FACULTY OF ENGINEERING
DEPARTMENT OF COMPUTER ENGINEERING
CENG435 DATA COMMUNICATIONS AND NETWORKING
2023-2024 Fall, MIDTERM EXAM PART II *prepared by* Ertan Onur

ORTA DOĞU TEKNİK ÜNİVERSİTESİ
MIDDLE EAST TECHNICAL UNIVERSITY

November 20, 2023 18:00

Name: ERTAN ONUR Number: Signature:

1. (3 points) Suppose within your Web browser you click on a link to obtain a Web page. The IP address for the associated URL is not cached in your local host or in your local DNS, so a DNS lookup is necessary to obtain the IP address. Suppose that 2 external DNS servers are visited iteratively by the local DNS before your host receives the IP address from DNS; each external DNS visit incurs an average round-trip-time (RTT) of 1 seconds. Further suppose that the Web page associated with the link contains exactly 8 small objects residing on the same server. The RTT between the local host and the web server containing the object is 100 milliseconds. The RTT between the local host and the local DNS is 10 milliseconds. Assuming zero transmission time of the object (they are small!), consider two cases:
a. Non-persistent HTTP with no parallel TCP connections.
b. Persistent HTTP (with no parallel TCP connections.)
Let T_a represent the time to download all of the objects for case a and T_b for case b. **Plot a picture for the scenario** and calculate $T_a - T_b$. **Show all your work.**

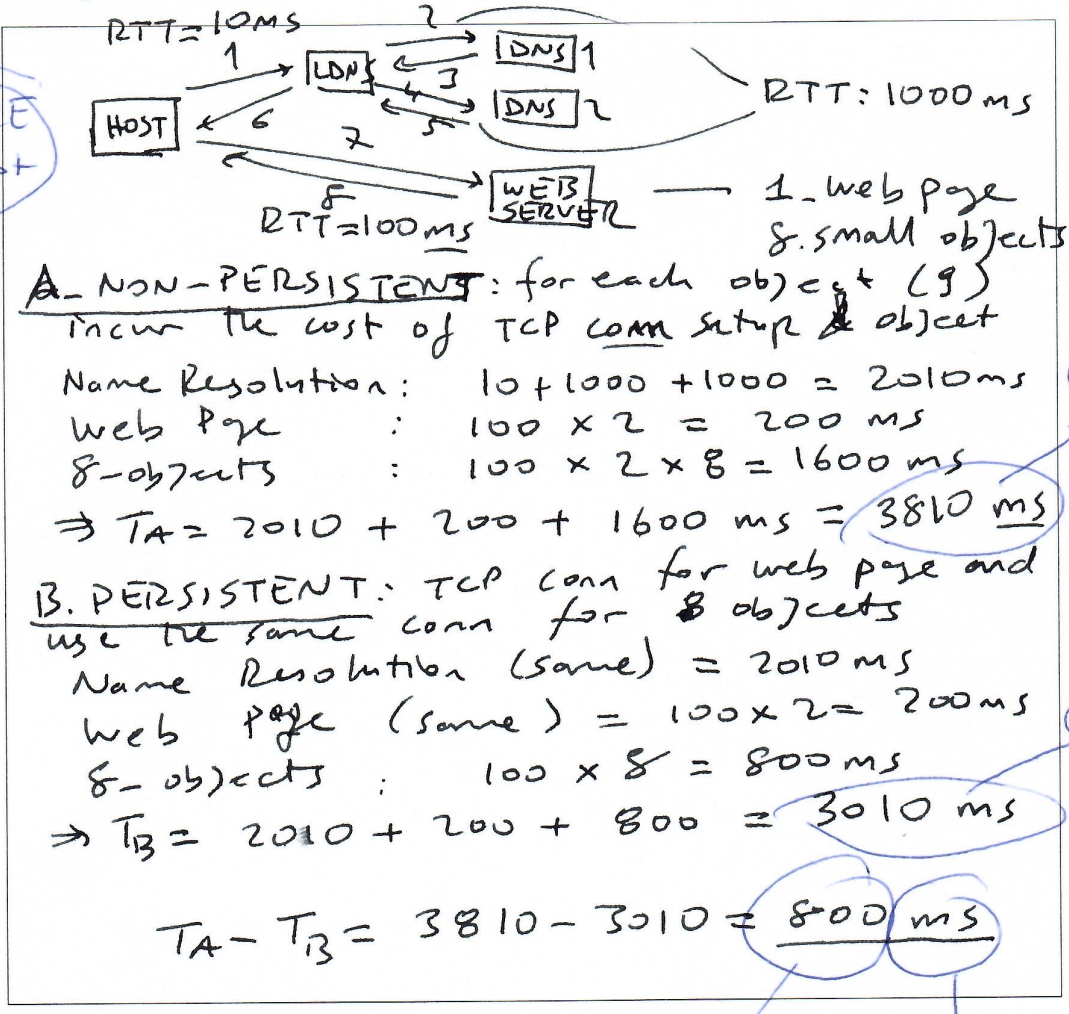

FIGURE 0.5 pt

A- NON-PERSISTENT: for each object (9) incur the cost of TCP conn setup & object

Name Resolution: 10 + 1000 + 1000 = 2010 ms
Web Page : 100 × 2 = 200 ms
8-objects : 100 × 2 × 8 = 1600 ms
⇒ T_A = 2010 + 200 + 1600 ms = 3810 ms

0.8 pt

B. PERSISTENT: TCP conn for web page and use the same conn for 8 objects

Name Resolution (same) = 2010 ms
Web page (same) = 100 × 2 = 200 ms
8-objects : 100 × 8 = 800 ms
⇒ T_B = 2010 + 200 + 800 = 3010 ms

0.8 pt

$T_A - T_B$ = 3810 − 3010 = 800 ms

$T_A - T_B$ correct 0.4 pt

UNITS 0.5 pt

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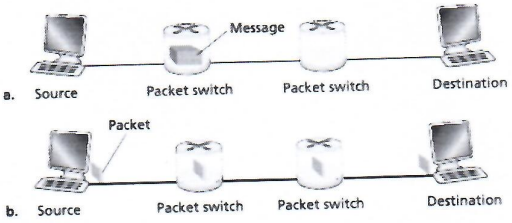
2. (3 points) The end-to-end transport of a message with and without message segmentation in a packet-switched network where **store-and-forward** packet switching is employed is shown in the following figure.

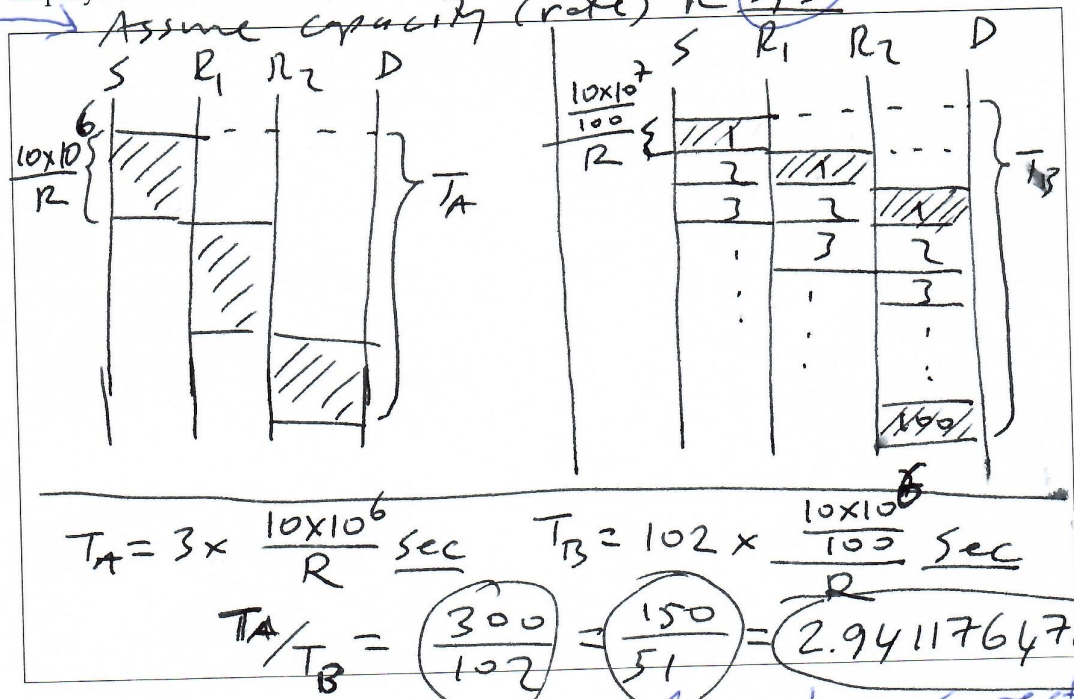


(a) without message segmentation, (b) with message segmentation.

Consider a 10 Mbits long message that is to be sent from source to destination. Ignore propagation, queuing, and processing delays. Assume all links have the same capacity. Consider two cases:
A. sending the message from source to destination without message segmentation,
B. sending the message employing message segmentation where the message is segmented into 100 packets (with each packet being 100 Kbits long.)
Considering the topology given in the above figure, let T_a represent the time in seconds to move the message to the destination from the source when message segmentation is **not employed** "as in case A". Let T_b represent the time in seconds to move the message to the destination from the source when **message segmentation** "as in case B" is employed. Calculate T_a/T_b, **show all your work?**

Assumptions

Assume capacity (rate) R bps unit



$T_A = 3 \times \frac{10 \times 10^6}{R}$ sec $\quad T_B = 102 \times \frac{\frac{10 \times 10^6}{100}}{R}$ sec

$T_A/T_B = \frac{300}{102} = \frac{150}{51} = 2.941176470\overline{59}$

$\frac{50}{17}$ $\frac{100}{34}$

Assume no headers

- Assumptions correct 0.5 pts
- T_A correct 1.0 pts
- T_B correct 1.0 pts
- T_A/T_B correct 0.5 pts