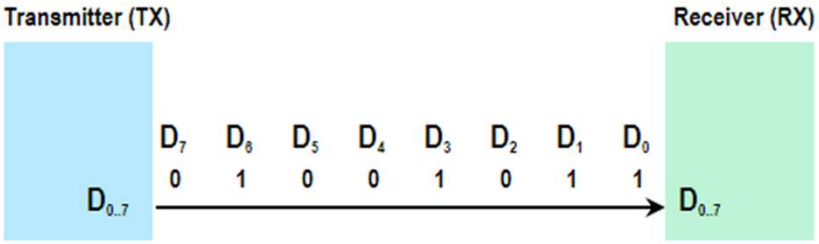
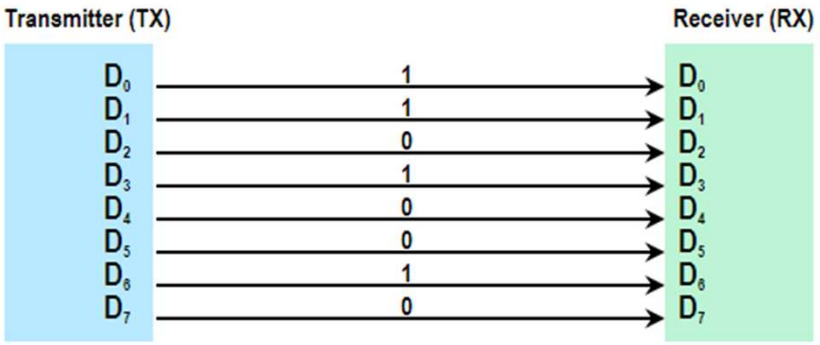
COMMUNICATION PROTOCOLS

COMMUNICATION

Two types:

1. Serial Communication
2. Parallel Communication





Synchronous

- Data is transmitted synchronously with clock.
- Data rate is same as clock.
- I2C, SPI, etc.

Asynchronous

- Data is not transmitted synchronously with clock
- Data rate is different for different applications.
- UART, CAN, etc.

Simplex

- Communication can occur only in one direction from device A to device B only.

Half Duplex

- Data transmission can occur between device A & device B, but only one at a time.

Full Duplex

- Data transmission can occur in between in both direction between Device A & B simultaneously.

- UART
- I2C
- SPI
- CAN

UART/USART/LPUART

UNIVERSAL ASYNCHRONOUS RECEIVER-TRANSMITTER

Serial Communication

Asynchronous

Full- Duplex

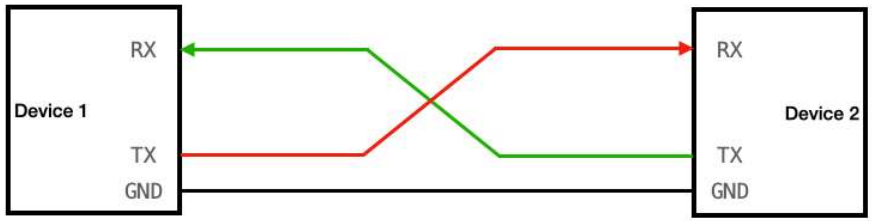
Widely- Used

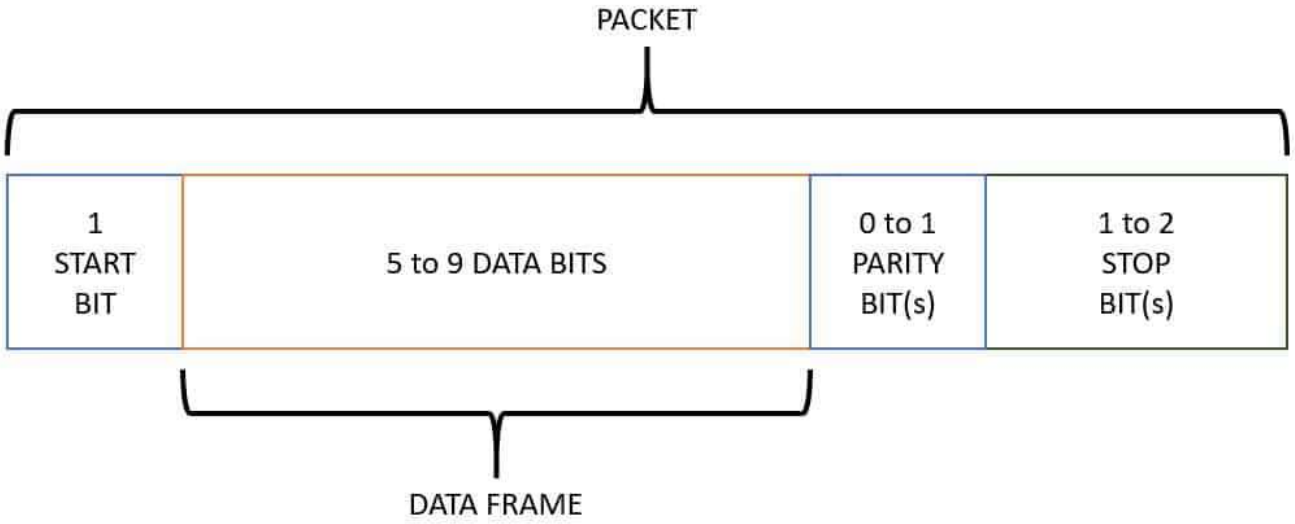
CONNECTIONS

Two Lines : Rx and Tx.

Rx is connected to Tx.

Tx is connected to Rx.

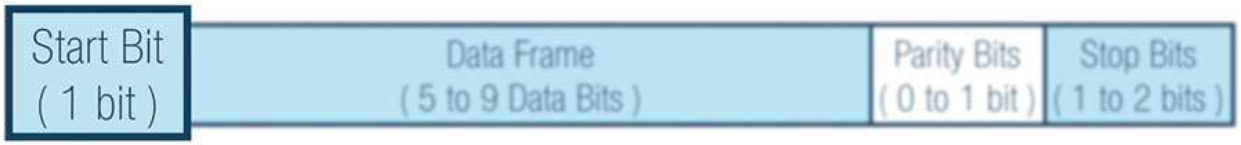



PACKET
1
START
BIT
5 to 9 DATA BITS
0 to 1
PARITY
BIT(s)
1 to 2
STOP
BIT(s)
DATA FRAME

DATA FORMAT

START BIT

- Every time a communication starts, the sender sends a logic “0” signal.

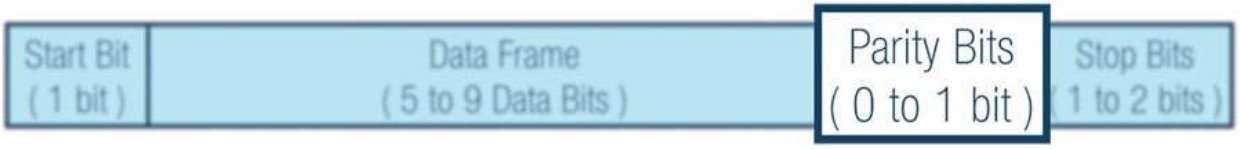


DATA FRAME

- After the start bit, we want to transmit the data.
- The data bits can be 5, 6, 7, 8, 9 bits, etc. to form a character (usually 8 bits).

PARITY BIT

- To verify the correctness of data transmission.
- Odd Parity.
- Even Parity.

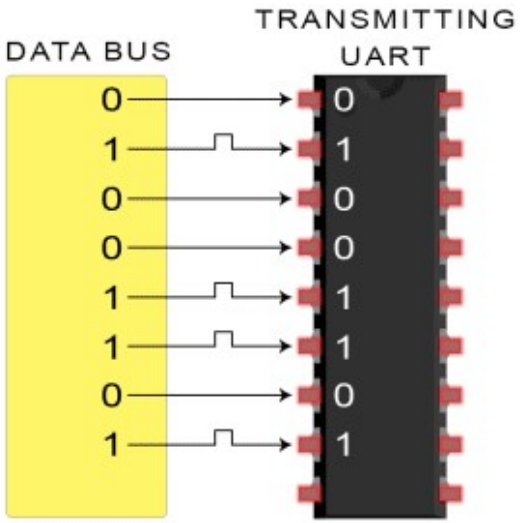


STOP BIT

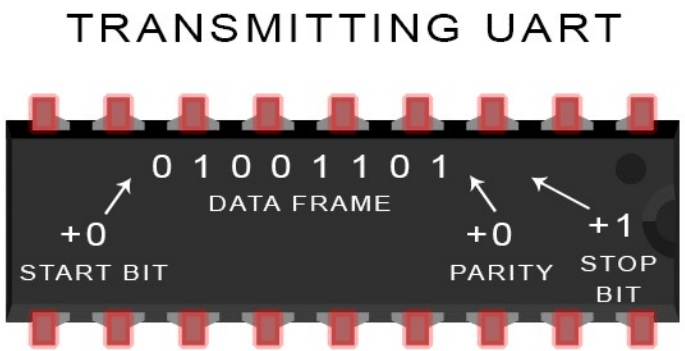
- It is an end marker for character data.

UART DATA TRANSMISSION

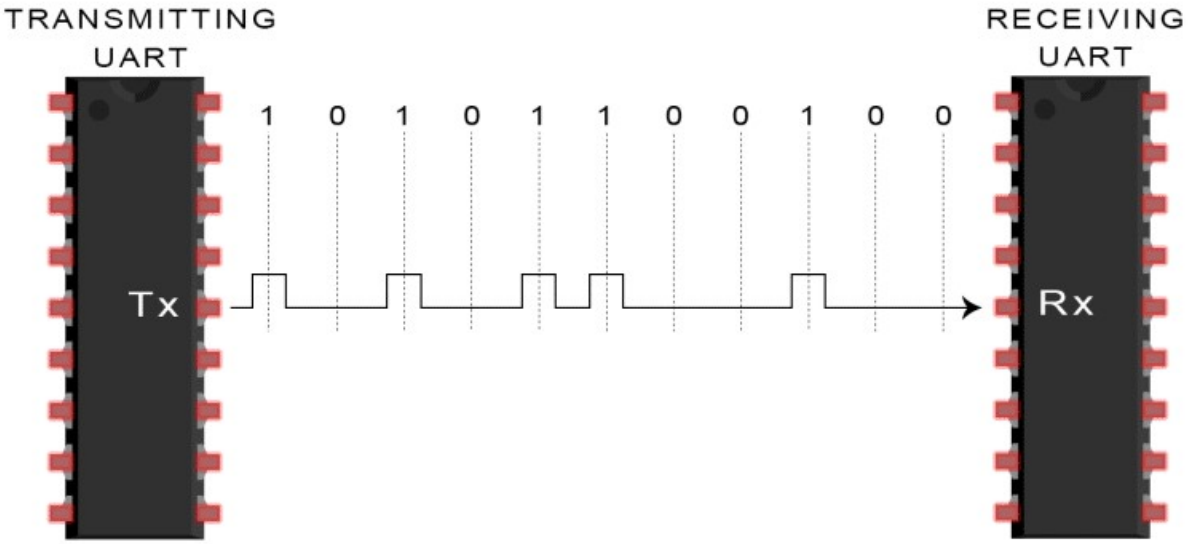
1. The transmitting UART receives data in parallel from the data bus.



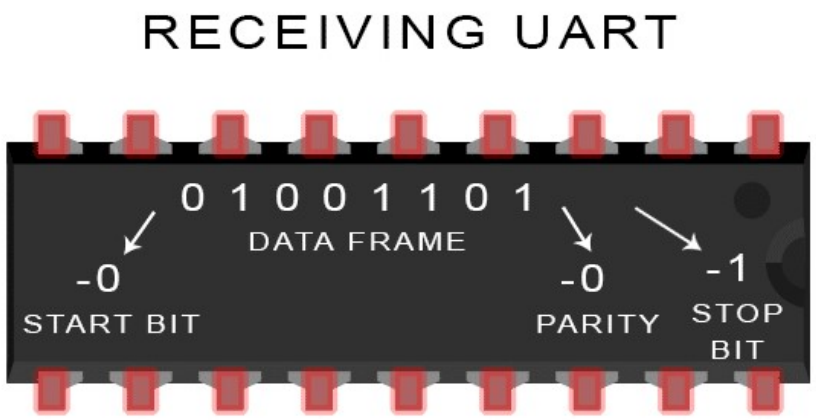
2. The transmitting UART adds the start bit, parity bit, and the stop bit(s) to the data frame.



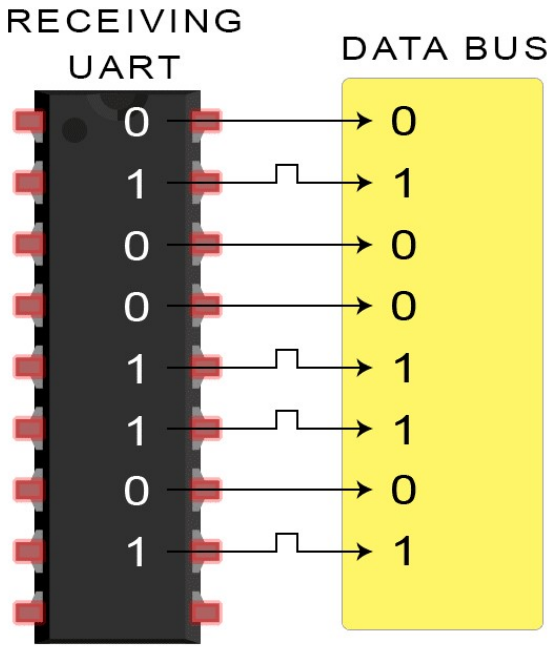
3. The entire packet is sent serially from the transmitting UART to the receiving UART. The receiving UART samples the data line at the pre-configured baud rate.



4. The receiving UART discards the start bit, parity bit, and stop bit from the data frame.



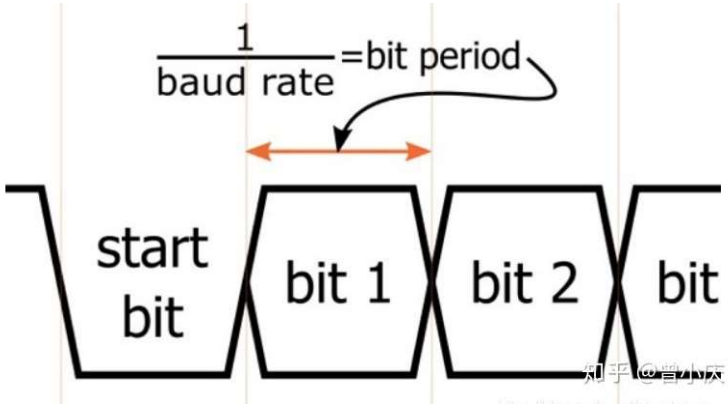
5. The receiving UART converts the serial data back into parallel and transfers it to the data bus on the receiving end.



BAUD RATE

Since there is no clock signal in asynchronous communication, the two communication devices need to agree on a baud rate.

Common ones are 4800, 9600, 115200, etc.



PROS

Only two wires for data communication

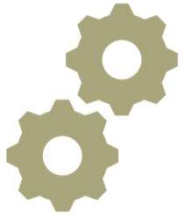
CLK signal is not required.

Parity bit for allowing to check the errors.

CONS:

Maximum can be connected is only 1.

Devices need to be on the same baud rate.



Debugging

Most GPS Modules

Radios like (Bluetooth, Wi-Fi)

USE CASES

SUMMARY

Wires	2
Speed	9600, 19200, 38400, 57600, 115200, 230400, 460800, 921600, 1000000, 1500000
Methods of Transmission	Asynchronous
Serial or Parallel?	Serial
Maximum Number of Masters	1
Maximum Number of Slaves	1