Seth Pratt HW1

1) Packet transmission = $\frac{L \text{ bits}}{R \text{ bits/sec}}$

1 KB = 1024 bytes = 8192 bits
1 Mb/s = 1×10^6 bits/s

$d_{trans} = \frac{8192 \text{ bits}}{1{,}000{,}000 \text{ bits/s}} = 8.19 \text{ (x/y) ms}$

2) 128 Kbps - bw 128,000 bps
55 Gm - dist 55×10^9 m
3×10^8 m/s - speed

$d_{prop} = \frac{\text{distance}}{\text{speed}} = \frac{55 \times 10^9 \text{ m}}{3 \times 10^8 \text{ m/s}} = \frac{550 \text{ m}}{3 \text{ m/s}} = 183.3 \text{ s}$

RTT = 366.6 s

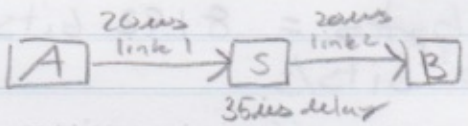
b) $d_{trans} = \frac{L \text{ bits}}{R \text{ b/s}}$

5 MB = 5,242,880 bits
R = 128,000

$d_{trans} = \frac{5{,}242{,}880 \text{ b}}{128{,}000 \text{ b/s}} = 40.96 \text{ s}$

183.3 s + 40.96 s = **224.26 s**

3) $d_{prop} = 20\mu s$ per link
$S = 1Mbps$ link
$S_{delay} = 35\mu s$



$$d_{trans} = \frac{L \text{ bits}}{R \text{ bits/sec}}$$

$L = 10,000$ bits $= \frac{10,000 \text{ b}}{1,000,000 \text{ b/s}} = .01s = 10,000\mu s$
$R = 1,000,000$ bits/s

$d_{trans} = (2 \times 10,000\mu s) + (2 \times 20\mu s) + 35\mu s$
$d_{trans} = 20,075\mu s$

$L = 5,000$ bits $= \frac{5000 \text{ b}}{1,000,000 \text{ b/s}} = .005s = 5,000\mu s$
$R = 1,000,000$ bits/s
T=0 Start sending P1
T=5,000 P1 sent start P2
T=5,020 P1 gets to S
T=5,055 P1 leaves S
T=10,020 P2 gets to S
T=10,055 P2 leaves S
T=10,075 P1 finishes
T=15,095 P2 finishes

$d_{trans} = 15,095\mu s$

4) Host -> 1 MB -> Host

1 sec = 50% compression

2 sec = 60% compression

Bandwidth = $\frac{\text{file size}}{\text{compressed data}}$

1 MB = 2024 KB

$BW = \frac{1024}{(.5)(1)} = \boxed{2048 \text{ Kb/s}}$

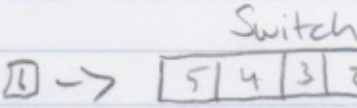
$BW = \frac{1024}{(.6)(2)} = \frac{1024}{1.2} = 853.3 \text{ Kb/s}$

b) Latency does not effect our compression time b/c latency delay happens during transmission.

5) dqueue = time waiting at output link for transmission

Packets = 1500 bytes

Bandwidth = 1 Mbps



$d_{trans} = \frac{(1500 \times 8) \text{ bits}}{1{,}000{,}000 \text{ bits/sec}} = .12 \text{ s / packet}$

$\frac{.12 \text{ s}}{\text{packet}} \times 4.5 \text{ packet} = .54 \text{ sec}$

General queuing delay

$n\left(\frac{L + {}^{x}/_{L}}{R}\right)$

6) Services like skype use VoIP (Voice over IP) for making phone calls. So skype uses the internet to make calls.

7) Submitted code and CSV for first 7 parts

The queing delay was most variable. The packets that were sent in bursts, depending on when, could hit a large queing delay, or very little queing delay