Arduino for FPGA Scope

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Spacetime Programming Meeting

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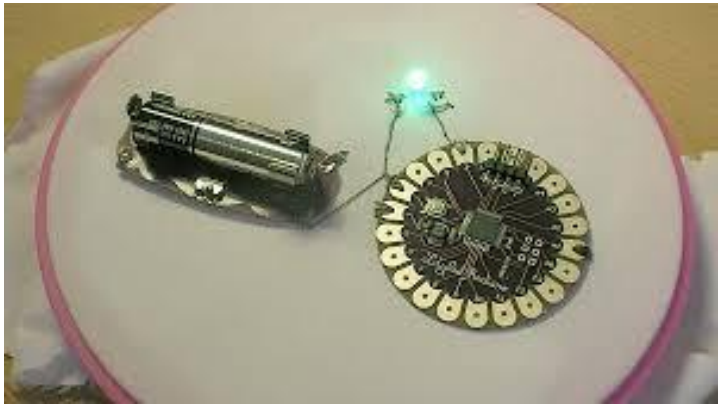
Broad Goals

- Interact with the real world using Chisel
- Identify easy/hard/impossible things in HW/SW maker community
- Implement most easy things in Chisel
- Make some hard/impossible things easy/possible
- Provide platform to enable community to make Arduino-like things using Chisel

What is Arduino

- Easy things easy, hard things maybe
- Homepage
- Based on Atmel 8-bit microcontrollers
- Processing IDE
- One-click compile, download, run



Arduino Experience

- HelloWorld Blink
- Idea -> implementation in seconds
- “Object-Oriented” concepts
- Easy debugging interface
- Somewhat robust to mistakes
  - Fuses, protection diodes

Easy things in Arduino

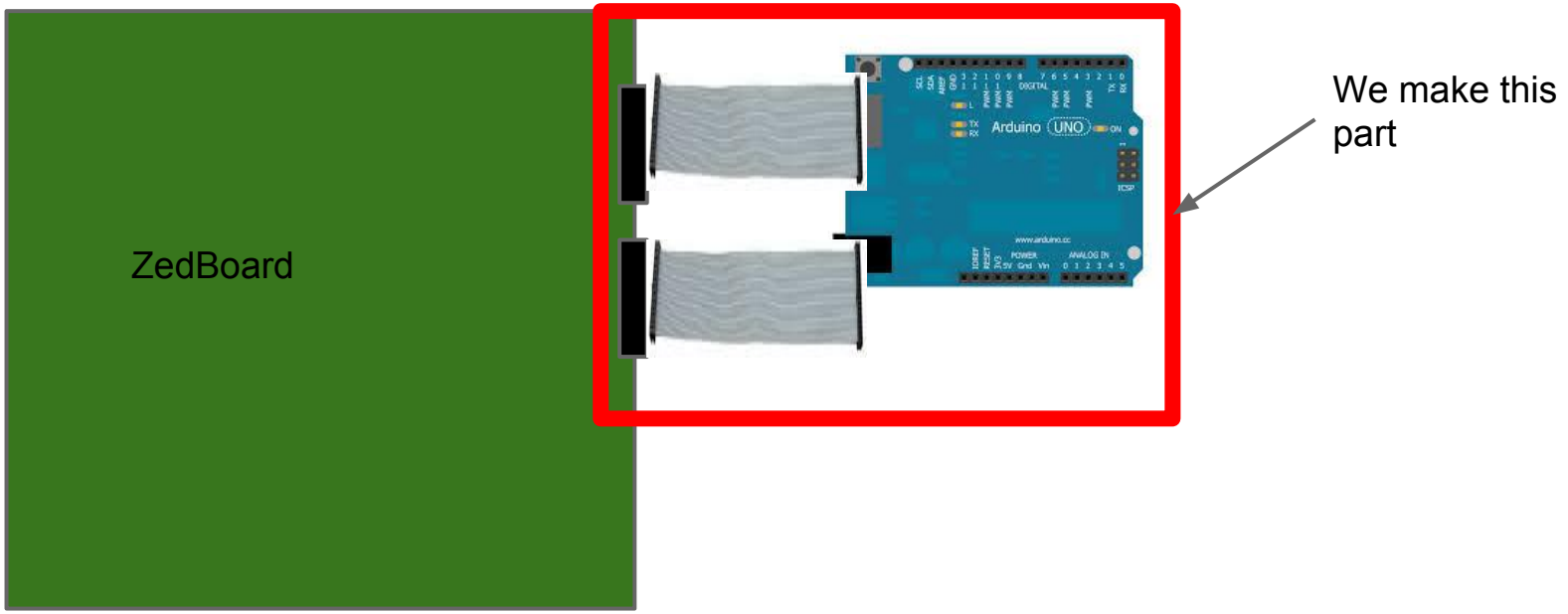
- Digital IO
  - Binary, PWM
  - Lights, switches, motors, servos
- Analog IO
  - ADC
  - Photocell,
- Communication
  - UART, I2C, SPI
  - Touch sensing, proximity, GPS, LCD via peripherals

Hard/Impossible things in Arduino

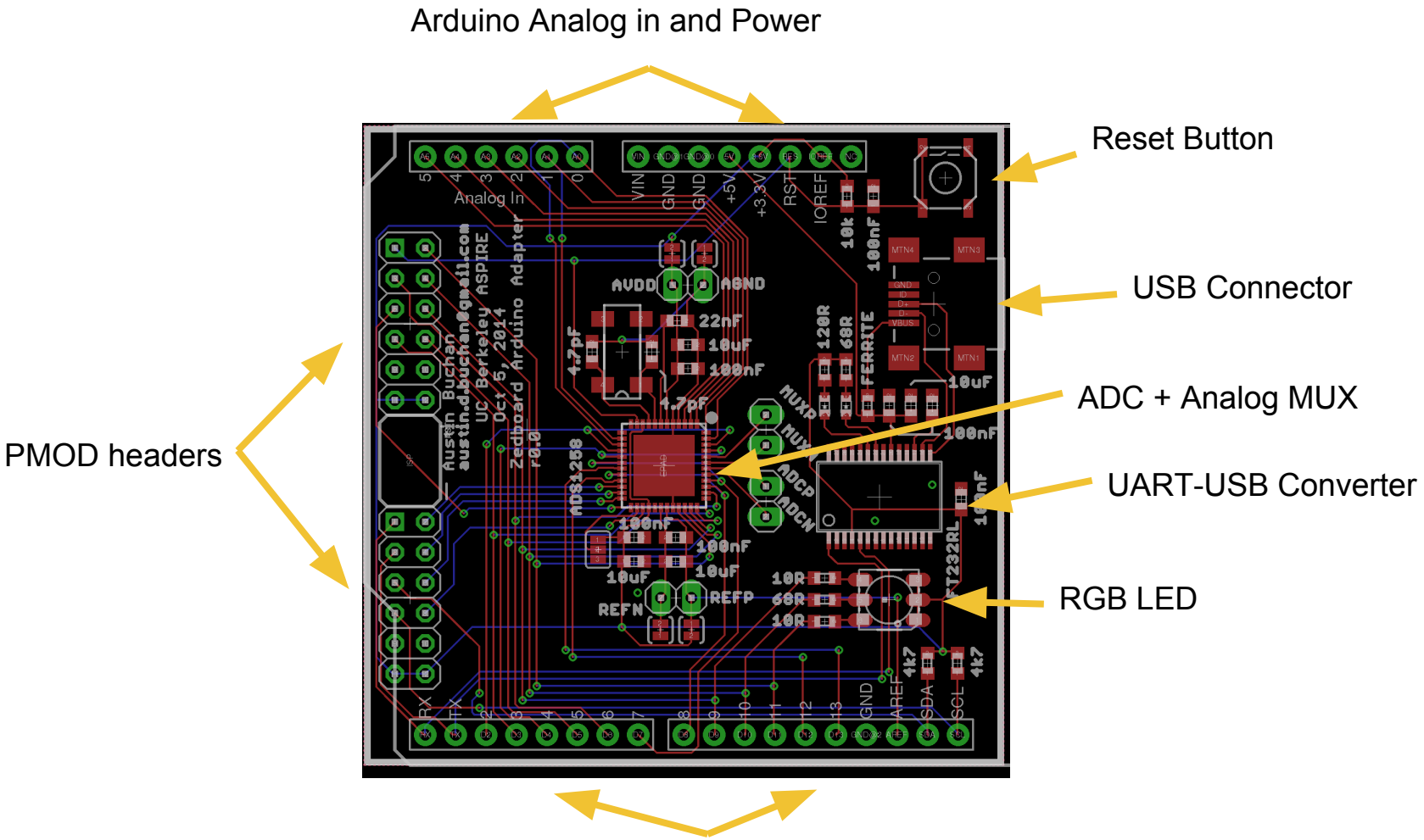
- Concurrency
- Physical parallelism
- Real-time
- Flexible peripherals
  - HW modification
  - Massive amounts of IO
  - High bandwith IO
- High-performance compute

FPGA Platform

- Provide Arduino physical interface and functionality via ZedBoard PMOD



Adapter Board Layout



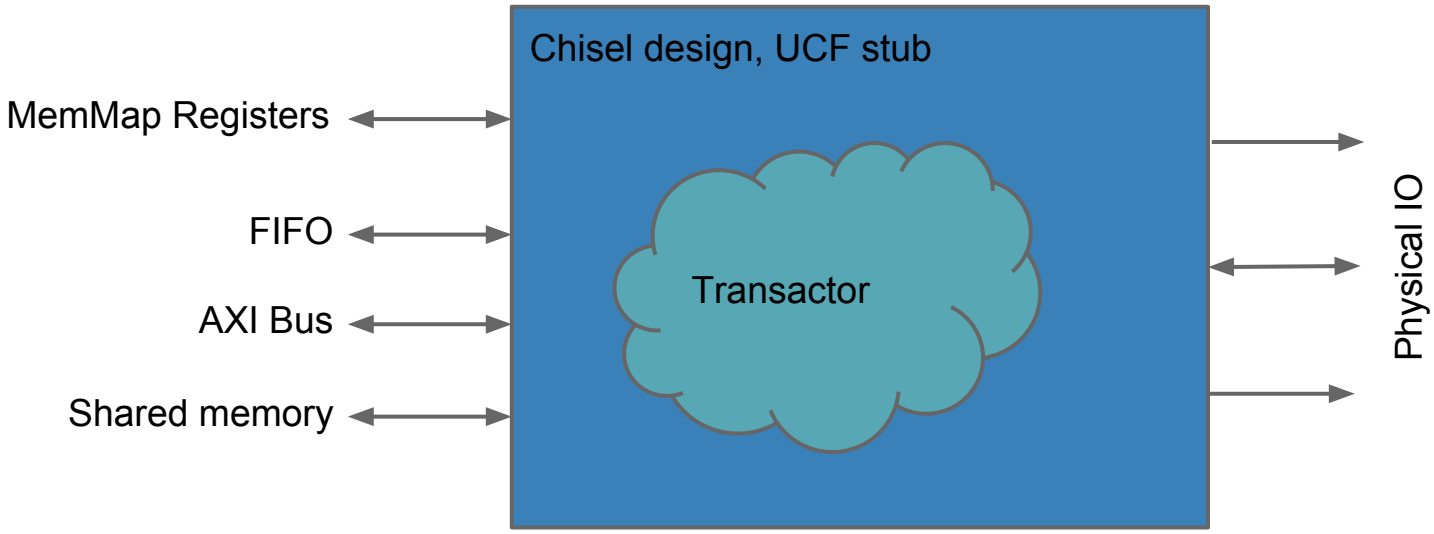
Other FPGA Arduinos

- Papilio (AVR8 softcore)
- Mojo v3 (FPGA + Arduino over serial)
- Arduissimo (Manycore arduino with “virtual peripherals”)

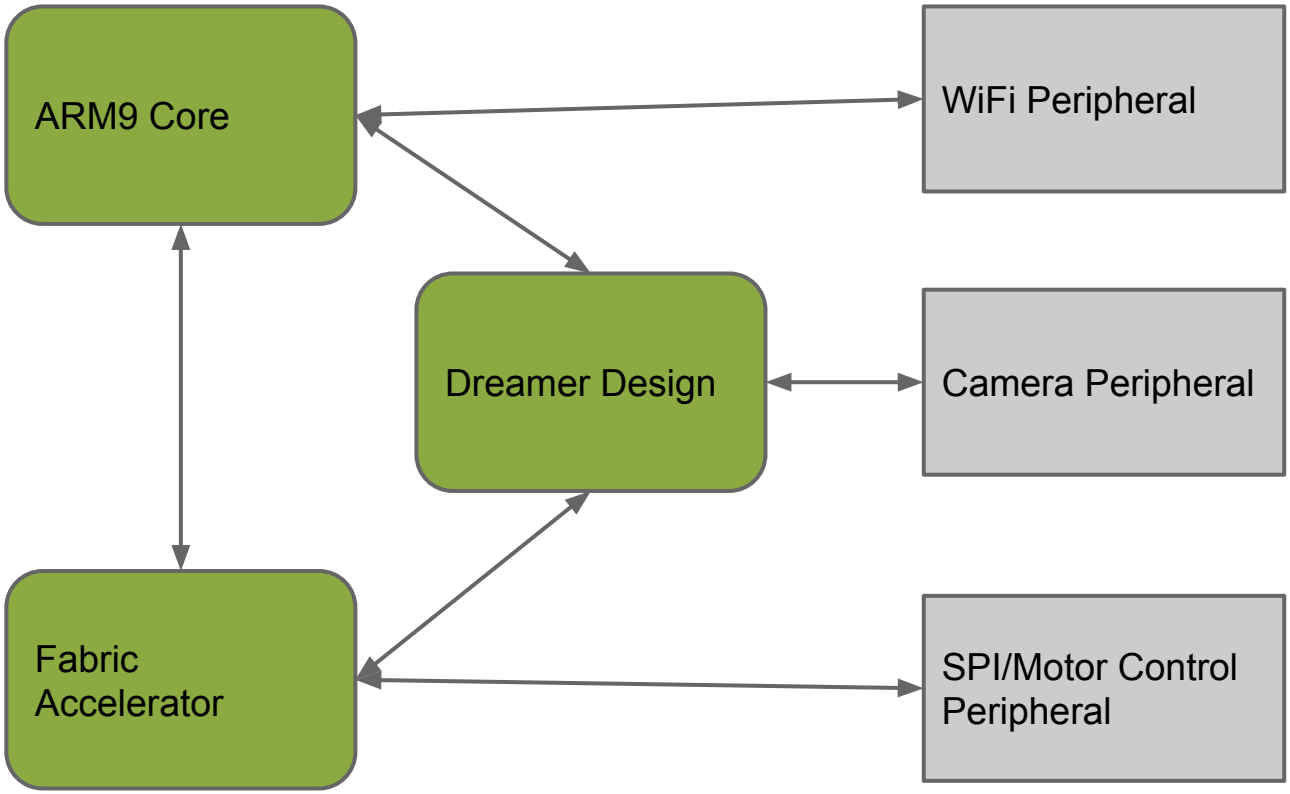
Chisel Implementation

- Procedural interface to chisel-arduino library
  - setup, loop, peripheral packages
- Implement peripheral hardware as extensible modules
- One-click (type make) compile and run to {bitfile/dreamer config} and executable
- Hardware configurator with text source
- High-powered compute interface
- Defined concurrent run-time semantics

Peripheral module specification



System/Runtime specification



Hack Friday ideas

- Arduino Starter Kit
- Arduino Project Ideas
- Shieldlist.org
  - Eg: Cellular smoke detector

Hack Friday Goals

- I will provide starter project to control Arduino peripherals (DIO, ADC, PWM, UART, SPI, I2C) as Vivado project and C/Python host interface
- All interested STP parties pick some set of shields/parts and write application in Chisel
- Debug, Debug, Debug
- Collaborate on system description, runtime model, build system

TODOs

- Look into zynq on-board Arduino (contracted)
- Visit from Othermachine corp
- Priorities (short term)
  - Build board
  - get basic Vivado project to duplicate Arduino functionality on ZedBoard
- Long term
  - rocket + hurricane + FGPA in Arduino package