

The Evolution of Digital Calibration Certificate (DCC) in NIMT

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Abstract

The National Institute of Metrology Thailand (NIMT) initially developed a Digital Calibration Certificate (DCC) prototype in PDF/A3 format, using Excel for certificate issuance. To transition to XML-based certificates, Excel's developer functions were used but proved inadequate for complex schemas. This led to the adoption of Python for managing DCCs, enabling efficient handling of XML complexities and ensuring compliance with ISO/IEC 17025.

NIMT developed an XML schema and an Excel template to streamline calculations while maintaining XML compatibility. A method was also created to render XML files in human-readable HTML. To ensure validity, NIMT collaborated with the Electronic Transactions Development Agency (ETDA), registering "NIMT's schema version 1.0" for public validation.

This integration of Python, XML, and ETDA's platform enhanced reliability and accessibility, modernizing calibration certificates while maintaining Excel's familiarity. This transition aligns with digital transformation, ensuring efficiency and global compatibility.

Background

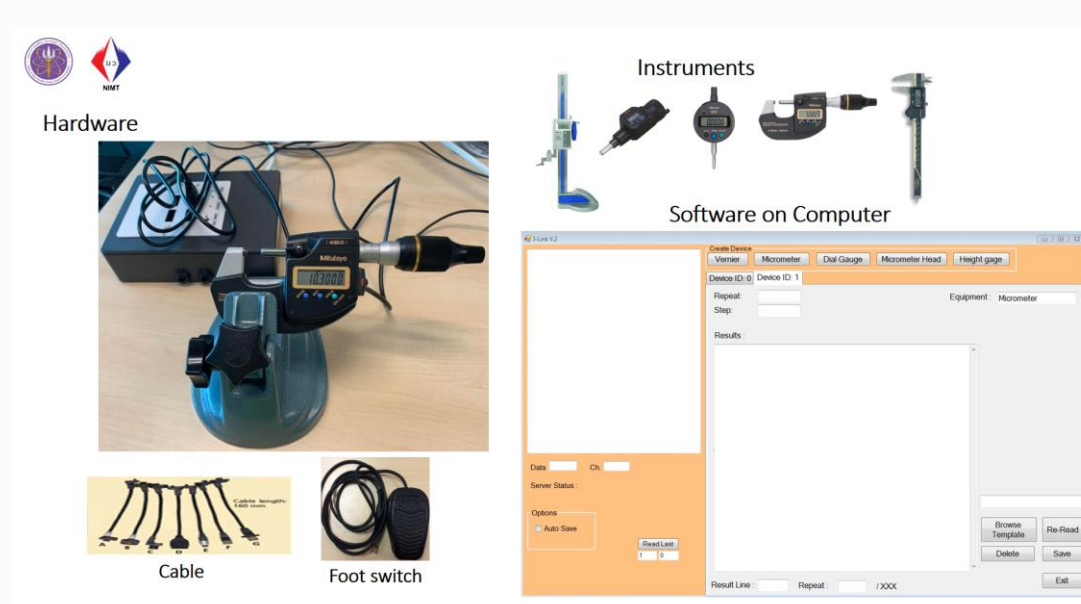
The world of metrology is changed to the digital era, Thailand must align with global trends. In 2022, the National Institute of Metrology Thailand (NIMT) proposed implementing a Digital Calibration Certificate (DCC) at the second international DCC conference. The proposal introduced a PDF/A-3 format using DataLink for error value retrieval. However, various transformation methods exist. This work focuses on XML, which enables machine-readable processing without middleware. The objective is to convert Calibration Certificates into XML-based DCCs while providing a web browser preview for human readability, ensuring accessibility, accuracy, and alignment with international digital standards.

Objectives

- ❑ To develop software for generating the DCC and to design a schema which are user friendly.
- ❑ To identify platform for validating schema and controlling accessibility.

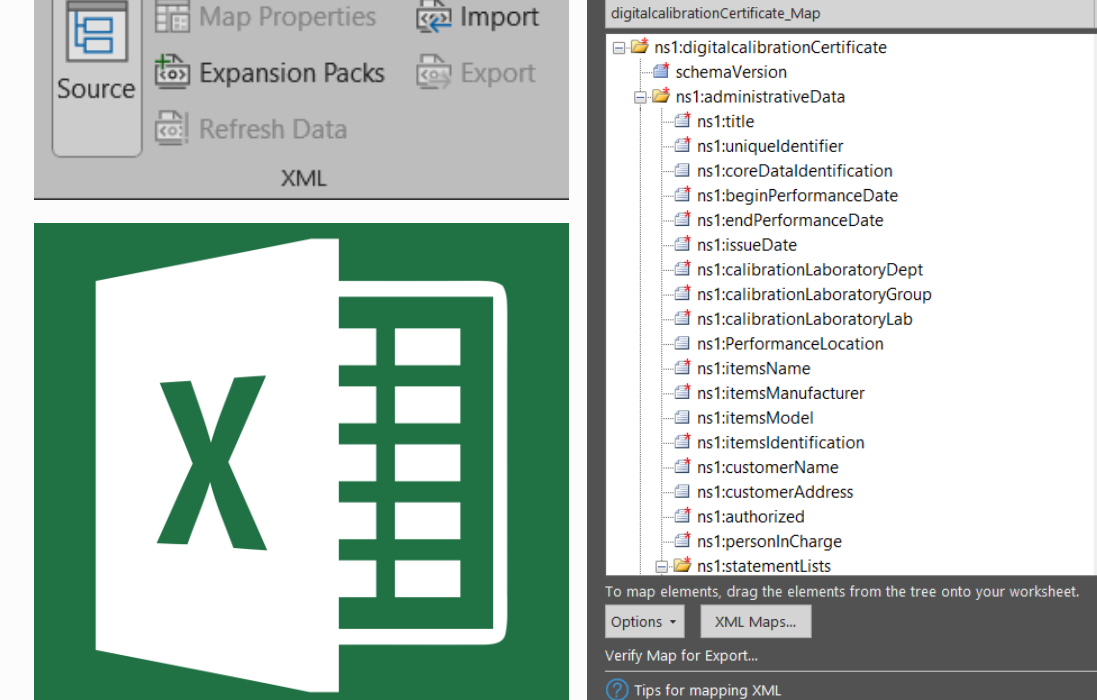
Implementation process of NIMT's DCC

DCC in PDF/A3 and DataLink



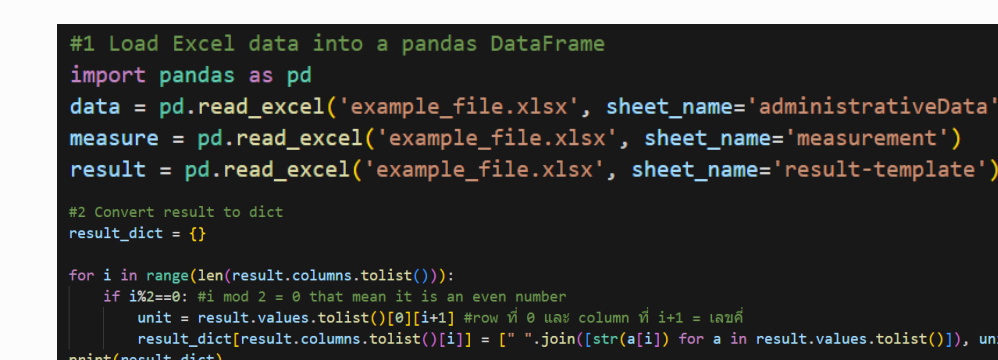
1. Issuing DCC in PDF/A3 with attach measurement result in .csv file
2. Manual extract .csv file and connect to DataLink.
3. Using the DataLink as a middleware to retrieve error values from .csv file for measurement result compensation

Developer function in MS Excel



1. Creating XML Schema and import it into XML map in developer function.
2. Dragging the XML element from the source pane to drop it on the corresponding column name.
3. Exporting the XML file and preview on web browser by using XSLT and Xpath.

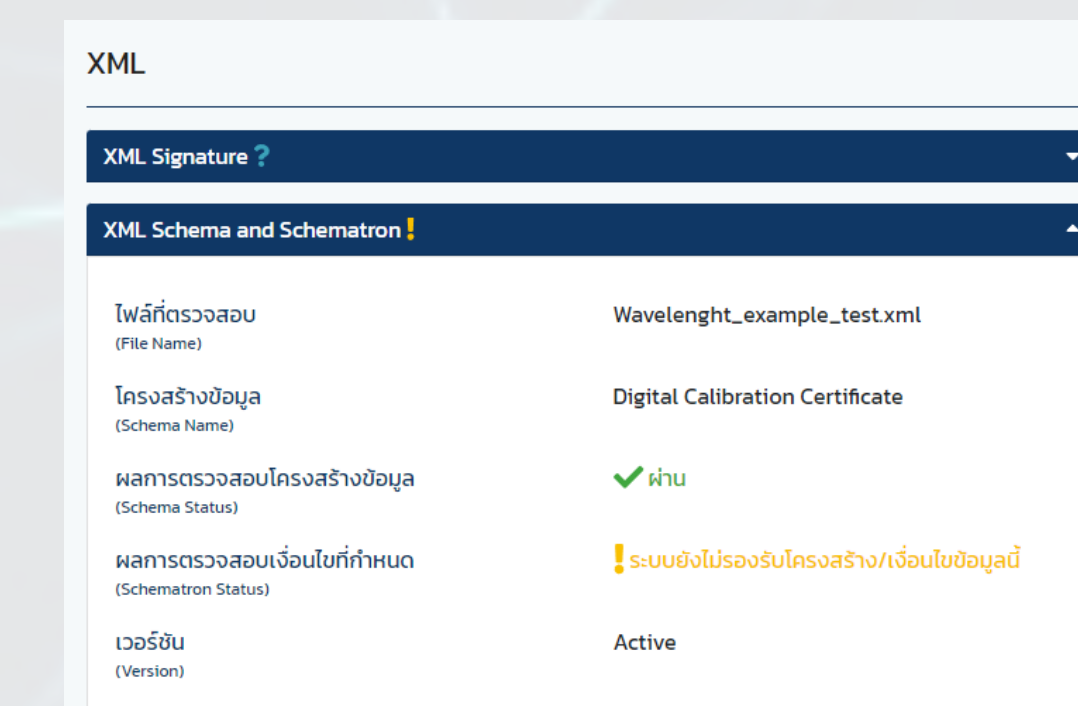
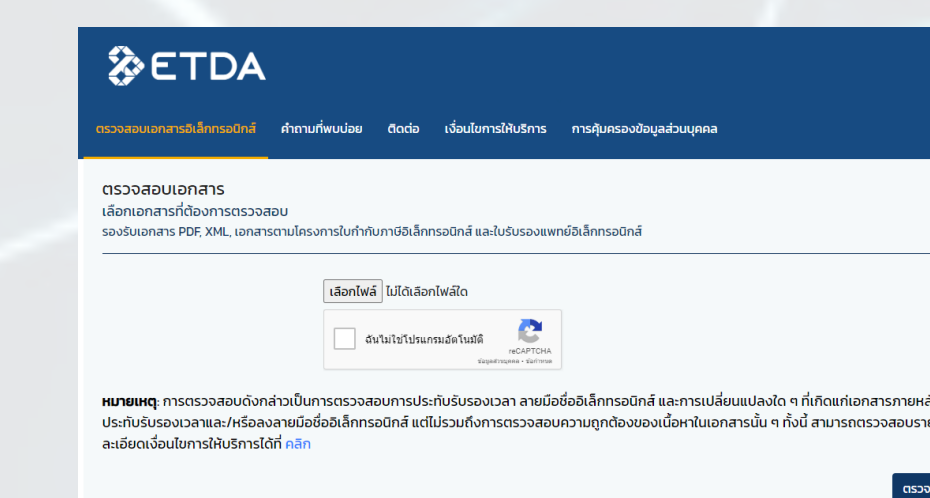
DCC in XML using Python



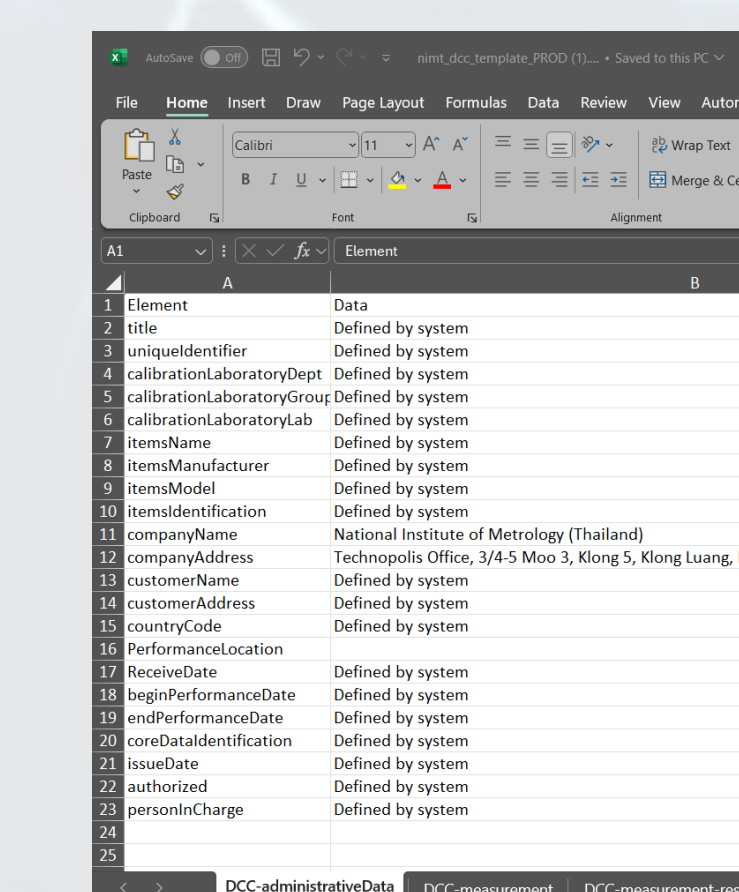
1. Creating template in MS Excel for preparing the data to transfer process.
 - Administrative data
 - Measurement statement
 - Measurement results
2. Converting excel file to XML file via Python
 - **Load data** - Loading data from Excel file use Pandas library
 - **Manipulate data** - Preparing data before create XML file
 - **Generate XML** - Creating an XML file use the xml.etree.ElementTree library
 - **Customize XML file** - Rearrange some part of XML file to design pattern
3. Previewing DCC in human-readable format (HTML)

Validation

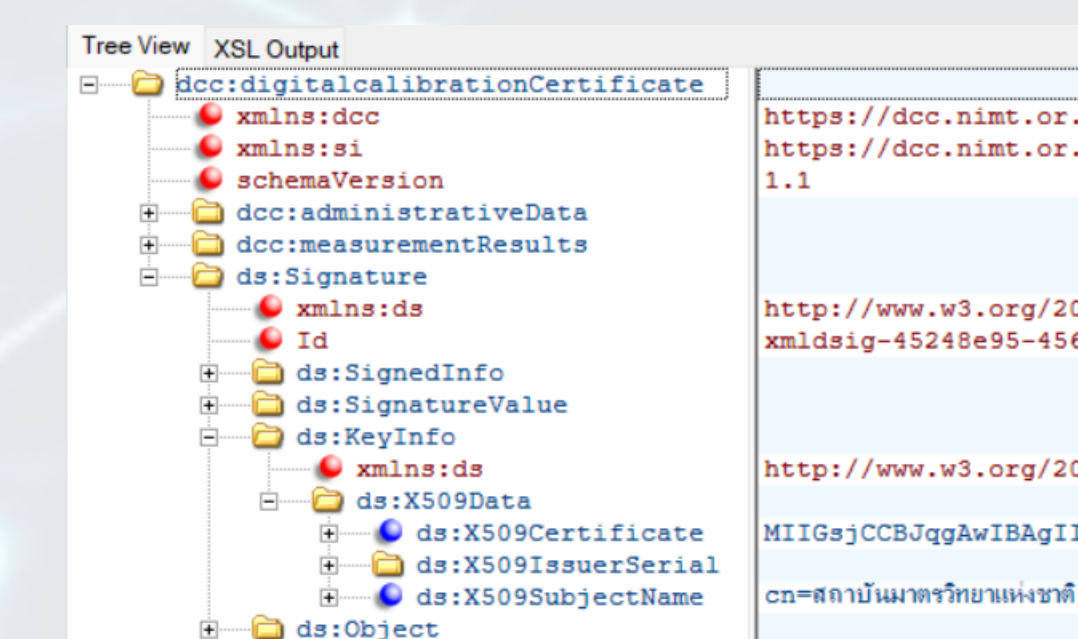
NIMT collaborate with ETDA, an organization under the Ministry of Digital Economy and Society, dedicated to ensuring secure and reliable online transactions. Through this partnership, we utilize ETDA's platform for schema and digital signature validation of our DCC.



Results



XML (Machine-readable)



MS Excel

Every method allows conversion from Excel to XML and PDF preview. However, we identified the pros and cons of PDF/A-3 and XML. PDF/A-3 is more user-friendly for human readability but requires manual extraction of attached files. In contrast, XML is optimized for machine readability, enabling seamless automated processing.



PDF (Human-readable)

Conclusion

NIMT modernized calibration certificates by transitioning from Excel to XML-based Digital Calibration Certificates (DCCs). Using Python for schema management and collaborating with ETDA for validation, we ensured compliance with ISO/IEC 17025. This transformation enhances efficiency, accuracy, and accessibility, aligning with global digital trends for reliable and standardized calibration certification.