Model-Based Enterprise Summit 2018
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QIF: Quality Information Framework

What is **ANSI QIF**?

An overview

www.qifstandards.org

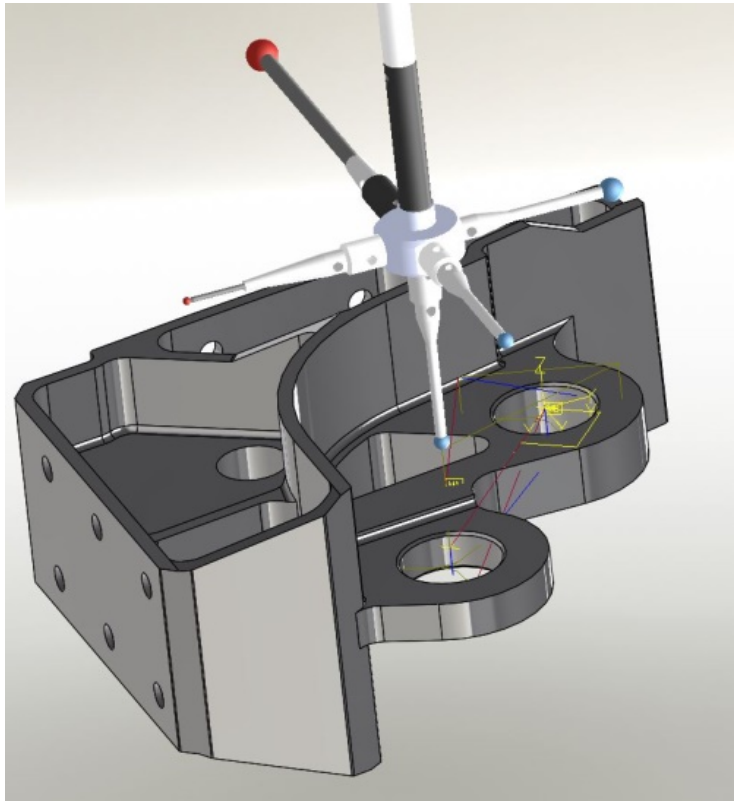
DMSC objective . . .

- To **reduce** the cost of quality,
- To gain the **freedom to choose** best in class / best in value solutions,
- Through **open, non-proprietary standards** for computer aided dimensional metrology.

Dimensional Metrology Standards Consortium DMSC

Who is the DMSC?

- a **non-for-profit**, cooperative sponsorship organization.
- **focused on** or relating to digital **dimensional** metrology.
- dedicated to identifying, promoting, fostering, and encouraging the **development** and **interoperability** of standards that benefit the dimensional metrology community.
- **accredited national standard-making organization** with international presence.



DMSC Members

ACTION ENGINEERING

inspectionXpert

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Origin

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QIF SOLUTIONS

CAPVIDIA

IPI
integrated | process | improvement

innovalia METROLOGY

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KOTEM

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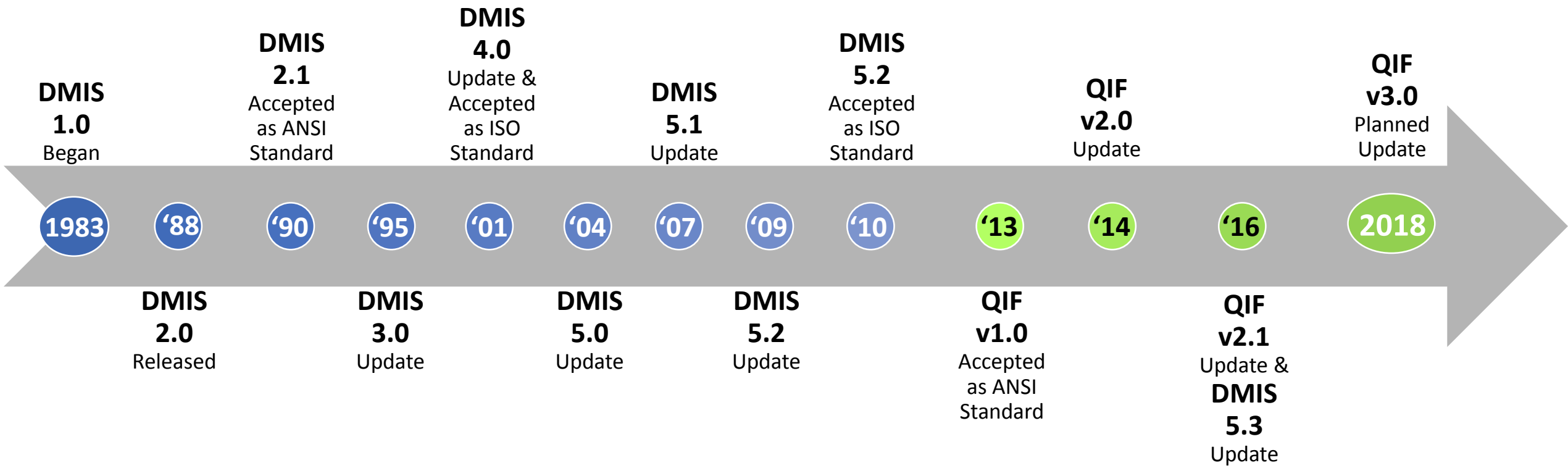
STEP Tools, Inc.
www.steptools.com

RENISHAW
apply innovation™

PAS TECHNOLOGY
Automated Metrology Solutions

The QIF Pedigree



QIF 3.0 Enhancements

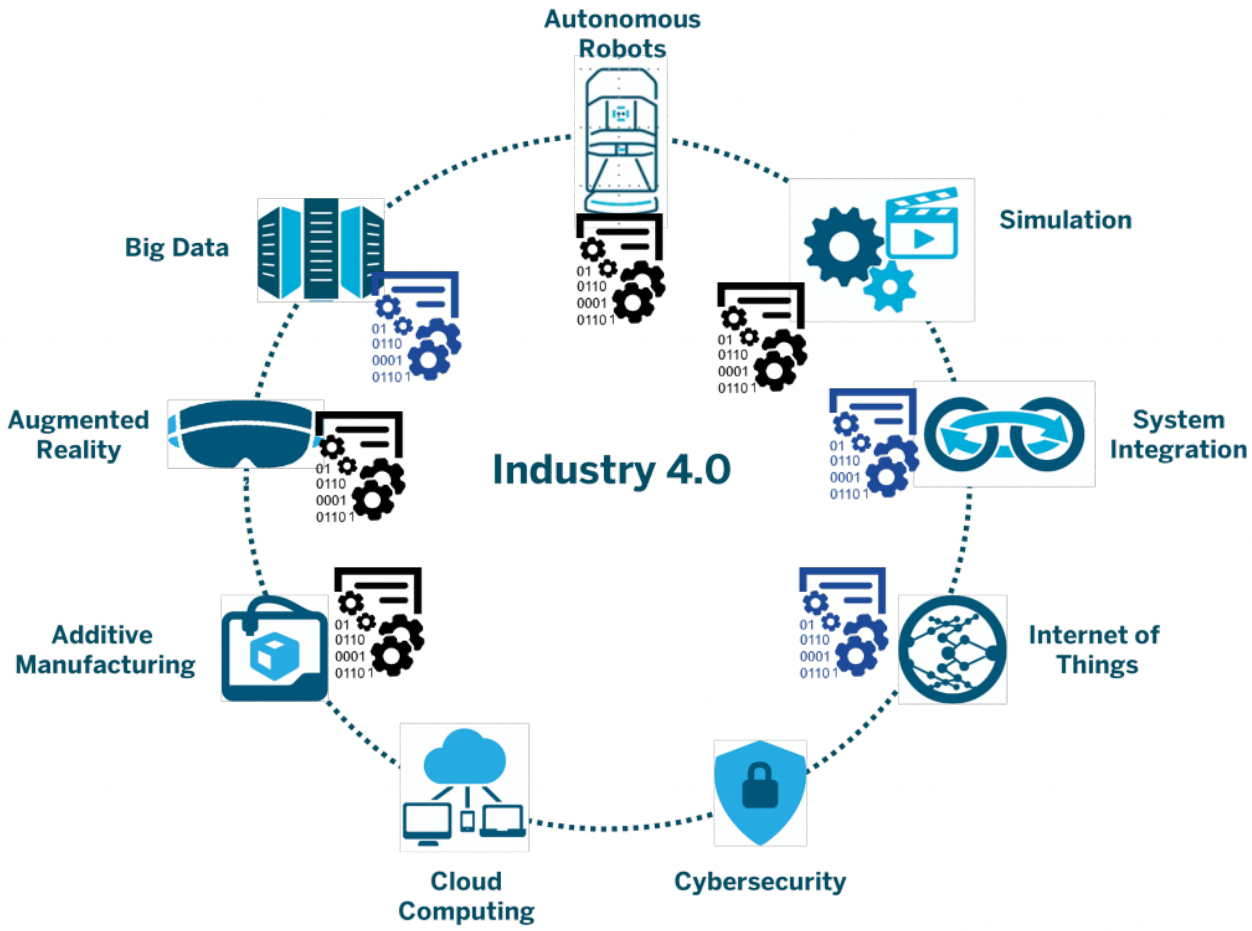
- Expansion of measurement workflow use cases supported by QIF
- Improvements to PMI modeling to support common CAD systems annotations like those from SolidWorks, PTC Creo, NX, and CATIA
- Concise measurement point storage
- Increased harmonization with ISO Geometrical Product Specification
- Improved support for metrology software and fitting algorithm specifications
- Improved traceability in statistics, including an option for bulk raw data
- Enhanced support for a comprehensive array of measurement device types in QIF Resources
- Support for measurement resource selection via QIF Rules
- Improved XSLT data integrity checking

Industry 4.0 Requires Data Traceability

Industry 4.0 is heavily reliant on **DATA**

Requirements of that **DATA** are that the **DATA** is:

- ✓ Semantic
- ✓ Machine readable
- ✓ Standard
- ✓ Interoperable

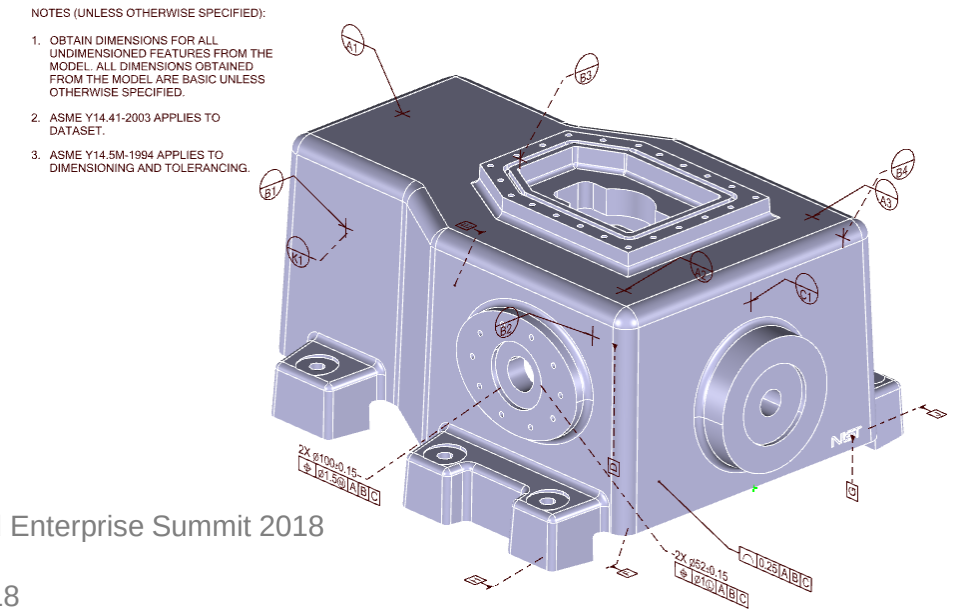


Digital Transformation of Industry

These are all about using DATA to solve business problems

(Data, not software)

It's all about **Digital Transformation**



Model Based Definition (MBD)

Model Based Enterprise (MBE)

Industry 4.0

Digital Enterprise

Advanced Manufacturing Enterprise

Digital Twin

Digital Thread

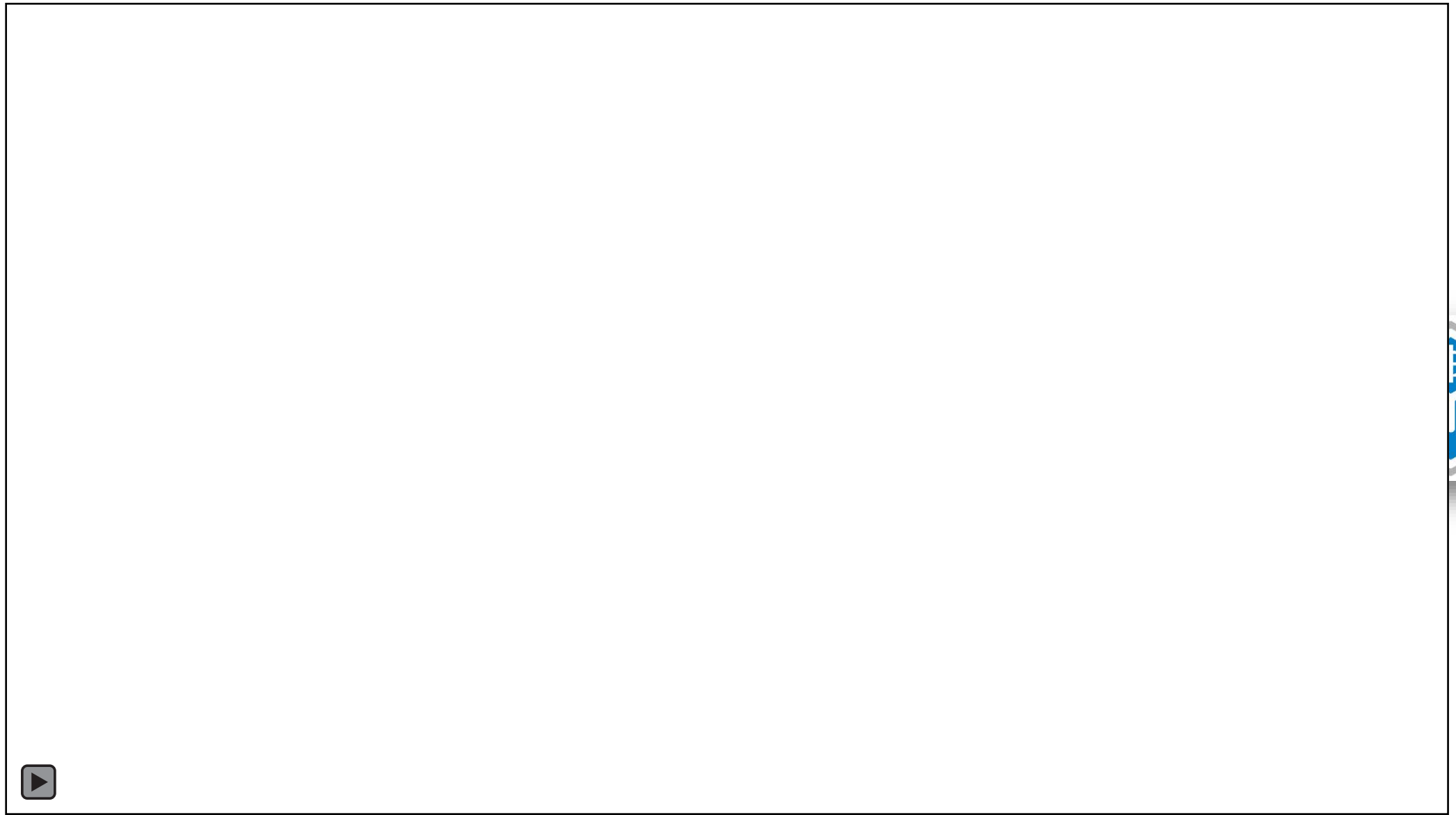
Digital Tapestry

Not all data is created equal. Consider:

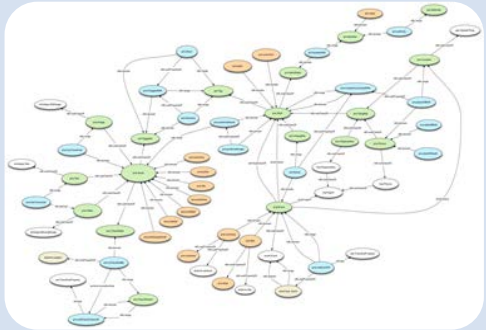
`dat` `txt` `tif` `csv` `xls`

`pdf` `xml` `prt` `stp` `jt`

MBD is the cornerstone of a Model-Based Enterprise



What is the QIF?



Feature-Based Ontology of Manufacturing Quality Metadata

< />

XML Technology: Simple Implementation and Built-In Code Validation

Information Semantically Linked to Model for Full Data Traceability to MBD

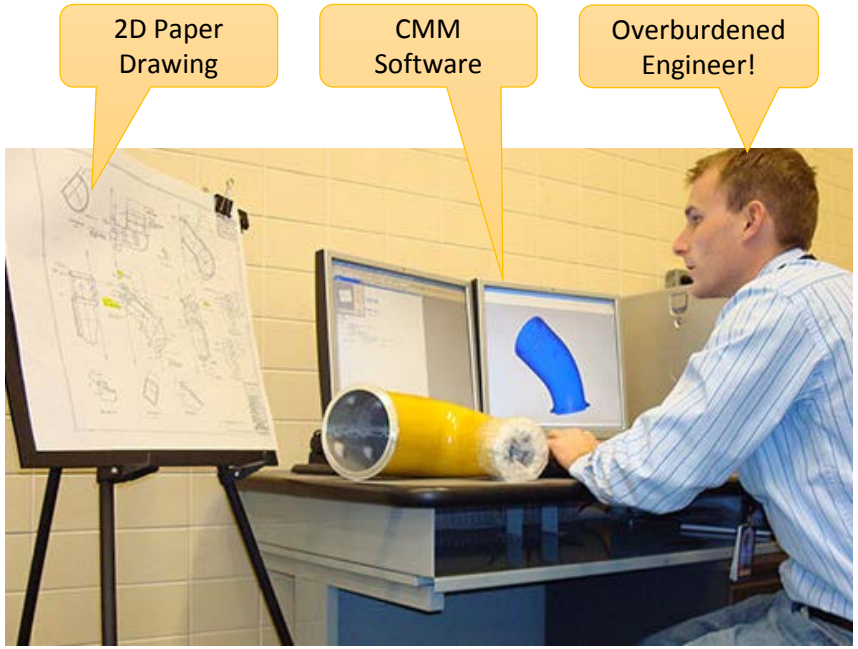
ANSI
American National Standards Institute

Approved ANSI Interoperability Standard

Digital Measurement – Current State

Problems:

- Can take weeks to program a single part
- Requires a skilled CMM technician with expert knowledge of GD&T, CAD and measurement
- High risk of transcription or interpretation errors with GD&T

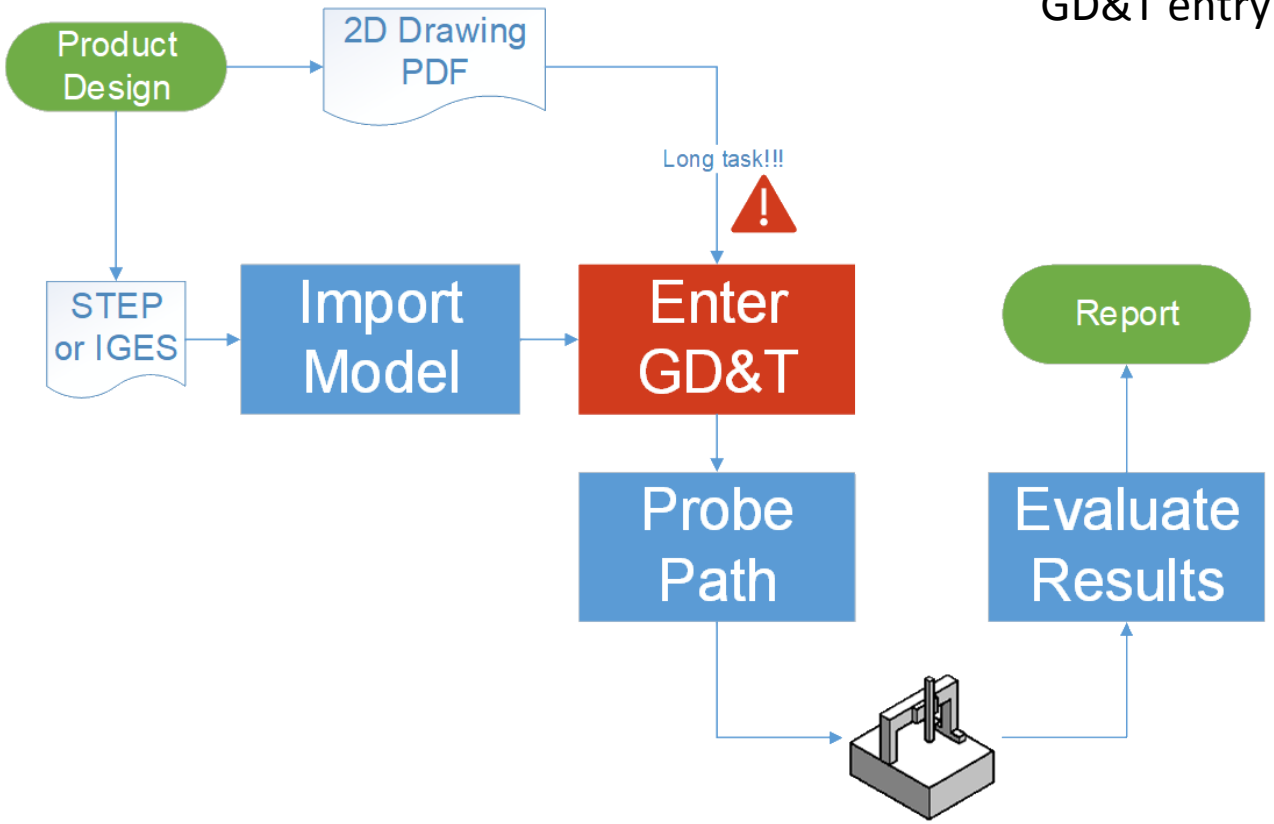


Enterprise measurement data is **siloed**:

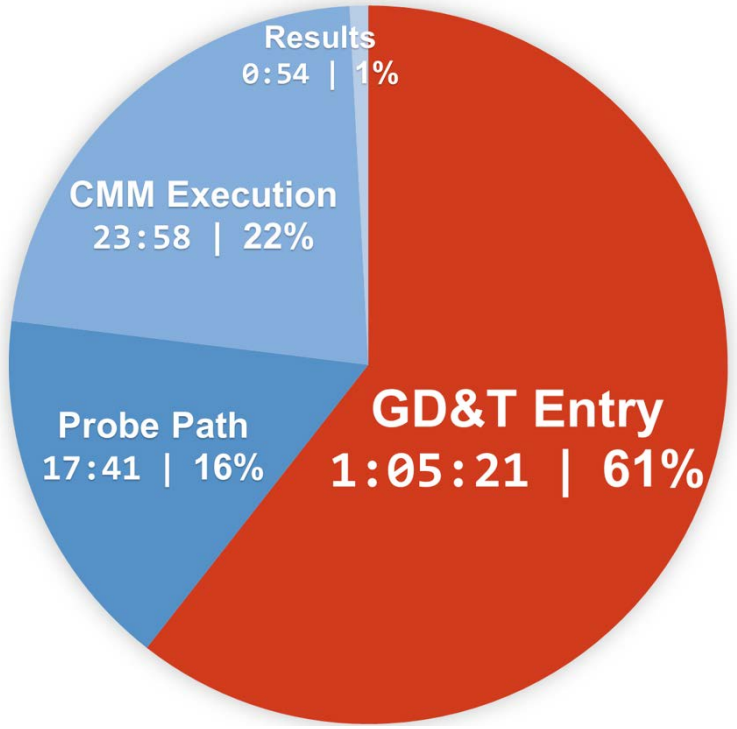
- Multiple, **proprietary data formats** are used
- **Not** linked to "**single source of truth**" – the design model and PLM
- **Non standard** data formats
- **No interoperability** between metrology and CAD systems

Case Study: KOTEM

Current workflow:



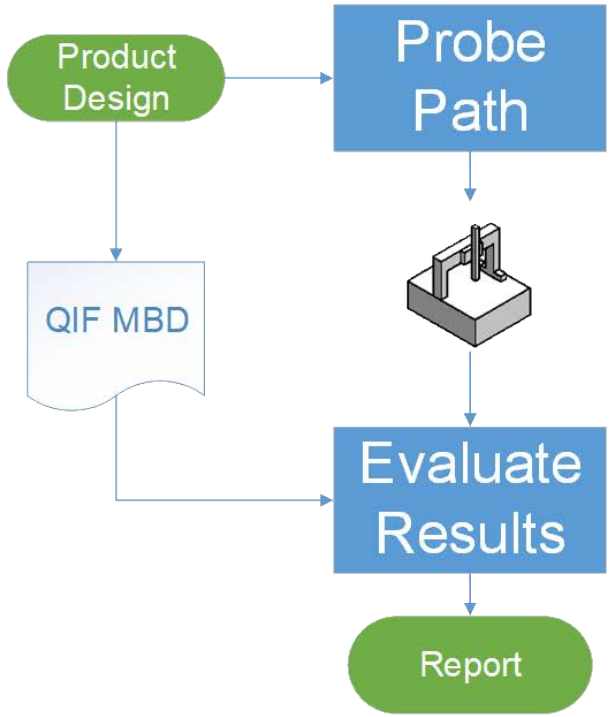
Highly manual process for metrology software, especially GD&T entry



Time spent

Case Study: KOTEM

Future workflow:



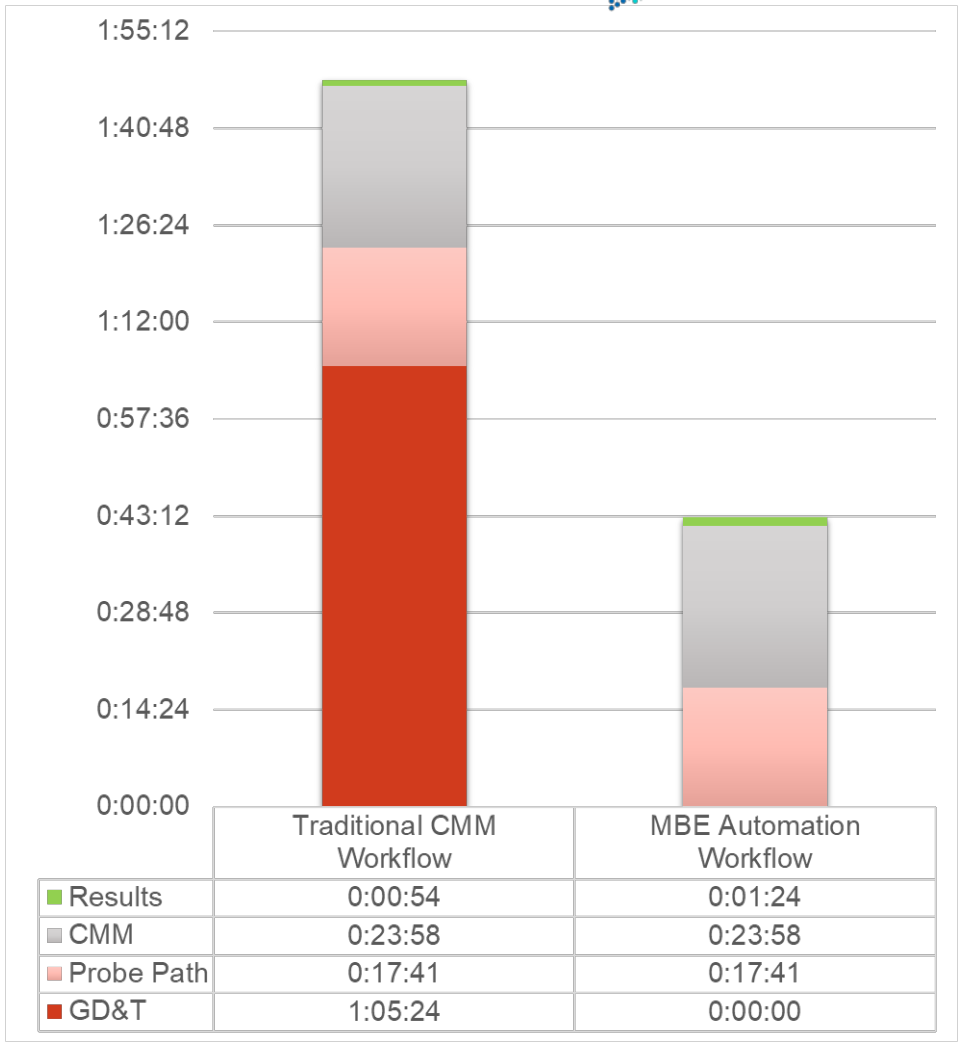
Traditional workflow:

1:47:57

MBE Automation Workflow:

0:42:33

60% more efficient



	Traditional CMM Workflow	MBE Automation Workflow
Results	0:00:54	0:01:24
CMM	0:23:58	0:23:58
Probe Path	0:17:41	0:17:41
GD&T	1:05:24	0:00:00

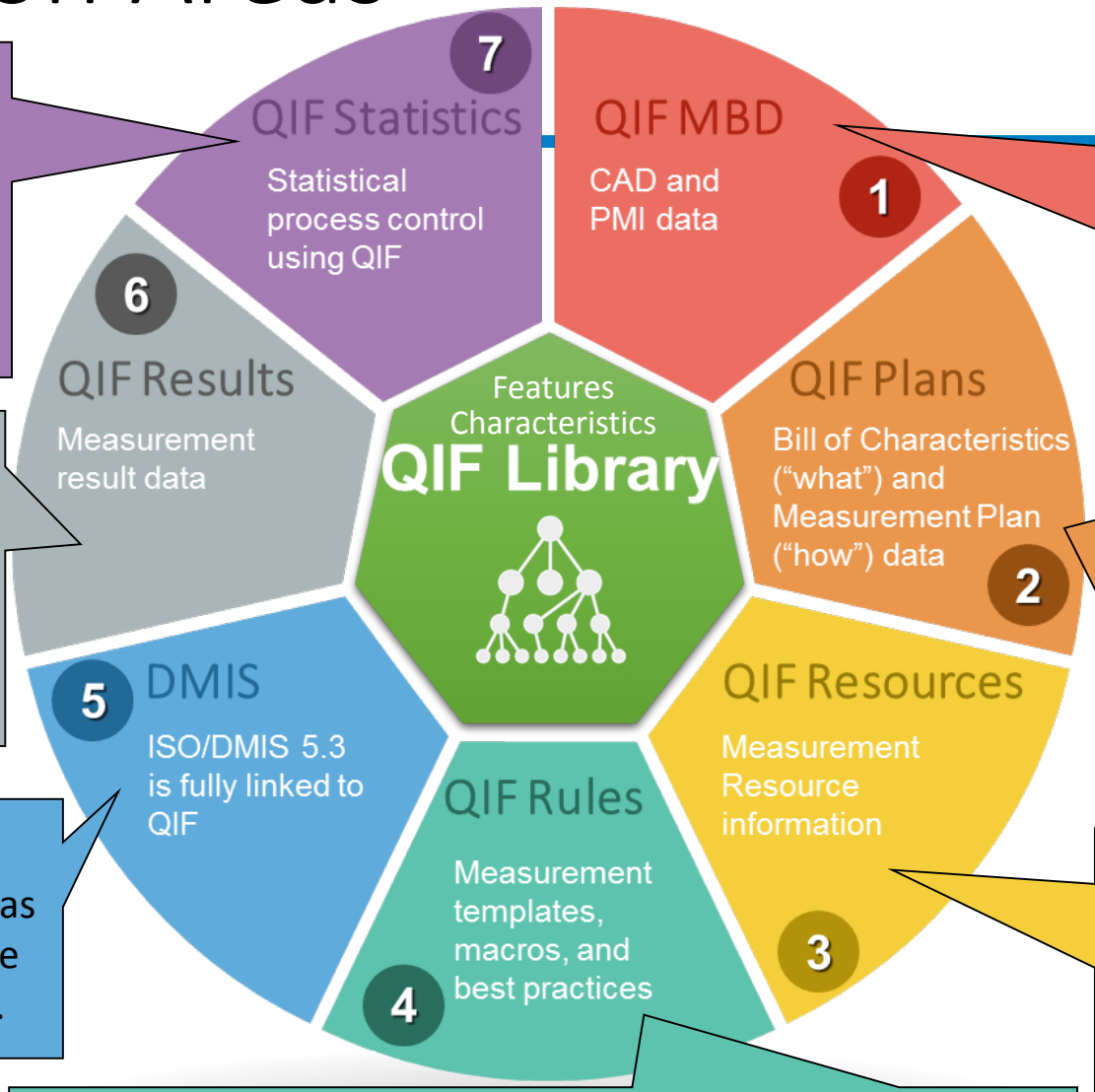
QIF Application Areas

QIF Application Areas

Reference a bundle of QIF Results sets and specify a statistical analysis method to be carried out. Can optionally include the results of the statistical analysis as well

Measurement results data, associated with the MBD! This can be just tolerance evaluation results, and can even include all the point cloud data from the features.

DMIS is not part of QIF, ISO 22093, however the latest ANSI DMIS 5.3 has been updated to harmonize with the data traceability mechanisms in QIF.



QIF MBD is the base for providing traceability to authority CAD data. It is not required for basic QIF use cases. Considered to be the strongest semantic CAD+PMI standard available.

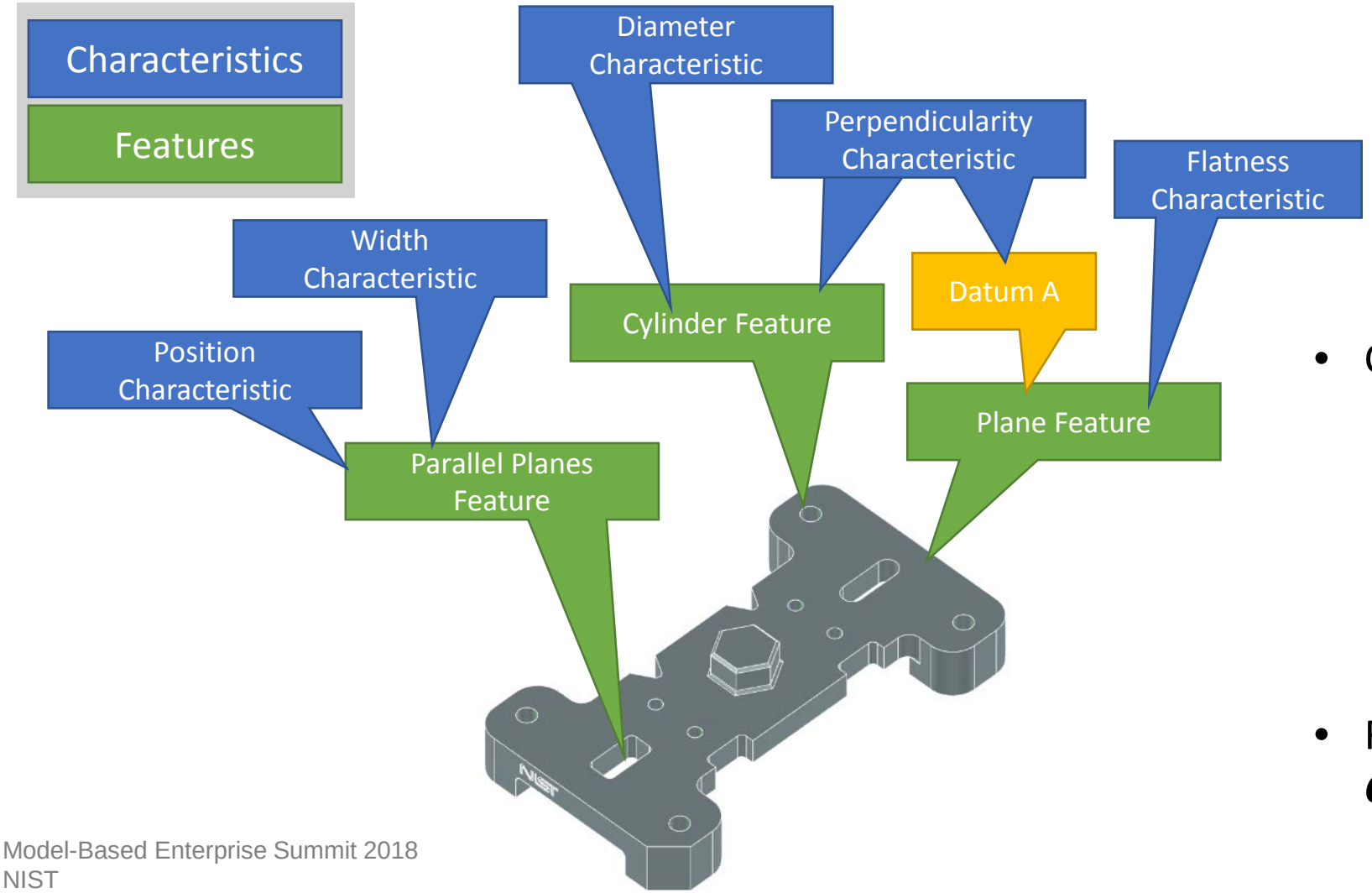
Wide range of optional levels of detail for measurement plans:

- What to Measure: Bill of Characteristics
- How to Measure: Inspection Plan
- Assign measurement resources
- Specify sampling point locations

Specify basic or highly detailed information about available measurement equipment (e.g., CMMs, probes, calipers, gages). As always, this data is contextual and semantic.

Create measurement rule templates. (e.g., *If a Surface Profile tolerance value is less than **x**, then use a CMM method with at least **y** number of point/sq.in.)*

Features & Characteristics



The fundamental constructs behind QIF: Features & Characteristics

- CAD geometry is wrapped by ***Features***
  - Different concept from CAD features!
  - Sometimes referred to as:
    - Tolerance Features
    - Metrology Features
    - Measurement Features
- Features are referenced by ***Characteristics***
  - Usually, these are GD&T

QPIDs – Persistent UUID within the QIF

QIF Persistent Identifier (QPId) *noun* Cu·pid \ˈkyü-pəd\

- Universally Unique Identifier (UUID) (adopted by Microsoft as GUID)
  - ISO/IEC 9834-8
  - 550e8400-e29b-41d4-a716-446655440000
- Chances of generating two that are the same within the universe are practically nil.
  - 340000000000000000000000000000000000 ($3.4x10^{38}$) possible UUIDs
- **Allows information to be combined later without resolving identifier conflicts**
- Many software development libraries generate UUIDs
- QPIds uniquely identify
  - QIF Document
  - QIF Plan
  - QIF Result
  - QIF Rule Set
  - Feature Item
  - Characteristic Item
  - Product Item
  - Resource Item

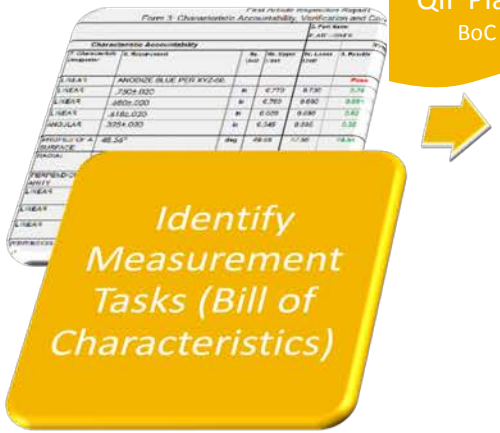
Important Mechanism that facilitates Lifecycle Connectivity w/ Traceability

Workflow Example

Process Stage 3:

Information generated throughout the entire process is linked to the authority model.

This list of tasks is called a Bill of Characteristics



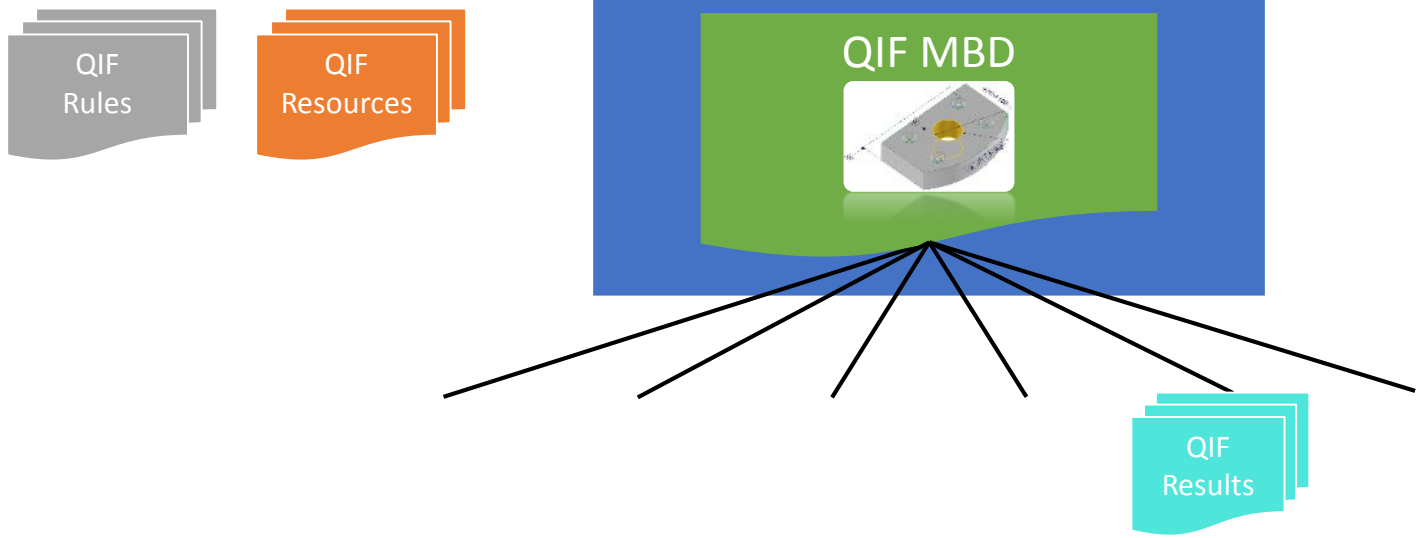
QIF Plans
BoC

QIF Plans
Meas Plan

DMIS

QIF
Results

QIF
Statistics



QIF Benefits

ANSI Standard

Traceability to authority CAD

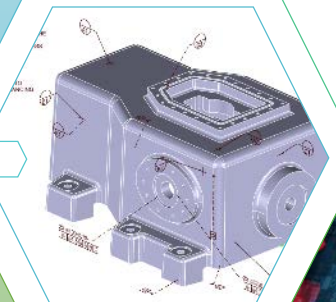
Rich Data Model

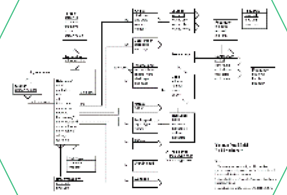
Unambiguous interoperability

XML smart data

Easy PLM integration

Integrity controlled through XSD/XSLT schemas





QIF Case Studies

Case Study: CheckMate & Raytheon

Current Workflow	
Total hours, existing manual workflow	**16 Hours**

New MBD Workflow	
MBDVidia	5 Minutes
FormatWorks import of Creo file	5 Minutes
Checkmate Setup Parameters	5 Minutes
Checkmate Auto Programming	
Accessibility	15 Minutes
Sorting for dependencies	1 Minutes
Auto Coordinate Systems	1 Minutes
Probe moves/rotations	1 Minutes
Collision detection	20 Minutes
Manual editing (estimate)	120 Minutes
Post process program	5 Minutes
Total, New MBD Workflow	178 Minutes
Total, New MBD Workflow	**3.0 Hours**

81% Reduction in Time

Raytheon Origin

Today's traditional, manual workflow for this part is estimated at about 16 hours.

The MBD pilot workflow took less than 3 hours.

ROI Analysis

Time reduction	
MBD Workflow time vs. Manual Workflow Time	19%
MBD Workflow decreases total time by:	**81%**

ROI Analysis	
Engineer fully burdened cost per hour	$ 150
Hours saved on MBD Workflow	13.0
Labor cost saved per part program	$ 1,955
Number of parts programmed per year	52
Cost savings per year, labor	**$101,660**

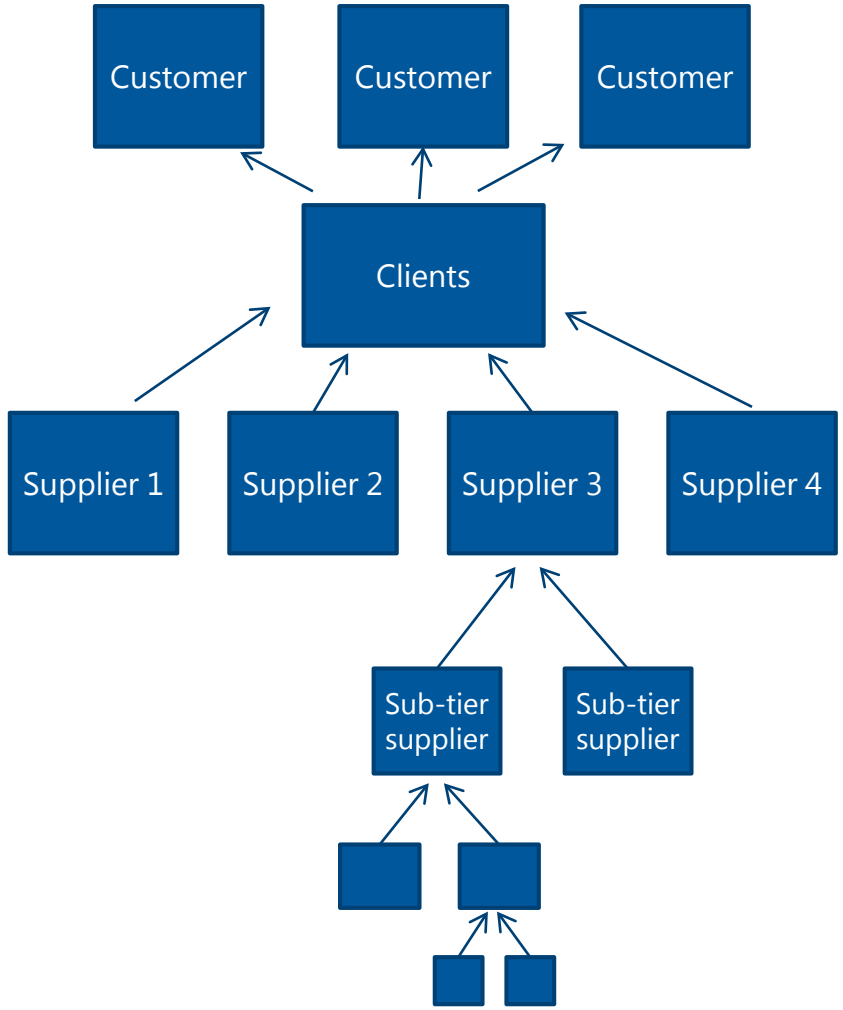
Case Study: Net-Inspect

net-inspect
supply chain and quality management software

- Quality management data, managed across multi-tier supply chains
- Typically, 75% or more of a product is manufactured and measured by suppliers

QIF Enabled

- Capvidia provides QIF integration for Net-Inspect
- Data traceability of measurement data across the supply chain



Action

- ***Now is the time, get involved by:***
  - ***Notify Your Favorite Vendor about the Benefits of the QIF***
  - ***Have Your Metrology Department Plan for the Use of the QIF***
  - ***Inform Your MBE Team the Impact of the QIF to MBE***
  - ***Visit the DMSC Booth at IMTS 2018***
  - ***Joining the DMSC along with your Favorite Vendor***
- **DMSC Membership (www.DMSC-Inc.com)**
  - **bsquier@dmsc-inc.com to Request an Application**
- **QIF Involvement (www.QIFStandards.org)**
  - **One or Many Working Groups**
- **Download DMSC/QIF 2016**
  - **www.QIFStandards.org/download-qif/**

Benefits to Joining

1. Your membership directly supports QIF adoption
2. Contribute to data interoperability
3. Network – Be part of the digital movement

Encourage your Favorite CAD Software vendor to support **QIF**

Visit www.qifstandards.org for more information.

About the DMSC

- Who is the DMSC?
  - A **group** of expert **metrologists worldwide**
- What is the DMSC doing?
  - Defining quality measurement **information exchange standards** like the QIF and DMIS
- How will DMSC membership benefit your company?
  - The DMSC is working on other important **manufacturing quality measurement standards** besides DMIS
  - Member companies have an **equal voice** in the definition and direction of each standard
  - Membership ensures worldwide implementation of the standards, which is critical to realizing **cost savings**
- Join the QIF and DMSC effort!
  - Email Bailey Squire to request an application bsquire@dmsc-inc.com
  - Visit www.dmsc-inc.org

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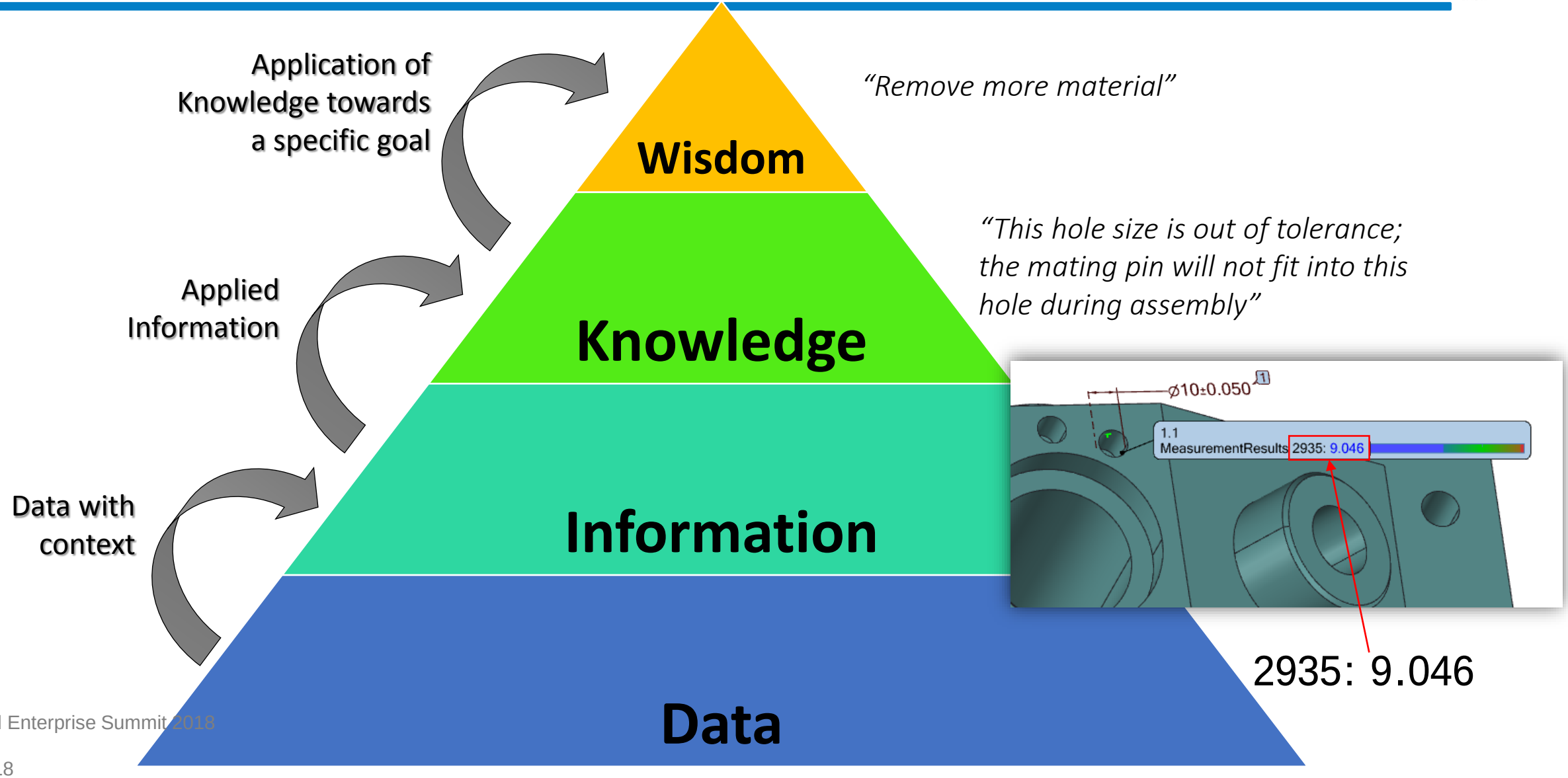
Dimensional Metrology Standards Consortium DMSC

BACKUP

DIKW Pyramid & QIF



DIKW Pyramid & QIF

*Without **context, data** cannot be transformed into **knowledge**.*

QIF provides this context.