Introduction to Communication protocols

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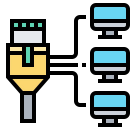
Outlines

- On-board communications vs. networking
- What is a communications system?
- Classifications of communications systems
- Bit rate and Baud rate
- Communications in Embedded Systems

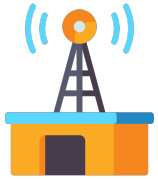
On-board communications vs. networking

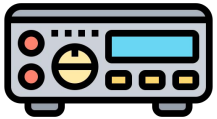
- **On-board communications**:
  - It is the communication interface that connects different parts of an embedded system.
  - **UART**
  - **SPI**
  - **I2C**
- **Networking**:
  - It is the interfaces that connects the embedded system to another systems.
  - **Wifi**
  - **Bluetooth**
  - **Ethernet**




What is a communications system?

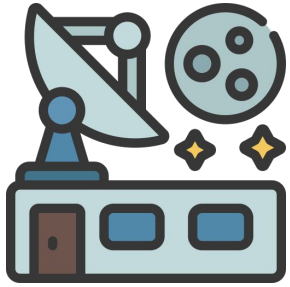
- **A simple communications system consists of:**
  - **Transmitter:**
    - It is the device that modifies/modulates the data to be able to transmit safely and securely in the transmission media.
  - **Transmission media:**
    - It is the media that the data will be transmitted through.
    - Ex: air, water, wires,....etc.
  - **Receiver:**
    - It is the device that retrieves the original data, it simply makes the reverse operation of the transmitter.





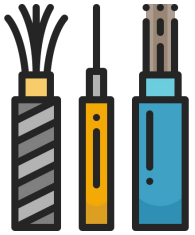
Classifications of communications systems

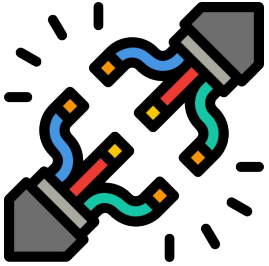
- **Wireless Communications**
  - Date are transmitted **without** need of **wires and cables**.
  - **Pros**:
    - **Communication devices are mobile.**
    - **Lower cost due to less cables.**
  - **Cons**:
    - **Communication speed is lower compared to wired communications.**
    - **Less Secure.**
    - **Less noise immunity.**



Classifications of communications systems

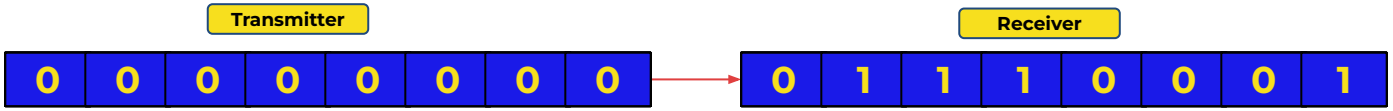
- **Wired Communications**
  - Data are transmitted **into cables and wires**.
  - **Pros**:
    - **Very high speed communications.**
    - **More secure.**
    - **More noise immune.**
    - **More suitable for large distances.**
  - **Cons**:
    - **Communication devices are fixed.**
    - **Larger cost due to long cables**.



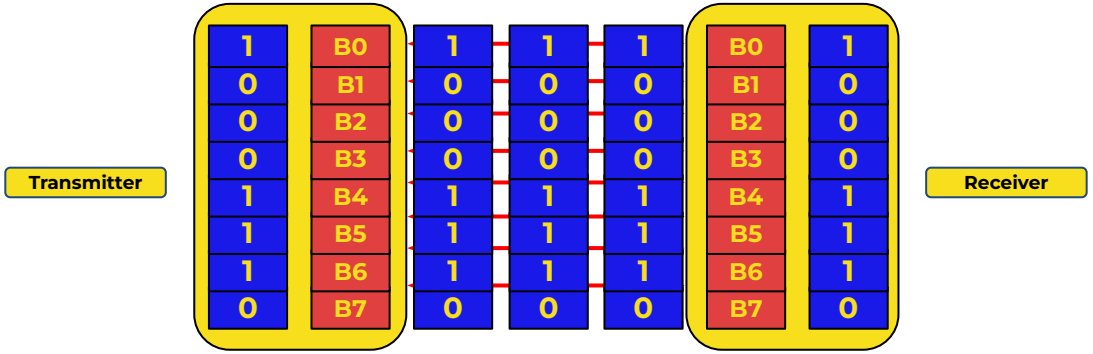


Classifications of communications systems

- **Serial Communications**

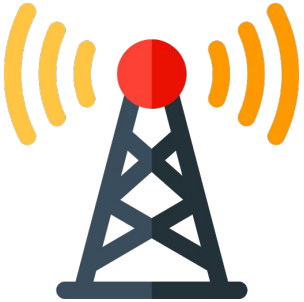


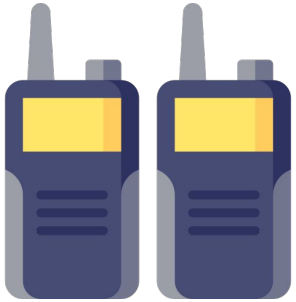
- **Parallel Communications**



Classifications of communications systems

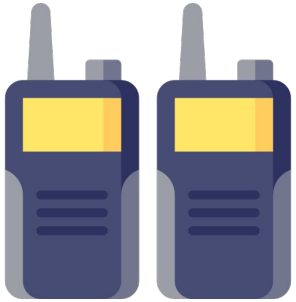
- **Simplex**
  - It is a **one way** communication
- **Half-duplex**
  - Communication must be **in one direction at a time**
- **Full-duplex**
  - Communication is **bidirectional**





Classifications of communications systems

- **Synchronous**
  - It is a communication where a **clock controls** the communication timing
- **Asynchronous**
  - It is a communication where a there is **no clock** and communication is controlled by a **controlling data added to the original data**



Bit rate and Baud rate

- **Bit rate**
  - It is the **number of bits transmitted per second**.
  - **Example**: 10Mbps.
- **Baud rate**
  - It is the **number of bauds (group of bits) transmitted per second.**
  - **Example**: 10 Mbaud/s, and baud = 3 bits, then
    - Bit rate = 10 M * 3 = 30Mbps

Communications in Embedded Systems

- **Parallel:** Interfacing an LCD.
- **Serial:** Interfacing with UART, SPI, I2C,....etc.
- **Wireless:** Interfacing with wifi or bluetooth, GSM, ...etc.
- **Half-duplex:** Interfacing with I2C.
- **Full-Duplex:** Interfacing with UART or SPI.
- **Synchronous:** Interfacing with SPI or I2C.
- **Asynchronous:** Interfacing with UART.

Summary

- You have learned what is a communication system
- Remember that there is a difference between on-board communications and networking
- Choosing the type of communication will depend on your system’s need and the other devices to communicate with