

CNT5106C Computer Networks, Fall 2009

Instructor: Prof. Ahmed Helmy

Homework #1

On the Internet Architecture, and Application Layer

[Date Assigned: Sept 21st, 2009. Due Date: October 7th, 2009 in class or to the TAs]

Full grade points: 70, Total Points: 87, Extra points: 17 points ~24%.

Q1. (8 points) In what ways is the Internet 'complex'? Give four different factors contributing to such complexity. Also show the impact of each complexity factor on the design aspects of the Internet protocols.

Q2. (8 points) What is the difference between a hierarchical and a flat architecture? What is the architecture of the Internet in that sense? Mention at least three reasons for such Internet architectural design.

Q3. I. (4 points) What is a push mechanism or protocol? What is a pull mechanism? Give an example application of each.

II. (4 points) If you are designing a new networked application for the Internet, which factors would you consider to decide whether to use a mostly pull or push mechanism? Show how such factors would influence your design.

Q4. I. (5 points) Can we provide absolute guarantees in the Internet based on its basic architecture? Why? [Contrast the Internet with another network to clarify your answer]

II. (5 points) How would you modify the design of the Internet to obtain better (or absolute) guarantees? Show what each modification would contribute to achieve your goal.

Q5. (8 points) Describe the two different ways in which the DNS queries can be propagated in the DNS hierarchy using figures to illustrate. Discuss the advantages and disadvantages of each.

Q6. (10 points) One of the main principles of the Internet design, called the 'end-to-end argument', argues that a function should be pushed out of the network (to the edges) unless absolutely necessary. Discuss putting the following functionalities in the network vs. at the edges, using 'for' and 'against' arguments:

- 1- reliability
- 2- congestion control

Q7. (6 points) 'Pee-to-peer communication is much slower than client-server communication' How would you argue for or against the above statement? Support your argument using expressions for transfer delays for large number of connections.

Q8. (10 points) For a link with capacity of 1Mbps, what is the maximum number of users can be supported at the same time in the following situations:

I. (2 points) Circuit switching

II. (2 points) Packet switching such that the probability of exceeding the maximum capacity is less than 0.0004

III. (6 points) Packet switching such that the probability of exceeding the maximum capacity is less than 0.00015

Assume that on average each user is active 10% of the time, and when active has a rate of 100kbps. Show your solution steps and calculations.

Q9. (5 points) (Stateful vs. Stateless) Discuss one advantage and one disadvantage of having a 'stateful' protocol for applications.

Q10. (5 point) (Web Caching) Describe how Web caching can reduce the delay in receiving a requested object. Will Web caching reduce the delay for all objects requested by a user or for only some of the objects? Why?

Q11. (9 points) One of the main problems in peer-to-peer networks is finding other peers and finding files/content, both of which relate to resource discovery problems. Describe three main approaches to resource discovery in peer-to-peer networks, discussing their advantages and disadvantages.