Digital Data transmission(DDT)

Data transmission refers to the process of transfers of data between two or more digital devices.

DDT affected by (a) energy (b) Distance (c) Noise and (d) bandwidth.

Transmission Modes in Data Transmission

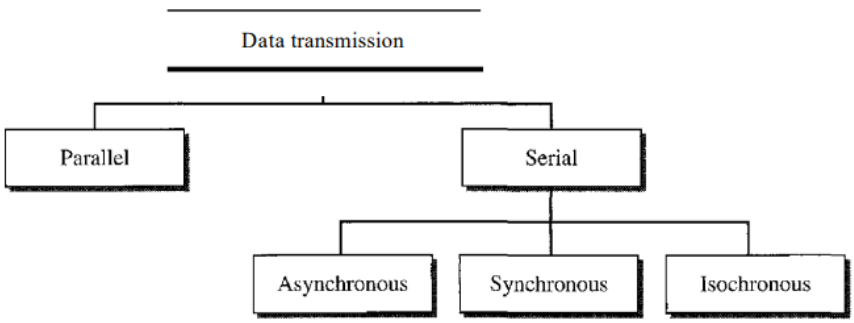
TRANSMISSION MODES Of primary concern when we are considering the transmission of data from one device to another is the wiring, and of primary concern when we are considering the wiring is the data stream.

Do we send 1 bit at a time; or do we group bits into larger groups and, if so, how? **The transmission of binary data across a link can be accomplished in either parallel or serial mode.**

In parallel mode, multiple bits are sent with each clock tick.

In serial mode, 1 bit is sent with each clock tick. While **there is only one way to send parallel data**, there are three subclasses of serial transmission: asynchronous, synchronous, and isochronous.

Figure 4.31 *Data transmission and modes*



Parallel Transmission:

Binary data, consisting of Is and Os, may be organized into groups of n bits each.

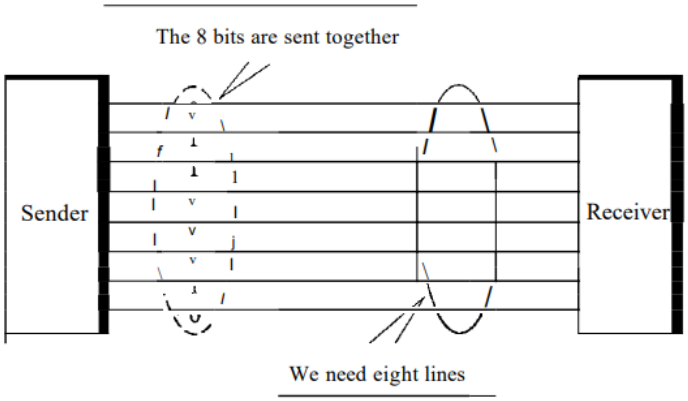
Computers produce and consume data in groups of bits much as we conceive of and use spoken language in the form of words rather than letters. **By grouping, we can send data n bits at a time instead of 1. This is called parallel transmission.**

The mechanism for parallel transmission is a conceptually simple one: **Use n wires to send n bits at one time**. That way each bit has its own wire, and all n bits of one group can be transmitted with each clock tick from one device to another.

The advantage of parallel transmission is speed. All else being equal, parallel transmission can increase the transfer speed by a factor of n over serial transmission.

Figure 4.32 shows how parallel transmission works **for n =8. Typically, the eight wires** are bundled in a cable with a connector at each end.

Figure 4.32 *Parallel transmission*



But there is a significant disadvantage: cost. Parallel transmission requires *n* communication lines (wires in the example) just to transmit the data stream. Because this is expensive, parallel transmission is usually limited to short distances.

Parallel transmission is used for short distance communication.

Advantages:

- Speed/faster- It provides greater speed. Here n bits are transmitted simultaneously with a single cable. It is n times faster than serial communication.
- Time require is only one cycle.

Disadvantages:

- Cost: It requires n communication lines (wires) which is expensive.
- It is usually limited to short distance.
- Cross talk occurs (wires are different length).
- Unreliable and complicated

Parallel transmission is half duplex since the data can be sent or received at any given time.

Example of parallel transmission: Computer to Printer

Serial Transmission:

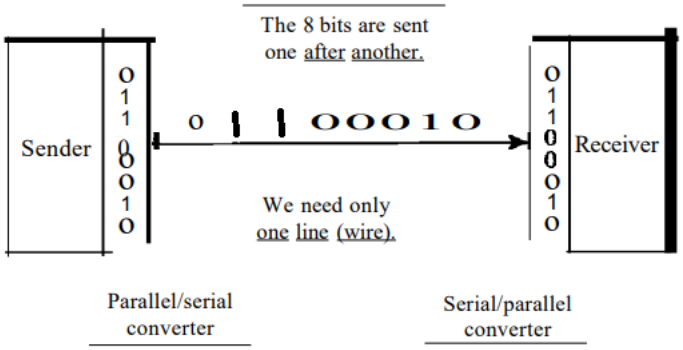
In serial transmission one bit follows another, so we need **only one communication channel** rather than n to transmit data between two communicating devices (see Figure 4.33).

The advantage of serial over parallel transmission is that with only one communication channel, serial transmission **reduces the cost of transmission** over parallel by roughly a factor of n.

Since communication within devices is parallel, conversion devices are required at the interface between the sender and the line (parallel-to-serial) and between the line and the receiver (serial-to-parallel).

In serial transmission one bit follows another, so we need only one communication channel rather than n to transmit data between two communicating devices (see Figure 4.33).

Figure 4.33 *Serial transmission*



Serial transmission occurs in one of three ways:

- asynchronous,
- synchronous, and
- Isochronous.

Asynchronous Transmission:

Asynchronous transmission is so named because the **timing of a signal is unimportant**. Each group, usually 8 bits, is sent along the link as a unit. The sending system handles each group independently, relaying it to the link whenever ready, without regard to a timer.

Without synchronization, the receiver cannot use timing to predict when the next group will arrive.

Asynchronous here means "asynchronous at the byte **level,"**
but the bits are still synchronized; their durations are the same.

To alert the receiver to the arrival of a new group, therefore, an extra bit is added to the beginning of each byte. This bit, usually a 0, is called the start bit.

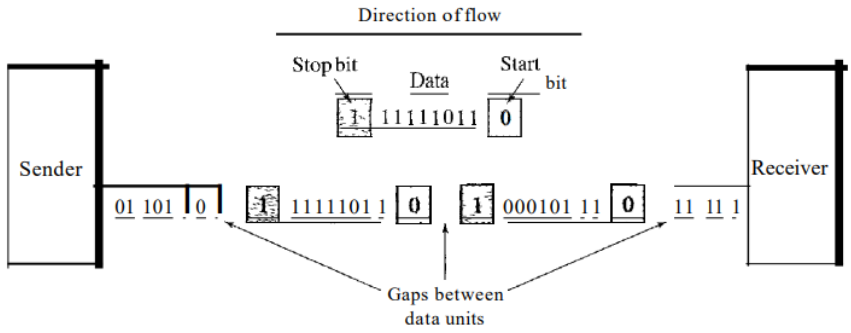
To let the receiver know that the byte is finished, 1 or more additional bits are appended to the end of the byte. These bits, usually Is, are called stop bits.

By this method, each byte is increased in size to at least 10 bits, of which 8 bits is information and 2 bits or more are signals to the receiver.

In addition, the transmission of each byte may then be followed by a gap of varying duration. This gap can be represented either by an idle channel or by a stream of additional stop bits.

CHAPTER 4 *DIGITAL TRANSMISSION*

Figure 4.34 *Asynchronous transmission*



In asynchronous transmission, we send 1 start bit (0) at the beginning and 1 or more stop bits (Is) at the end of each byte. There may be a gap between each byte.

The addition of stop and start bits and the insertion of **gaps** into the bit stream make asynchronous transmission **slower than** forms of transmission that can operate without the addition of control information.

But **it is cheap and effective**, two advantages that make it an attractive choice for situations such as **low-speed communication.**

For example, the connection of a **keyboard to a computer** is a natural application for asynchronous transmission.

A user types only one character at a time, types extremely slowly in data processing terms, and leaves unpredictable gaps of time between each character.

Disadvantages of asynchronous communication

- Large relative Overhead
- Additional overhead of start and stop bits
- slow
- False recognition of bits due to noise on the channel

An asynchronous transmission communication service or application does not require a constant bit rate.

Example of asynchronous serial transmission:

- **File transfer**
- **E-mail**
- **World wide web**

Synchronous Transmission:

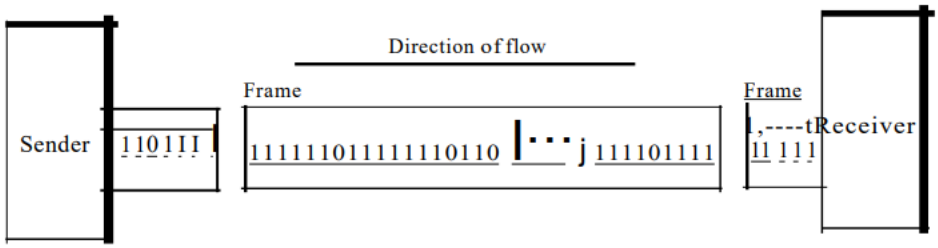
In synchronous transmission, **the bit stream is combined into longer "frames," which may contain multiple bytes.**

Each byte, however, is introduced onto the transmission link without a gap between it and the next one. It is left to the receiver to separate the bit stream into bytes for decoding purposes.

In other words, data are transmitted as **an unbroken** string of 1s and Os, and the receiver separates that string into the bytes, or characters, it needs to reconstruct the information.

In synchronous transmission, we send bits one after another without start or stop bits or gaps. **It** is the responsibility of the receiver to group the bits.

Figure 4.35 *Synchronous transmission*



Without gaps and start and stop bits, there is no built-in mechanism to help the receiving device adjust its bit synchronization midstream.

Timing becomes very important, therefore, because the accuracy of the received information is completely dependent on the ability of the receiving device to keep an accurate count of the bits as they come in.

The advantage of synchronous transmission is high speed. **With no extra bits or gaps** to introduce at the sending end and remove at the receiving end, and, by extension, with fewer bits to move across the link, **synchronous transmission is faster than asynchronous transmission**.

For this reason, it is more useful for **high-speed applications such as the transmission of data from one computer to another**.

Byte synchronization is accomplished in the data link layer. Perform error detection using CRC (Cyclic Redundancy check)

Example of Synchronous serial transmission:

- **Computer to computer communication**
- **Chat(message)**
- **voIP**
- **ip-TV (internet protocol television)**

Disadvantages of synchronous communication

- slightly more complex
- Hardware is more expensive
- Video and audio is not possible

Isochronous transmission:

It guarantees that the data arrive at a fixed rate.

Data must be delivered at just the right speed (real time) - not too fast and not too slow.

For example, **TV images are broadcast at the rate of 30 images per second; they must be viewed at the same or constant rate.**

In **real-time audio and video, in** which uneven delays between frames are not acceptable, synchronous transmission fails.

If each image is sent by using one or more frames, there should be no delays between frames. For this type of application, synchronization between characters is not enough; the entire stream of bits must be synchronized.

Use both synchronous and asynchronous modes used

Each character (byte) begin with start bit (0) and stop bit (1) but gap is fixed. So speed is faster than asynchronous.

Example of isochronous transmission:

- **Real Time Audio and video**
- **TV**