

ECE435: Network Engineering – Homework 7
More Internet Protocol

Due: Thursday, 26 October 2016, 12:30pm

For this homework short answers will suffice.

To submit, create a document with your answers (text, pdf, libreoffice, MS Office if you must) and e-mail them to *vincent.weaver@maine.edu* by the homework deadline. Title your e-mail “ECE435 Homework 7” and be sure your name is included in the document.

1. Which of the following are valid IPv4 addresses?

- (a) 10.10.10.10
- (b) 3232237569
- (c) 0xc0a80801
- (d) 123.267.67.88

2. A network is described as 192.168.13.0/24.

- (a) What would be the subnet mask for this subnet?
- (b) What would be the lowest IP address you could assign on this subnet?
- (c) What would be the highest IP address you could assign on this subnet?

3. You run the “route” command on a Raspberry Pi and you get an output like the following:

```
pi3:~$ /sbin/route
Kernel IP routing table
Destination      Gateway          Genmask         Flags Metric Ref    Use Iface
default          192.168.8.2     0.0.0.0         UG    0      0      0 eth0
192.168.8.0     0.0.0.0         255.255.255.0  U     0      0      0 eth0
```

- (a) If a packet is sent to 216.58.192.132, what is its first “hop” on the way?
- (b) If a packet is sent to 192.168.8.50 what is its first “hop” on the way?

4. Use the “ping” command on a network connected machine to ping `www.google.com`.

- (a) What is the round-trip packet time?
- (b) Do you notice anything odd about the hostname that responds?

5. Use the “traceroute” command. It’s tracert on Windows.

- (a) `traceroute www.maine.edu`.
How many hops away is it? Do you recognize any of the names in the hops along the way?
- (b) `traceroute www.facebook.com`.
How many hops away is it? Do the response times gradually go up for each further hop?

6. Which of the following are valid IPv6 addresses?

- (a) 2607:f8b0:4009:0801:0000:0000:200e
- (b) 2607:f8b0:4009:801::200e
- (c) 2607:f8b0::4009:801::200e
- (d) 123.45.67.189

7. We used tcpdump to gather the following Ethernet frame.

```
tcpdump port 53 -xe -i eth1 -XX
```

```
0x0000:  8875 563d 2a80 0030 18ab 1c39 86dd 6002  .uV=*..0...9..`.
0x0010:  2618 0031 1140 2610 0048 0100 08da 0230  &...1.@&..H.....0
0x0020:  18ff feab 1c39 2001 4860 4860 0000 0000  .....9..H`H`....
0x0030:  0000 0000 8844 e239 0035 0031 9c0e 8657  .....D.9.5.1...W
0x0040:  0120 0001 0000 0000 0001 0377 7777 0465  .....www.e
0x0050:  7370 6e03 636f 6d00 0001 0001 0000 2910  spn.com.....).
0x0060:  0000 0000 0000 00
```

The IP header starts at address 0xe. From the value found there you suspect this is an IPv6 packet, so use the class notes or RFC2460 to decode the various fields.

BEGIN IPv6 HEADER	Name of Field	Decoded Value
0x000e: 6		
0x000f: 00		
0x0010: 2 2618		
0x0012: 0031		
0x0014: 11		
0x0015: 40		
0x0016: 2610 0048 0100 08da 0230 18ff feab 1c39		
0x0026: 2001 4860 4860 0000 0000 0000 0000 8844		
END IPv6 HEADER		

8. You traceroute `www.cambridge.ac.uk` which is at Cambridge University in England. And get the following:

```
1  vl218.gw-o-neville.net.maine.edu (130.111.218.1)  1.055 ms  0.999 ms  0.878 ms
2  gi7-2.gw-orono.net.maine.edu (130.111.31.129)  0.638 ms  0.520 ms  0.486 ms
3  te2-3.gw-bangor.net.maine.edu (130.111.0.51)  0.570 ms  0.527 ms  0.631 ms
4  te3-1.gw-portland.net.maine.edu (130.111.0.34)  3.832 ms  3.856 ms  3.818 ms
5  po2.gw-portland2.net.maine.edu (130.111.0.17)  4.101 ms  4.025 ms  3.989 ms
6  nox300gw1-umaine-re.nox.org (192.5.89.73)  8.708 ms  8.703 ms  9.924 ms
7  i2-re-nox300gw1.nox.org (192.5.89.222)  26.341 ms  26.340 ms  26.236 ms
8  internet2.mx1.ams.nl.geant.net (62.40.124.46)  105.947 ms  106.022 ms  106.072 ms
9  ae2.mx1.lon.uk.geant.net (62.40.98.80)  101.728 ms  101.773 ms  101.828 ms
10 janet-gw.mx1.lon.uk.geant.net (62.40.124.198)  101.802 ms  104.006 ms  104.056 ms
11 ae29.londpg-sbr2.ja.net (146.97.33.2)  102.532 ms  102.284 ms  102.359 ms
12 ae30.londtw-sbr2.ja.net (146.97.33.6)  102.682 ms  102.612 ms  102.629 ms
13 146.97.38.18 (146.97.38.18)  105.703 ms  105.705 ms  105.585 ms
14 146.97.65.117 (146.97.65.117)  105.649 ms  105.917 ms  105.857 ms
15 University-of-Cambridge.cambab-rbr1.eastern.ja.net (146.97.130.2)  157.919 ms  157.869 ms  157.757 ms
16 d-dw.s-dw.net.cam.ac.uk (193.60.88.2)  106.787 ms  106.728 ms  106.686 ms
17 mws-83481.mws3.csx.cam.ac.uk (131.111.58.90)  106.184 ms  106.206 ms  106.138 ms
```

- (a) Can you tell which hop takes you across the Atlantic Ocean?
- (b) Can you guess what city this happens in based on the hostnames?

9. You `traceroute6 www.cambridge.ac.uk` which traces the same connection, but with IPv6 and you get the following:

```

1  vl218.gw-o-neville.net.maine.edu (2610:48:100:8da::1)  1.957 ms  1.908 ms  2.068 ms
2  gi7-2.gw-orono.net.maine.edu (2610:48::25)  0.769 ms  0.680 ms  0.836 ms
3  2610:48:0:a::9 (2610:48:0:a::9)  0.774 ms  1.004 ms  0.943 ms
4  2610:48:0:a::2 (2610:48:0:a::2)  21.907 ms  21.967 ms  21.878 ms
5  et-4-1-0.4072.rts.wash.net.internet2.edu (2001:468:ff:a02::2)  30.120 ms  30.076 ms  29.928 ms
6  abilene-wash.mx1.fra.de.geant2.net (2001:798:14:10aa::11)  126.785 ms  130.140 ms  126.743 ms
7  ael.mx1.ams.nl.geant.net (2001:798:cc:1401:2201::a)  120.872 ms  124.076 ms  120.840 ms
8  ae2.mx1.lon.uk.geant.net (2001:798:cc:2801:2201::1)  119.811 ms  116.640 ms  119.732 ms
9  janet-gw.mx1.lon.uk.geant2.net (2001:798:28:10aa::2)  129.290 ms  116.694 ms  129.300 ms
10 ae29.londpg-sbr2.ja.net (2001:630:0:10::1ca)  120.310 ms  117.270 ms  117.199 ms
11 ae30.londtw-sbr2.ja.net (2001:630:0:10::1ce)  120.909 ms  139.899 ms  139.835 ms
12 2001:630:0:10::17e (2001:630:0:10::17e)  120.647 ms  123.732 ms  133.303 ms
13 2001:630:0:1000:10::75 (2001:630:0:1000:10::75)  120.475 ms  120.632 ms  120.669 ms
14 2001:630:0:9000::2 (2001:630:0:9000::2)  123.632 ms  120.554 ms  120.494 ms
15 b-ec.c-ce.net.cam.ac.uk (2001:630:210:3::1)  133.603 ms  133.565 ms  133.567 ms
16 c-ce.d-dr.net.cam.ac.uk (2001:630:210:19::2)  124.555 ms  124.511 ms  133.799 ms
17 d-dr.s-dw.net.cam.ac.uk (2001:630:210:2002::2)  133.760 ms  121.897 ms  d-dr.s-dr.net.cam.ac.uk (2001:630:210:2002::2)
18 mws-83481.mws3.csx.cam.ac.uk (2001:630:212:8::8c:90)  133.478 ms  133.416 ms  133.175 ms

```

- (a) Why are there a different number of hops?
- (b) Did the route take the same path across the Atlantic?
- (c) Is the latency better or worse when using IPv6? Why might this be?