

LINUX

Revised 2/5/2012

/training/etc

The Art of Knowledge.

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Course Description:

This is the first in a series of courses focusing on the Linux Operating System. It is vendor neutral with an emphasis on the latest version of RedHat Linux. A comprehensive study of Linux is undertaken. Topics include Linux evolution, graphical environments, terminal interfaces and bash, file system, file manipulation commands, data manipulation commands, editors, software tools, networking tools, and system administration tools. The course is supplemented with many hands-on exercises that reinforce the lectures.

Who Should Attend:

This course is intended for programmers, end users, managers, and future system administrators.

Prerequisites:

Students are required to have some familiarity with an operating system such as DOS or Windows.

Benefits of Attendance:

Upon completion of this course, students will be able to:

- Understand the relationship between UNIX and LINUX.
- Log in and out of the system.
- Use the various components of the GNOME desktop.
- Perform work using terminal shell windows.
- Navigate through the file system.
- Get help using the on-line manual.
- Use the bash shell for a wide variety of functions.
- Edit files using the 'vi' editor.
- Use various file manipulation utilities.
- Use the rich set of common Linux filters.
- Locate important network configuration files.
- Use the rich set of LINUX file management utilities.
- Use network utilities including ssh, scp, and ftp.
- Write fundamental bash scripts.
- Kill processes through knowledge of the process tree.
- Modify bash startup files.
- Launch and control jobs.
- Understand the role of the system administrator.
- Be able to perform simple system administration functions.
- Use the robust set of software tools including ar and make.
- Launch applications graphically.

Course Outline:**An Introduction**

Operating Systems
History of UNIX/Linux
UNIX History
Richard Stallman and the GNU Project
Linus Torvalds and Linux
GNU, FSF, and the GPL
Commercialization of Linux

Getting Started

Logging in to Linux
Working in Linux
The X Server
The Gnome Display
Terminal Windows
Nautilus
Gnome Applications
Terminal Window Interface
Shell Command Lines
Getting Help
The man Command
The info Command
Linux Architecture

The Linux Filesystem

Filesystems
Top Level Directories
Home Directories
Complete vs. Relative Path Names
Directory Commands
The /etc/passwd File
The /etc/group File
The newgrp Command
The su Command
File and Directory Permissions
chmod
umask
passwd
Special Permissions
sudo

Shell Fundamentals

Shell Functionality
Shell Variables
The PATH Variable

The Command Line
Command History
Command Line Shortcuts
Command Substitution
Filename Expansion Characters
The Standard Output
The Standard Error
The Standard Input
Pipes
Aliases
Functions
Quoting
Control Sequences
Other Special Characters
Other Shell Features

File Manipulation Commands

cat
ls
cp
mv
ln
rm
wc
find
Linux Editors
vi Commands
aspell

Linux Filters

Perspective
grep
sort
head and tail
tr
cut
od
paste
split
uniq
sed
gawk
more and less
tee
lp

Processes

What is a Process?
Characteristics of a Process
Process Creation
ps
Job Control
Signals
kill
nohup

Shell Programming

Shells
Scripting Rationale
Scripting Prerequisites
Creating a bash Script
bash Startup Scripts
A Script's Environment
Exporting Variables
Exit Status
Programming the Shell
Parameter Passing
Operators
Decision Making - if
Complex Decisions
Arithmetic
Looping Constructs - for
Input and Output
Looping Constructs - while
Interrupts

Networking Applications

TCP/IP
IP Addresses
Network Configuration Files
Client/Server Computing
telnet
ping
ftp
ssh
scp

Software Tools

Building a Linux Utility
Creating a Utility

The C Compiler
Libraries
Static vs. Shared Libraries
make
Software Configuration Management
Revision Control
Data Compression

System Administration

Duties of the System Administrator
Bringing Up the System
Setting the Date
Shutting Down the System
Adding Users
Ownerships
The /dev Directory
mount File Systems
df - Free Disk Space
du - Disk Usage
find - Find Files
tar - Backup Files
Managing Services
at - Schedule Command
crontab - Schedule Commands
Managing Software
rpm - Managing Software
yum - Managing Software

Course Description:

This course focuses on the CentOS Operating System. A comprehensive study of CentOS is undertaken. Topics include CentOS evolution, graphical environments, terminal interfaces and bash, file system, file manipulation commands, data manipulation commands, editors, software tools, networking tools, and system administration tools. The course is supplemented with many hands-on exercises that reinforce the lectures.

Who Should Attend:

This course is intended for programmers, end users, managers, and future system administrators.

Prerequisites:

Students are required to have some familiarity with an operating system such as DOS or Windows.

Benefits of Attendance:

Upon completion of this course, students will be able to:

- Log in and out of the system.
- Use the various components of the GNOME desktop.
- Perform work using terminal shell windows.
- Navigate through the file system.
- Get help using the on-line manual.
- Use the bash shell for a wide variety of functions.
- Edit files using the 'vi' editor.
- Use various file manipulation utilities.
- Use the rich set of common CentOS filters.
- Locate important network configuration files.
- Use the rich set of file management utilities.
- Use network utilities including ssh, scp, and ftp.
- Write fundamental bash scripts.
- Kill processes through knowledge of the process tree.
- Modify bash startup files.
- Launch and control jobs.
- Understand the role of the system administrator.
- Be able to perform simple system administration functions.
- Use the robust set of software tools including ar and make.
- Launch applications graphically.

Course Outline:**An Introduction**

Operating Systems
History of UNIX/Linux
UNIX History
Linus Torvalds and Linux
GNU, FSF, and the GPL

Getting Started

Logging in to CentOS
Working in CentOS
The X Server
The Gnome Display
Terminal Windows
Nautilus
Gnome Applications
Terminal Window Interface
Shell Command Lines
Getting Help
The man Command
The info Command
CentOS Architecture

The CentOS Filesystem

Filesystems
Top Level Directories
Home Directories
Complete vs. Relative Path Names
Directory Commands
The /etc/passwd File
The /etc/group File
The newgrp Command
The su Command
File and Directory Permissions
chmod
umask
passwd
Special Permissions
sudo

Shell Fundamentals

Shell Functionality
Shell Variables
The PATH Variable
The Command Line
Command History
Command Line Shortcuts
Command Substitution
Filename Expansion Characters

The Standard Output
The Standard Error
The Standard Input
Pipes
Aliases
Functions
Quoting
Control Sequences
Other Special Characters
Other Shell Features

File Manipulation Commands

cat
ls
cp
mv
ln
rm
wc
find
CentOS Editors
vi Commands
aspell

CentOS Filters

Perspective
grep
sort
head and tail
tr
cut
od
paste
split
uniq
sed
gawk
more and less
tee
lp

Processes

What is a Process?
Characteristics of a Process
Process Creation
ps
Job Control
Signals

kill
nohup

Shell Programming

Shells
Scripting Rationale
Scripting Prerequisites
Creating a bash Script
bash Startup Scripts
A Script's Environment
Exporting Variables
Exit Status
Programming the Shell
Parameter Passing
Operators
Decision Making - if
Complex Decisions
Arithmetic
Looping Constructs - for
Input and Output
Looping Constructs - while
Interrupts

Networking Applications

TCP/IP
IP Addresses
Network Configuration Files
Client/Server Computing
telnet
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Software Tools

Building a CentOS Utility
Creating a Utility
The C Compiler
Libraries
Static vs. Shared Libraries
make
Software Configuration Management
Revision Control
Data Compression

System Administration

Duties of the System Administrator
Bringing Up the System

Setting the Date
Shutting Down the System
Adding Users
Ownerships
The /dev Directory
mount File Systems
df - Free Disk Space
du - Disk Usage
find - Find Files
tar - Backup Files
Exporting Variables
Managing Services
at - Schedule Command
crontab - Schedule Commands
Managing Software
rpm - Managing Software
yum - Managing Software

Course Description:

This course focuses on the basics of the Linux Operating System. It is vendor neutral with an emphasis on the latest version of RedHat's Fedora Linux. Topics include Linux evolution, graphical environments, terminal interfaces, the bash shell, Linux file system, file manipulation commands, and process management. The course is supplemented with many hands-on exercises that reinforce the lectures.

Who Should Attend:

This course is intended for users with little or no previous experience with Linux, including end users, new employees, project managers, and software support teams.

Prerequisites:

Students should have some familiarity with an operating system such as Windows or Mac.

Benefits of Attendance:

Upon completion of this course, students will be able to:

- Understand the relationship between UNIX and Linux.
- Log in and out of the system.
- Use the various components of the GNOME desktop.
- Launch graphical applications.
- Perform work using terminal shell windows.
- Navigate through the file system.
- Get help using the on-line manual.
- Use the bash shell for a wide variety of functions.
- Use various file manipulation utilities.
- Use the rich set of Linux file management utilities.
- Launch and control jobs.
- Kill processes through knowledge of the process tree.

Course Outline:**The History of Linux**

Operating Systems
History of UNIX
Richard Stallman and the GNU Project
Linus Torvalds and Linux
GNU, FSF, and the GPL
Commercialization of Linux

Getting Started with Linux

Logging in to Linux
The X Server
The GNOME Display
Terminal Windows
Nautilus
GNOME Applications
Terminal Window Interface
Shell Command Lines
Getting Help
man
info
Linux Architecture

The Linux File System

File Systems
Top Level Directories
Home Directories
Complete vs. Relative Path Names
Directory Commands
/etc/passwd
/etc/group
newgrp
su
File and Directory Permissions
chmod
umask
passwd
Special Permissions

Shell Fundamentals

Shell Functionality
Shell Variables
The PATH Variable
The Command Line
Command History
Command Line Shortcuts
Command Substitution
Filename Expansion Characters
The Standard Output
The Standard Error
The Standard Input
Pipes
Aliases
Quoting

Control Sequences
Other Special Characters
Other Shell Features

File Manipulation Commands

Linux Text Editors
cat
ls
cp
mv
ln
rm
wc
find
aspell

Processes

What is a Process?
Characteristics of a Process
Process Creation
ps
Job Control
Signals
kill
nohup

Appendix A: The Visual (vi) Editor

vi Modes
Starting and Stopping vi
Last Line Mode Commands
Cursor Movement Commands
Delete and Search Commands

Appendix B: SELinux

What is SELinux?
Privilege Escalation
Discretionary Access Control
Mandatory Access Control
Multi-Level / Multi-Category Security
SELinux Modes
Enabling / Disabling SELinux
How SELinux Works
Security Attributes
Security Contexts
Managing Users
Managing Roles
SELinux Booleans
Viewing Alerts
Other SELinux Commands

Course Description:

This course is an introduction to writing Linux shell scripts. Topics include the use of pipes and filters, shell variables, start-up scripts, looping and decision constructs, and script exit status. Hands-on exercises include writing scripts to schedule recurring tasks, automate system maintenance, create archives and backups, connect to remote machines, and send and retrieve files across the network. Students are also introduced to software tools available under Linux.

Who Should Attend:

This course is intended for system and application programmers, testers, configuration managers, and future system administrators.

Prerequisites:

Students should be comfortable using Linux and be able to edit text files using a text editor. Prior experience using a programming language is recommended.

Benefits of Attendance:

Upon completion of this course, students will be able to:

- Use the rich set of common Linux filters.
- Write scripts to control the bash shell.
- Modify bash startup files.
- Use networking utilities including ssh, scp, and ftp.
- Use software tools such as ar and make.
- Use administrative utilities such as tar, crontab, and yum.

Course Outline:**Linux Filters**

Perspective
grep
sort
head and tail
tr
cut
od
paste
split
uniq
sed
gawk
more and less
tee
lp

Shell Programming

Shells
Scripting Rationale
Scripting Prerequisites
Creating a bash Script
bash Startup Scripts
A Script's Environment
Exporting Variables
Exit Status
Programming the Shell
Parameter Passing
Operators
Decision Making - if
Complex Decisions
Arithmetic
Looping Constructs - for
Input and Output - echo and read
Looping Constructs - while
Functions
Interrupts

Networking Tools

TCP/IP
IP Addresses
Network Configuration Files
Client / Server Computing
telnet
ping
ftp
ssh
scp

Software Tools

Building a Linux Utility
Creating a Utility
The C Compiler
Libraries
Static vs. Shared Libraries
make
Data Compression

Administrative Tools

Setting the Date
Adding Users
Ownerships
sudo
df
du
tar
at
crontab
Managing Software
rpm
yum

Appendix A: The Visual (vi) Editor

vi Modes
Starting and Stopping vi
Last Line Mode Commands
Cursor Movement Commands
Delete and Search Commands

Course Description:

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

Who Should Attend:

This course is for those students wishing to learn CentOS System Administration.

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.

Benefits of Attendance:

Upon completion of this course, students will be able to:

- Install, configure, and maintain CentOS systems

Course Outline:

CentOS Hardware Discovery, Interaction, and Control

Hardware Discovery Tools
Configuring New Hardware with hwinfo
Hardware and System Clock Console
Virtual Terminals
Serial Ports
SCSI Devices
USB Devices
USB Configuration
Common UNIX Printing System
Defining a Printer
Managing Optical Media
Tape Drives
Tape Libraries
Managing CentOS Device Files
Kernel Hardware Info - /sys/ /sys/ Structure
udev
Kernel Modules
Configuring Kernel Components and Modules
Handling Module Dependencies
Configuring the Kernel via /proc/
Lab: Adjusting Kernel Options
Lab: Configuring Print Queues
Lab: Introduction to Troubleshooting Labs
Lab: Troubleshooting Practice: Kernel Modules

Boot Process and SysV Init

Booting CentOS on PCs
GRUB Configuration
Boot Parameters
Initial ramdisk
/sbin/init
System Init Styles
CentOS Runlevels
/etc/inittab
/etc/rc.d/rc.sysinit
/etc/init.d/boot
Novell's Configuration Utilities
Typical SysV Init Script
The /etc/rc.local File
Managing Daemons
Controlling Service Startup
Shutdown and Reboot
Lab: Boot Process
Lab: GRUB Command Line
Lab: Basic GRUB Security
Lab: Managing Services With chkconfig
Lab: Troubleshooting Practice: Boot Process

Software Maintenance

Managing Software
RPM Features
RPM Architecture
RPM Package Files
Working With RPMs
Querying and Verifying with rpm
Updating the Kernel RPM
Managing Software Dependencies
Using the YUM command

Using the Zypper command
YUM package groups
Zypper Services and Catalogs
Dealing With RPM & YUM Digest Changes
Configuring YUM
Yum Plugins
YUM Repositories
Compiling/Installing from Source
Manually Installed Shared Libraries
Installing Source RPM Packages
Lab: Managing Software with RPM
Lab: Creating a Custom RPM Repository
Lab: Querying the RPM Database
Lab: Installing Software via RPM & Source and Rebuilding SRPMs
Lab: Managing YUM Repositories
Lab: Managing Zypper Repositories
Lab: Using YUM
Lab: Using Zypper

Filesystem Administration

Partitioning Disks with fdisk
Partitioning Disks with parted
Filesystem Creation
Mounting Filesystems
Filesystem Maintenance
Persistent Block Devices
Resizing Filesystems
Swap
Two Types of Disk Space
Determining Disk Usage With df and du
Configuring Disk Quotas
Setting Quotas
Viewing and Monitoring Quotas
Filesystem Attributes
Backup Software
Backup Examples
Lab: Creating and Managing Filesystems
Lab: Hot Adding Swap
Lab: Setting User Quotas
Lab: Using tar and cpio for Backups
Lab: Using rsync and ssh for Backups
Lab: Using dump and restore for Backups
Lab: Creating ISO Images for Backups

LVM & RAID

Logical Volume Management
Implementing LVM
Creating Logical Volumes
Manipulating VGs & LVs
Advanced LVM Concepts
system-config-lvm
SLES Graphical Disk Tool
RAID Concepts
Array Creation with mdadm
Software RAID Monitoring
Software RAID Control and Display
Lab: Creating and Managing LVM Volumes
Lab: Creating and Managing a RAID-5 Array

Remote Storage Administration

Remote Storage Overview
Remote Filesystem Protocols
Remote Block Device Protocols
File Sharing via NFS

NFSv4
NFS Clients
NFS Server Configuration
Implementing NFSv4
Autofs
Autofs Configuration
Accessing Windows/Samba Shares from CentOS
SAN Multipathing
Multipath Configuration
Multipathing Best Practices
iSCSI Architecture
Open-iSCSI Initiator Implementation
iSCSI Initiator Discovery
iSCSI Initiator Node Administration
Mounting iSCSI Targets at Boot
iSCSI Multipathing Considerations
Lab: Using autofs
Lab: NFS Server Configuration
Lab: iSCSI Initiator Configuration

User/Group Administration

User and Group Concepts
User Administration
Modifying Accounts
Group Administration
Password Aging
Default User Files
Controlling Logins
Manual DS Client Configuration
system-config-authentication
SLES Graphical DS Client Configuration
System Security Services Daemon (SSSD)
Lab: User and Group Administration
Lab: Using LDAP for Centralized User Accounts
Lab: Troubleshooting Practice: Account Management
Lab: Using NIS for Centralized User Accounts

Pluggable Authentication Modules (PAM)

PAM Overview
PAM Module Types
PAM Order of Processing
PAM Control Statements
PAM Modules
pam_unix.so
pam_unix2.so
pam_nologin.so
pam_limits.so
pam_wheel.so
pam_xauth.so
Lab: Restricting superuser access to wheel group membership
Lab: Using pam_nologin to Restrict Logins
Lab: Setting Limits with the pam_limits Modules
Lab: Using pam_limits to Restrict Simultaneous Logins

Security Administration

Security Concepts
Tightening Default Security
Security Checker
Security Advisories
File Access Control Lists
Manipulating ACLs
Viewing ACLs

Backing Up ACLs
File Creation Permissions with umask
User Private Group Scheme
Alternatives to UPG
AppArmor
CentOS Security Framework
CentOS Modes
CentOS Commands
Choosing a CentOS Policy
CentOS Booleans
Permissive Domains
Graphical CentOS Policy Tools
Lab: User Private Groups
Lab: Using Filesystem ACLs
Lab: Exploring CentOS Modes
Lab: CentOS File Contexts

Process Administration

Automating Tasks at/batch/cron
The crontab Command
crontab Format
/etc/cron.* Directories
anacron
Viewing Processes
Managing Processes
Tuning Process Scheduling
Process Accounting
Enabling Process Accounting
Setting Resource Limits via ulimit
Lab: Creating and Managing User Cron Jobs
Lab: Adding System cron Jobs
Lab: Using BSD Process Accounting

Basic Networking

IPv4 Fundamentals
TCP/UDP Fundamentals
CentOS Network Interfaces
Ethernet Hardware Tools
Network Configuration with ip Command
Configuring Routing Tables
IP to MAC Address Mapping with ARP
Starting and Stopping Interfaces
NetworkManager
DNS Clients
DHCP Clients
system-config-network(tui,cmd)
YaST Network Configuration Tool
Network Diagnostics
Information from netstat
Managing Network-Wide Time
Continual Time Sync with NTP
Configuring NTP Clients
Useful NTP Commands
Lab: Network Discovery
Lab: NTP Client Configuration

Advanced Networking

Multiple IP Addresses
Configuring a DHCP server
Enabling IPv6
Interface Bonding
Interface Bridging
802.1q VLANs
Tuning Kernel Network Settings
Lab: Multiple IP Addresses Per Network Interface
Lab: Configuring IPv6
Lab: Troubleshooting Practice: Networking

The X Window System

The X Window System
X Modularity
X.Org Drivers
Configuring X Manually
Automatic X Configuration
Automatic X Configuration - SLES
Xorg and Fonts
The X Font Server
Installing Fonts for Modern Applications
Installing Fonts for Legacy Applications
The X11 Protocol and Display Names
Display Managers and Graphical Login
Starting X Apps Automatically
X Access Control
Remote X Access (historical/insecure approach)
Remote X Access (modern/secure approach)
XDMCP
Remote Graphical Access With VNC and RDP
Specialized X Servers
Lab: Remote X with XDMCP
Lab: Configure X Security
Lab: Configure a VNC Server
Lab: Launching X Apps Automatically
Lab: Secure X
Lab: Troubleshooting Practice: X11

Log File Administration

System Logging
Syslog-ng
Rsyslog
/etc/rsyslog.conf
Log Management
Log Anomaly Detector
Lab: Setting up a Full Debug Logfile
Lab: Remote Syslog Configuration

Monitoring & Troubleshooting

System Status - Memory
System Status - I/O
System Status - CPU
Performance Trending with sar
Troubleshooting Basics: The Process
Troubleshooting Basics: The Tools
strace and trace
Common Problems
Incorrect File Permissions
Inability to Boot
Typos in Configuration Files
Corrupt Filesystems
Rescue Environment
Lab: Recovering Damaged MBR

Pre-Installation Considerations

Pre-Installation Considerations
Hardware Compatibility
Multi-OS Booting
Partition Considerations
Filesystem Planning
Selecting a Filesystem

Installing CentOS

Anaconda: An Overview
Anaconda: Booting the System

Anaconda: Common Boot Options
Anaconda: Loading Anaconda and Packages
Anaconda: Storage Options
Anaconda: Troubleshooting
FirstBoot
Kickstart
A Typical Install
Lab: CentOS Installation
Lab: Automating Installation with Kickstart

Installing SLES11

Installation Choices
DVD-ROM Install Media
Network Installation
SLP for CentOS Installation
Local Hard Drive Installation
Install Program Interface
Installation Diagnostics
Language/Keyboard Selection and EULA
Installation Mode
Clock and Time Zone
Desktop Selection
Server Base Scenario
The YaST Installer Design
Disk Partitioning
Boot Loader Configuration
Software Package Selection
Kernel Crash Dump Configuration
Confirmation and File Installation
Setting the Root Password
Hostname and Domain Name
Network Configuration
SLES Services Configuration
Adding a User Account
Release Notes
Final Installation Hub
Installation Complete and AutoYaST2
Using AutoYaST2 files
Creating AutoYaST2 Files
linuxrc Automation
Lab: Installation
Lab: Automating Installation with AutoYaST

Appendix A: Xen Virtualization

Virtualization: What and Why?
What is Xen?
Xen Architecture
Xen Deployment Options and Considerations
Xen Networking
Live Migration of Xen Virtual Servers
xend Configuration
Guest Config Files
The xm Command
Common xm Usage
Xen Configuration Tools
Lab: Installing a Xen VM
Lab: Creating a Bootstrapped Xen Guest

Appendix B. CentOS Kernel Compilation

Why Compile?
Getting Kernel Source
Preparing to Compile
Configuring Kernel Compilation Options
Available Kernel Compile Options
Compiling the Kernel

Install Compiled Kernel Modules
Installing the Kernel
Tips and Tricks
Lab: CentOS Kernel 2.6 Driver
Compilation
CentOS Kernel 2.6 Compilation

Course Description:

Red Hat System Administration I (RH124) is designed for IT professionals who are new to Linux and require core Red Hat Enterprise Linux skills. Focused on administration tasks that will be encountered in the workplace, this course will actively engage students in task-focused activities, lab-based knowledge checks, and facilitative discussions to ensure maximum skill transfer and retention. In addition, GUI-based tools will be featured to build on the students' existing technical knowledge, while key command line concepts will be introduced to provide a foundation for students planning to become full-time Linux system administrators. By the end of the five-day course, students will be able to perform installation, establish network connectivity, manage physical storage, and perform basic security administration.

Who Should Attend:

This course is for Microsoft Windows system administrators who need to quickly learn core Red Hat Enterprise Linux proficiencies. It is also for system administrators, network administrators, and other IT professionals who require proficiency performing core tasks in Linux. Non-Linux IT professionals on the path to becoming full-time Linux system administrators should also attend this course.

Prerequisites:

Previous operating system administration experience is helpful but not required.

Benefits of Attendance:

Upon completion of this course, students will be able to:

- Install Linux graphically
- Manage physical storage
- Understand the command line
- Install and configure local components and services
- Establish network and secure network services
- Manage and secure files
- Administer users and groups
- Deploy file sharing services

Course Outline:**Unit 1: Getting Started with the GNOME Graphical Desktop**

Objective: Get started with GNOME and edit text files with gedit

Unit 2: Manage Files Graphically with Nautilus

Objective: Manage files graphically and access remote systems with Nautilus

Unit 3: Get Help in a Graphical Environment

Objective: Access documentation, both locally and online

Unit 4: Configure Local Services

Objective: Configure the date and time and configure a printer

Unit 5: Manage Physical Storage I

Objective: Understand basic disk concepts and manage system disks

Unit 6: Manage Logical Volumes

Objective: Understand logical volume concepts and manage logical volumes

Unit 7: Monitor System Resources

Objective: Manage memory and CPU utilization

Unit 8: Manage System Software

Objective: Manage system software locally and using Red Hat Network (RHN)

Unit 9: Get Started with Bash

Objective: Understand basic shell concepts, execute simple commands, and use basic job control techniques

Unit 10: Get Help in a Textual Environment

Objective: Use man and info pages and find documentation in /usr/share/doc

Unit 11: Establish Network Connectivity

Objective: Understand basic network concepts; configure, manage, and test network settings

Unit 12: Administer Users and Groups

Objective: Manage users and groups

Unit 13: Manage Files from the Command Line

Objective: Understand Linux filesystem hierarchy; manage files from the command line

Unit 14: Secure Linux File Access

Objective: Understand Linux file access mechanisms; manage file access from the GUI and the command line

Unit 15: Administer Remote Systems

Objective: Share and connect to a desktop; use SSH and rsync

Unit 16: Configure General Services

Objective: Manage services; configure SSH and remote desktops

Unit 17: Manage Physical Storage II

Objective: Manage filesystem attributes and swap space

Unit 18: Install Linux Graphically

Objective: Install Red Hat Enterprise Linux and configure the system with firstboot

Unit 19: Manage Virtual Machines

Objective: Understand basic virtualization concepts; install and manage virtual machines

Unit 20: Control the Boot Process

Objective: Understand runlevels and manage GRUB

Unit 21: Deploy File Sharing Services

Objective: Deploy an FTP server and a web server

Unit 22: Secure Network Services

Objective: Manage a firewall; understand SELinux concepts and manage SELinux

Unit 23: Comprehensive Review

Objective: Get a hands-on review of the concepts covered throughout the course

Course Description:

Red Hat System Administration II without the RHCSA Exam (RH134) is designed for IT professionals working to become full-time enterprise Linux system administrators. The course is a followup to System Administration I and continues to utilize today's best-of-breed, contemporary teaching methodology. Students will be actively engaged in task-focused activities, lab-based knowledge checks, and facilitative discussions to ensure maximum skills transfer and retention. Focusing on the foundation of command line skills covered in System Administration I, students will dive deeper into Red Hat Enterprise Linux to broaden their "tool kits" of administration skills. By the end of this five-day course, students will be able to administer and troubleshoot file systems and partitioning, logical volume management, access control, package management.

Who Should Attend:

This course is for IT professionals who have attended Red Hat System Administration I and want the skills to be full-time enterprise Linux administrators.

Prerequisites:

Students should have taken Red Hat System Administration I.

Benefits of Attendance:

Upon completion of this course, students will be able to:

- Perform network configuration and troubleshooting
- Manage file systems and logical volumes
- Control user and file access
- Install and manage services and processes
- Perform essential command line operations
- Troubleshoot

Course Outline:**Unit 1: Automated Installations of Red Hat Enterprise Linux**

Objectives: Create and manage kickstart configuration files; perform installations using kickstart

Unit 2: Accessing the Command Line

Objectives: Access the command line locally and remotely; gain administration privileges from the command line

Unit 3: Intermediate Command Line Tools

Objectives: Use hardlinks; use archives and compression; use vim

Unit 4: Regular Expressions, Pipelines, and I/O Redirection

Objectives: Use regular expressions to search patterns in files and output; redirect and pipe output

Unit 5: Network Configuration and Troubleshooting

Objectives: Configure network settings; troubleshoot network issues

Unit 6: Managing Simple Partitions and Filesystems

Objectives: Create and format simple partitions, swap partitions and encrypted partitions

Unit 7: Managing Flexible Storage with Logical Volumes

Objectives: Implement LVM and LVM snapshots

Unit 8: Access Network File Sharing Services

Objectives: NFS, CIFS and autofs

Unit 9: Managing User Accounts

Objectives: Manage user accounts including password aging; connect to a central LDAP directory service

Unit 10: Controlling Access to Files

Objectives: Manage group memberships, file permissions, and access control lists (ACL)

Unit 11: Managing SELinux

Objectives: Activate and deactivate SELinux; set file contexts; manage SELinux booleans; analyze SELinux logs

Unit 12: Installing and Managing Software

Objectives: Manage software and query information with yum, configure client-side yum repository files

Unit 13: Managing Installed Services

Objectives: Managing services, verify connectivity to a service

Unit 14: Analyzing and Storing Logs

Objectives: Managing logs with rsyslog and logrotate

Unit 15: Managing Processes

Objectives: Identify and terminal processes, change the priority of a process, use cron and at to schedule processes

Unit 16: Tuning and Maintaining the Kernel

Objectives: List, load, and remove modules; use kernel arguments

Unit 17: Troubleshooting

Objectives: Understand the boot process, resolve boot problems

Course Description:

Red Hat System Administration II with RHCSA Exam (RH135) is designed for IT professionals working to become full-time enterprise Linux system administrators. The course is a followup to System Administration I and continues to utilize today's best-of-breed, contemporary teaching methodology. Students will be actively engaged in task-focused activities, lab-based knowledge checks, and facilitative discussions to ensure maximum skills transfer and retention. Building on the foundation of command line skills covered in System Administration I, students will dive deeper into Red Hat Enterprise Linux to broaden their "tool kits" of administration skills. By the end of this five-day course, students will be able to administer and troubleshoot file systems and partitioning, logical volume management, access control, package management. Students who attend Red Hat System Administration I & II will be fully prepared to take the Red Hat Certified System Administration (RHCSA) exam.

Who Should Attend:

This course is for IT professionals who have attended Red Hat System Administration I and want the skills to be full-time enterprise Linux administrators and/or earn RHCSA certifications.

Prerequisites:

Students should have taken Red Hat System Administration I (RH124).

Benefits of Attendance:

Upon completion of this course, students will be able to:

- Perform network configuration and troubleshooting
- Manage file systems and logical volumes
- Control user and file access
- Install and manage services and processes
- Perform essential command line operations
- Troubleshoot

Course Outline:**Unit 1: Automated Installations of Red Hat Enterprise Linux**

Objectives: Create and manage kickstart configuration files; perform installations using kickstart

Unit 2: Accessing the Command Line

Objectives: Access the command line locally and remotely; gain administration privileges from the command line

Unit 3: Intermediate Command Line Tools

Objectives: Use hardlinks; use archives and compression; use vim

Unit 4: Regular Expressions, Pipelines, and I/O Redirection

Objectives: Use regular expressions to search patterns in files and output; redirect and pipe output

Unit 5: Network Configuration and Troubleshooting

Objectives: Configure network settings; troubleshoot network issues

Unit 6: Managing Simple Partitions and Filesystems

Objectives: Create and format simple partitions, swap partitions and encrypted partitions

Unit 7: Managing Flexible Storage with Logical Volumes

Objectives: Implement LVM and LVM snapshots

Unit 8: Access Network File Sharing Services

Objectives: NFS, CIFS and autofs

Unit 9: Managing User Accounts

Objectives: Manage user accounts including password aging; connect to a central LDAP directory service

Unit 10: Controlling Access to Files

Objectives: Manage group memberships, file permissions, and access control lists (ACL)

Unit 11: Managing SELinux

Objectives: Activate and deactivate SELinux; set file contexts; manage SELinux booleans; analyze SELinux logs

Unit 12: Installing and Managing Software

Objectives: Manage software and query information with yum, configure client-side yum repository files

Unit 13: Managing Installed Services

Objectives: Managing services, verify connectivity to a service

Unit 14: Analyzing and Storing Logs

Objectives: Managing logs with rsyslog and logrotate

Unit 15: Managing Processes

Objectives: Identify and terminal processes, change the priority of a process, use cron and at to schedule processes

Unit 16: Tuning and Maintaining the Kernel

Objectives: List, load, and remove modules; use kernel arguments

Unit 17: Troubleshooting

Objectives: Understand the boot process, resolve boot problems

Course Description:

The RHCSA Fast Track course without the RHCSA exam (RH199) is designed for experienced Linux System Administrators who want to harden their technical skill sets and become accredited with the RHCSA certification. Using a best-of-breed contemporary teaching approach, students will learn to properly manage a Linux workstation and server, including installation and configuration of local components and services as well as connections to existing network services. To successfully navigate this course, students must already have solid Linux command line experience to perform tasks at an accelerated pace. In addition, they should possess the necessary skills to execute common commands, such as cp, grep, sort, mkdir, tar, mkfs, ssh, and yum, and be familiar with accessing man pages for help.

Who Should Attend:

This course is for practiced Linux system administrators who currently manage Linux servers at the enterprise level, as well as skilled Linux system administrators who want or are required to demonstrate competencies by earning the RHCSA.

Prerequisites:

Students need to have full-time Linux administration with 1-3 years of experience. Students must also have the following skills: using the Bash shell and managing files and directories from the command line; configuring print queues to local and remote printers; monitoring system resources at a basic level (ps, kill); managing system software (installing and updating packages with yum); establishing network connectivity using DHCP; administering local user and group accounts; managing local, physical storage; and installing Linux graphically on a bare-metal system.

Benefits of Attendance:

Upon completion of this course, students will be able to:

- Manage local storage, including encrypted volumes
- Deploy network services, including VNC, SSH, FTP, and web services
- Secure files with ACLs and network services with the firewall and SELinux
- Manage virtual machines with KVM technology
- Automate installation of Linux using kickstart

Course Outline:**Unit 1: Establish Network Connectivity**

Objective: Configure, manage, and test static network settings

Unit 2: Administer Users and Groups

Objective: Implement password aging and configure an LDAP client

Unit 3: Monitor System Resources

Objective: Manage CPU, memory, and disk utilization; manage system logs

Unit 4: Manage System Software

Objective: Install software and query with yum using RHN and a custom repository

Unit 5: Deploy Network Services

Objective: Deploy VNC, FTP, and web services and require key authentication with SSH

Unit 6: Secure Filesystems and Network Services

Objective: Restrict file access with ACLs and secure network services with a firewall and SELinux

Unit 7: Manage Physical Storage

Objective: Manage encrypted partitions, filesystems, and swap space

Unit 8: Manage Logical Volumes

Objective: Understand Logical Volume concepts and manage Logical Volumes, including snapshots

Unit 9: Control the Boot Process

Objective: Understand runlevels and manage GRUB

Unit 10: Tune and Maintain the Kernel

Objective: Pass parameters to the kernel and manage kernel modules

Unit 11: Automate Installation with Kickstart

Objective: Create kickstart configurations and use them to install Linux

Unit 12: Manage Virtual Machines

Objective: Deploy and manage KVM virtual machines

Unit 13: Troubleshoot System Problems

Objective: Apply a systematic approach to diagnosing and correcting system failures

Unit 14: Research Red Hat Resources

Objective: Access Red Hat documentation and services

Course Description:

The RHCSA Fast Track course with exam (RH200) is designed for experienced Linux System Administrators who want to harden their technical skill sets and become accredited with the RHCSA certification. Using a best-of-breed contemporary teaching approach, students will learn to properly manage a Linux workstation and server, including installation and configuration of local components and services as well as connections to existing network services. To successfully navigate this course, students must already have solid Linux command line experience to perform tasks at an accelerated pace. In addition, they should possess the necessary skills to execute common commands, such as cp, grep, sort, mkdir, tar, mkfs, ssh, and yum, and be familiar with accessing man pages for help. At the completion of the course, students will be adequately prepared to take the Red Hat Certified System Administration (RHCSA) exam.

Who Should Attend:

This course is for practiced Linux system administrators who currently manage Linux servers at the enterprise level and for skilled Linux system administrators who want or are required to demonstrate competencies by earning the RHCSA.

Prerequisites:

Students need to have full-time Linux administration with 1-3 years of experience. Students must also have the following skills: using the Bash shell and managing files and directories from the command line; configuring print queues to local and remote printers; monitoring system resources at a basic level (ps, kill); managing system software (installing and updating packages with yum); establishing network connectivity using DHCP; administering local user and group accounts; managing local, physical storage; and installing Linux graphically on a bare-metal system.

Benefits of Attendance:

Upon completion of this course, students will be able to:

- Manage local storage, including encrypted volumes
- Deploy network services, including VNC, SSH, FTP, and web services
- Secure files with ACLs and network services with the firewall and SELinux
- Manage virtual machines with KVM technology
- Automate installation of Linux using kickstart

Course Outline:**Unit 1: Establish Network Connectivity**

Objective: Configure, manage, and test static network settings

Unit 2: Administer Users and Groups

Objective: Implement password aging and configure an LDAP client

Unit 3: Monitor System Resources

Objective: Manage CPU, memory, and disk utilization; manage system logs

Unit 4: Manage System Software

Objective: Install software and query with yum using RHN and a custom repository

Unit 5: Deploy Network Services

Objective: Deploy VNC, FTP, and web services and require key authentication with SSH

Unit 6: Secure Filesystems and Network Services

Objective: Restrict file access with ACLs and secure network services with a firewall and SELinux

Unit 7: Manage Physical Storage

Objective: Manage encrypted partitions, filesystems, and swap space

Unit 8: Manage Logical Volumes

Objective: Understand Logical Volume concepts and manage Logical Volumes, including snapshots

Unit 9: Control the Boot Process

Objective: Understand runlevels and manage GRUB

Unit 10: Tune and Maintain the Kernel

Objective: Pass parameters to the kernel and manage kernel modules

Unit 11: Automate Installation with Kickstart

Objective: Create kickstart configurations and use them to install Linux

Unit 12: Manage Virtual Machines

Objective: Deploy and manage KVM virtual machines

Unit 13: Troubleshoot System Problems

Objective: Apply a systematic approach to diagnosing and correcting system failures

Unit 14: Research Red Hat Resources

Objective: Access Red Hat documentation and services

Course Description:

Troubleshooting is both an art and a science. An instinct and a technique. In Red Hat Linux Troubleshooting (RH242), system administrators will learn techniques for troubleshooting a Linux system and how to use the troubleshooting tools available on Red Hat Enterprise Linux. This course is a four-day, heavily lab-oriented class designed to help the student learn or improve troubleshooting skills. Students will gain troubleshooting experience by debugging live, virtualized systems.

Who Should Attend:

This course is for Linux system administrators who understand how to install and configure a Red Hat Enterprise Linux system and who wish to deepen their understanding of troubleshooting on Linux.

Prerequisites:

Students must have successfully completed Red Hat System Administration I and II or RHCSA Rapid Track course, be a RHCSA certification holder or equivalent experience, and possess system administration knowledge under Red Hat Enterprise Linux.

Benefits of Attendance:

Upon completion of this course, students will be able to:

- Understand troubleshooting techniques
- Understand troubleshooting boot issues: working with advanced GRUB features, rescue and GRUB CDs, advanced ext2/ ext3 filesystem repair, rescuing RAID and LVM volumes
- Understand troubleshooting hardware: listing, testing, and analyzing devices
- Understand troubleshooting applications: diagnosing performance problems and investigating application/OS interactions
- Understand troubleshooting the network: configuration, testing, and diagnosing problems with basic and advanced configurations
- Work effectively with (and not against) security tools, including SELinux, SSL, and authentication
- Make the most of Red Hat support resources

Course Outline:

Introduction to troubleshooting techniques, including being prepared

Troubleshooting hardware, including listing, testing, and analyzing devices

Troubleshooting applications, including diagnosing performance problems and investigating application and OS interactions

Troubleshooting disks and file systems, including LVM, LUKS, ext3/4, and unauthorized changes

Troubleshooting the network, including configuring, testing, and diagnosing problems with basic and advanced configurations

Security, including working effectively with (and not against) security tools like SELinux, authentication, and firewall

Making the most of Red Hat support resources

Course Description:

Red Hat System Administration III (RH254) is designed for experienced Linux administrators who require networking and security administration skills. With a heavy emphasis on practical, hands-on labs, this course is tightly aligned with experienced Linux administrators' job tasks and the skills required for advancement. Focus is placed on enhancing the students' automation skills to securely configure, deploy and manage network services including DNS, Apache, SMTP, and network file sharing. In addition, this course emphasizes security, including monitoring, packet filtering, access controls, and SELinux. At the completion of this course, students already familiar with the RHCT/RHCSA administration skills will have exposure to all competencies tested by the RHCSA and RHCE exams.

Who Should Attend:

This course is for senior Linux system administrators who require networking and security administration skills, as well as Linux IT professionals who currently have RHCT/RHCSA certification, and are interested in earning an RHCE certification. This course is also for Linux IT professionals that can demonstrate the competencies needed to earn an RHCT/RHCSA, but have not passed the RHCSA exam provided with the Red Hat System Administration II course.

Prerequisites:

Students must have taken RHCSA Rapid Track Course (RH200) or Red Hat System Administration I & II, have equivalent experience to the RHCSA Rapid Track Course, and have skills required to earn an RHCT/RHCSA certification.

Benefits of Attendance:

Upon completion of this course, students will be able to:

- Enhance user security
- Perform disk management with iSCSI
- Perform system and network activity monitoring
- Perform network management and packet filtering
- Perform Software management
- Perform Web service management
- Perform File sharing across platforms
- Perform Basic SMTP management

Course Outline:**Unit 1: Getting Started with the Classroom Environment**

Objective: Given a virtualized environment, begin to administrate multiple systems using prerequisite skills

Unit 2: Enhance User Security

Objective: Configure system to use Kerberos to verify credentials and grant privileges via sudo

Unit 3: Bash Scripting and Tools

Objective: Automate system administration tasks utilizing Bash scripts and text-based tools

Unit 4: File Security with GnuPG

Objective: Secure files with GnuPG.

Unit 5: Software Management

Objective: Use yum plugins to manage packages and understand the design of packages to build a simple package

Unit 6: Network Monitoring

Objective: Profile running services then capture and analyze network traffic

Unit 7: Route Network Traffic

Objective: Configure system to route traffic and customize network parameters with sysctl

Unit 8: Secure Network Traffic

Objective: Secure network traffic through SSH port forwarding and iptables filtering/network address translation (NAT)

Unit 9: NTP Server Configuration

Objective: Configure an NTP server

Unit 10: Filesystems and Logs

Objective: Manage local file system integrity, monitor system over time, and system logging

Unit 11: Centralized and Secure Storage

Objective: Access centralized storage (iSCSI) and encrypt filesystems

Unit 12: SSL-encapsulated Web Services

Objective: Understand SSL certificates and deploy an SSL encapsulated web service

Unit 13: Web Server Additional Configuration

Objective: Configure web server with virtual hosts, dynamic content, and authenticated directories

Unit 14: Basic SMTP Configuration

Objective: Configure an SMTP server for basic operation (null client, receiving mail, smarthost relay)

Unit 15: Caching-Only DNS Server

Objective: Understand DNS resource records and configure a caching-only name server

Unit 16: File Sharing with NFS

Objective: Configure file sharing between hosts with NFS

Unit 17: File Sharing with CIFS

Objective: Configure file and print sharing between hosts with CIFS

Unit 18: File Sharing with FTP

Objective: Configure file sharing with anonymous FTP

Unit 19: Troubleshooting Boot Process

Objective: Understand the boot process and recover unbootable systems with rescue mode

Course Description:

Red Hat System Administration III with RHCE Exam (RH255) is designed for experienced Linux administrators who require networking and security administration skills. With a heavy emphasis on practical, hands-on labs, this course is tightly aligned with experienced Linux administrators' job tasks and the skills required for advancement. Focus is placed on enhancing the students' automation skills to securely configure, deploy and manage network services including DNS, Apache, SMTP, and network file sharing. In addition, this course emphasizes security, including monitoring, packet filtering, access controls, and SELinux. At the completion of this course, students already familiar with the RHCT/RHCSA administration skills will have exposure to all competencies tested by the RHCSA and RHCE exams. This class includes the RHCSA and the RHCE exams.

Who Should Attend:

This course is for senior Linux system administrators who require networking and security administration skills, as well as Linux IT professionals who currently have RHCT/RHCSA certification, and are interested in earning an RHCE certification. The course is also for Linux IT professionals who can demonstrate the competencies needed to earn an RHCT/RHCSA, but have not passed the RHCSA exam provided with the Red Hat System Administration II course.

Prerequisites:

Students should have taken RHCSA Rapid Track Course (RH200) or Red Hat System Administration I & II (RH124& RH134), have equivalent experience to the RHCSA Rapid Track Course, and have skills required to earn an RHCT/RHCSA certification.

Benefits of Attendance:

Upon completion of this course, students will be able to:

- Enhance user security
- Perform Disk management with iSCSI
- Perform system and network activity monitoring
- Perform network management and packet filtering
- Perform Software management
- Perform Web service management
- Perform File sharing across platforms
- Perform Basic SMTP management

Course Outline:**Unit 1: Getting Started with the Classroom Environment**

Objective: Given a virtualized environment, begin to administrate multiple systems using prerequisite skills

Unit 2: Enhance User Security

Objective: Configure system to use Kerberos to verify credentials and grant privileges via sudo

Unit 3: Bash Scripting and Tools

Objective: Automate system administration tasks utilizing Bash scripts and text-based tools

Unit 4: File Security with GnuPG

Objective: Secure files with GnuPG.

Unit 5: Software Management

Objective: Use yum plugins to manage packages and understand the design of packages to build a simple package

Unit 6: Network Monitoring

Objective: Profile running services then capture and analyze network traffic

Unit 7: Route Network Traffic

Objective: Configure system to route traffic and customize network parameters with sysctl

Unit 8: Secure Network Traffic

Objective: Secure network traffic through SSH port forwarding and iptables filtering/network address translation (NAT)

Unit 9: NTP Server Configuration

Objective: Configure an NTP server

Unit 10: Filesystems and Logs

Objective: Manage local file system integrity, monitor system over time, and system logging

Unit 11: Centralized and Secure Storage

Objective: Access centralized storage (iSCSI) and encrypt filesystems

Unit 12: SSL-encapsulated Web Services

Objective: Understand SSL certificates and deploy an SSL encapsulated web service

Unit 13: Web Server Additional Configuration

Objective: Configure web server with virtual hosts, dynamic content, and authenticated directories

Unit 14: Basic SMTP Configuration

Objective: Configure an SMTP server for basic operation (null client, receiving mail, smarthost relay)

Unit 15: Caching-Only DNS Server

Objective: Understand DNS resource records and configure a caching-only name server

Unit 16: File Sharing with NFS

Objective: Configure file sharing between hosts with NFS

Unit 17: File Sharing with CIFS

Objective: Configure file and print sharing between hosts with CIFS

Unit 18: File Sharing with FTP

Objective: Configure file sharing with anonymous FTP

Unit 19: Troubleshooting Boot Process

Objective: Understand the boot process and recover unbootable systems with rescue mode

Course Description:

RH290 Red Hat Enterprise Linux for Solaris Administrators quickly and efficiently covers many of the hands-on, practical skills needed when migrating from Solaris to Red Hat Enterprise Linux. Focusing on the differences between the two operating systems, the course covers Red Hat Enterprise Linux equivalents to Solaris-specific technologies, such as applying software patches, automated deployment with Jumpstart, and advanced filesystem features. In addition, the course demonstrates how to use RPM, yum, the Red Hat Network (RHN), and Kickstart to manage your environment. You will acquire and set Linux kernel tunables, explore and configure the many supported hardware devices available from multiple vendors, and secure your users and services. Upon completion of this course, you will have the knowledge and skillset to take RH253, Red Hat Linux Networking and Security Administration, or the RH300 Rapid Track Course.

Who Should Attend:

This course is for experienced Solaris system administrators transitioning to a Red Hat Enterprise Linux platform, Solaris administrators who are contemplating a migration to Red Hat Enterprise Linux and want to understand the difference in skillset that will be required, and Solaris administrators who want to quickly expand their skillsets to include Red Hat Enterprise Linux.

Prerequisites:

Students should have experience in Solaris at the power user, network operations, or system administrator level. Students should also have two years of Solaris experience installing server operating system and software, troubleshooting servers, and configuring and securing servers and services.

Benefits of Attendance:

Upon completion of this course, students will be able to:

- Apply Red Hat Enterprise Linux equivalents to Solaris-specific technologies.
- Acquire and set Linux kernel tunables.
- Explore and configure the many supported hardware devices available from multiple vendors.
- Secure your users and services.

Course Outline:**System overview**

Important differences between Solaris and RHEL, including their directory structures and commands

Where to get more documentation

System configuration

Configure and access various consoles for local and remote administration

Hands-on interaction with new tools

System initialization, services, and shutdown

Explore the x86 boot process, kernel modules and initialization

Manage service startup and shutdown

Software and update management

Manage software lifecycle with yum, Red Hat Network, and rpm

How to manage Solaris machines from Red Hat Network

Special devices

Understand and modify the partition table, character devices, and block devices

Create and manage software RAID, logical volumes, and iSCSI

Filesystems

Expand storage by adding new or reconfiguring existing filesystems and swap space

Configure autofs for on-demand network storage

Set up space and file quotas for users and groups

Security and authentication

Connect to network directory services like NIS and LDAP

Securely access systems and services using the NetFilter kernel-level firewall

Enforce security with SELinux

System monitoring

Collect system information, monitor system activity, and generate reports

Set up system auditing, centralized logging, and kernel monitoring and profiling

Enterprise deployment

Perform automated installations of Red Hat Enterprise Linux using Kickstart

Save kernel crash dumps to disk and over the network

Course Description:

The RHCE Fast Track Course with no exam (RH299) is a fast-paced preparation course that combines the RHCSA Fast Track Course (RH199) and System Administration III (RH254) courses, normally eight days of training, into a single four-day course. Building on the students' extensive knowledge of command line based Linux administration, the course moves very quickly through the intermediate and advanced tasks covered by lab-based knowledge checks and facilitative discussions. By the end of this course, the senior Linux administrator students will have been exposed to all the intermediate and advanced competencies tested by the RHCSA and RHCE exams.

Who Should Attend:

This course is for experienced Linux system administrators with a minimum of three years of Linux experience who want a fast-track solution to earn an RHCE certification. It is also for experienced Solaris system administrators who have completed the Red Hat Enterprise Linux for Solaris Administrators (RH290) course. This course is not recommended for students who have successfully completed the RHCSA Rapid Track Course (RH200). For those students, the Red Hat System Administration III (RH254) course is recommended.

Prerequisites:

Students must meet the requirements for attending Red Hat System Administration I, II, and III courses. Students must have the same skill set as an RHCT/RHCSA.

Benefits of Attendance:

Upon completion of this course, students will be able to:

- Perform package, network, and storage management
- Perform account and authentication management
- Perform installation, Kickstart, and virtualization
- Perform SELinux and firewall management
- Perform Web and email services
- Perform network file sharing services
- Perform SSH and VNC services

Course Outline:**Unit 1: Software Management**

Objective: Manage packages with yum, rpm, and RHN; build an RPM package and place it in a repository

Unit 2: Network Management

Objective: Configure and troubleshoot network settings; configure network bonding

Unit 3: Storage Management

Objective: Manage partitioning, filesystems and swap space; configure encrypted partitions and iSCSI initiator

Unit 4: Logical Volume Management (LVM)

Objective: Manage physical volumes, volume groups and logical volumes with their filesystems

Unit 5: Account Management

Objective: Provide password aging for accounts; use ACLs and SGID directories for collaborative directories

Unit 6: Authentication Management

Objective: Configure an LDAP and Kerberos client; configure autofs to support authentication client

Unit 7: Installation, Kickstart, and Virtualization

Objective: Install a system and manage kickstart and firstboot; use virtualization tools to manage virtual machines

Unit 8: Boot Management

Objective: Configure runlevels and sysctl; reset the root password; understand the boot process

Unit 9: Scheduling Commands (at and cron)

Objective: Schedule commands using at and cron

Unit 10: Security Enhanced Linux (SELinux) Management

Objective: Understand, troubleshoot, and manage SELinux

Unit 11: Firewall Management

Objective: Manage the firewall

Unit 12: Network Time Protocol (NTP) Service

Objective: Configure an NTP server and provide that service to clients

Unit 13: System Logging (rsyslog) Service

Objective: Troubleshoot by finding and analyzing logs; configure remote logging

Unit 14: Web (HTTP/HTTPS) Service

Objective: Manage a web server with virtual hosts and using file/directory access controls

Unit 15: Email (SMTP) Service

Objective: Null client; outbound smarthost relay; accept inbound connections

Unit 16: Domain Name System (DNS) Service

Objective: Configure a caching nameserver and DNS forwarder

Unit 17: Network File System (NFS) Service

Objective: Manage the NFS service; use autofs to access the NFS server

Unit 18: Common Internet File System (CIFS) Service

Objective: Configure a CIFS server; use autofs to access the CIFS server

Unit 19: File Transfer Protocol (FTP) Service

Objective: Provide anonymous-only download service; provide drop-box upload service

Unit 20: Common UNIX Printing System (CUPS) Service

Objective: Configure local and remote printers

Unit 21: Secure Shell (SSH) Service

Objective: Configure and implement SSH keys; use SSH for port forwarding; transfer data using rsync

Unit 22: Virtual Network Computing (VNC) Service

Objective: Configure remote desktops and connect to them securely

Unit 23: Comprehensive Review

Objective: Review tasks previously taught in class

Course Description:

The RHCE Fast Track Course with RHCSA and RHCE Exams (RH300) is designed for senior Linux system administrators who want to validate their competencies by earning the RHCSA and RHCE credentials. This is a fast-paced preparation course that combines the RHCSA Fast Track Course (RH199) and System Administration III (RH254) courses, normally eight days of training, into a single four-day course. Building on the students' extensive knowledge of command line based Linux administration, the course moves very quickly through the intermediate and advanced tasks covered by lab-based knowledge checks and facilitative discussions. By the end of this course, the senior Linux administrator students will have been exposed to all the intermediate and advanced competencies tested by the RHCSA and RHCE exams. The RHCSA and RHCE exams are included with this course.

Who Should Attend:

This class is for experienced Linux system administrators with a minimum of three years of Linux experience who want a fast-track solution to earn an RHCE certification, as well as experienced Solaris system administrators who have completed the Red Hat Enterprise Linux for Solaris Administrators (RH290) course. This course is not recommended for students who have successfully completed the RHCSA Rapid Track Course (RH200). For those students, the Red Hat System Administration III (RH254) course is recommended.

Prerequisites:

Students must meet the requirements for attending Red Hat System Administration I, II, and III courses. Students must have the same skill set as an RHCT/RHCSA.

Benefits of Attendance:

Upon completion of this course, students will be able to:

- Perform package, network, and storage management
- Perform account and authentication management
- Perform installation, Kickstart, and virtualization
- Perform SELinux and firewall management
- Perform Web and email service
- Perform network file sharing services
- Perform SSH and VNC services

Course Outline:**Unit 1: Software Management**

Objective: Manage packages with yum, rpm, and RHN; build an RPM package and place it in a repository

Unit 2: Network Management

Objective: Configure and troubleshoot network settings; configure network bonding

Unit 3: Storage Management

Objective: Manage partitioning, filesystems and swap space; configure encrypted partitions and iSCSI initiator

Unit 4: Logical Volume Management (LVM)

Objective: Manage physical volumes, volume groups and logical volumes with their filesystems

Unit 5: Account Management

Objective: Provide password aging for accounts; use ACLs and SGID directories for collaborative directories

Unit 6: Authentication Management

Objective: Configure an LDAP and Kerberos client; configure autofs to support authentication client

Unit 7: Installation, Kickstart, and Virtualization

Objective: Install a system and manage kickstart and firstboot; use virtualization tools to manage virtual machines

Unit 8: Boot Management

Objective: Configure runlevels and sysctl; reset the root password; understand the boot process

Unit 9: Scheduling Commands (at and cron)

Objective: Schedule commands using at and cron

Unit 10: Security Enhanced Linux (SELinux) Management

Objective: Understand, troubleshoot, and manage SELinux

Unit 11: Firewall Management

Objective: Manage the firewall

Unit 12: Network Time Protocol (NTP) Service

Objective: Configure an NTP server and provide that service to clients

Unit 13: System Logging (rsyslog) Service

Objective: Troubleshoot by finding and analyzing logs; configure remote logging

Unit 14: Web (HTTP/HTTPS) Service

Objective: Manage a web server with virtual hosts and using file/directory access controls

Unit 15: Email (SMTP) Service

Objective: Null client; outbound smarthost relay; accept inbound connections

Unit 16: Domain Name System (DNS) Service

Objective: Configure a caching nameserver and DNS forwarder

Unit 17: Network File System (NFS) Service

Objective: Manage the NFS service; use autofs to access the NFS server

Unit 18: Common Internet File System (CIFS) Service

Objective: Configure a CIFS server; use autofs to access the CIFS server

Unit 19: File Transfer Protocol (FTP) Service

Objective: Provide anonymous-only download service; provide drop-box upload service

Unit 20: Common UNIX Printing System (CUPS) Service

Objective: Configure local and remote printers

Unit 21: Secure Shell (SSH) Service

Objective: Configure and implement SSH keys; use SSH for port forwarding; transfer data using rsync

Unit 22: Virtual Network Computing (VNC) Service

Objective: Configure remote desktops and connect to them securely

Unit 23: Comprehensive Review

Objective: Review tasks previously taught in class

Course Description:

Virtualization allows users to make the most out of their IT environments by allowing a single server to run multiple server or desktop operating systems. As a leader in open source software, Red Hat has expanded choice in the virtualization industry with Red Hat Enterprise Virtualization—an open virtualization alternative for enterprises. The Red Hat Enterprise Virtualization course (RH318) arms professionals with the knowledge and skills needed to deploy and manage Red Hat Enterprise Virtualization technologies. This extensive hands-on training course explores the virtualization features of Red Hat Enterprise Linux with the advanced Red Hat Enterprise Virtualization platform*. This class includes the EX318 Red Hat Certified Virtualization Administrator (RHCV) exam on the last day.

With hands-on labs and a deep dive into the technology, this training course is the perfect first step for any enterprise planning or executing a virtualization deployment strategy.

Who Should Attend:

This class is for experienced Linux system administrators responsible for managing enterprise servers who are interested in learning how to manage large numbers of servers or virtual machines using Red Hat Enterprise Virtualization.

Prerequisites:

Students should have taken Red Hat Linux System Administration (RH133) or have equivalent experience with Linux. System administration experience on Microsoft Windows operating systems is beneficial but not required.

Benefits of Attendance:

Upon completion of this course, students will be able to:

- Effectively create, deploy, manage, and migrate Linux and Microsoft Windows virtual machines hosted on either Red Hat Enterprise Linux servers or dedicated hypervisor nodes using Red Hat Enterprise Virtualization Manager.

Course Outline:**Unit 1: Introduction to Red Hat Enterprise Virtualization Platform**

Red Hat Enterprise Virtualization overview
Red Hat Enterprise Virtualization demo
x86 Virtualization
Introduction to KVM

Unit 2: Red Hat Enterprise Linux 5.4 Hosts

Red Hat Enterprise Linux 5.4 hosts in the data center
Using live-CD tools

Unit 3: Red Hat Enterprise Virtualization Hypervisor

Architecture overview
Deployment modes
Installation and configuration
Reconfiguration/tools
Upgrading
Kernel command line parameters/automated installs
Boot process
Configuration persistence
Troubleshooting

Unit 4: Red Hat Enterprise Virtualization Architecture

Physical resources
Virtual resources
Data center creation examples
Populating ISO library

Unit 5: Red Hat Enterprise Virtualization Manager

Management console demonstration
Management console installation process
Management console post-installation

Unit 6: Red Hat Enterprise Virtualization Virtual Server

New virtual server
Creating your first VM
Editing VM properties
VM live migration

Unit 7: Red Hat Enterprise Virtualization Platform Image Management

New virtual server
Creating your first VM
Editing VM properties
VM live migration

Unit 8: Advanced topics and labs

Course Description:

Red Hat Enterprise Deployment and Systems Management (RH401) is a four-day lab-based course that explores the concepts and methods necessary for successful large-scale deployment and management of Red Hat Enterprise Linux systems. Experienced system administrators learn how to implement and manage Red Hat Enterprise Linux deployments efficiently and effectively, in ways that make their systems manageable by a team of administrators. Central to the course is hands-on training in the use of the Red Hat Network Satellite Server for deployment and provisioning of Red Hat Enterprise Linux systems. By the end of this course, students will have built their own RPM packages and will have used Subversion to make changes to scripts. The EX401 exam is administered on the 5th day.

Who Should Attend:

RH401 is aimed at experienced Linux system administrators responsible for the planning, deployment, and management of Red Hat Enterprise Linux systems. It is also for Red Hat Certified Engineers (RHCE®) who want to earn Certification of Expertise, Red Hat Certified Datacenter Specialist (RHCDs®), or Red Hat Certificate Architect (RHCA®).

Prerequisites:

Students should have Red Hat Certified Engineer (RHCE) certification or equivalent experience.

Benefits of Attendance:

Upon completion of this course, students will be able to:

- Build their own RPM packages and use Subversion to make changes to scripts.
- Implement and manage Red Hat Enterprise Linux deployments efficiently and effectively in ways that make the entire enterprise deployment manageable by a team.

Course Outline:**Unit 1 - Essential System Management**

Goals of Enterprise system management
Standardization, centralization, and scalability
Provisioning and automation

Unit 2 - Installing a Red Hat Network Satellite Server

Introduction to RHN Satellite - features, prerequisites
Installing Satellite Server software
Understanding software channels and entitlements
Importing channel content into a Satellite Server

Unit 3 - Red Hat Network Organization

Organization management and trust relationships
Managing user accounts
Assigning user roles (security)
Managing system groups

Unit 4 - Managing Changes with Revision Control

Introducing revision control concepts
Basic Subversion repository administration
Using Subversion to manage revisions

Unit 5 - Red Hat Network Client Configuration

Secure communication with SSL
Red Hat Network registration
Creating and using activation keys
Registration automation with bootstrap.sh
Troubleshooting RHN registration

Unit 6 - Red Hat Network Software Management

Software channel relationships
Cloning existing software channels
Managing custom software channels
Notifying clients of changes: managing errata

Unit 7 - Building RPMs

Building open source software
Using RPM macros
Writing custom spec files
Using rpmbuild to create RPMs
Signing packages for security

Unit 8 - RHN Application Programmer Interface

Uses for Red Hat Network API
Basic RHN API program structure
Sample programs

Unit 9 - Configuration File Management with Red Hat Network

Managing configuration channels
Configuration file macros
Configuration file management using command-line tools

Unit 10 - Provisioning with Kickstart

Anaconda kickstart options
Building a provisioning environment
Using Cobbler for provisioning

Unit 11 - Virtual Machine Management

Virtual host/virtual platform entitlements
Controlling Xen guests using RHN
Red Hat Network management of Xen virtual machines

Unit 12 - RHN Satellite Server Administration

High-availability options
Embedded database management
Certificate management
Changing from disconnected to connected operation
Inter-satellite synchronization (ISS)
Exporting software channels
Troubleshooting

Unit 13 - Red Hat Network Proxy Server

RHN proxy server installation
Configuring a client to use a RHN proxy server
Managing software with RHN package manager

Course Description:

Red Hat Enterprise Directory Services and Authentication is an intensive course that provides four days of instruction and labs on cross-platform integration of directory services to provide authentication or information service across the enterprise using the Red Hat Directory Server. An exam is administered on the last day.

Who Should Attend:

RH423 is aimed at senior Red Hat Enterprise Linux system administrators and other IT professionals who need to provide enterprise-wide authentication or information services or who desire training in the management of LDAP-based directory services and customization of Linux authentication using the Red Hat Directory Server.

Prerequisites:

RH423 requires RHCE-level skills. The RHCE certificate on Red Hat Linux 7.1 or later is recommended but not required. Prerequisite skills can be shown by passing the RHCE Exam in either RH302 or RH300, or by taking RH253 or by possessing comparable skills and knowledge. DHCP, and other networking services, and security are also required.

Benefits of Attendance:

Upon completion of this course, students will be able to:

- Understand the basic concepts, configuration, and management of LDAP-based services.
- Understand PAM, the Pluggable Authentication Modules system, and how it is integrated with services that require authentication and authorization.
- Integrate standard network clients and services with the directory service in order to take advantage of its capabilities.

Course Outline:**Introduction to Directory Services**

What is a directory?
LDAP: models, schema, and attributes
Object classes
LDIF

Understanding IPA
IPA requirements
Configuring IPA server
Configuring IPA clients

The LDAP Naming Model

Directory information trees and Distinguished Names
X.500 and "Internet" naming suffixes
Planning the directory hierarchy

Red Hat Directory Server: Basic Configuration

Installation and setup of Red Hat Directory Server
Using the Red Hat Console
Using logging to monitor Red Hat Directory Server activity
Backing up and restoring the directory
Basic performance tuning with indexes

Searching and Modifying the LDAP Directory

Using command line utilities to search the directory
Search filter syntax
Updating the directory

Red Hat Directory Server: Authentication and Security

Configuring TLS security
Using access control instructions (ACI's)
ACI's and the Red Hat Console

Linux User Authentication with NSS and PAM

Understanding authentication and authorization
Name service switch (NSS)
Advanced pluggable authentication modules (PAM) configuration

Centralized User Authentication with LDAP

Central account management with LDAP
Using migration scripts to migrate existing data into an LDAP server
LDAP user authentication

Kerberos and LDAP

Introduction to Kerberos
Configuring the Kerberos key distribution center (KDC) and clients
Configuring LDAP to support Kerberos

Directory Referrals and Replication

Referrals and replication
Single master configuration
Multiple master configuration
Planning for directory server availability

Cross-Platform Centralized Identity Management

Synchronizing Red Hat Directory Server with Active Directory
Managing users with Winbind and LDAP
Mapping attributes between Linux and Windows

Red Hat Enterprise IPA

Course Description:

Red Hat Enterprise Storage Management provides intensive hands-on experience with the emerging Shared Storage technology delivered by Red Hat Global File System™ (GFS). This 4-day course focuses on the implementation of native Red Hat Enterprise Linux technologies included in Cluster Suite and GFS. An exam is administered on the final day of class.

Who Should Attend:

RH436 is aimed at senior Red Hat Enterprise Linux system administrators and other IT professionals working in enterprise environments and mission-critical systems.

Prerequisites:

Participants in RH436 should already be familiar with Red Hat Enterprise Linux. Recommended minimum competency level is completion of the RHCE or equivalent knowledge.

Benefits of Attendance:

Upon completion of this course, students will be able to:

- Deploy and manage highly available storage data to the mission-critical enterprise computing environment.

Course Outline:**Review Red Hat Enterprise Clustering and Storage Management Technologies****Linux Dynamic Device Management**

udev Features
udev Rule Configuration

iSCSI

iSCSI as a Shared Storage Device
Configuring an iSCSI initiator
Configuring an iSCSI target
Authentication

Advanced Software RAID

Types and Differences
Monitoring
Optimization Techniques
Growth and High Availability

Device Mapper and Multipathing

Mapping Targets
LVM2 Snapshots
Multipath Device Configuration

Cluster Technology

Common Cluster Hardware
Shared Storage Alternatives

Cluster Suite Overview

Design and Elements of Clustering
Cluster Configuration Tools
Clustered Logical Volumes and Lock Management

Quorum and the Cluster Manager

Intracluster Communication
Cluster Tools

Fencing and Failover

Fencing Components
Failover Domains

Quorum Disk

Heuristic Configuration

Service Manager

Resource Groups and Recovery
Hierarchical Resource Ordering
High Availability Services

Global File System (GFS)

Implementation and Configuration
Lock Management
Planning For and Growing On-line GFS
Monitoring Tools
Journal Configuration and Management

Course Description:

Red Hat Enterprise Performance Tuning (RH442) is designed to teach senior Linux system administrators the methodology of performance tuning for Red Hat Enterprise Linux. This course discusses system architecture with an emphasis on understanding the implications of system architecture on system performance, methods for testing the effects of performance adjustments, open source bench-marking utilities, methods for analyzing system and networking performance, and tuning configurations for specific application loads. The EX442 exam will be administered on the 5th day.

Who Should Attend:

RH442 is aimed at experienced Linux system administrators responsible for maximizing resource utilization through performance tuning and RHCEs interested in earning a Red Hat Certification of Expertise, or an Red Hat Certified Architect (RHCA).

Prerequisites:

Participants in RH442 should already be familiar with Red Hat Enterprise Linux. Recommended minimum competency level is completion of the RHCE or equivalent knowledge.

Benefits of Attendance:

Upon completion of this course, students will be able to:

- Understand the implications of system architecture on system performance.
- Use methods for testing the effects of performance adjustments (benchmarking).
- Use open source benchmarking utilities.
- Understand and use methods for analyzing system performance and networking performance.
- Use tuning configurations for specific application loads.

Course Outline:**Introduction to performance tuning**

Understand the basic principles of performance tuning and analysis

Collecting, graphing, and interpreting data

Gain proficiency in using basic analysis tools and in evaluating data

General tuning

Learn basic tuning theory and mechanisms used to tune the system

Hardware profiling

Understanding and analyzing hardware

Software profiling

Analyze CPU and memory performance of applications

Mail server tuning

Learn about basic storage tuning using an email server as an example

Large memory workload tuning

Understand memory management and tuning

HPC workload tuning

Understand tuning for CPU-bound applications

File server tuning

Understand storage and network tuning in the context of a file server application

Database server tuning

Tuning memory and network performance using a database application as an example

Power usage tuning

Tuning systems with power consumption in mind

Virtualization Tuning

Tuning 'host' and 'guest' for efficient virtualization

Course Description:

This intensive course rapidly trains programmers to develop applications and programs on Red Hat Enterprise Linux. Over the span of five days, you'll get hands-on training, concepts, and demonstrations with emphasis on realistic labs and programming exercises. Learn concepts and skills essential to programming and software development for Linux-based applications and products.

Who Should Attend:

The course is for experienced C programmers who want to learn key skills for creating applications and programs on Red Hat Enterprise Linux. This course is also useful for Windows and UNIX programmers migrating their programs to Linux.

Prerequisites:

Students should have experience in C programming, RH133 or equivalent UNIX or Linux workstation user skills for developers, shell scripting in a UNIX or Linux environment, and experience with editors such as vi, emacs.

Benefits of Attendance:

Upon completion of this course, students will be able to:

- Develop applications and programs on Red Hat Enterprise Linux.

Course Outline:**GCC - GNU Compiler Collection**

GNU Compiler Collection
History of GCC
Four Stages of GCC
Interrupting the Compiler
Compiling a C Program
Preprocessor Features
Predefined Preprocessor Symbols
Warnings and Extensions
Optimization
Linking

Building Software with Make

Introducing make(1)
How make Works
Makefile Rule Syntax
Example: Makefile First Steps
Makefile Improved
Implicit Rules
Example: Simpler Is Better Makefile
Variables
Defining Variables
Example: Makefile with Variables
Automatic Variables
Special Targets
Defining Useful Phony Targets

The GNU C Library and System Calls

Library Goals
Library Standards
GNU C Library - glibc
Library Functions vs. System Calls
Using System Calls
Handling Errors with errno
Making Sense of errno
Using strace

Program Arguments and Environment

Program Startup
Using argc/argv
Handling Options with getopt()
Handling Options with getopt_long()
Environment
Manipulating the Environment
Program Exit
Registering Exit Handlers

Building Libraries

Why Use Libraries?
Static Versus Shared
Static Library Benefits
Shared Library Benefits
Creating a Static Library

Using Static Libraries
Creating a Shared Library
Using Shared Libraries
Shared Library Management
Library Locations
ldconfig

Time Functions

When Does Time Begin?
Time Data Types
Determining Real Time
Converting time_t
Converting tm Structure
Process Time
Time arithmetic
Second Resolution Timers
Fine-Grained Timers
< Real Time Clock (RTC)

Process Management

What a Process Is
Process Relationships
Create a Child Process
Doing Something Else
Related execve() Functions
Wait For a Child
More Precise Waiting
Changing Priority/Nice
Real Time Priority

Memory Operations

Allocating/Freeing Memory
Memory Alignment
Locked Memory
Memory Copy/Initialization
Memory Comparison/Search

Debugging

What Is My Program Doing?
Source Level Debugging
Invoking gdb
Getting Started with gdb
Examining and Changing Memory
Debuginfo Libraries
Using gdb with a Running Process
Using gdb to Autopsy a Crash
Debugging Libraries - ElectricFence
Debugging with valgrind
Profiling for Performance

Basic File Operations

Stream vs. System Calls
Opening/Closing Streams
Stream Input/Output Functions
Stream Status/Errors
Stream File Positioning
Stream Buffering

Temporary/Scratch Files
Opening/Closing File Descriptors
File Descriptor I/O
Repositioning File Descriptors
Stream/File Descriptor Conversions
cat using ANSI I/O
cat using POSIX I/O

Communicating with Pipes

Introduction to Pipes
Standard I/O: popen()/pclose()
Using popen()/pclose()
System Call: pipe()
Using pipe()
Named Pipes
Using Named Pipes
For Further Reading

Managing Signals

What Signals Are
Blocking/Checking Signals
Working with Signal Sets
Example of Blocking Signals
Handling Signals with sigaction()
sigaction() Example
Handling Signals with signal()
Sending Signals
Real-Time Signals

Programming with Threads

Introducing Threaded Programming
Applications Suited to Threads
Building Threaded Programs
Creating Threads
Thread Identity
Synchronizing by Joining
Detaching Threads
Stopping Threads
Synchronizing with Mutexes
Using Mutexes
Read/Write Locks
Conditional Variables
Using Conditional Variables
A Conditional Variable Gotcha
For Further Reading

Advanced File Operations

Directory Operations
File System Operations
Multiplexed I/O with select()
Miscellaneous I/O Functions
Memory Mapped I/O
Using Memory Mapped I/O
File Locking

Interprocess Communication (IPC)

Interprocess Communication (IPC)
POSIX IPC Overview
POSIX Shared Memory
POSIX Semaphores
POSIX Message Queues
System V IPC Overview
System V IPC Shared Memory
System V IPC Semaphore Arrays
System V IPC Message Queues

Basic Network Programming

Linux Networking Overview
Getting Started with socket()
Client Functions
Specifying IPv4 Addresses
Host Versus Network Byte Order
Example TCP/IP Client
Address Conversion Functions
Using getaddrinfo()
Server Functions
Example TCP/IP Server
Datagram Communication with UDP

Working with the Linux Community

Getting in Touch with the Community
General Considerations
Building a Community
Licenses
GPL
LGPL
BSD
Creative Commons

Course Description:

Red Hat Enterprise Linux Kernel Internals (RHD361) is a hands-on course providing experienced developers an intensive, low-level examination of the Linux kernel architecture. Topics include kernel compilation, debugging tools and techniques, and internal kernel APIs including synchronization, process management, and memory management. These topics provide a solid understanding of the kernel's architecture, providing a useful base from which more specialized topics such as device drivers or performance tuning can be addressed, such as those presented in Red Hat Enterprise System Monitoring and Performance Tuning (RH442) or Red Hat Enterprise Linux Kernel Device Drivers (RHD362).

Who Should Attend:

This class is for experienced developers who want to gain a thorough understanding of the Linux architecture, including the newest kernels.

Prerequisites:

Students should have experience in C programming. Knowledge of systems programming in a UNIX or Linux environment (register-level hardware programming knowledge is recommended but not required). Students should also have familiarity with basic tools, such as vi, Emacs, and file utilities and familiarity with Unix development tools such as gcc and make.

Benefits of Attendance:

Upon completion of this course, students will be able to:

- Understand and use more advanced performance tuning concepts.
- Understand how device drivers interact with the kernel.

Course Outline:

User and Kernel Mode

Kernel Compilation

Kernel Initialization

Kernel Modules

Introduction to Device Drivers

Kernel API Overview

Kernel Debugging

System Tap

Process Management

Scheduling

Real time and Red Hat Enterprise Linux RT

Kernel Threads

Timing

Interrupts

Synchronization

Memory

Working with the Linux Community

Course Description:

Red Hat Enterprise Linux Kernel Device Drivers (RHD362) teaches experienced C programmers already familiar with the Linux kernel architecture the skills and strategies they need to develop device drivers. The course covers device driver models (including character, block, and network device drivers), device interaction (including port I/O, memory mapped I/O, interrupt handling, and DMA transfers), managing PCI and USB devices, strategies for deferring activity using tasklets and work queues, device registration using the Unified Device model and the sysfs filesystem, and process interaction, including basic file operations, polling, and wait queues.

Who Should Attend:

This course is for experienced C programmers with a good understanding of the Linux kernel who want to learn how to develop device drivers for Linux systems.

Prerequisites:

Experience in C programming is required. Students should also have taken Red Hat Linux Kernel Internals (RHD361) or have equivalent experience.

Benefits of Attendance:

Upon completion of this course, students will be able to:

- Develop device drivers specifically for Linux systems.
- Understand the Linux architecture, hardware and memory management, modularization, and the layout of the kernel source.
- Grasp key concepts and skills for the development of character, block, and network drivers.

Course Outline:

Device driver models

Device driver registration

The Unified Device Model and the sysfs file system

Character device drivers and file operations

Interrupt handling

Deferring activity with tasklets

Deferring activity with work queues

Multiplexed I/O and polling

Wait queues

Interacting with devices using port I/O

Interacting with devices using memory mapped I/O

User space device drivers

Managing DMA transfers

PCI drivers

USB drivers

Introduction to network device drivers

Introduction to block device drivers

I/O Scheduling

Course Description:

Red Hat Enterprise Linux has gained considerable momentum as the operating system of choice for deploying network services such as web, ftp, email, and file sharing. Red Hat's RHCE curriculum provides training in deploying these services and on the essential elements of securing them.

Who Should Attend:

The audience for this course includes system administrators, consultants, and other IT professionals responsible for the planning, implementation, and maintenance of network servers. While the emphasis is on running these services on Red Hat Enterprise Linux, and the content and labs will assume its use, system administrators and others using proprietary forms of Unix may also find many elements of this course relevant.

Prerequisites:

RH253, RH300, or RHCE certification or equivalent work experience is required for this course. Course participants should already know the essential elements of how to configure the services covered, as this course will be focusing on more advanced topics from the outset.

Benefits of Attendance:

Upon completion of this course, students will be able to:

- Master basic service security.
- Understand cryptography.
- Log system activity.
- Secure BIND and DNS.
- Improve NFS security.
- Manage FTP access.

Course Outline:**The Threat Model and Protection Methods**

Internet threat model and the attacker's plan
System security and service availability
An overview of protection mechanisms

Basic Service Security

SELinux
Host-based access control
Firewalls using Netfilter and iptables
TCP wrappers
xinetd and service limits

Cryptography

Overview of cryptographic techniques
Management of SSL certificates
Using GnuPG

Logging and NTP

Time synchronization with NTP
Logging: syslog and its weaknesses
Protecting log servers

BIND and DNS Security

BIND vulnerabilities
DNS Security: attacks on DNS
Access control lists
Transaction signatures
Restricting zone transfers and recursive queries
DNS Topologies
Bogus servers and blackholes
Views
Monitoring and logging
Dynamic DNS security

Network Authentication: RPC, NIS, and Kerberos

Vulnerabilities
Network-managed users and account management
RPC and NIS security issues
Improving NIS security
Using Kerberos authentication
Debugging Kerberized Services
Kerberos Cross-Realm Trust
Kerberos Encryption

Network File System

Overview of NFS versions 2, 3, and 4
Security in NFS versions 2 and 3
Improvements in security in NFS4
Troubleshooting NFS4
Client-side mount options

OpenSSH

Vulnerabilities
Server configuration and the SSH protocols
Authentication and access control
Client-side security
Protecting private keys

Port-forwarding and X11-forwarding issues

Electronic Mail with Sendmail

Vulnerabilities
Server topologies
Email encryption
Access control and STARTTLS
Anti-spam mechanisms

Postfix

Vulnerabilities
Security and Postfix design
Configuring SASL/TLS

FTP

Vulnerabilities
The FTP protocol and FTP servers
Logging
Anonymous FTP
Access control

Apache security

Vulnerabilities
Access control
Authentication: files, passwords, Kerberos
Security implications of common configuration options
CGI security
Server side includes
suEXEC

Intrusion Detection and Recovery

Intrusion risks
Security policy
Detecting possible intrusions
Monitoring network traffic and open ports
Detecting modified files
Investigating and verifying detected intrusions
Recovering from, reporting, and documenting intrusions

Course Description:

RHS429 introduces advanced system administrators, security administrators, and applications programmers to SE Linux policy writing. Participants in this course will learn how SE Linux works; how to manage SE Linux; and how to write an SE Linux policy. This class culminates in a major project to scope out and then write policies for previously unprotected services.

Who Should Attend:

RHS429 is designed for computer security specialists and other system administrators responsible for setting and implementing security policies on a Linux computer. Applications programmers also may consider taking the course to understand how to provide a set of SE Linux policies for third party applications. Participants need not have in depth knowledge of SE Linux, but should have a basic understanding of the SE Linux security layer. For example, SE Linux information as taught in RH133 or RH300 is sufficient.

Prerequisites:

RHS429 requires RHCE-level skills. Prerequisite skills can be shown by passing the RHCE Exam in either RH302 or RH300, or by taking RH253 or by possessing comparable skills and knowledge.

Benefits of Attendance:

Upon completion of this course, students will be able to:

- Understand how SE Linux operates within the Red Hat targeted policy.
- Understand how policies are written, compiled, and debugged.
- Create a set of policies from scratch for a previously unprotected service.
- Analyze the service, determining its security needs.
- Design and implement a set of policies.
- Test and fix the policies.
- Document the service's new policies so that others can effectively administer the service.

Course Outline:**Unit 1 - Introduction to SELinux**

Discretionary Access Control vs. Mandatory Access Control
SELinux History and Architecture Overview
Elements of the SELinux security model:
SELinux Policy and Red Hat's Targeted Policy
Configuring Policy with Booleans
Archiving
Setting and Displaying Extended Attributes
Hands-on Lab: Understanding SELinux

Unit 2 - Using SELinux

Controlling SELinux
File Contexts
Relabeling Files and Filesystems
Mount options
Hands-on Lab: Working with SELinux

Unit 3 - The Red Hat Targeted Policy

Identifying and Toggling Protected Services
Apache Security Contexts and Configuration Booleans
Name Service Contexts and Configuration Booleans
NIS Client Contexts
Other Services
File Context for Special Directory Trees
Troubleshooting and avc Denial Messages
setroubleshootd and Logging
Hands-on Lab: Understanding and Troubleshooting the Red Hat Targeted Policy

Unit 4 - Introduction to Policies

Policy Overview and Organization
Compiling and Loading the Monolithic Policy and Policy Modules
Policy Type Enforcement Module Syntax
Object Classes
Domain Transition
Hands-on Lab: Understanding policies

Unit 5 - Policy Utilities

Tools available for manipulating and analyzing policies
Hands-on Lab: Exploring Utilities

Unit 6 - User and Role Security

Role-based Access Control
Multi Category Security
Defining a Security Administrator
Multi-Level Security
The strict Policy
User Identification and Declaration
Role Identification and Declaration
Roles in Use in Transitions
Role Dominance
Hands-on Lab: Implementing User and Role Based Policy Restrictions

Unit 7 - Anatomy of a Policy

Policy Macros
Type Attributes and Aliases
Type Transitions
When and How do Files Get Labeled
restorecond
Customizable Types
Hands-on Lab: Building Policies

Unit 8 - Manipulating Policies

Installing and Compiling Policies
The Policy Language
Access Vector
SELinux logs
Security Identifiers - SIDs
Filesystem Labeling Behavior
Context on Network Objects
Creating and Using New Booleans
Manipulating Policy by Example
Macros
Enableaudit
Hands-on Lab: Compiling Policies

Unit 9 - Project

Best practices
Create File Contexts, Types and Typealiases
Edit and Create Network Contexts
Edit and Create Domains
Hands-on Lab: Editing and Writing Policy