On this Rock I will build my System

Why Open-Source Firmware matters

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About me

- Member of Pengutronix graphics and kernel team

- Low-level infrastructure guy

- Working on projects with long maintenance times

Where do we come from?

- Minimalistic Firmware
  - Even got used to call them „bootloaders"

- Usually no run-time interaction with kernel

Old model – the good

- Full control over system operation in Linux kernel
  - Helps when debugging complex interactions

- Easy update story

Old model – the bad

- High complexity in Linux kernel
    - As bad as it sounds? Likely not…

- Some features hard to implement in a generic kernel

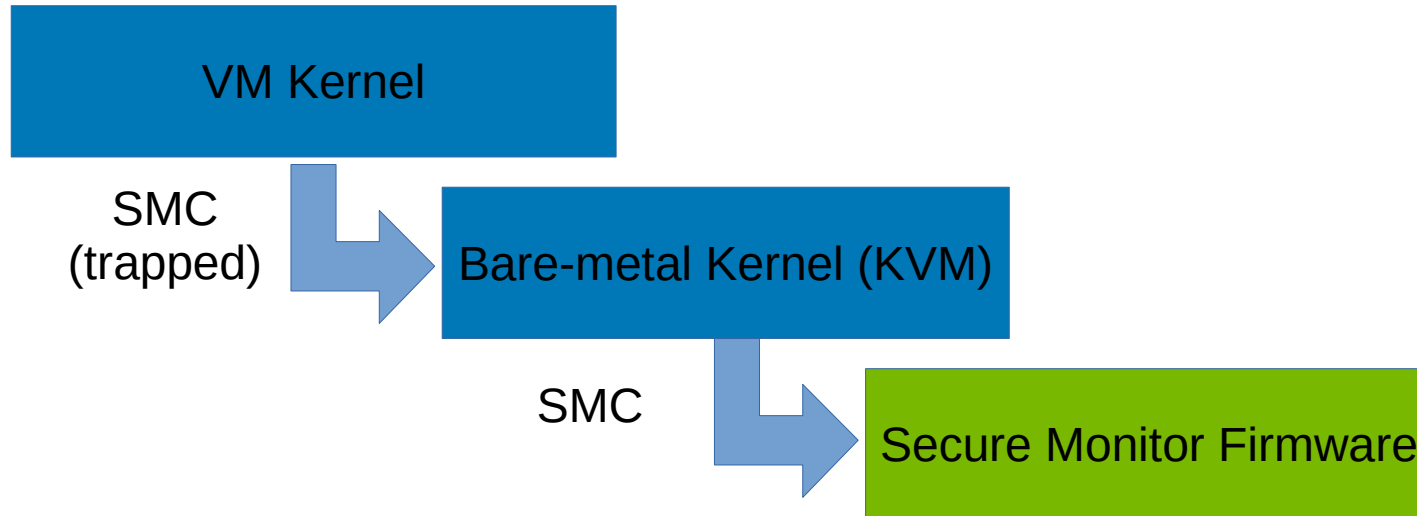- Things start to look different when virtualization is added

Enter PSCI

Power State Coordination Interface

- Moves system global and CPU power state into abstract interface
  - Trap based (like syscall)

- Bare-metal and virtualized kernel see same thing

Enter PSCI

Trusted Firmware

- Help vendors in implementing PSCI and other basic platform functions in a standard compliant way

- Started by ARM, now a Linaro project
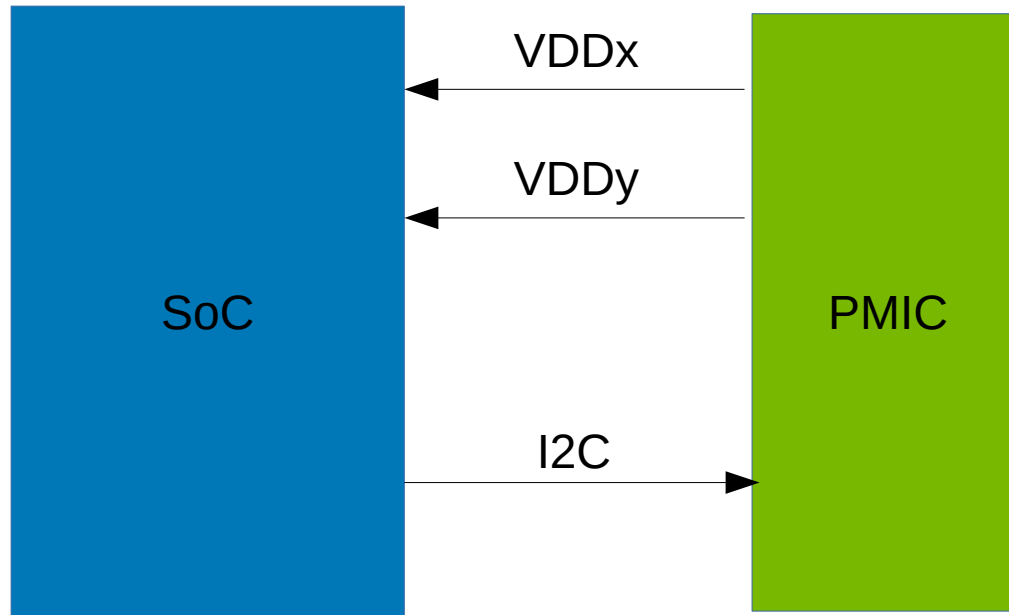
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PSCI – collision with reality

Real-world Hardware struggles: shared Registers

...	Device1 power control	Device0 power control	CPU1 power control	CPU0 power control
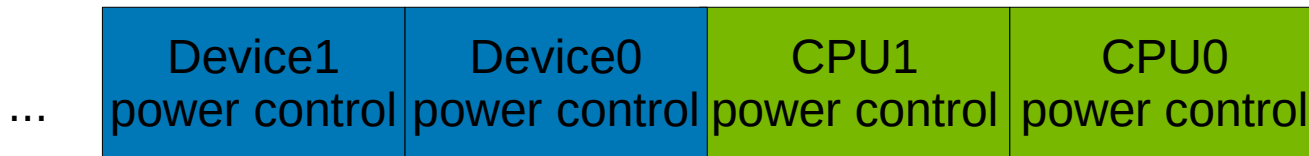
PSCI – collision with reality

Real-world Hardware struggles: shared Interfaces

PSCI – collision with reality

- Lots of hardware not designed to provide the separation required by PSCI

- May not even be possible entirely

Down the rabbit hole: SCMI

System Control and Management Interface

- Move lots more functionality to SCMI provider
  - Device power/performance states
  - Clocks
  - Sensors
  - System control

Down the rabbit hole: SCMI

- Linux kernel implementation gets easy

- Firmware get much more complex
  - Lots of runtime interactions between OS and FW
  - Sometimes hard to reason about

Complex Firmware
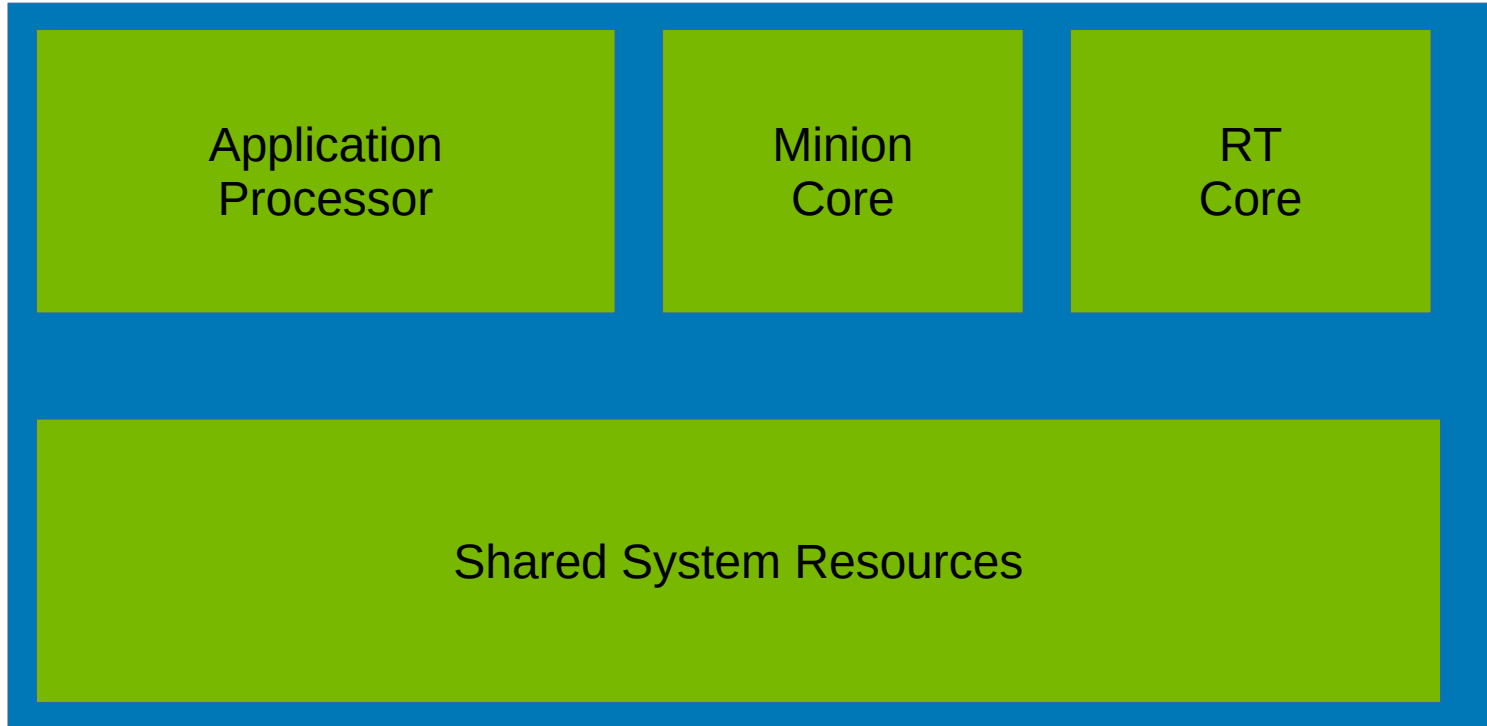
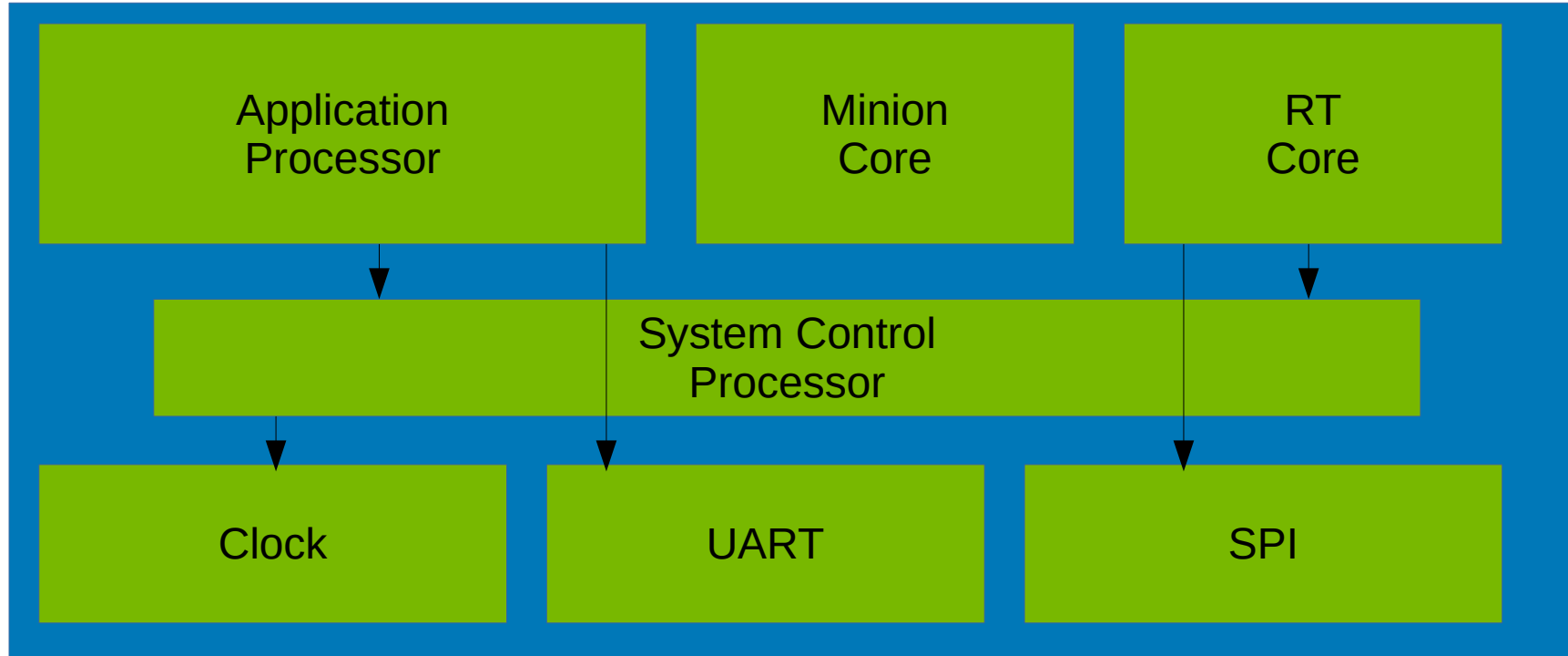Can I decide to just don't care?

Maybe...

Complex Firmware

Can I decide to just don't care?

Probably not!

Asymetric SoCs

Asymetric SoCs

Takeaways

- Firmware taking over more functionality is here to stay

- Incentive for chip vendors to open-source not as high as with Linux kernel

- Real risk of loosing some control