



BCS EXIN Foundation Certificate in OpenStack Software Syllabus

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This qualification is not regulated by the following United Kingdom Regulators -
Ofqual, Qualification in Wales, CCEA or SQA

BCS EXIN Foundation Certificate in OpenStack Software

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Change History

Any changes made to the syllabus shall be clearly documented with a change history log. This shall include the latest version number, date of the amendment and changes made. The purpose is to identify quickly what changes have been made.

Version Number	Changes Made
Version 1.1 April 2017	New syllabus template, re-format and layout changes only. No Material Change to Content or Syllabus. K levels checked
Version 1.1 December 2016	Strapline regarding regulated statement has been added
Version 1.0 April 2016	Syllabus Created

Introduction

OpenStack Software is a free and open-source cloud computing software platform. The technology consists of a series of interrelated projects that controls pools of processing, storage and networking resources throughout a data centre.

Foundation Certificate in OpenStack Software requires knowledge about the fundamental concepts of OpenStack Software and an understanding of the architecture, design and deployment of OpenStack Software.

The candidate needs to have knowledge of Compute, Storage, Identity management, Networking and Support Services.

Objectives

Candidates should be able to demonstrate knowledge of the fundamental concepts of OpenStack and an understanding of the architecture, design and deployment of OpenStack.

Specific Learning Objectives

- Compute
- Storage
- Identity management
- Networking
- Support Services

Target Audience

Foundation Certificate in OpenStack Software is intended for everyone who wants to learn more about OpenStack software. This module is suitable for beginners in OpenStack technology as well as the ones who design or build OpenStack infrastructure.

The following roles could be interested in this module: Architects, Solution Designers, Technical Consultants, Technical pre-sales and Solution Consultants.

Course Format and Duration

Candidates can study for this certificate in two ways: by attending an accredited training course provided by Accredited Training Organisation or by self-study. An accredited training course will require a minimum of 21 hours of study run over a minimum of 3 days.

Eligibility for the Examination

There are no specific pre-requisites for entry to the examination; however training is strongly recommended and a basic understanding of Linux and Cloud Computing is recommended, as well as some practical experience with OpenStack.

Format of the Examination

The format for the examination is a one hour multiple-choice examination consisting of 40 questions. The examination is closed book (no materials can be taken into the examination room). The pass mark is 26/40 (65%).

Note: This exam is Juno-based.

Additional time

For candidates requiring reasonable adjustments

Please refer to the [reasonable adjustments policy](#) for detailed information on how and when to apply.

For candidates whose language is not the language of the examination

If the examination is taken in a language that is not the candidate's native/official language, candidates are entitled to:

- 25% extra time
- Use their own **paper** language dictionary (whose purpose is translation between the examination language and another national language) during the examination
Electronic versions of dictionaries will **not** be allowed into the examination room.

Guidelines for Accredited Training Organisations

Each major subject heading in this syllabus is assigned an allocated time. The purpose of this is two-fold: first, to give both guidance on the relative proportion of time to be allocated to each section of an accredited course and an approximate minimum time for the teaching of each section; second, to guide the proportion of questions in the exam. Accredited Training Organisations may spend more time than is indicated and candidates may spend more time again in reading and research. Courses do not have to follow the same order as

the syllabus. Courses may be run as a single module or broken down into two or three smaller modules.

This syllabus is structured into sections relating to major subject headings and numbered with a single digit section number. Each section is allocated a minimum contact time for presentation.

Accredited Training Organisations may include additional exercises where they believe these add value to the training course.

The syllabus contains references to established standards. The use of referenced standards in the preparation of training material is mandatory. Each standard used must be the version quoted in the current version of this syllabus.

Use of Calculators

No calculators or mobile technology are acceptable.

Syllabus

For each top-level area of the syllabus a percentage and K level is identified. The percentage is the exam coverage of that area, and the K level identifies the maximum level of knowledge that may be examined for that area.

1. What is OpenStack – (10%, K2, 2.1 hours)

1.1 The candidate understands the concept of Cloud computing (3%)

The candidate can:

- 1.1.1 Explain what Cloud computing is.
- 1.1.2 Compare the four main Deployment Models for Cloud computing (Private, Public, Community and Hybrid cloud).
- 1.1.3 Describe the three main Service Models for Cloud computing (SaaS, PaaS and IaaS).

1.2 The candidate understands various important characteristics of OpenStack (3%)

The candidate can:

- 1.2.1 Describe the licensing model of OpenStack.
- 1.2.2 Summarize the role of the OpenStack foundation.
- 1.2.3 Identify the Cloud services model provided by OpenStack.

1.3 The candidate understands the high-level architecture of OpenStack (4%)

The candidate can:

- 1.3.1 Identify the various parts of OpenStack.
- 1.3.2 Summarize the responsibilities of each service.
- 1.3.3 Identify inter-service operations.
- 1.3.4 Describe the networks used in an OpenStack implementation.

2. OpenStack Compute – (15%, K2, 3.15hours)

2.1 The candidate understands the role of the Nova service (3%)

The candidate can:

- 2.1.1 Describe the component parts of Nova.
- 2.1.2 Describe provisioning instances using Nova.
- 2.1.3 Explain the purpose of the Nova scheduler.

2.2 The candidate understands the operation of Nova (7%)

The candidate can:

- 2.2.1 Describe the use of virtual and bare metal instances.
- 2.2.2 Explain the effect of processes such as reboot, rebuild, resize etc.
- 2.2.3 Describe the use of Flavors.

2.2.4 Explain the effects of using images or volumes.

2.3 The candidate understands the networking options available to Nova (3%)

The candidate can:

2.3.1 Explain the three (3) network types of Nova networks.

2.3.2 Describe the limitations of Nova networking.

2.4 Bare metal provisioning with Ironic (2%)

The candidate can:

2.4.1 Describe the component parts of Ironic.

2.4.2 Explain the role of hardware drivers in Ironic.

3. OpenStack and Storage – (30%, K2, 6.3 hours)

3.1 The candidate knows how to work with images and Glance (6%)

The candidate can:

3.1.1 Describe the operation and functionality of Glance, the image service.

3.1.2 Describe the process of creating an image.

3.1.3 Explain security that can be applied in Glance.

3.1.4 Explain the concept of containers.

3.1.5 Describe Glance's use of back ends including Cinder and Swift.

3.2 The candidate understands how to work with volumes and Cinder (9%)

The candidate can:

3.2.1 Identify the key responsibilities of the Cinder service.

3.2.2 Describe the benefits of block storage.

3.2.3 Describe the architecture and extensibility of Cinder.

3.2.4 Identify the key use of volume types and extra-specs.

3.2.5 Describe the operation and use of snapshots and backups.

3.3 The candidate understands how to work with Object Storage and Swift (9%)

The candidate can:

3.3.1 Explain the use cases for Object Storage.

3.3.2 Identify the key components of the Swift service.

3.3.3 Explain the distribution mechanisms used for accounts, containers and objects.

3.3.4 Identify the main management tools to use in Swift.

3.3.5 Describe the use of regions and zones in Swift.

3.4 Database access provided by Trove (3%)

The candidate can:

3.4.1 Explain the use cases for Database as a Service.

3.4.2 Identify the key components of the Trove service.

3.5 Share file system provided by Manila (3%)

The candidate can:

- 3.5.1 Explain the use cases for shared file systems.
- 3.5.2 Identify the key components of the Manila service.

4. OpenStack Identity Management – (10%, K2, 2.1 hours)

4.1 The candidate understands user authentication by Keystone (4%)

The candidate can:

- 4.1.1 Describe how Keystone handles authentication.
- 4.1.2 Describe user/tenant relationships in Keystone.

4.2 The candidate understands user authorization in OpenStack (2%)

The candidate can:

- 4.2.1 Describe the process of authorization.
- 4.2.2 Identify the components in authorization.
- 4.2.3 Identify the files used by authorization.

4.3 The candidate understands service oriented operations (2%)

The candidate can:

- 4.3.1 Describe the reason and operation of service registration.
- 4.3.2 Identify the requirement for and the creation of API endpoints.

4.4 Key management with Barbican (2%)

The candidate can:

- 4.4.1 Describe the reason and operation of key management using Barbican.
- 4.4.2 Identify the different kinds of secrets Barbican can handle.

5. OpenStack Networking – (20%, K2, 4.2 hours)

5.1 The candidate understands features of Neutron (10%)

The candidate can:

- 5.1.1 Describe the networking features and services provided by Neutron.
- 5.1.2 Identify the use cases for implementing Neutron.
- 5.1.3 Describe the extensibility of a network based on Neutron.

5.2 The candidate understands the Layer 3 services provided by Neutron (5%)

The candidate can:

- 5.2.1 Describe the use of Floating IP addresses and Network Address Translation (NAT).
- 5.2.2 Describe the DHCP function used by Neutron.
- 5.2.3 Describe the operation of routing within Neutron

5.3 The candidate understands the implementation of network security by Neutron (5%)

The candidate can:

5.3.1 Describe the use of security groups.

5.3.2 Describe the implementation of a security policy using security rules.

5.3.3 Describe the application of security groups to instances.

6. OpenStack Support Services – (15%, K2, 3.15 hours)

6.1 The candidate understands the implementation of metering using Ceilometer (3%)

The candidate can:

6.1.1 Identify the use cases of OpenStack Metering using Ceilometer.

6.1.2 Describe the various types of data supplied by Ceilometer.

6.1.3 Identify the workflow for gathering data, including user generated.

6.2 The candidate understands the Dashboard provided by Horizon (3%)

The candidate can:

6.2.1 Describe the dashboard functionality provided by Horizon.

6.2.2 Identify the various services Horizon depends on.

6.3 The candidate understands Orchestration using Heat (3%)

The candidate can:

6.3.1 Describe the orchestration functionality provided by Heat.

6.3.2 Identify the responsibilities of the Heat template.

6.3.3 Describe the operations that can be carried out on a Heat stack.

6.4 Managing service provided by Zaqr (3%)

The candidate can:

6.4.1 Describe the messaging functionality provided by Zaqr.

6.4.2 Identify the component parts of Zaqr.

6.5 DNS management with Designate (3%)

The candidate can:

6.5.1 Describe the DNS functionality management with Designate.

Identify the component parts of Designate.

Levels of Knowledge / SFIA Levels

This course will provide candidates with the levels of difficulty / knowledge skill highlighted within the following table, enabling them to develop the skills to operate at the levels of responsibility indicated. The levels of knowledge and SFIA levels are explained in on the website www.bcs.org/levels. The levels of knowledge above will enable candidates to develop the following levels of skill to be able to operate at the following levels of responsibility (as defined within the SFIA framework) within their workplace:





Level	Levels of Knowledge	Levels of Skill and Responsibility (SFIA)
K7		Set strategy, inspire and mobilise
K6	Evaluate	Initiate and influence
K5	Synthesise	Ensure and advise
K4	Analyse	Enable
K3	Apply	Apply
K2	Understand	Assist
K1	Remember	Follow

e-Competence Framework (e-CF)

The mapping of this certificate against the [e-Competence Framework](#).

e-CF Area	e-Competence	Level				
		e-1	e-2	e-3	e-4	e-5
BUILD	B.1. Application Development			Superficial		
	B.2. Component Integration		Partial			
	B.4. Solution Deployment	Partial				
MANAGE	E.8. Information Security Management		Partial			

Legend for coverage:

	General - The competence is covered at the level indicated
	Partial - The competence is covered to some extent
	Superficial - Relevant knowledge is covered to some extent
	The competence level is available in the framework
	The competence level is not available in the framework

Question Weighting

Syllabus Area	Target number of questions
1. What is OpenStack	4
2. OpenStack Compute	6
3. OpenStack and Storage	12
4. OpenStack Identity Management	4
5. OpenStack Networking	8
6. OpenStack Support Services	6
Total	40 Questions

Format of Examination

Type	40 Multiple Choice Questions
Duration	60 minutes. An additional 15 minutes will be allowed for candidates sitting the examination in a language that is not their native /mother tongue
Pre-requisites	Accredited training is strongly recommended, but is not a pre-requisite
Supervised	Yes
Open Book	No
Pass Mark	26/40 (65%)
Calculators	Calculators cannot be used during this examination.
Learning Hours	21 Hours
Delivery	Paper based examination

Trainer Criteria

Criteria	<ul style="list-style-type: none">▪ Hold the Foundation Certificate in OpenStack Software▪ Have 10 days' training experience or have a train the trainer qualification▪ Have a minimum of 3 years' practical experience in the subject area
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Classroom Size

Trainer to candidate ratio	1:15
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Invigilator to Candidate Ratio during examination

Trainer to candidate ratio	1:25
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Recommended Reading List

Due to the open-source character of OpenStack, the software is continually improved and functionality is added. There are no exam literature references due to the continual change. Up-to-date content documentation can be found on www.openstack.org.

Additional literature:

Title	Fundamentals of OpenStack
Author	Vishal Shukla
Publisher	CreateSpace Independent Publishing Platform
Publication Date	January 2014
ISBN	978-1494827595

List of Basic Terms

This list contains the terms and abbreviations with which candidates should be familiar.

API	Networking Infrastructure
Application	Neutron
Architecture	Node
Asymmetric key	Nova
Authentication	Nova architecture
Authorization	Nova service
Backup	Nova-API
Barbican	Nova-compute
Bare Metal	Nova-consoleauth
Bare Metal host (compute host)	Nova-network
Bare Metal instance	Nova-novncproxy
Bare Metal node	Object storage
Billing	On-demand self-service
Block storage	Open source
Boot	Open vSwitch
Ceilometer	Operating system
Cinder	orchestration
Cloud (private)	OS ISO
Cloud (public)	Outbound
Compute	Platform
Container	Platform-as-a-Service (PaaS)
Dashboard	Publishing workflow
Data network	PXE

Database as a Service (DBaaS)	qr-* network
Deploy image	qr-* port
Designate	RAM disk
DHCP	Rating
Directory	Reboot
DNS	Rebuild
DNS as a Service (DNSaaS)	Region
dnsmasq program	Release
Elasticity	Resize
Endpoint	Resource pooling
External network	Ring
Flat network	Role
Flat Network Manager	Root partition
Flavor	Routing
Generic Routing Encapsulation (GRE)	Secure Shell (SSH)
Glance	Security group
Glance architecture	Security level
GRE agent	Security policy
Heat	Security rule
Heat templates	Sensitive service
Horizon	Server (instance)
Hybrid	Server (physical)
Hypervisor	Service
Identity Management	Service catalog
Identity service	Service component
Image	Service endpoint
Inbound	Snapshot
Infrastructure	Software-as-a-Service (SaaS)
Infrastructure-as-a-Service (IaaS)	SSH rule
Instance	SSH server
Integration bridge	SSH service
IP address (fixed)	Stack
IP address (floating)	Storage
IP Address Management (IPAM)	Swift
IP tables	Symmetric key
IPMI	Template
IroniC	Tenant
Kernel	TFTP
Keystone	Transmission Control Protocol (TCP)
Layer	Trove

Management network	Tunnel
Manila	User
Metered service <i>or</i> measured service	User-defined data
Metering	Virtual Local Area Network (VLAN)
Multi-tier	Virtual Machine (VM)
NBP	Virtual Network Computing (VNC)
Network (external)	VLAN Network Manager
Network (internal)	VLAN networking
Network access	Volume
Network Address Translation (NAT)	Zaqar
Network node	Zone
Network-as-a-Service (NaaS)	