LEVEL 4

COMPUTER NETWORKS

Student Guide

Modification History

Version	Date	Revision Description
V1.0	June 2011	For Release
V1.1	September 2015	Assessment methodology updated

CONTENTS

1. Module Overview and Objectives

This unit aims to provide you with a broad introduction to the networking and communication systems commonly employed in a business environment, along with an understanding of the underlying theoretical frameworks and of associated issues such as the testing and security of these systems.

2. Learning Outcomes and Assessment Criteria

Learning Outcomes; The Learner will:	Assessment Criteria; The Learner can:
1. Understand network and communication protocols	1.1 Explain the overarching principles of the OSI seven-layer model 1.2 Explain the function of each layer of the OSI model, and the protocols associated with it. 1.3 Explain the function and application of a range of communication and network protocols. 1.4 Evaluate the use of various protocols against real-world purposes 1.5 Explain the function and rationale of wireless networking standards 1.6 Explain a range of contemporary wireless standards and their relevant applications.
2. Understand the principles of common network topologies and architectures	2.1 Explain the concept of network topology and its design. 2.2 Discuss various common network topologies and their application(s). 2.3 Propose a simple network topology in response to detailed requirements
3. Understand the application of network security measures	3.1 Install and configure a firewall on an internet-connected system 3.2 Install and configure essential software security measures
4. Be able to select and configure the hardware components of a computer network to meet the requirements of a precise specification.	4.1 Categorise network cables and connectors and their implementations 4.2 Select the hardware component of a network 4.3 Assemble the necessary hardware components to create a network according to a design specification. 4.4 Configure the hardware components for a wireless network. 4.5 Test the connectivity of a network 4.6 Troubleshoot client-side connectivity issues using appropriate tools

5. Be able to design and install network and server operating systems to meet the requirements of a precise specification.	5.1 Identify the software requirements for a computer network
	5.2 Install and run appropriate network software according to a design specification.
	5.3 Install and run software components for a wireless network.
	5.4 Test the correct operation of network and server software
6. Be able to install and configure internet telephony and communication systems	6.1 Install and configure a Voice over IP (VoIP) system
	6.2 Install and configure a web-based video conferencing solution
	6.3 Install and configure a Virtual Private Network (VPN)

3. Syllabus

Syllabus			
Topic No	Title	Proportion	Content
1	Introduction to the Module and Networks	1/12 4 hours of lectures 1 hour of laboratory sessions	• Introduction to module • What is a network? • Real world networks • The OSI seven-layer model *Learning Outcome: 1*
2	Network Protocols and Standards	1/12 4 hours of lectures 1 hour of laboratory sessions	• Communications and network protocols • Protocols and the OSI model • Protocols in real world networks • The Internet *Learning Outcome: 1*
3	Wireless Networking Standards	1/12 4 hours of lectures 1 hour of laboratory sessions	• Wireless devices • Wireless networking standards • Issues for wireless networks • Wireless networking protocols *Learning Outcome: 1*
4	Network Topology and Architecture	1/12 3 hours of lectures 2 hours of laboratory sessions	• Network topology concepts • Common network topologies and their application • Topologies and protocols *Learning Outcome: 2*

5	Network Media and Connectors	1/12 3 hours of lectures 2 hours of laboratory sessions	• Network media • Network connectors • Selecting media and connectors *Learning Outcome: 4*
6	Network Hardware	1/12 2 hours of lectures 3 hours of laboratory sessions	• Network hardware • Hardware selection • Creating a network *Learning Outcome: 4*
7	Wireless Network Hardware	1/12 2 hours of lectures 3 hours of laboratory sessions	• Wireless network hardware • Wireless hardware selection • Creating a wireless network *Learning Outcome: 4*
8	Security Software	1/12 3 hours of lectures 2 hours of laboratory sessions	• Network security threats • Security countermeasures • Security software • Installing and configuring security software *Learning Outcome: 3*
9	Firewalls	1/12 3 hours of lectures 2 hours of laboratory sessions	• Functions of a firewall • Types of firewall • Installing and configuring a firewall *Learning Outcome: 3*
10	Network and Server Software	1/12 2 hours of lectures 3 hours of laboratory sessions	• Network software requirements • Wireless network software requirements • Configuring network software *Learning Outcome: 5*

11	Voice over IP and Video Conferencing	1/12 2 hours of lectures 3 hours of laboratory sessions	- Voice over IP (VoIP) - Video conferencing - Installing and configuring voice networks - Installing and configuring video networks *Learning Outcome: 6*
12	Virtual Private Networks	1/12 2 hours of lectures 3 hours of laboratory sessions	- Virtual private networks (VPN) - Advantages and disadvantages of VPN - Installing and configuring VPN *Learning Outcome: 6*

4. Related National Occupational Standards

The UK National Occupational Standards describe the skills that professionals are expected to demonstrate in their jobs in order to carry them out effectively. They are developed by employers and this information can be helpful in explaining the practical skills you have covered in this module.

Related National Occupational Standards (NOS)
Sector Subject Area: 6.1 ICT Professional Competence
Related NOS: 4.1.A.1 – Contribute to IT architecture work; 4.8.A.1 – Prepare, under supervision, for IT/technology infrastructure design and planning activities; 4.8.A.2 – Assist with IT/technology infrastructure design and planning activities; 4.8.A.3 – Assist others with relevant information concerning IT/technology infrastructure design and planning assignments; 5.4.A.1 - Perform systems integration activities as directed; 5.4.P.2 - Perform systems integration activities; 5.5.A.1 - Assist with gathering and documenting information to support systems installation, implementation and handover; 5.5.P.1 - Perform systems installation, implementation and handover activities.

5. Teaching and Learning

Suggested Learning Hours					
Lectures:	**Tutorial:**	**Seminar:**	**Laboratory:**	**Private Study:**	**Total:**
34	-	-	26	90	150

The teacher-led time for this module is comprised of lectures and laboratory sessions. You will need to bring this Student Guide to all classes for this module. The breakdown of the hours for each topic is given in the topic notes below.

5.1 Lectures

Your lecturer will be presenting the basic knowledge and the theoretical concepts required for the unit during this time. He/she will use PowerPoint slides during the lecture time and you will be expected to take notes.

You will also be encouraged to be active during this time and discuss and/or practice the concepts covered. Lectures will include question and answer elements to promote participation and to check whether you understand the concepts they are covering.

5.2 Laboratory Sessions

Laboratory sessions are designed to follow the respective topic lecture. The purpose is to develop concepts in relation to real life networks and provide opportunity to develop the skills required to meet the practical assessment criteria. During these sessions, you will work through practical tutorials and various exercises. The details of these are provided in this guide.

5.3 Private Study

This Student Guide also contains details of the suggested private study exercises. You are expected to complete these exercises to improve your understanding. Your tutor will set deadlines for the completion of this work and go over the suggested answers with you.

You should also use this time to revise the content of lectures to ensure understanding and conduct extra reading. You should bring any questions to the next lecture or laboratory sessions for additional guidance and support.

6. Further Reading List

You will also be expected to undertake further reading to consolidate and extend your knowledge of the topics covered in this module. Your Accredited Partner Centre's library will contain a selection of useful sources of information and you can also make use of materials available online. The list below also provides suggestions of suitable reference books you may like to use:

Black, U. (2009). *Sams Teach Yourself Networking in 24 Hours,* 4th edition. Sams.
ISBN-10: 0768685761
ISBN-13: 978-0768685763

Olifer, N. & Olifer, V. (2006). *Computer Networks: Principles, Technologies and Protocols For Network Design.* John Wiley & Sons.
ISBN-10: 8126509171
ISBN-13: 978-8126509171

Sosinsky, B. (2009). *Networking Bible.* John Wiley & Sons.
ISBN-10: 0470431318
ISBN-13: 978-0470431313

Tanenbaum, A.S & Weatherall, D.J. (2010). *Computer Networks,* 5th edition. Pearson Education.
ISBN-10: 0132553171
ISBN-13: 978-0132553179

7.   Assessment

This module will be assessed by means of an assignment worth 100% of the total mark. The assessment will cover the learning outcomes and assessment criteria given above.

Topic 1: Introduction

1.1 Learning Objectives

This topic provides an overview of the module and provides an introduction to computer networks. It aims to help you to develop an understanding of the problems associated with communications between different devices.

On completion of the topic, you will be able to:

- Describe the purpose and development of computer networks;
- Explain the overarching principles of the OSI seven-layer model.

1.2 Timings

Lectures: 4 hours

Laboratory Sessions: 1 hour

Private Study: 7.5 hours

1.3   Laboratory Sessions

The laboratory time allocation for this topic is 1 hour.

Exercise 1:

Examine the computer network in your laboratory.

    a. List all items in the network (e.g. 10 Desktop PCs **NOT** 10 HP Pavillion P6799 Desktop PCs)

    b. List all the communications between items in the network (e.g. computers communicate with networked printer)

    c. List the external networks that the laboratory connects to

    d. Compare your list with the other groups

    e. Discuss the issues raised by networking these different devices and external networks

1.4　Private Study Exercises

You should spend approximately 7.5 hours on the Private Study for this topic. You should use this time to complete the exercises below, as directed by your lecturer, and to review the contents of this topic.

Exercise 1:

Research the development of computers and computer networks from the early days of computing to the modern day. Provide a brief overview of each decade from the 1950s to the present day.

Exercise 2:

Research ONE social issue that has arisen as the result of the implementation of computer networks. Explain what the issue is and describe how computer networks are the cause of the issue. Discuss the advantages and drawbacks of implementing such computer networks. Where possible use detail from newspapers or journal reports that highlight relevant cases in the public spotlight.

You should write 500-1000 words.

Exercise 3:

Research the international and national bodies that are responsible for developing and maintaining standards for telecommunications networks and the Internet. Name each body and briefly outline their responsibilities in your own words.

Topic 2: Network Protocols and Standards

2.1 Learning Objectives

This topic provides an overview of network protocols and standards, and discusses these in terms of real world networks including the Internet. It aims to provide you with an understanding of why protocols are developed and the usage of specific protocols.

On completion of the topic, you will be able to:

- Explain the purpose of network protocols;
- Relate protocols to the OSI Reference Model;
- Describe the use of protocols in real-life networks;
- Describe the protocols used by the Internet.

2.2 Timings

Lectures: 4 hours

Laboratory Sessions: 1 hour

Private Study: 7,5 hours

2.3   Laboratory Sessions

The laboratory time allocation for this topic is 1 hour.

Exercise 1:

Examine the computer network in your laboratory.

- a. Find the MAC address of three items on the network.

- b. Find the IP address of three items on the network that connect to the Internet

- c. Find the IP address of any router used.

- d. Describe the type of network used (e.g. Ethernet, client-server, etc)

- e. List all protocols used in the network. Give a brief description of any protocol not discussed in the lectures or in the private study exercises.

2.4   Private Study Exercises

You should spend approximately 7.5 hours on the Private Study for this topic. You should use this time to complete the exercises below, as directed by your lecturer, and to review the contents of this topic.

Exercise 1:

Research the following protocols and for each protocol:

- State the full protocol name

- Briefly explain how the protocol is used

The protocols to research are:

a. HTTP

b. FTP

c. IP

d. TCP

e. POP3

f. SMTP

g. IMAP

Exercise 2:

Research the IEEE 802 working groups. List each group with a brief description and state whether it is active or not.

Exercise 3:

Research the following standards and for each standard, briefly describe the devices to which it relates.

a. RS232

b. RS422

Exercise 4:

Research all of the protocols mentioned in Topic 2, Lecture 2. Give a brief overview of each one.

Exercise 5:

Research the IPv4 Datagram and explain each section of the header.

Topic 3: Wireless Networking Standards

3.1 Learning Objectives

This topic provides an overview of wireless networks, including the standards, protocols and some of the issues that are specific to wireless networking. It aims to provide you with an understanding of the historical development of wireless networking and the reasons why wireless is becoming increasingly popular.

On completion of the topic, you will be able to:

- Explain the function and rationale of wireless networking standards;
- Explain a range of contemporary wireless standards and their relevant applications.

3.2 Timings

Lectures: 4 hours

Laboratory Sessions: 1 hour

Private Study: 7.5 hours

3.3   Laboratory Sessions

The laboratory time allocation for this topic is 1 hour.

Exercise 1:

You are required to survey your computer laboratory to determine its suitability for installing a new wireless LAN. Draw a plan of the lab and identify all items that may affect the transmission range and transmission quality of wireless signals. Write a brief report outlining any issues you have discovered.

3.4   Private Study Exercises

You should spend approximately 7.5 hours on the Private Study for this topic. You should use this time to complete the exercises below, as directed by your lecturer, and to review the contents of this topic.

Exercise 1:

List all of the wireless devices in your home and college. Briefly explain the purpose of each device.

Exercise 2:

Research the IEEE 802.11g and 802.11n standards. Explain the key points of each standard and make a comparison between the two standards.

Exercise 3:

Find information on the following technologies and gain a basic understanding of each:

- Frequency Hopping Spread Spectrum

- Direct Sequence Spread Spectrum

- Orthogonal Frequency-Division Multiplexing

- Multiple-Input Multiple-Output

You are not expected to write a report, but you may be asked questions about these in lectures.

Exercise 4:

Find a Bluetooth enabled device in your college or home. Write a brief user manual explaining how this device connects to another device via Blootooth.

You should write around 300 words.

Exercise 5:

Research an application that uses RFID tags. Explain how the RFID tags are attached and what they are used for. Discuss any problems or issues raised by using RFID technology in this application.

You should write around 500-1000 words.

Topic 4: Network Topology and Architecture

4.1 Learning Objectives

This topic provides an overview of network topology, including the advantages and disadvantages of different topologies. It aims to provide you with an understanding of the different topologies commonly used, and an appreciation of the difference between logical topology and physical topology.

On completion of the topic, you will be able to:

- Explain the concept of network topology and its design;
- Discuss various common network topologies and their application(s);
- Propose a simple network topology in response to detailed requirements.

4.2 Timings

Lectures: 3 hours

Laboratory Sessions: 2 hours

Private Study: 7.5 hours

4.3   Laboratory Sessions

The laboratory time allocation for this topic is 2 hours.

Exercise 1:

Visit a computer laboratory in your college and create a network topology diagram that shows all relevant devices on the network plus links to any external networks, such as the Internet. Provide a written description of the network and explain the reasons, if possible, for choices of physical and logical topology.

You should draw your diagram using suitable software (e.g. MS Word and clipart) and aim to write approximately 500 words.

Exercise 2:

The network in your college is likely to use hubs and/or switches. Examine how the cabling terminates at a hub or switch. Typically, hubs and switches have LED displays that show activity on the network. Draw a labelled diagram of the hub or switch showing connections and LED display. Write a brief description of the connections and display.

4.4　Private Study Exercises

You should spend approximately 7.5 hours on the Private Study for this topic. You should use this time to complete the exercises below, as directed by your lecturer, and to review the contents of this topic.

Exercise 1:

Research the differences between an intranet, an extranet and the Internet. Write a brief report that:

- gives a definition of each one

- explains the difference between the three networks

- defines a typical topology of an intranet and an extranet with diagrams for each topology.

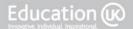Your report should be approximately 300 words.

Exercise 2:

The topology of the Internet is very complex. Research the efforts to map the Internet. Take notes on the problems with Internet mapping and the outcomes of at least one method. Note how one Internet map has been produced and if possible, take a copy of the mapping diagram produced.

Exercise 3:

Create a network diagram and brief report describing the network topology you would implement for the following scenario:

Your college wishes to extend its internal network to include, as a minimum, one networked PC for the teacher in every teaching room plus a wireless network open to all students and staff throughout the college that will also provide Internet access. This will be in addition to the current networks in your college.

(If your centre already has these network facilities then create a diagram and report based upon these current facilities.)

Topic 5:   Network Media and Connectors

5.1   Learning Objectives

This topic provides an overview of the available types of network media and connection devices used in typical computer networks.

On completion of the topic, you will be able to:

- Categorise network cables and connectors;
- Describe the usage of network cables and connectors.

5.2   Timings

Lectures: 3 hours

Laboratory Sessions: 2 hours

Private Study: 7.5 hours

5.3 Laboratory Sessions

The laboratory time allocation for this topic is 2 hours.

Exercise 1:

Examine the network in your college computer lab. State the type of network and physical topology used. Examine all network media and connectors in the lab. Write a brief report that gives the following detail:

    a. States the network type and physical topology (no diagram required)

    b. Describes each connection (e.g. computers to face plate – do not repeat for each computer connected in this way) in the network including:

        i.   Device at each end of the connection

        ii.   Cable used (or wireless)

        iii.   Connector used at each end

    c. Describes connection to any external network. For example, connection to the telecommunications closet and vertical cabling and/or connection to the Internet.

    d. If possible, get your teacher or network administrator to show you the data transfer rates on the network and include these in your report.

5.4   Private Study Exercises

You should spend approximately 7.5 hours on the Private Study for this topic. You should use this time to complete the exercises below, as directed by your lecturer, and to review the contents of this topic.

Exercise 1:

Research Category 5, 5e and 6 Ethernet cables and write a report giving a brief outline of each category including the frequencies used.

Your report should be approximately 300 words.

Exercise 2:

Investigate RJ-45 wiring standards for Ethernet. Write a brief report on the two standards, including wiring diagrams, and explain the difference between straight-through and crossover connections.

Your report should be approximately 200 words.

Exercise 3:

Investigate the range of fibre optic connectors available. Create a list of connector types not covered in the lecture, giving a very brief overview of each connector type you find (e.g. Avio – screw type – used in avionics).

Exercise 4:

Investigate the USB 2.0 standard that is used for connecting peripherals to computers. Make notes on the main features of this standard.

Topic 6: Network Hardware

6.1 Learning Objectives

This topic provides an overview of the hardware components of a network and the assembly of those components into an operational network.

On completion of the topic, you will be able to:

- Select the hardware components of a network;
- Assemble the necessary hardware components to create a network according to a design specification;
- Test the connectivity of a network;
- Troubleshoot client-side connectivity issues using appropriate tools.

6.2 Timings

Lectures: 2 hours

Laboratory Sessions: 3 hours

Private Study: 7.5 hours

6.3 Laboratory Sessions

The laboratory time allocation for this topic is 3 hours.

Exercise 1:

Create a small network in your computer lab that uses physical cables. As a minimum, this should include:

- 2 computers

- 1 hub/switch

- 1 peripheral device (e.g. a printer)

This may require the disconnection of current devices from the lab network and then adding them back into the network or introducing new devices to the network. The connections may be via patch cables and face plates in the wall or ducting. It is important to consult with your network administrator and lecturer whilst doing this to make the connections in a way that suits your centre's facilities.

During your private study time, you will write a full report of your work which includes the preliminary work before setting up the network, full details of all devices that are being connected, procedures for creating the physical connections, tests carried out to ensure the networked devices are working correctly, any troubleshooting and rectification of problems. In order to do this, you should make detailed notes as you create the network.

Exercise 2:

You are required to purchase hardware for a small business computer network that will use physical cables as media and includes:

- 12 workstation computers

- 1 fax machine

- 1 printer

- Internet connection for all workstations

You can decide the nature of this business yourself and tailor the needs of the network to this. Research the equipment available in your country and write a brief report that lists the equipment you would purchase for this network, including cabling, connection devices, etc. Your report should include costs for this equipment and a sketched network diagram showing the physical topology.

6.4 Private Study Exercises

You should spend approximately 7.5 hours on the Private Study for this topic. You should use this time to complete the exercises below, as directed by your lecturer, and to review the contents of this topic.

Exercise 1:

Complete your report for Exercise 1 from the laboratory sessions. This should include:

- the preliminary work you did before setting up the network
- full details of all devices that were connected
- procedures for creating the physical connections
- tests carried out to ensure the networked devices were working correctly
- any troubleshooting and rectification of problems

You will need to submit your report to your lecturer for marking.

Exercise 2:

Research routing protocols and write a brief report that explains the difference between Interior Gateway Protocols and Exterior Gateway Protocols. Describe the protocols used.

Your report should be approximately 500 words.

Exercise 3:

List all the different types of specialist server you can think of or find via the Internet and books (e.g. mail server). Briefly describe each one.

Exercise 4:

RAID technology is often used to provide fault tolerance and backup for networks. Research what RAID is and write a brief report that explains the technology and the common RAID configurations in use.

Your report should be approximately 300 words.

Exercise 5:

Research the tools available to troubleshoot network problems that were listed in the lecture. Make notes on each of the available tools. Add any other tools you feel are relevant.

Topic 7: Wireless Network Hardware

7.1 Learning Objectives

This topic provides an overview of the hardware components of a wireless network and the assembly of those components into an operational wireless network.

On completion of the topic, you will be able to:

- Select the hardware component of a network;
- Configure the hardware components for a wireless network;
- Test the connectivity of a network;
- Troubleshoot client-side connectivity issues using appropriate tools.

7.2 Timings

Lectures: 2 hours

Laboratory Sessions: 3 hours

Private Study: 7.5 hours

7.3   Laboratory Sessions

The laboratory time allocation for this topic is 3 hours.

Exercise 1:

Create a small wireless network in your computer lab. As a minimum this should include:

- 1 computer

- 1 peripheral device (e.g. a Bluetooth mouse)

- 1 PDA or smartphone

This may require the disconnection of current devices from the lab network and then adding them back into the network or introducing new devices to the network. The connections may be via an access point or as part of an ad-hoc peer-to-peer network. It is important to consult with your network administrator and lecturer whilst doing this to make the connections in a way that suits your college's facilities.

Exercise 2:

You are required to purchase hardware for a wireless network for your college. This network will allow roaming access for students and staff by using a common username and password for everyone, it will provide access to the Internet and should be available throughout the whole college.

You must survey your college and create a list of required hardware for the network. If your college is large, you should work in groups and break down the survey into smaller areas with each surveyed by one person. Research the equipment available in your country and write a list of the equipment you would purchase for this network including all connection devices, etc.

7.4 Private Study Exercises

You should spend approximately 7.5 hours on the Private Study for this topic. You should use this time to complete the exercises below, as directed by your lecturer, and to review the contents of this topic.

Exercise 1:

Complete your reports for the tasks in the laboratory sessions. You will need to submit these to your lecturer for marking.

Exercise 2:

Research DHCP. Write notes explaining what DHCP is and how a DHCP server works.

Exercise 3:

Research the steps to take when troubleshooting connection problems with a wireless network. Take notes on what should be checked in order to isolate any faults and, where possible, describe how these checks can be carried out.

Exercise 4:

RFID systems are increasingly used in business for purposes such as stock control and the tracking of deliveries. Research the use of RFID in a business and write notes explaining how RFID operates in the business and the benefits of using the RFID system.

Topic 8: Security Software

8.1 Learning Objectives

This topic provides an overview of the threats to the security of a network and countermeasures that may be used to reduce the likelihood of successful attacks on a network.

On completion of the topic, you will be able to:

- Understand threats to the security of a network;
- Describe a range of security countermeasures;
- Install and configure essential software security measures.

8.2 Timings

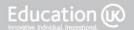Lectures: 3 hours

Laboratory Sessions: 2 hours

Private Study: 7.5 hours

8.3   Laboratory Sessions

The laboratory time allocation for this topic is 2 hours.

Exercise 1:

Examine the network security policies, tools and software used in your college network. Take notes on how network security is handled in the college, including details of policies, tools, hardware, software and authentication methods used in network security. Where possible identify security vulnerabilities and suggest ways to improve security. You are required to turn your notes into a formal report in Private Study Exercise 1.

Exercise 2:

Configure the antivirus software running on one computer on your college network. Take notes on the software and the configuration process. Consider the threats that this software protects the computer from, how you have chosen to configure the software in the way you have, and how the software keeps the protection up to date. Also note where antivirus software is part of a more comprehensive security package.

8.4   Private Study Exercises

You should spend approximately 7.5 hours on the Private Study for this topic. You should use this time to complete the exercises below as directed by your lecturer and to review the contents of this topic.

Exercise 1:

Complete your reports for the tasks in the laboratory sessions. You will need to submit these to your lecturer for marking.

Exercise 2:

Research recent phishing attacks and write a brief summary of one such attack giving detail of where each attack originated, how successful it has been and the features that identified it as a phishing attack rather than a genuine email.

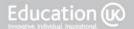Your summary should be no more than 200 words.

Exercise 3:

Research the methods available to authenticate human users in a computer network. Write notes that cover the different methods used and discuss the advantages and disadvantages of each method.

Exercise 4:

Research the common antivirus and network security software available in your country. Make brief notes on three broadly similar packages from three different suppliers. Your notes should include the company that produces them, variations available on each package and a list of features. Note if, in your opinion, an individual package offers benefits over its competitors.

Imagine you are responsible for the security of your college network and are required to buy new security software. The packages you study should be suitable for the college network.

Topic 9:   Firewalls

9.1   Learning Objectives

This topic provides an overview of firewalls including their purpose, the types of firewall and configuring a firewall on an Internet-connected network.

On completion of the topic, you will be able to:

- Describe the functions of a firewall;
- Describe different types of firewall;
- Install and configure a firewall on an Internet-connected system.

9.2   Timings

Lectures: 3 hours

Laboratory Sessions: 2 hours

Private Study: 7.5 hours

9.3   Laboratory Sessions

The laboratory time allocation for this topic is 2 hours.

Exercise 1:

Install, configure and test the firewall running on one computer on your college network. Take notes on the software used and the installation, configuration and testing processes. Note any problems that occurred and detail of how these problems were overcome. Highlight any functions that the firewall has for automatic updating/patching of the software.

You are required to create a formal report of the whole process in Private Study Exercise 1. It may be useful to take screenshots of the user interface where possible for use in your report.

9.4   Private Study Exercises

You should spend approximately 7.5 hours on the Private Study for this topic. You should use this time to complete the exercises below, as directed by your lecturer, and to review the contents of this topic.

Exercise 1:

Complete your reports for the tasks in the laboratory sessions. You will need to submit these to your lecturer for marking.

Exercise 2:

Research one of the software firewall package that can be purchased or downloaded from a well known security provider, such as Norton, McAfee, etc. Write notes describing the features provided by the software and the ways in which traffic can be blocked.

Exercise 3:

Find out what "network reconnaissance" is and provide a definition.

Topic 10:   Network and Server Software

10.1 Learning Objectives

This topic provides an overview of network software and network operating systems for both wired and wireless networks.

On completion of the topic, you will be able to:

- Identify the software requirements for a computer network;
- Install and run appropriate network software according to a design specification;
- Install and run software components for a wireless network;
- Test the correct operation of network and server software.

10.2 Timings

Lectures: 2 hours

Laboratory Sessions: 3 hours

Private Study: 7.5 hours

10.3 Laboratory Sessions

The laboratory time allocation for this topic is 3 hours.

Exercise 1:

Install, configure and test the network software on one computer in your centre's computer laboratory. This must be a networked computer, but may be a client computer, and the software must include network functions. Take notes on the software used, the installation process, configuration and testing processes. Note any problems that occurred and detail how these problems were overcome. Note the network functions of the software.

You are required to create a formal report of the whole process in Private Study Exercise 1. It may be useful to take screenshots of any user interface where possible for use in your report.

Exercise 2:

Research how permissions are allocated to users on your college network. Take notes on who is responsible for this, how this is done, the differences between access permissions for different users and any details of permissions for a guest user.

You are required to create a brief written report on the access permissions in your college in Private Study Exercise 1. This report should be no more than 400 words.

10.4 Private Study Exercises

You should spend approximately 7.5 hours on the Private Study for this topic. You should use this time to complete the exercises below, as directed by your lecturer, and to review the contents of this topic.

Exercise 1:

Complete your reports for the tasks in the laboratory sessions. You will need to submit these to your lecturer for marking.
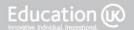
Exercise 2:

Research Database Management Systems (DBMS) and make brief notes on what a DBMS is and how a network operating system integrates with the DBMS.

Exercise 3:

Research the server software used in your computer laboratory. Write a description of this software, including all its features, even if these features are not used by your college, including:

- The manufacturer

- File sharing facilities

- Peripheral sharing

- Mail facilities

- Web servers

- Other servers included

- Setting user permissions

Topic 11: Voice over IP and Video Conferencing

11.1 Learning Objectives

This topic provides an overview of using the Internet for voice and video communications. It examines both Voice over IP (VoIP) and video conferencing technologies.

On completion of the topic, you will be able to:

- Describe the components of a Voice over IP (VoIP) system;
- Install and configure a VoIP system;
- Install and configure a web based video conferencing solution.

11.2 Timings

Lectures: 2 hours

Laboratory Sessions: 3 hours

Private Study: 7.5 hours

11.3 Laboratory Sessions

The laboratory time allocation for this topic is 3 hours.

Exercise 1:

Install and configure a VoIP system. This must allow you to have a conversation with another person. Take notes on the software used, the installation process and configuration process. Note any problems that occurred and how these problems were overcome.

You are required to create a formal report of the whole process in Private Study Exercise 1. It may be useful to take screenshots of any user interface where possible for use in your report.

Exercise 2:

Install and configure a web-based video conferencing solution. This must allow you to have a video conversation with another person. Take notes on the software used, the installation process and configuration process. Note any problems that occurred and how these problems were overcome.

This could be combined with VoIP software used in Exercise 1 where this is appropriate, e.g. Skype allows webcams for video VoIP calls.

You are required to create a formal report of the whole process in Private Study Exercise 1. It may be useful to take screenshots of any user interface where possible for use in your report.

11.4 Private Study Exercises

You should spend approximately 7.5 hours on the Private Study for this topic. You should use this time to complete the exercises below, as directed by your lecturer, and to review the contents of this topic.

Exercise 1:

Complete your reports for the tasks in the laboratory sessions. You will need to submit these to your lecturer for marking.

Exercise 2:

Research circuit-switched and packet-switched networks. Write notes explaining the difference between the two forms of switching.

Exercise 3:

Research delays inherent in a packet-switched network. Briefly list the delays that are typical of packet-switched networks.

Exercise 4:

Research the H.323 standard, list the protocols included in this framework and very briefly explain the purpose of each protocol.

Topic 12:   Virtual Private Networks

12.1 Learning Objectives

This topic provides an overview of Virtual Private Networks (VPNs) including the advantages and disadvantages of a VPN and installing and configuring a VPN.

On completion of the topic, you will be able to:

- Explain the operation of a Virtual Private Network (VPN);
- Describe the advantages and disadvantages of a VPN;
- Install and configure a VPN.

12.2 Timings
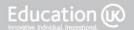
Lectures: 2 hours

Laboratory Sessions: 3 hours

Private Study: 7.5 hours

12.3 Laboratory Sessions

The laboratory time allocation for this topic is 3 hours.

Exercise 1:

Find details of both the server and client VPN software available for use in your computer laboratory. Research how to create a VPN connection from a client computer in the laboratory and make notes for a short user manual that shows a user how to set up a VPN connection from a client. You are required to create this manual in Private Study Exercise 1.

Exercise 2:

Create a VPN connection from a client computer to the college or laboratory network. You should follow the steps you have noted in Exercise 1. Make notes on any problems you encountered on setting up the VPN. Make notes on how the server is set up to allow the VPN connection and the protocols used. You are required to write a report including all relevant details in Private Study Exercise 1. This may be combined with the manual requested in Exercise 1.

12.4 Private Study Exercises

You should spend approximately 7.5 hours on the Private Study for this topic. You should use this time to complete the exercises below as directed by your lecturer and to review the contents of this topic.

Exercise 1:

Complete your reports for the tasks in the laboratory sessions. You will need to submit these to your lecturer for marking.

Exercise 2:

Research two VPN software applications and make notes on how each application operates, highlighting the key differences between the two applications. Your notes should include details of operating systems the software is compatible with, the protocols utilised by the software and a brief description of how the software is used to make a connection.