

ECE435: Embedded Systems – Homework 6
Internet Protocolv6

Due: Wednesday, 2 November 2016, 3pm

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 6” and be sure your name is included in the document.

1. Which of the following are valid IPv6 addresses?

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

2. You run tcpdump and you see packets like this. What protocol is this? What is it used for?

```
16:15:57.734294 Ethernet (len 6), IPv4 (len 4),  
Request who-has macbook-air tell a10, length 46  
16:15:57.734355 Ethernet (len 6), IPv4 (len 4),  
Reply macbook-air is-at 00:50:b6:47:1c:de (oui Unknown), length 28  
16:16:00.408107 Ethernet (len 6), IPv4 (len 4),  
Request who-has atom tell macbook-air, length 28  
16:16:00.408315 Ethernet (len 6), IPv4 (len 4),  
Reply atom is-at 00:22:4d:9f:d4:fc (oui Unknown), length 46
```

3. 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
```


connections? UDP connections? Other sort of connections?

6. 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?

7. 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?