

InterOpera

Digitale Interoperabilität in kollaborativen
Wertschöpfungsnetzwerken der Industrie 4.0

Digital Calibration Certificate*

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InterOpera Abschlusspräsentation, 27.10.2023

Ein Projekt gefördert vom



Bundesministerium
für Wirtschaft
und Klimaschutz

Durchgeführt von



Agenda



1. Our Team
2. DCC* Motivation
3. DCC* Design Requirements
4. Inside of DCC* AAS SM & Examples (Kazeem)
5. Future of DCC* and next steps
6. Q & A

Our Team



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Motivation of this Working Group I / II



Room sensor

SIEMENS KALIBRIERZERTIFIKAT / CALIBRATION CERTIFICATE

Model: AQF4150
Serial no.: B0001FDC2

Bezugs- und Gebrauchsnormale / Reference and working standards

Relative Feuchte / Relative humidity

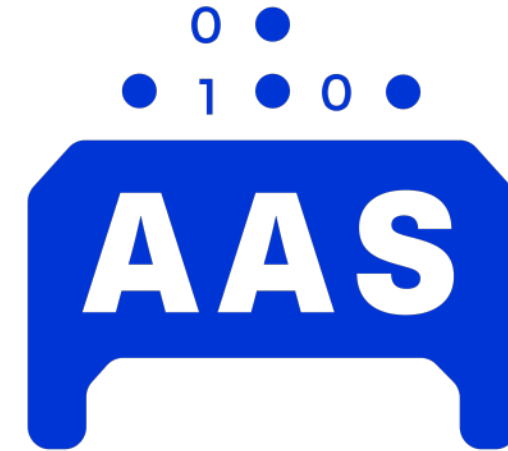
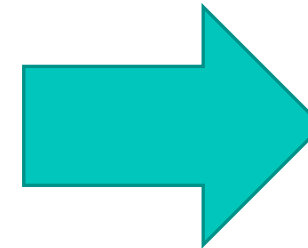
Skalwert	20 %	50 %	85 %	Skalpunkt
	Referenzwert	20.1	50.2	
Kalibrationswert	20.4	50.3	86.2	Kalibrationswert
Fehler	0.3	0.1	1.0	L-Tor
Spezifizierte Toleranz	± 0.6 %	± 0.5 %	± 1.6 %	Specified tolerance

Temperatur / Temperature

Skalwert	5 °C	23 °C	40 °C	Skalpunkt
	Referenzwert	5.4	23.2	
Kalibrationswert	5.5	23.4	40.0	Kalibrationswert
Fehler	0.1	0.2	0.1	Error
Spezifizierte Toleranz	± 0.6 K	± 0.4 K	± 0.6 K	Specified tolerance

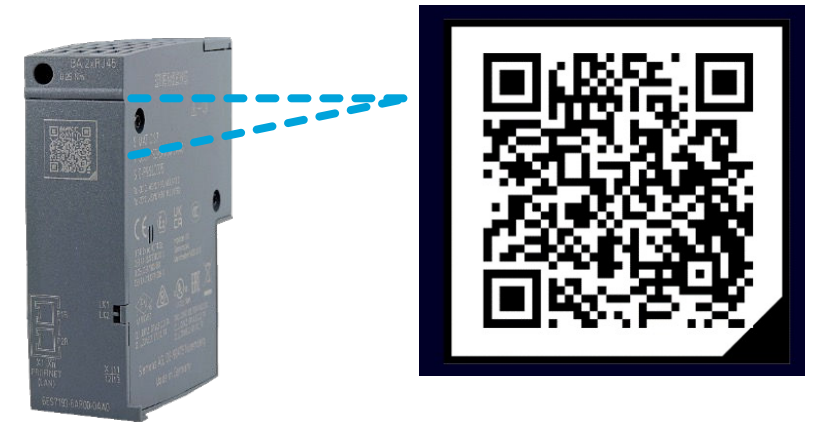
Bestanden / Passed

10. Oktober 2007 / October 10, 2007



Motivation of this Working Group II / II

- **Fast and uniform access** (e.g. via IEC 61406 – ID Link) to calibration metadata such as metrological information, accreditation certificates, measurement procedures and influencing factors (**human- and machine-readable**)
 - Faster obligation to prove that measurement results are trustworthy and meaningful
 - Accelerated comparability about the measurement accuracy and its reliability
- **Sustainability:**
 - due to the digital access of calibration information such as about tolerances values material waste can be avoided
 - avoidance of paper printouts of (multiple) calibration certificates and versions
- Possible (fixed) component of the future **Digital Product Passport (DPP4.0)** according to EU standard for measuring instruments



Requirements for the Digital Calibration Certificate Submodel



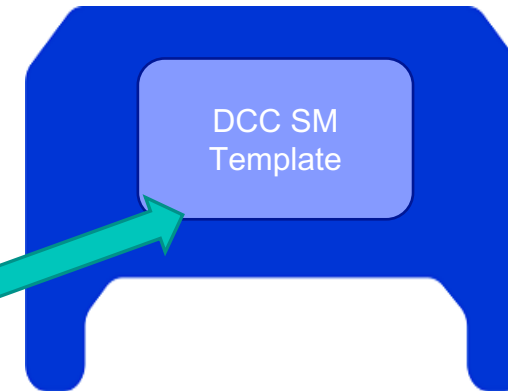
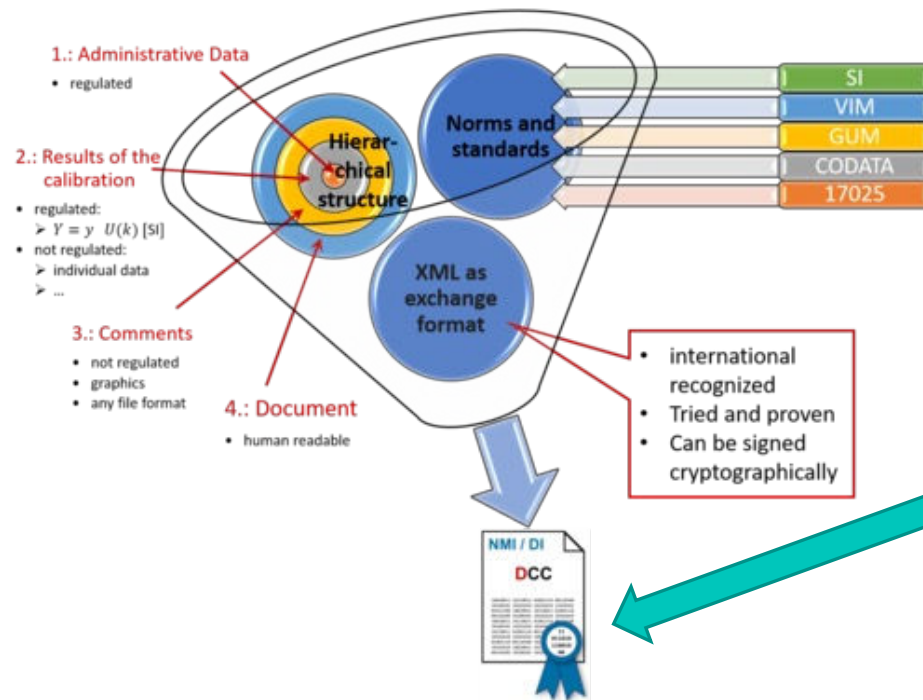
- Reflect existing Calibration Certificate standards such as **ISO/IEC 17025**
- Provide basic **metrological core information** (e.g., measured quantity, unit, measurement uncertainty)
- Specification of general traceability data such as **accreditation certificates**
- Specification of the **calibration/testing procedure**
- Statement of the factors **influencing the result**
- Indication of the **result** (of the test or calibration)
- All information with **units** (as far as reasonable in SI units) and with **uncertainty of measurement**.
- Related work (**DCC XML**):
 - <https://www.ptb.de/dcc/>
 - <https://gitlab.com/ptb/dcc>

Also see: https://interopera.de/wp-content/uploads/2022/10/2022_14_Digital_Calibration_Certificate.pdf

Base Working Assumption: DCC XML \leftrightarrow DCC SM

DCC: From

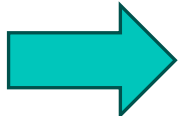
To



For AAS compatibility with other Tools already built for DCC, forward and backward transformation of the DCC certificate from XML to AAS submodel and vice versa should be considered .

Renaming



Digital Calibration Certificate*  Digital Quality Documents (DQD)

AAS Design Options (Kazeem)

```

AAS "DQD_submodelSample" [AssetAdministrationShell---54729C11]
├─ SM <T> "digitalCalibrationCertificate" [https://example.com/ids/sm/8572_6002]
│   ├── SMC "dcc:administrativeData" (7 elements)
│   ├── SMC "dcc:measurementResults" (1 elements)
│   ├── Prop "dcc:comment" = example Comment
│   ├── SMC "dcc:document" (0 elements)
│   └── SMC "ds:Signature" (3 elements)
    
```

Mapping of DCC XML with model with signature

```

AAS "DQD_submodelSample" [AssetAdministrationShell---54729C11]
├─ SM <T> "digitalCalibrationCertificate" [https://example.com/ids/sm/8572_6002]
│   ├── SMC "dcc:administrativeData" (7 elements)
│   ├── SMC "dcc:measurementResults" (1 elements)
│   ├── Prop "dcc:comment" = example Comment
│   └── SMC "dcc:document" (0 elements)
    
```

Mapping of DCC XML with model without signature

```

AAS "DQD_submodelSample" [AssetAdministrationShell---54729C11] of [, NotApplic
Asset Information
├─ SM <T> "dcc:digitalCalibrationCertificate" [https://example.com/ids/sm/8572_6002]
│   ├── SMC "dcc:administrativeData" (7 elements)
│   ├── SML "dcc:measurementResults" (1 elements)
│   ├── SMC "dcc:comment" (1 elements)
│   ├── SMC "dcc:document" (5 elements)
│   └── File "DCC" ⇒ /aasx/files/dcc_gp_temperature_simplified_v12.xml
    
```



Provision of a hybrid solution that Maps the DCC XML into AAS submodel and also integrate the DCC XML file that could be cryptographically signed by manufacturer

DCC XML Mapping Rules(Kazeem)



Element type mapping rules

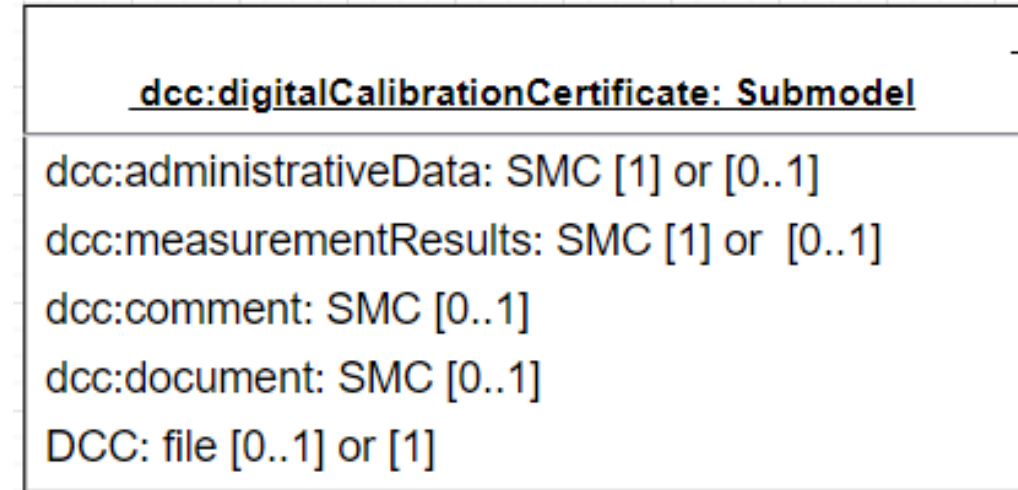
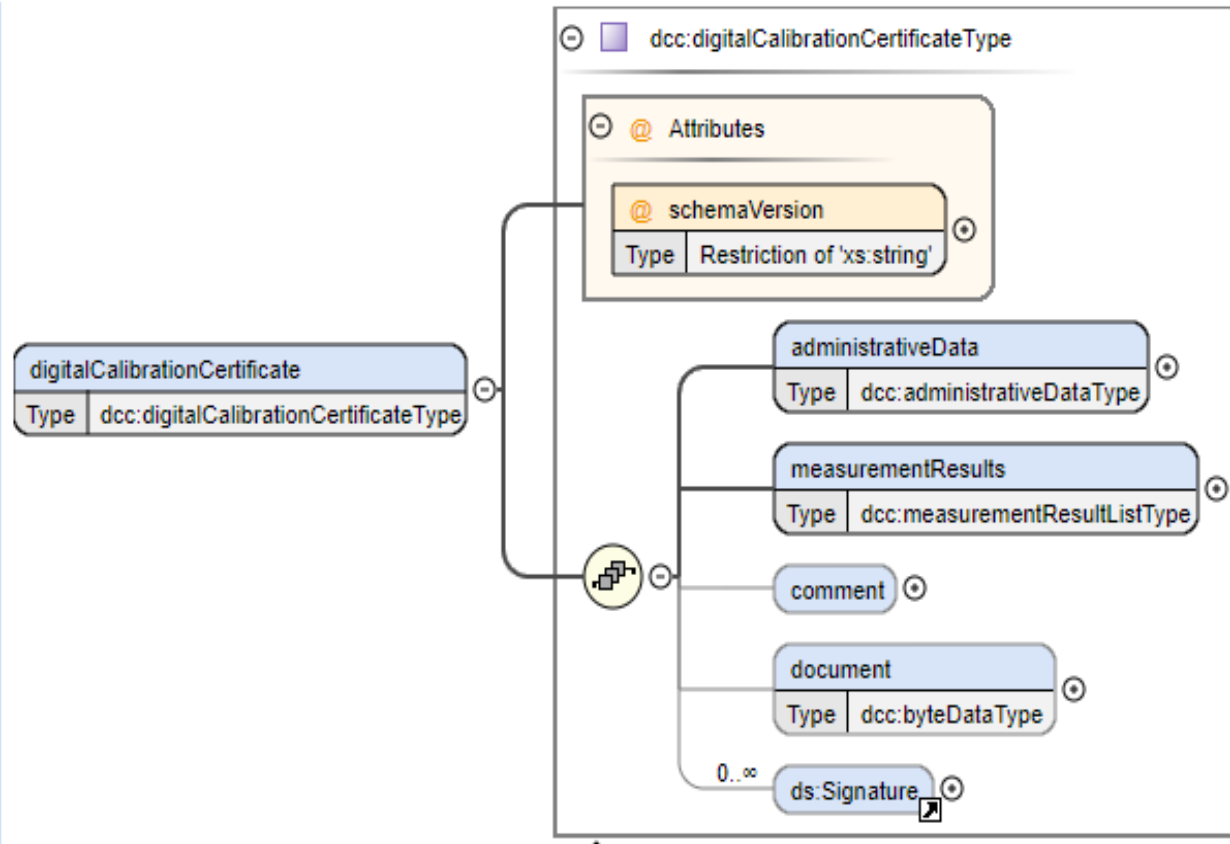
- DCC Elements with XSD primitive types → AAS data element (property) with corresponding XSD primitive types
- DCC Elements with complex(object) types → AAS submodel element collection (SMC)
- DCC Elements with complex(list) types → AAS submodel element list (SML)
- DCC Elements with dcc:xml type → AAS data element (BLOB) with XML notation

Elements cardinality definition rule

Because hybrid model is adopted for the submodel design,

If an external DCC document is referenced (e.g., DCC XML file is provided), the specified mandatory elements in the DQD Submodel are not obligatory (should be seen as optional). This is done to avoid repetition of mandatory elements in AAS submodel.

DCC Root Elements (Kazeem)



AAS Sample (Kazeem)



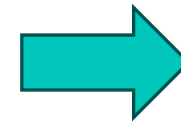
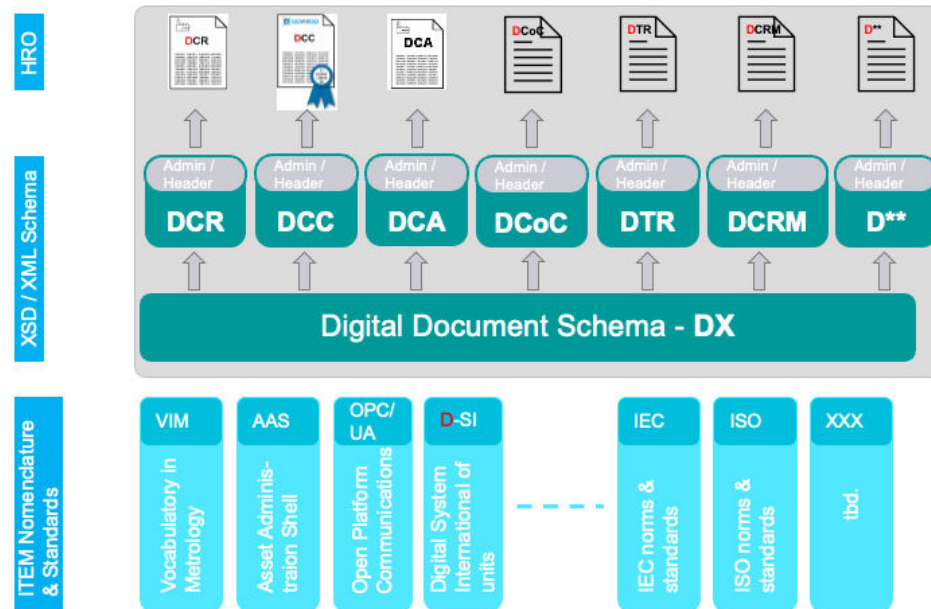
```

AAS "DQD_submodelSample" [AssetAdministrationShell--54729C11] of [, NotApplicable]
├─ Asset AssetInformation
├─ SM <T> "dcc:digitalCalibrationCertificate" [https://example.com/ids/sm/8572_6002_5032_4058]
│   └─ SMC "dcc:administrativeData" (7 elements)
│       └─ SML "dcc:dccSoftware" (1 elements)
│           └─ SMC #00 "software" (5 elements)
│               └─ MLP "dcc:name" → notepad++ (32-bit)
│                   └─ SMC "dcc:name" (1 elements)
│                       └─ Prop "dcc:release" = 8.2
│                           └─ Prop "dcc:type" = application
│                               └─ SMC "dcc:description" (4 elements)
│                                   └─ SMC "dcc:coreData" (12 elements)
│                                       └─ SMC "dcc:items" (7 elements)
│                                           └─ SMC "dcc:calibrationLaboratory" (5 elements)
│                                               └─ SML "dcc:respPersons" (1 elements)
│                                                   └─ SMC "dcc:customer" (6 elements)
│                                                       └─ SML "dcc:statements" (1 elements)
│                                                           └─ SML "dcc:measurementResults" (1 elements)
│                                                               └─ SMC #00 "dcc:quantity" (8 elements)
│                                                                   └─ MLP "dcc:name" →
│                                                                       └─ SMC "dcc:description" (4 elements)
│                                                                           └─ SML "dcc:usedMethods" (1 elements)
│                                                                               └─ SML "dcc:usedSoftware" (1 elements)
│                                                                                   └─ SML "dcc:measuringEquipments" (1 elements)
│                                                                                       └─ SML "dcc:influenceConditions" (1 elements)
│                                                                                           └─ SML "dcc:measurementMetaData" (1 elements)
│                                                                                               └─ SML "dcc:results" (1 elements)
│                                                                                                   └─ SMC #00 <no idShort!> (3 elements)
│                                                                                                       └─ SML "dcc:comment" (1 elements)
│                                                                                                           └─ SMC "dcc:document" (5 elements)
│                                                                                                               └─ File "DCC" ⇒ /aasx/files/dcc_gp_temperature_simplified_v12.xml

```

Future of "DCC"

A "DCC" SM should not only cover calibration certificates, as there are several different types of **documents** to proof data **quality**



Digital Quality Documents SM

Increase interoperability by specifying a single *entry-page* Submodel for quality documents

DCR = Digital Calibration Request **DCA** = Digital Calibration Answer
DCoC = Digital Certificate of Conformance **DTR** = Digital Test Report
DCRM = Digital Certificate for Reference Material **D**** ... more digital documents

Next Steps



- DCC is a first good start for the DQD
- However, we need to extend the current version so that it is also suitable for all other quality data document schemas
- Plans so far: DQD will be submitted to IDTA and the work will be continued there
- The takeover will take place at the beginning of 2024.





Digitale Interoperabilität in kollaborativen
Wertschöpfungsnetzwerken der Industrie 4.0

Danke für Ihr Kommen!

Ein Projekt gefördert vom



Bundesministerium
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