

The Faculty of Computing, Engineering and Science

Module Name: **Network and Protocols**
Module Code: **CE00997-6**
Title of Assignment: **Company Expansion**

Module Learning Outcomes for This Assignment

- DESIGN, IMPLEMENT AND INVESTIGATE NETWORKS USING APPROPRIATE SIMULATION SOFTWARE, INTERNETWORKING TOOLS AND TECHNOLOGY IN MULTI-PROTOCOL ENVIRONMENTS.

Deadline for submission:

23rd November 2012 (before 3.30pm)

Please note submissions after this deadline will score ZERO.

Weighting: **70%**

Coursework
September 2012

Introduction

This assignment is one of two parts of the formal assessment for CE00997-6 and is, therefore, compulsory. The assignment is weighted at 70% of the course grade. You will be required to work individually, so time management is very important.

When reading this assignment please read all elements fully and understand what is being asked of you, DO NOT rely on your friend to explain what is expected, if you have any issues, please ask the teaching team.

The aim of this assessment is to give you the opportunity to design, implement and investigate a network infrastructure for a defined purpose. You must use OPNET, a network simulation application to present your design and testing results.

Current Scenario

You have just started a new job as a network technician working for a private health company with its Headquarters (HQ) based in Stafford. The HQ is reasonably small clinic with a mix of doctors, nurses and administration staff who provide health care to a large number of patients. The company has a number of specialist health centres at a number of locations listed below:

- Birmingham
- Liverpool
- Derby

The current network at each location (HQ and three specialist branches) consists of a Router-Hub infrastructure which is based on a combination of 10BaseT with a 56 kbit/s connection to the Internet. The current logical layout of the network infrastructure is presented in figure 1 below.

Currently there are two servers at HQ site. The HTTP server has been installed on server 1 to host the company website and VoIP has been installed on server 2 to manage voice communication between different sites (*Please note that the VoIP server is used here for OPNET purpose and this service can be implemented without a dedicated server*).

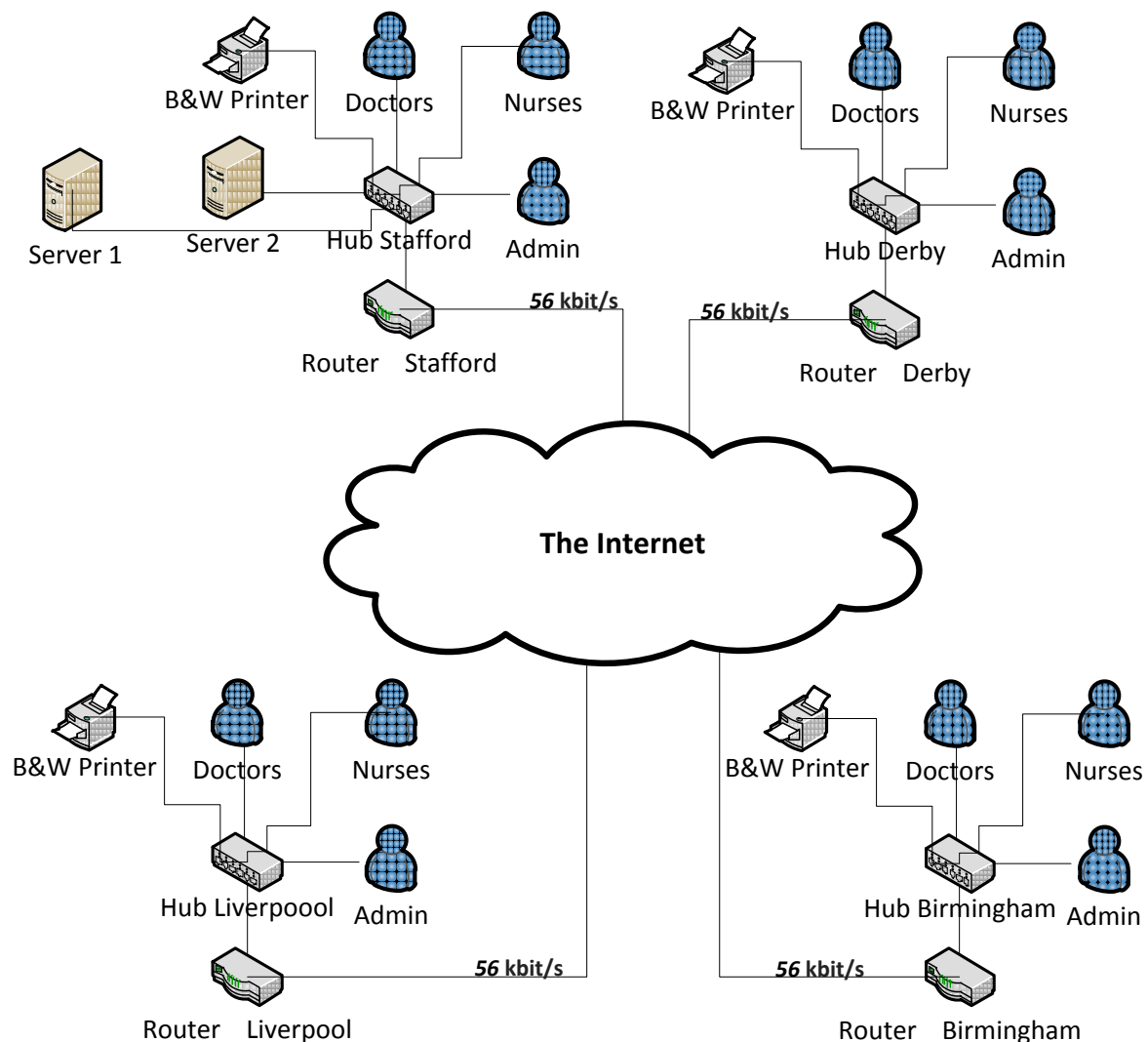


Figure 1: The logical layout of the network.

Five admin staff (one receptionist, two managers and two clerks), two nurses and five doctors are based at HQ (in total 12 employees). The layout of this area is shown in figure 2. Each of the Doctor and Nurse rooms has one PC in them and four machines are located in the administration staff room and one PC at the reception which is a part of the administration staff machines. There is also a shared black and white printer. The entire infrastructure currently is based on using a single Class A private IP address.

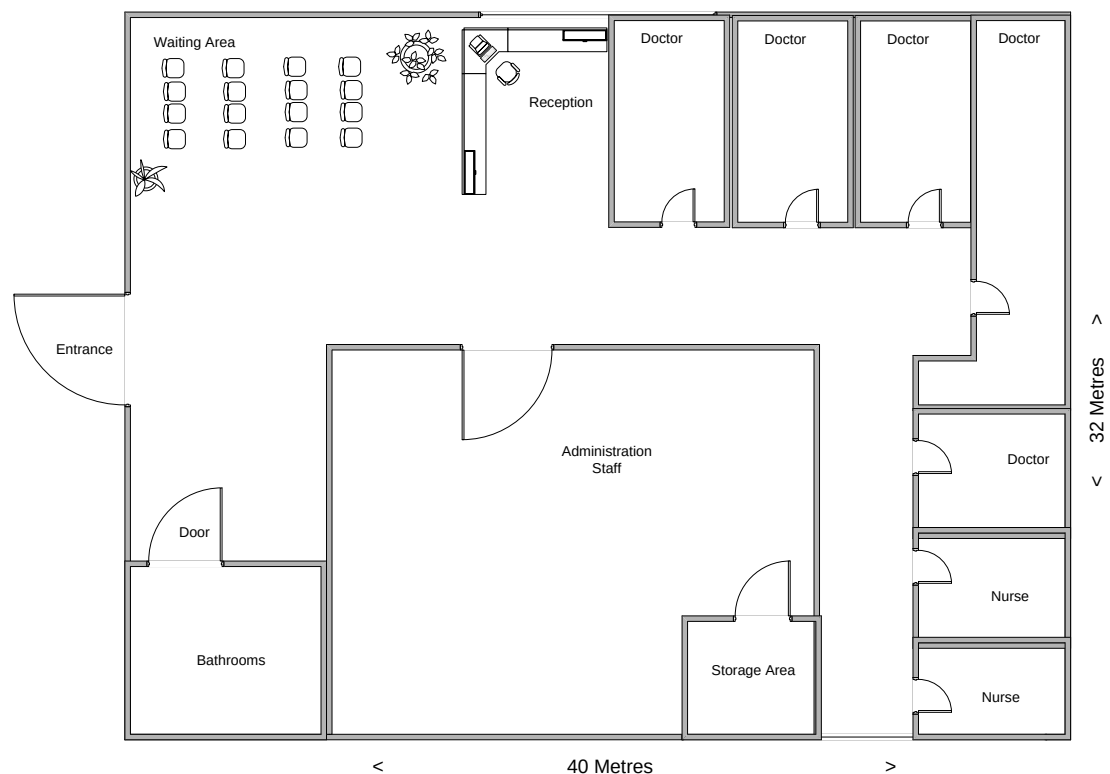


Figure 2: The physical layout of the HQ.

Within each of the specialist health centres there is one receptionist, 2 admin staff (manager and clerk), two nurses and three doctors. Each of them uses a PC. There is also a black and white printer in the reception area. There is only one design for all specialist health centres as shown in figure 3.

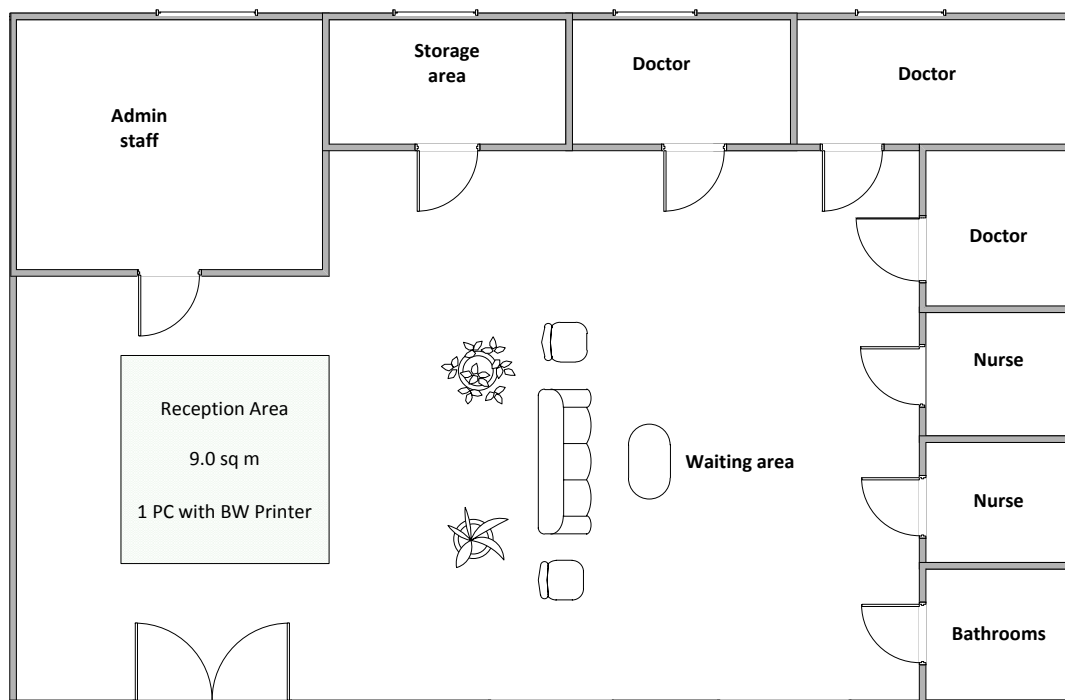


Figure 3: The physical layout of specialist centres.

Your Task

When the infrastructure was installed originally only a small number of the administration staff used computers, now all of the staff utilise them for the entire working day. You as a network and IT technician have been tasked with re-designing the diagram to improve network performance in particular VoIP. You have been also asked to implement FTP as well as HTTPS on server 1 at HQ to keep all patient records. All of the networking equipment and computers will be replaced as a part of this upgrade to future proof the network and to also introduce a level of reliability.

The HQ asked you to prepare a simulation of you proposed scenario using OPNET, together with the management report.

Management Report

You need to produce the following in the form of a management report (word count = 3500 +/-10%): Ensure that all of your work is word processed in a format. In addition ensure that all of your work is referenced where applicable.

The following sections (this is not a definitive guide; you may add pages/change names but you cannot leave out any)

1. Front cover

Including the module code, your name, your student number and the assignment title

2. Table of Contents

3. IP Addressing Scheme Design (20%)

The Doctors and Administration machines will require to be placed onto different subnets using VLSM for the most efficient use of the available address space.

Apart for upgrading computers there will also be a colour laser network printer for admin staff use, a black and white network laser printer for the doctors and nurses. All sites including the HQ require a guest Wireless provision. The Nurses rooms will also require access to the same data as the Doctors and as such should be allocated an IP address from the Doctors Range. The reception will need a machine which is part of the Admin staff pool of IP addresses.

You are required to use VLSM for the most efficient use of the available address space. The IP address which you need to use for your solutions will be:

Network address: _____ (Please ask your instructor)

When creating the subnets **do use** the zero subnet. For each of the subnets record the:

- Number of hosts needed;
- Network address of the subnet;
- First usable address of the subnet;
- Last usable address of the subnet
- Subnet Mask used;
- Broadcast address of the subnet;
- Default Gateway of the subnet;

Show in the following table the allocation of the IP addresses within your infrastructure.

Site / Subnet Name	Number of Hosts Needed	Network Address	Subnet Mask	IP address Start (useable)	IP Address End (useable)	Broadcast address	Default Gateway* (if applicable)
Example: The Octagon	120	192.168.0.0	255.255.255.128	192.168.0.1	192.168.0.126	192.168.0.127	192.168.0.126

4. A plan of your proposed network along with a justification for the design and finance (20%)

You should present a logical layout diagram similar to figure 1 with your upgrades. You have to justify selection of your devices, site to site connections and explain how this will help to improve the network performance. As the project manager for this you will need to supply the costs for cabling and network equipment. You do not need to include the cost of the server class machines but you do need to specify the workstations.

5. A plan for the upgrade of the HQ site and centres (20%)

You will need to produce a diagram which shows where the cables will run within HQ and specialist centres and where the switches, routers, computers and printers will be stored within the locations.

6. A simulation of your proposed existing network and investigation into the use of HTTP, FTP and VoIP for the staff at each site (40%)

Before your managers allow you to start installing the infrastructure you are expected to demonstrate that your solution will actually operate. To do this you need to create the infrastructure within the OPNET environment. This will be used to demonstrate that your solution will operate. You **do not** have to assign an IP address to the machines in OPNET, please use automatic configuration and only one switch can be used per site).

To justify your design you need to demonstrate an improvement when using the VoIP service. You have been asked to show a diagram with the existing performance i.e. end to end delay and jitter and compare it with diagrams after your network updates. Explain your results and justify with reference to published resources whether the VoIP performance will result in good quality of calls.

Although the FTP service is not implemented at the moment, you are asked to investigate the use of this service as well. The FTP server should be installed on server 1 at HQ. After upgrading your network you have been asked to produce the diagrams for HTTPS page response time and FTP download response time to corresponding servers. Explain your results and justify with reference to published resources whether the HTTPS page response time and FTP download response time will result in acceptable response times for these services.

You will also need to submit the simulation models so that results can be verified with the report.

7. References

A list of the resources you have made reference to in your report

Submission Guidelines

You need to submit your management report before the deadline.

Your documentation and a copy of simulation should be submitted in **electronic format** through the university VLE, Blackboard. An assignment drop box will be set up near to the deadline to allow you to submit them both. Please submit DOC or PDF version of the case study report otherwise it might NOT be recognised by the Turnitin system. If you have any questions/queries, please contact your tutor.

Advice

- Read the relevant literature, which is extensive, in this area. It is an absolute pre-condition for being able to understand and justify the design decisions that you make. It is important that you start your preparation early.
- Proof read your work before hand-in; check for any grammatical or spelling errors in both your Web site and report.
- If you have any questions or need further clarification on this assignment, please email the tutor (t.bosakowski@staffs.ac.uk or m.s.hasan@staffs.ac.uk) or make an appointment to see him.