BARCELONA SMART CITY

**Vision, approach and projects of the
Barcelona City to Smart Cities
- EXECUTIVE VERSION -**

Ajuntament de Barcelona | DOXA CONSULTING

Barcelona, 5th February, 2013

1. Vision

City people

Improve citizens well-being and quality of life

Technology as enabler for the city:

- ✓ Urban mobility more efficient and sustainable
- ✓ Environmental sustainability
- ✓ Business-friendly and attracting capital
- ✓ Integration and social cohesion
- ✓ Communication and proximity with people
- ✓ Knowledge, creativity and innovation
- ✓ Transparency and democratic culture
- ✓ Universal access to culture, education and health care

Economic progress

1. Vision

A city self-sufficient, of productive neighbourhoods at human speed, inside an hyper connected metropolis, of high speed and zero emissions
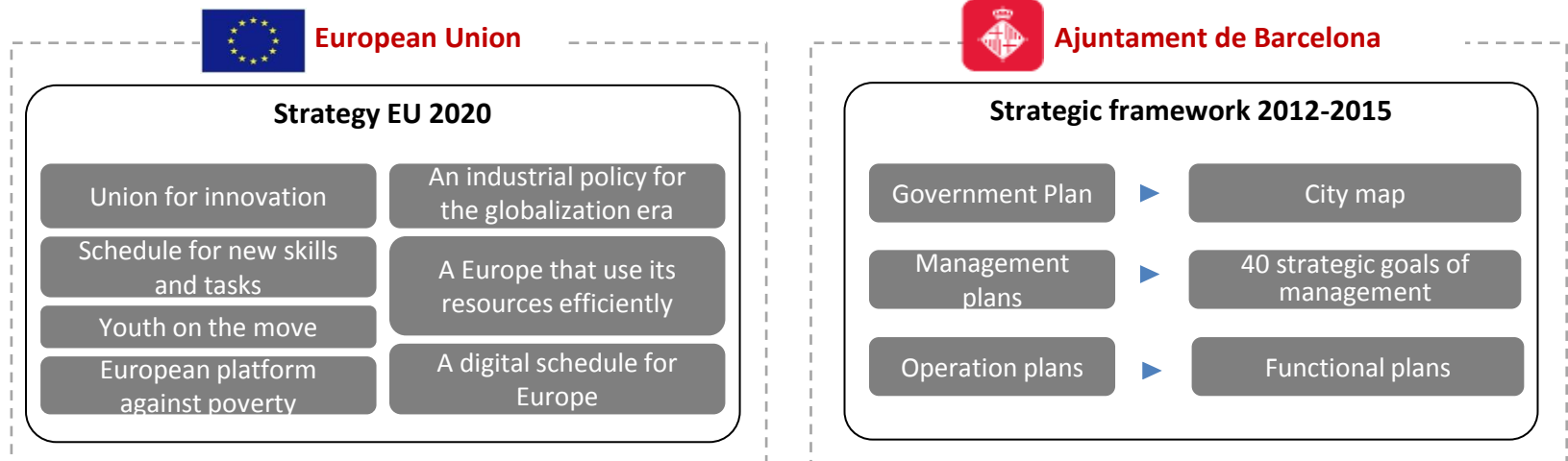
Axis	Vision
Intelligence	Building systems that both automate and interrelate the city processes, allowing the information to flow and be shared between different processes
Efficient	• Improvement of energy efficiency • Reducing response time in the city processes • Publics services Improvement • Corporate processes improvement (to achieve public services improvement)
Human	• Reducing air and acoustic pollution • Diluting vehicle traffic • Approaching the public service • Integrating all citizens to avoid exclusion groups (social action)

2. Framework of reference
Strategic framework

- **ICT strategic framework** of the Barcelona City Council (Ajuntament de Barcelona) is mainly conditioned for both environments: European Union strategy and the Council itself.

European Union

Strategy EU 2020

Union for innovation	An industrial policy for the globalization era
Schedule for new skills and tasks	A Europe that use its resources efficiently
Youth on the move	
European platform against poverty	A digital schedule for Europe

Ajuntament de Barcelona

Strategic framework 2012-2015

Government Plan	►	City map
Management plans	►	40 strategic goals of management
Operation plans	►	Functional plans

ICT framework of reference in the Barcelona City Council

City people   *City Map*

Axis

> **Citizens well-being and quality of life**
> **Economic progress**
> **Excitement of citizenship and confidence in the Institution**

Beneficiaries

1. PEOPLE and FAMILIES

"Favourite city to live with security, equity and quality of life "

1.1 Guaranteeing **accessibility, quality and equity** of services
1.2 Prioritize attention to **social collectives more vulnerable and persons** in **situation of dependency**
1.3 Promote actions that favour **reconciling work, familiar and personal life**
1.4 Making **education and culture** a **key factor of well-being** and success
1.5 Promote a **healthy citizenship**
1.6 Promote the **social function of sport**
1.7 Guarantee the **safety** of people
1.8 Guarantee the **local coexistence** and preserve **social cohesion**, such as that no man might be discriminated or see their fundamentals rights violated
1.9 Strengthen the **gender vision** in municipals policies
1.10 Encourage **stable and quality employment** for all
1.11 Create **channels for all citizens**, sensitivity to **internalize** what they say and **respond effectively**

citizens

...ONOMICS AGENTS and KNOWLEDGE CENTERS

...homy that generates opportunities for all"

... **etropolitan** Barcelona the **logistic capital** of the ... Europe
... when **emerging sectors** of high added value and ... **consolidated economic sectors**, establishing ...ona as quality reference
... **te the condition to attract capital** to invest in the city
... **te international contribution to the economy of** ...rcelona
... ting **SMEs and freelancers and promote** ... trepreneurship

3.6 Making Barcelona an **easy place for business** (Business Friendly)
3.7 Making Barcelona the **city of Culture, Knowledge, Creativity and Science** generating an enabling environment to attract and retain talent

Structure

4. "HABITAT URBÀ"

"A new model of healthy city that integrates environment, urbanism, infrastructures and ICT"

4.1 To promote the city **renaturing** and development **green connectors**

4.2 Guaranteeing **excellence in urban design** and buildings boosting a quality architecture

4.3 Boosting a responsible **environmental policy**, guaranteeing air quality and sustainability of water cycles of the area and energy efficiency

4.4 Leading the **re-information of the public space: smart cities** as impellers a new economy of urban services

"Productive neighbourhoods a human speed within a hyper connected city and zero emission"

4.5 **Promote access the quality housing and ensure their correct use**

4.6 Promote **self-sufficient islands** and **rehabilitation urban energy**

4.7 Encourage **hybrid neighbourhoods** in which we live and work

4.8 Improvement the urban **mobility** with sustainable and guaranteeing the same access opportunities around the city

4.9 Propel **news urban attractors**, that generate centrality around districts and distribute tourism for the city

4.10 Boosting the metropolitan area, **the integration of port, airport and frank zone, and develop areas of opportunity**

Resources

5. BUDGET

"Of a culture of spending to a culture of cost and prioritization results"

5.1 Management based on a **executive budget oriented achieve the goals of city**

5.2 Search **new sources of finance tied to capital**

5.3 Guaranteeing **investment capacity**

5.4 Improvement **efficiency, avoid duplications and release resources** for others priority programmes

5.5 Promote the **culture of result** and **austerity** in spending

6. GOVERNMENT, DIRECTORS and HUMAN RESOURCES

"Competitive institution, motivated and with pride of belonging and oriented to citizenship"

6.1 Guaranteeing the **quality** of attendance to citizenship preserving the **transparency and ethics** in public management

6.2 **Consider neighbourhood as a unit of municipal action** to win proximity and efficiency

6.3 Encourage strong human teams, with experience and ability to innovate and promote **motivation and compromise**

6.4 Guaranteeing productivity and **alignment** in all levels of the organization

7. KNOWLEDGE, TECHNOLOGY, INNVATION and COLLABORATION

"Barcelona, open innovation in public management"

7.1 Introduce a new model of collaboration with **the private sector and the third sector** based in contracts program

7.2 **Proactivity** on interaction with **other administrations** for **guarantee the better results**

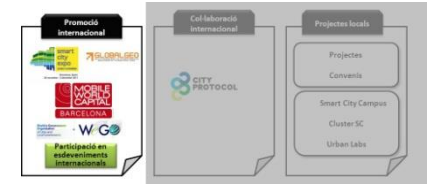7.3 **Improve ICT** to achieve a **administration more nearly and efficiency**

3. Smart Barcelona Project
Strategic axis

Actions of the *Barcelona Smart City* project development on three axis: **international promotion, international collaboration and local projects.**
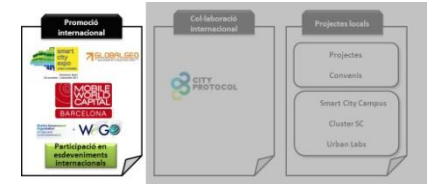

International promotion

Participation in international events

International collaboration

CITY PROTOCOL

Local projects

Projects
Agreements

Smart City Campus
Cluster SC
Urban Labs

3. Smart Barcelona Project
(a) International promotion

3. Projecte Smart Barcelona
(a) Participation in international events

3. Smart Barcelona Project
(a) Internationals acknowledgments
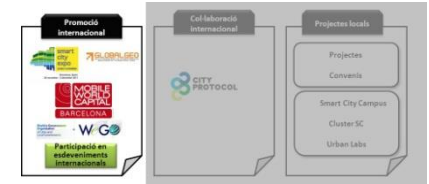
Top 10 of smart cities in Europe in 2012:

1. Copenhagen   6. Berlin
2. Stockholm   7. London
3. Amsterdam   **8. Barcelona**
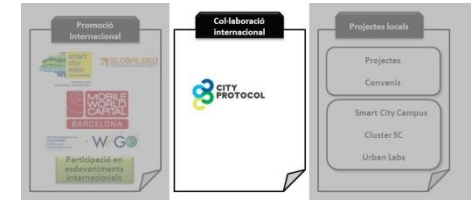4. Vienna   9. Munich
5. Paris   10. Frankfurt

Top 5 of smart cities in Spain in 2012:

1. **Barcelona**
2. Santander
3. Madrid
4. Málaga
5. Bilbao

**Certification "Biosphere World Class Destination"**
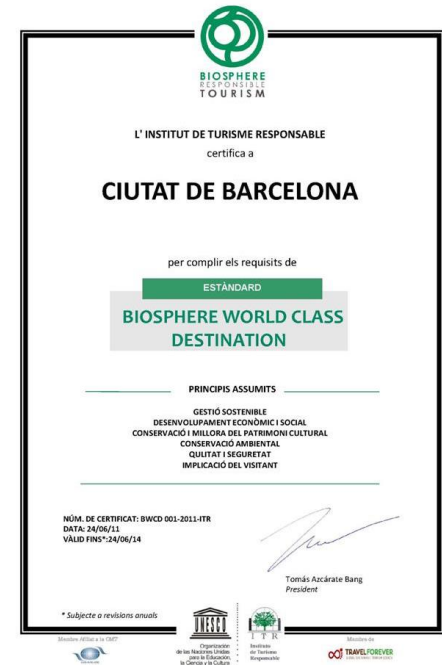
3. Smart Barcelona Project
(b) City Protocol Society

The *City Protocol Society* is a community of cities, companies, universities/research centres and others organizations based on mutual trust that use the knowledge and experience of all members to accelerate the sustainable transformation of the cities. The CPS assisting cities in the transformation process.
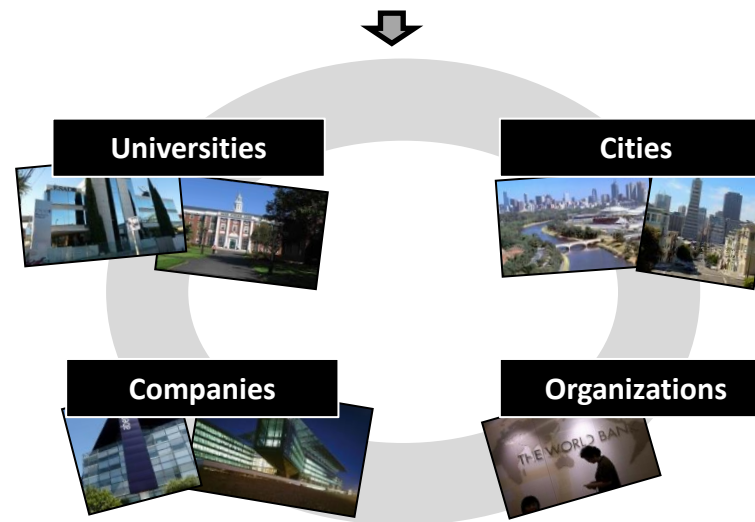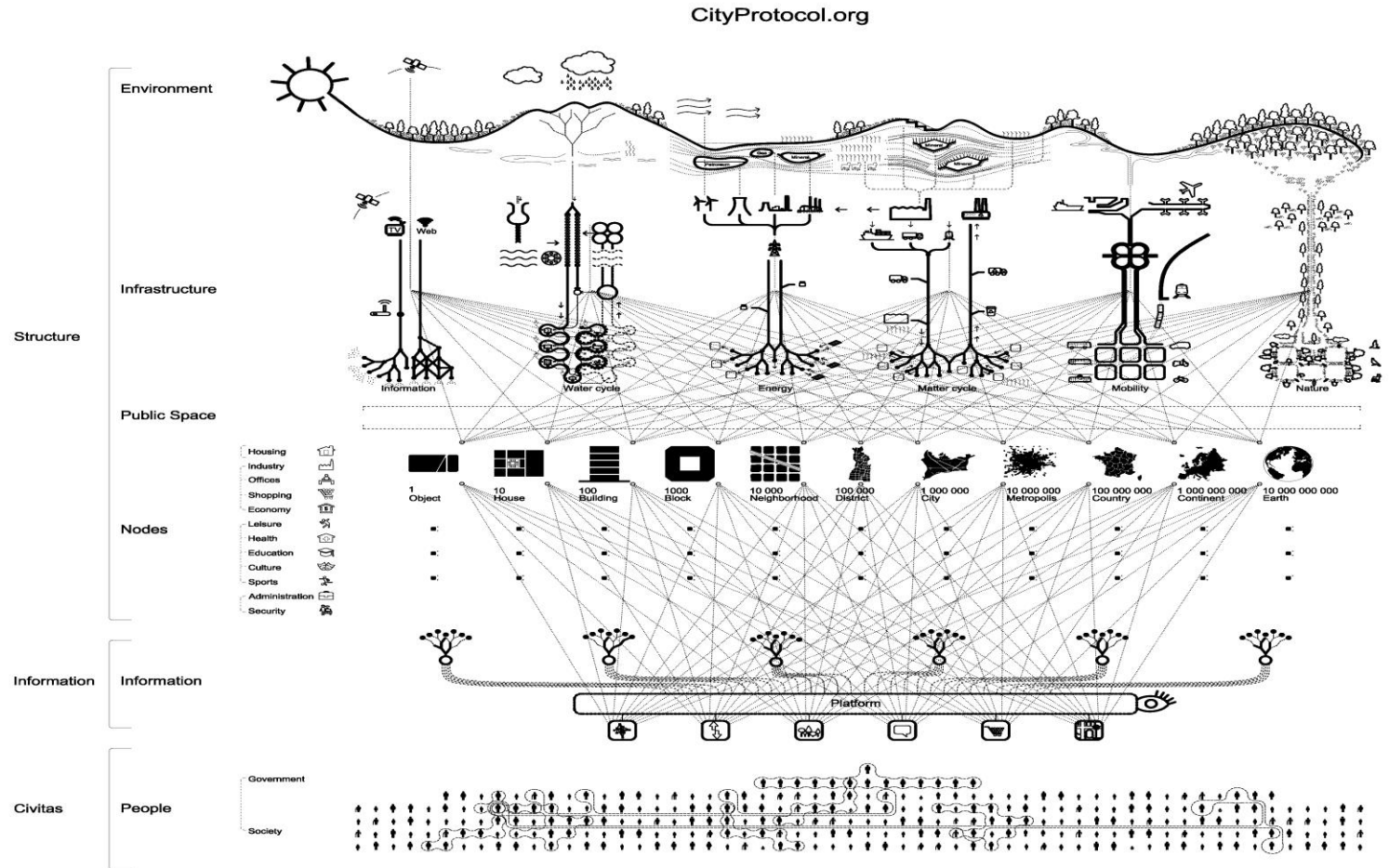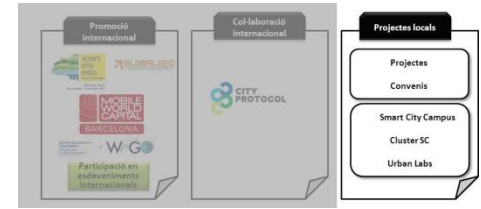

Better cities for everyone, worldwide: Built by cities, industry, academy, organizations and society working together
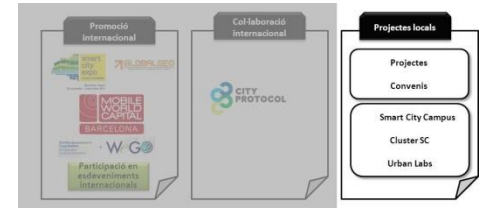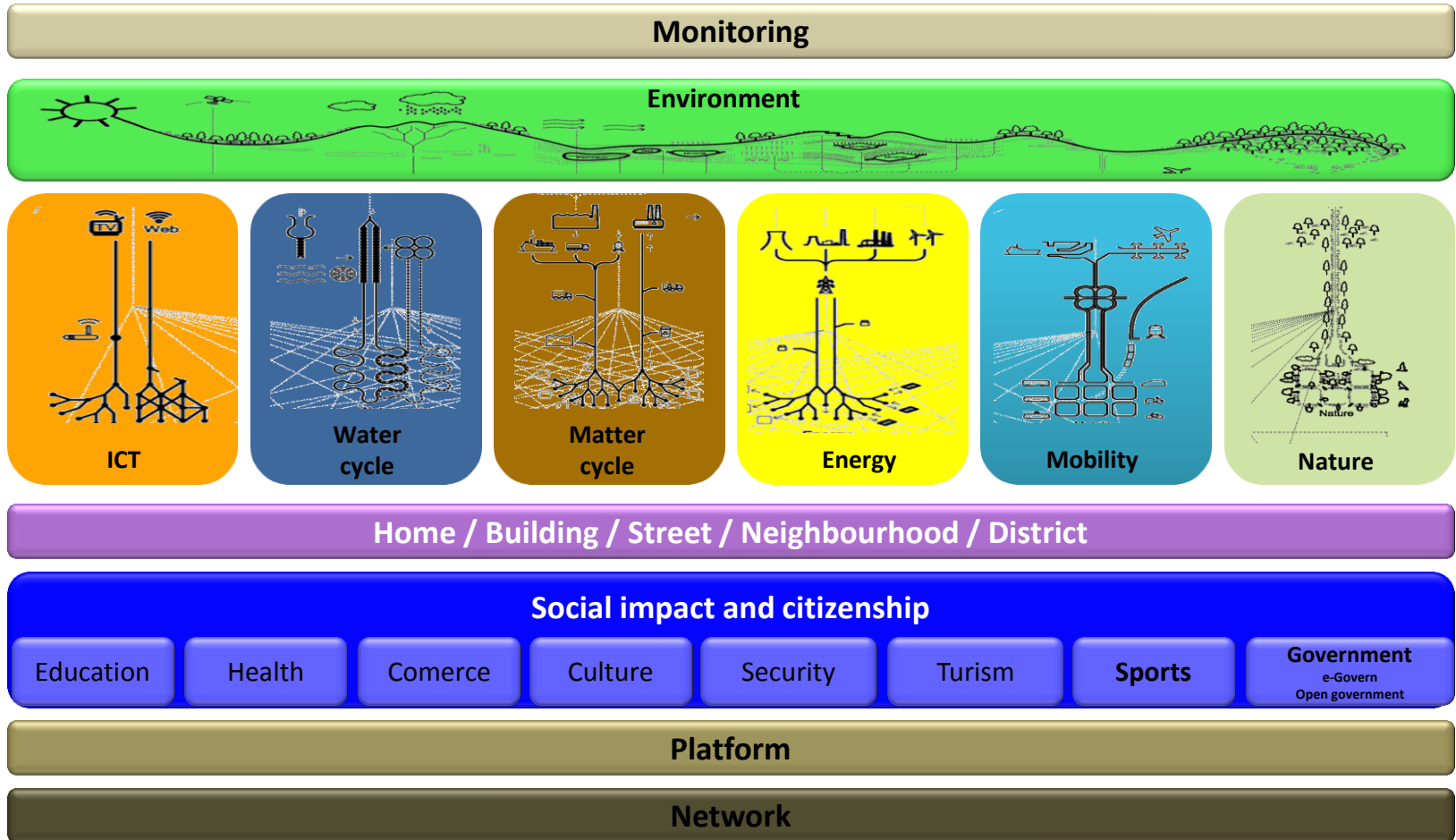
3. Smart Barcelona Project
Conceptual model of Smart City (I)

CityProtocol.org

3. Smart Barcelona Project
Conceptual model of Smart city (II)

Monitoring

Environment

| ICT | Water cycle | Matter cycle | Energy | Mobility | Nature |

Home / Building / Street / Neighbourhood / District

Social impact and citizenship

| Education | Health | Comerce | Culture | Security | Turism | **Sports** | **Government** e-Govern Open government |

Platform

Network

Main city projects

1. New Telecommunications Network

2. Urban Platform (CityOS, Barcelona Sensors Platform)

3. Intelligent data (Open Data, iCity, Situation Room)

Cross curricular projects

4. Municipal WiFi

5. Telemanagement irrigation

6. Master illumination plan

7. Self-sufficient islands

8. Promotion of electric vehicle

9. Orthogonal Bus Network

10. Urban Transformation (Remodeling Passeig de Gràcia, Passeig Sant Joan)

11. Barcelona pocket (Barcelona Contactless and mobile apps)

12. European projects
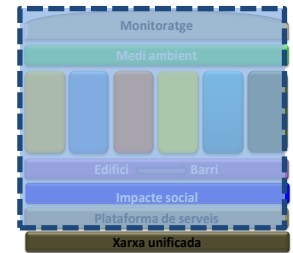
Vertical projects
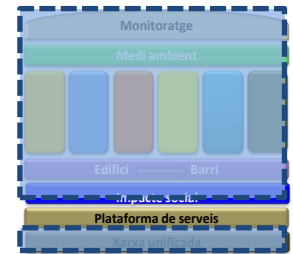
4. Main city projects

(1) Telecommunications Network (New Municipal Network)

IMI has begun a transformation process that should evolve:

- from the current model of vertical network of infrastructures separation and network for final services
- to a model of horizontal layers that independent in largely of the services and applications of the underlying infrastructure and telecommunications networks and facilitate the implementation of new services and ultimately the value of everything
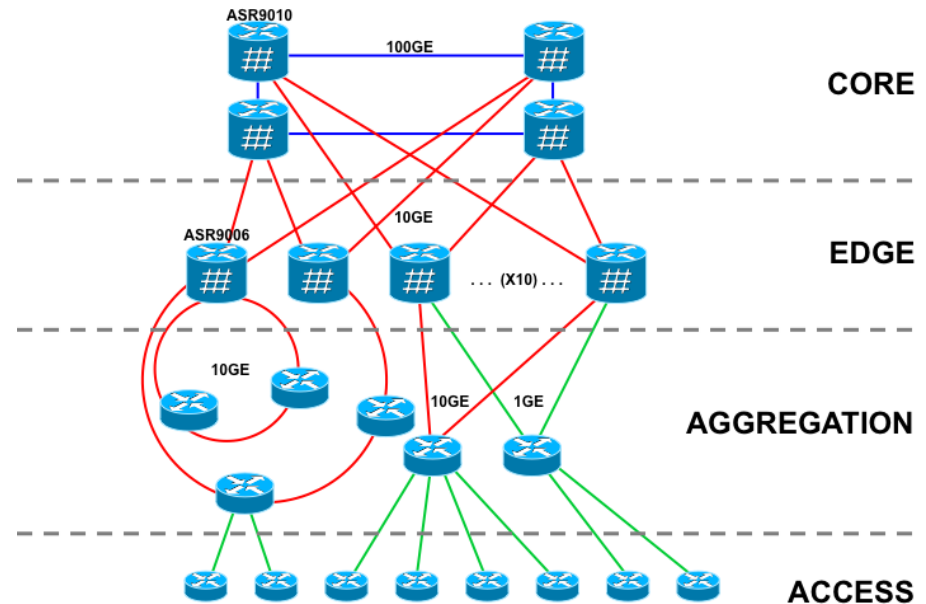

The final goal of the transformation that IMI wants to lead is the reduction of the net expenditure associated with the operation and maintenance of the various networks and explore possible scenarios to generate net revenue for the City Council

4. Main city projects
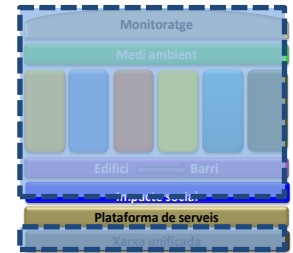## (2) Urban platform

Various data, with very different backgrounds, which can be represented, but not interpreted from a global version
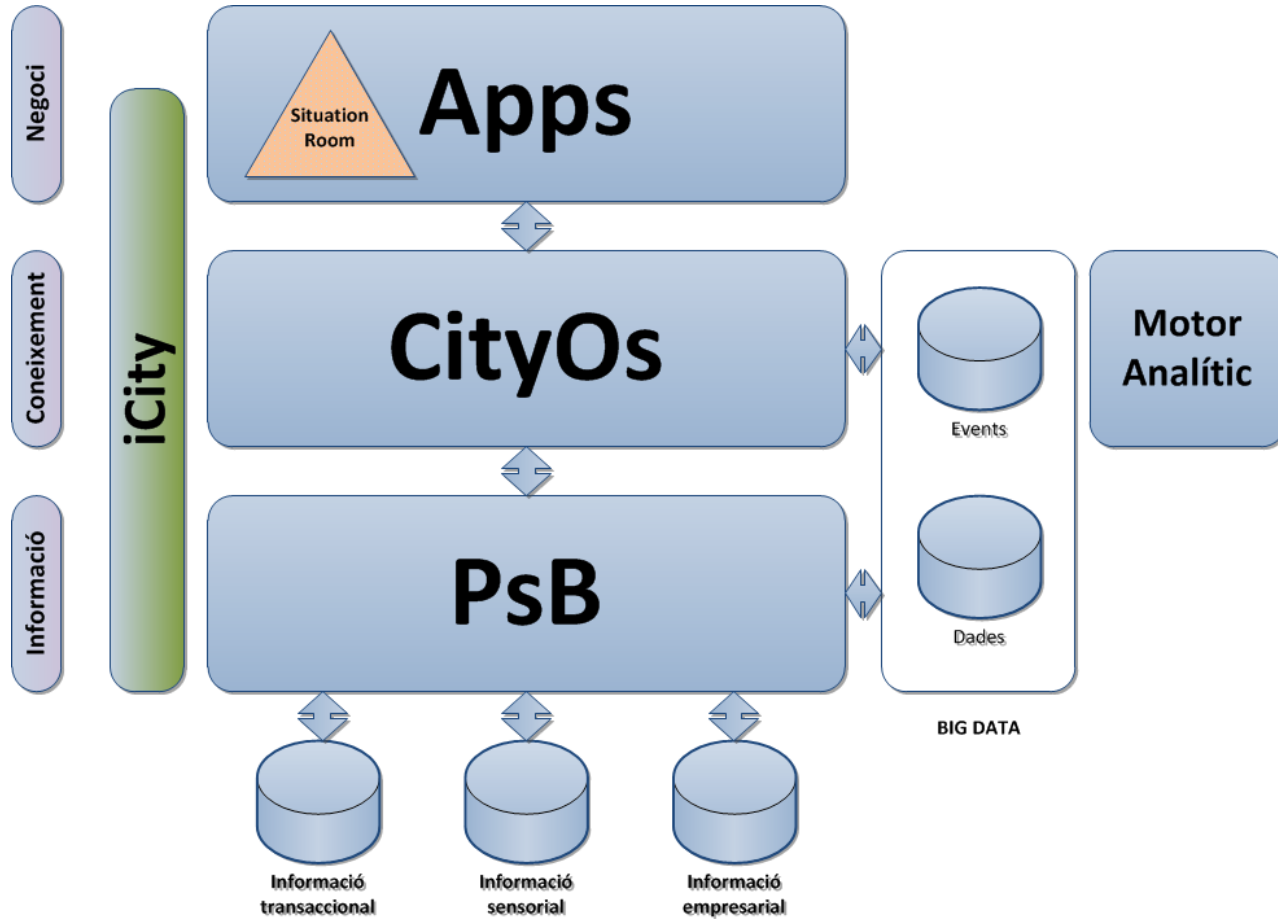
services

Public transport

works

commerce

Tourism
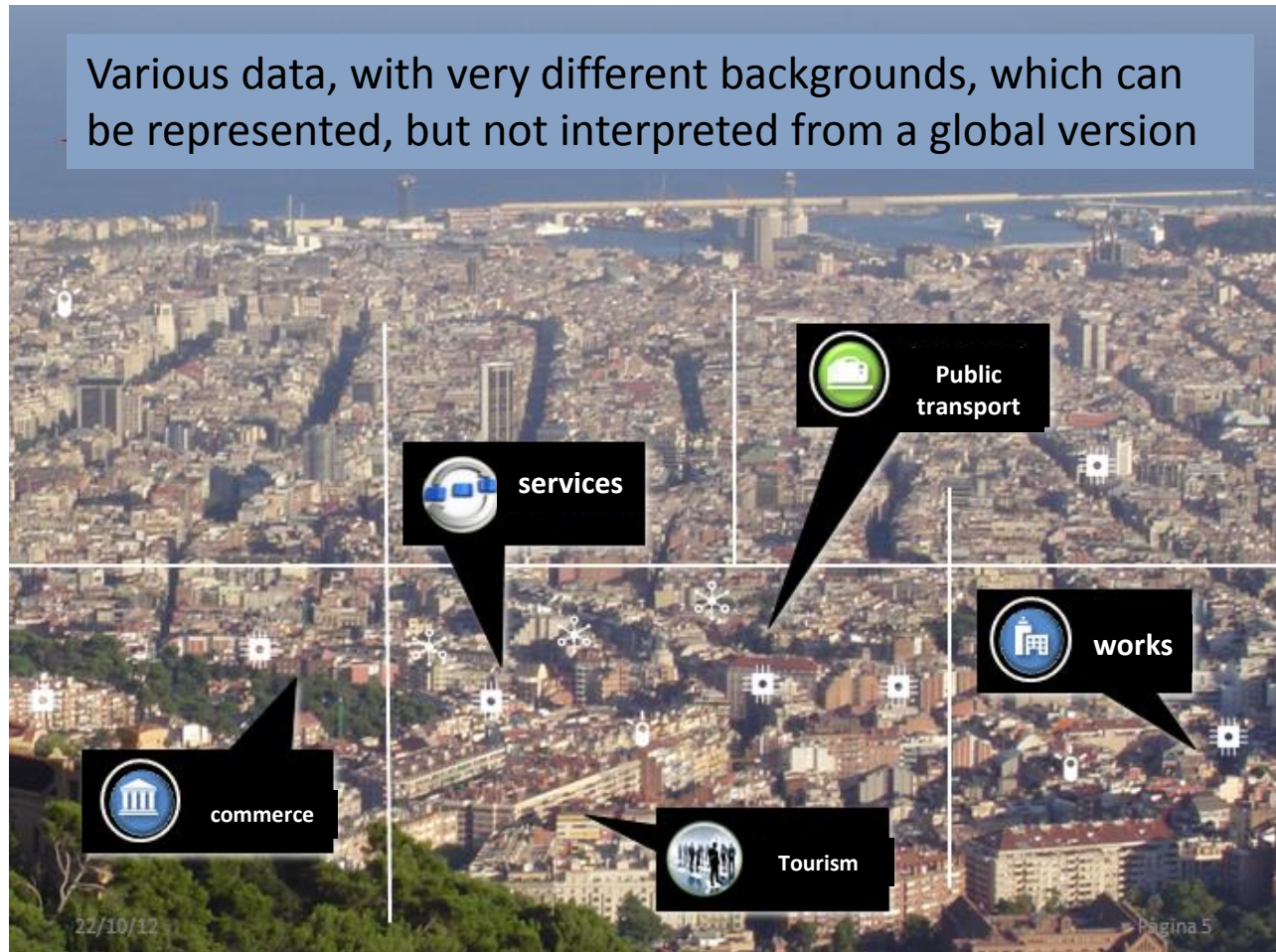
4. Main city projects
(2) Urban platform
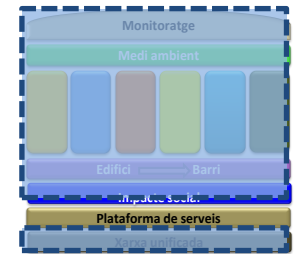
4. Main city projects
(2) Urban platform (City OS)

CityOs: sistema operatiu de ciutat

Permet desacoblar les solucions tecnologiques dels seus proveïdors, **definint processos de ciutat "complexos" que permetin la presa de decisions en temps real,** Generalitzant, possibilitant l'escalabilitat i definint un model exportable

Podem construir un **model estàndard de referència** que encaixi en els principis del *City Protocol*

Apps
Projectes Smart

CityOS

Intel·ligència / processos d'actuació horitzontal

Model de ciutat

Gestió d'events a la ciutat

Instrumentació
PSB
Sensors, actuadors, dispositius, aplicacions ...
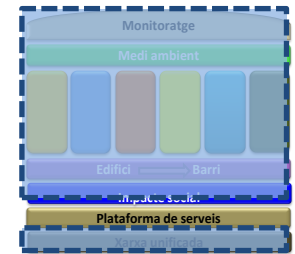
4. Main city projects
(2) Urban platform (Sensors platform)

Urban Platform **(BSP**) is a cross technological platform for the management of telecommunications networks and infrastructure of the city. Its implementation will allow industrialization of the network sensors deployed on the streets.

Vertical services

Applications

| ICT | LIFE | MAT | ENER | MOB | NAT |

BSP

Storage of data and processes

Will provide aggregate data of devices applications

Transport of data

Will provide different mechanisms for send the data from the devices to the data centre. (Wifi, 3G ...)

Acquisition of data

Will capture the data from the sensor network using a standard protocol and sends them to the transport networks

Temperature, humidity, light, ...

Sensor network

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4. Main city projects
(3) Intelligent data (Situation Room)

Situation Room, is the Platform for integration and sharing of information about the city and its services. It is a center that will control centers across the city, not management services integrated into it. Its goal is to have a tool to improve governance. It is not their goal incident management and monitoring of emergencies.

STATE SERVICES

STATE SERVICES
- ✓ Bus and Metro
- ✓ FGC and RENFE
- ✓ Natural Gas
- ✓ Others

EMERGENCIES
- ✓ Local Police
- ✓ Firemen

INFRASTRUCTURES
- ✓ Communications
- ✓ Access

Information "on-line" dynamic

"Situation Room"

Tool for decision making

Information "off-line" static

CITY INFORMATION

CITY COUNCIL
- ✓ Cleaning
- ✓ Lighting
- ✓ Traffic
- ✓ Others

PUBLIC COMPANIES
- ✓ TMB
- ✓ FGC
- ✓ RENFE
- ✓ Others

PRIVATE COMPANIES
- ✓ Endesa
- ✓ Gas Natural
- ✓ Telefónica

4. Main city projects
(3) Intelligent data (iCity, Opendata and CitySDK)

The goal of these projects is made available to third parties (mainly companies that can create new business processing and use) data and public infrastructure of the city (with the limitations of logical security).

These three european initiatives that aim to turn these platforms in standards that can be used in any city in Europe.

Put available to third parties (citizens and companies) **infrastructure for smart cities** of the city.

Providing **public information**, semantically normalized, companies and individuals to create these services used around public and / or private.

Development of a platform to facilitate the availability of third parties (citizens and businesses) **municipal applications.**

4. Main city projects
Vertical projects: Prominent milestones (I)

"550 ATMs, a million credit cards with NFC, 19,000 retailers dataphones city"

"180 electric cars, plug-in hybrids 20, 30 electric motorcycles, 250 charging points, users 3450, 5 hotels with service Mobechotel fruit of the European Molecular"

"Monitoring energy of 23 public buildings and implementation of monitoring in 31 buildings"

"Self-power public buildings, photovoltaic systems with 59, 1 and 2 Minieòlica Fred thermally activated"

"Remote from public sources 301, 35 stairs and 34 elevators"

"252 points in the citizen WiFi and 469 point in the municipal network in public"

"240 pneumatic waste collection points at 22 @"

" 44 points BCN public information "

4. Main city projects
Vertical projects: Prominent milestones (II)

"19,500 meters in the Olympic village and district 22 @"

"50 sensors deployed in different parts of the Eixample as the estimated time series of urban"

"Telecare service 50,000 homes, most people over 75 years"

"Urban network hot and cold of 14 km connecting 56 buildings (561,000 m2 of air-conditioned) and 22 @ Forum Zone"

"Network orthogonal Bus: 17 vertical lines and 3 horizontal 8 diagonals. With an estimated savings of 5 to 10% "
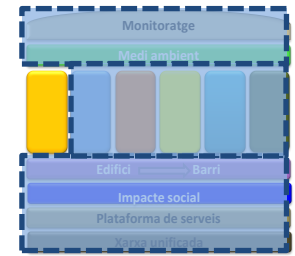
"Mobecpoint 20 stations that will serve simultaneously in more than 120 electric motorcycles"

"More than 500 hybrid taxis"

"3 LED street lighting with minimum energy consumption, more than 50 lanterns"

Below is a summary of the most significant ...

4. Main city projects
(4) Municipal WiFi (ICT field)

Municipal WiFi

GOAL

WiFi network deployment using public WiFi, which allows access to Internet and WiFi municipal public road, which forms the municipal network.
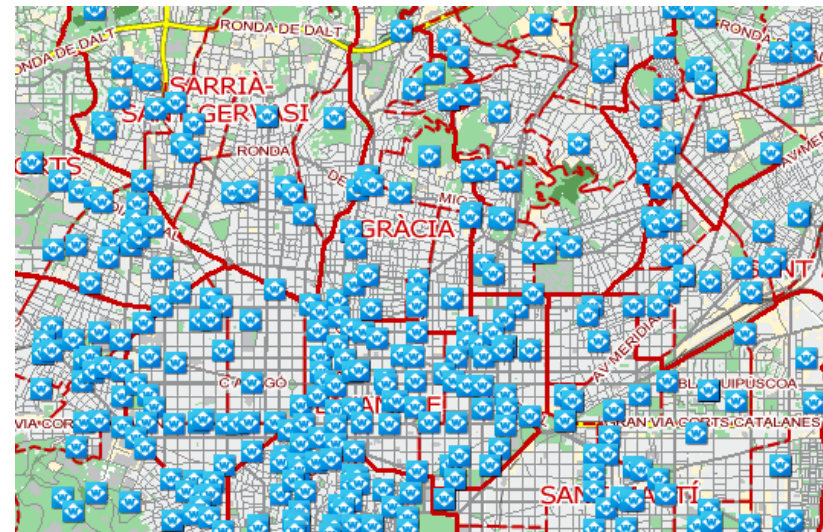
SCOPE

Network of public WiFi 251 points and 469 points comprising the assets of public WiFi, prioritizing areas where it has the highest usage in order to improve efficiency and allow the emergence of new applications.
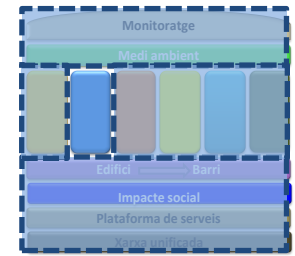
STATE

Project **in operation**.

MILESTONES

Responsible: Miriam Alvarado (IMI)

"251 points and 469 points WiFi public assets that make up the public WiFi"

Map of WiFi stations in Barcelona

4. Main city projects
(5) Remote management of irrigation (water field)

Remote management of irrigation

GOAL
Installation of a **SCADA system for remote centralized control automated irrigation infrastructure** in order to control the duration and frequency of irrigation in each area, depending on the needs.

SCOPE
Development of a system that integrates sensing probes of temperature, salinity and humidity, that allow through an irrigation controller, send the necessary information to the management system SCADA.

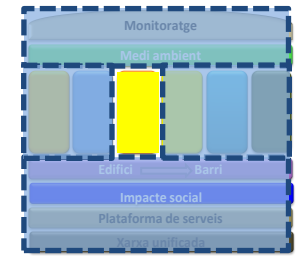### STATE
Joan Miró park **pilot project** in process.

MILESTONES

Responsible: Cristina Vila (Water Cycle)

"Currently 40% of parks have an automated system. Estimated to be 12% in November smart-13 "

Garden with humidity sensor

4. Principals projectes de ciutat
(6) Pla Director d'Il.luminació (àmbit Energia)

Lighting Plan

GOAL
The plan lighting Barcelona is a strategic plan, brand or technology does not determine criteria for projects. Therefore define the criteria which requires the city light: color temperature, levels, uniformity, contrast, or not determined numbers of lamps or lighting technology.

SCOPE
Considered a budget of 18 M € in enabling the streets and € 2M vertical plane ...
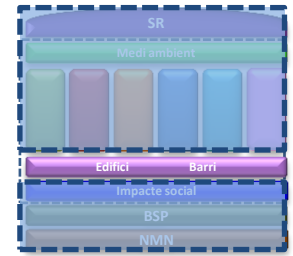
STATE
Effect. Plan covers a period of two years (2013/2015)

MILESTONES

Responsible: Luisa Cabezas (Street lighting)

Early interventions considering the lighting plan of the city, will be Galileu street, Tarradellas avenue, Passeig de Gràcia and the monument Mossèn Jacint Verdaguer

4. Main city projects
(7) Self-sufficient islands (Energy field)

Self-sufficient islands

GOAL

Creating energy self-sufficient island, in order to improve practices related to consumption and production of energy.

SCOPE

Study and definition of practices to improve energy production and consumption through the development of a pilot project in 2 buildings.

STATE

Pilot project **definition**.

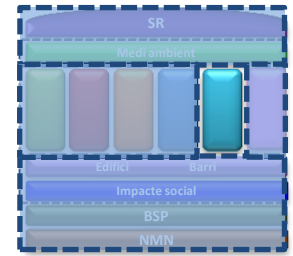**Partners**

Schneider Electric
TELVENT

MILESTONES

Responsible: Cristina Castells
(Energy agency)

It is based on the incorporation of solar roofs, mixed uses, joint district heating, water recycling, and the use of electric vehicles as the most outstanding proposals.

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4. Main city projects
(8) Fostering Electric Vehicle (mobility field)

Municipal strategic plan for the development of EV

GOAL

Development of electro-mobility in the coming years, short-term (2 years) and medium term (5 years) in Barcelona.

SCOPE

Defining a roadmap that can be the basis of the Platform Development Plan for the period 2013-2015 LIVE on the following strategic areas: 1. Development and operation of the platform LIVE 2. Incentives, regulatory and standardization, 3. Deployment of public and private fleets VE 4. Charging infrastructure, energy and communication systems, 5. Business development, 6. Communication, dissemination and promotion.
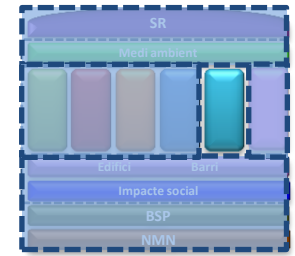
STATE

Development project.

Responsible: Àngel López

MILESTONES

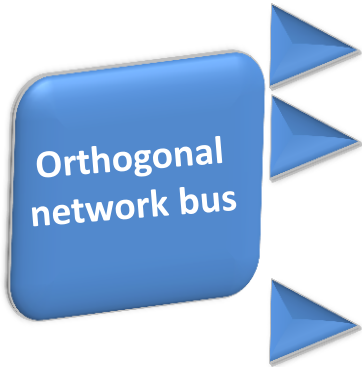**"Defining a roadmap that can be the basis of the Platform Development Plan for the period 2013-2015 LIVE"**

More than 240 public charging points

4. Main city projects
(9) Orthogonal network bus (mobility field)

Orthogonal network bus

GOAL

Orthogonal design of the bus from Barcelona to improve urban mobility.

SCOPE

Definition and implementation of ICT applications and services Smart applicable to the various stalls that make up the orthogonal network, including services related to bus service or stop using the infrastructure to provide other public services.

STATE

Pilot project **definition**.
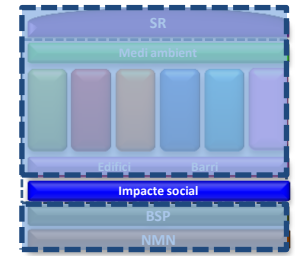
MILESTONES

Responsible: Josep Mensión (TMB)

17 vertical lines (from sea to mountain), 8 horizontal lines (parallels to Gran Via) and 3 diagonals (Sants – Paral·lel, Diagonal and Meridiana).
Estimated savings: 5 to 10%
Currently 5 lines and 6 points exchange

Orthoganal network bus

4. Main city projects
(10) Urban transformation (neighbourhood field)

Remodeling of the main streets

GOAL
As part of the redevelopment of the main streets of Barcelona (Passeig de Gracia initially, Paral·lel and Passeig de Sant Joan) project will develop a series of smart cities and telecommunications.

SCOPE

1. Expansion of the municipal network: fiber optic and WiFi connectivity ensure availability.
2. Mobile applications to provide services to professionals and the public.
3. Deployment of multiple sensors and systems telegestionats.

STATE
Project **in process.**

Partners

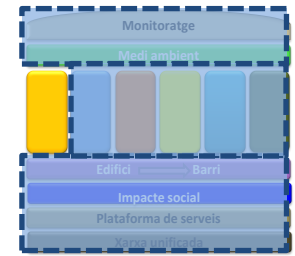CISCO · world sensing · urbiotica THE CITY OPERATING SYSTEM

Responsible: Juan García Rey
(Investment and Espai Vial)

MILESTONES

"More than 100 multi lights preinstalled. Over 30 WiFi access points with high capacity. More than 50 sensors and devices in Passeig de Gràcia. "

4. Main city projects
(11) Barcelona pocket (social/citizenship field)

Barcelona contactless (TAP & GO)

GOAL

Massive deployment in the city of contactless payment technology with mobile NFC. In the first phase, before generalising the terminals with NFC, payment can be made through credit cards, **any kind of service.**

SCAPE

Development and implementation in the first phase, during 2012, the payment by NFC contactless cards, to introduce a second phase, in 2013, the mobile payment. Inclusion of Bicing service payments.

STATE

Project under **implementation.**

Partners

MILESTONES

Responsible: Sergi Jerez (IMI)

- **550 ATMs, a million credit cards with NFC.**
- **Dataphones 19,000 retailers in the city.**
- **Barcelona full implementation in 2016, 3 million phones with NFC.**

4. Main city projects
(12) European projects in forecast

The Barcelona City Council has submitted or is in the process of submitting proposals for collaboration with various companies in European projects related to smart cities.

Arrowhead project development within the **ARTEMIS** European program "Leading Innovation" 2012 in the areas of energy and mobility.

FP7 European project Smart Cities and Smart Grid, aimed at energy efficiency.

European Project **LIFE** intelligent automated waste collection.

BESOS European project (**B**uilding **E**nergy decision **S**upport Systems f**O**r **S**mart cities), based on a platform of support for decision making in energy efficiency.

AFFINCITES project. Based on data gathering large city in order to adapt to the particular traffic mentioned in the needs and the optimization of public transport

5. Agreement
Agreement with Cisco

ılıılı CISCO.

Initial goals of the agreement ...

Desenvolupament de projectes pilots:

- ✔ ▪ Urban Platform

- ✔✖ ▪ Pay per light

- ✔ ▪ Monitoring of public buildings

- ✔ ▪ Energy self-sufficiency

- ✖ ▪ Improving the use of groundwater and rainwater

- ✔ ▪ Intelligent bus network

- ✖ ▪ Intelligent parking

- ✔ ▪ Internet in the neighborhood

...final goals

Become a **strategic partner** of the project Smart Barcelona, support and advice to the City Council on all projects Smart.

Make a **direct intervention** in the development of the Barcelona Sensor Platform (**BSP**) and the design of the **network**.

Carry out a **study of urban projects** (8 projects developed using Barcelona) as a basic methodology to include the City Protocol.

Development of **I+D** center in Barcelona Smart City Campus.

5. Agreement
Agreement with GDF Suez

GDF SUEZ

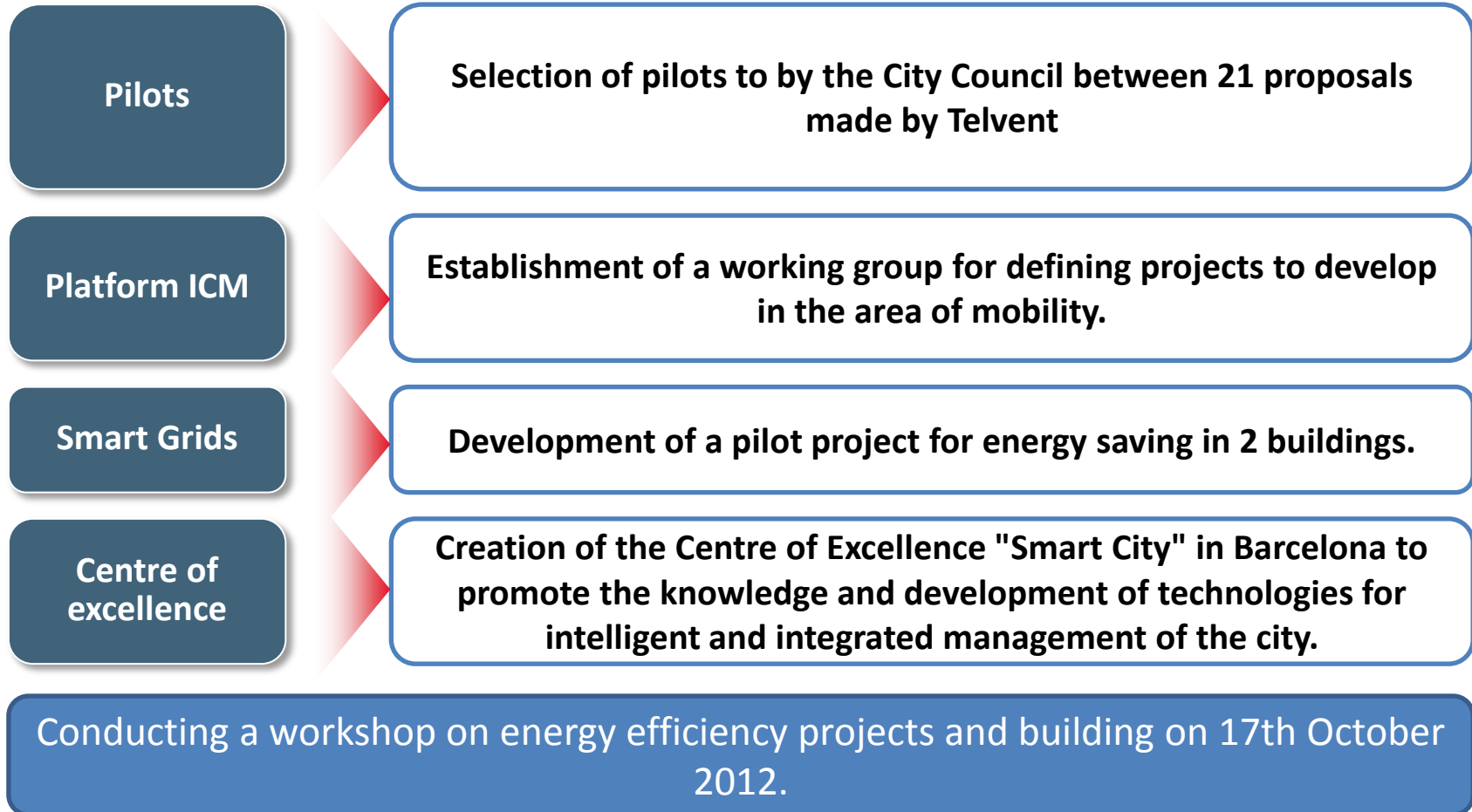| Heat and cold networks |
| Decentralized production |
| Energy efficiency |
| Sustainable mobility |
| Dashboard |
| Sustainable urbanism |

There will be a total of 18 pilots for all the 6 areas considered

The estimated budget for its development, is 3.75M €

The signing of this agreement, signed on 9th October 2012

5. Agreement
Agreement with Schneider Telvent

Schneider Electric
TELVENT

Pilots	**Selection of pilots to by the City Council between 21 proposals made by Telvent**
Platform ICM	**Establishment of a working group for defining projects to develop in the area of mobility.**
Smart Grids	**Development of a pilot project for energy saving in 2 buildings.**
Centre of excellence	**Creation of the Centre of Excellence "Smart City" in Barcelona to promote the knowledge and development of technologies for intelligent and integrated management of the city.**

Conducting a workshop on energy efficiency projects and building on 17th October 2012.

5. Agreement
Others agreements of collaboration with companies (I)

- **Telefónica and Abertis** respectively signed **agreements** with the City Council, working together to define pilots, but in both cases raising as main objective, to collaborate in **the process of integration of municipal networks as well as the development of sensing platform (BSP).**
- In addition, Telefónica is working with the project TAP & GO

- Indra is working with the City Council to establish a **collaborative agreement to develop the project in Arrowhead framework of the European ARTEMIS "Pilot Innovation" 2012**, in the **areas of energy and mobility**, so far unspecified projects pilots to develop.

- MOU with IBM for research and development of **City-OS** and its future application in other cities around the world.

5. Agreement
Others agreements of collaboration with companies (II)

- Presented **FP7 European project Smart Cities and Smart Grid**. In collaboration with the Turin city. Energy efficiency project divided into three axis:
  - ❑ Expansion of the smart grid network of electricity distribution.
  - ❑ Network expansion heat and cold in the city.
  - ❑ Rehabilitation of buildings to improve their energy efficiency.

- Presented **European project** of intelligent automated urban waste collection.

- Presented **BESOS European project** (Building Energy decision Support Systems fOr Smart cities). Proposes the deployment of management systems to improve energy efficiency in neighborhoods and facilitate citizen cooperation to this end.
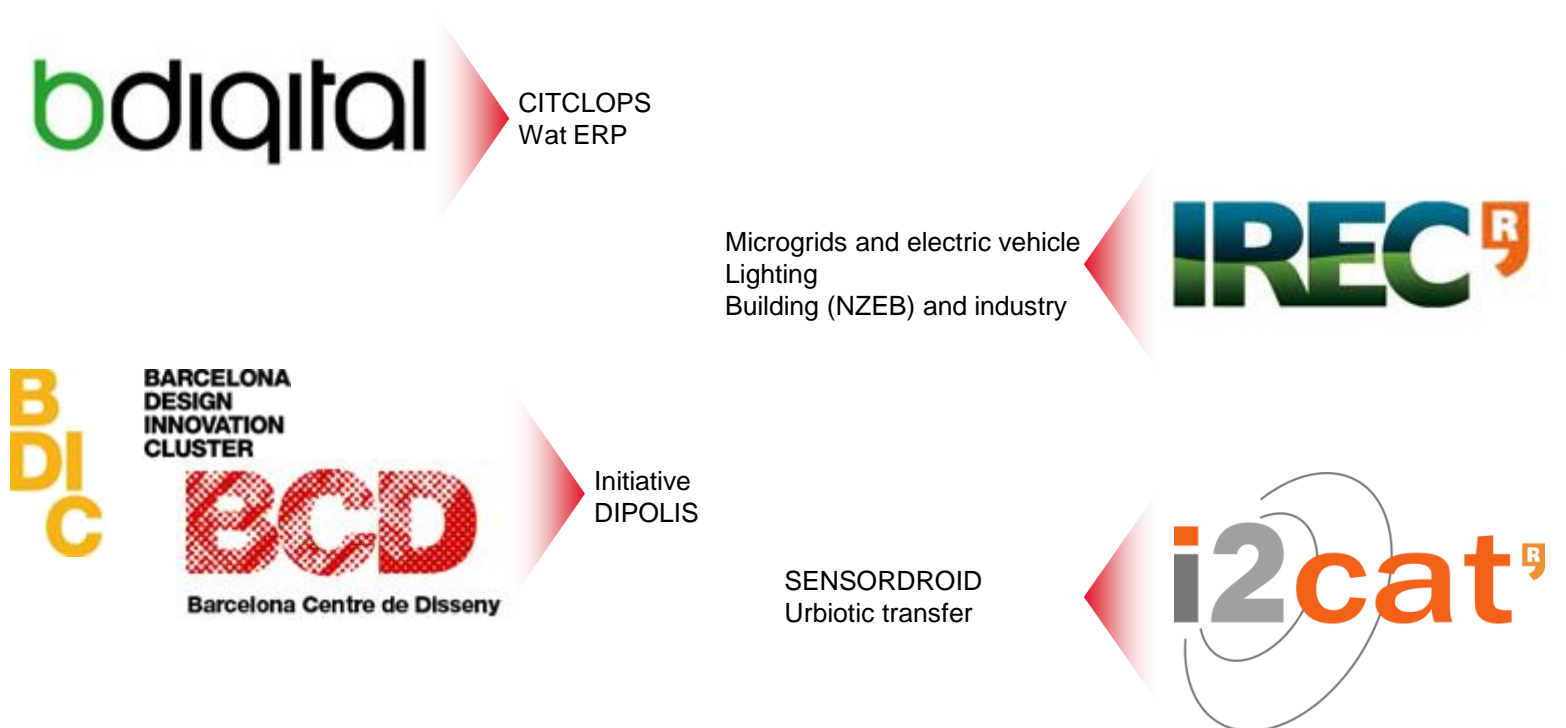
- Realization of a workshop lighting intelligent in December 2012.

5. Agreement
Collaboration with Catalan research centers

Collaboration with the Catalan research centers for RDI projects in Europe and to promote, together with the "Generalitat" of Catalonia, creating a **cluster of smart cities** to incorporate companies in Barcelona / Catalonia .
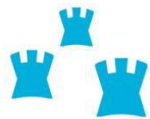
CITCLOPS
Wat ERP

Microgrids and electric vehicle
Lighting
Building (NZEB) and industry

Initiative
DIPOLIS

SENSORDROID
Urbiotic transfer

5. Agreement
Collaboration with others City Councils and institutions

Signed (or in signing process) collaboration agreements with different institutions in the field of smart cities.