Chapter 2: TCP/IP Protocol Suite

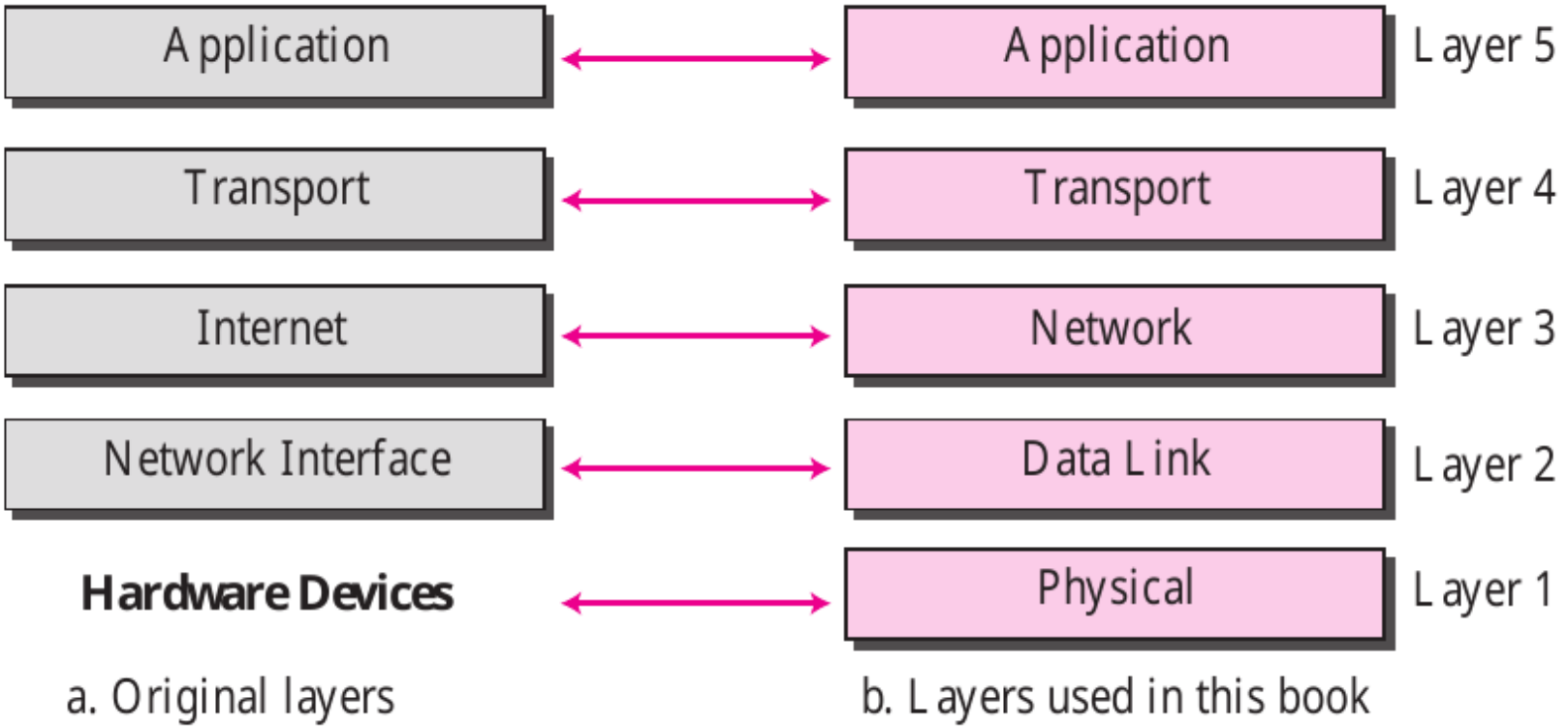
Objectives:

- To introduce the TCP/IP protocol suite and compare its layers with ones in the OSI model.
- To show the functionality of each layer in the TCP/IP protocol.
- To discuss the addressing mechanism used in some layers of the TCP/IP protocol suite for the delivery of a message from the source to the destination.

TCP/IP Protocol Suite

- The TCP/IP protocol suite was developed prior to the OSI model.
- The original TCP/IP protocol suite was defined as four software layers built upon the hardware.
- Today, however, TCP/IP is thought of as a **five-layer** model with the layers named similarly to the ones in the OSI model.

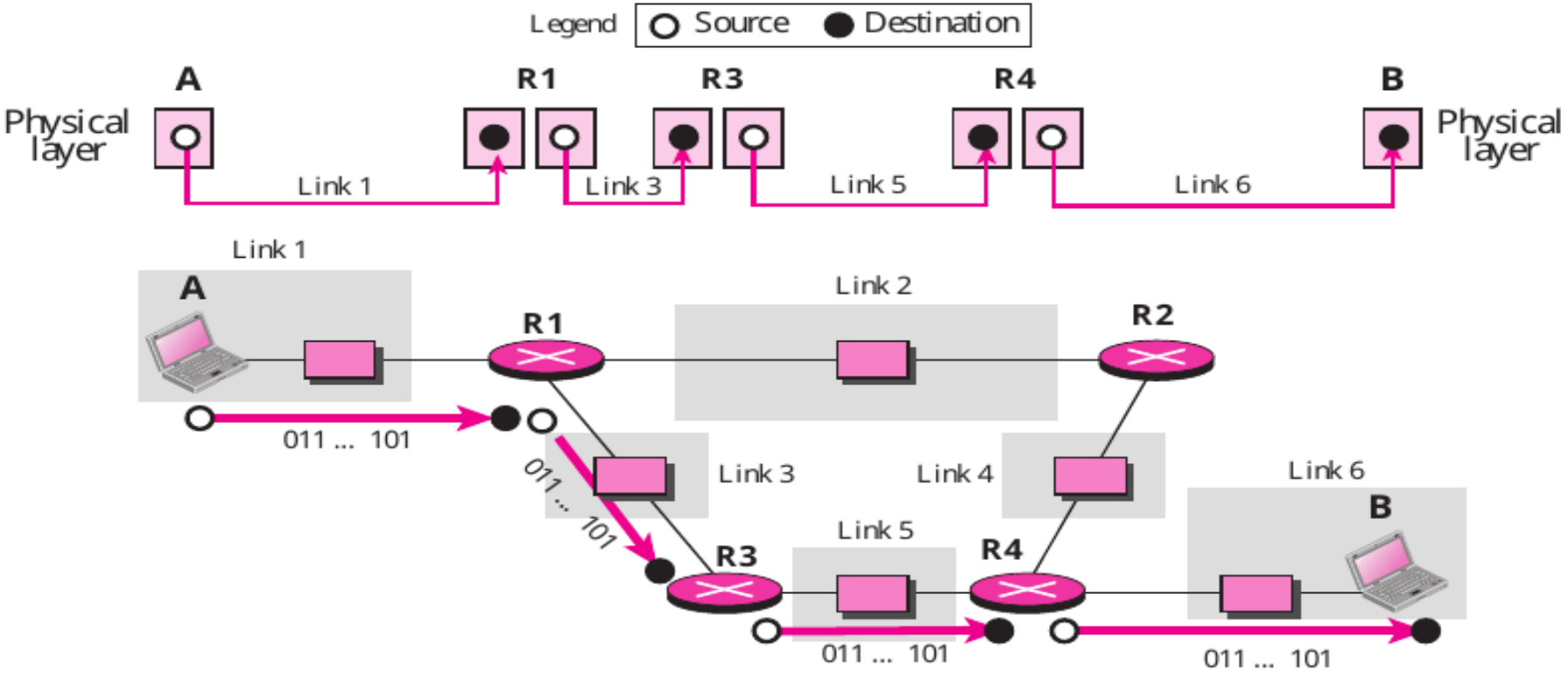
Layers of the TCP/IP Protocol Suite



Physical Layer

- The communication is between two hops or nodes, either computer or router.
- The unit of communication is a single **bit**.
- When the connection is established between the two nodes, a stream of bits is flowing between them.

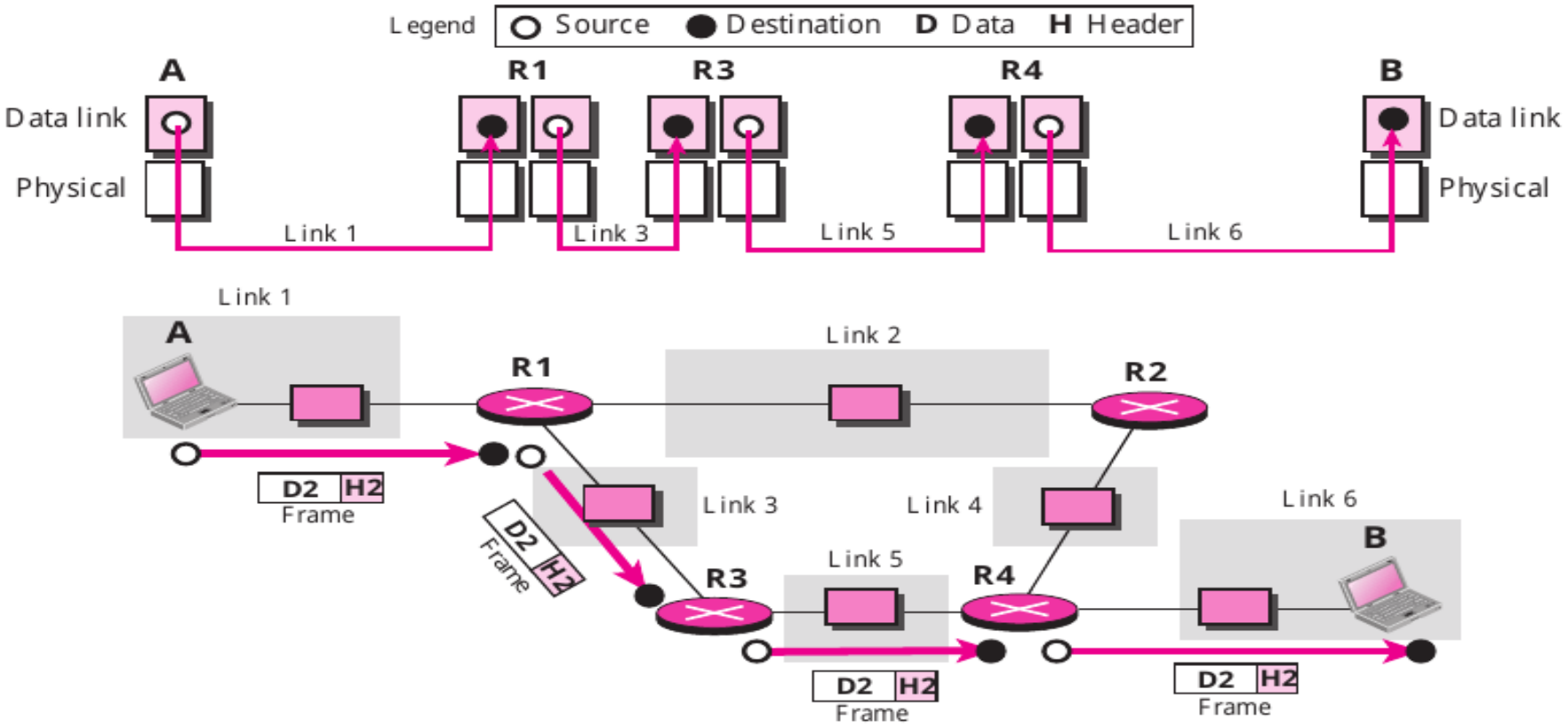
Physical Layer



Data Link Layer

- The communication is also between two hops or nodes.
- The unit of communication however, is a packet called a **frame**.
- A frame is a packet that encapsulates the data received from the network layer with an added header and sometimes trailer.
- The head includes the source and destination of frame.
- The destination address is needed to define the right recipient of the frame because many nodes may have been connected to the link.

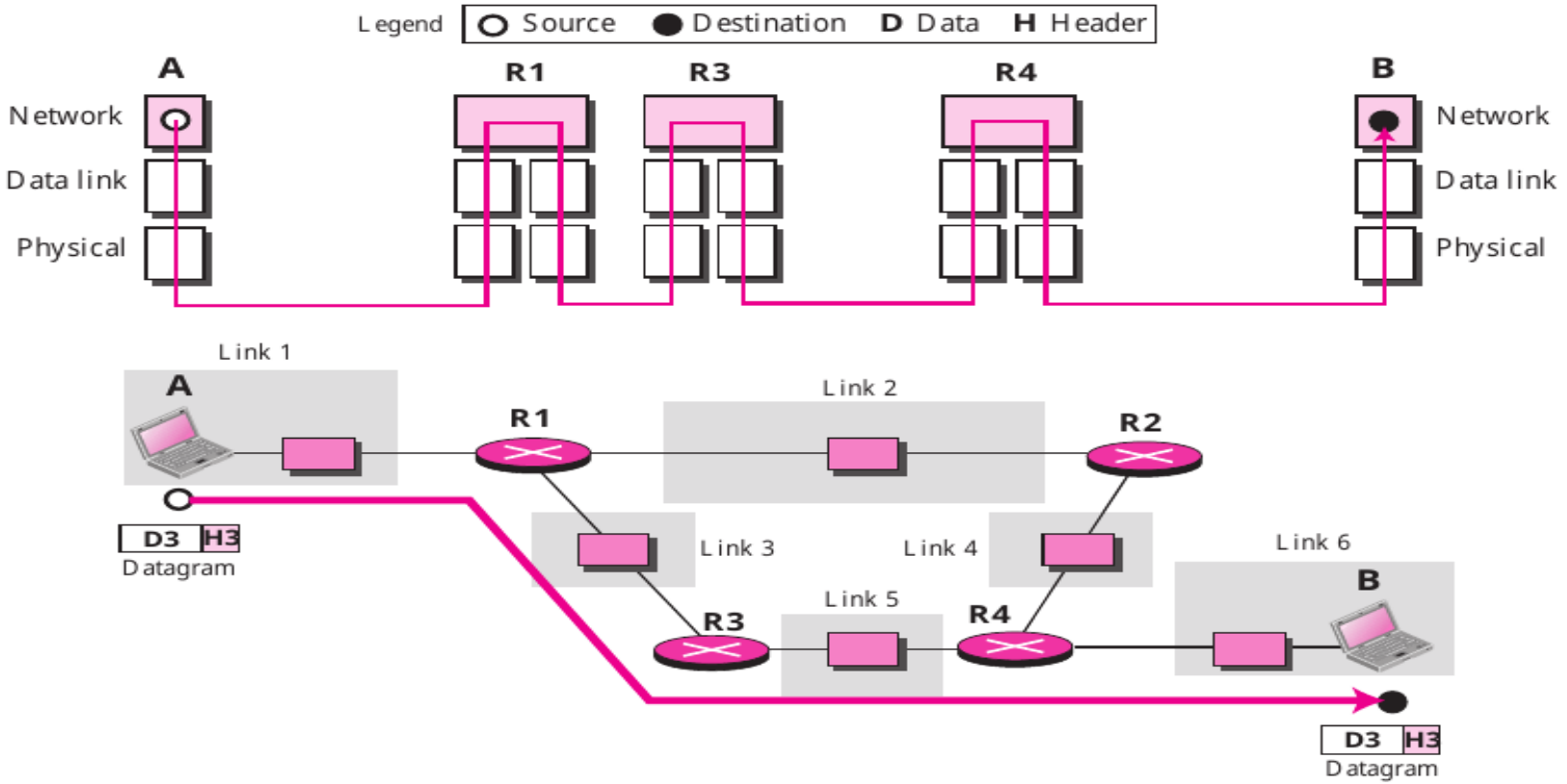
Data Link Layer



Network Layer

- The Internet Protocol is the transmission mechanism used by the TCP/IP protocols.
- IP transports data in packets called **datagrams**, each of which is transported separately.
- Datagrams can travel along different routes and can arrive out of sequence or be duplicated.
- IP does not keep track of the routes and has no facility for reordering datagrams once they arrive at their destination.
- The network layers of the routers can inspect the source and destination of the packet for finding the best route.

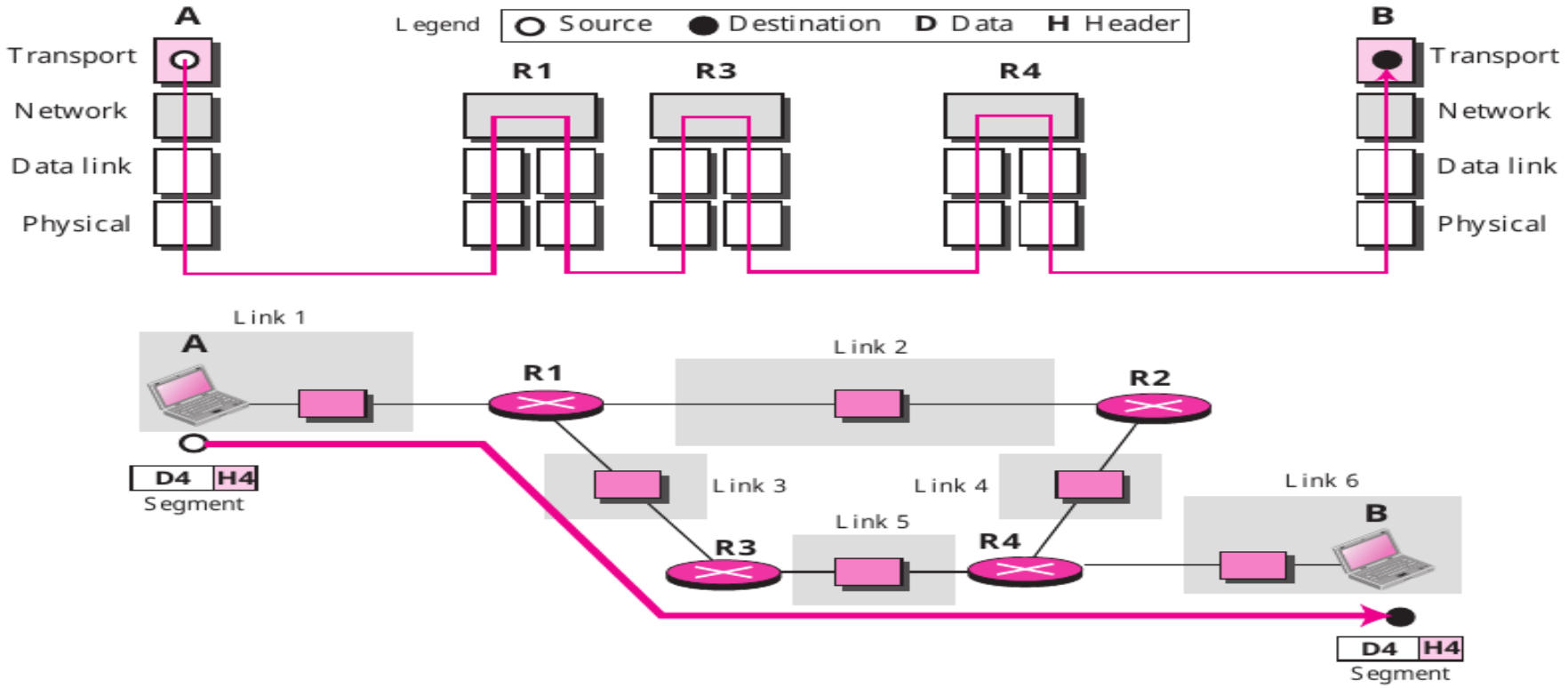
Network Layer



Transport Layer

- The transport layer is responsible for delivering the whole message, which is called a **segment**.
- A segment may consist of a few or tens of datagrams.
- The segment need to be broken into datagrams and each datagram has to be delivered to the network layer for transmission.
- Traditionally, the transport layer was represented in the TCP/IP suite by two protocols, User Datagram Protocol (UDP) and Transmission Control Protocol (TCP).

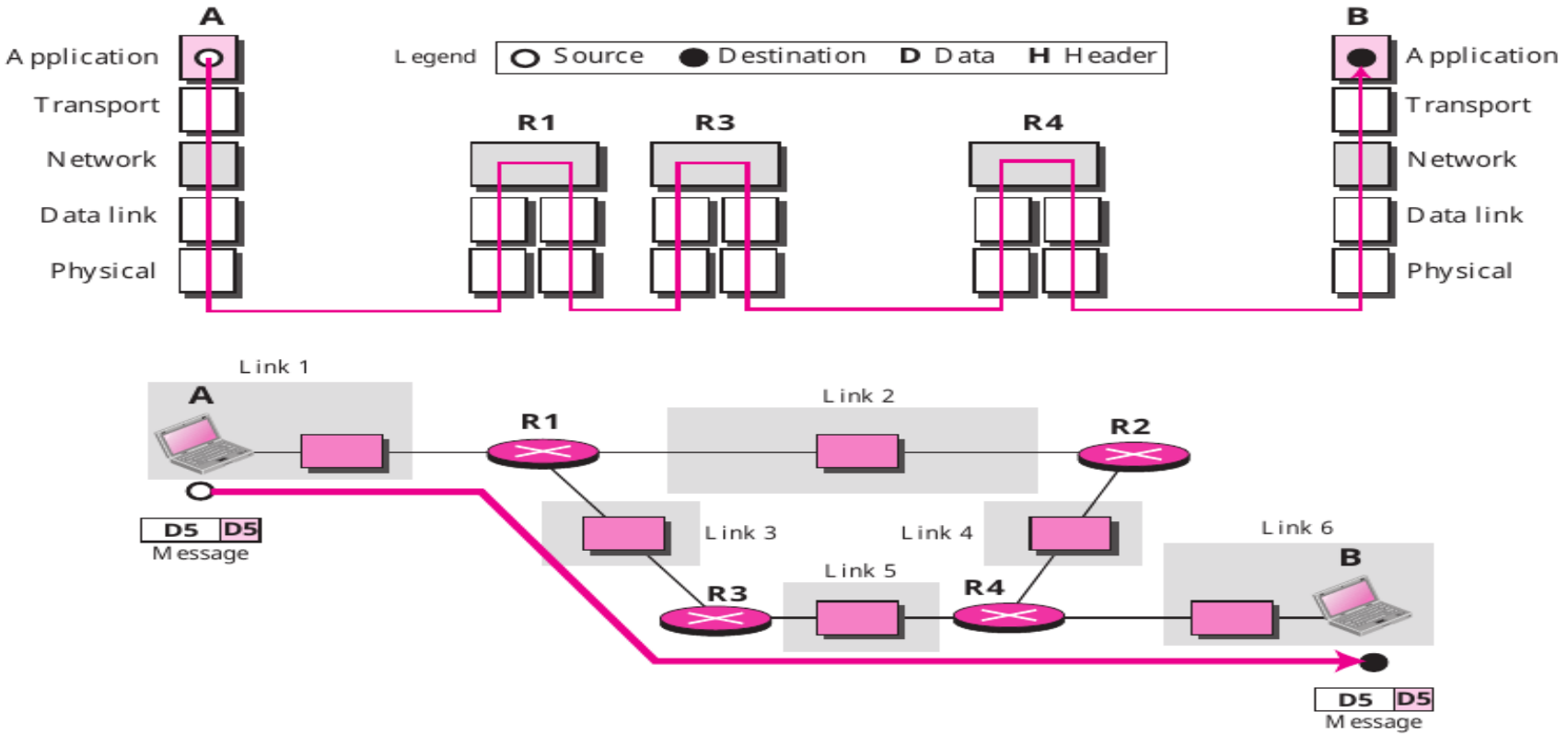
Transport Layer



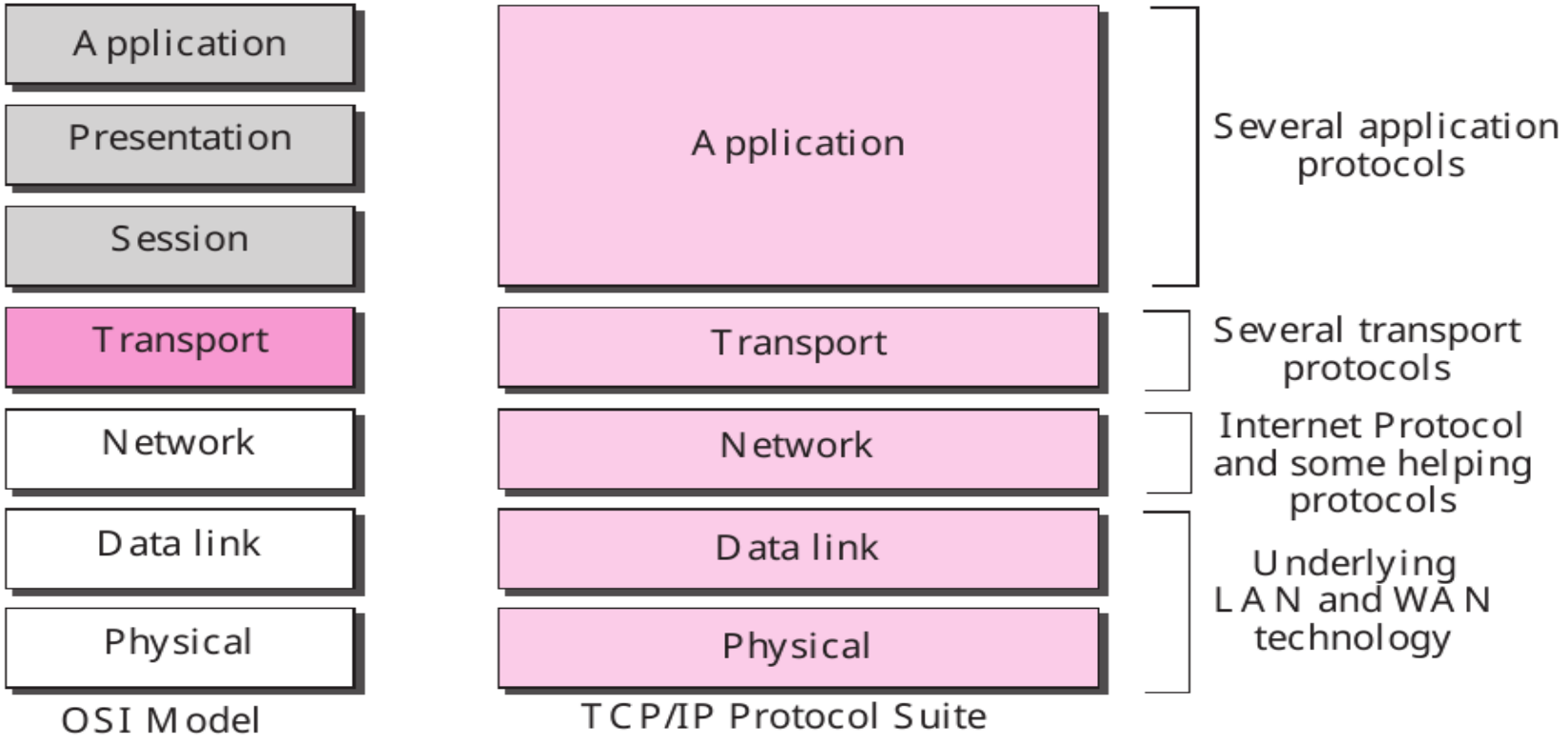
Application Layer

- The application layer in TCP/IP is equivalent to the combined session, presentation, and application layers in the OSI model.
- The application layer allows a user to access the services of our private internet or the global Internet.
- Many protocols are defined at this layer to provide services such as electronic mail, file transfer, accessing the world wide web, and so on.
- The unit of communication at the application layer is **message**.

Application Layer



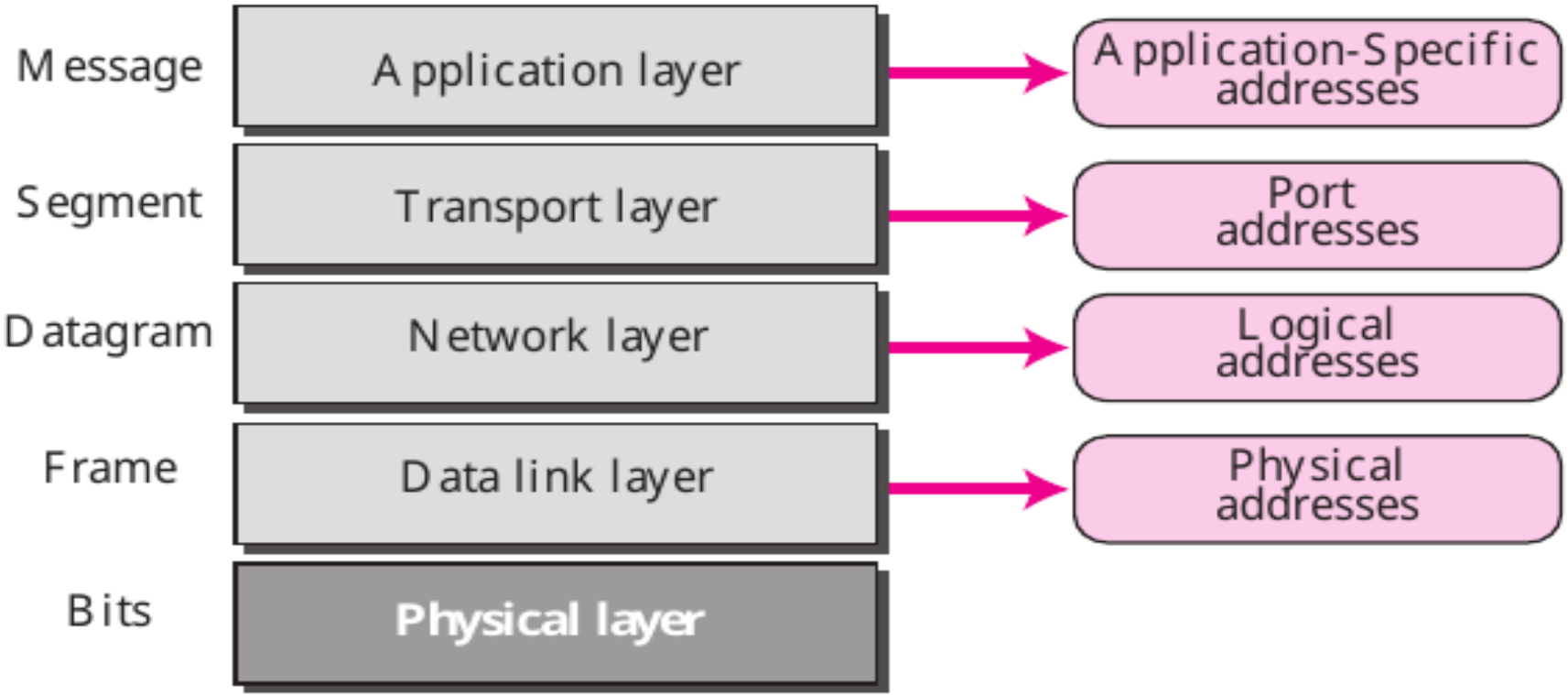
Comparison Between OSI and TCP/IP Protocol Suite



Addressing

- Four levels of addresses are used in an internet employing the TCP/IP protocols: each address is related to a one layer in the TCP/IP.
  - Physical address
  - Logical address
  - Port address
  - Application specific address

Addressing


Message
Application layer
Application-Specific addresses
Segment
Transport layer
Port addresses
Datagram
Network layer
Logical addresses
Frame
Data link layer
Physical addresses
Bits
Physical layer

Addressing

- Physical Address: also known as the link address.
- Example: Ethernet uses 6-byte (48-bit) physical address that is imprinted on the network interface card (NIC).
  - A 6-byte (12 hexadecimal digits) physical address, 07:01:02:01:2C:4B.
- Logical Address: in the Internet is currently a 32-bit address that can uniquely define a host connected to the Internet.
  - A 32-bit address like 192.168.100.1.

Addressing

- Port Address: is used to identify multiple processes running in the same computer, example running Telnet port number 23 and File Transfer Protocol (FTP) port 20.
- Application-Specific Address: Some applications have user-friendly addresses that are designed for the specific application.
  - Example. Universal Resource Locator (URL) www.google.com is equivalent to 172.217.19.68 address

End of Chapter 2

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