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Serial Communication Explained

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Do you want an easy understanding of serial communication? Before we jump into that, let's understand what is communication.
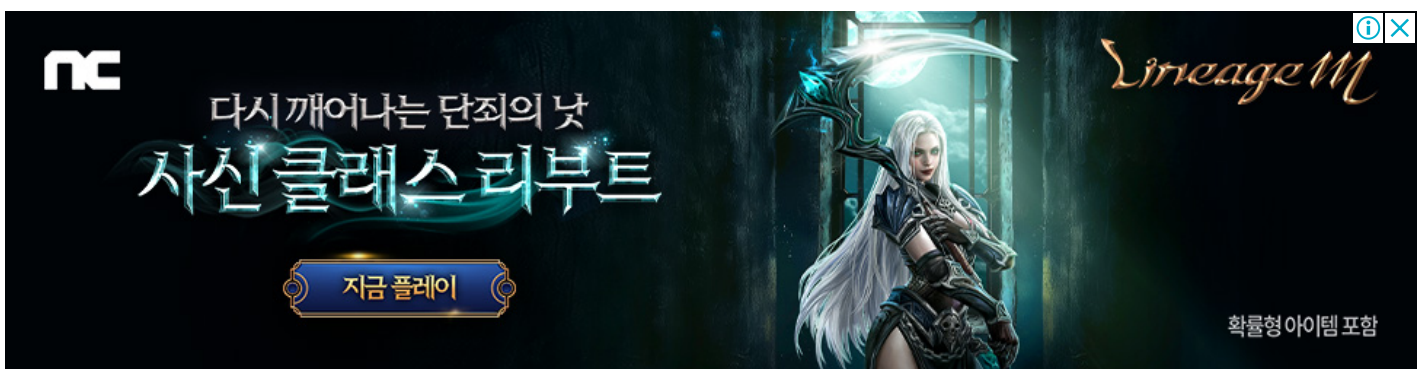
Well, communication is a way that helps in transferring the data from one source to another. In general, the data or information are exchanged in the form of bits.

The transformation of data can be approached in two ways. For example, if the data is transferred parallelly, communication would be considered parallel communication, and if the mode of data sharing is serial, then it is called serial communication.

Serial communication plays a significant role in the field of embedded systems. Various kinds of protocols are there in serial communication, some are too much easy, but some are a bit difficult. The lowest cost is one of the common and essential modes of transmission used by several platforms.

Types of Communication

There are two types of communication in general – **Parallel communication** and **Serial communication.**

Parallel Communication

In the case of parallel communication, all the 8-bits or 16-bits are transmitted together at the same time. Parallel communication requires more number of wires as compared to serial communication. For example, if you want to send 8 bits via a parallel interface, you would need 8 different lines to send those 8 bits at the same time. The images below explain how 8-bits data can be transferred over a parallel interface.
You can think about an 8-lane highway to imagine how parallel communication works. It 8-lanes or 16-lanes allows to move all the 8 / 16 vehicle move at the same time.
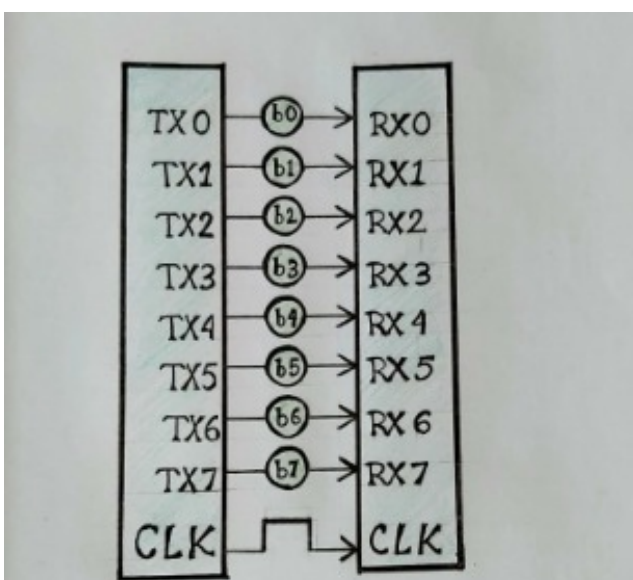
Serial Communication

On the other hand, the serial interface transmits one bit at a time. So, definitely the serial communication is slower than parallel communication.
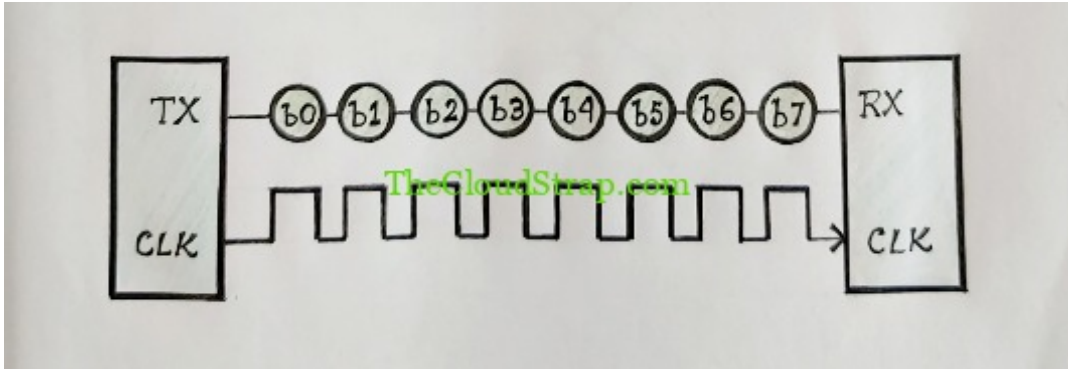
You can think of a serial communication as a 2-lanes road as compare to 8-lanes or 16-lanes highway. The 2-lanes road is definitely slower than the 8-lanes or 16-lanes highway. But, building a 2-lanes road costs less and it does the basic job of transferring goods/people from one place to another. Here is how the serial communication works:

Examples of Parallel Communication

Here are the examples of parallel communication – ATA, SCSI, PCI, IEEE 4888 etc.

Examples of Serial Communication

Some common examples of serial communication are – RS232, SPI, I²C, USB, CAN, ETHERNET, etc.
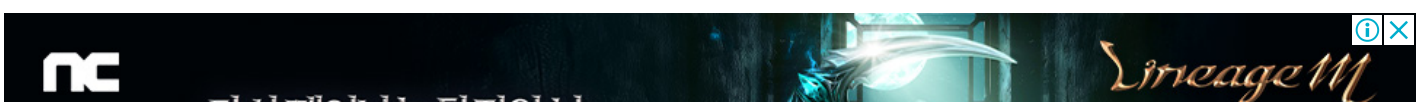
Transmission modes used by Serial Communication

As the serial data is transferred in the form of bites, the binary pulses are sent between two sources in a real sense. The binary pulse consists of two data – logic zero and one. Logic one basically defines HIGH and logic zero LOW. These are sent by various modes, such as simplex, half-duplex, and full-duplex; let's let them concisely discuss them.

Simplex

There are two parties in serial communication; they are sender and receiver. In simplex mode, they can send or share data at a time only, which means either sender or receiver can share data. So basically, it delivers a one-way communication process, where communication is active for one time. For example – TV, Radio, etc.

Half Duplex

In this mode of transmission, the sender and receiver can share data at the same time. But here, some data loss may occur. A walkie talkie is an example of half-duplex transmission. The users or sender need to send the request to get access to transmitting data.

Full Duplex

In this mode of transmission, the receiver and sender can share the data at a similar time. Talking over the phone would be the best example of a full-duplex transmission mode. Clock synchronization is essential in this mode. Nowadays, full-duplex is used in a wide area of communication.

Serial Communication – Synchronous

Broadly the serial communication is categorized into two parts – asynchronous and synchronous.

In the case of synchronous transmission, the data is sent along with the clock signal. All the devices on the synchronous serial communication bus share a common clock signal.

Examples of Synchronous serial communication – I2C, SPI etc.

Serial Communication – Asynchronous

In asynchronous transmission, the data is transmitted without the clock signal. So, the **external clock is not required** in the **Asynchronous** serial communication.

Examples of Asynchronous serial communication – RS-232, RS-422, RS-485.

How the data is transmitted through serial communication?

Apart from the mode of transmission, another term related to serial communication is **endianness**. This is important for accumulating data in a specific memory address. Again there are two types of endianness: Small endian and big-endian. The below steps will help you to imagine how the serial data transmission takes place. The device will need to make connections, which means the device will look for some other devices near 100 m. And this leads to the process of roaming.

Then you need to gather the devices with whom you want to communicate. However, all devices consist of a default configuration. In the embedded system, serial data transmission plays an important role in sharing information, and various kinds of methods and the digital data is shared in a serial form. The exchanged data are – audio, video, written data, verbal forms, etc.

Fundamental difference between serial and parallel communication

Parameters	Serial Communication	Parallel Communication
Communication Link	Only one communication link is operated to interchange the data between two sources in the serial transmission mode.	Here, several parallel links are required for transferring the data bit by bit in parallel transmission mode.
Clock Pulse	In this mode, one clock pulse is used to transfer one-bit data.	In this mode, at a time 8 bit of data can be shared through one clock pulse.
Speed of transmission	As one data can be shared through one clock pulse in the serial communication, so the transmission speed is lower compared with parallel communication.	In this mode, multiple data can be issued through one clockwise, so the transmission speed is comparatively first.

Parameters	Serial Communication	Parallel Communication
Crosstalk	This transmission model simple, so no crosstalk arrives through the transmission.	But in parallel communication, crosstalk may have arrived.
Distance	This translation method is compatible with sharing long distanced data.	Parallel communication is familiar with sharing data within a short distance.
Cost	As one communication link is used for the entire system, so it needs less price compare with parallel communication.	But at the same time in parallel communication, multiple data links are shared, so this is costlier than serial data transfer.
Difficulties	As one bit is transferred at a time, so there are no difficulties arrived in sharing data.	But in parallel transmission, multiple links are used for sharing multiple data, so this is comparatively difficult.

Pros and cons of Serial Communication

Pros

- As it operates on a single communication link, so it also requires fewer wires for connecting, and that is why it needs less cost.

- For long-distance communication, serial data transmission is an impeccable choice.
- As this communication process transmits only one bit at a time, so it follows an easy interface between the sender and receiver.
- It does not require any additional click for transmitting.
- As the wire or cable is used in a lower number, the entire process can be fit within the shortest place.
- It does not generate any cross talk.
- This process of communication can be easily implemented.

Cons

- Only one bit can be transmitted through a single clock pulse, so data transmission requires lots of time, so the transmission speed is low.
- As it covers extreme places rather than covering relevant data, so using unoccupied bandwidth is a drawback of this communication.

Conclusion

Serial data transmission protocol is an important and beneficial process for transmitting data in the embedded system era. The rate of transmitting data is completely dependent on their application. Here data rate is much important before interchanging data from sender to receiver. So it is better to select a single serial protocol for transmitting value.

Admin

This post was published by Admin.

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