OSI Data Link Layer

Network Fundamentals – Chapter 7

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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.

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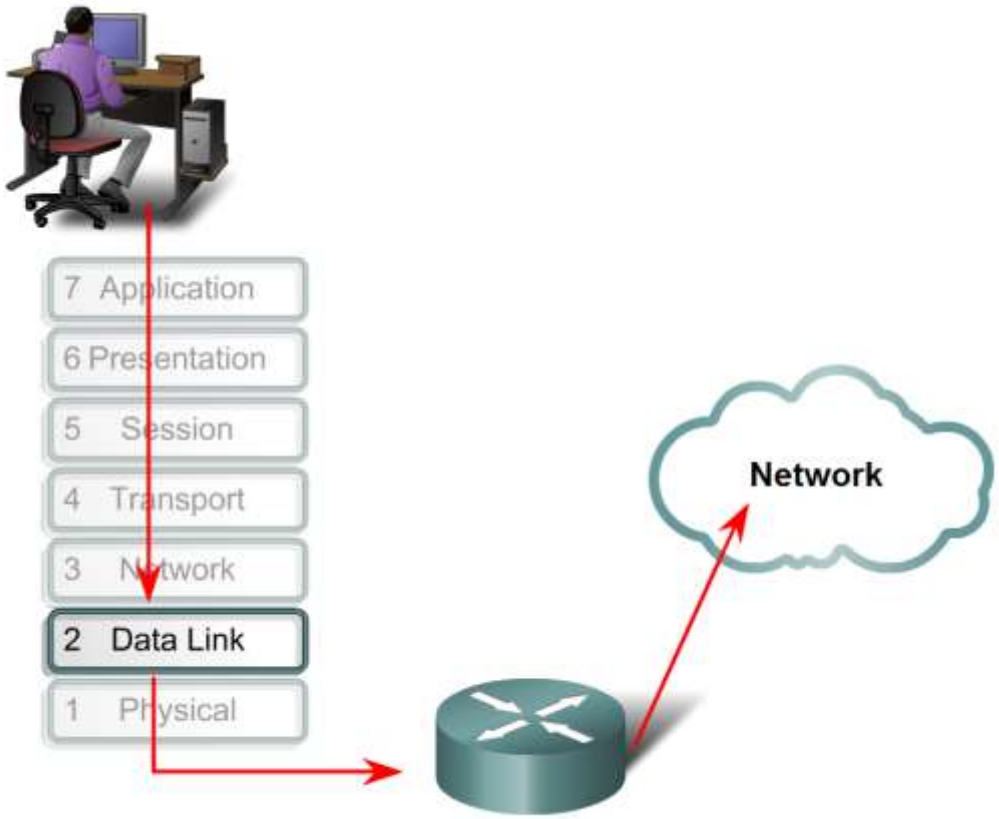
Data Link Layer – Accessing the Media

- 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.

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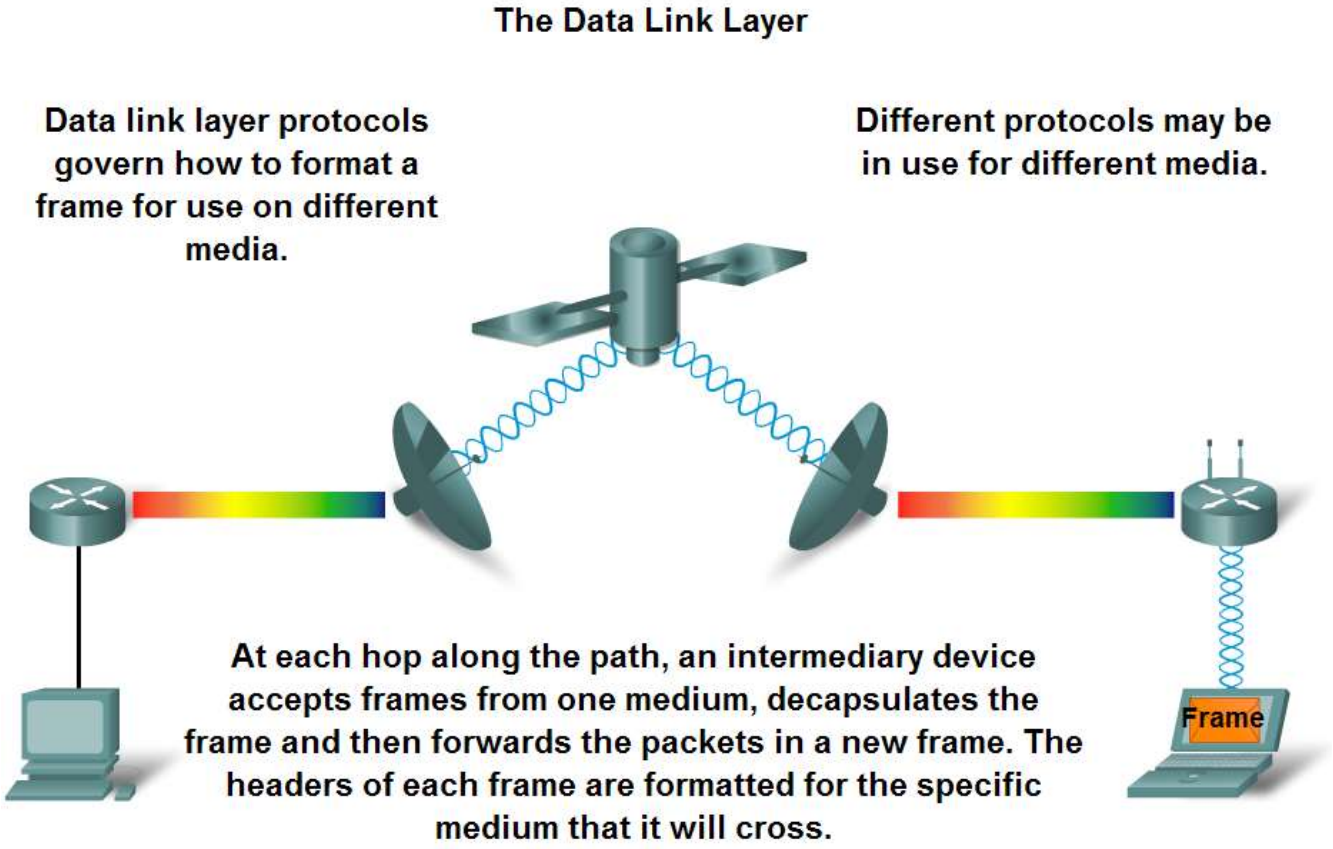
Data Link Layer – Accessing the Media

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



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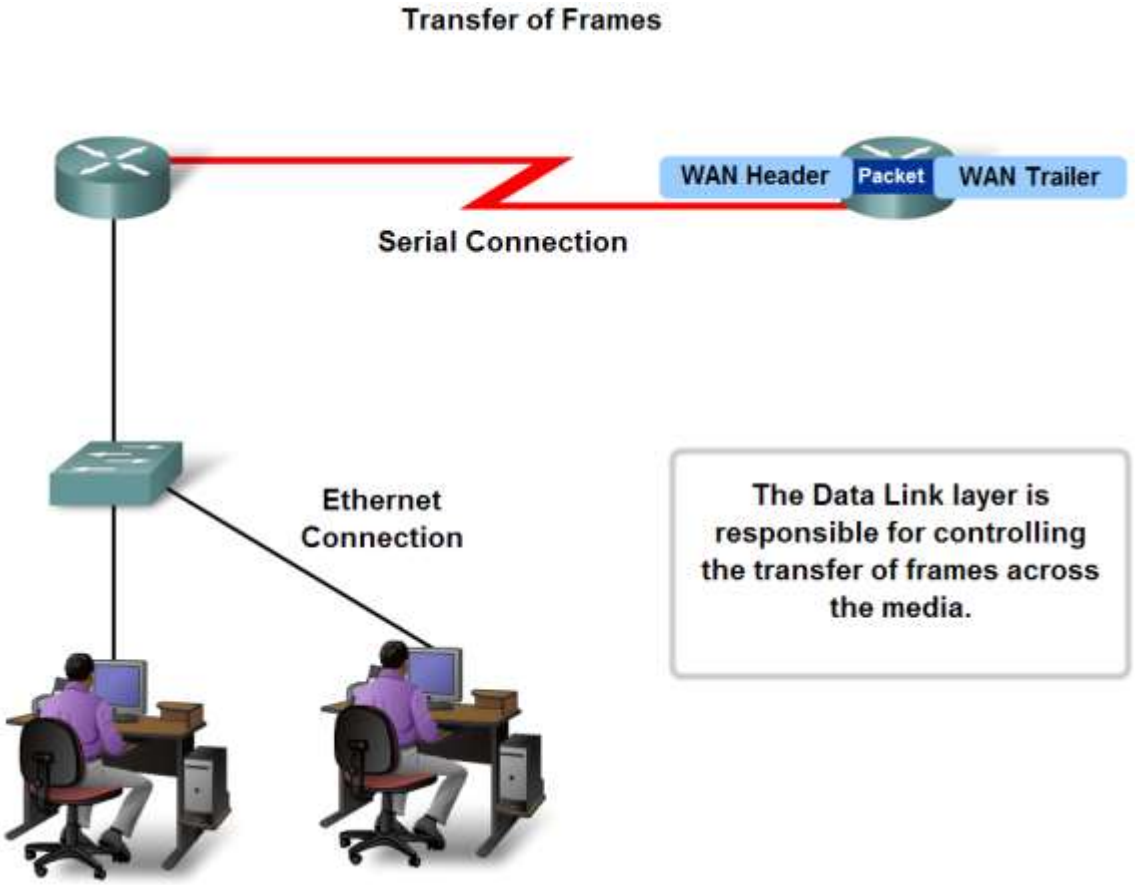
Data Link Layer – Accessing the Media

- Describe the role of framing in preparing a packet for transmission on a given media



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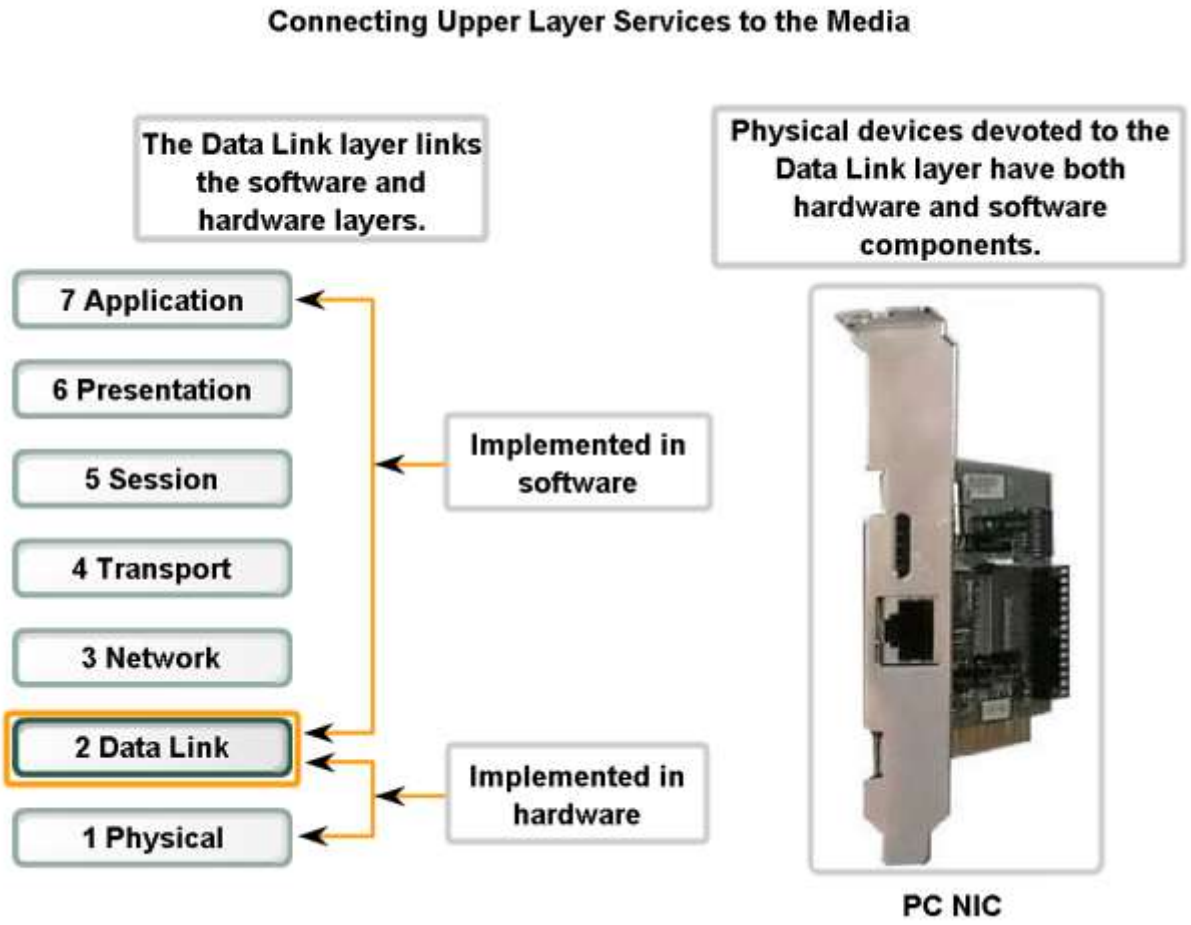
Data Link Layer – Accessing the Media

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



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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

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

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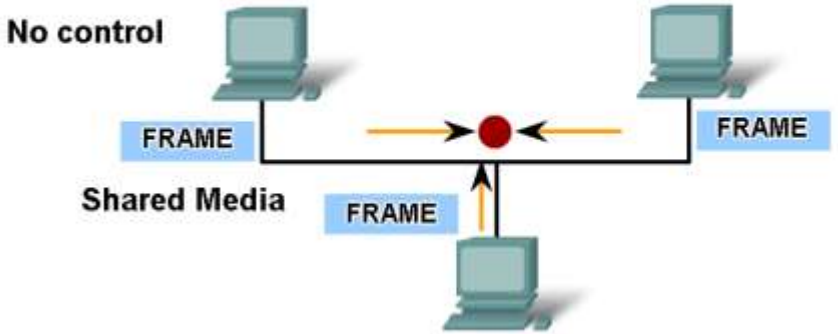
Media Access Control Techniques

- Explain the necessity for controlling access to the media

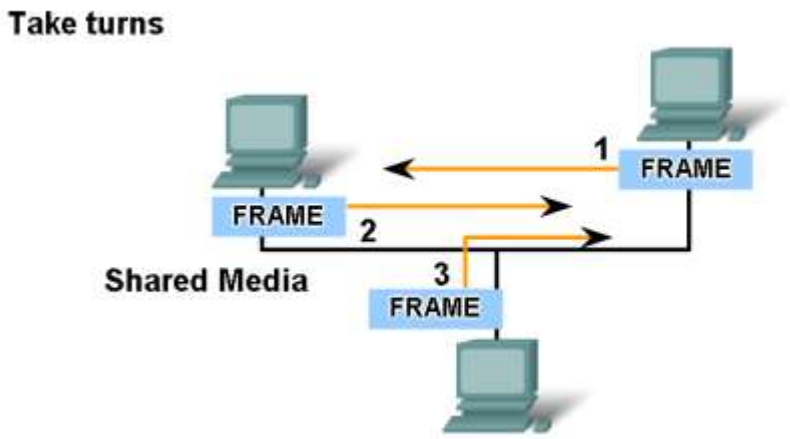
Media Access Control Methods

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.

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



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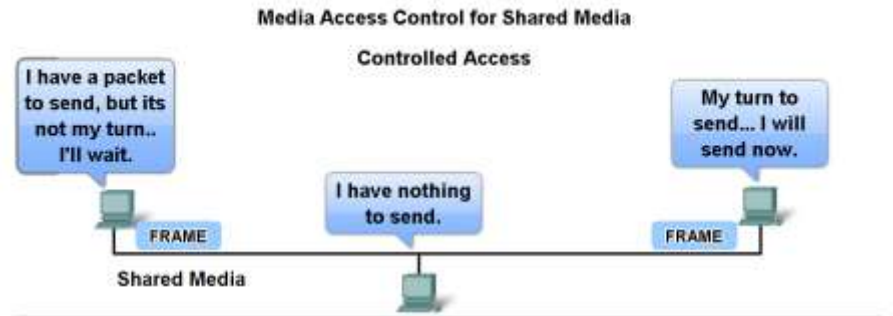
Media Access Control Techniques

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



Method	Characteristics	Example
Controlled Access	• Only one station transmits at a time • Devices wishing to transmit must wait their turn • No collisions • Some deterministic networks use token passing	• Token Ring • FDDI

Method	Characteristics	Example

Contention Based Access	• Stations can transmit at any time
	• Collisions exist
	• Mechanisms exist to resolve contention:
	  • CSMA/CD for Ethernet networks
	  • CSMA/CA for 802.11 wireless networks
		• Ethernet
		• Wireless

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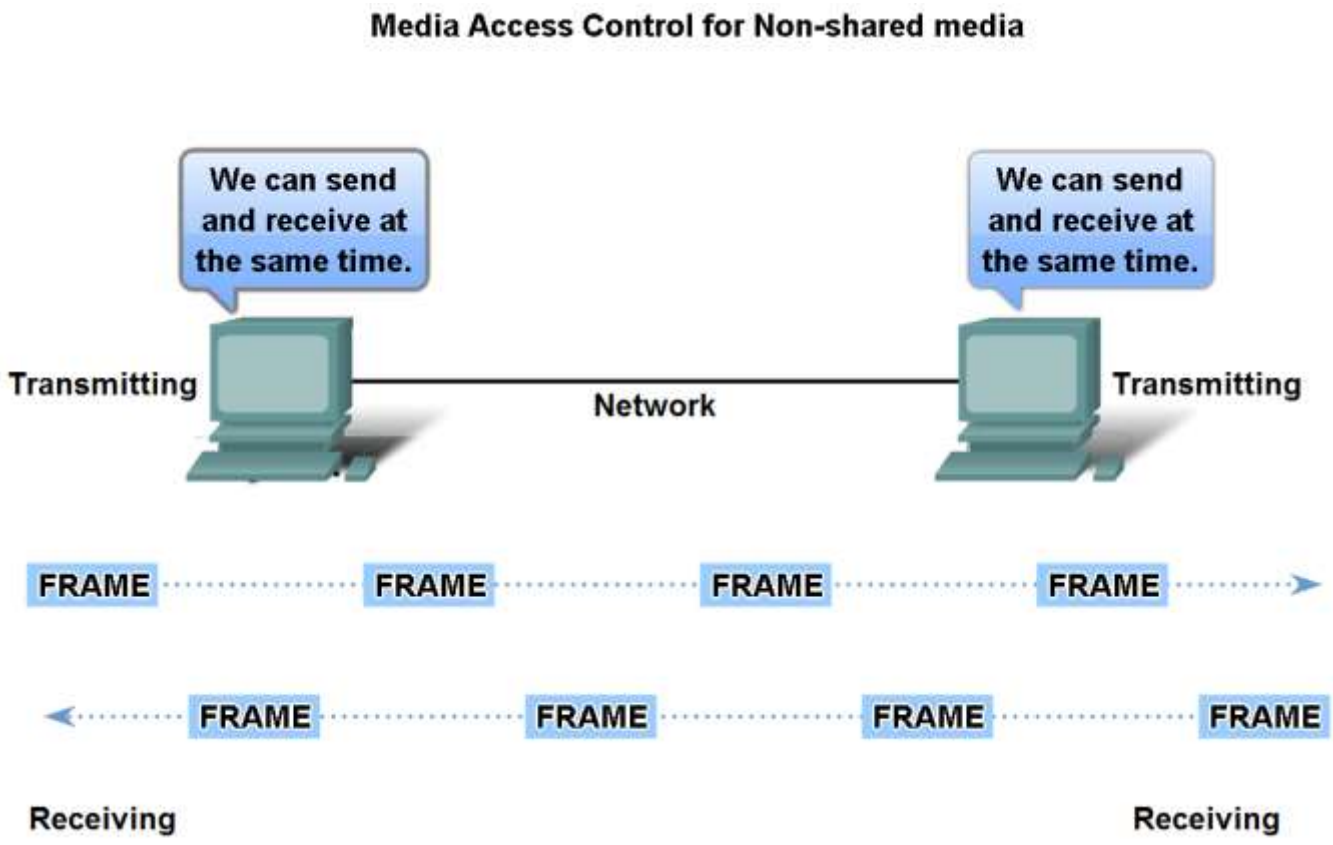
Media Access Control Techniques

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



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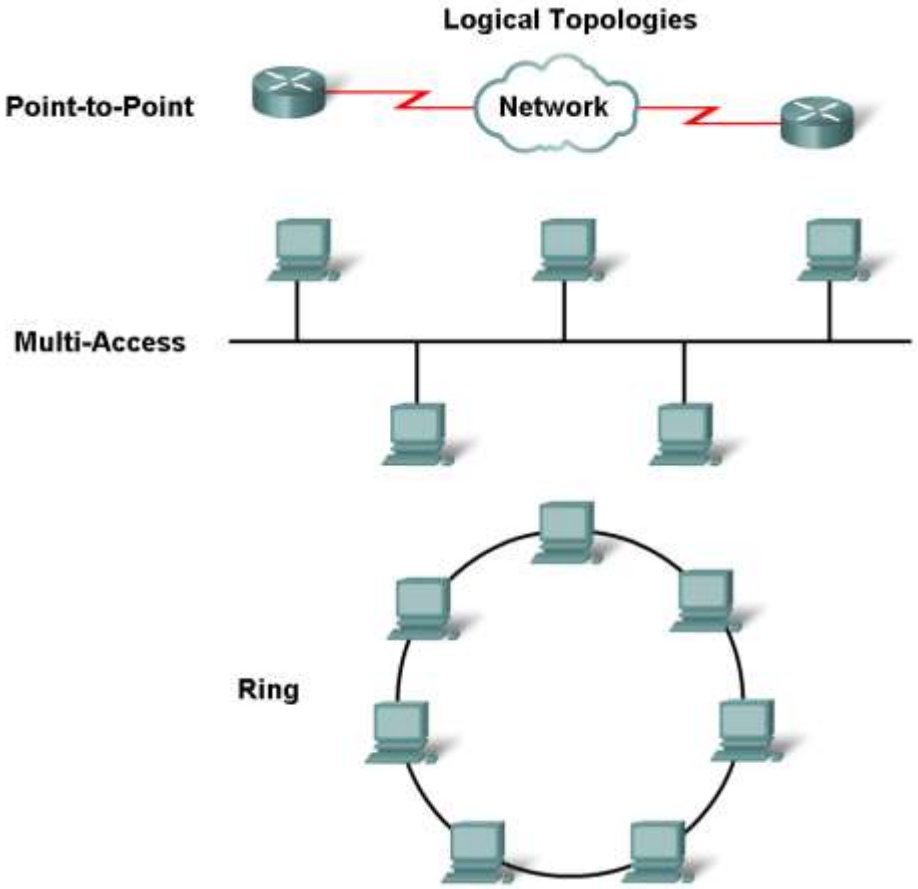
Media Access Control Techniques

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



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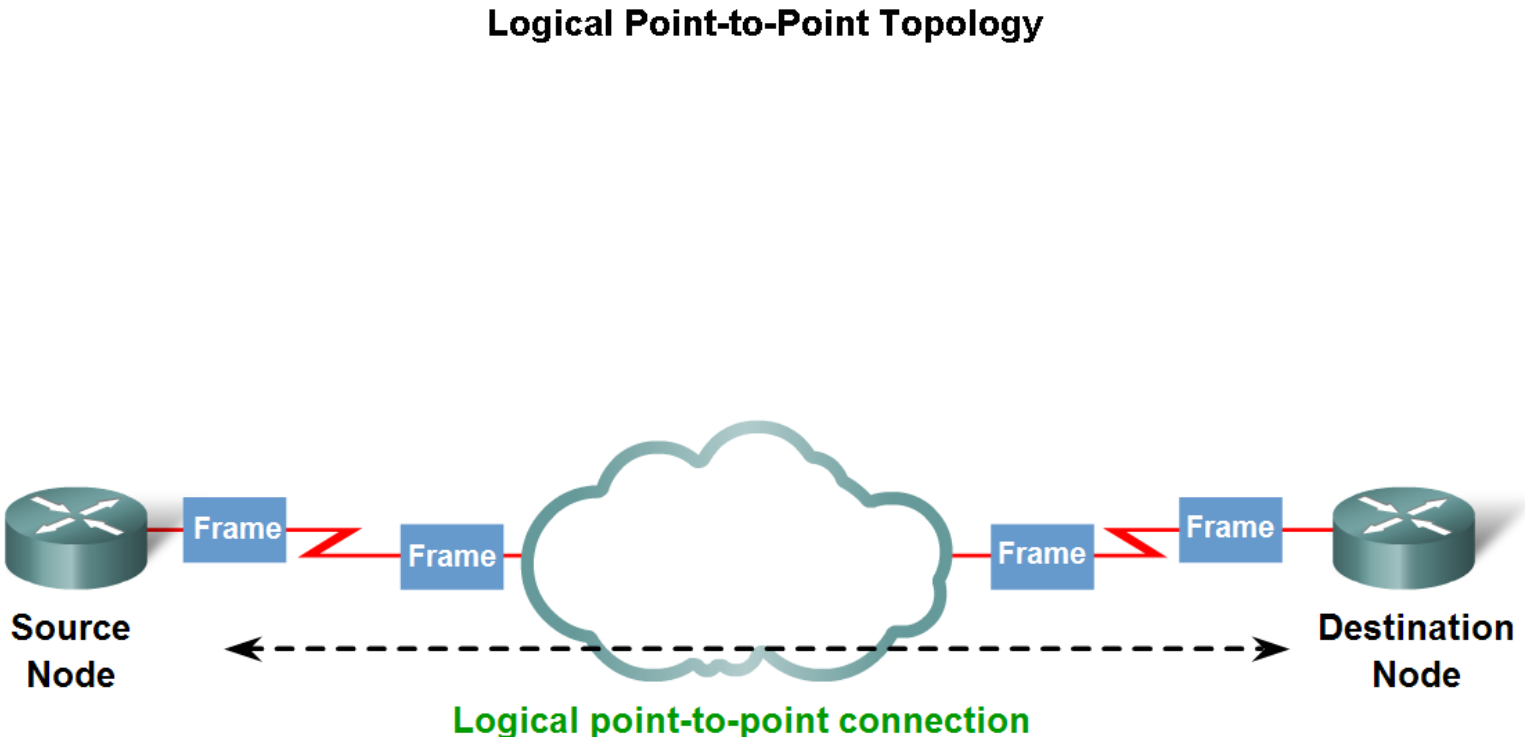
Media Access Control Techniques

- Contrast logical and physical topologies



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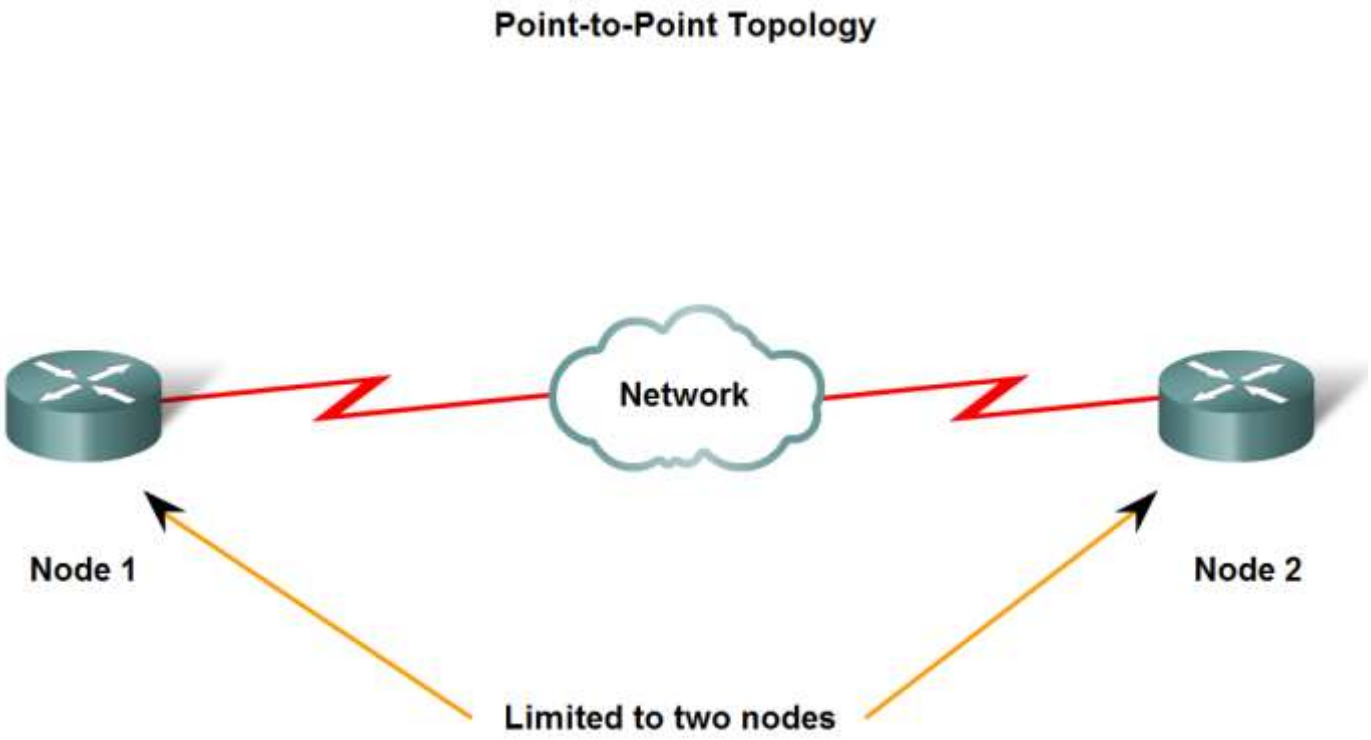
Media Access Control Techniques

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



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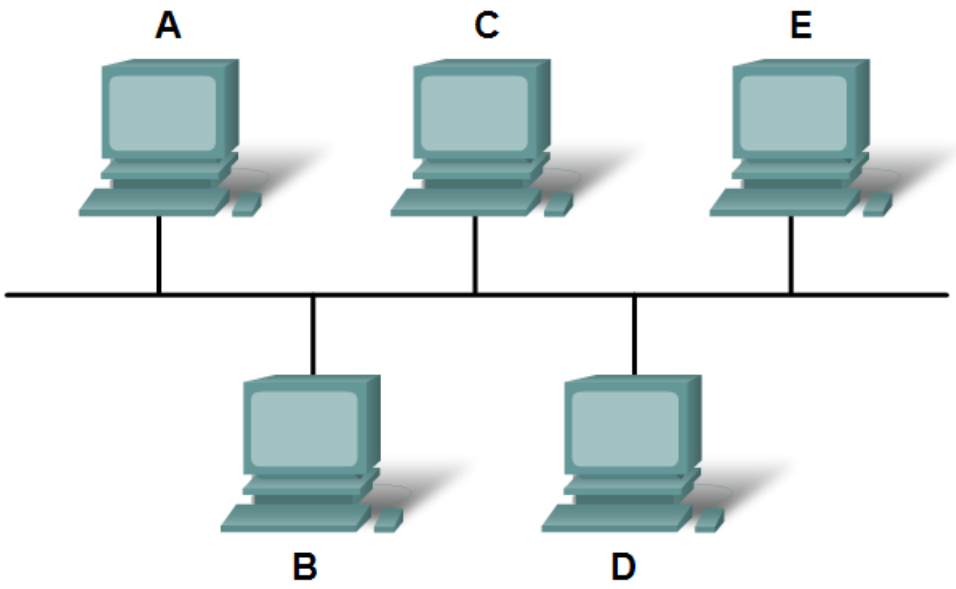
Media Access Control Techniques

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

Logical Multi-Access Topology



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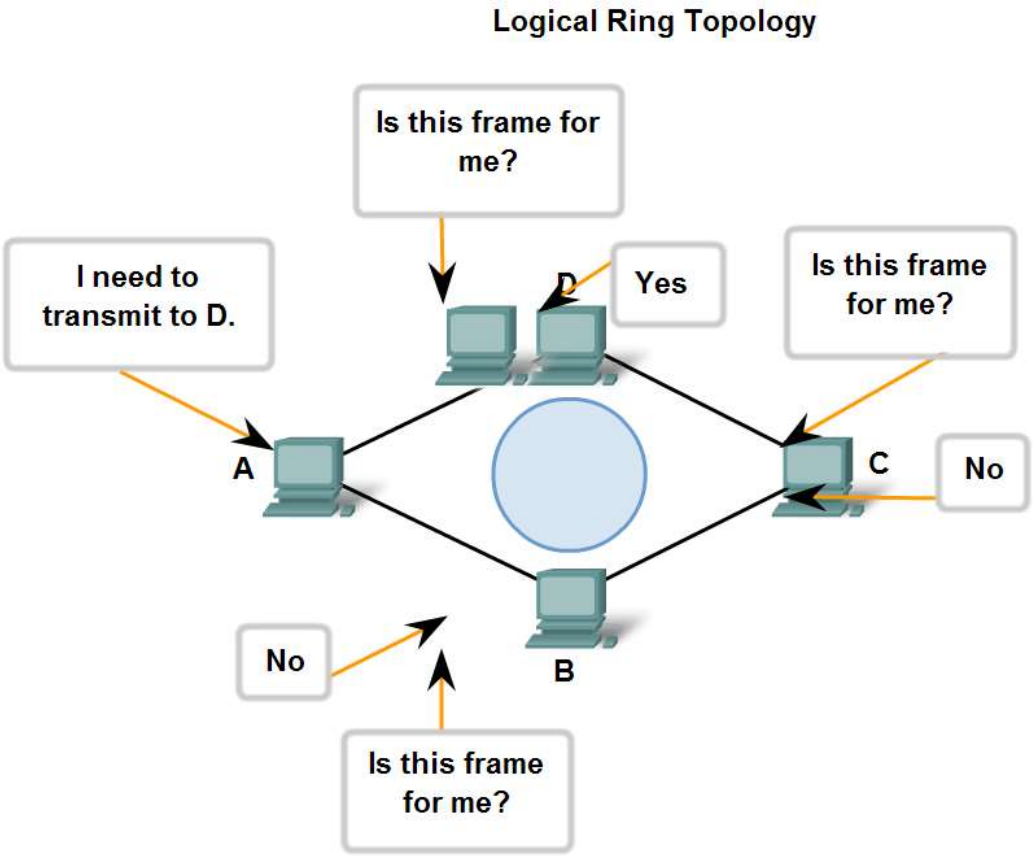
Media Access Control Techniques

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



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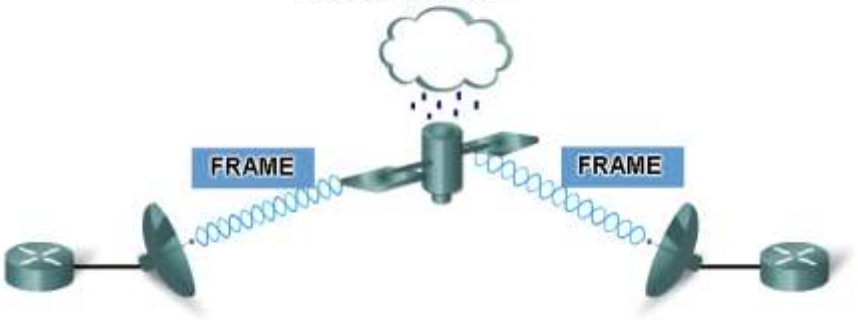
Media Access Control Addressing and Framing Data

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

Data Link Layer Protocols - The Frame

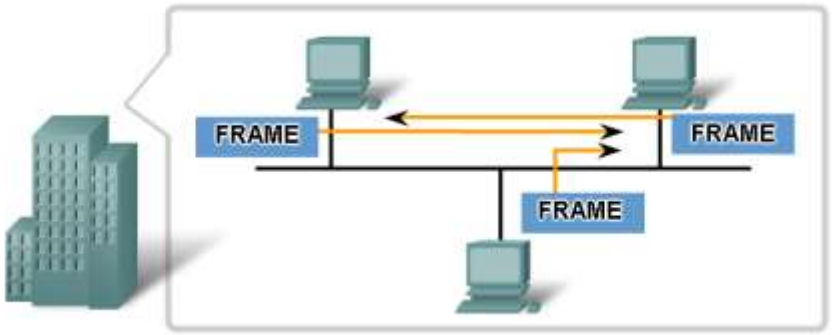
In a fragile environment, more controls are needed to ensure delivery. The header and trailer fields are larger as more control information is needed.

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



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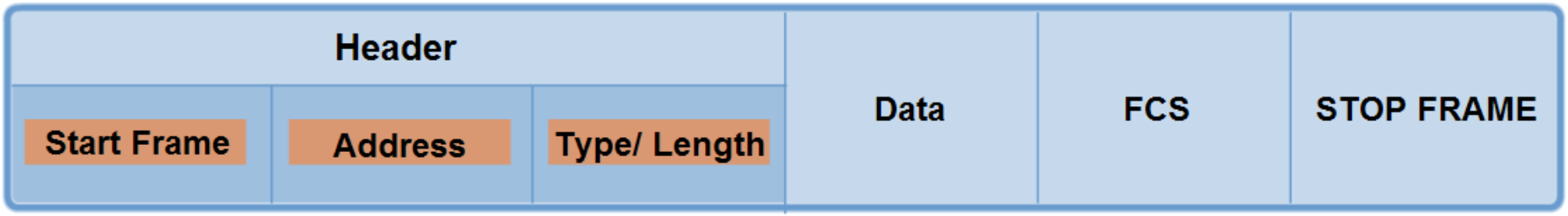
Media access control addressing and framing data

- 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



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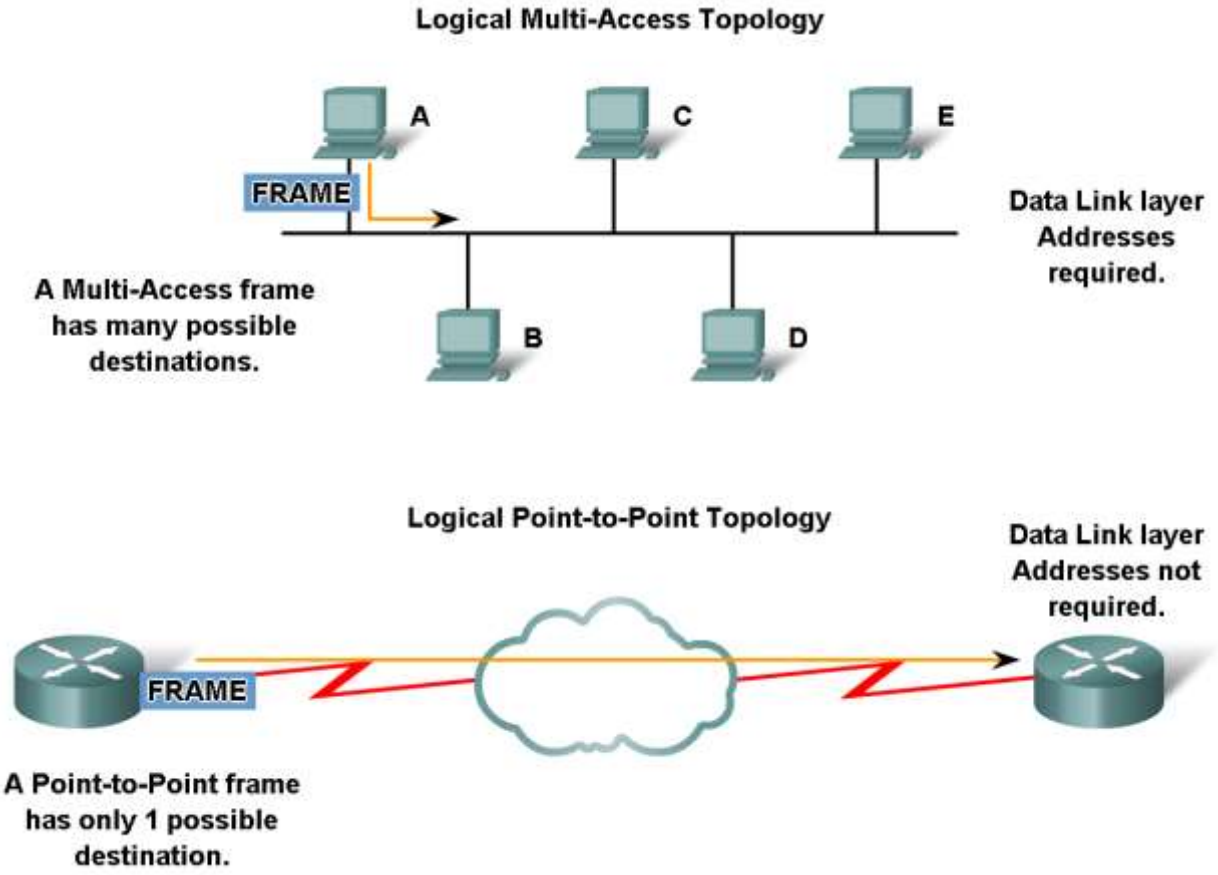
Media access control addressing and framing data

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



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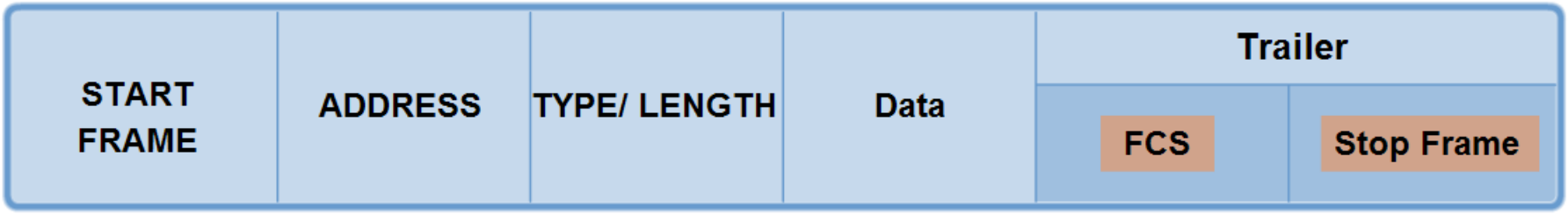
Media access control addressing and framing data

- 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



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Summary

In this chapter, you learned to:

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