THE BCS PROFESSIONAL EXAMINATION
Professional Graduate Diploma

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EXAMINERS' REPORT

Network Information Systems 2001

A number of candidates had clearly not followed the syllabus for this module and they produced answers which contained few points relevant to the question set. Others could have scored higher marks had they read and related their knowledge to the scenario given for the question. Candidates must appreciate that when examiners provide a scenario, it is to enable candidates to *apply* the knowledge they possess within the *context of the scenario*. In such cases general points, some of which are relevant and others which are clearly not relevant, suggests to the examiner that the candidate has simply learnt facts and does not understand how to apply such knowledge.

QUESTION ONE

The following passage refers to questions 1 and 2 ONLY:

E-markets.com is a small, privately owned company specialising in financial services to trading banks across the UK and Europe. The company provides financial information through standard Web servers, such as Apache and Netscape Netcenter, and a system wide data model to enable integration from different content providers.

The company employs Unix servers in the UK, and has various Windows NT based platforms in other parts of the world (a migration to Windows 2000 is being discussed within the company). E-markets.com is interested in extending their services to individuals in Europe and you have been appointed as their chief technology adviser.

a) Identify specialised devices that could be used to enable mobile connectivity by individuals who wish to gain access to the E-markets.com Web based system **(10 marks)**

b) Discuss how these specialist devices could be connected to the E-markets.com backbone network, indicating any potential problems
(15 marks)

Part a) answers demonstrated a wide variation in knowledge and understanding. Answers ranged from an almost total misunderstanding of the question to excellent answers indicating more than just academic knowledge of the subject.

Part b) Some excellent attempts, however a number of candidates provided long essay type answers without adding any valid points to their discussion. Other answers were too brief to convey an adequate understanding of the subject.

Discussion was required, not simply relating facts, in order to demonstrate understanding.

Answer Pointers

a) A good answer was expected to contain a discussion of some of the following issues:

1. Devices can be hand held or embedded.

2. Devices must provide support for specialised operations required by individuals interested in accessing financial data.

3. Devices must support specialised display formats to enable individuals to interact visually with recorded data.

4. Devices should also contain memory for storing user profiles, and temporary configuration information.

5. Devices should enable the communication using standard protocols – such as TCP/IP.

b) Answers were expected to contain discussion of some of the following issues:

1. Recognition that devices must enable information to be transferred within fixed time frames – as financial information can change rapidly. Any discussion on how this is to be supported (provision of a certain Quality-of-Service) will be rewarded.

2. Define means to deal with a large number of simultaneous transactions (scalability) of infrastructure – such as provision of regional servers or mirror sites to support traffic distribution.

3. Support mechanism for encryption transactions if devices are also used for funds transfer.

4. Connectivity could be through a base station in the house/office, which is then connected onto a wired network.

5. Connectivity can also be supported through a vendor based wireless network, which then routes traffic via the public telephone network.

QUESTION TWO

E-markets.com deals with many content providers who use their own specialised information systems, some of which have been in existence for a very long period of time.

a) Produce a policy for integrating their content providers' information systems within the E-markets.com financial system **(12 marks)**

b) Discuss the issues you would consider, and the strategy you would adopt, in order to support the migration from the existing systems to the integrated system **(13 marks)**

On the basis of the syllabus and the question set, examiners expected the technical issued to be addressed, such as user access, data formats and charging. Some candidates gave answers which attracted few marks because they were addressing the policy from the point of view of the content provider. The question asked for the policy from the point of view of *E-markets.* Many answers did not address any of the technical issues and simply gave broad management generalities.

For part b), again examiners expected the technical issued to be addressed, covering aspects of migrating content, networks and systems, rather than a discussion in terms of high level management generalities. It is clear that the question had not been read and understood by many as the majority of answers failed to mention any aspects of the migration of operating systems.

Answer Pointers

a) The policy should cover some of the following issues:

1. Stress constraints on access privileges and rights for a given category of users – and when access is permitted or denied (based on workload, time of day etc).

2. Identify ways to deal with specialised data formats of data types supported by the system of each content provider.

3. Ways to deal with inconsistent or incomplete information.

4. Charging strategy for sharing and accessing content.

Value added services provided by integrating content from different providers – and a charging strategy for such services.

b) Migration can be supported at various levels:

1. Content migration – supported by providing a system-wide data model.

2. Network migration and integration – supported by integrating local networks divided into zones, subnets and integrating these at an organisational level.

3. Systems migration – supporting organisation wide operating systems (environment) and providing a translation service from the operating environment of each constituent content provider. Such an operating environment must deal with network topologies, support for buffering data and flow control policies.

QUESTION THREE

a) Describe three operations that could be performed with a Domain Name Server (DNS), in order to support applications such as electronic mail
(12 marks)

b) Given the following address, www.mcs.anl.gov, describe in detail how a DNS server can be used to resolve the address to its one or more IP addresses
(13 marks)

Many answers covered application protocols, such as the SMTP, protocol for e-mail delivery and mentioned nothing about the role of DNS. Given the question set, answers should have stated what DNS functionality supported each application, such as electronic mail.

For part b) it is clear that the question had not been read. Very few answers described the resolution of the given address www.mcs.anl.gov. The answer should have described the mechanism for both recursive and iterative DNS lookups. Many answers mentioned application protocols. It is clear that most people who attempted this question did not understand DNS at all. One answer in particular was pure invention – innovative but very wrong.

Answer Pointers

a) A good answer could have covered the following:

1. **Host Aliasing:** A host with a complicated host name can have one or more alias names. For example, a host name such as relay1.west-coast.enterprise.com could have 2 aliases such as, enterprise.com and www.enterprise.com. In this case, the host name relay1.west-coast.enterprise.com is said to be canonical host name. Alias host names, when present are typically more mnemonic than a canonical host name. DNS can be invoked by an application to obtain the canonical host name for a supplied alias host name as well as the IP address of that host.

2. **Mail server aliasing:** For obvious reasons, it is highly desirable that email addresses be mnemonic. For example, if Bob has an account with Hotmail, Bob's email address might be as simple as bob@hotmail.com. However, the host name of the Hotmail mail server is more complicated and much less mnemonic than hotmail.com. (e.g. the canonical host name might be something like relay1.west-coast.hotmail.com). DNS can be invoked by a mail application to obtain the canonical host name for a supplied alias host name as well as the IP address of the host. In fact, DNS permits a company's mail server and Web server to have identical (aliased) host names; for example, a company's Web server and mail server can both be called enterprise.com.

3. **Load Distribution:** Increasingly, DNS is also being used to perform load distribution among replicated servers, such as replicated web servers. Busy sites, such as cnn.com, are replicated over multiple servers, with each server running on a different end system, and having a different IP address. For replicated Web servers, a set of IP addresses is thus associated with one canonical host name. The DNS database contains this set of IP addresses. When clients make a DNS query for a name mapped to a set of addresses, the

server responds with the entire set of IP addresses, but rotates the ordering of addresses within each reply. Because a client typically sends its HTTP request message to the IP address that is listed first in the set, DNS rotation distributes the traffic among all the replicated servers. DNS rotation is also used for email so that multiple mail servers can have the same alias name.

b) A DNS server supports two types of queries:

1. Iterative Queries – DNS tries to resolve host address using the local DNS server. If address cannot be found, the query is forwarded to an authoritative name server. Each domain must support at least one authoritative name server. There are only a few root servers in the world, and these must be aware of a domain specific authoritative name server. This forwarding of a query to a server higher up in the hierarchy is the iterative query mechanism. Once the address has been resolved at the authoritative name server level, the result is passed to the root server, and subsequently to the local name server – being cached at each point along the chain to support further similar requests.

2. Recursive Queries – the local name server forwards the request to the root server and the root server provides the address of the authoritative name server to the local name server. It is then up to the local Name Server to make a direct connection to the authoritative name server to resolve the address. Hence, in this case, the load on the root name server is reduced. A diagram to illustrate this process was rewarded.

QUESTION FOUR

The following passage refers to questions 4 and 5 ONLY:

cBay specialises in providing on-line auctions of services and goods, supporting person-to-person auctions. Businesses are also now being targeted to buy and sell items in more than 1,000 categories, including collectibles, antiques, sports memorabilia, computers, toys, beanie babies, dolls, figures, coins, stamps, books, magazines, music, pottery, glass, photography, electronics, jewellery, gemstones, and much more. Users can find the unique and the interesting on cBay, everything from chintz china to chairs, teddy bears to trains, and furniture to figurines.

cBay has decided to extend its operations into Europe, and is evaluating various networking infrastructures to decide on the best systems for running their European operations. Currently, cBay employ Sun UltraSparc servers to host electronic catalogues, maintained on either Oracle or Informix database management systems. The company is planning on additional servers to promote interactive customer dealings. The European clientele is likely to be more enthusiastic about auctions in antiques than the US market. New auctions are to be posted daily on cBay European web pages so that there will always be something new to look at. cBay's system of proxy bidding encourages buyers to offer the most they are willing to pay for an item generally referred to as the ``maximum bid''.

However, a buyer does not necessarily end up paying the ``maximum bid''. Each buyer is also allowed a ``bid increment'' from as little as 5 pence. To

enable automated auctions, cBay is also evaluating various software that would enable them to be on-line 24 hours a day, 7 days a week. A user (buyer or seller) could deploy a program to automatically perform the auctions on their behalf. The program would be parameterised with options such as ``maximum bid'', ``bid increment'' etc, and could then perform the actual auction dynamically only informing the user when a conflict arises, or when a sale has been made. To automate this operation, cBay are evaluating various networked machines, employing message passing middleware. They have looked at MPI and also solutions from Microsoft such as Wolfpack. Their intention is to enable cross platform integration of buyers and sellers connected across a network, and also to enable better performance than is generally present over the single server web engines.

Security is of primary concern to cBay, especially when automating auctions over the Internet.

Discuss the factors that you think are relevant when choosing a computing platform that will support Internet security and which reflects the particular needs of cBay.   (25 marks)

This was the most popular question and yet it is clear that most candidates had not read the scenario to which the question referred. Technical aspects were expected, covering security through each of the layers from hardware up to application layer. The third paragraph of the scenario identified the system components. The answers should have described the security aspect of each of these components. Candidates were expected to discuss the issue of establishing trust of and between clients. Many candidates knew about general security issues and chose to offer these general security issues as an answer without using and applying this knowledge to the particular requirements of the *cBay* organisation.

Answer Pointers

The choice of a computing platform should include a number of issues (identified below). A good answer should evaluate security at different levels (from application level security to data-link level security).

1. Type of authentication approach supported – passwords, certificates etc

2. Type of encryption technique supported – and at what level. For instance, are transactions encrypted at socket level (SSL), or is there an application specific protocol?

3. Can trust relationships be established between participants to enable use of alternative means of establishing trust – based, for example on previous interactions?

QUESTION FIVE

cBay would like to incorporate small Local Area Networks (LANs) in use by various local auction houses. Rather than support a single network and a database that maintains information centrally at cBay, a manager at cBay has proposed the building of a network of LANs.

a) Evaluate the manager's proposal (8 marks)

b) Describe a suitable architecture which may be used to implement a network of this kind (17 marks)

The second most popular question with a good spectrum of answers ranging from deep first hand knowledge of the subject to mere book regurgitation with little additional insight available from common sense awareness.

Most candidates did well in part b) of the question, with varying degrees of sophistication in the details provided.

Answer Pointers

a) The evaluation should consider benefits and costs of:

1. Supporting multiple networks

2. Developing subnets, and subsequent management

3. Supporting a single large network

4. Network management support, such as SNMP and the use of this protocol to handle multiple LANS

b) The architecture could utilise various network topologies to include the various LANs. The intention here is to integrate these LANs together using bridges. The answer should outline how integration is to take place, and what infrastructure components (such as switches per organisation, a router for domain) are needed to enable multiple local networks to work collectively. Benefits of grouping networking, and support for managing a network of this kind, using SNMP was rewarded.