OCR
Oxford Cambridge and RSA

Cambridge **TECHNICALS LEVEL 3**

IT

Cambridge TECHNICALS 2016

Unit 4 – Computer networks
DELIVERY GUIDE

Version 2

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The activities within this teaching and learning resource must not be used for summative assessment purposes. As part of our teaching we expect support to be given to your learners; such support is not permissible for summative assessment and is likely to be considered malpractice.

INTRODUCTION

This Delivery Guide has been developed to provide practitioners with a variety of creative and practical ideas to support the delivery of this qualification. The Guide is a collection of lesson ideas with associated activities, which you may find helpful as you plan your lessons.

OCR has collaborated with current practitioners to ensure that the ideas put forward in this Delivery Guide are practical, realistic and dynamic. The Guide is structured by learning outcome so you can see how each activity helps you cover the requirements of this unit.

We appreciate that practitioners are knowledgeable in relation to what works for them and their learners. Therefore, the resources we have produced should not restrict or impact on practitioners' creativity to deliver excellent learning opportunities.

Whether you are an experienced practitioner or new to the sector, we hope you find something in this guide which will help you to deliver excellent learning opportunities.

If you have any feedback on this Delivery Guide or suggestions for other resources you would like OCR to develop, please email resources.feedback@ocr.org.uk.

OPPORTUNITIES FOR ENGLISH AND MATHS SKILLS DEVELOPMENT AND WORK EXPERIENCE

We believe that being able to make good progress in English and maths is essential to learners in both of these contexts and on a range of learning programmes. To help you enable your learners to progress in these subjects, we have signposted opportunities for English and maths skills practice within this resource. We have also identified any potential work experience opportunities within the activities. These suggestions are for guidance only. They are not designed to replace your own subject knowledge and expertise in deciding what is most appropriate for your learners.

English

Maths


Work

Please note

The timings for the suggested activities in this Delivery Guide **DO NOT** relate to the Guided Learning Hours (GLHs) for each unit.

Assessment guidance can be found within the Unit document available from www.ocr.org.uk.

The latest version of this Delivery Guide can be downloaded from the OCR website.

UNIT AIM

Computer networks form a key part of the information economy. They are the foundation of the World Wide Web on which eBay, Amazon, Facebook and a multitude of other companies depend for their success. The demand for networking capability is enormous and increasing daily. The business world demands network administrators, engineers and technicians who can set up, manage and maintain its networks.

The emphasis of this unit is to give you the practical ability to plan, implement and maintain computer networks. The approach adopted by this unit is 'bottom up' where you begin with a solid set of components, cables and connectors of a network and then progressively build a networking capability. The range of protocols has been deliberately limited to those which are used in the vast majority of computer networks, TCP/IP and Ethernet.

The teaching content is designed to support networking qualifications for certifications such as Microsoft, Cisco and CompTIA Network+.

This unit is mandatory in the IT Infrastructure Technician specialist pathway in the Level 3 Diploma suite of qualifications due to its relevance in an IT technical environment. The unit supports the development of skills, knowledge and understanding relevant to a technical support or network technician job role.

Unit 4 Computer networks	
LO1	Understand the concept of networks
LO2	Be able to plan computer networks to meet client requirements
LO3	Be able to present network solutions to clients
LO4	Be able to plan maintenance activities for computer networks

To find out more about this qualification please go to: http://www.ocr.org.uk/qualifications/cambridge-technicals-it-level-3-certificate-extended-certificate-introductory-diploma-foundation-diploma-diploma-05838-05842-2016-suite

Cambridge TECHNICALS 2016

2016 Suite

- **New suite for first teaching September 2016**
- **Externally assessed content**
- **Eligible for Key Stage 5 performance points from 2018**
- **Designed to meet the DfE technical guidance**

RELATED ACTIVITIES

The Suggested Activities in this Delivery Guide listed below have also been related to other Cambridge Technicals in IT units/Learning Outcomes (LOs). This could help with delivery planning and enable learners to cover multiple parts of units.

This unit (Unit 4)	Title of suggested activity	Other units/LOs	
LO1	Sending digital information over a wire	Unit 1 Fundamentals of IT	LO1 Understand computer hardware
LO1	Decoding data from a wire	Unit 1 Fundamentals of IT	LO1 Understand computer hardware
LO1	Constructing an Ethernet frame	Unit 1 Fundamentals of IT	LO3 Understand business IT systems
		Unit 12 Mobile technology	LO1 Understand mobile technologies
LO1	Transferring Ethernet data	Unit 1 Fundamentals of IT	LO2 Understand computer software LO3 Understand business IT systems
		Unit 2 Global information	LO1 Understand where information is held globally and how it is transmitted
		Unit 12 Mobile technology	LO1 Understand mobile technologies
		Unit 17 Internet of Everything	LO1 Understand what is meant by Internet of Everything
LO1	IP addressing	Unit 1 Fundamentals of IT	LO2 Understand computer software LO3 Understand business IT systems
		Unit 2 Global information	LO1 Understand where information is held globally and how it is transmitted
		Unit 12 Mobile technology	LO1 Understand mobile technologies
		Unit 17 Internet of Everything	LO1 Understand what is meant by Internet of Everything
LO1	TCP addressing	Unit 1 Fundamentals of IT	LO2 Understand computer software LO3 Understand business IT systems
		Unit 2 Global information	LO1 Understand where information is held globally and how it is transmitted
		Unit 12 Mobile technology	LO1 Understand mobile technologies
		Unit 17 Internet of Everything	LO1 Understand what is meant by Internet of Everything
LO2	WiFi router configuration	Unit 1 Fundamentals of IT	LO1 Understand computer hardware LO2 Understand computer software
		Unit 12 Mobile technology	LO1 Understand mobile technologies
LO2	The routing table	Unit 1 Fundamentals of IT	LO2 Understand computer software
		Unit 12 Mobile technology	LO1 Understand mobile technologies
LO2	Public/private IP addressing	Unit 1 Fundamentals of IT	LO2 Understand computer software
		Unit 12 Mobile technology	LO1 Understand mobile technologies
LO2	Subnetting	Unit 1 Fundamentals of IT	LO2 Understand computer software
		Unit 12 Mobile technology	LO1 Understand mobile technologies
LO2	Firewalls	Unit 1 Fundamentals of IT	LO1 Understand computer hardware LO2 Understand computer software
		Unit 2 Global information	LO6 Understand the principles of information security
		Unit 3 Cyber security	LO3 Understand measures used to protect against cyber security incidents

This unit (Unit 4)	Title of suggested activity	Other units/LOs	
LO2	Troubleshooting IP connectivity	Unit 1 Fundamentals of IT	LO1 Understand computer hardware LO2 Understand computer software
		Unit 12 Mobile technology	LO1 Understand mobile technologies
		Unit 18 Computer systems – hardware	LO4 Be able to test and evaluate the functionality of computer systems
LO3	Network logical design	Unit 1 Fundamentals of IT	LO1 Understand computer hardware LO2 Understand computer software LO3 Understand business IT systems LO5 Understand ethical and operational issues and threats to computer systems
		Unit 2 Global information	LO1 Understand where information is held globally and how it is transmitted LO6 Understand the principles of information security
		Unit 3 Cyber security	LO1 Understand what is meant by cyber security LO3 Understand measures used to protect against cyber security incidents
		Unit 6 Application design	LO2 Be able to investigate potential solutions for applications development
		Unit 8 Project management	LO2 Be able to initiate and plan projects
		Unit 12 Mobile technology	LO1 Understand mobile technologies
		Unit 17 Internet of Everything	LO1 Understand what is meant by Internet of Everything
LO3	Network physical design	Unit 1 Fundamentals of IT	LO1 Understand computer hardware LO2 Understand computer software LO3 Understand business IT systems
		Unit 2 Global information	LO1 Understand where information is held globally and how it is transmitted LO6 Understand the principles of information security
		Unit 3 Cyber security	LO1 Understand what is meant by cyber security LO3 Understand measures used to protect against cyber security incidents
		Unit 12 Mobile technology	LO1 Understand mobile technologies
		Unit 17 Internet of Everything	LO1 Understand what is meant by Internet of Everything
LO3	Network utilisation	Unit 1 Fundamentals of IT	LO1 Understand computer hardware LO2 Understand computer software LO3 Understand business IT systems
		Unit 2 Global information	LO1 Understand where information is held globally and how it is transmitted
		Unit 12 Mobile technology	LO1 Understand mobile technologies
		Unit 17 Internet of Everything	LO1 Understand what is meant by Internet of Everything

This unit (Unit 4)	Title of suggested activity	Other units/LOs	
LO3	Network testing	Unit 1 Fundamentals of IT	LO1 Understand computer hardware LO2 Understand computer software LO3 Understand business IT systems
		Unit 3 Cyber security	LO3 Understand measures used to protect against cyber security incidents
		Unit 12 Mobile technology	LO1 Understand mobile technologies
		Unit 17 Internet of Everything	LO1 Understand what is meant by Internet of Everything
		Unit 18 Computer systems – hardware	LO4 Be able to test and evaluate the functionality of computer systems
LO3	Client requirements	Unit 6 Application design	LO2 Be able to investigate potential solutions for application developments
LO3	User acceptance testing	Unit 1 Fundamentals of IT	LO1 Understand computer hardware LO2 Understand computer software LO3 Understand business IT systems
		Unit 9 Product development	LO4 Be able to carry out acceptance testing with clients
		Unit 18 Computer systems – hardware	LO4 Be able to test and evaluate the functionality of computer systems
LO4	Replacing server hardware	Unit 1 Fundamentals of IT	LO1 Understand computer hardware LO2 Understand computer software LO3 Understand business IT systems
		Unit 18 Computer systems – hardware	LO3 Be able to build or upgrade computers LO4 Be able to test and evaluate the functionality of computer systems
LO4	Disaster recovery plan	Unit 1 Fundamentals of IT	LO1 Understand computer hardware LO2 Understand computer software LO5 Understand ethical and operational issues and threats to computer systems
		Unit 2 Global information	LO6 Understand the principles of information security
		Unit 3 Cyber security	LO3 Understand measures used to protect against cyber security incidents
		Unit 8 Project management	LO2 Be able to initiate and plan projects
		Unit 18 Computer systems – hardware	LO2 Be able to propose a computer system for identified business requirements LO3 Be able to build or upgrade computers
LO4	Check for security updates	Unit 1 Fundamentals of IT	LO2 Understand computer software LO5 Understand ethical and operational issues and threats to computer systems
		Unit 2 Global information	LO6 Understand the principles of information security
		Unit 3 Cyber security	LO3 Understand measures used to protect against cyber security incidents
LO4	Network maintenance plan	Unit 1 Fundamentals of IT	LO1 Understand computer hardware LO2 Understand computer software LO3 Understand business IT systems
		Unit 8 Project management	LO2 Be able to initiate and plan projects

This unit (Unit 4)	Title of suggested activity	Other units/LOs	
LO4	Network backup	Unit 2 Global information	LO6 Understand the principles of information security
		Unit 3 Cyber security	LO3 Understand measures used to protect against cyber security incidents
		Unit 18 Computer systems – hardware	LO2 Be able to propose a computer system for identified business requirements LO3 Be able to build or upgrade computers
LO4	Performance measurements	Unit 1 Fundamentals of IT	LO2 Understand computer software
		Unit 18 Computer systems – hardware	LO4 Be able to test and evaluate the functionality of computer systems

KEY TERMS

Explanations of the key terms used within this unit, in the context of this unit	
Key term	**Explanation**
ASCII	American Standard Code for Information Interchange. Code used to represent alphanumeric characters.
Backup	The backing up of network data to provide insurance against possible loss. Most network clients have their data stored on the network rather than locally. This makes it important that users suffer as little loss as possible as a result of network failure. Other critical data is the configuration information of all the hardware components of the network such as the file server or mail server.
Baud	The number of distinct signal changes occurring every second on a connecting link.
chkdsk	This is a built-in Windows utility that can used to determine the integrity of a hard drive on a client computer or server on the network. It is a console command which means that the command can only be entered at the command prompt (by running CMD). When the command console is open the range of capabilities can be determined by entering **chkdsk /?**
Classless addressing	Classful addressing can be very inefficient in the allocation of number of hosts. A Class C address, for example, will allocate 254 host addresses even if only 17 are required. The remaining addresses would then be unusable by anyone else. To overcome this problem another method, which supported a variable mask, was designed.
Collision	A collision occurs when two Ethernet devices attempt to transmit data at the same time. Normally a device will listen on the wire and will not transmit if it is already in use. But if the transmissions are simultaneous then no detection is possible and so a collision occurs. The protocol requires that both devices retry transmission but at a randomly chosen different time. As network traffic becomes more congested then this behaviour rapidly leads to a bottleneck for traffic and a resulting poor response to the users.
Contiguous	Connecting without a break. The contiguous 48 bits of an Ethernet address.
Default gateway	This is the IP address to which IP packets are forwarded if the destination host for the message is not on the local network.
DHCP	Dynamic Host Configuration Protocol. A set of rules to enable an application or service to manage the automatic distribution of IP configuration information. Host requesting configuration can be issued with a wide range of configuration settings but minimally this would be the IP address to be used on the host.
DHCP service	The application that is responsible for maintaining a database of configuration information and issuing this information to requesting hosts.
Disaster recovery plan	The set of procedures that must exist to enable the network to be brought back to a working state with little or no data loss. The documented procedures should be readily at hand and cover every disaster scenario. The plan should allow IT staff to locate data, equipment and scripts to automate recovery as far as possible.
Ethernet	A Link Layer protocol. Used to convey data on a single segment of a Local Area Network. This protocol is the first layer of the OSI Model that can support an actual address as a group of bits. This is Layer 2 of the OSI Model and is called the Data Link Layer. The Ethernet address is a group of 48-bits, usually expressed as 6 pairs of hexadecimal digits.
Ethernet frame	A formal data structure for conveying Ethernet data. The Ethernet preamble is not included as part of this structure.
Ethernet switch	Ethernet was originally designed so that multiple senders could place data on a single wire, although only one sender was allowed at one time. This caused problems when two or more senders attempted to send at the same and a 'collision' occurred. The busier the traffic the more such collisions occurred. An Ethernet switch provides a hardware path for every connected computer. The switch uses the MAC address in each Ethernet frame to construct (switch) a path between the source and the destination. Because of its dependence on the MAC address these devices are said to operate at Layer 2 of the OSI Model. Since no other connected computers are affected by this communication and because no collisions occur the efficiency of the network is much higher.

Explanations of the key terms used within this unit, in the context of this unit	
Key term	**Explanation**
Firewall	A device that monitors network traffic between an external (untrusted) network and the internal (trusted) network. Essentially these devices can examine the content of the network traffic being monitored. A set of rules can then be configured to make decisions about what traffic is allowed based on a whole range of parameters. Whilst the firewall is a critical component in providing network security it can also provide difficult challenges for the network troubleshooter.
IP router	An IP router is a device whose core function is to transport IP packets between networks with differing network addresses. So, if the network portion of a destination IP address is different from the network portion of the source address then the router can either convey the packet forward to the destination network or at least to a further router which will then repeat this process. Routers make decisions by consulting their routing table.
IPCONFIG	This is a command line utility. This utility is mainly used to display information regarding the configuration of an IP host. It can also be used to modify the configured settings of a host. This utility is a console application and requires access to the command prompt. Some settings require the command prompt to be run at the administrative level. The command IPCONFIG /? will provide a list of available actions that can be performed.
IPv4 address	This refers to the 32-bit binary value used to define the IP address of any host on the network. It is usually represented as a four-part decimal number such as 192.168.0.56. This address occurs at Layer 3 of the OSI Model, the Network Layer. The address is 32-bits in length, one part indicating the network address and another part indicating the host address; exactly how these addresses split is defined by the subnet mask.
MAC address	Media access control address. A unique physical address assigned to a device. This is a Layer 2 address and is 48-bits long, usually represented as six pairs of hexadecimal digits.
Manchester encoding	A data transmission method that ensures that a receiver can easily synchronise with a sender. The data and the synchronising clock are combined so that both signals appear on a single wire.
Network logical design plan	This is the plan of what the network is required to do for its users. No actual products are involved.
Network physical design plan	This is the plan of the actual physical components of the network based on the requirements specified on the logical design plan.
Network utilisation	This is a measure of how much traffic is being used on the network compared to its maximum design capacity.
NRZ	A data transmission method that transmits binary '0' as a low voltage and binary '1' as a high voltage. The clock signal is not part of the NRZ waveform and it is critical that sender and receiver, which have independent clocks, are as accurate as possible to ensure the data can be decoded correctly. For example, eight '1's would show a static level for the entire duration of the data and only the clock sample points would reveal that there were actually eight '1's.
OSI model	Open Systems Interconnection. Used as conceptual model to standardise communications functions.
Packet	This is a term commonly used to describe the unit of data that operates at the IP level.
Performance monitoring	This means regular monitoring of the parameters of the network to compare the result with previous values or a baseline. Performance monitoring is usually part of the network maintenance plan.
PING	This is a command console application command. The function of this command is to cause the target to echo back to indicate good connectivity.
Preamble	7 bytes of synchronisation followed by a 1-byte Start Frame Delimiter (SFD). The signal is an alternating set of '1's and '0's. Because this pattern is not allowed to occur in the actual data then a listening device can be sure that alternating '1's and '0's is definitely the preamble. It also doesn't matter that the first part of the preamble may have been missed; all that is necessary is that the receiver synchronises before the SFD.

Explanations of the key terms used within this unit, in the context of this unit	
Key term	**Explanation**
Private IP address	An IP address that is valid but will not be routed on the Internet. All Internet Service Providers agree never to route any packet with a destination that is a private address. Within a single organisation the private addresses must be unique. However, because the private packets are not routed on the Internet then every organisation is free to use the same private addresses.
Public IP address	An IP address that is valid and will be routed on the Internet. Because these addresses can be routed on the Internet they must be unique.
Segment	A section of wire directly shared by connected devices.
Self-clocking signal	Timing information that is embedded in a data stream. Used to ensure that sender and receiver can synchronise without the aid of a separate clock signal. This is a method of including a synchronising clock on the same wire as the actual data signal.
SSID	Service Set Identifier. An alphanumeric name broadcast by wireless router to indicate the availability of the wireless network to clients.
Subnet mask	This is a binary pattern that is used by a device to split an IP address into a network address and a host address. A subnet mask of 255.255.255.0 would define the upper 24 bits of an IP address as the network address and the lower 8-bits as host address.
Subnetting	This is a process of creating several internal networks from a given, standard network address. For example, given the Class C address 191.167.5.0, the subnet mask (255.255.255.0) could be extended by 2-bits (255.255.255.192) to allow for the creation of four internal networks by adding two more bits to the network portion of the address.
TCP port	A port is an addressing scheme used at Layer 4 of the OSI Model. This layer is also known as the Transport Layer and defines the address of a particular service. For example, email can be communicated by sending packets to port 25 of the IP address of a computer hosting this service. HTTP packets can also be communicated on port 80 of the same IP address. So one computer can support many services. The port field width of a TCP packet is 16-bits so the possible range of services on offer could be 65536 ports. Some ports are registered for specific services such as SMTP for email and are called 'well-known ports'.
TRACERT	This is a command console connectivity command. The command will cause the host at each hop in the route to the destination host to attempt to reply to the source address. IP packets can pass through many routers and this command can reveal which point in the path is failing to respond or perhaps taking too long to respond.
User acceptance testing	The client who requires a network will specify a set of requirements that must be provided before the client will accept (and pay) for the network. The client will usually commission their own staff or a third party to convert the network requirements into a set of tests (usually called test cases). These test cases will be conducted on completion of the build of the network. Conducting the complete range of tests should confirm that the network has been completed to the client's requirements.

MISCONCEPTIONS

Some common misconceptions and guidance on how they could be overcome		
What is the misconception?	**How can this be overcome?**	**Resources which could help**
APIPA addressing confuses diagnosis of IP connectivity problems	Automatic Private IP Addressing is used in all Windows networks to ensure that a host will always get an IP address even if there is no connection. This address will always be in the range 169.254.x.x. This address will not allow nor provide connectivity to the normal IP addresses on the network but it will look as if the host IP is working correctly. This address range always indicates a connectivity problem.	Numerous pages on websites provide excellent explanations of this addressing scheme and why it was thought to be necessary. A search on APIPA would produce, for example: http://compnetworking.about.com/cs/protocolsdhcp/g/bldef_apipa.htm
The difference between classful and classless addressing in IP	Classful (A, B, C and D) addressing was the first scheme to be used in IP addressing; the scheme employed a fixed structure to the subnet mask. Such a scheme worked well until the requirement for unique addresses outstripped the capacity of this scheme. Classless addressing was introduced with a variable subnet mask to make the addressing range more efficient. However, classful addressing is still used so much within the Internet that both schemes are still in use.	A search on 'Classful vs Classless addressing' will provide many insights into why these schemes still exist side by side. For example: http://infocellar.com/networks/ip/classful-vs-classless.htm
The need to use DHCP to manage IP configuration in a small network	A small network can quite easily be configured manually using IPCONFIG. But manual configuration can cause problems if values are incorrectly set when converting binary to decimal and vice versa. Also, DHCP can be configured to provide a wide range of IP addressing such as default gateway and DNS settings.	A search on 'advantages of dhcp addressing' will provide a good range of resources and include any disadvantages of using DHCP, for example: https://technet.microsoft.com/en-us/library/cc958943.aspx
The difference between TCP and UDP	Both of these protocols serve to transport data at the Transport layer of the OSI Model. TCP guarantees correct delivery of an entire message but this involves complex control information being passed backward and forward between the two ends. User Datagram Protocol is much faster because it does not use the control messages employed by TCP. However this means that UDP does not guarantee delivery and so other mechanisms must be used for this purpose.	A good explanation of the UDP vs TCP difference can be found by searching on 'difference between udp and tcp'. For example: http://www.cyberciti.biz/faq/key-differences-between-tcp-and-udp-protocols/
Network performance testing is not required after user acceptance of the network	After a network comes into use after acceptance there will inevitably be configuration changes, equipment changes, software updates, new applications etc. Each of these will possibly have an impact on network performance. Performance testing using a baseline will help to detect any deterioration in performance and provide an aid to effective diagnosis of the problem. A baseline is a specified set of measurements of network, disk, CPU and memory taken when the network was at its best.	Windows engineers use a utility called NTttcp. This utility can be used on any Windows-based network, it provides some good practical examples on working with multiple TCP ports and is free to download from: https://gallery.technet.microsoft.com/NTttcp-Version-528-Now-f8b12769

Some common misconceptions and guidance on how they could be overcome		
What is the misconception?	**How can this be overcome?**	**Resources which could help**
The OSI Model is only of use to network designers and academics	Although it is true that many of the uses of the OSI are theoretical in nature, it is definitely not true that it only applies in theory. Most network protocols are written on the basis of this model and the product details of most network hardware make references to the layer of the OSI Model on which it operates. The OSI Model was not the first model though; the TCP/IP Suite itself was based on a four-layer model which included some of the OSI Model layers. Both models are referred to in networking texts and are still very relevant.	You can get an idea of the importance of the OSI Model at: http://www.tcpipguide.com/free/t_WhyUnderstandingTheOSIReferenceModelIsImportantToY.htm An explanation of the Four Layer TCP/IP Model and a comparison with the seven-layer OSI Model can be found at: https://technet.microsoft.com/en-us/library/cc786900(v=ws.10).aspx
The nature of port addressing in TCP	Learners frequently confuse 'ports' with the hardware connections on a computer (for example USB port). A hardware port is a way of making an electrical connection to the components of a computer. A TCP port is a way in which multiple software services can be hosted on a single IP address. For example, a single IP address on a class computer can be a web server listening on port 80 and mail server listening on port 25. Sixteen bits are allocated to the port address field and the range of possible addresses on one host could be $2^{16} = 65536$.	A search on 'port addressing in TCP/IP' will provide a good range of coverage. But a good example would be: http://www.pcmag.com/encyclopedia/term/52617/tcp-ip-port
Troubleshooting network problems is complicated and requires sophisticated equipment and software	It is certainly true that there are some problems on networks that may require the use of sophisticated hardware. However, most common problems rely on little more than the built-in utilities IPCONFIG, PING, and TRACERT. Even some of the more difficult problems can be solved by software packages such as Network Monitor (free from Microsoft). The only real requirement is to learn how to use the tools effectively.	Explanations of a range of TCP/IP troubleshooting tools can be found at: http://blog.pluralsight.com/network-troubleshooting-tools
Software updates are a good thing and should always be applied	Software updates, either for applications or for security, are generally a good thing. They often remove software bugs that have been resulting in client problems. They also close holes in the security of the system. They can, however, cause major problems. Some applications, for example, may have taken advantage of system services that will no longer be available after the update. In fact this is a very common occurrence. When users arrive on Monday morning after a major weekend update there may be some difficult problems to solve. Preparation for such events is essential.	Updating the network requires procedures that follow best practice. You must decide whether the risk of applying the update is greater than not applying it. Some best practices can be found at: https://msdn.microsoft.com/en-us/library/cc750077.aspx
The difference been contiguous and continuous	These terms are sometimes used interchangeably but they are really quite different. A continuous sequence of words of Morse code will have short breaks between groups of symbols to enable the receiver to distinguish the meaning of each group. A contiguous stream will have no gaps between groups and so another mechanism must be used to distinguish between groups.	You will see the term 'contiguous' used frequently when discussing Manchester Encoding of data. A comparison and usage of the terms can be found at: http://the-difference-between.com/continuous/contiguous

SUGGESTED ACTIVITIES

LO No:	1		
LO Title:	**Understand the concept of networks**		
Title of suggested activity	**Suggested activities**	**Suggested timings**	**Also related to**
Sending digital information over a wire	For learners to understand how information is conveyed across a wire, tutors must ensure that the learners understand the nature of the signals used on the wire. An example waveform of a specific sequence of bits could be used to illustrate the importance of timing in recovering the information from the signal received on the wire. The learners could be split into groups and each group asked think about how an alphabetic character such as 'A' or '@' could be transmitted in such a way as to be received correctly at the other end of the wire. The tutor can then provide the whole group with a Manchester encoded or NRZ version of the signal to explain how the receiver can recover the data with emphasis on the importance of timing. Tutors and learners will benefit from the following tutorials: • Sending digital information over a wire • Intro to fiber optics and RF encoding • Clock synchronization and Manchester coding • Analyzing actual Ethernet encoding These can be accessed at: Organisation: Ben Eater Resource Title: Networking tutorial Website Link: https://www.youtube.com/watch?v=XaGXPObx2Gs&list=PLowKtXNTBypH19whXTVoG3oKSuOcw_XeW Description: A set of videos exploring ideas of how digital data can be conveyed on a connection.	1 hour	Unit 1 LO1

Title of suggested activity	Suggested activities	Suggested timings	Also related to
Decoding data from a wire	For learners to understand how Ethernet signals can convey data accurately, tutors must ensure that learners know how data is encoded onto a wire by a process of Manchester encoding. The learners should also understand that because the data stream on the wire is a contiguous chain of bits (no spaces between the characters), then it is essential for the receiver to know when it should begin looking at the data stream so that the data can be interpreted accurately. The learners could be split into groups, with each group being given an appropriately encoded pair of ASCII characters. Each group will then decode their respective waveforms. Tutors and learners will benefit from the following tutorials: • Clock synchronization and Manchester coding • Analyzing actual Ethernet encoding • The importance of framing • Frame formats These can be accessed at: Organisation: Ben Eater Resource Title: Network tutorial Website Link: https://www.youtube.com/watch?v=8BhjXqw9MqI Description: A set of videos explaining how digital data is encoded on a connection.	1 hour	Unit 1 LO1

Title of suggested activity	Suggested activities	Suggested timings	Also related to
Constructing an Ethernet frame	Tutors could introduce this topic by explaining to learners that the signals being received on the wire are a stream of values interpreted as '1's and '0's. Learners should understand that information is conveyed by encoding the '1's and '0's into meaningful groups using codes such as ASCII. But other information must also be included such as addressing. The class can be divided into groups. Each group is provided with an example stream of bits to decode. The groups will then consider the following: 1. How can the receiver know exactly when to divide the received data bits into appropriate groups? 2. How can the receiver know that it is the correct recipient of the data? 3. How can the receiver know that the data stream has not been corrupted? The groups will then report their findings back to the whole class. The tutor could then illustrate the format of an Ethernet Frame, emphasising the importance of the preamble bits in framing the data appropriately. Tutors and learners will benefit from the following tutorials: • The importance of framing • Frame formats These can be accessed at: Organisation: Ben Eater Resource Title: Network tutorials Website Link: https://www.youtube.com/watch?v=xrVN9jKjIKQ&index=5&list=PLowKtXNTBypH19whXTVoG3oKSuOcw_XeW Description: Explains how important it is to frame the data stream. Network Monitor is a free resource which is downloadable from: https://www.microsoft.com/en-gb/download/details.aspx?id=4865	1 hour	Unit 1 LO3 Unit 12 LO1

Title of suggested activity	Suggested activities	Suggested timings	Also related to
Transferring Ethernet data	Tutors could introduce this topic by explaining the format of an Ethernet Frame. It is important that learners understand that Ethernet frames can be shared by all devices on the same wire. A sent frame is received by all devices if they are connected to a single wire. The class could be split into at least three groups, each group representing a device on a single shared wire. Each group will discover the MAC address of a computer in the classroom which they will write down to represent the address of that group. All MAC addresses will then be given to the tutor. The tutor will then compile a table showing group name and MAC address which is then distributed to all groups. The learners are then asked to construct simple Ethernet Frames to be sent to each of the other groups. All these 'sent' messages are passed directly to the tutor. The tutor can now explain to the class that transmitted Ethernet Frames will be received by all devices on the same wire. Copies of all the messages are then passed to each group. The group will now examine their respective messages and identify those they accept and those they will ignore and then pass the messages back to the tutor. Tutors and learners will benefit from the tutorial at: Organisation: Ben Eater Resource Title: Lower layers of the OSI model Website Link: https://www.youtube.com/watch?v=MGAaTqFct_I&index=7&list=PLowKtXNTBypH19whXTVoG3oKSuOcw_XeW Description: Explains the lower layers of the OSI model.	1 hour	Unit 1 LO2, LO3 Unit 2 LO1 Unit 12 LO1 Unit 17 LO1

Title of suggested activity	Suggested activities	Suggested timings	Also related to
IP addressing	The tutor could introduce this topic by considering the limitation of data transfer at the Ethernet level. At the Ethernet level the addressing can only be made to another client on the same network segment. If the destination for data is on another network segment then some other means must be found in order to 'carry' the data across to that foreign segment. Learners must understand that at the IP level data transfer is not restricted to the local segment. To accomplish this the structure of the IP data (packet) must contain a new type of address that not only identifies a destination device (host) on the network, but it must also identify the network on which this destination host is connected. The tutor could then explain how this addressing scheme works. The class could be split into two groups, each representing different networks each with their own network address. Each group will also have its own MAC address. The tutor sits between both groups and acts as a router. The tutor will also have a MAC address and IP address associated with each group connected. The groups will deduce a procedure that allows the packet to be carried across the 'router' and report this back to the whole class. Tutors and learners will benefit from the tutorial at: Organisation: Ryan Clough Resource Title: IP Addressing Website Link: https://www.youtube.com/watch?v=Pj-27Q27kEc Description: Explains IP addressing.	2 hours	Unit 1 LO2, LO3 Unit 2 LO1 Unit 12 LO1 Unit 17 LO1
TCP addressing	The tutor could introduce this topic by explaining that it is common for a computer to be connected to multiple services at the same time. For example, a user could be connected to three websites, downloading music from another, downloading a file from another and sending email to a friend. The learners must understand that all of this communication is in the form of IP packets between the user and all these different services. The replies from the connected services back to the user will all arrive at one single computer with one single IP address. The class can be split into individuals, each one of which will have an identified function – website, email, file etc with an associated IP address. The tutor will act as the single computer with a single IP address that connects to all this functionality at the same time. Learners could then work out how the tutor (computer) could use all these data streams simultaneously and still make sense of all the data arriving and leaving the tutor (computer). The tutor could then discuss port addressing with the class and elicit learner thoughts on the completed activity.	1 hour	Unit 1 LO2, LO3 Unit 2 LO1 Unit 12 LO1 Unit 17 LO1

SUGGESTED ACTIVITIES

LO No:	2		
LO Title:	**Be able to plan computer networks to meet client requirements**		
Title of suggested activity	**Suggested activities**	**Suggested timings**	**Also related to**
WiFi router configuration	Learners need to understand that a WiFi router is a key component in enabling IP traffic between the local computer network and the Internet. This component will usually incorporate multiple functionality other than just WiFi access, such as DHCP. The tutor could introduce this topic by demonstrating the features of a typical WiFi router and how the router is managed. Learners can then be shown how to access the router in order to obtain configuration information. The tutor could then split the class into groups, with each group being given a specific set of configuration information to obtain from the router. For example: • DHCP • SSID • Default Gateway • IP Address • Public Addresses • Private Addresses Tutors and learners may find the following resources helpful: Organisation: TechVitamins Resource Title: How to configure a wireless router Website Link: https://www.youtube.com/watch?v=SJmRbQxvKHw Description: A comprehensive tutorial on router configuration. Organisation: Huskermania Resource Title: How to Create a Wireless Network in Your Home (In-Depth) Website Link: https://www.youtube.com/watch?v=Y_AyB240BcA Description: Explains how to set up a wireless network. Organisation: Tech Lab Resource Title: How to Setup and Configure Any Wireless Router Website Link: https://www.youtube.com/watch?v=6LofSwZ1aAs Description: Explains the wireless router setup.	1 hour	Unit 1 LO1, LO2 Unit 12 LO1

Title of suggested activity	Suggested activities	Suggested timings	Also related to
The routing table	Learners need to understand that routing is such a fundamental component of computer networking that every device on a network is required to know how IP packets have to be handled in order to provide for successful communication. Tutors could begin this topic by demonstrating the routing table that is present on one or more classroom computers by using the 'route print' command at the command console of these computers. The IP address of the destination sent packet can be compared against the each entry in the computer routing table in order to determine the actual IP address to which the packet should be sent next. Sometimes the next hop will be on the local network and other times it may be the address of a router. Tutors and learners will find the following explanation helpful in this process: Organisation: Think Like A Computer Resource Title: The Routing Table Website Link: http://think-like-a-computer.com/2011/08/24/the-routing-table/ Description: Explains the operation of a routing table. The class could be split into at least two groups with each group being given a local (private IP) address and an external (public IP) address. Groups could then determine the actions taken by the router for each type and report their findings back to the class. Other resources that may be helpful in understanding this process are: Organisation: CoachFactory Resource Title: Basics of IP ROUTING Website Link: https://www.youtube.com/watch?v=fZAbL17CWzk Description: Explains the basics of IP routing. Organisation: EduBrink Learning Resource Title: Computer Networking 101: 06 – IP Routing Website Link: https://www.youtube.com/watch?v=L9UKpaCk2hg Description: Explains the basics of IP routing.	2 hours	Unit 1 LO2 Unit 12 LO1

Title of suggested activity	Suggested activities	Suggested timings	Also related to
Public/private IP addressing	Learners should understand some of the limitations of the IPv4 addressing scheme. The scheme itself was developed in 1983 and still routes most Internet packs to this day. However, the initial development of this protocol has seen a dramatic explosion in the number of devices that require identification by means of an IP address. The range of available addresses for IPv4 was limited even before the introduction of smartphones and was in danger of running out. The tutor could split the class into two groups. Each group could then examine the private addressing on their local network and describe how the private address is distinguished from a public address by the host. The groups could also estimate how many private addresses are used within the entire school. Groups could then report their findings back to the class with any conclusion they may have regarding the number of IP addresses saved by the introduction of the private addressing scheme. The following resources could be helpful to both tutors and learners: Organisation: James Graves Resource Title: IPv4 Classes and Public -vs- Private Ranges Website Link: https://www.youtube.com/watch?v=EqRIFF5URIs Description: A tutorial that contrasts public and private addressing. Organisation: Nicholas Andre Resource Title: Classful vs Classless Addressing Website Link: https://www.youtube.com/watch?v=UZpz6sLYNIE Description: Explains classful and classless addressing. Organisation: BusinessInteractive Resource Title: Private and Public Addresses Website Link: https://www.youtube.com/watch?v=vKTReJ7ut7A Description: Explains public and private addressing.	2 hours	Unit 1 LO2 Unit 12 LO1

Title of suggested activity	Suggested activities	Suggested timings	Also related to
Subnetting	Learners should understand that an IP address defines the network portion of the address as well as the host portion of the address. Thus a Class A address defines the most significant 8 bits of the 32-bit address for the network component. The private address 10.45.4.2 is a Class A address with network address 10.0.0.0. Tutors could show how address 10.0.0.0 could represent a range of private networks by extending the Class A subnet mask. The class could be split into two or more groups; each group could be asked to configure a subnet mask to allow the network address to support a given number of sub-networks. The groups will then report their solutions back to the class. The following resources could be helpful to both tutors and learners: Organisation: School of Advanced Technology Resource Title: IPv4 - Basic Subnetting - Part 1 of 2 Website Link: https://www.youtube.com/watch?v=fVSClGAH-9s Description: Explains IPv4 - basic subnetting (two Parts). Organisation: Cisco Resource Title: Subnetting Explained Step by Step & Subnetting Chart Website Link: https://www.youtube.com/watch?v=Gt0RQX3QCO8 Description: Step-by-step explanation of subnetting.	2 hours	Unit 1 LO2 Unit 12 LO1

Title of suggested activity	Suggested activities	Suggested timings	Also related to
Firewalls	Tutors could introduce this topic by explaining that one function of a firewall is to examine IP packets coming into a computer. Because an IP packet has a well-known structure each part of the incoming packet can be filtered. Learners could then be shown how a firewall can detect an IP packet addressed to, say, port 1004 and could be configured to refuse to accept the packet. The class could be divided into groups, each with their own unique IP address. The tutor could then act as Firewall between the two groups, with one group inside the firewall and one group outside. The internal group wish to host the following services, for example: • Web server • Email server (POP3 and IMAP4) • Domain Name Service • File Transfer. The internal group will tell the tutor which port numbers they require open on the firewall to enable these services to operate correctly. The external group will give packets to the tutor for each service they wish to connect to. The tutor will communicate the result to each group. A table of well-known ports can be found at: https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers Tutor and learners may find the following resources helpful: Organisation: ifactner Resource Title: Firewall basics and network security Website Link: https://www.youtube.com/watch?v=0UXdEGAhPj4 Description: Explains firewall basics and network security. Organisation: Keep Going Resource Title: What is Firewall and how it works? Website Link: https://www.youtube.com/watch?v=GLMknVE-bWo Description: Explains what a firewall is and how it works.	2 hours	Unit 1 LO1, LO2 Unit 2 LO6 Unit 3 LO3

Title of suggested activity	Suggested activities	Suggested timings	Also related to
Troubleshooting IP connectivity	The tutor could introduce this topic by demonstrating a range of IP diagnostic utilities to learners. Learners should be familiar not only with what these utilities reveal about network connectivity, but also how they can be used effectively in pinpointing the cause of connectivity problems. The class could be split into groups and be asked to devise a procedure to troubleshoot lack of connectivity between a classroom computer and an external Internet website such as http://www.amazon.co.uk. The groups will then report their solutions back to the class. Tutor and learners may find the following resources helpful: Organisation: Sakitech Resource Title: Network Troubleshooting using PING, TRACERT, IPCONFIG, NSLOOKUP COMMANDS Website Link: https://www.youtube.com/watch?v=AimCNTzDlVo Description: Using PING, TRACERT, IPCONFIG. Organisation: SuperTerrificAwesom Resource Title: IP Configuration Utility via Command Prompt Website Link: https://www.youtube.com/watch?v=Ralyy-SqOug Description: Using the command line to configure IP.	2 hours	Unit 1 LO1, LO2 Unit 12 LO1 Unit 18 LO4

SUGGESTED ACTIVITIES

LO No:	3		
LO Title:	**Be able to present network solutions to clients**		
Title of suggested activity	**Suggested activities**	**Suggested timings**	**Also related to**
Network logical design	The tutor could introduce this topic by describing how a network is developed for an organisation. Learners must understand that the logical design of the network is the very first phase of the development process. No actual products are considered during this phase; the actual requirement is to come to an understanding of what exactly the network is going to provide for its users. For example: • How many users? • How much network bandwidth will be required? • IP address ranges needed? • Public and private addressing? A sketch can be drawn up which contains all these requirements; the Logical Network Diagram. The user requirements should be simple enough to enable completion of the activity in the allotted time. The tutor could represent the school that is tendering to a number of companies to develop the network. The class could be split into two groups; each group could be given a copy of the diagram together with the listed user requirements. Each group could then play the part of a company involved in the tendering process with the school. The groups would compile a list of relevant questions to ask the school about the network requirements. The tutor could then discuss these lists with the whole class. Tutors and learners may find the following helpful: Organisation: Edraw Resource Title: Logical Network Diagrams Website Link: https://www.edrawsoft.com/Logical-Network.php Description: Topics in logical network design and software. Organisation: Simple Talk Resource Title: Logical Network Layout for Small Networks Website Link: https://www.simple-talk.com/sysadmin/general/logical-network-layout-for-small-networks/ Description: Describes the network topology of small networks.	2 hours	Unit 1 LO1, LO2, LO3, LO5 Unit LO1, LO6 Unit 3 LO1, LO3 Unit 6 LO2 Unit 8 LO2 Unit 12 LO1 Unit 17 LO1

Title of suggested activity	Suggested activities	Suggested timings	Also related to
Network physical design	The tutor could introduce this topic by contrasting network logical design with network physical design. Learners must understand that the logical design must be complete before the physical design can begin. The logical network design diagram is used in order to select suitable products to realise the design requirements. The tutor could produce a simple network diagram. The class could be split into groups and each group would devise a list of physical items that would enable the given logical network to be built. The groups could then report their findings back to the whole class. Tutors and learners may find the following helpful: Organisation: MegaEssays Resource Title: The Difference Between a Network Logical and Physical Design Website Link: http://www.megaessays.com/viewpaper/7422.html Description: Comparing network logical and physical design.	2 hours	Unit 1 LO1, LO2, LO3 Unit 2 LO1, LO6 Unit 3 LO1, LO3 Unit 12 LO1 Unit 17 LO1
Network utilisation	Learners must understand that when translating the logical design of a network into the physical design, components will have to be chosen that will support the traffic that is specified for the network. The tutor could introduce this topic by demonstrating the network utilisation of the class network by use of the built-in Windows utility called Resource Monitor. The actual utilisation level can be observed by copying some very large files from a shared folder on the network whilst Resource Monitor is running. The class could then be split into at least two groups with each group researching one network utilisation tool. The groups will research information on tools that could inject traffic onto a network in order to test if the network meets its design capacity. The groups could then report back the major features of such a utility to the class. The tutor will need to coordinate the groups to ensure the researched products are different for each group. Tutors and learners may find the following resources helpful: Organisation: Raymond.CC Resource Title: 5 Free Tools to Test and Benchmark Your Network Speed Website Link: https://www.raymond.cc/blog/network-benchmark-test-your-network-speed/ Description: A range of tools for network benchmarking. Organisation: TechRepublic Resource Title: Use Resource Monitor to monitor network performance Website Link: http://www.techrepublic.com/blog/the-enterprise-cloud/use-resource-monitor-to-monitor-network-performance/ Description: How to use Resource Monitor to monitor network performance.	2 hours	Unit 1 LO1, LO2, LO3 Unit 2 LO1 Unit 12 LO1 Unit 17 LO1

Title of suggested activity	Suggested activities	Suggested timings	Also related to
Network testing	Learners must understand that when installation of a network is complete then testing of the network must be completed to the satisfaction of the requirements in the design plan. The tutor could introduce this topic by demonstrating a range of tests that could be carried out on the school network. The class could be given a simplified design plan of a network. The tutor could then split the class into at least two groups. Each group would produce a schedule of tests that the group would carry out to establish if the network meets its requirements. The groups would then report their schedules back to the class. Tutors and learners may find the following resources helpful: Organisation: Toolbox Resource Title: Creating a Network Test Plan Website Link: http://it.toolbox.com/blogs/enterprise-solutions/creating-a-network-test-plan-23553 Description: Steps to follow in creating a network test plan. Organisation: Cisco Resource Title: Crafting the Test Approach Website Link: http://www.ciscopress.com/articles/article.asp?p=1706355&seqNum=5 Description: How to write a network test plan.	2 hours	Unit 1 LO1, LO2, LO3 Unit 3 LO3 Unit 12 LO1 Unit 17 LO1 Unit 18 LO4
Client requirements	Learners must understand that vendors of computer networks have a very clear sense of what it is the client requires from a network. For example, a company tendering for the new school network will have to document clearly what the school needs. This is called documenting the 'client requirements'. This document is very important for the vendor because it will be used by the client to test if the network meets these requirements during user acceptance testing. The tutors could introduce this topic by providing some examples of what a client may be asking for during the initial meeting with a network vendor. The class could now be split into at least two groups, with each group role-playing the part of a network vendor. The tutor would role-play the part of the client for a simple network. Each group will interview the 'client' to establish requirements. Groups will create a list of testable requirements and report these back to the class. Tutors and learners may find the following resource helpful: Organisation: SlideShare Resource Title: Determining Client And Networking Requirements Website Link: http://www.slideshare.net/stevencahill/determining-client-and-networking-requirements Description: How to identify a client's requirements for a network design.	2 hours	Unit 6 LO2

Title of suggested activity	Suggested activities	Suggested timings	Also related to
User acceptance testing	Learners must understand that User Acceptance Testing (UAT) is a set of tests carried out by the end-user of the completed network. It is on the successful completion of these tests that the user will sign a 'ready-for-use' document which signals to the network vendor that their work is complete. The tutor could introduce this topic considering who would be responsible for such testing and giving examples of tests that would be carried out. The tutor could then split the class into at least two groups. The groups could be directed to carry out research on what 'test cases' are with respect to User Acceptance Testing. The groups could then create one test case for a client requirement given by the tutor. The test case for each group could then be reported back to the class. Tutors and learners may find the following resources helpful: Organisation: Testing Performance Resource Title: What is User Acceptance Testing? Website Link: http://www.testingperformance.org/definitions/what-is-user-acceptance-testing Description: A range of articles on UAT. Organisation: Techopedia Resource Title: User Acceptance Testing (UAT) Website Link: https://www.techopedia.com/definition/3887/user-acceptance-testing-uat Description: A definition of UAT.	2 hours	Unit 1 LO1, LO2, LO3 Unit 9 LO4 Unit 18 LO4

SUGGESTED ACTIVITIES

LO No:	4		
LO Title:	**Be able to plan maintenance activities for computer networks**		
Title of suggested activity	**Suggested activities**	**Suggested timings**	**Also related to**
Replacing server hardware	Learners must understand that most components of the network are susceptible to failure. Hard drives are particularly vulnerable within the network server because of high disk usage. Because most user data is stored on a server the drive behaviour should be monitored as part of an ongoing regular maintenance plan. The tutor could introduce this topic by demonstrating the read and write activity on a drive using a tool such as Resource Monitor and then copying a large file (or set of files) so that learners can visualise the activity on the drive. The class could be split into at least two groups. Each group is informed that weekly monitoring of the server hard drive has revealed increasingly excessive access times and is slowing the network down. The groups are directed to research the Internet for one utility that will provide more information about the suspected drive. Groups will report their findings back to the class. Tutor and learners may find the following resources helpful: Organisation: MakeUseOf Resource Title: 5 Signs Your Hard Drive Lifetime is Ending & What To Do Website Link: http://www.makeuseof.com/tag/5-signs-hard-drive-lifetime/ Description: Five signs your hard drive lifetime is ending and what to do. Organisation: MaximumPC Resource Title: How To: Detect a Faulty Hard Drive and Recover Data Website Link: http://www.maximumpc.com/how-to-detect-a-faulty-hard-drive-and-recover-data/ Description: A document explaining a number of ways to detect a faulty hard drive.	2 hours	Unit 1 LO1, LO2, LO3 Unit 18 LO3, LO4

Title of suggested activity	Suggested activities	Suggested timings	Also related to
Disaster recovery plan	Learners must understand the sudden failure of a network hard drive can bring down the entire network. During the ensuing down-time the organisation could lose a lot of business and complete loss of the data will almost certainly see the company go out of business. The tutor could introduce this topic explaining how delicate the hard drive mechanism is and why the lifetime component in a server would be limited when compared to the drive on a desktop machine. The class could be split into at least two groups. The groups are informed that the network server drive that is being monitored weekly is showing signs that it may fail. Each group should provide a list of items that they would include in a recovery plan for failure of the school network server hard drive. Groups will then report their lists back to the class. Tutor and learners may find the following resources helpful: Organisation: Zetta Net Resource Title: How To Build an Effective Disaster Recovery Plan Website Link: https://www.youtube.com/watch?v=7s2aMO1Lmis Description: A video that covers best practices in creating a disaster recovery plan. Organisation: STF Consulting Resource Title: Network Disaster Recovery Plan Website Link: https://www.youtube.com/watch?v=sk1iSt-vxvU Description: Explains creating a disaster recovery plan and providing a template.	2 hours	Unit 1 LO1, LO2, LO5 Unit 2 LO6 Unit 3 LO3 Unit 8 LO2 Unit 18 LO2, LO3

Title of suggested activity	Suggested activities	Suggested timings	Also related to
Check for security updates	The tutor could introduce this topic by demonstrating how a computer can be checked to ensure that the latest security updates have been applied to the computer. Learners must understand the consequences of not keeping the protection of a computer up-to-date. Unfortunately some security updates may also cause important applications to fail because such applications may now violate the newly applied security restrictions. The school network is especially vulnerable due to the wide range of activities carried out by students. The tutor could direct learners, in groups, to research why security updates are important. Each group could then list their top three security threats that would be minimised if the latest security updates are applied as well as any precautions they would take before and after applying these updates. The groups could then report their findings back to the class. Tutors and learners may find the following resources helpful: Organisation: University of Exeter Resource Title: The Importance of Security Updates Website Link: http://as.exeter.ac.uk/it/equipmentandsoftware/securityandsoftwareupdates/the_importance_of_security_updates/ Description: Explains the importance of computers having the latest security updates. Organisation: University of Illinois Resource Title: Privacy and Information Security Website Link: https://security.illinois.edu/content/updates-and-patches Description: Considers the importance of applying security patches. Organisation: Norton Resource Title: Why Security Updates Are Vital Website Link: http://uk.norton.com/vital-security/article Description: Outlines a number of reasons why security updates are critical on a computer network.	2 hours	Unit 1 LO2, LO5 Unit 2 LO6 Unit 3 LO3

Title of suggested activity	Suggested activities	Suggested timings	Also related to
Network maintenance plan	Learners must understand that when a computer network becomes operational it will be relied on by all its users with usually a 24/7 availability. Applications and security need to be updated, hardware may require replacing, anti-virus software may need to be updated and hot-fix applied. Tutors could introduce this topic by explaining that all these tasks must be planned so that users are inconvenienced as little as possible. The class could be split into at least two groups. The groups could be directed to research information on 'maintenance planning' so that they could devise a list of their top five items to include on their IT maintenance plan for the school network. Lists should include the times when these activities will be carried out. The groups could then report findings back to the class. Tutors and learners may find the following resources helpful: Organisation: The IT Donut Resource Title: How to plan your IT maintenance Website Link: http://www.itdonut.co.uk/it/buy-and-manage-it/regular-it-maintenance/how-to-plan-your-it-maintenance Description: Considers how you might plan IT maintenance for the network. Organisation: AAIS Resource Title: Maintenance plan Website Link: http://www.aaisinc.com/hardware/support/maintenanceplan.php Description: Considers the maintenance tasks for a range of typical network components.		Unit 1 LO1, LO2, LO3 Unit 8 LO2

Title of suggested activity	Suggested activities	Suggested timings	Also related to
Network backup	Learners must understand that the security of data stored on the network is paramount. Loss of this data may not just affect the users but also the configuration of the network and many operational details. Loss could render the entire IT infrastructure useless. The tutor could demonstrate the major features of a backup by using the built-in back-up utility that comes with an operating system such as Windows. Although backups are essential, they do take a long time to complete on an operational network and the act of doing the backup can impact the performance of the network for users during the process. The class could be split into at least two groups. The groups could then be directed to research backup software products. Each group could then devise a Top 5 list of a chosen backup product. The group will also explain why a particular item is featured in the Top 5 list. The groups could then report their findings back to the class. Tutors and learners may find the following resources helpful: Organisation: Backup4all Resource Title: Network backup Website Link: http://www.backup4all.com/kb/network-backup-110.html Description: Embedded videos explain the backup process. Organisation: CNET Resource Title: How to back up your Windows computer to a network hard drive Website Link: http://www.cnet.com/uk/how-to/how-to-back-up-your-windows-computer-to-a-network-hard-drive/ Description: Explains backup in a Windows environment using network storage devices.	2 hours	Unit 2 LO6 Unit 3 LO3 Unit 18 LO2, LO3

Title of suggested activity	Suggested activities	Suggested timings	Also related to
Performance measurements	Learners must understand that at the time the User Acceptance has been signed off the performance of the network will be at its highest. After continued normal use of the network infrastructure the users will eventually have some evidence of some slowdown. Sometimes this slowdown may be dramatic when serious issues arise on the network. Tools are available to monitor the many hundreds of parameters that affect the network. However, if the actual values of these parameters when the network was at its best are unknown, then knowing the new values may be of little help in diagnosing problems. Taking a limited set of important network measurements and keeping them is one way of being able to do a comparison at a later date. This process is called baselining. The tutor could introduce this topic by demonstrating the operation of a performance monitoring tool. For example, in Windows there is a tool called Performance Monitor. Learners could be shown how to launch this tool and how to monitor some of the important network parameters. The class could be split into at least two groups and be directed to research baselining on the computers in use the school. Each group could then devise a list of four parameters, each related to network traffic, they would consider worthy of saving as part of a baseline. They could also include the reason for selecting that parameter on the list. The group could then report their findings back to the class. Tutors and learners may find the following resources helpful: Organisation: TechTarget Resource Title: Windows 7 performance monitoring tools Website Link: http://searchitchannel.techtarget.com/feature/Windows-7-performance-monitoring-tools Description: Considers a number of ways to evaluate the performance of computers on the network. Organisation: SolarWinds Resource Title: Engineer's Toolset: Over 60 must-have network tools Website Link: http://www.solarwinds.com/engineers-toolset.aspx Description: Lists and describes a range of tools for monitoring the network. The toolkit is downloadable as a trial version. Organisation: Fluke Resource Title: IT Networking - Network Performance Testing Tools Website Link: http://www.flukenetworks.com/enterprise-network Description: Describes a range of hardware tools for monitoring the performance of the network.	2 hours	Unit 1 LO2 Unit 18 LO4

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