



Contents

Acknowledgments.....	xviii
Check-In	xix

I Installing and Configuring Linux I

I Basic Installation 3

Objective 1.01 Determine Customer Needs 4

The History of Linux 4

What Applications Linux Can Include for Clients 5

What Server Services Can Be Installed 6

Selecting a Distribution 6

Objective 1.02 Identify Required Hardware 7

Basic Hardware 8

Required Space 8

Scalability 9

Objective 1.03 Understand That Linux Is Just the Kernel 9

Numbering Schemes 9

Upgrades 10

Custom Kernels 10

Objective 1.04 Determine the Appropriate Installation

Method 11

Boot Method 11

Local Source 12

Network Source 13

Objective 1.05 Define Multimedia Options 14

Video 14

Sound 15

Codecs 16

	Objective 1.06 Identify Machine Requirements	16
	Packages and Package Groups	16
	Appliance	18
	Functional Server	18
	Desktop	19
	CHECKPOINT	19
	REVIEW QUESTIONS	20
	REVIEW ANSWERS	22
2	Configuring During and After Installation	23
	Objective 2.01 Select Appropriate Parameters for Installation	24
	Language	25
	Keyboard	26
	Pointing Device	26
	Time Zone	27
	Objective 2.02 Partition with fdisk and More	27
	Appropriate Directories for Dedicated Partitions	27
	RAID Configuration	28
	RAID 0	29
	RAID 1	29
	RAID 4	29
	RAID 5	29
	RAID 6	30
	Logical Volume Management Configuration	30
	Other Partition Management Tools	31
	Objective 2.03 Configure a Filesystem	31
	Standard Linux Filesystems	31
	Other Filesystems	33
	Objective 2.04 Understand and Reinstall a Boot Manager	33
	The Linux Loader (LILO)	34
	The Grand Unified Bootloader (GRUB)	35
	Other Bootloaders	37
	Objective 2.05 Identify Network Configuration Issues	37
	Network Fundamentals	37
	IP Addresses	38
	Connecting to a LAN	39
	Connecting via Telephone Modem	40
	The Internet Super Server	41

Objective 2.06	Configure Peripherals as Needed	41
	Printers	41
	Scanners	42
	Other Devices	42
Objective 2.07	Perform Post-Installation Package Management	42
	Installing New RPM Packages	43
	Upgrading RPM Packages	43
	Installing from a Compressed Tarball	44
	CHECKPOINT	45
	REVIEW QUESTIONS	46
	REVIEW ANSWERS	48

II Managing Linux Users, Files, Packages, Processes, and Services 49

3 Managing Files and Directories 51

Objective 3.01	Work with Files and Directories	52
	Basic Navigation	53
	The Tilde (~)	53
	Directories as a Dot (.) and a Double Dot (..)	53
	Hidden Files	53
	Wildcards	54
	The PATH	54
	Paths	55
	pwd	55
	cd	56
	ls	56
	Finding More with whereis	56
	Using the find and locate Commands	57
	find	57
	locate	59
	Searching with grep	59
	Comparing with diff	59
Objective 3.02	Create Files and Directories	60
	Creating Files with touch	60
	Creating Files with cp	60

Modifying Filenames with mv	61
Deleting Files with rm	61
Creating and Removing Directories with mkdir and rmdir	62
Objective 3.03 Manage Text Files	63
File Reading Commands	63
file	63
cat	64
head and tail	64
more and less	64
The Stream Editor, sed	65
The awk Text Manipulation Tool	65
The Visual Editor	65
vi Command Mode	66
Basic Text Editing	67
Objective 3.04 Create Linked Files	68
Hard Links	68
Soft Links	68
Objective 3.05 Modify Ownership and Permissions	69
File Ownership	69
Changing Ownership with chown and chgrp	70
Defining Permissions, Octally	71
Permissions on a Soft Link	71
Permissions on a Hard Link	72
Changing Permissions with chmod	72
The SUID, SGID, and Sticky Bits	73
The SUID Bit	73
The SGID Bit	74
The Sticky Bit	74
Defining Default Permissions with umask	74
Objective 3.06 Shell Command Management	75
Standard Output	75
Standard Input	76
Error Output	76
Quotes in the Shell	76
Interactivity	78
Command Completion	79
Escaping Special Characters	79
Objective 3.07 Create, Modify, and Run Basic Scripts	80
Shell Script Examples	80
Making a Shell Script Executable	81

	CHECKPOINT	81
	REVIEW QUESTIONS	82
	REVIEW ANSWERS	84
4	Media, Process, and Package Management	87
	Objective 4.01 Manage Storage Devices and Filesystems	88
	The Filesystem Hierarchy Standard	88
	Configuring with fdisk	90
	Checking with fsck	91
	Formatting with mkfs	92
	Tuning with tune2fs	93
	Objective 4.02 Mount Locally and Remotely	93
	Mounting on Your Own	94
	Mounting a Shared NFS Directory	94
	Mounting a Shared Samba/CIFS Directory	94
	Objective 4.03 Back Up and Restore Data	95
	Tape Archives and Compression with tar	95
	Input and Output with cpio	96
	Objective 4.04 Use Recordable Media	96
	Mounting Devices	97
	Writing to CD/DVDs	98
	Objective 4.05 Manage Runlevels	99
	The Boot Process	99
	Setting the Default Runlevel	100
	Changing Runlevels	101
	Services in Each Runlevel	101
	Other Initialization Scripts	101
	Objective 4.06 Learn Process Management	101
	Process Collections with ps	101
	Core Kernel and init Processes	102
	Stopping and Restarting a Job	103
	Load Monitoring with top	105
	Listing Open Files with lsof	105
	Changing Job Priorities	106
	Running Jobs in the Background: &, bg, jobs, fg	106
	nice and renice	106
	Objective 4.07 Identify Package Problems and Solve	
	with Updates	107
	Importing the Keyfile	107
	Identifying a Problem	108

Dependency Resolution	108
Package Updates	110
CHECKPOINT	110
REVIEW QUESTIONS	111
REVIEW ANSWERS	113
5 User and Service Management	115
Objective 5.01 Understand Network Troubleshooting	116
Confirming Connectivity with ping	116
Reviewing Network Connections with netstat	117
Tracing a Network Path with traceroute	118
Objective 5.02 Administer with Remote Management Tools ..	119
The “r” Commands	120
The Secure Shell	121
Objective 5.03 Configure Printer Systems	122
The Line Printer Daemon	122
The Common Unix Printing System	123
Running a Print Job	124
Checking Print Queues and Spools	124
Removing Print Jobs	125
Objective 5.04 Control Mail Servers	126
Basic sendmail	126
Basic Postfix	127
Objective 5.05 Understand Text-based Mail Clients	127
The mail Client	127
The mutt Client	128
Objective 5.06 Administrative Job Management	129
Standard and User cron Jobs	129
Creating an at Job	131
Objective 5.07 Manage User Accounts	132
User and Group Configuration Files	132
Adding User Accounts in Configuration Files	134
Adding Users and Groups from the Command Line	135
User and Group Management Commands	135
usermod	136
chage	136
groupmod	136
Managing Users and Groups with Quotas	137
Objective 5.08 Configure the Network Information Service ..	138
Basic NIS Client Configuration	138

NIS Commands	138
Common File Management	139
CHECKPOINT	140
REVIEW QUESTIONS	140
REVIEW ANSWERS	142

III **Configuring Linux Clients and Servers** 145

6 **Basic Client Configuration** 147

Objective 6.01 Set Up Environment Variables	148
Objective 6.02 Configure Mounted Directories	149
Editing /etc/fstab	150
Configuring Local Mounts in /etc/fstab	153
Configuring Network Mounts in /etc/fstab	154
/etc/mtab	155
Objective 6.03 Work Client Network Settings	155
Network Client Commands	155
Network Client Configuration Files	157
Objective 6.04 Manage a Network Card	158
Running ifconfig	158
Associated Configuration Files	159
Dynamic IP Configuration	161
Objective 6.05 Implement Name Resolution	161
/etc/hosts	162
Name Resolution Order	162
Remote DNS Services	163
Testing DNS Databases	163
Objective 6.06 Work with Log Files	165
As Defined in /etc/syslog.conf	165
Logs in the /var/log Directory	167
Log Rotation	168
Set Up Remote Logging	169
Objective 6.07 Use Makefiles	169
Compiling Drivers and Other Packages	170
Compiling a Kernel	170
Objective 6.08 Configure the X Window System	171
The X Window Server, Old and New	171

	Different Meanings for Client and Server	172
	X Window Configuration Tools	172
	The X Window Configuration File	174
	X Window Management	174
	Configuring the X Window System from the Command Line ...	174
	CHECKPOINT	175
	REVIEW QUESTIONS	176
	REVIEW ANSWERS	178
7	Basic Server Configuration	181
	Objective 7.01 Implement Basic Routing and Subnetting	182
	Managing Routing Tables	182
	IP Forwarding	183
	IP Masquerading	184
	Objective 7.02 Configure Basic Network Server Services	186
	Domain Name Service	186
	Forwarding DNS Server	187
	Caching-only DNS Server	187
	Slave Name Server	188
	Master DNS Server	189
	DNS Data Files	189
	Dynamic Host Configuration Protocol	190
	Squid	191
	Objective 7.03 Configure Samba	192
	The Basic Configuration File	193
	Stanzas and Directives	194
	Samba Configuration Commands	195
	Objective 7.04 Configure Apache	197
	The Structure of Apache Directories	197
	Associated Configuration Files	198
	Global Environment	199
	Main Server Configuration	200
	Virtual Hosts	200
	Control Through .htaccess	201
	Apache Command Controls	201
	Objective 7.05 Set Up Linux Print Services	202
	The Line Printer, Next Generation Service	202
	The Common Unix Printing System	203
	CUPS Configuration Files	204

- The cupsd.conf Configuration File 204
- CUPS Service Control Commands 206
- Sharing Printers with Samba 206
- Objective 7.06 Apply Basic Printer Permissions** 208
 - Limiting Access by Address 208
 - Limiting Access by User 208
- CHECKPOINT** 209
- REVIEW QUESTIONS 210
- REVIEW ANSWERS 212

IV Securing Accounts and Services 215

8 Security and Users 217

- Objective 8.01 Manage User Accounts** 218
 - Deactivating Accounts 218
 - Deleting Accounts While Keeping the Data 220
 - Deactivating Regular Accounts 221
 - Changing Groups 221
- Objective 8.02 Control Administrative Accounts** 222
 - Regular and Administrative Accounts 223
 - Temporary Administrative Access with su 223
 - Administrative Privileges with sudo 224
- Objective 8.03 Set Up Security Environment Files** 225
 - Users as Administrators in /etc/sudoers 225
 - Secure Shell Limits 226
 - Pluggable Authentication Module User Limits 228
 - FTP Access with ftpusers 230
 - Server Limits with /etc/hosts.allow and /etc/hosts.deny 231
- Objective 8.04 Work with Special File Permissions** 232
 - Identifying Files with Specialized Permissions 233
 - Preventing Specialized Permissions 233
 - Immutability Protects Files 234
 - Special Group Directories 235
- Objective 8.05 Configure Password Policies** 236
 - The Shadow Password Suite 236
 - Password Aging 237

Account Aging	237
PAM and Password Complexity	238
Objective 8.06 Promote User-level Security	239
Login Limits	239
Memory Usage and Process Limits with ulimit	241
CHECKPOINT	242
REVIEW QUESTIONS	243
REVIEW ANSWERS	245
9 System Security	247
Objective 9.01 Configure Encryption	248
Shadow Passwords	249
Password Strength	250
Disk Encryption	250
Other Encryption Schemes	250
Objective 9.02 Detect Intrusion Attempts	252
Logging Logins	252
Other Log Files	253
The w and who Commands	253
Checking Up on Users with last and utmpdump	254
Objective 9.03 Understand Intrusion Detection Systems	255
Snort	256
PortSentry	256
Command-line Monitoring	257
Objective 9.04 Decipher Basic Firewall Configurations	258
Common Ports	259
Configuring iptables	260
Objective 9.05 Audit Key Security Files	264
Security-related /etc/ Configuration Files	264
The Internet Super Server	264
Security Logs	266
Other Security Configuration Issues	266
Objective 9.06 Identify File Corruption	267
Verifying with rpm	267
Running Tripwire	268
Checking Download Integrity	268
CHECKPOINT	269

REVIEW QUESTIONS	270
REVIEW ANSWERS	271

V An Overview of Linux Documentation 273

10 Documentation and Configuration 275

Objective 10.01 Document a System Performance Baseline ... 276

Display Linux Performance with top	276
System Activity Reports with sar	277
Memory Statistics with vmstat	278
Review the Process Tree with pstree	278

Objective 10.02 Create Installation, Configuration, and Security

Management Procedures	280
Document the Installation Configuration	280
Back Up Configuration Files	280
Set Up Security Procedures	281

Objective 10.03 Document the Installed Configuration 281

Find the Package List	281
Document Compiled Package Options	284
Documented Hardware	284
Set Up Consistent Networking	285
Create Maintenance Procedures	285
When to Update the Kernel	285

Objective 10.04 Troubleshoot System and Application Errors with Logs 286

Monitoring Logs with head and tail	286
Searching Through Logs with grep	286

Objective 10.05 Access System Documentation 287

Command Manuals	287
Package Documentation	288
Online Documentation	289
Licensing	289

CHECKPOINT 290

REVIEW QUESTIONS	290
REVIEW ANSWERS	292

VI	Hardware Issues	295
11	Hardware on Linux	297
	Objective 11.01 Describe Common Hardware Components	298
	Connectors	298
	Basic Hardware Channels	299
	Interrupt Requests	299
	Input/Output Addresses	299
	Serial and COM Ports	300
	Parallel (LPT) Ports	300
	ISA Cards	300
	PCI Cards	301
	Graphics Cards	302
	Module Management	302
	Ismod	302
	insmod, rmmod, and modprobe	303
	Hardware Compatibility Lists	303
	Objective 11.02 Diagnose Hardware Issues	304
	Hardware Detected in /proc	304
	Using Disk Utilities	304
	Using a Live CD as a Rescue Disk	305
	Network Hardware	306
	Hardware Detection Commands	307
	Reviewing Device Files	307
	Reviewing dmesg Output	308
	Kernel Hardware Boot Parameters	309
	Objective 11.03 Understand Hardware Power Management ..	310
	Working with Advanced Power Management	310
	Managing the Advanced Configuration and Power Interface ...	311
	Objective 11.04 Identify and Configure Removable	
	System Hardware	311
	PC Cards	312
	USB Devices	312
	IEEE 1394 Devices	312
	Objective 11.05 Identify and Configure Mass	
	Storage Devices	313
	Hard Drives	313
	Traditional Internal PC Drives	313

SATA Drives	314
SCSI Drives	315
External Hard Drives	315
Floppy Drives	315
Tape Drives	315
Flash Memory Devices	316
CD/DVD Drives	316
CHECKPOINT	316
REVIEW QUESTIONS	317
REVIEW ANSWERS	319

VII **Appendixes** **321**

A **About the CD-ROM** **323**

Mike Meyers' Certification Passport CD-ROM Instructions	323
System Requirements	323
Installing and Running Wine	323
Installing and Running MasterExam	324
MasterExam	327
Help	328
Removing an Installation	328
LearnKey Technical Support	328
Content Support	328

B **Career Flight Path** **329**

Red Hat Certifications	329
Red Hat Certified Technician (RHCT)	329
Red Hat Certified Engineer (RHCE)	330
Red Hat Certified Security Specialist (RHCSS)	330
Red Hat Certified Datacenter Specialist (RHCDS)	330
Red Hat Certified Architect (RHCA)	331
Novell/SUSE Certifications	331
Novell Certified Linux Professional (CLP)	332
Novell Certified Linux Engineer (CLE)	332
Linux Professional Institute (LPI)	332
LPI Level 1	333
LPI Level 2	333
LPI Level 3	333

C	Installing CentOS-5, Step by Step	335
	Download CentOS-5	335
	Install CentOS-5	336
D	Testing Linux with VMware	343
	Acquiring VMware Server	344
	Installing VMware Server on Microsoft Windows	345
	Installing VMware Server on Ubuntu Dapper Drake	346
	Preparing VMware for Linux Installation	348
	VMware Snapshots	352
	Glossary	353
	Index	377