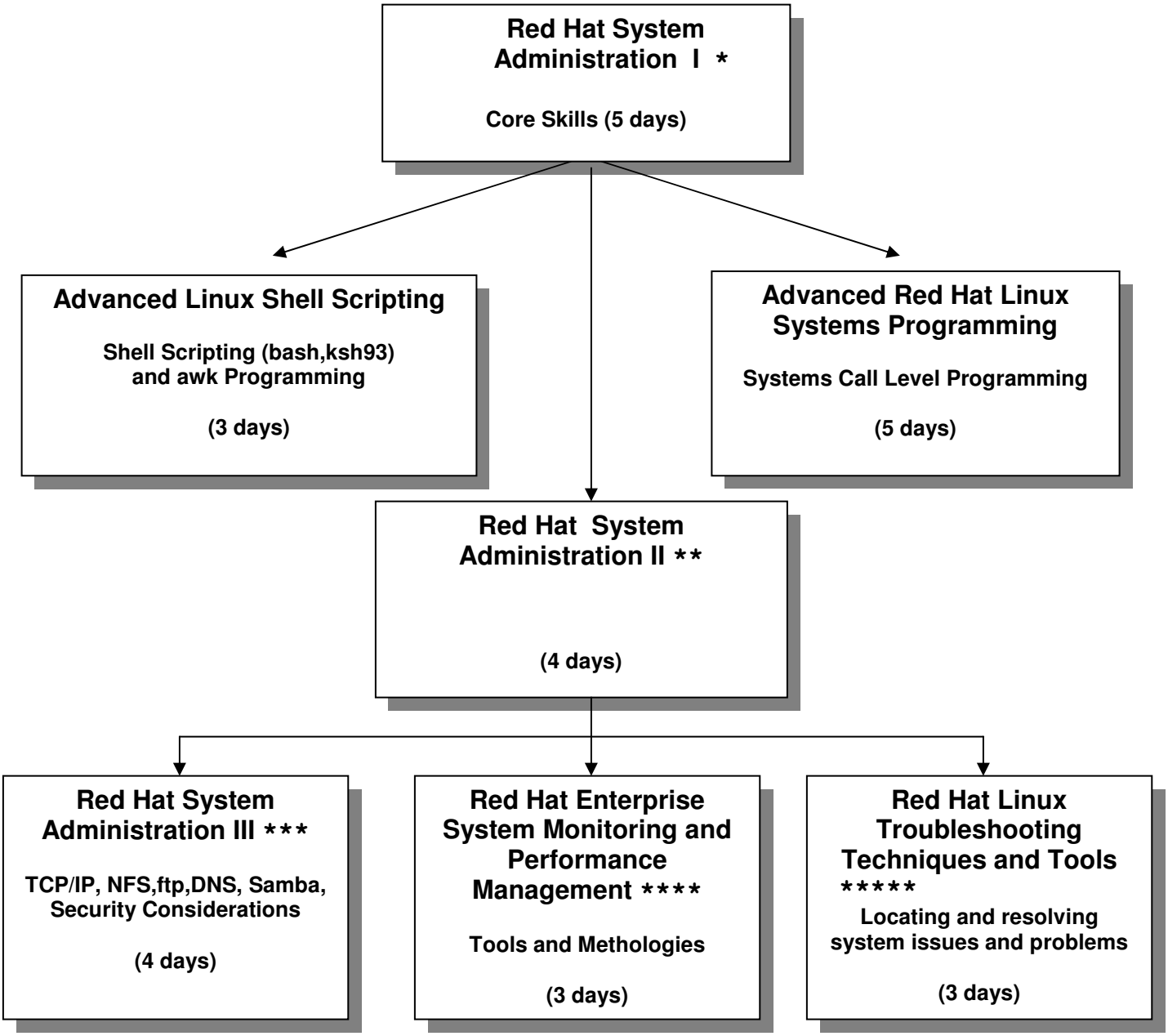
Red Hat Enterprise Linux (RHEL 6) Courses



- **equivalent to Red Hat courses: *(124) **(134) ***(254) ****(442) *****(142)**
- **all participants use their own virtualized RHEL 6 system for hands-on and lab exercises**

For more information, contact:

LAINE EDUCATIONAL ENTERPRISES, LTD ST LOUIS MO 63005
314.623.7371 laine@tetranet.net www.laineed.com

Red Hat System Administration I

COURSE DESCRIPTION

This course teaches the basic working environment of a **Linux** system. It introduces commonly required operations that can be performed by entering commands interactively in a command terminal, along with functions available in the **K** Desktop Environment (**KDE**) and **Gnome**. This course will concentrate on **Red Hat Enterprise Linux** (**RHEL**), **version 6** (**all update levels**).

This course is the **equivalent** of **Red Hat** course **124**, with **additional shell scripting topics.**

COURSE OBJECTIVES

Each participant will be able to use **RHEL 6 Bash Shell** techniques and commands to maintain collections of files, create files using interactive editor utilities, create and execute basic command procedures, communicate with other users, and tailor the interactive environment to meet their needs. Basic administrative features to setup a functioning **RHEL6** system will also be shown.

COURSE TOPICS

Understanding the User Environment

- **RHEL 6** System Overview
- Process Concepts
- The Graphical Environment GUIs (**KDE, Gnome**)
- Using **GUI**s remotely
- Customizing the Graphical Environments

Getting Started with the Command Language

- Logging Into an **RHEL 6** System
- **Bash** Shell Syntax Rules
- Documentation via **man** and **info**
- Command Line Editing
- Basic Network Operations

Red Hat System Administration I

COURSE TOPICS

Managing Files
- File Specification Syntax
- Device Specifications
- Directory Specifications
- Regular Expressions and Special Characters
- **RHEL 6** Commands to Manipulate Files
- File Protection Mechanisms

Creating and Editing Text Files: Part 1
- Using GUI-based editors (**kedit, gedit**)
- **vi** Editor
  - **ex** Editor (commands within **vi**)
- Alternative editors (**vim, nedit**)

Creating and Editing Text Files: Part 2
- Advanced Features of the **vi** Editor
  - abbreviations
  - mapping keys

Improving the User Interface
- Saving History Commands
- Creating Command Aliases
- Redirection of Input and Output
- Using Hard and Symbolic Links
- Process Control Commands

Shell Script Procedures
- Rules for Creating Procedures
- The **.bash_profile** procedure
- The **.bashrc** procedure

Red Hat System Administration I

COURSE TOPICS

Print and Batch Mechanisms

The **lp** command and options
The **at** command and options
The **crontab** command and options

User Level Tape Operations

tar utility syntax
tar commands for product access
Using compression/uncompression commands
gzip / **gunzip**

Writing Bash and Korn Shell Scripts

Bash / **Korn** Shell environment variables
User-defined variables
Substitution of variables
Command substitution in variables
Decision statements
Looping statement constructs
Formatting variable values for output (**printf**)
typesetting integer variables
Generating menus and processing with **case**
using and defining functions
special parameter/variable substitutions
defining and using **indexed arrays**

System Installation and Updating

Installation types and methods
Installing the **RHEL 6** operating system
Maintaining the system via patches
Managing system software

Red Hat System Administration I

COURSE TOPICS

Startup and Shutdown

- Components involved in the **Linux** boot
- **Grub** loader stages and configuration
- Default bootstrap
- Boot to single-user mode
- **Linux** startup methods, tools, and procedures
- Understanding **run levels**
- Adding procedures to the startup mechanisms
- Shutdown methods and control

Managing of System Users

- **UID** and **GID** concepts
- Creation of a user account
- Security through **password aging**
- Controlling access by groups

Managing Printer Queues

- Creation of an execution print queue
- Commands to manipulate queues
- Commands to manipulate jobs in queues

Managing Disk and Tape Volumes

- Commands to manipulate disks/filesystems
  - partitioning disk surfaces with **fdisk**
  - creating **ext2**/**ext3**/**ext4** file systems (**mkfs**)
  - manipulating file system structures
  - verifying file system structures (**fsck)**
  - making file systems available to software (**mount**)
  - configuring swap space(s)
  - Logical Volume Management (**LVM**)

Red Hat System Administration I

COURSE TOPICS

Network Setup and Configuration

- **TCP/IP** address selection
- Host names and related files
- Configuring network devices
- Network testing with **ping**
- Network utilities: **telnet, rlogin, rcp, rsh, ssh**

Maintaining System Integrity

- Login and user accounting
- Command/process level accounting
- Using **cron** tables

Basic Server Setups (Procedures and Mechanisms)

- **DNS (client)**
- **FTP**
- **Mail**
- **Web (Apache)**
- **Samba**

COURSE DURATION

This course normally requires **five** (5) days, approximately 50% lecture and 50% lab time.

COURSE PREREQUISITES

This course is considered to be the basic **Red Hat** course. Experience with any interactive system is helpful.

Advanced Linux Shell Scripting

COURSE DESCRIPTION

This course teaches the **Linux** / **Unix** computer professional (user, systems administrator, application/system programmer) the techniques needed to develop advanced shell and reporting type procedures. The techniques shown are applicable to all **Linux** system variants.

COURSE OBJECTIVES

Each participant will be able to use **bash** shell, **Korn** shell**,** and **awk** capabilities to maintain collections of files,manipulate data, implement process communication, synchronization, and data sharing. Brief comparisons in techniques and performance considerations with **Perl** will also be shown.

COURSE TOPICS

Review of Shell Scripting Features

- Importance of signatures
- Methods of script execution
- Debugging shell scripts
- Variable types
- Looping statement constructs
- Decision statements

Advanced Techniques in Shell Scripts

- Alternative script execution methods
- Defining a **trap** step debugger
- **Here Document** data
- Defining and using functions
- Using string pattern expressions
- Indexed array creation and access
- Option processing with **getopts**

Advanced Linux Shell Scripting

COURSE TOPICS

Advanced Techniques in Korn Shell Scripts

- Availability of variable data
- Defining and using **nameref** variables
- Active variables (and tied functions)
- Features of **Associative arrays**
- Direct control of file **I/O** (**exec, read, print**)
  - User-defined file descriptors
- Interprocess communication/synchronization
  - Co-processes
  - Reassignment of file descriptor paths
- **TCP** and **UDP** port access
  - Attaching to network listener processes

awk Scripting Features

- Importance of signatures
- Methods of script execution
- Patterns and actions
- Output formatting
- Defining and using associative arrays
- the **getline( )** function
- **awk** supplied function features
  - string handling
  - information
  - callouts for system features
  - arithmetic operations
- Defining and using functions
  - Passing arguments to functions

Introduction to Perl Scripting

- History, versions, ports
- **Perl** capabilities
- Comparison with shell scripts

Advanced Linux Shell Scripting

COURSE DURATION

This course normally requires **three** (3) days, approximately 50 % lecture, and 50 % lab time.

COURSE PREREQUISITES

This is an advanced **Linux** / **Unix** course. It is assumed that participants either have attended a **Red Hat Linux Essentials** course, or have equivalent command line experience with the **bash** and/or **Korn** shells.

Advanced Red Hat Linux Systems Programming

Course Description

This course introduces the participants to system level programming in the **C language** in a **RHEL 6** environment. The course focuses on **RHEL 6** system calls and library functions, how to use them, and their underlying mechanisms. The course deals with many facets of the **RHEL6** operating system, including: introduction to **RHEL6** kernel structure, I/O, Signals, Signal handlers, Timers, Processes, Multi-Tasking, Inter-Process Communication (**IPC**) Pipes, Shared memory, Message Queues, Semaphores, Networking, Sockets, using **TCP/IP** and **UDP/IP**.Throughout the course the information presented is related to the participant through: the execution of common **RHEL 6** user/administrator commands, and writing, compiling, and executing example **C language** programs which demonstrate the use of system routines and accessing system data structures on a live **RHEL 6** system.

Course Objectives

Upon completion of this course the participant will be able to:

- Explain the programmable mechanisms in a **RHEL6** environment
- Write applications using standard **RHEL6** system calls and library functions

Course Topics

System Programming Environment of the RHEL 6

- Environment of a **C** language program
- System level programming requirements:
  - **C** compiler issues
  - Header files and libraries
  - Special data types used
  - Useful functions
  - Error handling (basic)
- Documentation
- Security Issues

Advanced Red Hat Linux Systems Programming

Course Topics

File Systems

- Types of file I/O
- File I/O structures
- File I/O access types
- Dealing with STDIN, STDOUT, STDERR
- Creating and using temporary files
- Directory file access and manipulation
- Permissions

Process Creation and Control

- Attributes (username, UID, PID, Groups)
- Creation methods
- Multi-tasking
- Shells
- Synchronization
- An introduction to threads

Synchronization and System Information

- Time issues:
  - how time is maintained
  - timers
- General synchronization
  - semaphores
  - mutexes
  - spinlocks and barriers
  - signals (generation and handling)
- System information:
  - uname
  - hostname
  - load averages

Interprocess Data Communication Facilities

- Overview of **RHEL 6** IPC Facilities
- Memory Mapped files
- Pipes and Named Pipes
- Messages Queues
- Creating and Using Shared Memory structures

Advanced Red Hat Linux Systems Programming

Course Topics

Sharing Code Between Processes

- Building shared object (libraries)
- Static Linking
- Dynamic Linking

Networking

- Concepts and basic requirements
- Socket creation and usage
- TCP/IP level connections
- UDP/IP level connections

Course Duration

This course normally requires **five** (5) days, 60% lecture, 40% hands on lab exercises.

Course Prerequisites

It is assumed that the participant has a solid background in basic **RHEL 6** utilities and editors (such as **vim**), and a working knowledge of the **C** (or **C++**) programming language(s).

Red Hat System Administration II

COURSE DESCRIPTION

This course will teach the commands and methods needed to setup and manage a **RHEL 6** system. The course will also use a problem solving approach in the lab exercises to teach system administrators advanced topics, for long-term mangement of the system.

This course is the **equivalent** to **Red Hat** course **134**, and is a continuation and companion to **Red Hat** course **124**, and is the second preparation course for the **RHCSA** certification examination.

Systems: **Red Hat Enterprise Linux Version 6 (all update levels)**

COURSE OBJECTIVES

On completion of this course, a systems administrator should be able to install, update, and boot the **RHEL 6** operating system; set up user accounts and directories; prepare queues for use; perform backups for integrity and performance reasons; monitor the system for performance and do basic setup of network software and capabilities.

COURSE TOPICS

Advanced System Concepts for System Administrators

Linux history and timelines
Process concepts
Bash Shell command usage and review
Optimizing system help information
System administrator functions
Using the **root** account
root access via **sudo**
Using the **RHEL 6** administrative graphical interfaces
Manipulating system default environment files
Installing and using **webmin** for remote administration

Red Hat System Administration II

COURSE TOPICS

System Installation and Updating

- Installation types and methods (review)
- Installing the **RHEL 6** operating system via **kickstart**
- Package management via **yum** (repositories)
- Reconfiguring the **Linux** kernel (modules)

Startup and Shutdown

- Controlling kernel operations via boot time arguments
- **Grub** loader manipulation
  - alternative menu entries
  - password protections
- Boot time troubleshooting
- Upstart **init** service

Managing of System Users and Files

- Security through **PAM password aging**
- Group level password controls
- Access Control Lists (**ACL**s)
  - files
  - directory (defaults)
- Process priorities

Managing Printer Queues

- Creation of an execution print queue
- Commands to manipulate queues
- Commands to manipulate jobs in queues

Red Hat System Administration II

COURSE TOPICS

Managing Disk and Tape Volumes

- Commands to manipulate partitions
  - **fdisk**
  - **partprobe**
  - encrypting file systems
  - verifying file system structures with **fsck**
- Commands to manipulate archival volumes:
  - **tar** utility
  - **cpio** utility
  - **dump** and **restore** utilities
  - **LVM** snapshots

Monitoring System Activity

- Informational Utilities
- The **vmstat** utility
- The **iostat** utility
- The **sar** utility
- The **netstat** utility
- Maintaining swap and paging space(s)
- Using the **top** facility

Maintaining System Integrity

- **SELinux** basics
- Pluggable Authentication Module (**PAM**) basics
- Log file control (**logrotate**)

COURSE DURATION

This course normally requires **four** (4) days, approximately 60% lecture, and 40% lab time.

COURSE PREREQUISITES

It is assumed that the participant has successfully completed the **Red Hat System Administration I** course, or has equivalent system time as a user.

Red Hat System Administration III

Networking and Security Operations

COURSE DESCRIPTION

This course will teach the commands and methods needed to setup and manage advanced networking, security, and performance management on a **RHEL 6** system. The course will also use a problem solving approach in the lab exercises to teach system administrators advanced topics, for long-term mangement of the system.

This course is the **equivalent** to **Red Hat** course **254**, is used for preparation for the **RHCE** certification examination.

Systems: **Red Hat Enterprise Linux Version 6 (all update levels).**

COURSE OBJECTIVES

On completion of this course, a systems administrator should be able to install, update, and boot the **RHEL 6** operating system; setup a **RHEL 6** system to act as a: **DNS** server (and client), **VSFTPD** server, **Apache** web server, email server, **SAMBA** host. Topics covering basic encryption, performance management tools, and usage of **PAM** will also be covered.

COURSE TOPICS

Advanced RHEL 6 Networking Features

- automated network attributes setup
- network address types
- network information files
- controlling **telnet** services
- controlling trusted host services
- **TCP** Wrappers
- **syslog** (and remote logging)
- **logwatch**

Red Hat System Administration III

Networking and Security Operations

COURSE TOPICS

Domain Name System (DNS) Server / Client Setup

- reasons for **DNS**
- **DNS** layout and overview
- **FQDN** (fully qualified domain (host) name)
- **DNS** server types
- name resolution
- primary name server setup
- secondary and caching-only name server setup
- testing a primary name server
- resolver host setup
- controlling **named (**via **rndc)**

RHEL 6 Server Setups

SAMBA

- **SAMBA** overview
- basic **SAMBA** server installation
- accessing **SAMBA** server shared files
- **SAMBA** shared printer setup and access

sendmail

- mail components
- **sendmail** daemon
- changing sendmail configuration files
- replacing **sendmail** with **postfix**

web server

- **Apache** Web Server packages
- configuration files
- logging files
- executable scripts

ftp

- **ftp** servers overview
- **gssftp**
- **vsftpd**

Red Hat System Administration III

Networking and Security Operations

COURSE TOPICS

RHEL 6 Server Setups

NFS

NFS server setup
NFS client
automounter

DHCP

DHCP client setup
DHCP server setup

RHEL 6 Security

Unix types
Administrator responsibilities
Basic security considerations
Types of security and attacks
Reacting to a security problem

special file attributes (**SUID, SGID, STICKY**)
Access Control Lists (**ACLs**)
Default Access Control Lists (**ACLs**)
PAM (Pluggable Authentication Modules)

IPTABLES (Netfilter firewall)
IPSEC

Data encryption in **RHEL6 (files** and **filesystems)**
SSH
Using **SSH** tunnels for secure graphical connections

GRUB level security (boot files)

Red Hat System Administration III

Networking and Security Operations

COURSE TOPICS

Administrator Level BASH Shell Scripting

rules for writing shell scripts
shell built-in constructs
conditional and looping expressions
processing command line arguments and options
error and **control**/**C** handling

COURSE DURATION

This course normally requires **three** (3) days, approximately 60% lecture, and 40% lab time.

COURSE PREREQUISITES

It is assumed that the participant has successfully completed the **Red Hat System Administration I** (**RH 124**) and **Red Hat System Administration II** (**RH 134**) courses, or has equivalent system time as a user and a working systems administrator.

Red Hat Enterprise Linux Systems Administration

Troubleshooting Techniques and Tools

COURSE DESCRIPTION

This course will teach the commands and methods needed to perform troubleshooting networking, security, and performance issues on a functioning **RHEL 6** system. The course will also use a problem solving approach in the lab exercises to teach system administrators a **methodology** of: **discovery**, **analysis**, **tools**, and **solution** in each area that is covered.

This course is the **equivalent** to **Red Hat** course **142**.

Systems: **Red Hat Enterprise Linux Version 6 (all update levels)**

COURSE OBJECTIVES

On completion of this course, a systems administrator should be able to use a **methodology** to **analyze** and **solve problems** with system components, along with usage of tools to **proactively identify issues** as they occur (or before they occur).

COURSE TOPICS

Review of System Concepts for System Administrators

System administrator functions
Using the **root** account
root access via **sudo**
Using the **RHEL 6** administrative graphical interfaces
Manipulating **root** account history files
Installing and using **webmin** for remote administration

Red Hat Enterprise Linux Systems Administration

Troubleshooting Techniques and Tools

COURSE TOPICS

Overview of Troubleshooting Techniques
- methodologies
- available tools
  - in **RHEL 6** distributions
  - third party
  - freeware
  - system-specific ("**home-grown**")

Startup Time Issues and Resolutions
- review of boot time components
- troubleshooting **GRUB** problems
- building **GRUB** recovery boot media
- **alternate** methods of **booting**
  - single user mode
  - recovery or installation media
- fixing problems with filesystem structures
- resolving issues with **LVM** boot file systems

RHEL 6 Hardware Configuration
- location of key files and descriptions
- tools to manipulate hardware configuration files
- understanding **hardware discovery** and drivers
- diagnostic tools to test hardware components

RHEL 6 Software Configuration
- location of key files and descriptions
- tools to manipulate configuration files

Red Hat Enterprise Linux Systems Administration

Troubleshooting Techniques and Tools

COURSE TOPICS

Networking Troubleshooting Considerations

- review of networking hardware / software components
- techniques to manually configure network interfaces
- software **IP** configuration / testing using **ifconfig**
- testing areas and tools
  - network connectivity
  - server configuration (files)
    - **DNS**, **VSFTPD**, **DHCPD**, **SAMBA**
- available tools

Security Issues

- review of security in all major component areas
- impact of selected **security level**
  - **default** from installation
  - **SELinux**
  - via "**hardening**" tools
- **PAM**
  - security role in **RHEL 6**
  - functional areas
  - files and configuration
  - resolving issues with **PAM** controls
- security monitoring / troubleshooting tools

Application Troubleshooting

- writing utilities to sense problems
  - physical memory usage
  - paging file
  - disk and network **I/O** bandwidth

Red Hat Enterprise Linux Systems Administration

Troubleshooting Techniques and Tools

COURSE TOPICS

Resources for Troubleshooting Information
on-line searchable repositories
available diagnostic tools (summary)
Red Hat support options

COURSE DURATION

This course normally requires **three** (3) days, approximately 60% lecture, and 40% lab time.

COURSE PREREQUISITES

It is assumed that the participant has successfully completed the **Red Hat System Administration I** (**RH 124**) and **Red Hat System Administration II** (**RH 134**) courses, or has equivalent system time as a user and a working systems administrator.

Red Hat Enterprise Linux Systems Administration

System Monitoring and Performance Management

COURSE DESCRIPTION

The **Red Hat Enterprise Linux Systems Administration: System Monitoring and Performance Management** course introduces participants to performance management principles, monitoring utilities / tools, and analysis for the **RHEL 6** Operating Environment. The course includes a review of **RHEL 6** subsystems, along with the utilities provided to monitor system efficiency including **sar** and the ***stat** family of tools. In each area of discussion, emphasis will be placed on writing tools for monitoring and analysis. These tools will include **Korn shell** scripts, **Perl** procedures, and **C language** programs.

This course is the **equivalent** to **Red Hat** course **442**.

Systems: **Red Hat Enterprise Linux Version 6 (all update levels)**

COURSE OBJECTIVES

On completion of this course, a systems administrator should be able to:

- Describe performance management fundamentals
- Use the **RHEL 6** and third-party tools to analyze performance
- Write tools in various languages
- Use **RHEL 6** performance data extensions
- View and set kernel-based tuning parameters
- Monitor and report on process and thread activity
- Modify **CPU** scheduling and virtual memory operations
- Enable dynamic monitoring via **SystemTap** in all major areas

Red Hat Enterprise Linux Systems Administration

System Monitoring and Performance Management

COURSE TOPICS

Performance Basics

- Describe the principles of performance analysis
- Describe the performance management process
- Terms used to describe performance aspects
- Factors affecting system performance
- Performance metrics
- Virtual system caching
  - Effects of computer architecture

RHEL 6 Monitoring Capabilities

- Monitoring tools provided with **RHEL 6**
  - ***stat** family of programs
  - **sar** / **sadc**
  - Third party / freely available tools
    - **uptime**
    - **ManageEngine**
  - tools from **Red Hat**
- Introduction to **SystemTap**
- Kernel tunables (viewing, changing via **sysctl**)

Memory Management

- Memory layout and distribution
- Memory usage by the kernel
- Process creation
- Process virtual address space
- Buffer Cache (and allocation control)
- Shared Memory / Page Caching
- Paging and Swapping
- Monitoring Tools

Red Hat Enterprise Linux Systems Administration

System Monitoring and Performance Management

COURSE TOPICS

CPU Management
- Software priorities concepts
- Impact of the **nice** parameter
- Priority boosting
- Adjusting **CPU** scheduling mechanisms
- Tuning (**Java)** threaded applications
- Process states
- Monitoring tools

I/O Management
- Breakdown of disk I/O
- Measuring Disk and I/O
- **ext3**/**ext4** performance
  - File system structure concepts
  - File system caching
  - Name Lookup (meta-data) caching
  - Tuning the cache sizes and algorithms
  - (Re-)Defining the **I**/**O** scheduler
  - File system performance statistics
  - **ext3** parameters to improve efficiency
  - Alternative write strategies to **ext3**/**ext4** buffering
- Monitoring Tools

Network Management
- **TCP**/**IP** Layers
- Socket controls
- Controlling network services
- Setting network buffer values
- Monitoring tools

Summaries
- Memory management
- CPU management
- I/O management
- Network management
- User program management

Red Hat Enterprise Linux Systems Administration

System Monitoring and Performance Management

COURSE DURATION

This course normally requires **three** (3) days, approximately 60% lecture, and 40% lab time.

COURSE PREREQUISITES

It is assumed that the participant has successfully completed the **Red Hat System Administration** I (**RH 124**) and **Red Hat System Administration II** (**RH 134**) courses, or has equivalent system time as a user and a working systems administrator.