Guide2Code - Computer Networks (CN) Roadmap

🟢 Phase 1: Beginner Level

📚 Topics to Learn:

1. **Introduction to Computer Networks** (Basics, Uses, Network Types)
2. **Network Models** (OSI Model, TCP/IP Model, Layered Architecture)
3. **Physical Layer** (Transmission Media, Bandwidth, Data Encoding)
4. **Data Link Layer** (Framing, Error Detection, MAC Addressing)
5. **Networking Devices** (Hubs, Switches, Routers, Gateways)
6. **IP Addressing** (IPv4 & IPv6, Subnetting, CIDR)
7. **Network Protocols Basics** (HTTP, HTTPS, FTP, SMTP, DNS)
8. **Routing Basics** (Static vs Dynamic Routing, RIP, OSPF)
9. **Basic Network Security** (Firewalls, Encryption, VPN)
10. **Network Troubleshooting** (Ping, Traceroute, Netstat)

🛠️ Beginner Project Ideas:

- **Subnet Calculator** – Convert IPs and subnets
- **Simple Packet Sniffer** – Capture network traffic using Python
- **Basic Network Scanner** – Scan devices on a network
- **Client-Server Chat Application** – Implement using Python sockets
- **Network Speed Tester** – Measure upload/download speeds

🟡 Phase 2: Intermediate Level

📚 Topics to Learn:

1. **Error Detection & Correction** (CRC, Hamming Code)
2. **Advanced Routing Protocols** (BGP, OSPF, EIGRP)
3. **Transport Layer Protocols** (TCP vs UDP, Congestion Control)
4. **Wireless Networks** (WiFi, Bluetooth, Cellular Networks)
5. **DNS & DHCP** (Domain Name Resolution, Dynamic IP Assignment)
6. **NAT & Port Forwarding** (Public vs Private IPs, NAT Types)

7. **VPN & Proxy Servers** (How VPNs Work, Tunneling Protocols)
8. **Network Virtualization** (SDN, NFV, VLAN)
9. **Cloud Networking** (AWS, Azure, GCP Networking Basics)
10. **Network Monitoring & Tools** (Wireshark, Nmap, SNMP)

🛠 **Intermediate Project Ideas:**

- **Firewall Rule Simulator** – Implement basic packet filtering
- **Load Balancer Simulation** – Distribute network traffic efficiently
- **WiFi Packet Analyzer** – Capture and analyze WiFi packets
- **DNS Lookup Tool** – Resolve domain names to IP addresses
- **IoT Network Simulation** – Connect IoT devices using a simulated network

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🔴 **Phase 3: Advanced Level**

📚 **Topics to Learn:**

1. **Advanced Network Security** (Zero Trust, Intrusion Detection Systems)
2. **Deep Packet Inspection** (Packet Filtering, DPI Tools)
3. **IPv6 Transition Mechanisms** (Tunneling, Dual Stack)
4. **Network Automation** (Python for Networking, Ansible, Netmiko)
5. **Software-Defined Networking (SDN)** (OpenFlow, Controller-Based Networking)
6. **5G & Future Networks** (Architecture, Use Cases)
7. **Edge & Fog Computing** (Decentralized Networking Concepts)
8. **Blockchain in Networking** (Decentralized DNS, Security Applications)
9. **Network Load Balancing** (HAProxy, Nginx, Layer 4/7 Load Balancing)
10. **Cybersecurity & Ethical Hacking** (MITM Attacks, Packet Injection, Sniffing)

🛠 **Advanced Project Ideas:**

- **Intrusion Detection System (IDS)** – Detect network attacks
- **AI-Powered Network Analyzer** – Use ML to analyze traffic patterns
- **Dynamic VPN Configurator** – Automate VPN configurations
- **Decentralized DNS System** – Build a blockchain-based DNS

- **Cloud-Based Network Simulation** – Simulate SDN and virtual networks