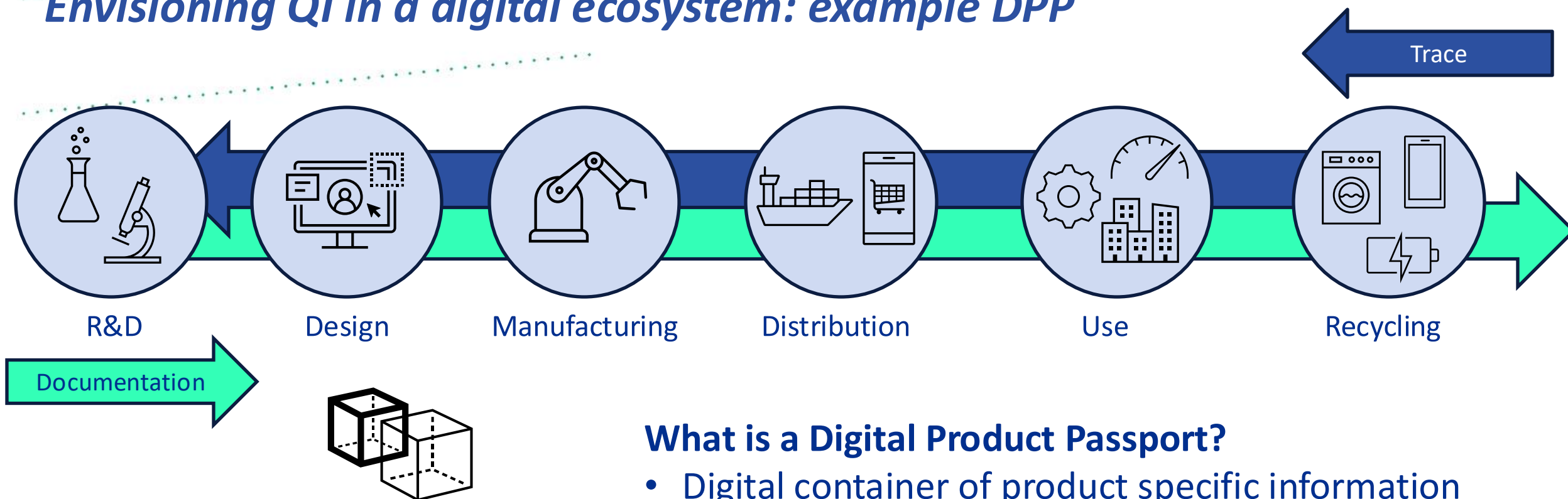


How to ensure and proof quality smarter? Germany's initiative "QI-Digital"

Sascha Eichstädt, Physikalisch-Technische Bundesanstalt, PTB

Envisioning QI in a digital ecosystem: example DPP



What is a Digital Product Passport?

- Digital container of product specific information
- Digital identity for the product, enabling traceability and transparency throughout its value chain



Digital Battery Passport: the first real-life DPP in Europe

IDTA

<https://industrialdigitaltwin.org/>



Identification

IDTA 02035-1
“Digital Nameplate”

Documentation

IDTA 02035-2 “Handover
Documentation”

Technical data

IDTA 02035-3 “Product
Carbon Footprint”

IDTA 02035-4
“Technical data”

IDTA 02035-6
“Material composition”

Lifecycle data

IDTA 02035-5
“Product condition”

IDTA 02035-7
“Circularity”



Digital Battery Passport: the first real-life DPP in Europe

IDTA

<https://industrialdigitaltwin.org/>



Technical data

IDTA 02035-4
"Technical data"

Mandatory property: C-rate (for assessing battery lifetime in terms of load cycles)

Machine-readable [semantic link](#) as Unified Resource Name (URN)

Property [description](#) as human-readable text

urn:samm:io.admin-
shell.idta.batterypass.technical_data:1.0.0#cRateLifeCycleTest

The C-rate should be provided separately for both the charge and discharge of the battery, if applicable.

The exception for non-cycle applications as mentioned in "Expected lifetime: Number of charge-discharge cycles" should apply to this data attribute as well.

[Prop]

[Decimal]

1

CRateOfRelevantCycleLifeTest



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Digital Battery Passport: the first real-life DPP in Europe

IDTA

<https://industrialdigitaltwin.org/>



Value to be provided by the economic operator

Technical data

IDTA 02035-4
"Technical data"

C-rate

Open questions:

- Which measurement conditions?
- Measurement uncertainty?
- Calibrated test and measurement system?
- Accredited laboratory or economic operator lab?

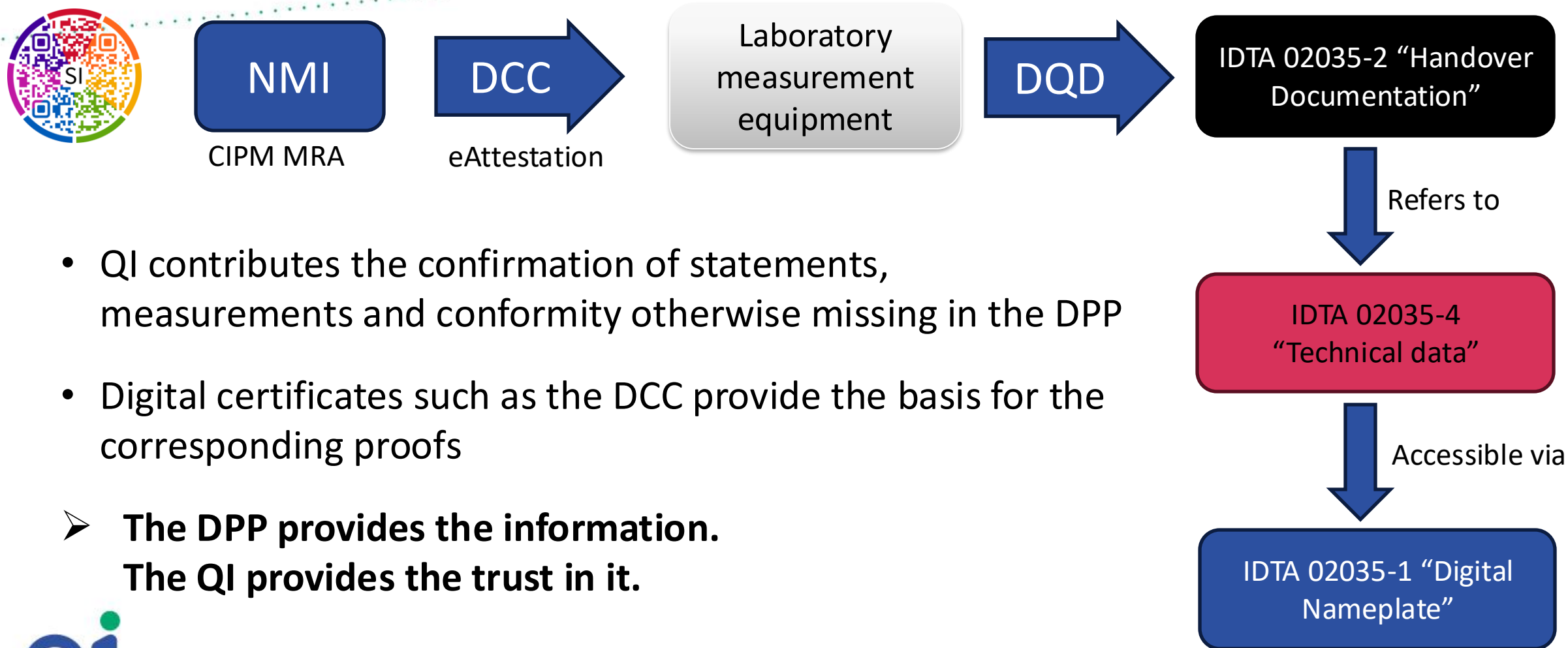
The DPP is authentic, cryptographically secured and unambiguously identified. But there is no information about accuracy and reliability of the reported values.



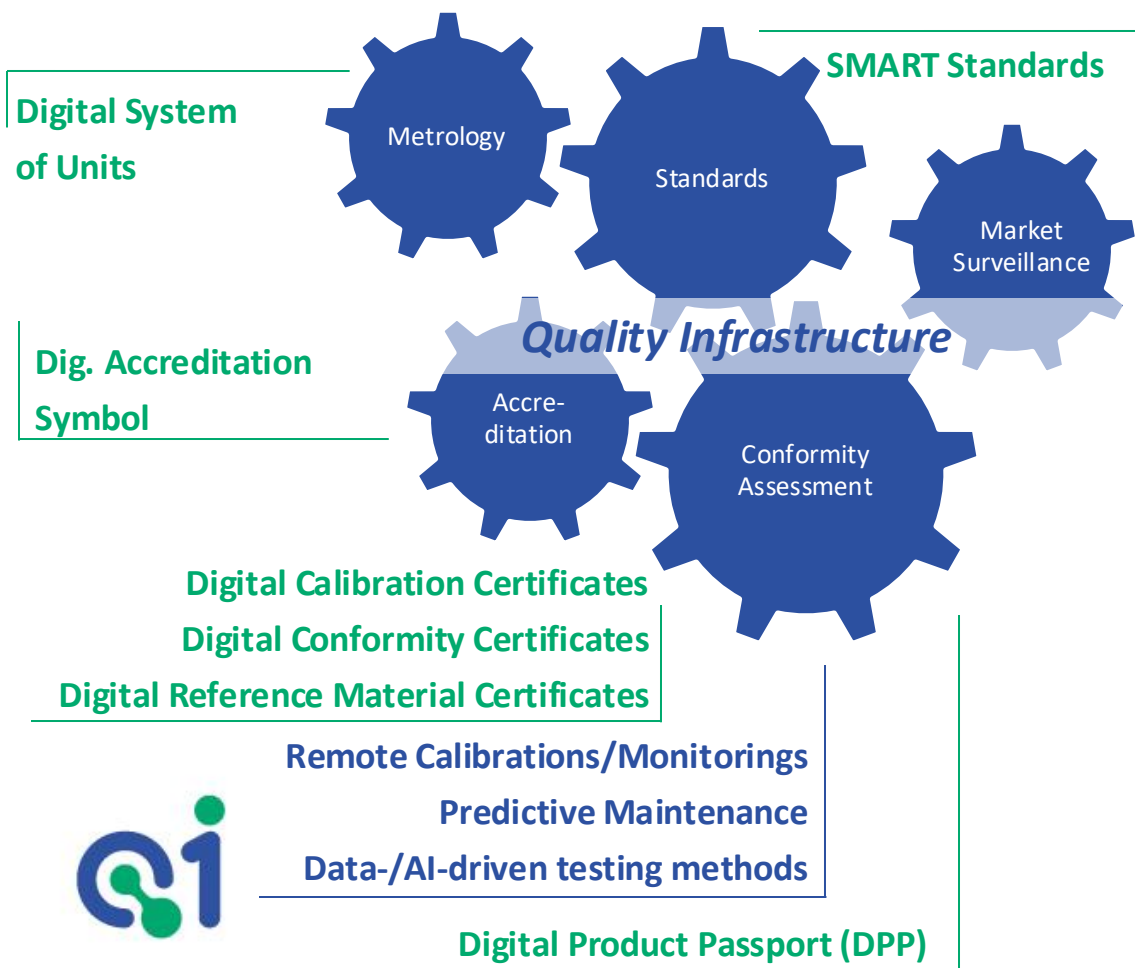
This is where quality infrastructure is needed!

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Digital Battery Passport: the first real-life DPP in Europe

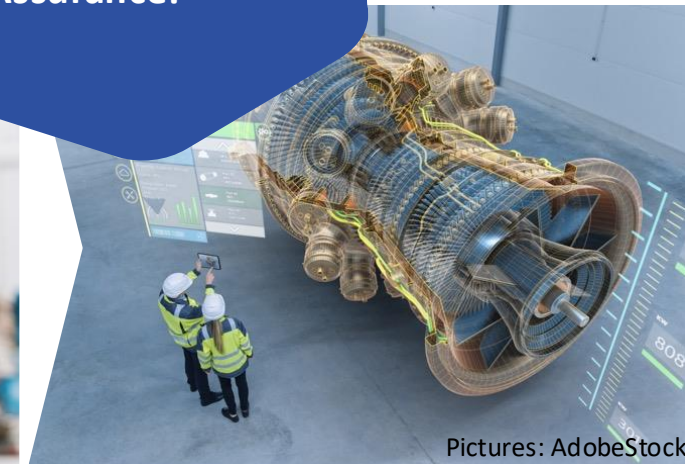


ENSURING QUALITY SMARTER with a digital Quality Infrastructure (QI)



From a **Document**- to a
Data-based Quality Assurance!

Supported by
 Federal Ministry
for Economic Affairs
and Energy



Pictures: AdobeStock

Joint initiative of the central German QI players



- We develop solutions for a modern and efficient QI
 - ☐ seamless integration of QI into Industry 4.0 processes
 - ☐ transparency and trust along value chains
 - ☐ international Interoperability
- R&D and demonstration along practical and **cooperative pilot projects**

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QI Digital – Multi-Stakeholder-Initiative

Advisory Board



Focus (working) groups

- Strategy/Internationalization
- Market Surveillance
- Regulatory Framework

International Network



Building a digital ecosystem for Quality Infrastructure

QI Toolbox

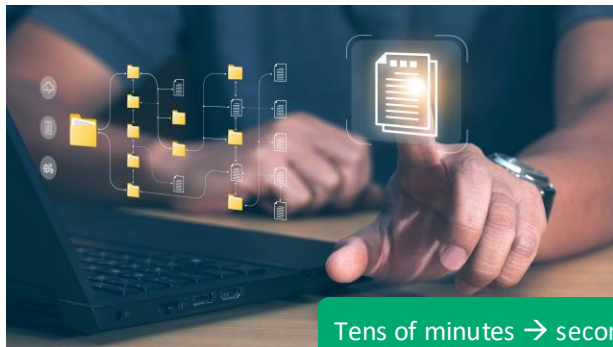
Smart Standards

Digital Calibration Certificate

Digital Conformity Certificates

Digital Reference Material Certificates

Dig. Accreditation Symbol



Methods and Processes

Remote Monitoring

Predictive Maintenance

Data-/AI-driven testing methods

Remote Calibration



Digital Ecosystem



Data Sharing and Management

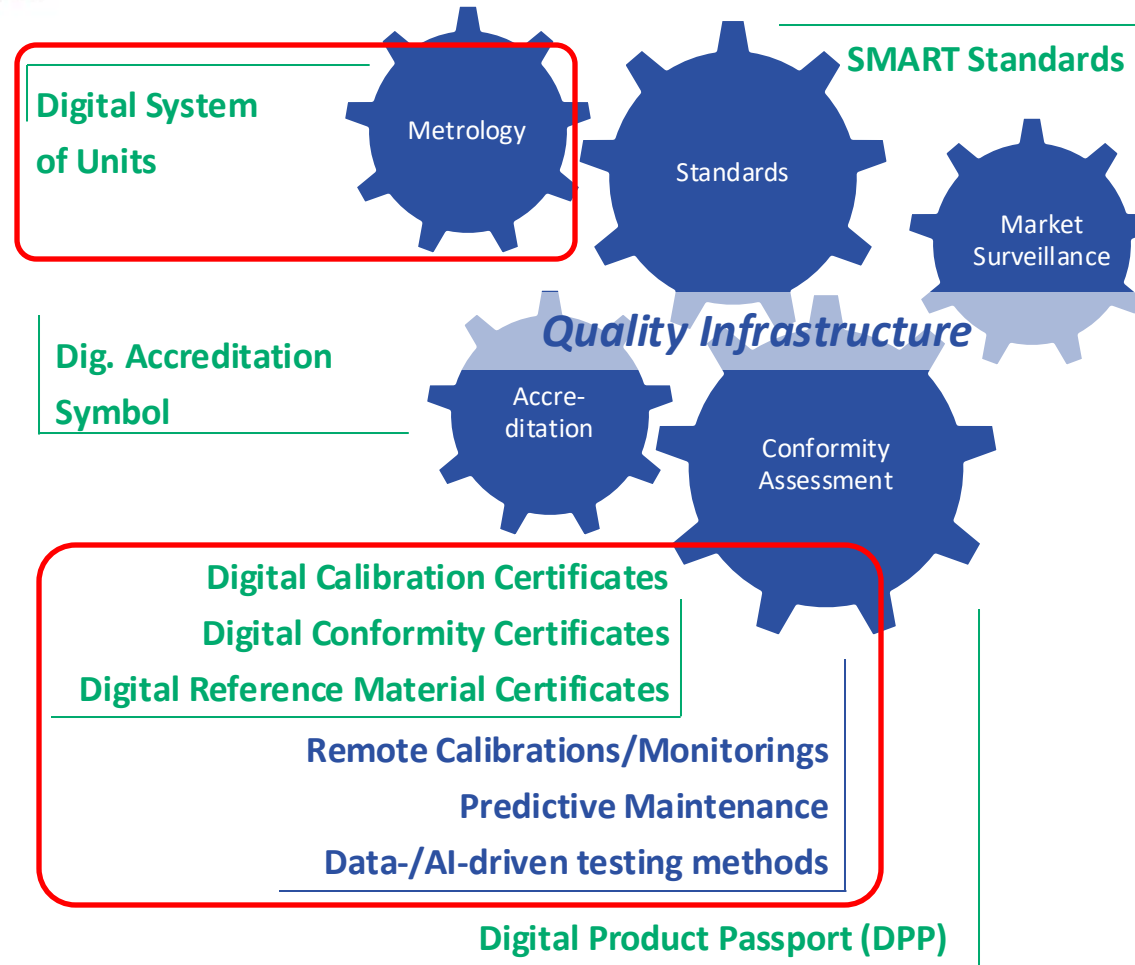
→ Connect to industrial digital ecosystems with Data Spaces, Asset Administration Shell (AAS), and Digital Product Passport (DPP)
- Integrating digital **trust** anchors

Transfer

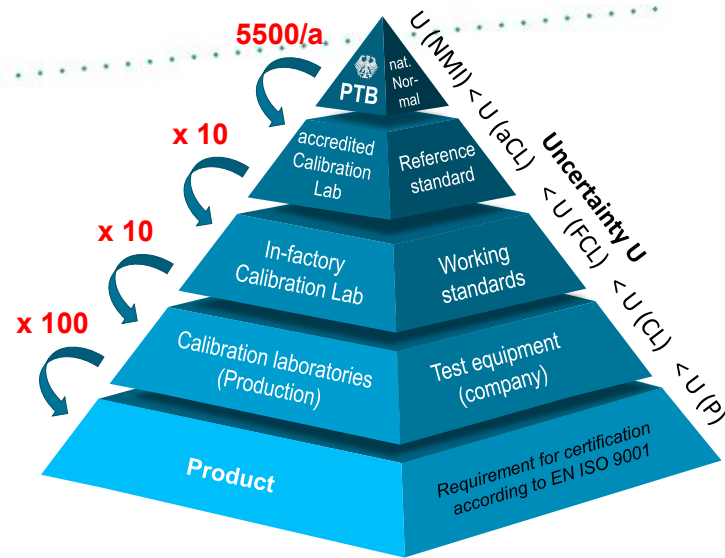
Stakeholder engagement and establishing suitable **framework conditions** (e.g. legal framework);
Strategy and Roadmapping

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Digital Certificates



Digital Calibration Certificates (DCC)



- Standardized data format on all levels
- Full digital traceability chain

Goal: enable **automated processing** of calibration information in a **legally compliant manner**

- ✓ Relieves staff of administrative tasks
- ✓ Avoidance of errors in data transmission
- ✓ Labour, time and therefore cost savings



XML-based exchange format



Developed with international partners, including industry



Automatic validation



Digital signatures



Digital Reference Materials Documents (DCMD)



BAM AS A RM PRODUCER



>100 Years of Experience
in RM production.



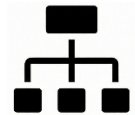
ISO 17034 Accredited
producer



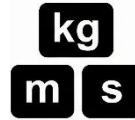
400+ Specialized Products
available via the BAM webshop.



Hosting COMAR
The premier international database for
reference materials.



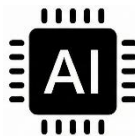
Schema: DCC-based XML
schema for ISO/IEC 17034
certificates, incorporating ISO
33401 content requirements.



Global Units: Seamless Digital
SI integration.



Digital Trust: W3C credentials
for Secure and verifiable
eAttestations (e.g., DAkkS)



AI-Powered Generator:
Converts PDFs to machine-
readable data.

INTERNATIONAL HARMONISATION

BIPM: CCQM Task
Group on Data
Digitalization (CCQM-
TG-DD) for DCC and
DCRD



Digital Certificate of Conformity (DCoC)

NoBoMet

European coordination group of
Notified Bodies in Legal Metrology

Framework

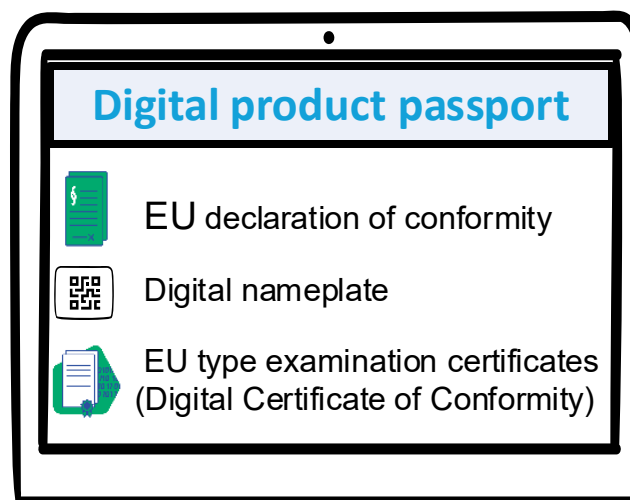
New Legislative Framework
(Decision **768/2008/EC**)

Features

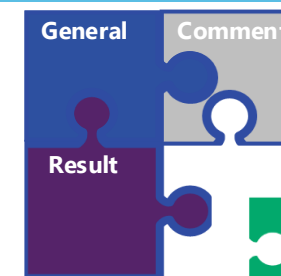
- **Machine-interpretable**
- **Modular structure**
general & specific elements
- Starting with **measuring instruments**
- **Template** for other product categories

Application

Interoperable with other developments
► Data can be referenced / transferred



Published Specifications



General certification information

Notification on the approval of QA system



Module B – Type approval

- Current focus: Legal metrology
- Next: Explosive atmospheres

IN PREPARATION:



Module F – Product verification



UN Transparency Protocol

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Semantic Core Model for Digital Conformity Attestations



Clear, consistent terminology across *all standards*

Aim

Semantic model for *digital reports* and *certificates* in the *quality infrastructure*

Activities

CIPM Forum Metrology & Digitalization, TG for semantics and conceptual modelling, TG DCC & DRMC
DKD expert report on administrative part of DCC
IDTA asset administration shell for Industry 4.0
CIRPASS 2 DPP core ontology including product conformity & measurement units
IEC Measurement units with references to BIPM in the *CDD*
WIPANO Harmonisation of semantic model pre-normative project



Accreditation statements and digital certificates

Electronic seal as “digital company stamp / fingerprint”

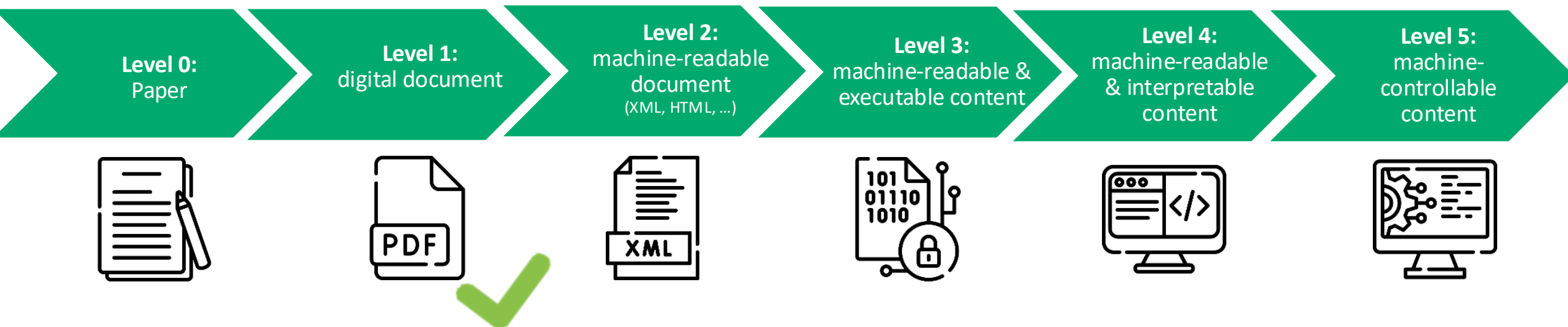


Icons: © Freepik auf <https://www.flaticon.com> & Carave Video

Information within digital accreditation symbol:

- **Name of legal entity** of a CAB
 - Unique **accreditation number** including reference to accreditation body and country
 - Information about accreditation symbol as national emblem representation
 - **Restriction** of seal usage only **on digital attestation** of a CAB
- **Technically secure** issuance of attestations and **machine-verifiable proof of accreditation**

Accreditation statements and digital certificates



Every accredited CAB
can start with PDF

machine-readable

Building a trust-based ecosystem

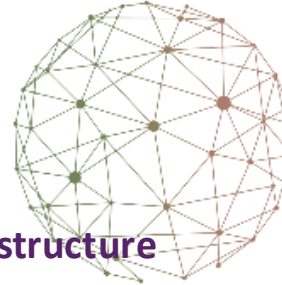
(Digitalized) Quality Infrastructure



- Institutional and technical system to ensure quality, safety, and environmental soundness of goods, services, and processes
- Digitally transformed tools and methods/processes, embedded in larger digital ecosystems



Federated Data Space Infrastructure



- provide a secure, decentralized and governed infrastructure for exchanging product data across complex supply chains; ensuring cross-company interoperability [Möller et al, 2024; Pettenpohl et al. 2022]

Digital Product Passport

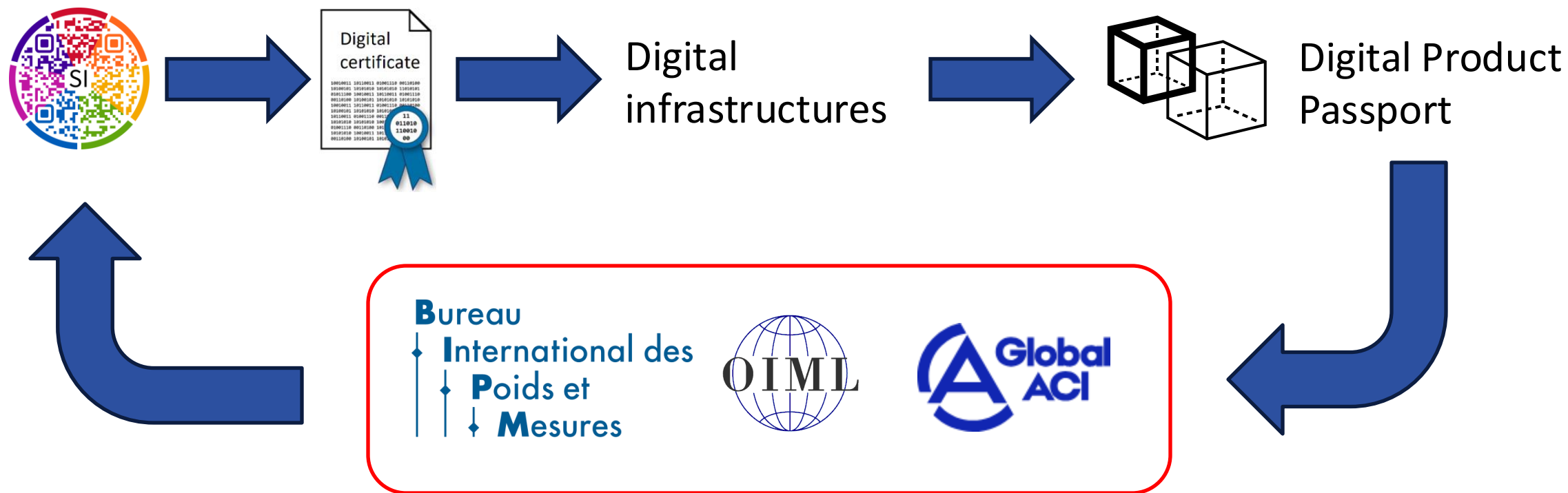


- EU's central instrument under the ESPR (and others) to support transparency, compliance, and circular decision-making
- Facilitate product-related information exchange
- ☐ Information must be persistent and verifiable



→ Provide trustworthy data to stakeholders along value chains and across lifecycles (suppliers, producers, customers, authorities, R-actors, ...)

The role of QI in a digital ecosystem of trust



The evolution of QI-Digital in Germany



<https://vectorified.com/>



2019 – Identifying the need to collaborate closely on digitalisation

2020 – Knowledge exchange and creating working team

2021 – Kick-off of the initiative “QI-Digital”

2022 – 2025 Joint projects around three broader use cases

2022 – Creating stakeholder council board

2026 – Preparing transition to “QI-Digital Platform”



- Sep 2026**

International collaboration towards a digital QI

CIPM / BIPM



CIE
INTERNATIONAL COMMISSION ON
ILLUMINATION



CODATA
COMMITTEE ON DATA OF THE ISC



IEC
INTERNATIONAL ELECTROTECHNICAL
COMMISSION



GLOBAL ACI
GLOBAL ACCREDITATION COOPERATION
INCORPORATED



IMEKO
INTERNATIONAL MEASUREMENT
CONFEDERATION



ISC
INTERNATIONAL SCIENCE COUNCIL



ISO
INTERNATIONAL ORGANIZATION FOR
STANDARDIZATION



IUPAC
INTERNATIONAL UNION OF PURE AND APPLIED
CHEMISTRY



NCSLI
NATIONAL CONFERENCE OF STANDARDS
LABORATORIES INTERNATIONAL



OIML
INTERNATIONAL ORGANIZATION OF LEGAL
METROLOGY

Joint statement of Intent

On the digital transformation in the international scientific and quality infrastructure

[...]

We the undersigned undertake to support in a way appropriate to each organisation the development, implementation, and promotion of the SI Digital Framework as part of a wider digital transformation of the international scientific and quality infrastructure.



Sep 2026

Digital Transformation of Quality Infrastructure

Let's move
forward together.

www.qi-digital.de/en
info@qi-digital.de



Whitepaper
*Federated Digital
Ecosystem*



Roadmap
for a digital QI



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