

CompTIA Linux+

Abstract:

This Study Guide will begin to prepare you for the Linux+ exam brought to you by CompTIA. The Linux+ certification measures vendor-neutral Linux knowledge and skills for an individual with at least 6 months practical experience. The Linux+ Target Audience or the target market for Linux+ certification is any individual interested in demonstrating fundamental Linux knowledge and skills. This exam will no doubt become the cornerstone for most other Linux based certifications to follow, as CompTIA is leader in vendor neutral based testing. As with any other study guide, do not make this your sole study resource. Use it as a guide to help you focus your studies and to guide you in finding more information to prepare with

Exam Info:

This exam is not finalized yet as it was just in beta stages. The Exam info will be released shortly. Until this info is released, you can always visit this links provided to update yourself on what the scoring will be:

COMPTIA: <http://www.comptia.org>

SYLVAN: <http://www.2test.com>

VUE: <http://www.vue.com>

Study Tips:

As usual, nothing beats hands on experience. This exam is focused on rudimentary Linux fundamentals and does not venture too deeply into impossibility

There are pitfalls – you MUST know the basics of Linux to pass the exam – but that is not saying that you cannot acquire this knowledge in a lab environment. You should set yourself up a lab with a Linux PC and go over the objectives one by one as you study so as to make sure you are comfortable doing what is listed and this will make the testing experience so much better for you

Study material: I highly recommend the following sources of information to help you in preparing for this exam. First, please glance over the LPI 1 and 2 Exam Notes that I put up on this site. The reason is, it is also fundamental knowledge you can use and the Links I submitted for those specific guides can be used for this exam as well

The following publications will help aid your studies:

Although this book is due on September 14, it is the onlu guide listed as of this moment:

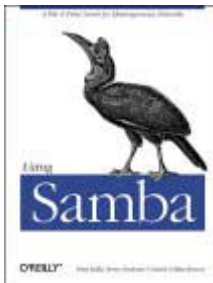
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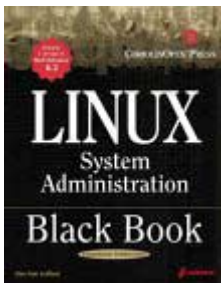
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Linux+ From Sybex
(Cant rate it – its not out yet)



How can you go wrong with O'Reilly? This is actually a good primer on Samba and goes in depth if needed



I happen to like this book **a lot**, as it is full of what you need to know to get the fundamentals of Linux down. Out of all the Linux books I have read, this one is rated high on my list

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Links:

Please download and read the following – It will help you to understand what is expected of you for the Linux+ exam:

- o [Linux+ White Paper](#)
- o [Linux+ Blueprint](#)
- o [Linux + Job Role Description](#)

Other Links:

Please visit my LPI Guides to find many usable links to aid in your studies:

[LPI Part I](#)

More Links:

- o [BrainBuzz Linux+](#)
- o [BrainBuzz Links](#)
- o [Linux Man Pages](#) (download via FTP)

Linux.org links:

- [Books](#)
- [Linux Software](#)
- [Usenet News Groups](#)
- [User Groups and Organizations](#)
- [Mailing Lists](#)
- [Internet Relay Chat \(IRC\)](#)
- [Videos, Newsletters, Magazines, and Ezines](#)
- [Non-Commercial Support Web Sites](#)
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Exam Notes

What you are responsible for:

Domain 1.0 Planning the Implementation

This domain requires the basic knowledge and skills to associate different hardware, software and services options with the specific purposes and requirements of Linux users

- Identify purpose of Linux machine based on predetermined customer requirements (e.g., appliance, desktop system, database, mail server)
- Identify all system hardware required and validate that it is supported by Linux (e.g., CPUs, RAM, graphics cards, storage devices, network interface cards, modem)
- Determine what software and services should be installed (e.g., client applications for workstation, server services for desired task), check requirements and validate that it is supported by Linux
- Determine how storage space will be allocated to file systems. (e.g., partition schemes)
- Compare and contrast how major Linux licensing schemes work (e.g., GNU/GPL, freeware, shareware, open source, closed source, artistic license)
- Identify the function of different Linux services (e.g., Apache, Squid, SAMBA, Sendmail, ipchains, BIND)
- Identify strengths and weaknesses of different distributions and their packaging solutions (e.g, tar ball vs. RPM/DEB)
- Describe the functions, features, and benefits of a Linux solutions as compared with other operating systems (e.g., Linux players, distributions, available software)
- Identify how the Linux kernel version numbering works
- Identify where to obtain software and resources
- Determine customer resources for a solution (e.g., staffing, budget, training)

Domain 2.0 Installation

This domain requires the basic knowledge and skills to determine installation methods, select appropriate settings, protocols and software packages, and validate correct performance

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- Determine appropriate method of installation based on the environment (e.g., boot disk, CD-ROM, Network (HTTP, FTP, NFS, SMB))
- Describe the different types of Linux installation interaction and determine which to use for a given situation (e.g., GUI, text, network)
- Select appropriate parameters for Linux installation (e.g., language, time zones, keyboard, mouse)
- Select packages based on the machine's "role" (e.g., Workstation, Server, Custom)
- Select appropriate options for partitions based on pre-installation choices (e.g., FDISK, third party partitioning software)
- Partition according to your pre-installation plan using fdisk (e.g., /boot, / , /usr, /var/home, SWAP)
- Configure file systems (e.g., (ext2) or (ext3) or REISER)
- Select appropriate networking configuration and protocols (e.g., modems, Ethernet, Token-Ring)
- Select appropriate security settings (e.g., Shadow password, root password, umask value, password limitations and password rules)
- Create users and passwords during installation
- Install and configure Xfree86 server
- Select Video card support (e.g., chipset, memory, support resolution(s))
- Select appropriate monitor manufacturer and settings (e.g., custom, vertical, horizontal, refresh)
- Select the appropriate window managers or desktop environment (e.g., KDE, GNOME)
- Explain when and why the kernel will need to be recompiled
- Install boot loader (e.g., LILO, MBR vs. first sector of boot partition)
- Install and uninstall applications after installing the operating system (e.g., RPM, tar, gzip)
- Read the Logfiles created during installation to verify the success of the installation
- Validate that an installed application is performing correctly in both a test and a production environment

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Domain 3.0 Configuration

This domain requires the basic knowledge and skills to configure system settings, network services, and access rights.

- Reconfigure the Xwindow System with automated utilities (e.g., Xconfigurator, XF86Setup)
- Configure the client's workstation for remote access (e.g., ppp, ISDN)
- Set environment variables (e.g, PATH, DISPLAY, TERM)
- Configure basic network services and settings (e.g., netconfig, linuxconf; settings for TCP/IP, DNS, DHCP)
- Configure basic server services (e.g., X, SMB, NIS, NFS)
- Configure basic Internet services (e.g., HTTP, POP, SMTP, SNMP, FTP)
- Identify when swap space needs to be increased
- Add and configure printers
- Install and configure add-in hardware (e.g., monitors, modems, network interfaces, scanners)
- Reconfigure boot loader (e.g., LILO)
- Identify the purpose and characteristics of configuration files (e.g., BASH, inittab, fstab, /etc/*)
- Edit basic configuration files (e.g., BASH files, inittab, fstab)
- Load, remove, and edit list modules (e.g., insmod, rmmod, lsmod, modprobe)
- Document the installation of the operating system, including configuration
- Configure access rights (e.g., rlogin NIS, FTP, TFTP, SSH, Telnet)

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Domain 4.0 Administration

This domain requires the basic knowledge and skills to manage users, file systems, services, devices and run levels using common shell commands, administrative utilities, and superuser privileges.

- Create and delete users
- Modify existing users (e.g., password, groups, personal information)
- Create, modify and delete groups
- Identify and change file permissions, modes and types by using chmod, chown and chgrp
- Manage and navigate the Linux hierarchy (e.g., /etc, /usr, /bin, /var)
- Manage and navigate the standard Linux file system (e.g., mv, mkdir, ls, rm)
- Perform administrative tasks while logged in as root, or by using the su command (e.g., understand commands that are dangerous to the system)
- Mount and manage filesystems and devices (e.g., /mnt, /dev, du, df, mount, umount)
- Describe and use the features of the multi-user environment (e.g., virtual terminals, multiple logins)
- Use common shell commands and expressions
- Use network commands to connect to and manage remote systems (e.g., telnet, ftp, ssh, netstat, transfer files, redirect Xwindow)
- Create, extract and edit file and tape archives using tar
- Manage runlevels using init and shutdown
- Stop, start, and restart services (daemons) as needed (e.g., init files)
- Manage print spools and queues
- Create, edit and save files using vi
- Manage and navigate the Graphical User Interface (e.g., menus, xterm)
- Program basic shell scripts using common shell commands (e.g., grep, find, cut, if)

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Domain 5.0 System Maintenance

This domain requires the basic knowledge and skills to monitor and maintain processes, network interfaces, system logs, security, and backup.

- Create and manage local storage devices and file systems (e.g., fsck, fdisk, mkfs)
- Verify user and root cron jobs and understand the function of cron
- Identify core dumps and remove or forward as appropriate
- Run and interpret ifconfig
- Download and install patches and updates (e.g., packages, tgz)
- Differentiate core services from non-critical services (e.g., ps, PID, PPID, init, timer)
- Identify, execute and kill processes (ps, kill, killall)
- Monitor system log files regularly for errors, logins, and unusual activity
- Document work performed on a system
- Perform and verify backups and restores
- Perform and verify security best practices (e.g., passwords, physical environments)
- Assess security risks (e.g., location, sensitive data, file system permissions, remove/disable unused accounts, audit system services/programs)
- Set daemon and process permissions (e.g., SUID – SGID – Owner/groups)

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Domain 6.0 Troubleshooting

This domain requires the basic knowledge and skills to identify, inspect and diagnose problems in the Linux operating system, and apply remedies using common commands and utilities.

- Identify and locate the problem by determining whether the problem is hardware, operating system, application software, configuration or the user
- Describe troubleshooting best practices (i.e., methodology)
- Examine and edit configuration files based on symptoms of a problem using system utilities
- Examine, start, and stop processes based on the signs and symptoms of a problem
- Use system status tools to examine system resources and statuses (e.g., fsck, setserial)
- Use systems boot disk(s) and root disk on workstation and server to diagnose and rescue file system
- Inspect and determine cause of errors from system log files
- Use disk utilities to solve file system problems (e.g., mount, umount)
- Resolve problems based on user feedback (e.g., rights, unable to login to the system, unable to print, unable to receive or transmit mail)
- Recognize common errors (e.g., package dependencies, library errors, version conflicts)
- Take appropriate action on boot errors (e.g., LILO, bootstrap)
- Identify backup and restore errors
- Identify application failure on server (e.g., Web page, telnet, ftp, pop3, snmp)
- Identify and use trouble shooting commands (e.g., locate, find, grep, ?, <, >, >>, cat, tail)
- Locate troubleshooting resources and update as allowable (e.g., Web, man pages, howtos, infopages, LUGs)
- Use network utilities to identify network and connectivity problems (e.g., ping, route, traceroute, netstat, lsof)

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Domain 7.0 Identify, Install, and Maintain System Hardware

This domain requires the basic knowledge and skills of core and peripheral hardware installation, configuration, and troubleshooting in a Linux environment. It includes generic hardware issues and Linux specific hardware issues.

- Identify basic terms, concepts, and functions of system components, including how each component should work during normal operation and during the boot process
- Assure that system hardware is configured correctly prior to installation (e.g., IRQs, BIOS, DMA, SCSI settings, cabling) by identifying proper procedures for installing and configuring ATA devices
- Assure that system hardware is configured correctly prior to installation (e.g., IRQs, BIOS, DMA, SCSI settings, cabling) by identifying proper procedures for installing and configuring SCSI and IEEE 1394 devices
- Assure that system hardware is configured correctly prior to installation (e.g., IRQs, BIOS, DMA, SCSI, cabling) settings by identifying proper procedures for installing and configuring peripheral devices
- Assure that system hardware is configured correctly prior to installation (e.g., IRQs, BIOS, DMA, SCSI, cabling) settings by identifying available IRQs, DMAs, and I/O addresses and procedures for device installation and configuration
- Remove and replace hardware and accessories (e.g., cables and components) based on symptoms of a problem by identifying basic procedures for adding and removing field replaceable components
- Remove and replace hardware and accessories (e.g., cables and components) based on symptoms of a problem by identifying common symptoms and problems associated with each component and how to troubleshoot and isolate the problems
- Identify basic networking concepts, including how a network works
- Identify proper procedures for diagnosing and troubleshooting ATA devices
- Identify proper procedures for diagnosing and troubleshooting SCSI devices
- Identify proper procedures for diagnosing and troubleshooting peripheral devices
- Identify proper procedures for diagnosing and troubleshooting core system hardware
- Identify and maintain mobile system hardware (e.g., PCMCIA, APM)

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Notes to Study:

- What is a DMA? You must know your IRQ's and DMA for this exam. It is important to know how to set Linux up with Hardware and this test asks you to show that. You will be hit with A+ terminology on a Linux based platform. DMA is an abbreviation of direct memory access, a technique for transferring data from main memory to a device without passing it through the CPU. Computers that have DMA channels can transfer data to and from devices much more quickly than computers without a DMA channel can. This is useful for making quick backups and for real-time applications.

IRQ Number	Function
0	System Time
1	Keyboard
2	Cascade
3	Com 2 – 4
4	Com 1 - 3
5	Available
6	Floppy
7	LPT1
8	Clock (Real Time)
9	Cascade
10	Available
11	Available
12	Mouse
13	Math Coprocessor
14	Hard Disk IDE
15	Available

DMA – Floppy on DMA 2

- For any special type of software modem, you must enable it in the BIOS and configure the proper port settings – With Linux Know how to configure the BIOS and set up your Hardware Configuration.
- The BIOS is typically placed in a ROM chip that comes with the computer (it is often called a ROM BIOS)
- This ensures that the BIOS will always be available and will not be damaged by disk failures. It also makes it possible for a computer to boot itself

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LILO and MBR:

- MBR - Short for Master Boot Record is a small program that is executed when a computer boots up
- Typically, the MBR resides on the first sector of the hard disk
- The program begins the boot process by looking up the partition table to determine which partition to use for booting
- It then transfers program control to the boot sector of that partition, which continues the boot process
- In DOS and Windows systems, you can create the MBR with the FDISK /MBR command
- LILO – Linux Loader is what boots Linux
- You can use FDISK /MBR to get LILO off to replace the MBR

Know SCSI Based Hardware:

- Most of the SCSI related problems are either termination based or SCSI ID based
- SCSI-1 was very stringent in its requirements in termination
- It used a 132ohm passive terminator
- This was not conducive to the higher speed data transfers used today and sometimes caused data errors when more than one device was added to the chain
- SCSI-2 uses an active terminator, or voltage-regulated. It lowers the impedance of the termination and improves reliability
- Fast SCSI delivers a 10 MB/sec transfer rate
- When combined with the 16-bit bus, this doubles to 20 MB/sec and this is called Fast-Wide SCSI
- Ultra SCSI, also called Fast-20 SCSI, is twice as fast as Fast SCSI
- Ultra-Wide SCSI incorporates the 16-bit bus, and the speed raises to 40MB/sec
- Fast SCSI delivers a 10 MB/sec transfer rate. When combined with the 16-bit bus, this doubles to 20 MB/sec
- This is called Fast-Wide SCSI. Ultra SCSI, also called Fast-20 SCSI, is twice as fast as Fast SCSI
- Ultra SCSI delivers 20MB/sec over the 8-bit bus. Ultra-Wide SCSI incorporates the 16-bit bus, and the speed raises to 40MB/sec

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Know USB Based Solutions for Linux:

- The latest Linux kernel supports USB
- USB is short for Universal Serial Bus, a new (but not really that new anymore) external bus standard that supports data transfer rates of 12 Mbps (12 million bits per second)
- A single USB port can be used to connect up to 127 peripheral devices, such as mice, modems, and keyboards
- USB also supports Plug-and-Play installation and hot plugging

Printing:

- Ldd prints the shared libraries required by each program specified on the command line
- For a.out programs, ldd simply forks and execs each program with argc equal to zero
- The a.out dynamic linker, ld.so, which normally loads the shared libraries, notices this special case and prints the dependencies
- For ELF programs, ldd forks and execs each program with the appropriate environment variables set
- The ELF dynamic linker, ld-linux.so, which normally loads the shared libraries, notices this special case and prints the dependencies
- Access control is provided by two means
 - First, all requests must come from one of the machines listed in the file /etc/hosts.equiv or /etc/hosts.lpd
 - Second, if the rs capability is specified in the printcap entry for the printer being accessed, lpr requests will only be honored for those users with accounts on the machine with the printer

MAN Pages:

- Man formats and displays the on-line manual pages
- This version knows about the MANPATH and (MAN)PAGER environment variables, so you can have your own set(s) of personal man pages and choose whatever program you like to display the formatted pages
- If section is specified, man only looks in that section of the manual
- You may also specify the order to search the sections for entries and which preprocessors to run on the source files via command line options or environment variables
- If name contains a / then it is first tried as a filename, so that you can do man ./foo.5 or even man /cd/foo/bar.1.gz\fr.\fP

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TAR and GZIP

- -z tells TAR to filter the archive through gzip
- tar is an archiving program designed to store and extract files from an archive file known as a tarfile
- A tarfile may be made on a tape drive, however, it is also common to write a tarfile to a normal file
- The first argument to tar must be one of the options: Acdrutx , followed by any optional functions
- The final arguments to tar are the names of the files or directories, which should be archived
- The use of a directory name always implies that the subdirectories below should be included in the archive

Chown

- chown changes the user and/or group ownership of each given file, according to its first non-option argument, which is interpreted as follows:
 - If only a user name (or numeric user ID) is given, that user is made the owner of each given file, and the files' group is not changed
 - If the user name is followed by a colon or dot and a group name (or numeric group ID), with no spaces between them, the group ownership of the files is changed as well
 - If a colon or dot but no group name follows the user name, that user is made the owner of the files and the group of the files is changed to that user's login group
 - If the colon or dot and group are given, but the user name is omitted, only the group of the files is changed; in this case, chown performs the same function as chgrp
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- If the colon or dot and group are given, but the user name is omitted, only the group of the files is changed; in this case, chown performs the same function as chgrp
- Know that v = Verbose

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Cron

- Cron should be started from /etc/rc or /etc/rc.local. It will return immediately, so you don't need to start it with '&'. Cron searches /var/spool/cron for crontab files which are named after accounts in /etc/passwd; crontabs found are loaded into memory
- Cron also searches for /etc/crontab and the files in the /etc/cron.d/ directory, which are in a different format (see crontab(5))
- Cron then wakes up every minute, examining all stored crontabs, checking each command to see if it should be run in the current minute
- When executing commands, any output is mailed to the owner of the crontab (or to the user named in the MAILTO environment variable in the crontab, if such exists)
- Additionally, cron checks each minute to see if its spool directory's modtime (or the modtime on /etc/crontab) has changed, and if it has, cron will then examine the modtime on all crontabs and reload those which have changed
- Thus cron need not be restarted whenever a crontab file is modified. Note that the Crontab (1) command updates the modtime of the spool directory whenever it changes a crontab
- Cron searches /var/spool/cron for crontab files which are named after accounts in /etc/passwd; crontabs found are loaded into memory
- Cron then wakes up every minute, examining all stored crontabs, checking each command to see if it should be run in the current minute
- When executing commands, any output is mailed to the owner of the crontab (or to the user named in the MAILTO environment variable in the crontab, if such exists)

Sendmail:

- Sendmail sends a message to one or more recipients, routing the message over whatever networks are necessary
- Sendmail does Internetwork forwarding as necessary to deliver the message to the correct place
- Sendmail is not intended as a user interface routine; other programs provide user-friendly front ends; sendmail is used only to deliver pre-formatted messages

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GUNZIP:

- gunzip can currently decompress files created by gzip, zip, compress, compress -H or pack
- The detection of the input format is automatic
- When using the first two formats, gunzip checks a 32 bit CRC
- For pack, gunzip checks the uncompressed length
- The standard compress format was not designed to allow consistency checks
- gunzip is sometimes able to detect a bad .Z file
- If you get an error when uncompressing a .Z file, do not assume that the .Z file is correct simply because the standard uncompress does not complain
- This generally means that the standard uncompress does not check its input, and happily generates garbage output
- The SCO compress -H format (lzh compression method) does not include a CRC but also allows some consistency checks

What is a Shell?

- The outermost layer of a program
- Shell is another term for user interface
- Operating systems and applications sometimes provide an alternative shell to make interaction with the program easier
- For example, if the application is usually command driven, the shell might be a menu-driven system that translates the user's selections into the appropriate commands
- UNIX systems offer a choice between several different shells, the most popular being the Cshell, the Bourne shell, and the Korn shell
- Each offers a somewhat different command language.

Uptime:

- uptime gives a one line display of the following information:
 - The current time
 - How long the system has been running
 - How many users are currently logged on
 - The system load averages for the past 1, 5, and 15 minutes
 - This is the same information contained in the header line displayed by w (1)

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FREE:

- free displays the total amount of free and used physical and swap memory in the system, as well as the shared memory and buffers used by the kernel
- The -b switch displays the amount of memory in bytes
- The -k switch (set by default) displays it in kilobytes
- The -m switch displays it in megabytes

Regular Expressions:

- Regular expression may be followed by one of several repetition operators:
 - ? - The preceding item is optional and matched at most once.]
 - * - The preceding item will be matched zero or more times
 - + - The preceding item will be matched one or more times
 - { n } - The preceding item is matched exactly n times
- A regular expression is a pattern that describes a set of strings
- Regular expressions are constructed analogously to arithmetic expressions, by using various operators to combine smaller expressions

SETGID and SETUID

- setgid sets the effective group ID of the current process
- If the caller is the superuser, the real and saved group ID's are also set
- Under Linux, setgid is implemented like the POSIX version with the _POSIX_SAVED_IDS feature
- This allows a setgid (other than root) program to drop all of its group privileges, do some un-privileged work, and then re-engage the original effective group ID in a secure manner
- If the user is root or the program is setgid root, special care must be taken
- The setgid function checks the effective gid of the caller and if it is the superuser, all process related group ID's are set to gid
- After this has occurred, it is impossible for the program to regain root privileges
- setuid sets the effective user ID of the current process
- If the effective userid of the caller is root, the real and saved user ID's are also set
- Under Linux, setuid is implemented like the POSIX version with the _POSIX_SAVED_IDS feature
- This allows a setuid (other than root) program to drop all of its user privileges, do some un-privileged work, and then re-engage the original effective user ID in a secure manner

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- If the user is root or the program is setuid root, special care must be taken
- The setuid function checks the effective uid of the caller and if it is the superuser, all process related user ID's are set to uid
- After this has occurred, it is impossible for the program to regain root privileges

Dig (domain information groper):

- Dig (domain information groper) is a flexible command line tool which can be used to gather information from the Domain Name System servers
- Dig has two modes:
 - imple interactive mode for a single query
 - batch mode which executes a query for each in a list of several query lines
 - All query options are accessible from the command line

FSCK:

- When you run fsck, make sure you are in single user mode so no one else can access the system at the same time

Final Tips:

This Exam was rough for the Linux Newbie. If you have experience as a Linux Admin and are A+ certified, you will find this exam to be pretty easy. DO not be fooled – you still have to study and prepare. When the Final Exam hits we will update the Examnotes to be more in tuned with the Final Product. **Good Luck.**

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Robert J. Shimonski

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