Patrician College of Arts and Science

Department of Computer Science

Data Communication and Networking

SAE6A

Even Semester

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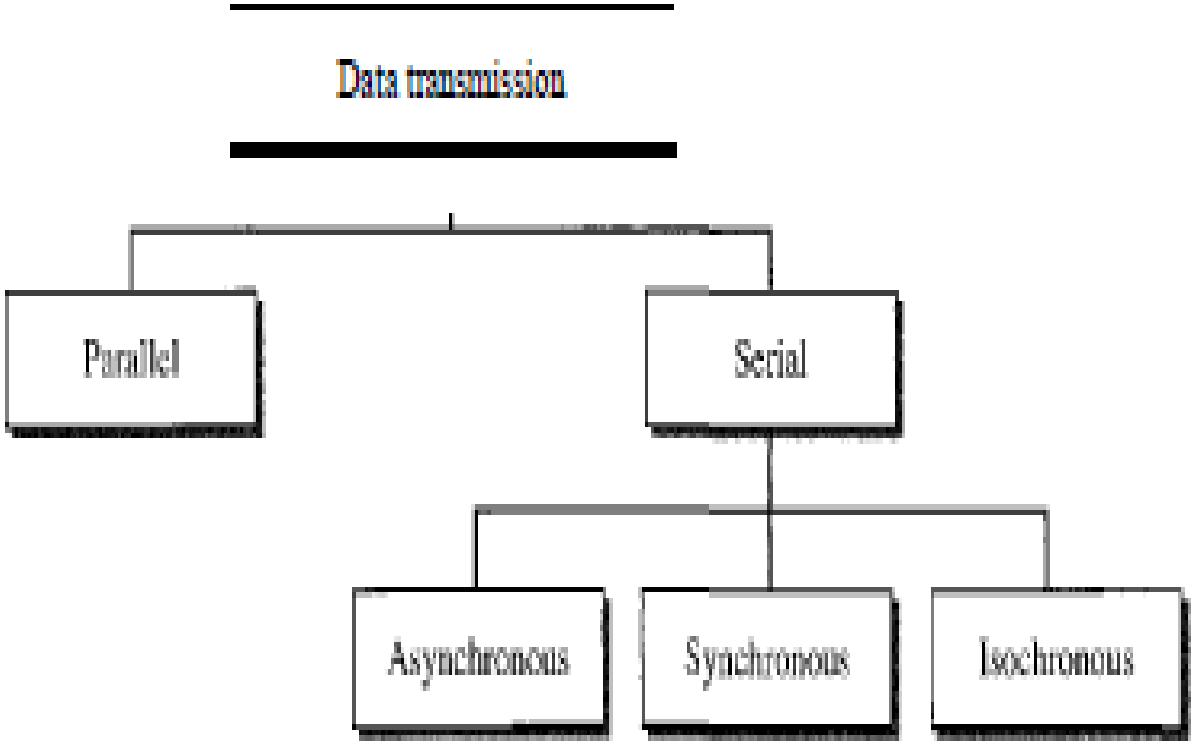
TRANSMISSION MODES

- 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*



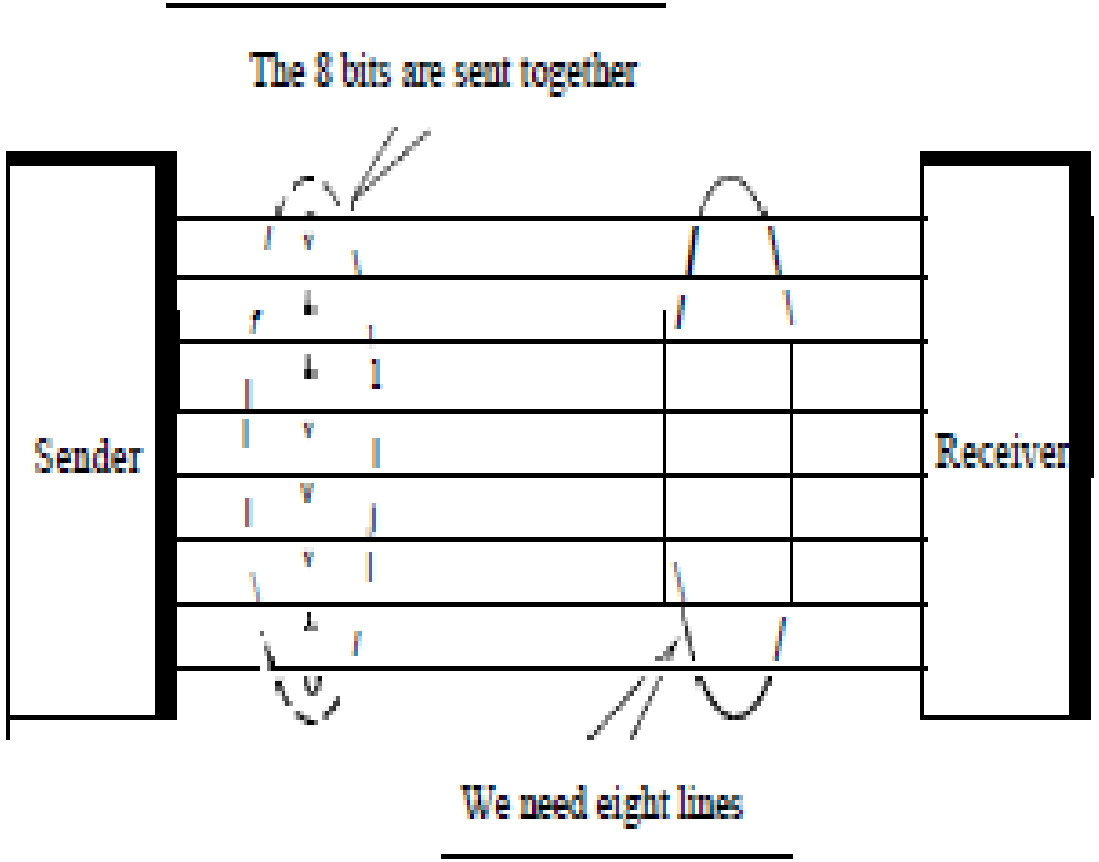
Parallel Transmission

- Binary data, consisting of 1s and 0s, may be organized into ***groups of n bits each.***
- Computers produce and consume data in groups of bits.
- By grouping, it is possible to 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.***

Parallel Transmission

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

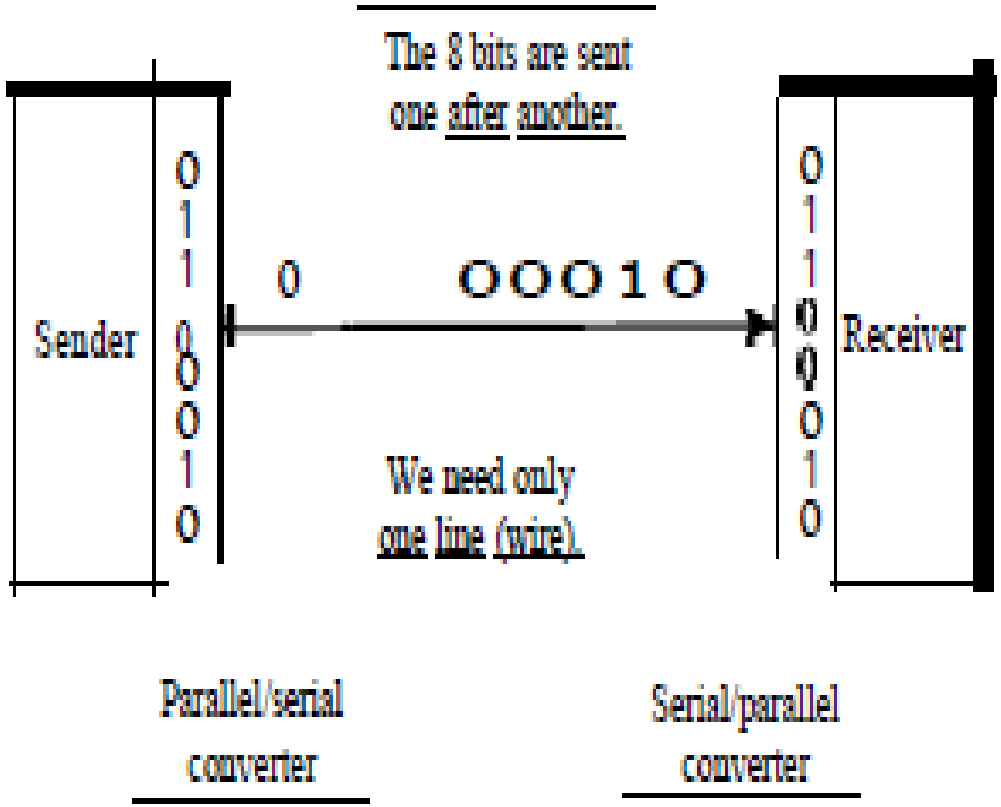
Figure 4.32 *Parallel transmission*



Parallel Transmission

- Advantage is **speed**..
- Disadvantage: **cost**.
  - Because this is expensive, parallel transmission is usually limited to short distances.

Figure 4.33 *Serial transmission*



Serial Transmission

- In serial transmission one bit follows another, so only one communication channel rather than *n* to transmit data between two communicating devices
- The advantage of serial is only one communication channel, serial transmission reduces the cost of transmission.

Serial Transmission

- 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**).
- Serial transmission occurs in one of three ways: **asynchronous, synchronous, and isochronous.**

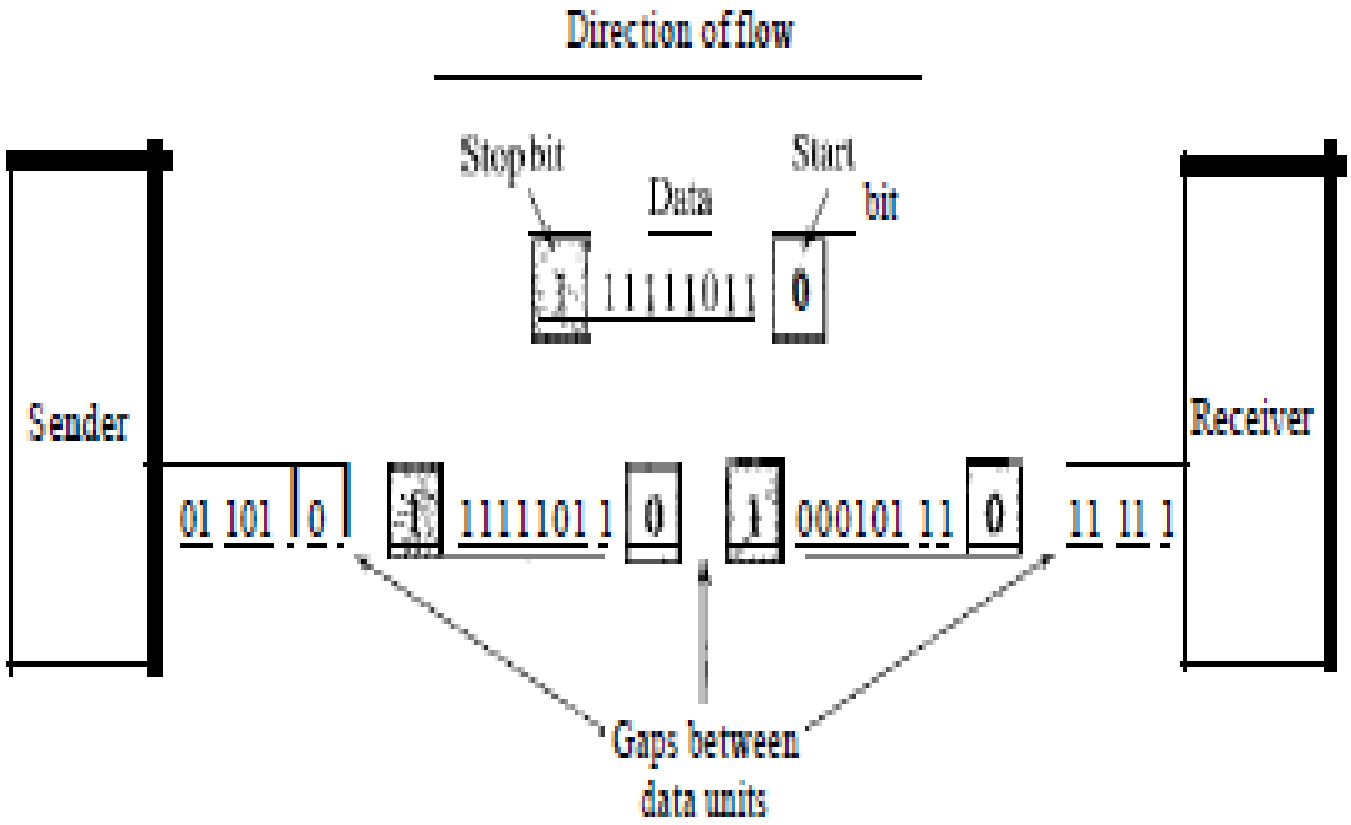
Asynchronous Transmission

- Asynchronous transmission is so named because the **timing of a signal is unimportant**.
- Instead, information is received and translated by agreed upon patterns.
- As long as those patterns are followed, the receiving device can retrieve the information without regard to the rhythm in which it is sent.
- Patterns are based on grouping the bit stream into bytes.

Asynchronous Transmission

- 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.
- 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.**

Figure 4.34 *Asynchronous transmission*



Asynchronous Transmission

- 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 **I s, 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.**

Asynchronous Transmission

- The start and stop bits and the gap alert the receiver to the beginning and end of each byte and allow it to synchronize with the data stream.
- This mechanism is called *asynchronous* because, at the byte level, the sender and receiver do not have to be synchronized.
- But within each byte, the receiver must still be synchronized with the incoming bit stream.

Asynchronous Transmission

- That is, some synchronization is required, but only for the duration of a single byte.
- The receiving device resynchronizes at the onset of each new byte.
- When the receiver detects a start bit, it sets a timer and begins counting bits as they come in.
- After *n* bits, the receiver looks for a stop bit.
- As soon as it detects the stop bit , it waits until it detects the next start bit.

Asynchronous Transmission

- 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.

Asynchronous Transmission

- 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.

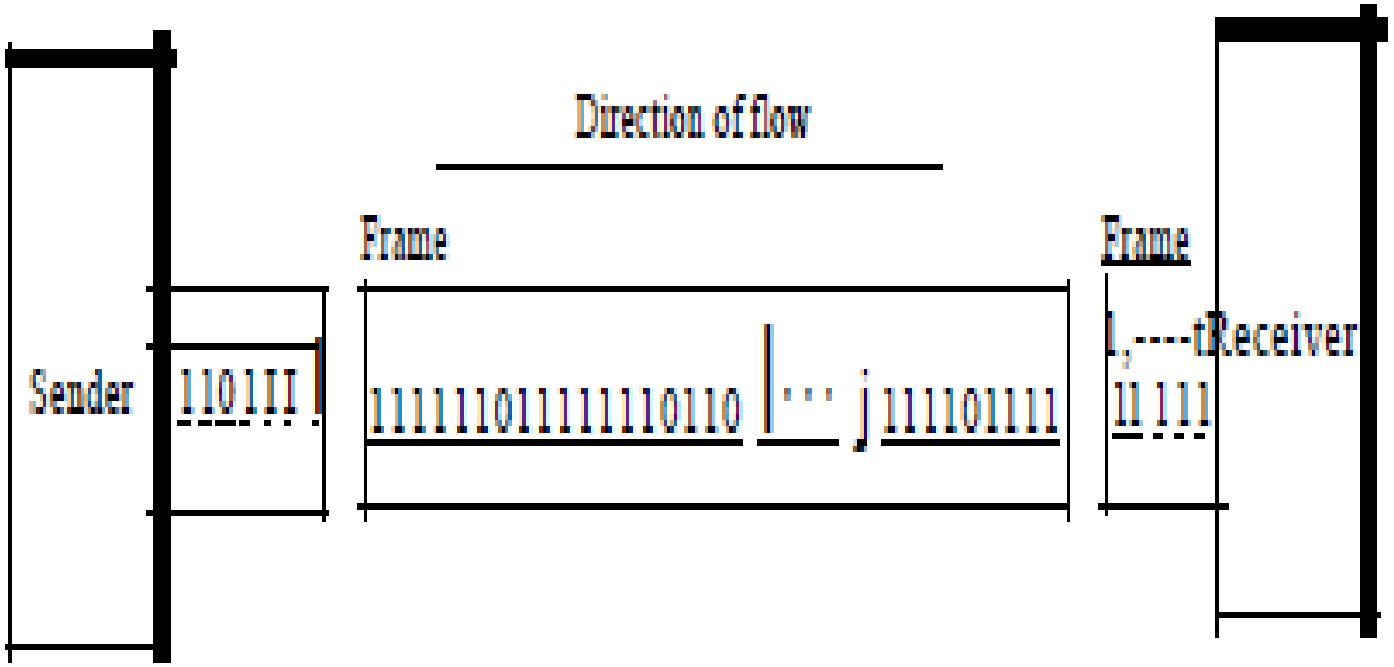
Synchronous Transmission

- In synchronous transmission, the bit stream is combined into longer "frames," whichmay 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.

Synchronous Transmission

- 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.
- If the sender wishes to send data in separate bursts, the gaps between bursts must be filled with a special sequence of 0s and Is that means *idle.*
- The receiver counts the bits as they arrive and groups them in 8-bit units.

Figure 4.35 *Synchronous transmission*



Synchronous Transmission

- The advantage of synchronous transmission is **speed**.
- Synchronous transmission is faster than Asynchronous transmission.

Synchronous 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.

Isochronous

- In real-time audio and video, in which uneven delays between frames are not acceptable, synchronous transmission fails.
- For example, TV images are broadcast at the rate of 30 images per second; they must be viewed at the same rate.

Isochronous

- 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.
- The isochronous transmission guarantees that the data arrive at a **fixed rate**.

Thank you

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