



# National Unit Specification

## General information

**Unit title:** Computer Network Fundamentals (SCQF level 4)

**Unit code:** J8E1 44

**Superclass:** CB

**Publication date:** July 2024

**Source:** Scottish Qualifications Authority

**Version:** 01

## Unit purpose

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

This is a non-specialist introductory unit intended for learners with an interest in computer networking. This is an optional within the National Progression Award in Computing Technologies at SCQF level 4. It may also 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 simple networks.

Upon completion of this unit, learners can progress to more advanced networking courses such as J519 45 Computer Network Fundamentals level 5 or explore related topics such as cyber security. The foundational knowledge and skills acquired in this unit will serve as a stepping stone for further exploration in the broader field of networking and technology.

On completion of this unit, learners may progress to J519 45 Computer Networking Fundamentals at SCQF level 5.

# National Unit Specification: General information (continued)

**Unit title:** Computer Network Fundamentals (SCQF level 4)

## Outcomes

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

1. Describe the features of computer networks.
2. Describe threats to network security.
3. Describe the components of computer networks.
4. Maintain a small computer network.

## Credit points and level

1 National Unit credit at Scottish Credit and Qualifications Framework (SCQF) level 4: (6 SCQF credit points at SCQF level 4).

## Recommended entry to the unit

Entry to this unit is at the discretion of the centre. No previous knowledge or experience of computer networks is assumed.

## Core Skills

Opportunities to develop aspects of Core Skills are highlighted in the support notes for this unit specification.

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

## 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.

If this unit is delivered as part of National Progression Award in Computing Technologies at SCQF level 4, it should be taught after J8DW 44 Computing Foundations and may be delivered concurrently with another optional unit such as H9E2 44 Data Security.

## 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:

[SQA Assessment Arrangements](http://www.sqa.org.uk/assessmentarrangements) (www.sqa.org.uk/assessmentarrangements).

# National Unit Specification: Statement of standards

**Unit title:** Computer Network Fundamentals (SCQF level 4)

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 features of computer networks.

### Performance criteria

- (a) Define computer network.
- (b) Describe network types.
- (c) Describe network protocols.
- (d) Describe basic network addressing.

## Outcome 2

Describe threats to network security.

### Performance criteria

- (a) Describe the risks associated with computer networks including malware.
- (b) Describe network hacking.
- (c) Describe how to keep data secure.
- (d) Describe safe online behaviour.
- (e) Describe the importance of updating software.

## Outcome 3

Describe the components of computer networks.

### Performance criteria

- (a) Describe the components of simple computer networks.
- (b) Describe network security devices.
- (c) Describe wireless technology.
- (d) Describe how components can be secured.

# National Unit Specification: Statement of standards (continued)

**Unit title:** Computer Network Fundamentals (SCQF level 4)

## Outcome 4

Maintain a small computer network.

### Performance criteria

- (a) Use network monitoring software.
- (b) Connect network components.
- (c) Configure a wireless device to connect to a network with and without security.
- (d) Troubleshoot simple network issues.
- (e) Use terminology correctly.

### Evidence requirements for this unit

Evidence is required to demonstrate that learners have achieved all outcomes and performance criteria. The evidence requirements for this unit will take two forms.

- 1. Knowledge evidence.
- 2. Performance evidence.

Knowledge evidence relates to outcomes 1, 2 and 3. All performance criteria must be evidenced. Minimal evidence, required to infer competence, is acceptable.

At this level, basic understanding of networks is required. Knowledge evidence may be produced throughout the duration of this unit in lightly controlled conditions with access to reference materials.

Knowledge evidence may be sampled when testing is used. Testing must be carried out in timed, supervised conditions **without** access to reference materials. The sampling frame must include questions from all three outcomes.

Performance evidence relates to outcome 4. Learners must be observed maintaining a small computer network. The performance evidence will comprise:

- 1. observation of the learner's use of network monitoring software.
- 2. observation of the learner connecting two or more network components.
- 3. observation of the learner configuring at least one wireless device, with and without security.
- 4. observation of the learner troubleshooting one or more network issues.
- 5. confirmation that the learner has used terminology correctly.

Performance evidence may be produced throughout the duration of this unit in lightly controlled conditions with access to reference materials.

## **National Unit Specification: Statement of standards (continued)**

**Unit title:** Computer Network Fundamentals (SCQF level 4)

When evidence is produced in loosely controlled conditions it must be authenticated. The Guide To Assessment provides advice on methods of authentication.

The SCQF level of this unit (level 4) provides additional context on the nature of the required evidence and the associated standards. Appropriate level descriptors should be used when making judgements about the evidence.

The Support Notes section of this unit specification provides specific examples of instruments of assessment that will generate the required evidence.



## National Unit Support Notes

**Unit title:** Computer Network Fundamentals (SCQF level 4)

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 basic network skills, maintenance and troubleshooting of a small network and how it can be secured.

The context for the unit is based upon a wide overview of networking along with connecting and troubleshooting of a small local area network, for example, a small home network or small office network, where a range of common network media and devices are typically found. Network security along with cyber security and network safety are also an intricate part of the course and should be integrated where possible into life or real life scenarios as this will aid comprehension and context of the unit.

As this unit is delivered as an optional unit of the National Progression Award in Computing Technologies, there is the potential for the teaching, learning and assessment to be integrated across the project unit of the National Progression Award.

### Outcome 1

- **What is a network?** (Inter connected devices, transfer of data, examples of how / what networks are used for and advantages should be discussed).
- **Types of networks (LAN, WAN)** and how they differ regarding geographical area and common uses).
- **Importance of networks in daily life** (areas that should be covered are Communication, Information Access, Social Connectivity).
- **What is an IP address?** (How it's made up 4, octets, used to address and uniquely identify, ensures data is delivered to the correct device).
- **Basics between IPv4 and IPv6** (running out of addresses at IPv4, brought in IPv6. IPv4 is made up of 4 octets and IPv6 eight groups of four hexadecimal digits).

# National Unit Support Notes (continued)

**Unit title:** Computer Network Fundamentals (SCQF level 4)

## Outcome 1 (continued)

- **How devices use IP addresses to communicate** (the idea of the function of IP addresses are like house addresses a device called a router helps and directs the data to the correct destination helps share information).
- **Recognise common communication protocols like TCP, IP and HTTP, HTTP's** (What they stand for, port numbers of HTTP's and HTTP and how they differ).

## Outcome 2

- **Network hacking**, an understanding of breaking into computer networks to steal information, disrupt services, or cause other damages.
- **Recognising and avoiding online threats.** At least one recognition and one avoidance of each (Ransomware, Cyberbullying, Phishing Attacks).
- **Basics of creating strong passwords** (Length, mixture of characters, Avoid Predictable Information, Passphrases.).
- **Understanding simple biometrics**, (Define biometrics, Biometric Characteristics including fingerprints, iris patterns, facial features, voice recognition used to keep data secure).
- **Safe online behaviour** (online safety and the potential risks associated with using the internet Reporting Online Harassment, Oversharing Personal Information, reporting Cyber bullying, on social media adjusting privacy settings and being selective about the information shared online).
- **Understanding the concept of digital footprint** (Digital footprint and how online activities can leave a lasting impact, positive or negative digital footprint on future opportunities, including an example for both positive and negative).
- **Importance of updating software.** Learners must reflect on the reason why updating software is important to security or performance or addition of new features or bug fixes learners will not be penalised if they wish to incorporate a number of reasons).

## Outcome 3

- **Components related to a simple network:** Introduction to Hubs, Switches, cabling and basic functions, (identification of each device and basic functions and place within the network. Hubs Broadcasts / sends out incoming data to all connected devices, limitations of hubs, such as the lack of intelligence and the potential for network congestion. Switches filters and forwards data based on addresses, reduces network congestion compared to hubs. Cabling: medium used to connect network and facilitates the transmission of data between devices, explore Cat5, Cat5e, Cat6).

# National Unit Support Notes (continued)

**Unit title:** Computer Network Fundamentals (SCQF level 4)

## Outcome 3 (continued)

- **Introduction to NIC** (definition of a NIC, basic functions- Facilitates communication between the computer and the network, often in the form of expansion cards for desktop computers or integrated into laptops. Distinguish between wired NICs (Ethernet) and wireless NICs (Wi-Fi).
- **How Wi-Fi works** basics of (WI-FI router, SSID, WI-FI signal, Connecting to the internet through an access point, Passwords, WI-FI channels, WI-FI Security).
- **A basic understanding of a Firewall.** It checks incoming and outgoing data based on a set of security rules and blocks harmful traffic and allow safe traffic.
- **Securing a Wi-Fi network with passwords.** Learner's should understand the need for strong passwords and how they secure data using encryption.

## Outcome 4

- **Connect a small network** (Learners have to create a small network, describing all the devices / media needed to connect the nodes together one node must be a wireless node, this should be connected to both a secure and unsecure access point. learners should complete basic trouble shooting if there are connection issues, Assessors may have to intervene if there are any protocol issues or issues out with the learners scope to ensure they have a working network.
- **Use of network Monitoring software:** Assessors may wish to use this opportunity to use the command line interface and use Ip/config in window based machines and ifconfig in linux an MacOS to show the unique IP addresses of the devices.
- **Common network issues and how to troubleshoot,** (Connection Checkup theme: introduce students how to check and ensure basic physical connections. Create a simulated network setup with computers, and switches. disconnect cables or introduce loose or broken connections, students to identify and fix the connection.

## 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 (a), (e) and outcome 4 should be underpinned with appropriate knowledge from outcomes 1, 2 and 3 (b),(c),(d) before learners commence these activities,

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 may expect some independent learning to take place and support students with this where appropriate.



# National Unit Support Notes (continued)

**Unit title:** Computer Network Fundamentals (SCQF level 4)

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: 10 hours.
- Outcome 4: 12 hours.

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, 2 and 3 (b),(c),(d)) and a practical assessment for the product evidence (outcomes 3 (a), (e) and outcome 4).

If using multiple-choice assessment it should ideally take place towards the end of unit. The test could consist of a number of selected response questions, chosen from outcomes 1, 2 and 3 (b),(c),(d) and their associated performance criteria. To ensure adequate coverage, all performance criteria should be tested. For example, a multiple-choice test, consisting of 20 items, each with four options, could be used. In this case, the pass mark would be 12 out of 20 (60%). The test would be timed (45 mins) and carried out under controlled, closed-book conditions, without access to reference material.

## National Unit Support Notes (continued)

**Unit title:** Computer Network Fundamentals (SCQF level 4)

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 (a), (e) and outcome 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 should match the performance criteria and not be overly complex. It should give the learner the opportunity to create a small network that covers all of the evidence required for outcomes 3 (a), (e) and outcome 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.

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

More contemporary approaches to assessment include the use of an electronic log or the creation of a portfolio. The electronic log would record learning over the life of the unit. Practical work could be recorded on a 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 outcomes 3 (a), (e) 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). Assessment for outcome outcomes 1, 2 and 3 (b), (c), (d) could also be undertaken through e-assessment or SOLAR

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 (continued)

**Unit title:** Computer Network Fundamentals (SCQF level 4)

## 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 [SQA e-Assessment](http://www.sqa.org.uk/Guide%20to%20best%20practice.pdf). (www.sqa.org.uk/Guide to best practice.pdf).

## Opportunities for developing Core and other essential skills

In networking, learners cultivate core and meta-skills essential for the digital landscape. Evaluating network type's **critical thinking** prompts strategic decision-making, enhancing analytical abilities. Troubleshooting common issues in network devices **problem-solving** instils adaptability, vital for evolving technologies. The study of IP addresses and protocols **communication** refines learners' articulation of technical concepts, fostering effective communication in network architecture.

Learners investigate Wi-Fi networks, understanding security measures and recognising online threats **digital literacy**. Simultaneously, ethical decision-making unfolds through discussions on personal information risks and the digital footprint concept **ethical decision-making**. Learners will also have to communicate findings and decisions that they make **Communications**.

Learners not only gain technical expertise but also a holistic skill set. This includes critical thinking, problem-solving, communication, digital literacy, adaptability, collaboration, and ethical decision-making. These competencies collectively prepare learners for the dynamic challenges and responsibilities inherent in the ever-evolving landscape of networking and technology.

## History of changes to unit

Version	Description of change	Date

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Unit template: February 2024

# General information for learners

**Unit title:** Computer Network Fundamentals (SCQF level 4)

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.

## Outcome 1

In outcome 1, Learners will establish a fundamental understanding of computer networks. Explore network concepts, data transfer, and practical applications. Differentiate between LAN and WAN, comprehend geographical variations, and recognise common network uses. Understand the vital role of networks in daily life, focusing on communication, information access, and social connectivity. Gain insights into IP addresses, their composition, and the shift from IPv4 to IPv6. Explore how devices utilise IP addresses for effective communication, and explore communication protocols.

## Outcome 2

Outcome 2 focuses on essential online security concepts. Understand the basics of network hacking, including breaking into computer networks to steal information or disrupt services. Learn to recognise and avoid online threats such as Ransomware, Cyberbullying, and Phishing Attacks. Master the basics of creating strong passwords, emphasising length, a mix of characters, and avoiding predictable information. Explore simple biometrics like fingerprints, iris patterns, and voice recognition for data security. Develop safe online behaviour, including reporting online harassment, adjusting social media privacy settings, and being selective about the information shared online. Understand the concept of a digital footprint and its impact on future opportunities, with examples of both positive and negative effects. Reflect on the importance of updating software for security, performance, new features, and bug fixes.

## Outcome 3

Outcome 3 will introduce you to fundamental components and concepts related to simple networks: Understand network components like Hubs, Switches, and Cabling. Hubs broadcast data to all devices, causing potential congestion due to their lack of intelligence. Switches filter and forward data based on addresses, reducing congestion compared to hubs. Cabling types like Cat5, Cat5e, and Cat6 facilitate data transmission. You will learn about Network Interface Cards (NICs), enabling communication between computers and networks. Differentiate wired NICs (Ethernet) and wireless NICs (Wi-Fi), commonly as expansion cards in desktops or integrated into laptops. You will also explore Wi-Fi basics, including routers, SSID (Service Set Identifier), signals, connecting via access points, setting passwords, channels, and security including an understanding of Firewalls, monitoring data based on security rules to block harmful traffic and permit safe traffic. Lastly you will Examine securing Wi-Fi networks with passwords, understanding strong passwords use encryption to secure data and prevent unauthorised access.

## General information for learners (continued)

**Unit title:** Computer Network Fundamentals (SCQF level 4)

### **Outcome 4:**

Outcome 4 focuses on practical network troubleshooting and maintenance skills. You will engage in creating and maintaining a small network, understanding the devices and media required to connect nodes, including at least one wireless node connected to both secure and unsecure access points. You will troubleshoot basic connection issues and learn to use network monitoring software, such as command-line interfaces like `ipconfig` in Windows or `ifconfig` in Linux and MacOS, to identify unique IP addresses of devices. Explore common network issues and their troubleshooting methods, focusing on physical connection checks through a "Connection Checkup" exercise with simulated network setups. By concluding with the creation of a small network, you will demonstrate practical application and troubleshooting skills, aiming to equip you with hands-on experience and tangible skills in efficient network troubleshooting and maintenance, bridging theoretical knowledge with practical application.