Linux Commands Detailed Guide — Advanced Commands Added

This supplement adds advanced system, networking, security, debugging, filesystem, and container commands across major distributions.

Advanced systemd & Services

Command: systemctl

Description: Manage systemd services and units

Example:

```
sudo systemctl status nginx sudo systemctl start nginx sudo systemctl enable nginx
```

Command: journalctl

Description: Query and follow systemd journal logs

Example:

```
sudo journalctl -u nginx.service --since '2025-01-01' -f
```

Command: systemd-analyze

Description: Analyze boot performance

Example:

```
systemd-analyze blame systemd-analyze critical-chain
```

Command: loginctl

Description: Manage user logins and sessions

Example:

```
loginctl list-sessions
```

Kernel & Modules

Command: uname -r

Description: Show kernel release

Example:

```
uname -r
```

Command: modprobe

Description: Insert or remove kernel modules

Example:

```
sudo modprobe overlay sudo modprobe -r dummy
```

Command: lsmod

Description: List loaded kernel modules

Example:

```
lsmod
```

Command: sysctl

Description: View or set kernel parameters at runtime

Example:

```
sysctl -a | grep vm.swappiness sudo sysctl -w vm.swappiness=10
```

Command: dmesg

Description: Kernel ring buffer messages

Example:

```
dmesg | grep -i sda
```

Filesystems, LVM & RAID

Command: mkfs.ext4

Description: Create ext4 filesystem

Example:

```
sudo mkfs.ext4 /dev/sdb1
```

Command: fsck

Description: Filesystem check and repair

Example:

```
sudo fsck -fy /dev/sdb1
```

Command: tune2fs

Description: Tune ext2/3/4 filesystem parameters

Example:

```
sudo tune2fs -l /dev/sda1
```

Command: pvcreate / vgcreate / lvcreate

Description: LVM physical/volume/group/logical volume commands

Example:

```
sudo pvcreate /dev/sdb1 sudo vgcreate vg_data /dev/sdb1 sudo lvcreate -L 50G -n
lv_data vg_data
```

Command: mdadm

Description: Manage Linux software RAID

Example:

```
sudo mdadm --create /dev/md0 --level=1 --raid-devices=2 /dev/sdb1 /dev/sdc1 sudo
mdadm --detail /dev/md0
```

Advanced Networking & Troubleshooting

Command: ip -s link / ip addr / ip route

Description: Modern iproute2 utilities

Example:

```
ip -s link show ip addr show dev eth0 ip route show
```

Command: ss

Description: Socket statistics, faster than netstat

Example:

```
ss -tulpen
```

Command: tcpdump

Description: Capture packets from network interfaces

Example:

```
sudo tcpdump -i eth0 port 80 -w capture.pcap
```

Command: nmap

Description: Network scanner and host discovery

Example:

```
sudo nmap -A 192.168.1.0/24
```

Command: iperf3

Description: Network performance testing

Example:

```
iperf3 -s (on server) iperf3 -c server_ip
```

Firewall, Packet Filters & QoS

Command: nft (nftables)

Description: Modern packet filtering framework

Example:

```
sudo nft list ruleset sudo nft add table inet mytable
```

Command: iptables / iptables-save

Description: Legacy IPv4 packet filter (still common)

Example:

```
sudo iptables -L -n -v sudo iptables-save > /root/iptables.backup
```

Command: firewalld / firewall-cmd

Description: Dynamic firewall for RHEL/Fedora/CentOS

Example:

```
sudo firewall-cmd --list-all sudo firewall-cmd --add-service=http --permanent &&
sudo firewall-cmd --reload
```

Command: tc

Description: Traffic control (QoS, shaping)

Example:

```
sudo tc qdisc add dev eth0 root tbf rate 1mbit burst 32k latency 400ms
```

Security & Access Control

Command: setfacl / getfacl

Description: File ACLs to set fine-grained permissions

Example:

```
sudo setfacl -m u:alice:rwx /data/project getfacl /data/project
```

Command: auditctl / ausearch / aureport

Description: Linux Audit framework commands

Example:

```
sudo auditctl -w /etc/passwd -p wa ausearch -f /etc/passwd
```

Command: semanage / semodule / getsebool

Description: SELinux management (RHEL/CentOS/Fedora)

Example:

```
sestatus sudo semanage port -a -t http_port_t -p tcp 8080
```

Command: visudo

Description: Safe edit for sudoers file

Example:

```
sudo visudo
```

Command: fail2ban-client

Description: Manage fail2ban to block abusive IPs

Example:

```
sudo fail2ban-client status sudo fail2ban-client set sshd banip 1.2.3.4
```

Performance Monitoring & Profiling

Command: perf

Description: CPU profiling and tracing (Linux perf tool)

Example:

```
sudo perf top sudo perf record -a -g sleep 10 && sudo perf report
```

Command: iotop

Description: Monitor I/O usage by process

Example:

```
sudo iotop -o
```

Command: iostat (sysstat)

Description: I/O and CPU statistics

Example:

```
iostat -x 2 3
```

Command: sar

Description: System activity reporter (historical stats)

Example:

```
sar -u 1 3
```

Command: vmstat

Description: Virtual memory stats

Example:

```
vmstat 2 5
```

Debugging & Tracing

Command: strace

Description: Trace system calls and signals

Example:

```
strace -f -o trace.out -p 1234 strace -e trace=open,read,write ./app
```

Command: ltrace

Description: Trace library calls

Example:

```
ltrace ./app
```

Command: gdb

Description: GNU Debugger for native programs

Example:

```
gdb --args ./app arg1 (gdb) run (gdb) bt
```

Command: lsof

Description: List open files and sockets

Example:

```
sudo lsof -i :80 sudo lsof /var/log/syslog
```

Command: perf record / report

Description: Collect and analyze performance data

Example:

```
sudo perf record -o perf.data -a sleep 5 sudo perf report -i perf.data
```

Containers & Virtualization (Commands)

Command: docker

Description: Docker container runtime (manage images/containers)

Example:

```
sudo docker run -d --name web -p 80:80 nginx sudo docker ps -a
```

Command: podman

Description: Daemonless container engine (rootless)

Example:

```
podman run --rm -it registry.fedoraproject.org/fedora bash
```

Command: kubectl

Description: Kubernetes CLI (manage k8s clusters)

Example:

```
kubectl get pods -A kubectl apply -f deployment.yaml
```

Command: qemu-img / virt-install / virsh

Description: QEMU/KVM virtualization & VM management

Example:

```
qemu-img create -f qcow2 vm.qcow2 20G virsh list --all
```

Backup, Sync & File Transfer

Command: rsync

Description: Efficient remote/local file synchronization

Example:

```
rsync -avz --progress /src/ user@host:/dst/
```

Command: borg / restic

Description: Deduplicating backup tools (example usage)

Example:

```
borg init --encryption=repokey /path/to/repo restic init -r /path/to/repo
```

Command: tar with pax/cpio

Description: Advanced archiving with options

Example:

```
tar --exclude='*.tmp' -czvf backup.tgz /home/user
```

Development & Build Tools

Command: make / cmake

Description: Build automation tools

Example:

```
make cmake .. && make -j4
```

Command: gcc / g++

Description: Compile C/C++ programs

Example:

```
gcc -O2 -Wall -o myprog main.c
```

Command: strace / valgrind

Description: Debugging & memory profiling

Example:

```
valgrind --leak-check=full ./app
```

Advanced Shell & Text Processing

Command: xargs

Description: Build and execute command lines from input

Example:

```
find . -name '*.log' -print0 | xargs -0 gzip
```

Command: parallel

Description: GNU parallel to run jobs in parallel

Example:

```
ls *.txt | parallel -j4 gzip {}
```

Command: awk (advanced)

Description: Field processing, complex one-liners

Example:

```
awk -F',' '{ if ($5>1000) print $1,$5 }' data.csv
```

Command: sed (advanced)

Description: Stream editor complex replacements

Example:

```
sed -n '1,200p' file | sed 's/\(error\)/\U\1/g'
```

Command: grep -P / rg

Description: Perl regex grep / ripgrep

Example:

```
grep -P '\d{4}-\d{2}-\d{2}' file.log rg 'TODO' -n
```

System Recovery & Rescue

Command: chroot

Description: Change root to repair system from live media

Example:

```
sudo mount /dev/sda1 /mnt && for d in /dev /proc /sys; do sudo mount --bind $d /mnt$d; done sudo chroot /mnt
```

Command: rescue mode / single user

Description: Boot into rescue or single-user to fix issues

Example:

```
systemctl rescue
```

Command: dd

Description: Low-level copy (use with caution)

Example:

```
sudo dd if=/dev/sda of=/backup/image.img bs=4M status=progress
```

End of Advanced Commands Supplement

If you want, I can merge this back into the full guide PDF (replacing the previous file) or keep both versions.