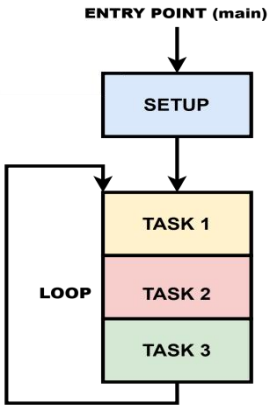
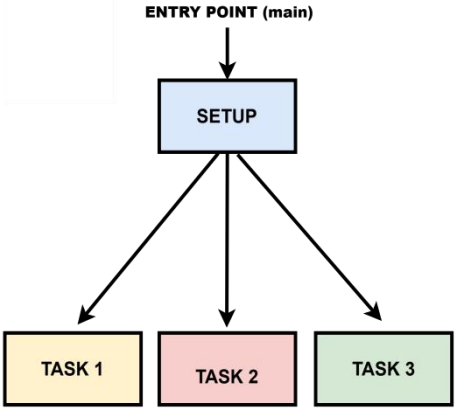
Bare Metal vs RTOS

Which One Is Right for Your Project?



Bare-Metal



RTOS

Swipe >

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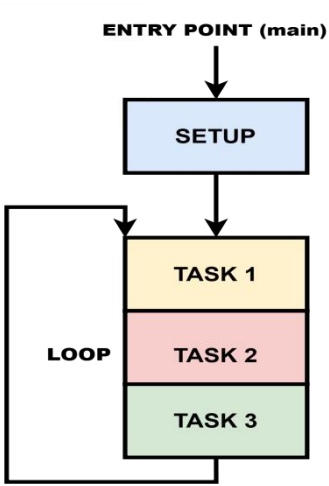
What Is Bare-Metal Programming?

Bare-Metal usually means programming hardware in **a single super loop** and **no OS**.

Some abstraction layers like HAL may still be used.



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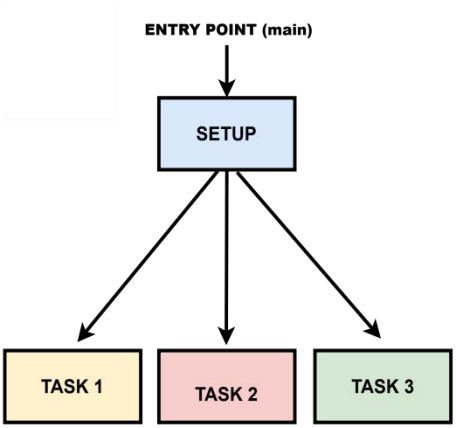
What Is an RTOS (e.g., FreeRTOS)?

RTOS = Real-Time Operating System

Allows running multiple tasks in parallel

Manages timing, task switching, and priorities



Bare-Metal vs FreeRTOS

Choosing between Bare-Metal programming and FreeRTOS depends on

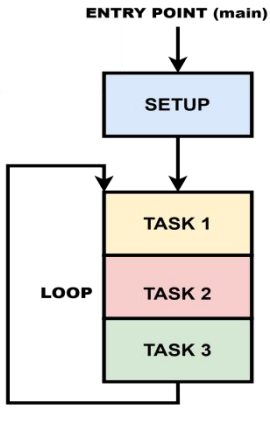
- your project's complexity,
- timing requirements, and
- maintainability goals.

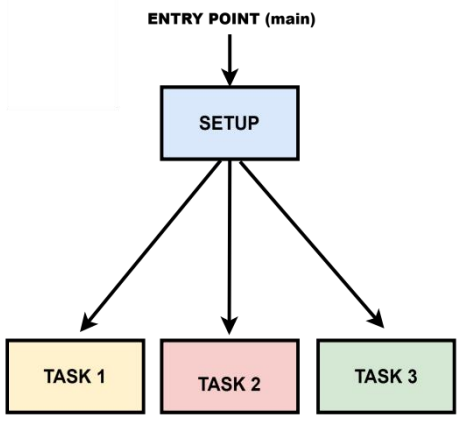
Here's a quick comparison.

Single Loop?

- **Bare-Metal:** Single main loop, no OS overhead.

- **FreeRTOS:** Task-based design with scheduler and features like timers, queues, and semaphores.

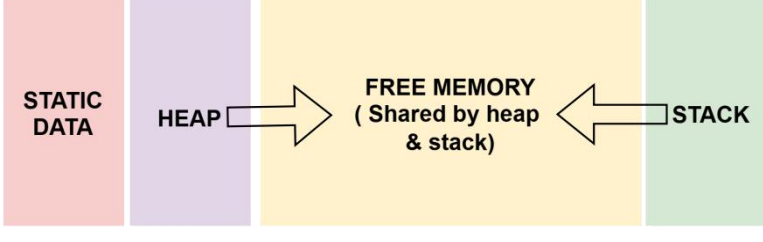




Memory Usage

- **Bare-Metal:** Low memory use due to no OS overhead.

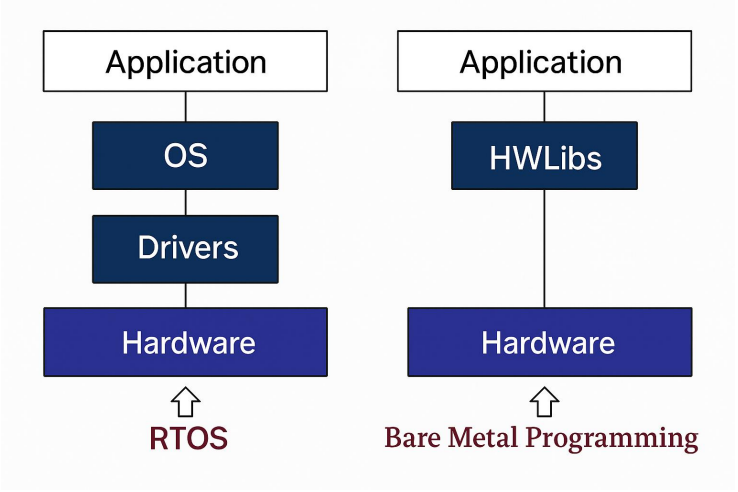
- **FreeRTOS:** Higher memory usage than bare-metal due to OS overhead.



Code Complexity

- **Bare-Metal:** Simple for small applications, harder to scale.

- **FreeRTOS:** Adds initial complexity but better modularity and scalability for larger applications.



Bare Metal vs RTOS – Side-by-Side

Feature	Bare Metal	RTOS (e.g., FreeRTOS)
OS Present?	No	Yes
Multitasking	Manual	Yes
Real-time response	possible in simple applications	deterministic behavior, can have delays
Memory Use	Very low	Higher due to OS overhead
Code Complexity	Simple to start	Higher complexity but scales better

Which One Should You Choose?

Use Bare-Metal if:

- Simple control or single-task device
- Limited memory
- You want precise timing control

Use RTOS if:

- Multiple tasks (sensors, display, comms)
- Complex or growing project
- Need better code structure

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