Et si on codait l'IOT...

#iot #SnowCamp2016

Merci @SnowCamp2016

Merci à vous

Philippe Charrière | **@k33g_org**

... en transition ...

technico-commercial/développeur/pre-sales

mix-IT

workshop expérimental

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Objectifs

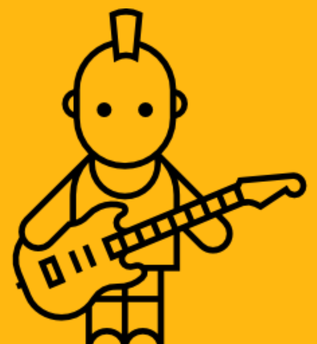
Petite introduction à l'IOT

Comprendre comment les “things”

communiquent entre eux en codant les échanges

et pas besoin de s’y connaître en électronique

des pistes pour le “DIY”



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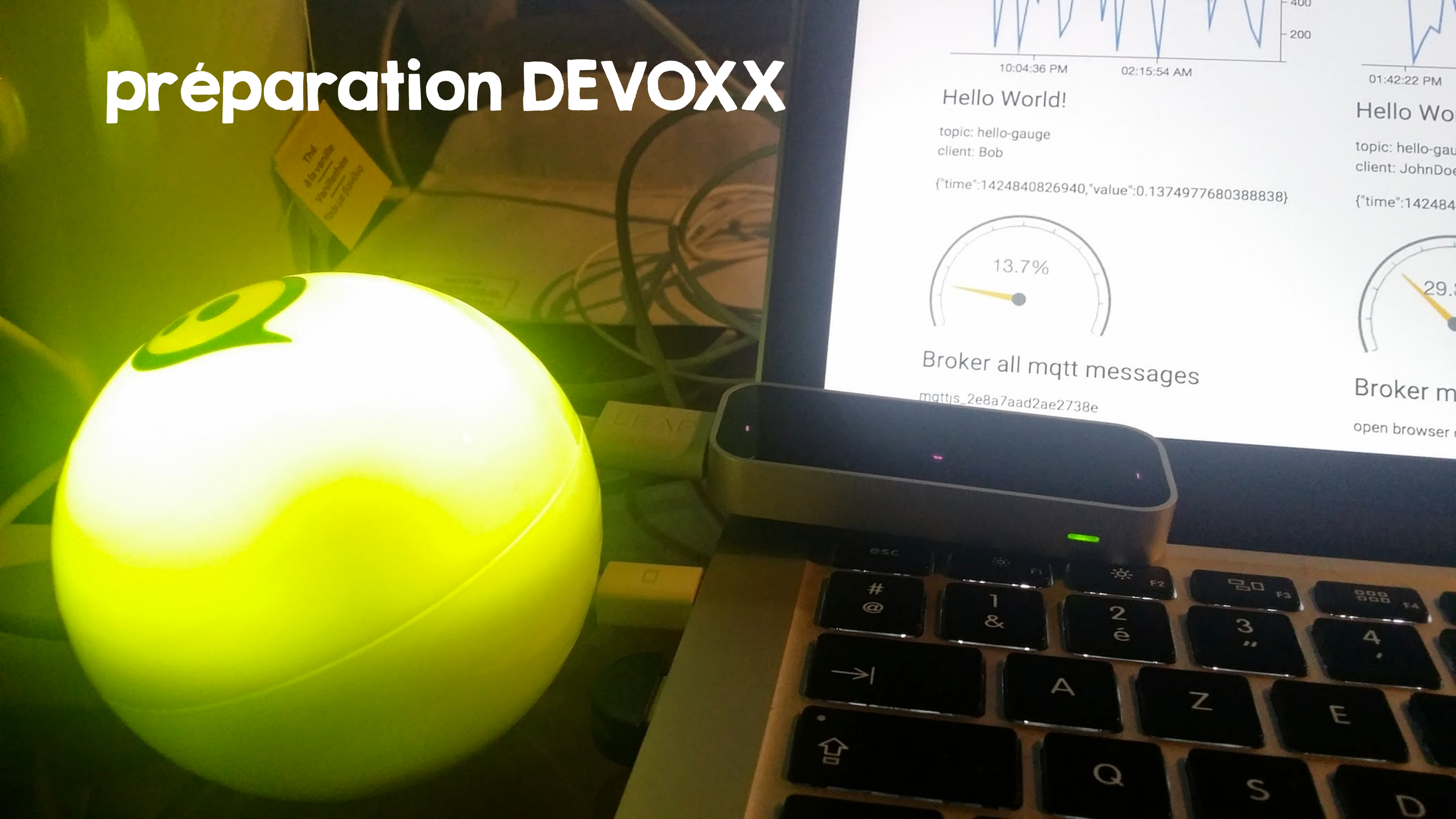
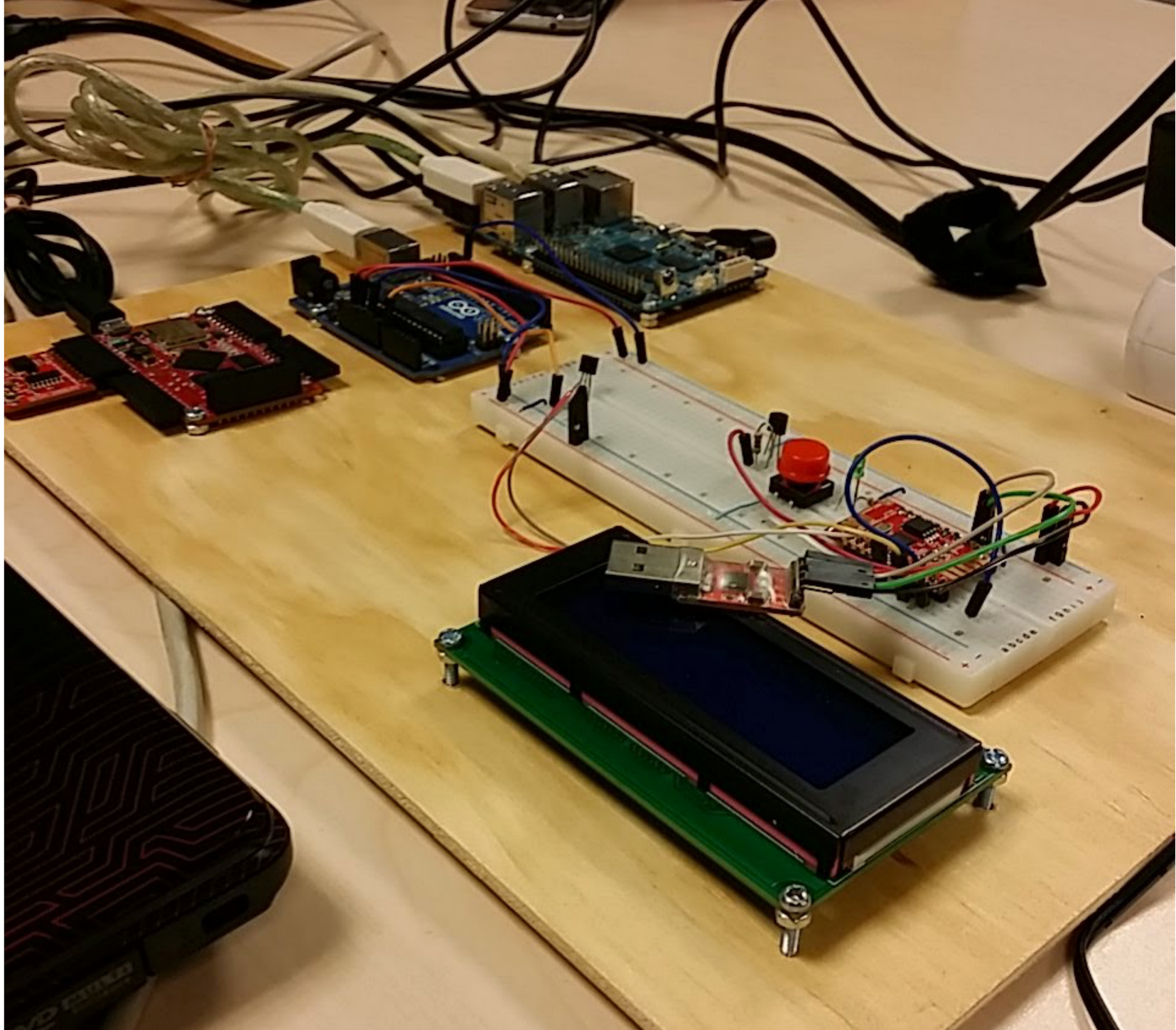
Comment j'en suis arrivé là?


préparation DEVOXX
400
200
10:04:36 PM
02:15:54 AM
Hello World!
topic: hello-gauge
client: Bob
{"time":1424840826940,"value":0.13749776803888388}
13.7%
Broker all mqtt messages
mqttjs_2e8a7aad2ae2738e
01:42:22 PM
Hello Wo
topic: hello-gau
client: JohnDoe
{"time":142484
29.
Broker m
open browser
esc
F1
F2
F3
F4
#
@
1
&
2
é
3
"
4
'
A
Z
E
Q
S
D

Laurent Huet
@lhuet35



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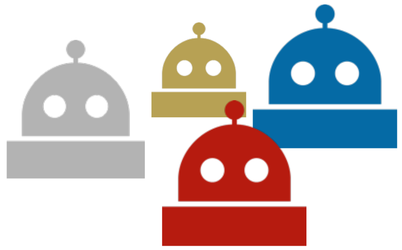
Objet connecté?

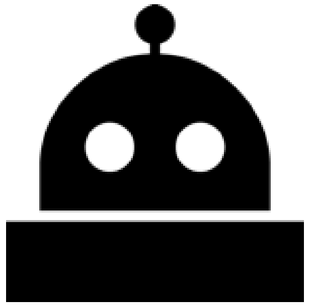
1 OC = {composantes} + API

Sensibilité à l'environnement

Identification



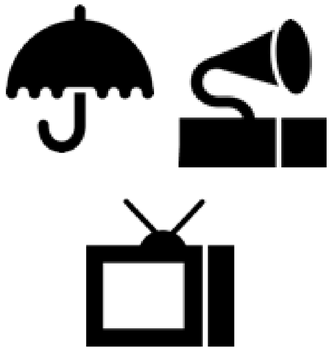
Interactivité



Représentation, Visualisation

Autonomie

IOT? WOT? IOE? ... ???



“isolés”, autonomes,
déconnectés

Machine to Machine

Télémétrie
Télématique
Domotique
Energie
Sécurité
Machine outils
Chaînes de production

**Monitorer, surveiller,
contrôle & gestion à distance**

Smart Systems
“intelligence in subnets of things”

Smart Homes
Connected Cars
Intelligent Buildings
Intelligent Transports Systems
Smart Meters & Grids
Smart Retailing
...

Things
Objets connectés

Sensors
Devices
Systems
People
Products
...

X° Connexions & flux de données

Diversité des “Things”

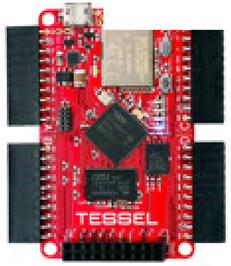
Les objets connectés deviennent de plus en plus complets & puissants

Les usages sont multiples (du récréatif à l’utile)

Certains ont la capacité à utiliser des langages & des technologies avancées

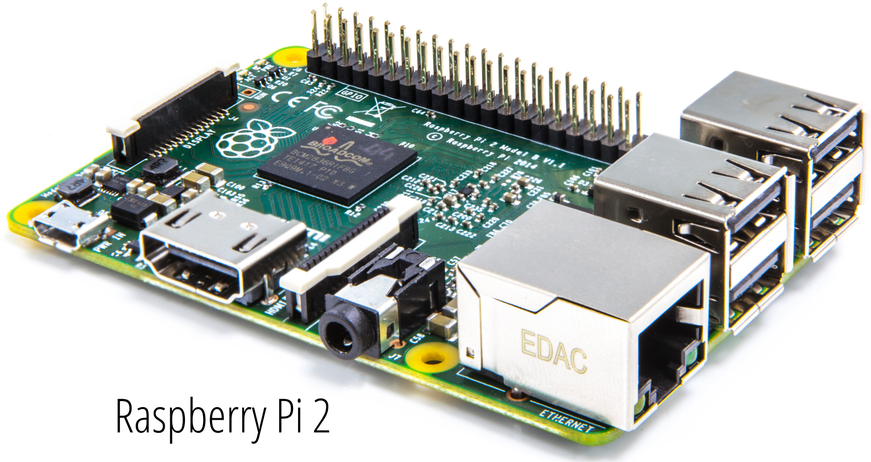




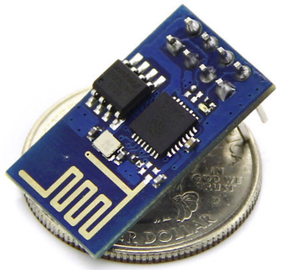
Nano-computer
vs
Micro-controller

Nano-computers vs Micro-controllers

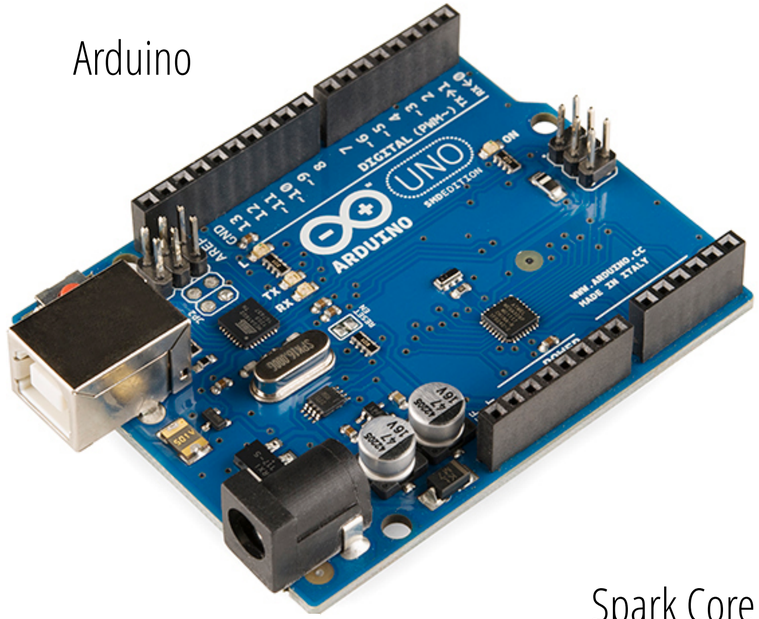


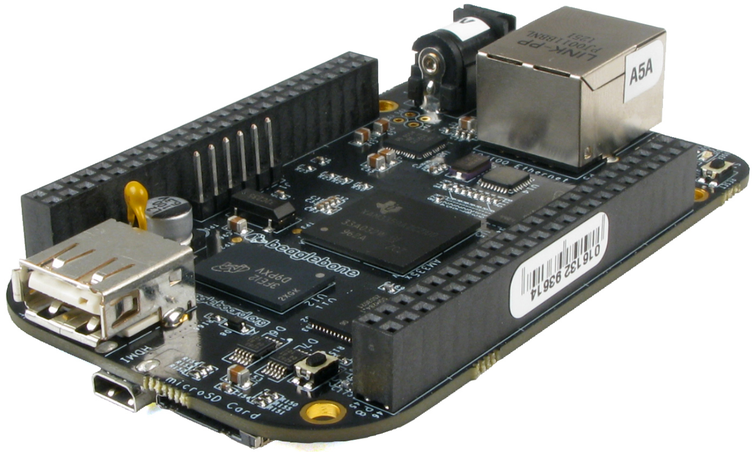
Raspberry Pi 2

ESP8266



Arduino

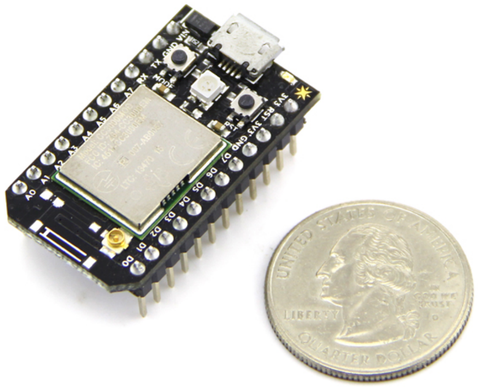




BeagleBone Black

Tessel

Spark Core



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Et tout ça doit “discuter”...

... sinon pas d’IOT

ZigBee

BLE

SIGFOX

MQTT

WiFi

LoRa

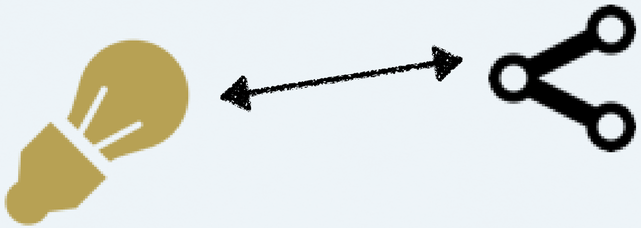
http://

coap://

hadoop

Things

Gateway Devices (Hub)



Edge devices Sensors

Smart(er) devices

Communication, SDK, Intelligence, ...

IOT Management

Cloud Infrastructures

Devices management (reco, provisionning, maintenance, position, ...)
Communications (Broker, abonnements, ...)

Données Stockage

Stockage
Sécurité des données
Chiffrement
...

mongoDB

Utilisation, Intelligence, Analyse, ...

BI, BigData, Recherche, ...

InfluxDB

redis

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exemples
“cas d’usage”


Restaurant La Vigne
Bar Belle Epoque
Quai Schoepflin
Avenue de la Liberté
Rue Marbach
Rue de la Nuée Bleue
Restaurant Le Pacha
Café de l'Opéra
L'Impro TNS
Place Broglie
La Taverne Française
Fiesta Makassi
Rue Brûlée
Le Bar Snooker
le bartholdi
Café Broglie
Le Grincheux
Bar Cintra
Rhumerie Bar Waikiki
Vino Strada Bar
La Pérestroïka
Alambar
Le Rafiot
Rive Gauche
Le Sulky
Place Kléber
Idéal L'
La Java
Hôtel Le 21ème
Café Atla
Rue du 22 Novembre
Le Saxo
Bar Les Aviateurs
L'Alchimiste
Kitsch'n bar
Le Trolleybus
L'Abattoir
Académie de la Bière
Golden Gate
La Petite France
Rue Calvin
Régent Petite France
& Spa *****
Jeannette et les Cycleux
Jimmy's Bar
Les BerThoM
The Dubliners
Quai des Bateliers
Le Festival
Exils
Ze Trou
Quai du Woerthel
Raven Café
Coco Lobo
La Suite
Hôtel Beaucour
Pub Nelson

Communiquer

MQTT
Message Queue Telemetry Transport

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MQTT

= Standard Simple & Léger

Standard OASIS (v3.1.1) depuis 11/2014

Faible overhead, Repose sur TCP/IP

Modèle événementiel

“Content agnostic”

MQTT

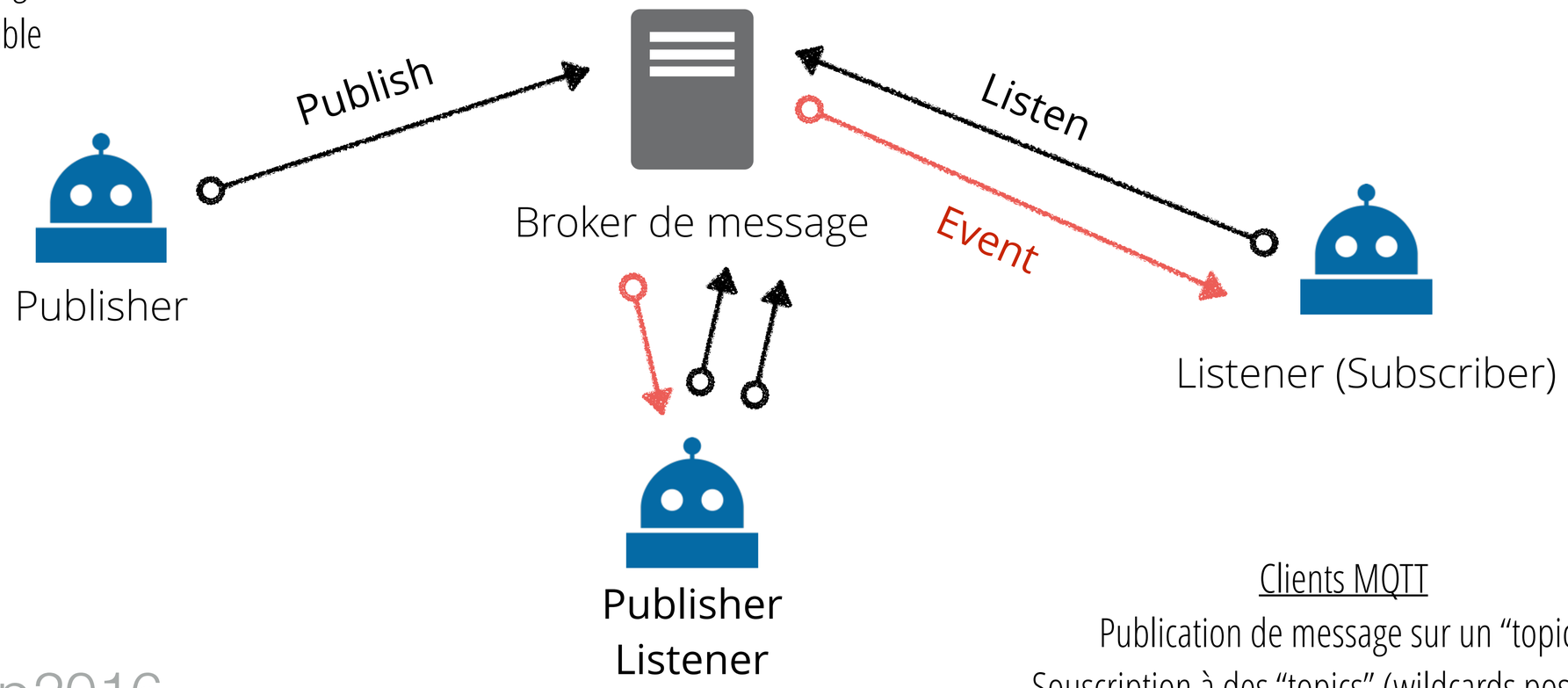
Publish / Subscribe pattern

Broker MQTT

Routage / Distribution

Rétention des messages

Mode bridge possible



Clients MQTT

Publication de message sur un “topic”

Souscription à des “topics” (wildcards possibles)

Brokers MQTT

https://github.com/mcollina/mosca

http://mosquitto.org/

https://github.com/andsel/moquette

eclipse

Clients MQTT

eclipse

“exercices - préparation”

k33g_org / exos · GitLab

Orion - Open Source Web and...

spacecows.local:5000/mixloginstatic/landing.html?redirect=http%3A%2F%2Fspacecows.local%3A5000&key=FORMOAuth

Search

ORION

Sign In Register

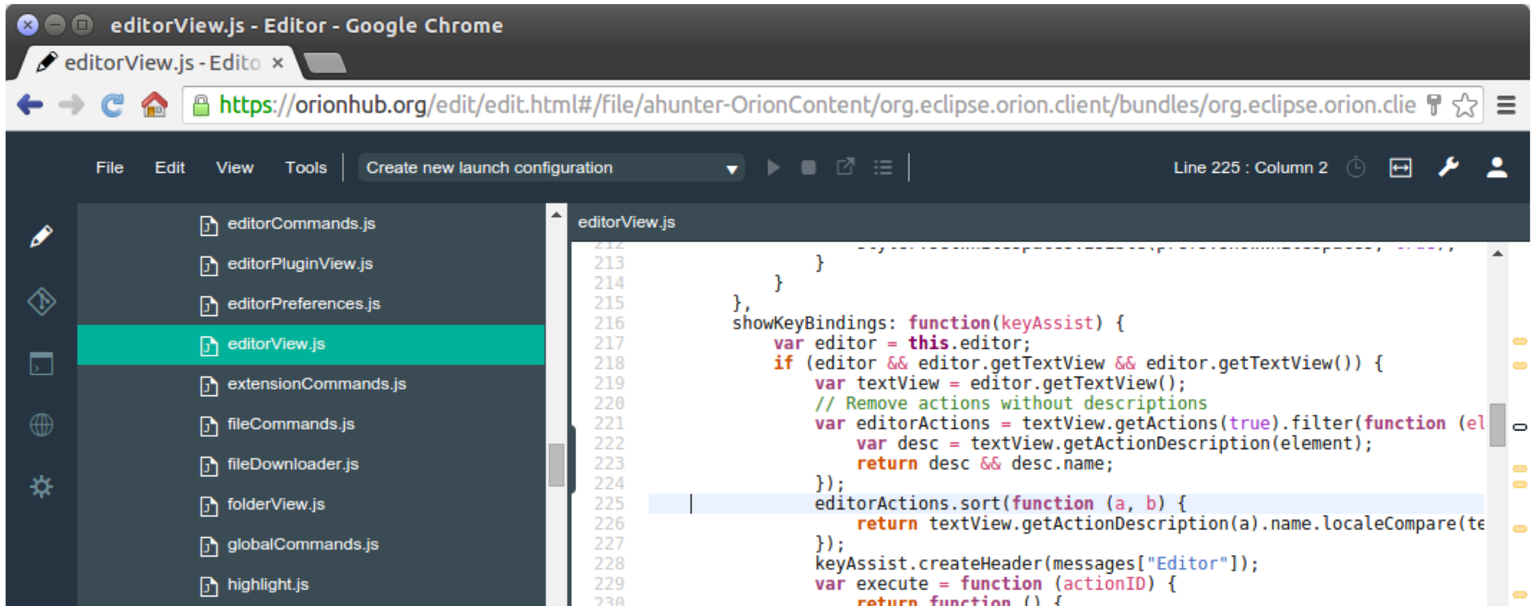
A modern, open source software development environment that runs in the cloud.

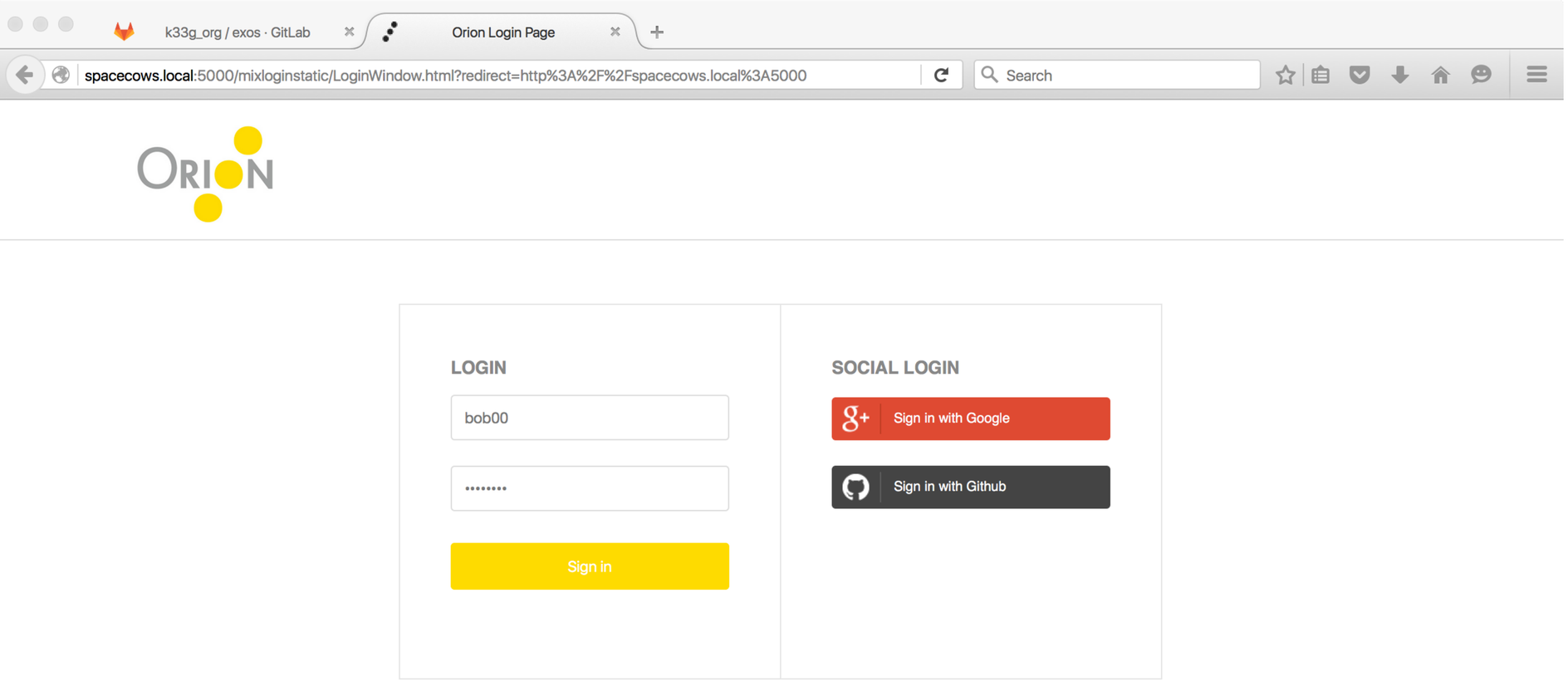
Code, deploy and run in the cloud.

Try It Now

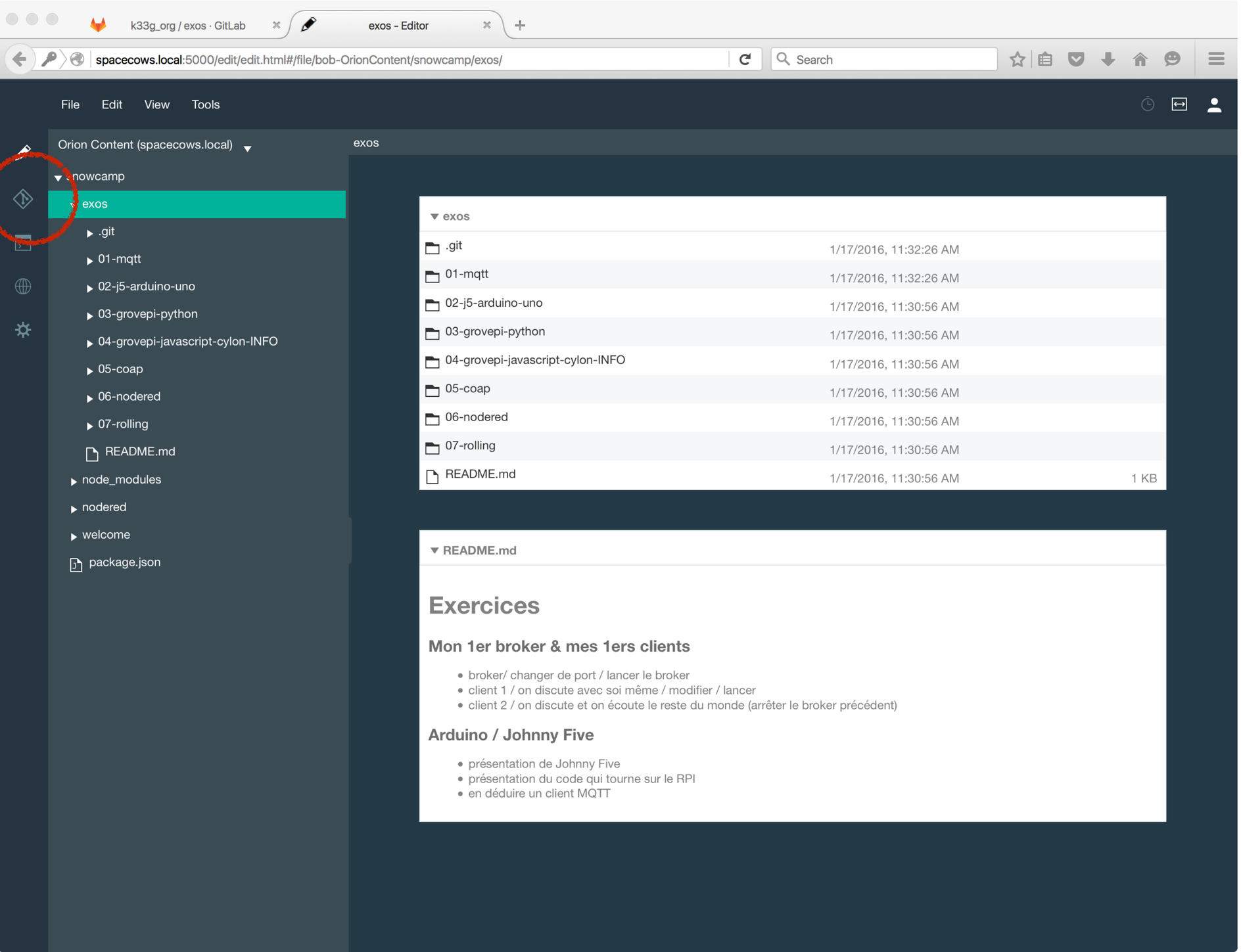
http://spacecows.local:5000

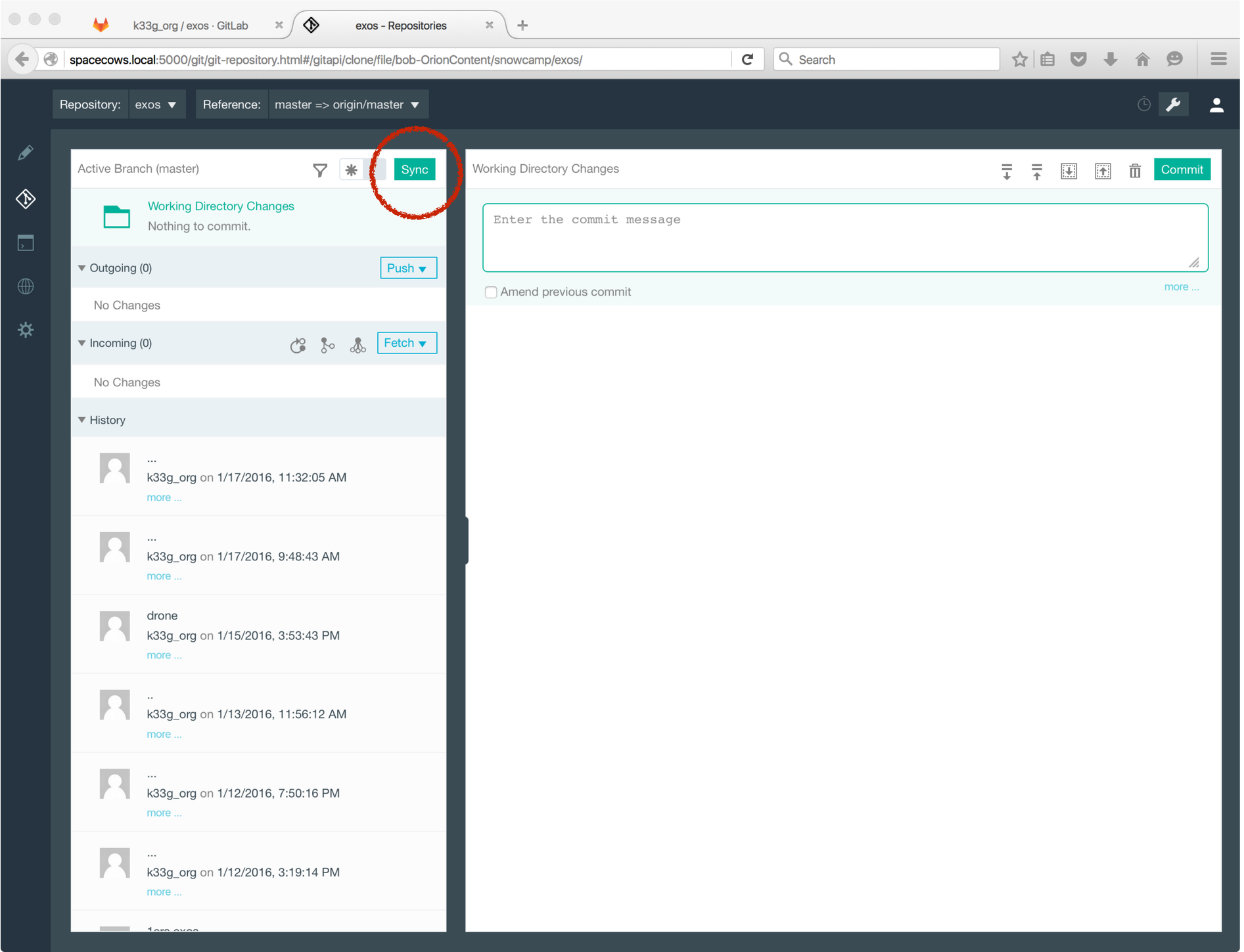
bobNN / snowcamp





bobNN / snowcamp


k33g_org / exos · GitLab
exos - Editor
spacecows.local:5000/edit/edit.html#/file/bob-OrionContent/snowcamp/exos/
Search
File
Edit
View
Tools
Orion Content (spacecows.local)
snowcamp
exos
.git
01-mqtt
02-j5-arduino-uno
03-grovepi-python
04-grovepi-javascript-cylon-INFO
05-coap
06-nodered
07-rolling
README.md
node_modules
nodered
welcome
package.json
exos
exos
.git 1/17/2016, 11:32:26 AM
01-mqtt 1/17/2016, 11:32:26 AM
02-j5-arduino-uno 1/17/2016, 11:30:56 AM
03-grovepi-python 1/17/2016, 11:30:56 AM
04-grovepi-javascript-cylon-INFO 1/17/2016, 11:30:56 AM
05-coap 1/17/2016, 11:30:56 AM
06-nodered 1/17/2016, 11:30:56 AM
07-rolling 1/17/2016, 11:30:56 AM
README.md 1/17/2016, 11:30:56 AM 1 KB
README.md
Exercices
Mon 1er broker & mes 1ers clients
broker/ changer de port / lancer le broker
client 1 / on discute avec soi même / modifier / lancer
client 2 / on discute et on écoute le reste du monde (arrêter le broker précédent)
Arduino / Johnny Five
présentation de Johnny Five
présentation du code qui tourne sur le RPI
en déduire un client MQTT



Pour avoir la dernière version

“exercice 01”

Exercice 01

- 2 parties
- cf README.md dans /exos/01-mqtt

“exercice 01 - corrections”

Partie 1

```
var mqtt = require('mqtt');

var client = mqtt.connect("mqtt://spacecows.local:1801?clientId=bob01");

client.on("connect", function() {

  client.publish(
    'bob01/messages',
    JSON.stringify({
      message:"Hello World!"
    })
  );

});
```

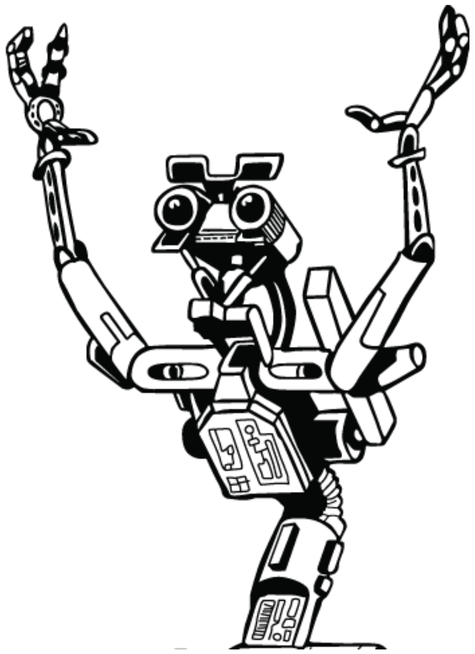
Partie 2

```
var mqtt = require('mqtt');
var client = mqtt.connect("mqtt://skynet.local:1883?clientId=bob01");

client.on("connect", function() {

  client.subscribe("bob02/messages");
  //client.subscribe("bob02/+");

  setInterval(function(){
    client.publish(
      'bob01/messages',
      JSON.stringify({
        message:"Hello World!" + Date(),
        from: "Bob 01"
      })
    );

  }, 2000);

});


client.on('message', function(topic, message)  {
  console.log(topic, ":", message.toString());
});
```

... ce qui va suivre pourrait choquer les “vrais” makers

Programmer les Things

de plus en plus de JavaScript JS



http://johnny-five.io/

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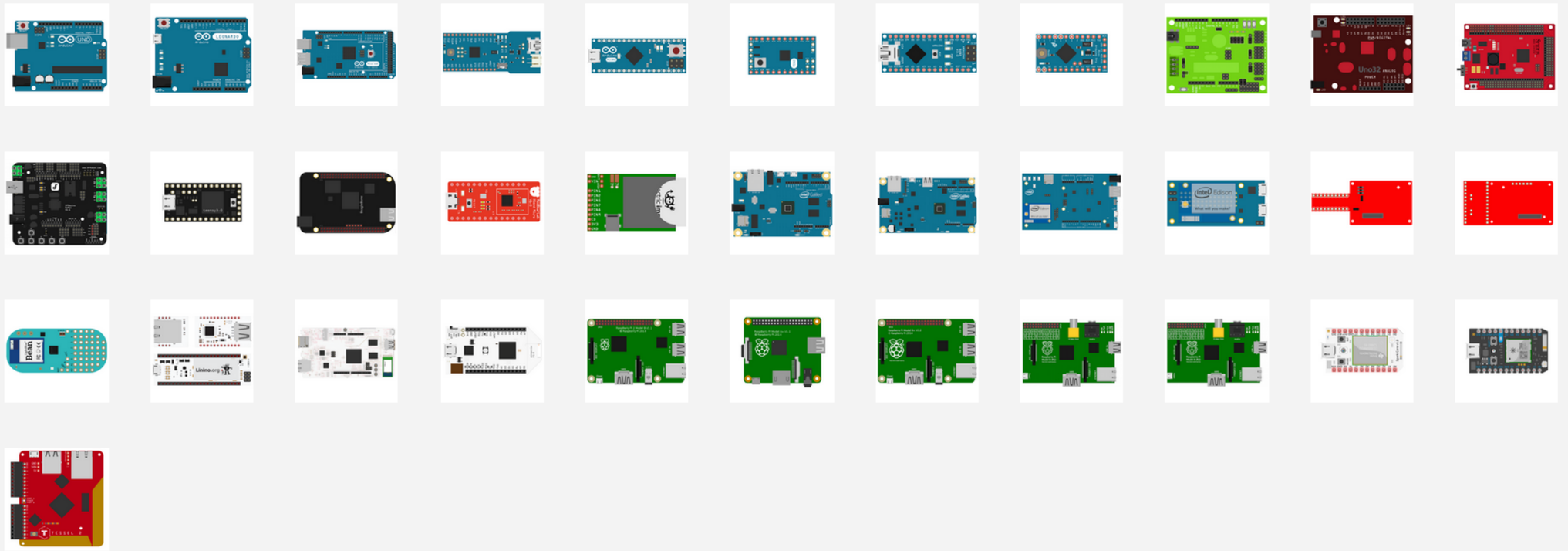
Johnny-Five

Programmer les Things

Johnny-Five has been tested with a variety of Arduino-compatible Boards. For non-Arduino based projects, platform-specific IO Plugins are available. IO Plugins allow Johnny-Five code to communicate with any hardware in whatever language that platform speaks!



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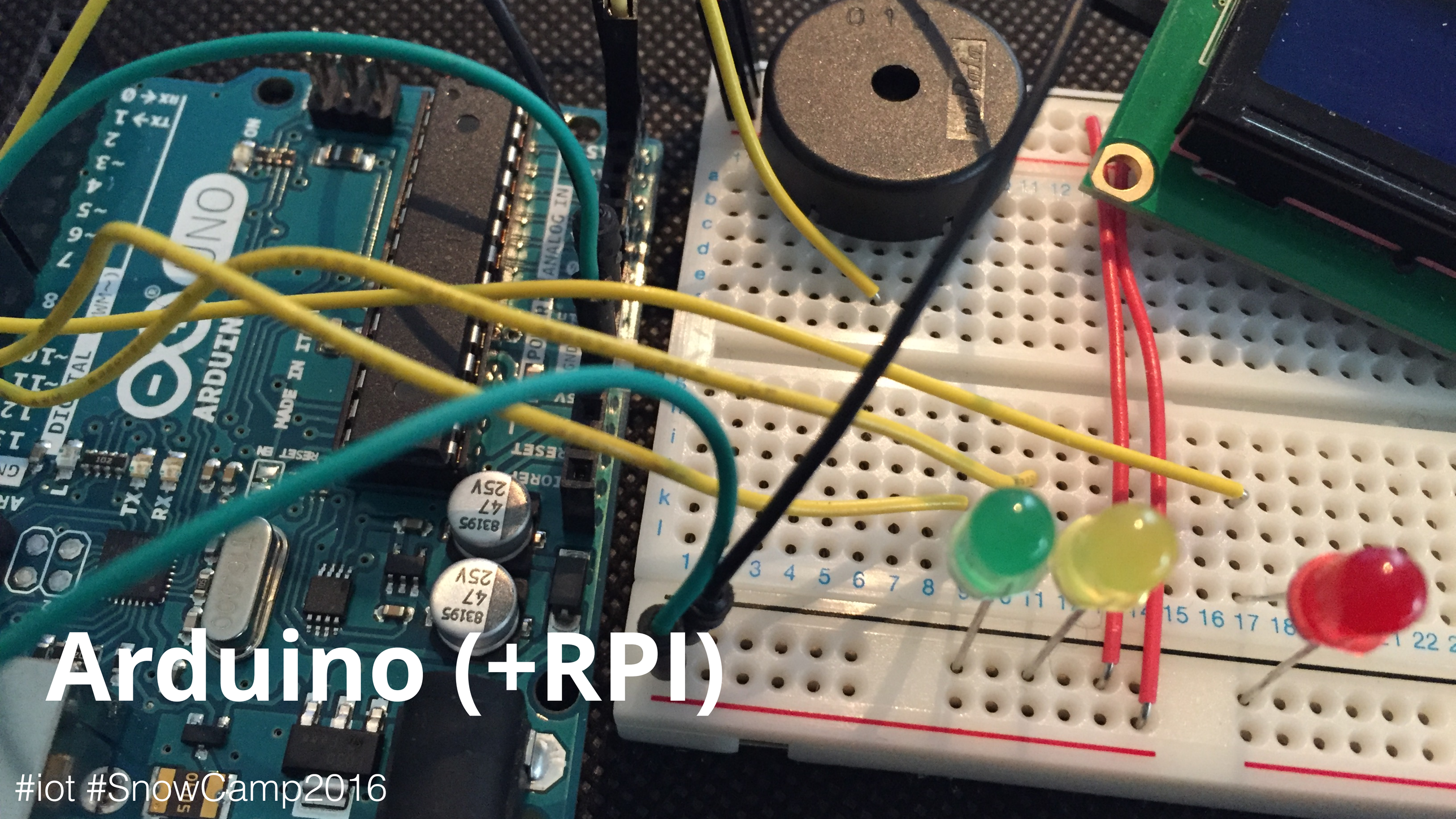

Arduino (+RPI)

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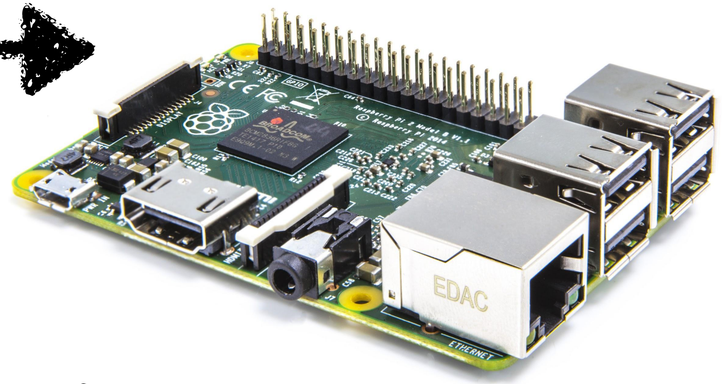
Arduino piloté par un RPI

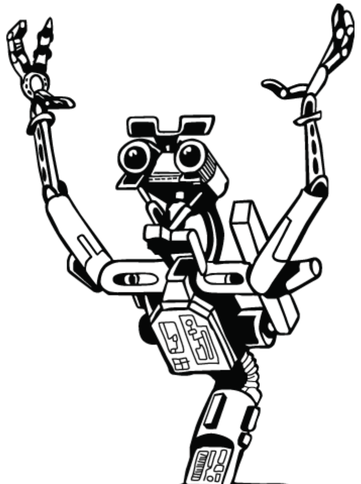
Arduino

Serial Port (UART)

Raspberry



protocole **Firmata** pour
communiquer avec le RPI



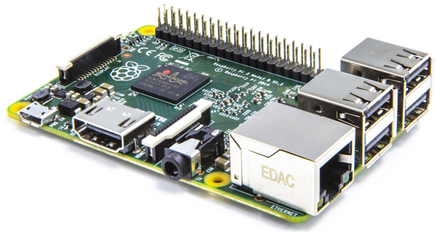
UART: Universal Asynchronous
Receiver / Transmitter

Envoyer des commandes au “Mood” module

Arduino

Serial Port (UART)

Raspberry

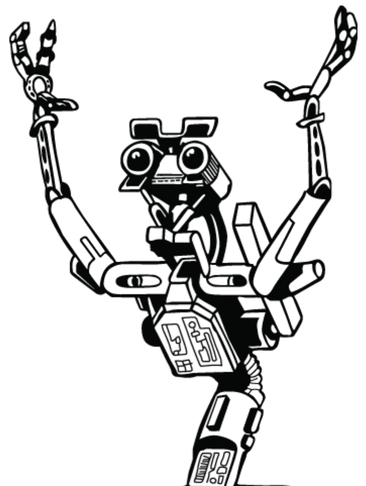


Software to manage Arduino
with Johnny-five
+
MQTT Client

MQTT

Messages MQTT Broker
“SKYNET”

+ MQTT Client
to send commands to RPI



MOSCA

“exercice 02”

Exercice 02

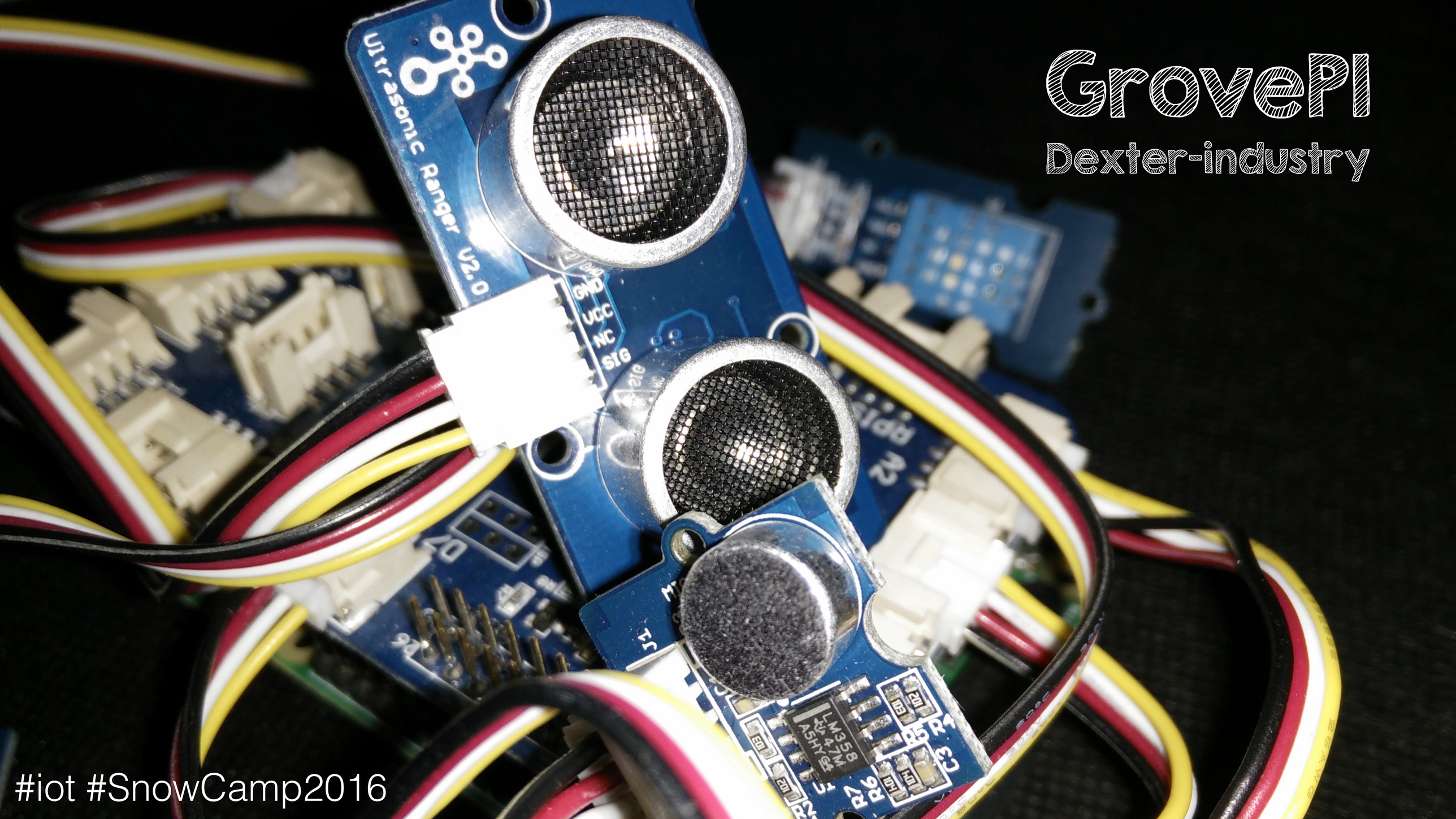
- compléter le client mqtt pour envoyer des commandes au raspberry-pi
- cf README.md dans /exos/02-j5-arduino-uno

“exercice 02 - corrections”

03-client.js

```
var recursiveQuestion = function() {
  rl.question(">>> cmd: ", function(answer) {

    // publish on topic
    client.publish(
      'arduino_pi/commands',
      JSON.stringify({
        cmd:answer, from: "somebody"
      })
    );
    recursiveQuestion();
  });
};
```


Ultrasonic Ranger V2.0
GND
VCC
NC
SIG
GrovePI
Dexter-industry
#iot #SnowCamp2016

RPI+Grove Shield

Messages MQTT Broker
SKYNET

Vous
MQTT.js

MQTT

Raspberry + GrovePI

MQTT

Temperature sensor
Distance sensor

“exercice 03”

Exercice 03

- compléter le client mqtt pour recevoir des données des capteurs
- cf README.md dans /exos/03-grovepi-python

“exercice 03 - corrections”

03-client.js

```
var mqtt = require('mqtt');

var client = mqtt.connect("mqtt://skynet.local:1883");

client.on("connect", function() {

  console.log("client is Listening ...");
  client.subscribe("grovepi/infos/+");

});


client.on('message', function(topic, message)  {
  console.log(topic, ":", message.toString());

  var json = JSON.parse(message.toString());

  client.publish(
    'infos/from/bob01', message.toString()
  );

});
```

README.md - Editor | bob@spacecows: ~/snowcamp/no... | Node-RED : spacecows.local

spacecows.local:2880/#

Search

Node-RED

Node-RED

Deploy

filter nodes

input

- inject
- catch
- status
- mqtt
- http
- websocket
- tcp
- udp

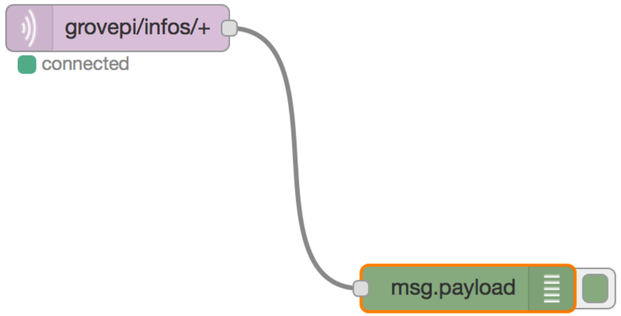
output

- debug
- mqtt
- http response
- websocket
- tcp
- udp

function

- function

Sheet 1



info | debug

1/17/2016, 3:10:07 PM eb25d68c.dc0428
grovepi/infos/distance : msg.payload : string [15]
{"distance": 9}

1/17/2016, 3:10:07 PM eb25d68c.dc0428
grovepi/infos/sound : msg.payload : string [13]
{"sound": 73}

1/17/2016, 3:10:07 PM eb25d68c.dc0428
grovepi/infos/light : msg.payload : string [14]
{"light": 649}

1/17/2016, 3:10:07 PM eb25d68c.dc0428
grovepi/infos/temperature : msg.payload : string [22]
{"temperature": 563.2}

1/17/2016, 3:10:07 PM eb25d68c.dc0428
grovepi/infos/humidity : msg.payload : string [22]
{"temperature": 921.6}

1/17/2016, 3:10:10 PM eb25d68c.dc0428
grovepi/infos/distance : msg.payload : string [15]
{"distance": 9}

1/17/2016, 3:10:10 PM eb25d68c.dc0428
grovepi/infos/sound : msg.payload : string [13]
{"sound": 69}

1/17/2016, 3:10:10 PM eb25d68c.dc0428
grovepi/infos/light : msg.payload : string [14]
{"light": 648}

1/17/2016, 3:10:10 PM eb25d68c.dc0428
grovepi/infos/temperature : msg.payload : string [22]
{"temperature": 563.2}

1/17/2016, 3:10:10 PM eb25d68c.dc0428
grovepi/infos/humidity : msg.payload : string [22]
{"temperature": 921.6}

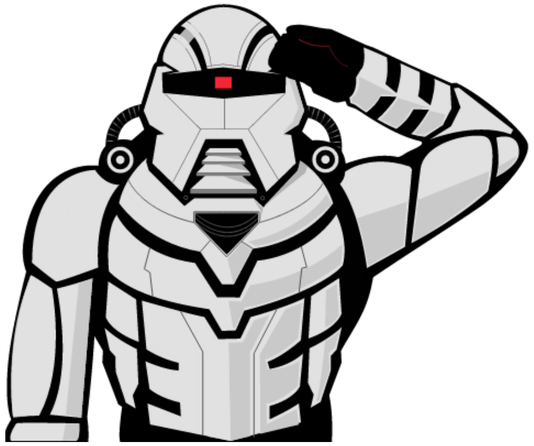
“exercice 04”

Exercice 04

- Démo: se connecter aux données des sensors (GrovePi) et les afficher
- se connecter aux données de simulation (spacecows.sh) et les afficher
- cf README.md dans /exos/04-nodered

Programmer les Things

de plus en plus de JavaScript JS



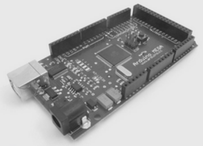
http://cylonjs.com/

CylonJS “esperanto” des things

Programmer les Things

ARDrone

Arduino



Arduino YUN

Audio

Beaglebone Black

Bebop

BLE

Bluetooth SMART

Crazyflie

Digispark

Imp

electric imp

Intel Galileo

Intel Edison

Intel IoT Analytics

intel

Joystick

Keyboard

Leap Motion

M2X

M2X

MiP

MQTT

MQTT

Nest

Neurosky

Ollie

OpenCV

Pebble

Philips Hue

Pinoccio

PowerUp

Rapiro

Raspberry Pi

Salesforce

Skynet

SKYNET

Spark

Speech

Sphero

Tessel

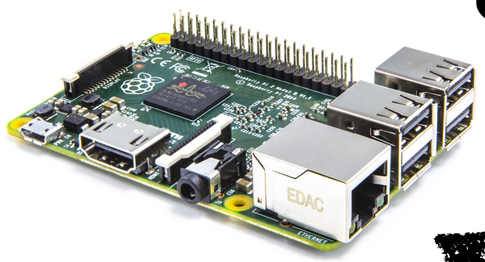
WICED Sense

Rolling Spider + RPI

+ Node-RED

Bluetooth 4.0

Gateway



WiFi

Messages MQTT Broker
SKYNET

SSH

Client BLE / Rolling-Spider
Client MQTT

Vous
Client Node-RED

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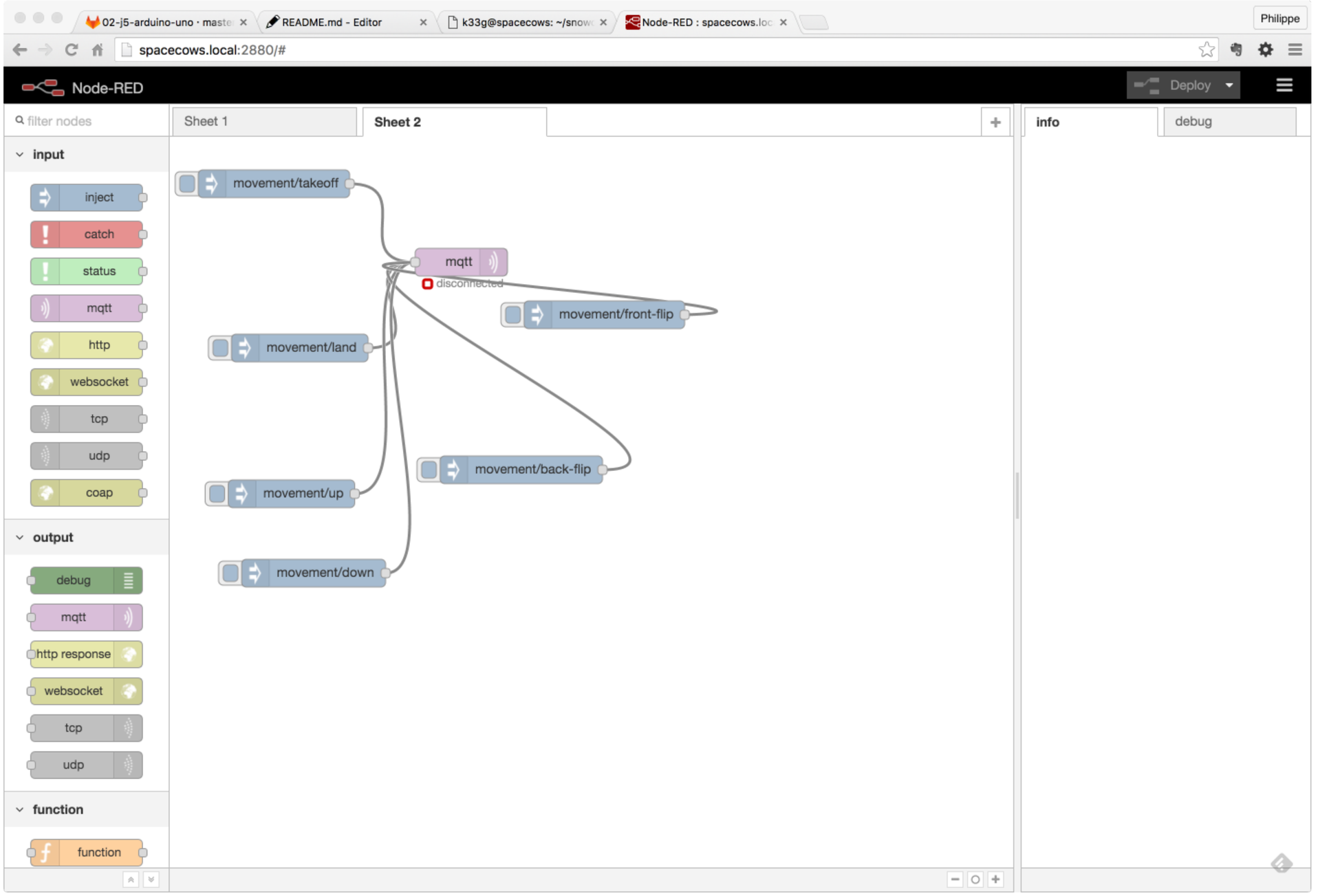
“exercice 05”

Exercice 05

- Etudier le client MQTT (drone.js) qui va être lancé sur le Raspberry-PI
- Préparer un projet Node-RED pour envoyer des commandes de pilotage pour le drone
- **Pas tous en même temps!** 
- cf README.md dans /exos/05-rolling



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Il n'y a pas que MQTT ...

Communiquer

COAP
Constrained Application Protocol

CoAP

“Protocole d’applications contraintes”

Un protocole RESTful:

Request/Response

GET, POST, PUT, DELETE

Pensé pour les réseaux LoWPAN

(Low-Power Wireless Personal Area Network)

= Réseaux de toutes petites machines

Messages légers pour des devices très simples

Le serveur est “sur” le hub ou l’objet connecté

(tout dépend les possibilités de l’objet)

CoAP

Un client interroge des ressources

GET /status/led/red

POST /control/switchon/red

Couches de transport alternatives

coap+sms://00660922111/sensors/temp-bedroom

CoAP

mcollina / **node-coap**

Watch 24 | Star 129 | Fork 33

CoAP - Node.js style

279 commits | **2** branches | **33** releases | **11** contributors

Branch: **master** | **node-coap** / +

server emits "close" when closed

boneskull authored on Aug 7 — latest commit `e38200e822`

examples	Add an example of proxy working	5 months ago
lib	server emits "close" when closed	a month ago
test	server emits "close" when closed	a month ago

Code
Issues 20
Pull requests 2
Wiki
Pulse
Graphs

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“exercice 06”

Exercice 05

- Etudier la simulation spacecows.groovy
- Ecrire le code JavaScript permettant de se connecter à une ressource particulière et en récupérer les données
- cf README.md dans /exos/06-coap

“exercice 06 - corrections”

CoAP

```
var coap = require('coap');
var bl = require('bl');

setInterval(function(){

  var requestToCoapGateway   = coap.request('coap://skynet.local:5715/Slate');

  requestToCoapGateway.on('response', function(res) {
    res.pipe(bl(function(err, data) {
      if(err) {}
      var json = JSON.parse(data);
      console.log(json);
    }));
  });
  requestToCoapGateway.end();

}, 1000);
```

Merci :)

Questions?