

Linux System Administration on Red Hat

Kenneth Ingham

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1 Course overview

This class is for people who are familiar with Linux or Unix systems as a user (i.e., they know file manipulation, an editor, and common Unix/Linux tools). The class covers information they will need to be a successful system administrator of a Red Hat Linux system. This class stresses troubleshooting problems an administrator is likely to encounter.

2 Course objectives

Students attending this class will learn:

- how to install the operating system
- the parts of a user account and the files where these data are stored
- how to verify, install, update, and remove software packages
- the structure of data on disks, including partitions and filesystems and how to work with them
- system administration tools such as *rsync* and *lsof*
- shell programming
- how to execute jobs at regular intervals
- logging, how to control it, how log files are rotated
- the information in the */proc* filesystem and how to work with it
- how the system boots and how to customize it
- how to configure the network to use static or dynamic IP addresses
- configuring and working with network services such as name lookups, NIS (optional), NFS, the automounter, and *ssh*.
- the Linux tools commonly used for backups
- tools for network monitoring and testing
- network performance tuning
- performance monitoring

3 Student background

If you are attending this class, then we assume that

- You are comfortable with basic Linux commands such as *cp*, *mv*, *rm*, *mkdir*, *rmdir*, *chmod*, *cat*, *more* or *less*, *passwd*, *date*, and *ls*.
- You know what absolute and relative paths are and the difference between them.
- You know what *.* and *..* mean and when you would use them.
- You know what the permissions on directories mean (they are different from files).
- You are comfortable working at the command line.
- You can read manual pages and other system documentation.
- You know an editor.
- Knowing a programming language will make shell programming much easier.

4 Logistics

The class lasts four days. Fedora core 4 or Centos 4 The class uses the following software:

- A CD DVD or USB memory to mount; the installation CDs/DVD work fine for this
- All backup software we use is on the OS distribution CDs
- Gnome for a desktop environment (on distribution CDs)
- Kernel source (from Internet or source CDs or DVDs; **not** on the normal distribution media)
- OS distribution CD 1 or Knoppix CD
- OS installation media
- The test partition created at install time
- *gkrellm* (on class web site)
- *iptraf* (if covered in this class)
- *nmap* (on distribution media)
- *ttcp* (on class web site)
- *xosview* (on class web site)
- a DHCP and DNS server for the class
- a package to install and upgrade (the instructor needs to be prepared for this)
- an NIS server on the instructor machine with an account the students will log into (if this class covers NIS)
- *bonnie* or *bonnie++* (on class web site)
- class network configuration information
- either Internet access or a local CentOS repository (the instructor needs to be prepared for this)
- static IP addresses (these do not need to be routable)
- un-allocated space left at install time.

No class network information specified.

The class needs a web server for the class web site. The instructor's laptop may be this web server; otherwise the machine provided in the classroom for the instructor is a good choice. This machine obviously will need web server software installed.

5 Class outline

1. Introduction (Lecture: 15; Lab: 0)
 - (a) Class Introductions
 - (b) Class Logistics
 - i. Class schedule
 - ii. Breaks
 - iii. Question policy
 - iv. Break room and restroom locations
 - v. Assumptions about your background
 - (c) Typographic conventions
2. Red Hat OS Installation (Lecture: 25; Lab: 75)
 - (a) Hardware requirements
 - (b) Installer options
 - (c) Disk partitioning
 - (d) Network configuration
 - (e) GNU/Linux as a guest OS
 - (f) Kickstart
 - i. Summary of CentOS 5 Installation
 - (g) Lab
3. Finding the answer (Lecture: 15; Lab: 40)
 - (a) General hints
 - (b) The help system
 - (c) The manual pages
 - (d) GNU info
 - i. Some *info* commands
 - (e) Summary
 - (f) Lab
4. Basic bash programming, part I (Lecture: 30; Lab: 40)
 - (a) Variables
 - i. Environment Variables
 - ii. Pre-defined Variables
 - (b) Comments and spaces
 - (c) Shell Scripts

- (d) Quoting
 - (e) Lab
5. Basic bash programming, part II (Lecture: 30; Lab: 50)
- (a) Exit status and **\$?**
 - (b) Expressions
 - i. Expressions (using *test*)
 - ii. String expressions (*bash* and *ksh*)
 - iii. File expressions
 - iv. Arithmetic expressions (*bash* and *ksh*)
 - (c) if
 - i. Examples
 - (d) case
 - (e) Lab
6. Basic bash programming, part III (Lecture: 20; Lab: 45)
- (a) for
 - (b) while
 - (c) Functions
 - i. Function arguments
 - ii. Example
 - iii. Output from running the example
 - iv. Local variables
 - (d) Debugging Shell Scripts
 - (e) Lab
7. User Information (Lecture: 40; Lab: 50)
- (a) User and group information files
 - i. ***/etc/passwd***
 - ii. ***/etc/shadow***
 - iii. ***/etc/group***
 - (b) Adding and deleting users
 - i. GUI
 - ii. *vipw*
 - (c) Password aging
 - i. *chage* command-line arguments
 - (d) ***login.defs***
 - (e) PAM
 - i. Example
 - (f) ***nsswitch.conf***
 - (g) *su* and the root account

- (h) *sudo*
 - i. *sudo* configuration
 - (i) Troubleshooting hints
 - (j) Summary
 - (k) Lab
8. RPM Packages (Lecture: 40; Lab: 50)
- (a) RPM overview
 - i. Names, labels, and file names
 - (b) Working with *rpm*
 - i. Querying packages
 - ii. Verifying package signatures
 - iii. Verifying installed packages
 - iv. Installing packages
 - v. Upgrading packages
 - vi. Removing packages
 - vii. Other RPM information
 - (c) *yum*
 - i. Yum repositories
 - ii. Repository configuration
 - iii. Installing software with *yum*
 - iv. Searching for software
 - v. Updating
 - vi. Removing software
 - vii. *yum* and proxies
 - (d) Keeping your system patched
 - (e) Summary
 - (f) Lab
9. Partitions and filesystems (Lecture: 40; Lab: 55)
- (a) Special files (devices)
 - i. Disk special files
 - (b) Partitions
 - i. Extended partitions
 - ii. *fdisk*
 - (c) Filesystem labels
 - (d) Mounting filesystems
 - i. *mount* and *umount*
 - ii. Boot time filesystem mounting
 - (e) Inodes
 - (f) The structure of a directory

- (g) Adding a disk
 - (h) *fsck*
 - (i) Dealing with filesystem problems
 - (j) Summary
 - (k) Lab
10. Filesystem tools (Lecture: 20; Lab: 30)
- (a) *df*
 - (b) *du*
 - (c) *locate* and *slocate*
 - (d) *find*
 - (e) Summary
 - (f) Lab
11. Useful sysadmin tools (Lecture: 40; Lab: 65)
- (a) *lsuf* and *fuser*
 - (b) *rsync*
 - i. Some *rsync* options
 - (c) *cron*
 - i. The **crontab** file
 - (d) Logging and log files
 - i. The syntax of **syslog.conf**
 - (e) Log file rotation
 - i. *logrotate* directives
 - (f) The **/proc** filesystem
 - (g) *sysctl*
 - (h) Summary
 - (i) Lab
12. Booting (Lecture: 45; Lab: 60)
- (a) The hardware boot process
 - i. How Linux on an Intel x86 architecture machine boots
 - (b) *grub*
 - i. Overview
 - ii. File specification to *grub*
 - iii. Commands
 - iv. Example
 - (c) Initial ramdisks
 - (d) Booting single user
 - (e) *init* and startup scripts
 - i. Run levels
 - ii. Interactive boot

- iii. *chkconfig*
 - iv. *service*
 - (f) Boot floppies/CDs
 - i. Booting rescue mode
 - (g) Shutting down the system
 - (h) Troubleshooting
 - (i) Summary
 - (j) Lab
- 13. Network Configuration (Lecture: 30; Lab: 45)
 - (a) Network configuration
 - i. DHCP client configuration
 - ii. Static network configuration
 - (b) DNS lookups
 - i. ***/etc/resolv.conf***
 - ii. *host*
 - (c) Virtual network interfaces
 - (d) *mii-tool* and *ethtool*
 - i. Examples
 - (e) *system-config-network*
 - (f) Troubleshooting
 - (g) Summary
 - (h) Lab
- 14. Network services (Lecture: 30; Lab: 45)
 - (a) *xinetd*
 - (b) *ssh*
 - i. Public key authentication
 - ii. Tunneling
 - (c) NFS
 - i. Client
 - ii. Server
 - (d) Automounter
 - (e) Troubleshooting
 - (f) Summary
 - (g) Lab
- 15. Network monitoring, testing, and tuning (Lecture: 45; Lab: 80)
 - (a) Network monitoring and testing tools
 - i. *tcpdump*
 - ii. *wireshark*

- iii. *telnet*
 - iv. *netcat*
 - v. *netstat*
 - (b) Tuning
 - i. Prerequisite assumptions
 - ii. Benchmarking
 - A. Example
 - iii. Parameters
 - A. Maximum Transmission Unit
 - B. Example
 - C. Bandwidth-Delay product
 - D. TCP parameters
 - E. IP fragmentation parameters
 - F. Other kernel parameters
 - (c) NFS performance
 - (d) Summary
 - (e) Lab
16. Performance monitoring (Lecture: 25; Lab: 25)
- (a) Introduction
 - (b) *ps* and threads
 - i. Example
 - (c) *sar*
 - (d) *free*
 - (e) *vmstat*
 - (f) *iostat*
 - (g) *top*
 - (h) Graphical tools
 - (i) Troubleshooting
 - (j) Summary
 - (k) Lab
17. Backups (Lecture: 30; Lab: 45)
- (a) Compression
 - (b) Incremental backups
 - (c) *tar*
 - i. Examples
 - (d) *dump* and *restore*
 - i. *dump*
 - ii. Example
 - iii. *restore*
 - iv. Interactive restore

- v. Examples
- (e) *rsync*
 - i. Example
- (f) Summary
- (g) Lab

Appendices

- A. Basics (Lecture: 20; Lab: 20)
 - (a) Logging in and out
 - (b) Typing and correcting mistakes
 - i. In dialog boxes
 - ii. In a terminal window
 - (c) Changing your password
 - (d) An overview of the Gnome Desktop
 - i. The decoration around windows
 - ii. The panel
 - iii. The Terminal Emulator
 - (e) An introduction to the Gnome file manager
 - (f) Command-line structure
 - (g) Some simple commands
 - (h) Displaying the contents of a file in a terminal
 - (i) Lab
- B. File manipulation (Lecture: 30; Lab: 50)
 - (a) An Overview of the UNIX filesystem
 - i. Pathnames
 - ii. Directories
 - iii. Filenames
 - (b) Listing files
 - (c) Renaming and Copying Files
 - (d) Removing Files
 - (e) The *file* command
 - (f) Creating and removing directories
 - (g) Links
 - (h) Lab
- C. File and directory permissions (Lecture: 15; Lab: 15)
 - (a) Introduction
 - (b) Looking at File Permissions
 - (c) Changing Permissions
 - (d) Lab

- D. The vi editor (Lecture: 20; Lab: 30)
 - (a) Introduction
 - (b) Getting in and out
 - (c) *vi* modes
 - (d) Moving around
 - (e) Adding text
 - (f) Deleting text
 - (g) More
 - (h) Lab
- E. The shell (Lecture: 55; Lab: 55)
 - (a) Introduction
 - (b) Metacharacters
 - i. Examples
 - (c) Redirecting I/O
 - i. Examples
 - (d) Pipes
 - (e) History and command line editing (*ksh* and *bash*)
 - (f) Shell startup and customization (*bash*)
 - (g) Aliases
 - (h) Additional *bash* features
 - (i) Lab
- F. Some useful tools, part I (Lecture: 35; Lab: 60)
 - (a) *grep*
 - (b) Regular expressions
 - i. Example
 - ii. Example
 - iii. Summary of regular expression characters
 - (c) *head* and *tail*
 - (d) *less*
 - (e) Summary
 - (f) Lab
- G. Some useful tools, part II (Lecture: 30; Lab: 30)
 - (a) *cut*
 - (b) *diff*
 - (c) *sort*
 - i. Example
 - (d) *uniq*
 - (e) *cat*
 - (f) *wc*

- (g) *tee*
- (h) *sleep*
- (i) Lab

H. Processes (Lecture: 30; Lab: 25)

- (a) Process information
- (b) Job control
- (c) *nice*
- (d) Looking at processes
 - i. *ps*
- (e) *top*
- (f) Killing processes
- (g) Lab