EECS 325 HW 1

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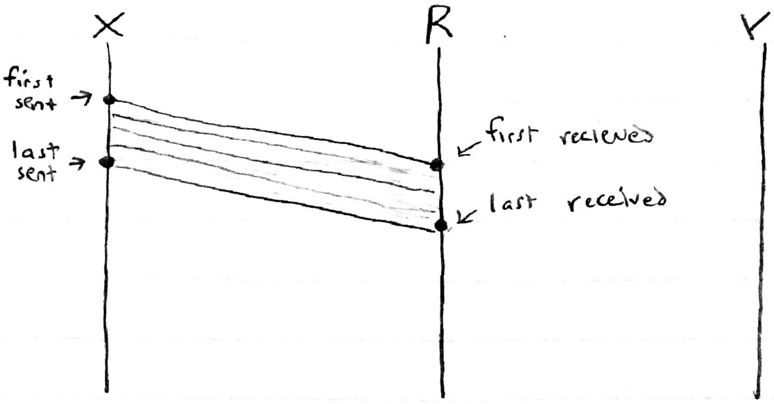
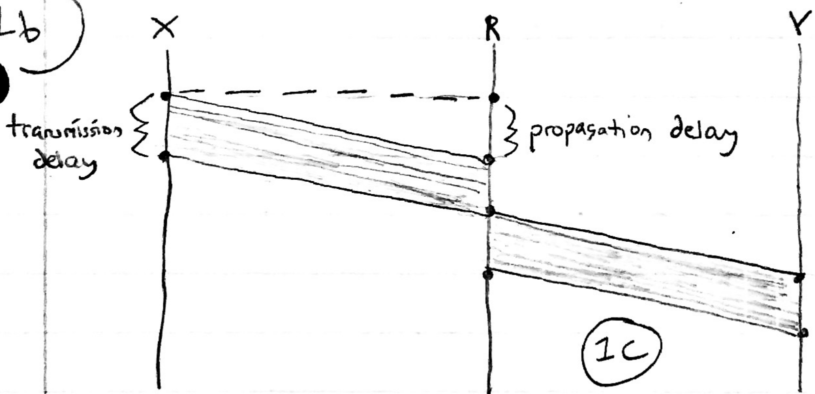
1a



1b



2a

Traceroute 1 : $D_1 = 0.75$ sec

Traceroute 2 : $D_2 = 0.92$ sec

Traceroute 3 : $D_3 = 0.97$ sec

★ taken early → mid-day

average $= \frac{0.75 + 0.92 + 0.97}{3} = 0.88$ s

$$\sigma = \sqrt{\frac{1}{N}\left[(D_1-\bar{D})^2 + (D_2-\bar{D})^2 + (D_3-\bar{D})^2\right]} = \sqrt{\frac{1}{3}\left[(0.75-0.88)^2 + (0.92-0.88)^2 + (0.97-0.88)^2\right]}$$

$= 0.11533$ seconds

(2b) The number of routers was 8 between the source and the destination. During the third trial, the number of routers changed to 9.

(2c) It seems that 6 or 7 of these IP addresses belong to the same ISP. The largest delays are going to be between adjacent ISP routers, evident by the round trip delays from different routers.

(2d) The intra-continent results are providing faster round trip delays. For the intercontinent traceroute, travelling over great distances like the Atlantic to England is causing large propagation delays.

3a) $d_{prop} = \frac{\text{distance}}{\text{speed}} = \frac{m}{s}$ seconds

3b) $d_{trans} = \frac{\text{bits}}{\text{bandwith}} = \frac{L}{R}$ seconds

3c) End - 2 - End $= d_{prop} + d_{trans} = \frac{m}{s} + \frac{L}{R}$ seconds

3d) At time $t = d_{trans}$, the last packet has just been transmitted onto the link.

3e) If $d_{prop} > d_{trans}$, then at $t = d_{trans}$ the first bit of the packet is being transmitted accross the link.

3f) If $d_{prop} < d_{trans}$, then at $t = d_{trans}$ the first bit of the packet has reached the endpoint seperated by "m" meters.

3g) $d_{prop} = d_{trans}$ $\quad m = ?$ $\quad L = 120$ bits

$\frac{m}{s} = \frac{L}{R}$ $\quad s = 2.5 \times 10^8$ $\quad R = 56{,}000$ bps

$\therefore m = \frac{Ls}{R} = \frac{120 \cdot 2.5 \times 10^8}{56{,}000} = \boxed{535{,}714 \text{ meters}}$

4a $d_{trans} = \frac{bits}{bandwidth} = \frac{8 \cdot 10^6}{2{,}000{,}000} = \boxed{4 \text{ seconds}}$ to the first switch

There are 3 links, each take 4 seconds $= \boxed{12 \text{ seconds}}$ to destination

4b $d_{trans} = \frac{bits}{bandwidth} = \frac{10{,}000}{2{,}000{,}000} = \boxed{0.005 \text{ seconds}}$ to the first switch

Neglecting queueing and processing delays, packet 1, will reach the second switch when packet 2 reaches the first switch. Packet 1 will travel over 2 links at 0.005 sec/link. Therefore, packet 2 reaches the first switch at
$2 \times 0.005 \text{ sec} = \boxed{0.01 \text{ secs}}$

4c It takes 0.015 secs for the first packet to arrive. Because of segmentation, each packet thereafter will be recieved with an additional 0.005 secs.

1 packet @ 0.015 secs
799 packets @ 0.005 secs $\rightarrow \boxed{4.01 \text{ seconds}}$ to destination

$4.01 < 12$ ∴ packet segmentation is faster when neglecting additional delays.

4d If a bit is corrupted, or a segment is lost, then the packet must be retransmitted. Easier to retransmit smaller smaller packets.

4e
- Rearranging packets from segmented form hogs processing resources
- If one packet is lost and not re-sent, then the other packets are useless.

5 **Host 1:**

Application Layer: Message Data D $\boxed{M}$

Transport Layer: Source Port: P1 Destination Port: P2 $\boxed{H_t}\boxed{M}$

Network Layer: Source IP: A1 Destination IP: AR1 $\boxed{H_n}\boxed{H_t}\boxed{M}$

Link Layer: Source MAC: M1 Destination MAC: MR1 $\boxed{H_l}\boxed{H_n}\boxed{H_t}\boxed{M}$

Physical Layer: Transmit bits over wire

Router Interface 1: $\boxed{H_n}\boxed{H_t}\boxed{M}$

Physical Layer: Recieves bits/packet over link

Link Layer: Destination MAC: MR1 = This MAC address, remove header

Network Layer: Destination Ip: AR1 - This IP address, remove header

Router Interface 2: $\boxed{H_l}\boxed{H_n}\boxed{H_t}\boxed{M}$

Network Layer: Source IP: AR2 Destination IP: A2

Link Layer: Source MAC: MR2 Destination MAC: M2

Physical Layer: Transmit bits over wire.

Host 2

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$\boxed{\text{Host 2}}$

Physical Layer: Receives data/packets over wire

Link Layer: Destination MAC: M2 = this MAC address, remove header $\boxed{H_l}\boxed{H_n}\boxed{H_t}\boxed{M}$

Network Layer: Destination IP: A2 = this IP address, remove header $\boxed{H_n}\boxed{H_t}\boxed{M}$

Transport Layer: Destination Port: P2 = this port, remove header $\boxed{H_t}\boxed{M}$

Application Layer: Message Data D $\boxed{M}$