Next Generation Higher National Unit Specification

Network Infrastructure (SCQF level 8)

Unit code: J68T 48

SCQF level: 8 (24 SCQF credit points)

Valid from: session 2022–23

Prototype unit specification for use in pilot delivery only (version 1.0) May 2022

This unit specification provides detailed information about the unit to ensure consistent and transparent assessment year on year.

This unit specification is for teachers and lecturers and contains all the mandatory information required to deliver and assess the unit.

This edition: May 2022 (version 1)

Unit purpose

This is a specialist unit, designed for a wide range of learners with an interest in computer networking. It is particularly suitable for those with a vocational interest in STEM-based subjects, or who wish to progress to higher education and/or vendor qualification-based computing subjects. Ideally, learners should have completed networking units at SCQF level 7 before progressing to this unit, or have relevant industry experience. Learners should have good knowledge of computer networking, the internet, computer hardware and software, and computer architecture.

This unit introduces learners to the more technical aspects of planning and implementing a network infrastructure environment. They use appropriate methods to plan logical and physical network topologies, and identify the types of operating systems, network hardware and network services likely to be within a network infrastructure. Learners also plan appropriate advanced network addressing schemes and physical aspects, such as cabling and wireless media, and placement of servers. They then consider the management and security techniques of a network infrastructure.

Opportunities exist for learners to use a range of networking-related hardware and software, in combination with networking terminology — this helps to reinforce core understanding.

On completion of this unit, learners can progress to advanced level networking subjects at SCQF level 9 and beyond.

Unit outcomes

Learners who complete this unit can:

1   design a network infrastructure
2   implement a network infrastructure
3   troubleshoot a network infrastructure
4   secure a network infrastructure
5   maintain a network infrastructure

Evidence requirements

Learners must provide both knowledge and product evidence.

Knowledge evidence

Learners should produce evidence in the form of a theoretical assessment that demonstrates their overall subject-based knowledge. They can do this periodically or on an ongoing basis, throughout the life of the unit (on a per-outcome basis), or in one final assessment at the end of the unit. If you test learners, it must be under controlled, timed and closed-book conditions.

Product evidence

This evidence demonstrates practical skills. Learners can design and develop a network from a given scenario. This should include:

♦   network design
♦   network topologies:
    — including considerations for security such as a demilitarised zone (DMZ)
♦   media and/or cabling to be used as part of the network:
    — cables/patch panels/wireless technology
♦   installation and configuration of networking devices:
    — configuration of routers, switches and access points
♦   installation and configuration of network hosts and nodes:
    — client and server operating systems
    — appropriate users, groups and permissions
♦   IP addressing schemes:
    — IPv6
    — subnetted class C addressing scheme
♦   configuration of network services:
    — logon, Dynamic Host Configuration Protocol (DHCP), email, Web, printing
♦   network security features:
    — dedicated devices (firewall)
    — host security (firewall and/or antivirus)
♦   network testing and troubleshooting
♦   network maintenance

Learners can develop evidence over time, throughout the life of the unit and under lightly controlled conditions. They can have access to books and reference materials.

They can record their progress and document their network using digital means, for example an e-portfolio or blog. Any work recorded electronically must collectively satisfy the evidence requirements.

You must ensure that any evidence produced is the learner's own work and that they reference any additional sources of information they use.

Knowledge and skills

The following table shows the knowledge and skills covered by the unit outcomes:

Knowledge	Skills
Learners should understand:	Learners can:
♦ network topologies: — physical — logical — secure zones, for example DMZ ♦ operating systems: — client — server — mobile devices (BYOD) — embedded (IoT) — users and groups — permissions ♦ IP addressing: — IPv4 (subnetted) — IPv6 ♦ network services: — Web — email — printing — file sharing — login services — DHCP ♦ network hardware: — access points — switches — routers — firewalls ♦ network media: — wired — wireless	♦ design a computer network ♦ develop a network topology: — logical topology — physical topology ♦ develop a secure topology: — DMZ ♦ design and implement an addressing scheme: — IPv4 (subnetted) — IPv6 ♦ develop a cabling scheme: — cables and patch panels ♦ install and configure network hardware: — routers/switches/access points ♦ implement wireless technology: — encryption ♦ install and configure operating systems: — systems administration — implementing users, groups and permissions ♦ implement secure network services: — logon services — DHCP — file services — printing — email — Web (HTTPS) ♦ implement a secure network: — DMZ and access control — firewall — host security ♦ troubleshoot a network ♦ test a network ♦ maintain a network: — remote access ♦ develop network documentation

Knowledge	Skills
Learners should understand: ♦ network security — client security — mobile device security — server security — intrusion detection and prevention — wireless encryption — access control ♦ network maintenance — remote access — network monitoring — testing — documentation	

Meta-skills

Throughout the unit, learners develop meta-skills to enhance their employability in the computing sector.

Self-management

These meta-skills include:

♦ focusing: sorting, attention, filtering
♦ integrity: ethics
♦ adapting: self-learning, critical reflection
♦ initiative: self-motivation, independent thinking, enterprising

Social intelligence

These meta-skills include:

♦ communicating: receiving information, giving information, listening
♦ collaborating: teamworking and collaboration
♦ leading: motivating others, inspiring others

Innovation

These meta-skills include:

♦ curiosity: observing, questioning, information sourcing, problem recognition
♦ creativity: visualising
♦ sense-making: holistic thinking, pattern recognition, analysis
♦ critical thinking: deconstruction, logical thinking, computational thinking

Literacies

Throughout this unit, learners have opportunities for the development of literacies.

Numeracy

Numeracy is developed through several areas of knowledge and skills, such as working with number systems, performing decimal, binary and hexadecimal calculations and IP addressing, subnetting and network arithmetic.

Communication

Communication is developed through several areas of knowledge and skills, such as word processing, communication and collaboration, report writing and presentation.

Digital

This unit contributes significantly towards learners' digital skills.

Delivery of unit

This unit can be done on its own or as part of a group award. It can be a basis for progression to more advanced networking topics in the HND in Networking and Infrastructure. This unit provides better understanding of the range of components and services within the wider perspective of a network infrastructure, as well as their practical implementation.

You should deliver this unit sequentially, given the nature of systems development. Take care not to concentrate solely on networking topics, as there is scope for delivery of these topics within other units in the HND in Networking and Infrastructure award. Give learners the opportunity to examine additional and overall features of a network infrastructure, such as:

♦ client and server technologies
♦ operating systems
♦ network services
♦ management of users and groups
♦ fundamentals of managing an infrastructure
♦ security

We suggest the following distribution of time:

Outcome 1 — Design a network infrastructure
(20 hours)
Outcome 2 — Implement a network infrastructure
(50 hours)
Outcome 3 — Troubleshoot a network infrastructure
(15 hours)
Outcome 3 — Secure a network infrastructure
(20 hours)
Outcome 4 — Maintain a network infrastructure
(15 hours)

During this unit you can introduce learners to a variety of software for drawing network design scenarios. For example, if networking lab facilities are available, you should give demonstrations to reinforce key concepts, and allow them to become accustomed to working with physical equipment.

Learners can employ virtualisation methods and/or network simulation to implement network scenarios. Additionally, learners can describe how they would complete any tasks that cannot be completed on physical equipment or within a virtual/simulated environment.

Additional guidance

The guidance in this section is not mandatory.

Design a network infrastructure (outcome 1)

You should start with planning and designing a secure network. For example the examination of types of topologies, and how they can impact on the performance and management of a computer network. You should also consider approaches to the creation of secure zones, such as a DMZ.

When an appropriate topology has been chosen, you can decide what devices to include, such as cabling, wireless, PCs, servers, network devices, and consider more contemporary approaches such as Bring Your Own Device (BYOD) and Internet of Things (IoT). This allows learners to form a logical topology design. When identifying devices and media for the network, learners should plan for the installation of operating systems, user and group structures and IP address schemes. They should consider the conservation of IP addresses with the design of a subnetted addressing scheme.

Implement a network infrastructure (outcome 2)

When learners have produced a logical topology, it should form the basis for a physical network topology. Ideally, they should produce this as part of a floorplan, depending on the requirements of the project or scenario. This should match the logical diagram in terms of nodes, network devices, cabling, addressing schemes and security features.

At this stage, learners should implement it as part of the network infrastructure. They must implement appropriate configurations on network devices, such as routing protocols and switching functionality. Installation of client and server operating systems (as well as additional devices such as mobile/BYOD and IoT) should also take place at this stage. Learners should add system users along with an appropriate group structure and a minimum of four network services, two of which must contain login services (via a centralised authentication or authorisation service such as a domain controller) and DHCP.

Troubleshoot a network infrastructure (outcome 3)

When learners have developed the network infrastructure, they must troubleshoot it to ensure viable operation of the system. Troubleshooting can be done incrementally as the system is being developed (as and when needed) and can also take place once the whole system has been implemented. Learners must log network and device configurations throughout the development of the system. You can introduce faults into the system to test troubleshooting skills.

Secure a network infrastructure (outcome 4)

When installation and troubleshooting of the network is complete, learners should take steps to ensure the security of the network. This can include installing and configuring dedicated network devices, a firewall and antivirus software onto end-user devices. Learners should implement a permissions scheme for users and groups on the system. They should configure wireless authentication (including appropriate encryption methods) for any wireless networks that they have implemented and introduce access control into portions of the network in the form of a DMZ.

Maintain a network infrastructure (outcome 5)

You should ensure that learners develop an appropriate strategy for maintenance of the network infrastructure. This should include testing various aspects of the network, such as end-to-end communication between nodes on the network and testing of any services that are in use, as well as authentication mechanisms and security features that have been introduced. Learners should log all testing and maintenance as part of their network documentation. They should introduce secure remote login features to allow remote administration of the system.

Assessment guidance

The knowledge-based assessment could be a multiple-choice assessment, with 50 questions covering all aspects of the unit. This should have a pass mark of 60 per cent (30 correct answers out of 50 questions) and should be closed-book, under timed exam conditions. You can do this in stages throughout the unit (at the end of each outcome) or as one final test at the end of the unit.

The product-based assessment should test practical skills and be based on a case study or scenario for the development of a secure network infrastructure. The product could be a report of no more than 1500 words, covering the development of the network (and all outcomes). The report should consist of network design diagrams, an implementation log or configuration checklist, and user, group and permission structure and testing strategy or logs, which learners should present as a network solution document.

You can ask learners to verify their work to ensure that it is their own and they must reference any additional sources of information they use.

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 should take into account the needs of individual learners when planning learning experiences, selecting assessment methods or considering alternative evidence.

Guidance on assessment arrangements for disabled learners and/or those with additional support needs is available on the assessment arrangements web page: www.sqa.org.uk/assessmentarrangements.

Information for learners

Network Infrastructure (SCQF level 8)

This section 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

This unit introduces you to the elements that comprise the planning and implementation of a secure network infrastructure environment. You use appropriate methods to plan logical and physical network topologies and identify the types of operating systems, network hardware and services likely to be within a network infrastructure. You plan appropriate network addressing schemes and physical aspects, such as cabling and placement of servers and users, groups and permissions and then consider the management and security of a network infrastructure.

Opportunities exist in this unit for you to use a range of networking-related hardware and software in combination with networking terminology. This can help to reinforce your core understanding of the implementation of a network infrastructure in the context of the wider IT infrastructure.

You can be assessed in two different ways:

1 Knowledge-based assessment — through multiple-choice questions.
2 Product-based assessment — using a practical assessment, where you have the opportunity to design, develop, secure and maintain a network infrastructure.

You also develop a range of additional meta-skills to prepare you for the workplace. these include:

♦ self-management: attention, self-learning, critical reflection, independent thinking
♦ social intelligence: listening, teamworking and collaboration, motivating others
♦ innovation: visualising, holistic thinking, analysis, logical thinking, computational thinking

Once you have completed this unit, you can progress to other HND networking-related units, such as Networking and Infrastructure, and networking-related subjects at SCQF level 9 and beyond, as well as vendor-related networking qualifications.

Administrative information

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Superclass: CB

History of changes

Version	Description of change	Date

Note: please check SQA's website to ensure you are using the most up-to-date version of this document.