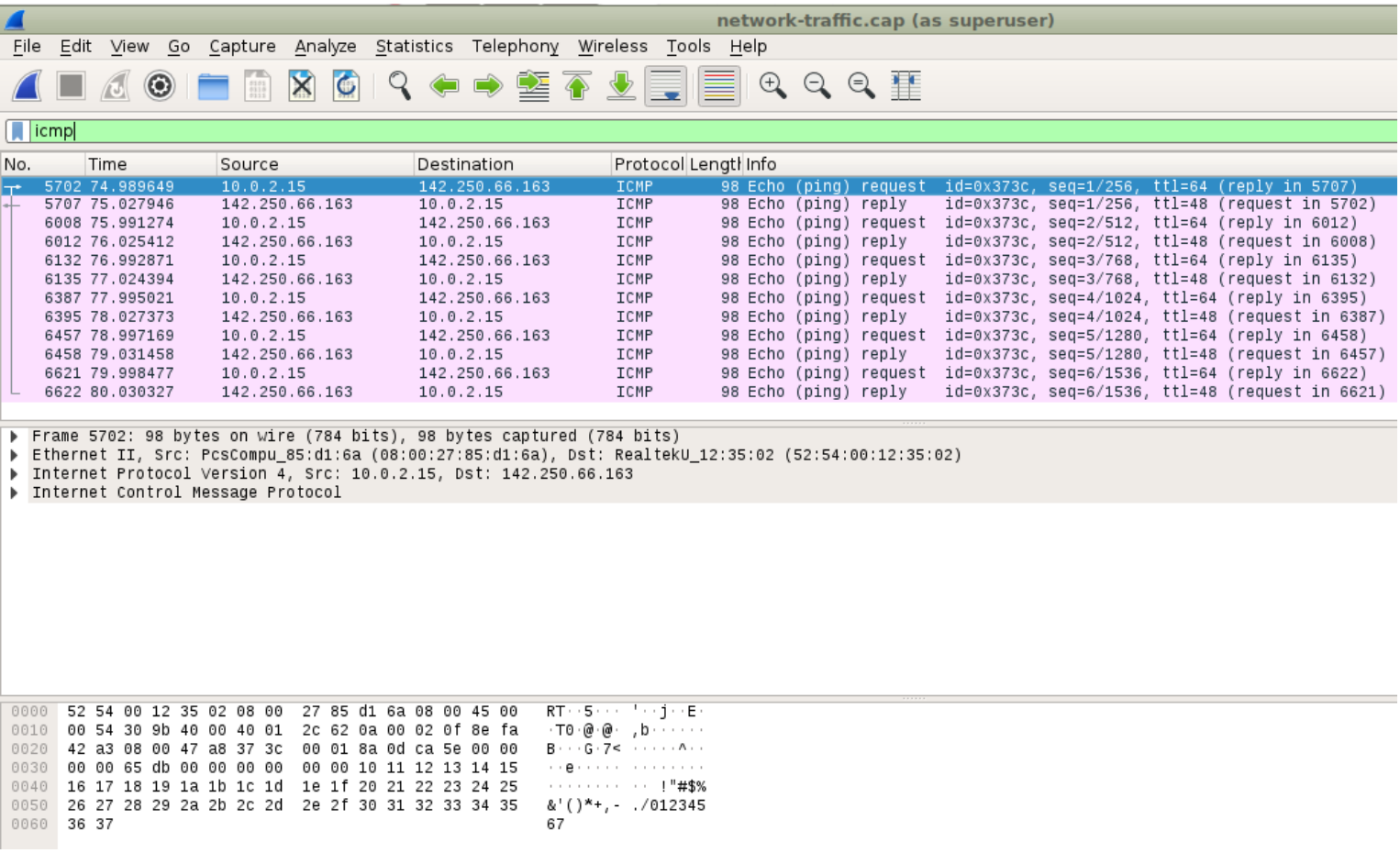
CHECKPOINT 4

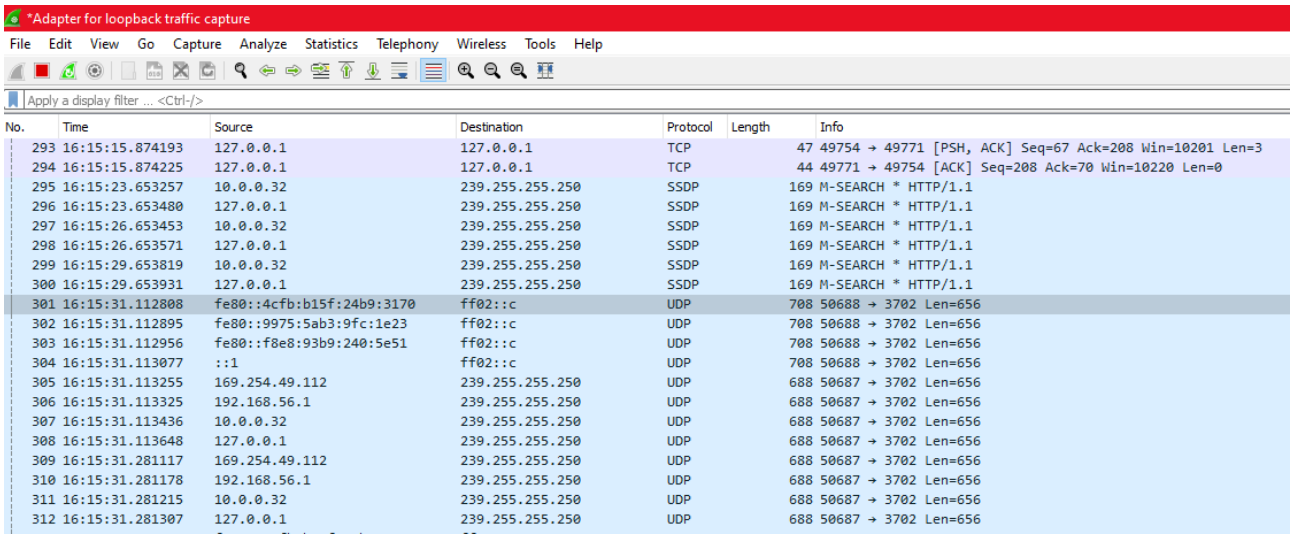
```
******* CLI Output *******
root@student64:~# tcpdump -i eth0 -w network-traffic.cap
tcpdump: listening on eth0, link-type EN10MB (Ethernet), capture size 262144 bytes
^C
6836 packets captured
6838 packets received by filter
0 packets dropped by kernel

root@student64:~# wireshark -r network-traffic.cap
```

Q) Can you identify ICMP traffic on the network interface?



Q) Or if running a VM, can you install and run Wireshark on the host machine running the VM to capture the VMs traffic?



These packets are largely just for identifying all the interfaces and services on my host (the VirtualBox VM network address is 169.254.49.112). There are no packets corresponding to pings or website requests that I run in the VM.

A couple of websites suggest capturing this traffic is not possible on Windows.

Supported Platforms

See CaptureSetup/NetworkMedia for Wireshark capturing support on various platforms. Summary: you can capture on the loopback interface on Linux, on various BSDs including macOS, and on Digital/Tru64 UNIX, and you *might* be able to do it on Irix and AIX, but you definitely **cannot** do so on Solaris, HP-UX, or Windows.

https://wiki.wireshark.org/CaptureSetup/Loopback

How to use Wireshark to capture between VirtualBox VM's

Created: Wednesday, 29 August 2018 10:34
Hits: 7473

A great question and problem.

The fundamental answer is you can't. Why? Depends on who you believe. My conclusion is that Wireshark (really dumpcap) has to use either Winpcap in Windows or Libpcap in Linux to access the packet data within the stack. With Virtualbox, there is no path to the packet data that dumpcap can reach, even though the VirtualBox networks/virtual interfaces appear. See the vboxnet intefaces I have below:

https://www.cellstream.com/reference-reading/tipsandtricks/396-wiresharinvboxvm

CHECKPOINT 5

******* CLI Output *******

The traceroute and tracepath commands just show all stars on the VirtualBox VM. So I ran these in WSL2 on my Windows host instead.

Q) Can you run the following commands and compare the resulting times to the host www.flinders.edu.au:

$ tracepath www.flinders.edu.au

```
pill0032@JOELZ:~$ tracepath flinders.edu.au
 1?: [LOCALHOST]                      pmtu 1500
 1:  JOELZ.mshome.net                                      0.311ms
 1:  JOELZ.mshome.net                                      0.250ms
 2:  10.0.0.1                                              4.452ms
 3:  ???                                                  14.714ms
 4:  ???                                                  12.697ms
 5:  be10-3999.core1.yourdc-haw.adl.aussiebb.net          14.081ms
 6:  be1.core2.yourdc-haw.adl.aussiebb.net                14.668ms
 7:  as7575.adl.edgeix.net.au                             23.849ms asymm  8
 8:  xe-0-0-2.pe1.adel.sa.aarnet.net.au                   21.904ms
 9:  gw1.vlan253.xe-5-2-0.pe1.adel.sa.aarnet.net.au       25.357ms asymm  8
10:  no reply
11:  no reply
12:  no reply
13:  no reply
14:  no reply
15:  no reply
16:  no reply
17:  no reply
18:  no reply
19:  no reply
20:  no reply
21:  no reply
22:  no reply
23:  no reply
24:  no reply
25:  no reply
26:  no reply
27:  no reply
28:  no reply
29:  no reply
30:  no reply
     Too many hops: pmtu 1500
     Resume: pmtu 1500
```

$ traceroute www.flinders.edu.au

```
pill0032@JOELZ:~$ traceroute flinders.edu.au --resolve-hostnames
traceroute to flinders.edu.au (129.96.88.39), 64 hops max
  1   172.22.48.1 (JOELZ.mshome.net)  0.228ms  0.166ms  0.162ms
  2   10.0.0.1 (10.0.0.1)  3.216ms  1.606ms  2.082ms
  3   100.80.0.1 (100.80.0.1)  12.619ms  12.267ms  10.519ms
  4   180.150.2.73 (180.150.2.73)  14.707ms  14.817ms  9.918ms
  5   202.142.143.194 (be10-3999.core1.yourdc-haw.adl.aussiebb.net)  18.123ms  13.852ms
12.659ms
  6   180.150.2.39 (be1.core2.yourdc-haw.adl.aussiebb.net)  13.138ms  12.807ms  17.840ms
  7   103.136.101.18 (as7575.adl.edgeix.net.au)  20.226ms  21.889ms  20.657ms
  8   113.197.15.130 (xe-0-0-2.pe1.adel.sa.aarnet.net.au)  22.506ms  19.396ms  19.910ms
  9   138.44.192.99 (gw1.vlan253.xe-5-2-0.pe1.adel.sa.aarnet.net.au)  22.723ms  23.986ms
20.479ms
 10   *  *  *
 11   *  *  *
 12   *  *  *
 13   *  *  *
 14   *  *  *
 15   *  *  *
 16   *  *  *
 17   *  *  *
 18   *  *  *
 19   *  *  *
 20   *  *  *
 21   *  *  *
 22   *  *  *
 23   *  *  *
 24   *  *  *
 25   *  *  *
 26   *  *  *
 27   *  *  *
 28   *  *  *
 29   *  *  *
 30   *  *  *
```

$ ping -c 10 www.flinders.edu.au

```
pill0032@JOELZ:~$ ping -c 10 www.flinders.edu.au
PING cdn.prod.flinders.adobecqms.net (13.35.149.54) 56(84) bytes of data.
64 bytes from server-13-35-149-54.syd1.r.cloudfront.net (13.35.149.54): icmp_seq=1 ttl=244
time=35.6 ms
64 bytes from server-13-35-149-54.syd1.r.cloudfront.net (13.35.149.54): icmp_seq=2 ttl=244
time=31.5 ms
64 bytes from server-13-35-149-54.syd1.r.cloudfront.net (13.35.149.54): icmp_seq=3 ttl=244
time=33.4 ms
64 bytes from server-13-35-149-54.syd1.r.cloudfront.net (13.35.149.54): icmp_seq=4 ttl=244
time=31.1 ms
64 bytes from server-13-35-149-54.syd1.r.cloudfront.net (13.35.149.54): icmp_seq=5 ttl=244
time=46.6 ms
64 bytes from server-13-35-149-54.syd1.r.cloudfront.net (13.35.149.54): icmp_seq=6 ttl=244
time=33.2 ms
64 bytes from server-13-35-149-54.syd1.r.cloudfront.net (13.35.149.54): icmp_seq=7 ttl=244
time=35.1 ms
64 bytes from server-13-35-149-54.syd1.r.cloudfront.net (13.35.149.54): icmp_seq=8 ttl=244
time=33.6 ms
64 bytes from server-13-35-149-54.syd1.r.cloudfront.net (13.35.149.54): icmp_seq=9 ttl=244
time=32.3 ms
64 bytes from server-13-35-149-54.syd1.r.cloudfront.net (13.35.149.54): icmp_seq=10 ttl=244
time=32.0 ms

--- cdn.prod.flinders.adobecqms.net ping statistics ---
10 packets transmitted, 10 received, 0% packet loss, time 9015ms
rtt min/avg/max/mdev = 31.144/34.491/46.696/4.298 ms
```

Q) Identify which hosts/routers create the largest latency

The two hosts/routers creating the largest latency are:

1. the first host/router outside my home network, which is 100.80.0.1 in traceroute
2. the host/router 103.136.101.18 (as7575.adl.edgeix.net.au) in step 6/7.

Both increase the RTT by around 8-10ms. They are highlighted in red above.

Q) Do you see asymmetric routes, if so why might that be?

Asymmetric routes occur when an outgoing packet takes a different path than a return packet and consequently has a large difference in time taken for outgoing vs return paths.

Tracepath identified two asymmetric routes in steps 7 and 9.

It also appears that one of the pings (ping 5, in blue) has a much higher RTT than the others, perhaps indicating an asymmetric route taken.

Traceroute works by sending out UDP packets with an incrementing Time To Live (TTL). When it makes the TTL number of hops (so TTL = 0), the node where it stopped will send back a ICMP message, that will count return hops. If return hops is not equal to TTL, then the route was asymmetric.

Ref 1: https://community.cisco.com/t5/data-center-documents/identifying-and-troubleshooting-asymmetric-routing-in-waas/ta-p/3123733

Ref 2: https://www.fir3net.com/Networking/Terms-and-Concepts/how-does-traceroute-calculate-asymmetric-routing.html

Q) Using tcpdump or wireshark, what type of traffic do these programs generate?

Pings generate ICMP and ARP traffic:

No.	Time	Source	Destination	Protocol	Length	Info
11	17:03:47.209696	172.22.55.180	13.224.179.8	ICMP	98	Echo (ping) request id=0x1844, seq=2/512, ttl=64 (reply in 12)
12	17:03:47.243219	13.224.179.8	172.22.55.180	ICMP	98	Echo (ping) reply id=0x1844, seq=2/512, ttl=244 (request in 11)
13	17:03:48.211803	172.22.55.180	13.224.179.8	ICMP	98	Echo (ping) request id=0x1844, seq=3/768, ttl=64 (reply in 14)
14	17:03:48.245823	13.224.179.8	172.22.55.180	ICMP	98	Echo (ping) reply id=0x1844, seq=3/768, ttl=244 (request in 13)
15	17:03:49.213385	172.22.55.180	13.224.179.8	ICMP	98	Echo (ping) request id=0x1844, seq=4/1024, ttl=64 (reply in 16)
16	17:03:49.247100	13.224.179.8	172.22.55.180	ICMP	98	Echo (ping) reply id=0x1844, seq=4/1024, ttl=244 (request in 15)
17	17:03:50.739417	Microsof_b7:df:b6	Microsof_ef:40:f3	ARP	42	Who has 172.22.55.180? Tell 172.22.48.1
18	17:03:50.739689	Microsof_ef:40:f3	Microsof_b7:df:b6	ARP	42	172.22.55.180 is at 00:15:5d:ef:40:f3
19	17:03:51.143845	Microsof_ef:40:f3	Microsof_b7:df:b6	ARP	42	Who has 172.22.48.1? Tell 172.22.55.180
20	17:03:51.143856	Microsof_b7:df:b6	Microsof_ef:40:f3	ARP	42	172.22.48.1 is at 00:15:5d:b7:df:b6

Tracepath generates DNS, ICMP and UDP traffic:

No.	Time	Source	Destination	Protocol	Length	Info
21	17:03:57.845335	172.22.55.180	172.22.48.1	DNS	75	Standard query 0x2062 A flinders.edu.au
22	17:03:57.845336	172.22.55.180	172.22.48.1	DNS	75	Standard query 0xaa69 AAAA flinders.edu.au
23	17:03:57.886693	172.22.48.1	172.22.55.180	DNS	106	Standard query response 0x2062 A flinders.edu.au A 129.96.88.39
24	17:03:57.908924	172.22.48.1	172.22.55.180	DNS	75	Standard query response 0xaa69 AAAA flinders.edu.au
25	17:03:57.909418	172.22.55.180	129.96.88.39	UDP	1514	40517 → 44444 Len=1472
26	17:03:57.909467	172.22.48.1	172.22.55.180	ICMP	590	Time-to-live exceeded (Time to live exceeded in transit)
27	17:03:57.909913	172.22.55.180	172.22.48.1	DNS	84	Standard query 0xa26f PTR 1.48.22.172.in-addr.arpa
28	17:03:57.910401	172.22.48.1	172.22.55.180	DNS	138	Standard query response 0xa26f PTR 1.48.22.172.in-addr.arpa PTR JOELZ.mshome.net
29	17:03:57.910740	172.22.55.180	129.96.88.39	UDP	1514	40517 → 44445 Len=1472
30	17:03:57.910768	172.22.48.1	172.22.55.180	ICMP	590	Time-to-live exceeded (Time to live exceeded in transit)
31	17:03:57.911089	172.22.55.180	172.22.48.1	DNS	84	Standard query 0x6030 PTR 1.48.22.172.in-addr.arpa
32	17:03:57.911468	172.22.48.1	172.22.55.180	DNS	138	Standard query response 0x6030 PTR 1.48.22.172.in-addr.arpa PTR JOELZ.mshome.net
33	17:03:57.911802	172.22.55.180	129.96.88.39	UDP	1514	40517 → 44446 Len=1472
34	17:03:57.916538	10.0.0.1	172.22.55.180	ICMP	590	Time-to-live exceeded (Time to live exceeded in transit)

Traceroute also generates DNS, ICMP and UDP traffic:

No.	Time	Source	Destination	Protocol	Length	Info
1	17:07:43.306341	172.22.55.180	172.22.48.1	DNS	75	Standard query 0xe0b4 A flinders.edu.au
2	17:07:43.311375	172.22.48.1	172.22.55.180	DNS	106	Standard query response 0xe0b4 A flinders.edu.au A 129.96.88.39
3	17:07:43.311983	172.22.55.180	129.96.88.39	UDP	51	49272 → 33434 Len=9
4	17:07:43.312035	172.22.48.1	172.22.55.180	ICMP	79	Time-to-live exceeded (Time to live exceeded in transit)
5	17:07:43.312503	172.22.55.180	129.96.88.39	UDP	51	49272 → 33434 Len=9
6	17:07:43.312544	172.22.48.1	172.22.55.180	ICMP	79	Time-to-live exceeded (Time to live exceeded in transit)
7	17:07:43.312837	172.22.55.180	129.96.88.39	UDP	51	49272 → 33434 Len=9
8	17:07:43.312854	172.22.48.1	172.22.55.180	ICMP	79	Time-to-live exceeded (Time to live exceeded in transit)
9	17:07:43.313760	172.22.55.180	129.96.88.39	UDP	51	49272 → 33435 Len=9
10	17:07:43.318378	10.0.0.1	172.22.55.180	ICMP	79	Time-to-live exceeded (Time to live exceeded in transit)
11	17:07:43.318691	172.22.55.180	129.96.88.39	UDP	51	49272 → 33435 Len=9
12	17:07:43.322243	10.0.0.1	172.22.55.180	ICMP	79	Time-to-live exceeded (Time to live exceeded in transit)