Unit 2- ARM Processors and Peripherals

UART Universal Asynchronous Receiver-Transmitter

- The **UART** is a hardware peripheral used for serial communication in embedded systems. It is often employed for transmitting and receiving data asynchronously between a microcontroller and other devices like sensors, computers, or other microcontrollers.
- UART communication typically uses two data lines: **TX (Transmit)** and **RX (Receive)**.
- UARTs whose name are UART 0 and UART 01 for standard transmit & get data- lines. This LPC2148 microcontroller contains two UART whose name are UART 0 and UART 01.
- These UARTs are provided the full mode control handshake interface during transmitting or receiving the data lines. These are used 16 Byte data rate during transmitting or receiving the data.
- For covering wide range of baud rate, they also contain the built-in functional baud rate generator, therefore there is no need of any external crystal of specific value

Serial I/O Controller

- I2C-bus LPC2148 includes two I2C bus controllers, and this is bidirectional. The inter-IC control can be done with the help of two wires namely an SCL and SDA.
- Here the SDA & SCL are serial clock line and the serial data line. Every apparatus is identified by an individual address.
- Here, transmitters and receivers can work in two modes like master mode/slave mode.
- This is a multi- master bus, and it can be managed by one or more bus masters linked to it. These microcontrollers support up to-400 kbit/s bit rates.

- **SPI Serial Input/Output Controller**
- These microcontrollers include a single SPI controller and intended to handle numerous masters & slaves associated with a specified bus Simply a master & a slave can converse over the interface throughout specified data transmission.
- During this, the master constantly transmits a byte-of-data toward the slave, as well as the slave constantly transmits data toward the master.

SSP Serial Input/Output Controller:

- These microcontrollers contain single SSP, and this controller is capable of process on an SPI, Microwire bus or 4-wire SSI.
- It can communicate with the bus of several masters as well as slaves But, simply a particular master, as well as slave, can converse on the bus throughout a specified data transmit.
- This microcontroller supports full-duplex transfers, by 4-16 bits data frames used for the flow of data from the master- the slave as well as from the slave-the master

OPERATION MODES:

USART can operate in two modes:

1.Asynchronous Mode: In this mode, data is transmitted and received without a clock signal. The transmitter and receiver use agreed-upon timing parameters (like baud rate) to synchronize the communication. It's widely used for communication over UART (Universal Asynchronous Receiver-Transmitter).

2.Synchronous Mode: In this mode, a clock signal is used to synchronize the data transmission between the transmitter and receiver. This mode is typically used for faster data communication and is more reliable over longer distances.

FUNCTIONS:

USART (Universal Synchronous/Asynchronous Receiver-Transmitter) offers the following key functions:

1.Data Transmission/Reception: Sends and receives data in both asynchronous and synchronous modes.

2.Baud Rate Configuration: Sets the data transfer speed.

3.Interrupts/Flags: Handles TX/RX interrupts and error flags (e.g., overrun, parity errors).

4.Parity: Supports parity bit generation/checking for error detection.

5.Stop Bits/Data Frame: Configures the number of stop bits and data frame size.

6.Flow Control: Supports hardware (RTS/CTS) and software flow control (XON/XOFF).

7.Full-Duplex: Allows simultaneous transmission and reception.

8.Synchronous Mode: Operates with a clock signal for faster communication.

9.Multi-Processor Communication: Supports address detection for multi-device setups.

10.DMA Support: Enables direct memory access for data transfer.

11.Clock Polarity/Phase: Configures clock signal timing in synchronous mode.

These functions enable efficient and reliable serial communication.

Advantages of USART:

1.Low Power Consumption: Efficient for embedded systems with limited power resources.

2.Versatile: Works in both asynchronous and synchronous modes.

3.Simple Communication: Requires minimal wiring and setup.

4.Full-Duplex: Allows simultaneous transmission and reception of data.

5.Error Detection: Supports parity, framing, and overrun error checking.

6.Flexible Baud Rate: Can adapt to different communication speeds.

Applications of USART:

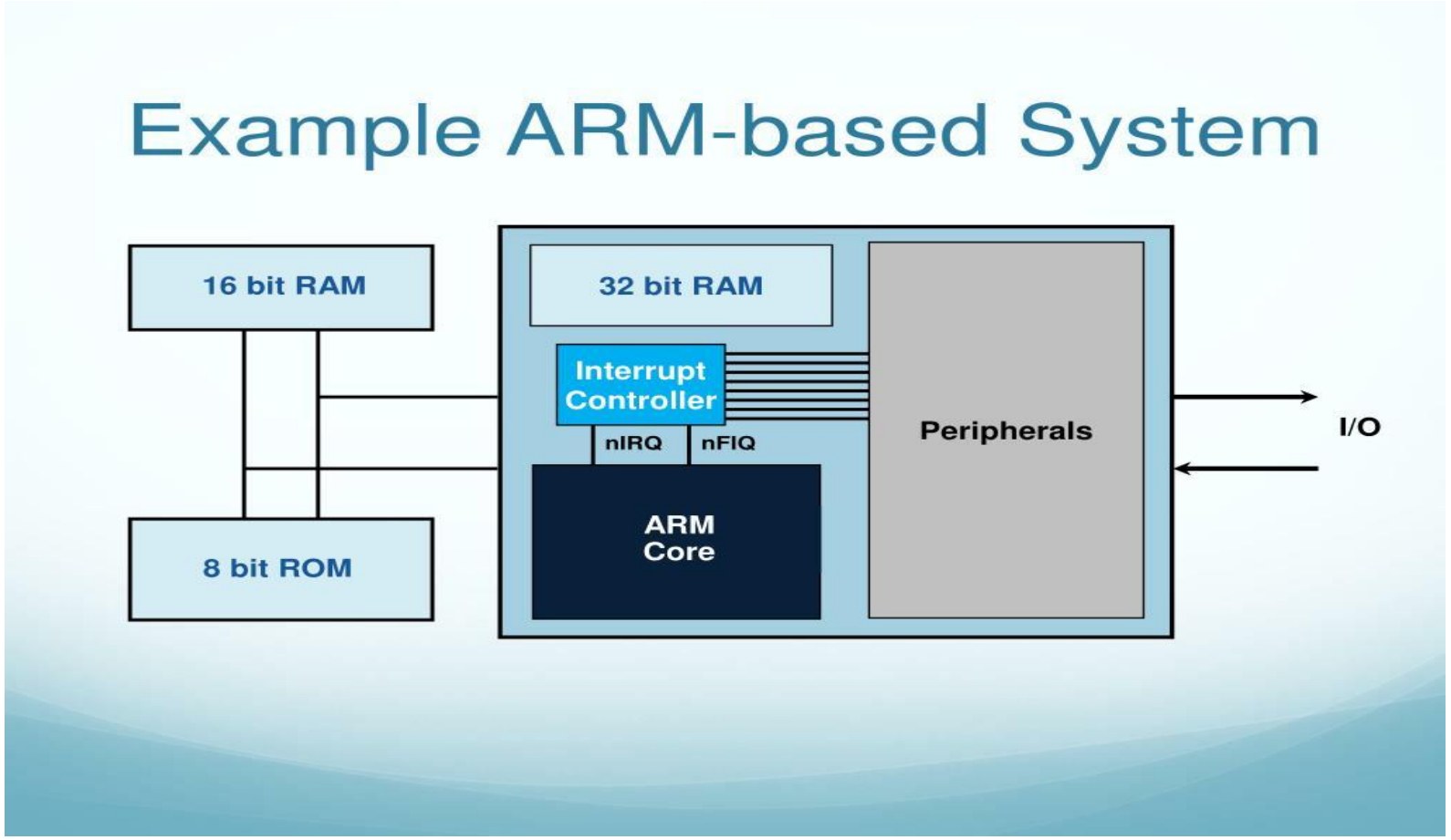
1.Microcontroller Communication: Between microcontrollers or peripherals (e.g., sensors).

2.Serial Communication: For PC to embedded system interfaces.

3.GPS, Bluetooth, and Wi-Fi Modules: Data exchange with devices.

4.Embedded Systems: In industrial, automotive, and consumer electronics.

5.Debugging: Used for debugging and logging data in embedded systems.


Example ARM-based System
16 bit RAM
32 bit RAM
Interrupt Controller
nIRQ
nFIQ
Peripherals
I/O
ARM Core
8 bit ROM

Thank you