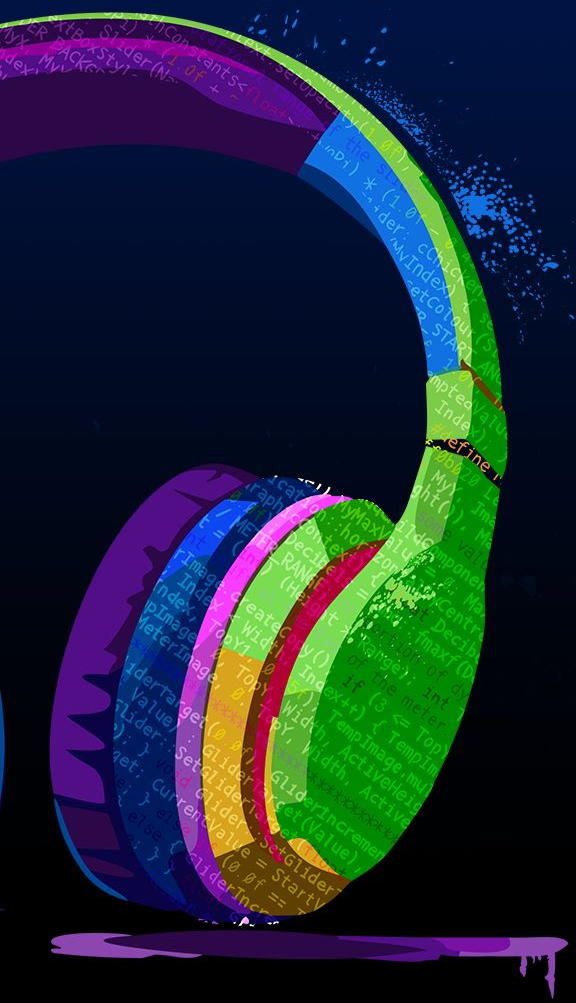

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GET REAL, FROM PLUGINS TO HARDWARE

INTRO TO SOFTWARE DEVELOPMENT OF AUDIO DEVICES

WOJTEK JAKOBCZYK

What will I talk about?

- Developing software for hardware
- Why?
- How? Architecture, tools, …
- Starter kit

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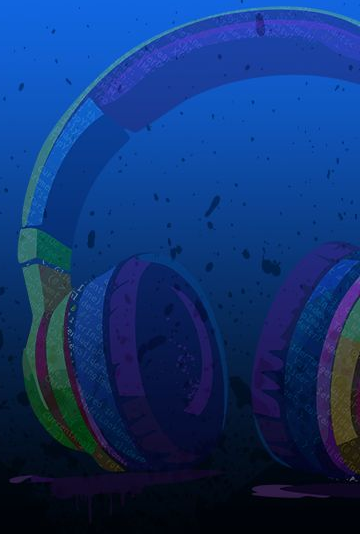

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Myself

- 25+ years in software development
- 4+ years in Polyend as Head of Software/Architect
- Polyend Tracker, Play and more

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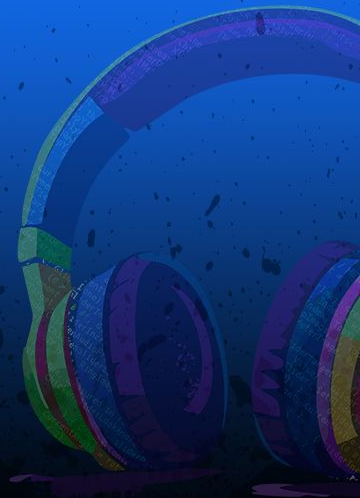

Why hardware?

- Fun!
- Creative - challenges because of limitations
- Different - new perspective, learning experience, out of the box thinking
- Simpler - where it counts - UI, for instance
- End user perspective

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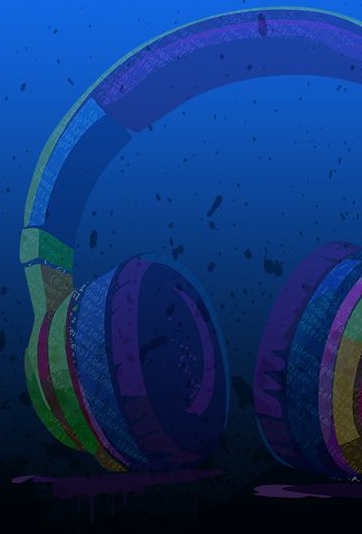

Not that different, really?

- System-level languages already prevail in real-time audio
- All the tooling is the same or similar
- Linux

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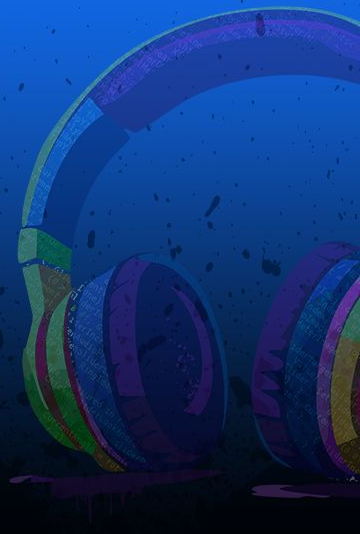

Architecture - hardware

- MCU/APU
  - CPU - ARM Cortex M4/M7/A
    - 32/64 bits, FPU, some SIMD, caches
  - RAM - 128 kB up to 2 MB
  - Flash - MBs
  - Peripherals - GPIO, I2C, I2S, SPI
- SDRAM
- Option: System-On-Module

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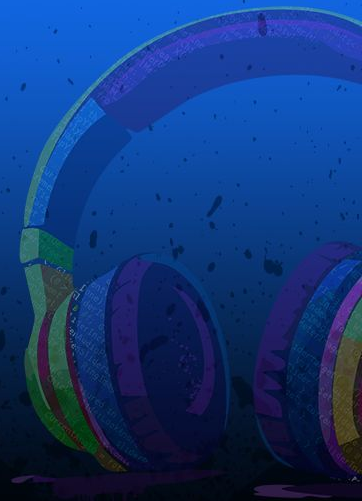

Architecture - hardware

- Audio codec
- Display + input (buttons, pots, encoders, …)
- MIDI
- USB, SD card, …

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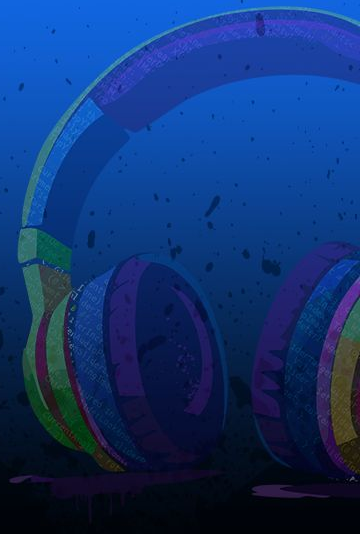

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Architecture - software

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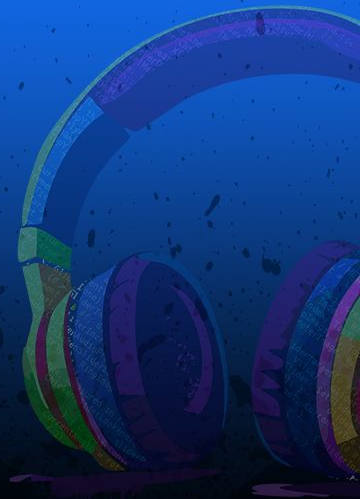
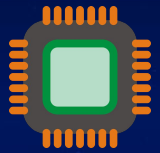


Architecture - software



Zephyr®

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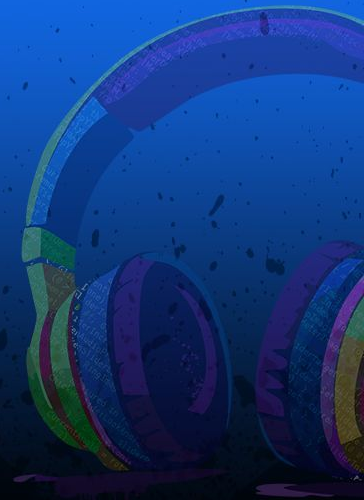

Architecture - software

- Audio buffers fill
  - Handle audio-related events
  - Incoming midi
  - Sequencer logic
- User interface
- System services - software updates, logging, …

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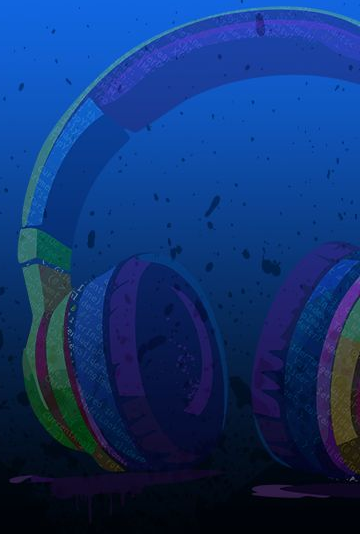

Architecture - software

- Threading vs interrupts
  - Linux - as on desktop
  - Bare metal
    - Audio buffers fill from codec interrupt
    - UI in main loop
    - Synchronization in the UI thread only
  - RTOS
    - Something in between

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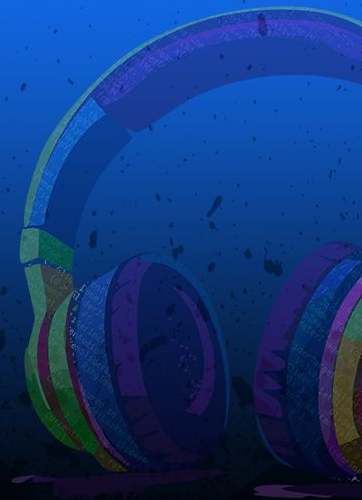

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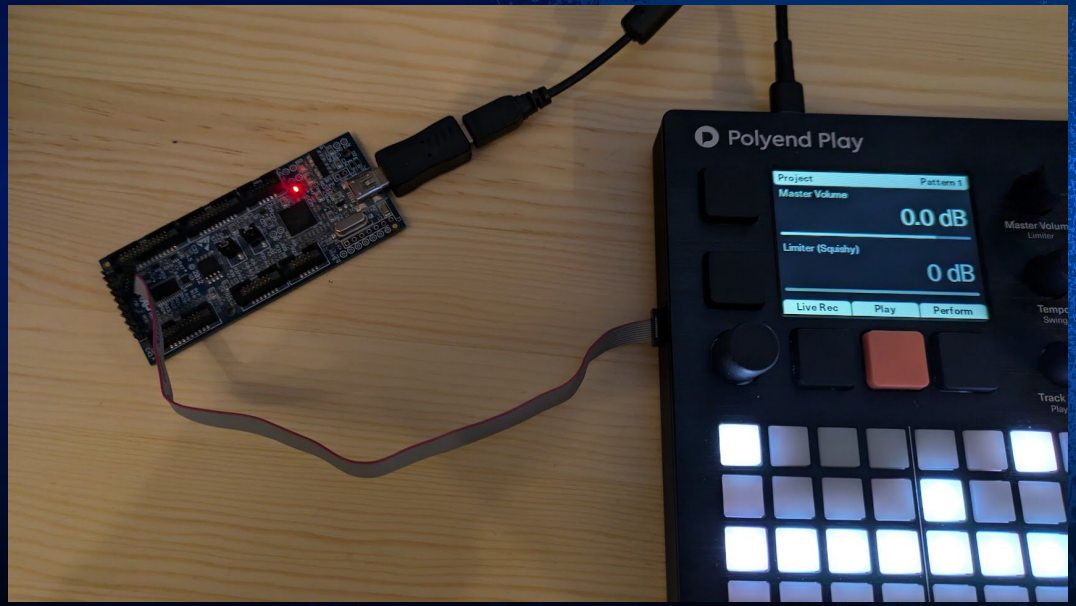
Working with hardware



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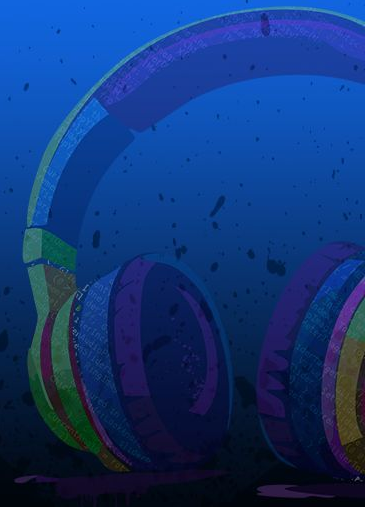
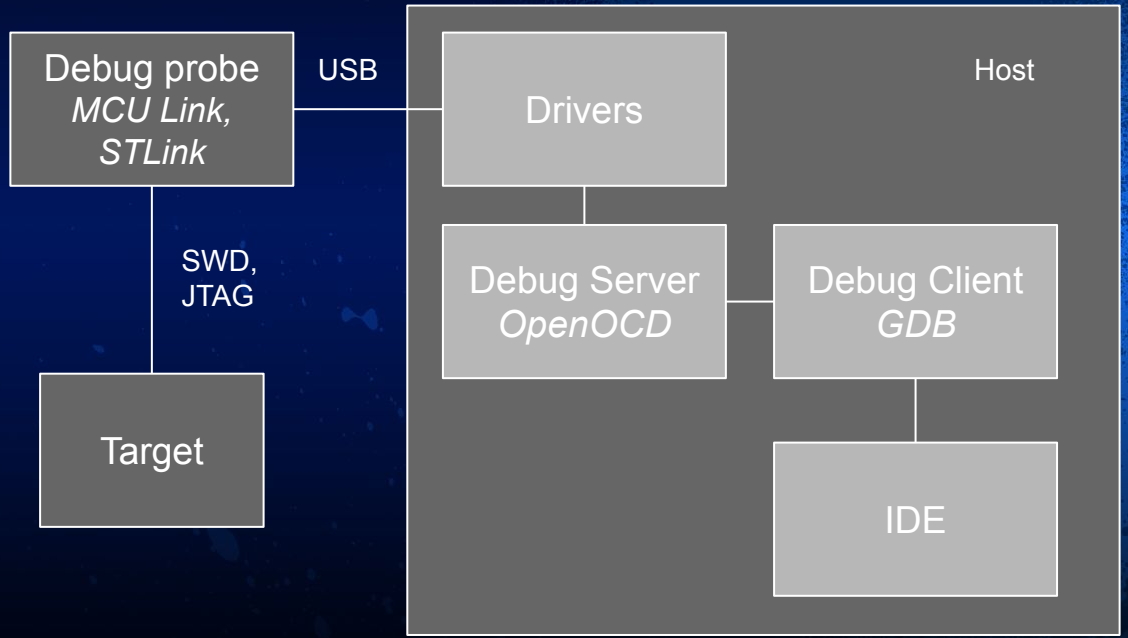


Working with hardware



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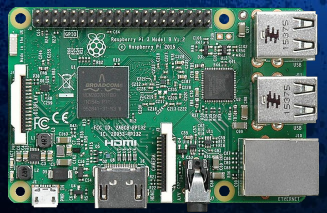
Prototyping platforms

- Raspberry Pi (Linux)
  - Audio shield / USB audio interface
  - Display
  - Shields with various input peripherals
- Electrosmith Daisy (bare metal / RTOS)
- Teensy (bare metal / RTOS)
- Zynthian (Linux)
- Eurorack dev modules



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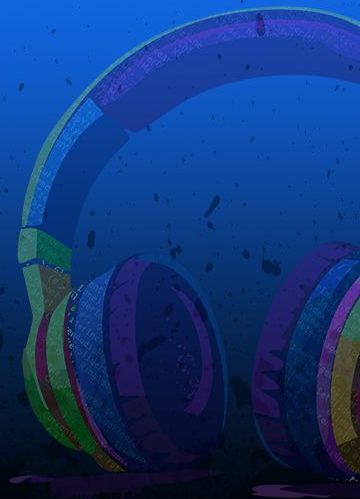

Open Source

- Zynthian
- Mutable Instruments Archive
  - https://github.com/pichenettes
- PreenFM3

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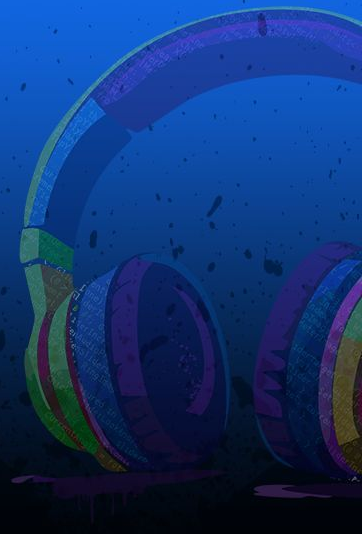
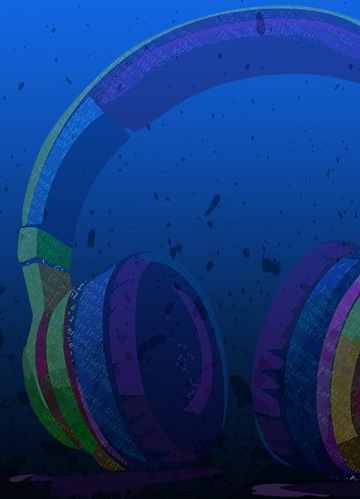


Thank you

Q&A

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