S-38.3157 Protocol Design Jörg Ott, Carsten Bormann

Exam 12 May 2008

Please write readably and in English.

There are three classes of questions: (a) expecting (relatively) short answers, (b) expecting more elaborate answers, and (c) a small or analysis design task. The questions are marked accordingly.

Questions:

1. [6p, a] Which basic two options for error repair do you have? What are their tradeoffs?
2. [6p, a] How does a TCP SYN flooding attack work? How can you counter (in principle) TCP SYN flooding attacks? How does SCTP address this problem?
3. [6p, a] Explain the *end-to-end principle*.
4. [6p, a] Which two functions do IP addresses perform today? Give two reasons why this linkage is a bad idea.
5. [6p, b] "Make or take" decisions are often an important design alternative in protocol design. Discuss two reasons in favor of each choice. Give one example for a protocol aspect where a *make* decision is a good idea and one example where a *take* decision is preferred; in each case, briefly explain why.
6. [6p, a] Discuss the issues that arise with congestion control in multicast networks. Sketch one approach how to address them. Describe which limitations (if any) arise.
7. [6p, b] (a) What does *evolvability* mean?

   (b) How are evolvability and interoperability related?

   (c) Describe two *technical* aspects to be considered for an evolvable protocol design.
8. [12p, c] Assume that you a low bit rate (< 100 kbit/s) and relatively low latency (less than to some 10s) IP network for which you need to design a reliable transport protocol with low overhead (unfortunately, using header compression is *not* in option in this network). Since TCP has proven to work well for many networks and you do not want to modify applications either, you decide to take TCP as the starting point. (The TCP header is shown below as a reminder.)

   (a) How would you "optimize" (reduce in size, leave out, re-interpret) fields in the TCP header to cut its size in half (from 20 to 10 bytes)? Remember that you want to keep the TCP functionality. Sketch the new header and explain for all (modified) fields how they work and why. Which fields did you not change? Why? Which issues may arise?

   (b) How can you minimize the bandwidth wasted in case of congestion?