SNS COLLEGE OF ENGINEERING

Kurumbapalayam(Po), Coimbatore – 641 107
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Department of Information Technology

Course Name – 23ITT204 Computer Networks

II Year / III Semester

Unit 1 – Introduction and Application Layer

Topic 3 and 4- Protocol Layering & TCP/IP Protocol Suite

PROTOCOL LAYERING

- A protocol defines the rules that both the sender and receiver and all intermediate devices need to follow to be able to communicate effectively.
- When communication is simple, we may need only one simple protocol; when the communication is complex, we need a protocol at each layer, or protocol layering.

Scenarios

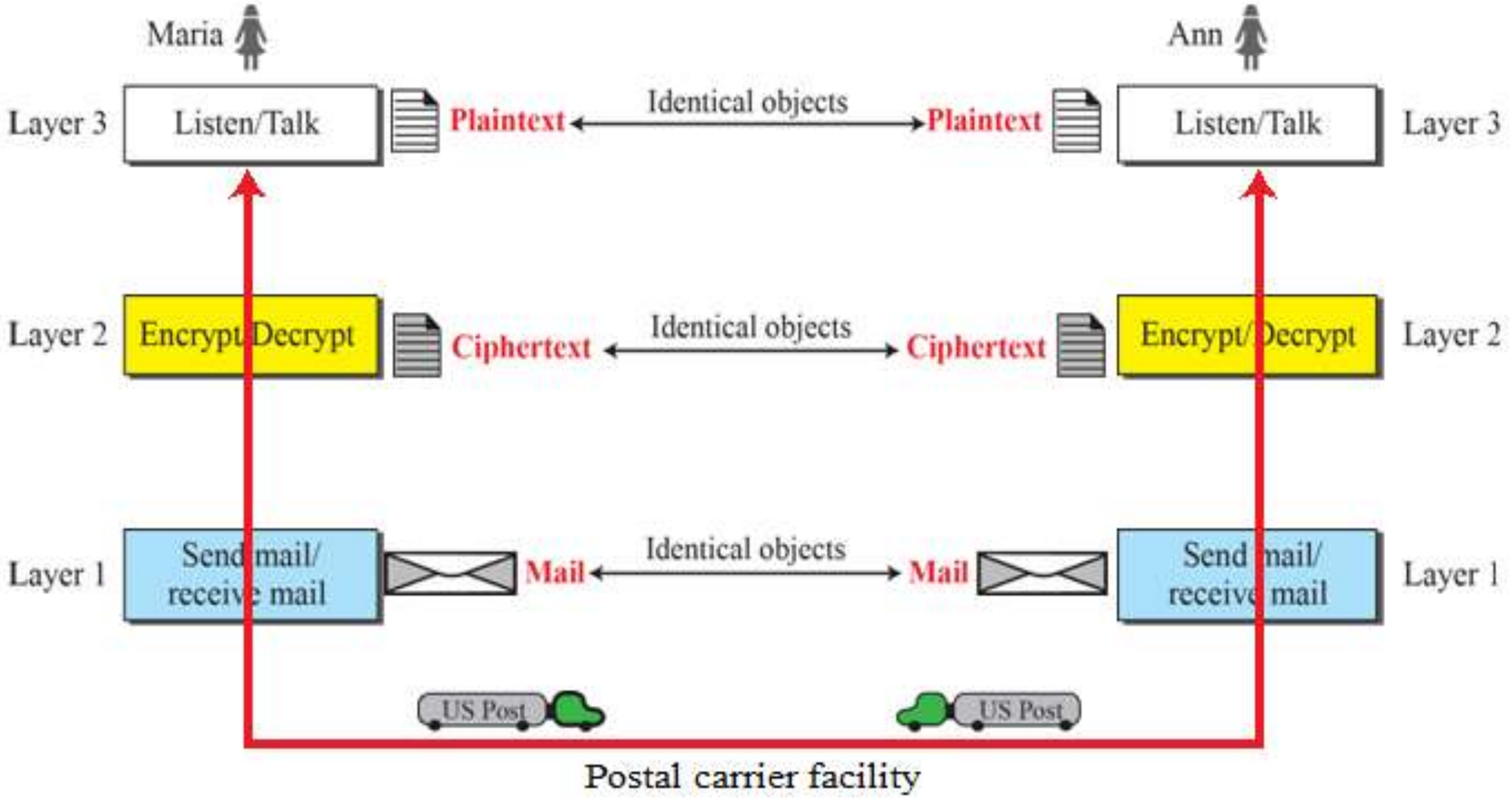
- Let us develop two simple scenarios to better understand the need for protocol layering.

- In the first scenario, communication is so simple that it can occur in only one layer.

- In the second, the communication between Maria and Ann takes place in three layers.

A single-layer protocol

A three-layer protocol



Principles of Protocol Layering

Two principles of protocol layering

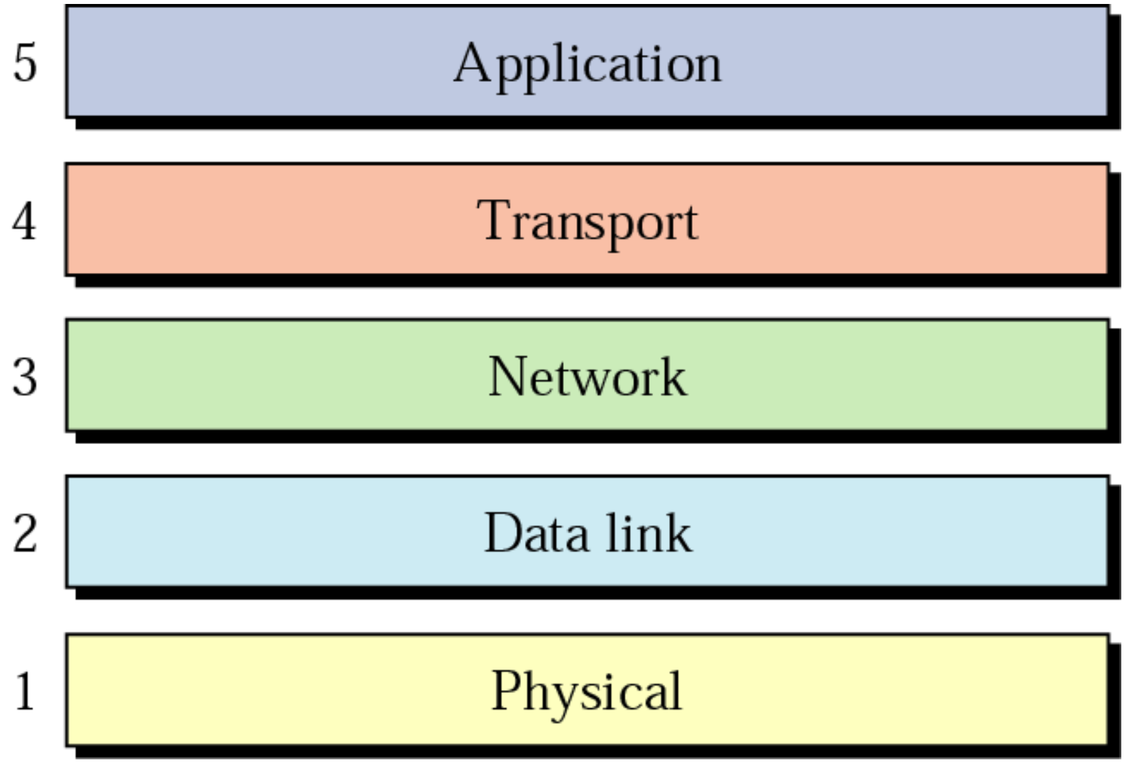
- The first principle dictates that if we want bidirectional communication, we need to make each layer so that it is able to perform two opposite tasks, one in each direction.

- The second principle that we need to follow in protocol layering is that the two objects under each layer at both sites should be identical.

TCP/IP PROTOCOL SUITE

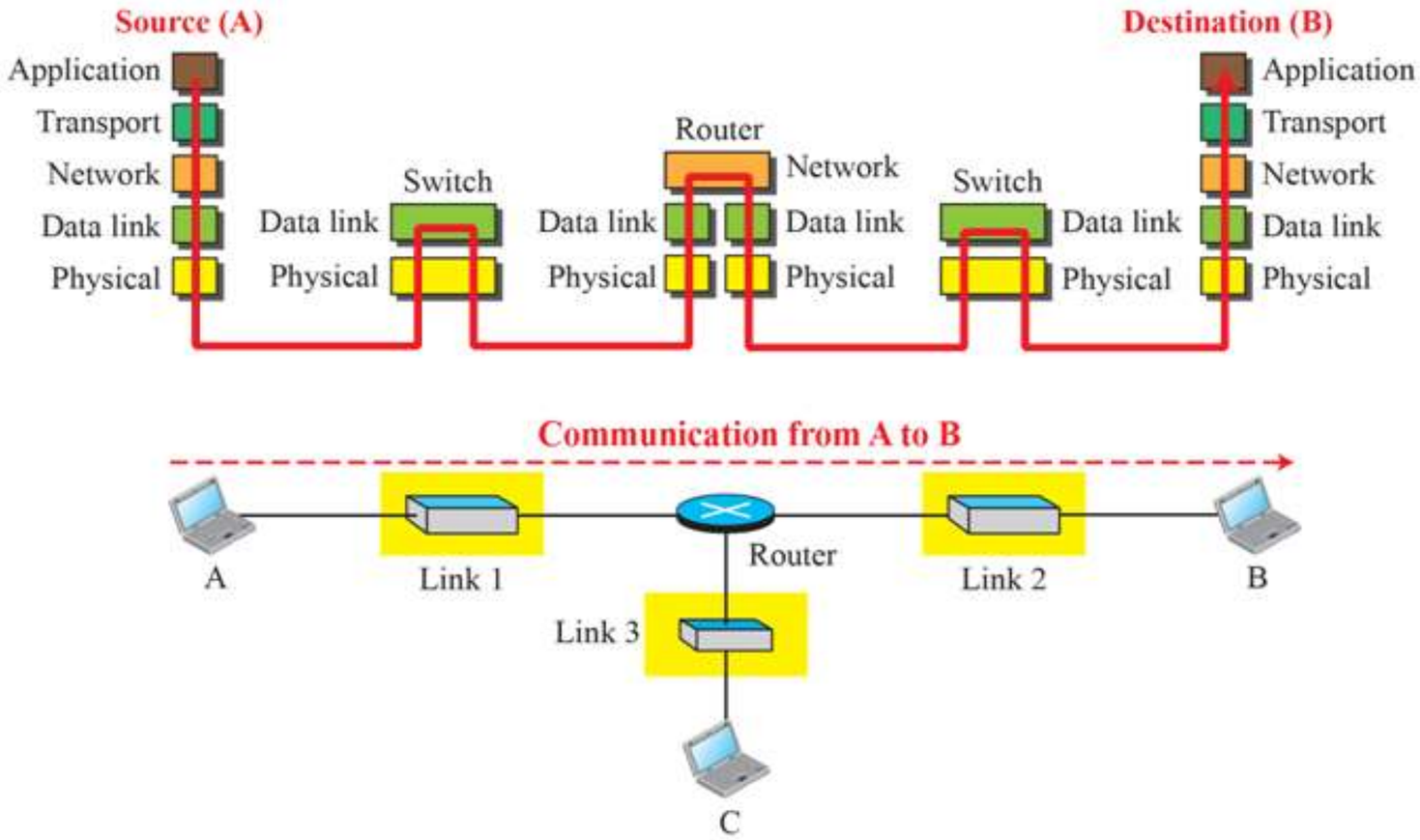
The layers in the TCP/IP protocol suite is made of five layers:

•Physical, data link, network, transport, and application.

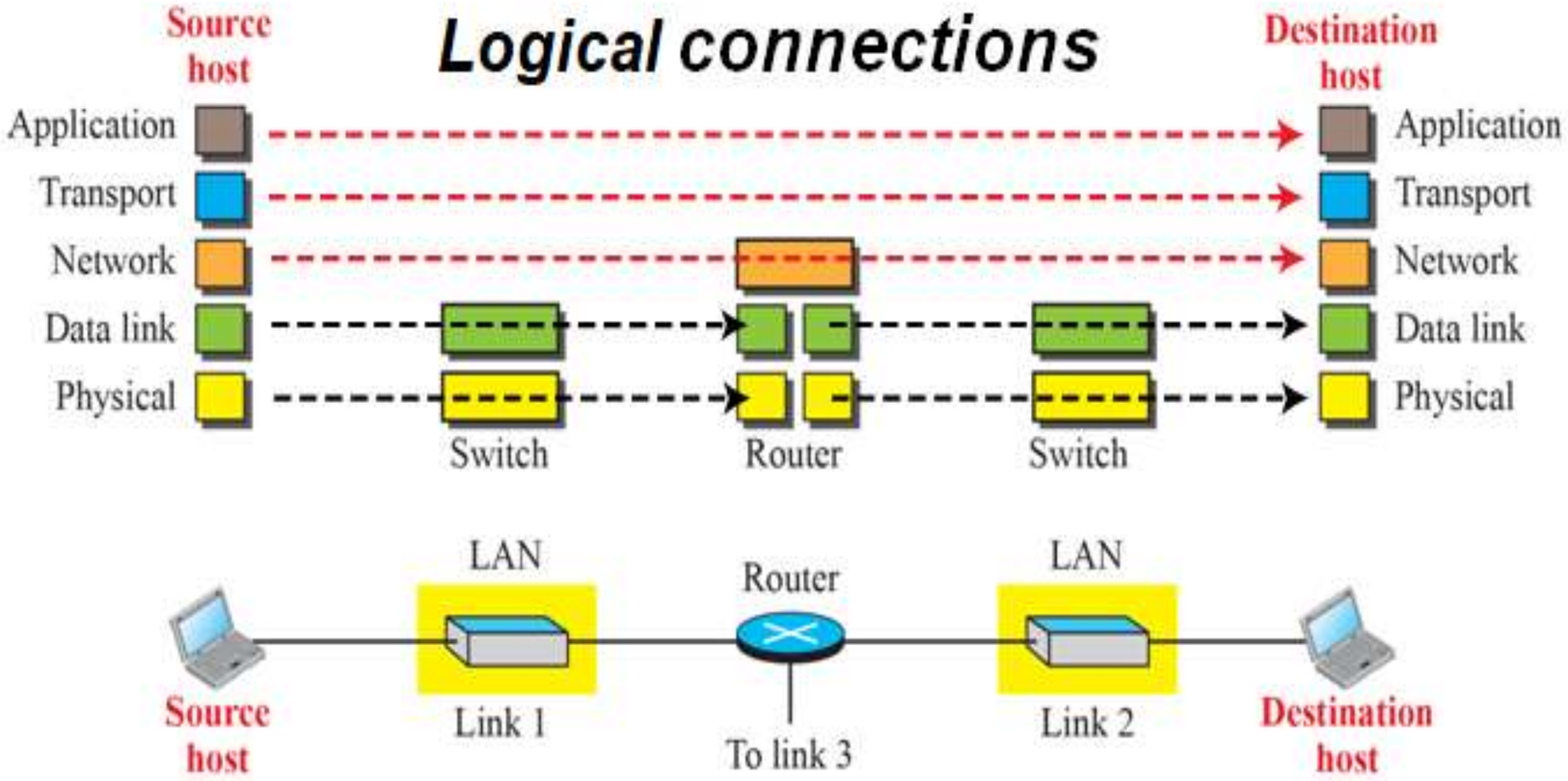


Layered Architecture

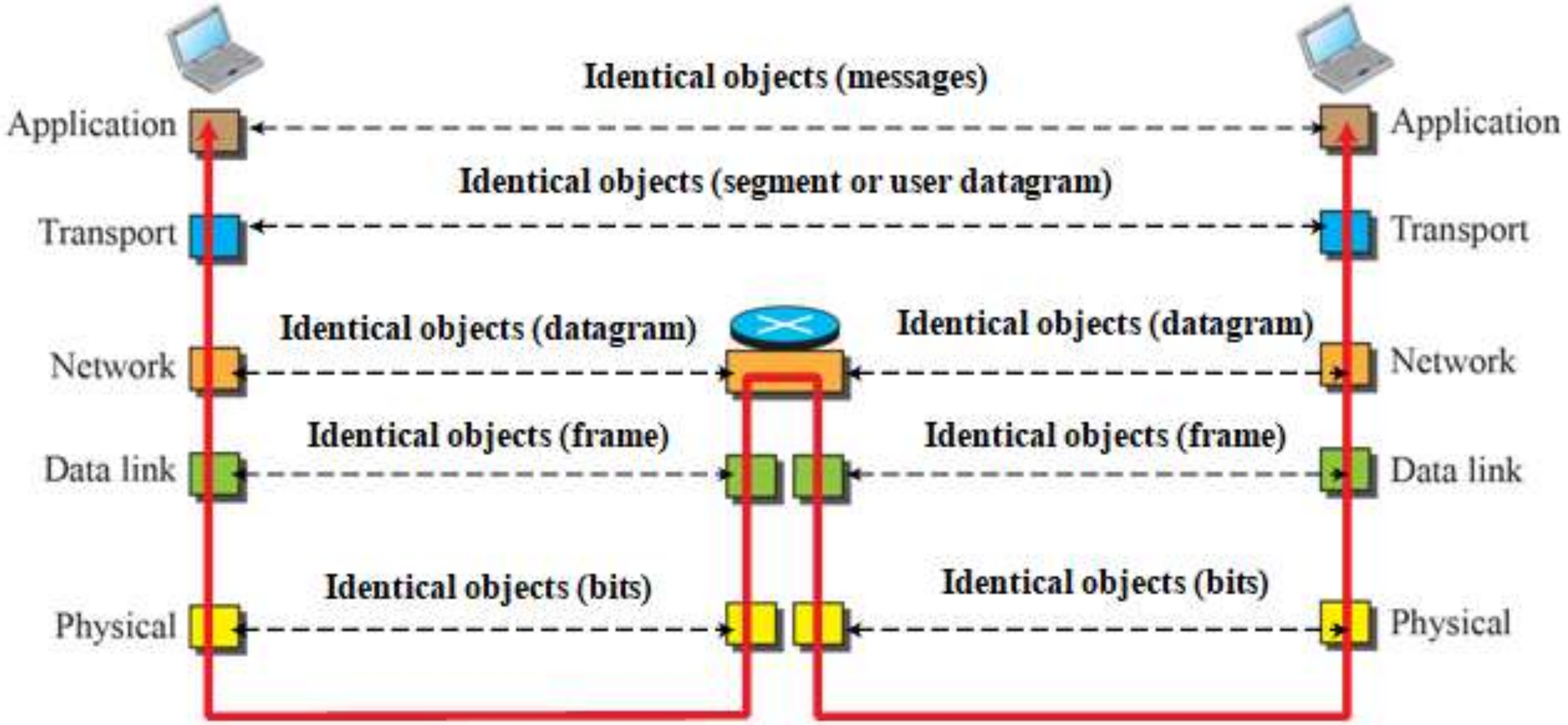
To show how the layers in the TCP/IP protocol suite are involved in communication between two hosts, we assume that we want to use the suite in a small internet made up of three LANs (links), each with a link-layer switch.



Layers in the TCP/IP Protocol Suite



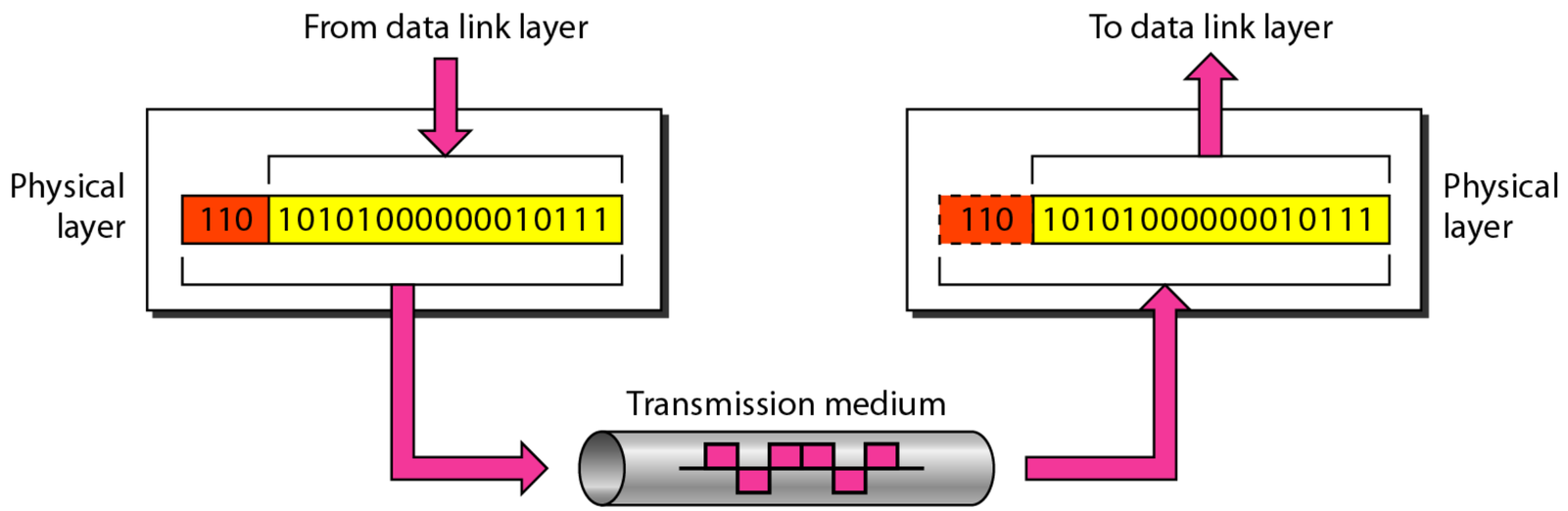
Identical objects in the TCP/IP protocol suite



Description of Each Layer

1.Physical layer

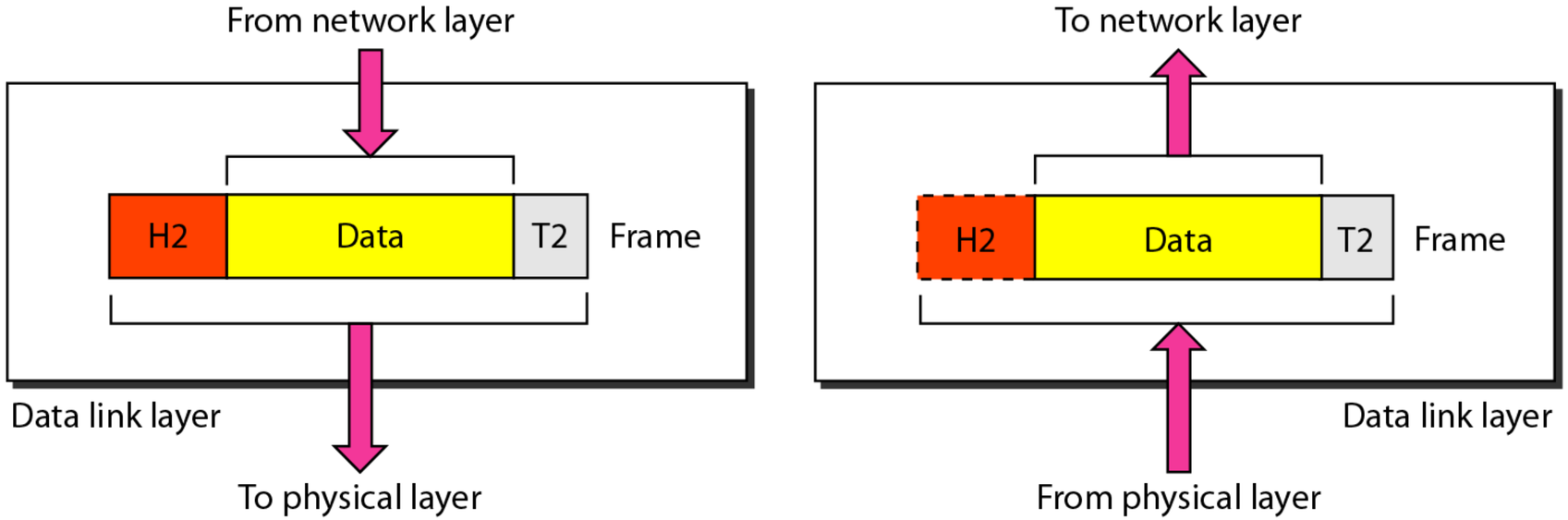
- The physical layer is responsible for movements of individual bits from one hop (node) to the next.
- Transmission Media is another hidden layer under the Physical Layer


From data link layer
To data link layer
Physical layer
110
10101000000010111
110
10101000000010111
Physical layer
Transmission medium

2. Data Link Layer

- The data link layer is responsible for moving frames from one hop (node) to the next over the link.
- The link can be Wired LAN/WAN or Wireless LAN/WAN.
- Some protocols provides complete error detection and correction, some protocols provide only error correction.
- At the Data link layer addresses are called MAC Address.

Data Link Layer



Data link Layer

Physical address (MAC)

- known also as the MAC or link address
- Is the address of a node as defined by its LAN or WAN
- It is included in the frame used by data link layer (Header)
- The MAC addresses are locally defined address

3. Network Layer

- The network layer is responsible for the delivery of individual packets from the source host to the destination host across multiple network.
- If two system are connected to the same link (network), no need for this layer.
- The network layer also response for routing the packet.
- IP is the main protocol of the network layer.
- At the Network layer addresses are called IP Address.

3. Network Layer

Logical addressing (IP)

- Network layer adds unique identifier (IP or logical address) to the packet.
- These unique identifier(as tel. no, each tel. has unique number) enable special devices called router to make sure the packet get to correct system.
- IP addresses are necessary for universal communications that are independent of physical network.

3. Network Layer

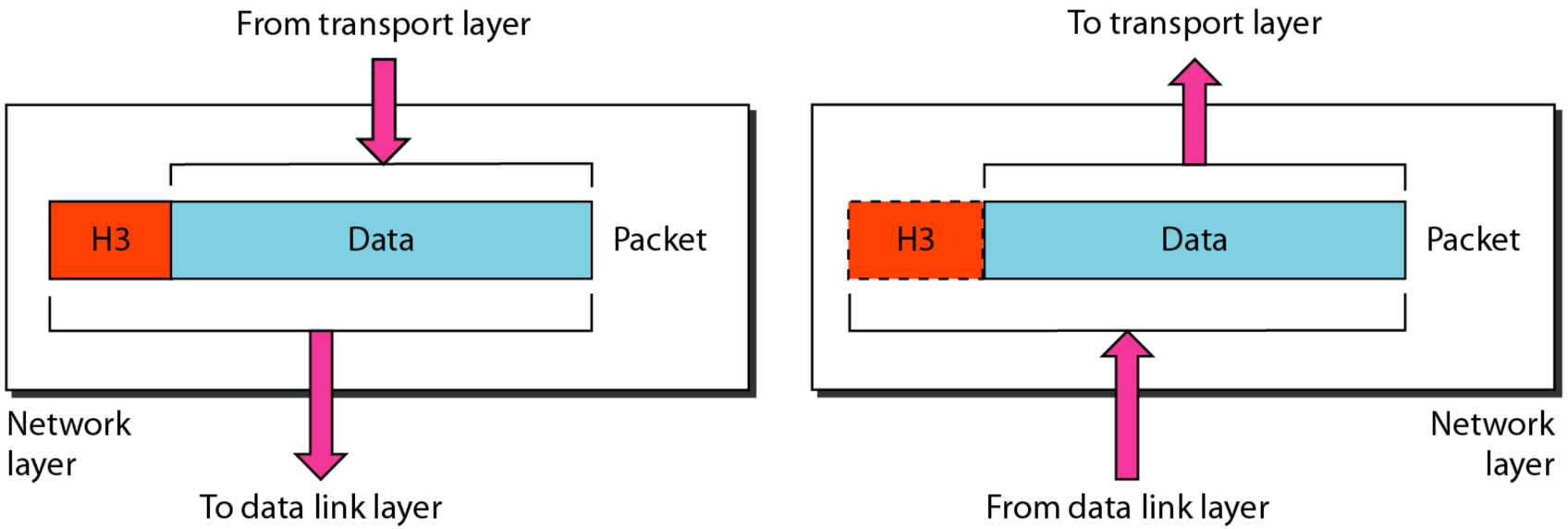
Routing:

Provide the routing mechanism for the router which route the packet to their final destination.

Routers :

Devices used when independent networks are connected to create an internetworking (network of networks)

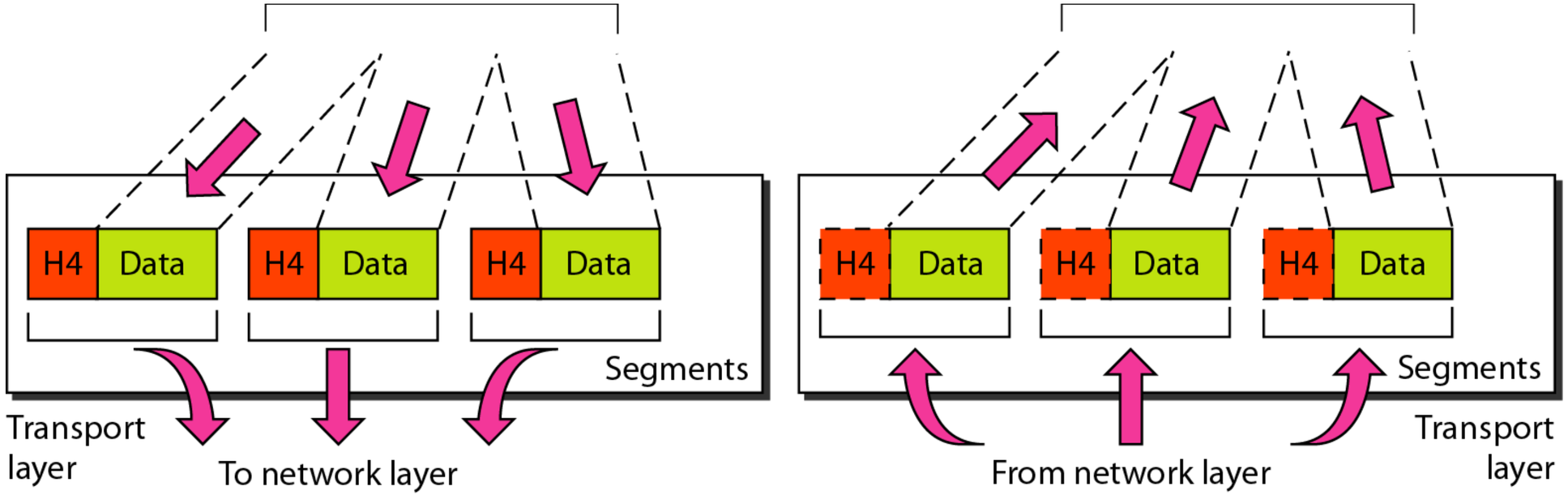
3. Network Layer



4. Transport Layer

- The transport layer is responsible for the delivery of a message from one process to another.
- At the Transport layer addresses are called Port Address.
- TCO/IP model defines 3 protocols :
  - TCP (Transmission Control Protocol)
  - UDP (User Datagram Protocol)
  - SCTP(Stream Control Transmission Protocol)

4. Transport Layer



4. Transport Layer

Port addressing (Service-point addressing)

- Computer often run several process (running programs) at the same time, so the process to process delivery means delivery from a specific process on a computer to specific process to the other.
- The transport layer header must include Port address
- Port address: 16-bit addresses represented by decimal number range from 0-65535 to choose among multiple processes on the destination host
- Destination port No is needed for delivery
- Source port No is needed for replay.

4. Transport Layer

The transport layer can be either connection less or connection oriented

1. Connection oriented protocol (TCP)

- Makes a connection with the transport layer at the destination machine first before delivering the packers.
- When the connection established a sequence of packets from source to the destination can be sent one after another on the same path and in sequential order.
- When all packets of message have been delivered, the connection is terminated

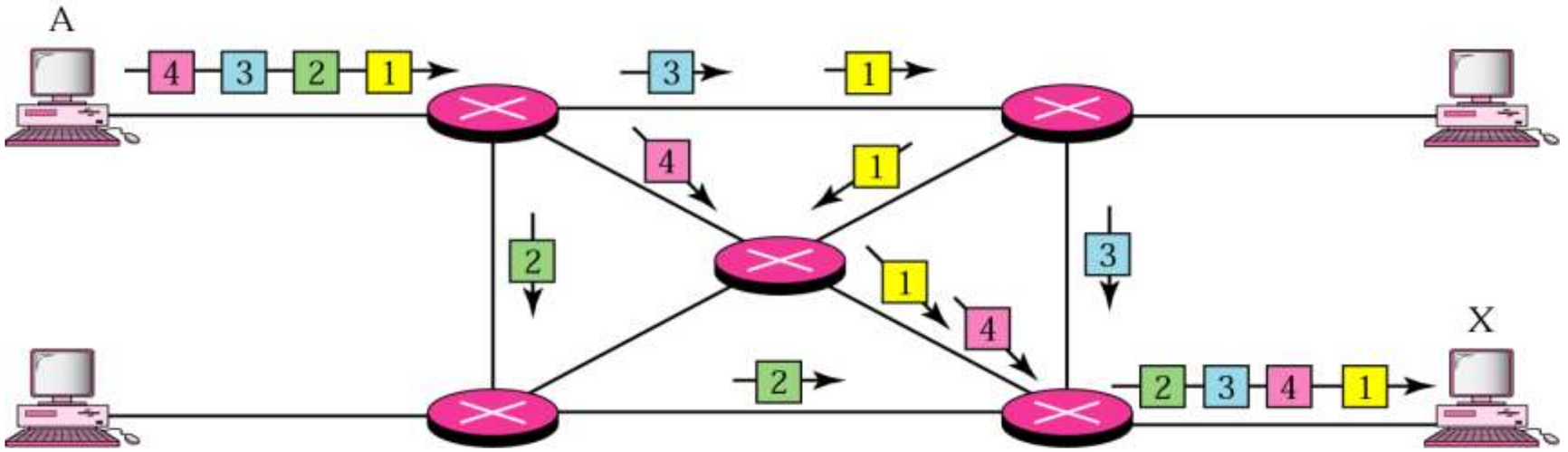
This makes the sending transport layer ensure that the message arrives at the receiving transport layer without error (damage, loss or duplication

4. Transport Layer

2. Connection Less Protocol (UDP)

It sends the data, but does not establish and verify a connection between hosts before sending data.

- Treats each packet independently, the packets in a message may or may not travel the same path to their destination.

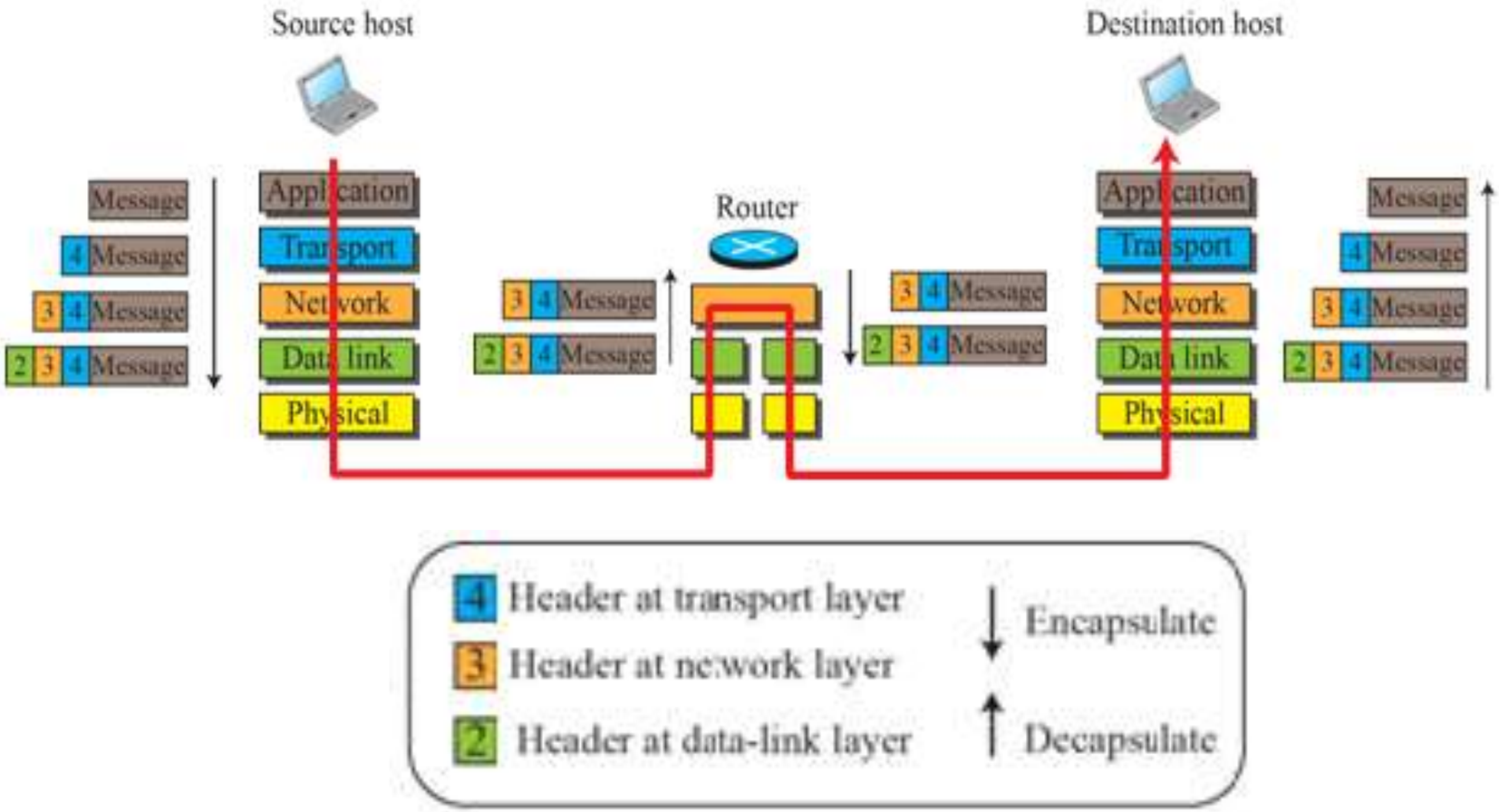


5. Application Layer

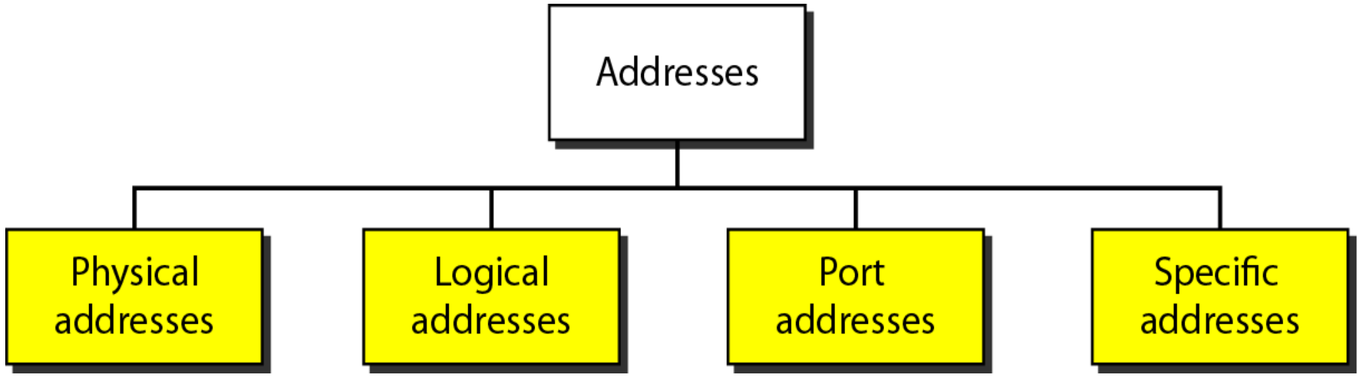
- The application layer exchange messages between each other.
- TCP/IP model defines the following protocols:
  - FTP:File transfer protocol is used for transferring files from one host to another .
  - Telnet: A service that enables users on the internet to log onto remote systems from their own host system.
  - HTTP: Hyper text transfer protocol used for network file transfers in WWW environment
  - SMTP: Simple mail transfer protocol used to send electronic mail on the internet.

Encapsulation and Decapsulation

One of the important concepts in protocol layering in the Internet is encapsulation/ decapsulation.



Addressing

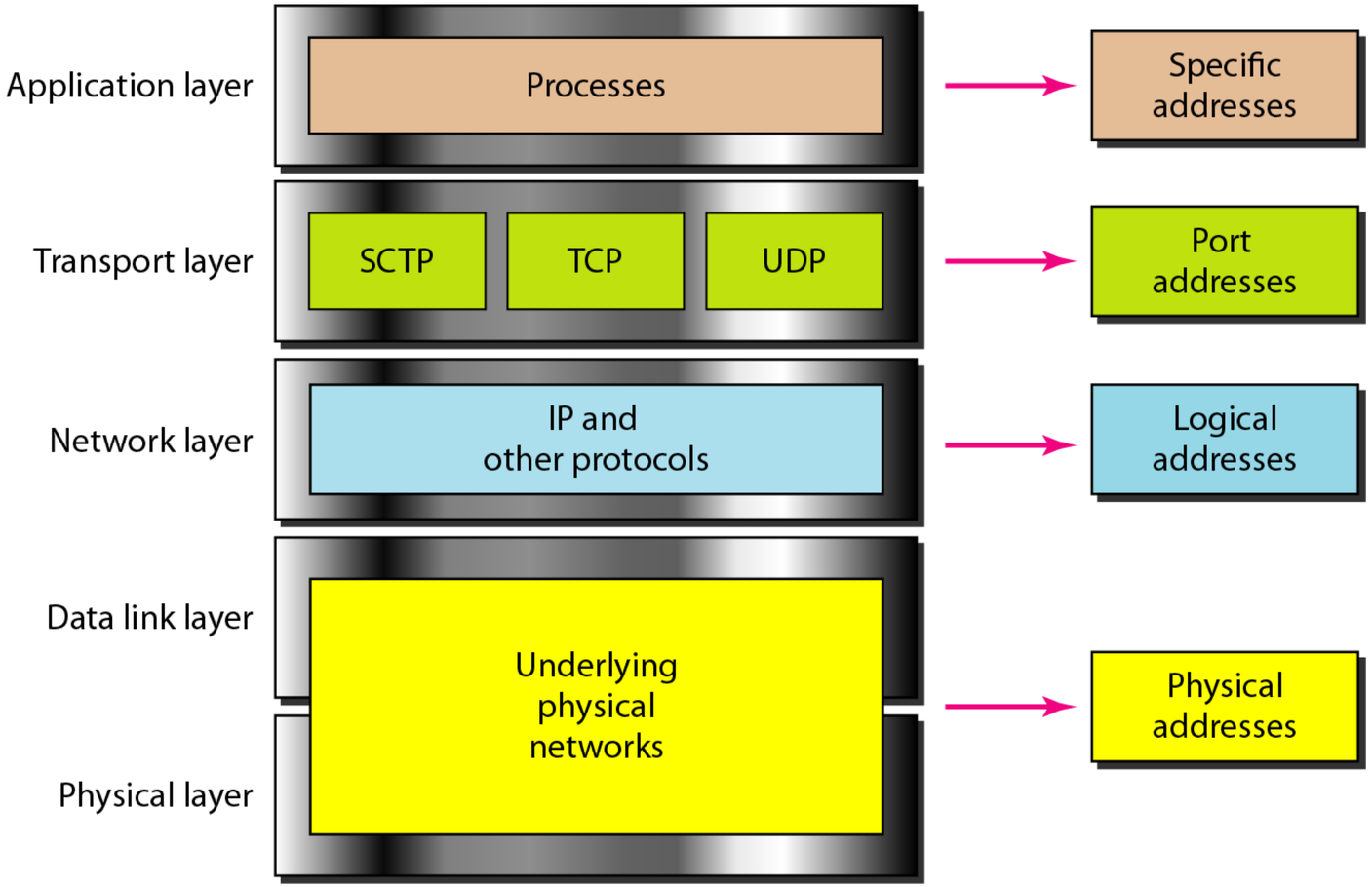


Examples for Specific addresses:

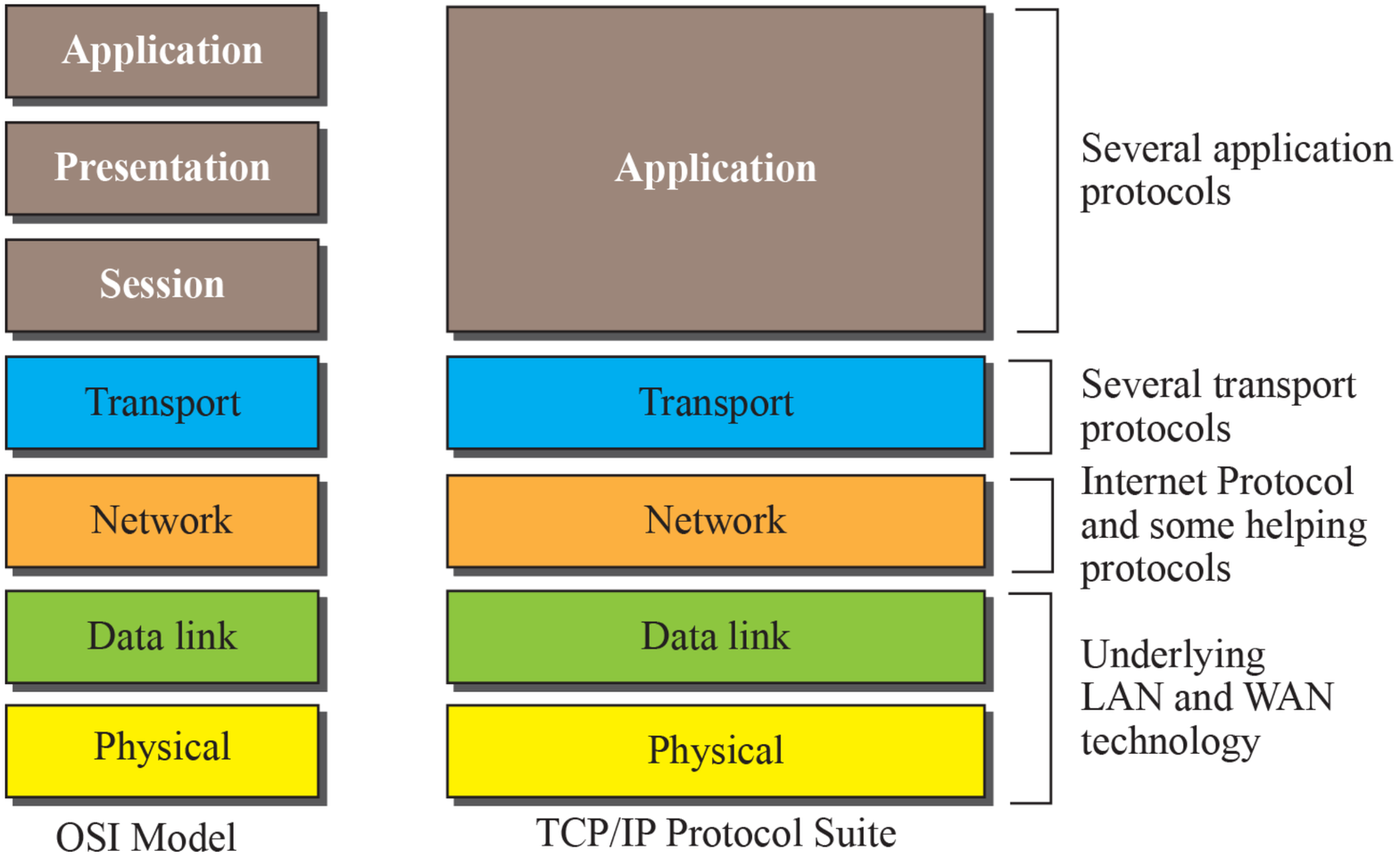
- e-mail addresses (Lhajr@yahoo.com) to define the recipient of an e-mail
- URL addresses (www.ksu.com) to find a document on the world wide web

The addresses get changed to the corresponding port and logical addresses by the sending computer

Relationship of layers and addresses in TCP/IP



OSI versus TCP/IP



THANK YOU