Network Reference Models

Reference Models

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

Where is the Café?

Content layer

Conversation Protocol Suite

1. Use a Common Language
2. Wait Your Turn
3. Signal When Finished

Rules layer

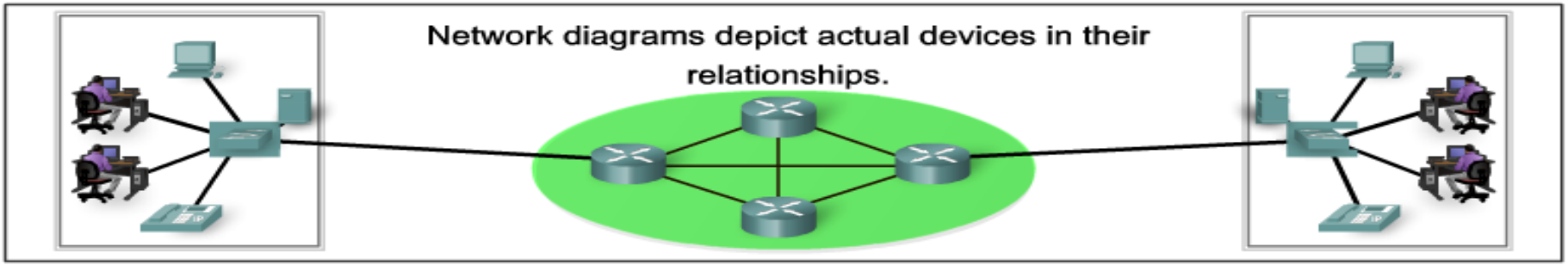
Physical layer

Reference Models

- a framework (guideline) for network implementation and troubleshooting
- divides complex functions into simpler components
- Importance of reference model:
  - ✓Vendor interoperability “standardization”.
  - ✓Better understanding of data transfer
- Reference model types :
  - ✓OSI (Open System Interconnection).
  - ✓TCP/IP (DOD Model).
  - ✓Other Models.

Reference Models

Models Provide Guidance



OSI Model

- Application
- Presentation
- Session
- Transport
- Network
- Data Link
- Physical

A networking model is only a representation of network operation. The model is not the actual network.

TCP/IP Model

- Application
- Transport
- Internet
- Network Access

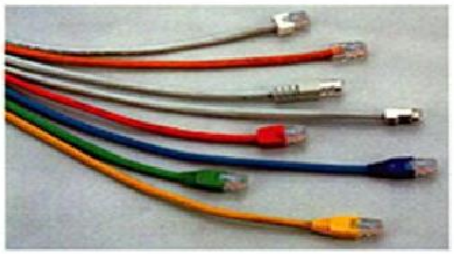
Reference Models

Physical

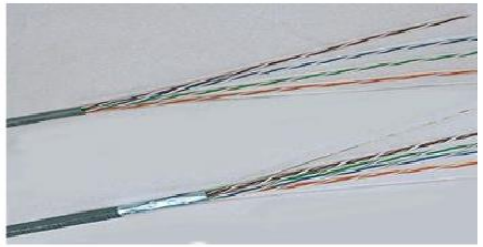
The Physical layer protocols describe the mechanical, electrical, functional, and procedural means to activate, maintain, and de-activate physical-connections for bit transmission to and from a network device.

Network media

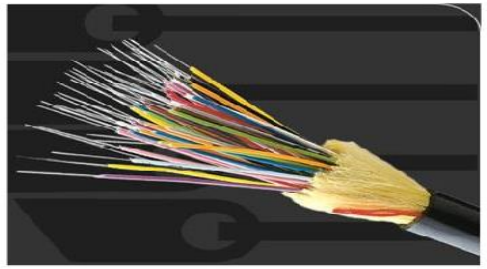
Network Media



Copper



Fiber Optics



Wireless

Reference Models

Data Link

The Data Link layer protocols describe methods for exchanging data frames between devices over a common media.

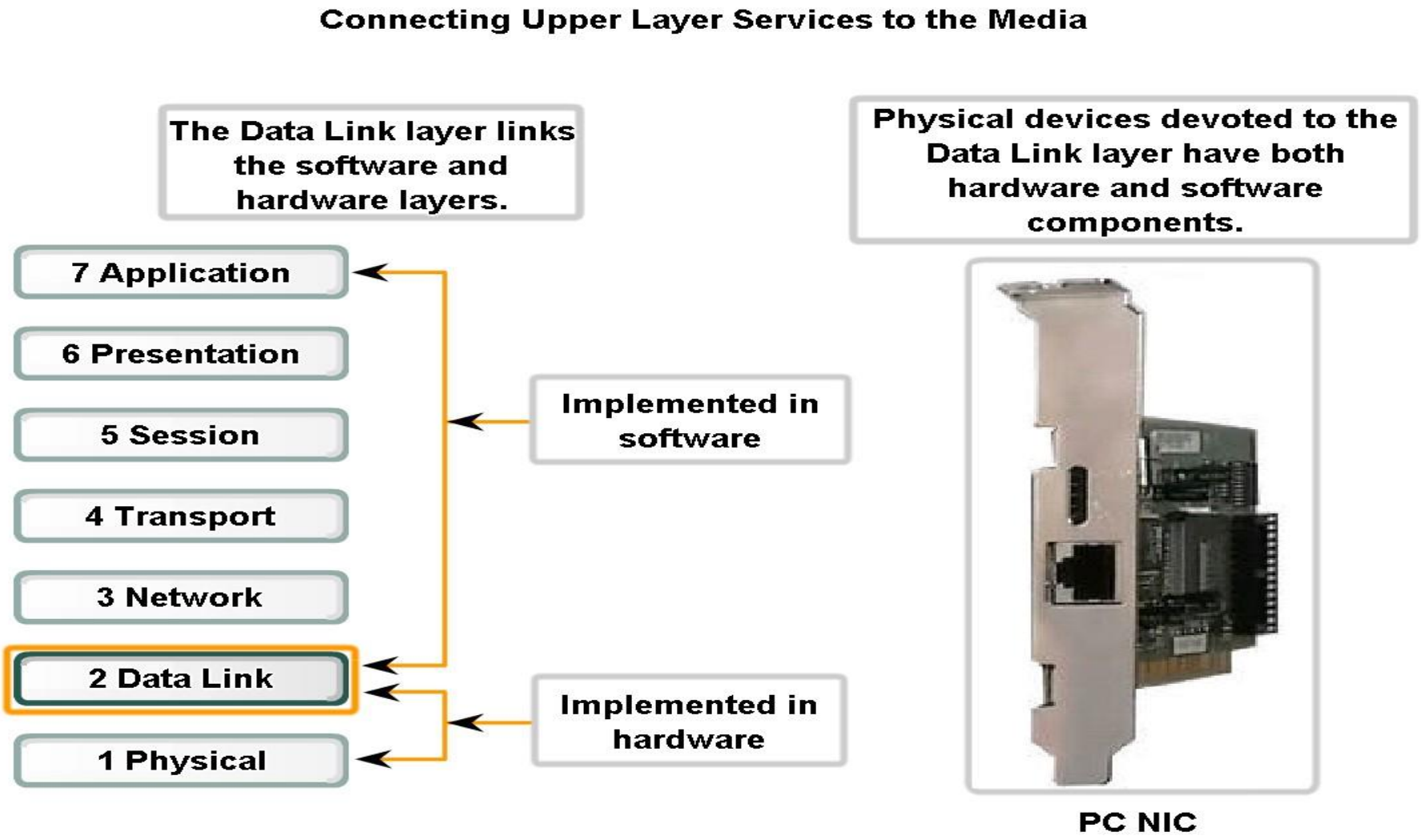
Data Link Layer – Accessing the Media

- Data link layer is responsible to provide an error-free transmission of information between two end stations.

- **Functions:**
  - Link establishment and termination
  - Frame traffic control
  - Physical addressing (**MAC addressing**)
  - Frame sequencing through the use of FCS (Frame Check Sequence)
  - Error Detection through the use of CRC (Cyclic Redundancy check)

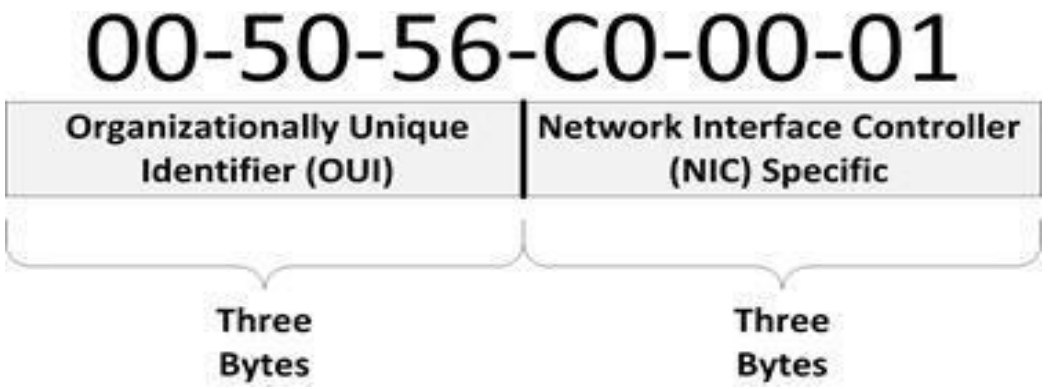
Data Link Layer – Accessing the Media

- Data Link layer links the software and hardware



MAC Address

- Unique, 48-bit unicast address assigned to each adapter (12 in Hex)
- Physical address
- Each manufacturer gets their own address range
- Cant be changed
- broadcast: all 1s
- multicast: first bit is 1



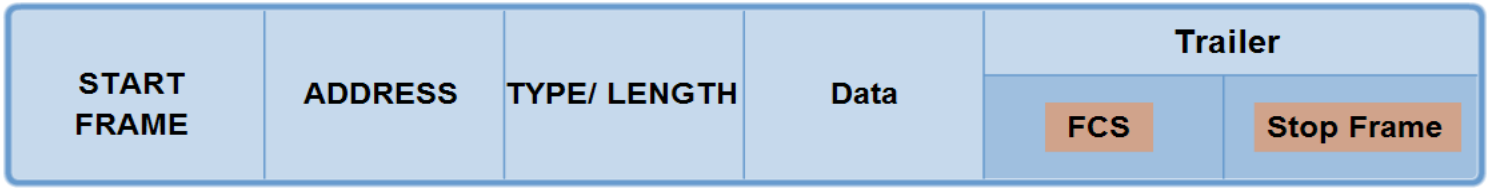
Frame Check Sequence (FCS)

- Each frame is given (assigned) a certain number.
- If frames arrives out of order, the frame sequencing number

is used to rearrange the frames in the correct order.

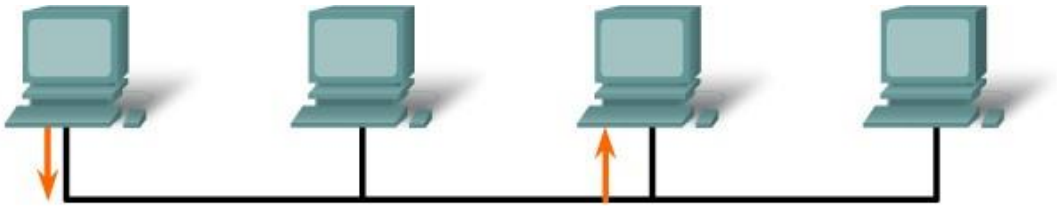
- If an error is detected within a frame (corrupted), the frame number is used to inform the transport layer to retransmit the corrupted frame.

The Role of the Trailer

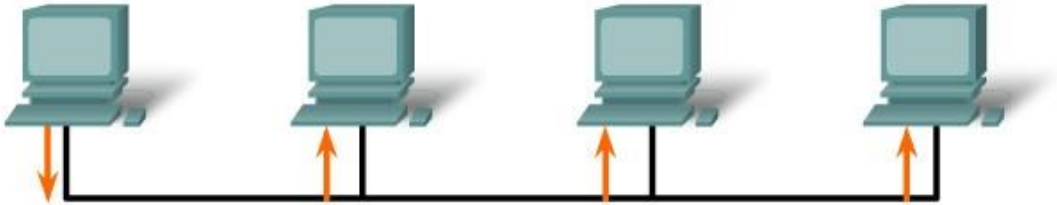


Types of Traffic Transmission

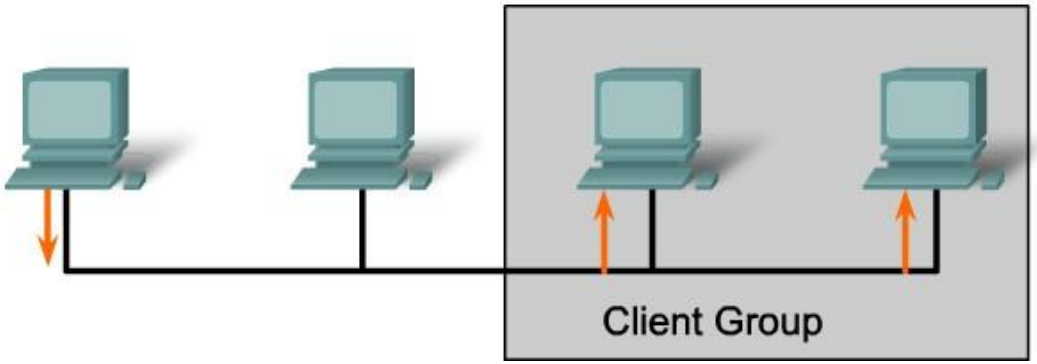
Unicast:
One sender and one receiver



Broadcast:
One sender to all other addresses



Multicast:
One sender to a group of addresses



Collision Domain

- Collision is the effect of two nodes sending transmissions simultaneously in Ethernet.
- When they meet on the physical media, the frames from each node collide and are damaged.
- Collision Domain is the network area in Ethernet over which

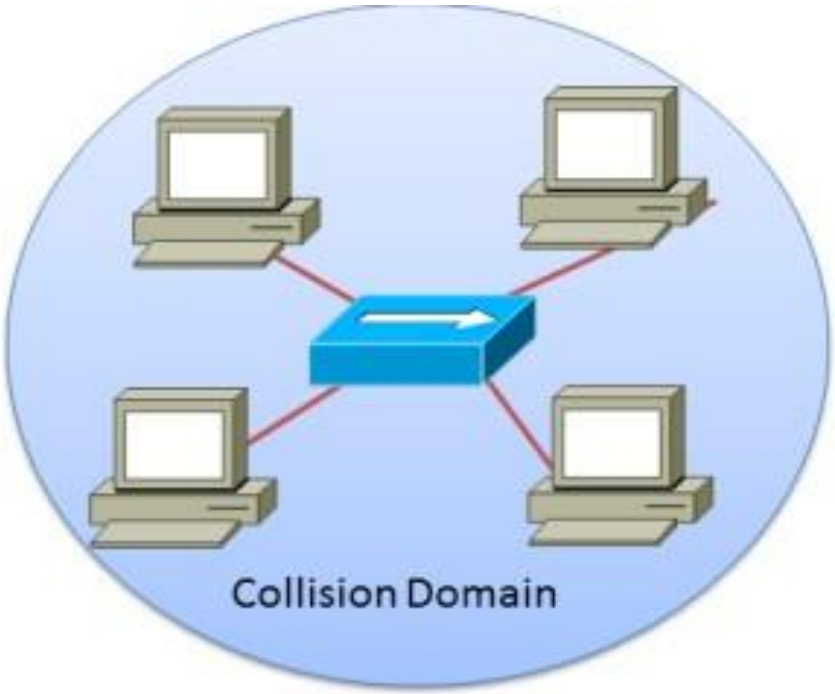
frames that have collided will be detected.

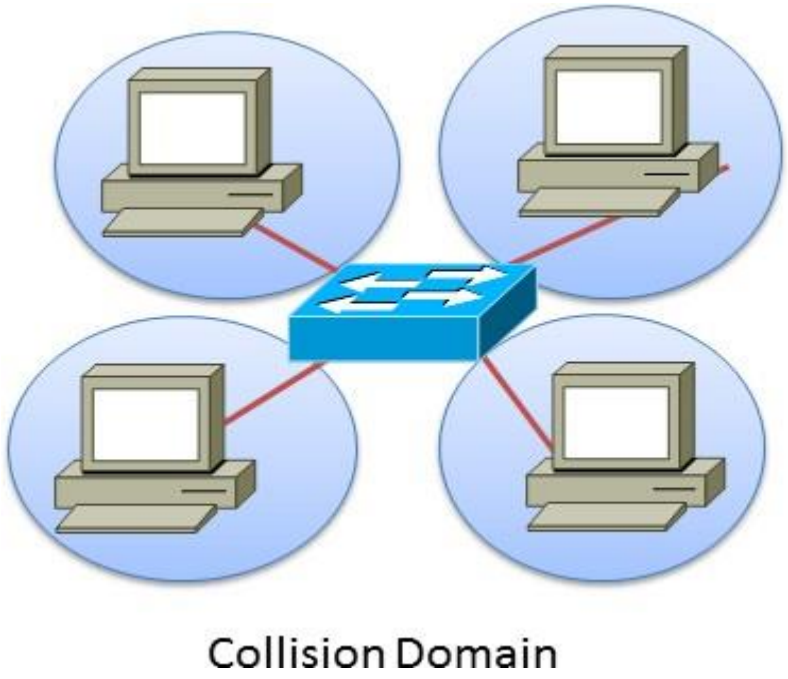
- Collisions are propagated by hubs and repeaters
- Collisions are Not propagated by switches, routers, or bridges

Collision Domain

- A collision domain is the segment where devices must compete to communicate.
  - All ports of a hub belong to the same collision domain.
  - Every port of a switch is a collision domain on its own.
  - A switch break the segment into smaller collision domains, easing device competition.

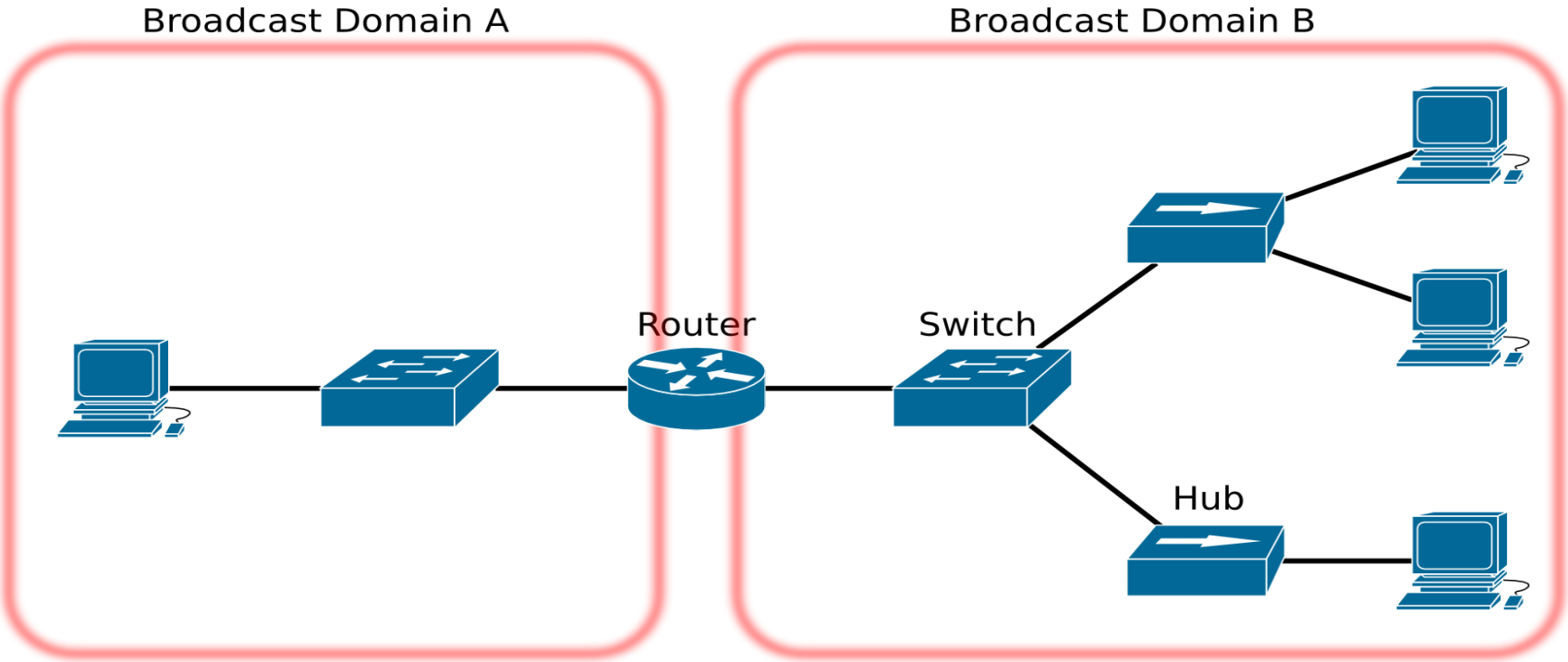
Collision Domain





Broadcast Domain

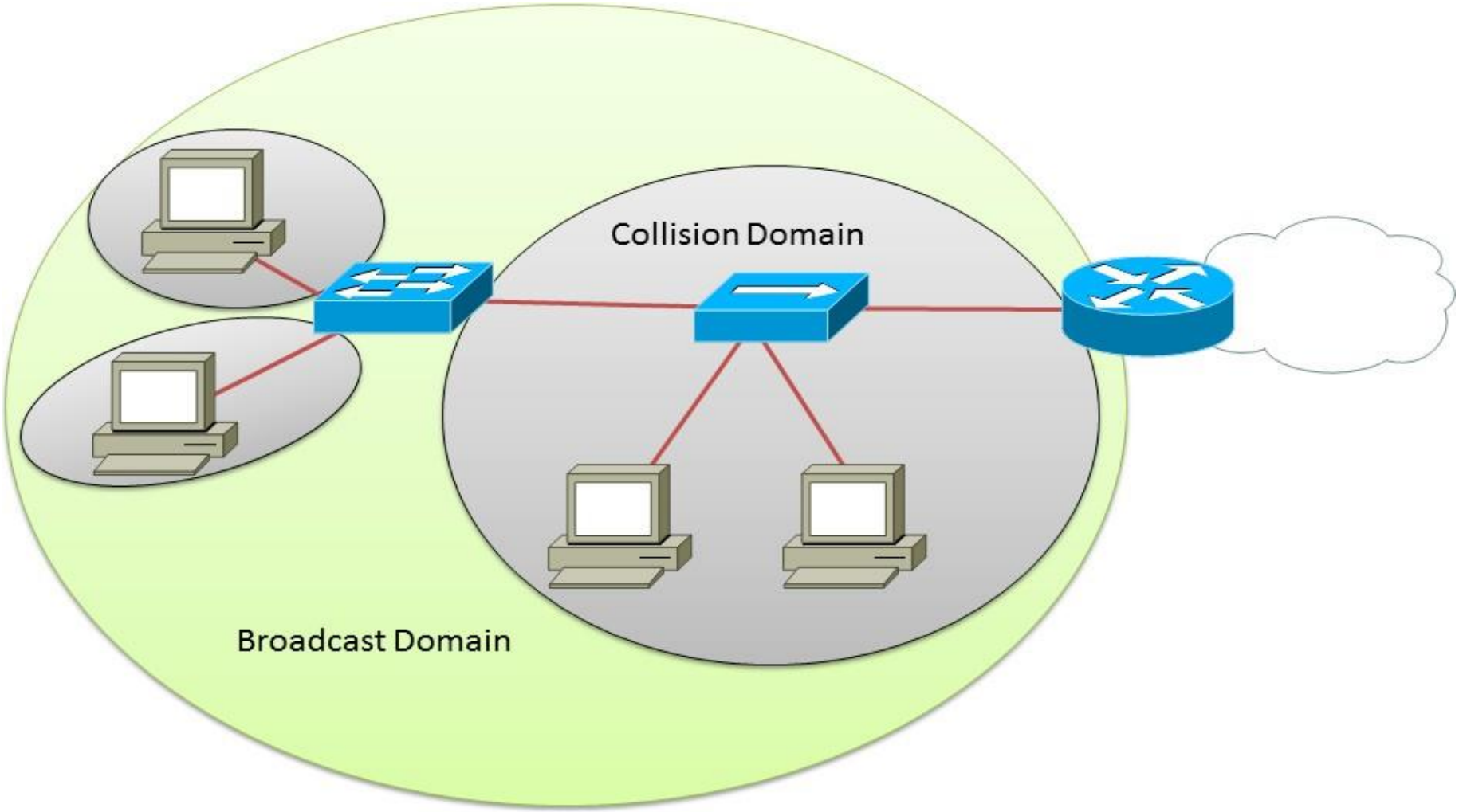
- A group of devices receiving broadcast frames initiating from any device within the group
- Routers do not forward broadcast frames, broadcast domains are not forwarded from one broadcast to another.



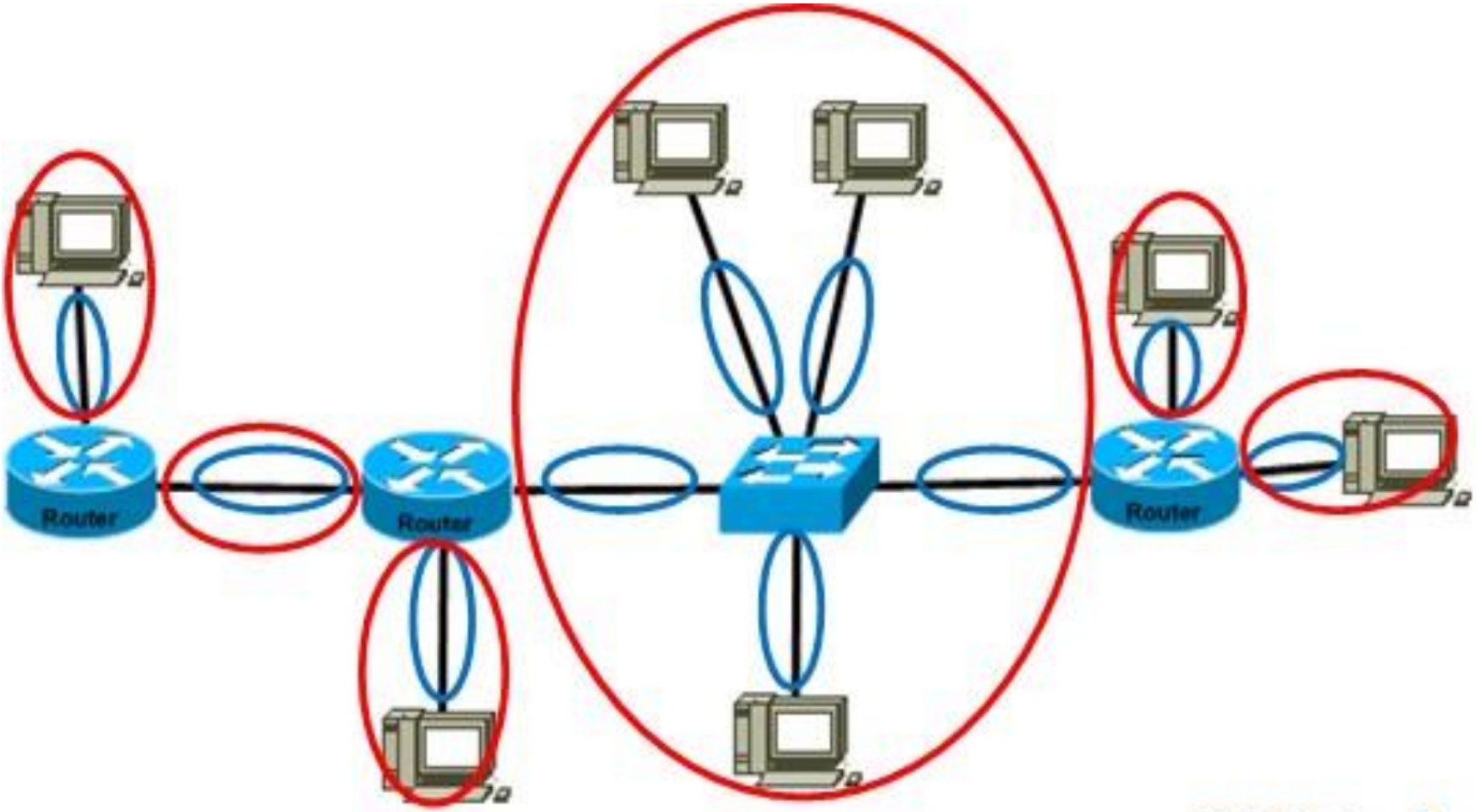
Broadcast Domain

- A broadcast domain is the extend of the network where a broadcast frame can be heard.
  - Switches forward broadcast frames to all ports; therefore, switches do not break broadcast domains.
  - All ports of a switch, with its default configuration, belong to the same broadcast domain.
  - If two or more switches are connected, broadcasts are forwarded to all ports of all switches, except for the port that originally received the broadcast.

Collision Domain & Broadcast



Collision Domain & Broadcast Domain



Reference Models

Network

The Network layer provides services to exchange the individual pieces of data over the network between identified end devices.

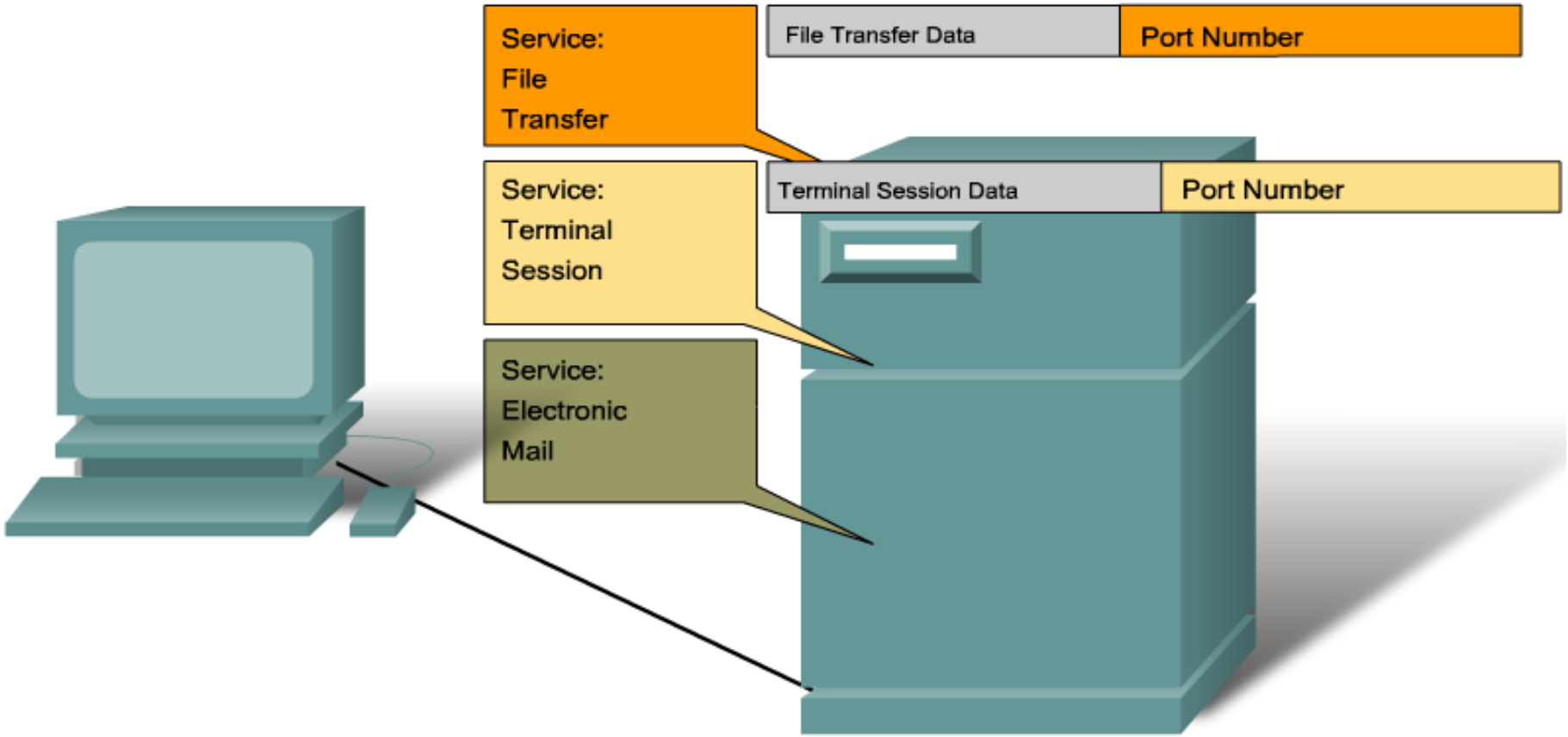
Reference Models

Transport

The Transport layer defines services to segment, transfer, and reassemble the data for individual communications between the end devices.

Reference Models

At the end device, the service port number directs the data to the correct conversation.

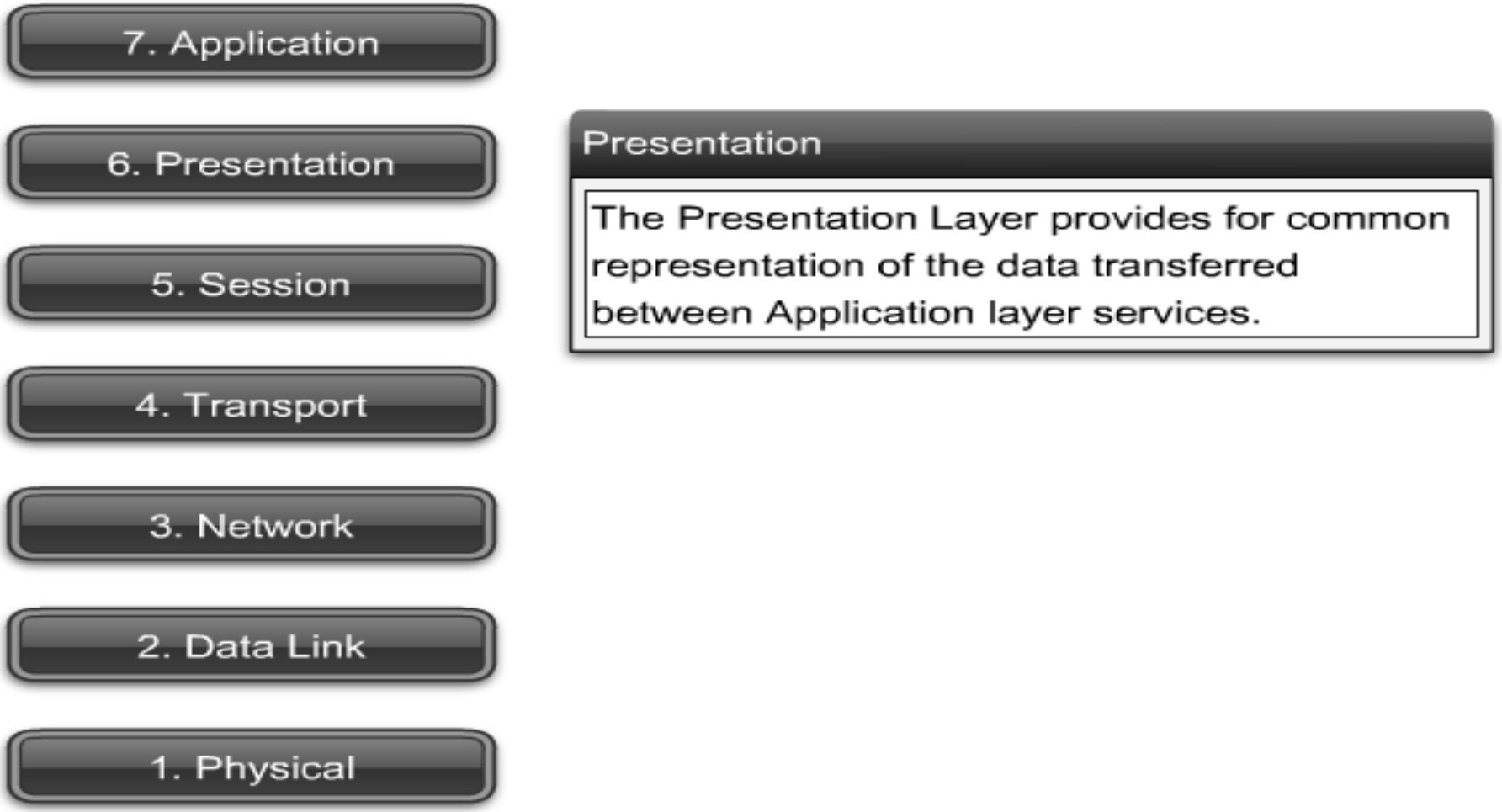


Reference Models

Session

The Session layer provides services to the Presentation layer to organize its dialogue and to manage data exchange.

Reference Models



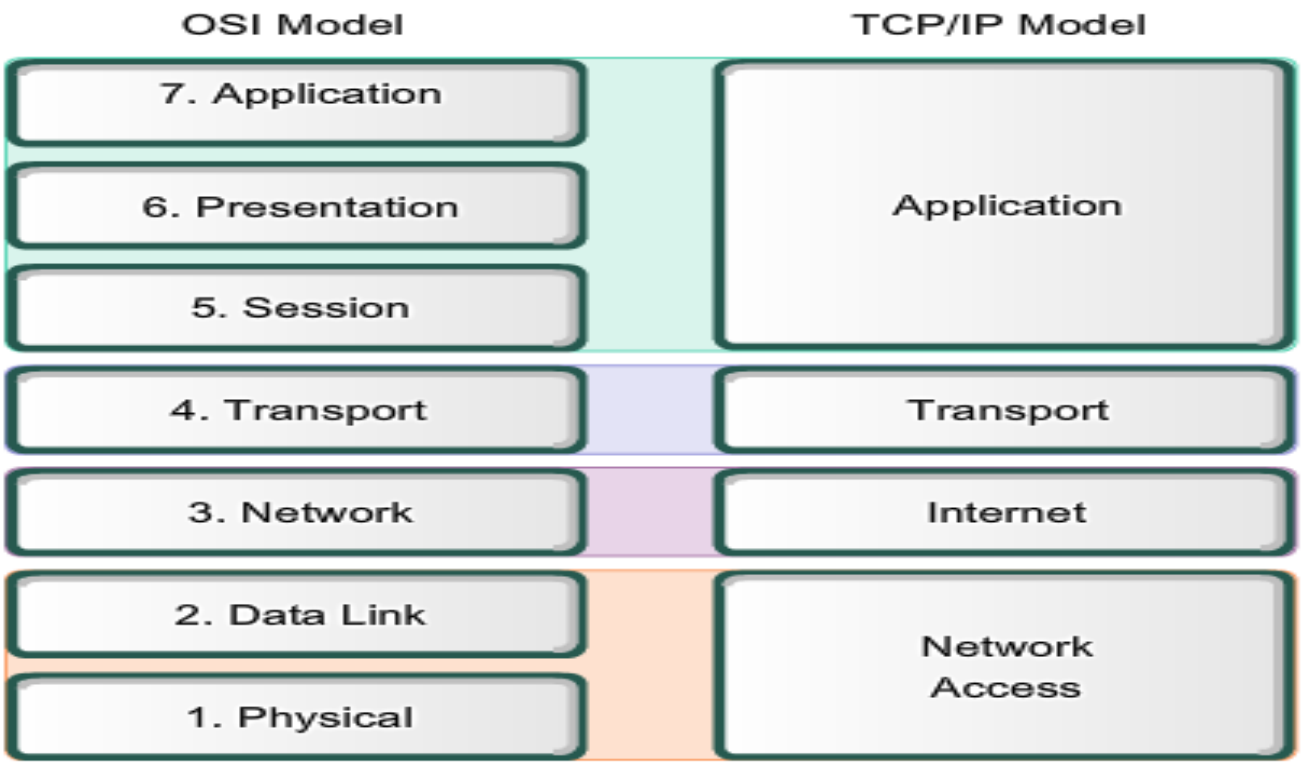
Reference Models

Application

The Application layer provides the means for end-to-end connectivity between individuals in the human network using data networks.

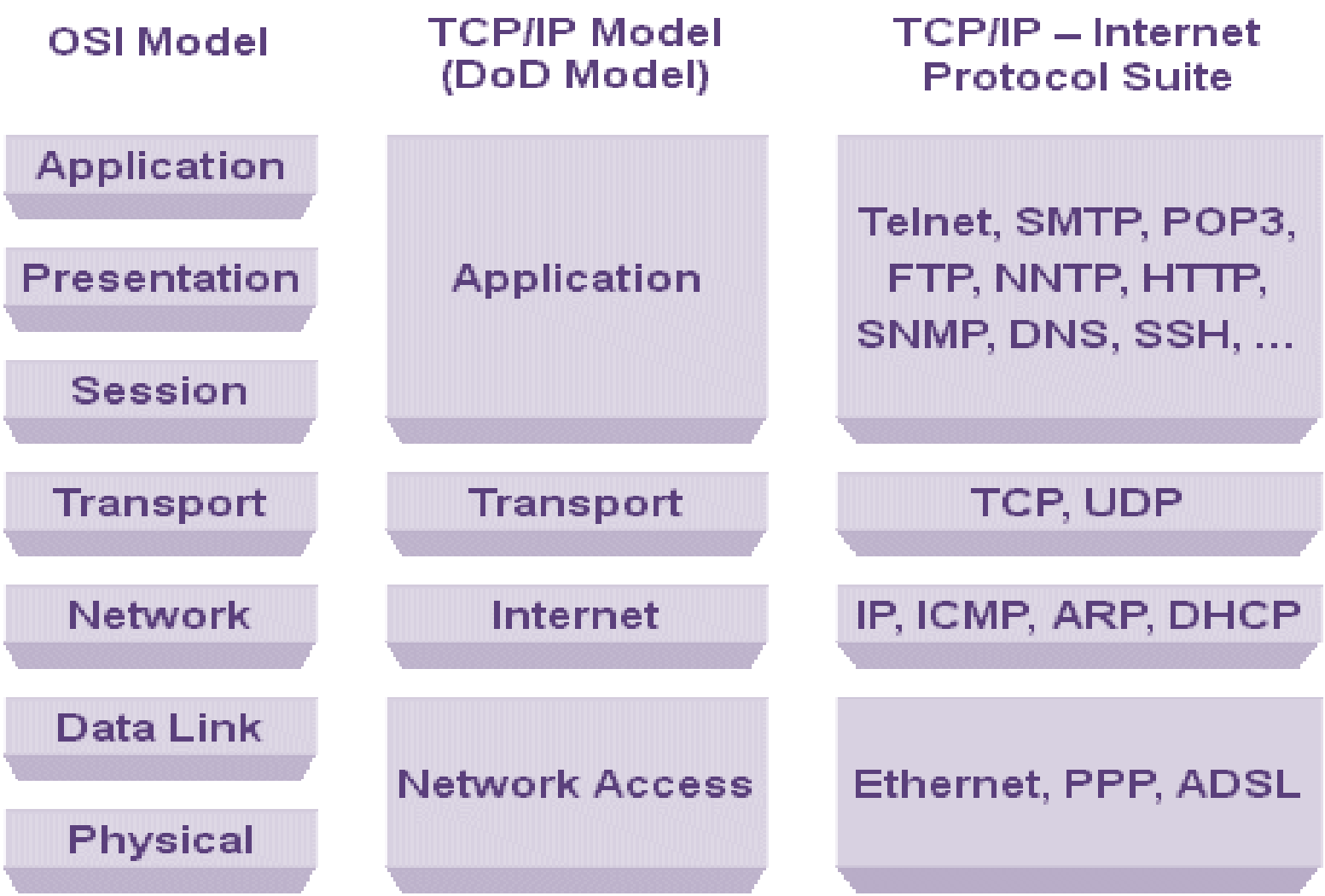
Reference Models

Comparing the OSI and TCP/IP models

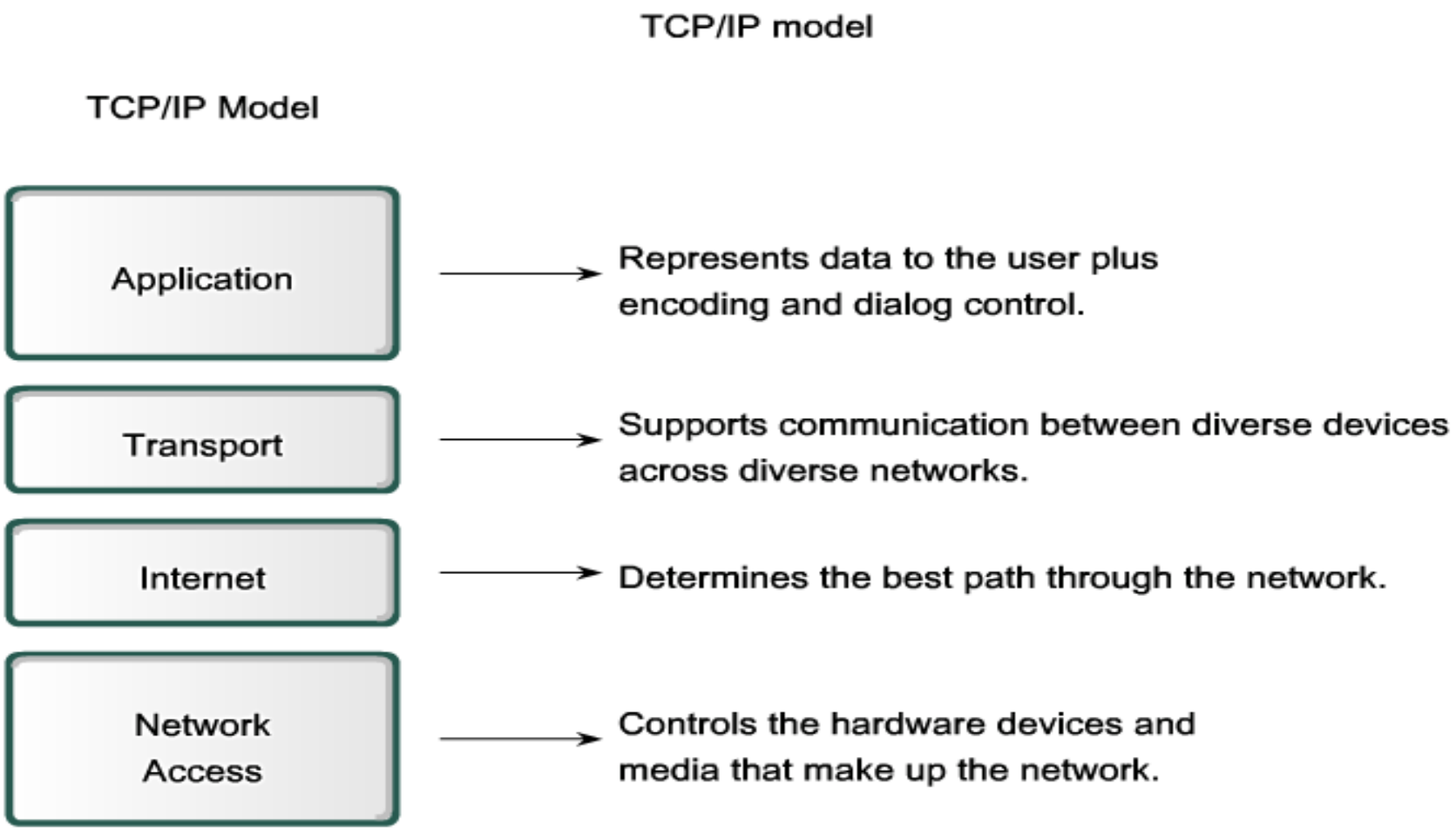


The key parallels are in the Transport and Network layers.

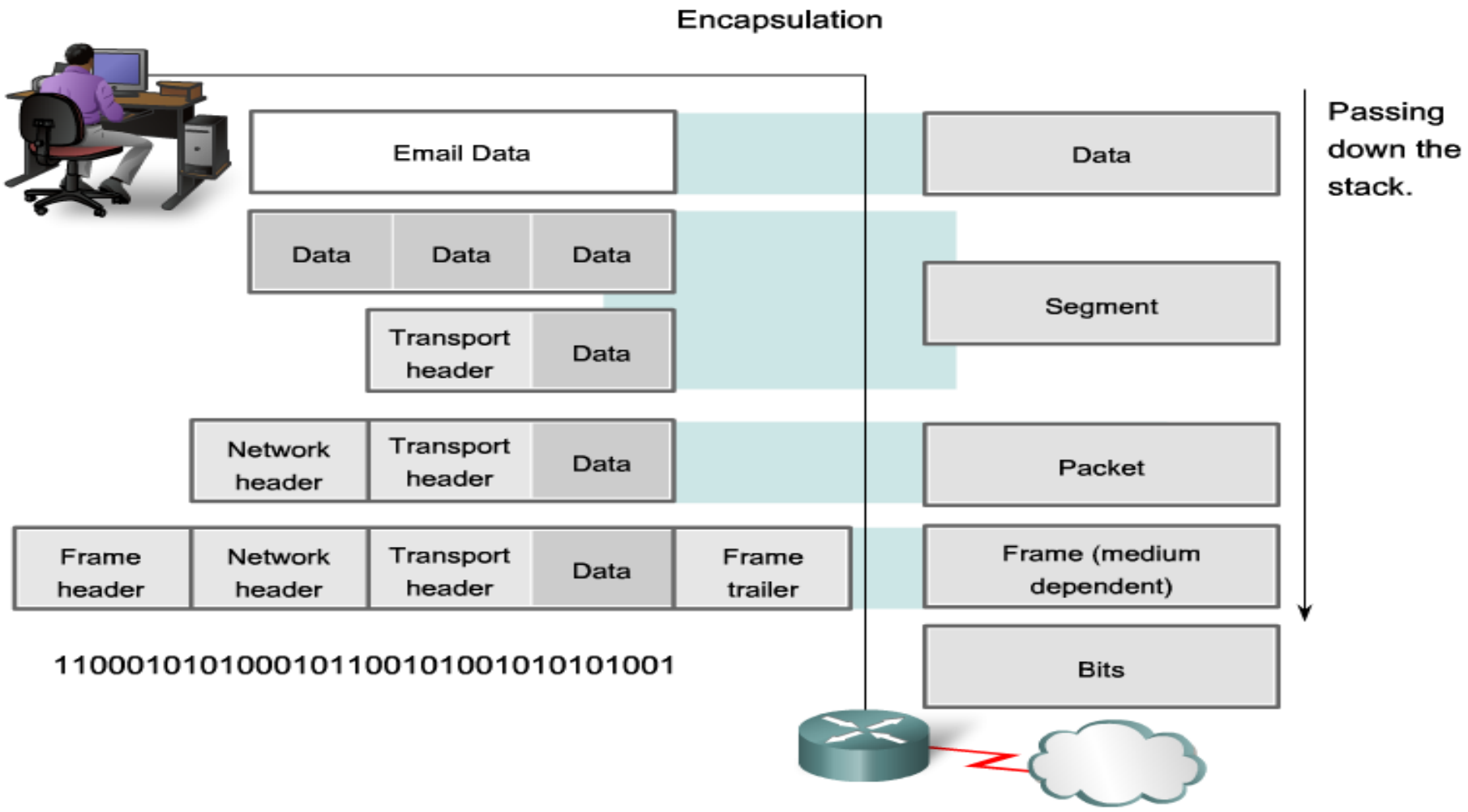
OSI Model vs TCP/IP Model



Reference Models



Layers with TCP/IP and OSI Model



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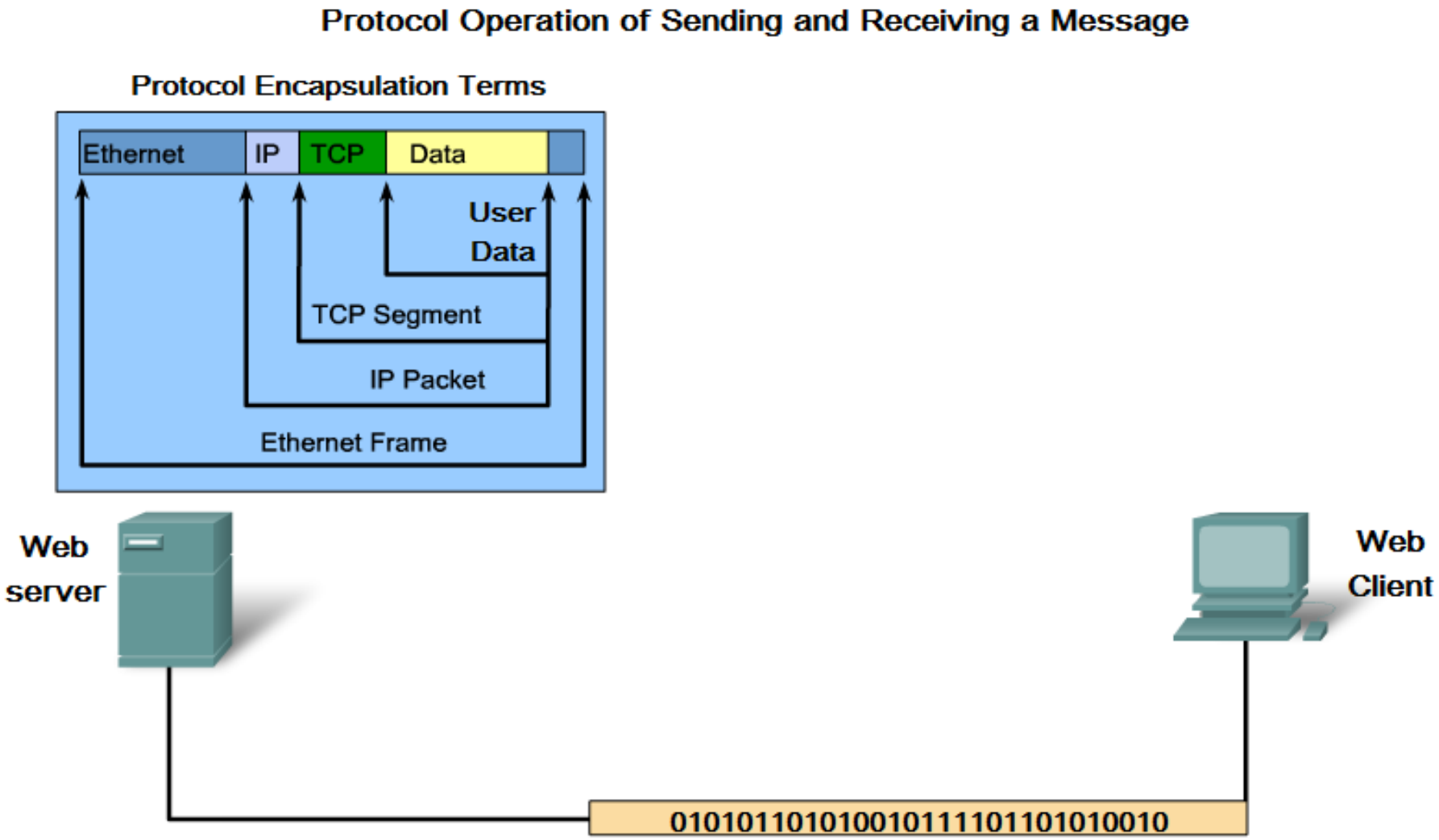

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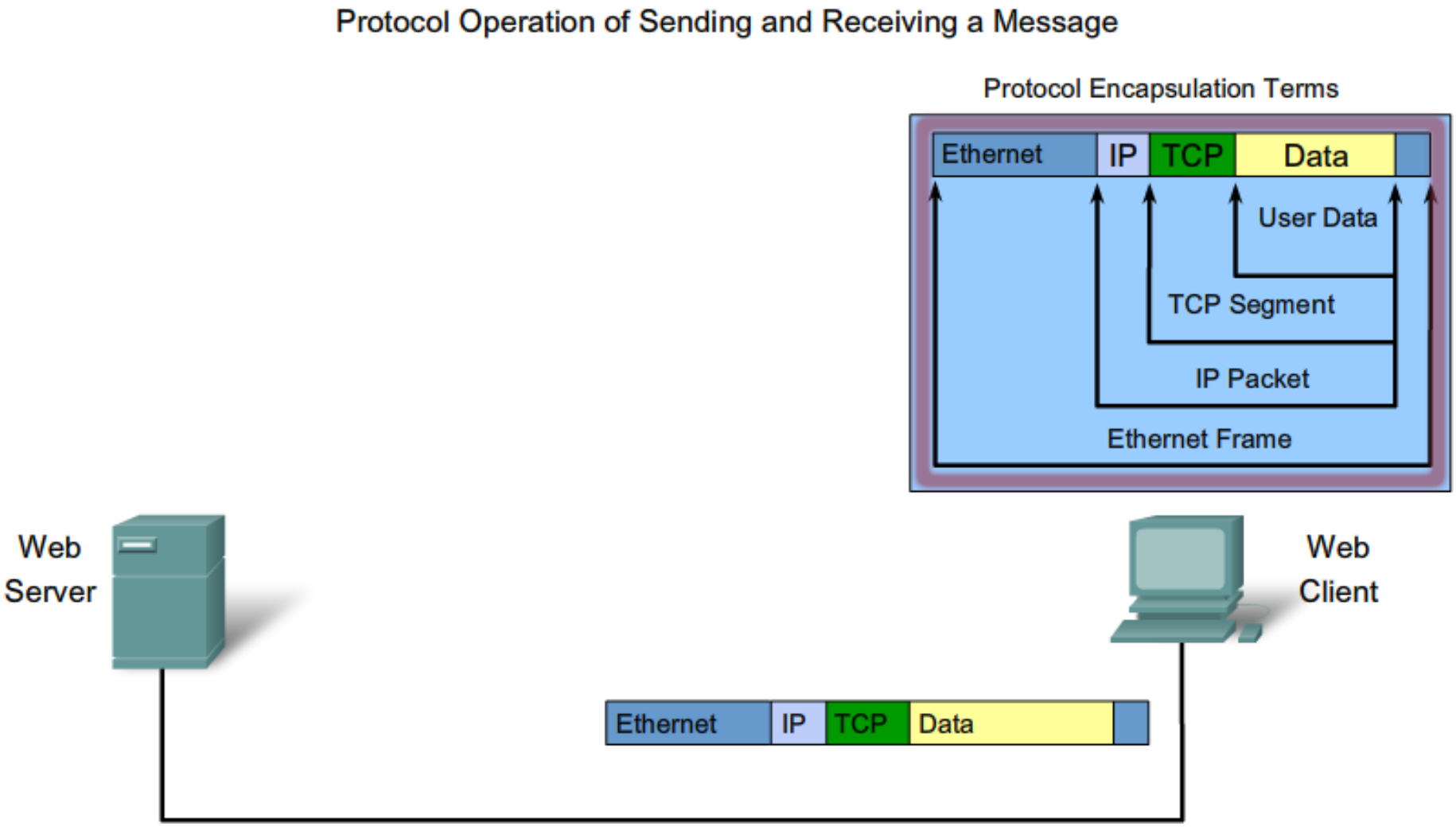

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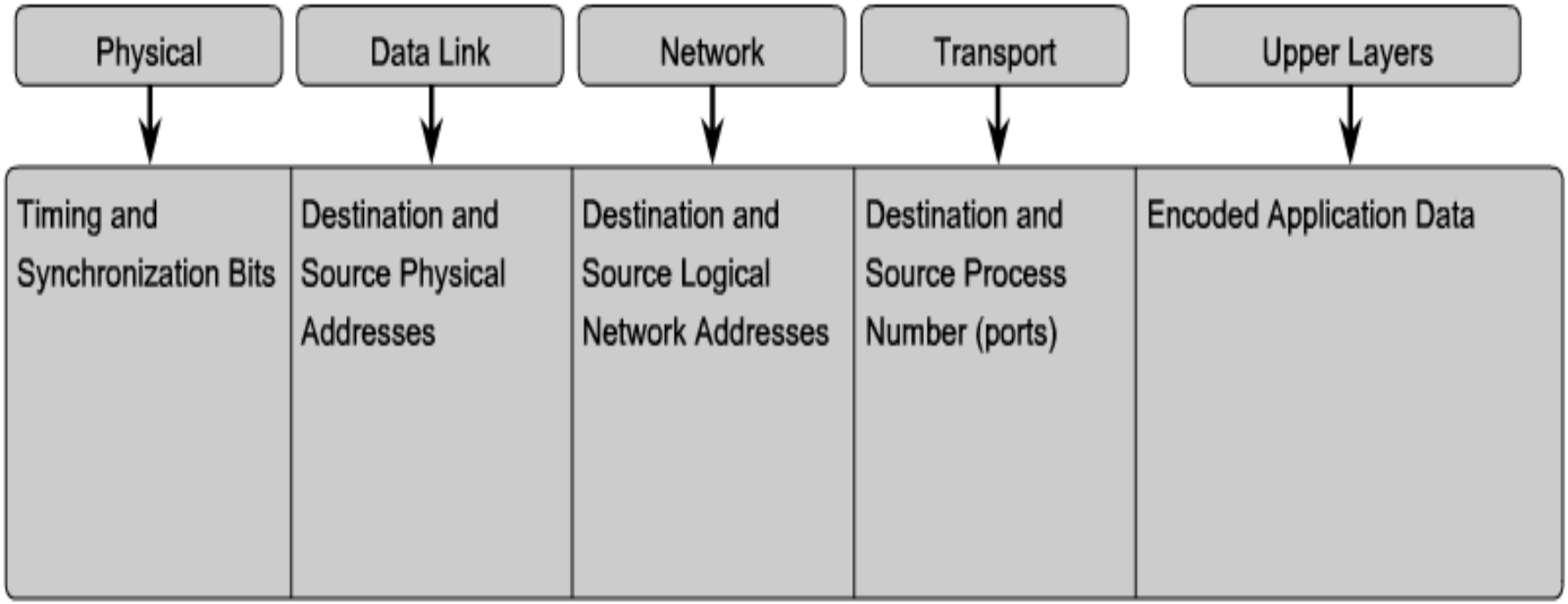

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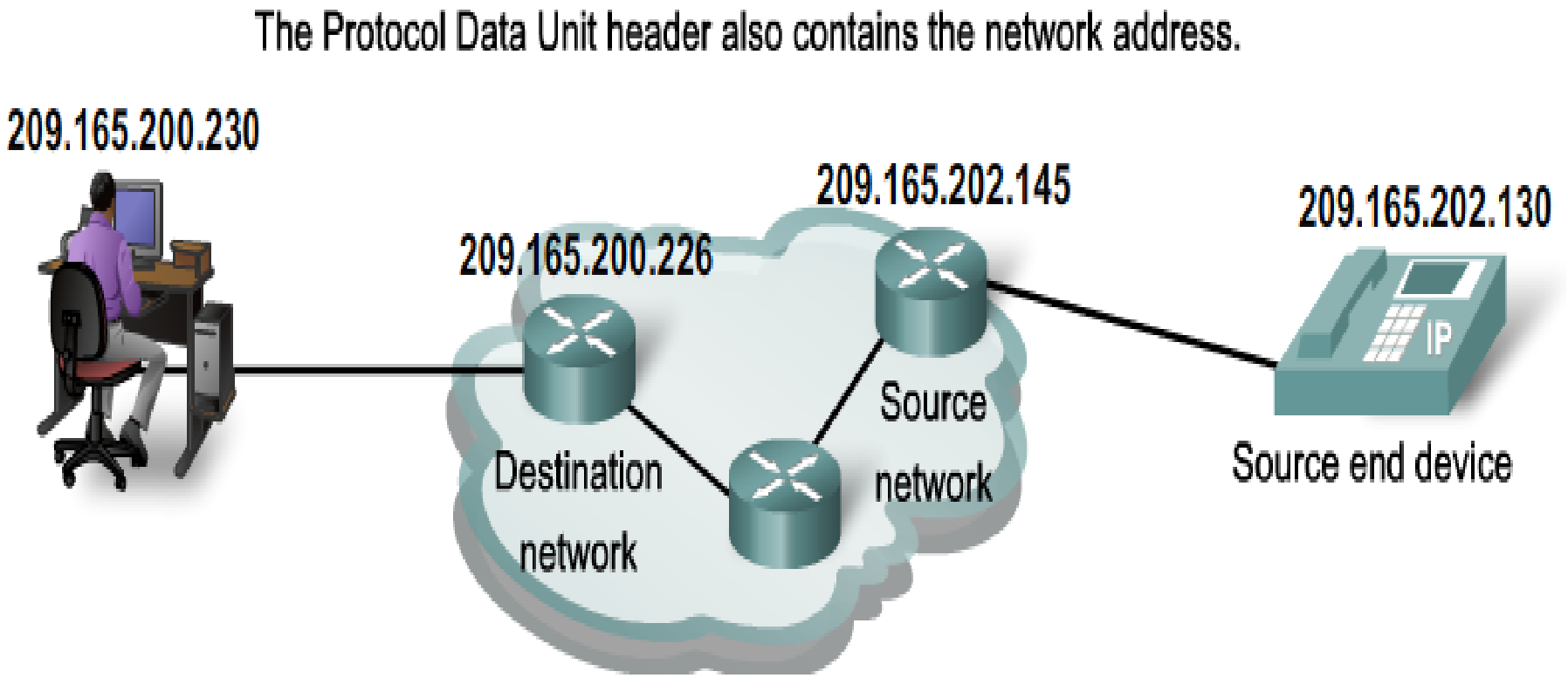
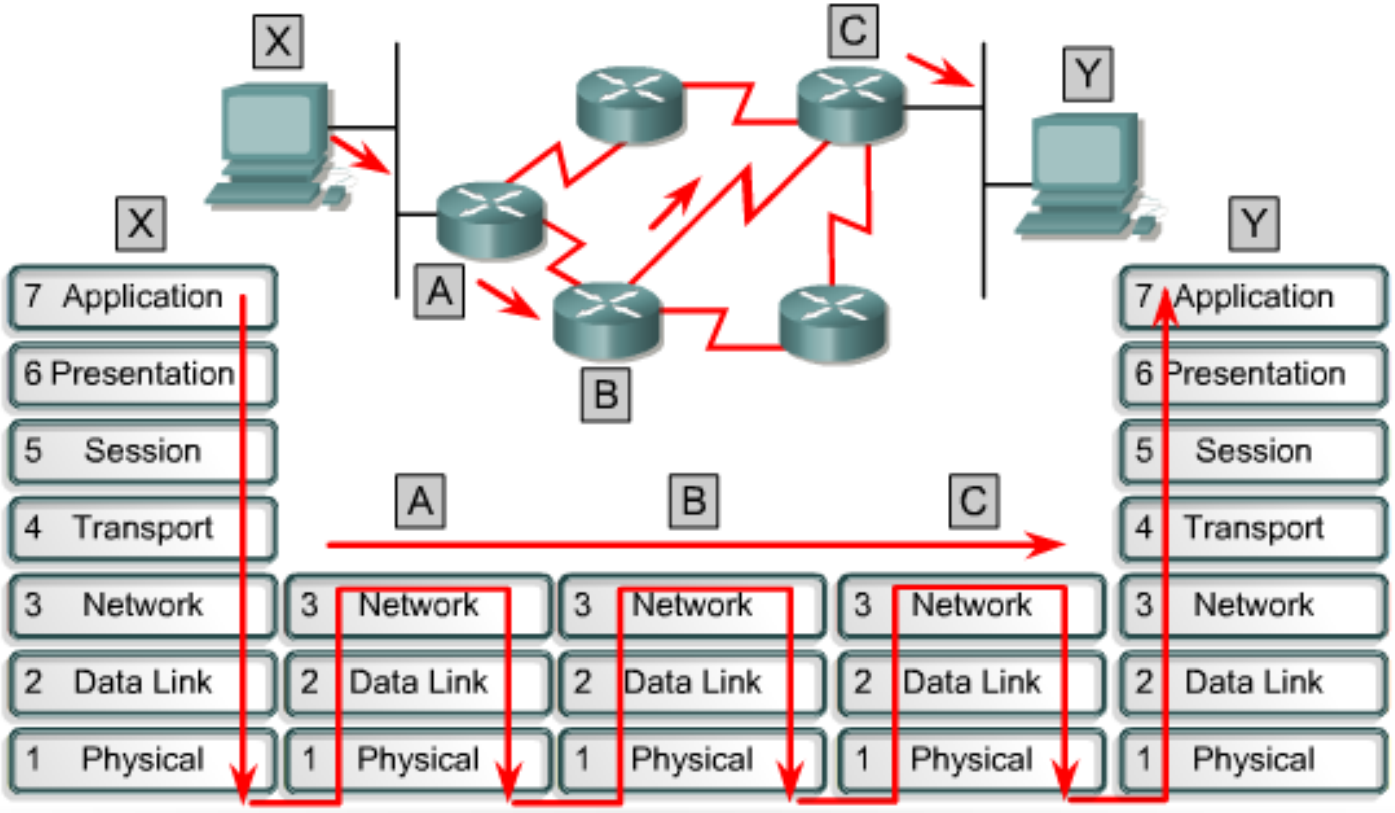


Transmission Example



Each router provides its services to support upper-layer functions.