



# BCS EXIN Foundation Certificate in OpenStack Software Neutron Syllabus

**Version 1.2**  
**April 2017**

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 Neutron

Introduction .....	4
Objectives .....	4
Specific Learning Objectives .....	4
Target Audience.....	4
Course Format and Duration.....	4
Eligibility for the Examination .....	5
Duration and Format of the Examination .....	5
Additional time .....	5
For candidates requiring reasonable adjustments .....	5
For candidates whose language is not the language of the examination .....	5
Guidelines for Accredited Training Organisations.....	6
Use of Calculators.....	6
Syllabus .....	7
1. Neutron Architecture – (25%, K3, 3.5 hours) .....	7
2. Neutron Plug-Ins and Extensions – (35%, K3, 4.9 hours) .....	7
3. Managing Networks – (20%, K3, 2.8 hours ) .....	8
4. Troubleshooting Methodology and Tools – (20%, K3, 2.8 hours) .....	9
Levels of Knowledge / SFIA Levels .....	10
e-Competence Framework (e-CF).....	10
Question Weighting.....	11
Format of Examination .....	11
Trainer Criteria .....	11
Classroom Size.....	11
Recommended Reading List.....	12
List of Basic Terms .....	12

## 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 Neutron is a cloud networking controller within the OpenStack cloud computing initiative. It focuses on delivering networking as a service. The BCS EXIN Specialist Certificate in OpenStack Software Neutron requires understanding and know-how of the architecture, design and deployment of a scalable extensible network within an OpenStack environment.

## Objectives

Candidates should be able to demonstrate knowledge and understanding of the architecture, design and deployment of a scalable extensible network within an OpenStack environment.

### Specific Learning Objectives

- Architecture
- Plug-ins and Extensions
- Managing Networks with the CLI, cURL
- REST API
- Troubleshooting Methodology and Tools

## Target Audience

BCXS EXIN Specialist Certificate in OpenStack Software Neutron is intended for people who are experienced in using OpenStack technology and the ones who design or build OpenStack infrastructure.

The following roles could be interested in this module: Network Administrators, Network Architects, Solution Architects, Sales Engineers, Technical Marketing Staff, OpenStack Administrators and OpenStack Architects.

## 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 14 hours of study run over a minimum of 2 days.

## Eligibility for the Examination

There are **no formal entry requirements to register** for this certification. However as the certificate covers specialist knowledge, the following is highly recommended:

- Gaining the BCS EXIN Foundation Certificate in OpenStack Software
- Following an BCS EXIN accredited training related specifically to Neutron

Requirements for certification:

- Gaining the BCS EXIN Foundation Certificate in OpenStack Software
- Following an BCS EXIN accredited training related specifically to Neutron
- Practical experience with OpenStack as well as a good grasp on networking fundamentals: TCP/IP, Ethernet, Routing, Firewalls etc.
- Understanding of the components of OpenStack and their function, particularly Keystone, Nova and Glance
- A good grasp on networking technologies and Linux fundamentals

## Duration and Format of the Examination

The format for the examination is a 90 minute 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 Kilo-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.

For each top-level area of the syllabus a percentage identifies the exam coverage of that area.

## 1. Neutron Architecture – (25%, K3, 3.5 hours)

### 1.1 The candidate can describe OpenStack Architecture, including Neutron

The candidate is able to:

- 1.1.1 Describe the function of the primary core components of the OpenStack Architecture.
- 1.1.2 Explain how Neutron provides extensibility through plug-ins.
- 1.1.3 Describe the function of OpenStack functional components and networks.
- 1.1.4 Identify the features and function of the Neutron API.

### 1.2 The candidate can describe a basic implementation with Open Vswitch

The candidate is able to:

- 1.2.1 Describe a basic implementation and requirements of OpenStack Networking service using the ML2 plug-in with Open vSwitch.
- 1.2.2 Demonstrate how traffic flow is configured with fixed and floating IP addresses.

### 1.3 The candidate can explain how to achieve high availability using OpenStack and DVR

The candidate is able to:

- 1.3.1 Explain basic concepts about high availability in an OpenStack infrastructure.
- 1.3.2 Explain how distributed virtual routing technology contributes to high availability.

## 2. Neutron Plug-Ins and Extensions – (35%, K3, 4.9 hours)

### 2.1 The candidate can describe network plug-ins and extensions

The candidate is able to:

- 2.1.1 Describe the features and functions of a plug-in and an extension.

### 2.2 The candidate can describe various plug-ins

The candidate is able to:

- 2.2.1 Explain the features and benefits of the ML2 and the OVS plug-ins.
- 2.2.2 Describe DHCP address acquisition and the role of floating IP addresses.

### **2.3 The candidate can explain L3 Routing and Network Address Translation (NAT)**

The candidate is able to:

- 2.3.1 Explain how the Networking API provides L3 routing.
- 2.3.2 Explain how L3 routing provides basic NAT capabilities on gateway ports.

### **2.4 The candidate can use overlay networking**

The candidate is able to:

- 2.4.1 Identify types of overlay network transports (GRE, VXLAN, STT) and their purposes.
- 2.4.2 Name the benefits of HP Virtual Cloud networking and OVSvAPP.

### **2.5 The candidate can describe Load-Balancer-as-a-Service (LBaaS) and Firewall-as-a-Service (FWaaS) plug-ins**

The candidate is able to:

- 2.5.1 Explain the benefits and operations of the LBaaS plug-in.
- 2.5.2 Explain the benefits, operations, architecture, and resources of the FWaaS plug-in.

### **2.6 The candidate can describe namespaces, security groups, and iptables**

The candidate is able to:

- 2.6.1 Summarize the role of namespaces.
- 2.6.2 Manage security groups with CLI tools or the OpenStack GUI.
- 2.6.3 Explain how OpenStack Compute manages iptables.

## **3. Managing Networks – (20%, K3, 2.8 hours )**

### **3.1 The candidate can describe the REST API**

The candidate is able to:

- 3.1.1 Explain how RESTful applications post, read, and delete data in OpenStack.

### **3.2 The candidate can Manage CRUD operations and describe Firefox RESTClient**

The candidate is able to:

- 3.2.1 Manage CRUD operations.
- 3.2.2 Describe the benefits of Firefox RESTClient.

### **3.3 The candidate can use CLI tools to manage OpenStack**

The candidate is able to:

- 3.3.1 Describe the benefits of CLI tools.
- 3.3.2 Explain how to set environment variables through OpenStack RC or openrc.sh files.
- 3.3.3 Discover the network topology by using CLI commands.

### **3.4 The candidate can use cURL to manage OpenStack**

The candidate is able to:

- 3.4.1 Explain how to generate and use authorization tokens with cURL.
- 3.4.2 Discover network topology and subnet ports using cURL.



#### **4. Troubleshooting Methodology and Tools – (20%, K3, 2.8 hours)**

##### **4.1 The candidate can use troubleshooting techniques and log files to resolve issues**

The candidate is able to:

- 4.1.1 Use OpenStack log files to troubleshoot an issue.
- 4.1.2 Use rsyslog to establish a centralized log server across multiple machines.

##### **4.2 The candidate can use troubleshooting techniques and tools to resolve networking issues**

The candidate is able to:

- 4.2.1 Use ip, ovs-vsctl, ping, traceroute, dig and tcpdump to troubleshoot Open vSwitch networking traffic.
- 4.2.2 Capture packets from the patch-tun internal interface on Integration Bridge.
- 4.2.3 Use the ovs-ofctl command to find the internal VLAN tag used for a GRE tunnel.
- 4.2.4 Use Wireshark to analyze network packets.
- 4.2.5 Use third-party tools (Nagios and RabbitMQ) to monitor network problems and usage trends and troubleshoot connection failures.
- 4.2.6 Use debugging tools to troubleshoot network namespaces.

## 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](http://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.2. Component Integration		General			
	B.4. Solution Deployment		General			
	B.6. Systems Engineering			General		
RUN	C.4. Problem Management			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 <b>not</b> available in the framework

## Question Weighting

Syllabus Area	Target number of questions
1. Neutron Architecture	10
2. Neutron Plug-ins and Extensions	14
3. Managing Networks with the CLI, cURL, and REST API	8
4. Troubleshooting Methodology and Tools	8
<b>Total</b>	<b>40 Questions</b>

## 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	14 Hours
Delivery	Paper based examination

## Trainer Criteria

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

Trainer to candidate ratio	1:12
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## Recommended Reading List

**Title** Networking in OpenStack using Neutron – Learner Guide  
**Publisher** Hewlett Packard Development Company, L.P  
**Publication Date** 2015, version H4S71S A.01

### Additional literature:

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](http://www.openstack.org)

## List of Basic Terms

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

Active/active configuration
Active/passive configuration
API
Cacheable
Chrome Postman client
Command Line Interface (CLI) tools
Client server
Cloud controller node
Compute node
CRUD (Create, Retrieve, Update, Delete)
cURL
Dynamic Host Configuration Protocol (DHCP)
dig command
Distributed Virtual Router (DVR)
Encapsulation
Extension
Firefox RESTClient
Firewall-as-a-Service (FWaaS)
Fixed IP address
Floating IP address
Generic Routing Encapsulation (GRE)

GRE key
GRE tunnel
High Availability
Horizon
ikepolicy
ipsecpolicy
ipsec-site-connection
iptables
Layer 3 (L3) routing
Linux bridge Neutron plug-in
Linux bridge
Linux container (LXC)
Load Balancer-as-a-Service (LBaaS)
Logging levels (DEBUG, INFO, AUDIT, WARNING, ERROR, CRITICAL, TRACE)
Mechanism driver
Modular Layer 2 (ML2) Neutron plug-in
Nagios network monitoring
Namespaces
Network
Network Address Translation (NAT)
Network node
Network topologies
Neutron
Neutron manager
Nova
Open Systems Interconnect (OSI) model
Open vSwitch
Open vSwitch (OVS) plug-in
Overlay Networks
Open vSwitch vAPP (OVSVAPP)
Packet
ping command
Private Internet Protocol (PIP)
Plug-in
Port
RabbitMQ
Representational State Transfer (REST)

RESTful API
Resource alerting
rsyslog
Security groups
Segmentation ID
Segmentation of concerns
Service
Stateful service
Stateless service
Stateless Transport Tunneling (STT)
Subnet
tcpdump
traceroute command
Type drivers
Uniform interface
Virtual Cloud Network
Virtual Extensible Local Area Network (VXLAN)
Virtual Private Network as a Service (VPNaaS)
Wireshark