The TCP/IP Reference Model

The layers in the TCP/IP protocol suite do not exactly match those in the OSI model. The original TCP/IP protocol suite was defined as having four layers:
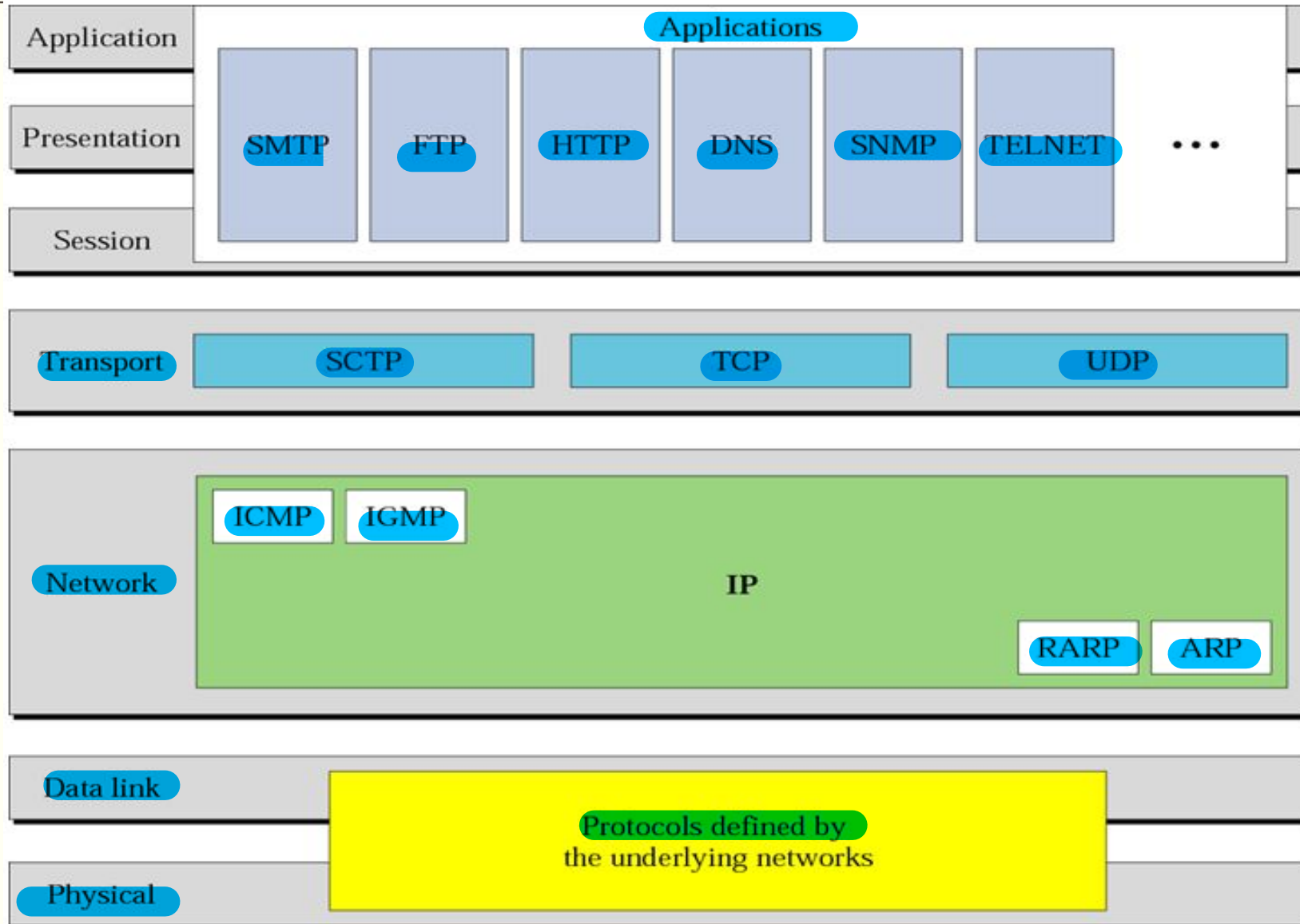
1. host-to-network (link).

2. Network (Internet).

3. Transport.

4. application.

The TCP/IP Reference Model

Comparing OSI and TCP/IP models.

- The **host-to-network (link)** layer is equivalent to the combination of the **physical** and **data link** layers.

- The **internet** layer is equivalent to the **network** layer.

- The **application** layer is roughly doing the job of the **session**, **presentation** and **application** layers with the transport layer in TCP/IP taking care of part of the duties of the session layer.

The TCP/IP and OSI Model

Application	**Applications**
Presentation	SMTP FTP HTTP DNS SNMP TELNET ...
Session	

Transport	SCTP TCP UDP

Network	ICMP IGMP IP RARP ARP

Data link	**Protocols defined by** the underlying networks
Physical	

The TCP/IP Reference Model

1. Host-to-network (link) Layer. (Physical and Data Link Layers)

TCP/IP does not define any specific protocol.

A network in a TCP/IP internetwork can be a local-area network or a wide-area network.

2. Network (Internet) Layer.

TCP/IP supports the **Internetworking Protocol (IP)**

IP uses four supporting protocols:

a- **ARP**, b- **RARP**, c- **ICMP**, and d- **IGMP**.

The TCP/IP Reference Model/ Network (Internet) Layer.

Internetworking Protocol (IP)

is the transmission mechanism used by the TCP/IP protocols.

It is an **unreliable** and **connectionless** protocol provides no error checking or tracking.

IP transports data in packets called **datagrams.**

a- ARP (Address Resolution Protocol).

Is used to associate a logical address with a physical address.

Each device on a link is identified by a physical address, usually imprinted on the network interface card (NIC).

Is used to find the physical address of the node when its IP address is known.

The TCP/IP Reference Model/ Network (Internet) Layer.

a- ARP (Address Resolution Protocol).

- Anytime a host or a router needs to find the link-layer address of another host or

- router in its network, it sends an **ARP** request packet.

- The packet includes the link-layer and IP addresses of the sender and the IP address of the receiver.

- only the intended recipient recognizes its IP address and sends back an ARP response packet.

The TCP/IP Reference Model/ Network (Internet) Layer.

b- RARP (Reverse Address Resolution Protocol).

It allows a host to discover its IP address when it knows only its physical address. It is used when a computer is connected to a network for the first time.

c- ICMP (Internet Control Message Protocol).

It is a mechanism used by hosts and gateways to send notification of datagram **problems** back to the sender.

d- IGMP (Internet Group Message Protocol).

It is used to facilitate the simultaneous transmission of a message to a group of receivers.

The TCP/IP Reference Model

3. Transport Layer

Transport layer was represented in TCP/IP by two protocols: TCP and UDP.

UDP and **TCP** are transport level protocols responsible for delivery of a message from a process (running program) to another process.

A new transport layer protocol, **SCTP**, has been devised to meet the needs of some newer applications.

a- **The User Datagram Protocol (UDP)**

It is a process-to-process protocol that **adds** only **port addresses**, **checksum error** control, and **length information** to the data from the upper layer.

The TCP/IP Reference Model

b- The Transmission Control Protocol (TCP)

TCP is a reliable **connection-oriented** transport protocol.

A connection must be **established** between both ends of a transmission before either can transmit data.

Each segment includes a **sequence number** for reordering.

At the receiving end, TCP collects each datagram as it comes in and reorders the transmission based on sequence numbers.

c- The Stream Control Transmission Protocol (SCTP)

provides support for newer applications such as voice over the Internet.