UI Beyond the Browser

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@christensenp

We live in a real world, full of real people and real things

Everybody Wants To Create

artists...

Everybody Wants To Create

athletes...

Everybody Wants To Create

young and old....

Everybody Wants To Create

politicians...

Everybody Wants To Create

engineers...

Everybody Wants To Create

designers....

But Software is Different

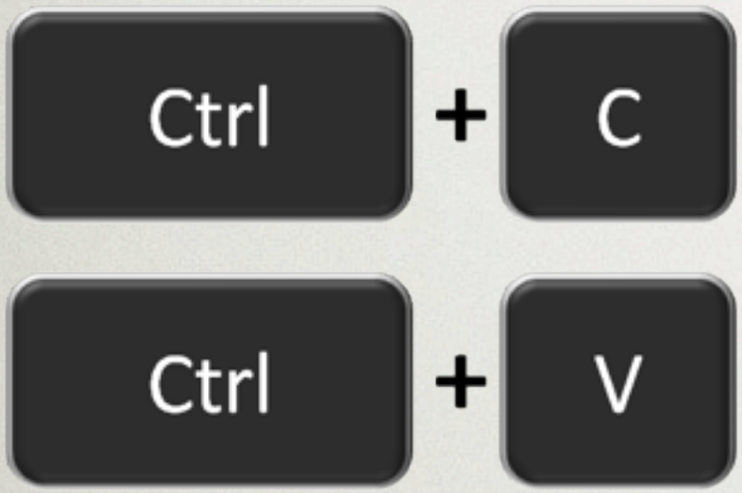
- Something about creating with software is qualitatively different

- How many pottery billionaires have you heard of lately?

- How many other young businesses have hundreds of millions of users?

Software is bits - information

Why Is Software Different?



vs

Software has no marginal cost to reproduce

Why Is Software Different?

first_script.html - Notepad

File Edit Format View Help

```
<!DOCTYPE HTML>
<HTML>
        <HEAD>
                <TITLE>A First Script</TITLE>
        </HEAD>

        <BODY>
                <SCRIPT LANGUAGE = "Javascript">
                        alert("Hello World")
                </SCRIPT>

        </BODY>
</HTML>
```

vs

Software has a low barrier to entry

Why Is Software Different?

vs

Distribution is easy and cheap

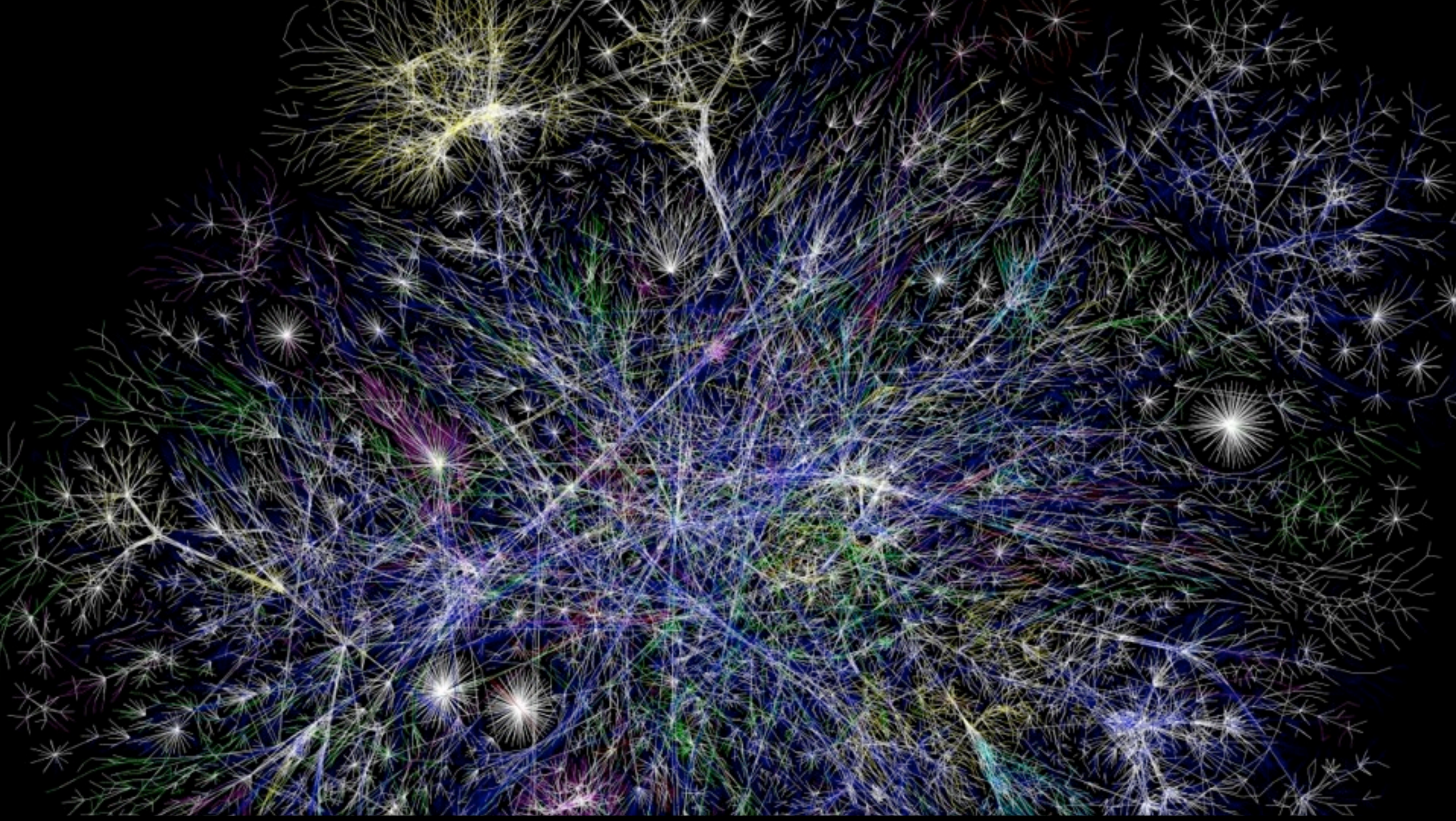
Why Is Software Different?

Tools for abstracting away non-core tasks

Why Is Software Different?

mozilla
FOUNDATION

Worldwide communities share freely, build on others' work



Software isn’t constrained by the real world

Software is Different

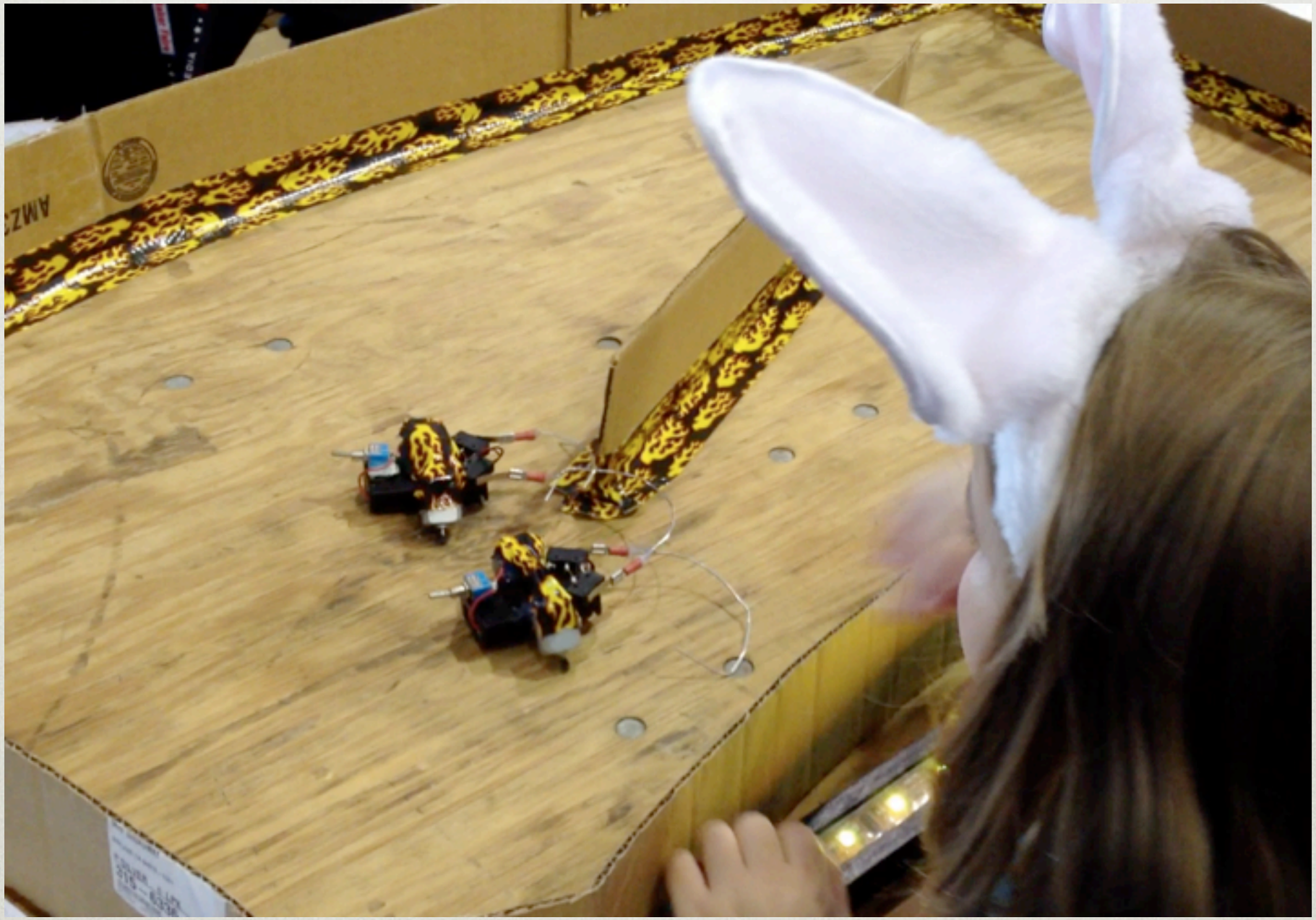
- The Internet started with a text-based protocol
- It expanded to full apps but was still limited to computers
- Mobile brings software closer to the real world, but...

What if the User Interface went beyond the browser?

Maker Faire

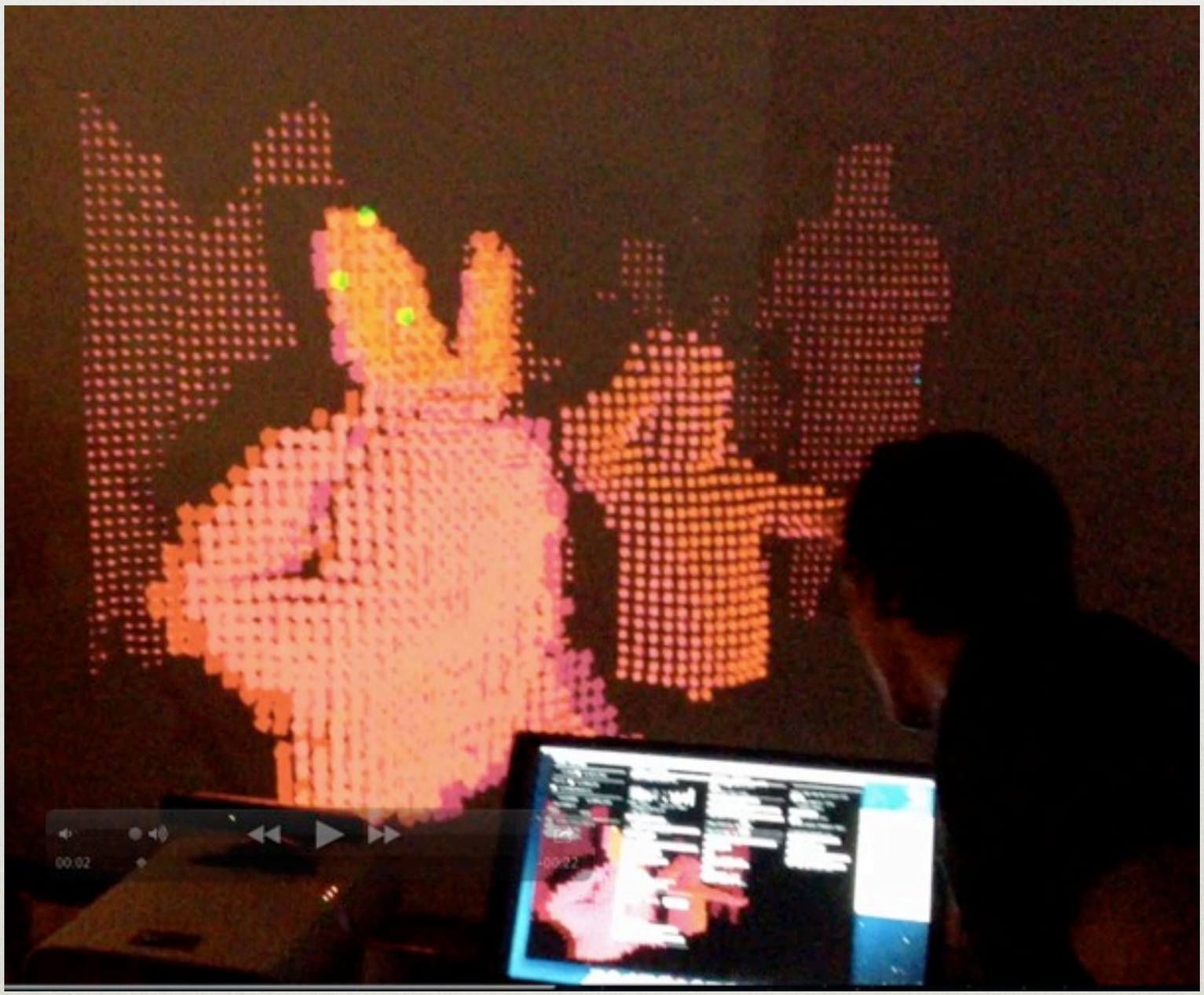
- "The Greatest Show and Tell On Earth"
- Build, Make, Show, Share, Repeat
- Display of some of the most innovative ideas in bringing software to the real world
- Also an owerwhelmingly awesome experience :)

Maker Faire



Robot bugs that skitter,
made with $10 of electronics

Maker Faire



Real-time visualization of dancing

https://github.com/benMcChesney/ofxOpenVJ

Maker Faire

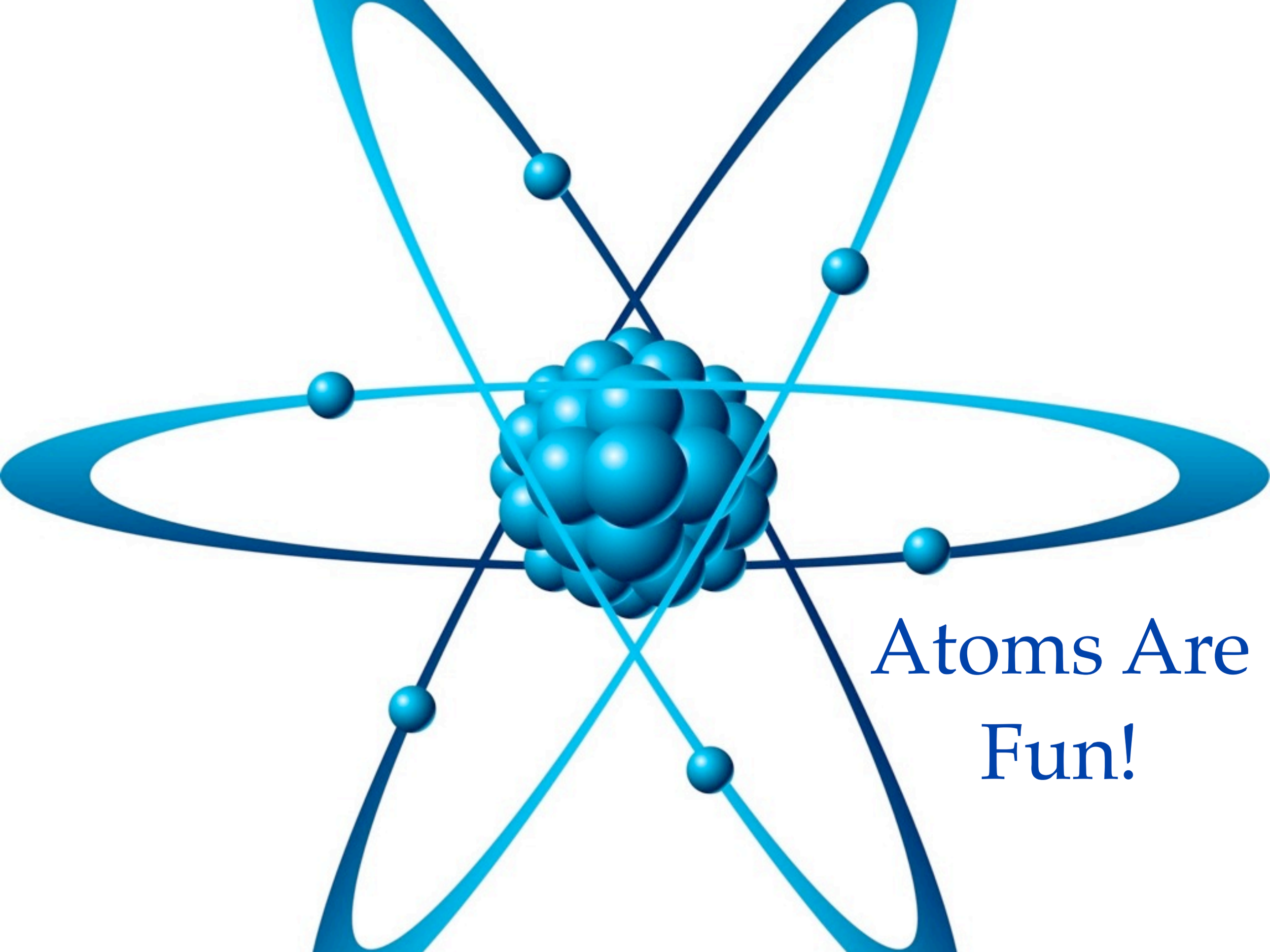
250 Fish and Lobsters Singing Beethoven's 9th

http://www.sashimitabernaclechoir.org/

Maker Faire

Coming Soon to a City Near You!

http://makerfaire.com/map/



Atoms Are Fun!

Software Enables Intelligent Interaction With *Abstract* Things

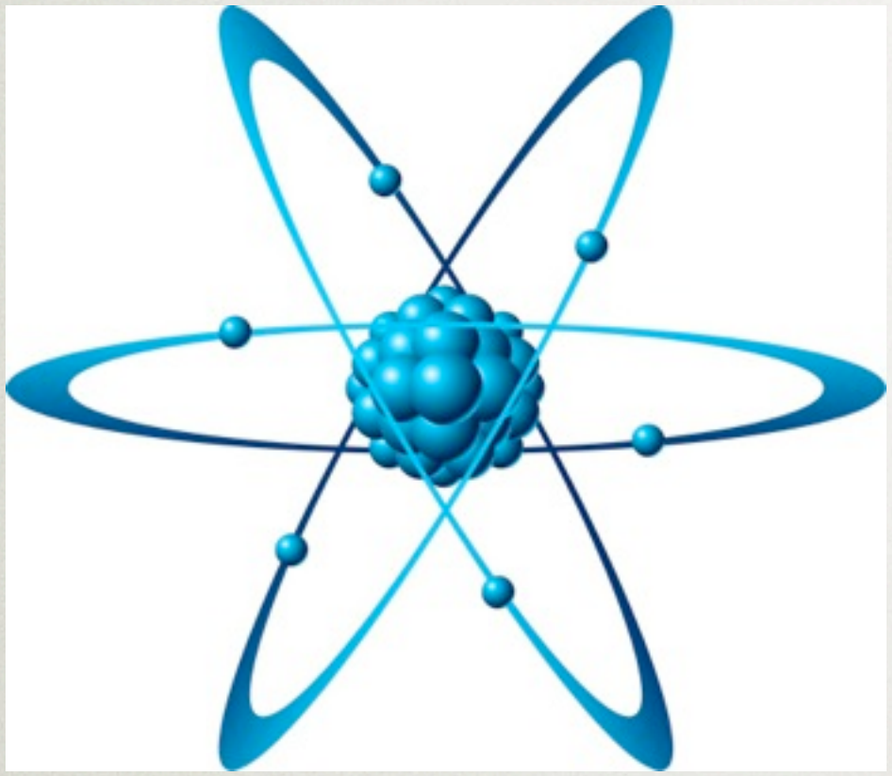
Hardware Enables Intelligent Interaction With *Physical* Things

Hardware Becoming Software

"Hackers love to build hardware, and customers love to buy it. So if the ease of shipping hardware even approached the ease of shipping software, we'd see a lot more hardware startups."

http://www.paulgraham.com/hw.html

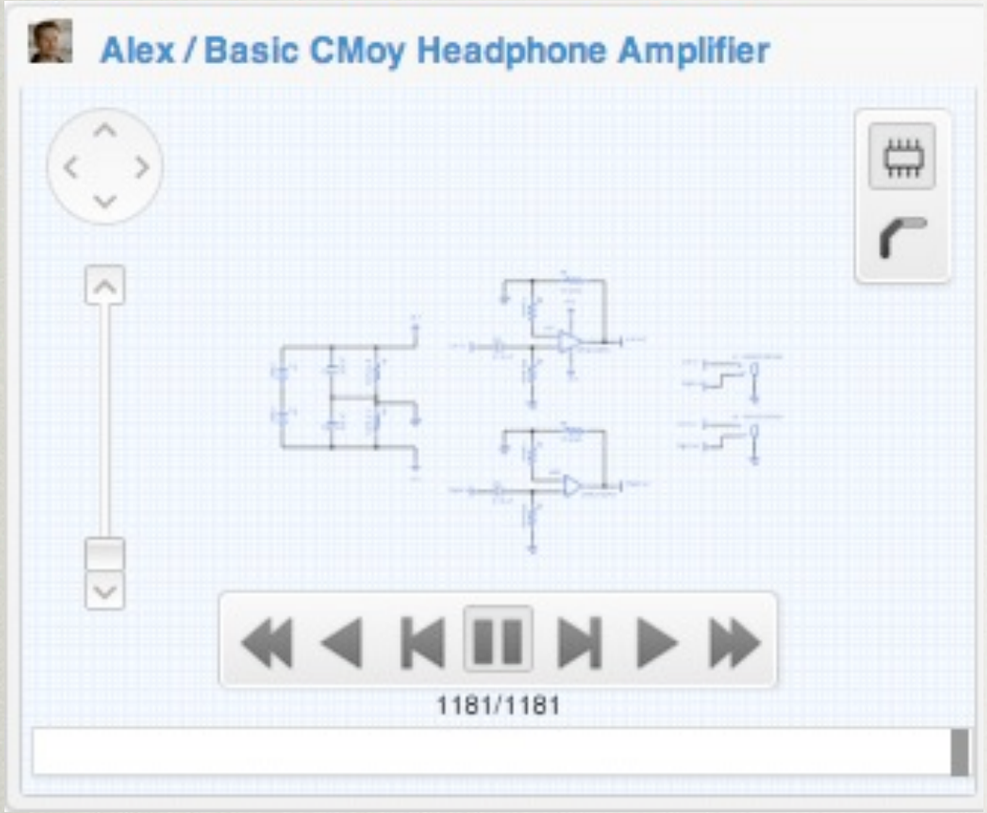
Hardware Becoming Software

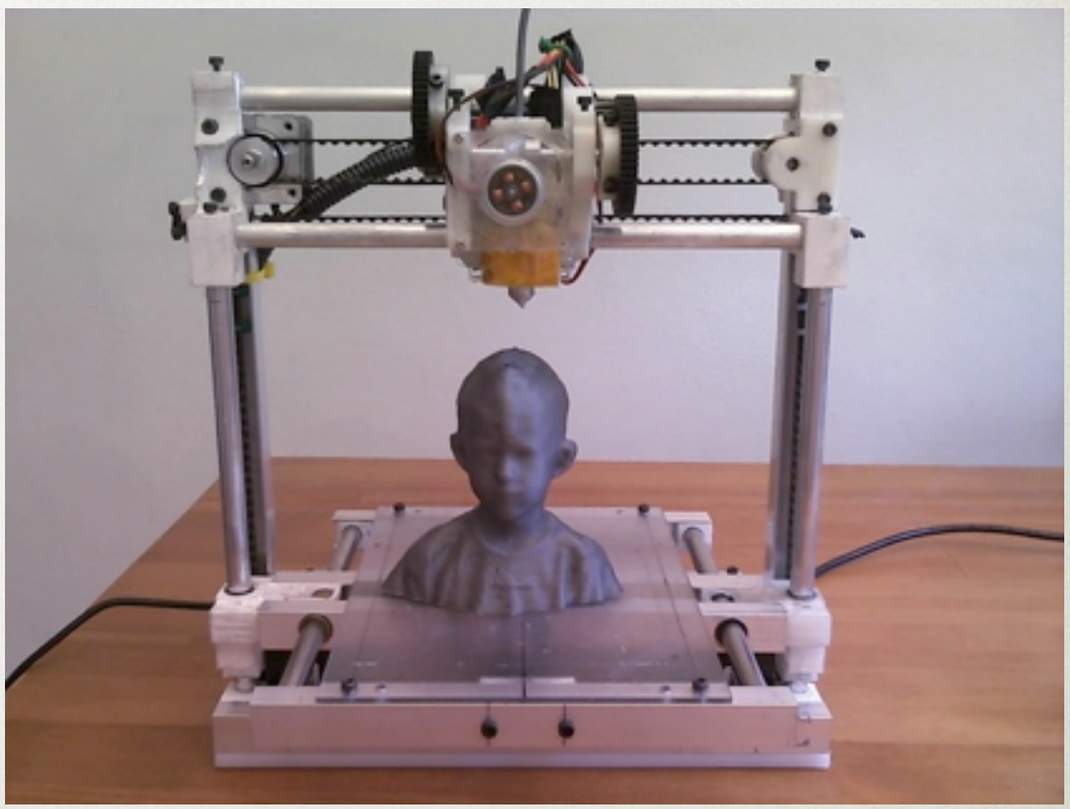


- Fast iteration
- Easier manufacturing
- More reliable funding
- Collaboration tools
- Abstract non-core tasks
- The Maker Movement

The Maker Movement

The Maker Movement





New tools for design and experimentation

Left: http://upverter.com for designing circuits

Right: 3D printer for prototyping complex shapes

The Maker Movement

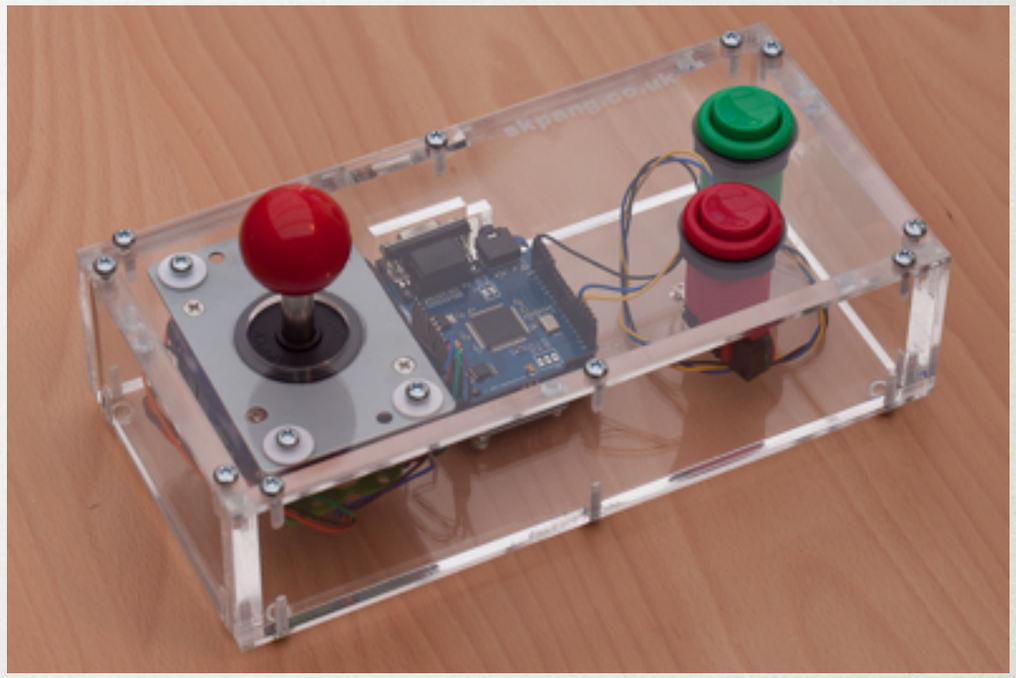
Tools and resources for learning

L: Adafruit tutorials http://learn.adafruit.com/

C: LightUp augmented reality http://www.lightup.io/

R: littleBits kits http://littlebits.com/

The Maker Movement



DIY Projects

Left: Roominate DIY Dollhouse Kits

http://www.roominatetoy.com/

Right: Retro Gaming with Raspberry Pi

http://learn.adafruit.com/retro-gaming-with-raspberry-pi

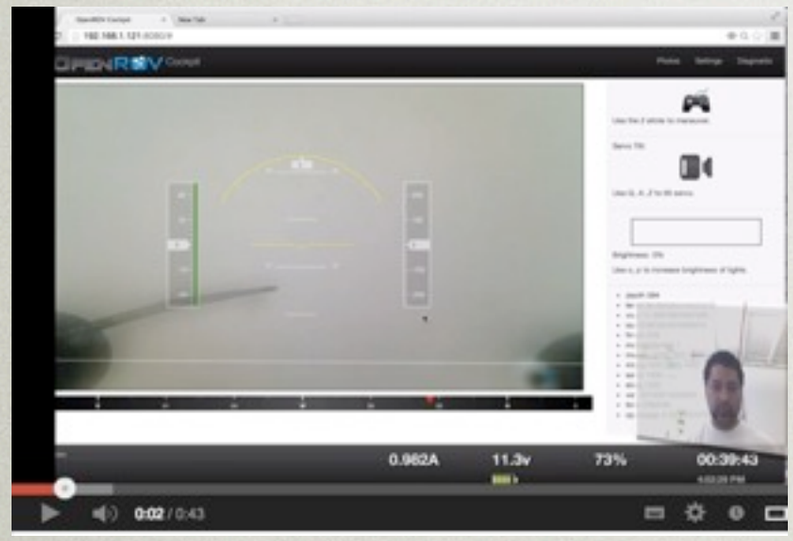
How I Got Into Hardware

How I Got Into Hardware

- I had no hardware background except for 1 college
- Found OpenROV on Kickstarter, contacted team: http://openrov.com
- YC hardware hackathon, met Tempo Automation: http://tempoautomation.com/
- NodeBots community: http://nodebots.io/

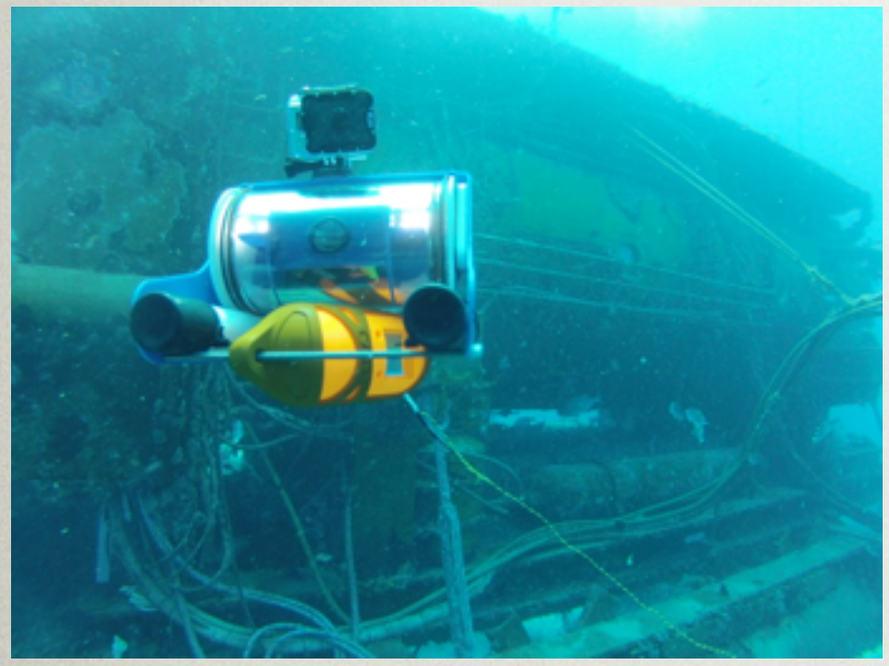
OpenROV

- Started by guys looking for “return on adventure”
- Sold > 100 kits on Kickstarter
- Open, worldwide community



http://www.youtube.com/watch?v=noTsGnQD8Go
http://www.youtube.com/watch?v=HCDhJJC0-Vc

OpenROV



- Node.js server serves cockpit web page, translates input into motor commands through Arduino

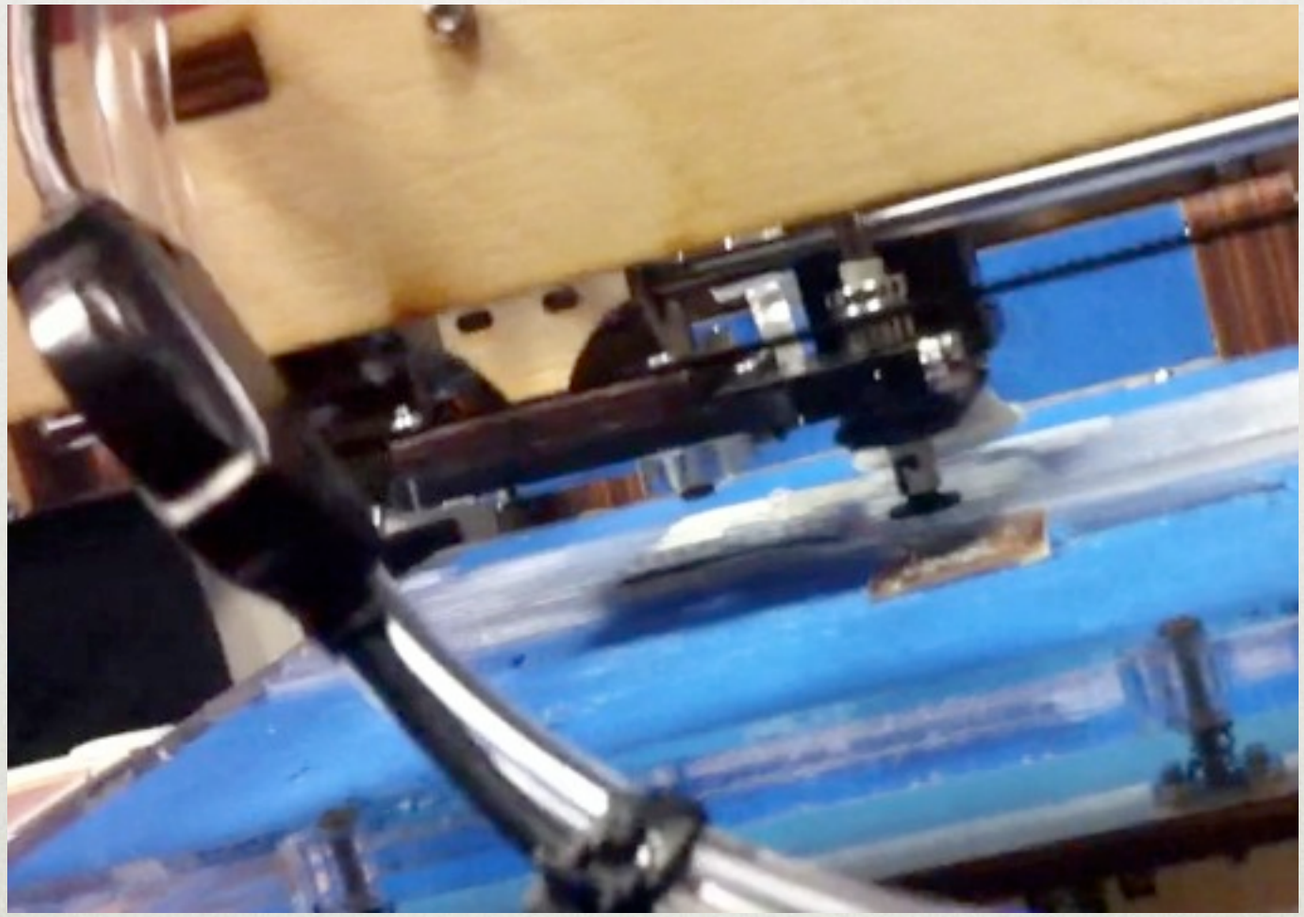
- I contribute software design and advice

- I take and post notes from monthly dev calls, helps community

Tempo Automation

- Desktop assembly of electronic circuit boards
- Met at YC Hardware hackathon in Feb ’13
- Asked a ton of very basic questions, learned basics of electronics, assembly, hardware/software interaction, etc
- Continued working with team, writing software for a prototype for Maker Faire

Tempo Automation



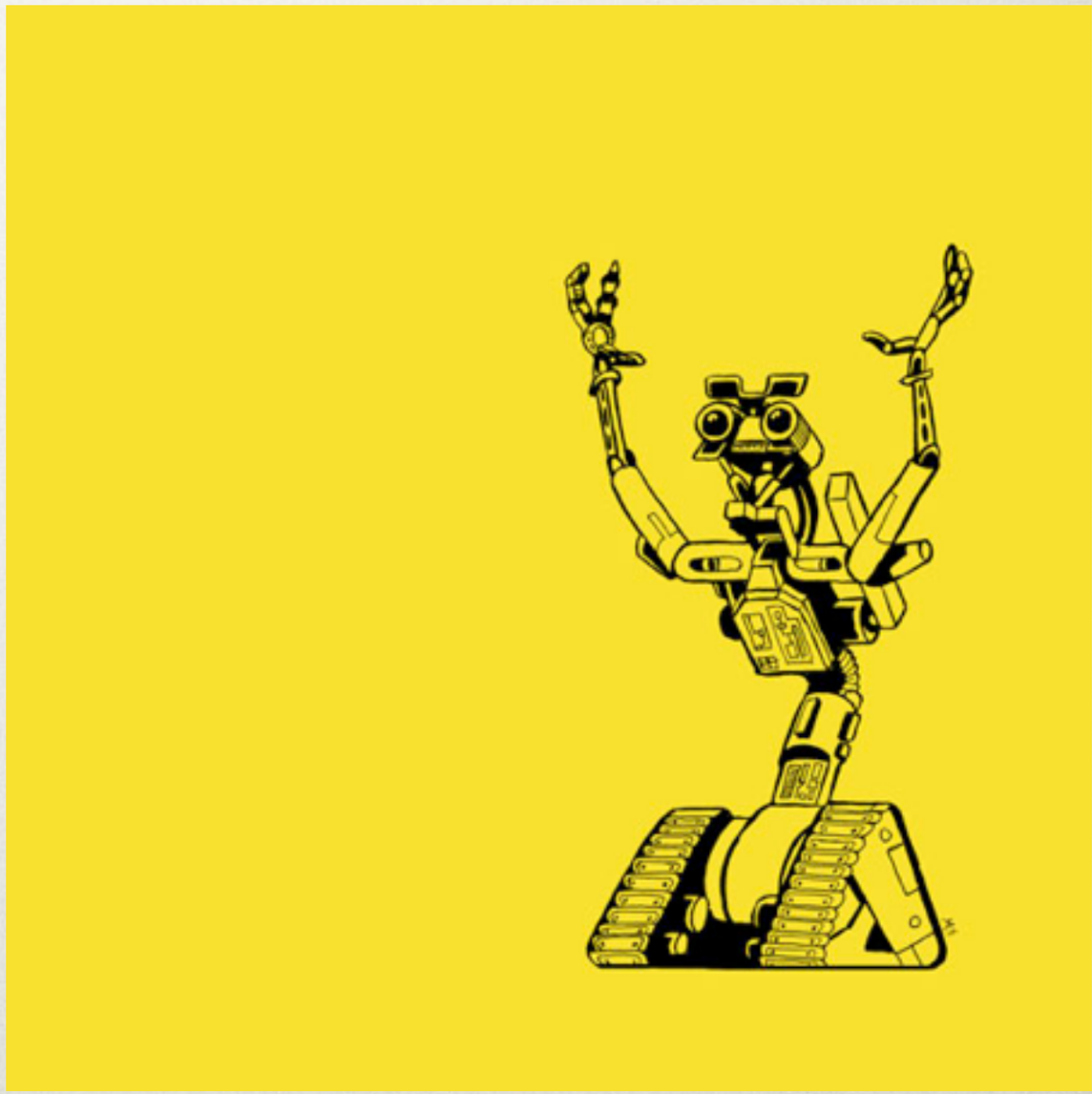
http://www.youtube.com/watch?v=-jsQF-xFdJM

https://www.facebook.com/video/embed?video_id=4184537549975

NodeBots Community

NodeBots
Hack Hardware With JS

NodeBots: a full day event where JS developers team up and use soldering guns and parts nearby to create amazing robotic devices.

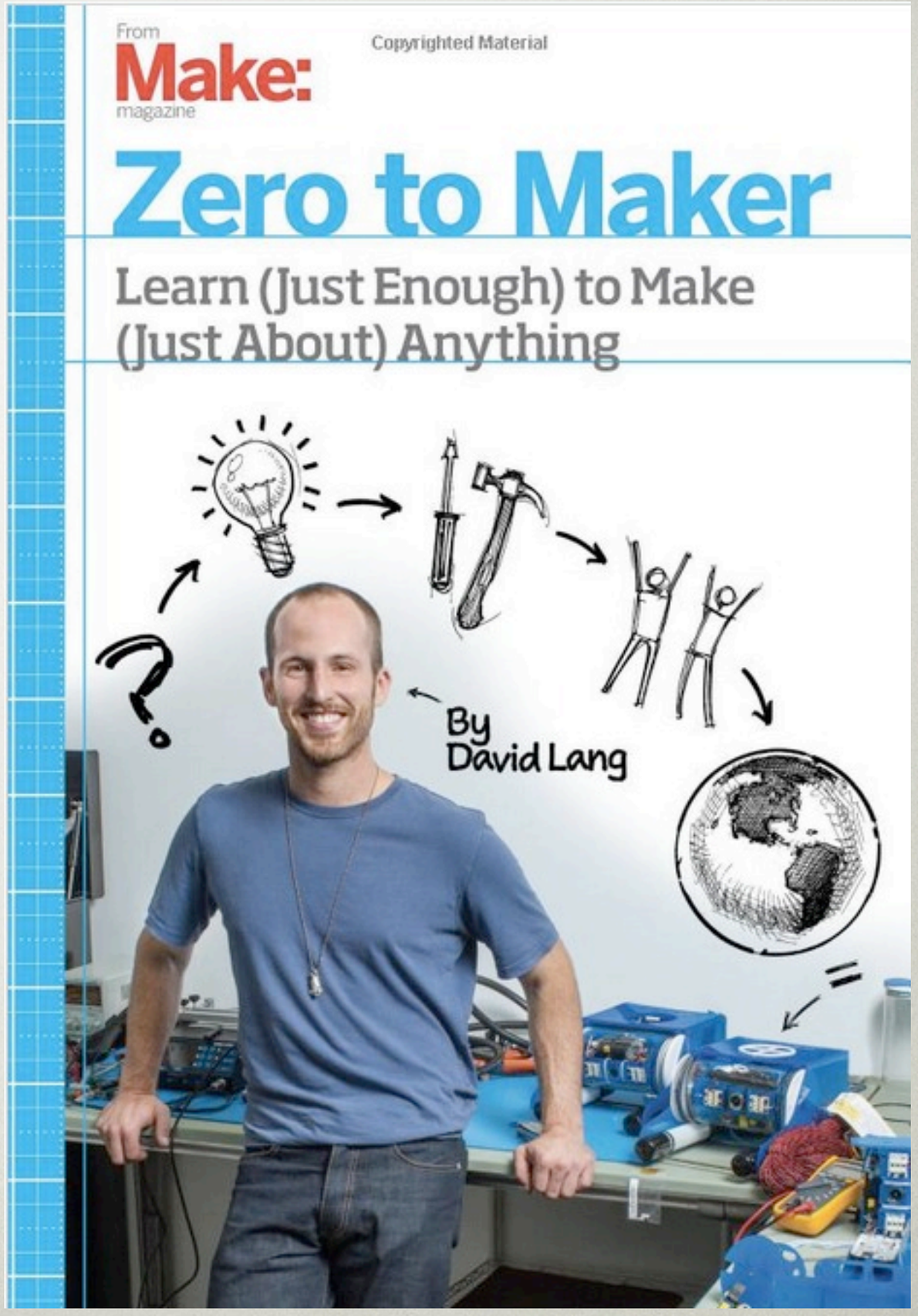


http://nodebots.io/

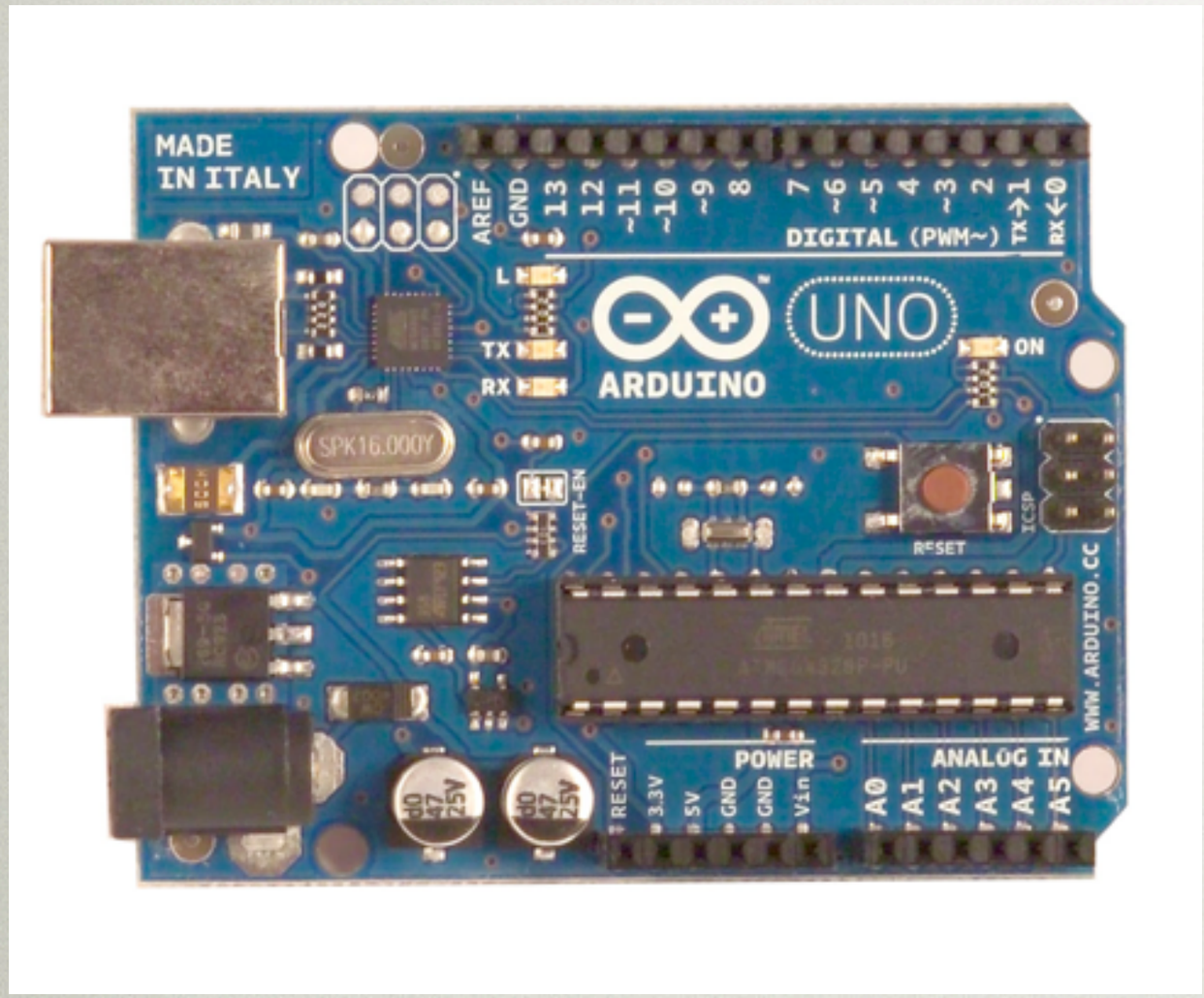
How Can You Get Started With Hardware?

READ THIS!

- How to continue learning for the rest of your life
- How to get started with different tools and hardware
- OpenROV founder
- http://www.zerotomaker.com/



Arduino



Arduino is an open-source electronics prototyping platform based on flexible, easy-to-use hardware and software. It's intended for artists, designers, hobbyists, and anyone interested in creating interactive objects or environments.

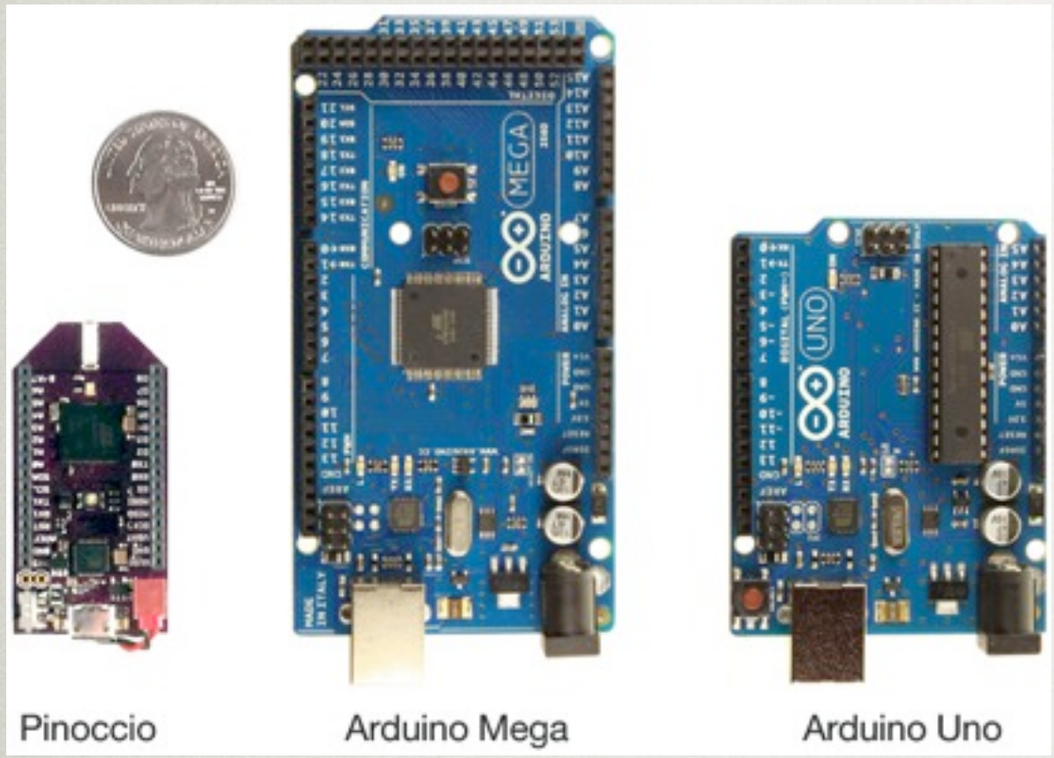
- http://www.arduino.cc/

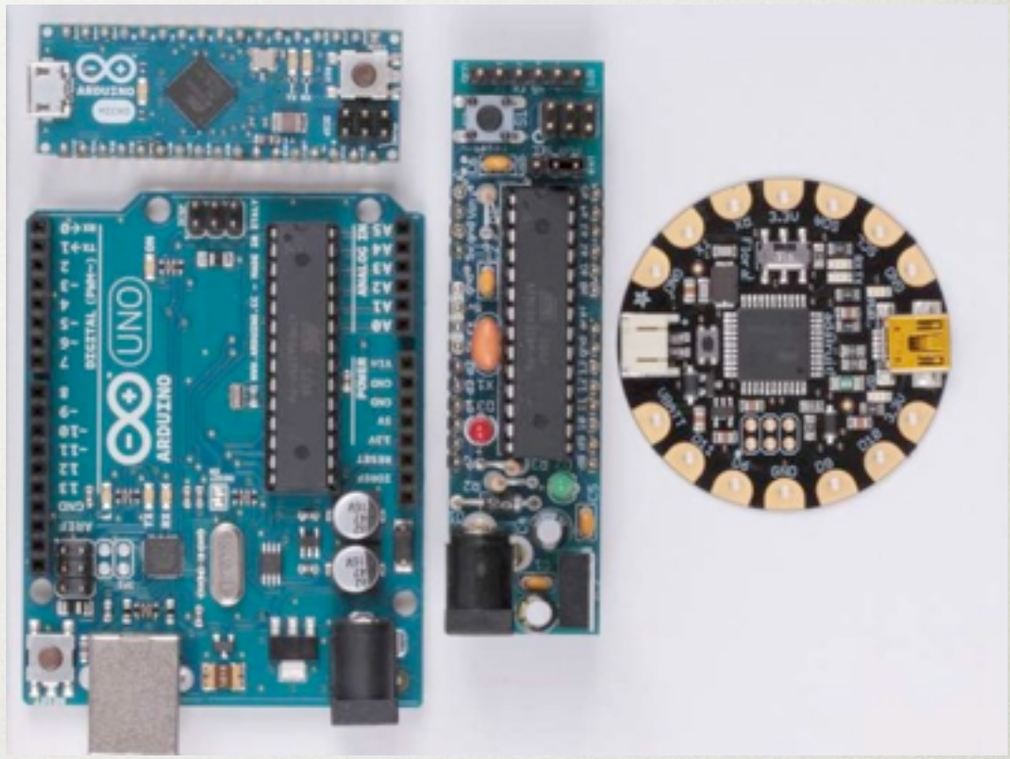
Arduino

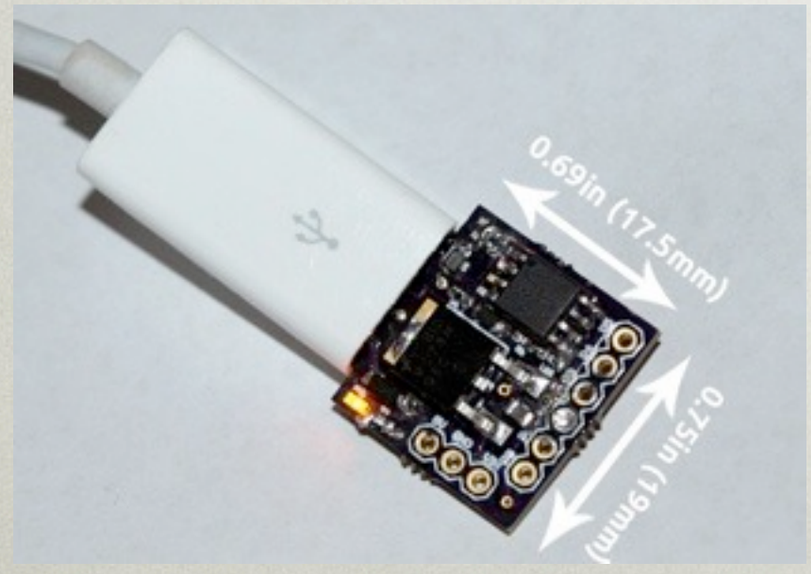
Arduino IDE

- Free, multiplatform
- Includes examples with documentation
- Compiles code and loads as firmware to any Arduino-compatible bord

Arduino







A family of compatible boards
with different options for:
extensibility, features,
size, power, cost,

Miniature Hardware

Raspberry Pi

Beagle Bone Black

Small, inexpensive general purpose computers with ARM chips, USB and HDMI ports, run Linux and any software (JVM, LAMP, OpenCV, etc)

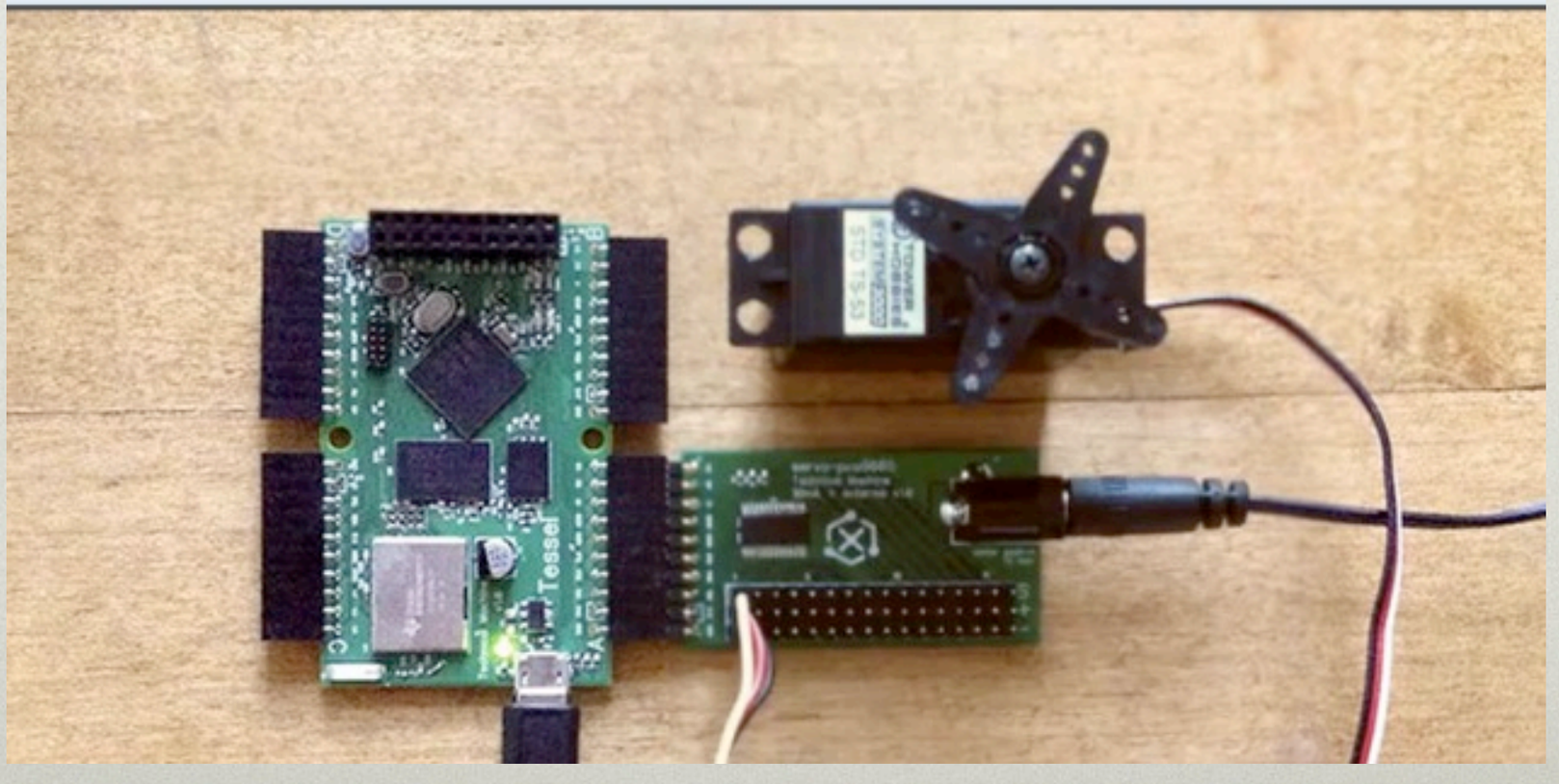
Javascript Hardware

Tessel - microcontroller that runs Javascript

How easy should hardware development be?

tessel push ↓

```
var tessel = require('tessel');
var servos = require('servo-pca9685')
  .connect(tessel.port('A'));

var degrees = 0;
setInterval(function () {
  servos.moveServo(1, degrees);
  degrees = degrees == 0 ? 180 : 0;
}, 500);
```



$$! €€! (?)

$$! €€! (?)

- Not expensive to start: ~$30 for Arduino, ~$45 for Raspberry Pi or BeagleBone
- Kits for < $100
- Whole pile of electronic parts and computers for < $200

$$! €€! (?)

- Prototyping parts are reusable; you only incur more costs when you:
  - break stuff (it happens)
  - want new features (motors, sensors, etc)
  - want to build more because you designed something useful

$$! €€! (?)

Where to Buy?

http://www.adafruit.com/

http://sparkfun.com/

http://www.hobbytronics.co.uk/

Get Involved With A Project

- Find a hardware project you're interested in
  - Maker Faire, Kickstarter, Meetups, etc
- Add to software, improve software practices
  - Source control, abstraction, testing, etc
  - Hardware + software projects combine people with diverse skillsets

Get Involved With A Project

- Build on hardware APIs
    - Every project needs testers, customers, reference projects, success stories
    - http://choosatron.com/
- Community contributions - documentation, testing, support, blogging, etc

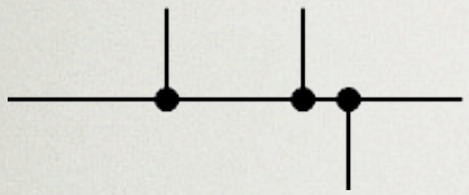
GOOF AROUND!!

Electronics Crash Course

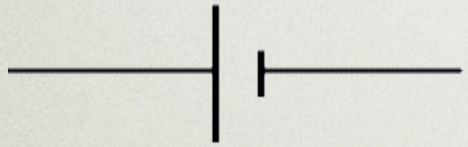
Electronics Crash Course

- Electrons flow from negative to positive (current)
- If there's no path, the flow stops (circuit)
- You can put stuff in the circuit to use, alter, or react to the current
- Each component is like a function with inputs and outputs, and they chain together

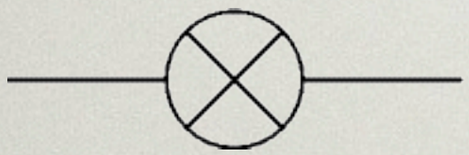
Electronics Crash Course



- Wire - connect 2 components, function argument



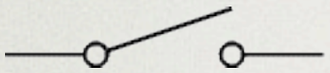
- Battery - provides current, run the program



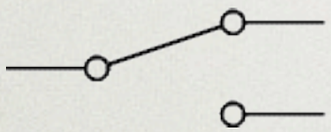
- LED - side effect, output

http://electronicsclub.info/circuitsymbols.htm

Electronics Crash Course



- On-off Switch - boolean variable

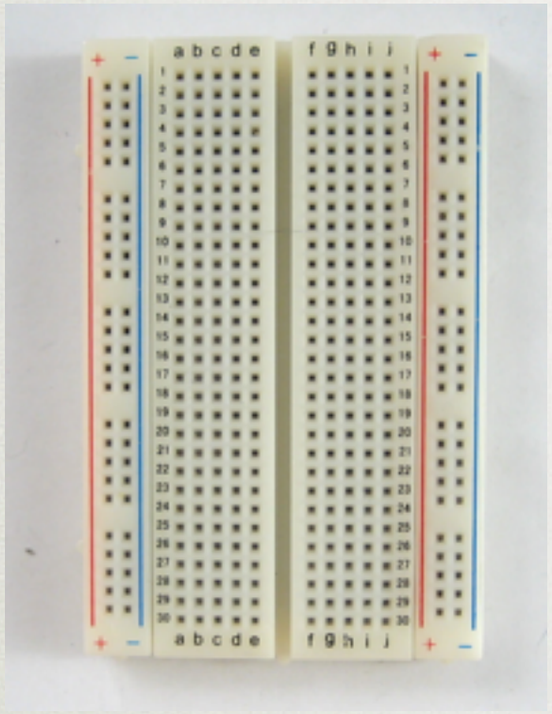


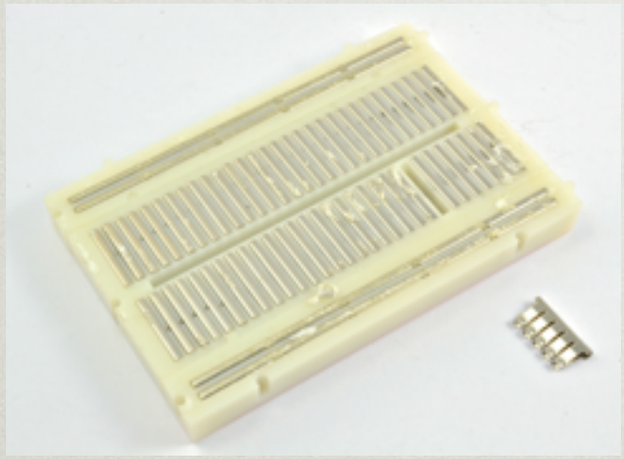
- 2-Way Switch - if statement

- Resistor - input checking

http://electronicsclub.info/circuitsymbols.htm

Electronics Crash Course

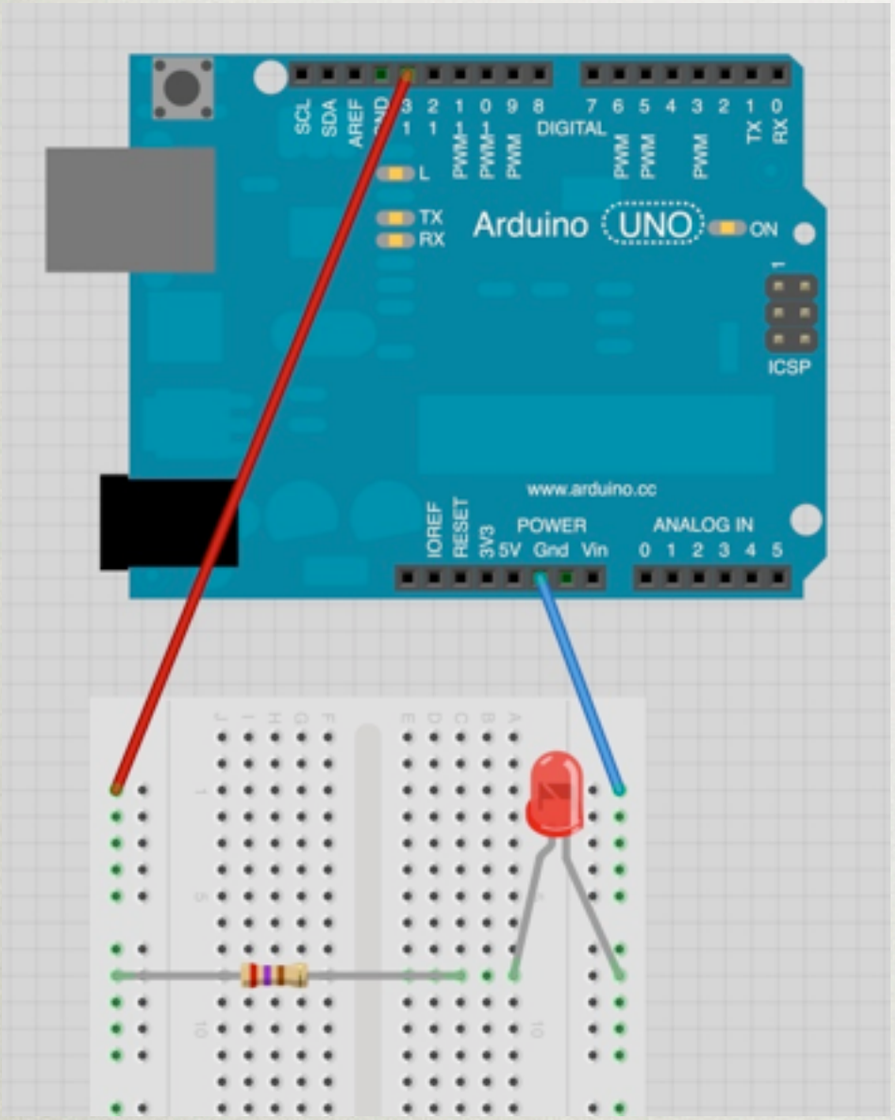


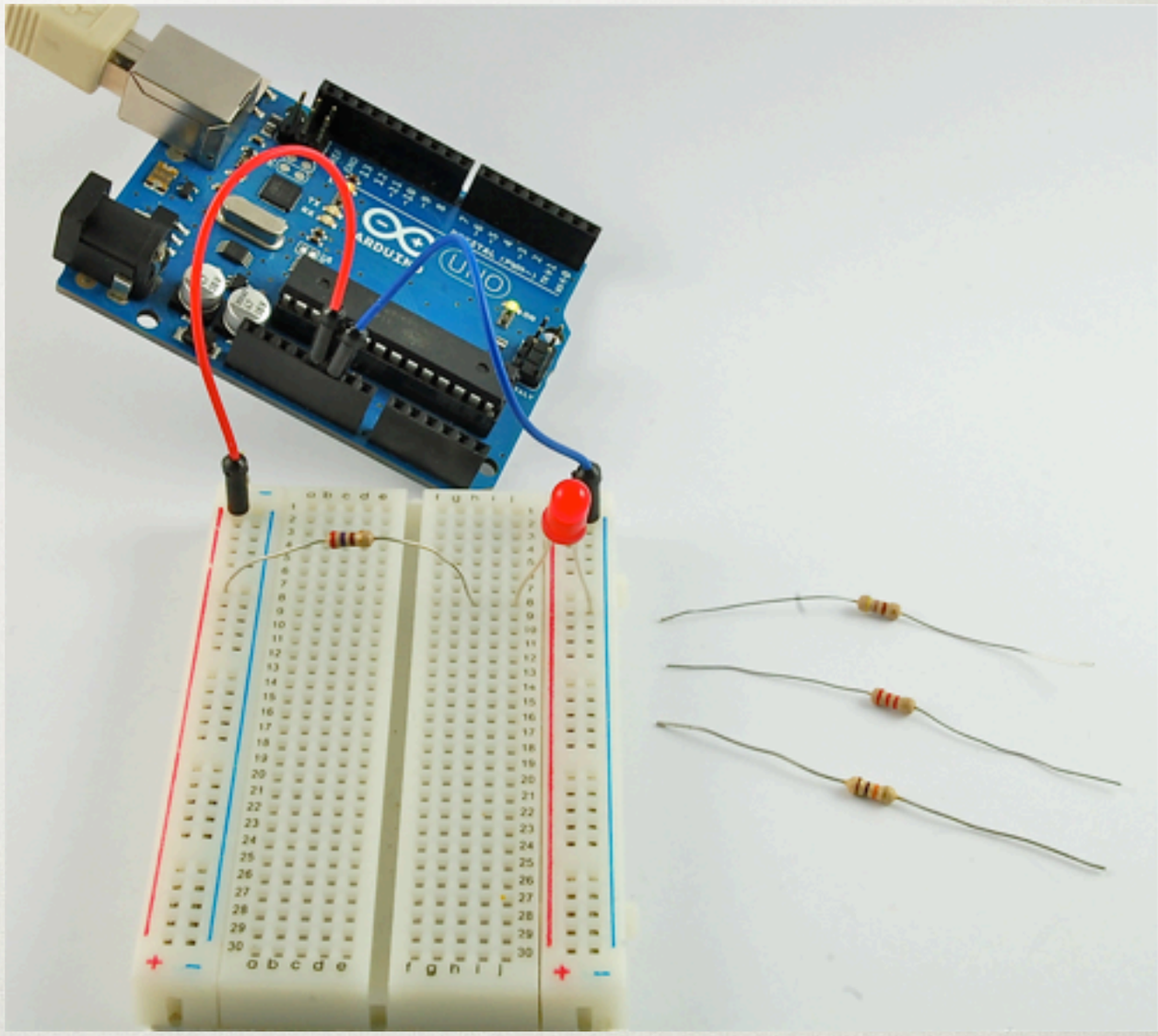


- Breadboard for prototyping
- Conductive strips underneath holes make easy connections
- Like a REPL or console

http://electronicsclub.info/circuitsymbols.htm

Electronics Crash Course





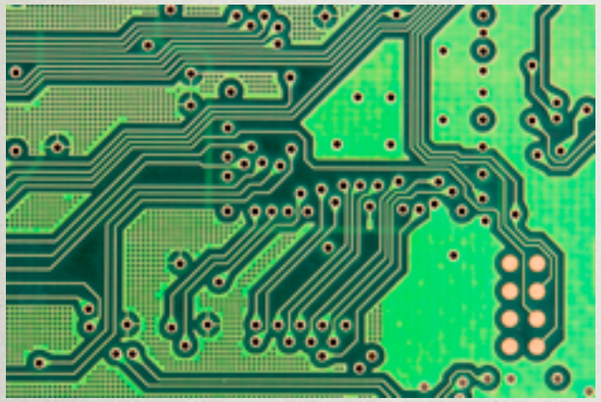
http://learn.adafruit.com/category/learn-arduino

Electronics Crash Course

- Arduino code has 2 requires functions
- void setup() - run once when the board is powered up
- void loop() - runs repeatedly until the board is powered down
- Other functions allowed for clarity

Electronics Crash Course

- Custom circuit design - Eagle, CAD, http://upverter.com



- Designs printed on a PCB (printed circuit board)

- Components assembled into finished hardware

Javascript for Makers

Javascript For Makers

- Javascript rose to new popularity coincident with the Maker movement

- Maker projects use the web

- Projects made by non-developers, tinkerers, engineers - smart people new to software

- Hardware is event-based, so JS is a good fit

- Javascript is a kind language for beginners - single numeric type, familiar syntax, type conversions

Javascript For Makers

Enabling Libraries

- node-serialport - https://github.com/voodootikigod/node-serialport
- Firmata - common firmware protocol for controlling microcontroller boards http://firmata.org/

Javascript For Makers

JohnnyFive

```
button = new five.Button(8);

// "down" the button is pressed
button.on("down", function() {
    console.log("down");
});

// "hold" the button is pressed for specified time.
//         defaults to 500ms (1/2 second)
button.on("hold", function() {
  console.log("hold");
});

// "up" the button is released
button.on("up", function() {
  console.log("up");
});
```

Firmata library with component behavior events

https://github.com/rwldrn/johnny-five

Javascript For Makers

Enabling Libraries - JohnnyFive

http://www.youtube.com/watch?v=gFiL4xVINdw

Gateway Hardware

Gateway Hardware

- Hacking on hardware is fun
- But it's a whole new skillset to learn separate from programming
- Sometimes you just want to *program* hardware
- Off-the-shelf robots make that easy
- And they're FUN! :)

Gateway Hardware - AR Drone

Gateway Hardware - AR Drone

- Quadcopter flying robot
- 50cm x 50cm, 400g (20” x 20”, ~1lb) - flying pizza box
- On-board video camera
- Controllable by open protocol - smartphone app or code

Gateway Hardware - AR Drone

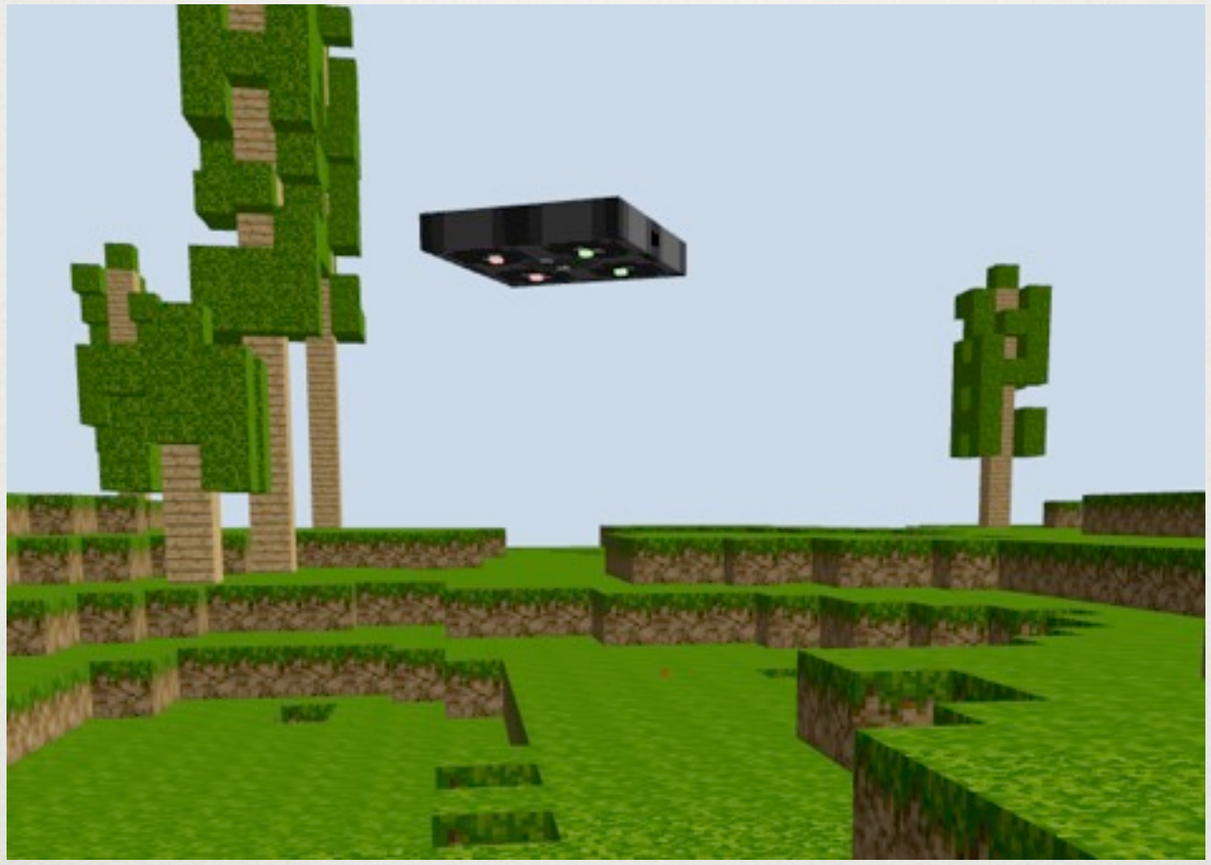
THE NODE COPTER

```
var arDrone = require('ar-drone');
var client = arDrone.createClient();

client.takeoff();

client
  .after(5000, function() {
    this.clockwise(0.5);
  })
  .after(3000, function() {
    this.animate('flipLeft', 15);
  })
  .after(1000, function() {
    this.stop();
    this.land();
  });
```

http://nodecopter.com/

http://www.youtube.com/watch?v=ymlbNEL5TQQ

Gateway Hardware - AR Drone



Voxel-js simulation of AR Drone
Implements the Nodebots API
http://shama.github.io/voxel-drone/

Gateway Hardware - Sphero

http://www.youtube.com/watch?v=43tctP24Xmo

Gateway Hardware - Sphero

- Robotic ball the size of an apple
- Bluetooth control by smartphone apps
- Scriptable by code
- Much better than AR Drone if you have kids, pets, small apartment

Gateway Hardware - Sphero

https://github.com/mick/node-sphero

```
var roundRobot = require('node-sphero');
var sphero = new roundRobot.Sphero();

sphero.on('connected', function(ball) {
  ball.setRGBLED(0, 255, 0, false);
});

sphero.connect();
```

Concluding Thoughts

- What would you make if you weren't stuck inside the computer or the internet?
- What objects do you interact with daily that you could make smarter?
- What would you do if you could program the real world?

You are only limited by *your imagination.*

What will

YOU

make?

Peter Christensen
http://pchristensen.com
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