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Week 6 Assignment

1. How can noise and distortion be introduced into a transmission medium? How does a channel's signal-to-noise ratio affect the reliability of data transmission?

Noise and distortion are introduced via electromagnetic interference (EMI), where neighboring electrical devices, cables, radio broadcasting towers, cellular antenna towers, lightning strikes, and thermal noise, the random agitation of electrons in the conductor material due to heat, into a transmission medium (Aksoy, 2008). The noise conducted along a medium can overwhelm the signal, making it impossible to interpret.

Pelin Aksoy and Laura DeNardis, *Information Technology in Theory*, Course Technology, 2008.

2. Describe simplex, half-duplex, and full-duplex transmission. Compare and contrast them in terms of cost and effective data transfer rate.

Simplex mode is a channel organization where messages are sent in only one direction along a single communications line. So long as the chances of transmission errors are small, this simple organization works fine, but the moment there is the possibility of errors, there arises the need for the receiving device to have a medium by which it can request the data be resent.

Half-duplex mode provides this capability. Using the same communications line, both sending and receiving devices are able to take turns sending messages to one another. When one node finishes sending a message, it sends a line turnaround control message, which informs the other node that it may assume transmitting. This way, receiving devices may notify senders of transmission errors or lack thereof with negative acknowledge (NAK) and acknowledge (ACK) control messages. This organization costs the same as simplex mode, but has a reduced transfer rate due to nodes switching roles for acknowledgement.

Full-duplex mode uses a second transmission line for bi-directional communications that are simultaneous. This mode has the best of both simplex and half-duplex modes, optimal transfer rates and bi-directional communications, with some additional noise; however, the second transmission line comes at a cost.

3. Compare and contrast serial and parallel transmission in terms of channel cost, data transfer rate, and suitability for long-distance data communication. Why are standards for connecting secondary storage devices migrating from parallel to serial transmission?

Parallel transmission uses a separate line for each bit transmission and one common return line. It has the advantage of a higher transfer rate that comes from combining the capacity of the eight lines; however, it has the disadvantage of being very costly and also

of becoming very error-prone over long distances, as differences in the eight lines cause the eight bits to get out of synch.

Serial transmission uses only a single line to transmit, plus a return wire, where the receiver reassembles the bits at the other end. Serial has the advantage of comparatively lower cost and increased reliability over longer distances; however, there is a loss in transmission speed.

Secondary storage devices are migrating to serial transmission due to the need for smaller transmission lines to aid in heat dissipation and miniaturization of devices, as well as the multiplicity of secondary storage devices, where multiple transmission lines increase signal noise. Additionally, advances in serial wiring technology make it technically feasible to switch to this transmission technology for secondary storage devices.

4. How does a packet from one LAN node find its way to a recipient on the same LAN? How does a packet find its way to a recipient on another LAN?

A packet sent from one node is received by another, which knows the addresses and physical locations of other nodes on its networks. In the event the receiving node does not know the address of the packet, it has a default LAN node that it forwards it to. LAN nodes will periodically exchange information about their addresses to inform them of changes in network topology.

5. Describe the CSMA/CD media access protocol including the IEEE standard(s) on which it is based, how collisions are detected or avoided, potential impacts on network throughput, and its inclusion in current Ethernet networks.

The CSMA/CD media access protocol is based on the IEEE's 802.3 network standards. The protocol listens for traffic and transmits its message when it finds none. If there are abnormally high signal levels after it has transmitted its message, indicative of a collision, then it ceases transmission and waits a random period of time before attempting to transmit the message again.

CSMA/CD is a simple protocol that doesn't require tokens and is implemented with simpler software and hardware that costs less; however, CSMA/CD is not the most efficient use of data transfer capacity. When a collision occurs, network transmission capacity is wasted. CSMA/CD is primarily used in networks implemented with a Bus and Network Interface Cards/Units.

1. Noise is introduced by external phenomena such as electromagnetic interference. It may also be introduced by switches or amplifiers. Noise adds elements to the signals which may be misinterpreted as data and/or which mask the data content of the "true" signal. Distortion is introduced by the transmission medium itself (e.g., resonances and partial or total attenuation). Distortion alters the content of the "true"

signal, possibly masking or altering its content. Transmission errors increase as S/N ratio decreases. As the "true" signal power decreases the receiver has greater difficulty separating it from "false" signal elements (i.e., noise and distortion) and thus makes more interpretation errors

4. If the packet destination is on another LAN, the hub or router examines the destination addresses, notices that the destination is not on the local LAN, and forwards the packet to another router or hub based on its internal routing configuration and protocol. Typically, packets are forwarded up a chain of default routers until a router is found that knows a route to the destination LAN. The packet is then forwarded to the hub or router of the destination LAN and then to the recipient.

5. Rather than prevent collisions from occurring, CSMA/CD defines a procedure for detecting and recovering from them.