

## Linux System Administration

### Course Content

#### Course Outline

**Module 1: System Startup and Shutdown** This module explains how to manage startup and shutdown processes in Linux.

#### Lessons

- Understanding the Boot Sequence
- The Grand Unified Boot Loader
- GRUB Configuration Files
- System Configuration Files in /etc
- The init Process
- SysVinit Startup
- chkconfig and service
- Upstart
- systemd
- Shutting down/Rebooting the System

#### Lab : Chapter Labs

- Boot into non-graphical mode using GRUB
- Add a new startup service with System V
- Add a new startup services with system
- Run Shutdown vs. Halt vs. Reboot

After completing this module, students will be able to:

- Manage startup process in Linux.
- Manage shutdown process in Linux.

**Module 2: Linux Filetree System Layout** This module explains how the Linux Filesystem is organized and points out the key directories and their roles.

#### Lessons

- Data Distinctions
- FHS Linux Standard Directory Tree
- root (/) directory
- /bin
- /dev
- /etc
- /home
- /lib and /lib64
- /media

- /mnt
- /opt
- /proc
- /sys
- /root
- /sbin
- /tmp
- /usr
- /var
- /run

#### **Lab : Chapter Labs**

- Change size of the default directories
- Touring the /proc Filesystem

#### **After completing this module, students will be able to:**

- Describe how the Linux Filesystem is set up.
- Demonstrate knowledge of how the key directories work.

**Module 3:** Kernel Services and Configuration This module explains how the Linux Kernel is configured, how the modules and utilities work, the function of sysctl and udev and Device Management.

#### **Lessons**

- Kernel Overview
- Kernel Configuration
- sysctl
- Kernel Modules
- Module Utilities
- Module Configuration
- udev and Device Management

#### **Lab : Chapter Labs**

- Manipulating system tunables with sysctl.
- Changing the maximum process ID.
- Working with Kernel modules.
- Working with udev

#### **After completing this module, students will be able to:**

- Describe how the Linux Kernel is configured.
- Work with Kernel modules.
- Manage devices.
- Work with udev and sysctl.

**Module 4:** Partitioning and Formatting Disks This module explains how to work with disks in Linux by naming, partitioning and sizing them.

#### **Lessons**

- Common Disk Types
- Disk Geometry
- Partitioning
- Naming Disk Devices
- Sizing up partitions
- Partition table editors

#### **Lab : Chapter Labs**

- Using a file as a disk partition image
- Partitioning a Disk Image file
- Using losetup and parted
- Partitioning a real hard disk

#### **After completing this module, students will be able to:**

- Partition disks.
- Name disk drives.
- Size partitions.
- Edit partition tables.

**Module 5: Linux Filesystems** This module explains how to work with Linux Filesystems, starting with the understanding that Linux treats everything as a file. It covers Virtual filesystem (VFS), Filesystem Usage and Attributes, Major types (ext4, XFS, btrfs) and how to create, format, mount, swap and repair Filesystems.

#### **Lessons**

- Some Notes About Filesystems
- Virtual Filesystem (VFS)
- Filesystem Concepts
- Disk and Filesystem Usage
- Extended Attributes
- ext4
- XFS
- btrfs
- Creating and formatting filesystems
- Checking and Repairing Filesystems
- Mounting filesystems
- Swap
- Filesystem Quotas

#### **Lab : Chapter Labs**

- Defragmenting a system.
- Modifying Filesystem parameters using tune2fs.
- Working with file attributes.
- Mounting options.
- Managing swap space.
- Filesystem quotas.
- Working with XFS

- Working with btrfs

**After completing this module, students will be able to:**

- Create Filesystems.
- Format Filesystems.
- Mount Filesystems.
- Use swap partitions.
- Manage Filesystem quotas.
- Repair Filesystems.

**Module 6: RAID and LVM**This module explains how to work with RAID and Logical Volume Management (LVM).

### Lessons

- RAID
- RAID Levels
- Software RAID Configuration
- Logical Volume Management (LVM)
- Volumes and Volume Groups
- Working with Logical Volumes
- Resizing Logical Volumes
- LVM Snapshots

### Lab : Chapter Labs

- Creating a RAID device
- Creating Logical Volumes

**After completing this module, students will be able to:**

- Understand, configure and monitor RAID.
- Create, resize and utilize Logical Volumes.
- Work with LVM snapshots.

**Module 7: Processes**This module explains how to work with Linux processes. It begins with an overview of what processes are and how they work before proceeding to illustrate how to create, monitor, prioritize and limit processes.

### Lessons

- Programs and Processes
- Process States
- Execution Modes
- Daemons
- Creating Processes
- Process Limits
- Process Monitoring
- Signals
- niceness
- Libraries

### **Lab : Installing and Configuring Windows 7**

- Controlling processes with ulimit
- Using ps and top
- Monitoring process states
- Examining signal priorities and execution

#### **After completing this module, students will be able to:**

- Describe the role of processes in Linux and how they relate to programs.
- Identify the different states processes can take.
- Monitor and limit processes.
- Set process priority using niceness values.

**Module 8: Package Management Systems** This module explains how to work with the major package management systems used in Linux distributions. Covers both RPM and DKPG as well as the use of version control systems such as git.

#### **Lessons**

- Software Packaging Concepts
- RPM (Red Hat Package Manager)
- DPKG (Debian Package)
- Revision Control Systems

#### **Lab : Chapter Labs**

- Using RPM
- Rebuilding the RPM database
- Using DKPG
- Version control with git

#### **After completing this module, students will be able to:**

- Understand the role and function of package management systems.
- Understand and use RPM.
- Understand and use DKPG.
- Understand the role of revision control systems, particularly git.

**Module 9: Package Installers** This module explains how to use the major package installers, including yum, zypper and APT. It also explains the role that package installers play in automating software management and dealing with dependencies.

#### **Lessons**

- Package Installers
- yum
- zypper
- APT

#### **Lab : Chapter Labs**

- Basic yum commands
- Using yum to find information about a package
- Managing groups of packages with yum

- Adding a new yum repository
- Basic zypper commands
- Using zypper to find information about a package
- Basic APT commands
- Using APT to find information about a package
- Managing groups of packages using APT

**After completing this module, students will be able to:**

- Describe the role that package installers play in managing the software update process.
- Demonstrate proficiency with APT, yum and zipper.

**Module 10: User and Group Account Management** This module explains how to work with users and groups in Linux. It also covers how to work with passwords, restricted shells, the root account, Pluggable Authentication Modules (PAM), LDAP and SSH.

**Lessons**

- User Accounts
- Management
- Passwords
- Restricted Shells and Accounts
- The root Account
- Group Management
- PAM (Pluggable Authentication Modules)
- Authentication Process
- Configuring PAM
- LDAP Authentication
- File Permissions and Ownership
- SSH

**Lab : Chapter Labs**

- Working with user accounts
- Working with groups
- Configuring PAM
- Using chmod

**After completing this module, students will be able to:**

- Manage users and groups by adding/deleting/modifying them.
- Configure and use LDAP.
- Configure on use PAM.
- Modify user processes and resources.
- Appropriately use the root account.
- Use SSH to securely access remote systems.

**Module 11: Backup and Recovery Methods** This module explains how to backup data in Linux. It covers the tools that are used for backup and compression as well as for moving and copying files and also for restoring files.

## Lessons

- [Backup Basics](#)
- [cpio](#)
- [tar](#)
- [Compression: gzip, bzip2 and xz and Backups](#)
- [dd](#)
- [rsync](#)
- [dump and restore](#)
- [mt](#)
- [Backup Programs](#)

## Lab : Chapter Labs

- Using tar for backup
- Using cpio for backup
- Using rsync for backup

### After completing this module, students will be able to:

- Describe the benefits of backup up data.
- Demonstrate proficiency with common backup tools.
- Demonstrate proficiency with common compression tools.

**Module 12:** Networking This module explains how to conduct basic networking in Linux. It covers IP addresses, Hostnames, Network Interfaces, Routing and Name Resolution.

## Lessons

- IP Addresses
- Hostnames
- Configuring Network Interfaces
- Routing
- Name Resolution
- Network Diagnostics

## Lab : Chapter Labs

- Static configuration of a network interface
- Adding a static hostname
- Adding a network interface alias

### After completing this module, students will be able to:

- Explain how IP addresses function.
- Manipulate hostnames.
- Configure network interfaces.
- Route traffic persistently and non-persistently.
- Perform network diagnostics.

**Module 13:** Firewalls This module explains how to work with firewalls in Linux. It covers both command line tools and GUI tools as well as firewalld. Zones and source management are discussed, as is service and port management.

## Lessons

- Firewalls
- Interfaces
- firewalld
- Zones
- Source Management
- Service and Port Management

## Lab : Chapter Labs

- Installing firewalld
- Examining firewall-cmd
- Adding services to a zone
- Using the firewall GUI

### After completing this module, students will be able to:

- Describe the role and function of firewalls.
- Understand the most commonly use tools.
- Describe the function of zones.
- Implement services on zones.

**Module 14:** Local System Security This module explains how to secure systems against both internal and external threats. It covers how to identify risks and provides guidance on how to decide what protection is appropriate. Finally, it covers the basic types of security available (physical, filesystem, and security modules e.g. SELinux).

## Lessons

- Local System Security
- Creating a Security Policy
- Updates and Security
- Physical Security
- Filesystem Security
- Linux Security Modules

## Lab : Chapter Labs

- Using SELinux
- Security and mount options
- Using umask
- Using setuid and scripts

### After completing this module, students will be able to:

- Describe the sources of threats to system security.
- Understand the components important to creating a security policy.
- Demonstrate basic familiarity with SELinux.

**Module 15:** Basic Troubleshoot and System Rescue This module explains how to conduct troubleshooting in Linux as well as likely sources of issues. It covers basic concepts in system rescue and recovery and how to identify corrupted filesystems.



## Lessons

- [Troubleshooting Overview](#)
- [Things to Check: Networking](#)
- [Boot Process Failures](#)
- [Filesystem Corruption and Recovery](#)
- [Virtual Consoles](#)
- [Rescue Media and Troubleshooting](#)
- [System Rescue and Recovery](#)

## Lab : Chapter Labs

- [Preparing to use Rescue/Recover media](#)
- [Recovering from a corrupted GRUB configuration](#)
- [Recovering from a password failure](#)
- [Recovering from partition table corruption](#)
- [Recovering using the install image](#)

## After completing this module, students will be able to:

- Describe the common sources of corruption/performance issues.
- Identify the cause of system issues.
- Recover a system after some of the most common types of issues.

## Additional Reading

To help you prepare for this class, review the following resources:

- Free 'Introduction to Linux' course available at:

<https://www.edx.org/course/introduction-linux-linuxfoundationx-lfs101x-2>