Networks HW 1 [ch1]

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R16

Delay components

- Transmition Delay
- Propagation Delay
- Procesing Delay
- Queing Delay

All delay are constant except for queing b/c it depends on forward packet execution

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R18

Packet Length $L = 1000$ bytes

Bit rate $R = 2$ Mbps

distance $d = 2500$ km

Speed $s = 2.5 \times 10^8$ m/s

Transmition Delay $L/R = \frac{(1000 \times 8)}{2 \text{ mbps} \times 1 \times 10^6 \text{ bps/mbs}} = 0.004\text{s}$ or 4 ms

Propagation delay $=$

$$d/s = \frac{(2500\text{km} * 1000\text{ m/km})}{(2.5 \times 10^8 \text{ m/s})} = 0.01\text{sec}$$ or 10 ms

Total Time $L/R + d/s = 14$ ms

R19

a) equivilent to slowest link, so 500 Kbps

b) Total file size = 4 million
1 byte = 8 bits

$$\frac{\text{File Size}}{\text{Throughput}} = \frac{4 \times 10^6 \times 8 \text{ bits}}{500 \times 10^3 \text{ bits/sec}} = 64 \text{ sec}$$

c) $R_1 = 500$ Kbps
$R_2 = 100$ Kbps
$R_3 = 1$ mbps

Slowest link is $R_2 = 100$ kbs
throughput = 100 Kbps

$$\text{Delay} = \frac{\text{Filesize}}{\text{throughput}} = \frac{4 \times 10^6 \times 8 \text{ bits}}{100 \times 10^3 \frac{\text{bits}}{\text{sec}}} = 320 \text{ sec}$$

d)

$$\text{End to End delay} = \frac{L}{R_1} + \frac{L}{R_2} + \frac{L}{R_3}$$

L = file size

R26

Virus: Copies itself onto other programs, deletes or modifies files, virus spreads slowly, cannot be easily removed

Worm: uses network to copy itself onto other computer, usually only monopolize cpu and memory, spreds quickly, easily removed.

P2 end to end delay $(d) = N \cdot \frac{L}{R}$

P packets $= d$

one packet $\times d_1 = d \times p$

$1 \times d_1 = [N \cdot (\frac{L}{R})] \times p$

$$d_1 = NP(\frac{L}{R})$$

P3 Circuit switch would be better in this case to transmit data in a steady state b/c it has faster communication and less error

P6

a) Propagation delay $\frac{\text{Distance}}{\text{propagation speed}} = d_{prop} = \frac{m}{s}$ seconds

b) Transmition time

Transmition time delay = $\frac{\text{Packet size (\# of bits)}}{\text{Bit rate (\# of bps)}}$

$d_{trans} = \frac{L}{R}$ second

c) propagation speed $= 2.5 \times 10^8$ m/s

$L = 120$ bits

$R = 56$ Kbps $= 56 \times 1024$ bps

$\frac{L}{R} = \frac{m}{s}$

$\frac{120}{56 \times 1024} = \frac{m}{2.5 \times 10^8} \Rightarrow m = \frac{300 \times 10^8}{5738} = 523.158$ km

P16

- Transmition delay = $\frac{L}{B} = \frac{1000 \times 8^4}{2 \times 10^6} = 4ms$

- process delay = $2 \times 3ms = 6ms$

- propagation delay = $\frac{\text{Distance}}{\text{Speed}}$ $(A-R_1)$ $\frac{5000 \times 10^3}{5 \times 10^8} = 10ms$

(R_1-R_2) $\frac{4000 \times 10^3}{5 \times 10^8} = 8ms$

(R_2-P) $\frac{21000 \times 10^3}{5 \times 10^8} = 2ms$

Transmition delay = $\frac{L}{B} = \frac{1000 \times 8^4}{2 \times 10^6} = 4ms$

Process

$i = 2$ $3 \cdot (3+4+8)$

$3 \cdot 15 = 45ms$

$i = 3$ $3 \cdot (3+4+2)$

$3 \cdot 9 = 27ms$

Total end-to-end delay = $51+45+27 = \boxed{123ms}$

P31

a) Total time = 3 x transmition delay

3 . 4 = 12sec

b)

tran. delay = $\frac{10^4 \text{ bits}}{10^6 \text{ bps}}$ = 10ms (time to reach first switch)

Total time = time of fist packe + 799 + time of other

3 x transdelay + 799 x trans delay

802 x 10 ms

P33

$T_{delay} = \frac{80+s}{R}$ Time + = Tdelay x no. of links

$T = ((80+s)/R) \times 3$

Total delay $= \left(\frac{80+s}{R}\right) \times 3 + \left(\frac{T}{s} - 1\right) \times \left(\frac{80+s}{R}\right)$

$T_{total} = \left(\frac{80+s}{R}\right)\left(\frac{T}{s} + 2\right)$

$\frac{\partial T}{\partial s} = 0$ $\frac{d}{ds}\left(\frac{80+s}{R}\right)\left(\frac{T}{s} + 2\right) = 0$

$\left(\frac{T}{s} + 2\right)\left(0 + \frac{1}{R}\right) + \left(\frac{80+s}{R}\right)\left(\frac{T}{s} + 0\right) = 0$

$\left(\frac{T}{sR} + \frac{2s}{R}\right) - \left(\frac{80+s}{R}\right)\left(\frac{T}{s}\right) = 0$

$\left(\frac{sT + 2s^2 - 80T - sT}{Rs}\right) = 0$

$2s^2 - 80T = 0$ $s^2 = 40T$

min transmition delay $s = \sqrt{40T}$

P34

Packet switching: emails are devided into packets and transmited through internet Protocol (IP)

Skype uses (VOIP) Voice over internet protocal

Voice is recoded & turned into packet samples and transfered through internet to telephone network