Homework 1 CS 352 Due 5PM Oct 4, 2021

15 Questions (0.5 point for first 10 questions, 2 points for last 5 questions)

1. List Five Layers of **Internet Protocol Stack** and Seven Layers of **ISO/OSI** Reference Model

    Five Layers of **Internet Protocol Stack**： application, transport, network, link, physical

    Seven Layers of **ISO/OSI** Reference Model: application, presentation, session, transport, network, link, physical

2. List Three Different Access Networks

    Home Access Network: DSL or Cable

    Institutional Network

    Wireless access networks

3. List Four Sources of Packet **Delay**

    nodal processing
    queueing delay
    transmission delay
    propagation delay

4. What is the key difference between **circuit-switched** network and **packet-switched** network

    Packet Switching is store and forward: entire packet must arrive at router before it can be transmitted on next link. Yet, Circuit Switching is for reserved resources, and it is end-end resources reserved for "call" between source & dest.

5. List Two Differences between **Servers** and **Clients** in a Client-Server (CS) Architecture

1. Sever is not always on host, but clients may not be always connected.

2. Sever has permanent IP address, but clients may have dynamic IP addresses.

6. List of Two Drawbacks of a Centralized DNS Solution

Single point of failure, and traffic volume

7. List key difference between **Nonpersistent** HTTP and **Persistent** HTTP

Nonpersistent HTTP: At most one object is sent over a single TCP connection. HTTP/1.0 uses nonpersistent HTTP.

Persistent HTTP: Multiple objects can be sent over a single TCP connection between client and server. HTTP/1.1 uses persistent connections in default mode.

8. List Three Advantages of Content Distribution Networks (CDN)

1. Reduce bandwidth requirements of content provider。

2. Reduce $$ of maintaining Servers.

3. Cache for server content.

9. List key difference between **Active** FTP and **Passive** FTP connection

Active connection is Data connection initiated from server, but passive connection always client initiated.

10. List key difference between Short Message Transfer Protocol (SMTP) and Mail Access Protocol (MAP)

SMTP: delivery/storage to receiver's server.

Mail access protocol: retrieval from server.

11: Consider the following circuit-switched network in Fig 1, and four switches A, B, C and D, going in the clockwise direction, and 4 circuits on each link.

(i)   In this network, calculate the maximum number of connections that can be in progress simultaneously at any one time?

(ii)   If all connections are between switches A and C, what is the maximum number of connections that can be in progress simultaneously?

(iii)   If we want to have 4 connections between A and C, and another 4 connections between B and D. Can we route these calls through the 4 links to accommodate all 8 connections?
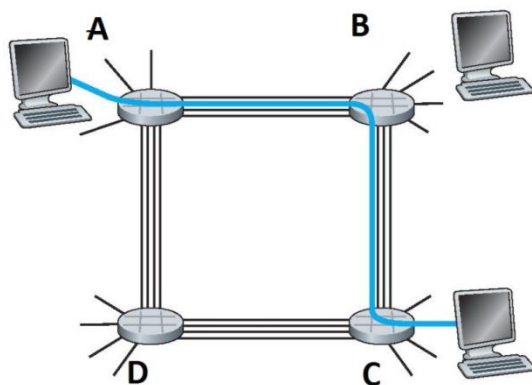

Fig 1

(i) . we can have 16 connections in one time. (For each switch, it has 4 connections with the adjacent switches.

(ii). Maximum number of connection is 8. Because each switch can   be   passed   by   4 connections.

(iii)   .Yes, we can have two connections for B-D passing A, and the other two connections passing C. Also, for A-C, we can have two connections passing B, and two connections passing D.

Mentioned in 33/67 in 1st lecture (List this for review)

12: Consider the throughput example corresponding to Fig.2. If we have are M client-server pairs instead of 10. Denote Rs, Rc, and R for the rates of the server links, client links, and network link. If all other links have enough capacity and that there is no other traffic in the network besides the traffic generated by the M client-server pairs. Please derive a general expression for throughput in terms of Rs , Rc , R , and M .
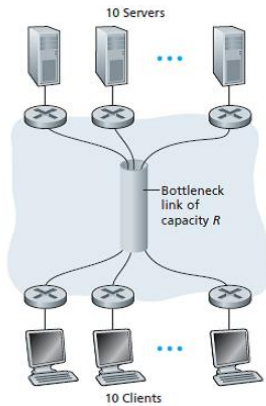

10 Servers

Bottleneck
link of
capacity R

10 Clients

Fig 2

general expression for throughput in terms of Rs, Rc, R, and M is min (Rc, Rs, R/M).

Mentioned in 49/67 in 1st lecture.

13: Assume an HTTP client that wants to obtain a web document at a given URL. The IP address of the HTTP server is unknown at first. The web document at the URL has one embedded GIF image that resides at the same server as the original document. What transport and application layer protocols besides HTTP are needed in this scenario?

DNS (for getting IP address), TCP (used for HTML) , and UDP (used for DNS).

Mentioned in 2ⁿᵈ and 3ʳᵈ lectures

14: Suppose you click on a link to obtain a Web page in your Web browser. The IP address for the associated URL is not cached in your local host, so a DNS lookup is necessary to obtain this IP address. Assume that n DNS servers are visited before your host receives the IP address from DNS; the successive visits incur an RTT of RTT1,...,RTTn. Further assume that the Web page associated with the link contains exactly one object, consisting of a small amount of HTML text. Let RTT0 denote the RTT between the local host and the server containing this object. Assuming zero transmission time of the object, how much time it will take from when the client clicks on the link until the client receives the object?

RTT1 + RTT2 + RTT3 + ... + RTTn for transmitting time.

When we get to know IP address, we need RTT0 for connecting and RTT0 for receiving.

So it is 2 * RTT0 + RTT1 + RTT2 + ... + RTTn

Mentioned in 32/37 in 3rd lecture

15: Referring to the above problem, suppose this HTML file references 8 very small objects on the same server. Neglecting transmission times, how much time elapses with (i) Non-persistent HTTP with no parallel TCP connections? (ii) Non-persistent HTTP with the browser configured for 5 parallel connections? (iii) Persistent HTTP?

(i) . $2 * RTT0 + 8 * 2 RTT0 + RTT1 + RTT2 + ... + RTTn = 18 * RTT0 + RTT1 + RTT2 + ...RTTn$ (requires 2 RTT0 per object)

(ii). $2 * RTT0 + 2 * 2 RTT0 + RTT1 + RTT2 + ...+ RTTn = 6 * RTT0 + RTT1 + RTT2 + ... + RTTn$ (Having 5 parallel, so it is just 4 additional here)

(iii) $2 * RTT0 + RTT0 + RTT1 + RTT2 + ...+ RTTn = 3 * RTT0 + RTT1 + RTT2 + ... + RTTn$ (Persistent, so just one more RTT0 here)

Mentioned in 32-33 in 3rd lecture