THE BRITISH COMPUTER SOCIETY

THE BCS PROFESSIONAL EXAMINATION
Professional Graduate Diploma

NETWORK INFORMATION SYSTEMS

26th April 2002, 2.30 p.m.-5.30 p.m.
Answer THREE questions out of FIVE. All questions carry equal marks.
Time: THREE hours.

*The marks given in brackets are **indicative** of the weight given to each part of the question.*

1. a) Jane in Cardiff sends an email message to Jamil in London. Jane uses Eudora as her mail client on a Windows PC, while Jamil reads his email using Netscape on a Sun workstation running Solaris.

   Identify the different software components that are involved in forwarding the message from Jane's mail client to Jamil's. Your answer should also briefly describe the protocol involved.   **(10 marks)**

   b) Jamil has started a new job recently as a sales consultant. As a consequence, he has to travel a great deal and must use a laptop or the computer at an Internet cafe to read his email which is held on a server at his company. If Jamil tries to read his email from different locations this may scatter his mailbox, leaving some on the local machine from where he reads his email, the rest at his mail server.

   Identify ways in which this could be prevented at the protocol level and suggest properties that Jamil should set on his mail server in order to read email from untrusted clients.   **(10 marks)**

   c) State the additional properties a protocol should support to enable Jamil to read his email from a mobile device, for example a Personal Digital Assistant (PDA) with limited memory.   **(5 marks)**

Use the following passage to answer questions 2 and 3

BrillTech has been established by two University graduates, and specialises in developing network management software. BrillTech brings together the expertise of Tom Schmutsky (a statistician) and Bill Zork (a computer scientist). The company aims to develop specialised monitoring software to enable Telecom vendors to meet their Quality of Service (QoS) criteria, especially for the new multimedia services being announced by many Telecom vendors. QoS is an important criteria for many companies, as it allows them to determine bounds on timing delays that are likely to affect packet flows for applications they create. In the era of Application Service Providers (ASPs), the QoS criteria becomes an important factor to monitor and enforce.

2. BrillTech have the potential to measure and record a large quantity of data about a network. This data may, for example, include traffic flows at a particular point in the network and the network configuration.

   a) Identify five different network components that could be monitored within a local area network up to the point where the company connects to the external Telecom vendor.   **(10 marks)**

   b) Describe the function of each of the network components mentioned in *a)* above.   **(10 marks)**

   c) Identify the reasons why one of the network components mentioned in *a)* above is the most critical component in supporting QoS.   **(5 marks)**

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3. Bill Zork suggests that the software developed by BrillTech could be best utilised at each router within a network. His theory is that a network router would be able to monitor traffic patterns and flow rates, and therefore adapt the routing tables appropriately using the software.

    Tom, on the other hand, feels that this is too complex, as the software must respond to events in real-time, and this is likely to have a high computational cost. Tom believes the software will always lag behind actual traffic patterns. His alternative suggestion is that the software should be deployed at specialised nodes in the network, and run on dedicated hardware.

    a) As an adviser to BrillTech, discuss the two suggestions and how you would help Bill and Tom make a decision on the correct suggestion to adopt. **(15 marks)**

    b) Often an end-to-end network connecting a company with another is not owned by a single Telecom vendor as it is made up of many different network segments. However, when reporting Quality of Service (QoS) criteria, a company like BrillTech must take into account that each of these network segments may offer a different QoS.

    Suggest ways in which BrillTech could help achieve a better estimation of QoS. **(10 marks)**

Use the following passage to answer questions 4 and 5:

Southwest University has 50 academic departments including a Computer Science Department. The Computer Science Department has 3 user areas which generate a lot of network traffic, most of which is between the user area computers and a user area server machine. The University has registered the domain name southwest.ac.uk and it has been allocated the class B IP address block 150.100.0.0/16. The University needs to set up a campus network, using Ethernet, which is also connected to the Internet. The network design must be efficient and scalable.

4. a) Design a network topology which will meet Southwest University's campus network requirements. Your design should be presented in diagrammatic form and should address the following issues:

    i)   Identify the subnet requirements **(8 marks)**
    ii) Identify the router requirements **(6 marks)**
    iii) Suggest an IP addressing scheme for the subnets **(6 marks)**

    b) Briefly describe how the campus network should be connected to the Internet. **(5 marks)**

5. The Computer Science Department at Southwest University offers some of its courses for remote access. Registered students can connect to server machines over the Internet and access course material and submit coursework for continuous assessment.

    Discuss the security requirements for implementing a remote access coursework system addressing the issues of physical security, operating system security, network security, data access and user authentication. **(25 marks)**