On the use of programmable logic in FabLabs

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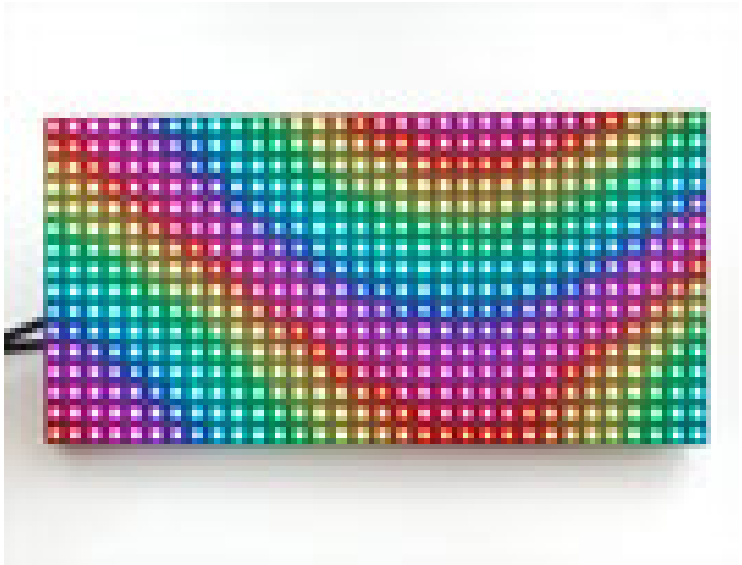
Self introduction

- Cord Elias
- Electrical Engineer
- Self employed: Embaix–Consulting
- Focus: Embedded Systems
- Motivation for being here: Providing and getting new ideas, make an offer, meeting interesting people

Source: `http://opensourceecology.org`



RGB LED Matrix Display
Control: challenging (timing)
Control with programmable logic: Very good fit

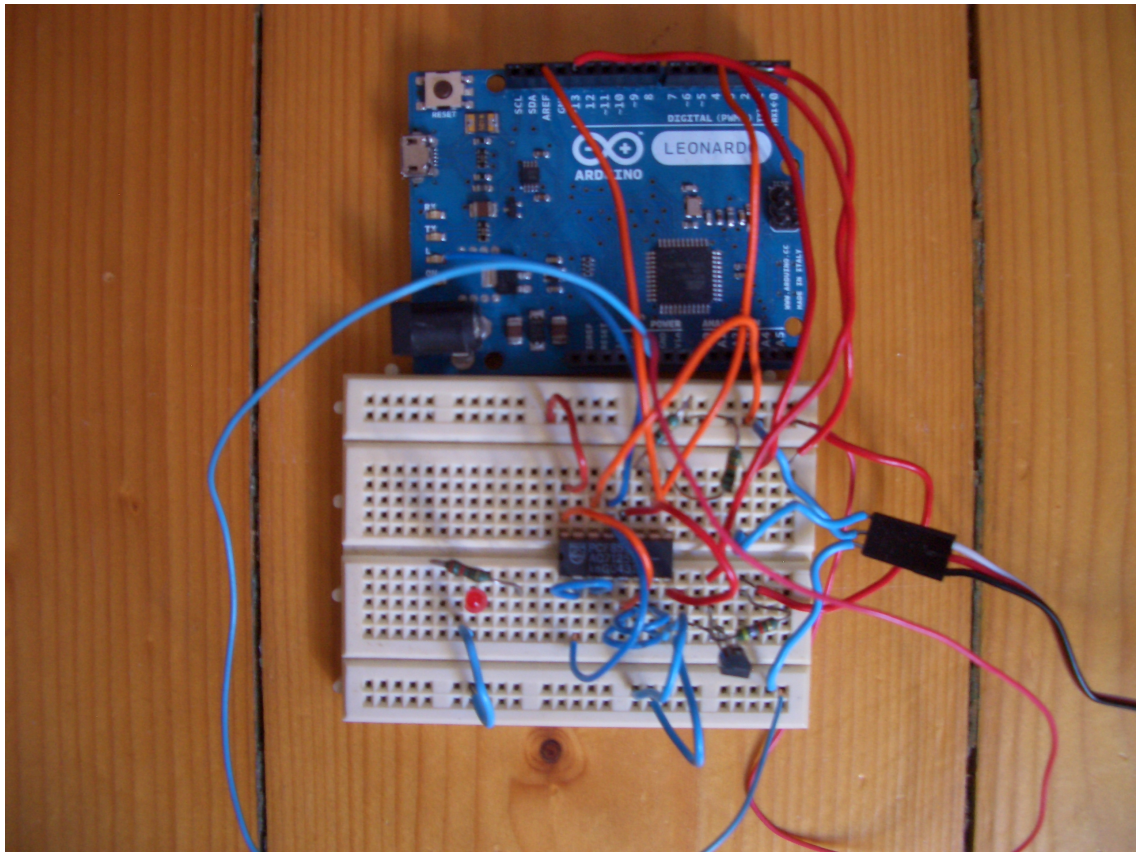
Programmable logic

- Complex Programmable Logic Devices (CPLD's)
- Field Programmable Gate Arrays (FPGA's)
- Ever heard about it?
- Ever used it?

Some myths about programmable logic

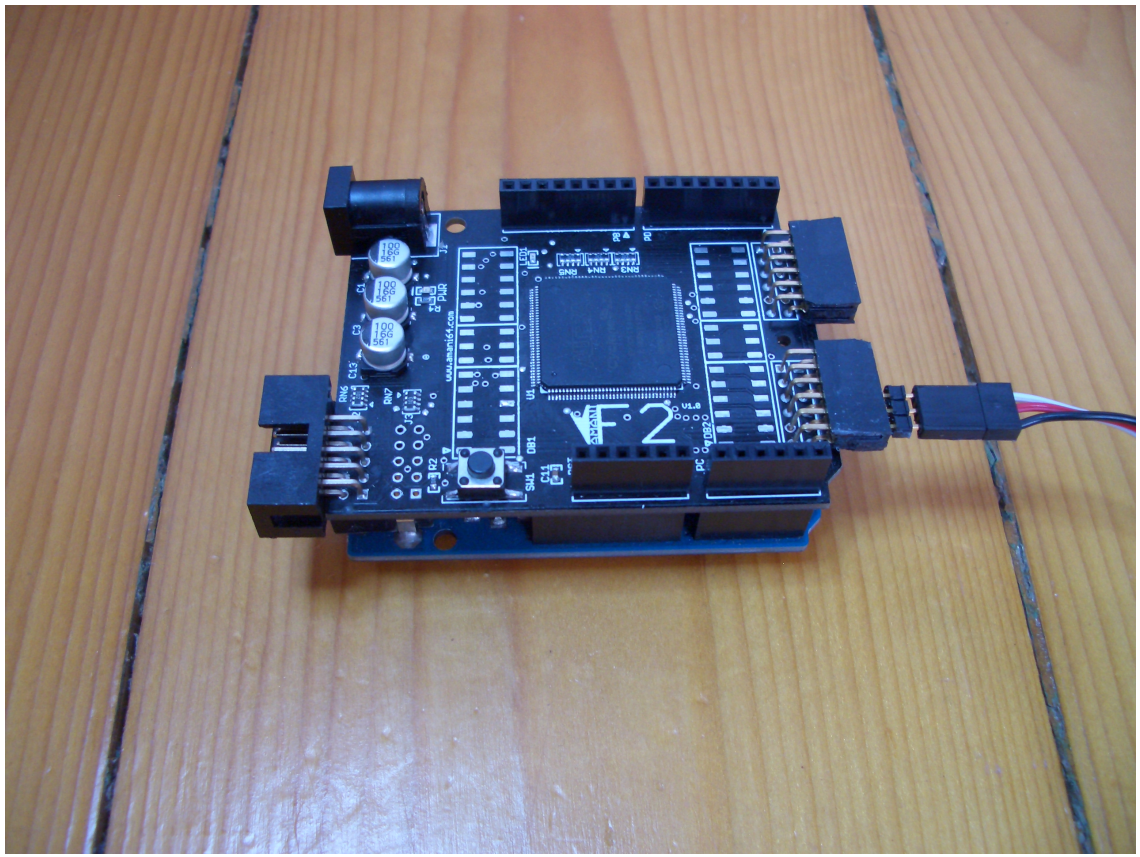
- Very complicated to use
- Only for people with engineering degree
- Development tools are very expensive

Typical maker szenario



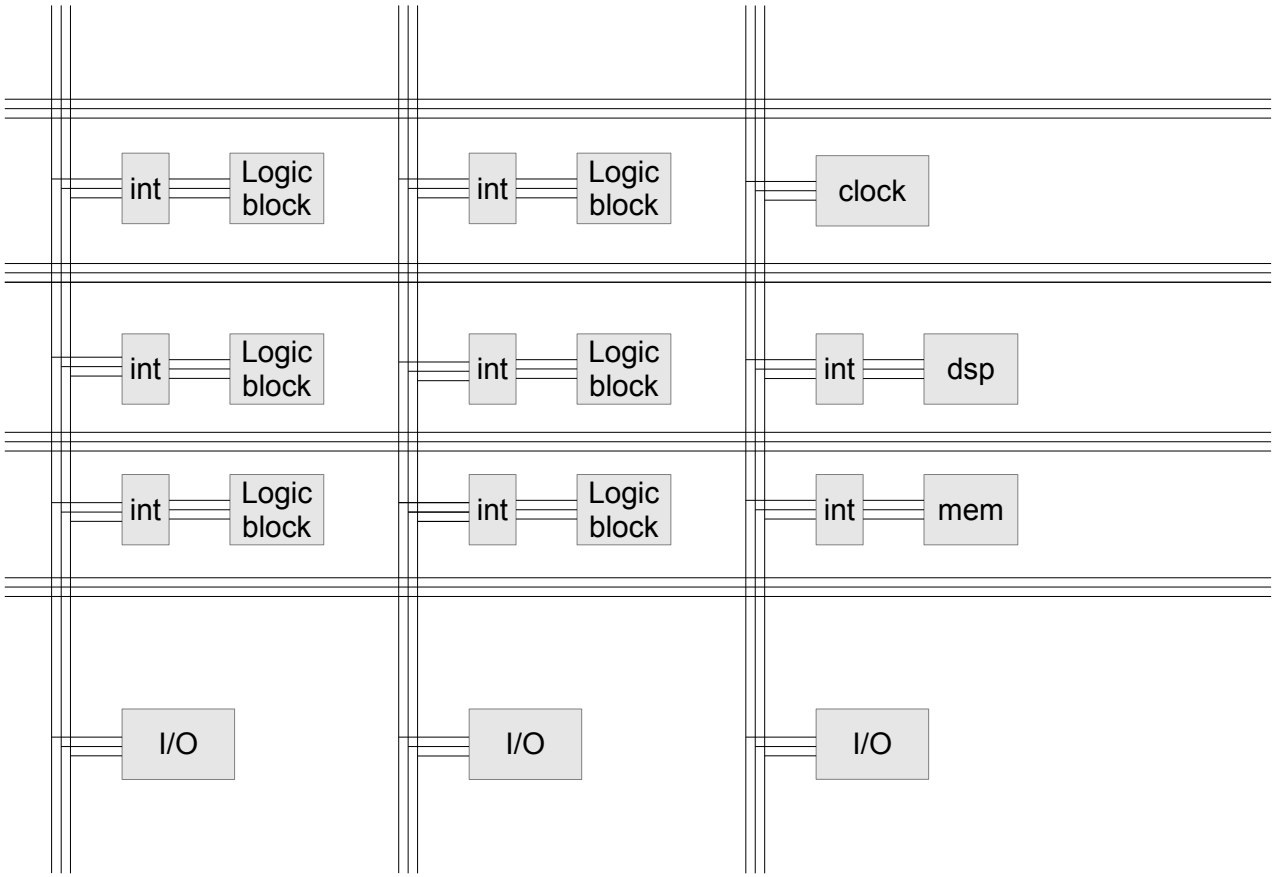
Arduino with Breadboard

Nicer maker szenario



Arduino with FPGA–Shield

FPGA Basics (1)



Inner FPGA components

FPGA Basics (2)

Main FPGA manufacturers:

- Altera®
- Xilinx®
- $>$ 90% market share

FPGA–Basics (3)

What do I need to get started with FPGA's?

- FPGA–Board (costs: around 100€)
- Cost free development tool (from FPGA manufacturer)

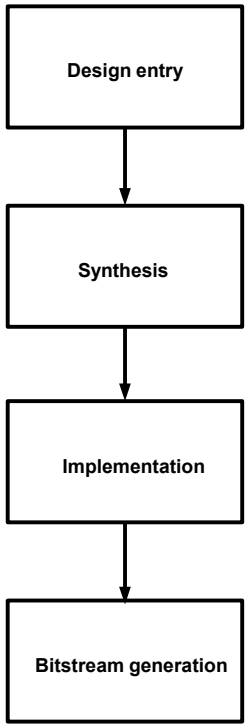
FPGA–Basics (4)

What do I need to know to get started?

- Basic knowledge of FPGA functionality
- Basic capabilities with development tools
- Basic VHDL knowledge (not mandatory, but highly recommended)

FPGA–Basics (5)

Development workflow

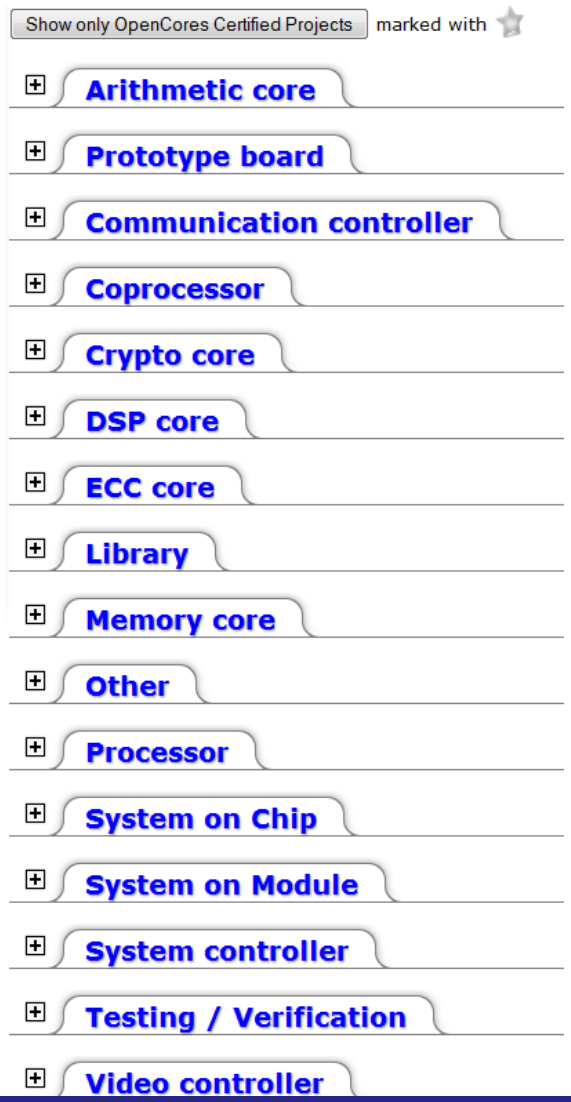


VHDL Entry

led_io33.vhd

```
library IEEE;
use IEEE.STD_LOGIC_1164.ALL;
use IEEE.STD_LOGIC_UNSIGNED.ALL;

entity led_io33 is
    Port ( clk_50 : in  STD_LOGIC;
           led_o : out  STD_LOGIC);
end led_io33;

architecture Behavioral of led_io33 is
signal cnt_r : std_logic_vector(23 downto 0) := (others=>'0');
begin

process(clk_50) is
begin
  if rising_edge(clk_50) then
    cnt_r <= cnt_r + 1;
  end if;
end process;

led_o <= cnt_r(23);

end Behavioral;
```

opencores.org



Topics

- FPGA board(s)
- FPGA design software installation
- Appropriate documentation
- Staff training

Documentation

- Proposal: FabLab standard
- Beginner level
- Tool installation guide
- "Get Started"
- Well worded out examples for typical FabLab digital electronic design tasks

FabLab staff training

- Kickstart workshop
- Development of Library with examples and design patterns ("Cookbook")
- Establish FabLab programmable logic design network
- Onsite programmable logic workshops

Summary

- Programmable logic can be very useful for FabLab users
- Utilization of programmable logic is feasible in a FabLab environment
- Some effort is necessary
- Challenge can be mastered collaboratively!