Chapter 1:

Mohammed Saada

* if all links Rate are equal (R) :-

Total Delay = $d_{trans} + d_{prop}$

$= \frac{L}{R}(\#pkts) + \frac{L}{R}(\#hops) + \frac{d}{s}(\#links)$

* if the links Rate are different :-

assume 2 links → $R_1 < R_2$

$D_{prop} = \frac{d}{s}(\#links)$

$D_{trans} = \frac{L}{R_1}(\#pkts) + \frac{L}{R_2}$

Total Delay = $D_{trans} + D_{prop}$

* Queueing Delay :-

L : packet size , R : transmission Rate

a : average packet arrival rate (Packet/sec)

La : bits/sec ⇒ traffic Intensity (I) = $\frac{La}{R}$

⇒ $\frac{La}{R} \approx 0$, small queueing delay

⇒ $\frac{La}{R} \to 1$, large queuing delay

⇒ $\frac{La}{R} > 1$, infinite queueing delay (loss)

* Queueing Delay = $I(\frac{L}{R})(1-I)$ for $I < 1$

Chapter 3 :-

* $EstimatedRTT = (1-\alpha)\,EstimatedRTT + \alpha\,SampleRTT$
  (new = old, old)

Typically : $\alpha = 0.125$

* $TimeoutInterval = EstimatedRTT + 4 * DIVRTT$

→ $DIVRTT = (1-\beta)\,DIVRTT + \beta\,|SampleRTT - EstimatedRTT|$
  (old)

Typically : $\beta = 0.25$

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rwnd: # bytes can read by reciever (free space Buffer)

At Reciever :

$LastByteRecieved - LastByteRead \leq RCVBuffer$

$rwnd = RCVBuffer - (LastByteRecieved - LastByteRead)$

At Sender :

$LastByteSent - LastByteAcked \leq rwnd$

Reno ⇒ 3 duplicate Acked ⇒ cut by half

Taheo ⇒ timeout ⟹ cut to 1 MSS

* TCP sender limits transmission :

lastByteSent − lastByteAcked ≤ cwnd

⇒ TCP Rate = $\frac{cwnd}{RTT}$ bytes/sec

SSthreshold = $\frac{1}{2}$ X cwnd (When event is loss)

Chapter 4

Router output links buffer :

$$\text{buffer} = RTT \times \text{Capacity} = RTT \times C$$

$$\text{or} = \frac{RTT \times C}{\sqrt{N}}$$

Address classes

Class A : Network . host . host . host

0XXXXXXX . * . * . *

Subnetmask 255 . 0 . 0 . 0 (/8)

the first octet can be from (1 – 126)

⇒ there are 126 Available networks

hosts $= 2^{24} - 2$

Class B : Network . Network . host . host

10XXXXXX . * . * . *

Subnetmask 255 . 255 . 0 . 0 (/16)

the first octet can be from (128 – 191)

⇒ there are 2^{14} Available networks

hosts $= 2^{16} - 2$

Class C

Network . Network . Network . host

110XXXXX . * . * . *

Subnet mask 255 . 255 . 255 . 0 (/24)

the first octet can be from (192 – 223)

⇒ there are 2^{21} Available networks

hosts = $2^8 - 2$

Class D

1110XXXX . * . * . *

Reserved for multicast traffic

e.g. Can't use on your network .

Multicast traffic : traffic sent to multiple hosts using one IP

for ex. a live web cast of a rock concert

first octet can be from (224 – 239)

Class E

1111 XXXX . * . * . *

Reserved for experimental use only

first octet can be from (240 – 255)

Addresses Reserved for Private use

Class A : 10.0.0.0 → 10 255.255.255

Class B : 172.16.0.0 → 172.31.255.255

Class C : 192.168.0.0 → 192.168.255.255