Red Hat System Administration I

Complete Quick Reference Guide

Ahmed Abdelwahed

Technical Trainer | Cloud & Infrastructure Specialist

Email	Blog	LinkedIn
ahmed@abdelwahed.me	www.abdelwahed.me	linkedin.com/in/ahmedmct

---

RHSA-I | Version 26.02 | www.abdelwahed.me

01. Access the Command Line

Linux Command Syntax

Every Linux command follows the structure: <cmd> [+- option] [argument]

Command / Option	Description
`<cmd>`	The executable program or script — e.g., ls, cd, echo
`[+- option]`	Flags that modify behavior. Single dash for short (-l), double dash for long (--help)
`[argument]`	Input or target for the command — e.g., ls -l /home (where /home is the argument)

Keyboard Shortcuts

Command / Option	Description
`Ctrl+C`	Interrupt (kill) the running command
`Ctrl+D`	Logout / send EOF
`Ctrl+U`	Clear line from cursor to beginning
`Ctrl+K`	Clear line from cursor to end
`Ctrl+A`	Move cursor to beginning of line
`Ctrl+E`	Move cursor to end of line
`Ctrl+W`	Delete one word backward
`Esc+D`	Delete next word forward
`Ctrl+L`	Clear the terminal screen
`Ctrl+R`	Reverse history search
`Ctrl+Alt+F2–F6`	Switch to virtual terminal tty2–tty6
`chvt 5`	Switch to virtual terminal 5
`pkill -9 -t tty4`	Send SIGKILL to all processes on tty4

NOTE Enable tab-completion: yum install bash-completion && source /etc/profile.d/bash_completion.sh

System Utility Commands

Date & Time

Command / Option	Description
`date`	Show current date and time
`$(date +%d-%m-%Y-%H:%M:%S)`	Format date output
`hwclock`	Show hardware clock
`hwclock --hctosys`	Set system clock from hardware clock
`hwclock --systohc`	Set hardware clock from system time

Command / Option	Description
`timedatectl list-timezones`	List all available time zones
`timedatectl set-timezone Asia/Muscat`	Set system time zone
`timedatectl set-ntp true/false`	Enable or disable NTP sync
`cal 6 1982`	Show calendar for June 1982

System Information

Command / Option	Description
`uptime`	Show how long system has been running and active users
`w`	Show uptime and logged-in users with activity
`watch -n 3 uptime`	Refresh uptime display every 3 seconds
`tty`	Show current terminal name
`whoami`	Print current effective username
`hostname / hostname -f`	Show system hostname
`hostname -I`	Show IPv4 address(es)
`uname -a`	Print kernel and OS details
`lscpu`	Show CPU architecture info
`lsmem / free -h`	Show memory status
`bc`	Launch scientific/binary calculator

Chrony NTP Configuration

Command / Option	Description
`vim /etc/chrony.conf`	Edit NTP config; add: server 192.168.100.100 iburst
`systemctl restart chronyd`	Restart the Chrony NTP daemon
`chronyc sources`	List current NTP sources
`ntpstat`	Show NTP daemon synchronization status

Aliases

Command / Option	Description
`alias cls='clear'`	Create alias 'cls' for the clear command
`alias update='sudo dnf update -y'`	Create an update alias
`alias ports='ss -tuln'`	Show listening ports with alias
`alias myip="ip a | grep inet"`	Quick IP display alias
`alias -p`	Print all current aliases
`unalias cls`	Remove the 'cls' alias
`unalias -a`	Remove ALL aliases
`\ls /  or  command ls /`	Run original command bypassing any alias

> **NOTE** To persist aliases, add them to ~/.bashrc then run: source ~/.bashrc

History & Command Recall

Command / Option	Description
`history`	List command history with line numbers
`history -c`	Clear history
`history -d 100`	Delete entry at line 100
`history -w`	Save current session history to ~/.bash_history
`cat ~/.bash_history`	View the saved history file
`!!`	Execute the last command
`!g`	Run last command starting with 'g'
`!$`	Use last argument from previous command
`!20`	Run command #20 from history
`^old^new`	Substitute 'old' with 'new' in previous command
`echo $HISTSIZE`	Show max commands kept in memory
`export HISTTIMEFORMAT="%F %T "`	Show timestamps in history

Filesystem Structure & Navigation

Command / Option	Description
`pwd`	Print working directory
`cd`	Go to home directory
`ls / ls -a / ls -lt / ls -lh`	List files; all; by time; human-readable sizes
`ls -ld /etc`	Show info about a directory (not its contents)
`ls -aF /etc`	Show all files with type indicators (/ for dirs)
`tree -L 2 / > system_structure.txt`	Export filesystem hierarchy to file
`man hier`	Manual page for filesystem hierarchy

File & Directory Management

Creating

Command / Option	Description
`mkdir -p par1/par2/dir`	Create nested directory structure
`touch f1 f2 f3`	Create multiple files
`touch "my file.txt"`	Create file with spaces in name

Viewing

Command / Option	Description
`cat -n /etc/passwd`	Display file with line numbers
`tac /etc/passwd`	Display file in reverse order
`less /etc/passwd`	Page through file (q to quit)
`diff file1 file2`	Compare two files and show differences
`tail -f /var/log/messages`	Follow a log file in real-time

Copying, Moving & Removing

Command / Option	Description
`cp -rvi file1 /media/file4`	Copy and rename with interactive prompts
`cp -f /etc/*.conf /home/data`	Copy all .conf files, overwriting existing
`dd if=/dev/sr0 of=/mnt/dvd.iso bs=1M`	Copy DVD content to ISO image
`mv file1 file2`	Rename a file
`mv file1 file2 file3 dir`	Move multiple files to a directory
`rm -r / rmdir`	Remove directory recursively
`shred passwd`	Securely destroy file content
`shred -u passwd`	Securely destroy and delete file

Text Filtering: grep, awk, sed, cut

grep & egrep

Command / Option	Description
`grep -e 'root' -e 'ahmed' /etc/passwd`	Search for multiple patterns
`egrep -i 'root|ahmed' /etc/passwd`	Extended regex multi-pattern search
`grep -i login$ /etc/passwd`	Lines ending with 'login'
`grep -irl 'error' /home`	Recursive case-insensitive search
`grep -v 'error' logfile.txt`	Exclude lines matching pattern
`grep -v '^$' file.txt`	Exclude empty lines
`cat /etc/passwd | grep -A 5 ahmed`	Show 5 lines after match

awk

Command / Option	Description
`ll | awk '{print $NF}'`	Print last field (filename) of each line
`awk -F: '{print $1}' /etc/passwd`	Print first field using ':' separator
`awk -F: '$3 > 1000 {print $1}' /etc/passwd`	Print usernames with UID > 1000
`ll | awk '{print $1, $NF}'`	Print permissions and filename

sed

Command / Option	Description
`sed 's/old/new/' file.txt`	Replace first occurrence of 'old' with 'new'
`sed -i 's/admin//g' passwd`	Remove all 'admin' occurrences in-place
`sed -i '/^user1/d' /etc/sudoers`	Delete lines starting with 'user1'
`sed -n '3p' file.txt`	Print only line 3
`sed -n '5,10p' file.txt`	Print lines 5–10
`sed '3i New line here' file.txt`	Insert before line 3
`sed '3a Goes after line 3' file.txt`	Append after line 3
`sed -i '/^$/d' passwd`	Delete all blank lines
`sed -e 's/foo/bar/' -e 's/linux/unix/' file.txt`	Multiple sed operations

cut, sort & uniq

Command / Option	Description
`cut -c 1-5 filename.txt`	Extract first 5 characters from each line
`cut -d: -f1 /etc/passwd`	Extract usernames using ':' delimiter
`cut -d: -f1-3 /etc/passwd`	Extract first 3 fields
`sort file1`	Sort alphabetically
`sort -r file1`	Sort in reverse order
`sort -k2 /etc/passwd`	Sort by second field
`sort file1 | uniq`	Sort and remove duplicates
`sort file1 | uniq -c`	Count occurrences of each duplicate

xargs

Command / Option	Description
`ls | xargs rm`	Delete files from ls output
`find /tmp -name '*.log' | xargs rm -v`	Find and delete log files
`ls *.txt | xargs wc -l`	Count lines in all .txt files

Wildcards

Command / Option	Description
`*`	Match any number of characters (including none)
`?`	Match exactly one character
`[]`	Match any character inside brackets — e.g., [ab]
`{}`	Alternative patterns — e.g., file{1..5}
`!`	Negate pattern — matches files NOT matching
`touch file0{1..9}`	Create 9 files: file01 to file09

Command / Option	Description
`touch dir{1..10}/file{1..100}`	Create 100 files in each of 10 directories

I/O Redirection

stdout (Standard Output)

Command / Option	Description
`>`	Redirect stdout to file (overwrite)
`>>`	Append stdout to file
`df -h > diskfree`	Redirect disk usage to file
`ls -l | tee out.txt`	Display and write to file simultaneously
`ls -l | tee -a out.txt`	Display and append to file

stderr (Standard Error)

Command / Option	Description
`2>`	Redirect stderr to a file
`&>`	Redirect both stdout and stderr to same file
`(cal 2010; 111) >op.txt 2>err.txt`	Separate stdout and stderr to different files
`cmd 2>/dev/null`	Suppress error output

stdin (Standard Input)

Command / Option	Description
`<`	Redirect stdin from a file
`|`	Pipe output of one command into another
`cat < /etc/passwd`	Redirect file as stdin
`ls /etc | grep '.conf'`	Filter command output with pipe

02. Get Help in Red Hat Enterprise Linux

Command Discovery Tools

Command / Option	Description
`whatis ls`	Show brief description of a command
`mandb`	Rebuild manual database (if whatis fails)
`whereis ls`	Locate binary, source, and manual pages
`whereis -b cat`	Find binary files of cat
`whereis -m cat`	Find manual pages of cat
`which ls`	Show full path to a command
`ls --help`	Display usage summary for a command

man — Manual Pages

man has 9 sections. Use man [section] [topic] to access specific sections.

Command / Option	Description
`man ls`	Open manual page for ls
`man 5 crontab`	Open section 5 of crontab manual
`man -K 'copy files'`	Global keyword search across all man pages
`man useradd | grep -i -A 20 ^files`	Find FILES section in useradd manual

man Navigation Keys

Command / Option	Description
`g or p`	Jump to beginning
`Shift+G`	Jump to end
`q`	Quit man page
`/`	Search forward
`?`	Search backward
`n / N`	Next / previous search match
`100g`	Jump to line 100
`Space`	Scroll one page forward

info — Extended Documentation

Command / Option	Description
`info vim`	View detailed info for vim
`info ls`	View info pages for ls

info pages provide more detail than man. Navigate with Space (next), Backspace (prev), u (up), s (search).

Vim Text Editor

Vim Modes Overview

Vim has three primary modes: Normal (navigation), Insert (editing), and Execute/Command (save/quit).

Entering Insert Mode

Command / Option	Description
`i`	Insert before cursor
`a`	Insert after cursor
`o`	Open new line below and enter insert
`O`	Open new line above and enter insert
`I`	Insert at start of line
`A`	Insert at end of line

Navigation (Normal Mode)

Command / Option	Description
`h / l / j / k`	Move left / right / down / up
`w / b`	Jump to next / previous word
`$ / 0 / ^`	End / beginning / first non-blank of line
`gg / G`	Go to top / bottom of file
`100g`	Go to line 100

Copy, Paste & Delete

Command / Option	Description
`yl / yw / yy`	Copy letter / word / line
`20yy`	Copy 20 lines
`p / P`	Paste below / above cursor
`dl / dw / dd`	Delete letter / word / line
`20dd`	Delete 20 lines
`d$ / dG`	Delete to end of line / end of file

Execute Mode Commands

Command / Option	Description
`:wq or :x`	Save and exit
`:q!`	Force quit without saving
`:%d`	Delete all lines
`:g/error/d`	Delete all lines containing 'error'
`%s/install/config/gc`	Replace with confirmation (interactive)
`:earlier 5m`	Go 5 minutes back in edit history

Command / Option	Description
`:later 1m`	Move 1 minute forward in edit history
`:X`	Encrypt file with password

Visual Mode

Command / Option	Description
`Ctrl+V > Shift+I > # > Esc`	Comment multiple lines
`Ctrl+V > y`	Copy multiple lines
`Ctrl+V > d`	Delete multiple lines

Vim Configuration (~/.vimrc)

```
set number        # Show line numbers
set ignorecase    # Case-insensitive search
set hlsearch      # Highlight search results
set smartcase     # Smart case matching
```

NOTE For global vim settings, edit /etc/vimrc. To view without editing: vim -R /etc/passwd

03. Manage Local Users and Groups

Understanding User Identity

Command / Option	Description
`id`	Show current user UID, GID, and groups
`id test1`	Show UID, GID, and groups for 'test1'

`UID 0`	Root — full system access
`UID 1–999`	System/service accounts
`UID 1000+`	Regular user accounts (default starting ID)
`GID`	Primary (private) Group ID — usually matches UID
`Groups`	Secondary groups for additional file access permissions

Creating & Managing Users

useradd Command

Command / Option	Description
`useradd user1`	Create user with all defaults
`useradd -c 'Full Name' -u 5002 -M -N -g user1 -G sales,hr -s /bin/sh ahmed`	Full custom user creation
`useradd -D`	View or change useradd defaults

useradd Options Reference

Command / Option	Description
`-c 'comment'`	Set comment / full name for the user
`-u UID`	Set specific User ID
`-M`	Do NOT create a home directory
`-N`	Do NOT create a group with the username
`-g group`	Set primary group
`-G group1,group2`	Add to supplementary groups
`-s /bin/sh`	Set default login shell
`-d /home/dir`	Set custom home directory

Password Management

Command / Option	Description
`passwd user1`	Set/change password for user1
`passwd -S ahmed`	Show password status for ahmed
`pwscore`	Check password quality (0–100 score)

Command / Option	Description
`pwunconv / pwconv`	Move passwords between /etc/passwd and /etc/shadow

Password Aging with chage

Command / Option	Description
`chage -l ahmed`	View password aging info for ahmed
`chage -d 0 user1`	Force password change at next login
`chage -M 42 user1`	Set password maximum age to 42 days
`chage -m 2 user1`	Set minimum 2 days before password can change
`chage -W 4 user1`	Warn user 4 days before expiry
`chage -E 2025-12-31 user1`	Set account expiration date

User Account Operations

Command / Option	Description
`usermod -L ahmed`	Lock user account
`usermod -U ahmed`	Unlock user account
`chsh -s /sbin/nologin ahmed`	Set non-interactive shell (block login)
`userdel -r ahmed`	Delete user and home directory
`newusers users.txt`	Create users in bulk from formatted text file

NOTE newusers format: LoginName:Password:UID:GID:Comment:home_dir:Shell

Managing Local Groups

Command / Option	Description
`groupadd sales`	Create 'sales' group
`groupadd -g 555 admins`	Create group with specific GID 555
`groupmod -n finance sales`	Rename 'sales' group to 'finance'
`groupmod -g 1100 hr`	Change GID of 'hr' group to 1100
`groupdel finance`	Remove the finance group

Group Membership Management

Command / Option	Description
`usermod -g wheel ahmed`	Change primary group to wheel
`usermod -aG wheel ahmed`	Add wheel as supplementary group (keep others)
`usermod -aG wheel,admins ahmed`	Add multiple supplementary groups
`newgrp wheel`	Switch current session's primary group to wheel
`gpasswd -a user01 wheel`	Add user01 to wheel group
`gpasswd -d user01 sales`	Remove user01 from sales group

Command / Option	Description
`gpasswd -M u1,u2,u3 sales`	Explicitly set members of sales group
`gpasswd -A user01 sales`	Set user01 as admin of sales group

Querying Group Info

Command / Option	Description
`groups ahmed`	List groups for ahmed
`groupmems -lg wheel`	List members of wheel group
`lid ahmed`	List groups associated with ahmed
`lid -g wheel`	Display members of wheel group
`getent group sales`	Query group database for sales

Sudo & Privilege Escalation

Command / Option	Description
`visudo`	Safely edit /etc/sudoers
`usermod -aG wheel ahmed`	Grant sudo via wheel group membership
`echo 'user4 ALL=(ALL) NOPASSWD:ALL' > /etc/sudoers.d/user4`	Grant passwordless sudo

> **NOTE** Files in /etc/sudoers.d/ take precedence over visudo entries. Set timestamp_timeout=-1 to disable sudo timeout.

Key Configuration Files

Command / Option	Description
`/etc/passwd`	User accounts and login info (world-readable)
`/etc/shadow`	Encrypted passwords and aging info (root-only)
`/etc/group`	Group definitions and memberships
`/etc/gshadow`	Secure group account information
`/etc/login.defs`	Default values for useradd, password rules, UID/GID ranges
`/etc/default/useradd`	Default settings for useradd command
`/etc/security/pwquality.conf`	Password quality rules (complexity, length)
`/etc/sudoers`	Sudo privilege definitions
`/etc/sudoers.d/`	Drop-in sudo rules directory

04. Control Access — File System Permissions

Permission Basics

Permissions are checked in order: user → group → others. Once matched, no further checks occur.

Permission	Octal	On File	On Directory
`Read (R)`	4	View with cat, less, more	List with ls
`Write (W)`	2	Modify with echo, vim	Create/remove with mkdir, rm
`Execute (X)`	1	Run script or program	cd into the directory
`No access`	0		

> **NOTE** Common permission values: 755 = rwxr-xr-x (owner full, others read+execute) | 644 = rw-r--r-- (owner read+write, others read-only)

Viewing Permissions

Command / Option	Description
`ls -l file01`	Show file permissions in long format
`stat file01`	Show full metadata including numeric permissions
`stat -c %A file01`	Show symbolic permissions only
`stat -c %a file01`	Show numeric (octal) permissions only

Modifying Permissions (chmod)

Symbolic Mode

Command / Option	Description
`chmod u+x file01`	Add execute for owner
`chmod g-w file01`	Remove write from group
`chmod o+r file01`	Add read for others
`chmod a+x file01`	Add execute for all (owner+group+others)
`chmod u=r,g=rw,o=rwx file01`	Set exact permissions symbolically
`chmod uo+x,g-w file01`	Multiple changes at once

Numeric Mode

Command / Option	Description
`chmod 755 file01`	rwxr-xr-x — full owner, read+exec for others
`chmod 644 file01`	rw-r--r-- — standard file permissions
`chmod 777 file01`	rwxrwxrwx — full access all (use with caution)
`chmod 400 file01`	r-------- — read-only for owner only

Command / Option	Description
`chmod -R 755 /dir`	Recursively apply permissions

Managing Default Permissions (umask)

Command / Option	Description
`umask`	Show current umask value
`umask 022`	Set umask (default: 022 — files=644, dirs=755)
`umask 0`	Set umask to 0000 (no masking)

NOTE Default permissions: Files = 0666, Directories = 0777. umask is subtracted from these defaults. To persist, add to /etc/bashrc (all users) or ~/.bashrc (current user).

Managing File Ownership (chown / chgrp)

Command / Option	Description
`chown user1 file01`	Change file owner to user1 (root only)
`chgrp sales file01`	Change group owner to sales
`chown user1:sales file01`	Change both owner and group
`chown -R user1:sales ./`	Recursively change owner and group
`ls -ldn dir1`	View numeric user and group IDs for directory

Special Permissions

Command / Option	Description
`chmod u+s file`	Set SUID — file runs with owner's privileges
`chmod g+s dir`	Set SGID — new files in dir inherit group
`chmod +t dir`	Set Sticky Bit — only owner can delete files
`chmod 4755 file`	SUID + rwxr-xr-x (numeric)
`chmod 2755 dir`	SGID + rwxr-xr-x (numeric)
`chmod 1777 dir`	Sticky + rwxrwxrwx (numeric, like /tmp)

Auditing Permission Changes

Command / Option	Description
`yum install audit`	Install the audit package
`systemctl enable --now auditd`	Enable and start the audit daemon
`auditctl -w /day2 -p a -k day2_permission_change`	Watch directory for permission changes
`ausearch -k day2_permission_change`	Search audit logs by tag
`echo '-w /day2 -p a -k tag' >> /etc/audit/rules.d/audit.rules`	Make audit rule persistent

05. File Links & the find Command

Hard Links vs Symbolic Links

Property	Hard Link	Symbolic (Soft) Link
Inode	Same inode as original	Different inode number
Appearance	Looks like a regular file	Shows path to original (ls -l)
Cross-filesystem	No — same filesystem only	Yes — can cross filesystems
If original deleted	Data still accessible	Becomes dangling link
For directories	Not allowed	Allowed
Creation	ln source target	ln -s source target

`ln /etc/passwd /root/passwd_hard`	Create hard link
`ln -s /etc/passwd /root/passwd_sym`	Create symbolic link
`ls -li /root/`	View inode numbers to confirm link type

Using the find Command

Search by Name

`find / -name 'file*'`	Find files matching name pattern
`find /etc -name '*.conf'`	Find all .conf files in /etc

Search by Type

Command / Option	Description
`find /tmp -type d -empty`	Find empty directories in /tmp
`find / -type f -name '*.mp3'`	Find all MP3 files
`find / -type l`	Find all symbolic links

Search by Size

Command / Option	Description
`find / -size +1G`	Find files larger than 1 GB
`find / -size +100M -size -500M`	Find files between 100MB and 500MB

Search by Permissions & Ownership

Command / Option	Description
`find / -type f -perm 644`	Find files with exact 644 permissions
`find / -type f -perm /4000`	Find files with SUID set
`find /tmp -user root`	Find files owned by root in /tmp
`find / -type f ! -perm 777`	Find files that do NOT have 777 permissions

Search by Time

Command / Option	Description
`find / -mtime 1`	Modified exactly 1 day ago
`find / -mtime -1`	Modified within the last 24 hours
`find / -mtime +7`	Modified more than 7 days ago
`find / -mmin -10`	Modified within the last 10 minutes
`find / -atime -5 2>/dev/null`	Accessed within last 5 days (suppress errors)

find with -exec (Actions)

Command / Option	Description
`find /usr/share/doc -name '*.html' -exec cp {} . \;`	Copy all HTML files to current dir
`find /root -type f -perm 0777 -exec chmod 500 {} \;`	Find 777 files and change to 500
`find / -type f -name '*.mp3' -size +10M -delete`	Delete MP3 files > 10MB
`find /root/d1 -type f -perm 644 -exec cp {} /root/d2 \; -exec chmod 666 {} \;`	Copy and chmod in one find

locate — Fast File Search

Command / Option	Description
`locate filename`	Fast search using pre-built database
`updatedb`	Rebuild locate database (must run before using locate)
`locate -i filename`	Case-insensitive search

> **NOTE** locate is faster than find but uses a database that may be outdated. Always run updatedb first for accuracy.

06. Monitor and Manage Linux Processes

Inspecting Processes (ps)

Command / Option	Description
`ps aux`	Detailed info on all running processes
`ps -elf`	Long-format with parent PIDs (PPID)
`ps -fU ahmed`	All processes owned by ahmed
`ps aux | grep http`	Find HTTP-related processes
`ps fax | less`	Tree view of processes with children
`ps -eo pid,ppid,uid,cputime,pmem,cmd`	Custom column output
`watch ps aux --sort=-%cpu | head -n 10`	Live top 10 CPU consumers
`ps aux --sort=-%mem | head -n 10`	Top 10 memory consumers

Foreground & Background Jobs

Command / Option	Description
`sleep 1000 &`	Start command in background
`jobs`	List background jobs in current session
`fg`	Bring last background job to foreground
`fg 1`	Bring job #1 to foreground
`bg`	Resume last stopped job in background
`Ctrl+Z`	Suspend current foreground process

Querying & Finding Processes

Command / Option	Description
`pgrep sleep`	Find PIDs of processes named 'sleep'
`pgrep --count sleep`	Count running 'sleep' processes
`ps p $(pgrep sleep)`	Show details of found PIDs
`lsof -i`	List all files open by network processes
`lsof -i :22`	List processes using port 22

Terminating Processes

kill Signals

Command / Option	Description
`kill 8537 or kill -15 8537`	Soft kill — SIGTERM (graceful shutdown request)
`kill -9 8537 or kill -SIGKILL 8537`	Hard kill — SIGKILL (forced, immediate)

Command / Option	Description
`kill 1234 5678 4321`	Kill multiple PIDs at once
`pkill sleep`	Send TERM to all 'sleep' processes by name
`pkill -KILL -u user`	Force-kill all processes owned by user
`killall sshd`	Send TERM to all sshd processes

Real-Time Monitoring (top / htop)

top Interactive Commands

Command / Option	Description
`f`	Add/remove display fields (e.g., PPID)
`z`	Toggle color display
`k`	Kill a process (enter PID when prompted)
`r`	Renice a process
`1`	Toggle per-CPU display
`i`	Show only active processes
`q`	Quit top
`dnf install htop`	Install htop (EPEL required)

Process Priority (nice / renice)

Nice values range from -20 (highest priority) to +19 (lowest priority). Default is 0.

Command / Option	Description
`nice -n 5 dd if=/dev/zero of=/dev/null &`	Start dd with lower priority (+5)
`nice -n -5 dd if=/dev/zero of=/dev/null &`	Start dd with higher priority (-5, root only)
`renice -n 10 -p 14721`	Change priority of running process PID 14721

NOTE Only root can set negative nice values. Set default nice in /etc/security/limits.conf: user hard priority 7

User Session Management

Command / Option	Description
`loginctl list-sessions`	List all active sessions
`loginctl terminate-session 4`	Terminate session ID 4
`loginctl list-users`	List all logged-in users
`loginctl terminate-user ahmed`	Kill all sessions for user ahmed
`loginctl user-status 1000`	Check status of user with UID 1000
`chvt 3`	Switch to virtual terminal 3

Stress Testing Tools

Command / Option	Description
`stress --cpu 2 --timeout 600`	Load 2 CPU cores for 10 minutes
`stress --vm 2 --vm-bytes 1024M --timeout 60`	Consume 1GB RAM for 60 seconds
`stress --hdd 2 --timeout 60`	Stress disk with 2 workers for 60 seconds
`yes > /dev/null &`	Quick CPU stress (single core)

07. Control Services and Daemons

systemctl — Service Management

Query & Status

Command / Option	Description
`systemctl -t help`	Show available unit types
`systemctl list-units`	List all loaded units
`systemctl list-unit-files --type=service`	List all service unit files
`systemctl list-units --type=service --state=inactive`	List inactive services
`systemctl status sshd.service`	Check status of sshd
`systemctl --type=service | grep active | wc -l`	Count active services
`systemctl is-active sshd`	Quick check if sshd is active
`systemctl is-enabled sshd`	Check if sshd starts at boot
`systemctl --failed --type=service`	List all failed services

Start, Stop & Restart

Command / Option	Description
`systemctl start sshd`	Start sshd
`systemctl stop sshd`	Stop sshd
`systemctl restart sshd`	Restart sshd (full stop then start)
`systemctl reload sshd`	Reload config without stopping service
`systemctl reload-or-restart sshd`	Reload if supported, otherwise restart

Enable & Disable at Boot

Command / Option	Description
`systemctl enable sshd`	Start sshd automatically at boot
`systemctl disable sshd`	Prevent sshd from starting at boot
`systemctl enable --now sshd`	Enable and start immediately

Masking Services

Command / Option	Description
`systemctl mask name.service`	Prevent service from being started (even manually)
`systemctl unmask name.service`	Remove mask
`systemctl list-unit-files --state=masked`	List all masked services

Inspect & Customize

Command / Option	Description
`systemctl cat httpd`	Show unit file configuration
`systemctl show httpd`	Show all properties of a unit
`systemctl edit httpd`	Create/edit override file for unit
`systemctl list-dependencies sshd`	Show dependency tree
`systemctl daemon-reload`	Reload systemd config after editing unit files

NOTE System unit files are in /usr/lib/systemd/system/. Override files go in /etc/systemd/system/. Edit ~/.bash_profile or /etc/environment to set default editor: export EDITOR=/usr/bin/vim

08. Configure and Secure SSH

Installation & Initial Setup

Command / Option	Description
`dnf whatprovides '*/sshd'`	Find which package provides sshd
`dnf install openssh`	Install OpenSSH
`systemctl enable --now sshd`	Enable and start SSH daemon

Changing SSH Port (example: port 1414)

```
1  Edit /etc/ssh/sshd_config — set Port 1414
2  firewall-cmd --add-port=1414/tcp --permanent && firewall-cmd --reload
3  semanage port -a -t ssh_port_t -p tcp 1414
4  systemctl restart sshd
5  semanage port -l | grep sshd  — verify
```

SSH Security Hardening

Edit /etc/ssh/sshd_config and set the following:

Command / Option	Description
`LoginGraceTime 3`	Restrict authentication window to 3 minutes
`PermitRootLogin no`	Disable direct root login via SSH
`PasswordAuthentication no`	Disable password auth (key-only)
`ChallengeResponseAuthentication no`	Disable challenge-response auth
`UsePAM no`	Disable PAM authentication
`MaxAuthTries 3`	Limit to 3 failed authentication attempts

NOTE After any sshd_config change: systemctl reload sshd To set session inactivity timeout, add to /etc/profile: export TMOUT=120

SSH Key-Based Authentication

```
1  ssh-keygen -t ed25519  — Generate key pair (stores in ~/.ssh/)
2  cat ~/.ssh/id_ed25519.pub  — View public key
3  ssh-copy-id -i ~/.ssh/id_ed25519.pub user@remotehost  — Copy key to server
4  ssh user@remotehost  — Test key-based login
```

NOTE Private key: ~/.ssh/id_ed25519 (keep secret) Public key: ~/.ssh/id_ed25519.pub (copy to servers) Ed25519 is the recommended key type — it's fast and secure.

09. Linux System Logs Monitor Guide

Key Log File Locations

System Logs

Command / Option	Description
`/var/log/messages`	General system messages — first place to check when troubleshooting
`/var/log/boot.log`	System boot process messages
`/var/log/kern.log`	Kernel messages — hardware and driver issues
`/var/log/secure`	Authentication logs — logins, sudo, SSH
`/var/log/cron`	Scheduled task execution logs (cron/at)
`/var/log/utmp / wtmp`	Current/historical login sessions (used by who, last)

Application & Service Logs

Command / Option	Description
`/var/log/maillog`	Mail server activity (Postfix/Sendmail)
`/var/log/httpd/`	Apache: access.log (requests) + error.log (errors)
`/var/log/mysqld.log`	MySQL errors, warnings, startup
`/var/log/yum.log`	Package manager history

Viewing & Searching Logs

Command / Option	Description
`tail -f /var/log/secure`	Follow a log file in real-time
`less +G /var/log/secure`	Open file at the bottom (most recent)
`less +/fail /var/log/secure`	Jump to first occurrence of 'fail'
`grep -c 'error' /var/log/messages`	Count lines containing 'error'
`grep -i 'failed' /var/log/secure | tail -20`	Recent failed login attempts
`sosreport`	Collect system logs and diagnostics for support

rsyslog — System Logging Service

rsyslog controls how log messages from various sources are collected, filtered, and stored.

Concept	Description
Facilities	Log categories: auth, cron, daemon, kern, mail, user, local0–local7
Priorities	Severity levels: emerg > alert > crit > err > warning > notice > info > debug
Destinations	Where logs go: files, remote syslog servers, console

Sample rsyslog Configuration

```
# /etc/rsyslog.conf or /etc/rsyslog.d/custom.conf
*.warn  /var/log/warnings
*.err   /var/log/errors
auth.warning  /var/log/auth_warnings
```

`systemctl restart rsyslog`	Apply configuration changes
`logger -p auth.warning 'Test login warning'`	Generate a test log entry

Log Rotation with logrotate

logrotate prevents logs from growing indefinitely by rotating, compressing, and deleting old files.

```
/var/log/secure { rotate 7  daily  missingok  compress  postrotate  /bin/systemctl reload rsyslog  endscript }
```

logrotate Options Reference

Command / Option	Description
`rotate N`	Keep N rotated copies before deleting
`daily / weekly / monthly`	Rotation frequency
`size 1M`	Rotate when file exceeds 1MB
`compress`	Compress rotated logs with gzip
`compresscmd /usr/bin/xz`	Use xz instead of gzip
`dateext`	Add date stamp to rotated filenames
`missingok`	No error if log file is missing
`postrotate / endscript`	Run command after rotation (e.g., reload service)

Command / Option	Description
`logrotate -d /etc/logrotate.conf`	Dry run — preview what would be rotated
`logrotate -f /etc/logrotate.conf`	Force immediate rotation

10. Managing Red Hat Enterprise Linux Networking

Basic IP Commands

Command / Option	Description
`ip a or ip addr show`	Show all network interfaces and addresses
`ip a show eth0`	Show details for eth0 interface
`ip -6 a`	Show IPv6 addresses
`ip link set eth0 down/up`	Disable or enable network interface
`ip addr add 192.168.1.100/24 dev eth0`	Assign temporary IP address
`ip r show or ip route show`	Show routing table
`ip route add 172.16.1.0/24 via 192.168.1.1`	Add temporary route
`ip n show`	Show ARP/neighbor table
`tracepath www.google.com`	Trace network path to host

Network Diagnostics

Command / Option	Description
`ping -c 5 www.google.com`	Send 5 pings to google.com
`ping -I eth0 www.yahoo.com`	Ping via specific interface
`tracepath www.google.com`	Trace route to destination
`tcpdump -i eth0 port 22`	Capture SSH traffic on eth0
`netstat -tupln or ss -tunap`	Show listening ports and connections
`netstat -r`	Show routing table (netstat)
`nmap -p 80 192.168.1.1`	Scan specific port on host
`nmap 192.168.1.1-100`	Scan range of hosts
`dig yahoo.com`	DNS query for yahoo.com
`dig mx yahoo.com`	Query MX (mail) records
`dig @1.1.1.1 yahoo.com`	Query using specific DNS server
`host -t MX yahoo.com`	Show mail server for domain
`dnf install bind-utils`	Install DNS tools (dig, host, nslookup)

nmcli — Network Manager CLI

Viewing Connections

Command / Option	Description
`nmcli d s or ip link`	Show all network devices

Command / Option	Description
`nmcli connection show`	List all connections
`nmcli connection show --active`	List only active connections
`nmcli device status`	Show device status

Managing Connections

Command / Option	Description
`nmcli connection add con-name newcon1 ifname ens224 ipv4.addresses 192.168.1.10/24 ipv4.gateway 192.168.1.1 ipv4.dns 1.1.1.1 ipv4.method manual type ethernet`	Add static IP connection
`nmcli con add type ethernet con-name newcon2 ifname ens224 ipv4.method auto`	Add DHCP connection
`nmcli connection modify 'ens160' ipv4.addresses '192.168.1.111/24' ipv4.gateway '192.168.1.1' ipv4.dns '1.1.1.1' ipv4.method manual autoconnect yes`	Modify existing connection
`nmcli connection up 'newcon1'`	Activate connection
`nmcli connection down newcon1`	Deactivate connection
`nmcli connection reload`	Reload all connections
`nmcli device disconnect eth0`	Disable NIC
`nmcli device connect eth0`	Enable NIC
`nmtui`	Launch graphical terminal network manager

Network Configuration Files

Command / Option	Description
`/etc/hostname`	System hostname
`/etc/hosts`	Static hostname-to-IP mappings
`/etc/resolv.conf`	DNS name server configuration
`/etc/sysconfig/network`	Global network settings
`/etc/NetworkManager/system-connections/`	Per-interface NM connection profiles (current location)
`systemctl restart NetworkManager`	Apply NetworkManager configuration changes

> **NOTE** Network config files moved from /etc/sysconfig/network-scripts/ifcfg-* to /etc/NetworkManager/system-connections/ in RHEL 8+

File Transfer & Downloads

Command / Option	Description
`wget [url]`	Download file from URL
`curl -O www.site.com/filename`	Download file (alternative to wget)

Command / Option	Description
`curl www.google.com`	Check if website is accessible
`scp file.txt user@host:/path/`	Secure copy to remote host
`rsync -avz src/ user@host:/dst/`	Sync directories over SSH

11. Archiving and Transferring Files

tar — Tape Archive

Basic Archiving

Command / Option	Description
`tar cvf home.tar /home/`	Create archive of /home directory
`tar cvf etc.tar /etc/`	Archive /etc directory
`file home.tar`	Check archive file type
`tar -tf etc.tar | grep rsyslog`	List/search archive contents

Extraction

Command / Option	Description
`tar xvf home.tar`	Extract in current directory
`tar xvf home.tar -C /mnt/`	Extract to specific directory
`tar xpvf home.tar -C /mnt/`	Extract preserving original permissions

Compression with tar

Type	Create	Extract	Notes
`gzip (-z)`	`tar -zcvf archive.gz /home/`	`tar -zxvf archive.gz -C /save`	Fast, widely supported
`bzip2 (-j)`	`tar -jcvf archive.tar.bz2 /home/`	`tar -jxvf archive.bz2 -C /save`	Better compression than gzip
`xz (-J)`	`tar -Jcvf archive.xz /home/`	`tar -Jxvf archive.xz -C /save`	Best compression ratio

`tar -Jcvf "$(date +%d-%m-%Y-%H:%M:%S)-etc.xz" /etc`	Create timestamped backup
`* * * * * /usr/bin/tar -Jcf /backup/etc-$(date +\%d-\%m-\%Y).xz /etc`	crontab scheduled backup

Standalone Compression Tools

gzip

Command / Option	Description
`gzip arch.tar`	Compress file with gzip
`gunzip arch*`	Decompress gzip files
`zcat file.gz`	Read compressed file without extracting
`zless file.gz`	Page through compressed file

bzip2

Command / Option	Description
`bzip2 file`	Compress file with bzip2
`bunzip2 file.bz2`	Decompress bzip2 file

xz

Command / Option	Description
`xz passwd`	Compress single file
`xz -k passwd`	Compress while keeping original
`xz f1.txt f2.txt f3.txt`	Compress multiple files
`xz -d passwd.xz`	Decompress xz file
`unxz -k passwd.xz`	Decompress while keeping .xz file
`xz -l passwd.xz`	Show compression info
`xzcat passwd.xz`	View without decompressing
`xz -k6ev centos7.iso`	Keep source, verbose, extreme mode, level 6

12. Installing and Updating Software in Red Hat

Red Hat Subscription Manager

```
1  subscription-manager register --username user111 --password pass123 --auto-attach --force
2  subscription-manager remove --all  (remove subscriptions)
3  subscription-manager unregister  (unregister system)
4  subscription-manager clean  (clean cached data)
```

Repository Management

EPEL & Repository Commands

Command / Option	Description
`dnf install epel*`	Install EPEL (Extra Packages for Enterprise Linux)
`dnf clean all`	Clear cached packages and metadata
`dnf repolist`	Show all enabled repositories
`dnf repolist all`	Show all repositories (enabled + disabled)
`dnf config-manager --set-enabled epel`	Enable EPEL repository
`dnf config-manager --set-disabled epel`	Disable EPEL repository
`dnf config-manager --add-repo='file:///repo/BaseOS'`	Add a repository

Creating a Local Repository

```
mkdir /mnt/repos && cp -r /mnt/dvd/AppStream/ /mnt/repos/ && cp -r /mnt/dvd/BaseOS/ /mnt/repos/
```

Create /etc/yum.repos.d/local.repo with the following content:

```
[LocalBaseOS] name=Local BaseOS baseurl=file:///mnt/repos/BaseOS enabled=1 gpgcheck=0  [LocalAppStream] name=Local AppStream baseurl=file:///mnt/repos/AppStream enabled=1 gpgcheck=0
```

dnf Package Manager

Package Queries

Command / Option	Description
`dnf list installed`	List all installed packages
`dnf list available`	List packages available to install
`dnf info httpd`	Show detailed info about httpd package
`dnf search all 'web server'`	Search packages by keyword
`dnf provides bash`	Find which package provides 'bash'

Command / Option	Description
`dnf repoquery --whatprovides webserver`	Query what provides a feature
`dnf deplist httpd`	Show dependencies for httpd
`dnf list | wc -l`	Count total available packages

Package Installation & Removal

Command / Option	Description
`dnf install nmap -y`	Install nmap (auto-confirm)
`dnf install httpd tree nmap`	Install multiple packages
`dnf remove httpd`	Remove httpd package
`dnf update`	Update all packages
`dnf update kernel`	Update only the kernel
`dnf check-update`	Check for available updates
`dnf download httpd`	Download package without installing
`dnf download --resolve httpd`	Download package with all dependencies
`dnf localinstall /path/*.rpm`	Install from local RPM files
`yum install nginx --disablerepo=* --enablerepo=LocalRepo`	Install from specific repo only

Transaction History

Command / Option	Description
`dnf history`	Show package management history
`dnf history info 21`	View details of transaction #21
`dnf history undo 21`	Undo transaction #21
`dnf history rollback 21`	Roll back system to state before transaction #21