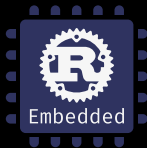


Embedded Rust, by example of RIOT-OS applications

An update on the 2018-11-27 meetup presentation

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Embedded Devices

- ▶ 10kB – 1MB ROM
- ▶ 1kB – 100kB RAM
- ▶ Typical hardware: ARM Cortex-M3, eg. STM32

Embedded Devices

- ▶ allocation: static or on stack
- ▶ Someone needs to initialize the RAM
- ▶ CPU specific linker scripts
- ▶ Software shipped via hardware debugger or using a bootloader

Options 1: Bare metal

- ▶ `cortex-m-rt`
- ▶ peripherals wrapped from `svd2rust` (eg. `rp2040-pac`)
- ▶ device drivers (eg. `rp2040-hal`)
- ▶ board support crate (eg. `rp-pico`)

See `rp-pico` crate for examples (eg. “blinky”)

Options 2: Rust operating systems or frameworks

- ▶ `rtic` has highly performant and precise descriptive concurrency
- ▶ `embassy` is a framework focused on asynchronous processing
- ▶ TockOS is a full operating system
- ▶ 2018: Limited hardware support and networking
- ▶ 2023: Much better, but still not quite there

Options 3: RIOT-OS

- ▶ Operating system written in C
- ▶ Trusted processes (cooperative or preemptive)
- ▶ Mature network stack
- ▶ Large community
- ▶ Good hardware support

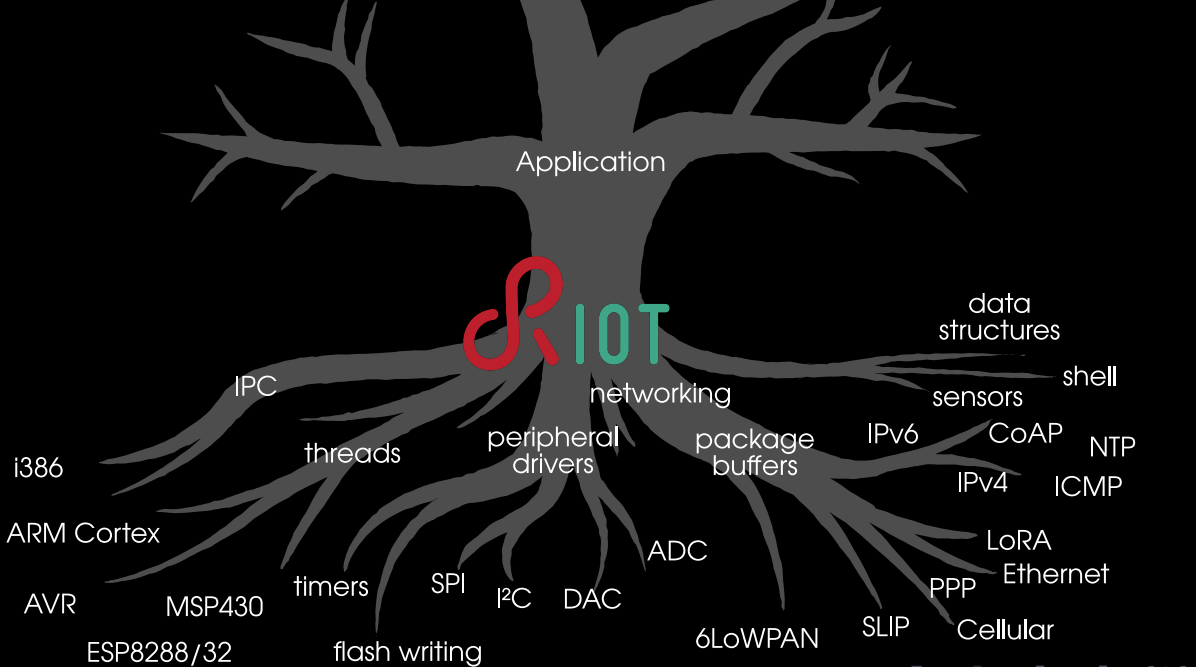
Which to pick?

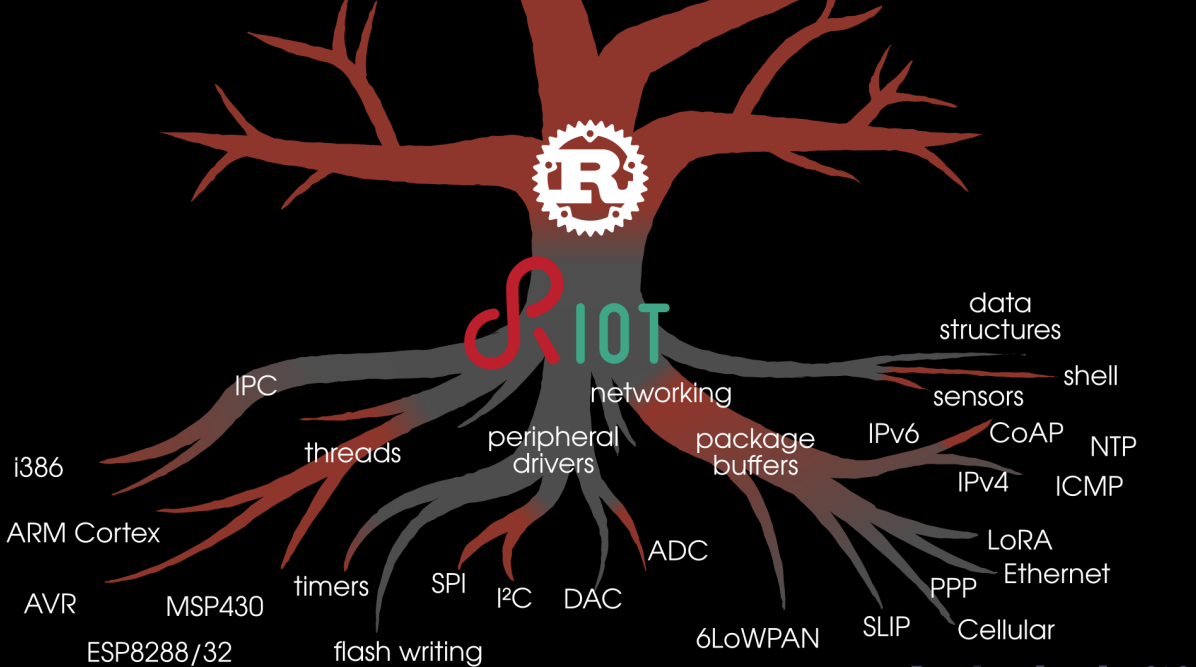
Does it matter?

RIOT Operating System



<https://riot-os.org>





Build system integration

```
$ make BOARD=stk3700 all flash term
make -C ./RIOT/boards/stk3700
...
make -C ./RIOT/cpu/cortexm_common/periph
RIOT_CFLAGS="-D... -I ..." cargo build --target arm-... --release
Compiling riot-sys v0.2.2
...
Compiling demo v0.1.0
    Finished release [optimized + debuginfo] target(s) in 1m 09s
arm-none-eabi-gcc .../*.o target/.../libdemo.a -o bin/demo.elf
### Flashing Target ###

main(): This is RIOT! (Version: ...)
Hello, world!
>
```

Application setup

```
#![no_std]

use riot_wrappers::{riot_main, i2c};
use embedded_hal::blocking::i2c::WriteRead as _;
use si7021::*;

fn main() {
    let bus = i2c::I2CDevice(0);

    let mut sensor = Si7021::new(i2c, SI7021_I2C_ADDRESS);

    ...
}

riot_main!(main);
```

Open issues

- ▶ ~~Header files with static inline vs. bindgen~~
- ▶ no constant propagation across languages
- ▶ API mappings are incomplete
- ▶ ~~Not enough users ;-)~~

Thanks for your attention

Slides and more links on <https://github.com/RustVienna/meetup-history/tree/master/2023-05/rust-on-riot/>

