COMP 535 Assignment 1

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Excercise 1

a. $d_{prop} = \frac{m}{s}$ (in seconds)

b. $d_{trans} = \frac{L}{R}$ (in seconds)

c. $d_{nodal} = d_{proc} + d_{queue} + d_{trans} + d_{prop} \approx \frac{m}{s} + \frac{L}{R}$ (in seconds)

d. The last bit is just leaving host A and is going to start its propagation through the link, since d_{trans} refers to the delay for all bits in this packet to finish transmission out onto the link.

e. Now the first bit in the link is propagating to host B. The time it takes for a bit to propagate from host A to B is d_{prop}. Also we know the first bit starts its propagation at time $t = 0$, so it will not finish its travel at time $t = d_{trans}$ if d_{trans} is less than d_{prop} and is still propagating.

f. The first bit has already arrived at host B. As stated above, time for its whole propagation is d_{prop}. Therefore for a larger period of time d_{trans}, it has finished its propagation and reached its destination, host B.

g. Let $\frac{m}{s} = \frac{L}{R}$ and we get $m = \frac{L \cdot s}{R}$ as the expression.

h. $m = \frac{100bits}{250kbps} \cdot 2.5 \times 10^8 \,\mathrm{m\,s^{-1}} = \frac{2.5 \times 10^{10}}{2.5 \times 10^5} = 10^5 \,\mathrm{m}$

Excercise 2

a. Data link layer.

b. 2^{48}

c. Network layer.

d. 2^{32}

e. First of all when there are limited amount of computers connected directly and forming a network, we assigned every device a unique ID to represent itself. However after the top-down network is designed, there are too many computers in the world and it's impossible to search all devices for a certain MAC address. IP address, on the other hand, is a hierarchically assgined and organized virtual address. It makes it convenient to make the routing through routing algorithms.

The two types of address are different in spaces as stated above. Also the MAC address is the physical address working for data link layer while IP address is a logical address used by the network layer. The MAC address is unique for every device and remains permanently but IP address is changeable and maybe reflecting which network it is connecting to. As a consequence, the former one is used to identify a device within the same broadcast network and the latter one is used to search for devices throughout all networks.

f. i)A
ii)D
iii)Not a valid IP address
iv)B

Excercise 3

1. An ARP query is sent within a broadcast frame because the querying host does not know which adapter it is looking for and it has to make a broadcast request.
An ARP response is sent with a specific destination MAC address because the responding host knows what is the address of the querying host from the broadcast frame.

2. Yes. Before PC-E send the packet, it will first figure out if the destination host is within the same subnet with itself or not. Based on their IP addresses and subnet masks, PC-E knows that PC-F is in the same LAN with PC-E. So to find out a host's MAC address that does not appear on PC-E's ARP table, it will need to make a broadcast ARP query in this subnet. Then PC-F will make response to it and PC-E learns about where to send this packet.

		OUT OF PC-A	OUT OF R1 G0/1	OUT OF R2 GO/1
	MAC DEST	000E.18D3.CD41	0065.1323.EC34	0061.45F8.BB0C
3.	IP DEST	192.168.2.100/24	192.168.2.100/24	192.168.2.100/24
	MAC SRC	0060.2F38.AC0D	0040.CD43.342C	0070.1453.AB04
	IP SRC	192.168.0.100/24	192.168.0.100/24	192.168.0.100/24

Excercise 4

Here I tracerouted bilibili.com, which is a video website in China, using Windows command.

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Tracing route to bilibili.com [61.244.33.181]
over a maximum of 30 hops:

  1     1 ms    <1 ms    <1 ms  mynetwork [192.168.2.1]
  2     7 ms    28 ms     8 ms  10.11.16.9
  3     4 ms     3 ms     4 ms  10.178.206.128
  4    16 ms     3 ms     3 ms  10.178.206.129
  5    23 ms    23 ms    22 ms  tcore3-montreal02_2-8-0-1.net.bell.ca [64.230.91.50]
  6    20 ms    19 ms    19 ms  tcore3-ashburnbk_hundredgige0-8-0-0.net.bell.ca [64.230.79.106]
  7    17 ms    16 ms    16 ms  bx1-ashburnbk_0-1-0-0.net.bell.ca [64.230.125.189]
  8    73 ms    71 ms    72 ms  eqix-dc2.telstra.com [206.126.237.239]
  9    81 ms    82 ms    81 ms  i-93.1wlt-core02.telstraglobal.net [202.84.253.85]
 10   229 ms   226 ms   226 ms  i-11106.hkhh-core02.telstraglobal.net [202.84.137.233]
 11   227 ms   226 ms   227 ms  i-0-0-0-1.hkhh11.bi.telstraglobal.net [202.84.154.138]
 12   213 ms   213 ms   214 ms  unknown.telstraglobal.net [134.159.128.10]
 13   223 ms   223 ms   223 ms  014136143017.ctinets.com [14.136.143.17]
 14     *        *        *     Request timed out.
 15     *        *        *     Request timed out.
 16   223 ms   223 ms   223 ms  061244033181.ctinets.com [61.244.33.181]

Trace complete.
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The first column of those information is the hop number, indicating how many routers between my machine and the corresponding router. The next three columns are RTTs. Since through traceroute, my machine sent three data packets out and receive it from the routers, these numbers represent time used for the round trip for each of the three packets. The last column is hostname and/or IP addresses.

There are asterisks in the 14 and 15 hop. It might be due to high latency or visiting a remote network. But after finding some information, I think it is very likely because of ICMP echo block, so the host would not reply any information to the ping request. Another confusing behaviour is that the RTTs sometimes decrease as the hop goes and it might be quite common for those routers because the latter router can indeed has a better traffic with my machine although it is further in this hopping route.

Number of routers between my machine and the target is 15.(The last hop as we can see has the same IP address with the host I am pinging as 61.244.33.181)