

MBD Data Interoperability Through Data Standards: A Case Study

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The Boeing Company

GLOBAL PRODUCT DATA INTEROPERABILITY SUMMIT 2023



Presenters Bio: Rohan Rana

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- ❖ **Joined Boeing in 2008 as a Propulsions Engineer**
- ❖ **Transitioned to 787 ECS Certification**
- ❖ **Aerodynamics Analyst for Commercial Aircraft**
- ❖ **Data Distribution Process Engineer**
- ❖ **Visualization/Physical Integration Process Engineer**
- ❖ **SME for TDP development and delivery in Boeing**
- ❖ **SME for Product Definition Data and engineering data integration**
- ❖ **SME for Visualization capabilities, processes, and technology**
- ❖ **SME for MBD and visualization data standard**



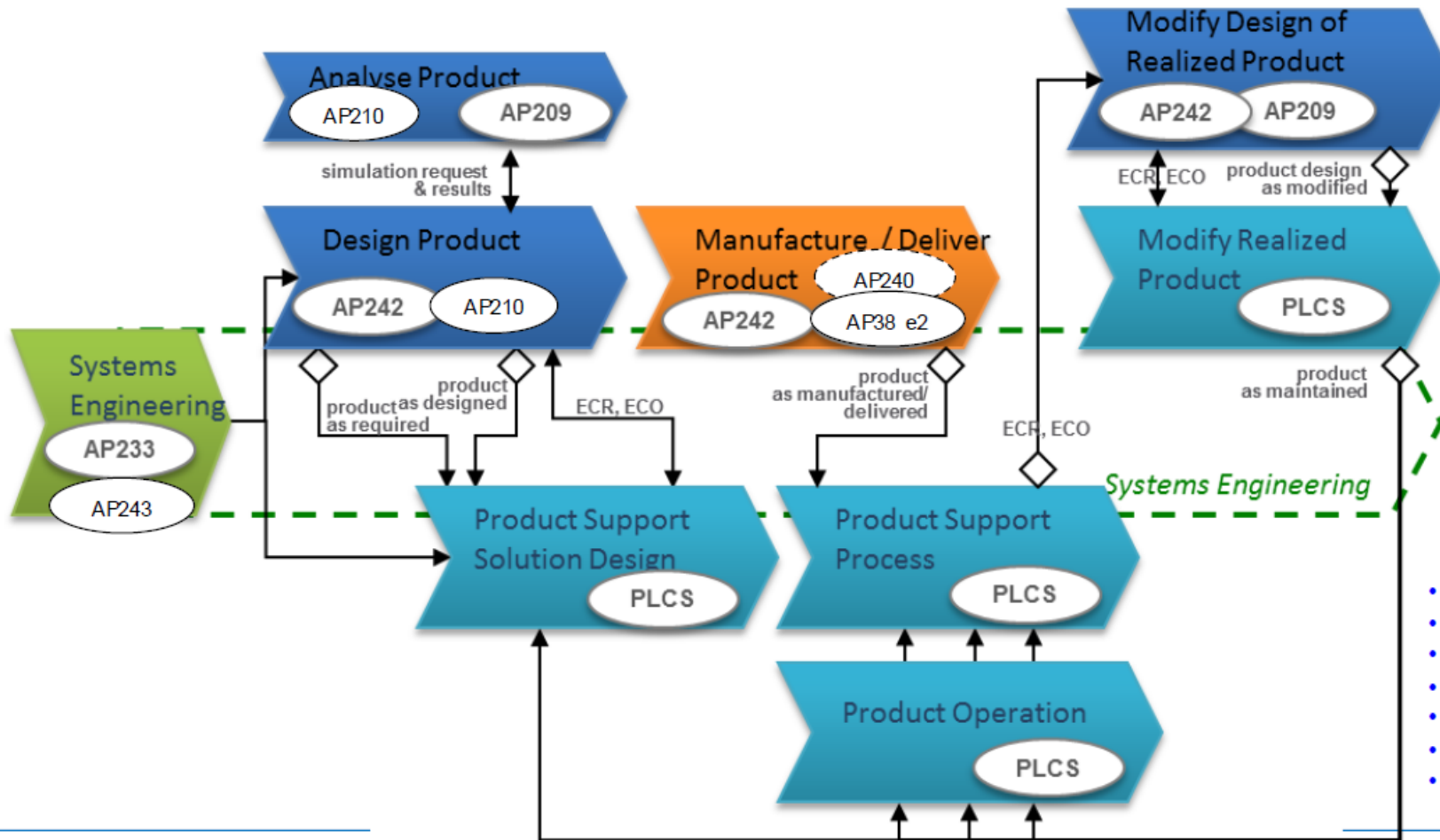
Agenda

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- ❖ Introduction
- ❖ Standards Overview
- ❖ Value of Data Standards to Boeing
- ❖ Standards Implementation Overview and Focus
- ❖ Digital thread overview
- ❖ Case Study
- ❖ Problems Everywhere
- ❖ The Path Forward
- ❖ Value
- ❖ Lessons learned
- ❖ Next Steps
- ❖ Closing Comments

Standards Overview

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High level activity model identifying:

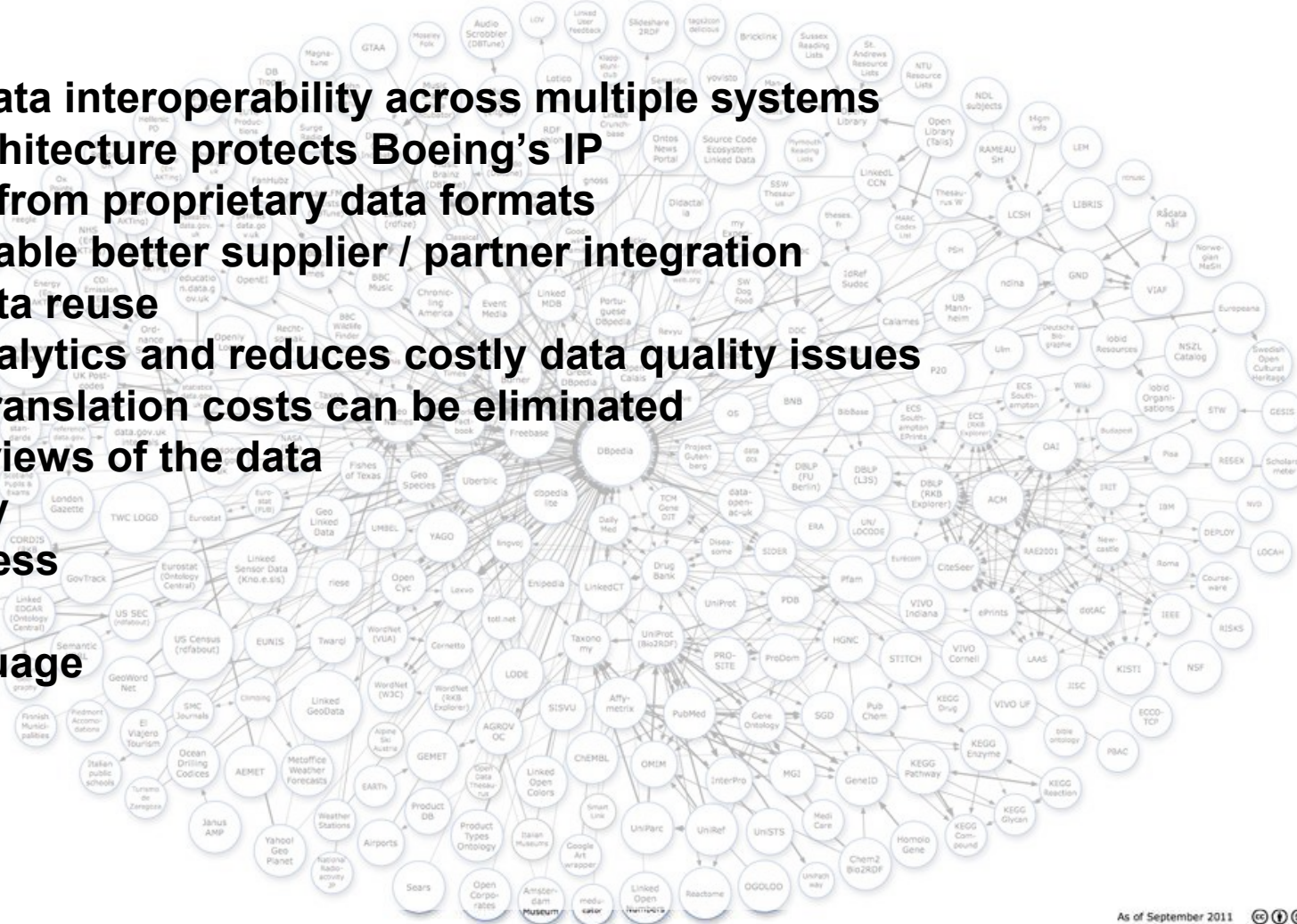
- the domain of usage
- and the data flows between the main STEP APs (Application Protocols)

- AP209 ed2: “Multidisciplinary Analysis and Design”
- AP210 ed3: “Electronic assembly, interconnect, & packaging design”
- AP238 ed2: “Model Based Integrated Manufacturing » (STEP-NC)
- AP233 “Systems Engineering”
- AP239 ed3: “Product Life Cycle Support” (PLCS)
- AP242 “Managed Model Based 3D Engineering »
- AP243 “Model. & Sim. Info. in a collab. SE Context” (MoSSEC)

Value of standards to Boeing

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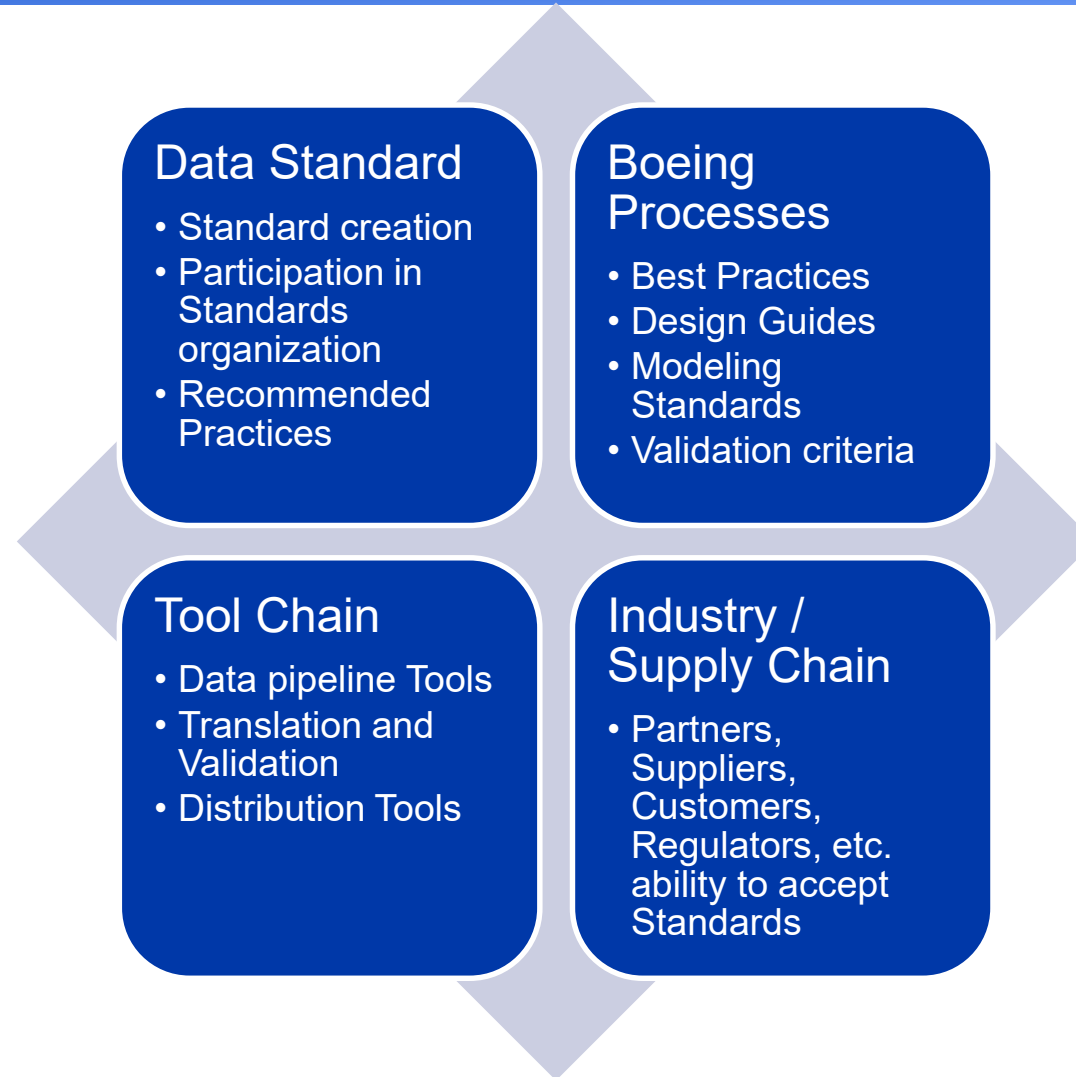
- ❖ Standards provide data interoperability across multiple systems
- ❖ Standards based architecture protects Boeing's IP
- ❖ Frees Boeing's data from proprietary data formats
- ❖ Standard formats enable better supplier / partner integration
- ❖ Standards enable data reuse
- ❖ Standards enable analytics and reduces costly data quality issues
- ❖ Multiple redundant translation costs can be eliminated
- ❖ Recognize multiple views of the data
- ❖ Provide data security
- ❖ Independent of process
- ❖ Independent of tools
- ❖ Independent of language



As of September 2011 

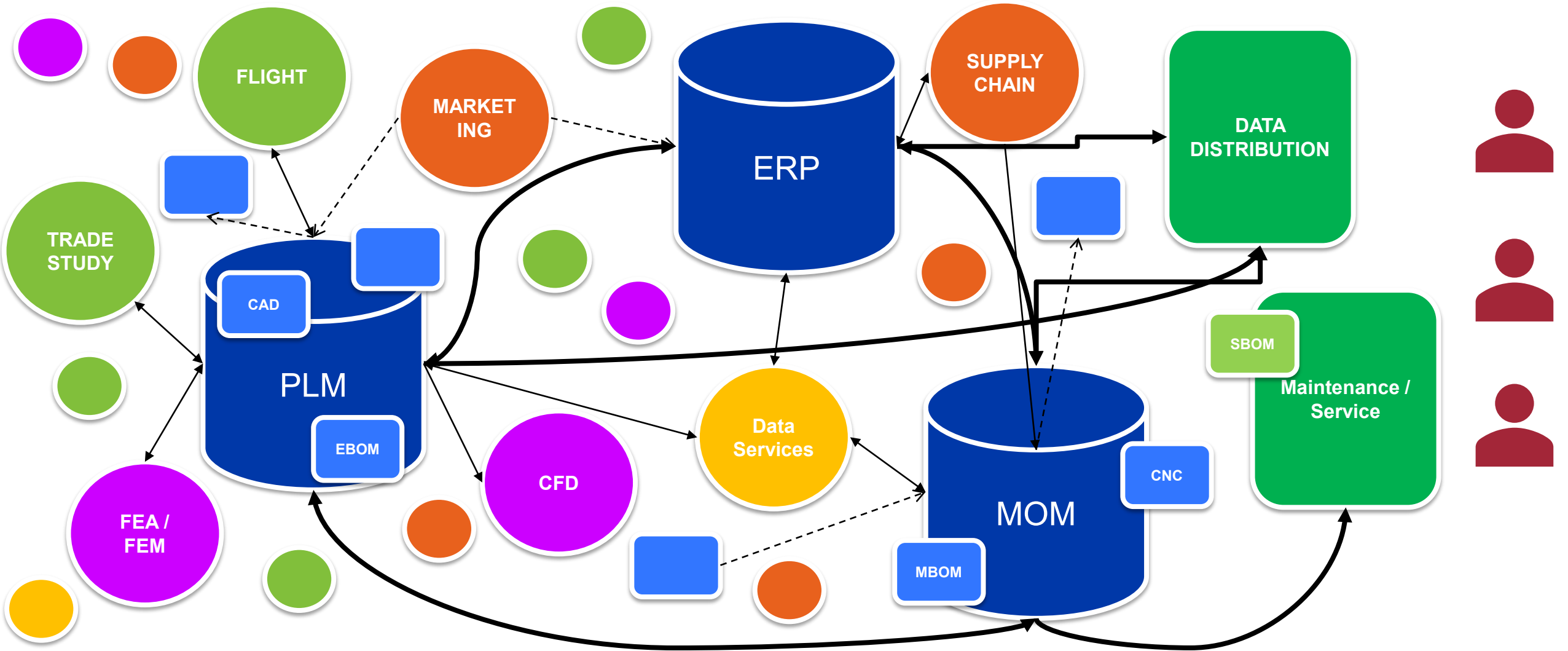
MBD Standards Implementation Challenges

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Example Simplified Tool Chain (“Digital Thread”)

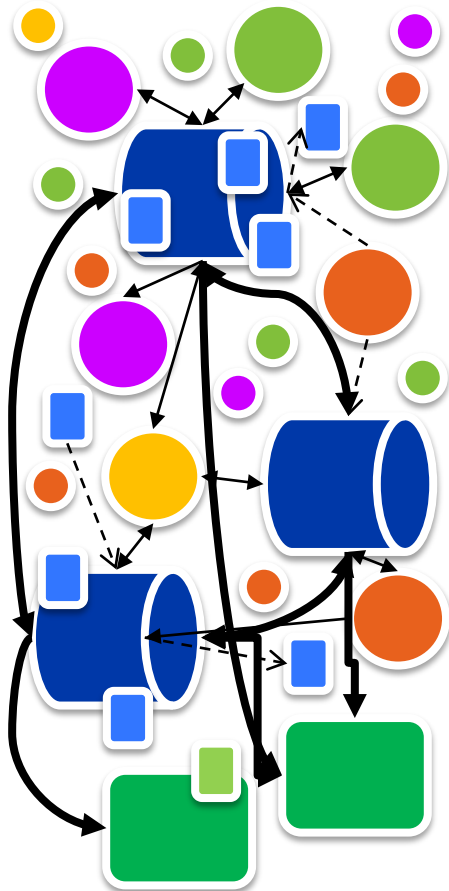
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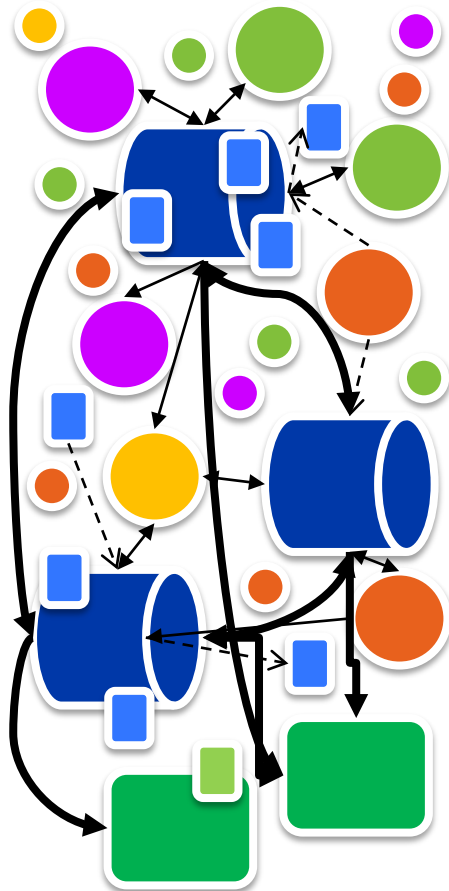
Enterprise View

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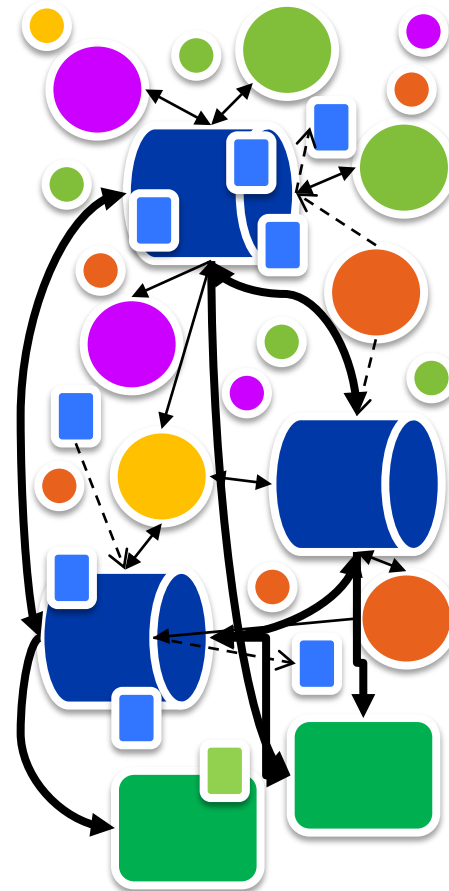
Business Unit A
Program 1



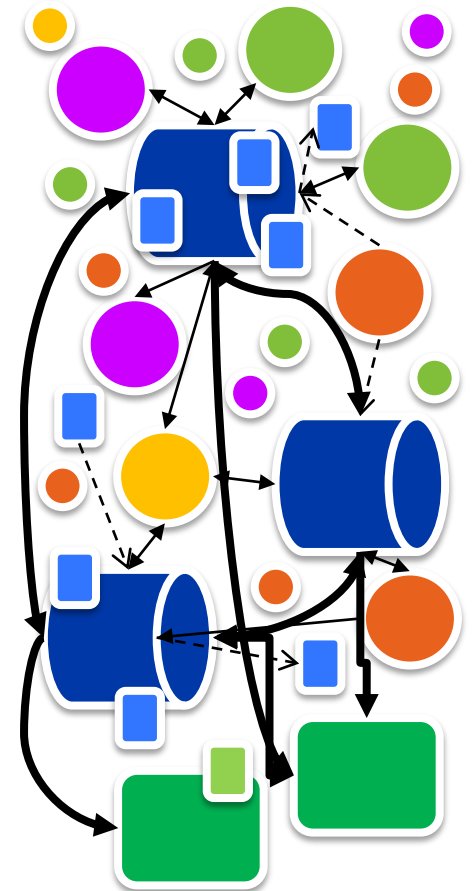
Business Unit A
Program 2



Business Unit B
Program 1

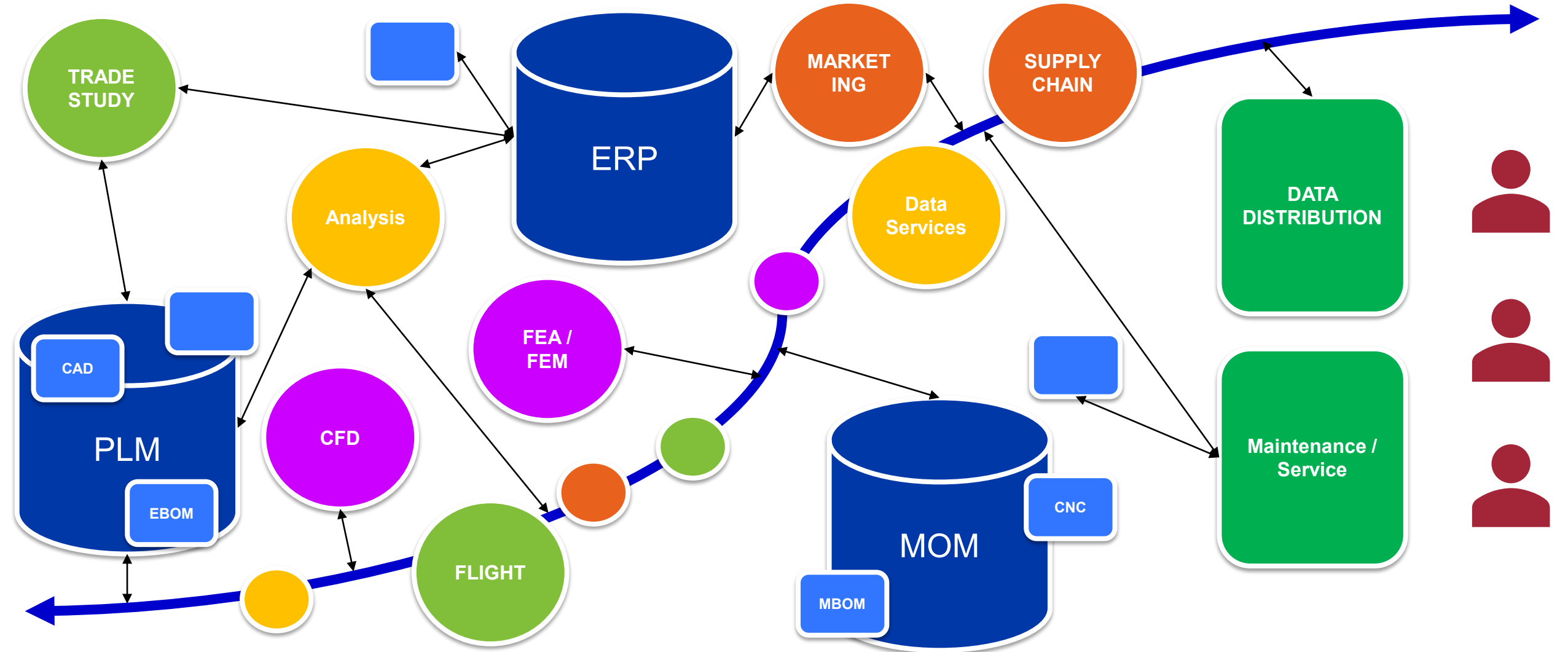


Business Unit C
Program 1



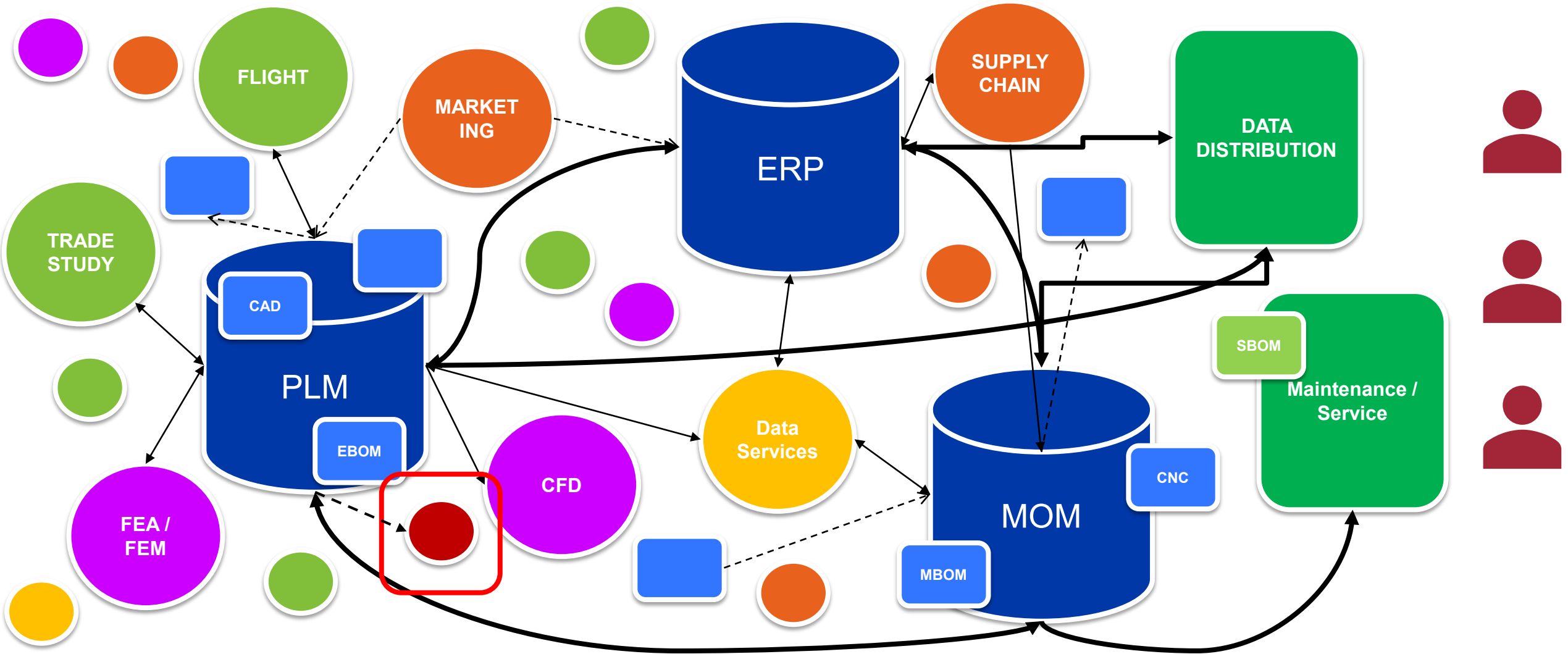
Digital Transformation Digital Thread

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Case Study

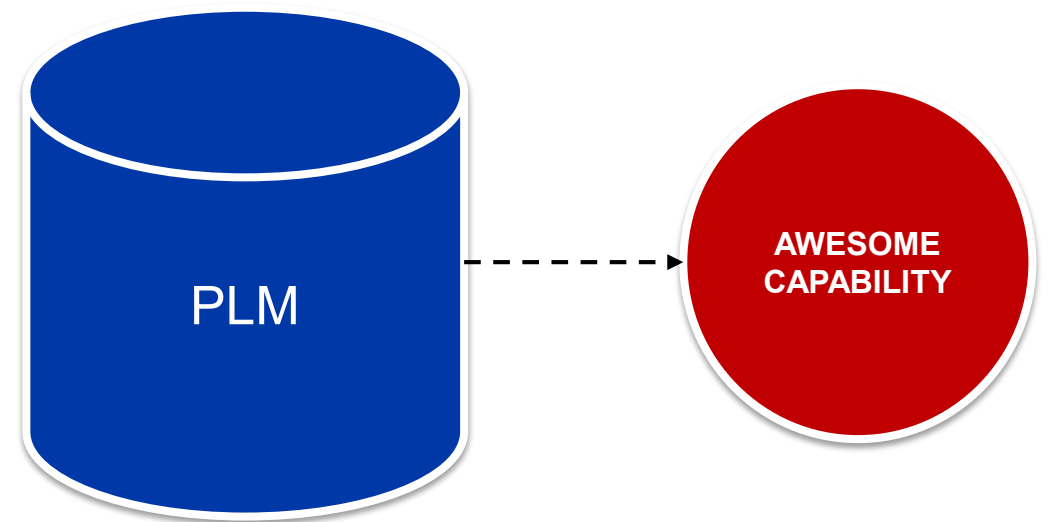
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Case Study – High Value Capability

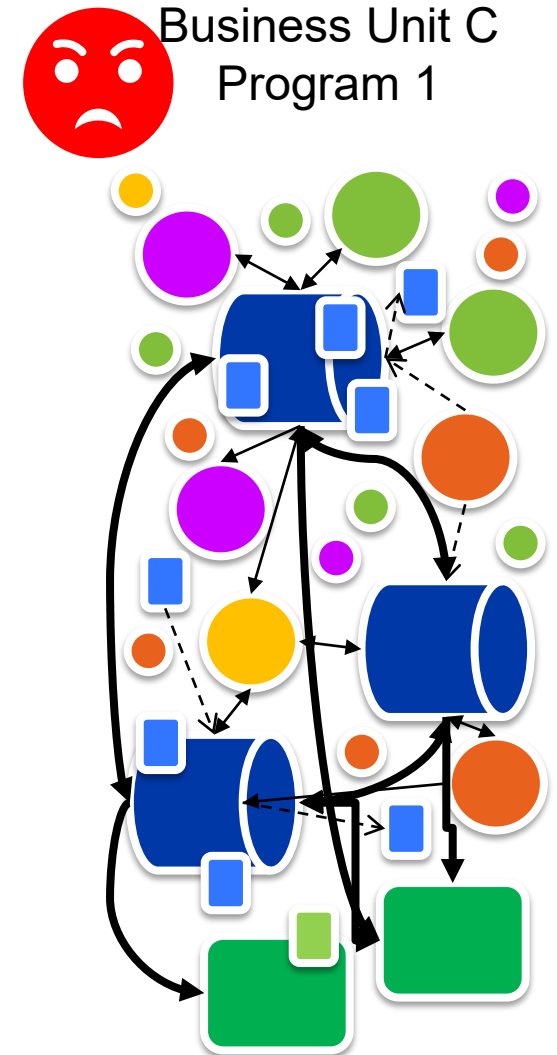
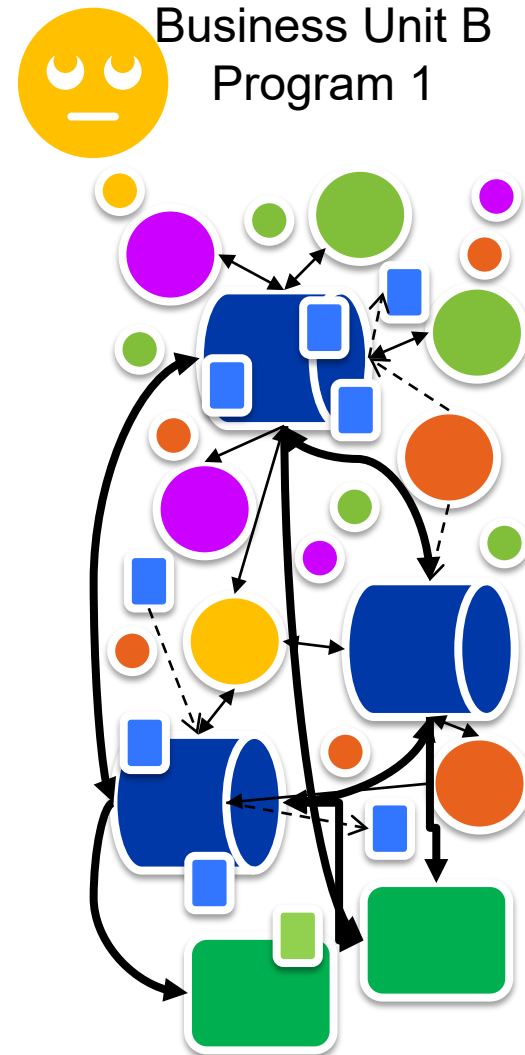
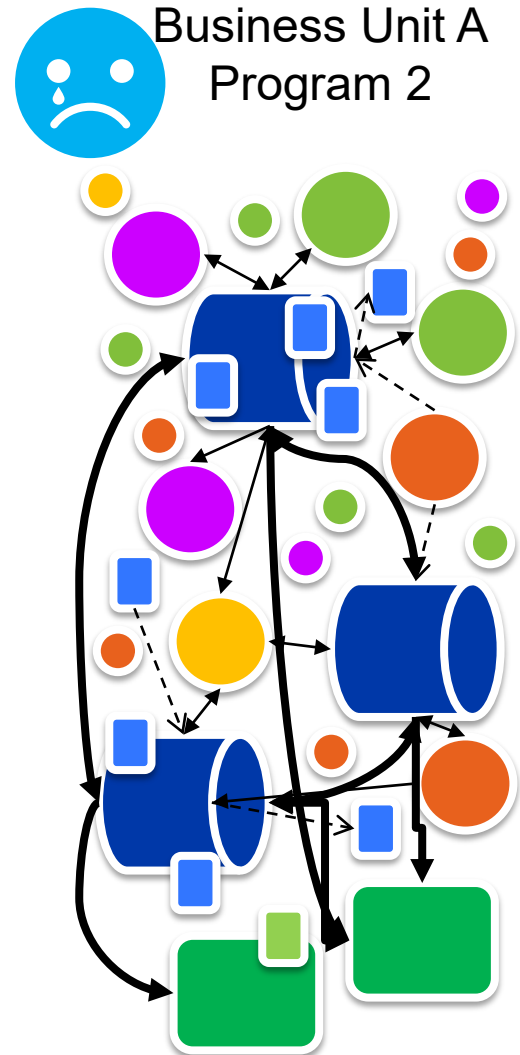
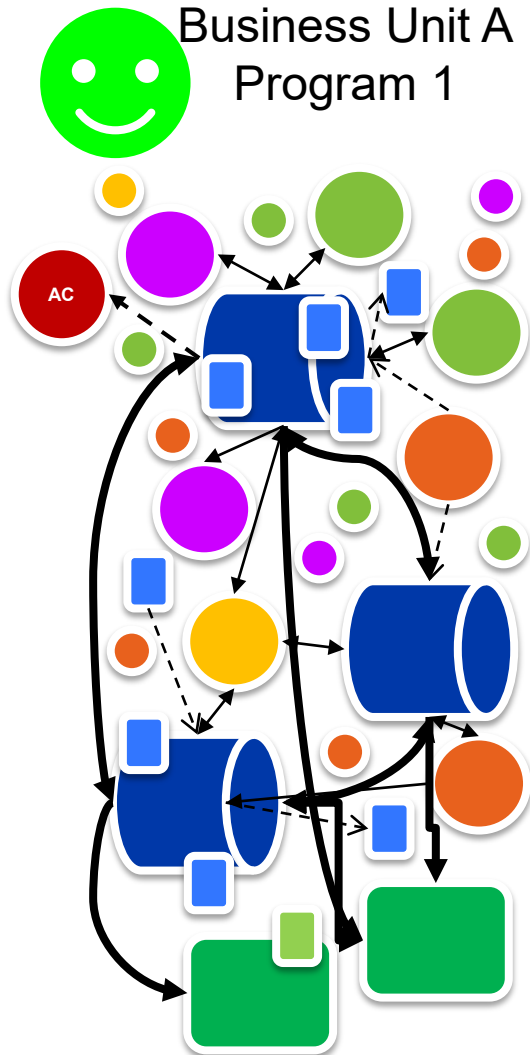
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- ❖ **Red Circle is a high value custom capability essential to the business (The “AC”)**
- ❖ **MBD data required for capability**
- ❖ **AC developed internally at significant investment and is valuable IP**
- ❖ **Integration with PLM is a point-to-point custom interface (not standards compliant)**
- ❖ **AC is only available to some and is very difficult to migrate to others**



High Value Capability Enterprise View

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High Value Capability and Digital Transformation

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- ❖ **AC is essential and high value to the business; needed for the future!**
- ❖ **How to transition AC into digital transformation for the future?**
- ❖ **How to Integrate AC into digital thread of the future? STANDARDS!**



How to transition to Future?

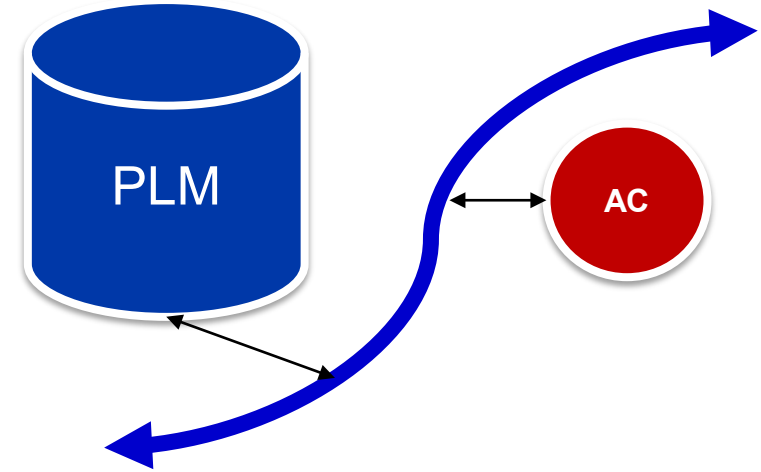
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Requirements:

- ❖ Essential and needed in future and across enterprise
- ❖ Must be integrated with digital thread(s)
- ❖ Must support the entire enterprise

Options:

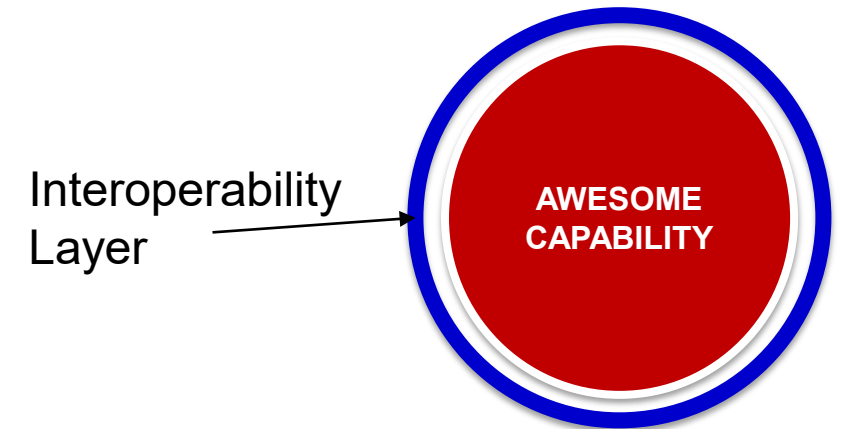
- ❖ 1: Eliminate AC for COTS capability from PLM or other vendor
- ❖ 2: Build point to point connection to only one PLM like before
- ❖ 3: Redevelop capability to be standards based from its core
- ❖ 4: Build standards based interoperability layer around capability and data integration APIs



Option 4: Standards Based Interoperability Layer

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- ❖ **Build an interoperability layer around the AC for data input / output**
- ❖ **Internal data structure and functions remain**
- ❖ **Normal enhancement development processes can continue without significant disruption**
- ❖ **Via a combination of internal development, open source tools, and COTS tools, developed a standards based interoperability layer**
- ❖ **Development time <1 year with initial MVP in <6 Months**
- ❖ **Small development team <5**



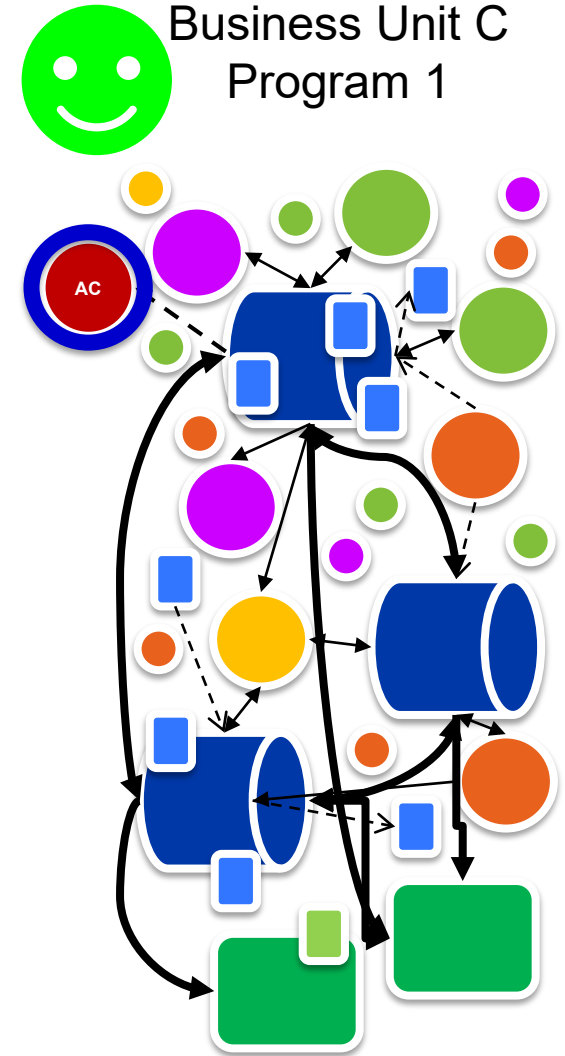
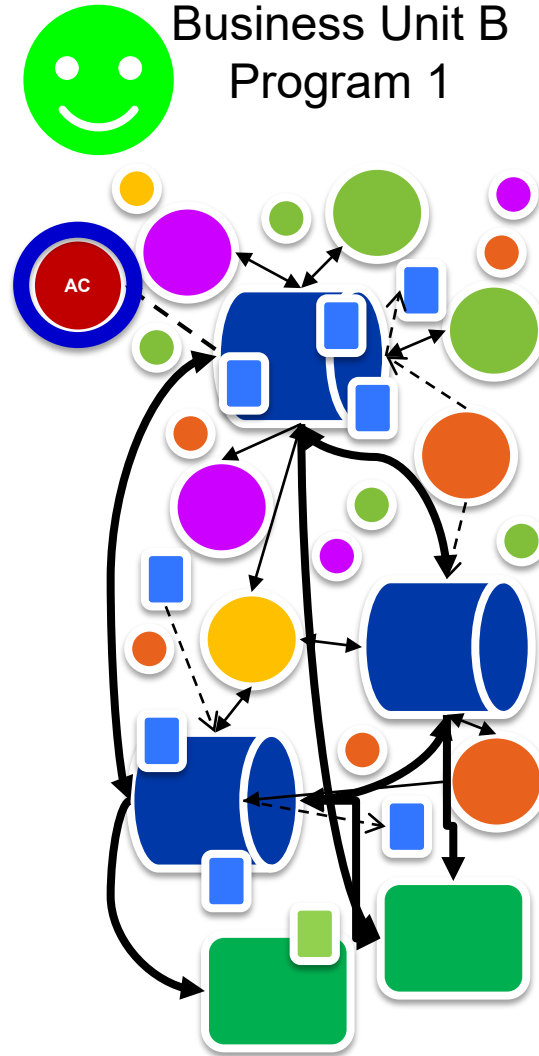
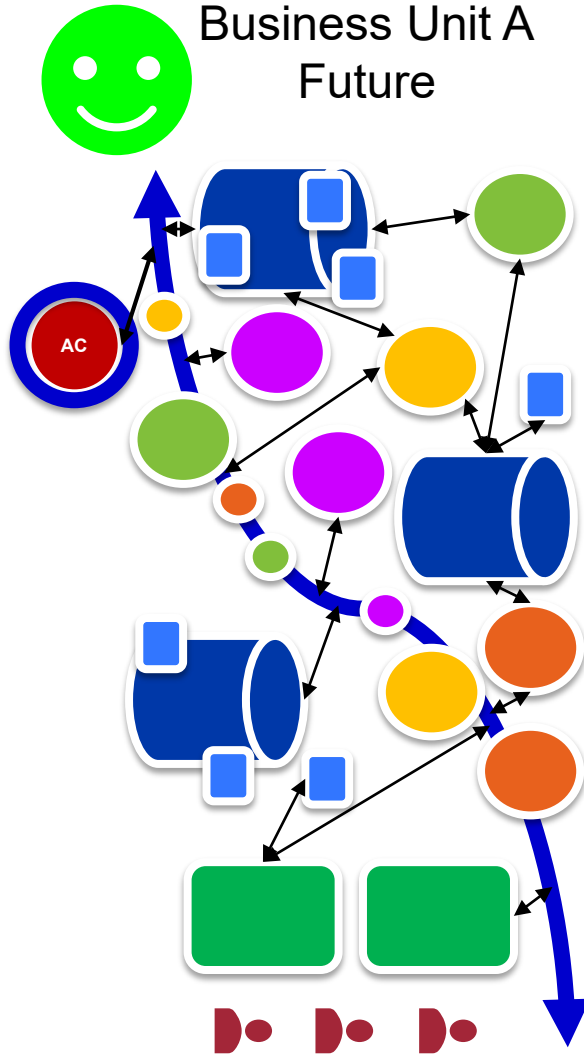
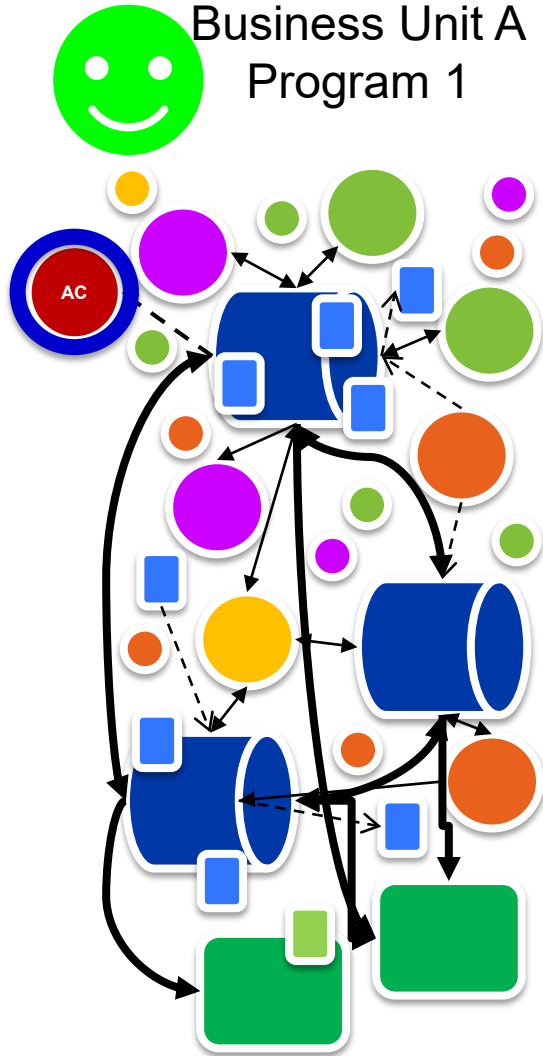
Value of AC with Interoperability Layer

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- ❖ **Support Digital Transformation future with a standards based digital thread**
- ❖ **Support multiple programs across the entire enterprise**
- ❖ **The cost to deploy to other digital threads/PLMs/data models significantly lowered**
- ❖ **Deprecate obsolete older capabilities with significant tech debt**
- ❖ **Maximize value/ROI of investment. The AC no longer only supports one area of the business**
- ❖ **Common capabilities allow standardizing certain business processes**
- ❖ **Enables future development of new capabilities**

On Path to Happy Future State

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Lessons Learned

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- ❖ **MBD data is as varied as the number of stars in the sky**
- ❖ **Standards are a work in progress; development needs to be flexible and easy to maintain**
- ❖ **Build initial prototype and proof of concept and test often and phased deployment**
- ❖ **Do not reinvent the wheel; use available industry resources**
- ❖ **Make smart “make/buy” decisions**
- ❖ **Think long term. Deployment, maintenance, updates and enhancements**
- ❖ **Open architecture and integration flexibility**
- ❖ **Integrating software is more difficult than integrating standards based data**
- ❖ **First Deployment is a challenge**

Next Steps

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- ❖ **Deploy to new areas of the business**
- ❖ **Integrate into business processes of new areas**
- ❖ **Enhance MBD data elements support; PMI, metadata, attributes, etc**
- ❖ **Enable more standard formats**
- ❖ **Downstream data use/reuse**
- ❖ **Additional integration features/automation to reduce deployment cost**
- ❖ **MBSE interoperability layer**
- ❖ **Integration with other analysis (AP209 support?)**

Closing Comments / Message to Community

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- ❖ **Standards are an essential part of Boeing's business**
- ❖ **Standards aren't a theoretical future value; they provide value today**
- ❖ **Data Interoperability Standards are essential for digital threads**
- ❖ **Standards are essential for freedom to use/reuse data**
- ❖ **Standards are essential for integrating data across businesses and partners**
- ❖ **Standards are only as good as the community that supports and embraces them**
- ❖ **For any business many capabilities will always be needed; integrating software, especially from multiple vendors, is time consuming, expensive, and not always possible. Data standards enables integration of the data without needing to integrate software.**
- ❖ **THE DATA MUST FLOW!**

Thank you! 😊

Q&A