

10th Assignment: Network Protocols and Architectures WS 10/11

Question 1: (20 + 10 + 10 = 40 points) *Interaction of Layers*

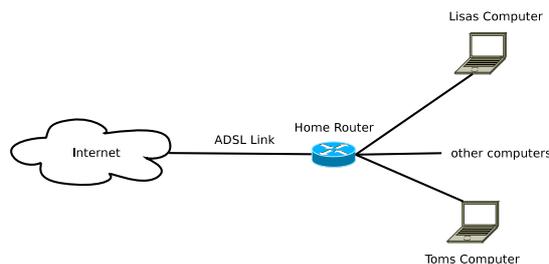


Figure 1: Topology

Assume a student flat where a single DSL line is shared by multiple computers. The bottleneck is the full-duplex, symmetric DSL line having a bandwidth of 1 Mbit/s. Lisa is downloading a large file from the Internet via HTTP. All of a sudden, the DSL uplink is fully utilized by 10 other users uploading large files to the Internet. Assuming that all computers are very powerful, and all of the downloads and uploads are not putting any strain on any computer (CPU, disk I/O, and so on).

- Will the simultaneous uploads slow down Lisas downloads? Why or why not? Justify your answer!
- How does your answer change when you have 1 Mbit/s upstream and 4 Mbit/s downstream as part of an ADSL connection. Discuss your thoughts.
- How could QoS help in this situation? How would you design a simple QoS scheme that would help in this situation (hint: you don't need to consider complex approaches such as IntServ or DiffServ)?

Question 2: (10 + 20 = 30 points) *Max-Min Fairness*

- Consider a link having a capacity of 27 packets/sec that is utilized by 5 simultaneous flows having arrival rates of 3, 4, 6, 8, 10 packets/sec. Show the max-min fair bandwidth allocation by stating the output rate for each flow. Use the algorithm outlined on slide 20 contained in the Resource Allocation slide set and show the result of each step of the algorithm in your solution.
- Show an arrival pattern for which the FIFO scheduling algorithm would result in a bandwidth allocation that is **not** max-min fair. Consider a discrete time model and provide your answer in a table like Table 1. Hint: it is sufficient to consider two flows. Justify why this allocation is not max-min fair.

Timeslot [sec]	Flow ID	Number of Arriving Packets
1	1	...
...

Table 1: Packet Arrival Pattern

Question 3: (10 + 10 + 10 = 30 points) *QoS in the Internet*

Assume a Voice over IP telephone call over the Internet.

- (a) Assume the calls data transfer stays within a single AS. Describe briefly how QoS can be enabled for this call.
- (b) Assume that the data transfer of the VoIP call spans over multiple ASes now. How can Quality of Service be implemented?
- (c) A QoS-enabled Internet does not yet exist. Briefly discuss difficulties in establishing a Internet wide QoS.

Due Date: Thursday, January, 20th 2011 only until 13:55 h s. t.

- **As PDF files (no MS Office or OpenOffice files):** Uploaded via ISIS (<https://www.isis.tu-berlin.de/course/view.php?id=3584>)
- **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.