

Unit 9: An Introduction to Communication Technologies

Unit code: Y/600/4035
QCF Level 2: BTEC Specialist
Credit value: 9
Guided learning hours: 60

Aim and purpose

The aim of this unit is to give learners an introduction into the technologies involved in LANs and WANs. Learners will connect a range of common network devices, learn about network addressing schemes and investigate the OSI model.

Unit introduction

Networking skills are particularly valued in the IT industry and this unit provides a solid foundation for learners to gain theoretical knowledge and practical application skills in networking.

In this unit learners will be introduced to network technologies ie the hardware and software involved and how these are connected to produce both local (LAN) and wide area (WAN) networks. They will investigate the function and operation of LANs and WANs and connect and troubleshoot networked systems for themselves, setting addresses and testing functionality. They will also investigate how data is sent through a network and learn about network models and protocols.

Learning outcomes and assessment 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 determine the standard required to achieve the unit.

On completion of this unit a learner should:

| Learning outcomes | Assessment criteria |
|---|--|
| 1 Know the difference between LANs and WANs | 1.1 explain the difference between LANs and WANs |
| 2 Be able to connect and troubleshoot data communications systems | 2.1 assign network addresses to a small LAN and test connectivity 2.2 test the function and capabilities of network devices |
| 3 Know the importance of addressing schemes in a data network | 3.1 explain how addressing and port numbers are used to send a packet of data across a network |
| 4 Understand the OSI reference model | 4.1 describe the data formats and protocol implementation used by the different layers of the OSI reference model |

Unit content

1 Know the difference between LANs & WANs

LANs (Local Area Networks): function, operation, uses, advantages, limitations

WANs (Wide Area Networks): function, operation, uses, advantages, limitations

2 Be able to connect and troubleshoot data communications systems

Network devices: servers eg file, printer, web; workstations; interconnection devices eg interface controller, repeater, passive, active and intelligent hubs, bridge, switch, router, gateway; network cards eg ethernet, wireless; vendor specific hardware; function; capabilities

Network software: application-based eg internet browsers, firewalls, email; operating system; utilities; function; capability

Connectivity: network cabling eg fibre optics, UTP, STP, coaxial; connectors; addressing; WAN connectivity eg ADSL, ISDN, broadband

Addressing: protocols eg IP, MAC, network layer

Testing: functionality; connectivity; addressing; recording/documentation

3 Know the importance of addressing schemes in a data network

Data packets: methods of transfer eg token passing, packet switching; addressing; ports

TCP/IP layers: data flow or network access, internet, transport, application

IP Addressing Schemes: IP address characteristics (network part, host part, subnet number); network classes eg class A, B, C, D, E; IP address range; subnet masks; public/private addressing; Ipv4, Ipv6; Media Access Control (MAC) addresses

Port numbers: used by different protocols eg HTTP, FTP, SMTP, POP

4 Understand the OSI reference model

OSI model: layers (Physical, Data Link, Network, Transport, Session, Presentation, Application); data formats; protocol implementations

Essential guidance for tutors

Delivery

A practical approach should be taken to enable learning and to prepare learners for assessment. Investigating LANs and WANs can be integrated with this learning. Learners may carry out their own research to explain the function, operation, uses, advantages and limitations of LANs and WANs.

Network addressing will need to be understood and practiced ready for assessment, as will testing of network devices. Learners should become confident with how to test devices and, as importantly, how to record their test procedures and take corrective action. This could involve the tutor setting up a small network, including network software with learners configuring IP addresses and network software, then carrying out testing of the system to check for connectivity and functionality.

Addressing should cover IP and MAC addressing with an understanding of, for example, the mechanism involved in connecting to a server and downloading a file. This should take into account how a file is divided into packets and the mechanisms and protocols involved in getting the file to the user's desktop.

The OSI model can present a challenge to explain but there are a lot of useful and informative websites eg www.sqa.org.uk/elearning, with quizzes and analogies which either teachers or learners can access. Learners need to go beyond the simple knowledge of the layers of the model and look at data formats and protocol implementations.

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"> • LANs and WANs – tutor directed research, production of posters • Network devices – tutor led, learner research, technician talk • Network software – tutor led, exercises • Cabling and connectors – technician demonstration • Connectivity – learner research • Protocols – tutor led exercises, exercises • Testing – tutor led, case studies, technician talk, practical exercises |
| Addressing schemes |
| <ul style="list-style-type: none"> • Data packets, TCP/IP layers, addressing schemes, ports – tutor led, learner research, technician input |
| Assignment 1 - Network Addressing |
| <ul style="list-style-type: none"> • OSI model – tutor led, technician input, research, e-learning modules |
| Assignment 2 - All about networks |

Assessment

It is suggested that this unit is assessed using two assignments as summarised in the *Programme of suggested assignments* table.

There is a practical element to the assessment in learning outcome 2 and three learning outcomes requiring 'written' work. The three theoretical elements could be covered in one presentation, which could be developed in three parts. Alternative presentation methods may be used eg leaflets, information sheets, posters etc.

Suggested Assignment 1

For learning outcome 2 learners do not need to physically build the network. Their job is to assign network addresses and test the connectivity of the devices. To document the setting of network addresses, learners can complete a worksheet and a witness statement can be used. Learners should have designed a test plan and recording documentation prior to the practical work, which they will complete as evidence. Again, a witness statement could provide valuable supporting evidence.

Suggested Assignment 2

If possible, learners could be asked to give a presentation to demonstrate their learning to a work experience employer (or to the centre's network technicians).

For learning outcome 1, learners should explain the function, operation, uses, advantages and limitations of both LANs and WANs and make some comparative points.

Learning outcome 3 requires an explanation of how addressing and port numbers are used and learners must explain the importance of addressing schemes in the transfer of data

Learning outcome 4 requires a description of the data formats and protocol implementations used by the layers of the OSI model. This is straightforward descriptive content, there is no requirement to explain how it works.

Programme of suggested assignments

The table below shows a programme of suggested assignments that cover the assessment 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 |
|------------------|--------------------|--|---|
| 2.1, 2.2 | Network addressing | You are to set network addresses and test network devices and connectivity on a given LAN. | Worksheet. Test plan. Test records. Witness statement. |
| 1.1, 3.1, 4.1 | All about networks | You are to give a presentation to an employer to demonstrate your knowledge of networking. | Presentation. |

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:

| Level 1 | Level 2 | Level 3 |
|---------|--------------------------|----------------------------|
| | Networking Principles | Networking Principles |
| | Setting up an IT Network | Communication Technologies |
| | | Computer Networks |
| | | Managing Networks |

This unit maps to some of the underpinning knowledge from the following areas of competence in the Level 2 National Occupational Standards for IT and Telecoms Professionals (ProCom):

- 4.7 Systems Design
- 5.1 Systems Development
- 5.3 IT/Technology Solution Testing.

Essential resources

Learners will need access to networking equipment and communications technologies, which will enable them to assign network addresses and test data communication. Learners can also use simulators or multimedia tools to gain prior experience before handling live resources.

Employer engagement and vocational contexts

Visits to a local Internet Service Provider (ISP) or using the academic centre network as a suitable vocational context.

There is a range of organisations that may be able help centres to engage and involve local employers in the delivery of this unit, for example:

- Learning and Skills Network – www.vocationallearning.org.uk
- Local, regional business links – www.businesslink.gov.uk
- National Education and Business Partnership Network – www.nebpn.org
- Network for Science, Technology, Engineering and Maths Network Ambassadors Scheme – www.stemnet.org.uk
- Work-based learning guidance – www.aimhighersw.ac.uk/wbl.htm
- Work experience/workplace learning frameworks – Centre for Education and Industry (CEI University of Warwick) – www.warwick.ac.uk/wie/cei

Textbooks

Dodd AZ – *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

Hogan C J, Chalup S R and Limoncelli T – *The Practice of System and Network Administration* (Addison Wesley, 2007) ISBN 0321492668

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

Journals

Network World

Websites

www.howstuffworks.com

www.networktutorials.info

www.practicallynetworked.com

www.webopedia.com

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 | creating network communications |
| ICT - Developing, presenting and communicating information | |
| Combine and present information in ways that are fit for purpose and audience | <p>explaining the difference between LANs and WANs</p> <p>explaining how addressing and port numbers are used to send packets of data across a network</p> <p>describing data formats and protocol implementations</p> |
| Mathematics - Representing | |
| Identify the situation or problems and identify the mathematical methods needed to solve them | assigning network addresses |
| Choose from a range of mathematics to find solutions | assigning network addresses |