National Unit specification: general information

Unit title: Computing: Networking Technologies (SCQF level 6)

Unit code: FX1L 12

Superclass: CB

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Source: Scottish Qualifications Authority

Version: 01

Summary

The purpose of this Unit is to enable candidates to understand computer networking concepts, and how computer networks operate. It provides an understanding of network protocols, standards and models associated with networking technology. The Unit provides a background to basic concepts of networked systems and methods of evaluation of networks and network applications. It also provides practical experience of installing, testing and troubleshooting a network.

This is an optional Unit in the NC Computing: Technical Support (SCQF level 6). It is also available as a freestanding Unit.

The Unit is suitable for candidates with an interest in computing studies, especially technical courses.

Outcomes

1 Describe networking principles.
2 Describe networking components.
3 Design a small network system.
4 Implement and support networked systems.

Recommended entry

While entry is at the discretion of the centre, it would be beneficial for candidates to have previously achieved Units at SCQF level 5 from NC Computing: Technical Support or any other appropriate NC Computing course.

National Unit specification: general information (cont)

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Credit points and level

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

**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

Describe networking principles.

Performance Criteria

(a) Describe network topologies, including advantages and disadvantages.
(b) Describe computer network concepts and terminology.
(c) Describe and compare recognised networking models.
(d) Describe network standards.

Outcome 2

Describe networking components.

Performance Criteria

(a) Describe the functions of a range of network equipment.
(b) Describe media characteristics.

Outcome 3

Design a small network system.

Performance Criteria

(a) Identify and justify an appropriate topology and media of a small network.
(b) Identify required hardware for a small network.
(c) Design and document a floor plan.
(d) Plan an IP addresses scheme and naming scheme.

Outcome 4

Implement and support networked systems.

Performance Criteria

(a) Install and configure the network.
(b) Test network communications and services.
(c) Troubleshoot network problems.

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. All activities must be carried out with due regard to current health and safety requirements.

Outcome 1

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

- describe the main features, advantages and disadvantages of two topologies
- describe three network concepts and terminology
- describe two functions of one of the layers of the OSI Model and compare with the equivalent layer of the TCP/IP networking model. This must include details of Protocols, devices and Protocol Data units operating within the specified layer
- describe a network or cabling standard

Evidence for this Outcome must be obtained under controlled, supervised, closed-book conditions.

Outcome 2

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

- describe two functions of each of the following
  - three network devices
  - one network component
  - two network tools
- describe two characteristics of two different types of medium

Evidence for this Outcome must be obtained under controlled, supervised, closed-book conditions.

Outcome 3

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

- identify and justify an appropriate topology and media of a small network. The network must be made up of a minimum of three computers
- identify required hardware for a small network that includes:
  - PC NICs
  - patch cables
  - switch/hub
  - server — if required
  - patch panel
- design and document a floor plan that includes:
  - device placement
  - network component placement
  - wall socket
  - cable runs

- plan and document an IP addresses scheme and naming scheme that includes:
  - IP address for each device
  - device name for each hardware component
  - workgroup name

Evidence for this Outcome must be obtained under controlled, supervised open-book conditions. Candidates will have access to notes and reference books.

Outcome 4

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

- install and configure a network
- test network communications and services including:
  - test each sections during installation
  - ping all other devices
  - share files
  - print
- troubleshoot network problems
  - a network problem either during installation or tutor created
  - cable faults
  - device faults
  - IP addressing problems

Evidence for this Outcome must be obtained under controlled, supervised, open-book conditions. Candidates will have access to notes and reference books.

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

This Unit aligns to the following National Occupational Standards (NOS) from eskills UK 4.8 IT/Technology infrastructure design and planning

Outcome 1

This Outcome involves the description of network topologies, network concepts, terminology and networking standards. This Outcome also compares the OSI and TCP/IP networking models.

Candidates should be able to describe network topologies including the main features, advantages and disadvantages of the following topologies:

- bus
- ring
- tree
- mesh
- star
- extended star

Candidates should be able to describe computer network concepts and terminology including

- bandwidth
- attenuation
- peer-to-peer network
- client/server network
- IP address
- MAC address

Candidates should be able to describe the layers of the OSI networking model, their function and PDU associated with each layer:

LAYERS	FUNCTION	PDUs
Layer 7: Application	Network process to application	Data
Layer 6: Presentation	Data representation and encryption	Data
Layer 5: Session	Interhost communications	Data
Layer 4: Transport	End-to-end connection and reliability	Segments
Layer 3: Network	Path determination and IP (logical addressing)	Packets
Layer 2: Data Link	MAC and LLC (Physical addressing)	Frames
Layer 1: Physical	Media, Binary and signal transmission	Bits

National Unit specification: support notes (cont)

Unit title: Computing: Networking Technologies (SCQF level 6)

Candidates should be able to describe the layers of the TCP/IP networking model and their function:

LAYERS	FUNCTION	PDUs
Layer 4: Application	Applications and processes that use the network	Data
Layer 3: Transport	Provides end-to-end data delivery services	Segments
Layer 2: Internet	Defines the datagram and handles routing of data	Packets
Layer 1: Network Access	Accessing physical medium	Frames

Candidates should gain an understanding of network standards:

IEEE802.3 Ethernet networks (Data transfer rates, medium types & distance)
IEEE802.11 Wireless networks — 802.11a, 802.11b, 802.11g, 802.11n (Basic details, ie data transfer rates and frequency they operate)
TIA/EIA T568A and T568B

Outcome 2

Candidates should be able to identify a range and purpose of network equipment, the PDU it works with and the layer of the OSI model it would operate. Examples include:

- Devices
  - Hubs — Physical layer — Bits
  - Switches — Data Link Layer — Frames
  - Routers — Network Layer — Packets
  - Repeaters — Physical Layer — Bits
  - Network card — Physical Layer — Bits
  - Bridges — Data Link Layer — Frames

- Components
  - Patch Panel
  - Telecommunication outlet

- Tools
  - Cable tester
  - Punch Down Tool/Krone Tool
  - LAN tester

Candidates should be able to demonstrate knowledge of media characteristics. Candidates should be aware of data transfer rates, maximum length of cable and connectors.

- Coaxial — Thinnet, Thicknet
- Twisted Pa — UTP, STP
- Optic
- Patch Cables — Straight through, Crossover, Console/Rollover
- Wireless

National Unit specification: support notes (cont)

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Outcome 3

Candidates should be able to plan a small network, including media type, topology, hardware, floor plan and naming & addressing scheme.

Outcome 4

Candidates should be able to install a small network consisting of PCs and a printer. When setting up and configuring the computer network, the candidate will select the equipment and configure the network as well as demonstrate that the network is working. This could be done by allowing the candidates to transfer files from one machine to the other and to access and print to a shared printer.

Candidates will troubleshoot a faulty network. It would therefore be useful if candidates were given the opportunity to study the choice and correct use of networking diagnostic tools to test and diagnose network problems. Hardware tools could include cable testers and software tools may include network diagnostic software as well as key commands such as ping and addressing diagnostics.

Guidance on learning and teaching approaches for this Unit

The actual distribution of time per Outcome is at the discretion of the centre. However, it is expected that Outcome 3 will require a longer focus of time than the others.

A practical hands-on approach to learning should be adopted to engage learners and exemplify key concepts. However, all practical activities should be underpinned with appropriate knowledge before candidates commence these activities.

It is recommended that candidates gain hands-on installation and configuration experience as many type of media and hardware as possible. While teaching will necessarily focus on specific products, the generic features of the hardware should be emphasised. Certain practical activities in this Unit may be performed in very small groups (two or three).

It would be beneficial if candidates were introduced in a systematic way to the types of common network faults. These faults may occur in general classroom activities or during the building and configuration of the network. An appropriate range of networking problems, at this level, would include faulty cables, faulty devices or incorrect IP Address. When recording faults candidates could be asked to record faults found along with the test used and how each fault was resolved.

When setting up and configuring the computer network, the candidate will select the equipment and configure the network as well as demonstrate that the network is working. This could be done by allowing the candidates to transfer files from one machine to the other and to access and print to a shared printer.

The use of simulation and/or virtual machines could be used effectively for teaching and assessment of parts of this Unit.

National Unit specification: support notes (cont)

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Guidance on approaches to assessment for this Unit

A practical, hands-on approach to learning should be adopted. The emphasis should be on learning-by-doing. Terminology and underpinning knowledge should be introduced in a practical context.

Throughout this Unit, candidate activities should relate to their personal or vocational interests. For example candidates locate process and communicate information relating to their academic work, hobbies and pastimes, recreational and entertainment preferences or other topics that can genuinely stimulate their interest.

Evidence of practical competence should be stored in a portfolio. At the completion of this Unit the portfolio should contain a range of evidence, drawn from the evidence requirements for each Outcome.

Candidate evidence could be stored and submitted in an e-portfolio (electronic portfolio). Opportunities exist for integration between teaching and assessment, for example the process of setting up a smartgroup to use as a repository for an electronic portfolio could in itself be a source of assessment evidence.

For Outcome 1 written and/or oral recorded evidence is required which demonstrates that the candidate has achieved the standard specified in the Outcome and Performance Criteria. The assessment will be supervised, controlled and under closed-book conditions and is recommended to last approximately 45 minutes. The assessment should be attempted on a single occasion.

For Outcome 2 written and/or oral recorded evidence is required which demonstrates that the candidate has achieved the standard specified in the Outcome and Performance Criteria. The assessment will be supervised, controlled and under closed-book conditions and recommended to last approximately 45 minutes.

For Outcome 3 written and/or oral recorded evidence is required which demonstrates that the candidate has achieved the standard specified in the Outcome and Performance Criteria. The assessment will be supervised and under controlled open-book conditions. The assessment may be attempted over an extended period of time.

For Outcome 4 candidates are required to produce a computer network of at least three PC and a printer. Written and/or oral evidence is required to document the testing and troubleshooting evidence.

Both product and written/oral evidence is required to demonstrate that the candidate meets the standard specified in the Outcome and Performance Criteria.

Performance evidence can be supplemented by assessor observation checklist and candidate logs. Evidence for these Outcomes will be carried out under supervised and controlled conditions, over an extended period of time. Candidates will have access to notes and reference work as well as online help for this assessment. The completed logbook entries must detail the steps taken in assembling and configuring the network.

All candidate evidence must be authenticated by the assessor who must confirm that the log is an accurate record of candidate activity. All activities should be carried out with due regard to current health and safety requirements.

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 installing, testing and troubleshooting a network. Candidates will:

- describe network topologies including their main features, advantages and disadvantages
- describe computer network concepts and terminology
- describe and compare recognised networking models
- describe the layers of the TCP/IP networking model and their function
- describe network standards and media characteristics
- identify the range and purpose of network equipment, the PDU it works with and the layer of the OSI model it would operate
- identify data transfer rates, maximum length of cable and connectors
- plan a small network, including media type, topology, hardware, floor plan and naming & addressing scheme
- install a small network
- select appropriate equipment and configure the network
- select networking diagnostic tools to test and diagnose network problems

This means that as candidates are doing this Unit they will be developing aspects of the Core Skills of *Communication*, *Problem Solving*, *Numeracy* and *Information and Communication Technology*.

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 together to explore different networking equipment and media.

National Unit specification: support notes (cont)

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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