Connecting the Dots: Integrating MBD, MBE, and MBSE for Lifecycle Value

GLOBAL PRODUCT DATA

INTEROPERABILITY

SUMMIT 2025

BOEING ELYSIUM LOCKHEED MARTIN NORTHROP GRUMMAN Parker PDES, Inc.® Connecting the Digital Enterprise

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EXPERTISE

- Project Management
- Agile Leadership & Scrum Mastery
- Organizational Change Management (OCM)
- Vendor & Stakeholder Relations
- Process Improvement
- PDM Administration
- Digital Modeling & Design
- Manufacturing & Material Handling Systems
- Space Planning & Layout Design
- Training Program Development

CREDENTIALS

- Certified ScrumMaster®, Scrum Alliance
- Cornell Change Leadership Certificate
- Cornell Change Management Certificate
- Material Handling & Warehouse/Distribution Center Layout, Georgia Institute of Technology
- Project Management, Mountain State Employer Council

PUBLICATIONS

- The MBE and PLM Lord of the Rings Saga

QUOTE

"It's not the strongest of the species that survive, nor the most intelligent, but the one most responsive to change."
– Charles Darwin

The Differences Between MBD, MBE, and MBSE

posted on MAY 14, 2024

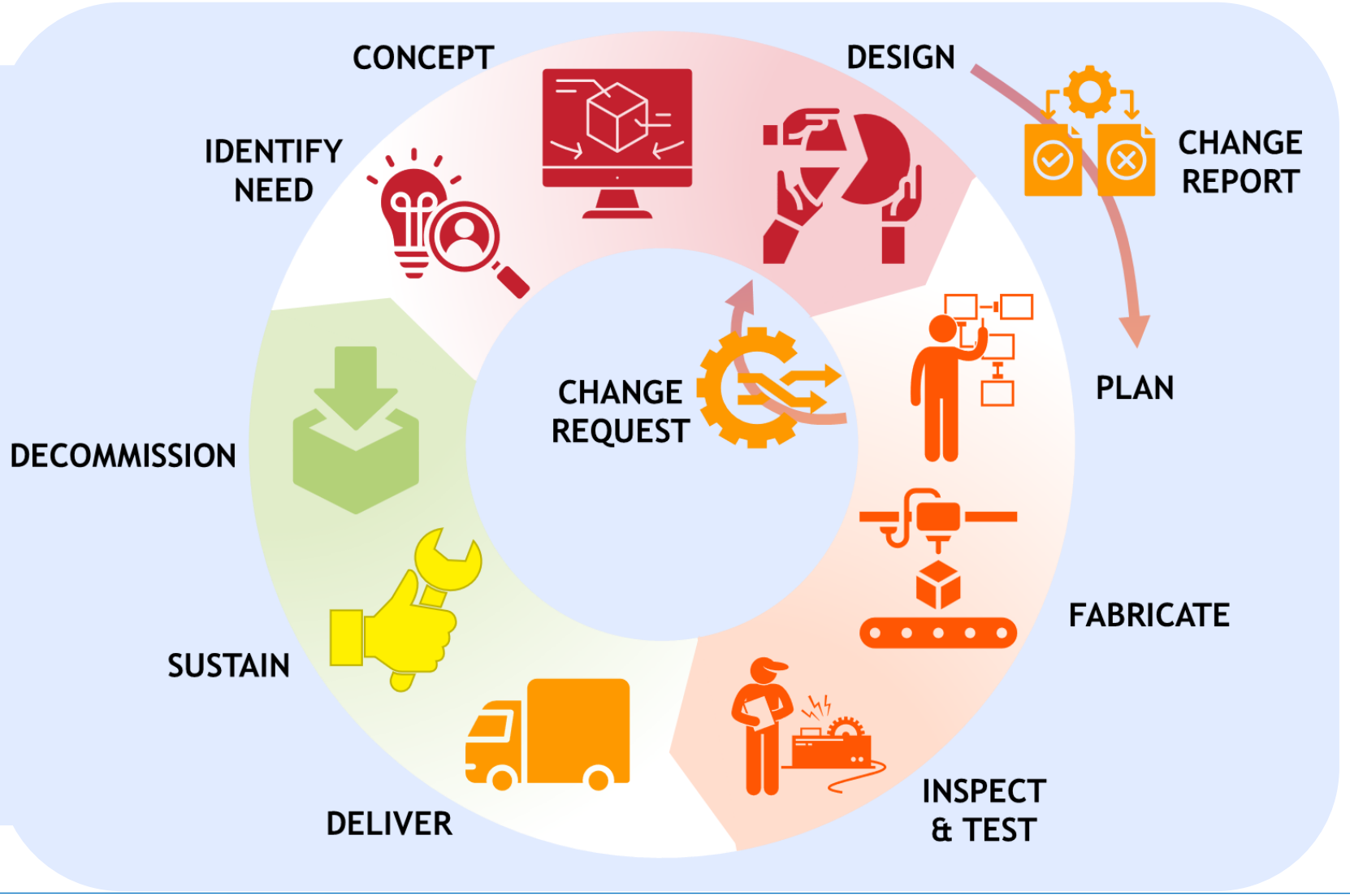
Author: Duane Hess

I have encountered some confusion and misunderstanding around the difference between Model-Based Definition (MBD), Model-Based Enterprise (MBE), and Model-Based System Engineering (MBSE) with people I

MBSE
Model-Based
Systems Engineering

MBE
Model-Based
Enterprise

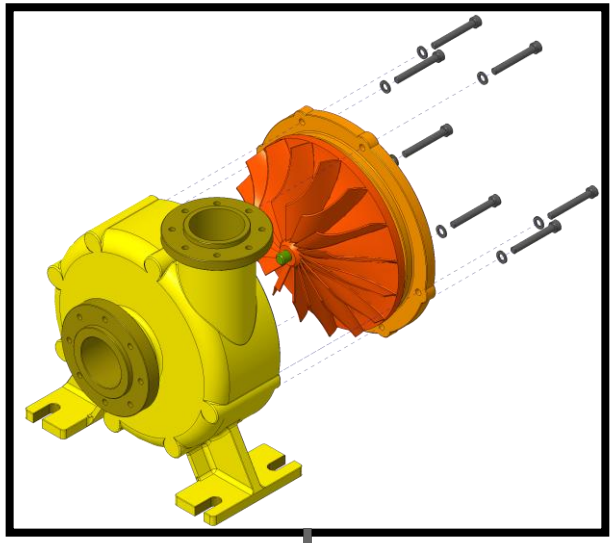
MBD
Model-Based
Definition



What is a Model?

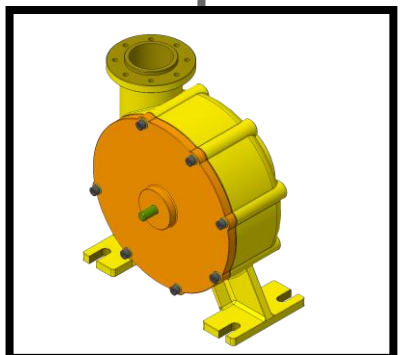
Discipline	MBSE (Model-Based Systems Engineering)	MBE (Model-Based Enterprise)	MBD (Model-Based Definition)
What the Model Represents	Abstract, logical representation of a system	Federated enterprise view of product & process information	Authoritative 3D digital definition of the product
Focus	Why the system exists and how it should behave	How data flows and is reused across the enterprise	What the product is
Typical Content	Requirements, functions, interfaces, behaviors, verification criteria	Product structures, workflows, lifecycle data, configurations	Geometry, annotations, attributes, CAD BOM, presentation states
Tools / Languages	SysML, UML, Modelica, Cameo, Rhapsody, Capella	PLM, ERP, MES, QMS, integration platforms	CAD systems, such as NX, Creo, CATIA, SolidWorks

What is Model-Based Definition?

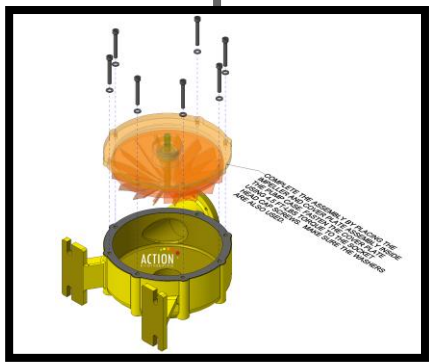


Model-Based Definition (MBD) is a 3D data set consisting of:

1) the **geometry** (Components, includes catalog parts)
2) the **annotations** (displayed notes, dimensions and tolerances or GD&T)
3) the **attributes** (metadata, often the source is PLM)
4) the **presentation states** (saved views, presentation organization)
5) the **CAD BOM*** (model tree, CAD hierarchy)



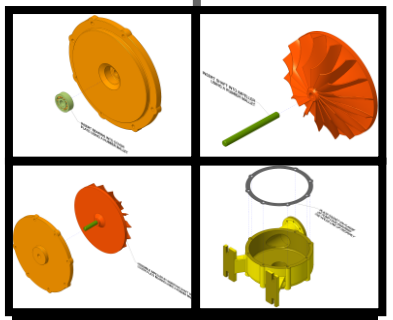
GEOMETRY



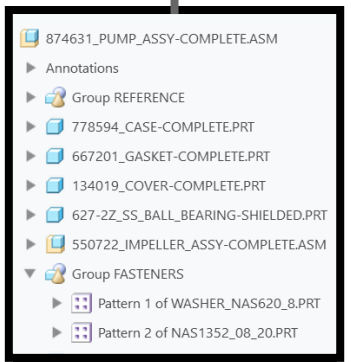
ANNOTATIONS

DESIGN_DATE	2020-10-01
DESIGN_NAME	T.DESIGNER
MFG_DATE	2020-10-15
MFG_NAME	M.MANUFACTURING
NEXT_ASSY	-
NOMENCLATURE	PUMP ASSEMBLY
PART_NUMBER	874631

ATTRIBUTES



PRESENTATION STATES

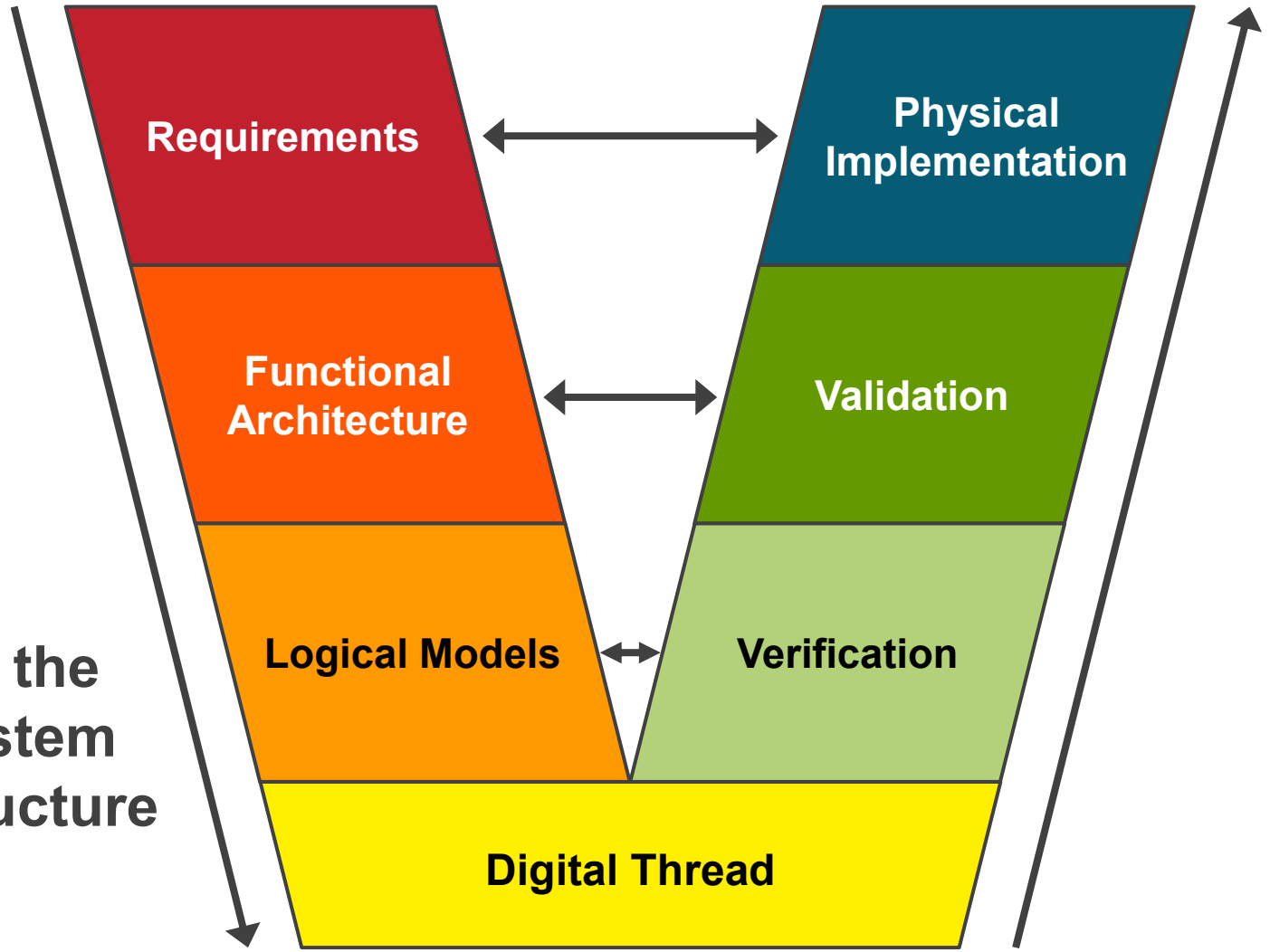


CAD BOM*

***For Assemblies Only**

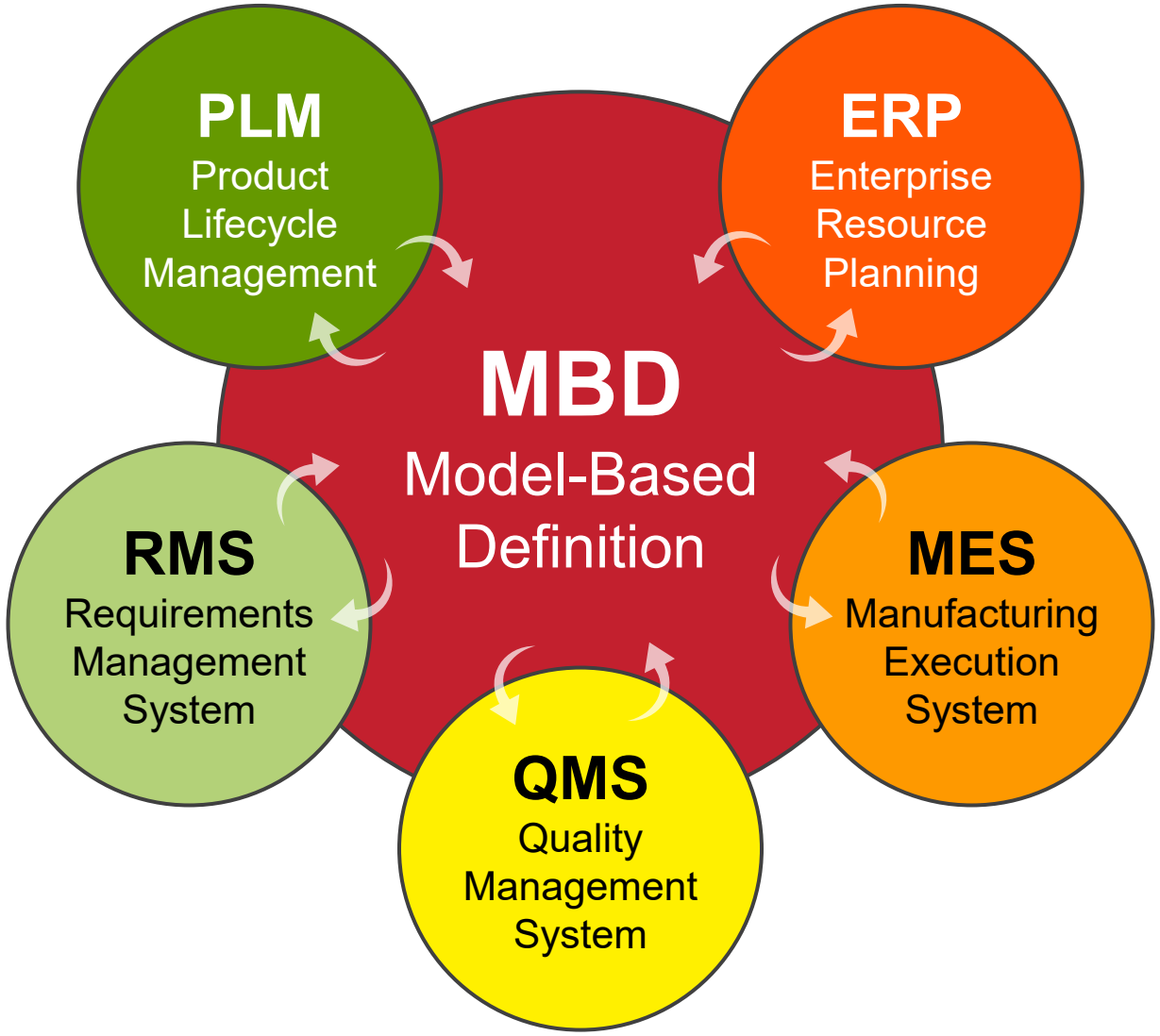
What is Model-Based Systems Engineering?

MBSE governs the definition of system behavior and structure

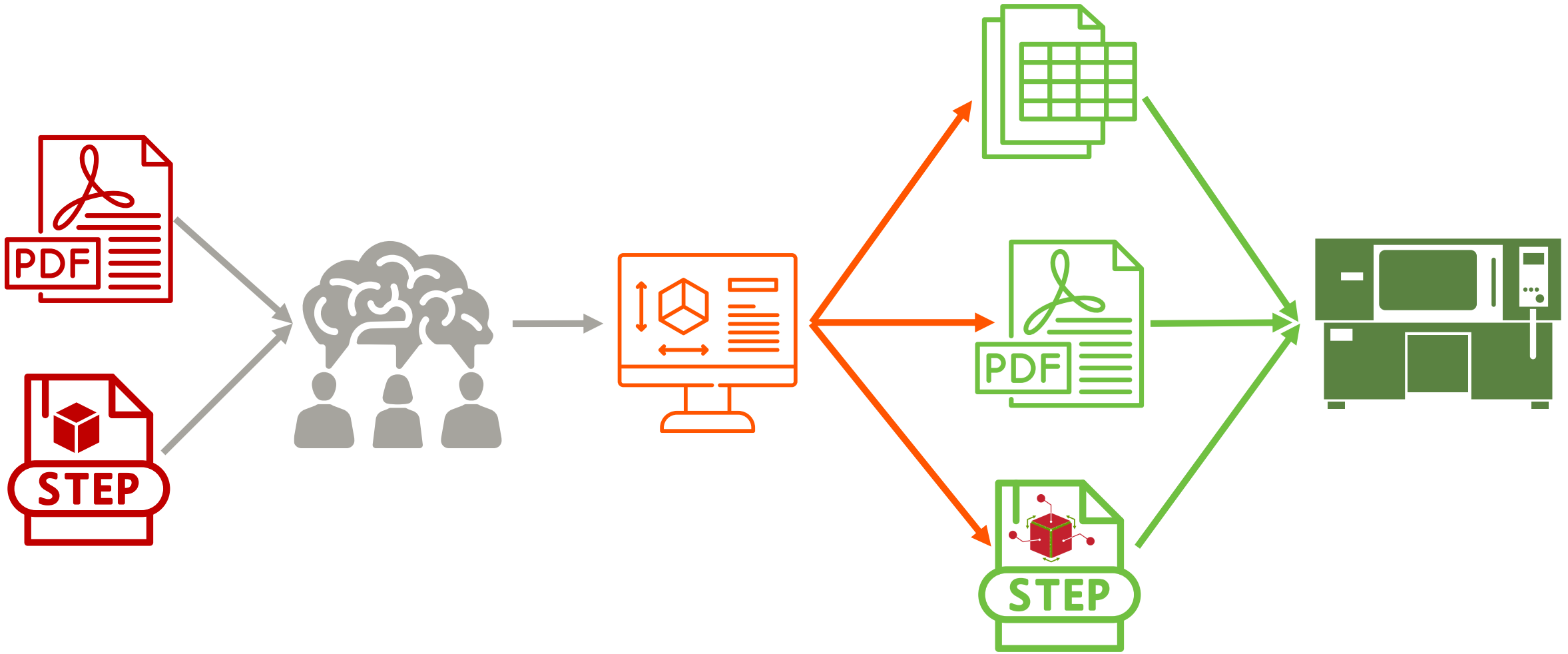


What is Model-Based Enterprise?

MBE enables enterprise-wide reuse of MBD

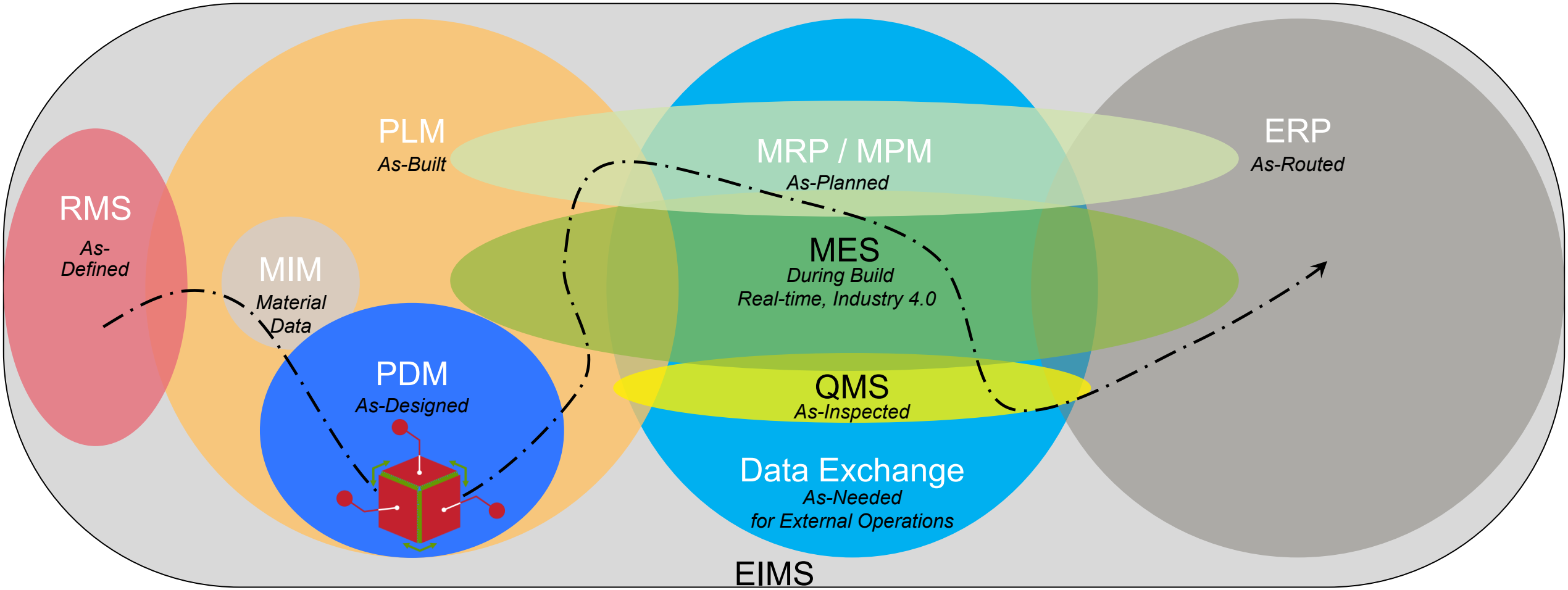


Why is this Important?



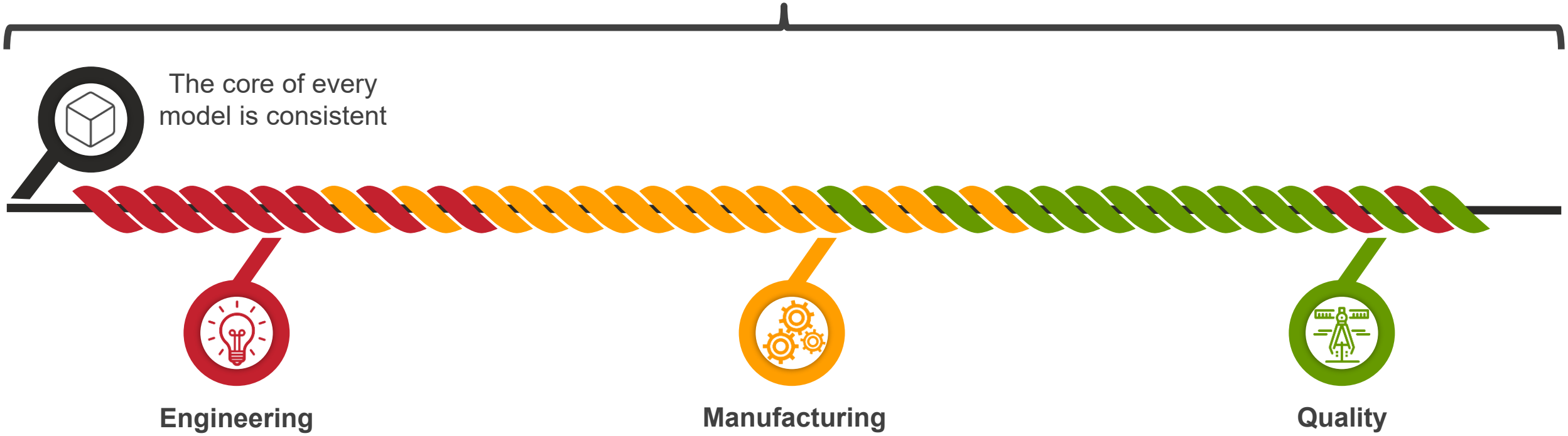
Why is this Important?

Connecting the Dots



Single Source of Truth ≠ Single Model

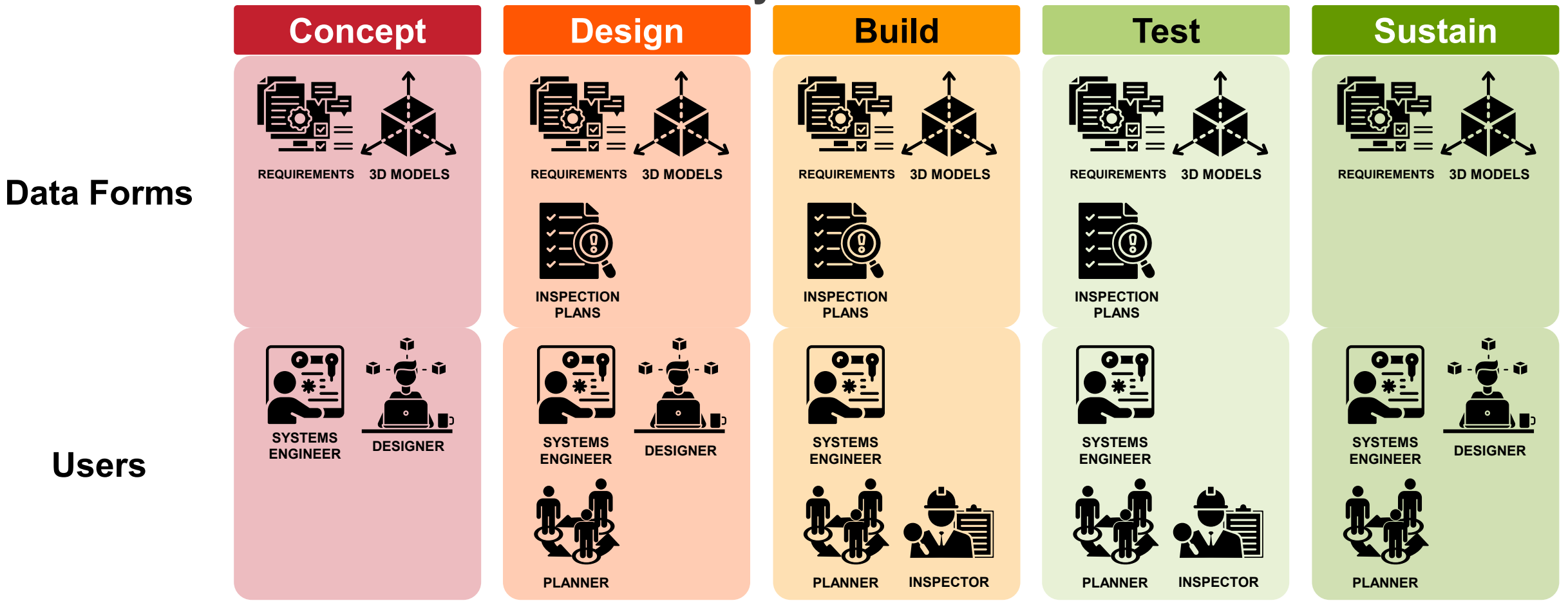
The single source of truth contains the entire thread.



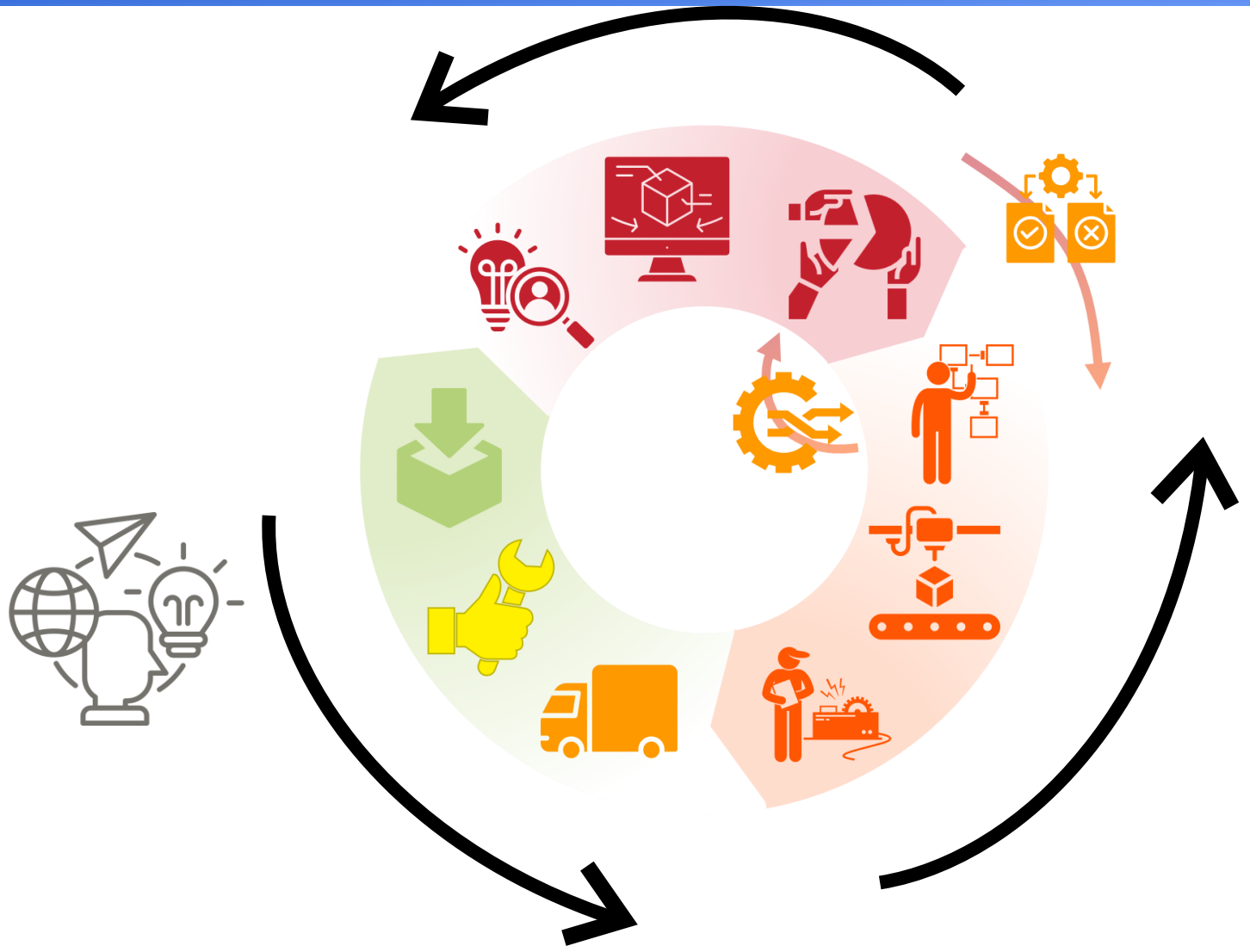
Each data set only shows what is needed.

Some data overlaps, but a streamlined model with focused data allows for quicker cognition and greater accuracy.

Data must evolve and stay traceable across contexts.



The Feedback Loop: Closing the Lifecycle



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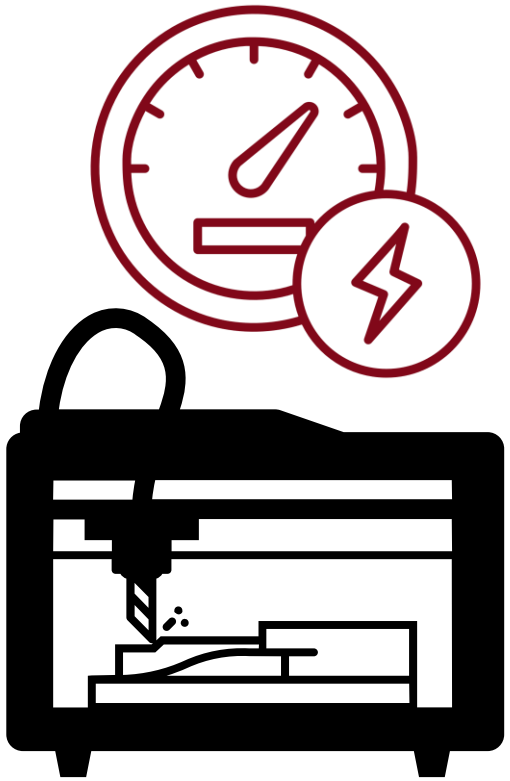

- Too Aggressive
- Complex Geometry
- Bad Toolpath

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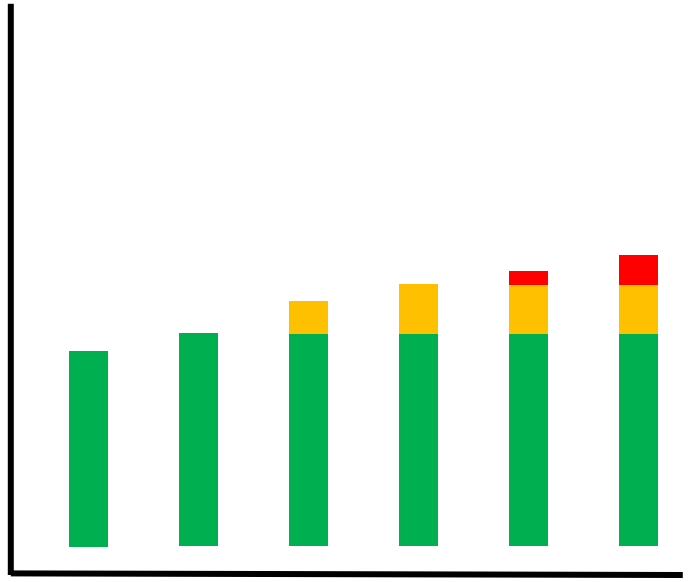
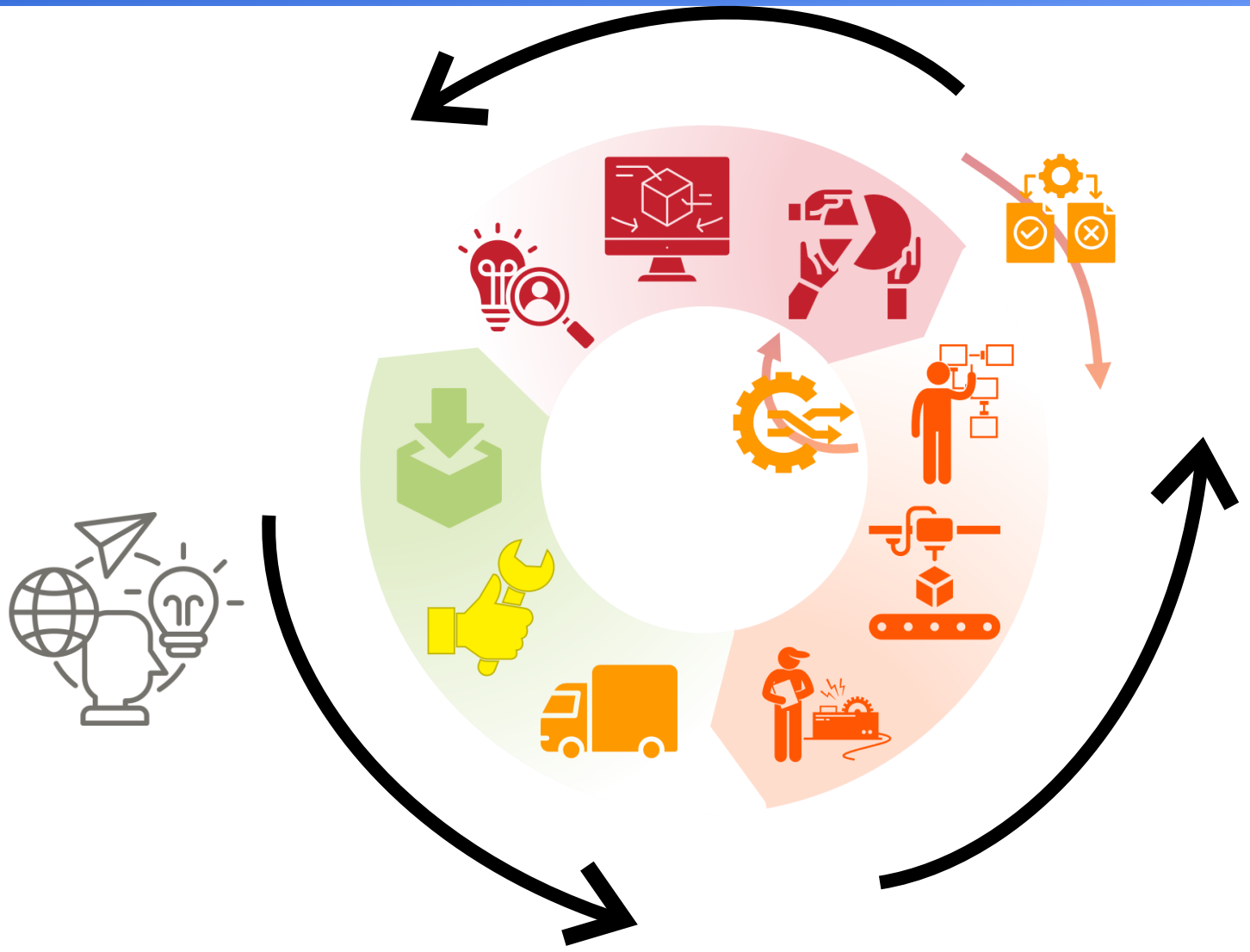


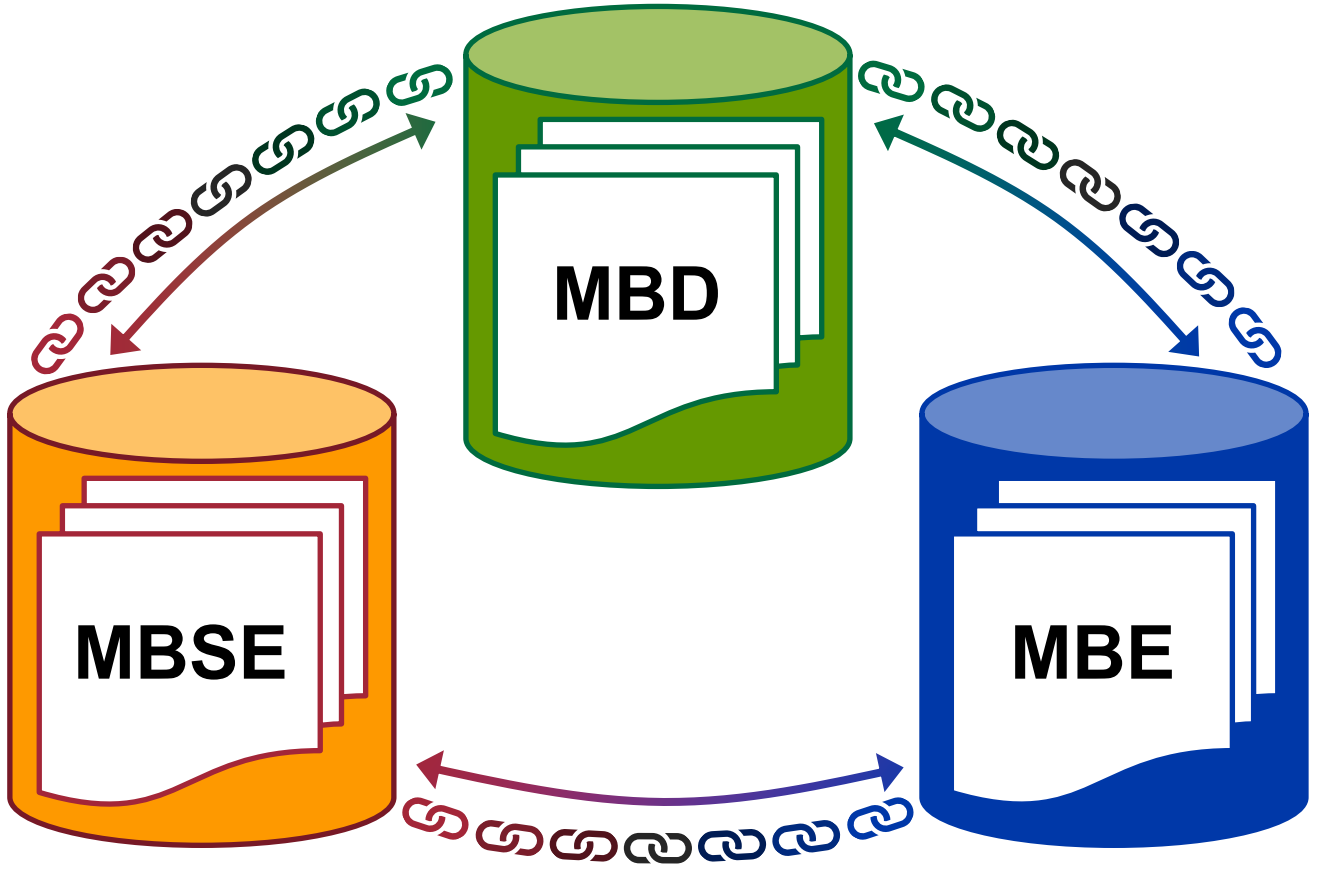
- Trigger Earlier Tool Replacement
- Revaluate Engineered Tolerances

The Feedback Loop: Closing the Lifecycle



How to Connect the Dots: Connect the Systems

- Integrate MBSE, MBD, and MBE environments
- Use standardized data formats for interoperability
- Connect directly or via middleware depending on system architecture

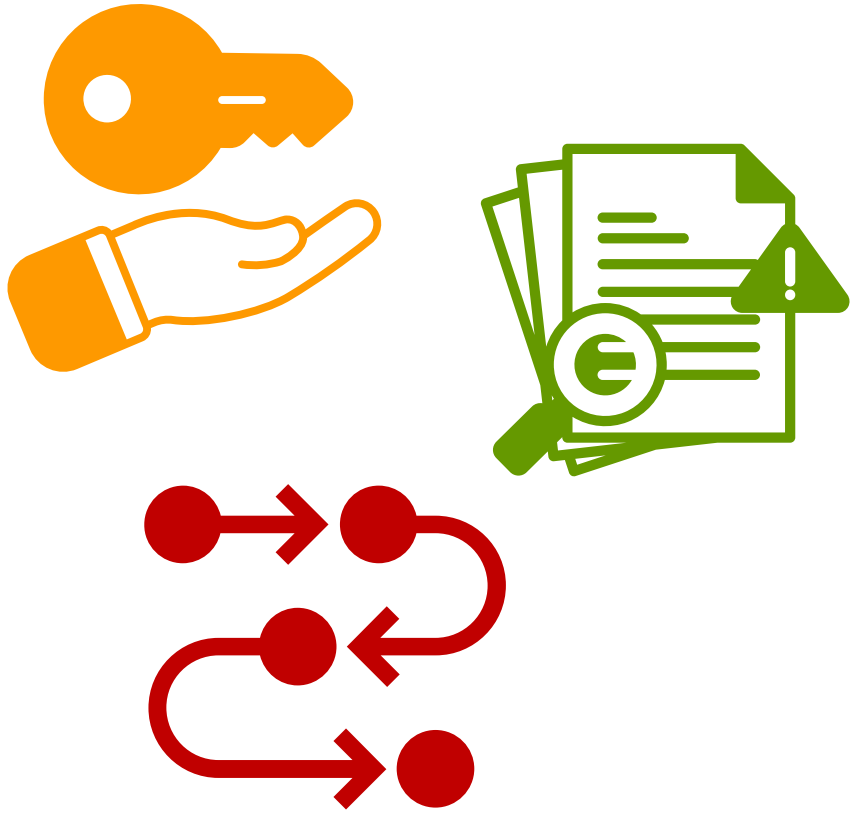


How to Connect the Dots: Enable Traceability

- Attach persistent IDs to all critical data elements:
  - Requirements
  - CAD features
  - BOM entries
  - Inspection results
  - Tooling and toolpaths
- Ensure data can be traced across systems and lifecycle stage

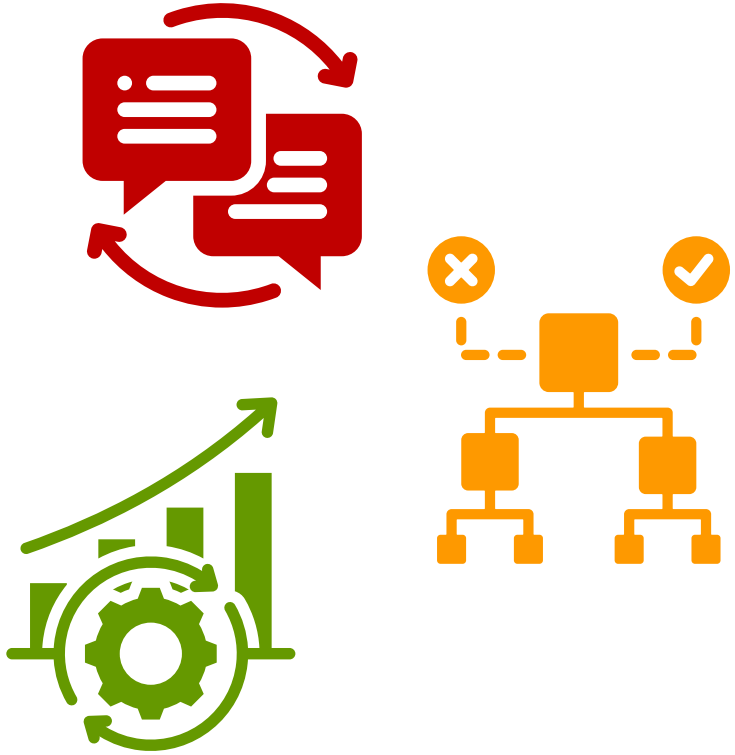
How to Connect the Dots: Governance

- Define ownership and integration points
- Document processes and change control
- Apply industry standards for data structure and quality
- **Establish a process for controlled updates to all the above**



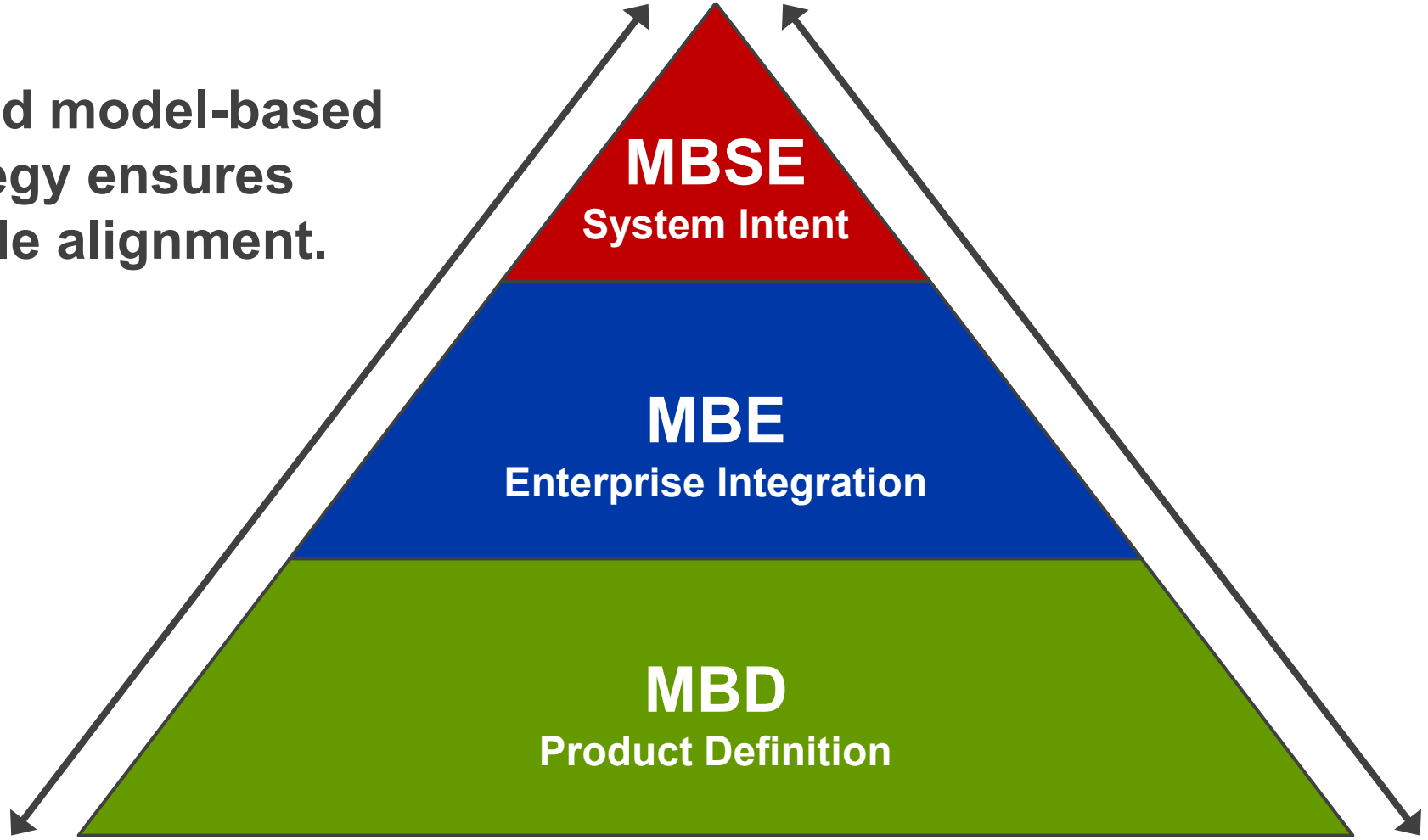
How to Connect the Dots: Make Data Actionable

- Interpret feedback data from manufacturing, inspection, and service
- Enable decisions through human review or AI
- Ensure data leads to design or process improvements



A Unified Framework: MBSE + MBE + MBD

Integrated model-based strategy ensures lifecycle alignment.



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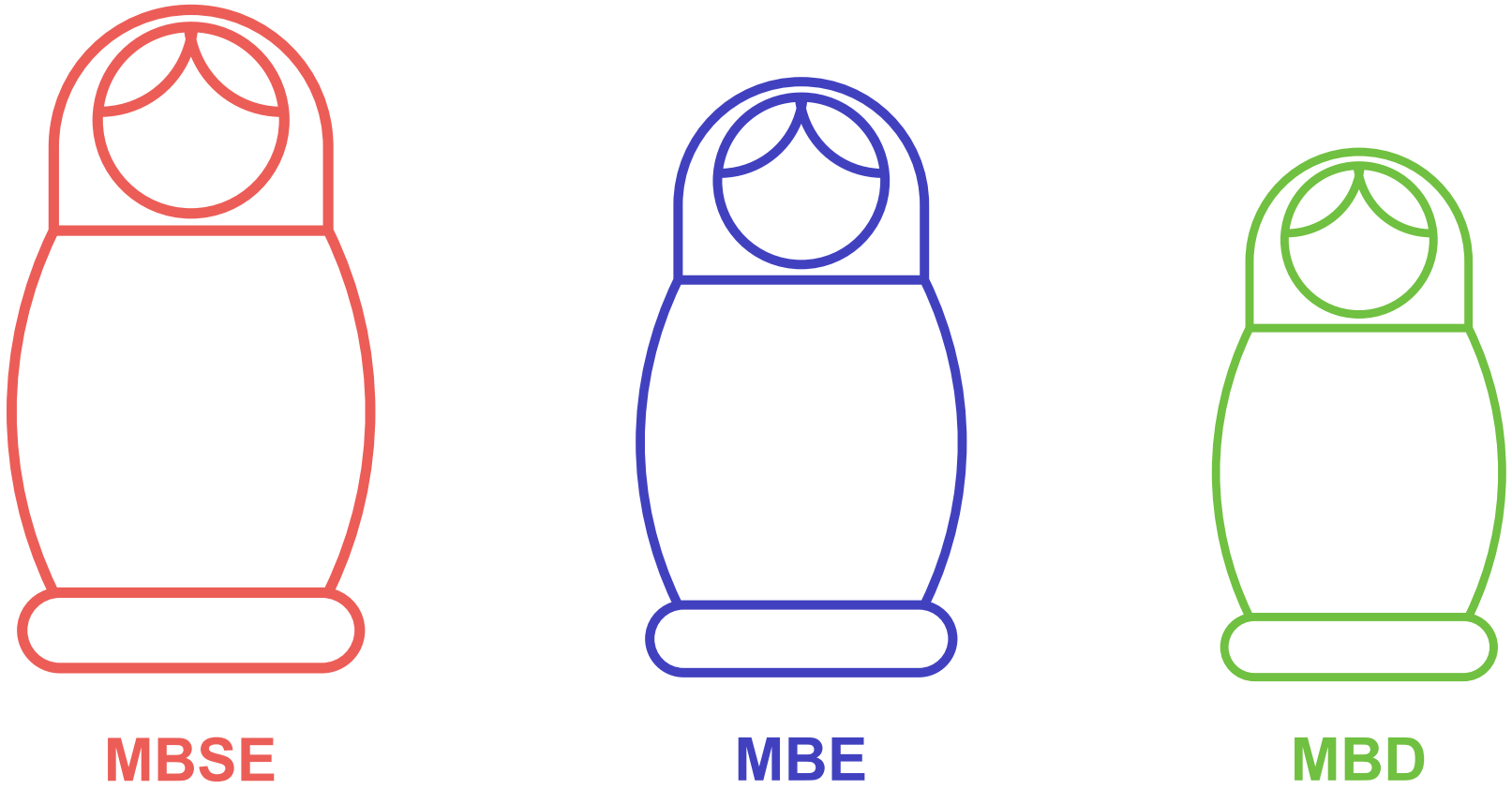

Improved quality

Faster decisions

Closed-loop validation

Traceability from concept to sustainment

Embrace connected model-based practices.

Questions?

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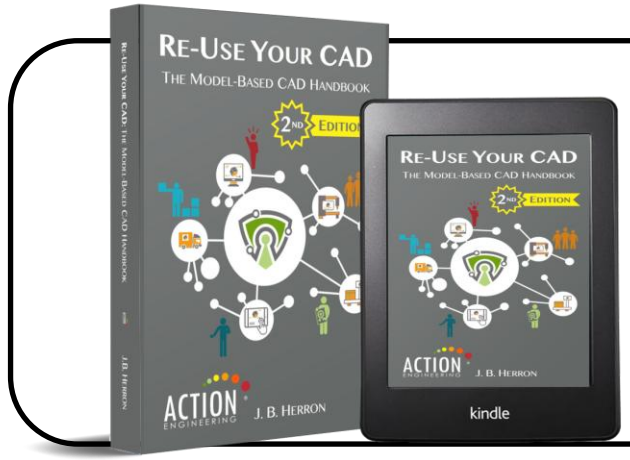
ActionEngineeringMBD



OSCAR™
Bringing MBD Within Reach

MBD Dictionary