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: • Layer 1—Physical • Layer 2—Data Link • Layer 3—Network • Layer 4—Transport • Layer 5—Session • Layer 6—Presentation • Layer 7—Application Classify how applications, devices, and protocols relate to the OSI model layers. • IP address • Frames • Packets • Cable	1.1 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: • Network Interface Layer • Internet Layer • Transport Layer • Application Layer • (Also described as: Link Layer, Internet Layer, Transport Layer, Application Layer)	1.1

Introduction to the OSI Model

- 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

- Each layer has specific functions it is responsible for

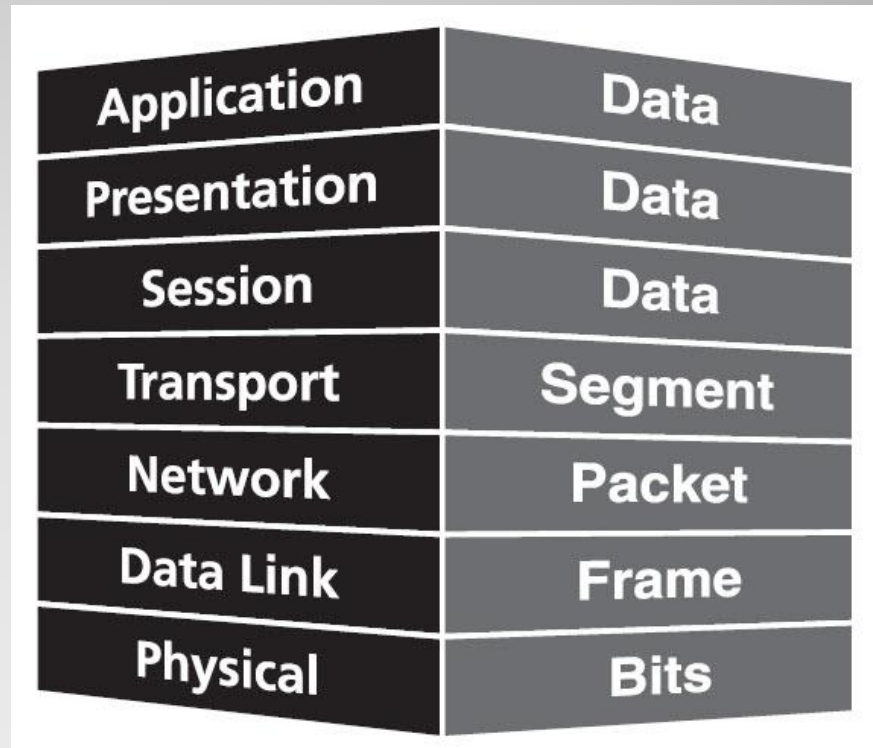- All layers work together in the correct order to move data around a network

Application	7
Presentation	6
Session	5
Transport	4
Network	3
Data Link	2
Physical	1
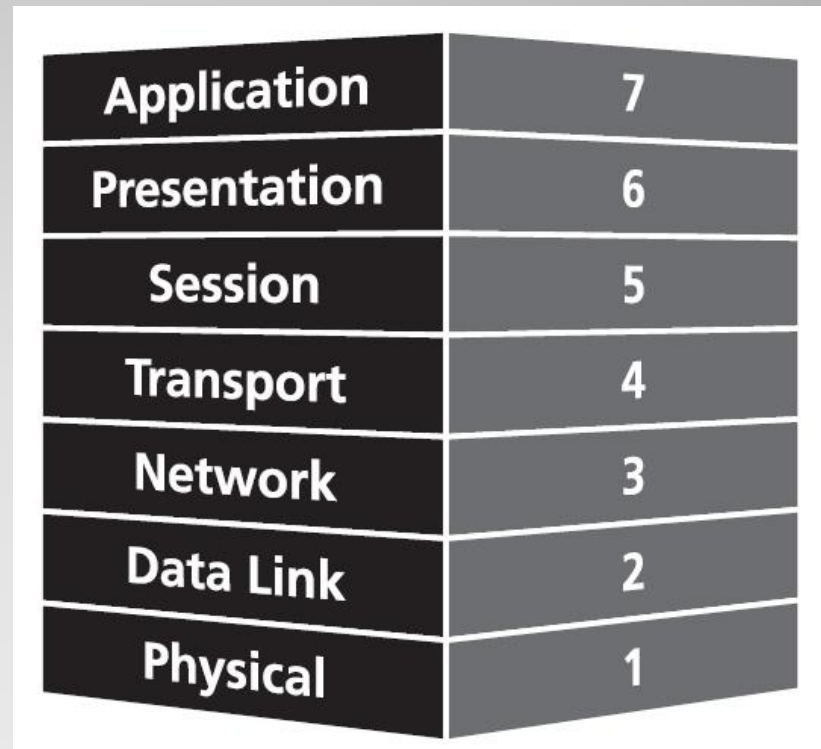
OSI Model Layer Mnemonics

- Top to bottom
  - **A**ll **P**eople **S**eem **T**o **N**eed **D**ata **P**rocessing
- Bottom to top
  - **P**lease **D**o **N**ot **T**hrow **S**ausage **P**izza **A**way

Encapsulation/De-encapsulation

- The process of moving data between layers of the OSI Model

- **Encapsulation:**
  Data > segment > packet > frame > bits

- **De-encapsulation:**
  Bits > frame > packet > segment > data

Application	Data
Presentation	Data
Session	Data
Transport	Segment
Network	Packet
Data Link	Frame
Physical	Bits

How Data Is Referred to in the OSI Model

Data	• Application, Presentation, and Session layers
Segment	• Transport layer
Packet	• Networking layer
Frame	• Data Link layer
Bits	• Physical layer

Physical Layer of OSI Model

- 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
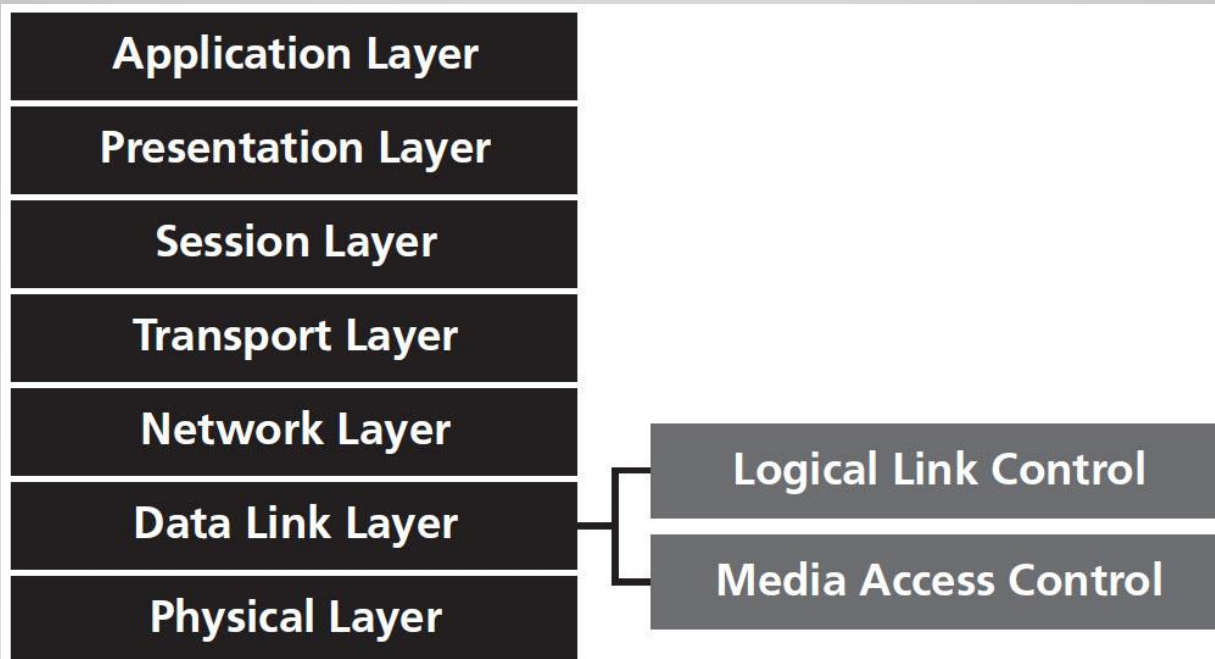
Physical Layer of OSI Model (Continued)

- 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

- 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)

- Device example: Switch

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

Application Layer	
Presentation Layer	
Session Layer	
Transport Layer	
Network Layer	
Data Link Layer	Logical Link Control
Physical Layer	Media Access Control

LLC and MAC Sublayers

- 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

- 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

- 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)

- 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

- 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

- Concerned with how data is presented to the network

- Handles three primary tasks:
  - Translation
  - Compression
  - Encryption

Presentation Layer of OSI Model (Continued)

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

- 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
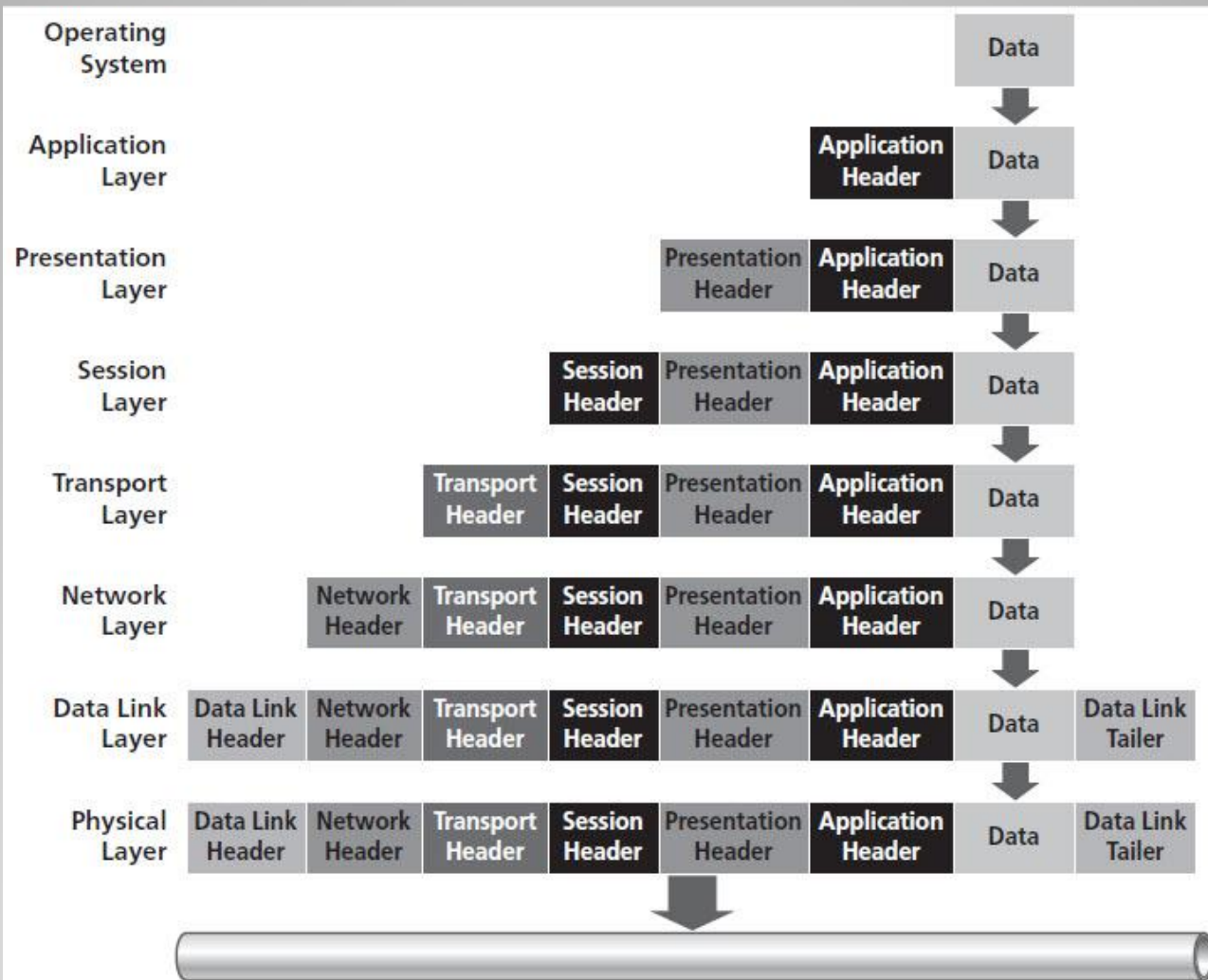
How Data Moves Through the OSI Model (Continued)

- 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
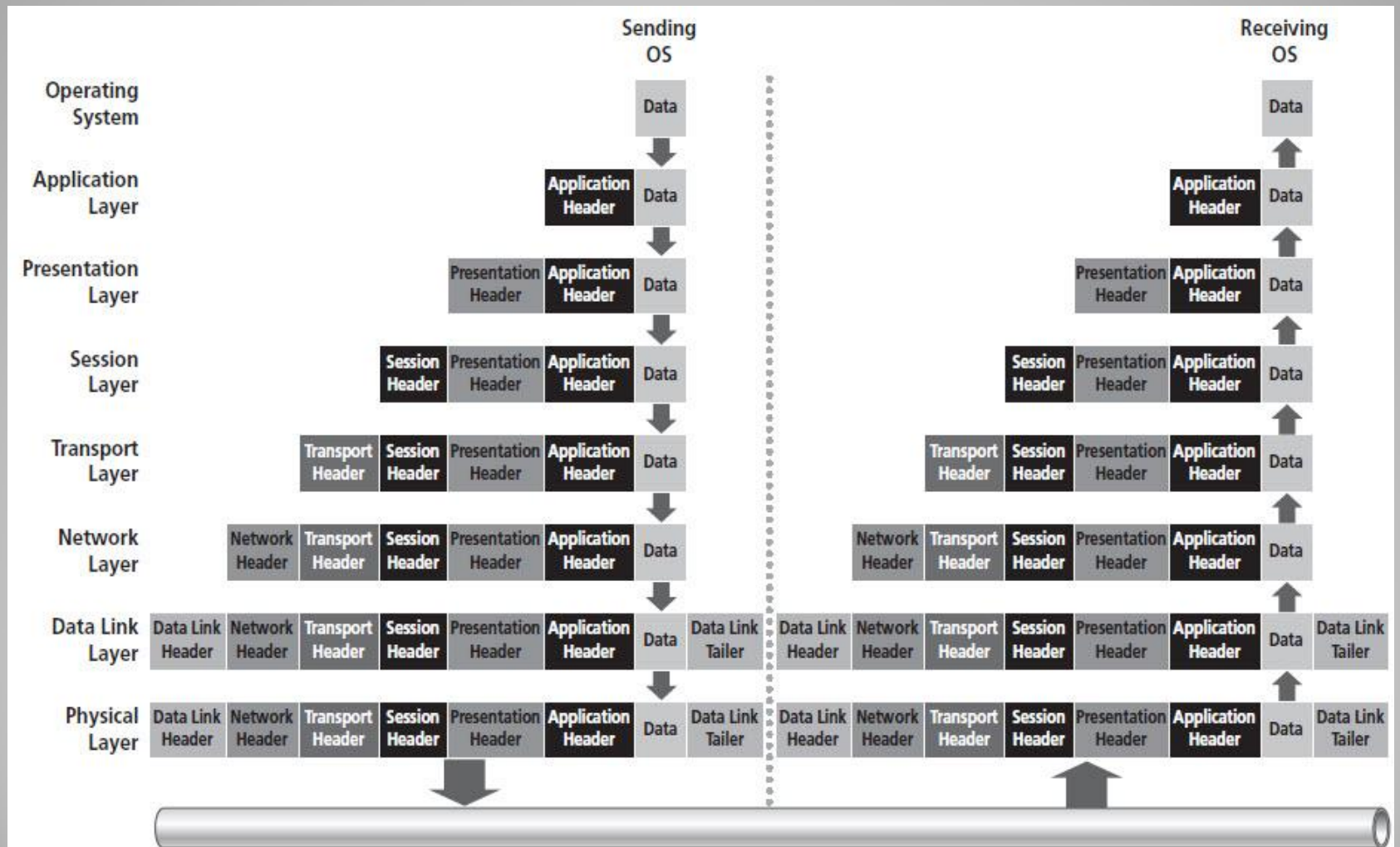
How Data Moves Through the OSI Model (Continued)

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

Data as It Appears to the System Moving Down the OSI Layers
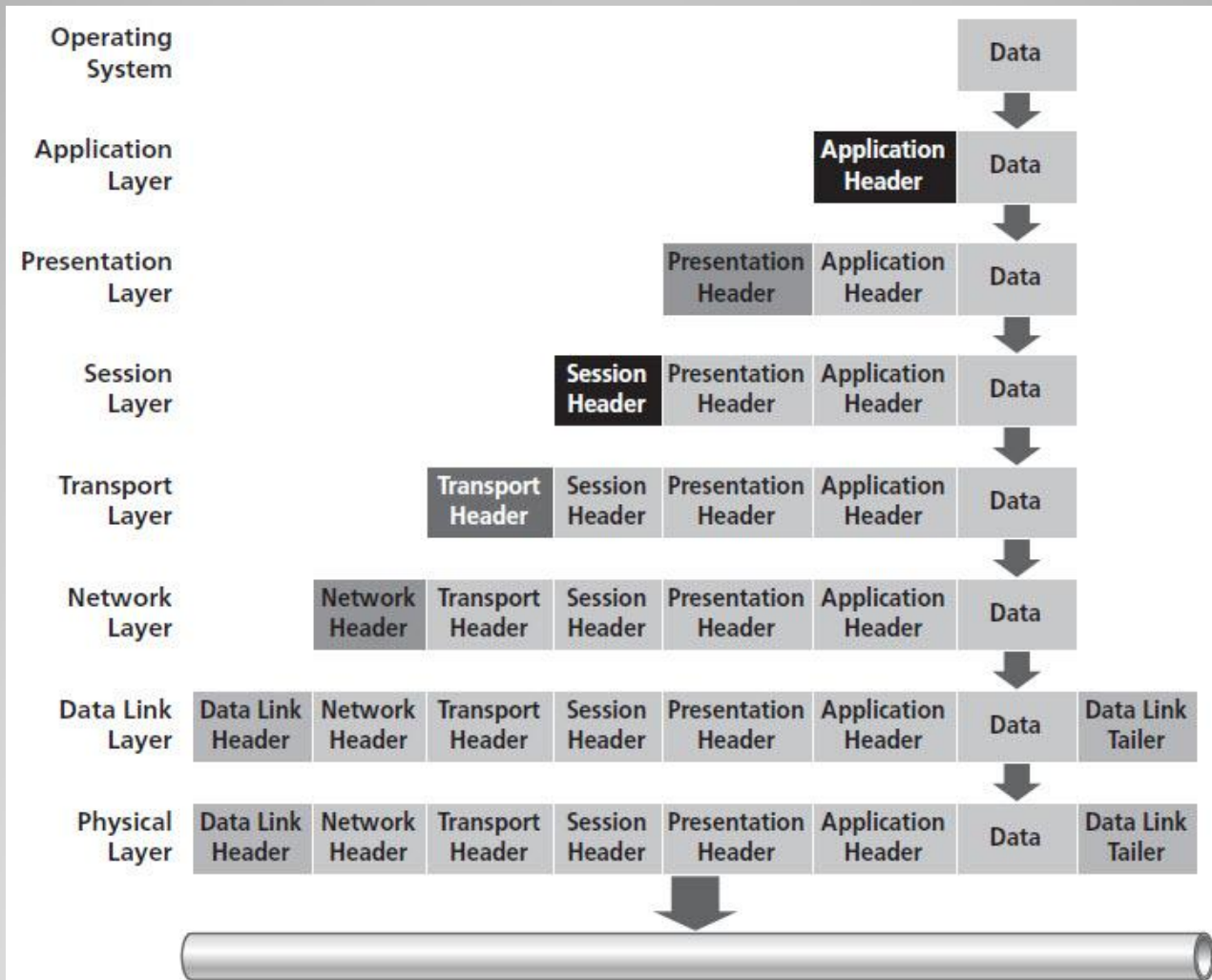
Data as It Moves Through OSI Layers, Sent by One Computer and Received by Another

TCP/IP Model

- 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
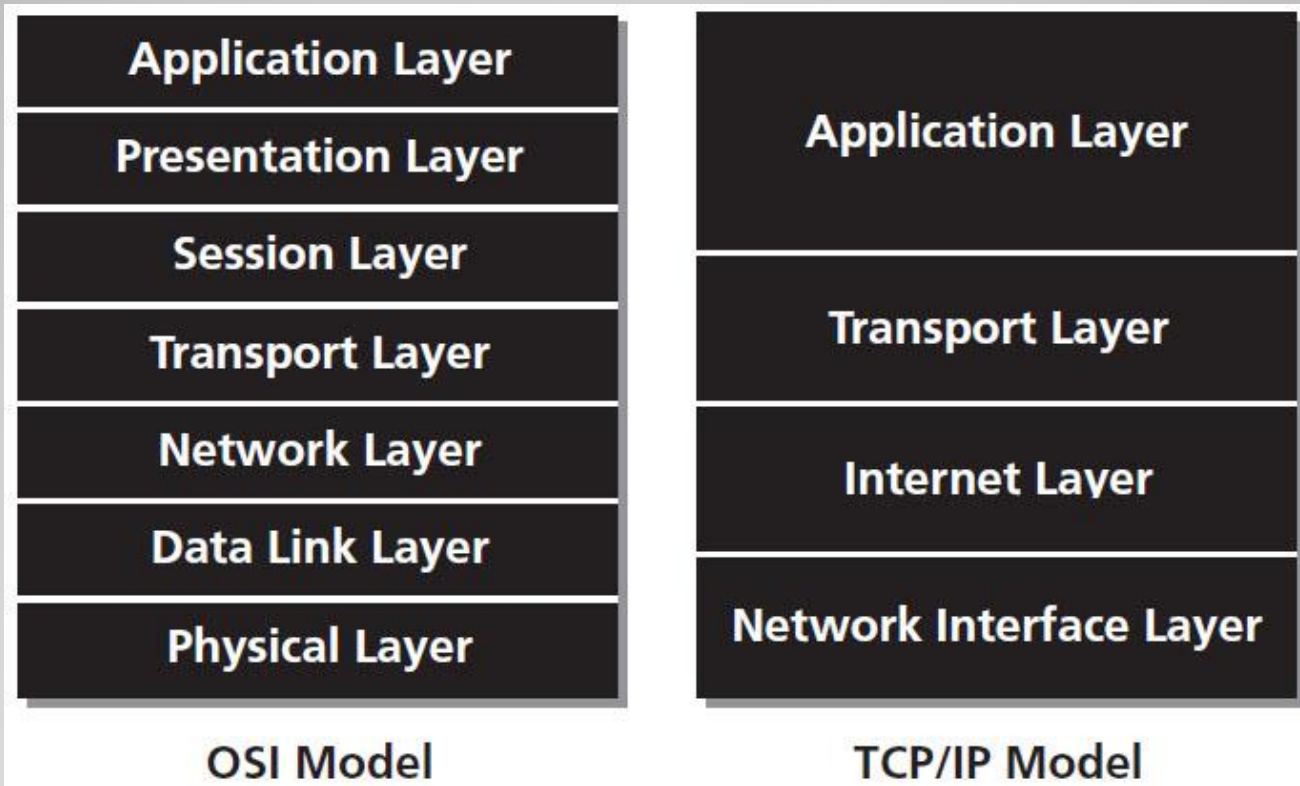
| Application Layer |
| Transport Layer |
| Internet Layer |
| Network Interface Layer |

TCP/IP Model (Continued)

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

OSI Model	TCP/IP Model
Application Layer	Application Layer
Presentation Layer	
Session Layer	
Transport Layer	Transport Layer
Network Layer	Internet Layer
Data Link Layer	Network Interface Layer
Physical Layer	

Application Layer of TCP/IP Model

Encompasses same functions as these OSI Model layers

Application	Presentation	Session

Transport Layer of TCP/IP Model

- 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

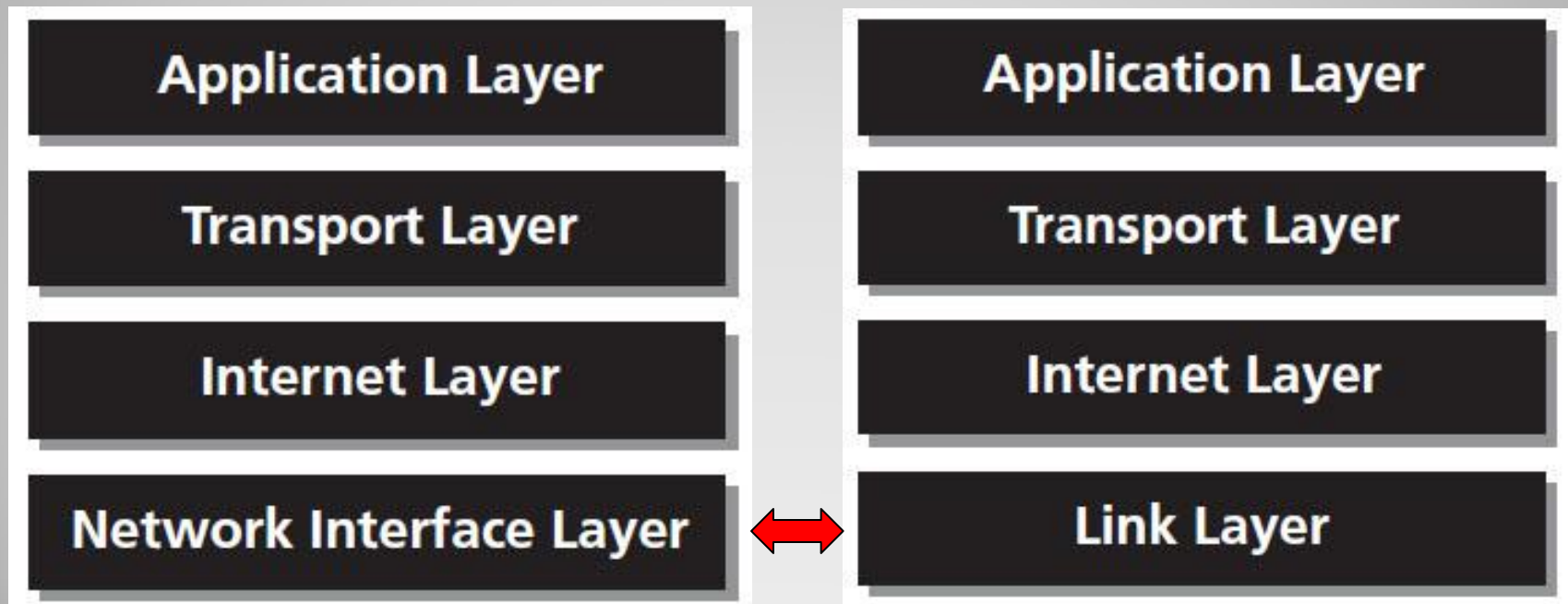# Internet Layer of TCP/IP Model

- 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

- 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

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

Application Layer		Application Layer
Transport Layer		Transport Layer
Internet Layer		Internet Layer
Network Interface Layer	↔	Link Layer

How the Layers Work Together

- 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
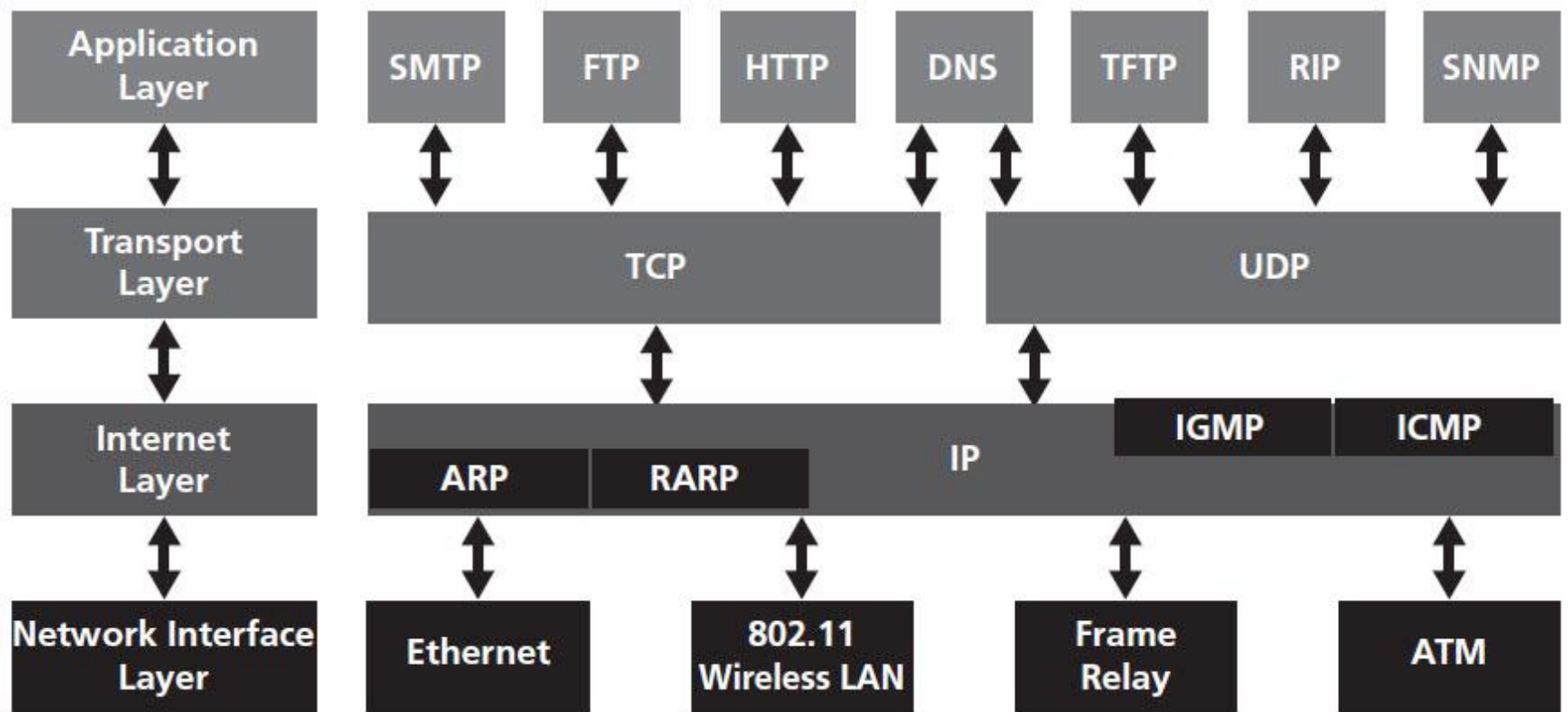
Summary

- 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)

- 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)

- 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)

- 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.