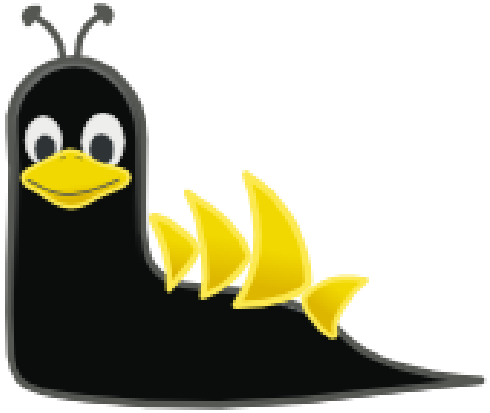
Welcome to Sydney Linux User Group

https://slug.org.au/

Download the Presentation PDF here:
http://www.networkdetective.com.au/PDFs/SLUG-Meetup-Wireshark-2023-07-28.pdf



Wireshark – Basic Introduction

SLUG Meetup

Phil Storey

28 July 2023

Agenda

The aim is to give you a quick run through of Wireshark and some features – so that you can get started on your own.

- What are Packets
- What is Wireshark and a little history
- Why would you use Wireshark
- Capturing, displaying and filtering
- Live ~~capture~~ and analysis

As usual → Interrupt and ask questions along the way

What are Packets?

- A network packet is a formatted unit of data carried by a packet-switched network.
- A packet consists of control information and user data, which is also known as the payload.
- Control information provides data for delivering the payload, for example: source and destination network addresses, error detection codes, and sequencing information.
- Typically, control information is found in packet headers and trailers.
- In packet switching, the bandwidth of the communication medium is shared between multiple communication sessions.

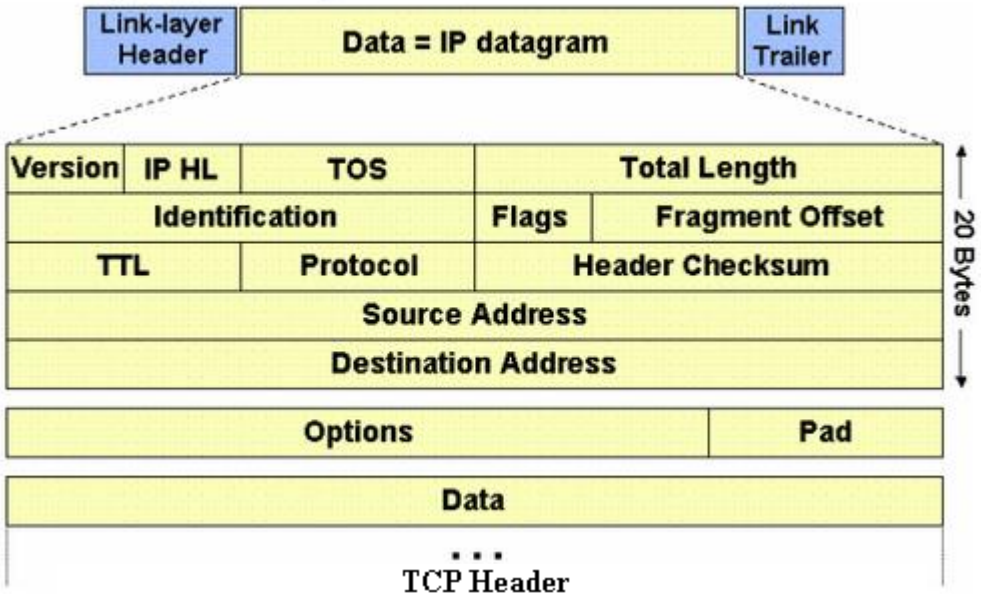
https://en.wikipedia.org/wiki/Network_packet

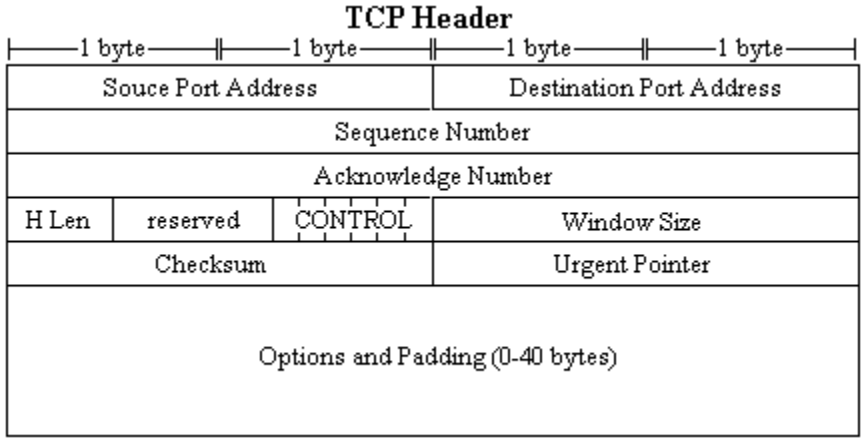
https://pressbooks.howardcc.edu/cmsy164/chapter/packet-analysis-ip-headers-tools-and-notes/
https://www.ardenstone.com/projects/seniorsem/reports/TCP_Protocol.html

Ethernet frame maximum size is 1500 bytes.

IP header is 20 bytes, leaving 1480 bytes for the IP data payload.

TCP header is 20-40 bytes, leaving 1440-1460 bytes for the TCP data payload.





Wireshark History

- Invented by Gerald Combs in 1998 and called “Ethereal”.
- Re-named “Wireshark” as the “Ethereal” name trademarked by someone else.
- Enormous community support and patches.
- Widely accepted as the de facto network protocol analyser available today.
- An open source software project, released under the GNU General Public License (GPL).
- Was sponsored by Riverbed but now stands alone as a non-profit.
- Website lists over 600 contributing authors.
- Annual “SharkFest” conferences in USA and Europe (sometimes Asia).

https://en.wikipedia.org/wiki/Wireshark

Wireshark Official Website

- Note the ".org"
- The "Download" page offers various executables as well as the source code.
- There is lots of online help available.
- The "SharkFest" links contain an enormous volume of videos and presentation papers from many Wireshark experts.

https://www.wireshark.org/

Wireshark Official Website - Download

- Various installation options for Windows and Mac.
- The deeper “downloads” page offers information about versions for several Linux variants (from the websites of the various distributions).

https://www.wireshark.org

Wireshark Official Website - Download

https://www.wireshark.org/docs/wsug_html_chunked/ChBuildInstallUnixInstallBins.html#_installing_from_rpms_under_red_hat_and_alike

2.6.2. Installing from debs under Debian, Ubuntu and other Debian derivatives

If you can just install from the repository then use

apt install wireshark

Apt should take care of all of the dependency issues for you.

[Note] Capturing requires privileges

By installing Wireshark packages non-root, users won't gain rights automatically to capture packets. To allow non-root users to capture packets follow the procedure described in https://gitlab.com/wireshark/wireshark/-/blob/master/packaging/debian/README.Debian (/usr/share/doc/wireshark-common/README.Debian.gz)

https://www.wireshark.org/download.html

Third-Party Packages

Wireshark packages are available for most platforms, including the ones listed below.

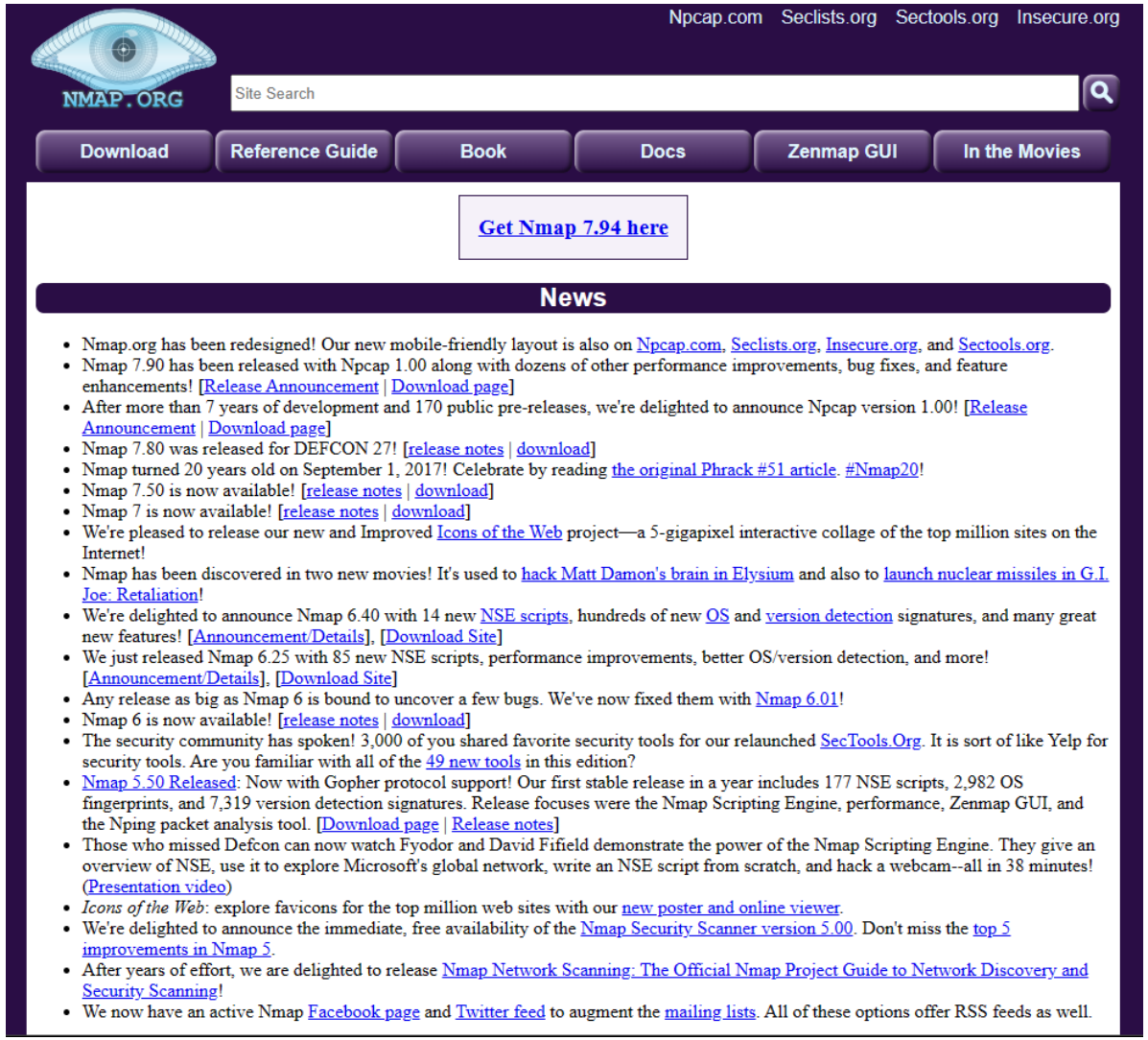
Standard package: Wireshark is available via the default packaging system on that platform.

Vendor / Platform	Sources
Alpine / Alpine Linux	Standard package
Apple / macOS	Homebrew cask (includes UI) Homebrew formula (CLI only)MacPortsFink
Arch Linux / Arch Linux	Standard package
Canonical / Ubuntu	Standard packageLatest stable PPA
Debian / Debian GNU/Linux	Standard package
The FreeBSD Project / FreeBSD	Standard package
Gentoo Foundation / Gentoo Linux	Standard package
HP / HP-UX	Porting And Archive Centre for HP-UX
NetBSD Foundation / NetBSD	Standard package
NixOS / NixOS	Standard package
openSUSE / openSUSE	Standard package
Offensive Security / Kali Linux	Standard package
OpenPKG / OpenPKG Project	Standard package
PC-BSD Software · iXsystems / PC-BSD	Push Button Installer
PCLinuxOS / PCLinuxOS	Standard package
Red Hat / Fedora	Standard package
Red Hat / Red Hat Enterprise Linux	Standard package
Slackware Linux / Slackware	SlackBuilds.org
Oracle / Solaris 11	Standard packageCSWUNIX Packages
* / *	The Written Word

Nmap Official Website

- Wireshark used to use a driver called, “WinPCAP”, to perform the packet capture within Windows.
- This has been superseded by a more modern and still actively updated driver, “Nmap”.
- You shouldn’t need to get the Nmap driver yourself – it is included with the Wireshark installer. You should be aware though, just in case.
- There is also an optional USBcap driver.

https://nmap.org/



Npcap.com Seclists.org Sectools.org Insecure.org

NMAP.ORG

Site Search

Download | Reference Guide | Book | Docs | Zenmap GUI | In the Movies

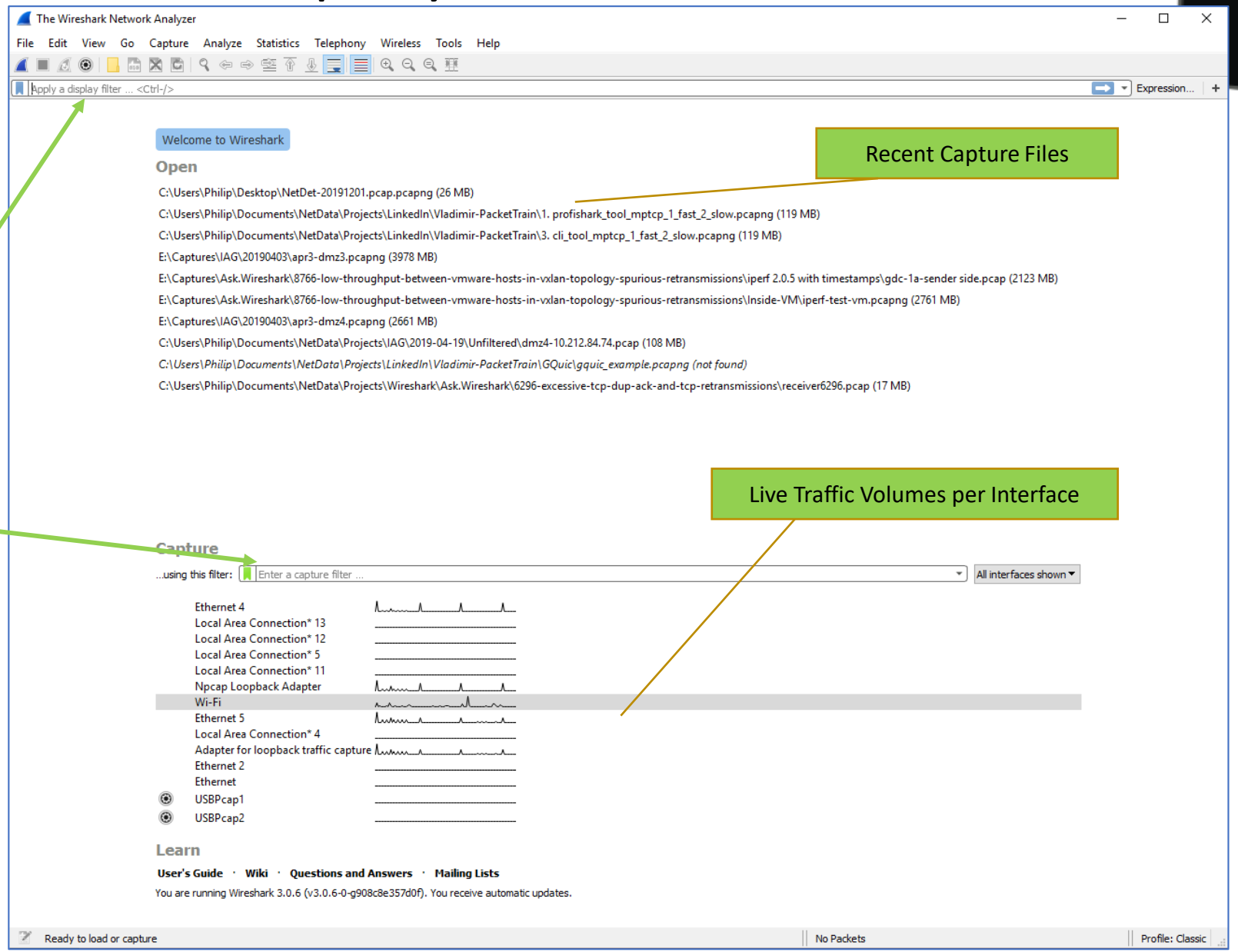
Get Nmap 7.94 here

News

- Nmap.org has been redesigned! Our new mobile-friendly layout is also on Npcap.com, Seclists.org, Insecure.org, and Sectools.org.
- Nmap 7.90 has been released with Npcap 1.00 along with dozens of other performance improvements, bug fixes, and feature enhancements! [Release Announcement | Download page]
- After more than 7 years of development and 170 public pre-releases, we're delighted to announce Npcap version 1.00! [Release Announcement | Download page]
- Nmap 7.80 was released for DEFCON 27! [release notes | download]
- Nmap turned 20 years old on September 1, 2017! Celebrate by reading the original Phrack #51 article. #Nmap20!
- Nmap 7.50 is now available! [release notes | download]
- Nmap 7 is now available! [release notes | download]
- We're pleased to release our new and Improved Icons of the Web project—a 5-gigapixel interactive collage of the top million sites on the Internet!
- Nmap has been discovered in two new movies! It's used to hack Matt Damon's brain in Elysium and also to launch nuclear missiles in G.I. Joe: Retaliation!
- We're delighted to announce Nmap 6.40 with 14 new NSE scripts, hundreds of new OS and version detection signatures, and many great new features! [Announcement/Details], [Download Site]
- We just released Nmap 6.25 with 85 new NSE scripts, performance improvements, better OS/version detection, and more! [Announcement/Details], [Download Site]
- Any release as big as Nmap 6 is bound to uncover a few bugs. We've now fixed them with Nmap 6.01!
- Nmap 6 is now available! [release notes | download]
- The security community has spoken! 3,000 of you shared favorite security tools for our relaunched SecTools.Org. It is sort of like Yelp for security tools. Are you familiar with all of the 49 new tools in this edition?
- Nmap 5.50 Released: Now with Gopher protocol support! Our first stable release in a year includes 177 NSE scripts, 2,982 OS fingerprints, and 7,319 version detection signatures. Release focuses were the Nmap Scripting Engine, performance, Zenmap GUI, and the Nping packet analysis tool. [Download page | Release notes]
- Those who missed Defcon can now watch Fyodor and David Fifield demonstrate the power of the Nmap Scripting Engine. They give an overview of NSE, use it to explore Microsoft's global network, write an NSE script from scratch, and hack a webcam--all in 38 minutes! (Presentation video)
- *Icons of the Web*: explore favicons for the top million web sites with our new poster and online viewer.
- We're delighted to announce the immediate, free availability of the Nmap Security Scanner version 5.00. Don't miss the top 5 improvements in Nmap 5.
- After years of effort, we are delighted to release Nmap Network Scanning: The Official Nmap Project Guide to Network Discovery and Security Scanning!
- We now have an active Nmap Facebook page and Twitter feed to augment the mailing lists. All of these options offer RSS feeds as well.

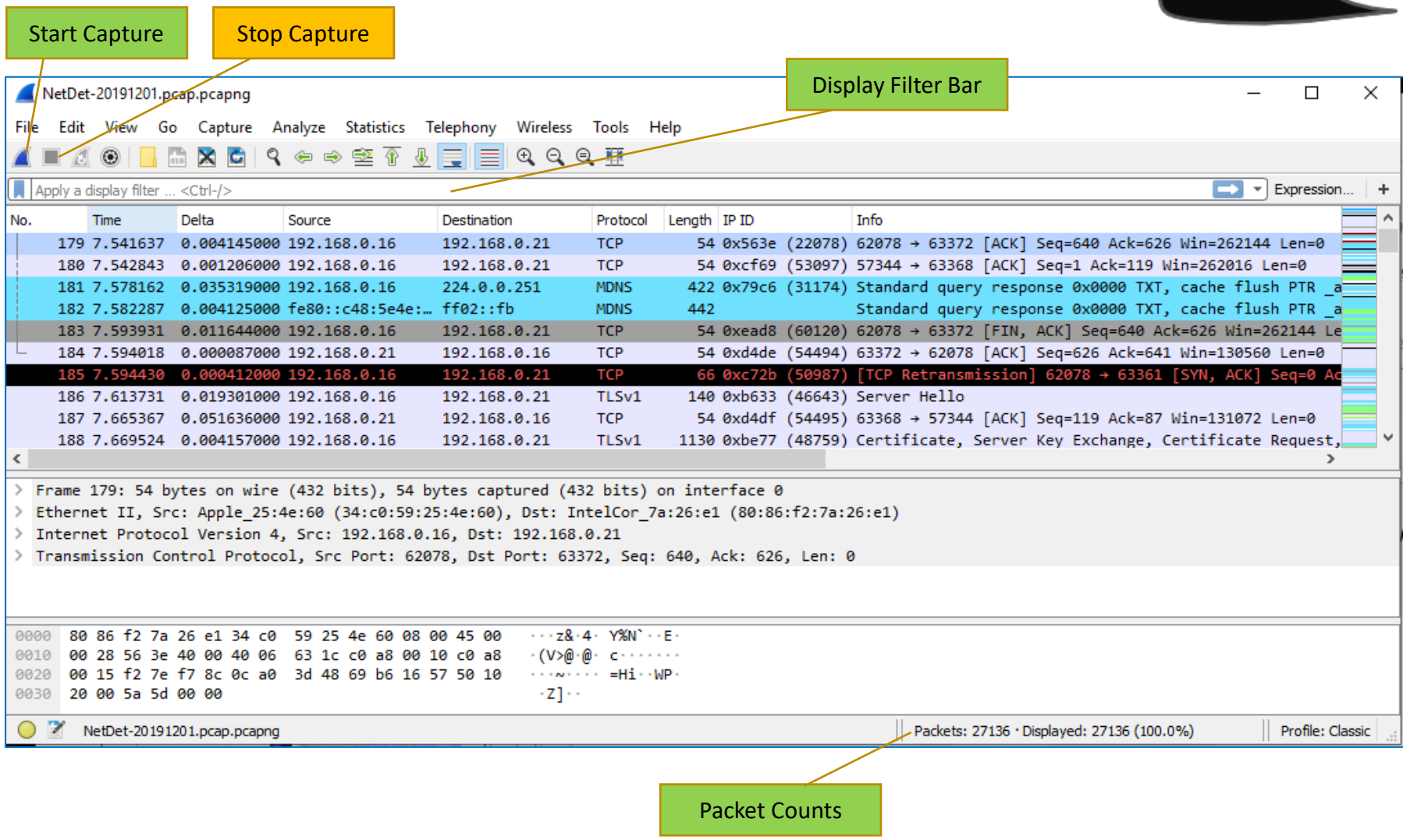
Wireshark Initial Display

- Recent trace files
  - Double-click to re-open
- List of interfaces
  - Live indication of traffic on each interface
  - Double-click to start capturing on just that interface
- Display Filter Bar
- Capture Filter field



Wireshark Display

- Menu options
  - File
  - Edit
  - Capture
  - Analyze
- Buttons
  - Start
  - Stop
- Display Filter Bar
- Panes
  - Packet List
  - Packet Details
  - Packet Bytes
- Colours

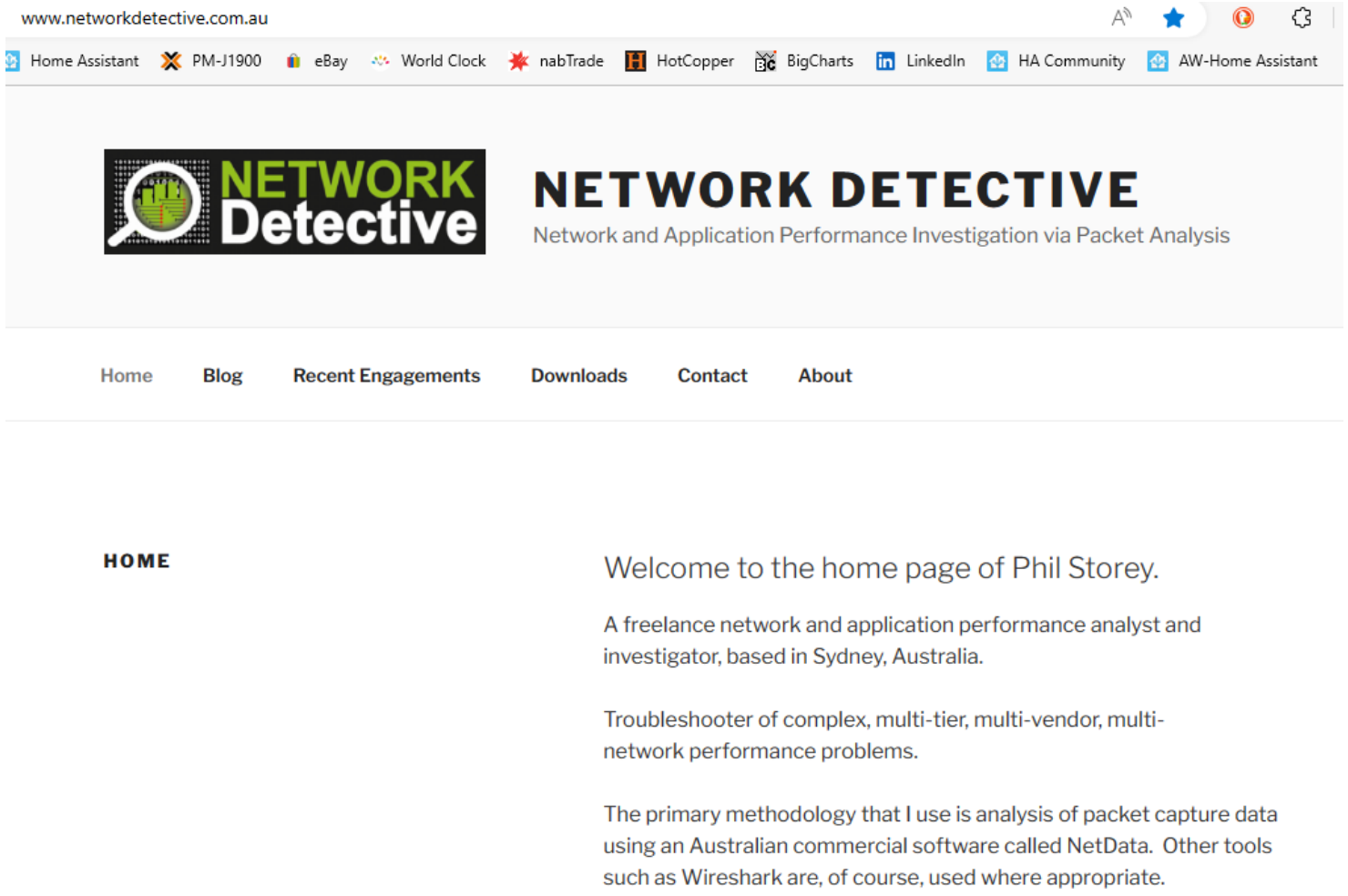


Wireshark Capture at Home

- I ran Wireshark for 55 seconds.
- In that time, I went to Wireshark, Nmap and my own website (www.networkdetective.com.au).
- There were 2,724 packets captured in that short time.
- We'll see that there was traffic to/from my laptop to/from lots of places.

Using My Own Website (Not HTTPS)

- I went to various websites, but most these days use HTTPS (encrypted)
- In order for us to see the same data in the PCAP, I used my own HTTP (non-encrypted) website.
- This is the home page.



Local PCAP

- This is the “Recent Engagements” page.
- Can we find this data in the PCAP?

Note: The URL is:

http://www.networkdetective.com.au/fast-results/

www.networkdetective.com.au/fast-results/

Home Assistant | PM-J1900 | eBay | World Clock | nabTrade | HotCopper | BigCharts | LinkedIn | HA Community | AW-Home Assistan

NETWORK Detective

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Network and Application Performance Investigation via Packet Analysis

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RECENT ENGAGEMENTS

Examples of recent, very successful troubleshooting engagements that produced fast results :

Duration	Client	Situation and Outcome
5 days	Airline	New automated bag-drop units (ABDs) were spending 7 seconds (and often much longer) keeping the bag stationary for unexplained reasons. There were three vendors involved, each with their own software running inside the ABD. Initial packet captures taken at the local switch provided data for a single ABD and showed three distinct phases during the time in question. Some “log” traffic generated by one of the vendors was used to identify these phases. The middle phase (of 3.5 seconds but often longer) was easily identified as a single HTTP POST to an application server located in an airline data centre.

Wireshark Display Filters

- Use these to “drill-down” into the capture.
- Syntax is different to “Capture Filters”.
- Capture filters are used to filter out packets during the capture phase (so that the “pcap” files are smaller).

https://wiki.wireshark.org/DisplayFilters/

https://wiki.wireshark.org/DisplayFilters

Google AU | Home Assistant | PM-J1900 | eBay | World Clock | nabTrade | HotCopper | BigCharts | LinkedIn | HA Community

Display filter is not a capture filter

Capture filters (like `tcp port 80`) are not to be confused with display filters (like `tcp.port == 80`).
See also CaptureFilters: Capture filter is not a display filter.

Examples

Show only SMTP (port 25) and ICMP traffic:

```
tcp.port eq 25 or icmp
```

Show only traffic in the LAN (192.168.x.x), between workstations and servers – no Internet:

```
ip.src==192.168.0.0/16 and ip.dst==192.168.0.0/16
```

TCP buffer full – *Source is instructing Destination to stop sending data*

```
tcp.window_size == 0 && tcp.flags.reset != 1
```

Filter on Windows – *Filter out noise, while watching Windows Client - DC exchanges*

```
smb || nbns || dcerpc || nbss || dns
```

14. Filter for http get and responses

```
http.request or http.response
```

17. Search traffic based on a keyword

```
tcp contains facebook
```

This displays all TCP packets that contain the word facebook. Just replace the word with want you want to search for. The only problem with this filter is it's limited to TCP packets only. To include all protocols use this filter

```
frame contains facebook
```

DNS: Statistics – Resolved Addresses

Note the various tabs and the dropdown.

- Highlighted my own website.
- Notice that my website domain name resolves to 203.170.86.34.
- Also notice all the other websites/IP addresses that were active in this 55 seconds.
- There are many more in this list.

Wireshark · Resolved Addresses

Hosts | Ports | Capture File Comments

Search for entry (min 3 characters) | Hosts

Address	Name
142.250.76.106	jnn-pa.googleapis.com
142.250.66.202	jnn-pa.googleapis.com
142.250.71.74	jnn-pa.googleapis.com
203.170.86.34	networkdetective.com.au
45.33.49.119	nmap.org
142.250.76.110	play.google.com
18.67.111.52	sb.scorecardresearch.com
18.67.111.113	sb.scorecardresearch.com
18.67.111.28	sb.scorecardresearch.com
18.67.111.98	sb.scorecardresearch.com
4.199.0.29	wd-prod-ss-au-southeast-1-fe.australiasoutheast.cloudapp.azure.
172.67.75.39	www.wireshark.org
104.26.10.240	www.wireshark.org
104.26.11.240	www.wireshark.org
142.250.204.14	youtube-ui.l.google.com
142.251.221.78	youtube-ui.l.google.com

Close

Name Resolution

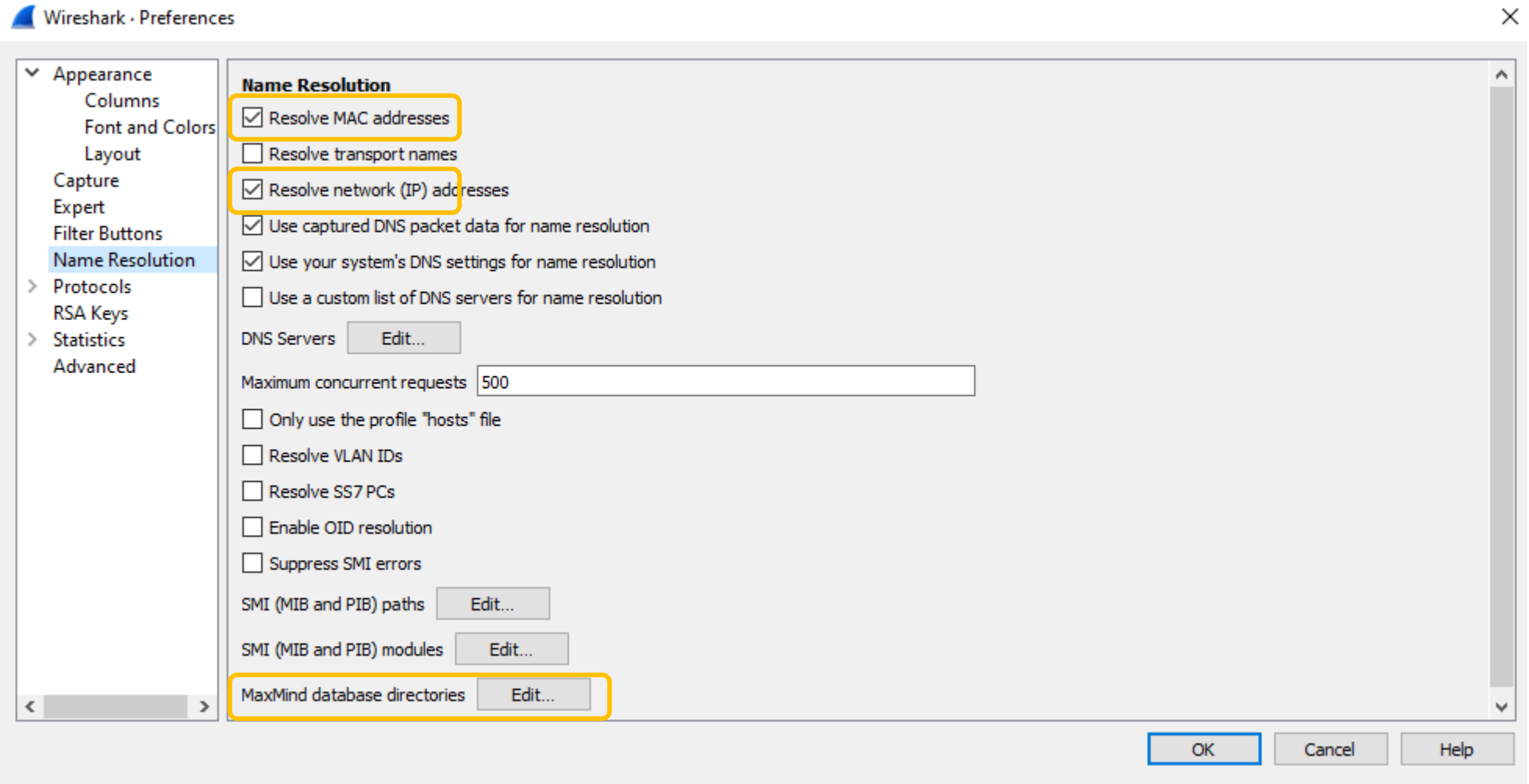
Edit

- Preferences
  - Name Resolution

You can choose whether to display names in the various parts of Wireshark's displays.

Note difference between

- MAC (Ethernet)
- IP (TCP/IP)
- Maxmind GEO Data



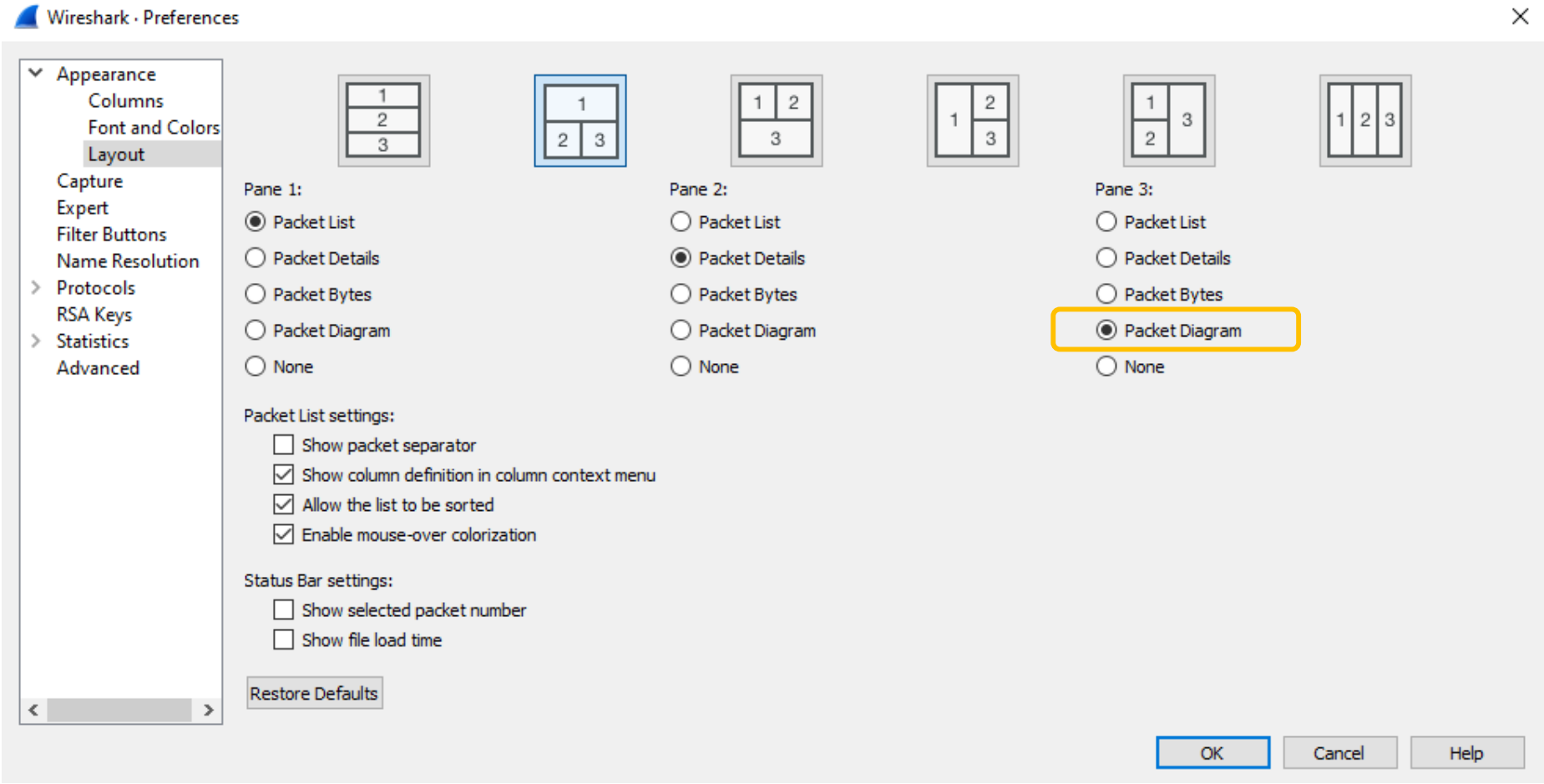
Wireshark Layout, Packet Diagram Form

Edit

- Preferences
  - Layout

You can choose how you want Wireshark's main display to be laid out.

"Packet Diagram" is interesting.



Statistics - Conversations

Note the various tabs

- Click on Headings to sort (here is sorted by "Packets")
- "IPv4" is likely to be the most interesting for now
- UDP is taking over these days – due to Google's QUIC protocol
- Notice that my website (203.170.86.34) was only the 8th largest in size of transfer.

Wireshark · Conversations · SLUG-Prep.pcapng

Ethernet · 46 | IPv4 · 69 | IPv6 · 7 | TCP · 49 | UDP · 119

Address A	Address B	Packets	Bytes	Packets A → B	Bytes A → B	Packets B → A	Bytes B → A	Rel Start	Duration	Bits/s A → B	Bits/s B → A
192.168.0.21	172.217.167.110	396	282 k	183	103 k	213	178 k	11.906573	5.1364	161 k	278 k
192.168.0.21	142.250.66.202	256	194 k	85	15 k	171	178 k	13.296507	0.8572	146 k	1663 k
192.168.0.21	23.62.8.82	202	141 k	68	11 k	134	129 k	31.334462	20.5534	4665	50 k
192.168.0.21	20.42.65.85	181	97 k	88	85 k	93	12 k	31.314225	3.8685	175 k	24 k
192.168.0.21	204.79.197.203	161	132 k	47	10 k	114	121 k	47.345361	3.3347	25 k	292 k
192.168.0.21	4.199.0.29	128	77 k	62	21 k	66	55 k	12.110531	30.3917	5619	14 k
192.168.0.21	192.168.0.1	114	14 k	57	4356	57	9761	9.434827	39.0635	892	1998
192.168.0.21	203.170.86.34	102	92 k	32	3295	70	89 k	18.771211	28.5760	922	25 k
192.168.0.21	104.26.11.240	83	36 k	45	17 k	38	19 k	9.457932	4.8041	28 k	32 k
192.168.0.21	142.250.76.110	80	27 k	40	15 k	40	12 k	43.900285	1.1986	100 k	84 k
192.168.0.1	192.168.0.255	53	6095	53	6095	0	0	0.315339	54.0571	902	0
192.168.0.21	204.79.197.200	49	24 k	21	4688	28	19 k	31.366464	0.4836	77 k	322 k
192.168.0.21	45.33.49.119	47	25 k	18	2880	29	22 k	8.590365	13.7826	1671	13 k
192.168.0.21	192.168.0.215	44	4862	22	2398	22	2464	2.127907	50.1392	382	393
192.168.0.21	23.62.8.96	44	24 k	21	21 k	23	2835	48.498733	0.2283	758 k	99 k
192.168.0.245	255.255.255.255	42	2673	42	2673	0	0	0.304167	54.5840	391	0
192.168.0.21	192.168.0.203	36	4721	24	2668	12	2053	2.003992	52.5684	406	312
192.168.0.21	23.206.198.27	34	4478	16	2238	18	2240	31.363190	11.0198	1624	1626
192.168.0.21	20.43.111.112	33	7354	14	1974	19	5380	24.916718	28.7830	548	1495
192.168.0.21	204.79.197.219	33	15 k	13	2076	20	13 k	31.367304	0.0748	222 k	1483 k
192.168.0.21	13.107.21.200	29	14 k	14	4847	15	9447	31.845770	0.2495	155 k	302 k
192.168.0.21	142.250.76.118	27	11 k	13	4086	14	7536	13.301484	0.1288	253 k	467 k
192.168.0.21	20.205.115.81	27	11 k	14	3663	13	8239	31.333385	0.9246	31 k	71 k
192.168.0.21	172.217.167.78	26	14 k	12	4694	14	9564	15.982817	0.3003	125 k	254 k
192.168.0.202	192.168.0.21	24	8112	24	8112	0	0	34.108191	7.2784	8916	0
184.105.129.23	192.168.0.21	20	1220	9	576	11	644	0.000523	54.1662	85	95
192.168.0.21	18.67.111.52	17	3077	9	1823	8	1254	31.334076	0.2454	59 k	40 k
192.168.0.21	255.255.255.255	14	3430	14	3430	0	0	0.760521	30.1461	910	0
192.168.0.24	255.255.255.255	11	2354	11	2354	0	0	1.032155	50.0637	376	0
192.168.0.63	255.255.255.255	11	2354	11	2354	0	0	1.225693	49.9730	376	0
192.168.0.151	255.255.255.255	11	2354	11	2354	0	0	1.955839	50.0594	376	0
192.168.0.208	255.255.255.255	11	2530	11	2530	0	0	4.305626	49.9659	405	0
192.168.0.209	255.255.255.255	11	2530	11	2530	0	0	1.635451	49.9949	404	0
192.168.0.218	255.255.255.255	11	2530	11	2530	0	0	3.888264	49.9703	405	0

Name resolution | Limit to display filter | Absolute start time | Conversation Types

Copy | Follow Stream... | Graph... | Close | Help

Statistics - Endpoints

- Click on Headings to sort (here is sorted by “Packets”)
- “IPv4” is likely to be the most interesting for now, but UDP (QUIC) is picking up.
- The Geolocation information is a new feature. It needs an external set of data files that can be downloaded for free.
- See YouTube video: https://www.youtube.com/watch?v=6p20HQNf-Bw

Wireshark · Endpoints · SLUG-Prep.pcapng

Ethernet · 36 | IPv4 · 64 | IPv6 · 9 | TCP · 78 | UDP · 136

Address	Packets	Bytes	Tx Packets	Tx Bytes	Rx Packets	Rx Bytes	Country	City	AS Number	AS Organization
192.168.0.21	2,277	1289 k	980	361 k	1,297	928 k	—	—	—	—
172.217.167.110	396	282 k	213	178 k	183	103 k	United States	—	15169	GOOGLE
142.250.66.202	256	194 k	171	178 k	85	15 k	United States	—	15169	GOOGLE
23.62.8.82	202	141 k	134	129 k	68	11 k	Australia	Sydney	20940	Akamai International B.V.
255.255.255.255	185	34 k	0	0	185	34 k	—	—	—	—
20.42.65.85	181	97 k	93	12 k	88	85 k	United States	Tappahannock	8075	MICROSOFT-CORP-MSN-AS-BLOCK
192.168.0.1	173	22 k	116	18 k	57	4356	—	—	—	—
204.79.197.203	161	132 k	114	121 k	47	10 k	United States	—	8068	MICROSOFT-CORP-MSN-AS-BLOCK
4.199.0.29	128	77 k	66	55 k	62	21 k	Australia	Melbourne	8075	MICROSOFT-CORP-MSN-AS-BLOCK
203.170.86.34	102	92 k	70	89 k	32	3295	Australia	—	38719	Dreamscape Networks Limited
104.26.11.240	83	36 k	38	19 k	45	17 k	—	—	13335	CLOUDFLARENET
142.250.76.110	80	27 k	40	12 k	40	15 k	United States	—	15169	GOOGLE
192.168.0.255	55	6585	0	0	55	6585	—	—	—	—
192.168.0.215	49	5908	27	3510	22	2398	—	—	—	—
204.79.197.200	49	24 k	28	19 k	21	4688	United States	—	8068	MICROSOFT-CORP-MSN-AS-BLOCK
45.33.49.119	47	25 k	29	22 k	18	2880	United States	Fremont	63949	Akamai Connected Cloud
23.62.8.96	44	24 k	23	2835	21	21 k	Australia	Sydney	20940	Akamai International B.V.
192.168.0.203	44	6186	20	3518	24	2668	—	—	—	—
192.168.0.245	42	2673	42	2673	0	0	—	—	—	—
23.206.198.27	34	4478	18	2240	16	2238	Australia	Sydney	20940	Akamai International B.V.
20.43.111.112	33	7354	19	5380	14	1974	Australia	Sydney	8075	MICROSOFT-CORP-MSN-AS-BLOCK
204.79.197.219	33	15 k	20	13 k	13	2076	United States	—	8068	MICROSOFT-CORP-MSN-AS-BLOCK
192.168.0.202	30	10 k	30	10 k	0	0	—	—	—	—
13.107.21.200	29	14 k	15	9447	14	4847	United States	—	8068	MICROSOFT-CORP-MSN-AS-BLOCK
20.205.115.81	27	11 k	13	8239	14	3663	Hong Kong	Hong Kong	8075	MICROSOFT-CORP-MSN-AS-BLOCK
142.250.76.118	27	11 k	14	7536	13	4086	United States	—	15169	GOOGLE
172.217.167.78	26	14 k	14	9564	12	4694	United States	—	15169	GOOGLE
224.0.0.251	24	5653	0	0	24	5653	—	—	—	—

Interesting

Name resolution | Limit to display filter | Endpoint Types

Copy | Map | Close | Help

Statistics – Endpoints: Map

- The map is zoomable and hovering the cursor pops-up the underlying IP address and other info.

Wireshark Can be Useful

- This shows a connect message with LWT specified
- If you have problems with any kind of network connection try Wireshark to capture the traffic

Wireshark identifies it as MQTT

TCP/1883

```
> Transmission Control Protocol, Src Port: 48076 (48076), Dst Port: 1883 (1883), Seq: 1, Ack: 1, Len: 102
v MQ Telemetry Transport Protocol
  v Connect Command
    > 0001 0000 = Header Flags: 0x10 (Connect Command)
      Msg Len: 100
      Protocol Name: MQTT
      Version: 4
    v 1100 0100 = Connect Flags: 0xc4
        1... .... = User Name Flag: Set
        .1.. .... = Password Flag: Set
        ..0. .... = Will Retain: Not set
        ...0 0... = QOS Level: Fire and Forget (0)
        .... .1.. = Will Flag: Set
        .... ..0. = Clean Session Flag: Not set
        .... ...0 = (Reserved): Not set
      Keep Alive: 60
      Client ID: WALKER01
      Will Topic: MIAW/LWT
      Will Message: WALKER01 has gone offline.  Read the will now.
      User Name: pyUser
      Password: pyPass8:07AM
```

Retain is not set

QoS level 0

LWT specified

The message to publish

More Information

- This is a very popular software tool so there are hundreds of sources for tips, “how to” videos, etc.

  - SharkFest “Retrospectives” https://sharkfestus.wireshark.org/retrospective
  - Tony Fortunato https://www.youtube.com/channel/UCGzLX2yif2uqobtoVTLbHhQ
  - Jasper Bongertz https://www.youtube.com/channel/UCZd-4IZtcbE1zM-CnOxd31A
  - Chris Greer https://www.youtube.com/user/packetpioneer
  - Betty DuBois https://www.youtube.com/channel/UCy4XzAs0O6UpDfGOHiPshrg
  - Kary Rogers https://www.youtube.com/@PacketBomb
  - Laura Chappell https://www.chappell-university.com/

  - Me at a previous Sydney Linux User Group Meetup (very long!!)
    https://www.youtube.com/watch?v=ZZfTbZ78YVw

The Demonstration

- Launch Wireshark
- Capture some WiFi packets
- Visit www.networkdetective.com.au (non-SSL site)
- Look at the layout and packets
- Look at a few “Analyze” outputs

Phil Storey

Phil@NetworkDetective.com.au

www.NetworkDetective.com.au

au.linkedin.com/in/philipstorey3

@PhilStorey24

www.youtube.com/c/NetworkDetective

ask.wireshark.org: @philst

NetData

An Australian packet analysis tool, focussed on providing data graphically.

Use Wireshark to do the packet capture, then NetData to do the analysis.

The author of NetData, Bob Brownell, regularly updates the software.

A free “NetDataLite” version can always be downloaded here:

https://www.dropbox.com/sh/s572ctzcd70mb28/AADfk5TQex4RrC4ipttb8XgQa?dl=0

Here’s a Kary Rogers (PacketBomb) video where I discuss NetData:

https://www.youtube.com/watch?v=Tkx18Ec8Vy0&t

*Note that NetData (and Lite) is a Windows only application.

Example NetData Charts (from Same PCAP)