Piece of cake

testing remote embedded devices made easy with MuxPi

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Agenda

1. Introduction
2. Previous efforts
3. Idea
4. Hardware
5. Software
6. Next steps
7. Conclusion

Introduction

Tizen



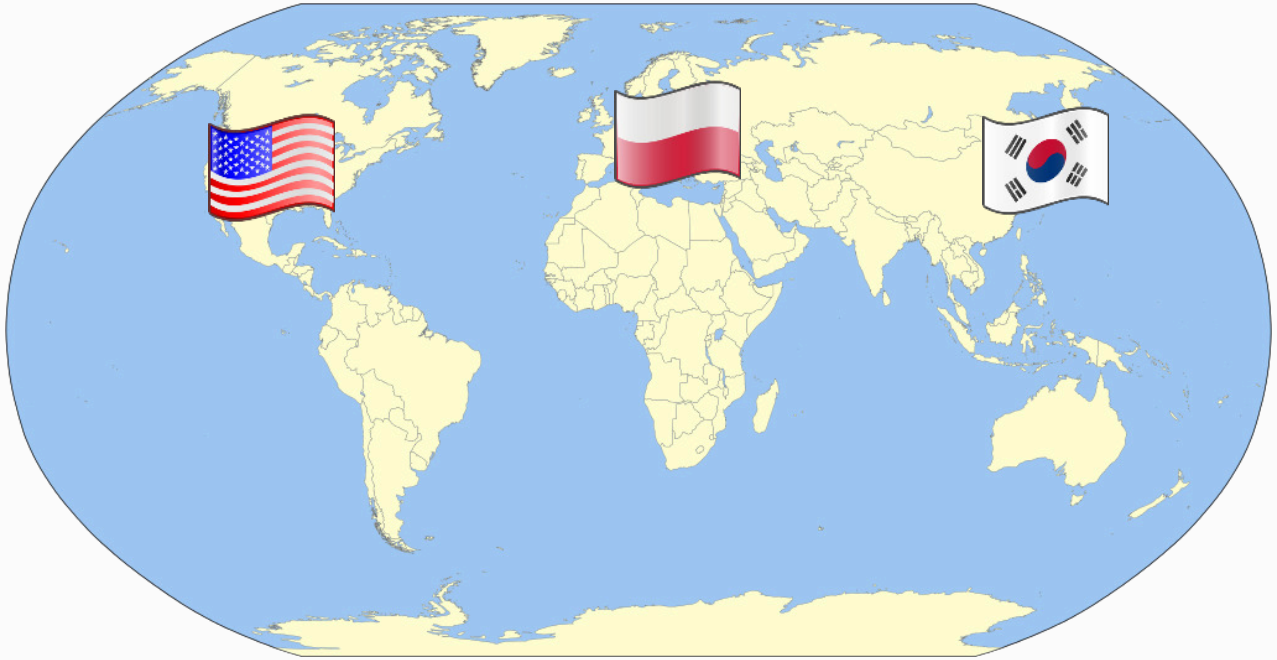

Use cases

https://news.samsung.com/global/
tizen-4-0-first-milestone-release-to-open-new-opportunities-in-the-iot-era

Release engineering

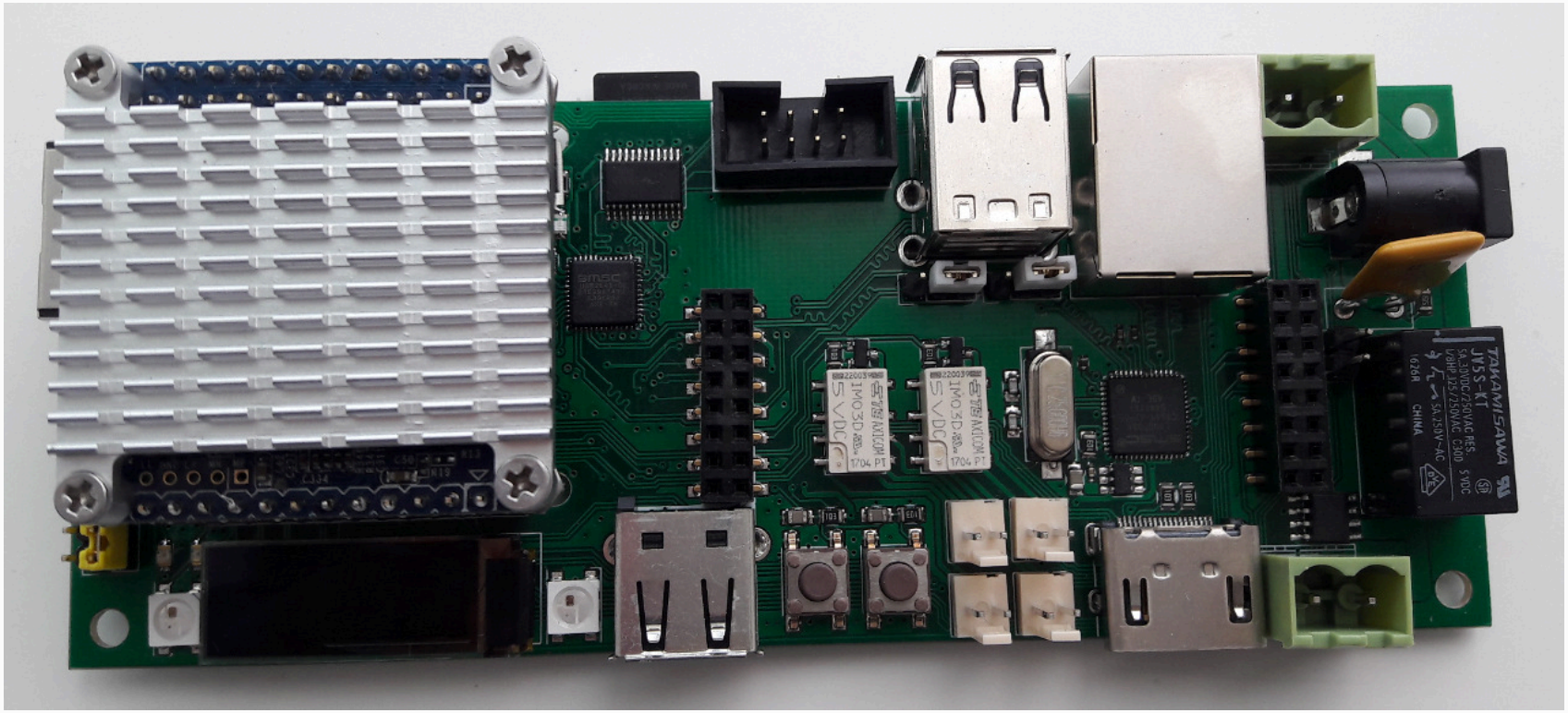
- Continuous platform development
- QA step prior pulling new changes
- Package internal tests are not enough

Remote accessibility

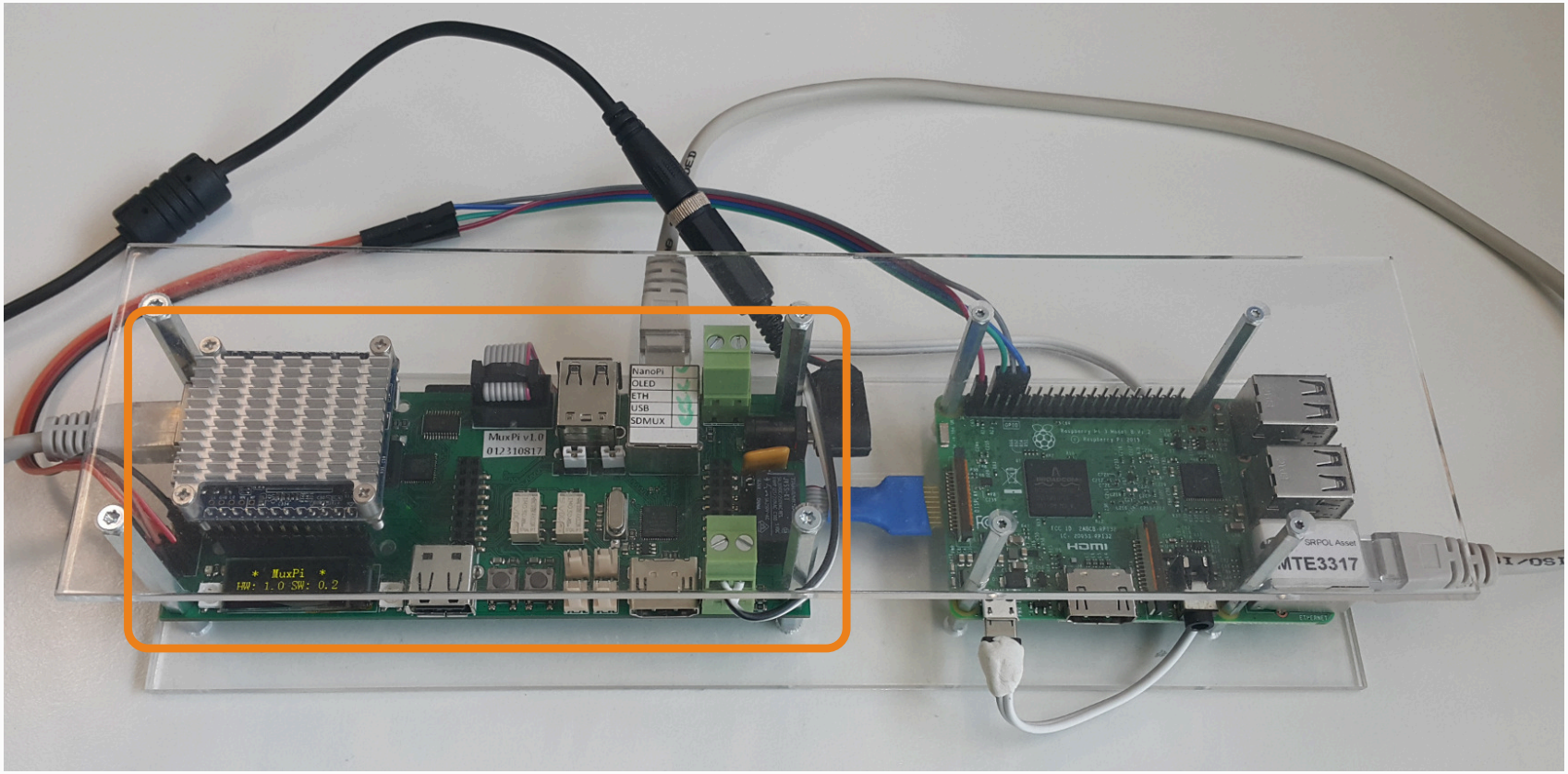


- Easy to store in a secure manner
- Less effort than per developer
- Better utilized when shared

Piece of cake (with MuxPi)



Piece of cake (with Dryad)



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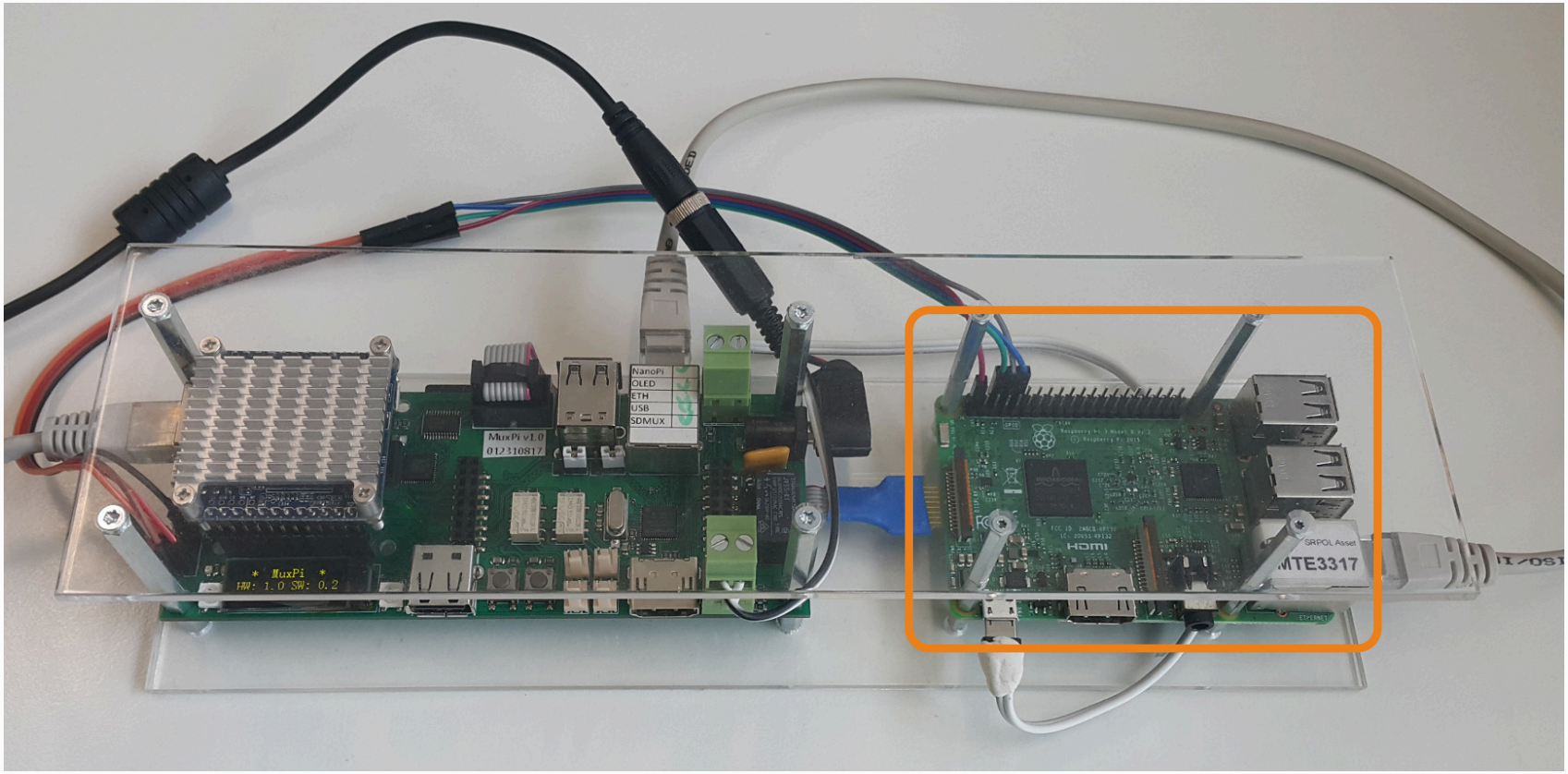

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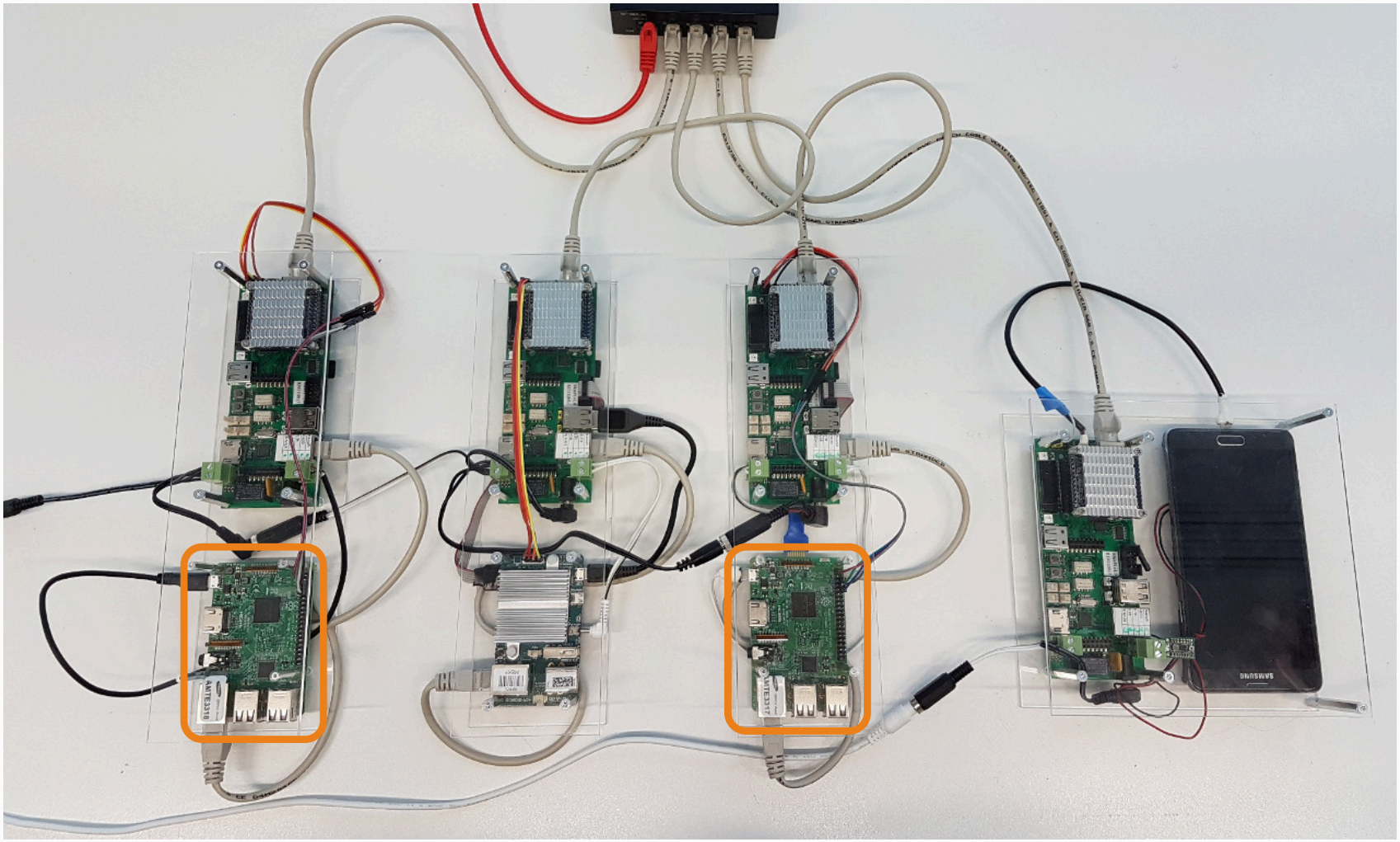

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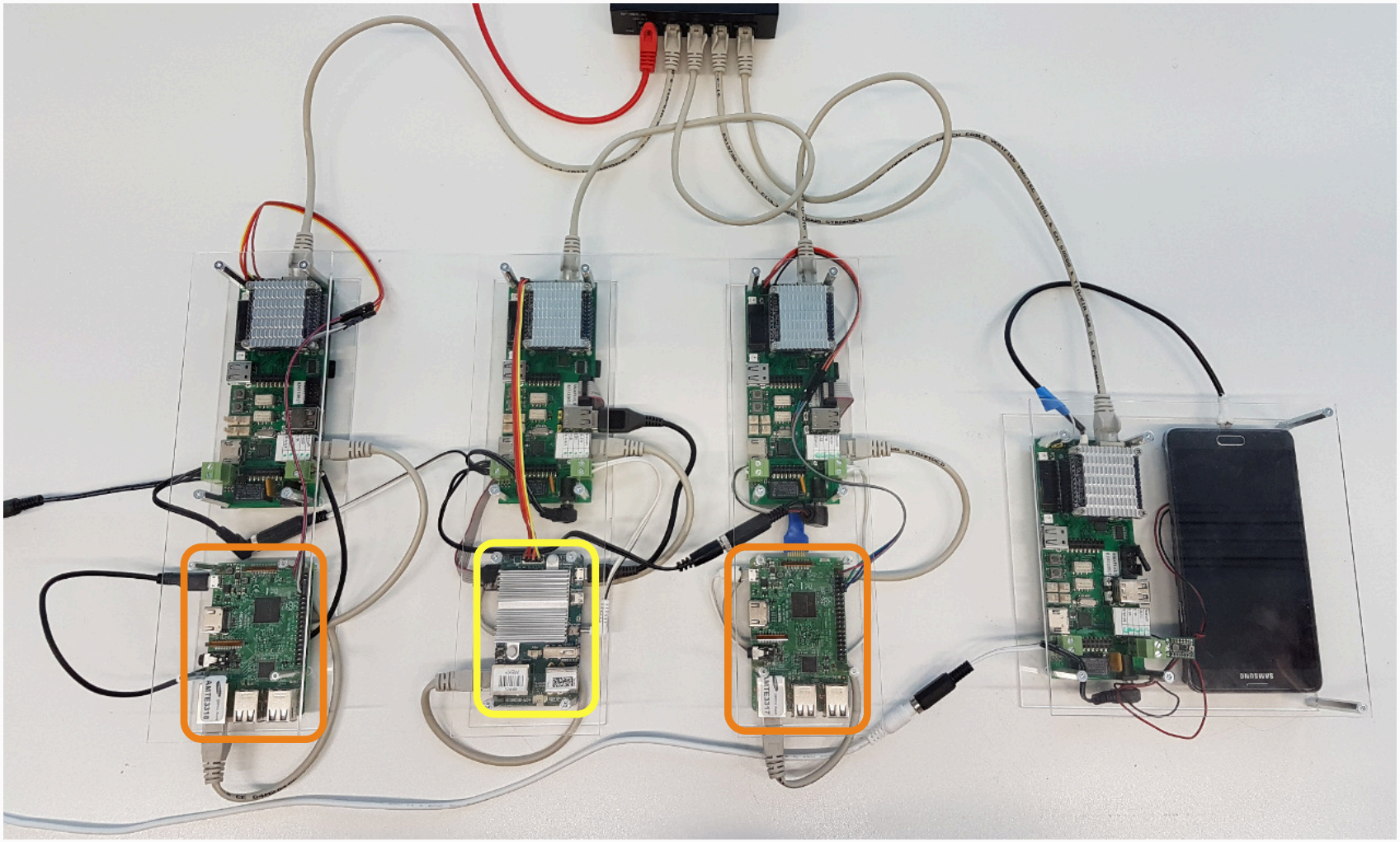

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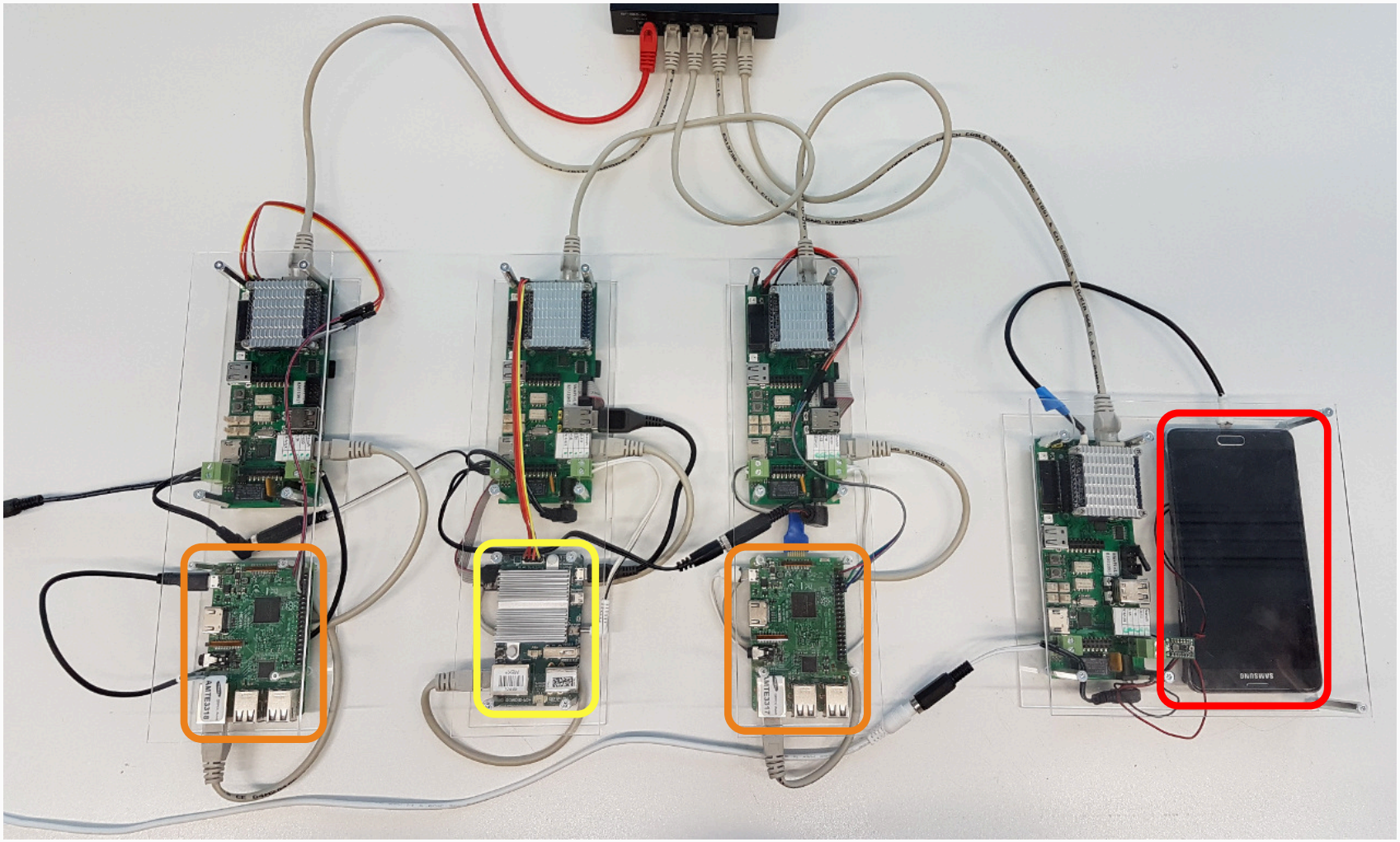
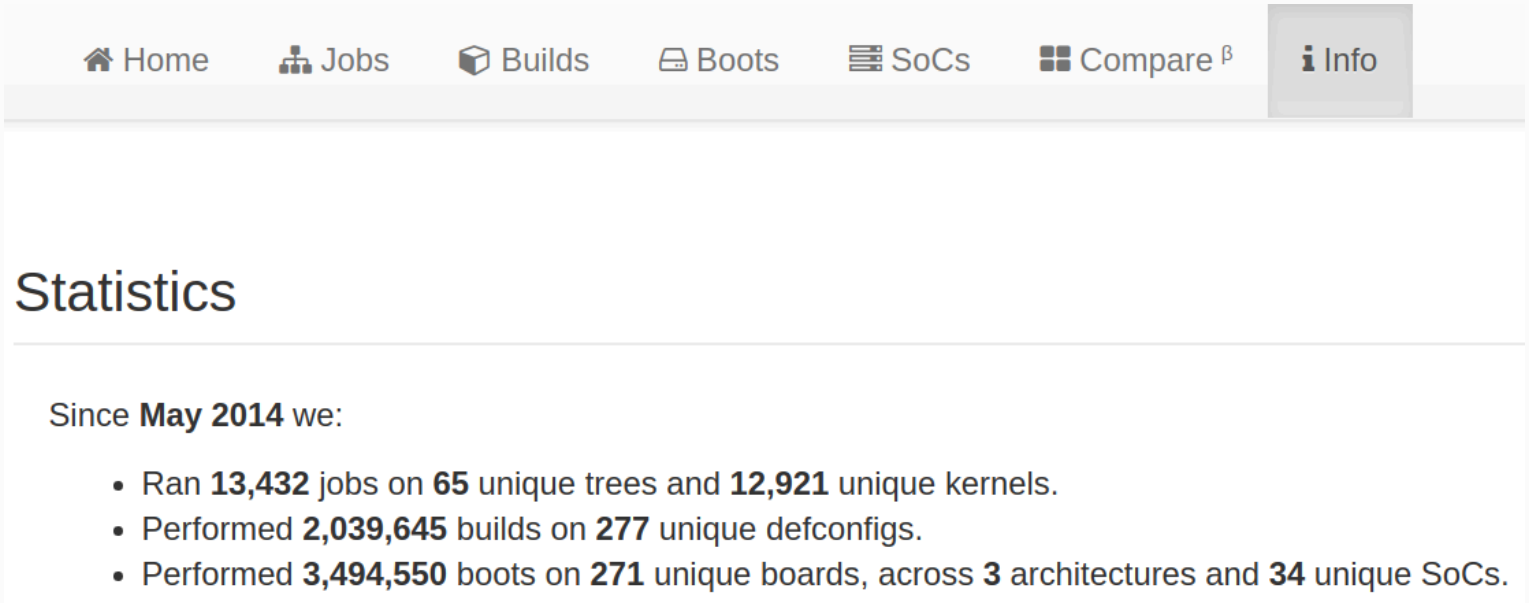


Previous efforts

LAVA

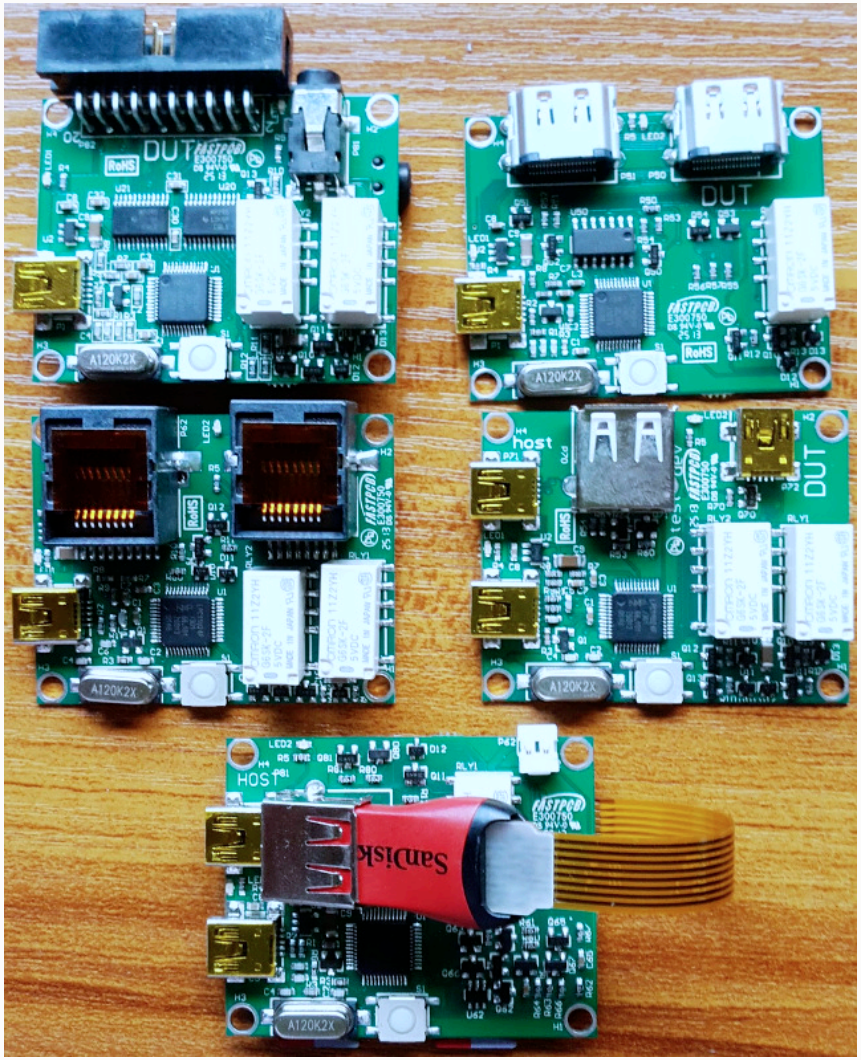
- Linaro Automated Validation Architecture
- Automation system for deploying operating systems
- Virtual and physical hardware supported
- Allows running boot, bootloader and system level tests

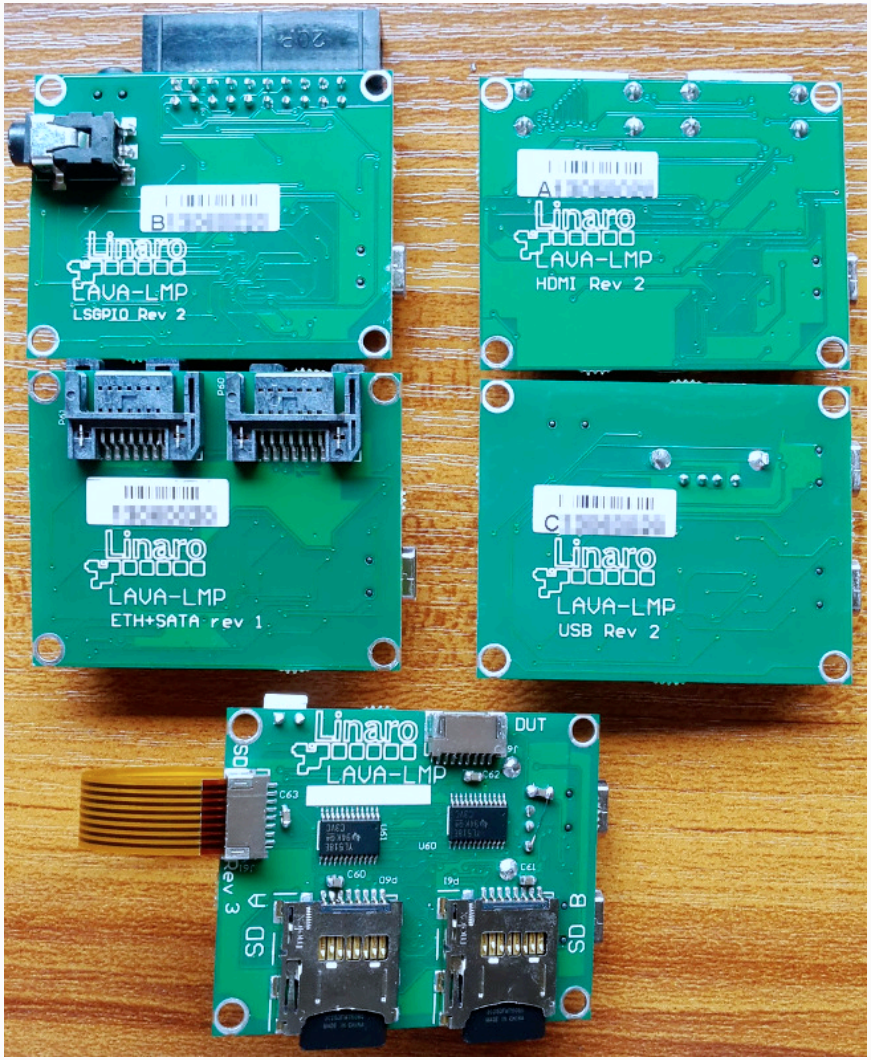
Kernel CI



https://kernelci.org/stats/

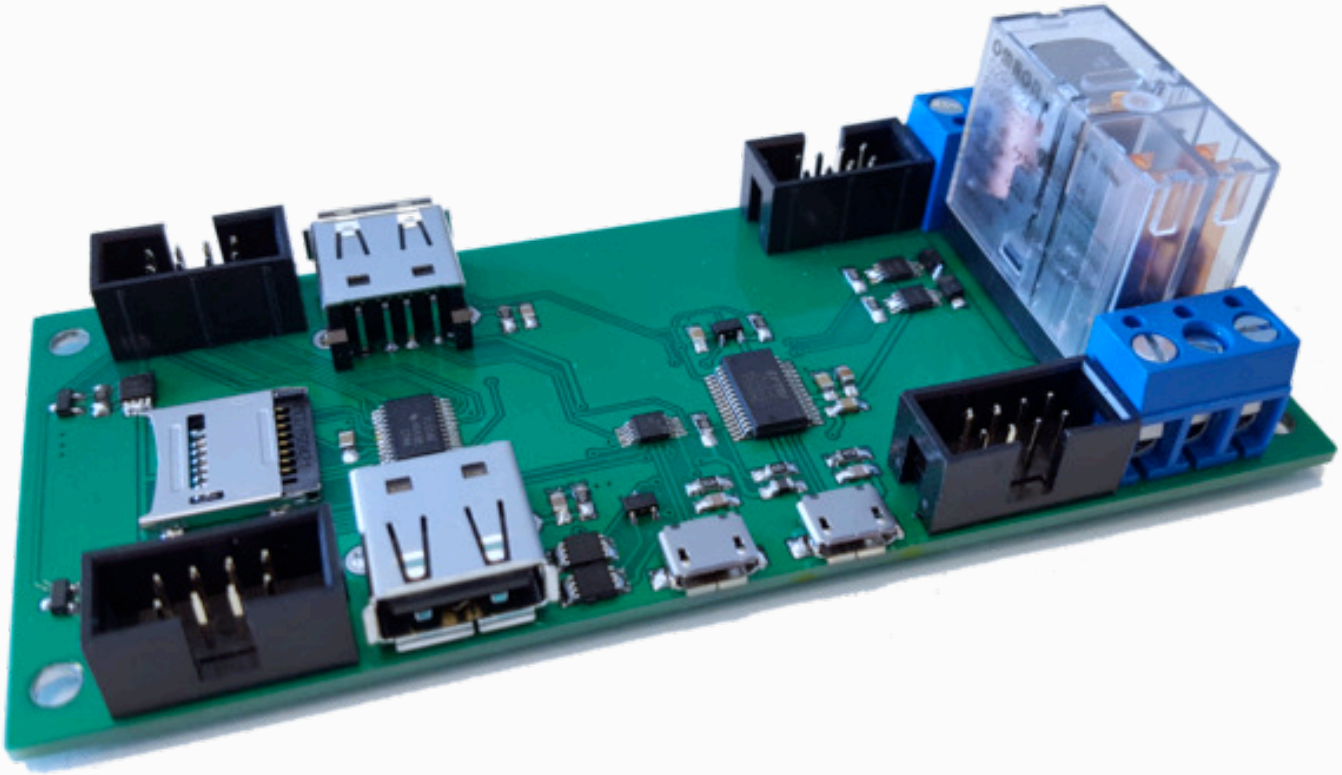
LAVA LMP



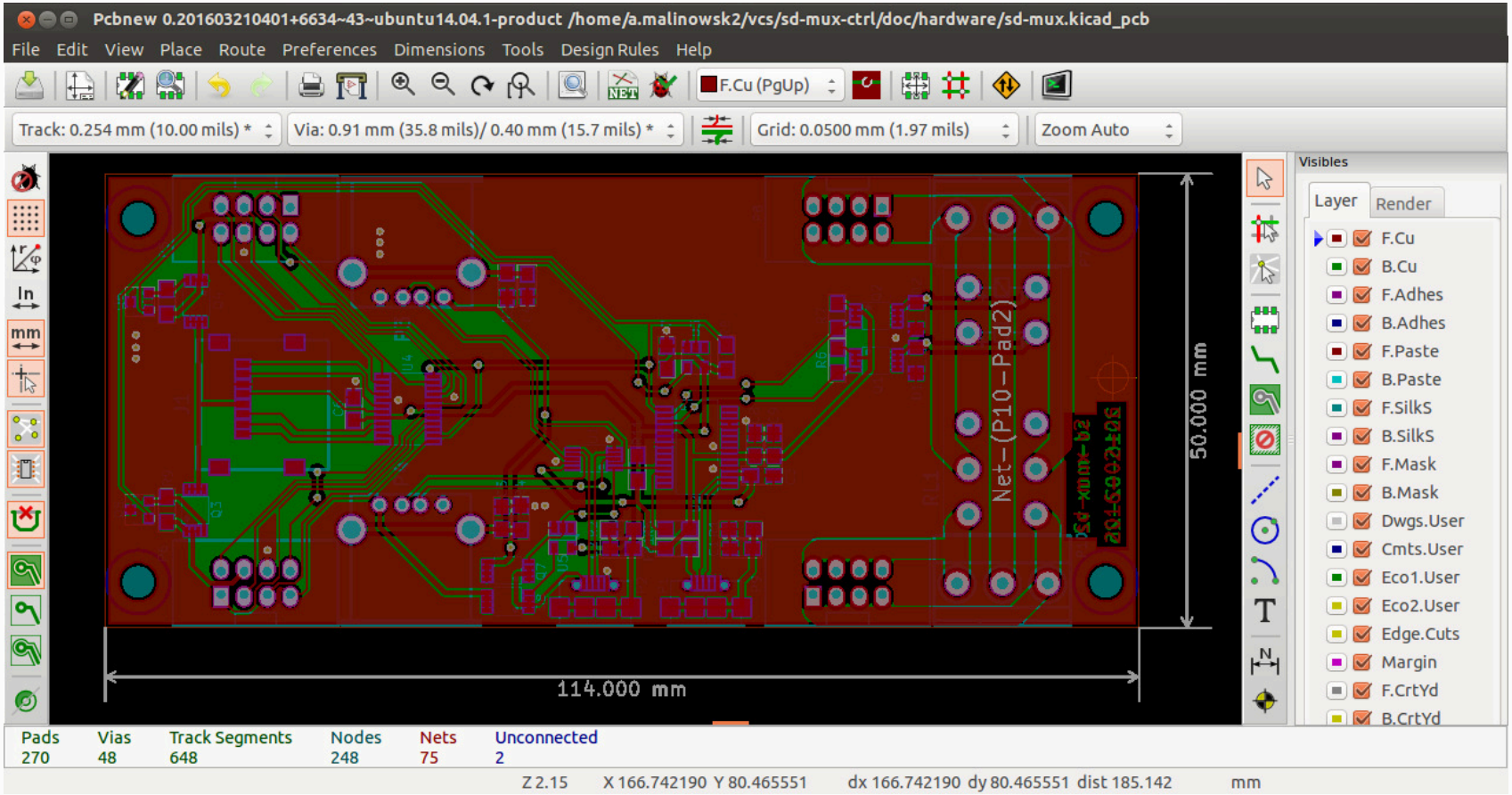


https://linux.codehelp.co.uk/the-problem-of-sd-mux.html

SD MUX



SD MUX – open hardware



https://git.tizen.org/cgit/tools/testlab/sd-mux

Autohat board (SD MUX-based)

https://github.com/resin-io/autohat-board

SD MUX issues

```
$ dmesg | tail -12
[ 98.375599] usb 3-1: new full-speed USB device number 12 using xhci_hcd
[ 98.487663] usb 3-1: device descriptor read/64, error -71
[ 98.703656] usb 3-1: device descriptor read/64, error -71
[ 98.919658] usb 3-1: new full-speed USB device number 13 using xhci_hcd
[ 98.919969] usb 3-1: Device not responding to setup address.
[ 99.123998] usb 3-1: Device not responding to setup address.
[ 99.327681] usb 3-1: device not accepting address 13, error -71
[ 99.439718] usb 3-1: new full-speed USB device number 14 using xhci_hcd
[ 99.440049] usb 3-1: Device not responding to setup address.
[ 99.644028] usb 3-1: Device not responding to setup address.
[ 99.847719] usb 3-1: device not accepting address 14, error -71
[ 99.847819] usb usb3-port1: unable to enumerate USB device
```

Idea

Constraints

- Only replaceable media
- No single point of failure parts
- No USB involvement
  (from test server)

Requirements

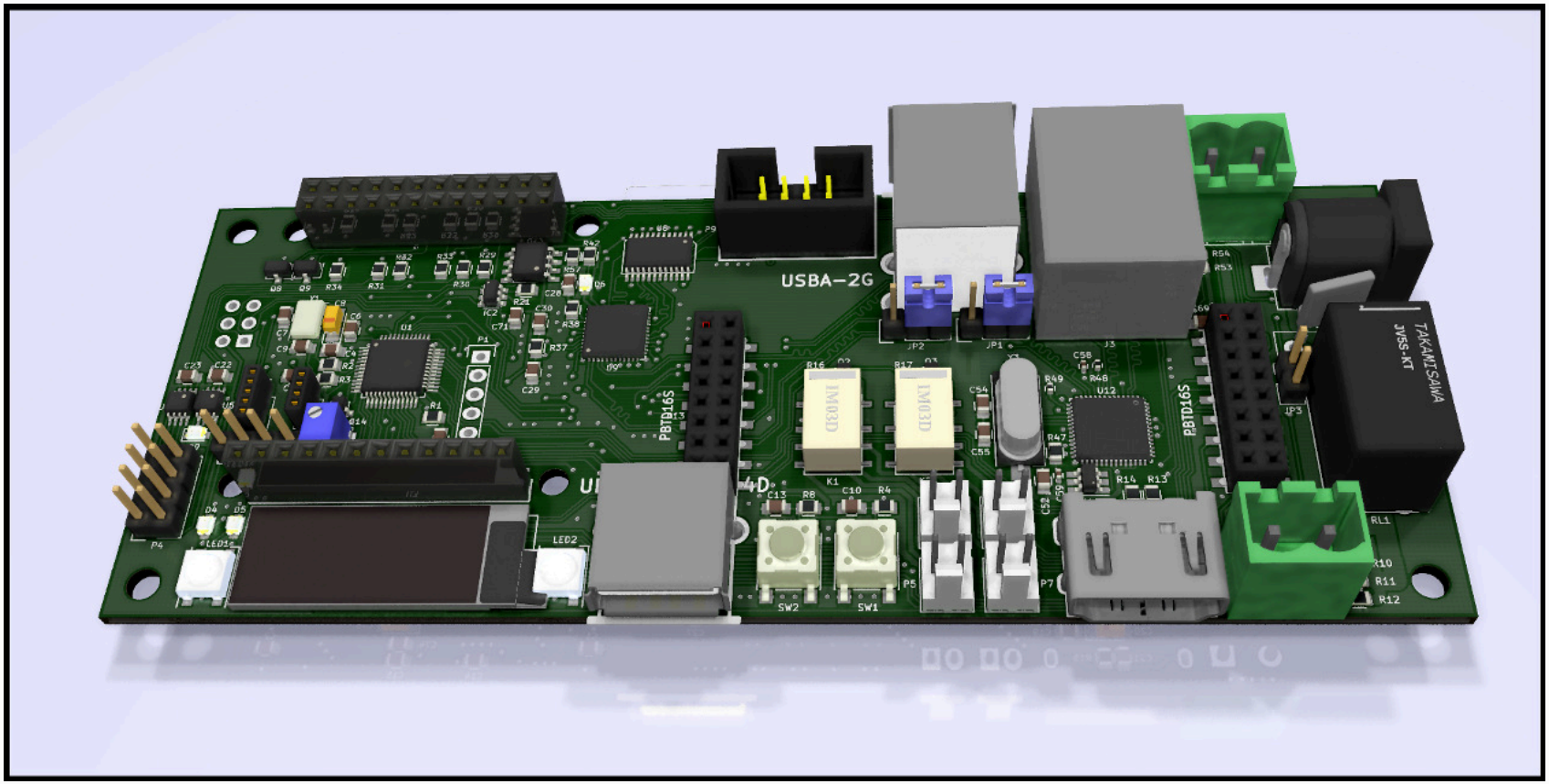
- Minimum external connections
- Unified remote access
  to target devices
- Easy setup and maintenance

Features

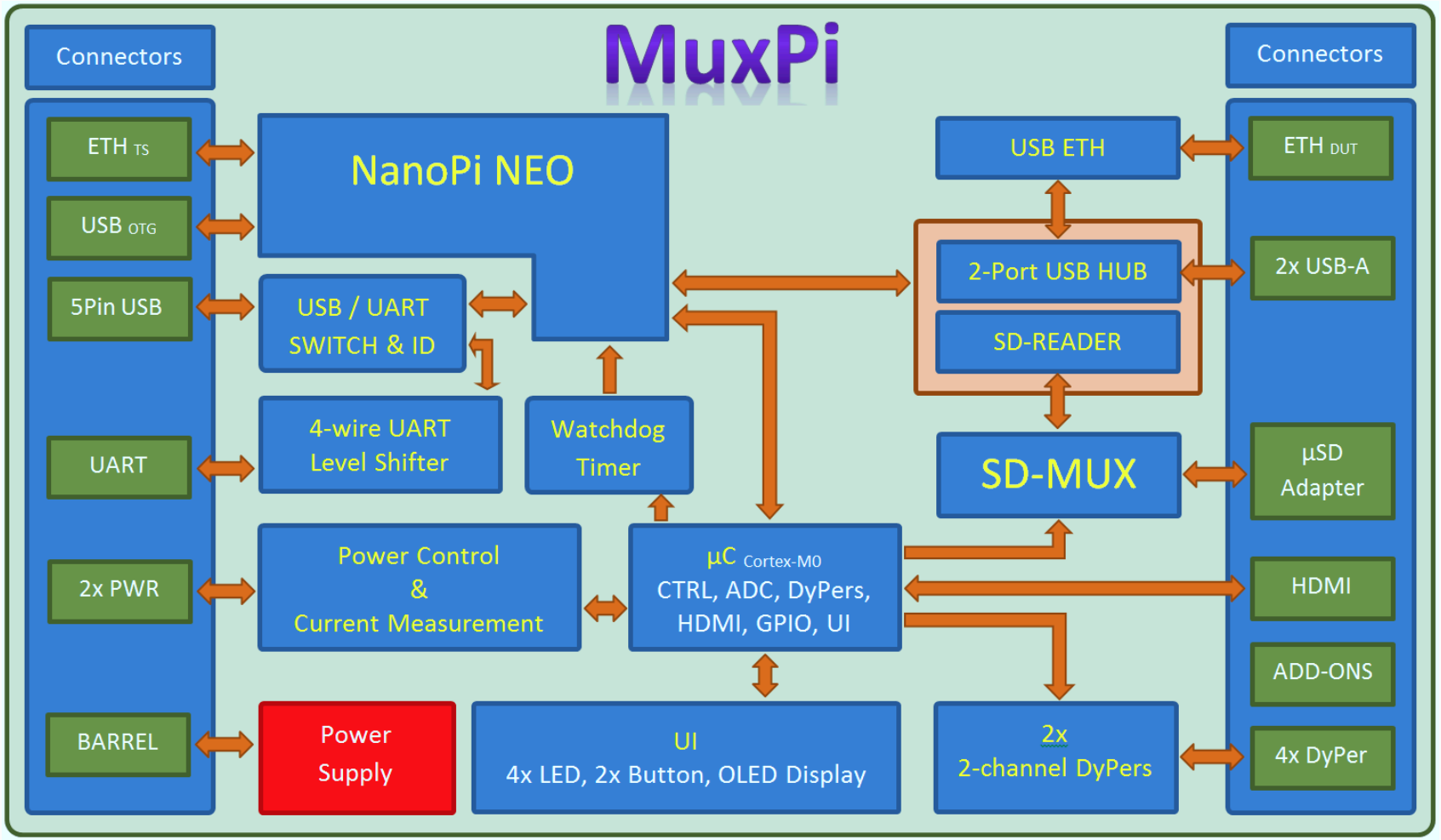
- User interface
  (often requested)
- Power measurement
  (increasing demand)
- Writing EDID to HDMI

Hardware

MuxPi



MuxPi components



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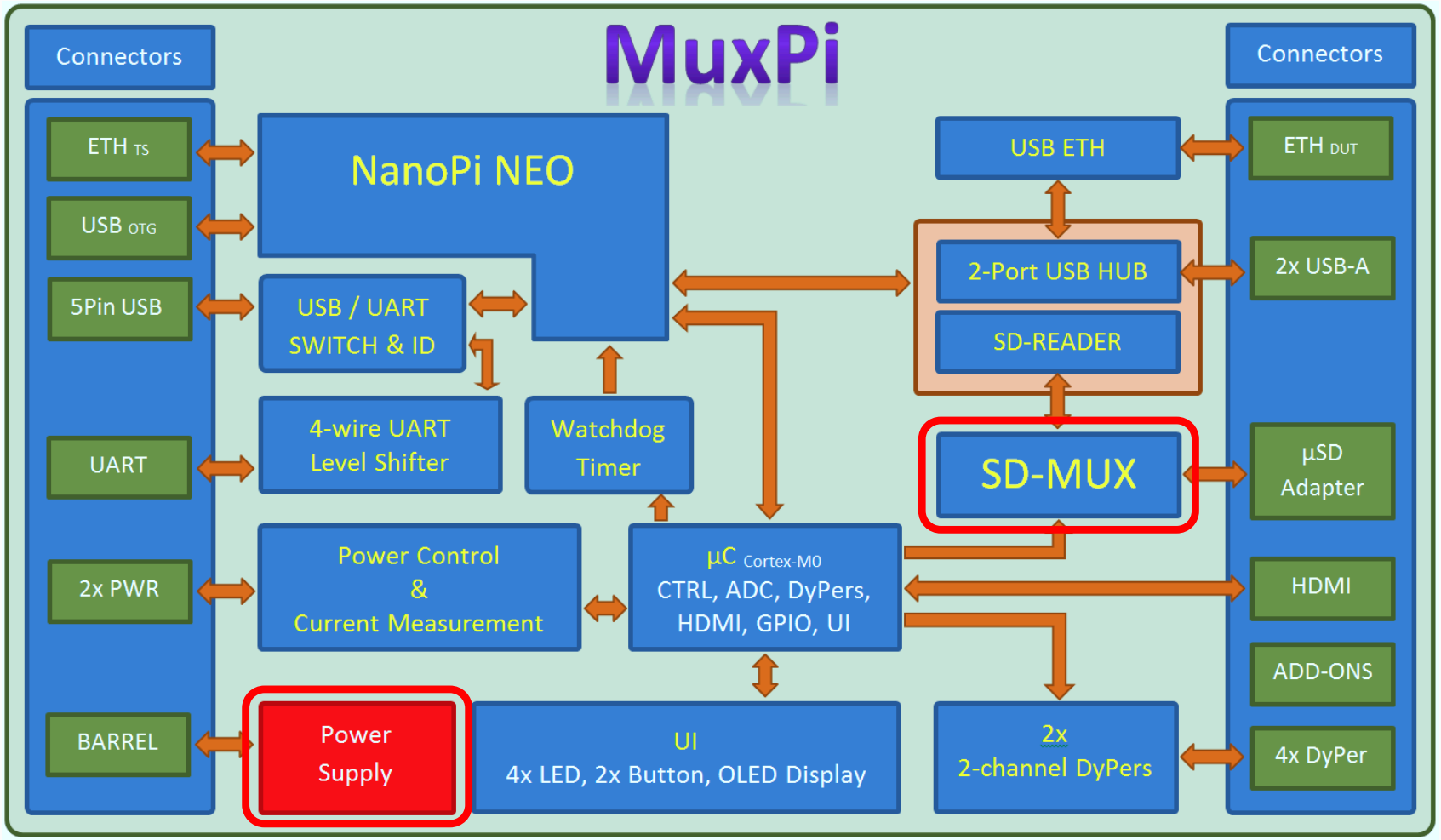

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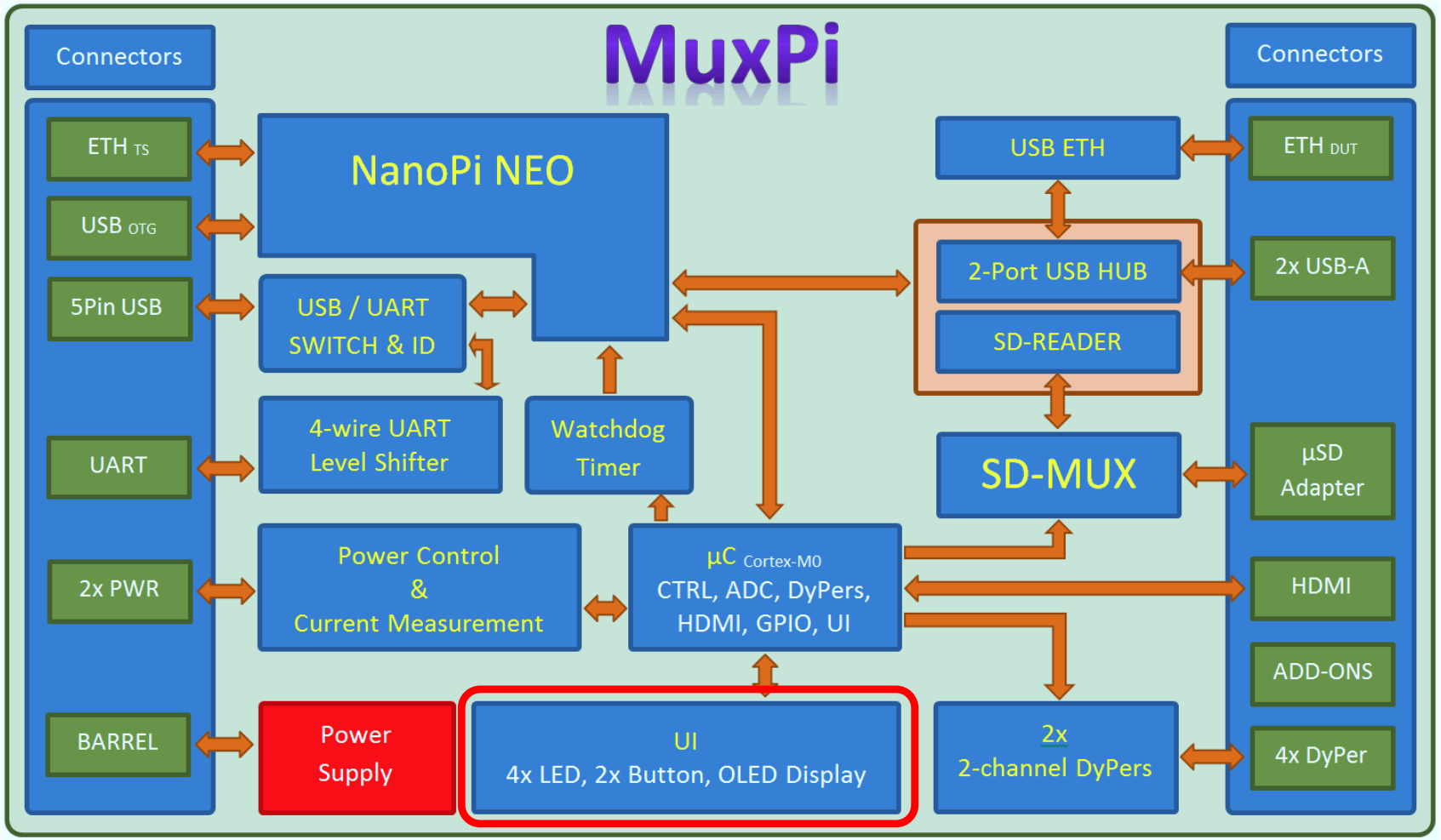
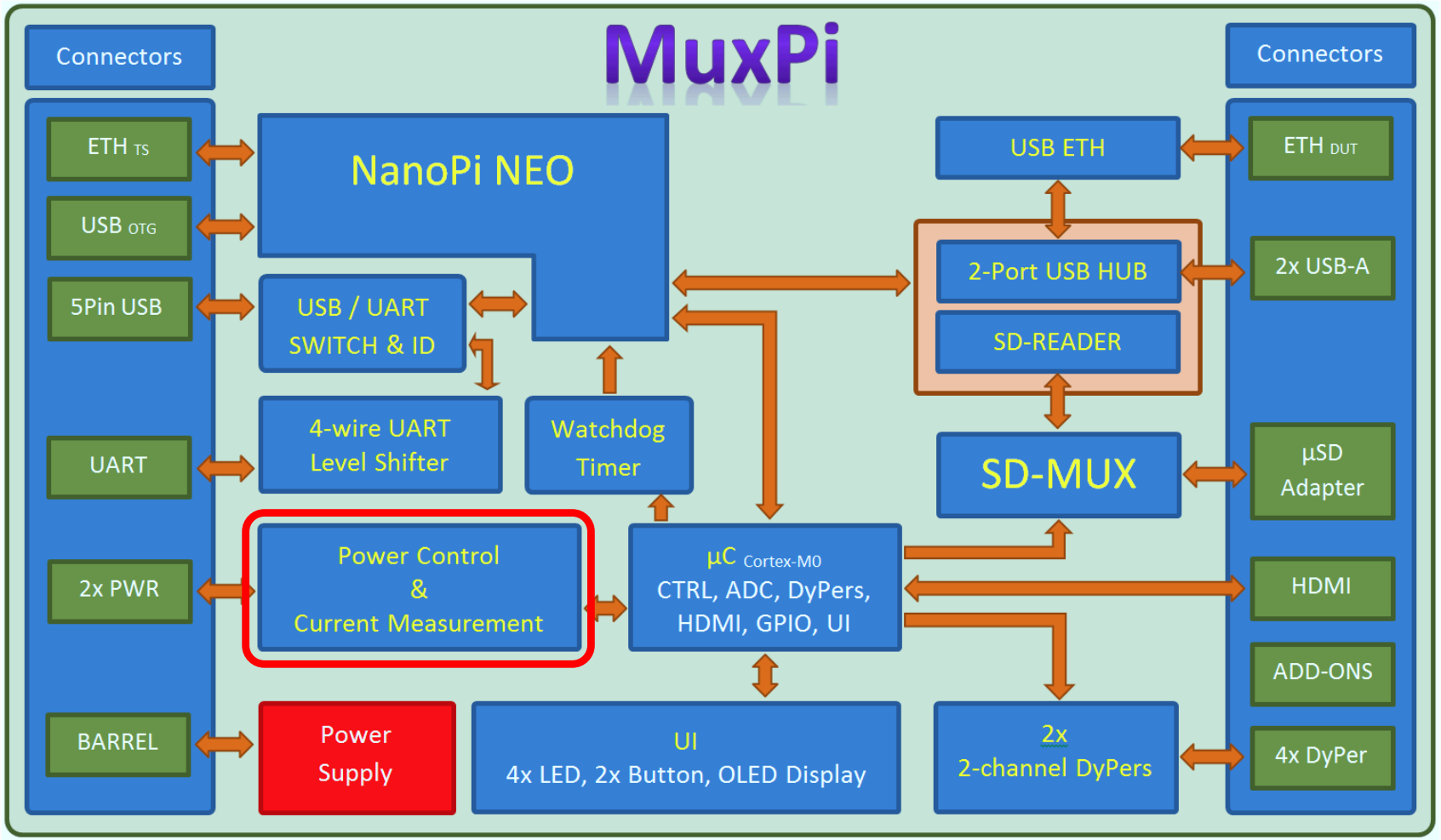
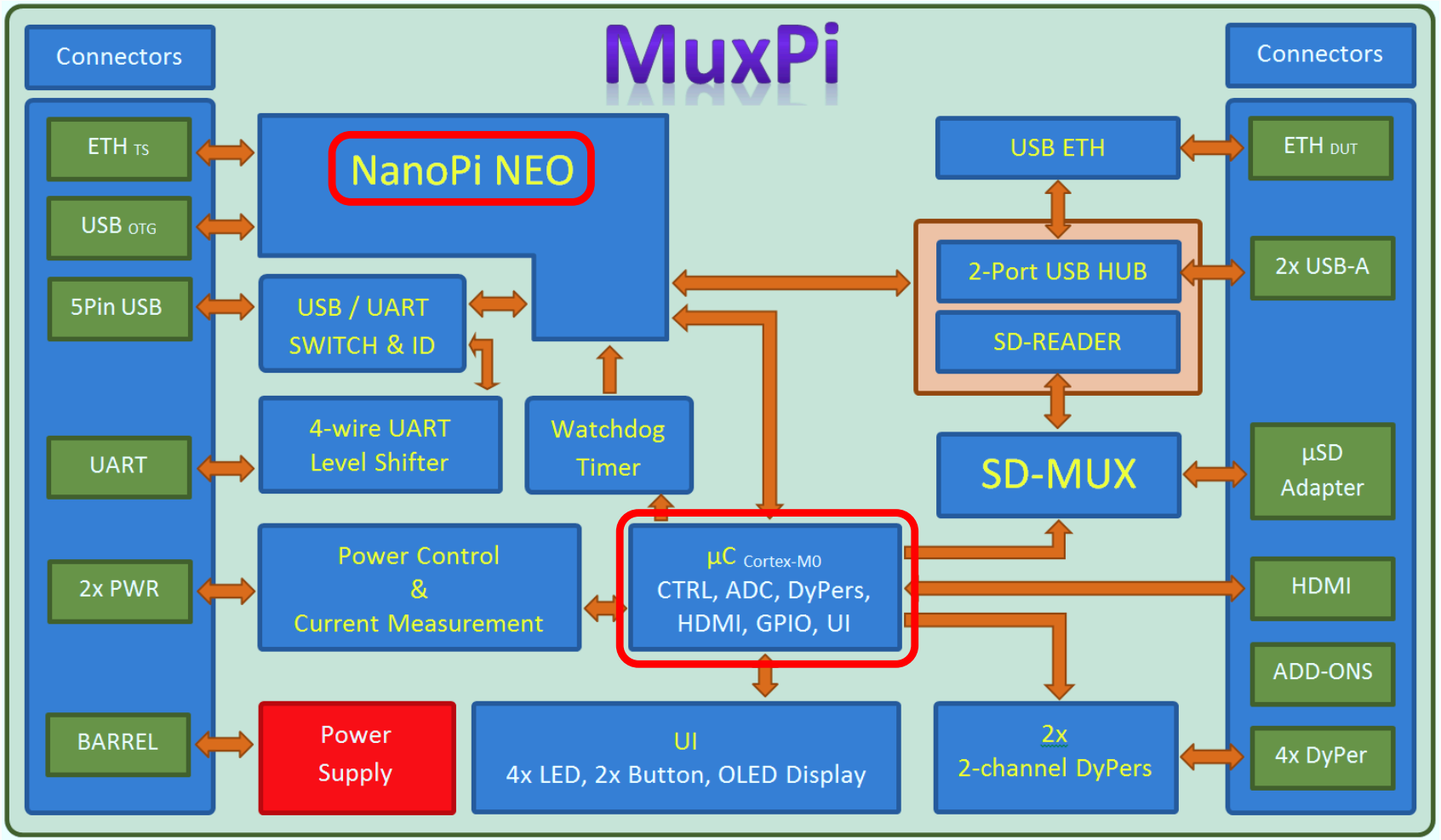


MuxPi components



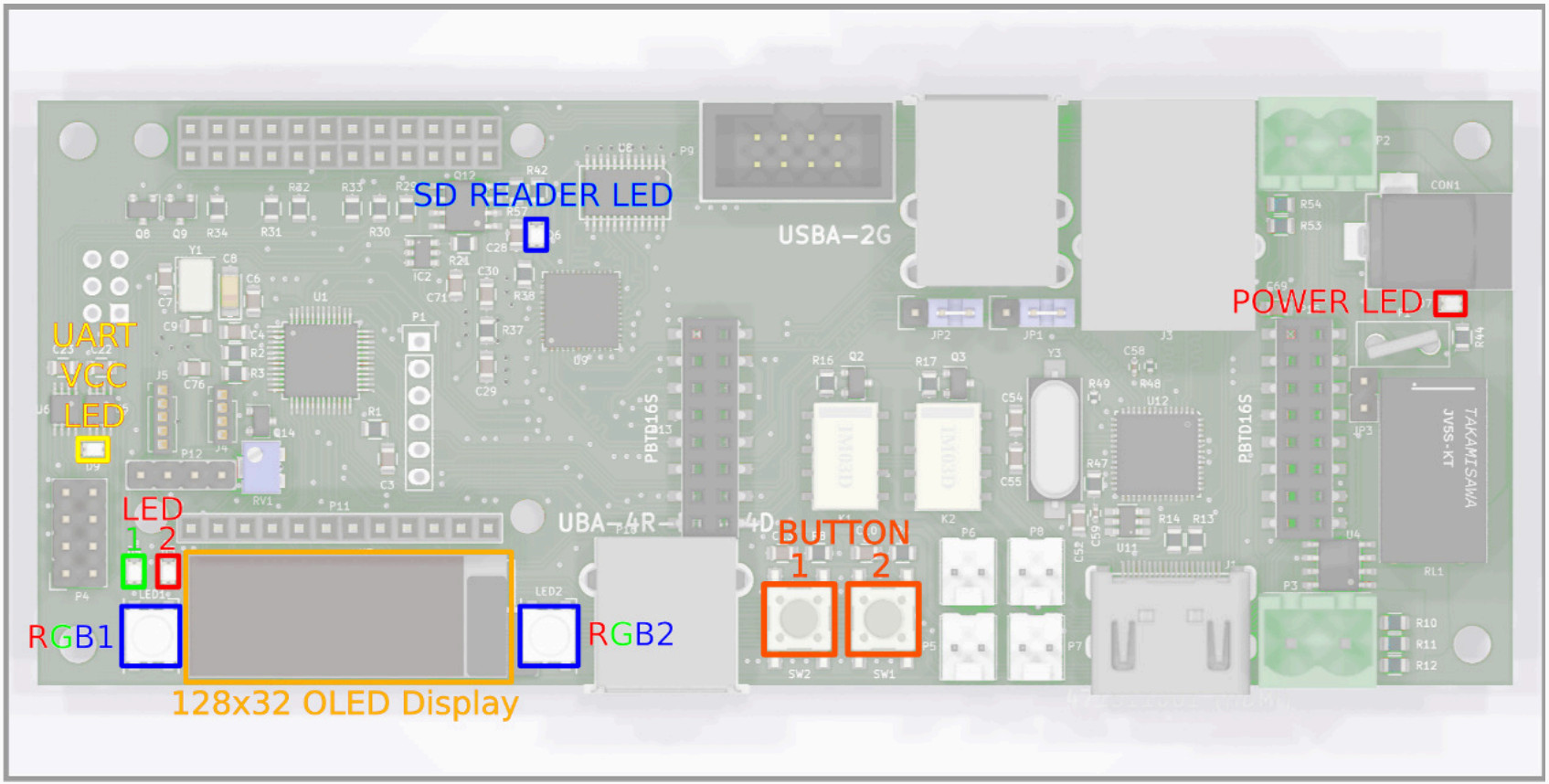
MuxPi components



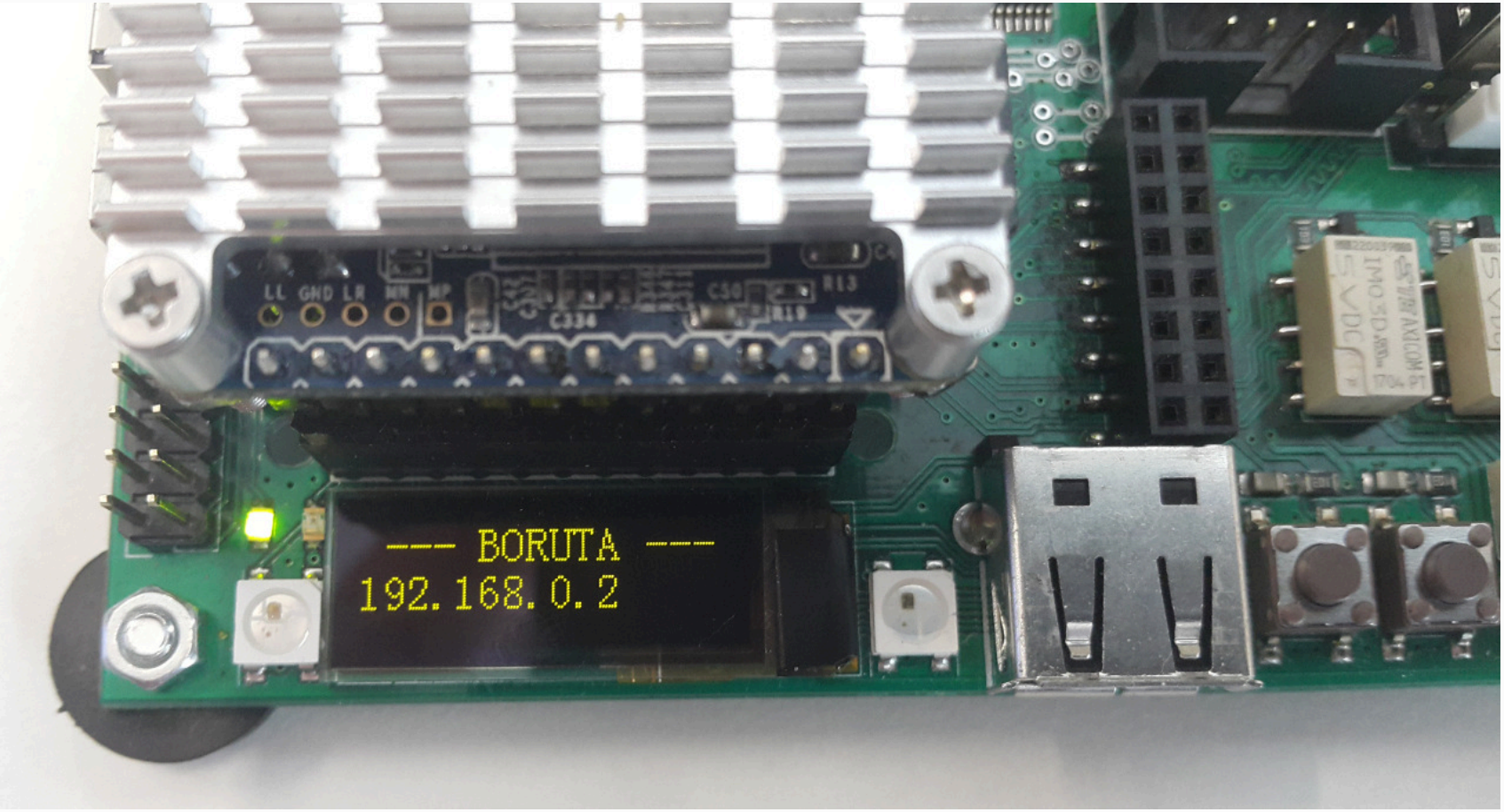
Essential MuxPi functions

- Switching a microSD card between DUT and TS
- Switching power supply for DUT
- Switching jumpers/buttons of DUT
- Measuring power consumption of DUT
- Writing EDID to DUT over HDMI connection
- Providing DUT connection (UART, USB, ETH, microSD card) over Ethernet
- Interacting with farm maintainer

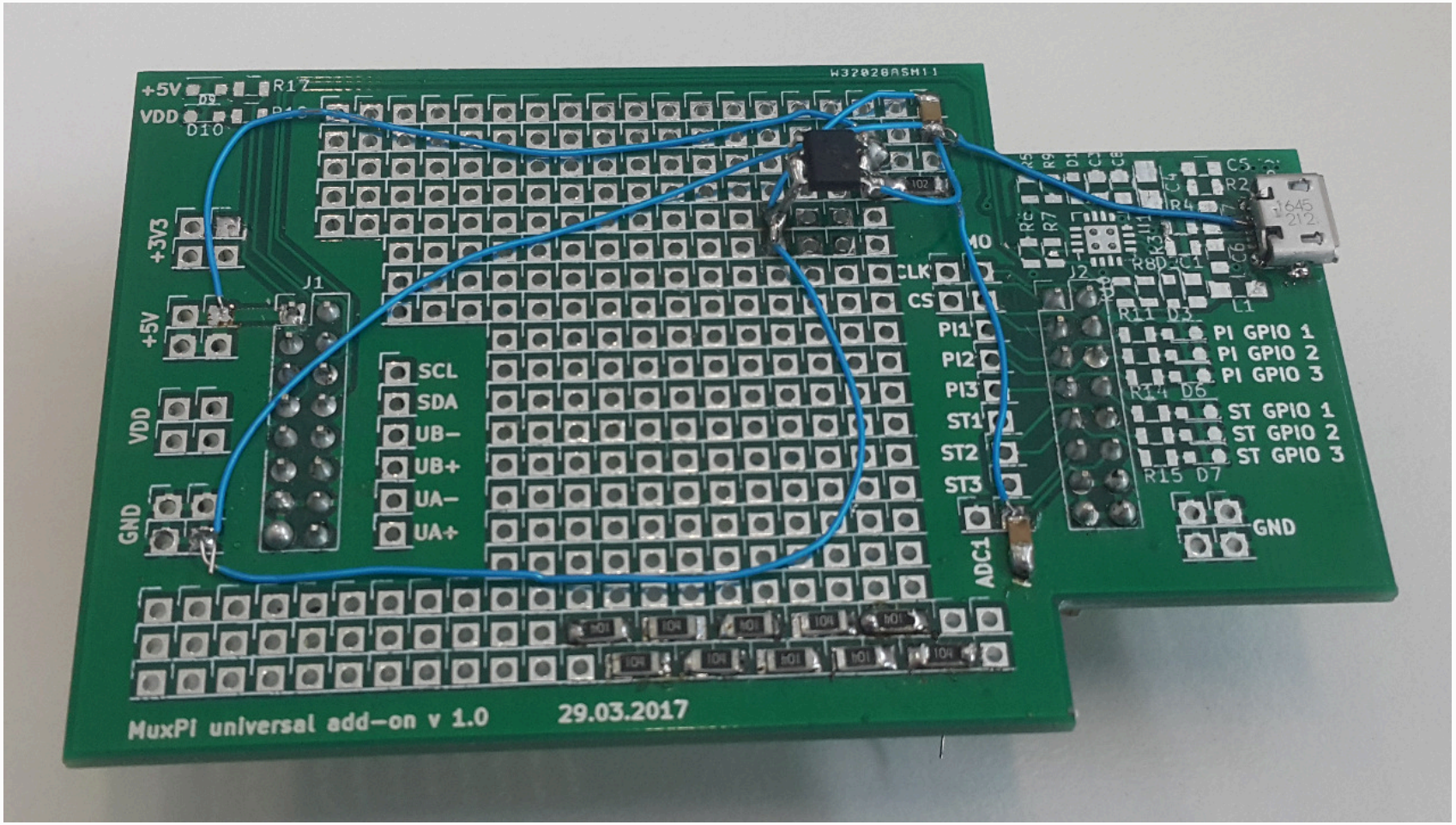
Indicators


SD READER LED
USBA-2G
POWER LED
UART
VCC
LED
LED
1 2
UBA-4R-4D
BUTTON
1 2
RGB1
RGB2
128x32 OLED Display

Easy maintenance



Extensibility



Major improvements

- Independent (standalone)
- Aware of its state
- Easy to maintain
- Extensible from start

Building your own

NanoPi NEO $\approx \$10$

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Parts	$\approx \$80$

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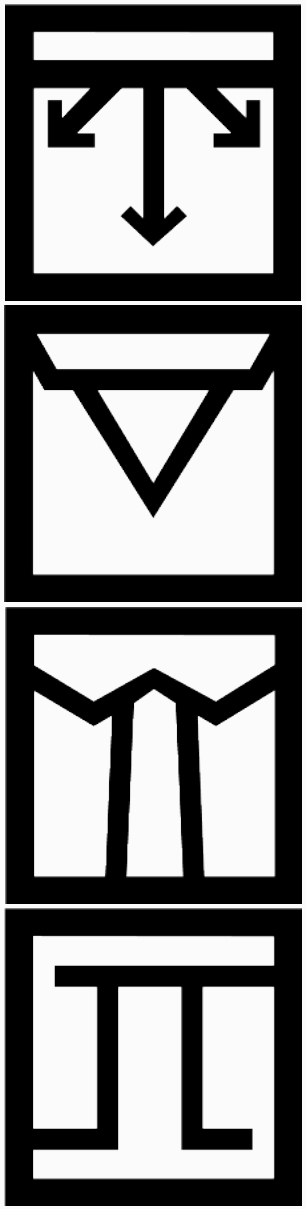
https://git.tizen.org/cgit/tools/muxpi

Software

Multitier architecture

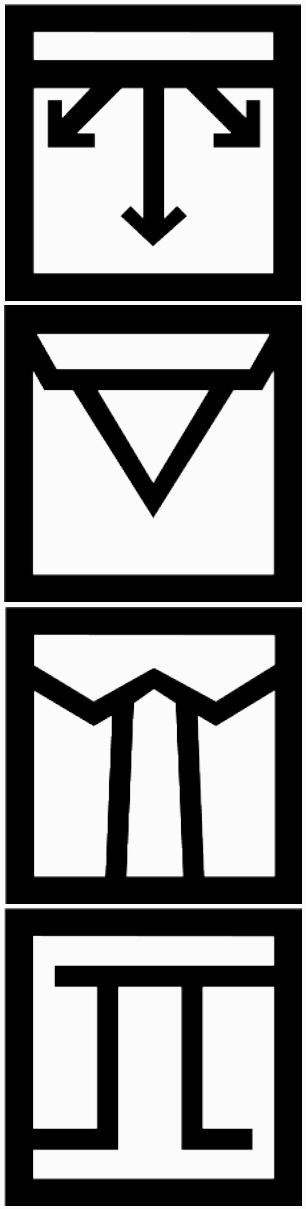
- “Do One Thing and Do It Well”
- RESTful HTTP APIs
- Homogeneous solution stack

Responsibilities



- Who knows what requires verification?
- Who knows which actions are necessary?
- Who knows where can it be done?
- Who knows how to do it?

Responsibilities



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  Perun

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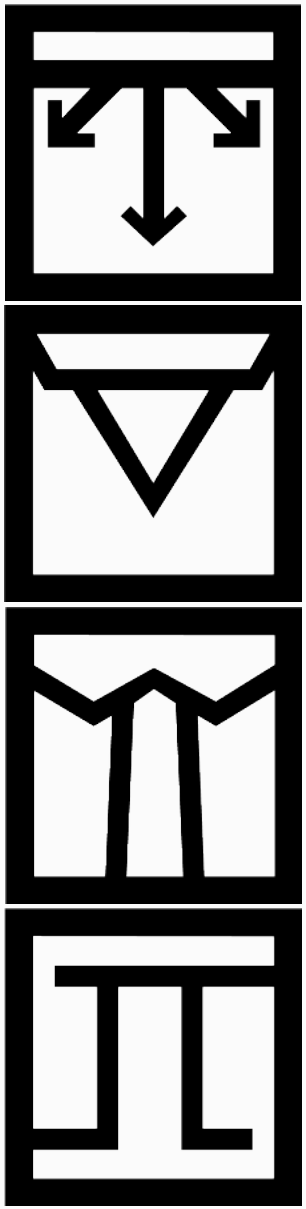

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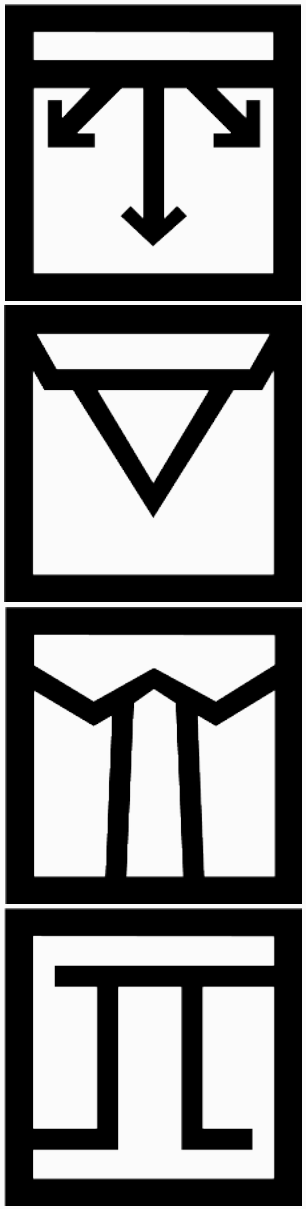

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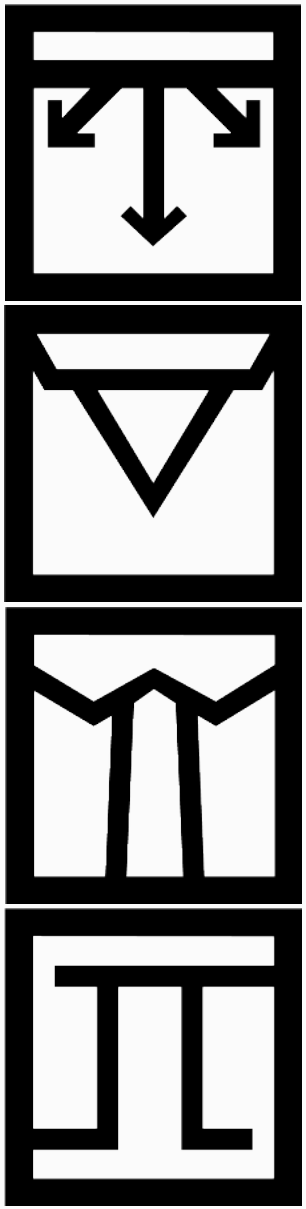
- Who knows where can it be done?

  Boruta

- Who knows how to do it?

Responsibilities



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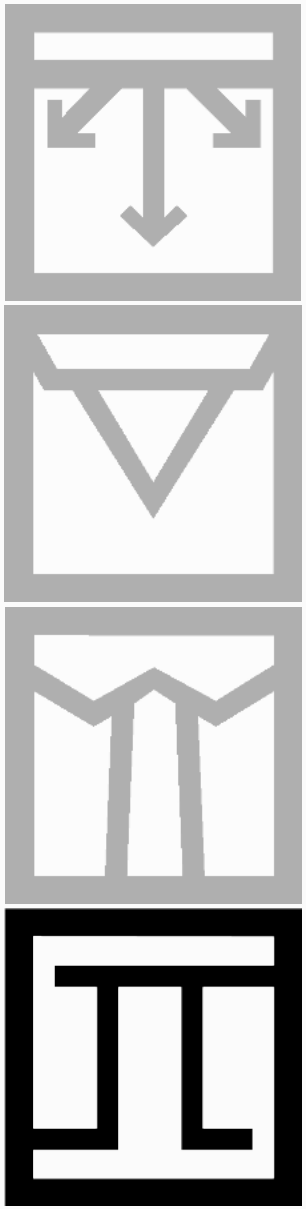
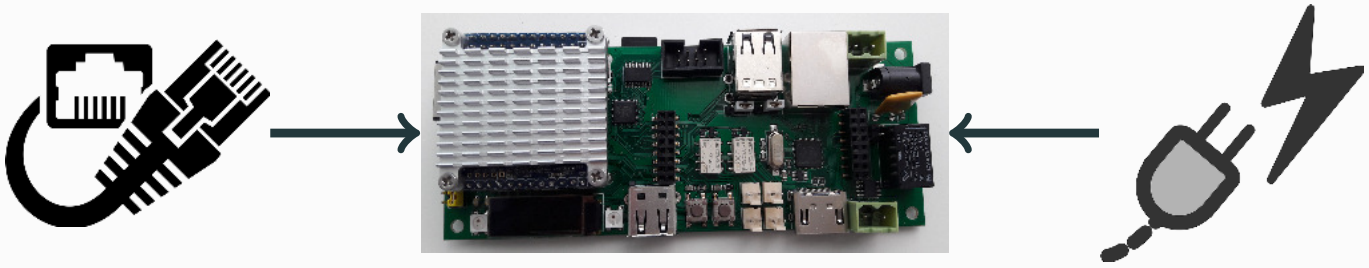
  MuxPi

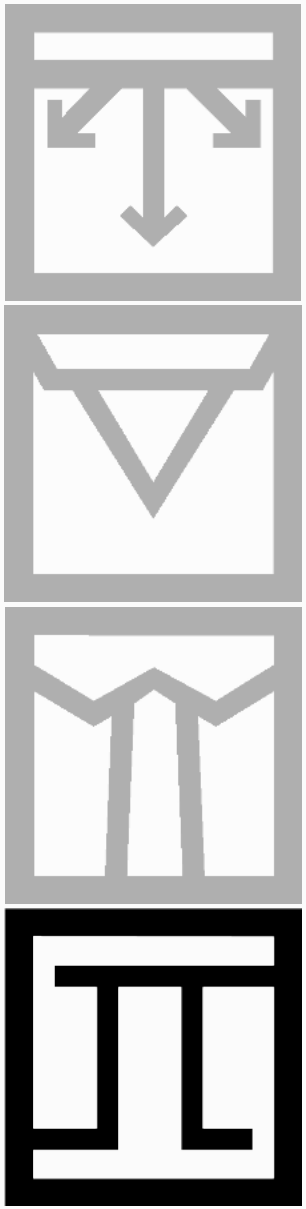
MuxPi (farm)



- Manages single DUT
- Fully aware of its capabilities
- Requires **only two** interfaces
  - Power supply
  - Network connection (Ethernet)

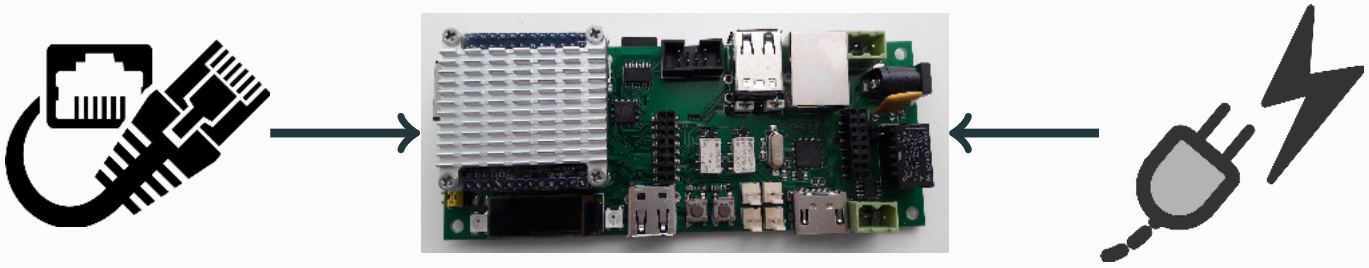


MuxPi (software)



```
$ fota --help
Usage of fota:
  -card string
    path to SDcard
  -map string
    path to JSON formatted mapping
  -md5 string
    URL to MD5SUMS file
  -quiet
    suppress logging
```

```
$ stm --help
Usage of stm:
  -dut
    connect SD card to DUT
  -m duration
    time delay for tick command
  -tick
    power off and on after 'm' (s)
  -ts
    connect SD card to test server
```



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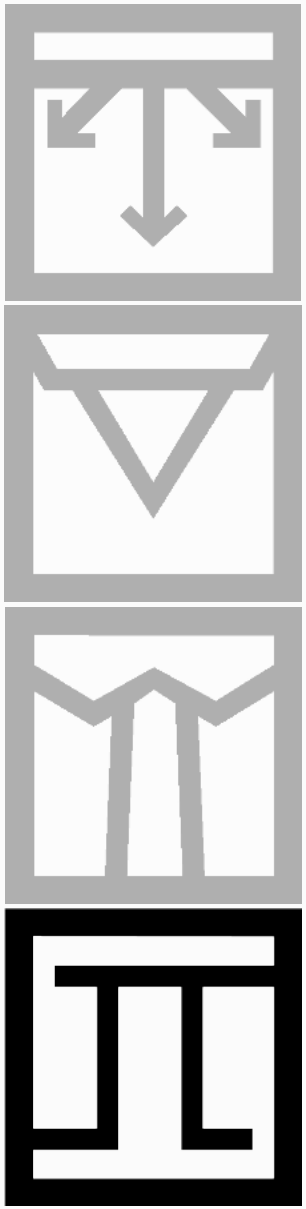

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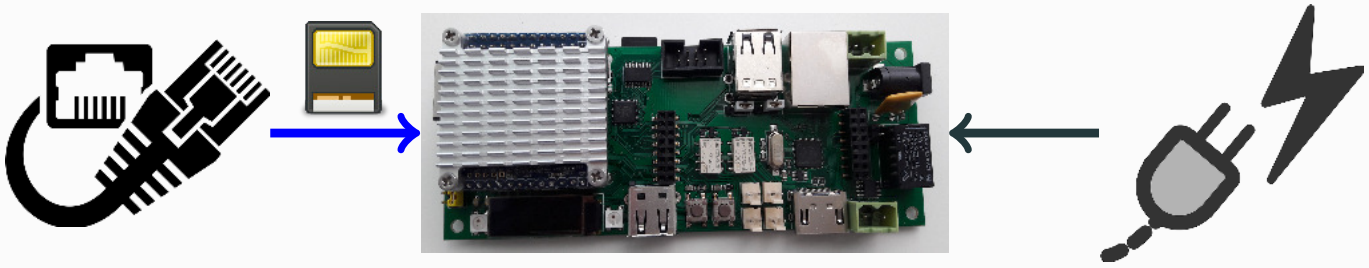

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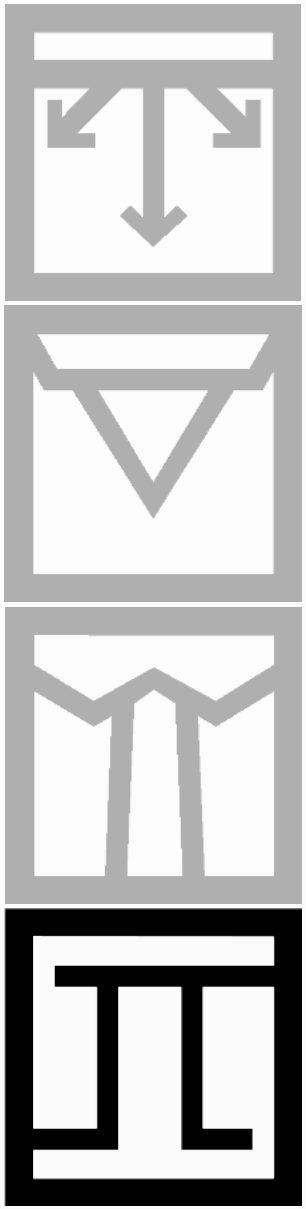

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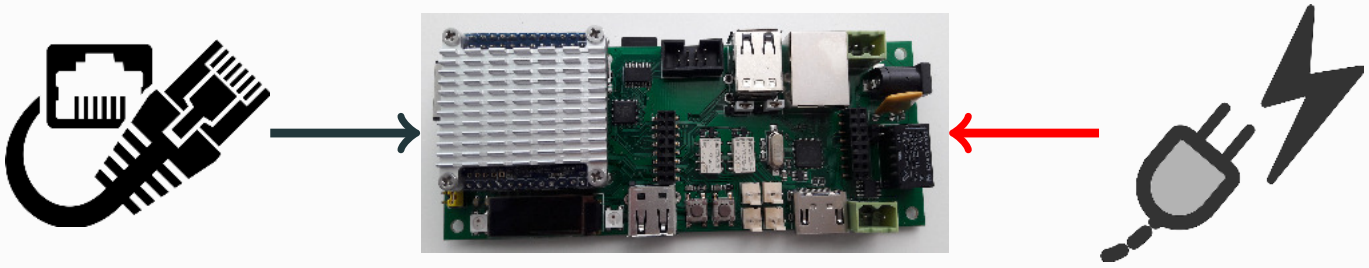

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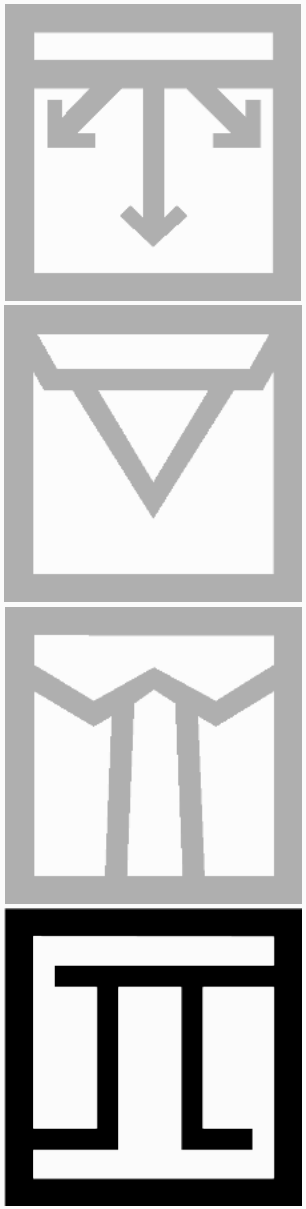

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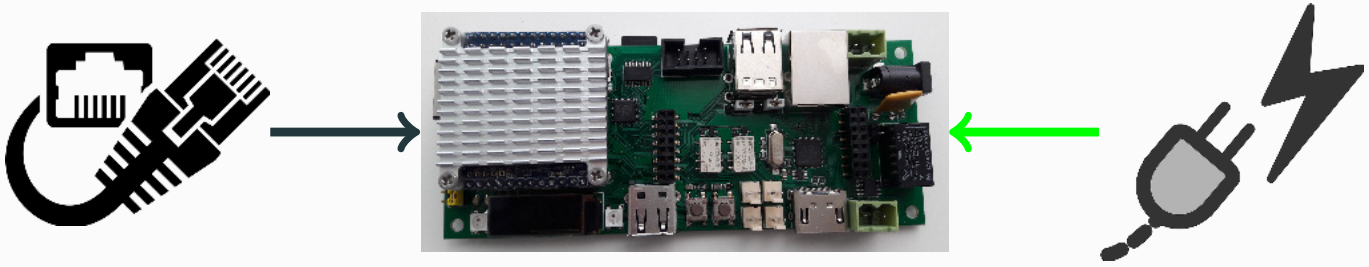
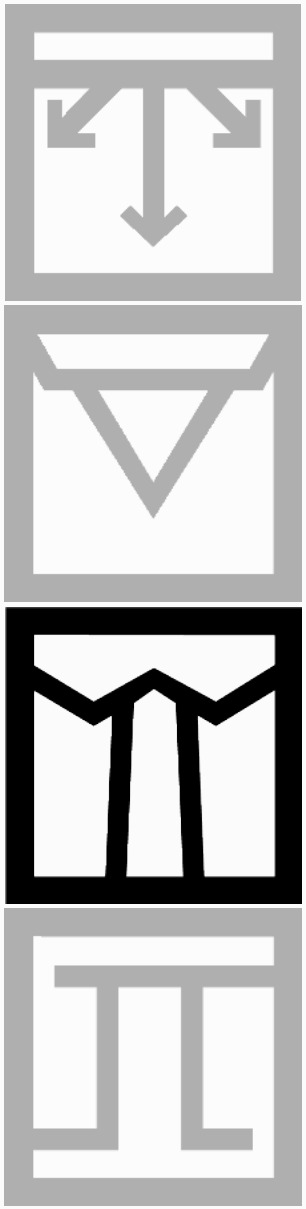
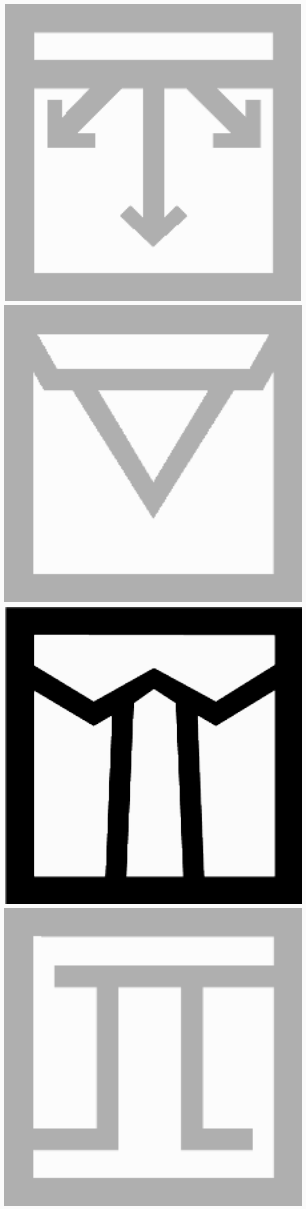


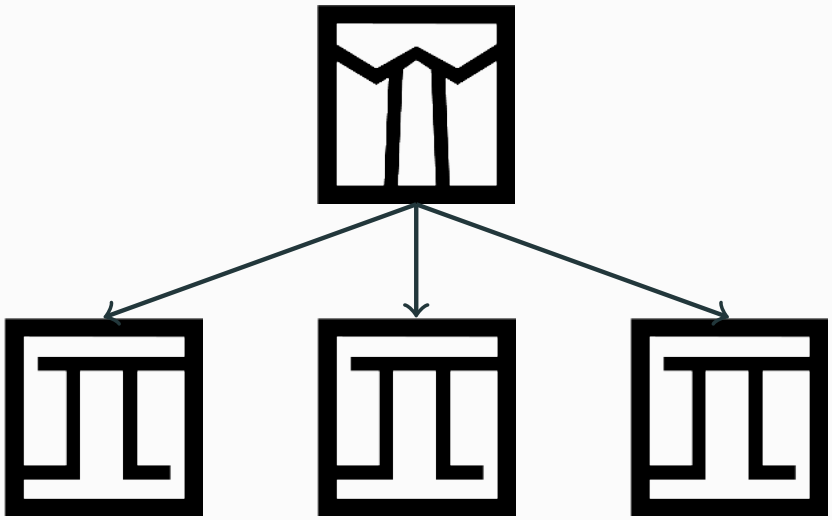
Boruta



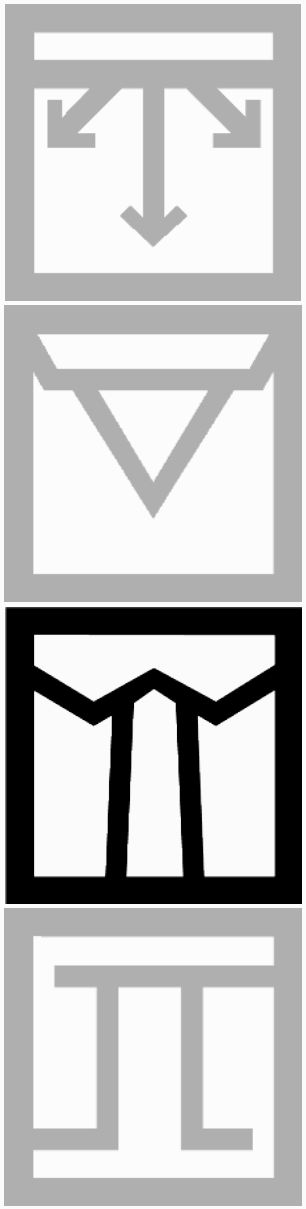
- Dryad farm management system
- Schedules requests
  - Priority
  - Device groups
  - Delayed access
- Provides convenient access to selected Dryad

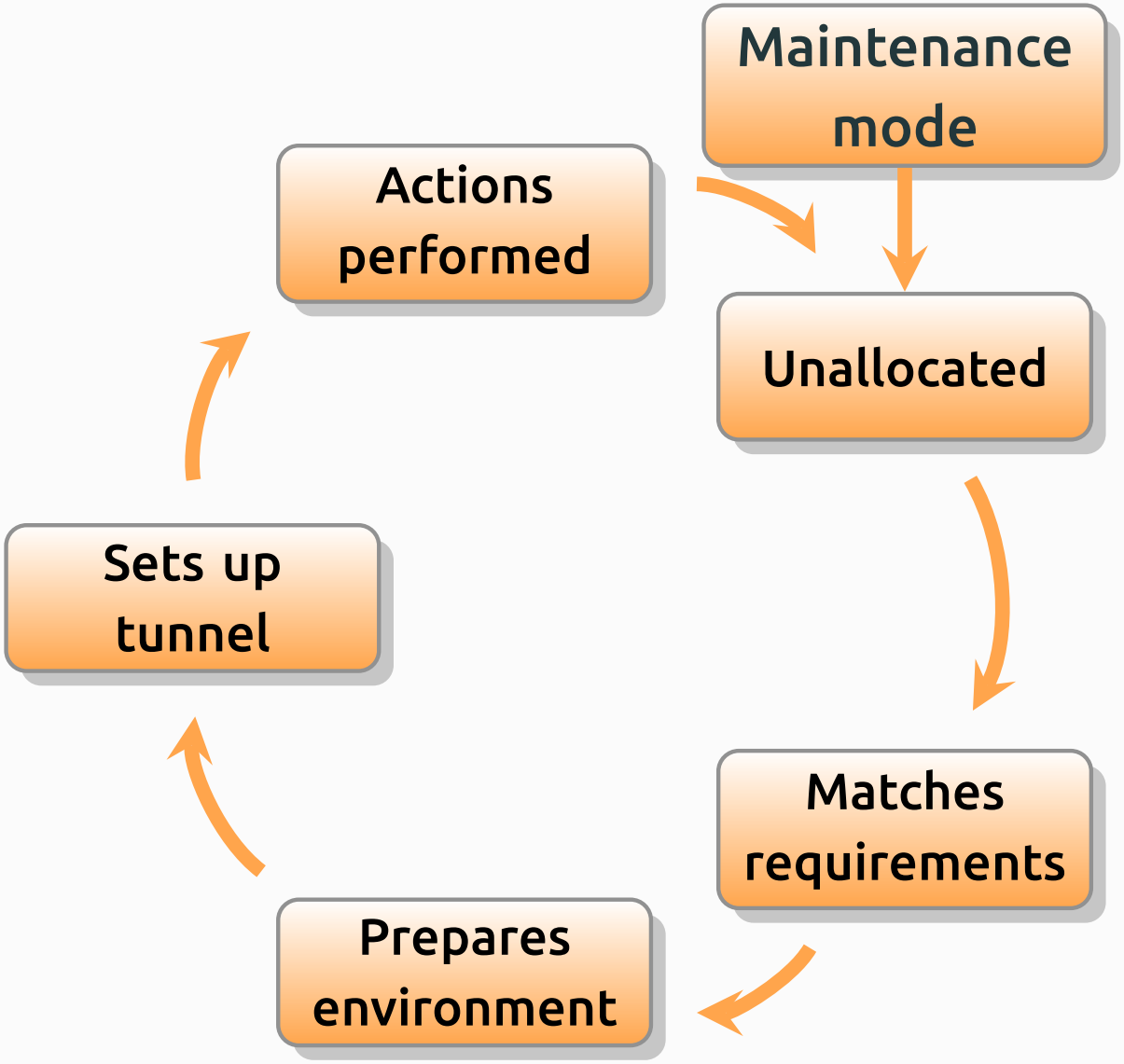
Boruta on stack



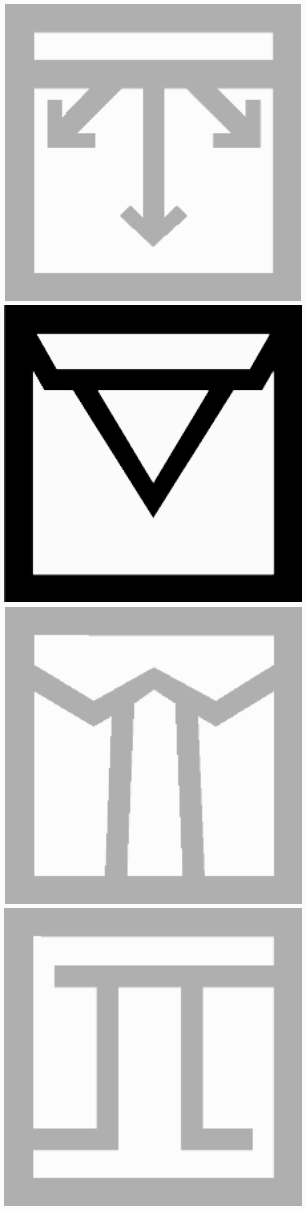


Dryad life cycle in Boruta



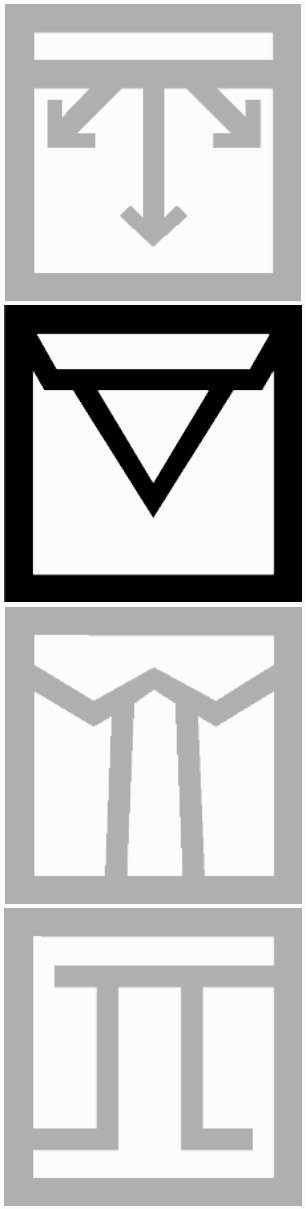


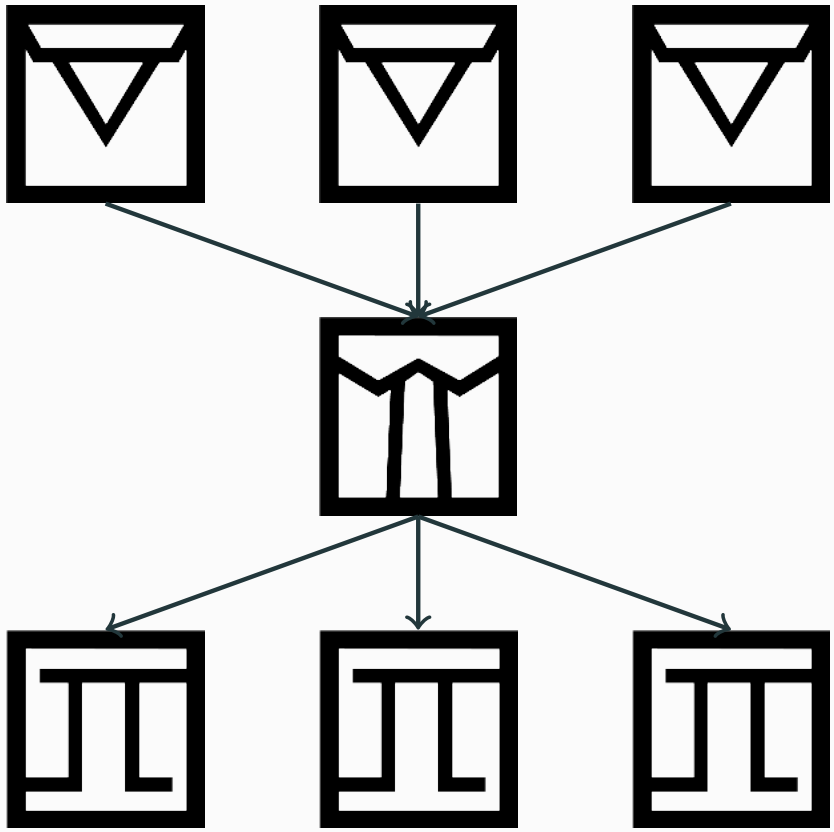
Weles



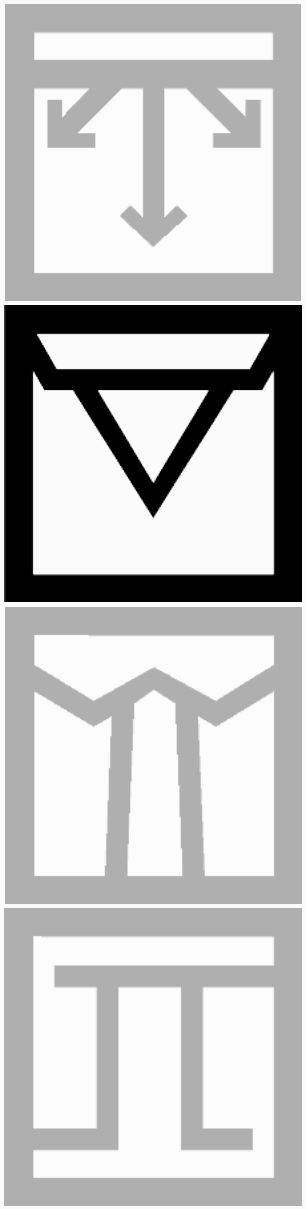
- Lightweight testing framework
- Provides LAVA-like interface
- YAML job definition $\mapsto$ actions executed on DUT
  - Deploy
  - Boot
  - Test
  - Collect

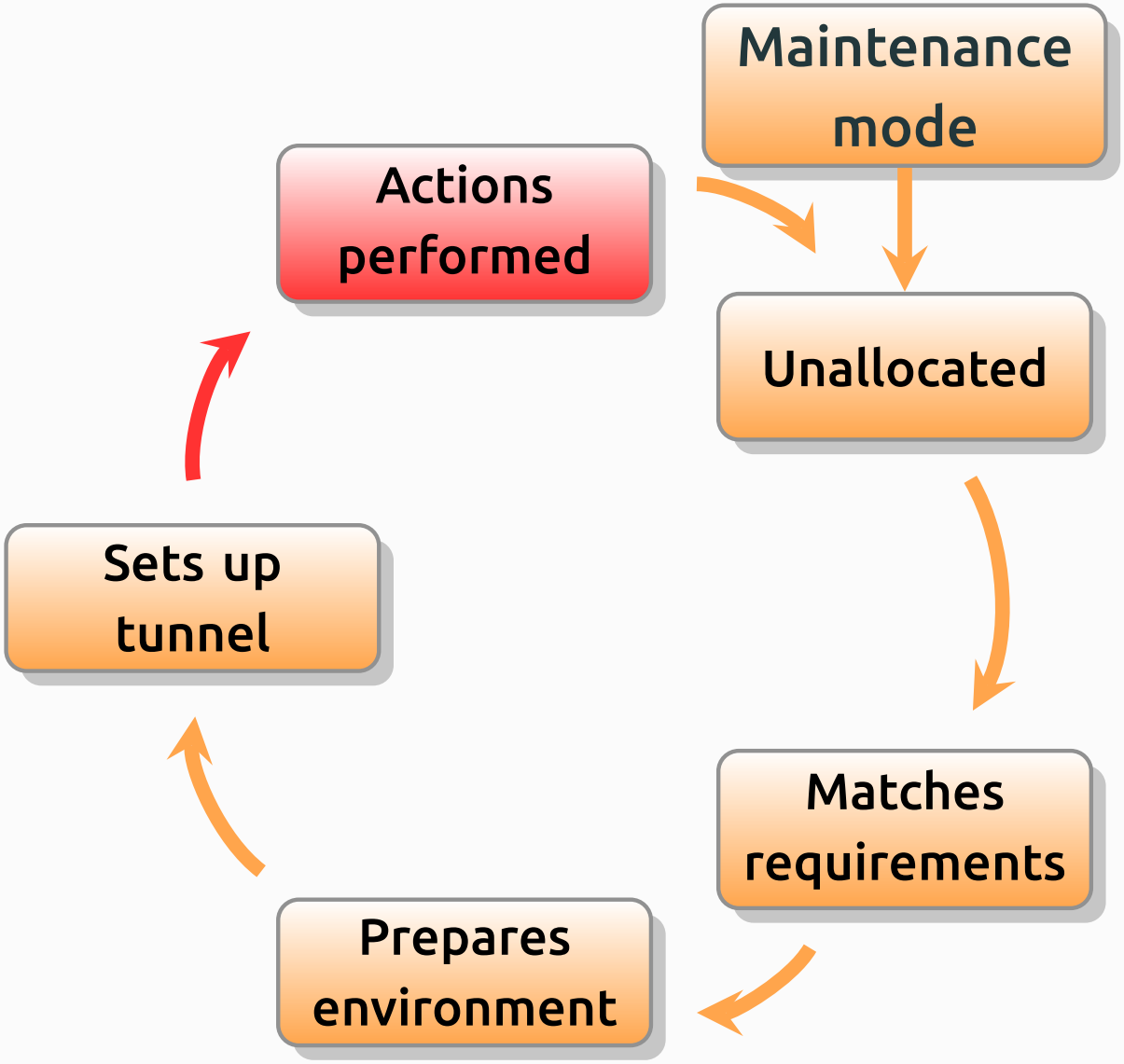
Weles on stack



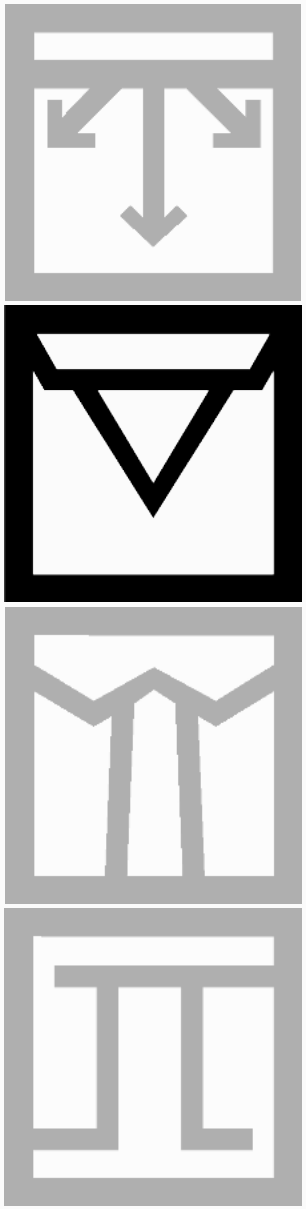


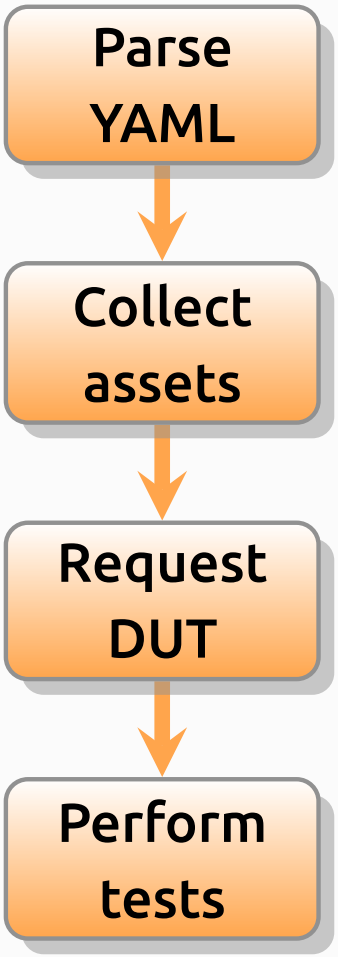
Weles purpose



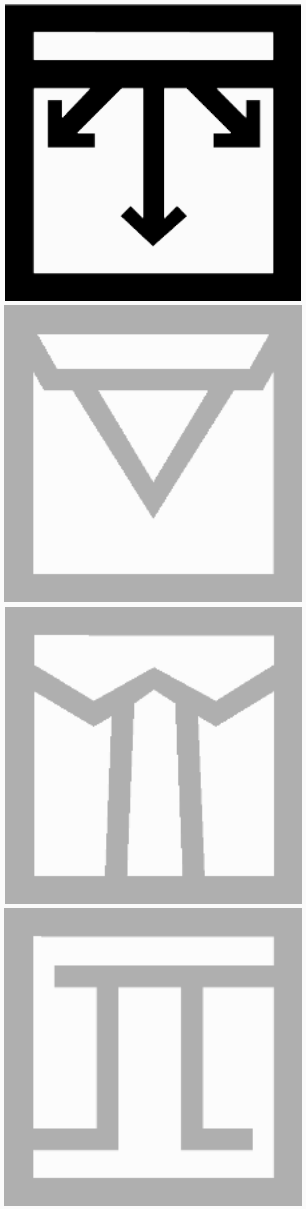


Weles action sequence



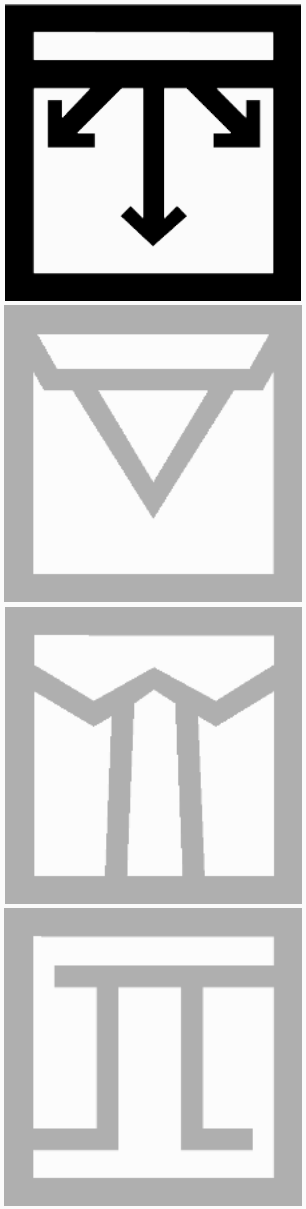


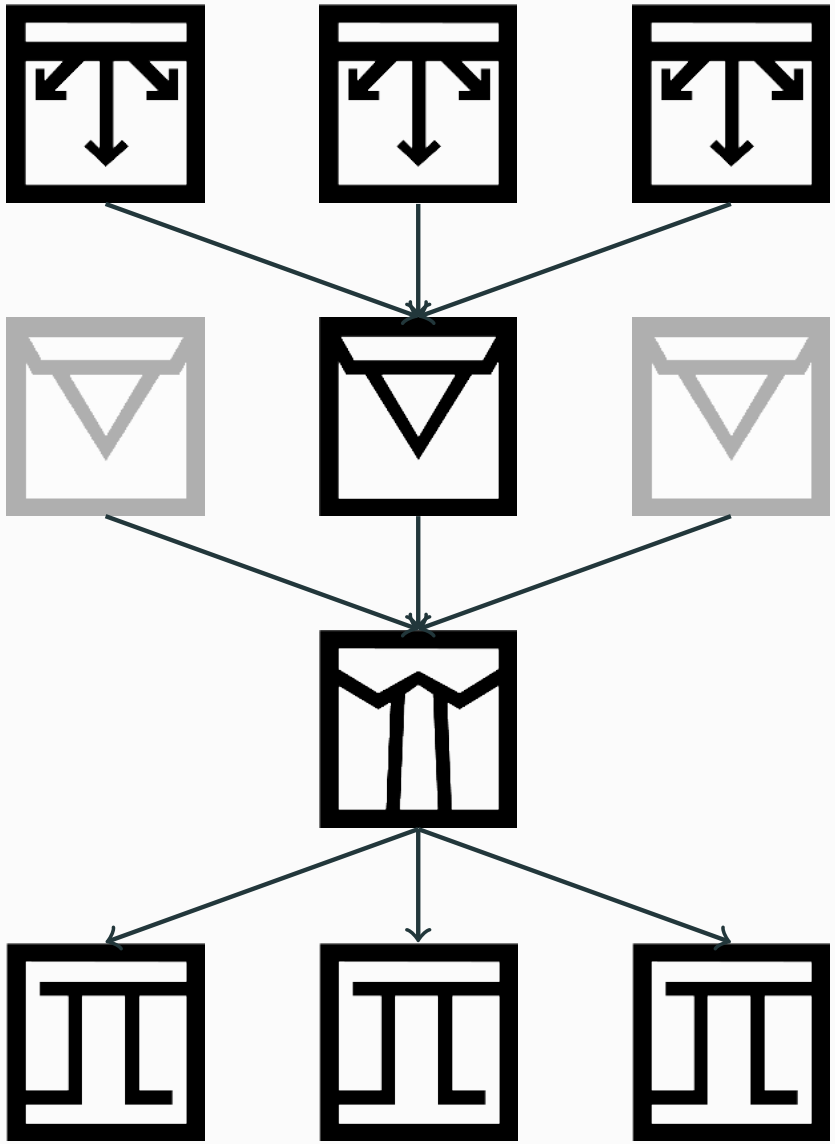
Perun



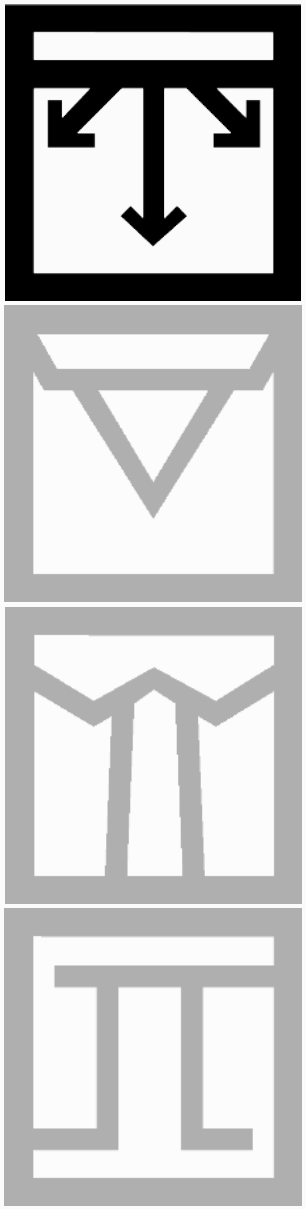
- OS images testing system
- Schedules verification
  (per new set of OS images)
- Automates QA step of
  Release Engineering Duty

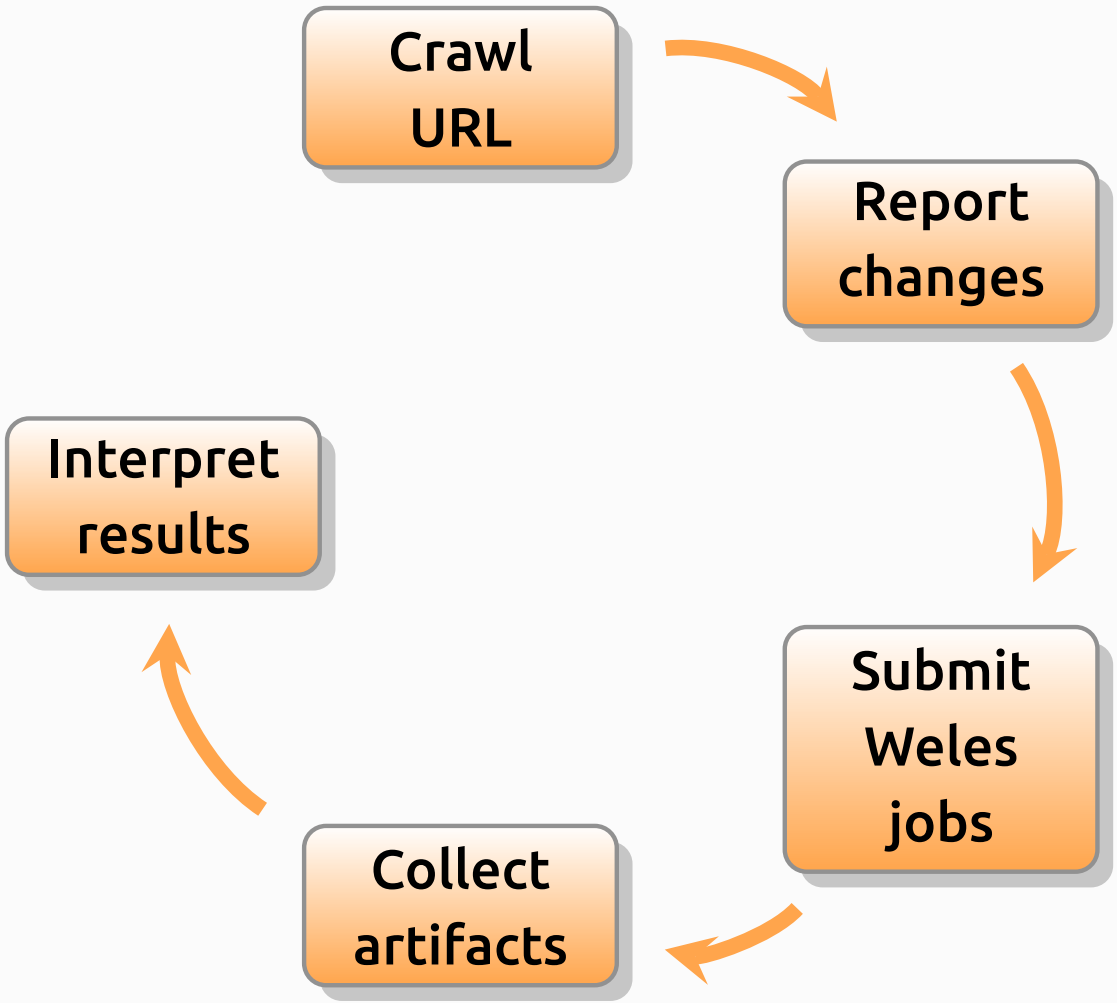
Perun on stack



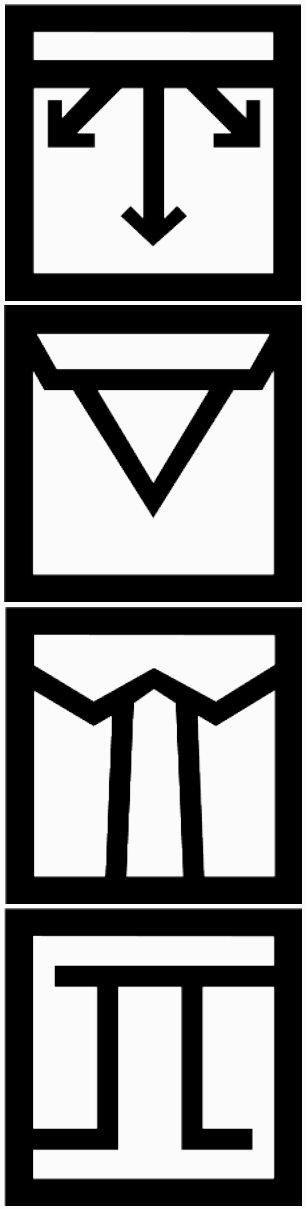


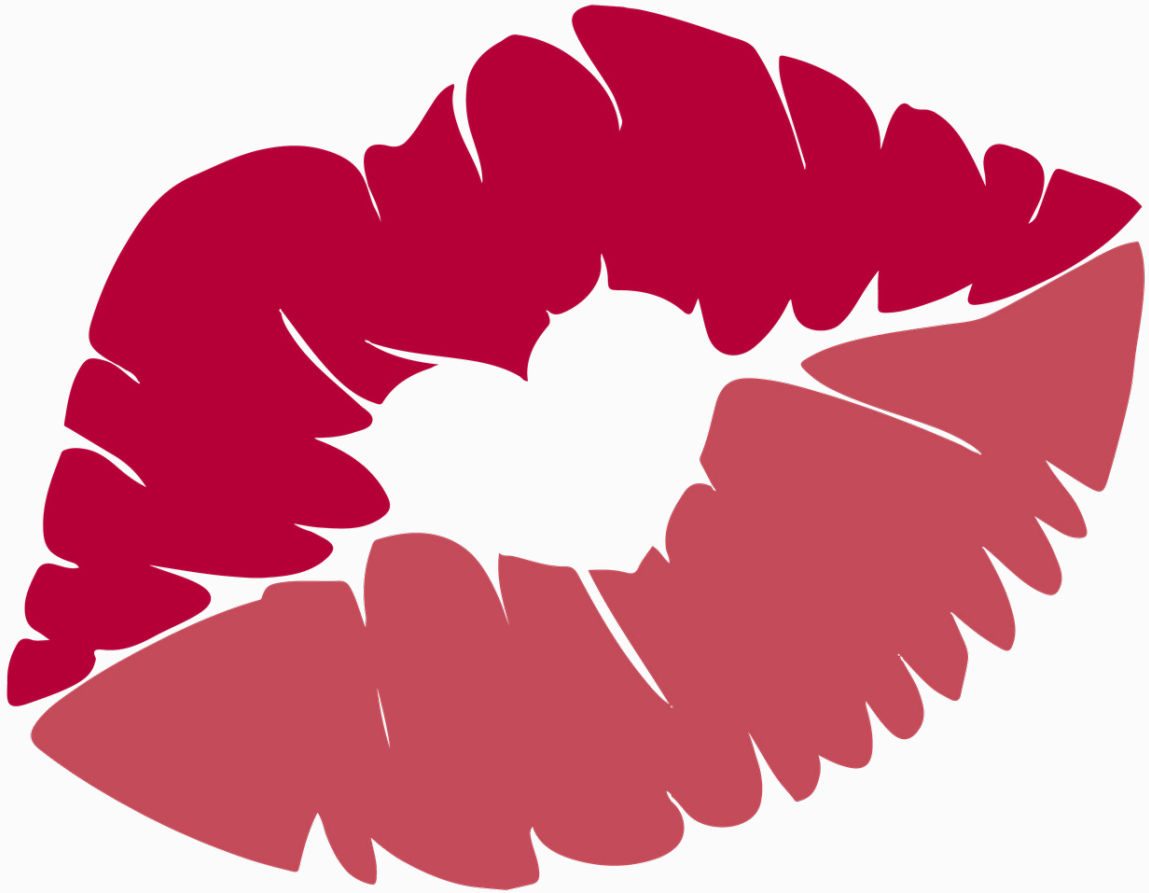
Perun action sequence



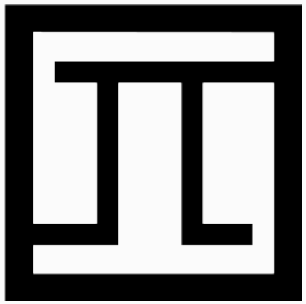


Keeping it simple

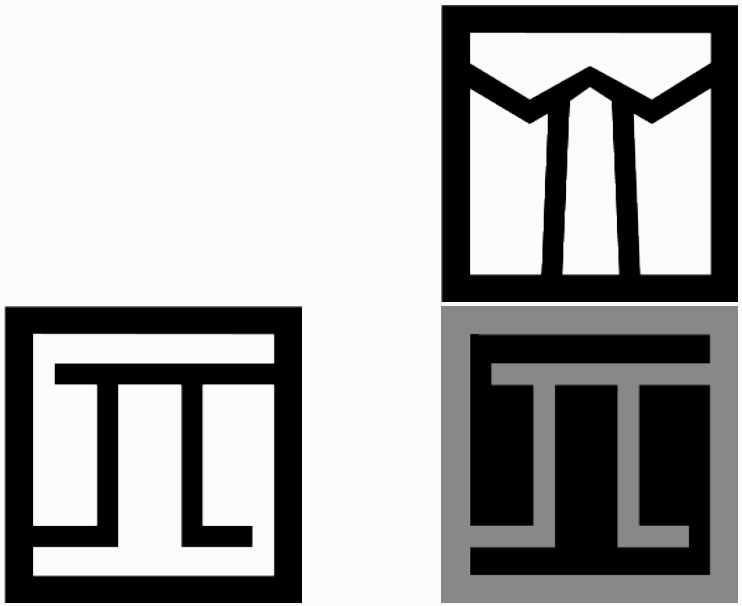




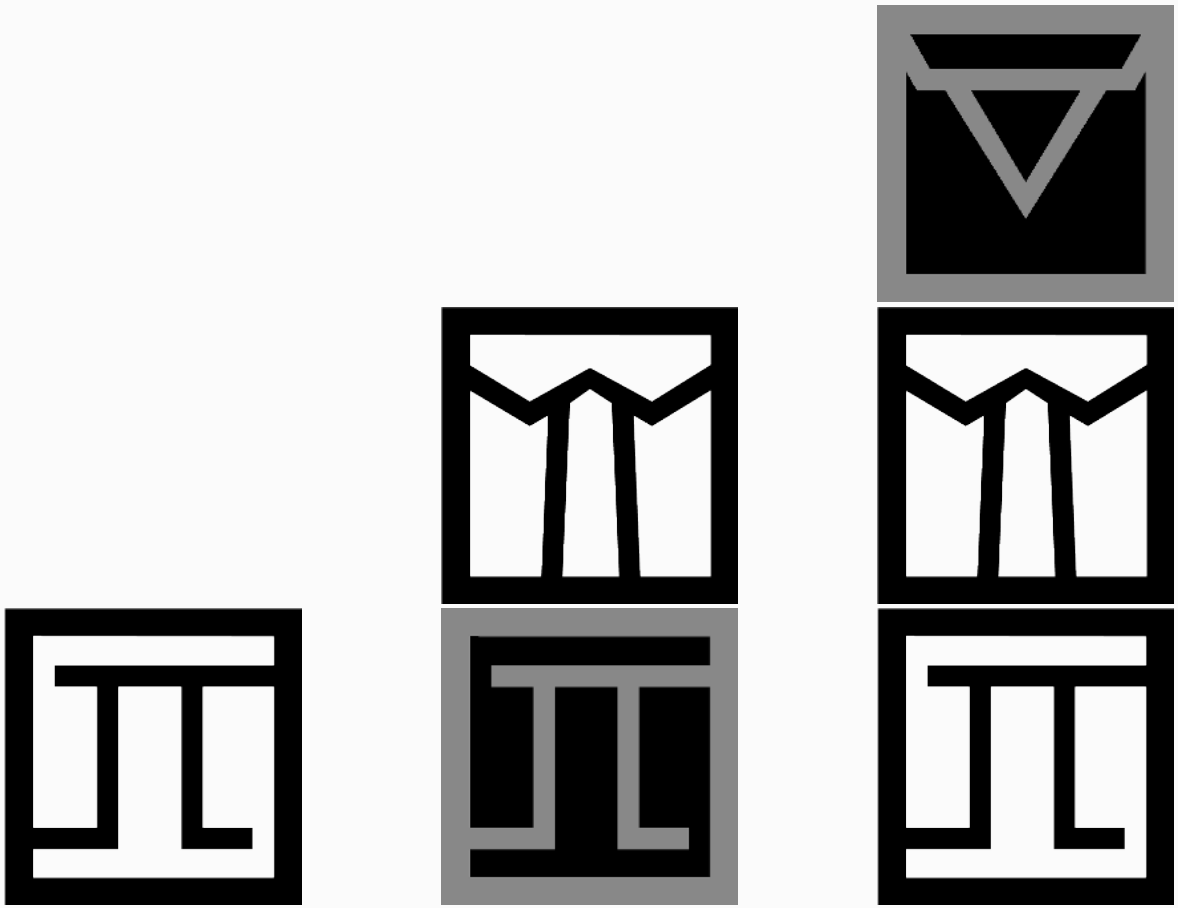
Keeping it simple (and decoupled)



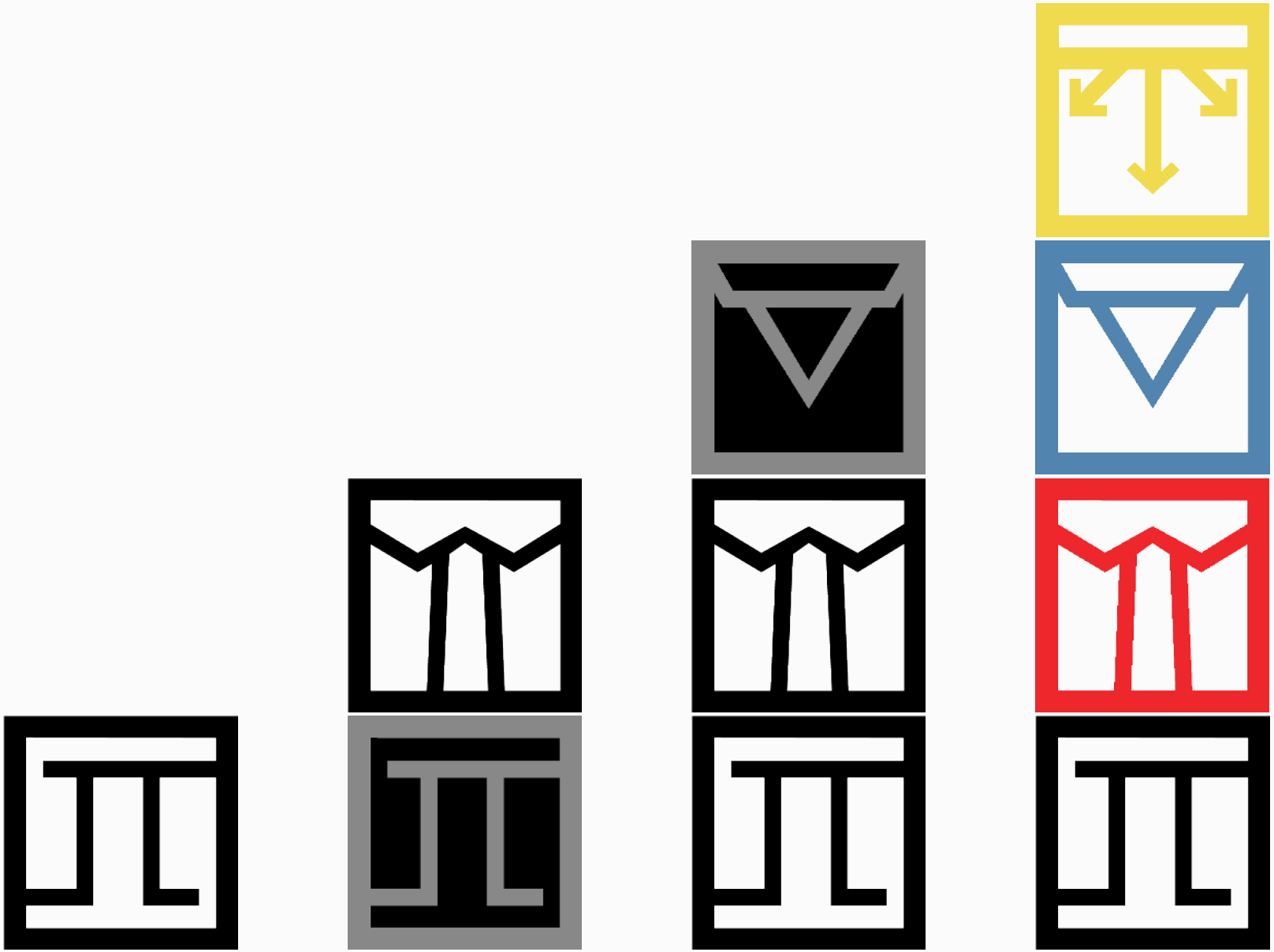
Keeping it simple (and decoupled)



Keeping it simple (and decoupled)



Keeping it simple (and decoupled)



Next steps

Future plans

Hardware

- Audio I/O
- USB Type C investigation
- NanoPi serial console on USB

Software

- Web interfaces for current layers
- Service state management
- Release engineer's layer

Further details

- MuxPi

  https://wiki.tizen.org/MuxPi
- SD MUX (deprecated – lesson learnt)

  https://wiki.tizen.org/SD_MUX

Help?

- Mailing list

  general@lists.tizen.org
- #tizen on Freenode

  https://webchat.freenode.net/?channels=tizen

Conclusion

Summary

- Quick setup
- Easy maintenance
- Responsibilities division
- Execution parallelization
- Environment unification

Questions?

Thank you!

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Samsung R&D Institute Poland

Acknowledgements

- Metropolis – simple, modern Beamer theme

Pictures used

- https://en.wikipedia.org/wiki/File:Heckert_GNU_white.svg
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