ECE435: Network Engineering – Homework 9

Link Layer and Ethernet

Due: Thursday, 29 November 2018, 3:30pm

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 9" and be sure your name is included in the document.

1. **Ethernet Header** (4pts)

   From previous homeworks, we used tcpdump to gather that output of our client program doing a simple web request. `sudo tcpdump port 80 -xe -i eth0 -XX`

```
0x0000:  0013 3b10 667f b827 ebaf 3711 0800 4500  ..;.f..'..7...E.
0x0010:  0038 572a 4000 4006 69cc c0a8 0833 826f  .8W*@.@.i....3.o
0x0020:  2e7f bda5 0050 cdc4 6a49 3c7b 6ca5 8018  .....P..jI<{l...
0x0030:  00e5 79f4 0000 0101 080a 0104 3e58 34a8  ..y.........>X4.
0x0040:  7bc3 4745 540a                           {.GET.
```

   (a) We now have enough knowledge to debug the whole thing. Use classnotes or the IEEE 802.3 specification to debug the Ethernet fields. Note that tcpdump is not able to capture the preamble/SFD or FCS (checksum) values.

BEGIN Ethernet HEADER	Name of Field	Decoded Value
`0x0000:` 0013 3b10 667f		
`0x0006:` b827 ebaf 3711		
`0x000c:` 0800		

   (b) Who owns the OUI of the MAC addresses in the source and destination? You can use a tool such as `https://www.wireshark.org/tools/oui-lookup.html` to find this info.

   (c) In any earlier homework we decoded the IPv4 part of this frame and saw its eventual destination is 130.111.46.127. This is not on the local network. Is the destination MAC address that of 130.111.46.127? If not, what machine does the MAC address correspond to?

2. **Protocol Mystery** (2pts)

   You run tcpdump and you see packets like this.

```
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
```

   (a) What protocol is this?

   (b) What is it used for?

3. **Investigating an Ethernet Interface** (2pts)

   Find a Linux machine to do this on, ideally with a wired Ethernet port (a Raspberry Pi works great for this). For best results the port should be connected to a network via a cable. If you don't have access to such a machine, let me know and I can provide sample output you can use for this question.

   (a) Determine the current speed being used by your Ethernet adapter. There are various ways you can do this:

   - On Linux you can check the system boot messages, something like
     `sudo dmesg | grep eth`
     although that might not work on some gigabit drivers.
   - Another way to check is to install the `ethtool` utility and run `sudo ethtool eth0`

   (b) Look at the information on your Ethernet device. Often on Linux this will be called `eth0` but this can vary for many reasons. Use the command `/sbin/ifconfig`

   i. What is your MAC address?
   ii. Look this up using an OUI lookup tool. Does it match what you expect?
   iii. What is the default frame size (MTU)?
   iv. How many bytes have been received (RX)?
   v. How many bytes have been transmitted (TX)?
   vi. Has your device seen any collisions?
   vii. Has your device dropped any packets?

   (c) If the collision count is low, can you explain why that is?

4. **Answer the following questions** (2pts)

   (a) Why did Ethernet win out over TokenRing?

   (b) Why is the minimum size of an Ethernet frame 64 bytes?

   (c) Why is the maximum size of an Ethernet frame 1500 bytes?

   (d) What does your Ethernet card do to a frame if it calculates an invalid CRC?