

# BIG IoT

Bridging the Interoperability Gap  
of the Internet of Things

## BIG IoT Project

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JORNADAS TÉCNICAS RedIRIS 2017



Horizon 2020  
European Union funding  
for Research & Innovation

- Project Overview
- Architecture
- Barcelona Pilot
- Questions & Answers

# Project Overview

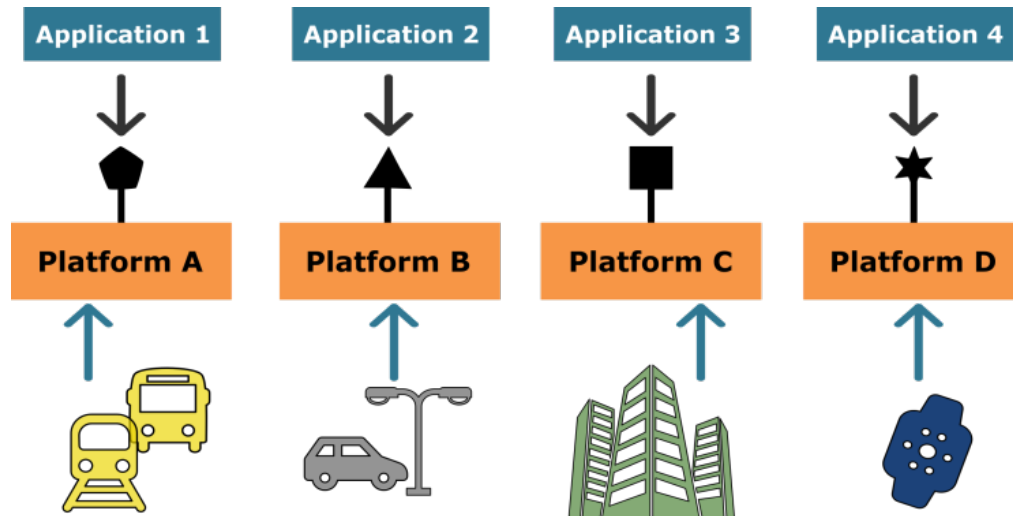
## Video



<https://youtu.be/H4Vjjvva4X8>

# Challenge – missing interoperability

- Today, we are dealing with many **heterogeneous, vertically oriented** IoT platforms.
- Thus, the development of **cross-platform** and **cross-domain applications** is tedious and expensive.
- Additionally, it leads to **high market entry barriers** for small innovative business.
- As a result of this, **no vibrant IoT ecosystem** exists.



## Don't:

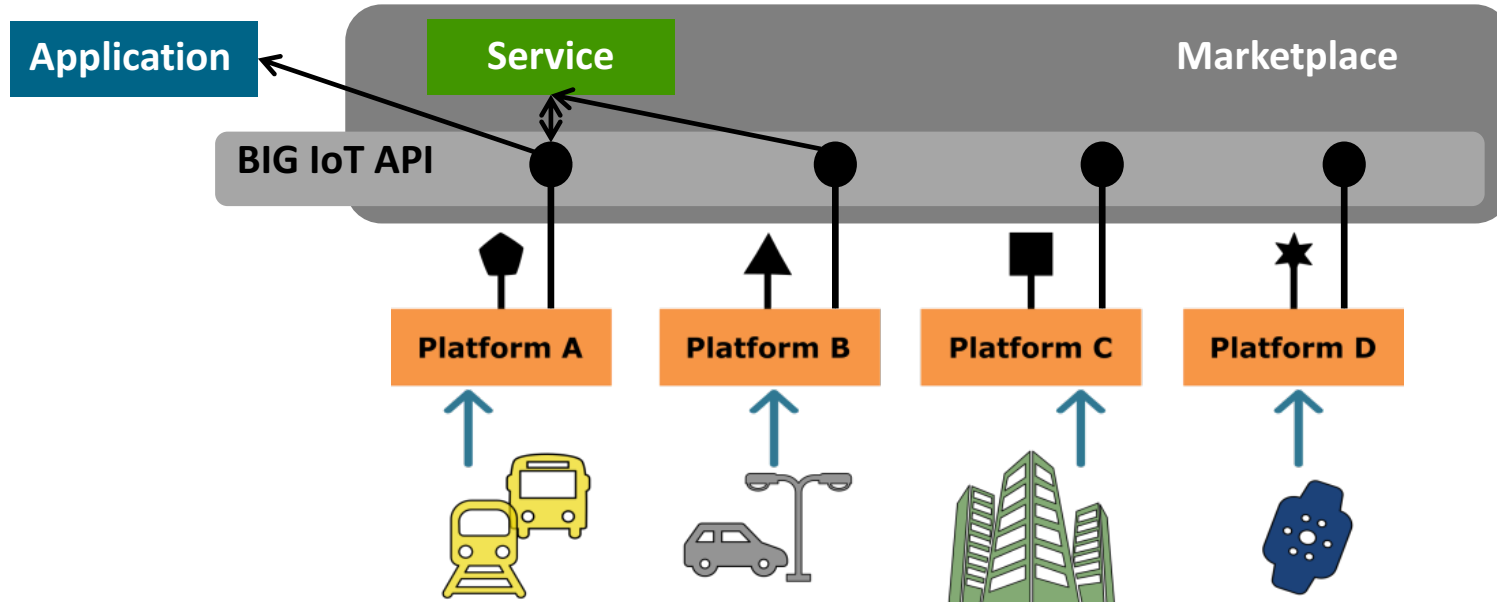
- Develop **yet another platform**

## Do:

- Enable syntactic & semantic **interoperability** of IoT platforms
- Reuse & build upon existing methods and **standards** to allow interweaving of platforms, things, and users
- Lower market entry barriers
- Foster an open **IoT ecosystems**

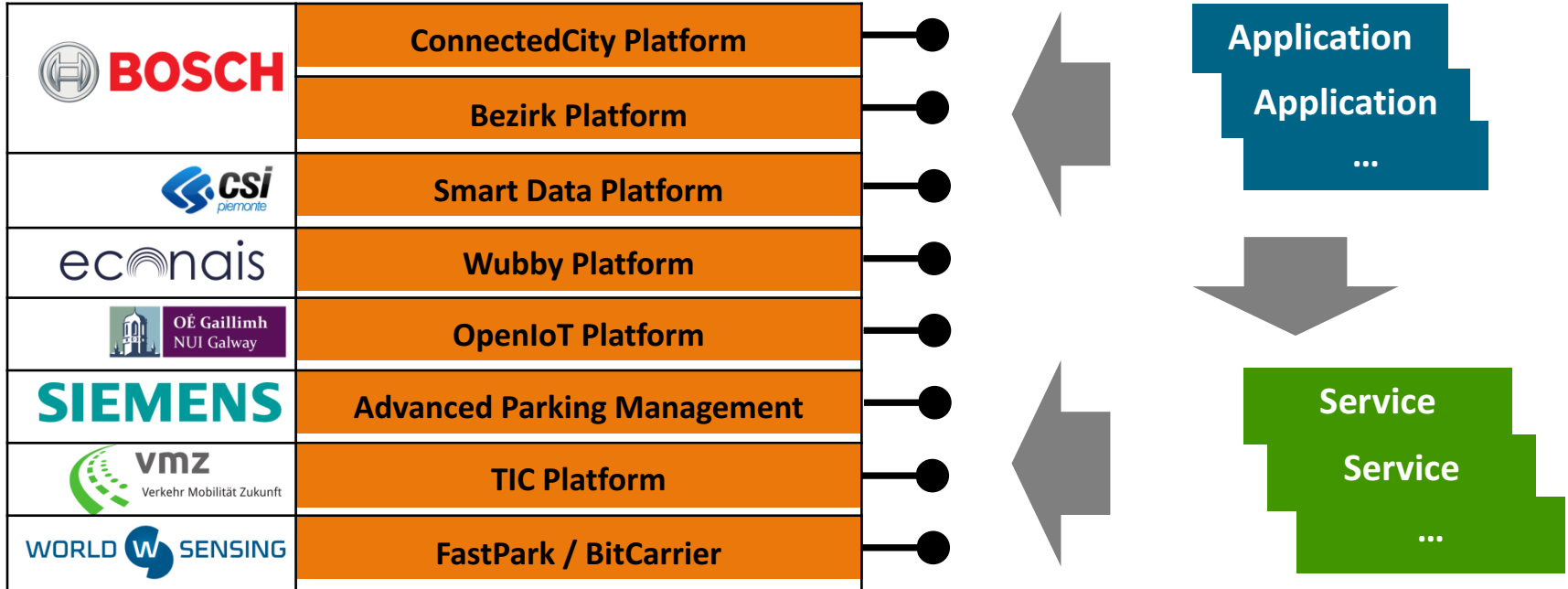
# Our approach

- **BIG IoT API** to provide and consume IoT resources from different platforms in an unify way
- **Marketplace** to share, discover and monetize IoT resources (data and services)
- Tool for easy development of new, cross- platform services and applications



# 8 IoT platforms already speak BIG IoT

## Platforms

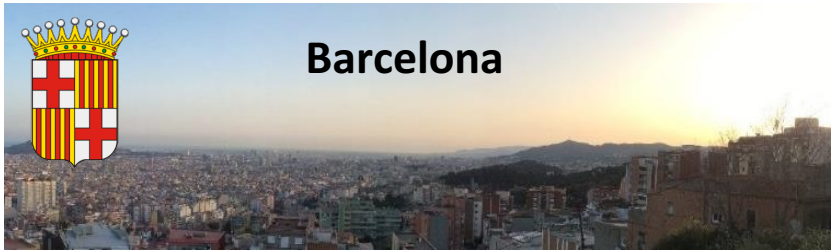




# Pilots & Use Cases

## Use Cases in the domain of Smart Mobility and Environmental Monitoring:

- Smart Parking
- Smart Traffic Management
- Public Transport Optimization
- Healthy Bike Navigation
- Smart Bike Sharing
- Incentive-based Green Route Planning
- Multimodal Route Optimization
- Smart Charging



# Project in a nutshell

Project Duration                      01.01.2016 - 31.12.2018

Consortium                              12 partners + 2 linked 3<sup>rd</sup> parties



**BOSCH**

**SIEMENS**



**SEAT**



econais



**vmz**

Verkehr Mobilität Zukunft



**wolfsburg AG**



**AALBORG UNIVERSITY**  
DENMARK



**OÉ Gaillimh**  
NUI Galway



**TU Clausthal**  
Clausthal University of Technology



**UNIVERSITAT POLITÈCNICA**  
**DE CATALUNYA**  
**BARCELONATECH**

- **€750k** for 3<sup>rd</sup> parties to implement new IoT solutions or integrate the existing ones into the BIG IoT ecosystem by making use of the BIG IoT enablers
- **2 Open Calls:**
  - first
    - Date: **26th Apr – 16th Jun 2017 – ONGOING**
    - Budget: €300k (up to €60k per project)
  - second
    - Date: **Jan – Feb 2018**
    - Budget: €450k





## What?

**Integrate** existing IoT data sources/platforms by using BIG IoT API and **offer** them on the BIG IoT Marketplace. The data sources should be related to **Smart Mobility** and **Environmental Monitoring**.



## Why?

- Join **strong ecosystem** , promote **your solution**, **increase usage** of your data for **new services and applications** of the second Open Call, get visibility in the European IoT community



## When?

Call Open:

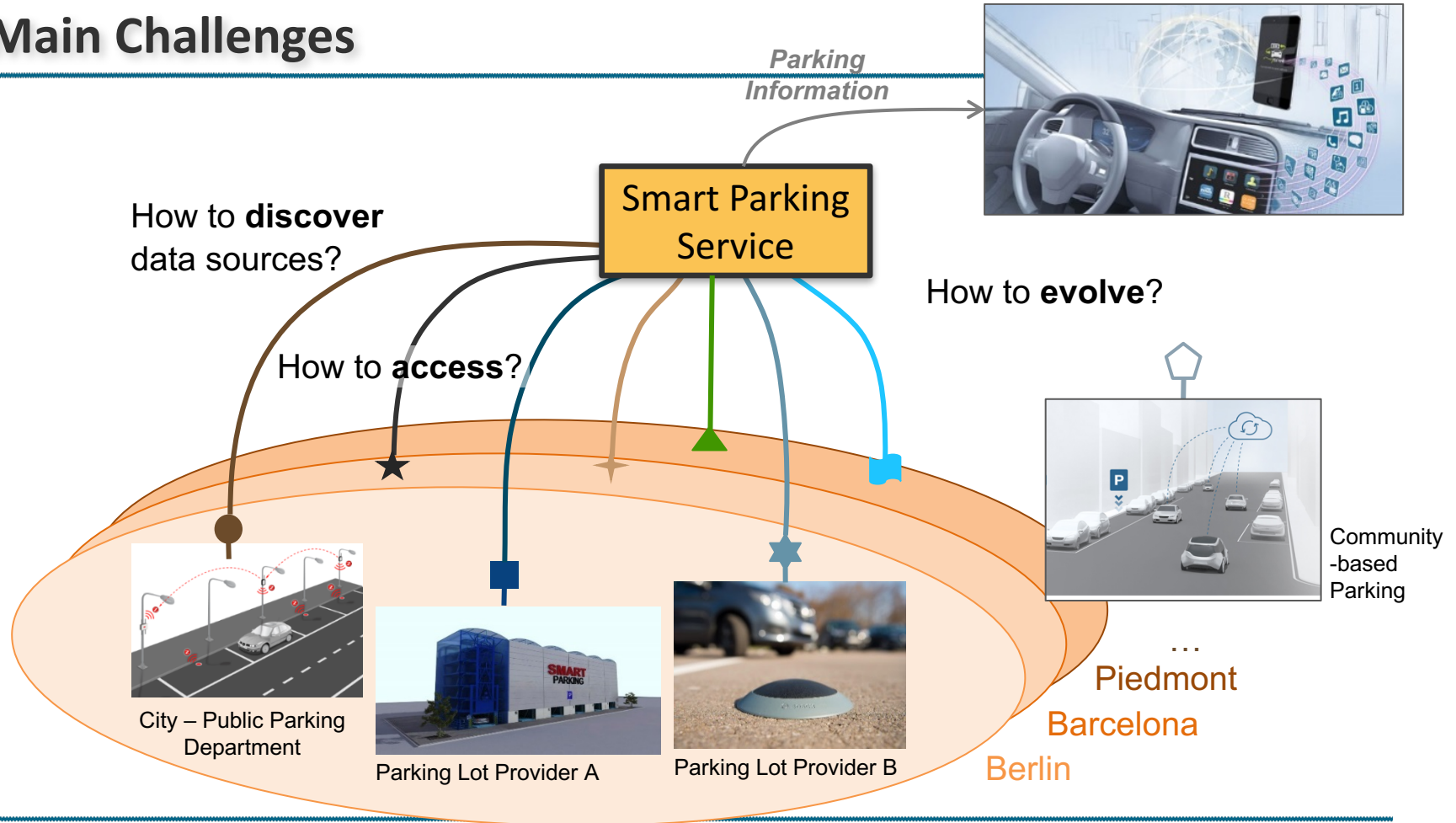
**26<sup>th</sup> Apr – 16<sup>th</sup> Jun 2017**

Project Implementation:

**Sep 2017- Jan 2018 (5 months)**

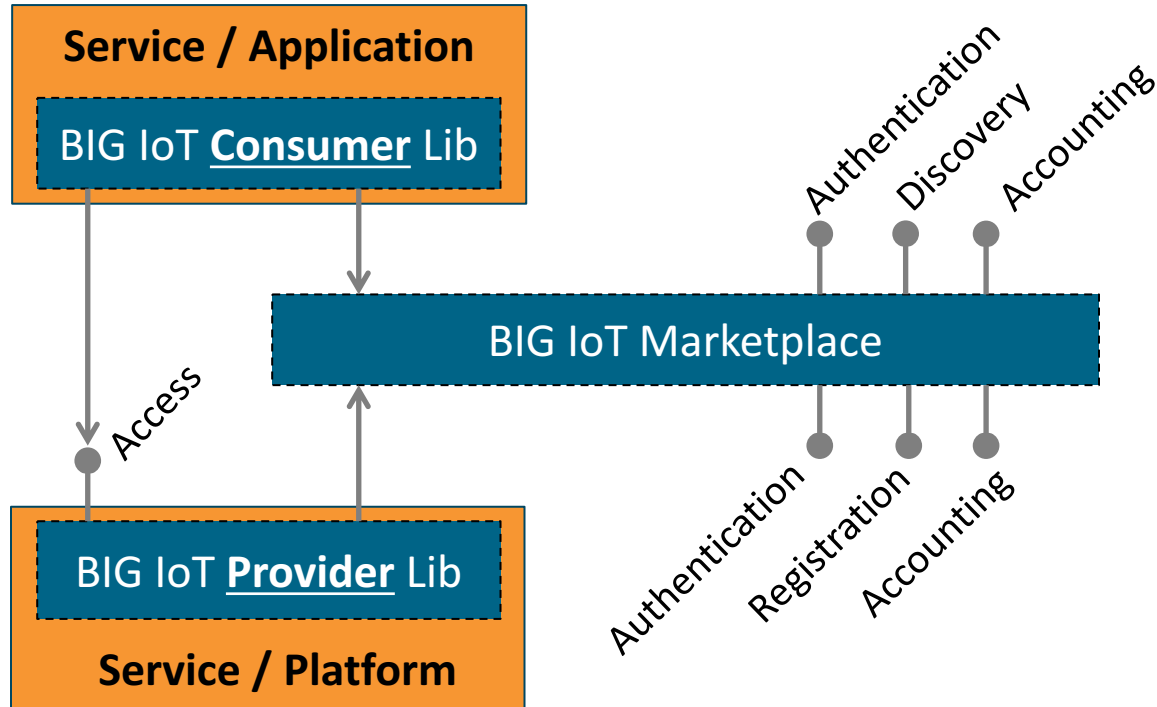
# BIG IoT Architecture

# Main Challenges



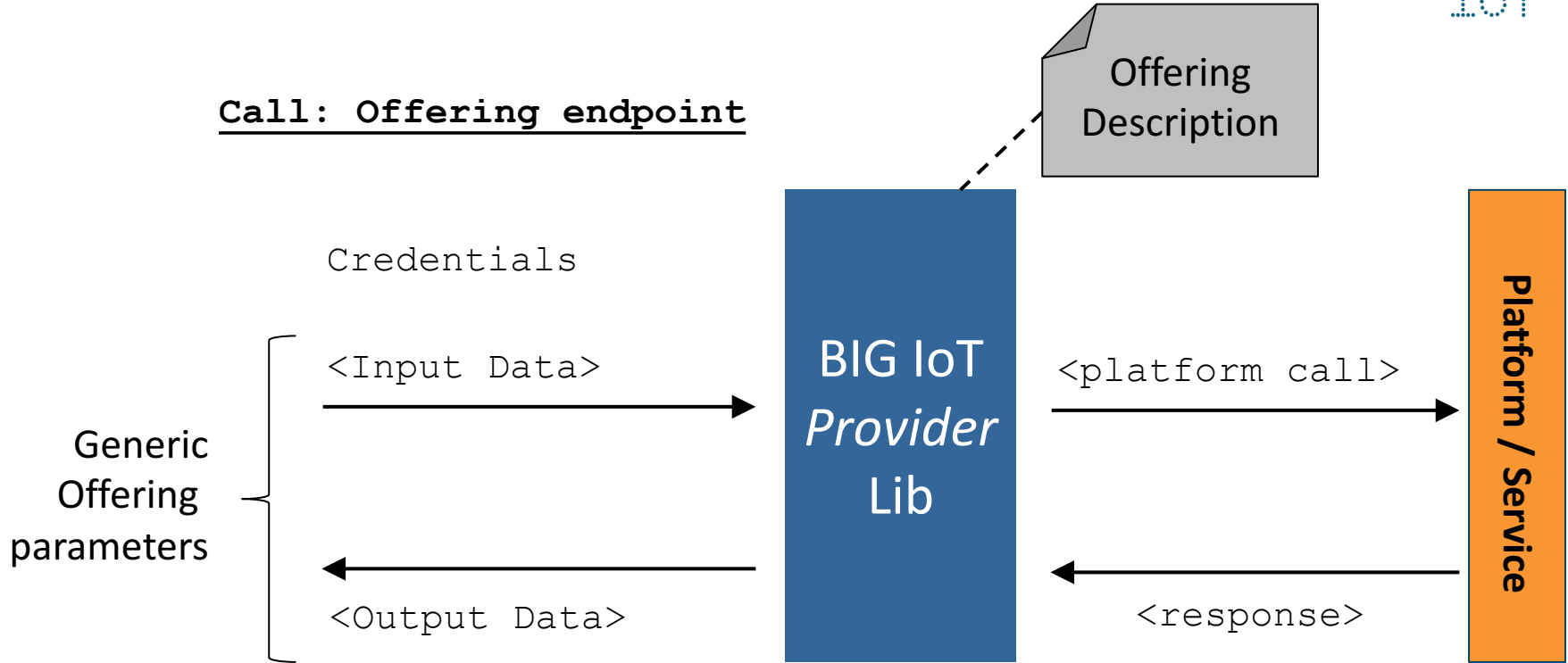


# High-level Architecture

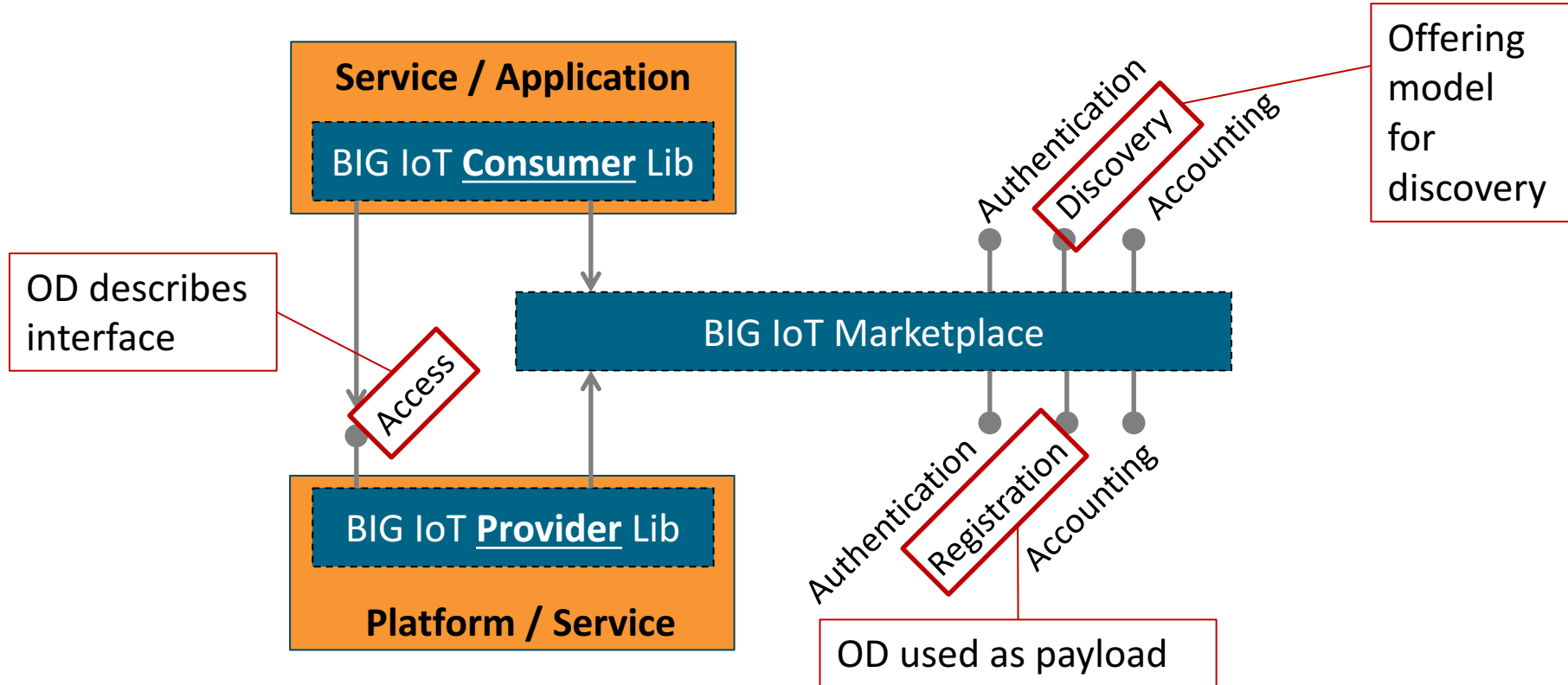




## Call: Offering endpoint



# Offering Description (OD)



# Offering Description – Example

Based on **W3C**<sup>®</sup>  
**Web of Things'**  
**Thing Description**

```
{ context: ["http://big-iot.eu/ctx" ,  
           {"schema" : "http://schema.org"}],  
  providerId: "Barcelona_City-provider"  
  name: "Sensor-level ParkingSpace Information"  
  category: "schema:parkingSiteManagement"  
  
  inputData: [  
    {name: "longitude", rdfType: "schema:longitude"},  
    {name: "latitude",  rdfType: "schema:latitude"},  
    {name: "radius",    rdfType: "schema:geoRadius"}  
  ]  
  outputData: [  
    {name: "longitude", rdfType: "schema:longitude"},  
    {name: "latitude",  rdfType: "schema:latitude"},  
    {name: "status",    rdfType: "schema:parkingSpaceStatus"}  
  ]  
  endpoints: { uri: "http://bigiot/access/parkinginfo", type: "HTTP_GET"}  
  
  licenseType: "OPEN_DATA_LICENSE", region: "Barcelona"...  
  
  price: { money: {amount: 0.002000, currency: "EUR"}, accountingModel: "PER_ACCESS" } }
```

Semantic  
annotations

URI of the  
Offering

# BIG IoT Marketplace ... for whom?

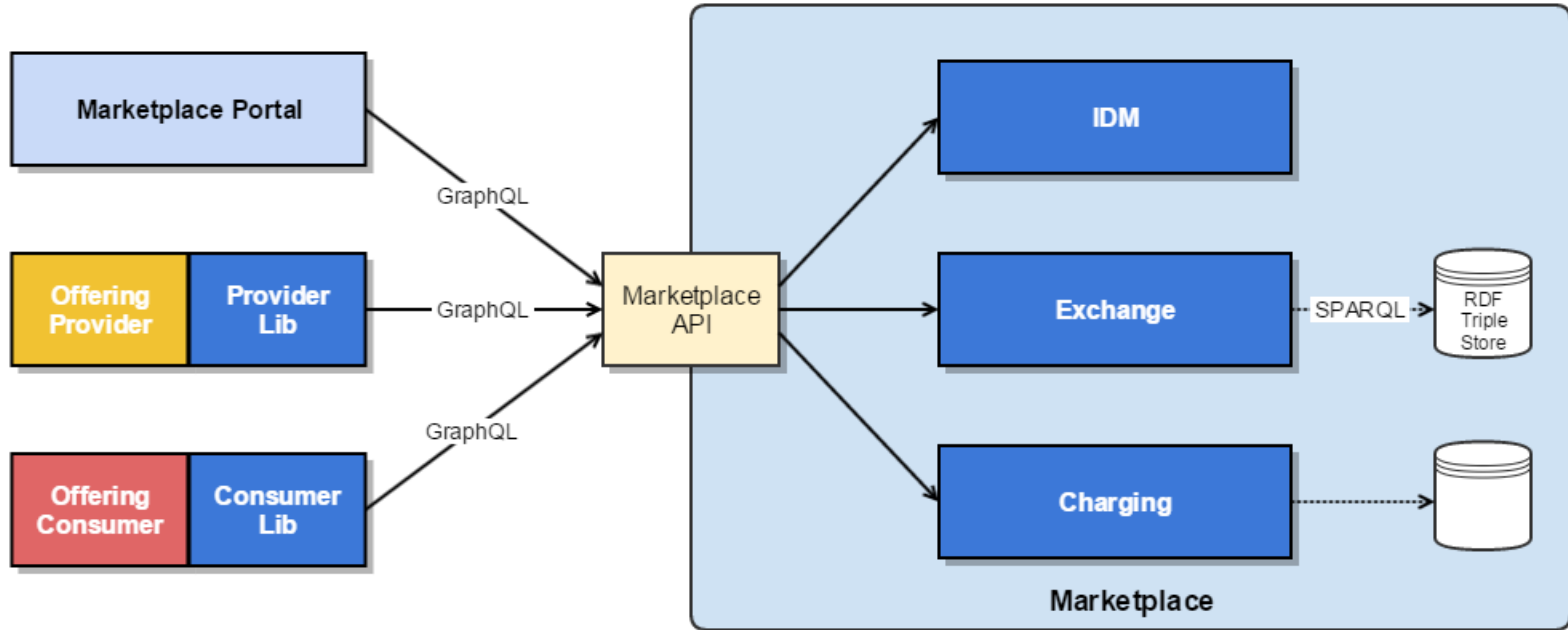
**End User** ... who are looking for apps



**Developers, IT guys, Creatives...**

- @ Smart City
- @ Mobility Company

... who need IoT *offerings* for their applications





All Offerings

My Offerings

My Providers

My Consumers

## Offering Query: Available Parking Offerings

Consumer	Parking Availability Service
Organization	Barcelona City
City	
Type	Parking - <i>bigiot:Parking</i>
Output Data	<b>availableParkingSpots:</b> Available Parking Spaces - <i>date:parkingNumberOfVacantSpaces</i>
Input Data	
License	
Price	

Copy Credentials to Clipboard



## Subscribed Offerings

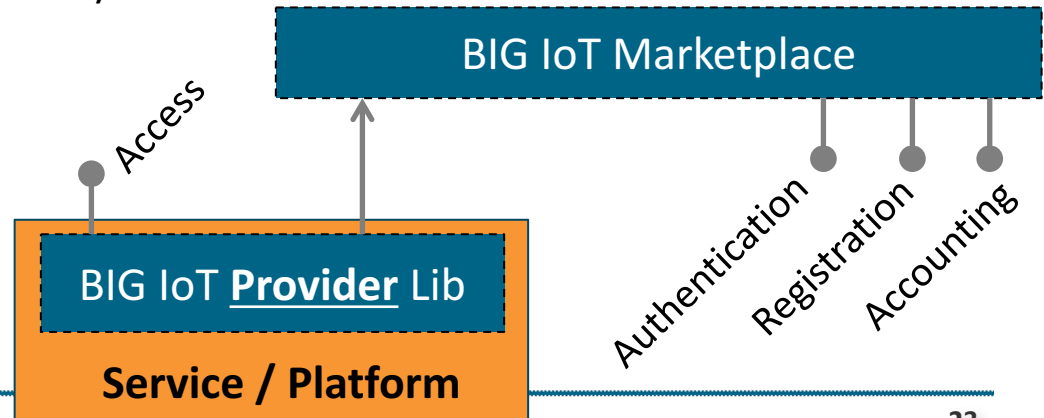
Subscription	Offering	Type	License	Price
<input type="checkbox"/>	Barcelo	Parking - <i>bigiot:Parkin</i>	Creative Commons	Free

## Other Matching Offerings

Subscription	Offering Name	Provider	Organization	City	Type	License	Price
<input type="checkbox"/>	Montalto Dora Parki...	Smart Data Platform	CSI	Montalto Dora	Parking - <i>bigiot:Parkin</i>	Creative Commons	Per Month: 1 Euro

# Your tasks to integrate with BIG IoT

1. Utilize **Provider Lib** (currently in Java) to implement access to your *Offerings*
2. Utilize **Provider Lib** to implement interactions with *Marketplace*
3. Create **Offering Description** for each of your offerings to register them
  - a. Collaborate to extend the **domain model** to accommodate your offerings
4. Provide offerings at BIG IoT marketplace **until end of BIG IoT project** for all partners
5. Provide **feedback** and shape an IoT Ecosystem



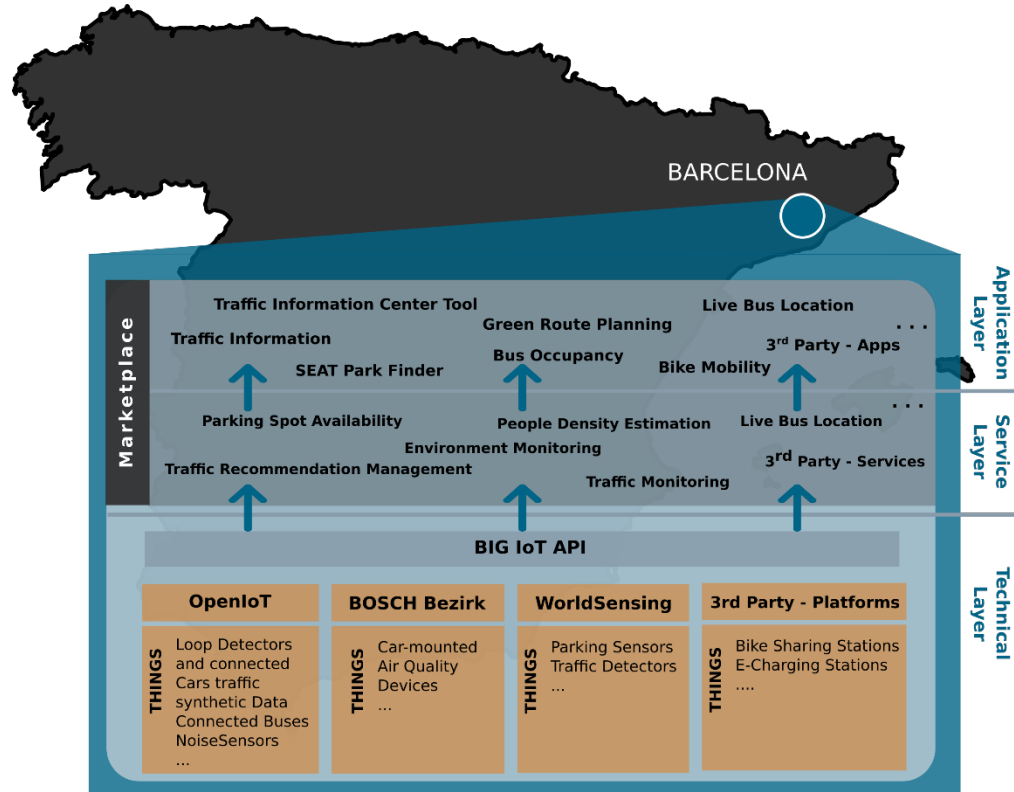
# More information: Developer Guide

The screenshot shows the 'Introduction' page of the BIG IoT Developer Guide. At the top, there are navigation links: 'Download API v0.7', 'Visit the (pre-release) Marketplace', and 'Visit the Project behind'. The page has a sidebar with 'DEVELOPER GUIDE' and 'RESOURCES' sections. The main content area is titled 'Introduction' and contains text about the API library and marketplace. A large, semi-transparent banner with a red border is overlaid diagonally across the page, containing the URL <https://big-iot.github.io/>. Below the text, there is a diagram illustrating the system architecture. The diagram shows a stack of services on the left: 'BIG IoT API' (with sub-components: Id & Lifecycle Management, Discovery, Access, Vocabulary Management, Security Management, and ...), 'Gateway', and 'Marketplace'. In the center, there are three 'Platform' boxes (A, B, and C) and a 'Service' box. Arrows indicate data flow from the platforms through the gateway to the marketplace, and from the marketplace to an 'Application' box at the top. The platforms are connected to a cloud containing icons for a bus, a car, and a smart meter.



















# Barcelona Pilot

# Barcelona Pilot



# Use Case Clusters Barcelona

Use Case Cluster	Northern Germany	Barcelona	Piedmont
Smart Parking			
Smart Traffic Management			
Public Transport Optimization			
Bike Mobility			
Incentive-based Green Route Planning			
Multi-Modal Route Optimizer			
Smart Charging			
Device-to-Device Communication			

# Smart Traffic Management

On the basis of **traffic and environment monitoring** (e.g., air quality sensors on connected cars or noise detectors), traffic recommendations will be supported to improve traffic conditions and minimize emissions caused by traffic jams, and waiting times.

- **Applications:** Traffic Information Center tool, Traffic Information to Citizens
- **Services:** Traffic monitoring, Environmental monitoring, Traffic Recommendations
- **Smart Objects:** Bluetooth and Magnetometers detectors, SEAT Cars Air Quality sensors, Simulated Data, Noise detectors
- **Platforms:** Open IoT, Bosch BEZIRK, Worldsensing, Sentilo




# Barcelona Pilot – Traffic Information Center Tool

BCN Pilot Application


Home Maps Entities Account Administration Language

## Traffic Information Center Tool


This is the Barcelona Pilot Smart Traffic Application



### Traffic Information Map



### Mobility Services Map



You are logged in as user "admin".

If you have any question:

- [BIG IoT Homepage](#)
- [BIG IoT Twitter](#)
- [InLab Homepage](#)
- [InLab Twitter](#)
- [UPC Homepage](#)

European Commission Horizon 2020  
inLab<sup>+</sup> FIB  
UNIVERSITAT POLITÈCNICA DE CATALUNYA BARCELONA-TECH  
Data provided by:  
Ajuntament de Barcelona  
WORLD SENSING  
With a collaboration of:  
BOSCH  
SEAT  
NUI Galway  
insight

# Smart Parking

Effective **navigation to parking spots** based on availability and distance, taking into account the current traffic conditions and parking prices.

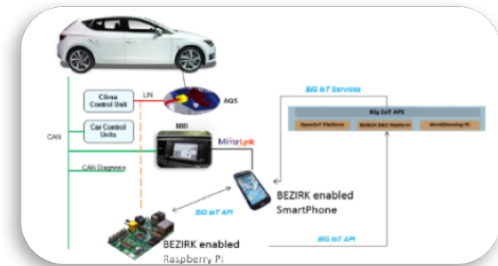
- **Application:** SEAT ParkFinder
- **Services:** Parking Spot Availability  
Service **Platforms:** WorldSensing  
FastPark
- **SmartObject:** Parking Detectors  
(WorldSensing/FastPark Platform)
  - Real-time access to 500 availability sensors in Les Corts area in Barcelona



# Incentive-based Green Route Planning







Usage of air quality and noise monitoring across the city in order to plan routes for cars in an environmental friendly manner. Participants will be **incentivized to follow green routes by car or use alternative means** (i.e. public transport or bikes).

- **Application:** Green Route Planning App
- **Services:** Traffic monitoring, Environment monitoring, Traffic Recommendations Service,...
- **Smart Objects:** Noise detectors, Bluetooth and Magnetometers detectors, SEAT Cars Air Quality sensors
- **Platform:** OpenIoT, BOSCH, WorldSensing
- **Other services:** Access to TMB services



# Barcelona Pilot - Overview



Barcelona Pilot Use Cases	In collaboration with
 Smart Parking	WorldSensing, <b>Barcelona City Council</b> , other external stakeholders
 Smart Traffic Management	WorldSensing, <b>Barcelona City Council</b>
 Incentive-based Green Route Planning	WorldSensing, <b>Barcelona City Council</b> , TMB (data provider)
 Public Bus Optimization (NEW!)	TMB
 Bike Mobility (NEW!)	<b>Barcelona City Council</b>
 Smart Charging (NEW!)	<b>Barcelona City Council</b>





- Using infrastructure based traffic detectors to measure speed, car count and related parameters.
  - These detectors are provided by WorldSensing, who also provides parking spot sensors.
  - Seat provides air quality sensing devices on connected cars.
- Our IoT platforms provide access to connected buses, connected cars, over 500 street parking sensors, several road-side magnetometers control-stations, and 37 Bluetooth/Wi-Fi antennas in the city.

- **Access to Open Data and Barcelona City platforms** (such as SENTILO) will also be enabled through the BIG IoT API, giving access to
  - noise detectors
  - bike sharing data
  - e-charging stations
  - ...
  
- We are using those *things* to implement mobility services and applications, such as a traffic information center tool, a smart parking app and green route planning.

# Questions & Answers



**Thank you for your attention!**



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[@BIG\\_IoT](https://twitter.com/BIG_IoT)



[big-iot.github.io](https://big-iot.github.io)



[BIG-IoT project group](#)



European  
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