

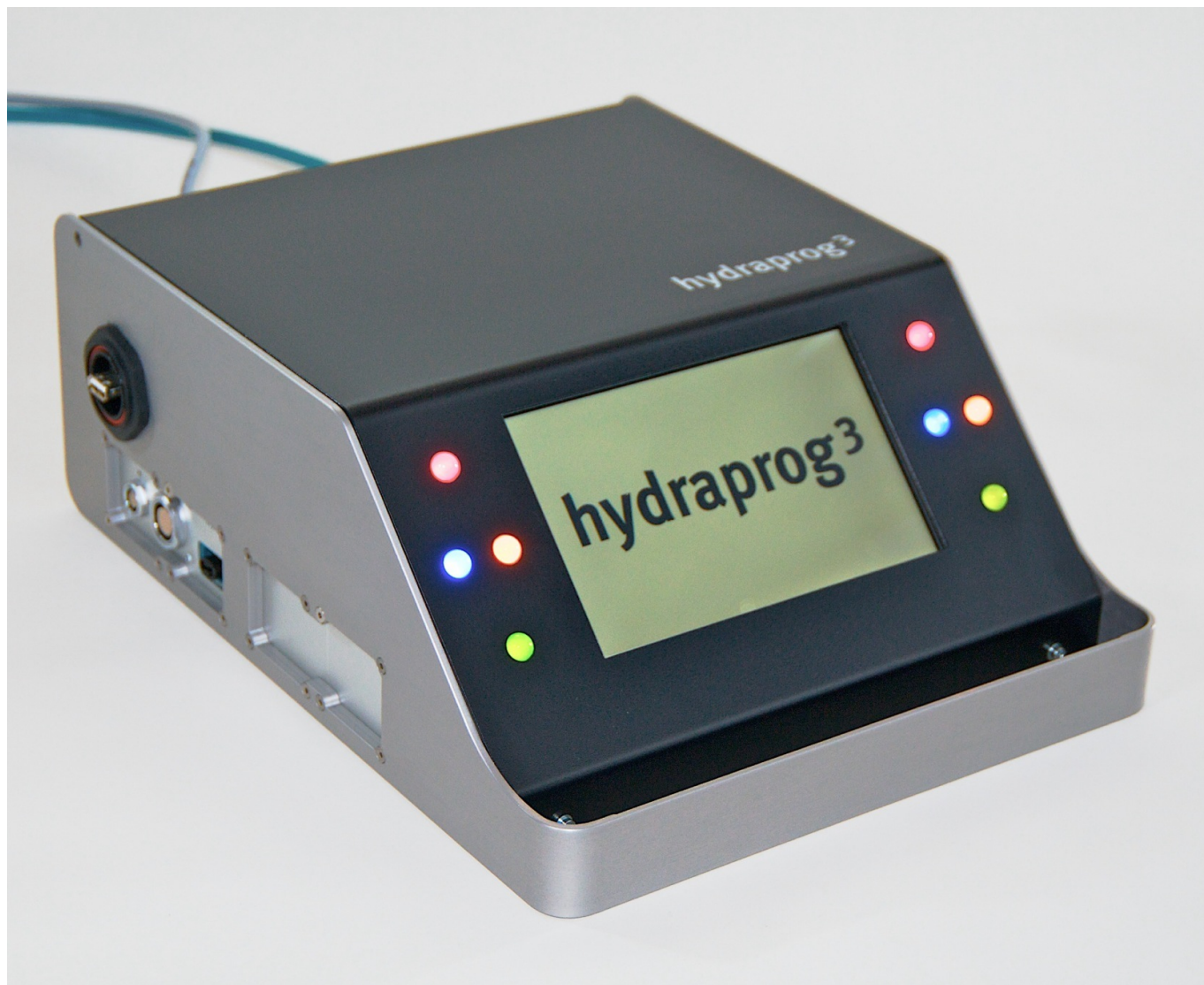
GRiSP

GRISP-BASE – SPECIALLY DESIGNED FOR ERLANG

**DIVE INTO A NEW EXPERIENCE
OF BUILDING WIRELESS
EMBEDDED SYSTEMS**



DIPL. PHYS.
PEER STRITZINGER
GMBH



**Mainboard
Mini ITX
Intel Atom
FreeBSD, Erlang**

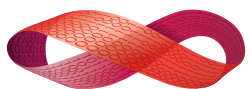
**Gateways
custom
Freescale
MPC5517
RTEMS**

Ethernet

USB

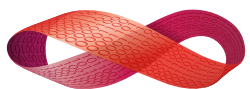
USB

Ethernet Switch / USB Hub

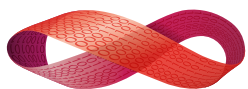


RTEMS Realtime „OS“

- For Hard-Real-Time and/or Embedded Applications
- Small Resource Usage
 - $\geq 32\text{KB}$ RAM, $\geq 96\text{KB}$ ROM, $\geq 12\text{ MHz}$ Clock
- Reliable Realtime Behaviours with pluggable Schedulers
 - Context switch $10\mu\text{s}$ on 25MHz MC68360
- Posix API (among others)



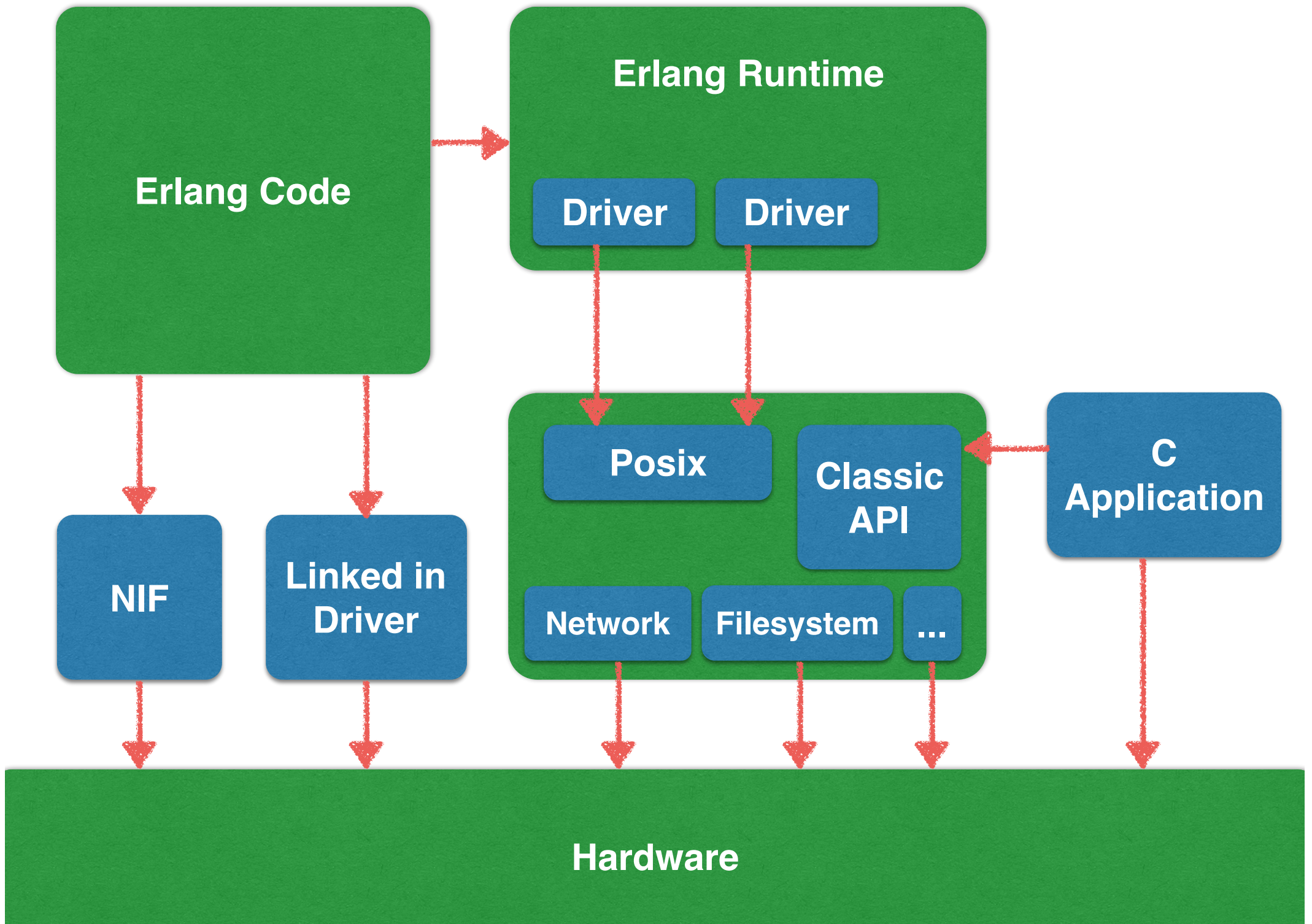
- Processes are actually Threads
- No virtual memory
- No memory protection
- Runs on basically all 32bit Architectures (and some 16bit)
- Can be ported to everything ≥ 32 Bit
- SMP Support!
- <http://www.rtems.org>

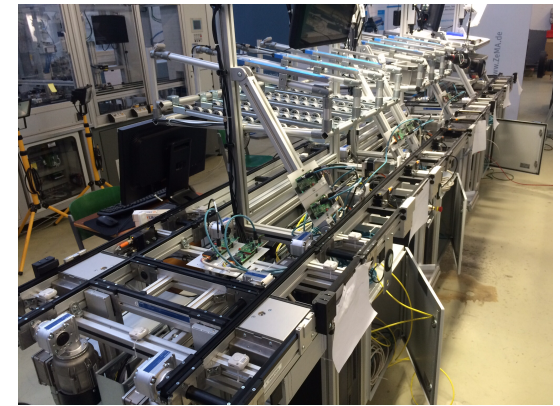
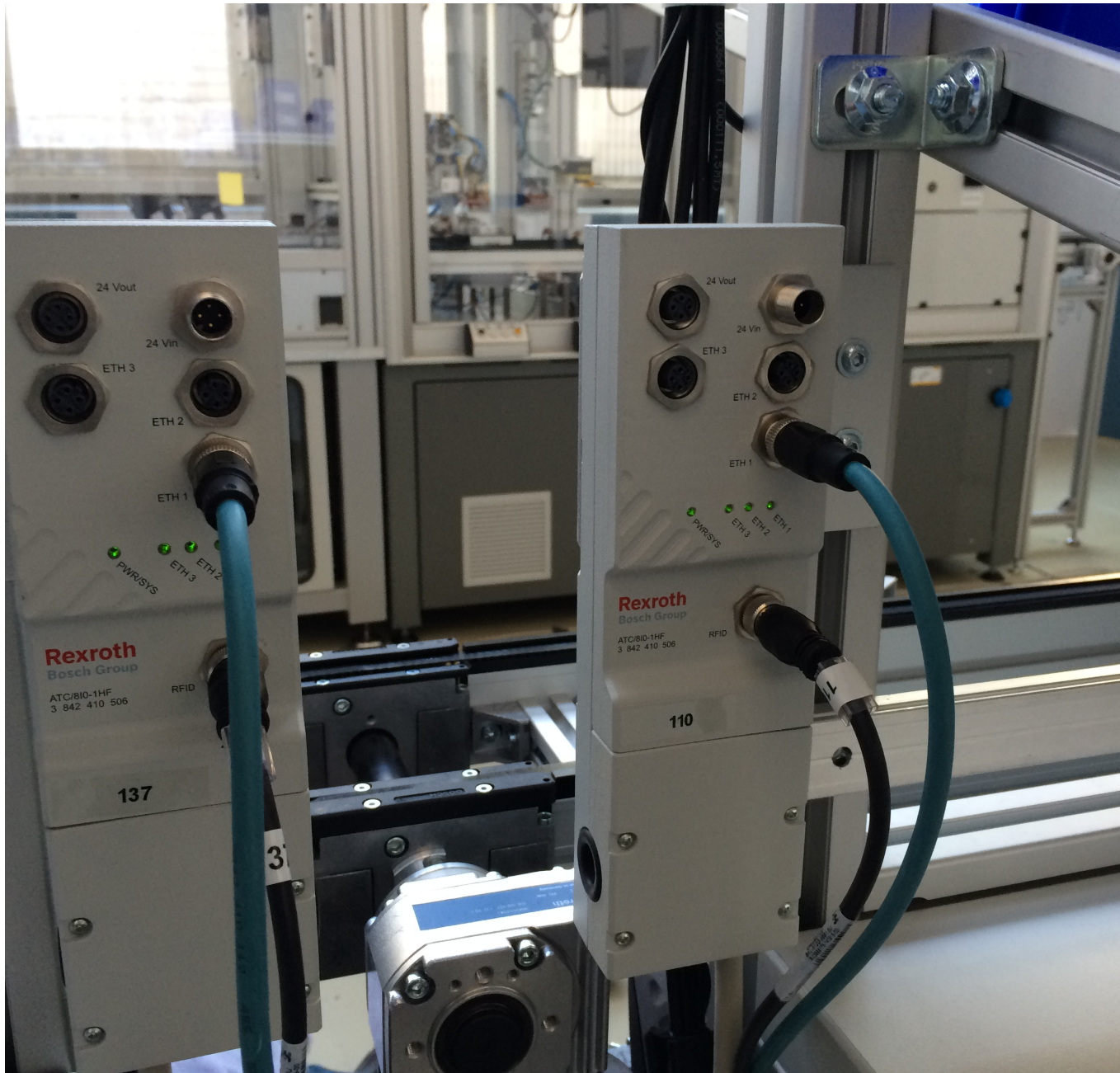


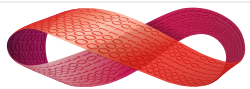


GRiSP









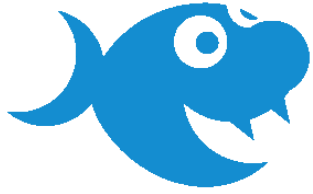


GRiSP BASE

www.grisp.org

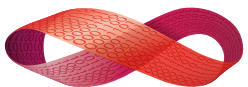


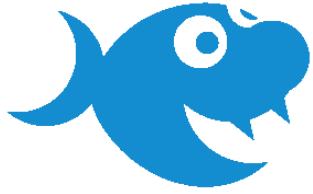
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CPU

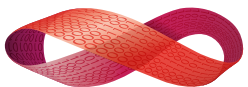
- Atmel SAM V71 (SAMV71Q21ES3)
- Core: ARM Cortex M7
- Running at up to 300MHz
- Single- and double-precision HW Floating Point Unit (FPU)
- DSP Extensions

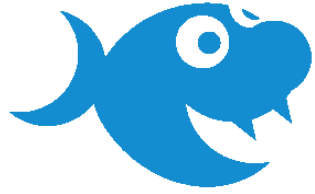




Memory

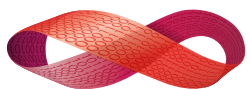
- Internal Memory
 - Flash: 2048 Kbytes (used for Bootloader)
 - SRAM: 384 Kbytes
- External MEMORY
 - SDRAM: 64 MBytes
 - MicroSD Socket for standard MicroSD cards
 - EEPROM: 2 KBit

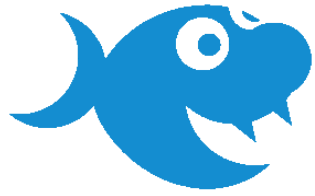




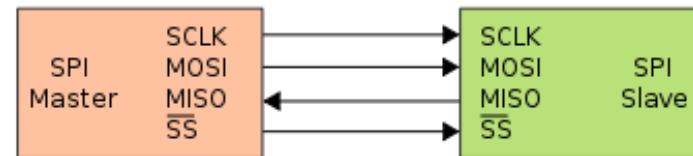
GPIO Switches and LEDs

- Just a few digital IO lines
- Driver support for Pulse With Modulation
- Switches and RGB LEDs
- Reset button

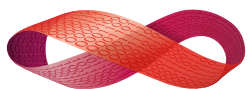
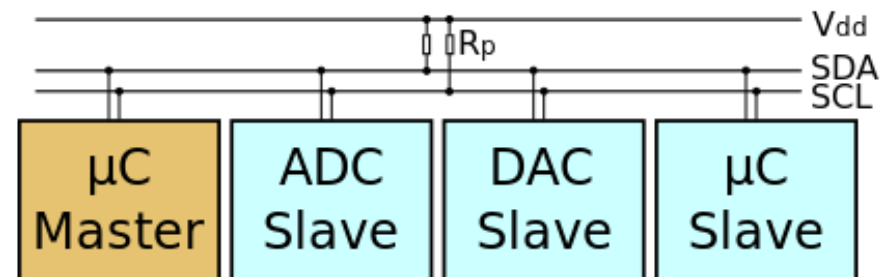


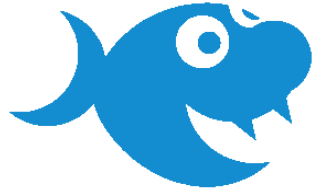


SPI and I2C



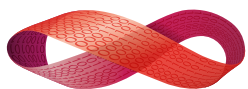
- SPI = Serial Peripheral Interface
- I²C = Inter-Integrated Circuit

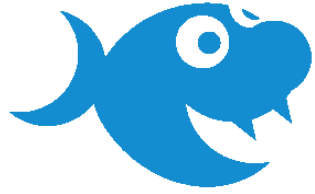




Dallas 1-Wire

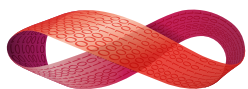
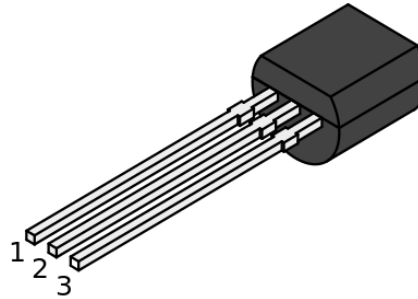
- Only needs **One Wire** ... and ground
- Power and Data on the same Wire
- Similar to I2C but slower and much longer range
- Unique 64bit id built into each endpoint
- Device discovery including type of device

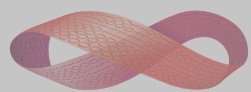
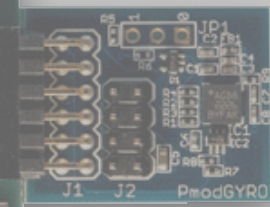
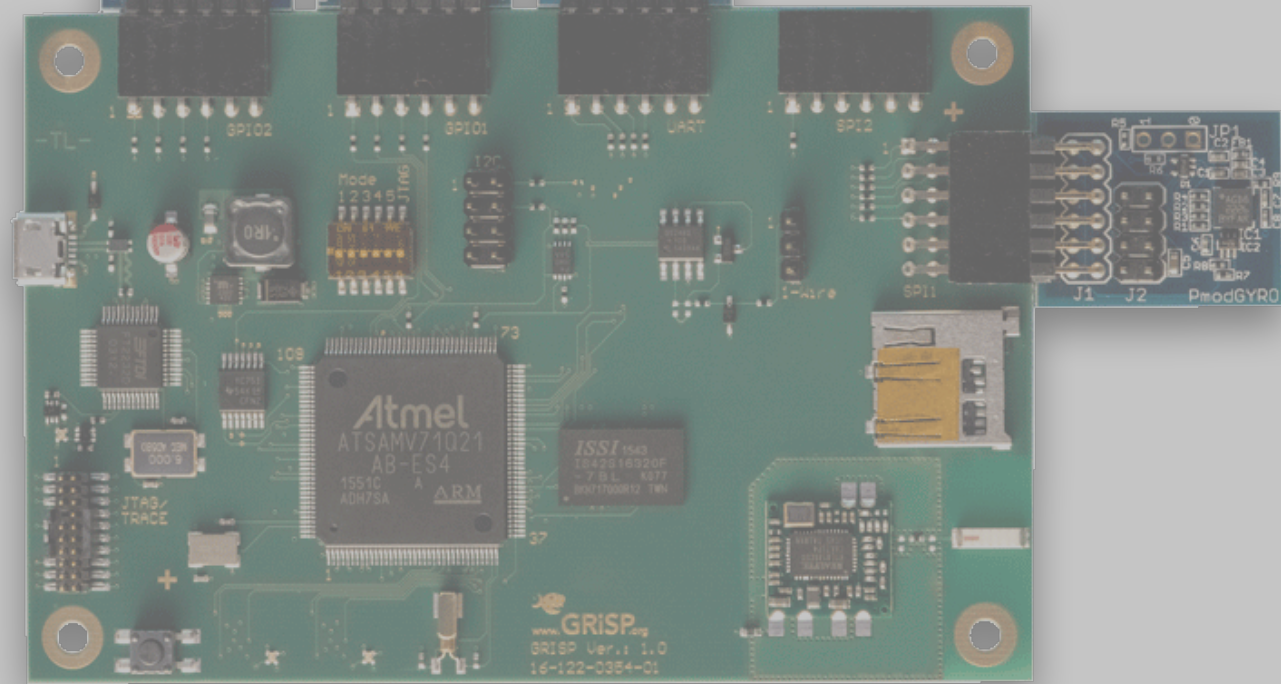
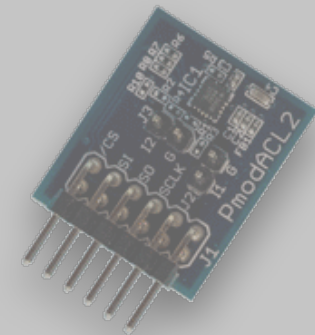
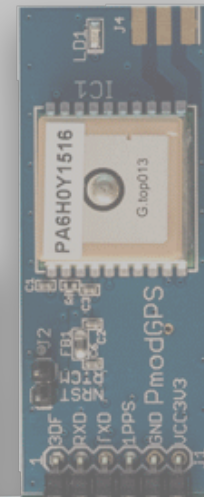
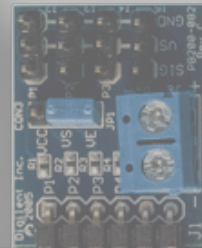
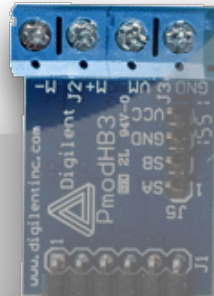
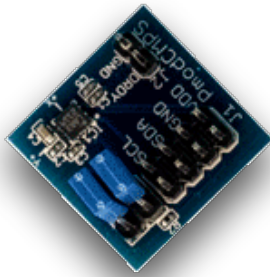




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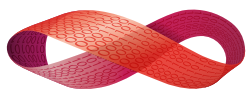
- Form factor TO92 or
- iButton
- Several IC form factors
- Temperature and Climate sensors
- Security devices





Digilent Pmod

- Easy way to get sensors and actuators
- Entrance point to own hardware designs
- Breadboard Pmod
- About 80+ different Pmods readily available
- Highlevel Drivers for common Pmods



DEMO

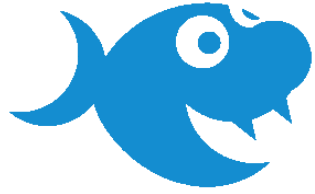


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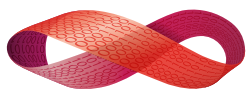


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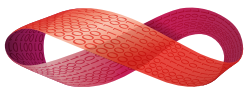
Build process

- rebar3
 - rebar3 new grisp-project
 - plugin for cross building Erlang
 - plugin for statically linked NIF
 - plugin for statically linked Port Drivers



Erlang Distribution

- Wirelessly over Wifi
- Project to make it encrypted by default ongoing
- There are Diligent PMODs with Ethernet interface
- Rewritten epmd in pure Erlang
 - <https://github.com/erlang/epmd>
 - Added a hook to start it before net_kernel





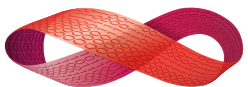
GRISP



luerl

Image attribution

- Wikimedia: TO-92_Front.svg: Inductiveload derivative work: MichaelFrey (talk) - TO-92_Front.svg
- Wikimedia: Stan Zurek - Own work, I-button
- Wikimedia: Single Master to Single Slave : basic SPI bus example en:User:Cburnett - Own work
- Wikimedia: A sample schematic with one master (a microcontroller), three slave nodes (an ADC, a DAC, and a microcontroller), and pull-up resistors R_p en:user:Cburnett



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