GL-120: Linux Fundamentals

Course Length: 5 days

Course Description: The "GL120 Linux Fundamentals" course is tailored for IT professionals aiming to enhance their Linux skills, focusing on essential system administration tasks and the automation of routine operations. This detailed program covers a broad spectrum of Linux functionalities, from basic command line operations and filesystem management to setting up and maintaining secure environments. It provides a deep dive into the Linux ecosystem, equipping IT personnel with the necessary tools to manage and optimize Linux-based systems.

In the more advanced sections, the course delves into shell scripting and process management, critical for scripting automated tasks, managing software processes, and scheduling tasks with cron. Participants will gain hands-on experience in writing effective scripts for a variety of administrative tasks, including system monitoring and batch processing. The training also covers process management in depth, including job scheduling, process prioritization, and handling, essential for ensuring optimal performance and stability of Linux systems.

Additionally, the course introduces participants to advanced text manipulation techniques and tools such as sed, awk, and Vim. These tools are fundamental in efficiently handling log files, configuring system settings programmatically, and performing data analysis tasks. By the end of the course, IT professionals will have a solid foundation in managing Linux environments, with practical skills in leveraging Linux for system administration, automation, and technical problem-solving in professional IT settings.

Audience:

1. IT Professionals: System administrators, network engineers, and other IT staff who need to manage and maintain Linux servers and desktops.
2. Software Developers: Developers who work on or deploy applications on Linux environments and require a deeper understanding of the operating system to optimize their development and testing workflows.
3. DevOps Engineers: Professionals in DevOps roles who are responsible for the integration and continuous deployment of software applications in Linux environments, leveraging automation and configuration management tools that run on Linux.
4. Technical Support Staff: Support technicians and helpdesk personnel who need to troubleshoot and resolve issues in Linux systems, understanding the underlying system to better assist users.
5. Computer Science Students: Undergraduate and graduate students studying computer science or related fields who are interested in building a strong foundation in Linux as part of their academic and professional preparation.

Benefits:

1. Enhanced Command Line Proficiency: Participants will master the Linux command line, enabling them to efficiently navigate the filesystem, execute commands, and automate tasks, which are essential skills for any IT specialist working with Linux-based systems.
2. Practical Skills in System Administration: The course equips IT professionals with practical, hands-on experience in managing Linux systems, from user and group management to configuring services and monitoring system performance.

3. Advanced Automation Capabilities: Through learning shell scripting and cron job scheduling, participants will be able to automate routine tasks such as updates, backups, and system checks, which increases operational efficiency and reduces the likelihood of human error.

4. Process Management Expertise: The training provides in-depth knowledge of process management, including starting, stopping, and monitoring processes. This is crucial for maintaining system stability and optimizing resource use in a Linux environment.

5. Proficiency with Text Manipulation Tools: IT professionals will gain expertise in using powerful text processing tools like sed, awk, and Vim. These skills are invaluable for tasks such as parsing logs, editing configuration files en masse, and automating complex text manipulation tasks across numerous files.

Prerequisites: Students should be comfortable with computers. No familiarity with Linux or other Unix operating systems is required.

Distributions: Red Hat Enterprise Linux 9

Course Outline

1. **WHAT IS LINUX?**
    1. Unix and its Design Principles
    2. FSF and GNU
    3. GPL – General Public License
    4. The Linux Kernel
    5. Linux Kernel and Versioning
    6. Components of a Distribution
    7. Slackware
    8. SUSE Linux Products
    9. Debian
    10. Ubuntu
    11. Red Hat Linux Products
    12. Oracle Linux

2. **LOGIN AND EXPLORATION**
    1. Logging In
    2. Running Programs
    3. Interacting with Command Line
    4. Desktop Environments
    5. GNOME
    6. Starting X
    7. Gathering Login Session Info
    8. Gathering System Info
    9. Uptime & w
    10. got root?
    11. Switching User Contexts
    12. sudo
    13. Help from Commands and Documentation
    14. whereis
    15. Getting Help Within the Graphical Desktop
    16. Getting Help with man & info
    17. $MANPATH, whatis and apropos
    18.

    LAB TASKS
    1. Login and Discovery
    2. Help with Commands
    3. Switching Users With su

3. **THE LINUX FILESYSTEM**
    1. Filesystem Support
    2. Unix/Linux Filesystem Features
    3. Filesystem Hierarchy Standard

4. Navigating the Filesystem
5. Displaying Directory Contents
6. Filesystem Structures
7. Determining Disk Usage With df and du
8. Determining Disk Usage (GUI)
9. Disk Usage with Quotas
10. File Ownership
11. Default Group Ownership
12. File and Directory Permissions
13. File Creation Permissions with umask
14. SUID and SGID on files
15. SGID and Sticky Bit on Directories
16. Changing File Permissions
17. User Private Group Scheme

LAB TASKS

1. Navigating Directories and Listing Files
2. Disk and Filesystem Usage
3. File and Directory Ownership and Permissions
4. Introduction to Troubleshooting Labs
5. Troubleshooting Practice: Filesystem

4. MANIPULATING FILES

1. Directory Manipulation
2. File Manipulation
3. Deleting and Creating Files
4. Managing Files Graphically
5. Drag and drop with Nautilus
6. Physical Unix File Structure
7. Filesystem Links
8. File Extensions and Content
9. Displaying Files
10. Previewing Files
11. Producing File Statistics
12. Displaying Binary Files
13. Searching the Filesystem
14. Alternate Search Method

LAB TASKS

1. Manipulating Files and Directories
2. File Examination & Search Commands

5. SHELL BASICS

1. Role of Command Shell
2. Communication Channels
3. File Redirection
4. Piping Commands Together
5. Filename Matching
6. File Globbing and Wildcard Patterns
7. Brace Expansion
8. Shell and Environment Variables
9. Key Environment Variables
10. Which and Type
11. General Quoting Rules
12. Nesting Commands

LAB TASKS

1. Redirection and Pipes
2. Wildcard File Matching
3. Shell Variables
4. Shell Meta-Characters
5. Command Substitution

6. ARCHIVING AND COMPRESSION

1. Archives with tar
2. Archives with cpio
3. The gzip Compression Utility
4. The bzip2 Compression Utility

5. The XZ Compression Utility
6. The PKZIP Archiving/Compression format
7. GNOME File Roller

LAB TASKS

1. Archiving and Compression

7. TEXT PROCESSING

1. Searching Inside Files
2. The Streaming Editor
3. Text Processing with Awk
4. Replacing Text Characters
5. Text Sorting
6. Duplicate Removal Utility
7. Extracting Columns of Text
8. Combining Files and Merging Text
9. Comparing File Changes

LAB TASKS

1. Processing Text Streams
2. Text Processing

8. REGULAR EXPRESSIONS

1. Regular Expression Overview
2. Regular Expression Implementations
3. Regular Expressions
4. RE Character Classes
5. Regex Quantifiers
6. RE Parenthesis

LAB TASKS

1. Pattern Matching with Regular Expressions
2. Extended Regular Expressions
3. Using Regular Expressions With sed

9. TEXT EDITING

1. Text Editing
2. Pico/GNU Nano
3. Pico/Nano Interface
4. Nano configuration
5. Pico/Nano Shortcuts
6. vi and Vim
7. Learning Vim
8. Basic vi
9. Intermediate vi

LAB TASKS

1. Text Editing with Nano
2. Text Editing with Vim

10. MESSAGING

1. System Messaging Commands
2. Controlling System Messaging
3. Internet Relay Chat
4. Instant Messenger Clients
5. Electronic Mail
6. Sending Email with sendmail
7. Sending and Receiving Email with mailx
8. Sending and Receiving Email with mutt
9. Sending Email with Pine
10. Evolution

LAB TASKS

1. Command Line Messaging
2. Messaging with talkd
3. Command Line Email
4. Alpine

11. COMMAND SHELLS

1. Shells
2. Identifying the Shell

3. Changing the Shell
4. Configuration Files
5. Script Execution
6. Shell Prompts
7. Bash: Bourne-Again Shell
8. Bash: Configuration Files
9. Bash: Command Line History
10. Bash: Command Editing
11. Bash: Command Completion
12. Bash: "shortcuts"
13. Bash: prompt
14. Setting Resource Limits via ulimit

LAB TASKS

1. Linux Shells
2. Bash History
3. Aliases
4. Bash Login Scripts
5. The Z Shell

12. INTRODUCTION TO SHELL SCRIPTING

1. Shell Script Strengths and Weaknesses
2. Example Shell Script
3. Positional Parameters
4. Input & Output
5. Doing Math
6. Comparisons with test
7. Exit Status
8. Conditional Statements
9. Flow Control: case
10. The for Loop
11. The while and until Loops

LAB TASKS

1. Writing a Shell Script

13. PROCESS MANAGEMENT AND JOB CONTROL

1. What is a Process?
2. Process Lifecycle
3. Process States
4. Viewing Processes
5. Signals
6. Tools to Send Signals
7. nohup and disown
8. Managing Processes
9. Tuning Process Scheduling
10. Persistent Shell Sessions with tmux
11. Job Control Overview
12. Job Control Commands
13. Persistent Shell Sessions with Screen
14. Using screen
15. Advanced Screen

LAB TASKS

1. Job Control Basics
2. Process Management Basics
3. Screen Basics
4. Using Screen Regions
5. Troubleshooting Practice: Process Management

14. AT AND CRON

1. Automating Tasks
2. at/batch
3. cron
4. The crontab Command
5. crontab Format
6. /etc/cron.*/ Directories

7. Anacron
8. Systemd Timers

LAB TASKS

1. Creating and Managing User Cron Jobs
2. Adding System cron Jobs
3. Troubleshooting Practice: Automating Tasks

15. MANAGING SOFTWARE

1. Downloading with FTP
2. FTP
3. lftp
4. Command Line Internet – Non-interactive
5. Command Line Internet – Interactive
6. Managing Software Dependencies
7. Using the Yum & DNF commands
8. Using the Yum command
9. YUM package groups
10. Configuring Yum
11. yumdownloader
12. Popular Yum Repositories
13. Using the Zypper command
14. Zypper Services and Catalogs
15. The dselect & APT Frontends to dpkg
16. Aptitude
17. Configuring APT

LAB TASKS

1. Command Line File Transfers
2. Using Yum
3. Using Zypper
4. Managing Yum Repositories
5. Managing Zypper Repositories
6. Using APT
7. Adding an APT repository

16. THE SECURE SHELL (SSH)

1. Secure Shell
2. ssh and sshd Configuration
3. Accessing Remote Shells
4. Transferring Files
5. Alternative sftp Clients
6. SSH Key Management
7. ssh-agent

LAB TASKS

1. Introduction to ssh and scp
2. SSH Key-based User Authentication
3. Using ssh-agent

17. MOUNTING FILESYSTEMS & MANAGING REMOVABLE MEDIA

1. Filesystems Concept Review
2. Mounting Filesystems
3. NFS
4. SMB
5. Filesystem Table (/etc/fstab)
6. AutoFS
7. Removable Media

LAB TASKS

1. Accessing NFS Shares
2. On-demand filesystem mounting with AutoFS

18. PRINTING

1. Legacy Print Systems
2. Common UNIX Printing System
3. Defining a Printer
4. Standard Print Commands

5. Format Conversion Utilities
6. enscript and mpage

LAB TASKS

1. Printing
2. Configuring Print Queues

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LAB TASKS

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B. THE X WINDOW SYSTEM

1. The X Window System
2. X Modularity
3. X.Org Drivers
4. Configuring X Manually
5. Automatic X Configuration
6. Xorg and Fonts
7. Installing Fonts for Modern Applications
8. Installing Fonts for Legacy Applications
9. The X11 Protocol and Display Names
10. Display Managers and Graphical Login
11. Starting X Apps Automatically
12. X Access Control
13. Remote X Access (historical/insecure)
14. Remote X Access (modern/secure)
15. XDMCP
16. Remote Graphical Access With VNC and RDP
17. Specialized X Servers

LAB TASKS

1. Remote X with XDMCP
2. Configure X Security
3. Configure a VNC Server
4. Configure a VNC Server
5. Configure a VNC Server
6. Secure X

C. EMACS

1. Emacs
2. The Emacs Interface
3. Basic Emacs
4. More Emacs Commands

LAB TASKS

1. Text Editing with Emacs