



National Unit Specification

General information

Unit title: Computing: Computer Networking Fundamentals (SCQF level 5)

Unit code: J519 45

Superclass: CB

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Unit purpose

This purpose of this unit is to introduce learners to the basic theoretical characteristics and practical elements that comprise small computer networks, as well as associated security considerations, for example in a home network or small office scenario.

This is a non-specialist introductory unit intended for learners with an interest in computer networking. This unit is mandatory within the National Progression Award in Computer Networks at SCQF level 5. However, it may be delivered on a standalone basis.

Learners will cover the fundamental concepts of computer networking, the types of devices that are part of a network, and how to install, configure and troubleshoot a small network. Learners will also learn about the maintenance and security aspects associated with small networks.

On completion of this unit, learners may progress to specific networking and/or other computing and IT related units at SCQF level 6 and 7.

Outcomes

On successful completion of the unit the learner will be able to:

- 1 Describe the concepts of computer networks.
- 2 Identify the components of computer networks.
- 3 Build a small computer network from a given brief.
- 4 Maintain the small computer network.

National Unit Specification: General information (cont)

Unit title: Computing: Computer Networking Fundamentals (SCQF level 5)

Credit points and level

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

Recommended entry to the unit

Entry to this unit is at the discretion of the centre. Learners should possess basic digital literacy and IT skills and have an awareness of computer networks and the Internet. This may be evidenced by possession of relevant Computing and/or ICT skills at SCQF level 4 or above.

Core Skills

Achievement of this Unit gives automatic certification of the following Core Skills component:

Core Skill component	Critical Thinking at SCQF level 5 Accessing Information at SCQF level 5
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There are also opportunities to develop aspects of Core Skills which are highlighted in the support notes of this unit specification.

Context for delivery

If this unit is delivered as part of a group award, it is recommended that it should be taught and assessed within the subject area of the group award to which it contributes.

This unit is part of the National Progression Award in Computer Networks at SCQF level 5. As such, it may be delivered alongside other component units such as J51A 45 *Computing: Install and Maintain Computer Software* and J15B 45 *Computing: Install and Maintain Computer Hardware*. In this circumstance, teaching, learning and assessment may take place on a holistic basis for all three units. Please see the support notes section of this document for further details.

Equality and inclusion

This unit specification has been designed to ensure that there are no unnecessary barriers to learning or assessment. The individual needs of learners should be taken into account when planning learning experiences, selecting assessment methods or considering alternative evidence.

Further advice can be found on our website www.sqa.org.uk/assessmentarrangements.

National Unit Specification: Statement of standards

Unit title: Computing: Computer Networking Fundamentals (SCQF level 5)

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 the concepts of computer networks.

Performance criteria

- (a) Describe network topologies
- (b) Describe network addressing
- (c) Describe network protocols
- (d) Identify Open Systems Interconnection (OSI) and Transmission Control Protocol/Internet Protocol (TCP/IP) models

Outcome 2

Identify the components of computer networks.

Performance criteria

- (a) Identify types of media and cabling
- (b) Describe the use of wireless technology
- (c) Describe the role of network devices
- (d) Identify Internet of Things (IoT) devices
- (e) Identify end-user devices
- (f) Describe the role of security

Outcome 3

Build a small computer network from a given brief.

Performance criteria

- (a) Configure basic network addressing schemes.
- (b) Install cabling and/or wireless access
- (c) Configure network interface cards (wired and/or wireless)
- (d) Configure network devices
- (e) Install and configure end devices
- (f) Perform network testing using appropriate tools

National Unit Specification: Statement of standards (cont)

Unit title: Computing: Computer Networking Fundamentals (SCQF level 5)

Outcome 4

Maintain the small computer network.

Performance criteria

- (a) Identify the use of network documentation
- (b) Configure an appropriate password scheme
- (c) Implement wired or wireless device security
- (d) Enable host-based firewalls
- (e) Implement anti-virus and malware protection

National Unit Specification: Statement of standards (cont)

Unit title: Computing: Computer Networking Fundamentals (SCQF level 5)

Evidence requirements for this unit

Evidence is required to demonstrate that learners have achieved all outcomes and performance criteria.

Assessors should use their professional judgement, subject knowledge and experience, and understanding of their learners to determine the most appropriate ways to generate evidence and the conditions and contexts in which they are used.

The evidence requirements for this unit will consist of two types of evidence: **knowledge evidence** and **product evidence**.

The **knowledge evidence** will relate to outcome 1 and outcome 2 and all associated performance criteria. It may take any appropriate format. The evidence for this unit may be written or oral or a combination of these. Evidence may be captured, stored, and presented in a range of media and formats. Particular consideration should be given to digital formats and the use of multimedia. The focus of the knowledge evidence is breadth, not depth, so the amount of evidence should be the minimum consistent with the performance criteria. It may be produced with access to reference materials over the life of the unit.

Sampling of knowledge is permissible in certain contexts, such as when traditional testing is used to generate the evidence. When sampling is used, the sampling frame must be broad enough to ensure that every outcome is covered. In this case, the test must be carried out under controlled, supervised and timed conditions, without access to reference materials.

The **product evidence** will relate specifically to outcome 3 and outcome 4 and all associated performance criteria. Product evidence will take the form of the installation and configuration of a small computer network. Evidence that demonstrates appropriate troubleshooting has taken place and that the network has been maintained and secured using suitable means, must also be produced.

Whenever possible, evidence should be a naturally occurring by-product of teaching and learning. However, it must be produced by the learner. Authentication must be used where this is uncertain.

There are no time limitations on the production of evidence. The evidence may be produced at any time during the life of the unit.

The SCQF level of this unit provides additional context on the nature of the required evidence and the associated standards. The level descriptors should be used (explicitly or implicitly) when making judgements about the evidence.

The *Guidelines on Approaches to Assessment* (see the support notes section of this specification) provide specific examples of instruments of assessment.



National Unit Support Notes

Unit title: Computing: Computer Networking Fundamentals (SCQF level 5)

Unit support notes are offered as guidance and 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 develop knowledge and skills of learners in the theoretical concepts, as well as practical components, of computer networking. Particular emphasis is placed on the practicalities of installation, maintenance and troubleshooting of a small network and how it can be secured.

The context for the unit is based upon the installation of a small local area network in, for example, a small home network or small office network, where a range of common network media and devices are typically found. Network security, as well as the security of end devices, is an important aspect in any scenario (no matter how big or small the network), therefore, this plays an important role in this assessment.

As this unit is delivered as part of the NPA in Computer Networks, there is the potential for the teaching, learning and assessment to be integrated across the component units of the NPA.

Outcome 1

Outcome 1 focuses on the theoretical concepts of computer networks and required underpinning knowledge of how these concepts relate to the logical characteristics of computer networking. Learners are introduced to the design considerations of a computer network and how the design relates to, both, the physical and logical layouts of a network, how these differ and the impact they have on how the network is managed. Network addressing should focus on applied numerical aspects with the formation and structure of an IP address, public and private addressing and how subnet masks are applied. Learners should be introduced to key protocols in combination with the TCP/IP and OSI models; how these models compare; the role protocols play, as well as how modular communication takes place.

Outcome 2

Outcome 1 should naturally flow into outcome 2. Whilst still focussing on theoretical aspects, outcome 2 should start to introduce more practical elements. Learners should be introduced to the different types of media/cabling that is available on a network. This should mainly focus on LAN (Local Area Network) media but should also take into account gigabit and fibre cabling, for example, in the context of broadband technologies. Wireless technologies should also be introduced at this stage, for example wireless protocols, access points and extenders.

National Unit Support Notes (cont)

Unit title: Computing: Computer Networking Fundamentals (SCQF level 5)

Outcome 2 should then shift to the types of common network devices that are found as part of a small network. This should not go into any great depth, but should take account of the basic functions of routers and switches, for example, the role and function of routers and switches on a network and how they make decisions about how they pass data across a network (which should relate back to the OSI and TCP/IP models and network protocols from outcome 1). Consideration should also be given to IoT devices, for example, smart technologies and sensors found within the home, as well as the variety of end-user devices eg PCs, mobile technologies and printers. The role (and importance) of security should be introduced during this outcome, for example, networking devices, protocols and basic preventative and endpoint security measures.

Outcome 3

In this outcome, learners should take their theoretical knowledge from the first two outcomes and apply it to a practical small networking scenario. For example, the scenario can be based on the installation of a home network, with a focus on the different range of end devices such as mobile technology, entertainment and IoT devices, and how these devices can be combined to create a secure integrated home solution. Another scenario would be the cabled installation of a small formal office environment which also allows for secure wireless provision for customers wishing to use their own mobile devices, and where security is a major concern (perhaps due to sensitive customer information).

Some planning should take place before creating a network addressing scheme. This need not be elaborate and should be based on a simple class C addressing scheme. Learners will then need to consider how they cable the network, or if this will be based upon a wireless scheme. Interfaces of each of the devices need to be configured, either statically or dynamically. Any networking devices on the network need to be appropriately configured, for example, default gateway and address configuration on a router. Finally, appropriate tools must be used to test the connectivity of the network. Learners may also employ tools to test the physical aspects of the network, for example, cable testing tools.

Outcome 4

Once the small network has been installed and tested, appropriate steps must be taken to ensure the installation has been logged and that the network has been secured. For example, a map of the physical topology of the network could be created with all devices and associated addresses. Learners must ensure that wireless networks have been secured with suitable levels of encryption and wireless passwords. End devices must also be secured by passwords as well as firewalls and anti-virus/malware protection software. Learners may wish to install dedicated firewall and/or access control devices rather than rely on endpoint security.

Guidance on approaches to delivery of this unit

A practical hands-on approach to learning should be adopted to engage learners and exemplify key concepts. However, all practical activities in outcomes 3 and 4 should be underpinned with appropriate knowledge from outcomes 1 and 2 before learners commence these activities, hence outcomes should ideally be delivered in sequential order.

National Unit Support Notes (cont)

Unit title: Computing: Computer Networking Fundamentals (SCQF level 5)

Learning should be a mix of tutor-led and learner-led learning. It is anticipated that some initial introduction and explanation will be required for each outcome. However, there is significant scope for learners to research and explore the topics once this initial seeding has taken place. Tutors should expect some independent learning to take place and support students with this where appropriate. The numerical elements of outcome 1(c) and outcome 3(a) may require more tutor exposition, perhaps supported by video resources as well as worked examples.

Learners should have access to a practical lab environment where they can access cabling, wireless technology and networking devices, in order to gain the hands-on experience of building a small network. Virtual environments may also be used, where students could create virtual machines and link them together on a local network. If using this option, learners must be careful to isolate virtual machines from any production networks. Opportunities also exist for learners to use network simulator software, such as Cisco Packet Tracer, where they can access a range of networking devices along with cabling and media.

The delivery of each outcome is at the discretion of the centre. However, it is suggested that the time distribution for each of the outcomes should be as follows:

- ◆ Outcome 1: 8 hours
- ◆ Outcome 2: 10 hours
- ◆ Outcome 3: 15 hours
- ◆ Outcome 4: 7 hours

The biggest proportion of time should be dedicated to outcomes 2 and 3, which focus on the more significant aspects of networking.

Throughout this unit learner activities should relate to their personal or vocational interests. Learners should be encouraged to become confident with as wide a range of networking technologies as possible.

Guidance on approaches to assessment of this unit

Evidence can be generated using different types of assessment. The following are suggestions only. There may be other methods that would be more suitable to learners.

Centres are reminded that prior verification of centre-devised assessments would help to ensure that the national standard is being met. Where learners experience a range of assessment methods, this helps them to develop different skills that should be transferable to work or further and higher education.

A traditional approach to assessment would comprise a multiple-choice test for knowledge evidence (outcomes 1 and 2) and a practical assignment for the product evidence (outcomes 3 and 4).

National Unit Support Notes (cont)

Unit title: Computing: Computer Networking Fundamentals (SCQF level 5)

The multiple-choice assessment should ideally take place towards the end of unit. The test could consist of a number of selected response questions, chosen mainly from outcomes 1 and 2 and their performance criteria. To ensure adequate coverage, all performance criteria should be tested. For example, a multiple-choice test, consisting of 25 items, each with four options, could be used. In this case, the pass mark would be 15 out of 25 (60%). The test would be timed (45 mins) and carried out under controlled, closed-book conditions, without access to reference material. Where re-assessment is required it should contain a significantly different sample selected from the range of mandatory content (at least 10% difference).

It is recommended that a holistic approach is taken to product evidence, and that outcomes 3 and 4 are assessed as a single practical project undertaken over a designated period of time. This could be achieved by a learner following one brief/task through all the stages of the development of a small network. The brief/task should be supplied by the assessor and need not be overly complex. It should give the learner the opportunity to design and build a small network that covers all of the evidence required for outcomes 3 and 4. The supplied brief/task can be of different contexts, for example the design and development of a small office network or of a small home network. There may also be opportunities to develop the task in the context of enterprise, employability or citizenship skills.

As this unit is delivered as part of the NPA Computer Networks, the supplied task may be of a wider remit in order to include assessment from J51A 45 *Computing: Install and Maintain Computer Hardware* and J51B 45 *Computing: Install and Maintain Computer Software*.

An assessor observation checklist could be used to record that the assessment tasks for all the outcomes have been undertaken successfully by the learner. An assessor should sign and date each learner's checklist.

More contemporary approaches to assessment include the use of a web log or the creation of a portfolio. The web log would record learning over the life of the unit. Practical work could be recorded on the blog in a variety of ways. The completed blog would have to satisfy all performance criteria. The blog would be assessed on a pass/fail basis using a checklist. Alternatively, a portfolio could be used as a repository for the identifications and descriptions required in outcome 1 and 2, and the output from learners' practical work in outcome 3 and outcome 4. The completed portfolio would have to satisfy all performance criteria. The portfolio would be assessed on a pass/fail basis using a checklist.

Formative assessment can be used to assess learners' knowledge at various stages in the unit. An ideal time to gauge their knowledge would be at the end of each outcome. This assessment could be delivered through an item bank of selected response questions, providing feedback to learners (when appropriate).

Authentication may take various forms including, but not limited to, oral questioning and plagiarism checks. Where evidence is generated under loosely controlled conditions (for example out of class) then a statement of authenticity should be provided by the learner to verify the work as their own.

National Unit Support Notes (cont)

Unit title: Computing: Computer Networking Fundamentals (SCQF level 5)

Opportunities for 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 learner evidence and that conditions of assessment as specified in the evidence requirements are met, regardless of the mode of gathering evidence. The most up-to-date guidance on the use of e-assessment to support SQA's qualifications is available at www.sqa.org.uk/e-assessment.

Opportunities for developing Core and other essential skills

This unit will provide opportunities for learners to develop the Core Skills of *Problem Solving* and *Information and Communication Technology* at SCQF level 5.

This unit will also provide opportunities for learners to develop skills in Digital Literacy due to the variety of software that they may use. Enterprise, employability and citizenship could also be incorporated depending on the nature of the task/brief.

The Critical Thinking component of Problem Solving and Accessing Information component of Information and Communication Technology at SCQF level 5 are embedded in this unit. When a learner achieves these units, their Core Skills profile will also be updated to include these components.

History of changes to unit

Version	Description of change	Date
02	Core Skills Components Critical Thinking and Accessing Information at SCQF level 5 embedded.	09/12/20

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Unit template: 200617

General information for learners

Unit title: Computing: Computer Networking Fundamentals (SCQF level 5)

This section will help you decide whether this is the unit for you by explaining what the unit is about, what you should know or be able to do before you start, what you will need to do during the unit and opportunities for further learning and employment.

This unit will introduce you to the basic theoretical and practical elements that comprise small computer networks. You will learn about the fundamental aspects of computer networks and the underpinning theoretical knowledge. This knowledge will be taken and applied to practical aspects of computer networks, for example, network cabling, wireless technology, devices, and security. You will learn to install, configure, and test a small network in a variety of contexts, for example a small office or home network.

The unit comprises four outcomes:

- 1 Identify the concepts of computer networks.
- 2 Describe the components of computer networks.
- 3 Build a small computer network from a given brief.
- 4 Maintain the small computer network.

The first two outcomes comprise the theoretical aspects and provide the opportunity for your knowledge skills to be assessed using a variety of methods, for example, multiple-choice tests.

Outcomes 3 and 4 will be assessed using practical means, for example, building a small network from a given brief/task where you will have the opportunity to develop skills and hands-on experience using a variety of devices.

Depending on the context of the brief/task, you will also have the opportunity to develop enterprise and employability skills along with citizenship skills.

No prior experience is needed for this unit; however, it would be beneficial if you had general IT and basic digital literacy skills as well as awareness of computer networks and the Internet.

On completion of this unit, you may progress to networking, computing and IT based subjects at SCQF level 6 and above. This unit also serves as an entry point into vendor-based qualifications such as Cisco Networking Essentials and CompTIA qualifications such as A+ and Network+.

This unit will provide opportunities for you to develop the Core Skills of *Problem Solving* and *Information and Communication Technology* at SCQF level 5.

The Critical Thinking component of Problem Solving and Accessing Information component of Information and Communication Technology at SCQF level 5 are embedded in this unit. When a learner achieves these units, their Core Skills profile will also be updated to include these components