Types of Firewalls

Packet Filtering Firewalls

- 1st Generation & Most Basic
- Basic Filtering Rules

Circuit-Level Firewalls

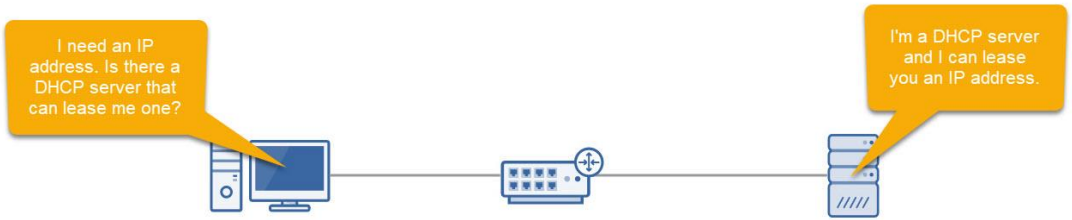
- 2nd Generation
- Monitors Valid/Invalid TCP Sessions

Application Layer 7 (NGFW) Firewalls

- 3rd Generation
- Much more Advanced; Covered Later in Course

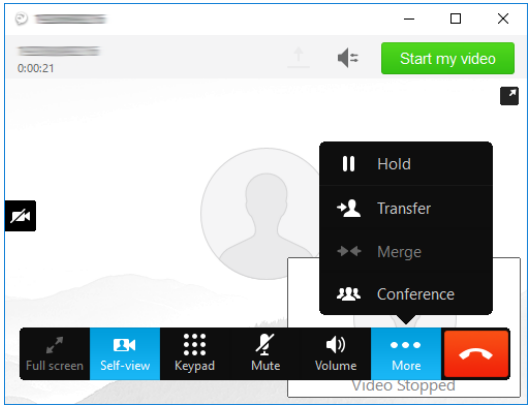
DHCP Server

- Dynamic Host Configuration Protocol (DHCP) Server
- Automatically Assigns IP Addresses to Hosts
- Makes Administering a Network Much Easier
- An Alternative is Static IP addressing
- We'll Talk More About DHCP Later in the Course



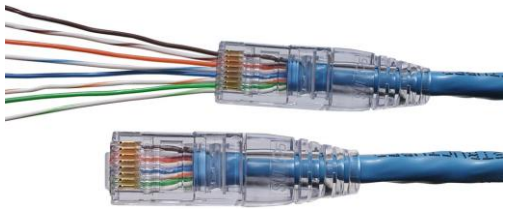
Voice over IP (VoIP) Endpoints

- Most phone systems run over IP networks via dedicated protocols, such as the Session Initiation Protocol (SIP), both in-home and office environments.
- VoIP endpoint devices are hardware devices (phones) or software, such as Cisco Jabber, that allow you to make phone calls.



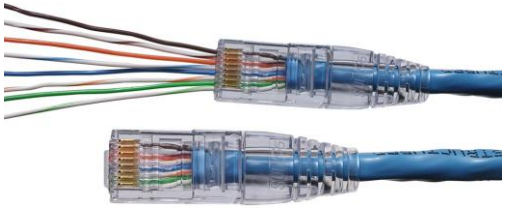
Types of Network Cabling

- Coaxial
- Twisted Pair
- Fiber Optic



Ethernet Explained

- Ethernet is a network protocol that controls how data is transmitted over a LAN.
- It's referred to as the Institute of Electrical and Electronics Engineers (IEEE) 802.3 Standard.
- It supports networks built with coaxial, twisted-pair, and fiber-optic cabling.
- The original Ethernet standard supported 10Mbps speeds, but the latest supports much faster gigabit speeds.
- Ethernet uses CSMA/CD & CSMA/CA access methodology.



Ethernet N<Signaling>-X Naming

- Ethernet uses an “xx Base T” naming convention: **10Base-T**
  - **N**: Signaling Rate, i.e., Speed of the cable.
  - **<Signaling>**: Signaling Type: Baseband (Base) communication.
  - **X**: Type of cable (twisted pair or fiber).

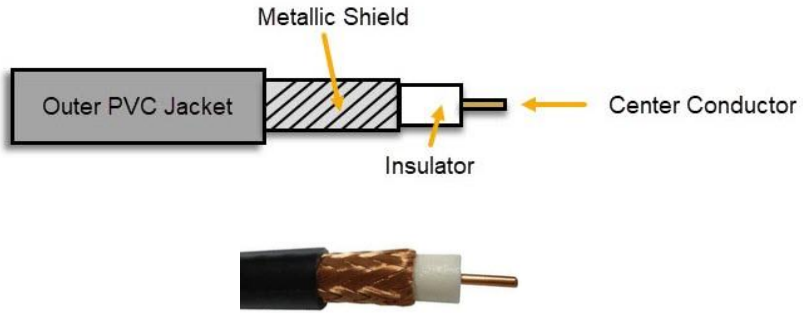
Twisted Pair Standards

Cat	Network Type	Ethernet Standard	Speed	Max. Distance
Cat 3	Ethernet	10Base-T	10Mbps	100 meters
Cat 5	Fast Ethernet	100Base-TX	100Mbps	100 meters
Cat 5e	Gigabit Ethernet	1000Base-T	1Gbps	100 meters
Cat 6	Gigabit Ethernet 10 Gigabit Ethernet	1000Base-T 10GBase-T	1Gbps 10Gbps	100 meters 55 meters
Cat 6a	10 Gigabit Ethernet	10GBase-T	10Gbps	100 meters
Cat 7	10 Gigabit Ethernet	10GBase-T	10Gbps	100 meters

Cat: Copper Cabling Standard.

Coaxial Cable

- Antiquated technology used in the 1980s. Coaxial cables are rarely used today, except for cable modem connections.
- Categorized as Radio Grade (RG)
  - **RG-6**: Used for modern cable TV and broadband cable modems.
  - **RG-8**: Used in early 10Base5 “Thick-net” Ethernet networks.
  - **RG-58**: Used in early 10Base2 “Thin-net” Ethernet networks.
  - **RG-59**: Used for closed-circuit TV (CCTV) networks
- Metallic shield helps protect against electromagnetic interference (EMI)



Coaxial Cable Connectors

F-Connector

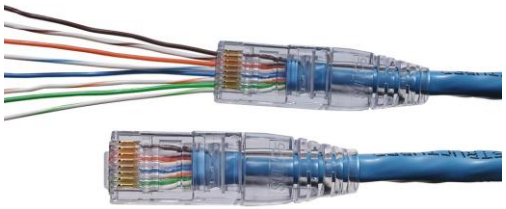
- Screw-on connection
- RG-6 Cable TV and Broadband Cable Applications.

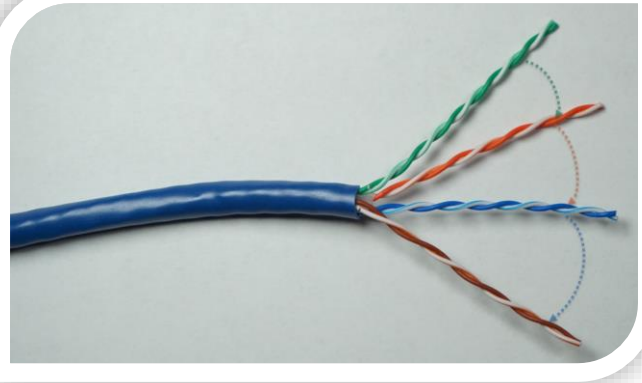
BNC Connector

- Tension spring twist-on connection
- RG-8 “Thick-net” and RG-58 “Thin-net” network applications.

Twisted Pair Copper Cabling

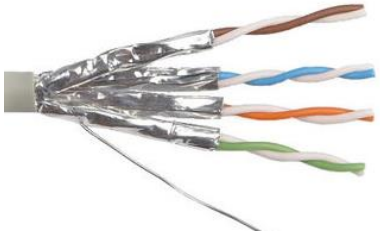
- 4 Twisted Pairs of Wires with RJ-45 Connector
- Balanced pair operation
  - + & - Signals
  - Equal & Opposite Signal
- Why are they twisted?
  - To Help Reduce Interference
    - Crosstalk
    - Noise (Electromagnetic Interference)
- Security concerns
  - Signal Emanations
- 100 Meters Maximum Distance
  - Signal Attenuation

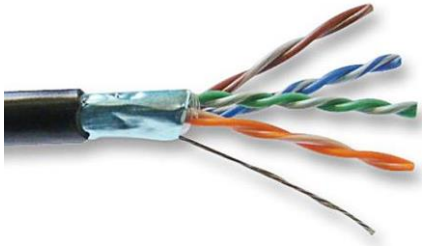


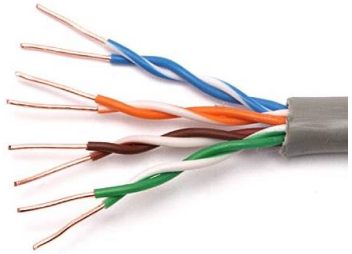


Shielded vs. Unshielded & EMI

- **Unshielded Twisted Pair (UTP)**
  - More susceptible to electromagnetic interference (EMI).
- **Shielded Twisted Pair (STP)**
  - Less susceptible to EMI & Crosstalk (if each pair shielded).
- **Electromagnetic Interference**
  - The disruption of an electronic device's operation when it's in the vicinity of an electromagnetic field caused by another electronic device (manufacturing equipment, microwave ovens, etc.).

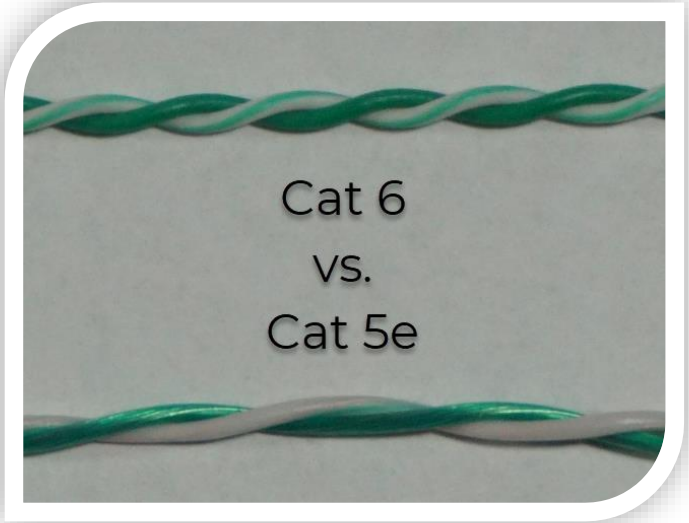






Roles of Twists

- Increased twists per inch:
  - Reduces Crosstalk
  - Increases Signals
  - Supports Faster Speeds



Twisted Pair Standards

Cat	Network Type	Ethernet Standard	Speed	Max. Distance	Frequency
Cat 3	Ethernet	10Base-T	10Mbps	100 meters	16 MHz
Cat 5	Fast Ethernet	100Base-TX	100Mbps	100 meters	100 MHz
Cat 5e	Gigabit Ethernet	1000Base-T	1Gbps	100 meters	100 MHz
Cat 6	Gigabit Ethernet 10 Gigabit Ethernet	1000Base-T 10GBase-T	1Gbps 10Gbps	100 meters 55 meters	250 MHz
Cat 6a	10 Gigabit Ethernet	10GBase-T	10Gbps	100 meters	500 MHz
Cat 7	10 Gigabit Ethernet	10GBase-T	10Gbps	100 meters	600 MHz

Cat: Copper Cabling Standard.

Other Copper Cable Connectors

RJ-11

- 4-pin connection used for telephone connections.

DB-9

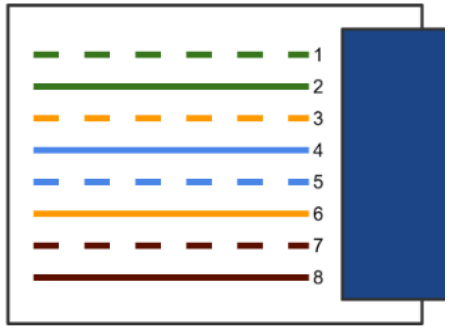
- 9-pin connection used for serial connections on networking devices

DB-25

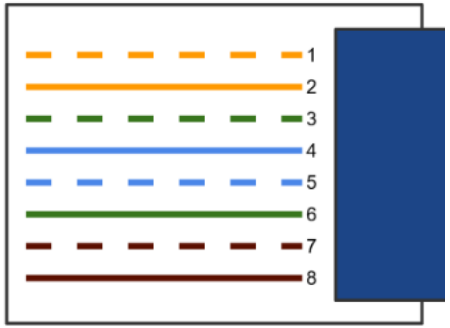
- 25-pin connection previously commonly used for serial printer connections.

TIA/EIA 568A & 568B Wiring Standards

- Industry-standard that specifies the pin arrangement for RJ-45 connectors.
- Two Standards:
  - 568A & 568B
- 568B is newer and the recommended standard.
- Either can be used.
- Why are standards important?
  - Lower Costs
  - Increase Interoperability
  - Easier Maintenance



TIA/EIA 568A



TIA/EIA 568B

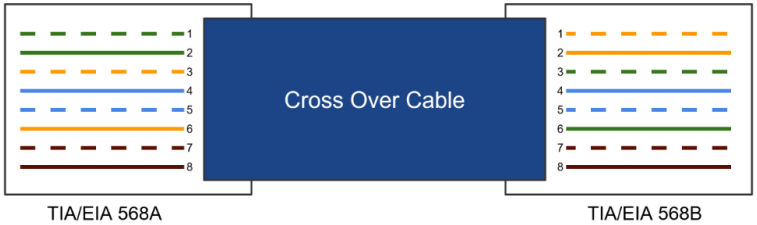
Straight-Through & Crossover Cables

Straight-Through Cable

- Connecting “Unlike” Devices
  - Computer to Switch
  - Switch to Router

Crossover Cable

- Connecting “Like” Devices
  - Router to Router
  - Computer to Computer



Which Twisted Pairs Are Used?

Ethernet & Fast Ethernet

Cat 3 and Cat 5

Only Green and Orange Pairs Used:

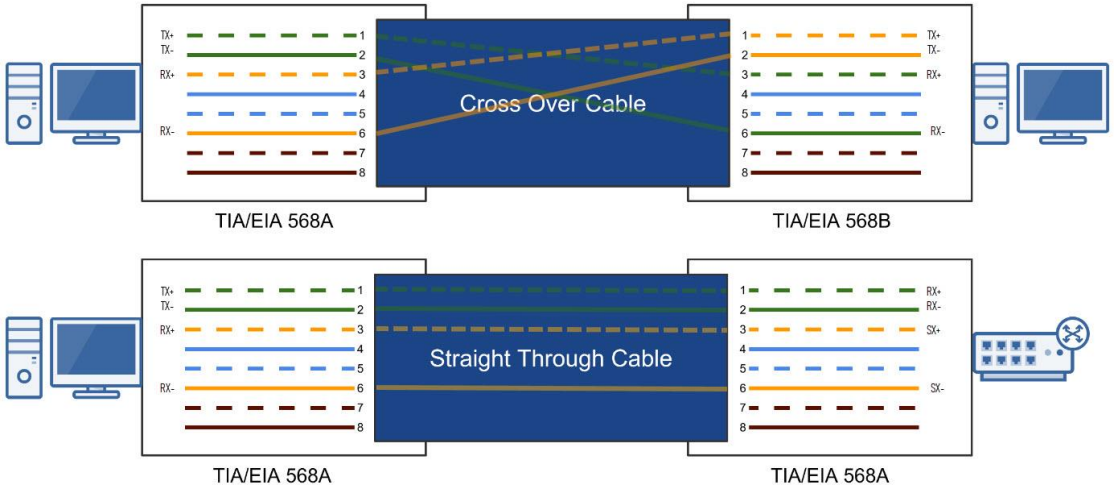
- Pins 1, 2, 3, and 6
  - One Pair to Transmit Data (TX)
  - One Pair to Receive Data (RX)

Gigabit & 10 Gigabit Ethernet

Cat 5e & Faster

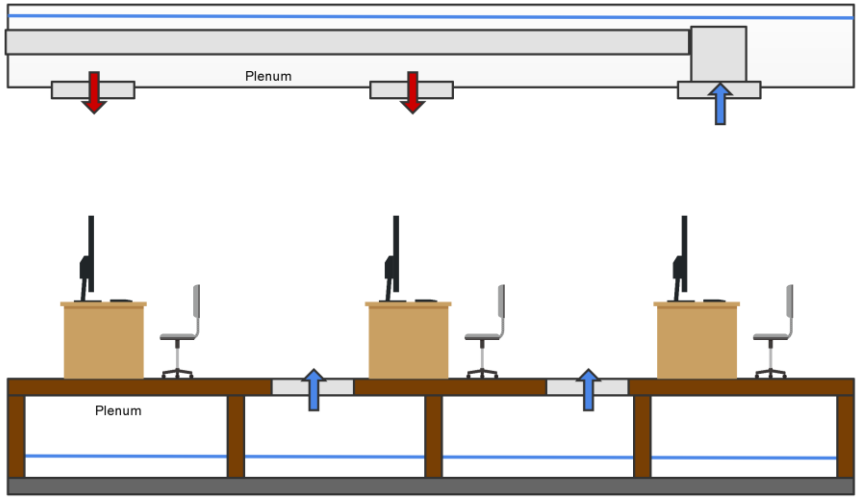
All Four Pairs Used:

- Supports bi-directional data transmission on each pair of wires.



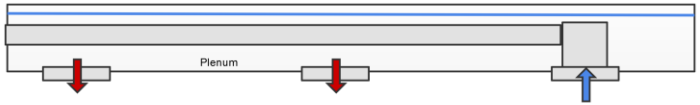
The Plenum

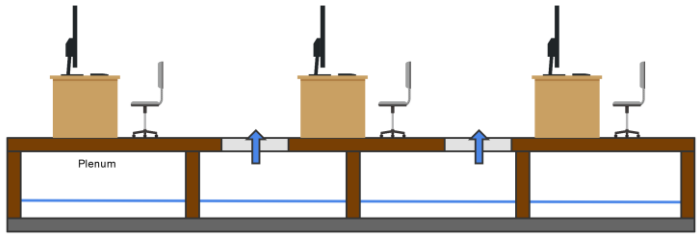
- The plenum is the open space above the ceiling or below a raised floor.
- A “plenum space” is the part of a building that enables air circulation by providing pathways for heated/air-conditioned and return airflows at a higher pressure than normal.
- All network cabling placed in the plenum should be “plenum-rated.”

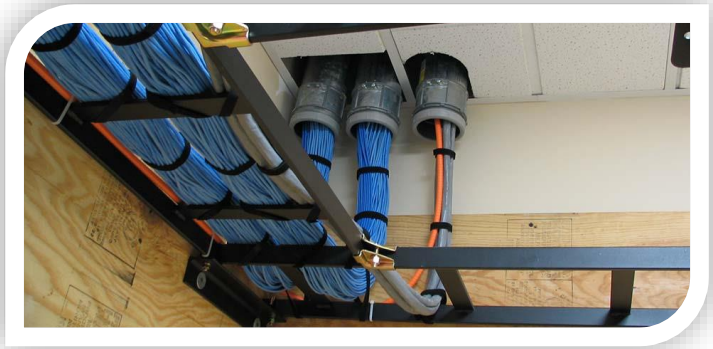


Non-Plenum-Rated & Fire Hazard

- Non-plenum cable or polyvinyl chloride (PVC) cable is often much less expensive than plenum-rated cable.
- When PVC burns or smolders, it releases toxic fumes into the air (Hydrochloric Acid and Dioxin).
- The plenum air return would unknowingly circulate toxic air throughout an office.
- Sprinkler systems typically can’t access the plenum area.
- Building codes often require Plenum Rated cable installed through any plenum space.







Plenum-Rated Cables

- Plenum-rated cables have a special insulation that has low smoke, low flame and non-toxic characteristics.
- Coated with nonflammable materials that minimize toxic fumes:
  - Teflon
  - Fluorinated ethylene polymer (FEP)
  - Low-Smoke PVC