

LAN Definition in Computer Networking



- A group of devices connected within one limited physical location



- Examples: office, building, home, or campus



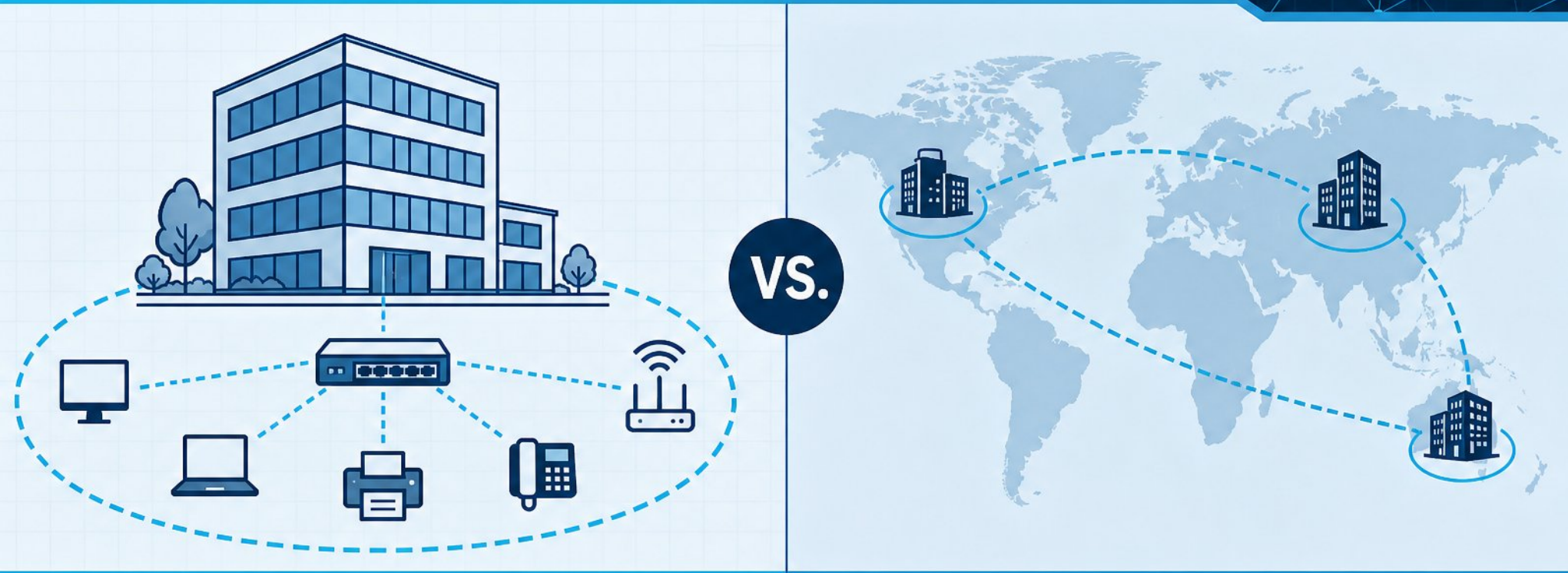
- Foundational for businesses, schools, and connected workplaces



- This training covers: definition, components, design, security, setup, troubleshooting

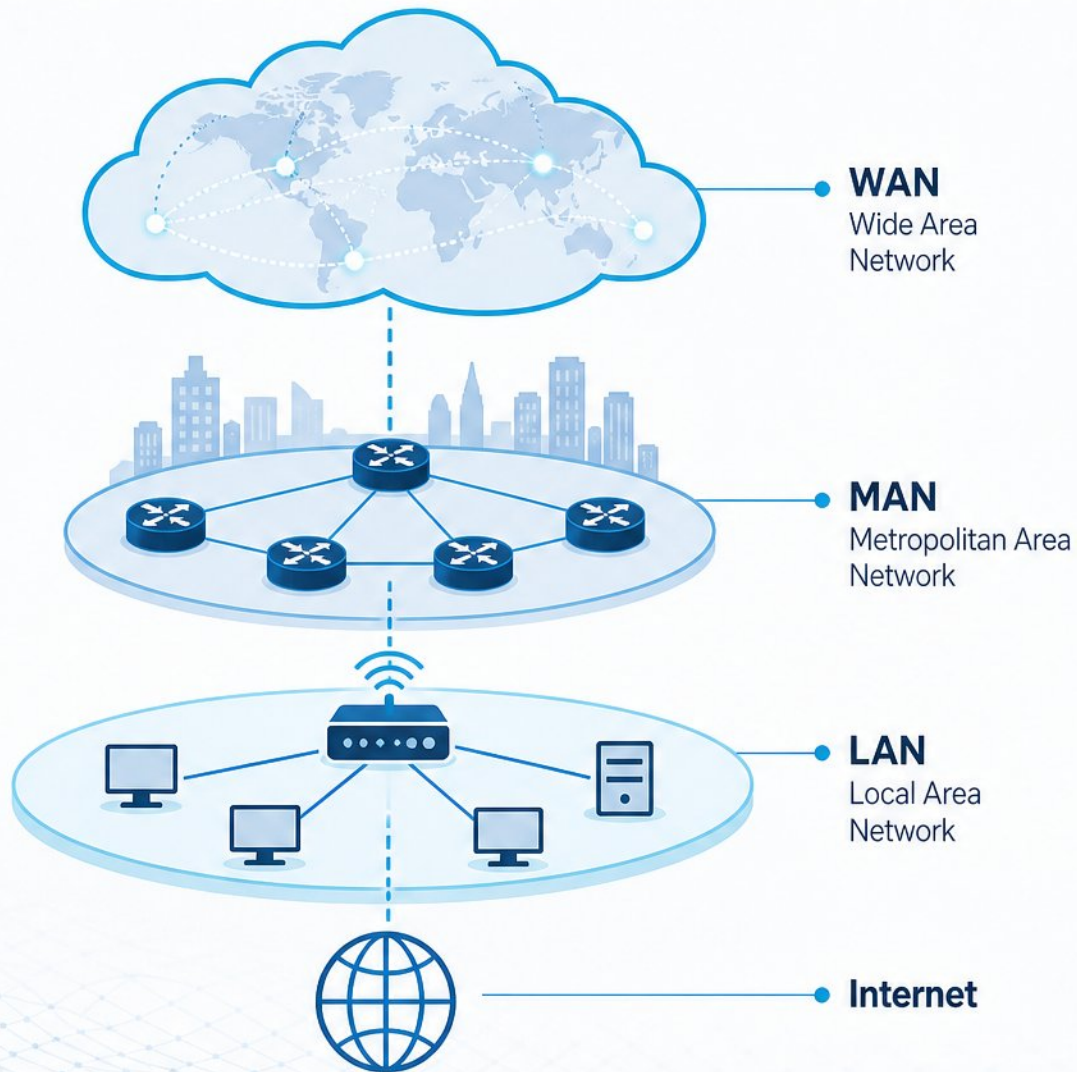


What Makes a Network Local?



- Limited physical area: building, office, home, or campus
- Locally owned and managed equipment
- Homes, schools, offices, and data centers
- LAN vs. PAN: personal device range
- LAN vs. MAN/WAN: larger area, carrier-managed

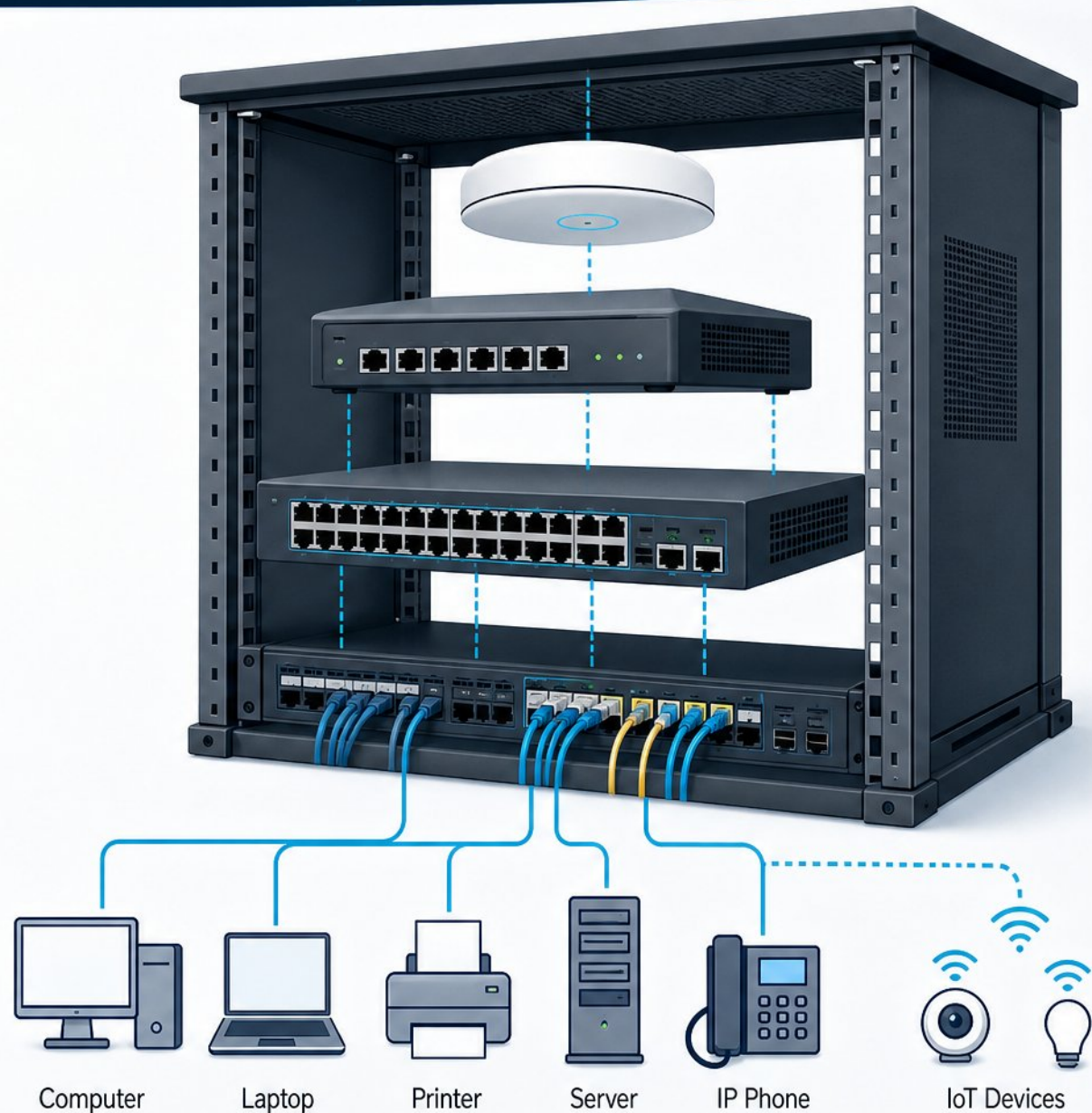
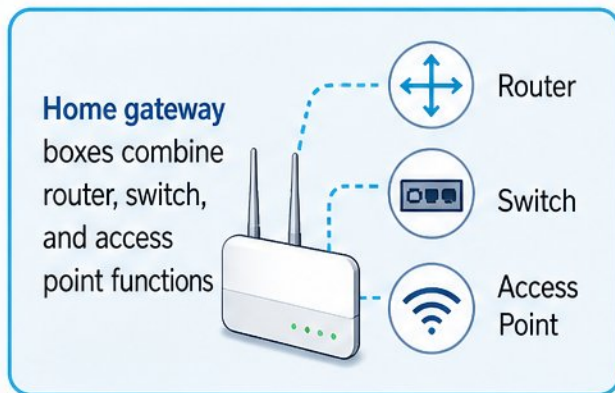
How a LAN Fits into the Bigger Picture



- Connects to the internet through a central router or gateway
- WANs link LANs across cities, countries, or continents
- MANs typically span a metro area, interconnecting nearby LANs
- Organizations own LAN gear but rent WAN services from carriers

Core Components of a LAN

- **End devices:** computers, laptops, printers, servers, IP phones, IoT devices
- **Network devices:** Layer 2 switches, routers, wireless access points
- **Interconnections:** Ethernet cabling, fiber, transceivers, Wi-Fi, network interface cards
- Home gateway boxes combine router, switch, and access point functions



Router, Switch, and Access Point: Who Does What?



- **Router:** connects networks and routes traffic by IP address



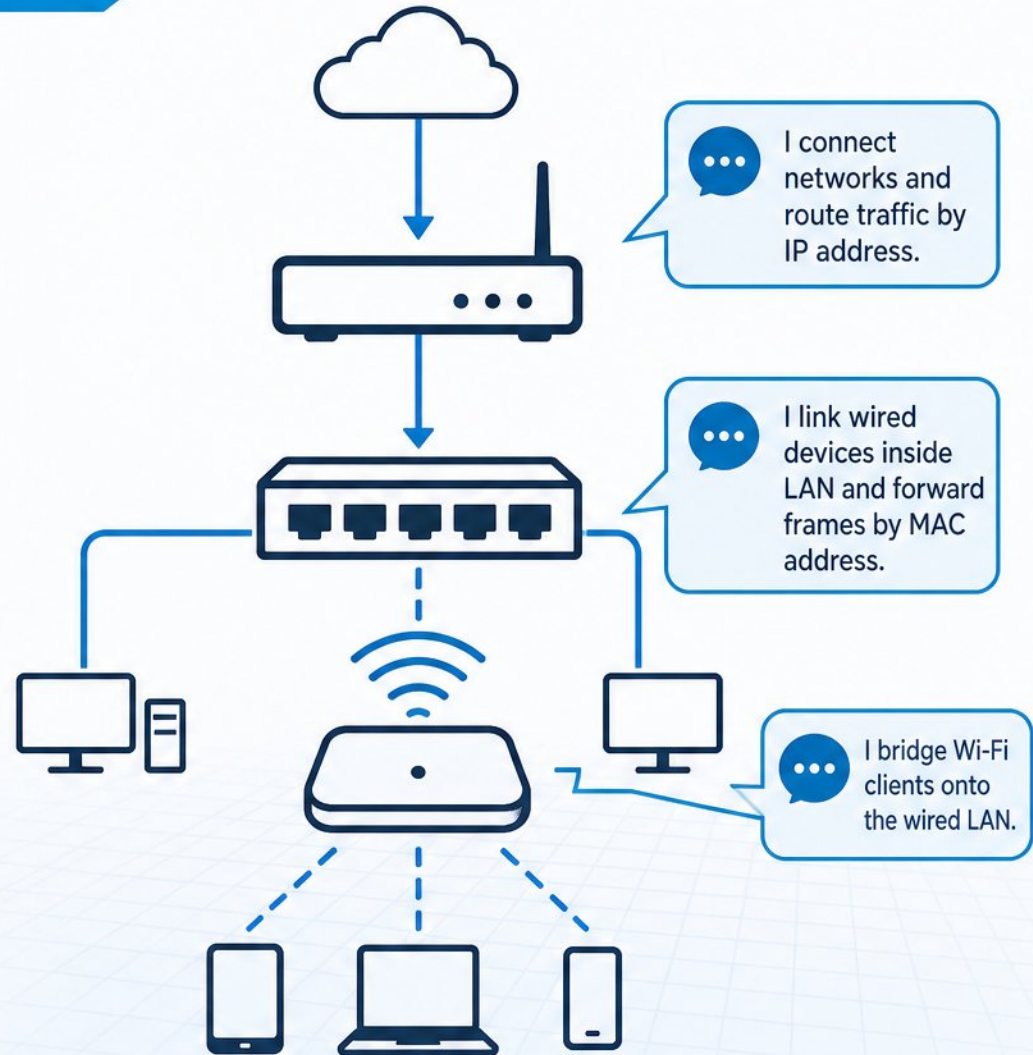
- **Switch:** links wired devices inside LAN and forwards frames by MAC address



- **Access point:** bridges Wi-Fi clients onto the wired LAN

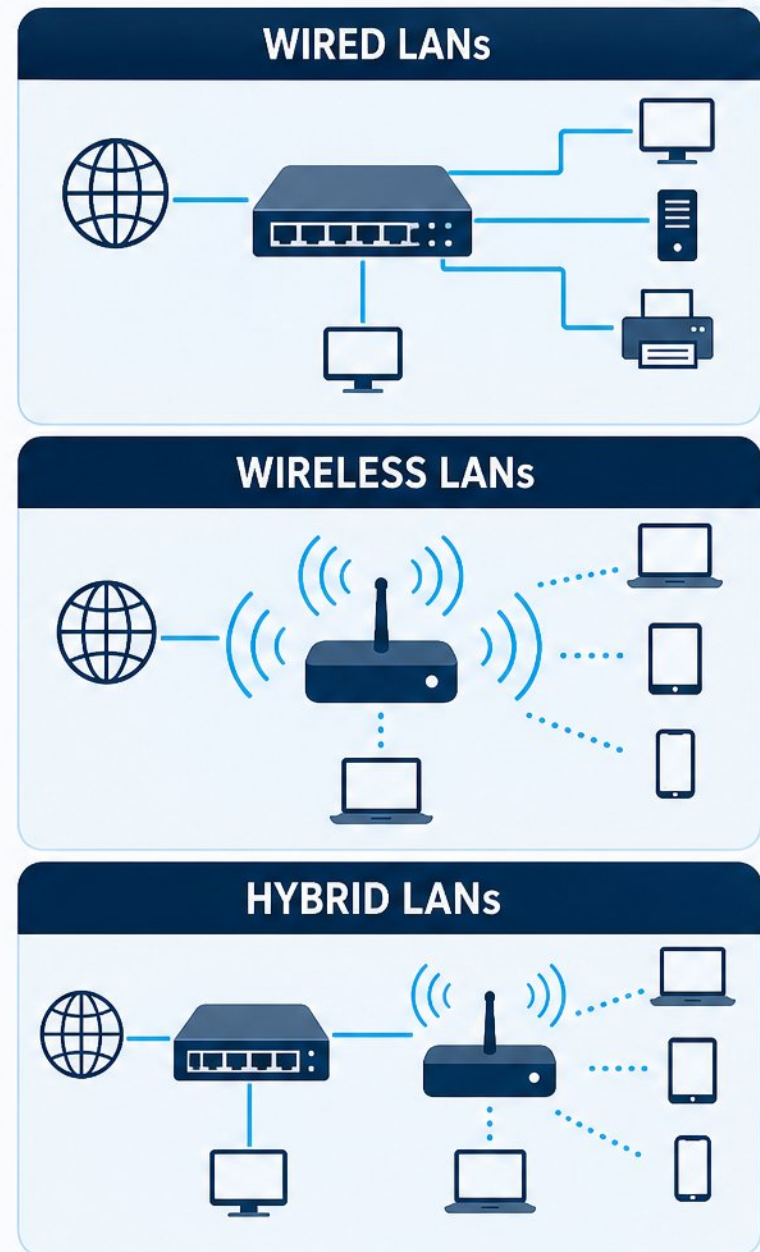


- Troubleshoot by function, not by retail label



Wired and Wireless LAN Types

- Wired LANs: switches and cabling for stable speed
- Wireless LANs: access points and radio waves for mobility
- Hybrid LANs: wired backbone plus Wi-Fi access
- Home, office, and campus LANs differ in scale
- Choose wired for performance, wireless for convenience



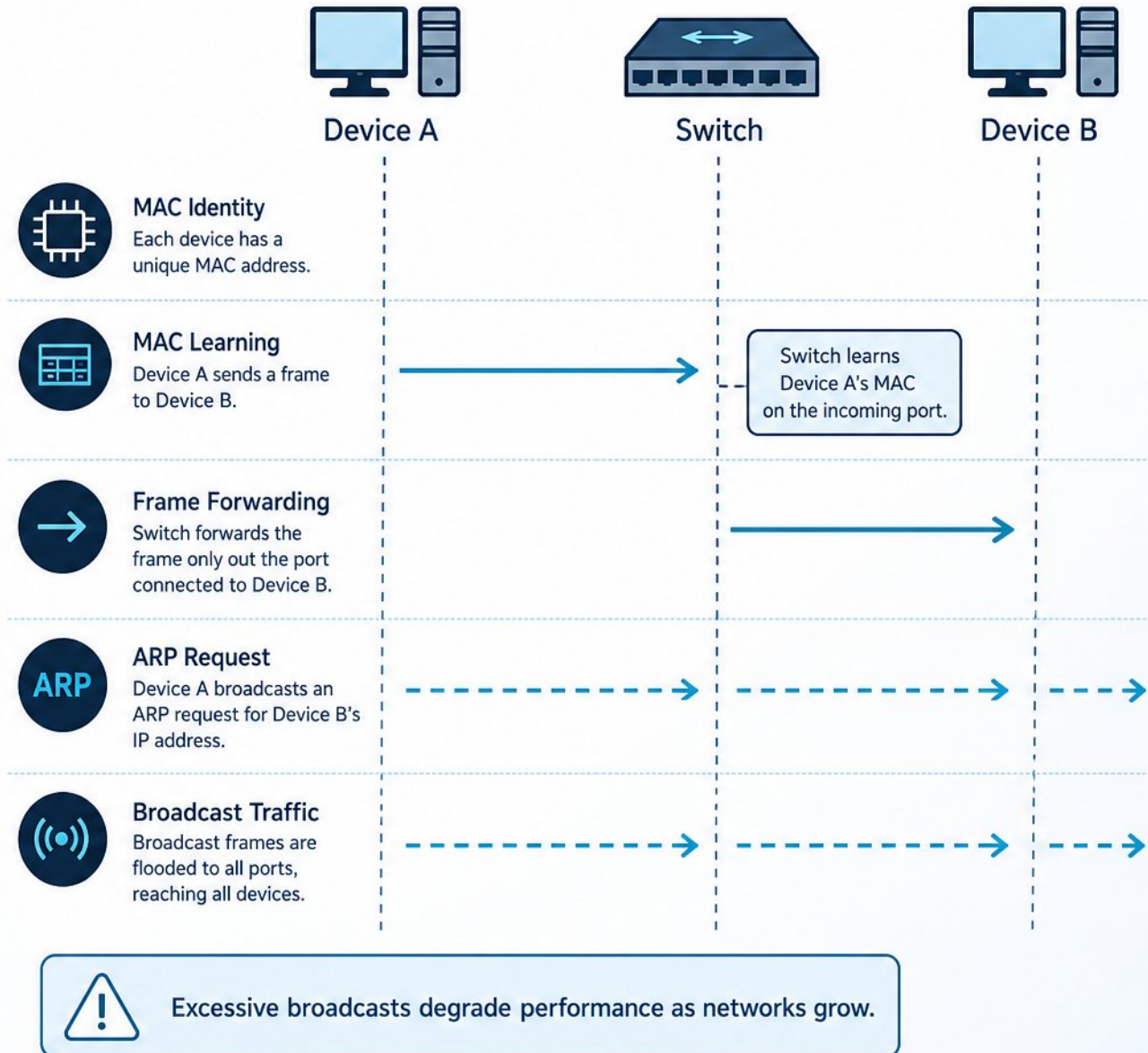
Ethernet, Wi-Fi, and the Standards That Define Them



- Ethernet (IEEE 802.3): dominant wired LAN technology
- Wi-Fi (IEEE 802.11): standard for wireless LAN access
- Ethernet gives consistent throughput and low latency
- Wi-Fi 7 adds 320 MHz channels and multi-link operation
- IEEE and IETF create interoperable LAN specifications

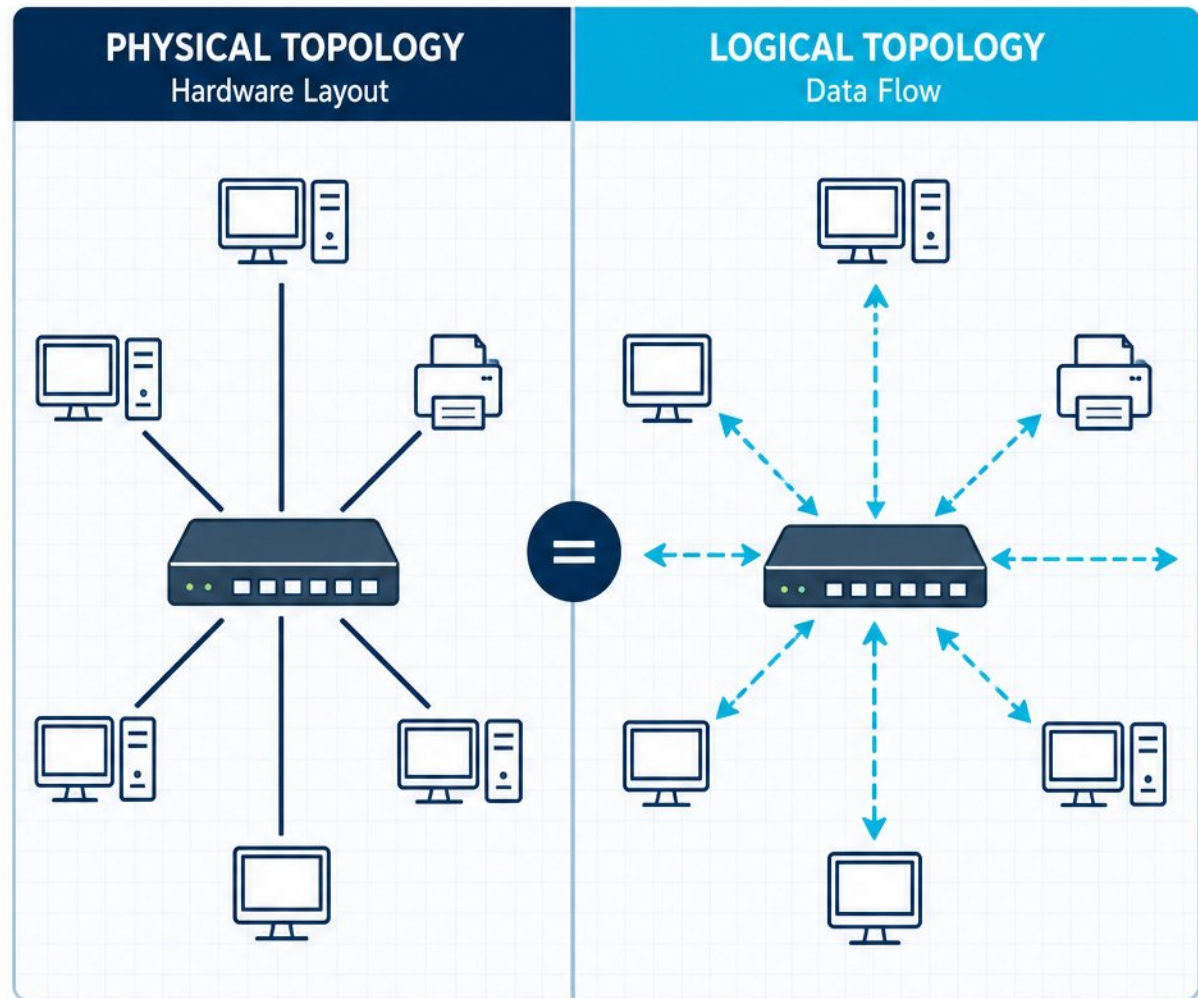
How Devices Communicate on a LAN

- MAC addresses give each device a local hardware identity
- Switches learn MAC addresses and forward frames to the correct port
- ARP maps IP addresses to MAC addresses for local delivery
- Broadcast traffic reaches all devices in a LAN
- Excessive broadcasts degrade performance as networks grow



Physical and Logical Topologies

- Physical topology shows hardware layout; logical topology shows actual data flow
- Common designs include bus, ring, star, mesh, and hybrid
- Star topology dominates modern LANs for reliability, easy growth, and simple troubleshooting
- Small offices and classrooms typically use a star layout with one central switch
- The central switch is a single point of failure; consider redundancy for critical setups



Designing a Practical Small LAN



- Start with needs: users, devices, growth, and essential applications



- Design flow: internet, gateway, switch, access points, endpoints



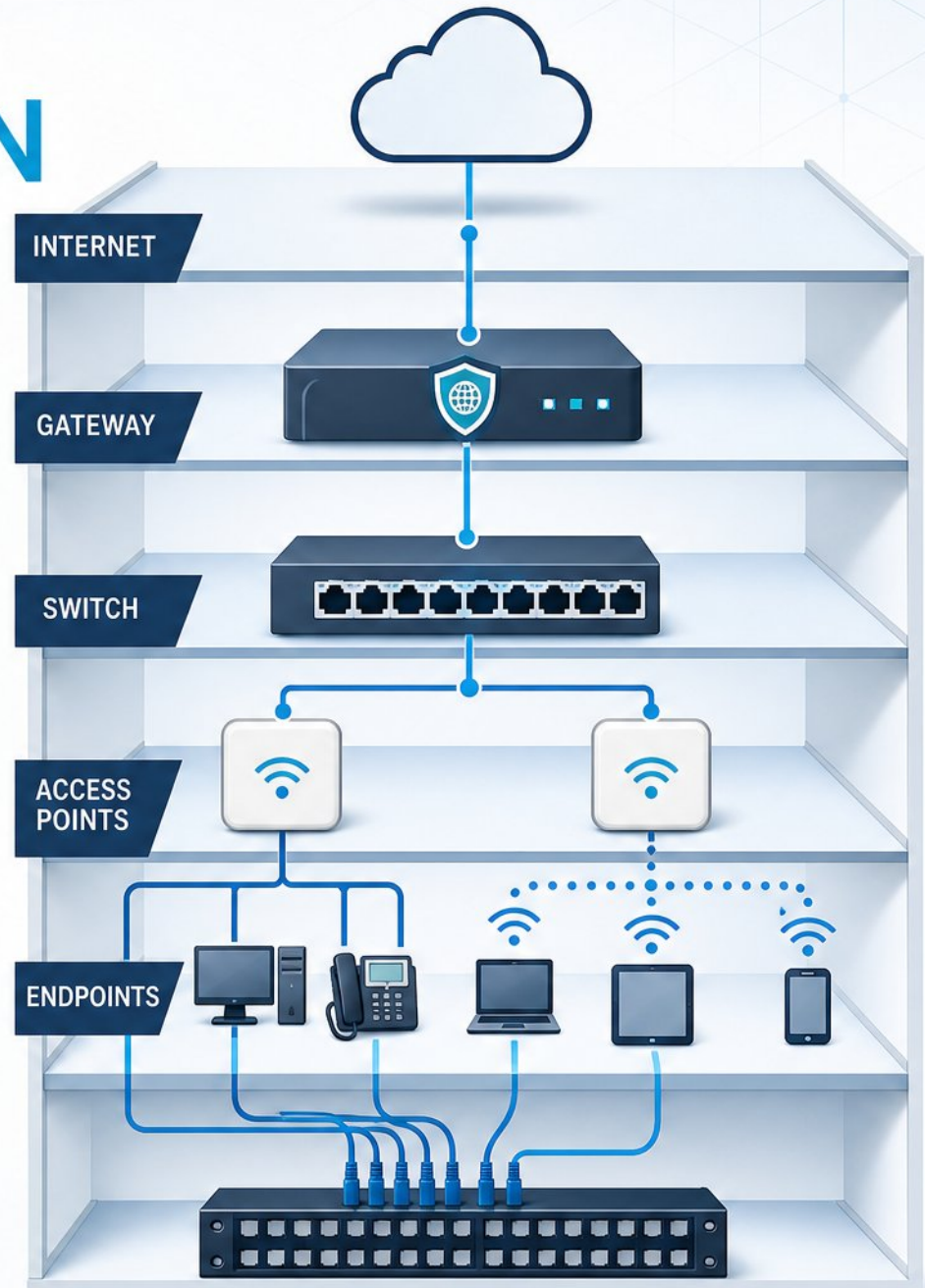
- Wire fixed devices; use Wi-Fi for mobile flexibility



- Plan spare ports, PoE budget, cable runs, and labels

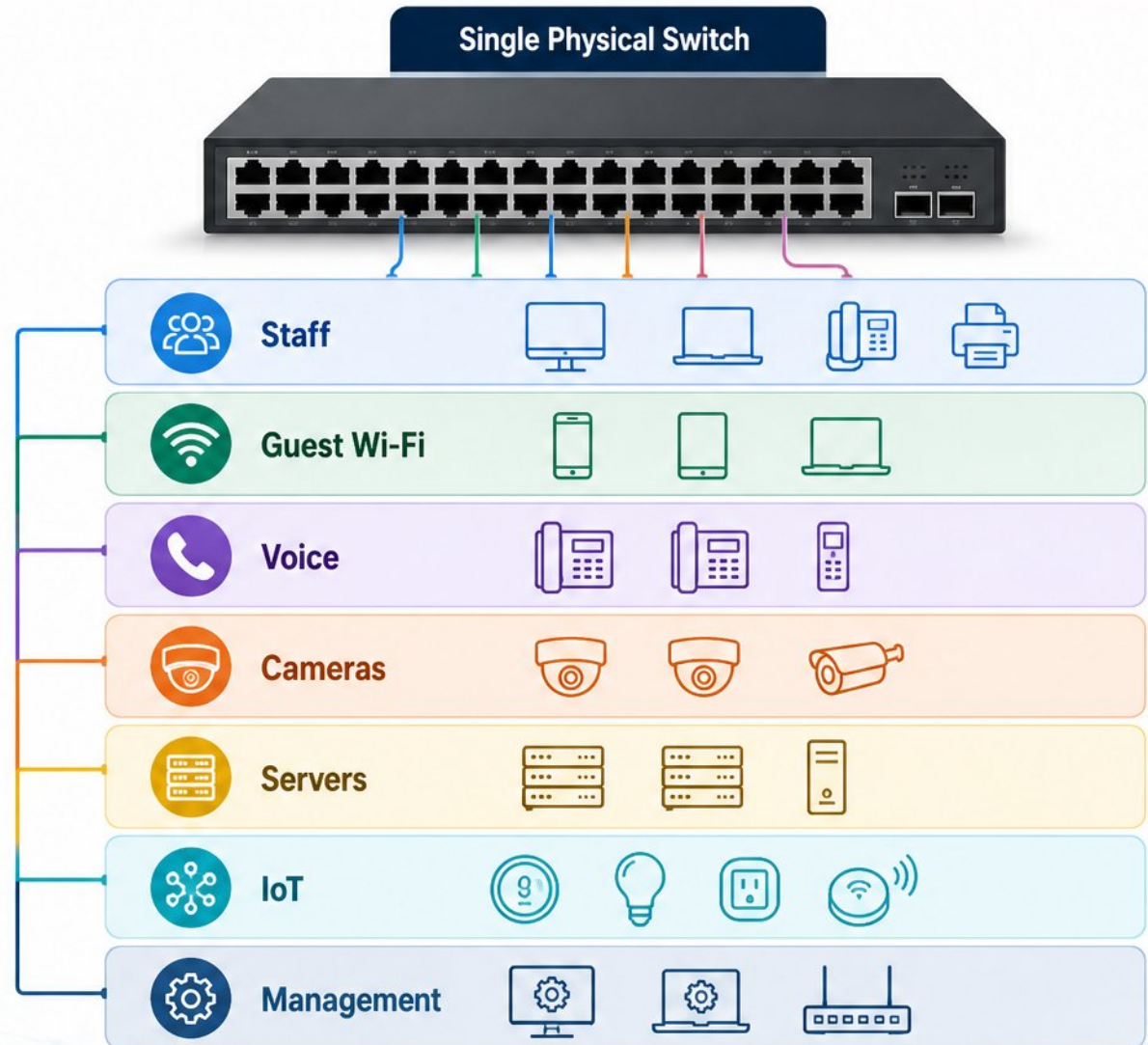


- Document IP plan, VLANs, devices, and network diagrams



VLANs and LAN Segmentation

- - A VLAN is a logical grouping that isolates traffic within a physical LAN
- - Separate traffic by function, user group, or security need without extra hardware
- - Common segments: staff, guest Wi-Fi, voice, cameras, servers, IoT, management
- - Extend VLANs to wireless by binding SSIDs or using dynamic RADIUS assignment
- - Segmentation limits how far a security incident or broadcast storm can spread



LAN Security Essentials



- Control physical access to equipment, closets, and cabling



- Use strong credentials, SSH instead of Telnet, and current firmware



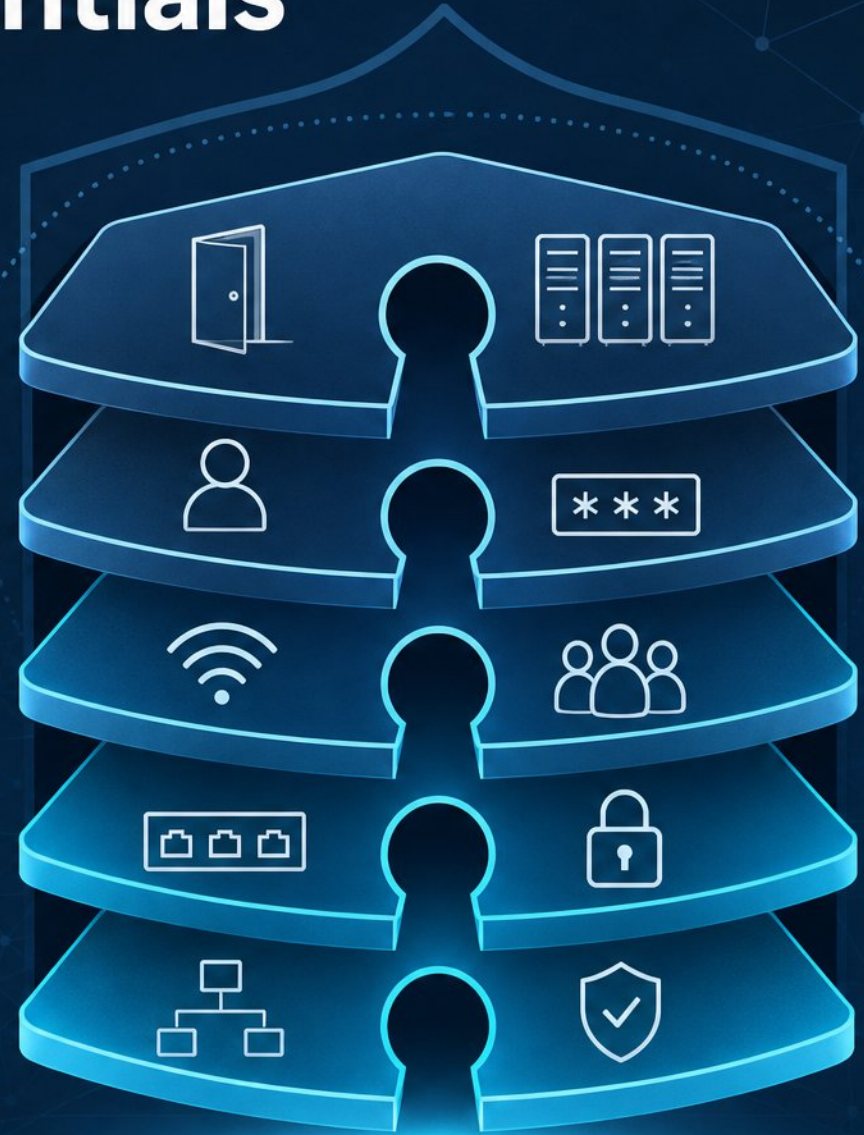
- Enable WPA3 where supported and isolate guest Wi-Fi



- Disable unused switch ports and limit management access



- Use VLANs and access controls to block lateral movement



Setting Up a Small LAN Step by Step



- Plan IP addressing, device inventory, VLANs, and growth before configuring hardware



- Connect ISP handoff to gateway/firewall, then to managed switch and access points



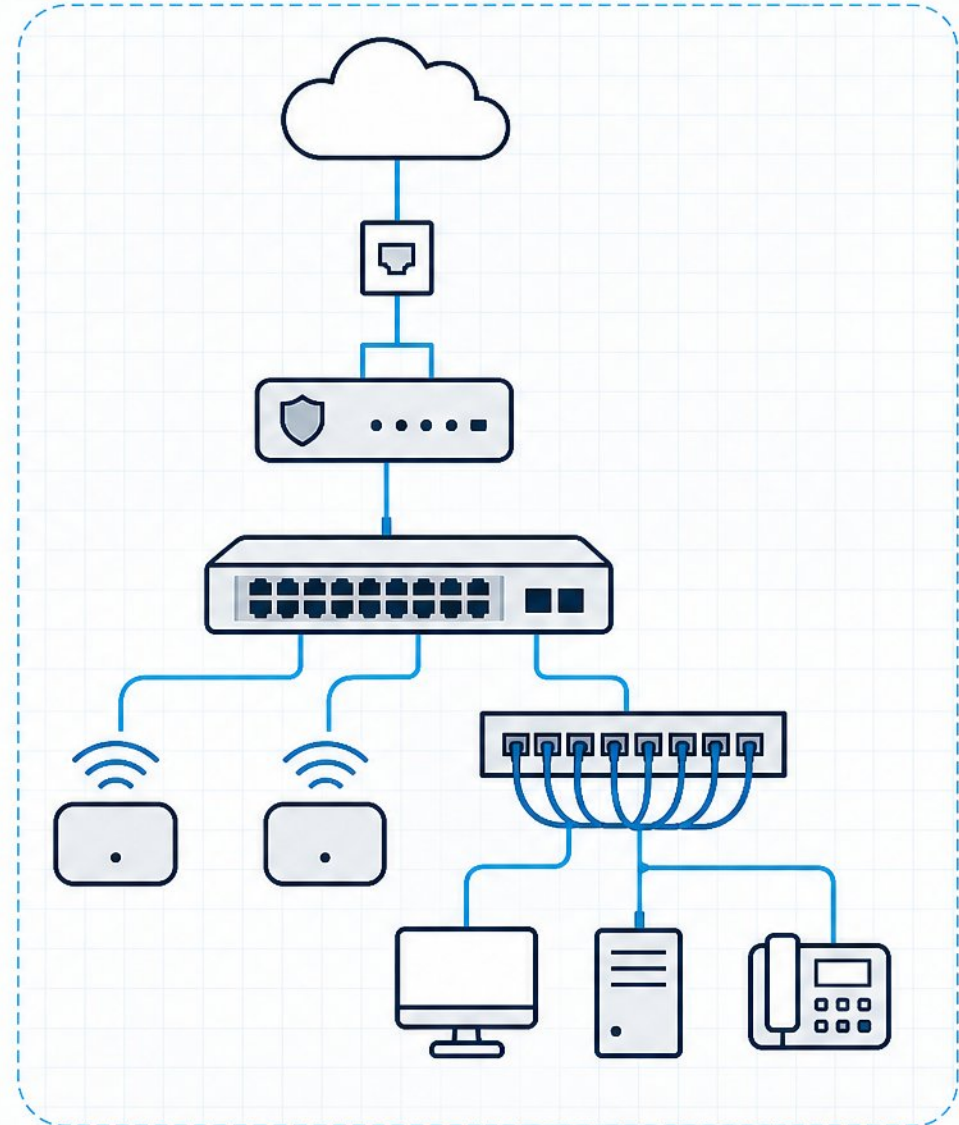
- Configure router, VLANs, DHCP, and wireless SSIDs from a documented baseline



- Label cables and patch panels; reserve IPs for critical devices



- Record the final design in a network diagram



Troubleshooting and Next Steps



- Check physical connectivity, power, and link status before changing configuration



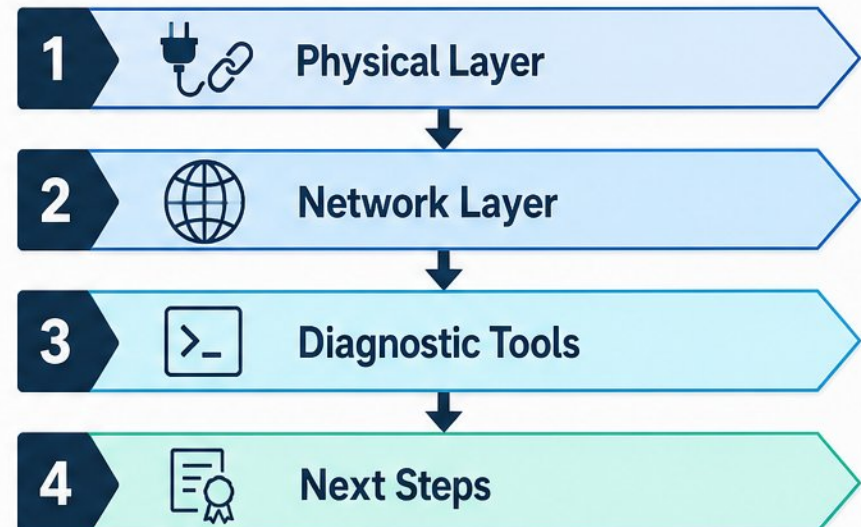
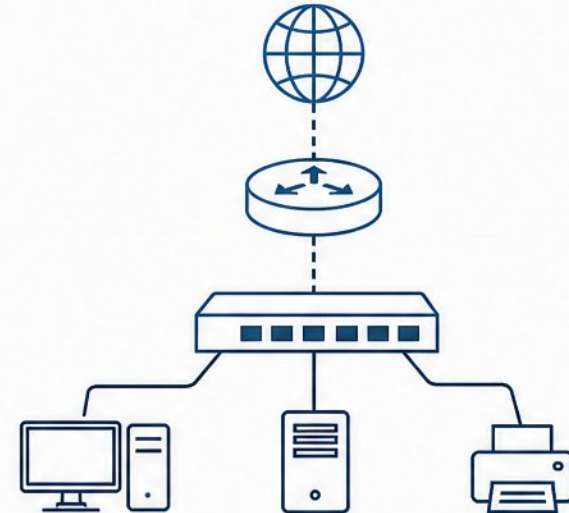
- Inspect IP settings, ping the local gateway, then test routing and name resolution



- Use ipconfig, ping, arp, tracert, and nslookup for diagnosis



- Progress toward CompTIA Network+ and Cisco CCNA certifications



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