ICE 4017: COMPUTER NETWORKS AND PROTOCOL

Lecture 6-1: TCP/IP Model and Examples

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TCP/IP Reference Models

Transport Layer:

Two end to end protocols are defined

(a) TCP (reliable) (b) UDP (unreliable)

TCP:

1. It is a reliable connection oriented protocol that allows transmission of data stream without any error.
2. The transmitting TCP will fragment the data into 'messages' and pass it to network layer. The receiving TCP will reassembles the messages.
3. Retransmission request is sent to the sending TCP if the received message is erroneous. TCP also handles flow control.

TCP/IP Reference Models

UDP (User Datagram Protocol):

It is unreliable connectionless protocol. It is useful for applications where the TCP sequencing, flow control and accurate delivery is not needed.

Network Layer (Internet Layer):

It holds the whole architecture together based on packet-switched connectionless network.

(a) The IP layer translates the source and destination address obtained from the TCP segment into a form, which is universally recognized by all the networks. For this an IP header will be attached.

TCP/IP Reference Models

(b) The second function of IP is to fragment the TCP segment into smaller pieces for proper routing (these will have the same IP header, but different sequence number). Rearranging is needed as they arrive at the destination in a different sequence.

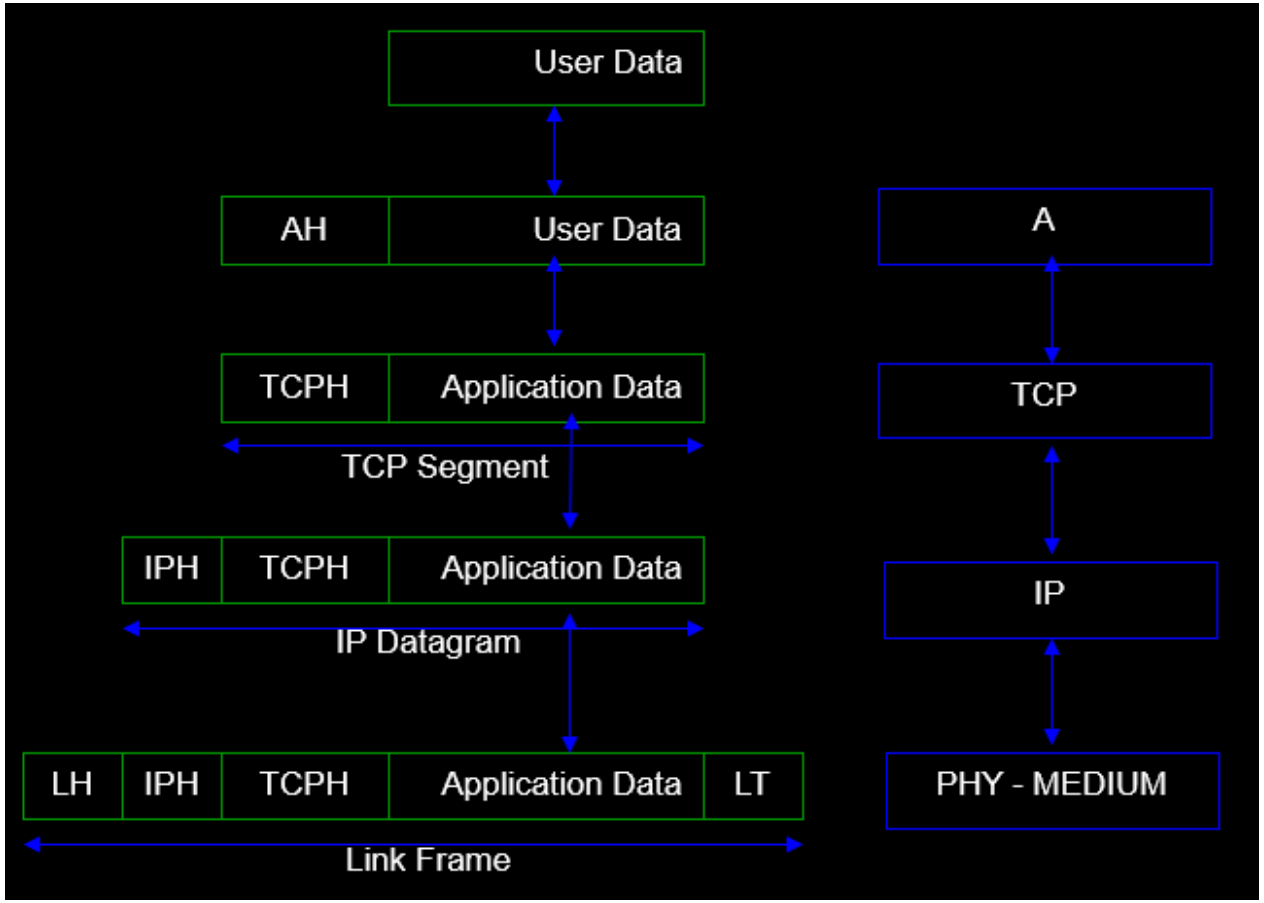
(c) The third function is to provide routing information in the IP header (to avoid congestion and longer routes)

Host - Network or Link Layer:

It provides a header and a trailer. The IP datagram along with the header and the trailer appended in this layer is called a *frame*.

The TCP/IP model does not say about what happens in this layer. The protocol varies from host to host and network to network.

TCP/IP Reference Models



Trailer is a 32 bit CRC used for error detection.

Reference Models – Comparison:

Similarities:

(a) Stack of independent protocols.

(b) Functions of the layers.

(c) End to end and application / user oriented services.

Differences:

Reference Models – Comparison:

	ISO – OSI	TCP / IP
1.	Clear distinction between the three concepts (services, interfaces and protocols) exist. (Services define the layer operation, protocol is a set of rules to implement the service, and interface tells the processes above it how to access it.	Not very clear distinction Ex: The real service offered by Internet layer is sending and receiving IP packets.
2.	Protocols are more hidden	Less hidden.
3.	The model came first and then the protocol.	The protocol came first and then the model.
4.	The protocols were quite general. Hence the layers were having less specific functionality. (Designers had less experience)	The protocols fit perfectly with the model. Good only for TCP / IP networks.

Reference Models – Comparison:

	ISO – OSI	TCP / IP
5.	7 layers	4 layers
6.	Supports both connection oriented and connectionless communication in the network layer.	Supports connectionless communication in network layer.
7.	Only connection oriented communication in transport layer.	Supports both connection oriented and connectionless communication in the transport layer (TCP, UDP)

Example Problems:

Example 1:

Find the propagation delay for a signal traversing the following networks at a speed of 2.3×10^8m/sec in cable;

i) A circuit board: 10 cm

ii) A campus: 1km

iii) Up and down to a geostationary satellite: 2 x 36,000 kms

Solution:

(i) Propagation delay, $t_p = 0.1\text{m}/ 2.3 \times 10^8\text{m/sec} = 0.435$ nsec

(ii) Propagation delay, $t_p = 1000\text{m}/ 2.3 \times 10^8\text{m/sec} = 4.35$ μsec

(iii) Propagation delay, $t_p = 2 \times 36000 \times 1000\text{m}/ 2.3 \times 10^8\text{m/sec} =$ 313 msec

Example Problems:

Example 2:

In the example 1, how many bits are in transit during the propagation delay if bits are entering the networks of example 1 at (i) 10 kbps (ii) 10 Mbps (iii) 10 Gbps.

Solution:

For the circuit board network:

(i) Number of bits in transit, b = (0.435 nsec) (10 kbps) = 4.35 μbits

(ii) b = (0.435 nsee) (10 Mbps) = 4.35 mbits

(iii) b = (0.435 nsee) (10 Gbps) = 4.35 bits

Example Problems:

For the campus network: .

(i) b = (4.35 μsec) (10 kbps) = 43.5 mbits

(ii) b =(4.35 μsec) (10 Mbps) = 43.5 bits

(iii) b =(4.35 μsec) (10 Gbps) = 43.5 kbits

For the geostationary satellite network:

(i)b = (313 msec) (10 kbps) = 3.13 kbits

(ii) b = (313 msec) (10 Mbps) = 3.13 Mbits

(iii) b = (313 msee) (10 Gbps)= 3.13 Gbits