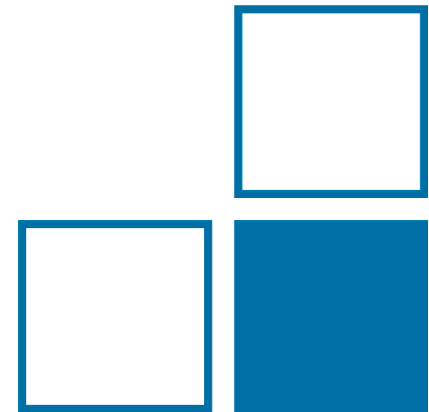




Physikalisch-Technische Bundesanstalt
Braunschweig und Berlin
Nationales Metrologieinstitut

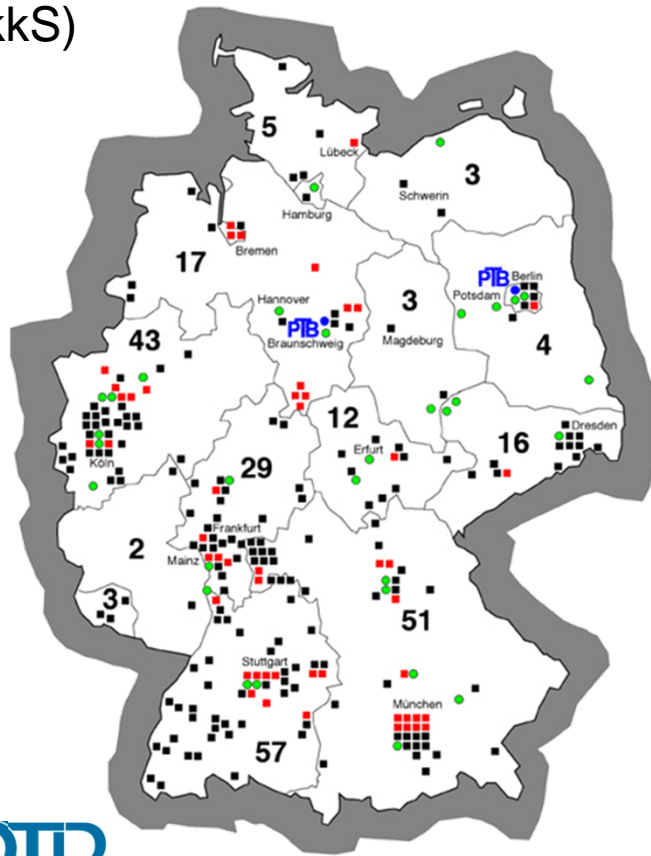
The Digital Calibration Certificate

Siegfried Hackel



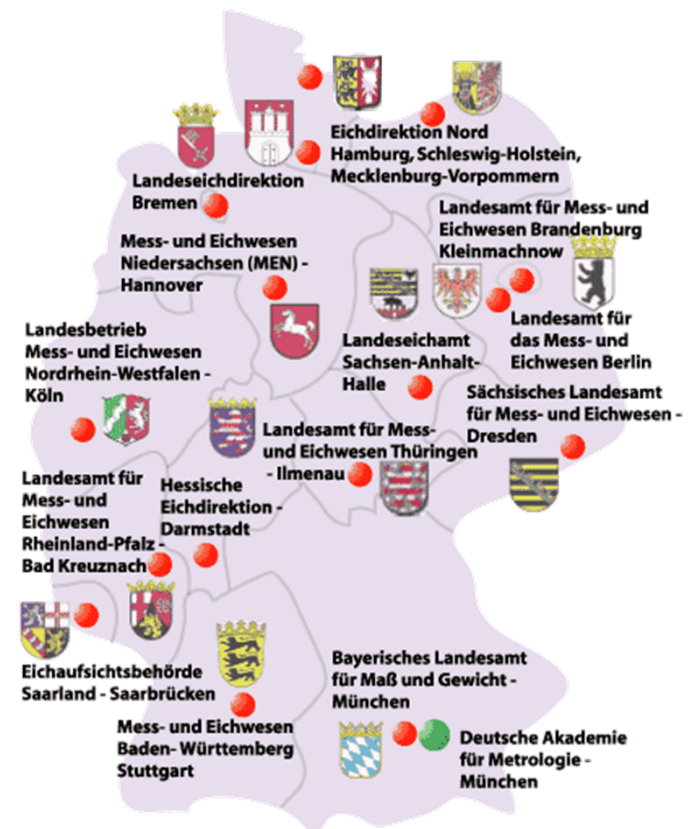
Digitalization in Metrology

Calibration for Industry: Accredited calibration laboratories (DAkkS)



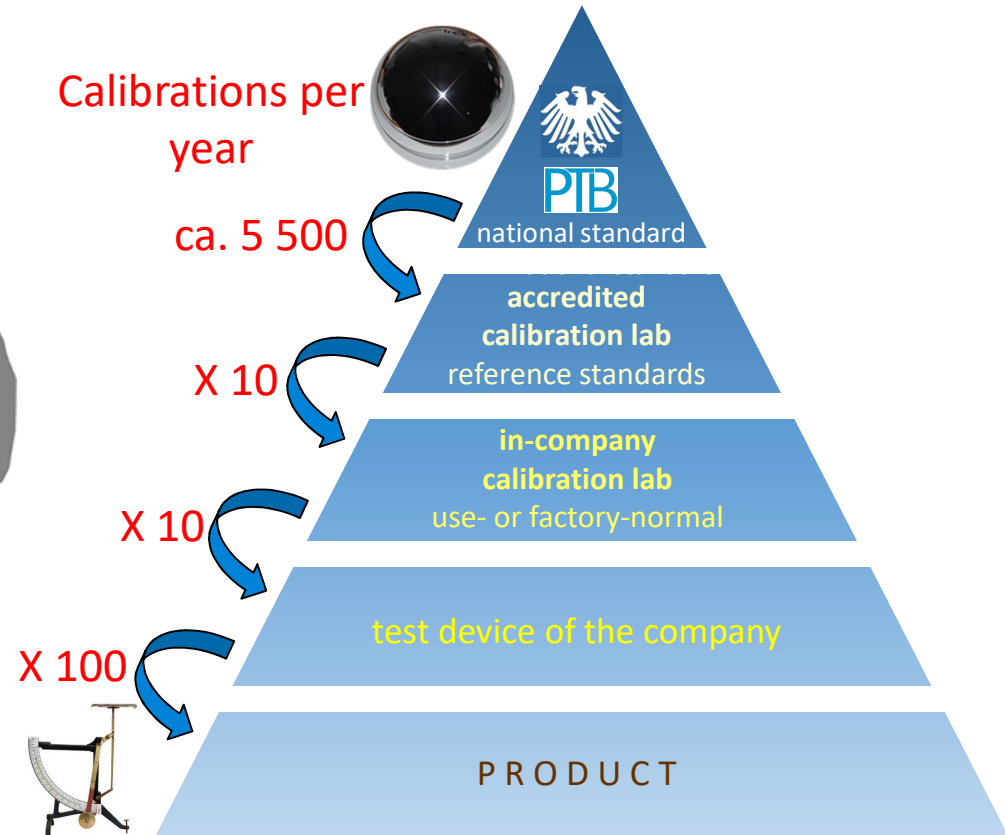
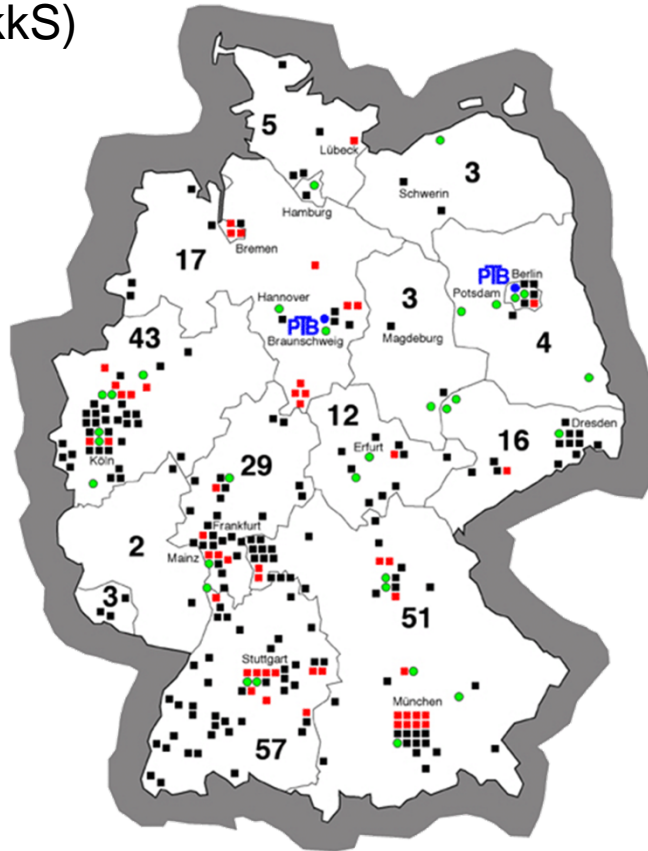
Kalibrierlaboratorium
 ■ in Großunternehmen
 ■ in kleinen und mittelständischen Unternehmen
 ● bei Sonstigen (TUV, Uni., Behörde usw.)

Legal Metrology:

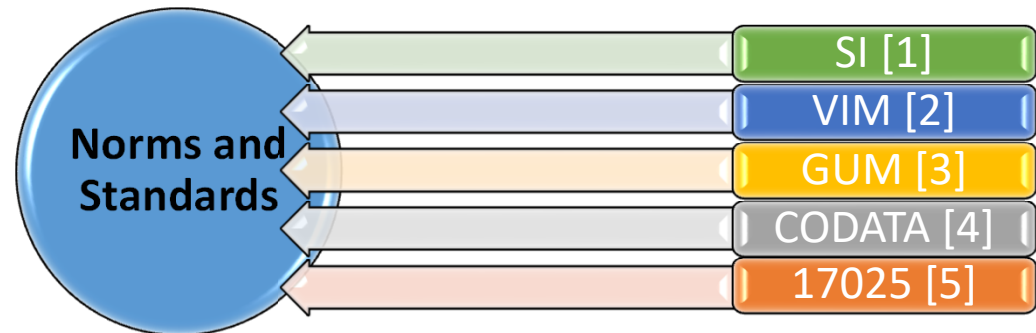


In focus

Calibration for Industry: Accredited calibration laboratories (DAkkS)



The Digital Calibration Certificate



- [1] *Le Système international d'unités/The International System of Units (Brochure sur le SI/SI brochure), 2006*
- [2] Brinkmann, B.: Internationales Wörterbuch der Metrologie. Grundlegende und allgemeine Begriffe und zugeordnete Benennungen (VIM); ISO/IEC-Leitfaden 99:2007 = Vocabulaire international de métrologie. Wissen: Messwesen. Berlin, Wien, Zürich: Beuth 2012
- [3] Norm JCGM 104:2009; Juli 2009. *Auswertung von Messdaten – Eine Einführung zum "Leitfaden zur Angabe der Unsicherheit beim Messen" und zu den dazugehörigen Dokumenten (GUM)*
- [4] Mohr, P. J., Newell, D. B. u. Taylor, B. N.: CODATA recommended values of the fundamental physical constants. 2014. *Reviews of Modern Physics* 88 3, S. 337
- [5] DIN EN ISO/IEC DIN EN ISO/IEC 17025 August 2005. *Allgemeine Anforderungen an die Kompetenz von Prüf und Kalibrierlaboratorien*

1.: Administrative Data

- regulated

2.: Results of the Calibration

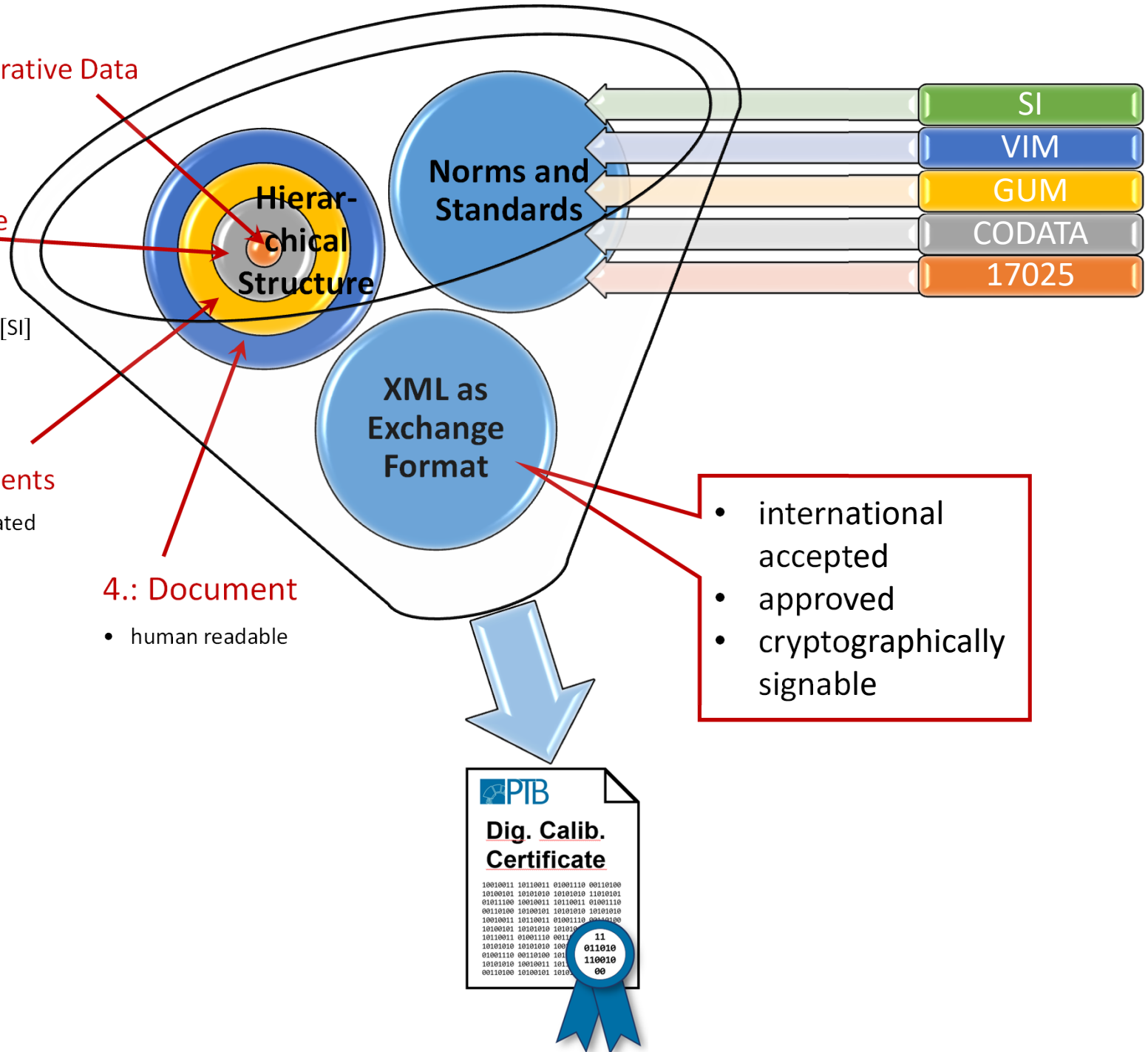
- regulated:
 - $Y = y \pm U(k) [SI]$
- not regulated:
 - individual data
 - ...

3.: Comments

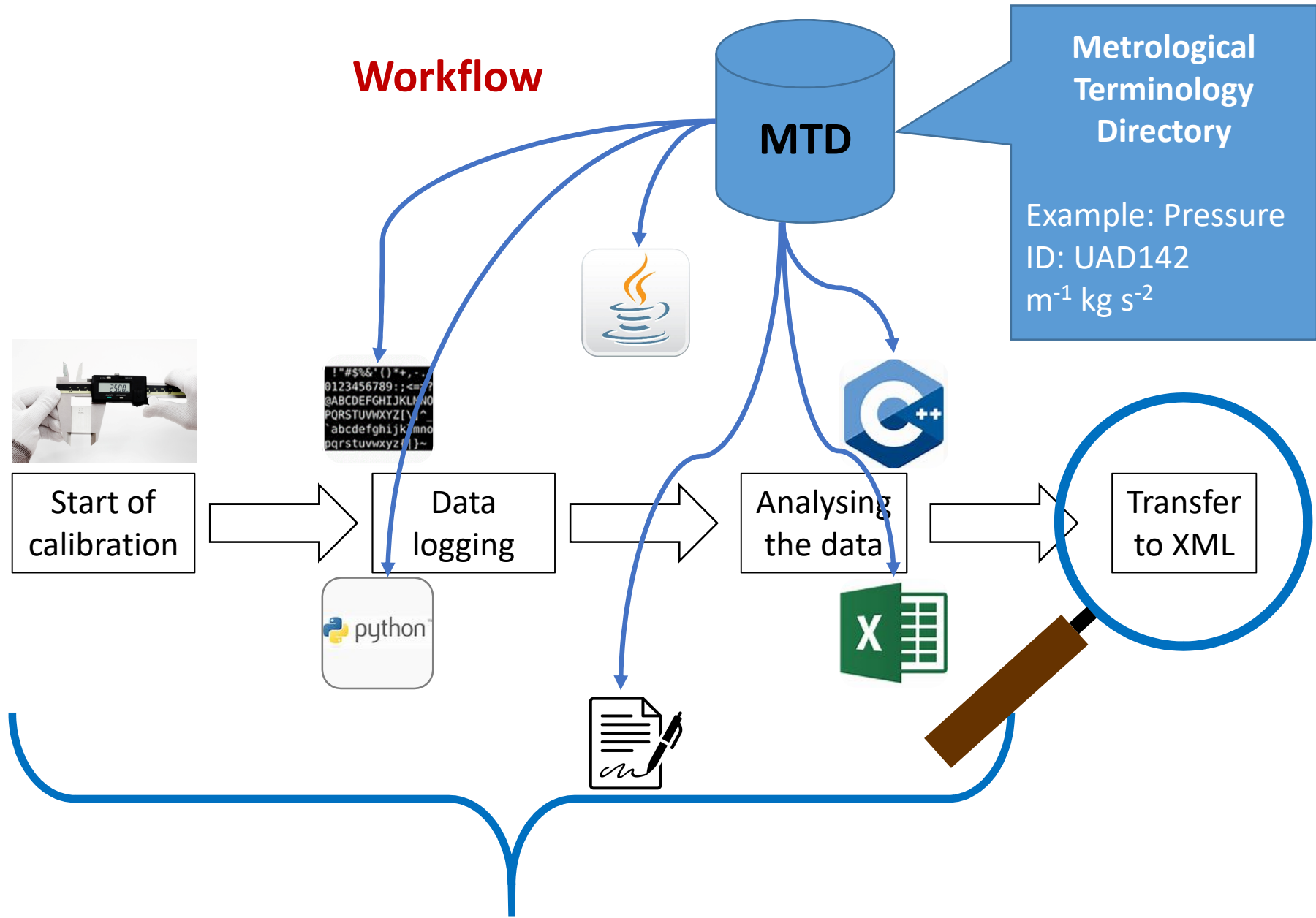
- not regulated

4.: Document

- human readable

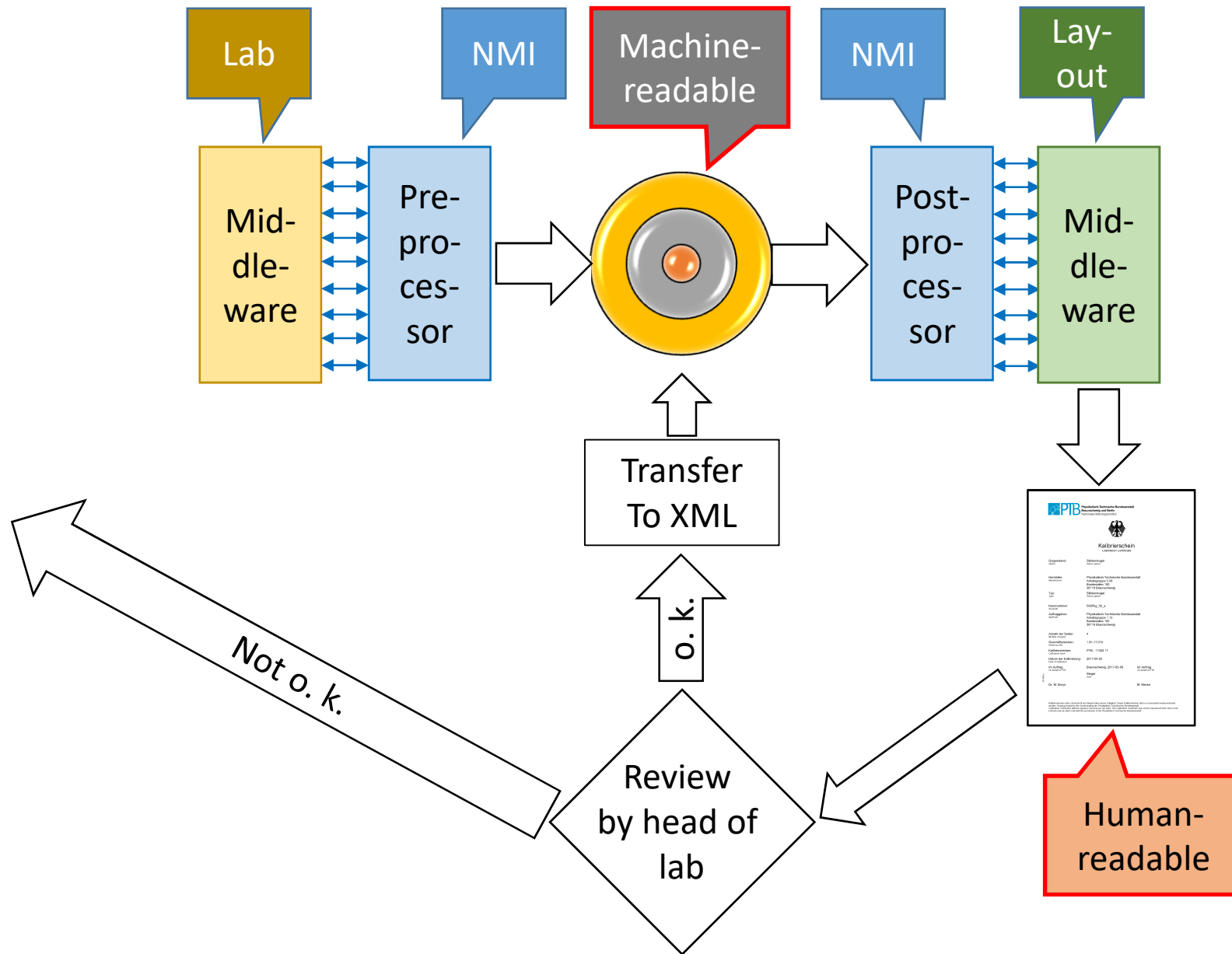


- international accepted
- approved
- cryptographically signable



Proceed as previously done

Transfer to XML



All informations are now in XML

1.: Administrative Data

- regulated

2.: Results of the Calibration

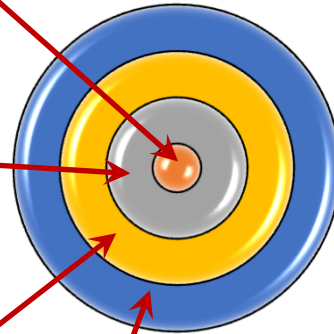
- regulated:
 - $Y = y \pm U(k) [SI]$
- not regulated:
 - individual data
 - ...

3.: Comments

- not regulated

4.: Document

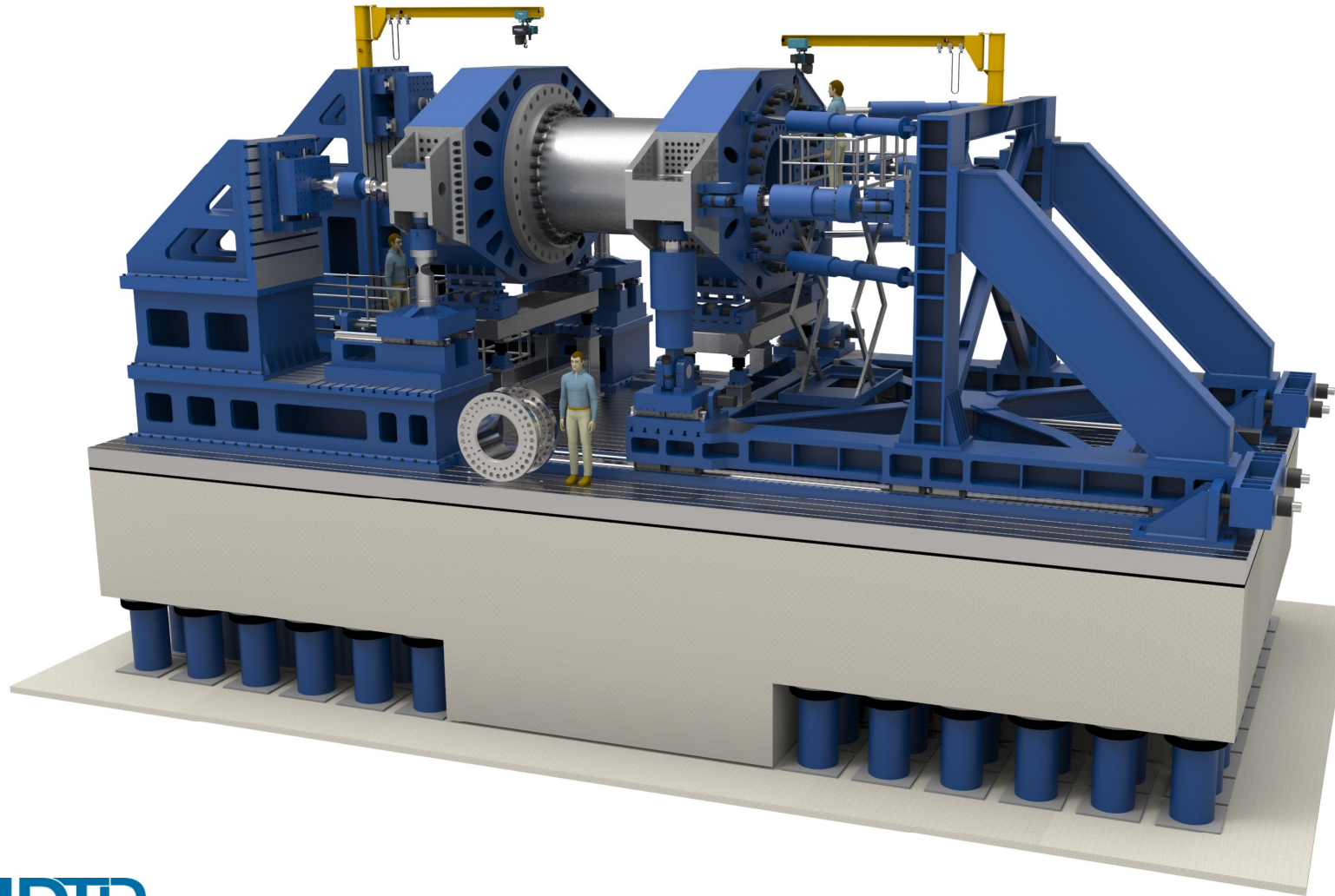
- human readable

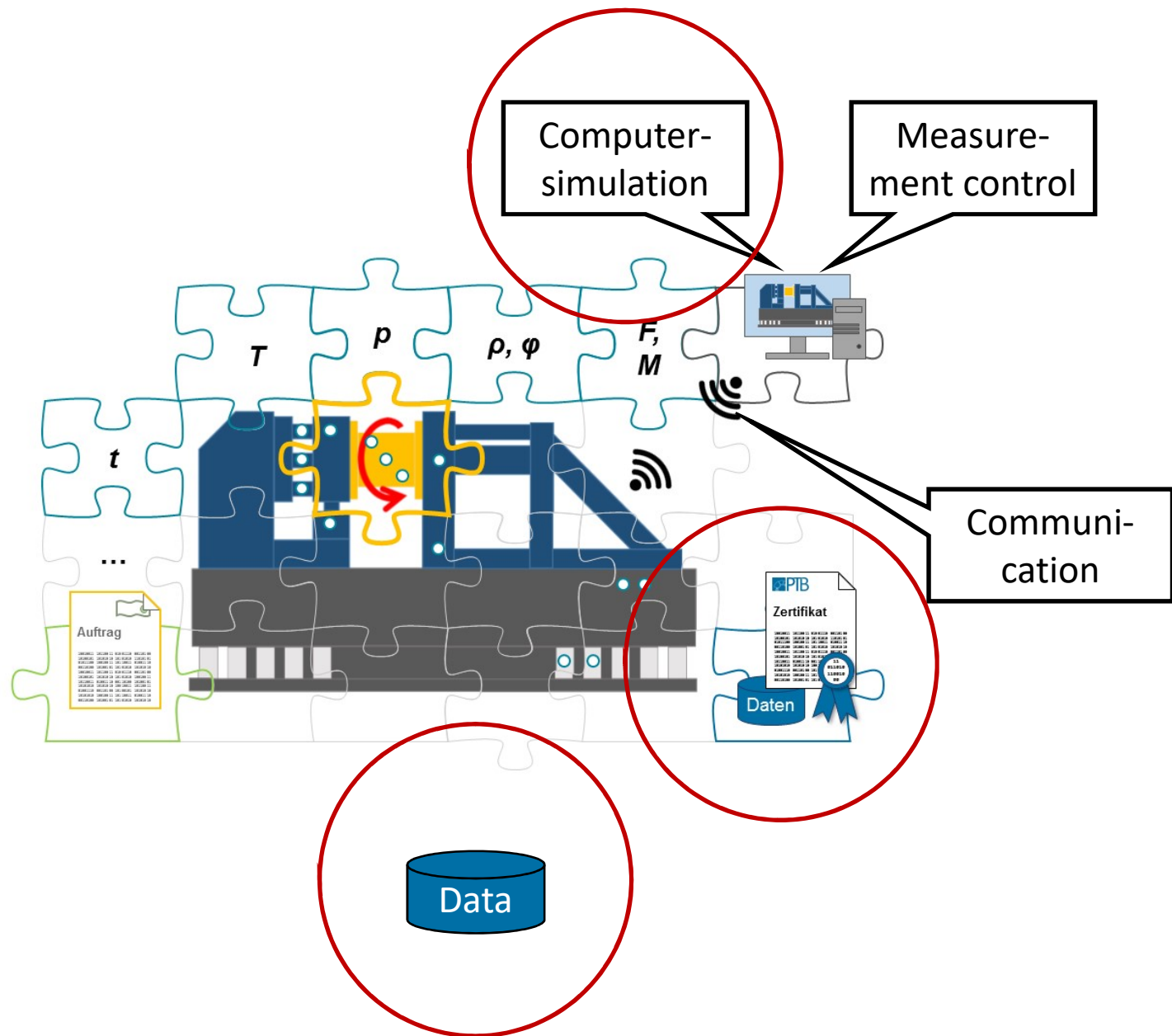


More than ten years in use:

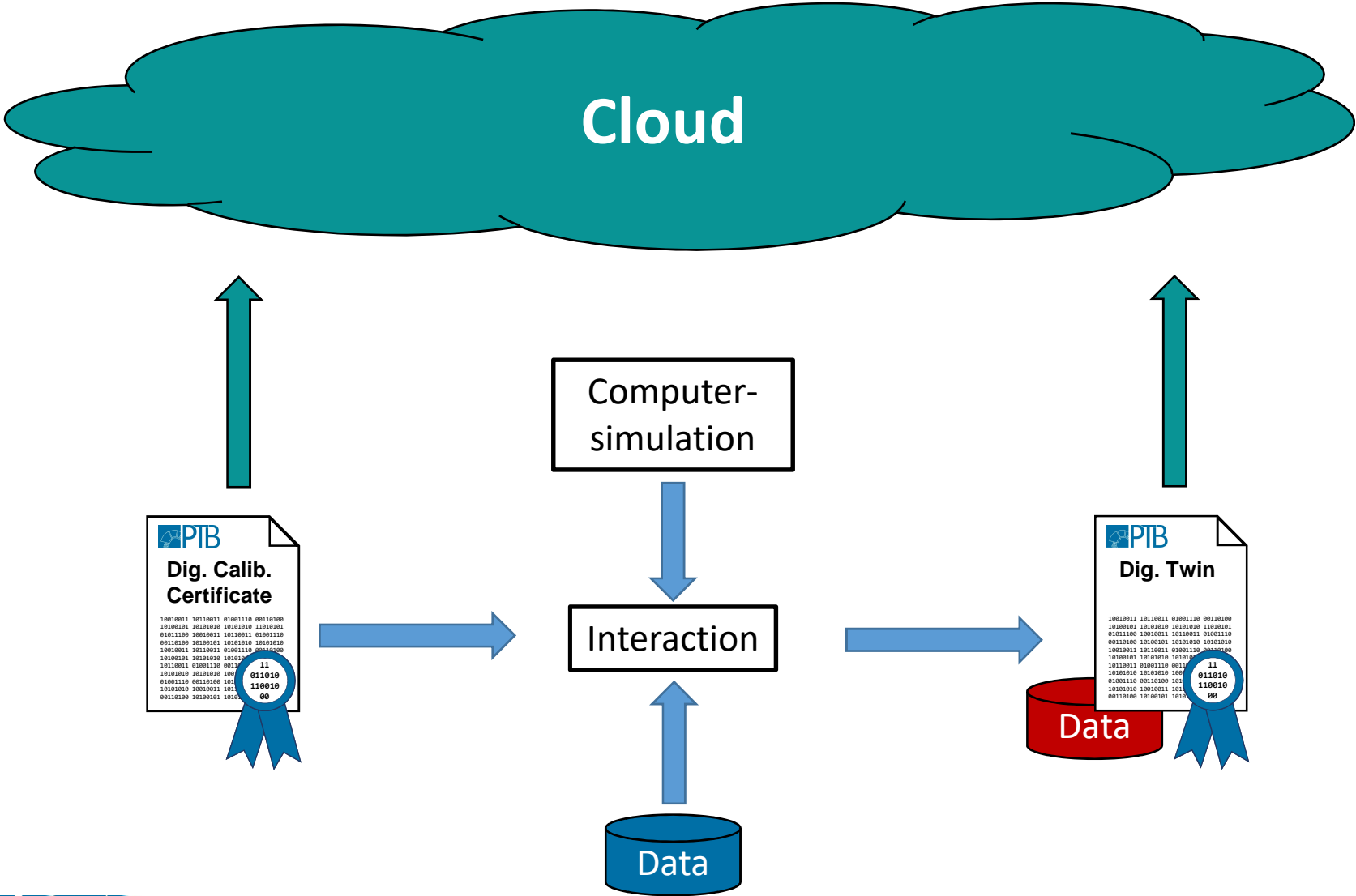
- Civil register office (“Standesamt”)
- Waste management
- Purchasing development
- ...

The way to Digital Twins (DT)

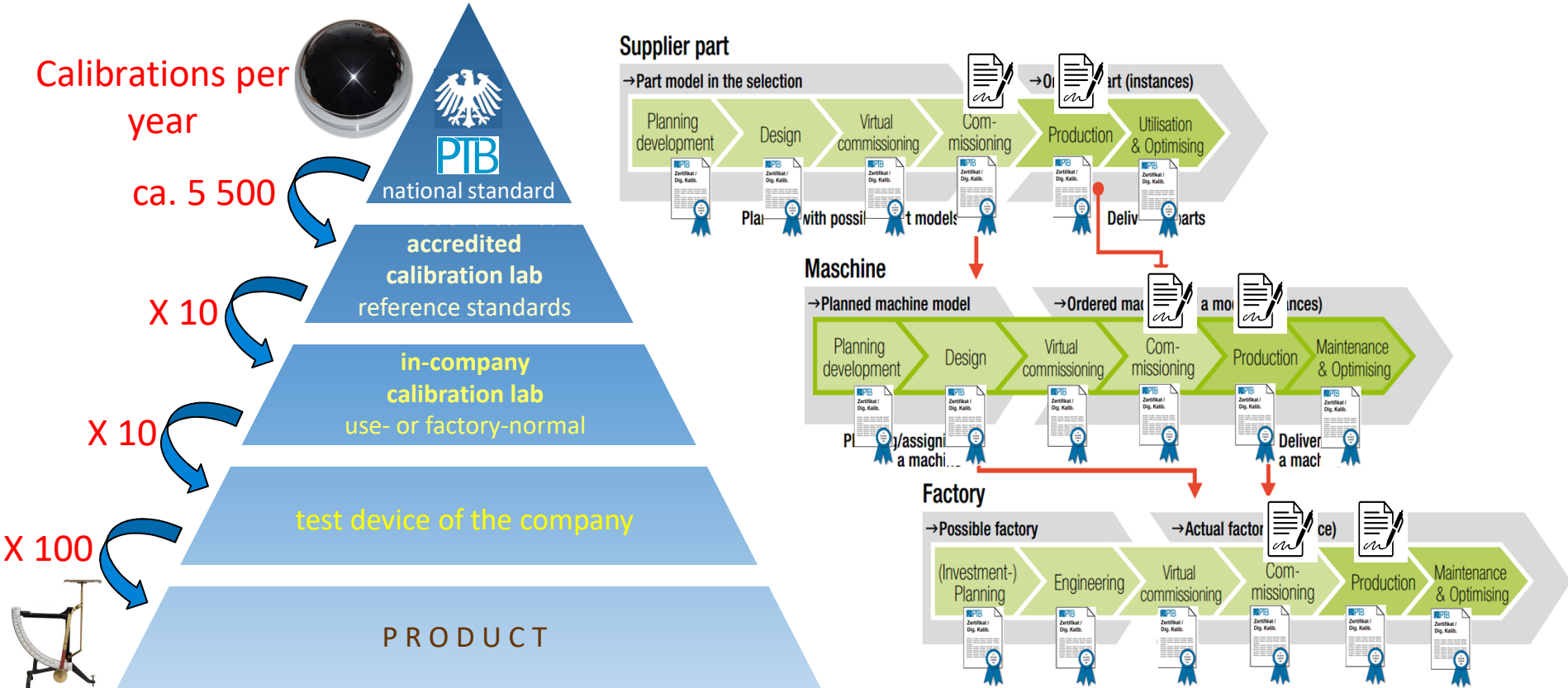




Project GEMIMEG



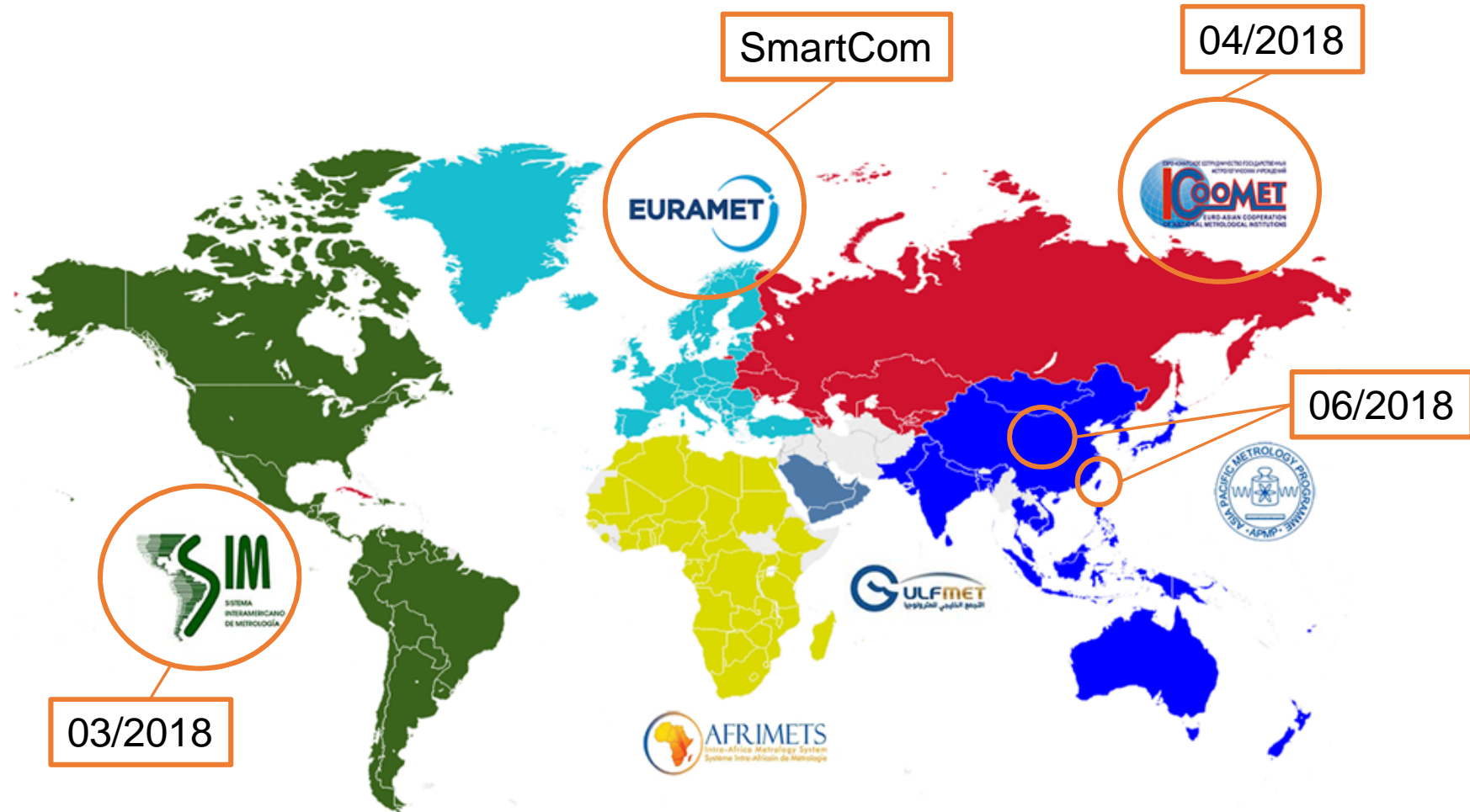
Calibration and Industry 4.0



From: Implementation Strategy Industrie 4.0, Bitkom e. V. , Jan. 2016
https://www.zvei.org/fileadmin/user_upload/Presse_und_Medien/Publikationen/2016/januar/Implementation_Strategy_Industrie_4.0_Report_on_the_results_of_Industrie_4.0_Plattform/Implementation-Strategy-Industrie-40-ENG.pdf

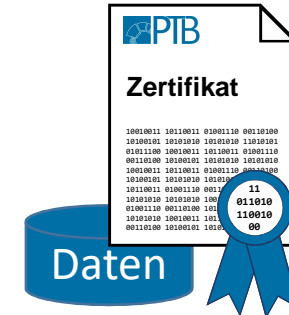
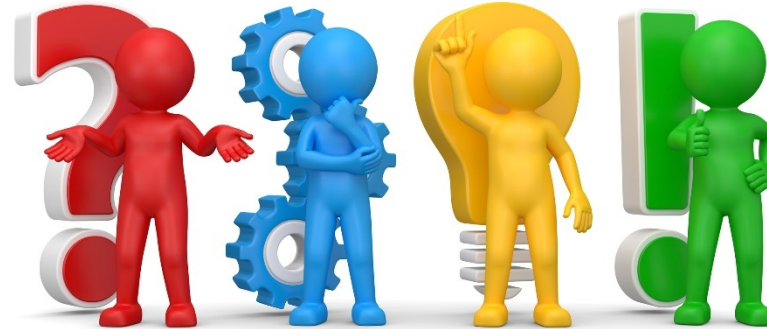
Digitalization is global...

- Planned contacts and cooperations for 2018



International Workshop “Digital Calibration Certificate”

Where: PTB; Brunswick
When: 2019-06-02 (Come together) – 2019-06-04
Participants: NMI's; National accreditation agencies



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Braunschweig und Berlin**

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E-Mail: siegfried.hackel@ptb.de

www.ptb.de



2018-06-14