



National Unit Specification: general information

UNIT Computing: Plan and Build a Computer Network (SCQF level 6)

CODE F3T3 12

SUMMARY

The overall aim of this Unit is to enable candidates to plan, design and then build and configure a computer network in a single location. The theory component of the Unit will introduce candidates to key computer networking terminology and concepts, networking equipment and media. Candidates will examine and compare the two networking models: Transmission Control Protocol/Internet Protocol (TCP/IP) and Open Systems Interconnection (OSI).

The practical component of the Unit will require candidates to safely build and test a computer network of at least three nodes. The candidate will also be required to select and safely use the correct tools to test, troubleshoot and fix a network in response to a user's error report. This Unit is aimed at candidates who have prior qualifications or experience of computer networking.

OUTCOMES

- 1 Demonstrate knowledge and understanding of computer networking concepts.
- 2 Plan and build a computer network to a given specification to enable file and print sharing.
- 3 Test and troubleshoot a computer network.

Administrative Information

Superclass: CB

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National Unit Specification: general information (cont)

UNIT Computing: Plan and Build a Computer Network (SCQF level 6)

RECOMMENDED ENTRY

While entry is at the discretion of the centre, candidates would normally be expected to have attained one of the following, or equivalent:

- ◆ Standard Grade *Computing Studies* at Credit level
- ◆ Intermediate 2 *Computing Studies*
- ◆ F1KH 11 *Computing: Computer Networking Fundamentals*

or similar qualifications or experience.

CREDIT VALUE

1 credit at Higher (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

While there is no automatic certification of Core Skills in this Unit there may be opportunities for developing aspects of Core Skills.

National Unit Specification: statement of standards

UNIT Computing: Plan and Build a Computer Network (SCQF level 6)

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

Demonstrate knowledge and understanding of computer networking concepts.

Performance Criteria

- (a) Describe computer network terminology and concepts
- (b) Describe and compare aspects of the TCP/IP and OSI models
- (c) Describe types and purpose of different network equipment and media

OUTCOME 2

Plan and build a computer network to a given specification to enable file and print sharing.

Performance Criteria

- (a) Determine the requirements for the computer network to meet the given specification
- (b) Produce a layout and the naming/addressing scheme for the proposed computer network
- (c) Select and assemble components to meet the given specification
- (d) Configure and test the network to meet the given specification

OUTCOME 3

Test and troubleshoot a computer network.

Performance Criteria

- (a) Test the computer network using appropriate diagnostic tools
- (b) Identify a range of different network problems
- (c) Troubleshoot a range of different network problems
- (d) Maintain accurate records of the troubleshooting process

National Unit Specification: statement of standards (cont)

UNIT Computing: Plan and Build a Computer Network (SCQF level 6)

EVIDENCE REQUIREMENTS FOR THIS UNIT

Evidence is required to demonstrate that candidates meet the requirements of all the Outcomes and Performance Criteria.

Written and/or oral recorded evidence, product and performance evidence is required to demonstrate that the candidate has achieved all the Outcomes and Performance Criteria.

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 should last no more than 45 minutes. The instrument of assessment will provide opportunities for the Outcome to be fulfilled by means of sampling across the range of the content of Outcome 1. The assessment should be attempted on a single occasion. Where re-assessment is required it should contain a different sample from the range of content. Achievement can be decided by use of a cut-off score. Each sample must be derived from each of the areas listed:

- ◆ Describe at least **five** networking terms and concepts from:
 - Topology
 - Bandwidth
 - Attenuation
 - Peer to Peer network
 - Client/Server network
 - Protocols
 - Encapsulation/Decapsulation
 - MAC (Media Access Control) Address
 - IP (Internet Protocol) Address
 - Protocol Data Units (PDUs)
- ◆ Describe and compare at least **five** aspects of the TCP/IP model and the OSI model
- ◆ Describe types and purpose of at least **five** different pieces of network equipment (each bullet point must be covered at least once):
 - devices: routers, bridges, switches, wireless access points, Network Interface Cards (NIC) [both wireless and wired], hubs and repeaters
 - components: patch panel and telecommunications outlet/connector
 - tools: cable tester and punch down tool (also known as Krone tool)
- ◆ Describe types, features and purpose of at least **five** different network media:
 - coaxial cable (Thinnet and Thicknet)
 - twisted pair cable (STP and UTP)
 - optic cable
 - straight-through cable
 - crossover cable
 - console (rollover) cable
 - Wireless 8011. versions

National Unit Specification: statement of standards (cont)

UNIT Computing: Plan and Build a Computer Network (SCQF level 6)

For Outcome 2 candidates are required to produce a computer network of at least three nodes. Product evidence is required to demonstrate that the candidate has completed and provided documentation relating to the network solution including:

- ◆ network plan including a topology diagram, a components list and a naming/addressing scheme
- ◆ complete test log compiled during installation and testing and detailing successful file and print sharing

Product evidence is also required for Outcome 3 in the form of:

- ◆ details of testing and identification of two network problems using at least two diagnostic tools
- ◆ complete error report for each network problem

Performance evidence supplemented by an assessor observation checklist and a candidate log is required for Outcomes 2 and 3. 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. Assessors must also confirm that all activities have been carried out with due regard to health and safety requirements.

The Assessment Support Pack for this Unit provides sample assessment materials such as an instrument of assessment for knowledge and practical activities including an assessor observation checklist. Centres wishing to develop their own assessments should refer to the Assessment Support Pack to ensure a comparable standard.

National Unit Specification: support notes

UNIT Computing: Plan and Build a Computer Network (SCQF level 6)

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 overall aim of this Unit is to enable candidates to plan, design and configure a computer network and to test and troubleshoot a network in response to an error report. The Unit blends both theory and practical skills in achieving this aim. This Unit is an optional Unit in the National Certificate in Digital Media Computing.

Outcome 1

This Outcome involves the description of computer terminology and concepts, the TCP/IP model and OSI model, the types and purpose of network equipment and the types and purpose of network media.

Candidates are required to be able to describe key networking terminology and concepts and should include:

- ◆ Topology
- ◆ Bandwidth
- ◆ Attenuation
- ◆ Peer to Peer network
- ◆ Client/Server network
- ◆ Protocols
- ◆ Encapsulation/Decapsulation
- ◆ MAC (Media Access Control) Address
- ◆ IP (Internet Protocol) Address
- ◆ Protocol Data Units (PDUs)

Candidates should be able to describe the PDU used by the appropriate network devices, eg

- ◆ routers use packets
- ◆ bridges and switches use frames
- ◆ hubs and repeaters use bits

National Unit Specification: support notes

UNIT Computing: Plan and Build a Computer Network (SCQF level 6)

Candidates should be able to describe the layers of the OSI networking model and their function:

Layer 7: Application
Layer 6: Presentation
Layer 5: Session
Layer 4: Transport
Layer 3: Network
Layer 2: Data Link
Layer 1: Physical

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

Layer 4: Application
Layer 3: Transport
Layer 2: Internet
Layer 1: Network Access

Candidates should be able describe the types and purpose of networking equipment. The term equipment is used to cover network devices and other network components and tools:

- ◆ devices: routers, bridges, switches, wireless access points, NICs (wired and wireless), hubs, repeaters
- ◆ components: patch panel and telecommunications outlets/connectors
- ◆ tools: cable tester and punch down tool (also known as Krone tool)

Candidates should be able to describe the different types, features and uses of network media:

- ◆ coaxial cable (Thinnet and Thicknet)
- ◆ twisted pair cable (STP and UTP)
- ◆ fibre-optic cable
- ◆ straight-through cable
- ◆ crossover cable
- ◆ console (rollover) cable
- ◆ wireless 8011. versions

National Unit Specification: support notes (cont)

UNIT Computing: Plan and Build a Computer Network (SCQF level 6)

Outcome 2

This Outcome involves:

- ◆ the planning, designing and creation of a computer network
- ◆ the use of the correct hardware and software to set up a small network to meet a given specification
- ◆ testing and troubleshooting of the network

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.

Outcome 3

Outcome 3 relates to the testing and troubleshooting of a small computer network consisting of three computers. Candidates will identify and use tools to test the network in an appropriate way. Candidates will troubleshoot a faulty network and keep accurate and up-to-date records of the troubleshooting process. 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.

National Unit Specification: support notes (cont)

UNIT Computing: Plan and Build a Computer Network (SCQF level 6)

GUIDANCE ON LEARNING AND TEACHING APPROACHES FOR THIS UNIT

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 of at least one example of each type of media and hardware. While teaching will necessarily focus on specific products, the generic features of the hardware should be emphasised. Certain practical activities in this Unit could be carried out in groups of two.

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 or incorrect IP Address or Subnet mask entries. 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.

An important aspect of this Unit is that candidates develop an appropriate technical vocabulary. Terminology and underpinning knowledge should be introduced and applied in a practical context throughout the Unit.

The actual distribution of time between Outcomes is at the discretion of the centre. However, one possible distribution of time could be:

Outcome 1	8 hours
Outcome 2	24 hours
Outcome 3	8 hours

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

This Unit may be delivered in a distance learning/online mode. In these circumstances centres must take appropriate steps to authenticate the candidate's evidence. This can be done in a variety of ways such as the use of webcams or VOIP.

National Unit Specification: support notes (cont)

UNIT Computing: Plan and Build a Computer Network (SCQF level 6)

OPPORTUNITIES FOR CORE SKILL DEVELOPMENT

In this Unit candidates are required to:

- ◆ plan the installation of a small network. This may provide an opportunity for developing aspects of the Core Skill in *Problem Solving*.
- ◆ record faults and explain how these have been resolved. This may provide an opportunity for developing aspects of the Core Skill in *Communication*.
- ◆ work together as part of the learning process to explore different networking equipment and media. These opportunities may allow candidates to develop aspects of the Core Skill of *Working with Others*.

GUIDANCE ON APPROACHES TO ASSESSMENT FOR THIS UNIT

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 communications technology (ICT), such as e-testing or the use of e-portfolios or e-checklists. 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)*.

It may be appropriate for some or all of the evidence for this Unit to be produced using e-assessment provided the National Standard is applied and conditions of assessment are consistent for all candidates. This may take the form of e-testing (for knowledge and understanding) and/or e-portfolios (for practical abilities).

A suitable form of assessment for Outcome 1 would be an objective test which covers all of the Performance Criteria. It is anticipated that this assessment will be carried out towards the end of the Unit once candidates have had an opportunity to acquire the essential knowledge and understanding. The assessment of Outcome 1 should last no more than 45 minutes and the questions answered on a single assessment occasion under controlled, supervised closed-book conditions. It is strongly recommended that an appropriate cut-off score is used to measure achievement.

If a centre is presenting Outcome 1 on-line the following assessment methods, where appropriate, may be selected —

- ◆ multiple choice
- ◆ drag and drop
- ◆ multiple response
- ◆ mix and match

or a combination of the above

National Unit Specification: support notes (cont)

UNIT Computing: Plan and Build a Computer Network (SCQF level 6)

Centres may consider the use of alternative questions types, particularly if using Computer Assisted Assessment approaches. However, care should be taken that the questions are valid and at an appropriate level. The use of simple true/false question responses is unlikely to achieve this.

Where re-assessment of knowledge and understanding is required the questions presented to the candidate must be different on each assessment occasion.

Product and performance evidence is required which demonstrates that the candidate has achieved Outcome 2 and Outcome 3. The evidence for these Outcomes should be obtained under controlled, supervised conditions. The performance evidence must be supplemented by an assessor observation checklist.

Centres may consider the use of alternative questions types, particularly if using Computer Assisted Assessment approaches. However, care should be taken that the questions are valid and at an appropriate level. The use of simple true/false question responses is unlikely to achieve this.

Where re-assessment of knowledge and understanding is required the questions presented to the candidate must be different on each assessment occasion.

Product and performance evidence is required which demonstrates that the candidate has achieved Outcome 2 and Outcome 3. The evidence for these Outcomes should be obtained under controlled, supervised conditions. The performance evidence must be supplemented by an assessor observation checklist.

The assessment of Outcomes 2 and 3 can be carried out as one overall assessment or as separate assessments for each of the Performance Criteria.

The Assessment Support Pack for this Unit provides sample assessment material. Centres wishing to develop their own assessments should refer to the Assessment Support Pack to ensure a comparable standard.

CANDIDATES WITH DISABILITIES AND/OR ADDITIONAL SUPPORT NEEDS

The additional support needs of individual candidates should be taken into account when planning learning experiences, selecting assessment instruments, or considering alternative Outcomes for Units. Further advice can be found in the SQA document *Guidance on Assessment Arrangements for Candidates with Disabilities and/or Additional Support Needs* (www.sqa.org.uk).