src host 136.159.5.20".

- **Logical Operations:**
- Values: not, and, or.
- Negation ("not") has highest precedence. Alternation ("or") and concatenation ("and") have equal precedence and associate left to right.
- For example,

"not tcp port 3128 and tcp port 80" is equivalent to "(not tcp port 3128) and tcp port 80".

CAPTURE FILTERS(EXAMPLES)

- **tcp port 80**

  Displays packets with tcp protocol on port 80.
- **ip src host** 136.159.5.20

  Displays packets with source IP address equals to 136.159.5.20.
- **host** 136.159.5.1

  Displays packets with source or destination IP address equals to 136.159.5.1.
- **src portrange 2000-2500**

  Displays packets with source UDP or TCP ports in the 2000-2500 range.

CAPTURE FILTERS(EXAMPLES)

- **src host 136.159.5.20 and not dst host 136.159.5.1**

  Displays packets with source IP address equals to 136.159.5.20 and in the same time not with the destination IP address 136.159.5.1.

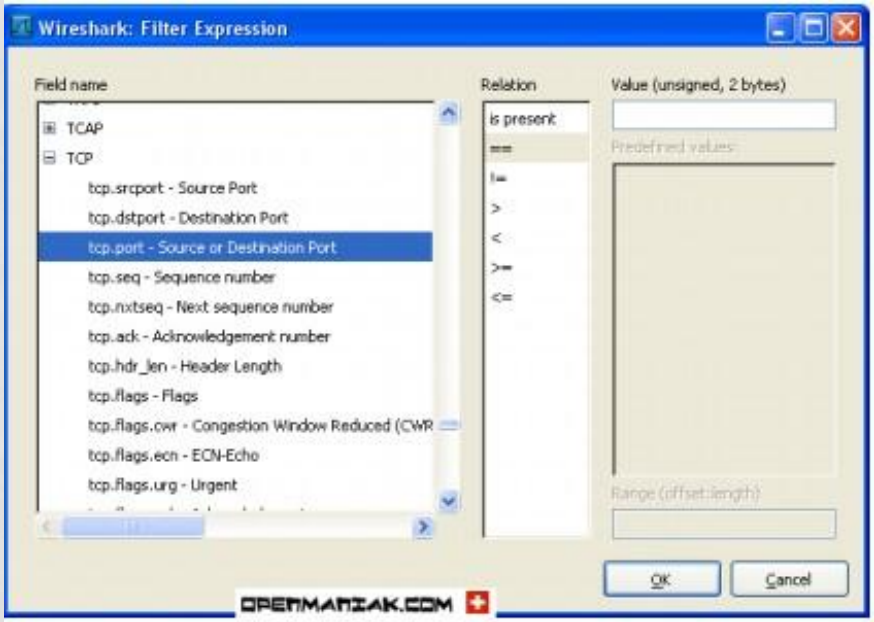
- **(src host 136.159.5.1 or src host 136.159.5.3) and tcp dst portrange 200-10000 and dst host 136.159.5.2**

  Displays packets with source IP address 136.159.5.1 or source address136.159.5.3, the result is then concatenated with packets having destination TCP portrange from 200 to 10000 and destination IP address136.159.5.2.

DISPLAY FILTERS

Syntax	Protocol	.	String 1	.	String 2	Comparison operators	Value	Logical Op.	Other Expr.
Example	http	.	request	.	method	==	get	or	tcp.port == 80

- String1, String2 (Optional settings): Sub protocol categories inside the protocol. To find them, look for a protocol and then click on the "+" character.



DISPLAY FILTERS(EXAMPLES)

- **ip.addr == 136.159.5.20**

  Displays the packets with source or destination IP address equals to 136.159.5.20 .
- **http.request.version=="HTTP/1.1“**

  Display http Version
- **tcp.dstport == 25**
- **tcp.flags**

  Display packets having a TCP flags
- **tcp.flags.syn == 0x02**

  Display packets with a TCP SYN flag.