<u>Two hours</u>

UNIVERSITY OF MANCHESTER
SCHOOL OF COMPUTER SCIENCE

Computer Networks

Date: Monday 14th January 2013

Time: 09:45 - 11:45

Please answer any THREE Questions from the FOUR Questions provided

Use a SEPARATE answerbook for each SECTION.

This is a CLOSED book examination

The use of electronic calculators is permitted provided they are
not programmable and do not store text.

[PTO]

Section A

1.

a) Give indication of two types of Quality of Service (QoS) parameters that an application might require from a network. For each give an example of the type of application, with reason, that would require this type of QoS.   [4 marks]

b) Two of the key elements of a good network application are extensibility and scalability, explain what each of these terms means.   [2 marks]

c) Coordination of information is a key element of operating a successful network. Describe how <u>either</u> the Domain Name System (DNS) does this for names or IP achieves this for addresses.   [4 marks]

d) Distribution of load is a key element in implementing a successful network application, describe **all** of the ways <u>either</u> the Domain Name System (DNS) or the web distribute load while still maintaining the ability to locate information.   [4 marks]

e) An application is being designed that allows users to manage and publish their contact details. The expected load is sufficient that it will be necessary to distribute the implementation of this application. Part of the specification is that it should be possible to find a person's details without knowing the location where they are managed.

Outline an architecture that could be used for the implementation of this application. Discuss ways in which the application could determine the correct location of information.   [6 marks]

2)

    a)   State the main purpose of the Internet Protocol (IP) and a transport protocol, like UCP or TCP. For each indicate how they identify their destination.   [3 marks]

    b)   Any computer needs configuring to enable it to communicate with other computers in a network environment. State the pieces of information that a computer requires to achieve this communication.   [3 marks]

    c)   For the information that you have identified in part b), describe how a computer can be dynamically configured with this information. Your answer should not just identify a process or protocol, but how this process operates.   [3 marks]

    d)   Show how the reliability mechanisms go-back-N and selective acknowledgements ensure that all of the data sent by a transmitter is delivered to a receiver. Also compare the overheads of each.   [7 marks]

    e)   Alice wants to use on-line banking on the server run by her bank, *myBank*. To ensure the security of her information, she would like to know that the server is the correct server and that the server confirms any instructions do come from Alice. Alice and myBank have already established a shared key that is known only to them. Design a protocol for authenticating instructions that gives the level of security that Alice requires and maximised the security of the shared key.
    [4 marks]

Section B

3)

    a)   Which two protocols are used to map from Internet resource names such as www.cs.manchester.ac.uk to the address of individual network ports a connected computer uses for network communication?   [2 marks]

    b)   How does the mapping process in part a) above differ when the data-link protocol used is ATM rather than Ethernet?   [2 marks]

    c)   A local network has several interconnected wired Ethernet switches. One switch blows a fuse and is powered down. What happens to the network when the switch fails?   [1 mark]

    d)   A new switch is bought. What must the network technicians do to install the new switch and make it work as a replacement for the failed device? Is this easy or hard to do? Why is it easy or hard?   [4 marks]

    e)   Why do network collisions seldom (never) occur on modern wired networks whereas they are common on many wireless networks?   [4 marks]

    f)   Briefly explain how wireless networking systems can avoid collisions where possible?   [7 marks].

4)

   a)   What happens when constant bit rate (CBR) voice over IP (VoIP) media traffic is mixed with typical web, FTP and email traffic bursts in:

        i)   A lightly loaded network connection?

        ii)   A congested network connection?   [7 marks]

   b)   A network connection (see diagram) between two routers operating at 10Mbps is to be shared by:

- A real-time live broadcast video service sending one stream of 20 frames per second of video where each packet burst is 300 kilo bits per burst of streamed video data. This stream operates from Router A towards router B.

- Up to 30 telephone calls, each telephone call being bidirectional and using 8000 one byte samples per second in each direction aggregated into packets transmitted every 20ms.

- The remaining bandwidth is available for ordinary best-effort network traffic.
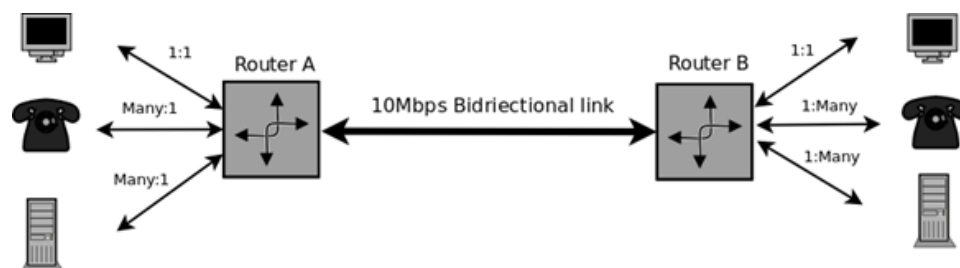
Assuming a best-effort service is provided for all these traffic types, roughly how many telephone calls can be made before the network link becomes congested?
                                                         [5 marks]

   c)   Suggest how to configure queuing in Router A for traffic to Router B so that the video and telephony services always work with a guaranteed quality of service and at the same time the TCP/UDP traffic is able to use any remaining bandwidth. Use a diagram to illustrate your answer,   [8 marks]

END OF EXAMINATION