1. **Cisco IOS Access**
    - **GUI vs. CLI**:
        - **GUI**: User-friendly (e.g., Windows, macOS).
        - **CLI**: More powerful, used for network devices (e.g., switches, routers).
    - **Access Methods**:
        - **Console**: Physical port for initial setup.
        - **SSH**: Secure remote access (encrypted).
        - **Telnet**: Insecure (plaintext passwords).
2. **IOS Navigation**
    - **Command Modes**:
        - **User EXEC (`>`)** – Limited commands (e.g., `ping`).
        - **Privileged EXEC (`#`)** – Full access (e.g., `show running-config`).
        - **Global Config (`(config)#`)** – Device-wide settings.
        - **Subconfiguration Modes** (e.g., `(config-if)#` for interfaces).
    - **Navigation Commands**:
        - `enable` → User to Privileged.
        - `configure terminal` → Privileged to Global Config.
        - `exit` / `end` / `Ctrl+Z` → Return to previous mode.
3. **Command Structure**
    - **Syntax**: `command [keyword] [argument]` (e.g., `ping 192.168.1.1`).
    - **Help Features**:
        - `?` – Context-sensitive help.
        - `Tab` – Auto-completes commands.
    - **Shortcuts**:
        - `Ctrl+C` – Cancel command.
        - `Ctrl+Shift+6` – Interrupt processes (e.g., `ping`).
4. **Basic Device Configuration**
    - **Hostname**: `hostname SW1`

- **Passwords**:
  - Console: `line console 0` → `password cisco` → `login`
  - Enable (Privileged): `enable secret class`

VTY (Remote): `line vty 0 15` → `password cisSSSco` → `login`

- **Encrypt Passwords**: `service password-encryption`
- **Banner**: `banner motd #Unauthorized Access Prohibited#`

5. **Saving Configurations**
   - **Running-config (RAM)**: Active settings (lost on reboot).
   - **Startup-config (NVRAM)**: Saved settings (`copy running-config startup-config`).
   - **Restore Defaults**: `erase startup-config` → `reload`.
6. **IP Addressing**
   - **Manual Configuration**: Assign IP, subnet mask, gateway.
   - **DHCP**: Automatic IP assignment (`ip address dhcp`).
   - **Switch SVI (VLAN 1)**:
     text

     ```
     interface vlan 1
     ip address 192.168.1.1 255.255.255.0
     no shutdown
     ```
7. **Verification**
   - `ping` – Test connectivity.
   - `show running-config` – View current settings.

Module 3: Protocols and Models

Key Concepts

1. **Communication Rules**
   - **Protocols**: Rules for sending/receiving data (e.g., TCP/IP, HTTP).

- **Requirements**:
    - Encoding/decoding.
    - Formatting (headers/trailers).
    - Timing (flow control, timeout).
    - Delivery (unicast, multicast, broadcast).

2. **Protocol Suites**
    - **TCP/IP**: Dominant suite (IETF standards).
        - **Layers**: Application, Transport, Internet, Network Access.
    - **OSI Model**: 7 layers (theoretical).
3. **Standards Organizations**
    - **IETF**: Manages TCP/IP.
    - **IEEE**: Ethernet/Wi-Fi standards (e.g., 802.11).
    - **ICANN/IANA**: IP/Domain management.
4. **Layered Models**

TCP/IP	OSI	Function
Application	Application	HTTP, FTP, DNS
Transport	Transport	TCP (reliable), UDP (fast)
Internet	Network	IP addressing, routing
Network Access	Data Link + Physical	MAC, Ethernet, cabling

5. **Data Encapsulation**
    - **PDUs**:
        - **Data** → **Segment** (Transport) → **Packet** (Network) → **Frame** (Data Link) → **Bits** (Physical).
    - **De-encapsulation**: Reverse process at destination.
6. **Addressing**
    - **Layer 3 (IP)**: Logical, end-to-end (e.g., `192.168.1.1`).
    - **Layer 2 (MAC)**: Physical, per-hop (e.g., `AA:BB:CC:DD:EE:FF`).

- **Default Gateway**: Router's IP for remote networks.