CN-Basic
L13

Networking tools

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Tools - `nc`

- `nc` (netcat)
  - Works as both layer client & server
  - Supports both TCP and UDP
  - Supports both IPv4 and IPv6
  - Common use
    - Simple TCP/UDP based data transfer
    - Shell script based HTTP clients and servers
    - Network daemon testing
    - SOCKS or HTTP ProxyCommand for `ssh`

Tools - nc

- `nc` usage
  - `-l` acting as server
  - `-u` use UDP
  - `-i` for interval based transmission (lines)
  - `-k` for keeping server up after connection close
- Examples
  - `nc` <servername> <server port> # client
  - `nc -l` port # server (add `-p` on windows)
  - To transfer files
    - Server: `nc -l` <port> >file.dat
    - Client: `cat` <file> | `nc` <servername> <port>

Usage: nc

- Terminating connection after idle time

  `nc -w 10` <server> <port> # timeout 10s

  - Don't use with server option
- Accessing a web server
  - ??

Tools - wget

- wget: `wget` [options] <url>
  - Options
  - `-d` # to debug headers
  - `-O` <file> # to save with different name
  - `-i` <urlsfile> # list of urls in a file
  - `-c` # to resume to broken download
  - `-b` # run in background
  - `--limit-rate=`500k
  - `--header=`<headers>
  - `--http-user=`user `--http-password=`..
  - `-mk` # mirroring with local link conversion
  - …

Tools - curl

Tools - ping

- `ping` (Packet Inter Network Groper)
  - Checking reachability
    - `ping` hostname
  - `-i` changing packet interval
  - `-c` packet count
  - `-f` flooding the network
  - `-q` quite mode
  - `-s` change packet size
  - `-W` response timeout

Usage: ping

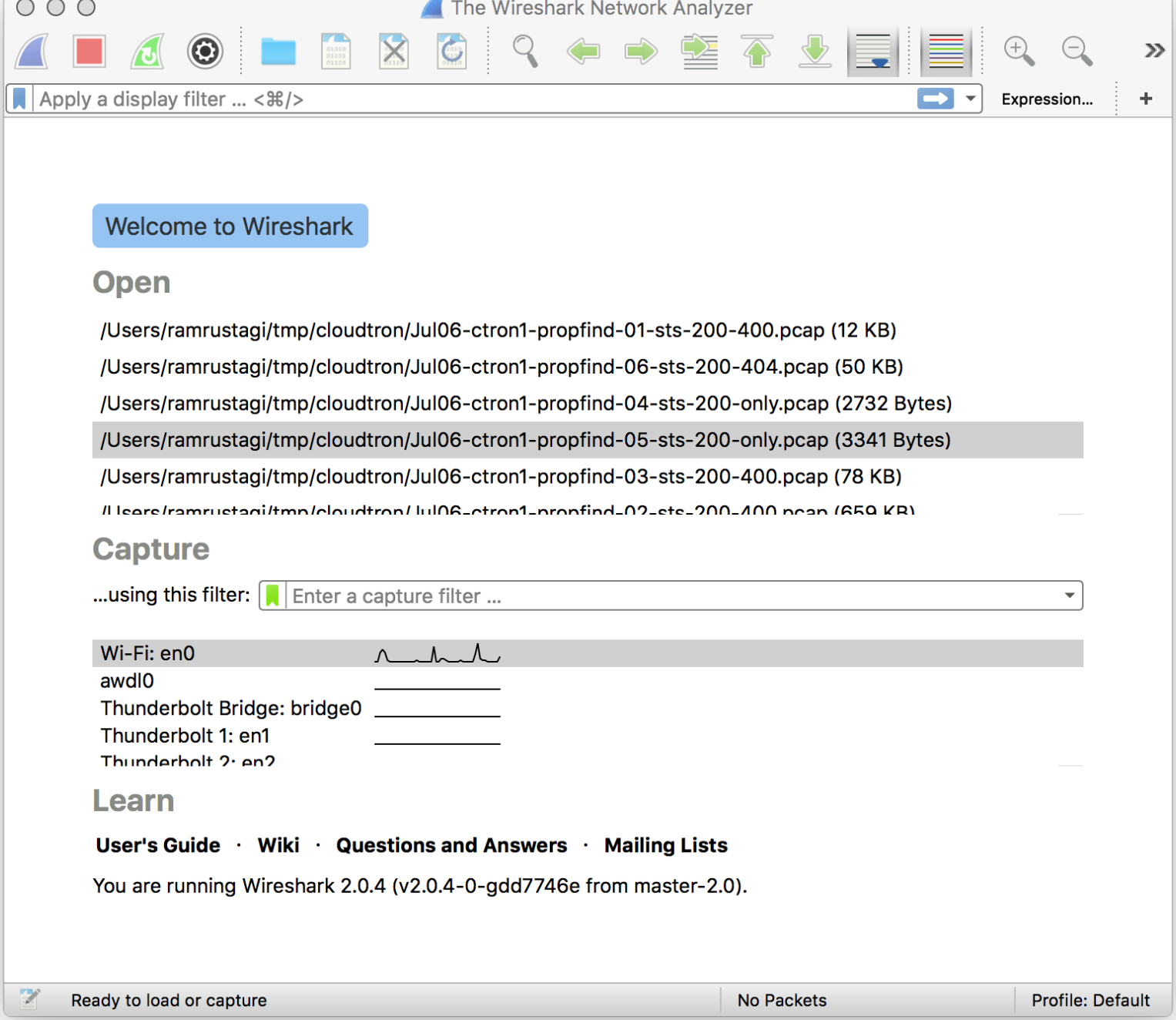
```
$ ping -c 10 www.google.com
PING www.google.com (74.125.203.104): 56 data bytes
64 bytes from 74.125.203.104: icmp_seq=0 ttl=47 time=93.346 ms
64 bytes from 74.125.203.104: icmp_seq=1 ttl=47 time=94.300 ms
64 bytes from 74.125.203.104: icmp_seq=2 ttl=47 time=99.392 ms
64 bytes from 74.125.203.104: icmp_seq=3 ttl=47 time=140.457 ms
64 bytes from 74.125.203.104: icmp_seq=4 ttl=47 time=168.882 ms
64 bytes from 74.125.203.104: icmp_seq=5 ttl=47 time=218.813 ms
64 bytes from 74.125.203.104: icmp_seq=6 ttl=47 time=270.833 ms
64 bytes from 74.125.203.104: icmp_seq=7 ttl=47 time=312.594 ms
64 bytes from 74.125.203.104: icmp_seq=8 ttl=47 time=263.280 ms
64 bytes from 74.125.203.104: icmp_seq=9 ttl=47 time=309.129 ms

--- www.google.com ping statistics ---
10 packets transmitted, 10 packets received, 0.0% packet loss
round-trip min/avg/max/stddev = 93.346/197.103/312.594/84.298 ms
```

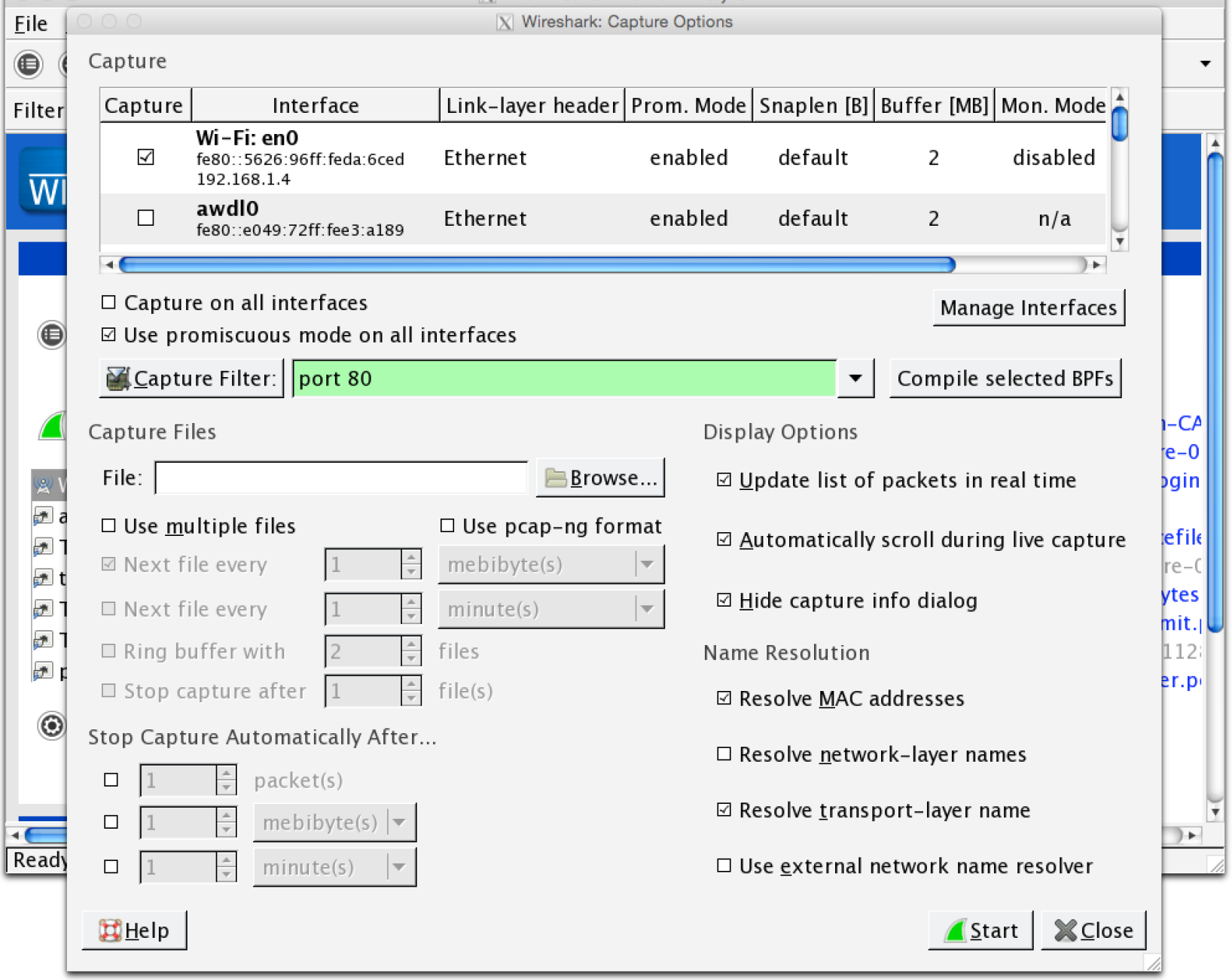
Tools - traceroute

- `traceroute` (Windows: `tracert`)
  - Checking reachability
    - `traceroute` hostname
  - ??

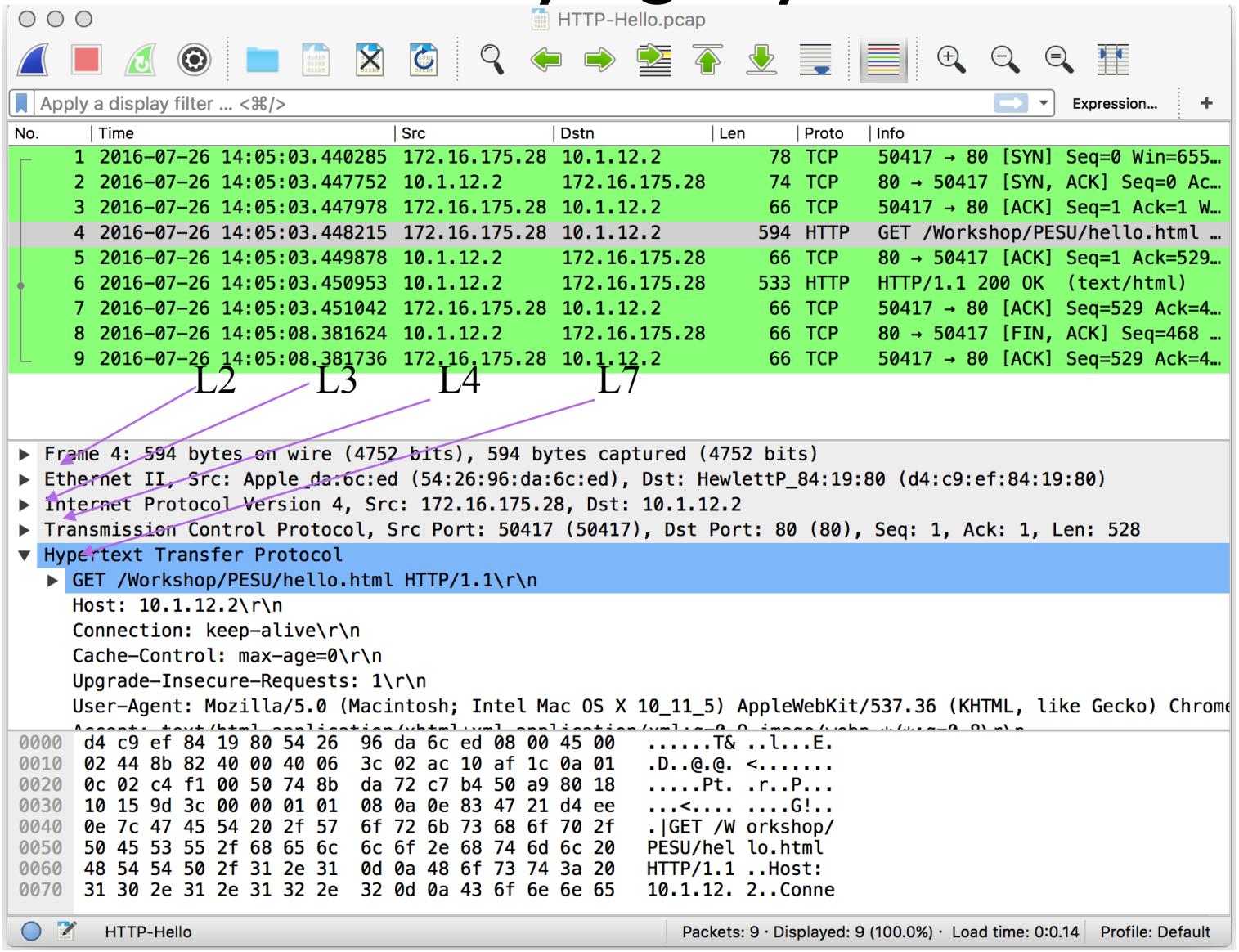
Tools

- `wireshark`
  - `https://www.wireshark.org/docs/wsug_html_chunked/`
  - Enables viewing of bytes sent/recd on network
  - Capture and Display filters
  - Graphical, built on tcpdump
  - TCP session display
  - Changing UI options
- `tcpdump:` command line capture tool
  - `-o` output file
  - `-c` packet count
  - `-i` interface names


The Wireshark Network Analyzer
Apply a display filter ... <⌘/>
Expression...
Welcome to Wireshark
Open
/Users/ramrustagi/tmp/cloudtron/Jul06-ctron1-propfind-01-sts-200-400.pcap (12 KB)
/Users/ramrustagi/tmp/cloudtron/Jul06-ctron1-propfind-06-sts-200-404.pcap (50 KB)
/Users/ramrustagi/tmp/cloudtron/Jul06-ctron1-propfind-04-sts-200-only.pcap (2732 Bytes)
/Users/ramrustagi/tmp/cloudtron/Jul06-ctron1-propfind-05-sts-200-only.pcap (3341 Bytes)
/Users/ramrustagi/tmp/cloudtron/Jul06-ctron1-propfind-03-sts-200-400.pcap (78 KB)
Capture
...using this filter:
Enter a capture filter ...
Wi-Fi: en0
awdl0
Thunderbolt Bridge: bridge0
Thunderbolt 1: en1
Learn
User's Guide · Wiki · Questions and Answers · Mailing Lists
You are running Wireshark 2.0.4 (v2.0.4-0-gdd7746e from master-2.0).
Ready to load or capture
No Packets
Profile: Default


File
Filter
Ready
Wireshark: Capture Options
Capture
Capture
Interface
Link-layer header
Prom. Mode
Snaplen [B]
Buffer [MB]
Mon. Mode
Wi-Fi: en0
fe80::5626:96ff:feda:6ced
192.168.1.4
Ethernet
enabled
default
2
disabled
awdl0
fe80::e049:72ff:fee3:a189
Ethernet
enabled
default
2
n/a
Capture on all interfaces
Use promiscuous mode on all interfaces
Manage Interfaces
Capture Filter:
port 80
Compile selected BPFs
Capture Files
File:
Browse...
Use multiple files
Use pcap-ng format
Next file every
1
mebibyte(s)
Next file every
1
minute(s)
Ring buffer with
2
files
Stop capture after
1
file(s)
Stop Capture Automatically After...
1
packet(s)
1
mebibyte(s)
1
minute(s)
Display Options
Update list of packets in real time
Automatically scroll during live capture
Hide capture info dialog
Name Resolution
Resolve MAC addresses
Resolve network-layer names
Resolve transport-layer name
Use external network name resolver
Help
Start
Close

Identifying Layers



Wireshark: UI Options

- Color coding
- Time format
- Packet reordering (in display)
- Defining protocol
- Using display filter
- Following TCP Stream
- Capture packets with proper capture filter
  - Needed for analyzing packet layers

Wireshark capture filters

- Traffic between A and either B or C

```
host A and \( B or C\)
```

- Traffic between A any host except B

```
host A and not B
```

- Capture web traffic

```
port 80
```

- Capture ICMP traffic (e.g. ping, traceroute)

```
icmp
```

- Capture web traffic

```
port 80
```

- Capture traffic for a subnet

```
net 10.211.55.0/24
```

Wireshark Display Filters

- Source IP filter
  - `ip.src == 10.1.1.1`
- Destination IP filter
  - `ip.dst == 10.1.1.101`
  - `ip.dst != 10.1.1.101`
- Protocol filter
  - `http || icmp`
- Port number
  - `tcp.port eq 80`
- TCP Seq
  - `tcp.stream eq 1`

Wireshark - Misc

- Saving file
  - Saving selected packets
- Reading from file
- Time display format
- Statistics
- Other options

tcpdump

- Command line interface
  - ASCII content
  - Capture full packet
  - Capture filters
  - Output file
  - Ethernet frame display

`tcpdump` - Usage Examples

- To capture between two specified hosts and save

```
$ sudo tcpdump -n -i eth0 -s 0 –w
file.pcap host <A> and host <B>
```

- To capture 100 packets received from host X

```
$ sudo tcpdump -n -i eth0 -c 100
src <X>
```

- To capture first 256 bytes and display in ASII

```
$ sudo tcpdump -n -i eth0 -s 256 -
A
```

- To capture with (link level) ethernet headers

```
$ sudo tcpdump -n -i eth0 -e
```

Use Case 1 : Using nc

- Take two systems in your home/lab and connect to a network. These can be connected by directing connecting them wia a LAN Cable (ethernet). If LAN cable is a issue, Enable mobile hotspot on your phone and connect the labopts to your mobile hotspot.
- If windows machine, install "netcat for windows"
  - (https://joncraton.org/blog/46/netcat-for-windows/)
  - It is available by default on Linux/Mac.
- Identify the IP address of each system.
- Establish a chat session between and exchange few messages.

Use Case 2 : Using ping

- Connect your in your home/lab to internet.
- Check reachability of google.com by sending 10 pkts
  - ping -c10 www.google.com (linux/mac)
  - ping -n 10 (www.google.com) (windows)
- Analyze the response time (min, max, avg and standard deviation).
- Repeat the above with 100 pkts with pkt size of 1000 bytes and analyze the response.
- Repeat the above 200 pkts, break down your internet connectivity for 30 seconds after 50 pkts
  - Analyze the packet loss and response time.

Use Case 3 : Using `traceroute`

- Connect your in your home/lab to internet.
- Traceoute google.com and identify all the routers in the path your home to google
- Analyze the response times of various routers.
  - Do you find any router at n^{th} hop which takes more time than router at $(n+1)^{th}$ hop
- Repeat the above for your other favourite websites.

Use Case 4 : Using wget/curl

- ??

Use Case 5 : Using wireshark

- Download and install wireshark on your sytem (www.wireshark.org).
- Launch wireshark application, select the active internet interface (e.g.etherent, wireless etc or even any) and start capturing with any caputre filter.
  - Access your favourite website e.g. your academic institution website in the browse.
  - Stop the capture after 1 minute in wireshark.
- Analyze the number of packets received.
- Identify all the protocols that are identified by wireshark

Use Case 6 : Using wireshark

- Connect two systems on the network and identify their IP addresses.
- Launch wireshark application and specify capture filter as other system's IP address.
- Initiate a chat session (using `nc`) between two systems and exchange few messages.
- Analyze the nc chat packets in wireshark.
- Analyze the number of packets received.
- Explore why there is no layer 7 packet in wireshark even though you are using nc as an application.

Use Case 7 : Using tcpdump

- Connect two systems on the network and identify their IP addresses.
- Launch tcpdump application with capture filter as IP address of your college website with packet size of 1500
- Open a browser and access your college website.
- Analyze the first 5 packets in tcpdump.
  - Analyze 3-way handshake
  - Analyze application data sent
  - Analyze response received

Summary

- nc
- ping
- traceroute
- wget
- curl
- tcpdump
- wireshark