Computer Networks

Fall 2023/24

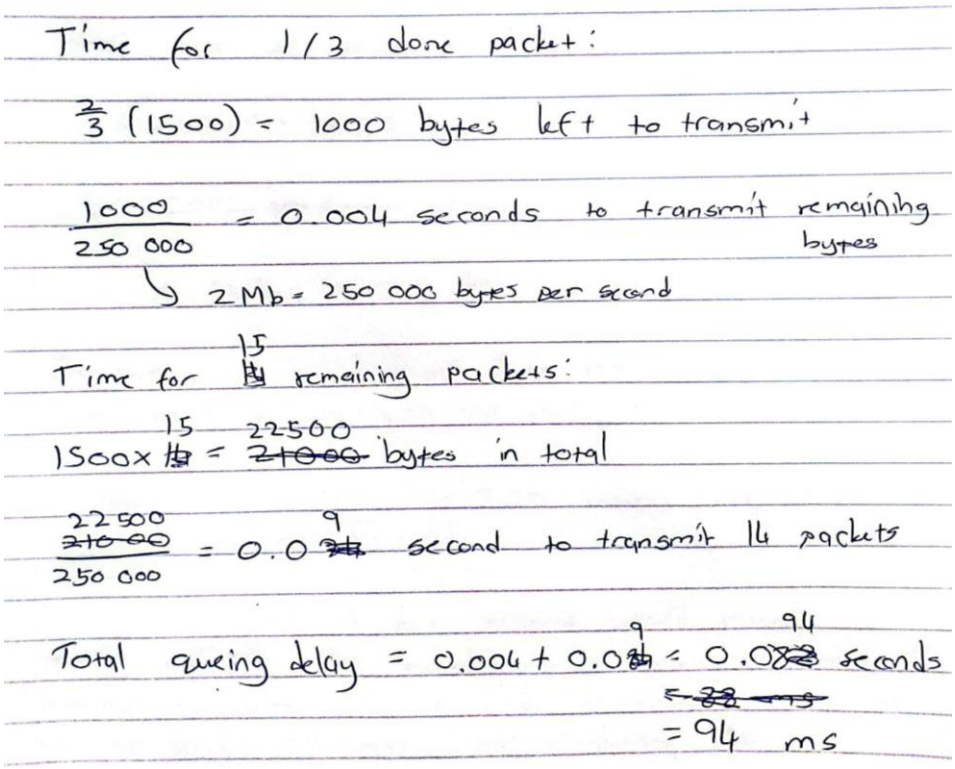
Exercise-1

Submission by Thursday, **7-1-2024** >>> **No late submissions will be accepted.** Submission is done by sending the solution to reichman.computer.networks@gmail.com The name of the submitted file must be Exercise1_username1.[suffix].
For example, Exercise1_israel-israeli.pdf. The first and last name of the student must appear.

Covers Chapter 1 from the textbook.

Problem 1.

A router receives packet P and determines the outbound link to which the packet should be forwarded. When P arrives, one other packet is **1/3** done being transmitted on this outbound link and **15** other packets are waiting to be transmitted on this outbound link (in a queue). Packets are transmitted in order of arrival. Suppose all the packets are **1500** bytes and the transmission rate is **2** Mbps (2M bits per second). What is the queuing delay for the packet P? That is, how much time does it take until P is at the head of the queue? Justify your answer.



Problem 2.

Suppose two hosts, A and B, are separated by **100,000** kilometers, and are connected by a direct link of R = **1** Mbps. Suppose the propagation speed over the link is **$2.5*10^8$** meters/sec.

(a) What is the propagation delay ?
(b) Consider sending a file of 532,000 bits from host A to B. Suppose the file is sent continuously as one big message. What is the maximum number of bits that will be in the link at any given time?
(c) What is the width (in meters) of a bit in the link (when there is a maximum number of bits in the link)?
(d) How the width of a bit will be effected if we increase the distance between A and B?
(e) How the width of a bit will be effected if we increase the propagation speed? (f) How the width of a bit will be effected if we increase R ? Justify your answers.

a) $\frac{10^8}{2.5\times 10^8} \rightarrow$ 100 000 km = 10^8 meters

$= 0.4$ seconds propagation delay

~~b) 2.5 × 1 Mbps = 2.5 Mb~~

~~∴ 2500000 bits are on~~

b) 0.4 × 1 Mbps = 0.4 Mb = 400 000 bits

∴ The maximum number of bits on the link at any given moment is 400 000 bits

c) ~~toc~~ $\frac{10^8 \text{ meters}}{400\,000 \text{ bits}}$ = 250 meters per bit

d) The width of a bit ~~would~~ would remain the same, ~~at because~~ the ~~number of bits~~ maximum number of bits on the link increases proportionally to the length of the link, ensuring that each bit length will be 250 meters.

e) Increasing the propagation speed would increase the width of a bit as a larger propagation speed results in a lower ~~number of maxim~~ maximum number of bits on the link at any given time, and since the length of the link remained the same, there is more space for each bit.

f) Increasing ~~the~~ P would decrease the width of a bit as a faster transmission rate results in a larger amount of bits on the wire at any given time, and since the length of the wire remained the same, there is less space for each bit.

Problem 3.

We wish to send a file of size **360** Mbit from source A to destination B. There are exactly **21** routers on the only existing route between A and B. All the links along the route between A and B support a transmission rate of **6** Mbps, except for the first link which supports a transmission rate of **4** Mbps, the last link which supports a transmission rate of **3** Mbps. Notice that the first link is the link between A and the first router and not the link between the first two routers! The last link is between the last router and B. The propagation speed between A and B is $2*10^8$ meter/sec and the distance is **10,000** km (that is, 10^7meter). We assume the file is divided into **10** equal-size packets for transmission (each of size **36** Mbit), all the routers implement store and forward techniques, and we are disregarding headers overhead. In addition, we assume that when a router is free, it can send a packet as soon as it gets the whole packet.

How much time in seconds will it take for the last bit of the file to reach host B?

Important: Notice that the transmission rate of the last link is **smaller** than that of the other links!

Justify your answer.

Transmission delay:

$\frac{36}{4} + \left(\frac{36}{6}\right)\cdot 20 + \frac{36}{3} = 141$ seconds

1st link — 20 middle links — last link

Propagation delay:

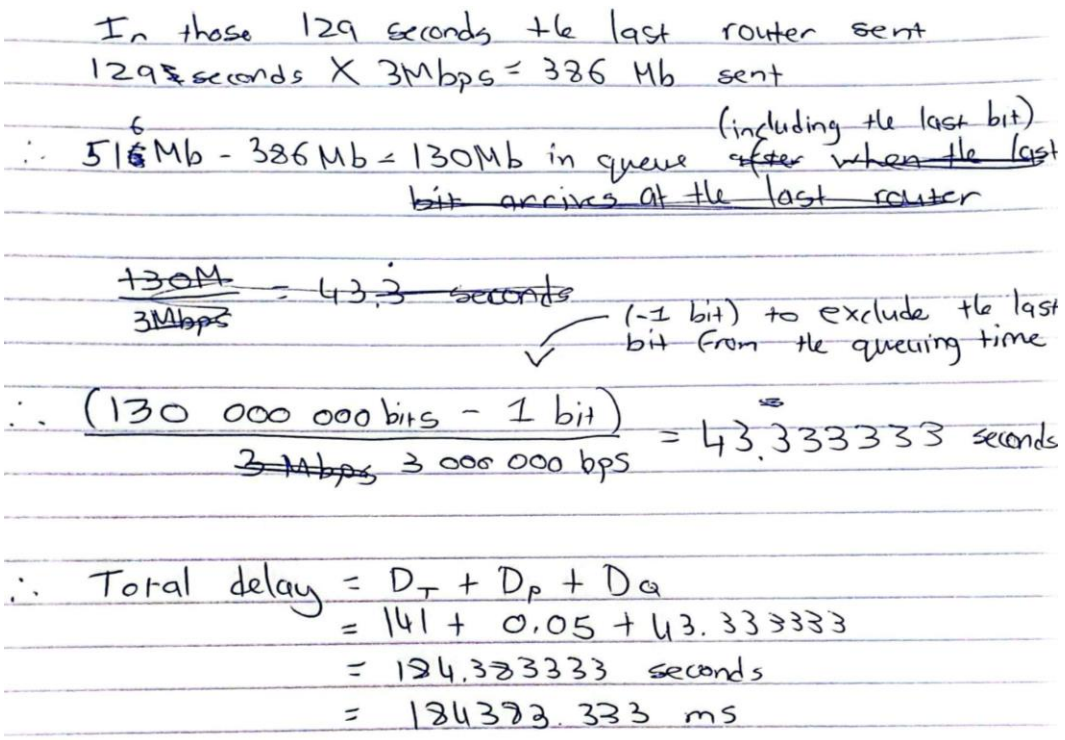
$\frac{10^7}{2\times10^8} = 0.05$ seconds

Queuing Delay:

It takes the last bit to reach the last link $\frac{36}{4} + 20\left(\frac{36}{6}\right) = 129$ seconds

In those 129 seconds, the last router recieved 129 seconds × 4Mbps = 516 Mb recieved

↑ speed of first link transmission + transmission (the other 20 links have faster and therefor the no queuing delay in those 20 links



Problem 4.

Find the domain names (i.e., URL's) that are associated with the following IP addresses:

a. 66.161.11.20
b. 80.67.70.22
c. 67.15.82.48
d. 207.171.166.252

Shortly explain how you solved this problem.

a. webgod.linksys.com
b. www-8cc.akamai.com
c. www.skype.com
d. 166-252.amazon.com

To find all the domain names I opened the command prompt, and for each IP address typed the command "nslookup [IP Address]", and the output gives me the domain name.

Problem 5.

Using only notepad please compose an HTML page, that includes:

1. The moving title in blue color: **Computer networks 2023: Exercise 1**
2. A fixed title in red color with your **full names**.
3. **Two** images centered, side by side, at the middle of the page (You may choose whatever picture you want.)
4. A link to the course website.
5. Another link to your favorite website.
6. A horizontal line.
7. An HTML Form containing: Sender, Receiver, Subject, Message Field, and Submit bottom.

You may want to use a table to better align your page. Please submit the page and the two images with your exercise. You are welcome to use the following link to help in completing HTML question: http://htmlgoodies.earthweb.com/primers/primer_1.html, http://www.w3schools.com/html/ .
(This is the only place where we will deal with HTML in the course.)

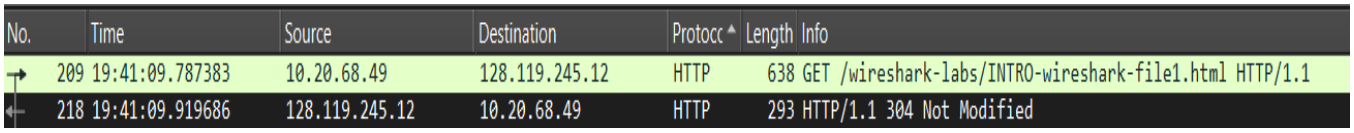
Answer: have to attach a proper HTML page.

Problem 6.

Enclosed please find the documents “Wireshark Lab: Getting Started” The goal of this first Lab is to introduce you to Wireshark.
At the end of the lab there are **4** simple questions that will demonstrate that you have been able to get Wireshark up and running. Answer these **4** questions. Where applicable, justify your answers using screen captures.

1. ARP, DHCP, DHCPv6, DNS, HTTP, ICMP, ICMPv6, IGMPv2, IGMPv3, LLC, LLMNR, MDNS, MNDP, NBNS, SSDP, STP, STUN, TCP, TLSv1.2, UDP

2. 0.132303 seconds = 132.303 ms
3. My Address: 10.20.68.49
   gaia.cs.umass.edu Address: 128.119.245.12



No.	Time	Source	Destination	Protocc	Length	Info
209	19:41:09.787383	10.20.68.49	128.119.245.12	HTTP	638	GET /wireshark-labs/INTRO-wireshark-file1.html HTTP/1.1
218	19:41:09.919686	128.119.245.12	10.20.68.49	HTTP	293	HTTP/1.1 304 Not Modified

4. See file "HTTP-packets.pdf"