



Low-cost & reliable wireless communication for asset management and industrial IoT applications

In several areas of industry, mission-critical communication platforms – being 100% operational - are a must. Think of communication lines between crane operators and ground personnel or between control rooms and security guards patrolling the floor.

In other industrial scenario's, asset management requires vehicles and goods to be tracked over long distances and periods of time, with a variable demand towards accuracy and data throughput.

At present, no single wireless technology in itself can assure this type of specifications at acceptable cost of ownership. License-exempt low-power wide-area network (LPWAN) technologies (SigFox, LoRa, DASH7, 802.15.4g) are reliable and power efficient. Yet each of them is designed for specific use cases, which limits their wider applicability.

To cover the demands of a lot of today's applications, multiple (redundant) systems - wireless and wired - are being deployed in parallel. Often resulting in the desired performance, but adding a lot of cost and complexity in the installation and interoperability.

MuSCLe-IoT is short for Multimodal Sub-Gigahertz Communication and Localization for Low-power IoT applications. Within MuSCLe-IoT, a solution has been developed that makes optimal use of multiple LPWAN standards for mission-critical communication and long-range multi-year asset management. For example, switch to LoRa at times when DASH7 coverage is lower. Or communicate over SigFox when less data throughput is needed. The MuSCLe-IoT prototype consists of a small, low-cost, battery-powered single-antenna device in combination with the required software algorithms for cloud- and edge computing to control the network.

The MuSCLe-IoT technology can be seamlessly implemented with existing communication devices (DECT phones, pagers, walkie-talkies...) at much lower cost of ownership compared to wired or redundant system installations. It can revolutionize the uptake of IoT solutions in sectors as marine (harbors), construction, retail, museums and many more.

THE OUTCOMES

1. A virtual operator capable of switching between LPWAN standards + corresponding software embedded at the device side

The single-antenna device with its advanced communication stack, both developed the by MuSCLe-IoT consortium, has the ability to switch between networks based on the needs of the current application, network availability, link quality and environmental conditions.

The single-module design is not only smaller and more cost-effective than multiple-antenna solutions, it also supports more generic hardware. Over-the-air updates enable the integration of new features, even while the device is in operation. Optimization of the switching between wireless protocols is executed by a central virtual operator, resulting in reliable communications while staying compliant with the specifications regarding reliability, data throughput and power consumption.

2. Integration with the backend of existing systems of the partnering organizations

Within the scope of the project, two implementations have been done whereby the MuSCLe-IoT technology was seemingly integrated with the backend systems of the industrial partners in the project:

- At DIVA, the new diamond museum in Antwerp, where MuSCLe-IoT enabled crisis buttons triggered messages to the existing communication devices of the security guards.

- At two locations of Aertssen construction company, where MuSCLe-IoT technology allowed for optimal asset tracking on-site and in transition between sites.

3. Integration of a variety of localization algorithms

For the use case of asset management, an optimized set of localization algorithms was implemented, based on LPWAN protocols. Allowing to switch from GPS-like accuracy for assets at a given site to a more course-grained localization of a few hundreds of meters for assets in transition from one location to another. All of this with low power in mind, resulting in multi-year operation on a single 3.6V battery charge.

NEXT STEPS

- Luc Deneubourg, Branch Manager Flash Private Mobile Networks: "Since I have been presenting the MuSCLe-IoT technology to our clients, we can't keep up with the orders. I already see this technology allowing for a substantial new offering to our existing clients and opening entirely new market segments."
- Dirk Indigne, CEO Engie M2M: "The main result of the project is that we can do even more precise location detection, thanks to a more refined triangulation through our network of antennas. We are currently implementing the results of MuSCLe-IoT in our existing solutions, mainly focusing on asset management."
- Kristoff van Rattinche, CEO Sensolus: "MuSCLe-IoT demonstrated the added value of a multi-modal approach, which today has almost become a standard requirement for our customers. Industrial IoT is not at all generic. The combination of protocols ensures tailored sensor solutions for our customers, which is often the key towards cost-effective process optimization."
- Jurgen Scheers, ICT Manager Aertssen Group NV, one of the Aertssen Group Business Units: "We use specific, expensive assets (e.g. a drill hammer) for which damage costs are very high if they are not maintained properly. With MuSCLe-IoT we have a solution to measure the actual usage and ensure that maintenance is taking place at the right moment."

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FACTS

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| NAME | MuSCLe-IoT |
| OBJECTIVE | Multimodal Sub-Gigahertz Communication and Localization for Low-power IoT applications |
| TECHNOLOGIES USED | Low-power wide-area network (LPWAN) technologies: SigFox, LoRa, DASH7. |
| TYPE | imec.icon project |
| DURATION | 01/04/2017 – 31/03/2019 |
| PROJECT LEAD | Luc Deneubourg, Flash Private Mobile Networks |
| RESEARCH LEAD | Maarten Weyn, IDLab, an imec research group at the University of Antwerp |
| BUDGET | 1,196,301 euro |
| PROJECT PARTNERS | Aannemingsbedrijf Aertssen, Engie M2M, Flash Private Mobile Networks, Sensolus |
| RESEARCH GROUPS | imec - IDLab – UGent, imec - IDLab - UAntwerpen |



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MuSCLe-IoT project partners:



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