

# NETWORKING CHEAT SHEET

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## 1. Communication System

- A system that enables the exchange of data between devices over a communication channel.
  - Consists of: Sender, Medium, Receiver, Protocols.
  - **Example:** Sending an email over the internet.
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## 2. Transmission Media

- **Wired:** Transmit data using physical cables.
    - Twisted Pair (used in Ethernet)
    - Coaxial Cable (used in cable TV)
    - Fiber Optic (used for high-speed internet)
  - **Wireless:** Transmit data through air.
    - Radio Waves (Wi-Fi)
    - Microwaves (satellite communication)
    - Infrared (TV remotes)
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## 3. OSI Model (7 Layers)

A conceptual model to standardize communication functions.

1. **Application** – User Interface (e.g., HTTP, FTP)
  2. **Presentation** – Data translation, encryption (e.g., JPEG, SSL)
  3. **Session** – Establishes, manages sessions (e.g., NetBIOS)
  4. **Transport** – Reliable delivery (TCP, UDP)
  5. **Network** – Routing and addressing (IP, ICMP)
  6. **Data Link** – MAC addressing and error detection (Ethernet)
  7. **Physical** – Transmission media (cables, signals)
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## 4. TCP/IP Model (4 Layers)

The practical networking model used on the Internet.

1. **Application** – DNS, HTTP, FTP, SMTP
2. **Transport** – TCP (reliable), UDP (fast, unreliable)
3. **Internet** – IP for routing, ICMP for diagnostics

- 4. **Network Access** – Deals with hardware and physical transmission (Ethernet, MAC)
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## 5. Router IOS & SDM

- **IOS:** Operating System used in Cisco routers; CLI-based.
    - **Example command:** `show ip interface brief`
  - **SDM:** GUI tool for configuring Cisco routers.
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## 6. Managing an Internetworking Router

- Access via CLI (console, SSH, Telnet)
  - Basic Commands:
    - `enable`: enter privileged mode
    - `configure terminal`: start global config
    - `show running-config`: view current config
    - `interface g0/0`: access interface
    - `ip route`: add static routes
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## 7. Overview of LAN

- Local Area Network connects devices in a small area.
  - **Examples:** Home network, Office LAN.
  - Devices: Switches, routers, computers, printers.
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## 8. VLAN (Virtual LAN)

- Divides a physical network into logical segments.
  - Reduces broadcast traffic and enhances security.
  - **Example:** VLAN 10 for HR, VLAN 20 for Finance.
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## 9. Switch Configuration

- Assign ports to VLANs, enable trunking.
- Example:

```
interface fastEthernet 0/1
switchport mode access
switchport access vlan 10
```
- Use `show vlan` to verify VLAN settings.

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## 10. Overview of STP (Spanning Tree Protocol)

- Prevents loops in a Layer 2 network.
  - Elects a Root Bridge and disables redundant paths.
  - Port States:
    - **Blocking:** Listens but doesn't forward
    - **Listening:** Checks for loops
    - **Learning:** Builds MAC table
    - **Forwarding:** Forwards traffic
  - **Example:** Two switches with redundant links—STP blocks one.
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## 11. Networking Protocols

- **Ethernet** – Used in LANs for frame transmission
  - **IP** – Logical addressing
  - **TCP** – Reliable, ordered delivery
  - **UDP** – Fast, no delivery guarantee
  - **HTTP** – Web browsing
  - **FTP** – File transfer
  - **DNS** – Resolves domain names
  - **DHCP** – Assigns IP addresses
  - **RIP, OSPF, BGP, EIGRP** – Routing protocols
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## 12. IP Addressing

- **FLSM (Fixed Length Subnet Masking):** All subnets have the same size.
    - Example: 192.168.1.0/24
  - **VLSM (Variable Length Subnet Masking):** Different subnet sizes.
    - Example: 192.168.1.0/25, 192.168.1.128/26
  - **CIDR (Classless Inter-Domain Routing):** IP addressing with flexible subnetting.
    - Format: 192.168.10.0/22
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## 13. Static Routing

- Manual configuration of routes.
  - **Example:** `ip route 192.168.2.0 255.255.255.0 192.168.1.1`
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## 14. Dynamic Routing

Routers share routing info and adapt to network changes.

- **RIP:** Distance-vector, uses hop count (max 15)
    - Easy to configure, but slow and limited
  - **IGRP:** Cisco protocol using bandwidth, delay
    - Now obsolete, replaced by EIGRP
  - **EIGRP:** Hybrid, fast convergence using DUAL
    - Cisco proprietary, supports VLSM
  - **OSPF:** Link-state, uses cost metric
    - Open standard, hierarchical with areas
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## 15. NAT (Network Address Translation)

- Converts private IPs to public IPs for internet access.
- **Static NAT:** One-to-one mapping
- **Dynamic NAT:** Many-to-many pool mapping
- **PAT:** Port-based translation (many-to-one)

**Example:** Private IP: 192.168.1.10 → Public IP: 203.0.113.5

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## 16. IPv6 Introduction

- 128-bit addressing system to replace IPv4.
  - Format: 2001:0db8:85a3::8a2e:0370:7334
  - Types:
    - **Unicast:** One-to-one
    - **Multicast:** One-to-many
    - **Anycast:** One-to-nearest
  - No NAT needed; large address space.
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## 17. WAN (Wide Area Network)

- Connects LANs over geographic areas.
  - Technologies:
    - **Leased Lines:** Dedicated point-to-point
    - **Frame Relay:** Packet-switched
    - **MPLS:** Fast, flexible routing
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## 18. Infrastructure Security

- Protects networks from unauthorized access.
  - Components:
    - **ACLs (Access Control Lists):** Permit/deny traffic
    - **Firewalls:** Block/allow based on rules
    - **IDS/IPS:** Detect and prevent intrusions
    - **VPN:** Encrypts data over public networks
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## 19. Software Defined Networking (SDN)

- Network control is moved from hardware to software controller.
  - Allows centralized management and automation.
  - Used in data centers, cloud networks.
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**TIP:** Use show commands for verification, e.g. `show ip route`, `show interfaces`, `show vlan`