

# **LFS201: Essentials of Linux System Administration**

**Modality: On Demand**

**Duration: 40 Hours**

*This course is for professionals planning to enroll in the LFCS Exam leading to the LFCS Certification. The official exam voucher is not included in this course. However, the official exam voucher can be purchased separately on request.*

## **About this Course:**

The LFS201: Essentials of Linux System Administration is a Beginner-Level course covering the core concepts of Linux Systems Management, Up-Gradation, & Configuration. This course delivers conceptual knowledge of working with the major Linux Distribution Families such as Debian/Ubuntu, SUSE, and Red Hat. The primary objective of this course is to train & prepare candidates for success in the LFCS Certification Exam.

Through this course, candidates & students will learn the art of building and managing Linux System & Infrastructure. The major Linux System Management Techniques are covered comprehensively in this course. Besides this, professionals get to learn File Searching, Manipulation, & Installation, Groups & Users Management, and Linux Services & Servers Configuration. On average, a proficient Linux Administrator earns \$78,743 annually.

## **Course Objectives:**

The core objective of this course is to help professionals develop a better understanding and sound knowledge of the following key concepts:

- Linux Commands Performance such as File Searching, Manipulating, and Installation
- Linux Programs Operations by Handling Scheduled Tasks and Boot Process
- Groups & Users Management by Configuration Addition, Modification, & Deletion
- User Procedures & Resource Modification and LDAP & PAM Configuration
- Network Performance Management and Traffic Tunneling, Tracking, & Configuration
- Configuration of Security-Enhanced Linux, Stocks DNS, and Secure Shell Services
- HTTP and DHCP Server Configuration
- Managing System Storage with Physical Volumes, Quotas, Partitions, and Clustering

## **Audience:**

Professionals who would like to gain knowledge about the Essentials of Linux System Administration and wants to pursue a career as a Linux System Administrator.

## **Prerequisites:**

There are no prerequisites for the LFS201 (Essentials of Linux System Administrator) course.

## Course Outline:

### Preface

- Introduction
- Relationship to LFS101x
- Using as LFCS Exam Preparation
- Course Formatting
- Read the Documentation
- Target Platform
- Command Line vs Graphical Interface
- Target Linux Distributions
- Installation: What to Use for this Course
- Course Timing
- Lab Exercises
- Change, Repetition, and Holy Wars
- The Linux Foundation
- Linux Foundation Training
- Labs

### System Startup and Shutdown

- Understanding the Boot Sequence
- BIOS
- Boot Loaders
- Configuration Files in /etc
- /etc/sysconfig
- /etc/default
- Shutting Down and Rebooting
- Labs

### GRUB

- What is GRUB?
- Interactive Selections with GRUB at Boot
- Installing GRUB
- GRUB Device Nomenclature
- Customizing the GRUB Configuration File
- Labs

### init: SystemV, Upstart, systemd

- The init Process
- Startup Alternatives
- SysVinit Runlevels
- SysVinit and /etc/inittab
- SysVinit Startup Scripts
- chkconfig

- service
- chkconfig and service on Debian-based Systems
- Upstart
- Upstart Utilities
- systemd
- systemd Configuration Files
- Systemctl
- Labs

## Linux Filesystem Tree Layout

- One Big Filesystem
- Data Distinctions
- FHS Linux Standard Directory Tree
- Main Directory Layout
- The root (/) Directory and Filesystem
- /bin
- /boot
- Other Files and Directories in /boot
- /dev
- /etc
- /home
- /lib
- /media
- /mnt
- /opt
- /proc
- /sys
- /root
- /sbin
- /tmp
- /usr
- /var
- /run
- Labs

## Kernel Services and Configuration

- Kernel Overview
- Main Kernel Tasks
- Kernel Command Line
- Kernel Boot Parameters
- sysctl
- Labs

## Kernel Modules

- Advantages of Kernel Modules

- Module Utilities
- Module Loading and Unloading
- modprobe
- Some Considerations with Modules
- modinfo
- Module Parameters
- Kernel Module Configuration
- Labs

## **Devices and udev**

- Device Nodes
- Major and Minor Numbers
- udev
- udev Components
- udev and Hotplug
- The udev Device Manager
- udev Rule Files
- Creating udev Rules
- Some Examples of Rules Files
- Labs

## **Partitioning and Formatting Disks**

- Common Disk Types
- Disk Geometry
- Partitioning
- Why partition?
- Partition Table
- Naming Disk Devices and Nodes
- More on SCSI Device Names
- blkid and lsblk
- Sizing up partitions
- Backing up and Restoring Partition Tables
- Partition table editors
- Using fdisk
- Labs

## **Encrypting Disks**

- Why Use Encryption?
- LUKS
- cryptsetup
- Using an Encrypted Partition
- Mounting at Boot
- Labs

## **Linux Filesystems and the VFS**

- Filesystem Basics
- Filesystem Tree Organization
- Virtual File System (VFS)
- Available Filesystems
- Journalling Filesystems
- Current Filesystem Types
- Special Filesystems
- Labs

## **Filesystem Features: Attributes, Creating, Checking, Mounting**

- Inodes
- Directory Files
- Extended Attributes and lsattr/chattr
- Creating and Formatting Filesystems
- Checking and Fixing Filesystems
- Mounting and Unmounting Filesystems
- mount
- mount Options
- umount
- Mounting Filesystems at Boot
- Listing Currently Mounted Filesystems
- Labs

## **Filesystem Features: Swap, Quotas, Usage**

- Swap
- Quotas
- Setting up Quotas
- quotacheck
- Turning quotas on and off
- Examining Quotas
- Setting quotas
- Filesystem Usage
- Disk Space Usage
- Labs

## **The Ext2/Ext3/Ext4 Filesystems**

- Ext4 History and Basics
- Ext4 Features
- Ext4 Layout
- Block Groups
- dumpe2fs
- tune2fs
- Superblock Information
- Data Blocks and Inodes
- Ext4 Filesystem Enhancements

- Labs

## **The XFS and btrfs Filesystems**

- XFS Features
- XFS Filesystem Maintenance
- The btrfs Filesystem
- Labs

## **Logical Volume Management (LVM)**

- LVM
- LVM and RAID
- Volumes and Volume Groups
- Logical Volumes Utilities
- Creating Logical Volumes
- Displaying Logical Volumes
- Resizing Logical Volumes
- Examples of Resizing
- LVM Snapshots
- Labs

## **RAID**

- RAID
- RAID Levels
- Software RAID Configuration
- Monitoring RAIDs
- RAID Hot Spares
- Labs

## **Local System Security**

- Local System Security
- Creating a Security Policy
- What to Include in the Policy
- What Risks to Assess
- Choosing a Security Philosophy
- Some General Security Guidelines
- Updates and Security
- Hardware Accessibility and Vulnerability
- Hardware Access Guidelines
- Protection of BIOS
- Protecting the Boot Loader with Passwords
- Filesystem Security: mount Options
- setuid and setgid
- Setting the setuid/setgid Bits
- Labs

## Linux Security Modules

- What are Linux Security Modules?
- LSM Choices
- SELinux Overview
- SELinux Modes
- SELinux Policies
- Context Utilities
- SELinux and Standard Command Line Tools
- SELinux Context Inheritance and Preservation
- restorecon
- semanage fcontext
- Using SELinux Booleans
- getsebool and setsebool
- Troubleshooting Tools
- Additional Online Resources
- AppArmor
- Labs

## Processes

- Processes, Programs and Threads
- The init Process
- Processes
- Process Attributes
- Controlling Processes with ulimit
- Process Permissions and setuid
- Process States
- Execution Modes
- User Mode
- System Mode
- Daemons
- Kernel-Created Processes
- Process Creating and Forking
- Creating Processes in a Command Shell
- Using nice to Set Priorities
- Modifying the Nice Value
- Labs

## Signals

- What are Signals?
- Types of Signals
- kill
- killall and pkill
- Labs

## System Monitoring

- Available Monitoring Tools
- The /proc and /sys Pseudo-file systems
- /proc Basics
- A Survey of /proc
- /proc/sys
- /sys Basics
- A Survey of /sys
- sar
- Labs

## **Process Monitoring**

- Monitoring Tools
- Viewing Process States with ps
- BSD Option Format for ps
- ps Output Fields
- UNIX Option Format for ps
- Customizing the ps Output
- Using pstree
- Viewing System Loads with top
- top Options
- Labs

## **I/O Monitoring and Tuning**

- Disk Bottlenecks
- iostat
- iostat Options
- iostat Extended Options
- iotop
- Using ionice to Set I/O Priorities
- Labs

## **I/O Scheduling**

- I/O Scheduling
- I/O Scheduler Choices
- I/O Scheduling and SSD Devices
- Tunables and Switching The I/O Scheduler at Run Time
- CFQ (Completely Fair Queue Scheduler)
- CFQ Tunables
- Deadline Scheduler
- Deadline Tunables
- Labs

## **Memory: Monitoring Usage and Tuning**

- Memory Tuning Considerations



- Memory Monitoring Tools
- /proc/sys/vm
- vmstat
- /proc/meminfo
- OOM Killer
- Labs

## Package Management Systems

- Software Packaging Concepts
- Why Use Packages?
- Packages Types
- Available Package Management Systems
- Packaging Tool Levels and Varieties
- Package Sources
- Creating Software Packages
- Labs

## RPM

- RPM
- Advantages of Using RPM
- Package File Names
- Database Directory
- Helper Programs and Modifying Settings
- Queries
- Verifying Packages
- Installing Packages
- Uninstalling Packages
- Upgrading Packages
- Freshening Packages
- Upgrading the Kernel
- Using rpm2cpio
- Labs

## DPKG

- DPKG Essentials
- Package File Names
- Source Packages
- DPKG Queries
- Installing/Upgrading/Uninstalling Packages
- Labs

## yum

- Package Installers
- What Is yum?

- Configuring yum to Use Repositories
- Repository Files
- Queries
- Verifying Packages
- Installing/Removing/Upgrading Packages
- Additional Commands
- Labs

## **zypper**

- What Is zypper?
- zypper Queries
- Installing/Removing/Upgrading
- Additional zypper Commands
- Labs

## **APT**

- What Is APT?
- apt-get
- Queries Using apt-cache
- Installing/Removing/Upgrading
- Labs

## **User Account Management**

- User Accounts
- Attributes of a User Account
- Creating User Accounts with useradd
- Modifying and Deleting User Accounts
- Locked Accounts
- User IDs and /etc/passwd
- /etc/shadow
- Why Use /etc/shadow?
- Password Management
- chage: Password Aging
- Restricted shell
- Restricted Accounts
- The root Account
- SSH
- ssh Configuration Files
- Labs

## **Group Management**

- Groups
- Group Management
- User Private Groups

- Group Membership
- Labs

## **File Permissions and Ownership**

- Owner, Group and World
- File Access Rights
- File Permissions and Security and Authentication
- Changing permissions: chmod
- chmod: Numerical Syntax for Permissions
- Changing User and Group File Ownership: chown and chgrp
- umask
- Filesystem ACLs
- Getting and Setting ACLs
- Labs

## **Pluggable Authentication Modules (PAM)**

- PAM: A Unified Approach to Authentication
- Authentication Process
- PAM Configuration Files
- PAM Rules
- LDAP Authentication
- Labs

## **Backup and Recovery Methods**

- Why Backups?
- What Needs Backup?
- Tape Drives
- Backup Methods
- Backup Strategies
- Backup Utilities
- cpio
- Using tar for Backups
- Using tar for Restoring Files
- Incremental Backups with tar
- Compression: gzip, bzip2 and xz and Backups
- dd
- dd Examples
- rsync
- dump and restore
- dump Options
- Level 0 backup with dump
- restore
- mt
- Backup Programs
- Labs

## Network Addresses

- IP Addresses
- IPv4 Address Types
- Special Addresses
- IPv6 Address Types
- IPv4 Address Classes
- Netmasks
- Hostname
- Getting and Setting the Hostname
- Labs

## Network Devices and Configuration

- Network Devices
- Problems with Network Device Names
- Predictable Network Interface Device Names
- Examples of the New Naming Scheme
- NIC Configuration Files
- ifconfig
- The ip Utility
- Examples of Using ip
- Routing
- Default Route
- Static Routes
- Name Resolution
- /etc/hosts
- DNS
- Network Diagnostic Utilities
- Labs

## Firewalls

- What is a Firewall
- Firewall Interfaces and Tools
- firewalld
- firewalld Service Status
- Zones
- Zone Management
- Source Management
- Service and Port Management
- Labs

## Basic Troubleshooting

- Troubleshooting Overview
- Basic Techniques
- Intuition and Experience

- Things to Check: Networking
- Things to Check: File Integrity
- Boot Process Failures
- Filesystem Corruption and Recovery
- Using Rescue/Recovery Media
- Common Utilities on Rescue/Recovery Disks
- Using Rescue/Recovery Media
- Labs

## **System Rescue**

- Emergency Boot Media
- Using Rescue Media
- Rescue USB Key
- Emergency Mode
- Single User Mode
- Labs