



CIMdata  Razorleaf

WEBINAR:

Setting a
Foundation for
Model-Based Enterprise

Thursday, September 8, 2022 | 1:00 PM EST



Agenda

Section	Speaker
Introduction	Derek Neiding, Razorleaf
Common Challenges for Model-Based Enterprise	Peter Bilello, CIMdata
3 Key Capabilities for MBE Success	Jonathan Scott, Razorleaf
Q&A	All
Next Steps	Derek Neiding, Razorleaf

Today's Speakers

Derek Neiding
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Jonathan Scott
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Common Challenges for Model-Based Enterprise

Setting a Foundation for Model-Based Enterprise

September 2022

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Strategic management consulting for competitive advantage in global markets

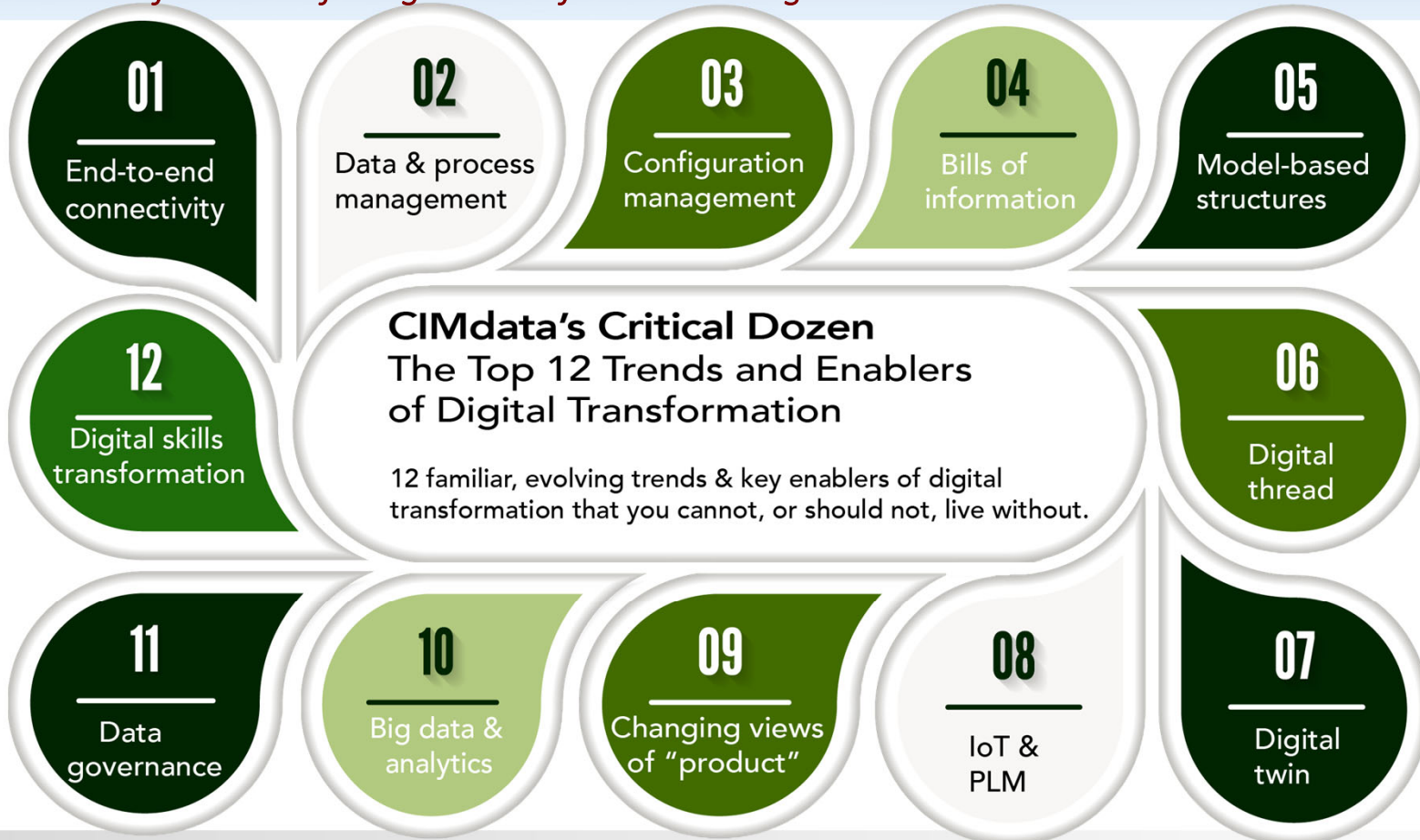


CIMdata is the leading independent global strategic management consulting and research authority focused exclusively on PLM and the digital transformation it enables.

We are dedicated to maximizing our clients' ability to design, deliver, and support innovative products and services through the application of PLM.

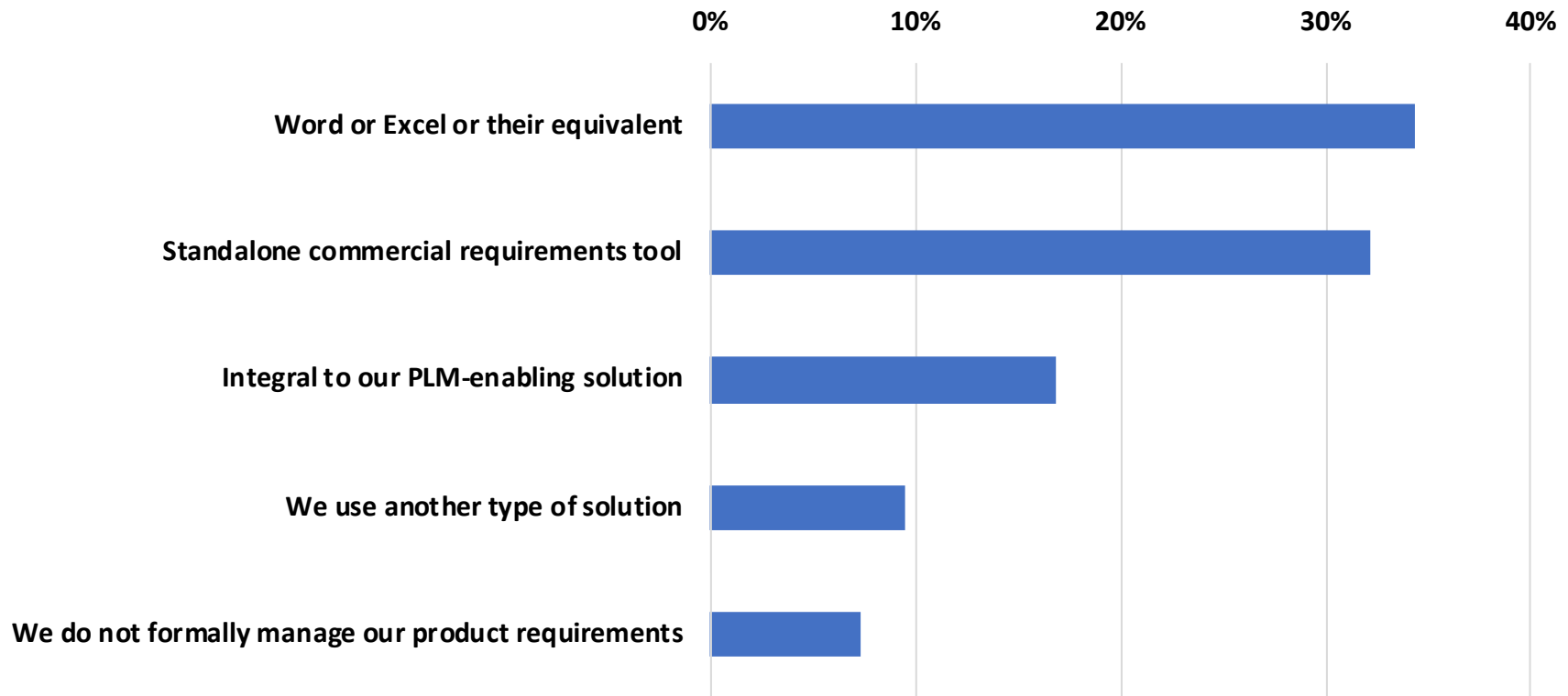
Model-Based, One of CIMdata's Critical Dozen

12 critical elements of a successful digital transformation—digitalization is at the core



By the Way...Status Quo Will Not Work

How does your organization manage your product requirements?



Defining Digitalization

Let's first get a few things straight (1 of 2)

- **Digitalization:** the administration of *digitalis* (used to treat congestive heart failure) until the desired physiological adjustment is attained—Merriam-Webster
- **Digitalization:** the use of digital technologies to change a business model and provide new revenue and value-producing opportunities; it is the process of moving to a digital business—Gartner

I think we should go with the second definition...

Defining Digitalization

Let's first get a few things straight (2 of 2)

- Fundamentally, digitalization is the logical next step in representing anything and everything in 1s and 0s—the next revolution
- Digitalization is moving from a fuzzy concept to the newest data-driven derailment of the status quo
- Digitalization is transforming products from physical goods and tangible services; in many cases data is the “product”
- The rate at which products and services are being bought and installed for the data they generate or collect is increasing
- New sources of information are speeding up innovation and product development

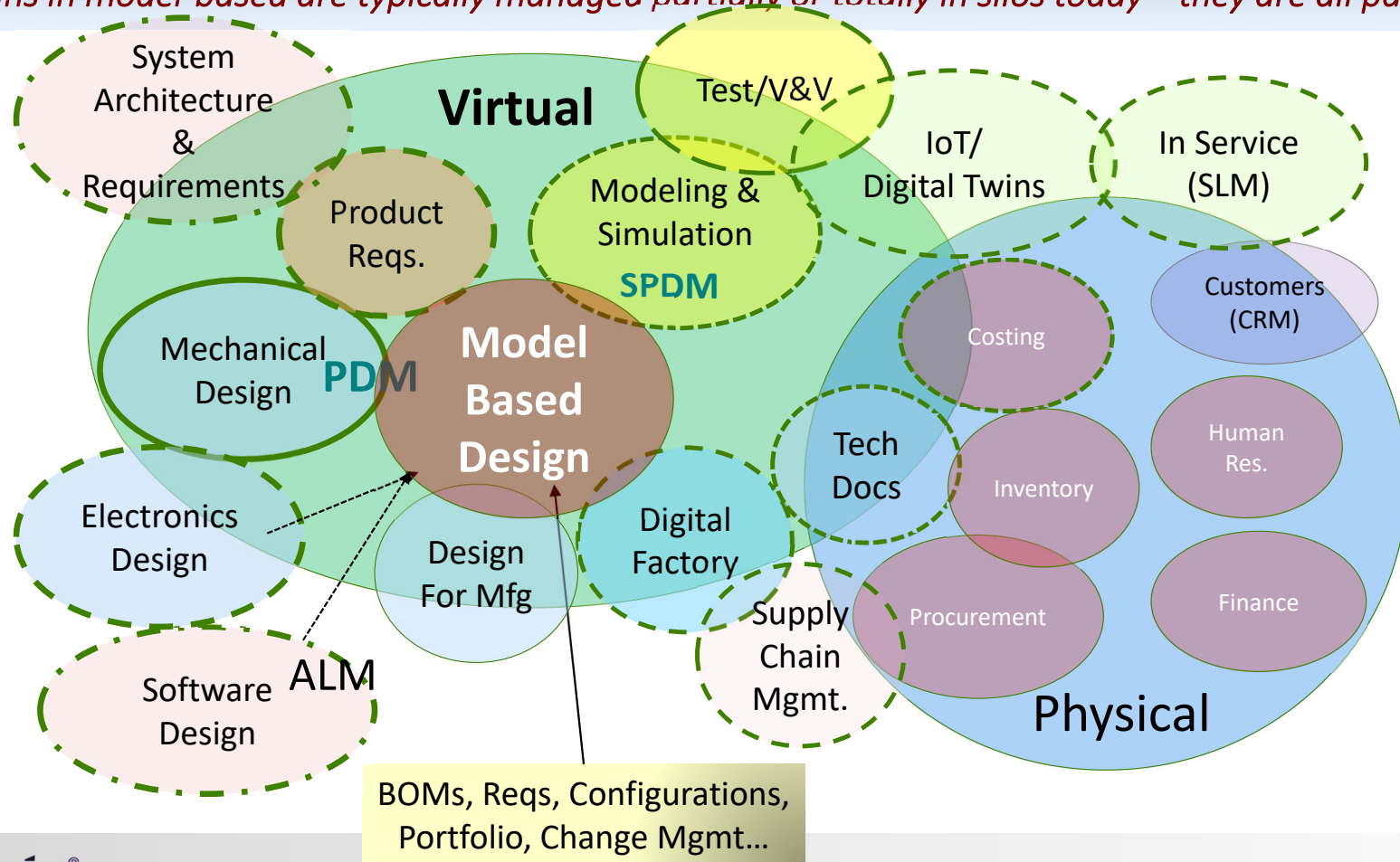
#5: Model-Based Structures

Overlapping & somewhat confusing terminology used by industry today—the acronym war isn't helping anyone

- **Model-Based Enterprise (MBE)** – “a vision to transform an enterprise’s engineering, manufacturing, and aftermarket services through product data reuse and derived context, rather than interpreting inputs and recreating the models and drawings.”
- **Model-Based Systems Engineering (MBSE)** – “the formalized application of modeling to support system requirements, design, analysis, verification and validation activities beginning in the conceptual design phase and continuing throughout development and later life cycle phases.”
- **Model-Based Engineering (MBE)** – Integrated use of models to define the system technical baseline across the full life cycle, across all disciplines, across all program members [models are the authoritative definition of the system]
- **Model-Based Definition (MBD)** – The practice of using 3D models (i.e., solid models, 3D PMI and associated metadata) within 3D CAD software to define (provide specifications for) individual components and product assemblies.
- **Model-Based Design (MBD)** – “A mathematical and visual method of addressing problems associated with designing complex control, signal processing and communication systems as applied in the design of embedded software.”

#5: Model-Based Structures

Key domains in model-based are typically managed partially or totally in silos today—they are all part of an MBE



A Model-Based Enterprise Framework

Seven levels of MBE as defined by the Next-Generation Model-Based Enterprise Maturity Index

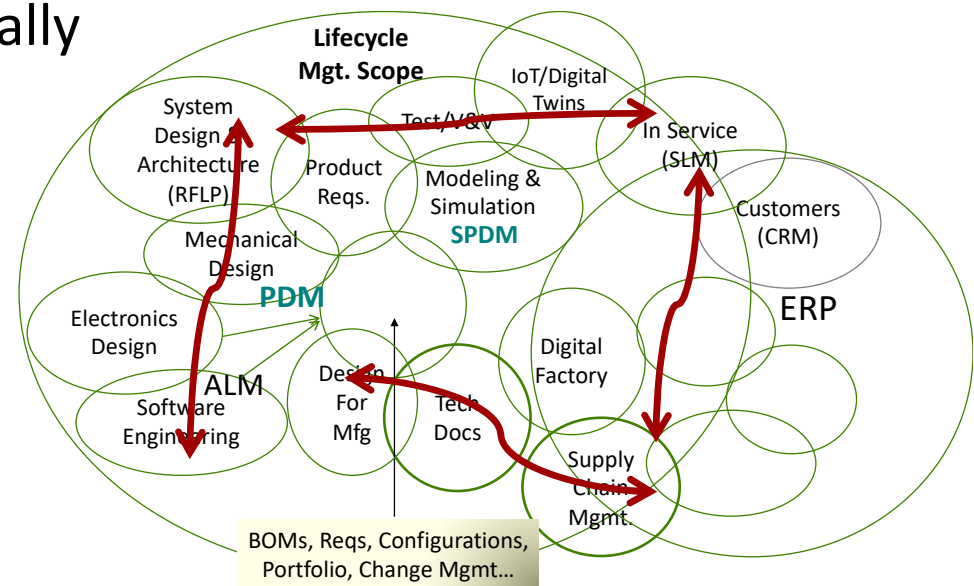
Drawing-Centric	Model-Centric	Validated Model-Centric	Formalized Model-Based Definition	Trusted Model-Based Definition	Integrated Model-Based Enterprise	Extended Model-Based Enterprise
Level 0	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6
<ul style="list-style-type: none"> • 2D Static Drawings Only • Models ad-hoc • Models not managed • Disconnected manufacturing / disconnect enterprise 	<ul style="list-style-type: none"> • 3D models create 2D drawings • STEP AP203 derivative • CAX STEP & 2D drawings • Models may be managed 	<ul style="list-style-type: none"> • 3D models create drawings & derivatives • Model checked and derivative compared & managed • Certificate of model quality • CAX derivatives w/2D drawings • Model images 	<ul style="list-style-type: none"> • Model-based definition (3D PMI, metadata) • 3d interactive viewable • 3D technical data packages • Lightweight viewing • MB animation • MBD, derivative & CAX managed 	<ul style="list-style-type: none"> • Model-based definition • Digital manufacturing certificate • LOTAR • 3DIV, 3D TDP, TDP deployed from PLM • TDPs used • Integrated mfg. 	<ul style="list-style-type: none"> • Model-based Enterprise • Model-based definition w/product characteristics • Auto MBD/TDP deployment to internal operation • LOTAR+ • Integrated mfg. 	<ul style="list-style-type: none"> • Model-based Enterprise • Model-based definition w/product requirements • Authenticated digital exchange • Auto MBD/TDP deployment to external operation • Integrated mfg.
File-Sharing	Doc-Centric PDM	Doc-Centric PDM	Part-Centric PLM	Part-Centric PLM	Digitally "1" PLM	Extended PLM
2D Drawings Authorized	2D Drawings Authorized	2D Drawings Authorized	2D Drawings Authorized	3D Model Authorized	3D Model Authorized	3D Model Authorized
<i>Design Activities</i>						
<i>Product Data Management Activities</i>						
<i>Manufacturing Activities</i>						
<i>Quality Activities</i>						
<i>Enterprise Enabling Activities</i>						

#6: Digital Thread

CIMdata's preferred definition

- **Digital Thread** refers to the communication framework that **connects data flows**, which can be used to produce an integrated and holistic view of an asset's data from physical and virtual systems (i.e., its digital twin) throughout its lifecycle across traditionally siloed functional perspectives.

Digital thread is enabled and supported by a robust end-to-end and connected systems model and MBSE processes

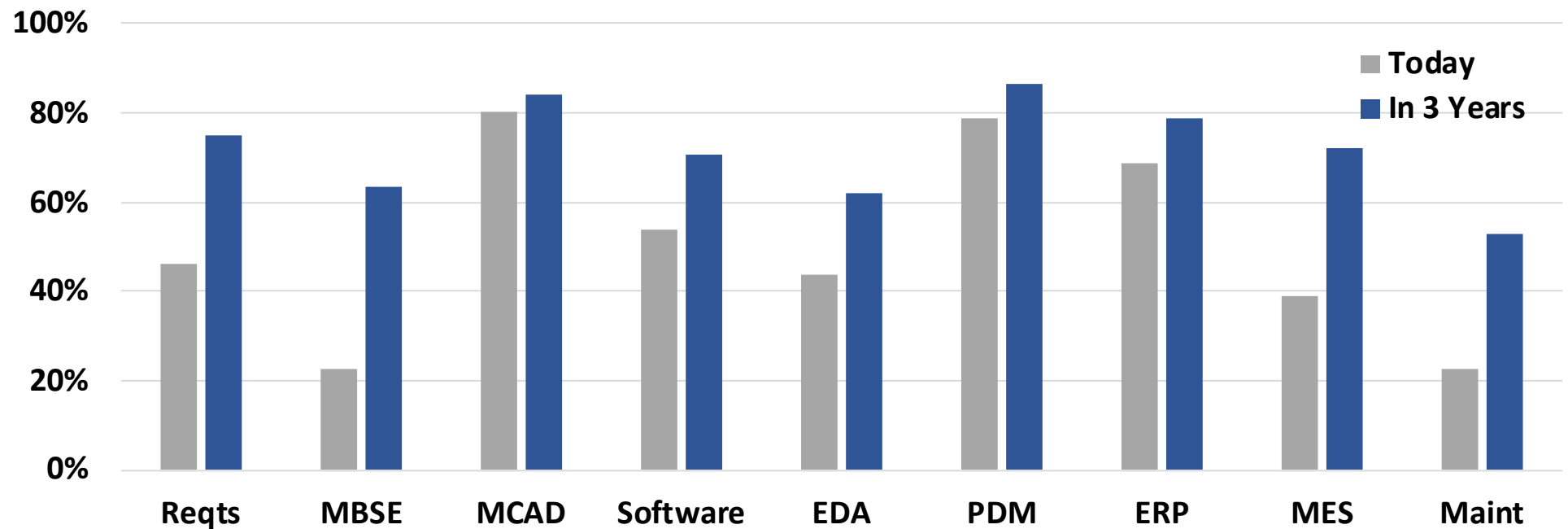


Extracted from: https://www.dodmantech.com/ManTechPrograms/Files/AirForce/Cleared_DT_for_Website.pdf

Also see: <http://www.manufacturing-operations-management.com/manufacturing/2016/04/what-is-the-digital-thread-and-digital-twin-definition.html>

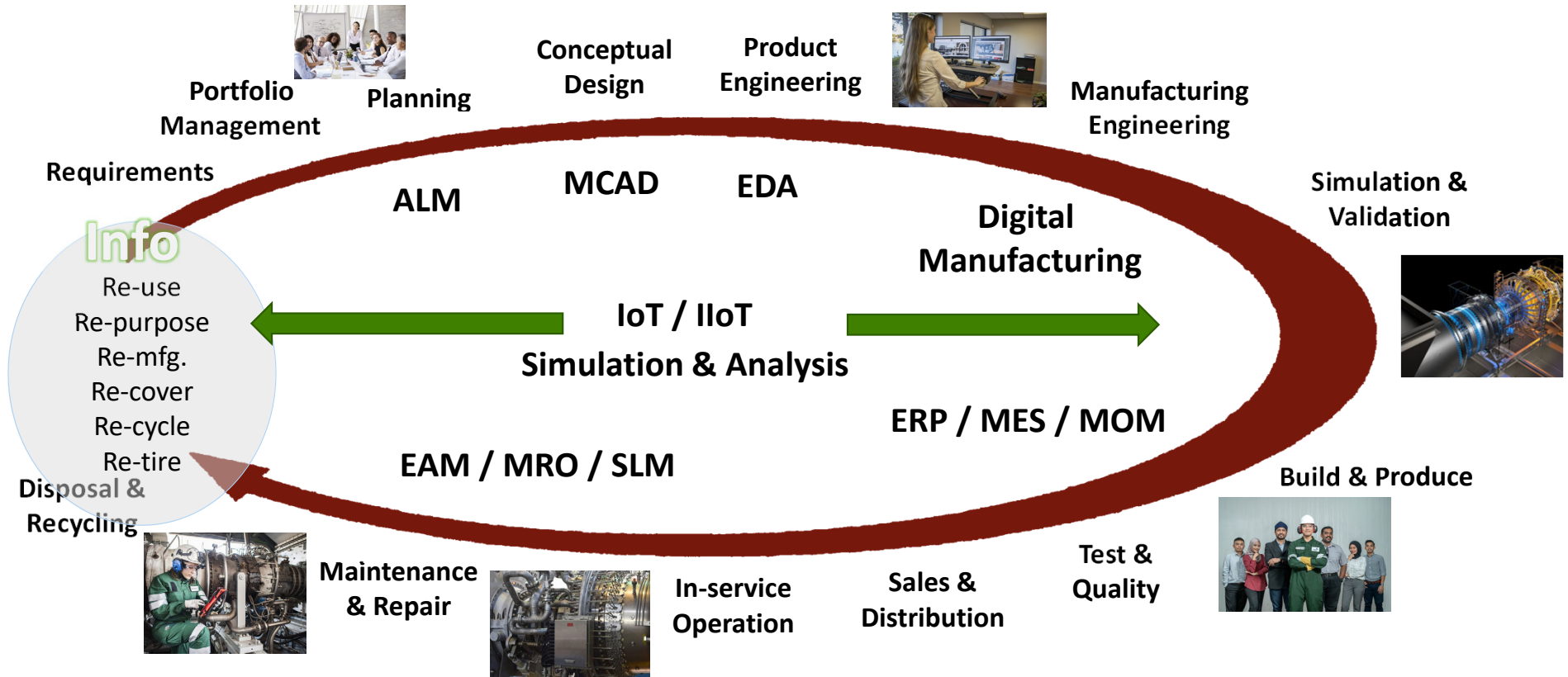
Breadth of the Digital Thread

What types of software offerings are contributing to your digital thread today? In three years?



Building the Digital Thread: Integration is Required

Integration across many applications, each often focused on a part of the lifecycle – not an exhaustive list!

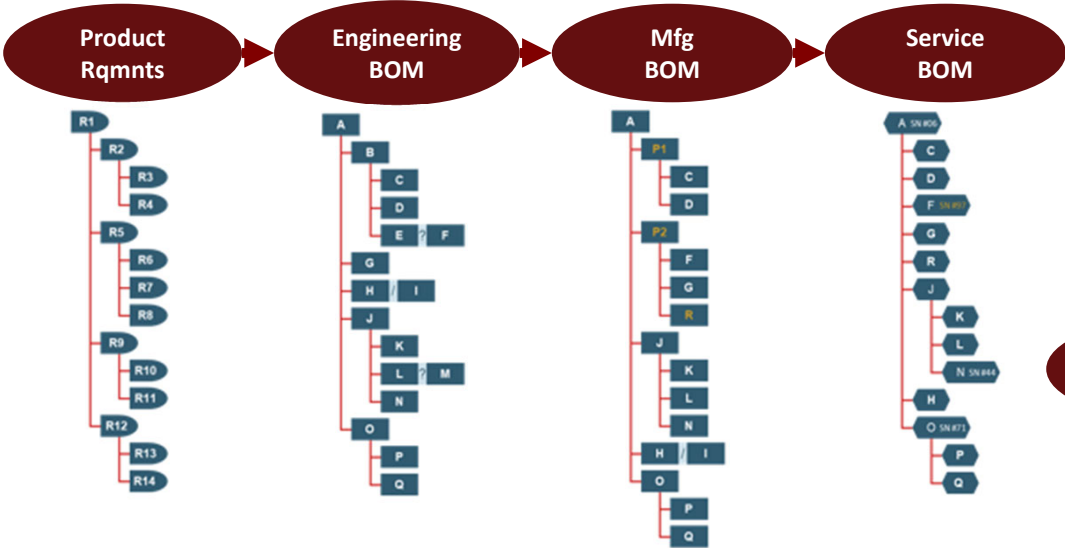


PLM Solutions—Information Management across Media, Process, Time, Geography & Enterprise

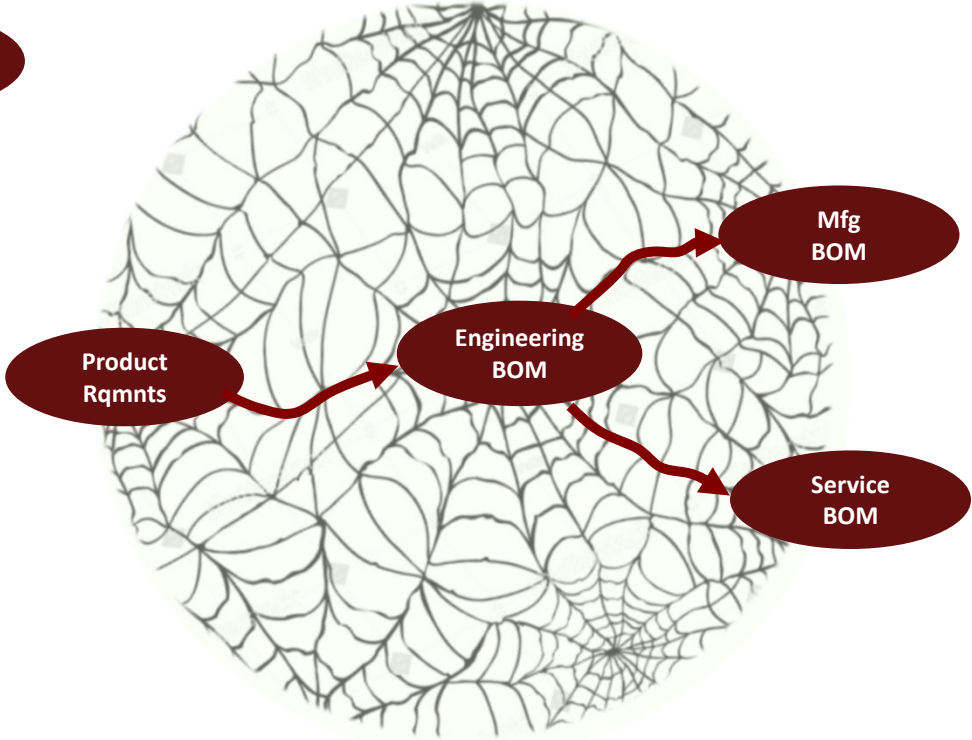
Lifecycle Product Structures

Connections between the four principal product structure configurations – Thread vs. Web

Product Lifecycle Timeline Sequence (Thread)

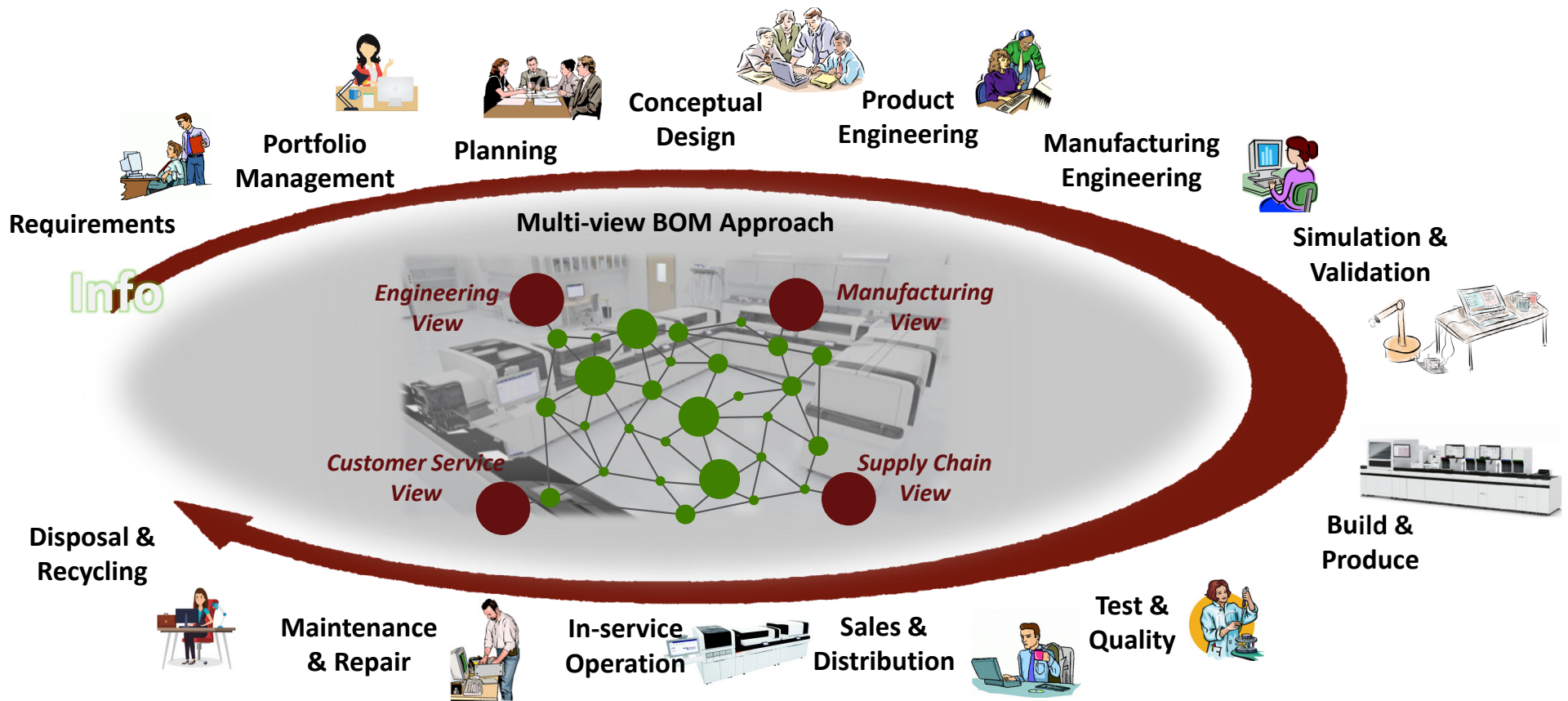


Derivative Dependencies (Web)



Enabling the Digital Web & Digital Twins

Over the last 3- to 5-years, commercial PLM solutions have advanced to enable the Digital Thread & Twins



#7: Digital Twin

An accurate digital representation of your products and/or services at any point throughout the lifecycle

- A **virtual representation** (i.e., digital surrogate) of a physical asset or collection of physical assets (i.e., physical twin) that exploits data flow to/from the associated physical asset(s).

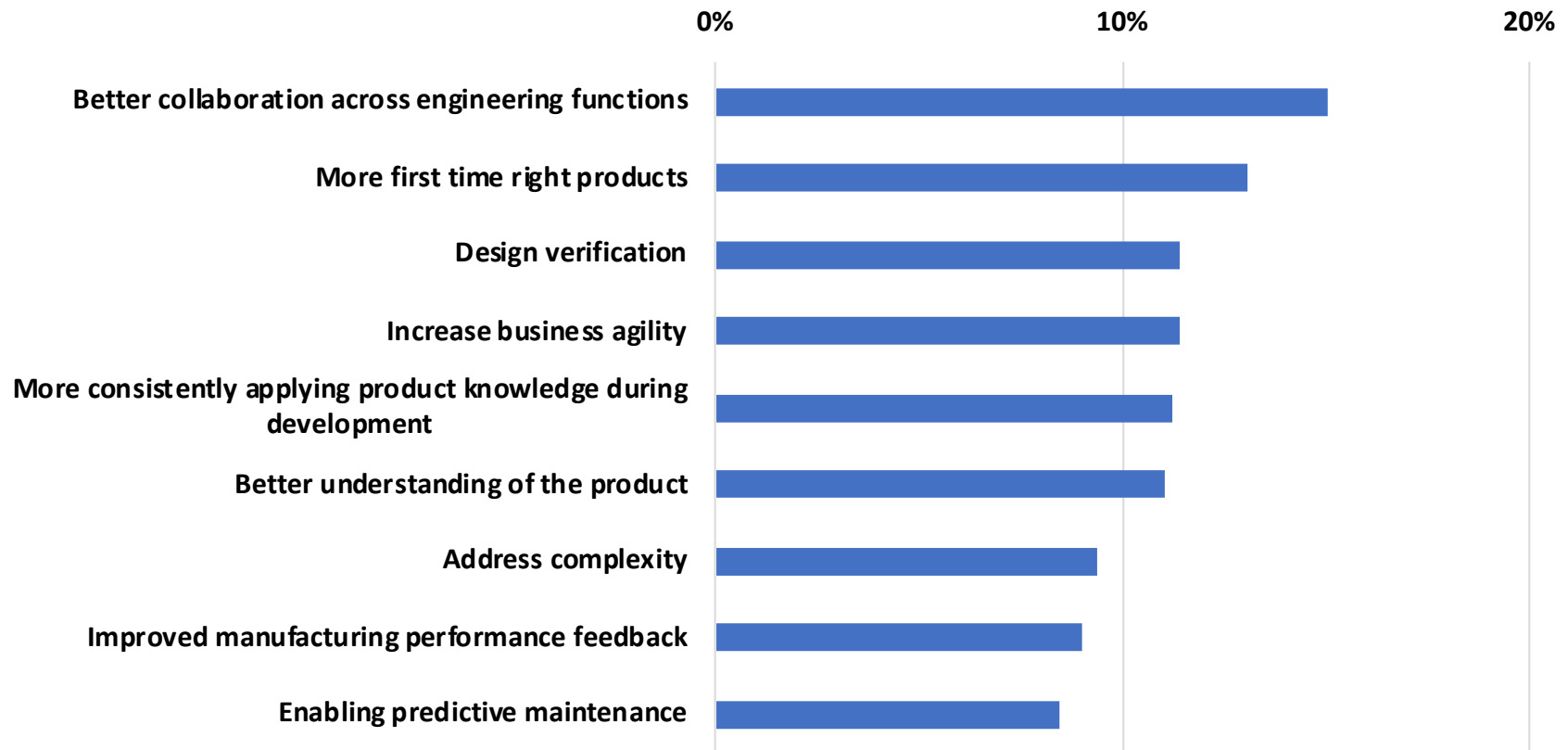


Digital twin is enabled and supported by a robust end-to-end and connected systems model and MBSE processes

*Adapted from input from ASSESS (see www.assessinitiative.com)

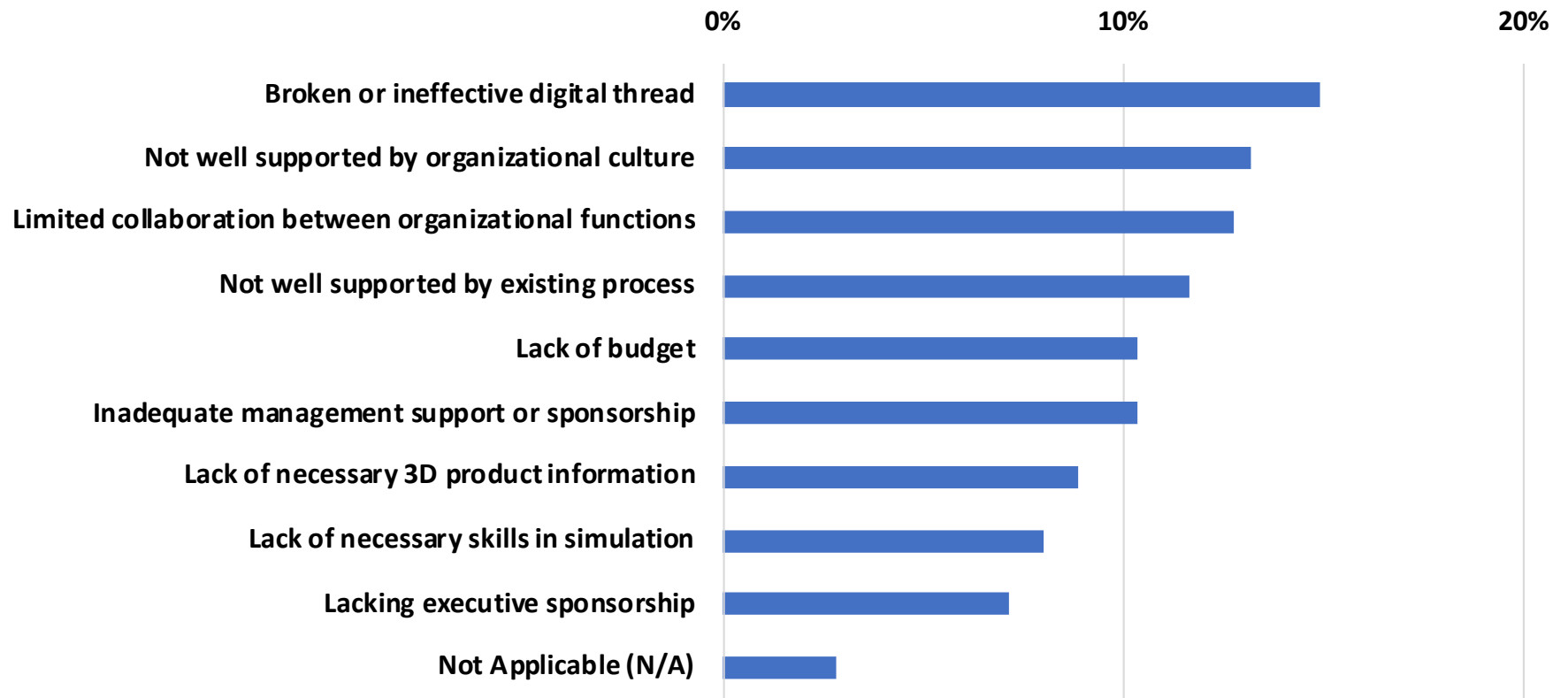
Expected Digital Twin Benefits

What benefits from digital twins does your organization expect?



Unfortunately, There Are Digital Twin Roadblocks

What factors will need to be overcome to enable your organization to reach its digital twin vision?



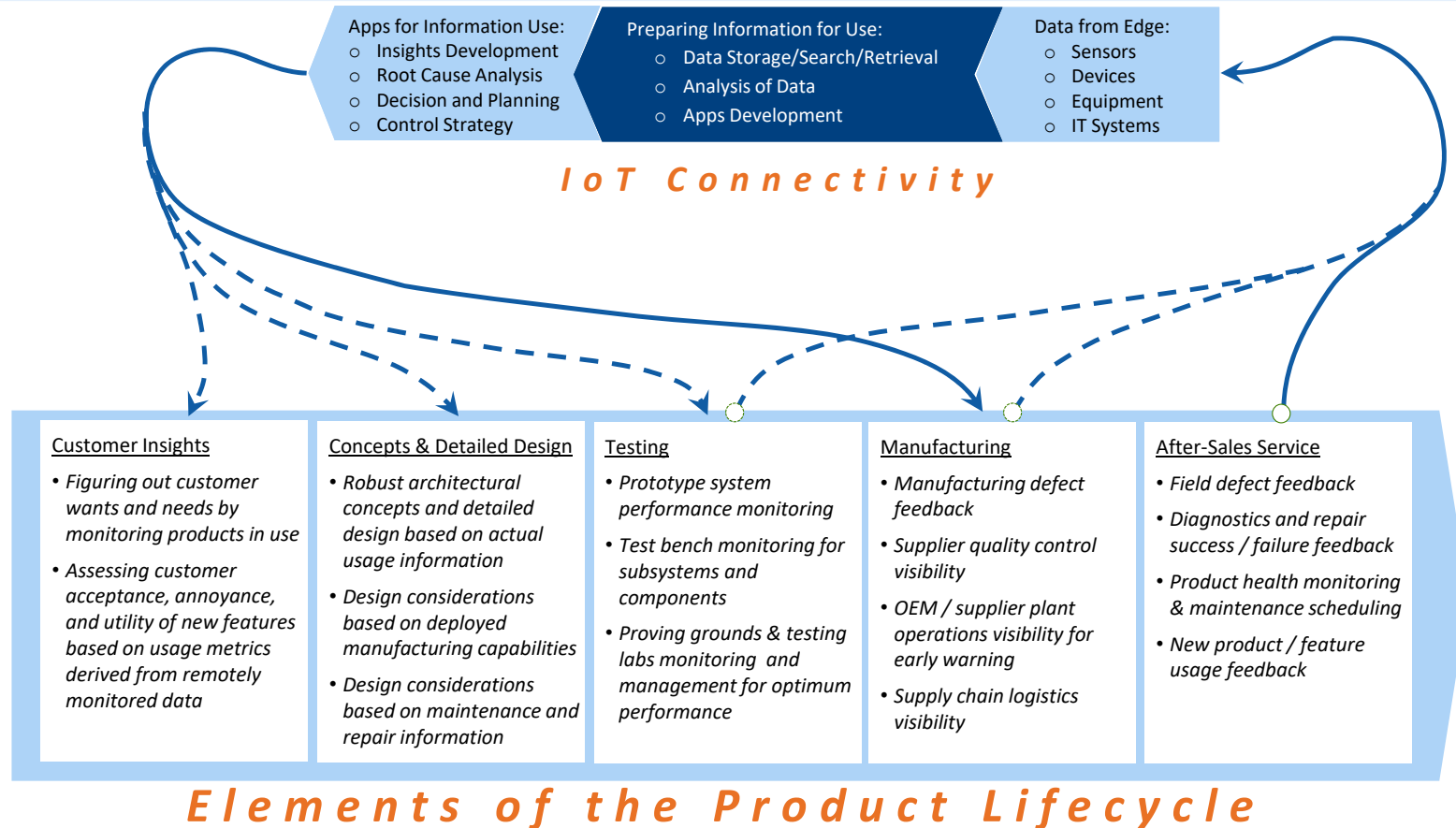
#8: IoT & PLM

Successful IoT enabled strategies require a strong PLM foundation

- A truly successful IoT strategy requires far more than collecting and analyzing data, and taking an action on it
 - Products can benefit from it all through their lifecycle
 - The why of Industrial Internet of Things (IIoT) seems clear and solid, but the what and how aren't...
 - Our research shows that success typically requires the ability to work cross-functionally – across IT, analytics, and business groups – to drive process transformation not just at the front end, such as in the field, but all the way across the middle and back office that support the front in scalable ways
- (Genpact Research Institute, 2016)*
- PLM acts as the cross-functional process and data backbone, a necessary requirement for success in IoT-enabled strategies

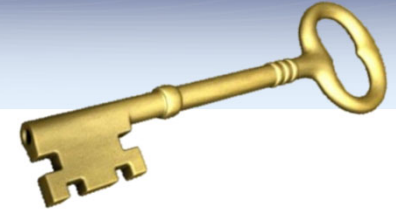
Again...Integration Enables Connectivity

Product & process innovation, efficiency & quality—the opportunities provided are numerous



Keys to Success

Important aspects and issues based on CIMdata's experience and research



- Use a broad vision and approach
 - People want a business solution, not another system
- Educate senior management & initial team
- Support and do not undermine company culture
- Select a partner; someone who understands your business needs and has a proven solution and track record
- Scope should be well defined and understood
- Use pilot projects; the key to success
 - Pilots per discipline, or department are often possible

Success = vision + organization + process + provider(s) + approach + environment

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Three Key Capabilities for MBE Success

Jonathan Scott



3 Key Capabilities for MBE Success



Maturing the Digital Thread



Data Exchange and Integration



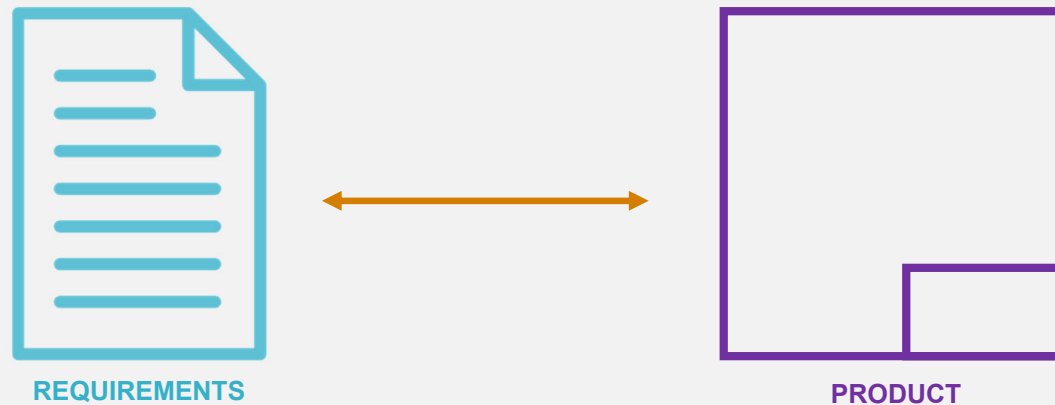
Organizational Change Management

Maturing Digital Thread

- Digital Thread value is independent of being model-based
- Digital Thread must be matured to achieve MBE:
 - Add more relevant nodes to the thread
 - Expose details of existing nodes (granularity and models)
 - Connect sub-nodes with strands (pieces of the thread)
 - Semantically enrich sub-nodes (smarter data)
 - Reuse rich data to create models

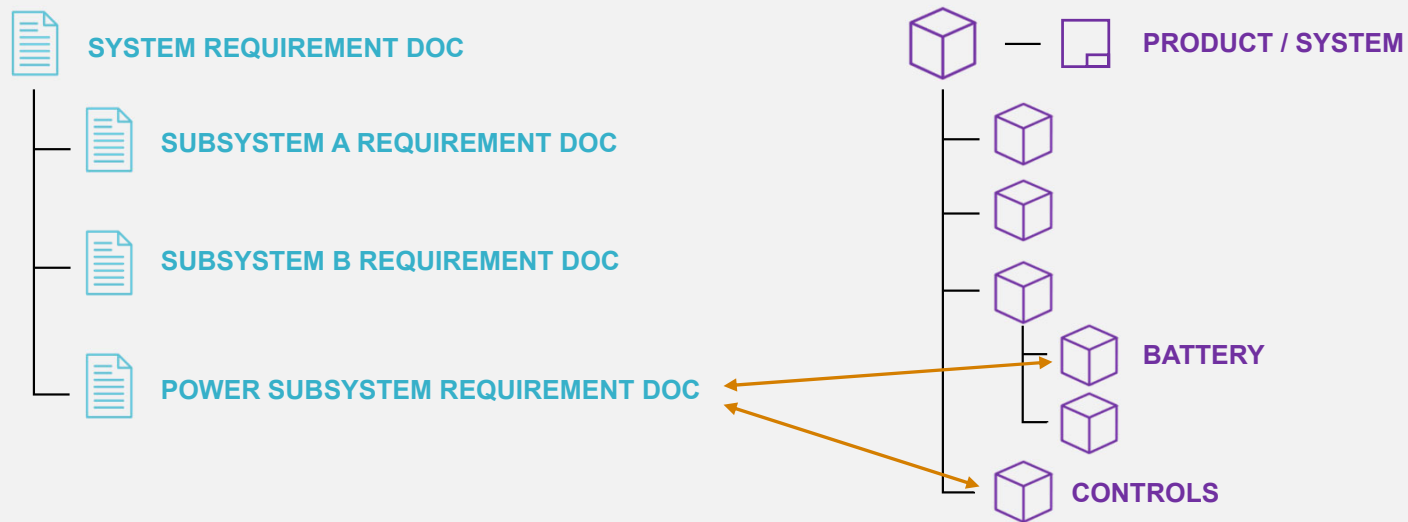
Maturing Digital Thread Example: Stage 1

- Weak thread
- General association of data
- Pseudo-digital



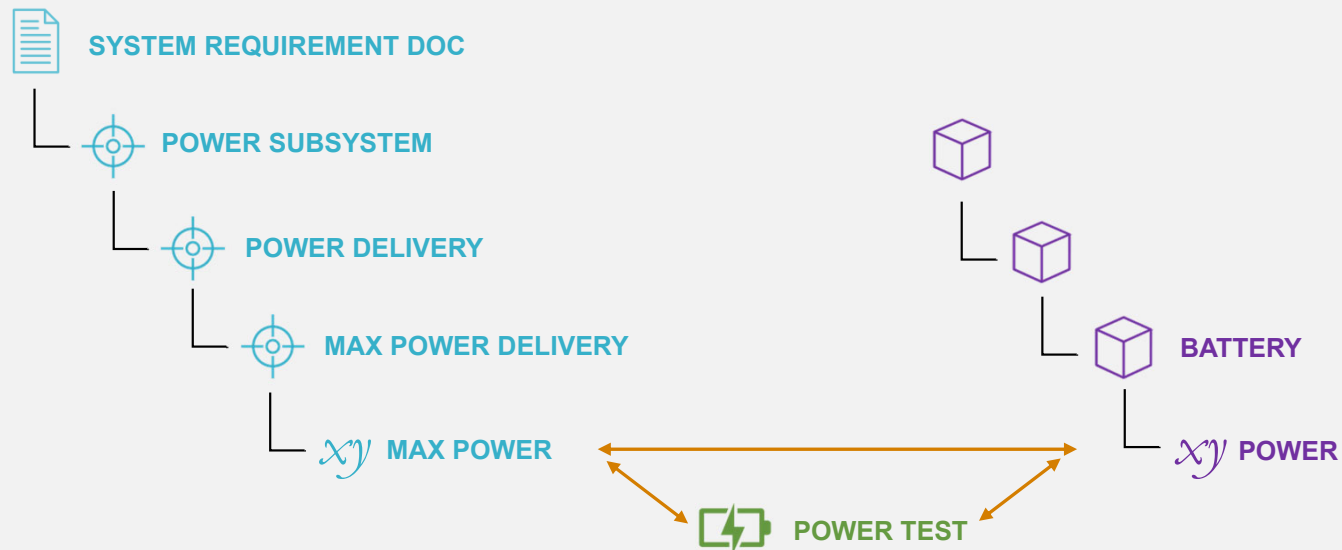
Maturing Digital Thread Example: Stage 2

- Stronger thread, multiple strands
- More specific connection of data
- True digital connection



Maturing Digital Thread Example: Stage 3

- Strong thread composed of many strands
- Granular, atomic data connections
- Multi-directional thread builds out a web

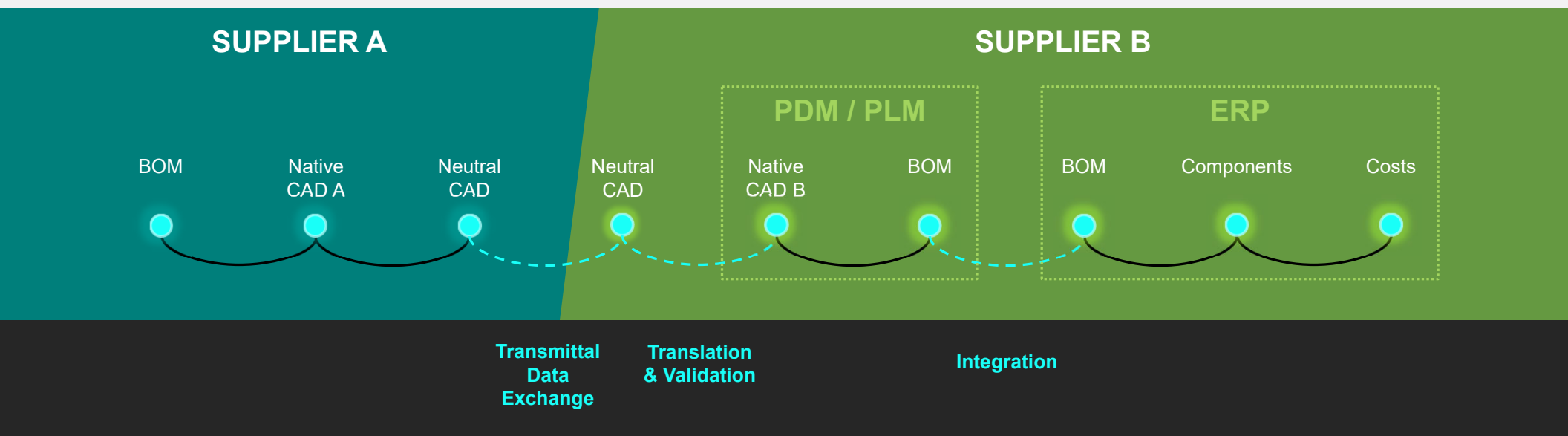


Data Exchange and Integration

Digital thread extension across *borders*

- System integration to cross system boundaries
- Translation, validation, and integration to cross groups/functions
- Data exchange via transmittals to cross organizations

Data Exchange and Integration Example



Organizational Change Management

This is a BIG change.



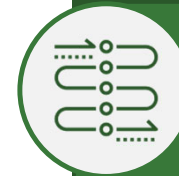
With Model Based Enterprise we're changing:

- How large parts of the internal organization operate
- How the organization works with partners and suppliers



Models are different:

- Models are specialized, complex, digital things
- Models can't be handled like electronic documents



Models are dynamic:

- Models don't fit the sequential paradigm of many business processes
- Models are constantly evolving, like code

Organizational Change Management

People won't change without:

A

D

K

A

R

Awareness

Introduction of model concepts and benefits

Desire

Understanding of why the organization needs models

Knowledge

Education on new model-based ways of working

Ability

Specific training to incorporate new tools and processes

Reinforcement

Support from all directions: technical, management, etc.

Organizational Change Management

What does MBE look like without successful OCM?

"I don't know why we're doing this new model thing; the drawing is good enough."



Confusion

"Engineers always overcomplicate things."

"I gave you all of the information, you just don't know how to look at it."



Frustration

"The supplier just tripled their price on the same part they quoted last month because we didn't send a drawing."



Sabotage

Organizational Change Management

The shift from documents to models is:

- easy for domain experts, but...
- difficult for those consuming information

Once non-experts understand the value of models and learn how to access and leverage them, ...the whole enterprise is more efficient & effective.



Alignment



Communication



Education
(on concepts)



Training
(on tools & processes)



Ongoing Support

3 Key Capabilities for MBE Success



Maturing the Digital Thread



Data Exchange and Integration



Organizational Change Management



Q&A



Continue to Join Us!

Free Digital Thread Assessment

www.razorleaf.com/digital-thread-assessment/

What's Next?

1. Give us a call, we are here to help.
2. Self-diagnose with the online assessment.
3. Stay tuned for more technical tips we will send participants and sign up for our newsletter.
4. Watch for our next MBE webinar in Q4.

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