NIST MBE Summit 2019
Gaithersburg, MD
April 1-4, 2019

Why QIF Matters

A Roadmap for Digital Manufacturing

www.qifstandards.org

Digital Transformation of Industry

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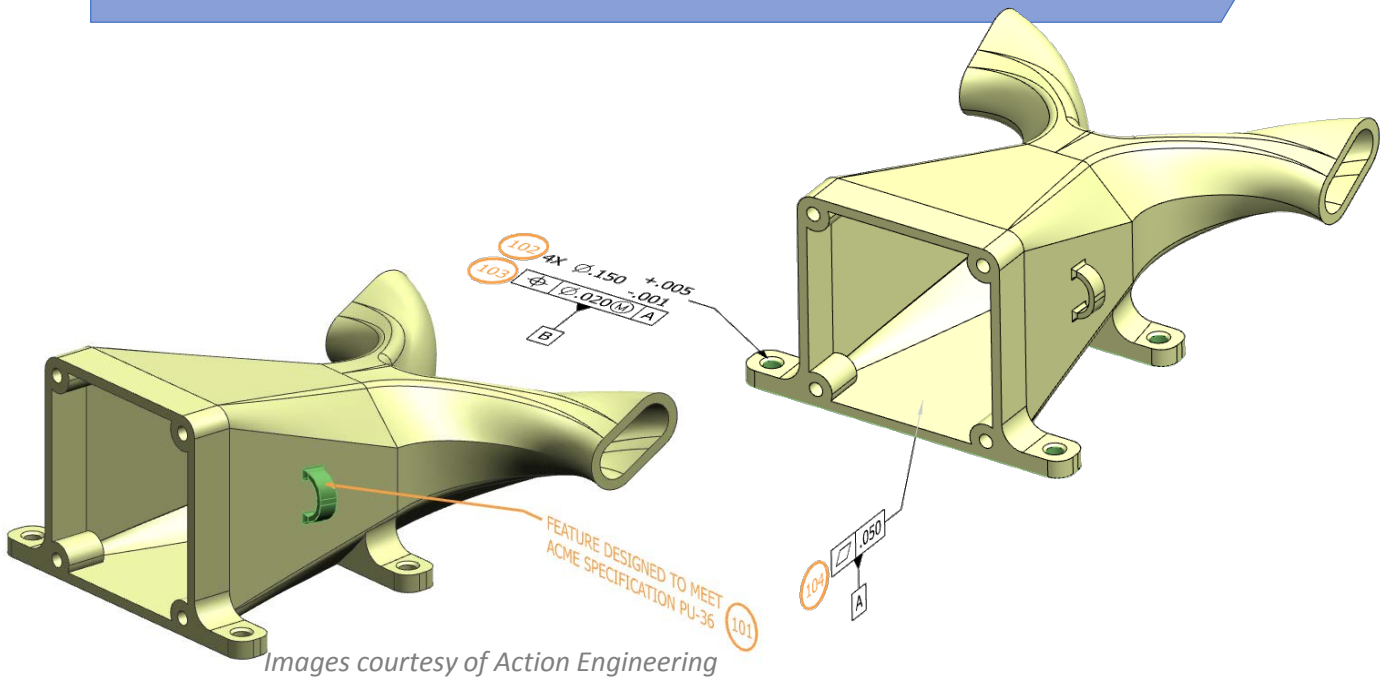
These are all about using DATA to solve business problems

(Data, not software)

It's all about **Digital Transformation**



Images courtesy of Action Engineering

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`

Looking to the Future: What is the Value of MBD?

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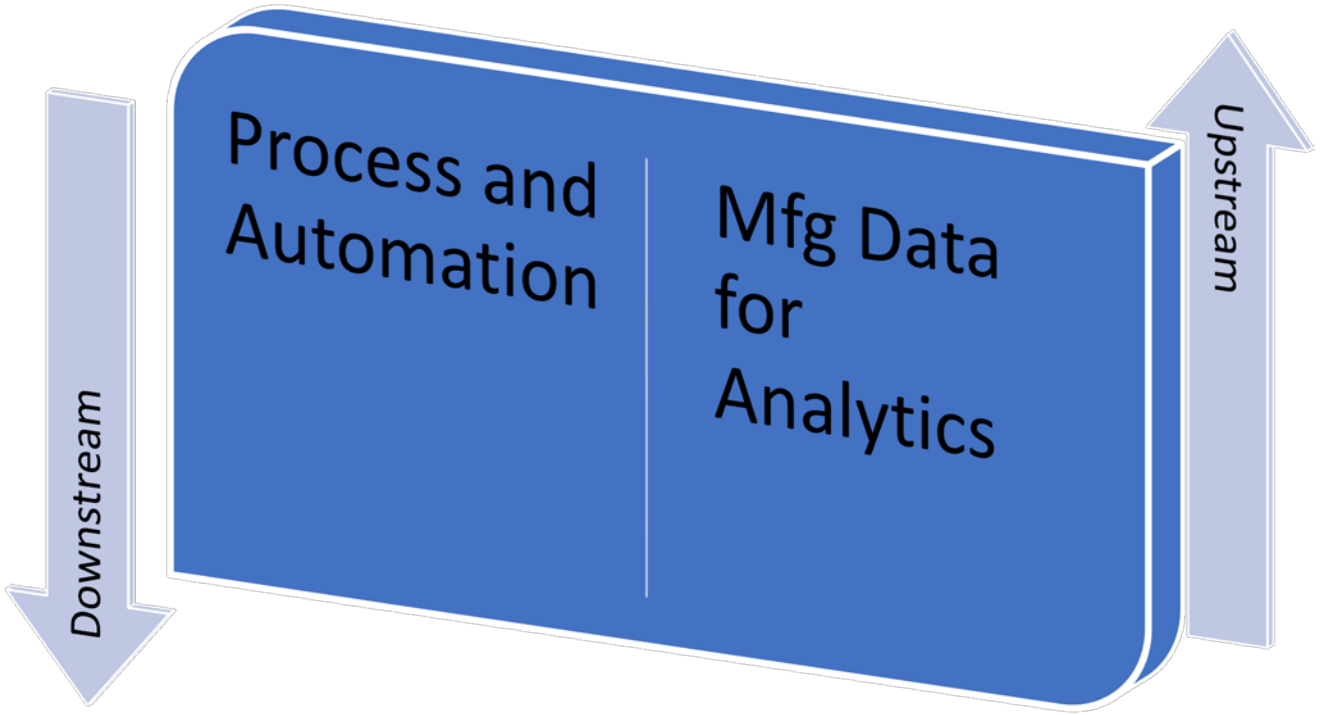
Model Based Definition provides a source of value in the downstream direction from design, and in the upstream direction from operations and deployment



This approach is embodied through QIF

What is the QIF?

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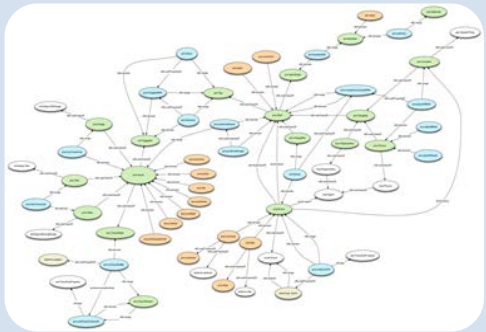

Feature-Based Ontology of Manufacturing Quality Metadata

< />

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

Harvesting by ISO/TC 184/SC 4

Process, and Process Automation

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Process over Personnel

Avoiding the a “human-in-the-loop” is always preferred in modern manufacturing

- Heavy human intervention means that the creativity and adaptability of the human mind is required to resolve a given step in the manufacturing process.
- Relying on human creativity, rather than rigorous corporate process, means a less repeatable outcome and higher risk.

Automation

When a business process can be adequately defined, automation becomes possible

- Increases speed of task completion
- Lowers costs due to decreased labor requirements
- Frees up valuable personnel for other tasks more suited for the human mind
- Automated processes are extremely repeatable and low in risk compared to relying on human involvement

QIF Application Areas

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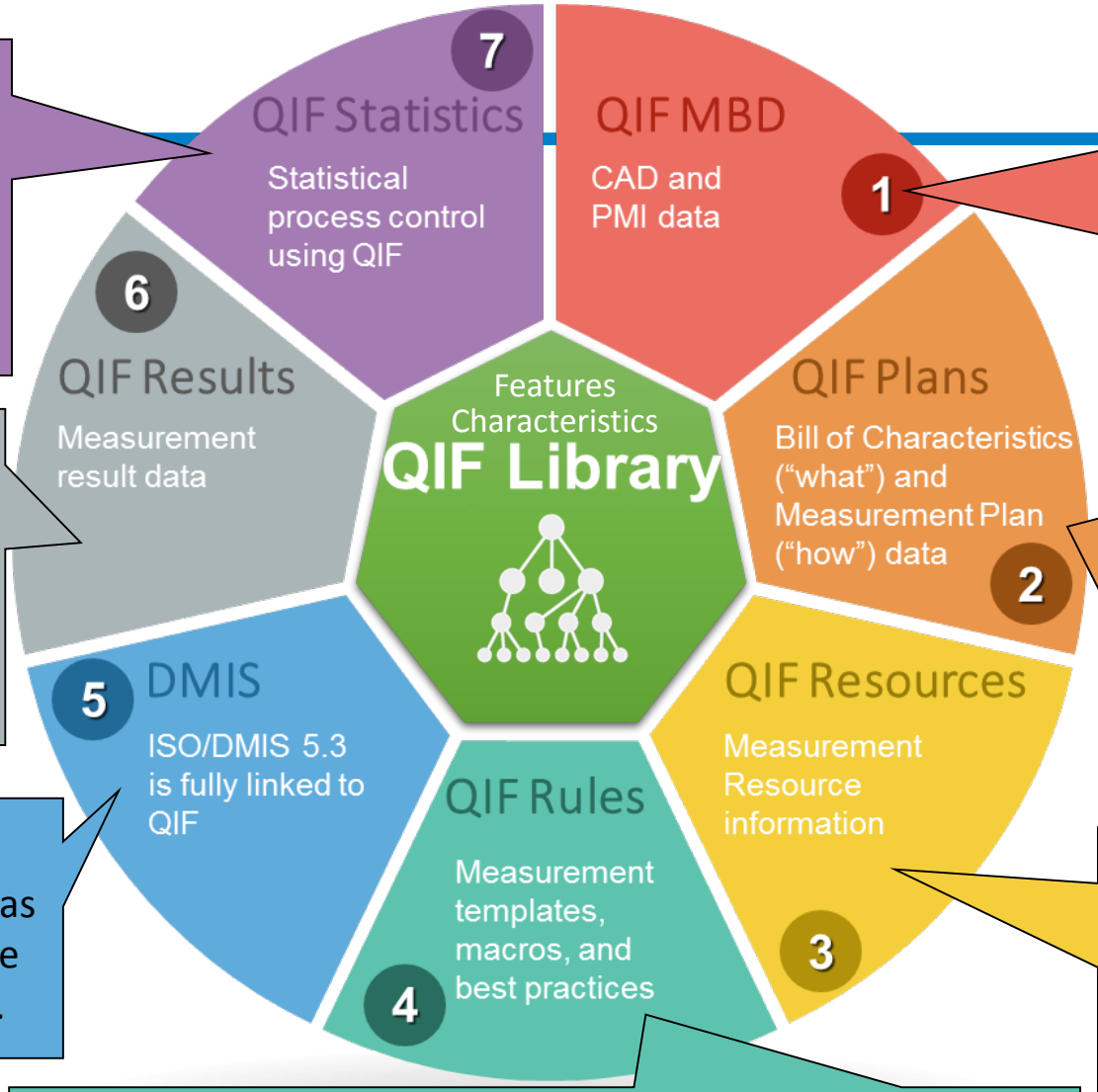
QIF Application Areas

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.

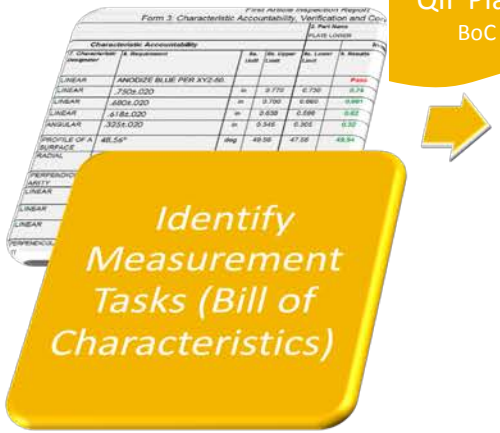
Create measurement rule templates. (e.g., *If a Surface Profile tolerance value is less than **x**, then use a CMM method with at least **y** number of point/sq.in.)*

Workflow Example

Process Stage 3:

Identify Measurement Tasks (Bill of Characteristics)

This list of tasks is called a Bill of Characteristics



QIF Plans
BoC

QIF Plans
Meas Plan

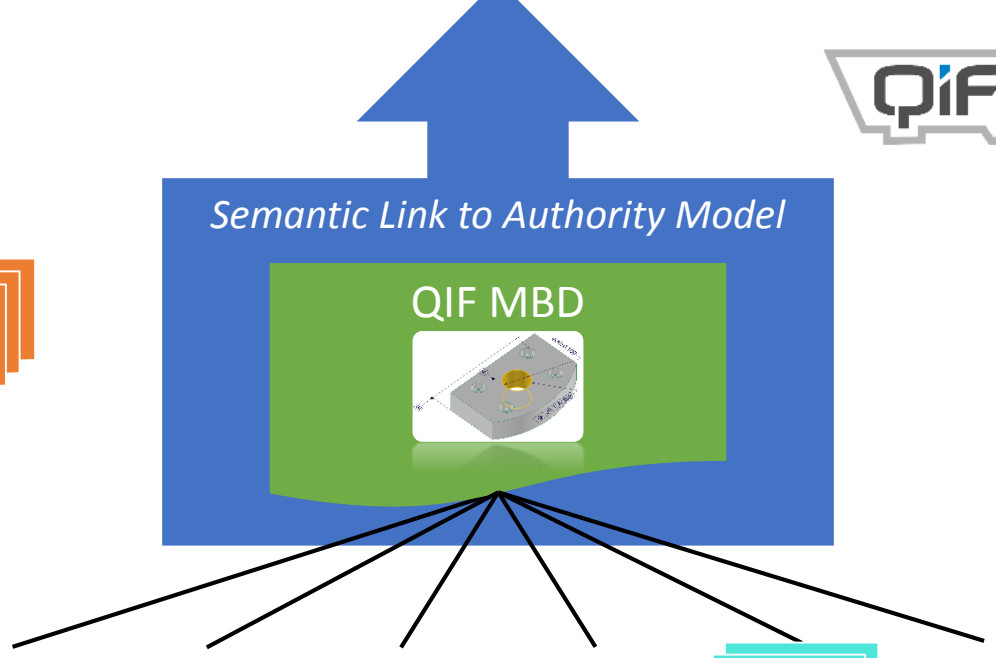
DMIS

QIF
Results

QIF
Statistics

QIF
Rules

QIF
Resources



QIF
Results

Value of Manufacturing Data

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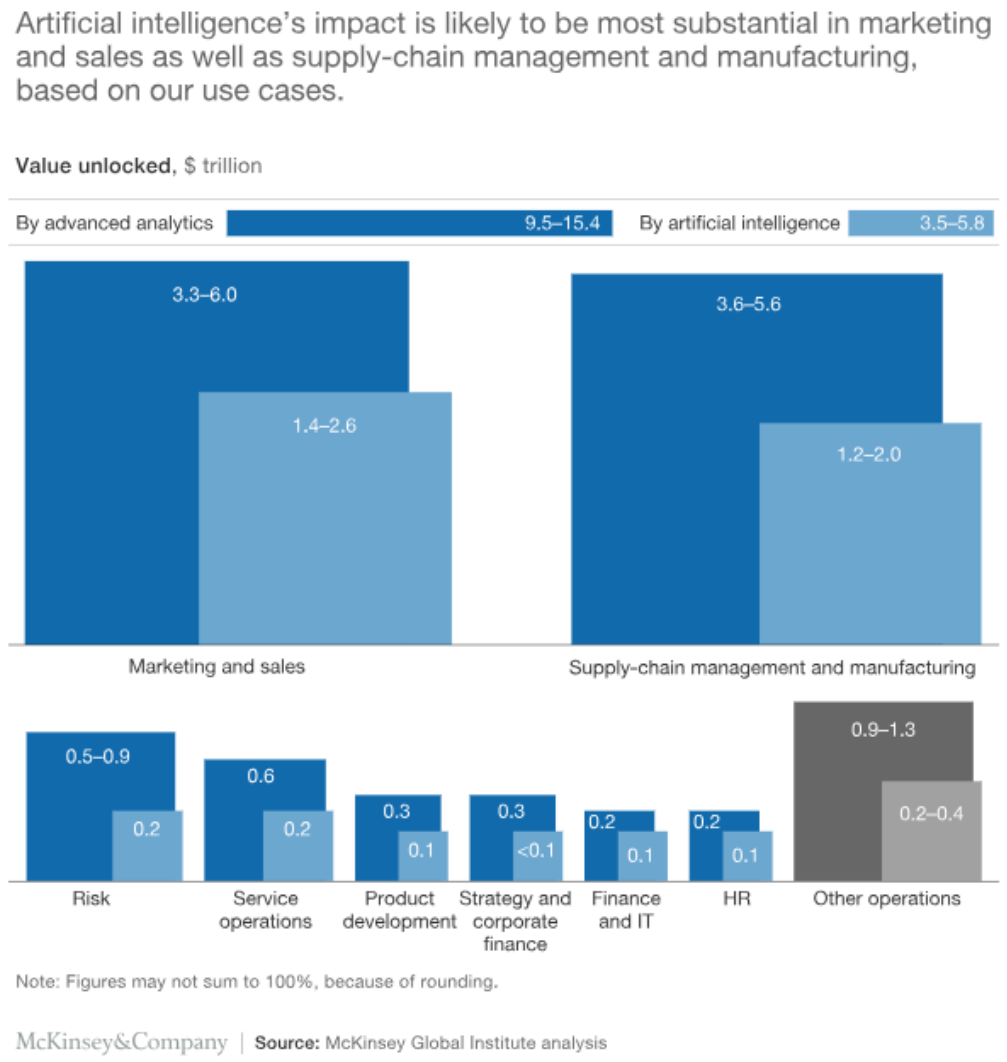
- Currently, manufacturing data is not fully exploited because of lack of structure
- A study by McKinsey & Company states:

  We estimate that the AI techniques we cite in this briefing together have the potential to create between $3.5 trillion and $5.8 trillion in value annually across nine business functions in 19 industries

- The second largest growth area for AI and Big Data is Supply-chain management and manufacturing
- Providing structure and data traceability is required to unlock this potential



DIKW Pyramid & QIF

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Application of Knowledge towards a specific goal

Applied Information

Data with context

Wisdom

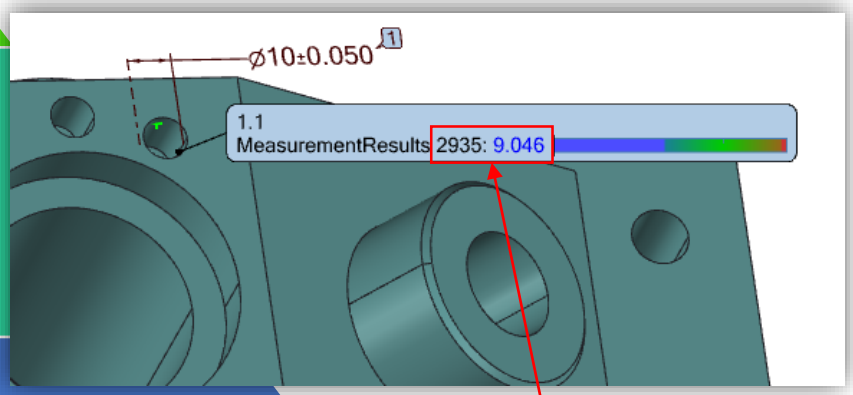
Knowledge

Information

Data

"Remove more material"

"This hole size is out of tolerance; the mating pin will not fit into this hole during assembly"



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DIKW Pyramid & QIF

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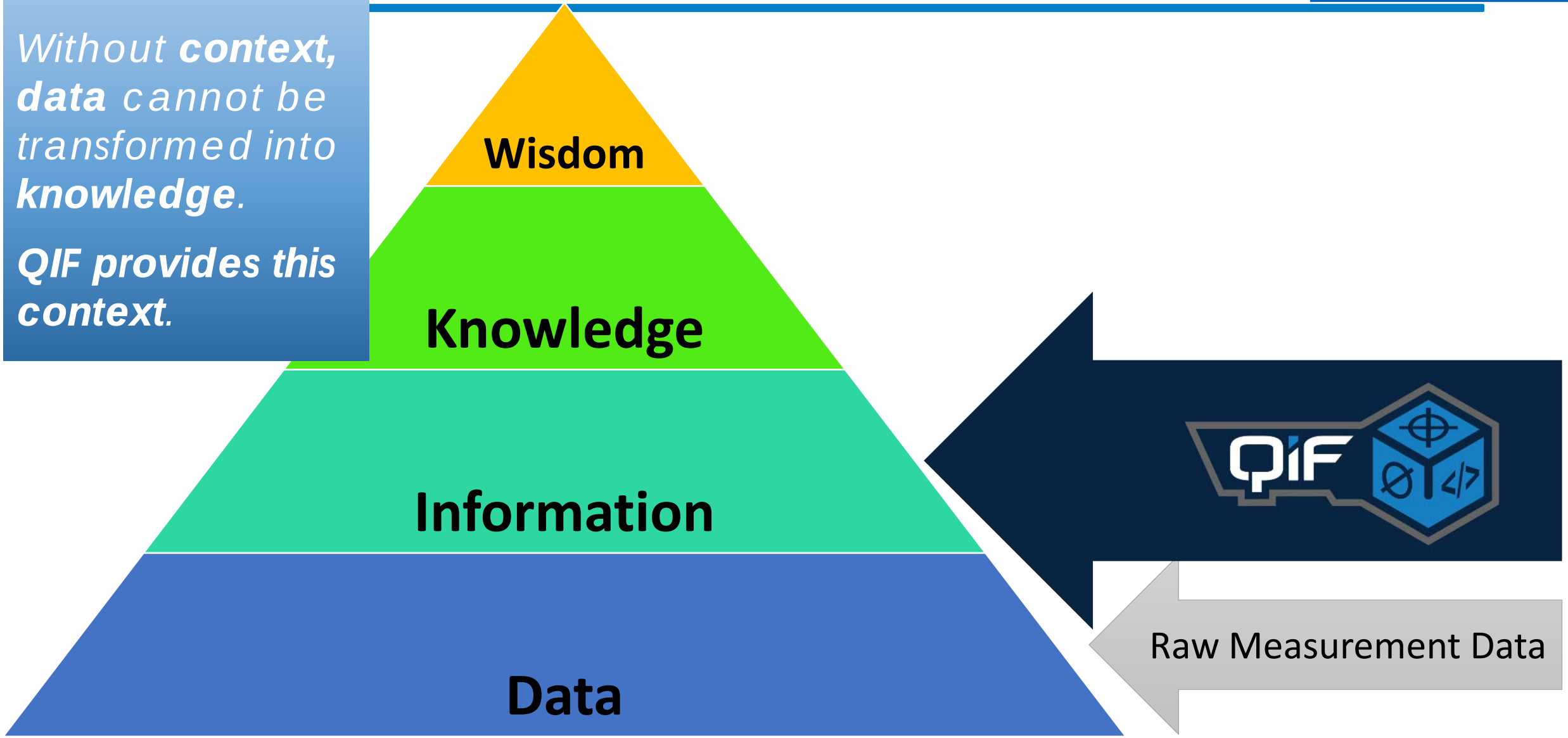
*Without **context, data** cannot be transformed into **knowledge**.*

QIF provides this context.



Features & Characteristics

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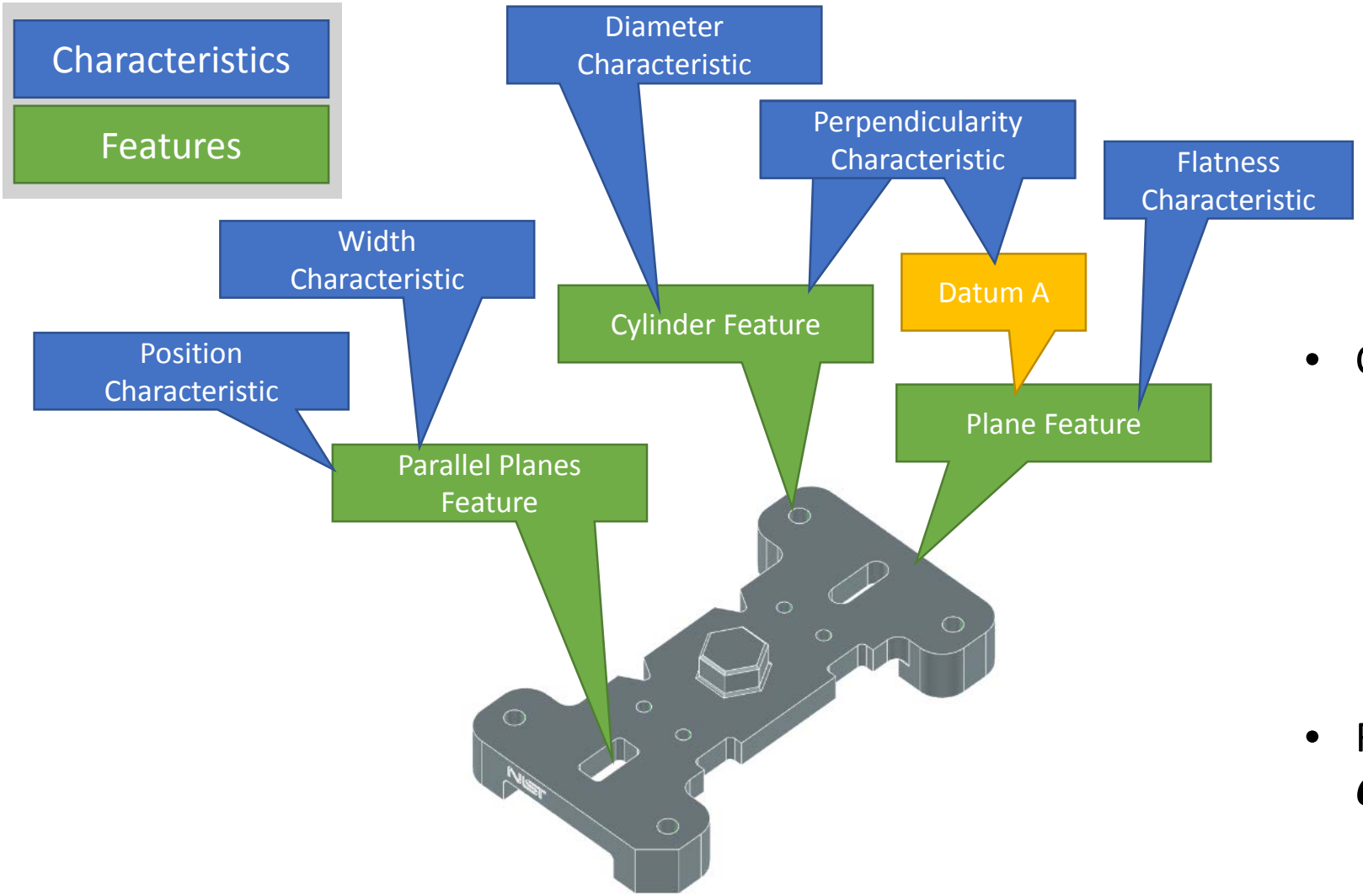

The fundamental constructs behind QIF: Features & Characteristics

- 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

Roadmap for Success

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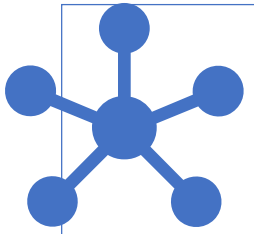
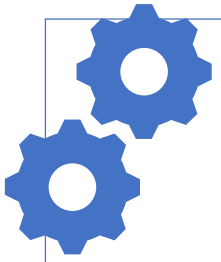


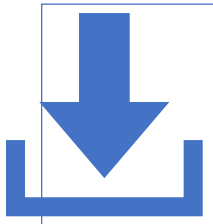
Active Schema Development

Data Integrity

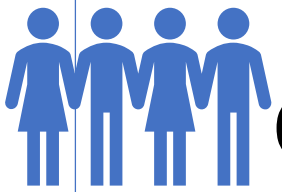
Standardization Efforts



Facilitate software development



Free Open Source Tools



QIF Community

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Thanks!

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Digital Metrology Standards Consortium DMSC

Download the Standard at: www.QIFStandards.org