

Model-Based Definition

FOR INDUSTRIAL PRACTICES

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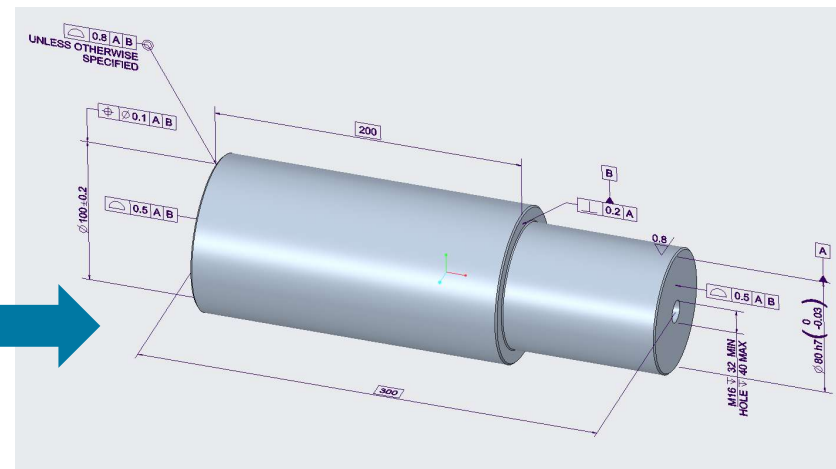
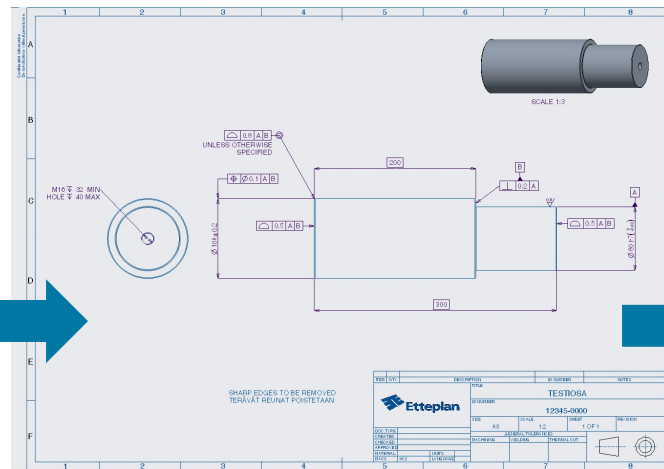
Technical Expert



Content

- **Basics of terms.**
- **MBD in Manufacturing Ecosystems.**
- **Experiences of MBD in Inspection process.**
- **Future expectations**

Product definition process is changing



Drawing-Centric Definition

- Up-to the 80s.
- Hand-drafted drawings.
- Design changes were laborious.
- 2D CAD was introduced.

Model-Centric Definition

- Since the 80s
- 2D Drawing as a master with a supplementary 3D model.
- Need to manage both 2D and 3D files.

Model-Based Definition

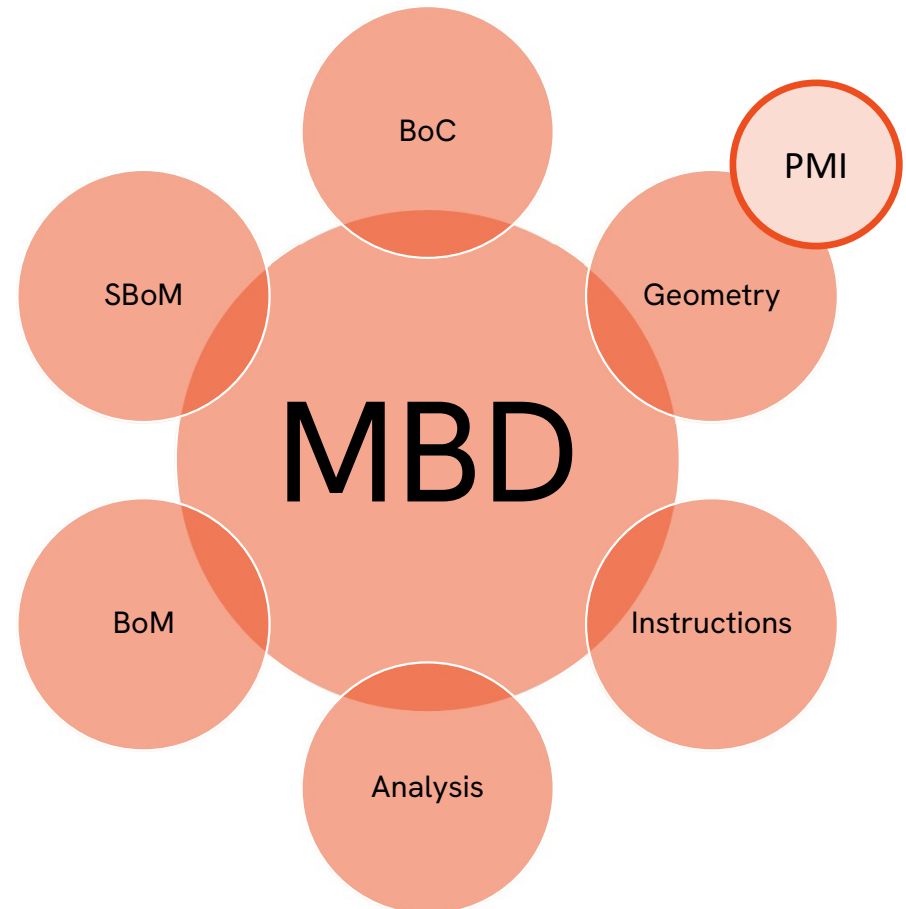
- Since ~2010
- 3D model as a single-source-of-truth.
- 2D drawings for reference only, when needed.
- MBD as a source of data reuse.

What is MBD?

Model-Based Definition (MBD) is based on a machine-readable (semantic) 3D model which includes all **Product and Manufacturing Information (PMI)**. This model is available for downstream processes that reuse the 3D-model data.

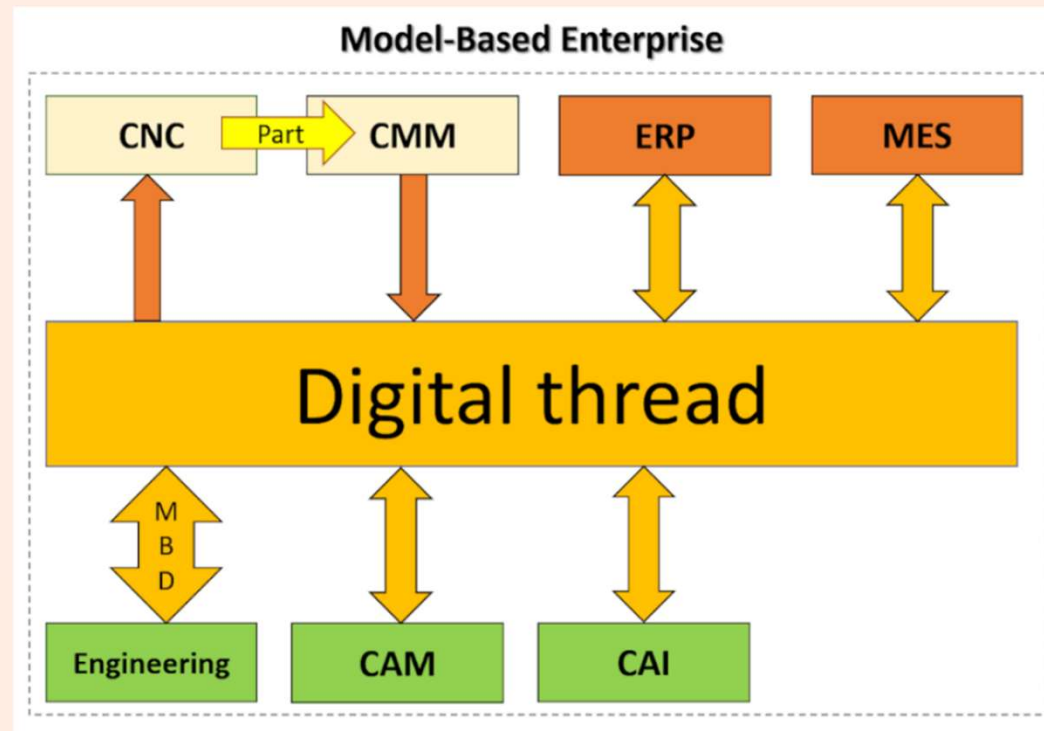
The MBD dataset includes the information that are typically seen in technical 2D drawings and in additional documents.

BoC	Bill of Characteristics
SBoM	Service Bill of Material
BoM	Bill of Material
PMI	Product and Manufacturing Information



What is MBE?

- **Model-Based Enterprise (MBE)** is an organization which utilizes the **MBD Datasets** enabled by the **digital thread**.



Source: Uski, P., Nieminen, J., Ellman, A. (2023) 'Will Model-Based Definition Accelerate the Inspection Phase in the Manufacturing Process?', in Proceedings of the International Conference on Engineering Design (ICED23), Bordeaux, France, 24-28 July 2023. DOI:10.1017/pds.2023.391

MBD in Manufacturing Ecosystems

Manufacturing Ecosystem (MaE) consists of members (such as companies and institutions) that act together to reach the same goal.

Members have different roles in MaE, and one has always a Keystone role which is like the Customer.

In the case of dissertation research, the MaE consisted of the Customer (Keystone) and four Suppliers (Niche and Physical Dominator) in addition to Inspection Laboratory (Niche).

The Keystone member needs to hold a business case that benefits all other MaE members to be able to invest in new systems and skills needed.

Both parties of communication need to have capabilities to make and/or use documentation.

Companies in low-level digital maturity can join Manufacturing Ecosystems thanks to human-readable MBD-enabled 3D model-based documents.

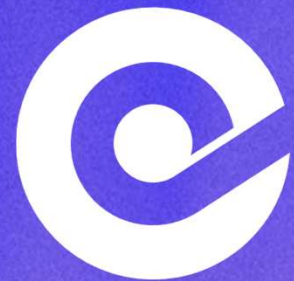
Experiences of MBD in Inspection process

- **An MBD Dataset enables fully automated CAI code (Computer-Aided Inspection) generation.**
- **Efficiency of the Inspection Process is better in small series because the human-assisted CAI code can be more efficient.**
- **Complexity of parts increases the CAI-programming time, but the MBD provides benefit in offline programming due to possibility to use CMM (Coordinate Measuring Machine) in other series.**

Future Expectations

- **The implementation of Model- Based Definition is considered to improve the quality of the company's operations, which is important for its competitiveness.**
- **The adoption of MBD by system integrators and Original Equipment Manufacturers (OEM) may serve as a catalyst for the wider adoption of MBD across the supply chain.**
- **Software Development is needed to utilize the common file transferring format, which enables the digital thread.**
- **The Digital Thread is a mandatory for the Model-Based Enterprise (MBE).**
- **Quality Information Framework (QIF), and Standard for the Exchange of Product model data (STEP AP242) are neutral file transferring formats for semantic 3D PMI annotations. However, QIF is gaining popularity among mechanical engineering industry.**

Thank You!



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