

Open FPGA Hardware Platform

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Reason for arranging this mini-workshop

- To find out if there is interest to start working on an open FPGA Hardware platform in this community
- Idea came up after discussion with Jeff Hill at the end of last EPICS meeting

How I see it

- Many sites are building their own FPGA (pizza boxes) that are good for at least a single application but are overkill for others and might lack some important features
- FPGA vendors provide evaluation boards that are OK for evaluation use: they typically have lots of connections but all on high density special connectors
- There is a need for easy to use FPGA platform that could be used for both prototyping and production use
- Modular platform with FPGA on backplane
- Pluggable modules for
 - Digital I/O (TTL, LVPECL, NIM, ...)
 - High speed bussed interfaces e.g. ADC/DAC
 - High speed serial interfaces also e.g. SFP (and also ADC/DAC)
- Standardized interfaces for different module types
- Reuse existing modules FMC, IP, Universal I/O
- Reuse existing HDL code and software

Current IOC Form Factors

- VME
- CompactPCI, PXI (+express)
- mTCA / ATCA
- CompactRIO
- VPX
- Most current form factors are CPU-centric
 - All communication between modules goes through CPU or through external cabling (exception mTCA has P2P high speed serial links)
- Management on mTCA is consuming too much developer resources
 - Is all software and hardware keying really necessary?

Example: Arduino Platform

- Very easy to build simple systems, possible in less than an hour when you are familiar with the platform
- No hardware design necessary
- Just purchase main board, peripherals. Wire up everything and you are ready to go
- Heavy use of I2C
- I/O on pin headers, usually requires wiring and hand soldering to assemble system

CompactRIO (National Instruments)

- Robust platform with variety of pluggable modules
- Compact I/O module size
- FPGA on backplane, CPU on backplane or CPU module

- Limited power dissipation on modules due to small size
- Limited I/O on modules (small 15-pin DSUB connector)
- Limited I/O bandwidth
- Programming only with LabVIEW / FPGA

- Single board RIO
 - Incorporated FPGA backplane and some I/O on bare PCB
 - Has I/O connectors / pin headers
 - cRIO module connectors

Now for the Open FPGA HW Platform

- **Form Factor**
 - Recommendation only?
 - EURO 1 system?
 - Custom form factors allowed
 - It would be nice to have options: select one form factor that suits best
- **Interfaces**
 - Define interfaces e.g. FMC, IP-module, Universal I/O, etc.
 - Interfaces are optional i.e. not all have to be supported simultaneously
- **Backplane**
 - Hardware required for timing receiver on backplane
 - Interface for some CPU e.g. Raspberry PI?
- **FPGA vendor to use (my preference is Xilinx)**
- **Does this make any sense or would we end up with everybody doing their own backplanes and modules?**

Open FPGA HW Platform - Firmware

- Each backplane should have an open source example application as a starting point to help start developing on the board
- Following is probably going to be difficult (everybody has their own preferences):
 - Could the internal bus structures be defined?
 - Development language VHDL, Verilog, or something else?
 - Module interfaces?

What's next?

- Are you interested?
- Would you like to participate in
 - Specification
 - Hardware Design
 - Firmware Design
 - Testing
 - Documentation
- Suggestions?

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