

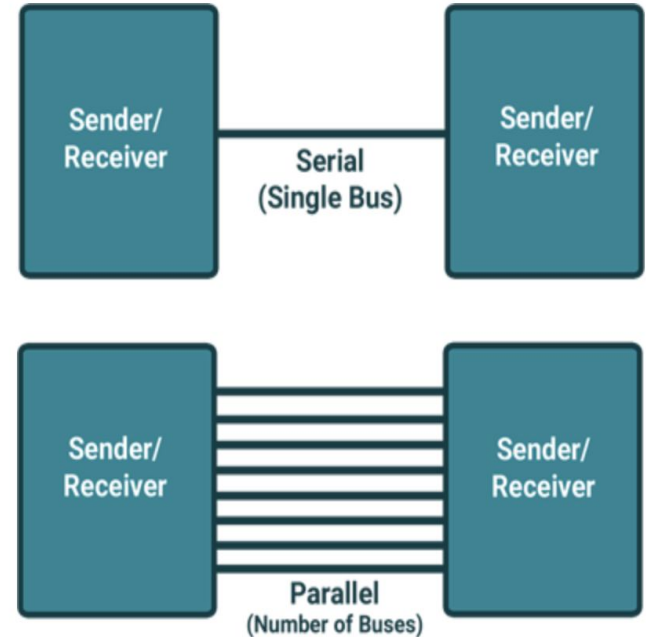
# Serial Communication

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- Serial communication means to transfer data bit by bit serially at a time.
- parallel communication, the number of bits that can be transferred at a time depends upon the number of data lines available for communication.

Two methods of serial communication are:

1. **Synchronous Communication:** Transfer of bulk data in the framed structure at a time.
2. **Asynchronous Communication:** Transfer of a byte data in the framed structure at a time



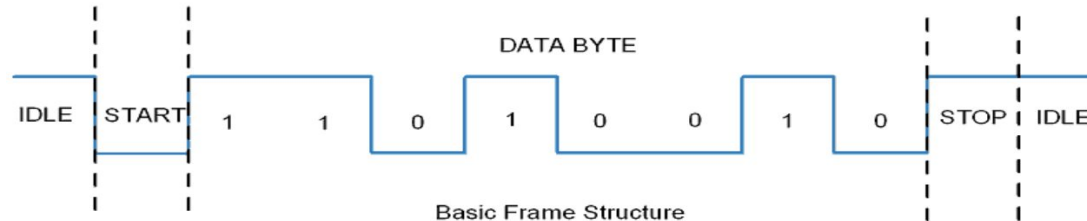
# Asynchronous communication

- Asynchronous serial communication is widely used for byte-oriented transmission.
- Frame structure in Asynchronous communication:

**START bit:** It is a bit with which serial communication starts and it is always low.

**Data bits packet:** Data bits can be 5 to 9 bits packet. Normally we use 8 data bit packet, which is always sent after the START bit.

**STOP bit:** This is one or two bits. It is sent after the data bits packet to indicate the end of the frame. The stop bit is always logic high.



**8051 Serial Frame Structure**

# Data transmission rate

- The data transmission rate is measured in bits per second (bps).
- In the binary system, it is also called a baud rate (number of signal changes per second).
- Standard baud rates supported are 1200, 2400, 4800, 19200, 38400, 57600, and 115200.

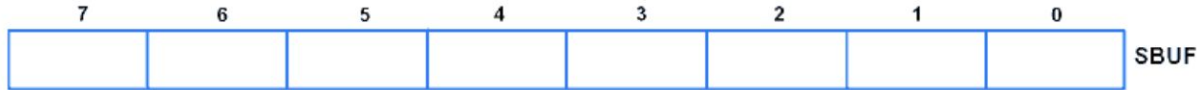
# Baud rate calculation

Baud Rate	TH1 (Hex)
9600	FD
4800	FA
2400	F4
1200	E8

# Serial communication Registers

## SBUF: Serial Buffer Register

This is the serial communication data register used to transmit or receive data through it.



## SCON: Serial Control Register

Serial control register SCON is used to set serial communication operation modes. Also it is used to control transmit and receive operations.



## Cont'd

Mode	SM0	SM1	Mode
0	0	0	1/12 of Osc frequency shift register mode fixed baud rate
1	0	1	8-bit UART with timer 1 determined baud rate
2	1	0	9-bit UART with 1/32 of Osc fixed baud rate
3	1	1	9-bit UART with timer 1 determined baud rate

# Programming steps

- Configure Timer 1 in auto-reload mode.
- Load TH1 with value as per required baud rate e.g. for 9600 baud rate load 0xFD. (-3 in decimal)
- Load SCON with serial mode and control bits. e.g. for mode 1 and enable reception, load 0x50.
- Start timer1 by setting TR1 bit to 1.
- Load transmitting data in the SBUF register.
- Wait until loaded data is completely transmitted by polling the TI flag.
- When the TI flag is set, clear it, and repeat from step 5 to transmit more data.