

# **The OSI and TCP/IP Models**

Lesson 2

# Objectives

## Exam Objective Matrix

Technology Skill Covered	Exam Objective	Exam Objective Number
Introduction to the OSI Model	Compare the layers of the OSI and TCP/IP models. OSI model: <ul style="list-style-type: none"><li>• Layer 1—Physical</li><li>• Layer 2—Data Link</li><li>• Layer 3—Network</li><li>• Layer 4—Transport</li><li>• Layer 5—Session</li><li>• Layer 6—Presentation</li><li>• Layer 7—Application</li></ul>	1.1
	Classify how applications, devices, and protocols relate to the OSI model layers. <ul style="list-style-type: none"><li>• IP address</li><li>• Frames</li><li>• Packets</li><li>• Cable</li></ul>	1.2

# Objectives

## Exam Objective Matrix

Technology Skill Covered	Exam Objective	Exam Objective Number
TCP/IP Model	Compare the layers of the OSI and TCP/IP models. TCP/IP model: <ul style="list-style-type: none"><li>• Network Interface Layer</li><li>• Internet Layer</li><li>• Transport Layer</li><li>• Application Layer</li><li>• (Also described as: Link Layer, Internet Layer, Transport Layer, Application Layer)</li></ul>	1.1

## Introduction to the OSI Model

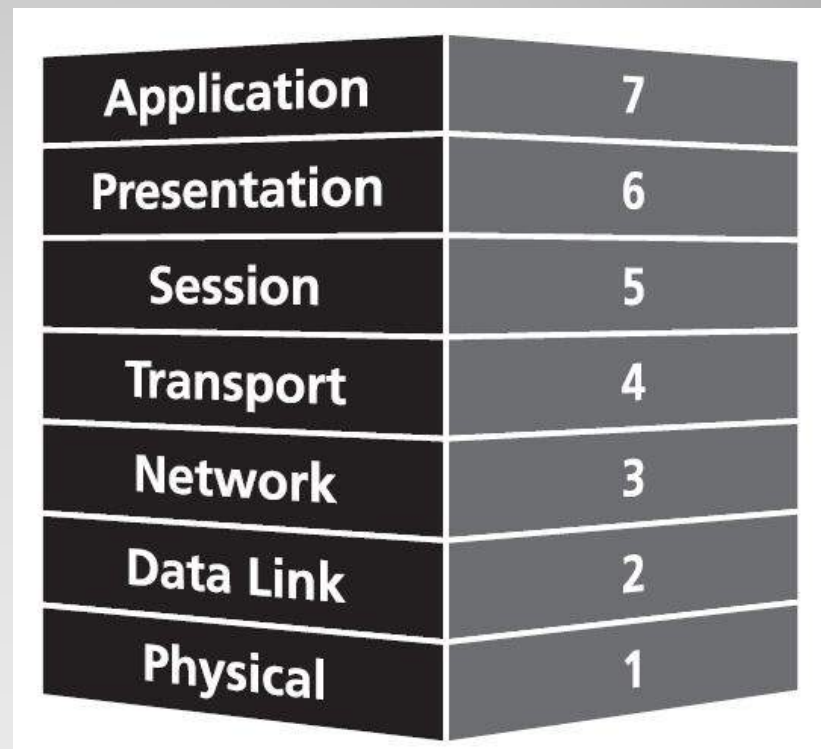
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- OSI stands for Open Systems Interconnection
- Created by International Standards Organization
- Was created as a framework and reference model to explain how different networking technologies work together and interact
- Is not a standard that networking protocols must follow

## What the OSI Model Looks Like

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- Each layer has specific functions it is responsible for
- All layers work together in the correct order to move data around a network



## OSI Model Layer Mnemonics

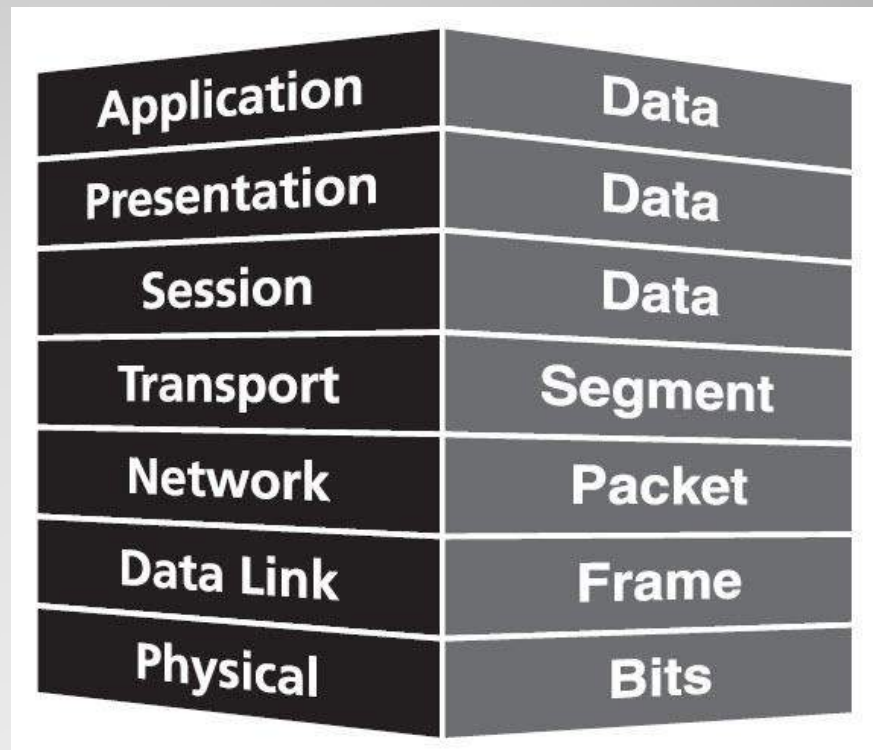
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- Top to bottom
  - All People Seem To Need Data Processing
- Bottom to top
  - Please Do Not Throw Sausage Pizza Away

# Encapsulation/De-encapsulation

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- The process of moving data between layers of the OSI Model
- **Encapsulation:**  
Data > segment > packet > frame > bits
- **De-encapsulation:**  
Bits > frame > packet > segment > data



# How Data Is Referred to in the OSI Model

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Data

- Application, Presentation, and Session layers

Segment

- Transport layer

Packet

- Networking layer

Frame

- Data Link layer

Bits

- Physical layer



## Physical Layer of OSI Model

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- Deals with all aspects of physically moving data from one computer to the next
- Converts data from the upper layers into 1s and 0s for transmission over media
- Defines how data is encoded onto the media used to transmit the data
- Defined on this layer: Cable standards, wireless standards, and fiber optic standards

## Physical Layer of OSI Model (Continued)

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- Device example: Hub
- Used to transmit data
  - Copper wiring, fiber optic cable, radio frequencies, anything that can be used to transmit data is defined on the Physical layer of the OSI Model

## Data Link Layer of OSI Model

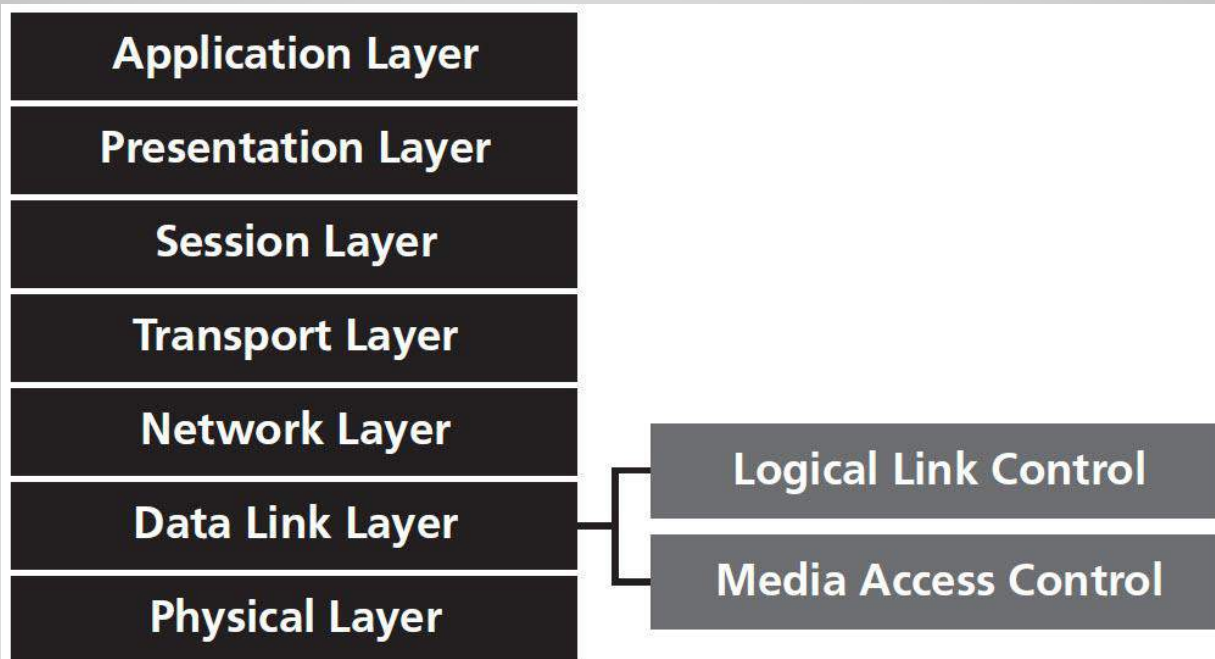
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- Is responsible for moving frames from node to node or computer to computer
- Can move frames from one adjacent computer to another, cannot move frames across routers
- Encapsulation = frame
- Requires MAC address. or *physical address*
- Protocols defined include Ethernet Protocol and Point-to-Point Protocol (PPP)

## Data Link Layer of OSI Model (Continued)

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- Device example: Switch
- Two sublayers: Logical Link Control (LLC) and the Media Access Control (MAC)



## LLC and MAC Sublayers

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- Logical Link Control (LLC)
  - Data Link layer addressing, flow control, address notification, error correction
- Media Access Control (MAC)
  - Determines which computer has access to the network media at any given time
  - Determines where one frame ends and the next one starts, called frame synchronization

## Network Layer of OSI Model

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- Responsible for moving packets (data) from one end of the network to the other, called *end-to-end communications*
- Requires ***logical addresses*** such as IP addresses
- Device example: Router
  - Routing is the ability of various network devices and their related software to move data packets from source to destination

## Transport Layer of OSI Model

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- Takes data from higher levels of OSI Model and breaks it into segments that can be sent to lower-level layers for data transmission
- Conversely, reassembles data segments into data that higher-level protocols and applications can use
- Also puts segments in correct order (called sequencing ) so they can be reassembled in correct order at destination

## Transport Layer of OSI Model (Continued)

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- Concerned with the reliability of the transport of sent data
- May use a *connection-oriented protocol* such as TCP to ensure destination received segments
- May use a *connectionless protocol* such as UDP to send segments without assurance of delivery
- Uses port addressing



## Session Layer of OSI Model

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- Responsible for managing the dialog between networked devices
- Establishes, manages, and terminates connections
- Provides duplex, half-duplex, or simplex communications between devices
- Provides procedures for establishing checkpoints, adjournment, termination, and restart or recovery procedures

## Presentation Layer of OSI Model

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- Concerned with how data is presented to the network
- Handles three primary tasks:
  - Translation
  - Compression
  - Encryption

## Presentation Layer of OSI Model (Continued)

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### Translation

- Changes data so another type of computer can understand it

### Compression

- Makes data smaller to send more data in same amount of time

### Encryption

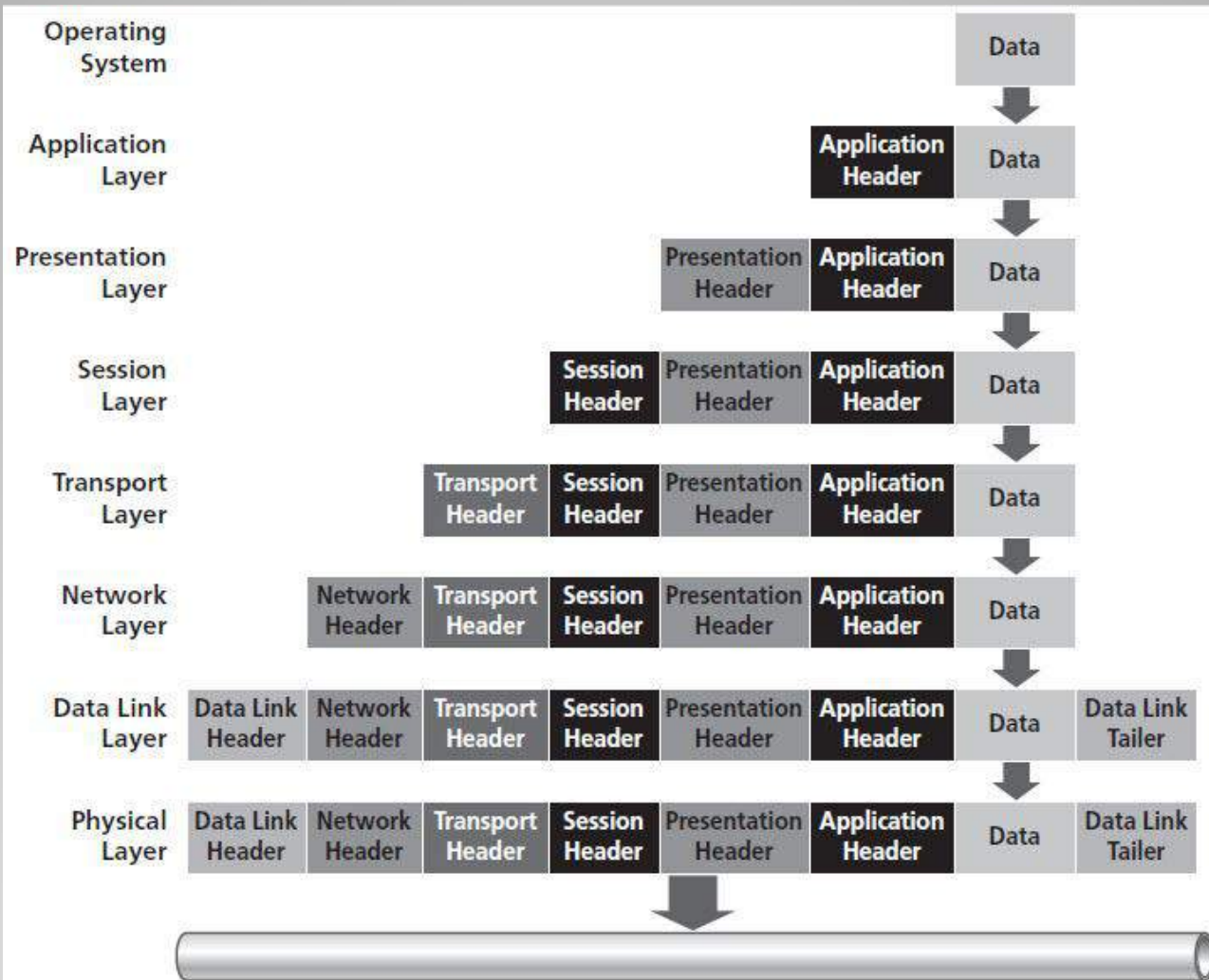
- Encodes data to protect from interception or eavesdropping

## Application Layer of OSI Model

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- Contains all services or protocols needed by application software or operating system to communicate on the network
- Examples
  - Firefox web browser uses HTTP (Hyper-Text Transport Protocol)
  - E-mail program may use POP3 (Post Office Protocol version 3) to read e-mails and SMTP (Simple Mail Transport Protocol) to send e-mails

# How Data Moves Through the OSI Model



## How Data Moves Through the OSI Model (Continued)

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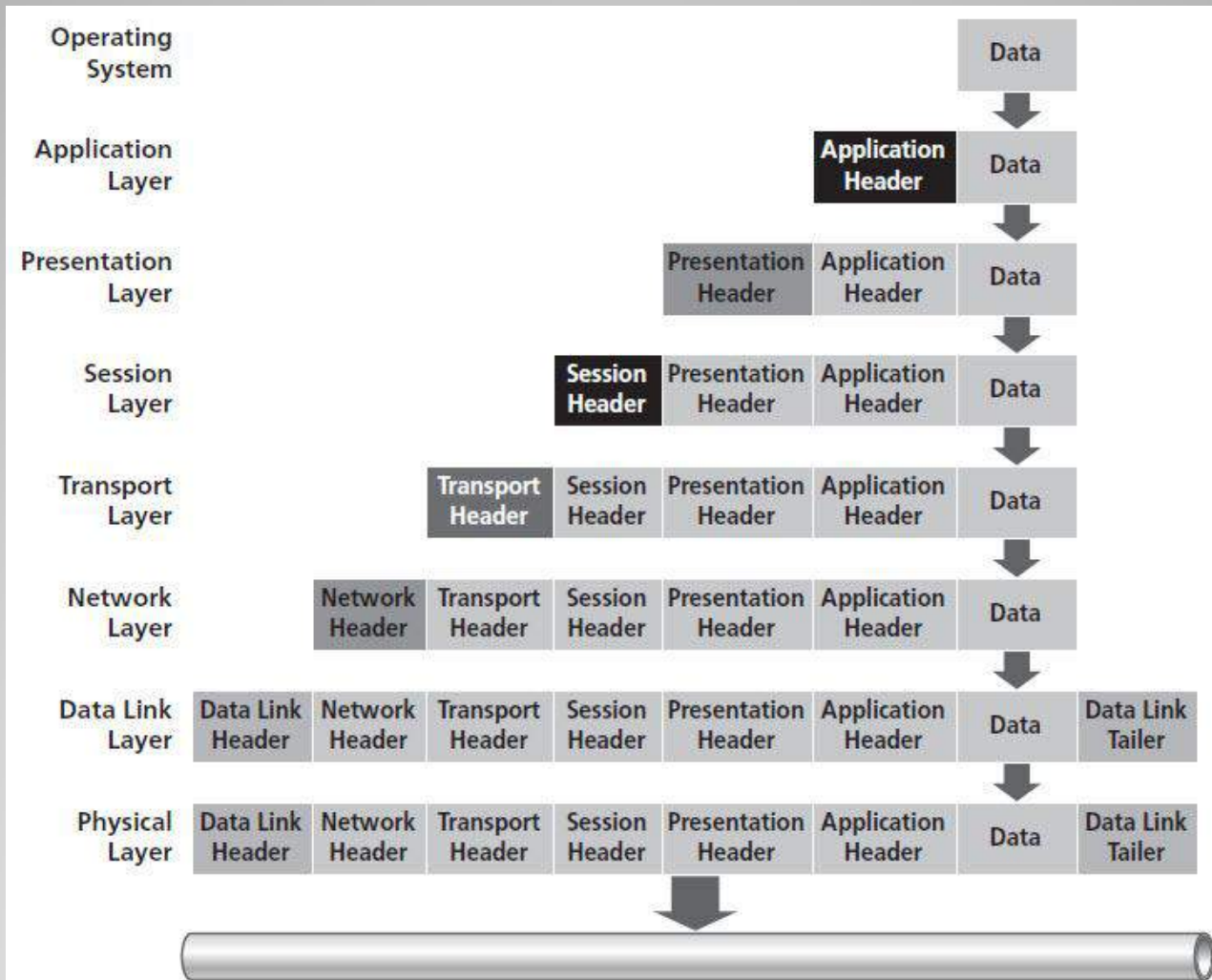
- Each layer of OSI Model except Physical adds its own *header* to the data that originated from the operating system
  - Adds own header in front of the header from the previous layer
  - Header contains information that describes what each layer of the OSI Model should do with the data

## How Data Moves Through the OSI Model (Continued)

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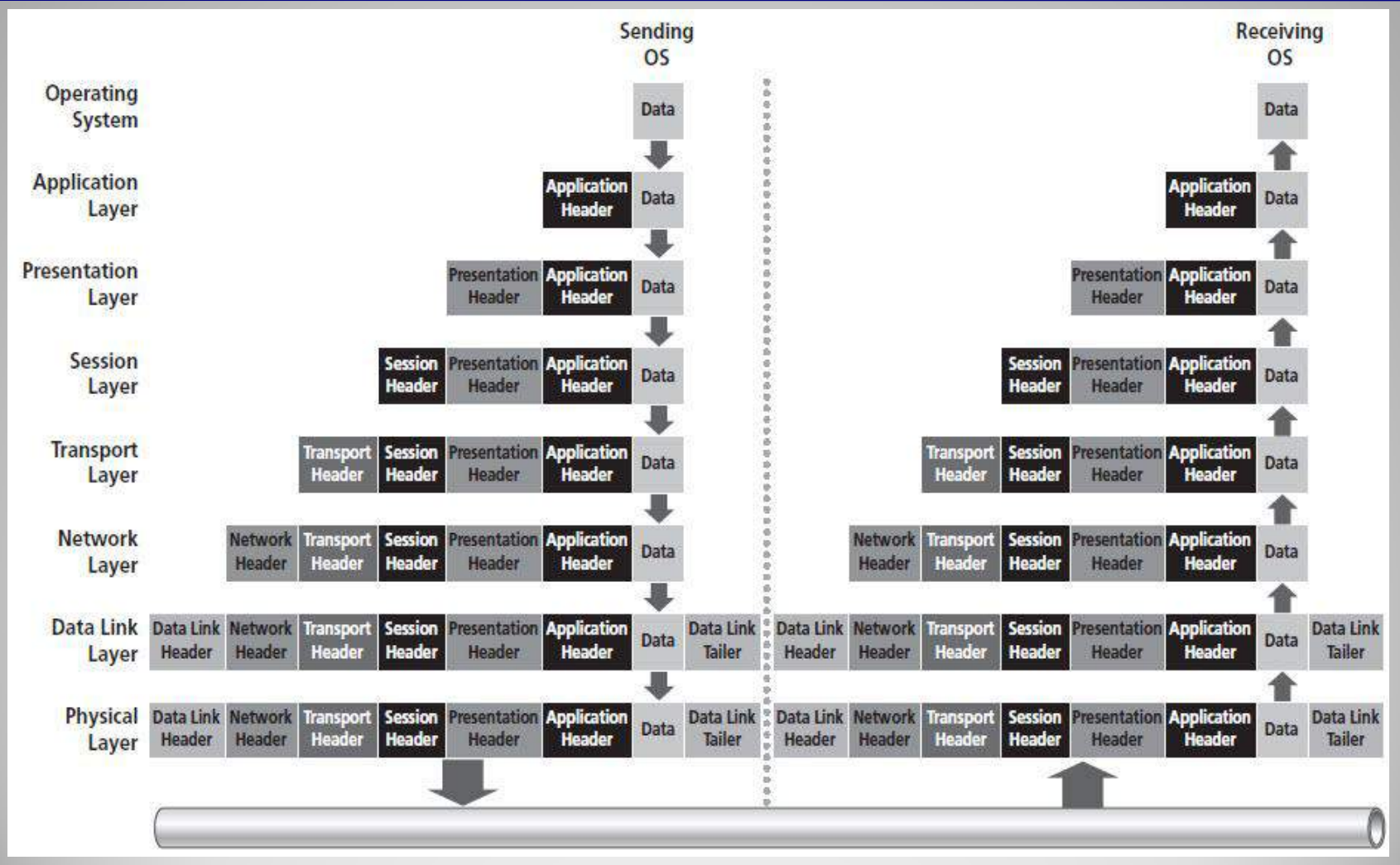
- Data Link layer also adds a *trailer*
  - Trailer contains additional information that deals with error correction

# Data as It Appears to the System Moving Down the OSI Layers





# Data as It Moves Through OSI Layers, Sent by One Computer and Received by Another



## TCP/IP Model

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- Built around the TCP/IP protocol suite
  - A *protocol suite* is a large number of related protocols that work together to allow networked computers to communicate

Application Layer

Transport Layer

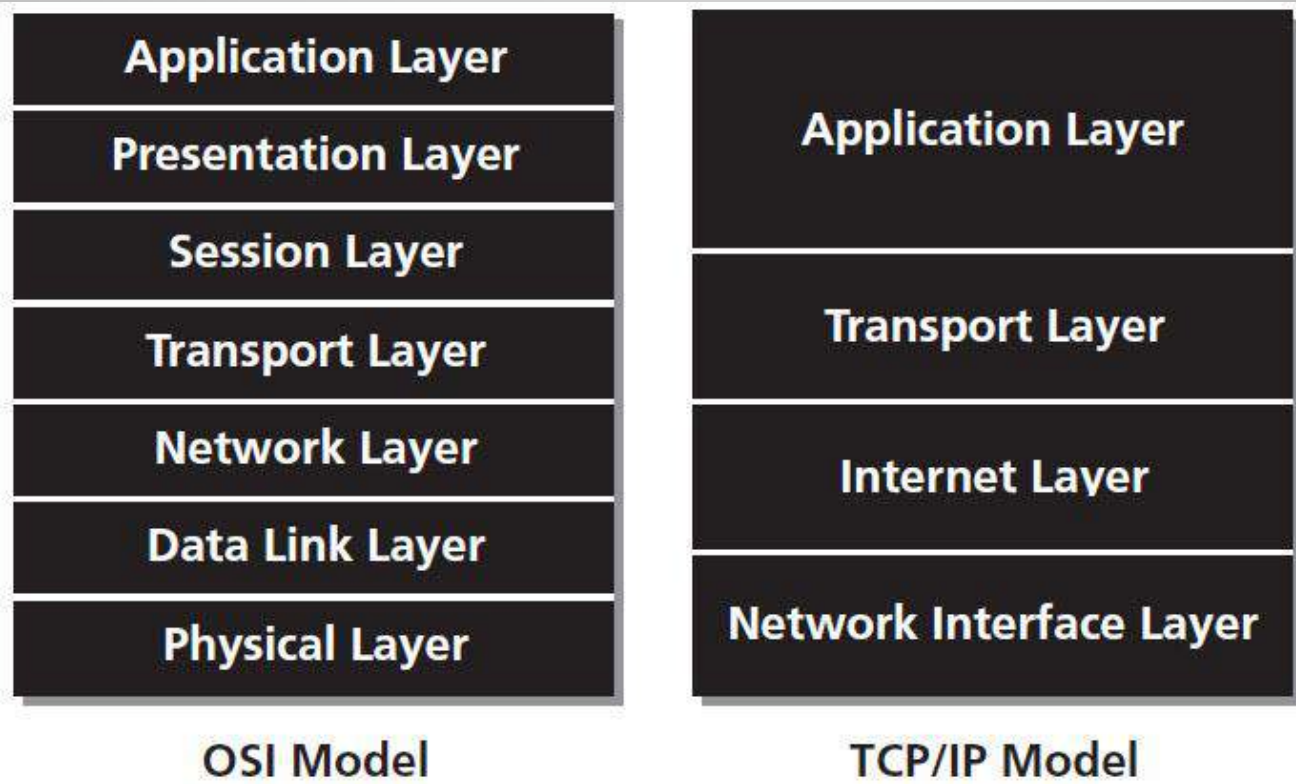
Internet Layer

Network Interface Layer

## TCP/IP Model (Continued)

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- Layers with same names as OSI Model don't function exactly the same



# Application Layer of TCP/IP Model

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Encompasses same functions  
as these OSI Model layers

Application

Presentation

Session

## Transport Layer of TCP/IP Model

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- Functions the same as the Transport layer in OSI Model and part of Session layer
  - TCP and other similar protocols take on some of the function of the Session layer
    - Synchronize source and destination computers to set up the session between the respective computers

## Internet Layer of TCP/IP Model

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- Performs:
  - Same functions as OSI Model Network Layer
  - Many of the functions of the Logical Link Control sublayer of the OSI Model's Data Link layer
- Primary protocol is Internet Protocol (IP)
- Also uses Address Resolution Protocol (ARP), which performs much of the LLC sublayer's job in the area of physical addressing

## Interface Layer of TCP/IP Model

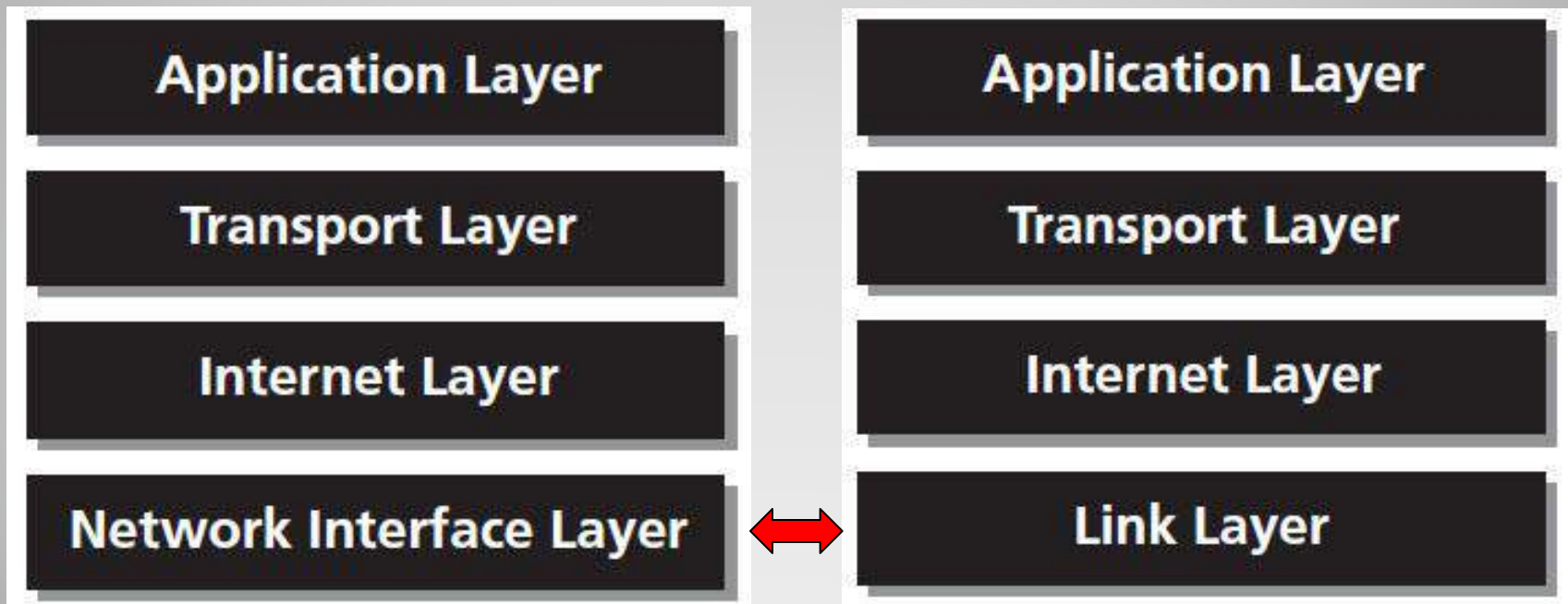
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- Performs much of the job of the MAC portion of the Data Link and Physical layers of the OSI Model
- TCP/IP Protocol does not dictate what happens on Network Interface layer
- TCP/IP protocol suite relies on standards created by the various standards organizations concerning how to encode bits onto media to do the work on this layer

## Alternate Layer Names for the TCP/IP Model

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- CompTIA Network+ objectives recognize alternate layer name for last layer in TCP/IP Model – the Link layer



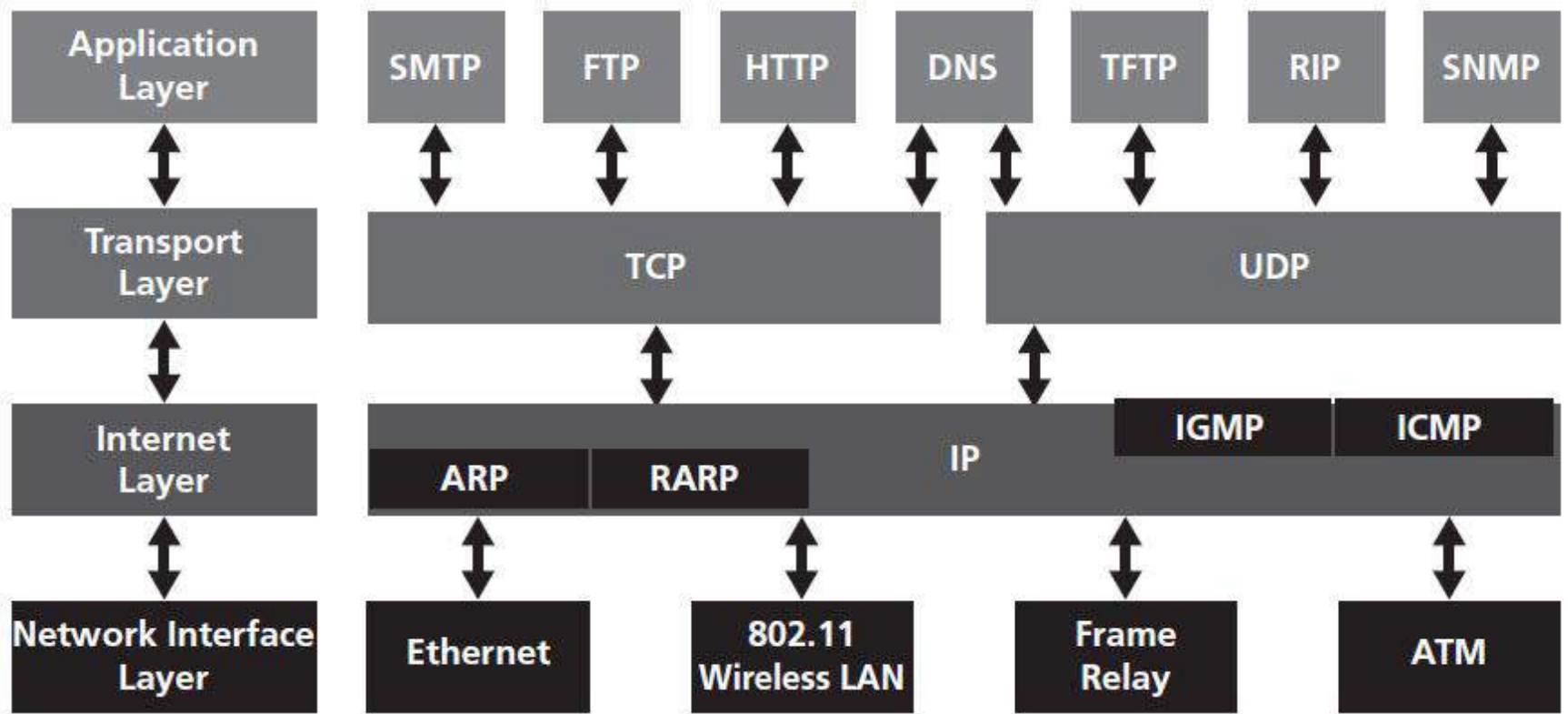


## How the Layers Work Together

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- Different protocols located on the Application layer of the TCP/IP Model connect to different Transport layer protocols
  - **Exception:** DNS protocol on the Application layer connects to both TCP (Transport Control Protocol) and UDP (User Datagram Protocol) protocols on the Transport layer

# TCP/IP Model and its Relation to Protocols of the TCP/IP Suite



## Summary

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- The OSI Model is a framework and reference model to explain how different networking technologies work together and interact.
- The Physical layer of the OSI Model deals with all aspects of physically moving data from one computer to the next.
- The Data Link layer of the OSI Model is responsible for moving frames from node to node or computer to computer.

## Summary (Continued)

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- The two sublayers of the Data Link layer are the LLC and MAC.
- The Network layer of the OSI Model is responsible for moving packets (data) from one end of the network to the other, called end-to-end communications.
- The TCP/IP Model is built around the TCP/IP protocol suite.

## Summary (Continued)

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- The Application layer of the TCP/IP Model encompasses the same functions as the Application, Presentation, and Session layers of the OSI Model.
- The Transport layer of the TCP/IP Model functions the same as the Transport layer in OSI Model and part of Session layer.
- The Internet of layer of the TCP/IP Model Performs the same functions as the OSI Model Network layer and many of the functions of the LLC sublayer of the OSI Model Data Link layer.

## Summary (Continued)

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- The Network Interface layer of the TCP/IP Model performs much of the job of the MAC portion of the Data Link and Physical layers of the OSI Model.