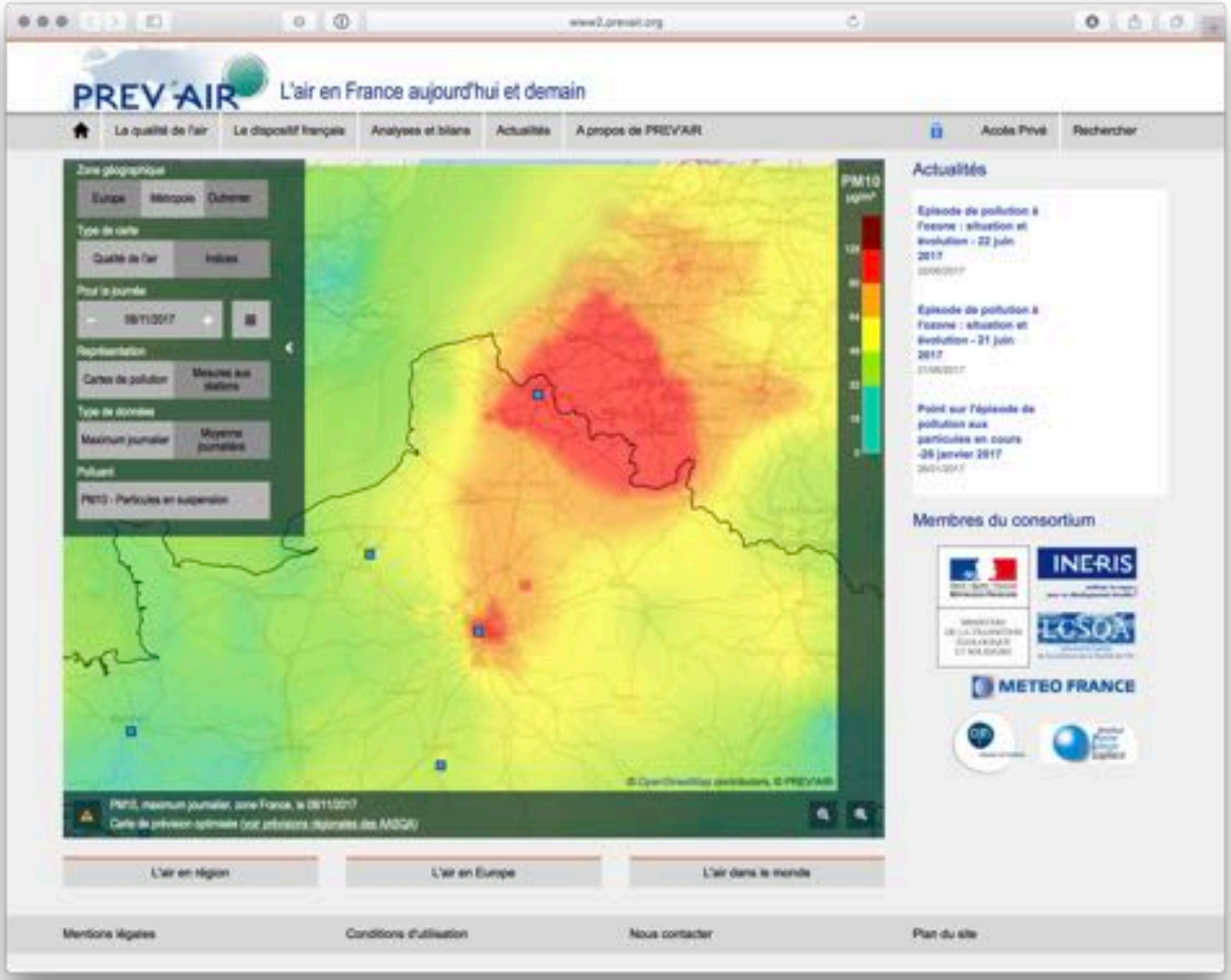
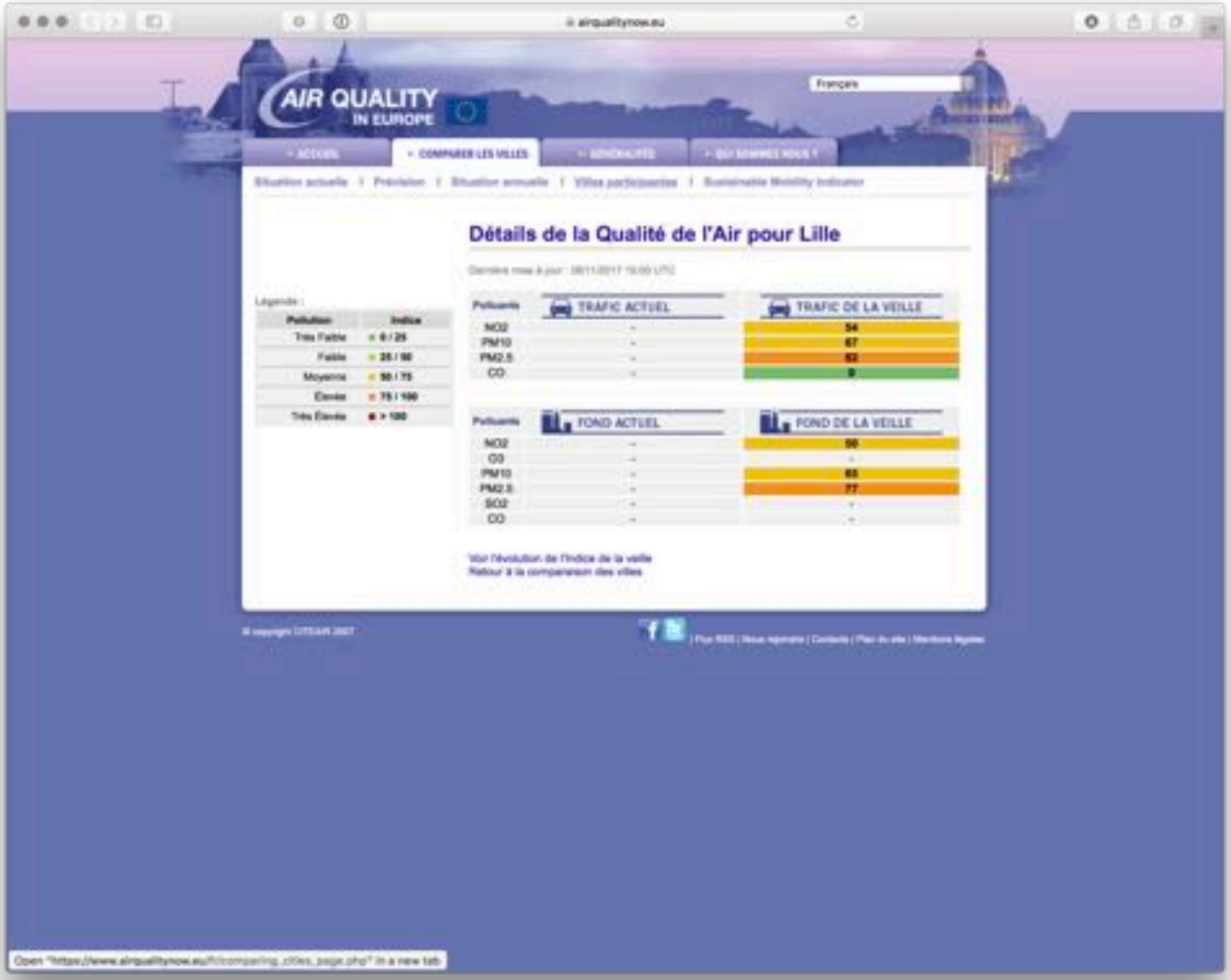
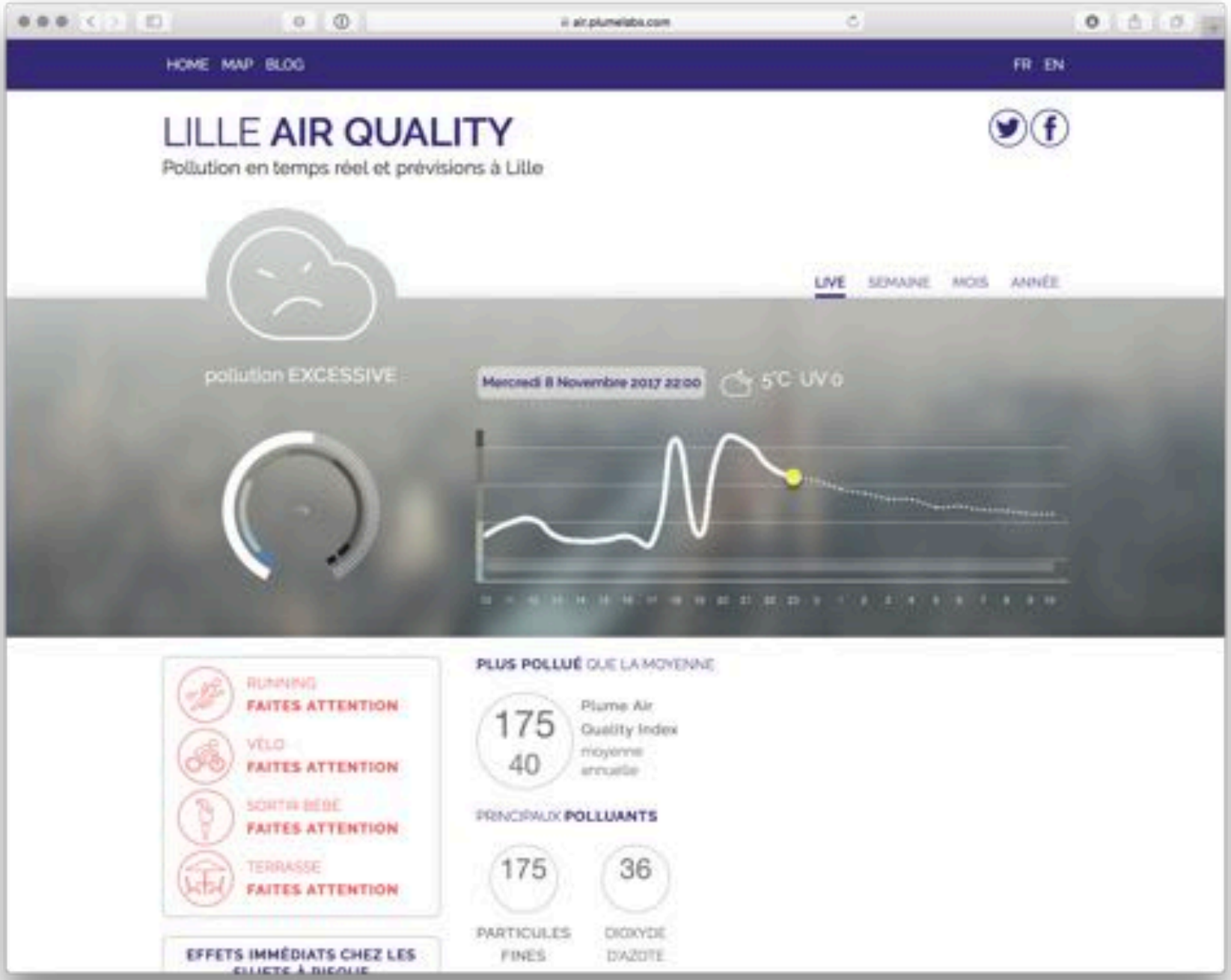
Mobile Crowd Sensing made easy!

Vers une gestion agile des grandes masses de données issues des capteurs environnementaux

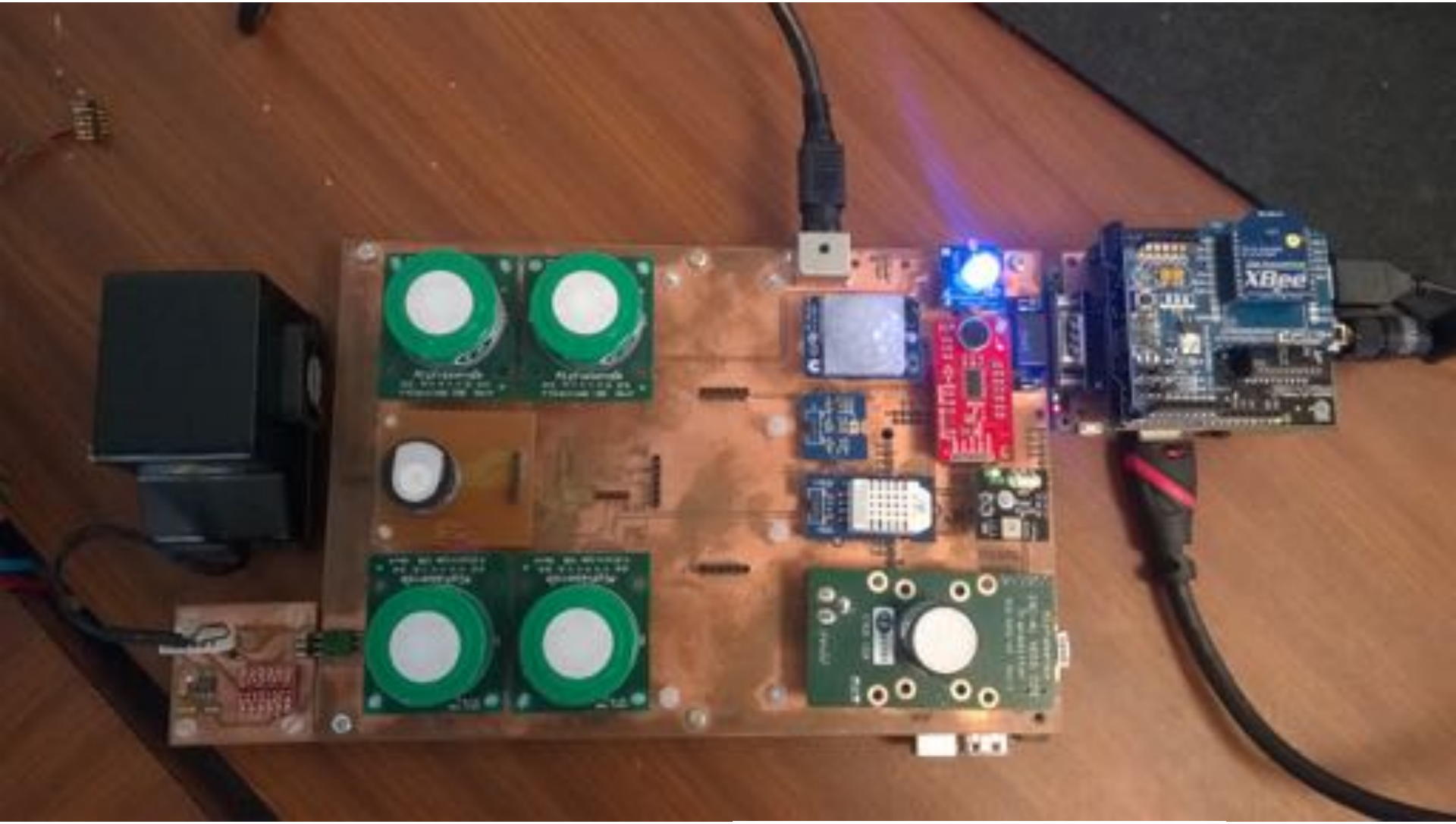
@RomainRouvoy


PREV'AIR
L'air en France aujourd'hui et demain
La qualité de l'air
Le dispositif français
Analyses et bilans
Actualités
A propos de PREV'AIR
Accès Privé
Rechercher
Zone géographique
Europe
Métropole
Outremer
Type de carte
Qualité de l'air
Indices
Pour la journée
08/11/2017
Représentation
Cartes de pollution
Mesures aux stations
Type de données
Maximum journalier
Moyenne journalière
Polluant
PM10 - Particules en suspension
PM10
PM10, maximum journalier, zone France, le 08/11/2017
Carte de prévision optimale (voir prévisions régionales des AASQA)
L'air en région
L'air en Europe
L'air dans le monde
Actualités
Episode de pollution à l'ozone : situation et évolution - 22 juin 2017
Episode de pollution à l'ozone : situation et évolution - 21 juin 2017
Point sur l'épisode de pollution aux particules en cours -26 janvier 2017
Membres du consortium
INERIS
METEO FRANCE
Mentions légales
Conditions d'utilisation
Nous contacter
Plan du site


airqualitynow.eu
AIR QUALITY
IN EUROPE
Français
ACCUEIL
COMPARER LES VILLES
QUI SOMMES NOUS ?
Détails de la Qualité de l'Air pour Lille
Légende :
Pollution
Indice
Très Faible
0 / 25
Faible
25 / 50
Moyenne
50 / 75
Elevée
75 / 100
Très Elevée
> 100
Polluants
TRAFIC ACTUEL
TRAFIC DE LA VEILLE
NO2
PM10
PM2.5
CO
54
67
83
0
Polluants
FOND ACTUEL
FOND DE LA VEILLE
NO2
CO
PM10
PM2.5
SO2
CO
50
65
77
Voir l'évolution de l'indice de la veille
Retour à la comparaison des villes
Open "https://www.airqualitynow.eu/fr/comparing_cities_page.php" in a new tab


air.plumelabs.com
HOME MAP BLOG
FR EN
LILLE AIR QUALITY
Pollution en temps réel et prévisions à Lille
LIVE SEMAINE MOIS ANNÉE
pollution EXCESSIVE
Mercredi 8 Novembre 2017 22:00
5°C UV 0
RUNNING
FAITES ATTENTION
VÉLO
FAITES ATTENTION
SORTIR BÉBÉ
FAITES ATTENTION
TERRASSE
FAITES ATTENTION
EFFETS IMMÉDIATS CHEZ LES
PLUS POLLUÉ QUE LA MOYENNE
175
40
Plume Air
Quality Index
moyenne
annuelle
PRINCIPAUX POLLUANTS
175
PARTICULES
FINES
36
DIOXYDE
D'AZOTE


CITOYENS
CAPTEURS



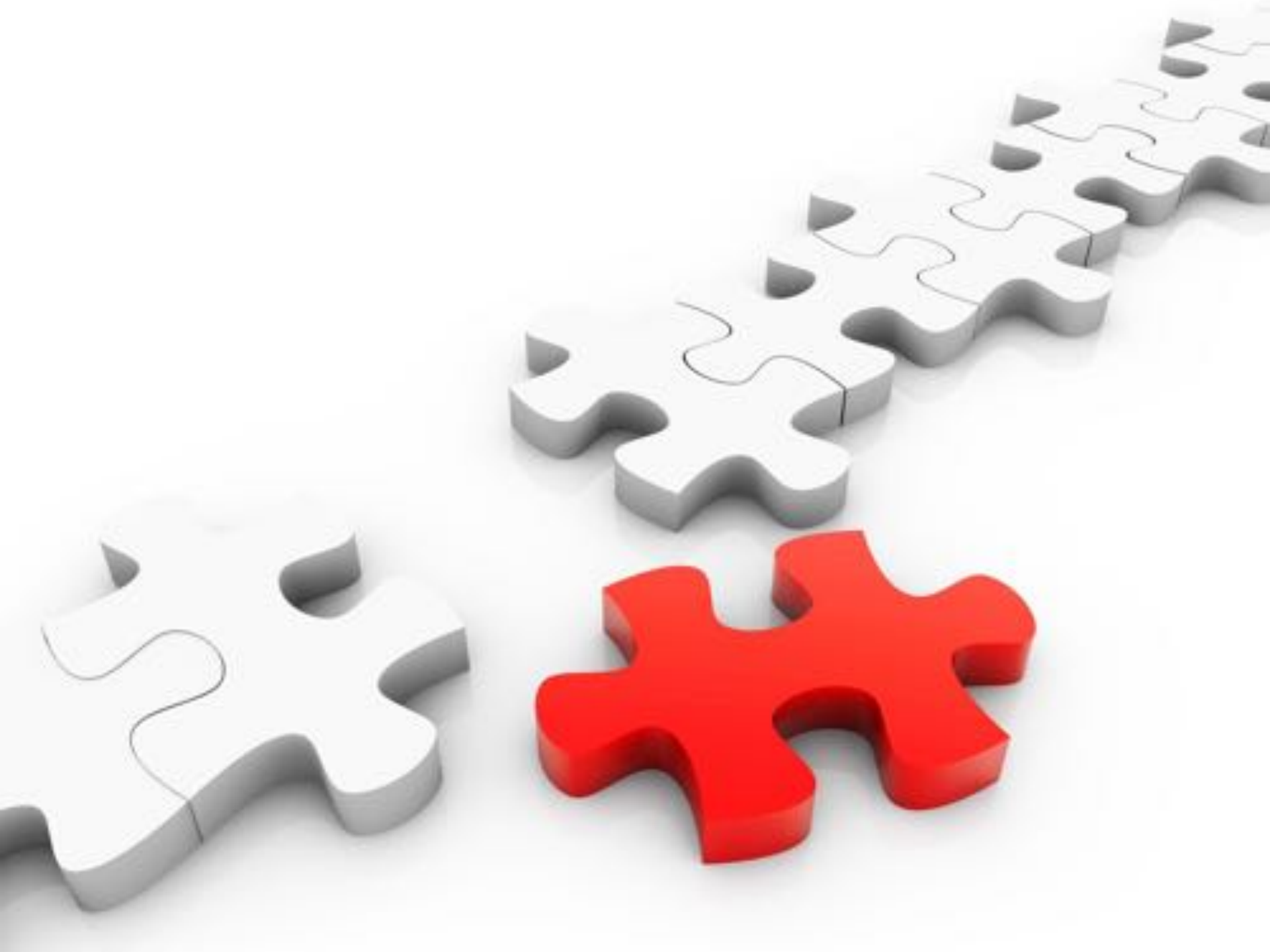
IRCICA Research Institute

PC2A


UNIVERSITÉ
DU LITTORAL
CÔTE D'OPALE

UNIVERSITÉ DU LITTORAL CÔTE D'OPALE


Apoline - Bureau 108
Concentration CO2
1207 ppm
Temperature Sensor
31 °C
Bureau 108 PC2A
ADD ROW




transparency
Android
scalability
platform
ubiquitous
activity
security
location
privacy
rewards
Big Data
STB
data
pervasive
awareness
network
energy
ranking
crowd
sensitization
security
cloud
privacy
open
sensing
STB
location
network
Big Data
cloud
mobile
signal
log
physics
GPS
human
iOS
participants
transparency
noise
devices
incentives
feedback
middleware
log
SaaS
prediction
physics
ranking
battery
GPS
sensors
governance
noise
data
signal
incentives
rewards
scalability
software
visualisation
devices
smartphone
phone
energy
deployment
recruitment

apisense

Mobile Crowd Sensing made easy!

https://apisense.io

Crowd & sensing

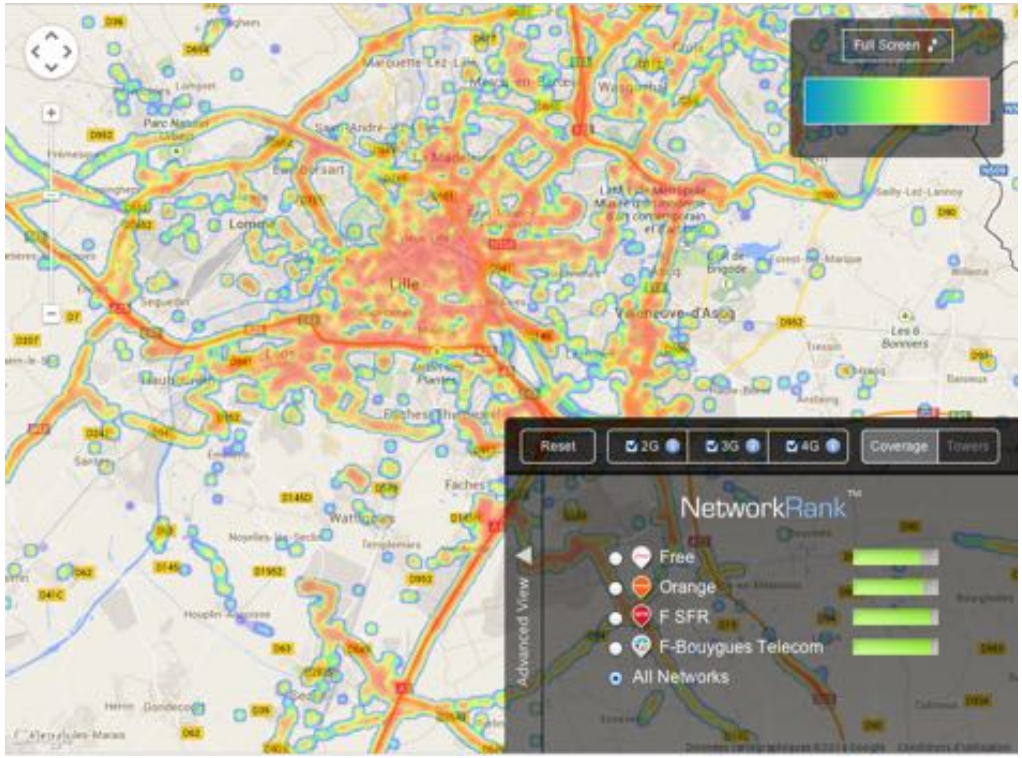
http://www.flickr.com/photos/40006794@N02/7223572802/

Crowd Sensing | kraʊdːsɛnsɪŋ |

*«Capability of lifting a (large) diffuse **group of participants** to delegate the task of retrieving **trustable data** from the field. This includes:*

- **Participatory sensing** *involves the user in the sensing task (eg. surveys)*
- **Opportunistic sensing** *uses mobile sensors carried by the user (eg. Smartphones)»*

Applications to data visualisation



source: http://opensignal.com

Applications to IoT monitoring

source: http://goo.gl/xw8huo

Applications to crowdsourcing

source: http://fr.clicandwalk.com


Location
Usage
Movement
Proximity
Bluetooth
External device
Media
Capture
Many more
SDK/API support
task
result
APISENSE®
Hive Service
APISENSE®
Mobile App
data
APISENSE® Honeycomb Service
(Cloud ready)
Visualizations
Reports
Notifications
Other
applications
INPUT
PLATFORM
OUTPUT

INPUT | PLATFORM | OUTPUT

mongoDB.

influxdb

elasticsearch

Spark

hadoop

jupyter

MEAN

Grafana

kibana

GREY CAT

apisense

Documentation Feedback Contact

Collect data easily with crowds of mobile phone sensors. Make sense and innovate on top of real world data feedback, in real time!

Login

Register

Spirals

••••••••••

Login

Forgot password?

Tweets by @APISENSE

APISENSE

KevinL59 just published a collect called data-airflow-test2 ! Contribute with Bee at

APISENSE

KevinL59 just published a collect called data-mobility-test !Contribute with Bee at

APISENSE

Embed View on Twitter

Google Play App Store

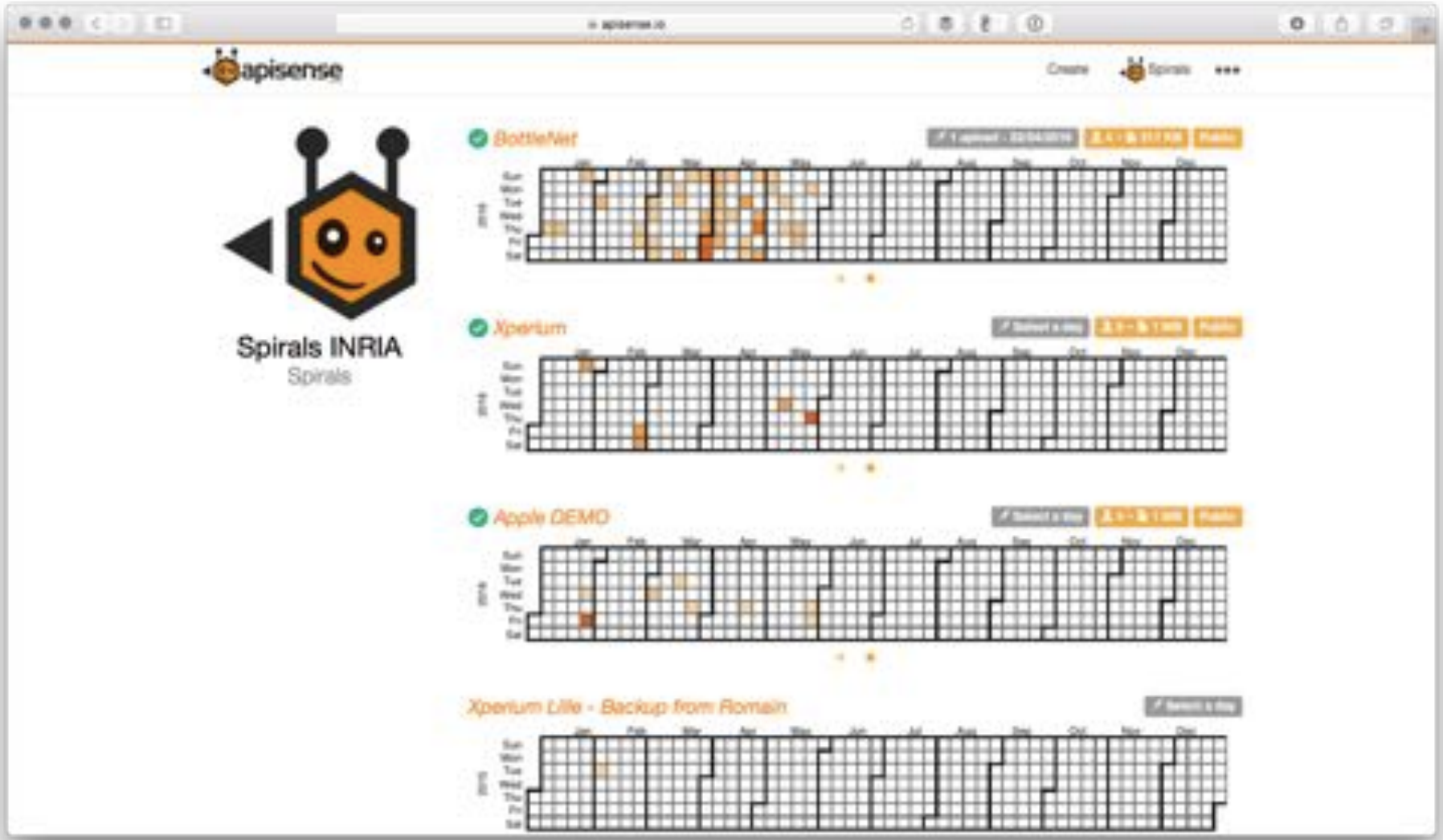
How does it work?

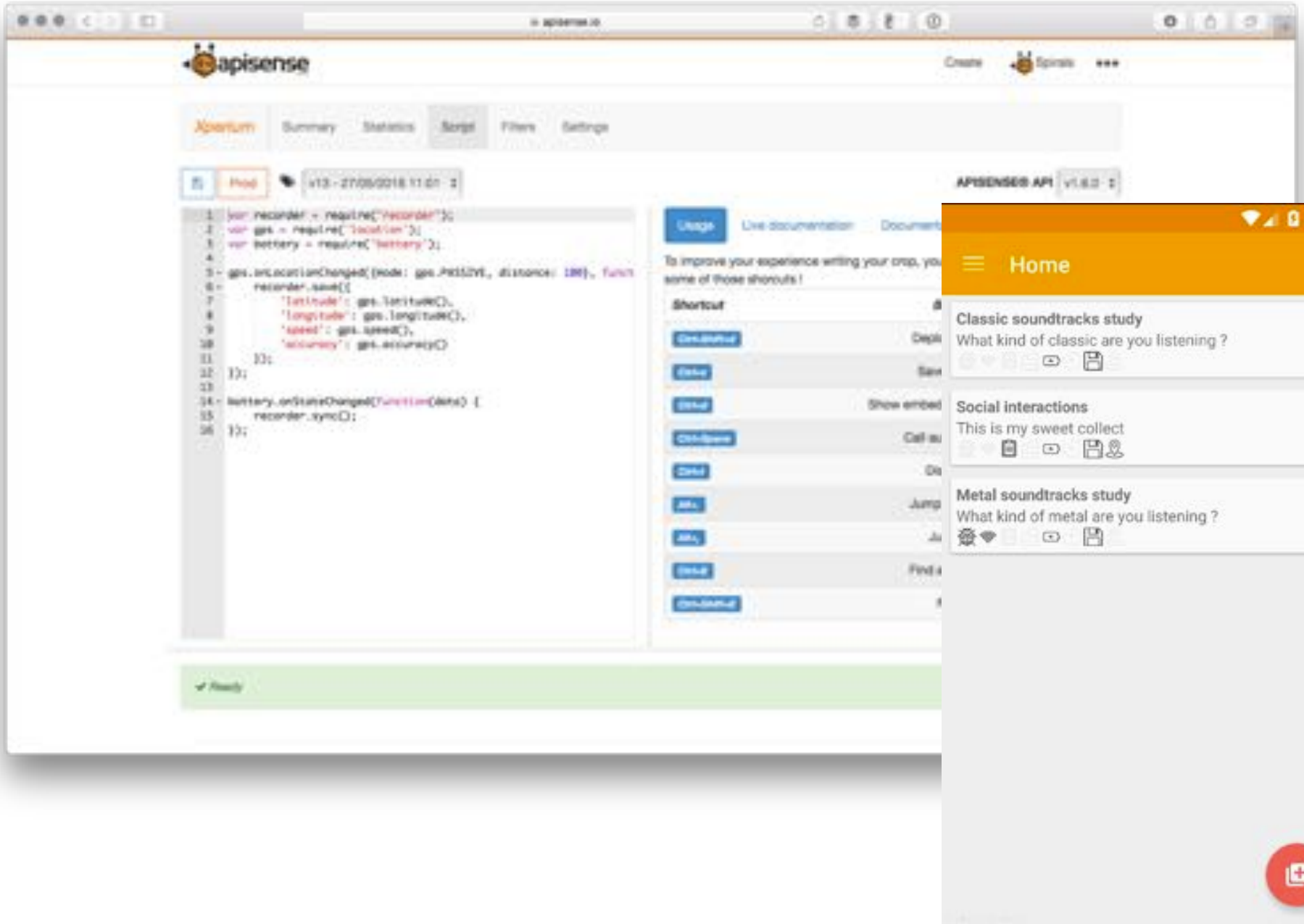
How does it work?

Privacy & Energy

How does it work?

Privacy & Energy


apisense
Create
Spirals
Spirals INRIA
Spirals
BottleNet
Xperium
Apple DEMO
Xperium Lille - Backup from Romain


apisense
Create
Spirals
Aparium
Summary
Statistics
Script
Filters
Settings
Prod
APISENSE® API
Usage
Live documentation
Shortcut
8:33
Home
Classic soundtracks study
What kind of classic are you listening ?
Social interactions
This is my sweet collect
Metal soundtracks study
What kind of metal are you listening ?

Device-level Sensing Task

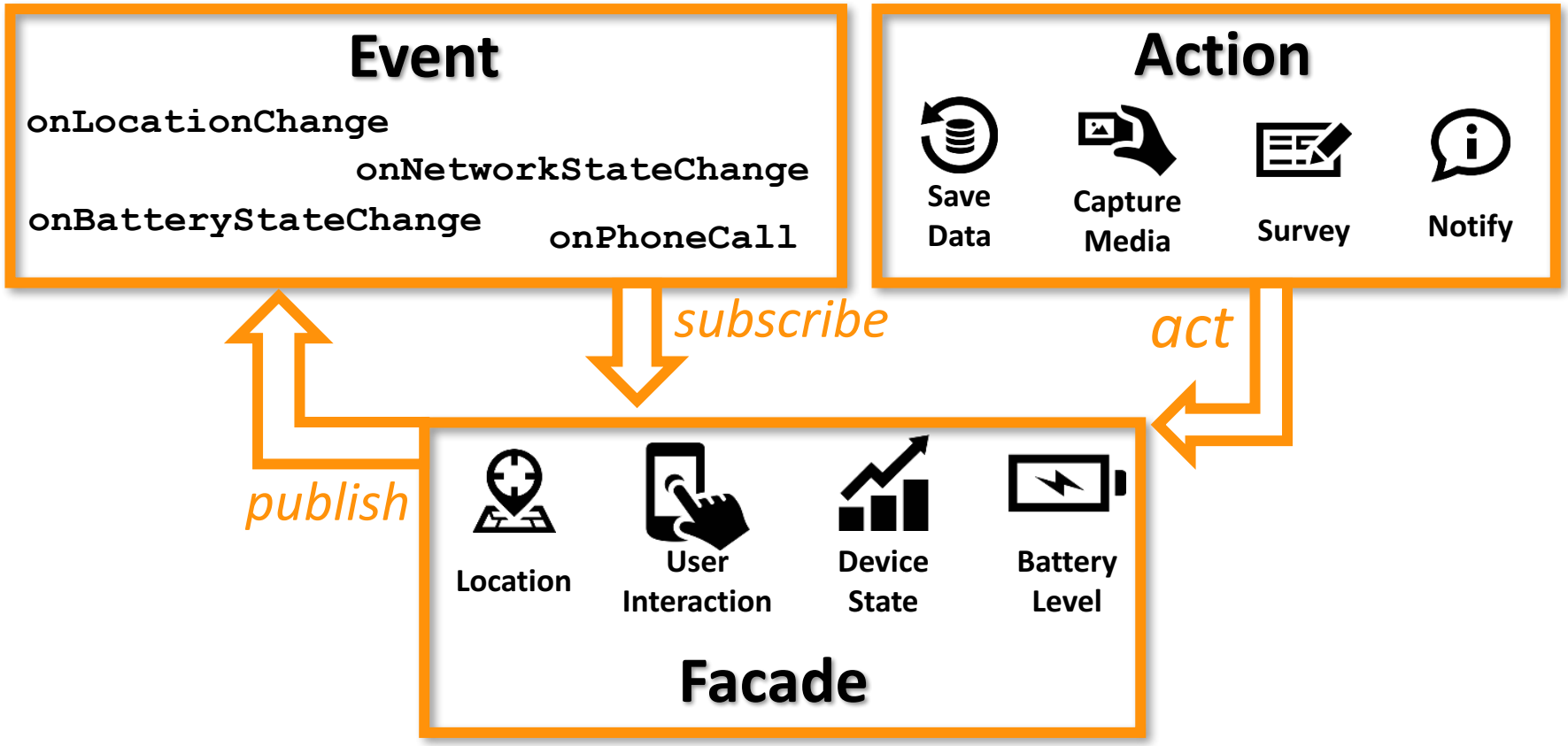
Façades

Event listener

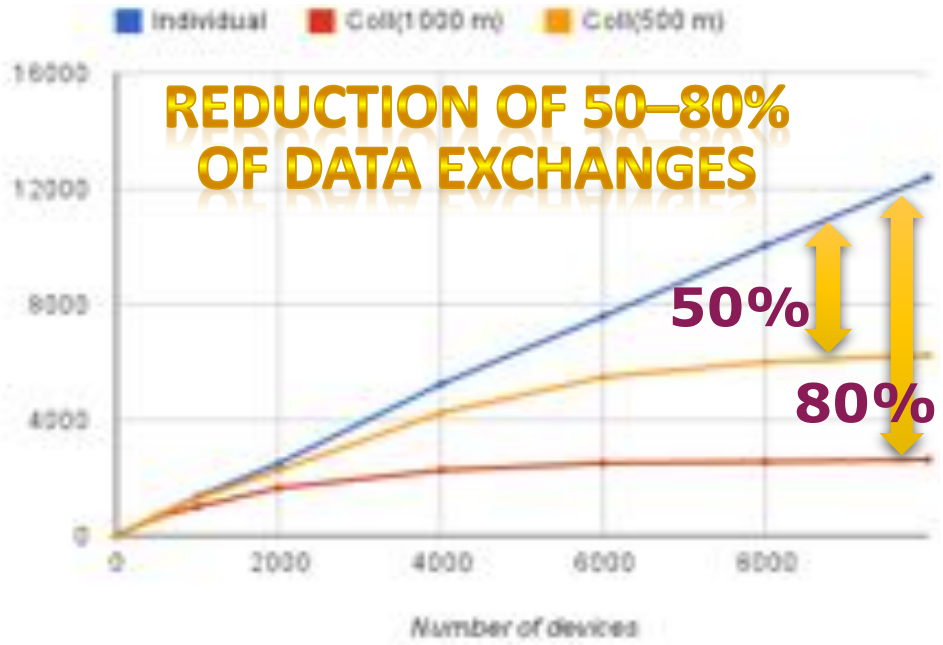
Data upload

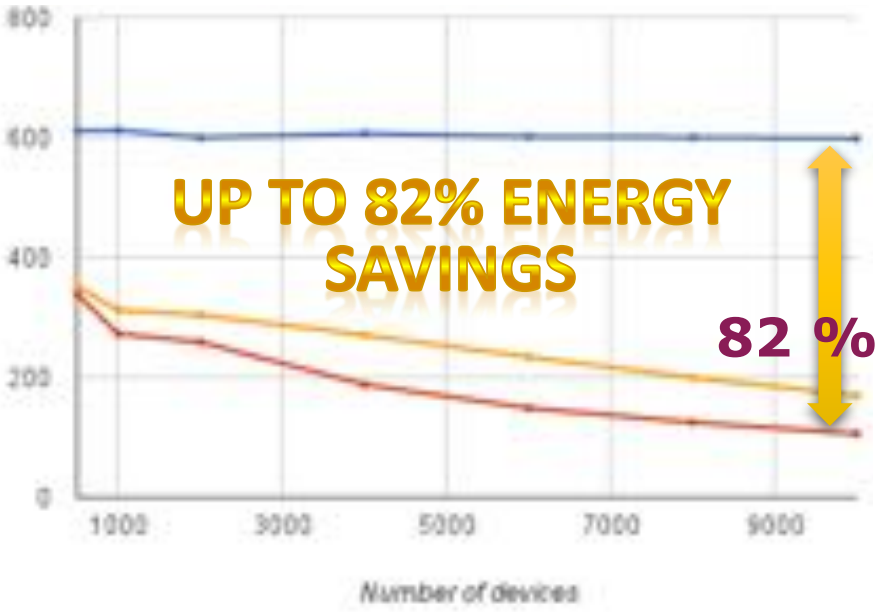
```
var location = requires('location');
var trace = requires('honeycomb');
var telephony = requires('gsm');

location.onLocationChange(function(event){

    trace.sync({
        lat : event.latitude,
        lng : event.longitude,
        signal : telephony.signalStrength()
    });
});
```

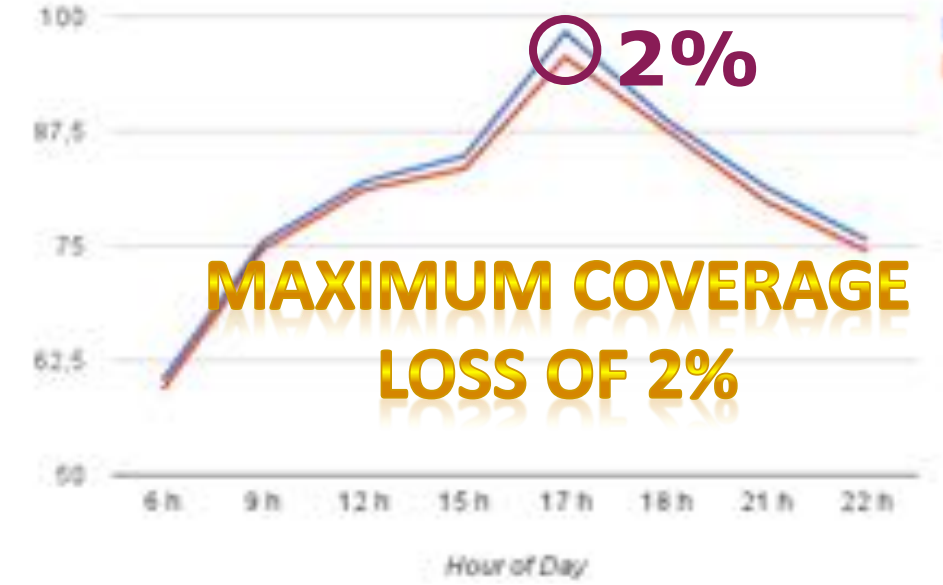
Device-level Sensing Task



Evaluation of APISENSE®







	W/B-Scanner opportunist	Citizen journalist participative
APISENSE®	**4**	**9**
Anonysense	5	N/A
Pogo	4	N/A
MyExperience	N/A	27
Medusa	N/A	45
PRISM	??	330


UNO
ARDUINO
DOWNLOAD THE NEW IDE
FROM ARDUINO.ORG
ARDUINO
YUN

android things

Espruino

Romain.Rouvoy@inria.fr

Book chapters

A Cloud-based Infrastructure for Crowdsourcing Data from Mobile Devices. N. Haderer, F. Paraiso, C. Ribeiro, P. Merle, R. Rouvoy, L. Seinturier. Cloud-based Software Crowdsourcing, Springer, 2014

Workshops

A preliminary investigation of user incentives to leverage crowdsensing activities. N.Haderer, R. Rouvoy and L. Seinturier. 2nd International IEEE PerCom Workshop on Hot Topics in Pervasive Computing (PerHot) (2013), pp. 199-204.

Towards Multi-Cloud Configurations Using Feature Models and Ontologies. C. Quinton, N. Haderer, R. Rouvoy and L. Duchien. 1st International Workshop on Multi-Cloud Applications and Federated Clouds (Multi-Cloud'13). April 2013, pp. 21-26.

Conferences

Dynamic Deployment of Sensing Experiments in the Wild Using Smartphones. N. Haderer, R. Rouvoy and L. Seinturier. 13th International IFIP 16 Conference on Distributed Applications and Interoperable Systems (DAIS), pages 43-56.

A Federated Multi-Cloud PaaS Infrastructure. Fawaz Paraiso, Nicolas Haderer, Phi- lippe Merle, Romain Rouvoy, Lionel Seinturier. In 5th IEEE International Conference on Cloud Computing (2012), pages 392-399.

Dissemination

APISENSE : Crowd-Sensing Made Easy. Nicolas Haderer, Romain Rouvoy, Christophe Ribeiro, Lionel Seinturier. ERCIM News, ERCIM, 2013, Special theme : Mobile Computing, 93, pp. 28-29.

Smartphones, mobile PCs, tablets and mobile routers with cellular connection

700 million mobile PCs, tablets and mobile router subscriptions

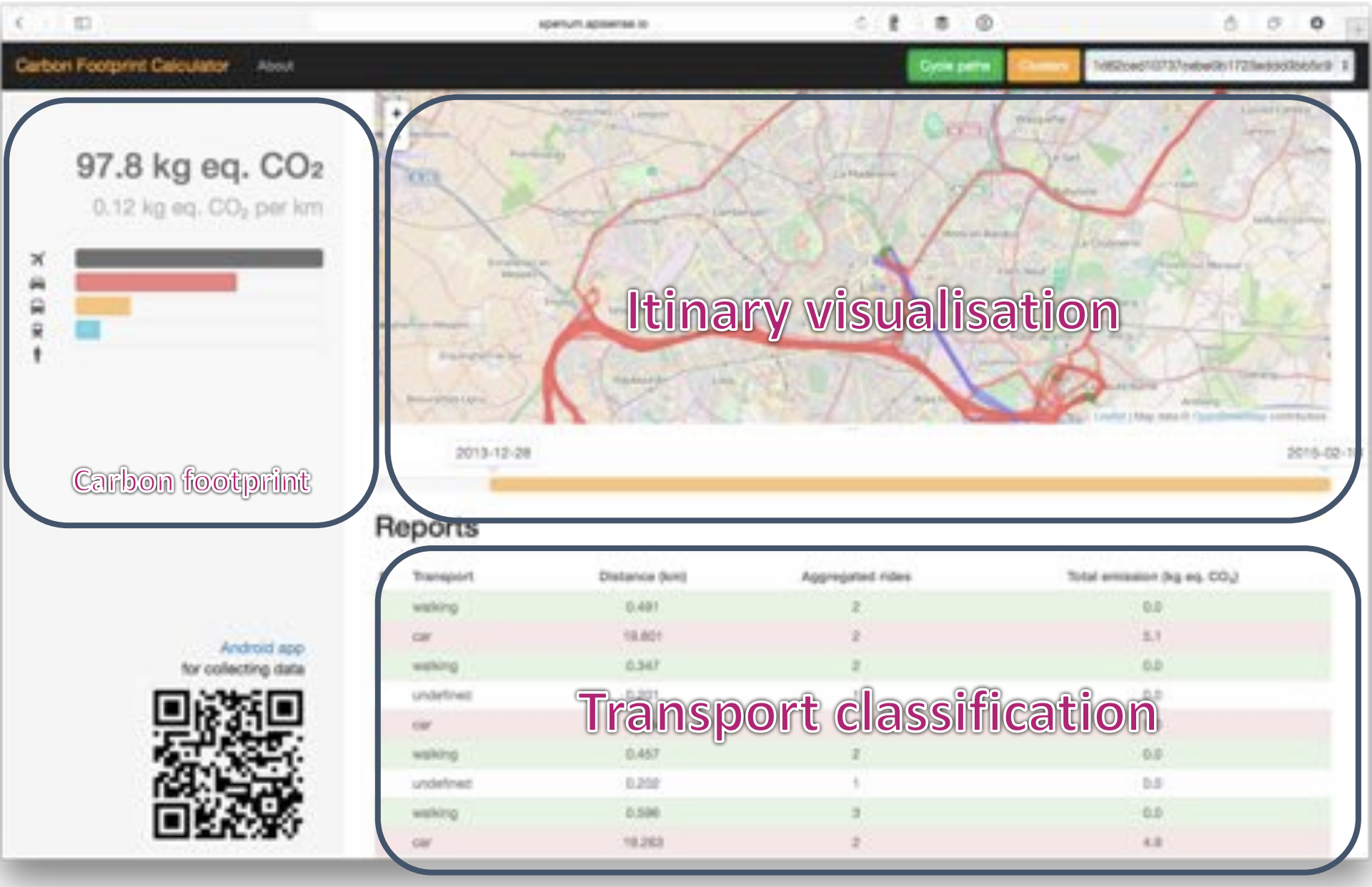
5.6 BILLION

smartphone subscriptions by the end of 2019

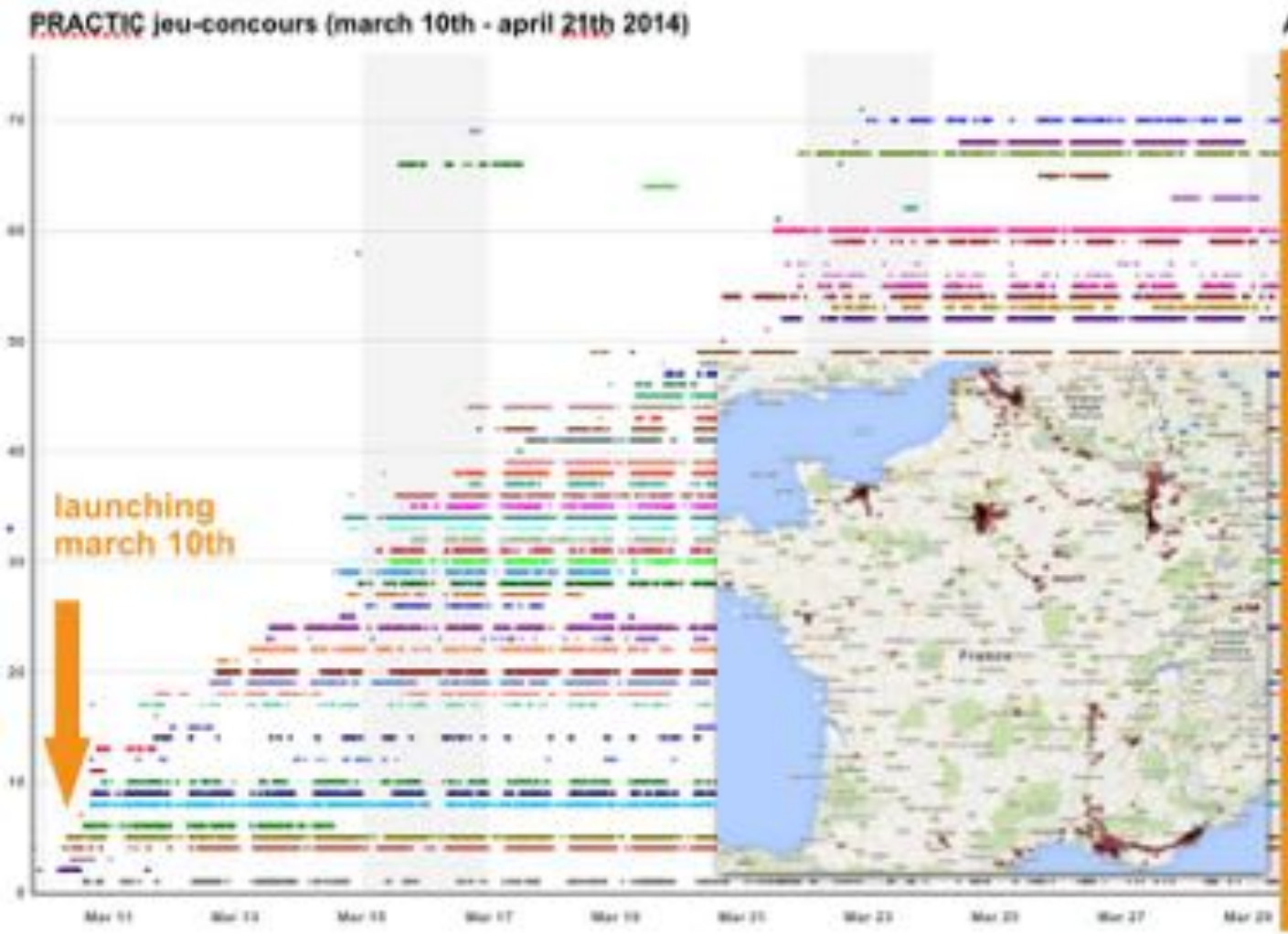
Mobile PCs, tablets and mobile router subscriptions

Smartphone subscriptions

Xperium : Mobility Analysis



PRACTIC : Human Analysis

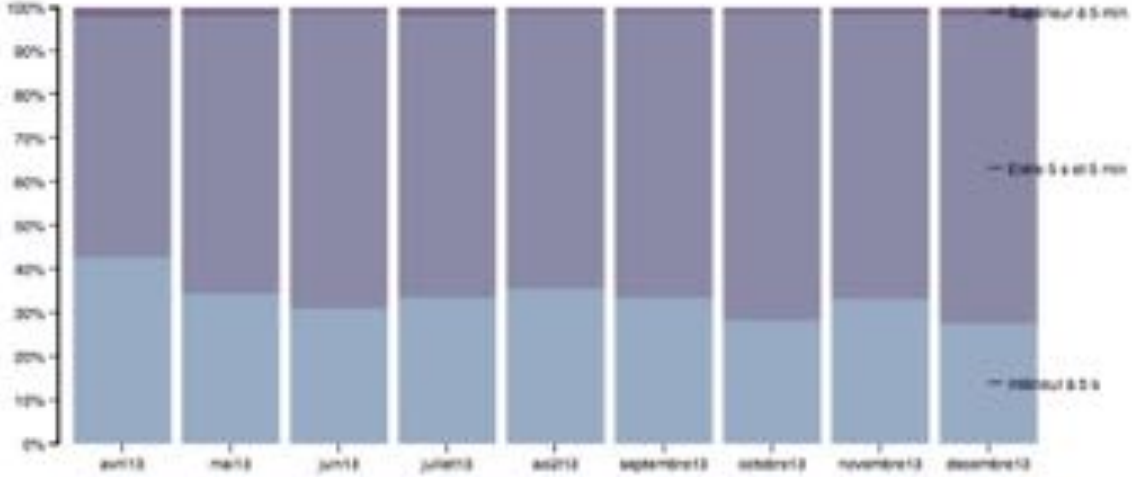


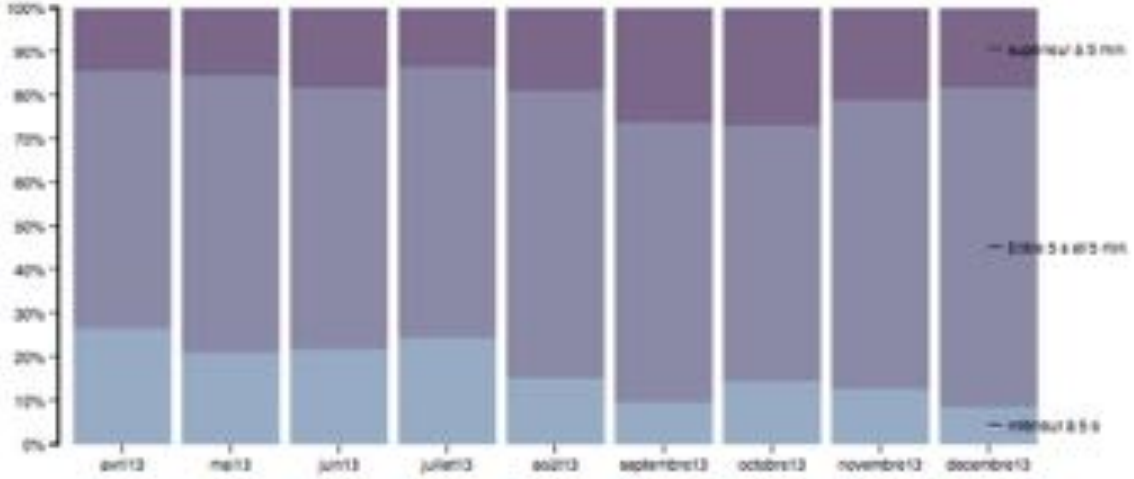
All Campaigns (except Caen)

112 371 of data	or 39 days of data per user (average)
97 volunteers	Of which : - 64 % male - 80 % age under 30 - 73 % single - 35% income < 1500€/m.
68 % of students	Of which : - 43% Computer Sc./ ingeneers - 22% Communication
14 device brands	Of which : - 41% Samsung - 24% LGE - 12%Sony
48 device models	Of which : - 12% LGE Nexus 5
13 telecom operators	Of which : - 77% Free, Orange, Bouygues and SFR; - 12% unknown
14 Android versions	Of which : 26% in 4.4.2

Frequency and duration of sessions on a smartphone and a tablet

(occurrences of the number of sessions according to 3 levels of duration)





Jeu de données d'un smartphone

Première donnée le 19 avril 2013

- Avril : 2371 sessions sur 12 jours
- Mai : 3579 sessions sur 25 jours
- Juin : 1000 sessions sur 4 jours
- Juillet : 7090 sessions sur 31 jours
- Août : 5507 sessions sur 29 jours
- Septembre : 8304 sessions sur 30 jours
- Octobre : 8188 sessions sur 31 jours
- Novembre : 6287 sessions sur 30 jours
- Décembre : 4867 sessions sur 26 jours

Soit une présence de 218 jours sur 257 (84.82%) pour 47193 sessions

Moyenne par jour : 216.5 sessions

Ecart-type par jour : 89.03

Jeu de données d'une tablette

Première donnée le 11 avril 2013

- Avril : 561 sessions sur 16 jours
- Mai : 824 sessions sur 29 jours
- Juin : 513 sessions sur 27 jours
- Juillet : 688 sessions sur 25 jours
- Août : 449 sessions sur 24 jours
- Septembre : 387 sessions sur 29 jours
- Octobre : 288 sessions sur 27 jours
- Novembre : 338 sessions sur 21 jours
- Décembre : 218 sessions sur 26 jours

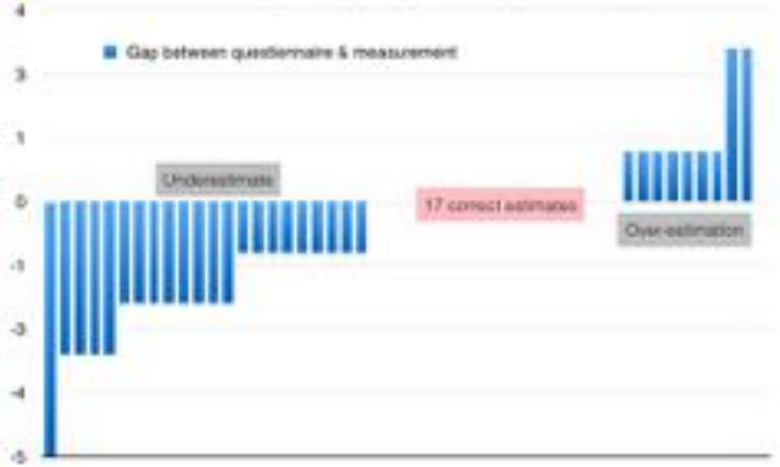
Soit une présence de 224 jours sur 265 (84.5%) pour 4266 sessions

Moyenne par jour : 19 sessions

Ecart-type par jour : 17.34

1

How much time per day do you use your smartphone?

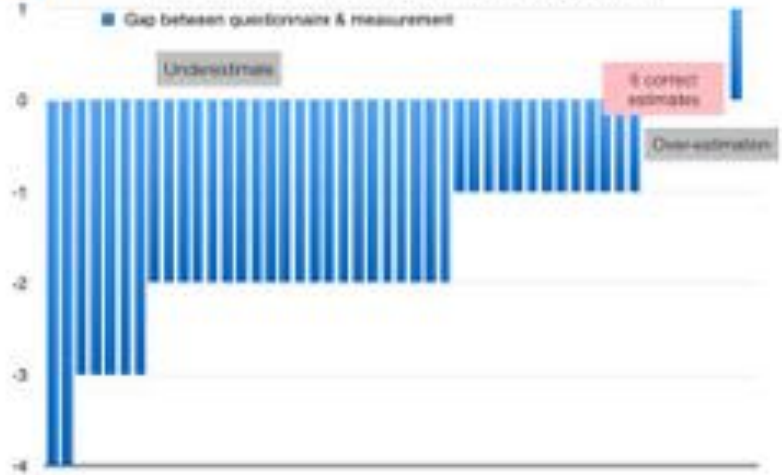


2

How many applications do you use daily?

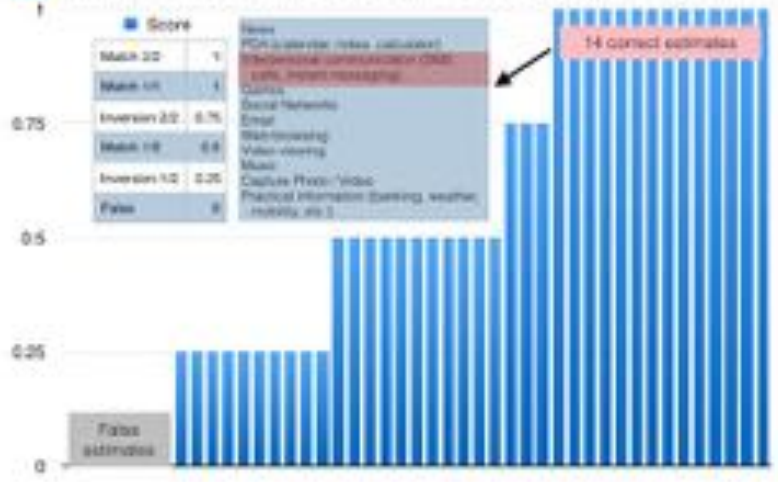
3

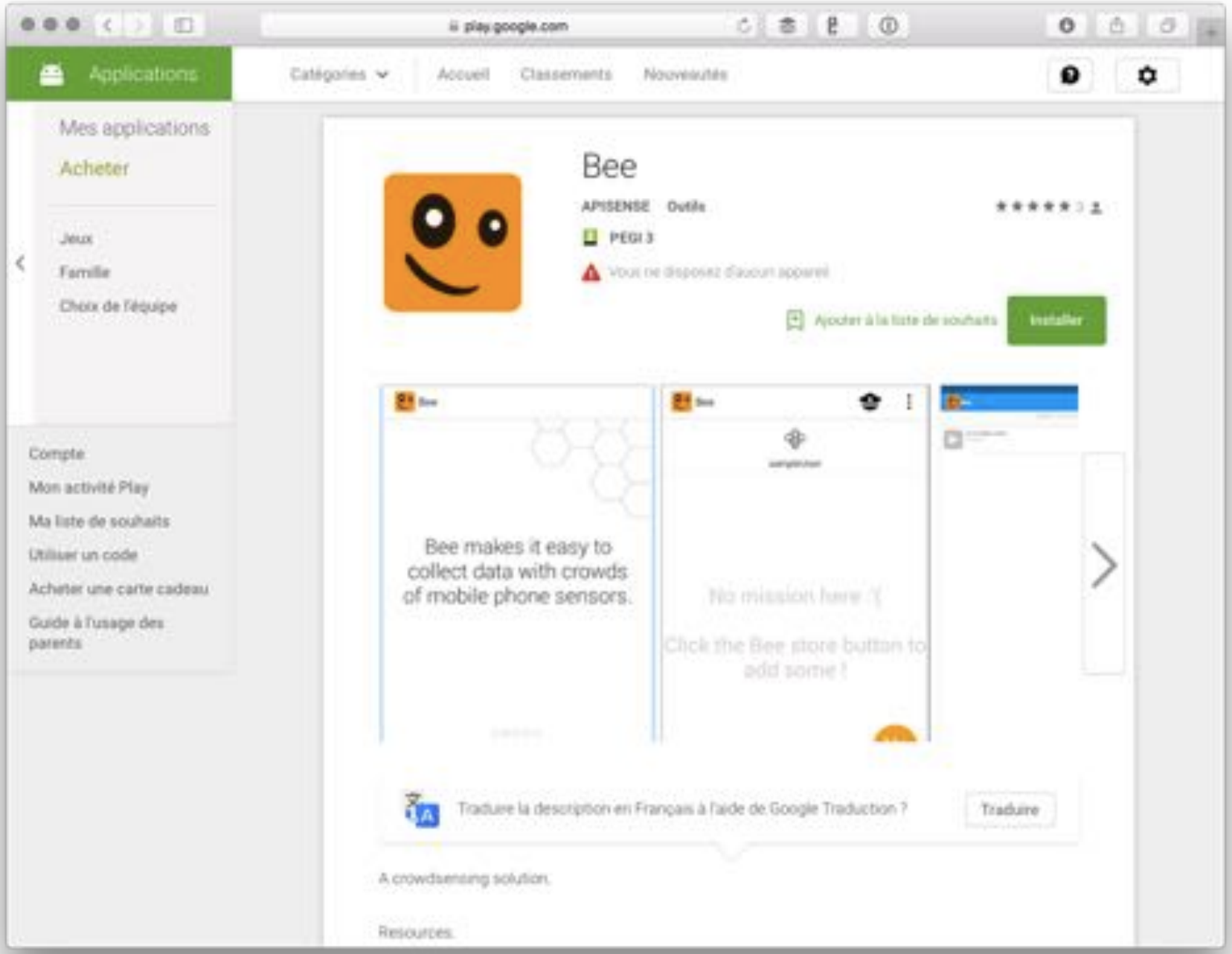
How many applications has your smartphone ?

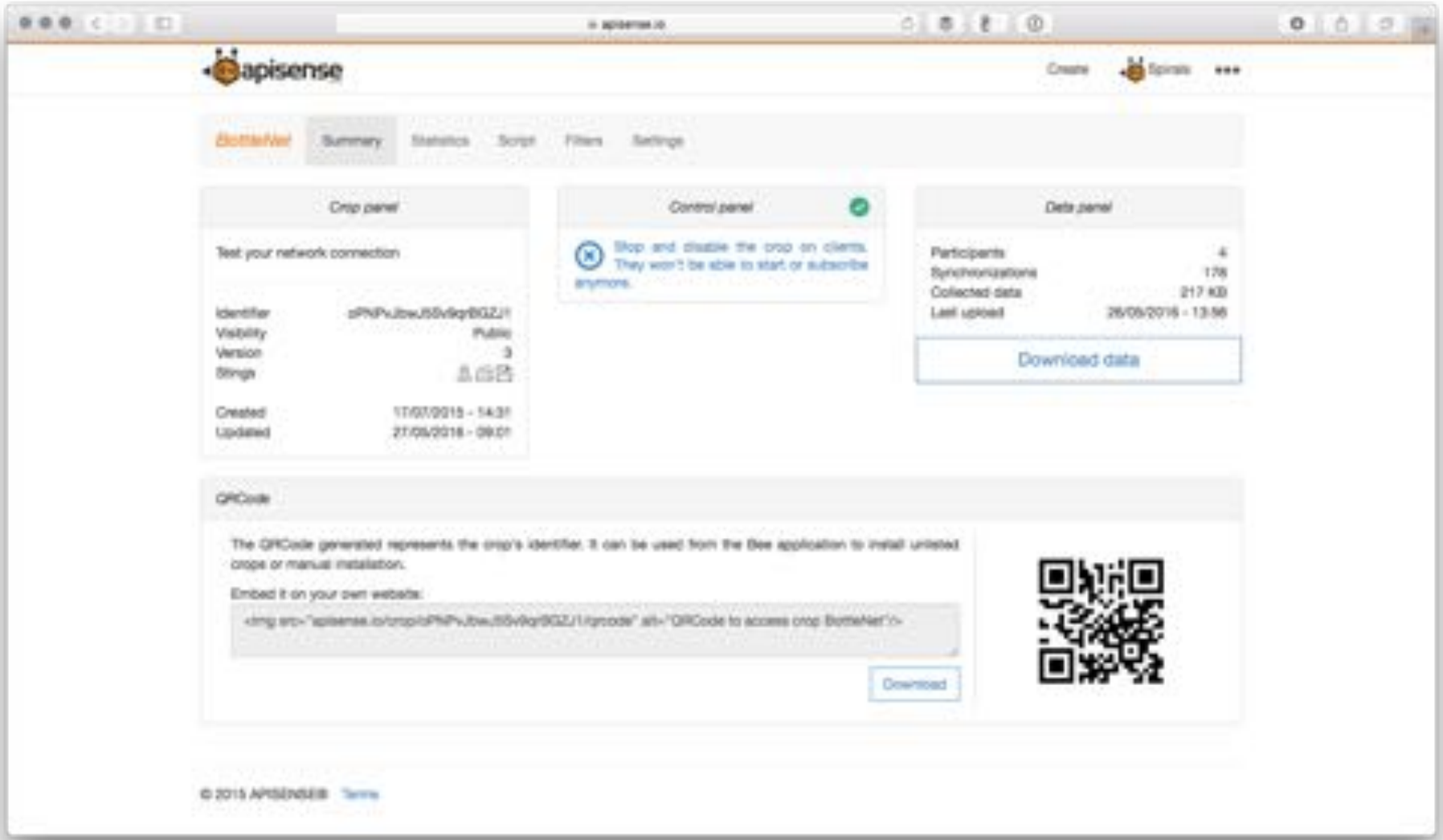


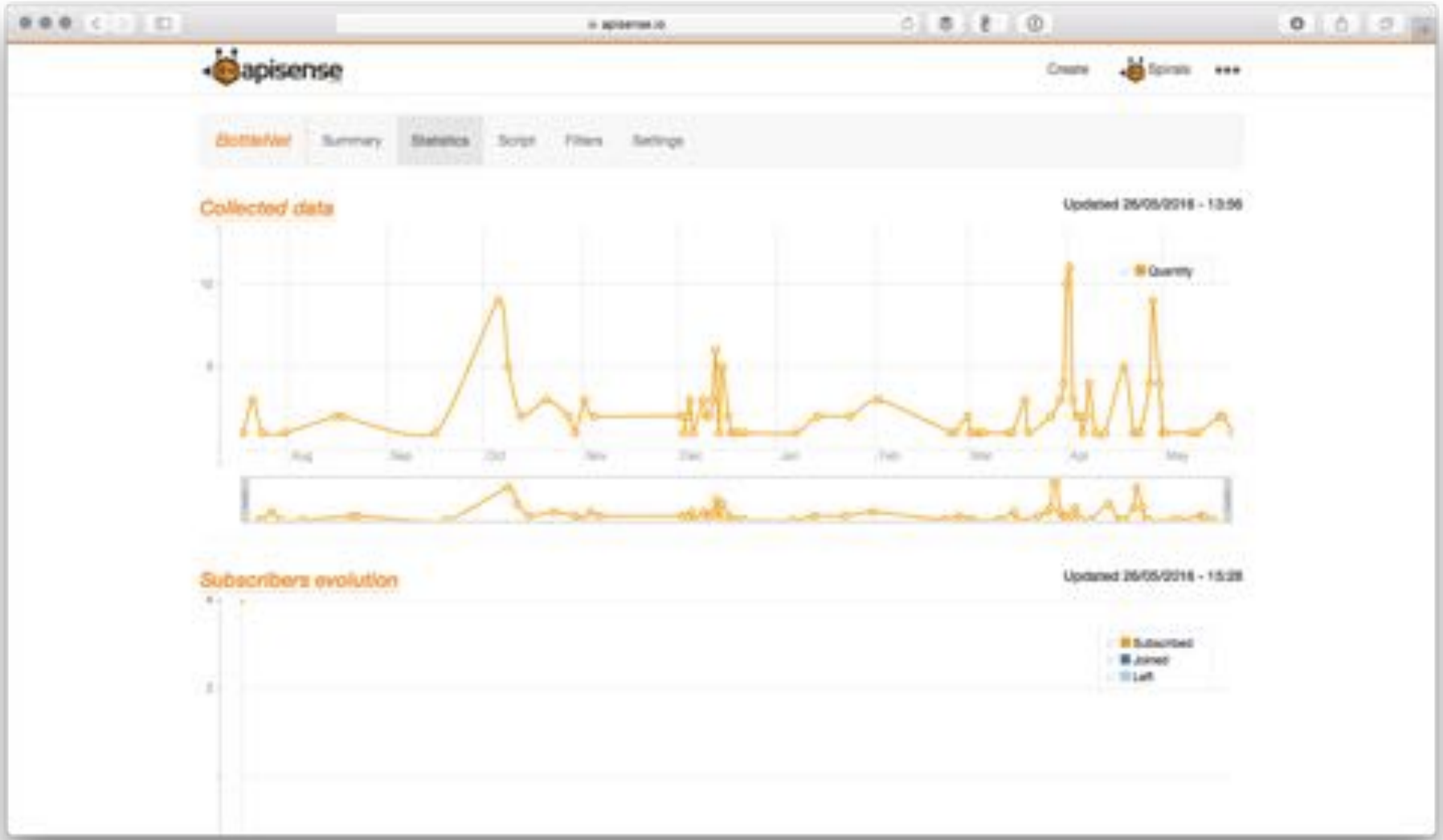
4

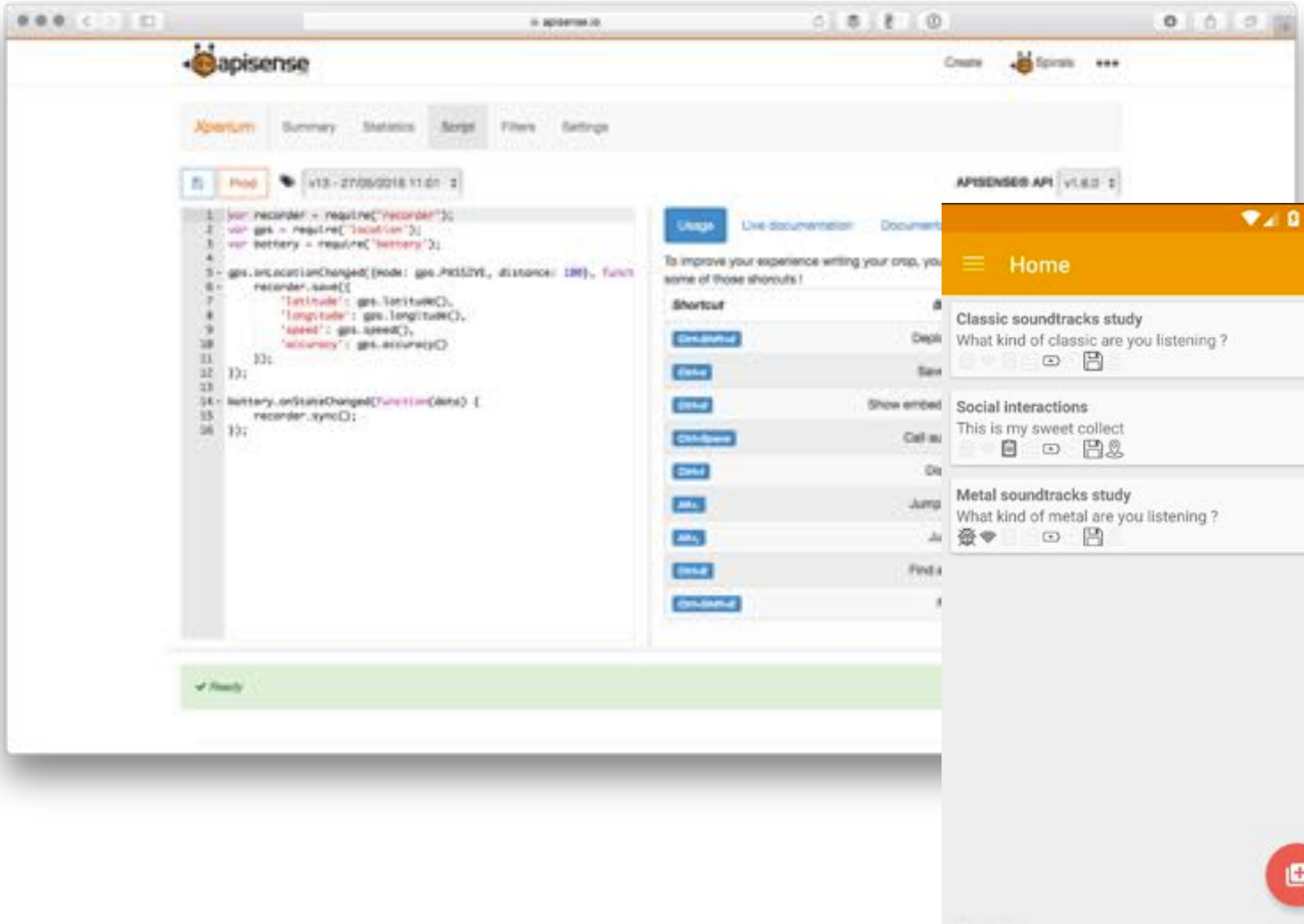
What are the first and second main uses of your smartphone?




play.google.com
Applications
Catégories
Accueil
Classements
Nouveautés
Mes applications
Acheter
Jeux
Famille
Choix de l'équipe
Compte
Mon activité Play
Ma liste de souhaits
Utiliser un code
Acheter une carte cadeau
Guide à l'usage des parents
Bee
APISENSE
Outils
PEGI 3
Vous ne disposez d'aucun appareil
Ajouter à la liste de souhaits
Installer
Bee makes it easy to collect data with crowds of mobile phone sensors.
No mission here :(
Click the Bee store button to add some !
Traduire la description en Français à l'aide de Google Traduction ?
Traduire
A crowdsensing solution.
Resources


apisense
Create
Spirals
BottleNet
Summary
Statistics
Script
Filters
Settings
Crop panel
Test your network connection
Identifier
Visibility
Version
Strings
Public
3
Created
17/07/2015 - 14:31
Updated
27/05/2016 - 09:01
Control panel
Stop and disable the crop on clients. They won't be able to start or subscribe anymore.
Data panel
Participants
4
Synchronizations
178
Collected data
217 KB
Last upload
26/05/2016 - 13:56
Download data
QRCode
The QRCode generated represents the crop's identifier. It can be used from the Bee application to install unlisted crops or manual installation.
Embed it on your own website:
Download
© 2015 APISENSE®
Terms


apisense
Create
Spirals
BottleNet
Summary
Statistics
Script
Filters
Settings
Collected data
Updated 26/05/2016 - 13:56
Quantity
Aug
Sep
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Subscribers evolution
Updated 26/05/2016 - 15:28
Subscribed
Joined
Left


apisense
Create
Spirals
Aparium
Summary
Statistics
Script
Filters
Settings
Prod
APISENSE® API
Usage
Live documentation
Shortcut
8:33
Home
Classic soundtracks study
What kind of classic are you listening ?
Social interactions
This is my sweet collect
Metal soundtracks study
What kind of metal are you listening ?

Crowd-scale Sensing Jobs

sense

```
sense(function( ) { … } )
```

---

recruit

```
accept(function( ) {
   if (network.connectionType() == 'mobile')
      return {battery : battery.level()};
};

ranking(function(users){
   return users.sort('battery');
};
```

---

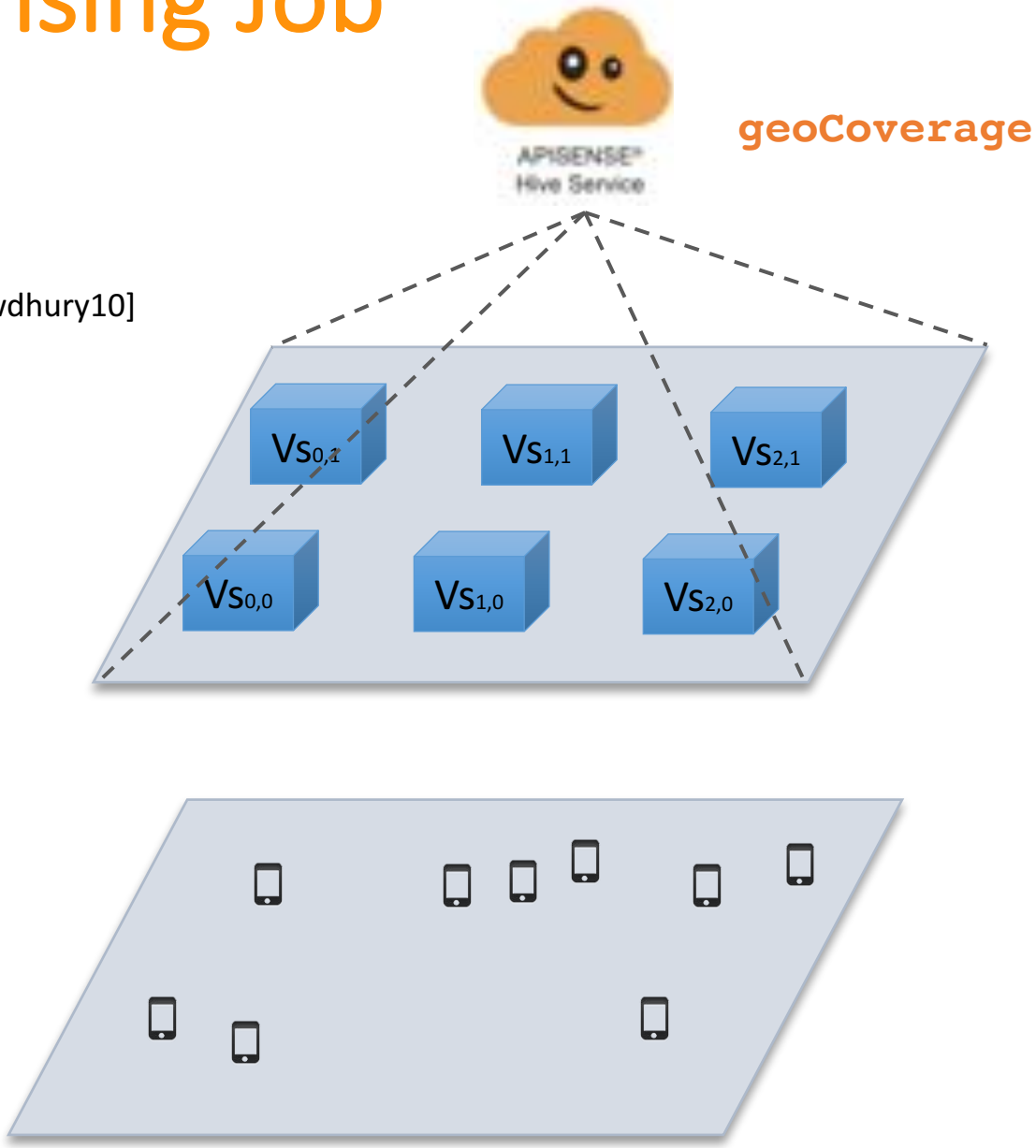
coverage

```
geoCoverage(
  [[50.614291,3.13282],[50.604159,3.15239]],
  '500 m');

timeCoverage('30 min','1 H');

duplicate(1);
```


Location
Usage
Movement
Proximity
Bluetooth
External device
Media
Capture
Many more
SDK/API support
task
result
APISENSE®
Hive Service
APISENSE®
Mobile App
data
APISENSE® Honeycomb Service
(Cloud ready)
Visualizations
Reports
Notifications
Other
applications
INPUT
PLATFORM
OUTPUT

Crowd-scale Sensing Job

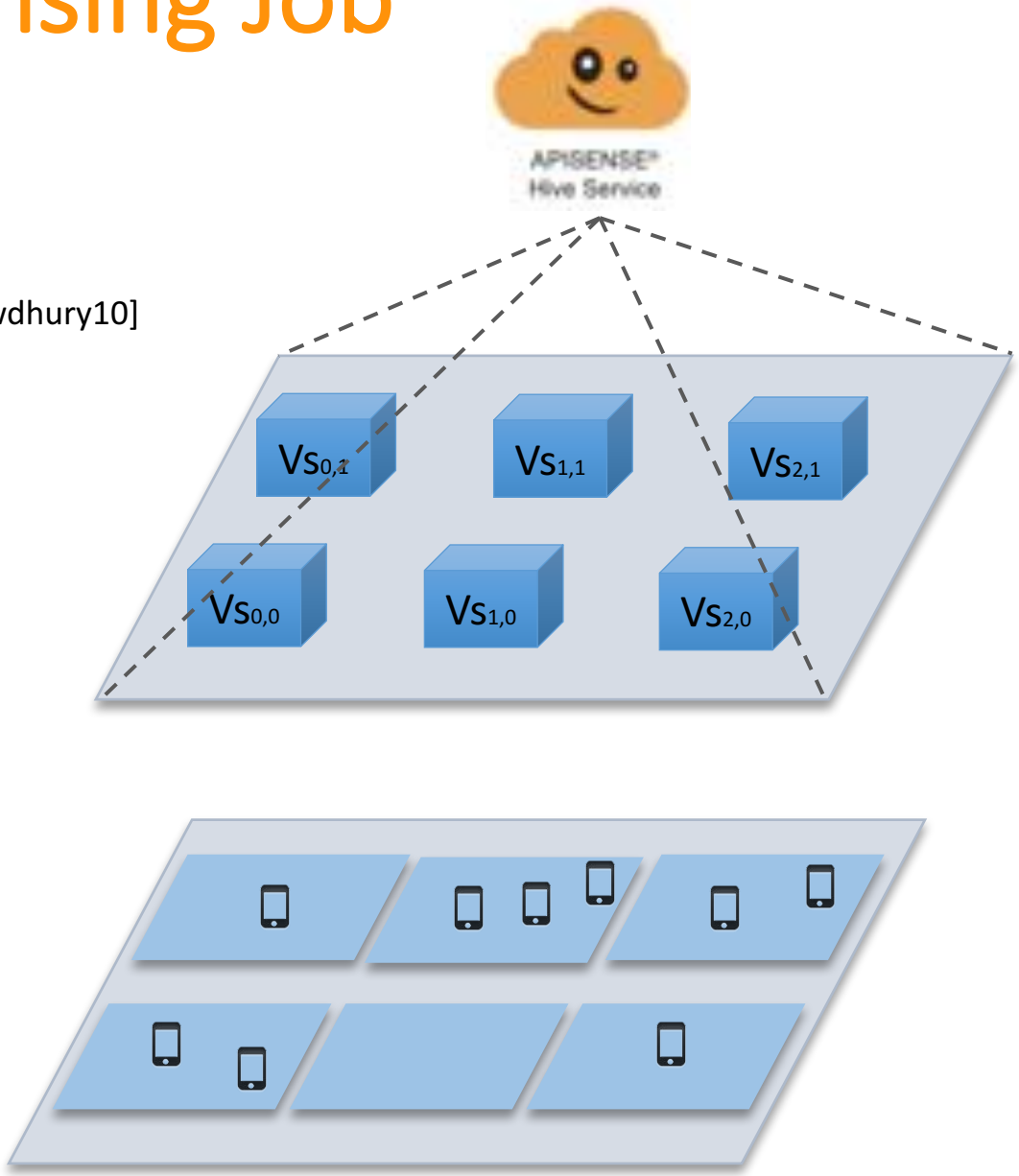
1. Virtual sensor deployment [Chowdhury10]



[Chowdhury10] **A survey of network virtualization**. *Computer Networks*. 2010

Crowd-scale Sensing Job

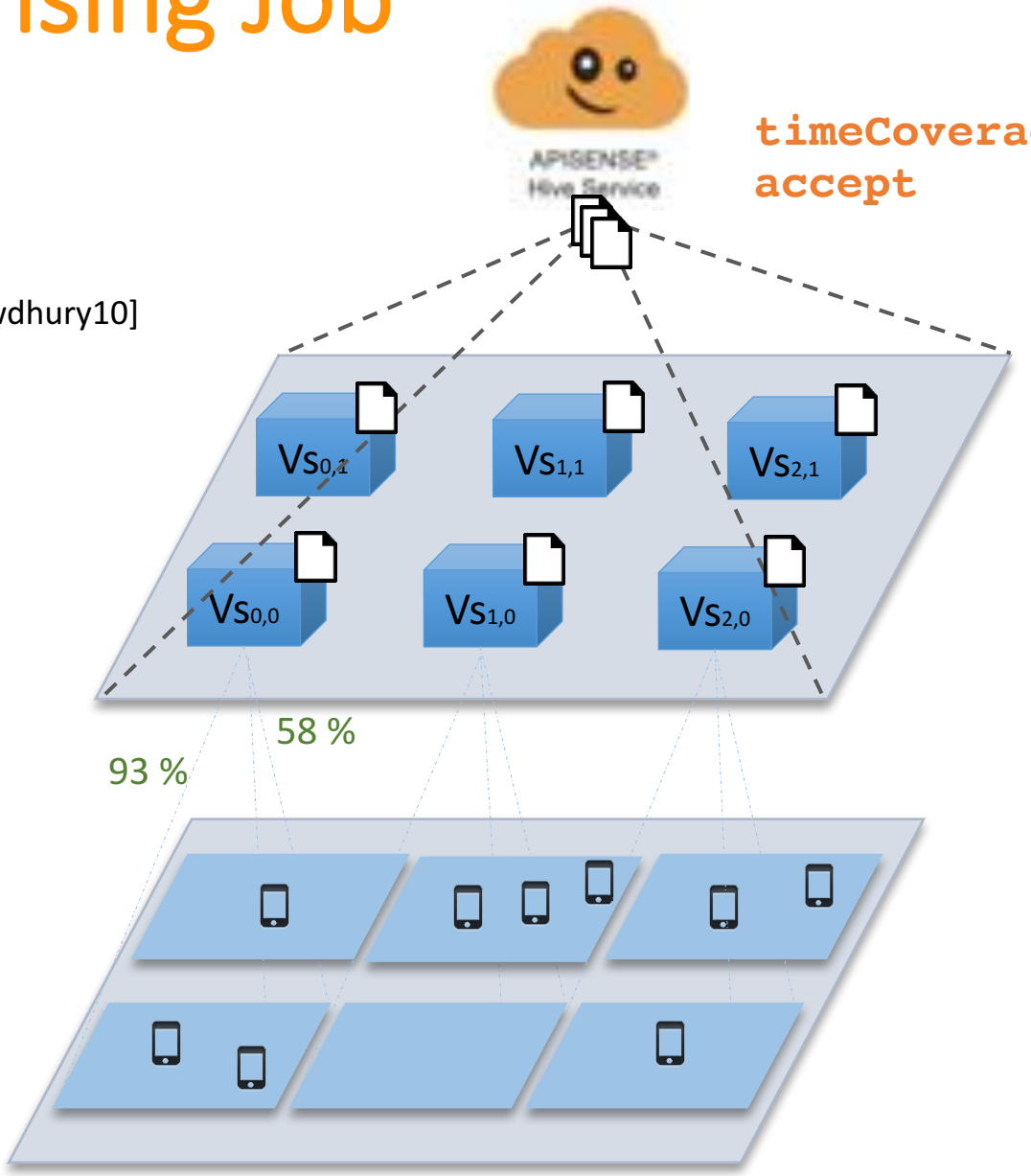
1. Virtual sensor deployment [Chowdhury10]
2. Connecting to physical devices



[Chowdhury10] **A survey of network virtualization**. *Computer Networks*. 2010

Crowd-scale Sensing Job

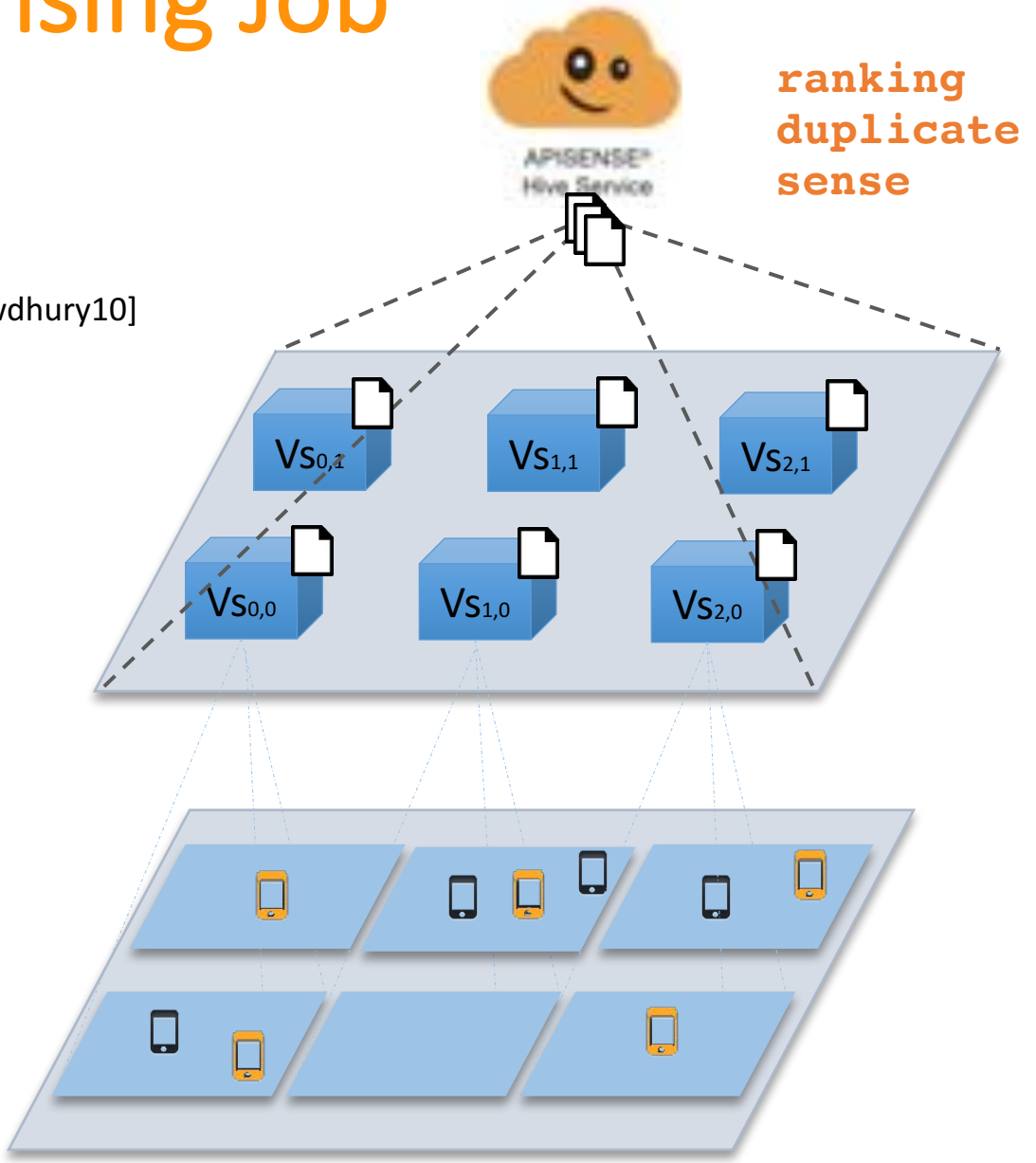
1. Virtual sensor deployment [Chowdhury10]
2. Connecting to physical devices
3. Assigning sensing tasks



[Chowdhury10] **A survey of network virtualization**. *Computer Networks*. 2010

Crowd-scale Sensing Job

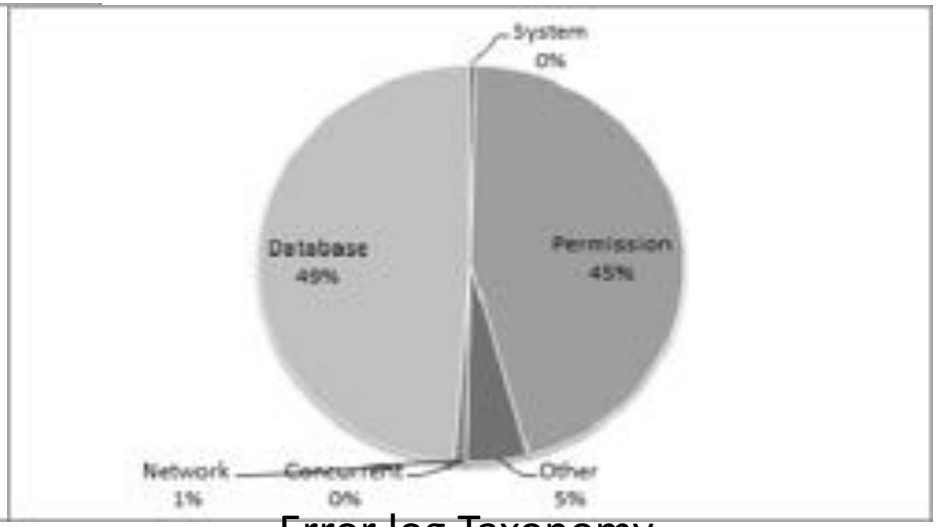
1. Virtual sensor deployment [Chowdhury10]
2. Connecting to physical devices
3. Assigning sensing tasks
4. Executing sensing tasks



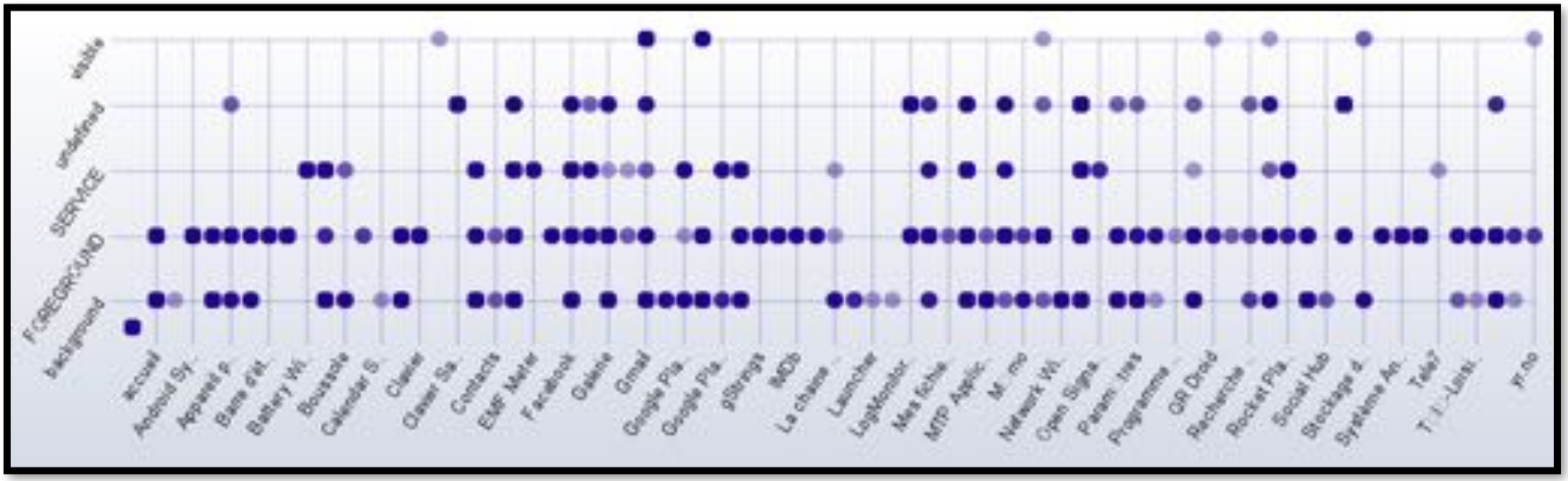
[Chowdhury10] **A survey of network virtualization**. *Computer Networks*. 2010

Collecting exception in the wild

Warning log Taxonomy



Error log Taxonomy



Assessing Machine Learning Models

- User context recognition implementation : ~ 30 lines

```
…
accelerometer.onChange(function(acc) { buffer.push(acc) });
// Learning phase
dialog.display({ message: "Select movement", spinner: classes },function(pattern){
  accelerometer.onChange(function(acc) { buffer.push(acc) });
  sleep('5s')
  model.record(attributes(buffer), pattern);
  buffer = new Array();
  return;
});
…
// Exploitation phase
time.schedule({ period: '5s' }, function() {
  trace.add({
      position: model.evaluate(attributes(buffer)),
     stats: model.statistics() });
     buffer = new Array();
} } });
```

	Predicted class						Acc (%)
	Walk	Jog	Stand	Sit	Up	Down	
Walk	**66**	0	4	0	0	0	94,3
Jog	0	**21**	0	0	0	0	100
Stand	4	0	**40**	0	0	0	90,9
Sit	0	0	2	**83**	0	0	97,6
Up stair	0	0	0	0	**22**	0	100
Down stair	0	0	0	0	0	**11**	100

Representative Confusion Matrix

Incentive : the model of a free service between *Quantified-self* and *Mydata*

Programmer un module Arduino

```
#include "Sensor.h"
#include "Module.h"
#include "Channel.h"

Channel* mlog = new LogChannel();
Sensor* sensorTmp = new Sensor(A0, "temperature", &convertTemperature);
Sensor* sensorLum = new Sensor(A2, "Lumiere", &convertLumiere);
Module* myModule = new Module();

void setup() {
    Serial.begin(9600);
}

void loop() {
    myModule->load(sensorTmp);
    myModule->load(sensorLum);
    myModule->setChannel(mlog);
    myModule->updateM();
    delay(300000);
}
```

```
int convertTemperature(int sensorTmpVal){
  float voltage = (sensorTmpVal/1024.0) * 5.0;
  float temperature = (voltage - .5) * 100;
  return temperature;
}
```