SQA Advanced Unit Specification

General information for centres

Unit title: Network Infrastructure 1: Implementation and Management

Unit code: HT0P 48

Unit purpose: This Unit is designed to introduce candidates to the issues involved in implementing and managing a network infrastructure. It is intended for candidates undertaking an SQA Advanced Certificate or SQA Advanced Diploma in Computing, Computer Networking or a related area who require a detailed knowledge of network infrastructure.

On completion of the Unit candidates should be able to:

1. Implement, manage and maintain IP addressing.
2. Implement, manage and maintain name resolution.
3. Implement, manage and maintain network security.
4. Implement, manage and maintain remote access.
5. Maintain a network infrastructure.

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

**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.*

Recommended prior knowledge and skills: Access to this Unit will be at the discretion of the Centre. There are no specific requirements but candidates would benefit from knowledge of personal computers and computer networks. This may be demonstrated by the possession of SQA Units such as HT0E 46 Operating System Concepts, HR8G 47 Network Concepts and HP2W 48 Network Server Operating System.

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: This Unit is included in the framework of a number of SQA Advanced Certificate and SQA Advanced Diploma group awards. It is recommended that it should be taught and assessed within the context of the particular group award to which it contributes.

Assessment: Evidence for the knowledge and/or skills for the entire Unit must be produced using a set of 50 restricted-response questions to assess candidates' knowledge and understanding. This may be administered as a single end-of unit test, or as several subtests, each covering one or more outcomes.

Candidates must answer at least 70% of the questions correctly in order to obtain a pass. If subtests are used, they must also score at least 70% in each subtest.

Testing must take place in a closed-book environment where candidates have no access to books, handouts, notes or other learning material. Testing can be done in either a machine-based or paper-based format and must be invigilated by a tutor or mentor. There must be no communication between candidates and communication with the administrator must be restricted to matters relating to the administration of the test.

If a candidate requires to be reassessed, a different selection of questions must be used. At least half the questions in the reassessment must be different from those used in the original test.

If an outcome has a practical component, this must be assessed by having the candidate use a logbook to record the practical tasks successfully completed. The logbook can be in paper or electronic form and must be authenticated by the tutor or mentor.

For some outcomes only a sample of the practical tasks needs to be completed and recorded for assessment purposes, e.g. three out of five. This is clearly indicated in the logbook instructions for the outcomes involved. Where this occurs, tutors must inform candidates of the tasks to be completed.

An Assessment Exemplar and Guidelines on the Delivery of the Unit have been produced to indicate the national standard of achievement required at SCQF level 8.

SQA Advanced 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 Outcomes 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

Implement, manage and maintain IP addressing.

Knowledge and/or skills

Configure TCP/IP addressing on a server computer.
Manage DHCP.
Troubleshoot TCP/IP addressing.
Troubleshoot DHCP.

Evidence requirements

Restricted response test

The knowledge and skills component of Outcome 1 must be examined by twelve questions, three derived from each of the four items listed below. Each question must be derived from a single item.

- Configure TCP/IP addressing on a server computer.

  Manual, automatic and dynamic configuration.

- Manage DHCP.

  Clients and leases, DHCP Relay Agent, manage DHCP databases, DHCP scope options, reservations and reserved clients.

- Troubleshoot TCP/IP addressing.

  Diagnose and resolve issues related to Automatic Private IP Addressing (APIPA) and incorrect TCP/IP configuration.

- Troubleshoot DHCP.

  Diagnose and resolve issues related to DHCP authorization; verify DHCP reservation configuration, examine the system event log and DHCP server audit log files.

The test may be administered on its own as a subtest or be combined with other outcome subtests in the Unit.

Alternatively, the 12 questions for this outcome may contribute towards a single end-of-unit test of 50 questions.

Logbook

The logbook for Outcome 1 must record successful completion by the candidate of **at least two** of the four tasks listed below. The tasks to be completed must be selected by the tutor.

Configure TCP/IP addressing on a server computer.

A record of the steps taken by the candidate to configure TCP/IP addressing on a server computer using a private addressing scheme with network address translation.

Manage DHCP.

A record of the steps taken by the candidate to manage DHCP, including at least two of the following: creating scopes, setting up a DHCP relay agent, setting up reservations, backing up and restoring the DHCP database.

Troubleshoot TCP/IP addressing.

A record of the steps taken by the candidate to diagnose and resolve at least two TCP/IP addressing problems.

Troubleshoot DHCP.

A record of the steps taken by the candidate to diagnose and resolve at least two DHCP problems.

Assessment guidelines

It is suggested that all the above concepts be presented and explained within the context of current real-world practice and applications.

The suggested time allocation for a restricted response test is 2 minutes for each question plus 5 minutes starting-up time and 5 minutes finishing-off time, thus a total of 110 minutes should be allocated for a 50-question end-of-unit test.

Although individual outcome tests are permissible, it is suggested that if subtests are to be used, outcomes should be combined to produce tests of no fewer than 10 questions. A 10-question test would therefore have a time allocation of 30 minutes.

Outcome 2

Implement, manage and maintain name resolution

Knowledge and/or skills

Install and configure the DNS Server service.
Manage DNS.
Monitor DNS.

Evidence requirements

Restricted response test

The knowledge and skills component of Outcome 2 must be examined by nine questions, three derived from each of the three items listed below. Each question must be derived from a single item.

Install and configure the DNS Server service.

Configure DNS server options, DNS zone options, DNS forwarding.

Manage DNS.

Manage DNS zone settings, DNS record settings, DNS server options.

Monitor DNS.

Use system tools.

The test may be administered on its own as a subtest or be combined with other outcome subtests in the Unit.

Alternatively, the 9 questions for this outcome may contribute towards a single end-of-unit test of 50 questions.

Logbook

The logbook for Outcome 2 must record successful completion by the candidate of **at least two** of the three tasks listed below. The tasks to be completed must be selected by the tutor.

Install and configure the DNS Server service.

A record of the steps taken by the candidate to configure DNS server options, DNS zone options and DNS forwarding.

Manage DNS.

A record of the steps taken by the candidate to manage DNS zone settings, DNS record settings and DNS server options.

Monitor DNS.

A record of the steps taken by the candidate to monitor DNS by using appropriate system tools.

Assessment guidelines

It is suggested that all the above concepts be presented and explained within the context of current real-world practice and applications.

The suggested time allocation for a restricted response test is 2 minutes for each question plus 5 minutes starting-up time and 5 minutes finishing-off time, thus a total of 110 minutes should be allocated for a 50-question end-of-unit test.

Although individual outcome tests are permissible, it is suggested that if subtests are to be used, outcomes should be combined to produce tests of no fewer than 10 questions. A 10-question test would therefore have a time allocation of 30 minutes.

Outcome 3

Implement, manage and maintain network security

Knowledge and/or skills

Implement secure network administration procedures.
Monitor and troubleshoot network protocol security.

Evidence requirements

The knowledge and skills component of Outcome 3 must be examined by six questions, three derived from each of the two items listed below. Each question must be derived from a single item.

Implement secure network administration procedures.

Implement security baseline settings and audit security settings by using security templates; implement the principle of least privilege.

Monitor and troubleshoot network protocol security.

Use system tools.

The test may be administered on its own as a subtest or be combined with other outcome subtests in the Unit.

Alternatively, the 6 questions for this outcome may contribute towards a single end-of-unit test of 50 questions.

Logbook

The logbook for Outcome 3 must record successful completion by the candidate of **at least one** of the two tasks listed below. The tasks to be completed must be selected by the tutor.

Implement secure network administration procedures.

A record of the steps carried out by the candidate to implement security baseline settings and audit security settings by using security templates and to implement the principle of least privilege.

Monitor and troubleshoot network protocol security.

A record of the steps carried out by the candidate to monitor and troubleshoot network protocol security by using appropriate system tools.

Assessment guidelines

It is suggested that all the above concepts be presented and explained within the context of current real-world practice and applications.

The suggested time allocation for a restricted response test is 2 minutes for each question plus 5 minutes starting-up time and 5 minutes finishing-off time, thus a total of 110 minutes should be allocated for a 50-question end-of-unit test.

Although individual outcome tests are permissible, it is suggested that if subtests are to be used, outcomes should be combined to produce tests of no fewer than 10 questions. A 10-question test would therefore have a time allocation of 30 minutes.

Outcome 4

Implement, manage and maintain remote access

Knowledge and/or skills

Configure remote access user authentication.
Manage remote access.
Manage TCP/IP routing.
Implement secure access between private networks.
Troubleshoot remote access routing.

Evidence requirements

Restricted response test

The knowledge and skills component of Outcome 4 must be examined by fourteen questions, three derived from four of the five items listed below and two from the remaining item. Each question must be derived from a single item.

Configure remote access user authentication.

Configure remote access authentication protocols; provide authentication for remote access clients; configure remote access policies to permit or deny access.

Manage remote access

Manage packet filters, remote access routing interfaces, devices and ports, routing protocols, remote access clients.

Manage TCP/IP routing.

Manage routing protocols, routing tables, routing ports.

Implement secure access between private networks.

Troubleshoot user access to remote access services; diagnose and resolve issues related to remote access VPNs and establishing a remote access connection.

Troubleshoot remote access routing.

Troubleshoot demand-dial routing, router-to-router VPNs.

The test may be administered on its own as a subtest or be combined with other outcome subtests in the Unit.

Alternatively, the 14 questions for this outcome may contribute towards a single end-of-unit test of 50 questions.

Logbook

The logbook for Outcome 4 must record successful completion by the candidate of **at least three** of the five tasks listed below. The tasks to be completed must be selected by the tutor.

Configure remote access user authentication.

A record of the steps taken by the candidate to configure remote access authentication protocols to provide authentication for remote access clients and configure remote access policies to permit or deny access.

Manage remote access.

A record of the steps taken by the candidate to manage remote access, including at least two of the following: packet filters, remote access routing interfaces, devices and ports, routing protocols, remote access clients.

Manage TCP/IP routing.

A record of the steps taken by the candidate to manage routing protocols, routing tables and routing ports.

Implement secure access between private networks.

A record of the steps taken by the candidate to troubleshoot user access to remote access services and diagnose and resolve issues related to remote access VPNs and establishing a remote access connection.

Troubleshoot remote access routing.

A record of the steps taken by the candidate to troubleshoot **either** demand-dial routing **or** router-to-router VPNs.

Assessment guidelines

It is suggested that all the above concepts be presented and explained within the context of current real-world practice and applications.

The suggested time allocation for a restricted response test is 2 minutes for each question plus 5 minutes starting-up time and 5 minutes finishing-off time, thus a total of 110 minutes should be allocated for a 50-question end-of-unit test.

Although individual outcome tests are permissible, it is suggested that if subtests are to be used, outcomes should be combined to produce tests of no fewer than 10 questions. A 10-question test would therefore have a time allocation of 30 minutes.

Outcome 5

Maintain a network infrastructure.

Knowledge and/or skills

Monitor network traffic
Troubleshoot connectivity to the Internet.
Troubleshoot server services.

Evidence requirements

Restricted response questions

The knowledge and skills component of Outcome 5 must be examined by nine questions, three derived from each of the three items listed below. Each question must be derived from a single item.

Monitor network traffic

Use system tools.

Troubleshoot connectivity to the Internet.

Troubleshoot server services.

Diagnose and resolve issues related to service dependency; use service recovery options to diagnose and resolve service-related issues.

The test may be administered on its own as a subtest or be combined with other outcome subtests in the Unit.

Alternatively, the 9 questions for this outcome may contribute towards a single end-of-unit test of 50 questions.

Logbook

The logbook for Outcome 5 must record successful completion by the candidate of **at least two** of the three tasks listed below. The tasks to be completed must be selected by the tutor.

Monitor network traffic.

A record of the steps taken by the candidate to monitor network traffic by using appropriate system tools.

Troubleshoot connectivity to the Internet.

A record of the steps taken by the candidate to troubleshoot connectivity to the Internet arising from private network or DHCP allocator problems.

Troubleshoot server services.

A record of the candidate's use of service recovery options to diagnose and resolve service-related issues.

Assessment guidelines

It is suggested that all the above concepts be presented and explained within the context of current real-world practice and applications.

The suggested time allocation for a restricted response test is 2 minutes for each question plus 5 minutes starting-up time and 5 minutes finishing-off time, thus a total of 110 minutes should be allocated for a 50-question end-of-unit test.

Although individual outcome tests are permissible, it is suggested that if subtests are to be used, outcomes should be combined to produce tests of no fewer than 10 questions. A 10-question test would therefore have a time allocation of 30 minutes.

Administrative Information

Unit code:	HT0P 48
Unit title:	Network Infrastructure 1: Implementation and Management
Superclass category:	CB
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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.

SQA Advanced Unit specification: support notes

Unit title: Network Infrastructure 1: Implementation and Management

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.

The recommended time allocations for each outcome (including assessment) are as follows:

Outcome 1: 20 hours
Outcome 2: 16 hours
Outcome 3: 12 hours
Outcome 4: 20 hours
Outcome 5: 12 hours

Guidance on the content and context for this Unit

During the delivery of this unit 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. Video presentations should be used where appropriate for providing an alternative explanation of a difficult topic, or as a focus for class discussion or group work.

Given the theoretical nature of this Unit, it is intended that a significant amount of time will be made available as a central part of the course for revision, tutorials and formative assessment exercises. Candidates should be strongly encouraged to undertake further reading, and opportunities for individual or group research should be provided.

The most important overall emphasis should be on the relevance and currency of content in such a rapidly-evolving field.

The following notes assume that the unit will be delivered using a Microsoft operating system. However, no restriction is placed on the operating system to be used and centres are free to choose alternative operating systems such as Linux/Unix.

This Unit may assist candidates in preparing for Microsoft examinations. Vendor certifications can change rapidly and candidates should be encouraged the check the current details at **www.microsoft.com/traincert** to ensure that all objectives have been covered. This examination contributes towards the Microsoft Certified Systems Administrator (MCSA) and Microsoft Certified Systems Engineer (MCSE) awards. The content of this unit may be delivered using relevant vendor-supplied materials, such as Microsoft Official Curriculum (MOC). As these materials are under continuous development, centres should check carefully to ensure that such materials meet all the requirements for the unit. If MOC materials are used, some of the practical tasks may contribute towards the assessment requirements for the unit.

Outcome 1: Implement, manage and maintain IP addressing

1 Configure TCP/IP addressing on a server computer

The candidate should be aware of Static IP addressing, obtaining an IP address automatically, and alternate configuration.

2 Manage DHCP

The candidate should be familiar with role of DHCP in network infrastructure, adding and authorising a DHCP server; clients and leases, DHCP Relay Agent; managing DHCP databases, DHCP scope options, reservations and reserved clients.

3 Troubleshoot TCP/IP addressing

The candidate should be able to diagnose and resolve issues related to Automatic Private IP Addressing (APIPA) and incorrect TCP/IP configuration.

4 Troubleshoot DHCP

The candidate should be able to diagnose and resolve issues related to DHCP authorization; verify DHCP reservation configuration, examine the system event log and DHCP server audit log files to find related events, diagnose and resolve issues related to configuration of DHCP server and scope options; verify that the DHCP Relay Agent is working correctly and verify database integrity.

Outcome 2: Implement, manage and maintain name resolution

1 Install and configure the DNS Server service

The candidate should be familiar with the role of DNS in network infrastructure; installing DNS server; configuring properties for DNS server; configuring DNS zones and zone transfers, configuring DNS dynamic updates; configuring a DNS client and delegating authority for zones.

2 Manage DNS

The candidate should be able to configure Time-to-Live (TTL) value, ageing and scavenging; integrate DNS with WINS, test DNS server configuration and verify existence of resource records by using Nslookup, DNSCmd and DNSLint command line utilities.

3 Monitor DNS

The candidate should be able to monitor DNS using system tools such as System Monitor, Event Viewer, Replication Monitor and DNS debug logs.

Outcome 3: Implement, manage and maintain network security

1 Implement secure network administration procedures:

The candidate should be able to implement security baseline settings and audit security settings by using security templates (basic, secure, high secure, miscellaneous); implement the principle of least privilege.

2 Monitor and troubleshoot network protocol security

The candidate should be able to monitor and troubleshoot network protocol security using system tools such as IP Security Monitor MMC snap-in, Kerberos tools, Event Viewer and Network Monitor.

Outcome 4: Implement, manage and maintain remote access

1 Configure remote access user authentication

The candidate should be able to configure remote access authentication protocols (EAP, MS-CHAP, MS-CHAPV2, CHAP, SPAP, PAP, unauthenticated access); provide authentication for remote access clients; configure remote access policies to permit or deny access.

2 Manage remote access

The candidate should be able to manage packet filters, remote access routing interfaces, devices and ports, routing protocols, remote access clients.

3 Manage TCP/IP routing

The candidate should be able to manage routing protocols, routing tables and routing ports.

4 Implement secure access between private networks

The candidate should be able to troubleshoot user access to remote access services; diagnose and resolve issues related to remote access VPNs and establishing a remote access connection; diagnose and resolve user access to resources beyond the remote access server.

5 Troubleshoot remote access routing

The candidate should be able to troubleshoot demand-dial routing, router-to-router VPNs.

Outcome 5: Maintain a Network Infrastructure

1 Monitor network traffic

The candidate should be able to monitor network traffic using system tools such as Network Monitor and System Monitor.

2 Troubleshoot connectivity to the Internet

The candidate should be able to troubleshoot connectivity to the Internet, including checking for faults and misconfigurations in private addressing schemes such as NAT (Network Address Translation) or ICS (Internet Connection Services).

3 Troubleshoot server services

The candidate should be able to diagnose and resolve issues related to service dependency and use service recovery options to diagnose and resolve service-related issues.

Guidance on the delivery and assessment of this Unit

This Unit is likely to form part of a group award which is primarily designed to provide candidates with technical or professional knowledge and skills related to a specific occupational area. It is highly technical in content and should not be adopted by group awards in other areas or delivered as a stand-alone Unit without careful consideration of its appropriateness.

It is a Unit which candidates are unlikely to find accessible at an introductory level; it is suggested that it be delivered only as part of an SQA Advanced Certificate/Diploma program in Computing or a related area. It should be delivered in tandem with other Computing Units and opportunities for teaching and assessment integration explored.

To minimise assessment overhead, one or more sets of restricted-response questions, totalling 50 questions in all, should be used to provide evidence of candidates' knowledge for all Outcomes. It is suggested that multiple-choice questions should be used as the preferred assessment method – as well as reducing the time required for assessment and marking, these reduce the need for candidates to memorise details and encourage understanding. 70% of the questions must be answered correctly to pass each assessment. Candidates must also complete a log book or checklist recording the practical work undertaken for each outcome.

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).

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.

General information for candidates

Unit title: Network Infrastructure 1: Implementation and Management

This is a 2-credit Unit at Level 8 intended for candidates undertaking a Computing or IT-related qualification who require an understanding of network infrastructure. It is designed to develop an understanding of the issues involved in managing a network infrastructure. On completion of the Unit you should be able to:

1. Implement, Manage and Maintain IP Addressing
2. Implement, Manage and Maintain Name Resolution
3. Implement, Manage and Maintain Network Security
4. Implement, Manage and Maintain Remote Access
5. Maintain a Network Infrastructure

In the first part of the course, you will study maintaining a network infrastructure, including monitoring network traffic, troubleshooting connectivity to the Internet and troubleshooting server services.

The second section covers implementing, managing and maintaining name resolution, including installing and configuring the DNS Server service, managing DNS and monitoring DNS.

The third section covers implementing, managing and maintaining network security, including implementing secure network administration procedures and monitoring and troubleshooting network protocol security.

The fourth section covers implementing, managing and maintaining remote access, including configuring remote access user authentication, managing remote access, managing TCP/IP routing, implementing secure access between private networks and troubleshooting remote access routing.

The final section covers maintaining a network infrastructure, including monitoring network traffic, troubleshooting connectivity to the Internet and troubleshooting server services.

There will be one or more closed-book restricted-response assessments covering all outcomes. You will be presented with a total of 50 questions and expected to answer 70% of these correctly. You will also be expected to keep a checklist or log book recording the practical tasks you have carried out during the Unit. You must satisfy the requirements for these assessments in order to achieve the Unit.

This Unit may assist you in preparing for Microsoft examinations. Vendor certifications can change rapidly, so you should check the current details at **www.microsoft.com/traincert** to ensure that all objectives have been covered. This examination contributes towards the Microsoft Certified Systems Administrator (MCSA) or Microsoft Certified Systems Engineer (MCSE) awards.