



arm

Mbed Silicon Partner Workshop

Tickless mode

- 27th of March 2018
 - Paris, France

Thread scheduling

Cooperative

- Active thread needs to yield execution for another thread to run
- Not supported by Mbed OS

Preemptive

- Central piece of software (scheduler) responsible for picking and running the threads
- Different algorithms can be used
 - Priority based round robin is used by Mbed OS
 - Threads are executed in equal time slots according to their priority



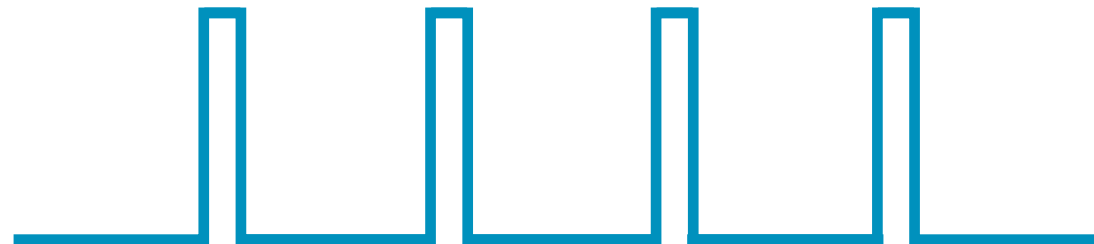
SysTick timer

Basic system timer with configurable tick period

- 1ms for Mbed OS

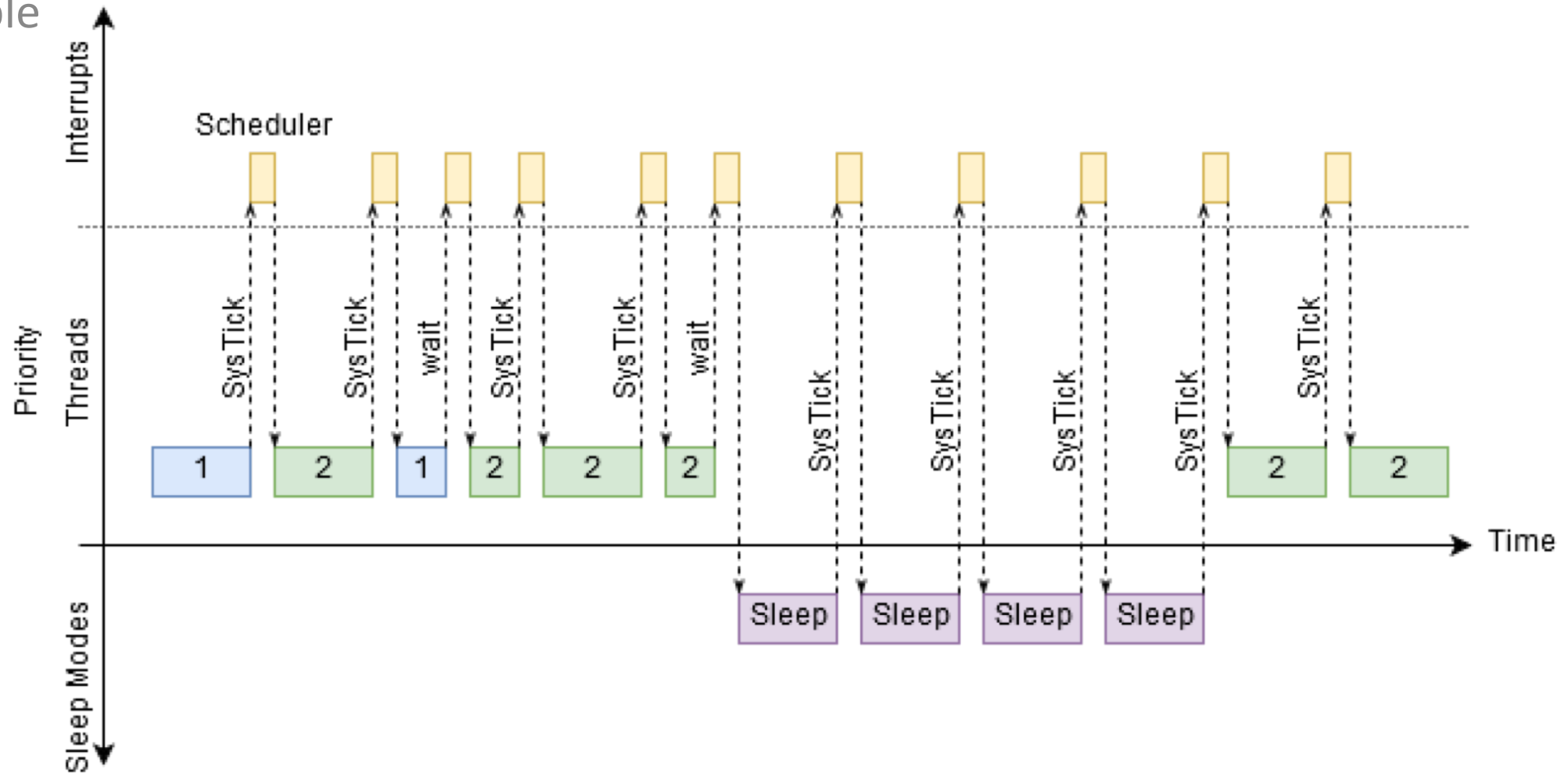
On every tick interrupt is generated

Used by the system to reschedule threads



Thread scheduling

Example



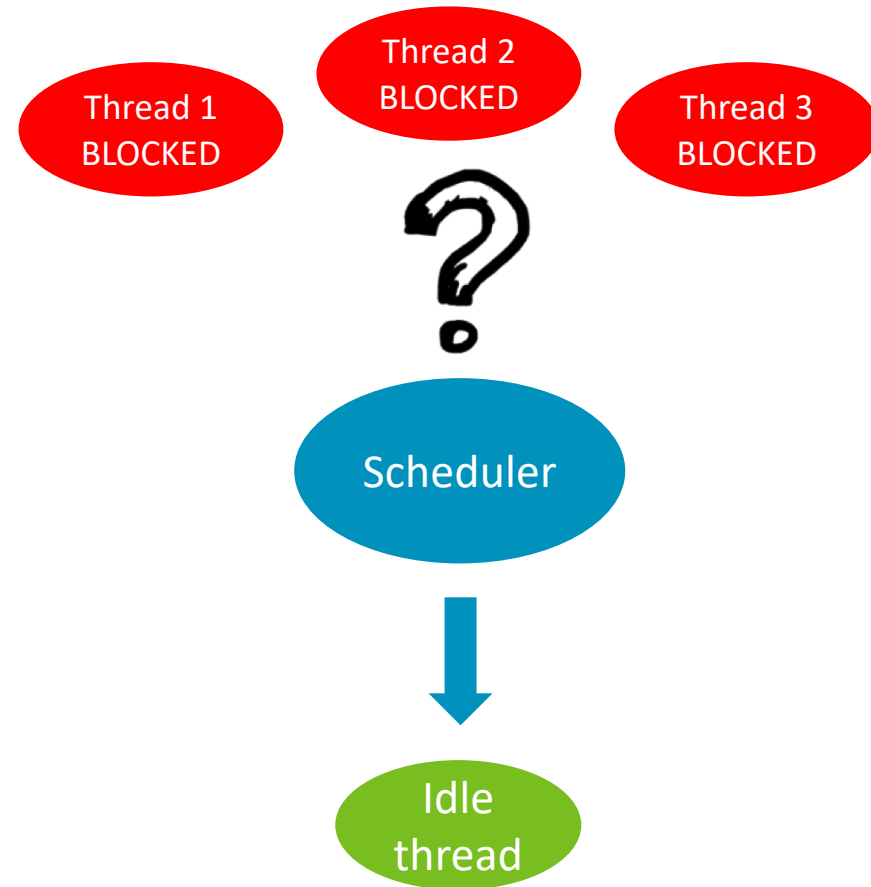
Idle

All the user threads are blocked

What can system do?

Special idle system thread

- Executed when there's nothing else ready to run



Idle thread

Executes every time no other thread is ready

Puts the system to sleep

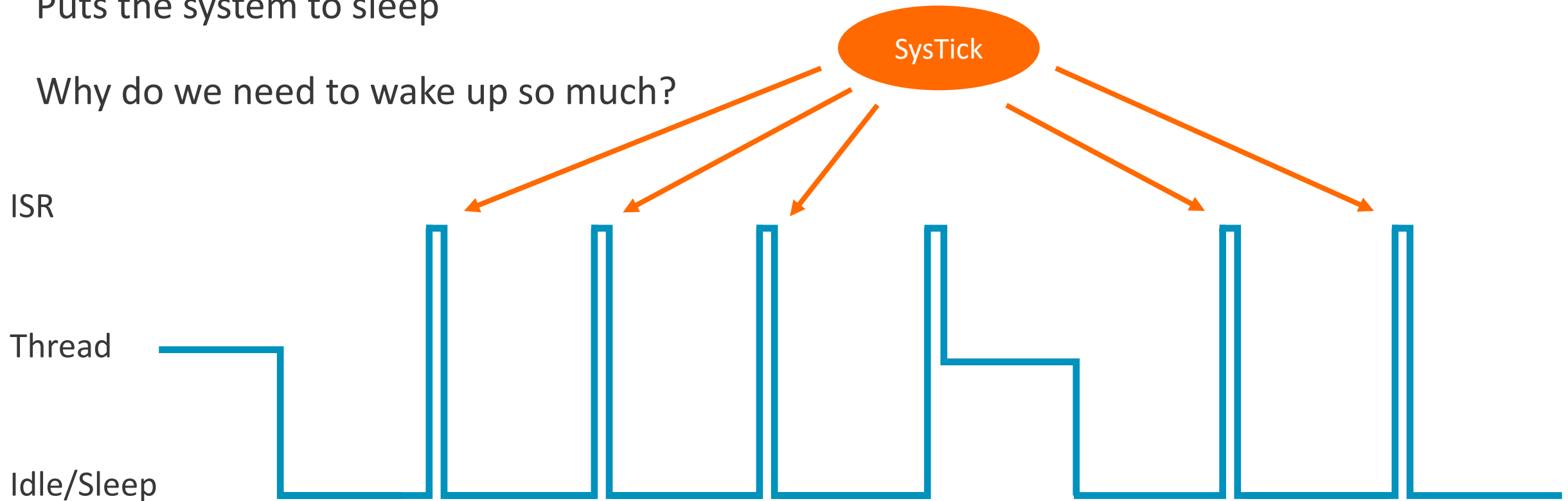
Transparent to the user

Idle thread

Executes every time no other thread is ready

Puts the system to sleep

Why do we need to wake up so much?



Tickless

Scheduler calculates how long until the next action is due to happen

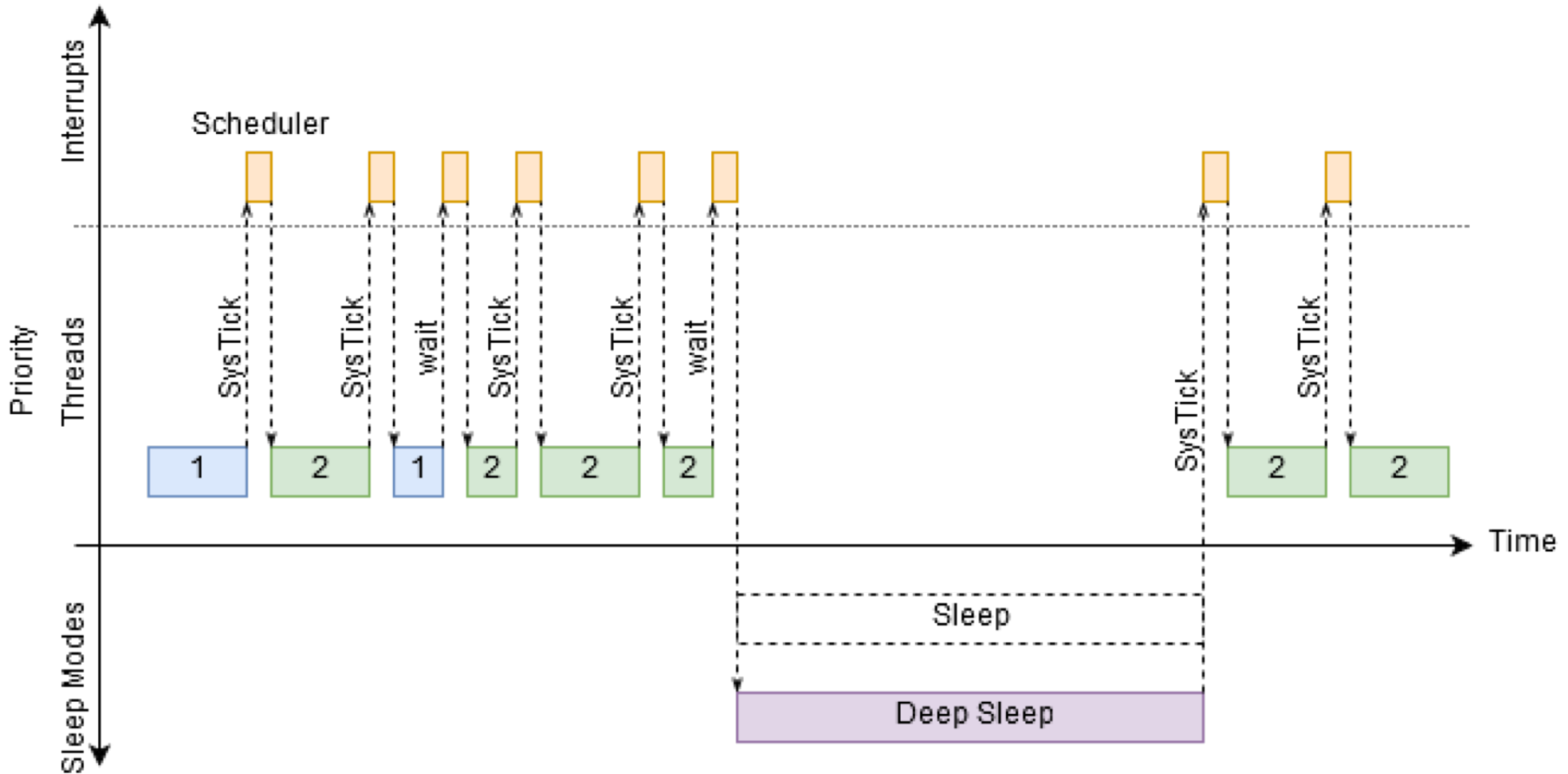
Idle thread

- Disables the SysTick
- Sets low power timer to fire when next action is due
 - Puts the board to sleep

Execution is resumed when timeout expires or other interrupt occurs

Fewer interrupts = Longer sleep = Power savings!

Tickless



What could possibly go wrong?

The execution is timed using two clocks

- System timer
- Low power timer

Drift over time!



How do we avoid drifting?

Mbed OS overrides SysTick with low power timer

Both "wake up", and "system tick" use the same source clock

No drift!



How to enable Tickless for your platform?

- Implement the improved HAL APIs:
 - Sleep
 - Low power ticker
- Add `MBED_TICKLESS` to macros section in `target.json`
<https://github.com/ARMmbed/mbed-os/blob/master/targets/targets.json>



What to look out for?

Low power ticker

- Unstable ticker implementation

Sleep

- Wake up latency

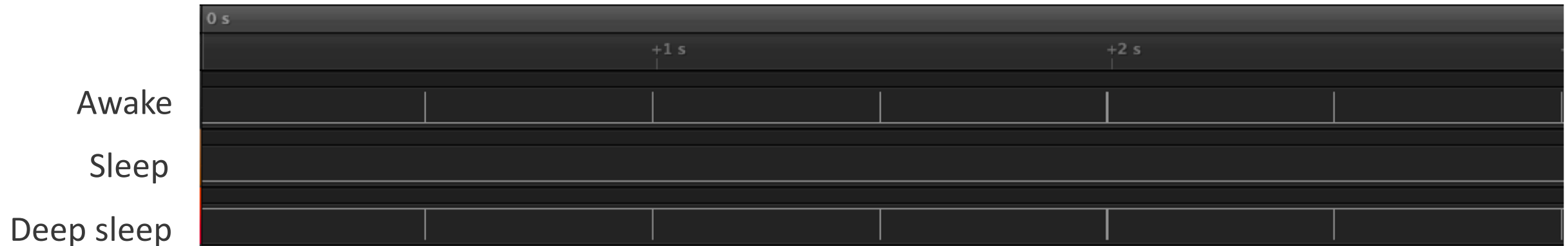


Tickless challenge

Without tickless



Tickless



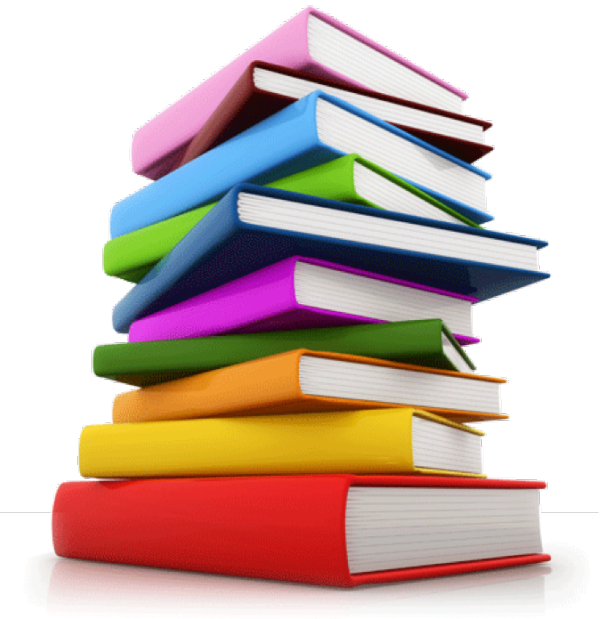
Tickless challenge

- Checkout `tickless_challenge` branch
- Cherry pick support for your board for new Sleep and Ticker APIs from
 - `feature-hal-spec-sleep`
 - `feature-hal-spec-ticker`
- Hook up the logic analyzer
 - Channel 0 to D0
 - Channel 1 to D1
 - Channel 2 to D2
 - You can configure the pins in `main.cpp`
- Run:

```
$ mbed compile --profile release -f
```
- Capture the trace
- Is it tickless?

References

<https://os.mbed.com/docs/v5.7/reference/contributing-target.html#tickless>



Thank You!

Danke!

Merci!

谢谢!

ありがとう!

Gracias!

Kiitos!

감사합니다

धन्यवाद

arm