**Chapter 3 questions**

**1: How does a multipoint circuit differ from a point-to-point circuit?**

(FitzGerald, J. p. 61)

Point-to-point –

It goes from one point to another (e.g., one computer to another)

Often called a dedicated circuit

Multipoint –

Many computers are connected to the same circuit

Often called a shared circuit

**2: Describe the three types of data flows.**

(FitzGerald, J. p. 62)

Simplex –

One-way transmission such as with radios and TVs

Half-duplex –

Two-way transmission but can only transmit in one direction at a time

Similar to walkie-talkie

Full-duplex –

You can transmit in both directions simultaneously with no turnaround time

**3: Describe the three types of guided media.**

(FitzGerald, J. p. 63 – 64)

Twisted-pair cable –

One of the most commonly used

Insulated pairs of wires that can be packed together

Wires usually twisted to minimize the electromagnetic interference between one pair and any other pair

Houses or apartments more than likely use this

Coaxial cable –

Type of guided medium that is quickly disappearing

Has a copper core with an outer cylindrical shell for insulation

Less prone to interference than basic low-cost twisted-pair wires

Cost about three times as much as twisted-pair cables

Can install specially shielded twisted-pair wire that provides the same quality as coaxial cable but at half cost

Fiber-optic cable –

Becoming widely used

Instead of carrying telecommunication signals it uses high-speed streams of light pulses from lasers or LEDS

Hair-thin strands of glass called optical fiber

**5: How do analog data differ from digital data?**

(FitzGerald, J.p. 73 & 75)

Computers are able to produce digital data which may be in the form of binary 0/1 false/true off/on, however, something like telephones produce analog data, meaning the data/electrical signals which they produce are more in the form of sound waves

**7: Explain why most telephone company circuits are now digital.**

Most telephone company circuits are now digital because of a variety of reasons, of which some are:

Digital transmissions tend to be more secure than non-digital transmissions, it is easier to encrypt

It is less expensive to use digital transmissions than analog

Using digital transmissions results in less errors compared to analog transmissions

It’s more efficient

Higher maximum transmission rates

The ability to integrate everything into the same circuit is much more simple with digital than analog

**10: How are data transmitted in parallel?**

(FitzGerald, J. p. 72)

Parallel transmission is the way the internal transfer of binary data takes place inside of a computer.

If the internal structure of the computer is 8 bit then all 8 bits of the data element are transmitted between the main memory and the central processing unit simultaneously on 8 separate connections, the same is true for 32-bit structure.

The circuit is physically made up of x number of wires, for 8 bit 8 wires.

**14: What is bandwidth? What is the bandwidth in a traditional North American telephone circuit?**

(FitzGerald, J. p. 78)

Bandwidth is the difference between the highest and lowest frequencies in a band or set of frequencies.

Standard telephone lines provide a bandwidth of 4,000 Hz, under perfect circumstances, the maximum symbol rate would then be about 4,000 symbols per second.

**16: Describe how data could be transmitted using frequency modulation.**

(FitzGerald, J. p. 75 & 76)

When we transmit data through the telephone lines, we use the shape of the sound waves we transmit to represent different data values. We do this by transmitting a simple sound wave through the circuit and then changing its shape in different ways to represent a 1 or a 0. Modulation is the technical term used to refer to these “shape changes.”

Basic modulation with AM, the amplitude or height of the wave is changed. One amplitude is the symbol defined to be 0, and another amplitude is the symbol defined to be a 1. In the AM, the highest amplitude symbol represents a binary 1, and the lowest a binary 0.

Frequency modulation, also called Frequency Shift Keying (FSK) is a modulation technique where each 0 or 1 is represented by a number of waves per second. In this case, the amplitude does not vary. One frequency is the symbol defined to be a, and a different frequency is the symbol defined to be a 0.

**18: Describe how data could be transmitted using a combination of modulation techniques.**

(FitzGerald, J. p. 77)

Sending multiple bits simultaneously each of the three basic modulation techniques, AM, FM, and PM, can be refined to send more than 1 bit at one time. For example, basic AM Sends 1 bit per wave by defining two different amplitudes, one for a 1 and one for a 0. It is possible to send 2 bits on one wave or symbol by defining four different amplitudes. This same approach can be used for FM and PM.

It’s also possible to combine modulation techniques. One popular technique to do this is quadrature amplitude modulation. It involves splitting the symbol into eight different phases (3 bits) and two different amplitudes (1 bit), for a total of 16 different possible values.

**19: Is the bit rate the same as the symbol rate? Explain.**

(FitzGerald, J. p. 78)

No. A bit is a unit of information. A baud is a unit of signaling speed used to indicate the number of times per second the signal on the communication circuit changes. Because of the confusion over the term baud rate among the general public, ITU-T now recommends the term baud rate be replaced by the term symbol rate.

The bit rate and the symbol rate are the same only when 1 bit is sent on each symbol.

**20: What is a modem?**

(FitzGerald, J. p. 78)

The modem, or modulator/demodulator, take the digital data from a computer in the form of electrical pulses and converts them into analog signal that is needed for transmission over an analog voice-grade circuit.

**23: What factors affect transmission speed?**

(FitzGerald, J. p. 79)

A modem’s data transfer rate is the primary factor that determines the throughput rate of data, but is it not the only factor. Data compression can increase the throughput of data over a communication link by literally compressing the data. Another factor which affects the transmission is the number of bits per signal sample, and number of samples per second.

**24: What is oversampling?**

(FitzGerald, J. p. 79)

The second method is to sample more frequently. This will reduce the “length” of each “step” also resulting in a smoother signal. To obtain a reasonable-quality voice signal, one must sample at least twice the highest possible frequency in the analog signal. You will recall that the highest frequency transmitted in telephone circuits is 4,000 Hz. Thus the methods used to digitize telephone voice transmissions must sample the input voice signal at a minimum of 8,000 times per second. Sampling more frequently than this is called oversampling and will improve signal quality.

**30: What is the purpose of multiplexing?**

(FitzGerald, J. p. 62 & 63)

Multiplexing means to break one high-speed physical communication circuit into several lower-speed logical circuits so that many different devices can simultaneously use it but still “think” that they have their own separate circuits.

The primary benefit of multiplexing is to save money by reducing the amount of cable or the number of network circuits that must be installed.

**34: If you were buying a multiplexer, would you choose TDM or FDM? Why?**

(FitzGerald, J. p. 63)

I would choose a TDM over a FDM because first of all they tend to be less expensive than FDM’s, they also are generally more favored over FDM’s as they also provide a higher data transmission speed. TDM is also in general more efficient than FDM for a variety of reasons. Maintenance for TDM is also usually lower than an FDM.

References:

FitzGerald, J., Dennis, A., & Durcikova, A. (2021). Business data communications and networking (Fourteenth). Wiley.

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