Next Generation Higher National Unit Specification

Cloud Computing (SCQF level 7)

Unit code: J68Y 47

SCQF level: 7 (16 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 non-specialist unit introduces learners to the principles and practice of cloud computing in a range of common usage scenarios. This unit develops learners' knowledge of what the cloud is and how it is used in the areas of networking, data storage, artificial intelligence (AI) and software development. Learners do not need any previous cloud knowledge, but they must have a general knowledge of computer operation.

This unit is primarily intended for learners who are doing an HNC in Computing, but it is also suitable for those with an interest in learning the basics of cloud computing. It may be appropriate for delivery within other group awards that require learners to have a foundational knowledge of the cloud

On completion of this unit, learners gain a good knowledge of how several cloud services could be used to solve a range of different problems. This helps progression into the Cloud Computing unit at SCQF level 8 or a more advanced study of cloud computing in one or more of its more specialist fields.

Unit outcomes

Learners who complete this unit can:

1 explain the organisation of modern cloud provision
2 use cloud services to build simple networks
3 use cloud services for data storage
4 use cloud services for AI
5 use cloud tools for software development

Evidence requirements

Learners must provide both knowledge and product evidence for this unit.

Knowledge evidence

Learners should produce the knowledge evidence for this unit without help. They must demonstrate that they have met all the knowledge points listed in the 'knowledge and skills' section.

Knowledge evidence can be written, oral or a combination of both. A minimum amount of evidence is required to show competence. When used, testing must be carried out under supervised conditions and controlled in terms of location and time. Learners are not permitted to access reference material under test conditions.

Product evidence

Product evidence must contain cloud configurations that include:

- configuration of a simple network infrastructure containing at least two virtual machines — only one of which is internet accessible
- configuration of a single relational or non-relational database containing a single table and results of some simple queries used to create and/or populate a table and select part of its content
- configuration of cloud-based object storage created by the learner, who should provide evidence that the object storage can be accessed for both read and write operations
- demonstration of the use of any two different AI cloud-based services, as well as one programming language environment
- configuration of any two separate cloud-based services in such a way that they complement one another

Product evidence may be produced over an extended period under lightly controlled conditions and with access to learning materials. Authentication is required when the evidence is produced under lightly controlled conditions.

The SCQF level of this unit provides additional context relating to the quality of evidence for both knowledge and product components.

Knowledge and skills

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

Knowledge	Skills
Learners should understand: ♦ cloud infrastructure components ♦ main cloud service types (IaaS, PaaS, SaaS, Serverless) ♦ cloud benefits and drawbacks ♦ cloud relational database configuration ♦ cloud non-relational database configuration ♦ object-based cloud storage concepts ♦ AI concepts ♦ cloud service pricing models ♦ cloud service interoperability	Learners can: ♦ configure a simple network infrastructure ♦ configure and correctly place multiple cloud-based servers within a network infrastructure ♦ configure cloud access control mechanisms ♦ configure cloud-based relational and NoSQL databases ♦ configure object-based storage ♦ configure security for data storage ♦ use cloud AI services for language translation ♦ use cloud AI services for speech-to-text translation ♦ use cloud AI services for text-to-speech translation ♦ use cloud AI services for text extraction ♦ use cloud AI services for photographic analysis ♦ use cloud programming services ♦ use complementary cloud services

Meta-skills

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

Self-management

Learners must select appropriate cloud services and focus on the configuration necessary to solve a given problem. You should encourage them to research alternative cloud providers' solutions to problems to gain a more rounded awareness of what is available, while adhering to the cost implications of those alternatives.

Social intelligence

Cloud computing offers natural opportunities for teamworking. An example of this is different learners developing separate parts of an infrastructure and connecting their configurations together to produce a solution.

Innovation

Learners become aware of the power cloud computing services offer over more traditional physical alternatives. They develop the ability to evaluate cloud solutions over traditional solutions and be aware of which one is best in different circumstances.

Literacies

Throughout this unit, learners have opportunities to develop their literacy skills.

Numeracy

Learners are required to understand cloud service costing calculations.

Communication

Learners have opportunities to work together in teams and create a unified solution from their individual efforts.

Digital

This unit contributes towards learners' digital skills.

Delivery of unit

This unit introduces learners to cloud services and does not rely on them having any previous knowledge or skills. You have opportunities to integrate this unit with database units and programming classes. You have the choice to use cloud services for these other units.

We suggest the following distribution of time:

Outcome 1 — Explain the organisation of modern cloud provision
(15 hours)
Outcome 2 — Use cloud services to build simple networks
(20 hours)
Outcome 3 — Use cloud services for data storage
(20 hours)
Outcome 4 — Use cloud services for AI
(10 hours)
Outcome 5 — Use cloud tools for software development
(15 hours)

Additional guidance

The guidance in this section is not mandatory.

Content and context for this unit

When delivering this unit, it is important that you introduce real-world examples of how cloud services can solve real-world problems. You should present concepts and terminology in a problem-solving context.

This unit is practical in nature, so a significant amount of time should be made available for tutorials and to allow a level distribution of the practical assessment component.

You should strongly encourage learners to do further reading of cloud service provider documents, and provide opportunities for individual or group research, particularly for the theoretical components. You should make learners aware that this unit teaches the basics but that each cloud service provides more advanced features, if required.

There are no restrictions on the cloud supplier you use, and you should introduce alternatives. If centres choose to use Amazon Web Services (AWS) Educate, learners can complete all outcomes in an AWS environment at no cost. You can use the Microsoft Azure service as an alternative.

This unit can help learners to prepare for vendor certifications such as AWS Cloud Practitioner. You can deliver the content of this unit using vendor-supplied materials. As these materials are under continuous development, you should check carefully to ensure that they meet all the unit requirements. If you use vendor materials, some of the tasks involved may contribute towards the practical assessments required for this unit.

We recommend that you deliver the unit outcomes in the following order.

Explain the organisation of modern cloud provision (outcome 1)

Learners should be familiar with what the cloud is on a physical level and how it evolved from earlier virtualisation technologies. You should develop this learning to include an understanding of both the physical and logical infrastructure of the cloud, and the ideas of hybrid and full cloud models. You should introduce learners to the cloud's various categories of services (PaaS, IaaS and Saas), as well as serverless categories, before discussing its benefits and shortcomings. You should also discuss costing models.

You should teach learners how to navigate a cloud service provider's interface and how to locate cloud service documents.

Use cloud services to build simple networks (outcome 2)

You should teach learners how to provision a variety of servers with different operating systems pre-installed on them. You should then teach them how to create networks that contain both public and private components, such as a bastion host configuration. Finally, learners should explore basic access controls.

If using AWS Educate, learners should be familiar with the underlying network infrastructure components such as Virtual Private Cloud, Subnets, Internet Gateways, Security Groups, NAT Gateways and Amazon Elastic Compute Cloud (Amazon EC2) instances, running both Linux and Amazon EC2 operating systems.

You should also teach learners how to calculate the costs of using the various networking components.

Use cloud services for data storage (outcome 3)

You should teach learners how to configure object storage on the cloud and how to secure access to keep it safe. You should discuss storage security encryption technologies and ways of securing data as it is uploaded and downloaded between the client and the storage service. You should discuss costing models.

Learners using AWS Educate should become familiar with the Amazon Simple Storage Service (Amazon S3) bucket concept as a basis for the data storage part of the unit. You should teach them how to organise storage into different folders as well as how to secure it both in transit and at rest.

You should teach learners provision of, and connection to, both relational and non-relational cloud database services and the basics of database queries to view and change database data.

If using AWS Educate, learners should become familiar with the Amazon Relational Database Service (Amazon RDS) and how it can provide relational database functionality to end users. They can use a variety of database vendor software as a learning platform for the query element.

The non-relational database platform could be Amazon DynamoDB, which provides a simple, NoSQL platform that is easy to configure and query.

You should teach learners how to calculate costs for both storage and database services.

Use cloud services for AI (outcome 4)

Learners should become familiar with the features of AI and learn to use some of the cloud services that provide it. Common examples may include, but are not limited to:

- speech-to-text translation
- text-to-speech translation
- language translation
- text extraction
- photographic analysis

If using AWS Educate, services include:

- Polly
- Translate
- Transcribe
- Textract
- Rekognition

You should teach learners how to calculate costs for the AI services you discuss.

Use cloud tools for software development (outcome 5)

Learners should become familiar with the cloud as a platform for software development. They should gain an appreciation of the methods it supports to allow the creation of simple programs.

If you use AWS Educate, the Cloud9 service can provide a variety of programming environments.

You should discuss costing models and teach learners how to calculate costs for software development services.

Use of multiple cloud services in conjunction with each other (outcomes 2, 3, 4 and 5)

It is important for learners to gain knowledge about how they can use cloud services individually and how to use different AWS together to enhance their power. You should teach this in the latter part of the course and give learners the opportunity to research related technologies for themselves.

The specific services depend on the cloud provider chosen, but common examples could include:

- accessing a storage space from within a virtual machine while keeping all traffic within the cloud network
- configuring a monitoring service to monitor cloud use and send logs to a separate storage area
- the creation of a WordPress site on an Amazon EC2 instance that links to a database on Amazon RDS

If you use AWS Educate, the Amazon EC2, Amazon RDS, Amazon S3 and AWS CloudTrail can all be used to achieve the previous examples.

You should teach learners how to calculate the costs incurred when using multiple services together.

Possible assessment evidence

Knowledge evidence

The knowledge evidence for the entire unit could be produced using a set of 20 multiple-choice questions to assess knowledge and understanding.

Testing could be done in either a machine-based or paper-based format and must be invigilated by a teacher or lecturer. There must be no communication between learners, and communication with the invigilator must be restricted to matters relating to the administration of the test.

Product evidence

The product evidence should be produced as specified in the evidence requirements.

Appropriate sample items (such as text or photographs) could be supplied for use in testing appropriate AI services. You could supply the learner with a simple program for testing of the programming environment.

The learner could maintain a portfolio for the product evidence. The portfolio would be produced over the life of the unit, with learners adding their best work as and when it is produced. This could be done under lightly controlled conditions, in which case authentication would be vital. For example, learner initials should appear as part of all configuration evidence, or learners could create a digital log to record their learning journey through the unit.

Alternatively, the practical assessments could be delivered holistically as, for example, part of a case study.

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

Cloud Computing (SCQF level 7)

This section explains:

- what this 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 principles and practice of cloud computing. It is a non-specialist unit, intended for learners with an interest in the area, but who have little or no previous knowledge. It is particularly suitable if you are doing an HNC in Computing. However, it may also be appropriate for other qualifications at SCQF level 7 that require a foundational knowledge of the cloud.

This unit covers the principles of what the cloud is, as well as its uses in a variety of networking, data storage, software development and basic artificial intelligence (AI) services. It is non-complex but it does provide a wide range of knowledge.

This unit contains a theoretical component, but it is mostly practical in nature. It places emphasis on teaching you how to use several services, including those which provide networking, data storage, database and AI solutions to real-world problems. On completion of this unit, you should have a basic understanding of a variety of cloud services and how to use them to solve a variety of problems.

Assessment can be a combination of a closed-book multiple-choice exam and practical assessments. The multiple-choice exam covers the underpinning theory of the services discussed, while the practical assessments give you the opportunity to perform several cloud-oriented tasks.

This unit also provides opportunities for you to enhance your meta-skills in self-management, social intelligence and innovation.

This unit is not aimed at specific cloud service providers or their examinations, but gives you part of the knowledge required to take any of the entry-level certifications they provide.

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.