Hybrid Linux with Cloud - Key Points

Linux Introduction

Linux: Open-source OS kernel created by Linus Torvalds in 1991.

Linux vs Windows:

Linux: Open-source, free, customizable.

Windows: Commercial, closed-source.

Kernel: Manages hardware resources (CPU, memory, devices).

Features of Linux:

Open-source, multi-user, multitasking, portable, secure, live CD/USB, GUI support.

Advantages:

Free, stable, secure, flexible, high performance, cost-effective.

Hardware Components

Motherboard: Main circuit board connecting RAM, CPU, HDD, etc.

Processor (CPU): Brain of the computer, executes instructions.

Types: Single, Dual, Multi-core.

Memory (RAM): Types: DDR, DDR2, DDR3, DDR4, DDR5.

Storage:

HDD: Magnetic storage, slower, cheaper.

SSD: Faster, no moving parts.

NVMe: High-speed SSD using PCIe interface.

Server Chassis: 1U, 2U, 3U, Blade, Microserver.

Linux Installation

System Requirements:

GUI: 2GHz CPU, 4GB RAM, 20GB disk.

CLI: 2GHz CPU, 512MB RAM, 2.5GB disk.

Steps to Install Linux:

Create bootable USB using Rufus (Windows) or Startup Disk Creator (Linux).

Boot from USB, select "Install Ubuntu".

Partition disk: `/boot`, `swap`, `/`, `EFI`.

Complete installation.

Directory Structure

Linux File Hierarchy:

`/`: Root directory.

`/bin`: Essential command binaries.

`/home`: User home directories.

`/etc`: Configuration files.

`/var`: Variable data (logs, databases).

`/tmp`: Temporary files.

`/usr`: User utilities and applications.

Linux Commands

Basic Commands:

`ls`: List files.

`cd`: Change directory.

`pwd`: Print working directory.

`touch`: Create empty file.

`cp`: Copy files.

`rm`: Remove files.

`mkdir`: Create directory.

`rmdir`: Remove directory.

System Monitoring:

`top`: Display running processes.

`ps`: Show active processes.

`kill`: Terminate processes.

File Operations:

`cat`: Display file content.

`grep`: Search text in files.

`find`: Search files/directories.

`tar`: Archive files.

Revision & Install Packages

Installing Skype:

Download `.deb` package.

Install using `dpkg` or `apt-get`.

Launch Skype from terminal or GUI.

IP Address & Networking

IP Address: Identifies devices on a network.

IPv4: 32-bit address (e.g., 192.168.1.1).

IPv6: 128-bit address (e.g., 2001:db8::1).

Types of IP:

Public: Accessible over the internet.

Private: Used within local networks.

Static: Permanent IP.

Dynamic: Temporary IP (assigned by DHCP).

Subnet Mask: Divides IP into network and host parts (e.g., 255.255.255.0).

Linux Services & Ports

Common Services:

SSH (Port 22): Secure remote login.

HTTP (Port 80): Web server.

HTTPS (Port 443): Secure web server.

FTP (Port 21): File transfer.

Service Management:

`systemctl start/stop/restart <service>`: Manage services.

`systemctl enable/disable <service>`: Enable/disable at boot.

Linux Security

hosts.deny: Block IPs from accessing services.

Example: `sshd: 192.168.1.100` (blocks SSH from this IP).

iptables: Firewall tool to block/allows IPs/ports.

Example: `iptables -A INPUT -s 192.168.1.100 -j DROP` (blocks IP).

UFW (Uncomplicated Firewall):

`ufw allow 22`: Allow SSH.

`ufw deny from 192.168.1.100`: Block IP.

Basic Shell Scripts

Shell Script: Automates tasks using commands.

Example:

bash

Copy

```
#!/bin/bash
echo "Hello World"
```

Variables:

```
name="John"
echo $name
```

Loops:

```
for i in {1..5}; do echo $i; done
```

DataCenter Tools

VNC: Remote desktop access.

IPMI: Remote server management.

KVM: Keyboard, Video, Mouse switch for multiple servers.

RAID: Redundant Array of Independent Disks.

- **RAID 0**: Striping (no redundancy).
- **RAID 1**: Mirroring (duplicate data).
- **RAID 5**: Striping with parity (fault tolerance).
- **RAID 10**: Mirroring + Striping (high performance & redundancy).

User Management

User Types:

- **Root**: Superuser with full access.
- **Regular Users**: Limited access.
- **System Users**: For system processes.

Commands:

- `useradd`: Add user.
- `usermod`: Modify user.
- `userdel`: Delete user.
- `passwd`: Set password.

System Monitoring

top: Monitor CPU, memory, processes.

ps: Show running processes.

kill: Terminate processes.

df: Disk space usage.

du: Disk usage by files/directories.

SSH (Secure Shell)

SSH: Secure remote login.

- Default port: 22.

Key pairs: Public (encryption) & Private (decryption).

Usage:

`ssh user@remote_host`: Connect to remote server.

`scp file.txt user@remote_host:/path`: Copy files securely.

System Usage

top: Monitor system resources.

ps: List processes.

kill: Terminate processes.

df: Check disk space.

du: Check directory size.

RAID

RAID Levels:

RAID 0: Striping (no redundancy).

RAID 1: Mirroring (duplicate data).

RAID 5: Striping with parity (fault tolerance).

RAID 10: Mirroring + Striping (high performance & redundancy).

User Info & Management

Types of Users in Linux

Superuser (Root): Full system control.

Regular Users: Limited access, UID starts from 1000.

System Users: For system processes, UID 1-99 or 500-999.

Service Users: For services, no login shell, UID 100-999.

User Management Commands

Add User: `sudo useradd <username>`

Set Password: `sudo passwd <username>`

Modify User: `sudo usermod -c "Comment" <username>`

Delete User: `sudo userdel <username>`

Check Password Policy: `chage -l <username>`

Configuration Files

/etc/passwd: User account info.
/etc/shadow: Encrypted passwords.
/etc/login.defs: Default user settings.

SSH (Secure Shell)

What is SSH?

SSH: Secure remote login and file transfer.
Key Pairs: Public (encryption) and Private (decryption).

SSH Commands

Connect: `ssh user@host`
Copy Files: `scp file.txt user@host:/path`
Change Port: `ssh -p <port> user@host`

System Monitoring

top Command

Usage: Monitor CPU, memory, and processes.
Options:

- `top -n 5`: Exit after 5 iterations.
- `top -u <username>`: Show processes for a specific user.
- `Shift + P`: Sort by CPU usage.

kill Command

Usage: Terminate processes.
Signals:

- `-9`: Forcefully kill.
- `-15`: Gracefully terminate.

ps Command

Usage: List active processes.

Options:

`ps -ax`: Show all processes.

`ps -u <username>`: Show processes for a user.

DNS (Domain Name System)

DNS Flow

Registrar: Domain registration (e.g., GoDaddy).

Name Server: Maps domain to IP (e.g., ns1.example.com).

DNS Server: Stores DNS records (A, CNAME, MX, etc.).

Web Server: Hosts website content (e.g., Apache, Nginx).

FTP Server: Stores files for the website.

DNS Records

A Record: Maps domain to IP.

CNAME: Alias for a domain.

MX: Mail server for the domain.

Mail Server

How Mail Works

SMTP: Sends email from sender to recipient's server.

MX Record: Locates recipient's mail server.

IMAP/POP3: Retrieves emails from the server.

Mail Server Commands

IMAP:

Port: 143 (unsecured), 993 (secured).

Service: `sudo service dovecot start`.

SMTP:

Port: 25.

Service: `sudo service postfix start`.

Alias & Crontab

Alias

Create Alias: `alias shortname='long command'`.
Remove Alias: `unalias shortname`.
Permanent Alias: Add to `.bashrc`.

Crontab

Edit Crontab: `crontab -e`.
List Crontab: `crontab -l`.
Syntax: `Minute Hour Day Month Weekday Command`.

Reset Password & HDD Test

Reset Password

Boot into recovery mode.
Replace `ro` with `rw init=/bin/bash`.
Run `passwd` to change password.

HDD Test

Use Ubuntu Desktop's "Disks" tool to run SMART tests.

Cloud Computing

What is Cloud?

Cloud: Servers accessed over the internet for storage, computing, and applications.

Types of Cloud

Private Cloud: Dedicated to one organization.

Public Cloud: Shared resources (e.g., AWS, GCP).

Hybrid Cloud: Combines private and public clouds.

Cloud Providers

AWS: Broad services, global reach.

GCP: AI and analytics focus.

DigitalOcean: Simple, cost-effective for SMBs.

Types of Cloud Computing Models:

Model	Description	Examples
IaaS (Infrastructure as a Service)	Provides virtual machines, storage, networking	AWS EC2, Google Compute Engine, Azure Virtual Machines
PaaS (Platform as a Service)	Provides a platform for developers to build applications	AWS Elastic Beanstalk, Google App Engine, Azure App Service
SaaS (Software as a Service)	Fully managed software solutions over the internet	Gmail, Microsoft 365, Dropbox

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Website Monitoring

Tools

Pingdom: Uptime and performance monitoring.

Google Search Console: SEO and indexing issues.

SiteScope: Infrastructure monitoring.

Steps to Monitor

Check Logs: Analyze access and error logs.

Performance Metrics: Monitor page load and server response times.

Synthetic Monitoring: Simulate user interactions.

Set Alerts: Notify when issues arise