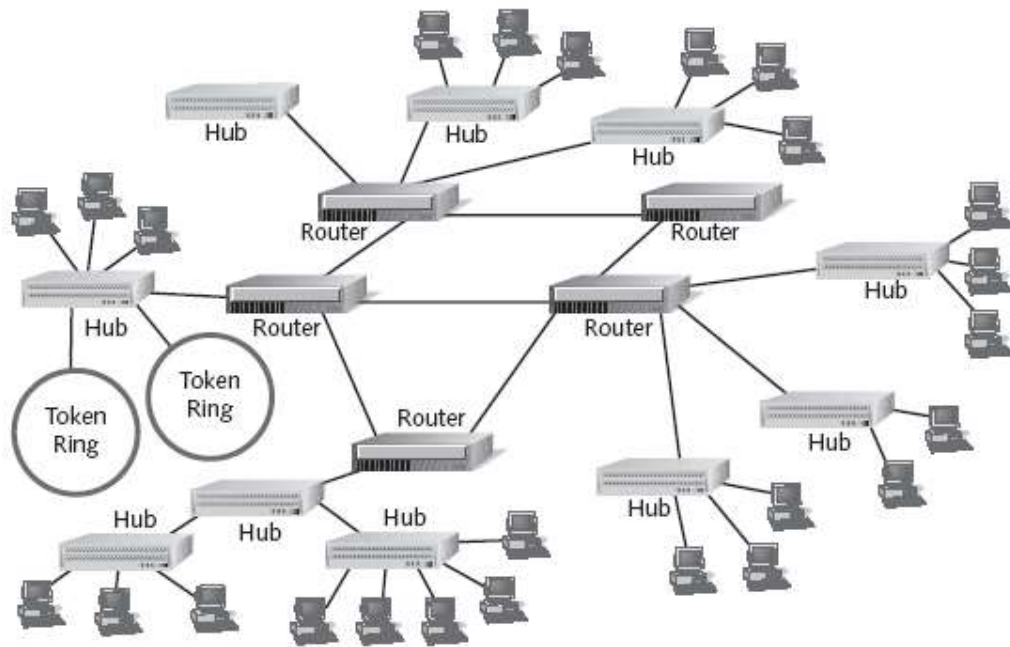


Module 1



Ethernet Topology, Cables And Network Components Student Materials

Student Materials for Module 1: Topology, Cables and Components

Lesson Objective

By the end of this lesson, students should be able to:

1. Identify hardware components of a Ethernet Network
2. Identify cabling used on an Ethernet Network.
3. Identify Network Topologies

	<u>Page</u>
Introduction	3
Topology-Star	3
Topology-Bus	4
Topology Ring	5
Topology Hybrid.....	5
Topology Mesh	6
Cabling	6
Network Components	8
Review Questions.....	10

Introduction:

Topology is the physical layout of a Network. Ethernet can be set-up in a Star or a Bus configuration. Today a Star configuration is the most common. In addition to a Star or Bus, other network topologies include Rings and Mesh.

Network components include computers and PLCs, printers and servers. Other device that may be found on Ethernet networks are Hubs, Switches, Routers and Gateways. Each component provides a specific function for the network.

To connect the network devices particular types and styles of cables are used. The number one network problem is cabling. (Addressing is number two).

Topology:

Star:

One of the most common type of Ethernet networks found today is a Star.

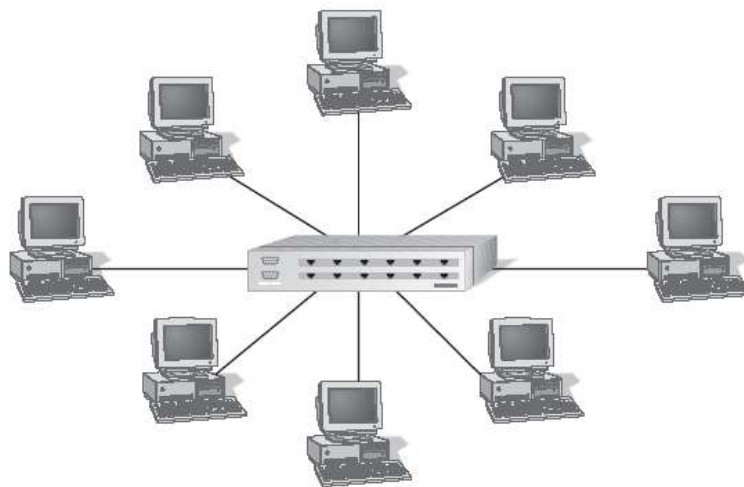


Figure 1-A

Devices are connected to Hubs or Switches (recommended on Industrial Networks) with twisted pair cables (Category 5 or higher). Star networks can run at the three primary speeds of Ethernet 10 Mbps (Megabits per seconds) (10 Base T), 100 Mbps (100 Base T) or 1000 Mbps (1000 Base T) or Gigabit Ethernet. Device on the same network will run at the same speed. By default Ethernet device are set to auto-detect network speed.

Connections are made with RJ-45 connectors at end of the UTP cables.
Cable length = 100 meters.

BUS:

The Bus topology was the original configuration for Ethernet. When this topology is used for Ethernet, coax cable is used to connect the components. Bus style of Ethernet will only run at 10Mbps. Cabling can be Thinnet coax for 185 meters (10 Base2) or Thicknet coax for 500 meters (10 Base5).

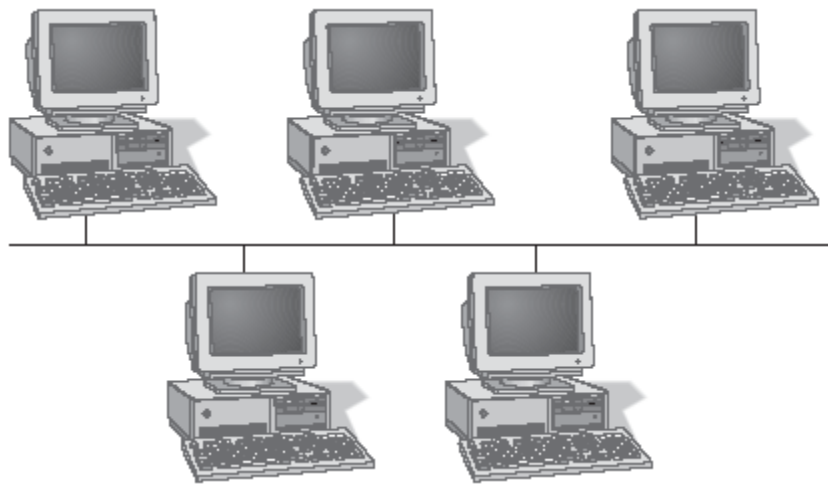


Figure 2-A

Thinnet coax use BNC connectors, for device linking

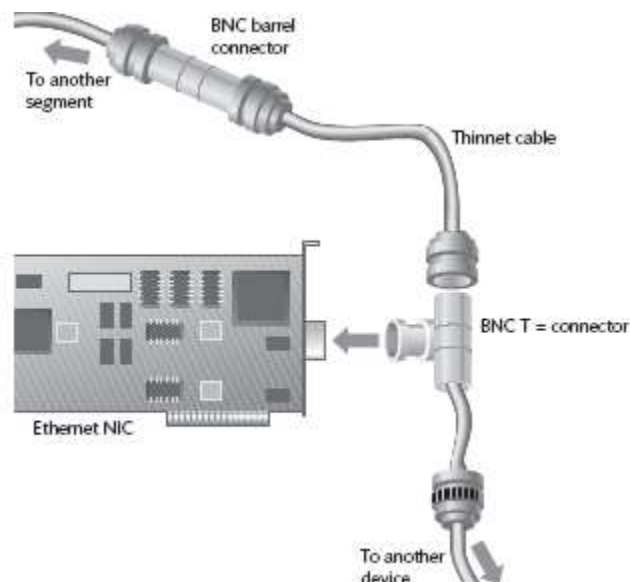


Figure 3-A

NIC is a Network Interface Card.

Ring Topology:

Although not initially associated with Ethernet, ring networks were commonly used by IBM in the 1980s and early 1990s.

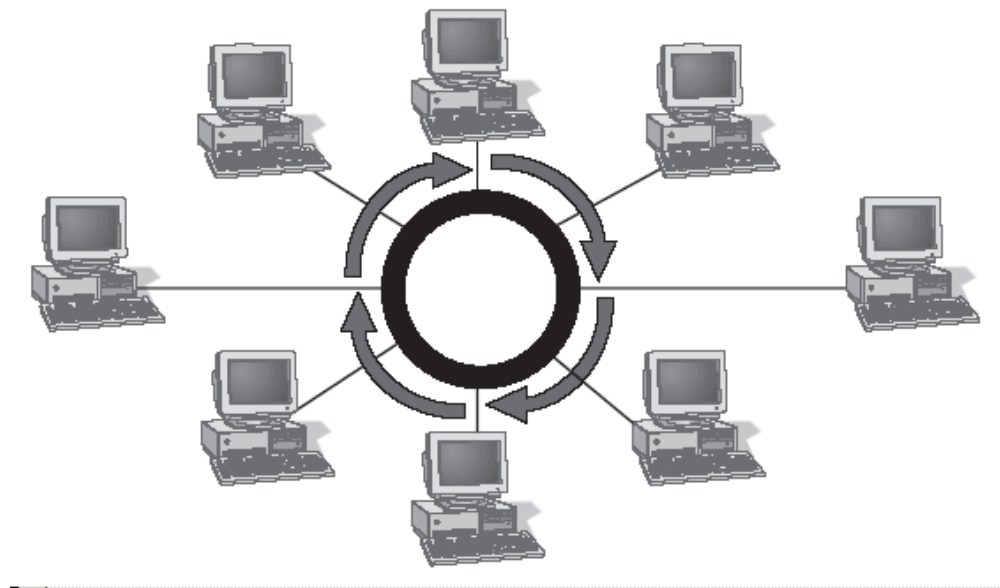


Figure 4-A

Ring network where associated with a data transfer scheme called token passing. Allen-Bradley using token passing for its Data Highway Plus / DH-485 networks. The Data Highway networks are configured in a Bus style. Ethernet can be found on redundant ring networks.

Hybrid Topology:

With Ethernet a common hybrid network is a combination of a Bus and a Star.

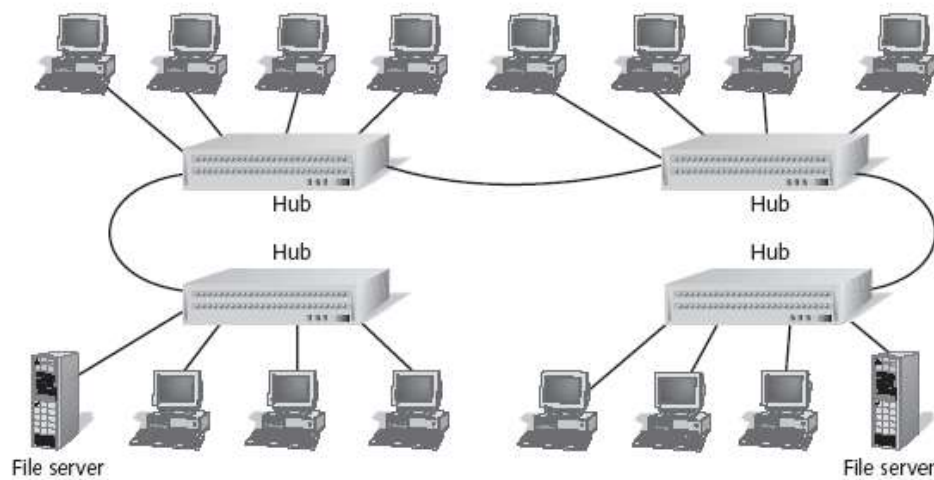


Figure 5-A

Cabling between Hubs/Switches may be Fiber, especially if length exceeds the 100 meter limit of UTP (unshielded twisted pair) cables.

Mesh:

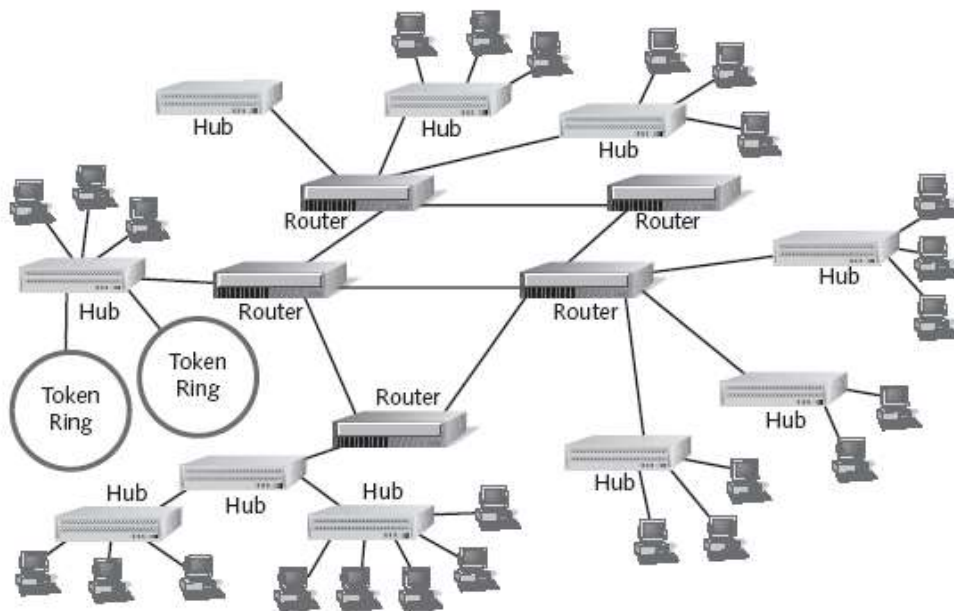


Figure 6-A

A mesh network allows more than one path between devices. If there are device failures, information may take alternate paths so information can still be transmitted. The Internet is an example of a partial mesh network.

Cabling:

When dealing with Ethernet the most common cabling that is used is TP (twisted pair) cabling. UTP – unshielded twisted pair / STP – shielded twisted pair

Category 5/5e or Category 6 is common UTP cables used.

Cat. 5 cabling has 8 conductors arranged in 4 pairs and is terminated to an RJ-45 plug.

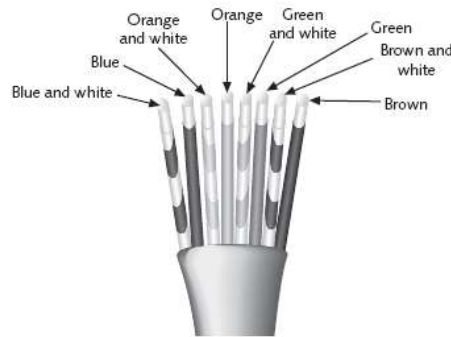


Figure 7-A

Hold the cable with the clasp down, pin 1 on the left side of the RJ-45 connector and pin 8 is on the right side of the connector. Referring to Figure 7-A, page 6, the blue-white conductor will be connected pin #1 of the RJ-45 connector.

There are numerous wiring schemes for UTP cables and RJ-45 connectors. One common scheme is T568B, where a straight-through cable will be wired as:

pin 1-white-orange
pin 2-orange
pin 3-white-green
pin 4-blue
pin 5-white-blue
pin 6-green
pin 7-white-brown
pin 8-brown

A cross-over cable will swap pins 1 and 3 and pins 2 and 6.

Straight-through cables are used to connect devices to hubs or switches.

Cross-over cables are used for point-to-point connections, such as directly connecting a computer to a 1756-ENBT module. Cross-over cables are useful in troubleshooting network problems.

Note: Many of today's Ethernet devices can automatically switch the RJ-45 port pins to accommodate either a straight-thru or cross-over cable.

Coax cables:

Used for Bus style of networks.

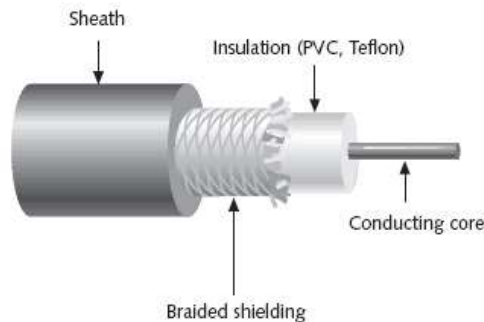


Figure 8-A

Thinnet (10 Base2) uses BNC connectors and has a maximum distance of 185 meters on Bus style networks.

Thicknet (10 Base5) has a maximum distance of 500 meters on Bus style of networks.

Fiber cables can also be used for Ethernet.

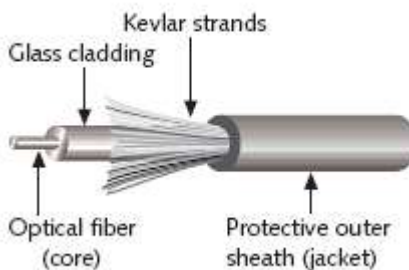


Figure 9-A

Fiber (10/100 BaseF) can run up to 2000 meters.

Since fiber uses light-pulses instead of electrical signals, RF does not interfere with data transfer. The disadvantage of fiber is cost and it is not as easy to work with as copper wiring.

Additional types of connectors found on some Ethernet devices are:

15-pin D-Shell connectors (AUI-attachment Unit Interface)
This type of connector is found on AB PLC 5 Ethernet processors.

Transceiver (MAU-Media Attachment Unit) – used to interface coax or TP cables to 15-pin D-Shell connectors.

Network Components:

Besides computers and PLCs, other common devices found on an industrial Ethernet network are switches. Switches allow more efficient use of network bandwidth than Hubs.



Figure 10-A

Switches serve as a connection point for computers, HMIs and PLCs. On office networks the connection points maybe hubs or switches.



Figure 11-A

Similar in appearance to switches, Hubs are generally not used on industrial networks.

A third type of network component found on Ethernet networks are routers. Routers are used to connect two different networks. This allows communication between two or more networks.

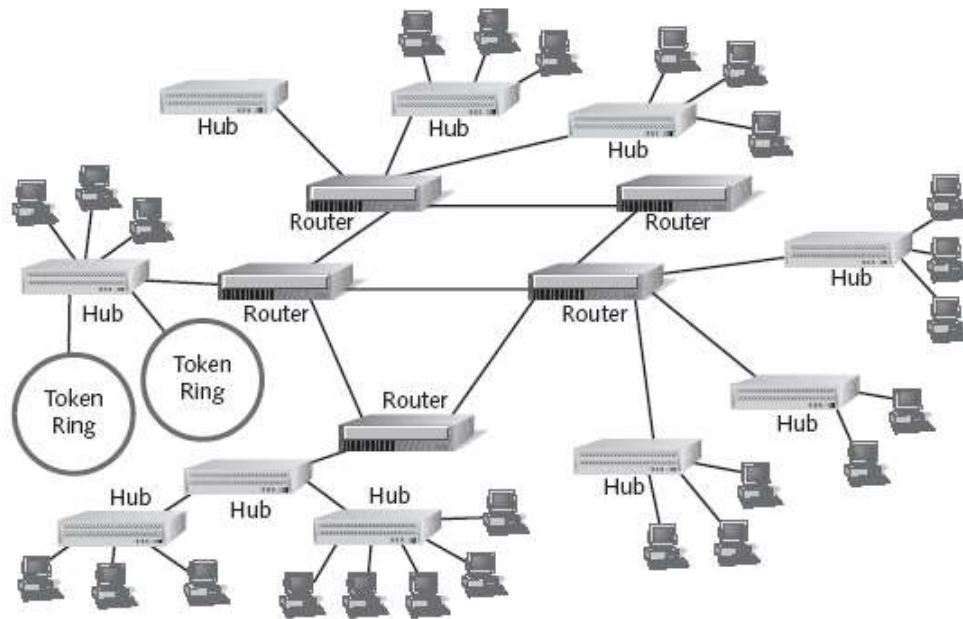


Figure 12-A

Gateways are devices that allow two different networks, running different protocols to communicate with each other. Examples of gateways are RSLinx Gateway or a ControlLogix chassis that contain an 1756-ENBT module and an 1756-DHRIO module. This will allow DH+ devices to communicate with Ethernet devices.

Review Questions

1. T F Ethernet can runs on a Star network.
2. Ethernet Bus networks run at _____ Mbps.
 - a) 5
 - b) 10
 - c) 1000
 - d) 100

3. **The most common type of cable used for Ethernet networks is-**
 - a) UTP
 - b) Thinnet Coax.
 - c) Fiber
 - d) Thicknet Coax.

4. **T F Cross-over cables can connect a computer directly to a 1756-ENBT module.**

5. **Maximum distance for UTP cables is:**
 - a) 100 feet
 - b) 185 meters
 - c) 500 meters
 - d) 500 feet
 - e) 100 meters

6. **T F Fiber cables can be used on Ethernet networks.**
7. **T F Hubs are generally found on industrial networks.**

8. **T F Switches connect two different Ethernet networks together.**

9. **T F Devices on the same network segment, run at the same speed.**

10. **Which module for ControlLogix is used for Ethernet connections :**

- a) 1756-L55
- b) 1756-EN2TR
- c) 1784-ETHIP
- d) 1756-ENBT

Review Question Answers

- 1) T
- 2) b
- 3) a
- 4) T
- 5) e
- 6) T
- 7) F
- 8) F
- 9) T
- 10) b, d



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