Technische Universität München
Lehrstuhl Informatik VIII
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**Master Course Computer Networks**

**Exercise 6**

**(submission until January 28th, 10:30 CET via SVN)**

**(submission of corrected version until January 31st, 10:30 CET via SVN)**

**Note:** Each subproblem gives you 0, 1 or 2 points. See the slides from October 29th for more information on the 0.3 bonus.

**Note 2:** Subproblems marked by * can be solved without preceding results.

## IPFIX  (Everything Flows)

a)* What are the entities/processes which take part in the Flow Information Export protocol? Briefly describe their purpose!

b)* What's the difference between active and inactive timeout? How does the relationship between active and inactive timeout need to be such that they can both be triggered separately?

c)* How do Flow Collectors and processing applications know how to interpret Flow Records?

Normally, a bidirectional flow is exported as two separate Flow Records, one for each direction.

d)* How can bidirectional flows be exported more efficiently (in terms of bandwith usage) in IPFIX ?

## Transport Protocols  (Merry question roundup)

These questions revolve in general around the transport protocols TCP, UDP and SCTP.

a)* What are SYN floods? How does SCTP prevent SYN floods? Is there a similar mechanism for TCP?

b)* What is the MSS? How is the default for IPv4 hosts calculated?

c)* What is the difference between the receiver window and the congestion window? How are they signaled to the respective TCP counterpart?

d)* How could congestion control be added to UDP?

# Congestion Control  (BONUS QUESTION)

This BONUS QUESTION needs to be answered correctly by all students who successfully completed all but one exercise sheet and want to get the 0.3 bonus. All others are encouraged to solve it voluntarily.

In this question you will simulate data transfer over TCP connections. Listing 1 shows the HTML of a web page that will be fetched over HTTP. Table 1 shows the sizes of the web objects as well as the RTT from the client to the server.

```
<html>
<head><title>BONUS QUESTION</title></head>
<body>
<p>
This BONUS QUESTION needs to be answered correctly by all students who
successfully completed all but one exercise sheet and want to get
the 0.3 bonus. All others are encouraged to solve it voluntarily.

...

<img src="bonus.jpg" />
<img src="http://ri.ck/astley.webp" />

...

<video src="http://roll.edu/give_up.webm" controls></video>
</body>
</html>
```

Listing 1: HTML code of http://bonus.net.in.tum.de/index.html web page.

| URL | Size[1] | RTT |
|---|---|---|
| http://bonus.net.in.tum.de/index.html | 5 kB | 50 ms |
| http://bonus.net.in.tum.de/bonus.jpg | 42 kB | 50 ms |
| http://ri.ck/astley.webp | 13 kB | 200 ms |
| http://roll.edu/give_up.webm | 37 kB | 350 ms |

Table 1: Size of the index.html page and referenced objects therein. Additionally the RTT to the server is given.

a)* How long does it take to transfer the HTML code of the web page shown in Listing 1, without fetching the referenced objects? The TCP implementation uses Slow Start, the initial congestion window is 1 MSS (use standard size) and the SSTRESH is "unlimited". Don't forget the TCP handshake, the `HTTP GET` request and finally the connection tear down! You can disregard the transmission delay. There is no packet loss!

b)* How long does it take to fetch the objects referenced on the `index.html` web page if they are fetched in parallel? How long does it take in total (`index.html` and referenced objects) if the objects are fetched immediately after the last data byte of the `index.html` has arrived and HTTP 1.0 is used? You can disregard the time for parsing the HTML.

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[1] 1 kB = 1000 Bytes

c) How does the transmission change when HTTP 1.1 is used? What's the total time for fetching the page and the referenced objects?

For the following two sub questions assume that the TCP segment containing byte 20,000[1] of `give_up.webm` is lost on the way from the server to the client. The timeout value for each segment is set to 1.5 seconds.

d)* Describe the process that happens when TCP Tahoe is used? How does this change the total transfer time? What's the average data rate?

e)* Describe the process that happens when TCP Reno is used? How does this change the total transfer time? What's the average data rate?

f)* BONUS bonus question (if you really have too much time): What do you need to change to make the HTML in Listing 1 valid HTML 5?