THE BRITISH COMPUTER SOCIETY

THE BCS PROFESSIONAL EXAMINATIONS
BCS Level 6 Professional Graduate Diploma in IT

NETWORK INFORMATION SYSTEMS

6th May 2008, 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.*

Calculators are **NOT** allowed in this examination.

1. The scope for open, configurable distributed systems is enhanced if the file service is structured as three components (refer to figure 1 below): a flat file service, a directory service and a client module.

    a) Explain the operation and the relationships between the various entities shown in the diagram.

    (5 marks)

    b) Define and discuss the division of responsibilities between the three components. You are expected to refer to unique file identifiers (UFID's) in your answer.

    (10 marks)

    c) Discuss the design issues involved in providing a range of services to address the requirements of clients with different goals with respect to these three components and the issue of fault tolerance.
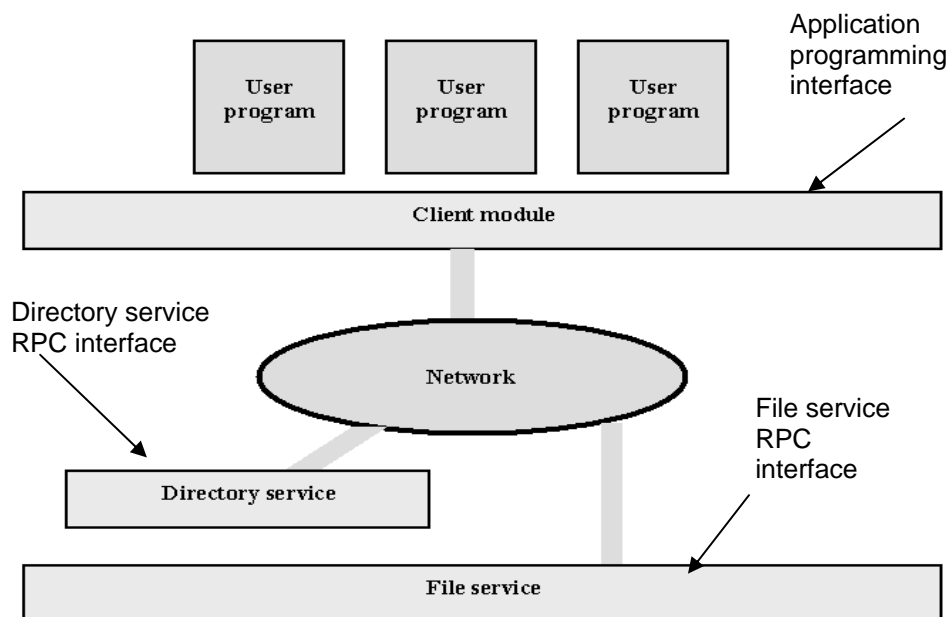
    (10 marks)

Figure 1: File service components

2. A University Computer Science Department wishes to offer some of its courses through remote access. Registered students should be able to 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 each of the following areas. Your answer should focus on the technical issues.

    a) Physical security.
    b) Operating system security.
    c) Network security.
    d) Data access.
    e) User authentication.

    (5 x 5 marks)

3. You have been tasked to provide a review of user requirements for a new distributed system being planned in your organisation. Discuss the issues you would consider under the following three headings and provide suitable explanations of the factors associated with each.

    a) Functionality.
        Among the factors you need to consider are operating systems. Discuss the following three options:
        i)   Adapt the existing operating system.
        ii)   Move to an entirely new operating system designed specifically for distributed systems.
        iii)   Emulation

        (9 marks)

    b) Re-configurability.
        Refer to the following two timescales in your discussion:
        i)   Short term changes
        ii)   Medium to long term evolution.

        (8 marks)

    c) Quality of Service.
        Include the following three factors in your discussion:
        i)   Performance.
        ii)   Reliability and availability.
        iii)   Security.

        (8 marks)

4. A company has a DSL Internet connection with 5 fixed IP addresses in the range 217.40.76.1 through to 217.40.76.5. The DSL router has the IP address 217.40.76.6. The company needs to have two Web servers, an FTP server and a mail server which are accessible from the Internet. The IT department has twenty employees, each of whom require unrestricted Internet and Intranet access from their desktop PCs. There are twenty administrative staff who require restricted Internet Web browsing and full Intranet access. There are ten sales staff who require wireless connections when on site with full Internet and Intranet access.

   a) Design a network topology for the company. Draw a diagram of the network layout and assign IP addresses to any subnets and computers. Clearly show any switching components and describe their function. Justify any decisions which you make.

   (15 marks)

   b) Identify the major software components which are required to implement the company's network. For each component recommend a product and give any configuration requirements.

   (10 marks)

5. Replication is the maintenance of on-line copies of data and other resources. For example, the USENET system maintains replicas of items posted to electronic bulletin boards across the Internet, the replicas being held within, or close to, the various organisations that provide access to it.

   a) Discuss the motivation for replication in terms of:
   - performance enhancement
   - enhanced availability
   - fault tolerance.

   (6 marks)

   b) The figure below shows a basic architectural model for the management of replicated data.
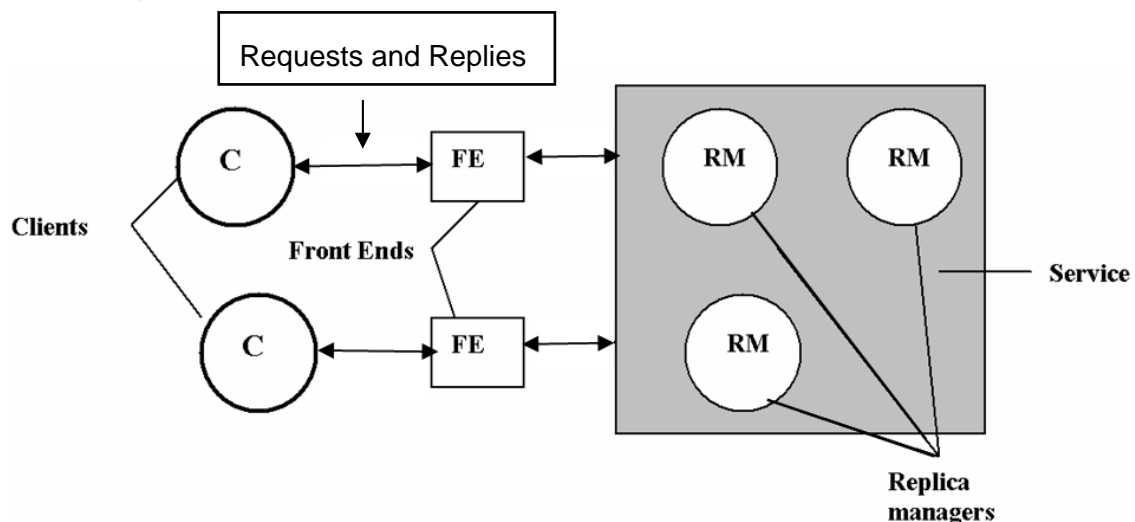
A basic model for the management of replicated data

   i)   Discuss the operation of this model.

   (4 marks)

ii)   If the clients and replica managers are separate processes, the model becomes what is commonly referred to as the 'gossip' model. Produce a modified version of the above diagram and use it to explain the 'gossip' model.

(7 marks)

iii)   To enhance availability, the 'primary' copy model is often used. Produce a modified version of the above diagram and use it to explain the operation of the 'primary' model. Suggest an architecture for a shared editor, which might be used in a multi-user collaboration environment and often referred to as 'groupware'.

(8 marks)