Data Communications Interview Questions And Answers Guide.

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Data Communications Job Interview Preparation Guide.

Question # 1
What is Data Communications?

Answer:-
The distance over which data moves within a computer may vary from a few thousandths of an inch, as is the case within a single IC chip, to as much as several feet along the backplane of the main circuit board. Over such small distances, digital data may be transmitted as direct, two-level electrical signals over simple copper conductors. Except for the fastest computers, circuit designers are not very concerned about the shape of the conductor or the analog characteristics of signal transmission.
Frequently, however, data must be sent beyond the local circuitry that constitutes a computer. In many cases, the distances involved may be enormous. Unfortunately, as the distance between the source of a message and its destination increases, accurate transmission becomes increasingly difficult. This results from the electrical distortion of signals traveling through long conductors, and from noise added to the signal as it propagates through a transmission medium. Although some precautions must be taken for data exchange within a computer, the biggest problems occur when data is transferred to devices outside the computer's circuitry. In this case, distortion and noise can become so severe that information is lost.
Data Communications concerns the transmission of digital messages to devices external to the message source. "External" devices are generally thought of as being independently powered circuitry that exists beyond the chassis of a computer or other digital message source. As a rule, the maximum permissible transmission rate of a message is directly proportional to signal power, and inversely proportional to channel noise. It is the aim of any communications system to provide the highest possible transmission rate at the lowest possible power and with the least possible noise.
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Question # 2
Explain Communications Channels?

Answer:-
A communications channel is a pathway over which information can be conveyed. It may be defined by a physical wire that connects communicating devices, or by a radio, laser, or other radiated energy source that has no obvious physical presence. Information sent through a communications channel has a source from which the information originates, and a destination to which the information is delivered. Although information originates from a single source, there may be more than one destination, depending upon how many receive stations are linked to the channel and how much energy the transmitted signal possesses.
In a digital communications channel, the information is represented by individual data bits, which may be encapsulated into multibit message units. A byte, which consists of eight bits, is an example of a message unit that may be conveyed through a digital communications channel. A collection of bytes may itself be grouped into a frame or other higher-level message unit. Such multiple levels of encapsulation facilitate the handling of messages in a complex data communications network.
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Question # 3
Explain Asynchronous vs. Synchronous Transmission?

Answer:-
Serialized data is not generally sent at a uniform rate through a channel. Instead, there is usually a burst of regularly spaced binary data bits followed by a pause, after which the data flow resumes. Packets of binary data are sent in this manner, possibly with variable-length pauses between packets, until the message has been fully transmitted. In order for the receiving end to know the proper moment to read individual binary bits from the channel, it must know exactly when a packet begins and how much time elapses between bits. When this timing information is known, the receiver is said to be synchronized with the transmitter, and accurate data transfer becomes possible. Failure to remain synchronized throughout a transmission will cause data to be corrupted or lost.
Two basic techniques are employed to ensure correct synchronization. In synchronous systems, separate channels are used to transmit data and timing information. The timing channel transmits clock pulses to the receiver. Upon receipt of a clock pulse, the receiver reads the data channel and latches the bit value found on the channel at that moment. The data channel is not read again until the next clock pulse arrives. Because the transmitter originates both the data and the timing pulses, the receiver will read the data channel only when told to do so by the transmitter (via the clock pulse), and synchronization is guaranteed.
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Question # 4
Explain Parity and Checksums?

Answer:-
Noise and momentary electrical disturbances may cause data to be changed as it passes through a communications channel. If the receiver fails to detect this, the received message will be incorrect, resulting in possibly serious consequences. As a first line of defense against data errors, they must be detected. If an error can be flagged, it might be possible to request that the faulty packet be resent, or to at least prevent the flawed data from being taken as correct. If sufficient redundant information is sent, one- or two-bit errors may be corrected by hardware within the receiver before the corrupted data ever reaches its destination.
A parity bit is added to a data packet for the purpose of error detection. In the even-parity convention, the value of the parity bit is chosen so that the total number of

'1' digits in the combined data plus parity packet is an even number. Upon receipt of the packet, the parity needed for the data is recomputed by local hardware and compared to the parity bit received with the data. If any bit has changed state, the parity will not match, and an error will have been detected. In fact, if an odd number of bits (not just one) have been altered, the parity will not match. If an even number of bits have been reversed, the parity will match even though an error has occurred. However, a statistical analysis of data communication errors has shown that a single-bit error is much more probable than a multibit error in the presence of random noise.

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Question # 5

What is Data Compression?

Answer:-

If a typical message were statistically analyzed, it would be found that certain characters are used much more frequently than others. By analyzing a message before it is transmitted, short binary codes may be assigned to frequently used characters and longer codes to rarely used characters. In doing so, it is possible to reduce the total number of characters sent without altering the information in the message. Appropriate decoding at the receiver will restore the message to its original form. This procedure, known as data compression, may result in a 50 percent or greater savings in the amount of data transmitted. Even though time is necessary to analyze the message before it is transmitted, the savings may be great enough so that the total time for compression, transmission, and decompression will still be lower than it would be when sending an uncompressed message.
Some kinds of data will compress much more than others. Data that represents images, for example, will usually compress significantly, perhaps by as much as 80 percent over its original size. Data representing a computer program, on the other hand, may be reduced only by 15 or 20 percent.
A compression method called Huffman coding is frequently used in data communications, and particularly in fax transmission. Clearly, most of the image data for a typical business letter represents white paper, and only about 5 percent of the surface represents black ink. It is possible to send a single code that, for example, represents a consecutive string of 1000 white pixels rather than a separate code for each white pixel. Consequently, data compression will significantly reduce the total message length for a faxed business letter. Were the letter made up of randomly distributed black ink covering 50 percent of the white paper surface, data compression would hold no advantages.

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Question # 6

Explain Data Encryption?

Answer:-

Privacy is a great concern in data communications. Faxed business letters can be intercepted at will through tapped phone lines or intercepted microwave transmissions without the knowledge of the sender or receiver. To increase the security of this and other data communications, including digitized telephone conversations, the binary codes representing data may be scrambled in such a way that unauthorized interception will produce an indecipherable sequence of characters. Authorized receive stations will be equipped with a decoder that enables the message to be restored. The process of scrambling, transmitting, and descrambling is known as encryption.
Custom integrated circuits have been designed to perform this task and are available at low cost. In some cases, they will be incorporated into the main circuitry of a data communications device and function without operator knowledge. In other cases, an external circuit is used so that the device, and its encrypting/decrypting technique, may be transported easily.

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Question # 7

What is Data Storage Technology?

Answer:-

Normally, we think of communications science as dealing with the contemporaneous exchange of information between distant parties. However, many of the same techniques employed in data communications are also applied to data storage to ensure that the retrieval of information from a storage medium is accurate. We find, for example, that similar kinds of error-correcting codes used to protect digital telephone transmissions from noise are also used to guarantee correct readback of digital data from compact audio disks, CD-ROMs, and tape backup systems.

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Question # 8

What is analog?

Answer:-

Although my artistic ability leaves much to be desired, this wave form is a depiction of a simple analog signal. The key to the analog signal is that it is *continuous*. In other words, notice how the wave slowly rises, peaks, slowly descends, bottoms out and slowly climbs again. Taken as a simple example, imagine many forms of this wave signal. Some of the waves are closer together than others, some may have more height, still others may actually start their peaks and descents in entirely different places! Encoding data can be done based on these various kinds of wave changes.
One of the important considerations in analog communications is the ability to decode these continuous wave forms. With the introduction of noise, or other signal disturbance, decoding a analog signal properly can be difficult. This is why we turn to the digital communications system

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Question # 9

What is digital?

Answer:-

Compared to the picture of the analog signal above, there is a major difference in this wave form. The transition from the peak of the wave to the bottom of the wave is *discrete*. In this case, the only way to represent data is by using the high or low point of the wave. For example, the high point may represent a "on" signal and the low point may represent a "off" signal. In the world of computers, this is also known as a binary numbering system consisting of only two digits. By using a digital signaling system in this fashion, it makes encoding and decoding data very simple. Generally, it will be very easy to determine where the peaks and valleys are, even with some signal loss or disturbance.
Digital methods are used as long as frequency response (bandwidth) is not a limitation. Analog methods are used only because multiple signal levels must be exploited to communicate a higher data rate of digital values in lieu of having adequate bandwidth.
A digital signaling system often has an analog component. Strictly speaking, this means the a digital wave isn't as sharp cornered as the picture shows above. The corners will likely be slightly rounded and even more so as the signal travels over some distance. For our purposes, this definition should give you a basic idea of how a digitally encoded system works.

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Question # 10

Explain modulation?

Answer:-

Modulation is a prescribed method of encoding digital (or analog) signals onto a waveform (the carrier signal). Once encoded, the original signal may be recovered by an inverse process called demodulation. Modulation is performed to adapt the signal to a different frequency range than that of the original signal. Here's how it flows:
bits -> modulator -> audio -> phone network -> audio -> demodulator -> bits
Hence the name MODEM short for modulator/demodulator. The modem is necessary because the phone network transmits audio, not data bits. The modem is for compatibility with existing equipment.

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Question # 11

What is crosstalk?

Answer:-

Crosstalk refers to the interference between channels. In the xDSL world, the interference between nearby cables can have a negative impact on the performance of the affected cable(s). Have you ever been on the phone and heard some other conversation, not yours, in the background? If so, you have experienced the effect of crosstalk.
Near-end crosstalk (NEXT) occurs when the transmitter sends a signal and a nearby transceiver at the same end of link, through capacitive and inductive coupling, "hears" the signal.
Far-end crosstalk (FEXT) occurs when the transmitter sends a signal and a transceiver at the far end of the link, through capacitive and inductive coupling, "hears" the signal. FEXT will be of more concern in an asymmetrical system such as ADSL than symmetrical systems like HDSL. This is because strong signals originating from the near end, can interfere with the weaker signals originating at the far end.

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Question # 12

What is the effect of noise?

Answer:-

Noise may be defined as the combination of unwanted interfering signal sources whether it comes from crosstalk, radio frequency interference, distortion, or random signals created by thermal energy. Noise impairs the detection of the smallest analog levels which may be resolved within the demodulator. The noise level along with the maximum clip level of an analog signal path set the available amplitude dynamic range.
The maximum data rate of a modem is limited by the available frequency range (bandwidth) and signal-to-noise ratio (SNR) which is amplitude dynamic range. If more of either is available, more bits may be transferred per second. The information carrying limit was discussed theoretically by Claude Shannon and is known as Shannon's limit, or information theory.
Because modems run close to Shannon's limit today, no further advances will be made to traditional telephone line modems other than incremental improvement of V.90. The frequency range of the audio channel is very limited at about 4 kHz. V.34+ modems are limited to a maximum data rate of 33.6Kb/s by an SNR of about 36 dB caused mostly by network PCM quantization noise. While V.90 improves the SNR by utilizing the network PCM levels directly, it is still subject to Shannon's limit.
xDSL modems take advantage of the spectrum above the telephone audio channel. While operating with somewhat less amplitude dynamic range they increase data rates by greatly increasing the frequency range of the communication signal (from about 10 kHz to over 1.0mHz). To do this they require the installation of special equipment at the central office and customer premise.

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