

# Raspberry Pi Pico (RP2040)

# Lecture 2: Hardware/software overview

## Today's objectives:

- Software/hardware levels of abstraction
- The RP2040 C SDK introduction
- Example in code

• Overview of the internal hardware available in the RP2040

### Hardware/software codesign

### Software/hardware levels of abstraction

#### **ProtoThreads**

A lightweight threading library, written in C, which facilitates concurrent programming of software that contains function calls from the C SDK

### RP2040 C SDK

A software library which abstracts register setting to function calls

#### **RP2040 Registers**

Configure and control the internal hardware

#### **RP2040 Internal Hardware** • CPU 1 • SPI • CPU 2 • PWM • DMA • UART • PIO • Timer • RTC • USB • SRAM • I2C • ADC • Watchdog • Spinlocks • Reset control • Integer divider System control • GPIO • Interpolators Intercore FIFO's • PLL



Tour of the hardware in the RP2040...









## GPIO ports connect internal hardware to the world



UART0 TX	2C0 SDA	SPI0 RX	GP0	1
UARTO RX	I2C0 SCL	SPI0 CSn	GP1	2
			GND	3
	2C1 SDA	SPI0 SCK	GP2	4
	I2C1 SCL	SPI0 TX	GP3	5
UART1 TX	2C0 SDA	SPI0 RX	GP4	6
UART1 RX	I2C0 SCL	SPI0 CSn	GP5	7
			GND	8
	2C1 SDA	SPI0 SCK	GP6	9
	I2C1 SCL	SPI0 TX	GP7	10
UART1 TX	2C0 SDA	SPI1 RX	GP8	-11
UART1 RX	I2C0 SCL	SPI1 CSn	GP9	-12
			GND	13
	2C1 SDA	SPI1 SCK	GP10	-14
	I2C1 SCL	SPI1 TX	GP11	15
UART0 TX	2C0 SDA	SPI1 RX	GP12	-16
UARTO RX	I2C0 SCL	SPI1 CSn	GP13	-17
			GND	18
	2C1 SDA	SPI1 SCK	GP14	-19
	I2C1 SCL	SPI1 TX	GP15	-20



SWDIO

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### Register descriptions in RP2040 datasheet

### The C SDK abstracts register manipulations to function calls

### C SDK levels of abstraction

### higher-level libraries

Built upon underlying hardware support libraries, these include a number of lower-level libraries to create higher-level API's (e.g. sleep)

Individual libraries that provide an API for interacting with each piece of physical hardware or peripheral. You'll work most at this level of abstraction

#### hardware\_structs

Organizes these registers into a set of C structs which represent the memorymapped layout of the RP2040

hardware\_regs

#define's every register in the RP2040

#### hardware support libraries

