Connecting Open Source Hardware to the Web

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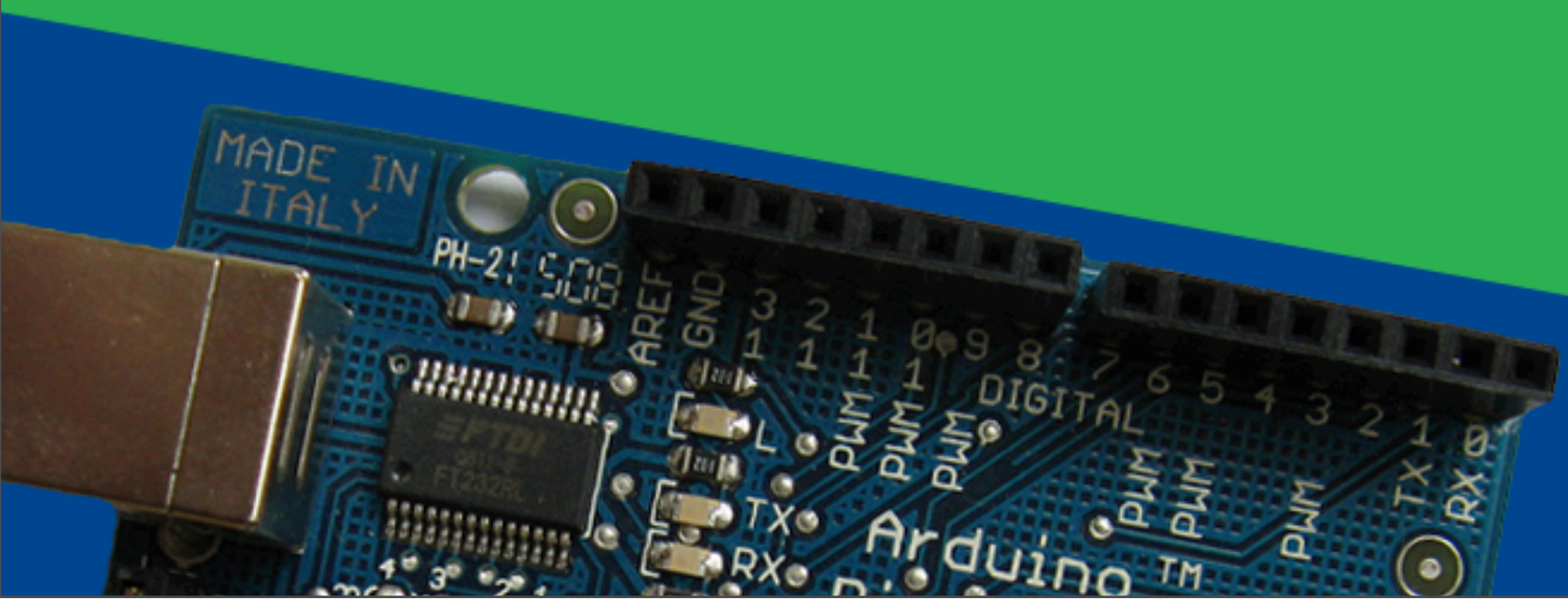


Who am I?

- Programming for 25 years
- Developing and creating web applications for 15 years
- Developer and trainer in Flex and ColdFusion
- Adode Community Professional

Arduino

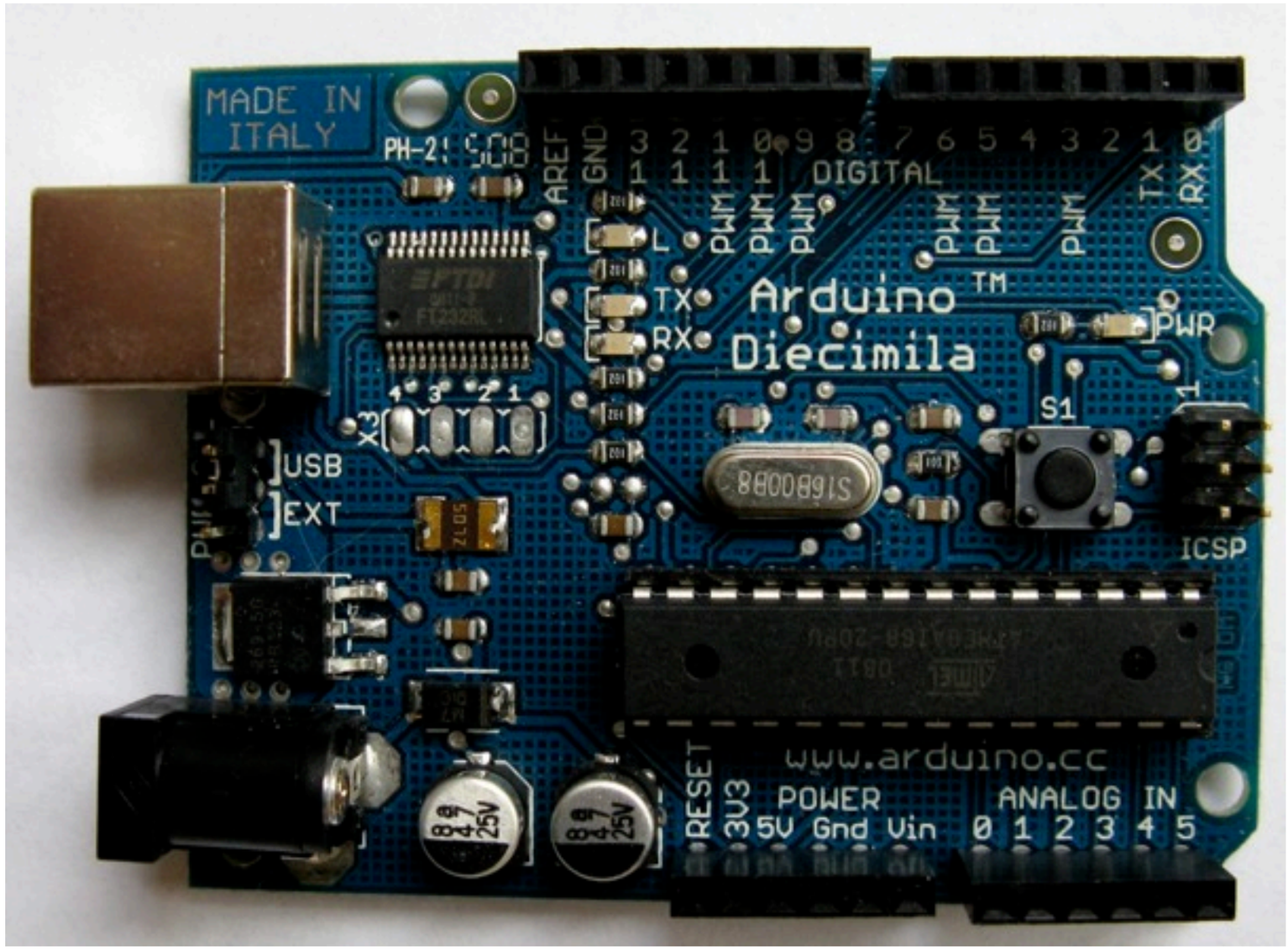
Overview of the Arduino Platform

Arduino Platform

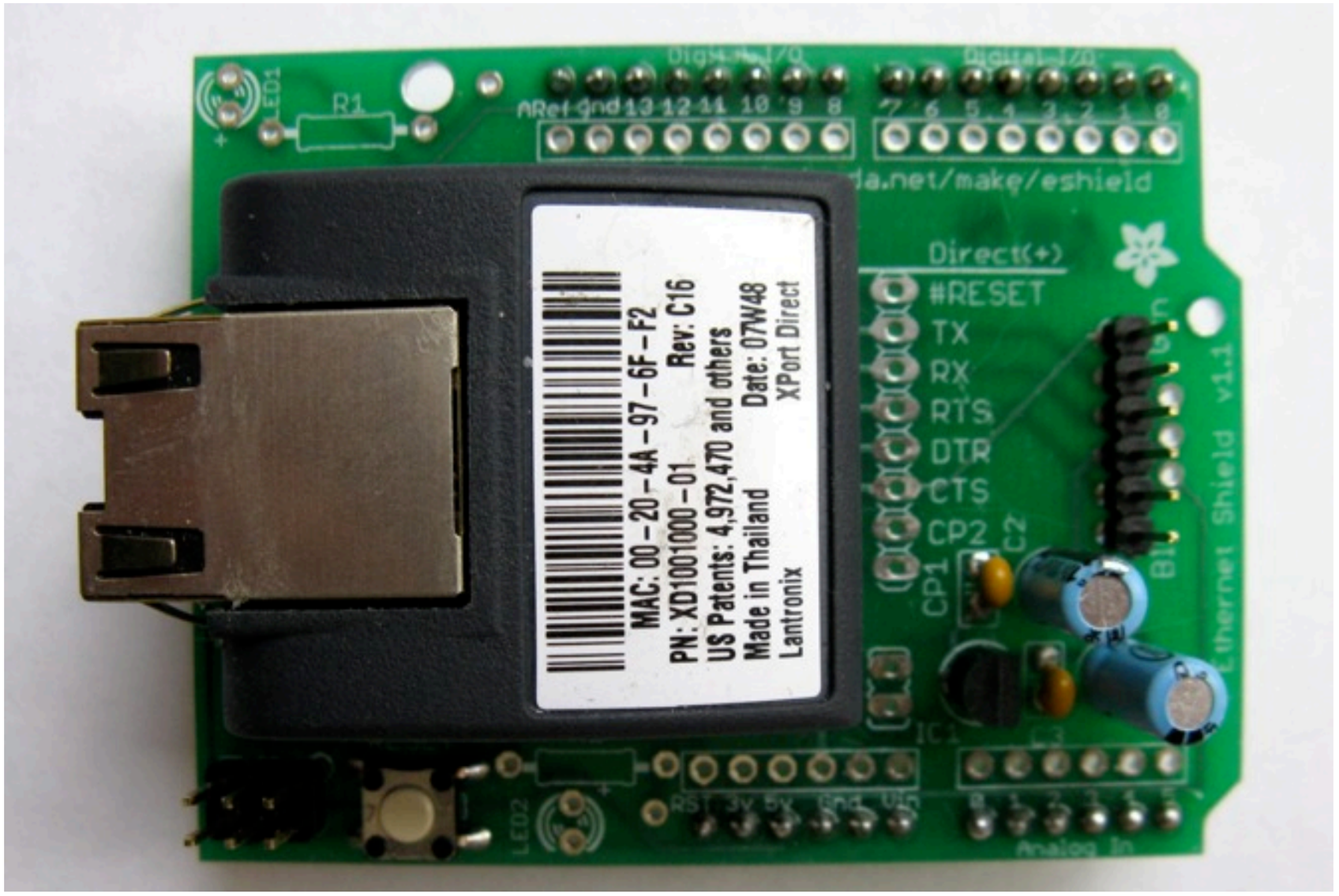
- Open source hardware and software platform
- Easy to program
- Hardware is flexible, fast and low power

Arduino Hardware

- Comes in a number of shapes sizes
- Low cost
- Easy to extend



Arduino Boards



Arduino Shields

Web Standards Group

Arduino Software Platform

- Open source cross platform IDE
- Alpha but very stable
- Code in high level C like language
- Updated frequently
- Growing and active community

Arduino Code

- C like high level language
- Inbuilt functions to read and set digital and analog inputs and outputs
- Includes libraries to perform common hardware or software tasks

SuperFluxRGB

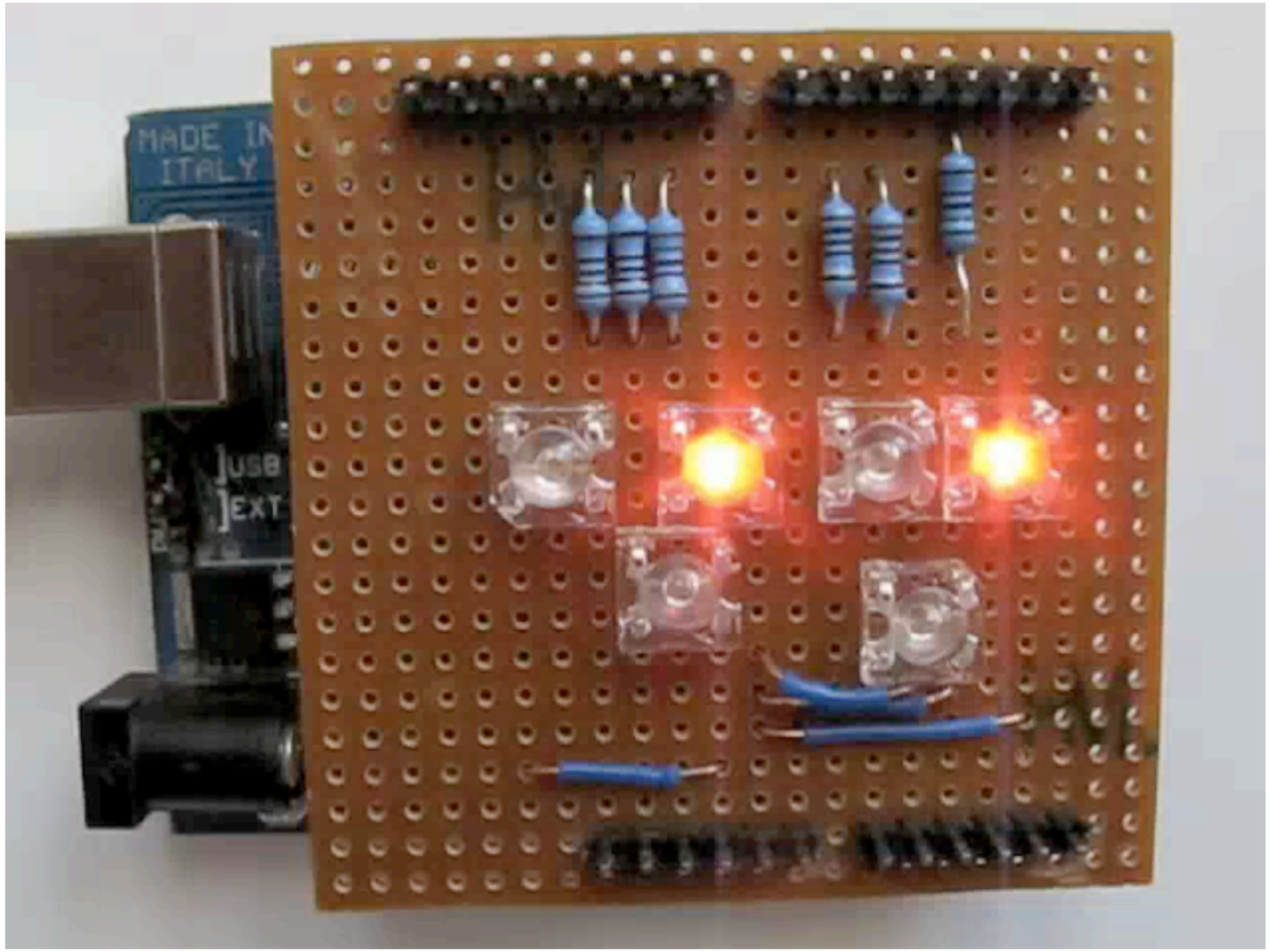
```
int redLed[] = {3,9};
int greenLed[] = {5,10};
int blueLed[] = {6,11};

float redFactor = 1.0;
float greenFactor = 76.0/160.0;
float blueFactor = 76.0/85.0;

void setLedColour(int led, int red, int green, int blue) {
  int redMod = int(red*redFactor);
  int greenMod = int(green*greenFactor);
  int blueMod = int(blue*blueFactor);

  Serial.print(redMod, DEC);
  Serial.print(' ');
```

Arduino IDE



Led Shield Demo

Web Standards Group

Issues

- Debugging can be hard
- Memory, power and speed limits
- Helps to have a little electronic knowledge

Connecting Arduinos to the Web

How Arduinos can communicate with the outside world.

Web Standards Group

Connection Methods

- Direct to computer
- Wireless (XBee modems)
- Ethernet or WiFi
- “The Cloud”

Supported Languages

- Flash and Flex
- Processing
- Python
- Ruby
- Java
- C, C++, C# and Objective C
- .NET

Direct Connection

How to communicate with Arduinos via a computer

Direct Communication

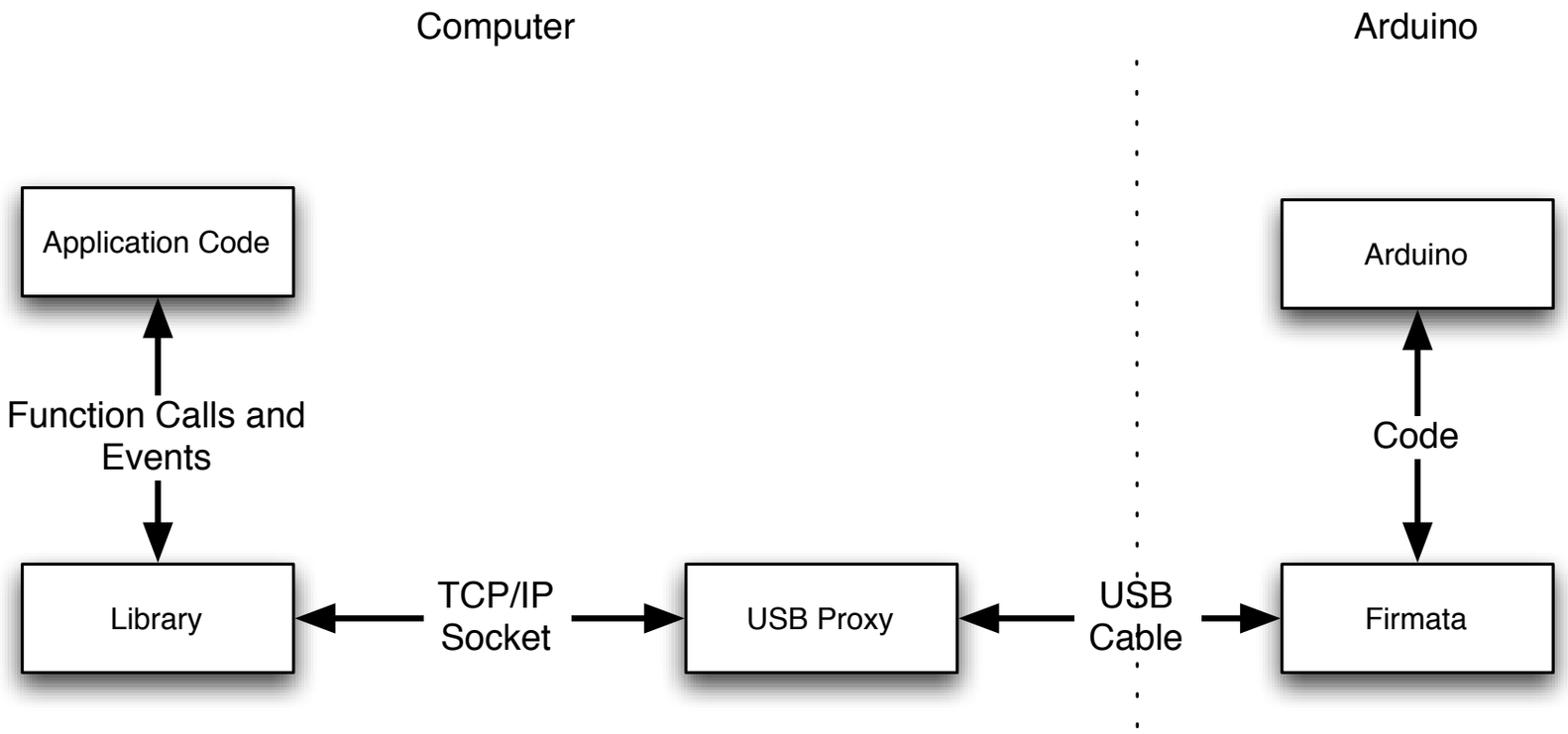
- Most languages can't talk USB
- Solution: Socket to USB proxy

Layers of Communication

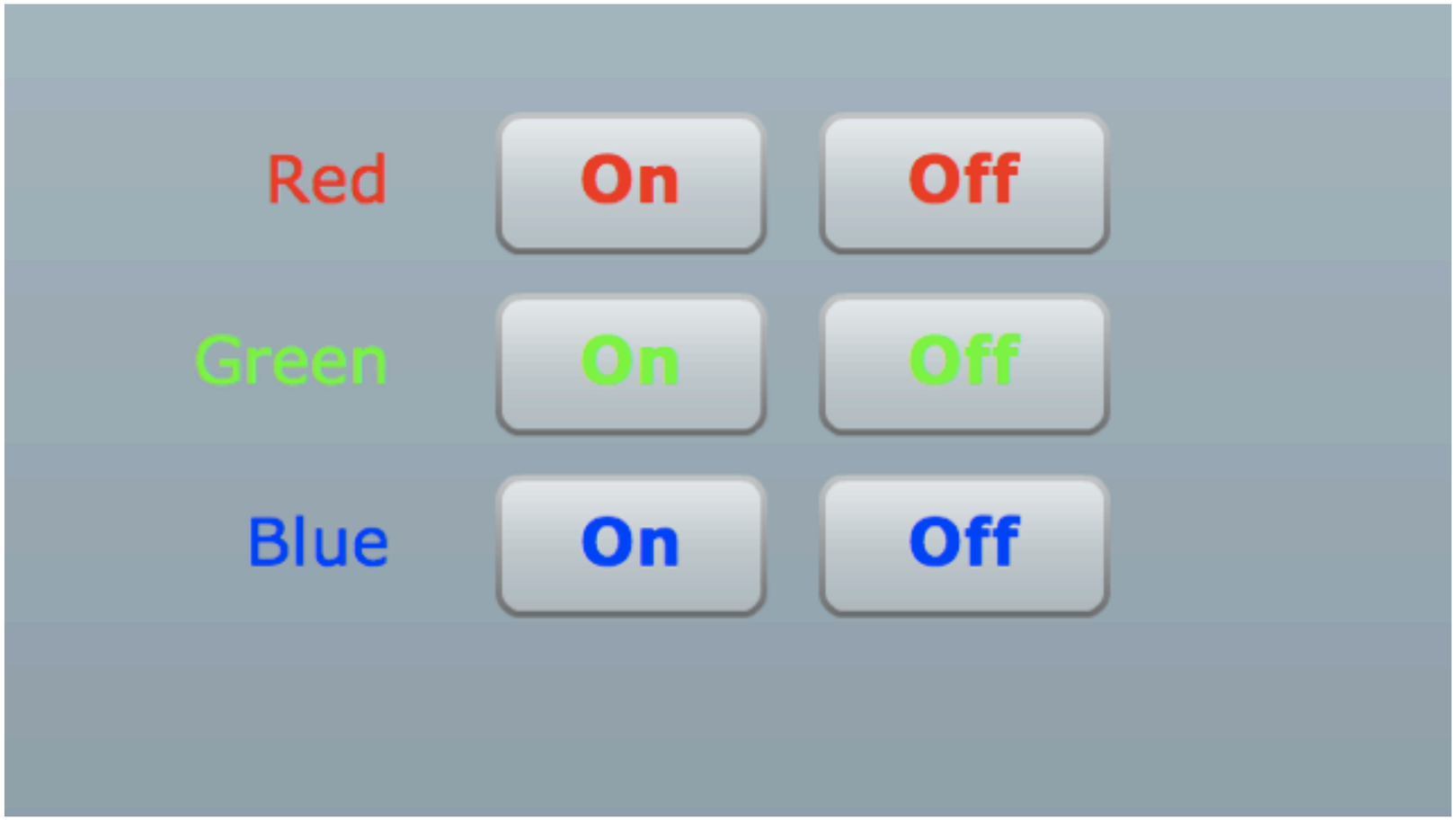
- Code Library
- Proxy to USB
- Program on arduino to USB

Firmata Protocal

- Standard Arduino library
- Simple binary protocol
- Based on MIDI
- Easy to extend



Connection Diagram



Firmata Demo

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Issues

- Works best with a persistent connection
- Otherwise startup time and auto reset may be issues
- Proxy must be running on computer the Arduino is connected to

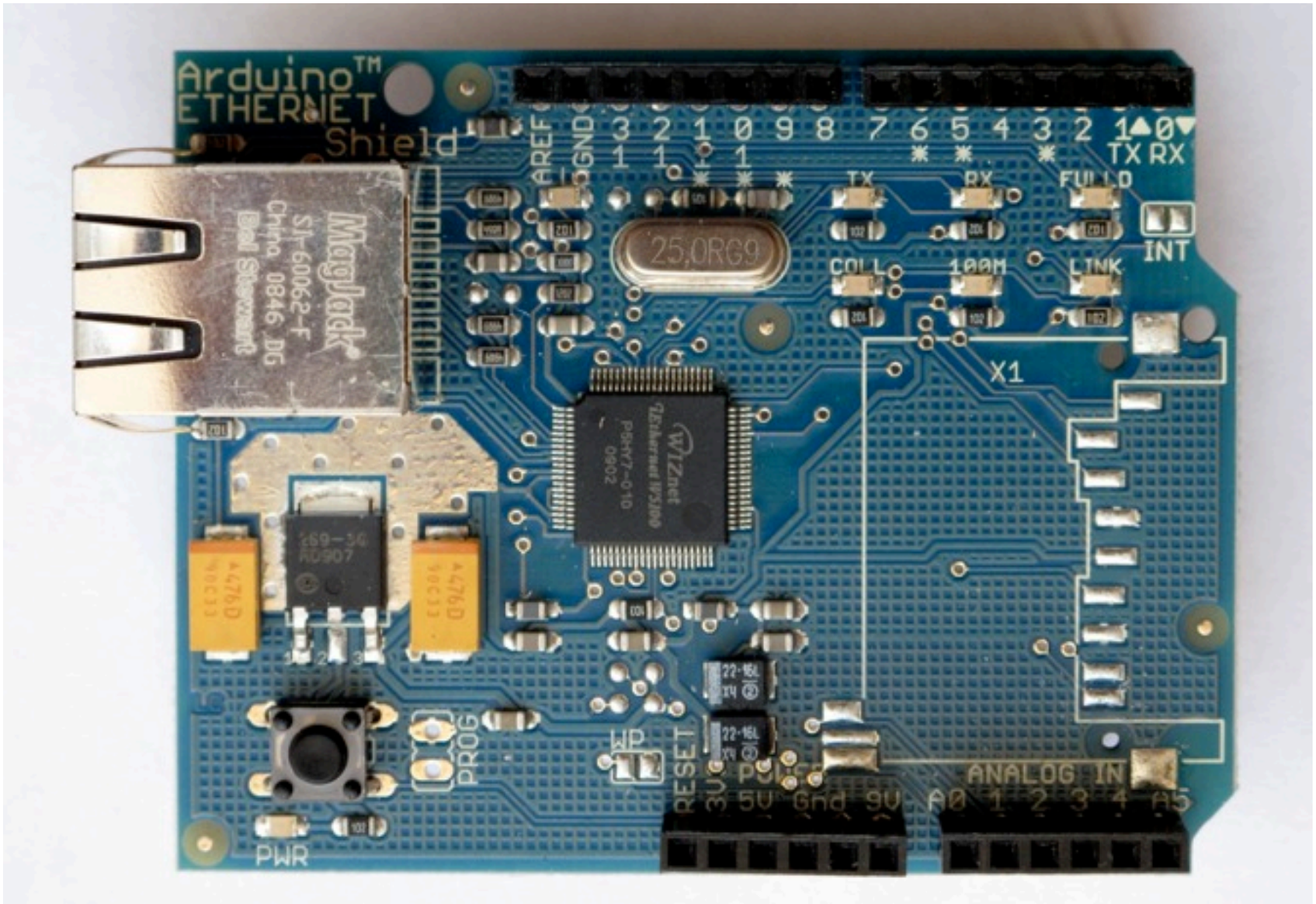
Ethernet

Using Arduino Ethernet Shields

Web Standards Group

Ethernet Shields

- Allow direct internet connection
- No computer needed
- Can act as web server or client
- Shields need a little configuration



Ethernet Shields

Web Servers

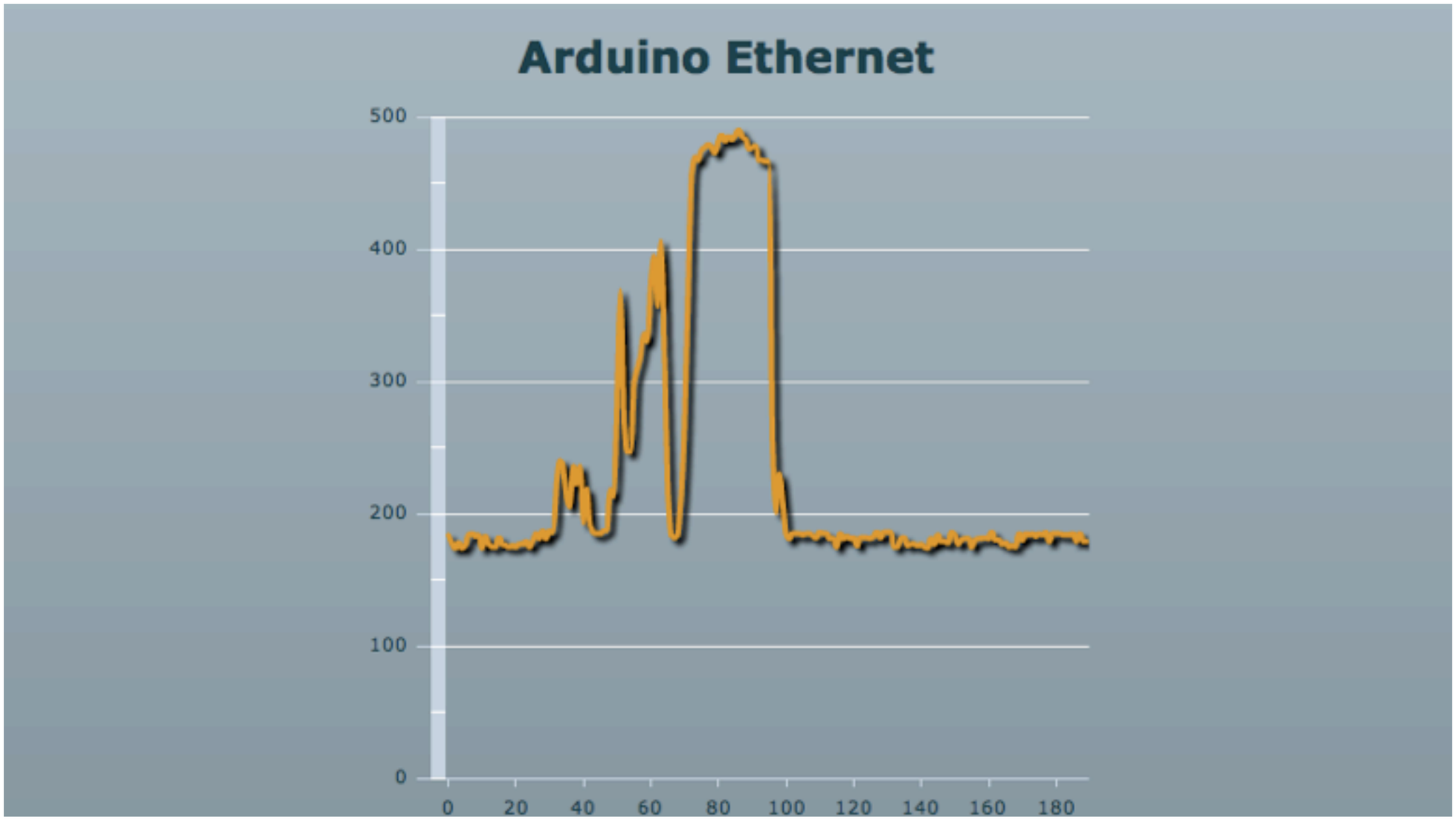
- Simpler than you think
- A web server:
  - Listens for connections
  - Parse requests
  - Send back status messages/resources requested

HTTP Requests

- Start with request “GET index.html HTTP/1.1”
- Optional headers “Accept-Language: en”
- Empty line
- Optional message body (POST and other requests)

Ethernet Arduino Code

- Web server code
- Easy to modify



Ethernet Demo

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Why do this?

- Expose yourself to new ideas and new ways of solving problems
- Involves interaction with the real world
- Encourages creativity
- Makes you a better programmer

It's Fun!

Useful Sites

List of useful hardware and software sites

Web Standards Group

Software Sites

- Arduino http://www.arduino.cc for software, user forum and playground
- Ethernet Shields http://arduino.cc/en/Reference/Ethernet
- Pachhub http://www.pachube.com/

Hardware Sites

- Little Bird Electronics (AUS) http://www.littlebirdelectronics.com/
- Spark Fun (US) http://www.sparkfun.com/
- Adafruit Industries (US) http://www.adafruit.com/
- Electronic Goldmine (US) http://www.goldmine-elec.com/

Other Sites

- Lady Ada http://www.ladyada.net/
- Evil Mad Scientist http://www.evilmadscientist.com/
- NY Resistor http://www.nycresistor.com/
- Make Zine http://makezine.com/