Course Outline

Enterprise Linux Systems Administration

Course Summary

Description

This custom course is an in-depth exploration of configuration and maintenance of Linux systems. The course focuses on issues universal to every workstation and server. This course provides material designed to provide extensive hands-on experience. Topics include: configuration; the boot process; user and group administration; filesystem administration, including quotas, FACLs, RAID and LVM; task automation; client networking; SELinux; software management; log files; troubleshooting; and more.

The course uses the Red Hat Enterprise Linux distribution with demonstrations and discussions with the Ubuntu distribution.

Topics

- Linux Kernel & Devices
- Systemd Overview
- Grub2/Systemd Boot Process
- Software Maintenance
- Local Storage Administration
- Lvm & Raid
- Remote Storage Administration
- User/Group Administration
- Pluggable Authentication Modules (Pam)
- Security Administration
- Basic Networking
- Advanced Networking
- Log File Administration
- Monitoring & Troubleshooting

Audience

This course is designed for those wanting to learn performance management principles, monitoring utilities / tools, and analysis for the RHEL and Ubuntu Operating Environments.

Prerequisites

Students should already be comfortable working in a Linux or Unix environment. Fundamentals such as the Linux filesystem, process management, and how to edit files will not be covered in class. An understanding of network concepts, and the TCP/IP protocol suite is helpful. These skills are taught in the GL120 "Linux Fundamentals" course.

Duration

Five days

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I. LINUX KERNEL & DEVICES

A. Hardware Discovery Tools
B. Kernel Hardware Info – /sys/
C. /sys/ Structure
D. udev
E. Managing Linux Device Files
F. List Block Devices
G. SCSI Devices
H. USB Devices
I. USB Architecture
J. Kernel Modules
K. Configuring Kernel Components and Modules
L. Handling Module Dependencies
M. Configuring the Kernel via /proc/
N. Console
O. Virtual Terminals
P. Keyboard & locale configuration
Q. Serial Ports
R. Random Numbers and /dev/random
S. LAB TASKS
   1. Adjusting Kernel Options
   2. Linux Kernel Driver Compilation
   3. Introduction to Troubleshooting Labs
   4. Troubleshooting Practice: Kernel Modules

II. SYSTEMD OVERVIEW

A. System Boot Method Overview
B. systemd System and Service Manager
C. Modifying systemd services
D. Systemd Service Sandboxing Features
E. systemd Targets
F. Using systemd
G. Linux Runlevels Aliases
H. Legacy Support for SysV init
I. LAB TASKS
   1. Managing Services With Systemd's systemctl
   2. Creating a systemd unit file

III. GRUB2/SYSTEMD BOOT PROCESS

A. Booting Linux on PCs
B. GRUB 2
C. GRUB 2 Configuration
D. The Boot Loader Specification
E. GRUB 2 Security
F. Boot Parameters
G. Initial RAM Filesystem
H. init
I. Systemd local-fs.target and sysinit.target
J. Systemd basic.target and multi-user.target
K. Legacy local bootup script support
L. System Configuration Files
M. RHEL8 Configuration Utilities
N. Shutdown and Reboot
O. LAB TASKS
   1. Boot Process
   2. Booting directly to a bash shell
   3. GRUB Command Line
   4. Basic GRUB Security
   5. Troubleshooting Practice: Boot Process

IV. SOFTWARE MAINTENANCE

A. Managing Software
B. Installing Debian Packages
C. Querying and Verifying with dpkg
D. The alien Package Conversion Tool
E. Managing Software Dependencies
F. The dselect & APT Frontends to dpkg
G. Configuring APT
H. LAB TASKS
   1. Troubleshooting Practice: Package Management

V. LOCAL STORAGE ADMINISTRATION

A. Partitioning Disks with fdisk & gdisk
B. Resizing a GPT Partition with gdisk
C. Partitioning Disks with parted
D. Non-Interactive Disk Partitioning with sfdisk
E. Filesystem Creation
F. Persistent Block Devices
G. Mounting Filesystems
H. Resizing Filesystems
I. Filesystem Maintenance
J. Managing an XFS Filesystem
K. Swap
L. Filesystem Structures
M. Determining Disk Usage With df and du
N. Configuring Disk Quotas
O. Setting Quotas
P. XFS Project quotas
Q. Viewing and Monitoring Quotas
R. Filesystem Attributes
S. LAB TASKS
   1. Creating and Managing Filesystems
   2. Hot Adding Swap
   3. XFS Copy-on-Write
   4. Setting User Quotas

Course Outline (cont'd)

VI. LVM & RAID

A. Logical Volume Management
B. Implementing LVM
C. Creating Logical Volumes
D. Activating LVM VGs
E. Exporting and Importing a VG
F. Examining LVM Components
G. Changing LVM Components
H. Advanced LVM Overview
I. Advanced LVM: Components & Object Tags
J. Advanced LVM: Automated Storage Tiering
K. Advanced LVM: Thin Provisioning
L. Advanced LVM: Striping & Mirroring
M. Advanced LVM: RAID Volumes
N. RAID Concepts
O. Array Creation with mdadm
P. Software RAID Monitoring
Q. Software RAID Control and Display
R. LAB TASKS
   1. Creating and Managing LVM Volumes
   2. Creating LVM Thin Volumes
   3. Using Boom to Boot to an LVM Snapshot
   4. Troubleshooting Practice: LVM
   5. Creating and Managing a RAID-5 Array

VII. REMOTE STORAGE ADMINISTRATION

A. Remote Storage Overview
B. Remote Filesystem Protocols
C. Remote Block Device Protocols
D. File Sharing via NFS
E. NFSv4+
F. NFS Clients
G. NFS Server Configuration
H. Implementing NFSv4
I. AutoFS
J. AutoFS Configuration
K. Accessing Windows/Samba Shares from Linux
L. SAN Multipathing
M. Multipath Configuration
N. Multipathing Best Practices
O. iSCSI Architecture
P. Open-iSCSI Initiator Implementation
Q. iSCSI Initiator Discovery
R. iSCSI Initiator Node Administration
S. Mounting iSCSI Targets at Boot
T. iSCSI Multipathing Considerations
U. LAB TASKS
   1. Using autofs
   2. NFS Server Configuration
   3. iSCSI Initiator Configuration
   4. Multipathing with iSCSI

VIII. USER/GROUP ADMINISTRATION

A. Approaches to Storing User Accounts
B. User and Group Concepts
C. User Administration
D. Modifying Accounts
E. Group Administration
F. Password Aging
G. Default User Files
H. Controlling Login Sessions
I. RHEL DS Client Configuration
J. System Security Services Daemon (SSSD)
K. LAB TASKS
   1. User and Group Administration
   2. Using LDAP for Centralized User Accounts
   3. Complete Session Logging with tlog
   4. Troubleshooting Practice: Account Management

IX. PLUGGABLE AUTHENTICATION MODULES (PAM)

A. PAM Overview
B. PAM Module Types
C. PAM Order of Processing
D. PAM Control Statements
E. PAM Modules
F. pam_unix
G. pam_nologin.so
H. pam_limits.so
I. pam_wheel.so
J. pam_xauth.so
K. LAB TASKS
   1. Restricting superuser access to wheel group membership
   2. Using pam_nologin to Restrict Logins
   3. Setting Limits with the pam_limits Modules
   4. Using pam_limits to Restrict Simultaneous Logins

X. SECURITY ADMINISTRATION

A. Security Concepts
B. Tightening Default Security
C. Security Advisories
D. Fine Grained Authorizations with Polkit
E. File Access Control Lists
F. Manipulating FACLs

Course Outline (cont'd)

G. Viewing FACLs
H. Backing Up FACLs
I. File Creation Permissions with umask
J. User Private Group Scheme
K. Alternatives to UPG
L. SELinux Security Framework
M. SELinux Modes
N. SELinux Commands
O. Choosing an SELinux Policy
P. SELinux Booleans
Q. Permissive Domains
R. SELinux Policy Tools
S. FirewallD
T. LAB TASKS
   1. User Private Groups
   2. Using Filesystem ACLs
   3. Exploring SELinux Modes
   4. SELinux File Contexts
   5. SELinux Contexts in Action

XI. BASIC NETWORKING

A. IPv4 Fundamentals
B. TCP/UDP Fundamentals
C. Linux Network Interfaces
D. Ethernet Hardware Tools
E. Network Configuration with ip Command
F. Configuring Routing Tables
G. IP to MAC Address Mapping with ARP
H. Starting and Stopping Interfaces
I. NetworkManager
J. DNS Clients
K. DHCP Clients
L. Network Diagnostics
M. Information from ss and netstat
N. Hardware and System Clock
O. Managing Network-Wide Time
P. Continual Time Sync with NTP
Q. Time Synchronization with Chronyd
R. LAB TASKS
   1. Network Discovery
   2. Basic Client Networking
   3. Chrony Client Configuration

XII. ADVANCED NETWORKING

A. Multiple IP Addresses
B. Configuring a DHCP server
C. IPv6
D. Interface Aggregation
E. Interface Bonding
F. Network Teaming
G. Interface Bridging
H. 802.1q VLANS
I. Tuning Kernel Network Settings
J. LAB TASKS
   1. Multiple IP Addresses Per Network Interface
   2. Configuring IPv6
   3. Troubleshooting Practice: Networking

XIII. LOG FILE ADMINISTRATION

A. System Logging
B. systemd Journal
C. systemd Journal's journalctl
D. Secure Logging with Journal's Log Sealing
E. Cockpit - Logs
F. Rsyslog
G. /etc/rsyslog.conf
H. Log Management
I. Log Anomaly Detector
J. Sending logs from the shell
K. LAB TASKS
   1. Using the systemd Journal
   2. Setting up a Full Debug Logfile
   3. Remote Syslog Configuration
   4. Remote Rsyslog TLS Configuration

XIV. MONITORING & TROUBLESHOOTING

A. System Status – Memory
B. System Status – I/O
C. System Status – CPU
D. Performance Trending with sar
E. Determining Service to Process Mapping
F. Real-time Monitoring of Resources — Cgroups
G. Troubleshooting Basics: The Process
H. Troubleshooting Basics: The Tools
I. strace and ltrace
J. Common Problems
K. Troubleshooting Incorrect File Permissions
L. Inability to Boot
M. Typos in Configuration Files
N. Corrupt Filesystems
O. RHEL8 Rescue Environment
P. LAB TASKS
   1. System Activity Reporter
   2. Cgroup for Processes
   3. Recovering Damaged MBR