A Practical Guide to Connecting Hardware to the Web

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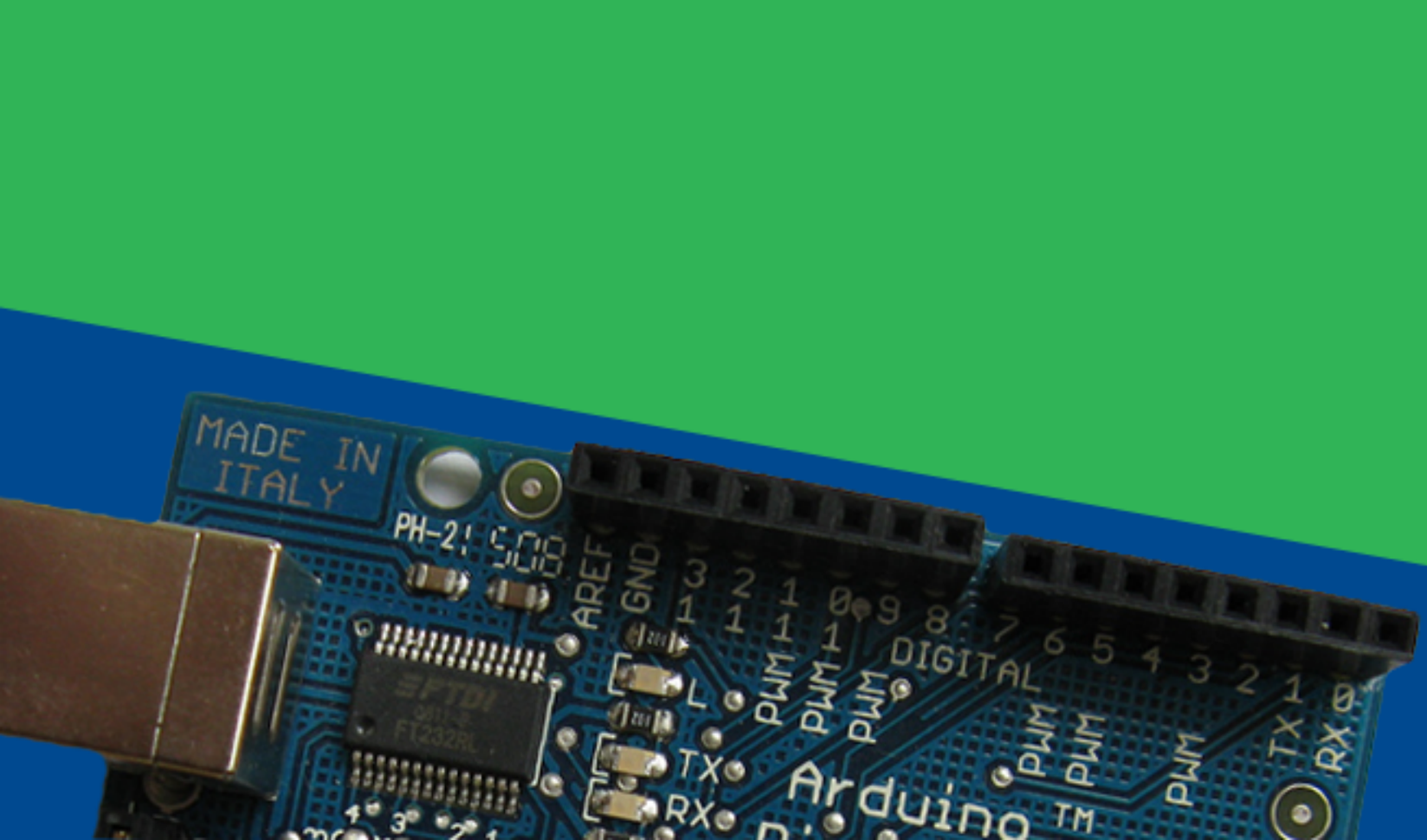
www.classsoftware.com



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Who am I?

- Director of Class Software for 15 years
- Developing and creating web applications for 15 years
- Programming for 25 years
- Adobe solution partner
- Adobe certified developer and trainer in Flex and ColdFusion
- Based in Sydney Australia

Electronics Trends

- Low cost
- Small components
- Complex components with simple interfaces

Computing Trends

- Easier to program
- Use of high level languages
- Software tools
- Open source

Are We There Yet?

- Low cost fast devices
- It's easy to communicate between devices and computers
- Can build complex systems from off the shelf components

Arduino

Overview of the Arduino Platform

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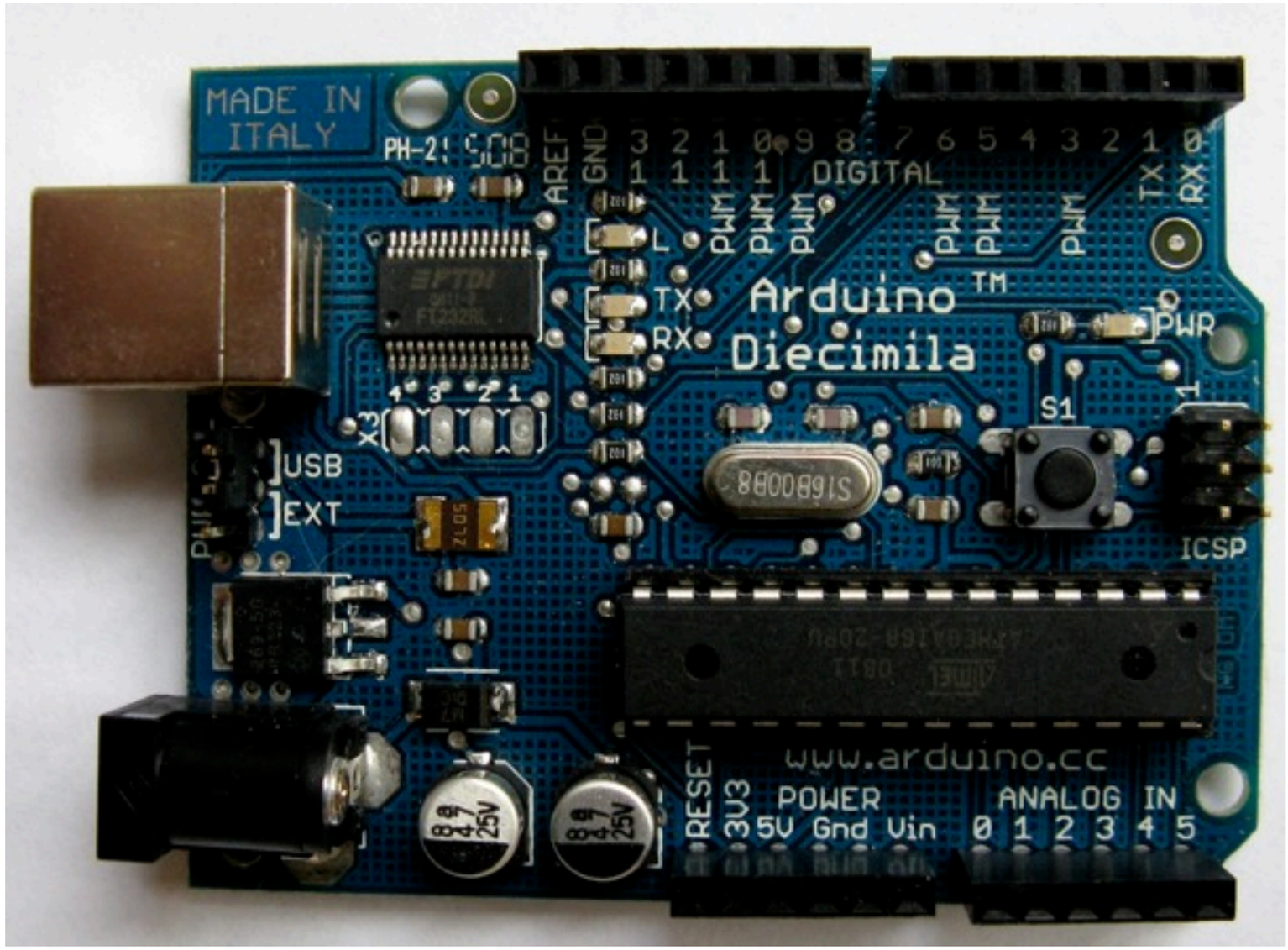
Arduino Platform

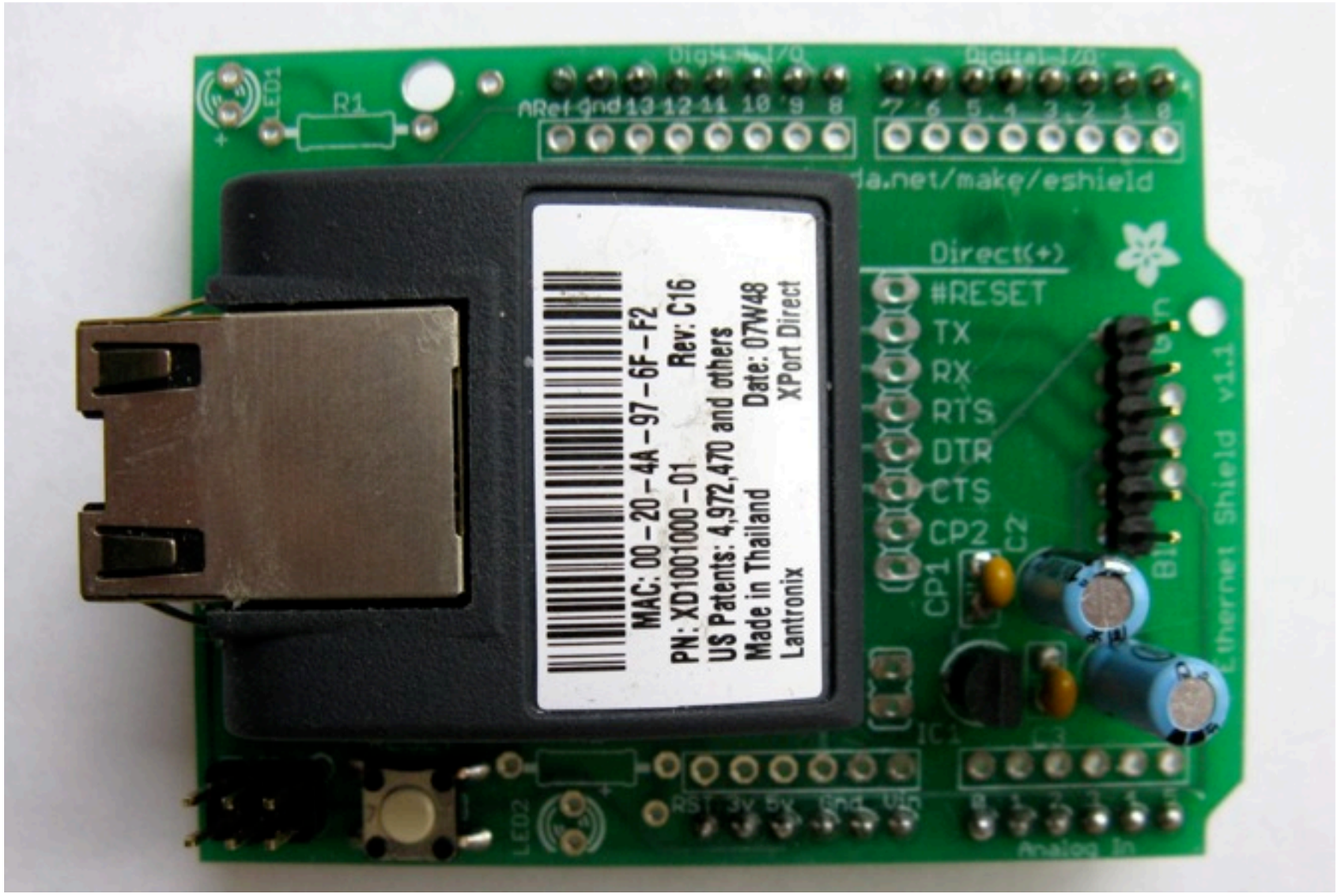
- Open source hardware and software platform
- Easy to program
- Hardware is flexible, fast, low power and low cost

Arduino Hardware

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



Arduino Boards



Arduino Shields

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

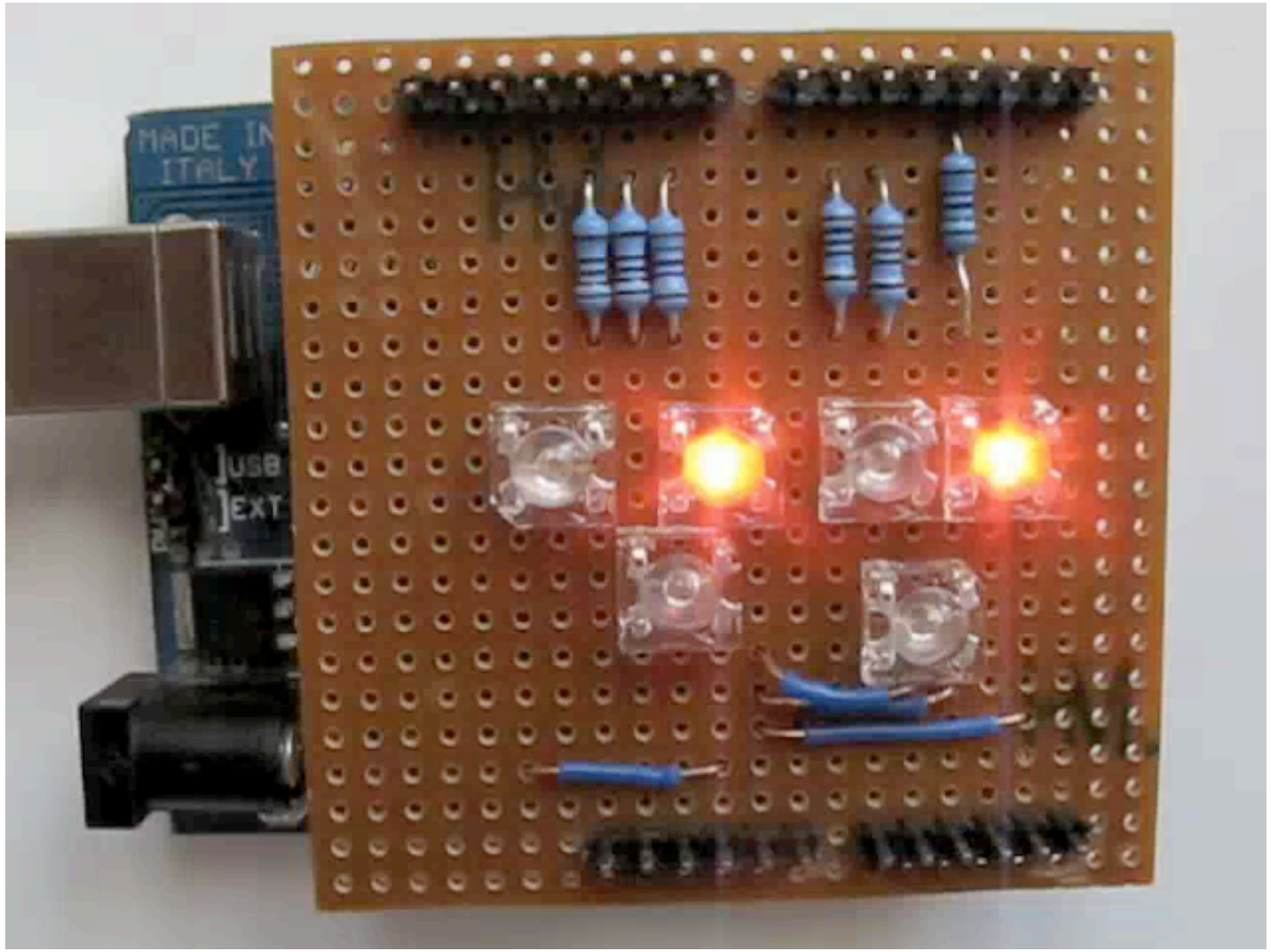
```
int redLed[] = {3,9};
int greenLed[] = {5,10};
int blueLed[] = {6,11};

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

Issues

- Debugging can be hard
- No simulator
- Memory, power and speed limits
- Helps to have a little electronic knowledge

Connecting Arduinos

How Arduinos communicate with the outside world

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Connection Methods

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

Supported Languages

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

Direct Connection

How to communicate with Arduinos and via PCs

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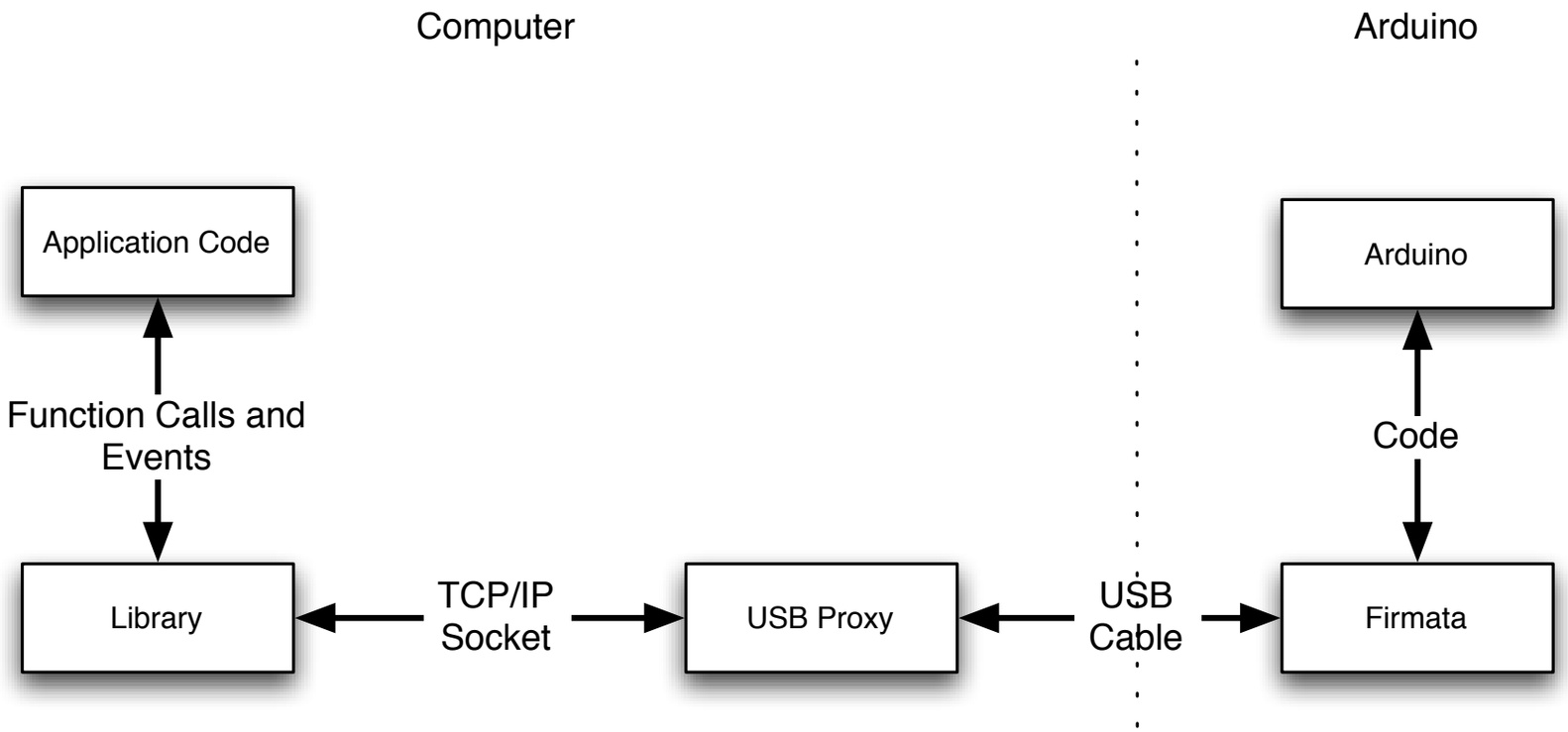
Direct Communication

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

Layers of Communication

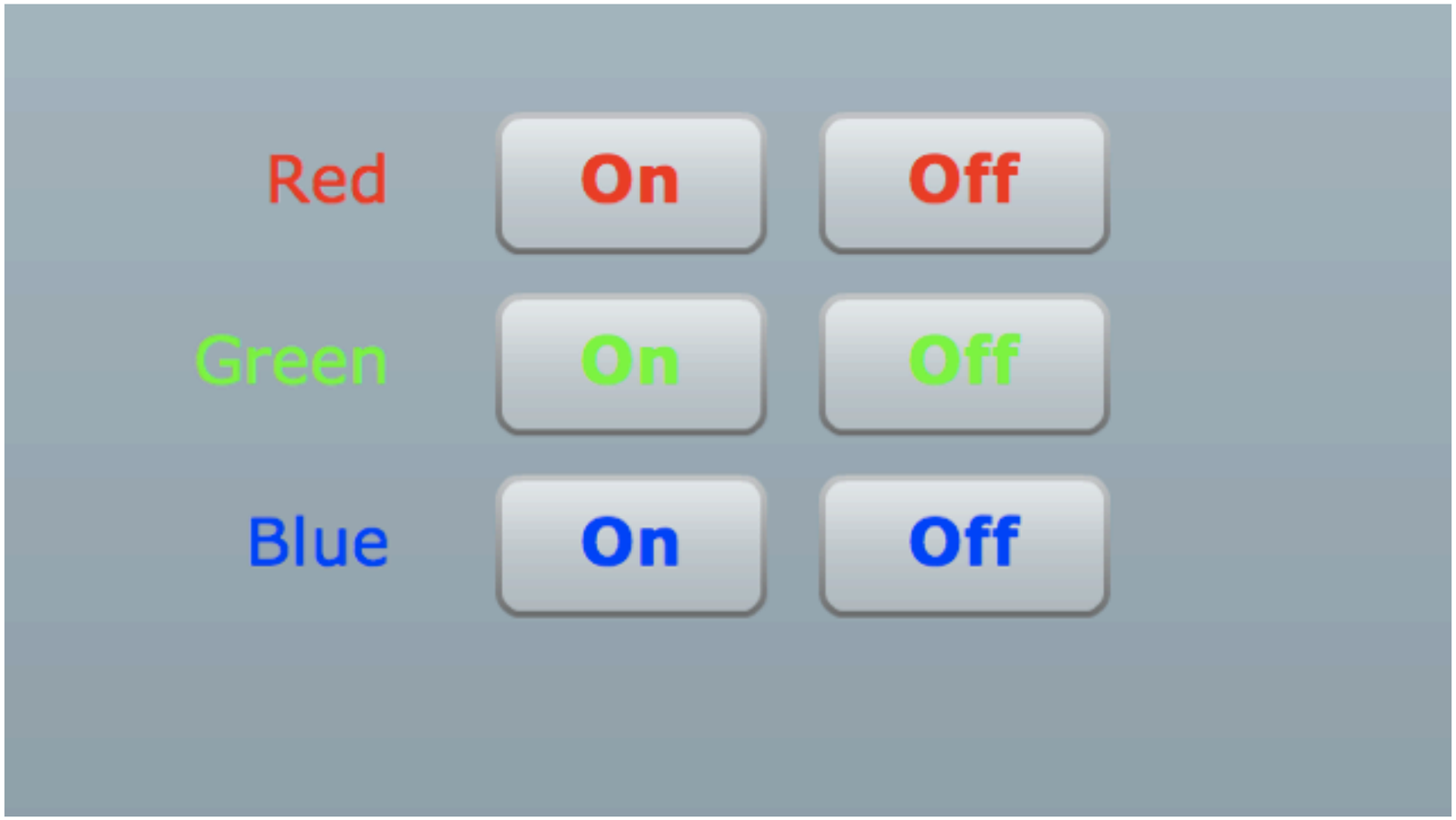
- Library to communicate with proxy
- Proxy to USB communication
- USB to arduino



Connection Diagram

Firmata Protocal

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



Arduino Demo

Issues

- Works best with a persistent connection
- If not persistent startup time and auto reset issues
- Solution: custom bootloader
- Needs a computer
- Proxy must be running on machine Arduino is connected to

Xbee Modems

Using Arduinos with XBee modems

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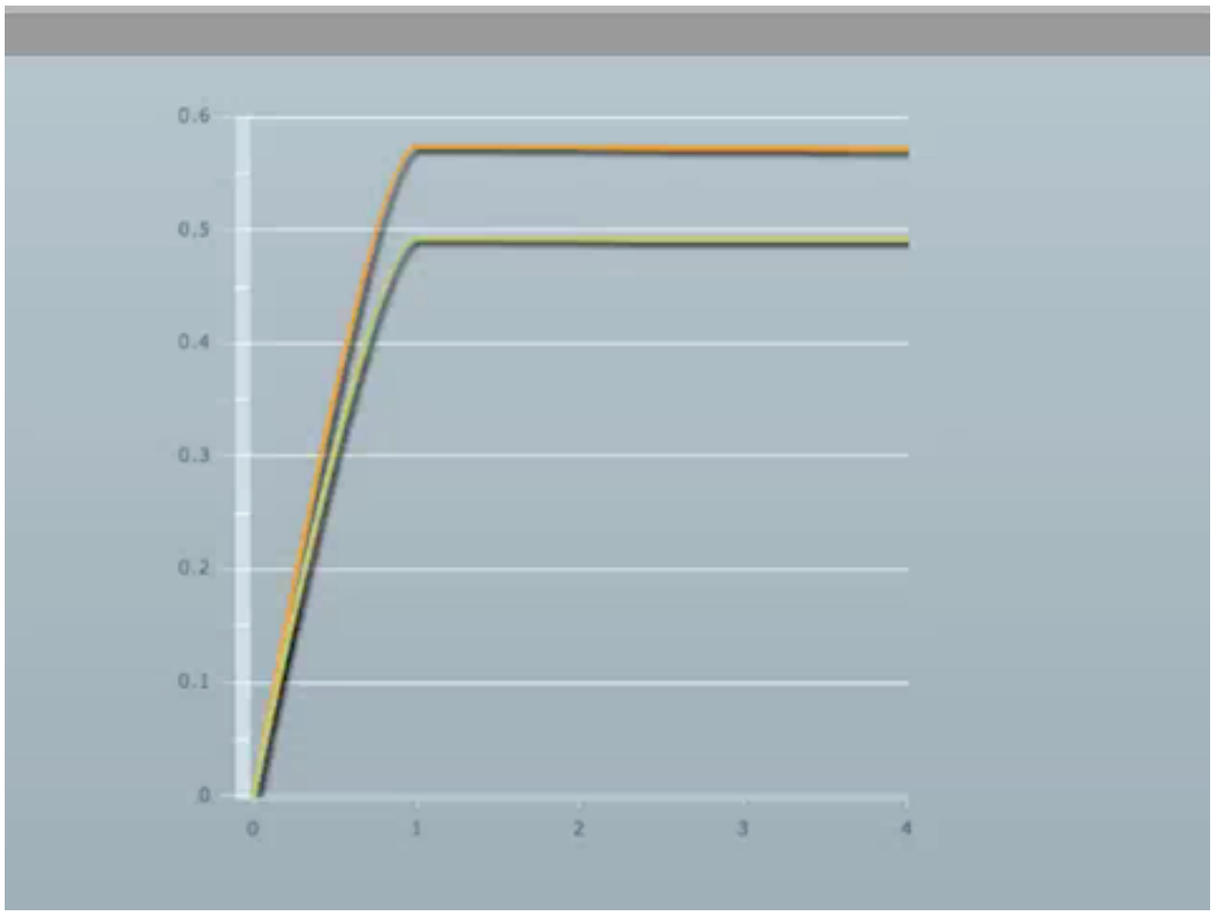
XBee Modems

- Hardware wireless modem
- Low cost
- Consume very little power
- Good range
- Easy to configure


MaxStream™
XBee™
FCC ID: OUR-XBEE
IC ID: 4214A-XBEE
www.maxstream.net
MaxStream™
XBee™
FCC ID: OUR-XBEE
IC ID: 4214A-XBEE
www.maxstream.net

XBee Modems



XBee Demo

Ethernet

Using Arduino Ethernet Shields

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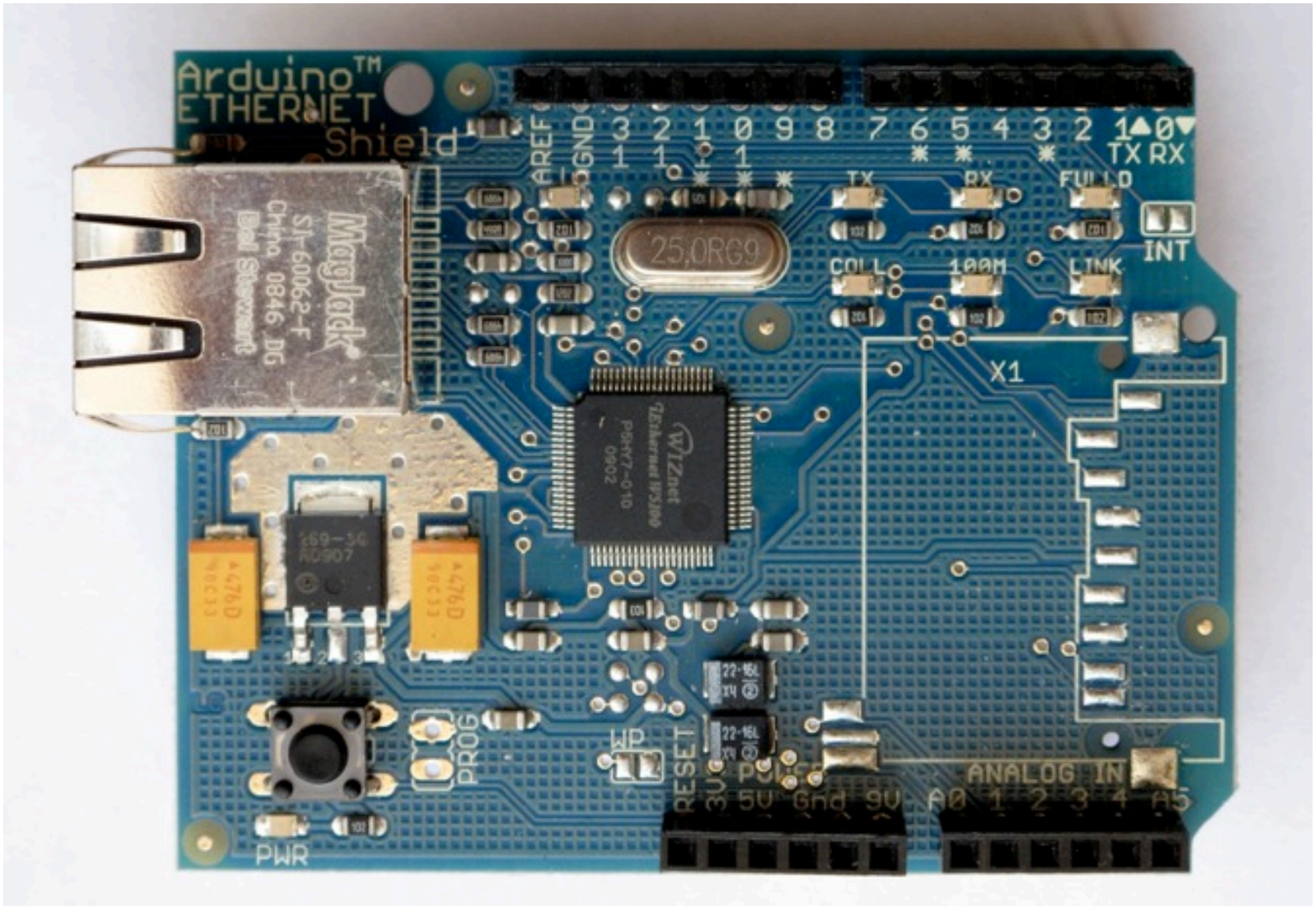
Ethernet Shields

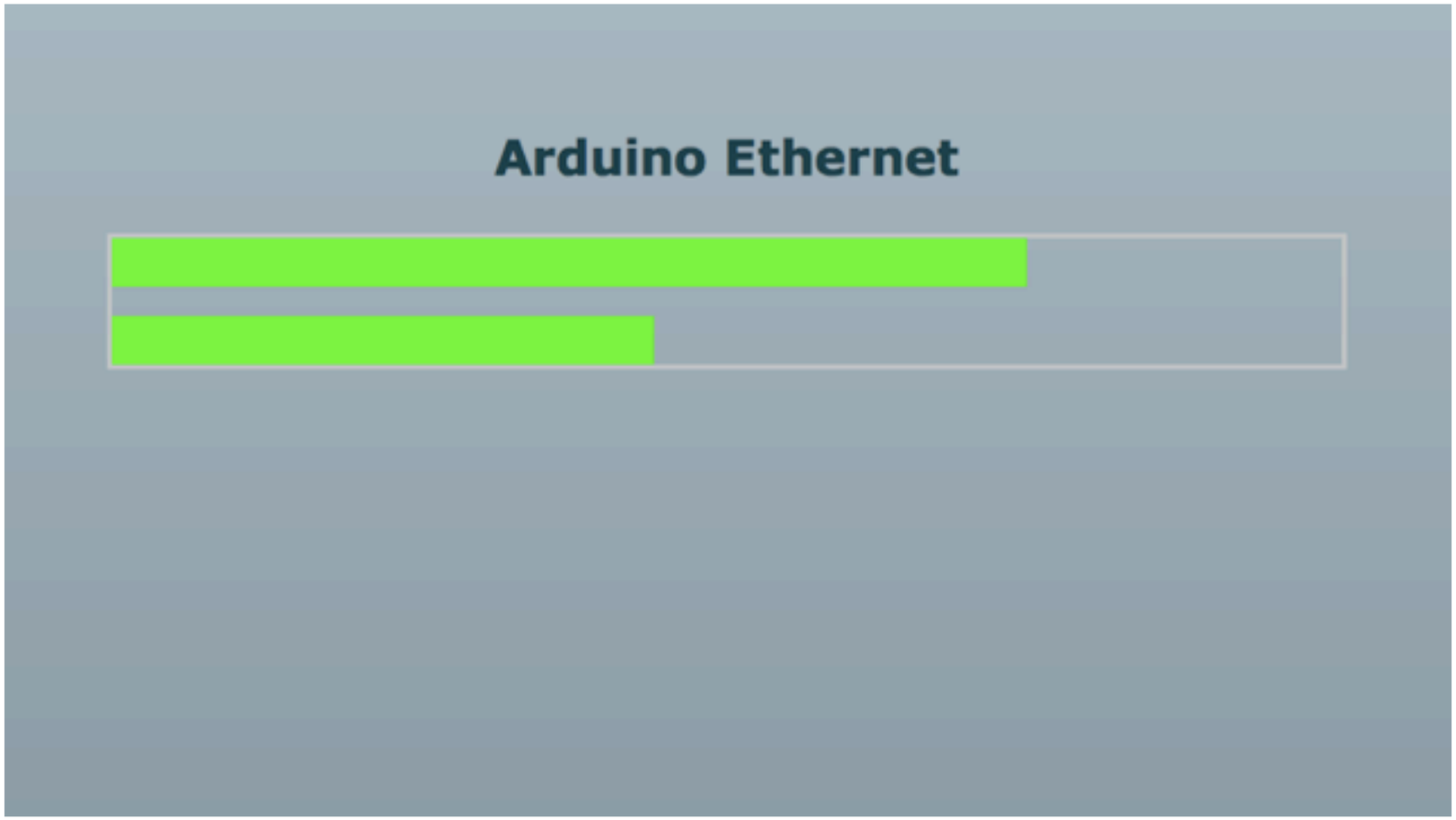
- Allow direct internet connection
- No dedicated computer needed
- Shields need a little config
- Can act as web server or client



Ethernet Shields

Ethernet Arduino Code

- Web server code
- Easy to modify



Ethernet Demo

Pachube

An easier way to connect Arduinos

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Pachube

- Store and share and acess realtime sensor data
- Simple and secure
- API to interact with all data and services
- Graphs and maps


pachube :: connecting environments, patching the planet
http://www.pachube.com/
Google
pachube :: connecting environmen...
pachube.apps | pachube.blog | pachube.community
my profile | my feeds | my favourites | 0 new messages | my settings | logout
pachube
about | tutorials | API | software/hardware | contact
Store, share & discover realtime sensor, energy and environment data from objects, devices & buildings around the world.
Pachube is a convenient, secure & scalable platform that helps you connect to & build the 'internet of things'.
Map view | List view
search feeds or tags
search
all | agriculture | building | device | energy | environment | transport | other
Satellite
Terrain
Google
search the map
Search
Terms of Use
send | link
RSS | Atom
input - register a feed
If you have a device, building, environment or sensor (either physical or virtual) that is connected to the internet (wired, wireless or via SMS gateway) and you want to store, share, graph and distribute its datastreams in realtime...
... then register a feed!
output - use a feed
If you have a device, building, environment or actuator (either physical or virtual) that is connected to the internet, or if you have a website, and you want to embed, monitor or connect to an existing environment...
... then use a feed!
latest news
Triggers bring 'push' capabilities to Pachube
As promised a few weeks ago, we're going to be rolling out a whole host of new features th... » more

Pachube

Pachube API

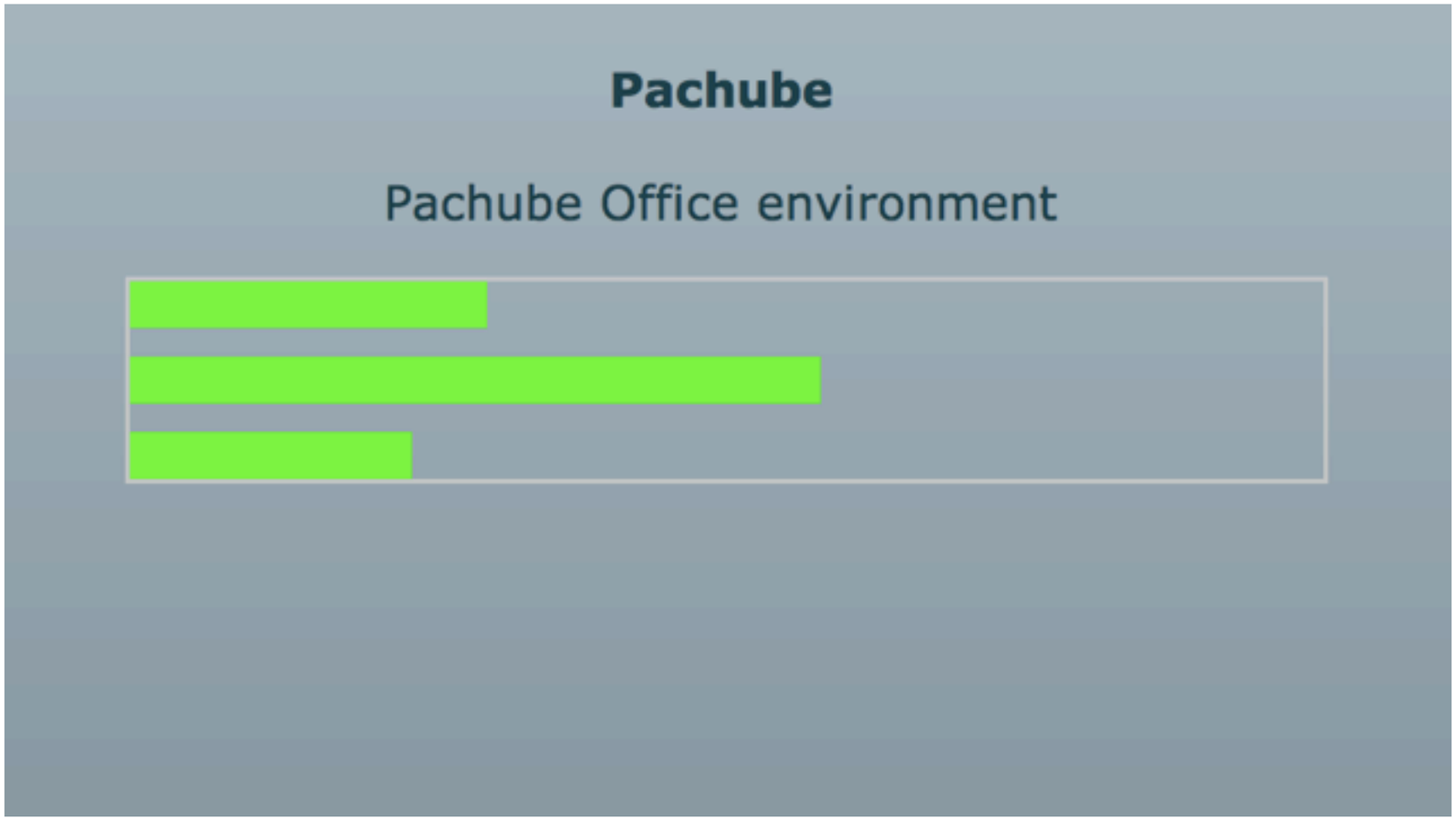
- Communicates HTTP
- Plain text (csv), XML or Jason
- REST based
- Large base of supported languages

Pachube Arduino Code

- Runs on Arduino with ethernet shield
- Sends values to Pachube
- Request values via Pachube

Pachube Interaction

- Call Pachube API using HTTP call
- Parse XML
- XML is in EEML format
- Display or act on values



Pachube Demo

Pachube Triggers

- Pachube can call an URL on value change
- The URL can be a dynamic

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!

Questions?

- Ask now, see me after session or email justin@classsoftware.com

Useful Sites

List of useful hardware and software sites

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

- 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/