

# Digital Transformation of Processing Metrological Services

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## Summary:

The realization of an end-to-end digital workflow for the metrological services of the PTB, such as calibrations, conformity assessments, and more, requires the future-oriented integration of three essential aspects: processes, data, and interfaces. We present our strategy to approach these individual three key factors while considering the holistic digital workflow for the PTB and acquiring our contribution for a future IT landscape beyond the PTB.

**Keywords:** Interoperable processes, digital transformation, digital calibration certificate, metadata, metrology, digital workflow

## Introduction

The digital transformation of metrological services at the German National Metrology Institute "Physikalisch-Technische Bundesanstalt" (PTB) demonstrates how an overall digital process can be created by sensibly combining individual processing steps whilst considering the necessary data formats.

A product-oriented approach was chosen to theorize the digital workflow from the product back to the points of data input to determine and priorities necessary process factors and to optimize their interactions. In our case, the product is the generation of the digital calibration certificate (DCC) for which the required data are regulated by international standards and therefore clearly defined [1]. Once the points of data input are determined, the workflow can be harmonized into a seamless digital process. During the development of this process framework, data integrity always remains our top prioritized.

## Data

One key factor for a seamless digital workflow is that data is collected once only, meaning that - once collected - their distribution is automatized and occurs from one database in order to minimize the risk of falsification by transmission errors. For this purpose, the PTB has developed a web-based customer portal, which will allow the customer to directly provide and maintain their administrative data. This portal, namely the E-Service, will then enable the customer to place a digital service request and deposit all necessary documents online. Furthermore it allows to track the process

status along the way. The administrative data that had been provided by the customer can be automatically integrated into the internal data management system of the PTB, the so-called E-Files [2]. For the generation of the DCC, the metrological data, generated in the laboratory, will be combined with the administrative data, which is available from the E-Files system (see Fig. 1).

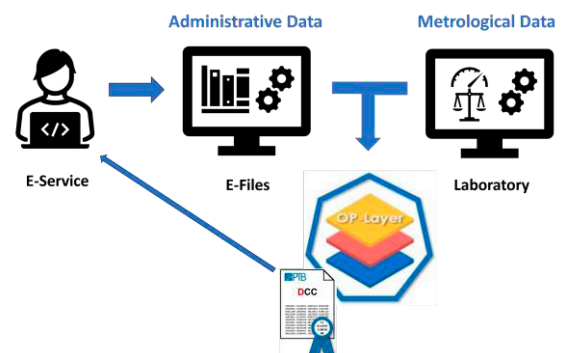


Fig. 1. Schematic illustration of the digital workflow of metrological services, including E-Files, the central data management system, OP-Layer that merges the administrative data provided by the E-Files and the metrological data, provided by the laboratories, to create a digital calibration certificate. The E-Service online portal enables the customer to supply and maintain his administrative data. Furthermore, it allows to submit a digital calibration application and to ultimately receive a DCC.

## Interfaces

A seamless digital workflow requires data integration without media discontinuity and thus suitable interfaces. Since the metrological data can be provided in different formats - depending on the individual necessities of the distinct

laboratories - an interoperable system of holistic data integration is required. Currently, the PTB is developing an open-type infrastructure with standardized interfaces, the so-called Operation Layer (OP-Layer) [3]. As a connector between all PTB systems, such as the E-Files system and the individual software solutions in the laboratories, the OP-layer can access administrative and metrological data of different formats and implement them jointly in a target document. The development of the OP-Layer is currently impelled by the automated generation of a digital calibration certificate (DCC) as first sample application (see Fig. 1).

### Processes

Successful digital transformation requires streamlined, preferably linear processes and with this provides the opportunity to rethink and optimize existing non-digital workflows. In order to meet these requirements, the PTB is deploying a comprehensive process management system. On the basis of initial process analysis and assessment of their efficiency, future processes are modeled. For the construction of such interoperable digital processes it is crucial to establish a standardization of process modules to pave the way for a complete automation of the overall process.

### Automation

We aim for a fully automated digital workflow to manage the metrological services within the PTB. This comprises the following process steps; order acceptance and order processing, calibration or conformity assessment, as well as the generation of the DCC and the digital provision of all necessary documents to the customer. This highest degree of automation requires uniform data structures concerning the involved documents as well as the utilized IT systems.

Once the digital workflow will have been established for the PTB, our gained knowledge, strategies, and IT infrastructure can be transferred beyond our institution and facilitate the creation of an international, interoperable IT system that enables the exchange of information and data automatically. To successfully acquire a comprehensive IT system in the future, the appropriate data structures and formats for the DCC, such as the digital SI (D-SI [4]), are currently coordinated internationally [5].

### Conclusion

The digital transformation of PTB's metrological services aims for a holistically automated end-to-end process and, thus, requires standards. With regard to the key components described

above (i.e., processes, data, and interfaces) the following requirements can be derived, while the integrity of the data remains top priority. One crucial precondition to recognize processual requirements is the critical examination of the existing work procedures as well as their considered harmonization into a streamlined digital process. Furthermore, secure and suitable data formats need to be selected that can be archived immutably and long-term. Additionally, standardized interfaces must be created for the automated merging of data into digital certificates. Moreover, for a universal and interoperable IT landscape standardized interfaces are paramount to facilitate future developments beyond the scope of PTB's metrological services [6].

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