Cisco Networking Academy
Mind Wide Open

Chapter 3: Network Protocols and Communications

Introduction to Networks v5.1

Chapter Outline

Section 3.1: Rules of Communication

Upon completion of this section, you should be able to:

- Describe the types of rules that are necessary to successfully communicate.

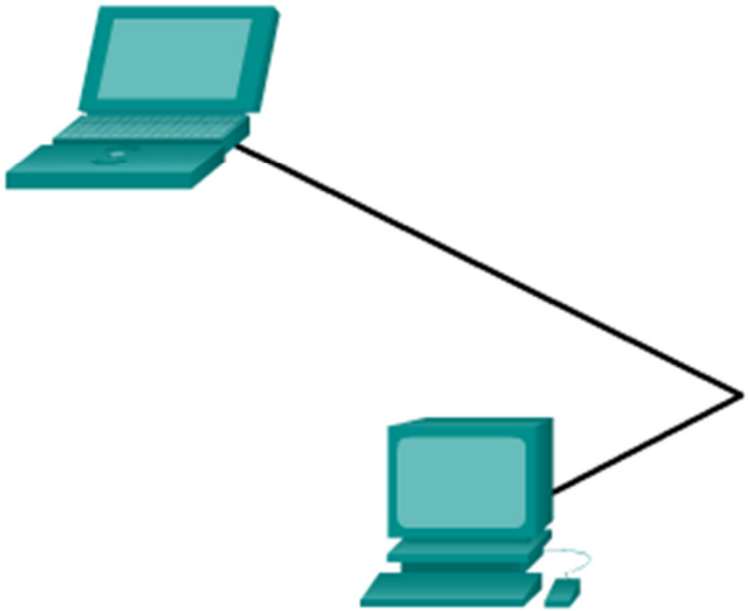
Topic 3.1.1:
The Rules

Communication Fundamentals

Human Communication

Communication Fundamentals (Cont.)

Computer Communication



Rule Establishment

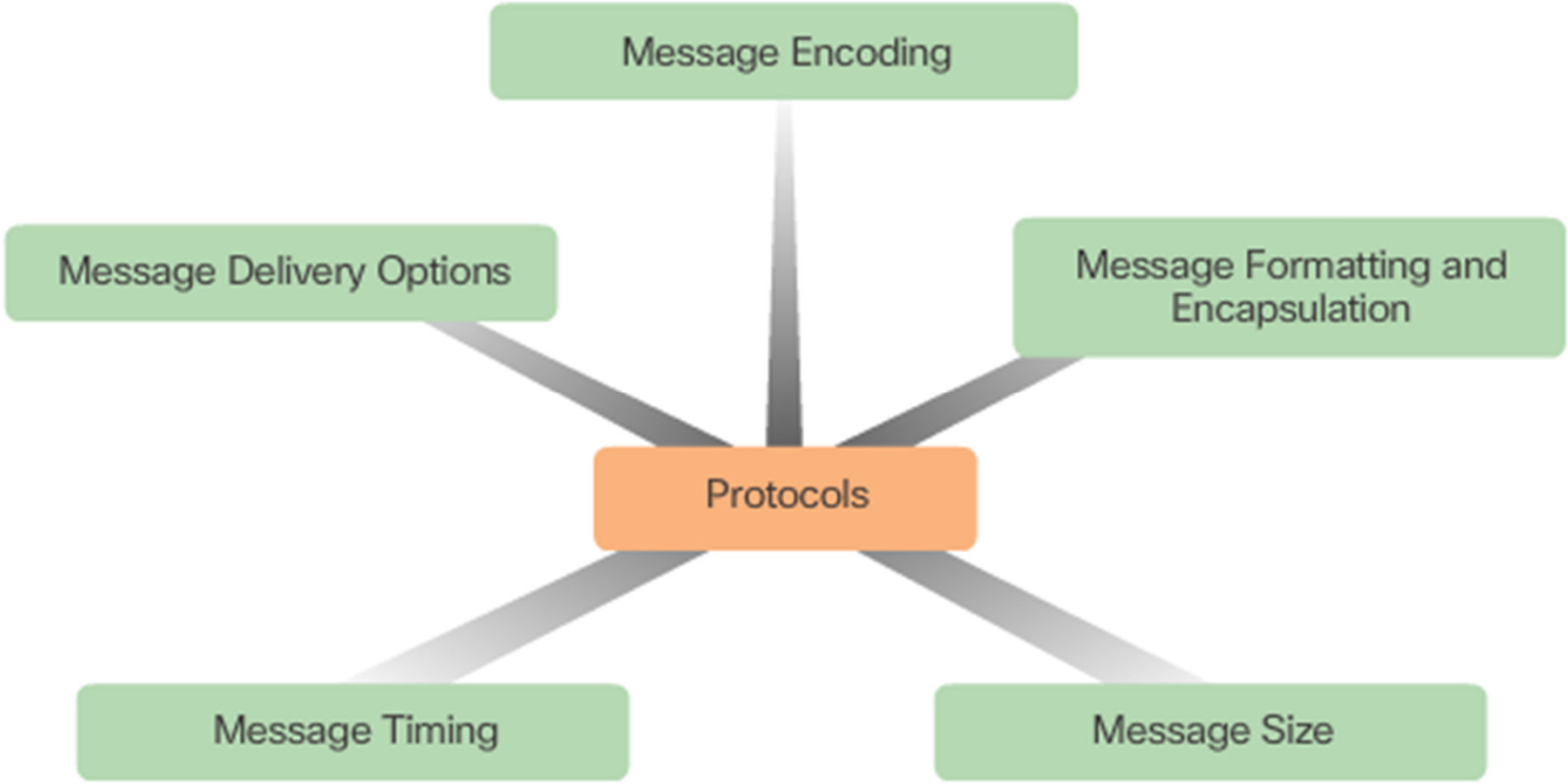
humans communication between govern rules. It is verydifficult tounderstand messages that are not correctly formatted and donot follow the established rules and protocols. A estrutura da gramatica, da lingua, da pontuacao e do sentance faz a configuracao humana compreensivel por muitos individuos diferentes.

Translate

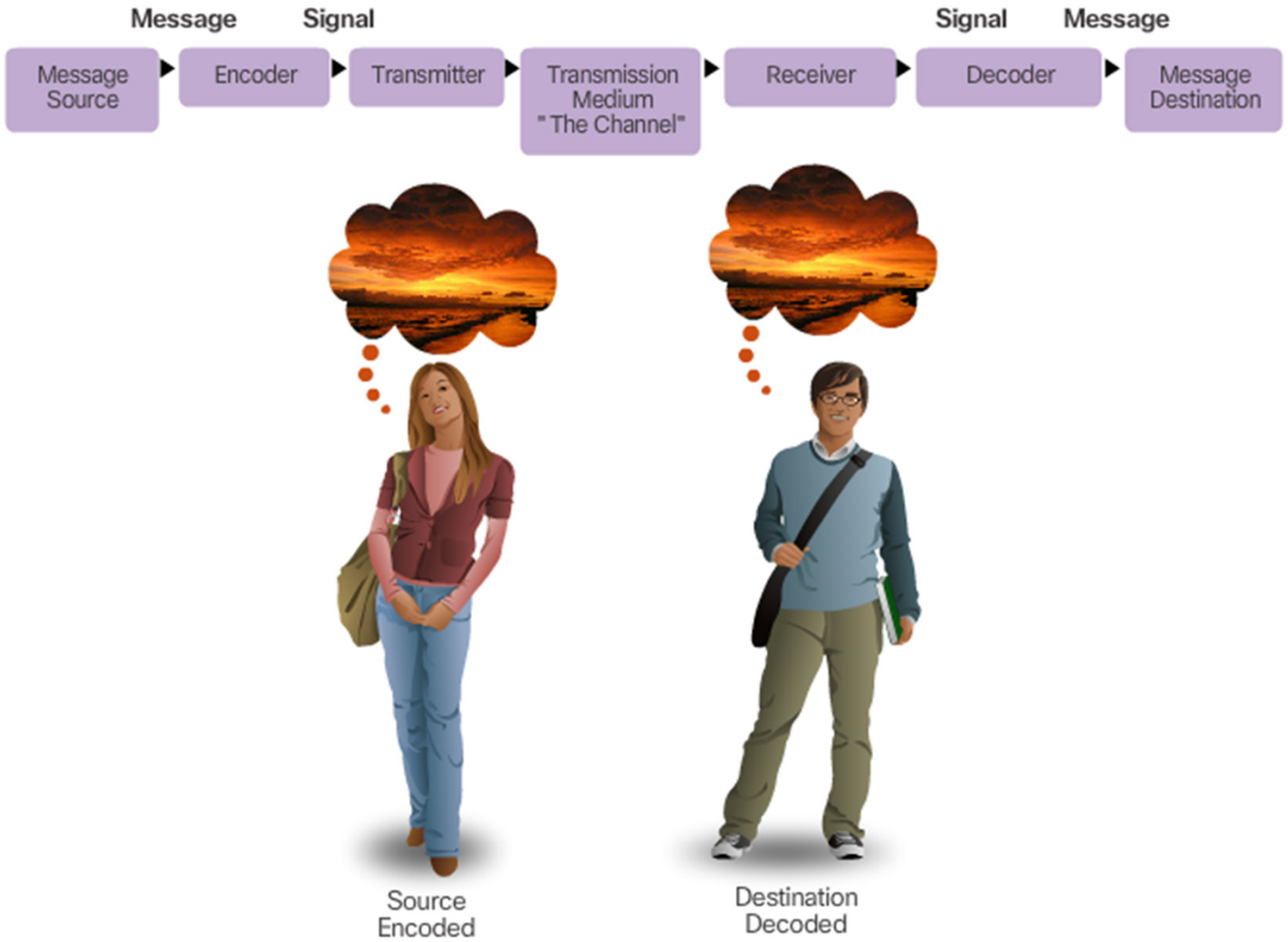
Rules govern communication between humans. It is very difficult to understand messages that are not correctly formatted and do not follow the established rules and protocols. The structure of the grammar, the language, the punctuation and the sentence make the configuration humanly understandable for many different individuals.

Untranslate

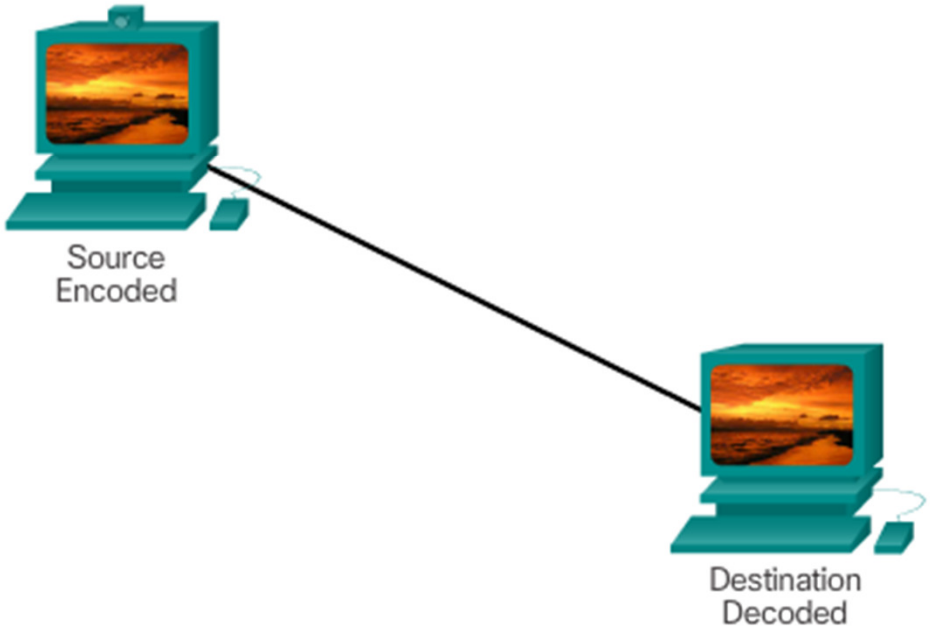
Rule Establishment (cont.)



Message Encoding



Message Encoding (cont.)



Message Formatting and Encapsulation

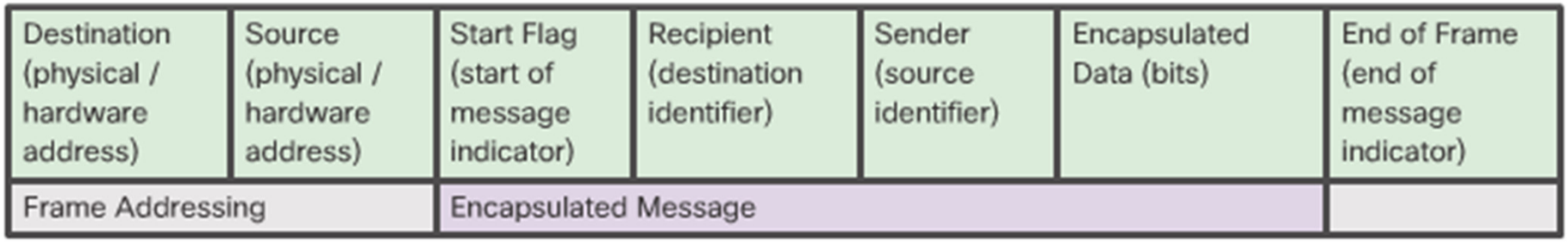
Recipient (destination) Location address	Sender (source) Location address	Salutation (start of message indicator)	Recipient (destination) identifier	Content of Letter (encapsulated data)	Sender (source) identifier	End of Frame (End of message indicator)
Envelope Addressing		Encapsulated Letter				
1400 Main Street Canton, Ohio 44203	4085 SE Pine Street Ocala, Florida 34471	Dear	Jane	I just returned from my trip. I thought you might like to see my pictures.	John	

Message Formatting and Encapsulation

Example: Personal letter contains the following elements:

- An identifier of the recipient
- A salutation or greeting
- The message content
- A closing phrase
- An identifier of the sender

Message Formatting and Encapsulation (cont.)



Message Size

Human Communication

Message Size

Computer Communication

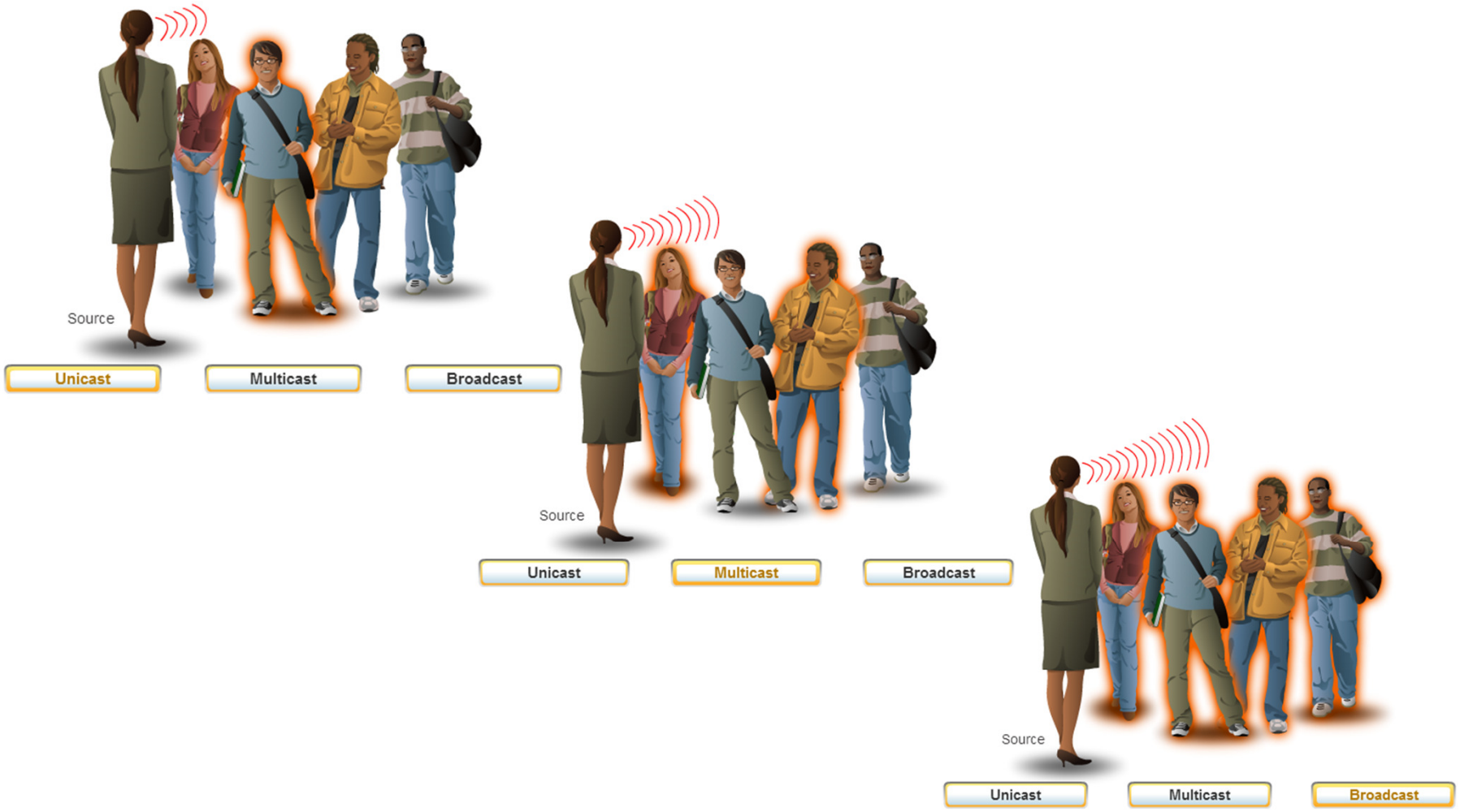
- The source host breaks a long message into individual pieces or frames that meet both the minimum and maximum size requirements.
- Each frame will also have its own addressing information.
- At the receiving host, the pieces are reconstructed to be processed and interpreted.

Message Timing

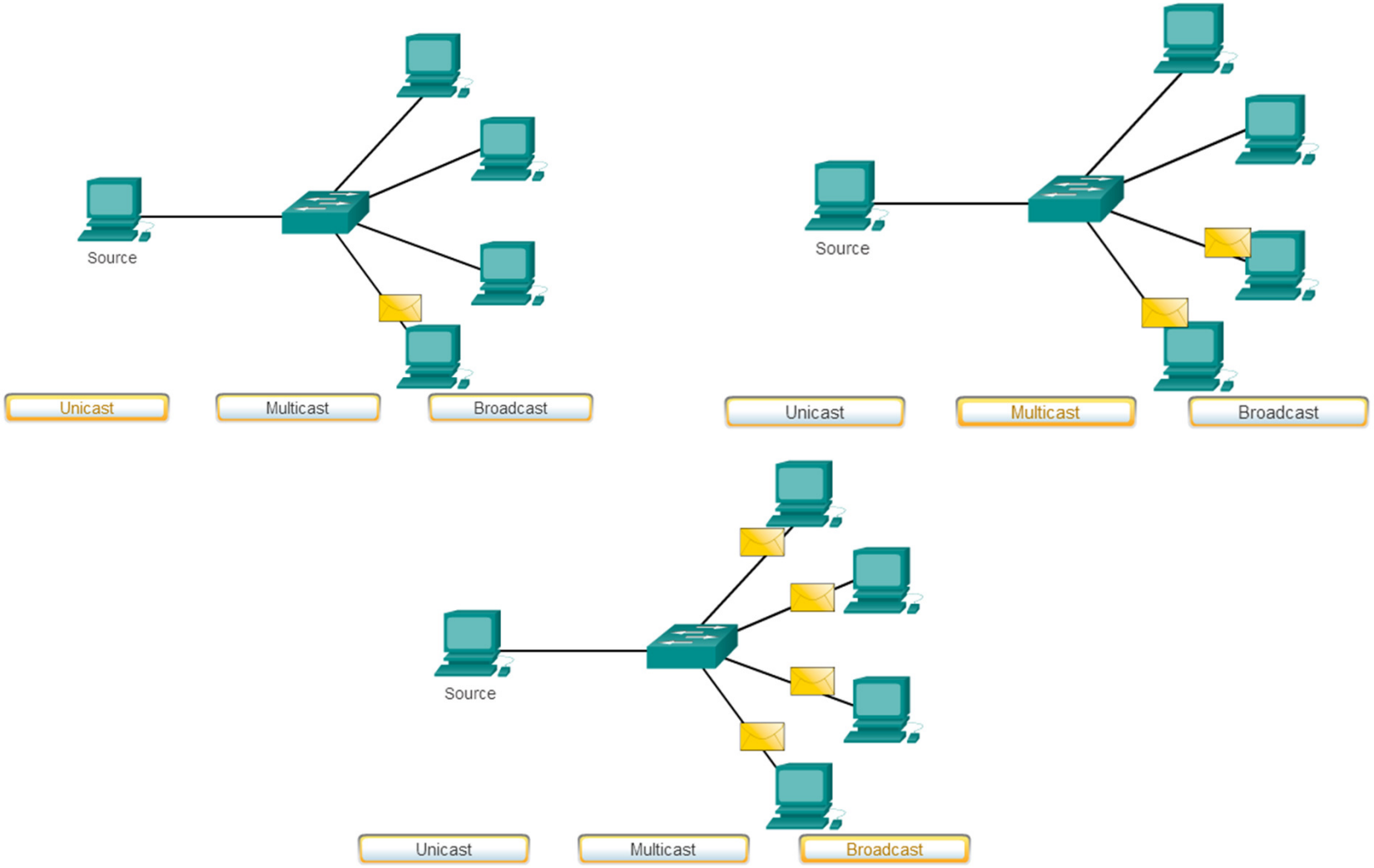
Rules of engagement:

- Access Method
- Flow Control
- Response Timeout

Message Delivery Options



Message Delivery Options (cont.)



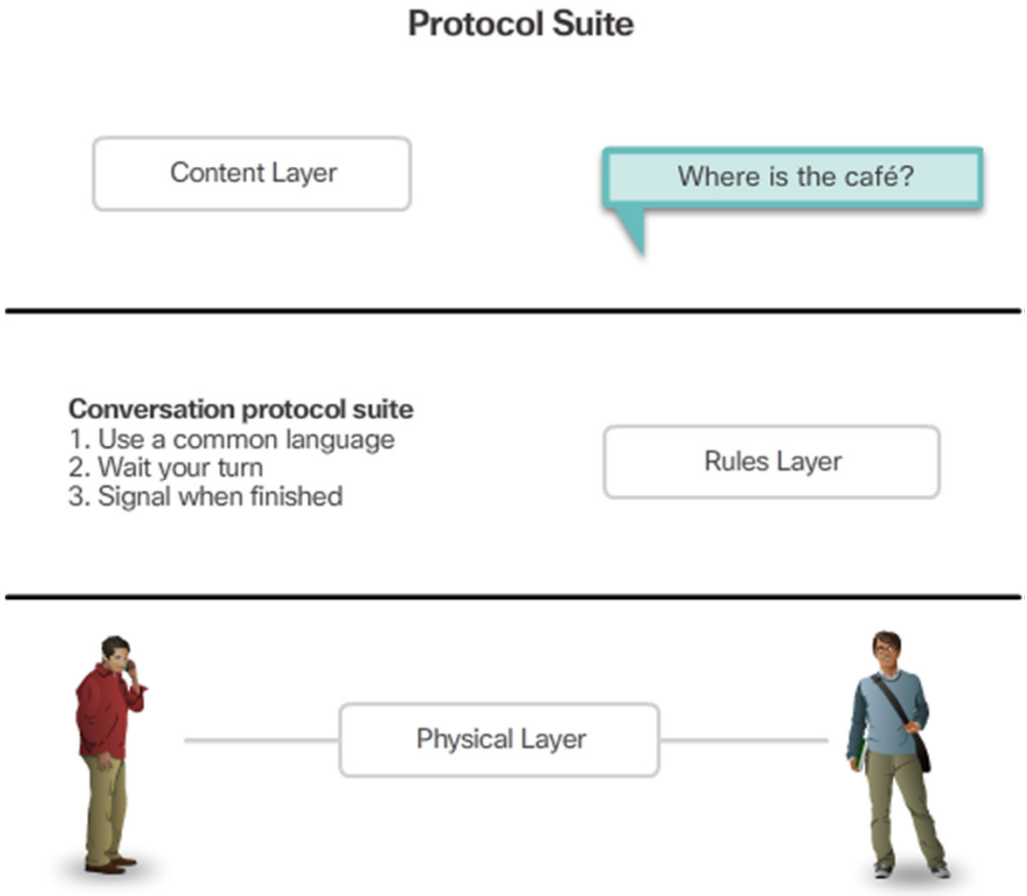
Section 3.2: Network Protocols and Standards

Upon completion of this section, you should be able to:

- Explain why protocols are necessary in communication.
- Explain the purpose of adhering to a protocol suite.
- Explain the role of standards organizations in establishing protocols for network interoperability.
- Explain how the TCP/IP model and the OSI model are used to facilitate standardization in the communication process.

Topic 3.2.1: Protocols

Rules that Govern Communications



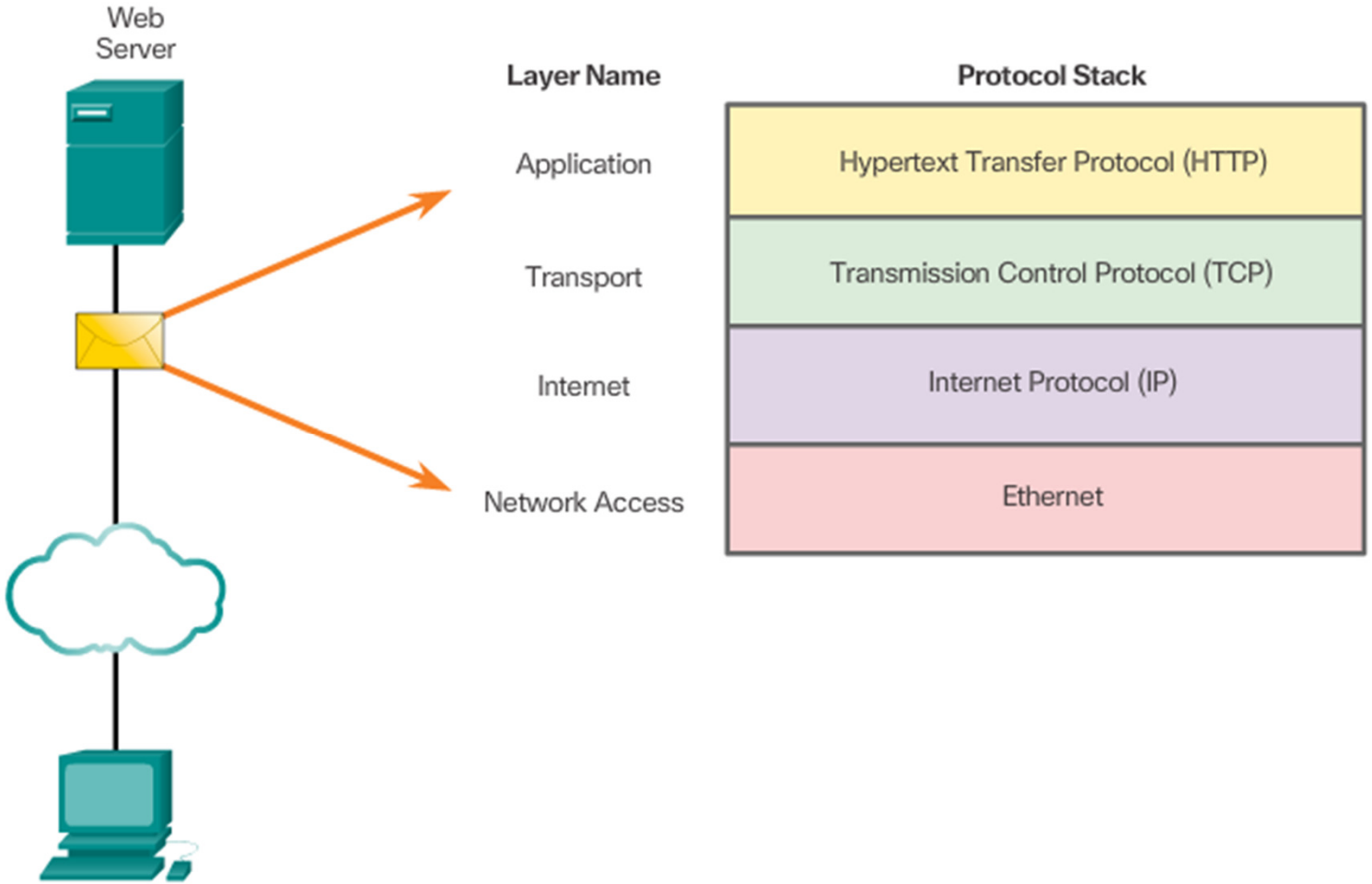
Protocol suites are sets of rules that work together to help solve a problem.

Network Protocols

- The role of protocols
- How the message is formatted or structured
- The process by which networking devices share information about pathways with other networks
- How and when error and system messages are passed between devices
- The setup and termination of data transfer sessions

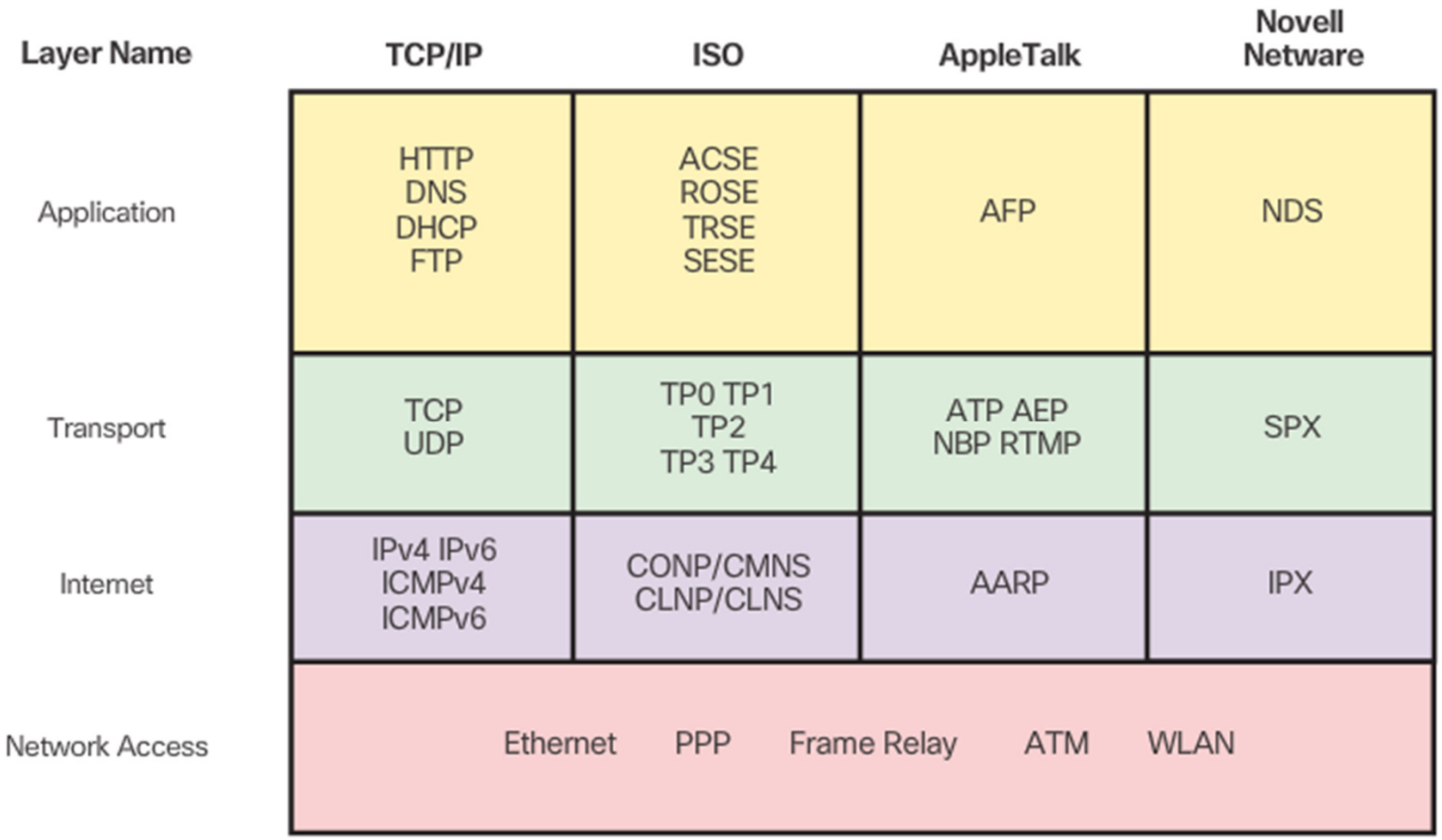
Protocol Interaction

Interaction of protocols in communication between a web server and web client.



Topic 3.2.2:
Protocol Suites

Protocol Suites and Industry Standards



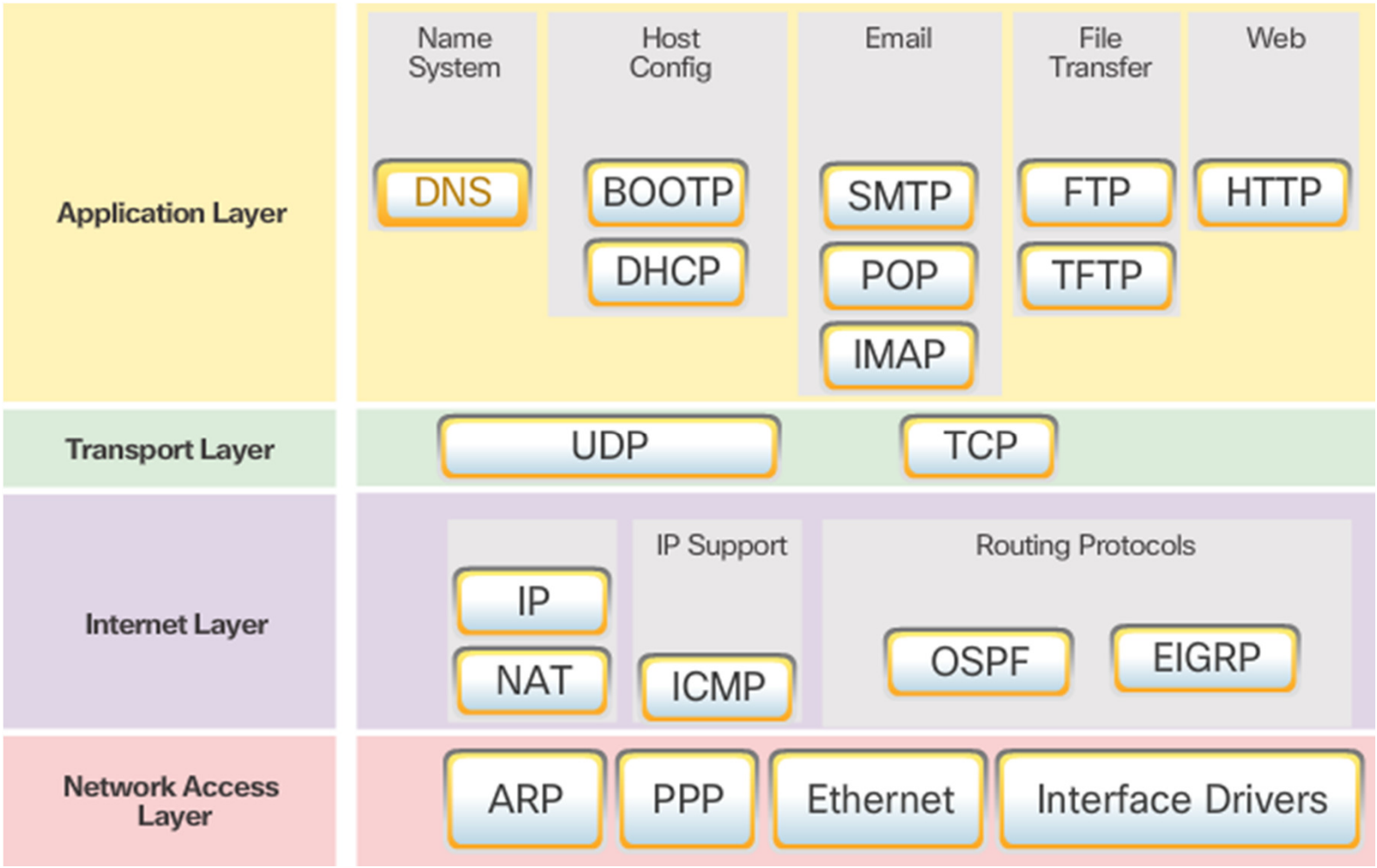
Development of TCP/IP

2011

The first World IPv6 Day (June 8, 2011), many websites and Internet service providers around the world, including Google, Facebook, and Yahoo!, participated with more than 1,000 other companies for a worldwide trial of IPv6.

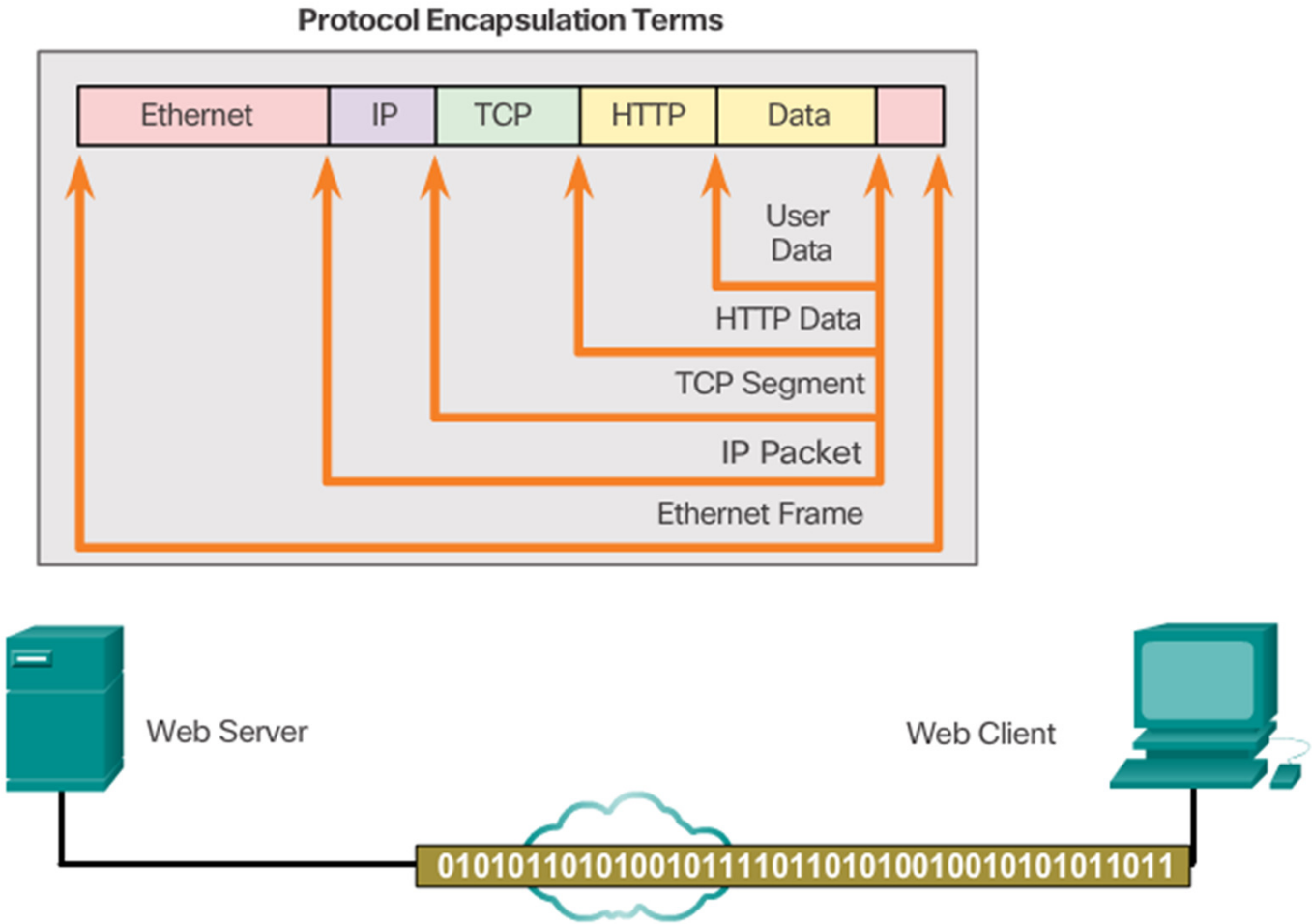
2015
2005
1995
1985
1975
1965

TCP/IP Protocol Suite



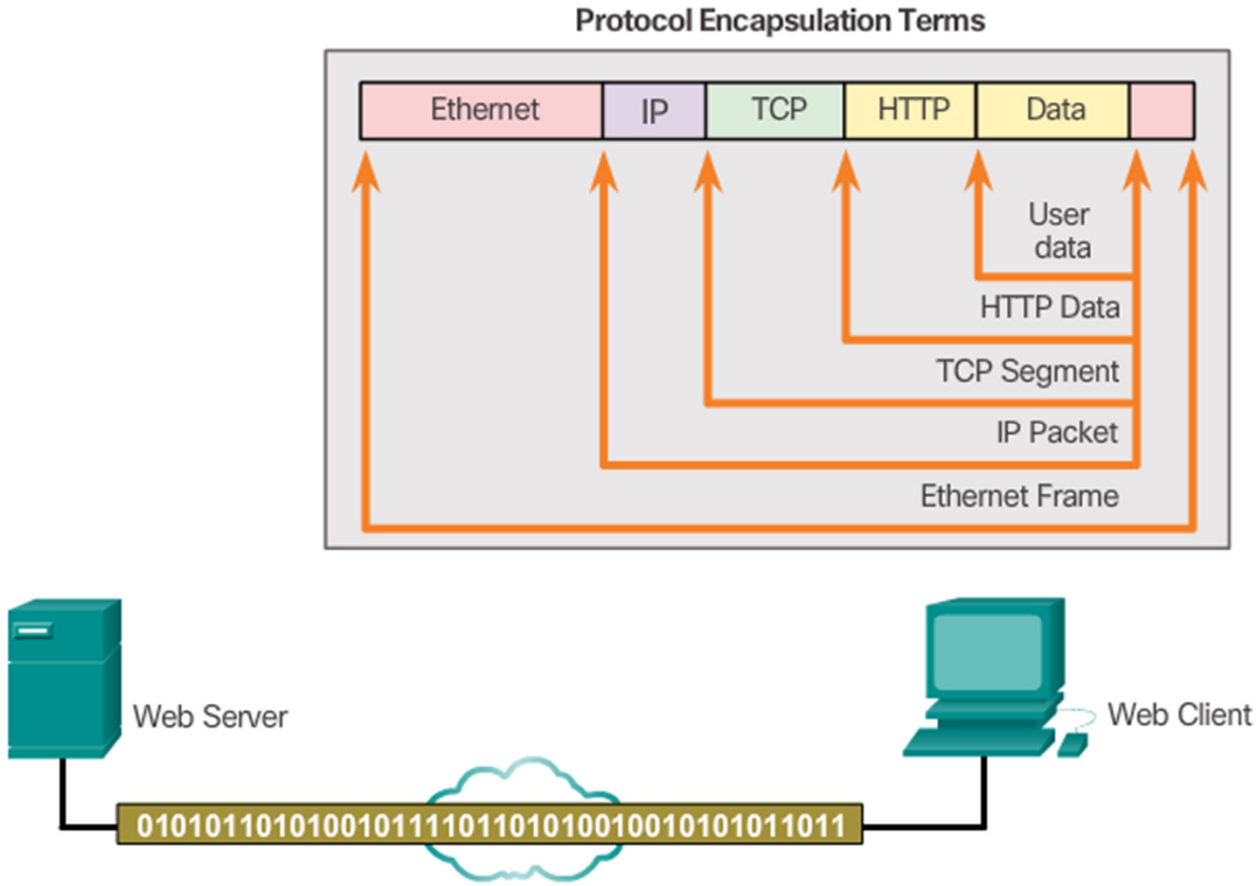
TCP/IP Communication Process

Protocol Operation - Sending a Message



TCP/IP Communication Process

Protocol Operation – Receiving a Message

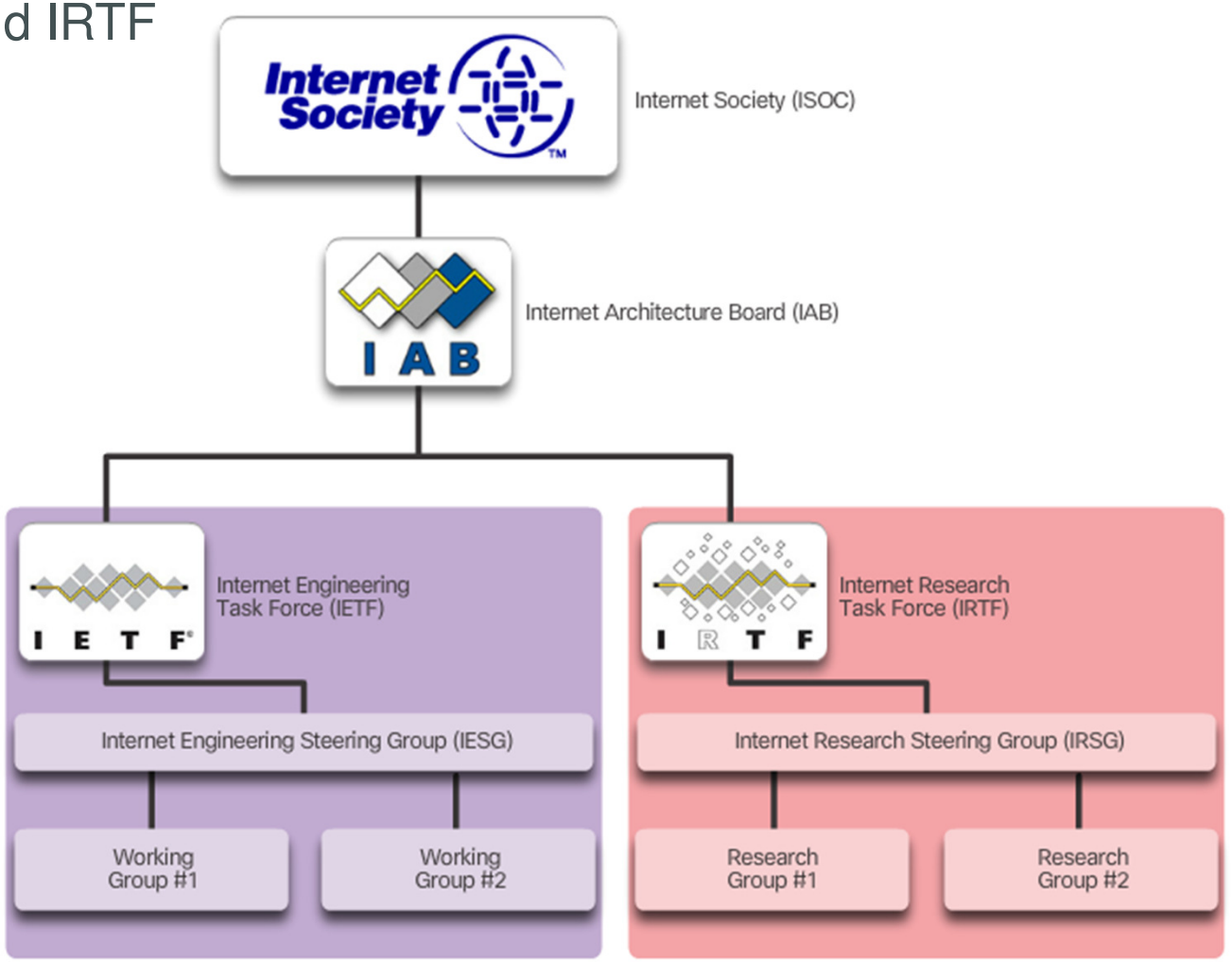


Topic 3.2.3:
Standard Organizations

Open Standards

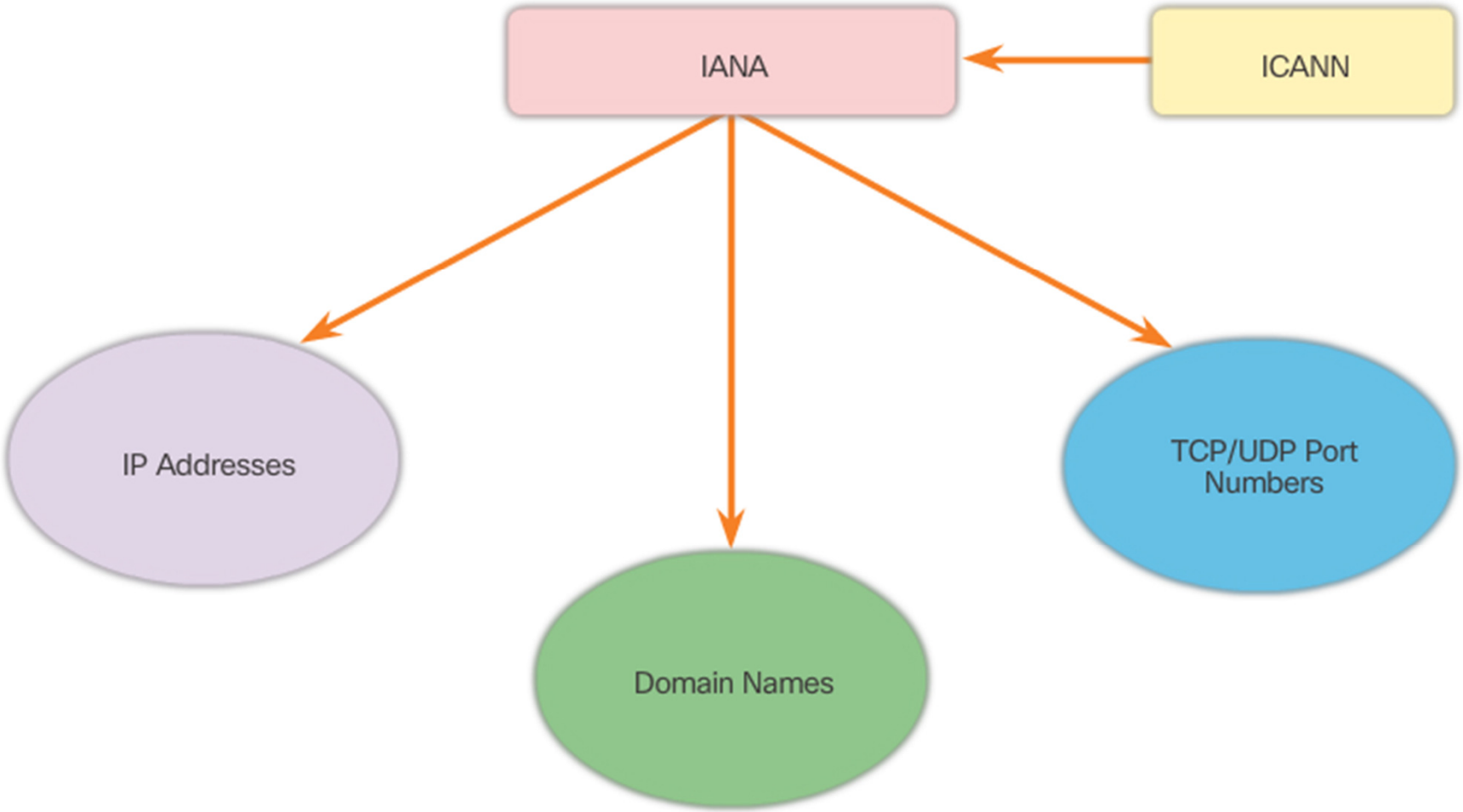
Internet Standards

ISOC, IAM, IETF, and IRTF



Internet Standards (cont.)

IANA and ICANN



Electronics and Communications Standard Organizations

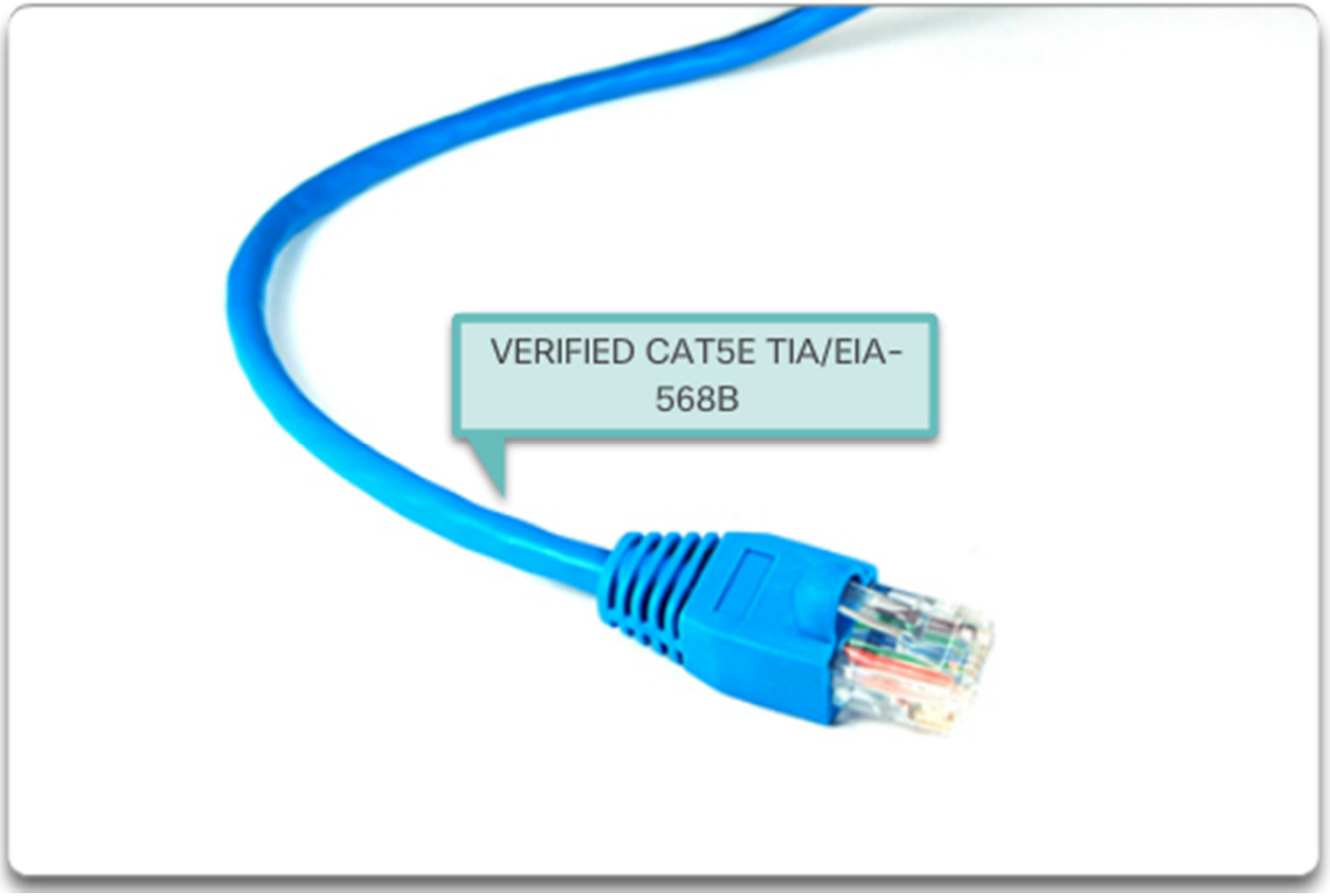
Institute of Electrical and Electronics Engineers (IEEE)

IEEE 802 Working Groups and Study Groups

- 802.1 Higher Layer LAN Protocols Working Group
- 802.3 Ethernet Working Group
- 802.11 Wireless LAN Working Group
- 802.15 Wireless Personal Area Network (WPAN) Working Group
- 802.16 Broadband Wireless Access Working Group
- 802.18 Radio Regulatory TAG
- 802.19 Wireless Coexistence Working Group
- 802.21 Media Independent Handover Services Working Group
- 802.22 Wireless Regional Area Networks
- 802.24 Smart Grid TAG

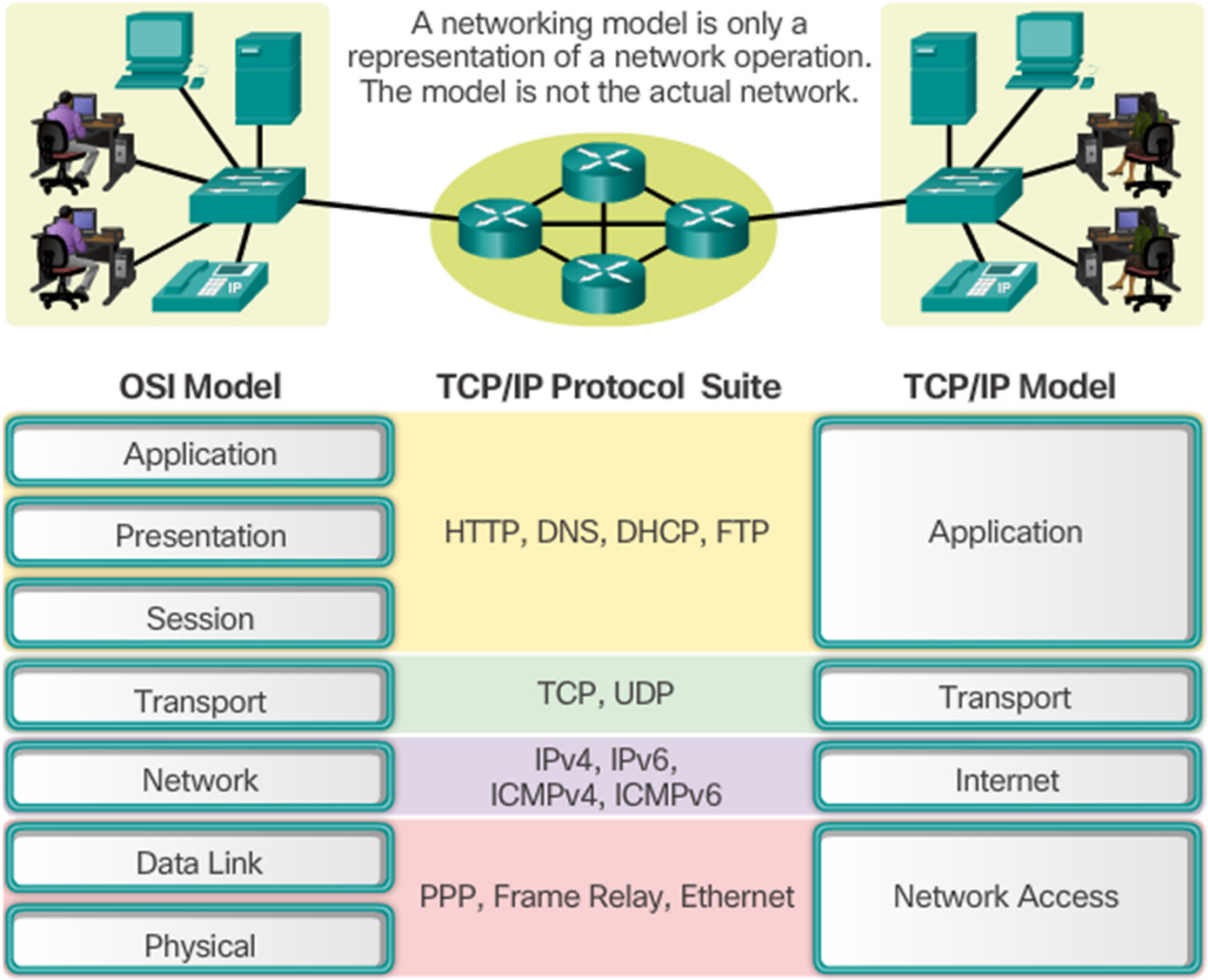
Electronics and Communications Standard Organizations (cont.)

EIA/TIA Standards



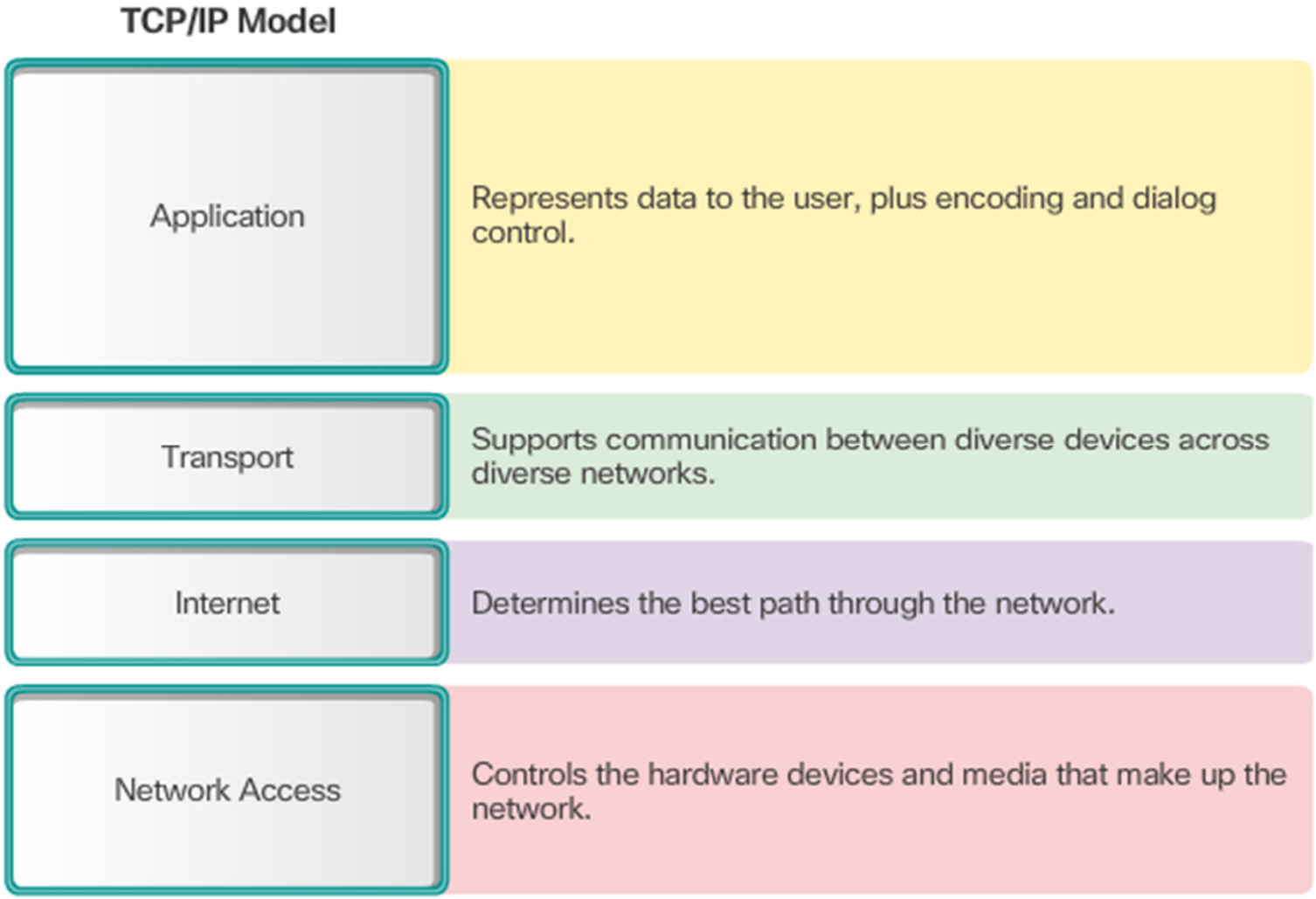
Topic 3.2.4:
Reference Models

The Benefits of Using a Layered Model

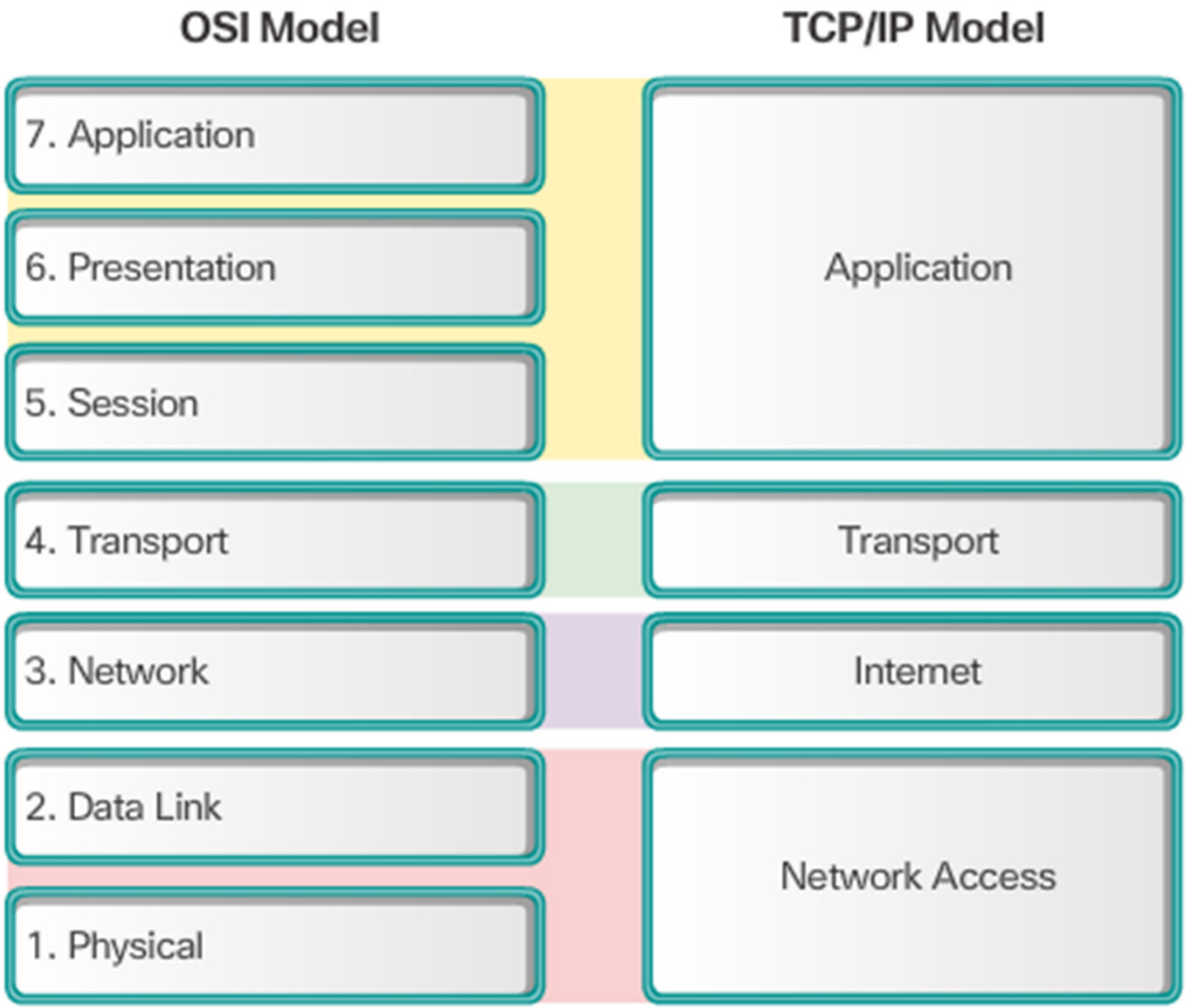


The OSI Reference Model

The TCP/IP Protocol Model



OSI Model and TCP/IP Model Comparison



Section 3.3: Data Transfer in the Network

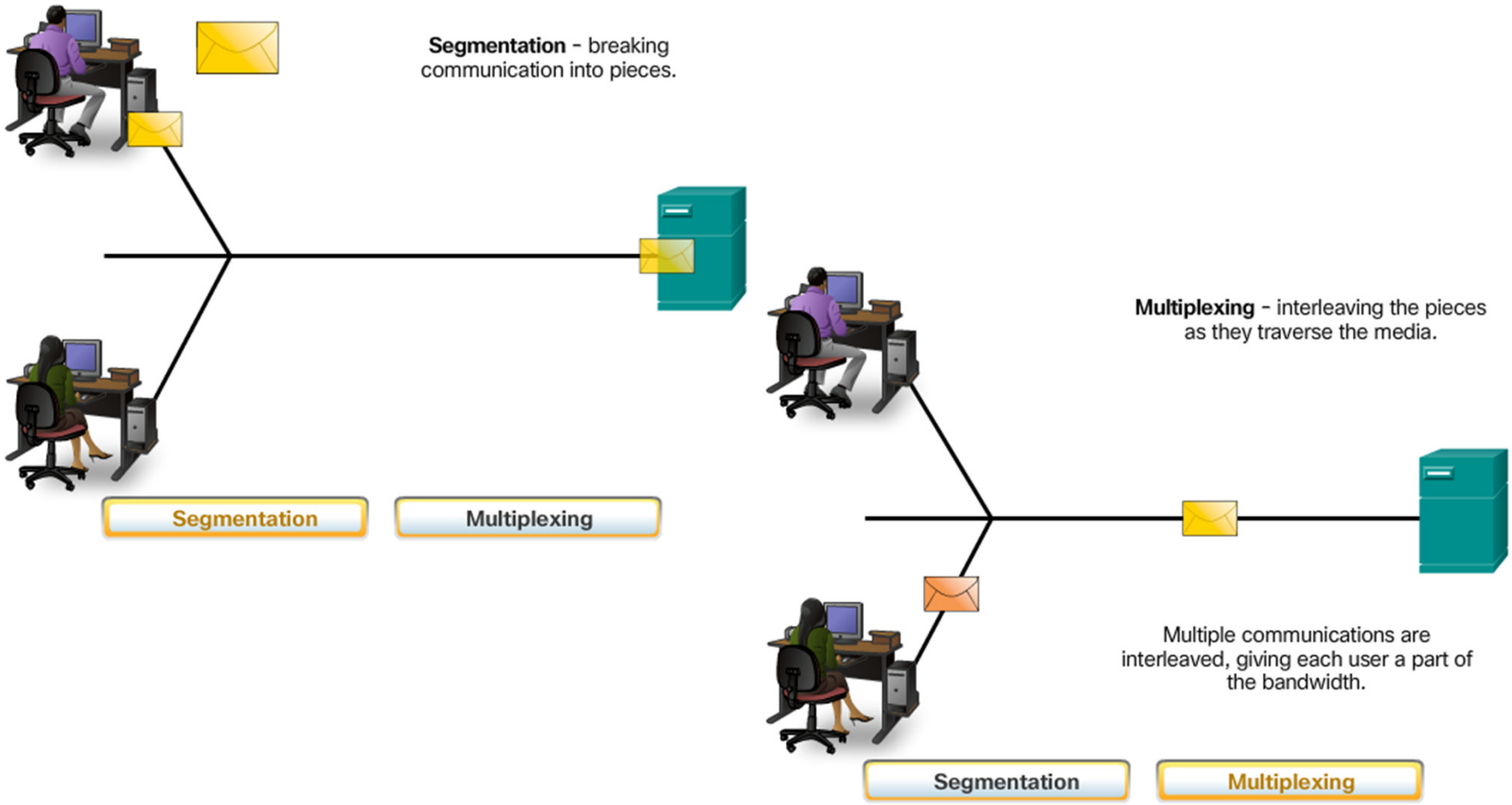
Upon completion of this section, you should be able to:

- Explain how data encapsulation allows data to be transported across the network.
- Explain how local hosts access local resources on a network.

Topic 3.3.1:
Data Encapsulation

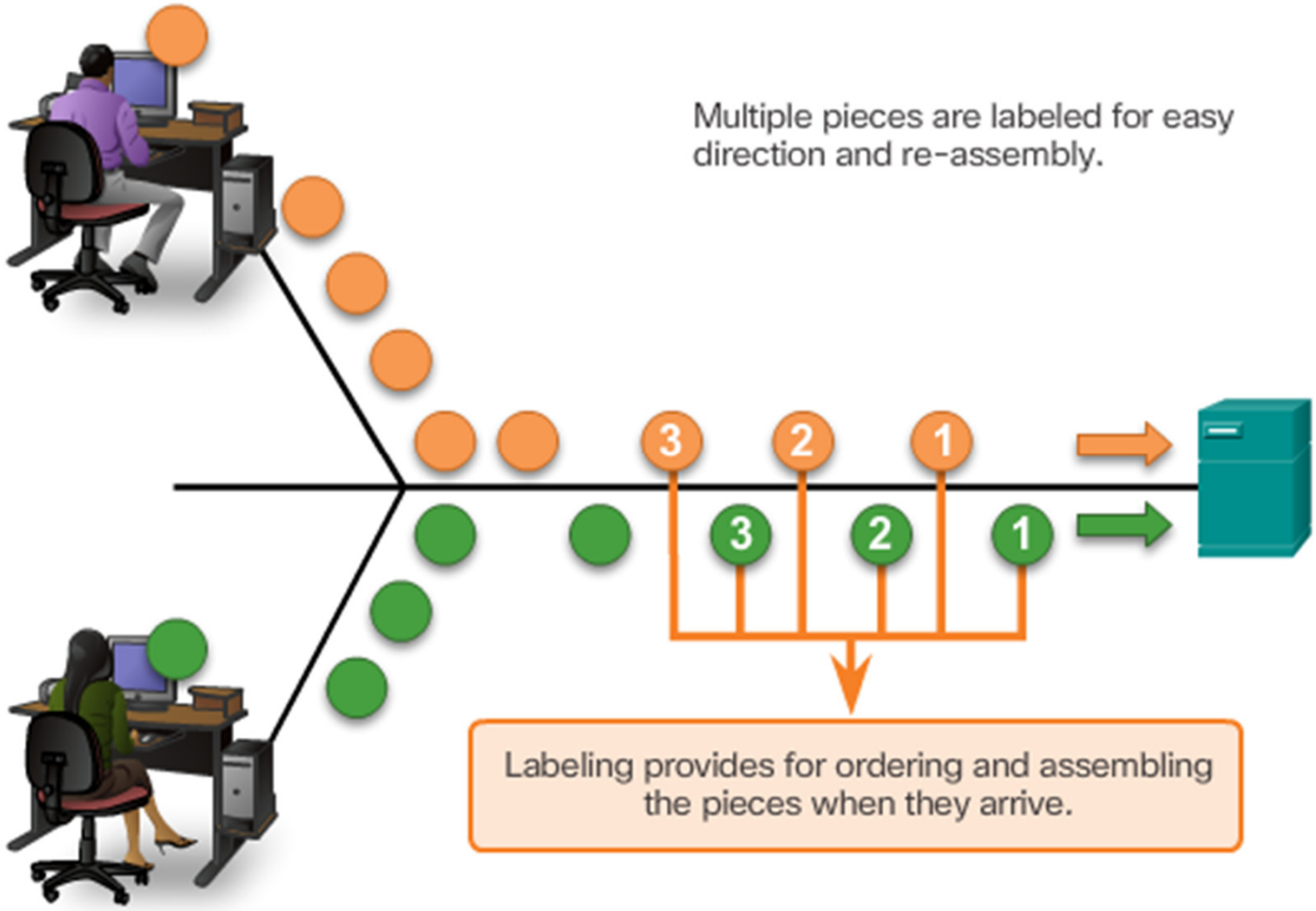
Message Segmentation

Communicating the Message



Message Segmentation (cont.)

Communicating the Message



Communicating the Message

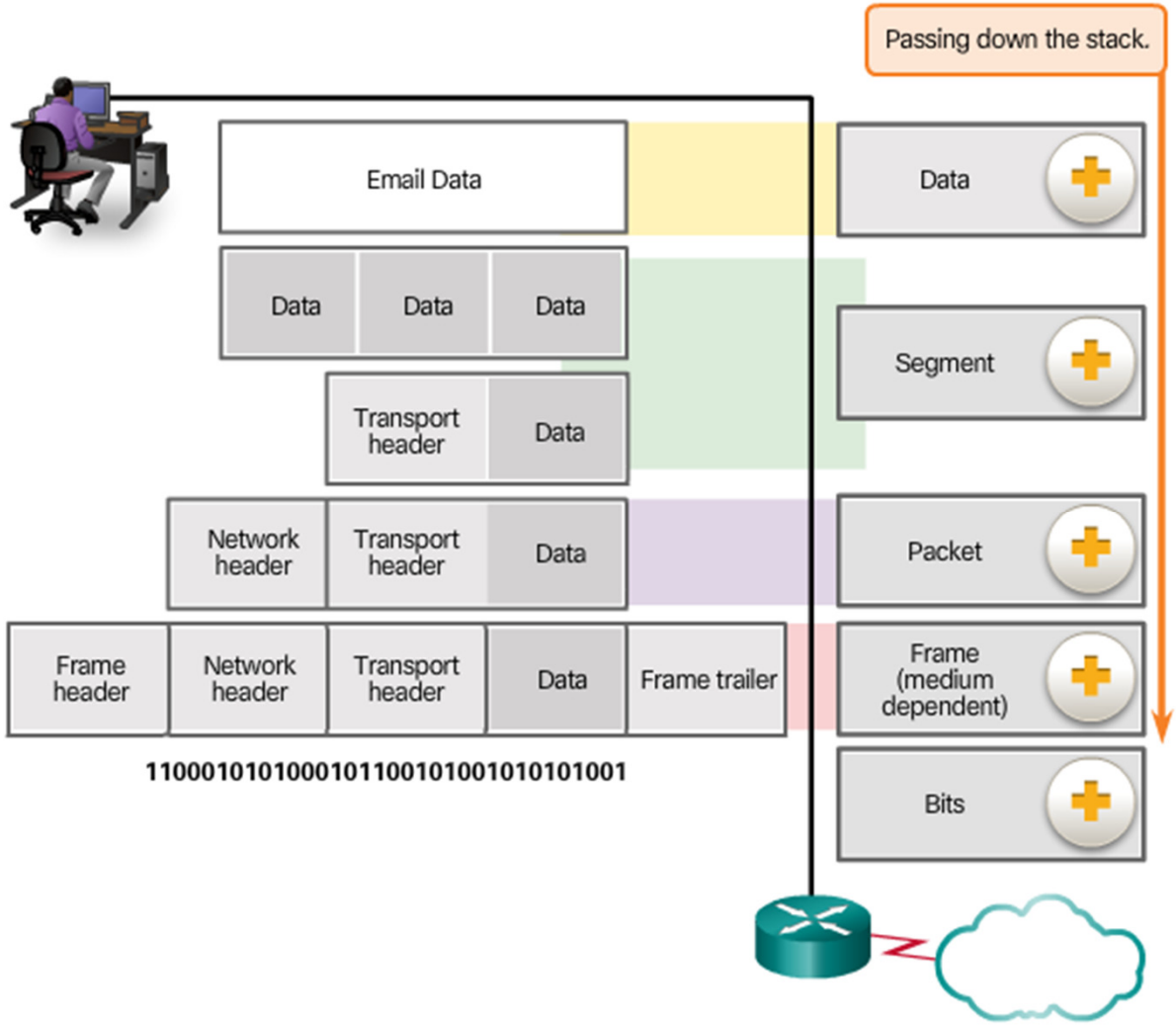
Segmenting Messages:

- Allows many different conversations to be interleaved
- Increases the efficiency of network communications
- Adds complexity

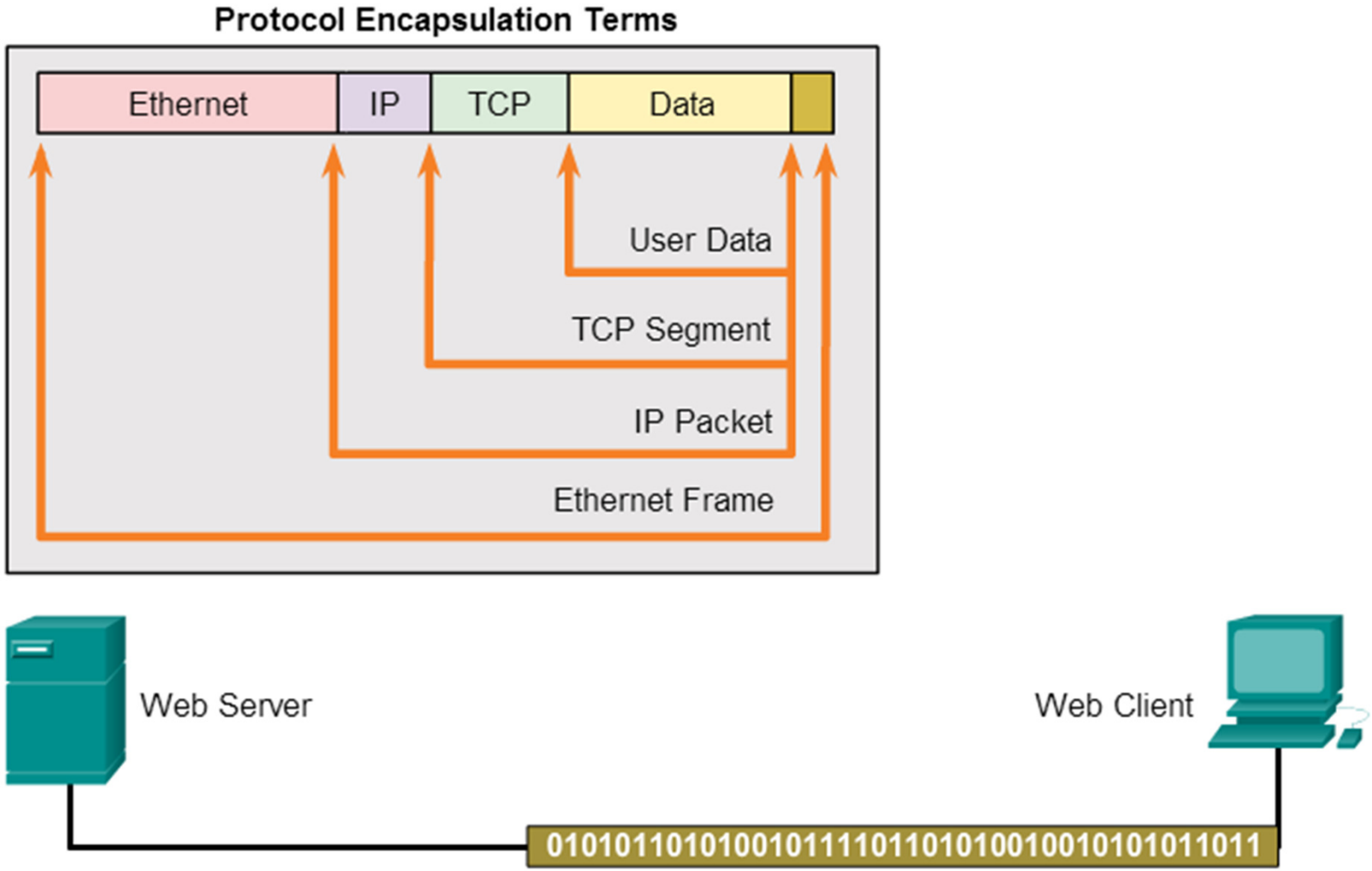
Protocol Data Units

Encapsulation

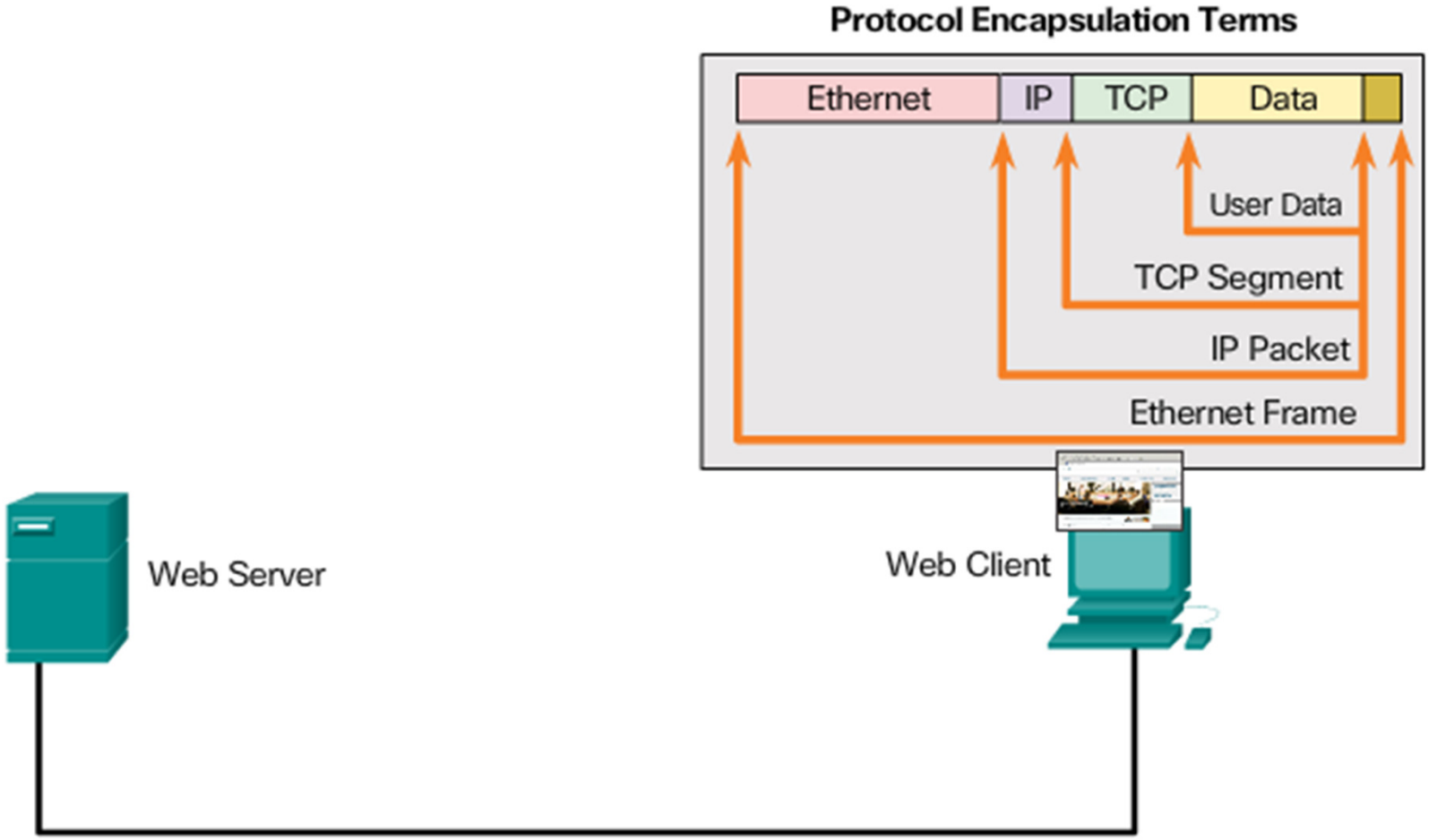
- Data
- Segment
- Packet
- Frame
- Bits



Encapsulation Example



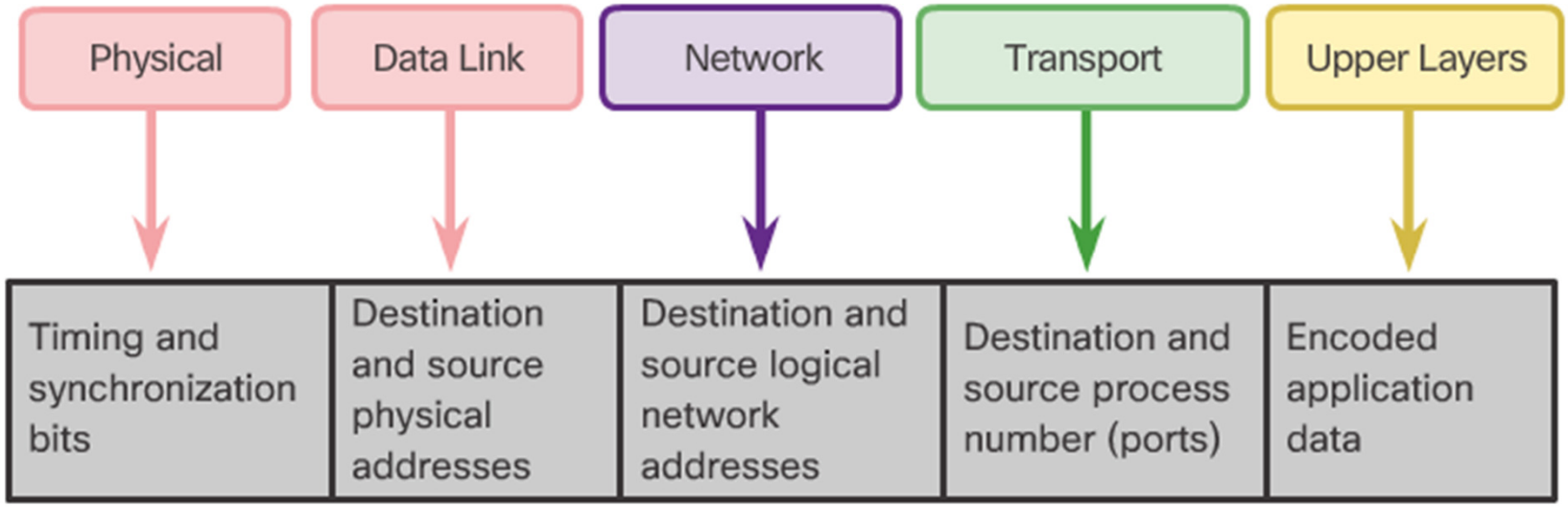
De-Encapsulation



Topic 3.3.2:
Data Access

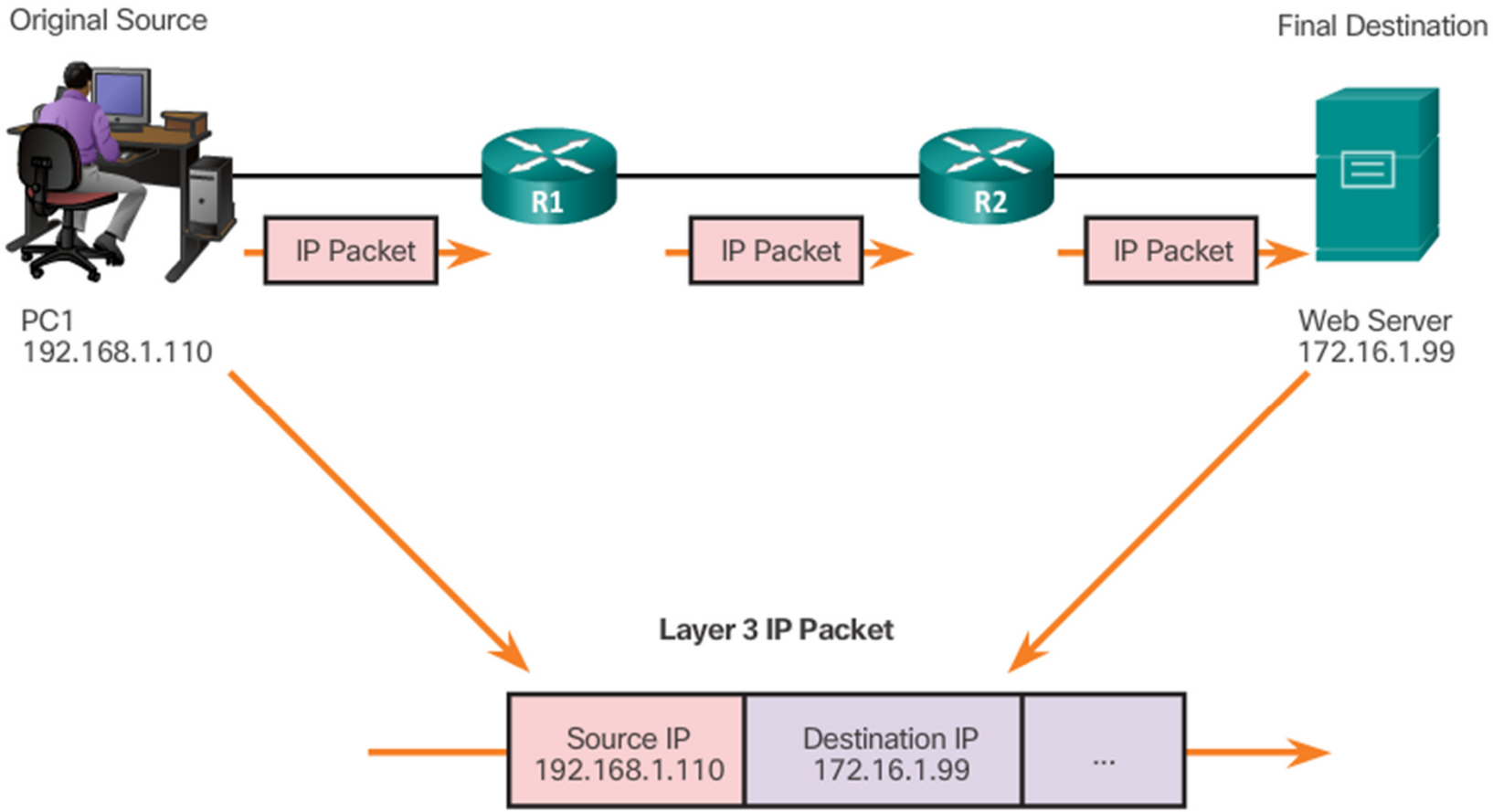
Network Addresses

Network Addresses and Data Link Addresses



Network Addresses (cont.)

Layer 3 Network Addresses



Data Link Addresses

Network Address

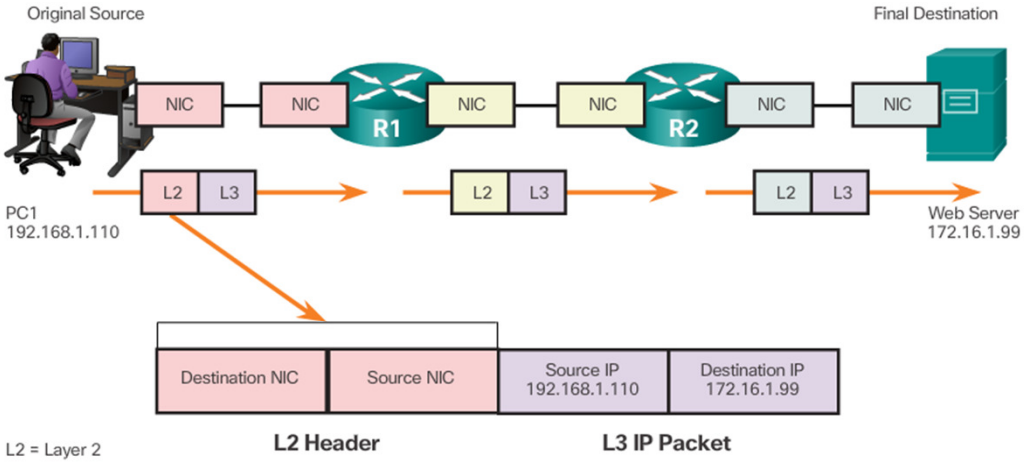
- Source IP address
- Destination IP address
- Responsible for delivering the IP packet from the original source to the final destination, either on the same network or to a remote network.

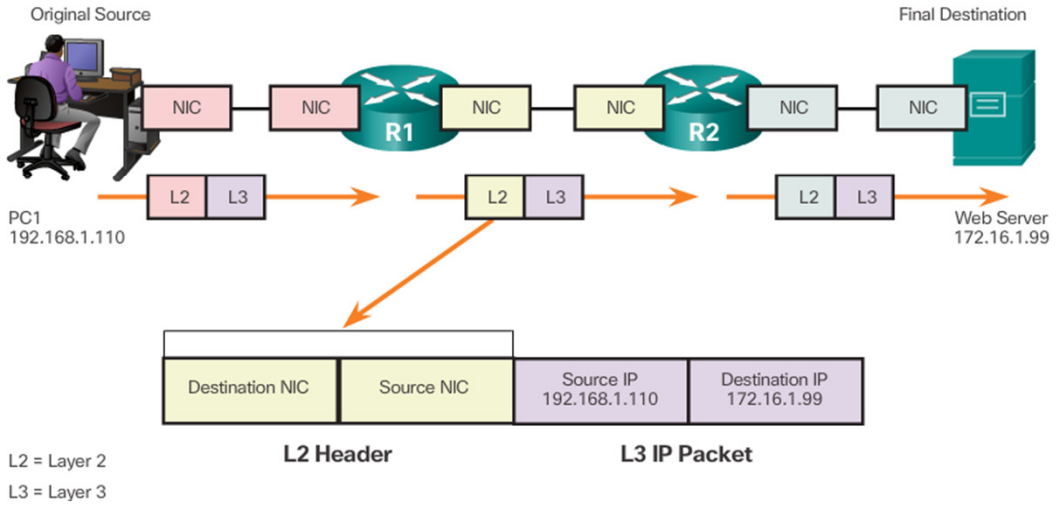
Data Link Address

- Source data link address
- Destination data link address
- Responsible for delivering the data link frame from one network interface card (NIC) to another NIC on the same network

Data Link Address (cont.)

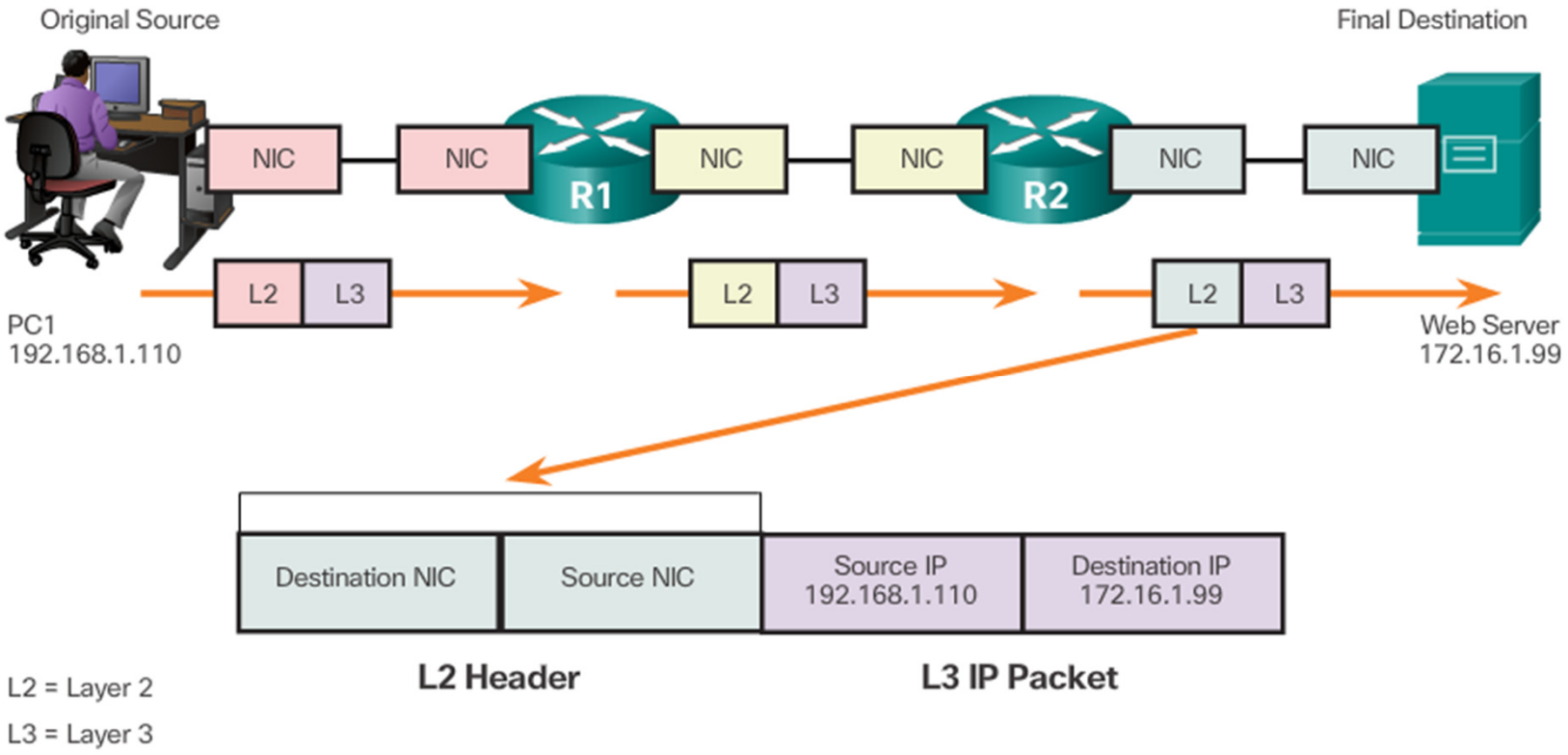
Layer 2 Data Link Addresses



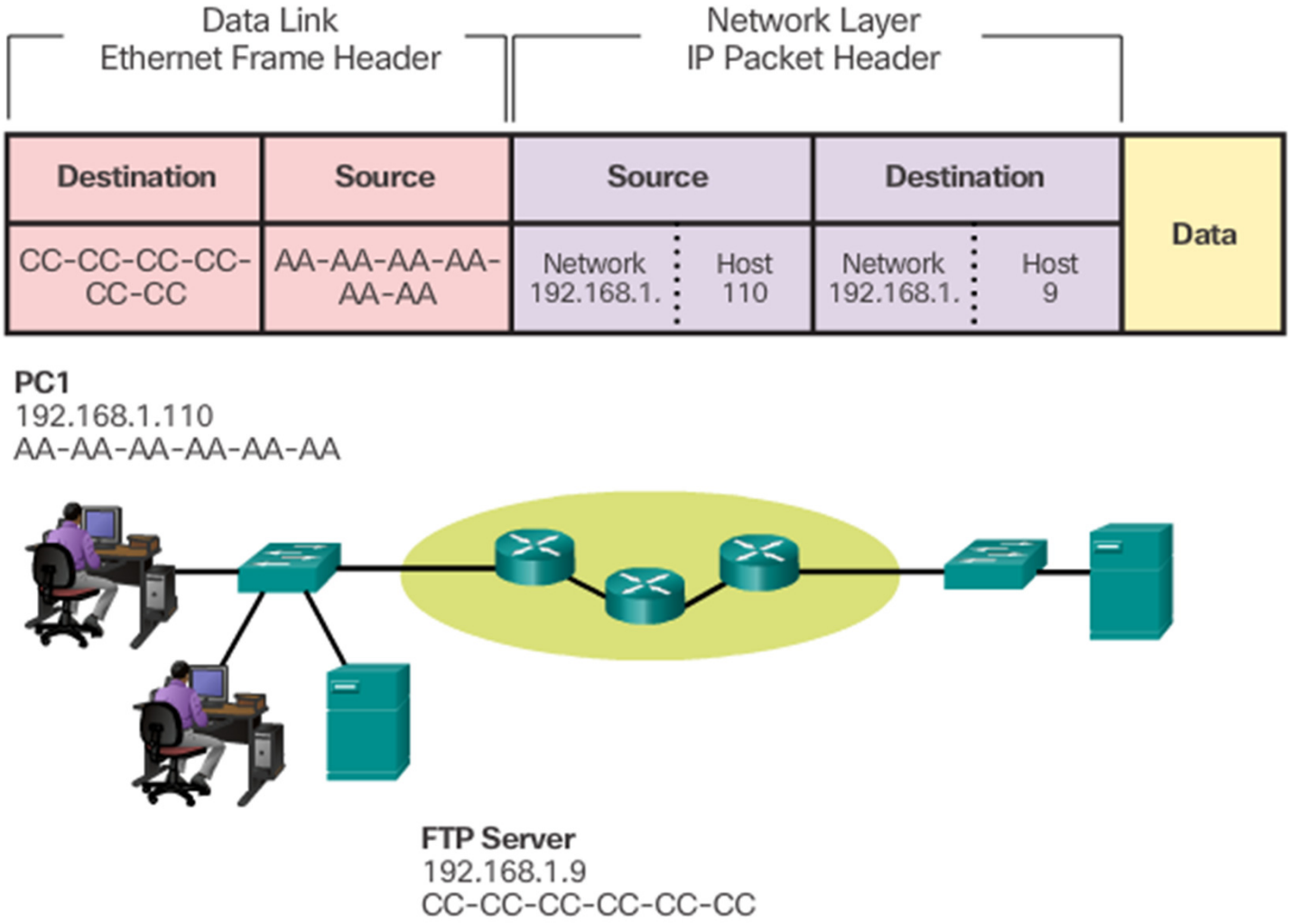


Data Link Address (cont.)

Layer 2 Data Link Addresses



Devices on the Same Network



Devices on the Same Network (cont.)

- Role of the Network Layer Addresses

  Network portion of the IP Address – The left-most part of the address that indicates which network the IP address is a member.

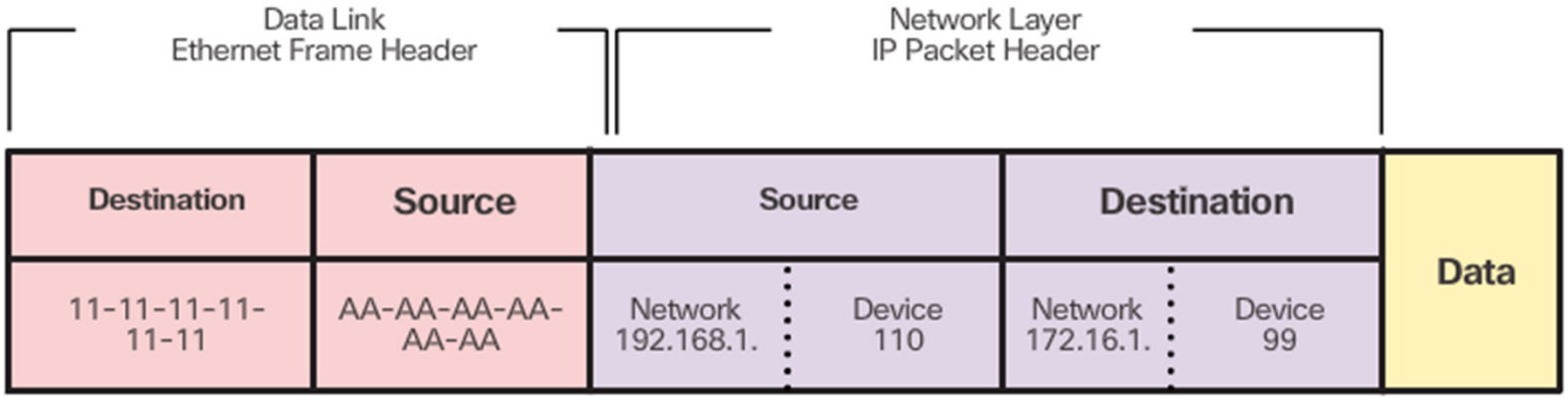
  Host portion – The remaining part of the address that identifies a specific device on the network.

- Source IP address – The IP address of the sending device
- Destination IP address – The IP address of the receiving device
- Role of the Data Link Layer Addresses

  Source MAC address – This is the data link address, or the Ethernet MAC address, of the sending device.

  Destination MAC address – When the receiving device is on the same network as the sending device, this is the data link address of the receiving device.

Devices on a Remote Network



Devices on a Remote Network (cont.)

Role of the Network Layer Addresses

- The source and destination IP addresses will represent hosts on different networks indicated by the different network portions of the source and destination addresses.

Role of the Data Link Layer Addresses

- Destination MAC address - When the receiving device is on a different network from the sending device, the sending device uses the Ethernet MAC address of the default gateway or router.

Section 3.4: Summary

Chapter Objectives:

- Explain how rules are used to facilitate communication.
- Explain the role of protocols and standards organizations in facilitating interoperability in network communications.
- Explain how devices on a LAN access resources in a small to medium-sized business network.

Thank you.

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