SharkFest '18 ASIA

Filter Maniacs

Goodies about display and capture filter

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Sample trace and configuration
https://www.ikeriri.ne.jp/sharkfest

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- Attending all Sharkfest
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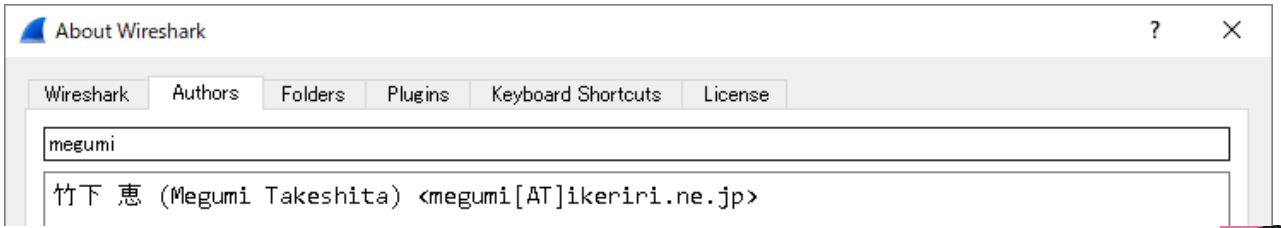


Filter Maniacs

TIPS and techniques about Wireshark display filters and WinPcap/libpcap capture filters. Wireshark has flexible and strong functions to filter packets, display filter by Wireshark, and capture filter by WinPcap/libpcap. We can capture the only packets you want and reduce trace file size using capture filters, and we can show the series of packets by display filter in a trace file.

This session Megumi shows practical TIPS and convenient techniques to use both filter using actual filter strings and trace files. You can utilize them in trace file and get the packet you need.

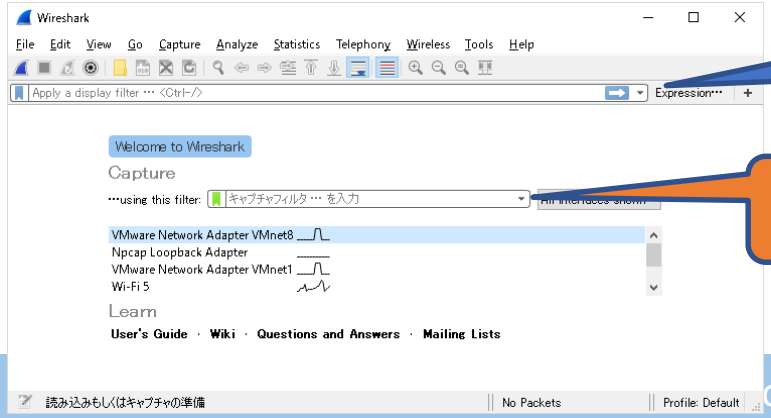
Agenda

- Capture and Display Filter Basics
- Capture Filter TIPS
- Display Filter TIPS
- Display filter Techniques
- Q & A

- # Capture and Display Filter Basics

Capture filter and Display Filter

- Capture filter is used by WinPcap/libpcap/Npcap and other capture drivers to filter packet data
- Display filter is used by Wireshark/tshark/dumpcap to filter display information of packet list pane
- Each text box is able to use auto complete



Display Filter

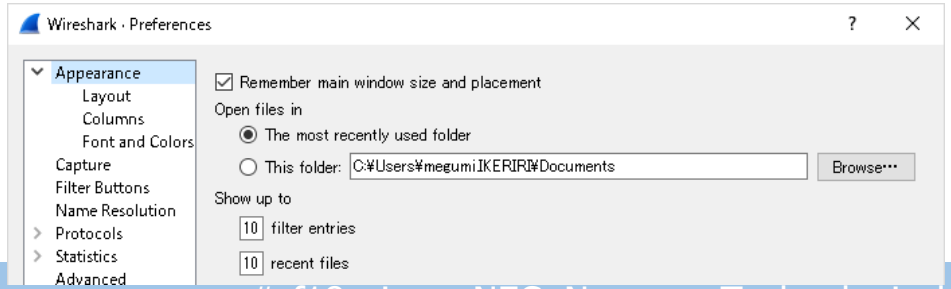
Capture Filter

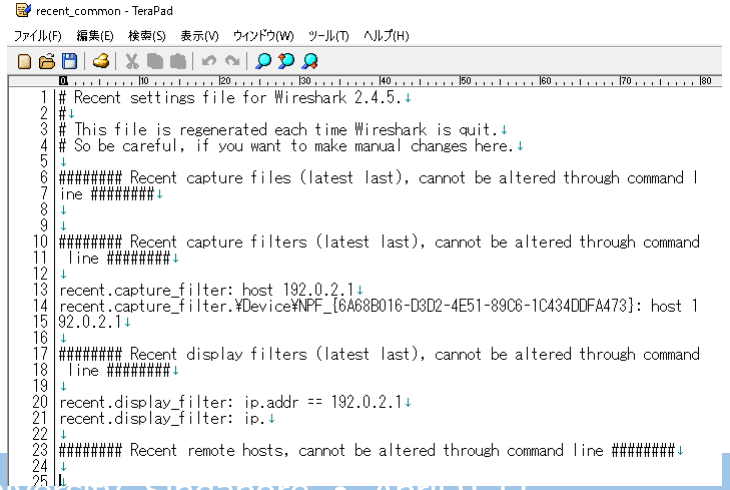
Difference between Capture and Display filter

	Capture Filter	Display Filter
Set by	WinPcap/libpcap/Npcap and packet capture driver	Wireshark
Applies to	Each interface	Each trace file
Syntax	Tcpdump, pcap_compile(), and pf()	Wireshark protocol.field.subfield
Layer	Under layer 4 based on tcpdump, pcap_compile()	All layer based on the fields of the Wireshark's dissector
Pcap file size	Reduced	No change
Statistics	X Bad Ratio of packets is changed	○ Good Ratio of packets is the same

History of filter

- If you once set Capture / Display filter, the latest filter string is saved in filter list, and also saved in **recent_common** file in Personal configuration folder
- The number of history can be changed in settings



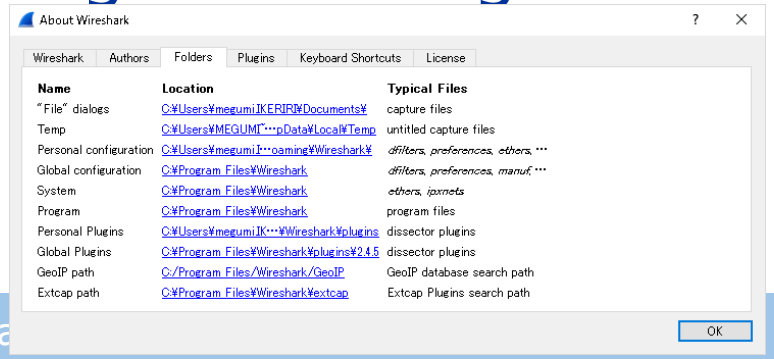


#1 check and test filter

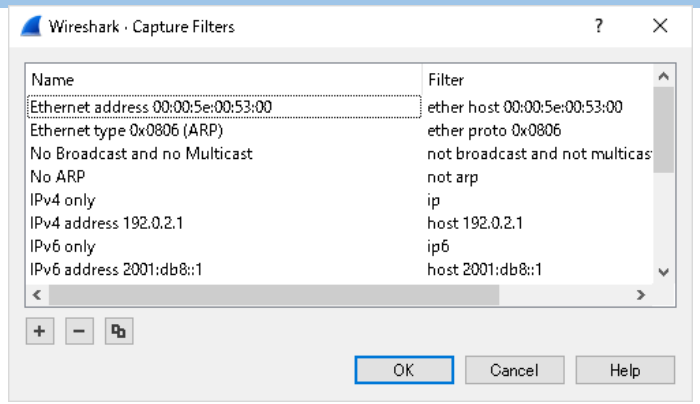
- Open Wireshark, set Capture filter (host 8.8.8.8) and start capturing, and stop.
- Open another Wireshark, set Display filter (ip.addr==8.8.8.8) and start capturing and stop.
- Check the difference of each Syntax, file size and statistics
- Open Personal Configuration folder by Help>About>Folders and open recent_common file.
- Check the number of history by Edit>Preferences (show up to XX filter entries, XX recent files)

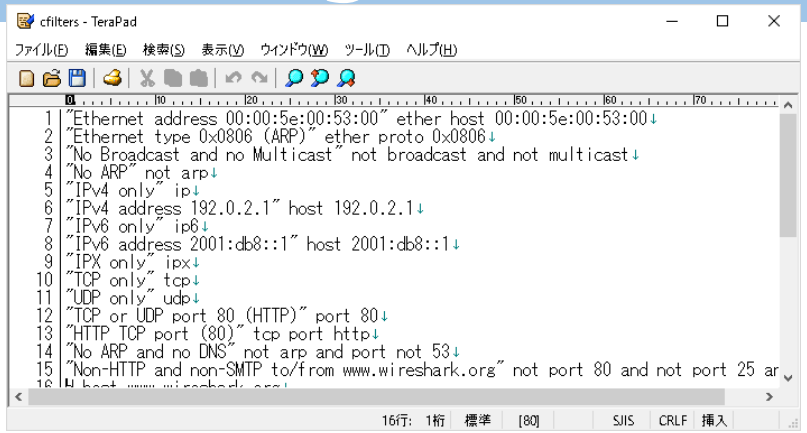
Configuration files of each filter

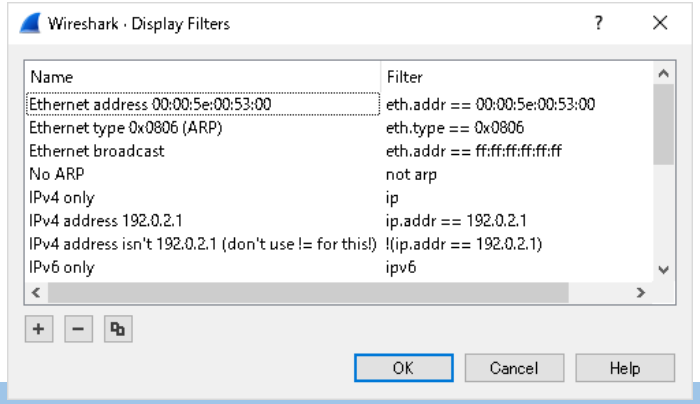
- Open Help>About Wireshark>Folders
- We can edit dfilters (Display filter template) and cfilters (Capture filter template) in Global configuration and Personal configuration (filter format using UTF8N and LF in Windows)
- You can also edit filters using filter dialog box Capture>Capture Filter… Analyze>Display Filter

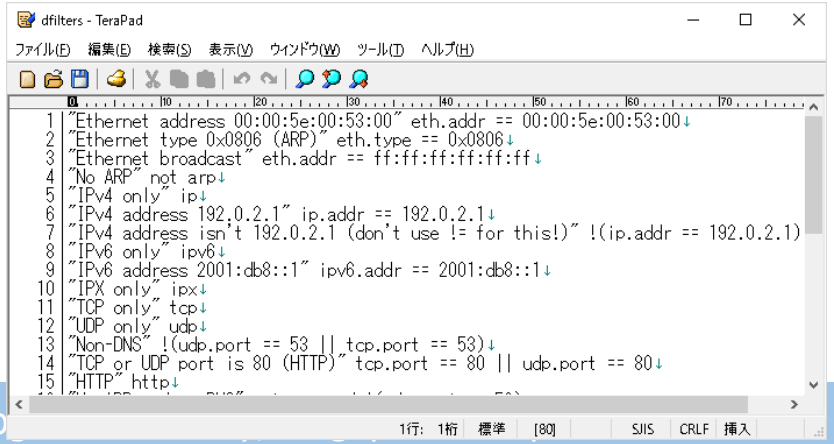


Check in Global configuration









Common example of Capture and Display filters

Address/port	Capture filter	Display filter
Source MAC address	ether src host	eth.src
Destination MAC address	ether dst host	eth.dst
Src and Dst MAC address	ether host	eth.addr
Source IPv4 address	src host	ip.src
Destination IPv4 address	dst host	ip.dst
Src and Dst IPv4 address	host	ip.addr
Source TCP port	tcp src port	tcp.srcport
Destination TCP port	tcp dst port	tcp.dstport
Src and Dst TCP port	tcp port	tcp.port

#2 Create your own filter template

- Create your own cfilters and dfilters and copy them into personal configuration from cfilter1 and dfilter1 and history
- Restart Wireshark and check each filter

cfilters - TeraPad

ファイル(F) 編集(E) 検索(S) 表示(V) ウィンドウ(W) ツール(T) ヘルプ(H)

```
1 "Source MAC address" ether src host 00:90:cc:11:11:11
2 "Destination MAC address" ether dst host 00:90:cc:11:11:11
3 "Src and Dst MAC address" ether host 00:90:cc:11:11:11
4 "Source IP address" src host 8.8.8.8
5 "Destination IP address" dst host 8.8.8.8
6 "Src and Dst IP address" host 8.8.8.8
7 "Source TCP port" tcp src port 80
8 "Destination TCP port" tcp dst port 80
9 "Src and Dst TCP port" tcp port 80
```

dfilters - TeraPad

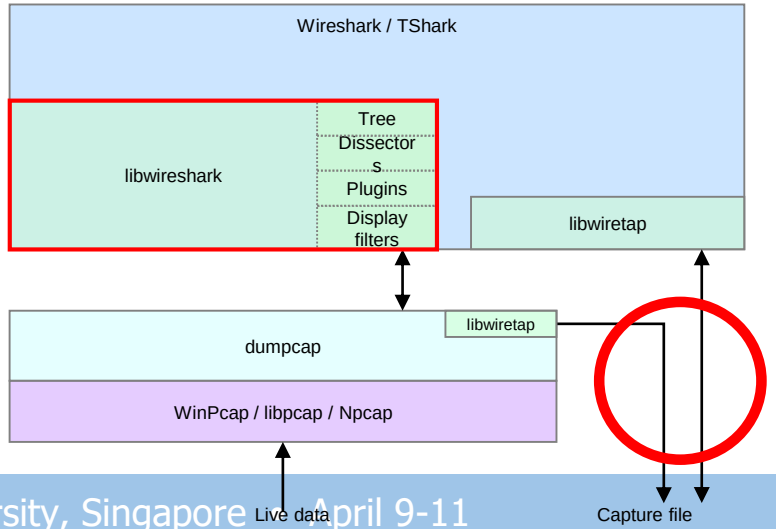
ファイル(F) 編集(E) 検索(S) 表示(V) ウィンドウ(W) ツール(T) ヘルプ(H)

```
1 "Source MAC address" eth.src == 00:90:cc:11:11:11
2 "Destination MAC address" eth.dst == 00:90:cc:11:11:11
3 "Src and Dst MAC address" eth.addr == 00:90:cc:11:11:11
4 "Source IP address" ip.src ==host 8.8.8.8
5 "Destination IP address" ip.dst == 8.8.8.8
6 "Src and Dst IP address" ip.addr == 8.8.8.8
7 "Source TCP port" tcp.srcport == 80
8 "Destination TCP port" tcp.dstport == 80
9 "Src and Dst TCP port" tcp.port ==80
```

Capture filter TIPS

Capture Filter Syntax

- Capture filter is set on each interface,
  Select interface then put filter string
- Capture filter syntax is derived from tcpdump, pcap_compile() and pf() firewall
- Capture filter is concerned about under Transport layer header information
  (radio, ether, wlan, ppp, ip, ipv6, arp, rarp, tcp,udp, icmp)
- Different from Display filter



name and network and port

- You can use hostname in capture filter string
  [src | dst] host www.ikeriri.ne.jp
- network address in capture filter string
  [src | dst] net 172.16
  [src | dst] net 192.168 mask 255.255.255.0
- Broadcast and Multicast
  [ip] broadcast and multicast
- The port from 0 – 1023
  [tcp | udp] portrange 0-1023

Examples

"Source host name" src host www.ikeriri.ne.jp

"Destination host name" dst host www.ikeriri.ne.jp

"Src and Dst host name" host www.ikeriri.ne.jp

"Src and Dst Network 172.16.0.0" net 172.16

"Src and Dst Network 192.168.0.0/24" net 192.168 mask 255.255.255.0

"Src Network 172.16.0.0" src net 172.16

"Dst Network 192.168.0.0/24" dst net 192.168 mask 255.255.255.0

"Ethernet broadcast and multicast" broadcast and multicast

"IP broadcast and multicast" ip broadcast and ip multicast

"Well known TCP port" tcp portrange 0-1023

"Well known UDP port" udp portrange 0-1023

Byte value, Frame size and VLAN/WLAN

- Set frame size using less or grater
  less 100 means capture only under 100bytes frame
  greater 1000 means capture only over 1000bytes frame
- VLAN traffic
  vlan [vlanid] (check name resolution setting)
- WLAN traffic
  wlan [host | src | dst]
- WLAN management, control, and data frame
  type [mgt | ctl | data]
- WLAN subtype (Beacon, Probe Request, Probe Response, Authentication, Association Request, Association Response, ACK, RTS, CTS, Deauthentication and Disassociation WITH AirPcap and other wireless capture devices)
  subtype [beacon | probereq | proberesp | auth | assocreq | assocresp | ack | rts | cts | deauth | disassoc]

Examples

"Frame size is under 100" less 100

"Frame size is over 1000" greater 1000

"IEEE802.1Q vlan frame" vlan

"VLAN ID is 10" vlan 10

"IEEE802.11 Wireless lan" wlan

"IEEE802.11 MAC address 00:90:cc:11:11:11" wlan host 00:90:cc:11:11:11

"IEEE802.11 Souce address 00:90:cc:11:11:11" wlan src 00:90:cc:11:11:11

"IEEE802.11 Destination address 00:90:cc:11:11:11" wlan dst 00:90:cc:11:11:11

"IEEE802.11 Management frame" type mgt

"IEEE802.11 Control frame" type ctl

"IEEE802.11 Data frame" type mgt

Examples

"IEEE802.11 Beacon frame" subtype beacon

"IEEE802.11 Probe Request frame" subtype probereq

"IEEE802.11 Probe Response" subtype proberesp

"IEEE802.11 Authentication" subtype auth

"IEEE802.11 Association Request" subtype assocreq

"IEEE802.11 Association Response" subtype assocresp

"IEEE802.11 ACK frame" subtype ack

"IEEE802.11 RTS frame" subtype rts

"IEEE802.11 CTS frame" subtype cts

"IEEE802.11 Deauthentication frame" subtype deauth

"IEEE802.11 Disassociation frame" subtype disassoc

#3 collect only Wi-Fi connection

cfilters2 - TeraPad

ファイル(F) 編集(E) 検索(S) 表示(V) ウィンドウ(W) ツール(T) ヘルプ(H)

```
"Source host name" src host www.ikeriri.ne.jp
"Destination host name" dst host www.ikeriri.ne.jp
"Src and Dst host name" host www.ikeriri.ne.jp
"Src and Dst Network 172.16.0.0" net 172.16
"Src and Dst Network 192.168.0.0/24" net 192.168 mask 255.255.255.0
"Src Network 172.16.0.0" src net 172.16
"Dst Network 192.168.0.0/24" dst net 192.168 mask 255.255.255.0
"Ethernet broadcast and multicast" broadcast and multicast
"IP broadcast and multicast" ip broadcast and ip multicast
"Well known TCP port" tcp portrange 0-1023
"Well known UDP port" udp portrange 0-1023
"Frame size is under 100" less 100
"Frame size is over 1000" greater 1000
"IEEE802.1Q vlan frame" vlan
"VLAN ID is 10" vlan 10
"IEEE802.11 Wireless lan" wlan
"IEEE802.11 MAC address 00:90:cc:11:11:11" wlan host 00:90:cc:11:11:11
"IEEE802.11 Souce address 00:90:cc:11:11:11" wlan src 00:90:cc:11:11:11
"IEEE802.11 Destination address 00:90:cc:11:11:11" wlan dst 00:90:cc:11:11:11
"IEEE802.11 Management frame" type mgt
"IEEE802.11 Control frame" type ctl
"IEEE802.11 Data frame" type mgt
"IEEE802.11 Beacon frame" subtype beacon
"IEEE802.11 Probe Request frame" subtype probereq
"IEEE802.11 Probe Response" subtype proberesp
"IEEE802.11 Authentication" subtype auth
"IEEE802.11 Association Request" subtype assocreq
"IEEE802.11 Association Response" subtype assocresp
"IEEE802.11 ACK frame" subtype ack
"IEEE802.11 RTS frame" subtype rts
"IEEE802.11 CTS frame" subtype cts
"IEEE802.11 Deauthentication frame" subtype deauth
"IEEE802.11 Disassociation frame" subtype disassoc
```

- Modify capture filter in Personal configuration using cfilter2 and set “collect only WiFi connection”
  Note: it needs IEEE802.11 wireless capture driver

Display filter TIPS

Display Filter Syntax

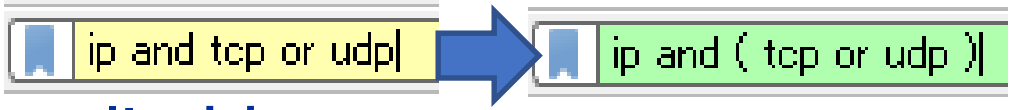
- Filter syntax is Protocol.field.subfield style
- Display filter is set **on each capture file**, set filter string in text box of display Filter toolbar
- Display filter syntax is derived from each protocol dissector of Wireshark, look at each field of **packet detail pane and status bar**.
- Display filter is concerned about **all layer and generated fields** such as GeoIP, Expert info, time

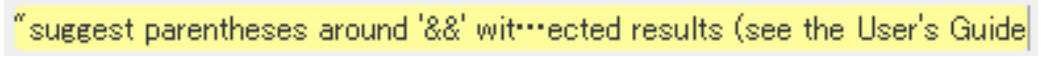
Color of filter text box

- Red means Error
  Filter string is not applied.

- Green means OK.

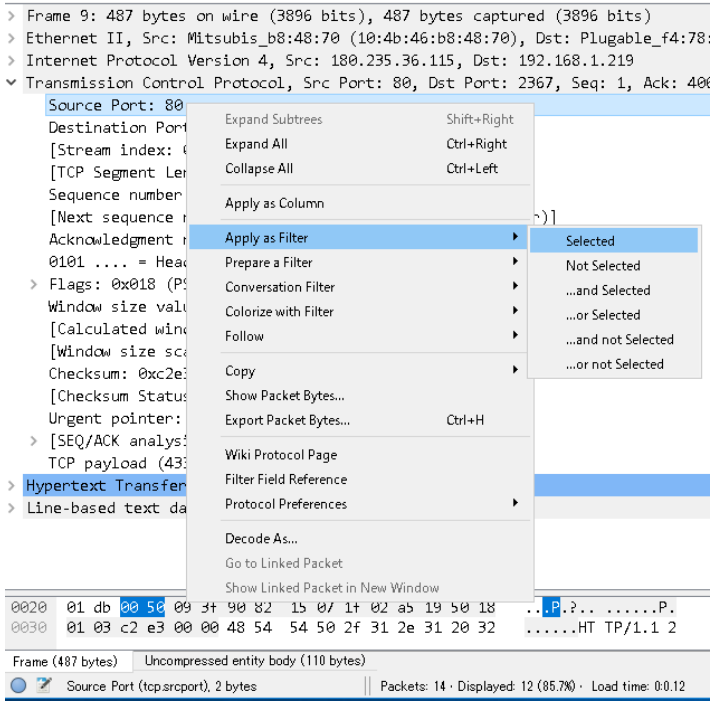
- the filter string can be applied
- Yellow means Warning
  the filter string can be applied but
  there are some ambiguous or contradiction
  look status bar and USE BRACKET to fix





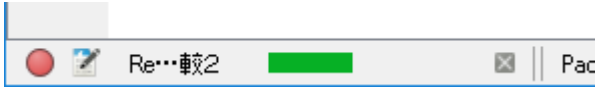
Cannot remember Filter String, select the field to right click

- If you cannot remember filter string, select each field of Packet detail pane.
- Wireshark display filter is derived from protocol dissectors, so look status bar.
- Select the field in Packet Detail Pane, Just right click to [Apply | Prepare] Filter > [Selected | Not Selected | …and Selected | …or Selected | … and not Selected | …or not Selected



Which one is good for Display Filter ? Apply or Prepare, try Prepare !

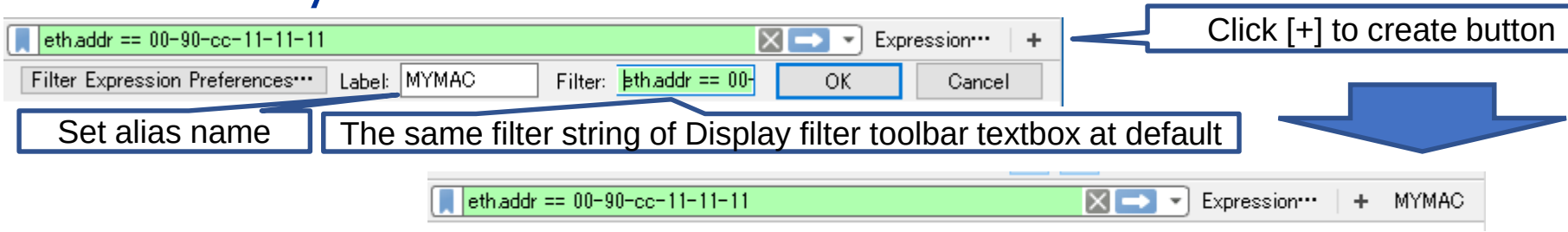
- If you create display filter in huge pcap/pcapng file, please try “Prepare Filter”, you can edit and check Display Filter string in Filter textbox.
- You can also add another filter string using “Prepare Filter”



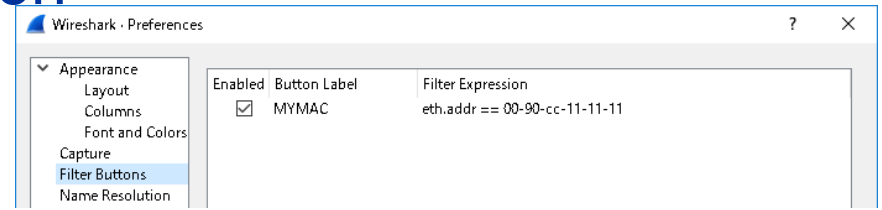
- “Apply Filter” works immediately, so it may take several minutes to finish.

Create Display Filter Button

- It is good idea to create Display Filter Button in case of commonly use such as device MAC address.

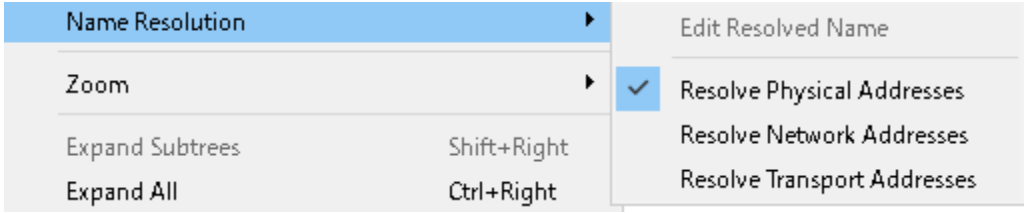


- You can add/del/edit Filter Button
  Edit>Preference>Filter Buttons



Name Resolution

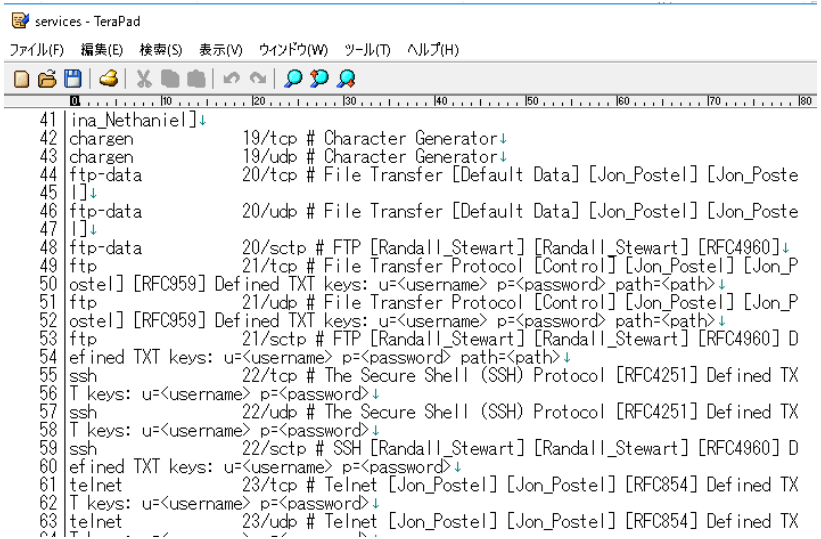
- Only Physical Address can be resolved at Default.
- You need to check “Resolve Network Address” in View>Name Resolution to use host name.



- Wireshark use manuf, hosts, services files in Global Configuration.
- You can also refer external DNS and DNS packet information to resolve name if you configure.

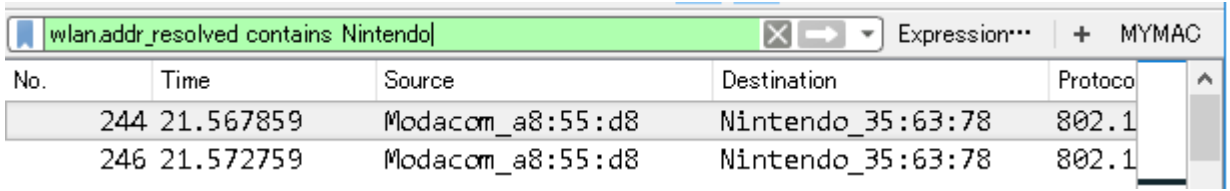
manuf, hosts, services

- You can edit manuf, hosts, services files to add your custom Name resolution aliases



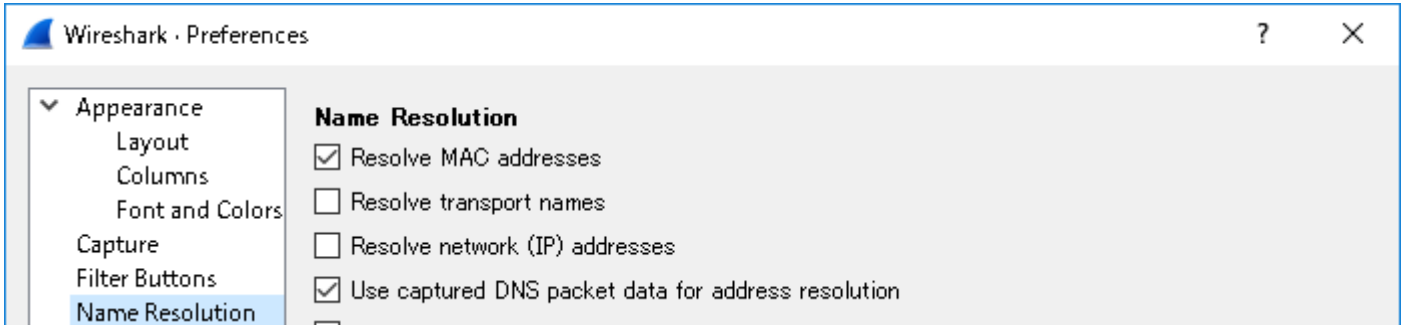
MAC Address Resolution

- You can use alias name of MAC address
  eth.addr_resolved (wlan.addr_resolved)
  eth.src_resolved (wlan.sa_resolved)
  eth.dst_resolved (wlan.da_resolved)
- If you want to look for Nintendo Switch type “wlan.addr_resolved contains Nintendo”



Host Name Resolution

- You can use host name in Display Filter
  ip.host ip.src_host ip.dst_host
  (View>Name Resolution> Resolve Network Address)
- You also need to refer Edit>Preference>Name Resolution



Examples (dfilter2)

"Sony's MAC address" eth.addr_resolved contains Sony

"source MAC address of Sony" eth.src_resolved contains Sony

"destination MAC address of Sony" eth.dst_resolved contains Sony

"Nintendo's wireless MAC address" wlan.addr_resolved contains Nintendo

"source wireless MAC address of Nintendo" wlan.sa_resolved contains Nintendo

"destination wireless MAC address of Nintendo" wlan.da_resolved contains Nintendo

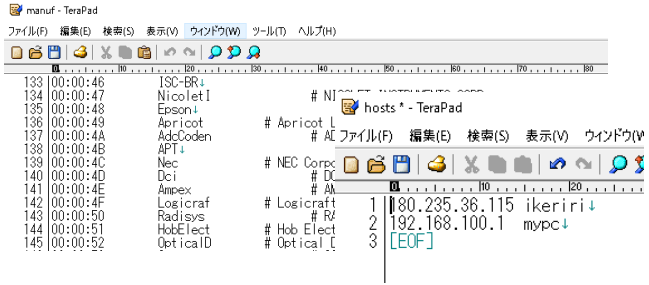
"Japan domain host" ip host contains jp

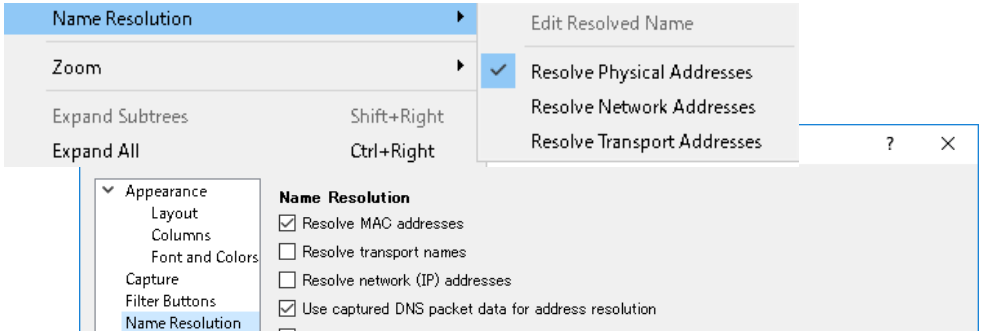
"source host of ikeriri" ip.src_host contains ikeriri

"destination host of ikeriri" ip.dst_host contains ikeriri

#4 edit your own alias

- Edit manuf and add alias of your own MAC address in Global configuration
- Edit hosts and add alias of your IP address too
- Check Resolve Network Address
- Restart Wireshark and start capturing





Display filter Techniques

Multiple address and port

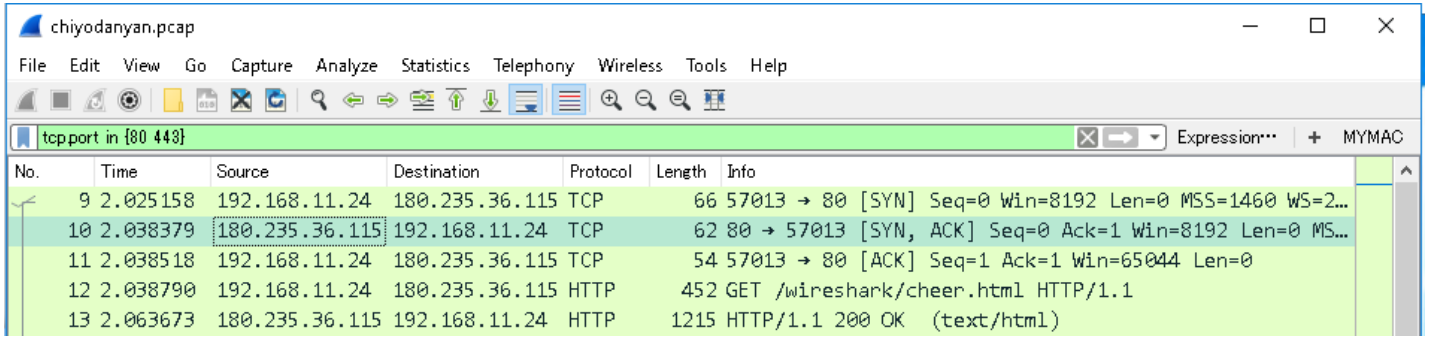
- If you want to grab the range of IP address and multiple port, there are some ways to filter packets.
- Filter IP Network
  ip.src>=192.168.100.0 and ip.src<=192.168.100.255
  ip.addr==192.168.100.0/24
- Filter HTTP and SSL port
  tcp.port == 80 or tcp.port == 443
  tcp.port in {80 443}

Examples (dfilter3)

"all address of network 192.168.100.0" ip.addr==192.168.100.0/24

"the range from 192.168.100.10 to 20" ip.src>=192.168.100.0 and ip.src<=192.168.100.255

"TCP HTTP and SSL port" tcp.port in {80 443}



Slices [] in Display Filter

- You can match hex value using slices []
  typically used with eth, eth.src, eth.dst, ip, tcp, udp and other header (sometimes may not work as you expected)
- [start byte index : length]
  eth.src[0:3] first 3 bytes in ethernet source address
- [start index – end index]
  eth.dst[1-2] second, third bytes of ethernet destination
- [: size]
  ip[:2] first 2 bytes of IP header

Examples (dfilter4)

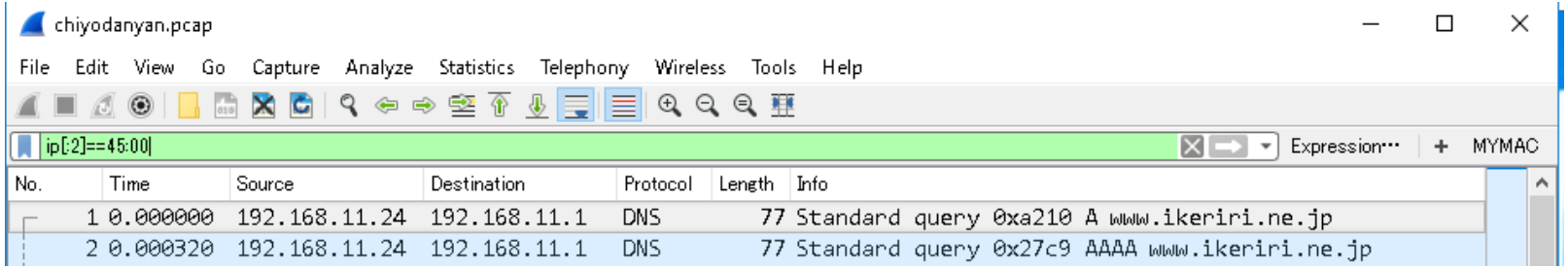
"OUI 00:D0:F1 (SEGA ENTERPRISES, LTD)" eth[0:3]==00:D0:F1

"second, third bytes of ethernet source is ff:ff" eth.src[1-2]==ff:ff

"second, third bytes of ethernet destination is ff:ff" eth.dst[1-2]==ff:ff

"IP version 4, length 20 TOS(DiffServ)=0 (first 2 bytes of IP header)" ip[:2]==45:00

"TCP destination port (from index 2 length 2 bytes) is 80(0x0050)" tcp[2:2]=00:50



Relation (contains / matches)

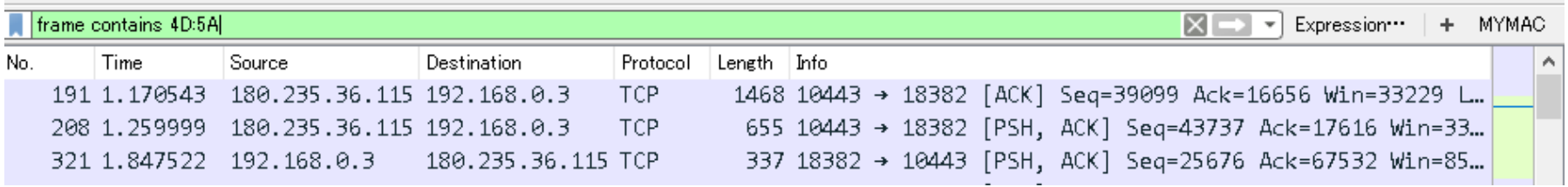
- Display filter string is commonly used with relation (eq(==), gt(>), lt(<), etc.)
- You can also use relation (and, or, not, xor)
- "**contains**" is convenient relation as wildcard of string value (ex. http.request.uri contains ikeriri
- "**matches**" is the relation of PCRE (Perl Compatible Regular Expressions)

Direct search of specified bytes value

- You can search specified bytes value in capture file using Display filters with “contains” relation
- Each file has a marker, the specified bytes value, for example JPEG file has a marker of Start (SOI: start of image) as “FF D8 FF”
- You can look for frame, tcp.segment, and more example frame contains ff:d8:ff

Examples (dfilter5)

"all frames that contains JPEG file SOI marker" frame contains FF-D8-FF
"all frames that contains PNG file signature (png.signature)" frame contains 89:50:4e:47:0d:0a:1a:0a
"find suspicious packets of Windows Executables (MZ marker)" frame contains 4D:5A
"find suspicious packets of Uboat RAT (remote access trojan) malware" frame contains 34:38:38



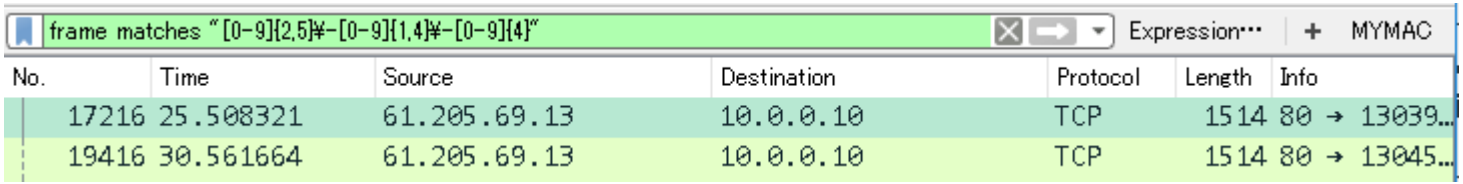
#5 sample use of PERC

- Search Japanese local phone number in packets xx-xxxx-xxxx (first digits appears 2-5 times, second digits appears 1-4 times, and last digits appears 4 times) frame matches "[0-9]{2,5}¥-[0-9]{1,4}¥-[0-9]{4}" (Note: in a single byte environment escape character "¥" should be removed.) ¥ is backslash in Japanese keyboard map
- Search email address (any composite of alphabet, number and ._%+- ,@, any composite of subdomain and top level domain) frame matches "[a-zA-Z0-9._%+-]+@[a-zA-Z0-9.-]+[.][a-zA-Z]{2,4}"

Examples (dfilter6)

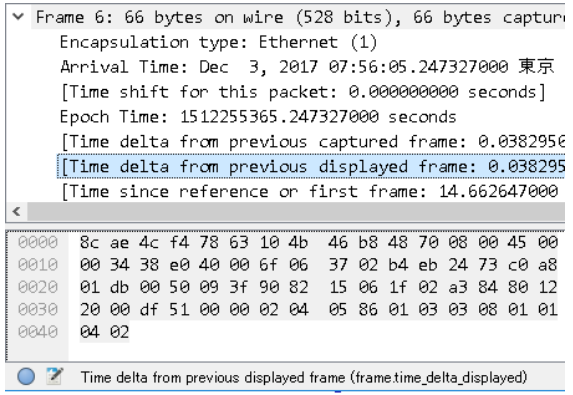
"Japanese local phone number in packets" frame matches "[0-9]{2,5}¥-[0-9]{1,4}¥-[0-9]{4}"

"Search email address" frame matches "[a-zA-Z0-9._%+-]+@[a-zA-Z0-9.-]+[.][a-zA-Z]{2,4}"



Use Wireshark generated fields

- Display filter can refer generated fields as well as actual field of the dissectors
- You can use time and duration value of Wireshark generated field
  ex. icmp.resptime > 1
  ex. http.time > 1 or dns.time > 0.5
  ex. tcp.analysis.initial_rtt > 0.03
  ex. frame.time_delta_displayed > 1
- Please refer to dfilter7



Examples (dfilter7)

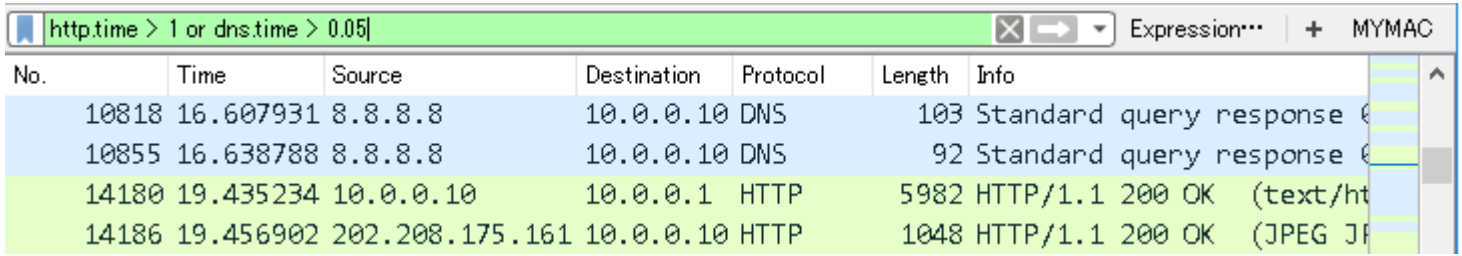
"Any frame that Ping responds in more than 1 second" icmp.resptime > 1

"Any frame that HTTP responds in more than 1 second" http.time > 1

"Any frame that DNS responds in less than 0.5 second" dns.time < 0.5

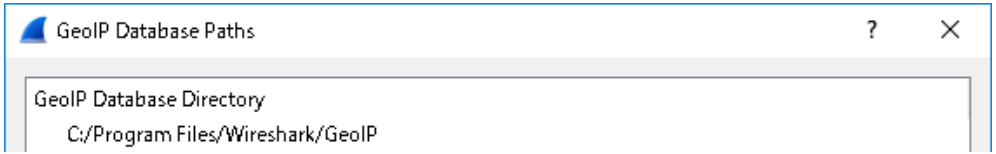
"Any frame that TCP initial Round Trip Time is more than 0.03 seconds" tcp.analysis.initial_rtt > 0.03

"Any frame that the time duration from previous displayed packet is more than 1 second" frame.time_delta_displayed > 1



#6 use GeoIP

- Set GeoIP database directories in Name Resolution of Preferences > Name Resolution

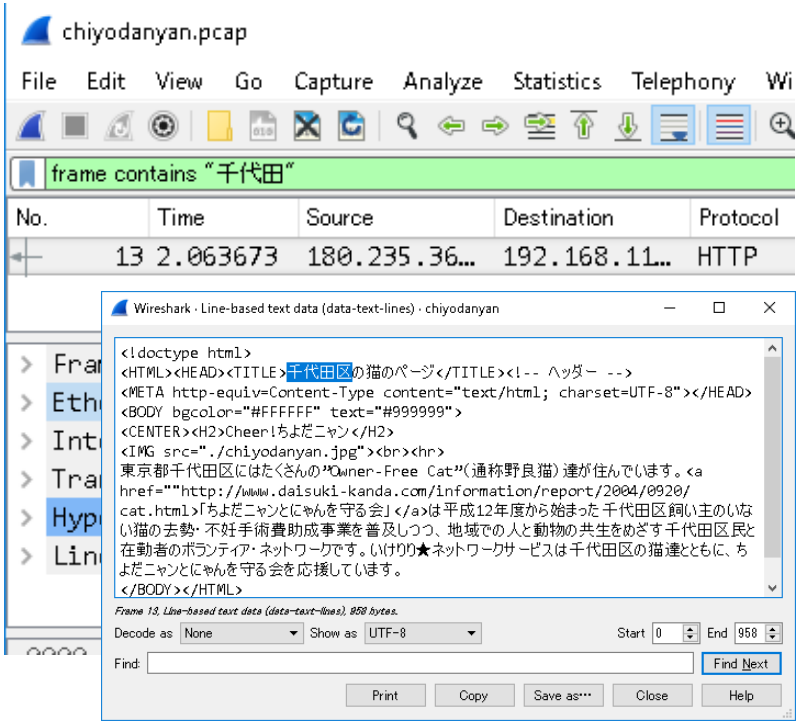


- Try to capture packets of Japanese website
- Try to filter packets using ip.geoip.country contains Japan or ipv6.geoip.country contains Japan

At last use multibytes

chiyodanyan.pcap

- open chiyodanyan.pcapng
- Try to use (if you have a multibytes character environment) frame contains "千代田"
- Wireshark can use UTF-8 characters including our CJK multibytes !



Q&A

Appendix Manpage and reference
Capture Filter https://www.tcpdump.org/manpages/pcap-filter.7.html
Display Filter https://www.wireshark.org/docs/man-pages/wireshark-filter.html
Display Filter references https://www.wireshark.org/docs/dfref/

USE Wireshark

Thank you very much !!

ワイヤーシャークを使おう！
どうもありがとうございました！