COMP 6461 Theory Assignment 1

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1. Circuit Switching aims at providing a better service through the reservation of the circuit (i.e. circuit is dedicated). Now, considering only the perspective of the communicating users over a Circuit Switching network (i.e. you should not be concerned with the entire utilization of the network or the advantages to other users), is it possible that Circuit Switching may actually end up harming its users instead of providing a better service to them. If yes, provide a scenario/case that shows that. If no, explain why this service will indeed provide the best service to its users at all times.

It is possible that circuit switching may actually end up harming its users instead of providing better service to them as circuit switching can service limited number of users at a time. For example, 1Gbps link where each user is active 10% of time and uses 100Mbps when active. Circuit switching will service 10 users maximum at a time thus harming other users to who want to connect to the network by increasing their waiting time. Even if the user is not exchanging the data the circuit remains reserved for that user until it breaks the connection thus wasting resource.

2. With DSL ISPs, dedicated lines usually connect to the local offices to the location where the service is provided (i.e. residential homes). In contrast, with Cable ISPs, the connection is shared between multiple homes in a neighborhood. In spite of this configuration that is clearly to the benefit of DSL users, service provided by Cable ISPs may still be superior to the one provided by DSL providers. Explain the reasons behind this. Further, if you are hired by a DSL provider, and taking into account that changes to the company's infrastructure (i.e. wiring) is quite costly, what would you propose in order to speed up the provided service while balancing the cost.

DSL uses FDM so the speed is constant, while cable uses TDM which allows higher speed based on number of users. So the best way to increase speed with DSL is to use fiber optics from ISP to the neighbourhood area, then use regular pre-existing copper wires to connect to the users. Simply put, cable ISP can offer better service to its client due to the superiority of its coaxial cable over the thin-copper wire used by DSL. DSL's cable was designed for telephone communication, not for high data transmission. The DSL's smaller cable means that the signal degrades over distance, meaning that clients who are far from the local office will have poor performance. As an employee of a DSL company, I would suggest that we use an optical fibre cable to an optical network unit located somewhere between the local office and the clients. This solution is cheaper than connecting each client directly with fiber optic cable, but it sufficiently reduces the length that the data must be transmitted over the copper wire.

3. HTP provides two connections methods: persistent and non-persistent. While there are clear advantages of persistent-HTTP, it is rather unclear whether non-persistent can be of any use. Conduct a small research to find out why these two modes of connections are provided. In specific, you should find out some of the advantages and disadvantages of each of them, hence justifying their concurrent existence.

Persistent and non-persistent communication modes are important. There are scenarios where only a single response is required from HTTP request such as simple get and post request on webform in which there is no need to have persistent connection. However, in order to retrieve multiple objects, we can use persistent connection to get those objects in connection.

Non-persistent Pros and Cons:

• Unused resources are freed immediately.

• 2RTT per object

Persistent Pros and Cons:

• Allows for HTTP pipelining

• Reduce network congestion

4. A successful attack to the Internet DNS would be devastating. Explain what type of attacks can be made towards DNS. Why, to-date, such attacks in practice have not been successful? In your answer, you should consider caching in particular. Why such technique has not only proven to provide better performance, which is its original goal, but also protection against security attacks.

a. Interception: Intercepting requests and replying with bad data.

b. Cache poisoning: Doesn't work because there are multiple copies of the cached data.

c. DDoS: Overwhelming requests. Doesn't work because requests won't go through.

5. Perform a Traceroute between your machine and any other host/server on the Internet, preferably an overseas server. Provide snapshots of what was returned and analyze the returned information. In specific, you should comment on any behavior that looks either different or unusual. Indicate the number of routers between your machine and the targeted host/server.

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Tracing route to www.bbc.net.uk [212.58.246.55]
over a maximum of 30 hops:

  1     1 ms    <1 ms    <1 ms  EMG2926.local [192.168.0.1]
  2    12 ms     9 ms     8 ms  10.69.16.1
  3    15 ms    13 ms    16 ms  216.113.122.9
  4    16 ms    21 ms    22 ms  216.113.123.194
  5    31 ms    24 ms    25 ms  mot1-b1-link.telia.net [62.115.148.108]
  6    31 ms    24 ms    27 ms  nyk-b2-link.telia.net [62.115.134.52]
  7    31 ms    75 ms    53 ms  nyk-bb1-link.telia.net [213.155.130.29]
  8    96 ms    92 ms    92 ms  ldn-bb3-link.telia.net [80.91.248.202]
  9    95 ms    92 ms    93 ms  ldn-b3-link.telia.net [62.115.134.131]
 10   103 ms    96 ms    97 ms  atos-ic-315185-ldn-b3.c.telia.net [62.115.144.15
9]
 11     *        *        *     Request timed out.
 12     *        *        *     Request timed out.
 13   104 ms    96 ms    97 ms  ae0.er01.cwwtf.bbc.co.uk [132.185.254.93]
 14   100 ms   101 ms   100 ms  132.185.255.165
 15    99 ms    99 ms    99 ms  bbc-vip046.cwwtf.bbc.co.uk [212.58.246.55]

Trace complete.
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6. BitTorrent uses a trading scheme referred to as tit-for-tat. While some researchers argued particular deficiencies in that scheme, others argued that if it was not for tit-for tat, it is likely that BitTorrent would not even exist today. Explain both points of view. In other words, you should indicate the disadvantages of the scheme, as well as why it is still crucial to have such a scheme, or an alternative one, for BitTorrent to exist.

The disadvantage of BitTorrent is the security and difficulty in monitoring the network as peers come and go into the network thus making it suitable environment for malicious file sharing activities as authenticity of the file cannot be verified as there is no single trusted source in the network. Tit for tat is necessary for torrent survival as if there is no tit for tat then peers would connect to network get the file and leave which would make this system equivalent to client server and starve the network. Because of this scheme peer connecting to the network receives data chunks and also sends them once it has enough data chunks to send thus making it true nature of peer to peer sharing.

7. (Textbook, Question P.22 – Page 179 (7th ed.) / 177 (6th ed.)). Consider distributing a file F of size 15 Gbits to N peers. The server has an upload rate of us= 30 Mbps, and each peer has a download rate of di = 2 Mbps and an upload rate of u. For N = 10, 100, and 1000 and u = 300 Kbps, 700 Kbps, and 2 Mbps, fill the following table by the minimum distribution time for each of the combinations of N and u for both client-server distribution and P2P distribution.

	N		
	10	**100**	**1000**
300Kbps	7500	50000	500000
700Kbps	7500	50000	500000
2Mbps	7500	50000	500000

P2P

	N		
	10	**100**	**1000**
300Kbps	7500	25000	45454.545
700Kbps	7500	15000	20547.95
2Mbps	7500	7500	7500

8. Suppose two hosts, A and B, are 12,000KM apart and are connected by a direct link of rate R = 5 Mbps. Assume further that the propagation speed over the link is 2 x 108, and that the packets to be transferred are of size 6 Mbits.

a. What is the propagation delay to send one packet from A to B? Propagation Delay = Distance between A and B / speed of medium = 12*106 / 2 *

108 = 60 msec.

b. What is the transmission delay to send 8 packets from A to B?

Transmission delay = NL/R = 8 * 6 / 5 = 9.6 seconds

9. Now assume some modifications to the network specified in Question 6 above, where 2 routers are installed between A and B at more or less equal distances. Further assume the link from A to the first router has been replaced by another link of rate R=4 Mbps, the link between the two routers was kept as before, and the link between the second router and B was replaced by a link of rate R=6 Mbps. Assume negligible processing and queuing delays in the routers.

a. What is the propagation delay to send one packet from A to B?

Propagation Delay = Distance between A and B / speed of medium = 12*106 / 2 *

108 = 60 msec.

b. What is the total transmission delay to send 2 packets from A to B?

Transmission delay A to R1 = 2*6/4 = 3 sec

Transmission delay R1 to R2 = 2*6/5 = 2.4 sec

Transmissions delay R2 to B = 2*6/6 = 2 sec

Total delay = 3 + 2.4 + 2 = 7.4 sec

c. How much time is needed to send one file of size 20 Mbits from A to B?

Total time = Transmission delay (A to R1) + Transmission delay (R1 to R2) +

Transmission delay (R2 to B) + Propagation delay

Total time = (20 / 4) sec + (20 / 5) sec + (20 / 6) sec + 0.06 sec

= 5 + 4 + 3.33 + 0.06 sec

= 12.39 sec