INDIAN INSTITUTE OF ENGINEERING SCIENCE AND TECHNOLOGY, SHIBPUR

B. TECH 6TH SEMESTER MID-SEMESTER EXAMINATION, MARCH 2022

SUBJECT: DIGITAL COMMUNICATION & COMPUTER NETWORKS
[CS 3202]

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Q2) given (i) slow start in interval [0,5]
(ii) Congestion avoidance in [6,16]
(iii) Triple duplicate acknowledgement received in 17
(iv) Congestion avoidance state in [18,22]
(v) Segment loss occured in 23

a) In the interval [0,5], TCP Reno is in slow start phase where cwnd starts from 1 and doubles every transmission

so

Transmission Round	0	1	2	3	4	5
cwnd	1	2	4	8	16	32

so after 5th transmission round, cwnd = 32

(b) ~~as the~~ now it is given that ~~after~~ [6, 16] was congestion avoidance, which is reached when cwnd ≥ ssthresh

at t=~~5~~4, cwnd was 16

at t=5 cwnd was 32

so ssthresh is between 16 & 32

∴ max ~~ss~~ initial ssthresh = 32

(c) in [6, 16] we are in congestion avoidance state where cwnd grows linearly

Transmission Round	6	7	8	9	10	11	12	13	14	15	16
cwnd	33	34	35	36	37	38	39	40	41	42	43

(d) at transmission 17, TCP Reno was still following congestion avoidance

so at t=17 → cwnd = 44

when it received triple Acknowledgement following thing happened.
(Fast Recovery)

$$ssthresh = \frac{44}{2} = 22$$

$$cwnd = \frac{44}{2} + 3 = 22 + 3 = 25$$

~~TCP Reno went~~

(e) in [18, 23] congestion avoidance

Transmission round	18	19	20	21	22	23
cwnd	~~25~~ 25	26	27	28	29	30

→ ~~then~~ so cwnd = 30

→ now we received segment loss, now cwnd = 1 & slow start phase again.

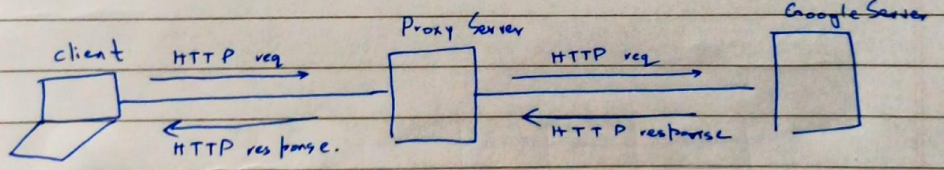
~~Q3) e) Web Cache~~

~~Q3) 5) Network Topology~~

Q3) 2) Web Cache

→ A Web ~~ch~~ cache is a network entity which stores previously made HTTP requests in disk and can satisfy HTTP requests on behalf on origin Web Server.

Eg



→ consider client want to access http://www.google.com & consider Proxy Server does not have ~~backup~~ cached copy of it

→ So the Proxy Server will act as client and connects with Google server ~~to get~~ via TCP and gives HTTP request & gets response from server

→ then Proxy Server forwards the object received to the client

→ After some time when client again asks for the same object, Proxy Server will not contact google server & directly give the cached copy. (assuming condition get ~~gives~~ by Proxy Server gives. 304)

→ Web Cache hence functions both as server (to clients) & also as client (to origin servers)

→ Due to caching, network bandwidth for common web objects gets saved and hence caching saves cost. & reduces response time for clients.

~~Q3) e) Virtual Circuit Networks~~

Q3) e) Data fragmentation & Reassembly

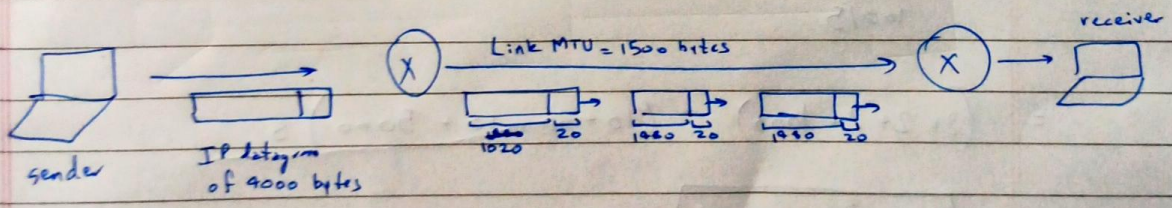
→ Happens in Network Layer.

→ Network Layer runs on top of Data Link Layer, which has a data size limitation based on the type of Data Link ~~Protocol being~~ Architecture being used

→ The maximum amount of data a link layer frame can have in a given Link Layer Architecture is called Maximum Transferrable Unit (MTU)

- → for Ethernet → 1500 bytes
- → for WAN → 576 bytes.

→ Network Layer ~~will~~ sometime fragment incoming datagram into different parts to allow bigger datagram to smaller one to allow parts to go through the network



→ fragmented packets will have same ID ⁄, & offsets ~~after~~ and flags to help reassemble them @ receiver's side.

Q1) given → link speed = 100 bit/s

→ data packet to be transferred = 100,000 bits.

→ control packet length = 200 bits

→ link supports N parallel connection, each getting $\frac{1}{N}$ speed.

→ User downloads 100 K bits data webpage which contains 5 referenced objects

(2) Non Persistent HTTP

→ considering that the page gets displayed after everything is received.

∴ Total time needed to receive all objects =

$$\left(\frac{200}{100} + \frac{200}{100} + \frac{200}{100} + \frac{100000}{100}\right) + \frac{200}{100/5} + \frac{200}{100/5} + \frac{200}{100/5}$$

$$+ \frac{100000}{100/5} \text{ seconds}$$

$$= (2 + 2 + 2 + 1000) + (10 + 10 + 10 + 5000)\,s$$

$$= \boxed{6036 \text{ seconds}}$$

(b) Persistent HTTP connection

$$\left(\frac{200}{100} + \frac{200}{100} + \frac{200}{100} + \frac{100000}{100}\right) + 5 \times \left(\frac{200}{100} + \frac{100000}{100}\right) \text{ sec.}$$

$$= (2 + 2 + 2 + 1000) + 5(2 + 1000) \text{ sec.}$$

$$= 1006 + 5010 \text{ sec}$$

$$= \boxed{6016 \text{ seconds}}$$