Unit:
Computer Networks

Assignment title:
Delight – Private Hire

Sample Assignment

Introduction

This assignment enables you to demonstrate your knowledge and understanding of computer networks. You are required to produce a substantial document that totals TWO THOUSAND SEVEN HUNDRED (2700) words. Consequently, you should start work on the assignment at an early stage during the unit. The assignment is divided into tasks, which relate to the sequence of the module, so you do not need to wait until all the teaching is finished to start.

Some aspects of this assignment will require you to research real components that are currently available in the marketplace. Furthermore, you will also be asked to make judgements about what is best for the particular scenario. The information provided is relatively brief, so you will need to make some assumptions. Please note that there is not always one right answer. However, you will need to justify your reasons for any choices you make to get high marks.

You are NOT required to design a complete network. You are required to detail the specifics covered by the task list shown below.

Scenario

Delight was established in order to provide a safe, efficient, accessible and affordable transport service that is responsive to the needs and requirements of its customers. It provides a variety of services, including pre-booked taxis, airport transfers, limousine hire and coach hire.

Alongside normal general public operations, it has contracts with local commercial organisations and youth and educational establishments. *Delight* has two offices in Leeds, UK.

Delight is a small enterprise, as defined by the European Commission with 44 employees altogether. The majority of these employees are drivers with ten members of staff located in their offices. The office staff generally share responsibilities due to the size of the business.

The *Delight* head office consists of a reception area, a main office, an Operations Manager/Chief Executive office, and a small meeting room. The main office hosts all admin staff besides the Operations Manager and Chief Executive. There is a large storage room at the back of the main *Delight* head office. This contains a number of documents including timesheets, driver/vehicle schedule printouts, invoices, purchase orders, quotes, fuel cards, insurance files as well as ISO certification (ISO14001 Environmental Management and ISO9001 Quality Management).

The *Delight* head office shares a location with other offices that collectively have security at the main gate who allow/prevent access depending on the nature of an individual's visit.

The branch office is located in the centre of Leeds. There are two members of administration staff on site 24 hours a day managing the logistics of all drivers. This branch is also where the drivers are located between their assigned fares.

Current IT systems

Delight have their emails and website hosted externally via a third party ISP known as Beaumont Web Design. The current head office LAN consists of a Windows Small Business Server 2008 R2 which operates as a Domain controller and hosts several application systems: Sage Line 50 financial package, Sage HR, customer database, taxi booking system, and database for vehicle maintenance.

There are a total of 10 client pcs of varying age in the head office and 2 at the branch office. All run Windows 7. At the head office some connect to the server via Wi-Fi and the ADSL router (protected with WPA2 14 character password and which has never been reviewed since their initial set up in 2010), others connect through 10baseT over Cat 5 UTP cabling and a hub. At the branch office both connect remotely to the server via Wi-Fi and the ADSL router offers the same protection as the head office and was also set-up in 2010.

Delight have traditional telephone lines. All drivers have company mobile phones.

Delight do not have any IT staff on site, however they do have access to an ad-hoc IT technician based locally. This IT technician is called whenever *Delight* experience an IT issue, with the technician either resolving the issue over the phone or by travelling to *Delight* head office.

Expansion plans

The CEO is keen to improve their IT systems and is looking to make improvements to the reporting and booking systems, with the addition of a facility for automatic payment through credit cards to refine the customer experience. *Delight* has invested in a solution to provide this functionality via a server-based application, and mobile app which enables drivers to select the booking and enter the price. The payments/ billing is provided via the server application. When this is successfully implemented, the CEO wants to extend it to contactless payment for customers.

The CEO has called you in to advise him about designing the new network to improve performance and security. He acknowledges that the computer hardware is mostly old and will need replacing.

The following outline requirements have been identified:

Overall System Requirements

1. To provide a network solution (hardware and software) to meet the needs of the company, which ensures timely and secure access to information.

2. To provide Internet access for office staff (via desktop) from head office and the branch office.

3. To provide secure and appropriate access to the head office applications and files by staff.

4. To provide network access between the head office (8 staff) and branch office (2 staff).

Data and information

1. Client information stored at the head office.
2. Corporate web email hosted at the head office (as it needs to integrate with the new booking and billing system).
3. Corporate Web site via ISP.
4. Client bookings/ records, including personal contact information stored at the head office.

Hardware

1. New computers to meet performance, security and storage requirements (including backup) running Microsoft Windows for all office based staff.
2. New network printers (2).
3. Network components & servers as required.

Software

1. Latest Microsoft Office suite required.
2. WordPress is used for the Web site. The company wish to keep this software.
3. New booking management software (bookings/ payments/ records) integrated with Exchange server and Android apps used by drivers.
4. Web & email Internet access.
5. Suitable security software

Security requirements

1. Information security must meet the UK Government's 'Cyber Essentials' programme (https://www.cyberessentials.ncsc.gov.uk/.
2. Restrictions are required to be implemented to control access to the confidential client information.
3. The system is required to be secure from internal and external threats.
4. An automated daily backup policy and procedure, for all the information stored within the business.
5. Further discussion will be required to establish downtime that is acceptable.

Task 1: Network Infrastructure and Protocols - 30 Marks

The head office requires new IT infrastructure. The CEO has asked you to provide a report to clarify the following:

a) It has been suggested that there are two major options for providing the network: Use Ethernet components/ cabling **or** use Wi-Fi.

The head office has a mixture of 10base T over Cat 5 UTP and Wi-Fi; Explain the difference between this and newer versions of Ethernet and Wi-Fi **and** make a recommendation about the technology the charity should use. You should discuss differences in data rate **and** the type of cable required **and** network contention. A good answer will relate your recommendation to the business requirements.

b) A hub, a switch, a wireless access point and a router are networking components. Explain the differences between them **and** identify the OSI layer at which each component operates. For each component, support your answer with ONE (1) reason.

c) Network architecture is frequently described in terms of the OSI 7-layer model. Explain the purpose of each of the 7 layers.

d) Given the applications that will be used and making any suitable assumptions, explain the purpose of SEVEN (7) protocols. For each protocol, identify the layer at which they operate.

This task requires around NINE HUNDRED (900) words.

Tasks continue on next page

Task 2: Addressing - 30 Marks

The company want you to provide a clear explanation about network addressing.

a) Explain why network components need addresses. Explain clearly the difference between a MAC address and an IP address. Distinguish briefly between IPv4 and IPv6.

b) The company would like you to explain the difference between a private IPv4 address and a public IPv4 address. Ensure you explain where/ if you would use each type in their network. State the Private IP address ranges.

c) Explain what DHCP is, where you would use it in the IT centre and remote offices **and** why you would use it.

d) What is ARP **and** why is it needed?

e) Define the terms Default Gateway **and** Subnet Mask **and** briefly explain why **both** are required in this project. You should provide THREE (3) points relating to a subnet mask for full marks.

f) Explain what is meant by an IP Routing Table **and** provide ONE (1) example of how a router uses its routing table on the Internet. You do NOT have to explain every field in the routing table. In your example, explain how a packet gets from source to destination.

This task requires around NINE HUNDRED (900) words.

Task 3: Security - 10 Marks

The CEO is seriously concerned about security.

a) Describe Three (3) measures that you recommend should be taken to keep the network secure. This could include hardware, software, policies or ways of checking them.

b) What do you think is the biggest threat for this system? Justify your answer.

This task requires around THREE HUNDRED (300) words.

Tasks continue on next page

Task 4: Diagram and explanation - 20 Marks

The company wants a clear diagram to show how the components of the new system will be connected. You should provide the following:

a) Draw a logical network diagram (topology) that shows the main components of the network (including connections to the branch office).

b) Invent **and** allocate suitable IPv4 addresses **and** add them in the diagram. You should ensure you include the subnet mask **and** identify those that need providing by the ISP.

c) Explain why you have chosen the particular hardware components **and** why you have connected them together in that way.

d) Give local prices and specification of suitable hardware/ software you recommend.

This task requires around THREE HUNDRED (300) words.

Task 5 Remote access– 10 Marks

The company employs drivers. These staff need to access email, and the bookings system via Android smartphones. The branch office also requires a remote connection to the head office network and (some of) its applications. Good communication is vital.

a) Explain how your solution incorporates secure remote access into the system from the branch office and mobile drivers. Identify the components you would need **and** actions you'd need to take to get it to work.

b) How does the remote access requirement from mobile devices impact the network security?

Your answer should be around THREE HUNDRED (300) words.

Guidance and submission requirements

- Your answers should be word-processed and total 2700 words in length (+/- 10%) You will lose marks if you go under or over this word count.

- Familiarise yourself with the NCC Education Academic Dishonesty and Plagiarism Policy and ensure you correctly reference all the sources which you use in your work.

- All references and citations must adhere to the Harvard system.

- Media containing viruses, or media which cannot be run directly, will result in a fail grade being awarded for this module.

Candidate checklist

Please use the following checklist to ensure that your work is ready for submission.

Have you read the NCC Education documents *What is Academic Misconduct? Guidance for Candidates* and *Avoiding Plagiarism and Collusion: Guidance for Candidates* and ensured that you have acknowledged all the sources that you have used in your work? ❑

Have you completed the *Statement and Confirmation of Own Work* form and attached it to your assignment? **You must do this.** ❑

Have you ensured that your work has not gone over or under the recommended word count by more than 10%? ❑

Have you ensured that your work does not contain viruses and can be run directly? ❑