

Title: Uniform communication interfaces in metrology for the Internet of Things

Abstract

The Internet of Things (IoT) is a network of physical objects (“things”) that are provided with unique identifiers, which makes it possible to transfer data over a network without human-to-human interaction. The exchange of information inside the IoT will be based on digital data; the challenge is to derive a common language despite the almost infinite number of well-established technical and logical interfaces. Pre-normative communication protocols are required, which consider the worldwide agreed definition of the SI-units, as well as the regulations specified in the GUM, in order to demonstrate the operational reliability for exchanging metrological data inside the IoT in a digital, safe, uniform, unambiguous and highly automated way.

Keywords

Internet of Things, IoT, Industry 4.0, SI-units, GUM, Communication Protocols

Background to the Metrological Challenges

The IoT is known as the fourth technical revolution [1]. Driven by the Internet, the real and virtual world grow together to form the IoT. In the future, the IoT should provide a platform for an intelligent, self-sufficient, and extremely flexible factory where machines and operating sequences organise themselves with minimal human interaction. It has been estimated [2] that by 2019, the IoT will be worth more than double the size of the smartphone, PC, tablet, connected car and wearable market combined, and will result in \$1.7 trillion in added value to the global economy.

The exchange of information inside the IoT will be based on digital data. Today, one central handicap that complicates simple communication between different “things”, lies in the almost infinite number of well-established technical and logical interfaces. Their proper communication requires expensive and customised solutions. One of the most challenging tasks for the future is therefore to overcome the incompatibility of the established data formats. In Europe, the “European Research Cluster on the Internet of Things” (IERC) [3] is targeting the coordination and establishment of a broad based consensus on the ways to realise the IoT in Europe.

Sensors play an essential role within the IoT as they provide the operational conditions on which algorithms and software make their “intelligent” decisions, particularly within manufacturing and production process control/evaluation. Therefore, measurement data must be seen as key information that will be exchanged inside the IoT and rules have to be defined that provide the required interoperability among the individual systems. Consequently, this requires a uniform IT language within the area of metrology.

Both the well-established SI units and the regulations of GUM provide an ideal platform for a unified and worldwide agreed exchange of measurement information. The definition of an internationally accepted syntax for IT in metrology is now required and, due to the many data formats currently in existence, this can only be defined on a meta-level.

Objectives

Proposers should address the objectives stated below, which are based on the PRT submissions. Proposers may identify amendments to the objectives or choose to address a subset of them in order to

maximise the overall impact, or address budgetary or scientific / technical constraints, but the reasons for this should be clearly stated in the protocol.

The JRP shall focus on research necessary to support standardisation in communication protocols for metrology inside the "Internet of Things" (IoT).

The specific objectives are

1. To assess, structure and specify requirements and data fields needed for the electronic exchange of measurement data, consistent with SI units and GUM, in an IoT environment.
2. To create pre-normative documents for the specification of metrological data exchange formats, enabling unambiguous and consistent dissemination of metrological certificates, measurement values and other relevant metrological information.
3. To develop an online validation system for the certification of metrological data exchange format.
4. To develop demonstrators for the communication between partners (NMIs and industry) exchanging metrological data in a digital, safe, uniform, unambiguous and highly automated way inside the IoT.
5. To facilitate the take up of the protocols developed by the project by the measurement supply chain (accredited laboratories, instrumentation manufacturers), standardisation bodies and end users.

The proposed research shall be justified by clear reference to the measurement needs within strategic documents published by the relevant Standards Developing Organisation or by a letter signed by the convenor of the respective TC/WG. EURAMET encourages proposals that include representatives from industry, regulators and standardisation bodies actively participating in the projects.

Proposers should establish the current state of the art, and explain how their proposed project goes beyond this.

EURAMET expects the average EU Contribution for the selected JRPs in this TP to be 0.4 M€, and has defined an upper limit 0.5 M€ for this project.

EURAMET also expects the EU Contribution to the external funded partners to not exceed 30 % of the total EU Contribution to the project. Any deviation from this must be justified.

Any industrial partners that will receive significant benefit from the results of the proposed project are expected to be unfunded partners.

Potential Impact

Proposals must demonstrate adequate and appropriate participation/links to the "end user" community, describing how the project partners will engage with relevant communities during the project to facilitate knowledge transfer and accelerate the uptake of project outputs. Evidence of support from the "end user" community (e.g. letters of support) is also encouraged.

You should detail how your JRP results are going to:

- Address the SRT objectives and deliver solutions to the documented needs,
- Feed into the development of urgent documentary standards through appropriate standards bodies,
- Transfer knowledge to software and hardware developers and the manufacturing sector.

You should detail other impacts of your proposed JRP as specified in the document "Guide 4: Writing Joint Research Projects (JRPs)".

You should also detail how your approach to realising the objectives will further the aim of EMPIR to develop a coherent approach at the European level in the field of metrology and include the best available contributions from across the metrology community. Specifically the opportunities for:

- improvement of the efficiency of use of available resources to better meet metrological needs and to assure the traceability of national standards
- the metrology capacity of EURAMET Member States whose metrology programmes are at an early stage of development to be increased
- organisations other than NMIs and DIs to be involved in the work

Time-scale

The project should be of up to 3 years duration.

Additional information

The references were provided by PRT submitters; proposers should therefore establish the relevance of any references.

- [1] Floridi Luciano; The Fourth Revolution - How the Infosphere is Reshaping Human Reality; Oxford university Press 978-0-19-960672-6
- [2] Greenough J: The 'Internet of Things' Will Be The World's Most Massive Device Market And Save Companies Billions Of Dollars; Business Insider UK; <http://uk.businessinsider.com/how-the-internet-of-things-market-will-grow-2014-10?r=US>; access 03/2015
- [3] European Research Cluster on the Internet of Things; Homepage; <http://www.internet-of-things-research.eu/>, access 03/2015