T2-5 Advanced Capture and Display Filtering

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SHARKFEST **'08**
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About your Presenter

Tony Fortunato, Sr Network Specialist, The Technology Firm

Certified Fluke Networks and Wireshark Instructor

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A Senior Network Specialist with experience in performance testing, network design, implementation, and troubleshooting LAN/WAN/Wireless networks, desktops and servers since 1989.

Tony has taught at Colleges/Universities, Networld/Interop and many onsite corporate settings to thousands of analysts.

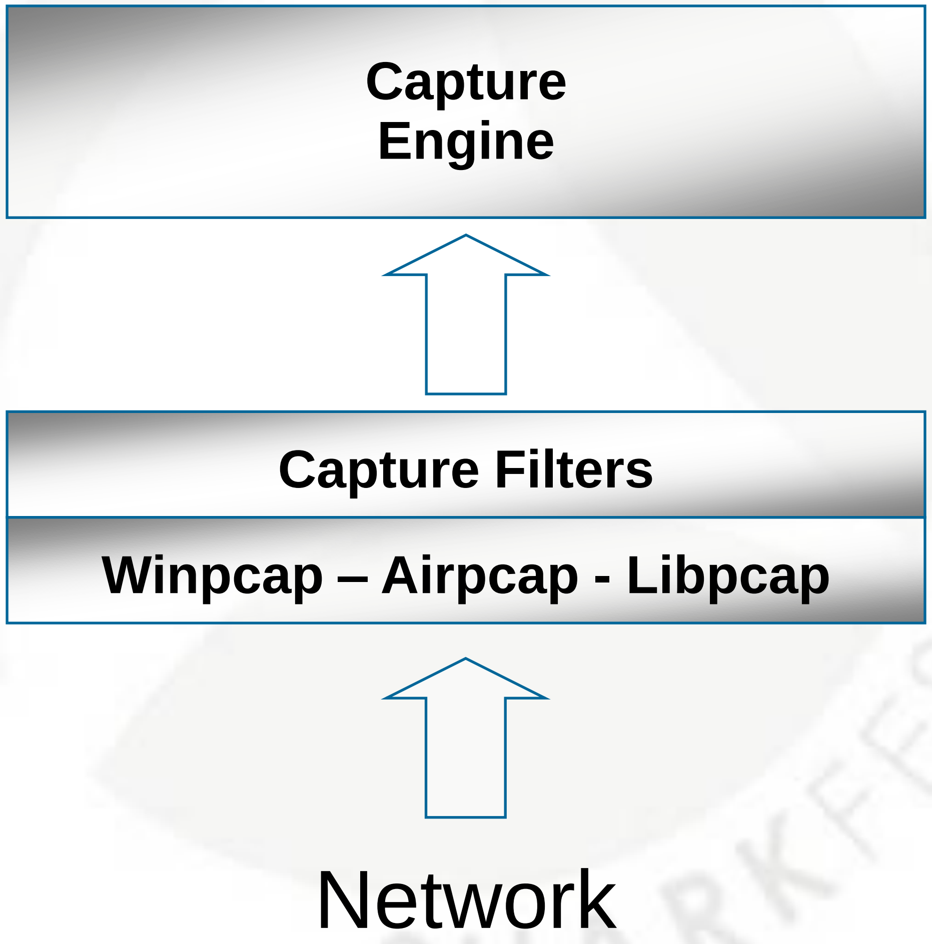
Tony is an authorized and certified Fluke Networks and Wireshark Instructor. His Pine Mountain Group CNA Level I and II certification demonstrates his vendor neutral approach to network design, support and implementations.

Tony has architected, installed and supported various types of Residential Wireless High Speed as well as hundreds of WIFI hotspots.. Tony combines custom programs, open source and commercial software to ensure a simple support infrastructure.

Tony works on networks from 2 to 120,000 nodes and specializes in post installation performance/design review. This process involves using various tools (Protocol analyzers, traffic generators and network management) and working on multi-vendor equipment (switches, routers, servers, etc).

Tony works at customer sites within a range of capacities from project management, network design, consulting, troubleshooting, designing customized courses and assisting with installing physical equipment.

Capturing Traffic



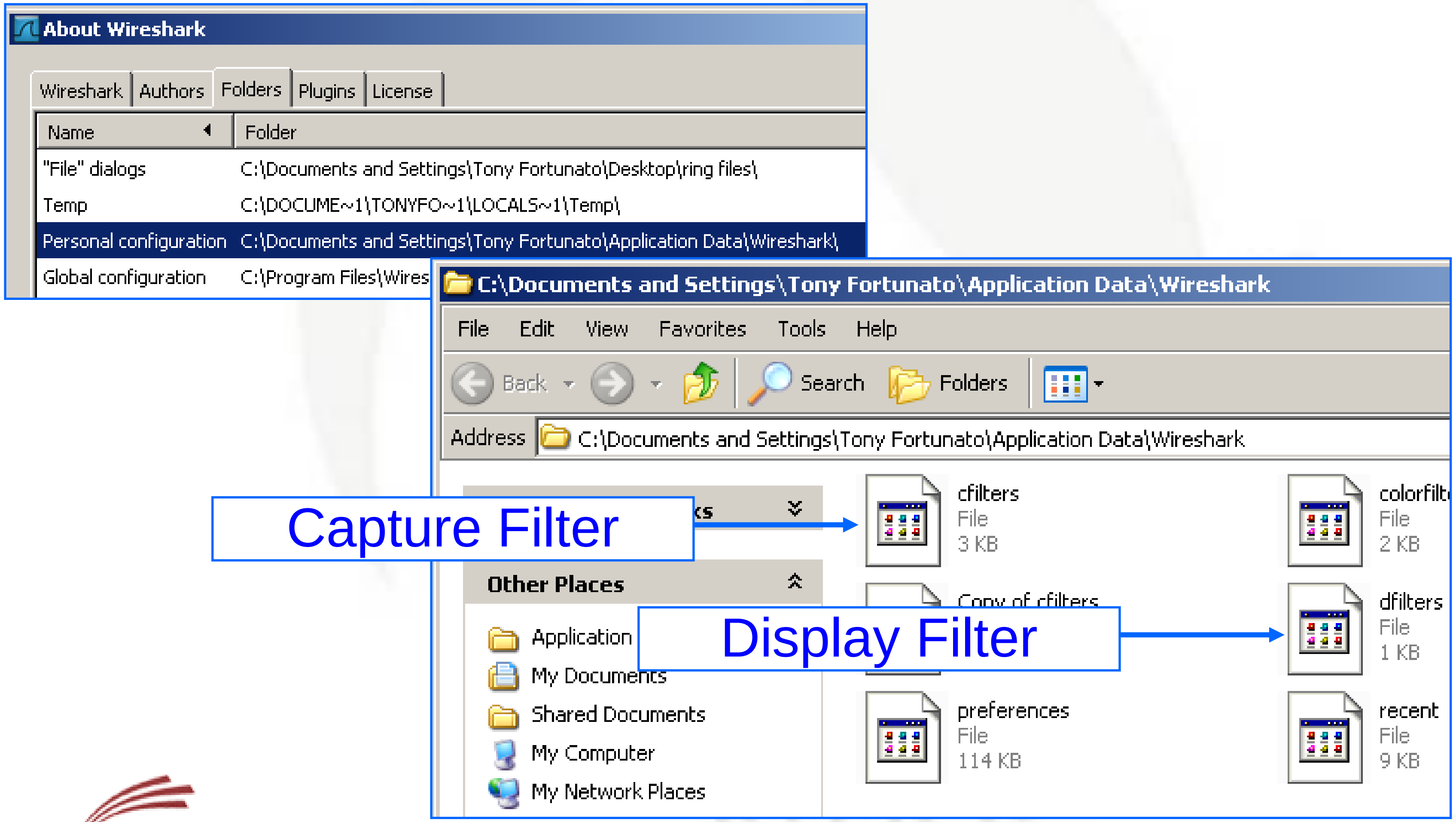
Options

When capturing with Wireshark, you have 2 options;

- Using the GUI
- Using the command prompt and *tshark*
  - *tshark –D*
  - *tshark –i*

Capture Filters

- Based on the tcpdump format
- Location identified in Help -> About under Folders Tab



About Wireshark

Wireshark | Authors | Folders | Plugins | License

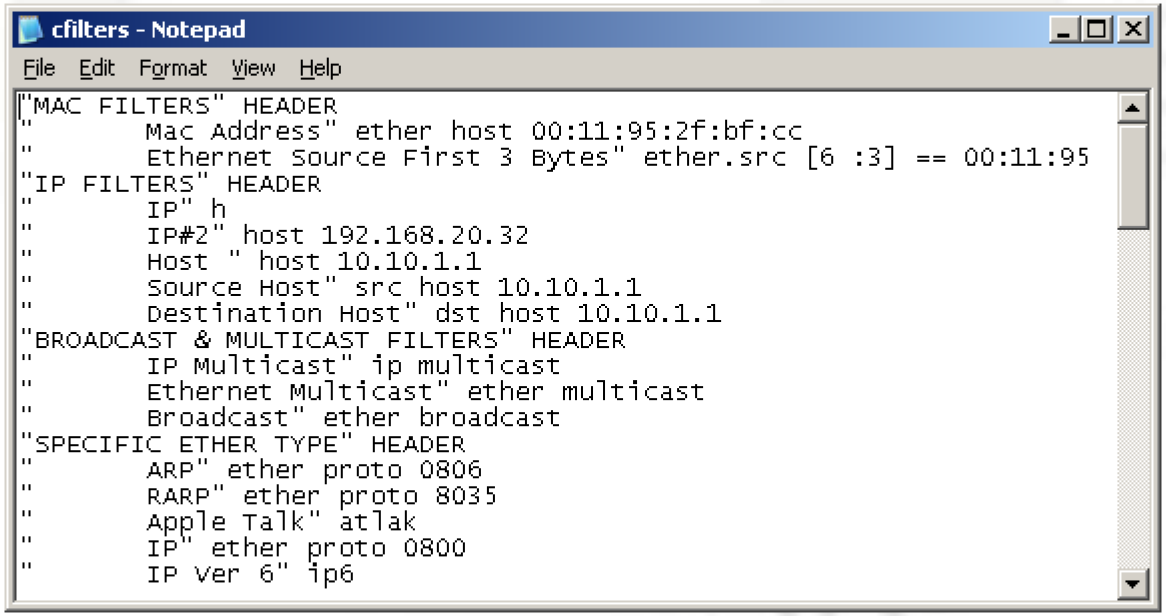
Name	Folder
"File" dialogs	C:\Documents and Settings\Tony Fortunato\Desktop\ring files\
Temp	C:\DOCUME~1\TONYFO~1\LOCALS~1\Temp\
Personal configuration	C:\Documents and Settings\Tony Fortunato\Application Data\Wireshark\
Global configuration	C:\Program Files\Wires

C:\Documents and Settings\Tony Fortunato\Application Data\Wireshark

Address C:\Documents and Settings\Tony Fortunato\Application Data\Wireshark

cfilters file notes

- Make sure you use a text editor, or save in a text format
- Ensure you have a blank line at the end of the file
- Good idea to create a header and indent the related filters



```
"MAC FILTERS" HEADER
"	Mac Address" ether host 00:11:95:2f:bf:cc
"	Ethernet Source First 3 Bytes" ether.src [6 :3] == 00:11:95
"IP FILTERS" HEADER
"	IP" h
"	IP#2" host 192.168.20.32
"	Host " host 10.10.1.1
"	Source Host" src host 10.10.1.1
"	Destination Host" dst host 10.10.1.1
"BROADCAST & MULTICAST FILTERS" HEADER
"	IP Multicast" ip multicast
"	Ethernet Multicast" ether multicast
"	Broadcast" ether broadcast
"SPECIFIC ETHER TYPE" HEADER
"	ARP" ether proto 0806
"	RARP" ether proto 8035
"	Apple Talk" atlak
"	IP" ether proto 0800
"	IP Ver 6" ip6
```

Capture Filter Reference

Command	Description
ether host *MAC address*	Capture all packets to and from a MAC *address*
IP Filters	
host *ip address*	Capture all packets to and from an *ip address*
src host *ip address*	Capture all packets from an *ip address*
dst host *ip address*	Capture all packets to an *ip address*
TCP/UDP Filters	
port *port*	Capture all packets to and from a port number
src port *port*	Capture all packets from a port number
dst port *port*	Capture all packets to a port number
IP Network Filters	
net *net*	Capture all packets to and from a *subnet*
src net *net*	Capture all packets from a *subnet*
dst net *net*	Capture all packets to a *subnet*

Capture Filter Examples

Command	Description
ether host 00:15:c5:37:40:60	Capture all packets to and from MAC 00:15:c5:37:40:60
IP Filters	
host 10.44.10.1	Capture all packets to and from 10.44.10.1
host www.wireshark.org	Capture all packets from www.wireshark.org
TCP/UDP Filters	
port 80	Capture all packets to and from TCP/UDP port number 80
portrange 67-68	Capture all DHCP bootps/bootpc
port http	Capture all packets from devices using http
tcp portrange 1200-2000	Capture all packets with TCP port # 1200-2000
IP Network Filters	
net 10.44.10	Capture all packets to and from a subnet 10.44.10
arp	Capture all arp packets
udp	Capture all udp packets
tcp	Capture all tcp packets

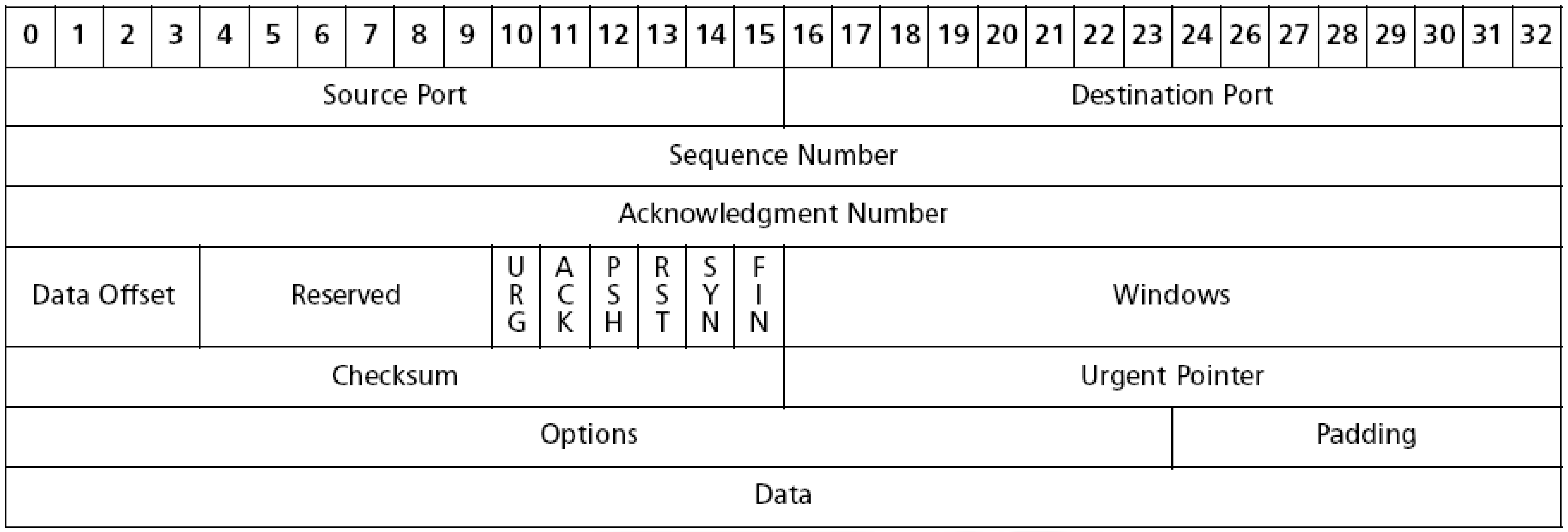
Supported Capture Protocols

- arp *Address Resolution Protocol*
- esp *Encapsulating Security Payload*
- icmp *Internet Control Message Protocol*
- icmp6 *Internet Control Message Protocol, for IPv6*
- igmp *Internet Group Management Protocol*
- igrp *Interior Gateway Routing Protocol*
- ip *Internet Protocol*
- ip6 *Internet Protocol version 6*
- pim *Protocol Independent Multicast*
- rarp *Reverse Address Resolution Protocol*
- stp *Spanning Tree Protocol*
- tcp *Transmission Control Protocol*
- udp *User Datagram Protocol*
- vrrp *Virtual Router Redundancy Protocol*

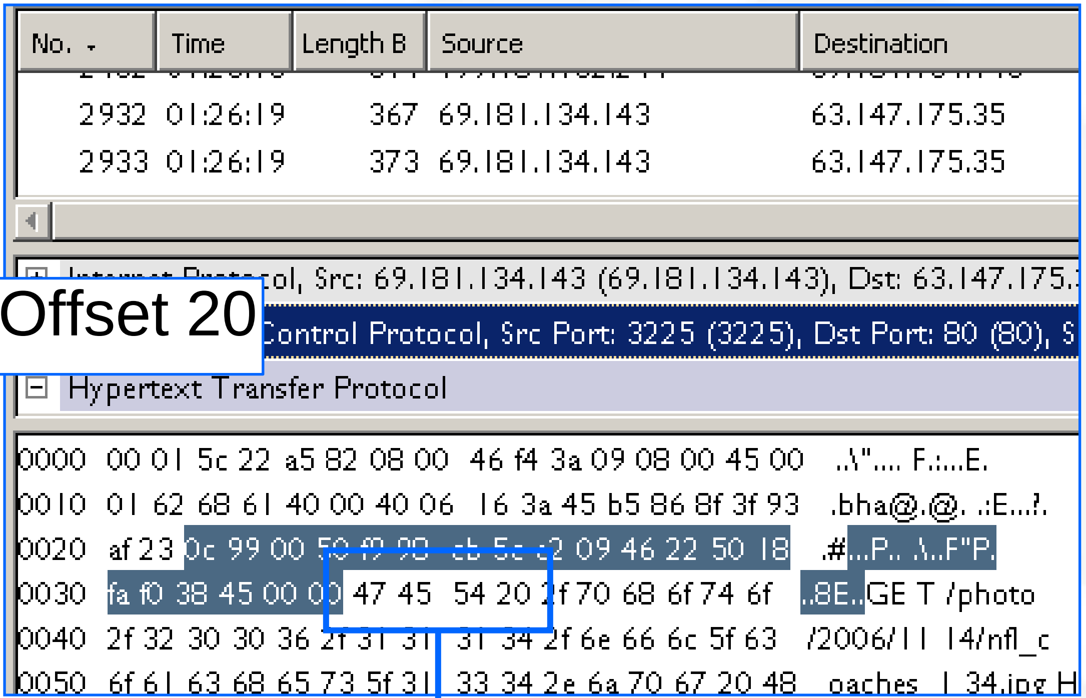
Data Pattern Offsets

To retrieve a single byte from a packet, use square brackets to indicate the offset of that byte from the beginning of a particular protocol. Offsets start at zero (e.g.,tcp[0] gives the first byte in the TCP header and tcp[1] gives the second byte)

TCP Header Layout



HTTP Get Offset Example



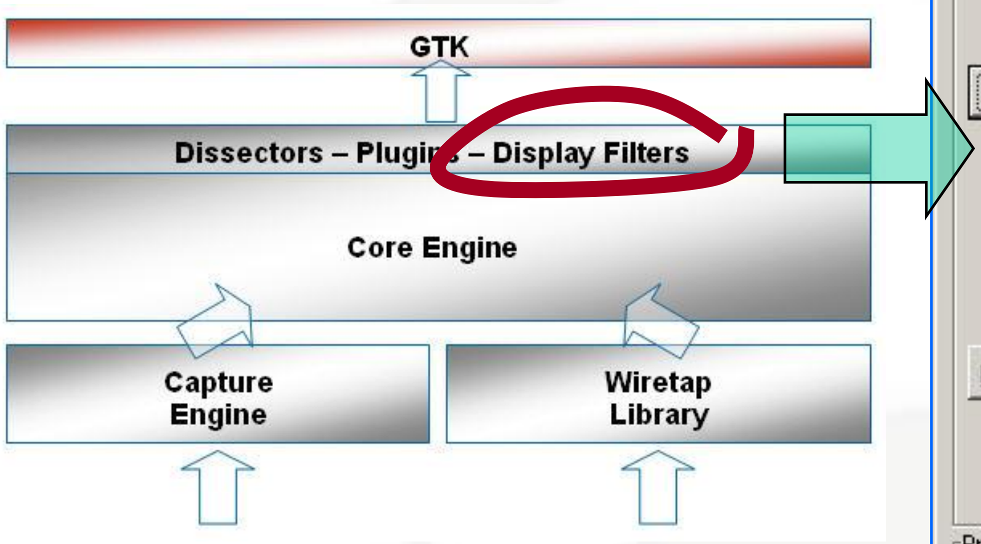
```
No.   Time      Length B  Source              Destination
2932  01:26:19  367       69.181.134.143      63.147.175.35
2933  01:26:19  373       69.181.134.143      63.147.175.35
```

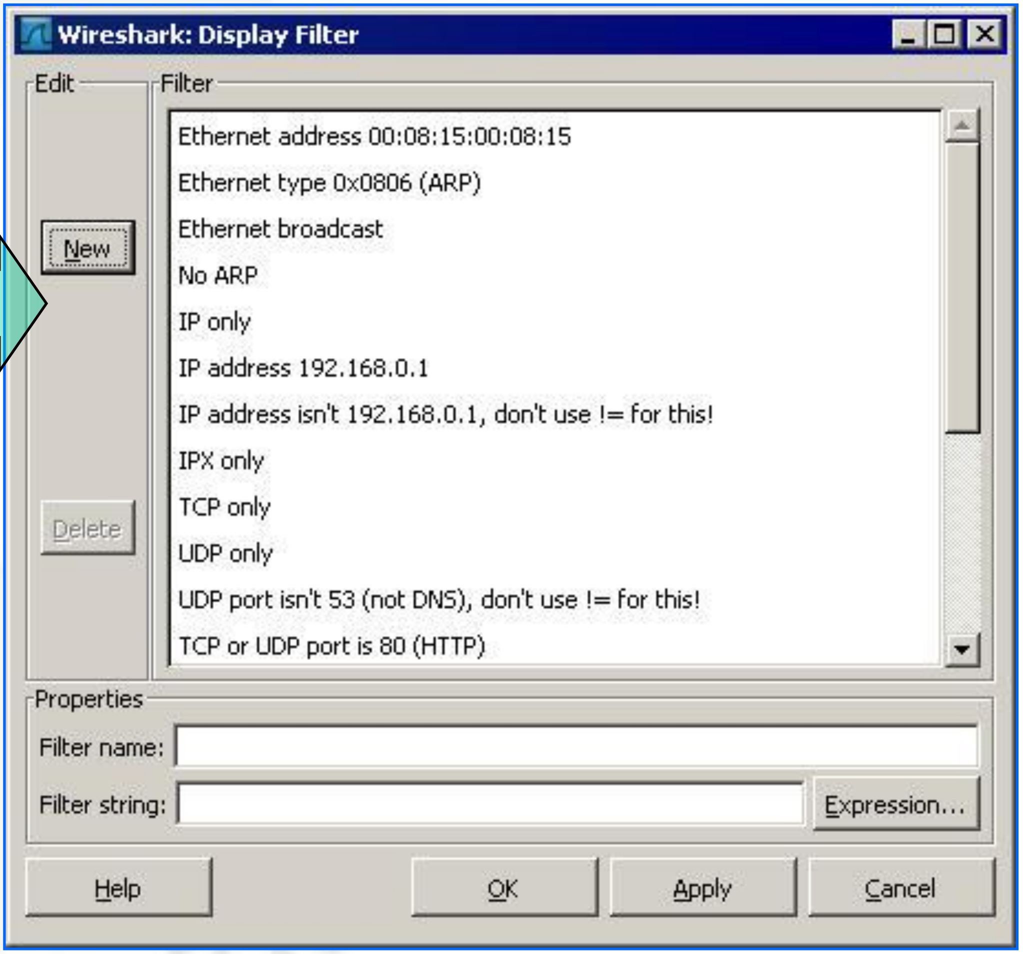
```
⊞ Internet Protocol, Src: 69.181.134.143 (69.181.134.143), Dst: 63.147.175.
  Control Protocol, Src Port: 3225 (3225), Dst Port: 80 (80), S
⊟ Hypertext Transfer Protocol
```

```
0000  00 01 5c 22 a5 82 08 00  46 f4 3a 09 08 00 45 00   ..\".... F.:...E.
0010  01 62 68 61 40 00 40 06  16 3a 45 b5 86 8f 3f 93   .bha@.@. .:E...?.
0020  af 23 0c 99 00 50 f0 98  cb 5c c2 09 46 22 50 18   .#...P.. .\..F"P.
0030  fa f0 38 45 00 00 47 45  54 20 2f 70 68 6f 74 6f   ..8E..GE T /photo
0040  2f 32 30 30 36 2f 31 31  31 34 2f 6e 66 6c 5f 63   /2006/11 14/nfl_c
0050  6f 61 63 68 65 73 5f 31  33 34 2e 6a 70 67 20 48   oaches_1 34.jpg H
```

Overview of Display Filters

- Can visit http://www.wireshark.org/docs/dfref





Filter

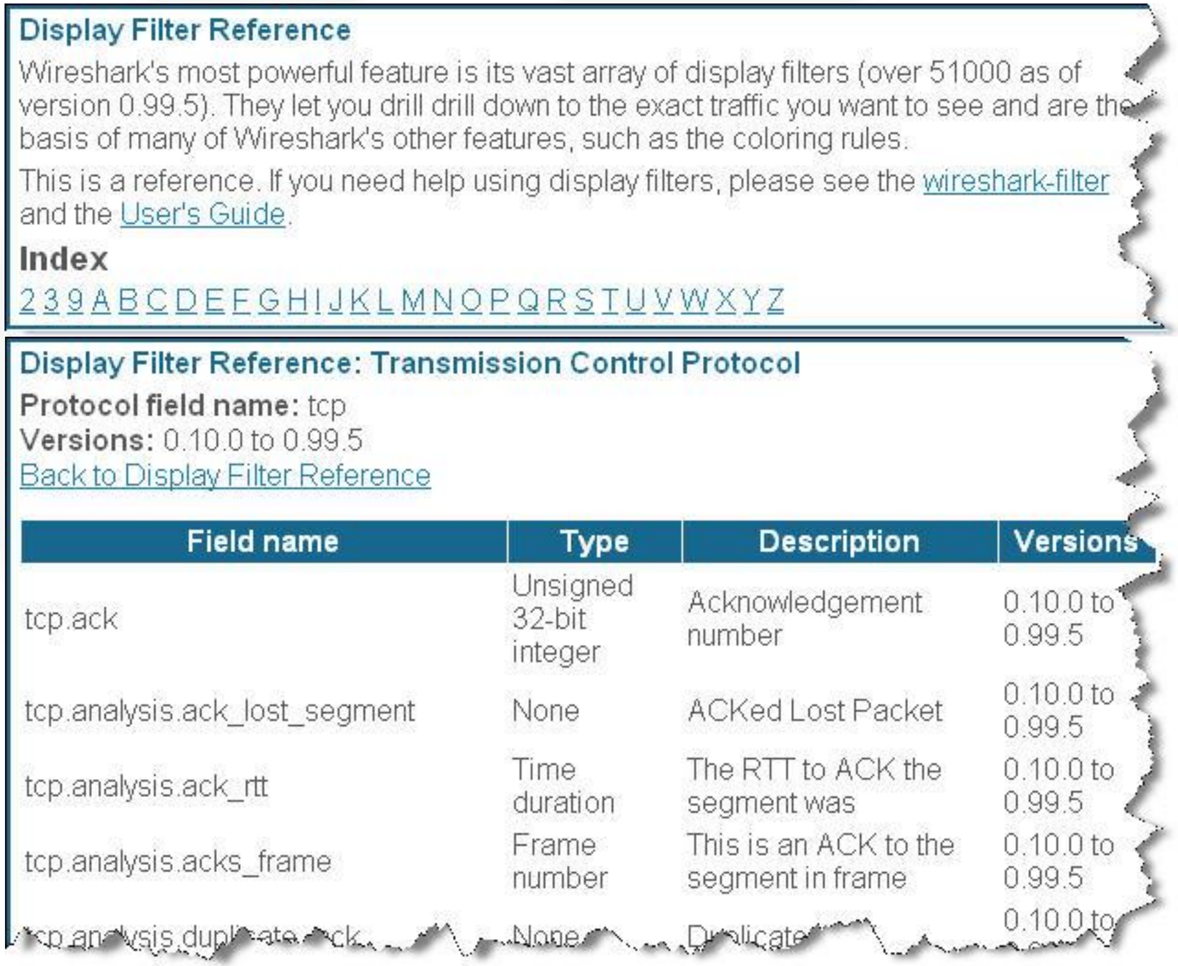
- Ethernet address 00:08:15:00:08:15
- Ethernet type 0x0806 (ARP)
- Ethernet broadcast
- No ARP
- IP only
- IP address 192.168.0.1
- IP address isn't 192.168.0.1, don't use != for this!
- IPX only
- TCP only
- UDP only
- UDP port isn't 53 (not DNS), don't use != for this!
- TCP or UDP port is 80 (HTTP)

Filter name:

Filter string:

Display Filter Syntax

Visit www.wireshark.org for the master list of Display Filter field names, types, descriptions and versions



Display Filter Reference

Wireshark's most powerful feature is its vast array of display filters (over 51000 as of version 0.99.5). They let you drill drill down to the exact traffic you want to see and are the basis of many of Wireshark's other features, such as the coloring rules.

This is a reference. If you need help using display filters, please see the wireshark-filter and the User's Guide.

Index

2 3 9 A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

Display Filter Reference: Transmission Control Protocol

Protocol field name: tcp
Versions: 0.10.0 to 0.99.5
Back to Display Filter Reference

Field name	Type	Description	Versions
tcp.ack	Unsigned 32-bit integer	Acknowledgement number	0.10.0 to 0.99.5
tcp.analysis.ack_lost_segment	None	ACKed Lost Packet	0.10.0 to 0.99.5
tcp.analysis.ack_rtt	Time duration	The RTT to ACK the segment was	0.10.0 to 0.99.5
tcp.analysis.acks_frame	Frame number	This is an ACK to the segment in frame	0.10.0 to 0.99.5
tcp.analysis.duplicate_ack	None	Duplicate	0.10.0 to

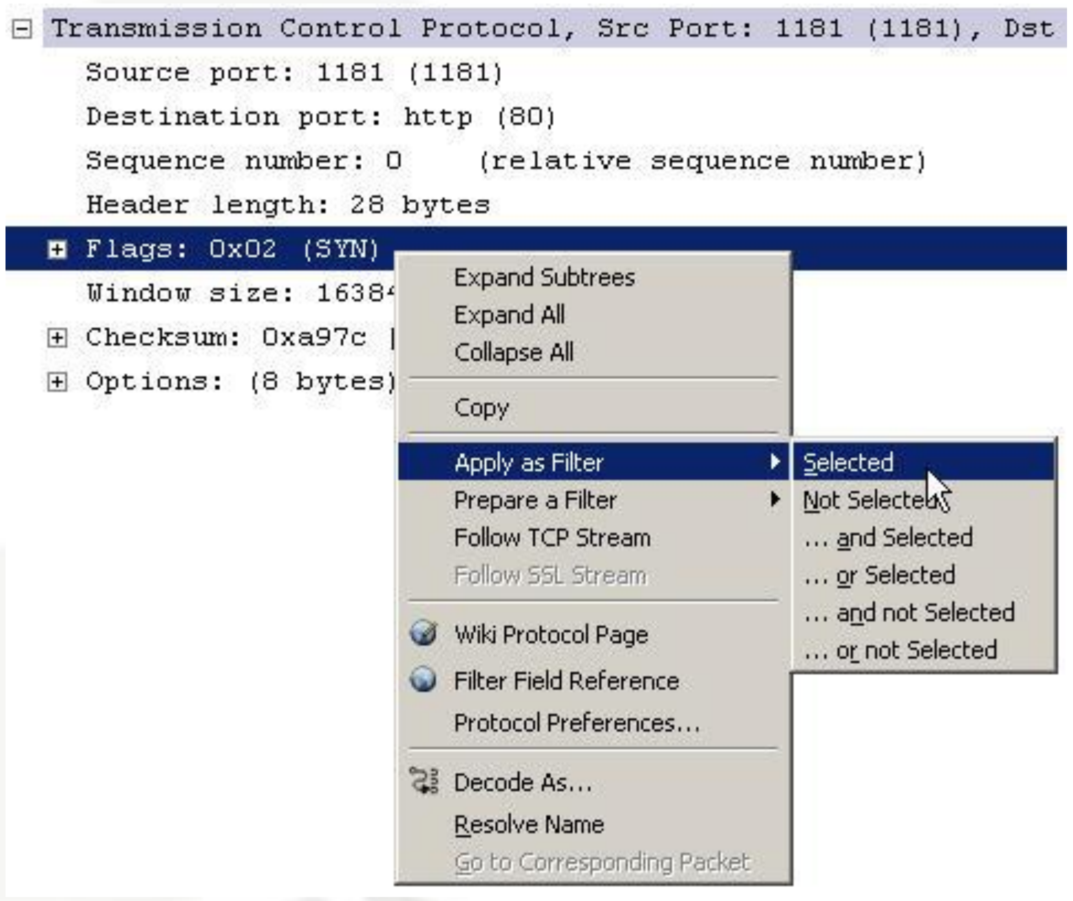
Operators and Advanced Filters

Operators

`==`	or	`eq`	equal to
`||`	or	`or`	or
`>`	or	`gt`	greater than
`>=`	or	`ge`	greater than or equal to
`<=`	or	`le`	less than or equal to
`<`	or	`lt`	less than
`!`	or	`not`	not
`!=`	or	`ne`	not equal to
`contains`			
`matches`			

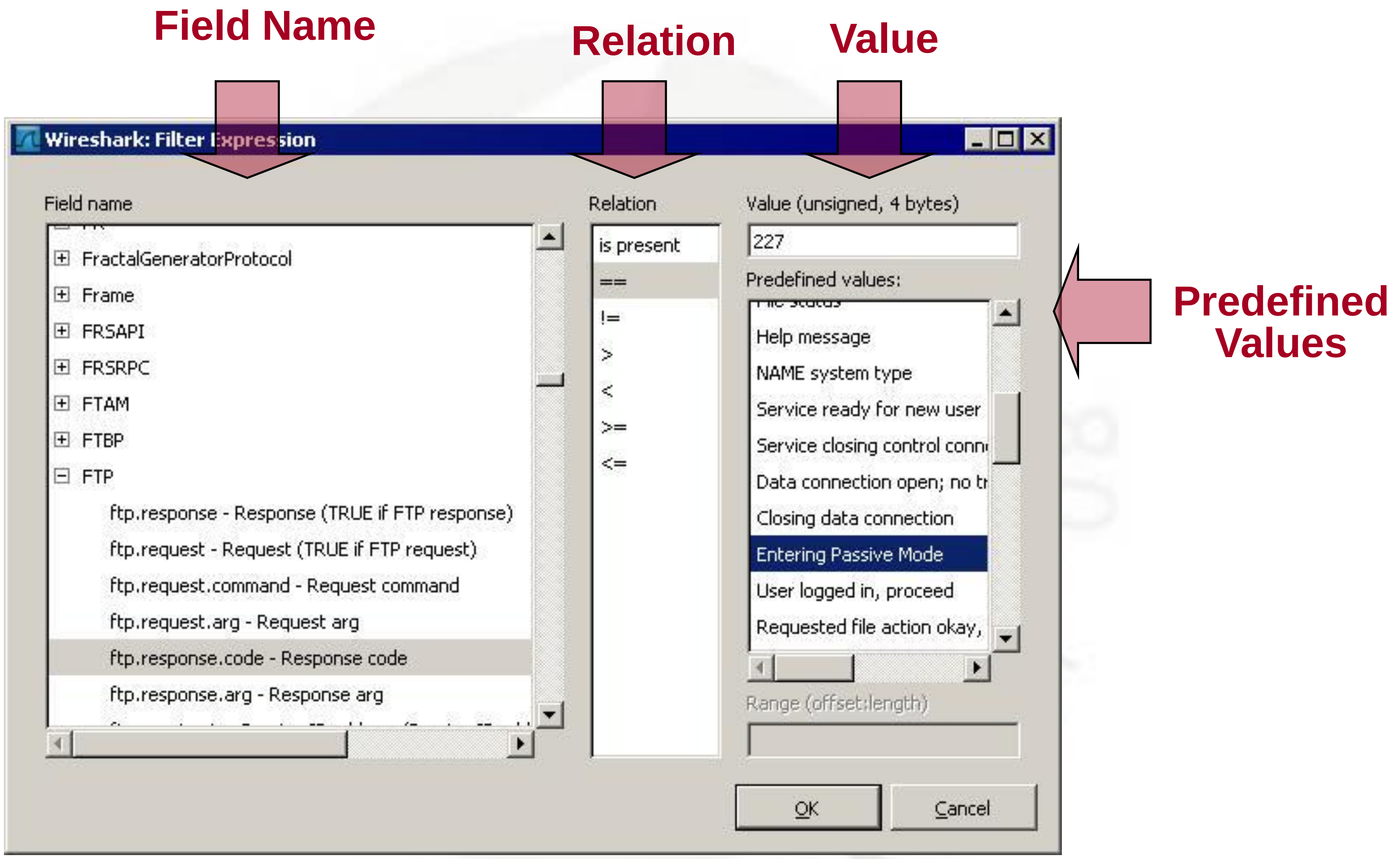
Build Filters Based on Captured Packet

Right mouse click on any field and either **Apply** or **Prepare** a filter based on the field and value (with an implied 'equal to' operator).



```
⊟ Transmission Control Protocol, Src Port: 1181 (1181), Dst
    Source port: 1181 (1181)
    Destination port: http (80)
    Sequence number: 0    (relative sequence number)
    Header length: 28 bytes
  ⊞ Flags: 0x02 (SYN)
    Window size: 1638
  ⊞ Checksum: 0xa97c |
  ⊞ Options: (8 bytes)
```

Build Filters Based on Expressions



Field name

- ⊞ FractalGeneratorProtocol
- ⊞ Frame
- ⊞ FRSAPI
- ⊞ FRSRPC
- ⊞ FTAM
- ⊞ FTBP
- ⊟ FTP
  - ftp.response - Response (TRUE if FTP response)
  - ftp.request - Request (TRUE if FTP request)
  - ftp.request.command - Request command
  - ftp.request.arg - Request arg
  - ftp.response.code - Response code
  - ftp.response.arg - Response arg

Relation

- is present
- ==
- !=
- >
- <
- >=
- <=

Value (unsigned, 4 bytes)

227

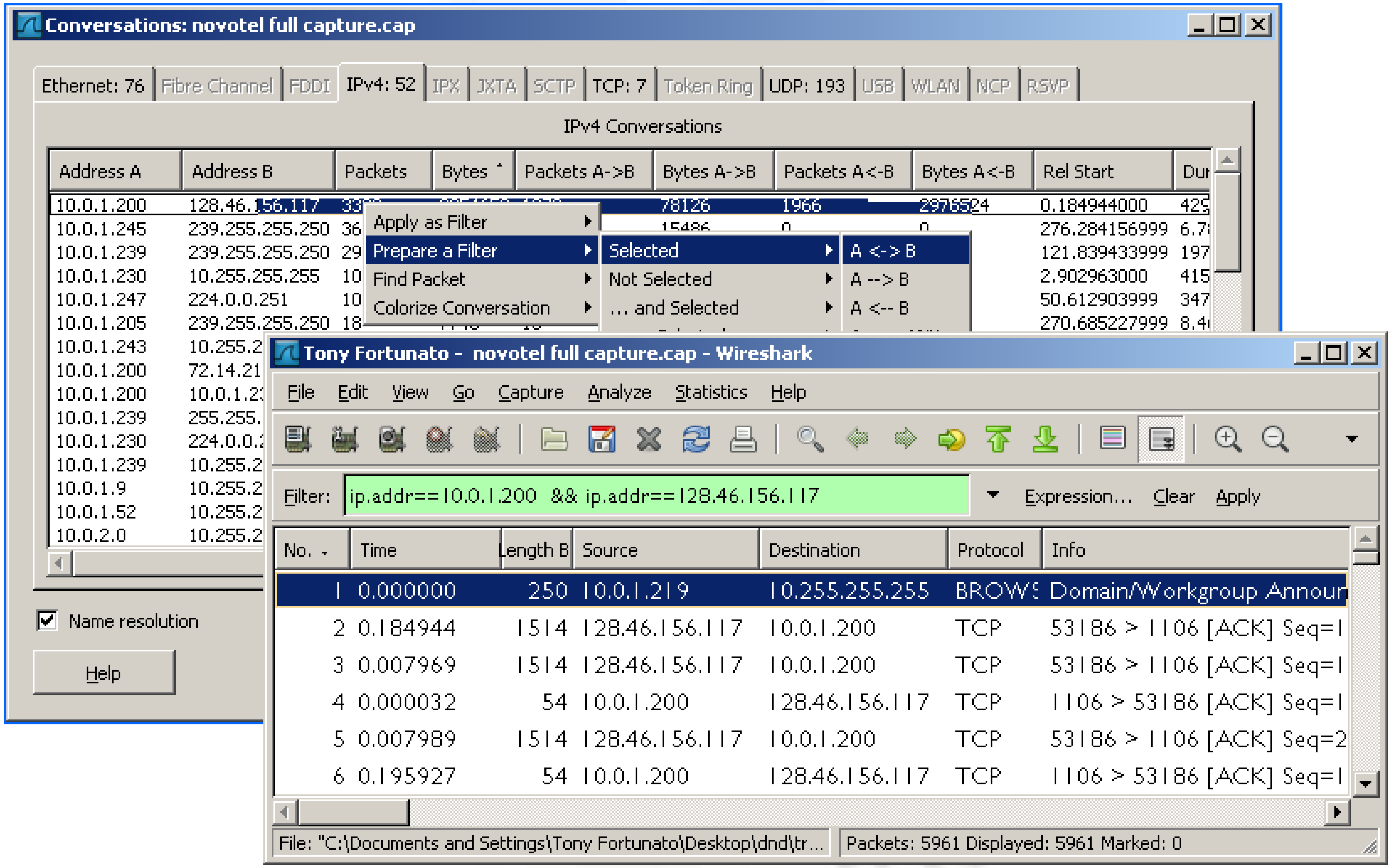
Predefined values:

- Help message
- NAME system type
- Service ready for new user
- Service closing control conn
- Data connection open; no tr
- Closing data connection
- Entering Passive Mode
- User logged in, proceed
- Requested file action okay,

Range (offset:length)

Build Filters from Statistics Reports

I use the ‘Prepare a Filter’ to build my filter



Conversations: novotel full capture.cap

Ethernet: 76 | Fibre Channel | FDDI | IPv4: 52 | IPX | JXTA | SCTP | TCP: 7 | Token Ring | UDP: 193 | USB | WLAN | NCP | RSVP

IPv4 Conversations

Address A	Address B	Packets	Bytes	Packets A->B	Bytes A->B	Packets A<-B	Bytes A<-B	Rel Start	Dur
10.0.1.200	128.46.156.117	33			78126	1966	2976524	0.184944000	429
10.0.1.245	239.255.255.250	36			15486	0	0	276.284156999	6.7
10.0.1.239	239.255.255.250	29						121.839433999	197
10.0.1.230	10.255.255.255	10						2.902963000	415
10.0.1.247	224.0.0.251	10						50.612903999	347
10.0.1.205	239.255.255.250	18						270.685227999	8.4
10.0.1.243	10.255.2								
10.0.1.200	72.14.21								
10.0.1.200	10.0.1.2								
10.0.1.239	255.255.								
10.0.1.230	224.0.0.								
10.0.1.239	10.255.2								
10.0.1.9	10.255.2								
10.0.1.52	10.255.2								
10.0.2.0	10.255.2								

Tony Fortunato - novotel full capture.cap - Wireshark

File Edit View Go Capture Analyze Statistics Help
Expression... Clear Apply

Filter: ip.addr==10.0.1.200 && ip.addr==128.46.156.117

No.	Time	Length B	Source	Destination	Protocol	Info
1	0.000000	250	10.0.1.219	10.255.255.255	BROWS	Domain/Workgroup Announ
2	0.184944	1514	128.46.156.117	10.0.1.200	TCP	53186 > 1106 [ACK] Seq=1
3	0.007969	1514	128.46.156.117	10.0.1.200	TCP	53186 > 1106 [ACK] Seq=1
4	0.000032	54	10.0.1.200	128.46.156.117	TCP	1106 > 53186 [ACK] Seq=1
5	0.007989	1514	128.46.156.117	10.0.1.200	TCP	53186 > 1106 [ACK] Seq=2
6	0.195927	54	10.0.1.200	128.46.156.117	TCP	1106 > 53186 [ACK] Seq=1

File: "C:\Documents and Settings\Tony Fortunato\Desktop\dnd\tr... Packets: 5961 Displayed: 5961 Marked: 0

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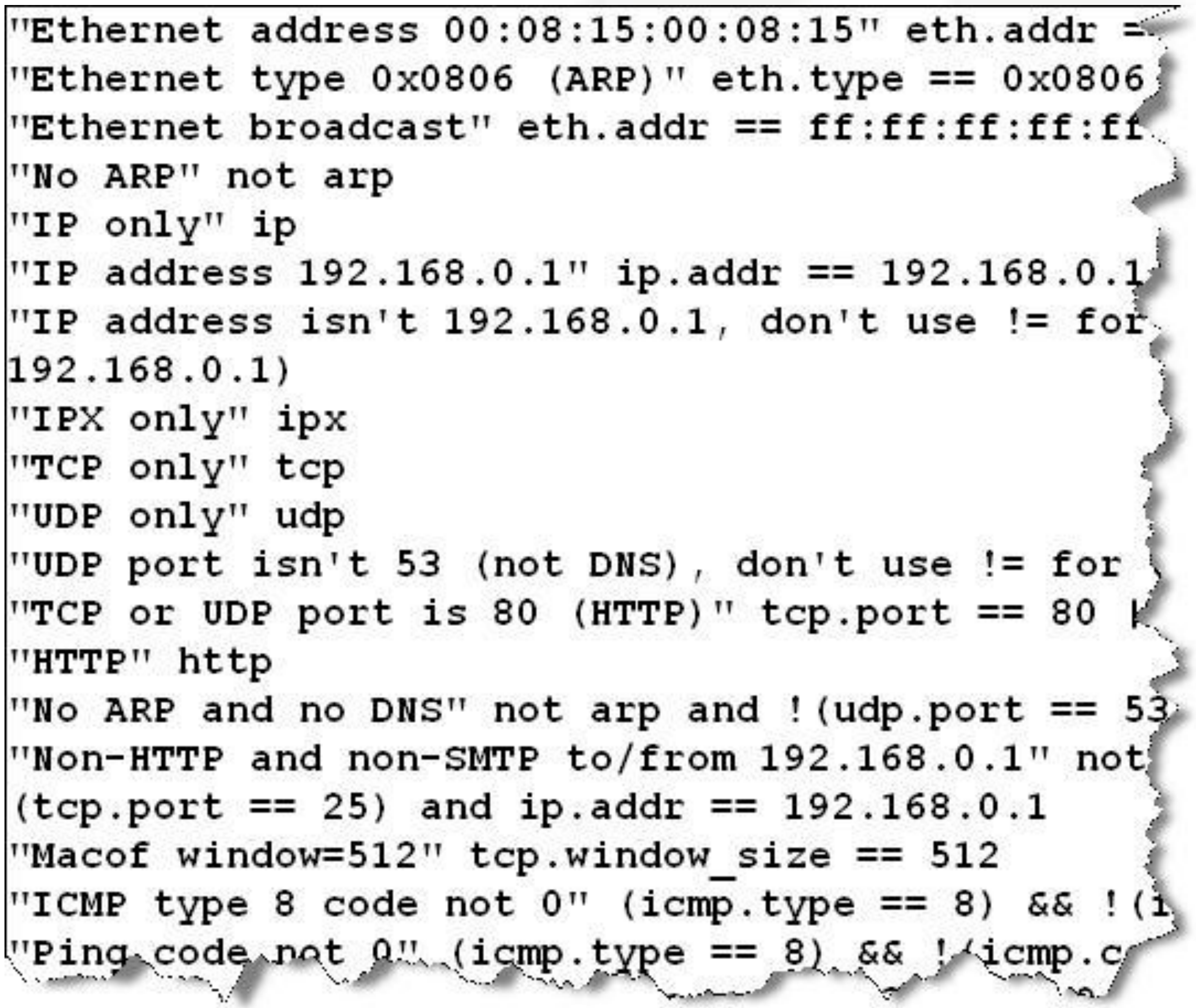
Top 10 Useful Filters

IP Address:	`ip.addr == x.x.x.x`
MAC Address:	`eth.addr == xx:xx:xx:xx:xx:xx`
ICMP!	`icmp`
My MAC Address:	`eth.addr == xx:xx:xx:xx:xx:xx`
DHCP:	`bootp`
High Delta Time:	`frame.time_delta > 1`
TCP Port:	`tcp.port == x`
UDP Port:	`udp.port == x`
TCP ACK RTT:	`tcp.analysis.ack_rtt > 1`
TCP Length: > x < y	`tcp.len > x && tcp.len < y`

Bonus

Not My MAC:	`!eth.addr == xx:xx:xx:xx:xx:xx`

Manually Editing the *dfilters* File



```
"Ethernet address 00:08:15:00:08:15" eth.addr =
"Ethernet type 0x0806 (ARP)" eth.type == 0x0806
"Ethernet broadcast" eth.addr == ff:ff:ff:ff:ff
"No ARP" not arp
"IP only" ip
"IP address 192.168.0.1" ip.addr == 192.168.0.1
"IP address isn't 192.168.0.1, don't use != for
192.168.0.1)
"IPX only" ipx
"TCP only" tcp
"UDP only" udp
"UDP port isn't 53 (not DNS), don't use != for
"TCP or UDP port is 80 (HTTP)" tcp.port == 80 |
"HTTP" http
"No ARP and no DNS" not arp and !(udp.port == 53
"Non-HTTP and non-SMTP to/from 192.168.0.1" not
(tcp.port == 25) and ip.addr == 192.168.0.1
"Macof window=512" tcp.window_size == 512
"ICMP type 8 code not 0" (icmp.type == 8) && !(i
"Ping code not 0" (icmp.type == 8) && !(icmp.c
```

- Do not append a file extension

- Include blank line after last filter

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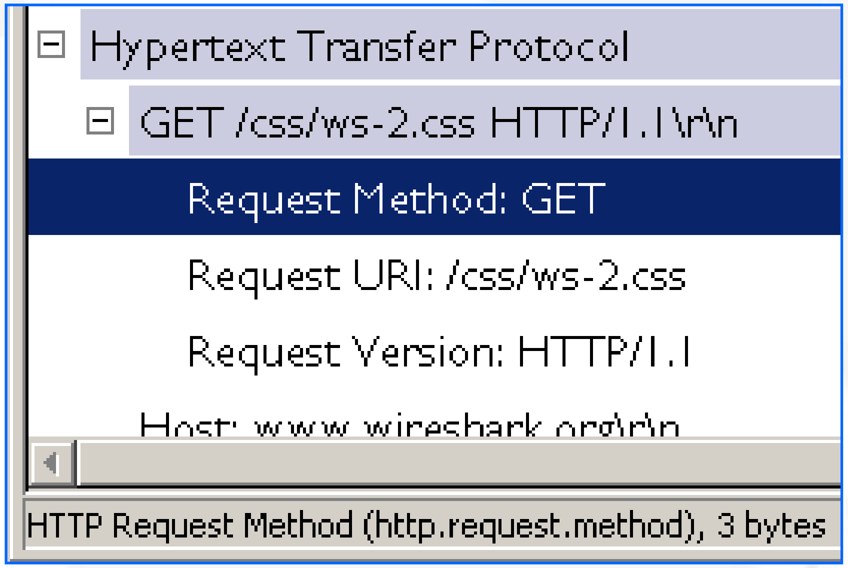
Display Filters

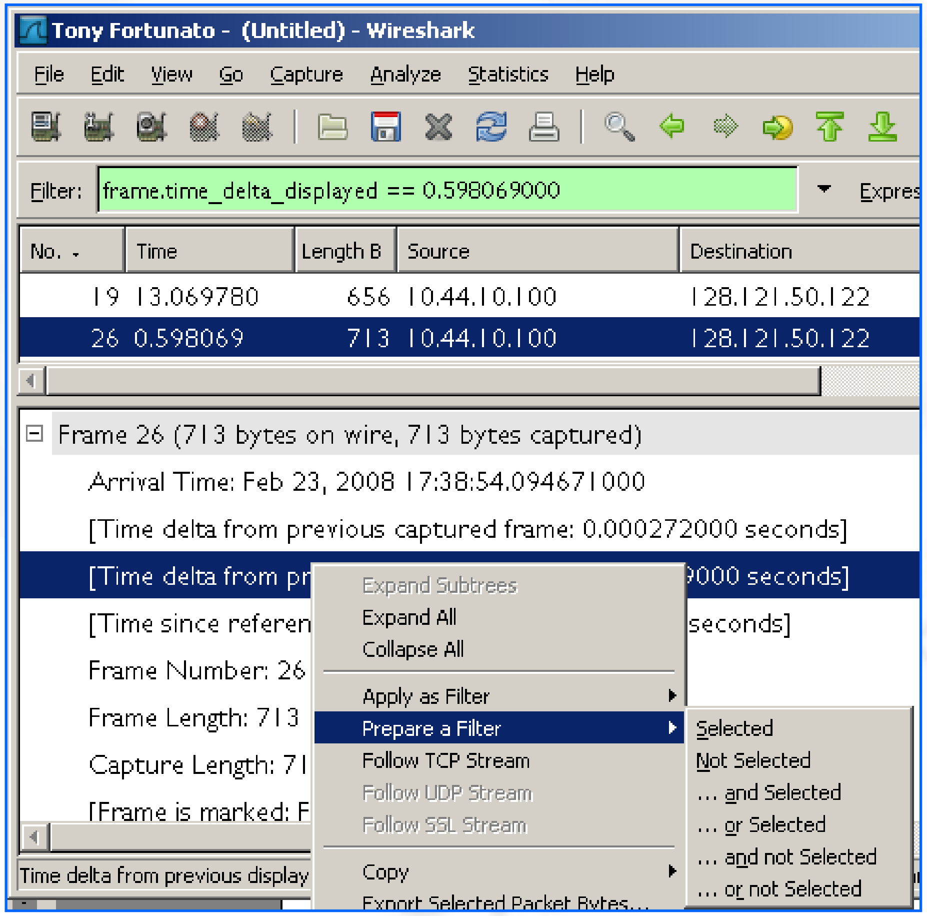
The easiest way to learn is to look at existing traces and reference the field name you are interested in;



```
⊟ Hypertext Transfer Protocol
   ⊟ GET /css/ws-2.css HTTP/1.1\r\n
         Request Method: GET
         Request URI: /css/ws-2.css
         Request Version: HTTP/1.1
      Host: www.wireshark.org\r\n
HTTP Request Method (http.request.method), 3 bytes
```

Display Filter Time Saver

When I want to build a filter, but don't want to type out a long fieldname, I simply right click on the field name and use the Prepare A Filter-> Selected and then modify the filter from there.



Tony Fortunato - (Untitled) - Wireshark

File Edit View Go Capture Analyze Statistics Help

Filter: frame.time_delta_displayed == 0.598069000 Expres

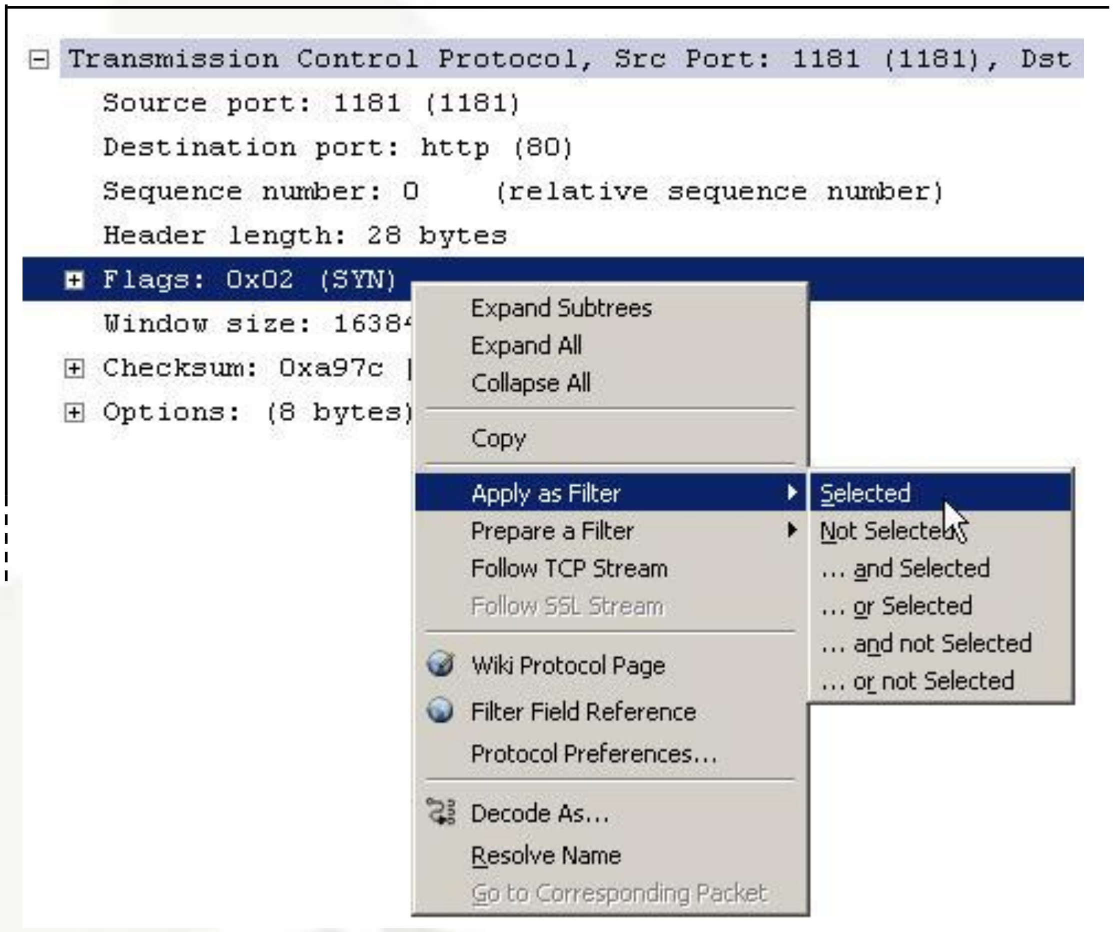
No.	Time	Length B	Source	Destination
19	13.069780	656	10.44.10.100	128.121.50.122
26	0.598069	713	10.44.10.100	128.121.50.122

```
⊟ Frame 26 (713 bytes on wire, 713 bytes captured)
    Arrival Time: Feb 23, 2008 17:38:54.094671000
    [Time delta from previous captured frame: 0.000272000 seconds]
    [Time delta from pr                    )000 seconds]
    [Time since referen                    seconds]
    Frame Number: 26
    Frame Length: 713
    Capture Length: 71
    [Frame is marked: F
```

Time delta from previous display

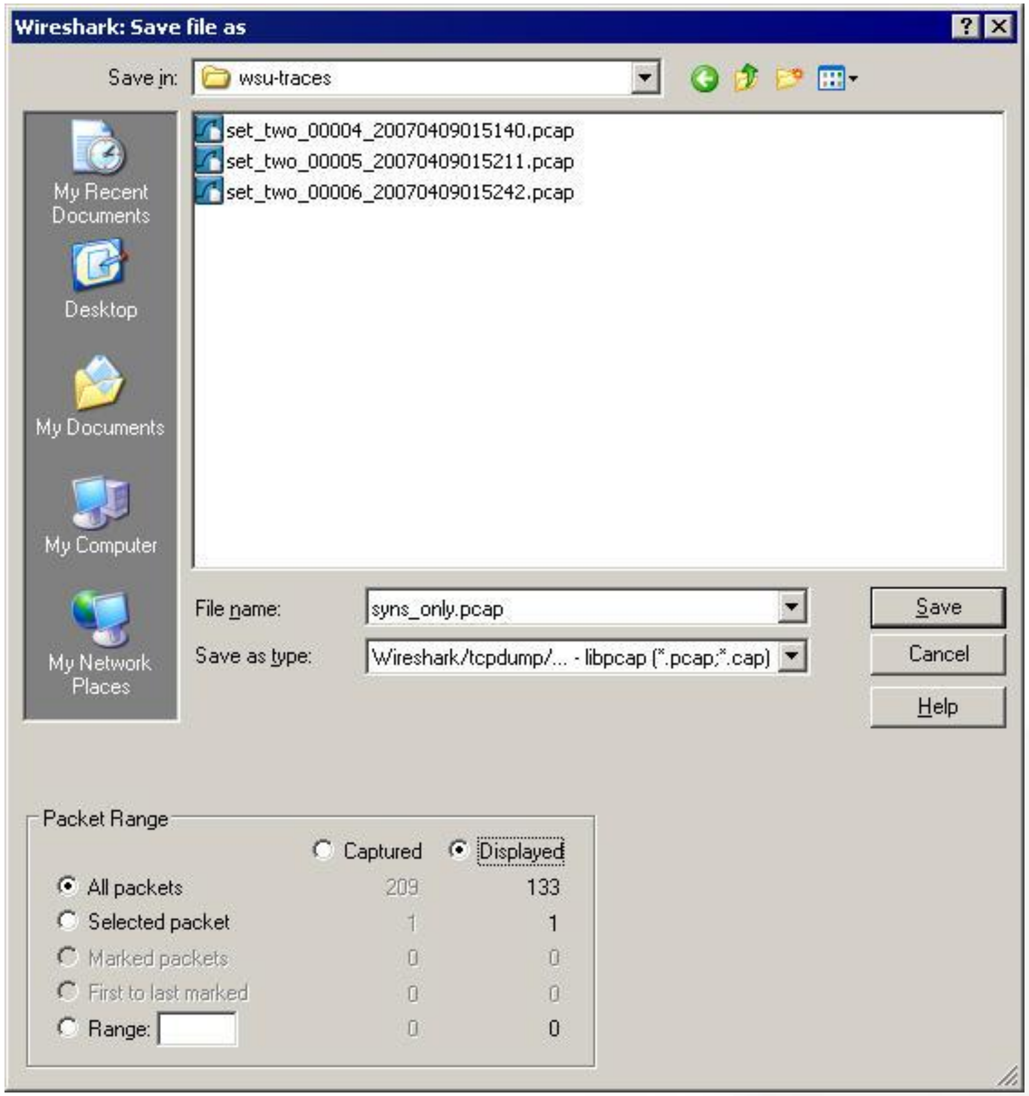
Build Filters Based on Packets

Right mouse click on any field and either **Apply** or **Prepare** a filter based on the field and value (with an implied ‘equal to’ operator).



```
⊟ Transmission Control Protocol, Src Port: 1181 (1181), Dst
    Source port: 1181 (1181)
    Destination port: http (80)
    Sequence number: 0    (relative sequence number)
    Header length: 28 bytes
  ⊞ Flags: 0x02 (SYN)
    Window size: 1638
  ⊞ Checksum: 0xa97c |
  ⊞ Options: (8 bytes)
```

Save Filtered, Marked and Ranges of Packets



Wireshark: Save file as

Save in: wsu-traces

- set_two_00004_20070409015140.pcap
- set_two_00005_20070409015211.pcap
- set_two_00006_20070409015242.pcap

File name: syns_only.pcap

Save as type: Wireshark/tcpdump/... - libpcap (*.pcap;*.cap)

Packet Range

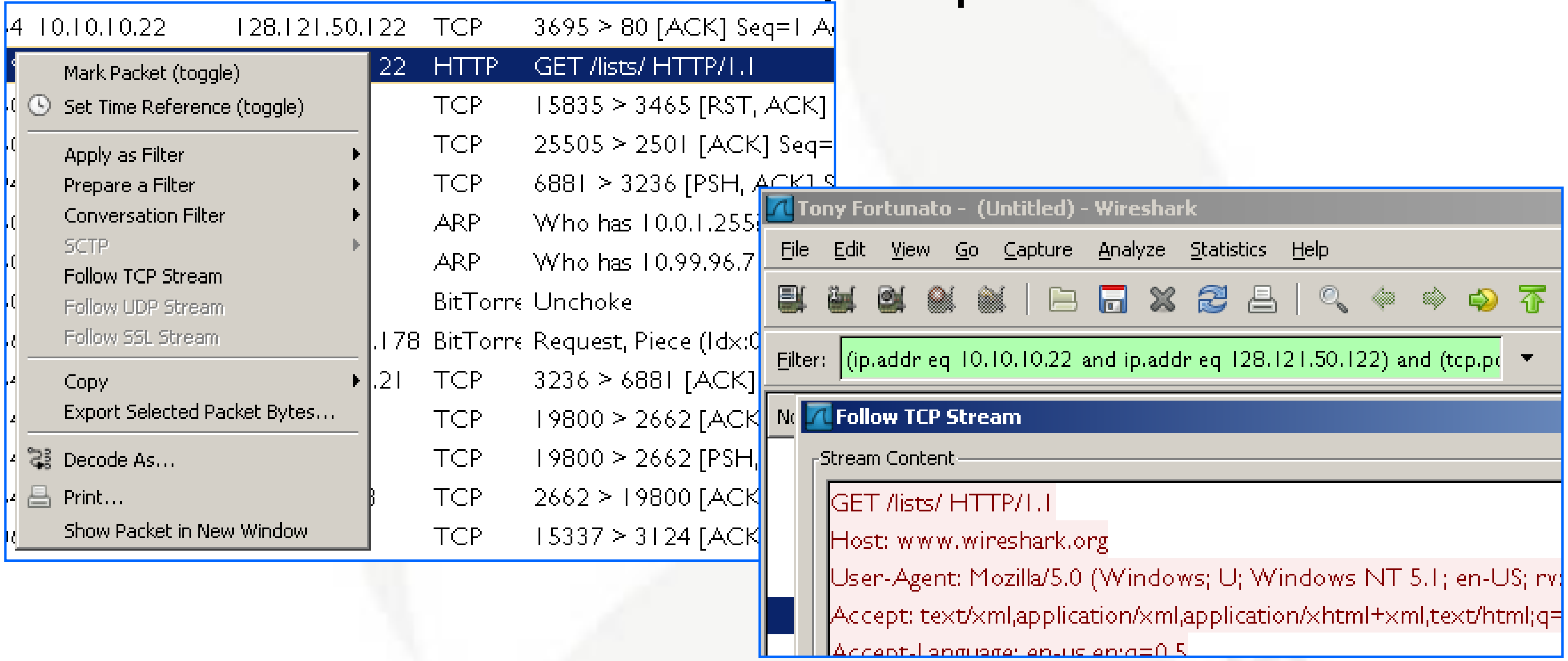
	Captured	[✓ Displayed]
[✓ All packets]	209	133
Selected packet	1	1
Marked packets	0	0
First to last marked	0	0
Range:	0	0

Packet Range Selection

- Captured/Displayed
- All packets
- Selected packets
- Marked packets
- First to last marked packet
- Range

Follow the Stream

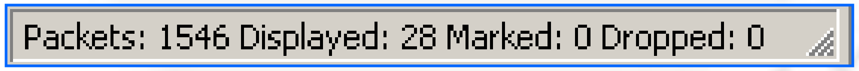
This feature creates a display filter of the selected Packet’s IP address and port pairs



```
4  10.10.10.22      128.121.50.122  TCP       3695 > 80 [ACK] Seq=1 A
                               22   HTTP      GET /lists/ HTTP/1.1
                                    TCP       15835 > 3465 [RST, ACK]
                                    TCP       25505 > 2501 [ACK] Seq=
                                    TCP       6881 > 3236 [PSH, ACK] S
                                    ARP       Who has 10.0.1.255
                                    ARP       Who has 10.99.96.7
                                    BitTorre  Unchoke
                             .178   BitTorre  Request, Piece (Idx:0
                              .21   TCP       3236 > 6881 [ACK]
                                    TCP       19800 > 2662 [ACK
                                    TCP       19800 > 2662 [PSH,
                                    TCP       2662 > 19800 [ACK
                                    TCP       15337 > 3124 [ACK
```

Filter: (ip.addr eq 10.10.10.22 and ip.addr eq 128.121.50.122) and (tcp.p

```
GET /lists/ HTTP/1.1
Host: www.wireshark.org
User-Agent: Mozilla/5.0 (Windows; U; Windows NT 5.1; en-US; rv:
Accept: text/xml,application/xml,application/xhtml+xml,text/html;q=
Accept-Language: en-us,en;q=0.5
```



Packets: 1546 Displayed: 28 Marked: 0 Dropped: 0

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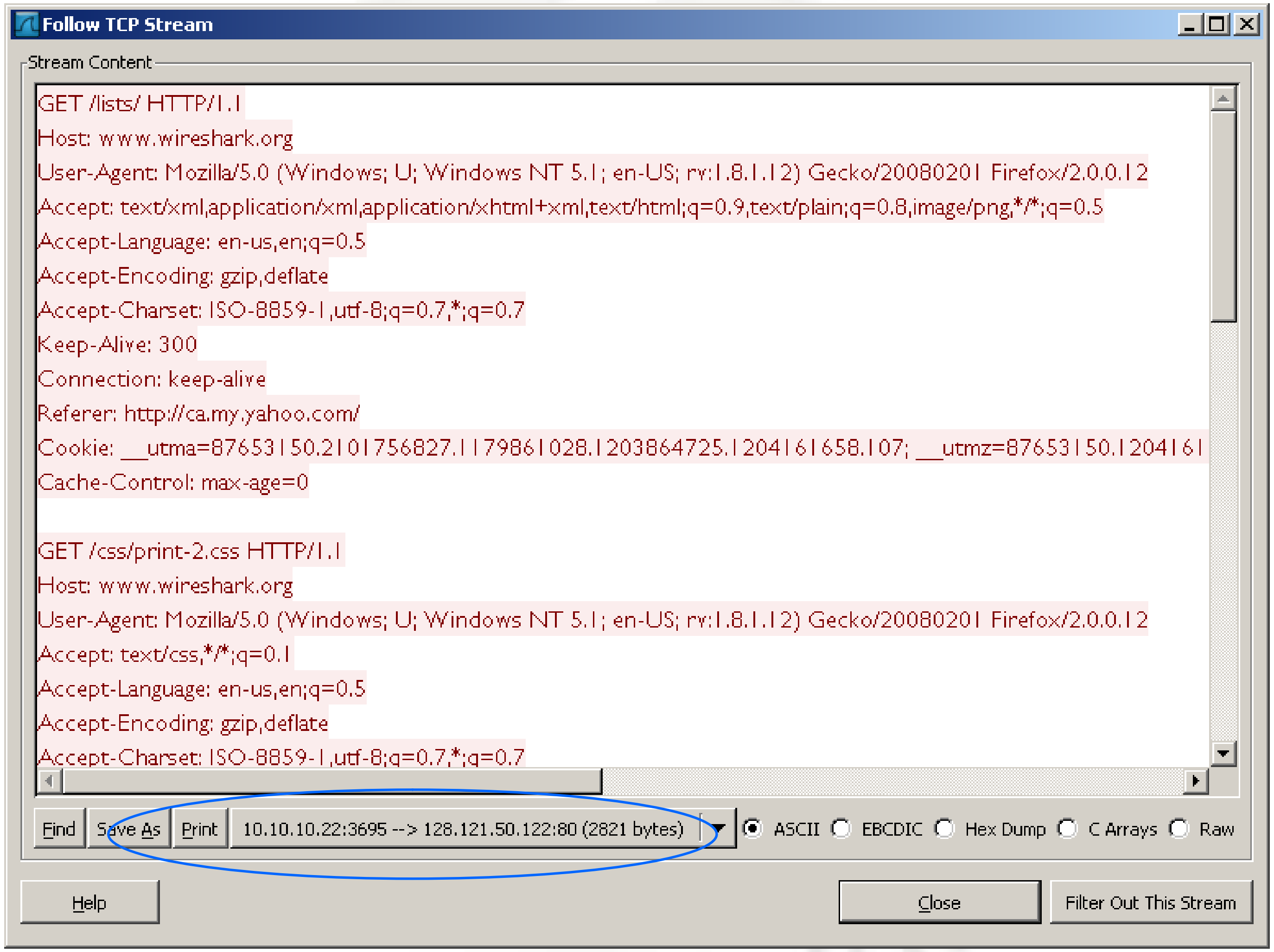
One Way stream

You can select the stream data from the client or Server

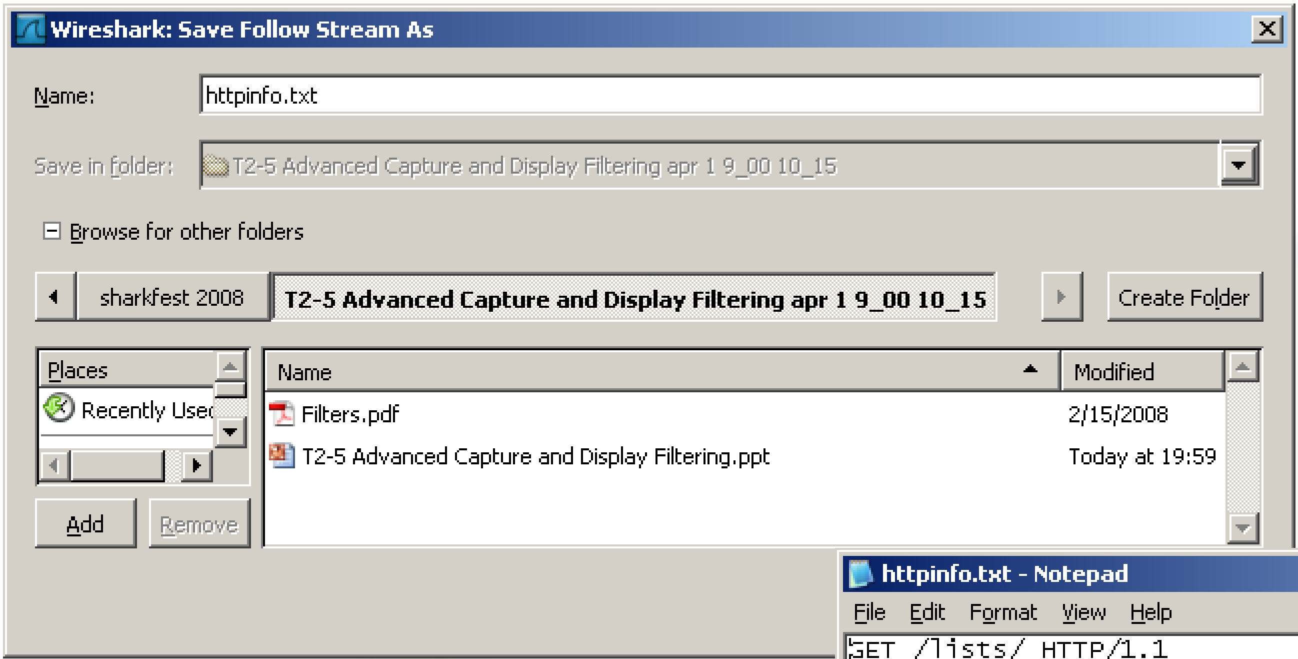


```
GET /lists/ HTTP/1.1
Host: www.wireshark.org
User-Agent: Mozilla/5.0 (Windows; U; Windows NT 5.1; en-US; rv:1.8.1.12) Gecko/20080201 Firefox/2.0.0.12
Accept: text/xml,application/xml,application/xhtml+xml,text/html;q=0.9,text/plain;q=0.8,image/png,*/*;q=0.5
Accept-Language: en-us,en;q=0.5
Accept-Encoding: gzip,deflate
Accept-Charset: ISO-8859-1,utf-8;q=0.7,*;q=0.7
Keep-Alive: 300
Connection: keep-alive
Referer: http://ca.my.yahoo.com/
Cookie: __utma=87653150.2101756827.1179861028.1203864725.1204161658.107; __utmz=87653150.1204161
Cache-Control: max-age=0

GET /css/print-2.css HTTP/1.1
Host: www.wireshark.org
User-Agent: Mozilla/5.0 (Windows; U; Windows NT 5.1; en-US; rv:1.8.1.12) Gecko/20080201 Firefox/2.0.0.12
Accept: text/css,*/*;q=0.1
Accept-Language: en-us,en;q=0.5
Accept-Encoding: gzip,deflate
Accept-Charset: ISO-8859-1,utf-8;q=0.7,*;q=0.7
```

Follow TCP Stream
Stream Content
Find
Save As
Print
10.10.10.22:3695 --> 128.121.50.122:80 (2821 bytes)
[✓ ASCII] EBCDIC Hex Dump C Arrays Raw
Help
Close
Filter Out This Stream

Saving A Stream

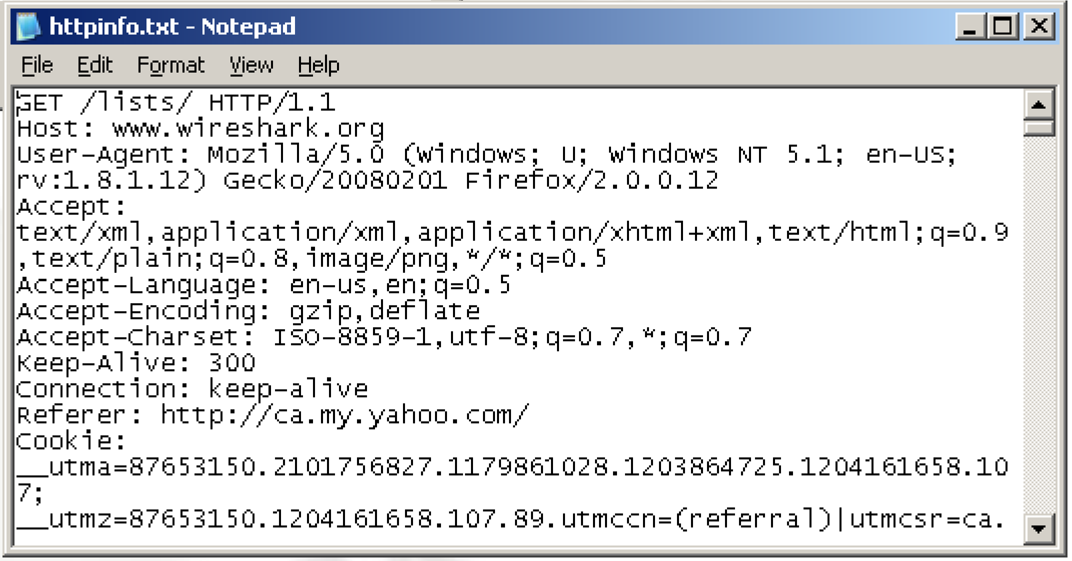


Wireshark: Save Follow Stream As

Name: httpinfo.txt

Save in folder: T2-5 Advanced Capture and Display Filtering apr 1 9_00 10_15

Name	Modified
Filters.pdf	2/15/2008
T2-5 Advanced Capture and Display Filtering.ppt	Today at 19:59



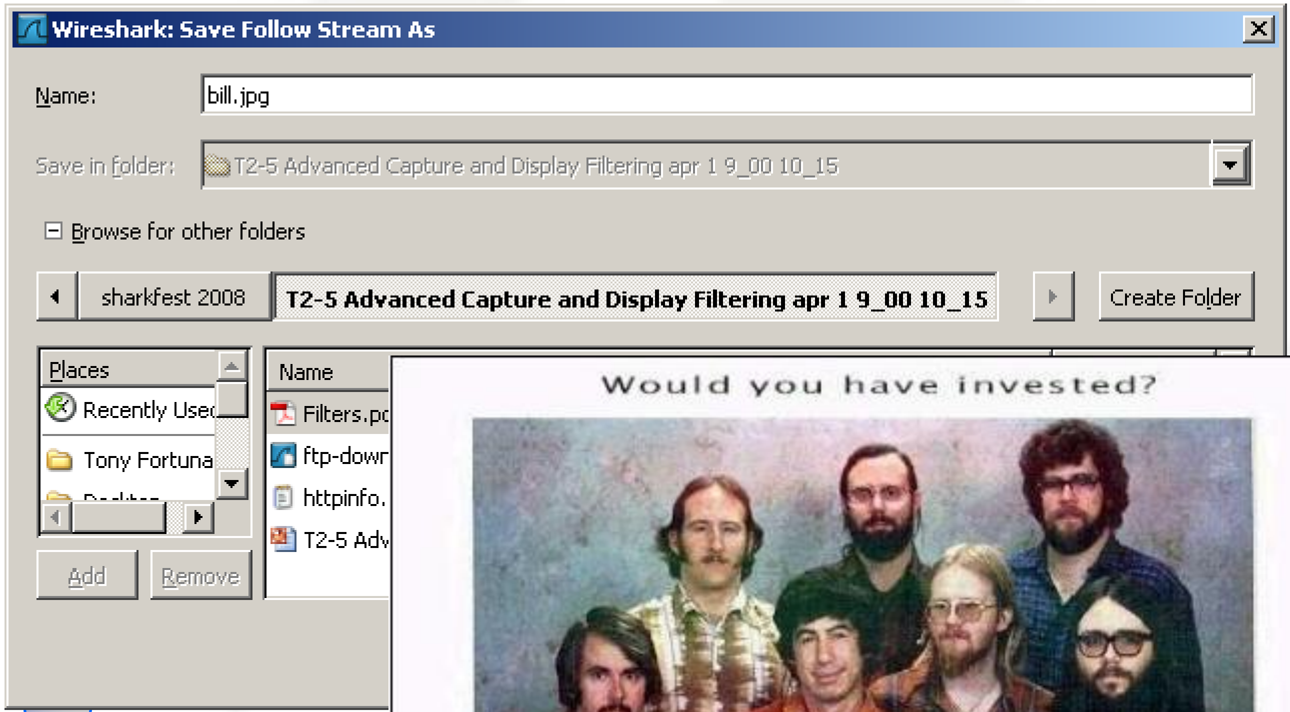
httpinfo.txt - Notepad

```
GET /lists/ HTTP/1.1
Host: www.wireshark.org
User-Agent: Mozilla/5.0 (Windows; U; Windows NT 5.1; en-US;
rv:1.8.1.12) Gecko/20080201 Firefox/2.0.0.12
Accept:
text/xml,application/xml,application/xhtml+xml,text/html;q=0.9
,text/plain;q=0.8,image/png,*/*;q=0.5
Accept-Language: en-us,en;q=0.5
Accept-Encoding: gzip,deflate
Accept-Charset: ISO-8859-1,utf-8;q=0.7,*;q=0.7
Keep-Alive: 300
Connection: keep-alive
Referer: http://ca.my.yahoo.com/
Cookie:
__utma=87653150.2101756827.1179861028.1203864725.1204161658.10
7;
__utmz=87653150.1204161658.107.89.utmccn=(referral)|utmcsr=ca.
```

Rebuilding a file

ftp-download-good.pcap

You can rebuild files from the stream



Wireshark: Save Follow Stream As

Name: bill.jpg

Save in folder: T2-5 Advanced Capture and Display Filtering apr 1 9_00 10_15

Browse for other folders

HTTP Filter Example

Common filters for HTTP

http.request.version == "HTTP/1.1“

Will return commands and responses