



Indian Institute of Technology Indore
Department of Computer Science and Engineering
Computer Networks (CS 306)
Spring 2020-21, Mid Semester Examination, Date: Jan 31, 2021
Course Instructor: Dr. Bodhisatwa Mazumdar
Max Marks: 30

Please read the following instructions carefully. Strict adherence to instructions is a must.

- (1) Attempt all questions. The question paper has two sections. Each section has to be submitted within its time limit.
- (2) The MSE answer-scripts must be sent to **cs306.iiti@gmail.com** before the end of completion time of exam. Answer-script sent to any other email-id will not be evaluated.
- (3) The **submission file for Section A must have the following taxonomy for the filename:** `<Student_Roll_Number>_MSE_SectionA.pdf`
The **subject line of the submission email for Section A must be** in the following format: `<Student_Roll_Number>:MSE_Section_A`
- (4) The **submission file for Section B must have the following taxonomy for the filename:** `<Student_Roll_Number>_MSE_SectionB.pdf`
The **subject line of the submission email for Section B must be** in the following format: `<Student_Roll_Number>:MSE_Section_B`
- (5) Emails with any other subject line shall not be considered for evaluation. The submitted scanned answer-script must have a good visual clarity. Blurred answer-scripts and answer-scripts with changing orientation between the pages, shall be liable for marks deduction.
- (6) If submissions from two (or more) students are found similar in text in whole or in part(s), it may affect the evaluation of all involved students.

Time for Section A: 14:30 to 15:30 hrs Time for Section B: 15:30 to 16:30 hrs

Section A

1. (a) Consider queuing delay in a router buffer. State the factors on which the length of queuing delay depends. When is the packet's queuing delay zero? When will be the queuing delay large?

(2)

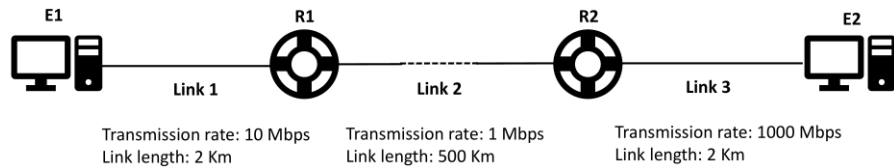


Figure 1: End systems with two routers.

- (b) Consider Figure 1 comprising end systems $E1$ and $E2$ and routers $R1$ and $R2$, and the tree links between them. Each link is specified with its transmission rate and link length. Assuming the length of the packet is 12Kbits, and the propagation delay of 3×10^8 m/s. Compute the transmission delay of Link 1, Link 2, and Link 3. Compute the propagation delay and total delay of Link 1, Link 2, and Link 3. (1 + 1 + 1)
- (a) Consider the case of sending a packet of L bits from one end system to another. The path comprises N links each of rate R . What is the end-to-end delay for this packet transmission? Compute the delay for sending P such packets back-to-back over the N links. ($\frac{1}{2} + \frac{1}{2}$)
 - (b) What are the component delays of a router node delay? Which of these delays influences the router's maximum throughput? ($\frac{1}{2} + \frac{1}{2}$)
 - (c) Explain the different forms of multiplexing in circuit switched network. How are circuit switched networks different from packet switched networks? (1+2)
- (a) Consider an HTTP server and client with the RTT delay between them of 30ms. The transmission delay of a webpage containing an object on the server to its outgoing link is 0.75 ms. An HTTP message containing no object has a zero transmission delay. Consider the case that the client makes 90 requests in sequence. In this process, the client waits for a reply to a request before sending the next request. Assume the client is using HTTP 1.1 and the IF-MODIFIED-SINCE header line. Assume 30% of the objects requested have not changed since the client downloaded them (before these 90 downloads are performed). How much time elapses (in milliseconds) between the client transmitting the first request, and the receipt of the last requested object? (2)
 - (b) Describe the differences between persistent and non-persistent HTTP connection. Explain the difference with respect to the RTT of a request and receipt of an HTML file. (3)

Section B

4. (a) Suppose a user attempts to access `gaia.cs.umass.edu`. However, the browser on his client system does not know the IP address of the webpage. What is the difference between iterative and recursive DNS query with respect to Fig 2. (3)

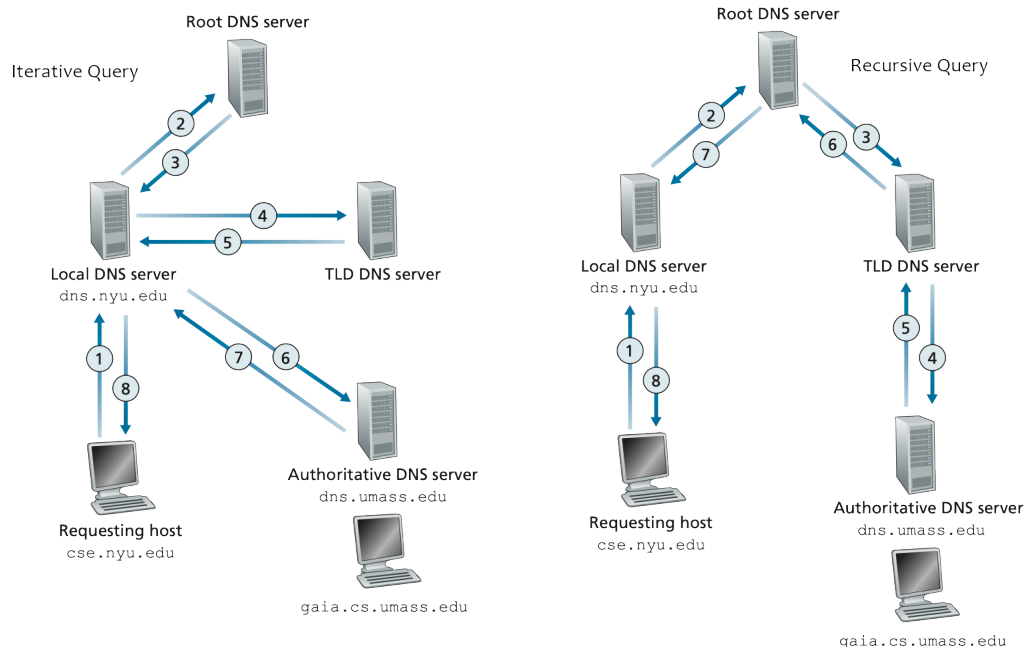


Figure 2: Iterated and Recursive DNS query.

- (b) How DNS caching occurs? Explain with the help of Figure 2. (2)
5. (a) For message transfer, the UDP server described needed only one socket, whereas the TCP server needed two sockets. Why? If the TCP server were to support n simultaneous connections, each from a different client host, how many sockets would the TCP server need? Justify. (1+1)
- (b) With the help of suitable diagrams, describe the interaction between the client and server programs considering TCP as the underlying transport layer protocol. (3)
6. (a) For the client-server application over TCP, why must the server program be executed before the client program? For the client-server application over UDP, why may the client program be executed before the server program? Justify. (1+1)

- (b) Compare the file distribution times in client-server architecture with that of P2P architecture. **(2)**
- (c) In BitTorrent file distribution system, explain the process of a peer joining the torrent. **(1)**