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Course: data communication and networks

Q.1: Protocol layering can be found in many aspects of our lives such as air travelling. Imagine you make a round-trip to spend some time on a vacation at a resort. You need to go through some processes at your city airport before flying. You also need to go through some processes when you arrive at the resort airport. Show the protocol layering for the round trip using some layers such as baggage checking/claiming, boarding/off-boarding, takeoff/landing.

Answer:

Protocol layering for the round trip for the vocation air travel.

Explanation:

Round trip means: Source --->

Destination ----->

Source Let us make the protocol layering for Source------>

Destination first. The layers at the Source Airport 1. Booking Tickets. 2. Passing Airport Security Check (In order to enter the Airport) 3. Checking in Baggage 4. Boarding the airplane from the Boarding gate. 5. Airplane Takeoff 6. Airplane take the route to destination. (This is an intermediate layer for both source and destination airport) Layers at the Destination Airport 7. Airplane Landing 8. De-boarding from a Gate 9. Claiming Baggage from the Baggage Carousel (The conveyor belt at the airport) 10. Filing Complain if any. 11. Exit the Airport. This is for Source ---->Destination.

Now as for the round trip. We will follow the same layers but from destination to source. (We assume return tickets were already booked) Layer at the Resort Airport: 1. Entering Airport gate (Passing security check) 2. Checking in the Baggage 3. Boarding flight from Gate 4. Airplane Takeoff 5. Airplane is routed to the source (By source i mean the source of the individual (City airport) as he/she is returning back) Layers at the city airport: 6. Airplane Landing 7. De-boarding flight from a gate. 8. Claiming baggage from the baggage carousel. 9. Filing Complain if any. 10. Exit Airport Routing of the Flight will act as an intermediate layer which routes the flight from the source to destination after takeoff and till landing.

Q.2: Give some advantages and disadvantages of combining the session, presentation and application layer in the OSI model into one single application layer in the TCP/IP protocol suite.

Answer:

- Advantages

  TCP/IP is a practical protocol model that is commercially used. It shows the application layer which represents the functionalities of the session and presentation layer. OSI model has separate session presentation and application but the model cannot be fully executed.

  It minimize the efforts required to traverse the layers as fewer layers mean less traversal.

- Disadvantages

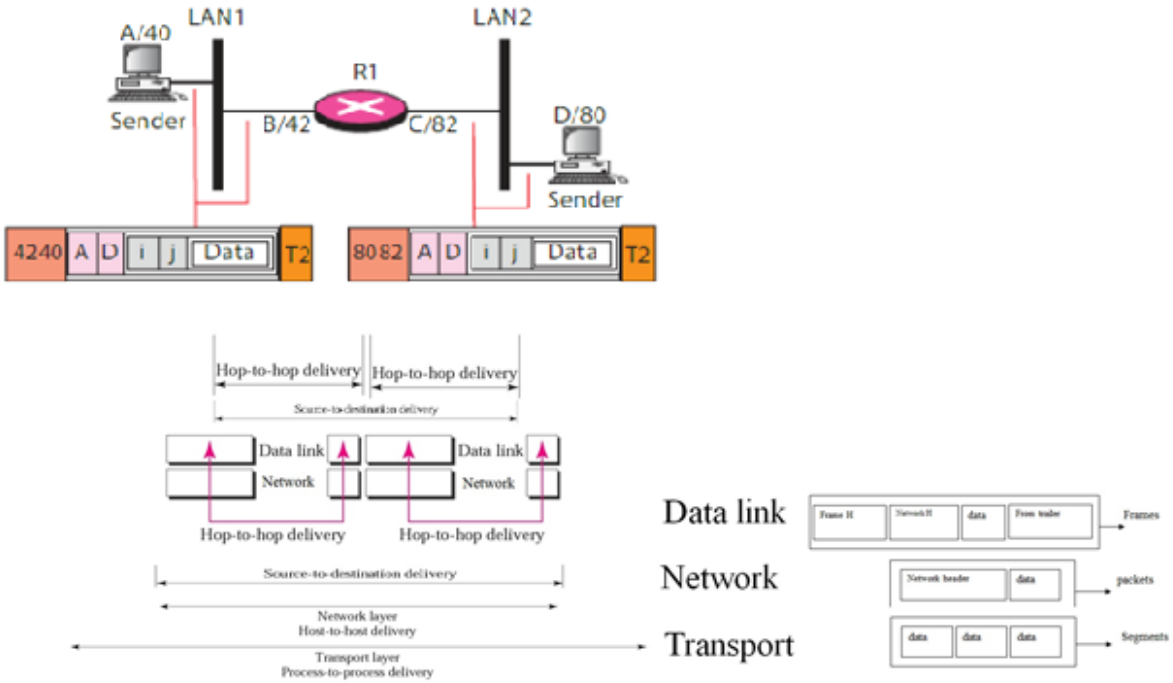
It can make troubleshooting tough as the many errors may generate at a single moment.

The security issues may generate by combining these layers.

The separate layers provide the capability to maintain the intermediate sessions easily which makes the sense to have these layers

Q.3: In Figure below assume that the communication is between a process running at computer A with port address m and a process running at compute D with port address n. show the contents of packets and frames at the network , data link and transport for each hop.

Answer:



Before using the destination address in an intermediate or the destination node, the packet goes through error checking that may help the node find the corruption (with a high probability) and discard the packet. Normally the upper layer protocol will inform the source to resend the packet.

Network layer:

- The network layer is responsible for the convert frames into packets.
- Logical addressing: if the packet passes the network boundary we need another addressing system to help (source to destination) connection.
- The delivery of individual packets from the original source to the final destination.
- It have Source-to-destination delivery (End-to-End).

Data link:

- The data link layer is responsible for the convert bits into frames.
- Dividing the stream of bits received from the network layer into manageable data units called frames.
- It have flow control and error control and access control
- Added trailer to the end of frame.
- The data link hop to hop delivery

Transport layer:

- The transport layer is responsible for convert packets into segments.
- A message is divided into transmittable segments each segment containing a sequence no.
- It have flow control and error control and connection control.
- It have process to process delivery

Q.4: what is the theoretical capacity of a channel in each of the following cases:

A: Bandwidth: 15 KHz $SNR_{db} = 30$

B: Bandwidth: 100 KHz $SNR_{db} = 2$

C: Bandwidth: 0.5 KHz $SNR_{db} = 10$

Answer:

We can approximately calculate the capacity as

A: $C = B (SNR_{db}/3) = 15$ KHz x $(30 / 3) = 150$ kbps

B: $C = B (SNR_{db}/3) = 100$ KHz x $(2 / 3) = 67$ kbps

C: $C = B (SNR_{db}/3) = 0.5$ MHz x $(10 / 3) = 1.7$ Mbps.

Q.5: A digitized system is operated at 4800 bps. If a signal element encodes an 8-bit word, what is the minimum required bandwidth of the channel?

Using Nyquist's equation: $C = 2B \log_2 M$

We have C = 4800 bps

and

$\log_2 M = 8$,

Because a signal element encodes a 8 bit- word

Therefore,

$C = 4800 = 2B\log_2 M$

C = 4800

4800 = 2B x 8

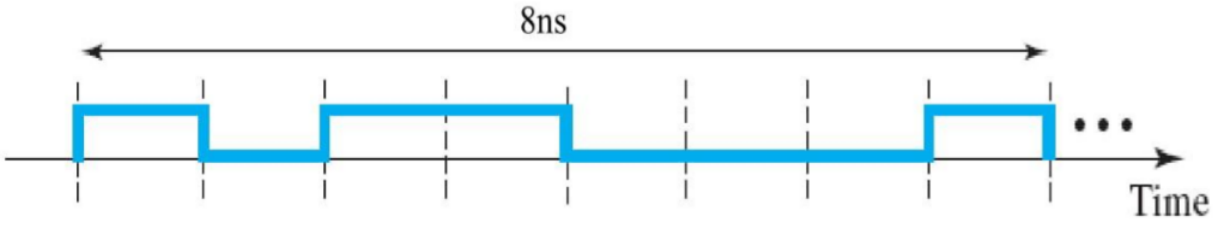
$B = \frac{4800}{2 \, x \, 8}$

= 300Hz

The minimum required bandwidth of the channel is = 300Hz.

Q.6: what is the bit rate for signal given below?

Answer:



No. of bits = 8

Bit duration = 8ns

Bit rate = 8 / (8 x 10^{-9}) = 1 x 10^{-9} bps = 1000Mbps.

Q.7: A capacity of the channel is given as 40 Mbps, the bandwidth of the channel is 6 MHz,

Assuming white thermal noise. What signal-to-noise ratio is required to achieve this capacity?

Answer:
Bandwidth (B) = 6 MHz

Channel capacity (C) = 40Mbps

Signal to noise ratio = SNR

$C = B \log_2(1+SNR)$

$4.0x10^7 = 6 \times 10^6 \log(1+SNR)$

$6.6667 = \log_2(1+SNR)$

$2^{6.6667} = 1+SNR$

SNR = 101.59 – 1

SNR = 100.59

101

Q.8: A composite signal that is non-periodic contains frequencies from 20 to 40 KHz. The peak amplitude is 10 V for the lowest and highest signals and is 30 v for the 30-KHz signal. Assuming that the amplitudes change gradually from the minimum to minimum, draw the frequency spectrum.

Answer:

The maximum Amplitude of 30 V is at 30 KHz as shown in the figure below where this is non-periodic contains frequencies.