

## **SQA Advanced Unit specification: general information**

**Unit title:** Computer Networking: Fundamentals

**Unit code:** HR87 47

**Superclass:** CB

**Publication date:** August 2017

**Source:** Scottish Qualifications Authority

**Version:** 01

### **Unit purpose**

This Unit is designed to introduce candidates to the basic components of contemporary local area networks (LANs) and wide area networks (WANs) and give an overview of their underlying technologies.

The Unit is intended for candidates undertaking an SQA Advanced Certificate/SQA Advanced Diploma in Computing or a related SQA Advanced Diploma in the Computing framework.

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

- 1 Describe the elements and characteristics of contemporary computer networks.
- 2 Describe the OSI model and the TCP/IP protocol suite.
- 3 Describe a range of WAN technologies.

### **Recommended prior knowledge and skills**

Access to this Unit will be at the discretion of the centre. There are no specific requirements.

### **Credit points and level**

1 SQA Credit at SCQF level 7: (8 SCQF credit points at SCQF level 7\*)

*\*SCQF credit points are used to allocate credit to qualifications in the Scottish Credit and Qualifications Framework (SCQF). Each qualification in the Framework is allocated a number of SCQF credit points at an SCQF level. There are 12 SCQF levels, ranging from National 1 to Doctorates.*

## **SQA Advanced Unit Specification**

### **Core Skills**

Opportunities to develop aspects of Core Skills are highlighted in the Support Notes of 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.

## **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.

Please refer to *Knowledge and/or Skills for the Unit* and *Evidence Requirements for the Unit* after the Outcomes.

### **Outcome 1**

Describe the elements and characteristics of contemporary computer networks.

#### **Knowledge and/or Skills**

- ◆ Describe the four basic elements of a network
- ◆ Describe the four fundamental characteristics of a contemporary computer network
- ◆ Identify and describe the function of a range of network infrastructure devices
- ◆ Describe the three main types of media used in networks and their characteristics

### **Outcome 2**

Describe the OSI model and the TCP/IP protocol suite.

#### **Knowledge and/or Skills**

- ◆ Describe the seven layered OSI model and the PDU encapsulation process
- ◆ Identify and describe the fundamental protocols from the TCP/IP protocol suite
- ◆ Identify and address resolution methods including DNS and ARP
- ◆ Describe IPv4 addressing including public and private class ranges, and unicast and broadcast addressing and the requirement for subnet masking

### **Outcome 3**

Describe a range of WAN technologies.

#### **Knowledge and/or Skills**

- ◆ Describe WAN physical layer terminology and devices including DCE/DTE, CO(central office), CPE (customer premises equipment), local loop, demarcation point, CSU/DSU, WAN switch, router, V35, X21, EIA/TIA-612/613
- ◆ Describe circuit switched and packet switched networks
- ◆ Describe WAN link connection options including leased lines, ISDN & PSTN, Frame Relay & X25 & ATM, DSL & cable modem
- ◆ Describe the requirements for VPN technology for remote access over the internet

## SQA Advanced Unit Specification

### Evidence Requirements for the Unit

The assessment for the Knowledge and understanding component of the Unit must be undertaken at the end of the Unit. Candidates' capabilities will be examined by 50 multiple-choice/multiple-response questions with appropriate sampling of the complete Unit content. The sample must cover **all** Outcomes with a suitable selection of at least 50% of the Knowledge and Skills points listed for each of the Outcomes.

The assessment must be undertaken in a closed-book environment where candidates have no access to the internet, books, handouts, notes or other learning material. Testing can be done in either a machine-based or paper-based format and must be invigilated. There must be no communication between candidates and communication with the invigilator must be restricted to matters relating to the administration of the test. The time allowed will be 1 hour 40 minutes.

The questions presented must significantly change on **each** assessment occasion.

Candidates must answer at least 60% of the questions correctly in order to obtain a pass.

### Unit specification: support notes

**Unit title:** Computer Networking: Fundamentals

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 40 hours.

### Guidance on the content and context for this Unit

The suggested time allocation for each Outcome (including assessment) is as follows:

Outcome 1 — 10 hours  
Outcome 2 — 20 hours  
Outcome 3 — 10 hours

As it is likely that the bulk of the material in this Unit will be delivered through lecturer exposition, it is important that every opportunity is taken to introduce real-world examples, opportunities for whole-class and group discussion and practical demonstrations wherever possible. Concepts and terminology should be presented in context throughout the Unit.

Candidates should be strongly encouraged to undertake further reading and opportunities for individual or group research should be provided.

Outcome 1 covers the basic components of local area networks and their characteristics:

- 1 Candidates should be aware of basic network elements such as protocols and the rules which govern their operation (for example the difference between connection oriented and connectionless).
- 2 The various types of media used to connect network devices (copper, fibre and wireless) should be discussed together with their characteristics.
- 3 Typical applications and data content generated by them for transmission over networks should be explored (data, voice, video).
- 4 Typical intermediary network devices (switches, routers, access points, firewalls) and end devices (printers, clients, servers, IP phones) should be described.
- 5 Network characteristics such as fault tolerance, scalability, quality of service and security should be discussed in relation to network availability, converged services (voice/video), and device and information security.

Outcome 2 covers the traditional discussion of the OSI model and the TCP/IP protocol suite.

The OSI model should be discussed in terms of the function of each layer and the encapsulation/decapsulation process and the function and placement of networking devices within the appropriate OSI layer.

The TCP/IP family of protocols should be introduced as the de facto protocol standard. Candidates should be familiarised with the common protocols and their basic function including the use of port numbers at transport layer.

## **SQA Advanced Unit Specification**

Outcome 3 is an overview of contemporary WAN technologies.

Candidates should be introduced to the basic types of WAN technologies such as leased lines, traditionally favoured by large enterprises, to more recent IP VPNs and MPLS technologies for secure and relatively low cost WAN connectivity.

### **Guidance on the delivery of this Unit**

This Unit will probably be delivered as part of an SQA Advanced Certificate in Computing Group Award. It is recommended that the Unit is scheduled after delivery of core Units such as HP1T 47 *Computer Systems: Fundamentals* and HP1V 47 *Troubleshooting Computer Problems*.

### **Guidance on the assessment of this Unit**

#### **Assessment Guidelines**

It is recommended the Unit is assessed by a single instrument of assessment: a multiple-choice/multiple-response test covering the knowledge and understanding of the Unit as a whole.

The questions applicable to each Outcome should be used in a single end of Unit test comprising a total of fifty questions. Centres cannot deviate from this where they choose to devise their own instruments of assessment. A sample of 50% of knowledge areas should be examinable in any test set.

### **Online and Distance Learning**

The theoretical nature of this Unit should lend itself to online and distance learning methods.

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.

### **Opportunities for the use of 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 candidate evidence and that conditions of assessment as specified in the Evidence Requirements are met, regardless of the mode of gathering evidence. Further advice is available in *SQA Guidelines on Online Assessment for Further Education (AA1641, March 2003)*.

### **Opportunities for developing Core Skills**

There are no opportunities to develop Core Skills in this Unit.

### Equality and inclusion

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

Further advice can be found on our website [www.sqa.org.uk/assessmentarrangements](http://www.sqa.org.uk/assessmentarrangements).

## History of changes to Unit

Version	Description of change	Date

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SQA acknowledges the valuable contribution that Scotland's colleges have made to the development of SQA Advanced Qualifications.

**FURTHER INFORMATION:** Call SQA's Customer Contact Centre on 44 (0) 141 500 5030 or 0345 279 1000. Alternatively, complete our [Centre Feedback Form](#).

### General information for candidates

#### Unit title: **Computer Networking: Fundamentals**

This is single credit Unit at SCQF level 7 and is designed to introduce you to the basic concepts of LAN and WAN technology. This Unit is intended for candidates undertaking an SQA Advanced Certificate in Computing or related area who require an introductory level knowledge of these technologies.

On completion of this Unit you should be able to:

- ◆ describe the elements and characteristics of contemporary computer networks.
- ◆ describe the OSI model and the TCP/IP protocol suite.
- ◆ describe a range of WAN technologies.

The first Outcome describes the four basic elements of a network, namely: Rules, Medium, Messages and Devices. These concepts will be expanded upon to describe their relevance to contemporary computer networks in relation to how they are connected, which type of internetworking devices are contained in them and what key characteristics they require to possess such as scalability and quality of service.

The second Outcome introduces a long-standing model, the OSI model, for describing network protocols. This will be further developed when explained in relation to a suite of implemented protocols, namely the de facto industry standard TCP/IP protocol suite.

The third Outcome introduces wide area networks (WAN). WAN technology is used to link LANs and there are a variety of ways in which this can be done. This Outcome describes the range of technologies available and describes their basic characteristics.

This Unit will be assessed by an end of Unit closed-book 50 question multiple-choice/multiple-response test paper. The assessment will last for 1 hour and 40 minutes and you must achieve at least a 60% score to pass the assessment.