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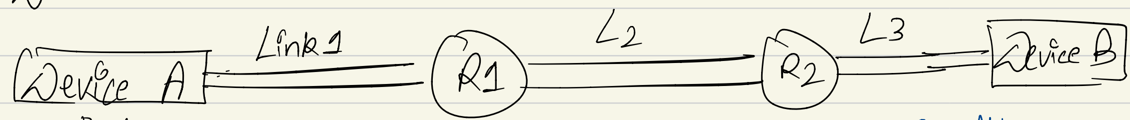
2011041

Assignment - 1

Q2



Transmission Rate : 400 Mbps = 4×10^8 bps | 100 Mbps = 10^8 bps | 200 Mbps = 2×10^8 bps

* Size of message A want to send = 100 KB = 10^5 bytes
* Propagation and processing delay = 0
* For Each packet, Meta-data = 100 bytes.

To reduce the time taken to deliver the msg, we can reduce the time delay, Propagation & processing delays are Zero, so we need to reduce Transmission delay.

$$\text{Transmission delay for a packet} = \frac{(\text{Packet Size})}{\text{Transmission Rate}}$$

Let us take different cases

Note :→ On same link two packets cannot travel.

a) 1 Packet

* Packet Size $= 100 \times 10^3 + 100$ bytes $= 100 \times 1001 \times 8$ bits

Total delay $= t_{L1} + t_{L2} + t_{L3}$

$$= \frac{100 \times 1001 \times 8}{400 \times 10^6} + \frac{100 \times 1001 \times 8}{100 \times 10^6} + \frac{100 \times 1001 \times 8}{200 \times 10^6}$$

$$= \boxed{14.014 \text{ ms}}$$

b) 10 packets

We will send 2^{nd} packet only when 1^{st} packet reaches at the end of $L1$.

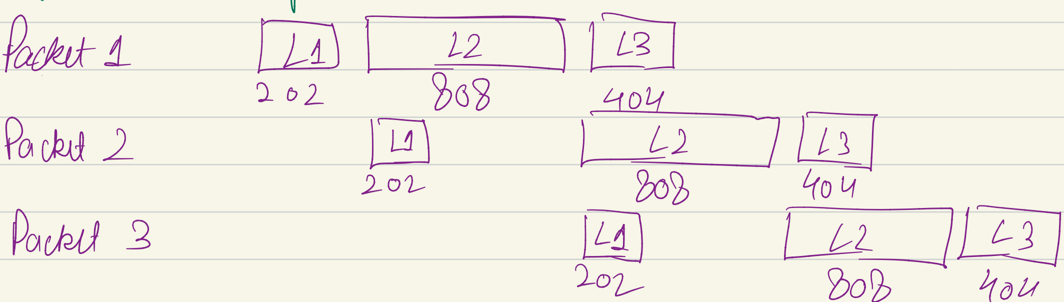
* Packet Size $= 100 + \frac{10^5}{10} = 10100 \times 8$ bits

$$(T.D)_{L1} = \frac{10100 \times 8}{400 \times 10^6} = 202 \ \mu s$$

$$(T.D)_{L2} = \frac{10100 \times 8}{100 \times 10^6} = 808 \ \mu s$$

$$(T.D)_{L3} = 404 \ \mu s.$$

Let us see what happens with 3 packets, then we can generalize it for n packets.



$$\therefore \text{Total time} = 202 + 404 + 3 \times 808$$

replace with n.

$\therefore$ for 10 packets $= 202 + 404 \times 10 \times 808 = \boxed{8686\ \mu s}$

c) 50 packets

* Packet Size $= 100 + \frac{10^5}{50} = 2100 \times 8$ bits

Delays $\Rightarrow$ $L1 = \frac{2100 \times 8}{400 \times 10^6} = 42\mu s$

$L2 = 168\mu s$

$L3 = 84\mu s$

Time $= 42 + 84 + 50 \times 168 = \boxed{8526\ \mu s}$

d) 100 pkts

* Packet Size $= 100 + \frac{100 \times 10^3}{100} = 1100 \times 8$ bits

Delays $\Rightarrow$ $L1 = \frac{1100 \times 8}{400 \times 10^6} = 22\mu s$

$L2 = 88\mu s$

$L3 = 44\mu s$

Time $: 22 + 44 + 100 \times 88 = \boxed{8866\ \mu s}$

$\therefore$ Minimum (delay) Time is for 50 packets

$\therefore$ $\boxed{\text{Ans} = 50 \text{ packets}}$

Q3

* Length of L_2 = 10 Kms = 10^4 mts = L
* Transmission Rate = 100 Gbps = 10^{11} bps = T.R
* Propagation Speed = $\frac{2}{3}c$ = 2×10^8 m/s = S

a) Propagation Delay = $\frac{L}{S} = \frac{10^4}{2\times10^8} \Rightarrow 50\mu s$.

b)

We need to find max^m bits on L_2 when first bit reaches R_2 from R_1.

* time taken to reach R_2 from R_1 = L/S sec
* bits released in (L/S) sec = $(T.R)\times(L/S)$ bits

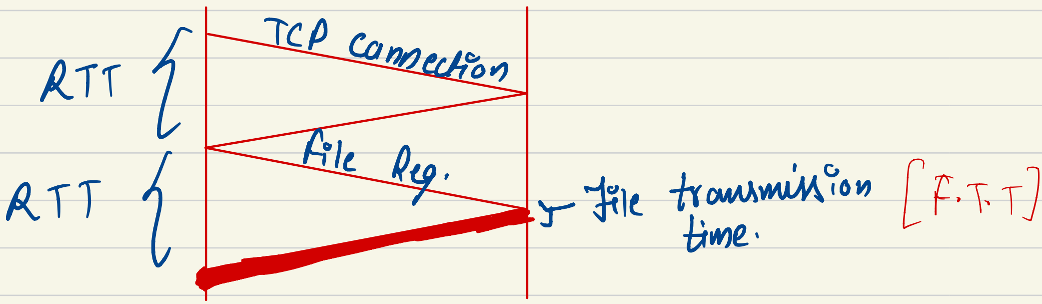
$\therefore$ Max^m bits on L_2 till 1st bit reaches R_2 from R_1 = $(T.R)\times(L/S) = 10^{11}\times50\times10^{-6}$
$= 5Mb$

c)
* In 1 Sec bit released = T.R
* In 1 sec distance covered = S
* length of 1 bit = $\frac{S}{R} = \frac{2\times10^8}{10^{11}}$ = 2 mm

Q4

* RTT between client & server = 10 ms
* Size of web page = 1 Kb
* Number of objects = 10
* Size of each object = 100 Kb

a) Non-Persistent [A TCP connection is established for every Request]



HTTP response time for loading web-page = (2RTT + file transmission time of HTML files)

HTTP response time for 10 objects = $10\left(2RTT + (F.T.T)_{object}\right)$

Total HTTP response time = $22RTT + (FTT)_{HTML} + 10(FTT)_{object}$

Assumption :- Neglecting FTT in comparision to RTT.

Total HTTP response time = 22 RTT = 0.22 sec.

b) Persistent [Single TCP connection]

$$\text{Total HTTP response time} = \underbrace{RTT}_{\text{TCP}} + \underbrace{RTT + (FTT)_{HTML}}_{\text{HTML}} + \underbrace{10[RTT + (FTT)_{object}]}_{\text{10 objects}}$$

$$= 12\,RTT + [(FTT)_{HTML} + 10(FTT)_{obj}]$$

$$= 12\,RTT \quad \text{[By Assumption]}$$

$$= 0.12 \text{ sec}$$

c) Persistent + Pipelined [All data are transferred in chucks in continous Stream]

$$\text{Total HTTP response time} = RTT + \underbrace{RTT + (FTT)_{HTML}}_{\text{to fetch Web page}}$$

$$+ \underbrace{RTT + (FTT)_{\underbrace{HTML + 10\,objects}_{\text{In pipelined way (chunks)}}}}_{\text{to fetch 10 objects at once}}$$

$$= 3RTT \quad \text{[By Assumption]}$$

$$= 0.03 \text{ sec.}$$

Note: If we consider t = file transmission time for 1 KB of data.

$(FTT)_{HTML} + (FTT)_{10\,objects} \Rightarrow (1Kb + 10 \times 100KB) \times t = 1001t$

If t is not negligible, add $1001t$ in final ans.

Q5.
a) 5 different protocols that I found.

1) ARP [Address Resolution Protocol]

* RFC no. = RFC 826

* Layer of operation = Data link layer

* Most of the applications use logical address (IP) to send / receive messages but actual communication happens over physical address. (from layer 2 [Data link])
* The function of ARP is to translate IP address to physical addresses.

2) TLS V1.2 [Transport Layer Security V 1.2]

* RFC no. = RFC 5246

* Layer of operation = Application Layer

TLS V1.2 used by endpoint devices & applications to authenticate and encrypt data securely when transferred over a network.

3) QUIC [Quick UDP internet connections]

* RFC no. = RFC 9000

* Layer of operation = Transport Layer

* This protocol improves performance of connection-oriented web applications using TCP protocol.

* Based on UDP & employs multiplexing.

4) TLS v1.3

* RFC no. = RFC

* Layer of operation = Transport Layer

* A major revision to the TLS protocol that is intended to provide better security & improve handshake performance.

5) MDNS [multicast DNS]

* RFC no. = RFC 6762

* Layer of operation = Data link layer

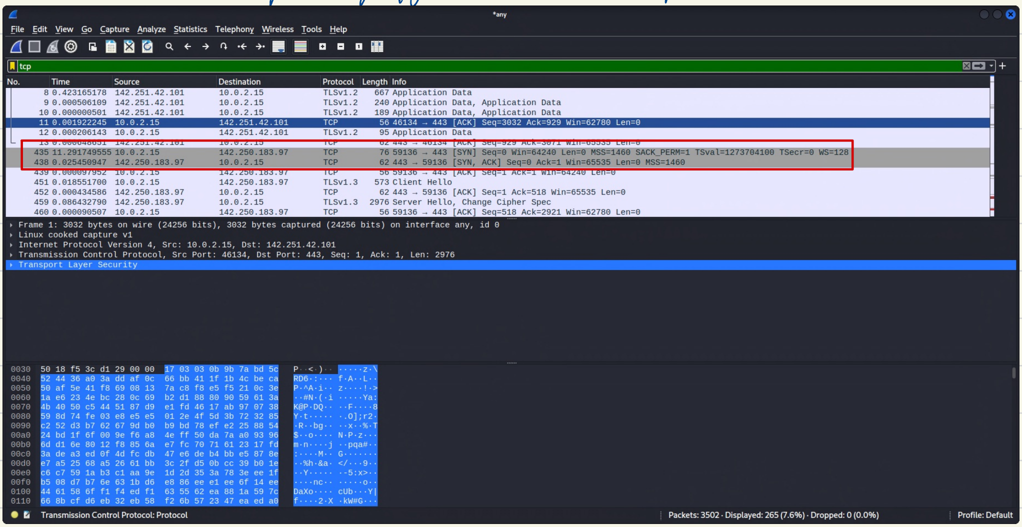
It resolves hostname to IP addresses in small networks that do not include a local name server.

b) * I Started playing a song on yotube to identify TCP handshakes on whireshark.

* I filter out TCP connections from all packet catches

* View -> time display format -> Seconds Since Previous Displayed packet

* This Settings helps/gives time elapsed in a TCP handshake

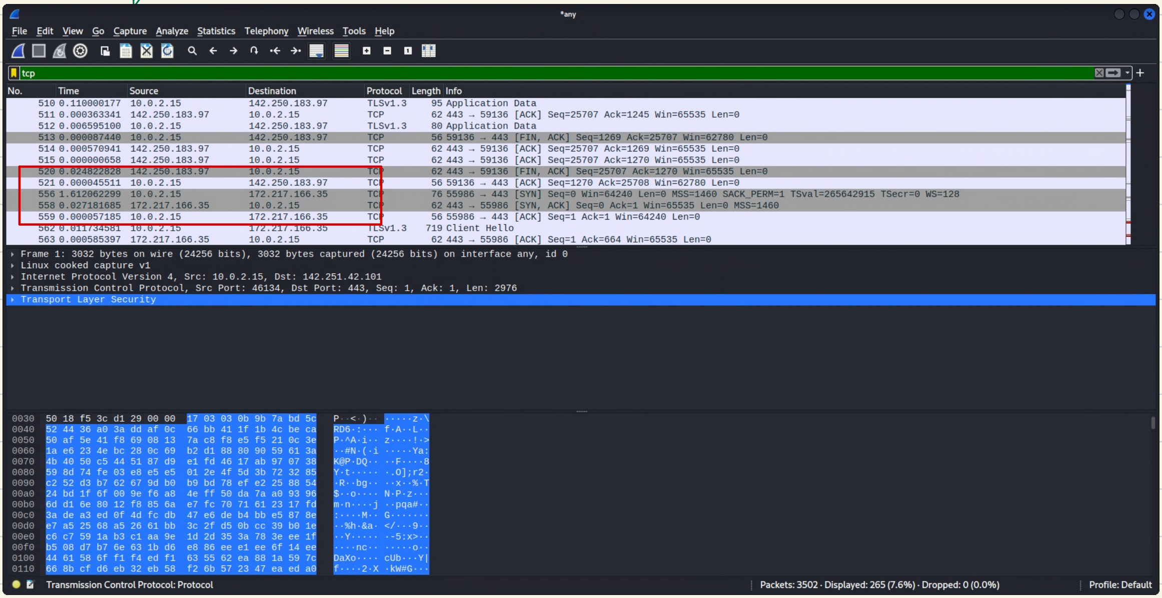


Here we can identify this as a TCP handshake, because Source is destination & destination

$\therefore$

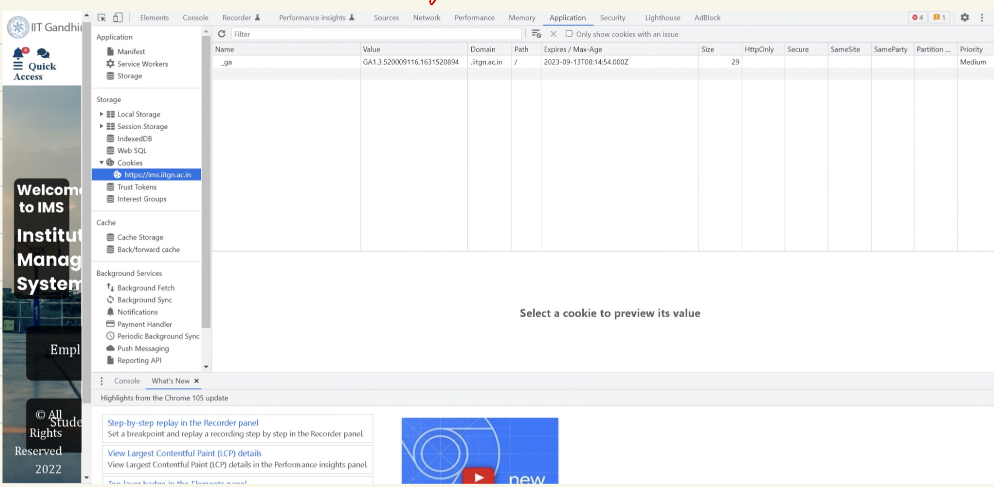
Time = 0.025450947 = RTT

Sim. for other TCP handshake



RTT = 0.02718685.

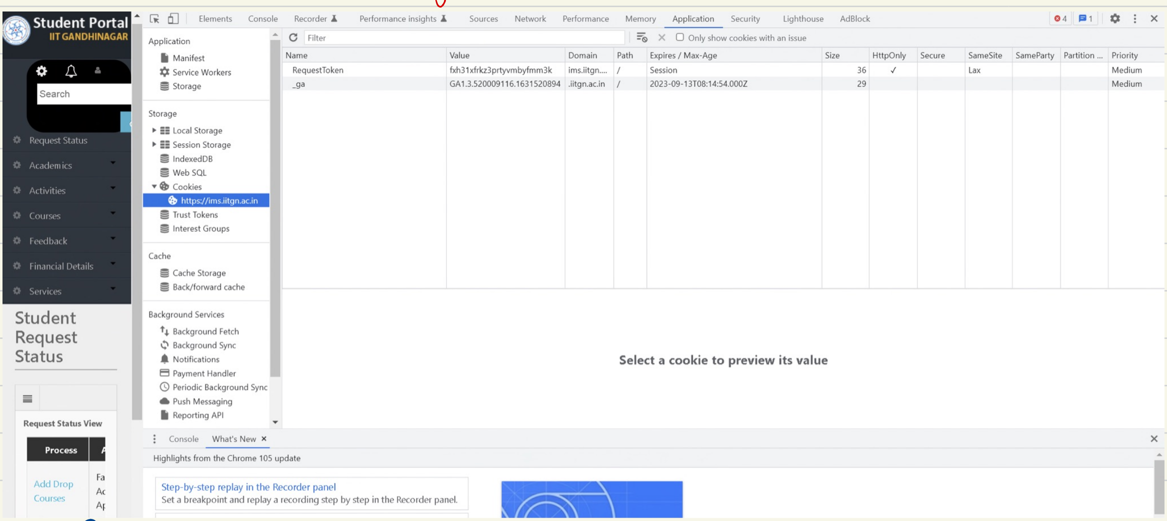
c) Cookies when loading ims.



Characteristics –

* It shows the domain which is .iitgn.ac.in
* Name of cookie
* Expiry date = 2023-09-13
* Size of cookie = 29
* Path of directory = '/'

Cookies when login as a Student.



Name	Value	Domain	Path	Expires / Max-Age	Size	HttpOnly	Secure	SameSite	SameParty	Partition ...	Priority
RequestToken	fxh31xfrkz3prtyvmbyfmm3k	ims.iitgn....	/	Session	36	✓		Lax			Medium
_ga	GA1.3.520009116.1631520894	.iitgn.ac.in	/	2023-09-13T08:14:54.000Z	29						Medium

Characteristics –

* Same domain [obv.]
* It has different name & value
* Same Path
* It is a session cookie which means it'll expire after we logout [session close].
* Size is 36 & it is Httponly.