EMPIR Call 2020 – Fundamental, Industry and Normative

Selected Research Topic number: **SRT-i25**
Version: 1.0

Title: Enabling the adoption of digital calibration certificates in metrology and industry

Abstract

Industry 4.0 and the Internet-of-Things are expected to generate a potential economic impact of up to $14.4 trillion by 2025. Therefore, a process for the exchange of metrological data within the new global Quality Infrastructure is urgently needed. This process must meet the goals set by the EC's Digital Single Market strategy and provide worldwide, cross-border, adoption of digital calibration certificates (DCCs) in metrology and industry. There is also a need to develop a software infrastructure that allows DCC operations to be undertaken in a secure and reliable manner. The software infrastructure should be sufficiently straightforward so as to enable adoption by end users and should be demonstrated to end-users in 'real' world applications of the exchange of metrological data, i.e. those most commonly used in manufacturing and process industries.

Keywords

Digital calibration certificates, cryptography, digital signatures, security, semantics, vocabulary, ontology

Background to the Metrological Challenges

Currently, the vast majority of calibration certificates are issued on paper. For secure storage and transfer of DCCs (or any other digital documents), the current state of the art is cryptographic digital signatures and seals, such as those defined for EU regulation 910/2014 Electronic Identification, Authentication and Trust Services (eIDAS). The eIDAS provides the framework to conduct digital business securely within the European Single Market and commits organisations delivering public digital services within the EU to recognise electronic identification from all EU member states. However, without a similar internationally agreed process for the provision of DCCs, they remain inaccessible for international customers.

Unfortunately, no single, agreed process currently exists for the creation of digital signatures in manner that is legally binding worldwide. This is despite the fact that, the technical standards for digital signatures and seals are largely universal and based on the International Telecommunications Union recommendation X.509 'Information technology - Open Systems Interconnection - The Directory: Public-key and attribute certificate frameworks'. A further issue is the large diversity and very large volumes of connected devices used, as well as the uncontrolled development of software tools and procedures for digital stamping and exchanging of digital documents at the national level.

The EMPIR project 17IND02 SmartCom is currently working on an infrastructure for the use of DCCs. The project has so far defined (i) a data model for DCCs that allows measurement results to be represented in a clear, unambiguous manner, (ii) a flexible and universal data structure for DCCs, and (iii) the requirements for the secure transfer of DCCs and initial cryptographic requirements. However, further work is needed. The 17IND02 project is also collaborating with the weighing industry, in developing demonstrators for the exchange of metrological data in real world applications. However, these demonstrators do not cover key metrology areas such as mass, length, temperature, pressure and flow, or highly regulated sectors such as the pharmaceutical industry.

The foundations for a global concept for the exchange of metrological data are also being investigated by the CIPM Task Group on the Digital SI and the EURAMET Technical Committee Interdisciplinary Metrology (TC-IM) 1448. Although, these working groups are focussed on more general harmonisation and fundamental development.

EURAMET EMPIR MSU
Phone: +44 20 8943 6666 Email: EMPIR.msu@euramet.org
msu.euramet.org

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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 the metrology required for the adoption of DCC in industry.

The specific objectives are

1. To develop a reliable infrastructure for the following aspects of the DCC cycle: (i) DCC generation; (ii) DCC storage; (iii) DCC validation; (iv) application of cryptographic technology (i.e. to ensure secure transfer of DCCs and secure storage for extended periods); and (v) extraction of information from DCCs. Interoperability of different data sources (e.g. data input to a DCC from different databases) should also be included.
2. To define and develop metrological vocabularies and meta-data references for the extension of DCC and Digital SI Extensible Markup Language (XML) schemas. This should include automated extraction of semantically significant calibration data from DCCs and reference key metrology documents (i.e. the International Vocabulary of Metrology, Guide to the Expression of Uncertainty in Measurement, and the BIPM SI Brochure: The International System of Units).
3. To develop a range of 'real' world demonstrators for the exchange of metrological data via the infrastructure developed in Objectives 1 & 2. The demonstrators should (i) cover the entire calibration process, (i.e. from measurements to DCC), (ii) ensure traceability to SI units, (iii) include on-line compensations, (iv) cover key metrology areas (e.g. mass, length, temperature, pressure and flow), (v) be applicable to common manufacturing and process industries as well as highly regulated sectors (e.g. the pharmaceutical industry) and (vi) be successfully presented to industry end users.
4. For each participant, to develop a long-term strategy for the generation and provision of DCC including knowledge transfer and training activities; in order to apply the technology and software infrastructure developed Objectives 1-3, in industry and key metrology areas (e.g. mass, length, temperature, pressure and flow).
5. To facilitate the take up of the technology and measurement infrastructure developed in the project by the measurement supply chain, standards developing organisations (those associated with ISO/IEC 17025 'Testing and Calibration Laboratories', EU regulation 910/2014 eIDAS, the CIPM Task Group on the Digital SI and EURAMET TC-IM 1448) and end users (in metrology and industry).

Proposers shall give priority to work that meets documented industrial needs and include measures to support transfer into industry by cooperation and by standardisation. An active involvement of industrial stakeholders is expected in order to align the project with their needs – both through project steering boards and participation in the research activities.

Proposers should establish the current state of the art, and explain how their proposed project goes beyond this. In particular, proposers should outline the achievements of the EMPIR project 17IND02 SmartCom and how their proposal will build on this.

EURAMET expects the average EU Contribution for the selected JRPs in this TP to be 1.5 M€, and has defined an upper limit of 1.8 M€ for this project.

EURAMET also expects the EU Contribution to the external funded partners to not exceed 30 % of the total EU Contribution across all selected projects in this TP.

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 the industrial 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.