Linux Academy

Study Guide

Linux Academy RHCSA 7 Prep

Contents

Basic Commands

- pwd • Show current working directory path
- cd • Change directory
- ls • List contents of directory
- sudo • Allows a super user to run a command with root priviledges
- mkdir • Create new directory
  - » -p • Create parent directories, if do not already exist
- rmdir • Remove directory
- rm -rf • Force remove a directory, recursively (includes all files inside)
- touch • Create new, empty files

Input-Output Redirection

- > • Redirect standard output to file
  - » echo "test" > file.txt
  - » Replaces file, if already exists
- >> • Redirects and appends standard output
  - » echo "test" >> file.txt
  - » Adds text to bottom of file
- | • Chain scripts, files and commands together by the STDOUT as STDIN for the next command
  - » cat /etc/passwd | grep root
- 2> • Redirect standard error
- 2>> • Redirect and append standard error
- /dev/null • Data sent to */dev/null* is lost
- 2>&1 • Redirect STDERR to STDOUT
- < • Accept input from file
  - » mysql < filedump.sql
- less • File viewing application and STDOUT can often piped into for ease of reading

- head • Show first ten lines of file
  - » -n • Define number of lines
- tail • Show last ten lines of file
  - » -n • Define number of lines

File System Hierarchy Standard

- /etc • Contains configuration files for programs and packages
- /var • Variable data specific to system. This data should not be removed or changed when the system reboots. Logs files tend to be stored within the /var directory
- /run • Runtime data for processes since last boot
- /home • Location of home directories; used for storing personal documents and information on the system
- /root • *root* user home directory
- /tmp • Files are removed after ten days; universal read/write permissions
- /boot • Files needed to start the system boot process
- /dev • Contains information on essential devices

Grep and Regular Expressions

- grep • Prints lines that match defined pattern
  - » grep pattern file.txt
  - » -i • Case insensative
  - » -v • Shows lines *not* containing pattern
- Examples including regex:
  - » grep linuxacademy filename • Search for *linuxacademy* in *filename*
  - » grep "^linuxacademy" filename • Search for lines starting with *linuxacademy*
  - » grep "linuxacademy$" filename • Search for lines ending with *linuxacademy*
  - » grep "^[abd]" filename • Search for characters not contained in brackets
  - » grep [lL]inuxacademy filename • Search for pattern starting with either capital or lowercase *L*

  - » grep "^$" filename • Search for empty lines
  - » grep -v ^# filename • Search for uncommented lines
- egrep • Same as grep, but using extended regular expressions
- fgrep • Interpret pattern as list of fixed strings

Access Remote Systems Using SSH

- **Password authentication** • Allows user to log in with only a password; considered to be less secure than using key-based authentication
- ssh user@server • Connect to remote host
- ssh server command • Issue command on remote host without connecting
- scp filename user@server:~/ • Secure copy file to server
- sftp user@server • Secure File Transfer Protocol
  - » ? • Display all options
  - » ls • List files
  - » cd • Mode directories
  - » get • Download
  - » quit • Exit sftp

Log In and Switch Users in Multi-User Targets

- **Target** • Systemd configuration files used for grouping resources
- **Interactive shell** • Any shell that has a prompt for user interaction
- su • Log in as another user
  - » su user • Log in to an interactive, non-login shell
  - » su - user • Log in to a login shell
- **GNU Bourne-Again Shell** • **Bash**
  - » Interactive shell uses either $ (user) or # (root) prompt
  - » Takes commands, which run programs
    - Made up of three parts:

- Command name
- Options or *flags* to pass into the command
- Arguments

Archive and Compress Using tar, star, gzip and bzip2

- tar • Archive files; does not handle compression
  - » -c • Create new archive
  - » -t • List contents of archive
  - » -x • Extract files from archive
  - » -z • Compress or uncompress file in gzip
  - » -v • Verbose
  - » -j • Compress or uncompress file in bzip2
  - » -f • Read archive from or to file
  - » Examples
    - tar -cf helloworld.tar hello world • Archive *hello* and *world* files into *helloworld.tar* archive
    - tar -tvf helloworld.tar • List all files in *helloworld.tar* archive
    - tar -xf helloworld.tar • Extract files in archive
    - tar -czvf helloworld.tar.gz hello world • Archive and compress (using gzip) *hello* and *world* files into *helloworld.tar.gz* archive
    - tar -zxvf helloworld.tar.gz • Uncompress (in gzip) and extract files from archive
- star • Archiving utility generally used to archive large sets of data; includes pattern-matching and searching
  - » -c • Create archive file
  - » -v • Verbose output
  - » -n • Show results of running command, without executing the actions
  - » -t • List contents of file

  - » -x • Extract file
  - » --diff • Show difference between files
  - » -C • Change to specified directory
  - » -f • Specify file name
  - » Examples"
    - star -c f=archive.tar file1 file2 • Archive *file1* and *file2* into *archive.tar* archive
    - star -c -C /home/user/ -f=archive.tar file1 file2 • Move to */home/user* and archive *file1* and *file2* from that directory into *archive.tar*
    - star -x -f=archive.tar • Extract *archive.tar*
    - star -t -f=archive.tar • List contents of *archive.tar*
- gzip • Compression utility used to reduce file sized; files are unavailable until unpacked; generally used with tar
  - » -d • Decompress files
  - » -l • List compression information
  - » Examples:
    - gzip file1 • Compress *file1* into *file1.gz*
    - gzip -d file1.gz • Unpack *file1*
    - gunzip filename • Unpack *filename*

Create and Edit Files

- vi • Text editor that is always installed and useable; replaced vim
- vim • Vi iMproved; full-featured version of vi
- nano • Simple text editor
- touch • Create empty file

Create, Delete, Copy and Move Files and Directories

- mkdir • Make directory

  - » -p • Create parent directories, if not already created
- cp • Copy files and directories
  - » -R • Copy directory recursively
- mv • Move files and directories
- rm • Remove files and directories
  - » -r/-R • Remove recursively
  - » -f • Force remove
  - » -i • Prompt before removal

Create Hard and Soft Links

- ln • Create links between files
  - » Without the -s flag, creates a hard link
  - » -s • Symlink files
- **symlinks** • Soft links that connects one file to another, symbolically; if the target file moves to changes, the symlink continues to try use the previous location and must be updated
- **Hard link** • Links directly to an inode to create a new entry referencing an existing file on the system

List, Set and Change Standard Permissions

- Two ways to define permissions on a standard Linux system:
  - » Using symbolic characters, such as *u*, *g*, *o*, *r*, *w* and *x*
  - » Using octal bits
  - » The RHCSA only requires knowledge of the symbolic
- chmod • Change mode; set the permissions for a file or directory
  - » u • User
  - » g • Group
  - » o • Other
  - » a • All
  - » r • Read

  - » w • Write
  - » x • Execute
  - » s • Set UID or GID
  - » t • Set sticky bit
  - » -X • Indicate the execute permissions should only affect directories and not regular files
  - » Octal bits:
    - 1 • Execute
    - 2 • Write
    - 4 • Read
- chown • Change owner and group permissions
  - » chown user:group filename
  - » -R • Set ownership recursively
- chgrp • Change group ownership
- setuid • Set user ID permissions on executable file
- setgid • Set group ID permissions on executable file
- umask • Set default permissions for new directories and files

Locate, Read and Use System Documentation

- command --help
- info • Read information files; provides more information than man
- which • Show full path of command; useful for scripting
- whatis • Display manual page descriptions
- locate • Locate files on system by name
- updatedb • Update locate command databases
- man • Documentation
  - » Nine sections:
    - **1** • Executable programs and shell commands
    - **2** • System calls

- **3** - Library calls
- **4** - Special files
- **5** - File formats
- **6** - Games
- **7** - Miscellaneous
- **8** - root user commands
- **9** - Kernel routines

- apropos - Search man pages and descriptions for text

Boot, Reboot and Shut Down a System

- Reboot:
  - » reboot
  - » systemctl reboot
  - » shutdown -r now
- Shutdown:
  - » No power off
  - » systemctl halt
  - » halt
  - » shutdown -h now
  - » init 0
- Power off:
  - » systemctl poweroff
  - » poweroff
  - » shutdown -P

Boot Into Different Targets Manually

- A **target** is a Systemd unit of configuration that defines a grouping of services and configuration files the must be started when the system moves into the defined target.
  - » A grouping of dependencies starts when a target is called

- systemctl list-units --type=target • View all targets on system
- systemctl list-units --type=target --all • View all targets on disk
- Common targets:
  - » **emergency.target** • su login; mounts only the root filesystem, which is read-only
  - » **multi-user.target** • Support concurrent log ins of multiple users
  - » **rescue.target** • su login; basic Systemd init
  - » **graphical.target** • Support concurrent log ins of multiple users on a graphical interface
- systemctl get-default • Show default target
- systemctl set-default • Set default target
- Configuration files:
  - » */usr/lib/systemd/system*
  - » */etc/systemd/system*
- systemctl -t help • View unit configuration types
- systemctl status service • Find status of service
- systemctl --type=service • List configuration files of active services
- systemctl enable service • Enable service configuration to start at boot
- systemctl --failed • List failed services
- Select a different target at boot:
  - » Reboot system
  - » At Grub menu, press **E** to edit entry
  - » Go to *linux16* kernel and press **CTRL+E**
  - » Add systemd.unit=target.target
  - » **CTRL+X**

Interrupt Boot Process to Access System

- Start or reboot system
- Stop Grub autoselection
- Ensure the appropriate kernel is highlighted and press **E** to edit

- Navigate to the *linux16* line, press **E**
- Add line rd.break
- **CTRL+X**
- System boots into emergency mode
- Mount */sysroot* with read and write permissions
  - » mount -oremount, rw /sysroot
- Switch into chroot jail:
  - » chroot /sysroot
- Reset root password
- Clean up
  - » touch /.autorelabel
- exit
- exit

Identify CPU/Memory Intensive Processes, Adjust Priority, Kill Processes

- top
  - » k • Kill process
  - » q • Quit
  - » r • Renice
  - » s • Change update rate
  - » P • Sort by CPU usage
  - » M • Sort by memory usage
  - » l • Toggle load average
  - » t • Toggle task display
  - » m • Toggle memory display
  - » B • Bold display
  - » u • Filter by username

  - » -b • Start in batch mode
  - » -n • Number of updates before exiting
  - » Columns:
    - **PID** • Process ID
    - **USER**
    - **PR** • Priority
    - **RES** • Non-swap memory
    - **SHR** • Shared memory size
    - **%CPU** • Task's share of elapsed CPU time
    - **%MEM** • Current amount of used memory
    - **TIME+** • CPU time minus the total CPU time the task has used since starting
- Nice priority:
  - » **-20** • Highest priority
  - » **19** • Lowest priority
  - » Any user can make a task lower priority
- pgrep • Search processes
  - » -u • Username
  - » -l • Display process name
  - » -t • Define tty ID
  - » -n • Sort by newest
- pkill • Kill process
  - » -u • Kill process for defined user
  - » -t • Kill process for defined terminal
- Kill signals:
  - » **1** • SIGHUP • Configure reload without termination; also used to report termination of controlling process
  - » **2** • SIGINT • Cause program to terminate
  - » **3** • SIGQUIT • When user requests to quit a process

  - **9** • SIGKILL • Immediately terminate process
  - **15** • SIGTERM • Send request to terminate process; request can be interpreted or ignored
  - **18** • SIGCONT • Restart previously stopped process
  - **19** • SIGSTOP • Stop a process for later resumption
  - **20** • SIGTSTP • Send by terminal to request a temporary stop
- ps • Process status

Locate and Interpret System Log Files and Journals

- journald • Responsible for event logging; records events from log files, kernel messages, etc.
  - Data does not persist after reboot
  - Can be configured for persistence in */etc/journald.conf*
  - Temporary log location: */run/log/journal*
  - Persistent log location: */var/log/journal*
- journalctl
  - -n • Set number of lines to show
  - -x • Provide explanation text, if available
  - -f • Show last ten events; continues listening
  - -b • Show messages from current boot only
  - -p • Show message priority type
  - _SYSTEM_UNIT=service • Get events related to service
  - --since=yesterday • Get events since defined time
  - --until=00:00:00 • Get event from before defined time
- Find information about system boot:
  - systemd-analyze
  - systemd-analyze blame

List, Create and Delete Partitions

- fdisk • Used to create master boot record-based partitions
- gdisk • Used to create GPT-based partitions

Create and Remove Physical Volumes, Logical Volumes

- **Physical volume** • The physical disk or disks; can be a partition or whole volume
- **Volume group** • A combination of physical volumes that work as a logical volume, with pooled space

LVM Set Up

- pvcreate • Create physical volume
- pvdisplay • Show available physical volumes
- vgcreate name /dev/disks • Create volume group
- vgdisplay • Show available volume groups
- lvcreate • Create logical volume
  - » -n • Volume
  - » -L • Size in bytes
- lvremove /dev/vg/volume • Remove volume
- pvremove /dev/disk • Remove physical volume

Configure System to Mount File System at Boot

- mkfs -t xfs /dev/xvdf1 • Make file system
- blkid • List available block devices on system
- lsblk • List all attached block devices
- mount /dev/disk /mnt/mountlocation • Non-persistent mount
  - » Mounting with the UUID ensures the appropriate mount is used
  - » Add to */etc/fstab* to mount persistently
- tune2fs -L labelname /dev/disk • Mount with file system label (ext)
- e2label /dev/disk labelname • Mount with file system label (ext)

- xfs_admin -L labelname /dev/disk • Mount with file system label (XFS)
- mount LABEL=labelname /mnt/mountlocation defaults 1 1 • Mount with label, non-persistent; edit */etc/fstab* for persistence
- mount -a • Mount all file systems in */etc/fstab*
- umount -a • Unmount all file systems in */etc/fstab*

Schedule Tasks Using at and cron

- at • Execute command at a later time
  - » ***/etc/at.allow*** • Configure users permitted to use at command
  - » ***/etc/at.deny*** • Configure users **not** permitted to use at command
  - » Accepts following time/date formats:
    - hh:mm
    - midnight
    - noon
    - teatime (16:00)
    - am/pm
    - Full dates
    - now + time
- atrm • Remove pending at task
- anacron • Execute commands periodically
  - » -f • Force execution, ignoring timestamps
  - » -u • Upload timestamps of all jobs; does not run jobs
  - » -n • Run jobs immediately, ignoring delays
  - » -t • Use specified configuration file, instead of default
  - » -h • Show help
  - » ***/etc/anacrontab*** • Configuration file
  - » ***/var/spool/anacron*** • Shows all timestamps for jobs
  - » Only root and superusers can use acacron

- Syntax:
  - **period in days** - Frequency of execution
  - **delay in minutes** - Number of minutes to wait before job execution
  - **job-identifier** - Unique name of job used in log files
  - **command** - Command to execute
  - **start_hours_range** - Time frame when jobs can be run
  - **random_day** - Stagger job starts at random times

Configure System to Use Time Services

- timedatectl list-timezones - List all available time zones
- tzselect - Select appropriate time zone
- timedatectl set-timezone zone/location - Set time zone
- timedatectl set-time YYYY-MM-DD hh:mm:ss - Set time and date
- timedatectl set-ntp true - Use Network Time Protocol
- NTP can be managed by either ntpd or chronyd
  - Generally, ntpd is for servers, and chronyd is for systems with frequent restarts
  - chronyd is the default for RHEL7

Install and Update Software Packages

- yum - Package management tool
  - install packagename - Install package
  - search string - Search packages
  - search all string - Searches name, description and summary
  - list - List installed packages
  - list all - Listed installed and available packages
  - list installed - List installed and available packages
  - check-update - Lists packages with available updates
  - update packagename - Update defined package

  - » update • Update all packages with available updates
  - » info package • Provide information about package
  - » provides /some/directory • Displays packages that match path
  - » list kernel • List installed and available kernels
  - » remove packagename • Removes defined package
  - » history • Display summary of installations and removes
  - » history undo idnumber • Reverse a transaction
  - » Working with groups (packages of software):
    - yum grouplist • Show available groups to install
    - grouplist hidden • Show all available groups
    - groupinstall groupname • Install defined group
    - groupinfo groupname • Display all packages to be installed with the group
      - - • Package is not installed and will not be installed
      - = • Package is installed as part of group
      - + • Package is not installed, but will be installed at next update
      - No symbol means that the package is installed, but was not installed as part of the group
  - » ***/var/log/yum*** • Log file

Enable Third-Party Repositories

- yum repolist • List repository ID, name and number of packages available
  - » -v • List more information about repos
  - » all • Show all repos
- yum repoinfo • Show information about both enabled and disabled repos
- ***/etc/yum.repos.d/reponame.repo*** • Location of repositories
- yum-config-manager • Set repositories
  - » --enable reponame • Enable repo
  - » --disable reponame • Disable repo
  - » --add-repo repourl • Add repository from defined URL

RPM

- RPM Package Manager
- Always use yum when possible
- rpm
  - » -i • Install
  - » -v • Verbose
  - » -e • Remove package
  - » -h • Use hashmarks for progress
  - » -U • Upgrade to install package
  - » -F • Upgrade already-installed package
  - » -q • Query for a package
  - » -a • Display all packages
  - » -qa • Display installed files
  - » -ql • List files in installed package
  - » -qd • List documentation for package
  - » -qpl • List files in RPM package

Create, Delete and Modify Local User Accounts

- id • Print user and group IDs
- UID ranges:
  - » **0** • root
  - » **1-200** • System users for Red Hat processes
  - » **201-999** • System users for processed that do not own files
  - » **1000+** • Regular users
- ***/etc/passwd*** • User login and password information
- ***/etc/shadow*** • User login and password hash information
- **Primary group** • The main group for a user; all files created by a user are set under this group

- ***/etc/groups*** • Group member information
- getent group username • Show all groups for a user
- useradd • Create user
- usermod • Modify user
- userdel • Delete user

Change Password and Password Aging

- chage • Modify amount of days between password changes
  - » -d • Number of days since 1970-01-01 to define password change
  - » -E • Set password expiration date
  - » -I • Number of days of inactivity before password expiration
  - » -l • Show account aging information
  - » -m • Minimum number of days between password changes
  - » -M • Maximum number of days between password changes
  - » -W • Days of warning before password change

Create, Delete and Modify Groups

- groupadd • Add a group
  - » -g • Group ID
  - » -r • Create system group
- groupmod • Modify group
  - » -g • New group ID
  - » -n • New group name
- groupdel • Delete group
- chmod g+s directoryname • Set group permissions for directory, and all files created in that directory have the same permissions

Create, Mount, Unmount and Use VFAT, EXT4 and XFS File Systems

- **VFAT** - Extension of FAT file system, allowing log file names; often used in SAMBA shares or when sharing files between Linux and Windows computers
  - » mkfs.ext /dev/xvdf1 - Create VFAT file system at location
  - » mount /dev/xvdf1 /mnt/location - Mount file system
  - » fsck.vfat /dev/xvdf1 - Check for file system consistency
- **EXT4** - Common among Linux systems; journaling-based file system that can support up to 16TBs on Red Hat and up to 50TB in file system size
  - » mkfs.ext4 /dev/xvdf1 - Create EXT4 file system on device
  - » mount /dev/xvdf1 /mnt/location - Mount the file system at location
  - » fsck /dev/xvdf1 - Check for file system consistency
  - » dumpe2fs /dev/xvdf1 - Get details of file system
  - » tune2fs /L labelname /dev/xvdf1 - Label the device
- **XFS** - Known for parallel processing and high I/O throughput; journaled file system that supports up to 500TB file size on Red Hat 7 with 500TB in file system size
  - » mkfs.xfs /dev/xvdf1 - Create XFS file system on device
  - » mount /dev/xvdf1 /mnt/location - Mount file system at location
  - » xfs_repair /dev/xvdf1 - Check for file system consistency
  - » xfs_info /dev/xvdf1 - Get details of file system
  - » xfs_admin /L labelname /dev/xdf1 - Label the device