**Linux Notes for Professionals**

***Structured, Sectioned, and Command-Focused***

**1. Getting Started with GNU/Linux**

**1.1 Useful Shortcuts (Terminal/Bash)**

* **Open terminal:**
  + **Ctrl + Alt + T or Super + T**
* **Cursor movement:**
  + **Ctrl + A: Start of line**
  + **Ctrl + E: End of line**
  + **Alt + F: Forward one word**
  + **Alt + B: Backward one word**
  + **Ctrl + F: Forward one character**
  + **Ctrl + B: Backward one character**
* **Text manipulation:**
  + **Ctrl + U: Cut to start of line**
  + **Ctrl + K: Cut to end of line**
  + **Ctrl + W: Delete previous word**
  + **Ctrl + Y: Paste last cut**
  + **Alt + T: Swap last two words**
  + **Alt + L/U/C: Lowercase/Uppercase/Capitalize to end of word**
  + **Alt + D: Delete to end of word**
  + **Ctrl + T: Swap last two characters**
* **History access:**
  + **Ctrl + R: Search history**
  + **Ctrl + P/N: Previous/Next command**
  + **Alt + R: Revert command edits**
* **Terminal control:**
  + **Ctrl + L: Clear screen**
  + **Ctrl + S/Q: Stop/Resume output**
  + **Ctrl + C: End current process**
  + **Ctrl + D: Logout/EOF**
  + **Ctrl + Z: Suspend process**
  + **Tab: Autocomplete**
* **Special characters:**
  + **Ctrl + H: Backspace**
  + **Ctrl + J/M: Return**
  + **Ctrl + I: Tab**
  + **Ctrl + G: Bell**
  + **Ctrl + @: Null**

**1.2 File Management Commands**

**Directory Navigation**

* **pwd: Print working directory**
* **cd -: Go to previous directory**
* **cd ~ or cd: Go to home directory**
* **cd ..: Go to parent directory**

**Listing Files**

* **ls -l: List files/directories in long format**
* **ls -ld dir: List info about directory itself**
* **ls -a: List all files, including hidden**
* **ls -F: Append symbol to indicate file type**
* **ls -lt: Sort by modification time**
* **ls -lh: Human-readable file sizes**
* **ls -lR: Recursive list**
* **tree: Tree representation of filesystem**

**File/Directory Create, Copy, Remove**

* **cp -p src dest: Copy file, preserve attributes**
* **cp -R src\_dir dest\_dir: Copy directory recursively**
* **mv file1 file2: Move/rename file**
* **rm -i filename: Remove file with confirmation**
* **rm -R dir: Remove directory recursively**
* **rm -rf dir: Force remove directory recursively**
* **rmdir dir: Remove empty directory**
* **mkdir dir: Create directory**
* **mkdir -p dir1/dir2: Create directory hierarchy**
* **touch filename: Create file or update timestamp**

**Permissions and Groups**

* **chmod <spec> filename: Change file permissions**
* **chmod -R <spec> dir: Change permissions recursively**
* **chown owner filename: Change file owner**
* **chgrp group filename: Change file group**
* **chgrp -R group dir: Change group recursively**

**1.3 Hello World**

* **Print "Hello World" to terminal:**

**bash**

**echo "Hello World"**

**1.4 Basic Linux Utilities**

**Getting Help**

* **man <name>: Manual page for a command**
* **man -k <keyword>: Search man pages**
* **apropos <keyword>: Search command descriptions**
* **help: List Bash commands**
* **help <name>: Info about a Bash command**
* **info <name>: Info about a command**
* **<command> --help: Command usage**

**User Identification**

* **hostname: System hostname**
* **whoami: Current user**
* **who: List logged in users**
* **w: System status, users**
* **last: Recent logins**
* **lastb: Bad login attempts**

**Process Information**

* **top: Live process view**
* **ps: List running processes**
* **ps aux: All processes**

**1.5 Searching for Files/Contents**

* **Find by name:**

**bash**

**find /path -name '\*.css'**

* **Find by content:**

**bash**

**grep font /path/to/file**

* **Recursive grep:**

**bash**

**grep -R font /path**

**1.6 File Manipulation**

* **Create file:**

**bash**

**touch myFile**

* **Rename file:**

**bash**

**mv myFile myFirstFile**

* **View file:**

**bash**

**cat myFirstFile**

* **View with pager:**

**bash**

**less myFirstFile**

* **View first lines:**

**bash**

**head myFirstFile**

* **View last lines:**

**bash**

**tail myFirstFile**

* **Edit file:**

**bash**

**vi myFirstFile**

* **List files:**

**bash**

**ls**

* **Create directory:**

**bash**

**mkdir myFirstDirectory**

* **Create nested directories:**

**bash**

**mkdir -p src/myFirstDirectory**

* **Move file to directory:**

**bash**

**mv myFirstFile myFirstDirectory/**

* **Change directory:**

**bash**

**cd myFirstDirectory**

* **Delete file:**

**bash**

**rm myFirstFile**

* **Move to parent directory:**

**bash**

**cd ..**

* **Delete empty directory:**

**bash**

**rmdir myFirstDirectory**

* **Delete non-empty directory:**

**bash**

**rm -rf myFirstDirectory**

**1.7 File/Directory Details**

* **Long format:**

**bash**

**ls -l**

* **Human-readable sizes:**

**bash**

**ls -lh**

* **Show hidden files:**

**bash**

**ls -a**

* **Directory size:**

**bash**

**ls -s**

* **Recursive:**

**bash**

**ls -R**

* **Change permissions:**

**bash**

**chmod 755 test**

* **Example permissions:**
  + **drwxr-xr-x (directory, user rwx, group r-x, others r-x)**

**2. Detecting Linux Distribution Name and Version**

* **For Debian-based systems:**

**bash**

**lsb\_release -a**

**or**

**bash**

**cat /etc/issue**

* **For Systemd-based systems:**

**bash**

**cat /etc/os-release**

**or**

**bash**

**source /etc/os-release && echo "$PRETTY\_NAME"**

* **For RHEL/CentOS/Fedora:**

**bash**

**cat /etc/redhat-release**

* **Kernel/system info:**

**bash**

**uname -a**

* **Find OS version (generic):**

**bash**

**cat /etc/\*release**

**3. Getting Information on a Running Linux Kernel**

* **Kernel info:**

**bash**

**uname -a**

* **Options:**
  + **-s: kernel name**
  + **-r: kernel release**
  + **-v: kernel version**
  + **-m: machine hardware**
  + **-o: operating system**

**4. Shell**

**4.1 Changing Default Shell**

* **List available shells:**

**bash**

**chsh -l**

**or**

**bash**

**cat /etc/shells**

* **Change shell:**

**bash**

**chsh -s /usr/bin/fish**

* **Check current shell:**

**bash**

**echo $SHELL**

**4.2 Basic Shell Utilities**

* **Customize prompt:**

**bash**

**PS1='\w $ '**

* **Common shortcuts:**
  + **Ctrl-k: Cut/kill line**
  + **Ctrl-y: Paste**
  + **Ctrl-a: Start of line**
  + **Ctrl-e: End of line**
  + **Ctrl-d: Delete character**
  + **Ctrl-l: Clear screen**
  + **Ctrl-u: Clear line**
  + **Ctrl-c: Interrupt**
  + **Ctrl-r: Reverse search**
  + **history: Show command history**

**4.3 Command Alias**

* **Create alias:**

**bash**

**alias install='sudo apt-get -y install'**

**4.4 Locate a File**

* **Locate file:**

**bash**

**locate mykey.pem**

* **Update locate database:**

**bash**

**updatedb**

* **Fallback:**

**bash**

**find / -name mykey.pem -print**

**5. Check Disk Space**

**5.1 Investigate Directories for Disk Usage**

* **Disk usage per directory:**

**bash**

**du -sh \***

* **Include hidden files:**

**bash**

**du -sh .[!.]\* \***

* **Total usage:**

**bash**

**du -sch .[!.]\* \***

* **Threshold filter:**

**bash**

**sudo du --threshold=1G -ch /.[!.]\* /\***

**5.2 Checking Disk Space**

* **Check partitions:**

**bash**

**df -h**

**6. Getting System Information**

**6.1 CPU, Memory, Network, Disk Stats**

* **CPU usage:**

**bash**

**mpstat 2 10**

* **Memory usage:**

**bash**

**vmstat 2 10**

* **Disk usage:**

**bash**

**iostat -kx 2**

* **Network usage:**

**bash**

**netstat -ntlp**

**or**

**bash**

**sudo iftop**

* **Overall system stats:**

**bash**

**dstat**

**6.2 Hardware Info**

* **CPU info:**

**bash**

**lscpu**

* **Detailed hardware:**

**bash**

**sudo lshw | less**

* **PCI info:**

**bash**

**lspci -tv**

* **USB info:**

**bash**

**lsusb -tv**

* **BIOS info:**

**bash**

**dmidecode -q | less**

* **Disk info:**

**bash**

**hdparm -i /dev/sda**

* **Disk power-on hours:**

**bash**

**smartctl -A /dev/sda | grep Power\_On\_Hours**

* **Disk speed test:**

**bash**

**hdparm -tT /dev/sda**

* **Bad blocks:**

**bash**

**badblocks -s /dev/sda**

**6.4 CPU Model/Speed**

* **CPU info:**

**bash**

**cat /proc/cpuinfo**

* **Count processors:**

**bash**

**grep -c processor /proc/cpuinfo**

**6.5 Process Monitoring**

* **Static process tree:**

**bash**

**ps -e -o pid,args --forest**

* **Top CPU consumers:**

**bash**

**ps -e -o pcpu,cpu,nice,state,cputime,args --sort pcpu | sed '/^ 0.0 /d'**

* **Memory usage by process:**

**bash**

**ps -e -orss=,args= | sort -b -k1,1n | pr -TW$COLUMNS**

* **Per-thread info for process:**

**bash**

**ps -C firefox-bin -L -o pid,tid,pcpu,state**

* **Open files by process:**

**bash**

**lsof -p $$**

* **Processes with open path:**

**bash**

**lsof ~**

* **Interactive monitors:**
  + **top**
  + **htop**
  + **atop**
  + **iotop**
  + **iftop**

**7. ls Command**

**7.1 Options**

* **ls -a: All files**
* **ls --color: Colored output**
* **ls -d: List directories**
* **ls -F: Append symbol**
* **ls -i: Inode number**
* **ls -l: Long format**
* **ls -lh: Human readable**
* **ls -r: Reverse order**
* **ls -R: Recursive**
* **ls -s: File size**
* **ls -S: Sort by size**
* **ls -t: Sort by time**
* **ls -X: Sort by extension**

**7.2 Examples**

* **ls**
* **ls -a**
* **ls -F**
* **ls -l**
* **ls -lh**

**8. File Compression with 'tar' Command**

**Common Options**

* **-c: Create archive**
* **-x: Extract archive**
* **-t: List contents**
* **-f: File**
* **-v: Verbose**
* **-z: gzip**
* **-j: bzip2**
* **-J: xz**

**Examples**

* **Compress folder:**

**bash**

**tar -czf my-archive.tar.gz my-folder/**

* **Extract archive:**

**bash**

**tar -xf archive.tar.gz**

* **Extract to directory:**

**bash**

**tar -xf archive.tar -C ./dest**

* **List contents:**

**bash**

**tar -tf archive.tar.gz**

* **Exclude folder:**

**bash**

**tar -cf archive.tar ./my-folder/ --exclude="my-folder/sub1"**

* **Strip components:**

**bash**

**tar -xf --strip-components=1 archive.tar**

**9. Services**

**9.1 List Running Services (Ubuntu)**

* **List all services:**

**bash**

**service --status-all**

* **Upstart services:**

**bash**

**sudo initctl list**

**9.2 Systemd Service Management**

* **List all units:**

**bash**

**systemctl**

* **Show failed units:**

**bash**

**systemctl --failed**

* **Get current default target:**

**bash**

**systemctl get-default**

* **Set default target:**

**bash**

**systemctl set-default <target>**

* **Start/stop/restart/reload/status:**

**bash**

**systemctl start [service]**

**systemctl stop [service]**

**systemctl restart [service]**

**systemctl reload [service]**

**systemctl status [service]**

* **Check if enabled/active:**

**bash**

**systemctl is-enabled [service]**

**systemctl is-active [service]**

* **Enable/disable service:**

**bash**

**systemctl enable [service]**

**systemctl disable [service]**

* **Mask/unmask service:**

**bash**

**systemctl mask [service]**

**systemctl unmask [service]**

* **Reload systemd daemon:**

**bash**

**systemctl daemon-reload**

**10. Managing Services**

* **Diagnose service:**

**bash**

**systemctl status [service]**

**journalctl -xe**

**journalctl -f -t [service]**

**journalctl -p err -S yesterday**

**tail -f /var/log/messages**

**tail -f /var/log/secure**

* **Start/Stop (SysV):**

**bash**

**service <service> start**

**service <service> stop**

* **Start/Stop (systemd):**

**bash**

**systemctl <service> start**

**systemctl <service> stop**

* **Status (SysV):**

**bash**

**service <service> status**

* **Status (systemd):**

**bash**

**systemctl status <service>**

**11. Modifying Users**

* **Set password:**

**bash**

**passwd**

* **Set another user's password:**

**bash**

**passwd username**

* **Add user:**

**bash**

**useradd username**

* **Remove user:**

**bash**

**userdel username**

* **Remove user & home:**

**bash**

**userdel -r username**

* **List groups (current):**

**bash**

**groups**

* **List groups (user):**

**bash**

**groups username**

**12. LAMP Stack**

**12.1 Install LAMP on Arch Linux**

* **Install packages:**

**bash**

**pacman -Syu apache php php-apache mariadb**

* **Edit /etc/httpd/conf/httpd.conf as needed.**
* **Set permissions:**

**bash**

**chmod 755 /home**

**chmod 755 /home/username**

**chmod 755 /home/username/public\_html**

* **Start MySQL:**

**bash**

**systemctl enable mysqld**

**systemctl start mysqld**

* **Secure MySQL:**

**bash**

**sh /usr/bin/mysql\_secure\_installation**

**12.2 Install LAMP on Ubuntu**

* **Install Apache, MySQL, PHP:**

**bash**

**sudo apt-get install apache2**

**sudo apt-get install mysql-server**

**sudo apt-get install php5 libapache2-mod-php5**

**sudo systemctl restart apache2**

**php -r 'echo "\n\nYour PHP installation is working fine.\n\n\n";'**

**12.3 Install LAMP on CentOS**

* **Install packages and start services:**

**bash**

**sudo yum -y install httpd**

**sudo systemctl enable --now httpd**

**sudo yum -y install mariadb-server**

**sudo systemctl enable --now mariadb**

**sudo yum -y install php php-common**

**sudo systemctl restart httpd**

**php --version**

**13. tee Command**

* **Write to stdout and file:**

**bash**

**ls | tee file**

* **Write to multiple files:**

**bash**

**ls | tee file1 file2**

* **Append to file:**

**bash**

**ls | tee -a file**

* **Pipe and write:**

**bash**

**crontab -l | tee crontab-backup.txt | sed 's/old/new/' | crontab -**

**14. SSH**

* **Connect to server:**

**bash**

**ssh -p port user@server-address**

* **ProxyJump:**

**bash**

**ssh -J user@host1:port user@host2 -p port2**

* **Install OpenSSH:**
  + **Debian: apt-get install openssh**
  + **Arch: pacman -S openssh**
  + **Yum: yum install openssh**
* **Configure SSH server:**
  + **Edit /etc/ssh/sshd\_config**
* **Passwordless connection:**

**bash**

**ssh-keygen -t rsa -b 4096 -C "email"**

**ssh user@host 'cat >> ~/.ssh/authorized\_keys' < id\_rsa.pub**

* **Disable SSH service:**

**bash**

**sudo service ssh stop**

**sudo systemctl disable sshd.service**

**15. SCP**

* **Copy local to remote:**

**bash**

**scp file user@host:/path/**

* **Copy remote to local:**

**bash**

**scp user@host:/path/file ./**

* **Copy directory:**

**bash**

**scp -r user@host:~/project/\* ./workspace/**

* **Use key file:**

**bash**

**scp -i my\_key.pem file user@host:/path/**

**16. GnuPG (GPG)**

* **Export public key:**

**bash**

**gpg --armor --export EMAIL > public\_key.asc**

* **Send key to server:**

**bash**

**gpg --send-keys PRIMARY\_ID**

* **Generate key:**

**bash**

**gpg --gen-key**

* **List keys:**

**bash**

**gpg --list-keys**

**17. Network Configuration**

* **Local DNS:**
  + **Edit /etc/hosts**
* **DNS servers:**
  + **Edit /etc/resolv.conf**
* **Routing (route):**
  + **route**
  + **route -n**
  + **route add -host x.x.x.x eth1**
  + **route add -net 2.2.2.0/24 eth0**
  + **route add default gw 2.2.2.1 eth0**
* **Routing (ip):**
  + **ip route show**
  + **ip route add default via 1.2.3.254**
* **Configure hostname:**
  + **Edit /etc/hosts or ~/.hosts**
* **Network interfaces:**
  + **ifconfig -a**
  + **ifconfig eth0**
* **Interface settings:**
  + **ethtool eth0**
* **IP address:**
  + **ip addr show**
  + **ip addr add 1.2.3.4/24 brd + dev eth0**
* **DHCP:**

**bash**

**dhclient <interface>**

* **Static config:**
  + **Edit /etc/network/interfaces**
* **Temporary static IP:**

**bash**

**ifconfig eth0 10.10.50.100/16 up**

**18. Midnight Commander**

* **Browsing mode function keys:**
  + **F1: Help**
  + **F2: User menu**
  + **F3: View file**
  + **F4: Edit file**
  + **F5: Copy**
  + **F6: Move**
  + **F7: New directory**
  + **F8: Delete**
  + **F9: Main menu**
  + **F10: Exit**
* **Edit mode function keys:**
  + **F2: Save**
  + **F3: Start selection**
  + **F4: Search/replace**
  + **F5: Copy selection**
  + **F6: Move selection**
  + **F7: Search**
  + **F8: Delete selection**
  + **F10: Exit**

**19. Change Root (chroot)**

* **Requirements:**
  + **Root privileges**
  + **Matching architectures**
  + **Necessary modules loaded**
* **Steps:**

**bash**

**cd /location/of/new/root**

**mount -t proc proc proc/**

**mount --rbind /sys sys/**

**mount --rbind /dev dev/**

**mount --rbind /run run/**

**cp /etc/resolv.conf etc/resolv.conf**

**chroot /location/of/new/root /bin/bash**

**source /etc/profile**

**source ~/.bashrc**

**export PS1="(chroot) $PS1"**

**exit**

**cd /**

**umount --recursive /location/of/new/root**

**20. Package Managers**

* **apt (Debian):**

**bash**

**sudo apt-get update**

**sudo apt-get upgrade**

**sudo apt-get dist-upgrade**

* **pacman (Arch):**

**bash**

**pacman -Ss string**

**sudo pacman -S package**

**sudo pacman -Syu**

* **yum (RHEL/CentOS):**

**bash**

**yum search <query>**

**sudo yum install <package>**

**sudo yum update**

**21. Compiling the Linux Kernel (Ubuntu)**

* **Install build dependencies:**

**bash**

**sudo apt-get build-dep linux-image-`uname -r`**

* **Download source:**

**bash**

**tar xf linux-\*.tar.xz && cd linux-\***

* **Configure:**

**bash**

**make menuconfig**

* **Build:**

**bash**

**make**

* **Result:**
  + **Kernel image at arch/[arch]/boot/bzImage**