

## SQA Advanced Unit Specification

### General information

**Unit title:** Open Source Operating Systems: Introduction to Command Line Administration (SCQF level 8)

**Unit code:** HP33 48

**Superclass:** CD

**Publication date:** August 2017

**Source:** Scottish Qualifications Authority

**Version:** 01

### Unit purpose

This unit is suitable for learners who wish to gain the basic skills and knowledge necessary for the use of an open source operating system. The unit will provide the underpinning theoretical knowledge necessary to perform basic command line operations, such as navigate a file structure and manipulate files and processes. The unit is intended for learners who will be working in open source operating system environment in technical support, software development, or who would like to gain a practical understanding of operating in a command line environment.

This unit provides a useful preparation for learners going on to study the units *Open Source Operating Systems: Basic Server Administration* HP34 48, *Open Source Operating Systems: Advanced Server Administration* HT0T 48, and *Open Source Operating Systems: Advanced Network Services Administration* HT0W 48.

### Outcomes

On completion of the unit the learner will be able to:

- 1 Manage open source operating systems installation, package management and system architecture.
  - 2 Demonstrate an understanding of and use of open source commands.
  - 3 Manage devices and open source filesystems.
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### Recommended entry to unit

While entry is at the discretion of the centre, it is recommended that learners should have relevant work experience or studied relevant SQA Advanced Computing or Networking units, eg *Computer Systems Fundamentals* HP1T 47, *Troubleshooting Computing Problems* HP1V 47, or *Multi-user Operating Systems* HR77 47.

### Credit points and level

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

### 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.

This unit is included in the framework for SQA Advanced Diploma in Computing: Technical Support and it is recommended the unit is taught within this context.

### 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).

**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: Statement of standards

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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. Learners 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

Manage open source operating systems installation, package management and system architecture.

##### Knowledge and/or skills

- ◆ Design hard disk layout
- ◆ Install a boot manager
- ◆ Manage shared libraries
- ◆ Use package management tools
- ◆ Determine and configure hardware settings
- ◆ Boot the system
- ◆ Change runlevels and shutdown or reboot system

#### Outcome 2

Demonstrate an understanding of and use of open source commands.

##### Knowledge and/or skills

- ◆ Work on the command line
- ◆ Process text streams using filters
- ◆ Perform basic file management
- ◆ Use streams, pipes and redirects
- ◆ Perform basic process management
- ◆ Modify process execution priorities
- ◆ Search text files using regular expressions
- ◆ Perform basic file editing operations using vi

#### Outcome 3

Manage devices, and open source filesystems.

##### Knowledge and/or skills

- ◆ Create partitions and filesystems
- ◆ Maintain the integrity of filesystems
- ◆ Control mounting and unmounting of filesystems
- ◆ Manage disk quotas
- ◆ Manage file permissions and ownership
- ◆ Create and change hard and symbolic links
- ◆ Find system files and place files in the correct location

### Evidence requirements

#### Outcome 1

Evidence for the knowledge/skills in this outcome will be demonstrated by means of a 19 question multiple-choice/short-response test. The test should consist of approximately one third MCSA (multi-choice single answer), one third MCMA (multi-choice multiple answers), and one third short-response questions. The amount of questions which should be drawn from each of the bullet points above is given by the numbers in brackets. The assessment will be closed-book and should be completed within 40 minutes. The minimum mark required to pass the test is 60%. The test could be incorporated into a single test which also covers Outcomes 2 and 3.

Questions should be drawn from the knowledge and skills areas as follows:

- ◆ Design hard disk layout (2)
- ◆ Install a boot manager (2)
- ◆ Manage shared libraries (2)
- ◆ Use package management tools (5)
- ◆ Determine and configure hardware settings (2)
- ◆ Boot the system (3)
- ◆ Change runlevels and shutdown or reboot system (3)

#### Outcome 2

Evidence for the knowledge/skills in this outcome will be demonstrated by means of a 26 question multiple-choice/short-response test. The test should consist of approximately one third MCSA (multi-choice single answer), one third MCMA (multi-choice multiple answers), and one third short-response questions. The amount of questions which should be drawn from each of the bullet points above is given by the numbers in brackets. The assessment will be closed-book and should be completed within 50 minutes. The minimum mark required to pass the test is 60%. The test could be incorporated into a single test which also covers Outcomes 1 and 3.

Questions should be drawn from the knowledge and skills areas as follows:

- ◆ Work on the command line (4)
- ◆ Process text streams using filters (3)
- ◆ Perform basic file management (4)
- ◆ Use streams, pipes and redirects (4)
- ◆ Perform basic process management (4)
- ◆ Modify process execution priorities (2)
- ◆ Search text files using regular expressions (2)
- ◆ Perform basic file editing operations using vi (3)

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### Outcome 3

Evidence for the knowledge/skills in this outcome will be demonstrated by means of a 15 question multiple-choice/short-response test. The test should consist of approximately one third MCSA (multi-choice single answer), one third MCMA (multi-choice multiple answers), and one third short-response questions. The amount of questions which should be drawn from each of the bullet points above is given by the numbers in brackets. The assessment will be closed-book and should be completed within 30 minutes. The minimum mark required to pass the test is 60%. The test could be incorporated into a single test which also covers Outcomes 1 and 2.

Questions should be drawn from the knowledge and skills areas as follows:

- ◆ Create partitions and filesystems (2)
- ◆ Maintain the integrity of filesystems (2)
- ◆ Control mounting and unmounting of filesystems (3)
- ◆ Manage disk quotas (1)
- ◆ Manage file permissions and ownership (3)
- ◆ Create and change hard and symbolic links (2)
- ◆ Find system files and place files in the correct location (2)

### SQA Advanced Unit support notes

**Unit title:** Open Source Operating Systems: Introduction to Command Line Administration (SCQF level 8)

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.

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

This unit is a core unit for SQA Advanced Diploma in Computing: Technical Support and it is expected it will be delivered in this context. It is also suitable for any learners wishing to learn basic usage of the UNIX/Linux command line environment.

The *Open Source Operating Systems: Introduction to Command Line Administration* HP33 48 unit should preferably be undertaken before the second core unit *Open Source Operating Systems: Basic Server Administration* HP34 48, though it is not a prerequisite.

The *Open Source Operating Systems: Introduction to Command Line Administration* HP33 48 unit is covered by the objectives of the LPIC-1 (Linux Professional Institute Certificate 1) exam 101. The objectives of the LPIC-1 exam 102 map to the unit *Open Source Operating Systems: Basic Server Administration* HP34 48.

Following is a list of suggested content for each outcome. This includes activities which should help learners achieve the relevant skills/knowledge, and also a list of files, terms and utilities which may be covered.

#### Outcome 1

##### Design hard disk layout

Design a Linux system disk partition scheme, ensuring that the /boot partition conforms to the hardware requirements for booting. Allocate filesystems and swap space to separate partitions or disks, and optimise the design for the intended use of the system.

Files, terms and utilities could include:

- ◆ /(root) filesystem
- ◆ /var filesystem
- ◆ /home filesystem
- ◆ swap space
- ◆ mount points
- ◆ partitions

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### Install a boot manager

Select, install and configure a boot manager. Include alternative boot locations and backup boot options. Install, configure, and interact with a boot loader, eg GRUB.

Files, terms and utilities could include:

- ◆ /boot/grub/menu.lst
- ◆ grub-install
- ◆ MBR
- ◆ superblock
- ◆ /etc/lilo.conf
- ◆ lilo

### Manage shared libraries

Identify, install, and load shared libraries. Identify the typical locations of system libraries. Files, terms and utilities could include:

- ◆ ldd
- ◆ ldconfig
- ◆ /etc/ld.so.conf
- ◆ LD\_LIBRARY\_PATH

### Use package management tools

Use tools for package management, eg install, un-install, re-install, and upgrade. Determine package information, eg version, content, dependencies, package integrity, and installation status. Use two sets of contemporary package management tools, eg Debian and Red Hat.

Files, terms and utilities could include:

- ◆ /etc/apt/sources.list
- ◆ dpkg
- ◆ dpkg-reconfigure
- ◆ apt-get
- ◆ apt-cache
- ◆ aptitude
- ◆ rpm
- ◆ rpm2cpio
- ◆ /etc/yum.conf
- ◆ /etc/yum.repos.d/
- ◆ yum
- ◆ yumdownloader

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### Determine and configure hardware settings

Configure external peripherals, eg keyboards, and enable/disable integrated peripherals. Differentiate between types of mass storage devices, and set the correct hardware ID for boot device. Configure coldplug and hotplug devices, and determine hardware resources for devices.

Files, terms and utilities could include:

- ◆ /sys
- ◆ /proc
- ◆ /dev
- ◆ modprobe
- ◆ lsmod
- ◆ lspci
- ◆ lsusb

### Boot the system

Use commands to configure the boot loader and provide options to the kernel at boot time. Use log files to check boot events, and describe the boot sequence from BIOS to boot completion.

Files, terms and utilities could include:

- ◆ /var/log/messages
- ◆ dmesg
- ◆ BIOS
- ◆ bootloader
- ◆ kernel
- ◆ init

### Change runlevels and shutdown or reboot system

Manage the runlevel of the system, including set the default runlevel, changing to single user mode, and alerting users. Use command line to shutdown, reboot the system and correctly terminate processes.

Files, terms and utilities could include:

- ◆ /etc/inittab
- ◆ shutdown
- ◆ init
- ◆ /etc/init.d
- ◆ telinit

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### Outcome 2

#### Work on the command line

Perform basic tasks using shell commands and one line command sequences. Modify the shell environment including defining, referencing and exporting environment variables. View and edit command history, and use commands outside of the defined path. The bash shell is recommended.

Files, terms and utilities could include:

- ◆ bash
- ◆ echo
- ◆ env
- ◆ exec
- ◆ export
- ◆ pwd
- ◆ set
- ◆ unset
- ◆ man
- ◆ uname
- ◆ history

#### Process text streams using filters

Use text utility filters to modify output of text files. Use standard UNIX commands found in the GNU textutils package.

Files, terms and utilities could include:

- ◆ cat
- ◆ cut
- ◆ expand
- ◆ fmt
- ◆ head
- ◆ od
- ◆ join
- ◆ nl
- ◆ paste
- ◆ pr
- ◆ sed
- ◆ sort
- ◆ split
- ◆ tail
- ◆ tr
- ◆ unexpand
- ◆ uniq
- ◆ wc

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### Perform basic file management

Use standard Linux commands and wildcard specifications to copy, move and remove files and directories. Use find to locate and act on files based on type, size, or time. Archive using tar, and cpio.

Files, terms and utilities could include:

- ◆ cp
- ◆ find
- ◆ mkdir
- ◆ mv
- ◆ ls
- ◆ rm
- ◆ rmdir
- ◆ touch
- ◆ tar
- ◆ cpio
- ◆ dd
- ◆ file
- ◆ gzip
- ◆ gunzip
- ◆ bzip2
- ◆ file globbing

### Use streams, pipes and redirects

Use streams, pipes and redirects to process text data. Redirect standard input, standard error, and send standard output to both stdout and a file. Pipe the output of commands as input to other commands, and use command output as arguments for another commands.

Files, terms and utilities could include:

- ◆ tee
- ◆ xargs

### Perform basic process management

Create, monitor and kill processes. Run jobs in the foreground and background, and signal programs to continue running after logout. Send signals to processes, and select and sort processes for display.

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Files, terms and utilities could include:

- ◆ &
- ◆ bg
- ◆ fg
- ◆ jobs
- ◆ kill
- ◆ nohup
- ◆ ps
- ◆ top
- ◆ free
- ◆ uptime
- ◆ killall

### Modify process execution priorities

Run programs with higher or lower priority than the default, and modify the priority of running processes.

Files, terms and utilities could include:

- ◆ nice
- ◆ ps
- ◆ renice
- ◆ top

### Search text files using regular expressions

Create and use regular expressions to search files and text data, including expressions containing several notational elements. Use regular expression tools to perform searches through a filesystem or file content.

Files, terms and utilities could include:

- ◆ grep
- ◆ egrep
- ◆ fgrep
- ◆ sed
- ◆ regex(7)

### Perform basic file editing operations using vi

Use vi navigation and basic vi modes to edit text files, eg inserting, deleting, copying and finding text.

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Files, terms and utilities could include:

- ◆ vi
- ◆ /, ?
- ◆ h,j,k,l
- ◆ i, o, a
- ◆ c, d, p, y, dd, yy
- ◆ ZZ,:w!,:q!,:e!

### Outcome 3

#### Create partitions and filesystems

Design and configure disk partitions, including swap partitions on storage media. Use mkfs to build filesystems, eg ext2, ext3, xfs, reiserfs, v3, vfat

Files, terms and utilities could include:

- ◆ fdisk
- ◆ mkfs
- ◆ mkswap

#### Maintain the integrity of filesystems

Maintain and verify the integrity of standard and journaling filesystems. Monitor free space and inodes, and carry out simple filesystem repairs.

Files, terms and utilities could include:

- ◆ du
- ◆ df
- ◆ fsck
- ◆ e2fsck
- ◆ mke2fs
- ◆ debugfs
- ◆ dumpe2fs
- ◆ tune2fs
- ◆ xfs tools (such as xfs\_metadump and xfs\_info)

#### Control mounting and unmounting of filesystems

Mount and unmount filesystems manually, on bootup, and as user mountable removable filesystems.

Files, terms and utilities could include:

- ◆ /etc/fstab
- ◆ /media
- ◆ mount
- ◆ umount

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### Manage disk quotas

Configure user disk quotas, and check, generate and edit quota reports for users.

Files, terms and utilities could include:

- ◆ quota
- ◆ edquota
- ◆ repquota
- ◆ quotaon

### Manage file permissions and ownership

Configure permissions and ownerships to control access for regular and special files and directories. Maintain security using the file creation mask and access modes, eg suid, sgid, and sticky bit. Grant access to group members using the group field.

Files, terms and utilities could include:

- ◆ chmod
- ◆ umask
- ◆ chown
- ◆ chgrp

### Create and change hard and symbolic links

Create and manage hard and soft file links, and use them in simple system administration.

Files, terms and utilities could include:

- ◆ ln

### Find system files and place files in the correct location

Find the location of important files, directories and commands in the Filesystem Hierarchy Standard (FHS) filesystem.

Files, terms and utilities could include:

- ◆ find
- ◆ locate
- ◆ updatedb
- ◆ whereis
- ◆ which
- ◆ type
- ◆ /etc/updatedb.conf

### Guidance on approaches to delivery of this unit

Although there is no practical outcome, it is recommended that learners are given extensive hands-on experience using the UNIX/Linux command line. This will aid them to acquire the skills/knowledge required to complete the unit. The unit is generic and could be delivered using one of the many packages or versions of UNIX/Linux available. The choice of operating system version is at the discretion of the delivering centre though care should be taken that the version chosen allows all evidence requirements to be achieved.

### Guidance on approaches to assessment of this unit

The assessments should be done under closed-book conditions. Centres are encouraged to explore opportunities for delivering the multi-choice/short-response test assessments online. This could be done using online learning environments such as Moodle. Centres which wish to use e-assessment must ensure that the national standard is applied to all learner 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)*.

Assessment for the unit can take the form of credit transfer after successfully passing either the LPIC-1 101 or CompTIA LX0-101 exams. Alternatively assessment could take the form of a centre devised multi-choice/short-response test that satisfactorily covers the evidence requirements described in the outcome section earlier.

### Opportunities for 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 learner evidence and that conditions of assessment as specified in the evidence requirements are met, regardless of the mode of gathering evidence. The most up-to-date guidance on the use of e-assessment to support SQA's qualifications is available at [www.sqa.org.uk/e-assessment](http://www.sqa.org.uk/e-assessment).

### Opportunities for developing Core or other essential skills

There is no automatic certification of Core Skills or Core Skill components in this unit.

## 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.

### General information for learners

**Unit title:** Open Source Operating Systems: Introduction to Command Line Administration (SCQF level 8)

This section will help you decide whether this is the unit for you by explaining what the unit is about, what you should know or be able to do before you start, what you will need to do during the unit and opportunities for further learning and employment.

This unit is designed to give you the basic skills and knowledge to use an open source operating system command line environment.

The unit will provide you with the underpinning theoretical knowledge necessary to perform basic command line operations, such as navigate a file structure and manipulate files and processes. The unit is intended for learners who will be working in an open source OS environment in technical support, or software development, or who would like to gain a practical understanding of operating in a command line environment.

On completion of the unit you should be able to:

- 1 Manage open source open source installation, package management and system architecture.
- 2 Demonstrate an understanding of and use of open source commands.
- 3 Manage devices and open source filesystems.

Outcome 1 includes the following:

- ◆ Design hard disk layout
- ◆ Install a boot manager
- ◆ Manage shared libraries
- ◆ Use package management tools
- ◆ Determine and configure hardware settings
- ◆ Boot the system
- ◆ Change runlevels and shutdown or reboot system

Outcome 2 includes the following:

- ◆ Work on the command line
- ◆ Process text streams using filters
- ◆ Perform basic file management
- ◆ Use streams, pipes and redirects
- ◆ Perform basic process management
- ◆ Modify process execution priorities
- ◆ Search text files using regular expressions
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Outcome 3 includes the following:

- ◆ Create partitions and filesystems
- ◆ Maintain the integrity of filesystems
- ◆ Control mounting and unmounting of filesystems
- ◆ Manage disk quotas
- ◆ Manage file permissions and ownership
- ◆ Create and change hard and symbolic links
- ◆ Find system files and place files in the correct location

Assessment is by multi-choice/short-response assessments that test your knowledge and skills in using the items above. There may be separate assessments for each outcome or they may be combined into a single test for the entire unit. The assessment will be carried out in supervised conditions, and will be closed-book (ie you will not be allowed to bring any notes, etc with you to the assessment event). The minimum pass mark is 60%. Alternatively assessment for the unit can take the form of credit transfer after successfully passing either the LPIC-1 101 or CompTIA LX0-101 exams.