Piece of cake – testing remote embedded devices made easy

using open-hardware MuxPi

Paweł Wieczorek

February 3, 2018

Samsung R&D Institute Poland

Agenda

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

Introduction

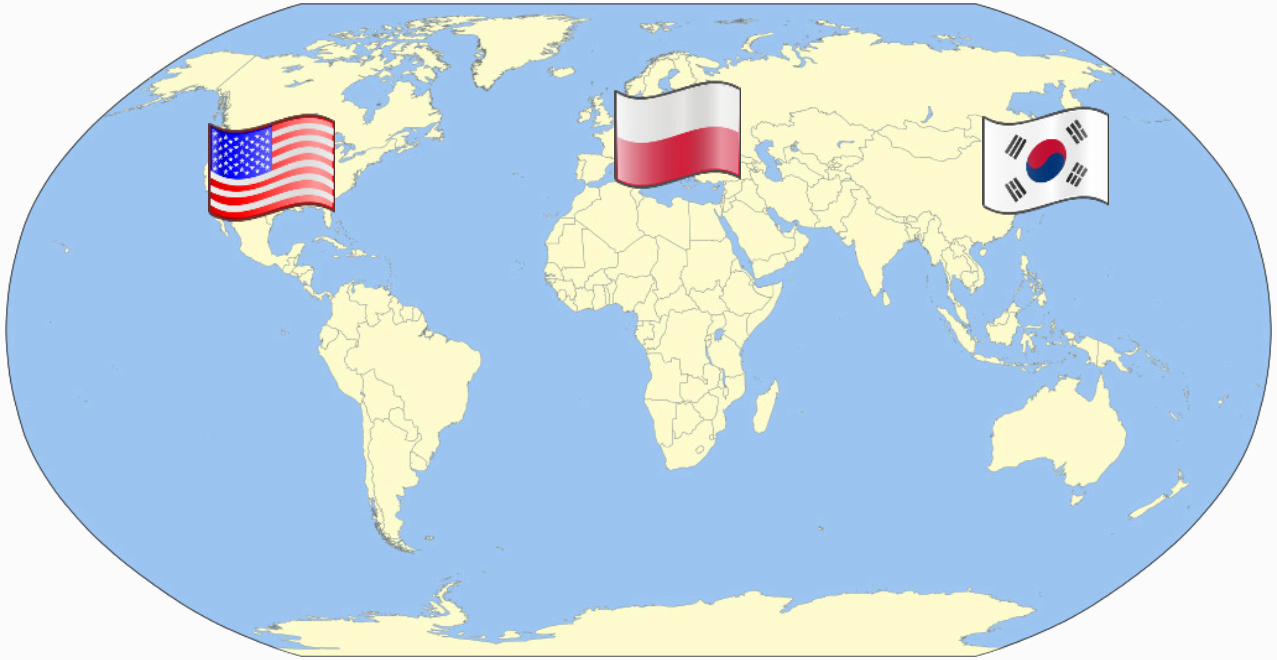
Tizen use cases

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



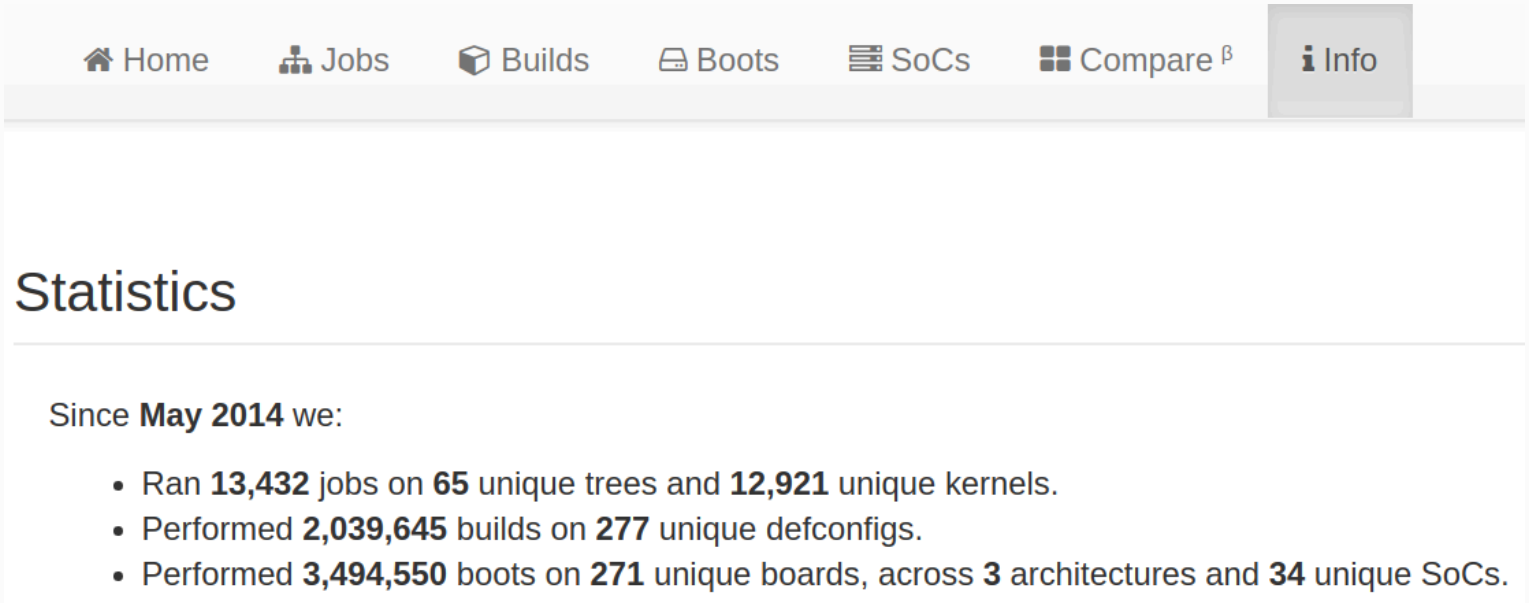
- Easy to store in a secure manner
- Less effort than per developer
- Better utilized when shared

Previous efforts

LAVA

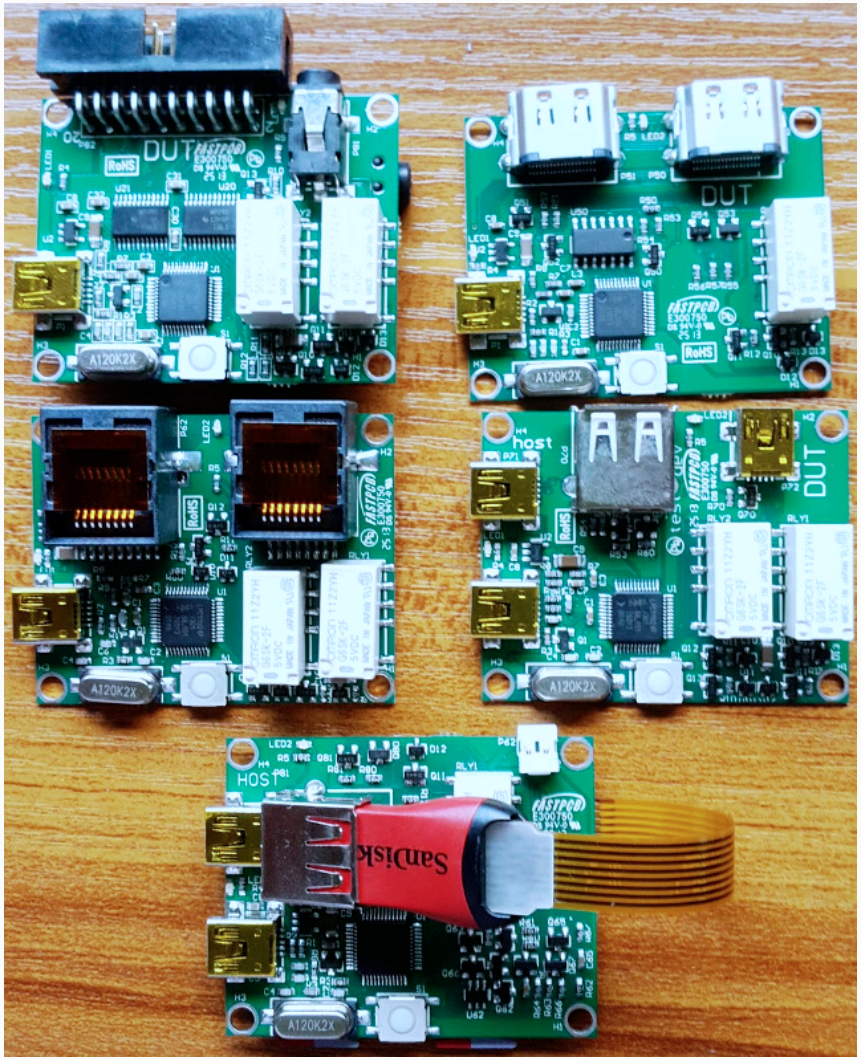
- Linaro Automated Validation Architecture
- Automation system for deploying operating systems
- Virtual and physical hardware supported
- Allows running boot, bootloader and system level tests

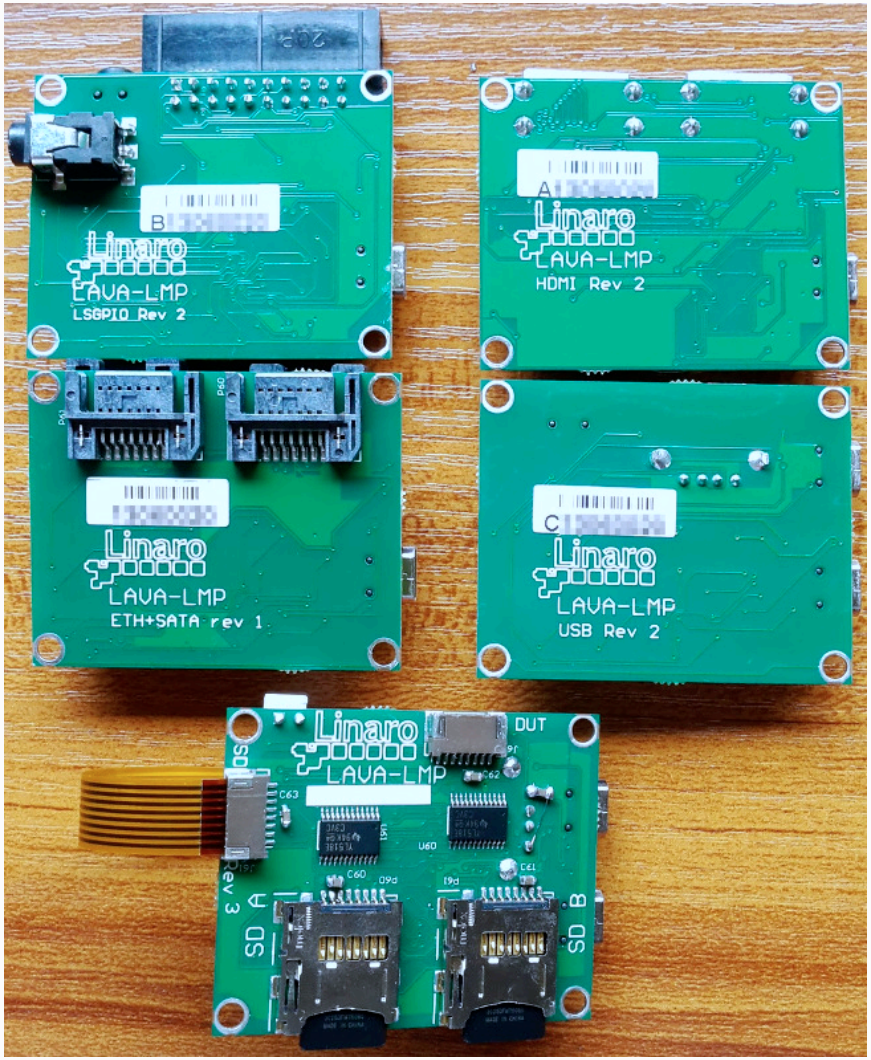
Kernel CI



https://kernelci.org/stats/

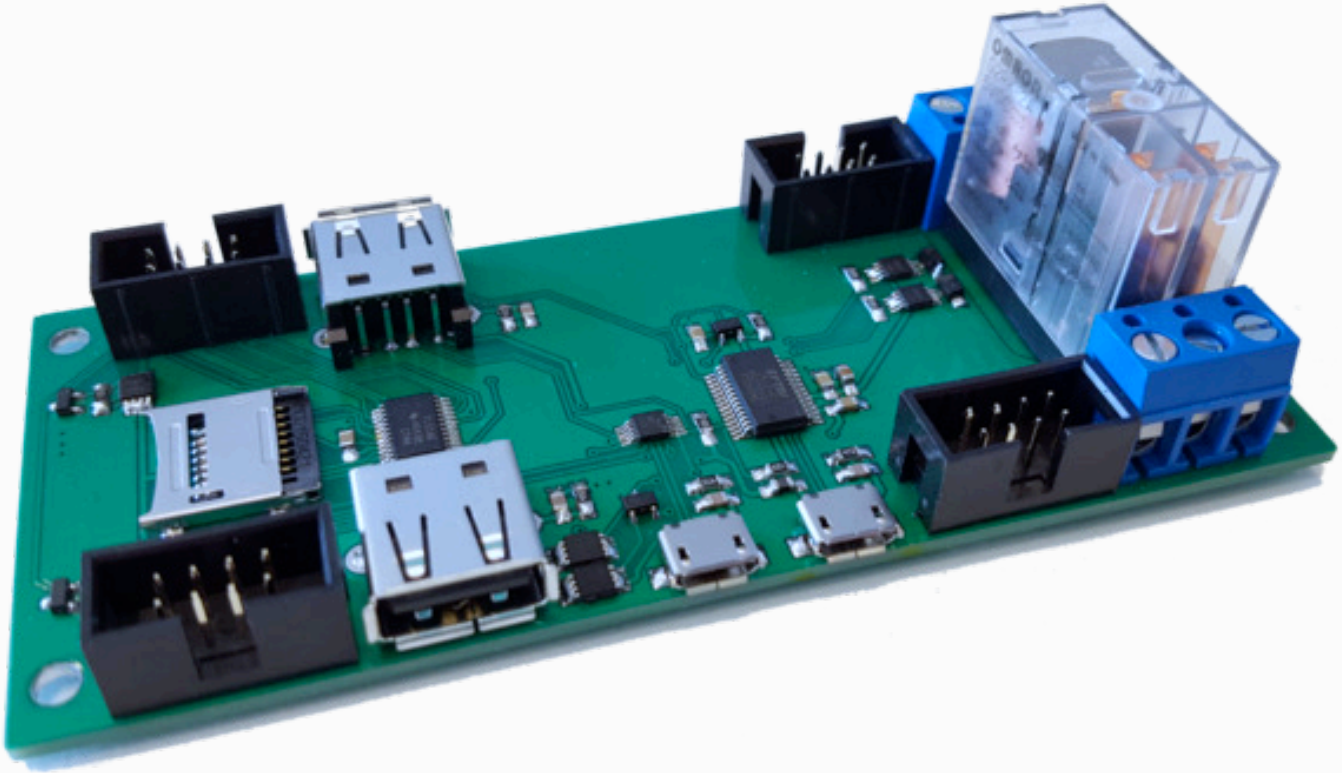
LAVA LMP





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

SD MUX – 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

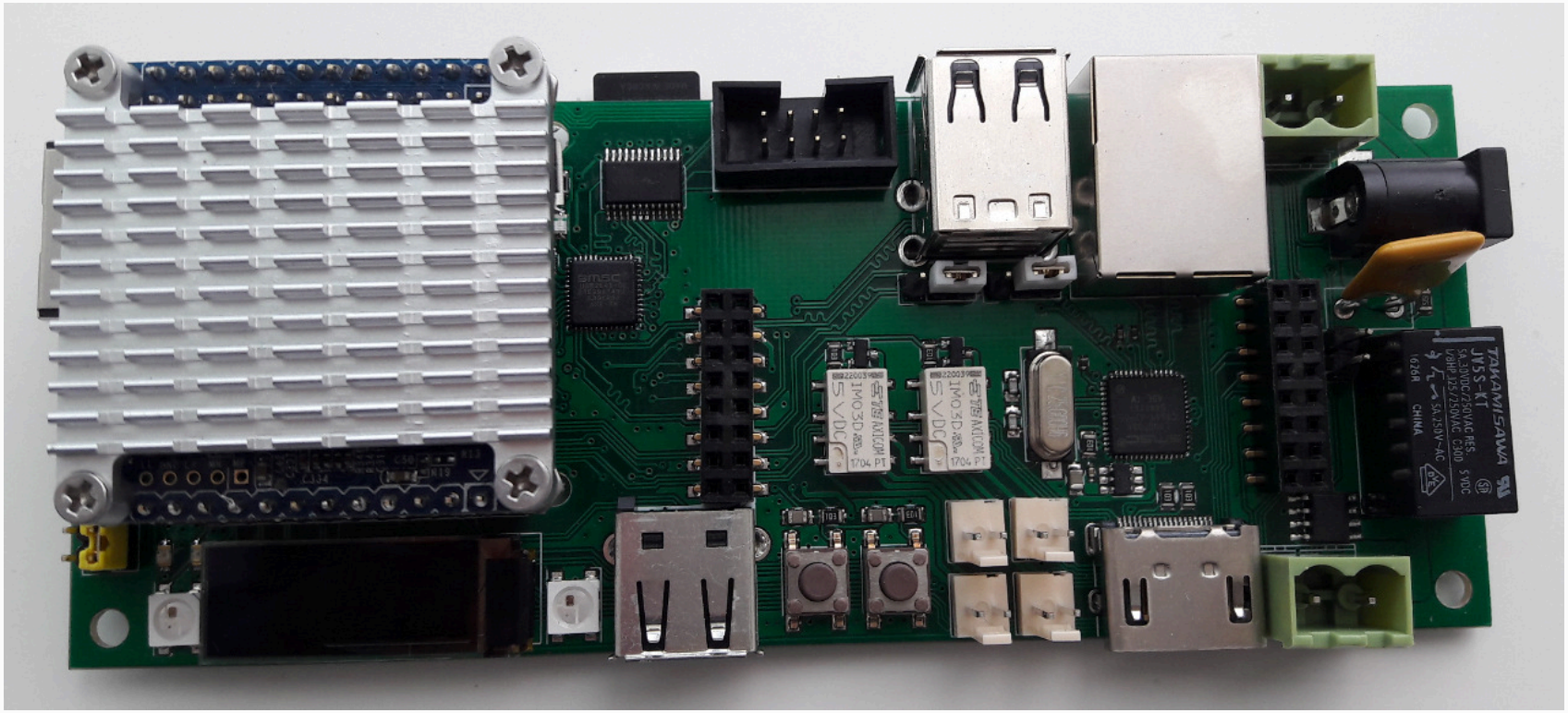
```
$ dmesg | tail -12
[ 98.375599] usb 3-1: new full-speed USB device number 12 using xhci_hcd
[ 98.487663] usb 3-1: device descriptor read/64, error -71
[ 98.703656] usb 3-1: device descriptor read/64, error -71
[ 98.919658] usb 3-1: new full-speed USB device number 13 using xhci_hcd
[ 98.919969] usb 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

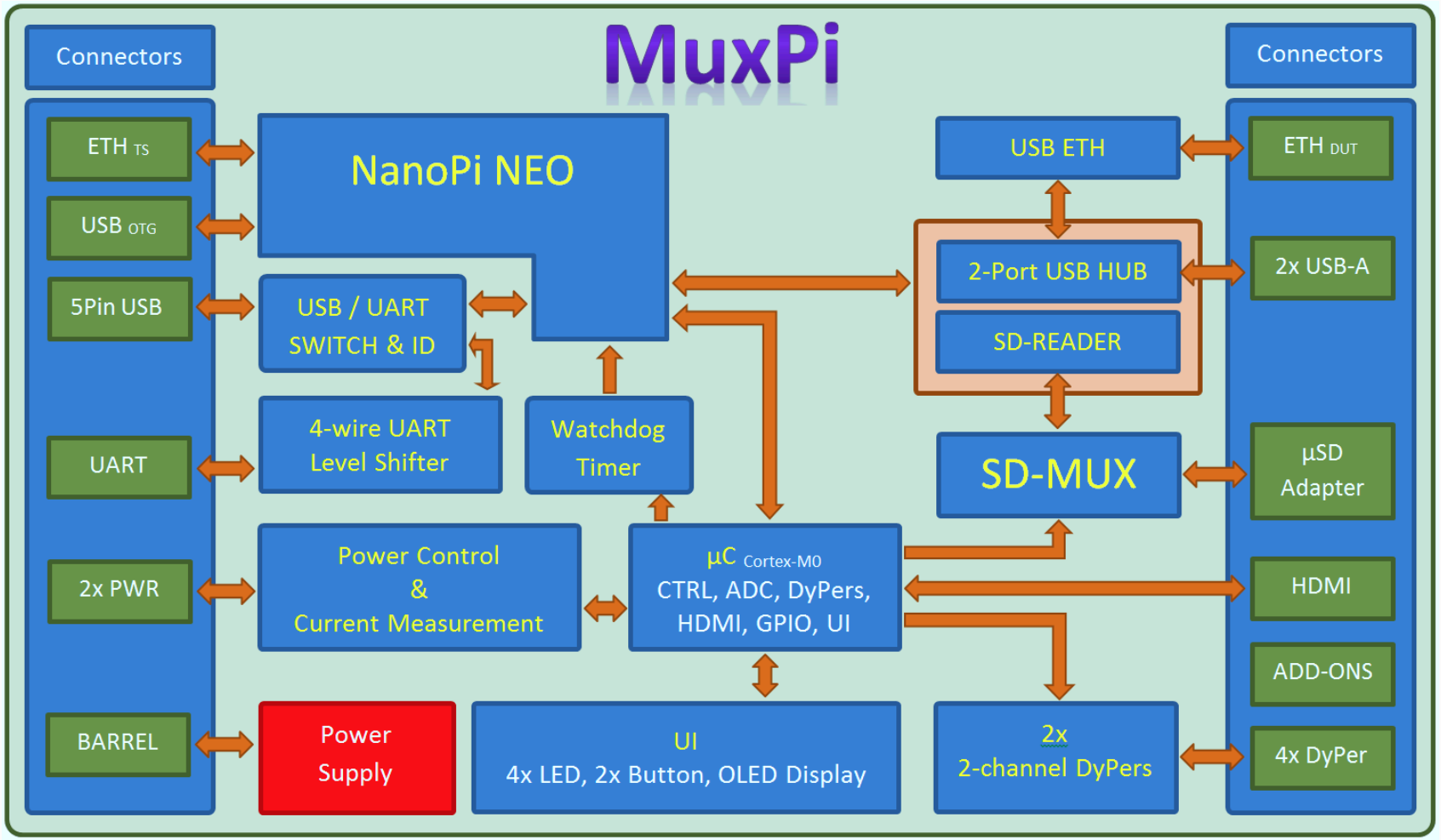
Lessons learnt

Hardware

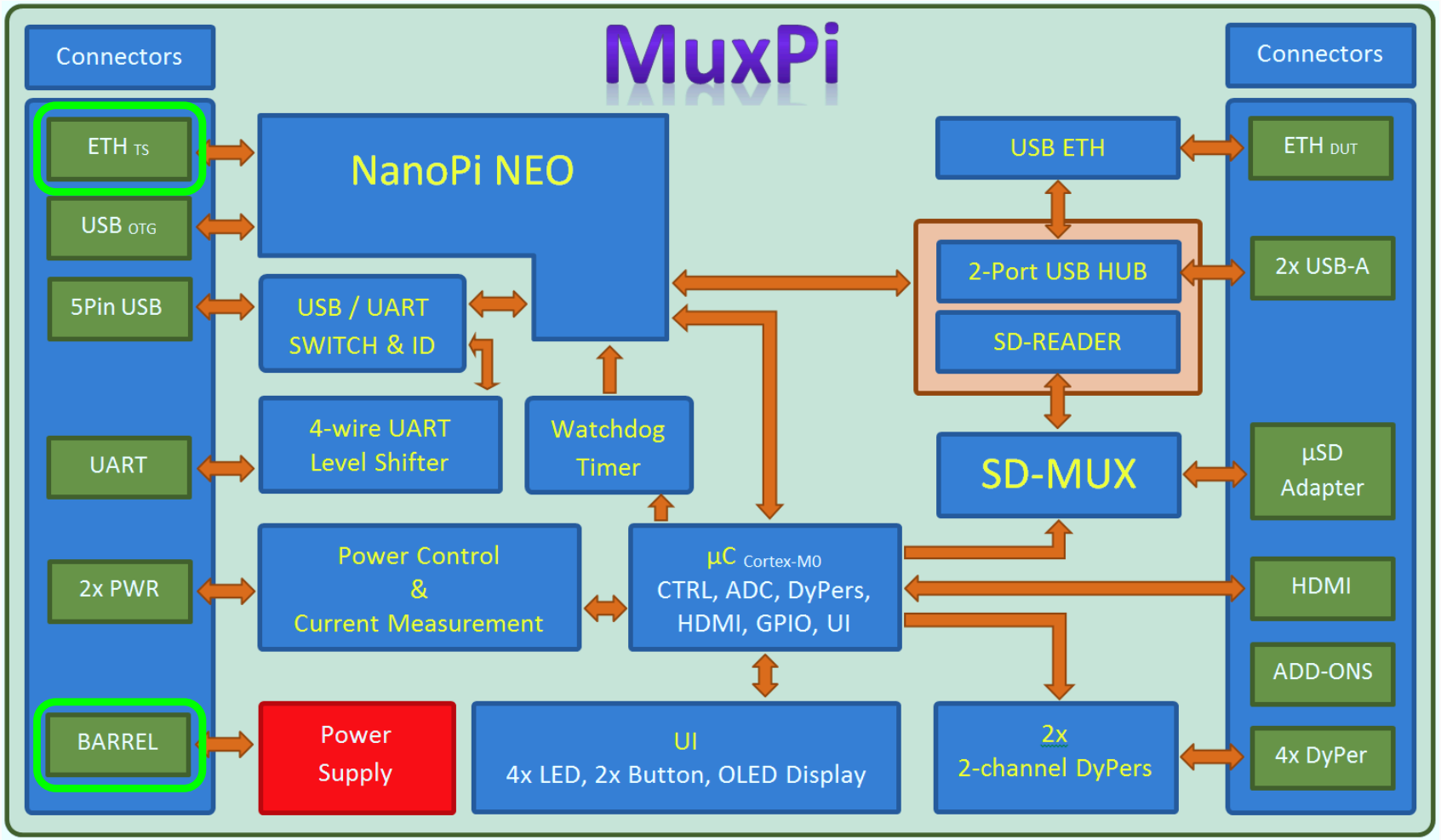
MuxPi



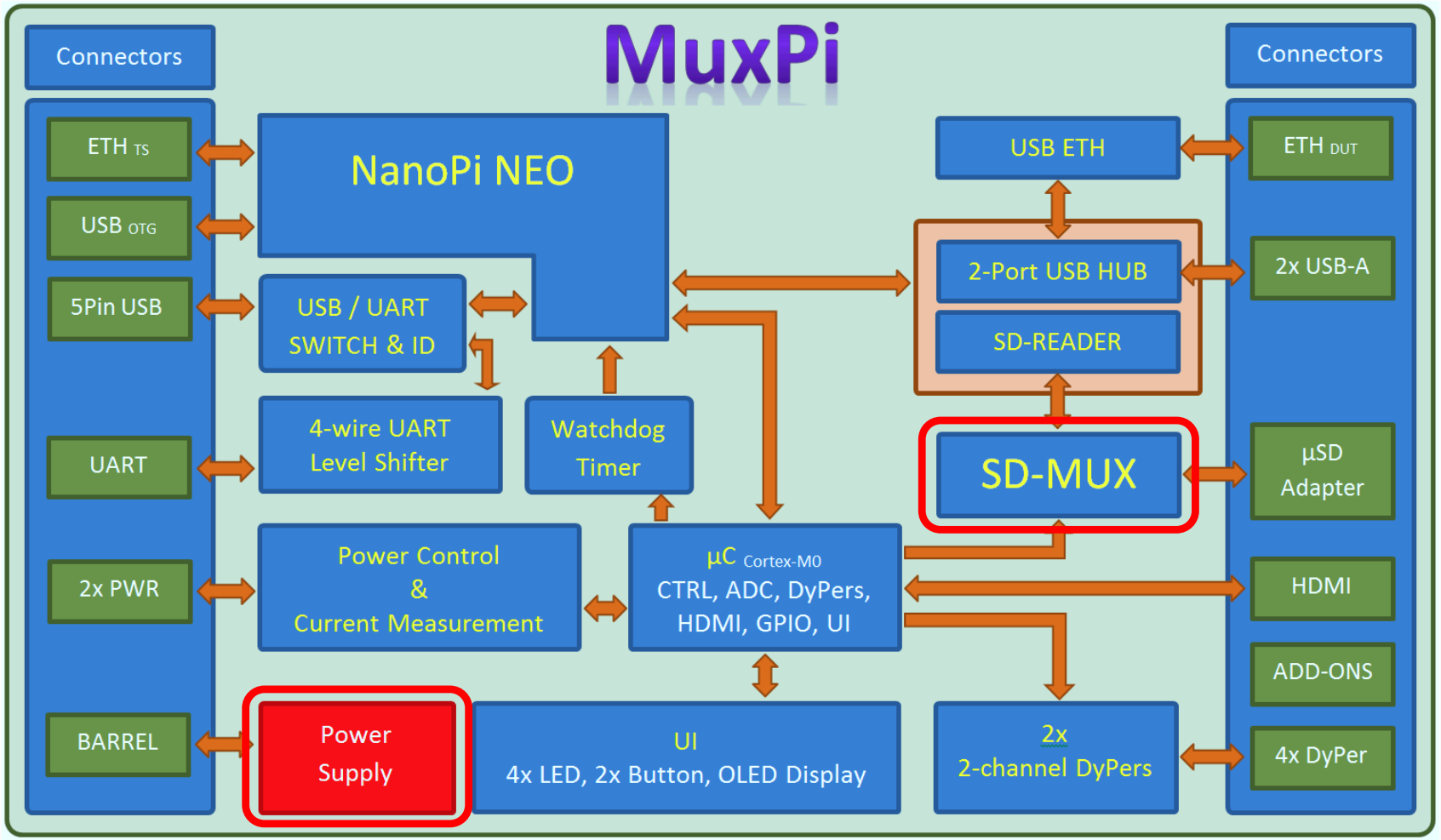
MuxPi components



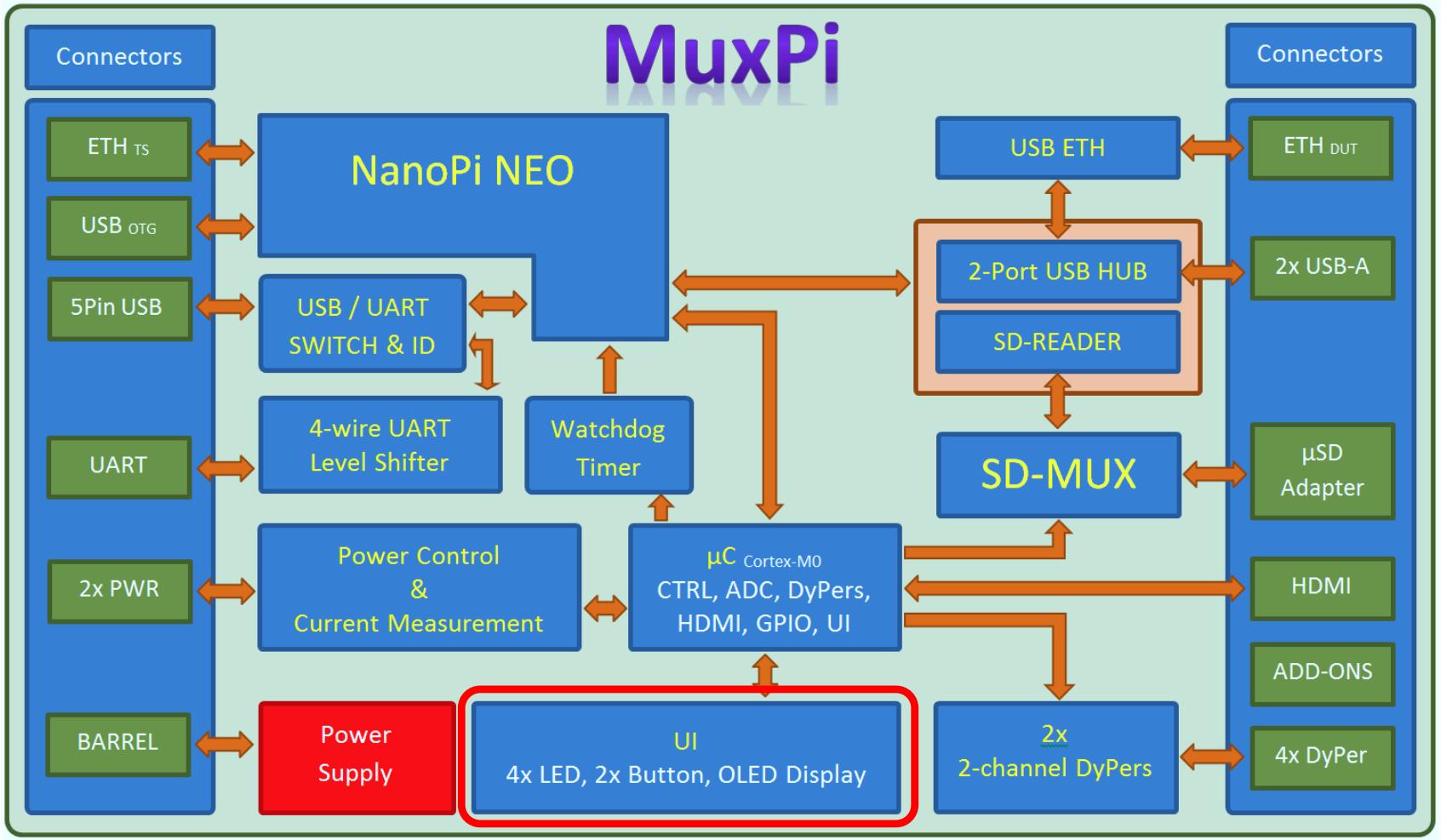
MuxPi components



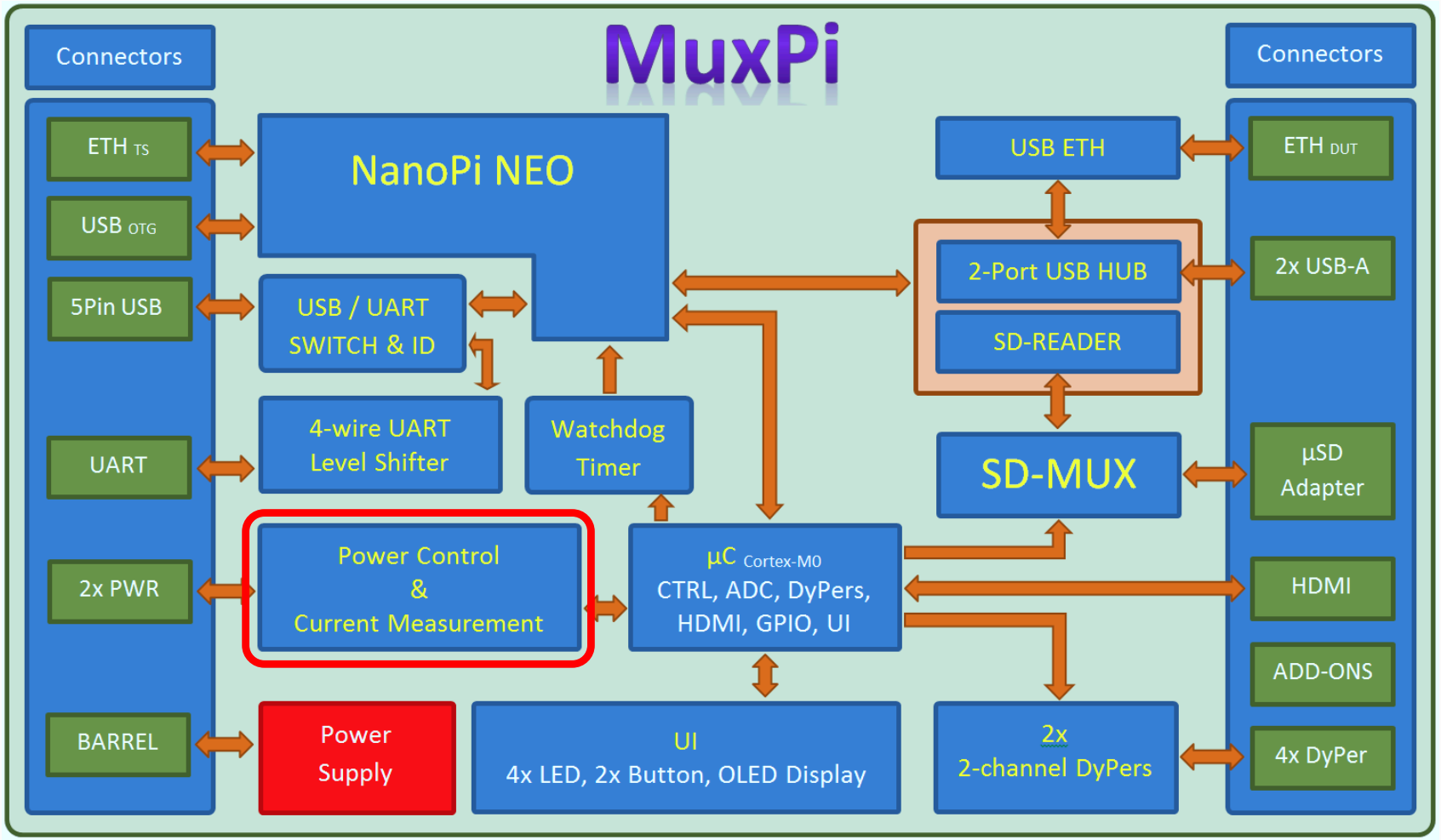
MuxPi components



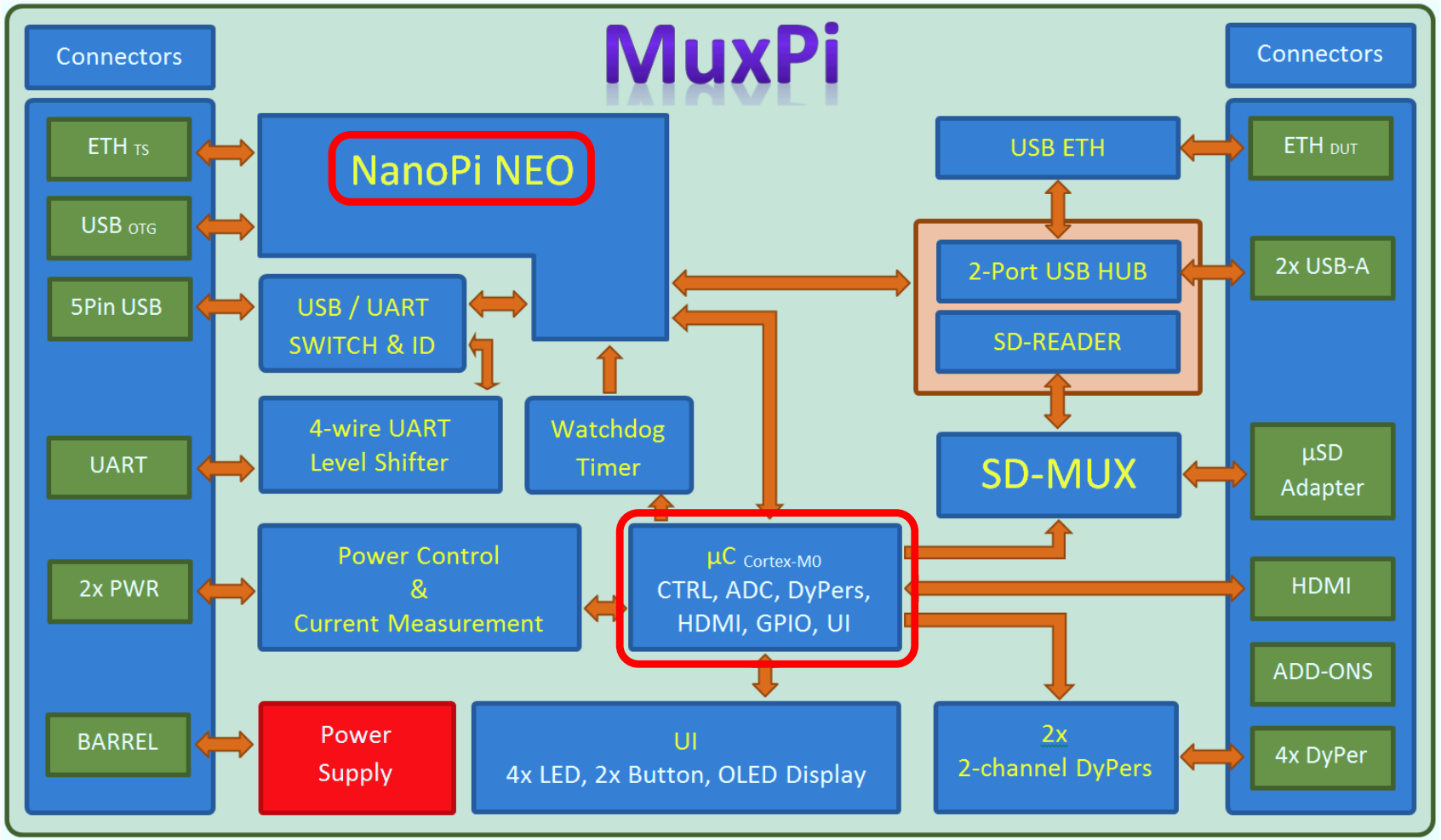
MuxPi components



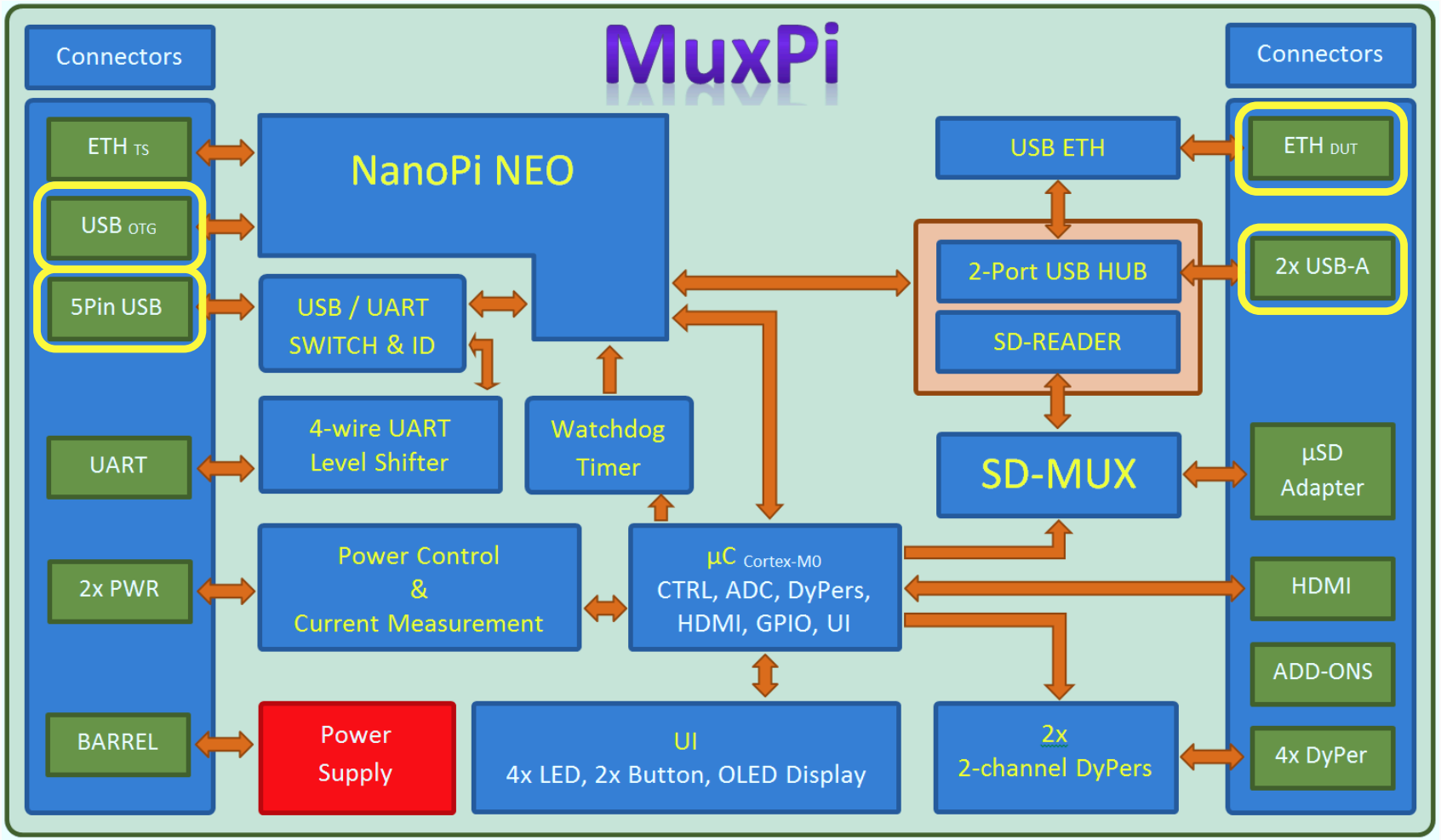
MuxPi components



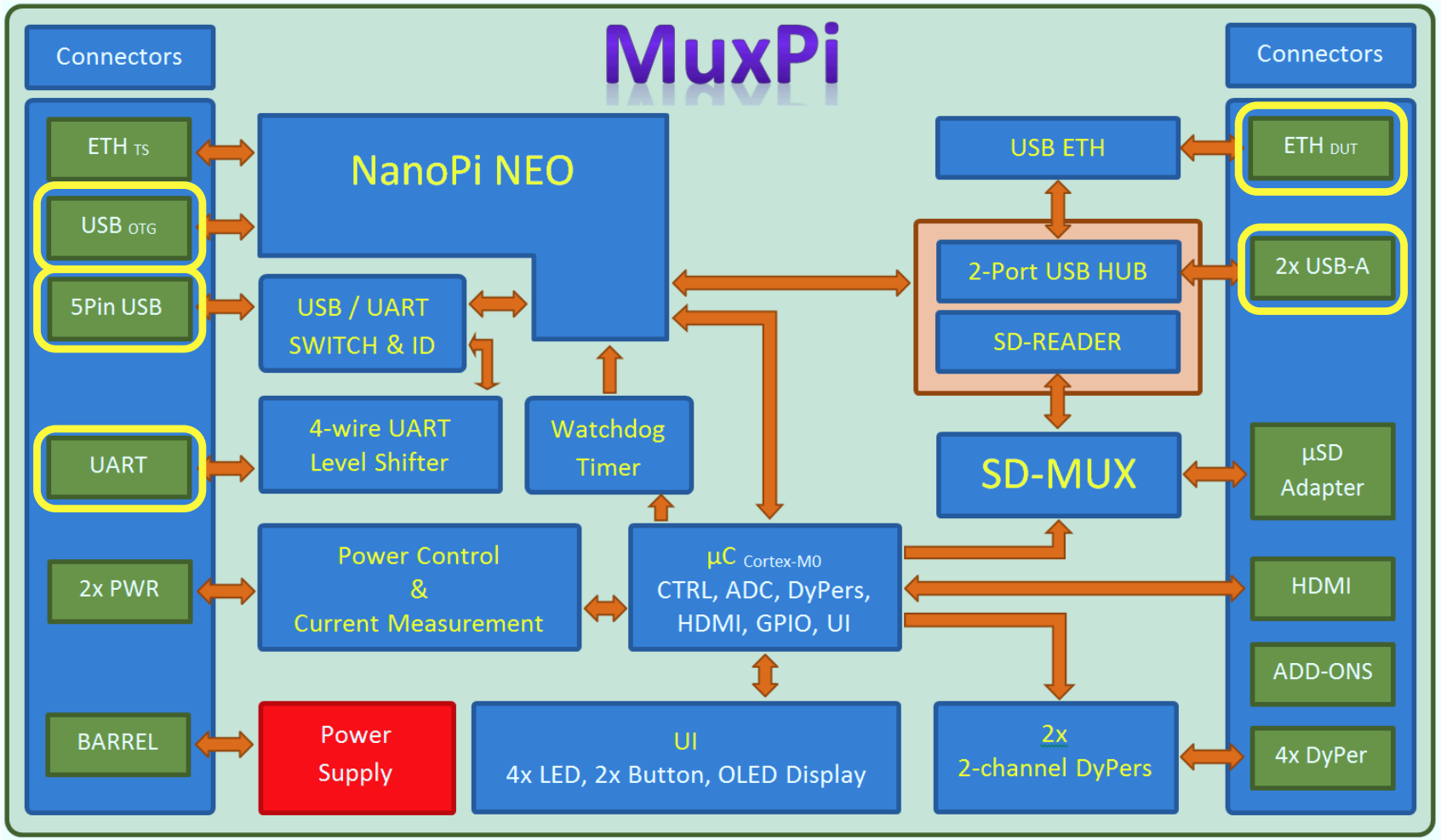
MuxPi components



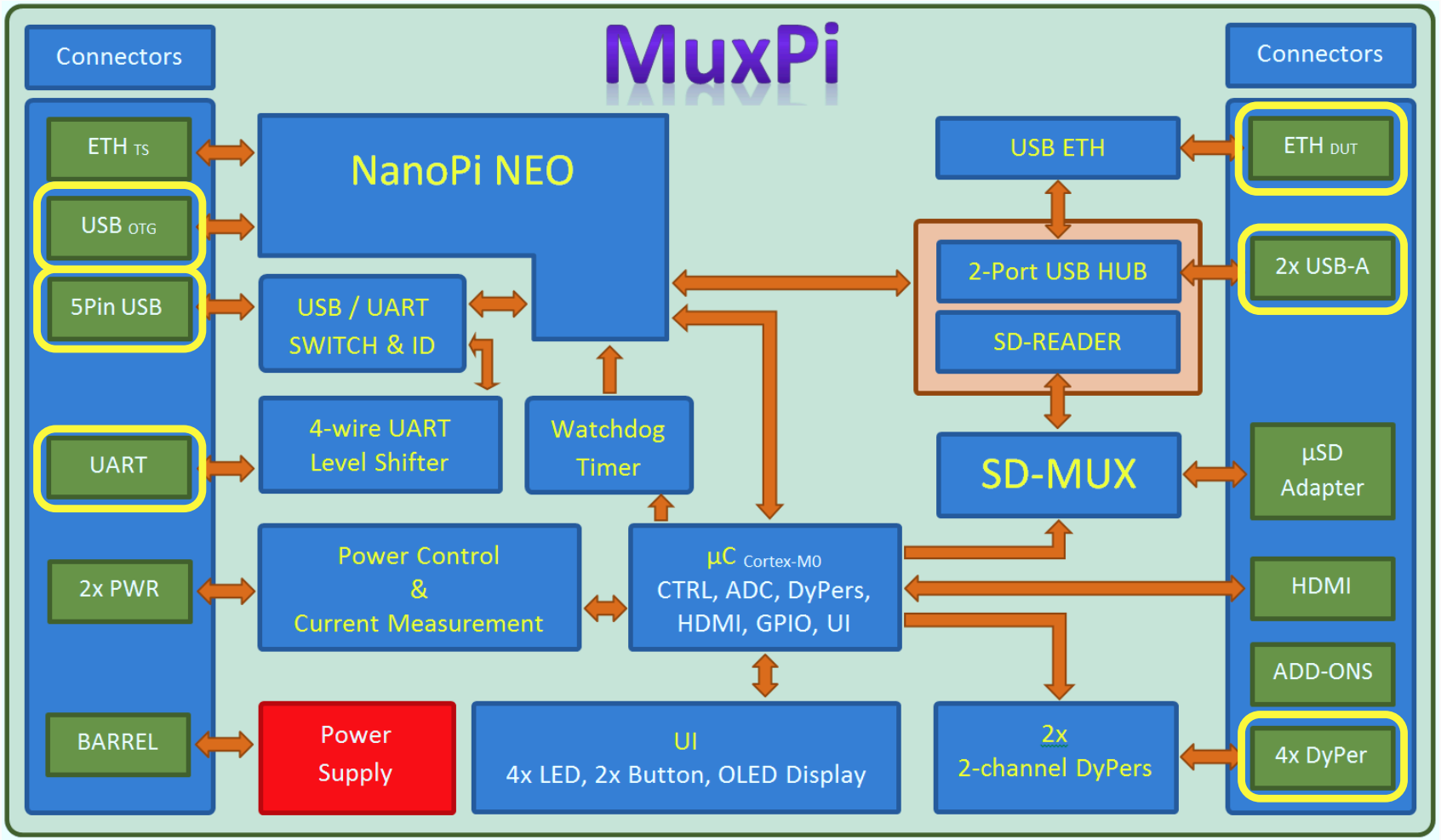
MuxPi components



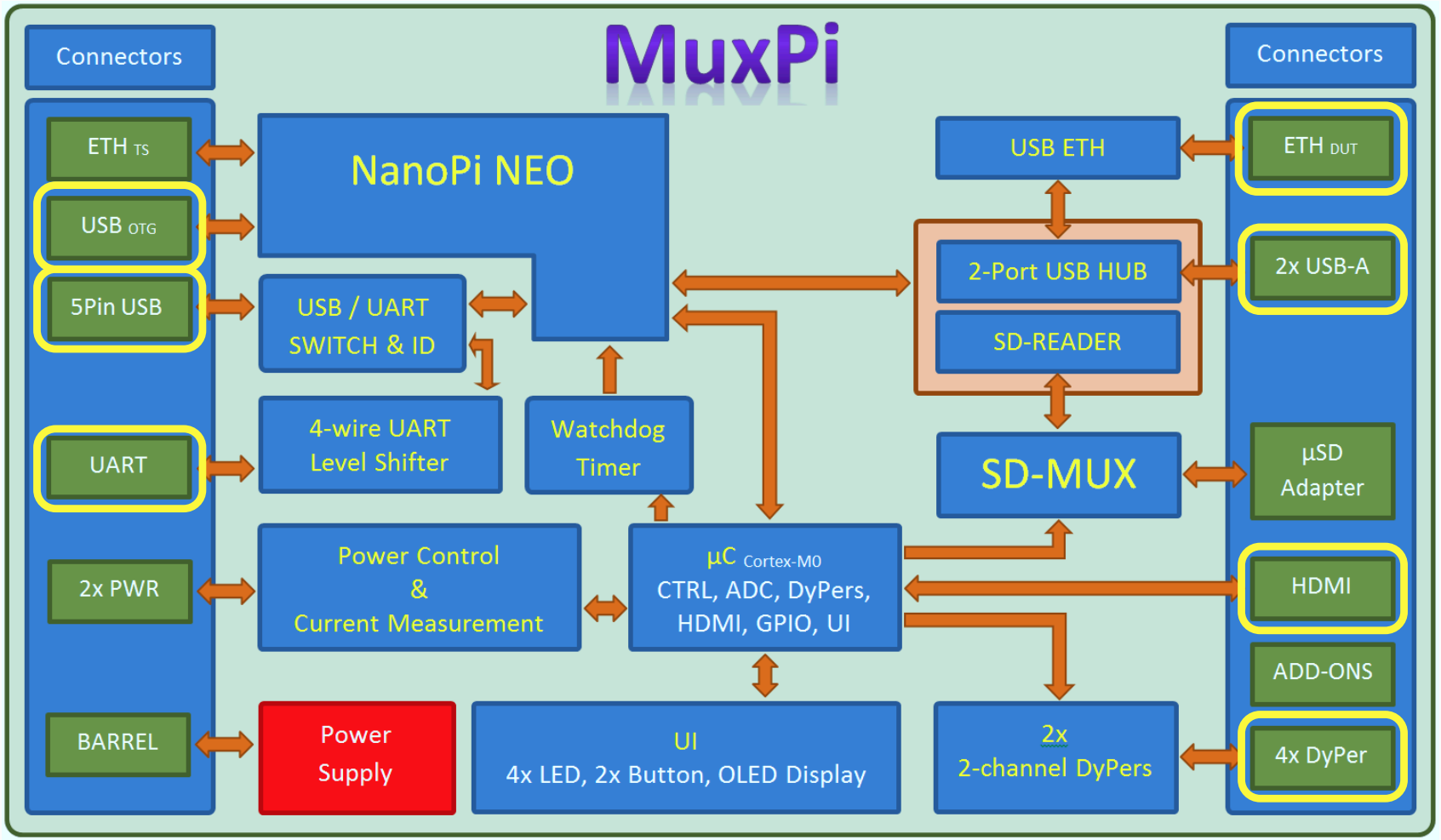
MuxPi components



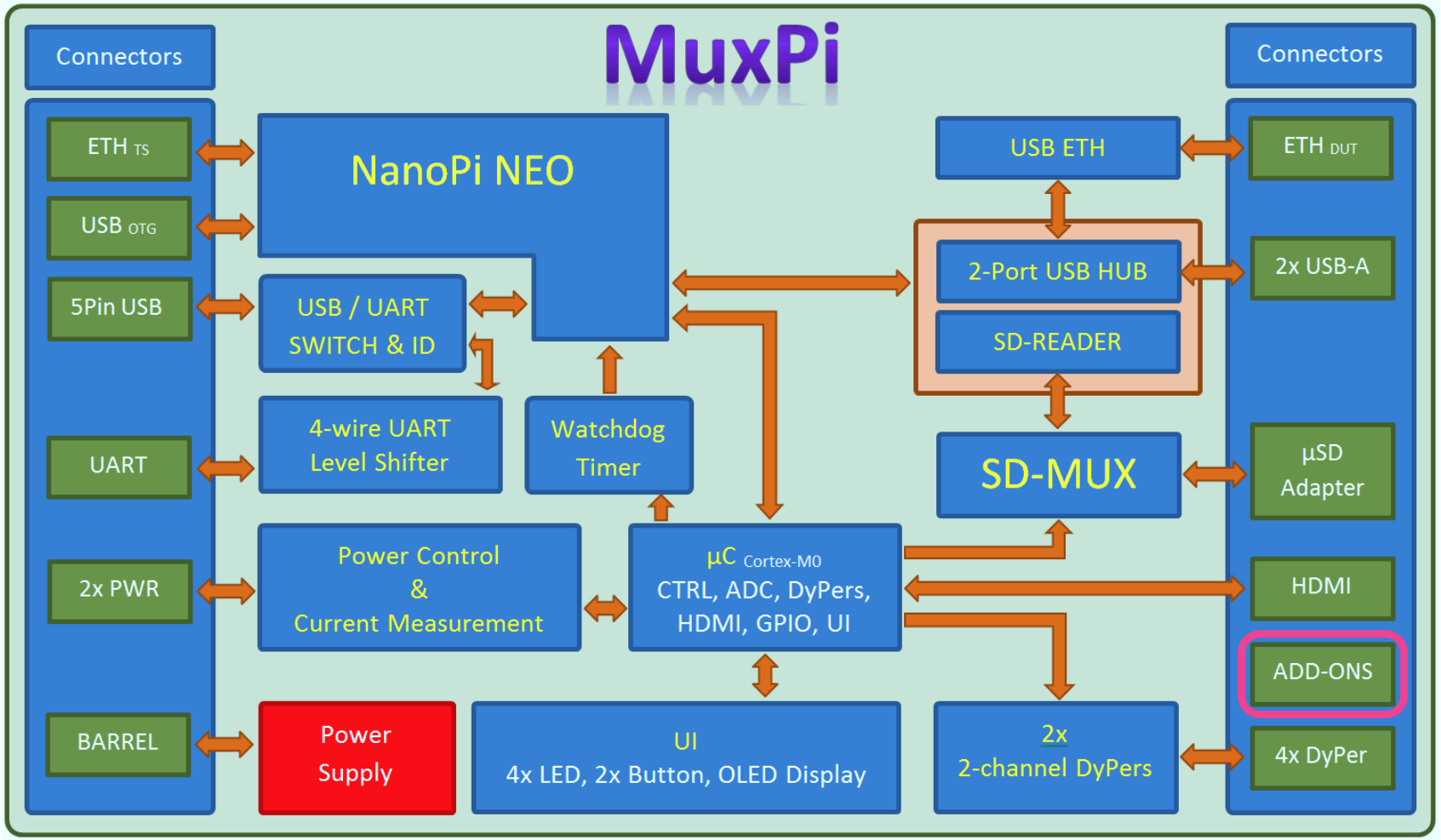
MuxPi components



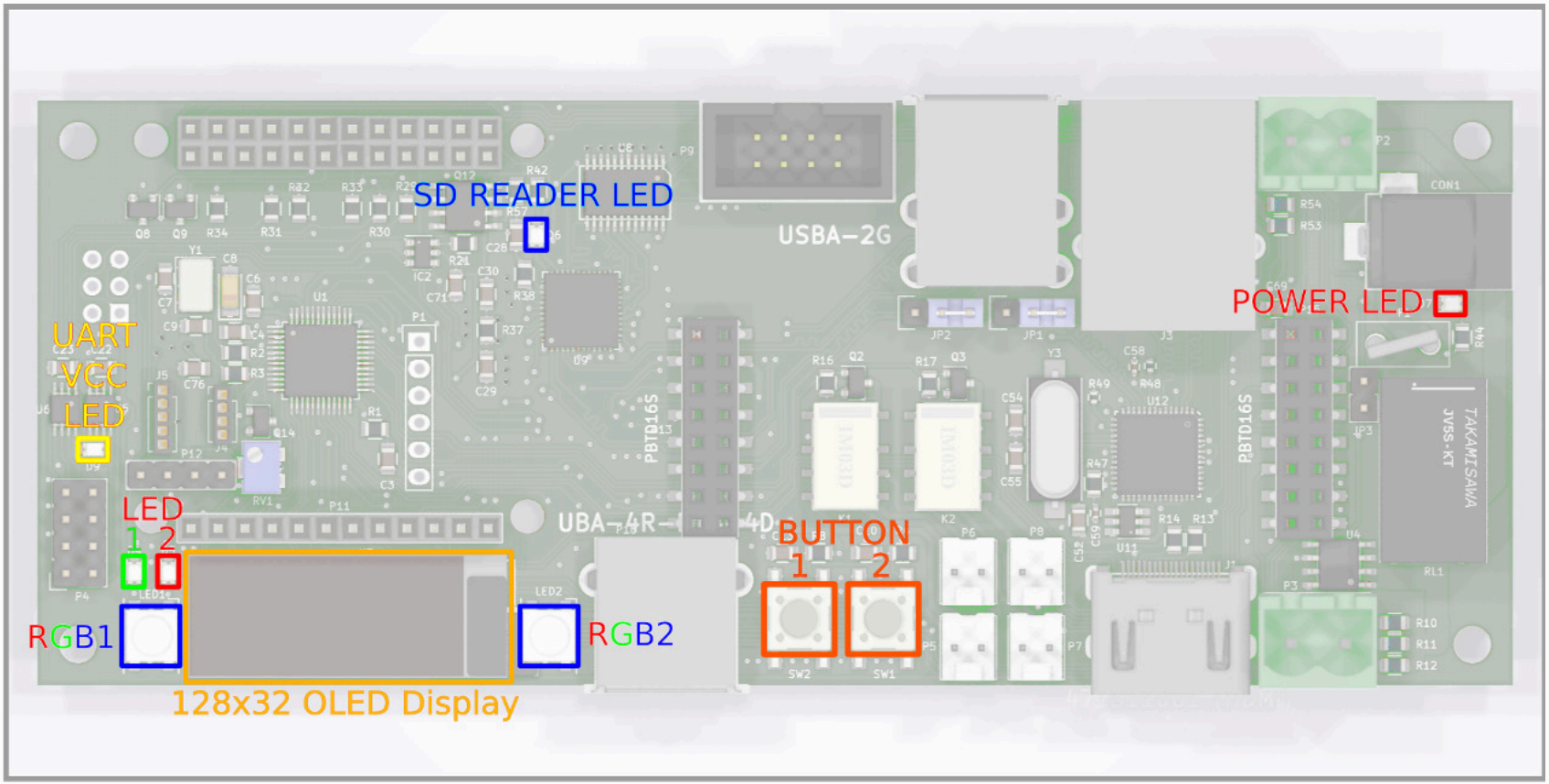
MuxPi components



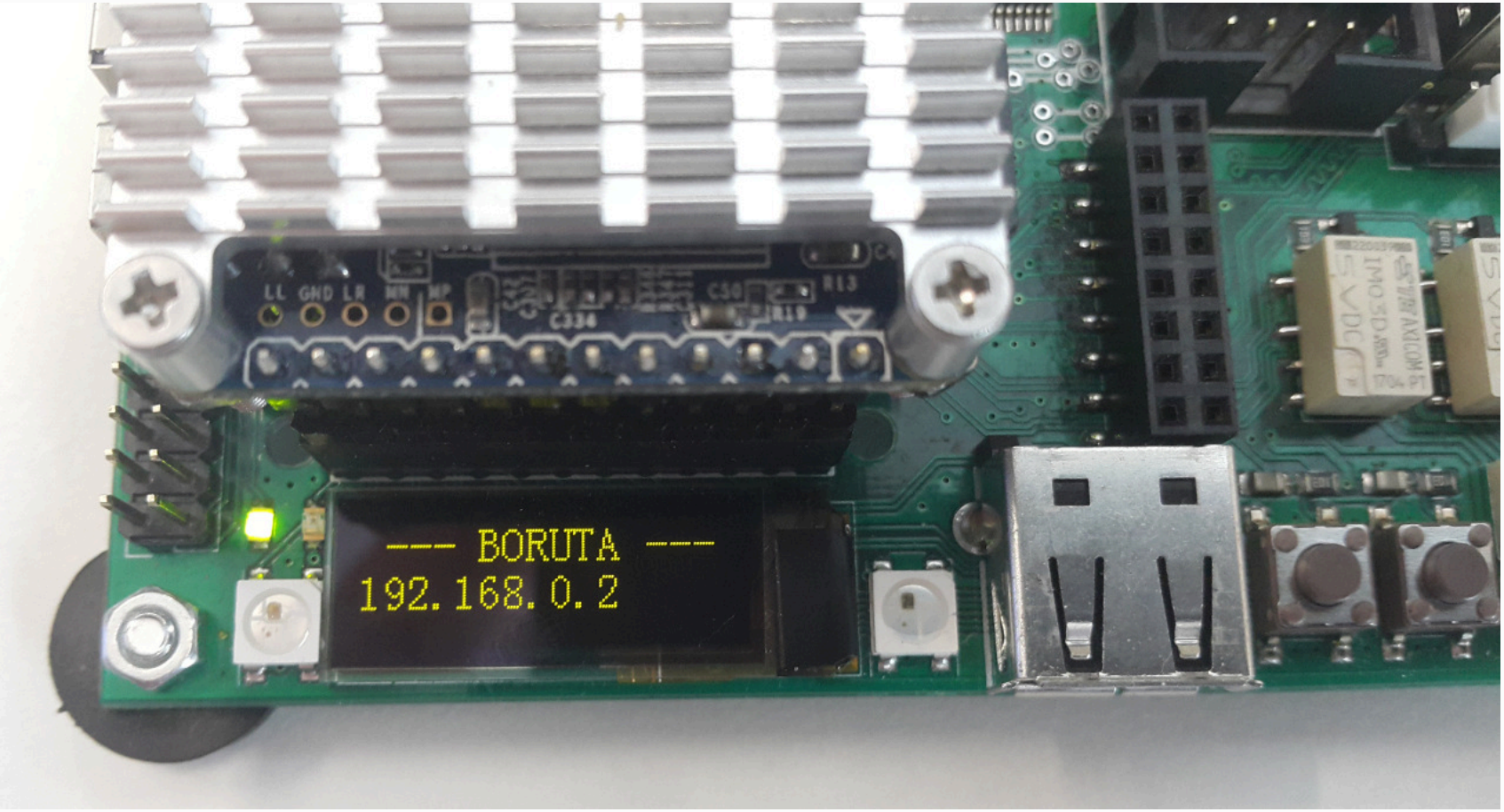
MuxPi components



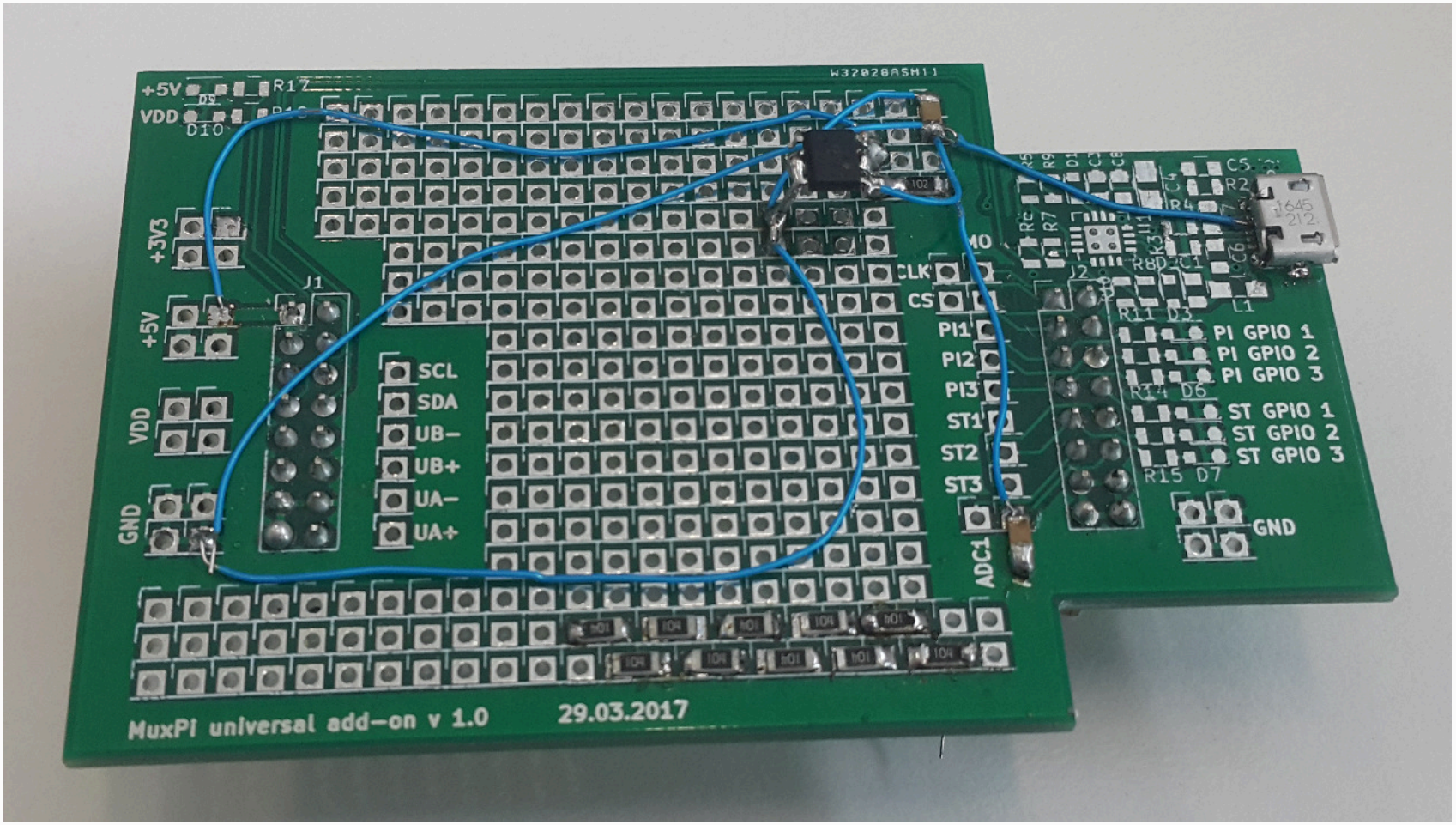
Indicators


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

Easy maintenance



Extensibility



Major improvements

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

Building your own

NanoPi NEO $\approx \$10$

Building your own

NanoPi NEO	$\approx \$10$
Parts	$\approx \$80$

Building your own

NanoPi NEO	$\approx \$10$
Parts	$\approx \$80$
Soldering skills	***High***

Building your own

NanoPi NEO	$\approx \$10$
Parts	$\approx \$80$
Soldering skills	***High***
Patience	**A LOT**

Building your own

NanoPi NEO	$\approx \$10$
Parts	$\approx \$80$
Soldering skills	***High***
Patience	**A LOT**

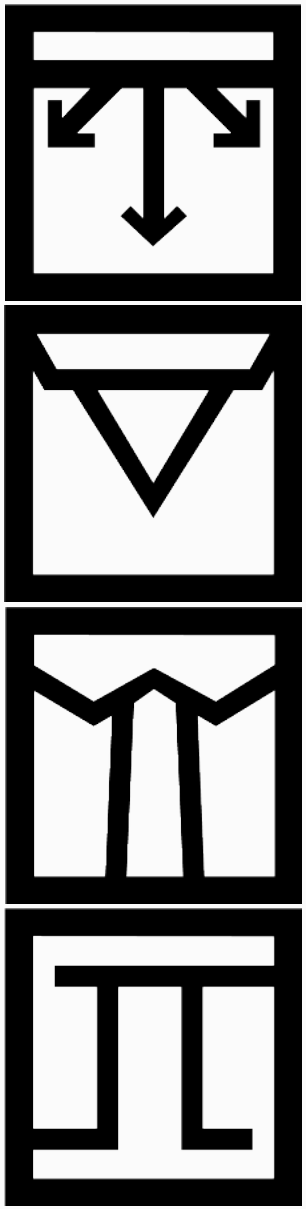
https://git.tizen.org/cgit/tools/muxpi

Software

Multitier architecture

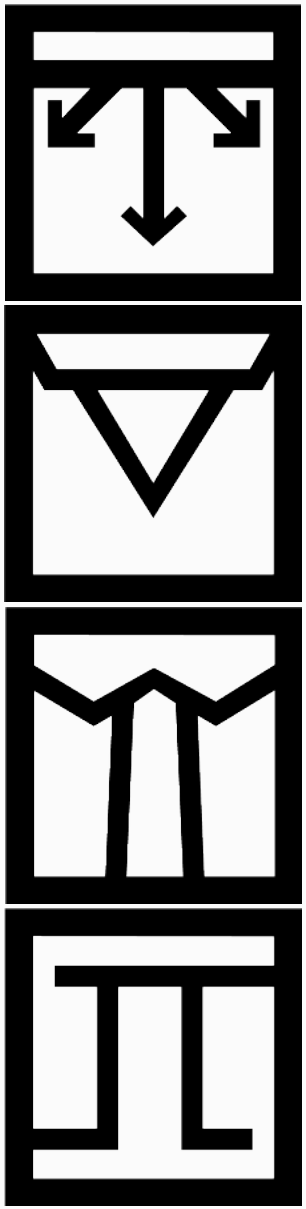
- “Do One Thing and Do It Well”
- RESTful HTTP APIs
- Homogeneous solution stack

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

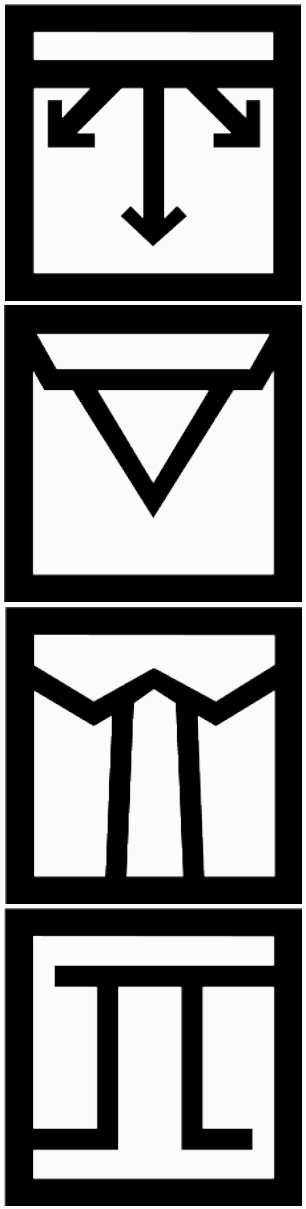


- Who knows what requires verification?

  Perun

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

Responsibilities



- Who knows what requires verification?

  Perun

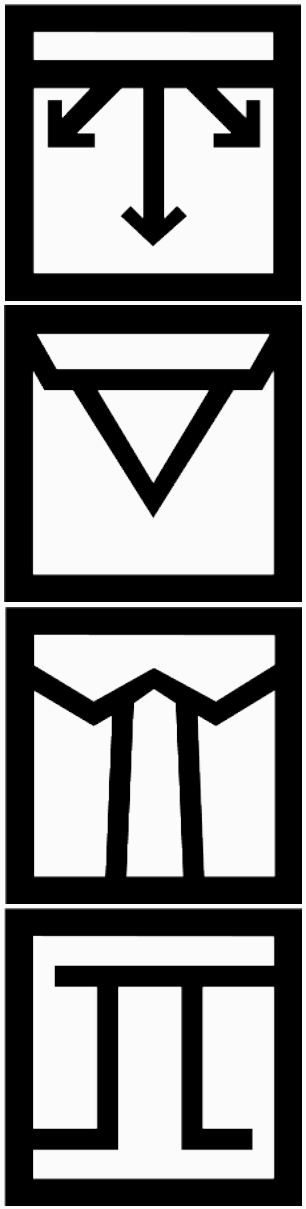
- Who knows which actions are necessary?

  Weles

- Who knows where can it be done?

- Who knows how to do it?

Responsibilities



- Who knows what requires verification?

  Perun

- Who knows which actions are necessary?

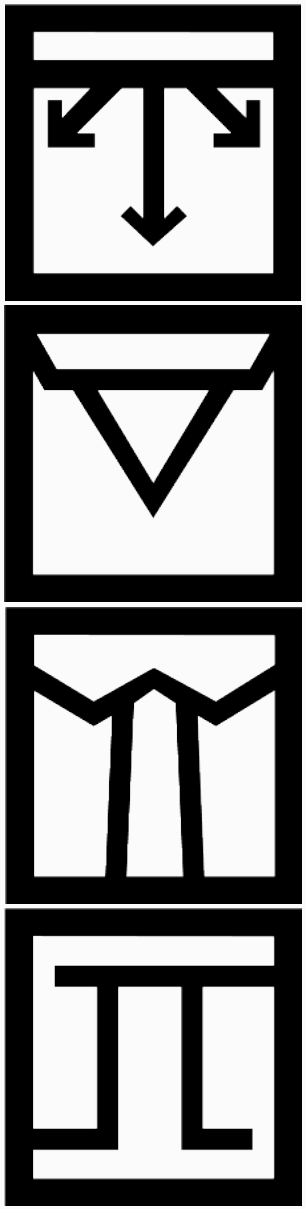
  Weles

- Who knows where can it be done?

  Boruta

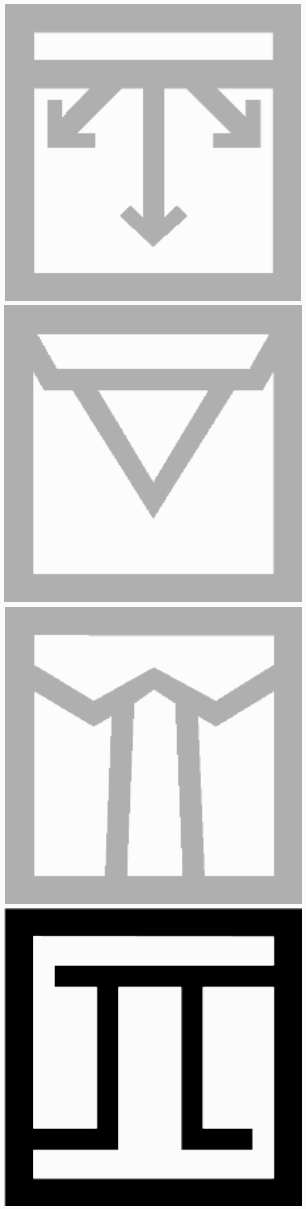
- Who knows how to do it?

Responsibilities



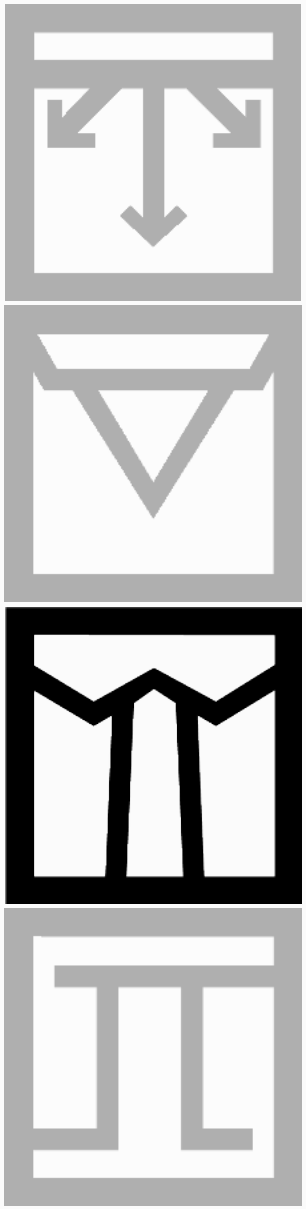
- Who knows what requires verification?
  Perun
- Who knows which actions are necessary?
  Weles
- Who knows where can it be done?
  Boruta
- Who knows how to do it?
  MuxPi

MuxPi (farm)



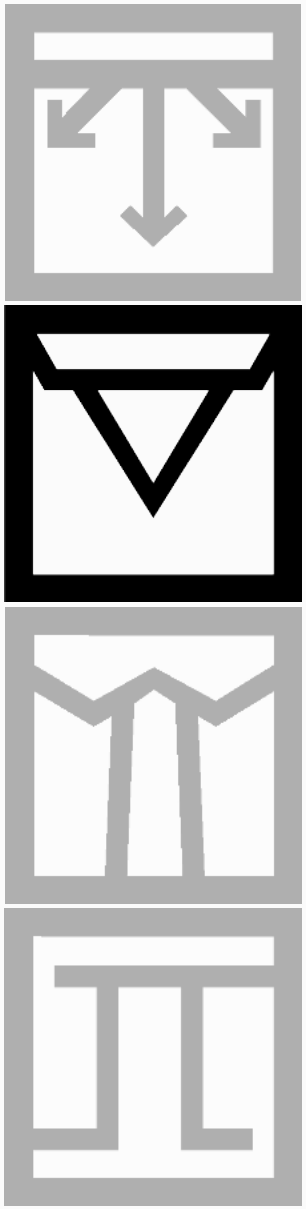
- Manages single DUT
- Fully aware of its capabilities
- Requires **only two** interfaces
  - Power supply
  - Network connection (Ethernet)

Boruta



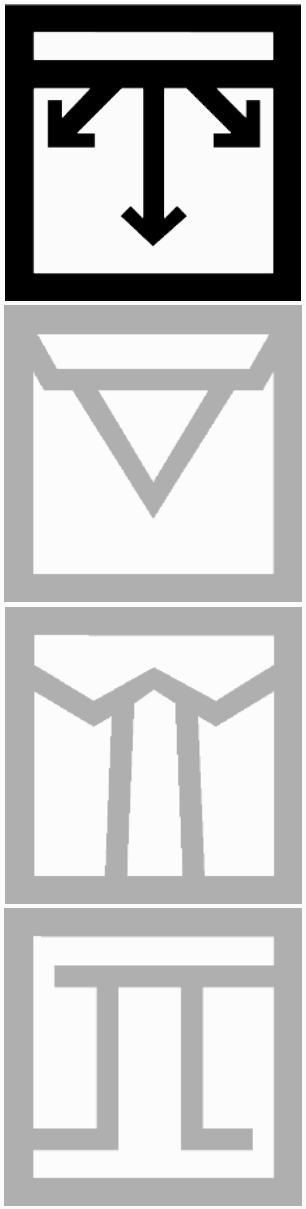
- Dryad farm management system
- Schedules requests
  - Priority
  - Device groups
  - Delayed access
- Provides convenient access to selected Dryad

Weles



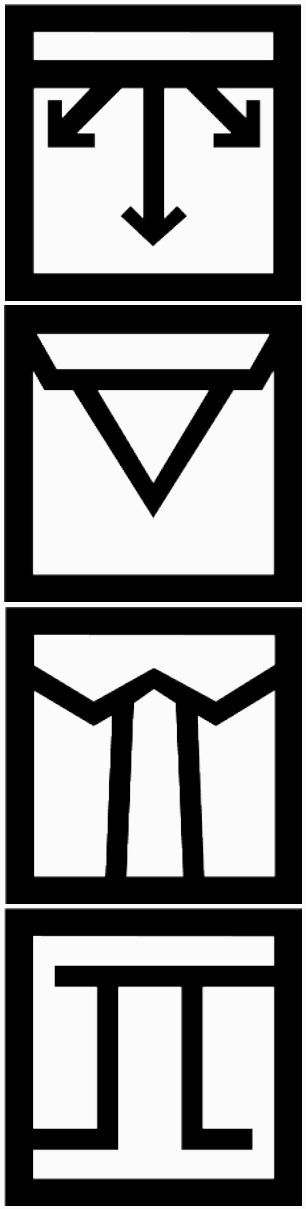
- Lightweight testing framework
- Provides LAVA-like interface
- YAML job definition $\mapsto$ actions executed on DUT
  - Deploy
  - Boot
  - Test
  - Collect

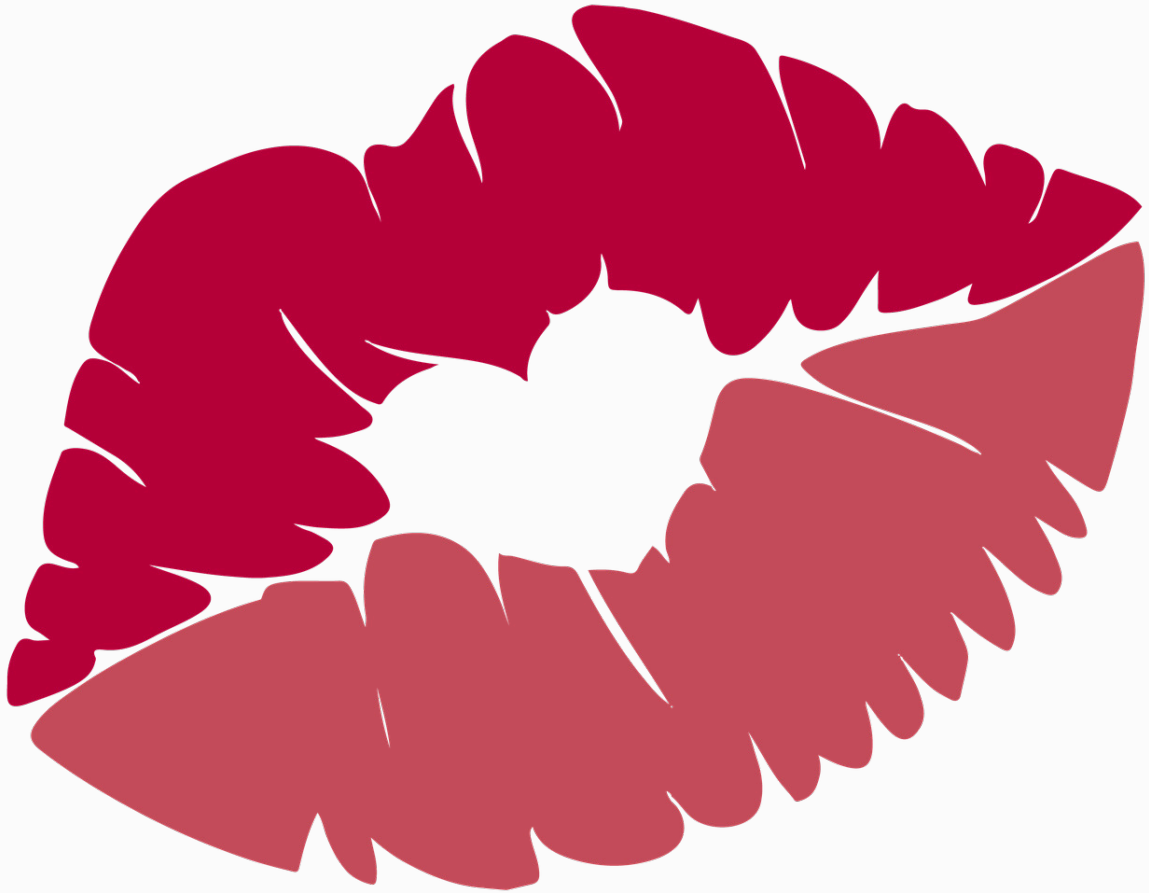
Perun



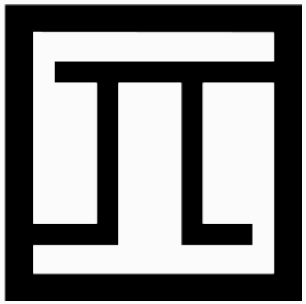
- OS images testing system
- Schedules verification
  (per new set of OS images)
- Automates QA step of
  Release Engineering Duty

Keeping it simple

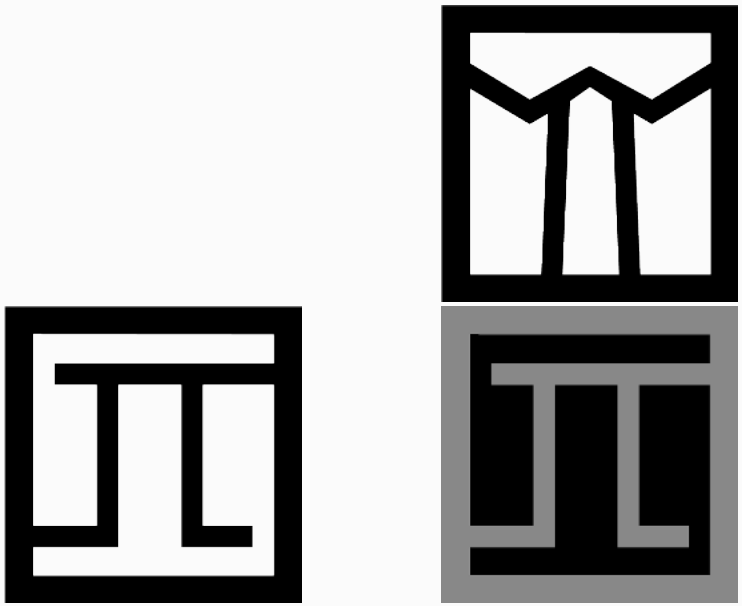




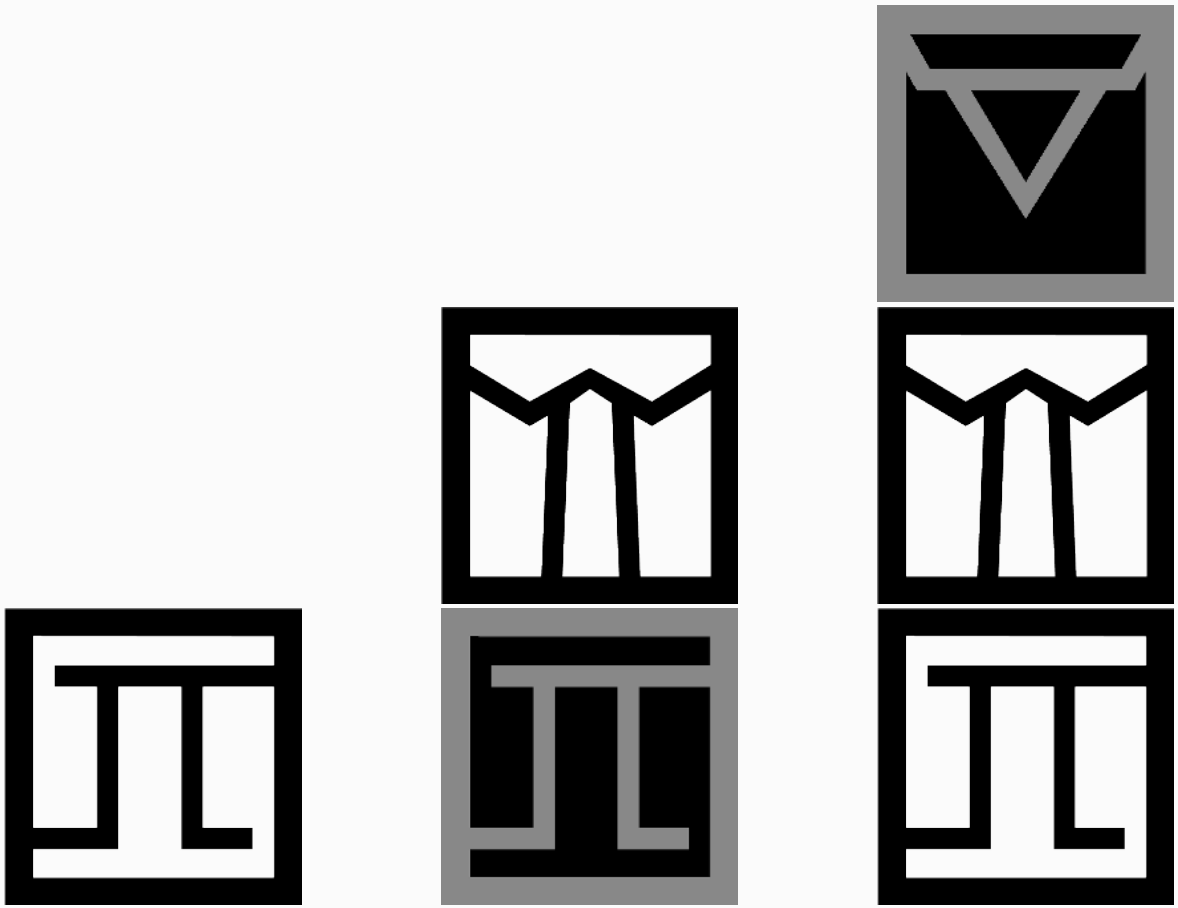
Keeping it simple (and decoupled)



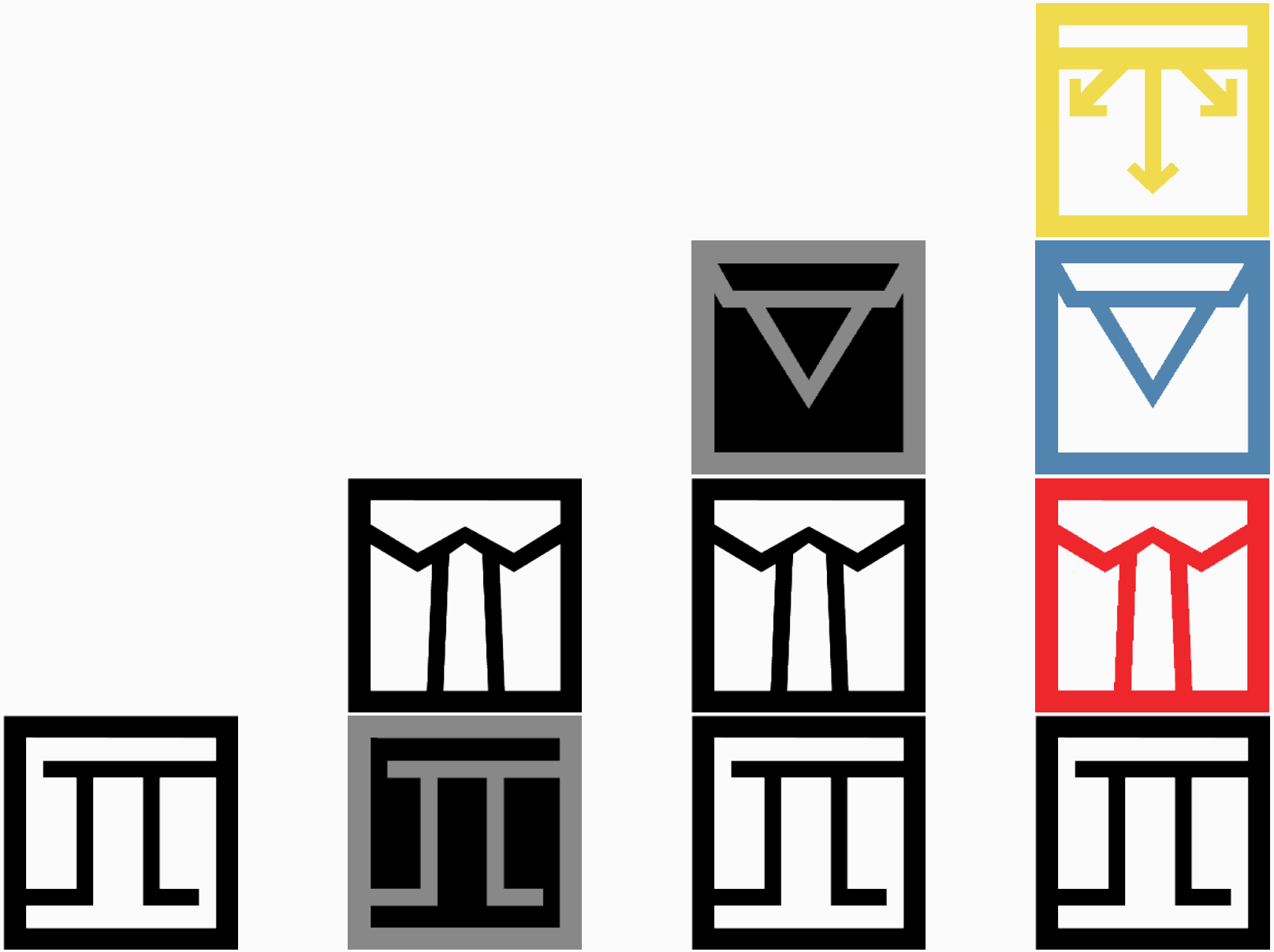
Keeping it simple (and decoupled)



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

Conclusion

Summary

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

Questions?

- MuxPi

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

  https://wiki.tizen.org/SD_MUX
- Mailing list

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

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

Thank you!

Paweł Wieczorek

p.wieczorek2@samsung.com

Samsung R&D Institute Poland

Acknowledgements

- Metropolis – simple, modern Beamer theme

Pictures used

- https://en.wikipedia.org/wiki/File:Heckert_GNU_white.svg
- https://commons.wikimedia.org/wiki/File:Tux.svg
- https://commons.wikimedia.org/wiki/File:Wayland_Logo.svg
- https://commons.wikimedia.org/wiki/File:Enlightenment_logo_black.png
- https://developer.tizen.org/sites/default/files/images/about_tizen_1.png
- https://pixabay.com/en/security-industrial-logistic-1491514/
- https://commons.wikimedia.org/wiki/File:ColoredBlankMap-World-10E.svg
- https://commons.wikimedia.org/wiki/File:Nuvola_Korean_flag.svg
- https://commons.wikimedia.org/wiki/File:Nuvola_Polish_flag.svg
- https://commons.wikimedia.org/wiki/File:Nuvola_USA_flag.svg
- https://validation.linaro.org/static/docs/v2/_images/lava.svg
- https://wiki.linaro.org/Platform/LAB/LMP_in_practice
- https://forums.resin.io/uploads/resin/original/1X/88ab2e061cd644b18b95fa99ede9ce6b98adfa44.jpg
- https://commons.wikimedia.org/wiki/File:Italian_traffic_signs_-_fermarsi_e_dare_precedenza_-_stop.svg
- https://farm9.staticflickr.com/8263/28955874330_d1b1202ae8_k_d.jpg
- https://pixabay.com/en/stars-new-advertisement-sign-146834/
- https://pixabay.com/en/update-upgrade-renew-improve-1672351/
- https://www.goodfreephotos.com/albums/vector-images/different-colored-layers-vector-file.png
- https://pixabay.com/en/kiss-lips-mouth-red-love-rosa-2928081/
- https://commons.wikimedia.org/wiki/File:PEO-smiley_smile.svg