

# Trusted IoT

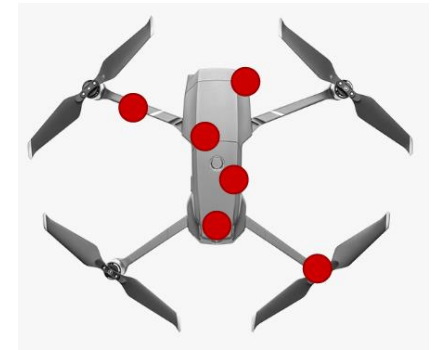
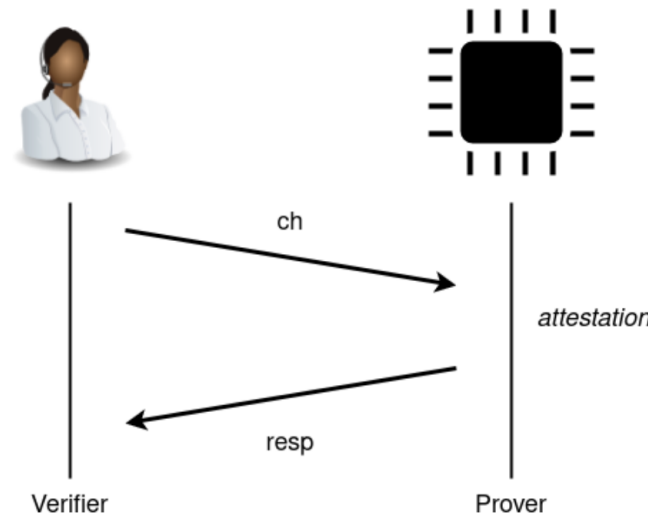
IIoTSBOM – November 16th, 2023

Multi-Core RISC-V platforms

# Trusted IoT – Multi-Core RISC-V platforms

- Many devices today consist of multiple processors
- To make sure the device is in a safe / good / known state:

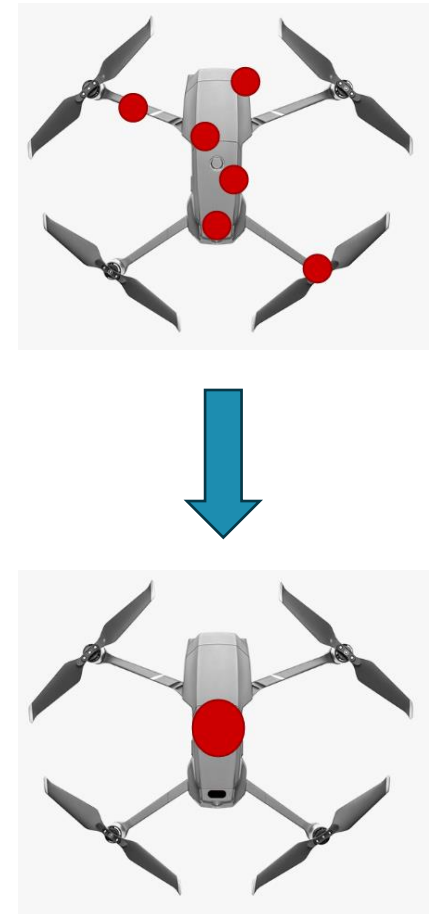
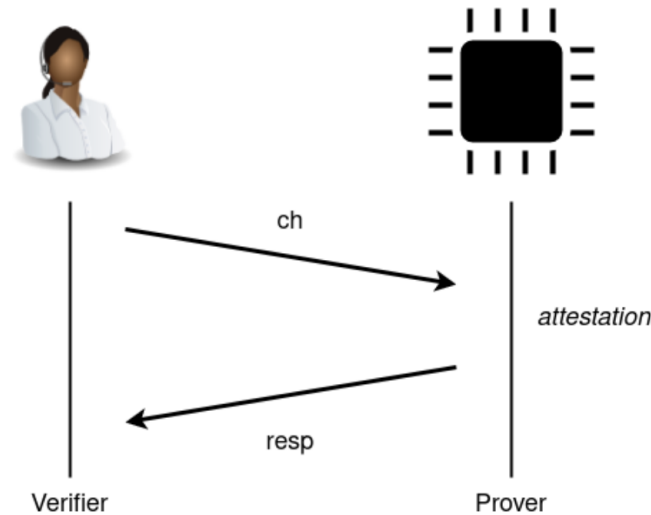
Attestation:



- You should run the attestation protocol on every processor

# Trusted IoT – Multi-Core RISC-V platforms

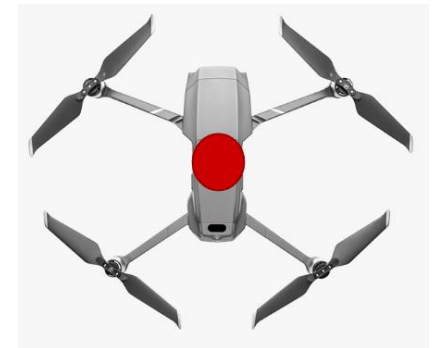
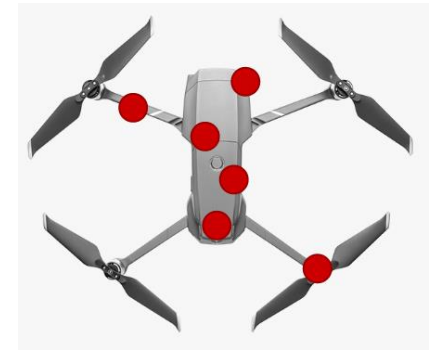
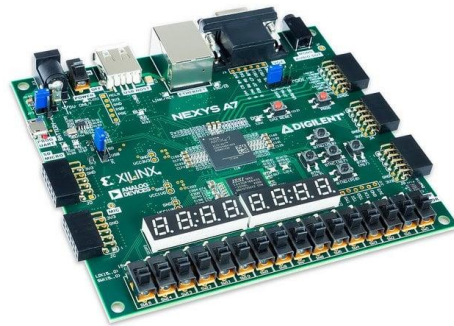
- Substituting the processors with a single chip reduces the complexity



# Trusted IoT – Multi-Core RISC-V platforms

- Substituting the processors with a single chip reduces the complexity
- How to merge different chips ?

Configure all of them in an FPGA



# Trusted IoT – Multi-Core RISC-V platforms

- Depending on the processor that the RISC-V is substituting a different implementation might be better suitable
- Three different RISC-V implementations will be used
  - Ibex (SystemVerilog)
    - MCU / Flight computer
  - NEORV32 (Verilog)
    - Communication
  - PicoRV32 (VHDL)
    - Electronic speed controllers



# Trusted IoT – Multi-Core RISC-V platforms

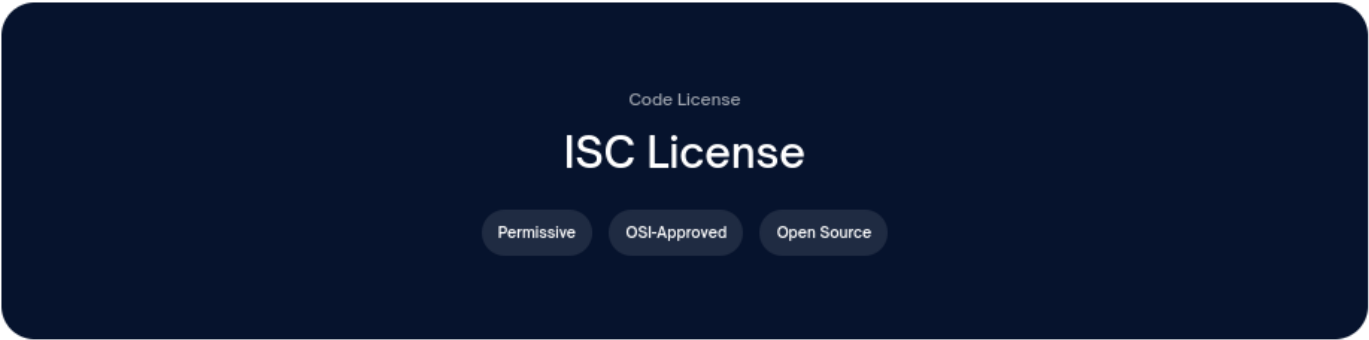
- All RISC-V implementations are subjected to different licenses

		ibex Apache License 2.0	NEORV32 BSD 3-clause	PicoRV32 ISC
cannot	Hold Liable	x	x	x
	Use Trademark	x	x	
must	Include copyright	x	x	x
	Include license	x	x	x
	State changes	x		
	Include notice	x		
can	Commercial use	x	x	x
	Modify	x	x	x
	Distribute	x	x	x
	Place warranty	x	x	
	Private use	x		
	Use patent claims	x		
	Sublicense	x		

- A website that might come in handy: <https://tldrlegal.com/>

# Trusted license forms

- All RISC-V im



Summary Full Text

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- A website that

✓ Can	✗ Cannot	! Must
Commercial Use	Hold Liable	Include Copyright
Modify		Include License
Distribute		

# Use-case in Trusted IoT

Drones

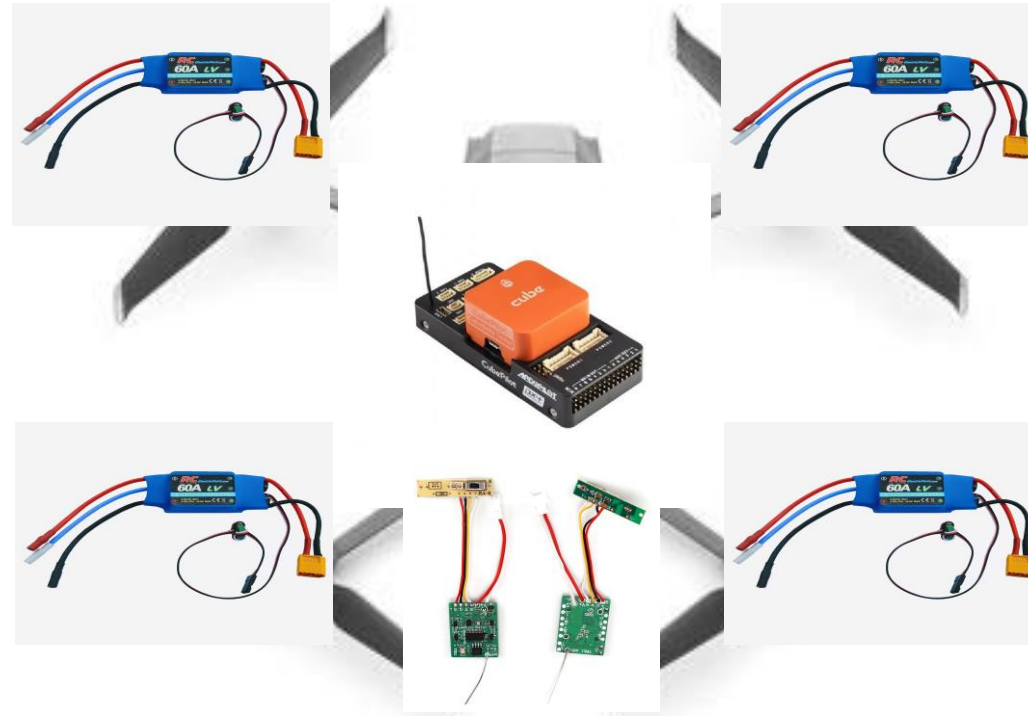


# Trusted IoT – Multi-Core RISC-V platforms



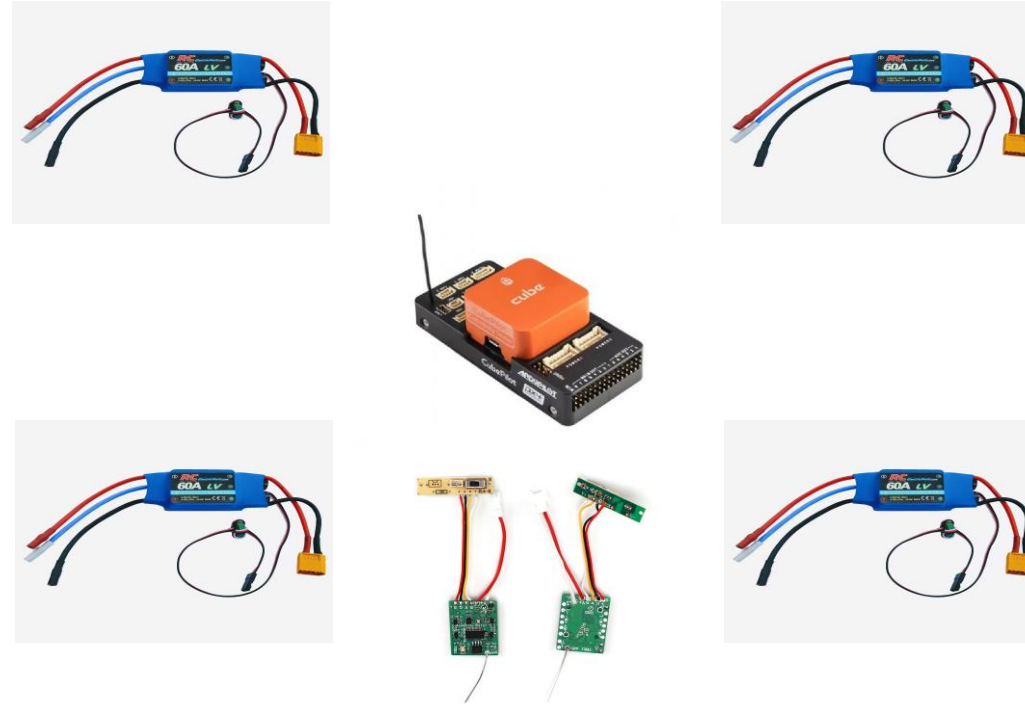
Take the device

# Trusted IoT – Multi-Core RISC-V platforms



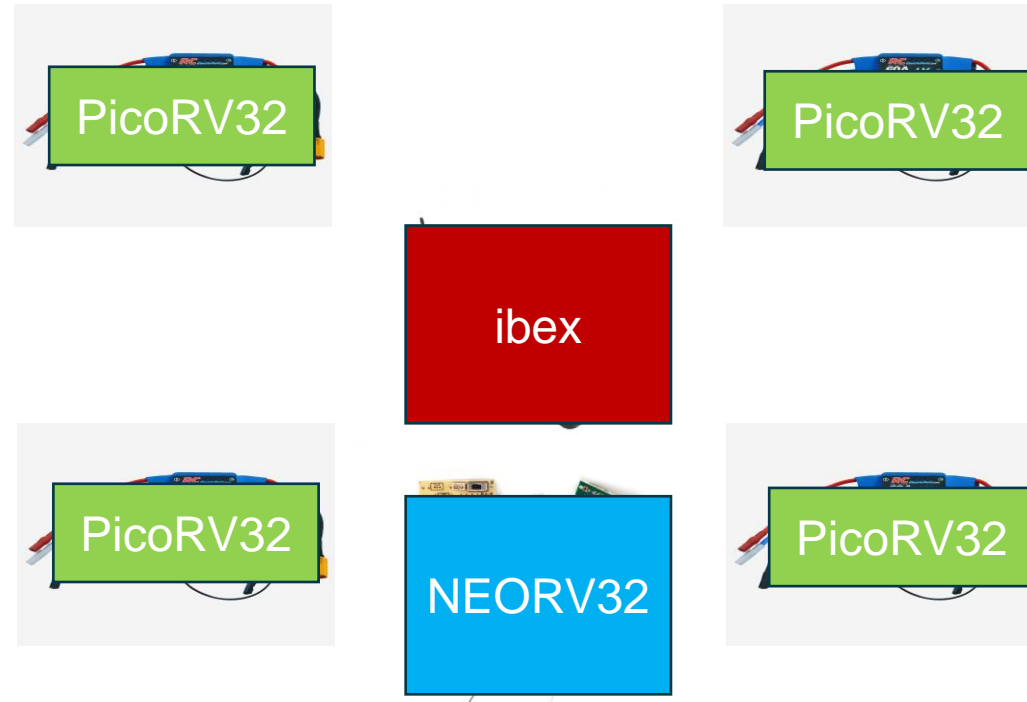
Identify the processors

# Trusted IoT – Multi-Core RISC-V platforms



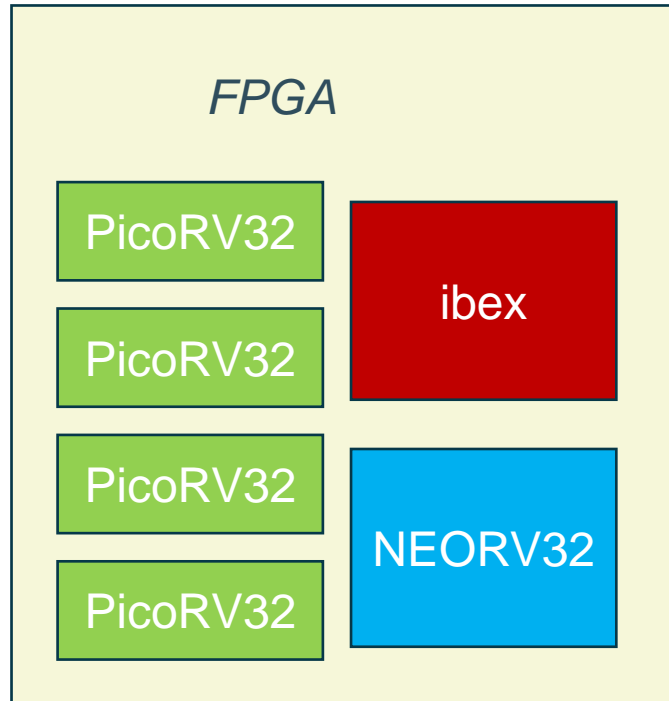
Identify the processors

# Trusted IoT – Multi-Core RISC-V platforms



Replace every processor with a suitable RISC-V implementation

# Trusted IoT – Multi-Core RISC-V platforms

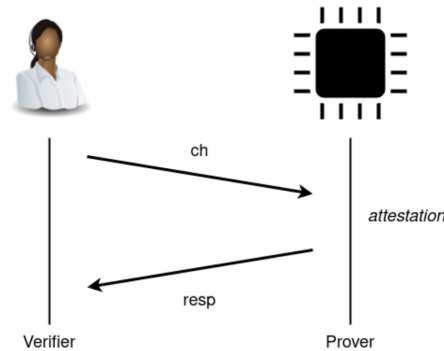


Merge all RISC-V implementations on a single FPGA

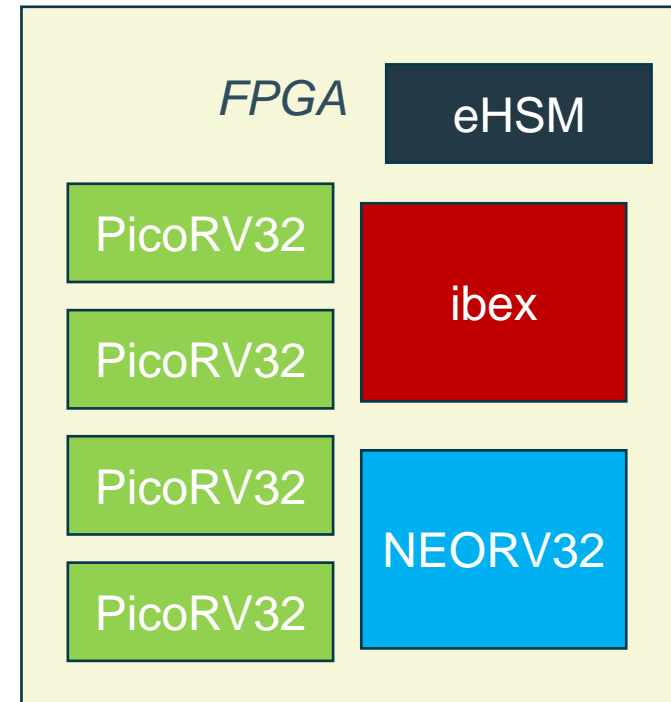
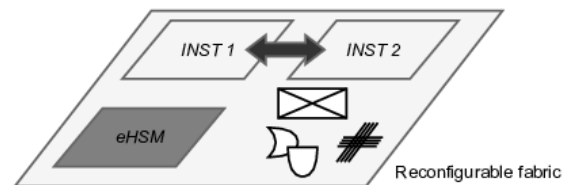
- Single device with multiple processors
- Maintain maximal backward compatibility
- Choose best-fitting RISC-V as platform

# Trusted IoT – Multi-Core RISC-V platforms

- An embedded Hardware Security Module takes care of crypto and attestation

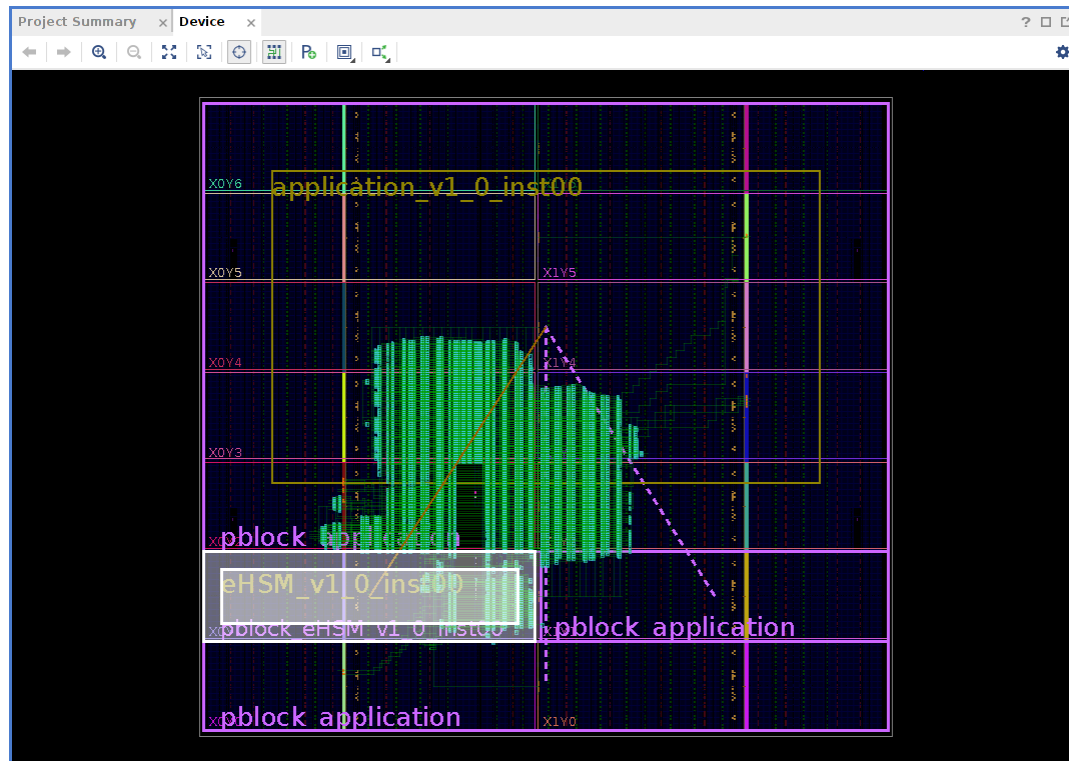


- FPGA can do readback of configuration



# Trusted IoT – Multi-Core RISC-V platforms

- First results towards implementation



```
Terminal - jvliegen@xps15-jo: ~/vc/github/trustediot/src/tools/python/UI
File Edit View Terminal Tabs Help

Trusted IoT - eHSM

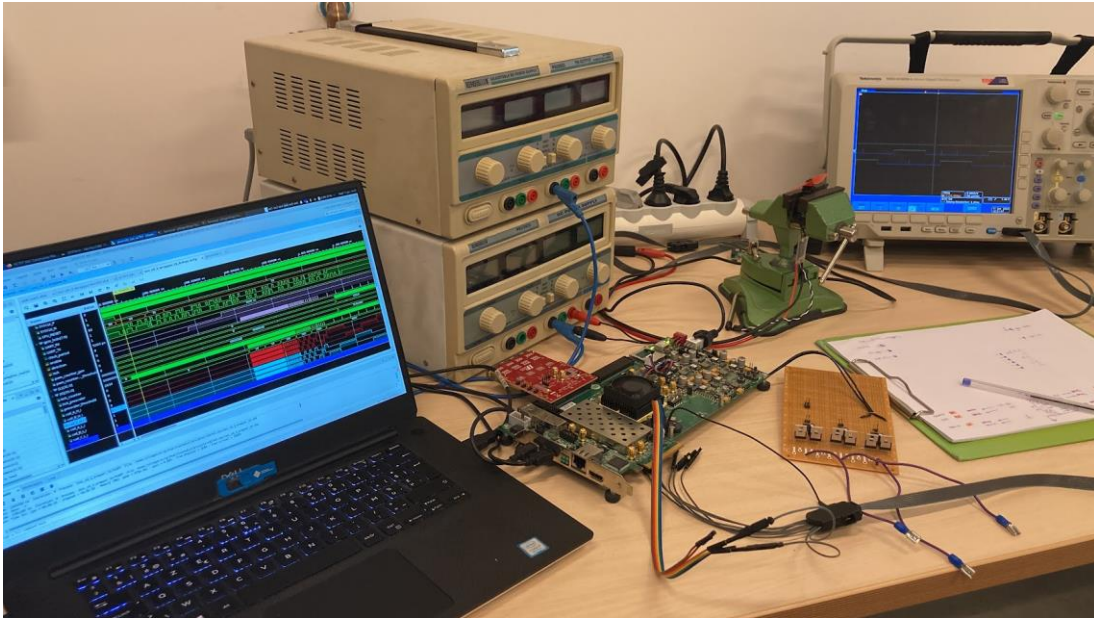
a - Set LEDs to '4'
z - Set LEDs to '6'
e - Set LEDs to '7'
r - Set LEDs to '0'
l - Readback IDCODE register
s - Print status register
f - Load ICAP firmware: frame readback
t - Toggle ICAP
p - Print postfifo word
y - Print postfifo empty flag
q - go back

feedback message:
```



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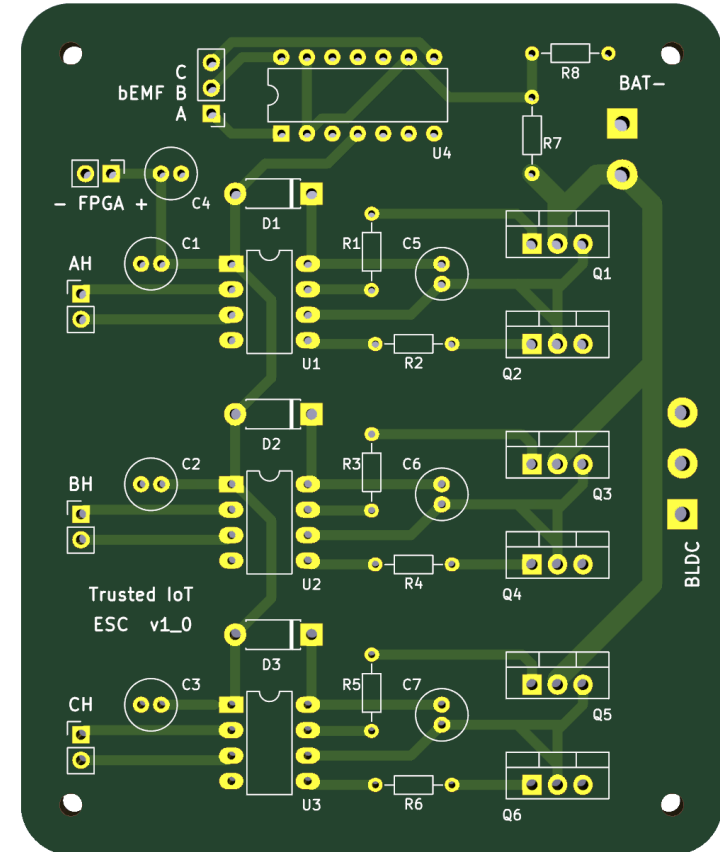
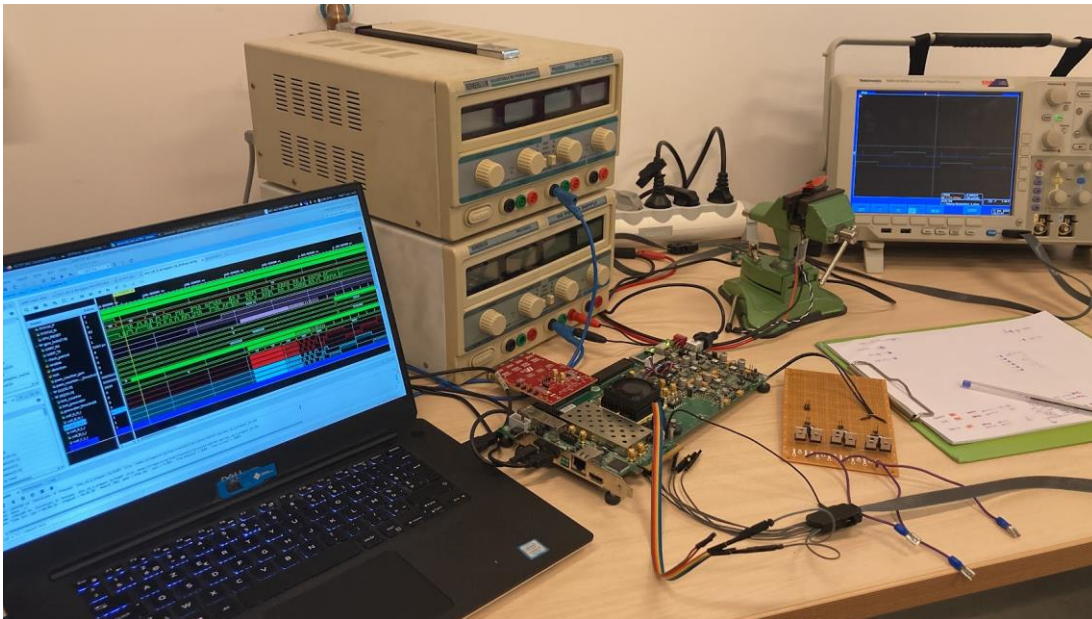
- First results towards demonstrator





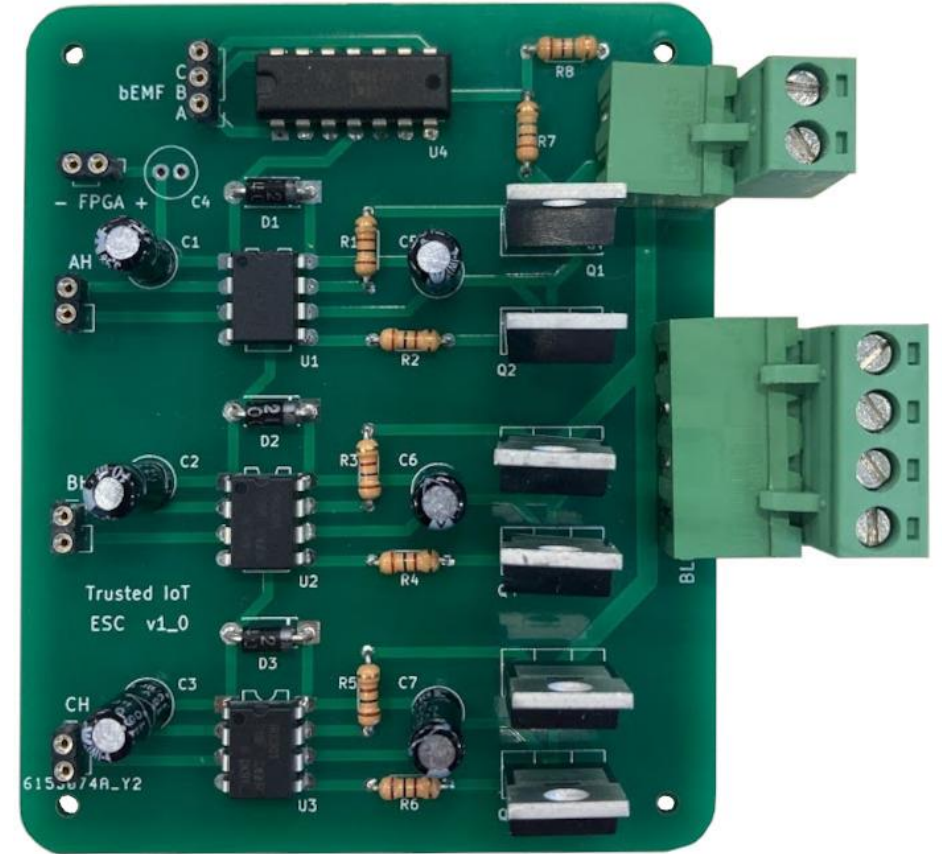
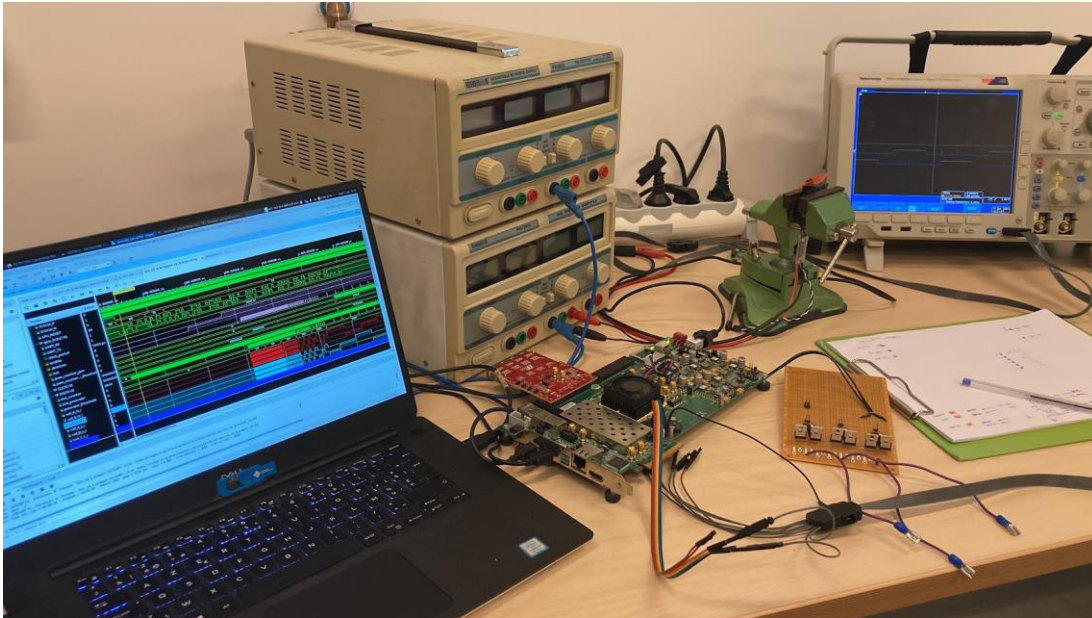
# Trusted IoT – Multi-Core RISC-V platforms

- First results towards demonstrator



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- First results towards demonstrator



# Trusted IoT – Multi-Core RISC-V platforms

- First results towards demonstrator

*Everything is on track*

# Multi-Core RISC-V platforms

Questions ?

