

Unit 9: Computer Networks

Unit code:	R/601/7320
QCF Level 3:	BTEC National
Credit value:	10
Guided learning hours:	60

● Aim and purpose

The aim of this unit is to ensure learners understand the key components of networked systems, know about network protocols and the services provided by network systems and develop the skills required to ensure network security.

● Unit introduction

Networks are used in one way or another by virtually every organisation, from simple use of internet services through internal file sharing to wide area networks exchanging data across continents. Therefore, it is essential that learners thinking of careers within the IT industry have a good understanding of the underlying principles of networking and how data travels around networks.

This unit starts by exploring the different types of networks and the standards relating to network systems, including local and wide area networks. Networks can be either wired or wireless systems and, although much of the underpinning content is similar, this unit does make reference to both.

The hardware and software components used in networks and their operation are explored and learners will develop an understanding of their functions and how they relate to each other, particularly how connections are made and the purpose of these connection devices.

As users of networks, we work with them mostly through the services that they provide, from simple services such as file sharing and communications to more complex services involving security and account management. Learners will explore and use the different services available.

For networks to be suitable they must be secure and networks distributed across several physical locations, perhaps via a WAN, makes the ensuring of security a complex business. Learners will be exploring the technologies used to create secure systems and putting security procedures and devices in place to secure a networked system. Learners will come to understand the risks to businesses from insecure networks.

● Learning outcomes

On completion of this unit a learner should:

- 1 Know types of network systems and protocols
- 2 Understand the key components used in networking
- 3 Know the services provided by network systems
- 4 Be able to make networked systems secure.

Unit content

1 Know types of network systems and protocols

Types of network: local area network (LAN); wide area network (WAN), internet; WAN technologies eg frame relay, MPLS, ATM; Personal Area Network (PAN); logical and physical topologies eg star, bus, ring, mesh, tree; network access methods eg CSMA, Token passing; network models eg OSI 7 layer, TCP/IP

Network protocols and standards: types eg TCP/IP, AppleTalk, UDP, 802.2, 802.3, FDDI, 802.5; wireless technologies eg 802.11, infrared, Bluetooth, 3G; factors affecting range and speed of wireless technologies

Application layer protocols: types eg DNS, DHCP, HTTP, FTP, SMTP

2 Understand the key components used in networking

Key components: network devices; interconnection devices; connectors and cabling; software

Network devices: workstations; servers eg print, mail, file, web, proxy; others eg network interface cards (NIC); features and functions

Interconnection devices: equipment eg router, switch, wireless access points; purposes, features and functions of each

Connectors and cabling: leased line; dedicated line; media types eg STP, Category 5, coaxial, UTP, fibre optic; wireless; mobile technology; cable/connection standards

Software: network operating system; virus checker; firewall; other eg email client

Commercial systems: software eg Mac OSX, Linux, Windows

3 Know the services provided by network systems

Directory services: used for eg account management, authentication management, active directory, DNS

Telecommunication services: communication eg email, internet relay chat (IRC), discussion boards; remote access eg via mobiles, remote desktop, social networking

File services: file transfer; file sharing

Application services: application software eg database, web, proxy; shared resources eg printing; storage space; Voice over IP (VoIP); mobile working; authentication eg users, hardware

4 Be able to make networked systems secure

Securing a system: passwords, authorisation permissions and access control lists; backing up and restoring; encrypting; others eg biometrics; physical security eg CCTV, locks, firewalls; security risk levels; software protection eg antivirus, intrusion detection systems

Business risks: loss of service; loss of business or income eg through loss of customer records; increased costs; loss of confidentiality; compromised data integrity; security issues eg malware (hostile, intrusive, or annoying software or program code), viruses, Trojans, worms, spyware, adware

Assessment and grading criteria

In order to pass this unit, the evidence that the learner presents for assessment needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria for a pass grade describe the level of achievement required to pass this unit.

Assessment and grading criteria		
To achieve a pass grade the evidence must show that the learner is able to:	To achieve a merit grade the evidence must show that, in addition to the pass criteria, the learner is able to:	To achieve a distinction grade the evidence must show that, in addition to the pass and merit criteria, the learner is able to:
P1 describe the types of networks available and how they relate to particular network standards and protocols	M1 compare the benefits and disadvantages of peer-to-peer network and client/server networks [IE3]	
P2 describe why different network standards and protocols are necessary		
P3 explain the key components required for client workstations to connect to a network and access network resources	M2 design a networked solution to meet a particular situation with specific requirements [IE1, CT1]	D1 justify the design and choice of components used in a particular networked solution [IE6]
P4 explain the function of interconnection devices		
P5 describe typical services provided by networks		D2 evaluate typical services available from a network operating system directory service.
P6 make a networked system secure.	M3 report on the business risks of insecure networks and how they can be minimised.	

PLTS: This summary references where applicable, in the square brackets, the elements of the personal, learning and thinking skills applicable in the pass criteria. It identifies opportunities for learners to demonstrate effective application of the referenced elements of the skills.

Key	IE – independent enquirers	RL – reflective learners	SM – self-managers
	CT – creative thinkers	TW – team workers	EP – effective participators

Essential guidance for tutors

Delivery

This unit is based on the principles of networking with a theoretical view to much of the content. However, centres should try to ensure that as many varied learning approaches are used as possible. Practical activities on real networks are recommended, examples are offered in *Assessment*.

Visits or talks given by outside professionals will be valuable – preparation may be necessary to ensure that the guest speaker understands the level of programme and is prepared to use appropriate language and respond to the learning outcomes where possible.

This unit can be offered in parallel to the many vendor units on offer and is designed to link into the other network-related units.

The unit content can be followed chronologically but this may not be the most appropriate sequence. Integrating practical activity to bring the unit alive will be vital. Much internet research can be carried out on network components and services and learners can work in teams to cover and collect information and pool findings.

A secure and separate network will be needed for learners to practise implementing security features. It is not possible to carry out much of the content but learners should understand where and when the use of techniques, such as encryption, is suitable.

Outline learning plan

The outline learning plan has been included in this unit as guidance and can be used in conjunction with the programme of suggested assignments.

The outline learning plan demonstrates one way in planning the delivery and assessment of this unit.

Topic and suggested assignments/activities and/assessment
Introduction to the unit
<ul style="list-style-type: none">• whole-class exercise – tutor presentation on different types of network• whole-class exercise – learning and understanding network protocols and standards• directed research – learn about application layer protocols
<ul style="list-style-type: none">• whole-class exercise – tutor demonstrates network devices, interconnection devices, connectors and cabling, software and commercial systems, followed by practical exercises.
Assignment 1 – Networking/not-working
<ul style="list-style-type: none">• whole-class exercise – practical work on directory, telecommunication, file and application services.
Assignment 2 – Bespoke Systems
<ul style="list-style-type: none">• individual exercise – use tutor-provided materials to research risk-related business issues• whole-class exercise – tutor sets a series of practical exercises to teach learners about securing data.
Assignment 3 – Service Provider
Assignment 4 – Securing a Network

Assessment

As this unit has substantial theory it is important that centres make as much use of varied assessment strategies as possible to maintain interest. This could include the use of online or conventional testing, learner presentations, assignments or question and answer sessions.

The suggested assessment is through four assignments as outlined in the *Programme of suggested assignments*.

Suggested Assignment 1 – Networking/not-working

The suggested scenario is that learners have been employed to explain possible network solutions to a business client

For P1, describing networks, protocols and standards, learners could produce a report/poster using diagrams. Alternatives are a small set of linked web pages or a presentation.

For P2, learners should be able to demonstrate they understand why different network standards and protocols are necessary. Examples given should be realistic. This can be linked to P1.

Before attempting M1, learners should, ideally, have the chance to see the operation of both types of networks and then the actual evidence presented as a verbal, written report etc would be based on real experience.

Suggested Assignment 2 – Bespoke Systems

For P3, learners are explaining the key components for connection to network systems. This, along with the evidence for P4 (the function of interconnection devices), could be produced as an information 'leaflet', which may be paper- or web based.

M2 is the design of a network and learners will need to be supplied with a specific scenario to develop their solution. Evidence could be diagrammatic with explanatory notes.

D1 is a justification of the design developed for M2. Pros and cons should be included.

Suggested Assignment 3 – Service Provider

The evidence for P5 and D2 can be in any appropriate format. To make for some variation this could be presented as a blog or simply a standard report format.

The unit content informs the expected coverage.

Suggested Assignment 4 – Securing a Network

The assumption here is that a network has already been set up and the assessment deals with implementing security procedures. Learners will obviously benefit from setting the system up as well, and evidence from that activity may be used for other networking units.

P6 will be evidenced with observation records and/or witness statements, which should be supplemented with any associated paperwork.

M3 is another 'report' but evidence could be presented orally and question and answer sheets used to assess knowledge and understanding.

Programme of suggested assignments

The table below shows a programme of suggested assignments that cover the pass, merit and distinction criteria in the assessment and grading grid. This is for guidance and it is recommended that centres either write their own assignments or adapt any Edexcel assignments to meet local needs and resources.

Criteria covered	Assignment title	Scenario	Assessment method
P1, P2, M1	Networking/not-working	You have been employed to explain possible network solutions to a business client.	Report Poster Presentation
P3, P4, M2, D1	Bespoke Systems	The client asks you to design a network for the business.	Leaflet Presentation Network diagram
P5, D2	Service Provider	The client wants you to explain some typical network services.	Presentation Blog Report
P6, M3	Securing a Network	The client asks you to secure the network.	Observation records Witness statements Report

Links to National Occupational Standards, other BTEC units, other BTEC qualifications and other relevant units and qualifications

This unit forms part of the BTEC in IT sector suite. This unit has particular links with the following unit titles in the IT suite:

Level 2	Level 3	Level 4
Unit 10: Setting up an IT Network	Unit 5: Managing Networks	Unit 24: Networking Technologies
Unit 11: IT Security	Unit 32: Networked Systems Security	Unit 43: Networking Infrastructure

This unit maps to some of the underpinning knowledge from the following areas of competence in the Level 3 National Occupational Standards for IT (ProCom):

- 4.7 Systems Design
- 6.2 IT Security Management.

Essential resources

Learners will need access to practical resources and suitable technology. They can also use simulators or multimedia tools to gain experience before handling 'live resources'.

Employer engagement and vocational contexts

Visits to a local ISP or using the academic centre network as a suitable vocational context.

Indicative reading for learners

Textbooks

Dodd A Z – *The Essential Guide to Telecommunications, 4th Edition* (Prentice Hall, 2005)
ISBN-10 0131487256, ISBN-13 978-0131487253

Hallberg B – *Networking: A Beginner's Guide, 5th Edition* (Osborne/McGraw-Hill US, 2009)
ISBN-10 0071633553, ISBN-13 978-0071633550

Lowe D – *Networking All-in-One Desk Reference for Dummies, 3rd Edition* (John Wiley & Sons, 2008)
ISBN-10 0470179155, ISBN-13 978-0470179154

Schiller J – *Mobile Communications, 2nd Edition* (Addison Wesley, 2003) ISBN-10 0321123816,
ISBN-13 978-0321123817

Websites

www.howstuffworks.com

www.webopedia.com

Delivery of personal, learning and thinking skills

The table below identifies the opportunities for personal, learning and thinking skills (PLTS) that have been included within the pass assessment criteria of this unit.

Skill	When learners are ...
Independent enquirers	exploring the issues, events or problems involved with peer-to-peer network and client/server networks, from different perspectives identifying a particular design of networked solution to resolve specific problems supporting conclusions about the design and choice of components used in a particular networked solution, using reasoned arguments and evidence
Creative thinkers	generating the design, and exploring possibilities of a networked solution to meet a particular situation with specific requirements
Effective participators	identifying improvements that would reduce the business risks of insecure networks and how this would benefit the whole organisation.

Although PLTS are identified within this unit as an inherent part of the assessment criteria, there are further opportunities to develop a range of PLTS through various approaches to teaching and learning.

Skill	When learners are ...
Self-managers	making a network secure.

● Functional Skills – Level 2

Skill	When learners are ...
ICT – Using ICT	
Select, interact with and use ICT systems safely and securely for a complex task in non-routine and unfamiliar contexts	making a network secure
ICT – Finding and selecting information	
Use appropriate search techniques to locate and select relevant information	researching network protocols
ICT – Developing, presenting and communicating information	
Combine and present information in ways that are fit for purpose and audience	explaining network solutions and services.