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LPI and CompTIA Certification

This book is used as the adopted text in many college classes. Because students who take these classes often seek LPI or CompTIA certification, instructors have asked for a mapping of certification objectives to the material covered in this book. This book fully covers LPI's Linux Essentials certification learning goals and provides extensive coverage of CompTIA's Linux+ exam objectives. This appendix maps these learning goals and exam objectives to pages in this book. The following icons are used throughout the book to mark the places where learning goals and exam objectives are discussed.

LPI This icon indicates coverage of a topic in the CompTIA's Linux+ exam objectives.

_LE_ This icon indicates coverage of a topic in the LPI's Linux Essentials certification learning goals.

_LE+_ This icon indicates coverage of a topic in the CompTIA's Linux+ exam objectives and a topic in the LPI's Linux Essentials certification learning goals.

More Information

LPI Linux Essentials: www.lpi.org/linux-certifications/introductory-programs/linux-essentials
LPI Certification Exams: www.lpi.org/linux-certifications/programs/lpic-1
CompTIA Exams: certification.comptia.org/getCertified/certifications/linux.aspx
CompTIA and LPI partnership: www.lpi.org/linux-certifications/partnership-programs/comptia

Linux Essentials

Topic 1: The Linux Community and a Career in Open Source

1.1 Linux Evolution and Popular Operating Systems

Description: Knowledge of Linux development and major distributions

Key Knowledge Areas
Open Source Philosophy
‣ Open-Source Software and Licensing page 6

Distributions
‣ Distribution page 6

Embedded Systems
‣ Embedded and mobile Linux page 6

Partial List of Used Files, Terms, and Utilities
Android
‣ Embedded and mobile Linux page 6

Debian
‣ Distribution page 6

CentOS

1.2 Major Open Source Applications

Description: Awareness of major applications and their uses

Key Knowledge Areas
Desktop Applications
‣ Desktop Applications page 1173

Server Applications
‣ page 464
‣ Chapter 13: Printing with CUPS page 539
‣ Chapter 18: The OpenSSH Secure Communication Utilities page 713
‣ Chapter 20: FTP: Transferring Files Across a Network page 753
‣ Chapter 21: **postfix**: Setting Up Mail Servers, Clients, and More page 779
‣ Chapter 22: NIS and LDAP page 813
‣ Chapter 23: NFS: Sharing Directory Hierarchies page 843
‣ Chapter 24: Samba: Linux and Windows File and Printer Sharing page 869

Mobile Applications

Development Languages

Package Management Tools and repositories

Partial List of Used Files, Terms, and Utilities
OpenOffice.org, LibreOffice, Thunderbird, Firefox, Blender, Gimp, Audacity, ImageMagick

Apache, MySQL, PostgreSQL

NFS, Samba, OpenLDAP, **postfix**, DNS, DHCP

C, Perl, shell, Python, PHP

1.3 UNDERSTANDING OPEN SOURCE SOFTWARE AND LICENSING
DESCRIPTION: OPEN COMMUNITIES AND LICENSING OPEN SOURCE SOFTWARE FOR BUSINESS

Key Knowledge Areas
Licensing

Free Software Foundation (FSF), Open Source Initiative (OSI)

Partial List of Used Files, Terms, and Utilities
GPL, BSD, Creative Commons

▸ GPL page 5

▸ Creative Commons page 1242 (Glossary)

Free Software, Open Source Software, FOSS, FLOSS

▸ FOSS/FLOSS page 7

Open Source business models

▸ Making money page 7

1.4 ICT Skills and Working in Linux

Description: Basic Information and Communication Technology (ICT) skills and working in Linux

Key Knowledge Areas

Desktop Skills

▸ Chapter 4: Introduction to Ubuntu page 97

Getting to the Command Line

▸ Working from the Command Line page 125

▸ Chapter 7: The Linux Utilities page 223

Industry uses of Linux, Cloud Computing, and Virtualization

▸ Chapter 17: Setting Up Virtual Machines Locally and in the Cloud page 687

Partial List of Used Files, Terms, and Utilities

Using a browser, privacy concerns, configuration options, searching the Web, and saving content

▸ Firefox: support.mozilla.org/en-US/products/firefox

▸ Chrome: www.google.com/intl/en/chrome/browser/features.html

▸ Opera: www.opera.com

Terminal and Console

▸ Using a Virtual Console page 127

Password issues

▸ User Accounts: Changing Your Account Type and Password (GUI) page 118

▸ Password Security page 143

▸ passwd: Changing Your Password (CLI) page 144

▸ Passwords page 615

Privacy issues and tools

▸ Search the Web for **browser privacy**

▸ Mozilla: support.mozilla.org/en-US/kb/private-browsing-browse-web-without-saving-info

▸ lifehacker.com/the-best-browser-extensions-that-protect-your-privacy-479408034

Use of common open-source applications in presentations and projects

▸ Desktop Applications page 1173

Topic 2: Finding Your Way on a Linux System

2.1 Command Line Basics

Description: Basics of using the Linux command line

Key Knowledge Areas

Basic shell
  ▸ Working from the Command Line page 125
  ▸ Chapter 5: The Shell page 149

Formatting commands
  ▸ The Command Line page 152

Working with Options
  ▸ Options page 153

Variables
  ▸ Parameters and Variables page 358
  ▸ Variables page 1053

Globbing
  ▸ Filename Generation/Pathname Expansion page 173
  ▸ Pathname Expansion page 418

Quoting
  ▸ Special Characters page 150
  ▸ Quoting the $ page 360
  ▸ Quotation marks page 418

Partial List of Used Files, Terms, and Utilities

echo
  ▸ echo: Displays Arguments page 227
  ▸ **echo –e** page 1031

history
  ▸ History page 382

PATH env variable
  ▸ Set **PATH** in **.bash_profile** page 337
  ▸ **PATH**: Where the Shell Looks for Programs page 365

which
  ▸ which page 263

Nice to Know

Substitutions
  ▸ Command Substitution page 416

||, **&&**, and ; control operators
  ▸ Lists page 170
  ▸ ; and NEWLINE Separate Commands page 347
  ▸ && and || Boolean Control Operators page 349

2.2 USING THE COMMAND LINE TO GET HELP

DESCRIPTION: RUNNING HELP COMMANDS AND NAVIGATION OF THE VARIOUS HELP SYSTEMS

Key Knowledge Areas

man

▸ man: Displays the System Manual page 135

info

▸ info: Displays Information About Utilities page 137

Partial List of Used Files, Terms, and Utilities

man

▸ man: Displays the System Manual page 135

info

▸ info: Displays Information About Utilities page 137

man pages

▸ man: Displays the System Manual page 135

/usr/share/doc

▸ **/usr/share/doc** page 141

locate

▸ locate: Searches for a File page 264

Nice to Know

apropos, whatis, whereis

▸ apropos: Searches for a Keyword page 137

▸ whatis page 137

▸ whereis page 263

2.3 USING DIRECTORIES AND LISTING FILES

DESCRIPTION: NAVIGATION OF HOME AND SYSTEM DIRECTORIES AND LISTING FILES IN VARIOUS LOCATIONS

Key Knowledge Areas

Files, directories

▸ Ordinary Files and Directory Files page 185

Hidden files and directories

▸ Hidden Filenames page 188

Home

▸ Your Home Directory page 151

Absolute and relative paths

▸ Absolute Pathnames page 189

▸ Relative Pathnames page 190

Partial List of Used Files, Terms, and Utilities

Common options for ls

▸ Options page 229

Recursive listings
  ▶ Recursive page 230

cd
  ▶ cd: Changes to Another Working Directory page 193

. and ..
  ▶ The . and .. Directory Entries page 194

home and ~
  ▶ Your Home Directory page 151
  ▶ ~ (Tilde) in Pathnames page 190
  ▶ Tilde (~) page 365
  ▶ Tilde Expansion page 413

2.4 Creating, Moving, and Deleting Files

Description: Create, move, and delete files and directories under the home directory

Key Knowledge Areas

Files and directories
  ▶ Ordinary Files and Directory Files page 185

Case sensitivity
  ▶ Case sensitivity page 187

Simple globbing and quoting
  ▶ Filename Generation/Pathname Expansion page 173
  ▶ Pathname Expansion page 418
  ▶ Special Characters page 150
  ▶ Quoting the $ page 394
  ▶ Quotation marks page 452

Partial List of Used Files, Terms, and Utilities

mv, cp, rm, touch
  ▶ mv, cp: Move or Copy Files page 195
  ▶ mv: Moves a Directory page 196
  ▶ mv: Renames or Moves a File page 245
  ▶ cp: Copies Files page 232
  ▶ rm: Removes a Link page 216
  ▶ rm: Removes a File (Deletes a Link) page 231
  ▶ touch: Changes File Modification and Access Times page 251

mkdir, rmdir
  ▶ mkdir: Creates a Directory page 192
  ▶ rmdir: Deletes a Directory page 194

TOPIC 3: THE POWER OF THE COMMAND LINE

3.1 ARCHIVING FILES ON THE COMMAND LINE
DESCRIPTION: ARCHIVING FILES IN THE USER HOME DIRECTORY

Key Knowledge Areas

Files, directories
  ‣ Ordinary Files and Directory Files page 185

Archives, compression
  ‣ Compressing and Archiving Files page 253

Partial List of Used Files, Terms, and Utilities

tar
  ‣ tar: Stores or Extracts Files to/from an Archive File page 257
  ‣ tar: Archives Files page 569

Common tar options
  ‣ Options page 257
  ‣ Modifiers page 259

gzip, bzip2
  ‣ xz, bzip2, and gzip: Compress and Decompress Files page 253

zip, unzip
  ‣ zip page 257
  ‣ unzip page 257

Nice to Know

Extracting individual files from archives
  ‣ Extract page 258

3.2 SEARCHING AND EXTRACTING DATA FROM FILES
DESCRIPTION: SEARCH AND EXTRACT DATA FROM FILES IN THE HOME DIRECTORY

Key Knowledge Areas

Command line pipes
  ‣ Pipelines page 166

I/O redirection
  ‣ Redirection page 161

Partial POSIX Regular Expressions (**.**, **[ ]**, *****, **?**)
  ‣ Appendix A: Regular Expressions page 1161

Partial List of Used Files, Terms, and Utilities

find
  ‣ find: Finds Files Based on Criteria page 237

grep
  ‣ grep: Searches for a Pattern in Files page 240

less
  ‣ less Is more: Display a Text File One Screen at a Time page 228

head, tail
  ‣ head: Displays the Beginning of a File page 243

▸ tail: Displays the Last Part of a File page 249

sort

  ▸ sort: Sorts and/or Merges Files page 247

cut

  ▸ cut: Selects Characters or Fields from Input Lines page 233

wc

  ▸ wc: Displays the Number of Lines, Words, and Bytes in Files page 252

Nice to Know

Partial POSIX Basic Regular Expressions ([^], ^, $)

  ▸ Appendix A: Regular Expressions page 1161

Partial POSIX Extended Regular Expressions (+, ( ), |)

  ▸ Appendix A: Regular Expressions page 1161

xargs

  ▸ xargs: Converts Standard Input to Command Lines page 268

3.3 TURNING COMMANDS INTO A SCRIPT

DESCRIPTION: TURNING REPETITIVE COMMANDS INTO SIMPLE SCRIPTS

Key Knowledge Areas

Basic text editing

  ▸ Tutorial: Using vim to Create and Edit a File page 270

  ▸ Tutorial: Using nano to Create and Edit a File page 277

Basic shell scripting

  ▸ Writing and Executing a Basic Shell Script page 134

Partial List of Used Files, Terms, and Utilities

/bin/sh

  ▸ sh Shell page 334

Variables

  ▸ Parameters and Variables page 358

  ▸ Variables page 1053

Arguments

  ▸ Arguments page 153

for loops

  ▸ **for...in** page 1017

  ▸ **for** page 1019

echo

  ▸ echo: Displays Arguments page 227

  ▸ **echo –e** page 1031

Exit status

  ▸ **$?**: Exit Status page 1051

Nice to Know

pico, nano, vi (only basics for creating scripts)

  ▸ Tutorial: Using vim to Create and Edit a File page 270

▸ Tutorial: Using nano to Create and Edit a File page 277
▸ pico, see Desktop Applications page 1173

bash
▸ Chapter 5: The Shell page 149
▸ Chapter 9: The Bourne Again Shell (bash) page 333
▸ Chapter 28: Programming the Bourne Again Shell (bash) page 1003

if, **while**, **case** statements
▸ **if...then** page 1005
▸ **if...then...else** page 1009
▸ **if...then...elif** page 1011
▸ **for...in** page 1017
▸ **for...in** page 1017

read and test, and [commands
▸ test builtin page 1005
▸ [ ] is a synonym for test page 1008
▸ test builtin page 1022
▸ read: Accepts User Input page 1063

Topic 4: The Linux Operating System

4.1 Choosing an Operating System

Description: Knowledge of major operating systems and Linux distributions

Key Knowledge Areas
Windows, Mac, Linux differences
▸ Choosing an Operating System page 19

Distribution life cycle management

Partial List of Used Files, Terms, and Utilities
GUI versus command line, desktop configuration
▸ Choosing an Operating System page 19

Maintenance cycles, Beta and Stable
▸ beta release page 1235 (Glossary)
▸ stable release page 1274 (Glossary)

4.2 Understanding Computer Hardware

Description: Familiarity with the components that go into building desktop and server computers

Key Knowledge Areas
Hardware
▸ Requirements page 30

Partial List of Used Files, Terms, and Utilities
Hard drives and partitions, motherboards, processors, power supplies, optical drives, peripherals
▸ Processor Architecture page 32
▸ Setting Up the Hard Disk page 38

▶ Peripheral, see device page 1244 (Glossary)
▶ motherboard page 1260 (Glossary)
▶ optical drive page 1263 (Glossary)
▶ power supply page 1266 (Glossary)

Display types
▶ Interfaces: Installer and Installed System page 33
▶ Working from the Command Line page 125
▶ ASCII terminal page 1233 (Glossary)
▶ graphical display page 1249 (Glossary)

Drivers
▶ Device files page 494
▶ Block and Character Devices page 496
▶ device driver page 1244 (Glossary)

4.3 Where Data Is Stored

Description: Where various types of information are stored on a Linux system

Key Knowledge Areas

Kernel
▶ Linux kernel page 2
▶ Linux Is More Than a Kernel page 6
▶ Linux Has a Kernel Programming Interface page 11
▶ kernel page 1255 (Glossary)

Processes
▶ Process page 158
▶ Processes page 379
▶ ps page 456
▶ process page 1266 (Glossary)

syslog, klog, dmesg
▶ rsyslogd: Logs System Messages page 585
▶ **klogd**: deprecated; www.linuxjournal.com/article/4058
▶ dmesg: Displays Kernel Messages page 454

/lib, **/usr/lib**, **/etc**, **/var/log**
▶ **/etc** page 198
▶ **/lib** page 198
▶ **/lib64** page 198
▶ **/usr/lib** page 198
▶ **/usr/x86_64-linux-gnu** page 199
▶ **/var/log** page 199
▶ **/etc** page 483
▶ **/var/log** page 492
▶ Log Files and Mail for **root** page 590

Partial List of Used Files, Terms, and Utilities

Programs, libraries, packages and package databases, system configuration

- ▸ **/etc** page 198
- ▸ **/usr/bin** page 198
- ▸ **/lib** page 198
- ▸ **/lib64** page 198
- ▸ **/usr/lib** page 198
- ▸ **/usr/sbin** page 199
- ▸ **/usr/x86_64-linux-gnu** page 199
- ▸ **/etc** page 483
- ▸ library page 1256 (Glossary)
- ▸ Software package page 510
- ▸ PMS page 510
- ▸ Software package formats page 510
- ▸ Repositories page 511

Processes and process tables, memory addresses, system messaging, and logging

- ▸ Process page 158
- ▸ Processes page 379
- ▸ dmesg: Displays Kernel Messages page 454
- ▸ ps page 456
- ▸ **rsyslogd**: Logs System Messages page 585
- ▸ process page 1266 (Glossary)

ps, top, free

- ▸ free: Displays Memory Usage Information page 261
- ▸ Process Identification page 380
- ▸ ps page 456
- ▸ top: Lists Processes Using the Most Resources page 577

4.4 YOUR COMPUTER ON THE NETWORK

DESCRIPTION: QUERYING VITAL NETWORKING SETTINGS AND DETERMINING THE BASIC REQUIREMENTS FOR A COMPUTER ON A LOCAL AREA NETWORK (LAN)

Key Knowledge Areas

Internet, network, routers

- ▸ Internet page 286
- ▸ Introduction to Networking page 286
- ▸ Internetworking Through Gateways and Routers page 293

Domain Name Service

- ▸ Chapter 25: DNS/BIND: Tracking Domain Names and Addresses page 891

Network configuration

- ▸ Chapter 16: Configuring and Monitoring a LAN page 661

Partial List of Used Files, Terms, and Utilities

route

- ▸ deprecated (route man page): see ip man page, **route** object instead

resolv.conf
   ‣ **/etc/resolv.conf** page 488
IPv4, IPv6
   ‣ IPv4 page 298
   ‣ IPv6 page 299
ifconfig
   ‣ deprecated: (ifconfig man page): see ip man page, **addr** and **link** objects instead
netstat
   ‣ netstat: see the netstat man page and wikipedia.org/wiki/netstat
ping
   ‣ ping: Tests a Network Connection page 311

Nice to Know
ssh
   ‣ ssh: Logs in or Executes Commands on a Remote System page 720
dig
   ‣ host and dig: Query Internet Nameservers page 313
   ‣ dig page 901
   ‣ dig page 902

TOPIC 5: SECURITY AND FILE PERMISSIONS
5.1 BASIC SECURITY AND IDENTIFYING USER TYPES
DESCRIPTION: VARIOUS TYPES OF USERS ON A LINUX SYSTEM

Key Knowledge Areas
Root and Standard Users
   ‣ Running Commands with **root** Privileges page 596
   ‣ The Special Powers of a User Working with **root** Privileges page 596
   ‣ Gaining **root** Privileges page 597
   ‣ Real UID Versus Effective UID page 599
System users
   ‣ **/etc/passwd** page 486

Partial List of Used Files, Terms, and Utilities
/etc/passwd, **/etc/group**
   ‣ **/etc/group** page 484
   ‣ **/etc/passwd** page 486
id, who, w
   ‣ w: Lists Users on the System page 262
   ‣ who: Lists Users on the System page 262
   ‣ who, whoami page 600
   ‣ id page 601
sudo
   ‣ Using sudo to Gain **root** Privileges page 602

Nice to Know

su

▸ Using su to Gain **root** Privileges page 600

5.2 CREATING USERS AND GROUPS

DESCRIPTION: CREATING USERS AND GROUPS ON A LINUX SYSTEM

Key Knowledge Areas

User and group commands

▸ useradd: Adds a User Account page 566

▸ userdel: Removes a User Account page 566

▸ groupadd: Adds a Group page 567

▸ groupdel and groupmod: Remove and Modify a Group page 567

▸ usermod: Modifies a User Account page 567

User IDs

▸ /etc/passwd page 486

▸ Real UID Versus Effective UID page 599

▸ user ID page 1279 (Glossary)

Partial List of Used Files, Terms, and Utilities
/etc/passwd, **/etc/shadow**, **/etc/group**

▸ **/etc/group** page 484

▸ **/etc/passwd** page 486

▸ **/etc/shadow** page 489

id, last

▸ id page 601

▸ last: see the last man page

useradd, groupadd

▸ useradd: Adds a User Account page 566

▸ groupadd: Adds a Group page 567

passwd

▸ User Accounts: Changing Your Account Type and Password (GUI) page 118

▸ passwd: Changing Your Password (CLI) page 144

Nice to Know

usermod, userdel

▸ userdel: Removes a User Account page 566

▸ usermod: Modifies a User Account page 567

groupmod, groupdel

▸ groupdel and groupmod: Remove and Modify a Group page 567

5.3 MANAGING FILE PERMISSIONS AND OWNERSHIP

DESCRIPTION: UNDERSTANDING AND MANIPULATING FILE PERMISSIONS AND OWNERSHIP SETTINGS

Key Knowledge Areas

File/directory permissions and owners

▸ Access Permissions page 199

Partial List of Used Files, Terms, and Utilities
ls –l
> ▸ **ls –l**: Displays Permissions page 199

chmod, chown
> ▸ chmod: Changes File Access Permissions page 201
> ▸ chown: Changes File Ownership page 203
> ▸ chmod: Makes a File Executable page 343

Nice to Know
chgrp
> ▸ chgrp: Changes File Group Association page 203

5.4 Special Directories and Files
Description: Special directories and files on a Linux system including special permissions

Key Knowledge Areas
System files, libraries
> ▸ Important Standard Directories and Files page 197
> ▸ library page 1256 (Glossary)

Symbolic links
> ▸ Symbolic Links page 214
> ▸ Symbolic links page 494
> ▸ symbolic link page 1276 (Glossary)

Partial List of Used Files, Terms, and Utilities
/etc, **/var**
> ▸ **/etc** page 198
> ▸ **/etc** page 483
> ▸ **/var** page 43
> ▸ **/var** page 199

/tmp, **/var/tmp** and Sticky Bit
> ▸ **/tmp** page 198
> ▸ **/var** page 199
> ▸ Sticky bit page 204
> ▸ sticky bit page 1275 (Glossary)

ls –d
> ▸ Directory page 229

ln –s
> ▸ Size page 230

Nice to Know
Hard links
> ▸ Hard Links page 212

Setuid/Setgid
> ▸ Setuid and Setgid Permissions page 204
> ▸ Setuid file page 598
> ▸ Setuid files page 614
> ▸ setuid page 1271 (Glossary)
> ▸ setgid page 1271 (Glossary)

CERTIFICATION EXAM 1 OBJECTIVES: LX0-101

101 SYSTEM ARCHITECTURE

101.1 DETERMINE AND CONFIGURE HARDWARE SETTINGS

Enable and disable integrated peripherals

Configure systems with or without external peripherals such as keyboards

Differentiate between the various types of mass storage devices
> ▸ **/dev** page 481

Set the correct hardware ID for different devices, especially the boot device

Know the differences between coldplug and hotplug devices
> ▸ Hotplug page 495

Determine hardware resources for devices

Tools and utilities to list various hardware information (e.g., lsusb, lspci, etc.)
> ▸ dmesg: Displays Kernel Messages page 454
> ▸ lspci: Lists PCI Information page 664
> ▸ lsblk: Lists Block Device Information page 665
> ▸ lshw: Lists Hardware Information page 665
> ▸ lsusb: Lists USB Devices page 666

Tools and utilities to manipulate USB devices
> ▸ Writing to a USB Flash Drive page 52

Conceptual understanding of sysfs, udev, hald, dbus
> ▸ udev page 494

Partial List of Used Files, Terms, and Utilities
/sys
> ▸ **/sys** page 198
> ▸ **/sys** page 492
> ▸ **/sys** page 495

/proc
> ▸ **/proc** page 198
> ▸ **/proc** page 490
> ▸ **proc** page 498

/dev
> ▸ Device file page 160
> ▸ **/dev** page 197
> ▸ **/dev** page 481
> ▸ Device files page 494

modprobe
> ▸ modprobe page 444

lsmod
- ▶ lsmod page 444

lspci
- ▶ lspci: Lists PCI Information page 664

lsusb
- ▶ lsusb: Lists USB Devices page 666

101.2 BOOT THE SYSTEM
Provide common commands to the boot loader and options to the kernel at boot time
- ▶ Modifying Boot Parameters (Options) page 75
- ▶ GRUB: The Linux Boot Loader page 444

Demonstrate knowledge of the boot sequence from BIOS to boot completion
- ▶ BIOS setup page 32
- ▶ CMOS page 32
- ▶ Booting the System page 438
- ▶ GRUB: The Linux Boot Loader page 444
- ▶ BIOS page 445
- ▶ BIOS page 1235 (Glossary)

Check boot events in the log file
- ▶ dmesg: Displays Kernel Messages page 454

Partial List of Used Files, Terms, and Utilities
/var/log/messages
- ▶ **/var/log/messages** page 492
- ▶ **/var/log/syslog** page 587
- ▶ Log Files and Mail for **root** page 590
- ▶ Truncating log files page 591

dmesg
- ▶ dmesg: Displays Kernel Messages page 454

BIOS
- ▶ BIOS setup page 32
- ▶ BIOS page 445
- ▶ BIOS page 1235 (Glossary)

boot loader
- ▶ GRUB: The Linux Boot Loader page 444

kernel
- ▶ Linux kernel page 2
- ▶ Linux Is More Than a Kernel page 6
- ▶ Linux Has a Kernel Programming Interface page 11
- ▶ kernel page 1255 (Glossary)

init
- ▶ **init** daemon page 380
- ▶ The Upstart Event-Based **init** Daemon page 427
- ▶ SysVinit (**rc**) Scripts: Start and Stop System Services page 435
- ▶ Upstart **init** daemon page 439

101.3 CHANGE RUNLEVELS AND SHUTDOWN OR REBOOT SYSTEM

Set the default runlevel

Change between runlevels including single-user mode

Shutdown and reboot from the command line

Alert users before switching runlevels or other major system events

Properly terminate processes

Partial List of Used Files, Terms, and Utilities
/etc/inittab

shutdown

init

/etc/init.d

telinit

102 LINUX INSTALLATION AND PACKAGE MANAGEMENT

102.1 DESIGN HARD DISK LAYOUT

Allocate filesystems and swap space to separate partitions or disks

Tailor the design to the intended use of the system

Ensure the **/boot** partition conforms to the hardware architecture requirements for booting

Partial List of Used Files, Terms, and Utilities

/ (root) filesystem
- ▶ / (root) page 42
- ▶ / (root) page 189
- ▶ / page 197
- ▶ root filesystem page 1270 (Glossary)

/var filesystem
- ▶ **/var** page 43
- ▶ **/var** page 199

/home filesystem
- ▶ **/home** page 44
- ▶ **/home** page 198

swap space
- ▶ (swap) page 42
- ▶ swap page 491
- ▶ swap space page 1276 (Glossary)

mount points
- ▶ Mount Points page 40
- ▶ Mount point page 499

partitions
- ▶ Partitions page 38
- ▶ Partition table page 38
- ▶ Primary, Extended, and Logical Partitions page 39
- ▶ Guided Partitioning page 41
- ▶ Guided partitioning page 65
- ▶ The ubiquity Advanced Partitioning Screen page 67
- ▶ Manual Partitioning Using the Textual Partition Editor page 82
- ▶ gnome-disks: The GNOME Disk Utility page 88
- ▶ Example minimum partition sizes page 44
- ▶ partition page 1264 (Glossary)

102.2 INSTALL A BOOT MANAGER

Providing alternative boot locations and backup boot options

Install and configure a boot loader such as GRUB
- ▶ GRUB: The Linux Boot Loader page 444

Interact with the boot loader
- ▶ Booting the System to Recovery (Single-User) Mode page 451

Partial List of Used Files, Terms, and Utilities
/boot/grub/menu.lst
- ▶ Configuring GRUB page 445

grub-install
- ▶ grub-install: Installs the MBR and GRUB Files page 450

MBR
  ‣ Reinstalling the MBR page 450
  ‣ MBR page 445
  ‣ grub-install: Installs the MBR and GRUB Files page 450
superblock
  ‣ superblock page 1275 (Glossary)
/etc/lilo.conf
lilo deprecated

102.3 MANAGE SHARED LIBRARIES
Identify shared libraries
  ‣ ldd page 618
Identify the typical locations of system libraries
Load shared libraries

Partial List of Used Files, Terms, and Utilities
ldd
  ‣ ldd & **libwrap** page 616
  ‣ ldd page 618
ldconfig
/etc/ld.so.conf
LD_LIBRARY_PATH

102.4 USE DEBIAN PACKAGE MANAGEMENT
Install, upgrade, and uninstall Debian binary packages
  ‣ JumpStart: Installing and Removing Software Packages Using apt-get page 512
Find packages containing specific files or libraries which may or may not be installed
  ‣ Finding the Package That Holds an Application or File You Need page 514

Obtain package information like version, content, dependencies, package integrity, and installation status (whether or not the package is installed)
  ‣ apt-cache: Displays Package Information page 522
  ‣ **dpkg ––list**: Displays Information About a Package page 526
Partial List of Used Files, Terms, and Utilities
/etc/apt/sources.list
  ‣ **sources.list**: Specifies Repositories for APT to Search page 516
dpkg
  ‣ dpkg: The Debian Package Management System page 524
dpkg-reconfigure
  ‣ dpkg-reconfigure: Reconfigures **postfix** page 796
apt-get
  ‣ JumpStart: Installing and Removing Software Packages Using apt-get page 512
  ‣ apt-get: Works with Packages and the Local Package Index page 519
  ‣ apt-get source: Downloads Source Files page 523

apt-cache
  ▶ apt-cache: Displays Package Information page 522

aptitude

102.5 USE RPM AND YUM PACKAGE MANAGEMENT
See Chapter 12: Finding, Downloading, and Installing Software page 509

Install, re-install, upgrade, and remove packages using RPM and YUM
  ▶ Installing and Removing Software Packages Using yum page 1178
  ▶ Working with yum page 1179

Obtain information on RPM packages such as version, status, dependencies, integrity, and signatures
  ▶ Working with yum page 1179

Determine what files a package provides, as well as find which package a specific file comes from
  ▶ Finding the Package That Holds a File You Need page 1179

Partial List of Used Files, Terms, and Utilities

rpm
  ▶ RPM page 1178

rpm2cpio

/etc/yum.conf
  ▶ **yum.conf**: Configures yum page 1182

/etc/yum.repos.d/
  ▶ yum Repositories page 1182

yum
  ▶ Installing and Removing Software Packages Using yum page 1178
  ▶ Working with yum page 1179
  ▶ Finding the Package That Holds a File You Need page 1179
  ▶ Updating Packages page 1180
  ▶ yum Commands page 1181
  ▶ **yum.conf**: Configures yum page 1182
  ▶ yum Repositories page 1182

yumdownloader

103 GNU AND UNIX COMMANDS
103.1 WORK ON THE COMMAND LINE
See Chapter 5: The Shell page 149

See Chapter 9: The Bourne Again Shell (bash) page 333

See Chapter 7: The Linux Utilities page 223

See Chapter 28: Programming the Bourne Again Shell (bash) page 1003

Use single shell commands and one line command sequences to perform basic tasks on the command line
  ▶ Chapter 5: The Shell page 149
  ▶ Chapter 7: The Linux Utilities page 223
  ▶ Chapter 9: The Bourne Again Shell (bash) page 333

Use and modify the shell environment including defining, referencing, and exporting environment variables
▸ Parameters and Variables page 358
▸ Variables page 1053

Use and edit command history
▸ History page 382

Invoke commands inside and outside the defined path
▸ Absolute versus relative pathnames page 157
▸ **PATH**: Where the Shell Looks for Programs page 365

Partial List of Used Files, Terms, and Utilities

. (dot)
▸ **.** (Dot) or source: Runs a Startup File in the Current Shell page 338
▸ exec versus **.** (dot) page 1067

bash
▸ Chapter 5: The Shell page 149
▸ Chapter 9: The Bourne Again Shell (bash) page 333
▸ Chapter 28: Programming the Bourne Again Shell (bash) page 1003

echo
▸ echo: Displays Arguments page 227
▸ **echo –e** page 1031

env
▸ env: Runs a Program in a Modified Environment page 1057

exec
▸ Opening a File Descriptor page 1039
▸ Duplicating a File Descriptor page 1039
▸ exec: Executes a Command or Redirects File Descriptors page 1067

export
▸ declare: Lists and Assigns Attributes to Variables page 363
▸ readonly and export page 363
▸ export: Puts Variables in the Environment page 1054

pwd
▸ pwd page 151

set
▸ **set ±o**: Turns Shell Features On and Off page 406
▸ set: Initializes Positional Parameters page 1046

unset
▸ unset: Removes a Variable page 362

man
▸ man: Displays the System Manual page 135

uname
▸ uname: Displays System Information page 460

103.2 PROCESS TEXT STREAMS USING FILTERS

Send text files and output streams through text utility filters to modify the output using standard UNIX commands found in the GNU **textutils** package

Partial List of Used Files, Terms, and Utilities

103.3 PERFORM BASIC FILE MANAGEMENT

Copy, move, and remove files and directories individually

Partial List of Used Files, Terms, and Utilities

tar
> ▸ tar: Stores or Extracts Files to/from an Archive File page 257
> ▸ tar: Archives Files page 569

cpio
> ▸ cpio: Archives Files page 571

dd

file
> ▸ file: Displays the Classification of a File page 237

gzip
> ▸ xz, bzip2, and gzip: Compress and Decompress Files page 253

gunzip
> ▸ unxz bunzip2 gunzip page 256

bzip2
> ▸ xz, bzip2, and gzip: Compress and Decompress Files page 253

file globbing
> ▸ Filename Generation/Pathname Expansion page 173
> ▸ Pathname Expansion page 418

103.4 USE STREAMS, PIPES, AND REDIRECTS

Redirecting standard input, standard output, and standard error
> ▸ Redirecting Standard Output page 162
> ▸ Redirecting Standard Input page 163
> ▸ Redirecting Standard Error page 339
> ▸ redirection page 1268 (Glossary)
> ▸ standard error page 1274 (Glossary)
> ▸ standard input page 1274 (Glossary)
> ▸ standard output page 1274 (Glossary)

Pipe the output of one command to the input of another command
> ▸ Pipelines page 166
> ▸ Filters page 169
> ▸ filter page 1248 (Glossary)
> ▸ pipeline page 1265 (Glossary)

Use the output of one command as arguments to another command
> ▸ xargs: Converts Standard Input to Command Lines page 268

Send output to both stdout and a file
> ▸ tee page 170

Partial List of Used Files, Terms, and Utilities

tee
> ▸ tee page 170

xargs
> ▸ xargs: Converts Standard Input to Command Lines page 268

103.5 Create, Monitor, and Kill Processes

Run jobs in the foreground and background
- ‣ Running a Command in the Background page 171
- ‣ Moving a Job from the Foreground to the Background page 172
- ‣ Background process page 381
- ‣ background process page 1235 (Glossary)
- ‣ foreground process page 1248 (Glossary)

Signal a program to continue running after logout

Monitor active processes
- ‣ Process Identification page 380
- ‣ ps page 380
- ‣ ps page 456

Select and sort processes for display
- ‣ Process Identification page 380
- ‣ ps page 456
- ‣ top: Lists Processes Using the Most Resources page 577

Send signals to processes
- ‣ Aborting Execution page 130
- ‣ kill: Aborting a Background Job page 172
- ‣ kill: Sends a Signal to a Process page 455
- ‣ killall: Kills a Command page 457
- ‣ pkill: Kills a Command page 458
- ‣ Signals page 1069

Partial List of Used Files, Terms, and Utilities
&
- ‣ Running a Command in the Background page 171
- ‣ Background process page 381
- ‣ background process page 1235 (Glossary)
- ‣ foreground process page 1248 (Glossary)

bg
- ‣ Moving a Job from the Foreground to the Background page 172
- ‣ bg: Sends a Job to the Background page 354
- ‣ background process page 1235 (Glossary)

fg
- ‣ Foreground page 171
- ‣ Moving a Job from the Foreground to the Background page 172
- ‣ fg: Brings a Job to the Foreground page 353
- ‣ foreground process page 1248 (Glossary)

jobs
- ‣ Determining the number of a job using jobs page 172
- ‣ jobs: Lists Jobs page 352

kill
- ‣ kill: Aborting a Background Job page 172
- ‣ kill: Sends a Signal to a Process page 455

nohup
ps
> ▸ Process Identification page 380
> ▸ ps page 456

top
> ▸ top: Lists Processes Using the Most Resources page 577

free
> ▸ free: Displays Memory Usage Information page 261

uptime
> ▸ uptime: Displays System Load and Duration Information page 261

killall
> ▸ killall: Kills a Command page 457

103.6 MODIFY PROCESS EXECUTION PRIORITIES

Know the default priority of a job that is created
> ▸ Process Identification page 380
> ▸ ps page 456
> ▸ top: Lists Processes Using the Most Resources page 577

Run a program with higher or lower priority than the default

Change the priority of a running process

Partial List of Used Files, Terms, and Utilities

nice
ps
> ▸ Process Identification page 380
> ▸ ps page 456

renice
top
> ▸ top: Lists Processes Using the Most Resources page 577

103.7 SEARCH TEXT FILES USING REGULAR EXPRESSIONS

See Appendix A: Regular Expressions page 1161

Create simple regular expressions containing several notational elements
> ▸ Appendix A: Regular Expressions page 1161
> ▸ Regular Expressions page 1123 (Python)

Use regular expression tools to perform searches through a filesystem or file content
> ▸ *See preceding entry.*

Partial List of Used Files, Terms, and Utilities

grep
> ▸ grep: Searches for a Pattern in Files page 240

egrep
> ▸ Extended regular expression page 241

fgrep
sed
> ▸ **regex**(7)

103.8 PERFORM BASIC FILE EDITING OPERATIONS USING VI

A Practical Guide to Ubuntu Linux, Fourth Edition covers the vim *editor. All commands discussed here are compatible between* vi *and* vim.

Tutorial: Using vim to Create and Edit a File page 270

Navigate a document using vi
  ▸ Moving the Cursor page 274

Use basic vi modes
  ▸ Command and Input Modes page 272

Insert, edit, delete, copy, and find text
  ▸ Entering Text page 273
  ▸ Deleting Text page 275
  ▸ Correcting Text page 276

Partial List of Used Files, Terms, and Utilities

vi
  ▸ Tutorial: Using vim to Create and Edit a File page 270

/, **?**

h, **j**, **k**, **l**
  ▸ Moving the Cursor page 274

i, **o**, **a**
  ▸ Entering Text page 273
  ▸ Entering Additional Text page 276

c, **d**, **p**, **y**, **dd**, **yy**
  ▸ Deleting Text page 275

ZZ, **:w!**, **:q!**, **:e!**
  ▸ Ending the Editing Session page 276

104 DEVICES, LINUX FILESYSTEMS, FILESYSTEM HIERARCHY STANDARD

104.1 CREATE PARTITIONS AND FILESYSTEMS

Use various mkfs commands to set up partitions and create various filesystems such as:

ext2
  ▸ **ext2** page 497
  ▸ **ext2** to **ext3** page 505

ext3
  ▸ **ext3** page 497
  ▸ **ext3** to **ext2** page 505

xfs
  ▸ The XFS Filesystem page 506

reiserfs v3
  ▸ **reiserfs** page 498

vfat
  ▸ **vfat** page 498

Partial List of Used Files, Terms, and Utilities

fdisk

  ▶ fdisk: see the fdisk man page
  ▶ See also parted: Reports on and Partitions a Hard Disk page 579

mkfs

  ▶ mkfs: Creates a Filesystem page 457

mkswap

  ▶ **swap** page 491

104.2 MAINTAIN THE INTEGRITY OF FILESYSTEMS

Verify the integrity of filesystems

  ▶ fsck: Checks Filesystem Integrity page 503

Monitor free space and inodes

  ▶ df: shows where directory hierarchies are mounted page 846

Repair simple filesystem problems

  ▶ fsck: Checks Filesystem Integrity page 503

Partial List of Used Files, Terms, and Utilities

du

  ▶ du: Displays Disk Usage Information page 501

df

  ▶ df: shows where directory hierarchies are mounted page 846

fsck

  ▶ fsck: Checks Filesystem Integrity page 503

e2fsck

mke2fs

debugfs

dumpe2fs

tune2fs

  ▶ tune2fs: Changes Filesystem Parameters page 504

xfs tools (such as xfs_metadump and xfs_info)

104.3 CONTROL MOUNTING AND UNMOUNTING OF FILESYSTEMS

Manually mount and unmount filesystems

  ▶ mount: Mounts a Filesystem page 499
  ▶ umount: Unmounts a Filesystem page 501
  ▶ mount: Mounts a Directory Hierarchy page 849
  ▶ Mounting Shares page 876

Configure filesystem mounting on bootup

  ▶ **fstab**: Keeps Track of Filesystems page 502
  ▶ **fstab** file page 849
  ▶ **/etc/fstab**: Mounts Directory Hierarchies Automatically page 853

Configure user mountable removable filesystems
▸ Mount Options page 500

Partial List of Used Files, Terms, and Utilities
/etc/fstab
▸ **fstab**: Keeps Track of Filesystems page 502
▸ **fstab** file page 849
▸ **/etc/fstab**: Mounts Directory Hierarchies Automatically page 853

/media
mount
▸ mount: Mounts a Filesystem page 499
▸ mount: Mounts a Directory Hierarchy page 849
▸ Mounting Shares page 876

umount
▸ umount: Unmounts a Filesystem page 501

104.4 Manage Disk Quotas

Set up a disk quota for a filesystem
▸ Disk Quota System page 592

Edit, check and generate user quota reports
▸ quota and repquota page 593

Partial List of Used Files, Terms, and Utilities
quota
▸ quota and repquota page 593

edquota
▸ edquota and quotaon page 593

repquota
▸ quota and repquota page 593

quotaon
▸ edquota and quotaon page 593

104.5 Manage File Permissions and Ownership

Manage access permissions on regular and special files as well as directories
▸ chmod: Changes File Access Permissions page 201
▸ chmod: Makes a File Executable page 343

Use access modes such as suid, sgid, and the sticky bit to maintain security
▸ Setuid and Setgid Permissions page 204
▸ Setuid file page 598
▸ Setuid files page 614
▸ setgid page 1271 (Glossary)
▸ setuid page 1271 (Glossary)

Know how to change the file creation mask
▸ umask: Specifies the File Permission Mask page 459

Use the group field to grant file access to group members
- ▶ **ls –l**: Displays Permissions page 199
- ▶ chmod: Changes File Access Permissions page 201
- ▶ **/etc/group** page 484

Partial List of Used Files, Terms, and Utilities

chmod
- ▶ chmod: Changes File Access Permissions page 201
- ▶ chmod: Makes a File Executable page 343

umask
- ▶ umask: Specifies the File Permission Mask page 459

chown
- ▶ chown: Changes File Ownership page 203

chgrp
- ▶ chgrp: Changes File Group Association page 203

104.6 CREATE AND CHANGE HARD AND SYMBOLIC LINKS

Create links
- ▶ ln: Creates a Hard Link page 212
- ▶ ln: Creates Symbolic Links page 215

Identify hard and/or softlinks
- ▶ ls and link counts page 214
- ▶ ls and inodes page 214
- ▶ hard link page 1250 (Glossary)
- ▶ link page 1256 (Glossary)
- ▶ symbolic link page 1276 (Glossary)

Copying versus linking files
- ▶ cp Versus ln page 213

Use links to support system administration tasks
- ▶ ln: Creates a Hard Link page 212
- ▶ ln: Creates Symbolic Links page 215

Partial List of Used Files, Terms, and Utilities

ln
- ▶ ln: Creates a Hard Link page 212
- ▶ ln: Creates Symbolic Links page 215

104.7 FIND SYSTEM FILES AND PLACE FILES IN THE CORRECT LOCATION

Understand the correct locations of files under the FHS
- ▶ Important Standard Directories and Files page 197
- ▶ Important Files and Directories page 480

Find files and commands on a Linux system
- ▶ whereis page 263
- ▶ locate: Searches for a File page 264

Know the location and purpose of important files and directories as defined in the FHS

Partial List of Used Files, Terms, and Utilities
find
locate
updatedb
whereis
which
type
/etc/updatedb.conf

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105 SHELLS, SCRIPTING, AND DATA MANAGEMENT

105.1 CUSTOMIZE AND USE THE SHELL ENVIRONMENT
See Chapter 9: The Bourne Again Shell (bash) page 333

Set environment variables (e.g., **PATH**) at login or when spawning a new shell
Write bash functions for frequently used sequences of commands
Maintain skeleton directories for new user accounts
Set command search path with the proper directory

Partial List of Used Files, Terms, and Utilities
/etc/profile

105.2 CUSTOMIZE OR WRITE SIMPLE SCRIPTS

See Chapter 9: The Bourne Again Shell (bash) page 333

See Chapter 28: Programming the Bourne Again Shell (bash) page 1003

Perform conditional mailing to the superuser

Correctly select the script interpreter through the shebang (#!) line

Manage the location, ownership, execution, and suid-rights of scripts

Partial List of Used Files, Terms, and Utilities

for

while

test

if

read

seq

105.3 SQL Data Management

Use of basic SQL commands

Perform basic data manipulation

Partial List of Used Files, Terms, and Utilities

insert

update

select

delete

from

where
  ▸ WHERE page 1149
group by
order by
  ▸ ORDER BY page 1148
join
  ▸ Joins page 1152

106 USER INTERFACES AND DESKTOPS

106.1 INSTALL AND CONFIGURE X11

See X Window System page 471

Verify that the video card and monitor are supported by an X server
  ▸ Displays page 116

Awareness of the X font server

Basic understanding and knowledge of the X Window configuration file

Partial List of Used Files, Terms, and Utilities
/etc/X11/xorg.conf

xhost
  ▸ xhost Grants Access to a Display page 473

DISPLAY
  ▸ The **DISPLAY** Variable page 474

xwininfo

xdpyinfo

X
  ▸ X Window System page 471

106.2 SET UP A DISPLAY MANAGER

Turn the display manager on or off

Change the display manager greeting

Change default color depth for the display manager

Configure display managers for use by X-stations

Partial List of Used Files, Terms, and Utilities
/etc/inittab
  ▸ **/etc/inittab** page 486

xdm configuration files

kdm configuration files

gdm configuration files
  ▸ Graphical login page 440
  ▸ The **Xorg –nolisten tcp** Option page 472

106.3 ACCESSIBILITY

Keyboard Accessibility Settings (AccessX?)

Visual Settings and Themes

Assistive Technology (ATs)

Partial List of Used Files, Terms, and Utilities

Sticky/Repeat Keys

Slow/Bounce/Toggle Keys

Mouse Keys

High Contrast/Large Print Desktop Themes

Screen Reader

Braille Display

Screen Magnifier

On-Screen Keyboard

Gestures (used at login, for example gdm)

Orca

GOK

emacspeak

107 ADMINISTRATIVE TASKS

107.1 MANAGE USER AND GROUP ACCOUNTS AND RELATED SYSTEM FILES

Add, modify, and remove users and groups

Manage user/group info in password/group databases

Create and manage special purpose and limited accounts

Partial List of Used Files, Terms, and Utilities
/etc/passwd
/etc/shadow
/etc/group
/etc/skel

chage
▶ chage page 567

groupadd
▶ groupadd: Adds a Group page 567

groupdel
▶ groupdel and groupmod: Remove and Modify a Group page 567

groupmod
▶ groupdel and groupmod: Remove and Modify a Group page 567

passwd
▶ User Accounts: Changing Your Account Type and Password (GUI) page 118
▶ passwd: Changing Your Password (CLI) page 144

useradd
▶ useradd: Adds a User Account page 566

userdel
▶ userdel: Removes a User Account page 566

usermod
▶ usermod: Modifies a User Account page 567

107.2 AUTOMATE SYSTEM ADMINISTRATION TASKS BY SCHEDULING JOBS

Manage **cron** and at jobs
▶ cron and anacron: Schedule Routine Tasks page 573
▶ at: Runs Occasional Tasks page 576

Configure user access to **cron** and at services
▶ **/etc/at.allow**, **/etc/at.deny**, **/etc/cron.allow**, and **/etc/cron.deny** page 484

Partial List of Used Files, Terms, and Utilities
/etc/cron.{d,daily,hourly,monthly,weekly}
▶ Crontab Files page 573

/etc/at.deny
▶ **/etc/at.allow**, **/etc/at.deny**, **/etc/cron.allow**, and **/etc/cron.deny** page 484

/etc/at.allow
▶ **/etc/at.allow**, **/etc/at.deny**, **/etc/cron.allow**, and **/etc/cron.deny** page 484

/etc/crontab
▶ **/etc/crontab** page 574

/etc/cron.allow
▶ **/etc/at.allow**, **/etc/at.deny**, **/etc/cron.allow**, and **/etc/cron.deny** page 484

/etc/cron.deny
▶ **/etc/at.allow**, **/etc/at.deny**, **/etc/cron.allow**, and **/etc/cron.deny** page 484

/var/spool/cron/∗
▶ Crontab Files page 573

crontab
▶ User crontab files page 574
▶ cron and anacron: Schedule Routine Tasks page 573

at
▶ at: Runs Occasional Tasks page 576

atq

atrm

107.3 LOCALIZATION AND INTERNATIONALIZATION

Locale settings
▶ Locale page 374
▶ locale page 1257 (Glossary)

Time zone settings
▶ tzconfig page 378
▶ tzselect page 378
▶ **/etc/timezone** page 378

Partial List of Used Files, Terms, and Utilities
/etc/timezone
▶ **/etc/timezone** page 378
/etc/localtime
▶ **/etc/localtime** page 379
/usr/share/zoneinfo
▶ **/usr/share/zoneinfo** page 378

Environment variables:
▶ **LC_**: Locale Variables page 374
▶ Environment Variables page 1054

/usr/bin/locale
▶ locale: Displays Locale Information page 375

tzselect
▶ tzselect page 378

tzconfig
▶ tzconfig page 378

date
▶ date: Displays the System Time and Date page 226

iconv

UTF-8
▶ **LC_**: Locale Variables page 374
▶ UTF-8 page 1280 (Glossary)

ISO-8859
▶ LC_: Locale Variables page 374

ASCII
▶ ASCII page 1233 (Glossary)

Unicode
▸ Unicode page 1279 (Glossary)

108 ESSENTIAL SYSTEM SERVICES

108.1 MAINTAIN SYSTEM TIME
Set the system date and time
▸ timedatectl: Reports on and Sets the System Clock page 579

Set the hardware clock to the correct time in UTC

Configure the correct time zone
▸ Time page 377

Basic NTP configuration

Knowledge of using the pool.ntp.org service

Partial List of Used Files, Terms, and Utilities
/usr/share/zoneinfo
▸ **/usr/share/zoneinfo** page 378
/etc/timezone
▸ **/etc/timezone** page 378
/etc/localtime
▸ **/etc/localtime** page 379
/etc/ntp.conf
date
▸ date: Displays the System Time and Date page 226
▸ timedatectl: Reports on and Sets the System Clock page 579
hwclock
ntpd
ntpdate
pool.ntp.org

108.2 SYSTEM LOGGING
Syslog configuration files
▸ **rsyslog.conf** page 585
syslog
▸ **rsyslogd**: Logs System Messages page 585
standard facilities, priorities, and actions
▸ Selectors page 585
▸ Facilities page 585
▸ Priorities page 586
▸ Actions page 586

Partial List of Used Files, Terms, and Utilities
syslog.conf
▸ **rsyslog.conf** page 585
syslogd
▸ **rsyslogd**: Logs System Messages page 585
klogd
logger

108.3 MAIL TRANSFER AGENT (MTA) BASICS

*See Chapter 21: **postfix**: Setting Up Mail Servers, Clients, and More page 779*

Create e-mail aliases
▸ **/etc/aliases** page 794
Configure e-mail forwarding
▸ **~/.forward** page 796
Knowledge of commonly available MTA programs (**postfix**, **sendmail**, Qmail, **exim**) (no configuration)
▸ Alternatives to **postfix** page 783

Partial List of Used Files, Terms, and Utilities
~/.forward
▸ **~/.forward** page 796
sendmail emulation layer commands
newaliases
▸ newaliases page 795
mail
mailq
▸ mailq page 786
postfix
▸ Introduction to **postfix** page 781
▸ Setting Up a **postfix** Mail Server page 784
▸ JumpStart: Configuring **postfix** to Use Gmail as a Smarthost page 787
▸ Configuring **postfix** page 789
sendmail
▸ The **postfix** to **sendmail** Compatibility Interface page 782
▸ **sendmail** page 783
▸ Outbound Email page 785
exim
▸ **exim4** page 783
qmail
▸ Qmail page 783

108.4 MANAGE PRINTERS AND PRINTING

See Chapter 13: Printing with CUPS page 539

Basic CUPS configuration (for local and remote printers)
  ▸ The System Configures a Local Printer Automatically page 542
  ▸ JumpStart I: Configuring a Printer Using system-config-printer page 542
  ▸ JumpStart II: Setting Up a Local or Remote Printer page 544
  ▸ Working with the CUPS Web Interface page 548
  ▸ Configuring Printers page 549
Manage user print queues
  ▸ Managing Print Queues page 555
Troubleshoot general printing problems
Add and remove jobs from configured printer queues
  ▸ BSD and System V command-line print utilities page 557

Partial List of Used Files, Terms, and Utilities
CUPS configuration files, tools, and utilities
  ▸ JumpStart I: Configuring a Printer Using system-config-printer page 542
  ▸ Working with the CUPS Web Interface page 548
  ▸ Sharing CUPS Printers page 555
/etc/cups
  ▸ Example lpadmin Commands page 553
lpd legacy interface (lpr, lprm, lpq)
  ▸ Traditional UNIX Printing page 557

109 NETWORKING FUNDAMENTALS

See Chapter 8: Networking and the Internet page 285

109.1 FUNDAMENTALS OF INTERNET PROTOCOLS

See Network Protocols page 296

Demonstrate an understanding of network masks
  ▸ Subnet mask page 304
  ▸ network mask page 1262 (Glossary)
Knowledge of the differences between private and public "dotted quad" IP addresses
  ▸ Private address space page 667
  ▸ private address space page 1266 (Glossary)
Setting a default route
Knowledge about common TCP and UDP ports (20, 21, 22, 23, 25, 53, 80, 110, 119, 139, 143, 161, 443, 465, 993, 995)
  ▸ Each chapter covering a server discusses which ports that server uses.

‣ Ports page 318
‣ port page 1265 (Glossary)

Knowledge about the differences and major features of UDP, TCP, and ICMP

‣ UDP page 296
‣ UDP: User Datagram Protocol page 298
‣ TCP page 296
‣ TCP: Transmission Control Protocol page 297
‣ ping: Tests a Network Connection page 311
‣ UDP page 1279 (Glossary)
‣ TCP page 1276 (Glossary)
‣ ICMP page 1252 (Glossary)

Knowledge of the major differences between IPv4 and IPv6

‣ IPv4 page 298
‣ IPv6 page 299

Partial List of Used Files, Terms, and Utilities
/etc/services

‣ Network Services page 319
‣ **/etc/services** page 489

ftp

‣ Chapter 20: FTP: Transferring Files Across a Network page 753

telnet

‣ telnet: Logs In on a Remote System page 309

host

‣ host and dig: Query Internet Nameservers page 313

ping

‣ ping: Tests a Network Connection page 311

dig

‣ host and dig: Query Internet Nameservers page 313
‣ dig page 901
‣ dig page 902

traceroute

‣ traceroute: Traces a Route over the Internet page 312

tracepath

109.2 BASIC NETWORK CONFIGURATION

Manually and automatically configure network interfaces

‣ Configuring the Systems page 666
‣ NetworkManager: Configures Network Connections page 667

Basic TCP/IP host configuration

Partial List of Used Files, Terms, and Utilities
/etc/hostname
/etc/hosts
/etc/resolv.conf
/etc/nsswitch.conf
ifconfig

ifup

ifdown

route

ping

109.3 BASIC NETWORK TROUBLESHOOTING
Manually and automatically configure network interfaces and routing tables to include adding, starting, stopping, restarting, deleting, or reconfiguring network interfaces

Change, view, or configure the routing table and correct an improperly set default route manually

Debug problems associated with the network configuration

Partial List of Used Files, Terms, and Utilities
ifconfig

ifup

ifdown

route

host
hostname
dig

netstat

ping

▸ ping: Tests a Network Connection page 311

traceroute

▸ traceroute: Traces a Route over the Internet page 312

109.4 CONFIGURE CLIENT SIDE DNS

See Chapter 25: DNS/BIND: Tracking Domain Names and Addresses page 891

Demonstrate the use of DNS on the local system

▸ JumpStart: Setting Up a DNS Cache page 906

Modify the order in which name resolution is done

▸ Resolver page 894

Partial List of Used Files, Terms, and Utilities
/etc/hosts

▸ Hostnames page 306

▸ **/etc/hosts** page 485

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110 SECURITY

110.1 PERFORM SECURITY ADMINISTRATION TASKS

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Being able to use nmap and netstat to discover open ports on a system

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/etc/inetd.d/* [deprecated]

/etc/inetd.conf [deprecated]

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/etc/hosts.deny
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