

# xBOM Management Across the Lifecycle

## CIMdata 2020 PLM Market & Industry Forum

### xBOM Management Across the Lifecycle

#### PLM Market & Industry Forum

A CIMdata PLM Leadership Event  
April 2020

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*Strategic management consulting for competitive advantage in global markets*

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

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# xBOM Management Across the Lifecycle

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### Key Takeaways

*xBOM Management Across the Lifecycle—2020 CIMdata PLM Market & Industry Forum*

- xBOM is shorthand for the ability to create and manage a configuration-controlled series of structures across the lifecycle by defining and managing relationships between structures
- A robust xBOM capability is a core requirement for successful digital transformation in most companies, and especially those with smart, connected products (eBOM<->mBOM is not enough)
- Bi-directional links between requirements, simulation, design, manufacturing, test, and in-service operations data items form the digital thread: a key requirement of an actionable digital twin strategy are far from production deployment
- Structure management services in the product innovation platform can solve this issue without the need for custom solutions

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### Agenda

- xBOM Basics
- In the Beginning
- Concluding Remarks

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4

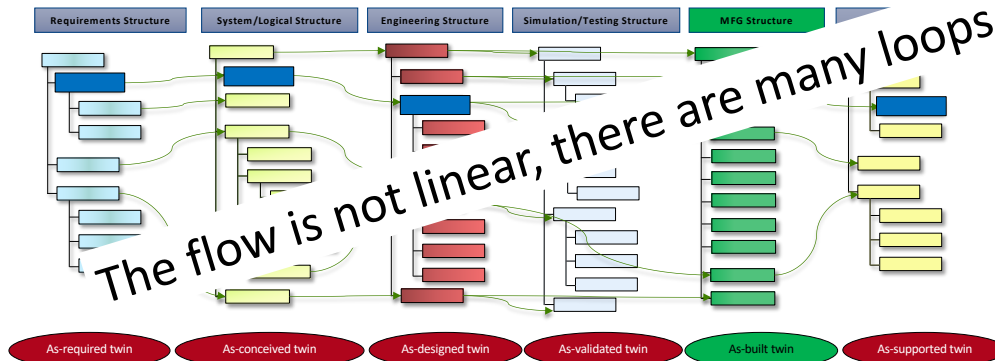
# xBOM Management Across the Lifecycle

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### What does xBOM Mean?

*Definition and next level of detail*

- xBOM is shorthand for the ability to create and manage a configuration-controlled series of structures across the lifecycle by defining and managing relationships between structures



Source: Derived from PTC

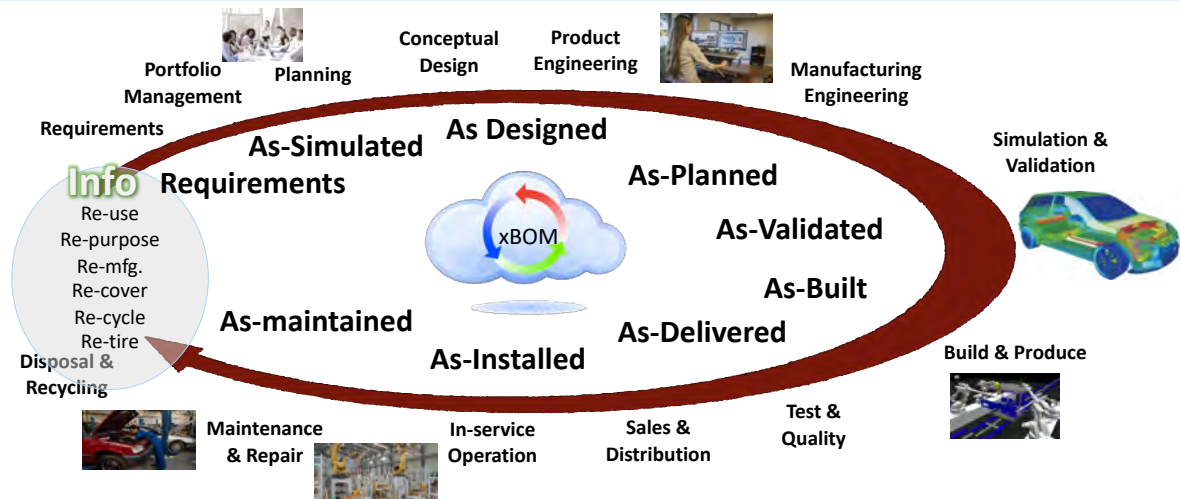
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### xBOM—Configuration Controlled Structures

*Managing relationships between structures across the lifecycle*



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

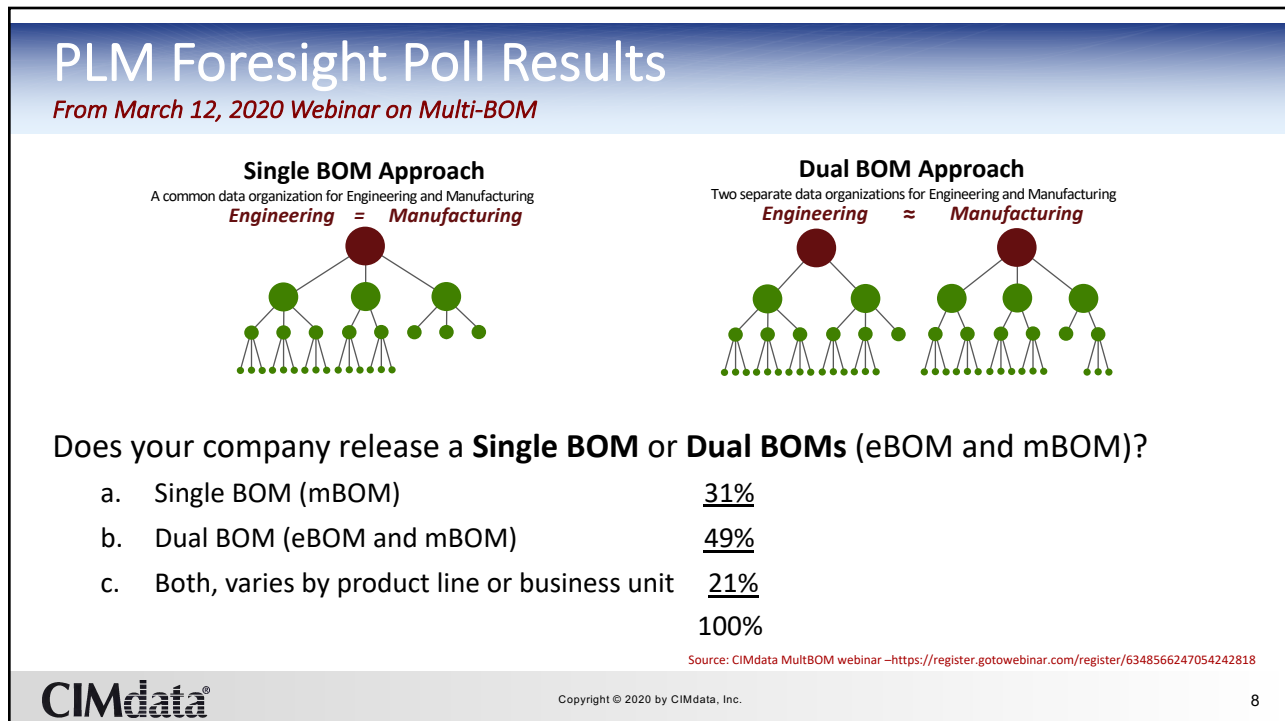
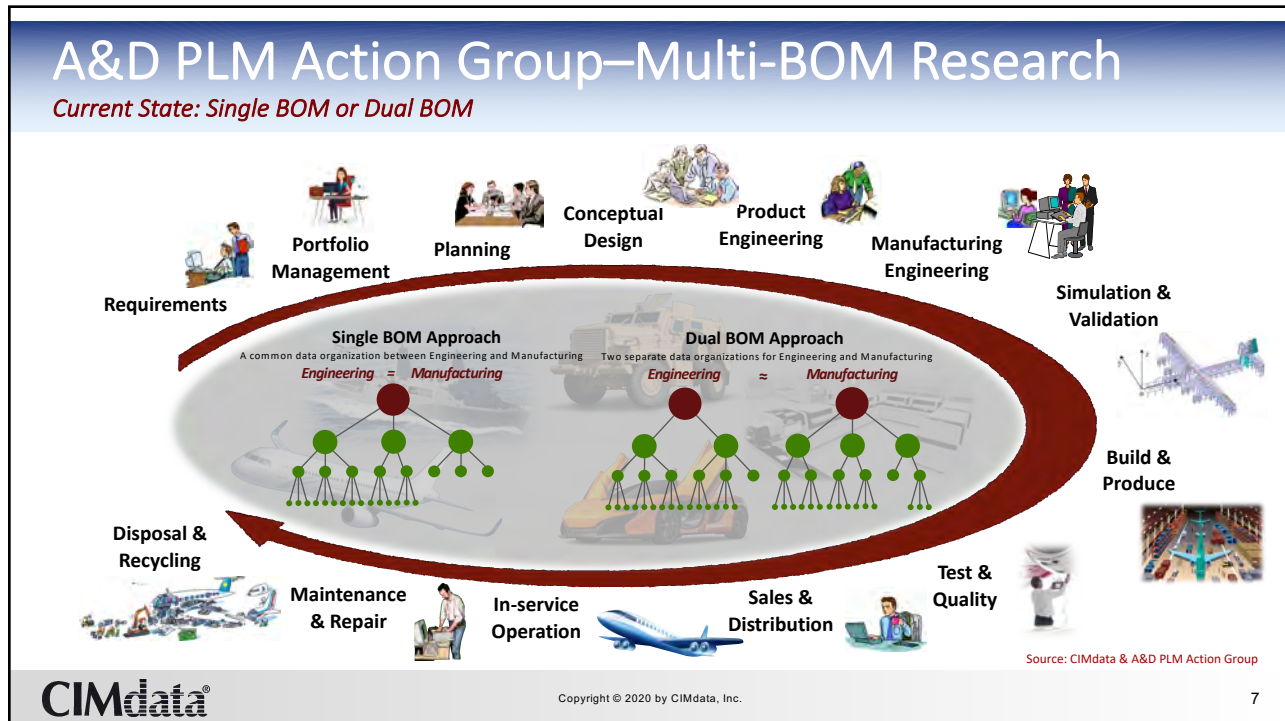
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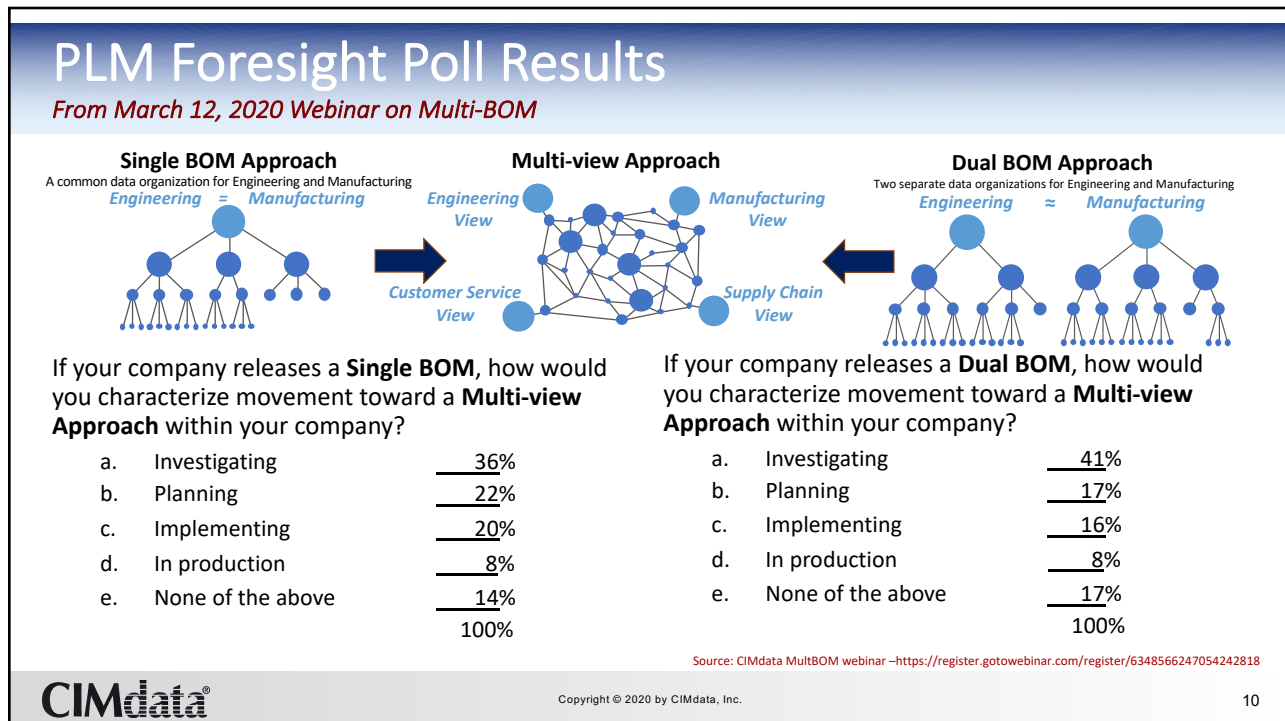
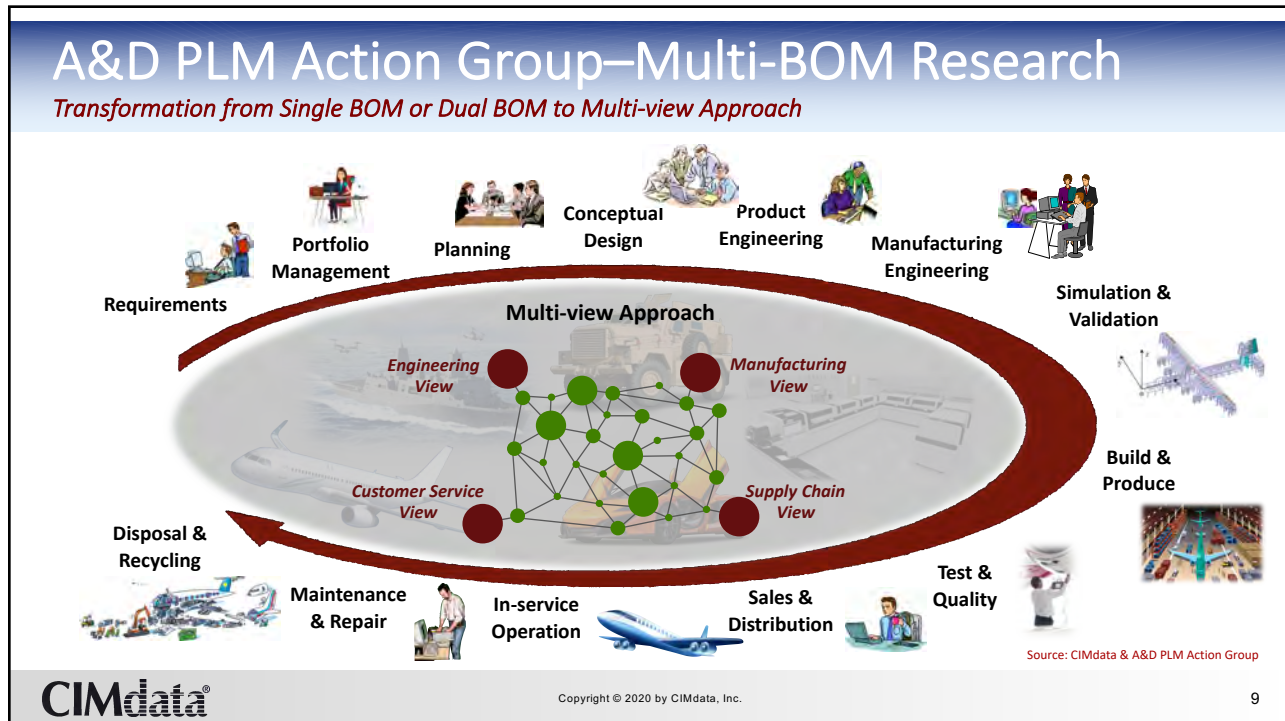
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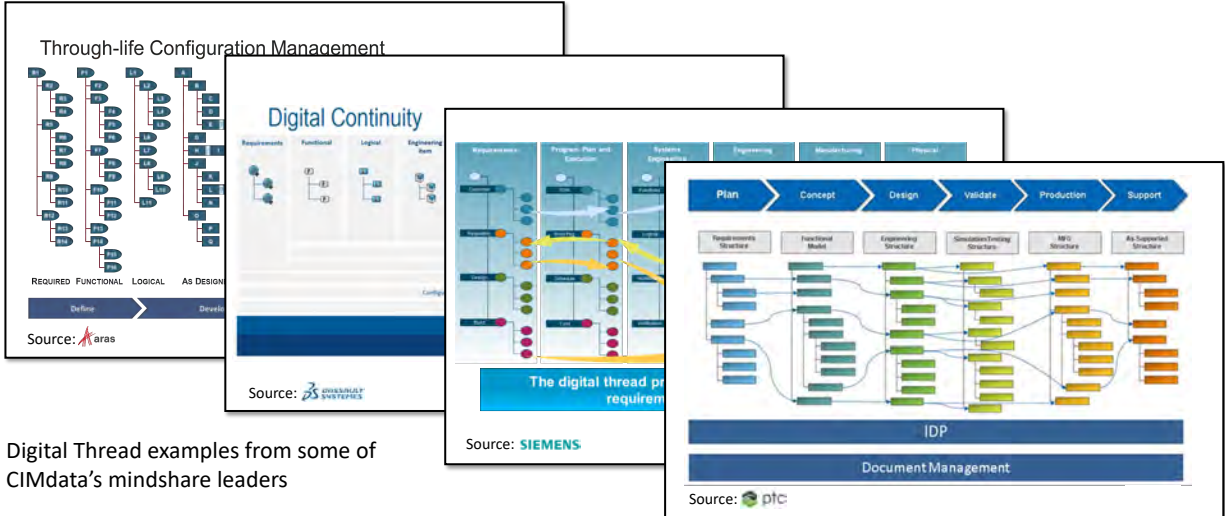


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### xBOM Concepts—Everyone Has One

*Digital Thread = Multiple views of product configuration with traceability through the product lifecycle (xBOM)*



Digital Thread examples from some of CIMdata's mindshare leaders

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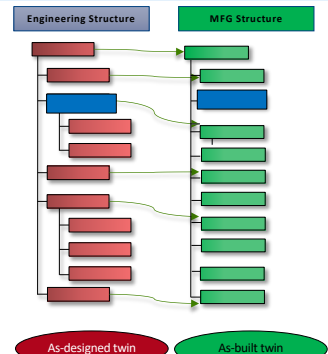
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### Why is xBOM Difficult Even for eBOM/mBOM?

*Solution providers is this a solved problem?*

- Rules (Process)
  - Legacy processes
  - Regulatory requirements
- Discipline (People)
  - Organizational Change Management (OCM)
- Limitations (Technology)
  - Solution provider boundaries
  - Solution capabilities
  - Data formats



1969 → 50 years → 202x?

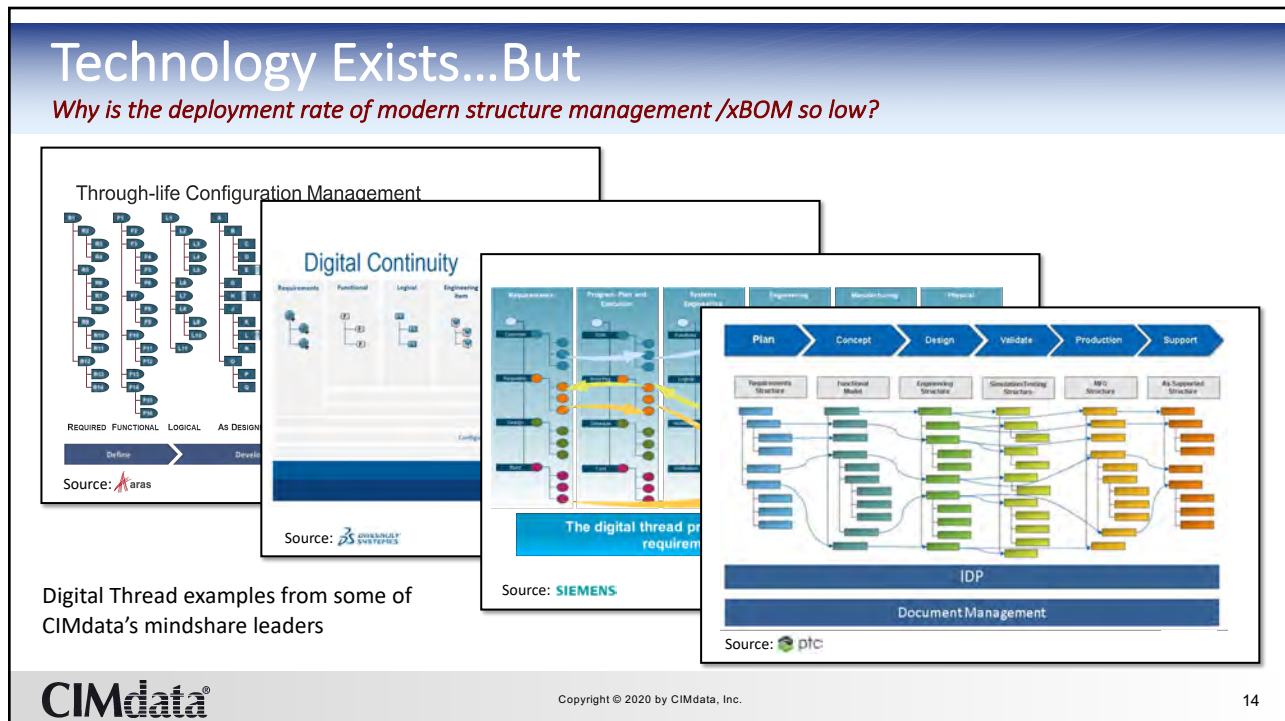
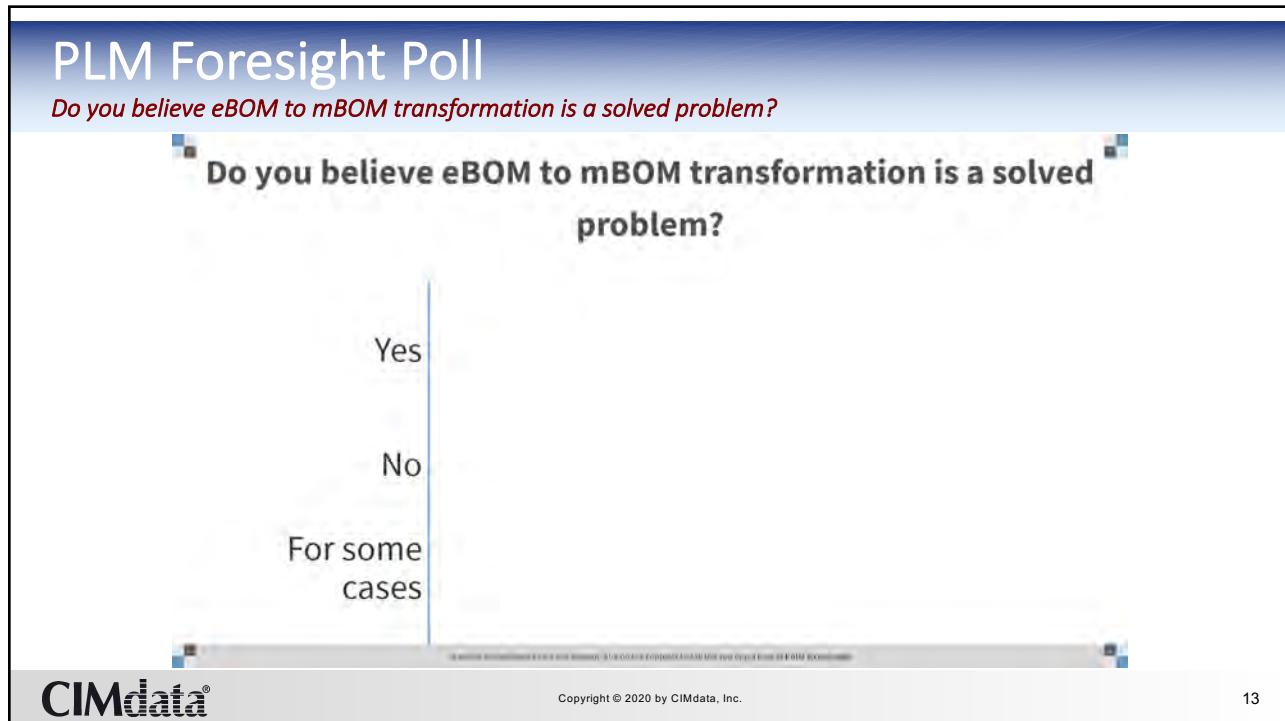
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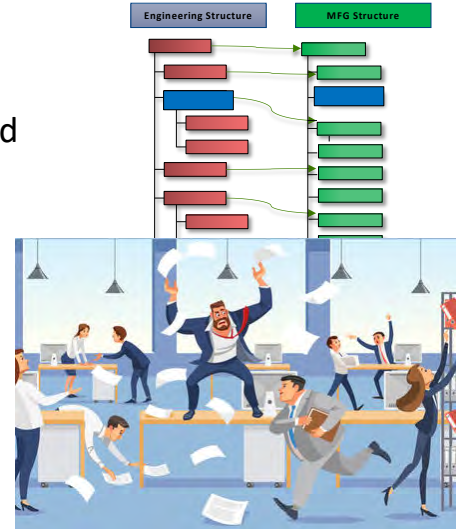
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### Why is xBOM difficult?

*Solution providers is this a solved problem?*

- Mostly agree eBOM<->mBOM is solved
  - High value milestone in most implementation plans
- Somewhat agree eBOM/mBOM<->sBOM is solved
  - Implementations are not seen often
- But...
- No integration in 6 of my last 8 industrial engagements!
- Most had technology available, but not deployed
- Reality: **Slow, Error Prone, Manual Processes**

**Yet...**



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### eBOM/mBOM/sBOM Works

*So, is it a customer or implementor problem?*

- **NO!**
- Not if you want happy customers or you want to leave money on the table
  
- What can be done?
- Improve software?
- Improve implementation process?
- Or, is it mostly Organizational Change Management?

**YES!**

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- In the Beginning (of the lifecycle)
- Concluding Remarks

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### Requirements to As-Validated

*Standalone solution to support this use case?*

- Historically, done manually with prototypes and testing
- Issues
  - Formats
  - Still disconnected from physical configuration in most implementations
  - Silos—Legacy DOORS
  - One by one allocation and maintenance is labor intensive
- Starting to leverage ALM to support this, especially in Medical Devices
  - Siemens Polarion, PTC Integrity, Atlassian
- Seeing tools such as PTC Integrity or Siemens Polarion set up as backbone
  - Windchill & Teamcenter treated as PDM for document management
  - Connection to product structure/configuration still an issue

*Also wanted and needed by smaller companies with simpler products*

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### Requirements to As-Designed

*Standalone solution*

- Historically, done manually using DOORS
- Initial allocation ok – sort of, lots of clicks
- Legacy products ok – sort of, incremental product improvements are manageable
- Issues
  - Hard to maintain
    - One by one allocation
  - Hard to reuse
  - Falls apart before validation
  - Silos–Legacy DOORS
  - High innovation areas e.g., electric propulsion, hard to support due to EBOM variability
  - OSLC provides support, but not enough

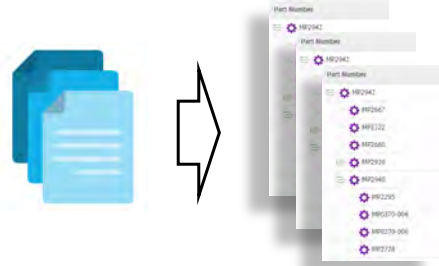


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### Solving Requirements to As-Designed

*Several approaches*

- Assumption: Requirements decomposed as objects, not in documents
- Multiple methods
  - Structure synchronization
  - MBSE/RFLP
  - Automated mapping
    - Classification
    - machine learning
- Issues
  - Data semantics for security & configuration management
  - Interoperability

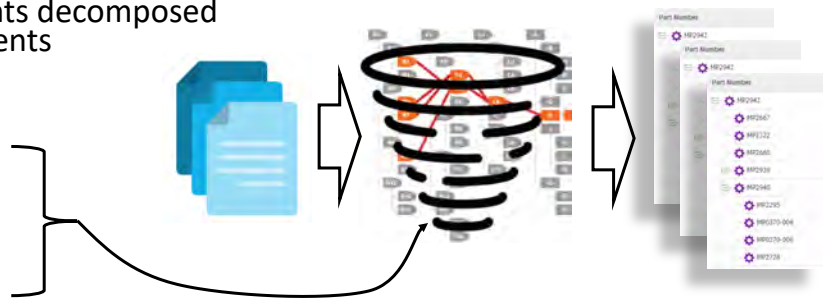


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### Structure Synchronization

*Relatively proven approach*

- Mapping items from one structure to another with associativity
- Manufacturing process planning
  - Consumes EBOM, discharges MBOMs
- Common Platform Service
  - Good reason for MBOM within same platform as EBOM

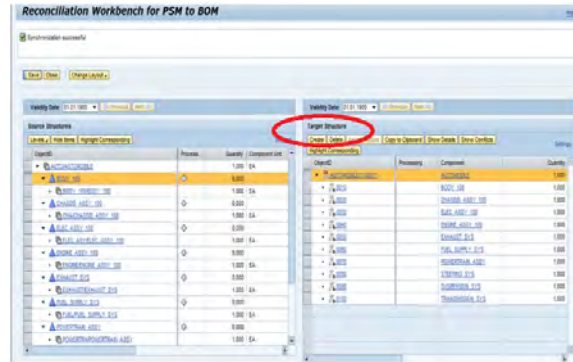


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### MBSE/RFLP

*Model Based System Engineering/Requirements Logical Functional Physical*

- Used in high value/complex industries  
Auto/Aero/Industrial Equipment
- Strong methodology but implementations vary
  - Very powerful within a tool
- [Many] Standards
- Typically siloed operations
- Subset used for ALM
- Issues
  - Very fragmented tools and formats
  - Configuration management across domains extremely difficult, more so cross-solution provider
  - ALM support for physical structures is weak



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### Automated Mapping

*The [near] future*

- Machine Learning
  - Promising, hot topic, good demos
  - Waiting for production deployments, case studies
- Semi-Automated
  - Classification – also a ML opportunity
  - Most intriguing demo is when physical parts are classified and associated with logical elements
  - Leads to scalable solution

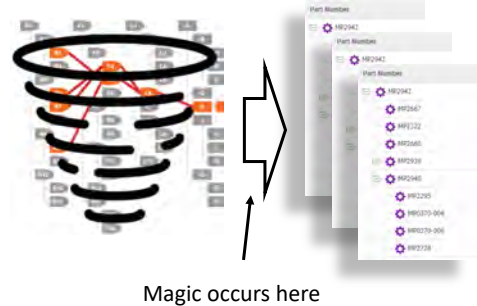


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### What is the Business Opportunity?

*How can the PLM Economy best support these requirements?*

- BOM management is heading into a major upgrade – 8% are using multi-view BOM technology, over 50% of single and dual BOM users are interested or planning a migration\*
- Multi-view is needed to support full lifecycle integration and especially MBSE effectively, customer technology upgrade likely, OCM support, definitely
- Process reengineering, data governance, and OCM must key parts of implementation deliverables if customers are to succeed
- As complexity grows, MBSE becomes a necessity, companies with simpler products still want to manage requirements through verification and validation, so a product innovation platform approach can give them a solid foundation

\*from CIMdata webinar survey

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### Concluding Remarks

*BOM management still has opportunity*

- Ensuring structure and BOM data stay under configuration control across the lifecycle is a **still** critical, core, and time-consuming activity
- Establishing a robust architecture that can support the wide variety of data types needed to bring a product from concept to market and support its operation is key to successful digital transformation
- Table stakes have moved beyond eBOM<->mBOM integration; digital twin enablement requires, a digital thread that configuration controls other structures including rqrts., simulation, test, and in-service configuration
- A digital thread enabled by a robust xBOM process improves the effectiveness of traceability and impact analysis making the digital twin actionable

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### To Learn More...

- Tom Gill, Senior Consultant
- Email: [t.gill@CIMdata.com](mailto:t.gill@CIMdata.com)
- Tel: +1.734.668.9922
- CIMdata has several useful resources on this topic
  - Webinar "[Making Multiple-view BOM Management a Reality](#)" from March 12, 2020
  - A&D PLM Action Group Microsite: <https://www.cimdata.com/en/aerospace-and-defense>

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27

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28