Agenda

• Brief Introduction into the World of M2M
• Moving towards the Internet of Things (IoT)
• Smart Farming - Farms as IoT Spaces
• Case Studies – Smart Farming through Sensing
• LPWAN for Agriculture
• Conclusions
The Three Waves of M2M

After-Market Applications
- Low/Medium volume per application
- Add-on networking: retrofit
- Medium/High cost per unit
- Often requires high level of support
- Good fit for MVNOs/resellers

Regulatory
- Medium/High Volume during install
- Embedded networking
- Low cost per unit
- Favours tendering process
- Good fit for MNOs
- eCall a crossover (see note below)

Line Fit
- Medium/High Volume
- Embedded networking
- Low cost per unit
- Increasingly requires international coverage
- Fit with international MNOs and MVNOs

Note: eCall in EU is now a unique crossover of Regulatory with Line Fit characteristics
Coexistence of Waves
M2M Strategic Choice (operational efficiency and new services generation)

Source: Beecham Research
M2M World of Connected Services
The Internet of Things
[+] Focusing on Sector needs - securely

[-] Not Enabling Wide Interactions
The Internet of Things
From Applications to Spaces

IoT Applications
INTERACTION
UNDERSTANDING
CONTROL
INSIGHT
& more

DATA

Boston | London
info@beechamresearch.com +44 (0)845 533 1758  www.beechamresearch.com

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Smart City as an IoT Space

- Connected Offices
- Connected Schools
- Connected Hospitals
- Connected Urban Agriculture
- Connected Vehicles
- Connected Citizens

Connected Citizens
Smart Farm as an IoT Space

Precision farming

Small-sized field farming

Precision livestock farming

In-door farming

Source: Beecham Research
Small-sized Field Farming

Sensors are positioned in the soil or somewhere very near to the plants. The data is then sent to gateways via short-range connection. The data is then exchanged between the gateways and the farmer via long-range connectivity (usually cellular). The exchange can be made of text, but also data. The farmer usually has a Farm Management Information Systems (FMIS). The solution is applied primarily in the fruit segment. This model is also used in remote irrigation management system. A common example is vineyards. The estimation is 100 sensors per hectare. There are cases in which productivity has increased by 15% and use of fertilizers reduced by 20%.

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Source: Beecham Research
Sensors are usually positioned around floating bars. The data is then sent to gateways via short-range connection. The data is then exchanged between the gateways and the fish farmer via long-range connectivity (usually cellular). The exchange can be made of text, but also data. The farmer usually has some forms of Farm Management Information Systems. An example could be oyster farms in Australia. There are more than 500 oyster farms. Each oyster has a sensor. The estimate is around 200,000 sensors. It can also be designed through satellite-tracked fishing device aggregators.

Source: Beecham Research
Smart Farming Technologies

- Robotics
- Sensing technologies
- Data analytics solutions
- Hardware and Software Systems
- Software applications
- Communications systems - e.g. cellular
- Telematics, positioning technologies

Source: Beecham Research
Background and aims
In the vineyard, diseases and pests adversely affect wine grape production and cause major economic losses annually.

Implementation details
Elmitel.o.o. developed its Elmitel Sensing cloud-based decision support system. It had help from European private and public start-up accelerators, which provided additional mentoring and coaching on business. Libelium’s Waspmote Plug & Sense! Nodes collected environmental data from the vines including temperature and soil humidity.

Results and lessons learned
Growers can make ready and apply insecticides precisely when they are needed. Over one season spraying has been reduced by 20 percent. The system is dynamic, learning from the outcomes of actual conditions and in-field activities and observations.
Case Study – Monitoring Olive Grove in Slovenia

Background and aims
The olive fruit fly *Bactrocera Oleae* is a serious pest causing major losses of the crop. Oil extracted from the infested fruit has a lower quality compared with non-infested fruit.

Implementation details
TeamDev, an Italian software company, has developed a decision support system based on weather data collected by Libelium’s *Waspmote Plug & Sense! Sensor Platform*. The company worked with *Assoprol Umbria*, an organisation of Umbrian olive producers, to develop a Web-based platform to support a defense plants against the pest.

Results and lessons learned
The software created the model of fly diffusion based on weather conditions in each olive grove. The understanding of growing and environmental conditions enabled better control of the pest. *The technology investment was recovered over one year.*
Case Study – Preventing Environmental Impact in Wastewater Irrigation - Australia

Background and aims
The Australian Meat Manufacturer AJ Bush commissioned Pacific Environment to provide sensor network in a wastewater irrigation area. The company has two large-scale meat rendering plants based in Queensland and New South Wales. Organic wastes from such facilities pose significant environmental management challenges; the management of soil moisture in wastewater irrigation is essential for the protection of groundwater from nitrate contamination.

Implementation details
Pacific Environment developed its Envirosuite software platform for forecasting and reporting. Libelium’s Waspmote Plug&Sense network collected and monitored soil moisture, electrical conductivity, temperature and dissolved oxygen.

Results and lessons learned
The real time system enabled effective management of operations and adherence to compliance processes. The investment was recovered in 18 months, through improved labour efficiencies, and laboratory cost and waiting time savings.
Note: At the end of 2015, there were 262 million cellular (2G,3G,4G) connections globally.

Source: Beecham Research
## MNOs in Smart Farming

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Source: Beecham Research
The Rise of LPWA Technologies

Requirements:
- Low data rates
- Latency tolerant
- High coverage

Permits:
- Low complexity/cost
- Low power
LPWA Landscape

- Low power and low data rate applications and networks
- Smart parking, smart farming, alarms
- Reaching almost 350 million connections by 2020

Source: Beecham Research, “LPWAN for IoT Applications – Market Report And Forecasts”, Published 2015
LPWA APPLICATIONS AS PART OF IoT WORLD OF CONNECTED SERVICES

IoT WORLD OF CONNECTED SERVICES

LPWA SERVICE APPLICATIONS LAYER

ESSENTIAL ATTRIBUTES
- Battery Life
- Transmit Modes
- Message Delivery
- Latency
- Scalability
- Data Rates
- Geographic Coverage
- Security
- Device Cost
Examples of LPWA Applications for Farming

**WATER METERING**

- **Application Description** - Remote monitoring of water meters and leak detection
- **Core Benefit** - Notification of leaks, Minimize Losses
- **Essential Attributes** - Low latency real-time connection essential for leak detection
  - Up to 10-12 years battery life
- **Application Specific Attributes** - High availability
  - Good in-building & in-ground coverage
- **Benefits in Using LPWA** - 'Fit & forget' connectivity due to long battery life & Superior in-building coverage

**PRECISION LIVESTOCK**

- **Application Description** - Tracking animals grazing in open pastures
- **Core Benefit** - Locating asset, Minimise losses
- **Essential Attributes** - Coverage in rural areas
  - Long battery life (5yrs covers most livestock needs)
- **Application Specific Attributes** - Geolocation
  - Low cost, ruggedised device availability
- **Benefits in Using LPWA** - Low cost finding with the need for GPS
The Role of IoT Platforms

- As solutions become more complex and mission critical, platforms to support them also need to evolve.
- Need to extend managed environment to the edge.
- Increasing attention on IoT platforms for smart farming environments such as John Deere and Trimble.
- Increasing importance of data management, API management and security.
Thank You

www.beechamresearch.com
sromeo@beechamresearch.com
@Saverio_Romeo