



50 Sensor Applications for a Smarter World

Get Inspired!

INTRODUCTION



Alicia Asín
Libelium's CEO



David Gascón
Libelium's CTO

Since 2008, there are more objects connected to the Internet than persons in the world and this figure will hit 50 billion by 2020!. Now we can interact not only with contents in websites but with real objects.

For the first time, we can live in Smart Cities full of sensors that help us to improve our lifestyle and machines which talk to other machines on their own. As a result, people and objects jump into the Internet adding new layers of data and complexity. The “virtual” Internet we knew is becoming more “physical” than ever: we have entered into the Internet of Things era.

Now we are able to collect data everywhere from our environment, infrastructures, businesses and even ourselves, and this huge amount of information is generating a new ecosystem of business opportunities around its storage, analysis and accessibility.

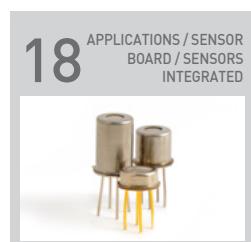
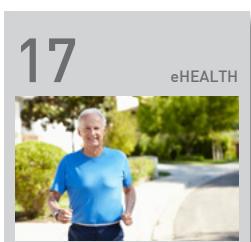
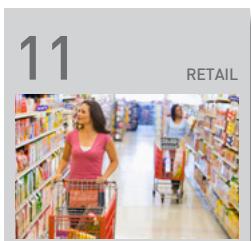
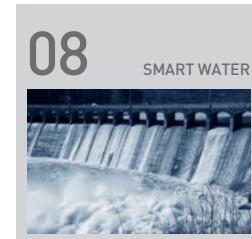
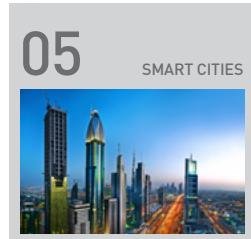
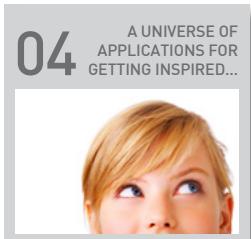
In Libelium we believe that the new Internet of Things requires an open platform capable of dealing with different technologies, communication protocols and sensor databases. For this reason we released 2 years ago the first Wireless Sensor Network Platform to be Open Source, horizontal, modular and accessible to help developers design and deploy sensor applications on top, easily and within the minimum time to market. This new platform reached the market under the name “WaspMote”.

During the past 2 years, more than 2,000 developers worldwide have joined our sensor platform, creating a compact and incredibly reliable framework which forms the base of the Libelium Community. They have proved WaspMote’s versatility by doing amazing applications and new business models with it. In this document we show just 50 of the hundreds that were sent when we started asking our Community members about what they had been doing with WaspMote during this past two years.

We want this document to be an inspirational guide that helps you to create imaginative and profitable applications in the new Internet Of Things era. Our mission is supporting you along all this way.

Let's start now: Think, Develop, Go!

CONTENTS



A UNIVERSE OF APPLICATIONS FOR GETTING INSPIRED...



Welcome to Libelium World

In this catalogue you will find a list with some of the possible applications with our products. If you want more information about them, visit our Applications section: <http://www.libelium.com/applications>

There, you will access to whitepapers and success stories related to each application.

What
are you
looking for?



Tell us your need,

and we will help you to find a solution:
commercial@libelium.com





SMART CITIES

01 Smart Parking

Monitoring of parking spaces availability in the city.

02 Structural health

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

03 Noise Urban Maps

Sound monitoring in bar areas and centric zones in real time.

04 Smartphones Detection

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

05 Electromagnetic Field Levels

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

06 Traffic Congestion

Monitoring of vehicles and pedestrian levels to optimize driving and walking routes.

07 Smart Lighting

Intelligent and weather adaptive lighting in street lights.



Smart City technology investment will total \$108 billion by 2020.

Pike Research



SMART CITIES

08 Waste management

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

09 Smart Roads

Intelligent Highways with warning messages and diversions according to climate conditions and unexpected events like accidents or traffic jams.



Smart City technology investment will total \$108 billion by 2020.

Pike Research



SMART ENVIRONMENT

10 Forest Fire Detection

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

11 Air Pollution

Control of CO₂ emissions of factories, pollution emitted by cars and toxic gases generated in farms.

12 Snow Level Monitoring

Snow level measurement to know in real time the quality of ski tracks and allow security corps avalanche prevention.

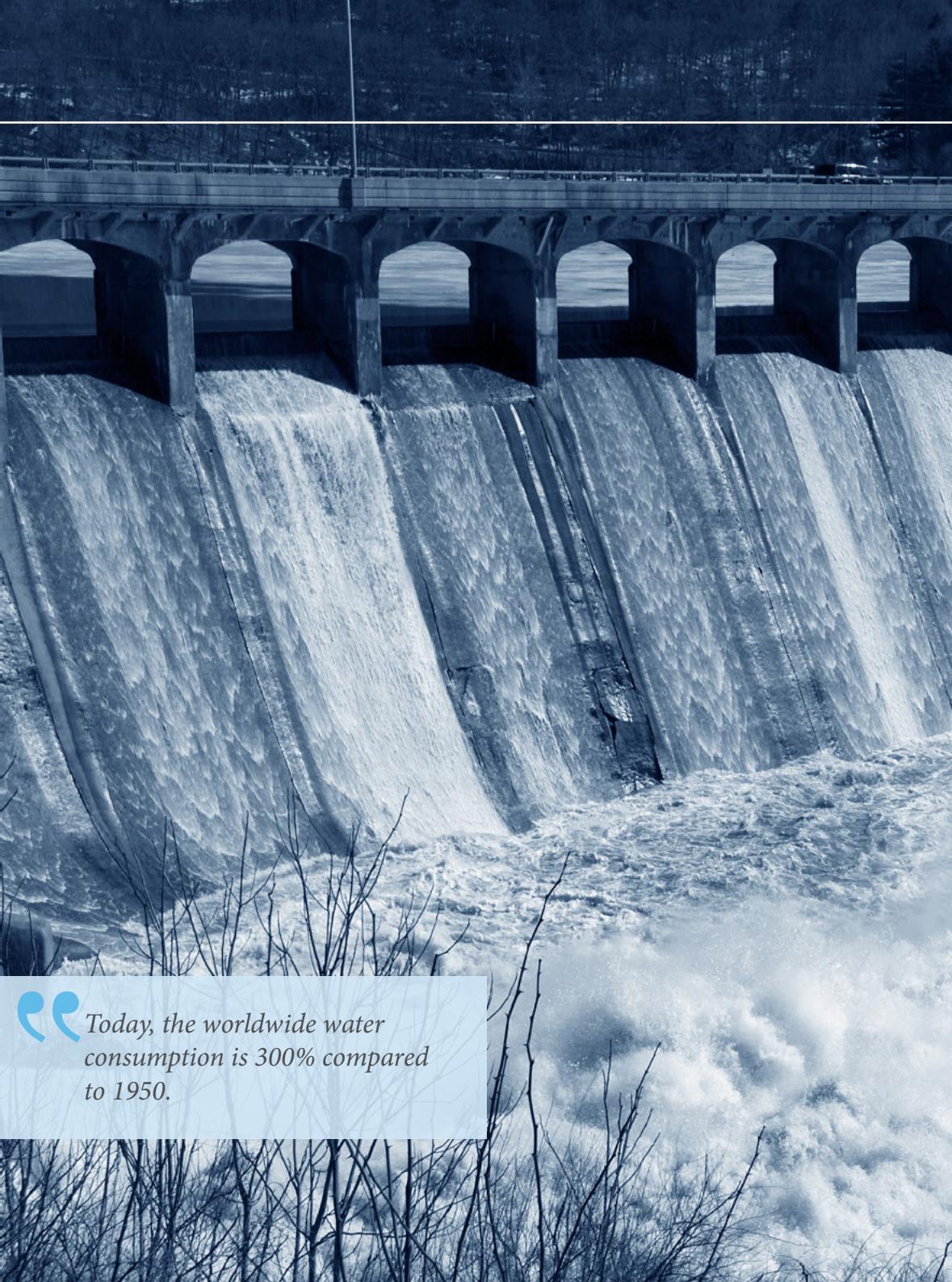
13 Earthquake Early Detection

Distributed control in specific places of tremors.

14 Landslide and Avalanche Prevention

Monitoring of soil moisture, vibrations and earth density to detect dangerous patterns in land conditions.

“More than 100,000 wildfires clear 4 million to 5 million acres (1.6 - 2 million ha) of land only in the USA.



SMART WATER

15 Water Quality

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

16 Water Leakages

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

17 River Floods

Monitoring of water level variations in rivers, dams and reservoirs.

“Today, the worldwide water consumption is 300% compared to 1950.



European Union mandates that 100% of European households have smart metering capabilities by 2022.

SMART METERING

- 18 **Smart Grid**
Energy consumption monitoring and management.
- 19 **Tank Level**
Monitoring of water, oil and gas levels in storage tanks and cisterns.
- 20 **Photovoltaic Installations**
Monitoring and optimization of performance in solar energy plants.
- 21 **Water Flow**
Measurement of water pressure in water transportation systems.
- 22 **Silos Stock Calculation**
Measurement of emptiness level and weight of the goods.



SECURITY & EMERGENCIES

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

24 Liquid Presence
Liquid detection in data centers, warehouses and sensitive building grounds to prevent break downs and corrosion.

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

26 Explosive and Hazardous Gases
Detection of gas levels and leakages in industrial environments, surroundings of chemical factories and inside mines.

Nuclear energy covers 16% of the planet energy needs.



RETAIL

27 Supply Chain Control

Monitoring of storage conditions along the supply chain and product tracking for traceability purposes.

28 NFC Payment

Payment processing based in location or activity duration for public transport, gyms, theme parks, etc.

29 Intelligent Shopping Application

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

30 Smart Product Management

Control of rotation of products in shelves and warehouses to automate restocking processes.

Failure to restock supermarket shelves costs the FMCG industry 4 billion € each year.

ECR Europe



LOGISTICS

31 Quality of Shipment Conditions

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

32 Item Location

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

33 Storage Incompatibility Detection

Warning emission on containers storing inflammable goods closed to others containing explosive material.

34 Fleet Tracking

Control of routes followed for delicate goods like medical drugs, jewels or dangerous merchandises.

“Each year, more than 100 million shipping containers travel around the globe.”



INDUSTRIAL CONTROL

35 M2M Applications

Machine auto-diagnosis and assets control.

36 Indoor Air Quality

Monitoring of toxic gas and oxygen levels inside chemical plants to ensure workers and goods safety.

37 Temperature Monitoring

Control of temperature inside industrial and medical fridges with sensitive merchandise.

38 Ozone Presence

Monitoring of ozone levels during the drying meat process in food factories.

39 Indoor Location

Asset indoor location by using active (ZigBee) and passive tags (RFID/NFC).

40 Vehicle Auto-diagnosis

Information collection from CanBus to send real time alarms to emergencies or provide advice to drivers.

The volume of cellular M2M subscriptions is expected to increase fourfold between 2010 and 2016.

Pyramid Research



SMART AGRICULTURE

41 Wine Quality Enhancing

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

42 Green Houses

Control micro-climate conditions to maximize the production of fruits and vegetables and its quality.

43 Golf Courses

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

44 Meteorological Station Network

Study of weather conditions in fields to forecast ice formation, rain, drought, snow or wind changes.

45 Compost

Control of humidity and temperature levels in alfalfa, hay, straw, etc. to prevent fungus and other microbial contaminants.

 The 60% of water is needed in irrigation, and 20-30% out of this figure is wasted due to evaporation and over-watering.



“

The CH₄ emissions from animal farming in the U.S. have increased a 17% during the past decade.

U. S. Environmental Protection Agency

SMART ANIMAL FARMING

46 Offspring Care

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

47 Animal Tracking

Location and identification of animals grazing in open pastures or location in big stables.

48 Toxic Gas Levels

Study of ventilation and air quality in farms and detection of harmful gases from excrements.



DOMOTIC & HOME AUTOMATION

49 **Energy and Water Use**
Energy and water supply consumption monitoring to obtain advice on how to save cost and resources.

50 **Remote Control Appliances**
Switching on and off remotely appliances to avoid accidents and save energy.

51 **Intrusion Detection Systems**
Detection of windows and doors openings and violations to prevent intruders.

52 **Art and Goods Preservation**
Monitoring of conditions inside museums and art warehouses.

“European Union homes should cut energy consumption by 20% by 2020 according to Kyoto Protocol.”



eHEALTH

- 53 Fall Detection**
Assistance for elderly or disabled people living independent.

- 54 Medical Fridges**
Control of conditions inside freezers storing vaccines, medicines and organic elements.

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

- 56 Patients Surveillance**
Monitoring of conditions of patients inside hospitals and in old people's home.

- 57 Ultraviolet Radiation**
Measurement of UV sun rays to warn people not to be exposed in certain hours.



65+ people will go from 7% to 12% by 2030.

APPLICATIONS / SENSOR BOARD / SENSORS INTEGRATED

	Application	Sensor Board	Sensors integrated
SMART CITIES	01 Smart Parking	Smart Parking	Magnetic field
	02 Structural Health	Smart Cities	Crack detection, crack propagation, accelerometer, linear displacement
	03 Noise Urban Maps	Smart Cities	Microphone (dBSPLA)
	04 Smartphones Detection	Meshlium Scanner	Wifi and Bluetooth radio scanner
	05 Electromagnetic Field Levels	Electromagnetic Field Sensor Board	Electromagnetic field sensor
	06 Traffic Congestion	Smart Parking	Magnetic field
	07 Smart Lighting	Events /Actuation	Light sensor (LDR), actuator relay
	08 Waste Management	Smart Cities	Ultrasound sensor (measure capacity)
	09 Smart Roads	Smart Parking / Events	Magnetic field, crack sensor, water and ice detection sensors

APPLICATIONS / SENSOR BOARD / SENSORS INTEGRATED

	Application	Sensor Board	Sensors integrated
SMART ENVIRONMENT	10 Forest Fire Detection	Gases	CO, CO ₂ , temperature, humidity
	11 Air Pollution	Gases	NO ₂ , SH ₂ , CO, CO ₂ , Hydrocarbons, Methane (CH ₄)
	12 Snow Level Monitoring	Smart Metering / Smart Cities	Ultrasounds
	13 Landslide and Avalanche Prevention	Smart Cities / Agriculture	Crack detection, crack propagation, accelerometer, linear displacement, soil moisture
	14 Earthquake Early Detection	Any	Accelerometer
SMART WATER	15 Water Quality	Smart Water	PH, dissolved oxygen, turbidity
	16 Water Leakages	Smart Metering	Liquid flow sensor
	17 River Floods	Events	Level sensor (switch), ultrasound sensor

APPLICATIONS / SENSOR BOARD / SENSORS INTEGRATED

	Application	Sensor Board	Sensors integrated
SMART METERING	18 Smart Grid	Smart Metering	Current and voltage sensors
	19 Tank Level	Smart Metering / Events	Level sensor (switch), ultrasound sensor (capacity measurement)
	20 Photovoltaic Installations	Smart Metering	Current and voltage sensors
	21 Water Flow	Smart Metering	Liquid flow sensor
	22 Silos Stock Calculation	Smart Metering	Ultrasound sensor (capacity measurement), load cells
SECURITY AND EMERGENCIES	23 Perimeter Access Control	Events	PIR (infrared), hall effect (windows, doors), RFID and NFC tags
	24 Liquid Presence	Events	Water detection sensor
	25 Radiation Levels	Radiation / Agriculture	Geiger Muller tube (Beta and Gamma) [β , γ], ultraviolet sensor (UVA, UVB)
	26 Explosive and Hazardous Gases	Gases	O_2 , H_2 , CH_4 , Isobutane, Ethanol

APPLICATIONS / SENSOR BOARD / SENSORS INTEGRATED

	Application	Sensor Board	Sensors integrated
RETAIL	27 Supply Chain Control	Any	RFID and NFC tags
	28 NFC Payment	Any	RFID and NFC tags
	29 Intelligent Shopping Application	Any	RFID and NFC tags
	30 Smart Product Management	Smart Metering	Weight sensor (load cell), RFID and NFC tags
LOGISTICS	31 Quality of Shipment Conditions	Events	Light, temperature, humidity, impact, vibrations, accelerometer
	32 Item Location	Any	RFID and NFC tags
	33 Storage Incompatibility Detection	Gases / Events	O ₂ , H ₂ , CH ₄ , Isobutane, Ethanol, RFID and NFC tags
	34 Fleet Tracking	Any	GPS

APPLICATIONS / SENSOR BOARD / SENSORS INTEGRATED

Application	Sensor Board	Sensors integrated
35 M2M Applications	Events	Voltaje, vibration, accelerometer, current
36 Indoor Air Quality	Gases	CO, CO ₂ , NH ₃ , NO ₂ , SH ₂ , O ₃
37 Temperature Monitoring	Events	Temperature, humidity, pressure
38 Ozone Presence	Gases	Ozone (O ₃)
39 Indoor Location	Any	Passive tags (RFID+NFC) + Active tags (ZigBee, Wifi, Bluetooth)
40 Vehicle Auto-diagnosis	Events	Voltaje, vibration, accelerometer, current

APPLICATIONS / SENSOR BOARD / SENSORS INTEGRATED

	Application	Sensor Board	Sensors integrated
SMART AGRICULTURE	41 Wine Quality Enhancing	Agriculture	Soil temperature / moisture, leaf wetness, atmospheric pressure, solar radiation (PAR), trunk diameter
	42 Green Houses	Agriculture	Soil temperature / moisture, leaf wetness, atmospheric pressure, solar radiation (PAR), trunk diameter
	43 Golf Courses	Agriculture	Soil moisture
	44 Meteorological Station Network	Agriculture	Anemometer, wind vane, pluviometer
	45 Compost	Agriculture	Humidity, soil moisture, soil temperature
SMART ANIMAL FARMING	46 Offspring Care	Gases	CH_4 , SH_2 , NH_3 , temperature, humidity
	47 Animal Tracking	Any	Passive tags (RFID+NFC) + Active tags (ZigBee, Wifi, Bluetooth)
	48 Toxic Gas Levels	Gases	CH_4 , SH_2 , NH_3 , temperature, humidity

APPLICATIONS / SENSOR BOARD / SENSORS INTEGRATED

	Application	Sensor Board	Sensors integrated
DOMOTIC AND HOME AUTOMATION	49 Energy and Water Use	Smart Metering	Current and voltage sensors, liquid flow sensor
	50 Remote Control Appliances	Events / Actuation	Actuator relay
	51 Intrusion Detection Systems	Events	PIR (infrared), hall effect (windows, doors)
	52 Art and Goods Preservation	Gases	Temperature, humidity, pressure, O ₂
eHEALTH	53 Fall Detection	Any	Accelerometer
	54 Medical Fridges	Events	Light, temperature, humidity, impact, vibrations, accelerometer
	55 Sportsmen Care	eHealth	ECG, pulse, accelerometer, respiration
	56 Patients Surveillance	eHealth	ECG, pulse, accelerometer, respiration
	57 Ultraviolet Radiation	Agriculture	Ultraviolet sensor (UVA, UVB)

THE LIBELIUM EXPERIENCE: THINK, DEVELOP, GO!



About Our Technology

For system integrators delivering Smart Cities solutions, Libelium is the wireless sensor (MOTE) provider that delivers easy to program, modular, open source and low-power consuming devices.

Only Libelium is supported by a community of developers in the world's largest companies with deployments in 75 countries.

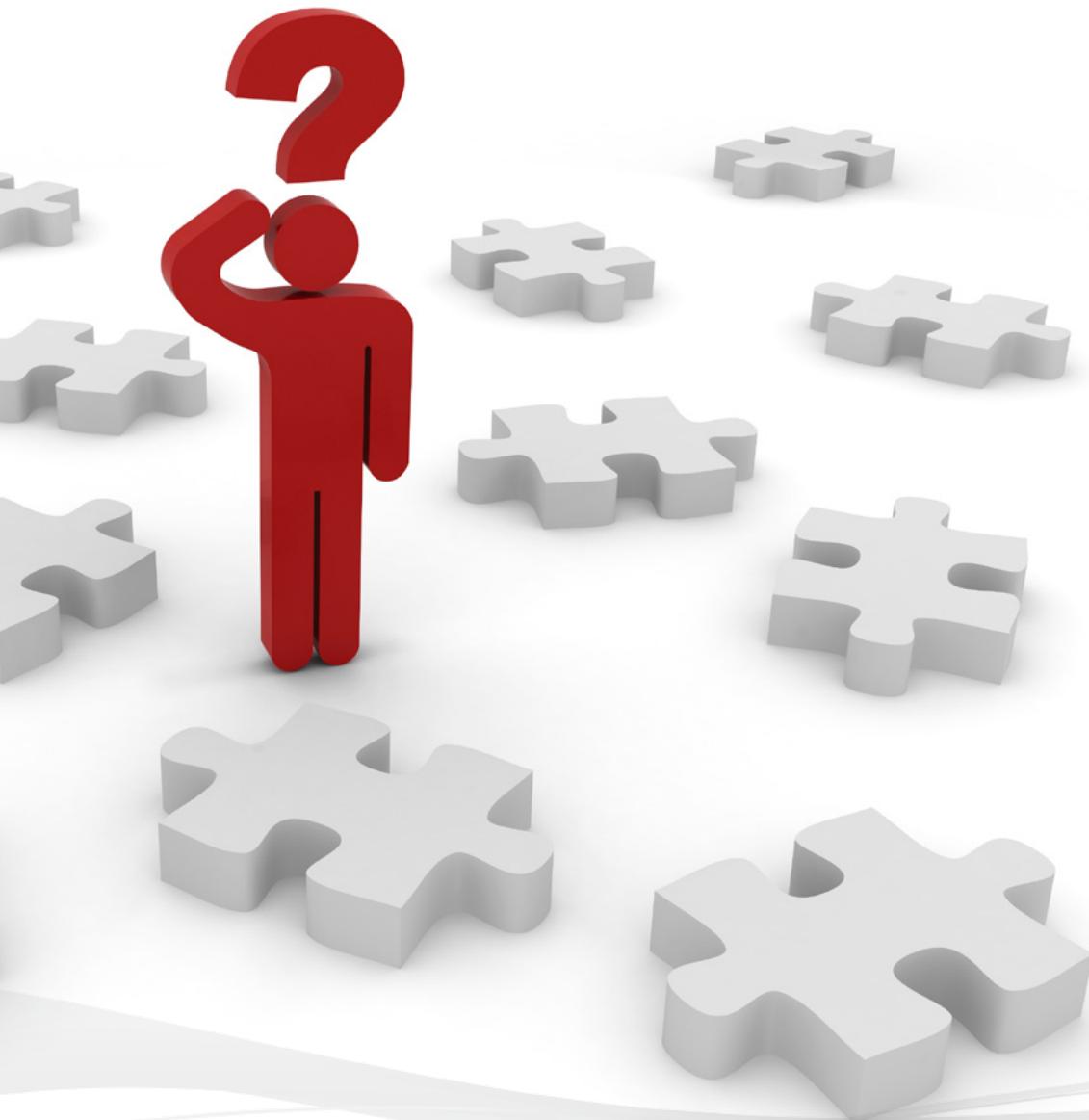
Easy Deployment

 *The Wasp mote platform, together with its understandable Software and broad extension capabilities, is a great tool to ease the entry into the complex world of Wireless Sensor Networks.*

*Sebastian Bader
Mid Sweden University (Sweden)*



THE LIBELIUM EXPERIENCE: THINK, DEVELOP, GO!



think

Before starting

- Our catalog will guide you step by step through all the different options available in Wasp mote: radios, sensors, power complements, etc. giving both technical and pricing information. You can ask for our products catalogue here: <http://www.libelium.com/products/buy>
- You will have a sales engineer assigned to you to ensure you choose the right and optimal configuration to your needs.
- Once ready, we will arrange the shipping and delivery directly to you without distributors.

Horizontal Platform



As Global System Integrator, we highly value the fact that the Wasp mote platform allows us to be in any vertical within the minimum time to market, the comprehensive API gives us a lot of flexibility to program with a fast-learning curve.

D.A. - Consultant (Singapur)



THE LIBELIUM EXPERIENCE: THINK, DEVELOP, GO!



Develop

During the design

- You will access to all the information in the development and support sections. If you have any doubt, you can ask in our Community forum where our R&D team and a more than 2,000 developers worldwide will help you.
- The programming environment is Open Source and platform independent, you do not need to incur in software licenses costs.
- Our fast-learning API will make you able to develop the solution in the minimum time to market. If you want to speed up the deployment of your solution, we also offer in-company training and consultancy services.

Support



We had access to a wide range of information about the product, including its characteristics and possible applications through all the steps involving the purchase. Starting from before purchasing the product to the very end.

Cima Nuevas Tecnologías S.L (Spain)



THE LIBELIUM EXPERIENCE: THINK, DEVELOP, GO!



Go! Go!

Reach the market!

- If you have designed a product and plan to sell it in big amounts, we can help you with the hardware optimization for making a more cost-effective and efficient solution for you.
- Wasp mote is so modular that you can just change the sensors on top, make very few changes in your program and have a new application market ready for expanding your business and maximizing your initial investment.
- We have advantages in prices, training and demo units for our partners. For more information, visit: <http://www.libelium.com/contact/>
- You can use our website for promoting your success story and we can even make a press release together.

Training



The training was excellent, and I got enough coding practice to give me some confidence that I can review the C++ guide as well as the function parameter in order to develop some test products.

*M.J. - Training Course Attendee
Mobile Operator Company (USA)*



TECHNOLOGY: WASPMOTE, PLUG & SENSE!, MESHLIUM



About our Technology

WaspMote and Meshlium are awarded products present in more than 45 countries.

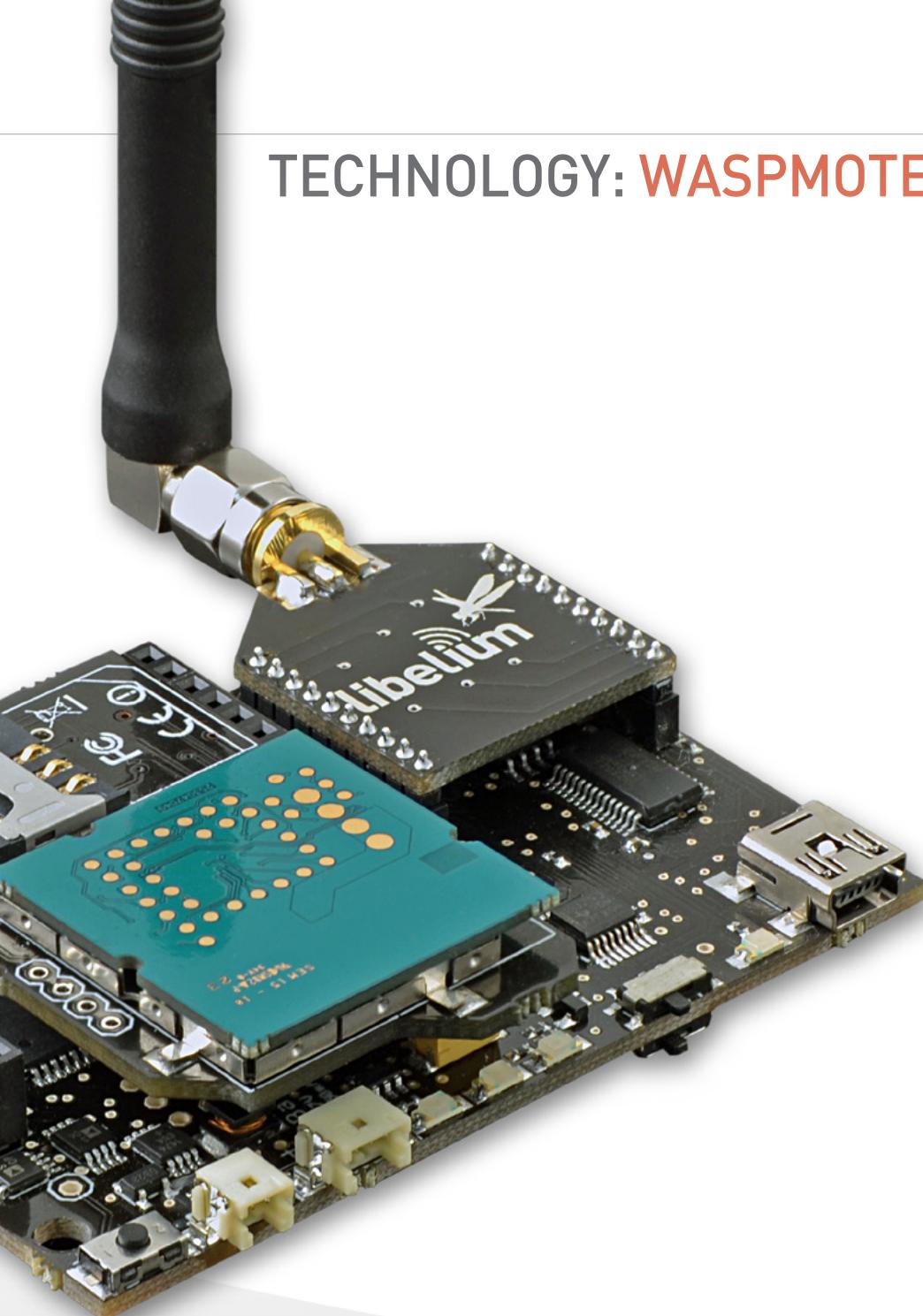
All our products are modular, horizontal and easy to integrate into 3rd party systems.

Excellent Technology

 Libelium took home an award in the Data Acquisition Products category for its WaspMote modular WSN platform. WaspMote offers not only impressive specifications but couples them with open source software as well as specialized sensor boards for particular applications. The judges loved the modular nature of the platform, its use of open source software, and its ruggedness, so important for monitoring applications of all kinds.

*Melanie Martella
2010 Best of Sensors Expo Awards (Chicago, USA)*

TECHNOLOGY: WASPMOTE, PLUG & SENSE!, MESHLIUM



WaspMote

Is a sensor device specially oriented to developers. It works with different protocols (ZigBee, Bluetooth, 3G/GPRS) and frequencies (2.4GHz, 868MHz, 900MHz) being capable of getting links up to 12km.

It counts with an hibernate mode of 0.7uA which allows to save battery when it is not transmitting. More than 50 sensors already available and a complete open source IDE (API libraries + compiler) made really easy to start working with the platform.

More info:

<http://www.libelium.com/waspmote>

Cutting-edge Technology



Libelium took a new award in the Data Acquisition category for its Radiation Sensor board that couples a Geiger counter with its WaspMote wireless sensor networking platform to create an emergency radiation sensor network. The judges loved how timely this product is; it illustrates all the qualities that make wireless sensor networks such a vital, exciting and, above all, useful technology — it is rapidly and flexibly deployed and it gives you information you need, in a useful form, and fast.

Melanie Martella

2011 Best of Sensors Expo Awards (Chicago, USA)



TECHNOLOGY: WASPMOTE, PLUG & SENSE!, MESHLIUM



Waspmote Plug&Sense!

The new waspmote Plug&Sense! line allows developers to forget about electronics and focus on services and applications. Now you can deploy wireless sensor networks in a easy and scalable way ensuring minimum maintenance costs.

The new platform consists of a robust waterproof enclosure with specific external sockets to connect the sensors, the solar panel, the antenna and even the USB cable in order to reprogram the node [Over the Air Programming is also available]. It has been specially design to be scalable, easy to deploy and maintain.

More info:
<http://www.libelium.com/plug-sense/>

Minimum time-to-market



We have reduced the complexity of installation with a solution that provides low-cost maintenance and a high degree of scalability, ensuring the shortest time to market for system integrators and end users

David Gascón
Libelium CTO



TECHNOLOGY: WASPMOTE, PLUG & SENSE!, MESHLIUM



Meshlium

Is a Linux router which can contain 5 different radio interfaces: Wifi 2.4GHz, Wifi 5GHz, 3G/GPRS, Bluetooth and ZigBee. As well as this Meshlium can also integrate a GPS module for mobile and vehicular applications and be solar and battery powered. These features along with an aluminium IP67 enclosure allows Meshlium to be placed anywhere outdoor.

Meshlium comes with the Manager System, a web application which allows to control quickly and easily the Wifi, ZigBee, Bluetooth and 3G/GPRS configurations along with the storage options of the sensor data received.

More info:
<http://www.libelium.com/meshlium>

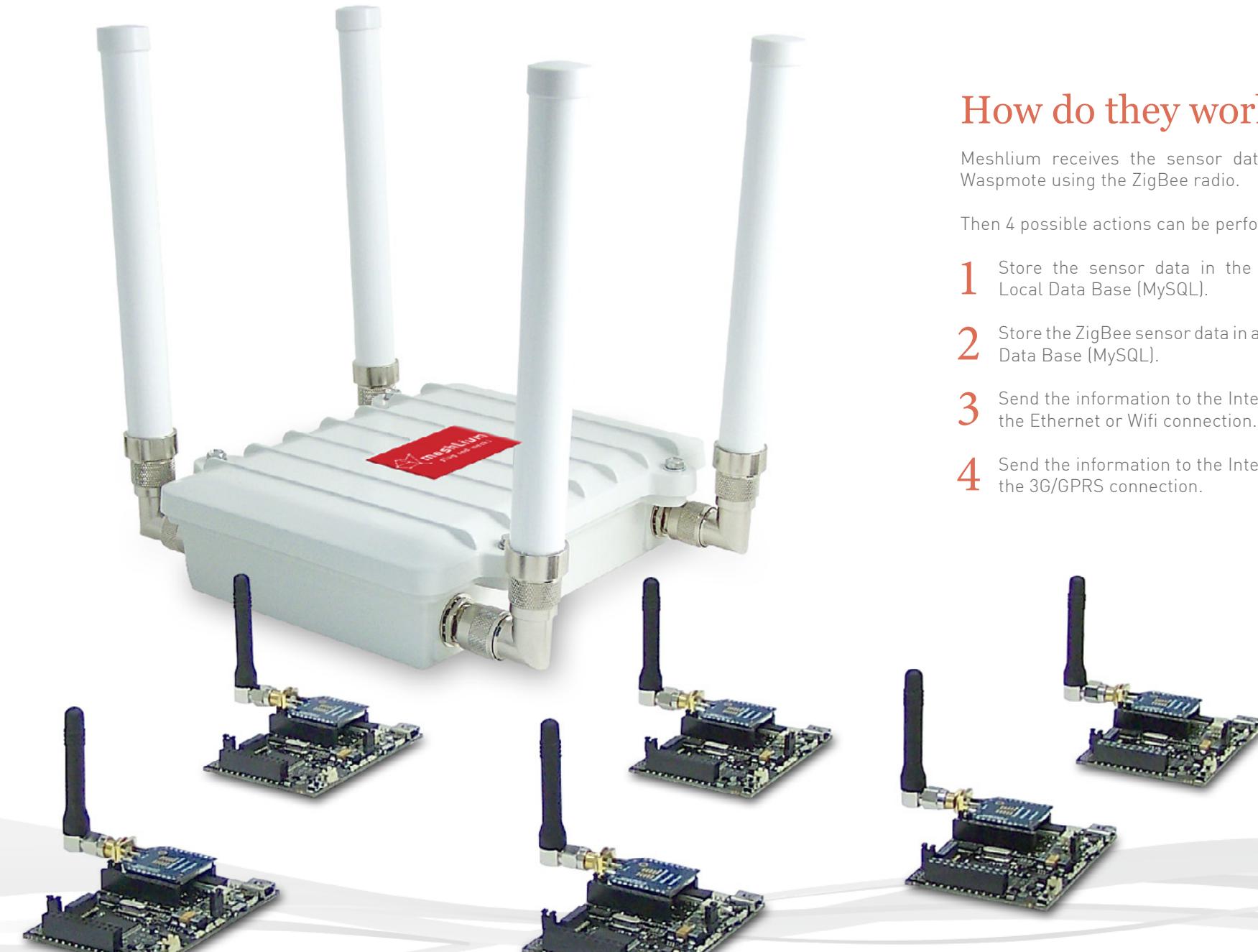
Range VS Consumption

“The quality of the demonstrators was high as reflected by the close result. The ‘Best Demo Award’ winner was Libelium for their Wasp mote platform which can communicate over long distances while maintaining low power consumption.”

Costis Kompis (Sweden)
Wireless Sensing Demonstrator Showcase 2010



TECHNOLOGY: WASPMOTE, PLUG & SENSE!, MESHLIUM



How do they work together?

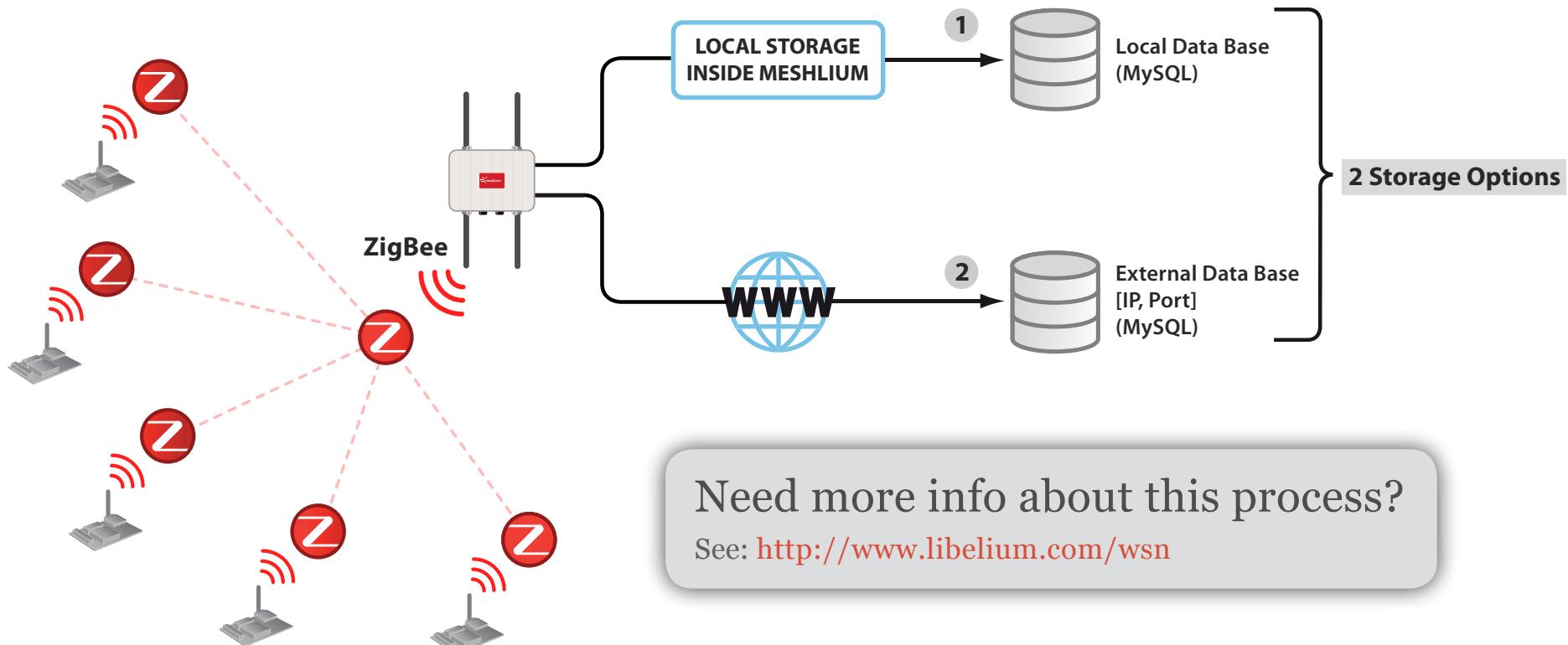
Meshlium receives the sensor data sent by WaspMote using the ZigBee radio.

Then 4 possible actions can be performed:

- 1 Store the sensor data in the Meshlium Local Data Base (MySQL).
- 2 Store the ZigBee sensor data in an External Data Base (MySQL).
- 3 Send the information to the Internet using the Ethernet or Wifi connection.
- 4 Send the information to the Internet using the 3G/GPRS connection.

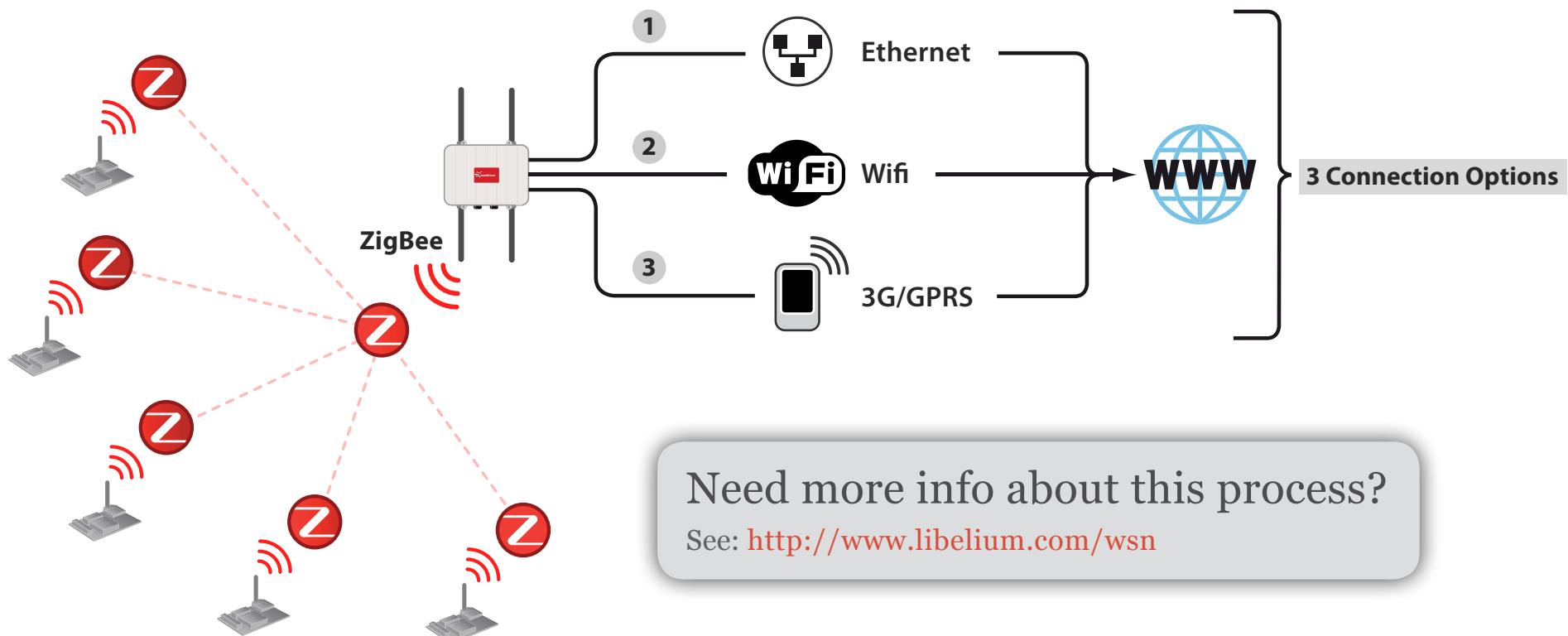
TECHNOLOGY: WASPMOTE, PLUG & SENSE!, MESHLIUM

Storage Options Chart:



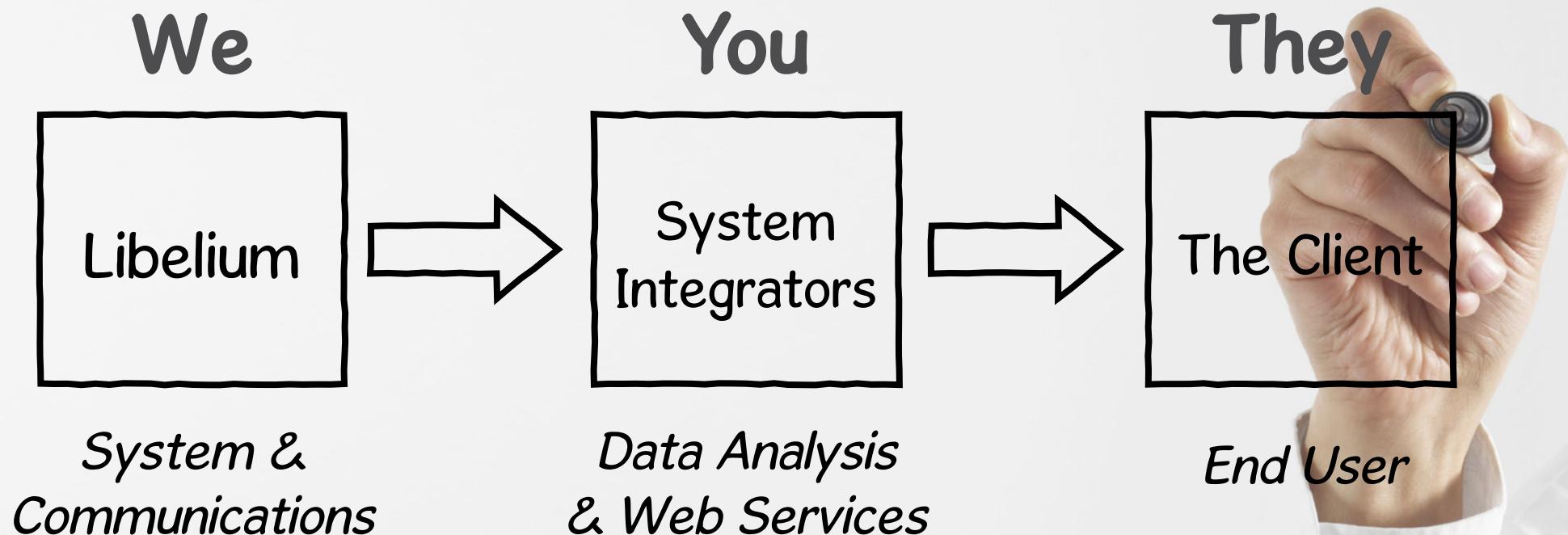
TECHNOLOGY: WASPMOTE, PLUG & SENSE!, MESHLIUM

Connection Options Chart:



LIBELIUM'S VALUE CHAIN

→Enablers of the Internet of Things:



LIBELIUM'S CASE STUDIES



■ Smart Agriculture project in Galicia to monitor vineyards with WaspMote

Challenge: Create a statistical model to predict the appearance of plagues withing the vineyard with wireless sensor networks.

Researchers from Grupo Austen, a Spanish company, have developed a system called 'Siega System' that allows to monitor in real-time a bunch of variables in order to create a whole Smart Agriculture system. This system is able to monitor different parameters such as ambient temperature and humidity, soil temperature and humidity or leaf wetness and has been deployed in Pontevedra, a city in the North of Spain. [Read more](#).



■ Smart Water project in Valencia to monitor Water Cycle Management

Challenge: create a hybrid sensor network between mobile and fixed nodes and integration of water quality specific sensors.

This project was developed by the Institute of Computer Technology in collaboration with the Polytechnic University of Valencia and Telefonica Cathedra in Valencia (Spain). The Smart Water System consist of a mobile wireless sensor network that can be fast deployed in a particular area to monitor water quality by measuring parameters such as PH, conductivity, oxydation reduction potential (redox), dissolved oxygen (DO) and turbidity. In this case, modularity and horizontal architecture of WaspMote allowed the customers to easily integrate these new sensors. [Read more](#).



■ Smart City project in Serbia for environmental monitoring by Public Transportation

Challenge: deploy a mobile wireless sensor network with the sensor nodes located in vehicles.

The EkoBus system was developed in collaboration with Ericsson and deployed in the cities of Belgrade and Pancevo. Several WaspMotes were installed on public transportation vehicles to monitor a set of environmental parameters over a large area as well as to provide additional information for the end-user like the location of the buses and estimated arrival times to bus stops. The GPS and 3G/GPRS modules allowed the WaspMotes to work as autonomous sensor collectors. [Read more](#).



LIBELIUM'S CASE STUDIES



■ Smart City project in Salamanca to monitor Air Quality and Urban Traffic

Challenge: use one single sensor network infrastructure to monitor 7 environmental parameters and provide multiple services.

This project has been developed by several companies and leaded by "Fundación CARTIF". Its main goal was to achieve sustainable management of the traffic in the city of Salamanca by using two key-elements: a pervasive air-quality sensor network along with prediction models. The project required the measurement of 7 parameters: CO, NO₂, O₃, temperature, humidity, dust particles (PM-10) and noise. The flexibility of Wasp mote allowed to integrate all of them in the same sensor node, making the most of each point of the the network deployed. [Read more](#).



■ Wireless Sensor Networks to control Radiation Levels

Challenge: fast design of a radiation detection sensor board for Wasp mote in response to the accident in Fukushima.

The creation of the Radiation Sensor Board was motivated by the nuclear disaster in Fukushima after the unfortunate earthquake and tsunami that struck Japan in March 2011. We wanted to help authorities to measure the levels of radiation of the affected zones without compromising the life of the security and rescue teams. For this reason we designed in just 3 weeks a Geiger Counter sensor board for Wasp mote, which could read the radiation levels automatically and send the information in real time using wireless technologies like ZigBee and 3G/GPRS to the control point without human intervention. [Read more](#).



■ Detecting Forest Fires using Wireless Sensor Networks

Challenge: deployment of sensor networks in harsh outdoors environments.

SISVIA "Vigilancia y Seguimiento Ambiental" deployed a Wireless Sensor Network in Asturias (Spain) in order to detect forest fires by monitoring CO, CO₂, humidity and temperature in 210 hectares. In a hard environment like this long range communication links along with low power consumption and solar panels as energy source were Wasp mote's most valuable features. [Read more](#).



LIBELIUM'S CASE STUDIES



■ Smart Parking and environmental monitoring in one of the world's largest WSN

Challenge: use the mesh capabilities of ZigBee and other adhoc protocols in a massive deployment of more than 1000 nodes located under the ground in order to enable the car detection in the streets of the city.

SmartSantander is an ambitious project leaded by Telefonica that proposes a unique in the world city-scale experimental research facility sufficiently large, open, flexible and horizontal to stimulate the development of new applications by researchers, companies and citizens. At the same time, the network must provide services to Santander inhabitants such as helping them to find free parking spots and monitoring pollution levels. In this case, Wasp mote modularity and flexibility has allowed to incorporate a second communication radio enabling experimentation while ensuring high availability services. [Read more.](#)



Next Step?

Tell us about your project.
We want to make it real.

- Website: <http://www.libelium.com>
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