

Assignment -1

(100 points)

Due on August 23, 2020 23:59

Basics of Internet (30 points)

1. What is Internet? Distinguish between Internet and internet. (5 points)
2. Distinguish the Access and Core networks. (5 points)
3. Compare the ISO/OSI networking model with the TCP/IP model, and describe the pros and cons of layered architecture. (10 points)
4. Consider you have a 100MB file on your computer and you need to upload it to a server machine on a Campus network. You are connected through a WiFi that has a maximum of 54 Mbps bandwidth and has reliable transmission probability of 0.6. You are also connected on a wired network with a link bandwidth of 20Mbps. The core network connecting the server has a bandwidth of 50Mbps. Now answer the following (10 points)
 - a. Determine the total time needed to upload the file if you use the wired interface (2pt)
 - b. Determine the total time needed to upload the file using the WiFi (2pt)
 - c. Determine the total time needed to upload the file when you can use both the interfaces simultaneously to transmit data (3pt).
 - d. Suppose the bandwidth of the core network is doubled, what is the impact on total time to upload the file? (3pt)

Circuit Switching vs Packet Switching (20 points)

5. Discuss Circuit switching and packet switching networks. List the pros and cons of both the approaches (5 points)
6. Distinguish TDM and FDM. Present any two real-life use cases (one each for TDM and FDM) where you would apply TDM and FDM? (5points)
7. Consider a shared network link with capacity of 250Mbps and consider that each user requires 30Mbps to transmit data and are active only 20% of the time. Now answer the following questions: (10 points total)
 - (a) What is the maximum number of users that can be supported with circuit switching? (2pt)
 - (b) What is the maximum possible number of users that can be supported with packet switching mode (assume the link capacity is fully utilized and users share without contention)? (4pt).
 - (c) Assuming a total of 10 users, what is the probability that a given specific user is transmitting and rest of the users are idle? (4pt).

Web and HTTP (40 points)

8. 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, so a DNS lookup is necessary to obtain the IP address. Suppose that your local DNS server has cached the TLD Name Server's address. Thus, a number N of DNS servers are visited (starting with your local DNS server which has the cached entry for the TLD DNS) before your host receives the IP address from DNS. What is the number N of DNS servers visited? Assume the successive visits (including the local DNS) incur an RTT of RTT_1, \dots, RTT_N . Further suppose that the Web page associated with the link contains exactly one object, consisting of a small amount of HTML text. Let RTT_0 denote the RTT between the local host and the server containing the object. Assuming zero transmission time of the object, how much time elapses from when the client clicks on the link until the client receives the object? Ignore all transport protocol effects. (10 points)
9. Referring to Problem 8, suppose the HTML file references three (3) very small objects on the same server. Neglecting transmission times, how much time elapses with following modes: (10 points)
 - (a) Non-persistent HTTP (with no parallel TCP connections)? (5 points)
 - (b) Persistent HTTP (with no parallel TCP connections)? (5 points)
10. How does the "Last Modified" header line help in the HTTP protocol? (2 points)
11. Describe the use of the "If-Modified-Since" header in the HTTP protocol. (3 points)
12. What is the role of a HTTP proxy server in network? What does it do when it gets requests from a client browser and response from a server? What does it do when it gets a subsequent request from a different client? (5 points)
13. Consider the campus network with 1000Mbps LAN and 200Mbps access link connecting to the public Internet with RTT of 1 second. Let us suppose the average request size and rate to be 100KB and 30 requests per second respectively. (10 points)
 - (a) What is the average LAN utilization and access link utilization? (2points)
 - (b) In the current setup would it be useful to deploy a Local web cache in the campus network and why? (2point)
 - (c) Now let us consider the number of active users increases by 100 fold and accordingly the active requests per second increased by 100x. Now what is the LAN and Link utilization? (2 points)
 - (d) If the local cache is deployed and it is observed to have a hit rate of 0.7. What is the impact on LAN and access link utilizations and what is the impact on total delay? (4 points)

Tools (10 points)

14. Consider the host IP address to be 10.0.0.1. Specify either the tcpdump or Wireshark filter rule that can enable to capture the following traffic cases.
- (a) Capture only the outgoing ICMP Echo response messages (1pt)
 - (b) Capture only the incoming ICMP Echo request and corresponding outgoing Echo response messages (2pt)
 - (c) Capture the HTTP and HTTPS traffic (2pt)
 - (d) Assume the Google servers use the IP address in the 172. 18. X. X. Capture all the traffic exchanged with the Google. (4pt)
 - (e) Capture all the DNS traffic (1pt).

Grace Question (10 points)

15. Consider a packet switched network with bandwidth of 10MBps (all the links). Source needs to send a message of size 1000 bytes. Source will packetize the data and transmit to the receiver. Each packet that needs to be transmitted need to add an additional 100 bytes header per packet.

- (1) Consider the propagation and processing delays are zero. Identify which of the below configurations would result in minimum time for delivering the message to the receiver. (5 points)
- e. 1 Packet
 - f. 5 packets
 - g. 10 packets
 - h. 20 packets

16. Now consider the same topology. Assume the Queue at each intermediate device can only hold 2 packets and the sender/router has to wait when the queue is full. How would this affect the overall transmission delay? (5 points)

