University of Uppsala

Department of Computer Systems (DoCS)

Final Examination

Datakommunikation (DVP))

Data Communication and Networks

INSTRUCTIONS TO CANDIDATES

- This is a SIX (6) hour examination
- Answer all questions on the paper provided
- All questions to be answered in English
- Dictionaries are Permitted
- Marks total 170
- There are 12 questions
- The exam paper is 5 pages including this cover page.

Question 1

In answering the following questions use the following network configuration. Each node in the network represents a router, and the weights of the arcs represent the values of a cost metric used by a distance vector routing scheme.

a. Construct and write down the routing vector for node C.

b. Write out the contents of the routing vectors sent to router F. Show how these vectors are used to computer a new set of entries for F's routing vector.

c. If the link between A and B fails, show the effects on the routing vectors of the nodes A, B and F in the update cycle that immediately follows the failure.

d. List three common routing metrics used in distance vector routing.

[13]

Question 2

Discuss (using appropriate diagrams) the operation of the standard TCP 3-way handshake used to setup a connection between two Transport level entities.

If the underlying network is not reliable packets can be lost during connection setup. For each of the possible situations listed below, draw a picture that shows the situation, describe the problem that arises, and discuss the techniques that can be used to prevent protocol failure.

a. The connection request is lost.

b. The ACK packet from the receiver is lost.

c. A connection request stored in the network is suddenly delivered to a destination host after the connection to which it refers has been used and terminated.

[22]

Question 3

Discuss the issues surrounding the termination of connections. What makes termination a hard problem? Describe a scenario that is often used to explain the connection termination situation. Use this scenario to analyse the termination problem and decide if it can be solved.

[16]

Question 4

Describe the operation of the *Slow Start Algorithm*. Explain how the algorithm works, and draw a graph which explains how the algorithm behaves over time in response to changes in network. What enhancements can be made to the standard algorithm to make it more responsive.

[12]

Question 5

Write a paragraph on each of the following topics concerning the implementation and operation of mobile IP.

a. List four important limitations/requirements that are to be taken into consideration when implementing mobile IP.

b. What are Foreign and Local Agents. Outline the services they provide to a mobile host.

c. How does traffic destined to a mobile host in a remote location get to the correct destination network without detours?

[18]

Question 6

Describe the ARP and RARP protocols. What do they do, and where and why are they used?

[14]

Question 7

Consider the problem of managing traffic in a TCP connection that consist of a wireless and optical fibre section. Discuss how the characteristics of the different sections of the network affect the interpretation of metrics that are used to measure congestion. Describe two approaches to resolving the issues that arise in this situation and comment on their elegance and efficiency.

[12]

Question 8

Explain what framing is, and describe two framing methods. Give the advantages and disadvantages of these methods.

Framing is used in conjunction with payload stuffing. What is stuffing? Give an example of character and bit stuffing and comment on their relative efficiencies in terms of data transmission overhead.

[14]

Question 9

Define RTT. An estimate of RTT is used to set packet timeout counters in the sender side of a connection. Explain how estimates of RTT can be misleading, and describe a method used to resolve this problem.

[8]

Question 10

Explain the "go-back-n" method for managing the retransmission of lost or corrupt PDUs. Describe another technique that can be used to solve this problem. Contrast the efficiency of the techniques in terms of buffer utilisation when transmitting data over a high bandwidth and high latency connection.

[14]

Question 11

Describe the theoretical basis of CRC error detection. Show how the CRC is computed given the following parameters. Give the bit pattern for the final transmitted frame including the CRC.

$$G(x) = x^5 + x^2 + x + 1$$

$$Frame : 1001\ 1101\ 0111\ 10110001\ 0101$$

[12]

Question 12

Describe the physical characteristics of an optical fibre and explain how it can be used to transmit data.

Comment on the jointing techniques that are used to connect fibres, and the possible loss of signal that results.

Describe how data traffic can be multiplexed onto an optical fibre, and discuss any problems that may arise. What issues need to be considered?

Optical fibre networks are replacing copper networks at a rapid rate. Why is this happening, and what are the benefits to telecommunications companies of doing this?

[15]