

LAN vs WAN

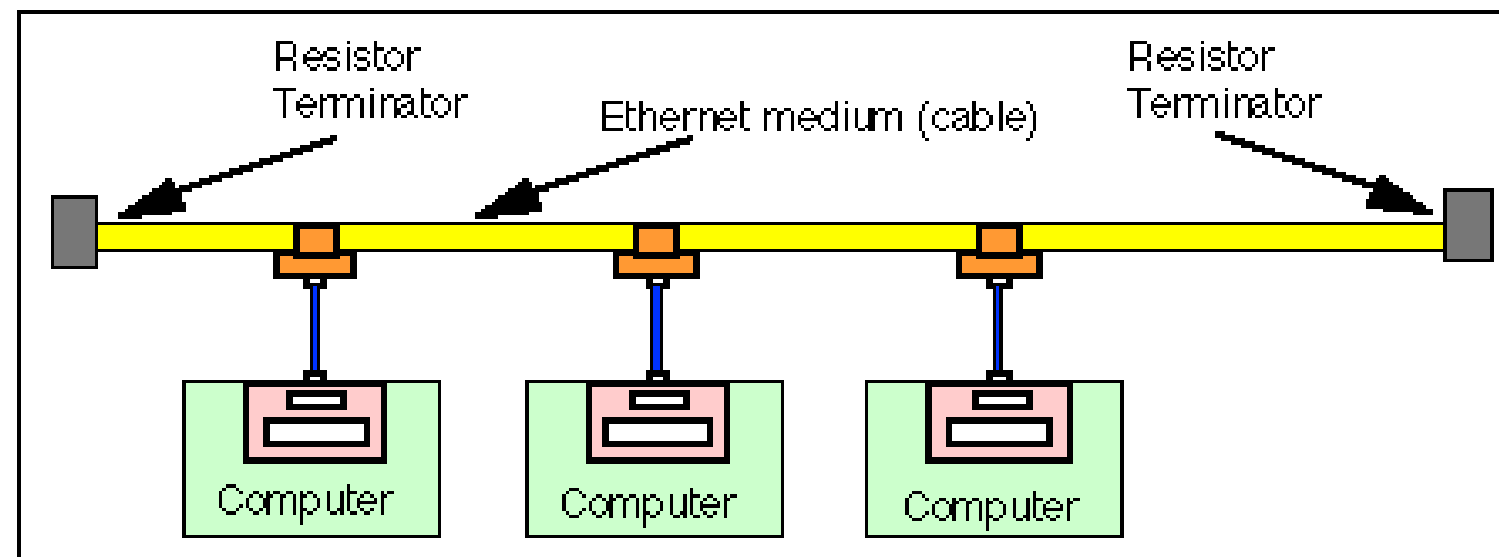
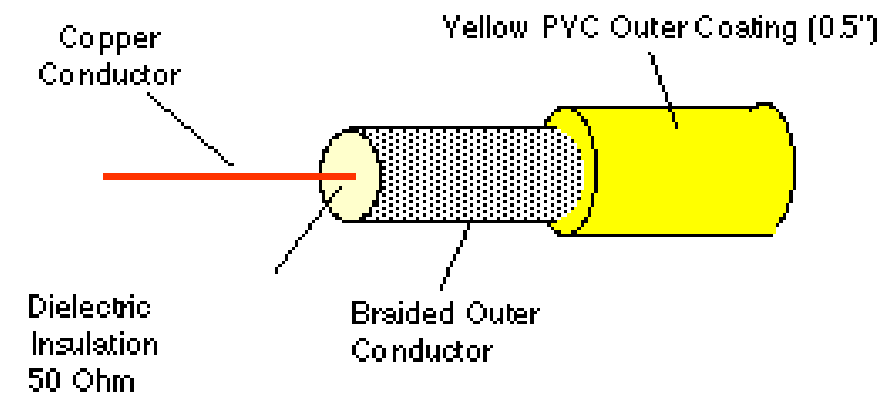
- Local Area Network
 - Bus connection that supports multiple computers
 - Generally less expensive than WAN for comparable speed
 - Span relatively short distances
- Examples:
 - **Ethernet**
 - Token Ring
 - FDDI
- Wide Area Networks
 - Point-to-point or Multipoint
 - Generally more expensive compared to LAN for comparable speed
 - Can span large distances
 - Depicted as lightning bolt
- Examples:
 - 56K dedicated circuit
 - T1, T3, OC3, OC12
 - Frame-Relay
 - ATM

Classic 10Mbps Ethernet

- Ethernet interfaces
 - Thick Ethernet (10base5)
 - Thick coaxial cable (0.5” diameter)
 - 500meter max length
 - Thin Ethernet (10base2 802.3a)
 - RG58 coaxial cable
 - 185 meter max length
 - Twisted Pair Ethernet (10baseT 802.3i)
 - 4 pair UTP (unshielded twisted pair) cable
 - 100 meter max length

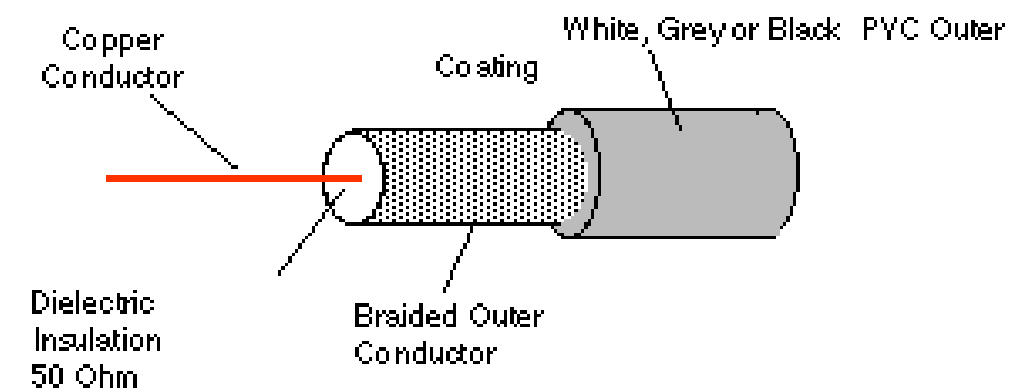
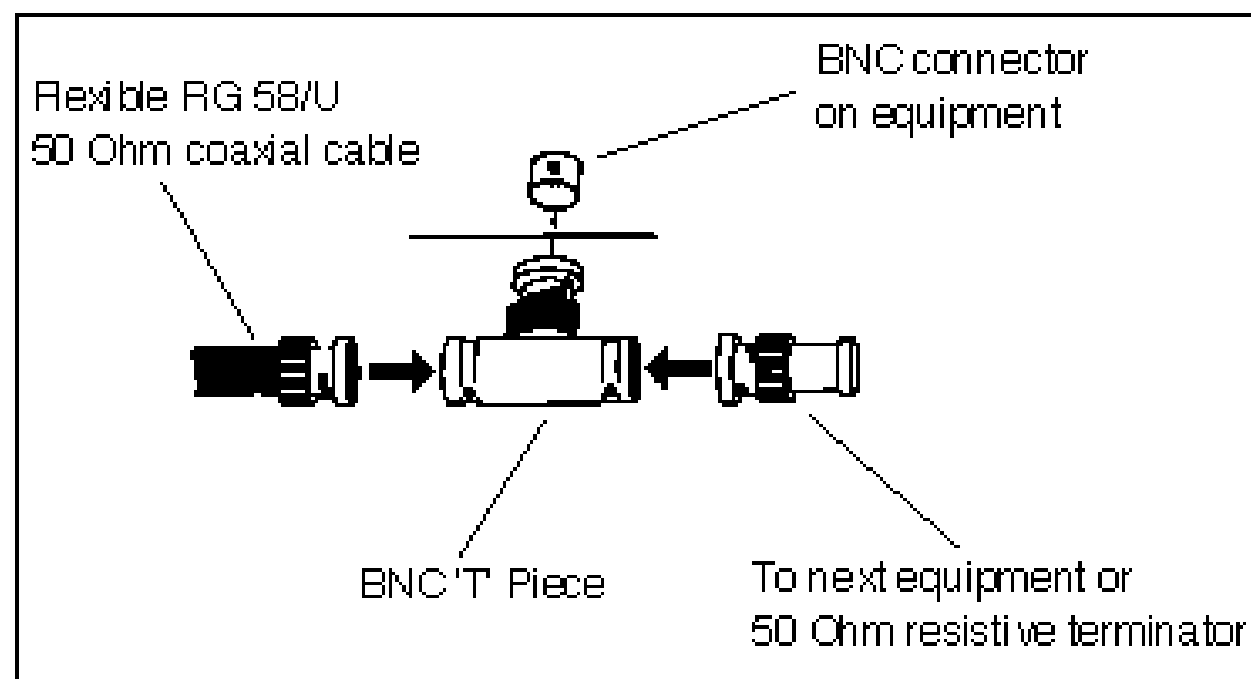
Classic 10Mbps Ethernet

- Thick Ethernet (10base5)
 - Thick coaxial cable (0.5" diameter)
 - Up to 100 drops per segment
 - Drill vampire tap into cable
 - Large minimum bend radius
 - 500m max segment length
 - 4 repeaters max for 2.5km total length



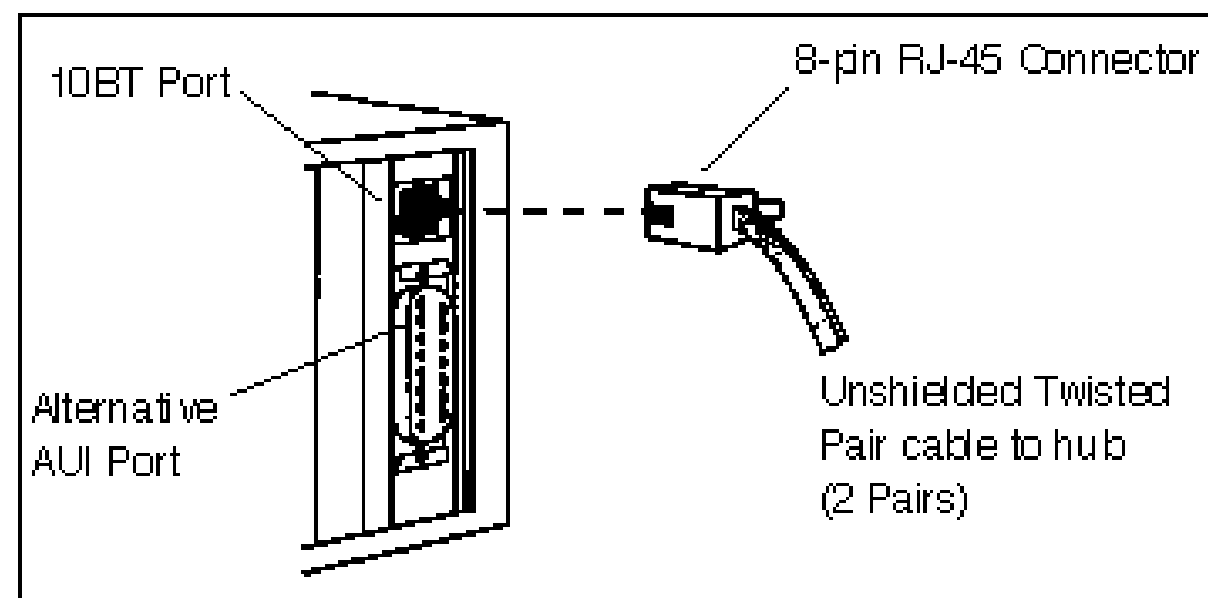
Classic 10Mbps Ethernet

- Thin Ethernet (10base2 802.3a)
 - RG58 coaxial cable
 - 185m max length, 30 drops max
 - Easy to implement, difficult to troubleshoot



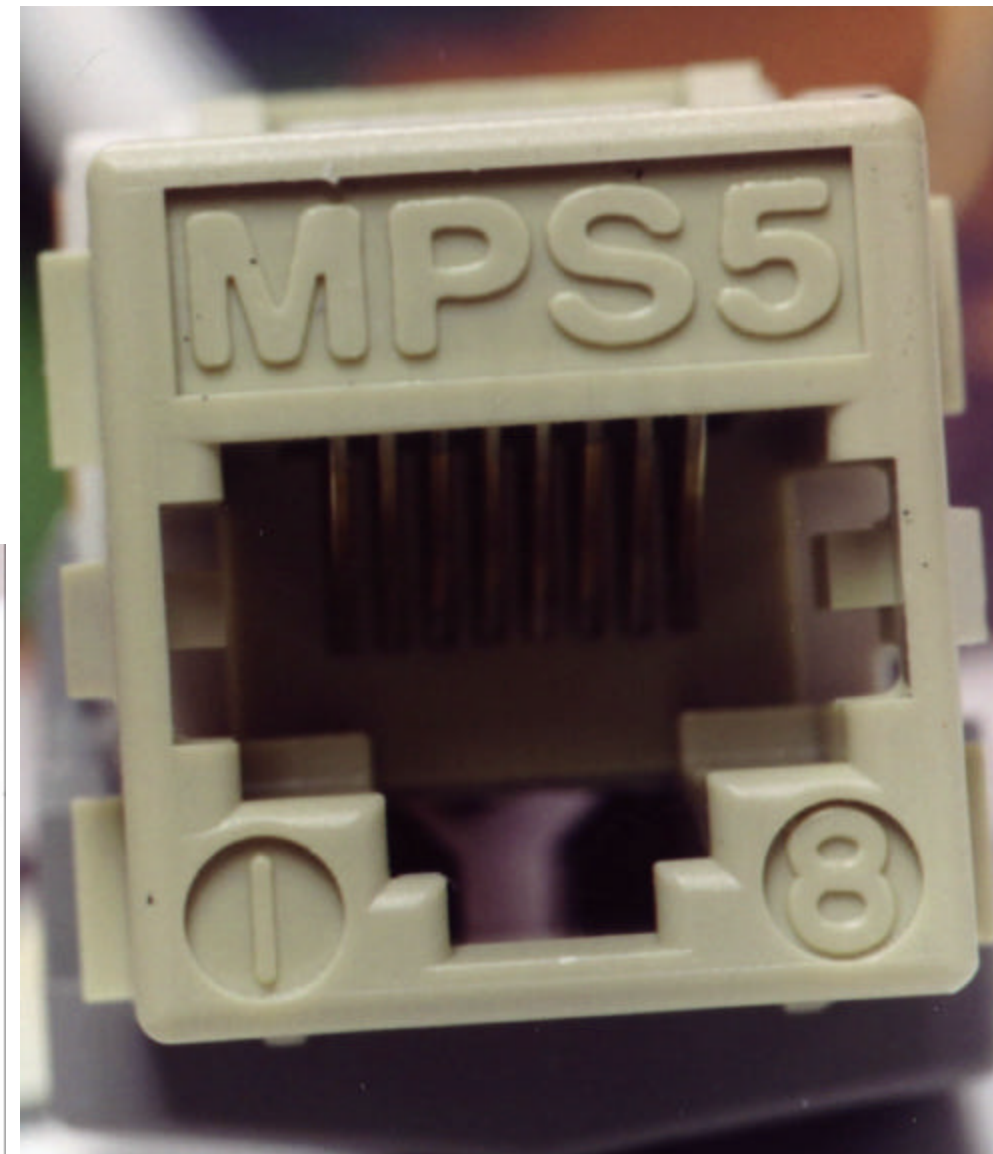
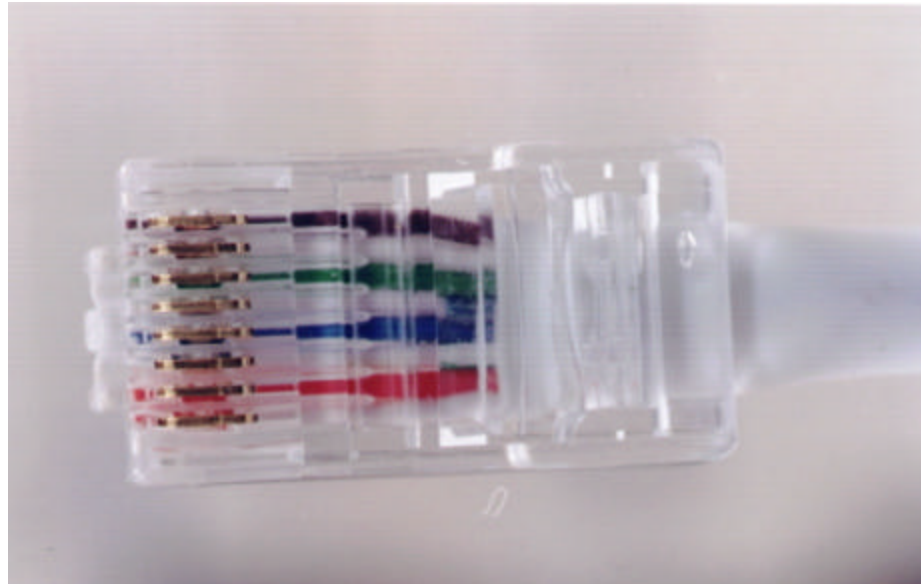
Classic 10Mbps Ethernet

- Twisted Pair Ethernet (10baseT 802.3i)
 - Standard 4x UTP (unshielded twisted pair) 24 AWG cable (uses 2 of the 4 pairs)
 - 100 meter max length
 - Need category 3 or better cable
 - Media supports full duplex operation
 - Can use external or internal transceiver



Classic 10Mbps Ethernet

- Twisted Pair Ethernet (10baseT 802.3i)

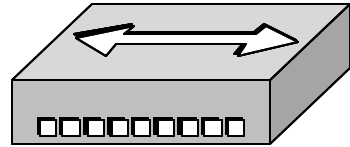


Ethernet Family

- 10Mbps
 - “10baseT” over copper (100m)
 - “10baseFL” or “FOIRL” over fiber
- 100Mbps
 - “100baseTX” over copper (100m)
 - “100baseFX” over fiber (2km)
- 1Gbps
 - “1000baseT” over copper (100m)
 - “1000baseSX” over multimode fiber (550m)
 - “1000baseLX” over singlemode fiber (5km – 10km)
 - “1000baseZX” over singlemode fiber (70km)
- 10Gbps
 - “10GBASE-E”
- 10/100 Ethernet (over copper)
- 10/100/1000 Ethernet (over copper)

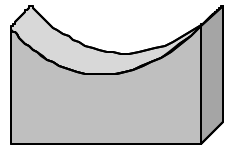
Repeaters, Bridges, Routers

- Repeaters (ISO model layer 1)



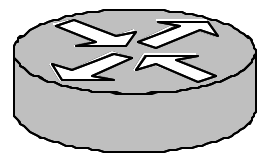
- Regenerate ethernet signal to increase length
- Ethernet hubs

- Bridges (ISO model layer 2)

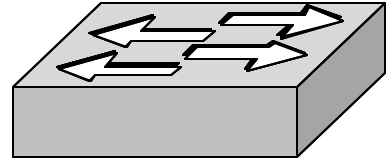


- Reduce collision domain
- Learn ethernet MAC addresses by listening and forward only when destination MAC known to be on other side or unknown
- Implement spanning tree protocol to avoid loops

- Routers (ISO model layer 3)



- Reduce broadcast domain
- Routes IP packets
- Use routing table built from static routes and routing protocols to decide how to forward traffic



Layer 2 Switches

- Basic models are like bridges, but with more ports
- Fancier models are manageable, speak SNMP and TELNET server and allow for advanced features like
 - Segment ports into VLAN (Virtual LAN) groups
 - Handle multiple instances of spanning tree, one per VLAN
 - Use 802.1Q to “Trunk” between switches
 - MDI / MDI-X detection
 - VTP (VLAN Trunk Protocol)
 - Maintain error and other counters on a per-port basis
- Useful in network lab environment to quickly change the topology

Layer 3 Switches

- Function at Layer 3 like routers
- Can switch packets very quickly in hardware
- Offer limited routing protocol support
- Generally a lot less expensive than a router when you need a large number of ports.

show cdp neighbor

- cat2#sh cdp nei
- Capability Codes: R - Router, T - Trans Bridge, B - Source Route Bridge
- S - Switch, H - Host, I - IGMP, r - Repeater

Device ID	Local Intrfce	Holdtme	Capability	Platform	Port ID
cat1	Gig 0/1	154	T S	WS-C3524-X	Gig 0/1
R31	Fas 0/11	129	R	2500	Eth 0
R30	Fas 0/12	175	R	2500	Eth 0
R71	Fas 0/28	131	R	2500	Eth 0
R60	Fas 0/23	164	R	2500	Eth 0
R70	Fas 0/27	172	R	2500	Eth 0
R51	Fas 0/19	159	R	2500	Eth 0
R40	Fas 0/15	120	R	2500	Eth 0
R41	Fas 0/16	174	R	2500	Eth 0
R50	Fas 0/20	171	R	2500	Eth 0
R91	Fas 0/36	166	R	2500	Eth 0
R80	Fas 0/31	164	R	2500	Eth 0
R81	Fas 0/32	139	R	2500	Eth 0

show interface

- cat2#show interfaces FastEthernet 0/47
- FastEthernet0/47 is up, line protocol is up
- Hardware is Fast Ethernet, address is 0004.9a36.38af (bia 0004.9a36.38af)
- Description: R120 E0
- MTU 1500 bytes, BW 10000 Kbit, DLY 1000 usec,
- Auto-duplex (Half), Auto Speed (10), 100BaseTX/FX
- 5 minute input rate 0 bits/sec, 0 packets/sec
- 5 minute output rate 1000 bits/sec, 1 packets/sec
- 329818 packets input, 57504066 bytes
- Received 29056 broadcasts, 0 runts, 0 giants, 0 throttles
- 0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored
- 0 watchdog, 5653 multicast
- 0 input packets with dribble condition detected
- 10693141 packets output, 874456402 bytes, 0 underruns
- 0 output errors, 2 collisions, 1 interface resets
- 0 babbles, 0 late collision, 6 deferred
- 0 lost carrier, 0 no carrier
- 0 output buffer failures, 0 output buffers swapped out

Network Lab1 Cabling

- For each network class workspace on table “X”, we have:
 - Computer Eth0 port to jack JX-9
 - Computer Eth1 port to ethernet hub
 - First router E0 port to jack JX-11
 - First router E1 port to ethernet hub
 - Second router E0 port to jack JX-12
 - Second router E1 port to ethernet hub

show VLAN

- cat2#show vlan
- VLAN Name Status Ports
- -----
- 1 default active Gi0/2
- 10 VLAN0010 active Fa0/9, Fa0/10, Fa0/13, Fa0/14,
- Fa0/17, Fa0/18, Fa0/21, Fa0/22,
- Fa0/25, Fa0/26, Fa0/29, Fa0/30,
- Fa0/33, Fa0/34, Fa0/37, Fa0/38,
- Fa0/41, Fa0/42, Fa0/45, Fa0/46
- 11 VLAN11 active
- 21 VLAN21 active Fa0/12
- 31 VLAN31 active Fa0/11, Fa0/15
- 41 VLAN41 active Fa0/16, Fa0/20
- 51 VLAN51 active Fa0/19, Fa0/23
- 61 VLAN61 active Fa0/24, Fa0/27
- 71 VLAN71 active Fa0/28, Fa0/32
- 81 VLAN81 active Fa0/31, Fa0/35
- 91 VLAN91 active Fa0/36, Fa0/40
- 101 VLAN101 active Fa0/39, Fa0/43
- 111 VLAN111 active Fa0/44, Fa0/48
- 121 VLAN121 active Fa0/47

Cat5 Ethernet Cables

- Modular 8-position RJ45 connectors on both ends
- PC network cards connect to HUBS with normal straight-through cables, transmit on pins 1&2, and listen on pins 3&6
- PC to PC, or HUB to HUB connections require a “crossover” cable where cable pins 1&2 and 3&6 are reversed
- Routers and tranceivers are wired like PCs
- Switches are wired like HUBs
- Normal cables are usually blue or yellow or gray; crossover cables are usually red or orange but not always
- Connect routers to each other with normal cables and a HUB or a crossover cable