

Higher National Unit Specification

General information for centres

Unit title: Computer Networks: Administering Network Systems

Unit code: D75S 35

Unit purpose: This Unit is designed to enable candidates to understand the concepts of network systems and enable them to be proficient in the system administration of such systems. Candidates will develop a broad knowledge of the principles and be able to exercise specialised skills in administering network systems.

On completion of the Unit the candidate should be able to:

1. Install and configure network server operating system software
2. Install and configure network clients
3. Maintain users, groups and security on a network system
4. Install and configure shared printing devices
5. Manage and monitor a network system

Credit value: 2 HN Credits at SCQF level 8: (16 SCQF credit points at SCQF level 8)

SCQF (the Scottish Credit and Qualifications Framework) brings Scottish qualifications into a single framework of 12 levels ranging from SQA Access 1 to doctorates. The SCQF includes degrees; HNC/Ds; SQA National Qualifications; and SVQs. Each SQA Unit is allocated a number of SCQF credit points at a specific level. 1 SCQF point = 10 hours of learning. HN candidates are normally expected to input a further number of hours, matched to the credit value of the Unit, of non-contact time or candidate-led effort to consolidate and reinforce learning.

Recommended prior knowledge and skills: Access to this Unit will be at the discretion of the Centre, however it is recommended that candidates should have good computer skills and background knowledge of networking or multi-user system concepts would be beneficial. These may be demonstrated by the achievement of appropriate HN and AH Units or considerable practical experience which would include system set-up and/or administration in a stand alone or network computer environment.

Core skills: There may be opportunities to gather evidence towards core skills in this Unit, although there is no automatic certification of core skills or core skills components.

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.

Higher National Unit specification: General information for centres (cont)

Assessment: The Unit should be assessed in small discrete parts periodically throughout the Unit duration. The emphasis is on the candidate gaining practical system administration skills in the installation, configuration and day-to-day administration and management of a network system. The candidate in the practical assessments will demonstrate significant autonomy.

An Assessment Exemplar has been produced to indicate the national standard of achievement required at SCQF level 8.

Higher National Unit specification: statement of standards

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The sections of the Unit stating the Outcomes, knowledge and/or skills, and evidence requirements are mandatory.

Where evidence for an Outcome is assessed on a sample basis, the whole of the content listed in the knowledge and/or skills section must be taught and available for assessment. Candidates should not know in advance the items on which they will be assessed and different items should be sampled on each assessment occasion.

Outcome 1

Install and configure network server operating system software

Knowledge and/or skills

- Attributes of a multi-user, network operating system
- Role, privileges and access of network operating system administrator / superuser
- Different network operating systems and protocols
- Hardware requirements of network operating systems
- Efficient preparation and installation of network server operating systems and protocols

Evidence requirements

The candidate will need evidence to show that s/he can:

- Describe the attributes of a multi-user, network operating system
- Describe the role, privileges and access of network operating system administrator/ superuser
- Describe and compare examples of different network operating systems and protocols

Evidence for these three items may be provided as an extended-response report requiring additional independent research, analysis and evaluation by candidates.

- Complete a hardware configuration proforma for at least two target servers. The candidate must evaluate the hardware configuration proforma against the hardware requirements for the chosen network operating systems.
- Carry out efficiently the installation and configuration of at least two different common network operating systems and network protocol stacks on a target server. Any services necessary to permit remote login must also be installed and configured. Successful completion would be accepted with the candidate demonstrating an error-free server boot up and successful connection using the superuser login on a remote client. Evidence for this item will be provided by the candidate completing a log of all work carried out. A blank pro-forma log sheet should be provided for this purpose.

Higher National Unit specification: statement of standards (cont)

Assessment guidelines

System documentation and/or Internet access should be available to candidates during system installations.

It is recommended that TCP/IP be adopted as the primary protocol used throughout this Unit by candidates, but they should also be provided with knowledge and experience of others still in common use such as NetBEUI and IPX/SPX.

Services required for remote connection will depend on the server/client configurations selected, and might include for example the Telnet or TCPwrappers daemon for a multi-user UNIX system or Windows Terminal Server for a Microsoft NT or 2000 applications server.

The requirement to test the installations by connecting to the servers from a remote client provides opportunity to integrate delivery and assessment of this Outcome with Outcome 2.

Outcome 2

Install and configure network clients

Knowledge and/or skills

- Identify risks and use safe working practices
- Efficient physical installation and configuration of client hardware
- Efficient physical connection of client systems to a network
- Selection and configuration of client software and network protocols
- Effective testing and evaluation of systems

Evidence requirements

The candidate will need evidence to show that s/he can:

- Demonstrate an awareness of risks to health and safety of ESD damage to equipment, and of issues surrounding cabling fire risks and the use of LSZH sheathing

Evidence could be provided by the candidate answering correctly all of a short set of questions and certifying that safe working practices have been explained and demonstrated to him/her.

- Carry out efficiently the installation and configuration of two client systems. Following installation the client should be connected into the network system and appropriate and effective testing performed to ensure installation and connection have been successful. The candidate should obtain and submit a hard copy of any modified system files, and must provide evidence in the form of a log of all work carried out. A blank proforma log sheet should be provided for this purpose.

Higher National Unit specification: statement of standards (cont)

The assessor should indicate whether safe working practices have been followed by signing the candidate's log on completion.

Assessment guidelines

Candidates must be encouraged to work safely at all times, to identify workplace risks and respond appropriately by changing working practices and minimising and reporting hazards. Evidence of awareness of risks could be provided by using a short set of written short answer or restricted response questions. Candidates must have safe working practices explained and demonstrated to them. As a simple safety precaution, this practice is also recommended as a prerequisite for any candidate attempting practical work.

The requirement to test the installations by connecting clients to a server provides opportunity to integrate delivery and assessment of this Outcome with Outcome 1.

Outcome 3

Maintain users, groups and security on a network system

Knowledge and/or skills

- Identify group and user requirements
- Create and manage new and built-in groups and users on network system
- Define and implement user directory structure and file organisation
- Create login scripts

Evidence requirements

Each candidate will perform a paper-based exercise to correctly identify group and user requirements from a case study. The case study should include both users who can be assigned operating system built-in group or user accounts, and those requiring new groups and accounts. The candidate must plan an efficient hierarchical structure for user home directories and shared data and define appropriate security and access permissions. The candidate should research these areas as part of the assessment. There will be no single solution to this exercise and the candidate should demonstrate a standard and systematic approach to user login and password assignments, and to directory structure design. For the paper-based exercise, the candidate must complete a pro-forma issued by the assessor.

Using the case study and the paper-based exercise, each candidate must complete a practical assignment of creating the required new groups, users and directory structures on the network system. At least two groups and four users should be created. Refinement of user permissions including login times, forcing a password change on first login and login scripts must be incorporated in this task. Testing must be carried out to ensure user permissions and file access permissions have been correctly implemented. The candidate must provide evidence in the form of a completed log of all work carried out, and must submit a hard copy of any files that are created or modified. A blank pro-forma log sheet should be provided for this purpose.

Higher National Unit specification: statement of standards (cont)

Assessment guidelines

The assessor should check the completed planning pro-forma before the candidate implements the specified number of groups and users on the Network system. It should be organised appropriately so that each candidate can add different users to the system. Therefore, after all candidates have completed there will be a large number of different group and user accounts on the server.

Depending on the system being used different login scripts may be available, eg system, group, user. Candidates should be aware of all of those available on the system used for assessment purposes. A login script is any method of automatically running a specific program or programs on user login and which can be different for each user or group, eg profile.

Outcome 4

Install and configure shared printing devices

Knowledge and/or skills

- Analyse cable types and connection considerations
- Install local and remote printing devices
- Configure printing device
- Manage printing devices and print jobs

Evidence requirements

The candidate must install and configure one printing device local to the network server and one connected remotely to a dedicated print-server. In both situations the device must be shared and accessible by users across the network system. Following each installation the printing device should be tested to ensure installation has been successful, and print jobs submitted. The candidates must demonstrate his/her ability to manage these jobs by modifying the print priority of at least one job and deleting at least one other.

The candidate must provide evidence in the form of a completed log of all work carried out, and must submit a hard copy of any files that are created or modified. A blank pro-forma log sheet should be provided for this purpose.

Assessment guidelines

It is essential that all necessary components and cables etc. are available to the candidate. It would also be advisable to have the appropriate manuals applicable to the hardware and/or software being used during the installation tasks. If suitable driver software is not provided, then access to the Internet should be provided to permit candidates to locate and download files as required.

Higher National Unit specification: statement of standards (cont)

Outcome 5

Manage and monitor a network system

Knowledge and/or skills

- Manage a system start-up and scheduled system shutdown
- Utilise administration tools to monitor system usage and performance
- Install system or utility software
- Install application software on server for shared access by users
- Upgrade a network server operating system
- Monitor and control the progress of tasks
- Schedule routine tasks
- Define and implement a backup strategy
- Perform a restoration of data from a backup

Evidence requirements

Each candidate must perform:

- An installation of an application program with access allowed to a group of users
- An installation of anti-virus software
- An upgrade or patch to the server operating system
- Post-installation tests of each application and of upgraded operating system

Monitoring tools must be used to identify if users are on-line and what files are open prior to application program installation and operating system upgrade. Users should be informed of planned installation/upgrade and the completion of such activities.

The candidate must select and use system tools to monitor active users, determine what files are open and notify users of updates, system maintenance and scheduled shutdowns. Such maintenance tasks should then be automated using system-scheduling software.

The candidate must design a backup strategy using multiple backup media. The strategy must incorporate both full and incremental backups appropriately, and must include consideration of media rotation, storage and location. The candidate must then implement this strategy over an extended period, maintaining an ongoing log of his/her actions. On at least two occasions during this period, the assessor will delete information from the system and require the candidate to restore it correctly and efficiently. It is essential that no data is lost during this activity and that the candidate follows all appropriate precautions independently without assistance from the assessor.

Evidence for practical tasks in this Outcome will be in the form of a log sheet completed for each task. Blank pro-forma should be provided for this purpose. Evidence for the design of a backup strategy will take the form of an extended-response report produced by the candidate that describes backup strategies in general and then proposes one appropriate for the system in use.

Higher National Unit specification: statement of standards (cont)

Assessment guidelines

Active login(s) and open files should be present before the candidate attempts this assessment. The candidate should take the appropriate action to have the server in the appropriate state before progressing.

Administrative Information

Unit code: D75S 35

Unit title: Computer Networks: Administering Network Systems

Superclass category: CB

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Higher National Unit specification: support notes

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This part of the Unit specification is offered as guidance. The support notes are not mandatory.

While the exact time allocated to this Unit is at the discretion of the Centre, the notional design length is 80 hours.

Guidance on the content and context for this Unit

The Unit is primarily intended to prepare candidates for role of a system administrator of a Multi User system in a commercial environment.

Although the Unit is expressed in generic terms, it could be related to a single large case study or scenario to allow candidates to have a context to which each assessment will be related. If necessary the terminology used in the Unit can be adapted to suit particular operating systems, eg partition with volume, administrator with super-user.

The Unit can be approached from the standpoint of a particular organisation installing a server-based network system, the layout and plans of which have already been agreed. The candidate can then follow through the development of the system and server to the stage where it fully meets the needs of the organisation. If candidates can be given the same server for every assessment then a feeling of ownership and easier development of the network will occur due to the familiarity that will be created.

Examples of network operating systems that could be used are UNIX (including Linux), Windows NT or 2000 Server, or Novell NetWare.

Outcome 1 looks at the prior preparation and planning necessary as well as the actual installation of network operating systems. The emphasis is on the system administrator tasks involved with the gathering and checking of the hardware requirements against target server configuration and the physical installation. The candidate should also be fully aware of:

- What a modern multi-user network server operating system is and the functions it performs
- Examples of available industry standard network server operating systems and network protocols
- The tasks that would be expected of a system administrator.

At least two different server operating systems must be planned and installed for this Outcome. The function and nature of different network protocols, including TCP/IP, NetBEUI and IPX/SPX, should be explained and candidates must include this as a central component in their planning and implementation. While not a formal part of this Unit, the role of specific network (and especially Internet) service software such as web servers should be described, and where possible candidates should be encouraged to include such services as part of their server installations.

Use of hardware tools and third-party software may also be encouraged to examine hardware configurations. Candidates should carry out research using manuals and textbooks and use of the Internet should be recommended.

Higher National Unit specification: support notes (cont)

In Outcome 2, candidates create a network by adding at least two clients. These nodes can be added to a single server to develop a large multi-user network system or can be added to several separate servers to develop a number of smaller systems for future administration tasks to be performed on. The latter, although less general, is probably more practical as it would enable several candidates to be assessed simultaneously on different networks. This will ultimately depend on the resources available within the Centre.

It is essential that all necessary components such as NICs, cables etc. are available to the candidate. It would also be advisable to have the appropriate manuals applicable to the hardware and/or software being used during the installation tasks. Internet access may be required if appropriate documentation or software is not provided.

The precise nature of the clients will depend on the server systems in use, and care should be exercised in the selection of these to ensure candidates receive as broad an experience of different environments as possible. These could range from basic Telnet or X-terminal thin-clients connecting into a Unix system, conventional thick-client PCs connecting into a Novell Netware, NT or 2000 server for secure file and printer sharing, to thin-client application server scenarios using Windows Terminal Server or Citrix Metaframe. The importance of giving candidates a rich variety of experiences in such different environments cannot be overstated.

Outcome 3 considers the ongoing administration of the system by introducing the tasks of user management. This involves the candidate being aware of the groups and user permissions available from built-in groups and users of the operating system. The facilities to customise and create new group and user access should also be covered. Candidates should be given the skills to be able to evaluate user requirements along with system usage policies and implementing the users on the system appropriately. Common occurrences of forgotten passwords, accounts locked, logins disabled and access to folders/files not granted should be reviewed and the tools used to solve these problems should be covered.

Outcome 4 allows for the candidate to set up and configure shared printing devices. In this Outcome it would be important to cover the different types of print servers and locations of printing device connections along with their pros and cons. The candidate can then install one of the devices covered. If resources allow, a large multiple printing system could be developed as each candidate adds subsequent printing devices to the system.

In Outcome 5 the emphasis should be on the routine management tasks that need to be completed periodically after a network server is up and running. It is also important to cover the ways in which administrators can keep in contact with the users in relation to system maintenance and scheduled shutdowns, eg message of the day (motd), e-mail and direct terminal communication for users currently logged on. The use of network resource monitoring software should be covered to assist the administrator in knowing what the system is doing and to aid fault finding. An application should be installed centrally on the server and appropriate access given to the target users. The Internet could be used to source up-to-date operating system patches/upgrades that the candidate can then install on the server. An appropriate backup strategy must be planned and implemented; this should include both periodic full and more frequent incremental backups of all or part of the system (restricting backups to user data, for example, would speed this process up considerably).

Higher National Unit specification: support notes (cont)

The location and storage of backups should be discussed with candidates and this element should be included in their strategies.

External speakers from and visits to organisations that have implemented and use server-based network systems on a day-to-day basis would be invaluable. These would both be encouraged to allow candidates to apply their knowledge and understanding to 'real' situations. They would also allow analysis, synthesis and evaluation of the principles and specialised skills which the candidates are learning within the Unit.

Guidance on the delivery and assessment of this Unit

This Unit forms part of the group award HND Computing: Technical Support which is primarily designed to provide candidates with technical knowledge and skills related to the support aspect of computing. In these circumstances, the Unit is likely to be delivered towards the end of the group award by which time candidates should have a good appreciation of stand alone computer systems and the Multi User operating system interface and commands.

This should allow the Unit to be delivered in a way that enables candidates to appreciate its relevance to the occupational area concerned and have the appropriate skills as noted in the recommended prior knowledge and skills section of this specification. Wherever possible, links should be drawn with situations that candidates will understand. The candidate should obtain and submit a hard copy of any modified system files to have as evidence of successful completion of tasks. Checklists should also be used for all observed practical tasks.

There are no closed book assessments in this Unit and candidates will be permitted reference to textbooks, handouts or other material that the candidate has prepared. Use of the Internet for research purposes and the downloading of the latest versions of software should be encouraged.

If this Unit is being delivered as part of a Professional Development Award which receives endorsement from a vendor such as Microsoft, it must be delivered and evidence generated as detailed in the document "*Approval to certification*" which is associated with that particular vendor and the Professional Development Award.

Higher National Unit specification: support notes (cont)

Links to Vocational Qualifications

This Unit may have covered the knowledge and understanding for the following VQ Units.

VQ	VQ Unit no. and name	VQ Element no.	Outcome in this Unit
Operating IT Systems Level 3 and Installing and Supporting IT Systems Level 3	315 Install Software	1, 2 & 3	1, 5
Operating IT Systems Level 3 and Installing and Supporting IT Systems Level 3	316 Contribute to system testing	1, 2 & 3	2, 5
Operating IT Systems Level 3	318 Operate information technology systems	1, 2 & 3	5
Operating IT Systems Level 3	319 Provide backup and file storage systems	1, 2 & 3	5
Operating IT Systems Level 3	322 Control the operation of data communications and networks	3a, c, d, e, f, g, h	1, 2, 3, 4, 5

Open learning

If this Unit is delivered by open or distance learning methods, additional planning and resources may be required for candidate support, assessment and quality assurance. A combination of new and traditional authentication tools may have to be devised for assessment and re-assessment purposes. For further information and advice, please see *Assessment and Quality Assurance for Open and Distance Learning* (SQA, February 2001 — publication code A1030).

Special needs

This Unit specification is intended to ensure that there are no artificial barriers to learning or assessment. Special needs of individual candidates should be taken into account when planning learning experiences, selecting assessment instruments or considering special alternative Outcomes for Units. For information on these, please refer to the SQA document *Guidance on Special Assessment and Certification Arrangements for Candidates with Special Needs and Candidates for whom English is an Additional Language* (SQA, 2000).

General information for candidates

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1. Install and configure network server operating system software
2. Install and configure network clients
3. Maintain users, groups and security on a network system
4. Install and configure shared printing devices
5. Manage and monitor a network system

You will follow through the development of a modern multi-user network system to the stage where it fully meets the needs of an organisation. You will begin with the preparation and planning necessary before the actual installation of a suitable operating system on a target server. The emphasis will be on the system administrator tasks involved with the gathering and checking of the hardware requirements against target server configuration and the physical installation.

You will then develop the system by adding clients and printing devices to the network. User management is a key issue and you will be given the skills needed to create and manage user logins and passwords and customise user permissions and access rights. The importance of backup and the different methods available will be covered along with the practical task of performing actual backups and restoration. Installing application software and upgrading the operating system will also be practical tasks covered. The skills of auditing and monitoring the network along with testing each amendment will also play a role within the Unit delivery.

Assessment will be mainly practical assignments to complete the system administrator tasks mentioned above, where you will be required to keep logs of work carried out. A few paper-based exercises will need to be completed as planning of the practical tasks that you will carry out and you will be expected to present these in the form of completed pro-forma record sheets and one extended response report. There are no closed book assessments in this Unit and reference will be permitted to textbooks, handouts or other material that you have prepared yourself.