

MECHATRONICS AND ROBOTICS

**SERIAL COMMUNICATION
SYSTEM : BASICS**

LECT 12

MECHATRONICS AND ROBOTICS

SECTION 2

TOPIC:- SERIAL COMMUNICATION SYSTEMS

Communication, Data communication, Protocols, Data Communication Standard, Serial and Parallel Data Communication, Synchronous and Asynchronous serial data Communication

WHAT IS A COMMUNICATION?

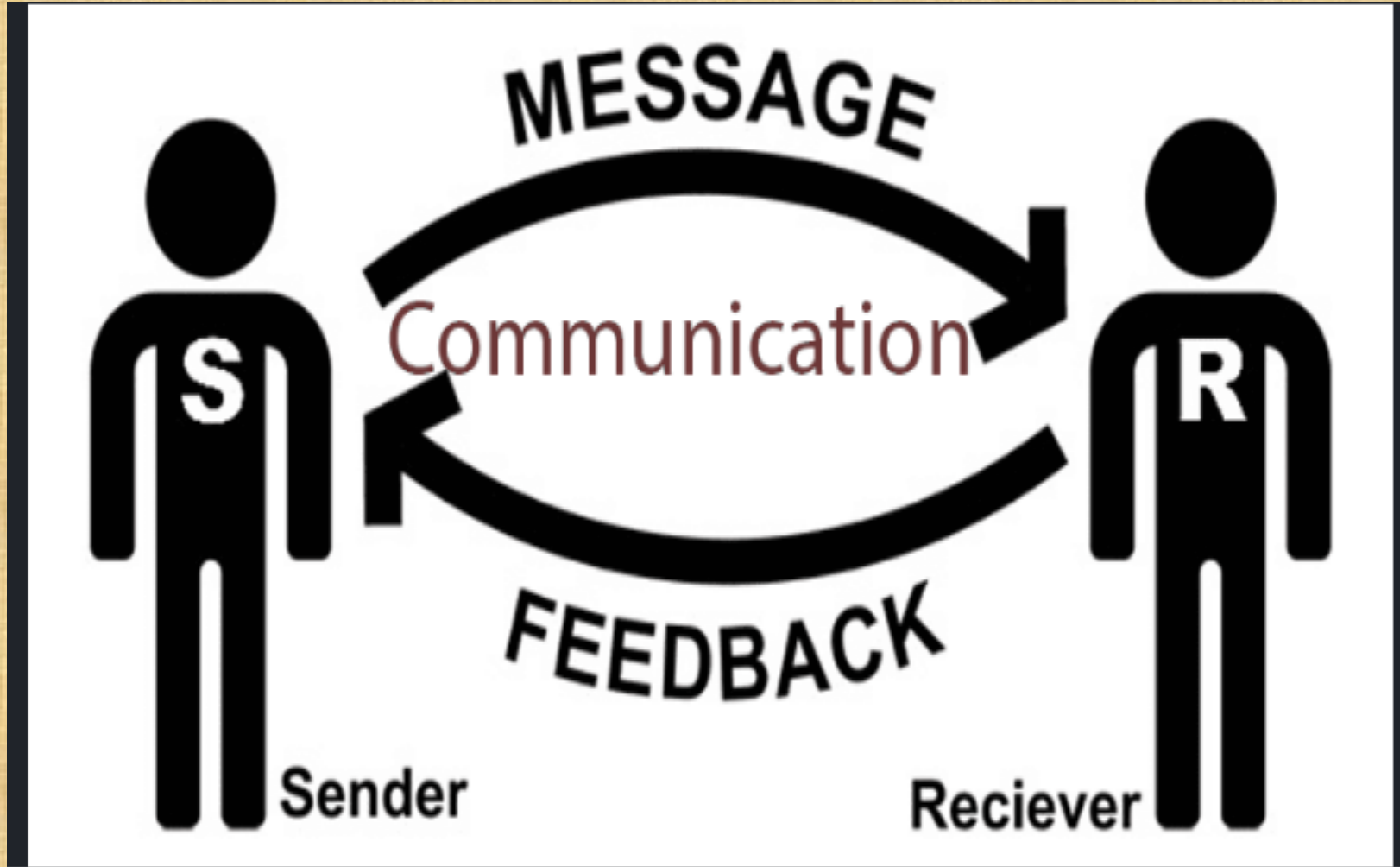
Communication is the act of conveying meanings from one entity or group to another through the use of mutually understood signs, symbols, and semiotic rules.

Communication is a process by which information is exchanged between individuals through a common system of symbols, signs, or behavior

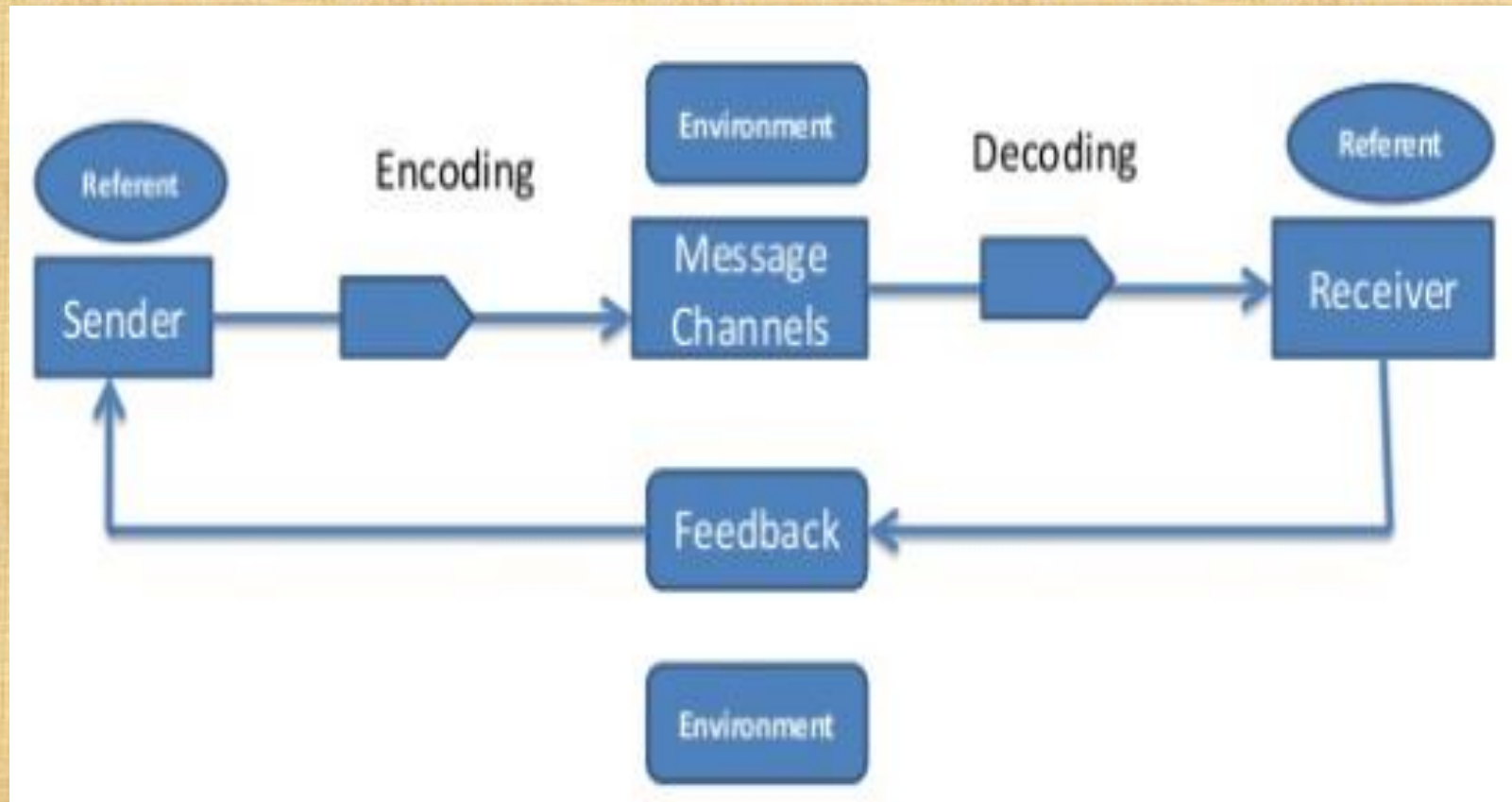
.....Webster's Dictionary

WHAT IS A COMMUNICATION? :

General



WHAT IS A COMMUNICATION?:- Technically



DATA COMMUNICATION

In recent years, the technological development is revolutionized by the term “DATA” owing to digital revolution in modern technology

DATA essentially mean; information coded in digital form, that is, 0s and 1s

Sending such **DATA** from one point to the other either directly or through a network in a systematic and organized manner is known as **Data Communication**

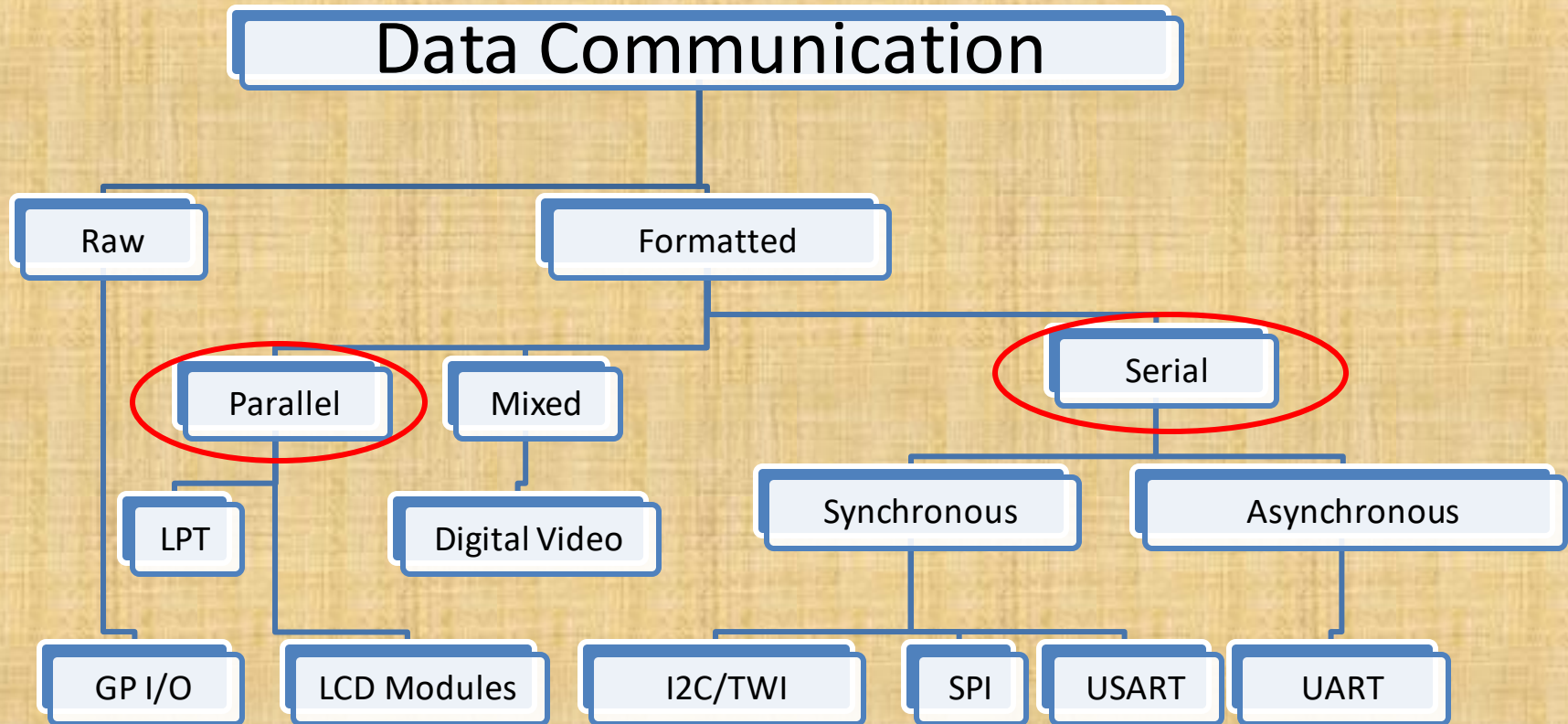
PROTOCOLS

During the **data Communication**, in order to have proper interaction between the **data transmitter** (the device needing to commence data communication) and the **data receiver** (the system which has to receive the data sent by a transmitter) there has to be **some set of rules** which all the interested parties must obey are better known as **PROTOCOLS**

The PROTOCOL requirement has finally paved the way for some **DATA COMMUNICATION STANDARDS.**

DATA COMMUNICATION: STRATEGY

Depending on the **requirement of applications**, one has to choose the appropriate type of Data communication strategy. There are basically two major classifications, namely **SERIAL** and **PARALLEL**, each with its variants. .



Note:- Not complete nor absolutely accurate, Shared for understanding relevant technologies.

DATA COMMUNICATION: STANDARD

Data communication standard comprises

- The protocol.
- Signal/data/port specifications for the devices or additional electronic circuitry involved.

All the data communication systems follow some specific set of standards defined for their communication capabilities so that the systems are not Vendor specific but for each system the user has the advantage of selecting the device and interface according to his own choice of make and range.

DATA COMMUNICATION: SERIAL AND PARALLEL

Communication between two machines requires a transfer of signal from an output to an input.

There needs to be a sender and receiver of the signal for the complete communication process to take place.

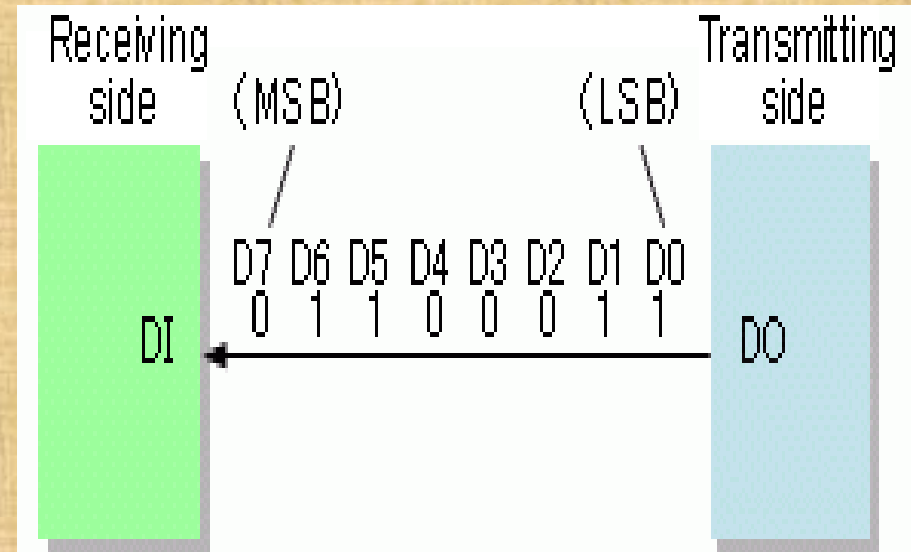
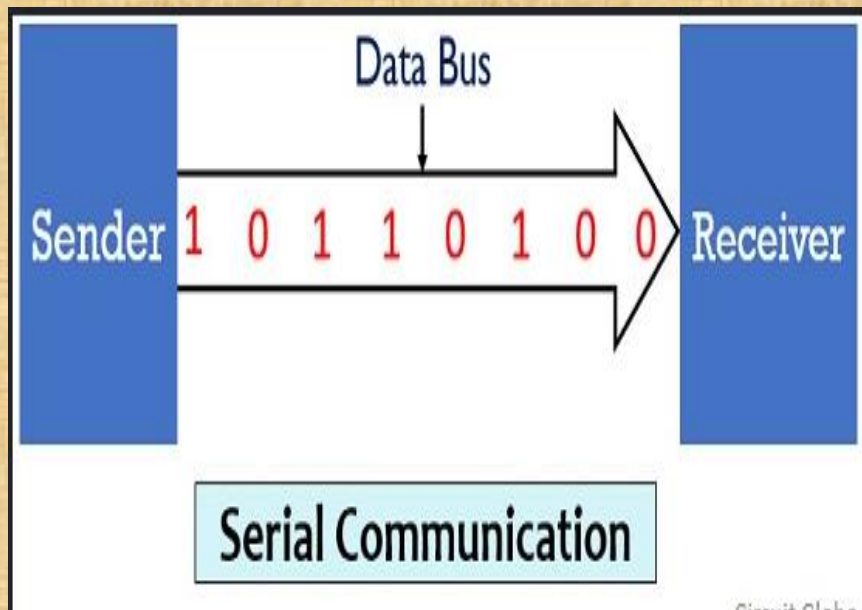
Serial and parallel communications are both ways of transferring data over networks. Both systems have a unique way of operating, with differences between the two ranging from the mode of relaying signals to the level of connectivity they require.

SERIAL COMMUNICATION

Serial data communication is the most common **low-level protocol** for communicating between two or more devices.

This is the primary mode of transfer in **long-distance data communication**.

Serial communication involves sending **one data bit at a time** over a **single data channel or bus**



SERIAL COMMUNICATION

In serial communication the data bits are transmitted **serially** over a common communication link one after the other.

Basically it does not allow **simultaneous transmission** of data because only a **single channel** is utilized. Thereby allowing **sequential data transfer** rather than **simultaneous data transfer**.

But as only a **single data bit** is transmitted per clock pulse thus the transmission of data is a **quiet time consuming process (slow data transfer)**

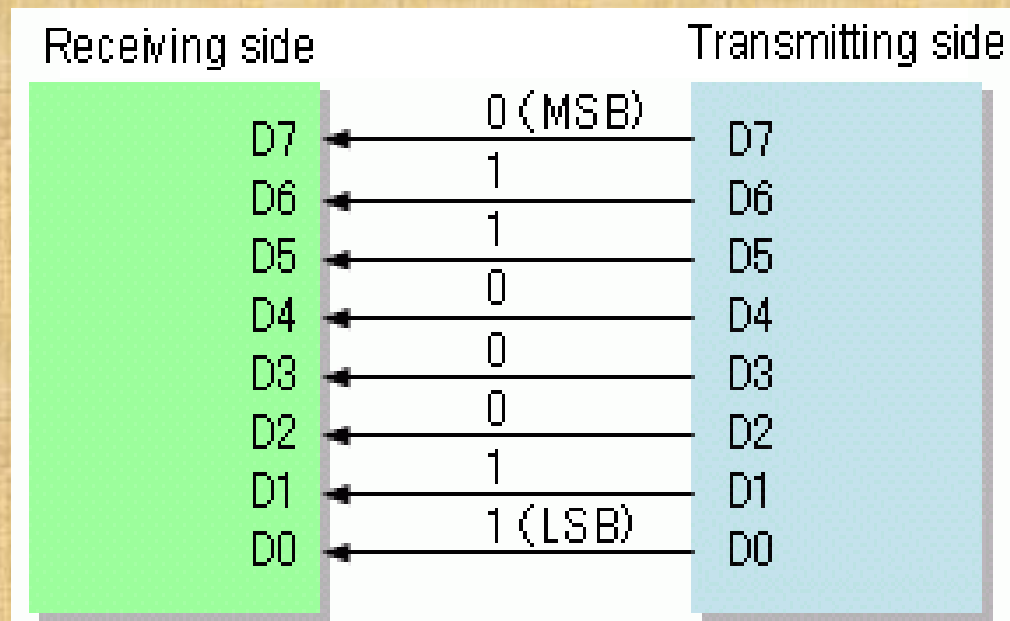
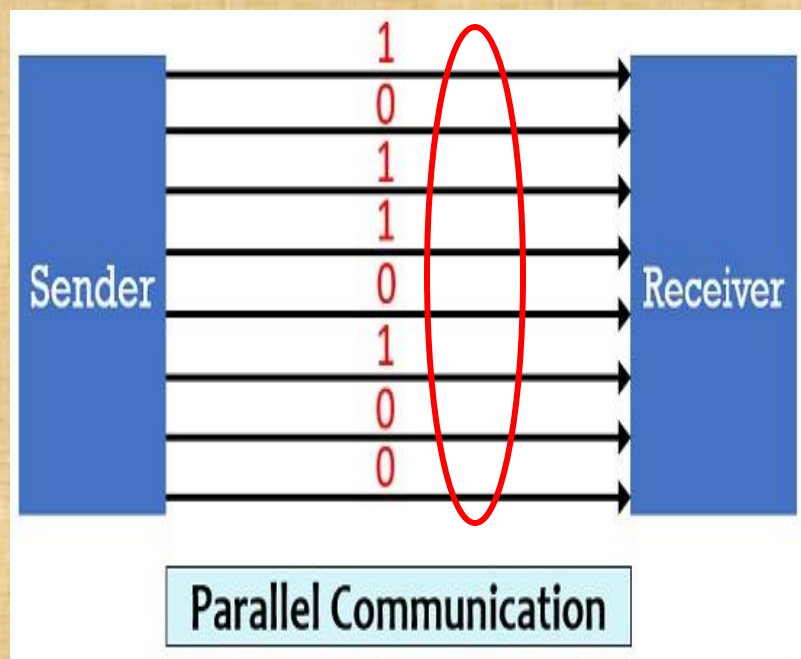
PARALLEL COMMUNICATION

In Parallel transmission involves grouping several bits, say n , together and sending all the n bits **at a time**.

In **parallel communication** the various data bits are simultaneously transmitted using **multiple communication links** between sender and receiver.

Here, despite using a single channel between sender and receiver, various links are used and each bit of data is transmitted separately **over all the communication link**.

PARALLEL COMMUNICATION



For the transmission of 8-bit of data, 8 separate communication links are utilized. And so rather following a sequential data transmission, simultaneous transmission of data is achieved

PARALLEL COMMUNICATION

This leads to a **faster communication** between the sender and receiver. But for **connecting multiple lines** between sender and receiver multiple connecting unit are to be present between a pair of sender and receiver.

Hence, parallel communication is **not suitable** for **long distance** transmission, because connecting multiple lines to large distances is **very difficult and expensive**.

for the transmission of 8-bit of data, 8 separate communication links are utilized. And so rather following a sequential data transmission, simultaneous transmission of data is allowed.

S.No	Serial Communication	VS	Parallel Communication
1	Data is transmitted bit after the bit in a single line		Data is transmitted simultaneously through group of lines(Bus)
2	Data congestion takes place		No, Data congestion
3	Low speed transmission		High speed transmission
4	Implementation of serial links is not an easy task.		Parallel data links are easily implemented in hardware
5.	In terms of transmission channel costs such as data bus cable length, data bus buffers, interface connectors, it is less expensive		It is more expensive
6	No , crosstalk problem		Crosstalk creates interference between the parallel lines.
7	No effect of inter symbol interference and noise		Parallel ports suffer extremely from inter-symbol interference (ISI) and noise, and therefore the data can be corrupted over long distances.
8	The bandwidth of serial wires is much higher.		The bandwidth of parallel wires is much lower.
9	Serial interface is more flexible to upgrade , without changing the hardware		Parallel data transfer mechanism rely on hardware resources and hence not flexible to upgrade.
10	Serial communication work effectively even at high frequencies.		Parallel buses are hard to run at high frequencies.

SERIAL COMMUNICATION: ADVANTAGES

- **Reduced cost of cabling:** Lesser number of wires is required as compared to parallel connection
- **Reduced cross talk:** Lesser number of wires result in reduced cross talk
- **Availability** of suitable communication media
- **Inherent device characteristics:** Many devices are inherently serial in nature
- Portable devices like PDAs, etc use serial communication to **reduce the size** of the **connector**
- **Long distance data** communication

Serial and Parallel Data Transmission:-

<https://youtu.be/CGuIJriYNSI>

ASYNCHRONOUS AND SYNCHRONOUS SERIAL COMMUNICATION

There are two **basic approaches** for serial communication to achieve synchronization of data transfer between the source-destination pair. These are referred to as – **asynchronous and synchronous**.

In **Asynchronous serial communication** , data are transmitted in small sizes, say character by character, to **avoid timing problem** and make data transfer self-synchronizing.

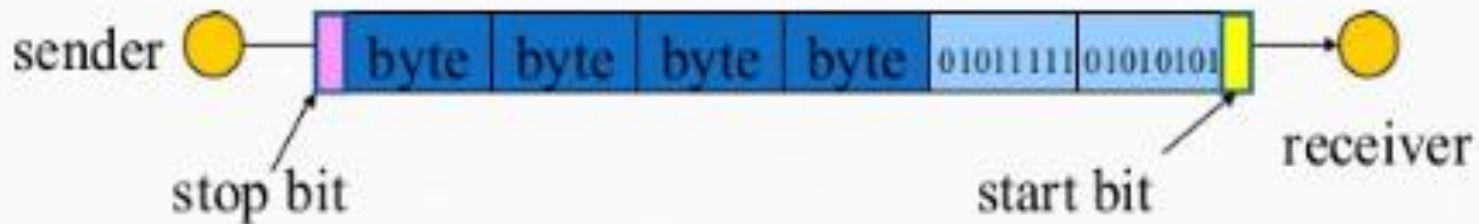
However, it is not very efficient because of **large overhead**. To **overcome this problem**, **synchronous mode is used**.

In **Synchronous mode**, a block with large number of bits can be sent **at a time**. However, this requires tight synchronization between the transmitter and receiver clocks.

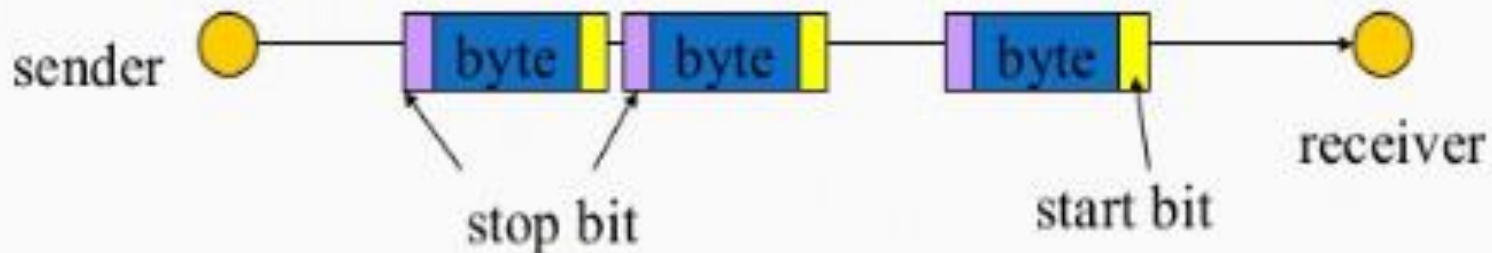
ASYNCHRONOUS AND SYNCHRONOUS SERIAL COMMUNICATION

- Serial communication uses two methods:

- In synchronous communication, data is sent in blocks of bytes.



- In asynchronous communication, data is sent in bytes.



SYNCHRONOUS VS ASYNCHRONOUS SERIAL COMMUNICATION

SYNCHRONOUS DATA TRANSFER

A data transfer method that sends a continuous stream of data to the receiver using regular timing signals that ensures both transmitter and receiver are synchronized with each other

Sender and receiver operate on the same clock frequencies

Faster

There is no overhead of extra start and stop bits

There are no gaps between data - data flows as a continuous stream

Uses constant time intervals

Used in chat rooms and video conferencing

ASYNCHRONOUS DATA TRANSFER

A data transfer method that sends data from transmitter to receiver with parity bits (start and stop bits) in uneven intervals

Sender and receiver operate on different clock frequencies

Slower

Uses start and stop bits

There can be gaps between data

Uses random or irregular time intervals

Used in emails

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THANKS