

Module 22 Professional Certification

Module title	Professional Certification
Module NFQ level (only if an NFQ level can be demonstrated)	7
Module number/reference	BSCO-PC
Parent programme(s)	Bachelor of Science in Computing Science
Stage of parent programme	Award stage
Semester (semester1/semester2 if applicable)	Semester 2
Module credit units (FET/HET/ECTS)	ECTS
Module credit number of units	10
List the teaching and learning modes	Direct, Blended
Entry requirements (statement of knowledge, skill and competence)	Learners must have achieved programme entry requirements.
Pre-requisite module titles	BSCH-CH, BSCH-OSD, BSCH-NDA
Co-requisite module titles	None
Is this a capstone module? (Yes or No)	No
Specification of the qualifications (academic, pedagogical and professional/occupational) and experience required of staff (staff includes workplace personnel who are responsible for learners such as apprentices, trainees and learners in clinical placements)	Qualified to as least a Bachelor of Science (Honours) level in Computer Science or equivalent and with a Certificate in Training and Education (30 ECTS at level 9 on the NFQ) or equivalent.
Maximum number of learners per centre (or instance of the module)	60
Duration of the module	One Academic Semester, 12 weeks teaching
Average (over the duration of the module) of the contact hours per week	3.5
Module-specific physical resources and support required per centre (or instance of the module)	One class room with capacity for 60 learners along with one computer lab with capacity for 25 learners for each group of 25 learners

Analysis of required learning effort		
	Minimum ratio teacher / learner	Hours
Effort while in contact with staff		
Classroom and demonstrations	1:60	18
Monitoring and small-group teaching	1:25	24
Other (specify)		
Independent Learning		
Directed e-learning		
Independent Learning		118
Other hours (worksheets and assignments)		90
Work-based learning – learning effort		
Total Effort		250

Allocation of marks (within the module)					
	Continuous assessment	Supervised project	Proctored practical examination	Proctored written examination	Total
Percentage contribution	40%			60%	100%

Module aims and objectives

The aim of the module is to teach the learner how to install, configure and maintain a Linux operating system. All the relevant concepts and techniques are explained and exemplified in the clearest, simplest language. The objectives are to facilitate the learner to achieve the CompTIA LX0-103 professional certification.

Minimum intended module learning outcomes

On successful completion of this module, the learner will be able to:

1. Work at the Linux command line
2. Perform Linux maintenance tasks including assisting users, adding users to a larger system, executing backup & restore, shutdown & reboot
3. Install and configure a Linux workstation (including the windowing system) and connect it to a LAN, or a stand-alone PC via modem to the Internet.
4. Design and implement a partitioned file system layout that facilitates easy back up and upgrades.
5. Perform system service administration tasks through the use of process management, runlevel management and manipulation of configuration files.

Rationale for inclusion of the module in the programme and its contribution to the overall MIPLOs

Linux is widely used in system administration and web services areas. As such there is a demand for people who are comfortable with administering and managing Linux

based systems. This module equips the learner with the basic sysadmin skillset needed for administering such systems. While there are many different Linux certifications available the exam chosen is a superset of LPIC-1 and is not distribution specific. Appendix 1 of the programme document maps MIPLOs to the modules through which they are delivered.

Information provided to learners about the module

Learners receive a programme handbook to include module descriptor, module learning outcomes (MIMLO), class plan, assignment briefs, assessment strategy and reading materials.

Module content, organisation and structure

System Architecture

- Determine and Configure hardware settings
- Boot the System
- Change runlevels / boot targets and shutdown or reboot system

Linux Installation and Package Management

- Design hard disk layout.
- Install a boot manager.
- Manage shared libraries.
- Package management

GNU and Unix Commands

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

Devices, Linux Filesystems, Filesystem Hierarchy Standard

- 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.

Module teaching and learning (including formative assessment) strategy

The module is taught as a combination of lectures and lab sessions. The lecture sessions discuss and explain to learners the theoretical underpinnings of how a Linux operating system works. The practical lab sessions give the learners to install, configure, and maintain a Linux virtual machine in accordance with the tasks required by the chosen Linux certification.

Assessment is divided into three elements. First there are a number of worksheets that will take the learner through the process of configuring a Linux distribution for use. This will use a virtual machine where the learner must install a chosen distribution. The worksheets build week on week to produce a fully working Linux installation. There is a class MCQ test to assess the learner's understanding of the concepts covered throughout the module. Finally, the Learner takes the CompTIA LX0-103 exam.

Timetabling, learner effort and credit

The module is timetabled as one 1.5-hour lectures and one 2-hour labs per week.

Continuous assessment spreads the learner effort to focus on small steps before integrating all steps into the overall process of computer program design and implementation.

There are 42 contact hours made up of 12 lectures delivered over 12 weeks with classes taking place in a classroom. There are also 12 lab sessions delivered over 12 weeks taking place in a fully equipped computer lab. The learner will need 118 hours of independent effort to further develop the skills and knowledge gained through the contact hours. An additional 90 hours are set aside for learners to work on worksheets and assignments that must be completed for the module.

The team believes that 250 hours of learner effort are required by learners to achieve the MIMLOs and justify the award of 10 ECTS credits at this stage of the programme.

Work-based learning and practice-placement

There is no work based learning or practice placement involved in the module.

E-learning

The college VLE is used to disseminate notes, advice, and online resources to support the learners. The learners are also given access to Lynda.com as a resource for reference.

Module physical resource requirements

Requirements are for a classroom for 60 learners equipped with a projector, and a 25-seater computer lab for practical sessions with access to a Linux installation on a virtual machine.

Reading lists and other information resources

Recommended Text

Suehringm, S. (2017) CompTIA Linux+ and LPIC Practice Tests: Exams LX0-103/LPIC-1 101-400, LX0-104/LPIC-1 102-400, LPIC-2 201, and LPIC-2 202. Indianapolis: Wiley

Bresnahan, C., Blum, R. (2015) CompTIA Linux+ Powered by Linux Professional Institute Study Guide: Exam LX0-103 and Exam LX0-104, Sybex. Indianapolis: Wiley

Specifications for module staffing requirements

For each instance of the module, one lecturer qualified to at least Bachelor of Science (Honours) in Computer Science or equivalent, and with a Certificate in Training and Education (30 ECTS at level 9 on the NFQ) or equivalent.. Industry experience would be a benefit but is not a requirement.

Learners also benefit from the support of the programme director, programme administrator, learner representative and the Student Union and Counselling Service.

Module Assessment Strategy

The assignments constitute the overall grade achieved, and are based on each individual learner's work. The continuous assessments provide for ongoing feedback to the learner and relates to the module curriculum.

No.	Description	MIMLOs	Weighting
1	A series of worksheets to install and configure a Linux distribution on a Virtual Machine.	1,2,3,5	25%
2	1 class MCQ test	1,2,3,4,5	15%
3	Final exam LX0-103	1,2,3,4,5	60%

All repeat work is capped at 40%.

Sample assessment materials

Note: All assignment briefs are subject to change in order to maintain current content.

Worksheet 1: Installation of a linux distribution using the command line.

Introduction:

In this worksheet you will be tasked with installing a linux distribution on a virtual machine through the use of the command line. As explained in lectures you will not always have access to a GUI as with servers most of the time you are connecting, installing and maintaining remotely.

With this installation your main task is to generate a cohesive filesystem using the standard linux filesystem ext4 and also the use of swap space. You will also be required to install a boot loader (GRUB) in order to make the system startup.

Your installation will be considered successful if the virtual machine can boot up, the root user can log into the system, and the system can be shut down.

Tasks:

01) Boot the virtual machine with the ISO attached and make sure the ISO has a higher boot priority than the disk. You must install the distribution using the command line as later tasks will require lists of commands as evidence that the task has been done on the command line.

02) Follow the install guide for the given distribution until you hit the point where the disk has to be partitioned. You are required to use the following arrangements of partitions.

- /boot (1GB in size)
- /home (10GB in size)
- /var (10GB in size)
- / (20 GB in size)
- Swap space (2GB in size)

You are also required to use the fdisk and mkfs commands to implement this partitioning. List the full command sequences (including your full interactive session with fdisk) you used to generate the partitions and format them. Also list what partitions correspond to each part of the filesystem e.g. /boot is on /dev/sda1

03) Mount the filesystem with the mount command such that /boot, /home, and /var are all mounted within the / partition. / must be mounted at wherever the installation guide needs it to be mounted.

04) Install the distribution as per the install guide until you hit the point where you must install a boot loader

05) If given a choice you must install the GRUB bootloader. The boot loader must be installed on /dev/sda and you must generate a GRUB config file such that it knows where the kernel image is in /boot and also it knows where the root partition (/) is.

06) Finish off installation, if you have not set a root password set one now. The password should be "LinuxCertificationPassword".

07) Reboot the system, log in as the root user, and then shutdown the system.

Worksheet 2: Interacting with the package manager and preparations for managing services and config file editing.

Introduction:

NOTE: if you have not completed worksheet 1 you will need to do this before you can carry on with this worksheet.

In this worksheet you will need to use the package manager that your distribution provides to update the system, install a few packages, and remove one or two packages. You will also need to get used to using a command line text editor as this will be your mechanism for adjusting the system configuration in the absence of a GUI.

As the distribution and package manager may change over time please refer to the lecture notes for the commands needed to interact with the package manager. You will be required to list your command sequences and screenshot the output of each task.

Tasks:

01) Run an update the repositories to get the most up to date package information. Follow this by doing a system wide package update. Depending on the difference between the install date and the release date of the ISO this can take a short time or a long time.

02) Install the following packages: vim, openssh, httpd, mariadb

03) Remove the packages httpd, mariadb

04) using vim open the /etc/inittab file and change the name of runlevel 5 to fullserver (refer to the cheatsheet for how to use vim)

05) add a user to the system called "someuser" with the password "JustANormalUser"

06) using systemctl enable and start the sshd service. This will enable the SSH remote login service. To test this is working use a program like PuTTY to log into localhost using the details of "someuser"

07) using vim open up /etc/ssh/sshd_config and change the login grace time to 1 minute. Save the config file and restart the service.

08) using systemctl disable the sshd service

Sample MCQ (note that this is not a full MCQ but will give a sample of the questions that will be asked)

1) Which of the following is not a standard directory that would appear if you ran the command "ls /"

- a) sys/
- b) bin/
- c) var/
- d) src/

2) What is contained in the /etc. directory

- a) User manuals with examples on system configuration
- b) The collection of configuration files for all services and the kernel
- c) User manuals only
- d) Examples on system configuration only

3) What is the primary reason for splitting up the filesystem into multiple partitions

- a) Enables the choice of filesystems tailored for each partition
- b) Permits easy upgrade or change of distribution without destroying user data each time
- c) Ensures a strict division of disk space between partitions
- d) All of the above.

4) Using the chmod command we would like to change the permissions on a file such that the only person that can read and write it is the user (execute not allowed). Which of the following sets of permission numbers will make this change

- a) 600
- b) 700
- c) 644
- d) 666

5) Which of the following commands would create a symbolic link "/etc/localtime" that points to the file "/usr/share/zoneinfo/Europe/Dublin"

- a) ln /etc/localtime /usr/share/zoneinfo/Europe/Dublin
- b) ln /usr/share/zoneinfo/Europe/Dublin /etc/localtime
- c) ln -s /etc/localtime /usr/share/zoneinfo/Europe/Dublin
- d) ln -s /usr/share/zoneinfo/Europe/Dublin /etc/localtime

- 6) What is the purpose of runlevel 2
- a) full system with GUI running (X or Wayland)
 - b) full multiuser system command line only
 - c) Single user system
 - d) None of the above
- 7) top is a command line tool that enables a sysadmin to do what
- a) See and manage what processes are currently running on the system
 - b) Determine what is using the most network bandwidth
 - c) See who is logged into the system for the most time
 - d) None of the above
- 8) Which of the following information is stored within the BIOS? (Choose TWO correct answers.)
- a) Boot device order
 - b) Linux kernel version
 - c) Hardware configuration
 - d) Timezone
- 9) During a system boot cycle, what program is executed after the BIOS completes its tasks?
- a) The bootloader
 - b) The inetd program
 - c) The init program
 - d) The kernel
- 10) Which run levels should never be declared as the default run level when using SysV init?
(Choose TWO correct answers.)
- a) 0
 - b) 3
 - c) 5
 - d) 6