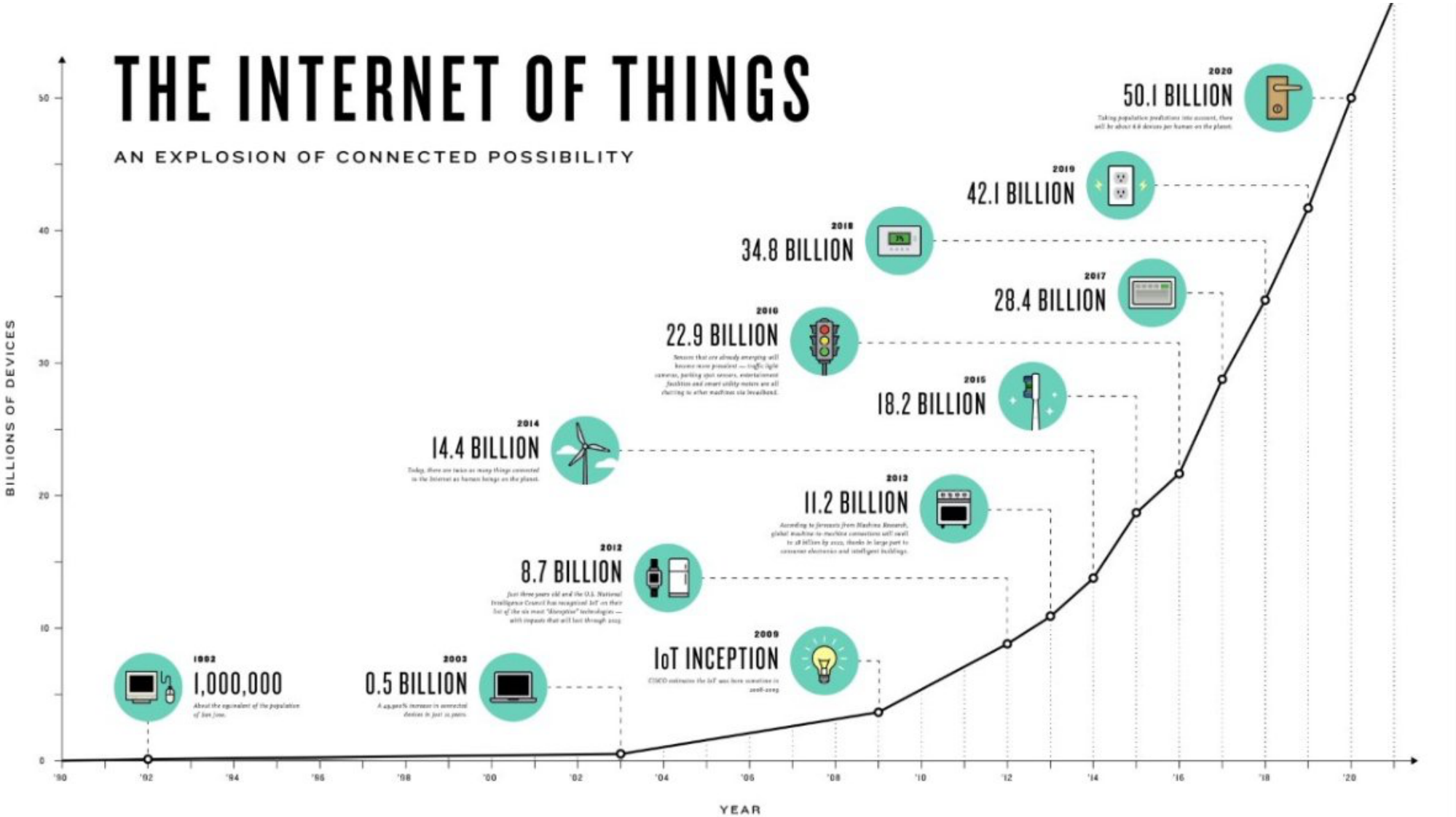
@RomainRouvoy



https://www.ncta.com/broadband-by-the-numbers

Internet of Things: Perfect Storm or Wash Out?

Brian Partridge

Proprietary built for purpose

Devices/sensors → M2M ← Networks; Applications

Related but distinct

Big Data → IoT ← Devices; apps, people processes; Cloud

Cloud + Big/Fast Data are critical

IoT = Business Process Change

Data is driving value

Still in its early days

Limitless Applications

Smart mirror — basic medical info

Now: - strategy - verticals

Medium term - capacity - differentiation

Long term - mainstream - volume

What are the vertical + volume solutions?

What are the horizontal + wide appeal solutions?

Enterprise demand

Suppliers driving

Network operators

Government

Market Drivers

Device costs ↓ ; Ubiquitous connectivity

Cloud computing

Data tools

Machine data → New insights + value

Complex ecosystem

Connectivity driving M2M growth for network operators

Strong demand for low volume deployments

Anyone

Corporate → PC

Corps + Devs → Mobile

IoT — collaborative

Increasing democratization

Beware the Hype!

Growth potential exists but there are headwinds

- Small devices
- Security
- Network availability
- Privacy
- Data management
- ROI - costs are too high

Best Practices

- Flexibility — OSS/BSS; Pricing
- Experiment — new business models
- De-Risk — analysis; understand value
- Global/local

Licensing — make sure you're protected

Every provider has different APIs — who wrote this?

Understand billing models

SLAs vary by provider

Start small, plan for scale

The market is outpacing reality... don't over-buy

Hype leads to procrastination

Just over half understand cloud

No migration plan in place

Move now, adjust as technology advances

Hybrid Cloud: Private, Public, SaaS, SP

Rob Carter, Windstream

Benefits:

- Licensing models
- Regulatory requirements for private cloud
- Auditor comfort
- Guarantee performance
- Legacy infrastructure

But, also:

- Ease of management issues
- Resiliency
- Tier applications for cost-effectiveness

New + Future Cloud

Build servers on fly

Consider/think through data migration

VM sprawl becomes cloud sprawl

Think about sprawl + analytics challenges

Choose proven providers

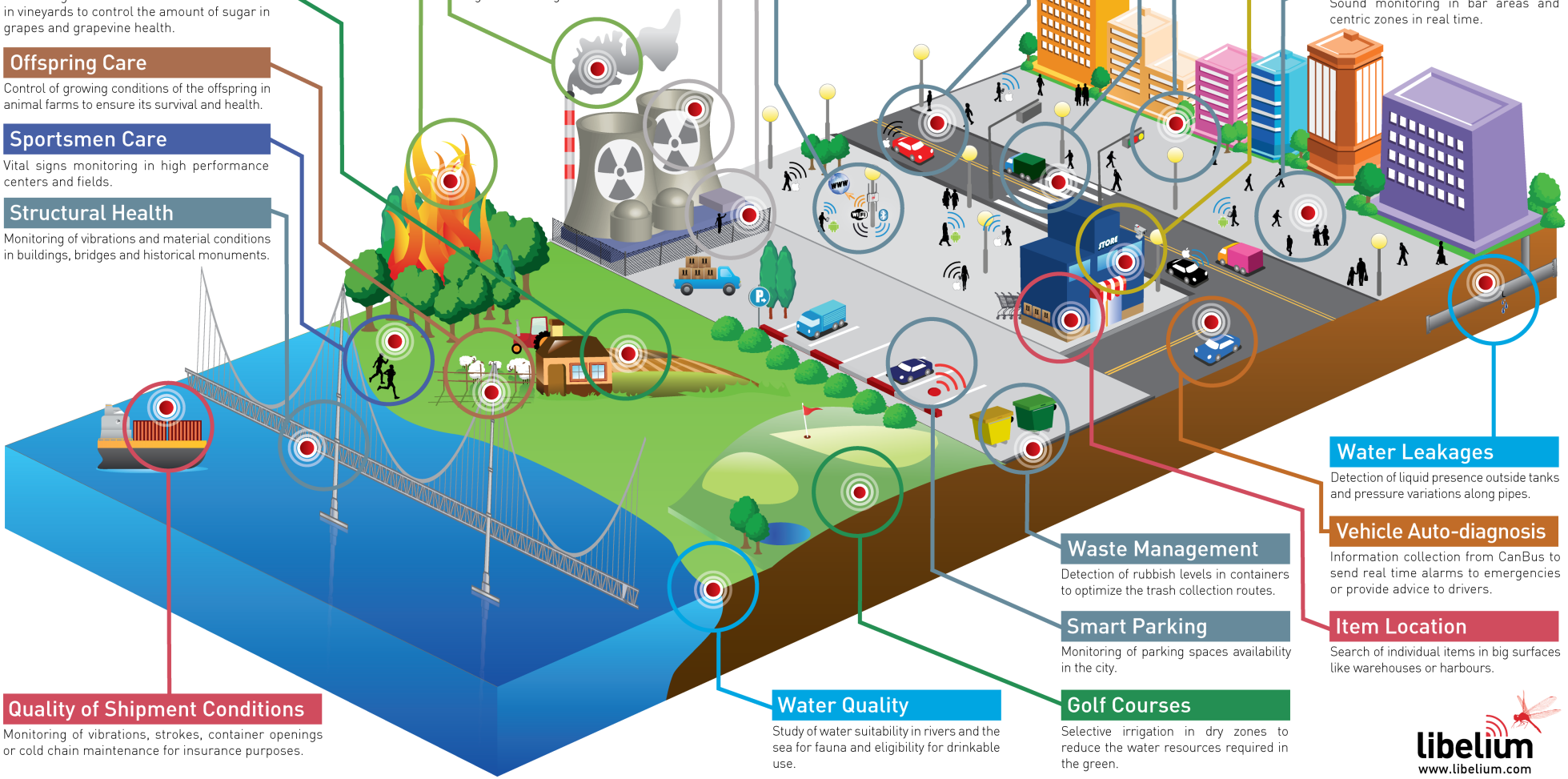
Do what's right for you

Buyer beware — hype in marketing

451 Research®

https://451research.com

Libelium Smart World



Air Pollution
Control of CO_2 emissions of factories, pollution emitted by cars and toxic gases generated in farms.

Forest Fire Detection
Monitoring of combustion gases and preemptive fire conditions to define alert zones.

Wine Quality Enhancing
Monitoring soil moisture and trunk diameter in vineyards to control the amount of sugar in grapes and grapevine health.

Offspring Care
Control of growing conditions of the offspring in animal farms to ensure its survival and health.

Sportsmen Care
Vital signs monitoring in high performance centers and fields.

Structural Health
Monitoring of vibrations and material conditions in buildings, bridges and historical monuments.

Quality of Shipment Conditions
Monitoring of vibrations, strokes, container openings or cold chain maintenance for insurance purposes.

Smartphones Detection
Detect iPhone and Android devices and in general any device which works with Wifi or Bluetooth interfaces.

Perimeter Access Control
Access control to restricted areas and detection of people in non-authorized areas.

Radiation Levels
Distributed measurement of radiation levels in nuclear power stations surroundings to generate leakage alerts.

Electromagnetic Levels
Measurement of the energy radiated by cell stations and and WiFi routers.

Traffic Congestion
Monitoring of vehicles and pedestrian affluence to optimize driving and walking routes.

Smart Roads
Warning messages and diversions according to climate conditions and unexpected events like accidents or traffic jams.

Smart Lighting
Intelligent and weather adaptive lighting in street lights.

Intelligent Shopping
Getting advices in the point of sale according to customer habits, preferences, presence of allergic components for them or expiring dates.

Noise Urban Maps
Sound monitoring in bar areas and centric zones in real time.

Water Leakages
Detection of liquid presence outside tanks and pressure variations along pipes.

Vehicle Auto-diagnosis
Information collection from CanBus to send real time alarms to emergencies or provide advice to drivers.

Waste Management
Detection of rubbish levels in containers to optimize the trash collection routes.

Smart Parking
Monitoring of parking spaces availability in the city.

Item Location
Search of individual items in big surfaces like warehouses or harbours.

Water Quality
Study of water suitability in rivers and the sea for fauna and eligibility for drinkable use.

Golf Courses
Selective irrigation in dry zones to reduce the water resources required in the green.

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THE IOT ECOSYSTEM NEEDS TO COME TOGETHER QUICKLY


apolline.lille.inria.fr
Apolline - Bureau 108
Zoom Out
Last 7 days
Refresh every 5s
Concentration CO2
1207 ppm
Temperature Sensor
31 °C
Bureau 108 PC2A
3000 ppm
2500 ppm
2000 ppm
1500 ppm
1000 ppm
500 ppm
0 ppm
concentration
50 °C
45 °C
40 °C
35 °C
30 °C
25 °C
20 °C
temperature
3/16 12:00
3/17 00:00
3/17 12:00
3/18 00:00
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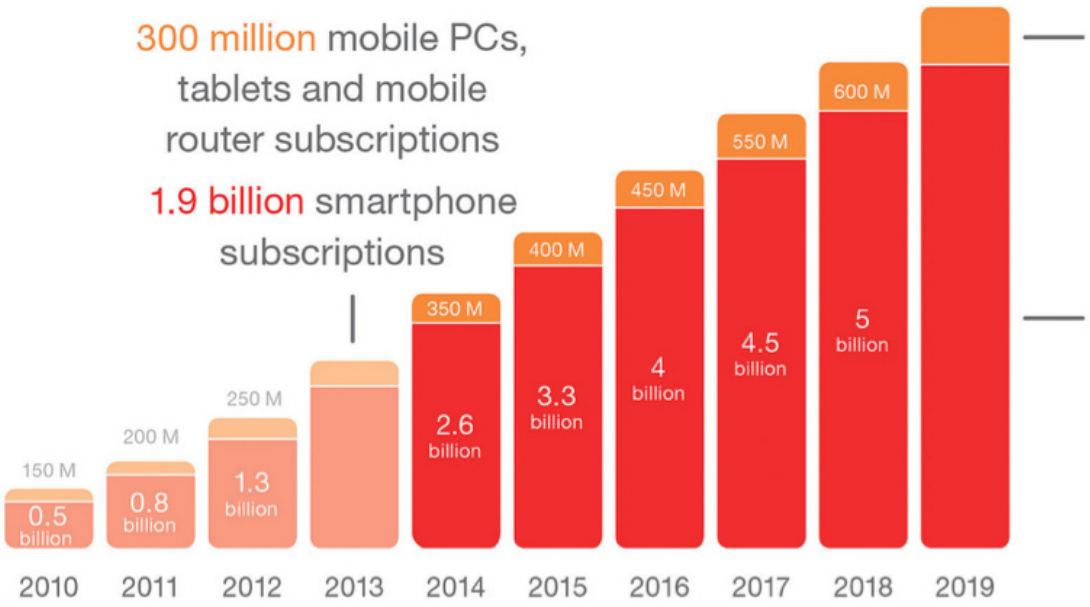
3/19 00:00
3/19 12:00
3/20 00:00
3/20 12:00
3/21 00:00
3/21 12:00
3/22 00:00
3/22 12:00
3/23 00:00
CO2
Min: 258 ppm
Max: 2113 ppm
Avg: 749 ppm
Current: 1207 ppm
Temperature
Min: 24 °C
Max: 46 °C
Avg: 30 °C
Current: 31 °C
+ ADD ROW

How to…

1. continuously **deploy** software atop of things
2. continuously **monitor** and collect things' data
3. continuously **process** things' data at scale

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

apisense

Crowd-sensing made easy!

http://apisense.io

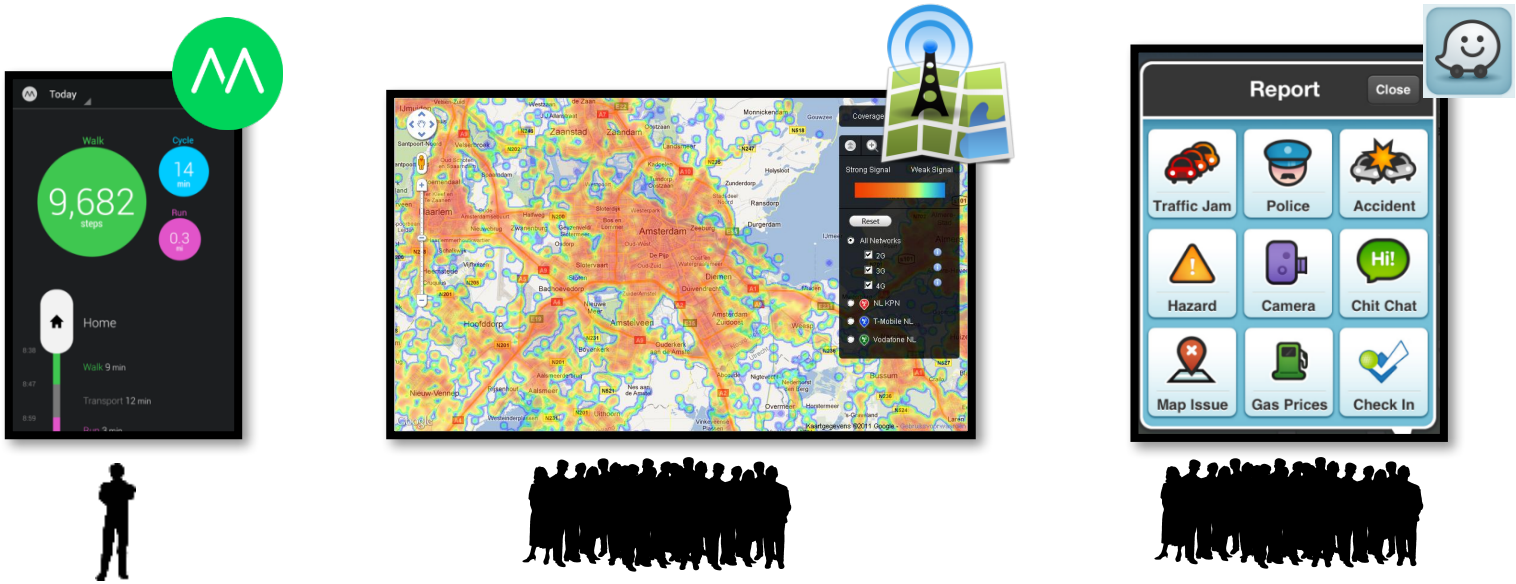
Crowd & sensing

http://www.flickr.com/photos/40006794@N02/7723572802/

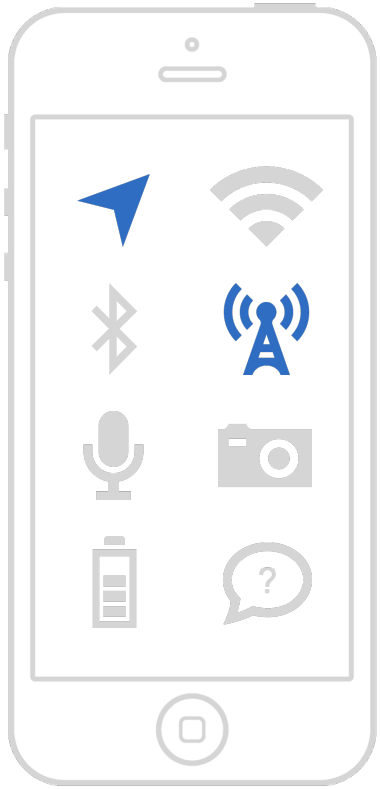
Crowd-sensing | kraʊd:sɛnsɪŋ |

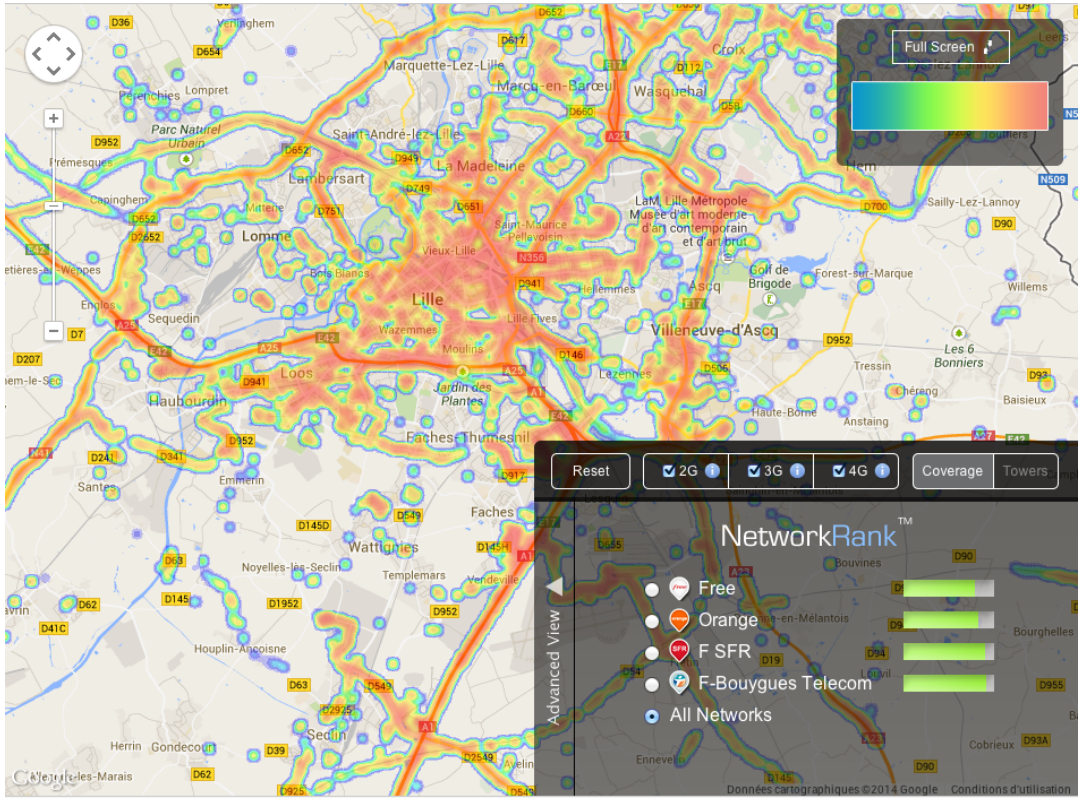
*Capability of lifting a (large) diffuse **group of participants** to delegate the task of retrieving **trustable data** from the field. This includes:*

- **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

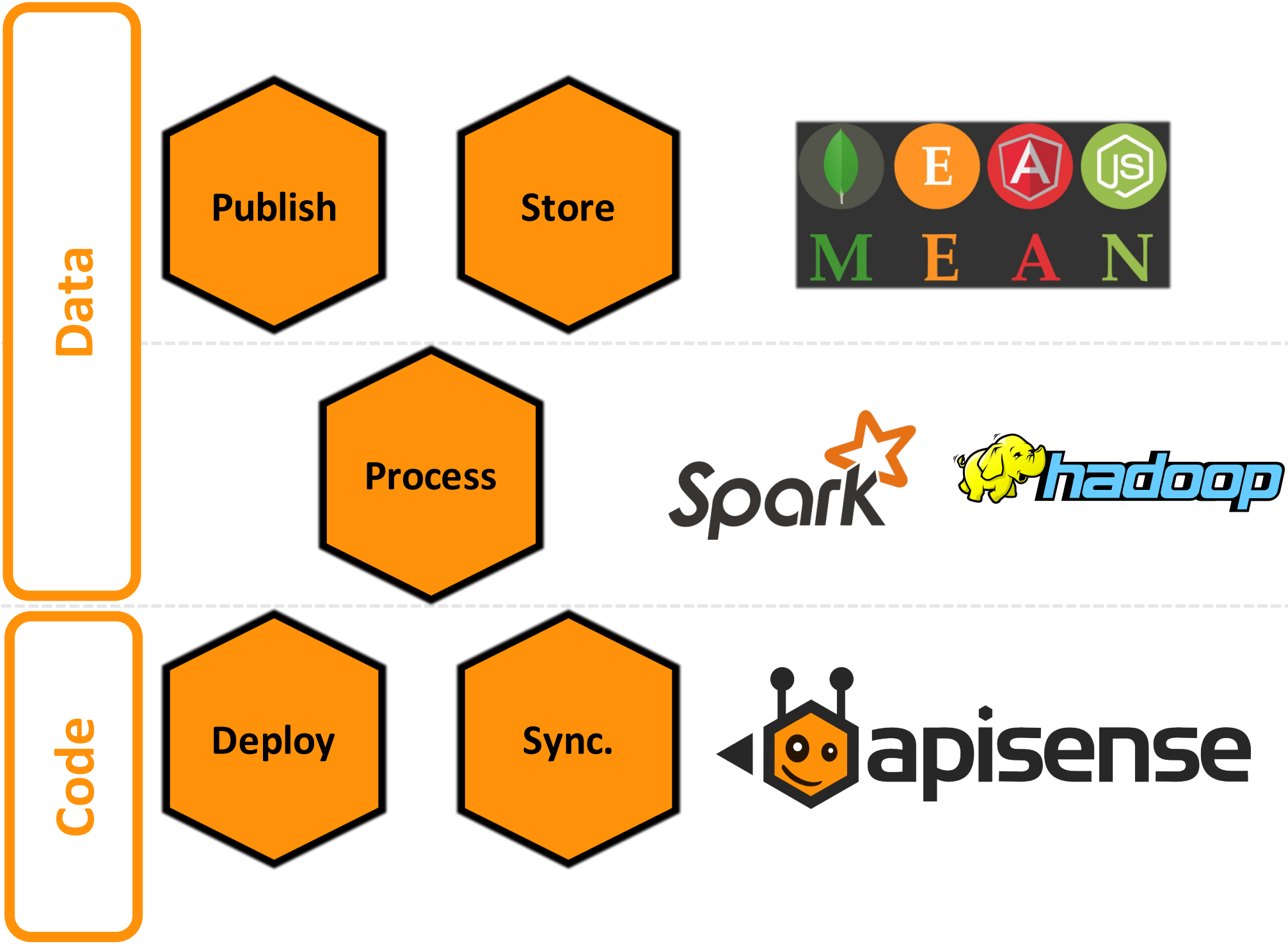




source: http://opensignal.com

Applications to IoT monitoring

source: http://goo.gl/xw8huo


Data
Publish
Store
MEAN
Process
Spark
hadoop
Code
Deploy
Sync.
apisense


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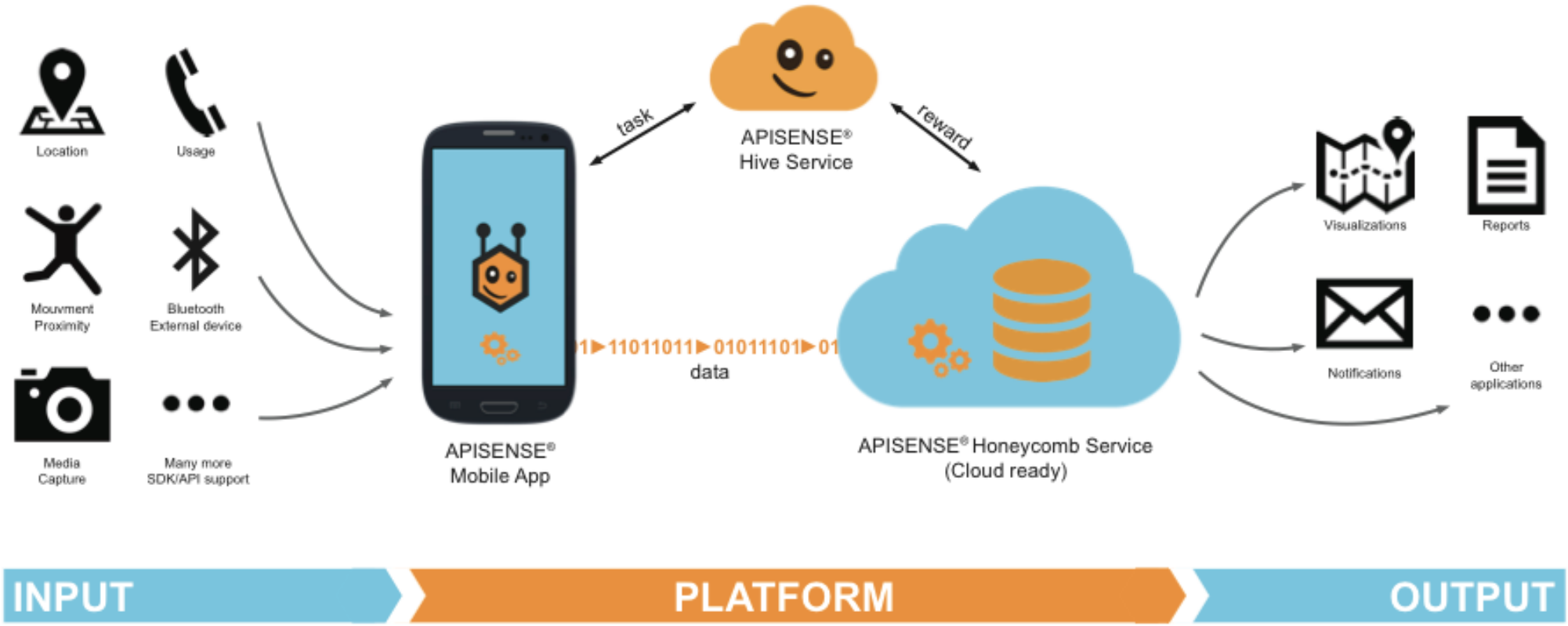
devices
smartphone
phone
platform
energy
human
deployment
awareness
recruitment
prediction


Location
Usage
Mouvment
Proximity
Bluetooth
External device
Media
Capture
Many more
SDK/API support
APISENSE®
Mobile App
task
APISENSE®
Hive Service
reward
1▶11011011▶01011101▶01
data
APISENSE® Honeycomb Service
(Cloud ready)
Visualizations
Reports
Notifications
Other
applications
INPUT
PLATFORM
OUTPUT

apisense

Create chrissom

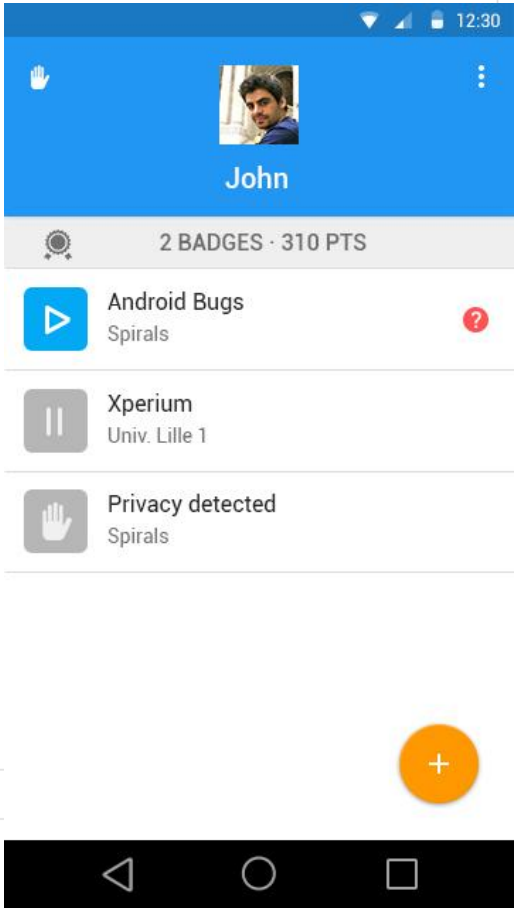
Location

Script Settings

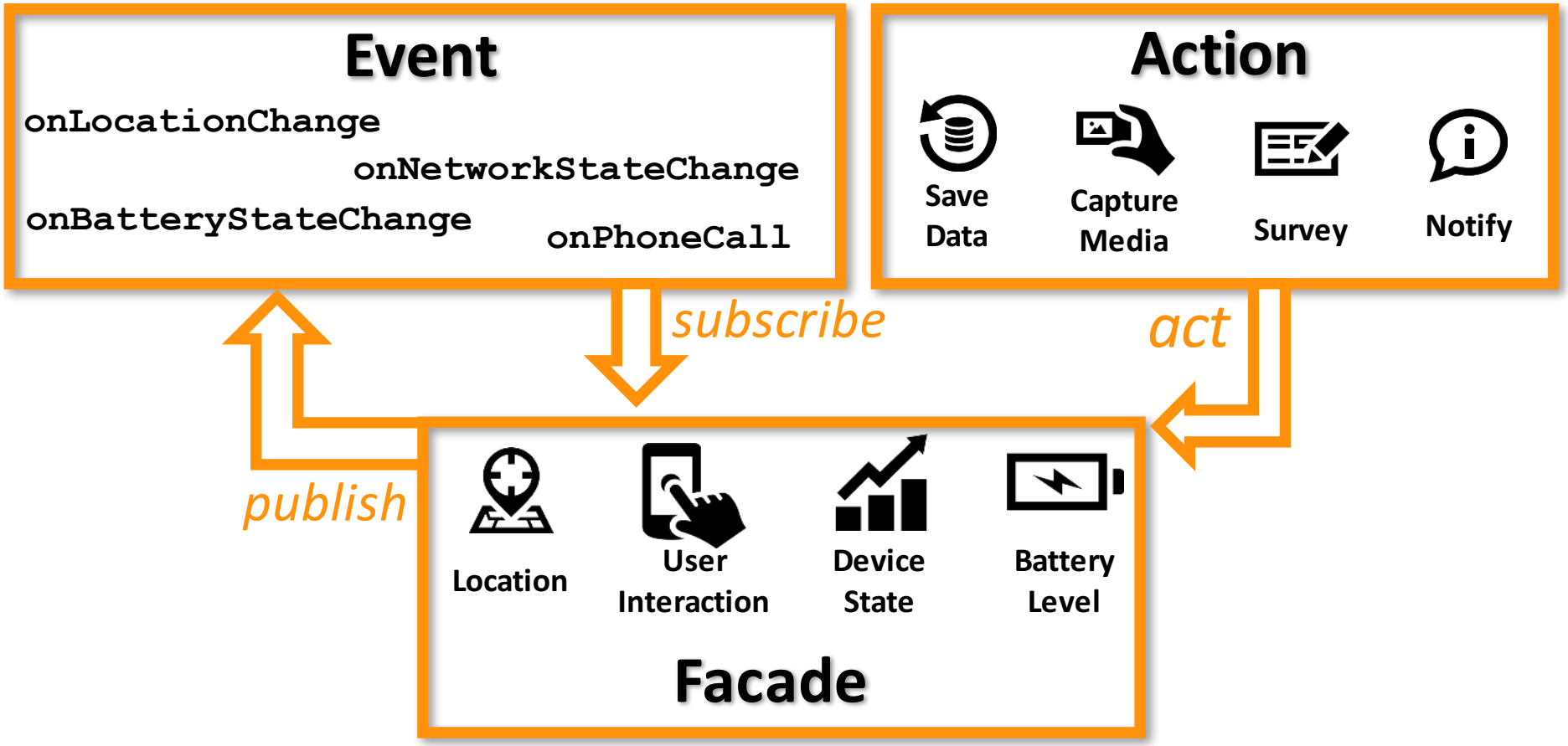
Prod

Documentation

```
var distance = 0;
var provider = ["gps"];
var eachFiveMinutes = 1000*60*5;

var options = {
    provider: provider,
    period: eachFiveMinutes,
    distance: distance
};

location.onLocationChanged(options, function(event){

    trace.add({
        latitude: event.latitude,
        longitude: event.longitude,
        provider: event.provider,
        accuracy: event.accuracy
    });

    // OR
    // trace.add(event);

});
```



Device-level Sensing Task



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()
    });
});
```

Crowd-scale Sensing Job

sense

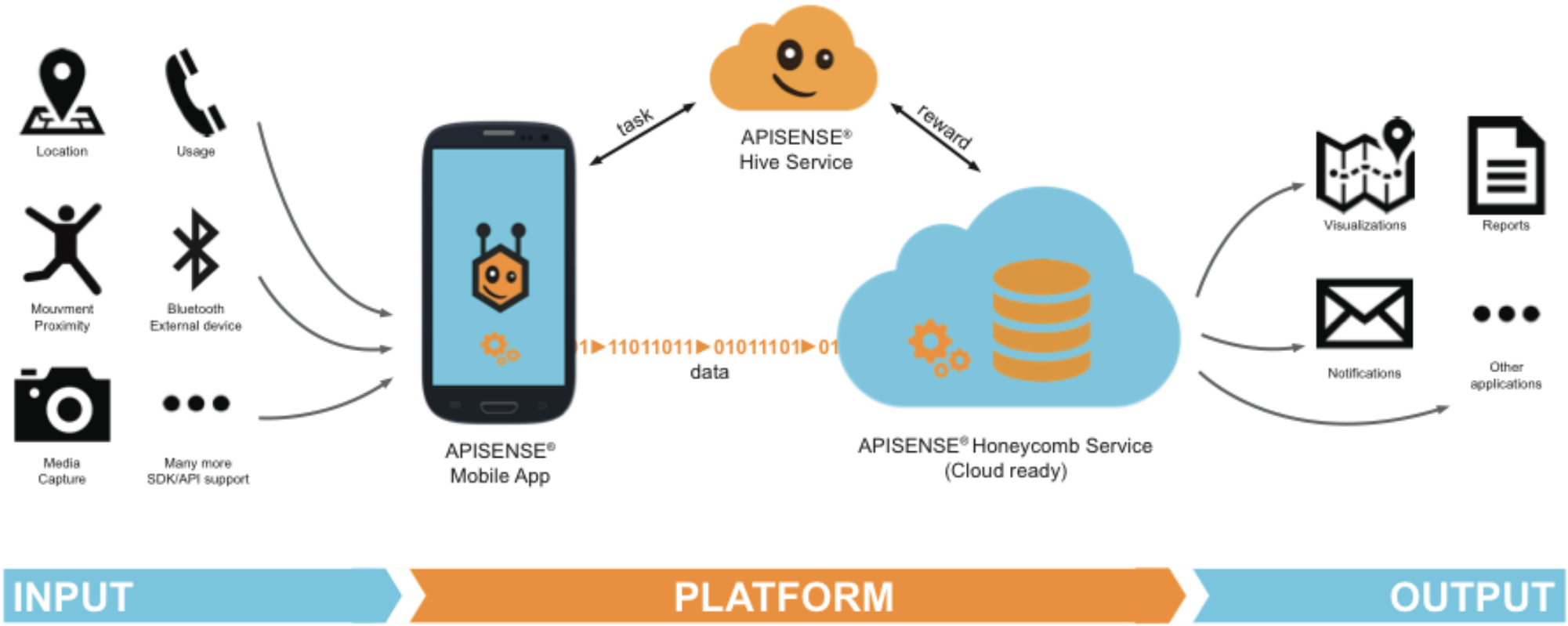
```
sense(function( ) { … } )
```

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
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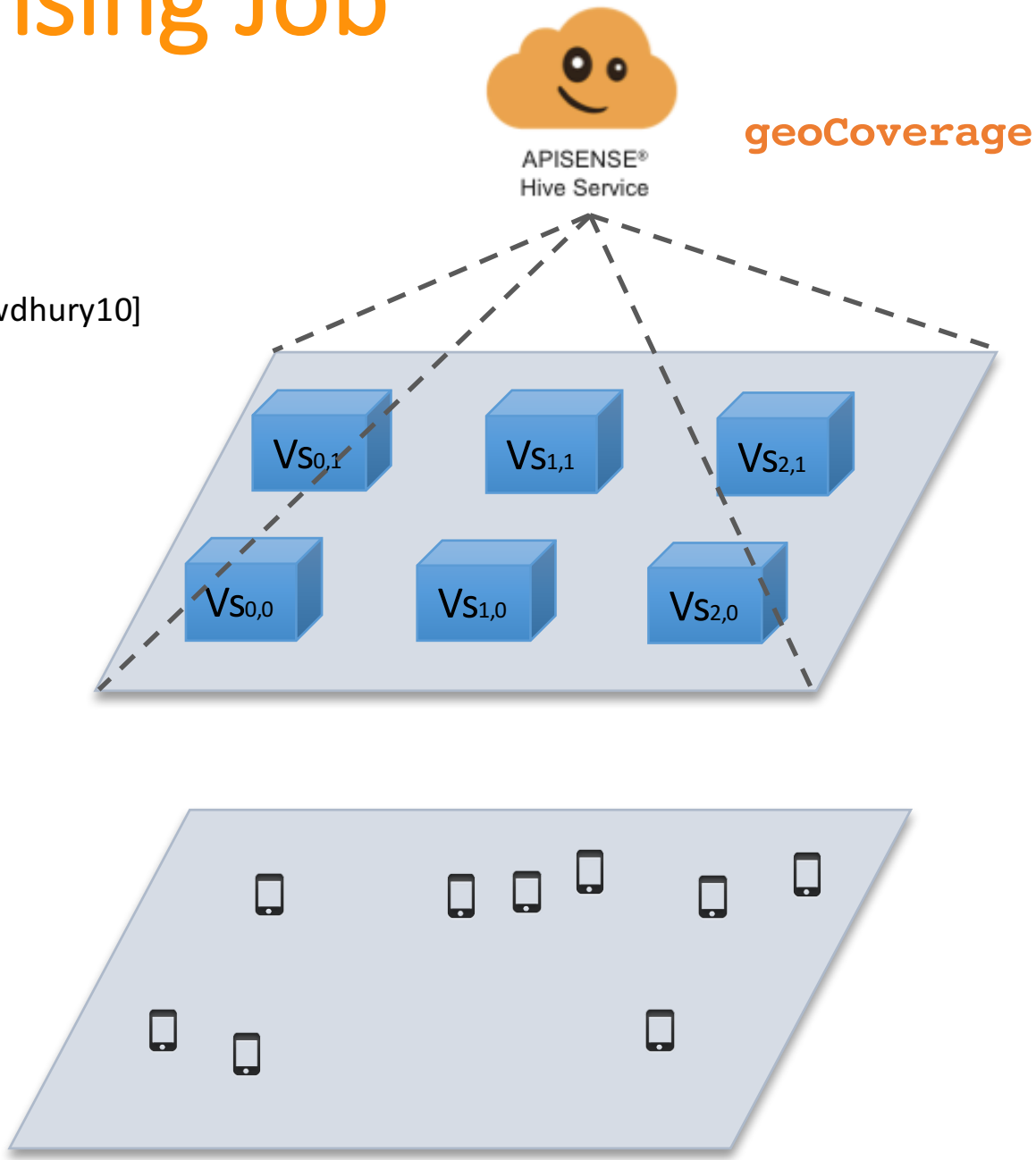
PLATFORM
OUTPUT

Crowd-scale Sensing Job

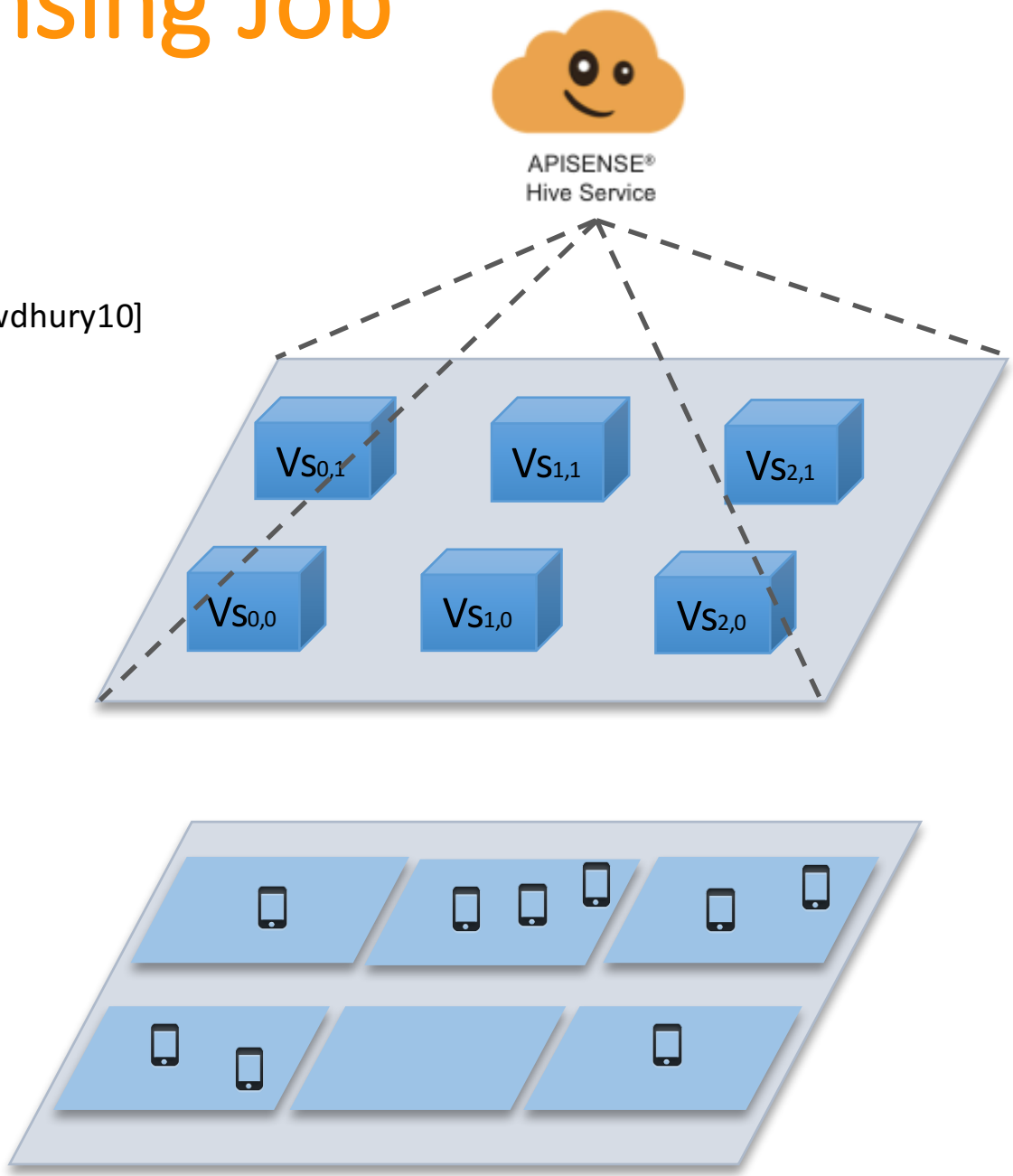
1. Virtual sensor deployment [Chowdhury10]



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

Crowd-scale Sensing Job

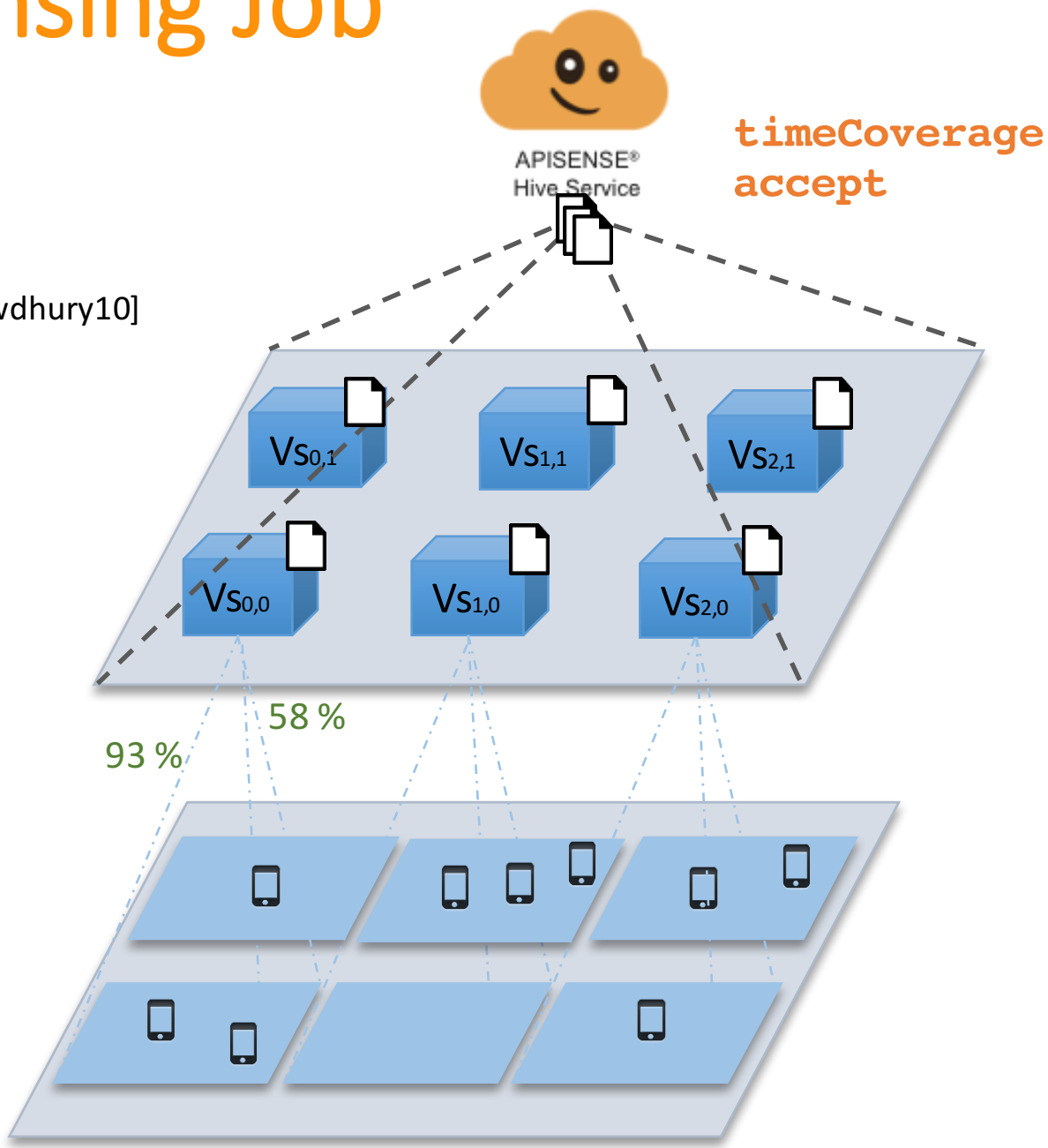
1. Virtual sensor deployment [Chowdhury10]
2. Connecting to physical devices



[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



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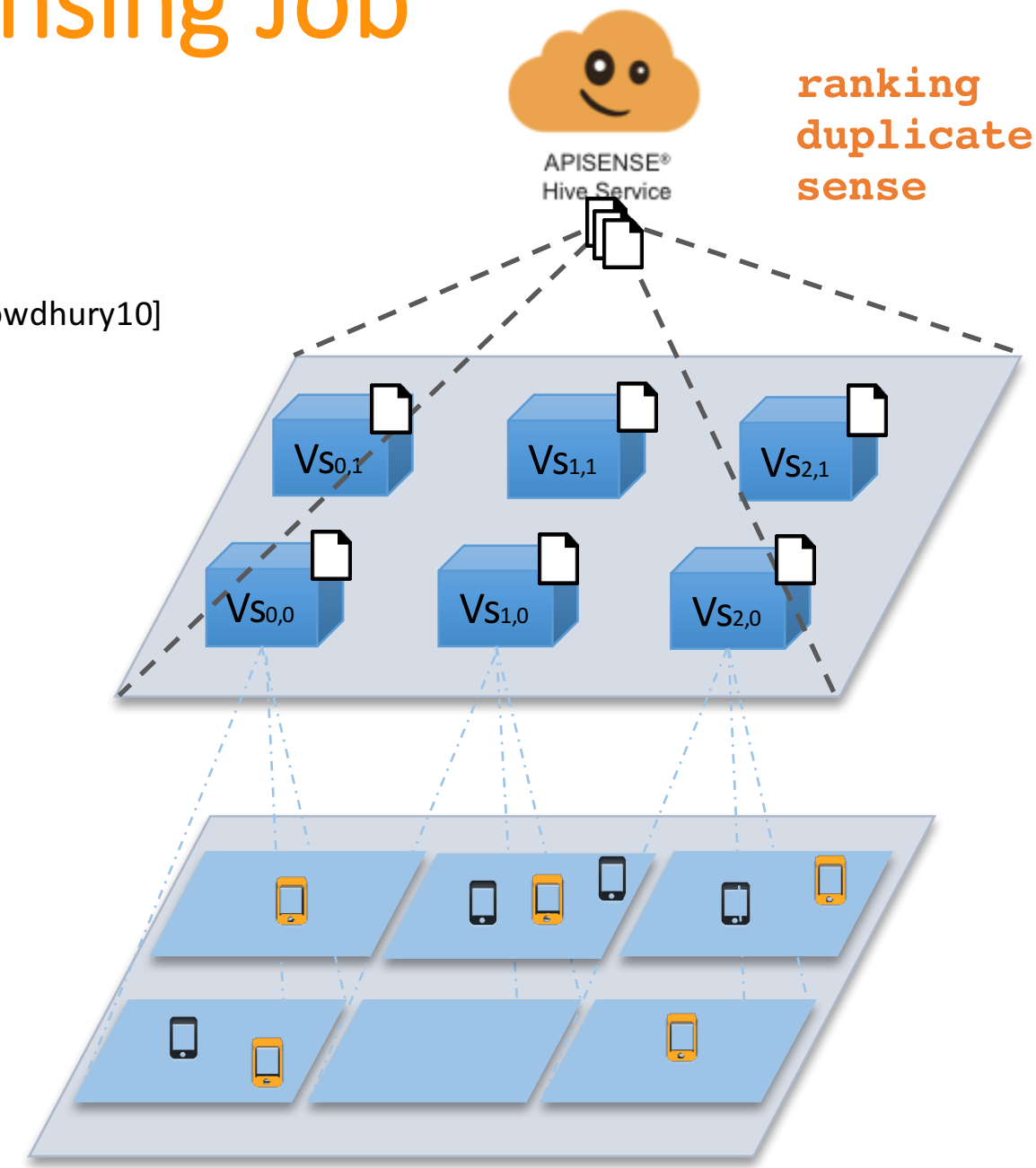
Crowd-scale Sensing Job

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



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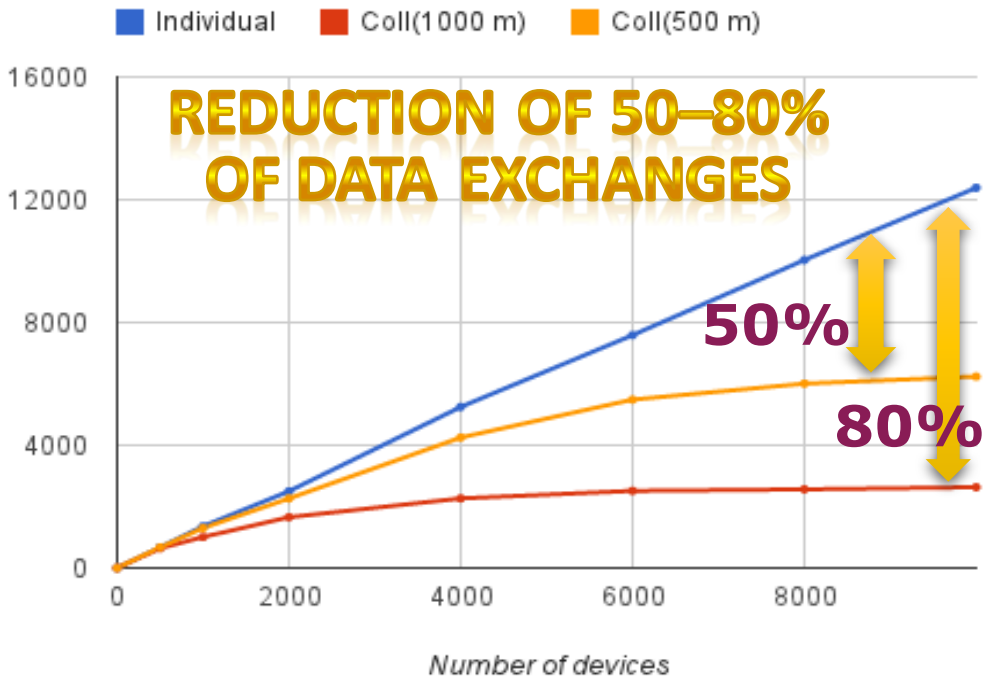
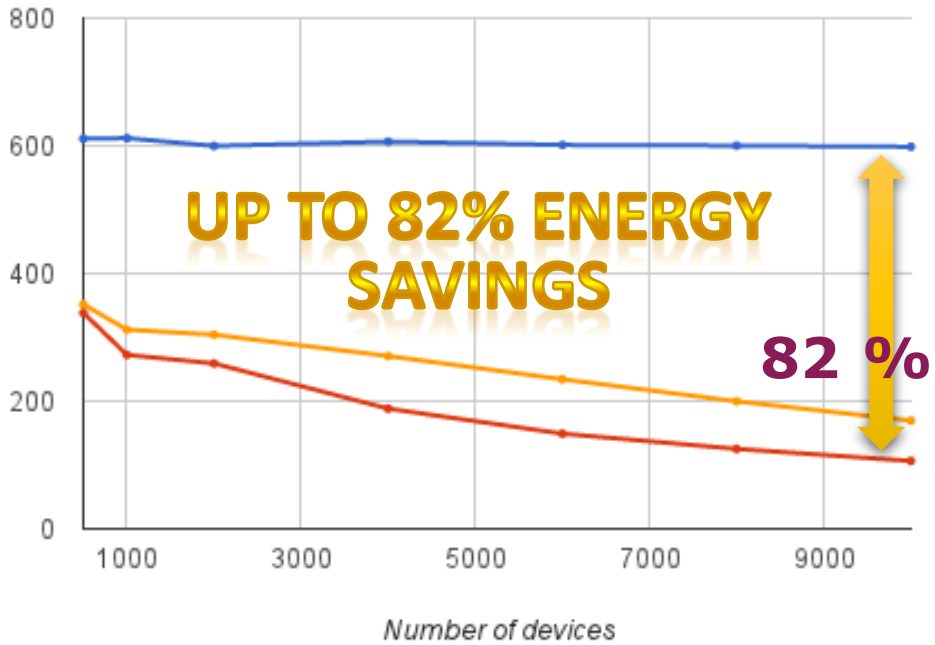
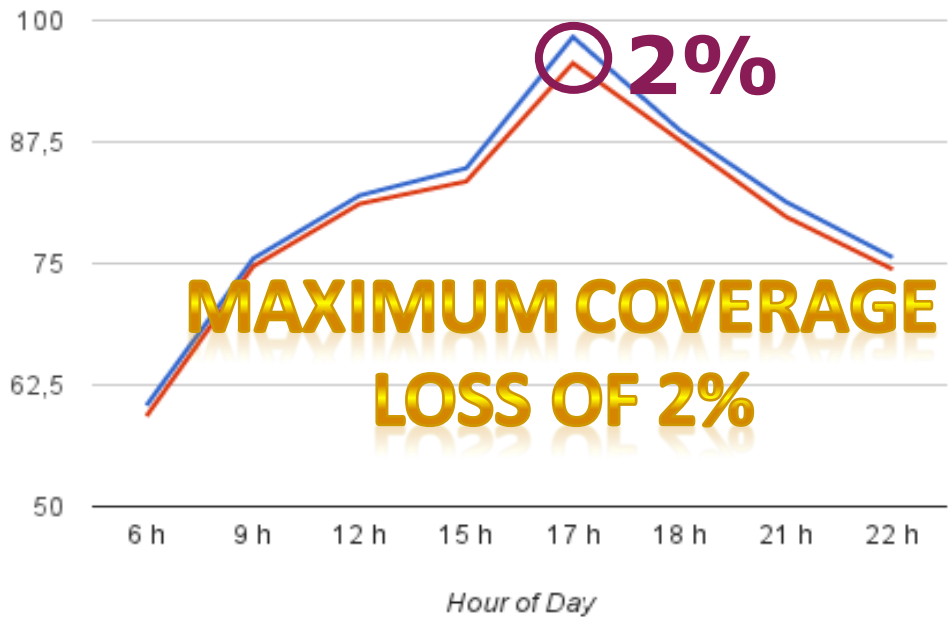
Evaluation of APISENSE®







	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

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Book chapters

A Cloud-based Infrastructure for Crowdsourcing Data from Mobile Devices. Nicolas Haderer, Fawaz Paraiso, Christophe Ribeiro, Philippe Merle, Romain Rouvoy, Lionel Seinturier Wenjun Wu. Cloud-based Software Crowdsourcing, Springer, 2014 (To appear)

Workshops

A preliminary investigation of user incentives to leverage crowdsensing activities. Nicolas Haderer, Romain Rouvoy and Lionel 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. Clément Quinton, Nicolas Haderer, Romain Rouvoy and Laurence Duchien. In Proceedings of the 1st International Workshop on Multi-Cloud Applications and Federated Clouds, Multi-Cloud'13. Prague, Czech Republic, 22 April 2013, pp. 21-26.

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Dynamic Deployment of Sensing Experiments in the Wild Using Smartphones. Nicolas Haderer, Romain Rouvoy and Lionel Seinturier. In 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 Confe- rence 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.

Le capteur, c'est vous! Nicolas Haderer, Christophe Ribeiro, Romain Rouvoy, Simon Charneau, Vassili Rivron, Alan Ouakrat, Sonia Ben Mokhtar, Lionel Seinturier L'Usine Nouvelle, L'Usine Nouvelle, 2013, 3353, pp. 74-75

Campagne de collecte de données et vie privée. Nicolas Haderer, Miguel Nuñez Del Prado Cortez, Romain Rouvoy, Marc-Olivier Killijian and Matthieu Roy. 3ème Journées du GDR CNRS GPL (2012), pp. 253-254.

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