



# OSI Data Link Layer



## Slide Set 1

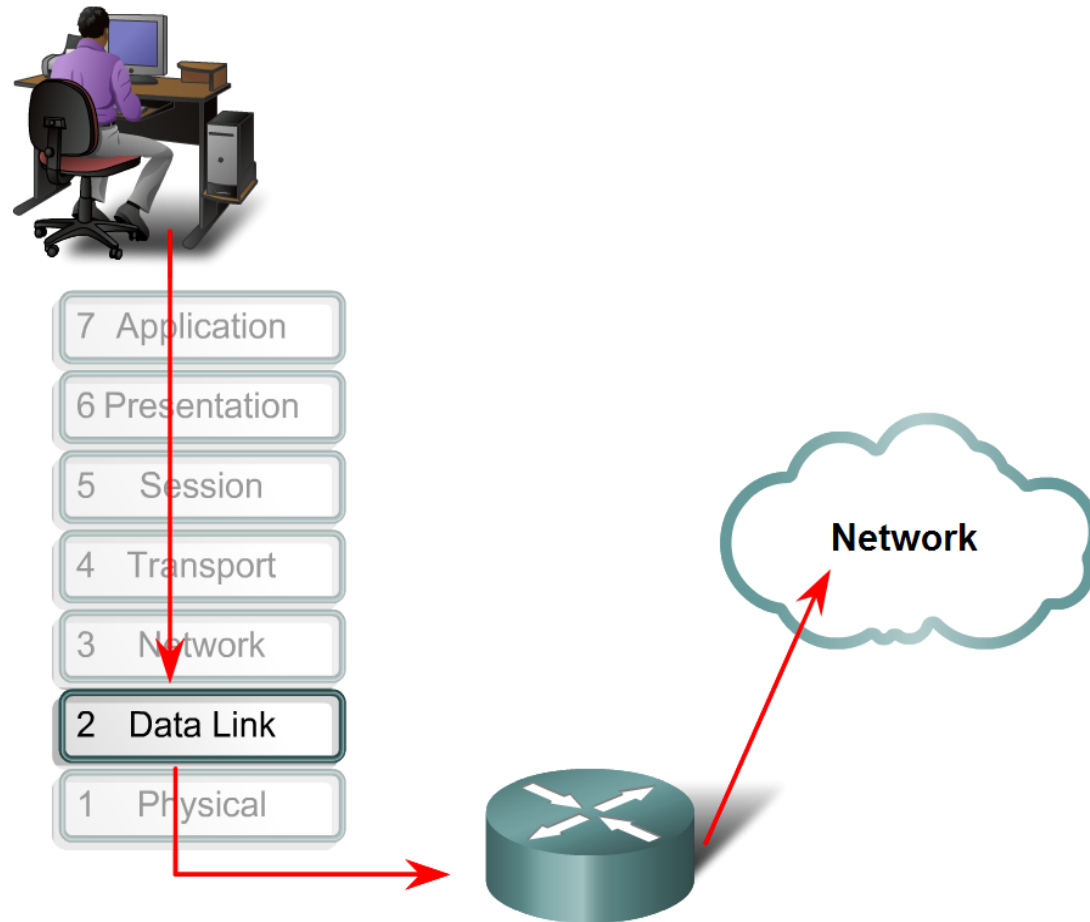
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# Objectives

- Explain the role of Data Link layer protocols in data transmission.
- Describe how the Data Link layer prepares data for transmission on network media.
- Describe the different types of media access control methods.
- Identify several common logical network topologies and describe how the logical topology determines the media access control method for that network.
- Explain the purpose of encapsulating packets into frames to facilitate media access.
- Describe the Layer 2 frame structure and identify generic fields.
- Explain the role of key frame header and trailer fields including addressing, QoS, type of protocol and Frame Check Sequence.

# Data Link Layer – Accessing the Media

- Describe the service the Data Link Layer provides as it prepares communication for transmission on specific media



**The Data Link layer prepares network data for the physical network.**

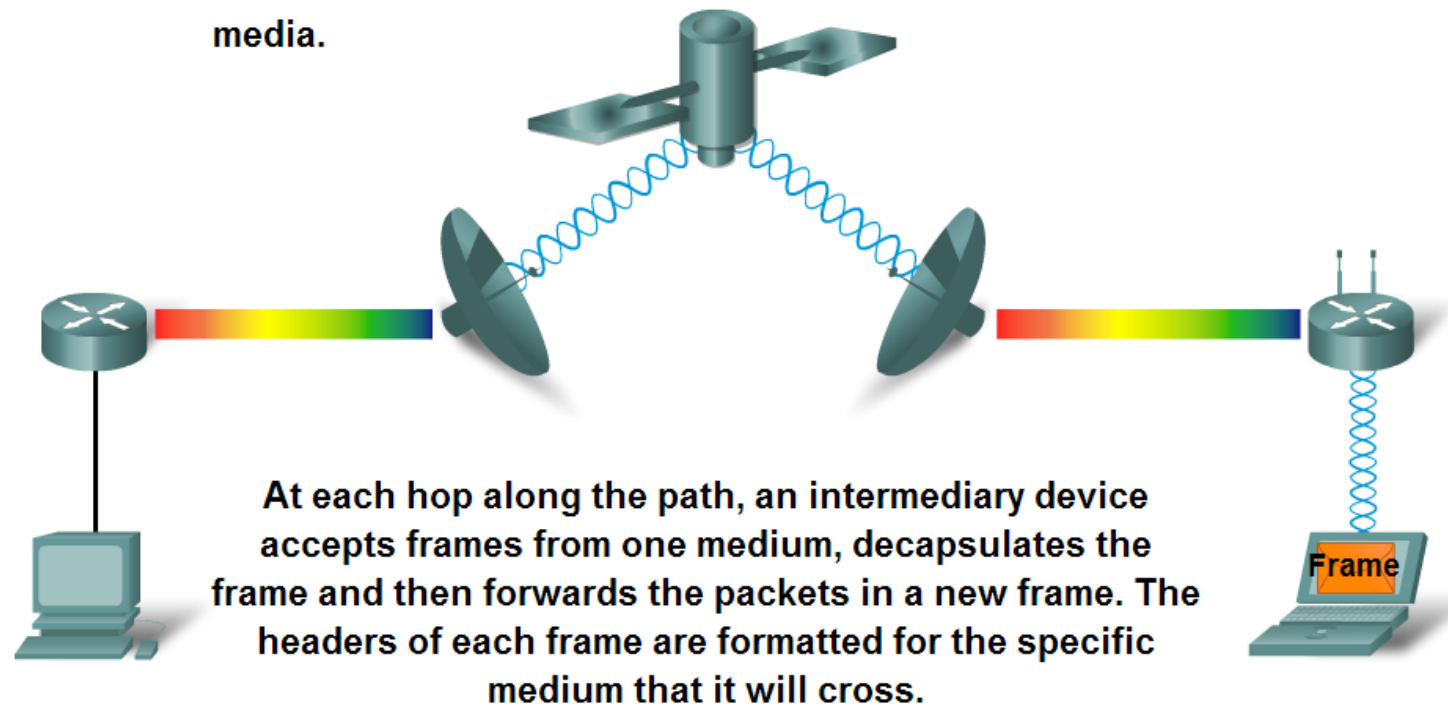
# Data Link Layer – Accessing the Media

- Describe why Data Link layer protocols are required to control media access

## The Data Link Layer

Data link layer protocols govern how to format a frame for use on different media.

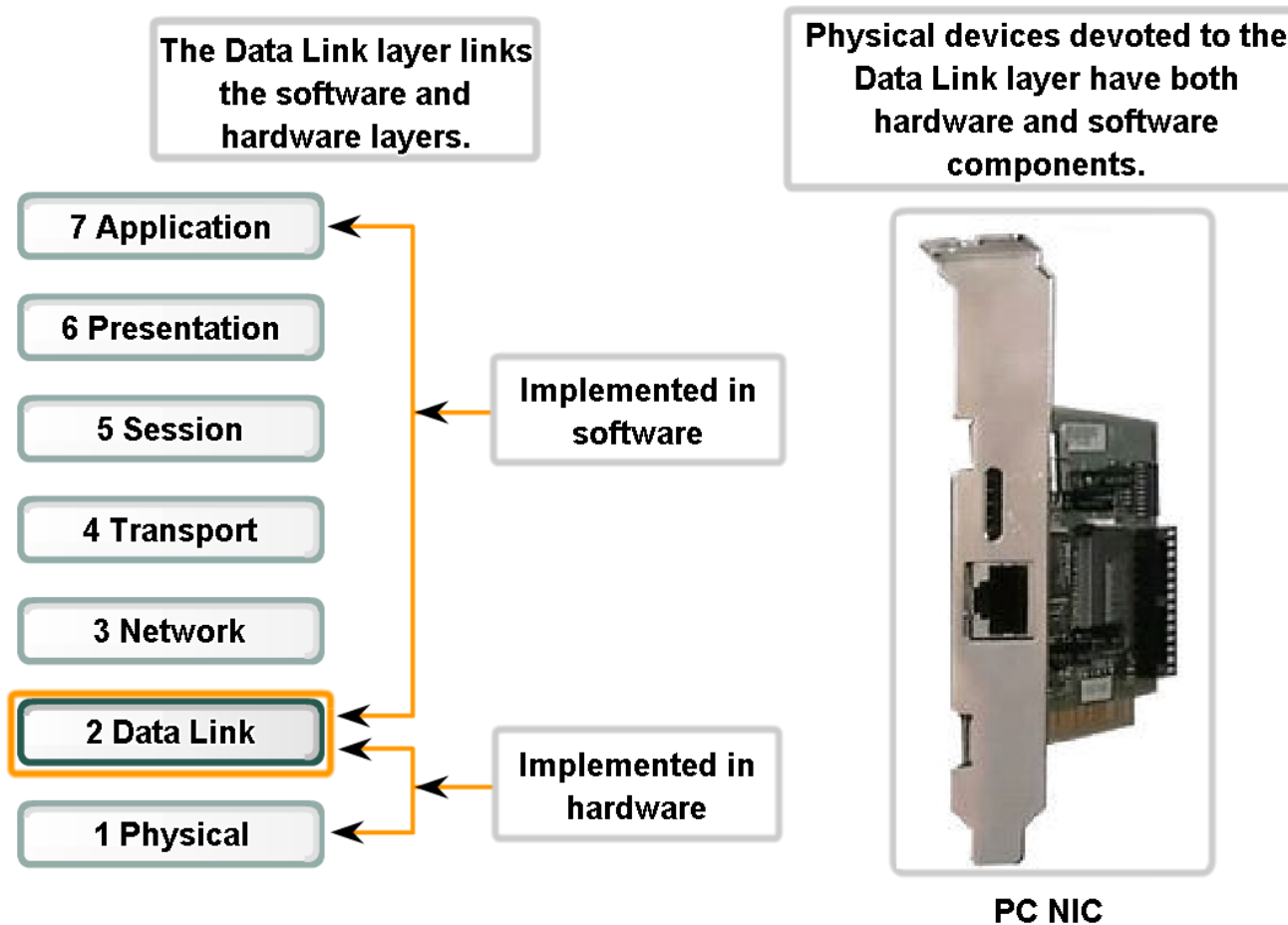
Different protocols may be in use for different media.



# Data Link Layer – Accessing the Media

- Describe the role the Data Link layer plays in linking the software and hardware layers

Connecting Upper Layer Services to the Media



# Data Link Layer – Accessing the Media

- Identify several sources for the protocols and standards used by the Data Link layer

Standards for the Data Link Layer

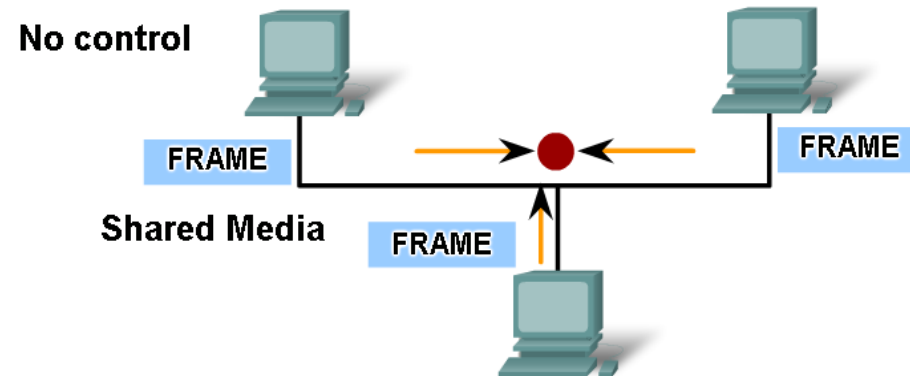
|              |   |
|--------------|---|
| <b>ISO:</b>  | <b>HDLC (High Level Data Link Control)</b>  |
| <b>IEEE:</b> | <b>802.2 (LLC),<br/>802.3 (Ethernet)<br/>802.5 (Token Ring)<br/>802.11(Wireless LAN)</b>                        |
| <b>ITU:</b>  | <b>Q.922 (Frame Relay Standard)<br/>Q.921 (ISDN Data Link Standard)<br/>HDLC (High Level Data Link Control)</b> |
| <b>ANSI:</b> | <b>3T9.5<br/>ADCCP (Advanced Data Communications Control Protocol)</b>  |

# Media Access Control Techniques

- Explain the necessity for controlling access to the media

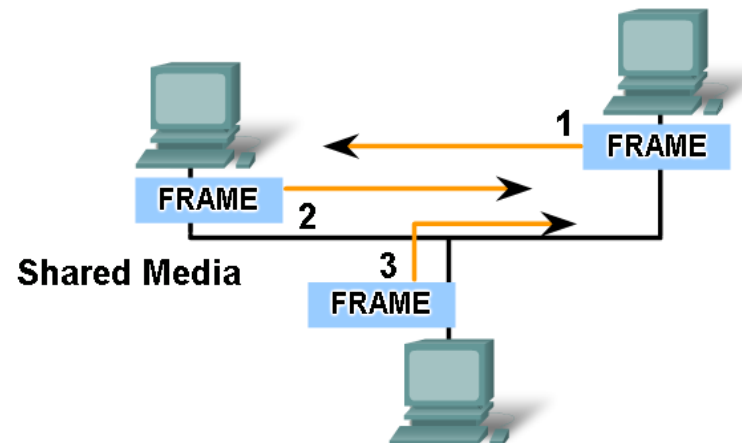
## Media Access Control Methods

No control at all would result in many collisions. Collisions cause corrupted frames that must be resent.



Methods that enforce a high degree of control prevent collisions, but the process has high overhead.

### Take turns



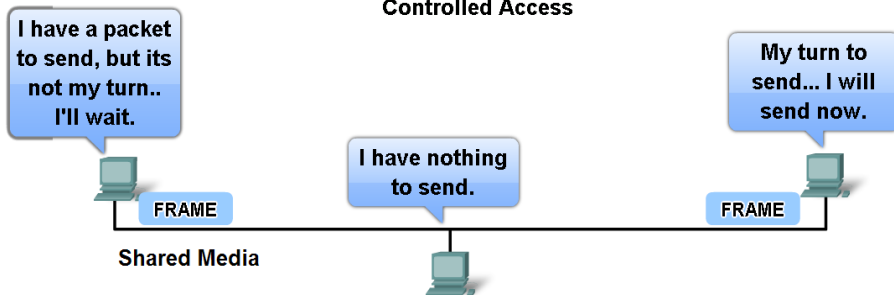
Methods that enforce a low degree of control have low overhead, but there are more frequent collisions.

# Media Access Control Techniques

- Identify two media access control methods for shared media and the basic characteristics of each

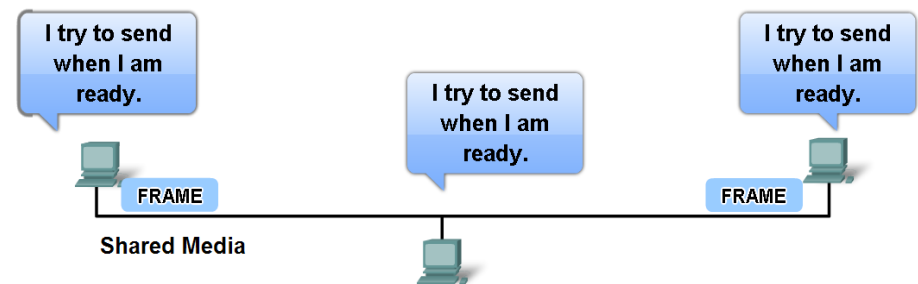
Media Access Control for Shared Media

## Controlled Access



Media Access Control for Shared Media

## Contention-Based Access



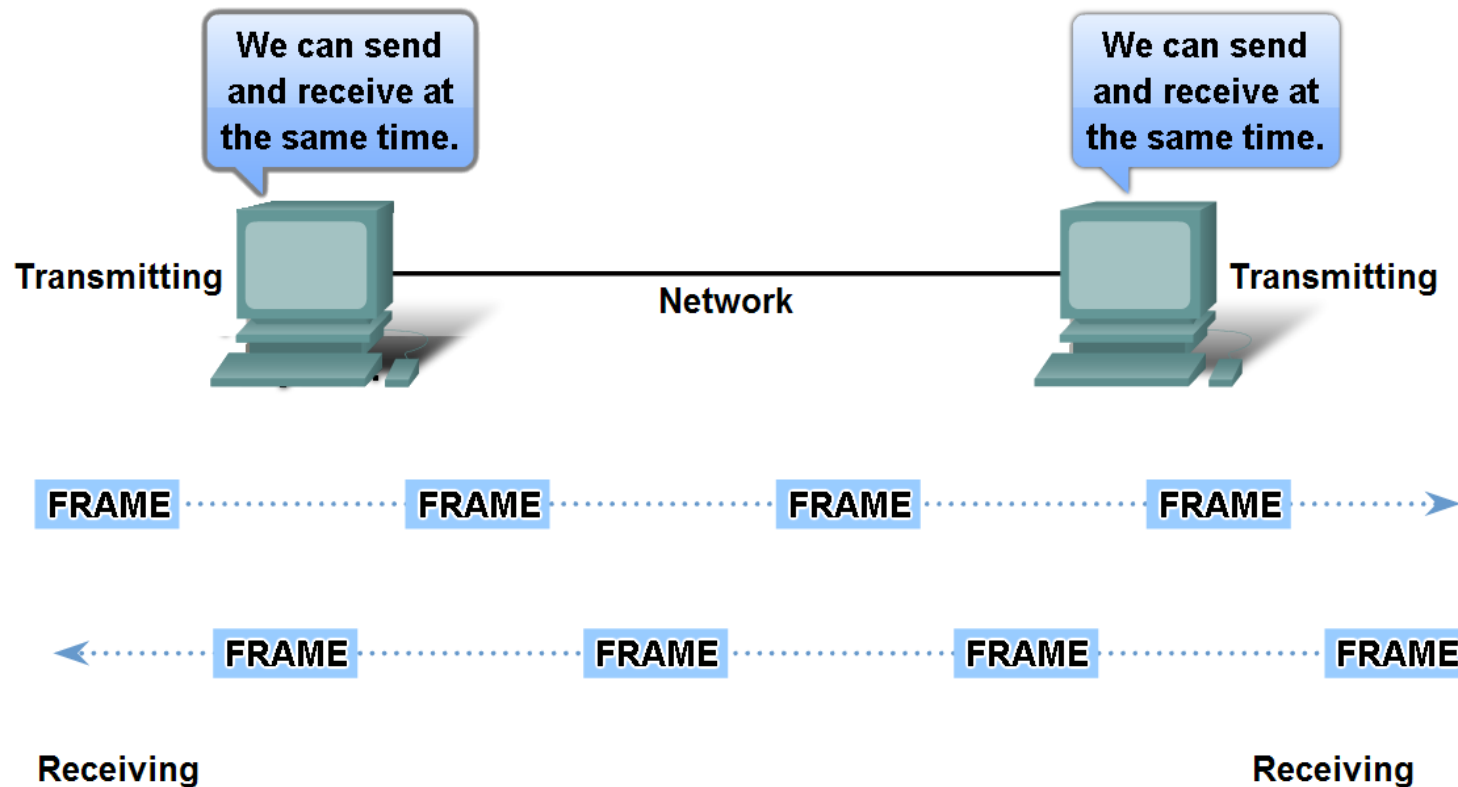
| Method            | Characteristics  | Example  |
|-------------------|--|--|
| Controlled Access | <ul style="list-style-type: none"> <li>Only one station transmits at a time</li> <li>Devices wishing to transmit must wait their turn</li> <li>No collisions</li> <li>Some deterministic networks use token passing</li> </ul> | <ul style="list-style-type: none"> <li>Token Ring</li> <li>FDDI</li> </ul> |

| Method                  | Characteristics   | Example  |
|-------------------------|---|--|
| Contention Based Access | <ul style="list-style-type: none"> <li>Stations can transmit at any time</li> <li>Collisions exist</li> <li>Mechanisms exist to resolve contention:                             <ul style="list-style-type: none"> <li>CSMA/CD for Ethernet networks</li> <li>CSMA/CA for 802.11 wireless networks</li> </ul> </li> </ul> | <ul style="list-style-type: none"> <li>Ethernet</li> <li>Wireless</li> </ul> |

# Media Access Control Techniques

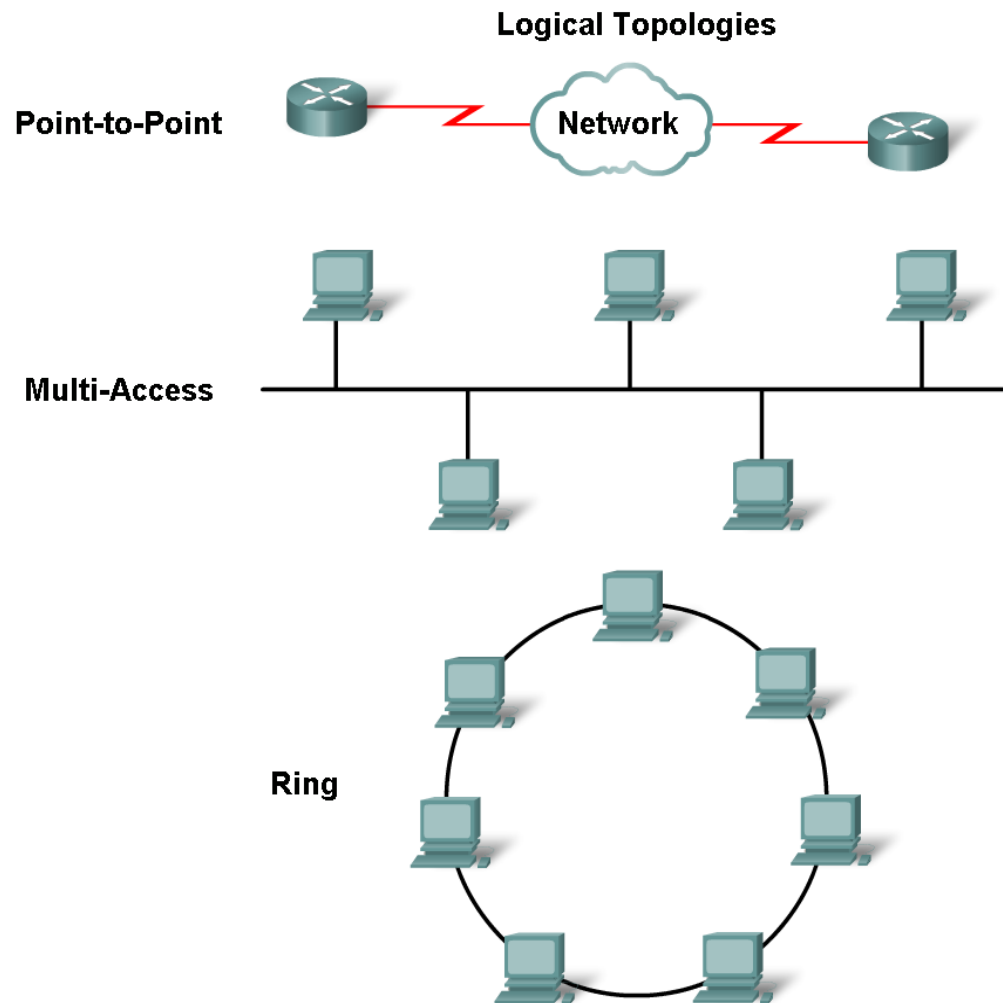
- Define Full Duplex and Half Duplex as it relates to Media Access Control for non-shared media

Media Access Control for Non-shared media



# Media Access Control Techniques

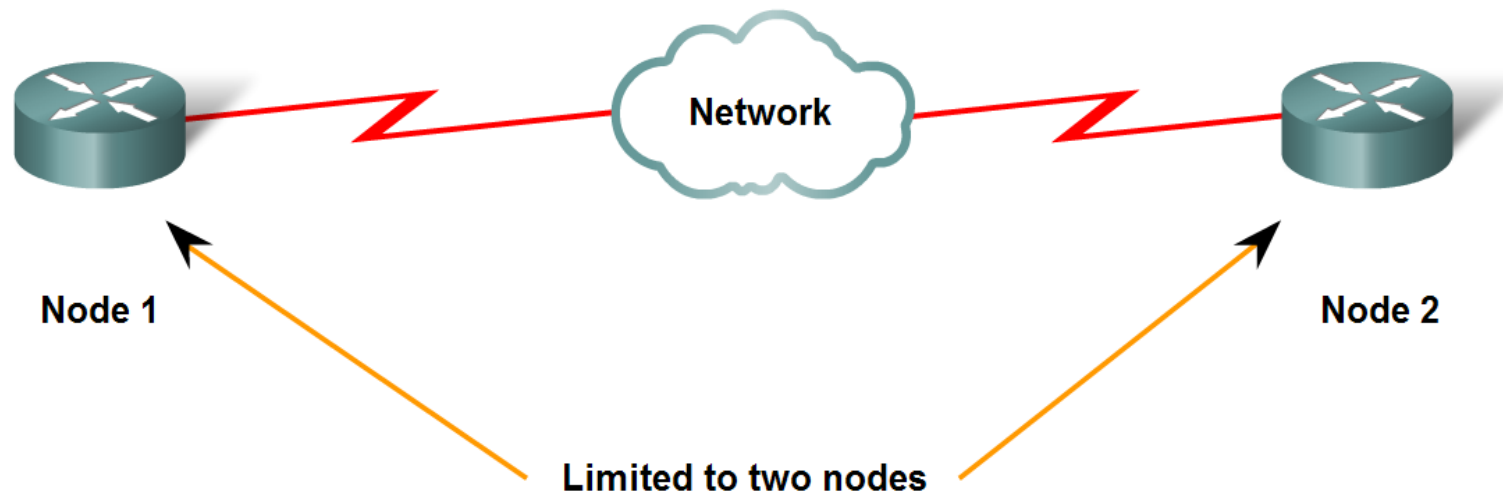
- Describe the purpose of a logical topology and identify several common logical topologies



# Media Access Control Techniques

- Identify the characteristics of point-to-point topology and describe the implications for media access when using this topology

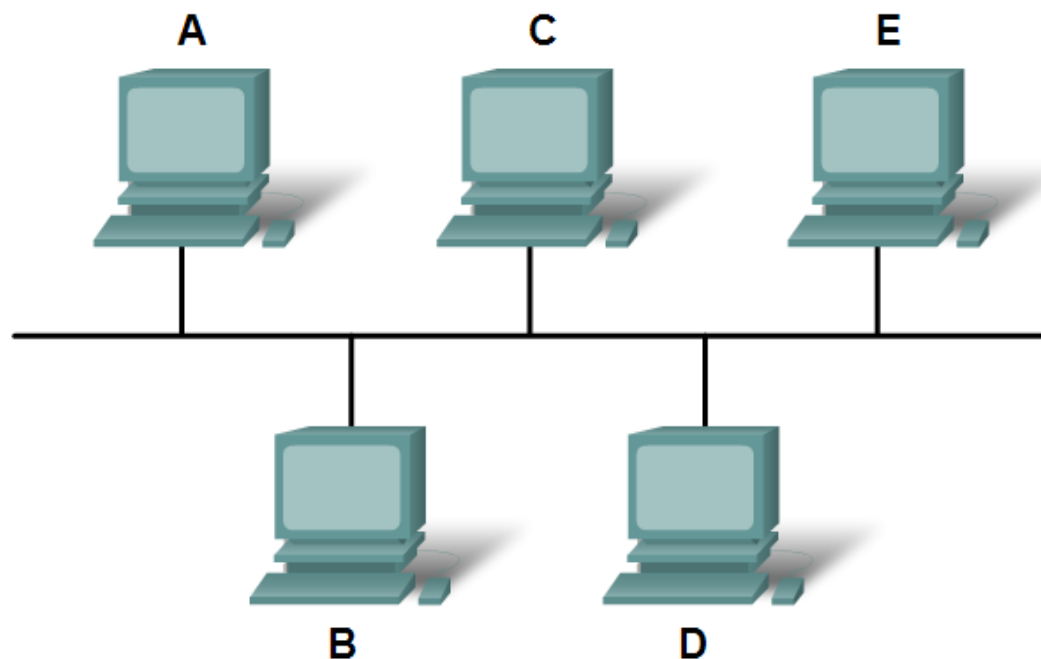
Point-to-Point Topology



# Media Access Control Techniques

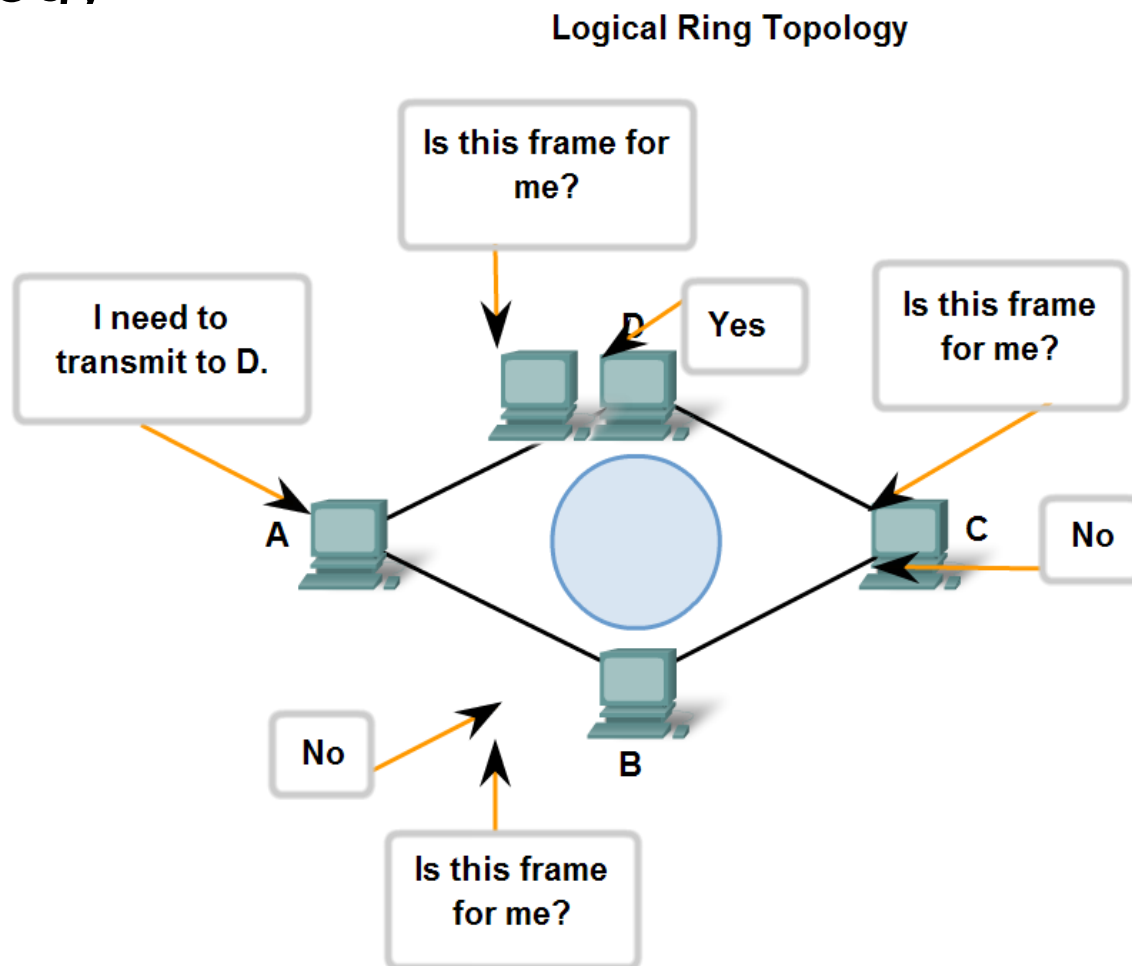
- Identify the characteristics of multi-access topology and describe the implications for media access when using this topology

Logical Multi-Access Topology



# Media Access Control Techniques

- Identify the characteristics of ring topology and describe the implications for media access when using this topology



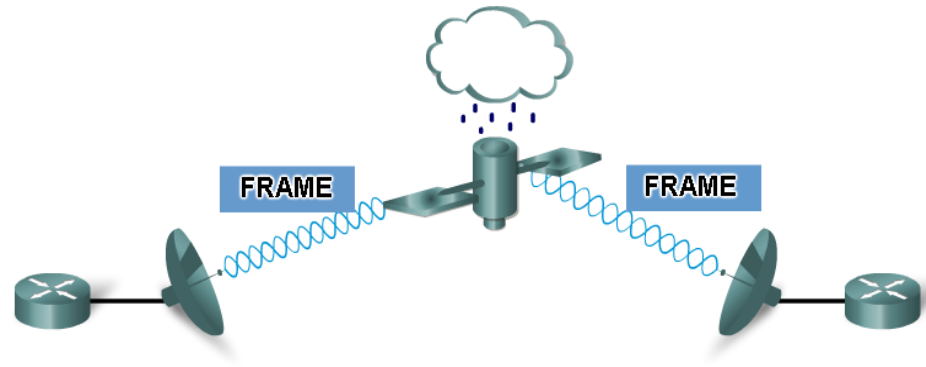
# Media Access Control Addressing and Framing Data

- Describe the purpose of encapsulating packets into frames to facilitate the entry and exit of data on media

## Data Link Layer Protocols - The Frame

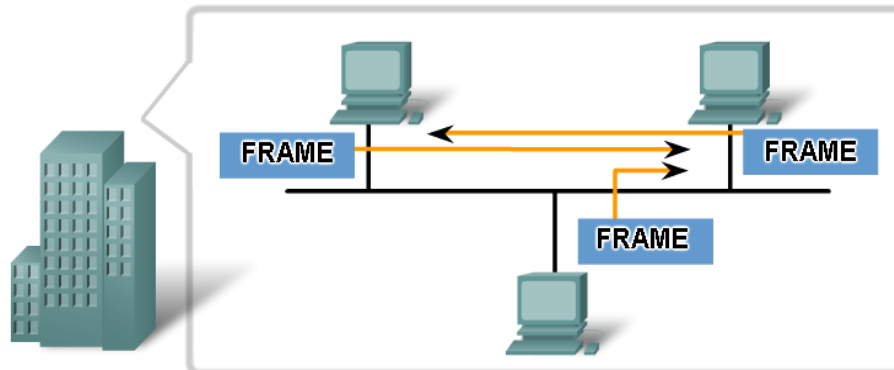
**In a fragile environment,** more controls are needed to ensure delivery. The header and trailer fields are larger as more control information is needed.

Greater effort needed to ensure delivery = higher overhead = slower transmission rates



**In a protected environment,** we can count on the frame arriving at its destination. Fewer controls are needed, resulting in smaller fields and smaller frames.

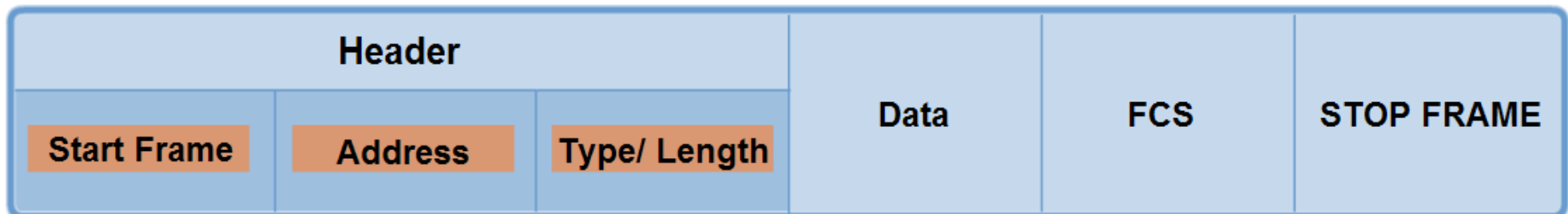
Less effort needed to ensure delivery = lower overhead = faster transmission rates



## Media Access Control addressing and framing data

- Describe the role of the frame header in the Data Link layer and identify the fields commonly found in protocols specifying the header structure

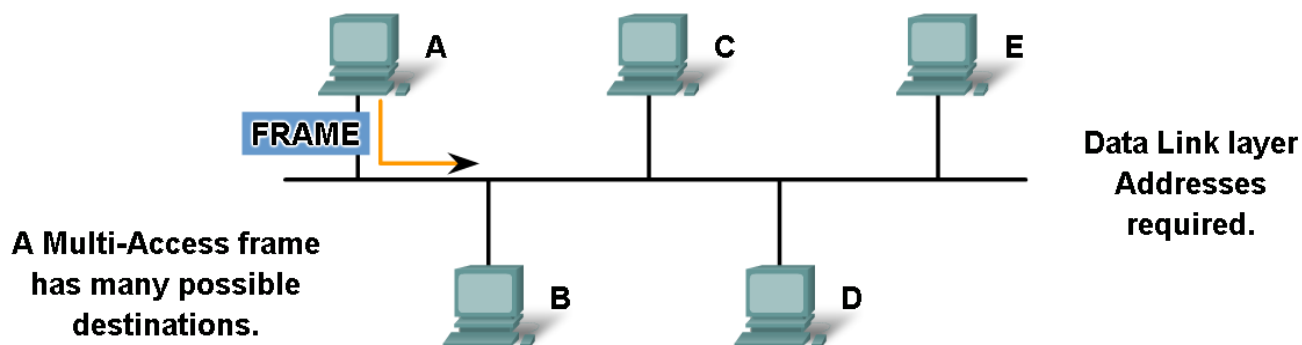
### The Role of the Header



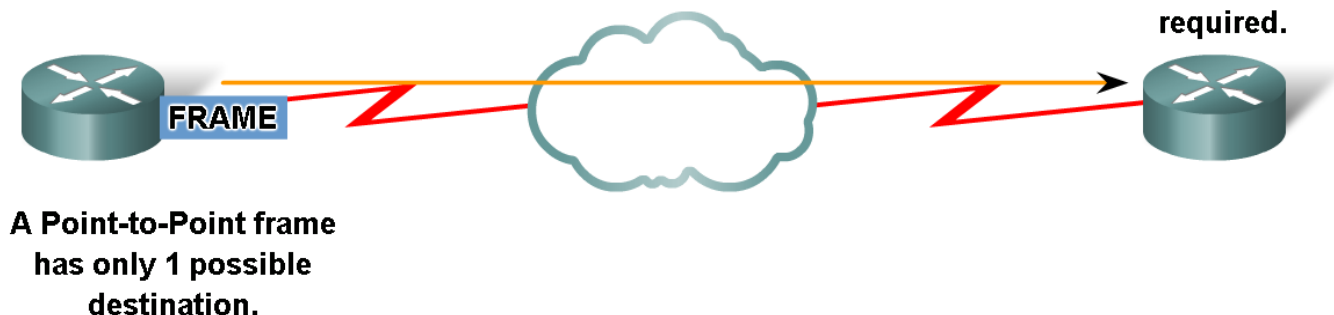
# Media Access Control addressing and framing data

- Describe the role of addressing in the Data Link layer and identify cases where addresses are needed and cases where addresses are not needed

Logical Multi-Access Topology



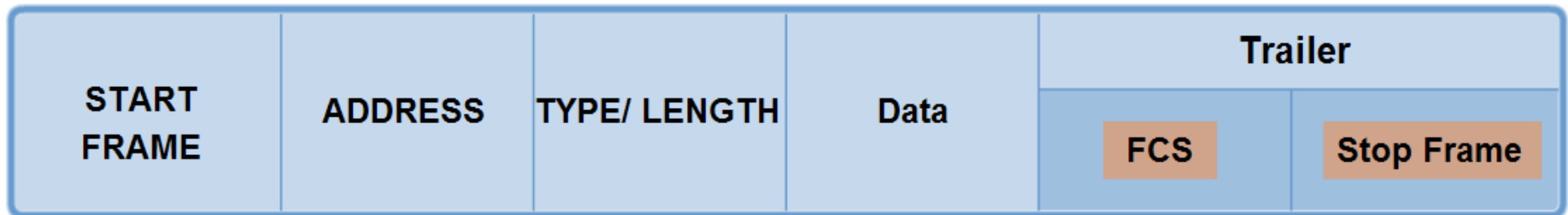
Logical Point-to-Point Topology



## Media Access Control addressing and framing data

- Describe the importance of the trailer in the Data Link layer and its implications for use on Ethernet, a "non-reliable" media

### The Role of the Trailer



# Summary

## In this chapter, you learned to:

- Explain the role of Data Link layer protocols in data transmission.
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