



CD4002/CN4002
Computer Systems & Networks

Topic:
Networks Protocols & Models

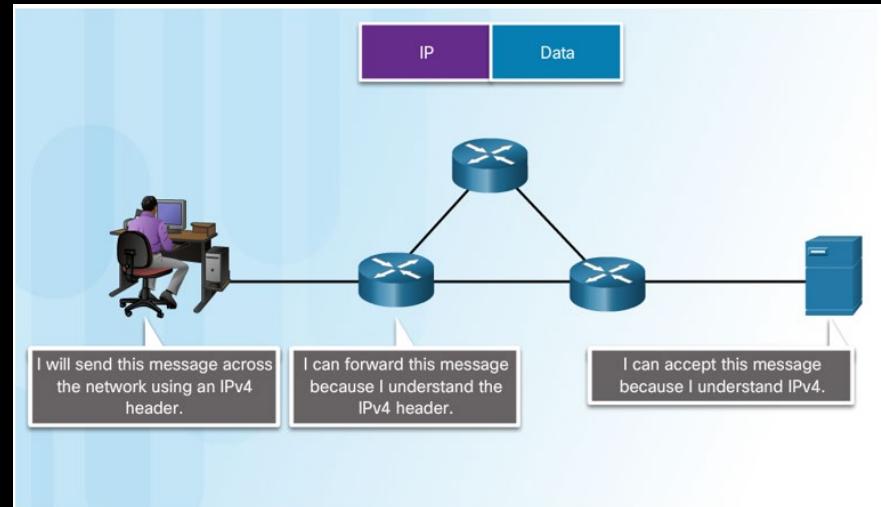
Objectives

- Explain why protocols are necessary in network communication.
- Explain how OSI and TCP/IP models are used to facilitate standardization in the communication process.
- Describe the functionalities of layers of OSI reference model.
- Explain how data encapsulation allows data to be transported across the network.



Network Protocols

- Networking protocols define a common format and set of rules for exchanging messages between devices.
- Some common networking protocols are Hypertext Transfer Protocol (HTTP), Transmission Control Protocol (TCP), and Internet Protocol.



Rules that Govern Communications

- Protocol suites are implemented by hosts and networking devices in software, hardware or both.
- The Protocols are viewed in terms of layers, with each higher-level service depending on the functionality defined by the protocols shown in the lower levels.

OSI Model

The screenshot shows the homepage of the International Organization for Standardization (ISO) website. At the top, the ISO logo and the text "International Organization for Standardization" are visible, along with a search bar and links for "Home", "Products", "Standards development", "News and media", and "About ISO". Below this, there are two main content areas: "How ISO develops standards" (with an image of three people working at a desk) and "More than 100 ISO standards for aluminum production on new CD-ROM" (with an image of a factory floor). To the right, a sidebar titled "Latest news" lists recent developments like "New ISO standard helps ensure that building and construction 'plastics people' worldwide talk the same language" and "ISO and IEEE strengthen partnership for development of international standards". Further down, there are sections for "Products", "Standards development", "ISO Magazines", and "Subscriptions".

- The *International Organization for Standardization (ISO)* released the Open Systems Interconnection (OSI) reference model in 1984.
- www.iso.org for more information

OSI Model

- *Breaks network communication* into smaller, *more manageable parts*.
 - Makes learning it easier to understand.
 - Prevents changes in one layer from affecting other layers.
- *Standardizes network components* to allow *multiple vendor* development and support.
- Allows *different types* of network hardware and software *to communicate* with each other.



OSI Model

Layers			
7	Application	All	Away
6	Presentation	People	Pizza
5	Session	Seem	Sausage
4	Transport	To	Throw
3	Network	Need	Not
2	Data Link	Data	Do
1	Physical	Processing	Please

Usually
referenced by
layer number

These two layers
are not commonly
referred to in most
instances.

OSI Model

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Primary concern: Communications between applications

Primary concern: Moving raw data cross the network

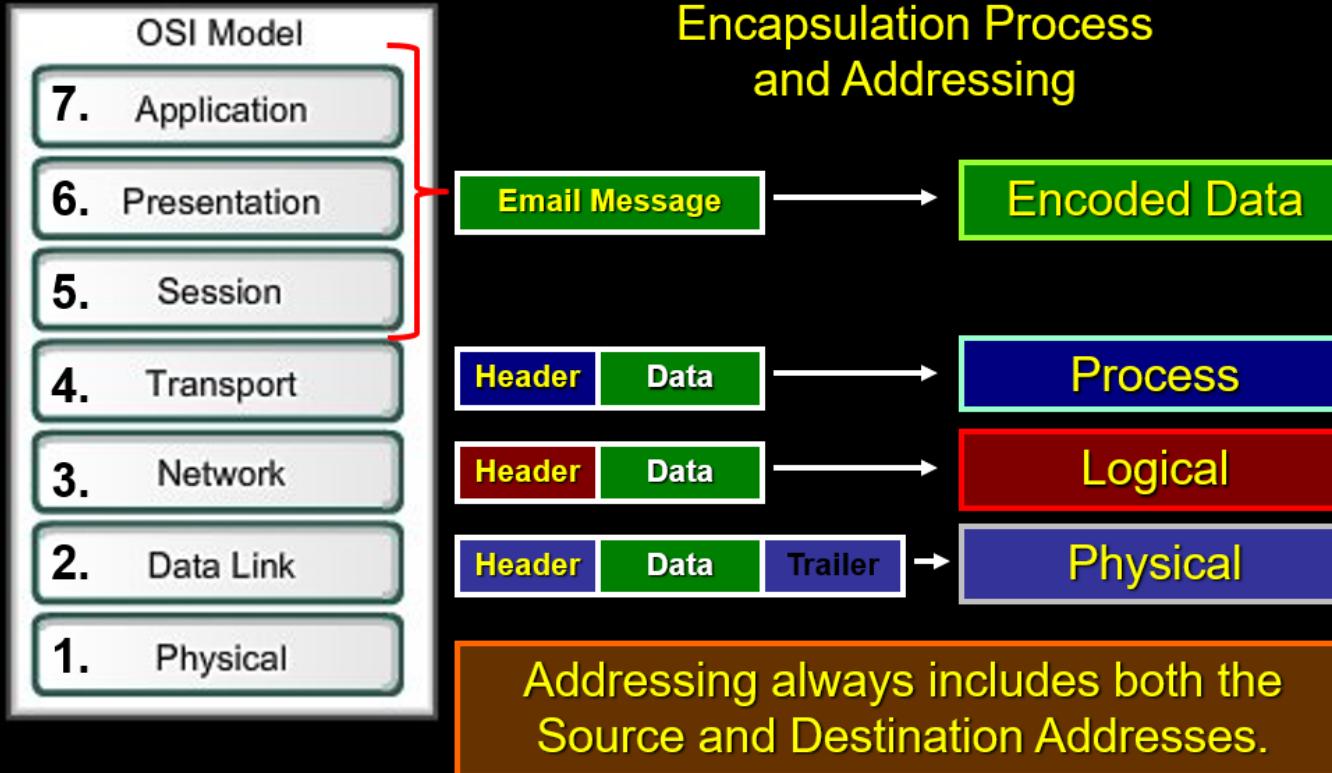
Comparing the OSI and TCP/IP Models

OSI Model		Layer Function	Protocol Data Unit	Device
7	Application	Provides the interface between the user application and the network. A web browser and an email client are examples of user applications.	Data	
6	Presentation	Controls the <i>formatting and syntax</i> of user data for the application layer. This ensures that data from the <i>sending</i> application can be understood by the <i>receiving</i> application.		
5	Session	Responsible for establishing, maintaining, and ultimately terminating <i>sessions</i> between devices. If a session is <i>broken</i> , this layer can attempt to recover the session.		
4	Transport	Responsible for the <i>reliable</i> transfer of data, by ensuring that data arrives at its destination error-free and in order.		Segment
3	Network	Controls <i>internetwork</i> communication, and has two key responsibilities: Logical addressing – provides a unique address that identifies both the <i>host</i> , and the <i>network</i> that host exists on. Routing – determines the <i>best path</i> to a particular destination network, and then <i>routes</i> data accordingly.		Packet Router
2	Data Link	Packages the higher-layer data into frames , so that the data can be put onto the physical wire. This packaging process is referred to as framing or encapsulation .		Frame Switch
1	Physical	Controls the signaling and transferring of raw bits onto the physical medium.		Bit Hub

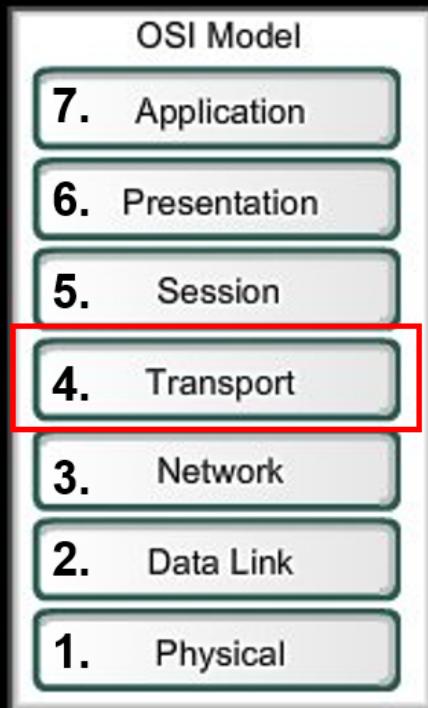
OSI Model

OSI Model Layer	Addressing
Application	Encoded Application Data
Presentation	
Session	(Usually referred to as the <u>Upper Layers</u>)
Transport	Source and Destination: Process Address
Network	Source and Destination: Logical Network Address
Data Link	Source and Destination: Device Physical Address
Physical	Timing and Synchronization Bits

Getting Data to the End Device



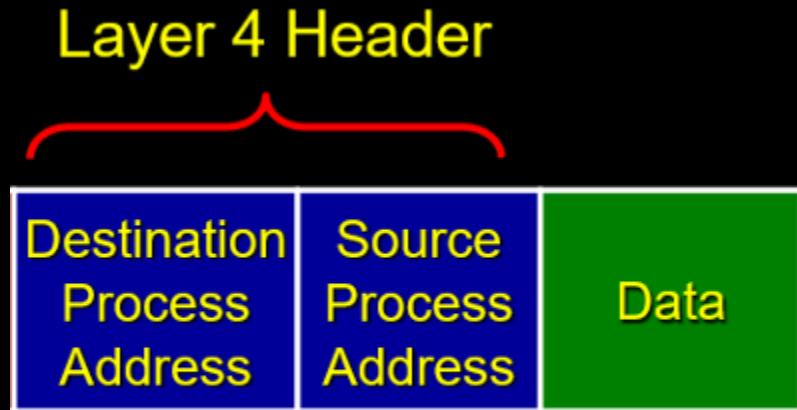
Getting Data To The Right Application



Layer 4 Addressing

- Identifies the *specific process* or service running on the destination host *that will act on the data*.
 - Multiple, simultaneous applications.*
- Header** **Data** → **Process**
- Under TCP/IP, a *port number* to identify the application.
 - Port 80: HTTP (Web Browser)
 - Port 25: SMTP (Email)
 - Port 23: Telnet

Getting Data To The Right Application



Getting Data Through The Network



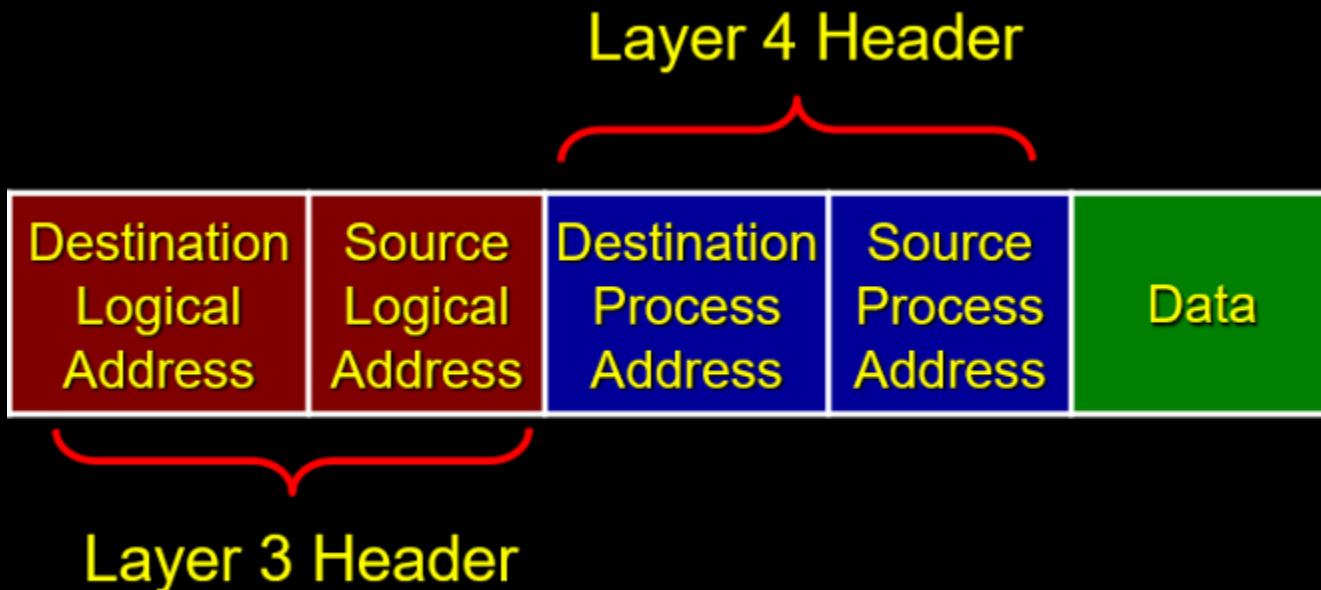
Layer 3 Addressing

- Move data from one local network to another local network.
- *Addresses must identify both the network and the host on that network.*
- Used by routers to determine the best path to the destination host.



Source and
Destination
Logical Network
Address
(IP, IPX, etc.)

Getting Data Through The Network



Getting Data to the End Device

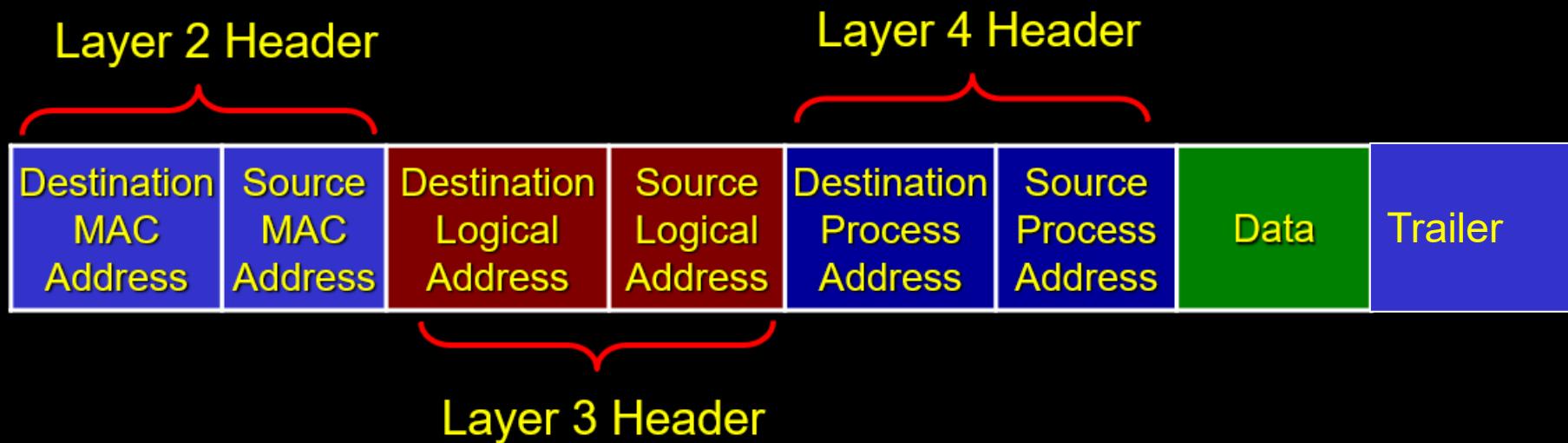


Layer 2 Addressing

- Delivery on a *single local network*.
- Unique on the network and represents the device.
- Codes placed on the **NIC** by the manufacturer.
- Referred to as the *physical address* or the **MAC address**.



Getting Data To The End Device



Comparing the OSI and TCP/IP Models

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4	Transport	Responsible for the <i>reliable</i> transfer of data, by ensuring that data arrives at its destination error-free and in order.	Segment		Transport
3	Network	Controls <i>internetwork</i> communication, and has two key responsibilities: Logical addressing – provides a unique address that identifies both the <i>host</i> , and the <i>network</i> that host exists on. Routing – determines the <i>best path</i> to a particular destination network, and then <i>routes</i> data accordingly.	Packet	Router	Internet
2	Data Link	Packages the higher-layer data into frames , so that the data can be put onto the physical wire. This packaging process is referred to as framing or encapsulation .	Frame	Switch	Network Access
1	Physical	Controls the signaling and transferring of raw bits onto the physical medium.	Bit	Hub	

Problem 1

Match the following to one or more layers of the OSI model:

- a. Route determination
(network)
- b. Flow control
(data link and transport)
- c. Interface to transmission media
(physical)
- d. Provides access for the end user
(application)

Problem 2

Match the following to one or more layers of the OSI model:

- a. Reliable process to process message delivery
(transport)
- b. Route selection
(network)
- c. Defines frames
(data link)
- d. Provides user services such as e-mail and file transfer
(application)
- e. Transmission of bit stream across physical medium
(physical)

Problem 3

Match the following to one or more layers of the OSI model:

- a. Format and code conversion services
(presentation)
- b. Establishes, manages and terminates sessions
(session)
- c. Ensures reliable transmission of data
(data link and transport)
- d. Log-in and log-out procedures
(session)
- e. Provides independence from differences in data representation
(presentation)

Problem 4

Match the following to one or more layers of the OSI model:

- a. Communicates directly with user's application program
(application)
- b. Error correction and retransmission
(data link and transport)
- c. Mechanical, electrical and functional interface
(physical)
- d. Responsibility for carrying frames between adjacent nodes
(data link)