National Unit specification: general information

Unit title: Computing: Install, Configure and Test ICT Networks (SCQF level 5)

Unit code: FX1H 11

Superclass: CB

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Version: 01

Summary

This Unit gives candidates the necessary skills and knowledge to install, configure and test computer networks. Candidates will be introduced to networking concepts, gaining knowledge on different network technologies and network communication protocols. The Unit will enable candidates to build a small computer network and understand the Transmission Control Protocol/Internet Protocol (TCP/IP) and Open System Interconnect (OSI) models. Candidates will be introduced to IPv4, IPv6 and MAC addressing. Candidates will also gain practical skills in the use of ICT equipment to install and configure a computer network, testing the functionality of a network and troubleshooting a network.

This is an optional Unit within the NC Computing: Technical Support (SCQF level 5), but may be taken as a freestanding Unit. It is appropriate for anyone wishing to enhance their IT skills by studying the concepts of computer networks and technologies and supporting ICT networks.

Outcomes

1 Identify network and data communication concepts.
2 Identify network hardware and IP addressing.
3 Set up, configure and test a computer network.

Recommended entry

While entry is at the discretion of the centre, it would be beneficial if the candidate possessed basic IT skills.

National Unit specification: general information (cont)

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Credit points and level

1 National Unit credit at SCQF level 5: (6 SCQF credit points at SCQF level 5*)

**SCQF credit points are used to allocate credit to qualifications in the Scottish Credit and Qualifications Framework (SCQF). Each qualification in the Framework is allocated a number of SCQF credit points at an SCQF level. There are 12 SCQF levels, ranging from Access 1 to Doctorates.*

Core Skills

Opportunities to develop aspects of Core Skills are highlighted in the Support Notes of this Unit specification.

There is no automatic certification of Core Skills or Core Skill components in this Unit.

National Unit specification: statement of standards

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Acceptable performance in this Unit will be the satisfactory achievement of the standards set out in this part of the Unit specification. All sections of the statement of standards are mandatory and cannot be altered without reference to SQA.

Outcome 1

Identify network and data communication concepts.

Performance Criteria

(a) Identify network types and concepts.
(b) Identify physical network topologies and their characteristics.
(c) Identify network media access control protocols and their characteristics.
(d) Identify the layers in communication models and the relevant Protocol Data Units (PDUs) and hardware devices.
(e) Identify uses for computer networks and the services they provide.

Outcome 2

Identify network hardware and IP addressing.

Performance Criteria

(a) Identify network hardware components and their operation.
(b) Identify the different media used to connect networks, standards and the connector types required.
(c) Identify the operation of IPv4, IPv6, MAC addressing and basic IPv4 subnetting.
(d) Identify the tools required to build, test and troubleshoot a network.

Outcome 3

Set up, configure and test a computer network.

Performance Criteria

(a) Plan and configure a small network by identifying the components required.
(b) Test the network using appropriate tool selection.
(c) Create a file share and transfer a file between the connected computers.
(d) Troubleshoot hardware and software faults to resolution.

National Unit specification: statement of standards (cont)

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Evidence Requirements for this Unit

Evidence is required to demonstrate that candidates have achieved all Outcomes and Performance Criteria.

Outcome 1

Written and/or oral recorded evidence is required that demonstrates that candidates can:

- identify at least three key networking concepts
- identify at least two types of computer network
- identify at least two types of network architecture and their characteristics
- identify at least two physical network topologies and their characteristics
- identify at least one network media access control protocol and its features
- identify at least one layer of the Transmission Control Protocol / Internet Protocol (TCP/IP) model, its function and components
- identify at least one layer of the Open Systems Interconnect (OSI) model and its function/ components
- identify at least two uses of computer networks and services they provide

Evidence for this Outcome will be generated via sampling. On any assessment occasion, any five of the bullet points given above must be covered. Evidence will be obtained under controlled, supervised conditions.

Outcome 2

Written and/or oral recorded evidence is required that demonstrates that candidates can:

- identify at least two network hardware components and their operation
- identify at least two network media types
- identify at least one type of media connector
- identify at least two Internet Protocol (IP) address characteristics
- identify at least one Media Access Control (MAC) address characteristic
- identify at least one tool required to build, test and troubleshoot a network

Outcome 2 will be assessed under open-book, supervised conditions.

National Unit specification: statement of standards (cont)

Unit title: Computing: Install, Configure and Test ICT Networks (SCQF level 5)

Outcome 3:

Performance evidence is required which demonstrates that candidates can build, configure and test a small network of at least two computers. This must include:

- planning and selecting the correct Unshielded Twisted Pair (UTP) cable wiring format for the network to be setup. The cable should be tested before use and each end should be connected to the appropriate port
- assembling the network using the necessary equipment
- configuring the network and testing the configuration, troubleshooting as necessary
- using the network by creating a file share and sharing files across it
- locating one hardware and one software fault, troubleshooting these and recording the solution and problem. Candidates must retest the network to show troubleshooting steps were successful

Outcome 3 will be assessed under open-book, supervised conditions.

National Unit specification: support notes

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This part of the Unit specification is offered as guidance. The support notes are not mandatory.

While the exact time allocated to this Unit is at the discretion of the centre, the notional design length is 40 hours.

Guidance on the content and context for this Unit

The aim of this Unit is to provide knowledge of key networking concepts and terminology to enable candidates to install, configure and test ICT networks. The Unit will provide information on networking components, cabling, topologies, standards and addressing. Candidates will also learn to use networking tools and be able to test and troubleshoot a network. The Unit provides information on key networking terminology and features throughout to ensure candidates have the underpinning knowledge to setup a small computer network.

This Unit is aligned to the following e-Skills UK National Occupational Standards Level 2: IT/technology infrastructure design and planning.

Outcome 1

Outcome 1 aims to provide candidates with the theory of networking concepts. Candidates should be made aware of the definition of a network, different types of networks and architectures along with the uses and services of a network for either wired and or wireless technologies. Furthermore candidates should be made aware of the various physical and or logical topologies which could be either wired or wireless, media access control protocols and their features. MAC protocols could take a wired or wireless approach. Candidates should also be introduced to the TCP/IP and OSI networking models together with the networking hardware that functions at each level and the relevant Protocol Data Unit (PDU) of each level.

The Outcome should introduce candidates to common concepts and terminology which may include but are not limited to: Internet, Intranet, Local Area Network (LAN), Wide Area Network (WAN), Metropolitan Area Network (MAN), Wireless Local Area Network (WLAN), Wireless Metropolitan Area Network (WMAN), IEEE 802.11 standards, Wireless Fidelity (Wi-Fi), Basic Service Set (BSS), Extended Basic Service Set (EBSS), Independent Basic Service Set (IBSS), Radio Frequency (RF), Access Point (AP), antenna's, reflection, refraction, signal interference, Carrier Sense Multiple Access/ Collision Detection (CSMA/CD), Carrier Sense Multiple Access/ Collision Avoidance (CSMA/CA), shared medium, frequency, amplitude, modulation, Security Set Identifier (SSID), Encrytpion, Wireless Equivalent Protocol (WEP), Wireless Protected Access (WPA), cell, pico cell, association, broadcast, unicast, peer to peer, client/ server, Protocol Data Unit (PDU), frame, packet, bits, bytes, bandwidth, attenuation, OSI, TCP/IP, protocols (Ethernet, Token Ring, FDDI), topologies (ring, star, bus, mesh, partial mesh). Communication types such as wired, wireless, infrared and Bluetooth. Services such as e-mail, resource sharing, file transfer.

National Unit specification: support notes (cont)

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Outcome 2

Outcome 2 introduces candidates to the various network hardware components and their features. Candidates will learn the following terminology: Network Interface Card (NIC), hub, switch, bridge, gateway, and router; wireless technologies can also be used within the range of hardware components. Outcome 2 also requires candidates to understand the various media types and connectors such as; twisted pair (STP & UTP), fibre optic, coax, wireless standards (802.11x) and twisted pair wiring standards (straight through and cross over). Connector types such as RJ-45, BNC, Fibre Connector types.

Candidates will learn the various classes of IPv4 addressing (Class A, B and C) and the address ranges, some basic IPv4 class C subnetting should be introduced. Information should be given on IPv6 addressing to a basic level. Candidates will learn the tools used to build and troubleshoot a network including; cable tester, punch down tool, cable crimper.

Outcome 2 prepares candidates for selecting the appropriate networking tools and hardware as well as configuring the network.

Outcome 3

Outcome 3 enables candidates to build a small network. This Outcome relates to installing, configuring and testing a network. Candidates are required to choose the appropriate hardware and cable types to build a small network client/server, peer to peer, basic service set or an independent basic service set. The network implementation can be either wired or wireless. Candidates should configure the network as to meet the requirements set out and be able to locate and troubleshoot one hardware and one software fault (software configuration; faulty or incorrect hardware/ cabling). Candidates should be able to use the correct tools to test the network and keep records by filling out their log books.

Candidates must make the correct choice for hardware, software and cabling to build the network. The selection of hardware and setup would differ depending upon the network setup (wired or wireless). In order to test the network candidates must select the correct tools and also make use of command line commands to check the configuration such as ping and ipconfig. Candidates should know how to set and change TCP/IP addresses to enable two computers to successfully communicate on a network. Candidates must be able to use the network for successful file share to illustrate successful setup and function of the computer network.

National Unit specification: support notes (cont)

Unit title: Computing: Install, Configure and Test ICT Networks (SCQF level 5)

Guidance on learning and teaching approaches for this Unit

The aim of this Unit is to enable candidates to successfully build a small computer network. A practical approach should be taken, however the theory behind computer networks must first be taught in order for candidates to gain the knowledge required to understand networking concepts, build and troubleshoot a network.

Candidates should gain practical experience of using and identifying different network hardware. This should include straight through and crossover twisted pair cabling where a wired network approach is taken and/or the appropriate components for wireless. An understanding of where to implement these cable types and factors to consider for wireless network implementation should be covered. Network configuration and testing of software and hardware configurations should also be undertaken. Virtual machines could also be used in order to carry out practical tasks.

Guidance on approaches to assessment for this Unit

The approach to assessment for this Unit could be integrative, with Outcome 2 integrated within Outcome 3.

For Outcome 1, a question set could be used to sample knowledge of networking concepts.

Assessment for Outcome 1 should include a range of questions which meet the Performance Criteria for the Outcome. The assessment is a closed-book assessment held under controlled, supervised conditions, with a recommended duration of 45 minutes. Re-assessments should include a different set of questions and a different sample of the Performance Criteria. Questions could be provided using multiple choice/response, drag and drop, mix and match or a combination of questioning styles.

Outcome 2 can be integrated into Outcome 3, employing a practical approach to ascertain that candidates meet the Performance Criteria and/or use of questions. If Outcome 2 is assessed along with Outcome 3, observation checklists or questioning should be included alongside the evidence gathered for Outcome 3.

Outcome 3 is a practical assessment requiring candidates to utilise the knowledge they have gained and record each task carried out and procedure taken. Candidates are encouraged to use resources such as the internet for research, though all submissions should be in their own words and efforts should be taken by tutors to ensure the authenticity of their work.

Candidates could be provided with a networking scenario in which they need to use the correct hardware and software to build, configure and test the network. An activity log will be maintained by candidates to record the activities carried out and to ensure Performance Criteria are met. This will include correct setup of the network, use and choice of twisted pair cabling, hardware/software and correct configuration. The activity log should also detail the testing process providing information on correct tool selection and appropriate command line commands. Activity logs can be populated over a period of time or during a set number of hours decided upon at the discretion of the centre. Activity logs and observation checklists should be authenticated and verified by assessors.

National Unit specification: support notes (cont)

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Opportunities for the use of e-assessment

E-assessment may be appropriate for some assessments in this Unit. By e-assessment we mean assessment which is supported by Information and Communication Technology (ICT), such as e-testing or the use of e-portfolios or social software. Centres which wish to use e-assessment must ensure that the national standard is applied to all candidate evidence and that conditions of assessment as specified in the Evidence Requirements are met, regardless of the mode of gathering evidence. Further advice is available in *SQA Guidelines on Online Assessment for Further Education (AA1641, March 2003), SQA Guidelines on e-assessment for Schools (BD2625, June 2005)*.

Opportunities for developing Core Skills

In this Unit candidates will develop skills in computer networks and technologies to support ICT networks. Candidates will:

- choose the appropriate hardware, software and cabling to build a small network
- configure the network to meet customer requirements
- use the network by creating a file share and sharing files across the network
- locate and troubleshoot hardware and software faults
- use the correct tools to test the network
- maintain log books

As candidates are doing this Unit they will be developing aspects of the Core Skills of *Problem Solving* and *Communication*.

In addition, whilst completing this Unit, candidates may develop aspects of the following Core Skill where specific learning and teaching approaches are adopted:

- *Working With Others* — candidates may work in groups to undertake the practical tasks.

Disabled candidates and/or those with additional support needs

The additional support needs of individual candidates should be taken into account when planning learning experiences, selecting assessment instruments, or considering whether any reasonable adjustments may be required. Further advice can be found on our website **www.sqa.org.uk/assessmentarrangements**

History of changes to Unit

Version	Description of change	Date