beginner's FPGA

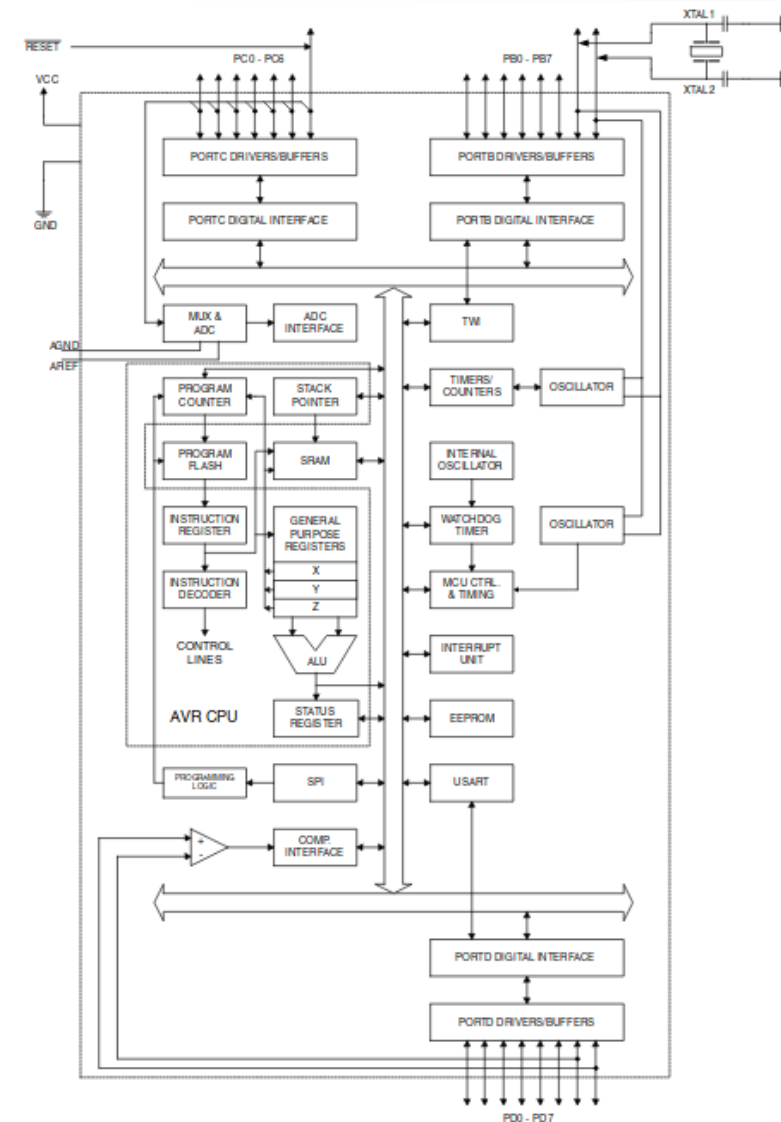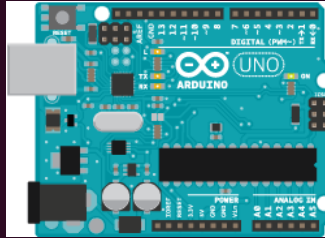**Bilbao Makerfaire 2018**
@matthewvenn

Arduino: 2 buttons and LED

```
int button1 = 1;
int button2 = 2;
int led = 3;

void setup()
{

        pinMode(button1, INPUT);
        pinMode(button2, INPUT);

}

void loop()
{

        // read buttons
        bool pressed1 = digitalRead(button1);
        bool pressed2 = digitalRead(button2);

        // if pressed, light LED
        if (pressed1 && pressed2)
                digitalWrite(led, True);
        // otherwise don't
        else

                digitalWrite(led, False);

}
```
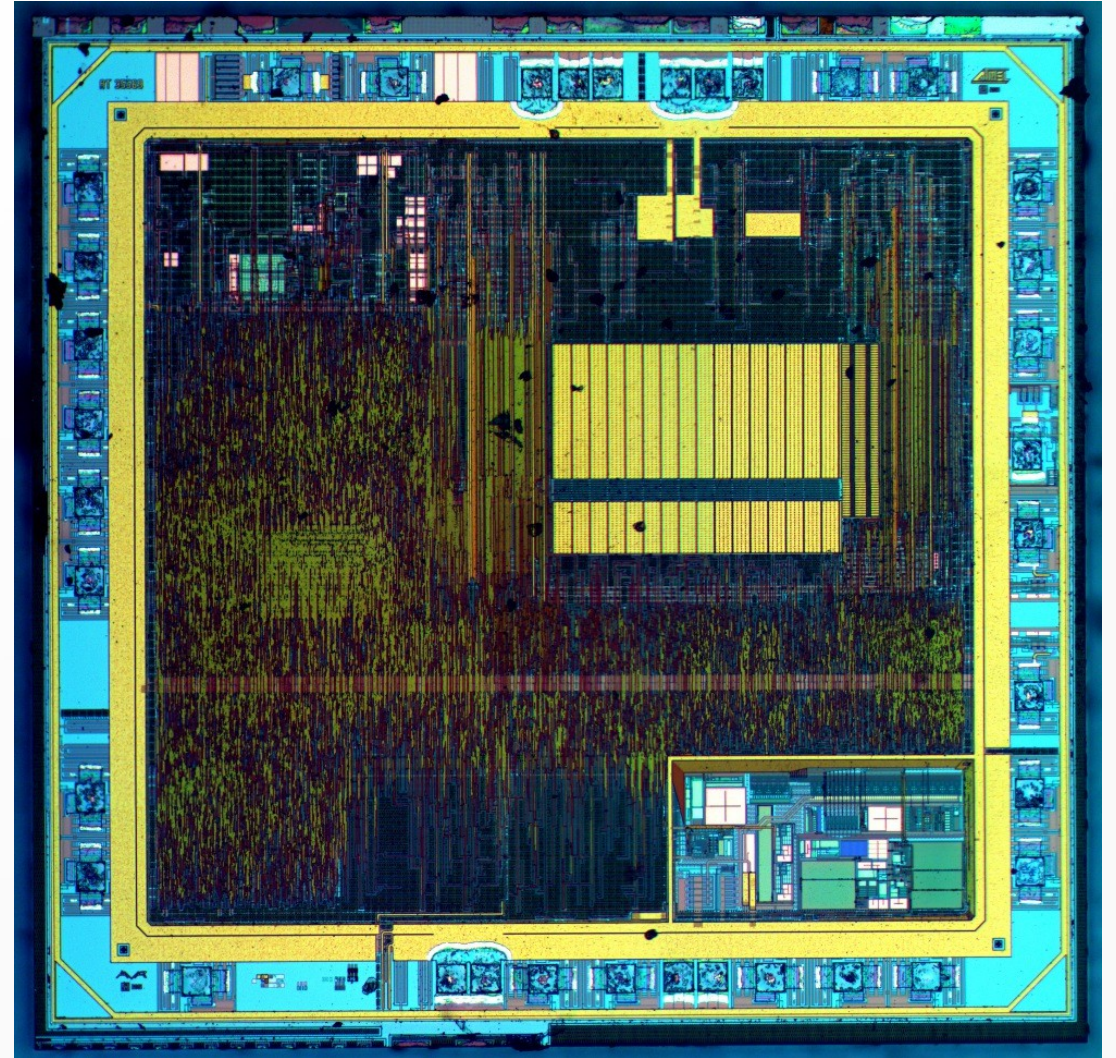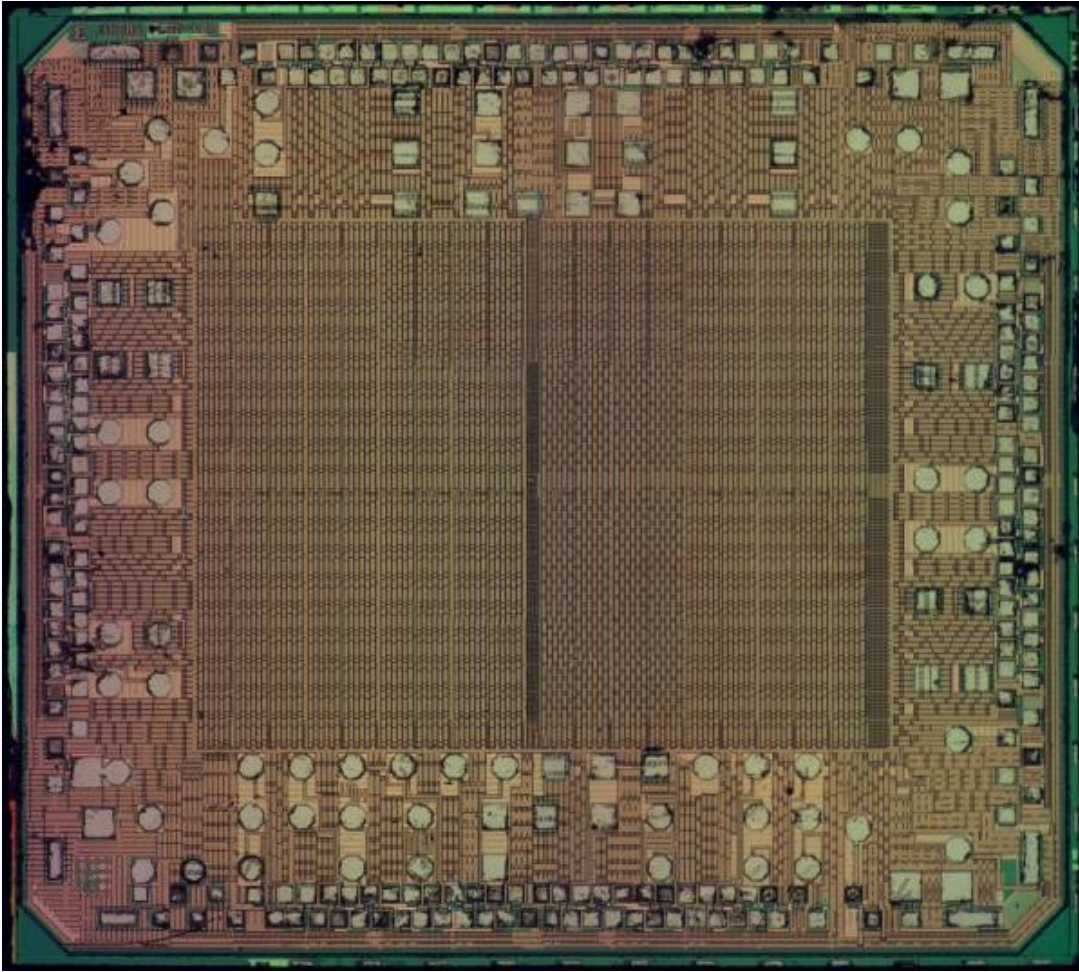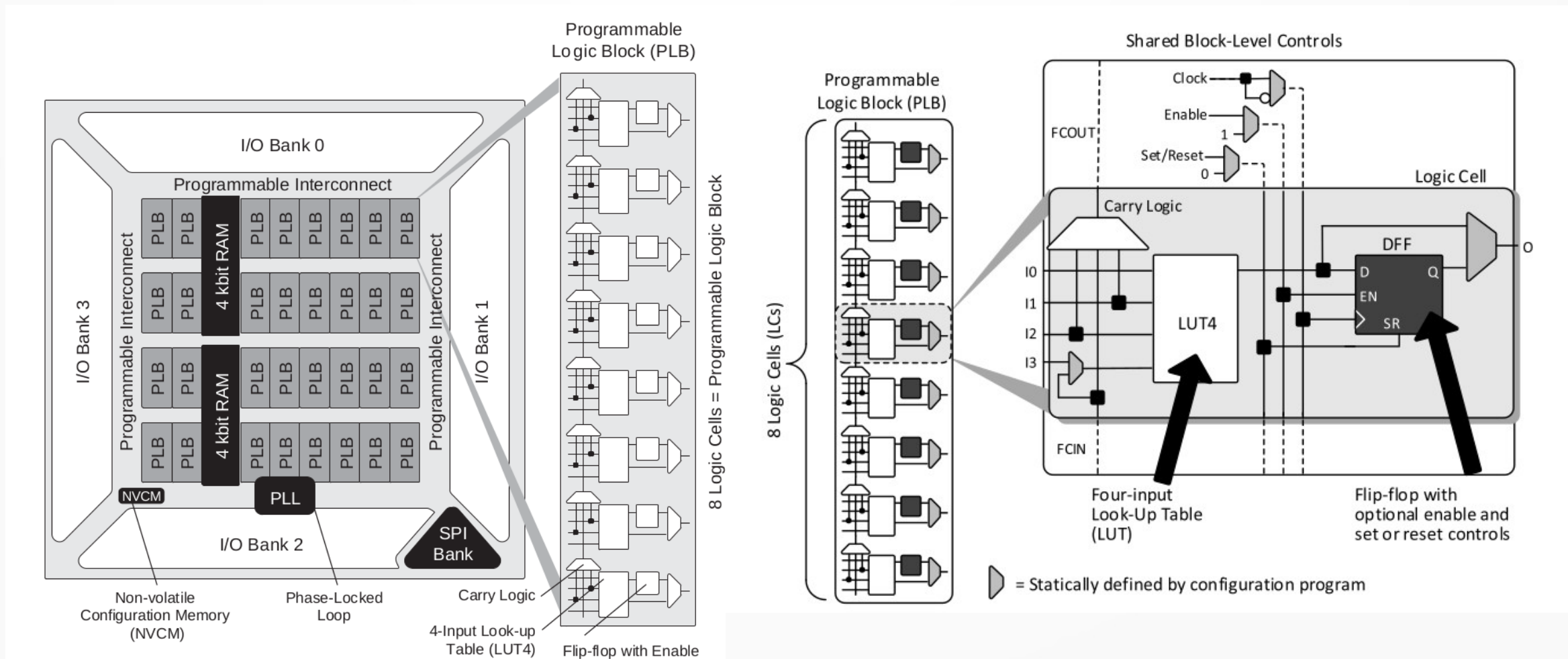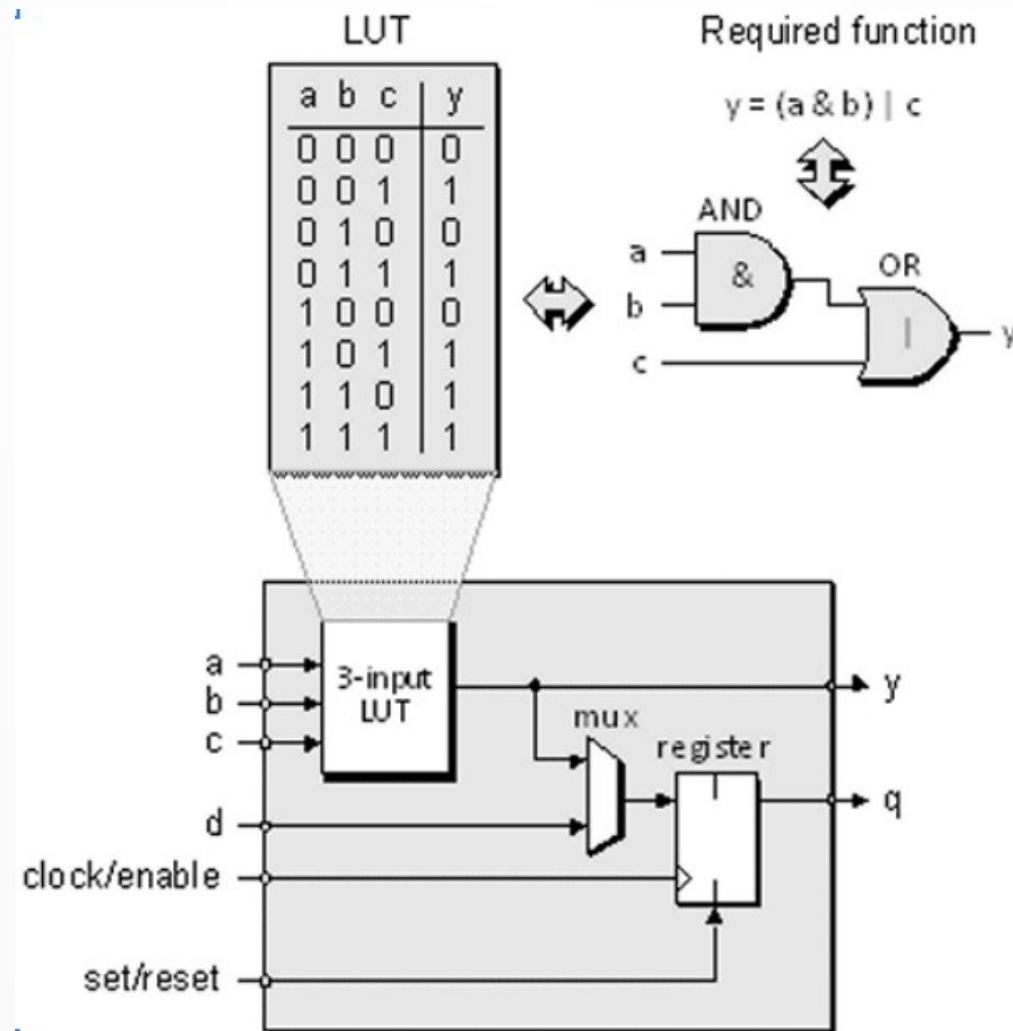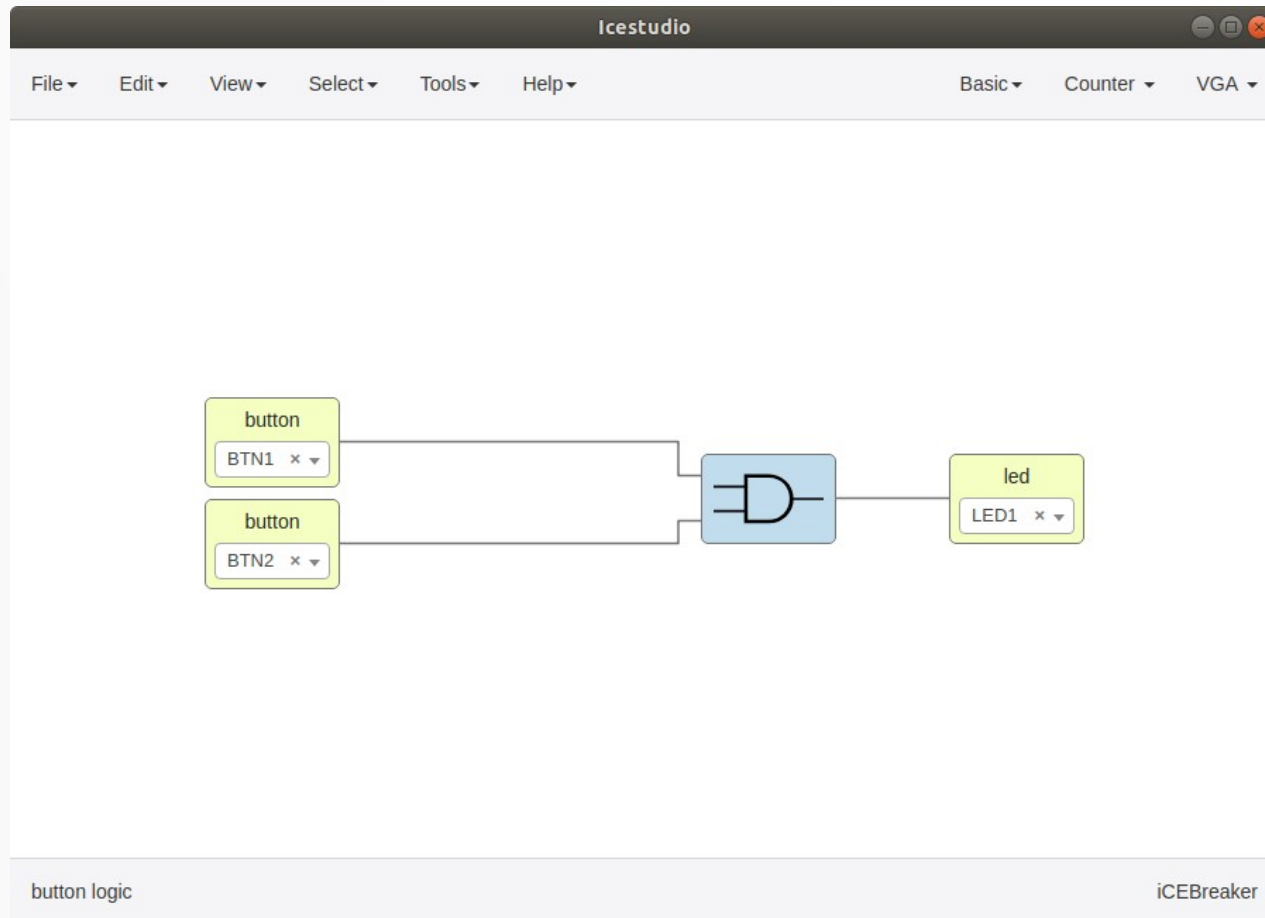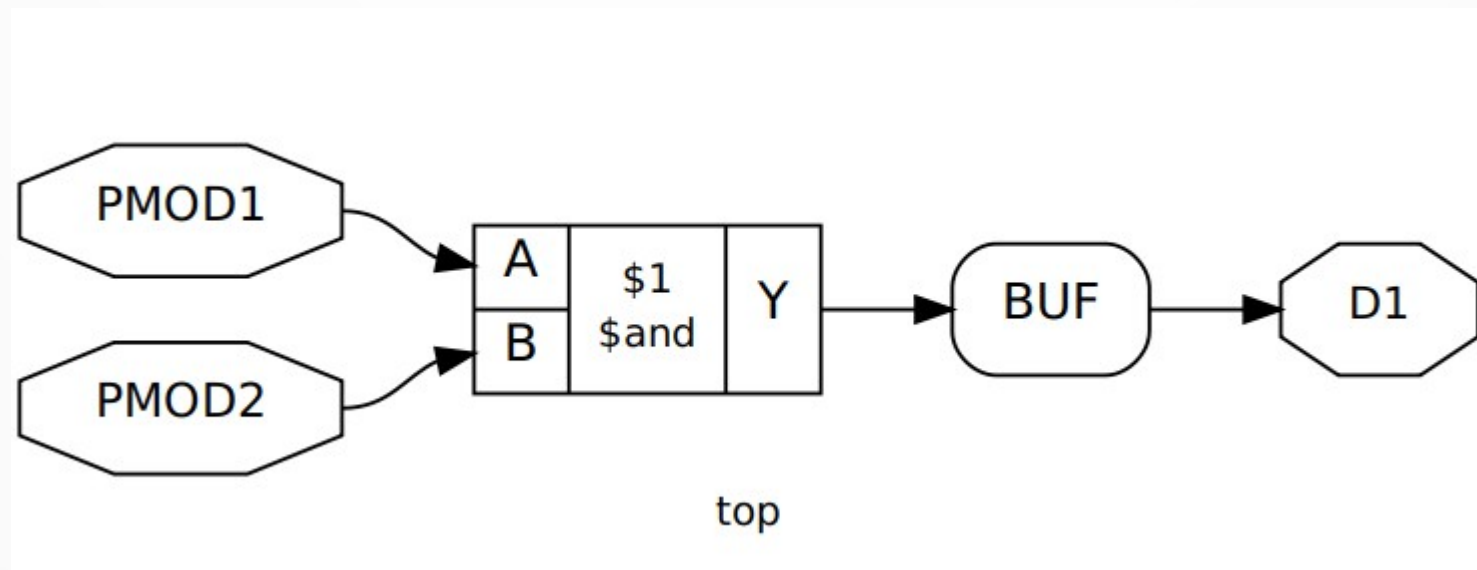
Silicon: FPGA vs Arduino

FPGA structure

Programmable Logic Block (PLB)

8 Logic Cells = Programmable Logic Block

Carry Logic
4-Input Look-up Table (LUT4)
Flip-flop with Enable

I/O Bank 0
Programmable Interconnect
I/O Bank 3
I/O Bank 1
I/O Bank 2
Programmable Interconnect
PLB
4 kbit RAM
NVCM
PLL
SPI Bank

Non-volatile Configuration Memory (NVCM)
Phase-Locked Loop

Programmable Logic Block (PLB)
8 Logic Cells (LCs)

Shared Block-Level Controls
Clock
Enable
Set/Reset
FCOUT
FCIN
Carry Logic
Logic Cell
LUT4
DFF
D   Q
EN
SR
O
I0
I1
I2
I3
1
0

Four-input Look-Up Table (LUT)
Flip-flop with optional enable and set or reset controls

= Statically defined by configuration program

LUTs = Lookup Tables

FPGA: 2 buttons and LED

Yosys show - inference

Place and Route