

Communication and Validation for Smart Metrology Data in IoT Networks - SmartCom

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Presentation - Overview

1. NPL Data Science – Who are we?
2. Overview of SmartCom - Digital Metrology Project
 - “Communication and Validation for Smart Metrology Data in IoT Networks”
3. Future Digital Metrology
 - Met4FoR – “Metrology for Factory for the Future” - EMPIR(EU) Funded
 - EMC – “European Metrology Cloud”

1. NPL DATA SCIENCE – WHO ARE WE?

Data Science Group – Who are we?

- 20+ scientists: mathematicians, statisticians, computer scientists, data scientists.
 - Based in Teddington, Huddersfield, Cambridge and Strathclyde.
- Partly government funded via NMS, partly grant funded, partly 3rd party business.
- Collaborate with most other groups at NPL: real mix of data problems.
- Collaborations with academia via joint appointments (Surrey, Strathclyde, Cambridge), students (12 PhD, 2 sandwich course) & the Alan Turing Institute.
- Strong links with NPL equivalents in other countries.
- Developing collaborative projects for/with industry.

Data science for advanced manufacturing

- Data Provenance and Curation
- Making best use of the data gathered throughout the manufacturing process
- Digitally enabled supply chain and “digital twins”
 - Combining data and modelling to reduce waste, predict performance, and improve knowledge of products
- Sensor networks
 - Combining data from multimodal sensors of varying quality taking data quality (uncertainties) into account
- Large dataset analysis
 - Handling large volumes of data and analysing time series data for correlations, trends, and event identification/prediction.

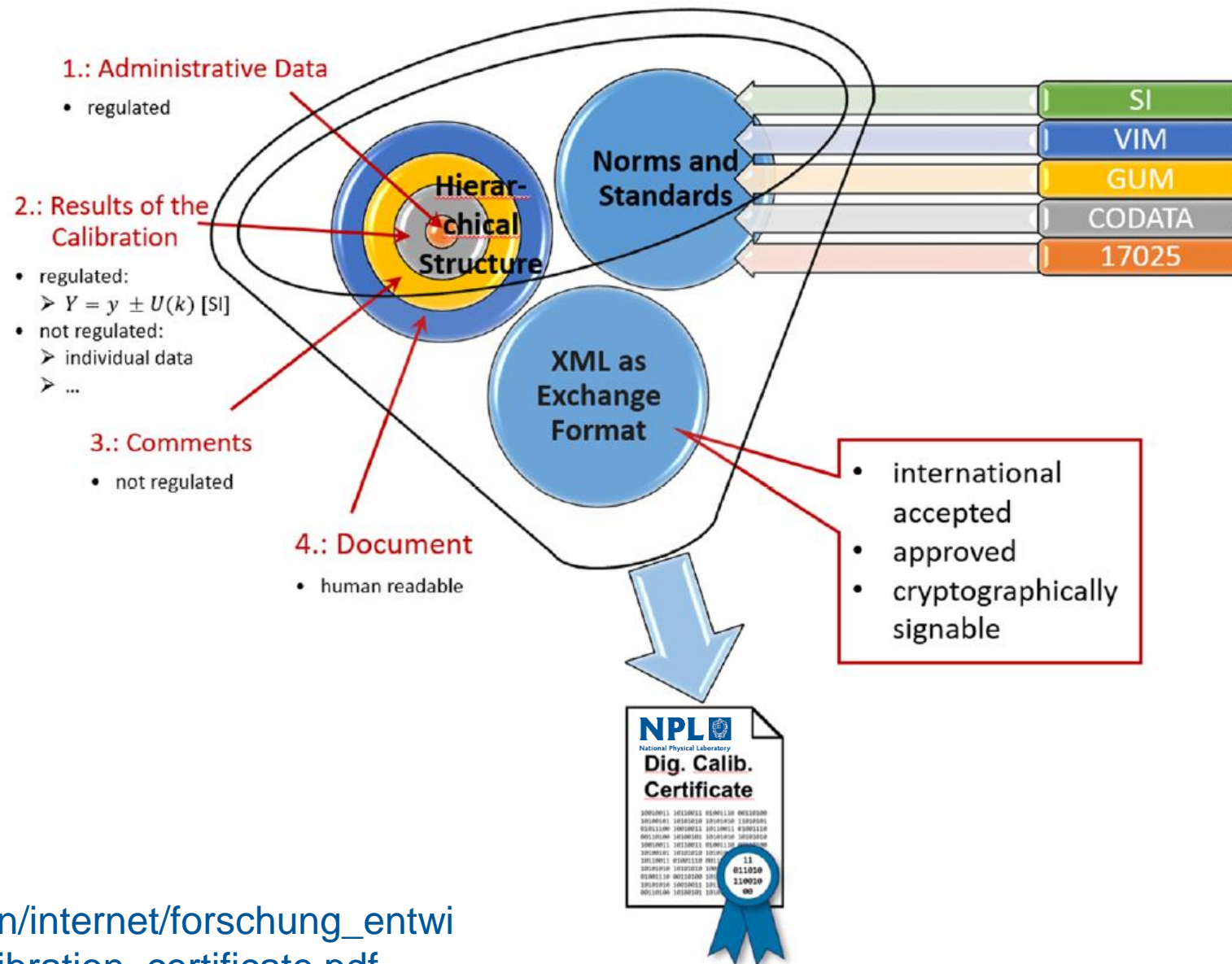
2. OVERVIEW OF SMARTCOM

“Communication and Validation for Smart Metrology Data in IoT Networks”

In a Nutshell:

- Design of Digital Calibration Certificates (no more paper CCs)
- Ensuring that DCCs can be securely transferred between calibrator and client
- Provide demonstration technology to ensure the reliable and secure communication of data between devices connected via the IoT network.

Digital Calibration Certificate



Advantages of Digital Calibration Certificates

- Not paper based – Based on XML file format
- Secure Communications
- Readable and Storable in digital storage systems e.g. Databases
- Still Human Readable as an option
- But more importantly – Machine Readable (potentially storable in device)

Informal approval from UKAS and relevant sections of ISO-17025:2017 –

“General requirements for the competence of testing and calibration laboratories”

How could Digital Calibration Certificates be used in the future? – Example 1

- Standard Calibration of item of equipment

Paper CC Process – Slow, Insecure communications, Vulnerable to transcription error

1. Receive paper based certificate – Slow, Insecure communication
2. Store data from certificate in Measuring Application– Vulnerable to transcription error

DCC Process – Fast, Secure, No need for manual transcription

1. Digital, secure communication using industry standard methods
2. Direct storage in Measurement Applications
3. Or potentially even securely in the device itself

How could Digital Calibration Certificates be used in the future? – Example 2

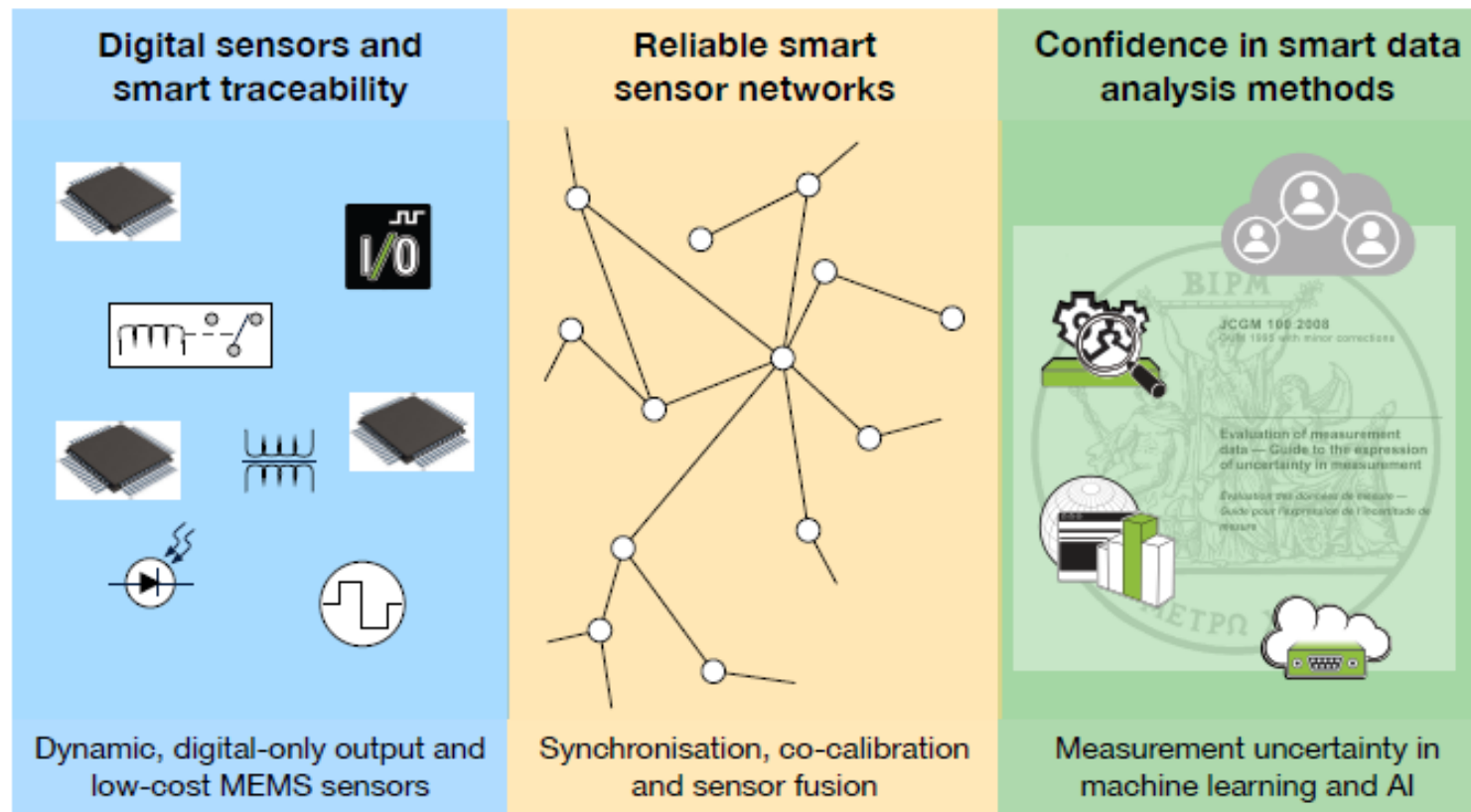
- Legal Metrology - Fuel Pump (IoT)
 1. Embedded digital logic, comms and memory on the Fuel Pump will allow the DCC to be loaded directly onto the Fuel Pump
 2. The fuel pump itself will use the data from the DCC to do self-tests to confirm correct function. If it fails it may:
 1. Try to correct the error e.g. use internal back-up equipment
 2. If this fails it could switch itself off and send an email to request an engineer
 3. Send information to a central system for legal compliance monitoring or for commercial data analysis.

3. FUTURE DIGITAL METROLOGY

Future Digital Metrology 1

- Metrology for the Factory of the Future

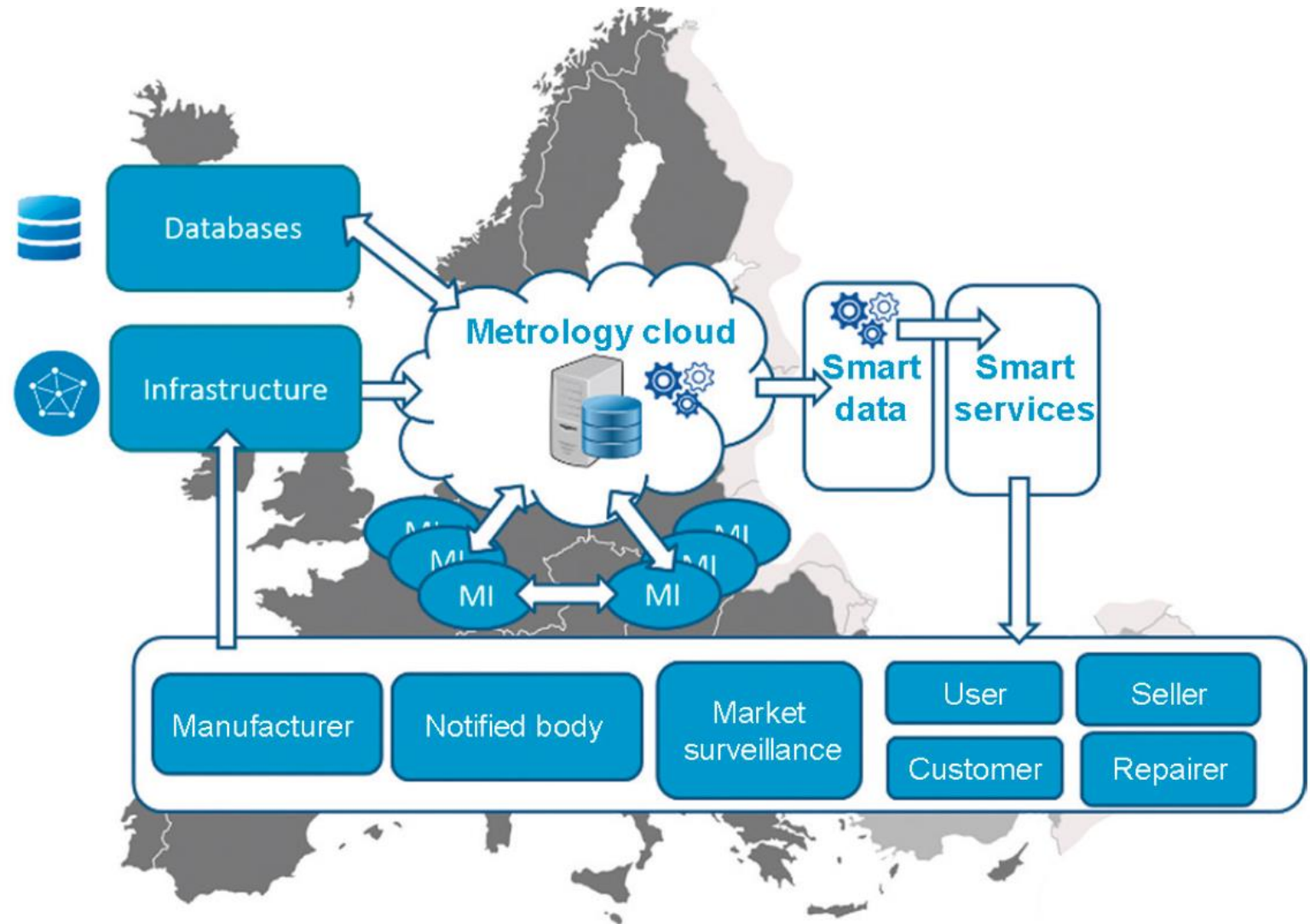
Overall aims of Met4FoF



MEMS – Microelectromechanical Systems – components typical size 1 to 100 micrometers – device size 0.02 to 1.0mm

Future Digital Metrology 2

- European Metrology Cloud



What are the Future Benefits of Digital Metrology and IoT?

- Analysis – Use of analytics for performance evaluation of factors like:
 - Energy efficiency
 - Accuracy
 - Wear
- Devices that can read, store and use embedded calibration information
- Devices that can self-monitor and so provide for automation of quality management processes
- Ability to centralise measurements from multiple sensors and perform real time analysis (e.g. data mining) on the information gathered..

Thank You!

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For SmartCom and Met4FoF

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