Chapter 2

Network Models

PROTOCOL LAYERING

A protocol: 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.

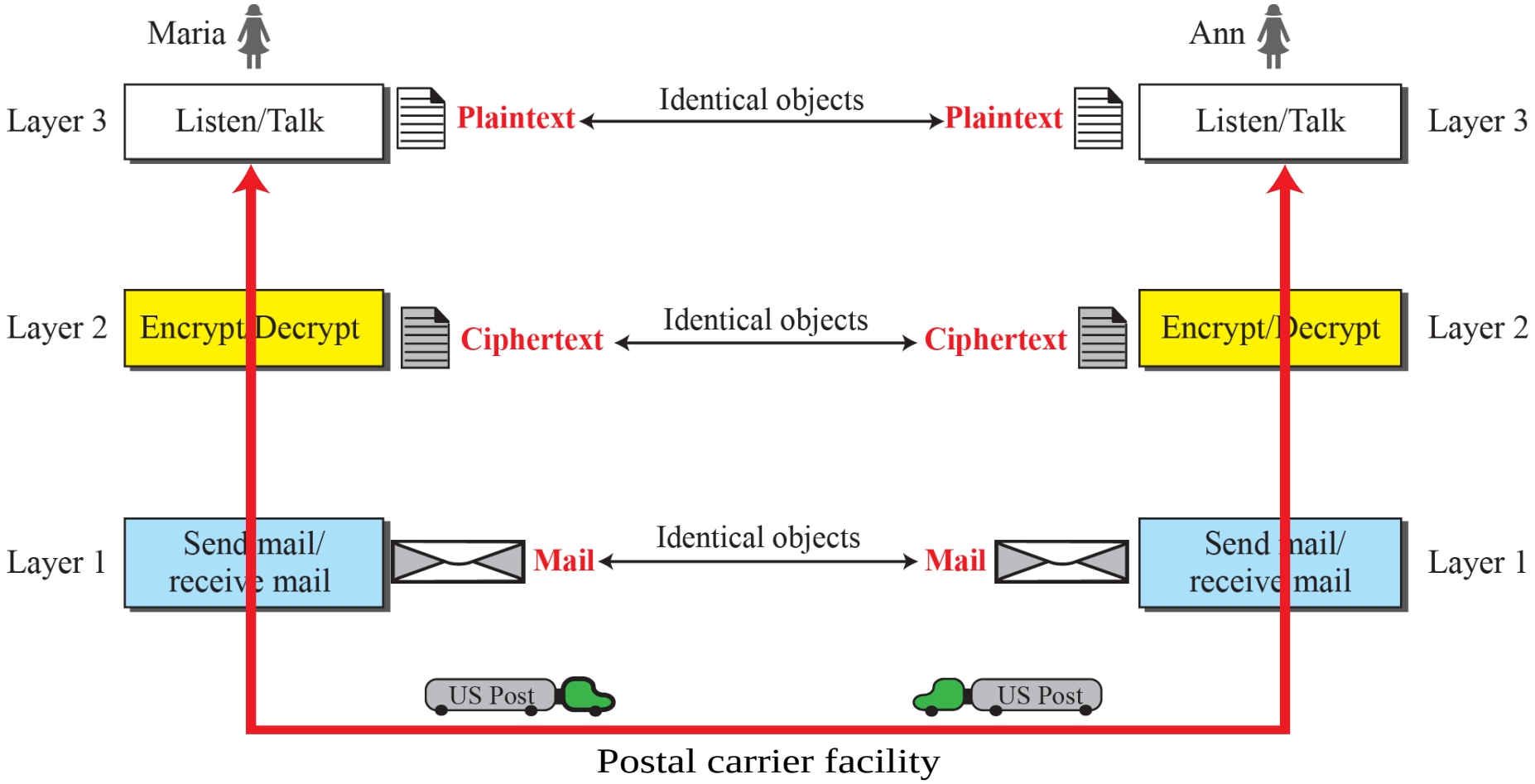
Let us develop two simple scenarios to better understand the need for protocol layering.

1) communication is so simple that it can occur in only one layer

2) the communication between Maria and Ann takes place in three layers.

A single-layer protocol

A three-layer protocol



Principles of Protocol Layering

Let us discuss 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.

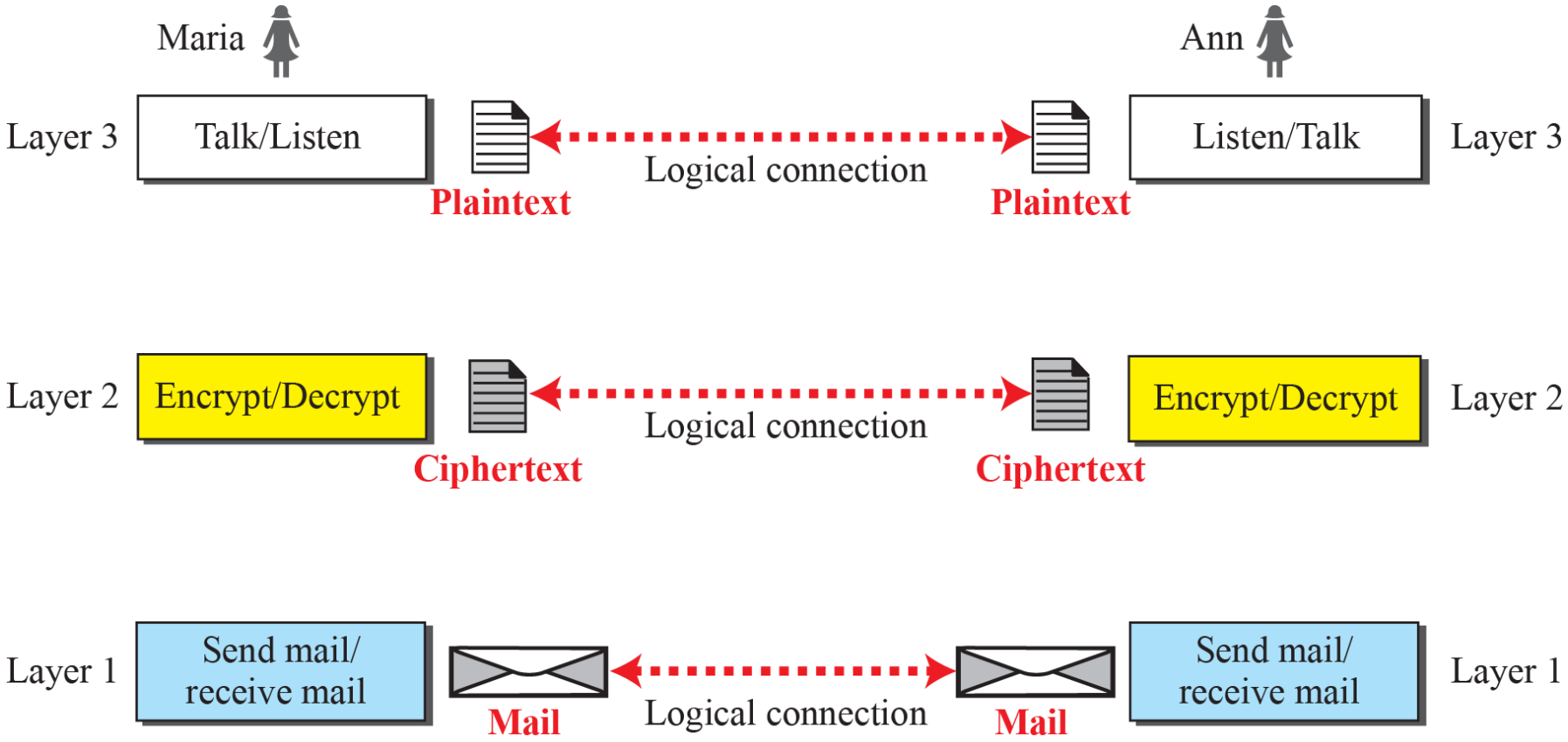
The second principle that we need to follow in protocol layering is that the two objects under each layer at both sites should be identical.

Logical Connections

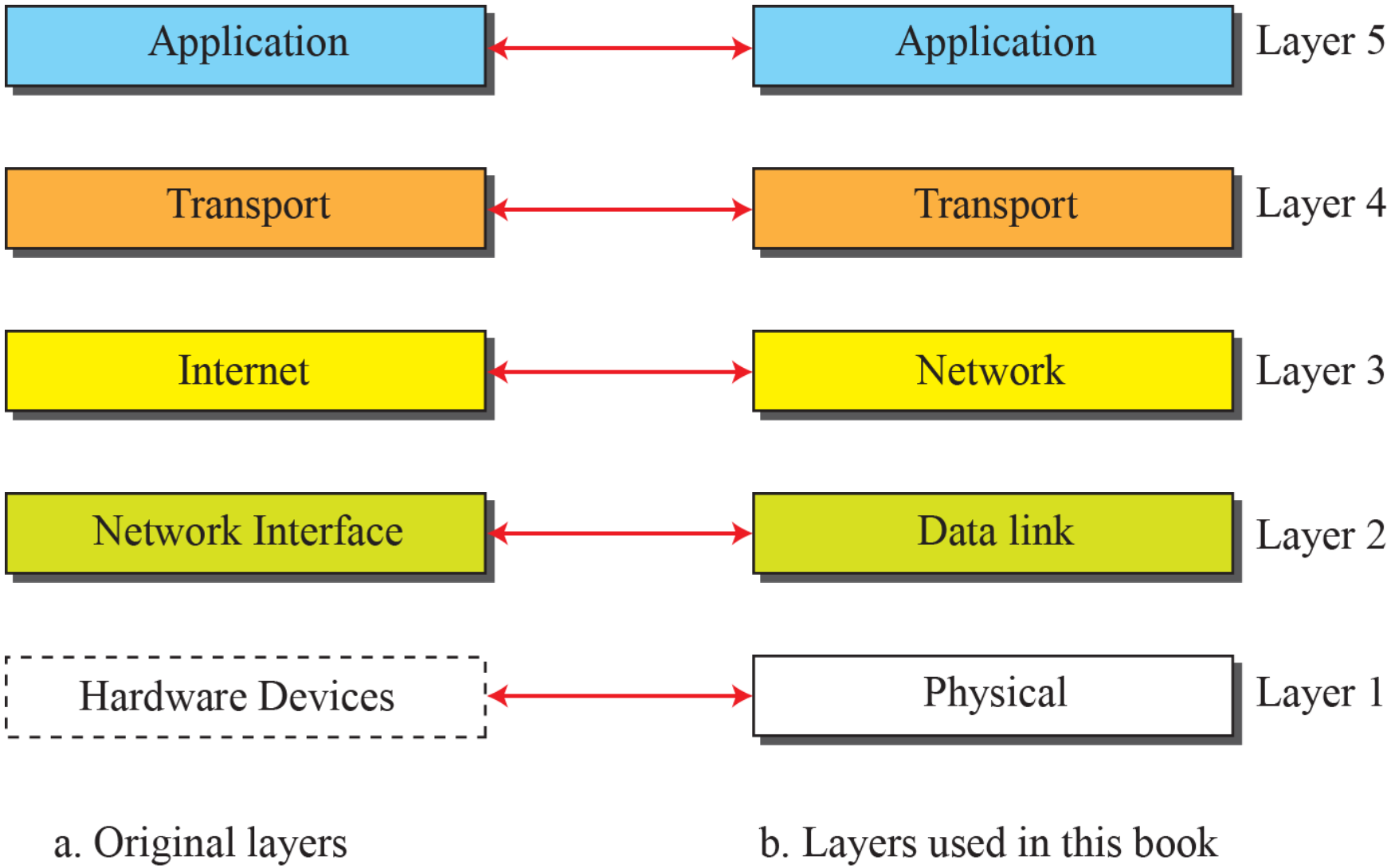
We can think about logical connection between each layer → layer-to-layer communication

Maria and Ann can think that there is a logical (imaginary) connection at each layer through which they can send the object created from that layer.

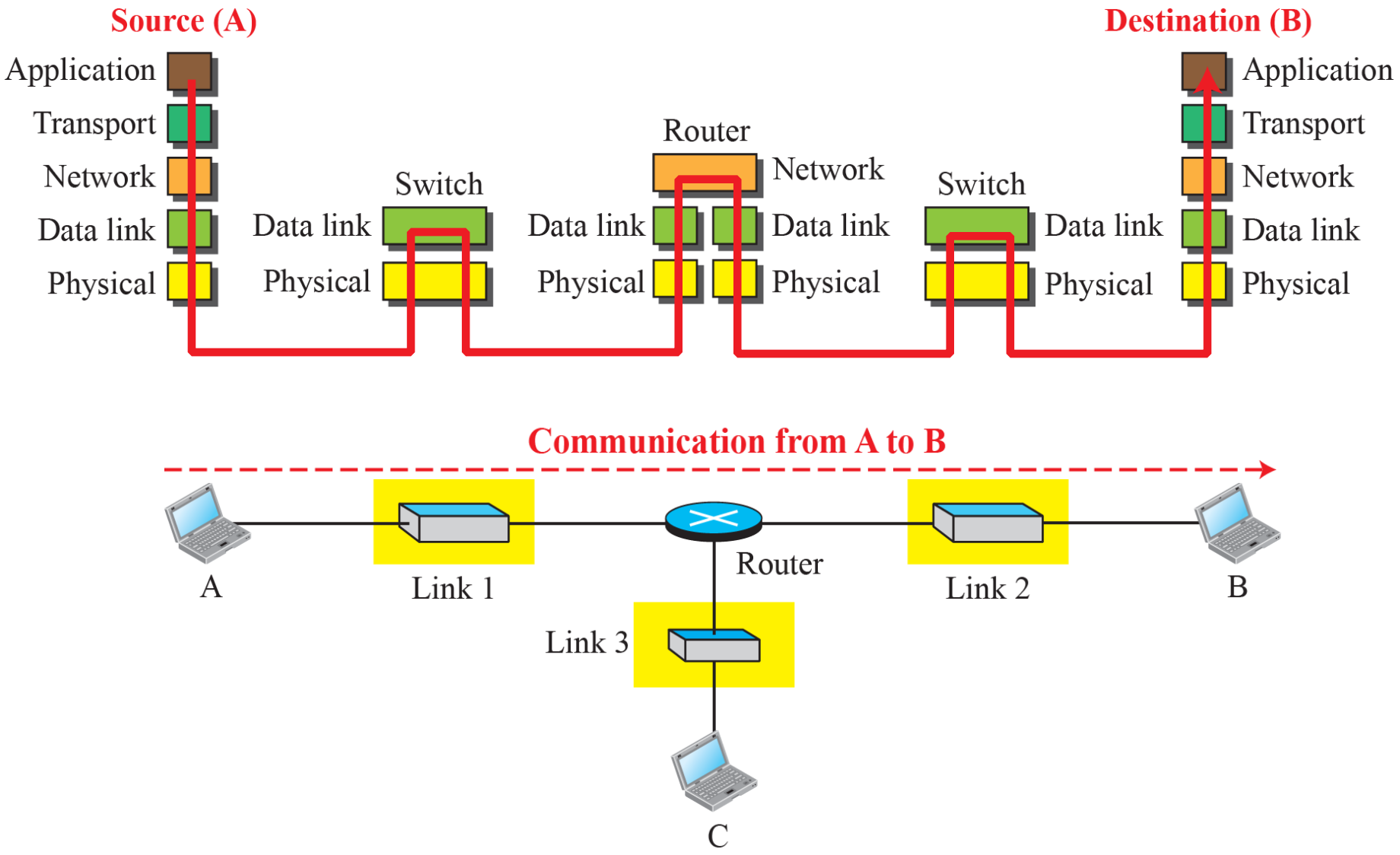
Logical connection between peer layers



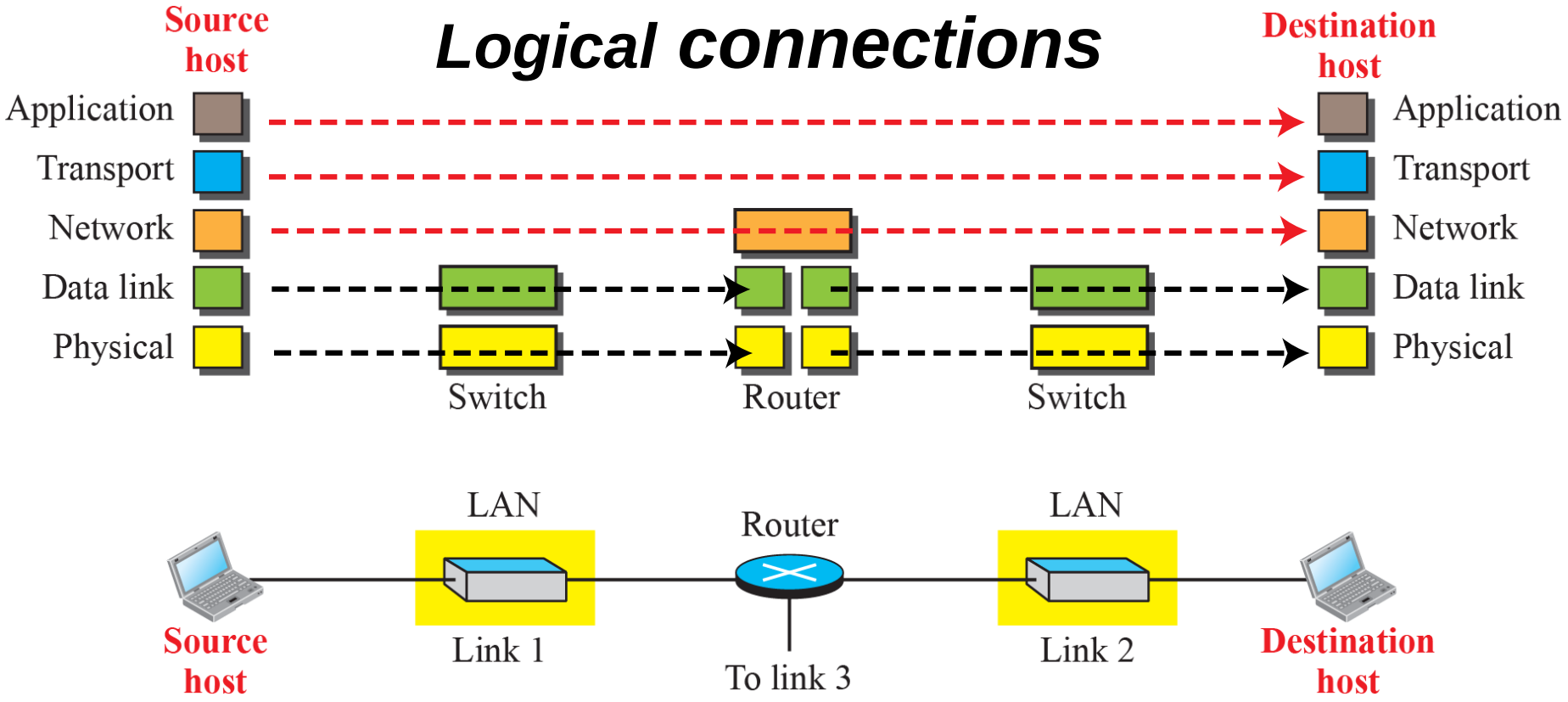
Layers in the TCP/IP protocol suite



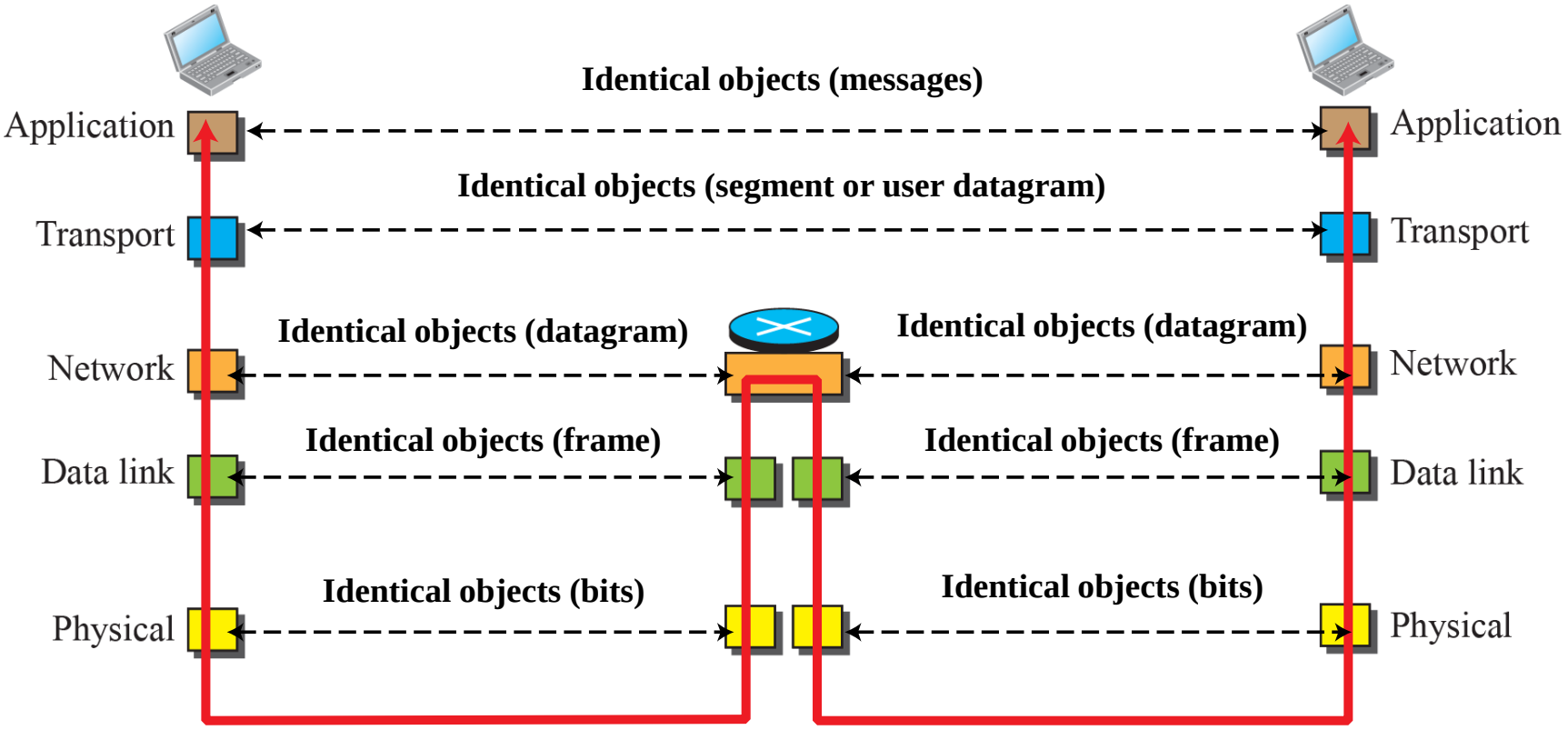
Communication through an internet



Logical connections between layers in TCP/IP



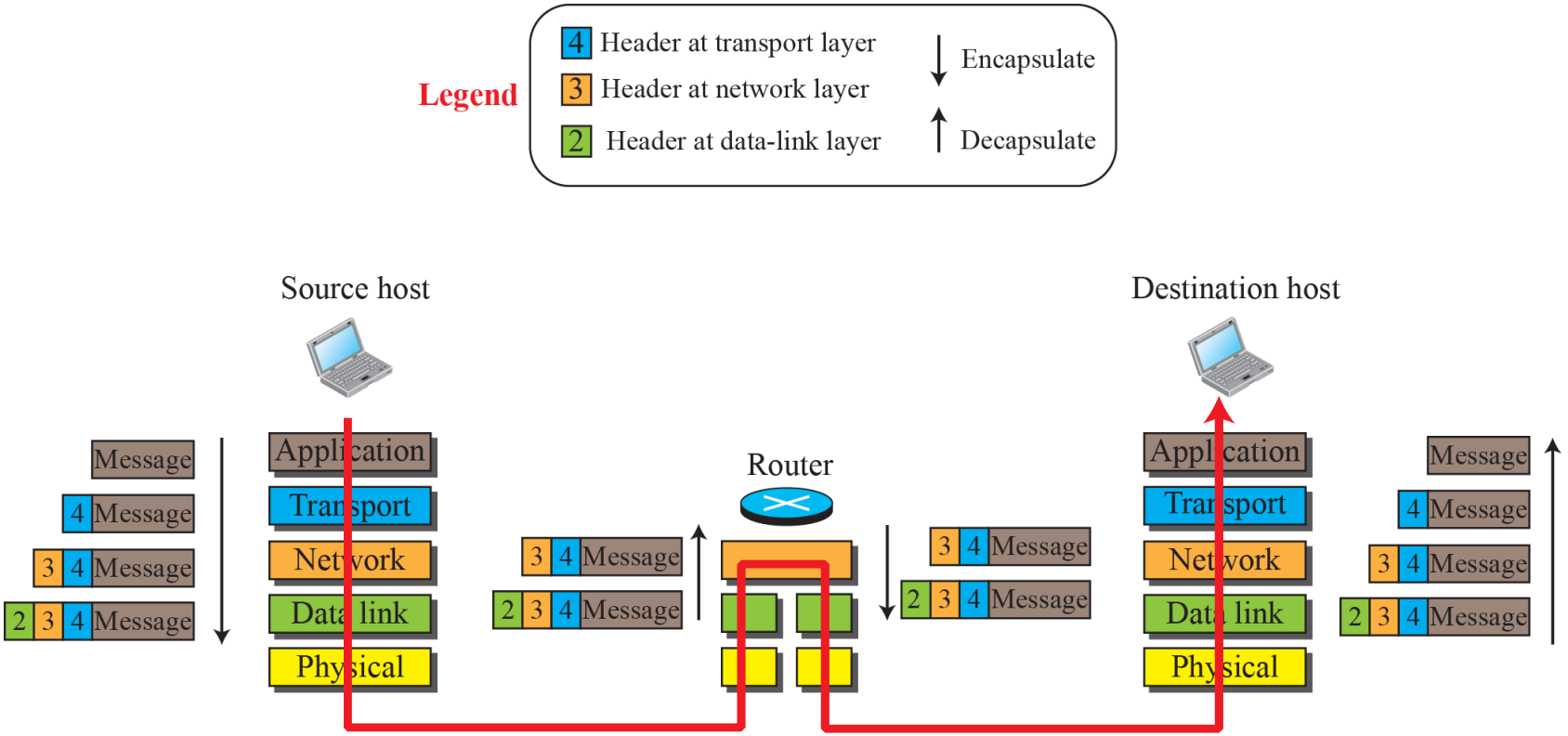
Identical objects in the TCP/IP protocol suite



Encapsulation and Decapsulation

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

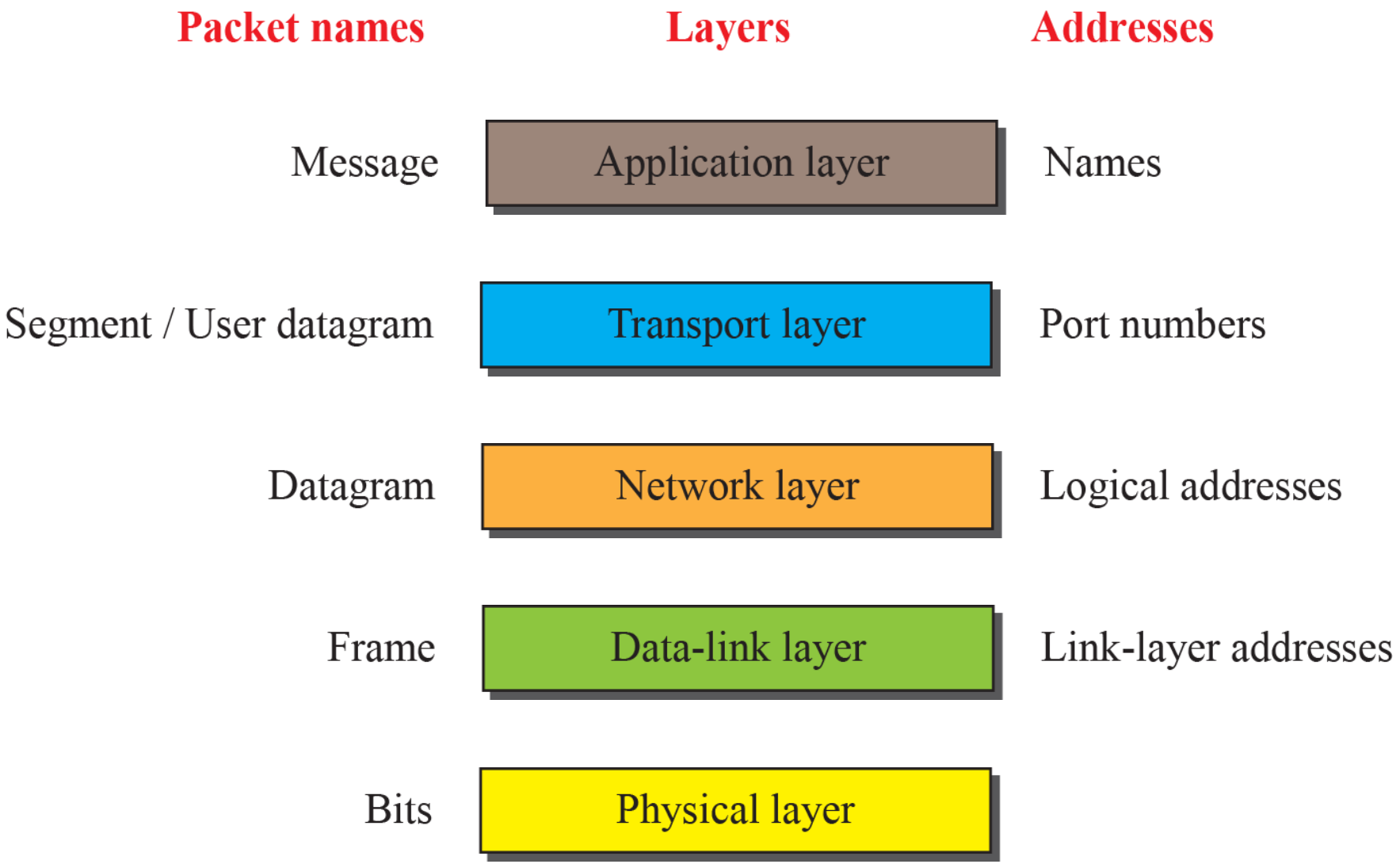
Encapsulation / Decapsulation



Addressing

Any communication that involves two parties needs two addresses: source address and destination address.

Addressing in the TCP/IP protocol suite

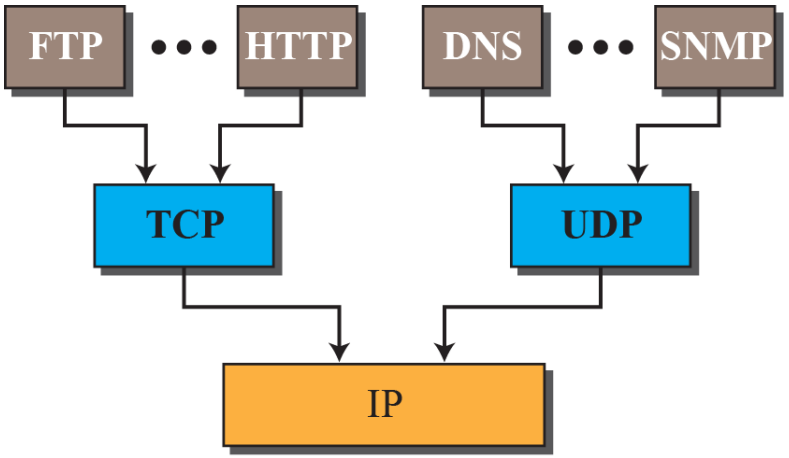


Multiplexing and Demultiplexing

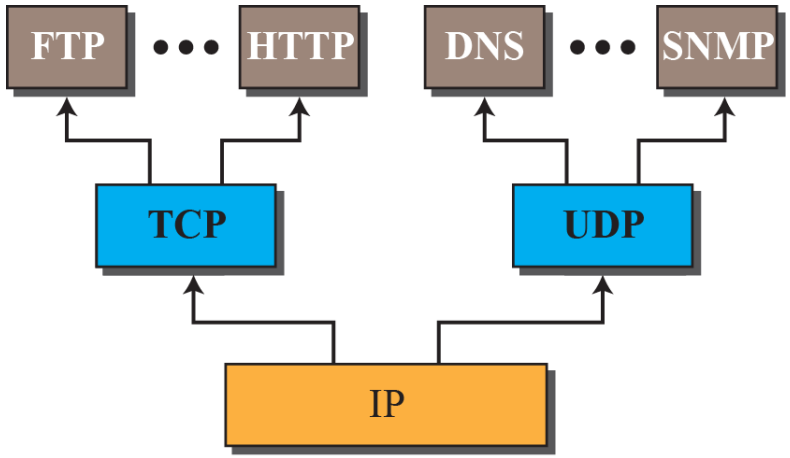
Since the TCP/IP protocol suite uses several protocols at some layers, we can say that we have multiplexing at the source and demultiplexing at the destination.

Multiplexing in this case means that a protocol at a layer can encapsulate a packet from several next-higher layer protocols (one at a time); demultiplexing means that a protocol can decapsulate and deliver a packet to several next-higher layer protocols (one at a time).

Multiplexing and demultiplexing

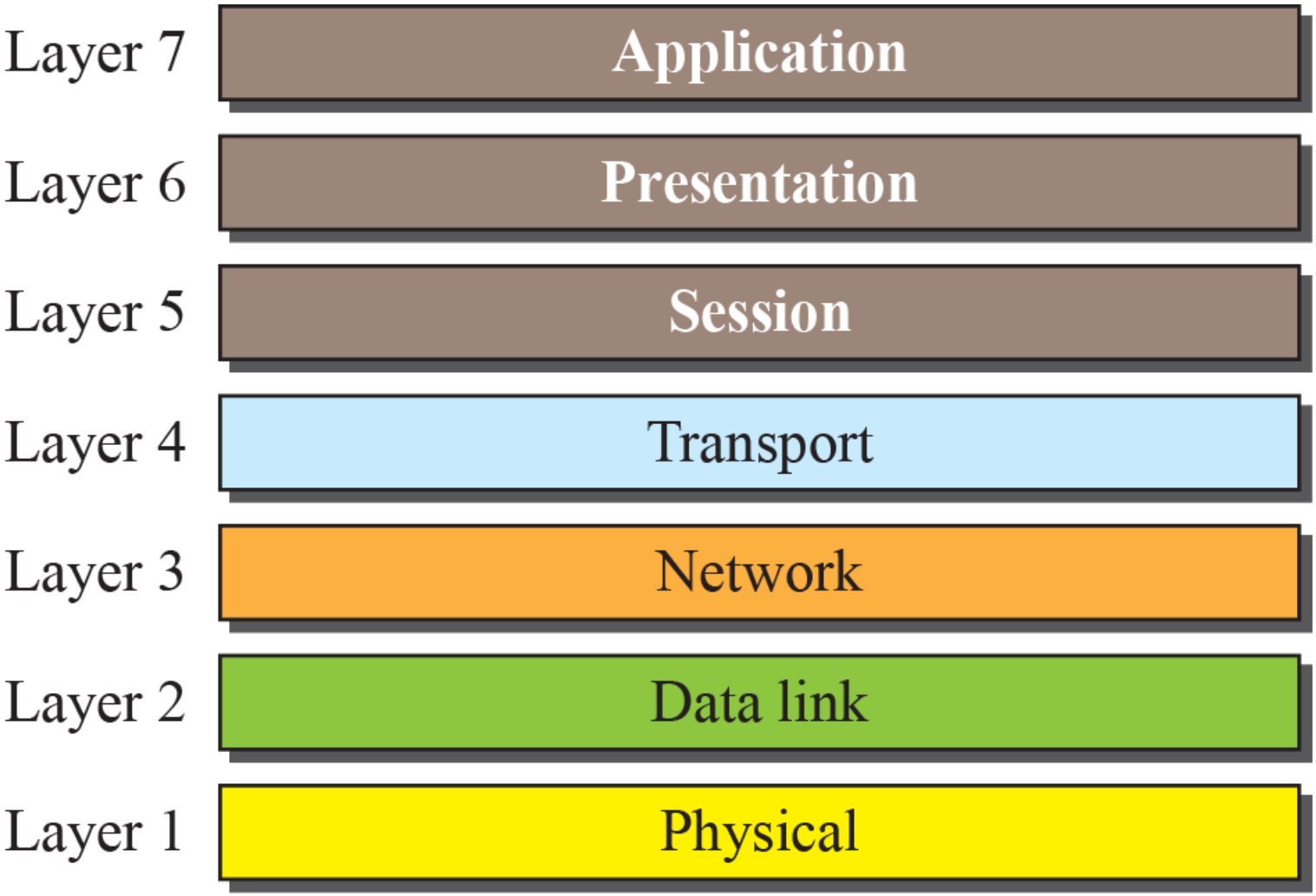


a. Multiplexing at source



b. Demultiplexing at destination

The OSI model

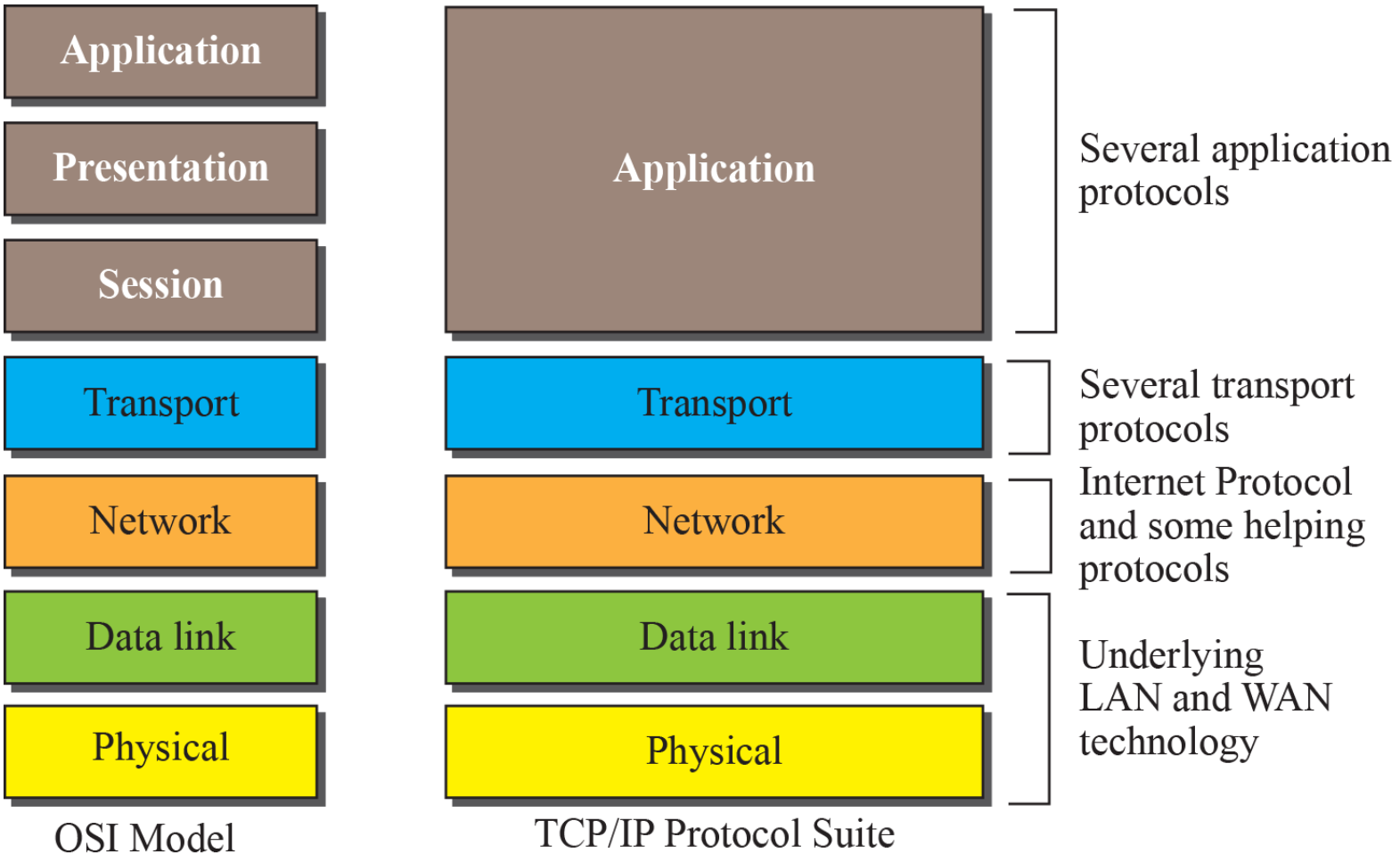


OSI versus TCP/IP

- *Two layers, session and presentation, are missing from the TCP/IP protocol suite.*

- *The application layer in TCP/IP is usually considered to be the combination of three layers in the OSI model*

TCP/IP and OSI model



Lack of OSI Model's Success

The OSI model appeared after the TCP/IP protocol suite. Most experts were at first excited and thought that the TCP/IP protocol would be fully replaced by the OSI model. This did not happen for several reasons, but we describe only three, which are agreed upon by all experts in the field.