



## 4th Assignment: Network Protocols and Architectures WS 09/10

### Question 1: (15 + 20 = 35 points) *BitTorrent (P2P)*

In the lecture you learned the concepts of Peer-to-Peer (P2P) networks. Today, BitTorrent is the most popular P2P-system accounting for roughly 15% of the network traffic. In scientific literature several aspects of BitTorrent mechanisms have been discussed.

- There is a parameter in BitTorrent defining the minimum number of simultaneously connected peers for each client, defaulting to 20. Discuss how changing this default would affect overall performance.
- BitTorrent uses the “rarest piece first” algorithm. Explain how it works and how it improves the performance of BitTorrent. Over the lifetime of a torrent, which are the effects of this algorithm? *(i)* In the beginning, shortly after the initial seed joined the torrent and all other peers are leechers, *(ii)* during the peak period of a torrent, i.e., the time when the highest number of concurrent peers participates, and *(iii)* when a torrent is slowly fading away and only very few peers are still connected. During which time period(s) is the rarest first algorithm important to keep the torrent working?

### Question 2: (10 + 10 + 15 = 35 points) *Review: Application Layer*

- List three nonproprietary Internet applications and the application-layer protocols that they use. *Hint:* Think of which user-agents do you often use that require an Internet connection.
- In what way is instant messaging a hybrid of client-server and Peer-to-Peer architectures?
- Suppose Alice, with a Web-based e-mail account (e.g., Hotmail), sends a message to Bob, who accesses his mail from his mail server using POP3. Discuss how the message gets from Alice’s host to Bob’s host. Be sure to list the series of all application-layer protocols that are used to move the message between the two hosts. Assume that neither Alice’s Browser nor Bob’s Mailreader is started upfront.

### Question 3: (10 + 10 + 10 = 30 points) *Fundamentals of Transport Protocols*

- Suppose telnet client A initiates a session with server S. At about the same time, telnet client B also initiates a session with server S. Provide possible source and destination port numbers for
  - the segments sent from A to S.
  - the segments sent from B to S.
  - the segments sent from S to A.
  - the segments sent from S to B.

If A and B are on different hosts, is it possible that the source port number in the segments from A to S is the same as that from B to S? How about if they are running on the same host?

- Why does UDP exist? Would it not be sufficient, if processes were to send pure IP packets only? Name and explain the two protocol functions (transport layer services) of UDP.
- Both TCP and UDP use port numbers to identify the destination entities to whom a message must be sent. Give two reasons why for these protocols, abstract IDs are inserted as port numbers instead of process numbers, which were readily available when these protocols were developed.

**Due Date: Thursday, November, 19th 2009 only until 13:55 h s. t.**

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- **On paper:** Postbox in the Telefunkenhochhaus (basement, behind the doorman right)
- Put your name, StudentID number (Matrikelnummer) **and** the name of your tutor on your solution.