

Fiber Optic

- Light instead of electricity
- Immune to lightning, short circuits
- One cable for sending, One for receiving
- **Multi-mode** , LED's used to send multiple light signals; short distance; slow
- **Single-Mode** , laser light ; high transfer rate ; long distance

Coax / BNC

- Mostly for satellite and modem
- RG name (RG-59, RG-6 most common)
- Rated by impedance
- **BNC connector** → quarter-twist connector
- **F-type connector** → Screw connection
 - Usual top speed = 50 Mbps

Network Devices

- **Hubs (Dumb box)**
 - Incoming signals are repeated among all devices
 - Bandwidth is shared among devices
- **Switches**
 - Point-to-point connections between devices
 - Full bandwidth
- **Bridges**
 - Connect ethernet networks
 - Different media
- **NAS (Network Attached Storage)**
 - Storage space in network
- **Router**
 - Connects LANs using TCP/IP
 - **At least 2 connections :**
 - WAN
 - LAN

Structured Cabling

- Standards defined by **TIA/EIA** (Telecommunications Industry Association / Electronic Industries Alliance)
- Most networks are star
- **3 components :**
 - **Telecommunications room :**
 - All networking equipment
 - Racks are 19 inch wide, height varies
 - Rack mounted equipment uses Us (measure unit), U = 1.75 inch
 - Most devices are 1U, 2U or 4U
 - Patch panel : box with row of female connectors in front and permanent connections in back
 - For horizontal cabling
 - Used for securing, organizing and labeling cables

- Come with CAT ratings
 - Most common uses 110 block
 - Punchdown tool needed
- **Horizontal cabling :**
 - A single piece of cabling is called a run
 - CAT 5e or better UTP
 - All defined by TIA/EIA (type of wires, number of pairs and fire ratings)
- **Work area :**
 - Wall outlet that serves as termination point for horizontal cabling
 - 1 or 2 ports
 - Some use the same connectors (110 punchdowns)
 - Patch cable to connect from outlet to PCs
- **UTP cable types:**
 - Solid core (horizontal cabling)
 - Stranded core (Patch cable)

TCP/IP (Transmission Control Protocol/ Internet Protocol)

- Primary protocol of most modern networks and Internet

– Network Addressing (IP address)

- Any address must provide 2 pieces of information
 - Identify the machine
 - Locate the machine within the larger network

– IP address

- **Network ID**
- **Host ID**
- **Unique** for each host
- Cannot end in 0 or 255

– Class licenses :

– A:

- First octet → Network ID
- **Private Network Range :**
 - 10.0.0.0
 - 10.255.255.255

– B:

- First 2 octets → Network ID
- **Private Network Range :**
 - 172.16.0.0
 - 172.32.255.254
- 169.254.0.0 - 169.254.255.254 = APIPA (Automatic Private IP Addressing)
 - **APIPA** → If no DHCP server, the computer randomly chooses an address and asks if it's taken, if it is not, the address is assigned to that computer

- **C:**
 - First 3 octets → Network ID
 - **Private Network Range :**
 - 192.168.0.0
 - 192.168.255.254
 - 127.0.0.0 - 127.255.255.255 → loopback

Network Class	Address Range	No. of Network Addresses Available	No. of Host Nodes (Computers) Supported
A	1-126	129	16,777,214
B	128-191	16,384	65,534
C	192-223	2,097,152	254

- **Subnet Mask**
 - Used to distinguish what part of the IP address is the network ID and what is the host ID

— TCP/UDP

- **The TCP/IP protocol needs to know if communication is :**
 - Connection-Oriented (TCP) → Acknowledge each other
 - Connectionless (UDP) → No acknowledgement
 - VoIP
 - Video and Audio streaming
- ~95% of applications use TCP
- **TCP/IP services**
 - HTTP (**H**yper**T**ext **T**ransfer **P**rotocol)
 - Telnet
 - Ping
 - Nslookup → determine the information that DNS is giving
 - Tracert → Shows route that the packet takes
 - Good for bottlenecks of network troubleshooting

IPv6

- 32-bit → **128-bit** addresses
- **Hexadecimal** characters
- Last 64-bit are chosen by OS :
 - Random
 - Based on MAC (EUI-64)
- Uses **CIDR** (Classless Inter-Domain Routing) for subnets
 - Maximum of 64 bits for Network ID
 - Usually 48-bit or 64-bit

- **Up to 3 IP addresses on a single NIC**
 - **Link-local :**
 - APIPA equivalent
 - Starts with FE80:: (FE80:0000:0000:0000)
 - **Global Addresses :**
 - Public address
 - Given by default Gateway
 - Requested with RS (Router Solicitation) message
 - Responded with RA (Router Advertisement)
 - Tells network ID, Subnet and DNS
 - Last 64-bits generated by computer

Installing a NIC:

- **3 things needed for network connectivity :**
 - **NIC:**
 - **Modes:**
 - **Duplex** = Send and receive at the same time
 - **Half-Duplex** = Only one at the time
 - **Link-light** gives the status of the link
 - **Activity light** → Blinking = Activity
 - **Protocol**
 - **Network Client** = Interface that allows the computer system to speak to the protocol

NET command

- **NET View** : displays a list of NetBIOS names of computers available on network
- **NET Use** : used to map network drives

NBTSTAT command :

- NetBIOS over TCP/IP statistics
- Windows related “stuff” on your network

Troubleshooting LAN

- **Check de NIC light!**
- **Loopback plug for NIC troubleshooting**
- **Time-Domain Reflectometer (TDR)** : Measures impedance in network cabling. If there is any, something is wrong with the cable.
- **Toners** (cable tracer) :
 - Used to trace or locate cables
 - **2 devices :**
 - **Tone Generator** : Connects to cable and sends a signal
 - **Tone Probe** : Emits a sound when near the cable connected to the tone generator

- **Failing to connect to a New Resource**
 - Usually bad configuration
 - Name/Password?
 - Right share name?
 - Permission?
 - Right Homegroup/Domain/Workgroup?
 - Is it Shared?
 - Does it exist?
- **Failing to connect to a Previously Used Resource**
 - Verify connection with nbtstat -s
 - Check network places/Network
 - Check serving system is on
 - Check physical connection to serving system

References :

- Mike Meyers - CompTIA A+ Certification All-In-One Exam Guide 8th edition