Computer Communication Network

Topic: TCP/IP

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THE TCP/IP PROTOCOL SUITE

- The **TCP/IP protocol suite** was developed prior to the OSI model.
- The layers in the TCP/IP protocol suite do not match exactly with those in the OSI model.
- The original TCP/IP protocol suite was defined as four software layers built upon the hardware.
- But now a days TCP/IP is thought of as a five-layer model with the layers named similarly to the ones in the OSI model.
- The five-layer model for networking is from bottom (the link) to top (the user application), these are the physical, data link, network, transport, and application layers.

Layers in the TCP/IP Protocol Suite

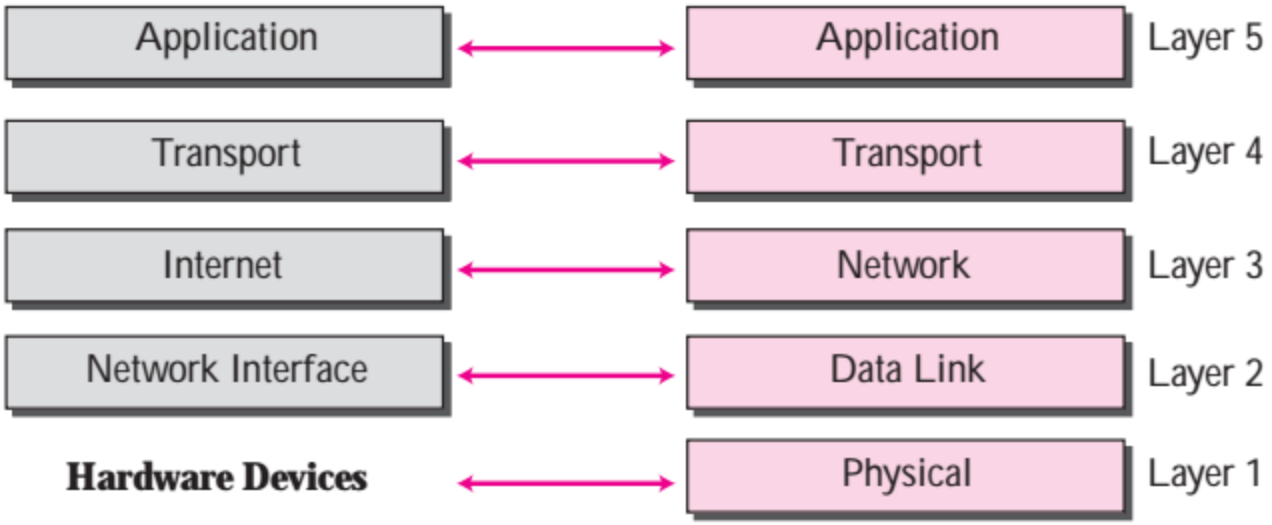


Fig. The five layers of TCP/IP. Older models often show only four layers, combining the physical and data link layers.

Layers in the TCP/IP Protocol Suite

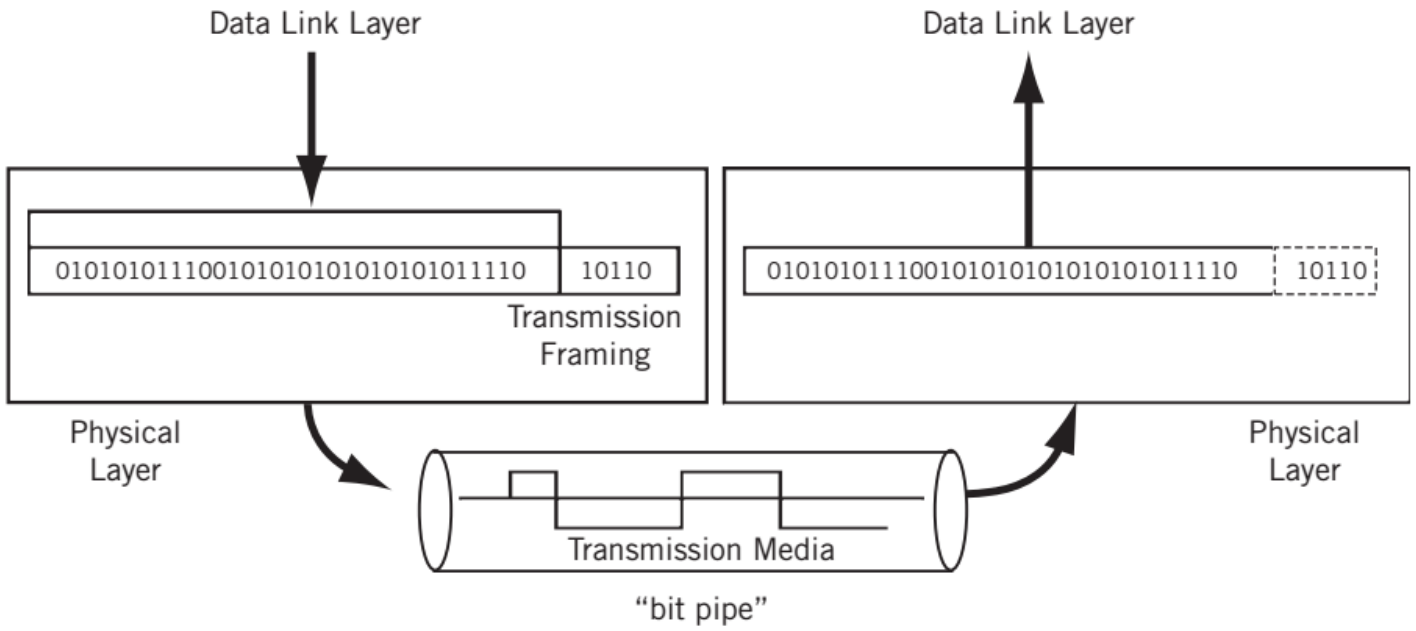
- The TCP/IP stack is comprised of modules.
- Each module provides a specific function, but the modules are fairly independent.
- The TCP/IP layers contain relatively independent protocols that can be used depending on the needs of the system to provide whatever function is desired.
- In TCP/IP, each higher layer protocol is supported by lower layer protocols.

Suite, Stack, and Model

- The term “protocol stack” is often used synonymously with “protocol suite” as an implementation of a reference model.
- However, the term “protocol suite” properly refers to a collection of all the protocols that can make up a layer in the reference model.
- The Internet protocol suite is an example of the Internet or TCP/IP reference model protocols, and a TCP/IP protocol stack implements one or more of these protocols at each layer.

TCP/IP Layers

- **Physical Layer:** Contains all the functions needed to carry the bit stream over a physical medium to another system.
- Figure shows the position of the physical layer to the data link layer and the transmission medium.

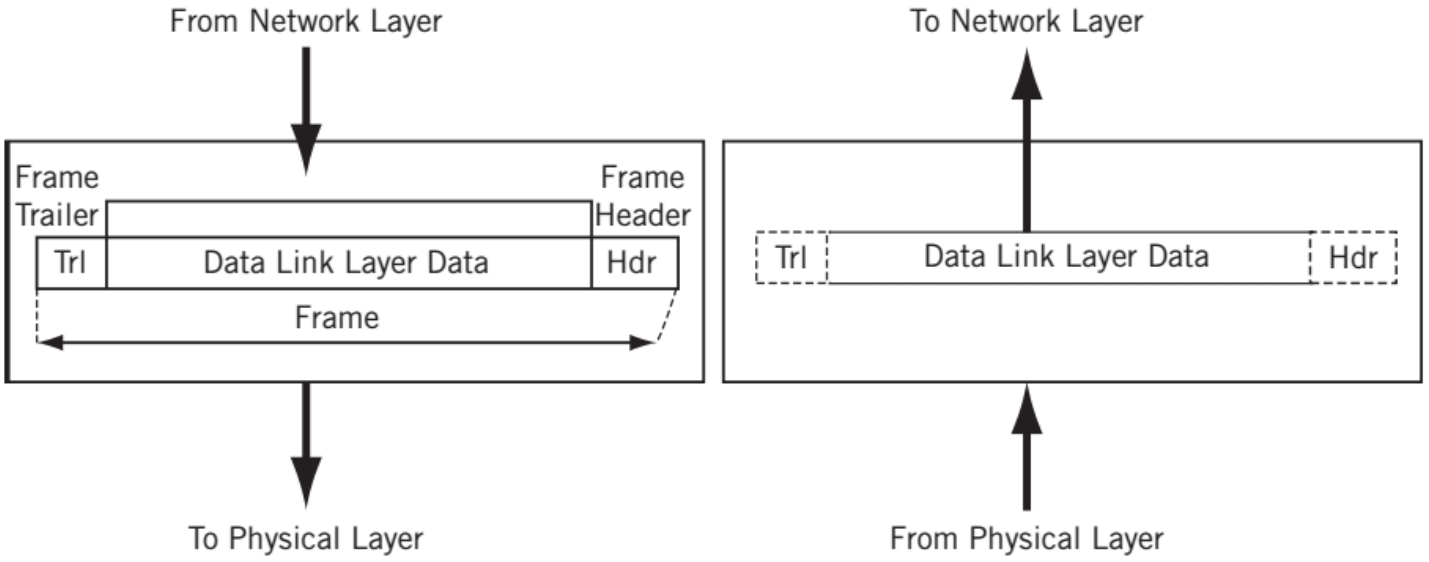


TCP/IP Layers

- The transmission medium forms a pure “bit pipe” and should not change the bits sent in any way.
- The goal is to enable the receiver to reconstruct the bit stream exactly as sent .
- Some information in the form of *transmission framing* can be added to the data link layer data, but this is only used by the physical layer and the transmission medium itself.
- Physical layer specifications have four parts: mechanical, electrical or optical, functional, and procedural.

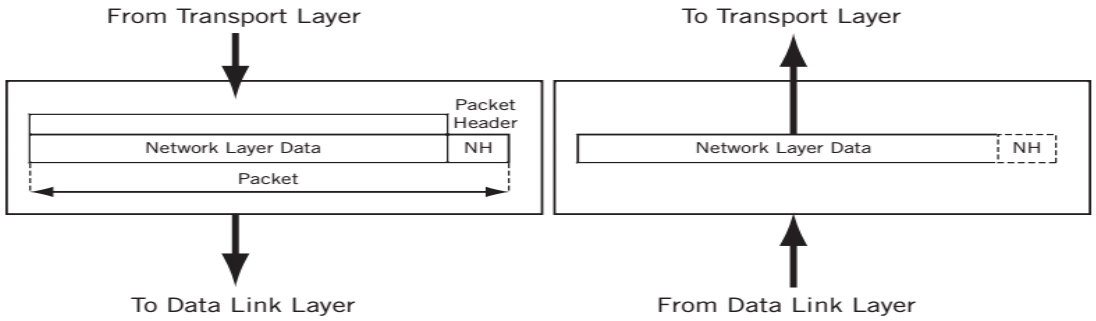
TCP/IP Layers

- **Data Link Layer:** Organizes the bit stream into a data unit called a “frame” and delivers the frame to an adjacent system.



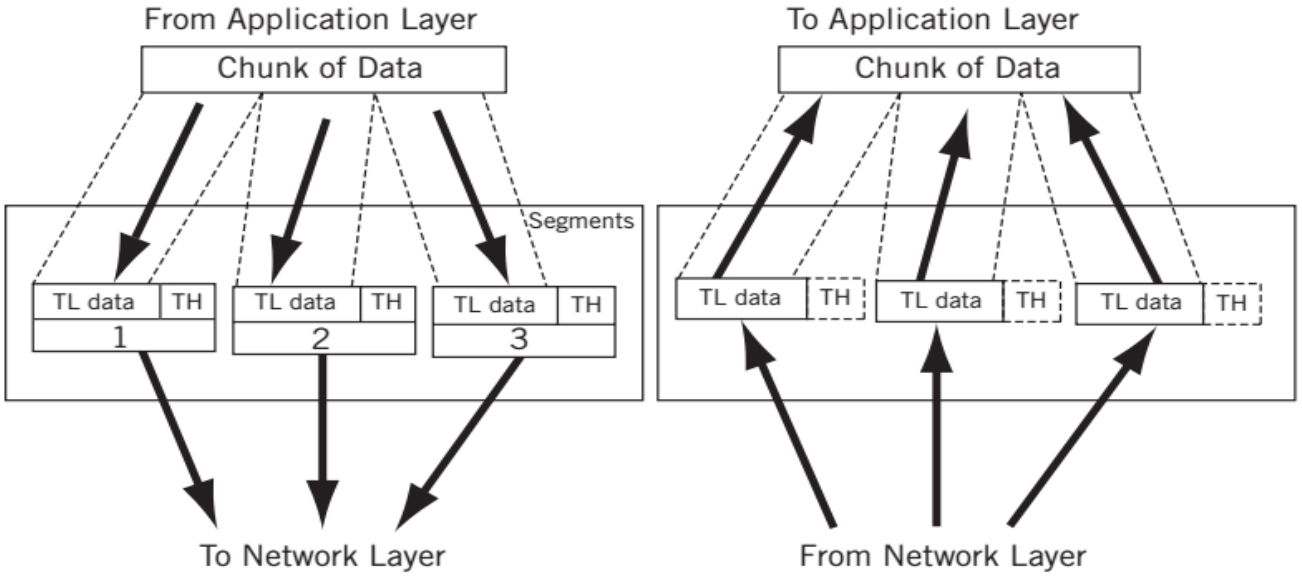
TCP/IP Layers

- **Network Layer:** Delivers data in the form of a packet from source to destination, across as many links as necessary, to non-adjacent systems.
- The biggest difference between the network layer and the data link layer is that the data link layer is in charge of data delivery between *adjacent* systems (directly connected systems one hop away), while the network layer delivers data to systems that are not directly connected to the source.



TCP/IP Layers

- **Transport Layer:** Concerned with process-to-process delivery of information.



The transport layer, showing how data are broken up if necessary and reassembled at the destination.

TCP/IP Layers

- Getting a packet to the destination system is not quite the same thing as determining which process should receive the packet's *content*. A system can be running file transfer, email, and other network processes all at the same time, and all over a single physical interface.
- Naturally, the destination process has to know on which process the sender originated the bits inside the packet in order to reply.
- Also, systems cannot simply transfer a huge multimegabit file all in one packet. Many data units exceed the maximum allowable size of a packet.
- This process of dividing message content into packets is known as *segmentation*.

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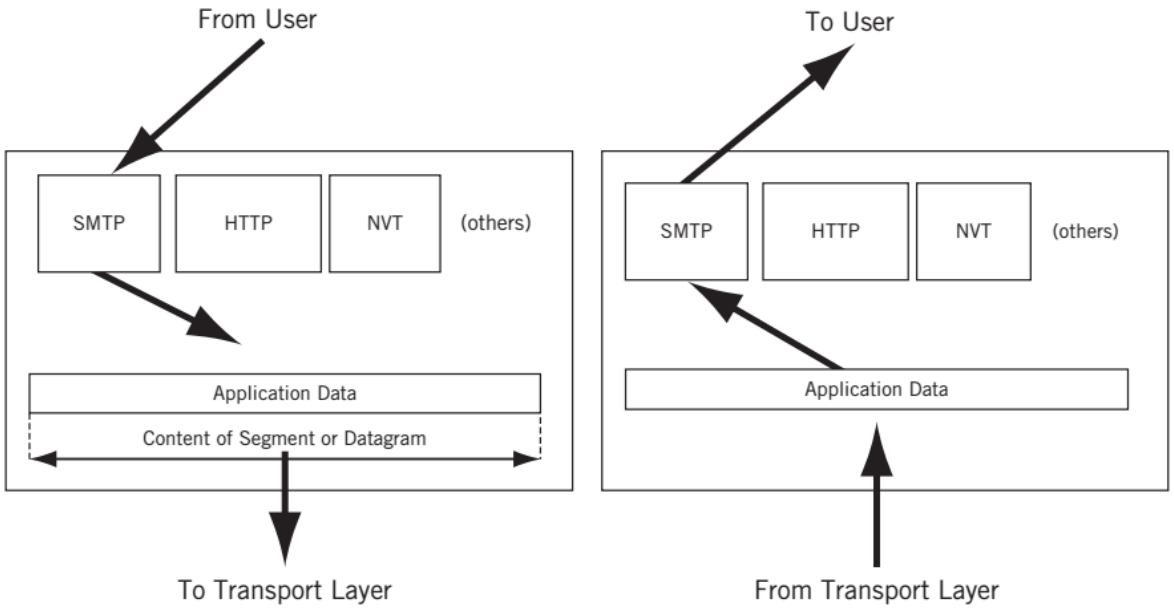
TCP/IP Layers

- **Application Layer:** Concerned with differences in internal representation, user interfaces, and anything else that the user requires.

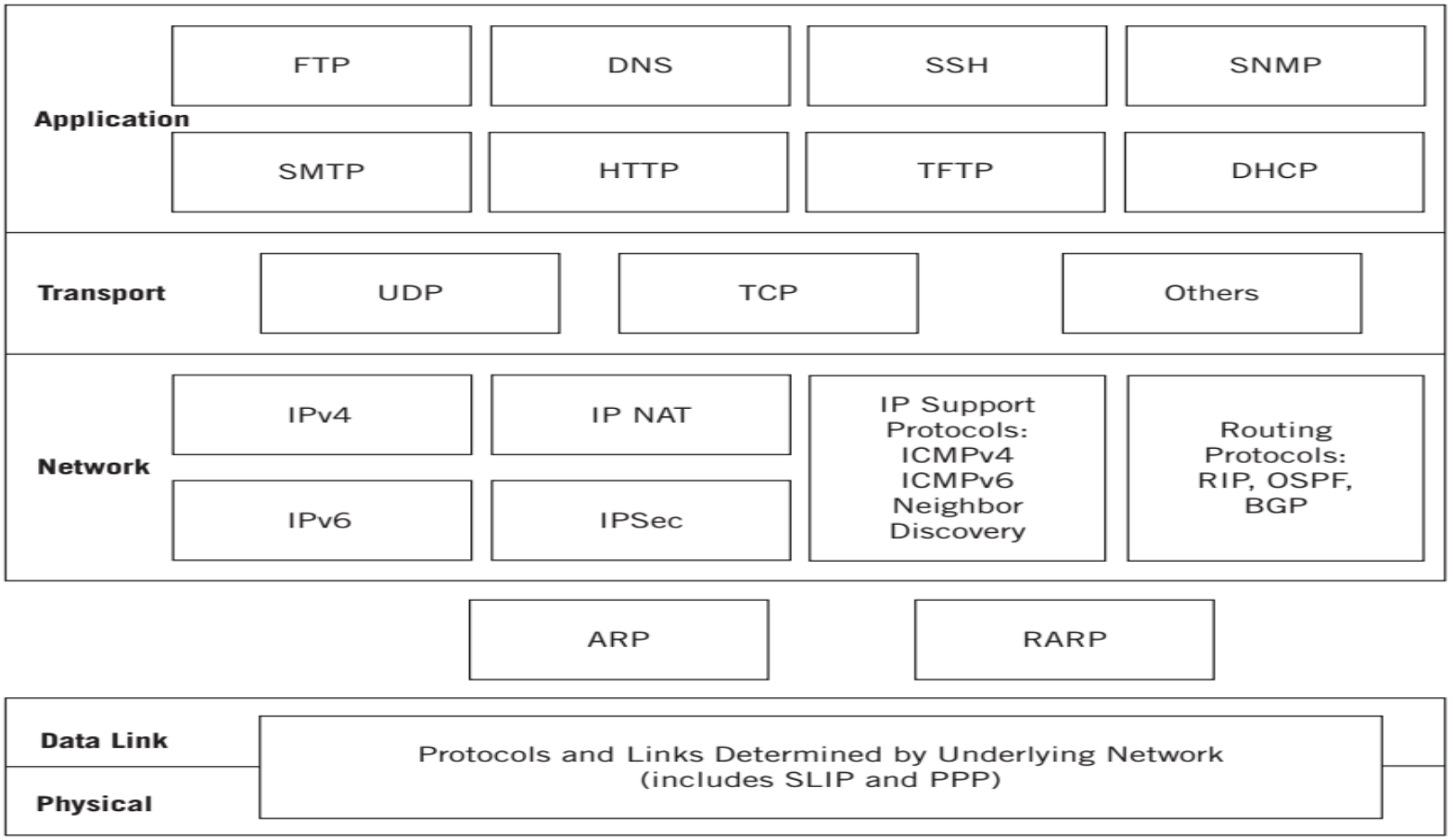


TCP/IP applications, showing how multiple applications can all share the same network connection.

Protocols and Interfaces

- It is important to note that when the layers of TCP/IP are on different systems, they are *only* connected at the physical layer
- Direct peer-to-peer communication between all other layers is impossible.
- This means that all data from an application have to flow "down" through all five layers at the sender, and "up" all five layers at the receiver to reach the correct process on the other system.
- These data are sometimes called a *service data unit* (SDU).
- Likewise, each layer on the receiving system unwraps the received message, often called a *protocol data unit* (PDU).

Protocols and Interfaces



- FTP - File Transport Protocol at the application layer.
- Telnet - Remote session at the application layer.
- SMTP - Simple Mail Transport Protocol at the application layer.
- DHCP - Dynamic host configuration protocol is used to assign IP addresses dynamically to network cards. It works at the application layer.
- TCP - Transport Control protocol is a connection oriented reliable protocol working at the transport layer.
- UDP - User Datagram Protocol is a connection less unreliable protocol working at the transport layer.
- ICMP - Internet Control Message Protocol is used to perform network error reporting and status. It works at the transport layer.
- IGMP - Internet Group Management Protocol is used to manage multicast groups and it works at the transport layer.
- IP - Internet Protocol is used for software addressing of computers and works at the network layer.
- ARP - Address Resolution Protocol is used to resolve the hardware address of a card to package the ethernet data. It works at the network layer.
- RARP - Reverse Address Resolution Protocol used for disk less computers to determine their IP address using the network. It works at the network layer.