



Higher National Unit specification: general information

Unit title: Open Source Operating Systems: Introduction to Command Line Administration

Unit code: H18C 35

Superclass: CD

Publication date: October 2012

Source: Scottish Qualifications Authority

Version: 02

Unit purpose

This Unit is suitable for candidates 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 candidates 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 candidates going on to study the Units *Open Source Operating Systems: Basic Server Administration* H18E 35, *Open Source Operating Systems: Advanced Server Administration* H18D 35, and *Open Source Operating Systems: Advanced Network Services Administration* H18F 35.

On completion of the Unit the candidate 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.

Recommended prior knowledge and skills

While entry is at the discretion of the centre, it is recommended that candidates should have relevant work experience or studied relevant HN Computing or Networking Units, eg *Computer Systems Fundamentals* H175 34, *Troubleshooting Computing Problems* H177 34, or *Multi-user Operating Systems* DH3A 34.

General information (cont)

Credit points and level

1 Higher National Unit credit at SCQF level 8: (8 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 Access 1 to Doctorates.*

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 HND Computing: Technical Support and it is recommended the Unit is taught within this context.

Higher National Unit specification: statement of standards

Unit title: Open Source Operating Systems: Introduction to Command Line Administration

Unit code: H18C 35

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

- 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

Evidence Requirements

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)

Higher National Unit specification: statement of standards (cont)

Unit title: Open Source Operating Systems: Introduction to Command Line Administration

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

Evidence Requirements

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)

Higher National Unit specification: statement of standards (cont)

Unit title: Open Source Operating Systems: Introduction to Command Line Administration

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

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)

Higher National Unit specification: support notes

Unit title: Open Source Operating Systems: Introduction to Command Line Administration

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 40 hours.

Guidance on the content and context for this Unit

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

The *Open Source Operating Systems: Introduction to Command Line Administration* H18C 35 Unit should preferably be undertaken before the second core Unit *Open Source Operating Systems: Basic Server Administration* H18E 35, though it is not a prerequisite.

The *Open Source Operating Systems: Introduction to Command Line Administration* H18C 35 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* H18E 35.

Following is a list of suggested content for each Outcome. This includes activities which should help candidates 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

Higher National Unit specification: support notes (cont)

Unit title: Open Source Operating Systems: Introduction to Command Line Administration

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

Higher National Unit specification: support notes (cont)

Unit title: Open Source Operating Systems: Introduction to Command Line Administration

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

Higher National Unit specification: support notes (cont)

Unit title: Open Source Operating Systems: Introduction to Command Line Administration

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

Higher National Unit specification: support notes (cont)

Unit title: Open Source Operating Systems: Introduction to Command Line Administration

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.

Higher National Unit specification: support notes (cont)

Unit title: Open Source Operating Systems: Introduction to Command Line Administration

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.

Higher National Unit specification: support notes (cont)

Unit title: Open Source Operating Systems: Introduction to Command Line Administration

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

Higher National Unit specification: support notes (cont)

Unit title: Open Source Operating Systems: Introduction to Command Line Administration

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

Higher National Unit specification: support notes (cont)

Unit title: Open Source Operating Systems: Introduction to Command Line Administration

Guidance on the delivery of this Unit

Although there is no practical Outcome, it is recommended that candidates 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 the assessment of this Unit

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.

Assessment Guidelines

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 candidate 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)*.

Online and Distance 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.

Opportunities for the use of 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 candidate 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)*.

Higher National Unit specification: support notes (cont)

Unit title: Open Source Operating Systems: Introduction to Command Line Administration

Opportunities for developing Core Skills

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

Disabled candidates and/or those with additional support needs

The additional support needs of individual candidates should be taken into account when planning learning experiences, selecting assessment instruments, or considering whether any reasonable adjustments may be required. Further advice can be found on our website www.sqa.org.uk/assessmentarrangements

History of changes to Unit

Version	Description of change	Date
02	Error corrected in Outcome 1 Evidence Requirements from 20 MCQs to 19 MCQs.	19/10/12

© Scottish Qualifications Authority 2012

This publication may be reproduced in whole or in part for educational purposes provided that no profit is derived from reproduction and that, if reproduced in part, the source is acknowledged.

Additional copies of this Unit specification can be purchased from the Scottish Qualifications Authority. Please contact the Business Development and Customer Support team, telephone 0303 333 0330.

General information for candidates

Unit title: Open Source Operating Systems: Introduction to Command Line Administration

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 candidates 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
- ◆ Perform basic file editing operations using vi

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

General information for candidates (cont)

Unit title: Open Source Operating Systems: Introduction to Command Line Administration

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.