



## Higher National Unit specification: general information

**Unit title:** Open Source Operating Systems: Basic Server Administration

**Unit code:** H18E 35

**Superclass:** CD

**Publication date:** March 2012

**Source:** Scottish Qualifications Authority

**Version:** 01

### Unit purpose

This Unit is suitable for candidates who wish to gain the basic skills and knowledge necessary for Server administration using an Open Source Operating System. The Unit will provide the underpinning theoretical knowledge necessary to perform basic command line administration, including networking and security setup. The Unit is intended for candidates who will be working in an Open Source Operating System environment in technical support, software development, or who would like to gain a practical understanding of operating a server running Open Source Operating System software.

This Unit provides a useful preparation for candidates going on to study the Units *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 Administer users, system, and desktops.
- 2 Manage shells, scripts and essential system services.
- 3 Administer network and security configuration.

### 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 *Open Source Operating Systems: Introduction to Command Line Administration* H18C 35, *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: Basic Server Administration

**Unit code:** H18E 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

Administer users, system, and desktops.

#### Knowledge and/or Skills

- ◆ Install and configure X Windows
- ◆ Setup a display manager
- ◆ Configure accessibility settings
- ◆ Manage user and group accounts and related system files
- ◆ Automate system administration tasks by scheduling jobs
- ◆ Configure localisation and internationalisation settings

#### Evidence Requirements

Evidence for the Knowledge/Skills in this Outcome will be demonstrated by means of a 17 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 35 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:

Install and configure X Windows (2)  
Setup a display manager (2)  
Configure accessibility settings (1)  
Manage user and group accounts and related system files (5)  
Automate system administration tasks by scheduling jobs (4)  
Configure localisation and internationalisation settings (3)

## Higher National Unit specification: statement of standards (cont)

**Unit title:** Open Source Operating Systems: Basic Server Administration

### Outcome 2

Manage shells, scripts and essential system services.

#### Knowledge and/or Skills

- ◆ Customise and use the shell environment
- ◆ Customise or write simple scripts
- ◆ Manage SQL data
- ◆ Maintain system time
- ◆ Configure system logging
- ◆ Configure Mail Transfer Agent (MTA) client
- ◆ Manage printers

#### Evidence Requirements

Evidence for the Knowledge/Skills in this Outcome will be demonstrated by means of a 20 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 1 and 3.

Questions should be drawn from the Knowledge and Skills areas as follows:

Customise and use the shell environment (4)  
Customise or write simple scripts (4)  
Manage SQL data (2)  
Maintain system time (3)  
Configure system logging (2)  
Configure Mail Transfer Agent (MTA) client (3)  
Manage printers (2)

## Higher National Unit specification: statement of standards (cont)

**Unit title:** Open Source Operating Systems: Basic Server Administration

### Outcome 3

Administer network and configure security.

#### Knowledge and/or Skills

- ◆ Demonstrate understanding of TCP/IP
- ◆ Configure basic TCP/IP on client
- ◆ Troubleshoot basic TCP/IP on client
- ◆ Configure client for DNS
- ◆ Perform basic security administration
- ◆ Configure basic security on client
- ◆ Use encryption to secure data

#### Evidence Requirements

Evidence for the Knowledge/Skills in this Outcome will be demonstrated by means of a 23 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 45 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:

Demonstrate understanding of TCP/IP (4)  
Configure basic TCP/IP on client (4)  
Troubleshoot basic TCP/IP on client (4)  
Configure client for DNS (2)  
Perform basic security administration (3)  
Configure basic security on client (3)  
Use encryption to secure data (3)

## Higher National Unit specification: support notes

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

The *Open Source Operating Systems: Basic Server Administration* H18E 35 Unit covers the objectives of the LPIC-1 (Linux Professional Institute Certificate 1) exam 102. The objectives of the LPIC-1 exam 101 map to the Unit *Open Source Operating Systems: Introduction to Command Line Administration* H18C 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

##### Install and configure X11

Verify that the video card and monitor are supported by an X server. Demonstrate understanding and knowledge of the X Window configuration file. Show awareness of the X font server.

Files, terms and utilities could include:

- ◆ /etc/X11/xorg.conf
- ◆ xhost
- ◆ DISPLAY
- ◆ xwininfo
- ◆ xdpinfo
- ◆ X

## Higher National Unit specification: support notes (cont)

**Unit title:** Open Source Operating Systems: Basic Server Administration

### Setup a display manager

Setup and customise a display manager. These could include the following: XDM (X Display Manger), GDM (Gnome Display Manager) and KDM (KDE Display Manager). Turn the display manager on or off. Change the display manager greeting. Change default colour depth for the display manager. Configure display managers for use by X-stations.

Files, terms and utilities could include:

- ◆ /etc/inittab
- ◆ xdm configuration files
- ◆ kdm configuration files
- ◆ gdm configuration files

### Configure accessibility settings

Configure Keyboard Accessibility Settings, Visual Settings and Themes, and Assistive Technology (ATs).

Files, terms and utilities could include:

- ◆ Sticky/Repeat Keys
- ◆ Slow/Bounce/Toggle Keys
- ◆ Mouse Keys
- ◆ High Contrast/Large Print Desktop Themes
- ◆ Screen Reader
- ◆ Braille Display
- ◆ Screen Magnifier
- ◆ On-Screen Keyboard
- ◆ Gestures (used at login, for example gdm)
- ◆ Orca
- ◆ GOK
- ◆ emacspeak

## Higher National Unit specification: support notes (cont)

**Unit title:** Open Source Operating Systems: Basic Server Administration

### Manage user and group accounts and related system files

Add, remove, suspend and change user accounts. Add, modify and remove users and groups. Manage user/group info in password/group databases. Create and manage special purpose and limited accounts.

Files, terms and utilities could include:

- ◆ /etc/passwd
- ◆ /etc/shadow
- ◆ /etc/group
- ◆ /etc/skel
- ◆ chage
- ◆ groupadd
- ◆ groupdel
- ◆ groupmod
- ◆ passwd
- ◆ useradd
- ◆ userdel
- ◆ usermod yum
- ◆ yumdownloader

### Automate system administration tasks by scheduling jobs

Use cron or anacron to run jobs at regular intervals. Use at to run jobs at a specific time. Configure user access to cron and at services.

Files, terms and utilities could include:

- ◆ /etc/cron.{d,daily,hourly,monthly,weekly}
- ◆ /etc/at.deny
- ◆ /etc/at.allow
- ◆ /etc/crontab
- ◆ /etc/cron.allow
- ◆ /etc/cron.deny
- ◆ /var/spool/cron/\*
- ◆ crontab
- ◆ at
- ◆ atq
- ◆ atrm



## Higher National Unit specification: support notes (cont)

**Unit title:** Open Source Operating Systems: Basic Server Administration

### Configure localisation and internationalisation settings

Localize a system in a different language than English. Use LANG=C when scripting. Set Locale and Timezone.

Files, terms and utilities could include:

- ◆ /etc/timezone
- ◆ /etc/localtime
- ◆ /usr/share/zoneinfo
- ◆ Environment variables:
  - ◆ LC\_\*
  - ◆ LC\_ALL
  - ◆ LANG
- ◆ /usr/bin/locale
- ◆ tzselect
- ◆ tzconfig
- ◆ date
- ◆ iconv
- ◆ UTF-8
- ◆ ISO-8859
- ◆ ASCII
- ◆ Unicode

## Higher National Unit specification: support notes (cont)

**Unit title:** Open Source Operating Systems: Basic Server Administration

### Outcome 2

#### Customise and use the shell environment

Customise global and user profiles, and set environment variables at login or when spawning a new command interpreter. Create functions for frequently used sequences of commands. Maintain skeleton directories for new user accounts, and set command search path with the proper directory. The bash shell is recommended.

Files, terms and utilities could include:

- ◆ /etc/profile
- ◆ env
- ◆ export
- ◆ set
- ◆ unset
- ◆ ~/.bash\_profile
- ◆ ~/.bash\_login
- ◆ ~/.profile
- ◆ ~/.bashrc
- ◆ ~/.bash\_logout
- ◆ function
- ◆ alias
- ◆ lists

#### Customise or write simple scripts

Create basic shell scripts including conditionals and loops, and correct use of shebang (#!). Perform customisation of existing scripts, and set ownership and permissions on scripts. Test return values for success or failure, and use command substitution to direct output of one command as input to another. The bash shell is recommended.

Files, terms and utilities used could include:

- ◆ for
- ◆ while
- ◆ test
- ◆ if
- ◆ read
- ◆ seq

## Higher National Unit specification: support notes (cont)

**Unit title:** Open Source Operating Systems: Basic Server Administration

### Manage SQL data

Use basic SQL commands to manipulate data, and perform queries including subqueries using subselects. Combine tables using joins.

Files, terms and utilities used could include:

- ◆ insert
- ◆ update
- ◆ select
- ◆ delete
- ◆ from
- ◆ where
- ◆ group by
- ◆ order by
- ◆ join

### Maintain system time

Configure Network Time Protocol (NTP) to synchronize and maintain system time, and know how to use pool.ntp.org. Set the time and timezone of the hardware clock in Coordinated Universal Time (UTC).

Files, terms and utilities used could include:

- ◆ /usr/share/zoneinfo
- ◆ /etc/timezone
- ◆ /etc/localtime
- ◆ /etc/ntp.conf
- ◆ date
- ◆ hwclock
- ◆ ntpd
- ◆ ntpdate

### Configure system logging

Configure the syslog utility including mapping actions to facilities and priorities. Set syslogd to send log output to, or to act as central log server.

Files, terms and utilities used could include:

- ◆ syslog.conf
- ◆ syslogd
- ◆ klogd
- ◆ logger

## Higher National Unit specification: support notes (cont)

**Unit title:** Open Source Operating Systems: Basic Server Administration

### Configure Mail Transfer Agent (MTA) client

Perform basic MTA client configuration including e-mail forwarding and alias setup. Describe common MTA programs, eg sendmail, postfix.

Files, terms and utilities used could include:

- ◆ ~/.forward
- ◆ newaliases
- ◆ mail
- ◆ mailq
- ◆ postfix
- ◆ sendmail
- ◆ exim
- ◆ qmail

### Manage printers

Perform and troubleshoot basic CUPS and cups-lpd configuration including managing print jobs and queues.

Files, terms and utilities used could include:

- ◆ CUPS configuration files, tools and utilities
- ◆ /etc/cups
- ◆ lpd legacy interface (lpr, lprm, lpq)

## Higher National Unit specification: support notes (cont)

**Unit title:** Open Source Operating Systems: Basic Server Administration

### Outcome 3

#### Demonstrate understanding of TCP/IP

Demonstrate an understanding of IPv4 protocol including dotted decimal addressing, subnet masks, public and private IP ranges, and default routes. Use common ICMP commands, and demonstrate an understanding of major features of IPv6. Demonstrate an understanding of Transport layer protocols TCP and UDP including well-known port numbers.

Files, terms and utilities could include:

- ◆ /etc/services
- ◆ ftp
- ◆ telnet
- ◆ host
- ◆ ping
- ◆ dig
- ◆ traceroute
- ◆ tracepath

#### Configure basic TCP/IP on client

Configure, verify and view network interface TCP/IP settings.

Files, terms and utilities could include:

- ◆ /etc/hostname
- ◆ /etc/hosts
- ◆ /etc/resolv.conf
- ◆ /etc/nsswitch.conf
- ◆ ifconfig
- ◆ ifup
- ◆ ifdown
- ◆ route
- ◆ ping

## Higher National Unit specification: support notes (cont)

**Unit title:** Open Source Operating Systems: Basic Server Administration

### Troubleshoot basic TCP/IP on client

Configure network interfaces including starting, stopping, adding, and deleting interfaces. Troubleshoot routing table problems including adding routes manually and setting default routes.

Files, terms and utilities could include:

- ◆ ifconfig
- ◆ ifup
- ◆ ifdown
- ◆ route
- ◆ host
- ◆ hostname
- ◆ dig
- ◆ netstat
- ◆ ping
- ◆ traceroute

### Configure client for DNS

Configure manual and dynamic name resolution on a network host.

Files, terms and utilities could include:

- ◆ /etc/hosts
- ◆ /etc/resolv.conf
- ◆ /etc/nsswitch.conf

### Perform basic security administration

Configure local security including password policy settings and limits on user logins, processes and memory usage. Use sudo, setuid and setgid to run programs with enhanced privileges, and use nmap and netstat to view open ports on system.

Files, terms and utilities could include:

- ◆ find
- ◆ passwd
- ◆ lsof
- ◆ nmap
- ◆ netstat
- ◆ sudo
- ◆ /etc/sudoers
- ◆ su
- ◆ usermod
- ◆ chage

## Higher National Unit specification: support notes (cont)

**Unit title:** Open Source Operating Systems: Basic Server Administration

### Configure basic security on client

Enhance security by switching off unused services. Demonstrate understanding of shadow passwords to control access to encrypted passwords, and TCP wrappers to implement access control lists.

Files, terms and utilities could include:

- ◆ /etc/nologin
- ◆ /etc/passwd
- ◆ /etc/shadow
- ◆ /etc/xinetd.d/\*
- ◆ /etc/xinetd.conf
- ◆ /etc/inetd.d/\*
- ◆ /etc/inetd.conf
- ◆ /etc/inittab
- ◆ /etc/init.d/\*
- ◆ /etc/hosts.allow
- ◆ /etc/hosts.deny

### Use encryption to secure data

Configure OpenSSH 2 on a client and demonstrate understanding of server host keys and SSH port tunnels. Carry out basic GNU Privacy Guard configuration.

Files, terms and utilities could include:

- ◆ ssh
- ◆ ssh-keygen
- ◆ ssh-agent
- ◆ ssh-add
- ◆ ~/.ssh/id\_rsa and id\_rsa.pub
- ◆ ~/.ssh/id\_dsa and id\_dsa.pub
- ◆ /etc/ssh/ssh\_host\_rsa\_key and ssh\_host\_rsa\_key.pub
- ◆ /etc/ssh/ssh\_host\_dsa\_key and ssh\_host\_dsa\_key.pub
- ◆ ~/.ssh/authorized\_keys
- ◆ /etc/ssh\_known\_hosts
- ◆ gpg
- ◆ ~/.gnupg/\*

## Higher National Unit specification: support notes (cont)

**Unit title:** Open Source Operating Systems: Basic Server 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.

### 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)*.

### Opportunities for developing Core Skills

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



## **Higher National Unit specification: support notes (cont)**

**Unit title:** Open Source Operating Systems: Basic Server Administration

### **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](http://www.sqa.org.uk/assessmentarrangements)

## History of changes to Unit

Version	Description of change	Date

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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: Basic Server Administration

This Unit is designed to give you the basic skills and knowledge to operate a server using an Open Source Operating System environment.

The Unit will provide you with the underpinning theoretical knowledge necessary to perform basic operations, such as navigate a file structure and manipulate files and processes. The Unit is intended for candidates who will be working in a Unix/Linux environment in technical support, or software development, or who would like to gain a practical understanding of operating a server in an Open Source Operating System environment.

On completion of the Unit you should be able to:

- 1 Administer users, system, and desktops.
- 2 Manage shells, scripts and essential system services.
- 3 Administer network and configure security.

Outcome 1 includes the following:

- ◆ Install and configure X Windows
- ◆ Setup a display manager
- ◆ Configure accessibility settings
- ◆ Manage user and group accounts and related system files
- ◆ Automate system administration tasks by scheduling jobs
- ◆ Configure localisation and internationalisation settings

Outcome 2 includes the following:

- ◆ Customise and use the shell environment
- ◆ Customise or write simple scripts
- ◆ Manage SQL data
- ◆ Maintain system time
- ◆ Configure system logging
- ◆ Configure Mail Transfer Agent (MTA) client
- ◆ Manage printers

Outcome 3 includes the following:

- ◆ Demonstrate understanding of TCP/IP
- ◆ Configure basic TCP/IP on client
- ◆ Troubleshoot basic TCP/IP on client
- ◆ Configure client for DNS
- ◆ Perform basic security administration
- ◆ Configure basic security on client
- ◆ Use encryption to secure data

Assessment is by a multi-choice/short-response assessment that tests your knowledge and skills in using the items above. 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-1 102 or CompTIA LX0-102 exams.