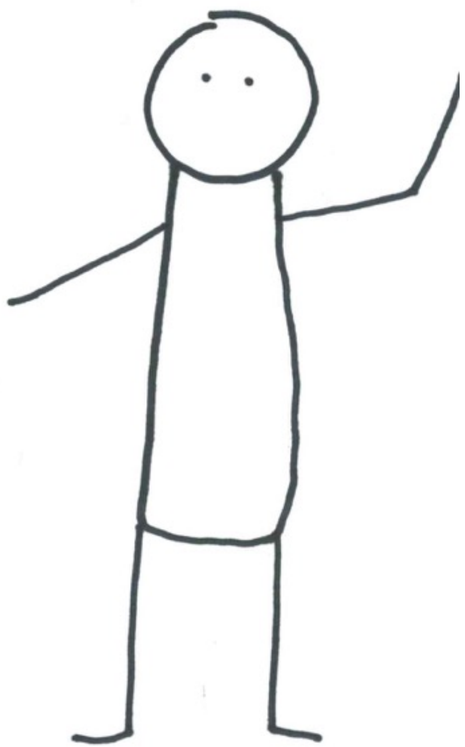
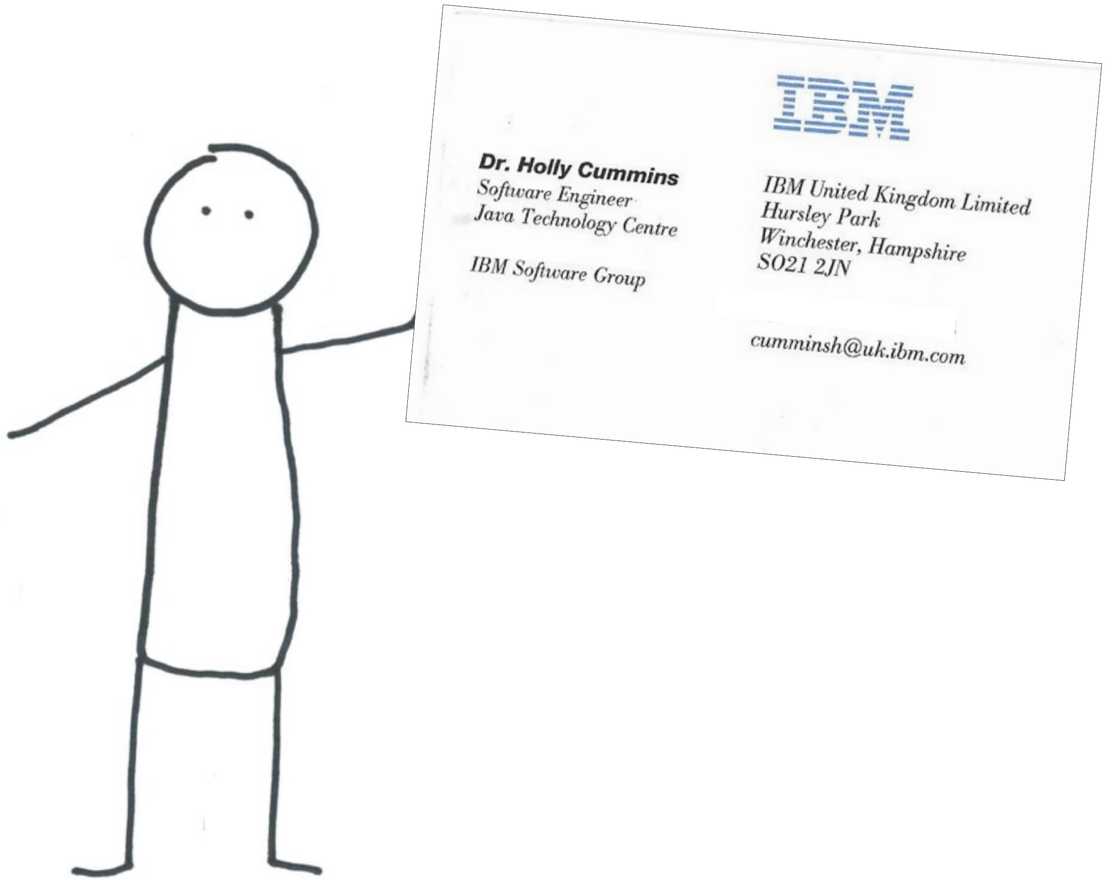
Arduinos, Application Servers, and me

adventures in and out of the cloud

Holly Cummins
@holly_cummins



?


IBM
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IBM Bluemix™


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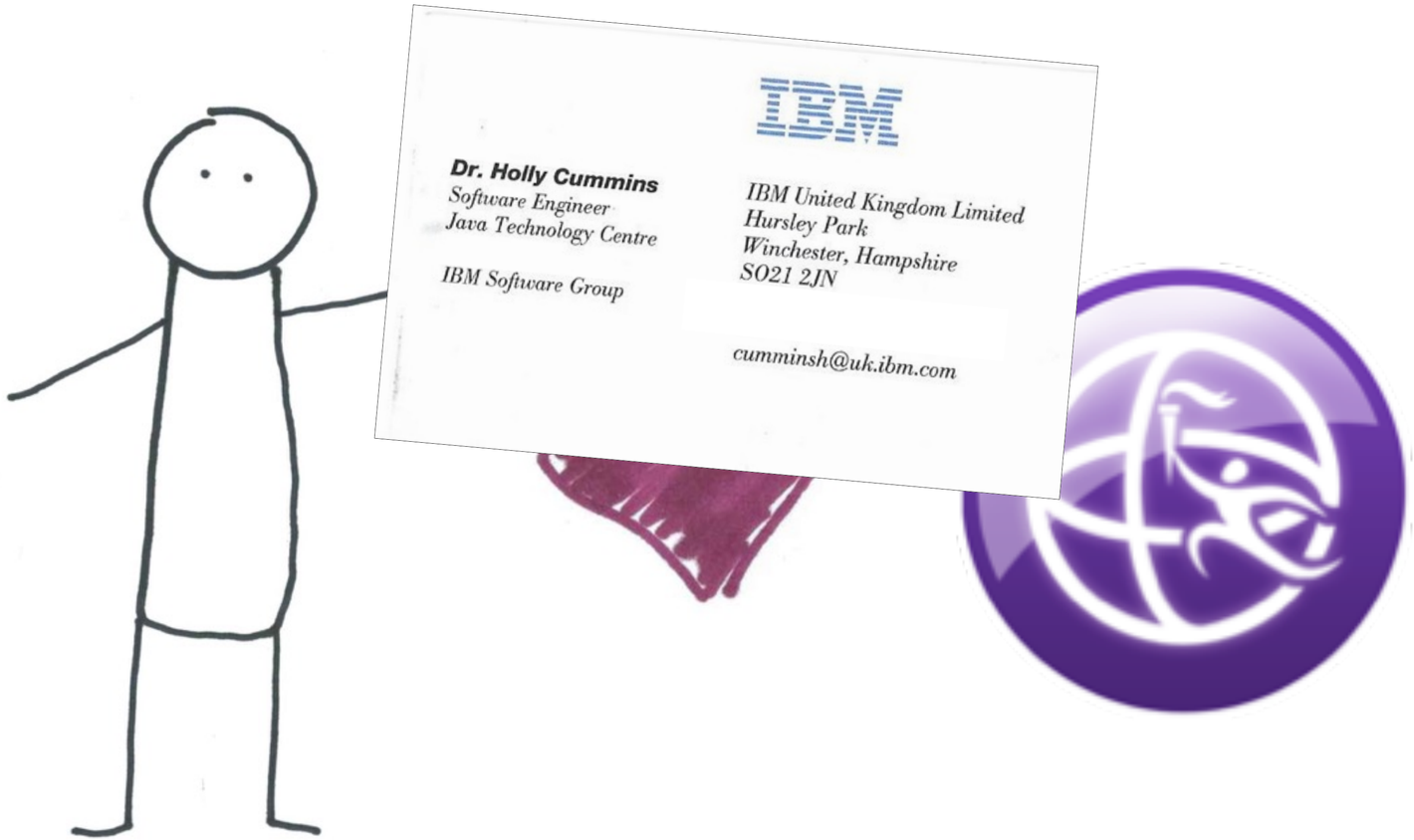
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Enterprise
OSGi
IN ACTION
Holly Cummins
Timothy Ward
MANNING

http://ibm.biz/bluemixgaragelondon

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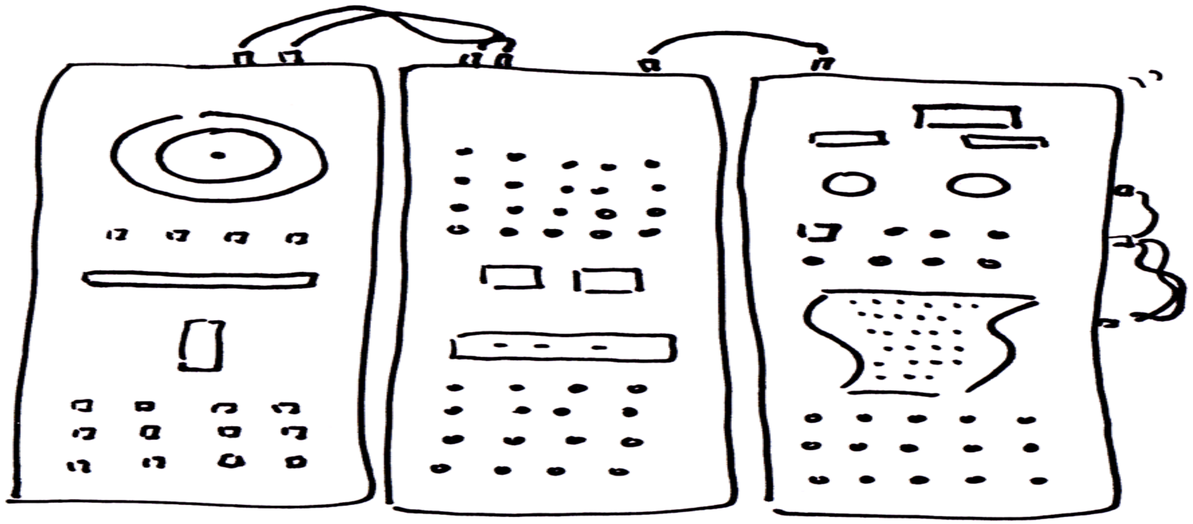
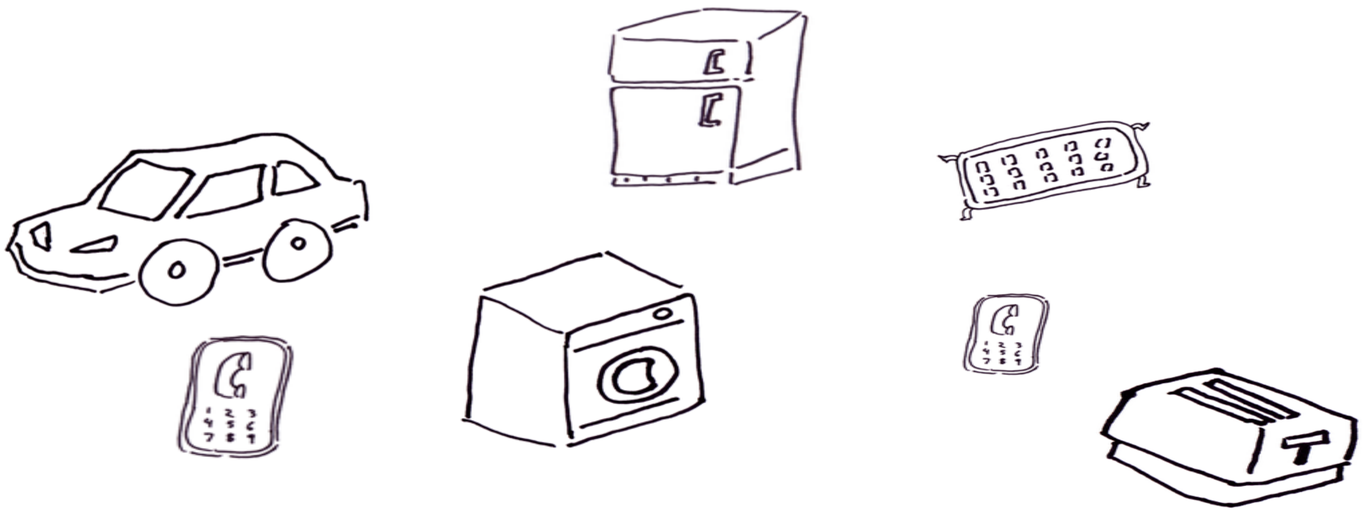
“I think there is a world market for maybe five computers.”

Thomas Watson
chairman of IBM
1943

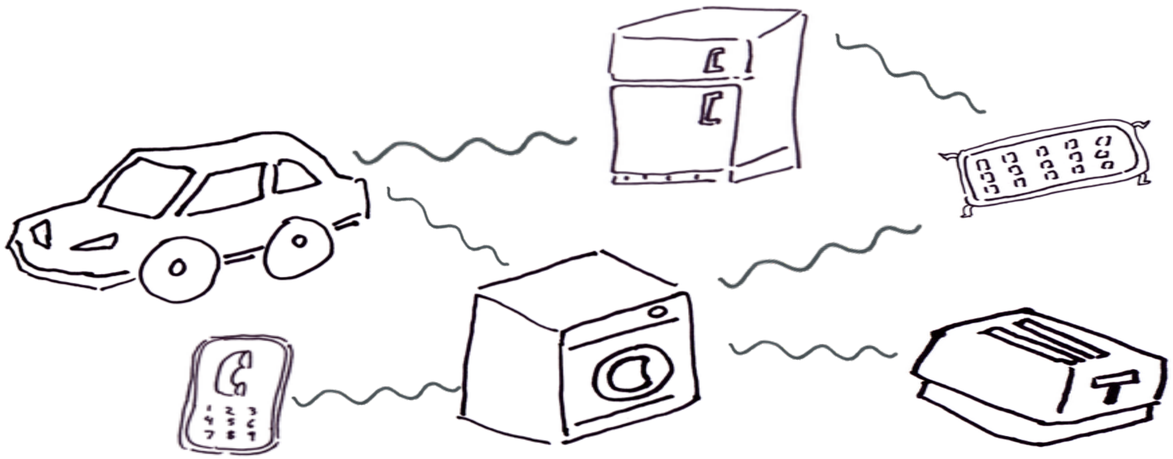
Then: HARDware



Now: Everyware

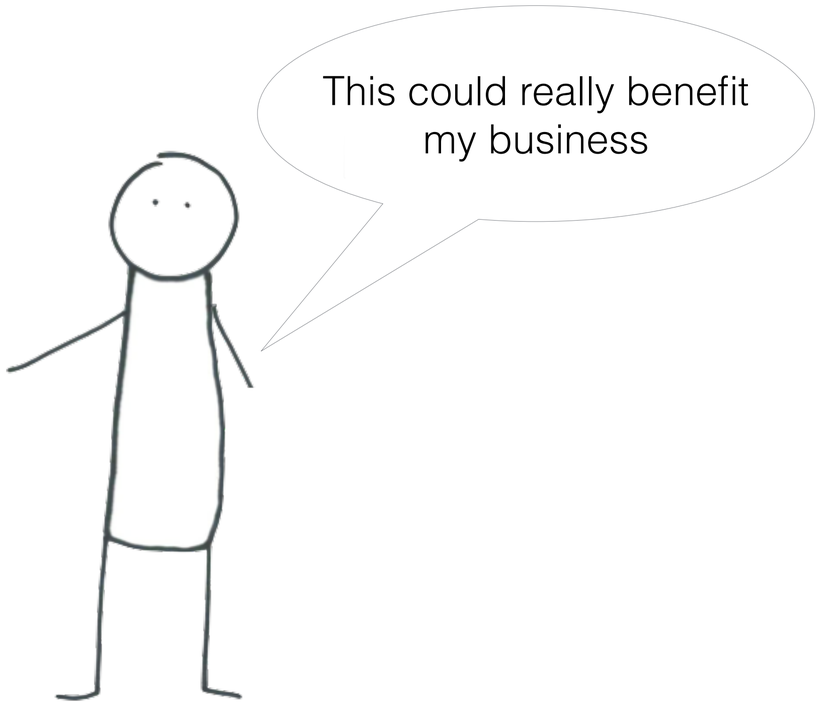


Next: Connected-ware

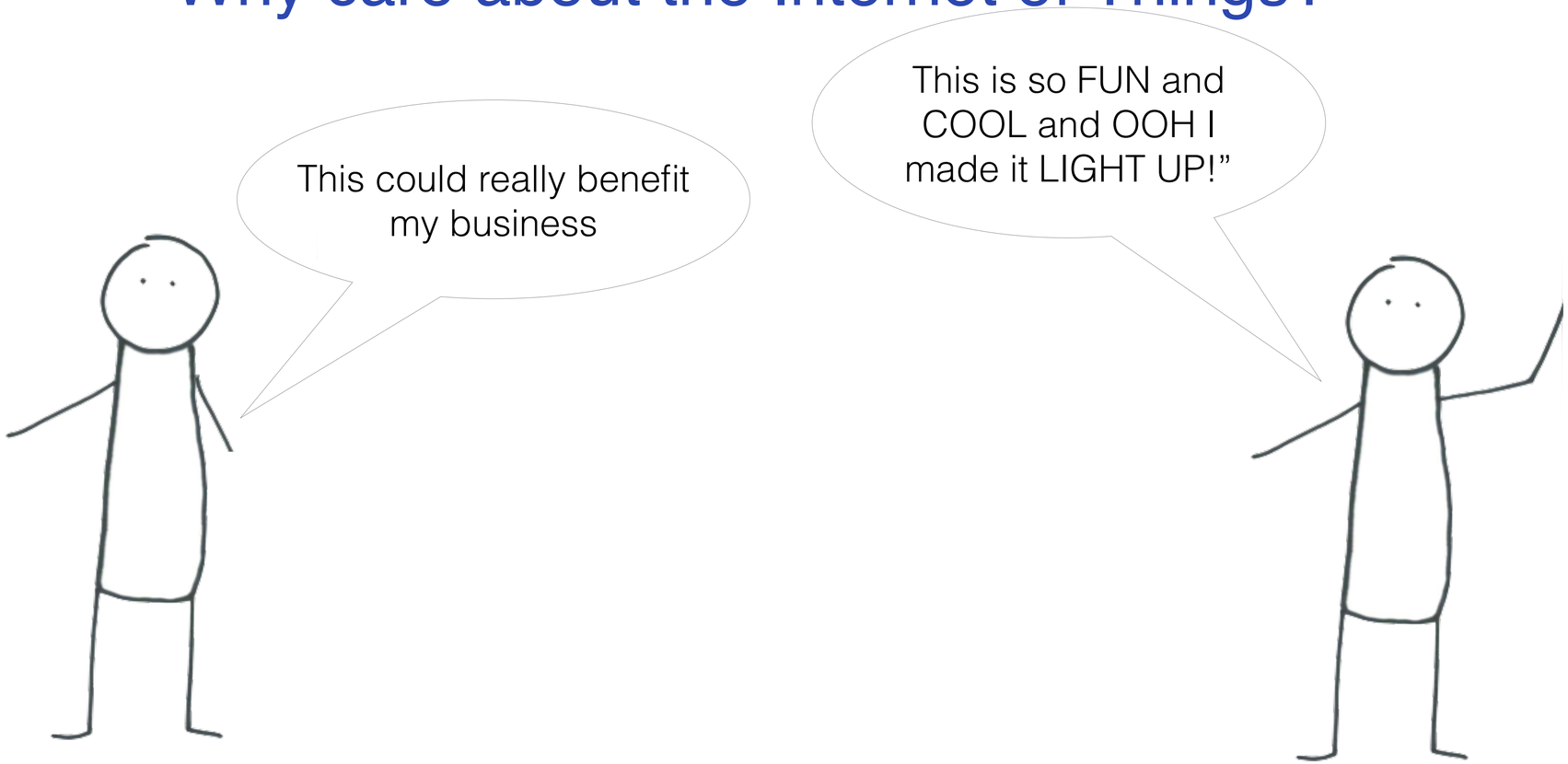


Why care about the Internet of Things?

Why care about the Internet of Things?



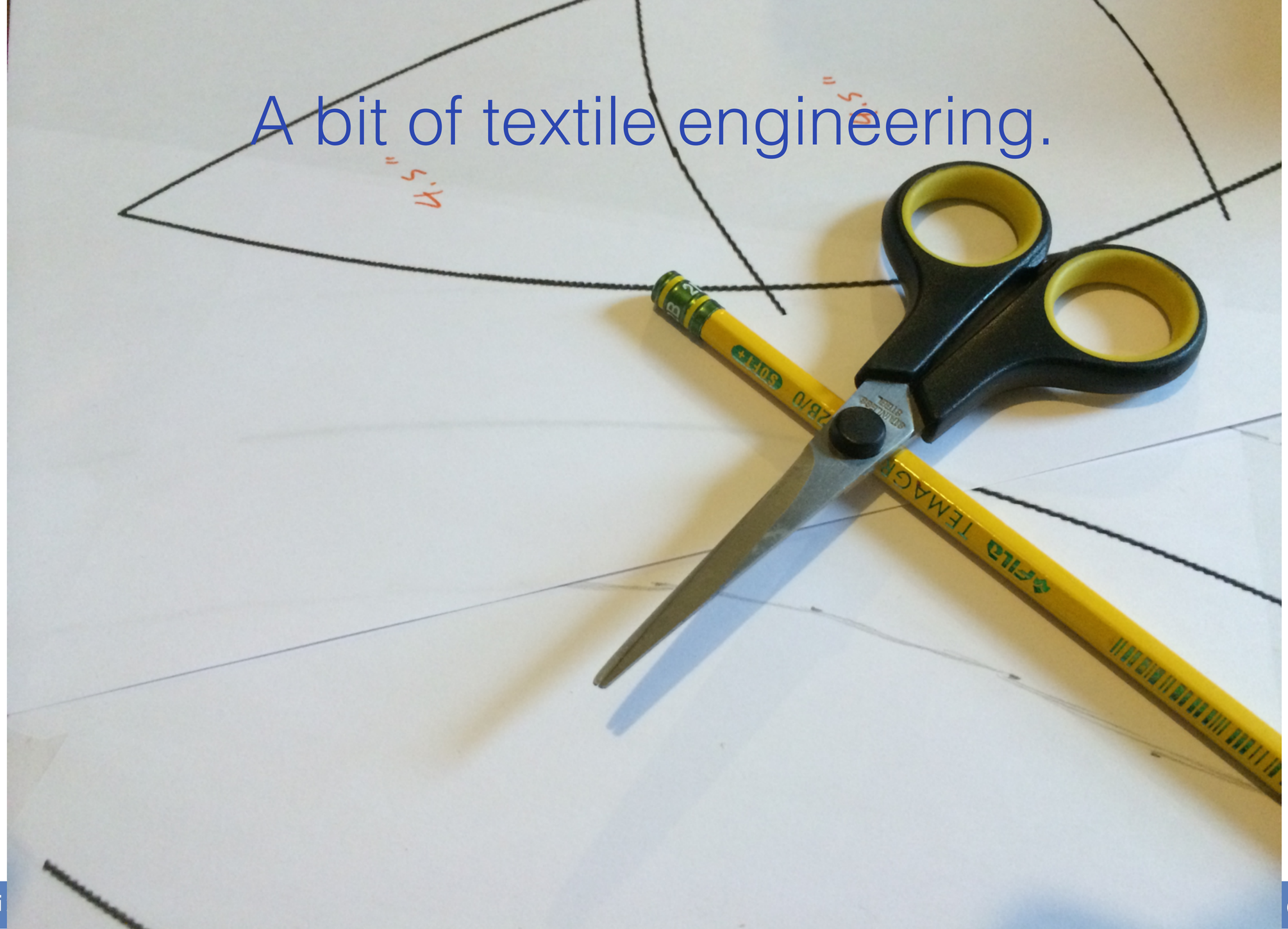
Why care about the Internet of Things?



Poll-time.

Hmm. Can we be more precise?

A bit of textile engineering.



A bit more textile engineering.

Ta-daa!

Ta-daa!

Ta-daa!

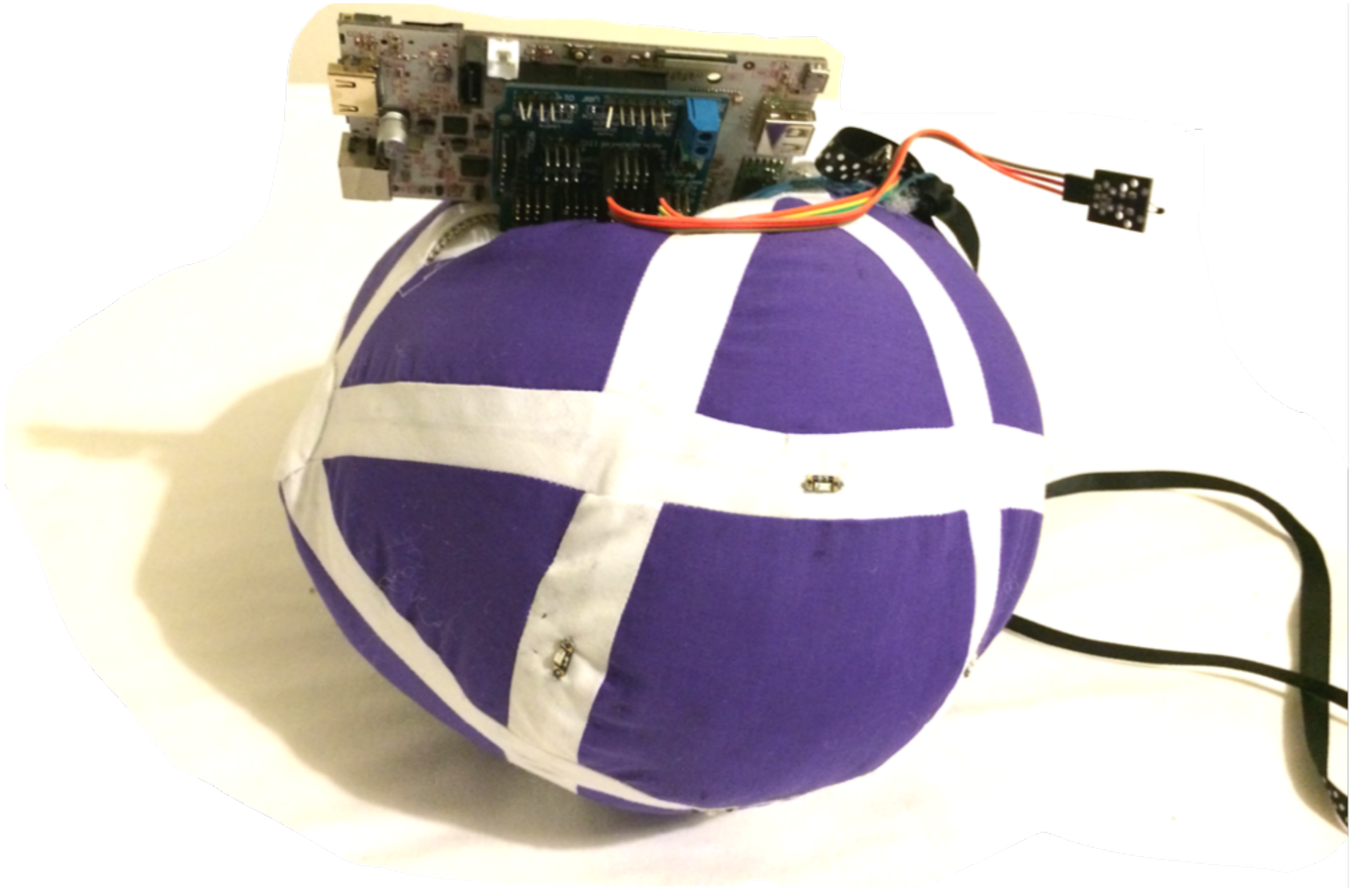

Presenting:
The WebSphere Sphere
(“the cuddly application server”)

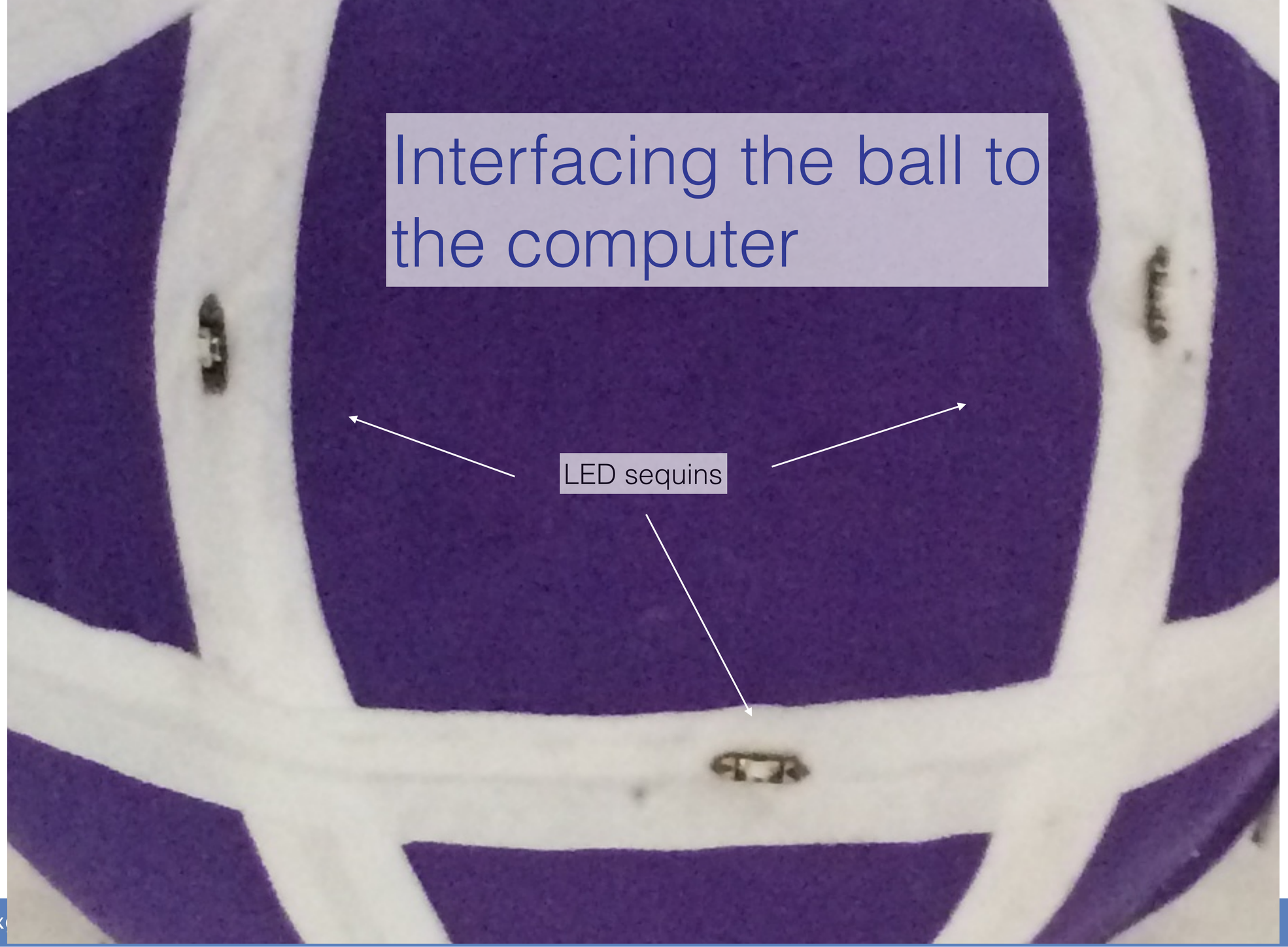
Remind you of anything?

Not really.
It’s very lumpy, isn’t it?

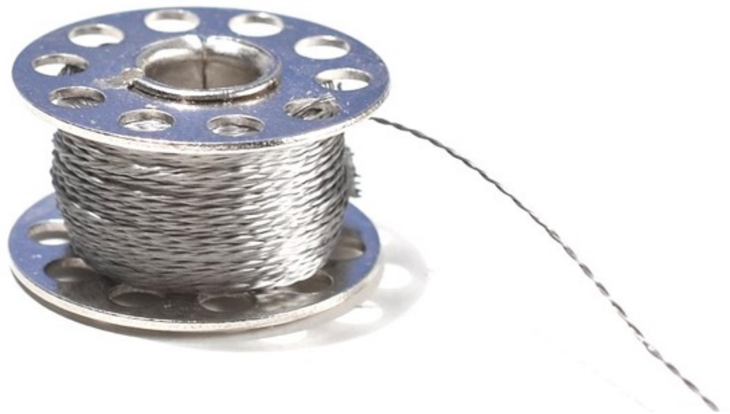
Software faults can be corrected without re-typing the whole program.

It’s a computer case



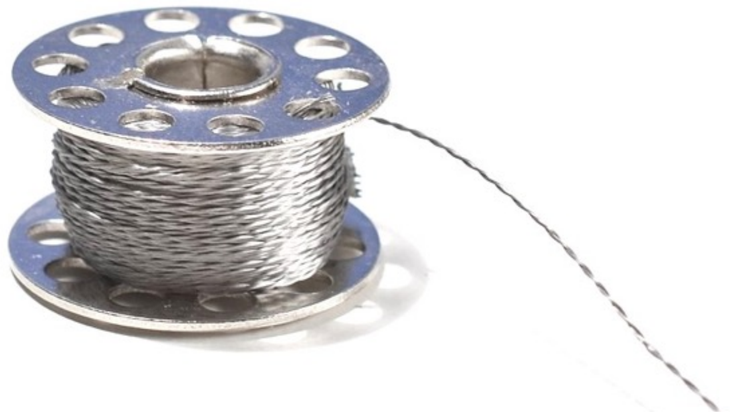

Interfacing the ball to the computer
LED sequins

Soft circuits



Soft circuits

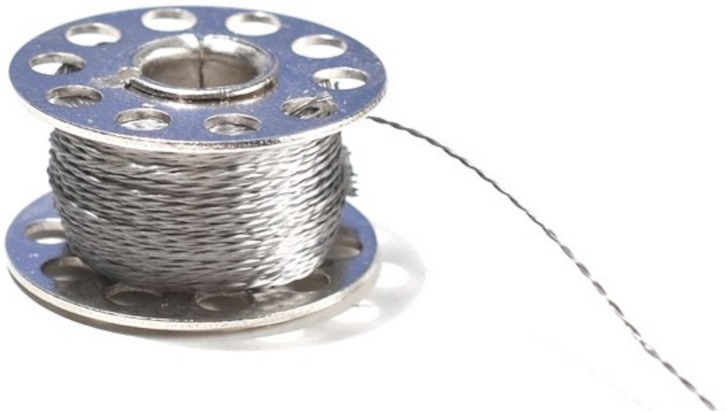
Conductive thread



Soft circuits

£6.78

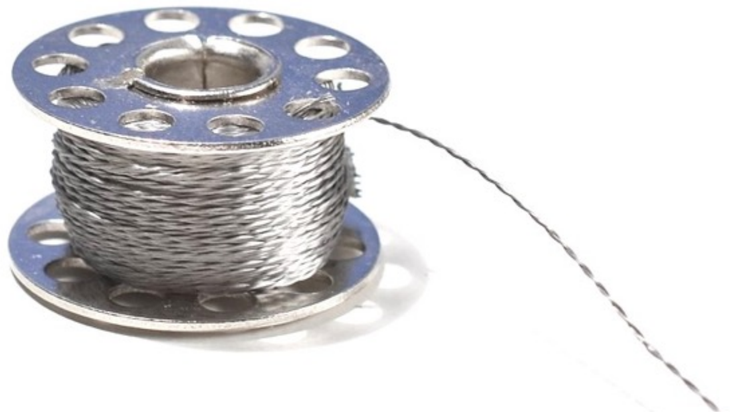
Conductive thread



Soft circuits

Stainless steel
Conductive thread

£6.78



Soft circuits

Stainless steel
Conductive thread

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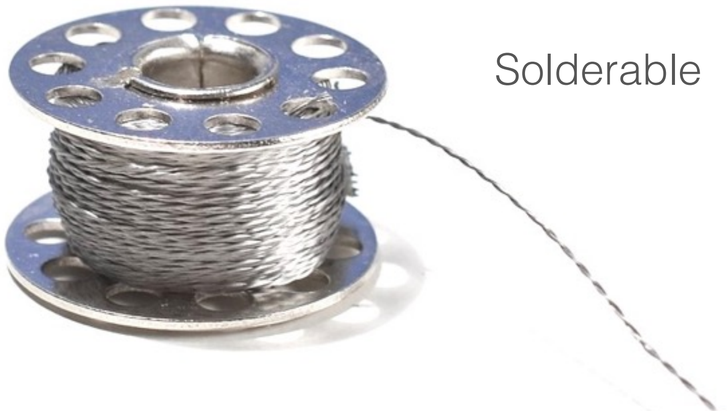
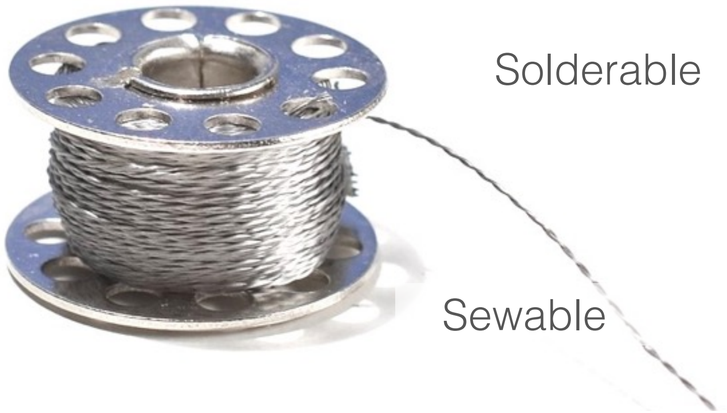


Solderable

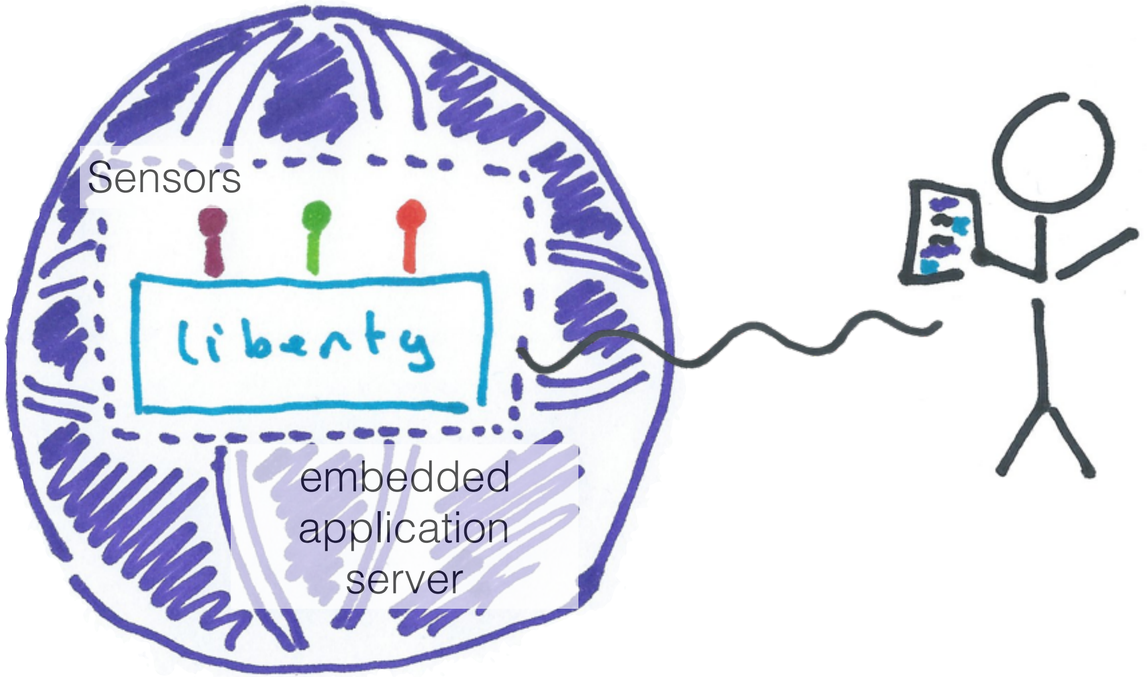
Soft circuits

Stainless steel
Conductive thread

£6.78



Architecture



Let’s have a play

SSID: sphere

password: websphere

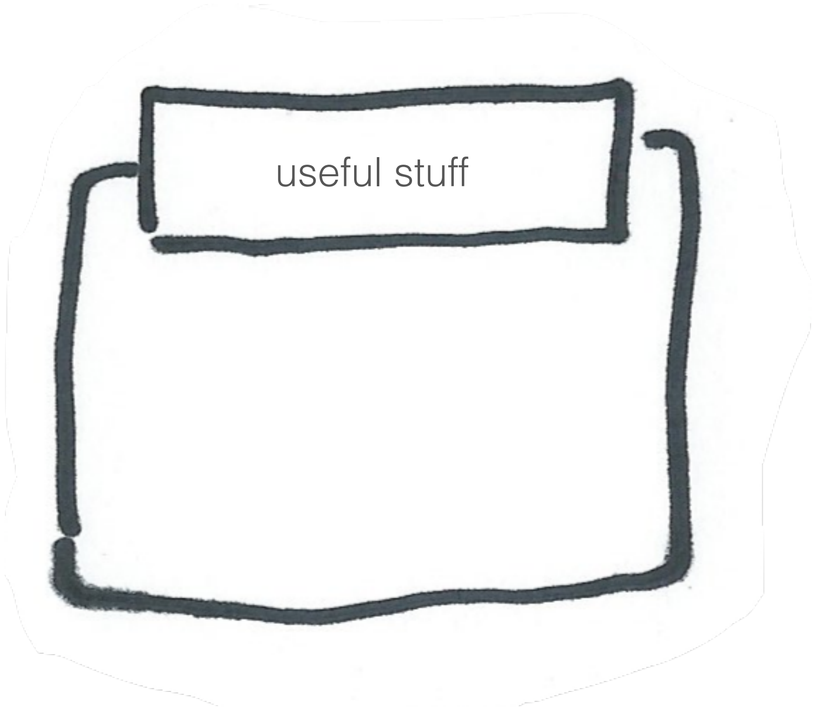
Let’s have a play

http://192.168.8.1/sphere

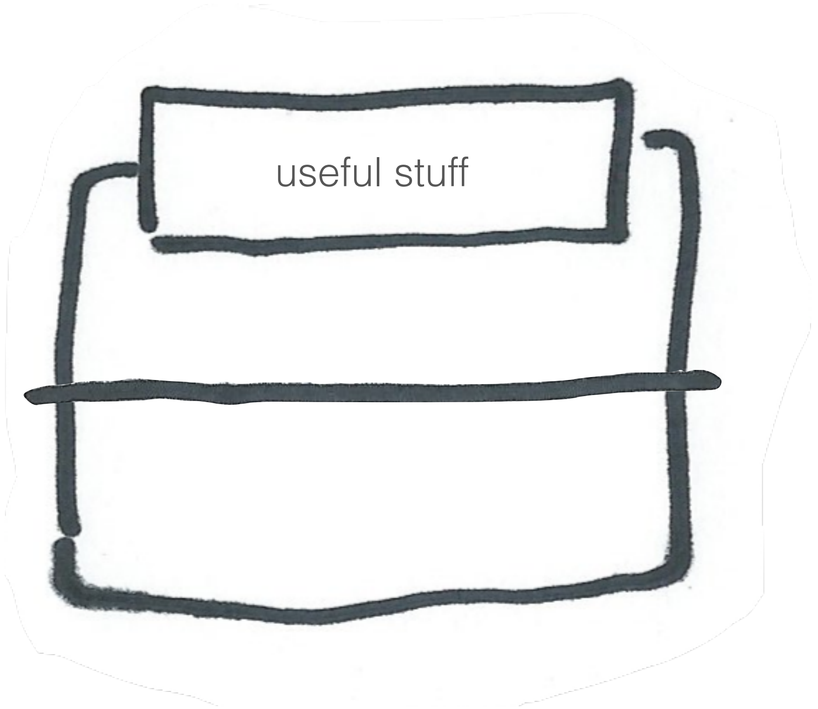
SSID: sphere

password: websphere

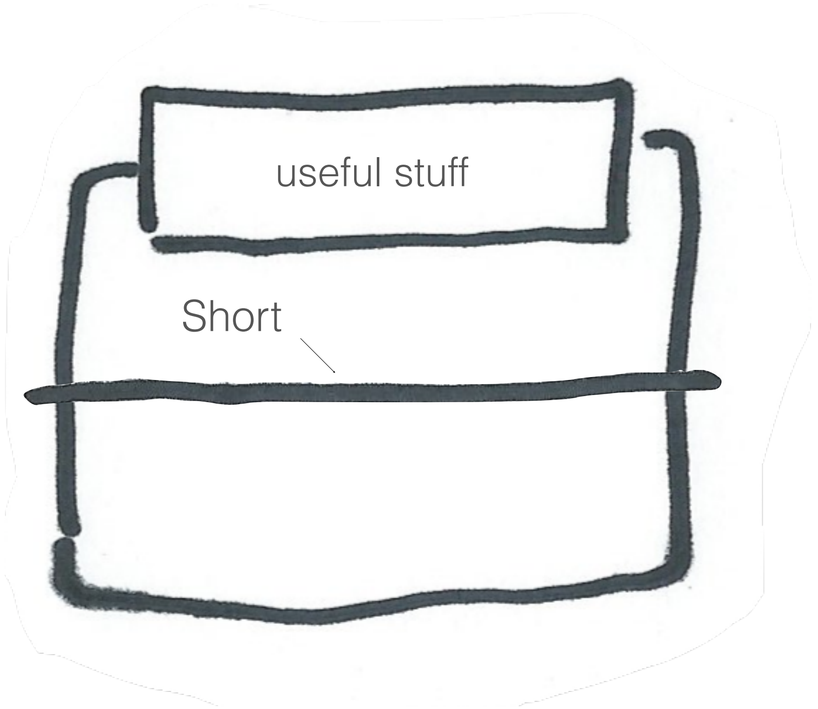
The physical world



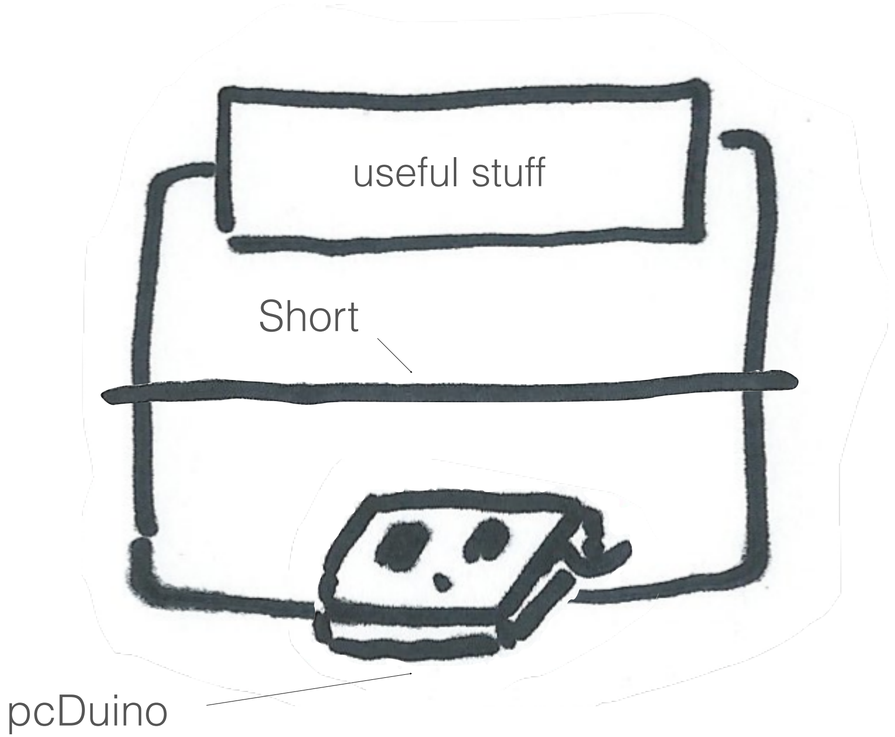
The physical world



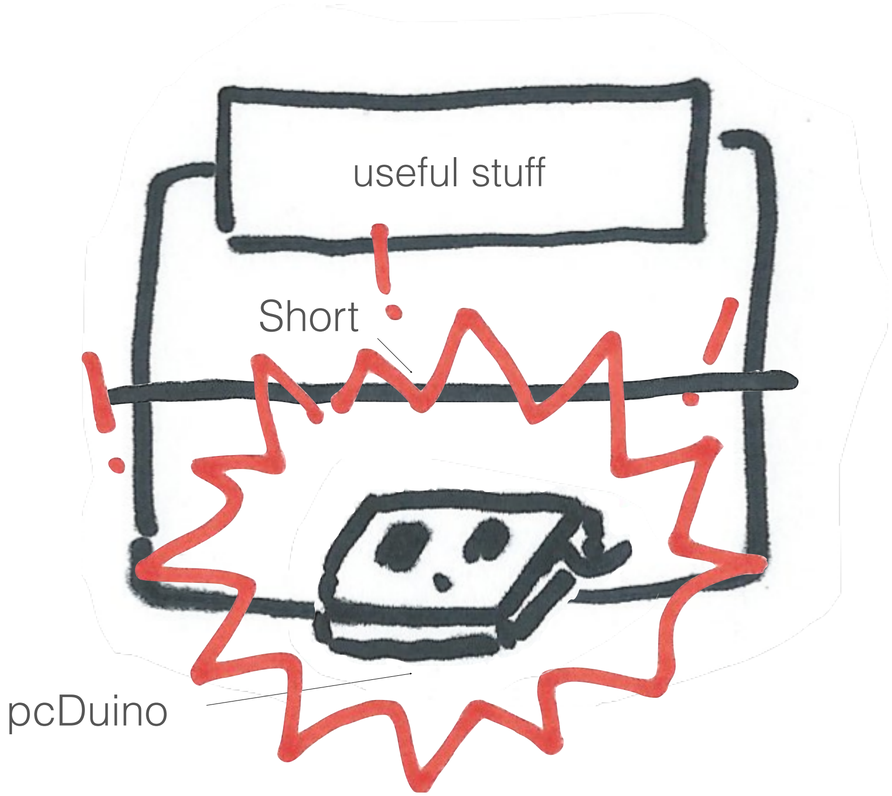
The physical world



The physical world

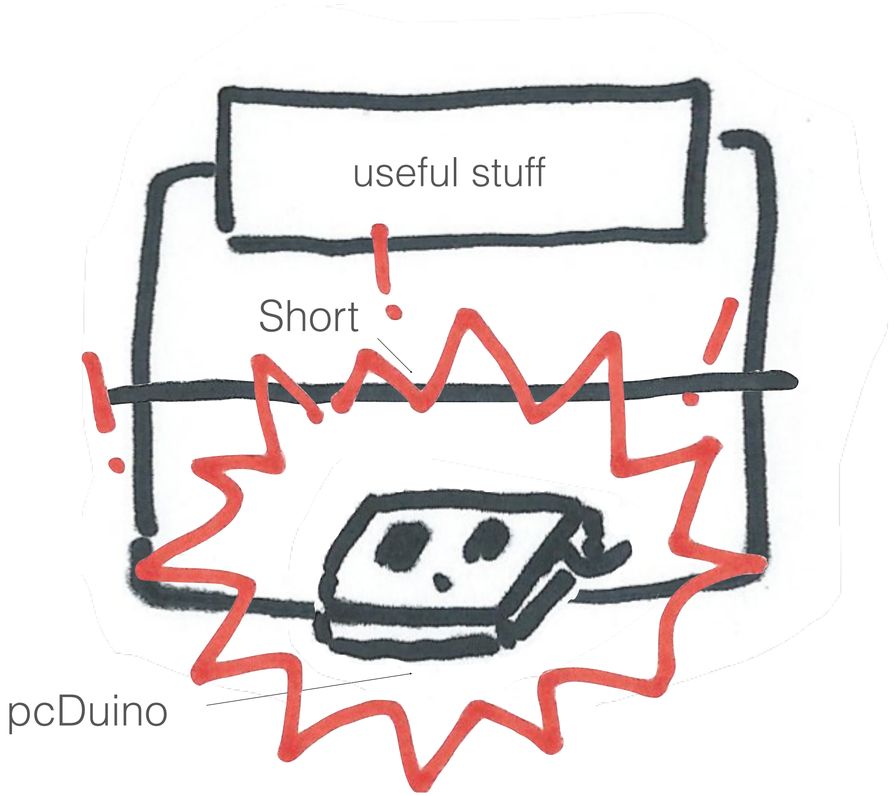


The physical world

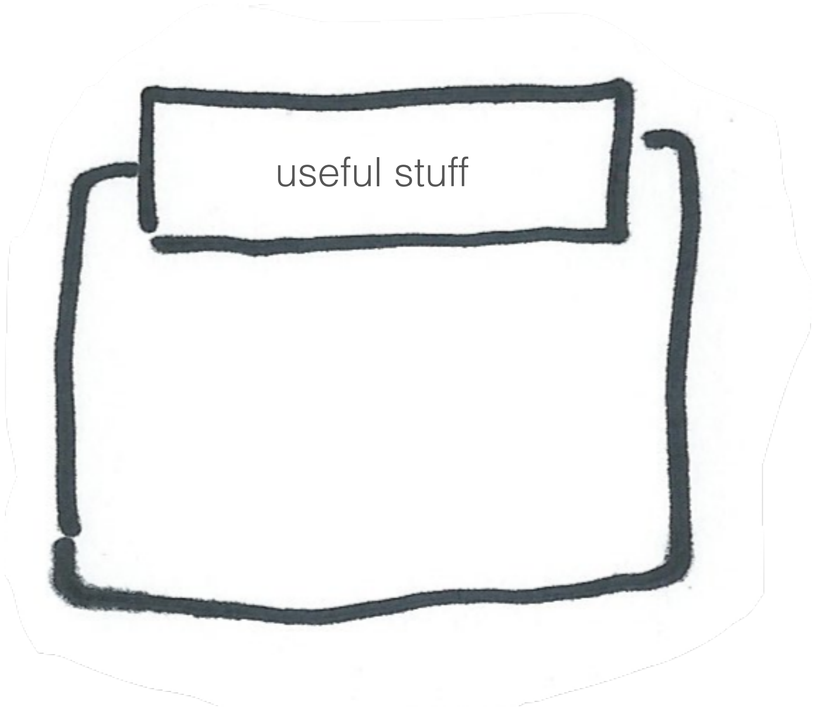


The physical world

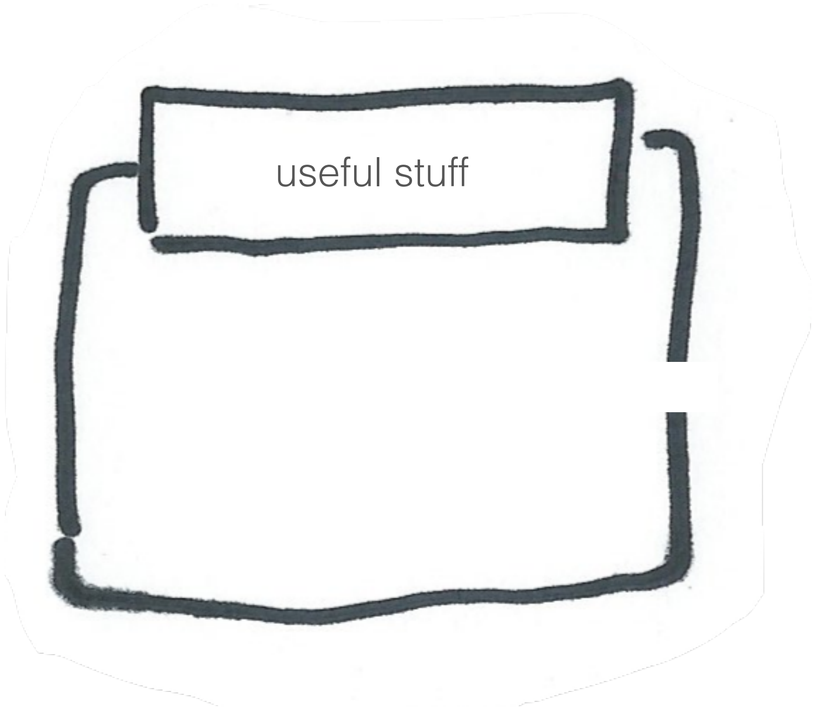
Maybe having your pins and your processor intimately connected isn't such a great idea.



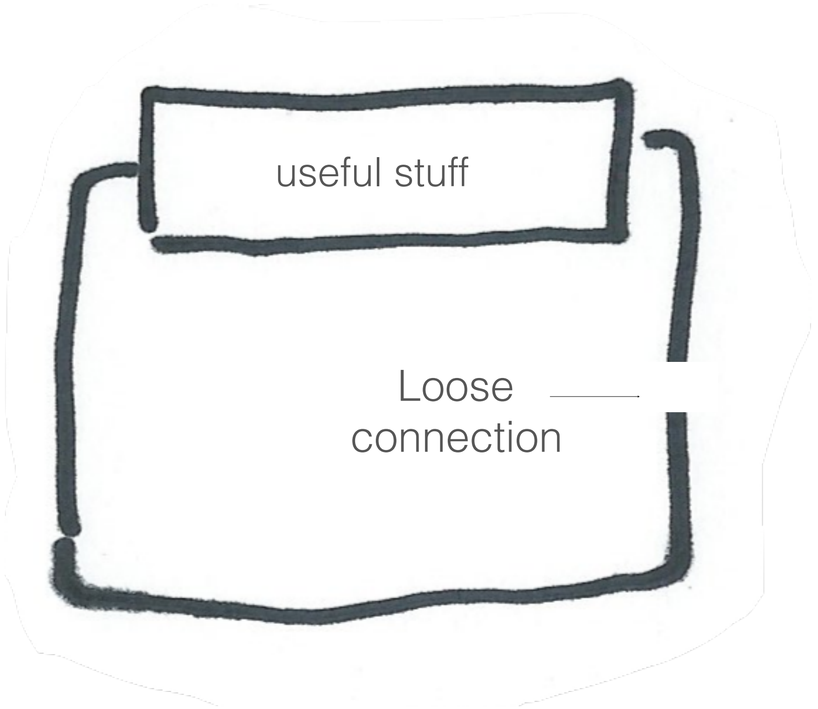
The physical world



The physical world

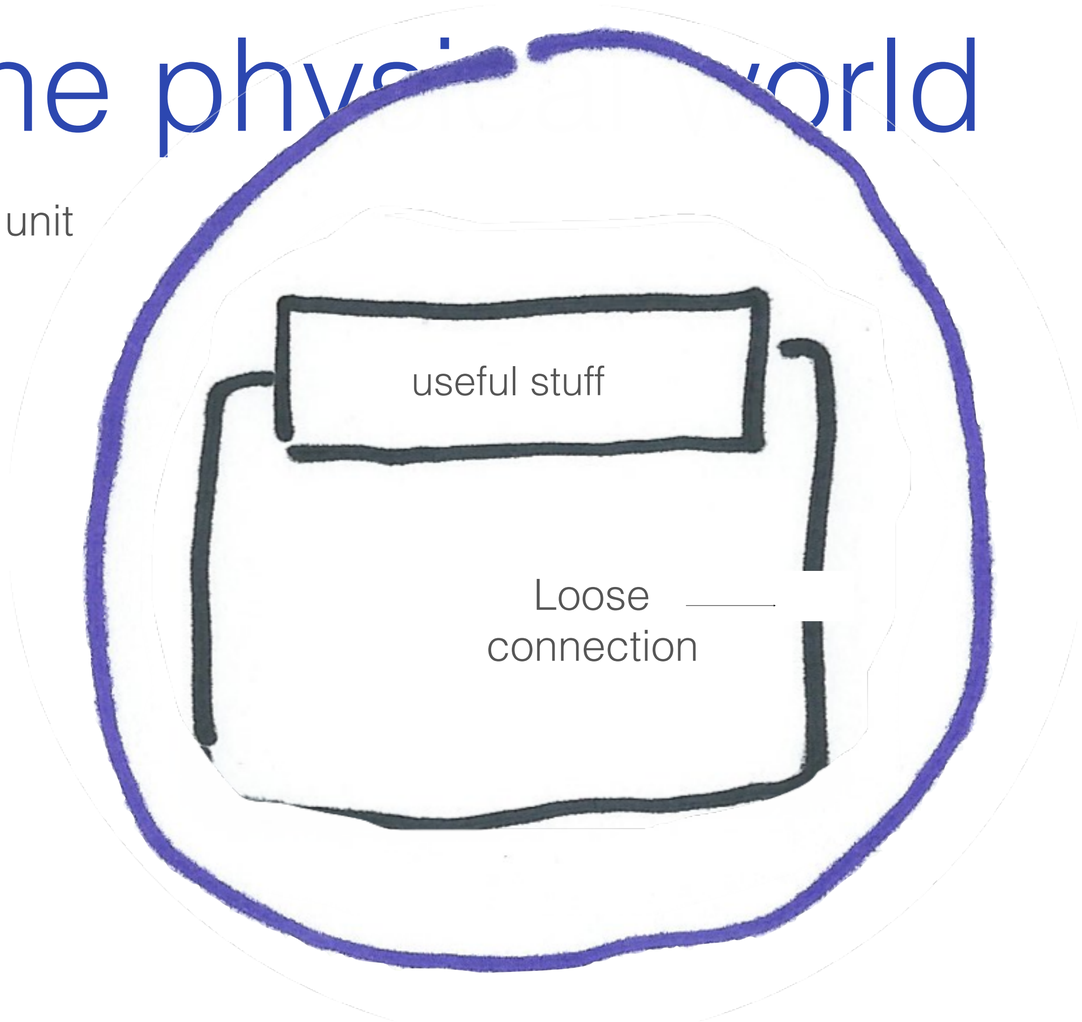


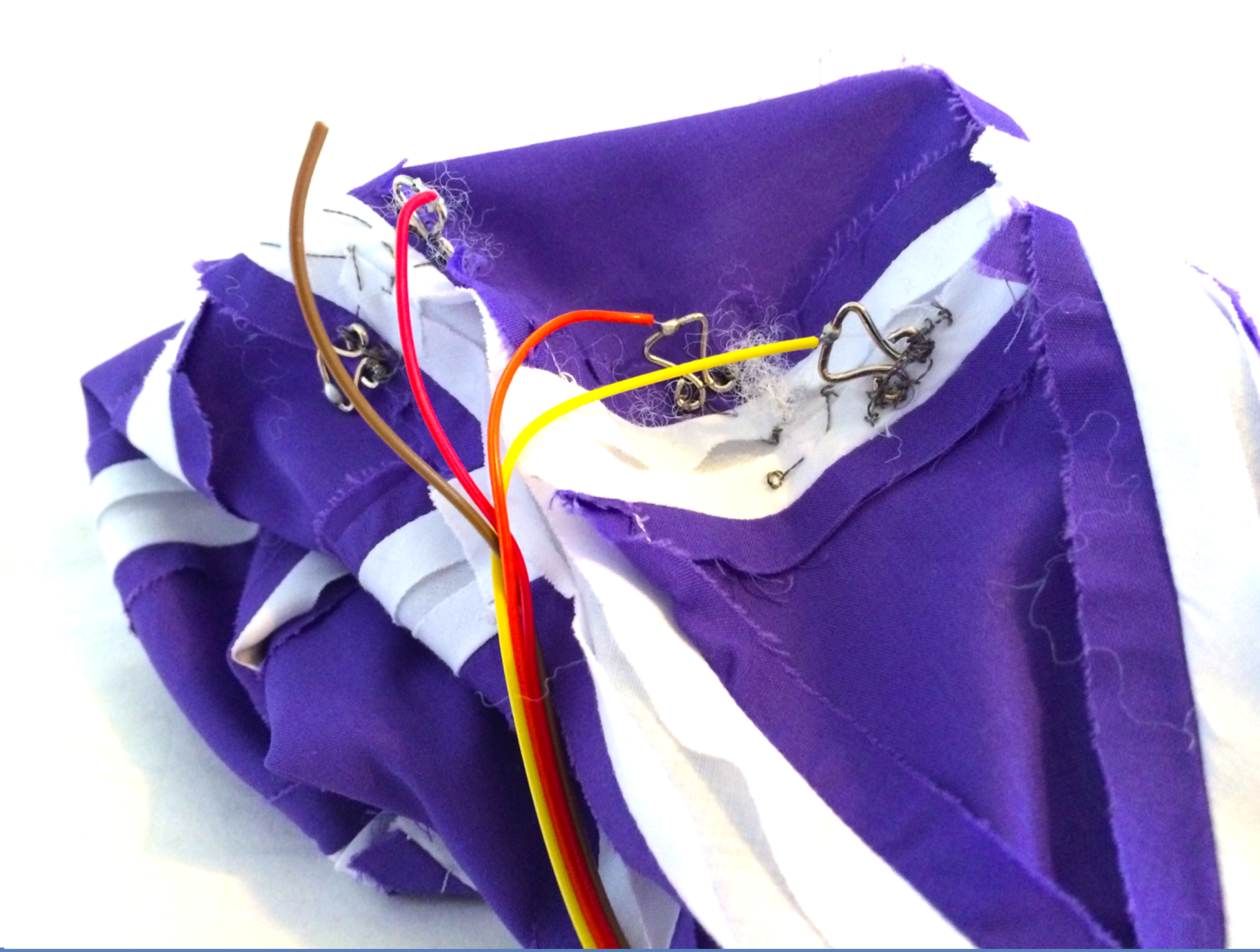
The physical world



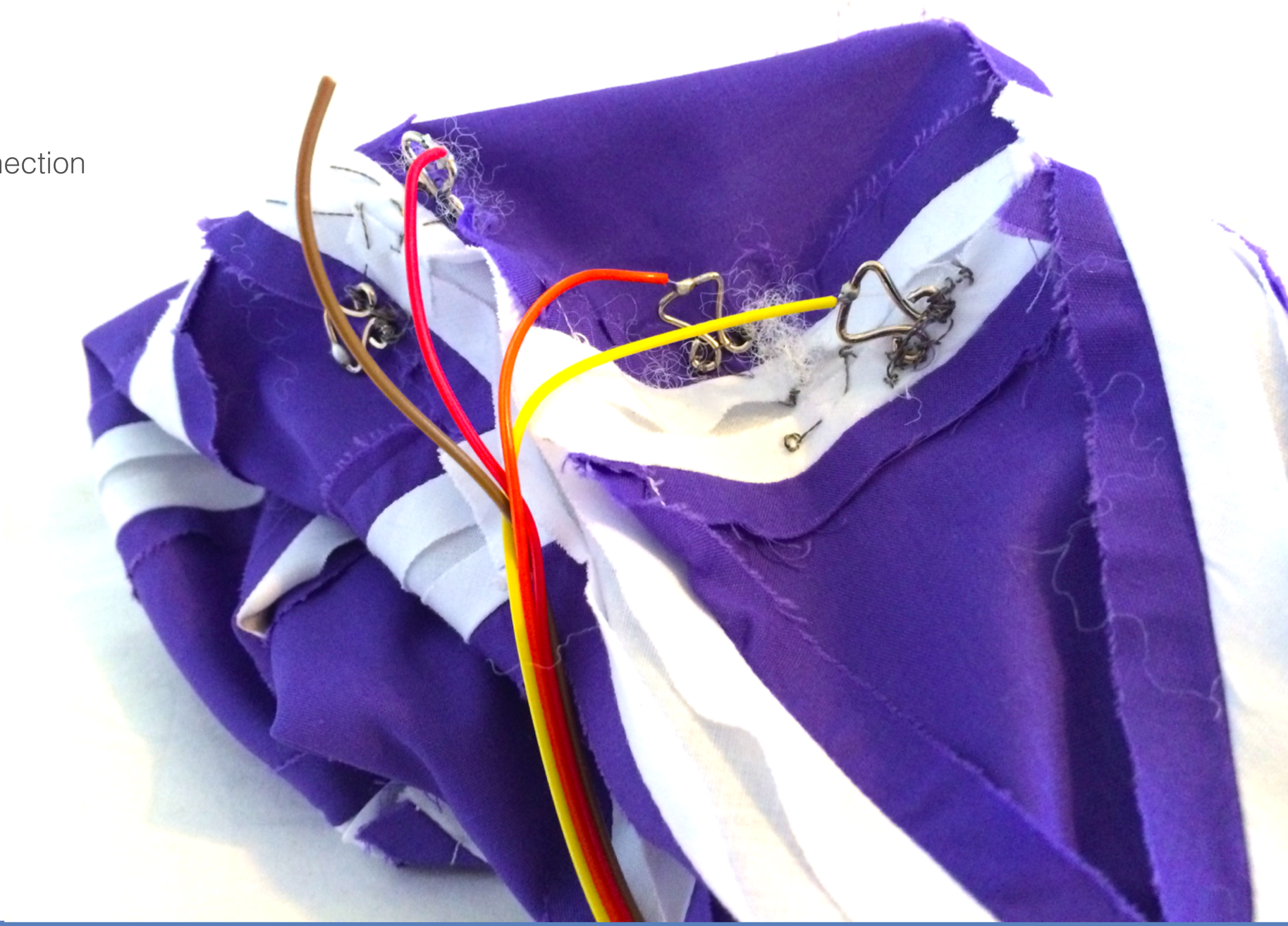
The physical world

sealed unit





“Loose” connection



Holly's Catalogue of IoT misfortune

Wires snapped. Many times.

Holly's Catalogue of IoT misfortune

pcDuino never displayed to any monitor.

Holly's Catalogue of IoT misfortune

Burned kitchen worktop with soldering iron.

Holly's Catalogue of IoT misfortune

Insufficient voltage from battery for lights.

And sensors.

Holly's Catalogue of IoT misfortune

USB power connectors ripped from board.

Twice.

Holly's Catalogue of IoT misfortune

Sensor started smoking, stopped working.

Had to buy a new one.

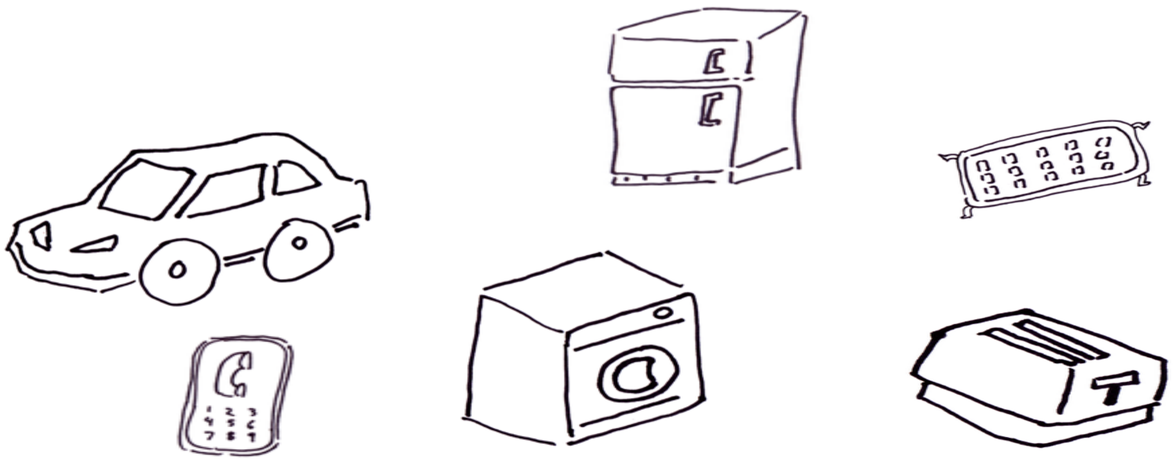
Holly's Catalogue of IoT misfortune

pcDuino stopped working.

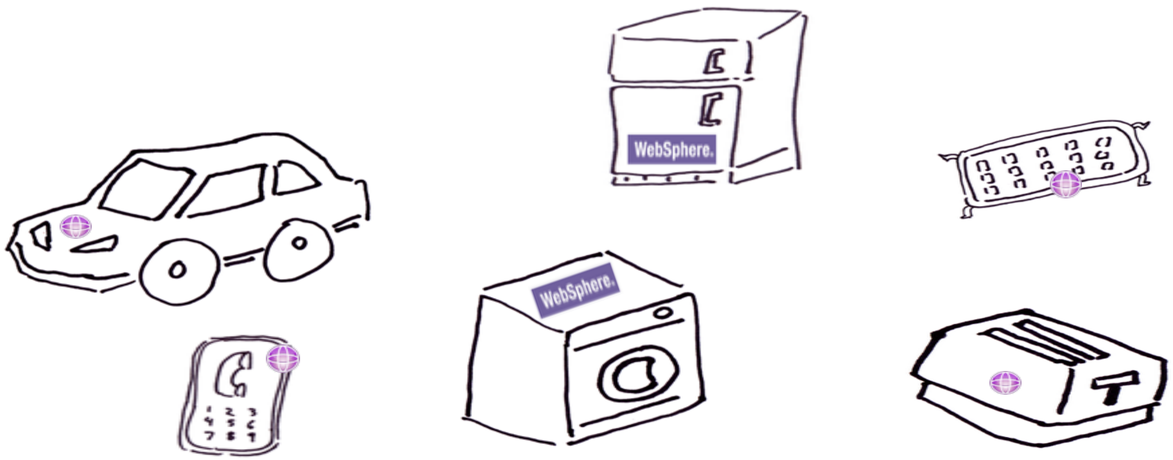
Had to buy a new one :(

What’s running it?

Ubiquitous computing++



Ubiquitous computing++



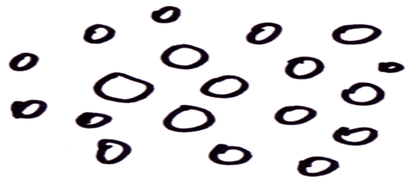
Cloud-Embeddable convergence

Cloud-Embeddable convergence

Density

Cloud-Embeddable convergence

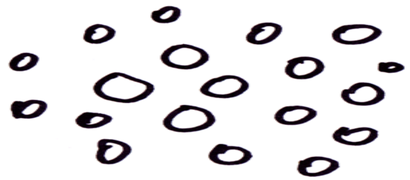
Density



- Small download
- Small memory footprint

Cloud-Embeddable convergence

Density

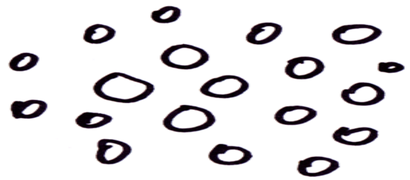


- Small download
- Small memory footprint

Elasticity

Cloud-Embeddable convergence

Density



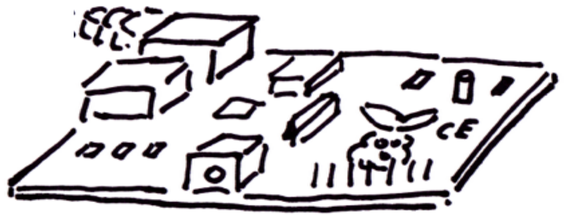
- Small download
- Small memory footprint

Elasticity

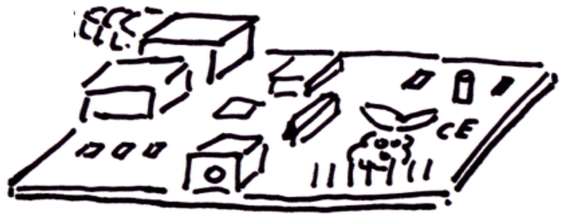
- Enable and disable function
  - …dynamically
- Easy install
  - Easy uninstall

But is it really IoT?

But is it really IoT?



But is it really IoT?



Thing

But is it really IoT?

Embedded thing

But is it really IoT?

Very very embedded thing

But is it really IoT?

Network, but not internet

Very very embedded thing

But is it really IoT?

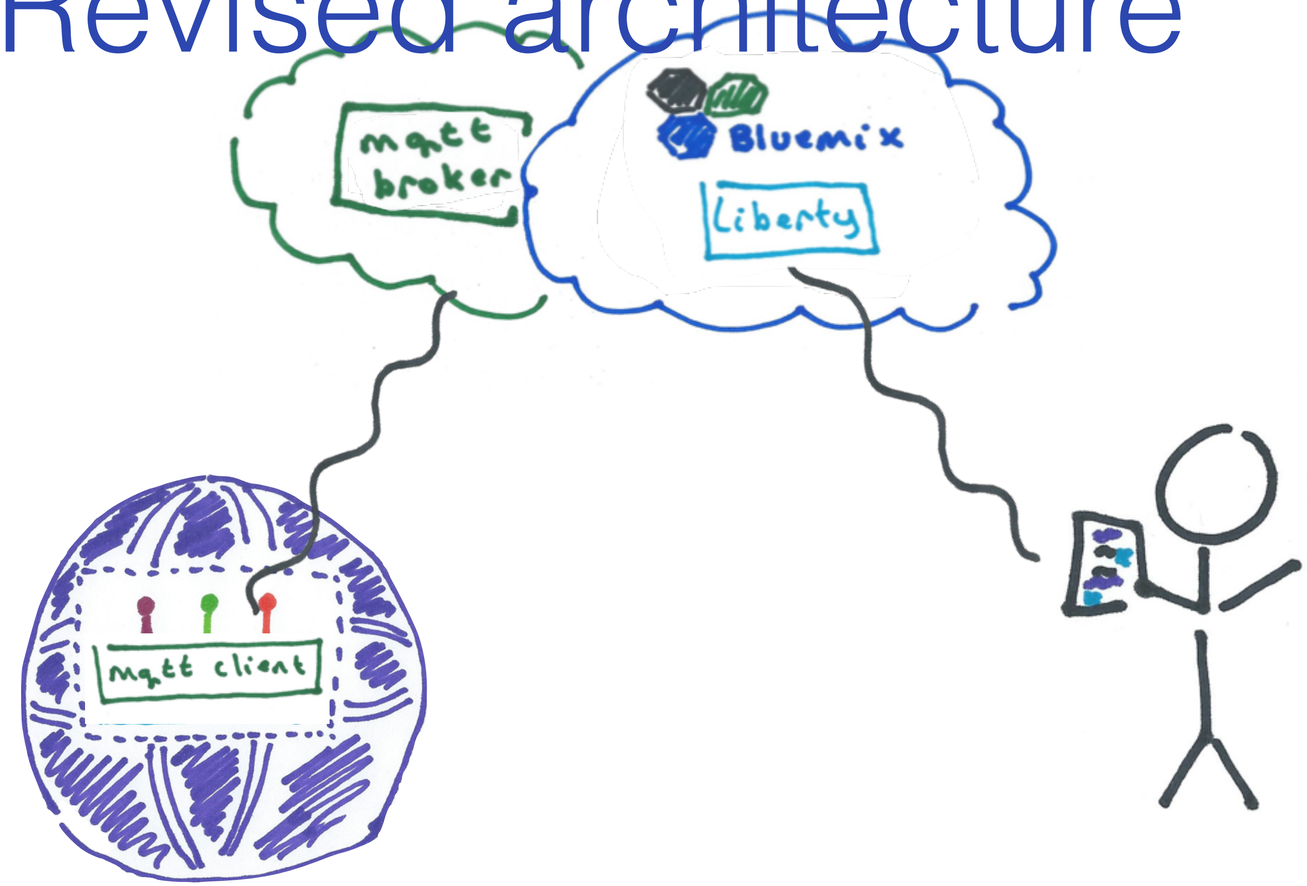
But is it really IoT?

No machine-to-machine

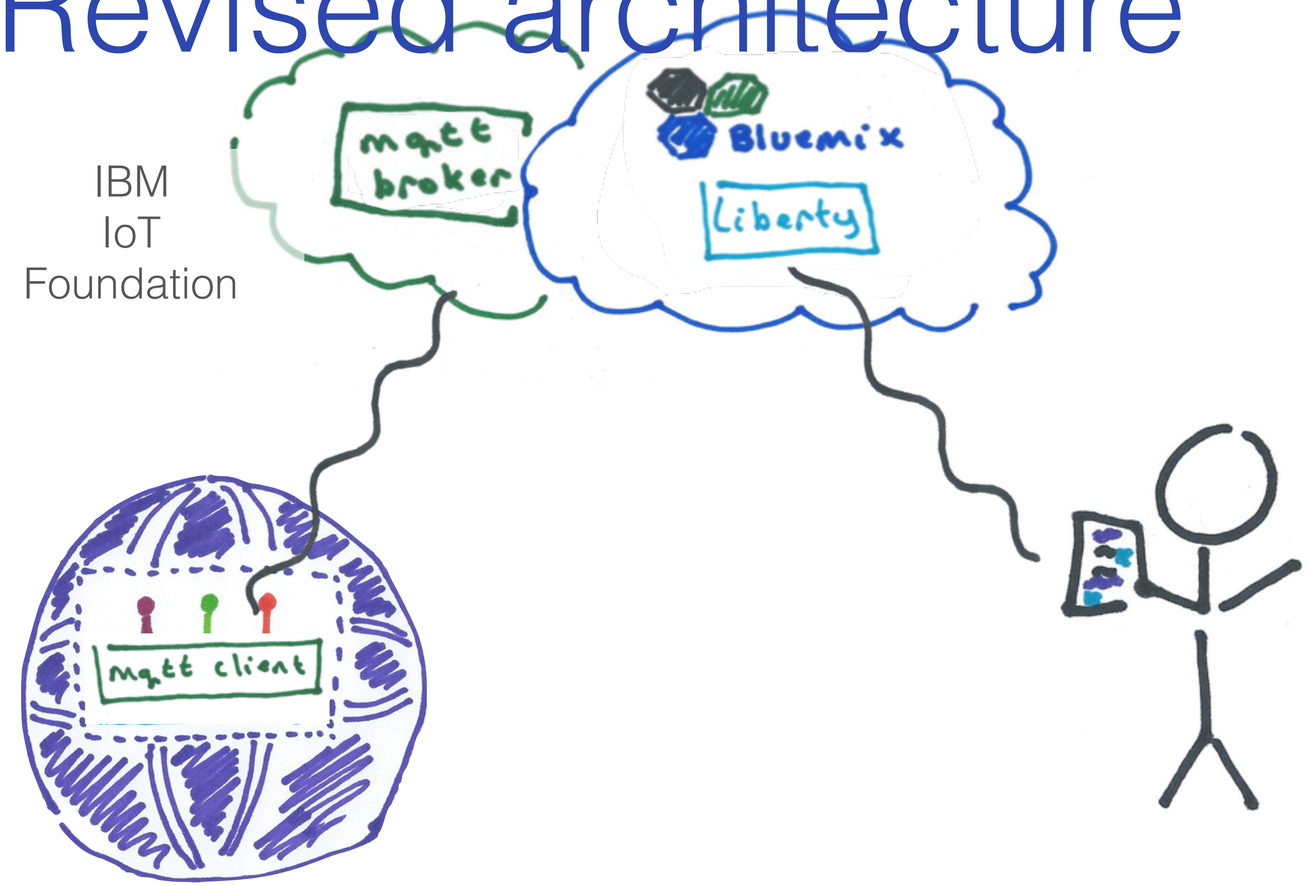
M2M


MQTT.ORG

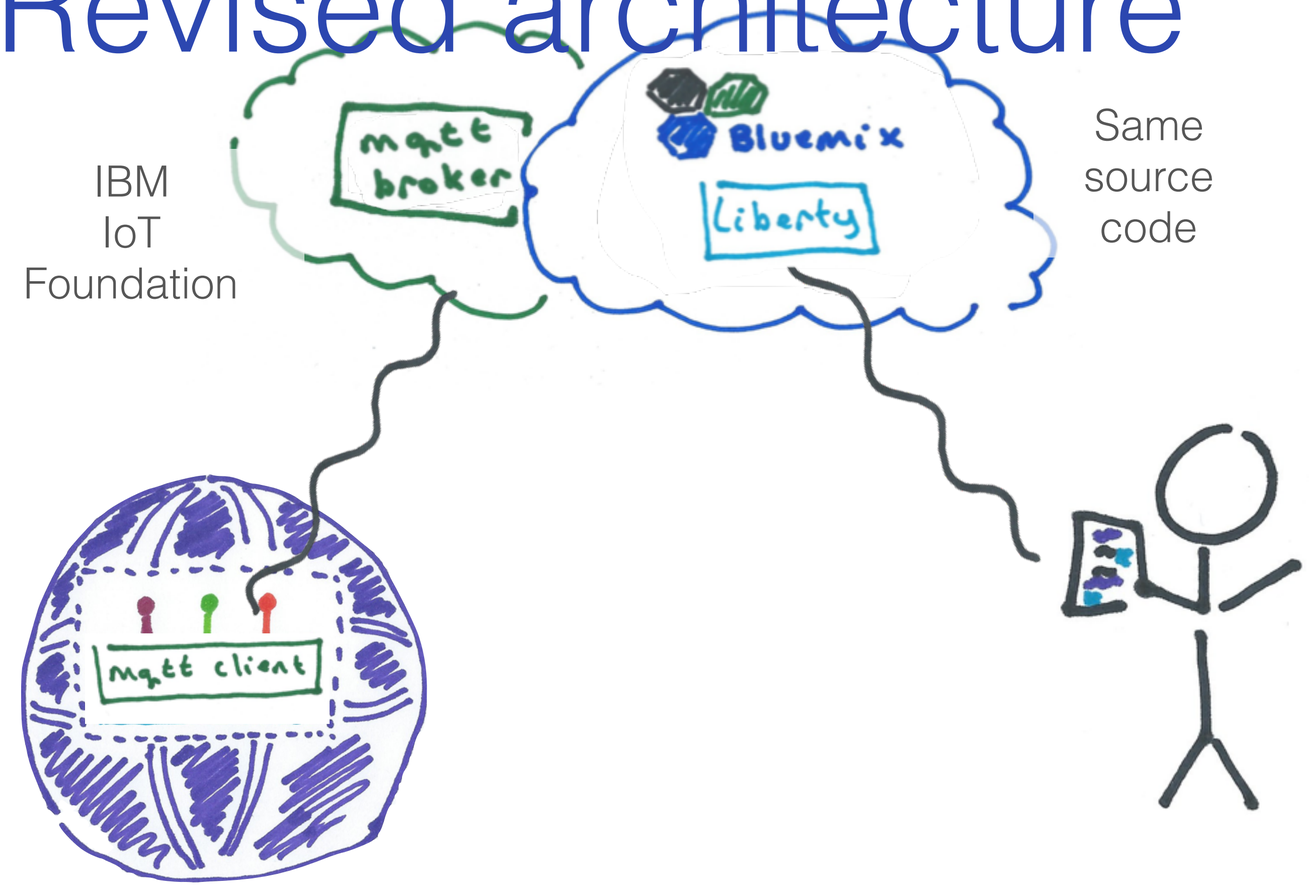
Revised architecture



Revised architecture



Revised architecture



http://sphere.mybluemix.net/sphere

Bluemix and IoT foundation

```
// parse VCAP_SERVICES
String VCAP_SERVICES = System.getenv("VCAP_SERVICES");

JSONObject vcap = new JSONObject(VCAP_SERVICES);
JSONArray json = vcap.getJSONArray("iotf-service");
JSONObject credentials = json.getJSONObject(0).getJSONObject("credentials");
String host = (String) credentials.get("mqtt_host");
Integer port = (Integer) credentials.get("mqtt_u_port");
…

MqttClient client = new MqttClient(uri, id);
MqttConnectOptions opts = new MqttConnectOptions();
opts.setUserName(username);
opts.setPassword(password.toCharArray());
client.connect(opts);
client.setCallback(this);
client.subscribe("iot-2/type/+/id/+/evt/+/fmt/+");
```

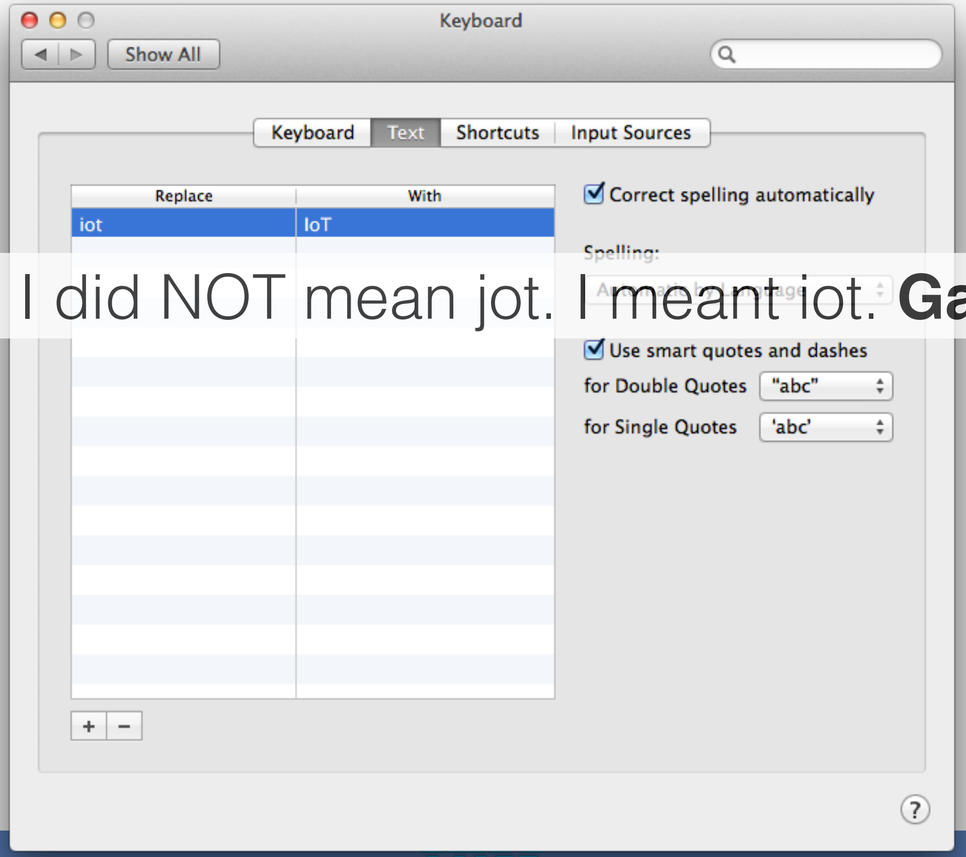
Working with IoT

Working with IoT: step 1

Working with IoT: step 1

“**No**, I did NOT mean jot. I meant iot. **Gah!**”

Working with IoT: step 1

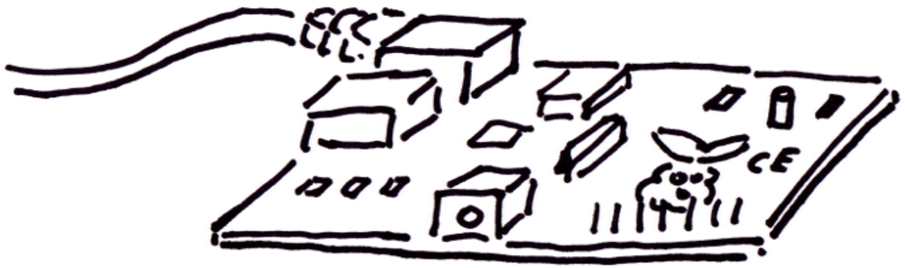


"**No**, I did NOT mean jot. I meant iot. **Gah!**"

Working with IoT: step 2

Working with IoT: step 2

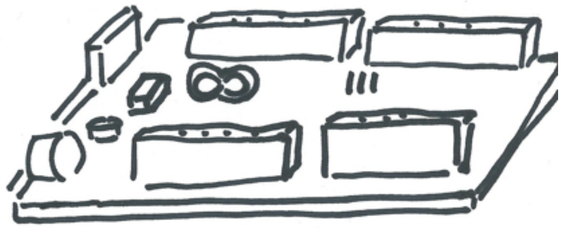
Get some kit



Taxonomy of embedded devices

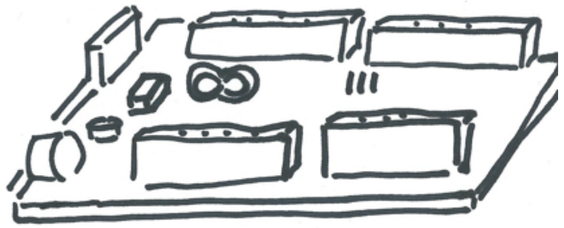
Taxonomy of embedded devices

Microcontroller

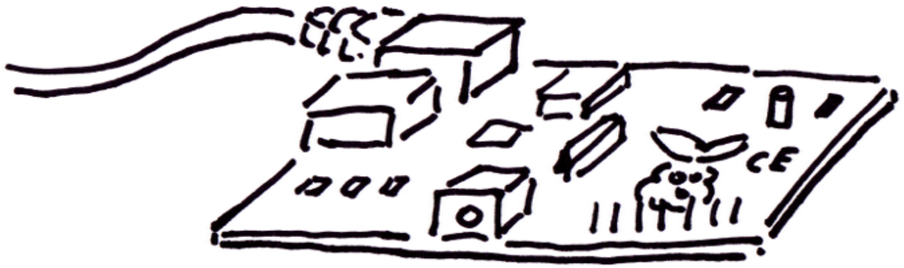


Taxonomy of embedded devices

Microcontroller

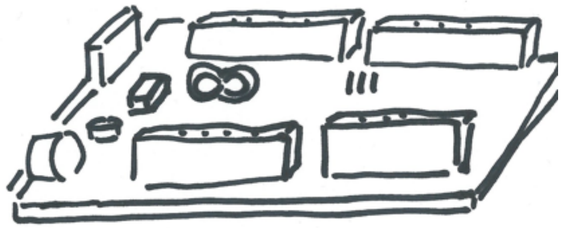


Microprocessor



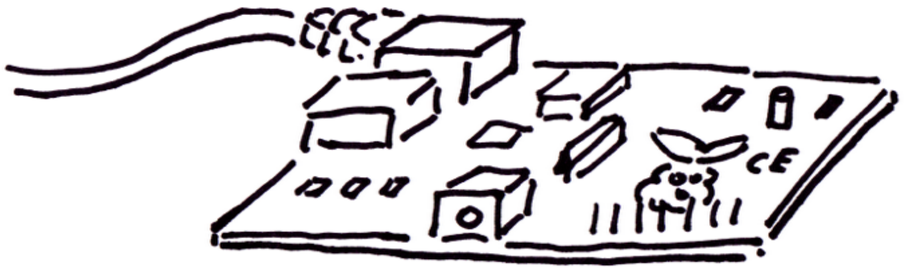
Taxonomy of embedded devices

Microcontroller



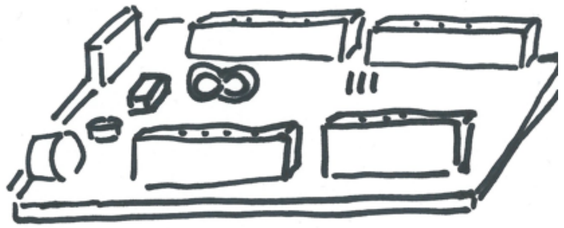
Sort-of-a-computer

Microprocessor



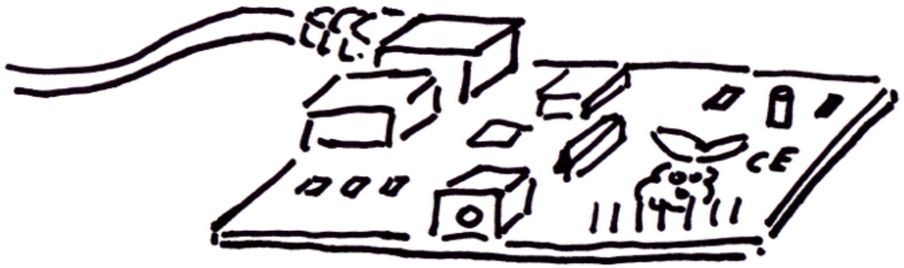
Taxonomy of embedded devices

Microcontroller



Sort-of-a-computer

Microprocessor



Really-a-computer

The microcontroller zoo

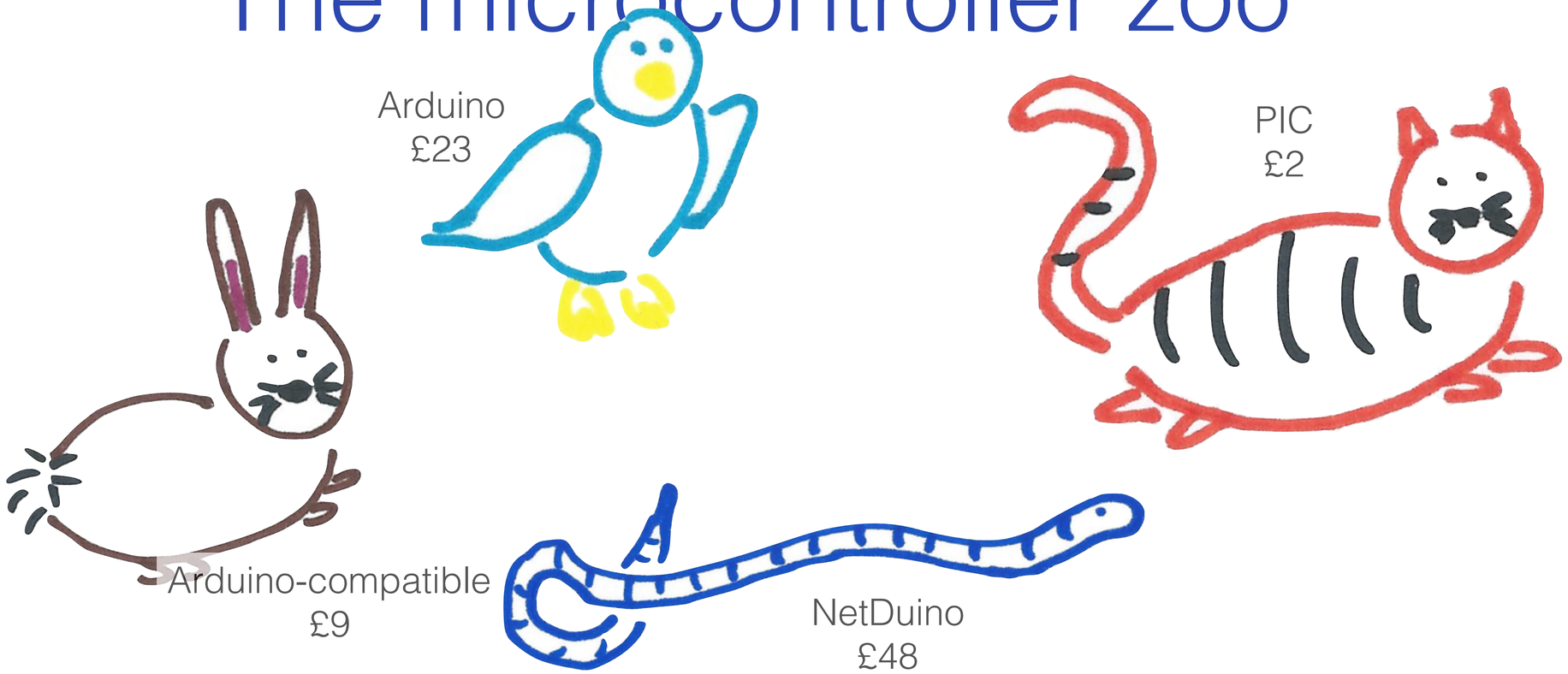
The microcontroller zoo

The microcontroller zoo

The microcontroller zoo

The microcontroller zoo

The microcontroller zoo

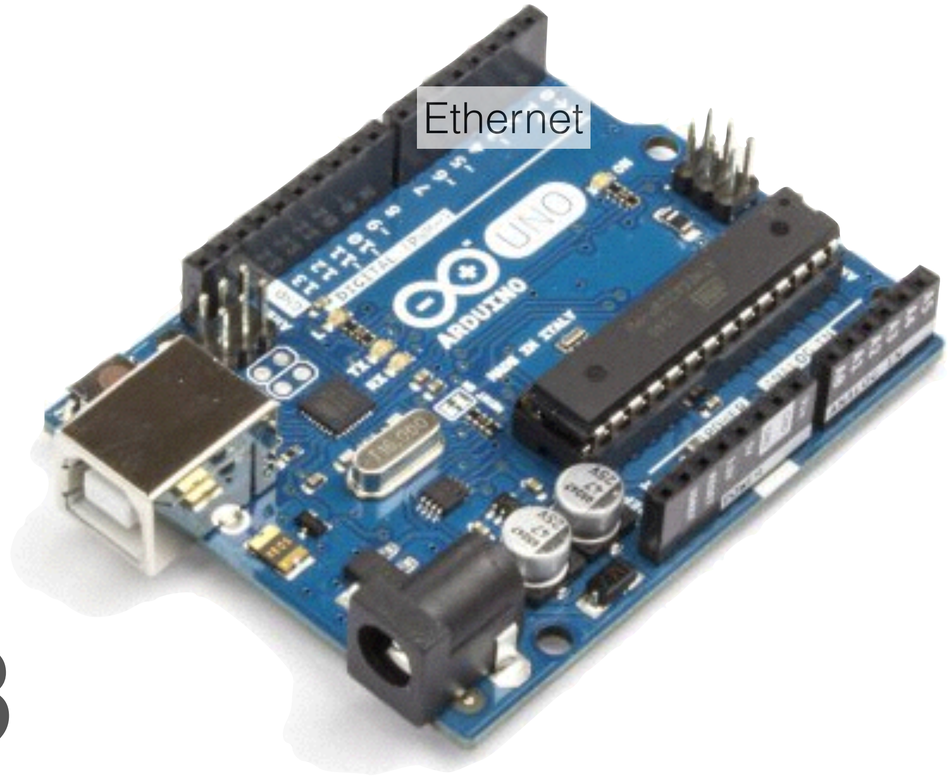


Arduino

Arduino

£23

Arduino

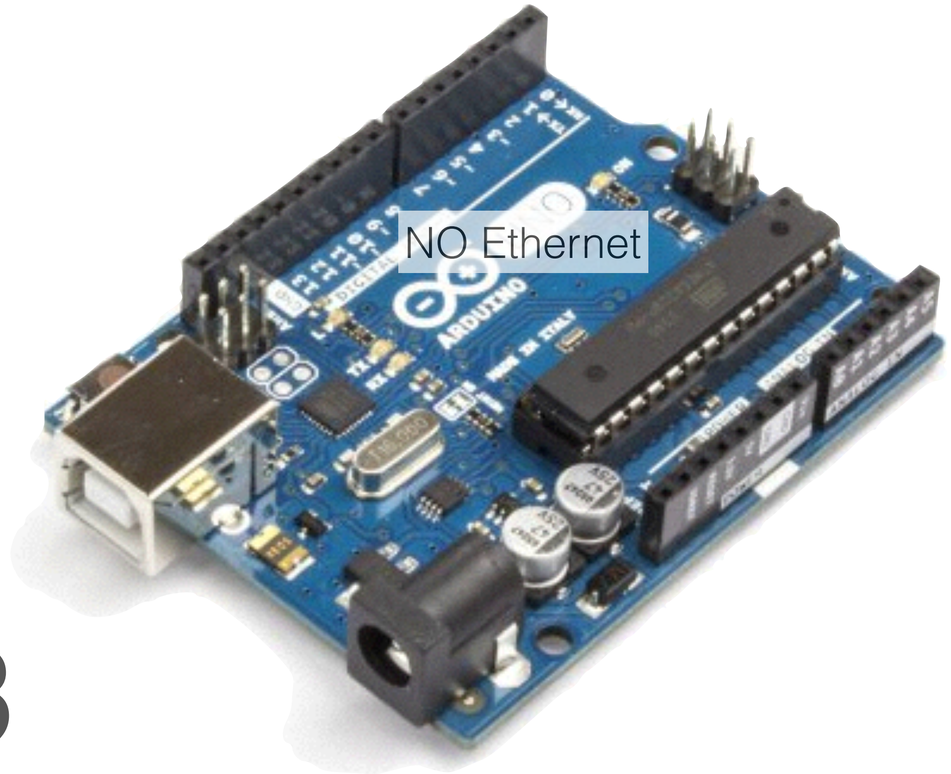


£23

Arduino

£23

Arduino

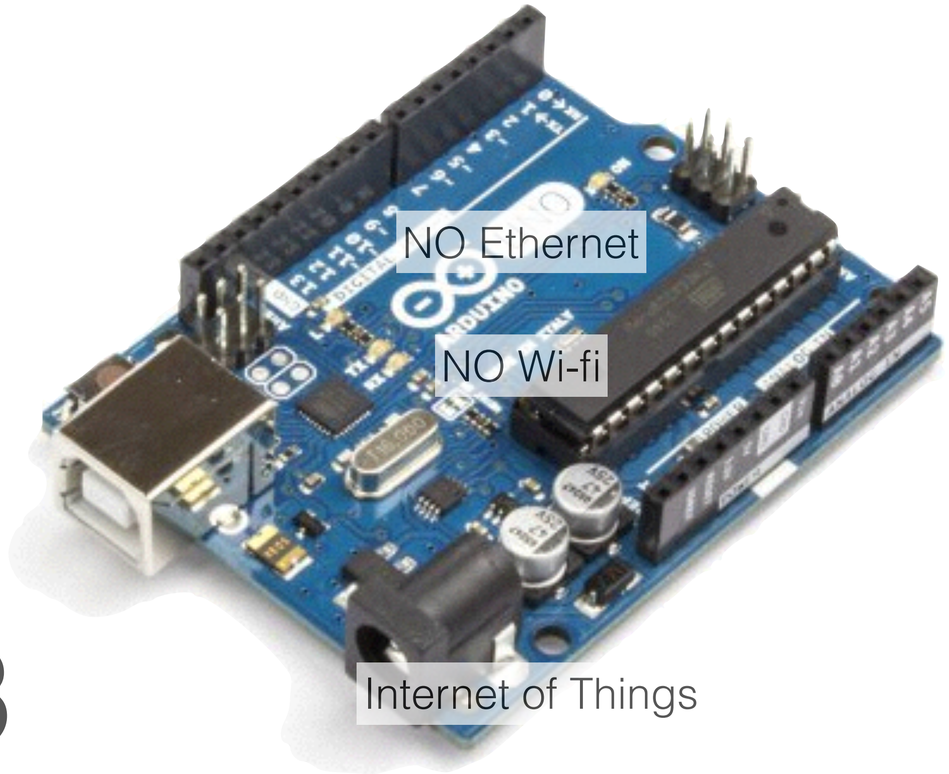


£23

Arduino

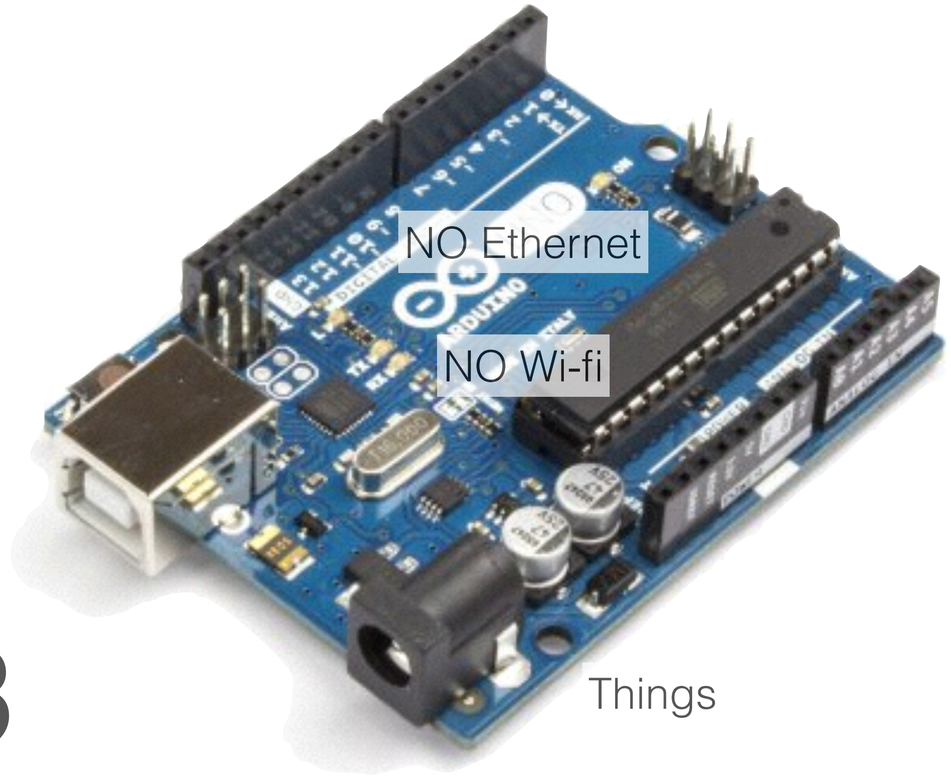
£23

Arduino



£23

Arduino



£23

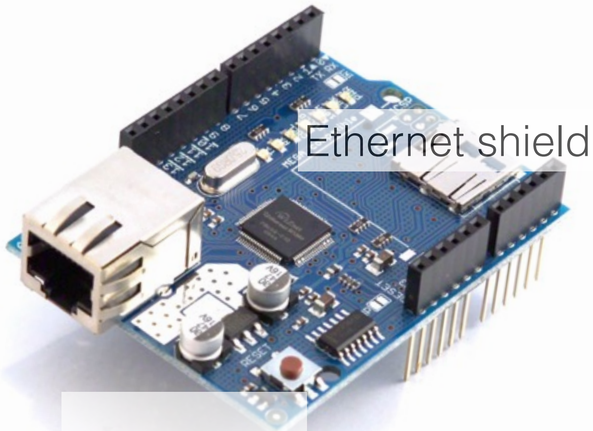
Things

Connecting an Arduino to the Internet

Connecting an Arduino to the Internet

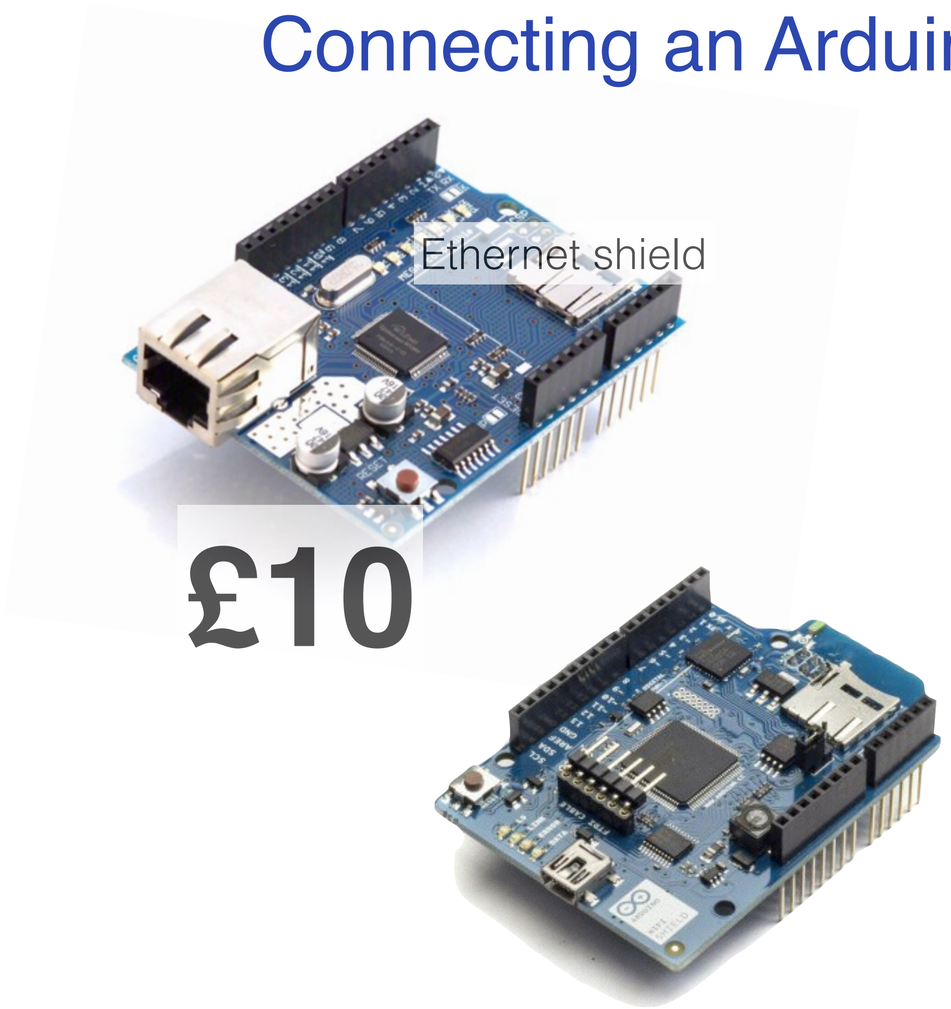
Connecting an Arduino to the Internet

Connecting an Arduino to the Internet

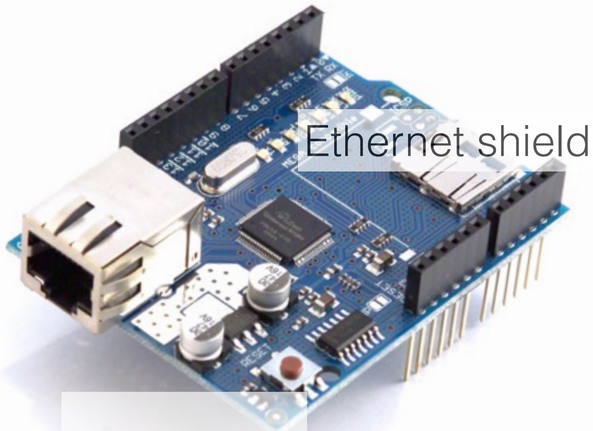


£10

Connecting an Arduino to the Internet

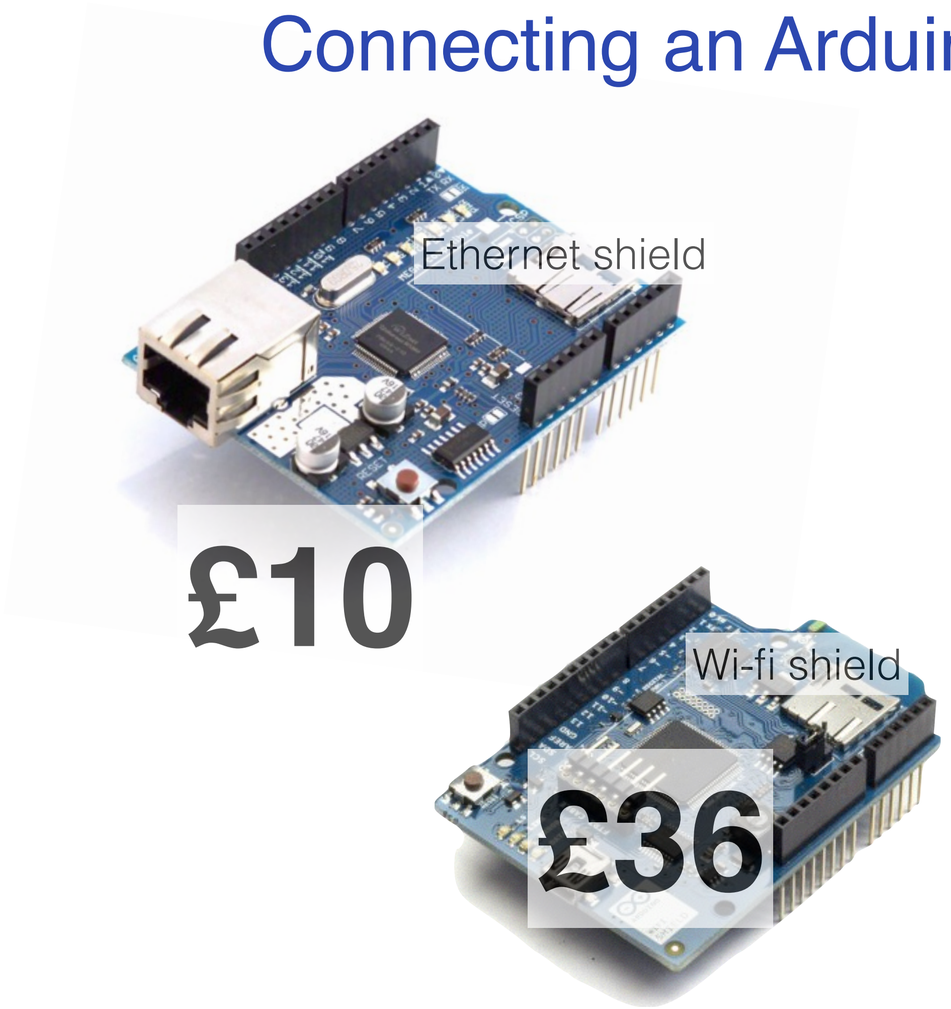


Connecting an Arduino to the Internet

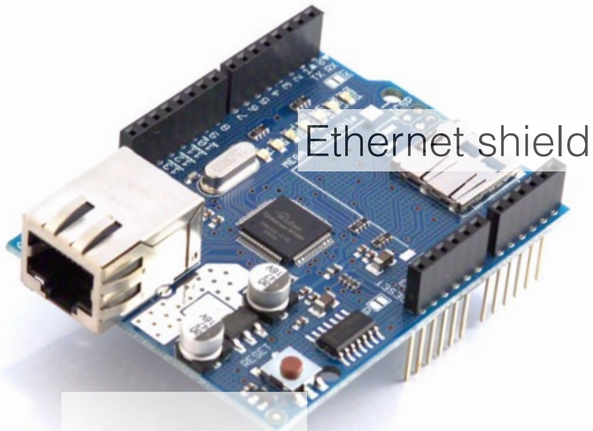


£10

Connecting an Arduino to the Internet



Connecting an Arduino to the Internet

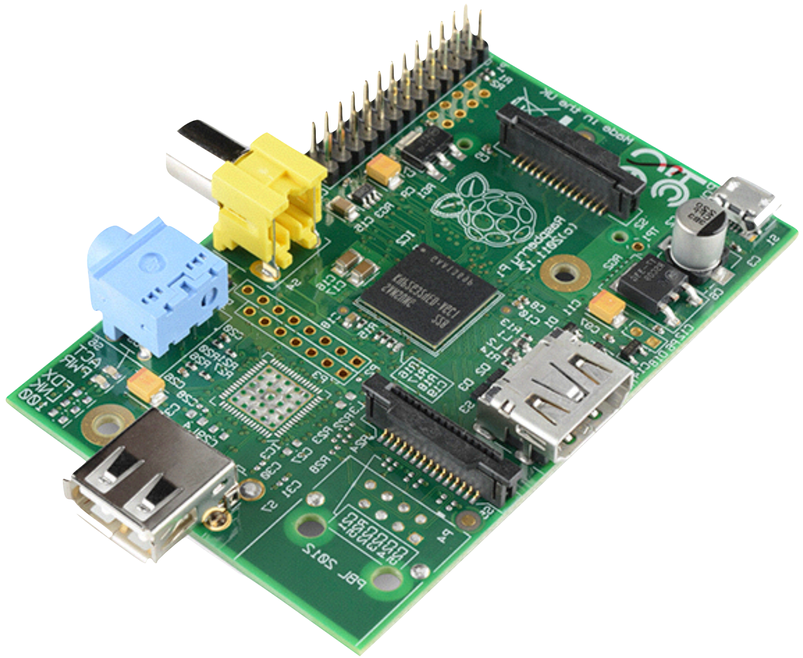


Ethernet shield

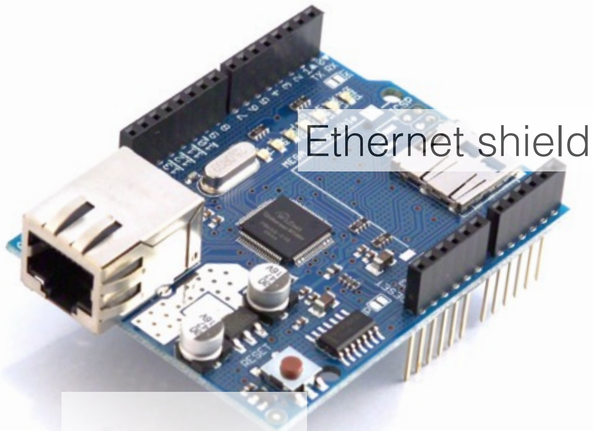
£10

Wi-fi shield

£36



Connecting an Arduino to the Internet



Ethernet shield

£10

Wi-fi shield

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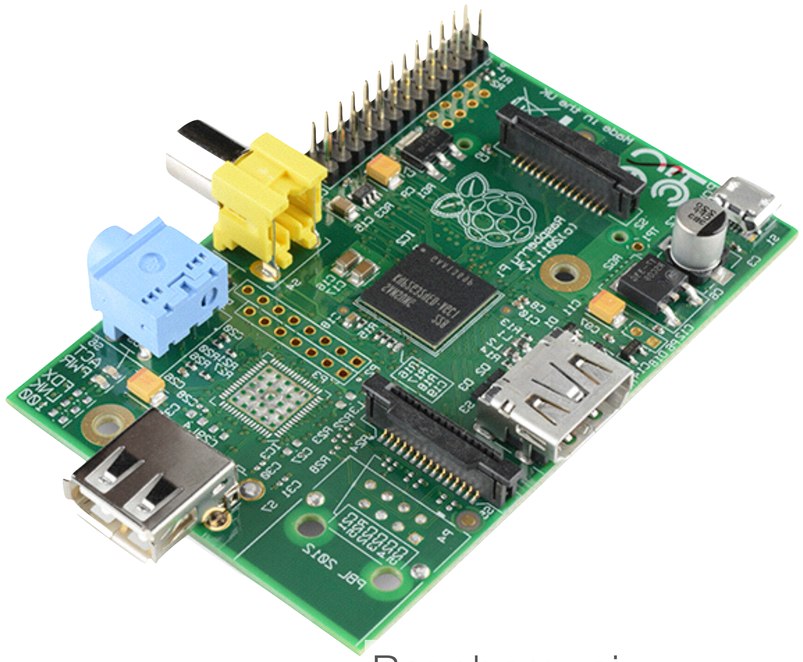
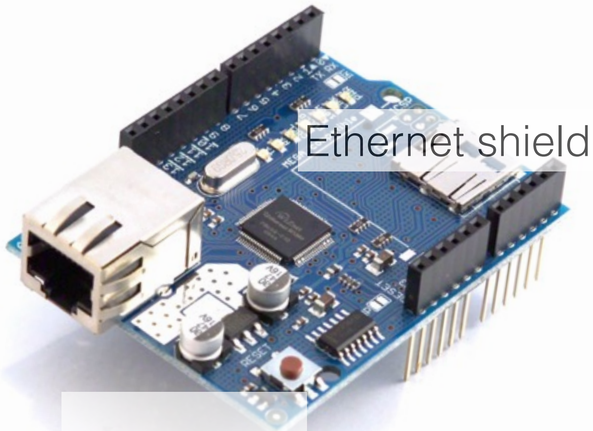


Raspberry pi

Connecting an Arduino to the Internet



Ethernet shield

£10

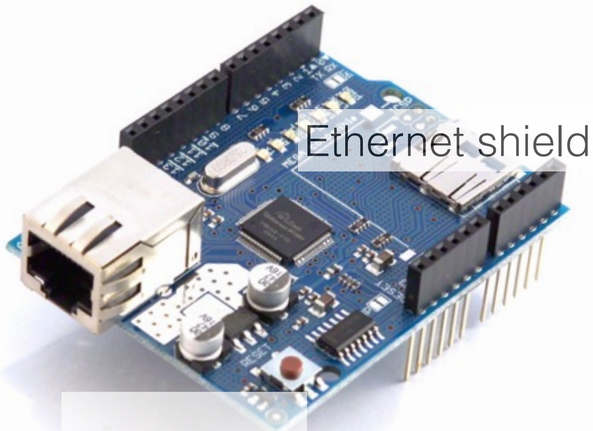
Wi-fi shield

£36

£25

Raspberry pi

Connecting an Arduino to the Internet



Ethernet shield

£10

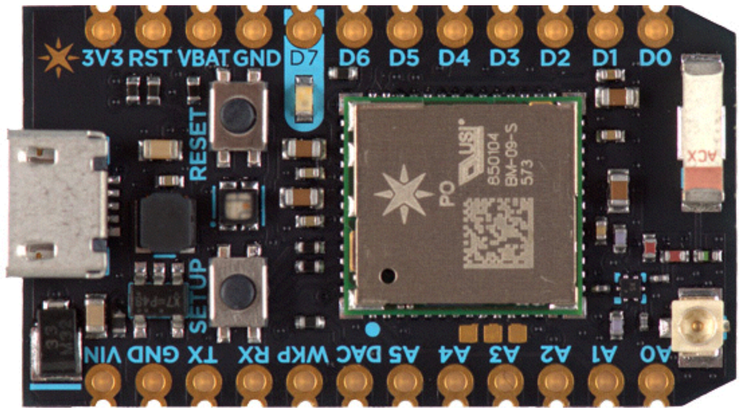
Wi-fi shield

£36

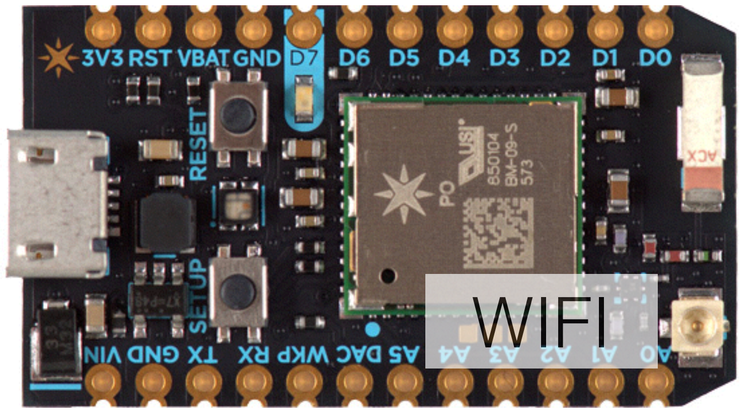
free

Raspberry pi

Particle Photon

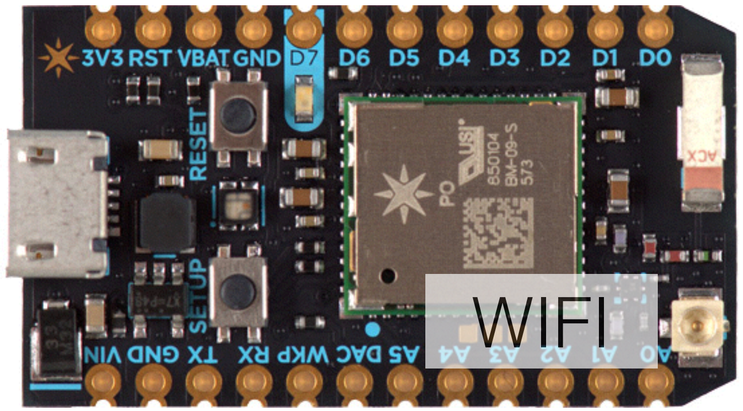


Particle Photon



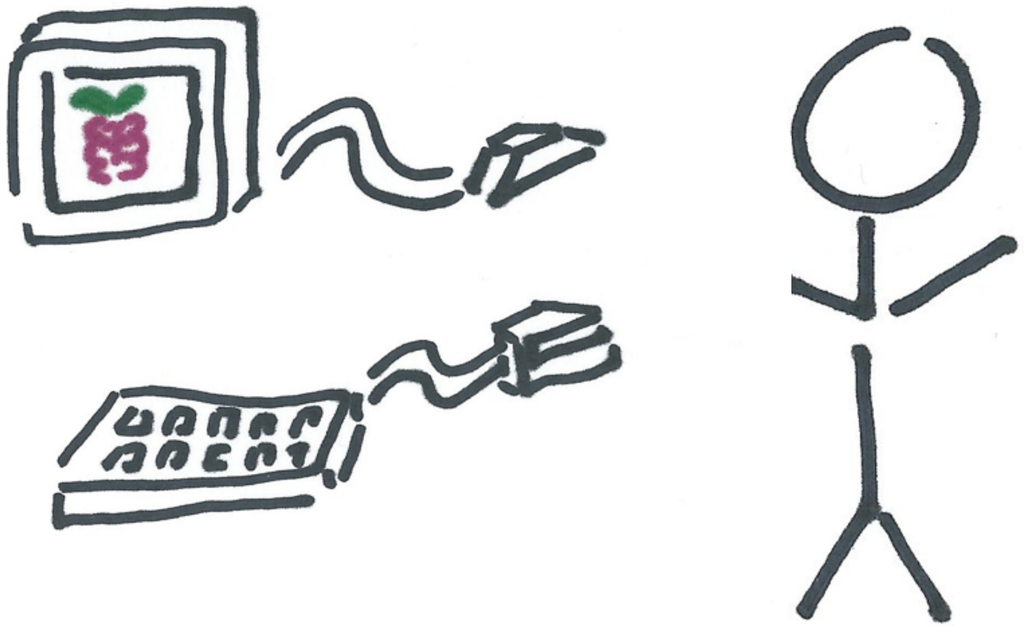
Particle Photon

£15

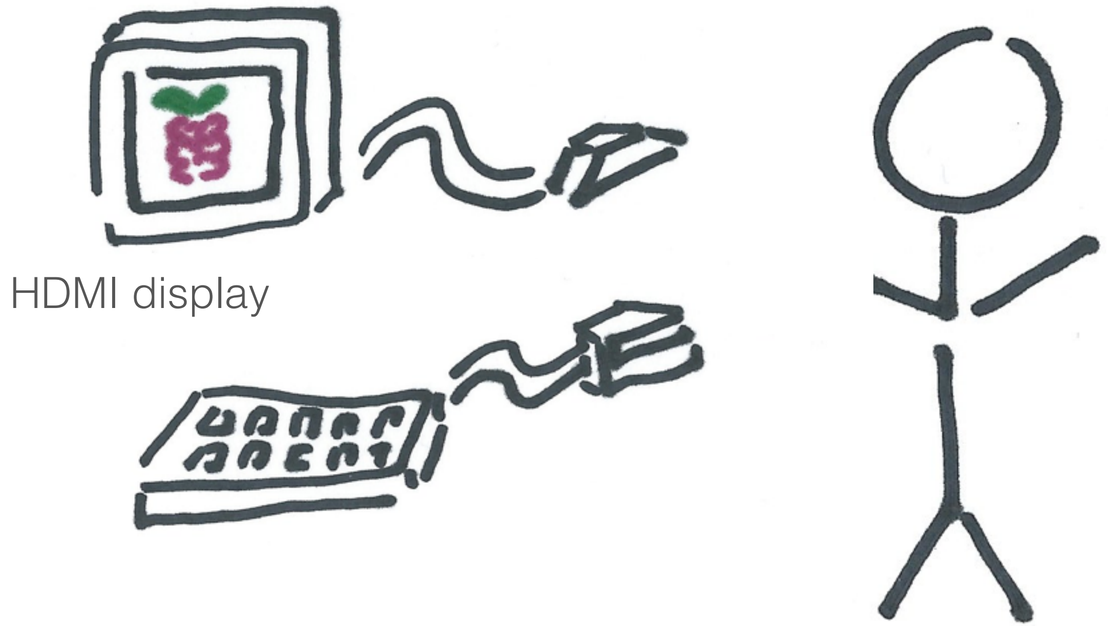


Managing headless devices

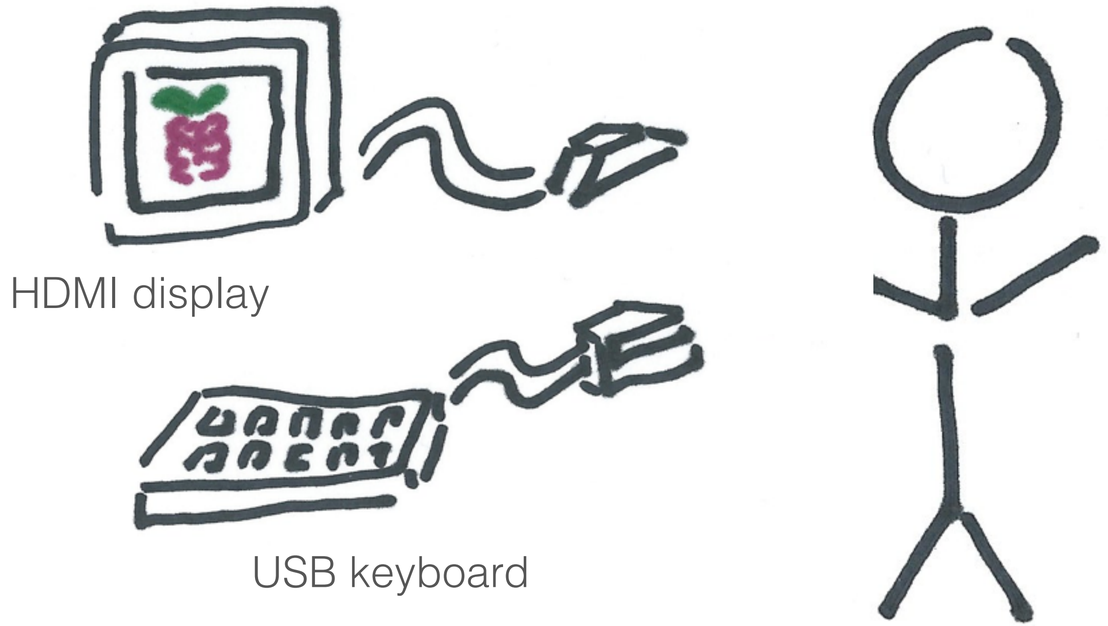
Managing headless devices



Managing headless devices



Managing headless devices



Managing headless devices

Managing headless devices

```
My-Computer:~ holly$ ssh 192.168.1.2
```

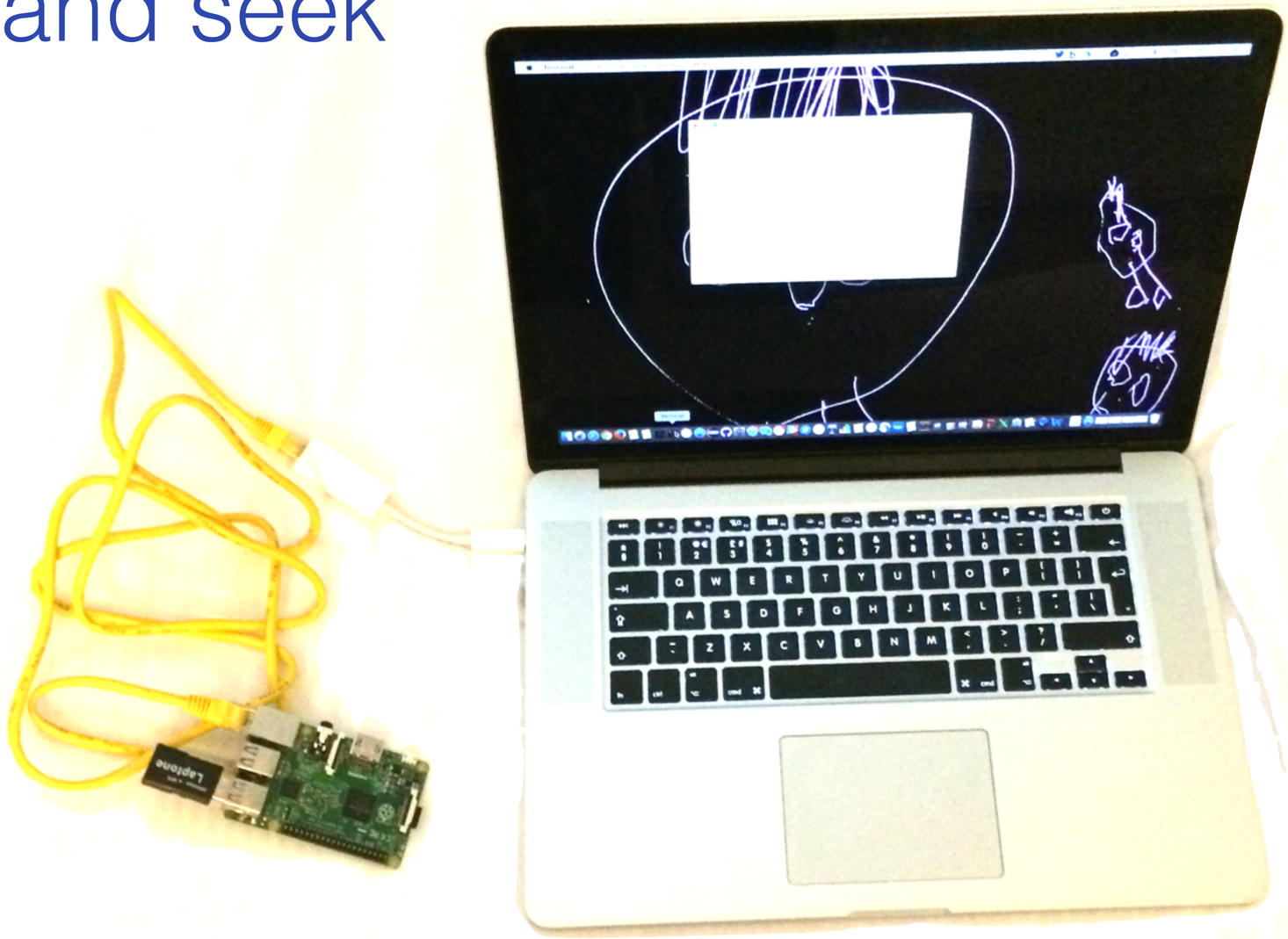
Managing headless devices

```
My-Computer:~ holly$ ssh ??.??.??.!!
My-Computer:~ holly$ ssh 192.168.1.2
```

Managing headless devices

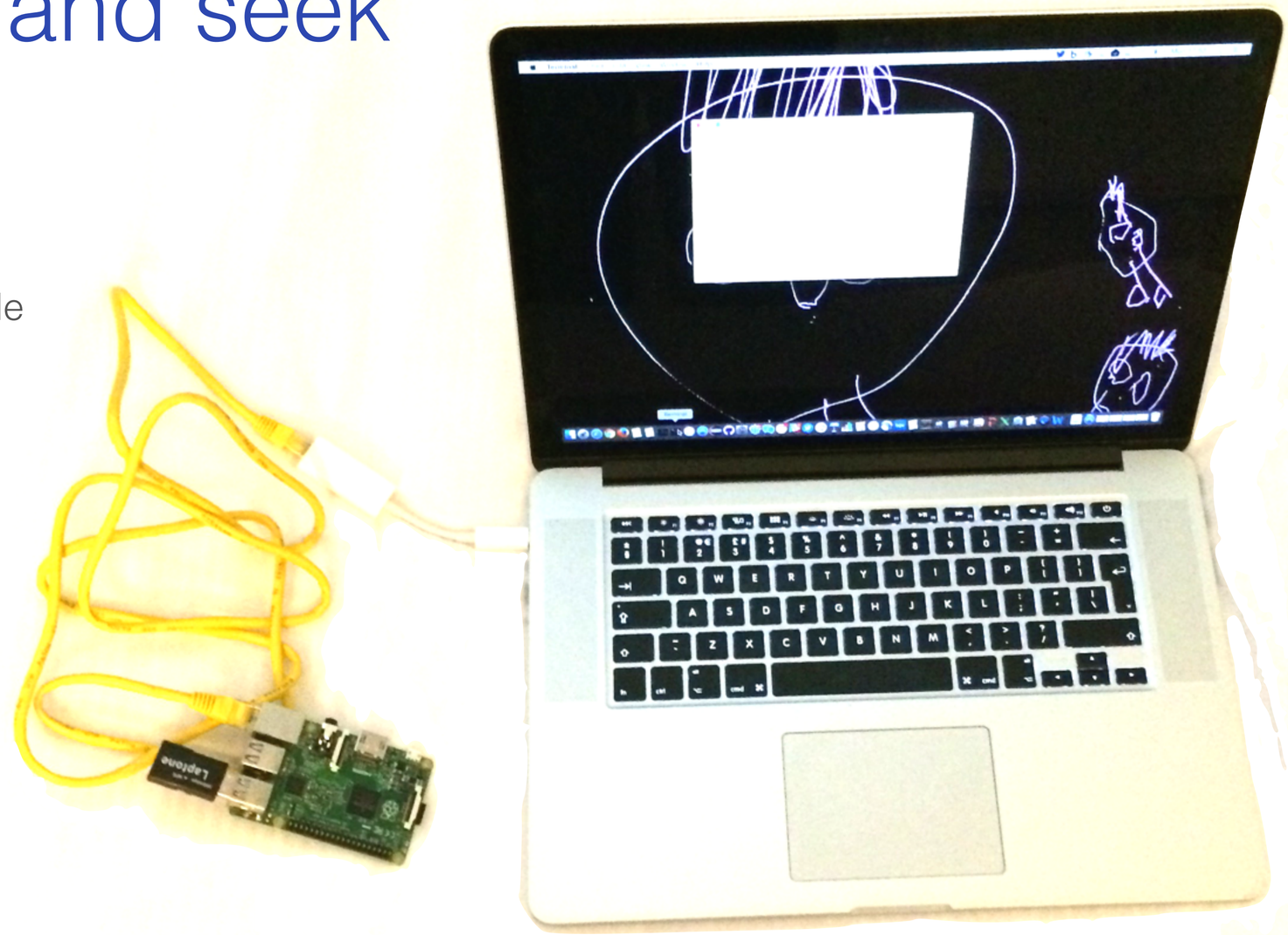
```
My-Computer:~ holly$ ssh ??.??.??.!!
My-Computer:~ holly$ ssh 192.168.1.2
```

Workflow for “pi and seek”



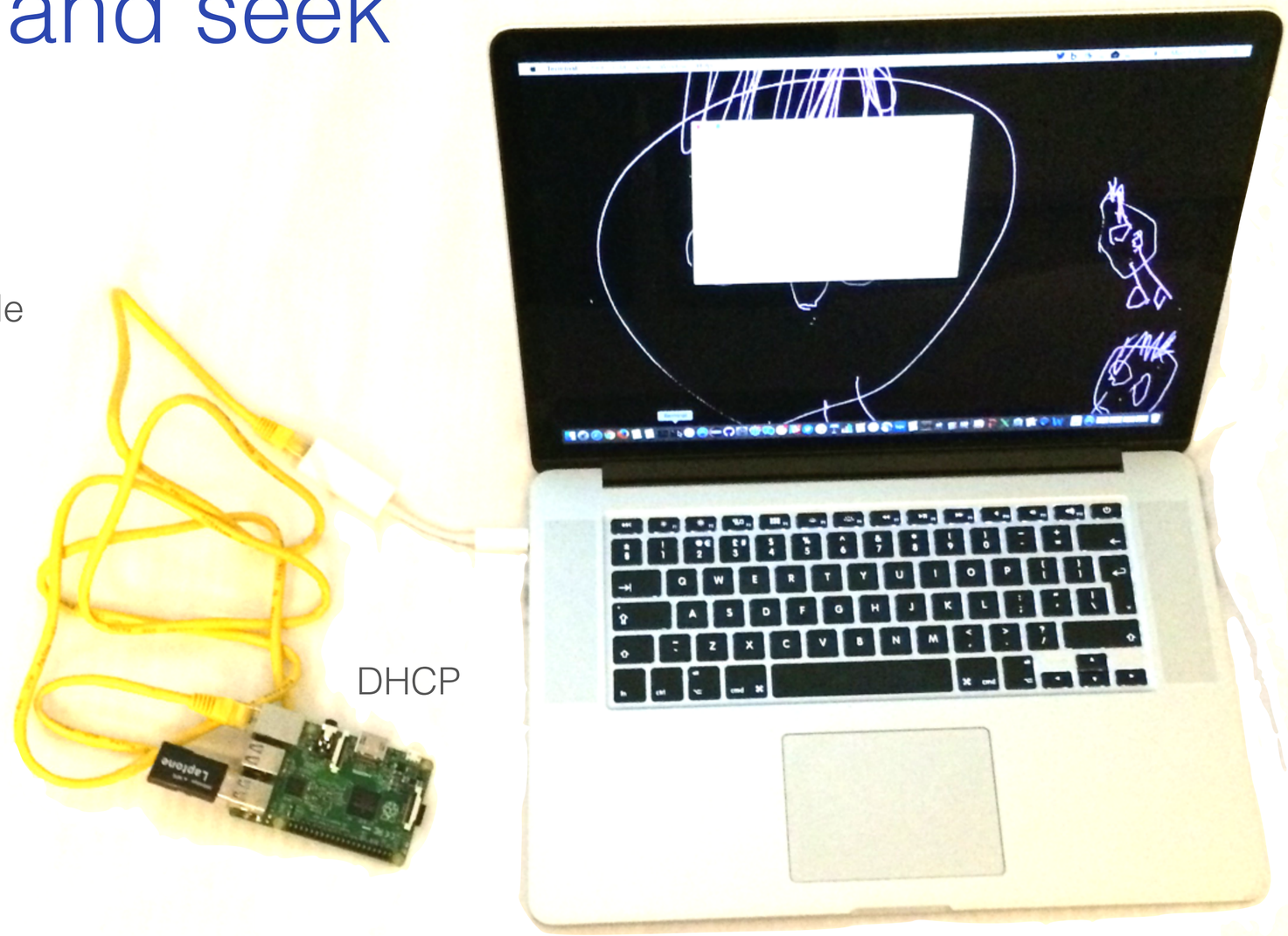
Workflow for “pi and seek”

Ethernet cable



Workflow for “pi and seek”

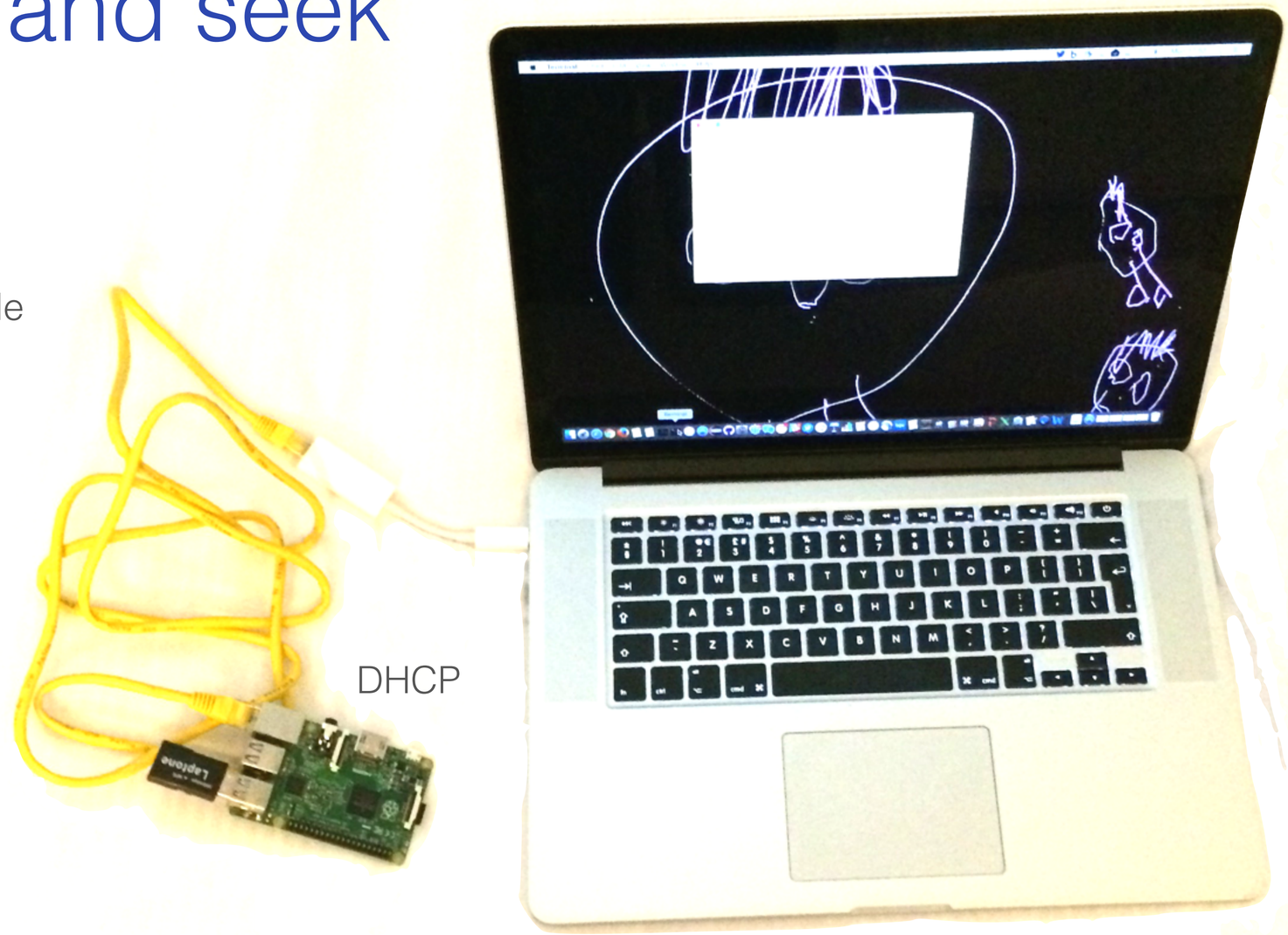
Ethernet cable



DHCP

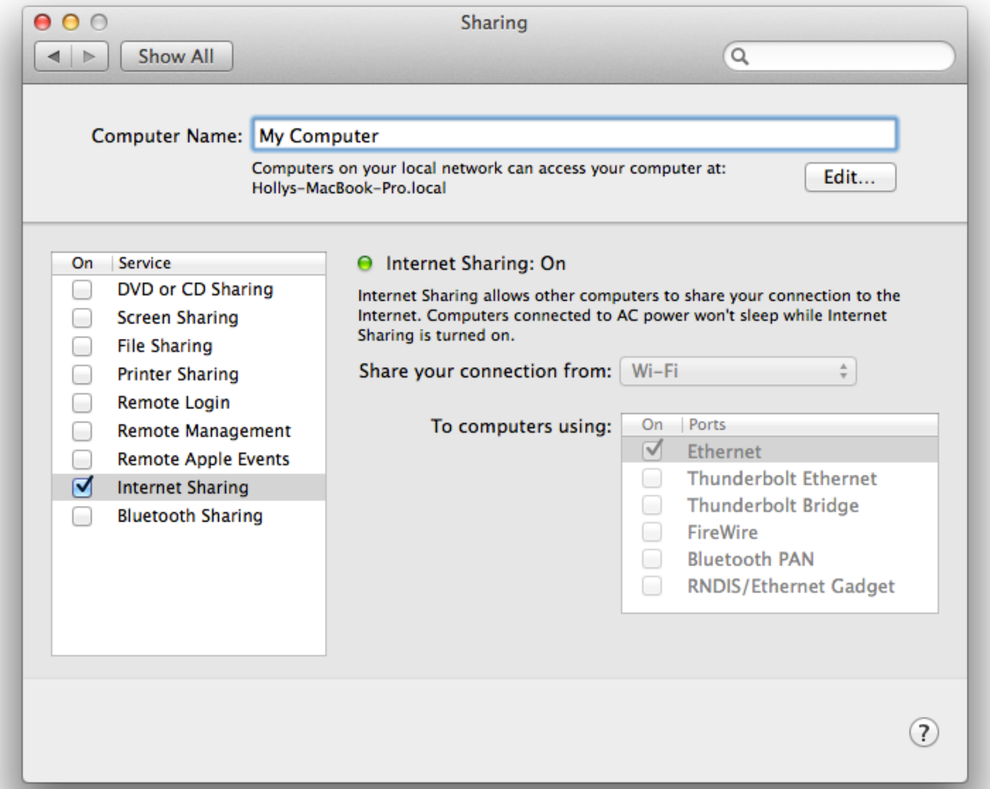
Workflow for “pi and seek”

Ethernet cable



DHCP

Getting a connection



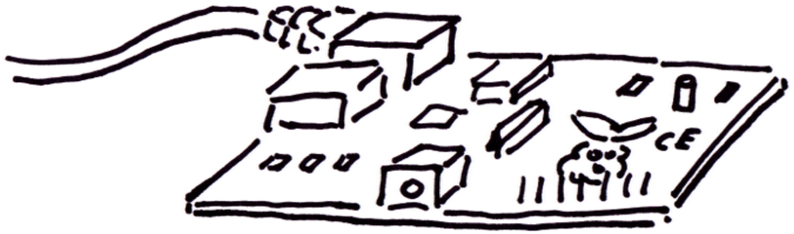
Finding the IP address

```
my-mac:~ holly$ ifconfig | grep -A3 bridge100
bridge100:
flags=8863<UP,BROADCAST,SMART,RUNNING,SIMPLEX,MULTICAST> mtu 1500
   options=3<RXCSUM,TXCSUM>
   ether 3e:07:54:e0:26:64
   inet 192.168.2.1 netmask 0xffffff00 broadcast 192.168.2.255

my-mac:~ holly$ nmap -sn 192.168.2.0/24

Starting Nmap 6.47 ( http://nmap.org ) at 2015-02-28 16:26 GMT
Strange error from connect (65):No route to host
Nmap scan report for 192.168.2.3
Host is up (0.00056s latency).
Nmap done: 256 IP addresses (1 host up) scanned in 4.16 seconds
```

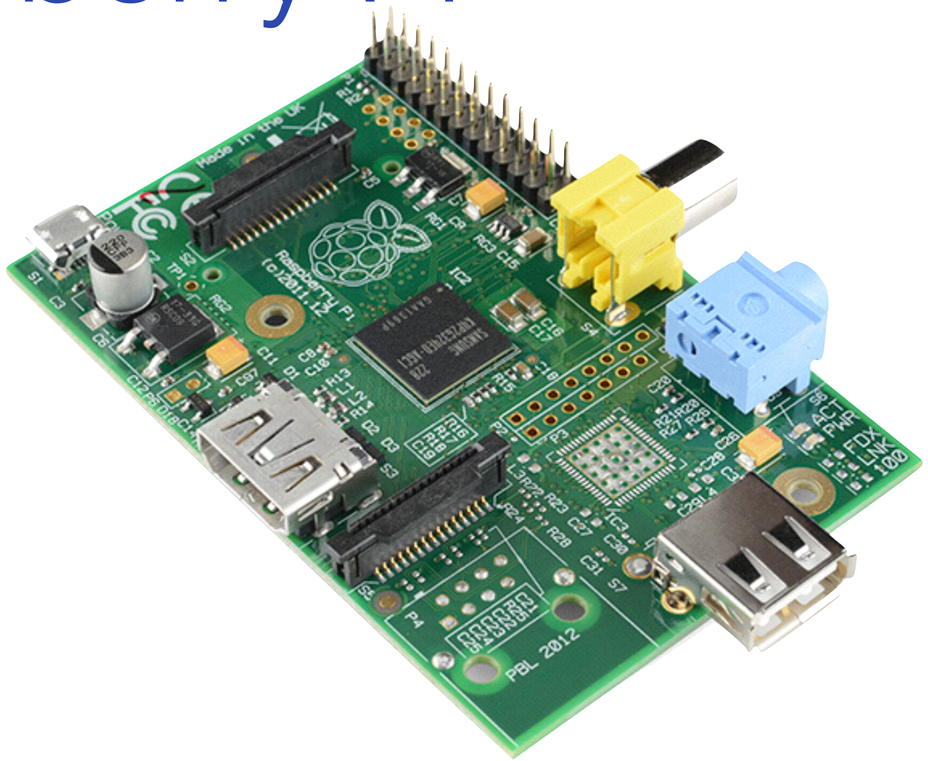
Or just use avahi.

```
my-mac:~ holly$ ping pcduino.local
```

The single board computer zoo

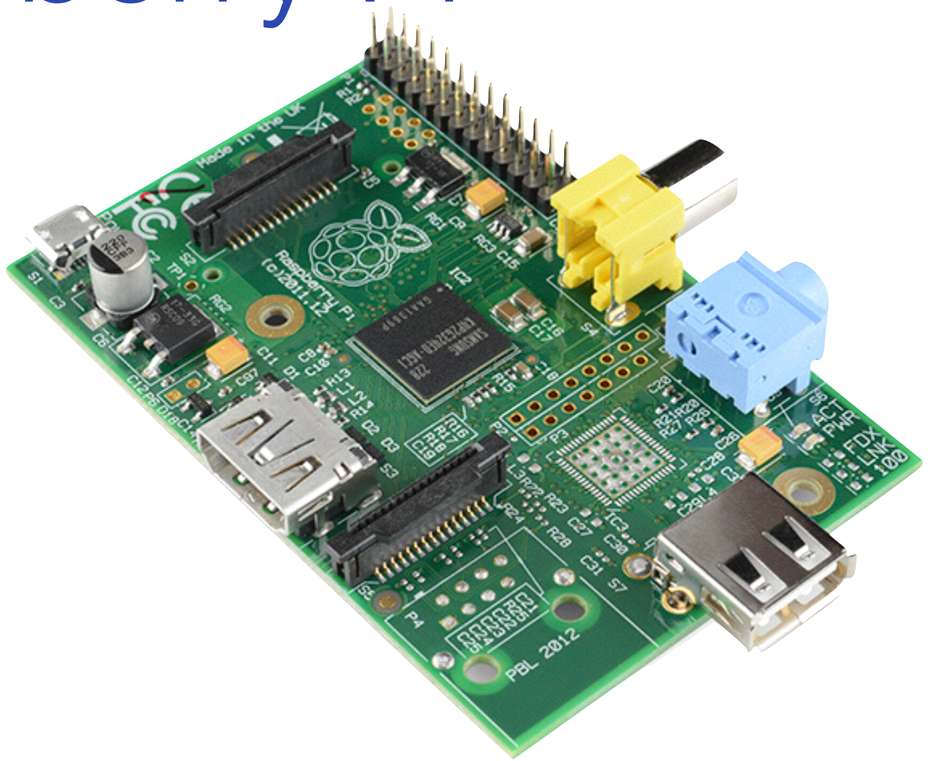


Raspberry Pi



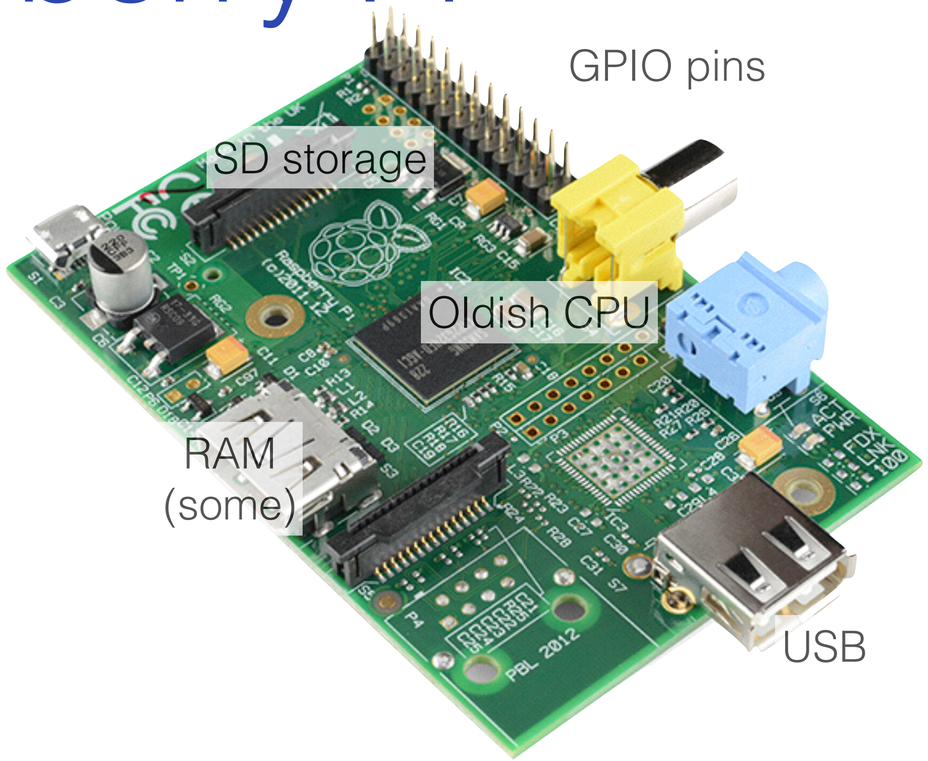
Raspberry Pi

£25



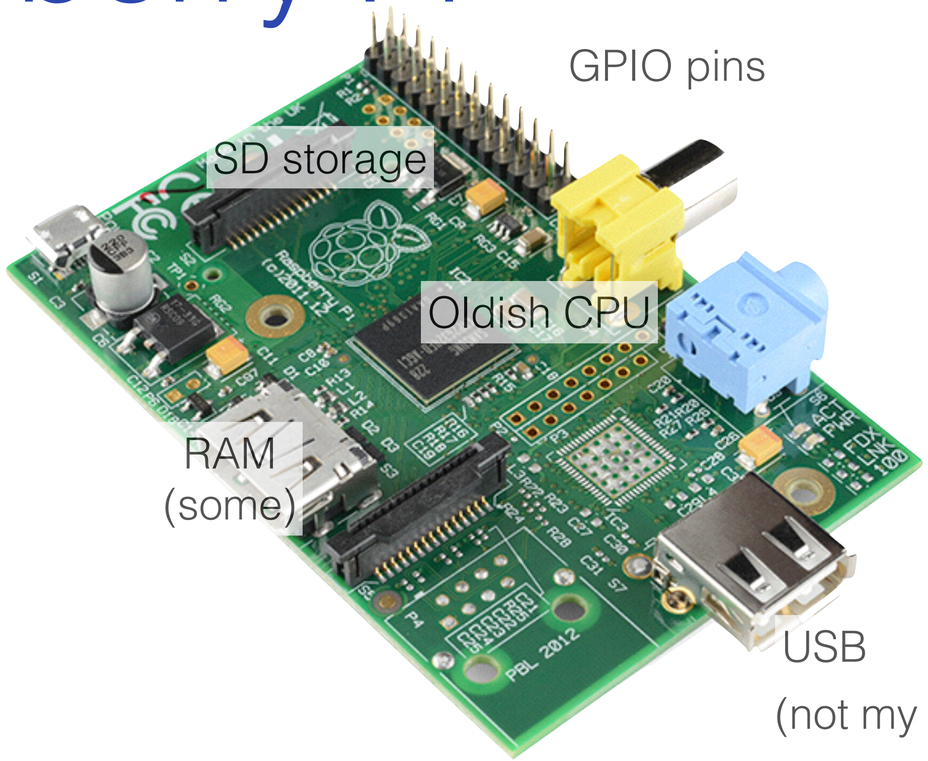
Raspberry Pi

£25



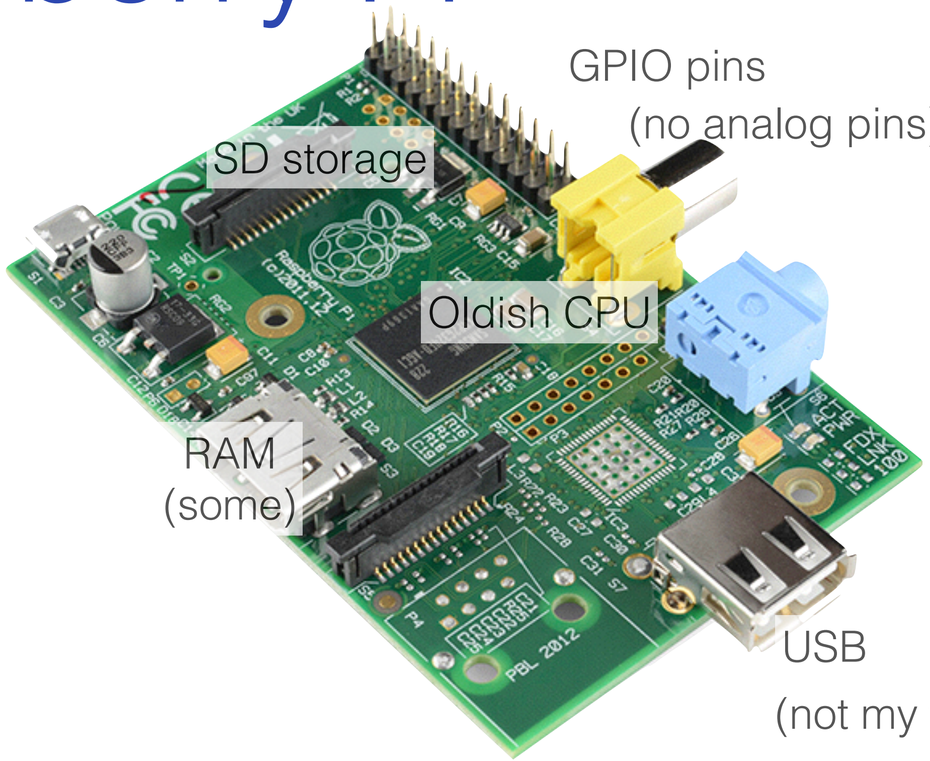
Raspberry Pi

£25



Raspberry Pi

£25



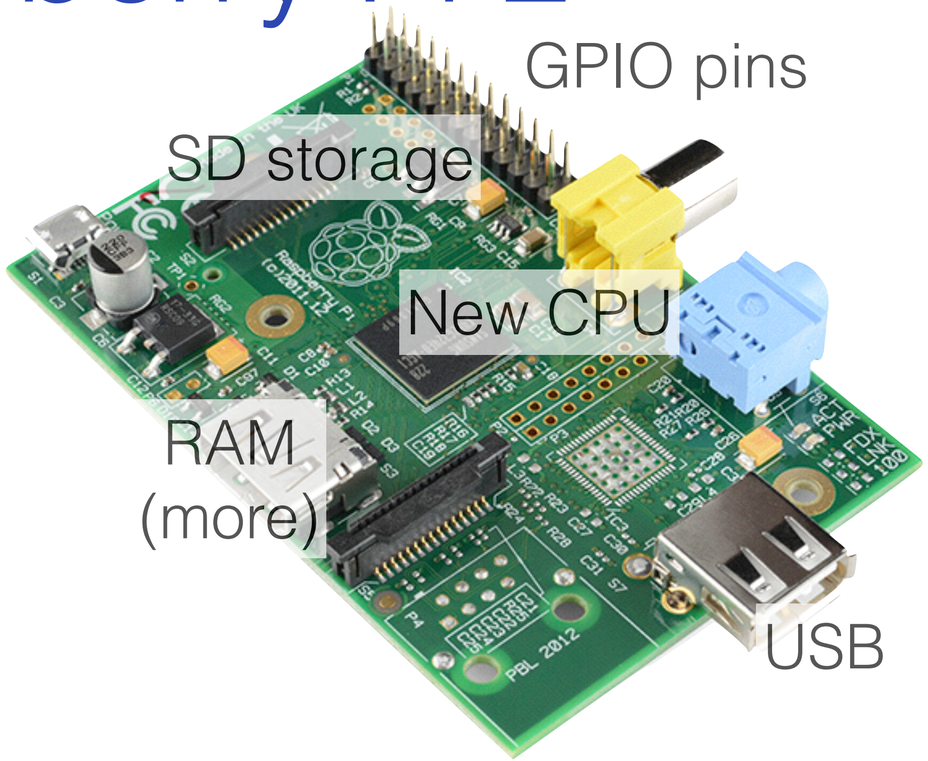
Raspberry Pi 2

Raspberry Pi 2

£30

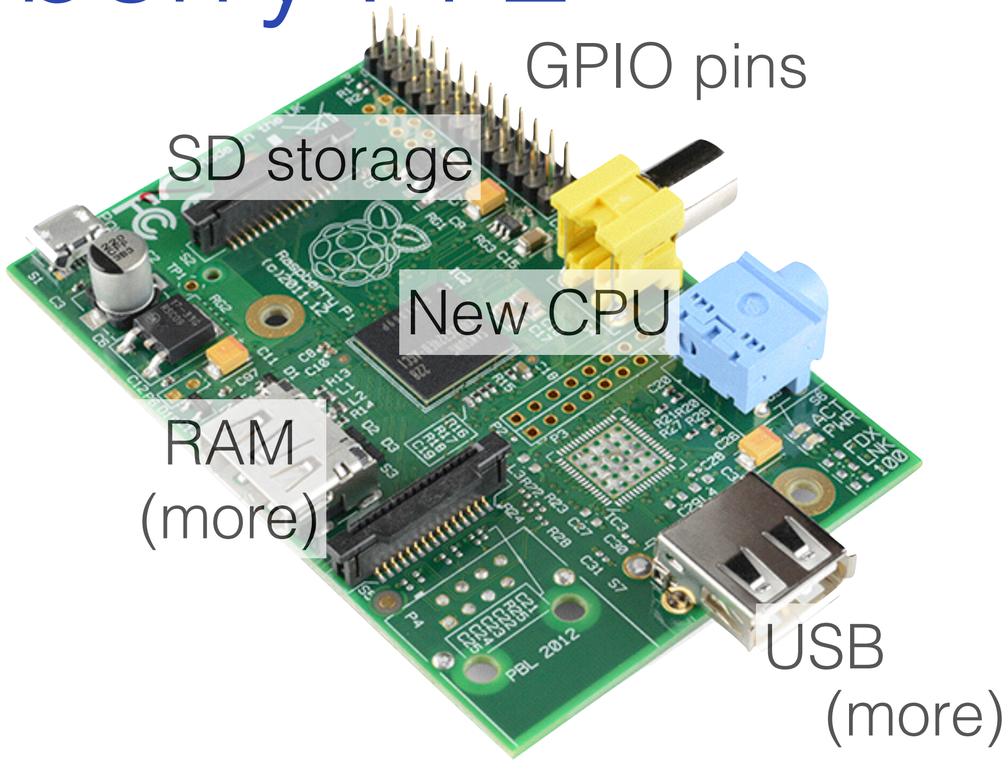
Raspberry Pi 2

£30



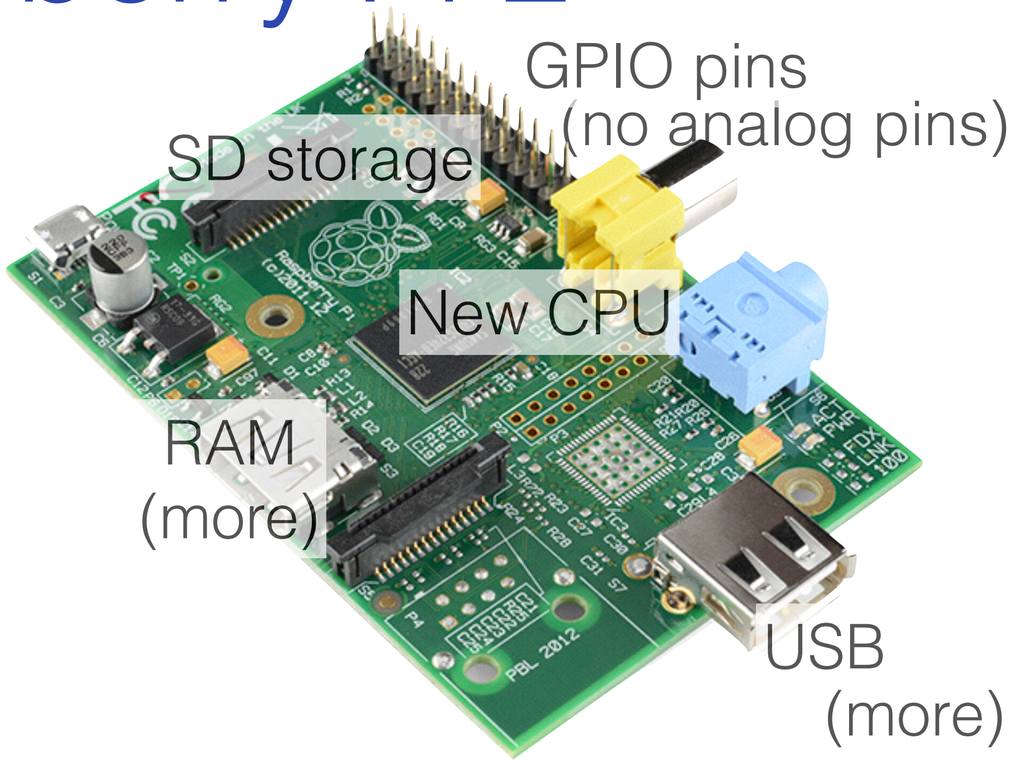
Raspberry Pi 2

£30

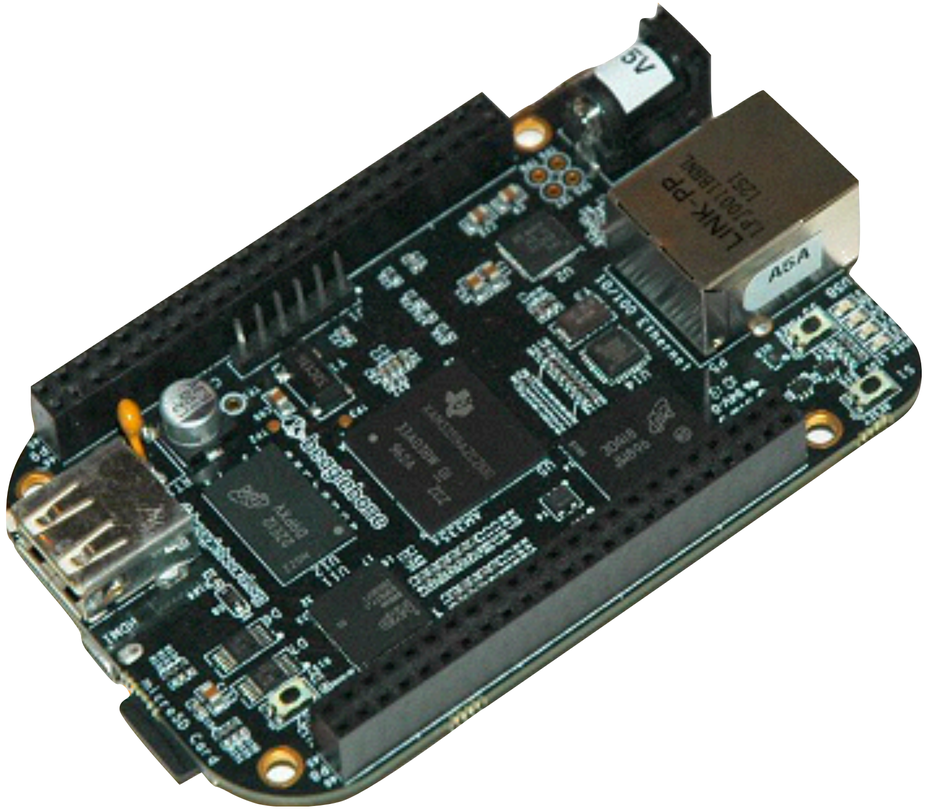


Raspberry Pi 2

£30

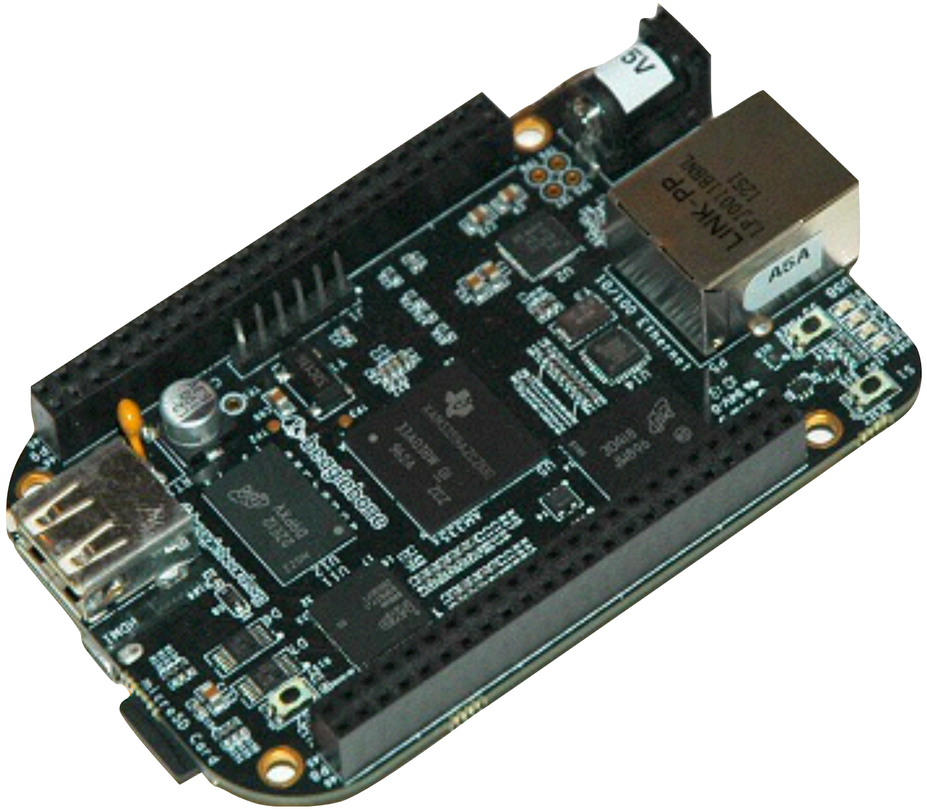


BeagleBone black



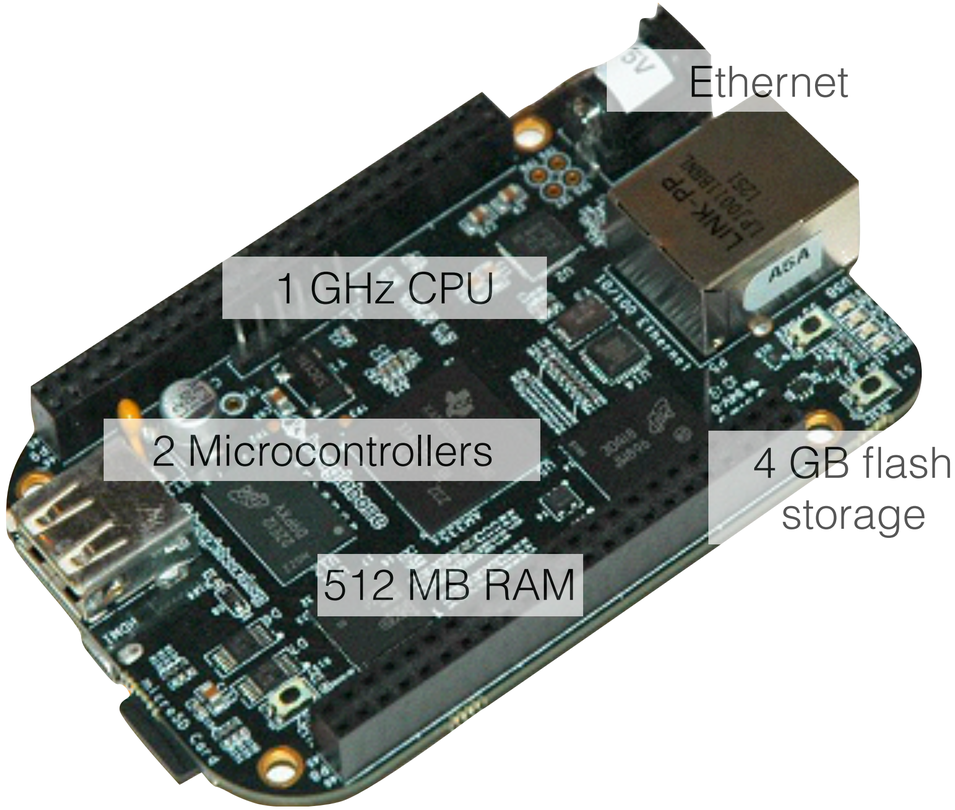
BeagleBone black

£42



BeagleBone black

£42



Arduino Yún

Arduino Yún

£57

Arduino Yún

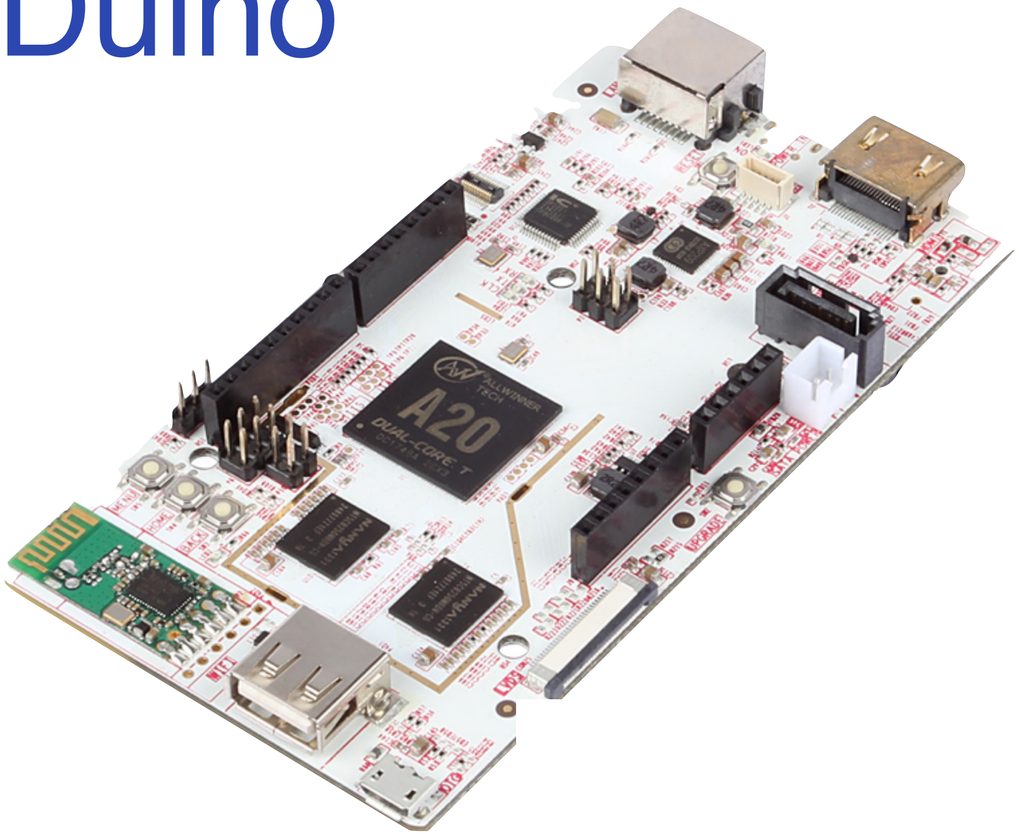
£57

Odroid

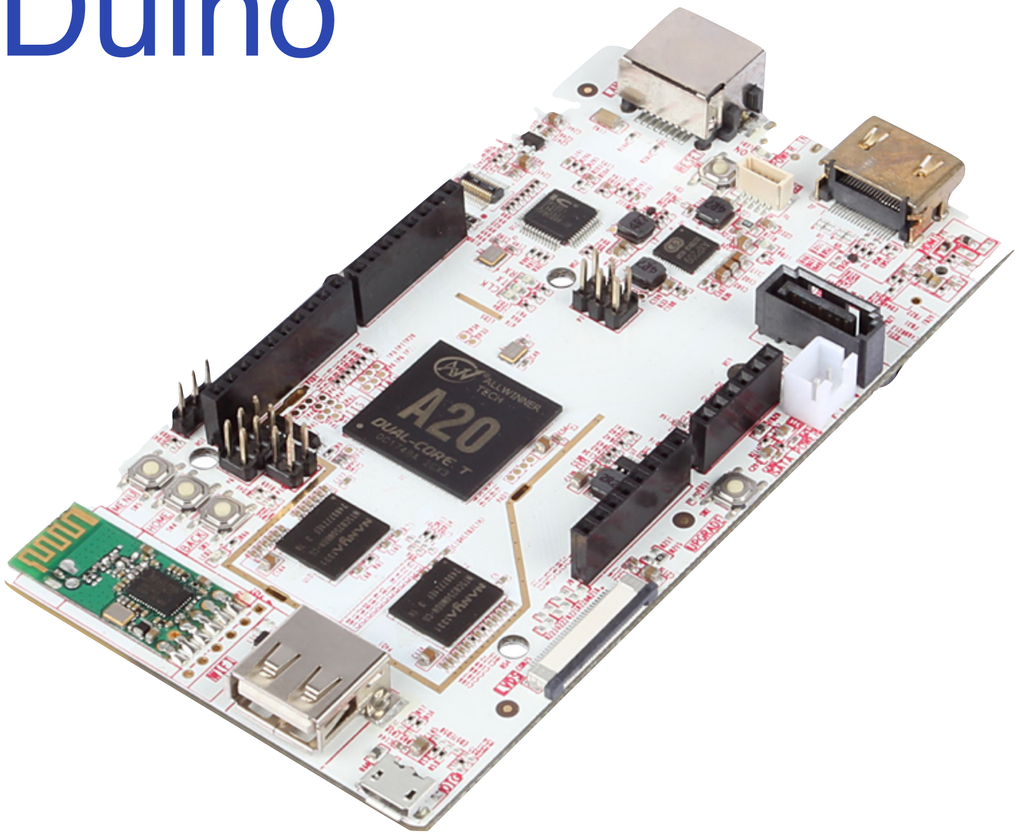
Odroid

£60

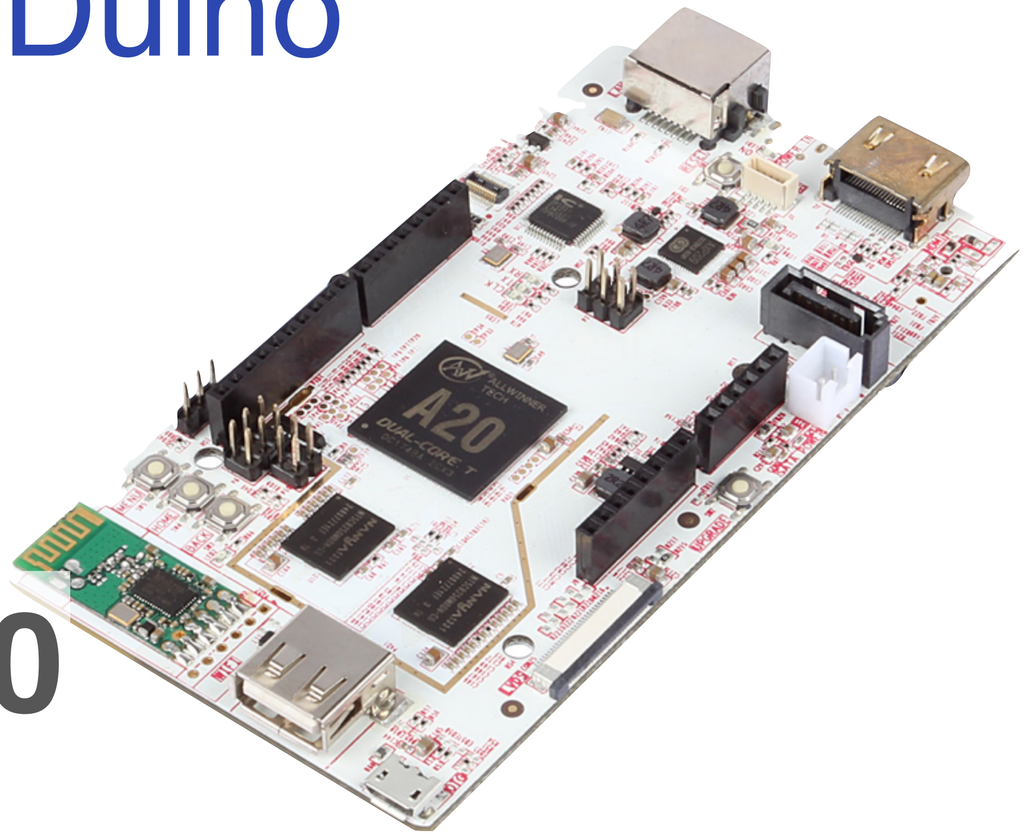
pcDuino



pcDuino

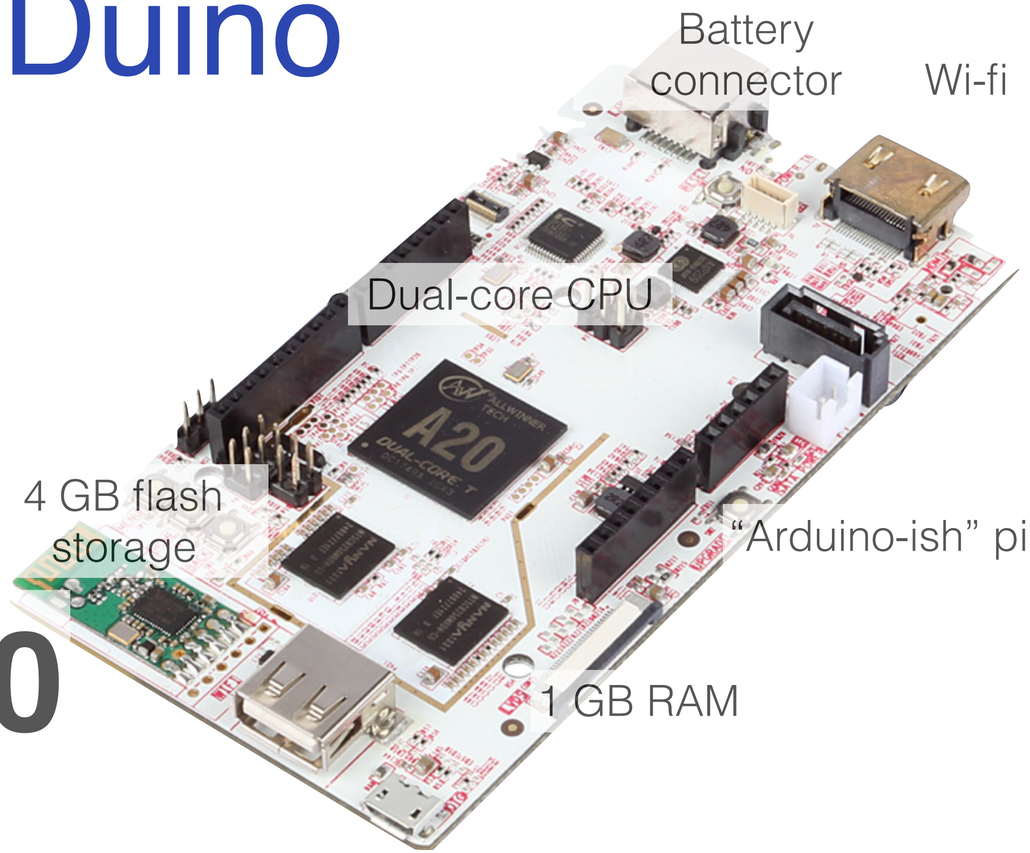


pcDuino

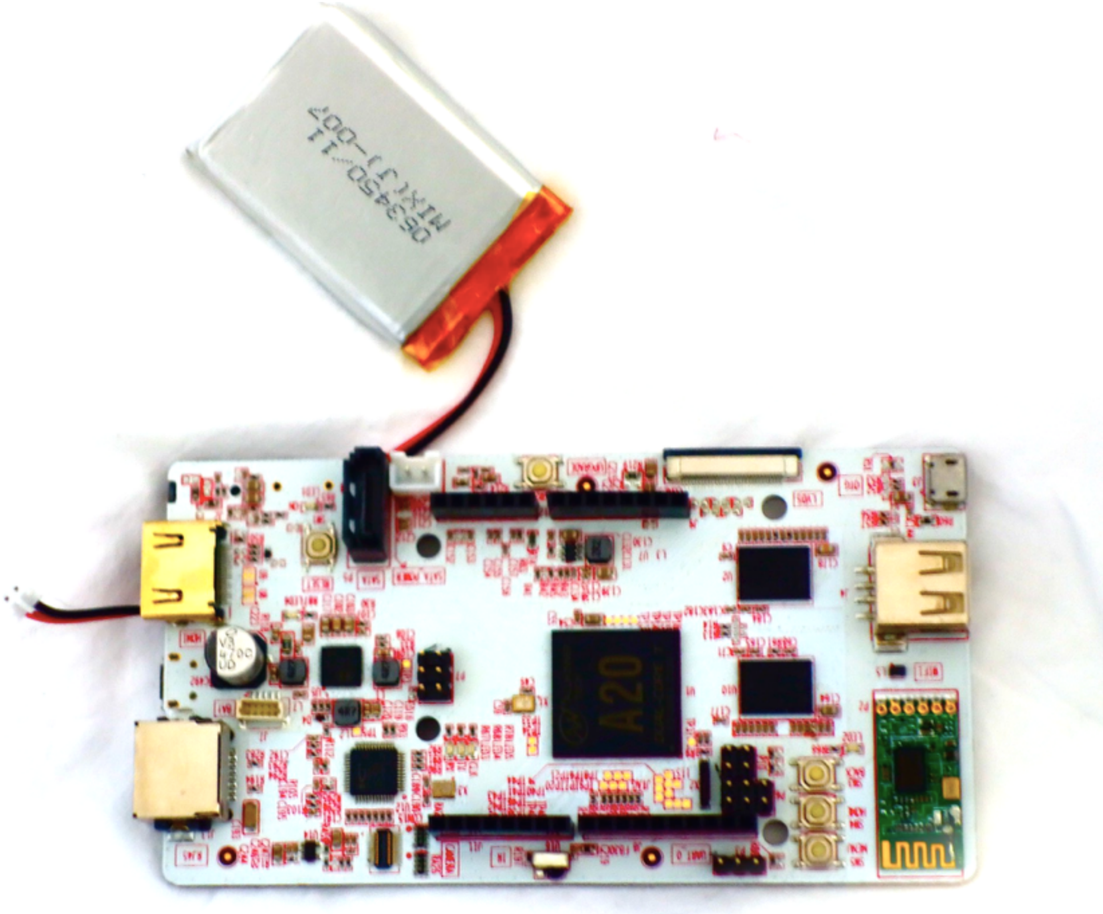


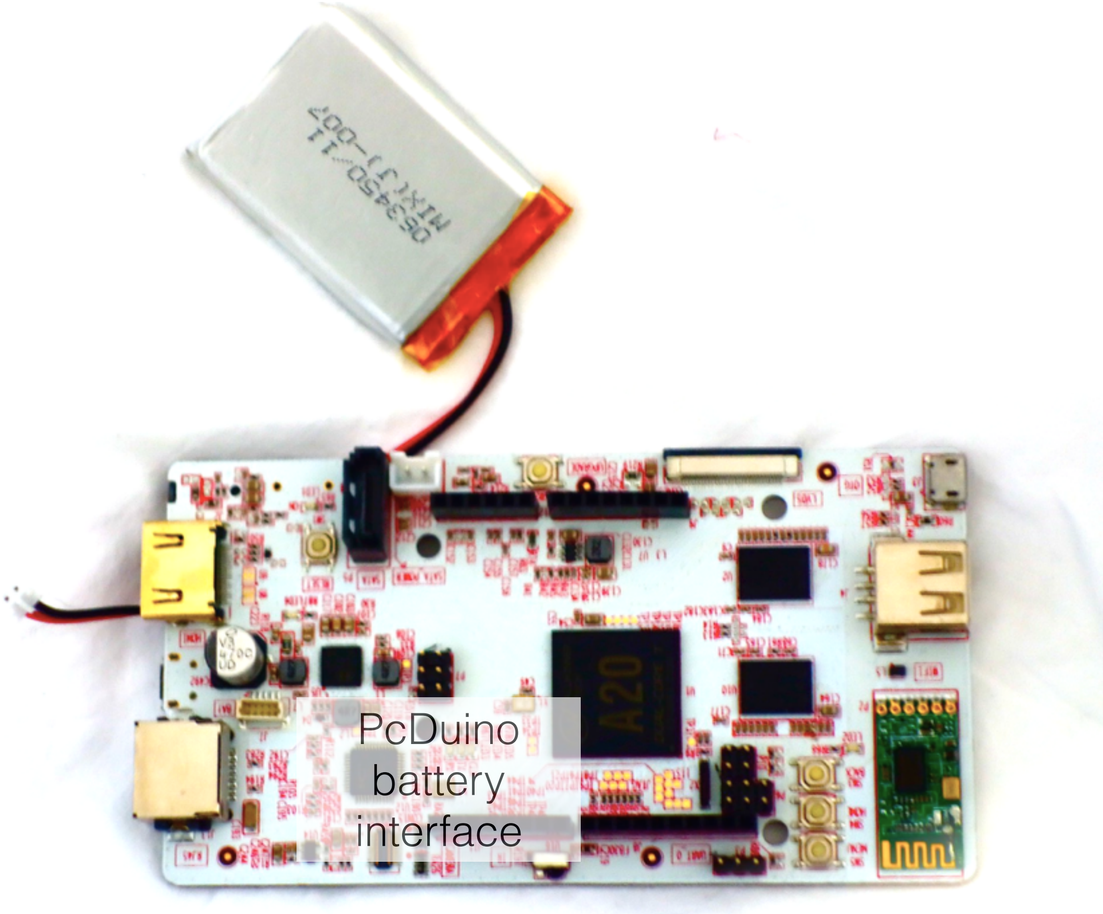
£60

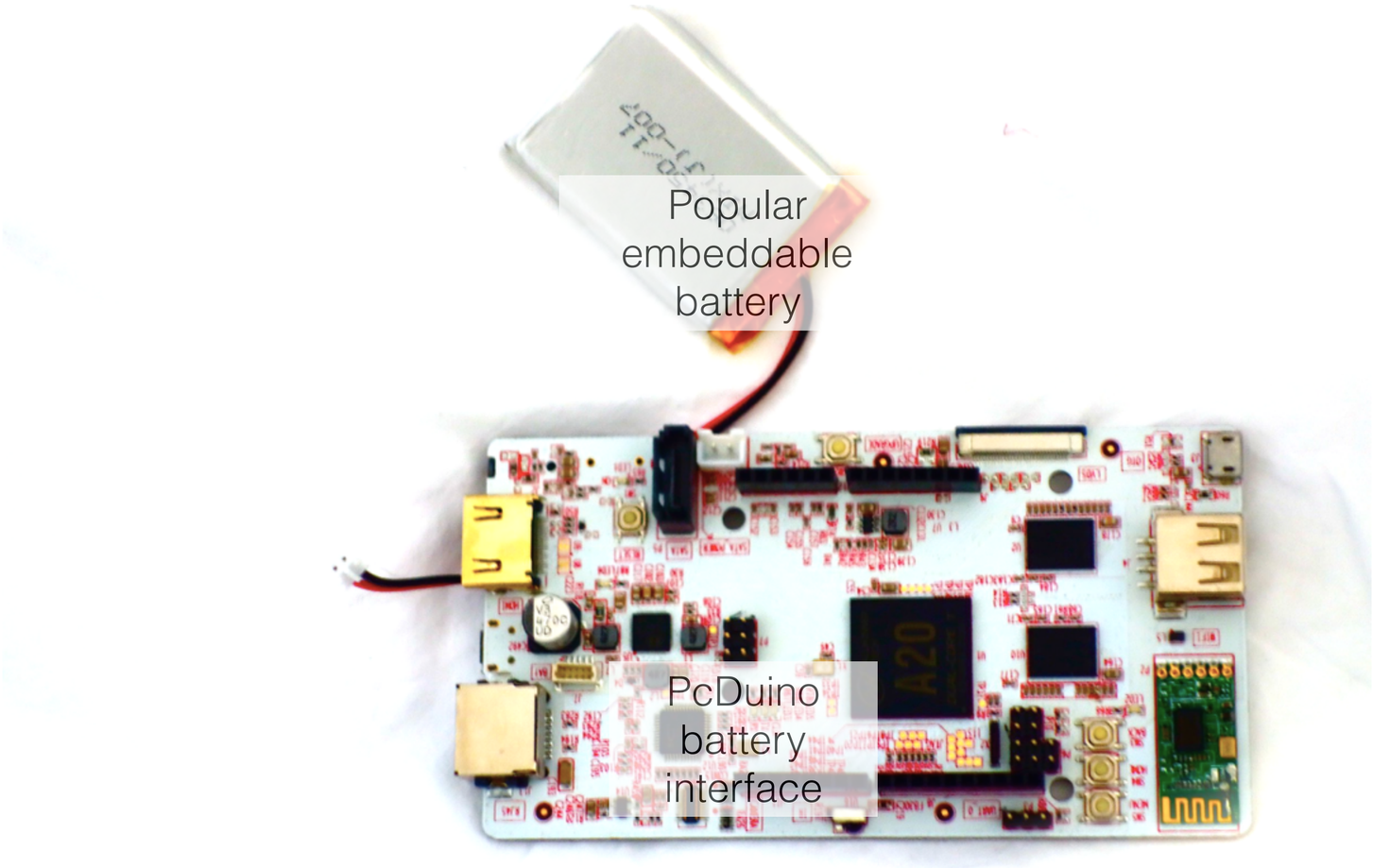
pcDuino

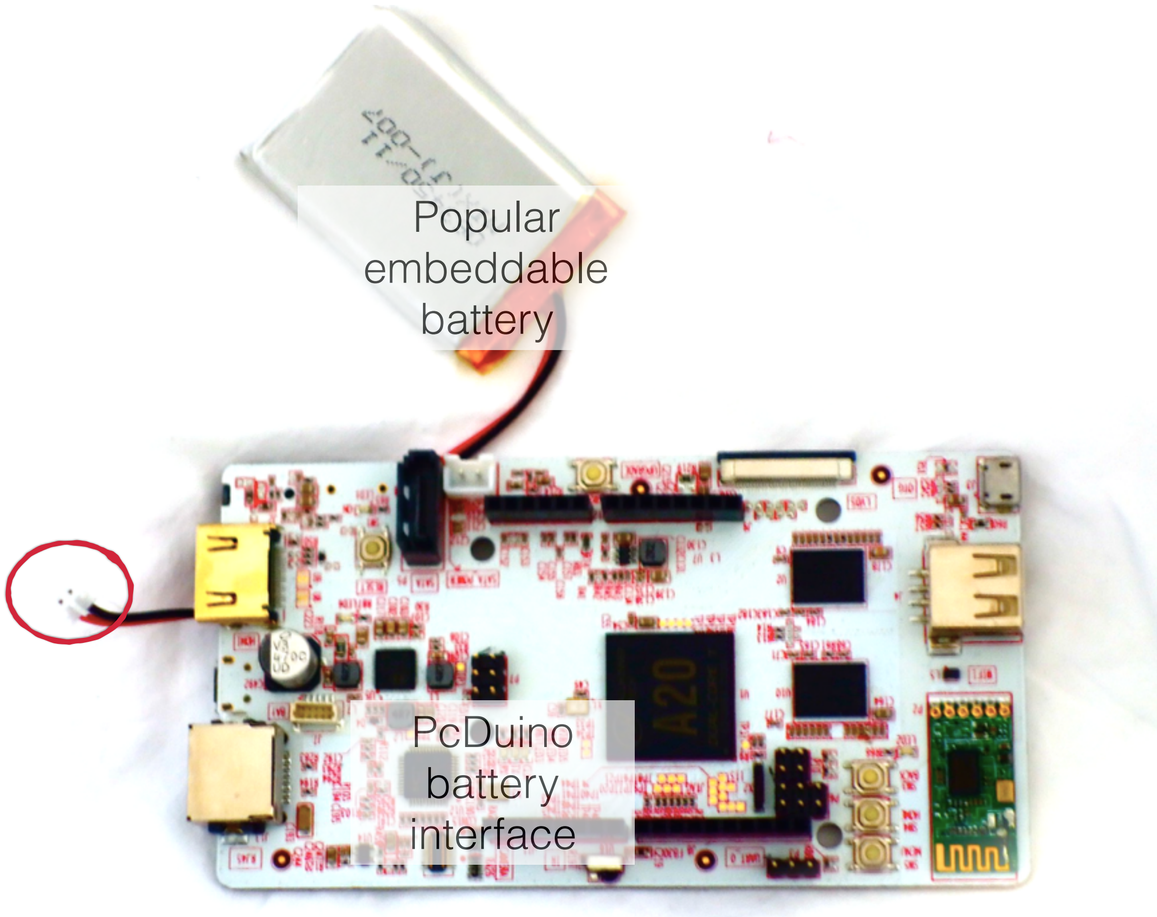

Battery connector
Wi-fi
Dual-core CPU
4 GB flash storage
“Arduino-ish” pins
1 GB RAM

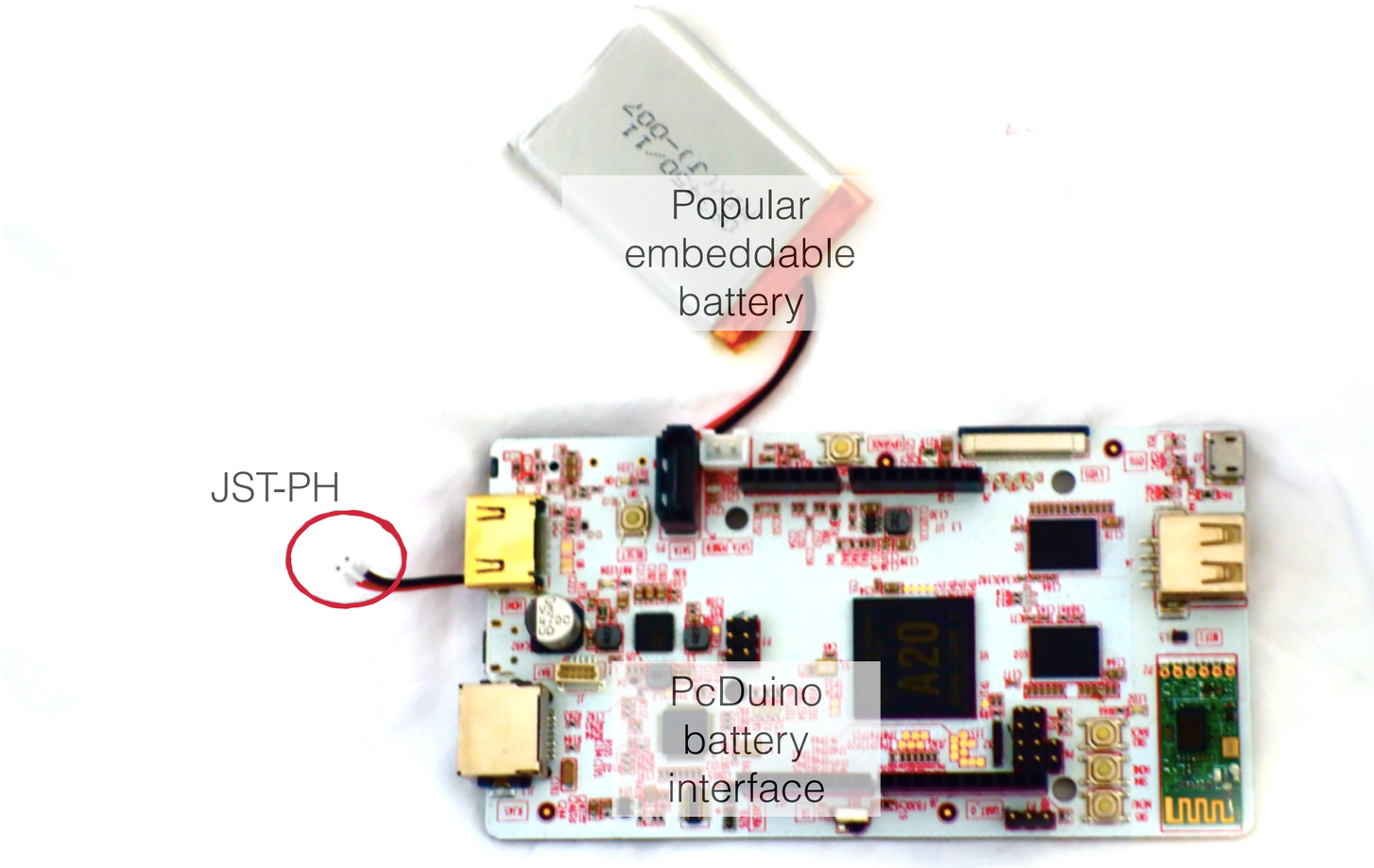
£60

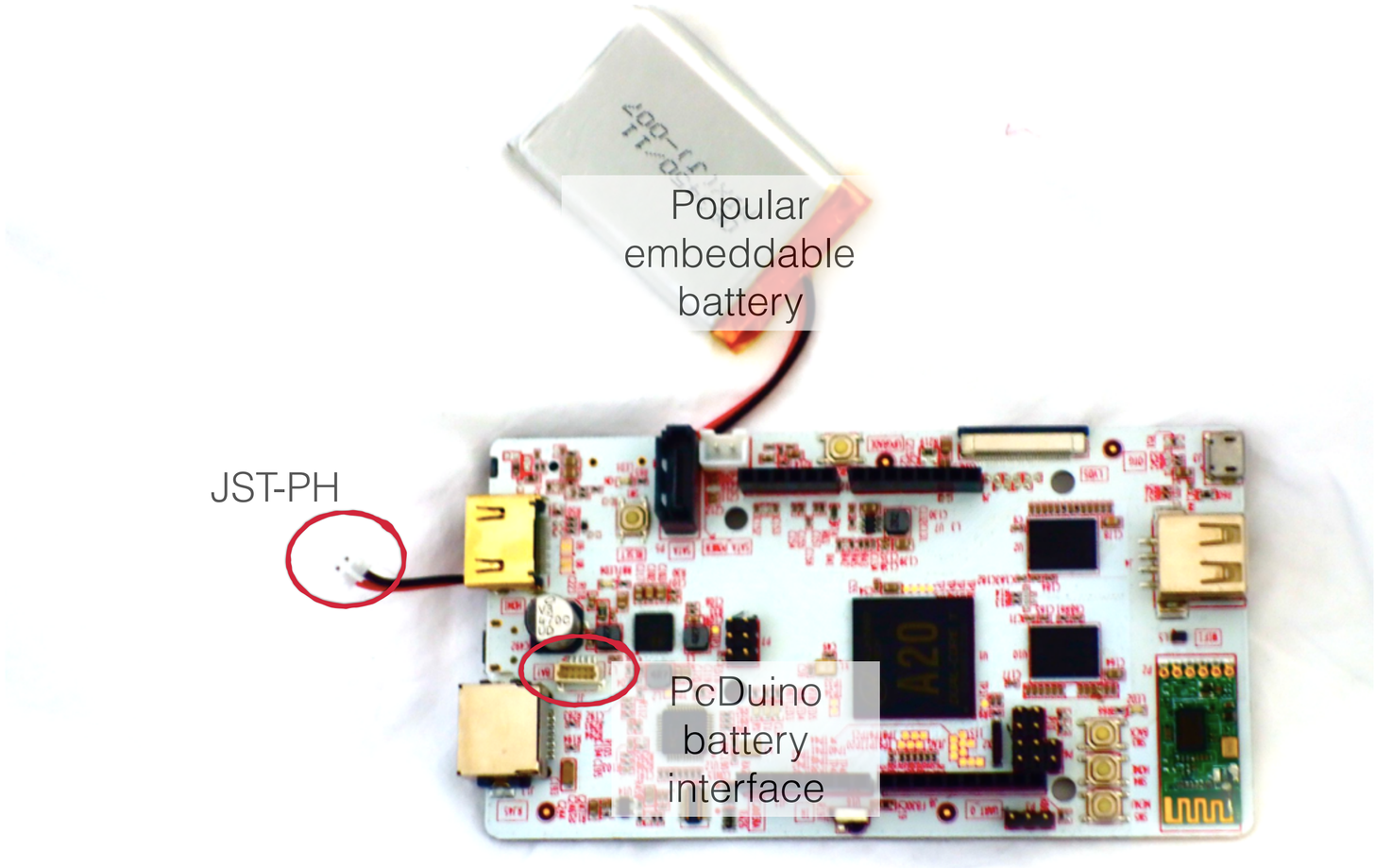

A20

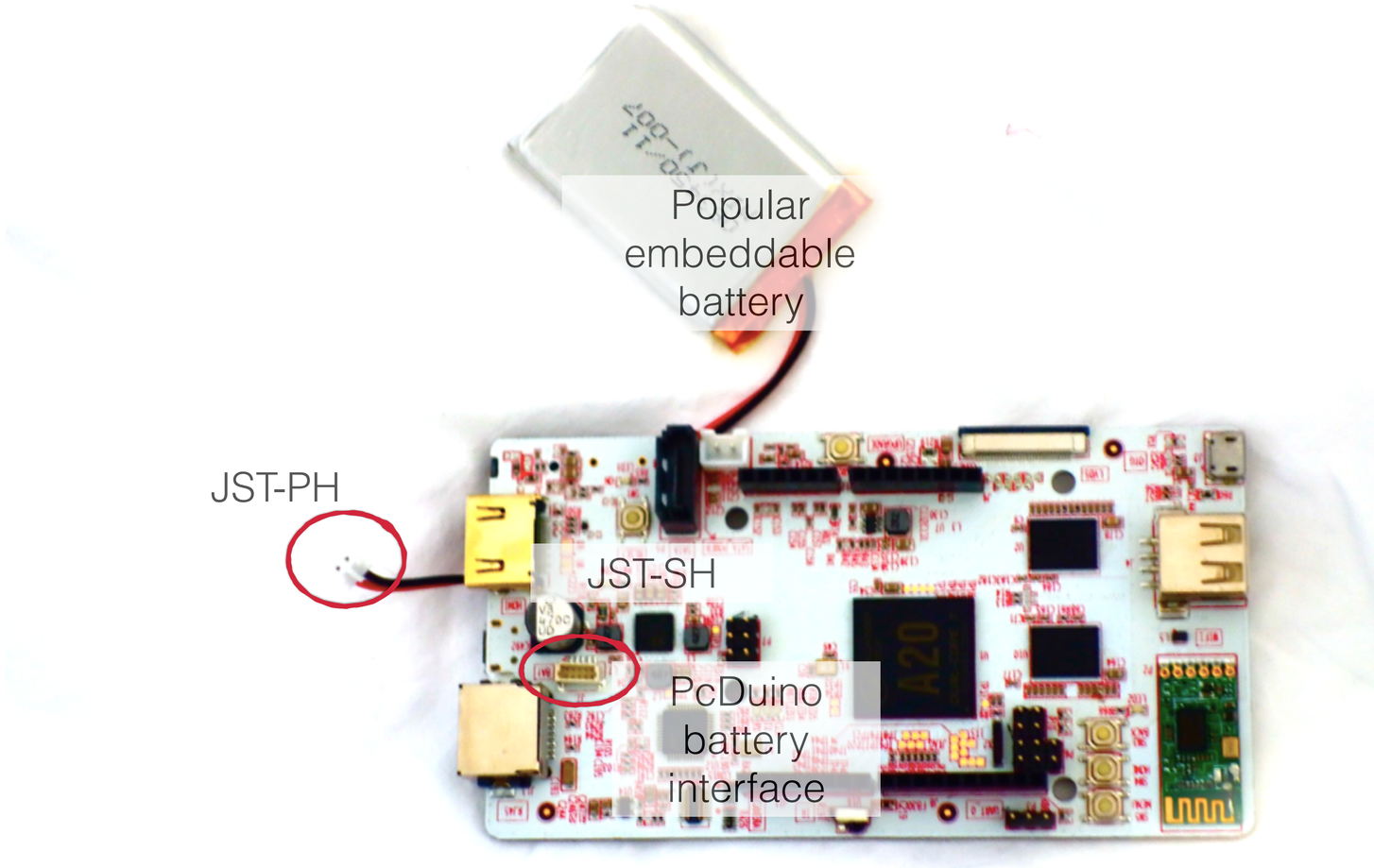

PcDuino
battery
interface


Popular
embeddable
battery
PcDuino
battery
interface


Popular
embeddable
battery
PcDuino
battery
interface


Popular
embeddable
battery
JST-PH
PcDuino
battery
interface


Popular
embeddable
battery
JST-PH
PcDuino
battery
interface


Popular
embeddable
battery
JST-PH
JST-SH
PcDuino
battery
interface

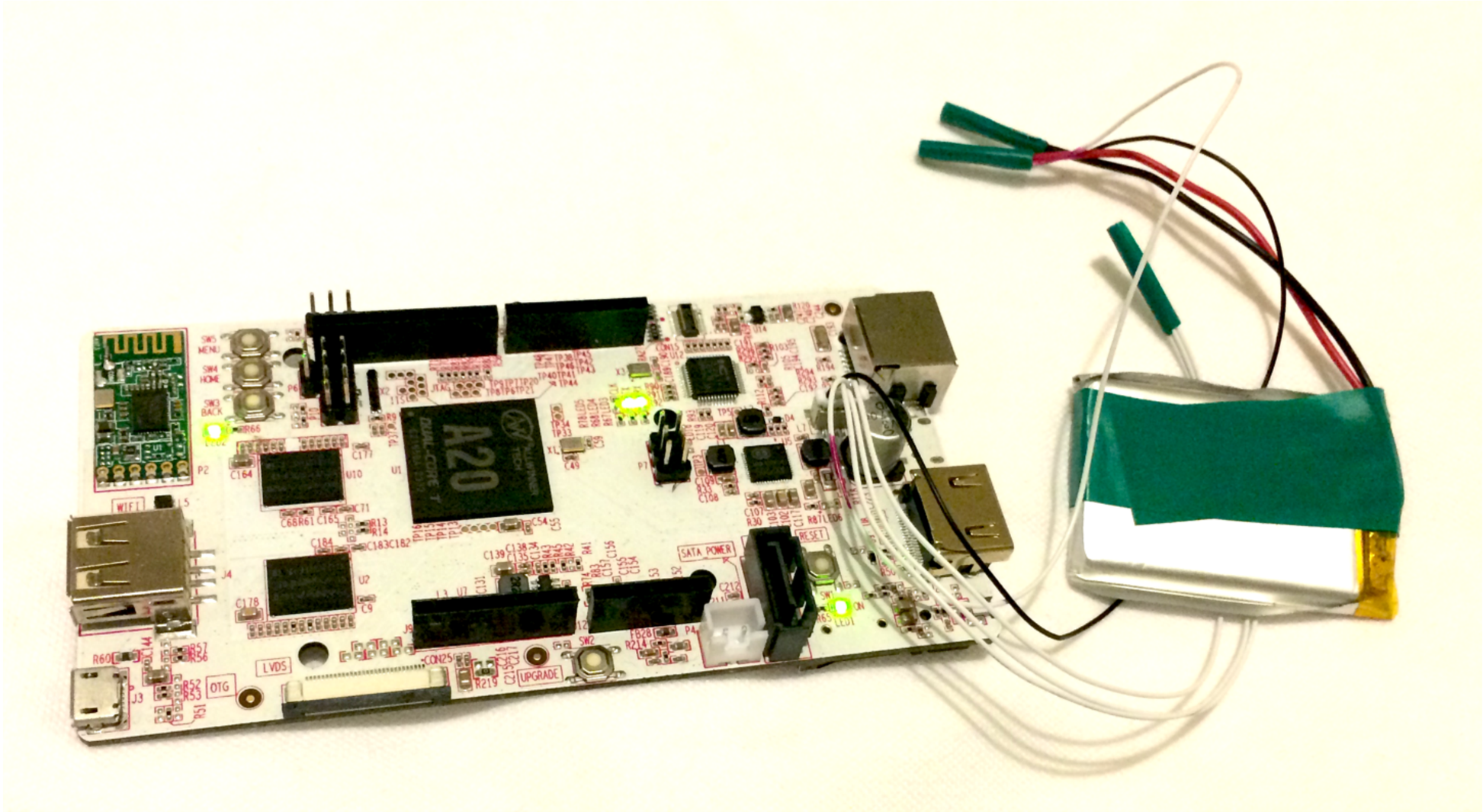
“The board features a difficult-to-get JST-SH connector. You won’t find a battery with a ready-made five-pin JST-SH connector. ”

http://wt.tuxomania.net

“The board features a difficult-to-get JST-SH connector. You won’t find a battery with a ready-made five-pin JST-SH connector. ”

!&!^@*!

http://wt.tuxomania.net


A20
DUAL-CORE
WIFI
LVDS
OTG
UPGRADE
SATA POWER
RESET

Power.

You can do more.

You can know less.

You can know different things.

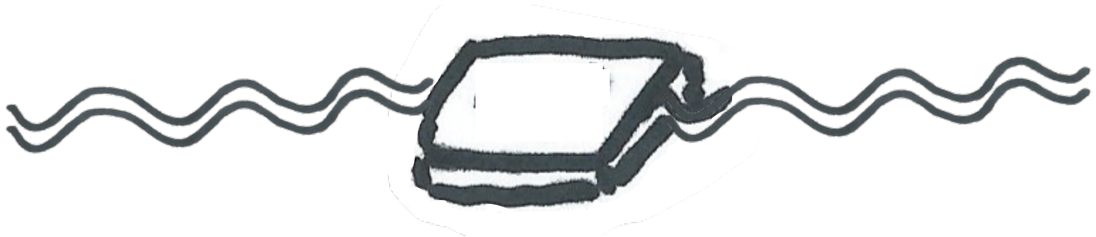
You can know different things.

But …

£30

£2

Size



A power brick

A power brick

(sorry)

Then again …

You can have an application server!

```
@WebServlet({ "/poll" })
public class WelcomeServlet extends MyServlet {
```

```
@Inject
private ColdnessService service;
```

```java
@javax.persistence.Entity
public class MyModel implements java.io.Serializable {

    @javax.persistence.Id
    @javax.persistence.GeneratedValue(strategy = GenerationType.IDENTITY)
    private short id;
```

```java
@Path("tempdata")
public class TempResultsRest {

    @Inject
    private ColdnessService service;

    @GET
    @Produces(MediaType.APPLICATION_JSON)
    public String getGetTemperatureData() throws Exception {

        System.out.println("Reading REST temperature data");
```

```
¶
····@ServerEndpoint(value·=·"/pathparamtest/deploy1/{Object-var}")¶
····public·static·class·WebSocket·{¶
········@OnMessage¶
········public·String·echoText(String·text,·@PathParam("Object-var")·Object·objectVar)·{¶
············return·text;¶
········}¶
¶
····}¶
¶
····@OnOpen¶
····public·void·onOpen(final·Session·session,·EndpointConfig·ec)·{¶
········_curSess·=·session;¶
····}¶
¶
····@OnClose¶
····public·void·onClose(Session·session,·CloseReason·reason)·{¶
```

IBM Bluemix™

Attend a Bluemix workshop

Hands-on workshop

Develop your first Bluemix app

Time&Venue: 09:00-12:00 at IBM Client Center, Kista Alléväg 60, Kista.

Free hands-on workshop

- Learn the fundamentals of building and deploying your application in the Cloud with IBM Bluemix.
- See how to leverage the full capabilities of the Bluemix catalog and utilize the micro-services available.
- Ask any questions you have about cloud application development.

Agenda

- 08:45-09:00 **Registration and coffee is served**
- 09:00-09:15 **Presentation of Bluemix and walkthrough of the two labs**
- 09:15-10:15 **Lab 1: Gather Internet of Things sensor data in Bluemix using Node-RED**
- 10:15-10:30 **Break**
- 10:30-12:00 **Lab 2: Integrate Google Maps and a weather service into your Bluemix app**

Dates during 2016: February 12th, March 15th and April 14th.

The seminar is free of charge, but registration is required. Send an e-mail to Christina Wristel at christina.wristel@se.ibm.com and you will receive a confirmation upon successful enrollment.

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Any questions?

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