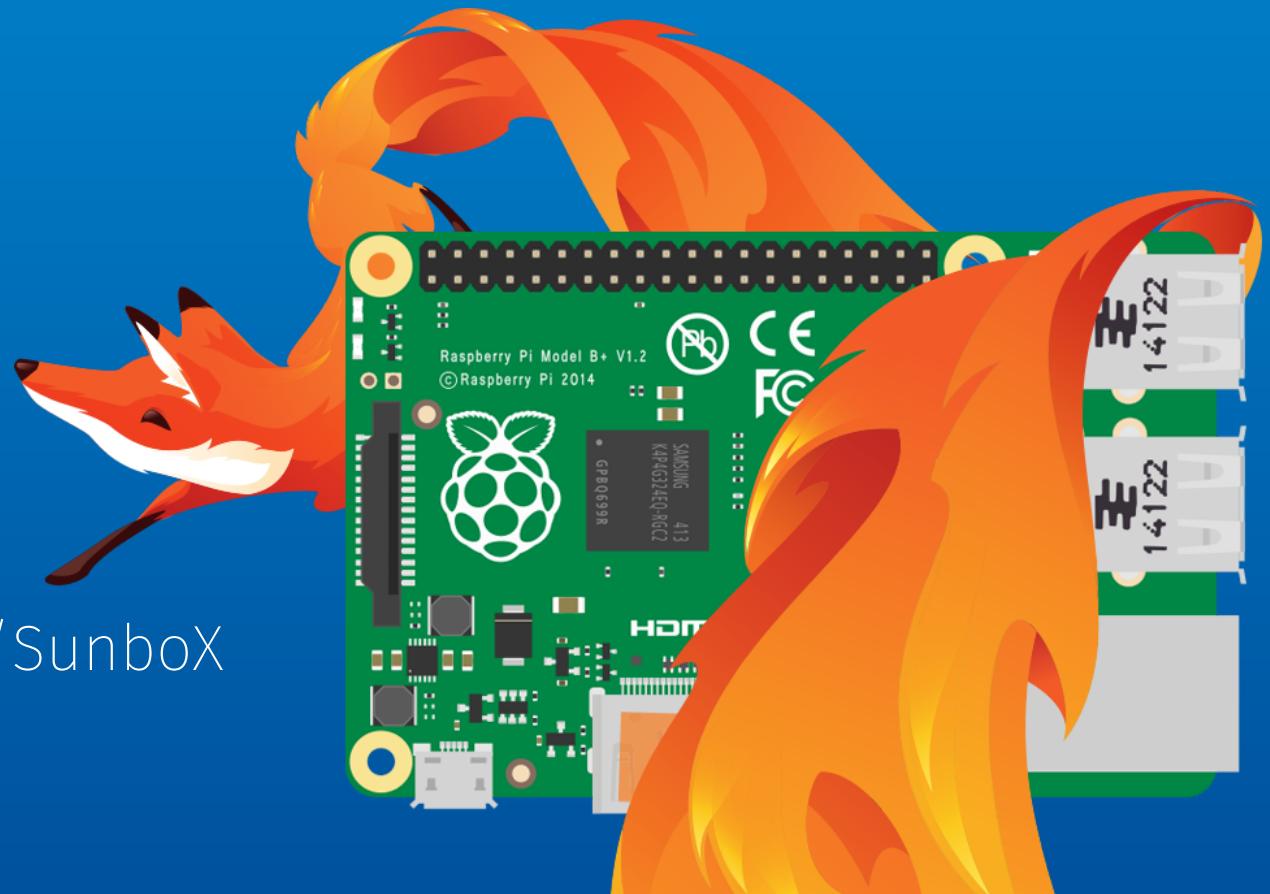


HOW TO USE OPENDATA, FIREFOX OS AND A RASPBERRY PI TO BUILD A BETTER WASHING MACHINE

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How current washing works.

Washing machines have to clean your laundry.

If it's dirty after washing no one would ever buy this machine again.

To achieve this, washing machines

- consume too much water
- consume too much energy / time
- consume too much detergent

... and they don't inform you when they did finish.

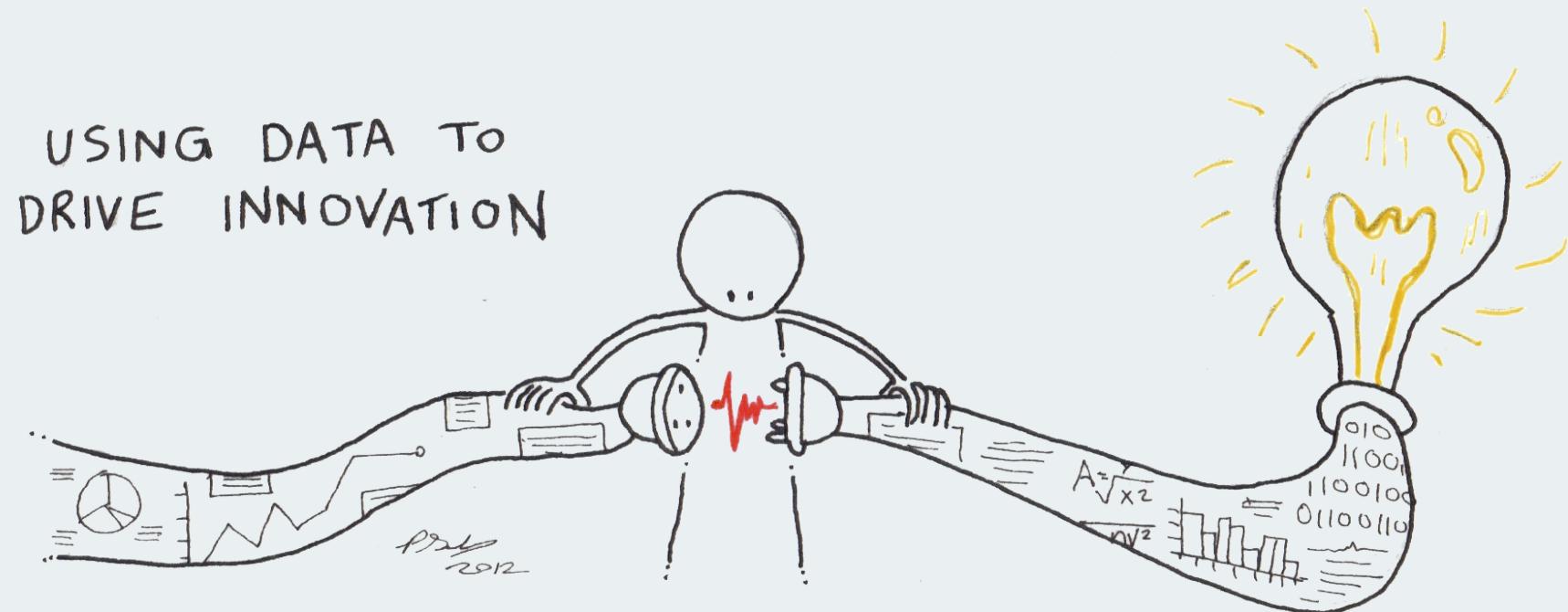
Why do they use too much of all?

- (most) machines don't know the weight of your laundry
- they don't know the water hardness
- they don't know the type of detergent to use
- detergent manufacturer trick you to overdose their detergents



How to fix this?

- using more data – OpenData
- smarter washing machines – Internet of Things (IoT)



Internet of Things?

Smarter washing machines that automatically dose the detergent and water by using OpenData and at the end using less energy.

Smarter washing machines that provide data, like used energy, used water, washing time and all kind of stats so someone else could build up on this.

Using more data

Measuring the weight is easy, but how about the water hardness and used detergent?



OpenData to the rescue

Since February 2014 there's a initiative called „Code for Germany“

<http://codefor.de>

Volunteers work together with german city councils to digitalize open data and make it easy accessible to everyone. A good example is the Open Data Lab Heilbronn. They put all their data on Github here <https://github.com/opendata-heilbronn>

I used their water data for my washing machine sample,
by providing it through an API:

https://github.com/SunboX/fxos-washing-machine_water-api

This simple example shows how much OpenData can be used to make things better. Even if the people who opened this data to the public didn't really know what it can be used for. All cities have collected data about your water quality (and much more) – very few make it open. So „Code for Germany“ is really necessary to make all the public data accessible to everyone.

Ok, now we know the hardness of our water. But how about the detergents?

Same thing here, make it public available. Every detergent manufacturer prints it on the packaging. But by now there's no database containing this data.

Who want's to build a website for collecting it? I've already a proposal how the API could look like: <https://gist.github.com/SunboX/d688d76ff6ca7b1a2f24>

So now we have enough data to work with,
the really cool thing...



FIREFOX OS RUNNING ON A RASPBERRY PI



#FirefoxOSAndIoT

11/26

Firefox OS running on a Raspberry Pi

Firefox OS is great for rapid prototyping. It's as easy as writing a web page.

There's a wiki page about the current state of FxOS on RPi and some info about how to flash it onto your RPi: https://wiki.mozilla.org/Fxos_on_RaspberryPi

I've used a special build by Jan Jongboom who is currently working on improved GPIO support. You can download this build from here:

<https://gist.github.com/janjongboom/94d575526a689687a6b8>



How does it work?

I'm running a stripped down version of FxOS called JanOS: <http://janos.io/>

It's basically your RPi booting into a HTML page rendered by Gecko (FxOS).



The washing machine interface is all build using web technology. It's controlled by an app running on a FxOS phone. The washing machine is providing a REST API allowing the phone to talk to it. This REST API is running on a web server implemented in pure JavaScript.

Lets go into detail of this...



The washing machine interface

You can find the source code for the interface at:

https://github.com/SunboX/fxos-washing-machine_interface



After the RPi did boot up it tries to automatically connect to wifi (which is pre-defined by now) and than it fires up the web server. The server implementation is based on <https://hacks.mozilla.org/2015/02/embedding-an-http-web-server-in-firefox-os/>

```
wm.WashingApi = (function () {
  let wifiManager = navigator.mozWifiManager,
      lastIp,
      httpServer,
      init = function () {
        if ('onconnectioninfoupdate' in wifiManager) {
          wifiManager.onconnectioninfoupdate = e => {
            if (e.ipAddress && lastIp !== e.ipAddress) {
              httpServer = new HTTPServer(wm.Config.ApiServerPort);
            }
          }
        }
      }
    }
  );
}

export default wm.WashingApi;
```

The server provides a simple JSON REST API which is used to tell the washing machine about water hardness and detergents, to start/stop the machine and for getting stats.

```
httpServer.addEventListener('request', e => {
  e.response.headers['Content-Type'] = 'application/json; charset=utf-8';

  switch (e.request.path) {
    case '/start':
      body = JSON.stringify({
        success: wm.WashingProgram.start()
      });
      break;
    case '/data/water-hardness':
      let programUuid = e.request.params.programUuid;
      let waterHardness = e.request.params.waterHardness;
      body = JSON.stringify({
        success: wm.WashingProgram.setWaterHardness(programUuid, waterHardness)
      });
      break;
  }
});
```



If all data is collected and the start command was requested, the washing program will be calculated and it starts a timer. Also a LED connected to the GPIO pins of the RPi begins to blink.

If this were a real machine, it should first automatically dose the detergents based on the given data and after that start to run through the washing program.

How to blink the LED?

... because blinking LED's is cool. ;o)

```
navigator.gpio.setPinMode(3, 'output').then(pin3 => {
  pin3.writeDigital(0);

  let blinkValue = 0;
  let blink = () => {
    blinkValue ^= 1;
    pin3.writeDigital(blinkValue);
    setTimeout(blink, 500);
  }

  wm.WashingProgram.addEventListener('start', e => {
    blink();
  });
})
```



Next the app...



The washing machine app

You can find the source code for the app at:

https://github.com/SunboX/fxos-washing-machine_app

The app will provide some open data like water hardness (after getting the current location) and washing powder dosis to the washing machine.

So, what's next?



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23/26

What's next?

There are three points which can be worked on next:

- Finishing the software – Interface & App
- The hardware – using real Sensors, maybe a real Washing Machine?
- OpenData webpage & API for collecton washing detergent dosis

Want to help?

I'm looking for someone interested to help, or taking over the whole project if it fits to him better.

I'm interested in a lot of things and this small „project“ was just meant to get me updated about current state of OpenData, IoT and FxOS on RPi.

So if you want to get this further, plz help me or take it. :o) Otherwise I will (maybe) work on it from time to time.



<Thank You!>

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