

CNT5106C Computer Networks, Fall 2012
Instructor: Prof. Ahmed Helmy
Homework #1
On Internet Architecture and Application Layer
[Date Assigned: Sept 23rd, 2014. Due Date: Oct 2nd, 2014]

Q1. (10 points) What is the difference between a flat network architecture and a hierarchical network architecture? Discuss pointing out the advantages and disadvantages of each.

Q2. (10 points: 5+5) What is the Internet's architecture? Discuss from: I- an administrative point of view and II- a routing point of view, pointing out concrete examples of the advantages of such architecture for the Internet.

Q3. (10 points: 5+5) Derive an expression for the calculation of delays in computer-related (telephone and data) networks. Customize such expression to calculate delays in: I- circuit switching and II- packet switching, noting which of the terms are static or dynamic (and under which conditions is it dynamic).

Q4. (8 points) Discuss the following statement, pointing out to what extent is it true or false: We can never guarantee services over computer networks, even in circuit switching or the packet switched Internet, when the demand exceeds the available capacity the network goes into congestion and quality guarantees are lost.

Q5. (15 points: 12+3) What were some of the main design requirements/principles during the design of the original Internet? (Mention at least four).

If you are to re-design the Internet today, which new design requirements would you include as very high priority (excluding the original requirements) and why. [Include at least two].

Q6. (10 points) Security: Why is it not sufficient to offer security at the lowest layer of the protocol stack (i.e., the physical layer)?

- Give two examples of attacks that cannot be prevented using encryption and secret keys.

Q7. (12 points) DNS attacks: Discuss four different attacks on the DNS system. For each describe the characteristics or measures of DNS to thwart or ameliorate the severity of the attacks.

Q8. (8 points) Discuss the adequacy of existing transport layer protocols (TCP and UDP) to support today's Internet applications and services, noting how application developers deal with these two options as transport layer. [Support your answer with example applications and their use of the transport layer].

Q9. (4 points) What are RFCs and why are they important?

Q10. (6 points) Compare and contrast the client-server model and the peer-to-peer model as paradigms for connection in the Internet, pointing advantages and disadvantages of each.

Q11. (6 points) What do we mean by the ‘thin waist’ of the Internet? And why was this term used to describe the Internet? Discuss advantages and/or disadvantages of such phenomenon.

Q12. (6 points) What is the ‘end-to-end’ principle of Internet design? Discuss advantages and disadvantages of such principle. Has this principle been violated (e.g., through layer violation) since the inception of the Internet? [Provide examples if so].

Q13. (4 points) In slide 1-68 (the 68th slide of chapter 1 discussed in class), explain the probability of ‘0.0004’ when 35 users are active.

Q14. (16 points) Napster, Gnutella, Bittorrent, and Skype are examples of peer-to-peer file distribution networks. Discuss their architecture and the advantages and disadvantages of such architecture.

Q15. (6 points) Give an example of a stateless protocol. Can such a protocol be made stateful? How and what would be the purpose?

Q16. (10 points) Discuss the concept of ‘push’ vs. ‘pull’ architecture as relates to p-2-p networks, discussing the advantages and disadvantages of each. Provide another architecture as relates to the data push or pull schemes? What would be the trade-off for such architecture?

Q17. (4 points) How many sockets (minimum) would a UDP server need to support ‘n’ connections? What about a TCP server?

Q18. (4 points) What’s a DHT and why is it used in p-2-p networks?

Q19. (6 points) In the circular DHT example in Chapter 2 (slide 77, or book page 153) if peer 3 learns that peer 5 left the p-2-p network. How does peer 3 update its successor state information? Which peer is not its first successor? Its second successor?

Q20. (6 points) In the same DHT if a new peer ‘6’ wants to join the DHT and initially knows peer 15’s IP address, what steps are taken?