

Multi-view BOM Value Potential

PLM Road Map @ GPDIS

The Digital Thread is Really a Web, with the Engineering Bill of Materials at Its Center

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James Roche, Executive Consultant, A&D Practice Director
Email: j.roche@CIMdata.com
Tel: +1.734.668.9922
#PLMWebinar

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The Digital Thread – Current State, Future

Direction

Introduction

- Driving Influences for Digital Thread Design
- Laying Out a Digital Thread Design
- Case Study
- A&D PLM Action Group Collaborative Research with PLM Solution Providers
- Concluding Remarks
- Q & A

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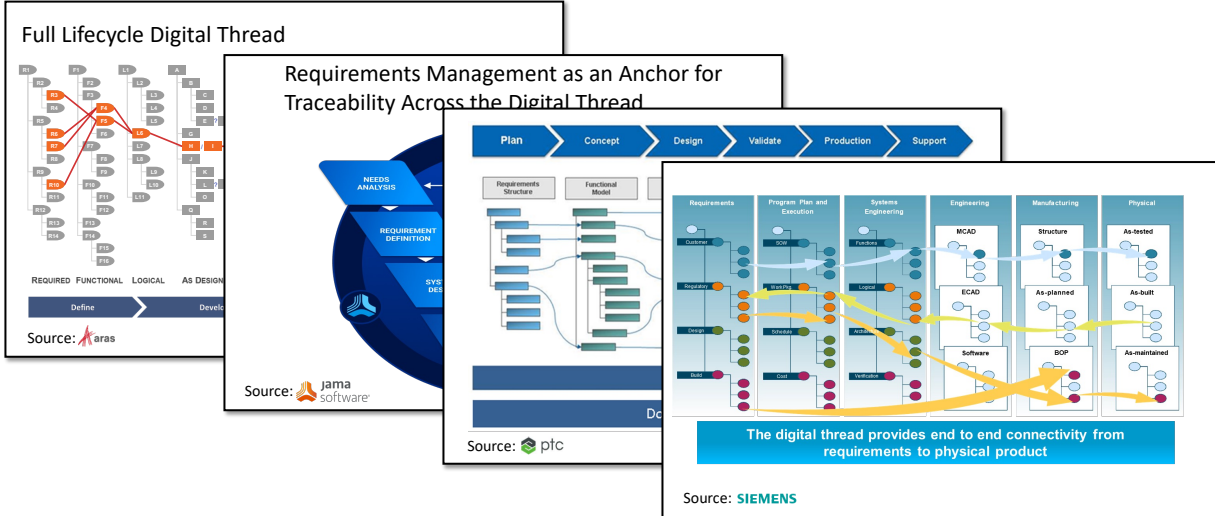
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Digital Thread Comes of Age

With recent advances in commercial PLM solutions, the Digital Thread has become technically feasible



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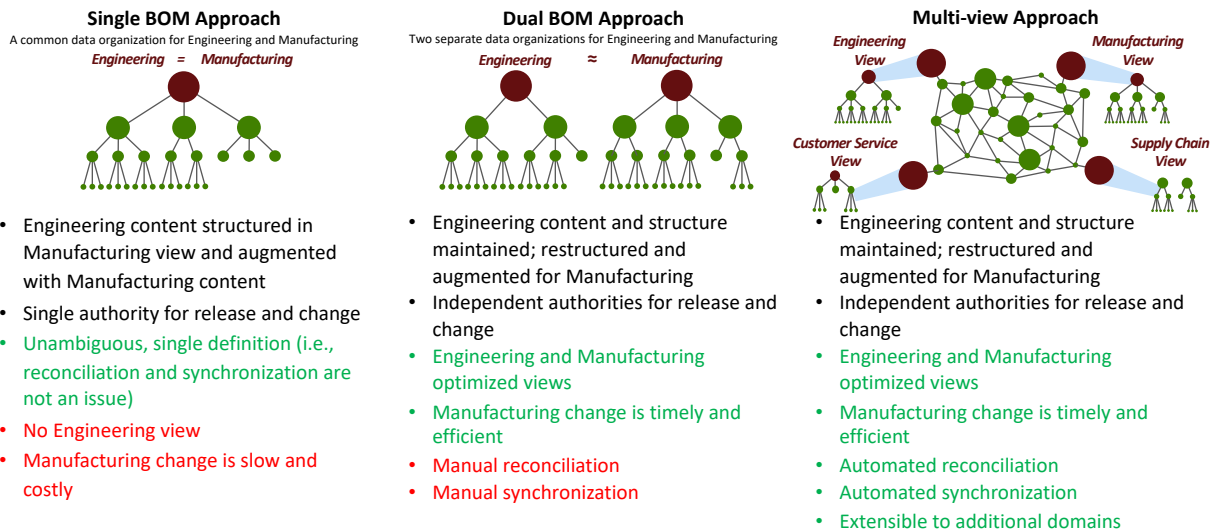
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Multi-view Approach is Core to Digital Thread

BOM Management Concepts – Three approaches to managing the transition of BOM definition



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Agenda

- Driving Influences for Digital Thread Design
 - Systems Engineering
 - Program Planning & Control
- Laying Out a Digital Thread Design
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Systems Engineering

A driving influence for the digital thread

Systems Engineer

The systems engineer should develop the skill for identifying and focusing efforts on assessments to **optimize** the overall design and not favor one system/subsystem at the expense of another while constantly **validating** that the goals of the operational system will be met.

Source: NASA Systems Engineering Handbook

Optimization

Finding an alternative with the most cost effective or highest achievable performance under the given constraints, by maximizing desired factors and minimizing undesired ones.

Source: BusinessDictionary.com

Validation

Showing that the product accomplishes the intended purpose in the intended environment—that it meets the expectations of the customer and other stakeholders as shown through performance of a test, analysis, inspection, or demonstration.

Source: NASA Systems Engineering Handbook

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Systems Engineering

Methods Maturity (1 of 2)

Level 1 – Requirements analysis and design

Optimization in the judgement of a good designer

Level 2 – Modeling and simulation

Simulation and trade studies to support requirements analysis and design alternatives evaluation

Level 3 – Modeling and simulation with physical validation

Simulation and trade studies to support requirements analysis and design alternatives evaluation, and testing for validation and certification

Level 4 – Modeling and simulation with virtual validation

Application of modeling to support system requirements, design, analysis, verification and validation

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Systems Engineering

Why "Functional" analysis?

The functional model is the link between requirements and physical design

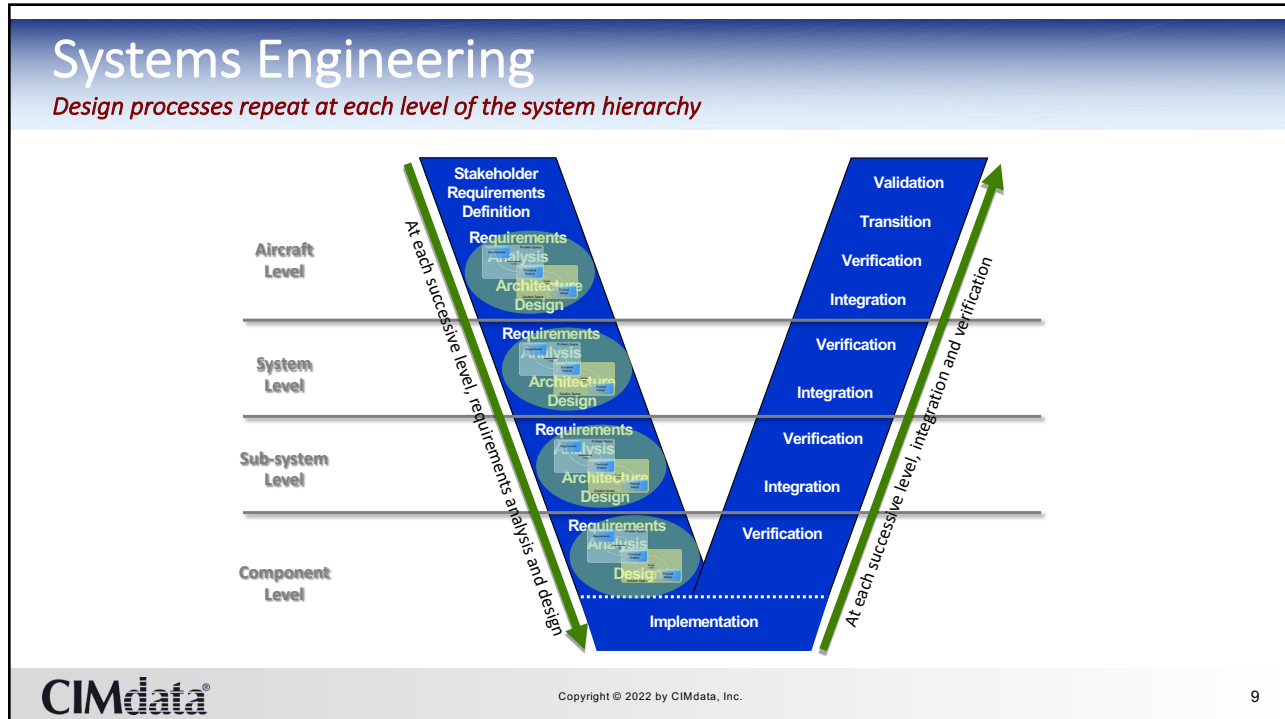
Source: G. Esdras and S. Lisouët-Hanke, Bombardier Product Development Engineering, Aerospace, Montréal QC, ~2014

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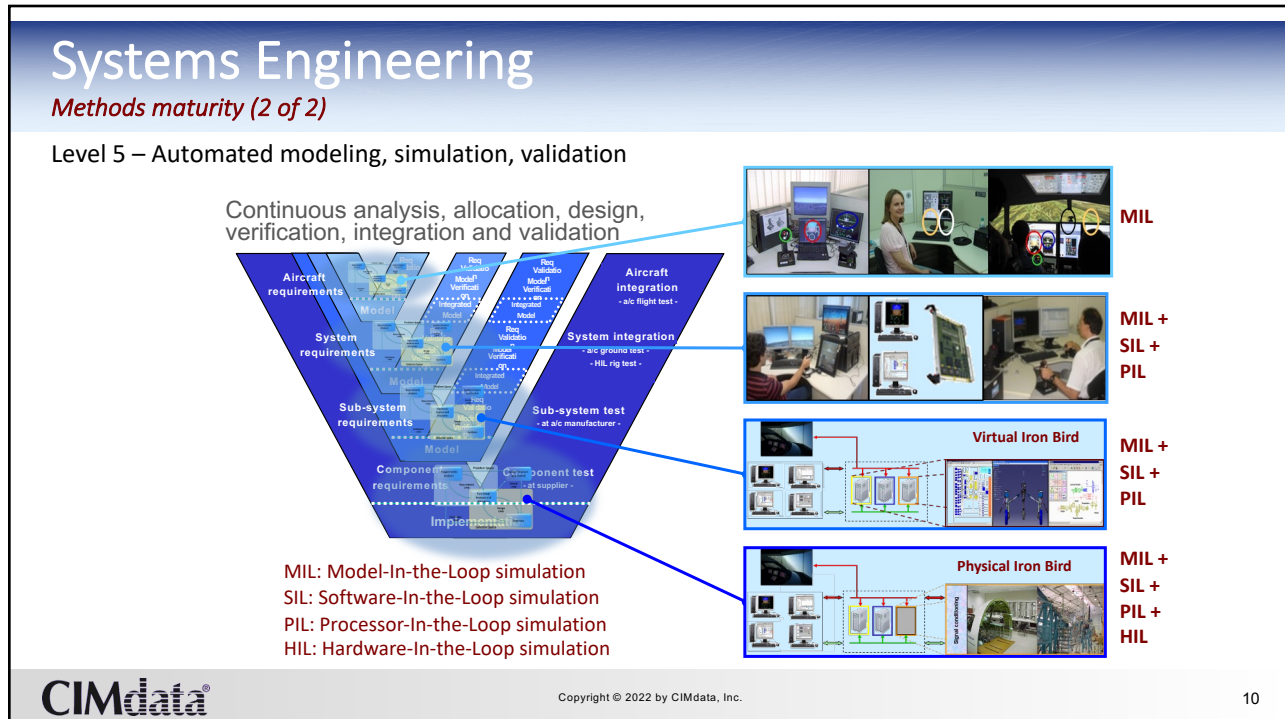
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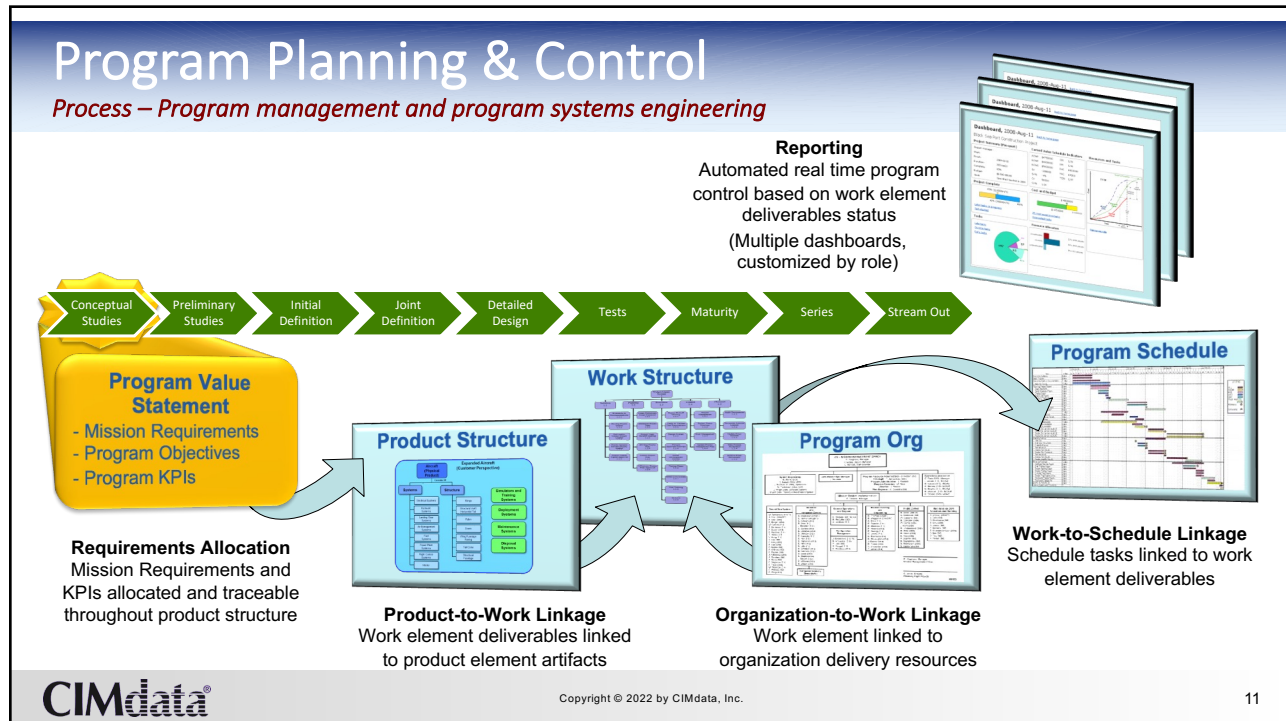
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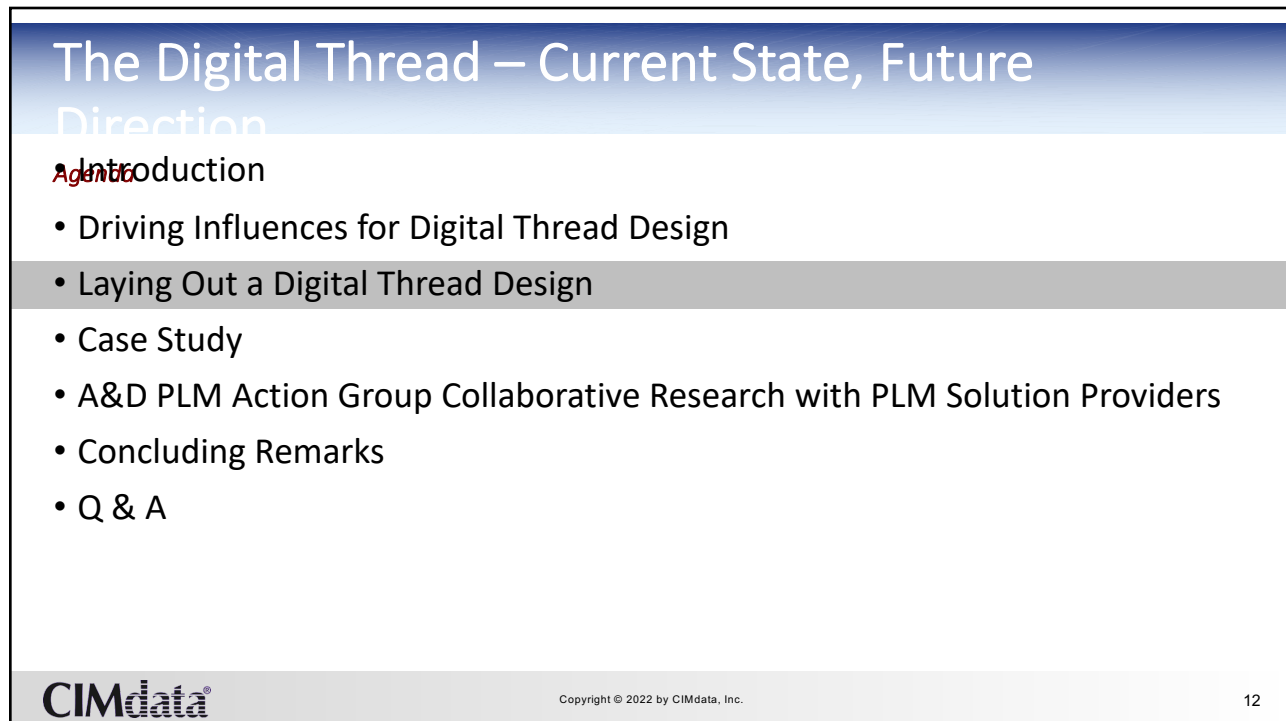
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Lifecycle Product Structures

Framework for the Digital Thread

Product structure is the organizing construct for the data sets that define and are associated with the product definition throughout its lifecycle. There are many views by which these data sets can be combined and configured. Examples of Lifecycle Product Structures include

- Requirements data
 - Functional and logical data
 - Engineering data (i.e., eBOM)
 - Simulation data
 - Test data
 - Purchasing data
 - Manufacturing data (i.e., mBOM)
 - Service data (i.e., sBOM)
 - Sales data
- and many others, including variants, such as as-built and inspected data



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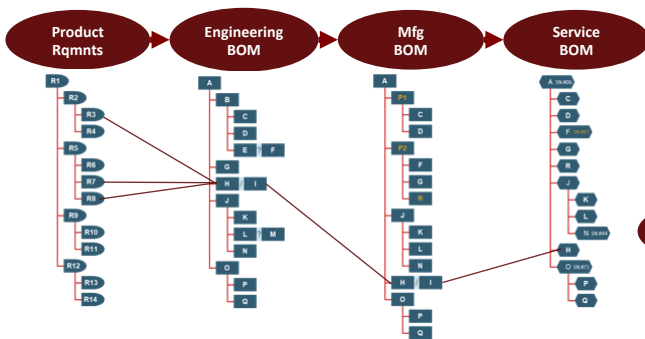
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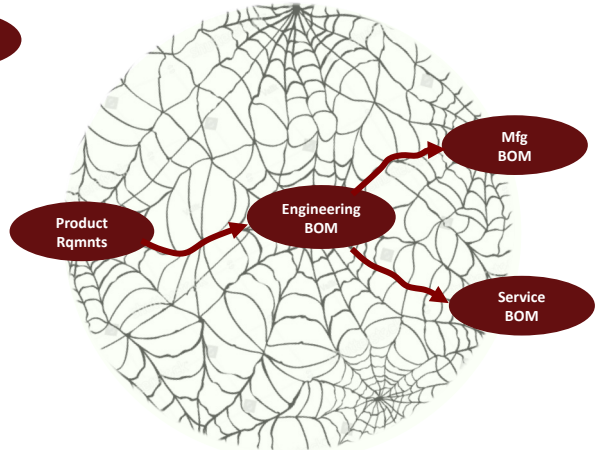
Lifecycle Product Structures

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

Product Lifecycle Timeline Sequence (Thread)



Derivative Dependencies (Web)



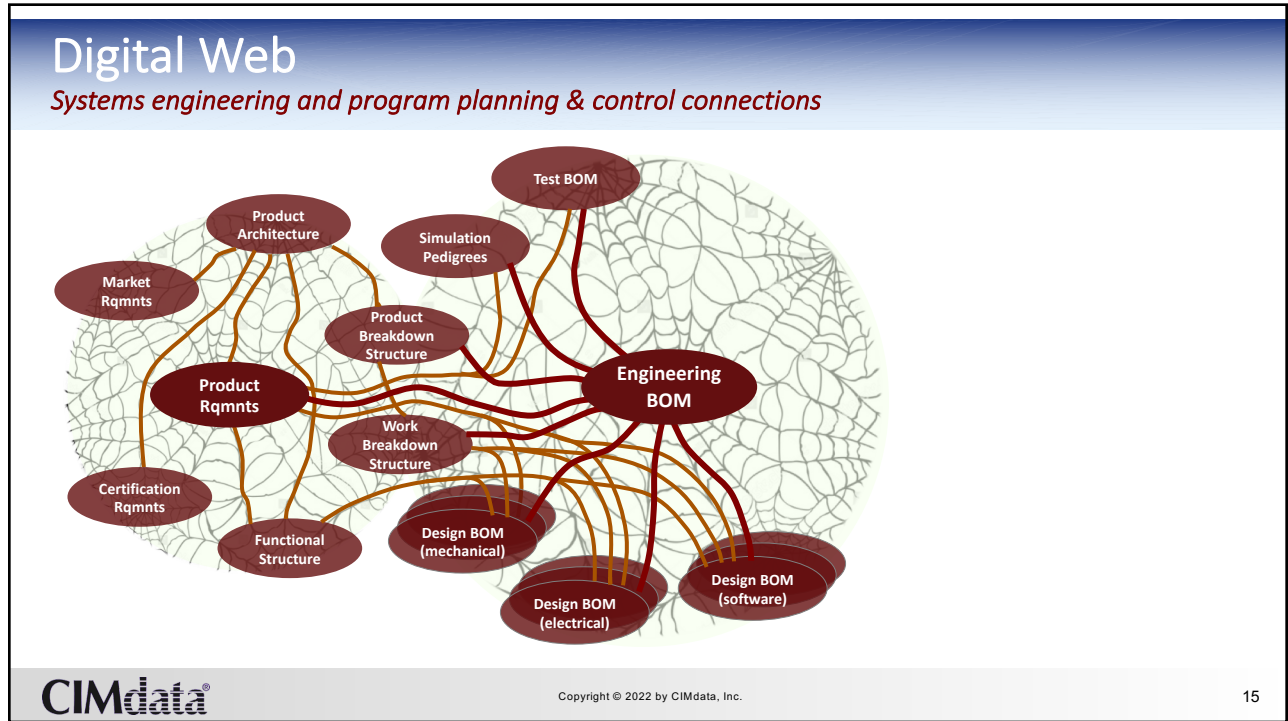
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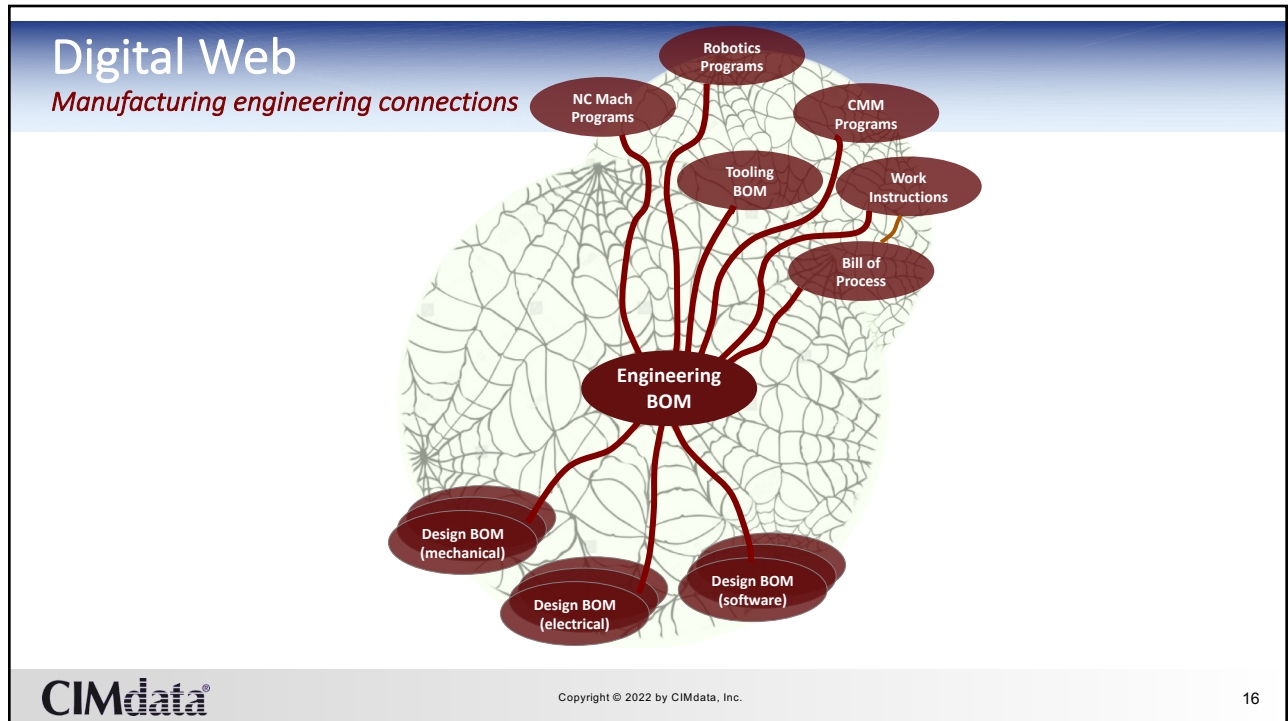
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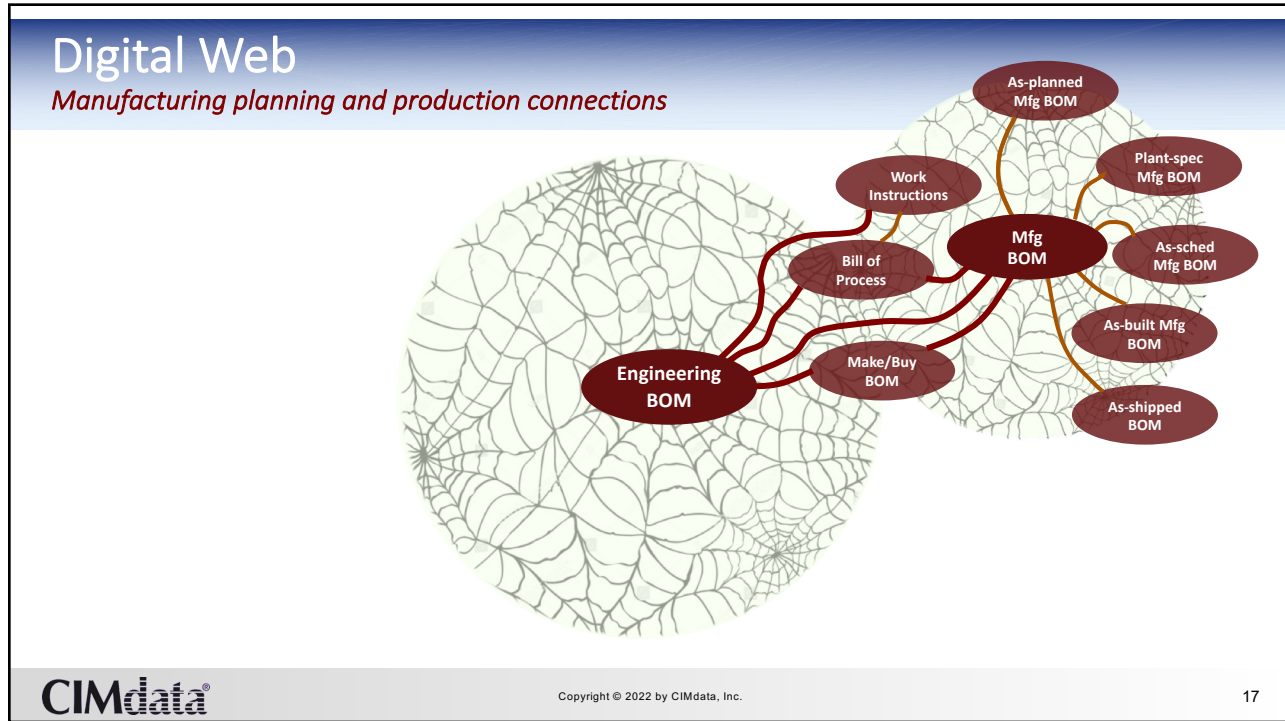
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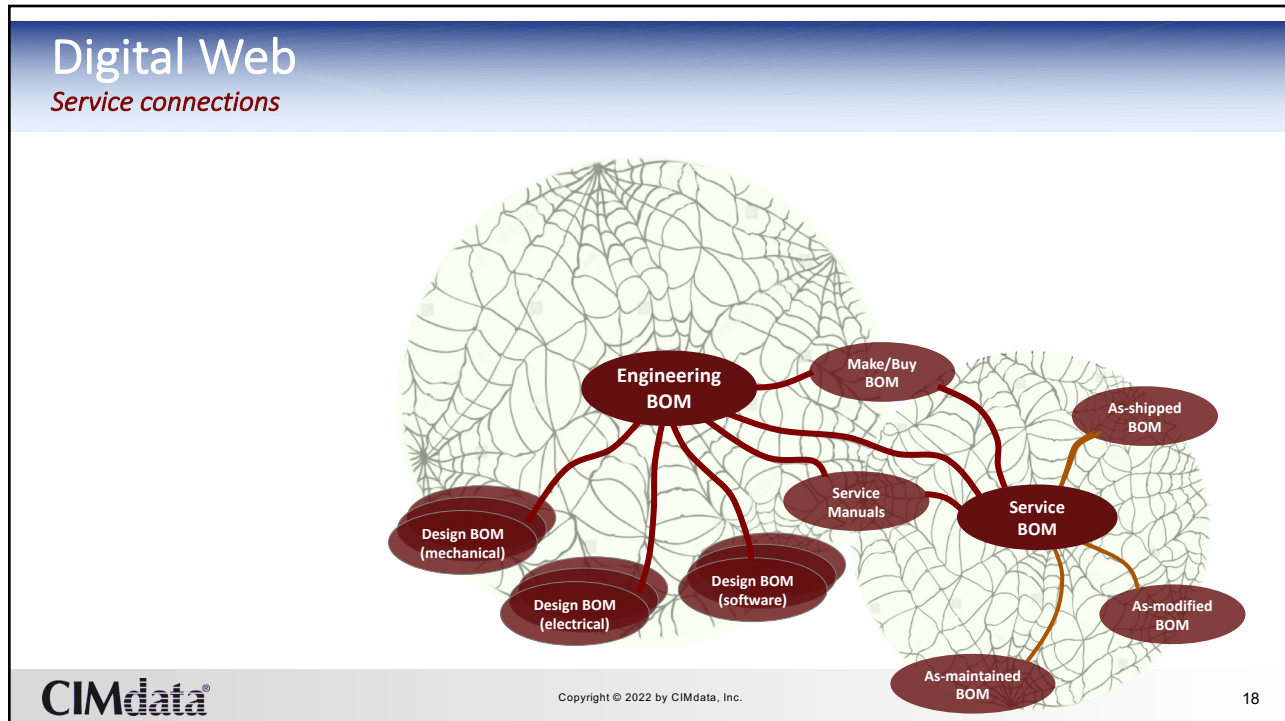
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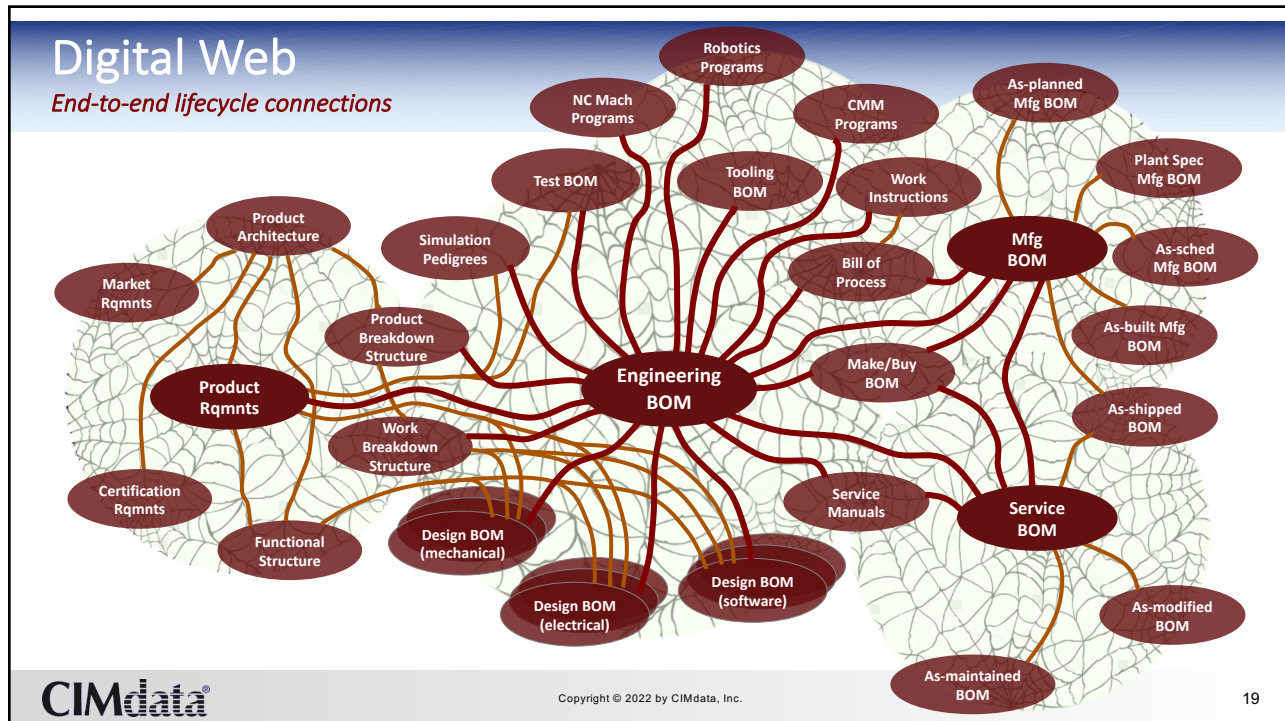
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Case Study: Heavy Equipment & Support Packages

Business situation

Problem Statement

- The company engineers and manufactures heavy equipment
- An order may be for moderate to large volumes of these items which may be of multiple configurations, and since the equipment is expensive and lasts for a long time, they also sell complex support packages
- Preparing proposals was a major problem – very slow, error prone, high dependence on tribal knowledge
- In addition to expense and risk, they were leaving money on the table

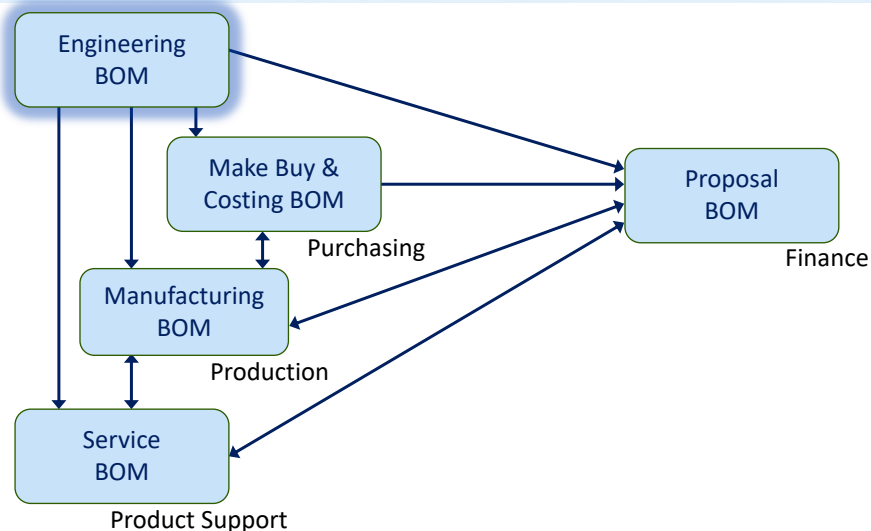
Goal

- Improve speed, efficiency and accuracy of proposal preparation

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Case Study: Heavy Equipment & Support Packages

Scope



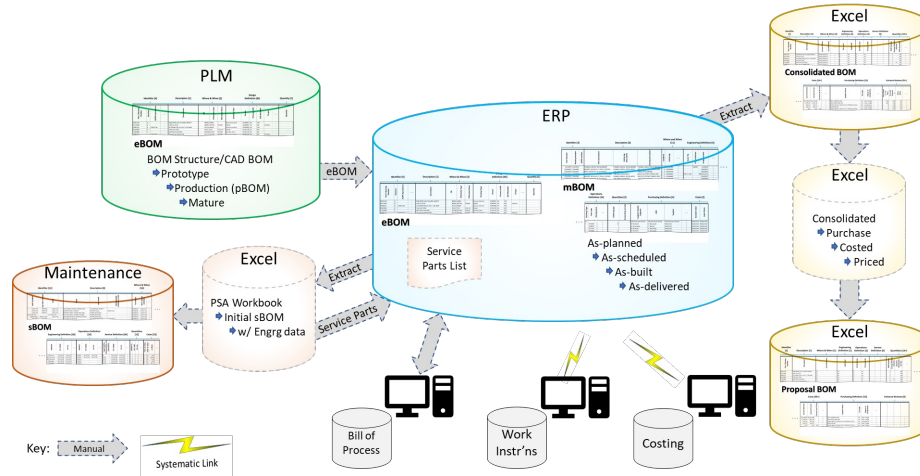
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Case Study: Heavy Equipment & Support Packages

Initial state



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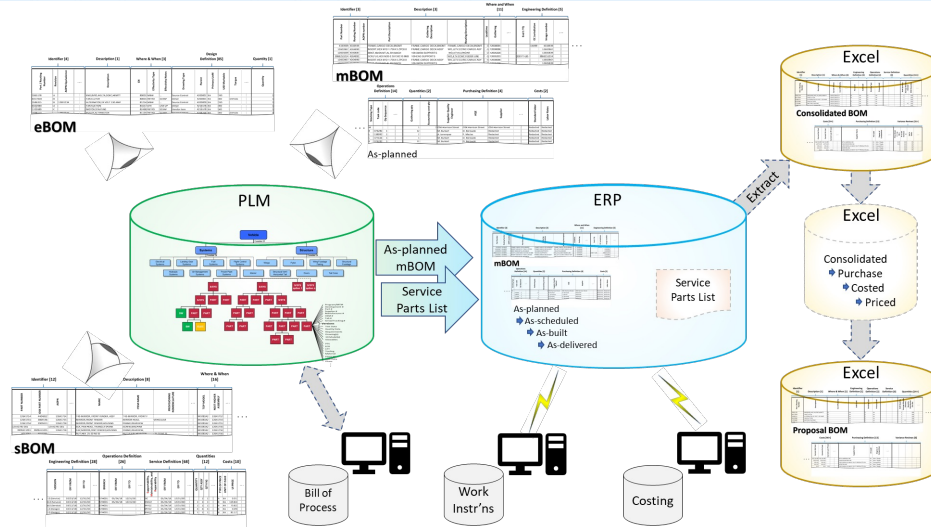
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Case Study: Heavy Equipment & Support Packages

Future state – step 1



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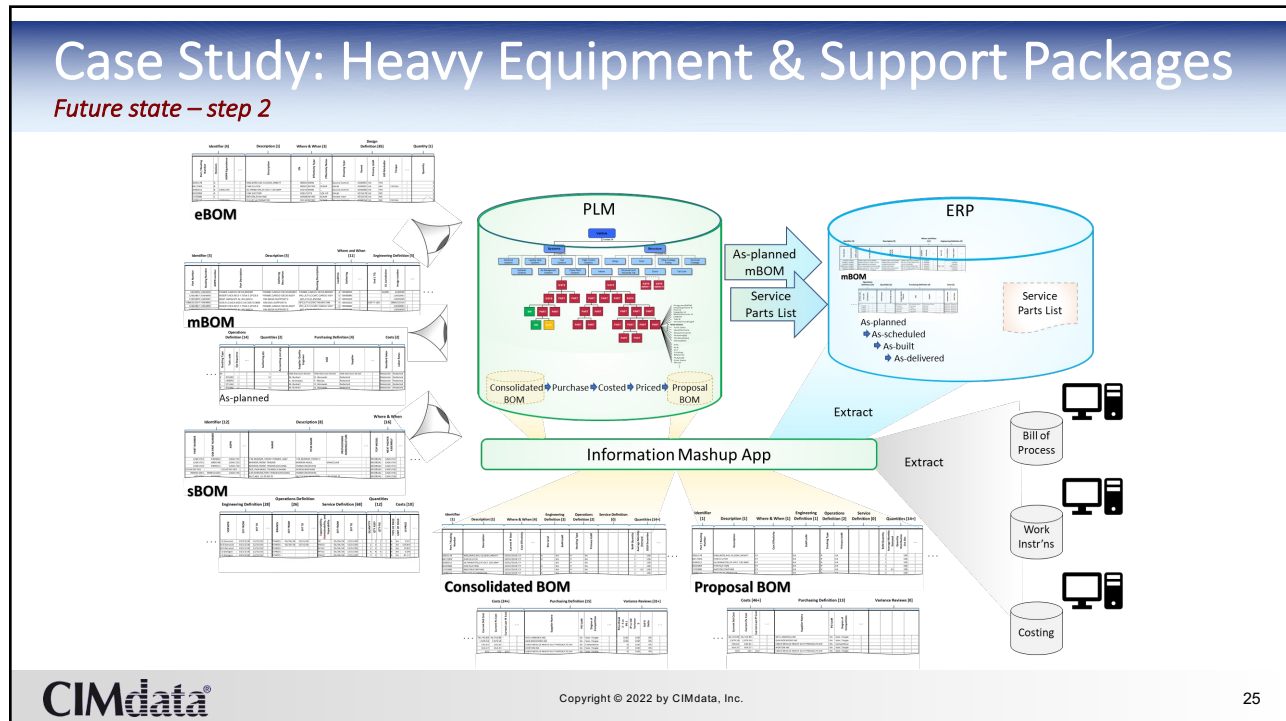
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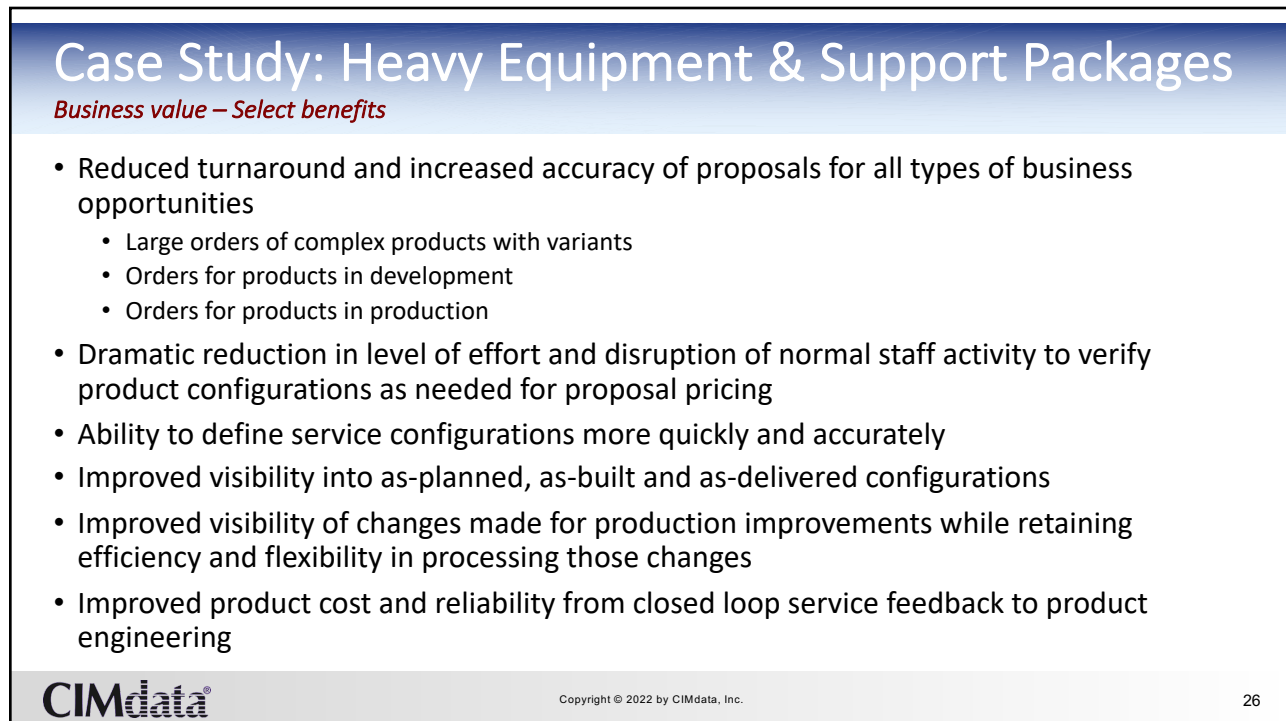
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Collaborative Research Program

Study Digital Thread current state and future trends



Sponsors



Objective

The A&D PLM Action Group members and the PLM solution provider sponsors share a common objective for this research

To gain understanding of needs and opportunities within industry that will inform Digital Thread solution strategy and roadmap

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Concluding Remarks

Digital thread investment is substantial, but status and direction within industry are not well understood

- Digital Thread is a straightforward and powerful metaphor for the concept of linking multiple representations of a product, each tuned to the needs of various creators and consumers, along the lifecycle
- With recent advances in commercial PLM solutions, enablement of the Digital Thread has become technically feasible, even for complex products
- Industry implementations are only now starting to roll out and go live, so there is not much available in the way of lessons learned or actual value realized
- Leading PLM solution providers, such as Aras, Eurostep, Jama Software, PTC and Siemens DISW, continue to advance the technology and together with the Aerospace & Defense PLM Action Group member companies are seeking insight from industrial users
- You have an opportunity to influence Digital Thread solution strategy and roadmap and to learn what is going on with Digital Thread in industry

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To Learn More...

- Access A&D PLM Action Group resources at www.ad-pag.com
 - Multiple View Bill of Materials (BOM) Solution Evaluation Benchmarks, report, Jul 2020
 - Multiple View Bill of Materials, position paper, Feb 2019
 - *Problem Statement, Desired State, and Requirements*
 - *Appendix A: Glossary*
 - *Appendix B: Concept Definition and Use Cases*
- Access CIMdata resources at www.CIMdata.com
 - Multi-view BOM Value Potential, webinar, Apr 2022
 - Why an mBOM Alone Isn't Sufficient, webinar, Oct 2021
 - The Digital Thread is Really a Web, with the Engineering Bill of Materials at Its Center, webinar, Sep 2021
 - Making Multi-view BOM a Reality, webinar, Mar 2020
- Contact for further discussion
James Roche, Director, Aerospace & Defense Practice
Email: j.roche@CIMdata.com
Tel: +1.734.668.9922



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Q&A

Let's hear what's on your mind?



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Strategic consulting for competitive advantage in global markets



World Headquarters
Ann Arbor, Michigan USA
Tel: +1.734.668.9922

Main Office - Europe
Weert, NL
Tel: +31 (0) 495.533.666

Main Office - Asia-Pacific
Tokyo, JAPAN
Tel: +81.47.361.5850

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