

Next Generation Higher National Unit Specification

Client Operating Systems (SCQF level 7)

Unit code: J89A 47
SCQF level: 7 (16 SCQF credit points)
Valid from: session 2024 to 2025

Prototype unit specification for use in pilot delivery only (version 1.0) June 2024

This unit specification provides detailed information about the unit to ensure consistent and transparent assessment year on year. It is for lecturers and assessors and contains all the mandatory information you need to deliver and assess the unit.

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This edition: June 2024 (version 1.0)

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Unit purpose

This is a specialist unit that introduces learners to the features of a modern computer operating system. The aim of the unit is to develop learners' knowledge of the features of an operating system to enable them to configure it correctly and efficiently.

The unit is suitable for learners who require the knowledge and skills to install and configure modern computer operating systems. It is also appropriate for learners who wish to develop their computing skills.

On completion of the unit, learners have a good understanding of the features of a client operating system. This adds to their general computing knowledge and helps them to progress to more specialist Higher National Diploma (HND) qualifications. It also provides a good foundation for studying server-side operating systems and operating system vendor certification examinations.

Unit outcomes

Learners who complete this unit can:

- 1 install and configure a client operating system for accessible use
- 2 secure and manage operating system resources
- 3 configure and secure network connectivity and shared resources
- 4 manage, maintain, and protect disks and data
- 5 monitor and analyse computer performance

Evidence requirements

Learners must provide product evidence that demonstrates the required knowledge and skills across all outcomes.

Knowledge is inferred from the product evidence. The product evidence requirements emphasise the practical nature of the unit, but knowledge is required to demonstrate the skills components.

The product evidence comprises screenshots, reports and assessor checklists related to:

- ◆ installing an operating system using either attended or unattended means (screenshots, assessor checklist)
- ◆ configuring an operating system to make it accessible to users with sensory or mobility needs (screenshots, assessor checklist)
- ◆ pre- and post-installation checks, with a justification for the installation method chosen (screenshots, report)
- ◆ creating an image of a computer operating system configuration and successful deployment of it to another computer (screenshots, assessor checklist)
- ◆ setting up and testing user accounts to match stated permission requirements (screenshots, assessor checklist)
- ◆ configuring and testing access permissions to shared folders from a remote computer (screenshots, assessor checklist)
- ◆ configuring network folders to be available while not connected to a network (screenshots, assessor checklist)
- ◆ configuring account, password and user rights policies to maintain system security (screenshots, assessor checklist)
- ◆ auditing attempts to logon or access folders by unauthorised individuals (report)
- ◆ configuring a series of disks in a redundant array of independent disks (RAID) architecture to meet a specification (screenshots, assessor checklist)
- ◆ applying disk quotas to disks (screenshots, assessor checklist)
- ◆ disk maintenance processes (screenshots, assessor checklist)
- ◆ restoring the operating system configuration and user on a computer (disaster recovery) (screenshots, assessor checklist)

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- ◆ analysing performance trends in monitoring data from the main components of the computer: random access memory (RAM), central processing unit (CPU), network interface card (NIC) and disk (screenshots, report)
- ◆ configuring a firewall to secure a computer network connection (screenshots, assessor checklist)
- ◆ configuring a web browser's data retention settings and privacy settings (screenshots, assessor checklist)
- ◆ configuring a shared printer to control access to it from a network (screenshots, assessor checklist)

Learners may produce product evidence over an extended period of time in lightly-controlled conditions. This could be either throughout the unit as a set of tasks, or towards its end as a single integrated assessment across all outcomes. Learners should have access to learning materials. Authentication is required where the evidence is produced in lightly-controlled conditions.

The standard of evidence should be consistent with the SCQF level of the unit.

Knowledge and skills

Knowledge	Skills
<p>Learners should understand:</p> <ul style="list-style-type: none"> ◆ manual operating system installation ◆ automated operating system installation ◆ image creation and deployment ◆ operating system installation verification ◆ how to configure: <ul style="list-style-type: none"> — a user account — a security group — a basic disk — a dynamic disk — a printer — an accessibility tool — a firewall ◆ file system security ◆ offline folders ◆ local group policy ◆ disk quotas ◆ disk maintenance ◆ data backup ◆ system backup ◆ snapshots ◆ previous version management ◆ real-time performance monitoring ◆ scheduled performance monitoring ◆ network connectivity ◆ web browser security ◆ the effect of permission inheritance and cumulative permissions on both local and remote access ◆ the effect on permissions of moving and copying files and folders 	<p>Learners can:</p> <ul style="list-style-type: none"> ◆ perform pre-installation checks ◆ install an operating system manually ◆ perform post-installation checks and updates ◆ prepare appropriate files for an unattended installation ◆ perform an unattended installation ◆ configure accessibility settings to make the computer available to users with sensory or mobility needs ◆ prepare a test personal computer (PC) for imaging ◆ create a hard disk image ◆ deploy and verify the image deployment ◆ use graphical user interface (GUI) and command line interface (CLI) tools to create accounts ◆ use GUI and CLI tools to configure account groups ◆ use GUI and CLI tools to assign users to one or more groups ◆ use built-in groups sensibly ◆ configure local file and folder permissions ◆ configure shared file and folder permissions ◆ make network folders available offline ◆ encrypt data ◆ configure local policies relating to account lockout, passwords, auditing and user rights ◆ create, format, name and re-size one or more primary partitions ◆ create a dual-boot system ◆ create basic and dynamic disks

Knowledge	Skills
	<p>Learners can:</p> <ul style="list-style-type: none"> ◆ configure multiple disks for RAID to ensure resilience or maximise input and output ◆ implement disk quotas ◆ defragment a disk and perform error-checking of its file system ◆ back up user files using a scheduled backup ◆ perform a system backup ◆ perform disaster recovery ◆ create and restore system snapshots ◆ create and manage previous versions of files ◆ monitor disks, memory, CPU and network interfaces in real time ◆ monitor disks, memory, CPU and network interfaces at pre-set frequencies ◆ compare current configurations to earlier or baseline configurations, to ascertain trends ◆ configure internet protocol (IP) addressing both manually and automatically ◆ configure client domain name system (DNS) or default gateway settings both manually and automatically ◆ configure allow and deny rules on a client firewall ◆ configure common web browser security settings, including cookies, data retention and history ◆ configure a local printer ◆ configure a shared printer ◆ configure a network printer

Meta-skills

You must give learners opportunities to develop their meta-skills throughout this unit. We've suggested how to incorporate the most relevant ones into the unit content, but you may find other opportunities.

Self-management

This includes focusing, integrity, adapting and initiative. The most relevant are:

- ◆ focusing:
 - attention to detail in applying security to file storage and sharing
- ◆ adapting:
 - tailoring of client operating systems in different scenarios
- ◆ initiative:
 - taking responsibility for the performance of client operating systems

To complete the unit, learners must perform an appropriate configuration that is necessary to solve a given problem. They may need to consider and test a range of solutions before selecting the most appropriate one.

Social intelligence

This includes communicating, feeling, collaborating and leading. The most relevant are:

- ◆ communicating:
 - listening carefully to the statement of requirements when configuring a client operating system
- ◆ collaborating:
 - teamwork throughout the practical system configuration work

Although you assess learners individually, they should work together during class exercises to solve a problem.

Innovation

This includes curiosity, creativity, sense-making and critical thinking. The most relevant are:

- ◆ creativity:
 - setting up user groups and applying permissions
- ◆ sense-making:
 - understanding the requirements of a given scenario and identifying patterns
- ◆ critical thinking:
 - making judgements about permissions and levels of access to files

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You should encourage learners to perform online research in solving problems and configure an appropriate solution based on their findings.

Learning for Sustainability

Throughout this unit, you should encourage learners to develop their skills, knowledge and understanding of sustainability.

This includes:

- ◆ a general understanding of social, economic and environmental sustainability
- ◆ a general understanding of the United Nations Sustainable Development Goals (SDGs)
- ◆ a deeper understanding of subject-specific sustainability
- ◆ the confidence to apply the skills, knowledge, understanding and values they develop in the next stage of their life

You should demonstrate how client operating systems open up the way for users of all abilities to access computer systems safely and securely. They also provide greater efficiency in the use of computers to accomplish tasks. You should show how this makes a significant contribution to access to digital technologies and their efficient use in industry and business. The emphasis on security of data and computer systems is important for data privacy for the individual, as well as organisations, and relates to SDG 9.

Delivery of unit

This unit introduces learners to the features of a computer's operating system. It does not rely on any prior knowledge.

The notional time for delivery and assessment is 80 hours. The amount of time you allocate to each outcome is at your centre's discretion. We suggest the following distribution of time, including assessment:

Outcome 1 — Install and configure a client operating system for accessible use
(20 hours)

Outcome 2 — Secure and manage operating system resources
(15 hours)

Outcome 3 — Configure and secure network connectivity and shared resources
(15 hours)

Outcome 4 — Manage, maintain, and protect disks and data
(15 hours)

Outcome 5 — Monitor and analyse computer performance
(15 hours)

Additional guidance

The guidance in this section is not mandatory.

Content and context for this unit

During the delivery of the unit, it is important that you explain how learners can use various operating system configurations to solve real-world problems. This promotes a better understanding of those concepts that might appear more abstract.

Given the practical nature of the unit, you should allocate a significant amount of time for practical tutorials. This helps you to distribute the practical assessment component evenly throughout the unit, and helps learners to compile their portfolios of evidence.

You should strongly encourage learners to carry out personal research into any troubleshooting issues that occur. Help them realise that continual updates are made available to operating systems, changes occur, and configuration methods change with time.

You may use the unit to help learners prepare for vendor certifications. You could use vendor-supplied materials in the delivery of the content. As these materials are under continuous development, you should always check carefully to ensure that materials meet all the requirements for the unit. If you use vendor materials, some of the practical tasks involved may contribute towards the practical assessments required for the unit.

Resources

There are no restrictions on the operating system you use. If you use the Microsoft Windows family of operating systems, free trial versions are available from the [Microsoft Evaluation Centre](#). Using these in tandem with the rearm facility provides resources for the duration of the unit.

We recommend that centres provide learners with a set of virtual machines on which to carry out the practical exercises of installing and configuring a client operating system.

Approaches to delivery

We recommend that you deliver outcomes in the order listed below.

Install and configure a client operating system for accessible use (outcome 1)

You should introduce learners to the purpose of the core hardware components in a modern computer. You could distinguish between the 'minimum' and 'recommended' requirements specified by the vendor of the operating system. You could direct learners to explore the hardware component requirements for a variety of operating systems and become aware that some require more specialised hardware than others. Common examples include trusted-platform modules (TPMs) and multi-core CPUs. You should ensure that learners understand the advantages of the more modern unified extensible firmware interface (UEFI) and secure boot system over the more traditional basic input/output system (BIOS) boot manager, and direct them to conduct research that builds their understanding of these.

You should follow this by teaching the basics of partitioning and formatting of disks. Initially, you could limit this to the role a primary partition plays in supporting an operating system, because the principles will be better developed later. In parallel with this, you can introduce learners to the purpose of formatting, as well as the current formats available.

Having gained an understanding of the system requirements, you can give learners the practical task of performing a manual installation of a client operating system. Follow this by emphasising the importance of updating the operating system immediately and scheduling future automatic updates on a regular basis. Once completed, you can ask learners to verify that all device drivers are installed and operational and that the installation logs do not reveal any problems. You can also teach the procedure for manually installing outstanding drivers, as well as how the operating system can usually detect, locate and install these automatically using its plug and play ability. You should complete this by introducing learners to a security suite and its implementation.

Your next steps could be to introduce the concept and advantages of performing an unattended installation as an alternative to manual installation. You should demonstrate how to create customised answer files that include user accounts, partitions and passwords, before applying this to an unattended installation. When the unattended installation is complete, you should require learners to verify everything is working and that the required settings are present.

You should explain the importance of accessibility considerations when setting up a computer system for users with sensory and mobility needs. Demonstrate how to configure a variety of accessibility settings using tools that support audio, visual and motor impairments.

You should introduce learners to the advantages of using software images to create a set of identically configured computers, and require them to configure a test computer for imaging. You should provide a practical exercise for learners to check that the test computer's operating system is installed correctly and install any customisations required in the image. You should emphasise the importance of removing PC-specific settings before making an image of the computer's hard disk, and require learners to perform this using appropriate imaging software. You could ask learners to manually deploy this image to another computer and then check that it has been deployed correctly.

Secure and manage operating system resources (outcome 2)

You should teach learners the purpose of a user account and why each user should have an individual account. Demonstrate how they can create user accounts using both graphical and command-line tools, while emphasising how groups simplify management of multiple users. You should require learners to create groups and assign multiple users to them. As before, they can do this graphically or at the command-line, making use of common built-in groups.

You should introduce the importance of secure access to files and folders and the various levels of access permissions. Explain how multiple group membership and folder hierarchies affect access levels. You should develop learners' skills in applying various restrictions, including read, write and update access. Restrictions could be placed on users and groups of users to both individual files and entire folders or subfolders. You should provide learners with an understanding of the effect on security of moving and copying files and folders in and between different drives.

Introduce learners to the concept of folder shares and how to implement them and restrict remote access. You should make learners aware of the different levels of remote access and how they combine with the local access permissions configured against the resource being accessed.

Develop learners' skills to include creating network files and folders that can be made available to a computer when it is not connected to the network. Show learners how to apply encryption to a folder and test it to make sure the encryption works.

To consolidate understanding of file system security, you should require learners to perform a range of permissions-related tasks using a variety of scenarios. You could also require that they test their configurations to make sure they really do meet requirements.

You should demonstrate the techniques to configure a variety of group policies to restrict the abilities of all users on a computer. This should include configuring the operating system so that password parameters such as history, length, complexity and age timeouts are set to sensible levels. Similarly, you could configure lockout policies to prevent hacking attacks. You should instruct them on the ways to configure user rights and auditing policies to lock down and monitor the operating system.

Configure and secure network connectivity and shared resources (outcome 3)

You should introduce learners to the methods for connecting a client computer to a network using both IPv4 and IPv6 addressing. Explain to learners the importance of DNS and default gateway settings and require them to configure these manually and automatically.

You should explain the necessity of a firewall on a client computer, and demonstrate the methods for configuring a firewall to allow or block specific traffic from leaving or entering the computer.

Explain the role of cookies in a web browser and the risks they pose to safe operation. You should also demonstrate how to configure a web browser for cookie management and how to restrict the data it retains (such as passwords and bank details) and its history lists.

You should explain the concept of a shared printer and require learners to install a printer and share it, including a printer connected directly to a network.

Manage, maintain, and protect disks and data (outcome 4)

You should teach learners the methods they should use to create, format, name and re-size an existing primary partition and create multiple partitions on the same disk. You could then demonstrate the creation of a dual-boot system using multiple partitions.

You should introduce the concept of a dynamic disk and teach learners the methods to configure the different volume types: simple, striped and mirrored. You should cover the various formatting standards and how and when they might be used, along with an explanation of disk quota configuration.

You should show learners the effect of disk fragmentation on various disk types and how they can mitigate these effects. Introduce learners to the use of operating system tools available to perform disk error-checking and fix errors in the file system.

Teach learners the common backup methods, such as full, incremental and differential, and how they can combine these into a backup strategy, including scheduling of backups. You should ask learners to perform a manual backup of data and then restore it, before verifying the restoration has worked. They could then configure a scheduled backup.

You should demonstrate the methods of performing a complete system backup before performing a disaster recovery by restoring the system backup, plus all data files, to return the computer to its earlier state. You should demonstrate how they could then verify this.

Explain to learners that data backups are not the only way of protecting data. Introduce the operating system's snapshot feature and explain its role in rolling back some configurations. Learners should use file snapshotting to manage a series of different versions of a file.

Monitor and analyse computer performance (outcome 5)

You should demonstrate the process of performing real-time monitoring of a computer's memory, hard disks, CPU and network cards. You could use tools that allow both real-time monitoring and capturing data on a scheduled basis over a period of time. This latter feature allows learners to appreciate the role benchmarking and trend analysis play in system monitoring and the actions that they could take based on analysis of the data they collect.

Approaches to assessment

Learners should perform practical exercises as a set of exercises forming a portfolio of evidence, or as components of a single larger project that enables the creation of the required evidence. Learners must meet the evidence requirements, demonstrated by screenshots and reports, or assessor checklists to signify that they have successfully completed individual tasks.

There are opportunities to assign tasks that enable learners to produce evidence for more than one outcome in the unit. Your centre should design the assessor checklists associated with tasks. You should complete them and store them securely. Learners should store the corresponding screenshots in their portfolios.

You should specify the user accounts that learners should create, to ensure that the range of possible access permissions is covered. Take a similar approach for network accounts and user rights policies. In the case of accessibility configurations, you should provide learners with a set of common requirements for implementation.

Equality and inclusion

This unit is designed to be as fair and as accessible as possible with no unnecessary barriers to learning or assessment.

You must consider the needs of individual learners when planning learning experiences, selecting assessment methods or considering alternative evidence.

Guidance on assessment arrangements for disabled learners and those with additional support needs is available on the [assessment arrangements web page](#).

Information for learners

Client Operating Systems (SCQF level 7)

This information explains:

- ◆ what the unit is about
- ◆ what you should know or be able to do before you start
- ◆ what you need to do during the unit
- ◆ opportunities for further learning and employment

Unit information

In this unit, you learn the features of a modern computer operating system. It is a specialist unit intended for learners with an interest in this area, but who have little or no previous knowledge. It is particularly suitable if you are carrying out a computing qualification, such as HNC Computing. The unit may also be appropriate for you if you wish to gain a good understanding of operating system features.

You learn how to install and configure an operating system to make sure it is secure and used efficiently. The unit is not complex, but it does cover a wide scope of knowledge and understanding in relation to client operating systems.

You learn the theory of client operating systems through practical tasks. The unit emphasises the knowledge and skills you need to perform a range of system configurations and understand their purpose and the contexts in which they are used. You gain a sound understanding of how to configure a client operating system for a given purpose.

On completion of the unit, you can:

- 1 install and configure a client operating system for accessible use
- 2 secure and manage operating system resources
- 3 configure and secure network connectivity and shared resources
- 4 manage, maintain, and protect disks and data
- 5 monitor and analyse computer performance

You are assessed through a range of configuration tasks. These may take the form of individual assignments or a project that requires you to demonstrate the skills you need to select and configure computer operating systems.

The unit provides you with some of the knowledge you need to complete an entry-level operating system certification provided by operating system vendors. It also prepares you for future study in server operating system technologies and gives you confidence and competence in the use of computer systems.

Meta-skills

Throughout this unit, you develop meta-skills for the computing sector.

Meta-skills are transferable behaviours and abilities that help you adapt and succeed in life, study and work. There are three categories of meta-skills: self-management, social intelligence and innovation.

Self-management

This includes focusing, integrity, adapting and initiative. The most relevant are:

- ◆ focusing:
 - attention to detail in applying security to file storage and sharing
- ◆ adapting:
 - tailoring of client operating systems in different scenarios
- ◆ initiative:
 - taking responsibility for the performance of client operating systems

Social intelligence

This includes communicating, feeling, collaborating and leading. The most relevant are:

- ◆ communicating:
 - listening carefully to the statement of requirements when configuring a client operating system
- ◆ collaborating:
 - teamwork throughout the practical system configuration work

Innovation

This includes curiosity, creativity, sense-making and critical thinking. The most relevant are:

- ◆ creativity:
 - setting up user groups and applying permissions
- ◆ sense-making:
 - understanding the requirements of a given scenario and identifying patterns
- ◆ critical thinking:
 - making judgements about permissions and levels of access to files

Learning for Sustainability

Throughout this unit, you develop skills, knowledge and understanding of sustainability.

You learn about social, economic and environmental sustainability principles and how they relate to the computing sector. You also develop an understanding of the [United Nations Sustainable Development Goals](#).

You learn how client operating systems open up the way for users of all abilities to access computer systems safely and securely, and demonstrate greater efficiency in their use of computers to accomplish tasks. The emphasis on security of data and computer systems is important for data privacy for the individual, as well as organisations, and relates to SDG 9.

Administrative information

Published: June 2024 (version 1.0)

Superclass: CB

History of changes

Version	Description of change	Date

Please check [SQA's website](#) to ensure you are using the most up-to-date version of this document.