CISCO CCNA1

CCNA Routing and Switching: Introduction to Networks

HOOFDSTUK 3

Network Protocols and Communications

DE HOGESCHOOL MET HET NETWERK

Hogeschool PXL – Elfde-Liniestraat 24 – B-3500 Hasselt
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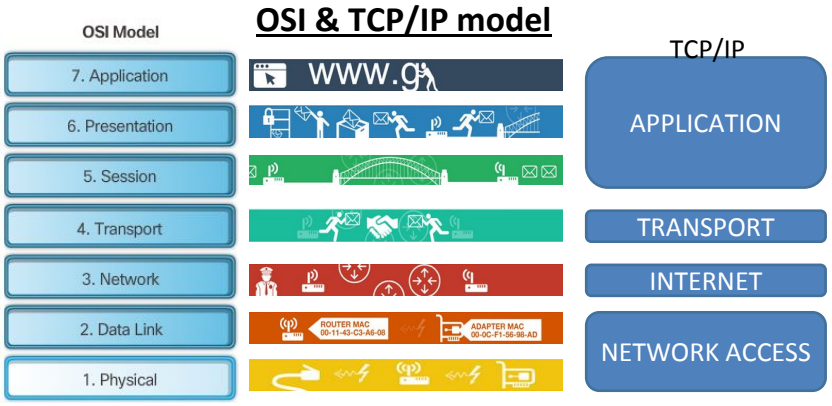
CCNA1 - Overzicht

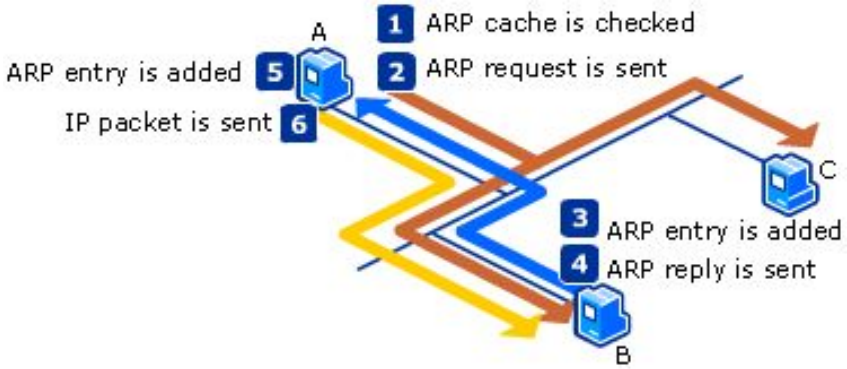
- OSI model en de belangrijkste (LAN) protocollen.
- Data Flow in een LAN
  (verklaring volgens het OSI model).
- IP en subnetting.
- Het toepassen en onderzoeken van bovenstaande 3 in Packettrace oefeningen.

CCNA1 - Overzicht

1. OSI model en de belangrijkste (LAN) protocollen.



2. Data Flow in een LAN (verklaring volgens het OSI model)



3. IP en subnetting

Situering hoofdstuk 3

In dit hoofdstuk worden het TCP/IP-model en het OSI-model besproken en in praktijk bekeken .
Het eerste deel van dit hoofdstuk (3.1 & 3.2) bespreek het OSI & TCP/IP model. Aan de hand van deze modellen worden verschillende items besproken; de meest gebruikte protocollen, adressering, data-flow, encapsulation, … .
Het tweede deel (3.3) beschrijft de data transfer in een netwerk. Hoe worden te versturen gegevens opgebouwd en wat is het gebruik van network(IP)- en datalink (MAC) adres. (Dit komt nog uitgebreid aan bod in chapter 4,5,6)

Doelstellingen:

- Ken en begrijp het OSI & TCP/IP model!
- Weet waar het model gebruikt wordt en waarom het zo belangrijk is.
- Ken en begrijp het proces van (de-) encapsulation. (+ PDU benamingen !)
- Ken en begrijp de meest voorkomende protocollen. Afkorting, omschrijving en situering in het OSI model. Dit komt in volgende hoofdstukken uitgebreid terug.
- Ken en begrijp het verschil tussen netwerk adressering (IP/logisch) en data-link adressering (MAC/fysisch). Wat gebeurt er bij datacommunicatie in éénzelfde netwerk t.o.v. in een remote network? (Dit komt in volgende hoofdstukken terug.)
- Gebruik packettracer als ondersteuning. De PT oefening omschrijft een eenvoudig netwerk, analyseer het netwerk a.d.h.v. het OSI model. Bekijk de 'events' in PT en bestudeer de protocollen.
- De slides in summary zijn zeer belangrijk. Dergelijke schema's ken je als netwerker als de binnenkant van je broekzak! Let op, leer niet enkel van buiten, maar BEGRIJP!

Activity en PT:

- 3.2.2.5 Mapping the protocols
- 3.2.4.5 Identify layers and functions
- 3.3.1.5 Identify the PDU Layer
- 3.2.4.6 PT-Investigating the TCP/IP and OSI models in action

Leertip:

Lees het hoofdstuk aandachtig en zorg dat je de activities vlot kan. De samenvattende slides geven het hele hoofdstuk in één oogopslag.

Zie leerpad op blackboard!

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

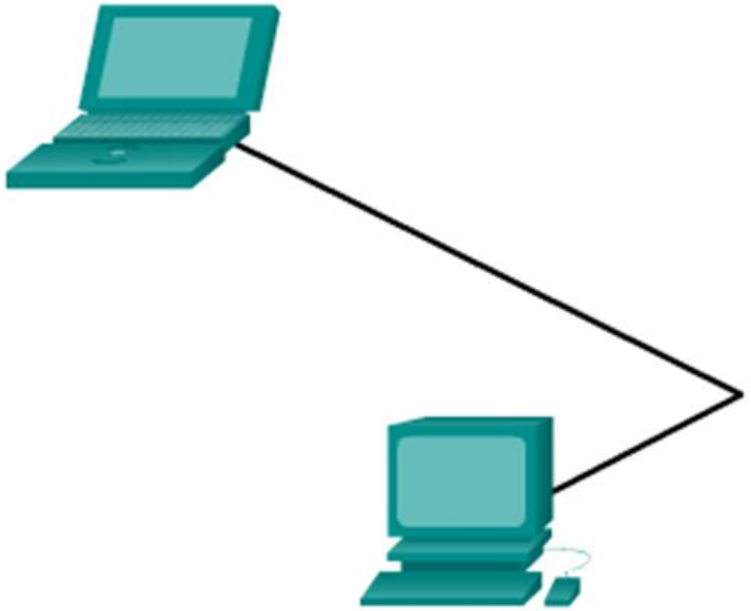
3.1.1: The Rules

3.1.1: The Rules

3.1.1.1 Communication Fundamentals

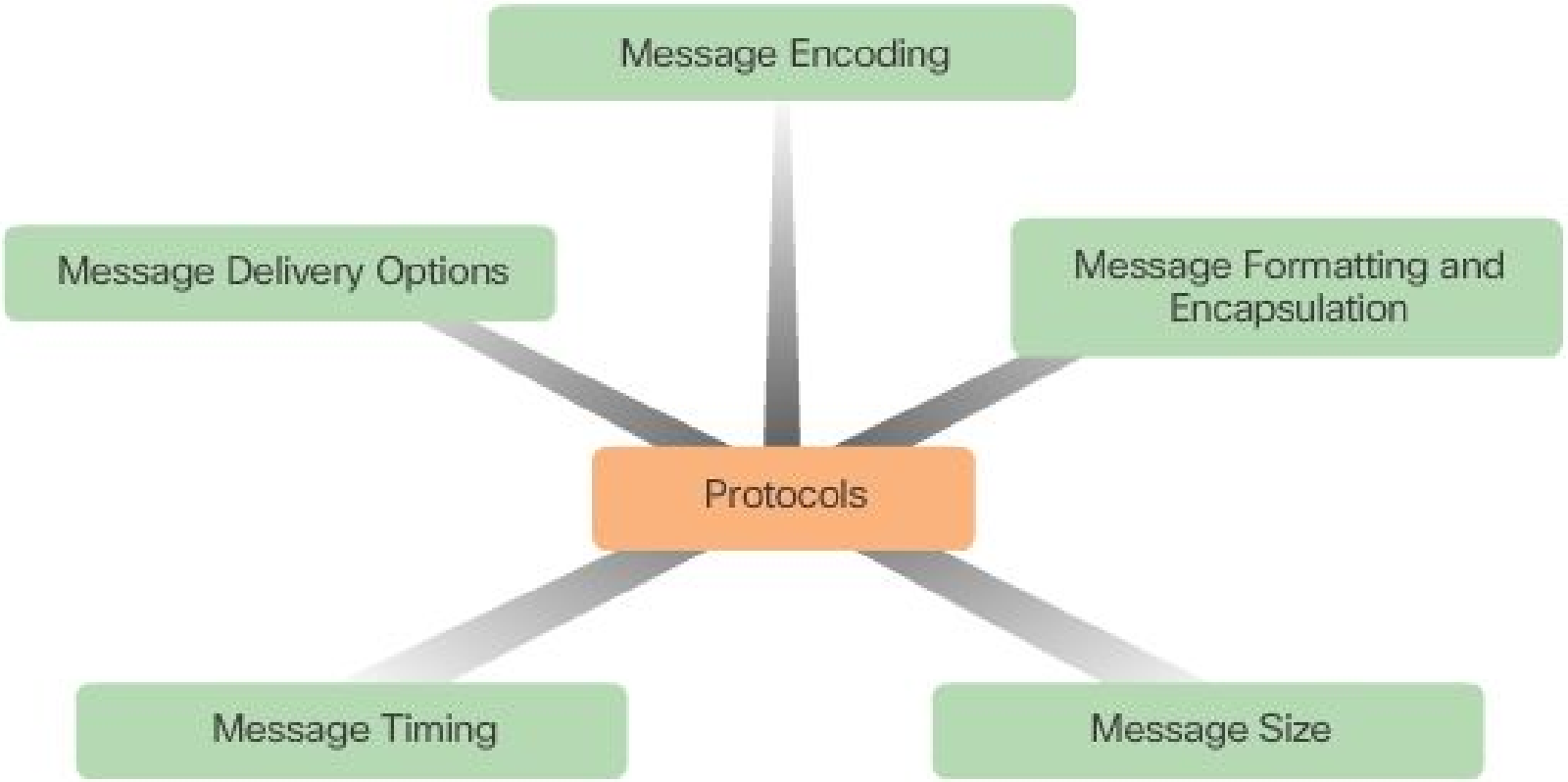
Human Communication

Computer Communication



3.1.1: The Rules

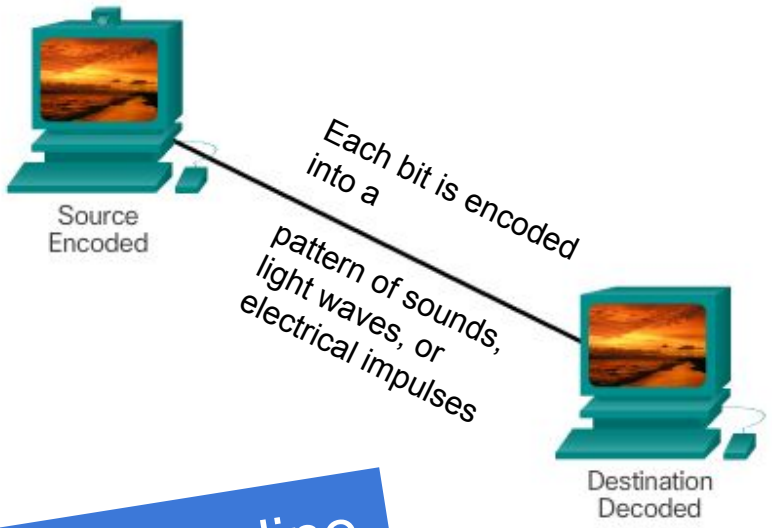
3.1.1.2 Rule Establishment



see next slides

3.1.1: The Rules

3.1.1.3 Message Encoding



see animation online

3.1.1: The Rules

3.1.1.4 Message Formatting and Encapsulation

a message must use
a specific format and
structure

letter is encapsulated in an envelope

Destination (physical / hardware address)	Source (physical / hardware address)	Start Flag (start of message indicator)	Recipient (destination identifier)	Sender (source identifier)	Encapsulated Data (bits)	End of Frame (end of message indicator)
Frame Addressing		Encapsulated Message				

see animation online

3.1.1.5 Message Size

- 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.

3.1.1.6 Message Timing

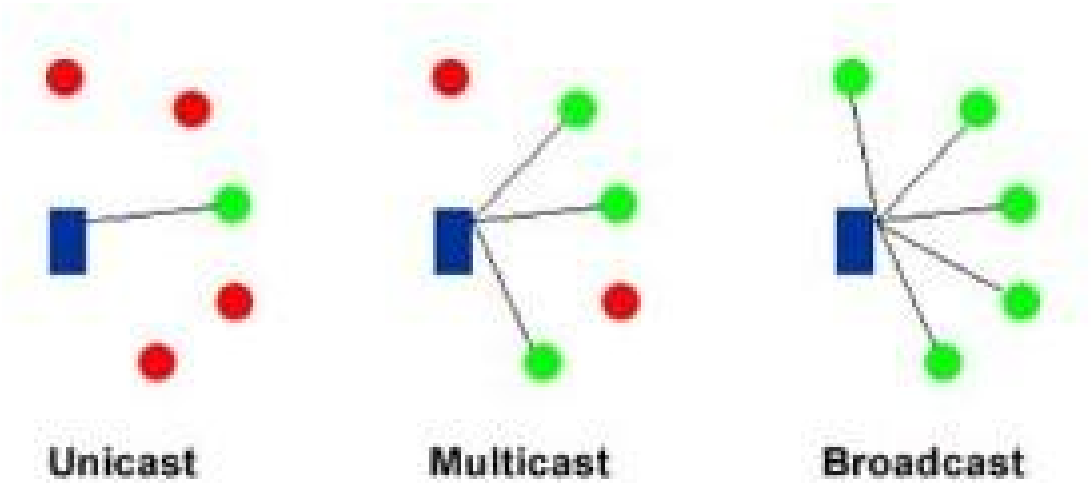
- Access Method → Do not talk at the same time
- Flow Control → Do not talk too fast
- Response Timeout → How long to wait for a response

3.1.1: The Rules

3.1.1.7 Message Delivery Options

- Unicast
- Multicast
- Broadcast

see animation online

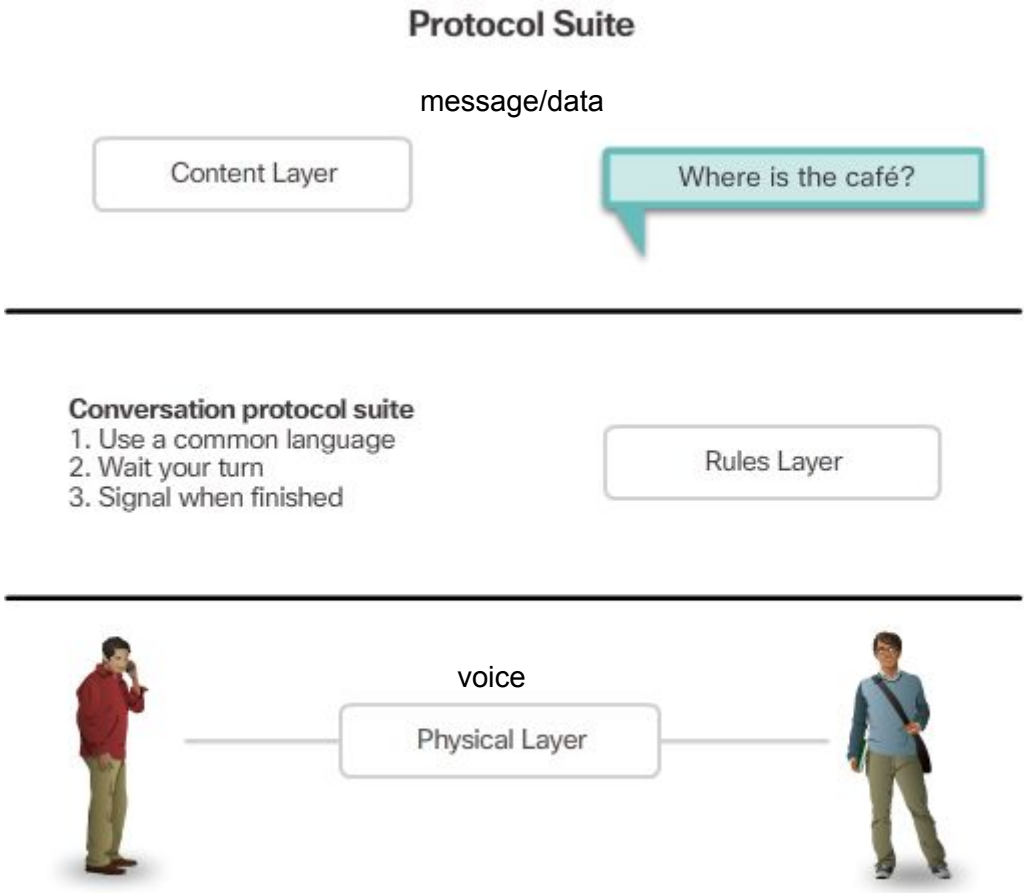


Section 3.2:
Network Protocols and Standards

3.2.1: Protocols
3.2.2: Protocol Suites
3.2.3: Standard Organizations
3.2.4: Reference Models

3.2.1: Protocols

3.2.1.1 Rules that Govern Communications



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

3.2.1: Protocols

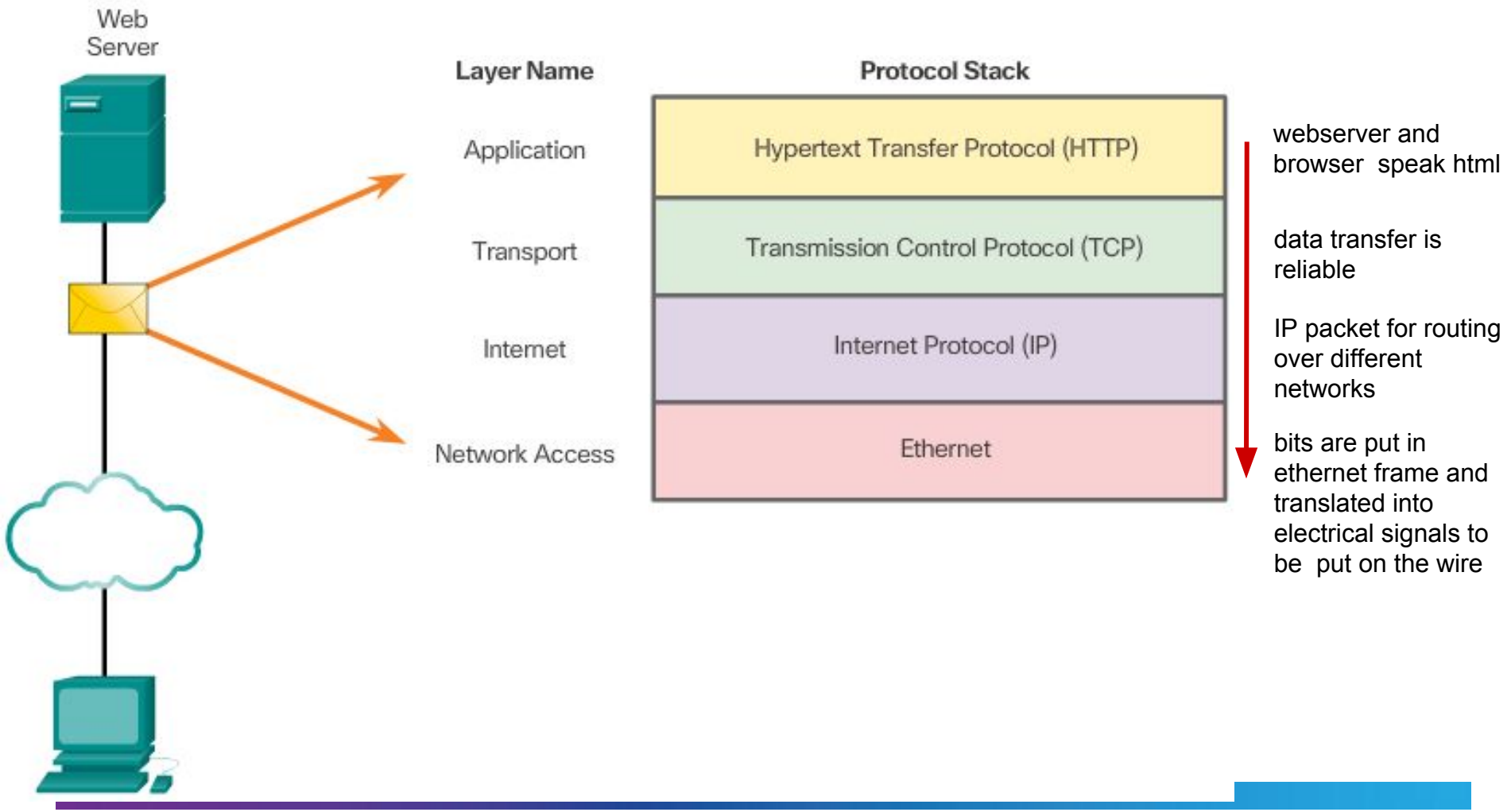
3.2.1.2 Network Protocols

- 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

3.2.1: Protocols

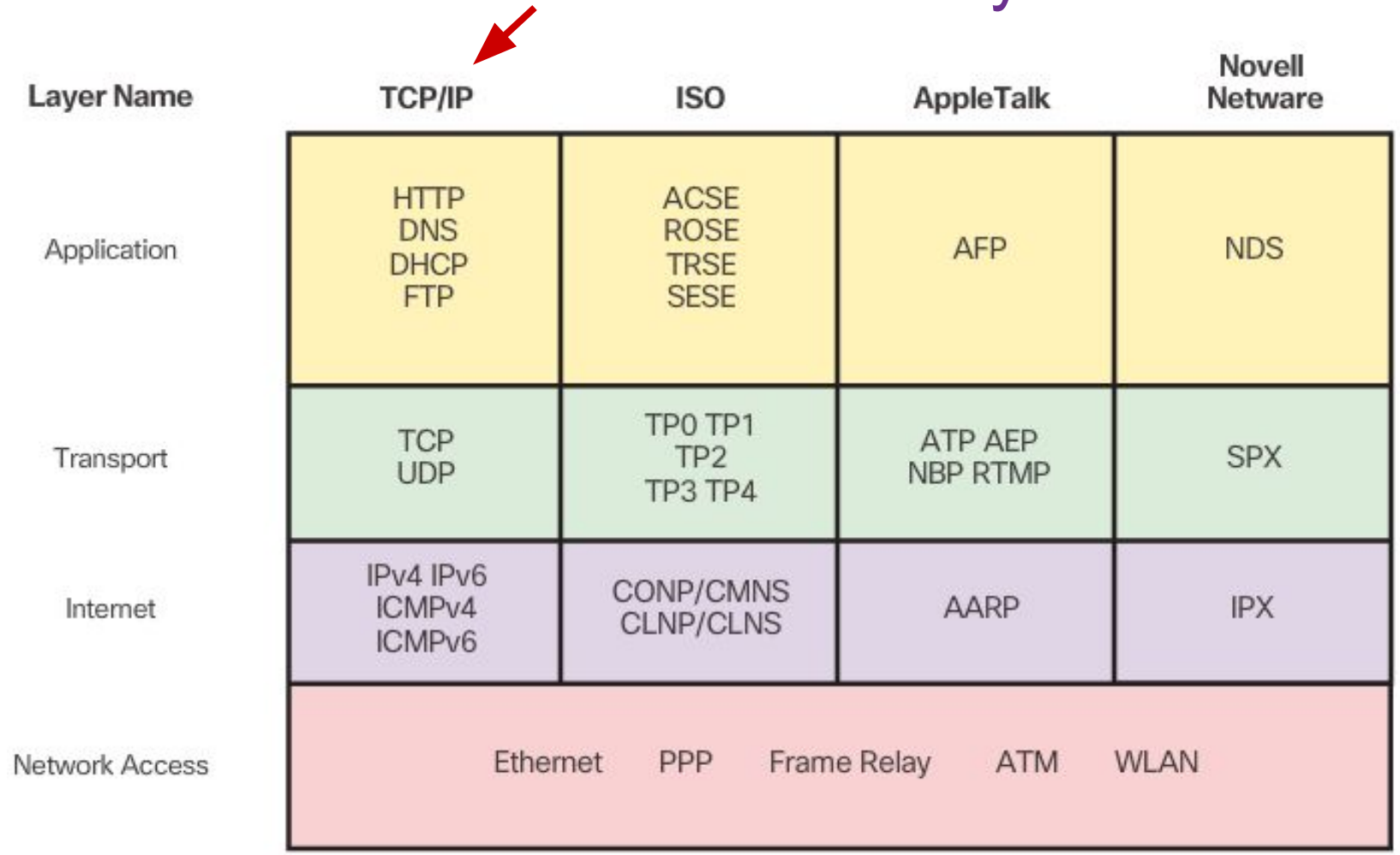
3.2.1.3 Protocol Interaction

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



3.2.2: Protocol Suites

3.2.2.1 Protocol Suites and Industry Standards



3.2.2: Protocol Suites

3.2.2.2 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.

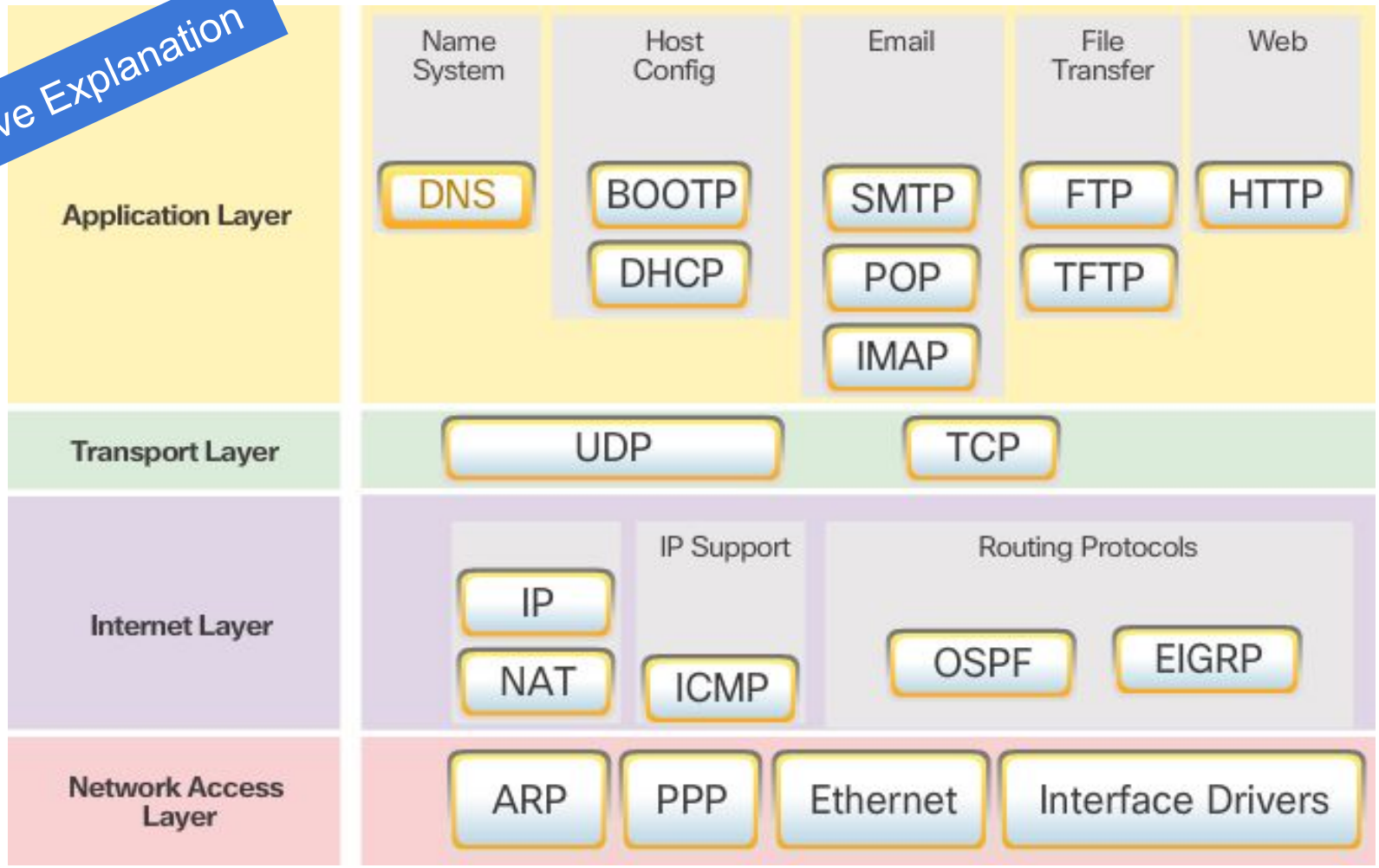
2015
2005
1995
1985
1975
1965

@Home

3.2.2: Protocol Suites

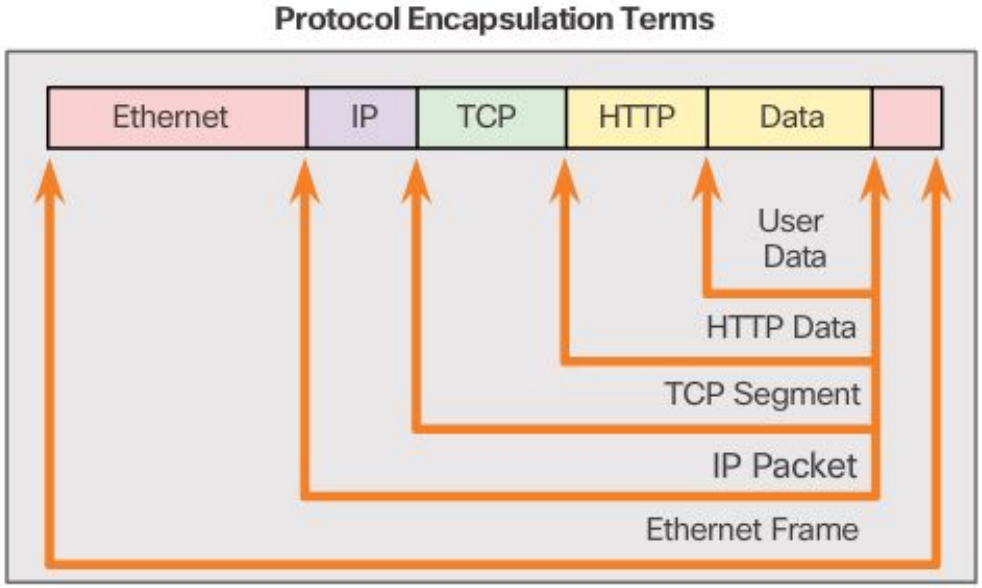
3.2.2.3 TCP/IP Protocol Suite

Interactive Explanation



3.2.2.4 TCP/IP Communication Process

Protocol Operation - Sending a Message



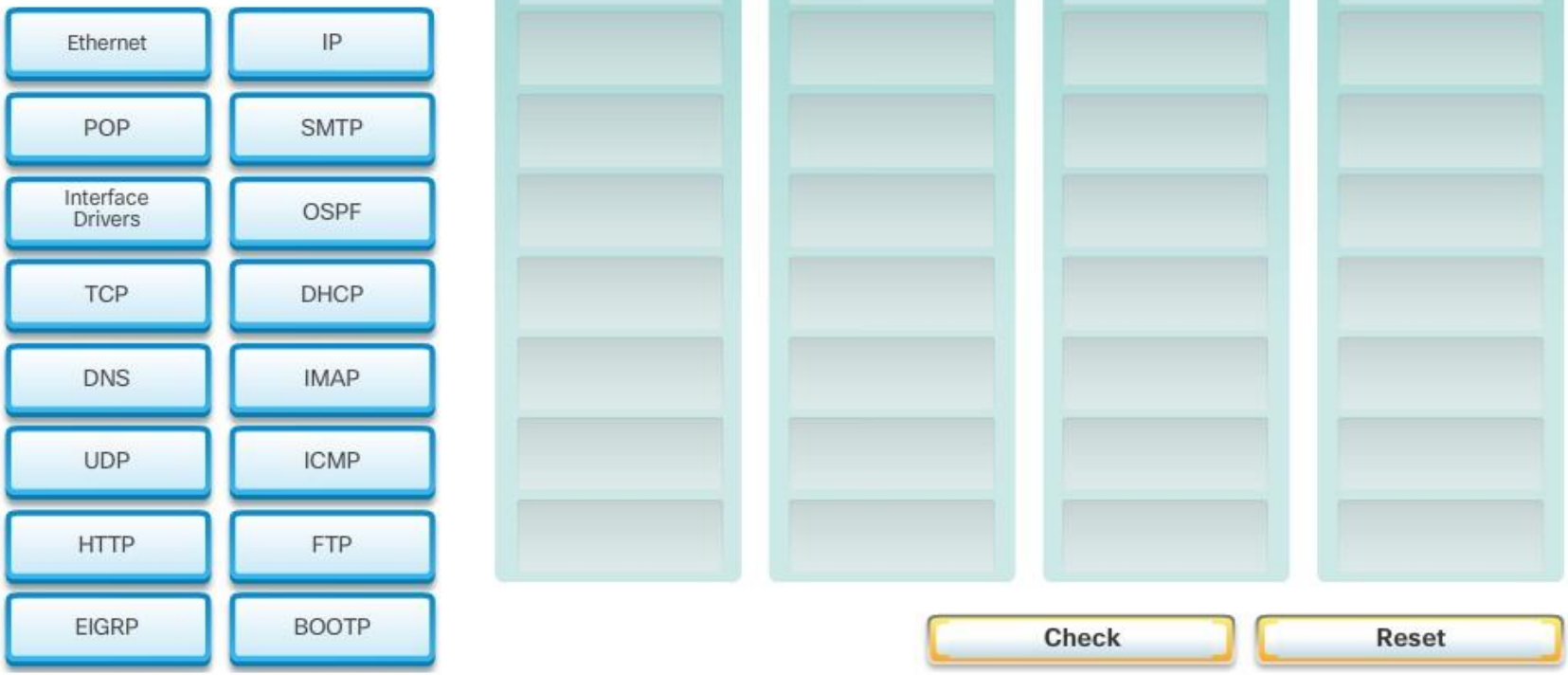
see animation online

3.2.2: Protocol Suites

3.2.2.5 Activity - mapping the protocols

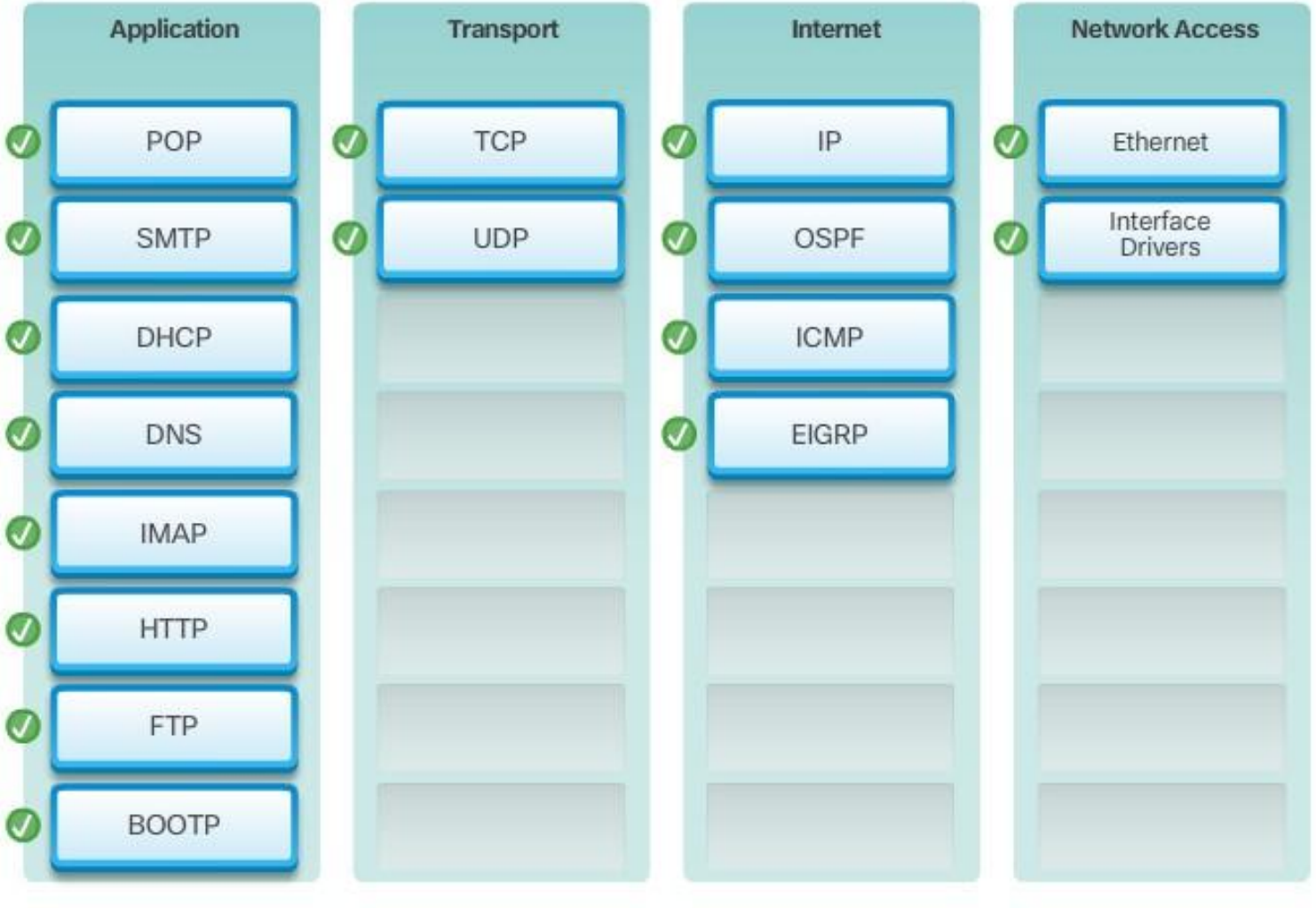
Activity - Protocols and Layers

Drag the protocol or standard to the TCP/IP layer name as described.



3.2.2: Protocol Suites

3.2.2.5 Activity - mapping the protocols

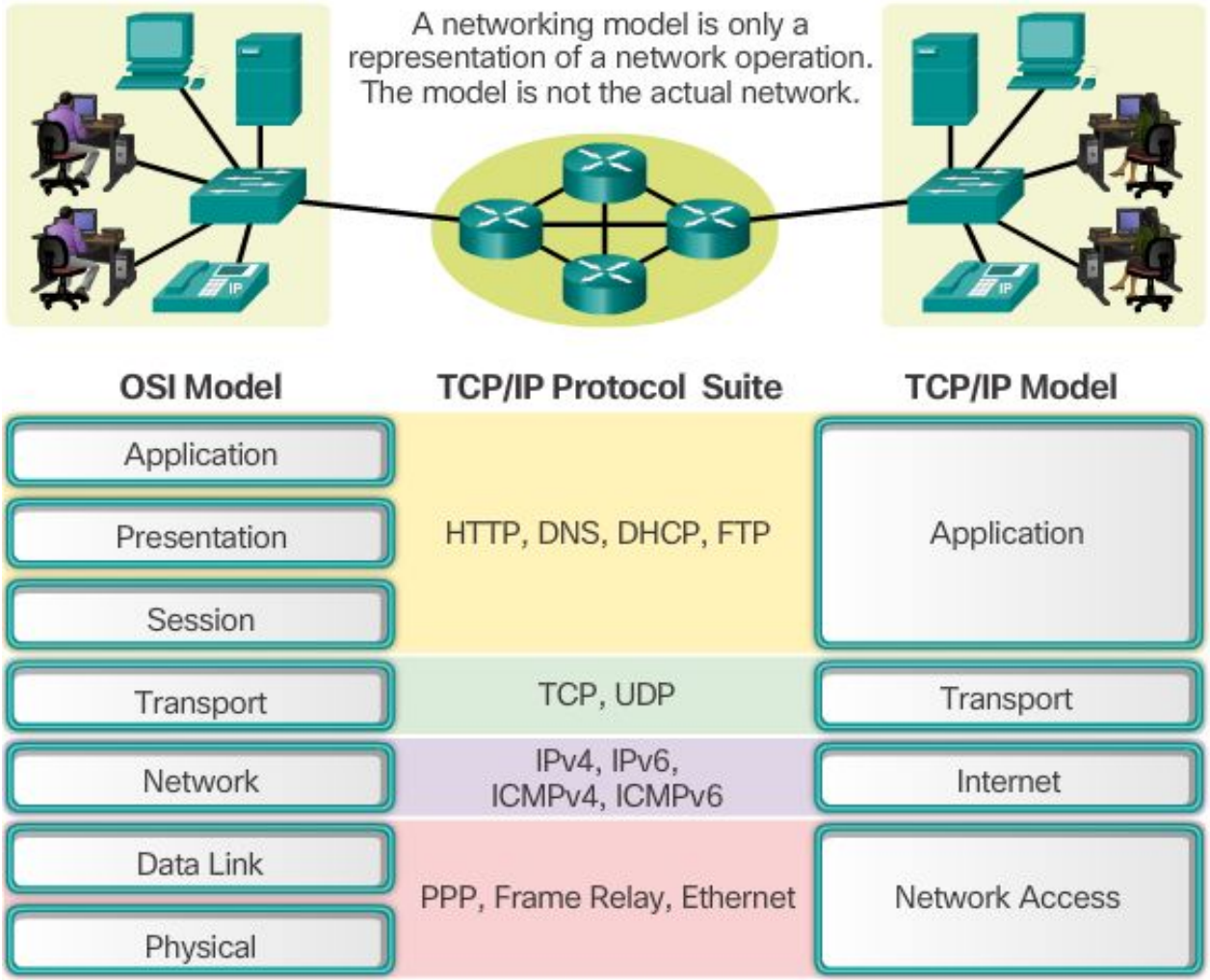


3.2.3: Standard Organizations

3.2.3.1 Open Standards
3.2.3.2 Internet Standards
3.2.3.3 Electronics and Communications Standard Organizations

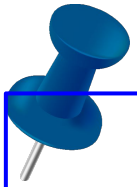
3.2.4: Reference Models

3.2.4.1 The Benefits of Using a Layered Model



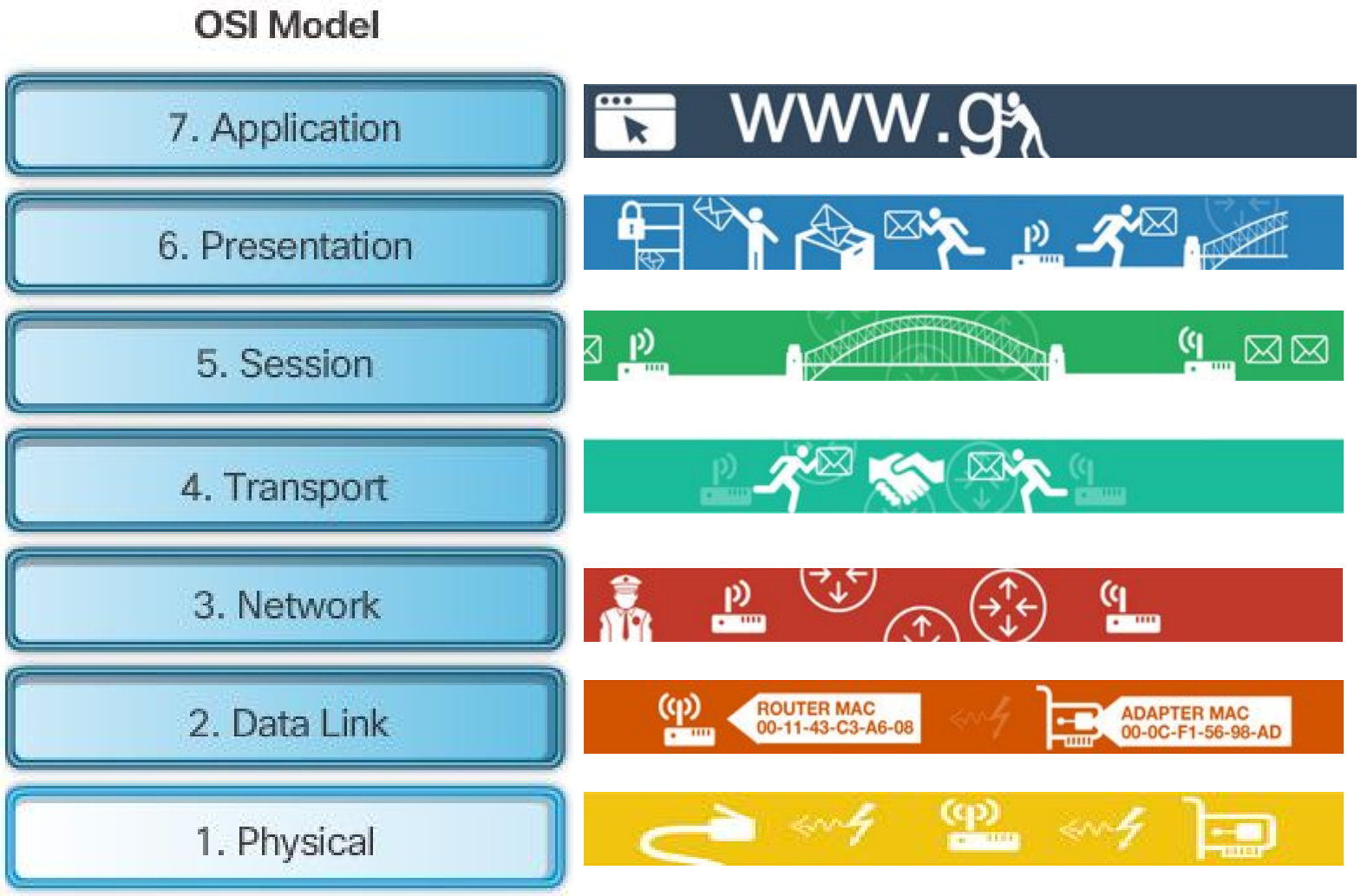
3.2.4: Reference Models

3.2.4.2 The OSI Reference Model



All
People
Seem
To
Need
Data
Protocols

3.2.4.2 The OSI Reference Model



3.2.4: Reference Models

3.2.4.2 The OSI Reference Model

- mechanical, electrical, functional
- physical connections
- transmitting bits (to and from a network device)

- PDU: Bit

Physical + Data Link (OSI) = Network Access (TCP/IP)

3.2.4: Reference Models

3.2.4.2 The OSI Reference Model

- Methods for exchanging data frames between devices over a common media.
- Physical addressing
- MAC address
- Switch
- Ethernet frames

- PDU: Frame

Physical + Data Link (OSI) = Network Access (TCP/IP)

3.2.4: Reference Models

3.2.4.2 The OSI Reference Model

- “services to exchange the individual pieces of data over the network between identified end devices”
- path determination
- Logical addressing
- IP address
- Router
- IP packet

- PDU: Packet

Network (OSI) = Internet (TCP/IP)

3.2.4: Reference Models

3.2.4.2 The OSI Reference Model

- transfer, and reassemble the data for individual communications between the end devices.
- End-to-end communication and reliability
- services to segment
- Ports
- TCP, UDP segments

- PDU: Segment

Transport (OSI) = Transport (TCP/IP)

3.2.4: Reference Models

3.2.4.2 The OSI Reference Model

- Service to presentation
- Controls the dialogues and data exchange
- Interhost communication
- establishes, manages and terminates sessions between the local and the remote application
- eg. cookie session and php session

- PDU: Data

Session + Presentation + Application (OSI) = Application (TCP/IP)

3.2.4: Reference Models

3.2.4.2 The OSI Reference Model

- Data representation
  - different computers might have different representations of characters
  - eg. ASCII vs EBCDIC
- Data compression (image, audio, video)
- Data encryption

- PDU: Data

Session + Presentation + Application (OSI) = Application (TCP/IP)

3.2.4: Reference Models

3.2.4.2 The OSI Reference Model

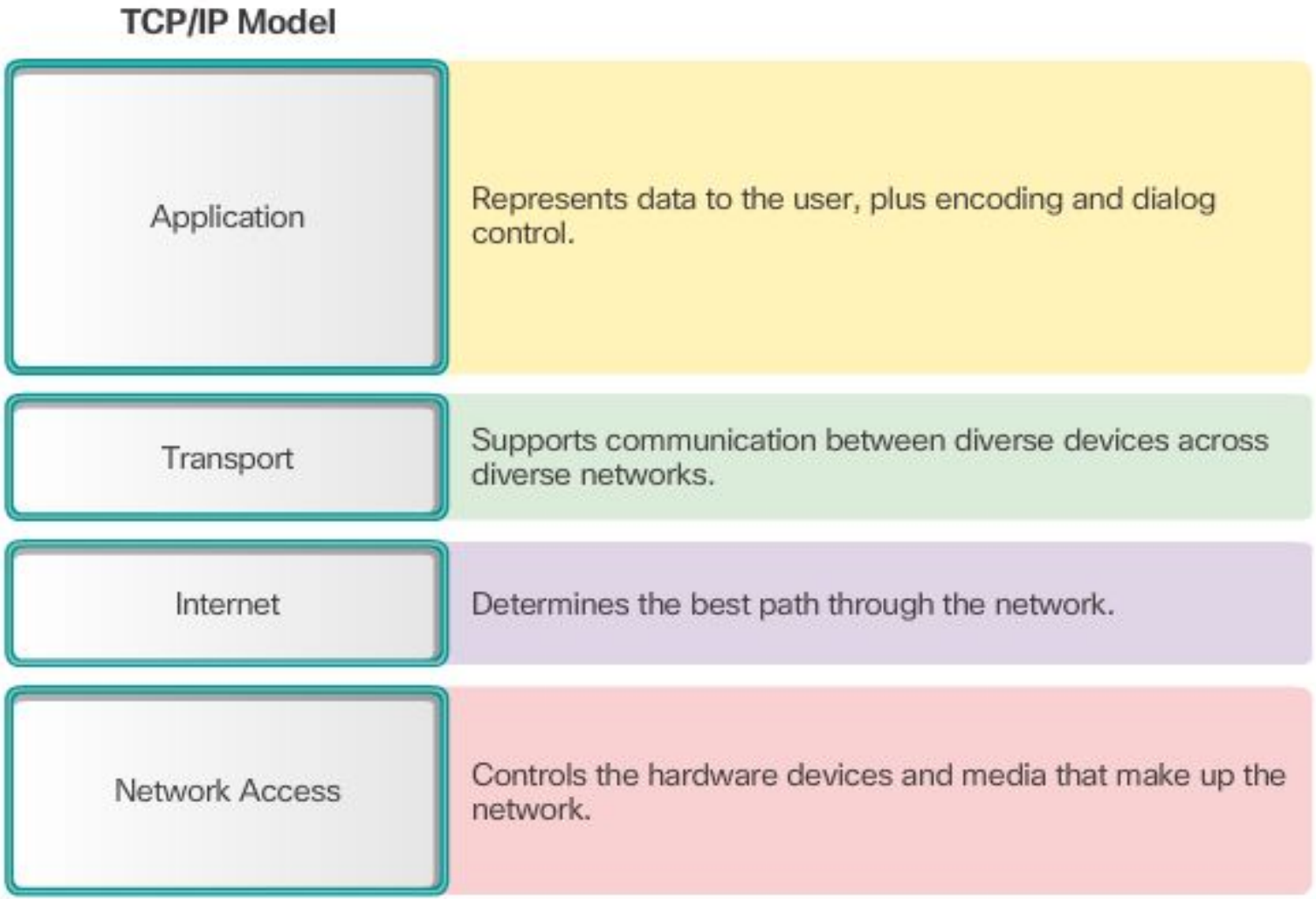
- Protocols used for process-to-process communications
- Appication data

- PDU: Data

Session + Presentation + Application (OSI) = Application (TCP/IP)

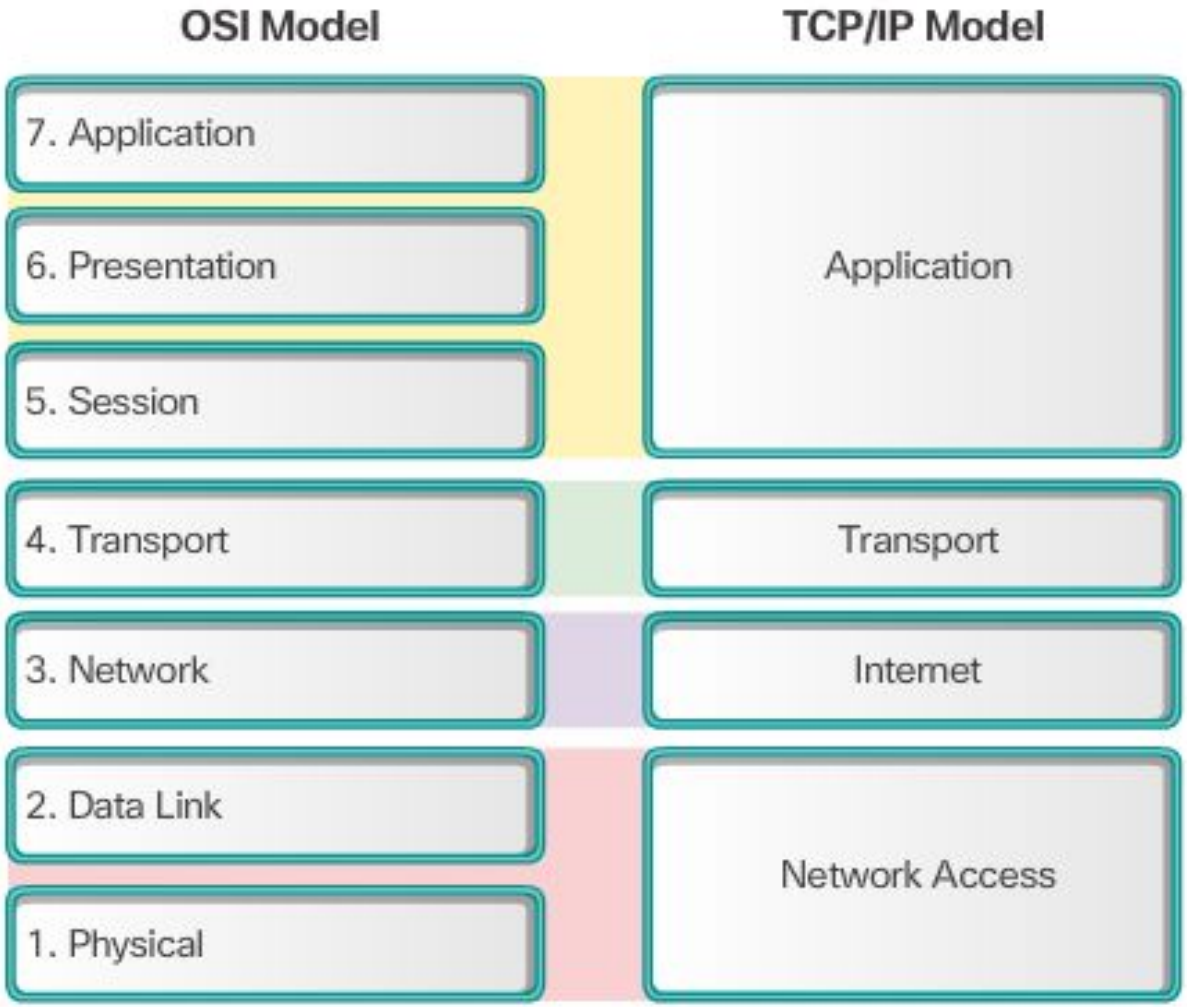
3.2.4: Reference Models

3.2.4.3 The TCP/IP Protocol Model



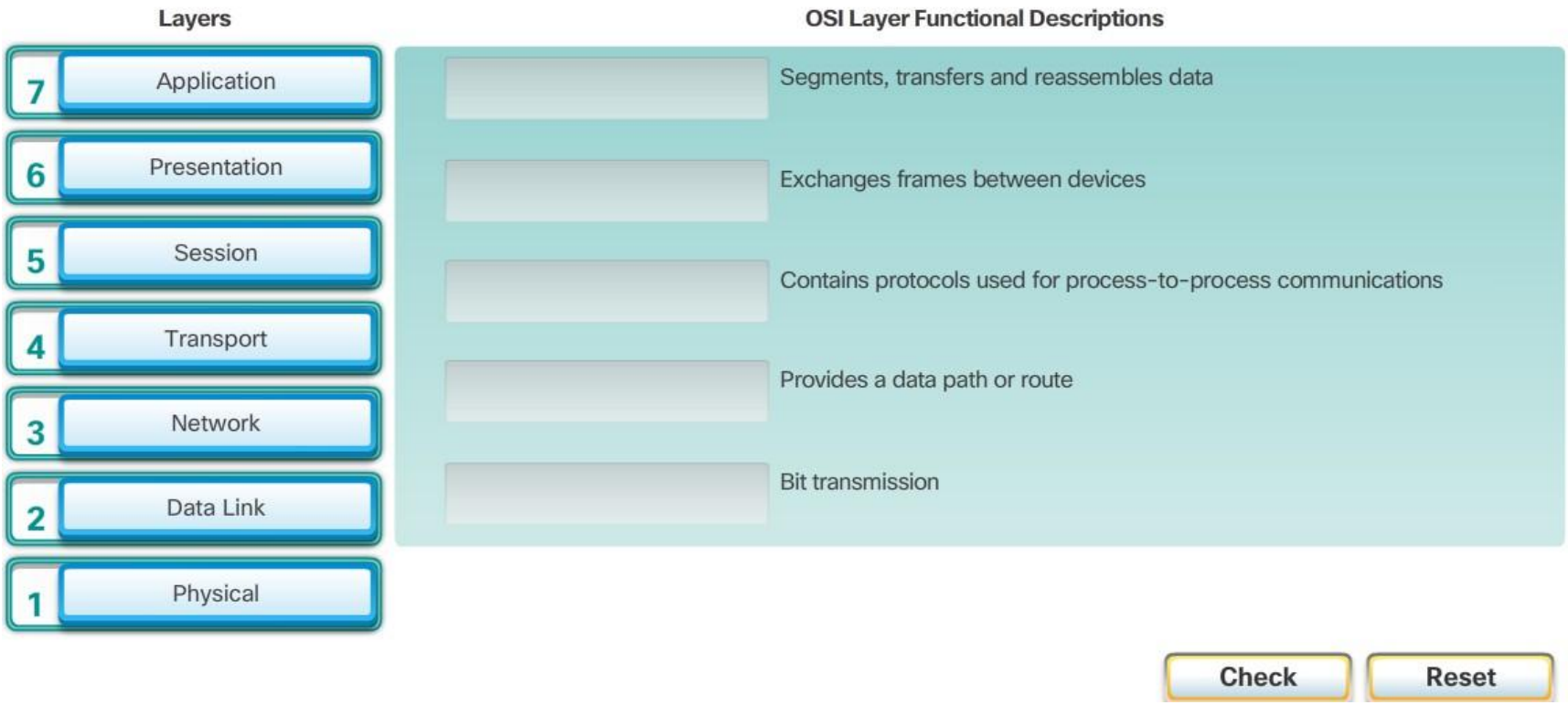
3.2.4: Reference Models

3.2.4.4 OSI Model and TCP/IP Model Comparison



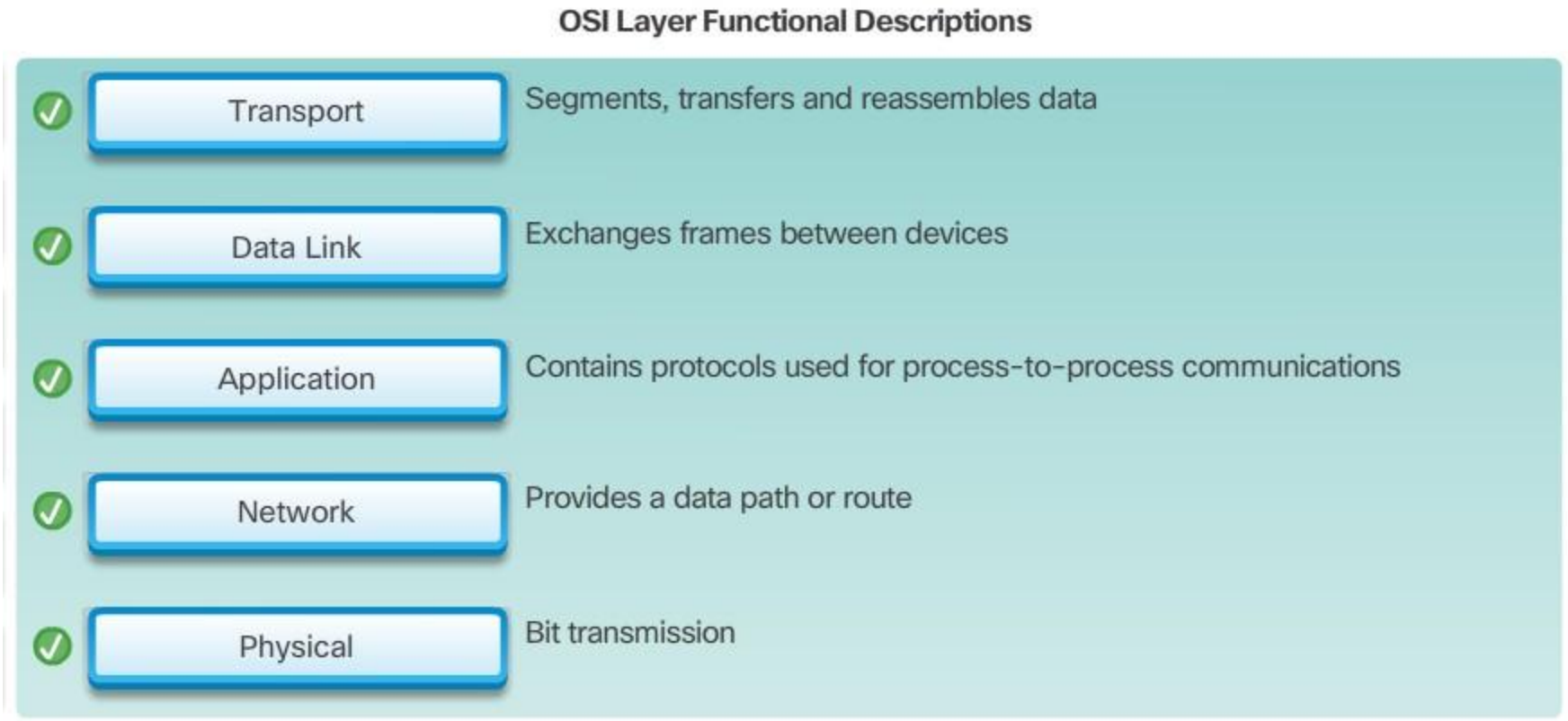
3.2.4: Reference Models

3.2.4.5 Activity - Identify Layers and functions



3.2.4: Reference Models

3.2.4.5 Activity - Identify Layers and functions



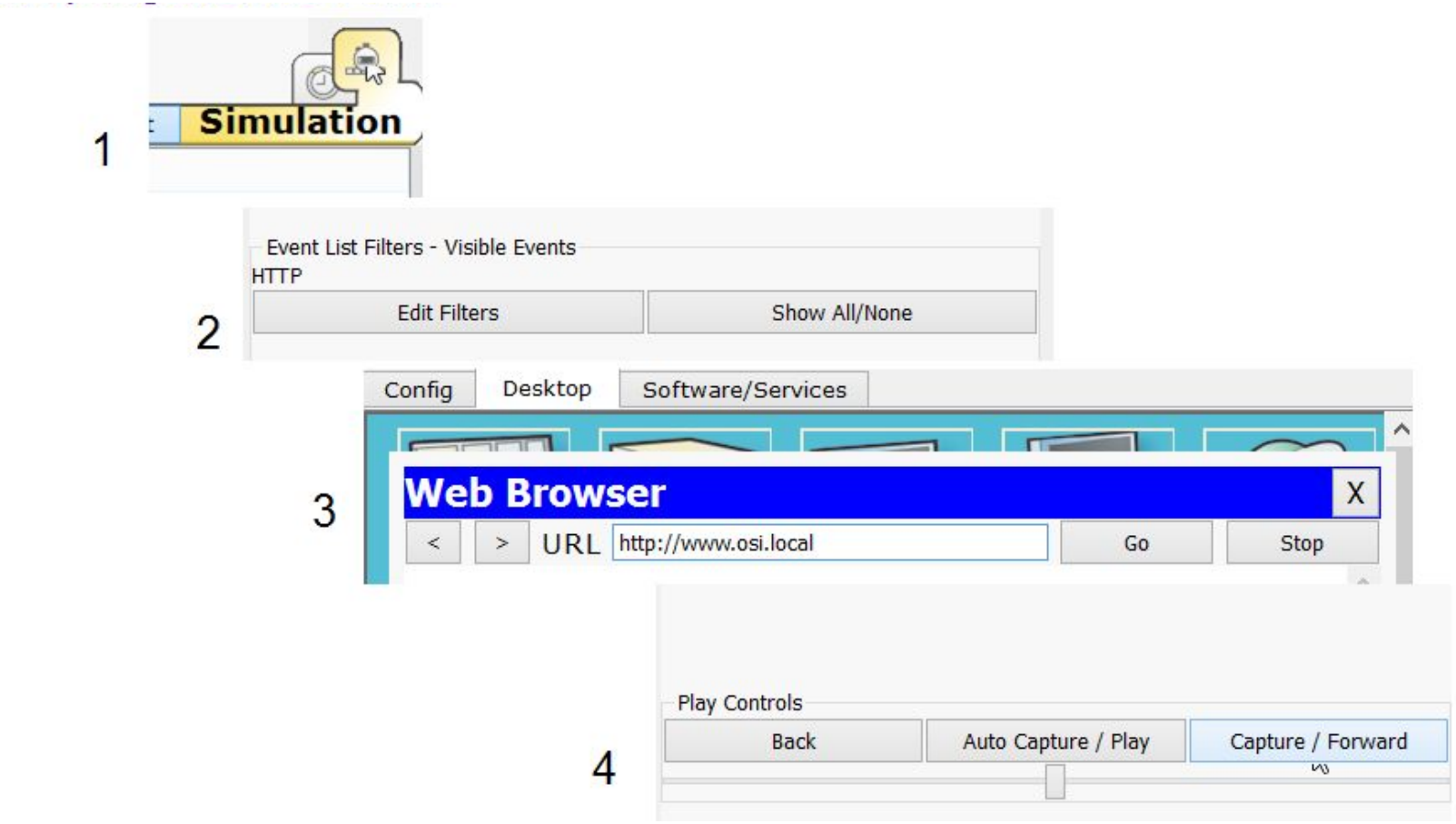
3.2.4: Reference Models

3.2.4.6 PT – Investigating the TCP/IP and OSI Models in Action

3.2.4: Reference Models

3.2.4.6 PT – Investigating the TCP/IP and OSI Models in Action

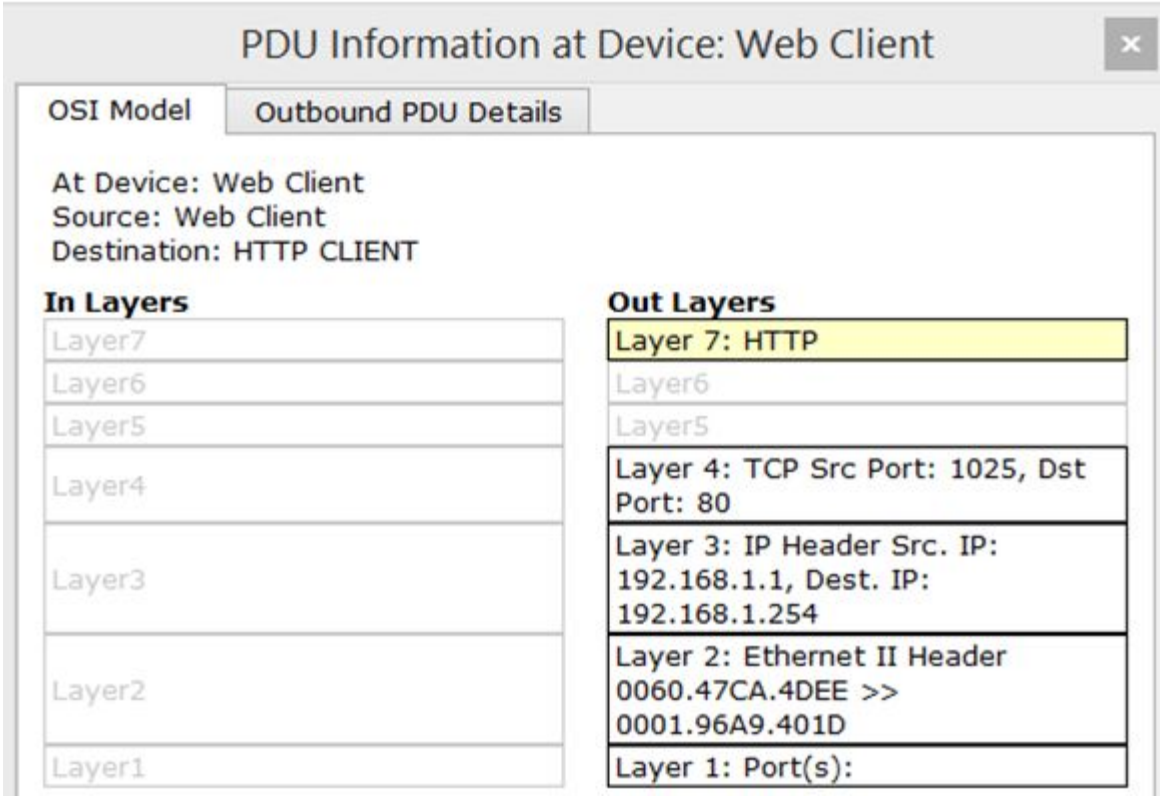
Step1: Generate data traffic



3.2.4: Reference Models

3.2.4.6 PT – Investigating the TCP/IP and OSI Models in Action

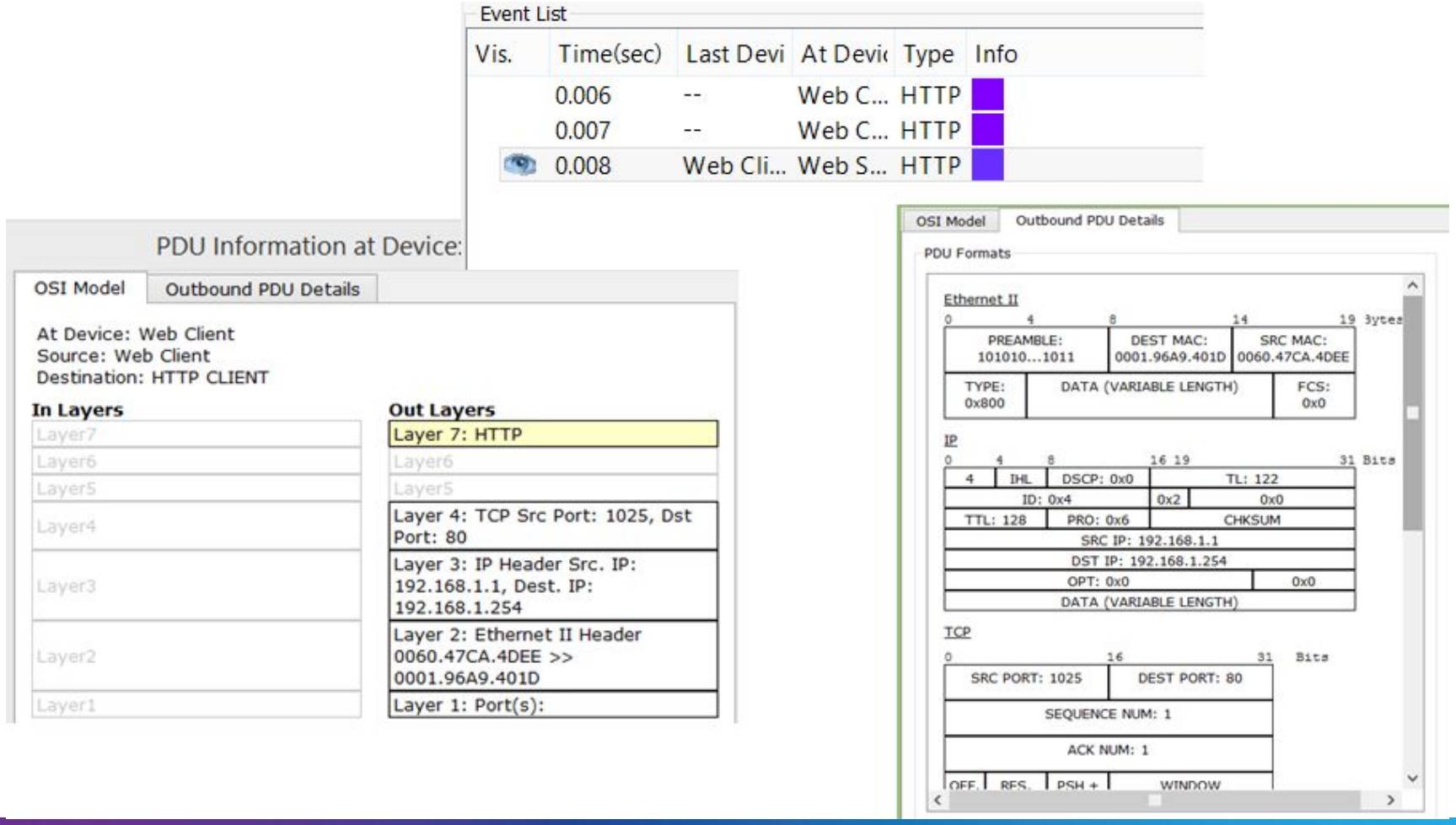
Step2: Check it out: OSI in packet tracer …



3.2.4: Reference Models

3.2.4.6 PT – Investigating the TCP/IP and OSI Models in Action

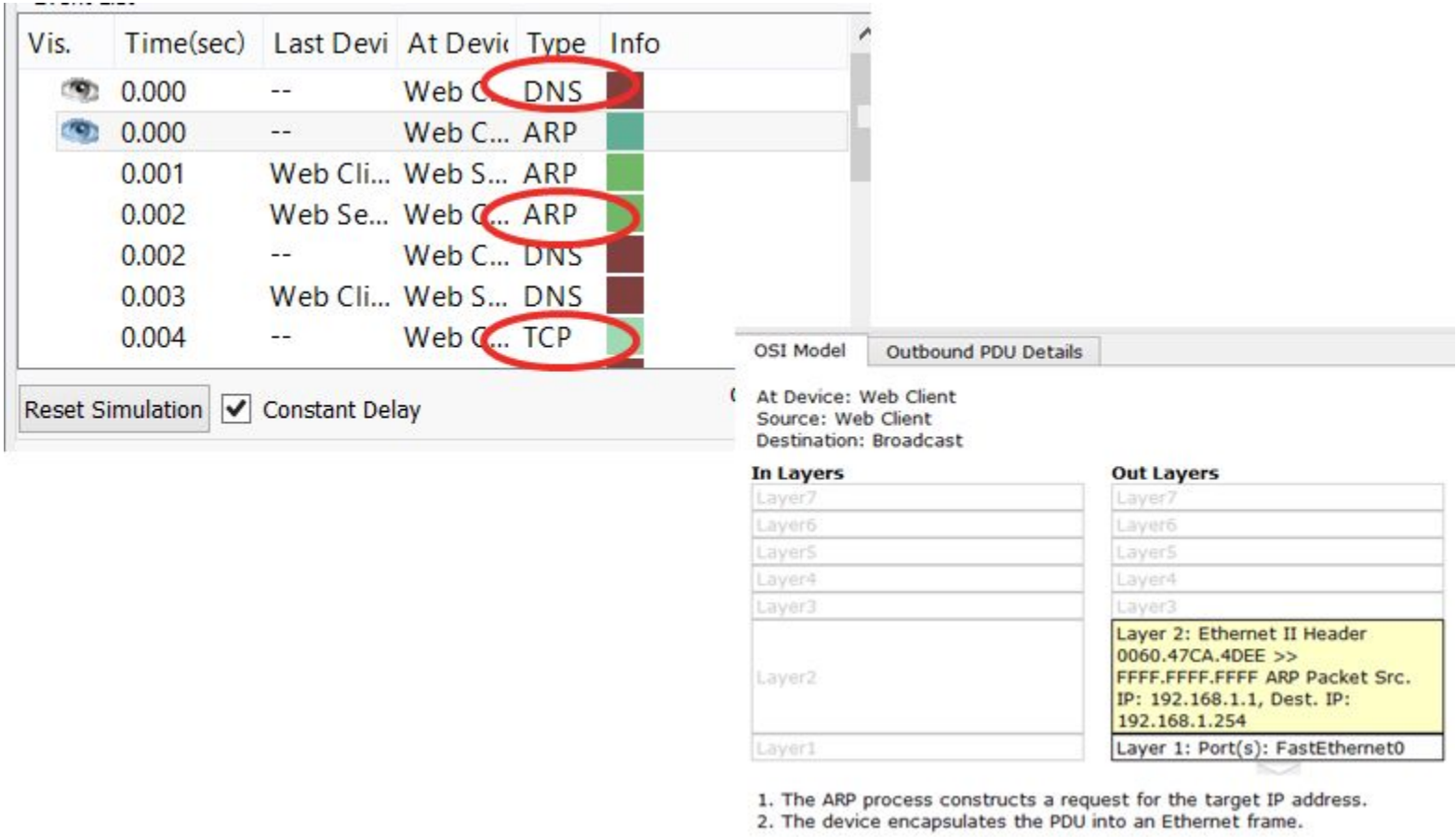
Step3: View the HTTP protocol



3.2.4: Reference Models

3.2.4.6 PT – Investigating the TCP/IP and OSI Models in Action

Step4: View the other protocols (DNS, ARP, TCP)

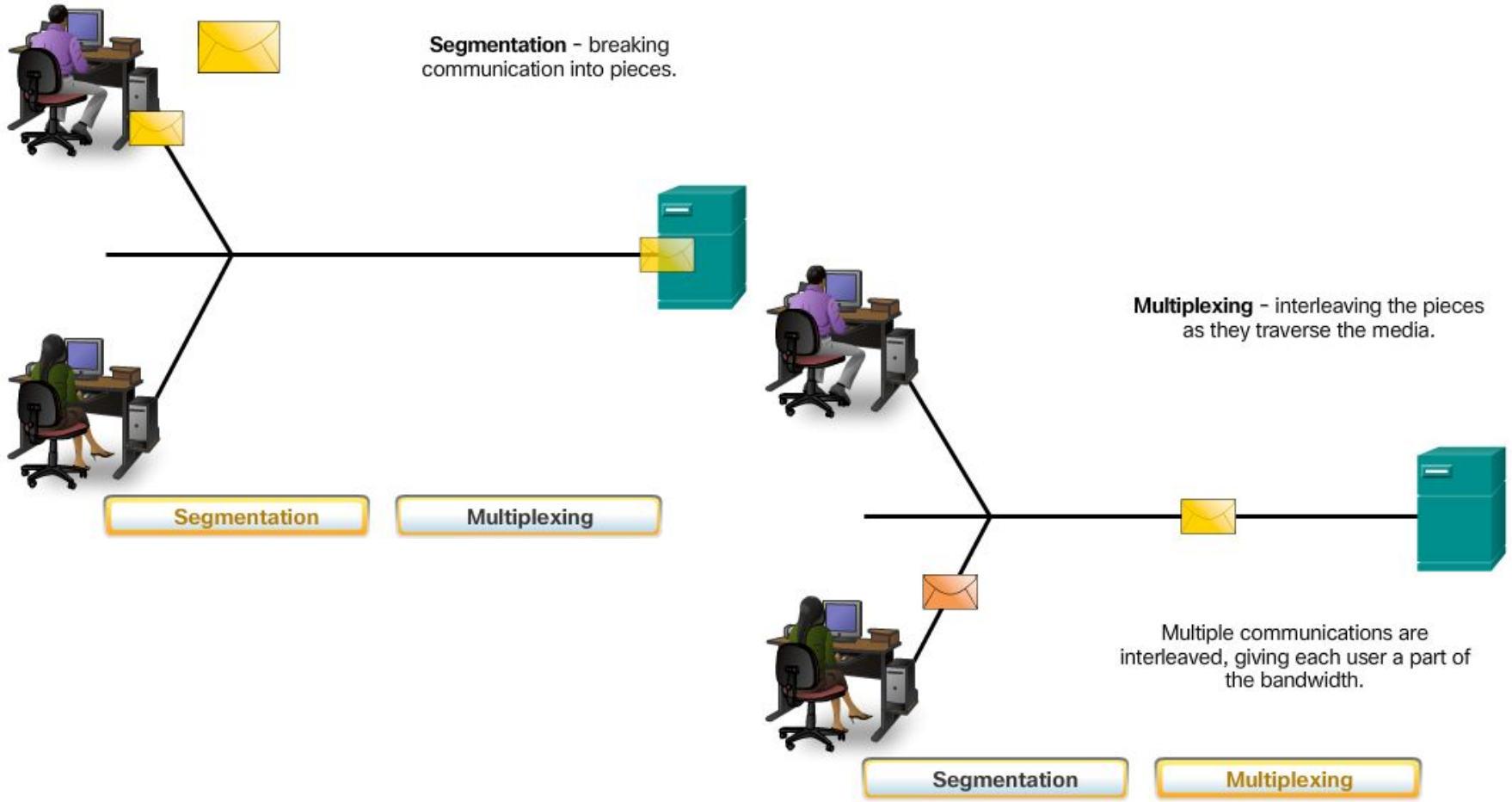


Section 3.3:
Data Transfer in the Network

3.3.1: Data Encapsulation
3.3.2:Data Access

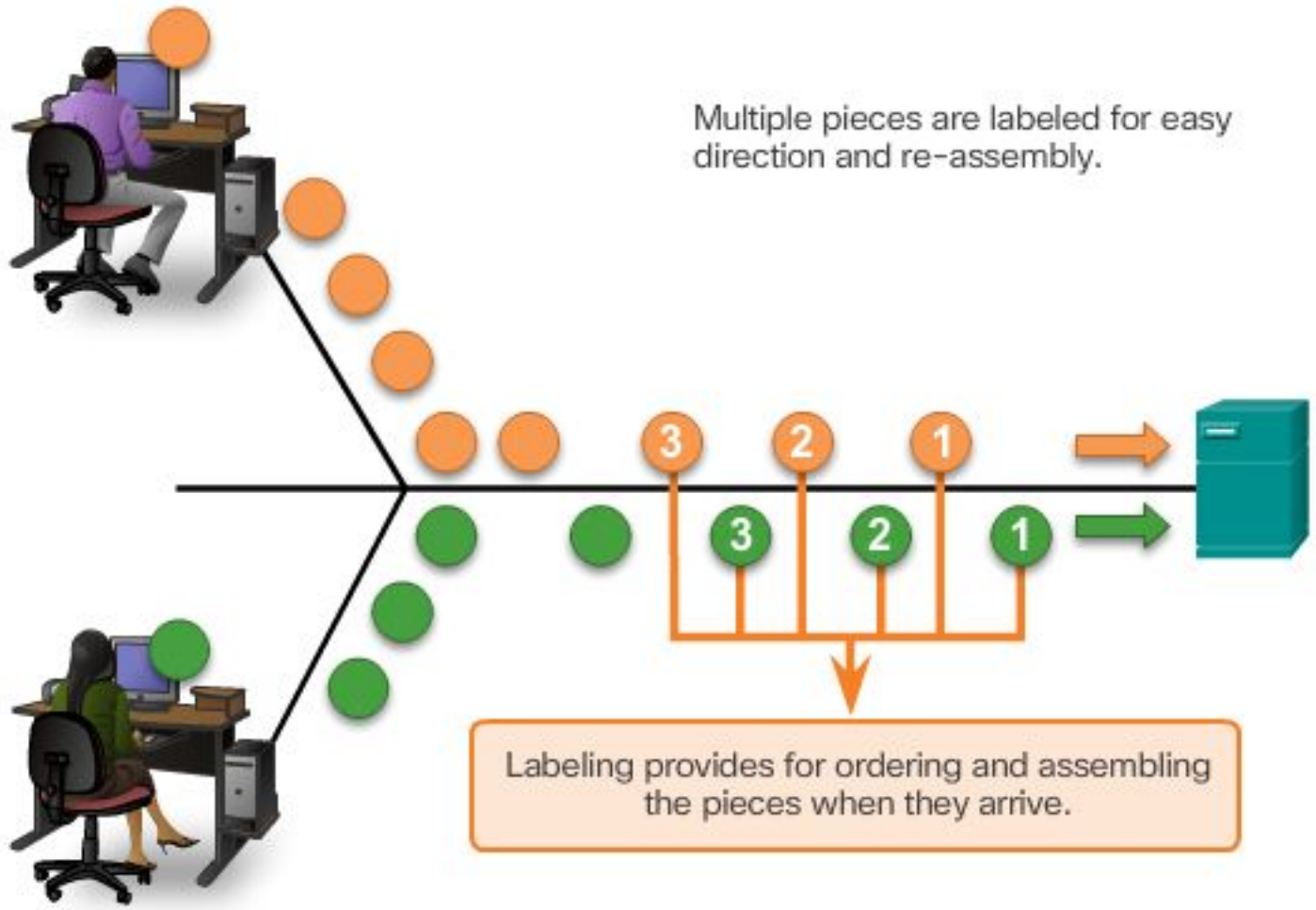
3.3.1.1 Message Segmentation

Communicating the Message



3.3.1.1 Message Segmentation (cont.)

Communicating the Message

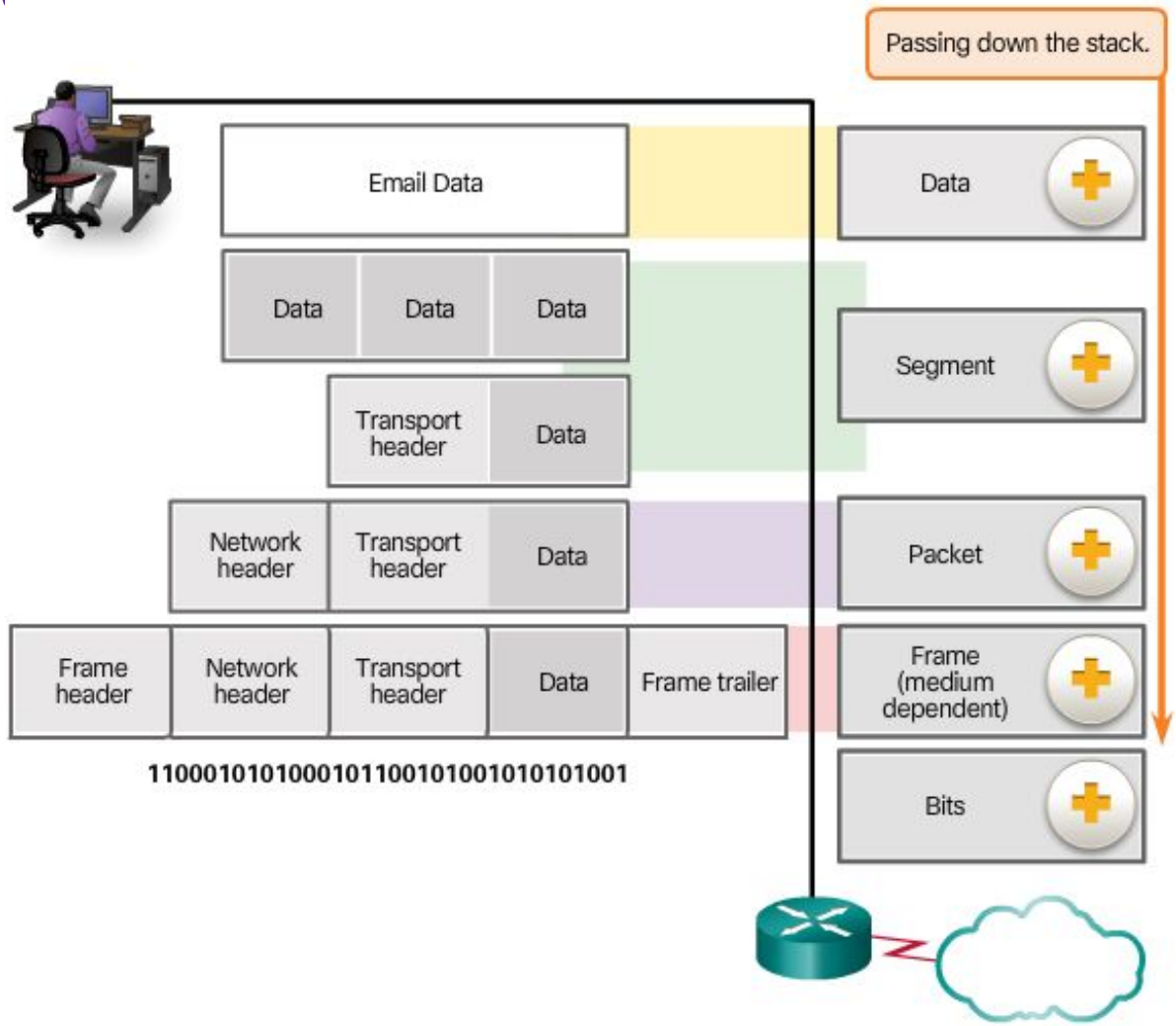


3.3.1: Data Encapsulation

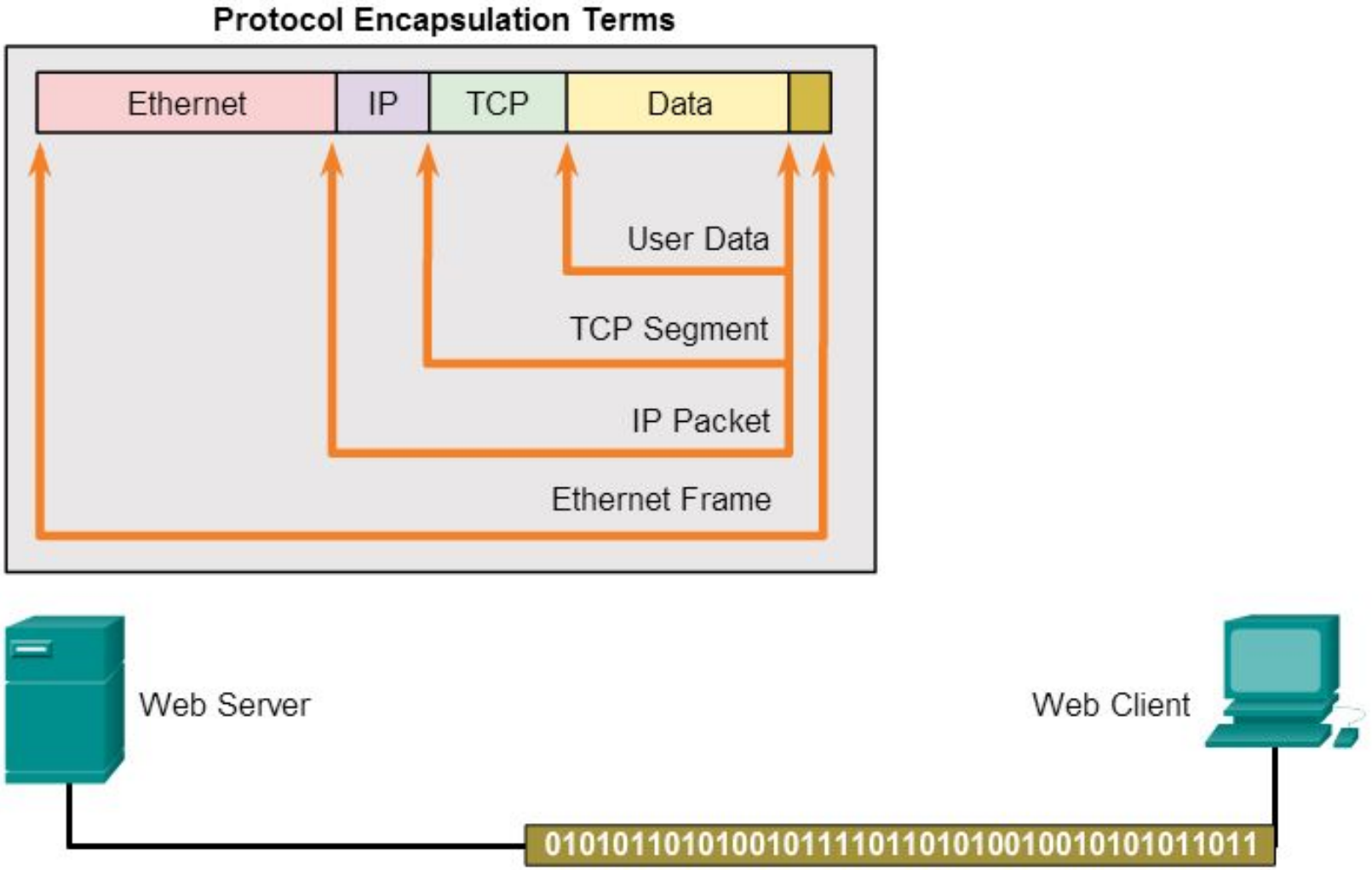
3.3.1.2 Protocol Data Units

Encapsulation

- Data
- Segment
- Packet
- Frame
- Bits

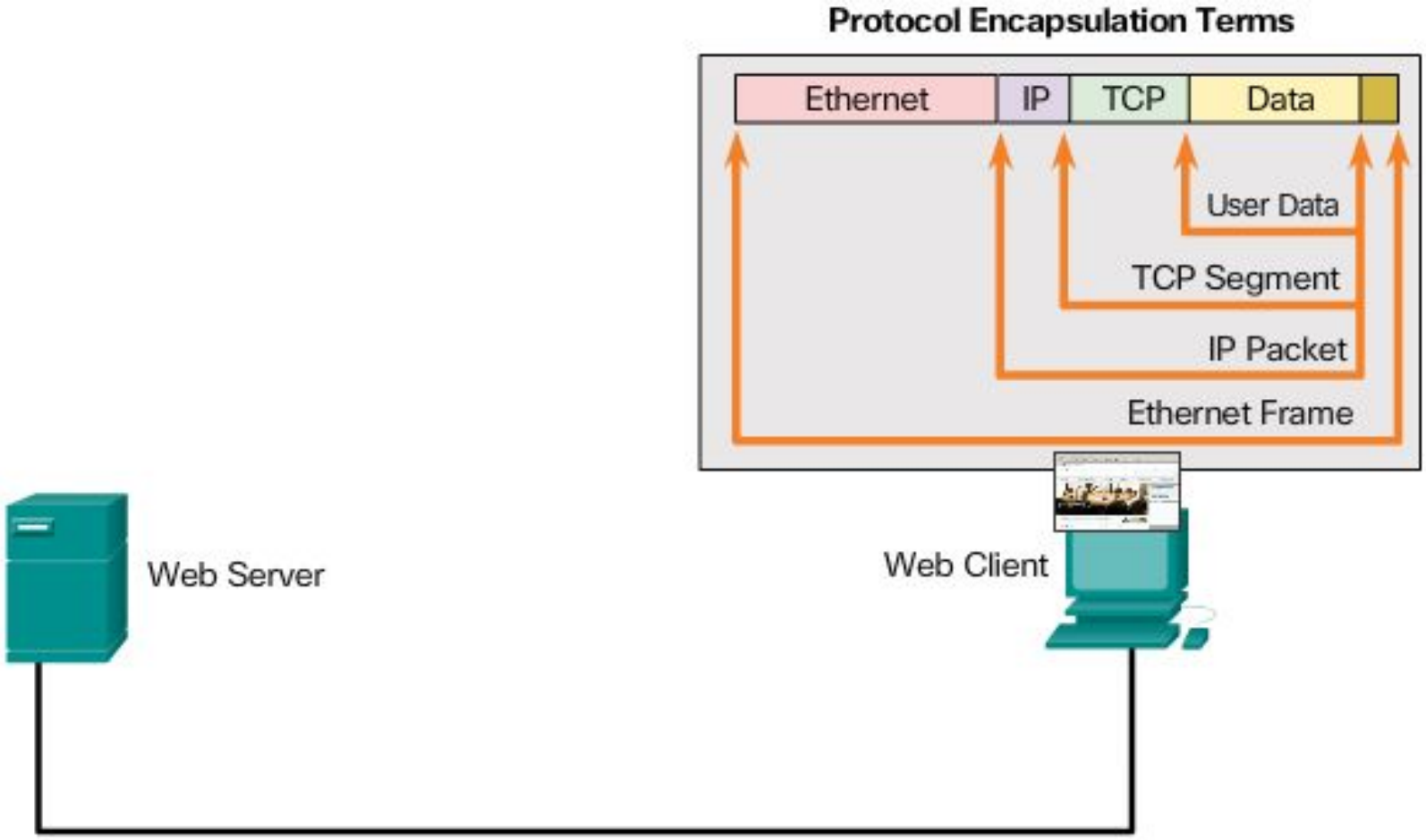


3.3.1.3 Encapsulation Example



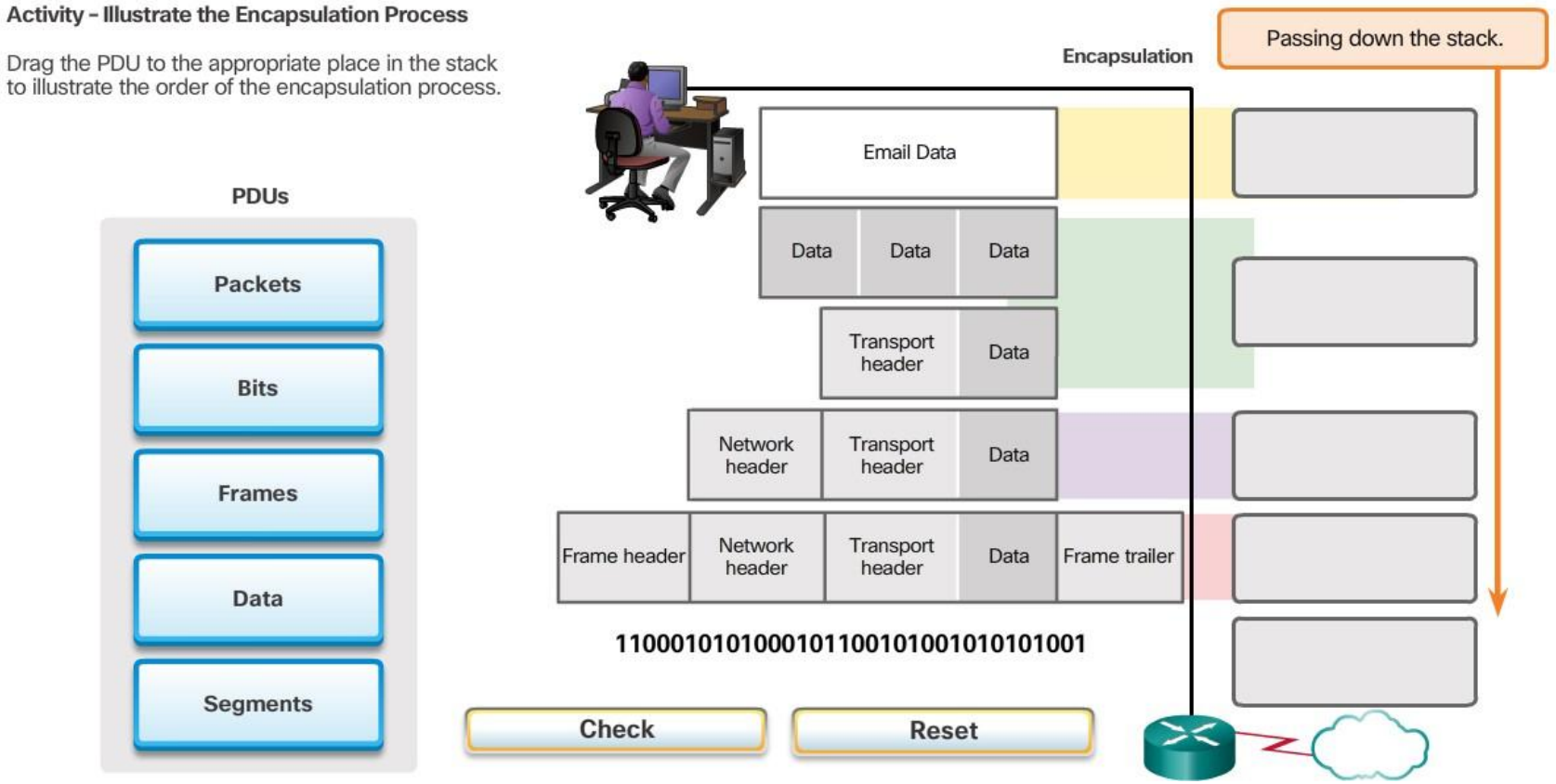
3.3.1: Data Encapsulation

3.3.1.4 De-Encapsulation



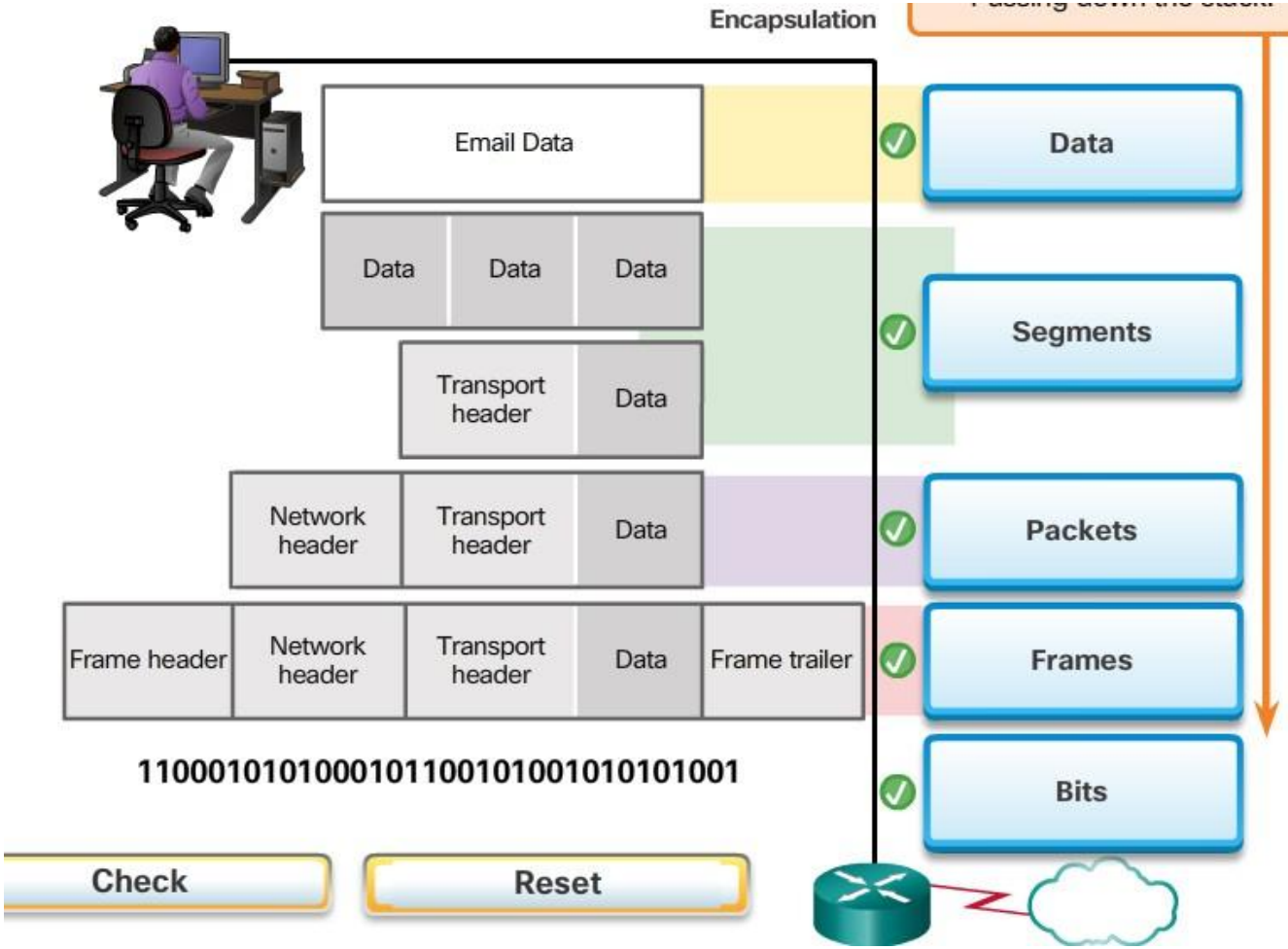
3.3.1: Data Encapsulation

3.3.1.5 Activity – Identify the PDU Layer



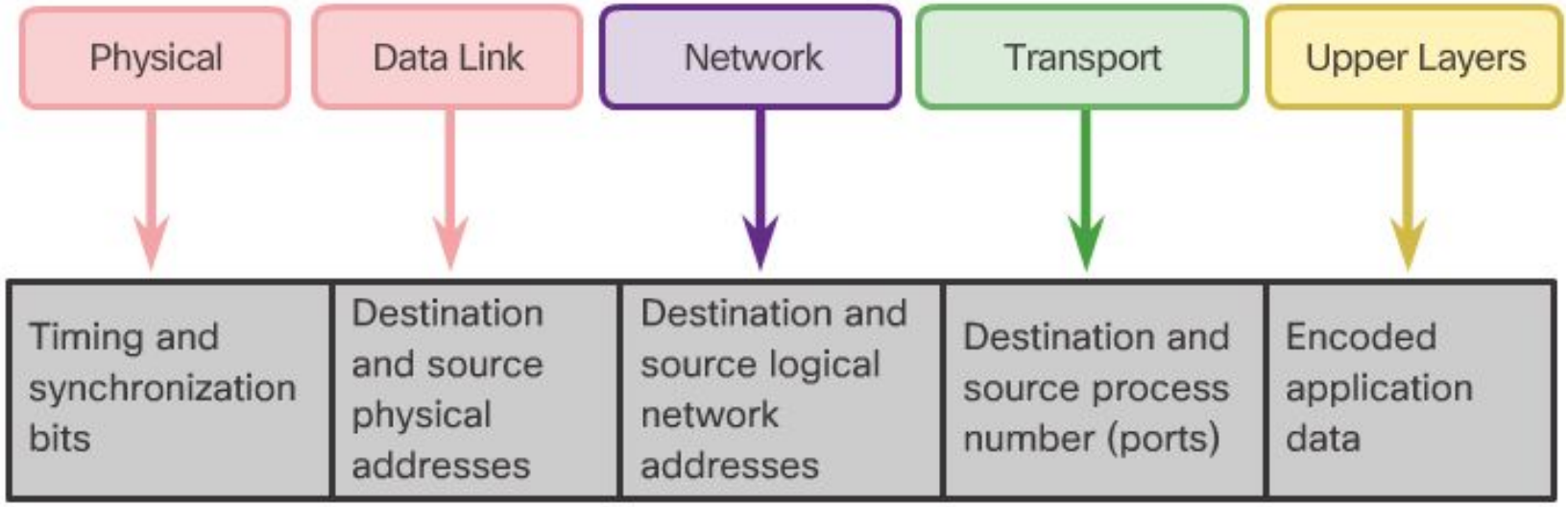
3.3.1: Data Encapsulation

3.3.1.5 Activity – Identify the PDU Layer



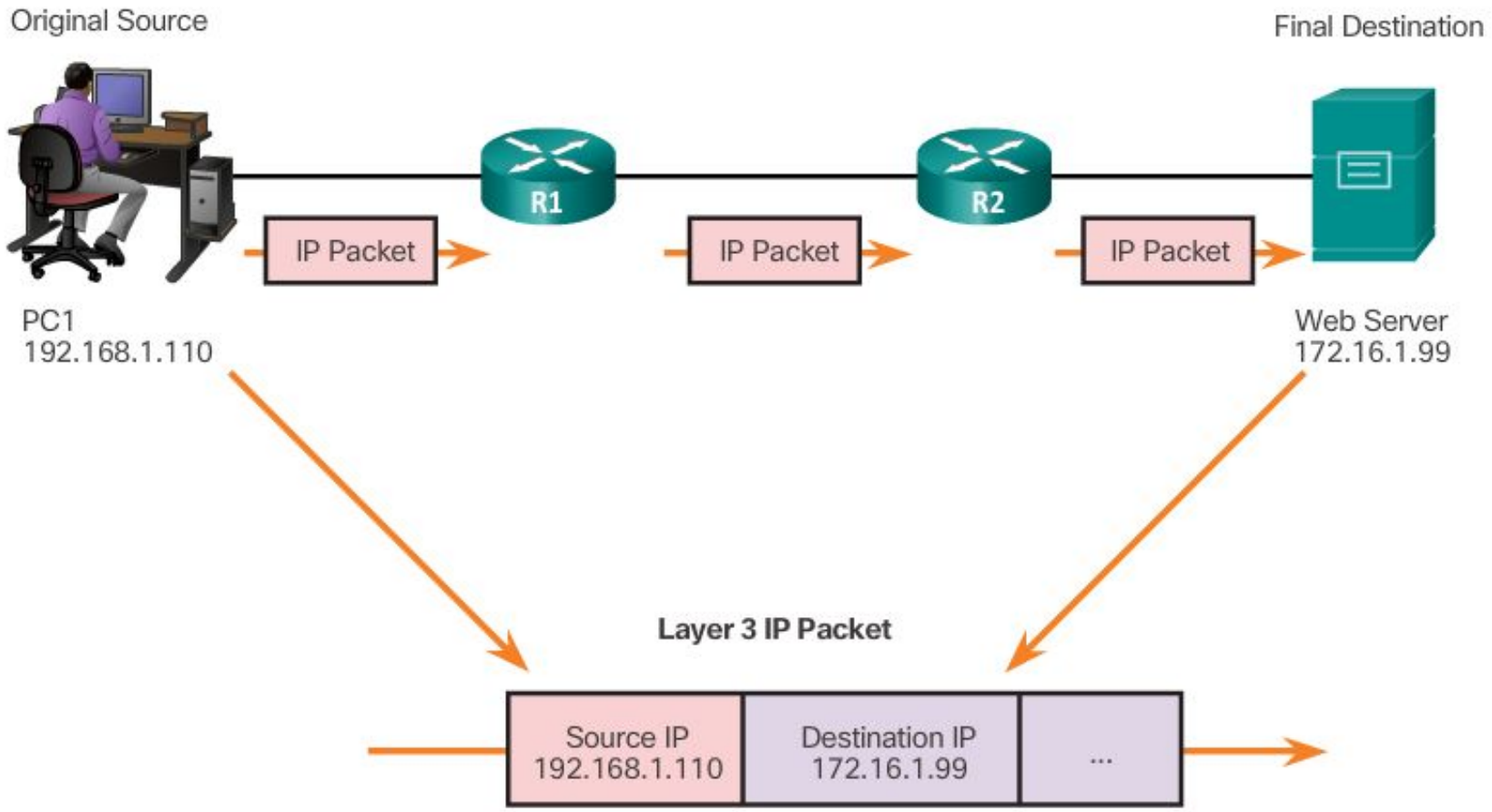
3.3.2.1 Network Addresses

Network Addresses and Data Link Addresses



3.3.2.1 Network Addresses (cont.)

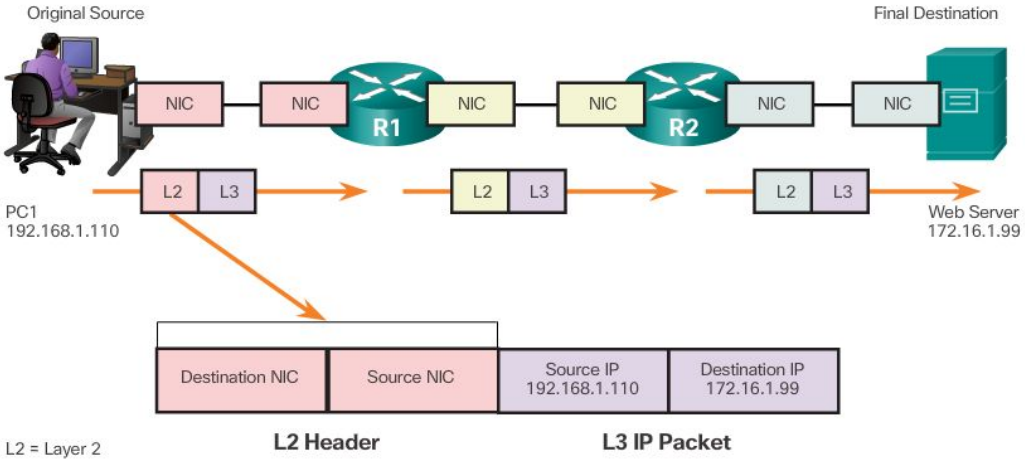
Layer 3 Network Addresses

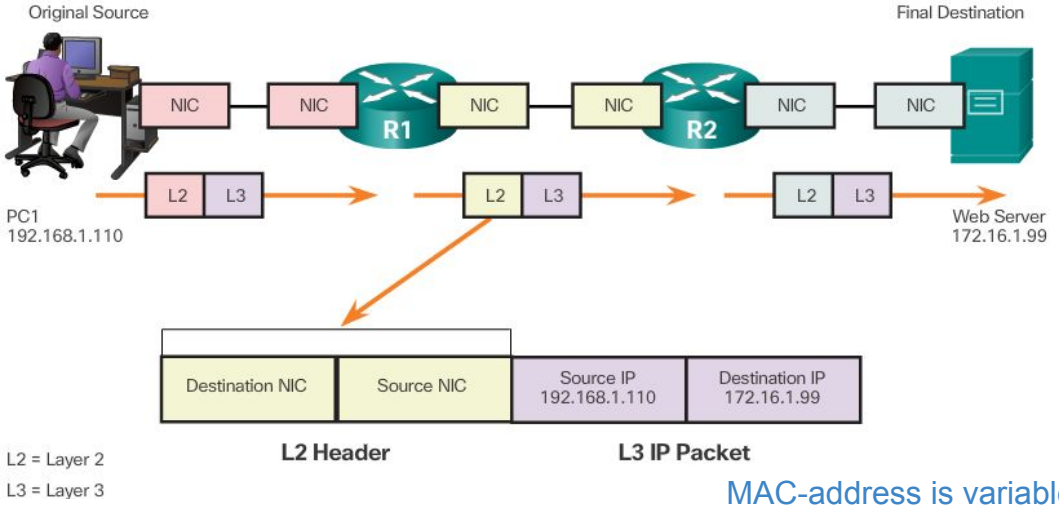


IP-address is fixed

3.3.2.2 Data Link Address

Layer 2 Data Link Addresses





MAC-address is variable

3.3.2.2 Data Link Addresses

Network Address

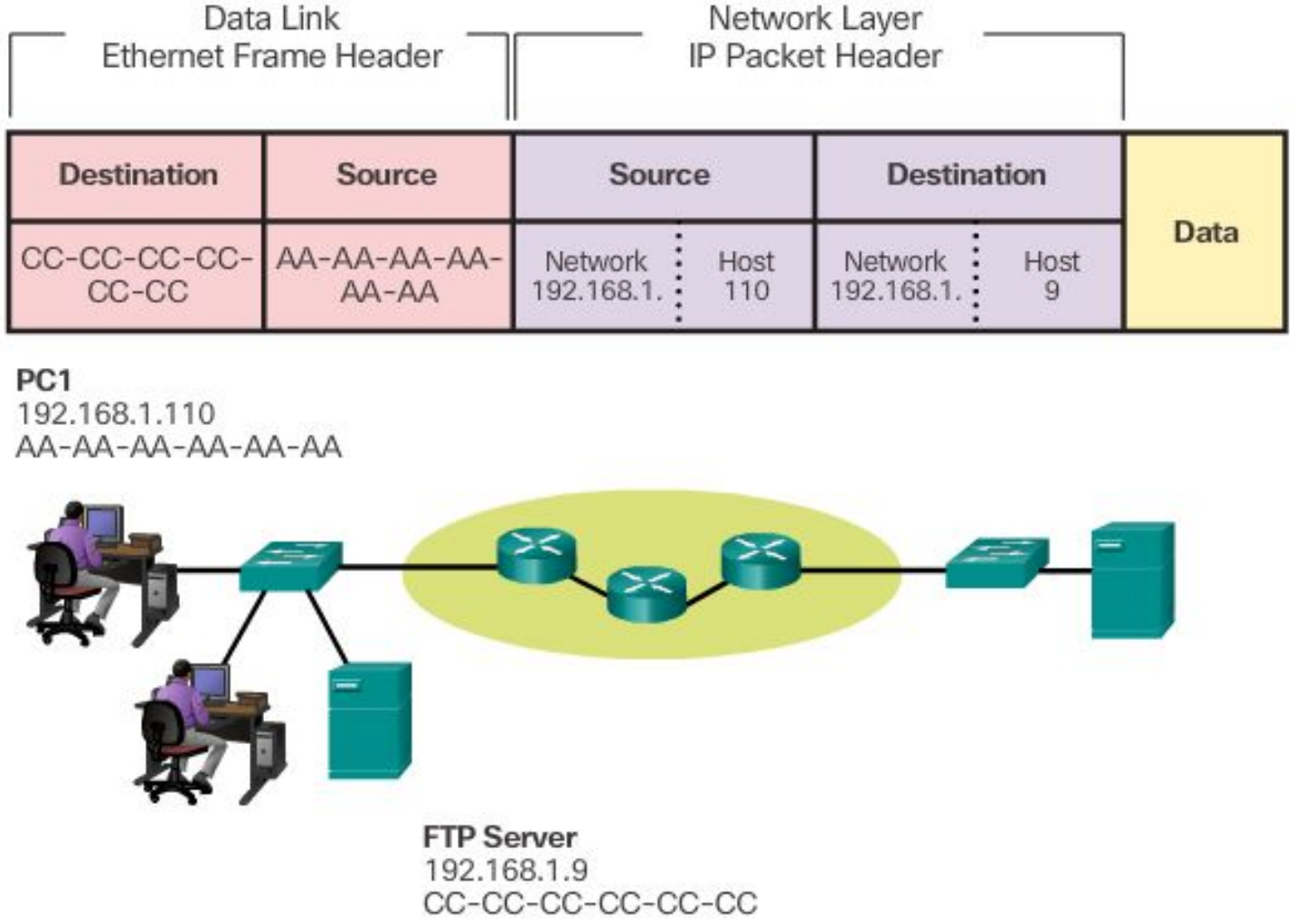
- Source IP address
- Destination IP address
- Responsible for delivering the IP packet from the original source to the final destination, either on the same network or to a remote network.

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

3.3.2: Data Access

3.3.2.3 Devices on the Same Network



3.3.2.3 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.

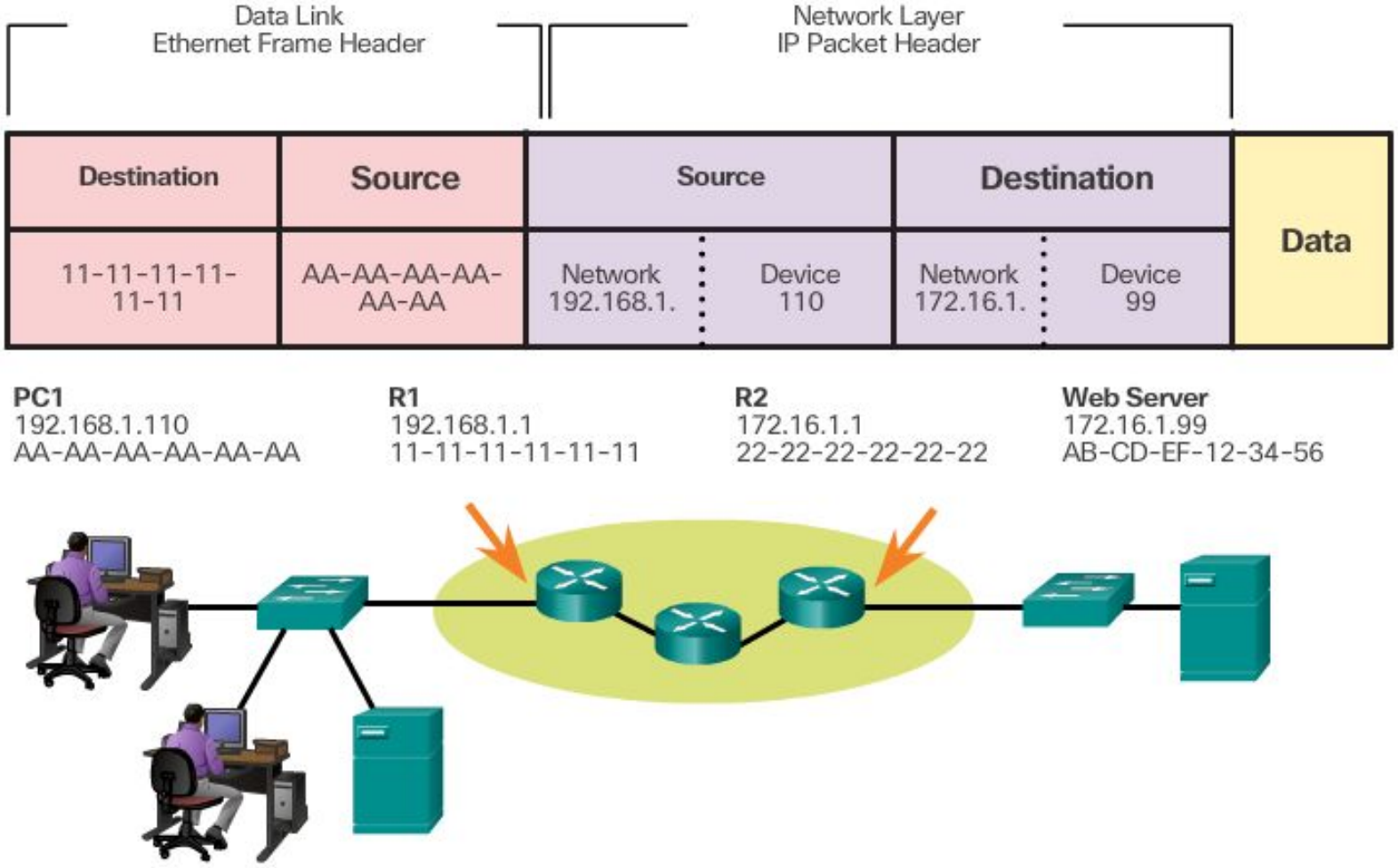
  Host portion – The remaining part of the address that identifies a specific device on the network.

- 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.

3.3.2.4 Devices on a Remote Network



3.3.2.4 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.

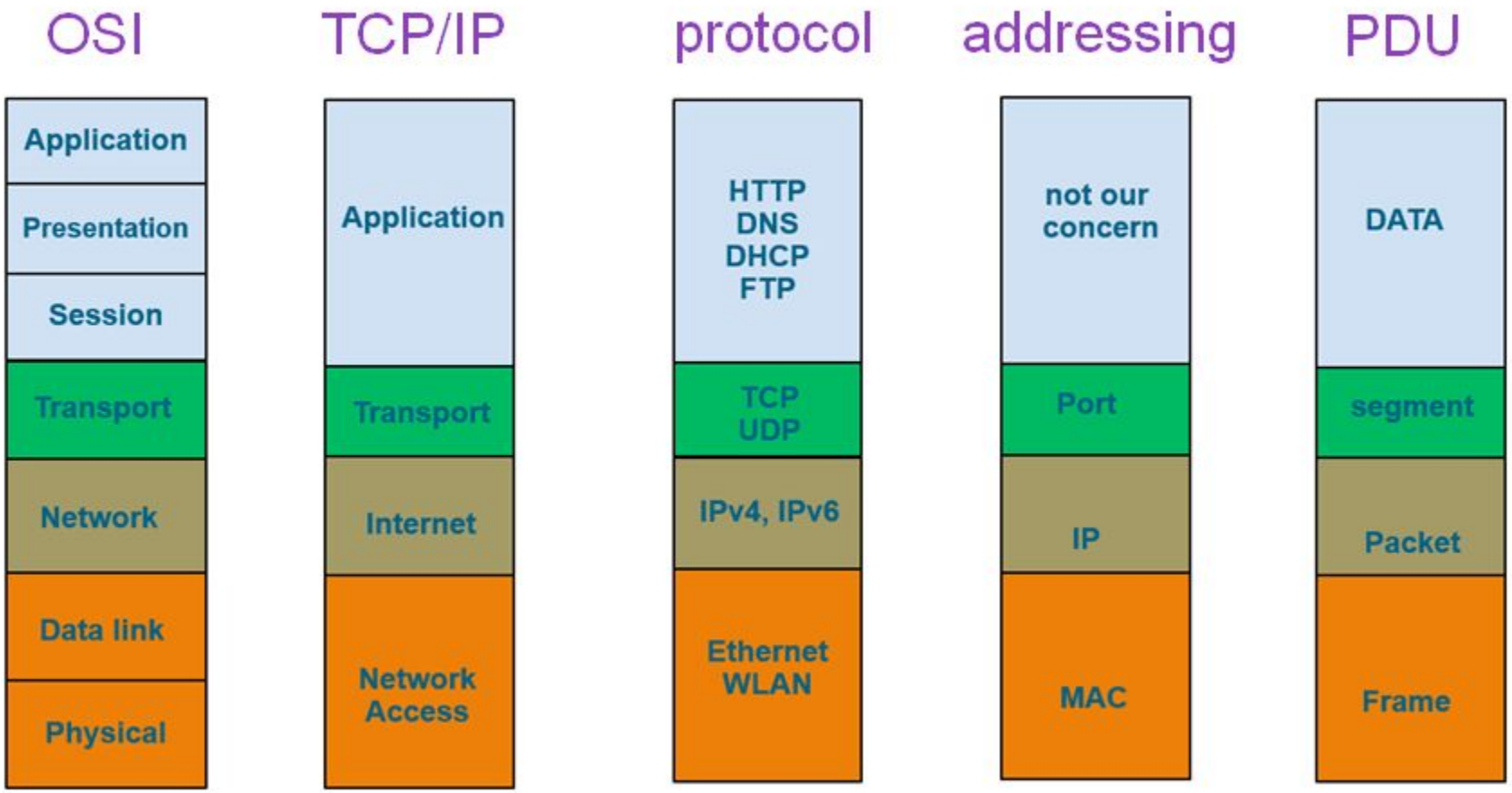
Role of the Data Link Layer Addresses

- 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.

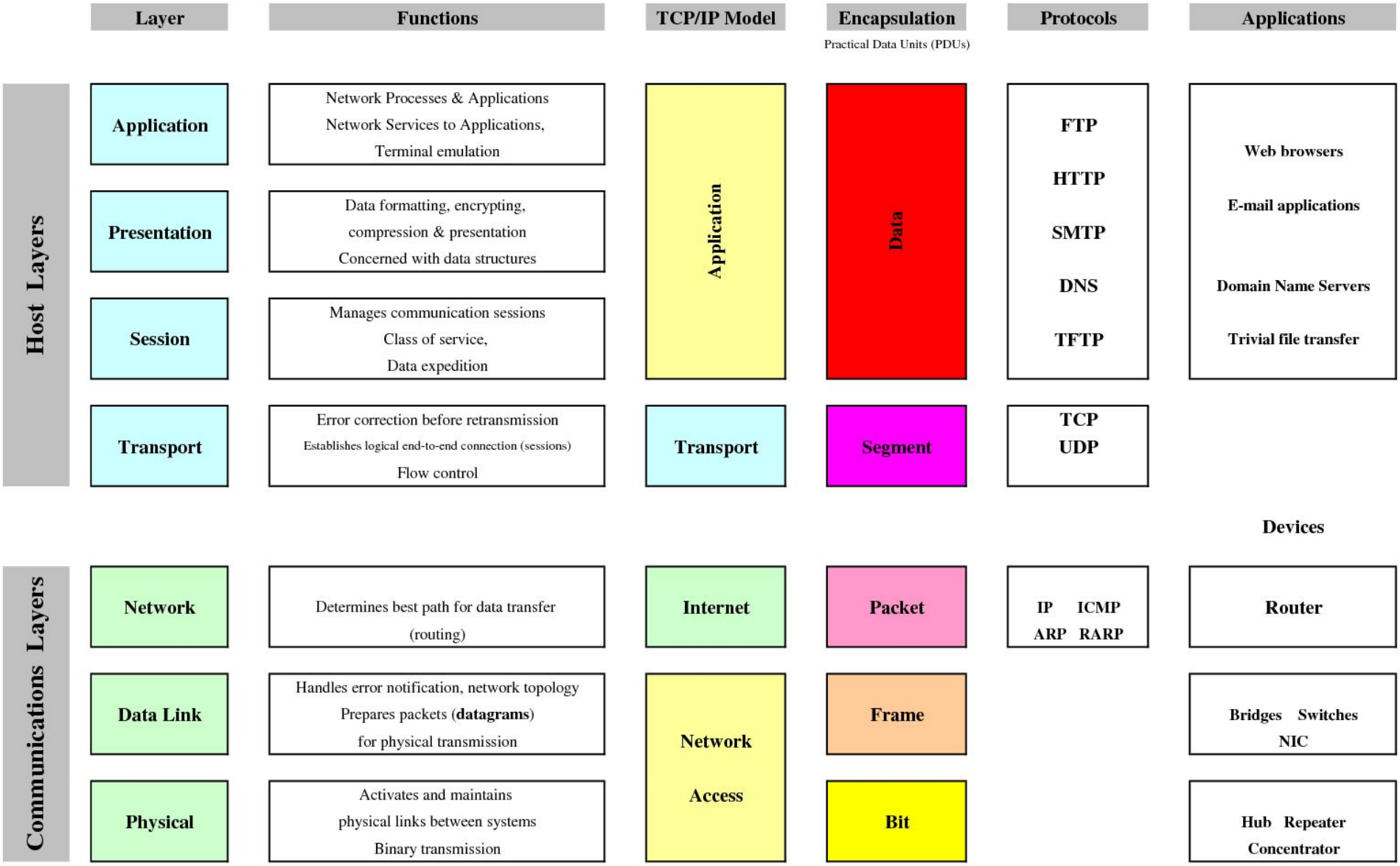
Section 3.4: Summary

- 3.0 Introduction
- 3.1 Rules of Communication
- 3.2 Network Protocols and Standards
- 3.3 Data Transfer in the Network

3.4 Summary



3.4 Summary


Layer
Functions
TCP/IP Model
Encapsulation
Practical Data Units (PDUs)
Protocols
Applications
Host Layers
Application
Network Processes & Applications
Network Services to Applications,
Terminal emulation
Application
Data
FTP
HTTP
SMTP
DNS
TFTP
Web browsers
E-mail applications
Domain Name Servers
Trivial file transfer
Presentation
Data formatting, encrypting,
compression & presentation
Concerned with data structures
Session
Manages communication sessions
Class of service,
Data expedition
Transport
Error correction before retransmission
Establishes logical end-to-end connection (sessions)
Flow control
Transport
Segment
TCP
UDP
Devices
Communications Layers
Network
Determines best path for data transfer
(routing)
Internet
Packet
IP ICMP
ARP RARP
Router
Data Link
Handles error notification, network topology
Prepares packets (datagrams)
for physical transmission
Network
Access
Frame
Bridges Switches
NIC
Physical
Activates and maintains
physical links between systems
Binary transmission
Bit
Hub Repeater
Concentrator

3.4 Summary

Data access

- Layer 2 addressing
  - MAC address (NIC)
  - Communicate on the same network (till gateway)
- Layer 3 addressing
  - IP address
  - Communicate on different network (through gateway)