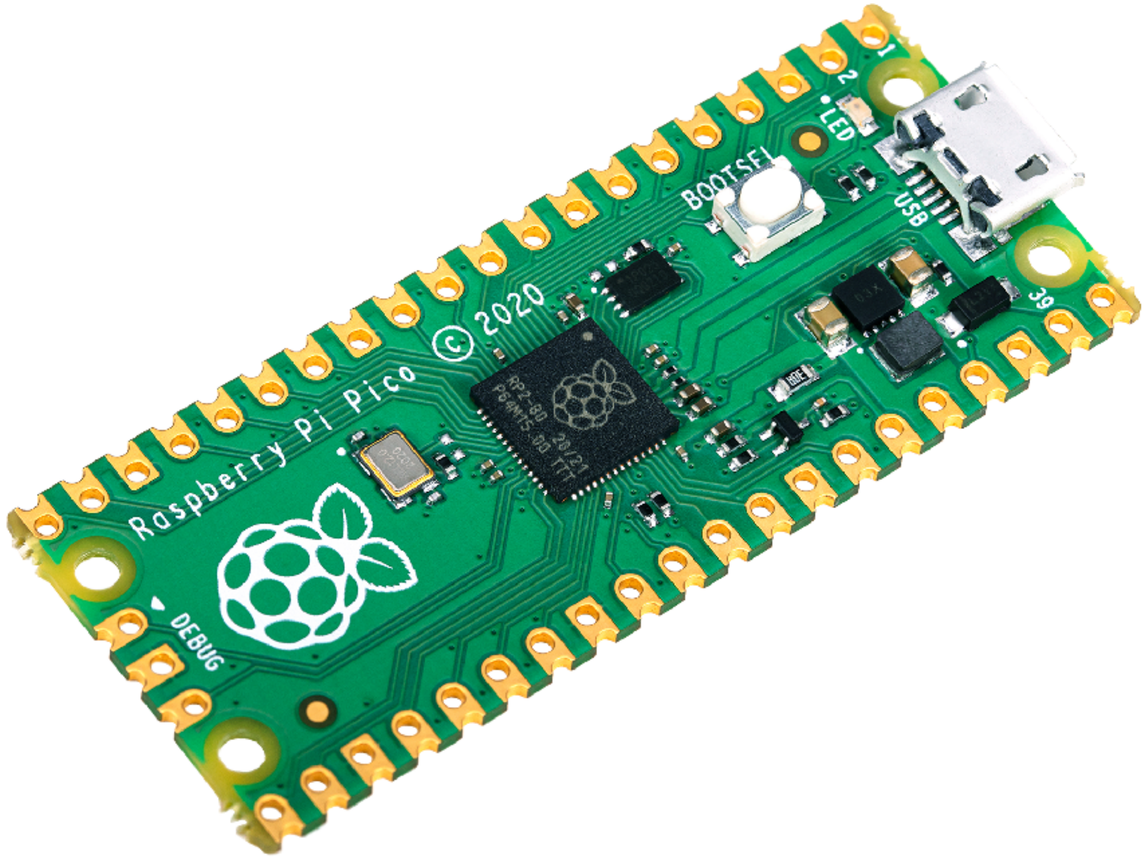


Raspberry Pi Pico (RP2040)

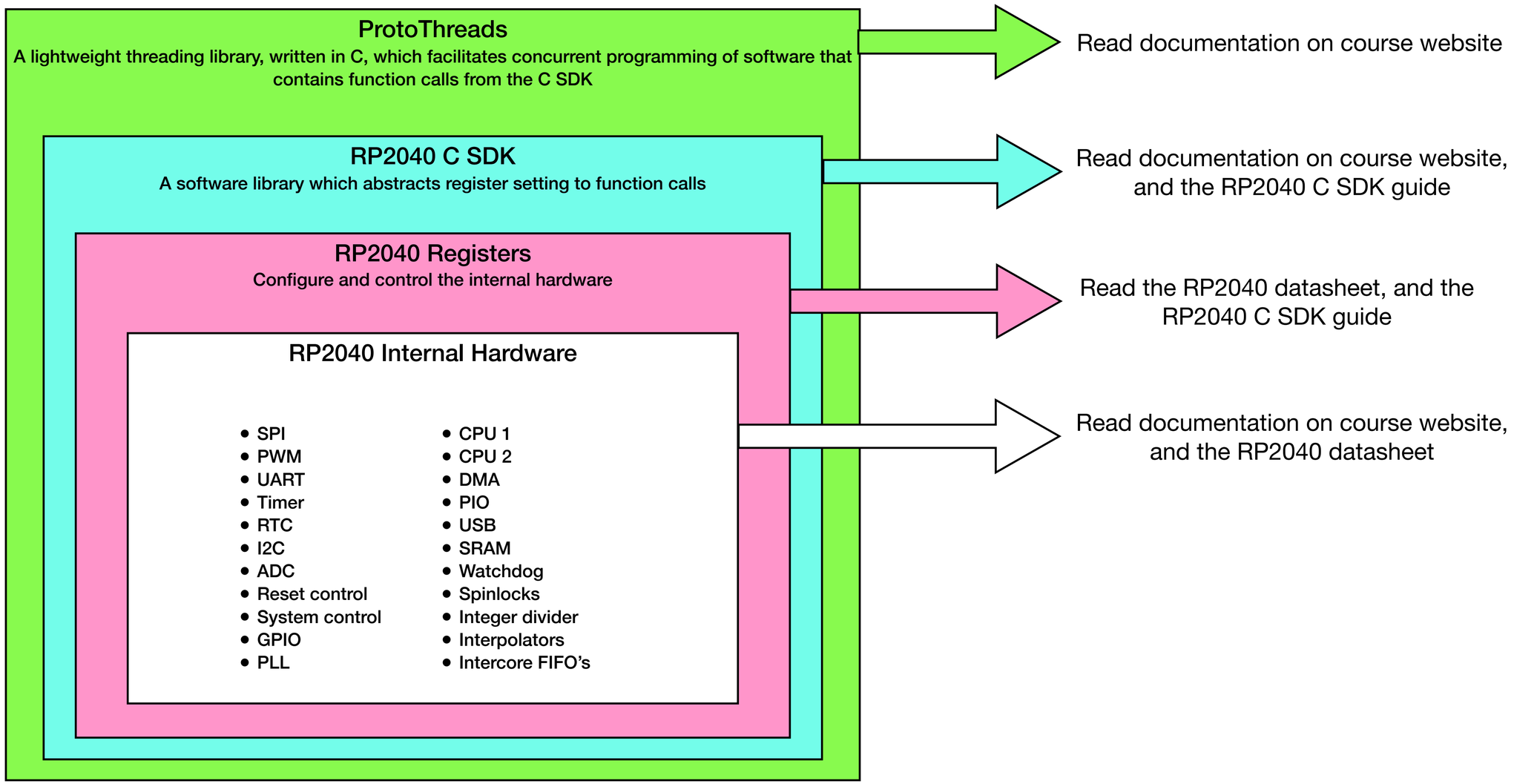
Lecture 2: Hardware/software overview

Today’s objectives:

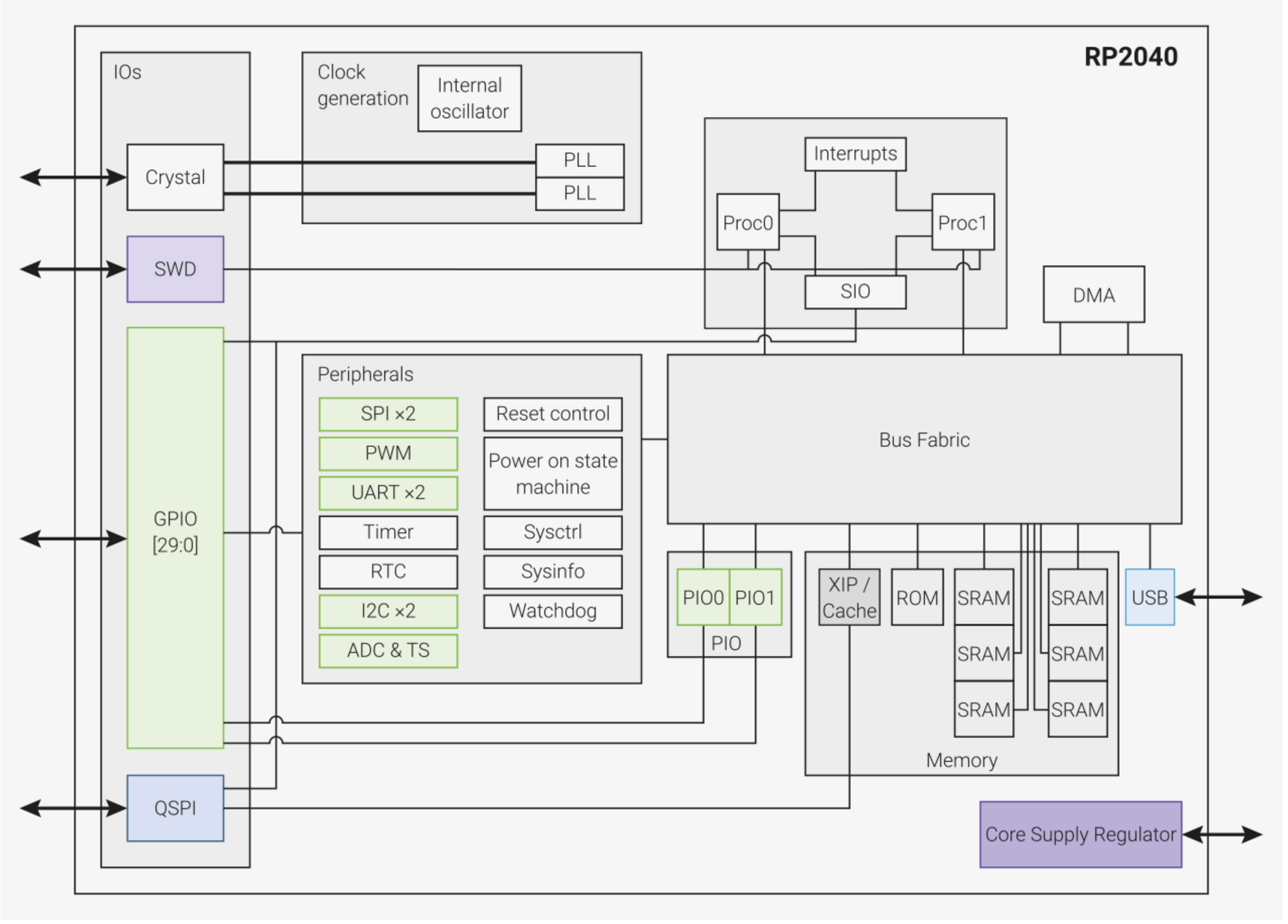
- Overview of the internal hardware available in the RP2040
- Software/hardware levels of abstraction
- The RP2040 C SDK introduction
- Example in code

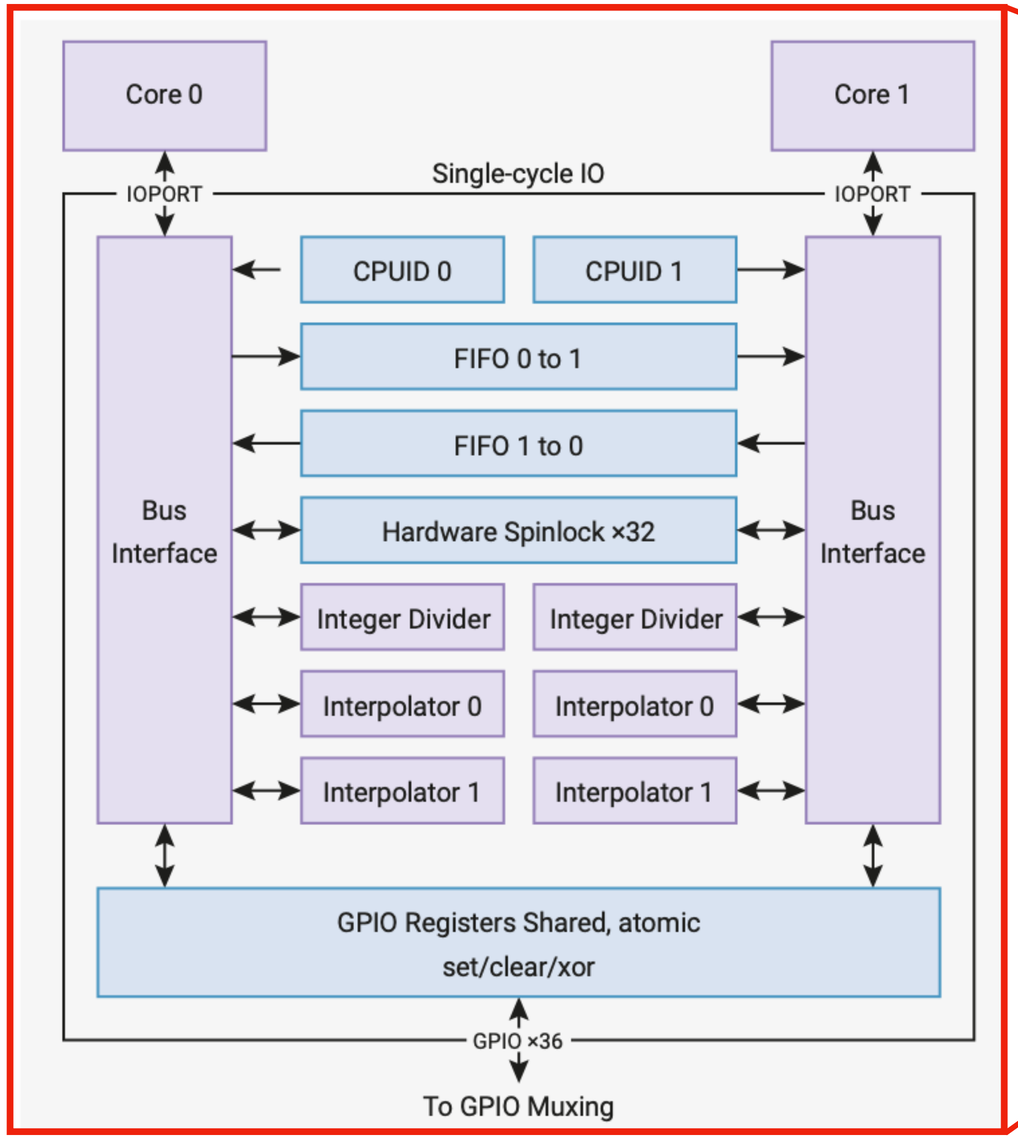
Hardware/software codesign

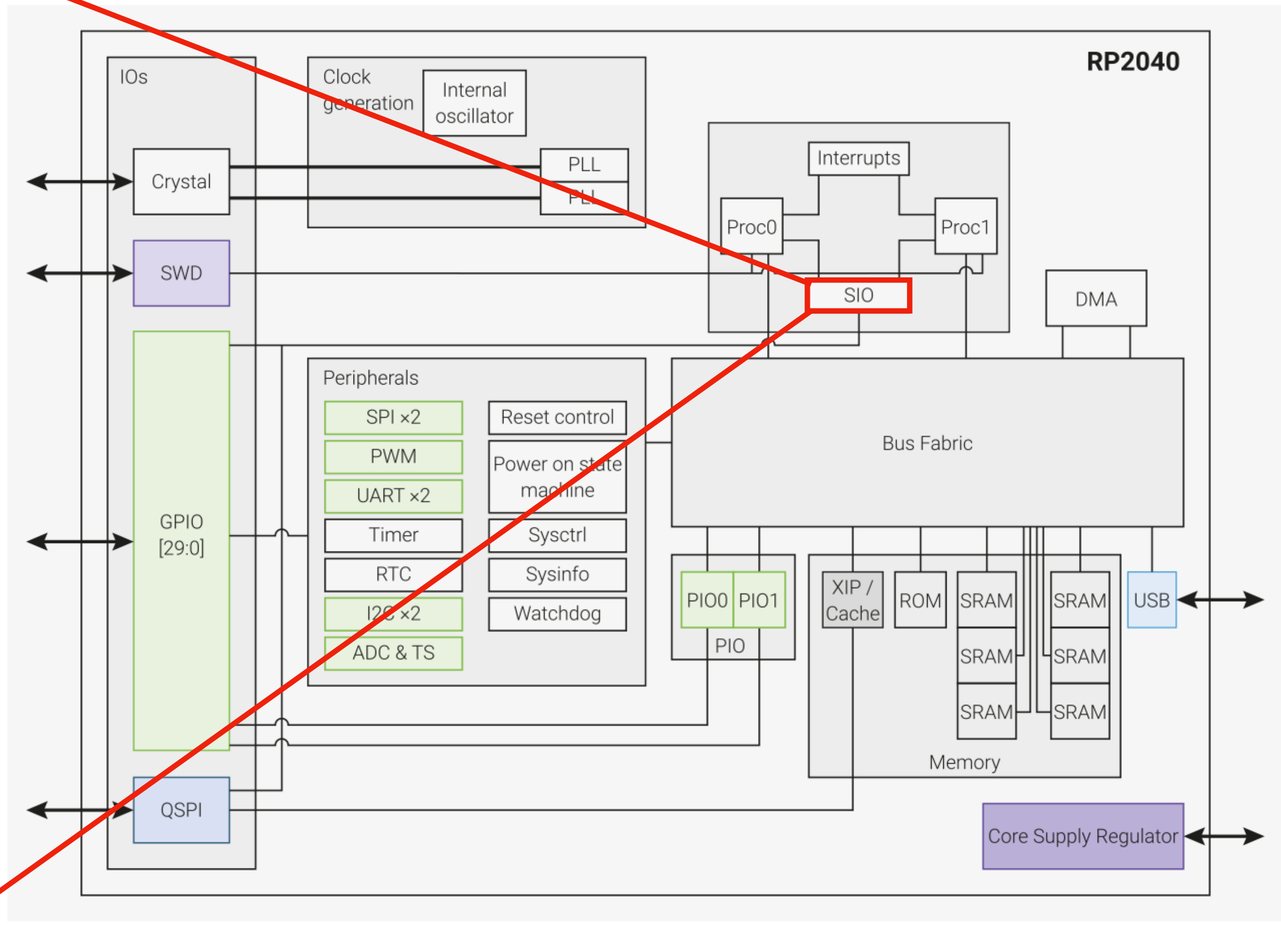
Software/hardware levels of abstraction

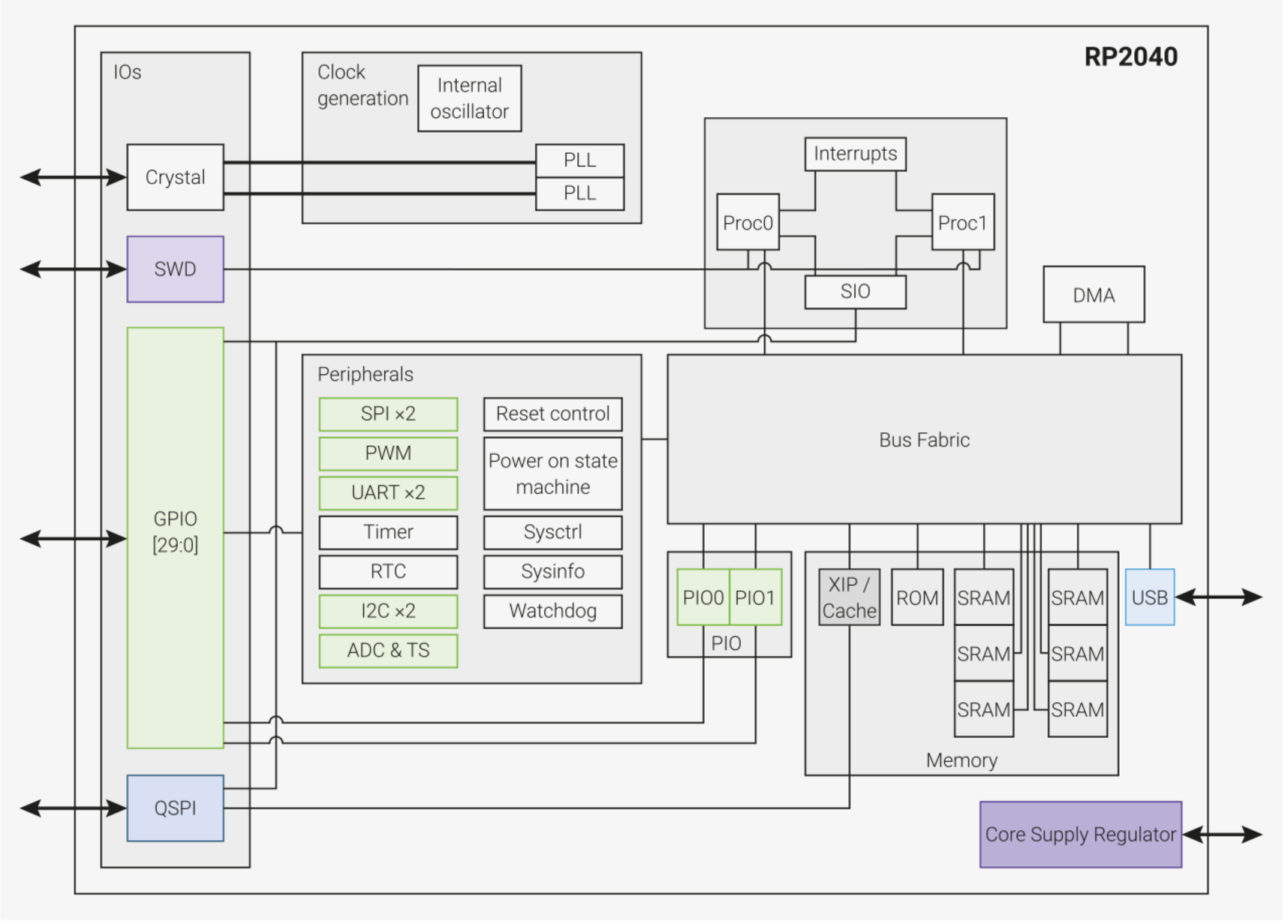


Tour of the hardware in the RP2040 . . .

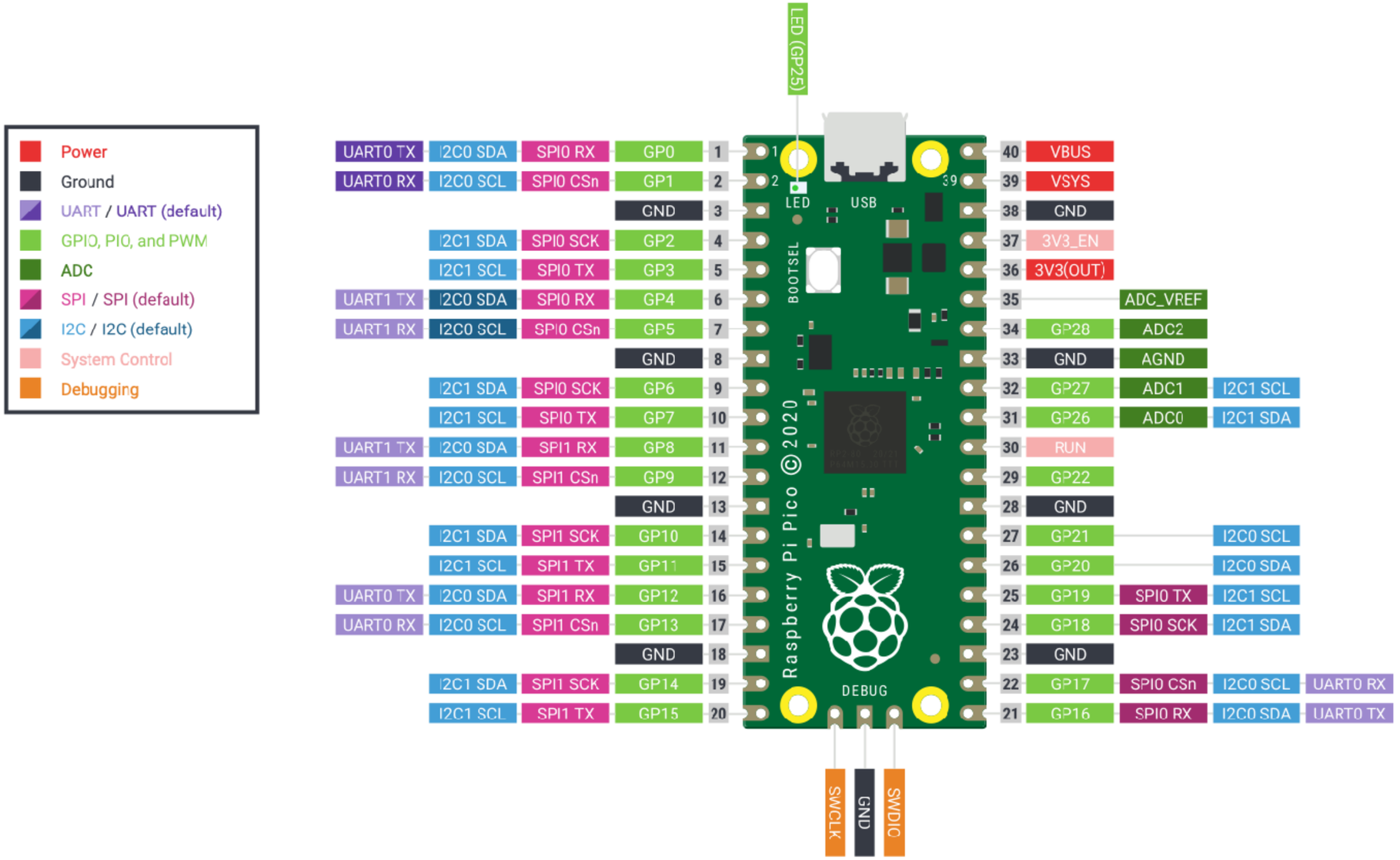

RP2040
IOs
Crystal
SWD
GPIO
[29:0]
QSPI
Clock
generation
Internal
oscillator
PLL
PLL
Interrupts
Proc0
Proc1
SIO
DMA
Peripherals
SPI ×2
PWM
UART ×2
Timer
RTC
I2C ×2
ADC & TS
Reset control
Power on state
machine
Sysctrl
Sysinfo
Watchdog
Bus Fabric
PIO0
PIO1
PIO
XIP /
Cache
ROM
SRAM
SRAM
SRAM
SRAM
SRAM
SRAM
Memory
USB
Core Supply Regulator


Core 0
Core 1
IOPORT
Single-cycle IO
IOPORT
Bus Interface
CPUID 0
CPUID 1
FIFO 0 to 1
FIFO 1 to 0
Hardware Spinlock ×32
Integer Divider
Integer Divider
Interpolator 0
Interpolator 0
Interpolator 1
Interpolator 1
Bus Interface
GPIO Registers Shared, atomic set/clear/xor
GPIO ×36
To GPIO Muxing

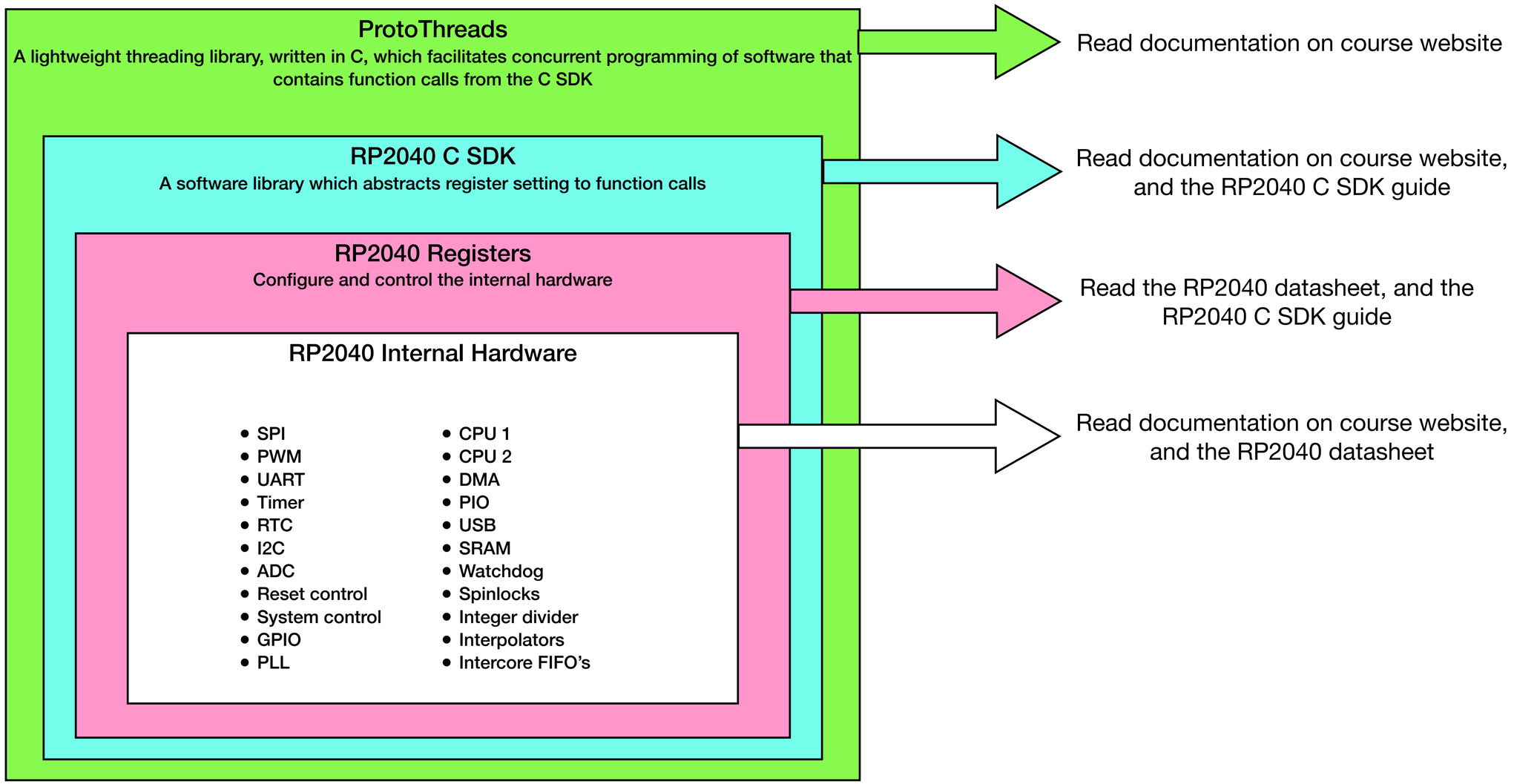

RP2040
IOs
Crystal
SWD
GPIO [29:0]
QSPI
Clock generation
Internal oscillator
PLL
Interrupts
Proc0
Proc1
SIO
DMA
Peripherals
SPI ×2
PWM
UART ×2
Timer
RTC
I2C ×2
ADC & TS
Reset control
Power on state machine
Sysctrl
Sysinfo
Watchdog
Bus Fabric
PIO0
PIO1
PIO
XIP / Cache
ROM
SRAM
SRAM
SRAM
SRAM
SRAM
SRAM
Memory
USB
Core Supply Regulator


RP2040
IOs
Crystal
SWD
GPIO
[29:0]
QSPI
Clock
generation
Internal
oscillator
PLL
PLL
Interrupts
Proc0
Proc1
SIO
DMA
Peripherals
SPI ×2
PWM
UART ×2
Timer
RTC
I2C ×2
ADC & TS
Reset control
Power on state
machine
Sysctrl
Sysinfo
Watchdog
Bus Fabric
PIO0
PIO1
PIO
XIP /
Cache
ROM
SRAM
SRAM
SRAM
SRAM
SRAM
SRAM
Memory
USB
Core Supply Regulator

GPIO ports connect internal hardware to the world



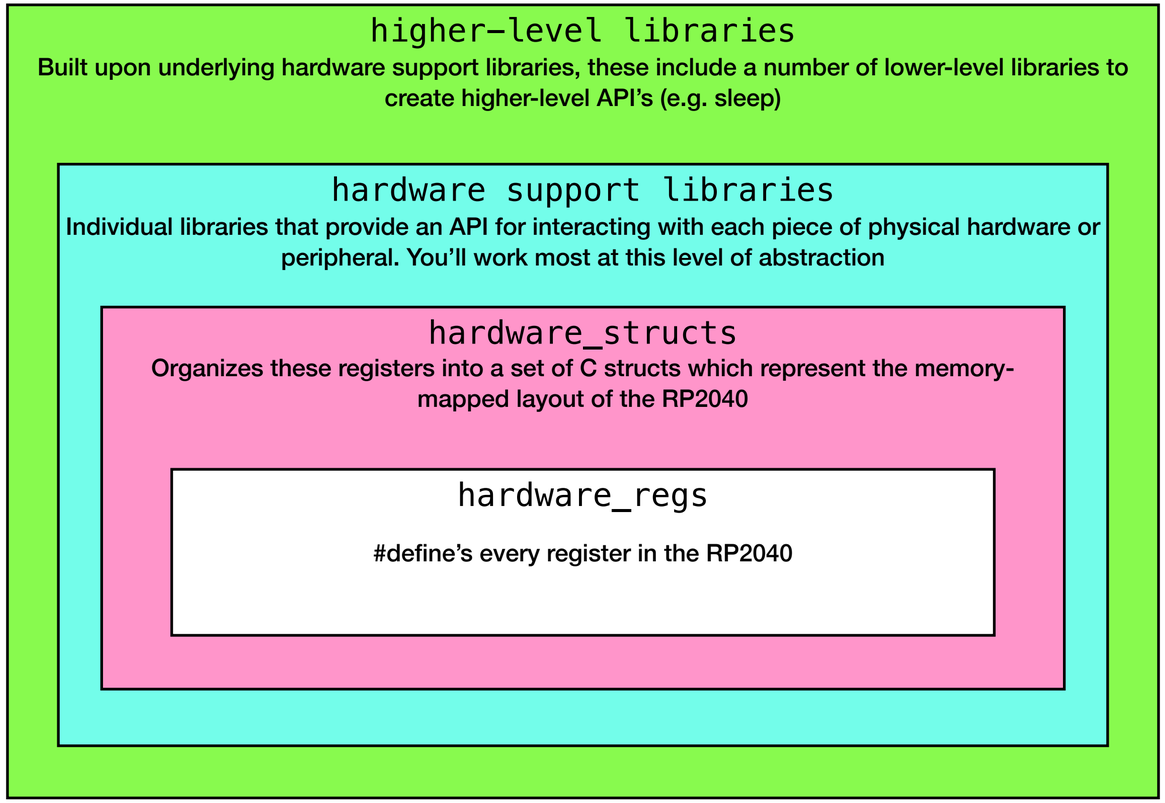
Software/hardware levels of abstraction



Register descriptions in RP2040 datasheet

The C SDK abstracts register manipulations to function calls

C SDK levels of abstraction



To the code!