Data and computer communications essay sample

Technology, Computer

An intermediate node serves to translate the message before passing it on. Note that the intermediate node handles the message only up to the second level; a minister's level is not needed. Perhaps the major disadvantage is the processing and data overhead. There is processing overhead because as many as seven modules (OSI model) are invoked to move data from the application through the communications software. There is data overhead because of the appending of multiple headers to the data. Another possible disadvantage is that there must be at least one protocol standard per layer. With so many layers, it takes a long time to develop and promulgate the standards. There is no way to be assured that the last message gets through, except by acknowledging it. Thus, either the acknowledgment process continues forever, or one army has to send the last message and then act with uncertainty. A case could be made either way.

First, look at the functions performed at the network layer to deal with the communications network (hiding the details from the upper layers). The network layer is responsible for routing data through the network, but with a broadcast network, routing is not needed. Other functions, such as sequencing, flow control, error control between end systems, can be accomplished at layer 2, because the link layer will be a protocol directly between the two end systems, with no intervening switches. So it would seem that a network layer is not needed. Second, consider the network layer from the point of view of the upper layer using it. The upper layer sees itself attached to an access point into a network supporting communication with multiple devices. The layer for assuring that data sent across a network is delivered to one of a number of other end systems is the network layer. This argues for inclusion of a network layer.

In fact, the OSI layer 2 is split into two sublayers. The lower sublayer is concerned with medium access control (MAC), assuring that only one end system at a time transmits; the MAC sublayer is also responsible for addressing other end systems across the LAN. The upper sublayer is called Logical Link Control (LLC). LLC performs traditional link control functions. With the MAC/LLC combination, no network layer is needed (but an internet layer may be needed). 2. 6 a. No. This would violate the principle of separation of layers. To layer (N – 1), the N-level PDU is simply data. The (N – 1) entity does not know about the internal format of the N-level PDU. It breaks that PDU into fragments and reassembles them in the proper order.

b. Each N-level PDU must retain its own header, for the same reason given in (a). 2. 7 Data plus transport header plus internet header equals 1820 bits. This data is delivered in a sequence of packets, each of which contains 24 bits of network header and up to 776 bits of higher-layer headers and/or data. Three network packets are needed. Total bits delivered = 1820 + 3 × 24 = 1892 bits. 2. 8 UDP provides the source and destination port addresses and a checksum that covers the data field. These functions would not normally be performed by protocols above the transport layer. Thus UDP provides a useful, though limited, service.

In the case of IP and UDP, these are unreliable protocols that do not guarantee delivery, so they do not notify the source. TCP does guarantee delivery. However, the technique that is used is a timeout. If the source does not receive an acknowledgment to data within a given period of time, the source retransmits. 2. 10 UDP has a fixed-sized header. The header in TCP is of variable length. 2. 11 Suppose that A sends a data packet k to B and the ACK from B is delayed but not lost. A resends packet k, which B acknowledges. Eventually A receives 2 ACKs to packet k, each of which triggers transmission of packet (k + 1). B will ACK both copies of packet (k + 1), causing A to send two copies of packet (k + 2). From now on, 2 copies of every data packet and ACK will be sent.

TFTP can transfer a maximum of 512 bytes per round trip (data sent, ACK received). The maximum throughput is therefore 512 bytes divided by the roundtrip time. Source: [STEV94]. The " netascii" transfer mode implies the file data are transmitted as lines of ASCII text terminated by the character sequence {CR, LF}, and that both systems must convert between this format and the one they use to store the text files locally. This means that when the " netascii" transfer mode is employed, the file sizes of the local and the remote file may differ, without any implication of errors in the data transfer. For example, UNIX systems terminate lines by means of a single LF character, while other systems, such as Microsoft Windows, terminate lines by means of the character sequence {CR, LF}. This means that a given text file will usually occupy more space in a Windows host than in a UNIX system. 2. 14 If the same TIDs are used in twice in immediate succession, there's a chance that packets of the first instance of the connection that were delayed in the network arrive during the life of the second instance of the connection, and, as they would have the correct TIDs, they could be (mistakenly) considered as valid. TFTP needs to keep a copy of only the last packet it has sent, since the acknowledgement mechanism it implements guarantees that all the previous packets have been received, and thus will not need to be retransmitted. 2. 16 This could trigger an " error storm". Suppose host A receives an error packet from host B, and responds it by sending an error packet back to host B. This packet could trigger another error packet from host B, which would (again) trigger an error packet at host A. Thus, error messages would bounce from one host to the other, indefinitely, congesting the network and consuming the resources of the participating systems.

The disadvantage is that using a fixed value for the retransmission timer means the timer will not reflect the characteristics of the network on which the data transfer is taking place. For example, if both hosts are on the same local area network, a 5second timeout is more than enough. On the other hand, if the transfer is taking place over a (long delay) satellite link, then a 5-second timeout might be too short, and could trigger unnecessary retransmissions. On the other hand, using a fixed value for the retransmission timer keeps the TFTP implementation simple, which is the objective the designers of TFTP had in mind.

TFTP does not implement any error detection mechanism for the transmitted data. Thus, reliability depends on the service provided by the underlying transport protocol (UDP). While the UDP includes a checksum for detecting errors, its use is optional. Therefore, if UDP checksums are not enabled, data could be corrupted without being detected by the destination host.

The internet protocol can be defined as a separate layer. The functions performed by IP are clearly distinct from those performed at a network layer and those performed at a transport layer, so this would make good sense. b. The session and transport layer both are involved in providing an end-to-end service to the OSI user, and could easily be combined. This has been done in TCP/IP, which provides a direct application interface to TCP.

If f1 (t) is periodic with period X, then f1 (t) = f1 (t +X) = f1 (t +nX) where n is an integer and X is the smallest value such that f1 (t) = f1 (t +X). Similarly, f2 (t) = f2 (t +Y) = f2 (t + mY). We have f(t) = f1 (t) + f2 (t). If f(t) is periodic with period Z, then f(t) = f(t + Z). Therefore f 1 (t) + f2 (t) = f1 (t + Z) + f2 (t + Z). This last equation is satisfied if f1 (t) = f1 (t + Z) and f 2 (t) = f2 (t + Z). This leads to the condition Z = nX = mY for some integers n and m. We can rewrite this last as (n/m) =
(Y/X). We can therefore conclude that if the ratio (Y/X) is a rational number, then f(t) is periodic. 3. 9 The signal would be a low-amplitude, rapidly changing waveform. 3. 10 No transmission medium is capable of transmitting the entire spectrum of frequencies. A real signal therefore is bandlimited, with frequencies above a certain point absent. However, most of the information is in the lower frequencies. This is not a problem if it is remembered that the object of the transmission is to send signals that represent binary 1s and 0s. Even though there will be some distortion because of the loss of higher frequencies, the shape of the original pulse is

known (by the specifications for the transmission system). Thus, the receiver will usually be able to distinguish a binary 0 from a binary 1.

A 6-bit code allows only 64 unique characters to be defined. Several shift lock codes were defined in various versions of TTS (shift, supershift, unshift). These codes change the meaning of all codes that follow until a new shift lock code appears. Thus, with two shift locks, 3 × (64 – 3) = 183 different codes can be defined. The actual number is less, since some codes, such as space, are “ don’t-cares” with respect to shift locks Refer to the reasoning of Section 3. 2. Retaining the vertical resolution of 483 lines, each horizontal line occupies 52. 5 µsec. A horizontal resolution of H lines results in a maximum of H/2 cycles per line, thus the bandwidth of 5 MHz allows: -10-

5 MHz = (H/2) / 52. 5 µsec

H = 525 lines

Now, if we assume the same horizontal resolution of H = 450, then for a bandwidth of 5 MHz, the duration of one line is:

5 MHz = (450/2) / T

T = 45 µsec

allowing 11 µsec for horizontal retrace, each line occupies 56. 2 µsec. The scanning frequency is:

(1/30 s/scan) /V lines = 56. 2 µsec/line

V = 593 lines

3. 13 a. (30 pictures/s) (480 × 500 pixels/picture) = 7. 2 × 106 pixels/s Each pixel can take on one of 32 values and can therefore be represented by 5 bits:

R = 7. 2 × 106 pixels/s × 5 bits/pixel = 36 Mbps

b. We use the formula: C = B log2 (1 + SNR)

B = 4. 5 × 106 MHz = bandwidth, and

SNRdB = 35 = 10 log10 (SNR), hence

SNR = 10 35/10 = 103. 5, and therefore

C = 4. 5 × 106 log2 (1 + 103. 5) = 4. 5 × 106 × log 2 (3163) C = (4. 5 × 106 × 11. 63) = 52. 335 × 106 bps

c. Allow each pixel to have one of ten intensity levels and let each pixel be one of three colors (red, blue, green) for a total of 10 × 3 = 30 levels for each pixel element.

3. 14 N = 10 log k + 10 log T + 10 log B

= –228. 6 dBW + 10 log 104 + 10 log 107

= –228. 6 + 40 + 70 = –118. 6 dBW

Source: [FREE98]

3. 15 Using Shannon's equation: C = B log2 (1 + SNR)

We have W = 300 Hz (SNR)dB = 3

Therefore, SNR = 100. 3

C = 300 log2 (1 + 100. 3) = 300 log2 (2. 995) = 474 bps

3. 16 Using Nyquist's equation: C = 2B log2M

We have C = 9600 bps

a. log2 M = 4, because a signal element encodes a 4-bit word Therefore, C = 9600 = 2B × 4, and B = 1200 Hz

b. 9600 = 2B × 8, and B = 600 Hz

3. 17 N = 1. 38 × 10–23 × (50 + 273) × 10, 000 = 4. 5 × 10–17 watts -11-

Using Shannon's formula: C = 3000 log2 (1+400000) = 56 Kbps b. Due to the fact there is a distortion level (as well as other potentially detrimental impacts to the rated capacity, the actual maximum will be somewhat degraded from the theoretical maximum. A discussion of these relevant impacts should be included and a qualitative value discussed. 3. 19 Nyquist analyzed the theoretical capacity of a noiseless channel; therefore, in that case, the signaling rate is limited solely by channel bandwidth. Shannon addressed the question of what signaling rate can be achieved over a channel with a given bandwidth, a given signal power, and in the presence of noise. 3. 20 a. Using Shannon's formula C = 106 log2 (1 + 63) = 6 MHz. b. Data rate = 4 MHz. Using Nyquist's formula 4 × 106 = 2 × 106 log2 M M = 22 = 4

C = B log2 (1 + SNR)

20 × 10 6 = 3 × 106 × log 2 (1 + SNR)

log2 (1 + SNR) = 6. 67

1 + SNR = 102

SNR = 101

3. 22 a. Output waveform:

sin (2πf1 t) + 1/3 sin (2π(3f 1)t) + 1/5 sin (2π(5f 1)t) + 1/7 sin (2π (7f 1)t)

where f1 = 1/T = 1 kHz

Output power = 1/2 (1 + 1/9 + 1/25 + 1/49) = 0. 586 watt

b. Output noise power = 8 kHz × 0. 1 μWatt/Hz = 0. 8 mWatt

SNR = 0. 586/0. 0008 = 732. 5 (SNR)db = 28. 65

The twisting of the individual pairs reduces electromagnetic interference. For example, it reduces crosstalk between wire pairs bundled into a cable. 4. 2 Twisted pair wire is subject to interference, limited in distance, bandwidth, and data rate.

Unshielded twisted pair (UTP) is ordinary telephone wire, with no form of electromagnetic shielding around the wire. Shielded twisted pair (STP) surrounds the wire with a metallic braid or sheathing that reduces interference. 4. 4 Optical fiber consists of a column of glass or plastic surrounded by an opaque outer jacket. The glass or plastic itself consists of two concentric columns. The inner column called the core has a higher index of refraction than the outer column called the cladding.

Point-to-point microwave transmission has a high data rate and less attenuation than twisted pair or coaxial cable. It is affected by rainfall, however, especially above 10 GHz. It is also requires line of sight and is subject to interference from other microwave transmission, which can be intense in some places. 4. 6 Direct broadcast transmission is a technique in which satellite video signals are transmitted directly to the home for continuous operation.

A satellite must use different uplink and downlink frequencies for continuous operation in order to avoid interference.
4. 8 Broadcast is omnidirectional, does not require dish shaped antennas, and the antennas do not have to be rigidly mounted in precise alignment. 4. 9 The two functions of an antenna are: (1) For transmission of a signal, radiofrequency electrical energy from the transmitter is converted into

electromagnetic energy by the antenna and radiated into the surrounding environment (atmosphere, space, water); (2) for reception of a signal, electromagnetic energy impinging on the antenna is converted into radio-frequency electrical energy and fed into the receiver. 4. 10 An isotropic antenna is a point in space that radiates power in all directions equally.

A parabolic antenna creates, in theory, a parallel beam without dispersion. In practice, there will be some beam spread. Nevertheless, it produces a highly focused, directional beam.

4. 12 Effective area and wavelength.

Free space loss.

Refraction is the bending of a radio beam caused by changes in the speed of propagation at a point of change in the medium.

Diffraction occurs at the edge of an impenetrable body that is large compared to the wavelength of the radio wave. The edge in effect become a source and waves radiate in different directions from the edge, allowing a beam to bend around an obstacle. If the size of an obstacle is on the order of the wavelength of the signal or less, scattering occurs. An incoming signal is scattered into several weaker outgoing signals in unpredictable directions.