Written examination in  
TDTS43 Computer Networks and Distributed Systems  
2003-03-15 at 14–18

Localities  
U14, U7, U10, and U11.

Permissible aids  
A calculator (with memory erased), an English dictionary, and 4 pages of hand-written notes on A4-sized paper are allowed.

Results  
Published within twelve working days from the examination date in LADOK.

Points  
Maximum 40 points, with no requirements for a specific amount of points in each part. For a passed examination ca 20 p. are needed. For grades 4 and 5 ca 28 p. and ca 36 p. respectively are needed.

Teacher on duty  
Eduard Turcan, 0707-70 79 55, who visits the hall at 15 and 17.

Instructions  
Read the questions carefully before you answer and make sure you understand them. Answers should be brief and to the point and explain the solutions. Motivate your answers and state explicitly any assumptions that you make. The use of figures is encouraged. You can use either English or Swedish when you write your answers. Please, see also the instructions on the front of the folder that this examination was contained in.

Good luck!
1. Application layer: Describe how the naming service of the DNS is distributed across several machines, that is, how the distributed database of names is structured on the Internet. Also, give an example of an iterated and a recursive query, respectively. (4 p.)

2. Transport layer
   a. Why does UDP exist? Would it not have been enough to just let the user processes send raw IP packets? (2 p.)
   b. Regarding the implementation of congestion control in TCP: Why do you think one should avoid timeouts (the timer to go off)? (2 p.)

3. Network layer
   a. What are the basic steps of Link State (LS) routing? (2 p.)
   b. Name one problem that can occur with the LS routing algorithm and how it can be solved. (2 p.)
   c. Name one well-known protocol based on LS and also one based on Distance Vector routing. Furthermore, place them in a typical Internet environment (Where are they used?). (2 p.)

4. Data link layer
   a. Suppose you have a data link layer protocol that implements an acknowledged connection-oriented service. When does the network layer become aware of a data link layer retransmission and when does it not? (2 p.)
   b. CSMA/CD limits the maximum allowed distance between two computer attached to the same network. Assume a bandwidth of 10 Mbps, a minimum packet size (including control information and data) of 500 bits, and a speed of light in the medium of $2 \times 10^8$ meters/sec. What is the maximum distance between two computers in this network? (3 p.)
   c. What is the basic difference between CSMA/CD and a token-ring type of protocol for Medium Access Control? (1 p.)

5. Quality of Service
   a. How can an Internet telephony application recover from packet losses? Describe one method. (2 p.)
   b. What is the purpose of the leaky bucket? Exemplify. (2 p.)

6. Security
   a. How can one implement security in the network layer? Give an example of an available security mechanism, and also discuss what type of security services (authentication, data integrity, etc.) one can implement with the mechanism in the layer in question. (3 p.)
Distributed systems

7. Distributed systems in general
   a. What is the difference between a distributed operating system and a network operating system?  
   b. What is a three-tiered client-server architecture? Give an example of where it is used.

8. Transparency
   a. Explain what is meant by transparency in a distributed system. Give two examples of different types of transparency.
   b. Give one example of a situation where transparency is not a good idea, and also explain why.

9. Why do you think it is useful, as in Corba, to define the interfaces of an object in IDL?

10. Explain the roles of the overlay network, the virtual neighbours, and the bootstrapping node in the context of a peer-to-peer network, such as KaZaA.