

PLM A&D Action Group

Multiview BOM project

Progress report out

Aleksander Przybylo

GLOBAL PRODUCT DATA
INTEROPERABILITY
S U M M I T
2018



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Presentation outline

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- **PLM A&D Action Group**
- **Quick history overview**
- **Session with vendors**
- **Position Paper updates**
- **Glossary sample**
- **Restructuring scenarios**
- **Product Structures and Accountability methods**
- **Key takeaways**
- **Questions and comments**

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Rolls-Royce



<https://www.cimdata.com/zh/memberships/aerospace-defense-plm-action-group>

Problem statement

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Many A&D companies or aircraft programs are based on a “Design as Built” methodology for the design process.

As programs mature from product development, manufacturing priorities take center stage and demand adjustments to the Bill of Material (BOM).

Today’s PLM tools allow for multiple views of the BOM and Product structures but require reconciliation and complex consumption methods to demonstrate regulatory compliance.

The complexity surrounding management of multiple BOM views increases with compounding restructuring use cases.

PLM solutions don’t offer out of the box capability or best practice for robust management of accountability.

The multi-view BOM concept must facilitate a consistent representation of the same product across its lifecycle, from Design through Manufacturing, Procurement, Certification, and post production services.

Previous GPDIS presentations

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- **2016 – Bruce Hiebert, Ian Gilkerson & Benoit Planté – Multi BOM Configuration Management**
Focused on configuration control zones and EBOM splits on the MBOM.
- **2017 – Kenneth Swope – PLM A&D Action Group Multi-View Bill of Materials Development and Status**
Expanded focused to more restructuring use cases, such as manufacturing assemblies and condition of supply.
- **2018 – Aleksander Przybylo – PLM A&D Action Group Multi-view BOM progress report out**

Workshops

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March 2017
Toulouse

September 2017
Seattle

March 2018
Paris



Session with vendors

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- **One day session with vendors: Aras, Dassault Systèmes, PTC, SAP, Siemens PLM**
- **The good**
 - All major vendors participated and were receptive
 - Vendors recognize the need for the standardization of accountability processes
- **The struggles**
 - Vendors push towards requirements, not collaboration
 - Difficulty of interacting with each vendor separately

Progress on the position paper

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- **Version 2.2 published**
 - Major content restructure
 - Completed subproject content
 - Added high level requirements for each subproject
 - Added Effectivity Management content
- **New appendices published**
 - Glossary
 - Restructuring use cases
 - Product Structures and Accountability Methods

Glossary

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#		Acronym or Term	Meaning	Source of definition	Synonym	Difficulty to agree	Status
3	Agreed	Aircraft Identification Number	The manufacturer's permanently-applied serial number for the airframe.	ATA_SPEC-2000_2011-01	MSN	Low	Term in published glossary
4	Agreed	Alternate Part Number	An alternate part number identifies a part which fully meets required functional and 106, 2200, structural specifications of the primary part number, and is approved for use in lieu of the primary part number Alternate part must be defined as global or local.	ATA_SPEC-2000_2011-01	Interchangeable, Optional part, Substitute, Replaceable	Medium	Term in published glossary
24	Agreed	Effectivity	A designation defining the product or product range; e.g., serial numbers, lot numbers, model, dates, or event at which the usage of a specific product configuration applies, a change to a specific product is to be or has been impacted, or to which a variance applies.	Based in EIA-649-A 2004		Low	Term in published glossary
195	Cancelled	Interchangeable	Parts with the same Part Number that can be freely used on any location and unit without installation conditions: the original part can be removed and the new one can be installed in its place.	OWN		Low	3

Summary of position on major topics

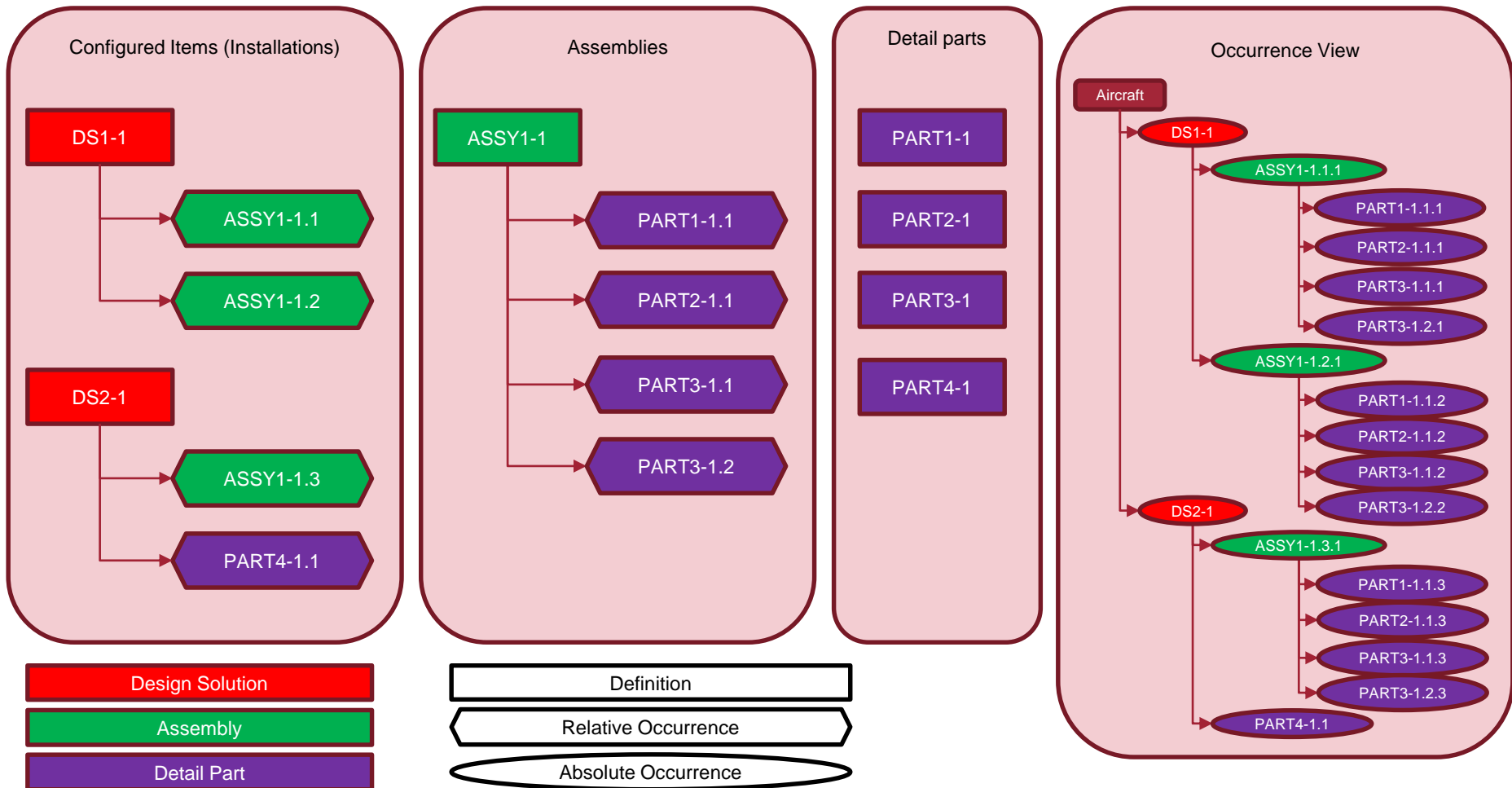
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- **Accountability**
 - System enforced accountability at and post release time
 - Ability to incrementally validate accountability (as opposed to once product is built)
 - Ability to enforce accountability across units and beyond user session
- **Engineering/Assembly requirements**
 - Ability to manage requirement consumption at arbitrary level (installation/fastener group/single fastener/spec/step)
- **Supplier integration**
 - Ability to exchange and synchronize configured structures for each OEM/supplier integration scenario (BTP/Des/D&B)
- **Evolving configuration for specific AIN**
 - Ability to define multiple configurations for a specific AIN (as opposed to fly-away only) with enforced accountability

Restructuring use cases

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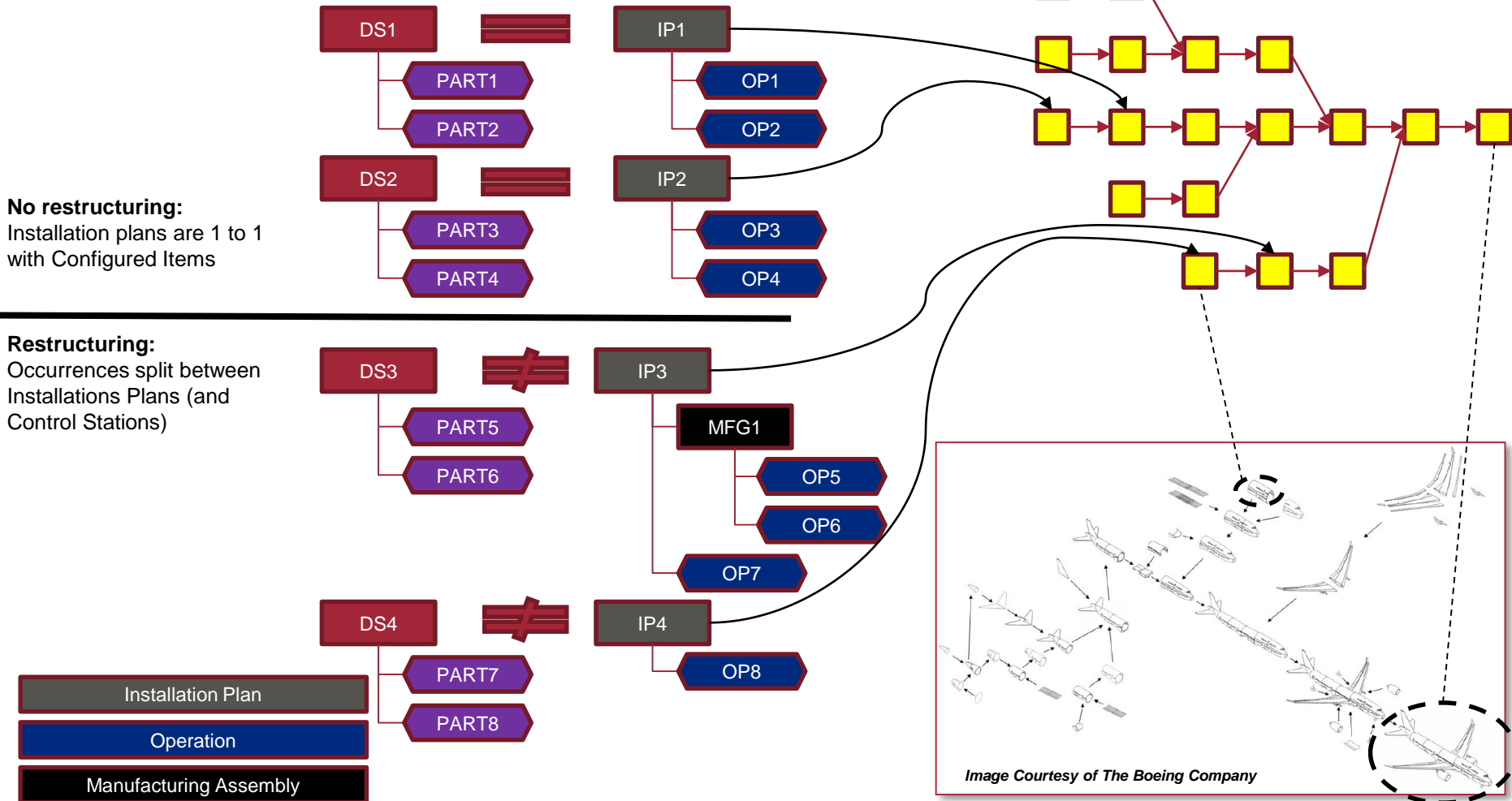
Symbol legend (Engineering)



Restructuring use cases

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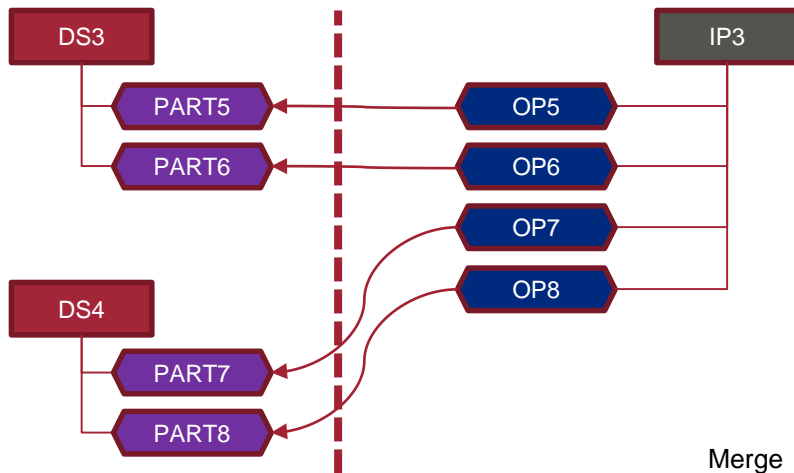
Symbol legend (Manufacturing)



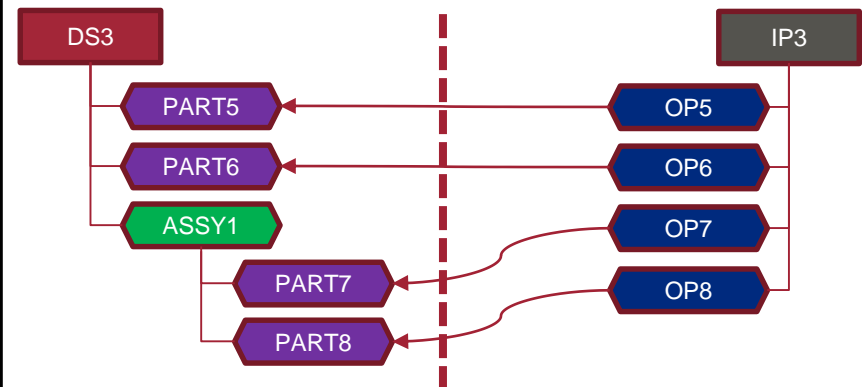
Restructuring use cases

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Hierarchy restructure

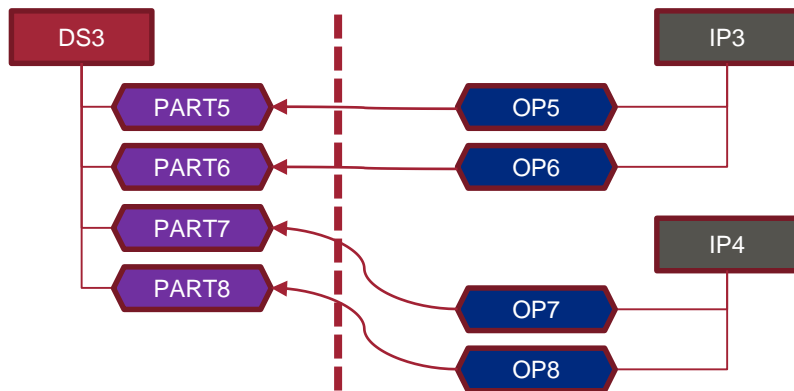


Merge

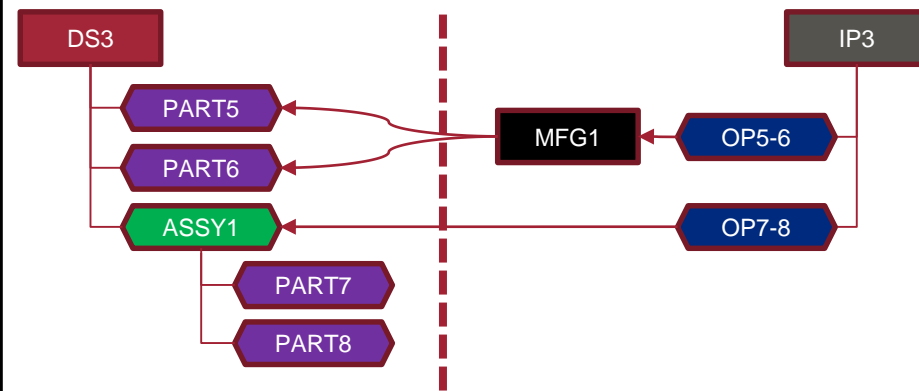


Make on Assembly (MOA)

Split



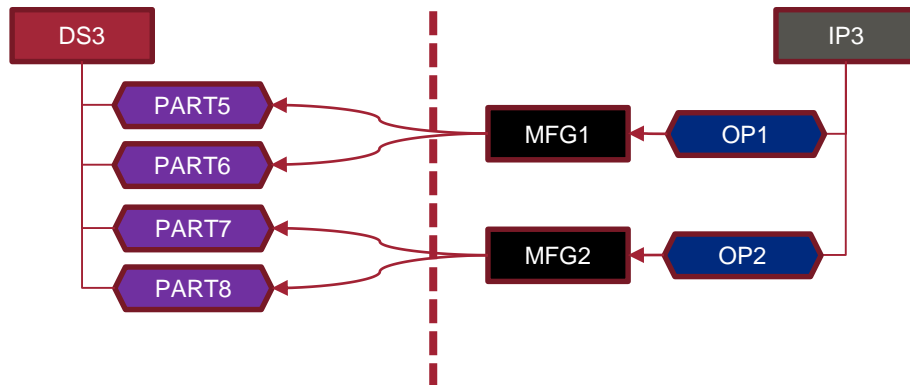
Manufacturing Assembly (Subtypes on following page)



Restructuring use cases

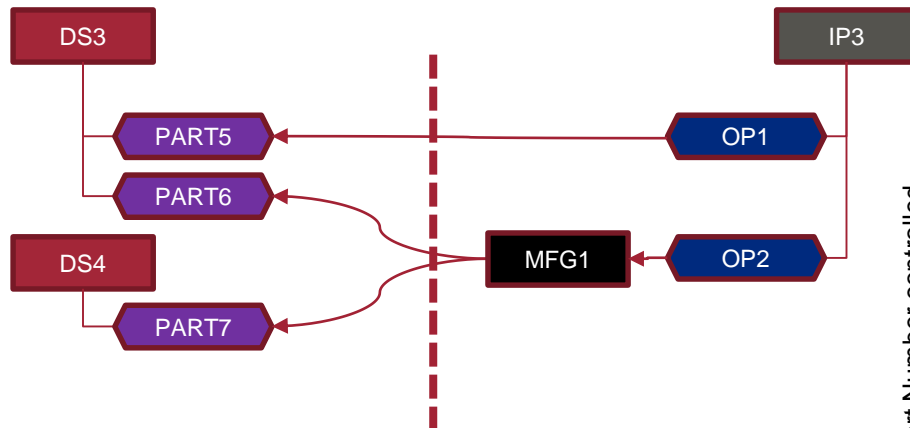
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Manufacturing Assembly

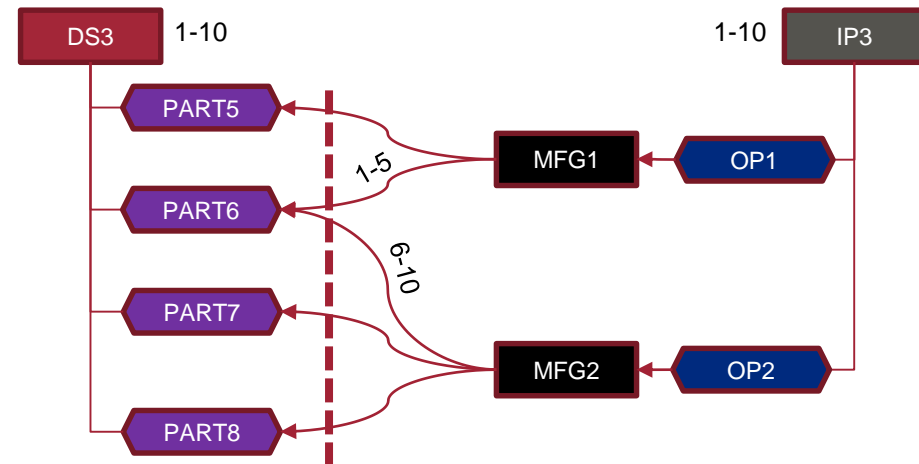


Subset

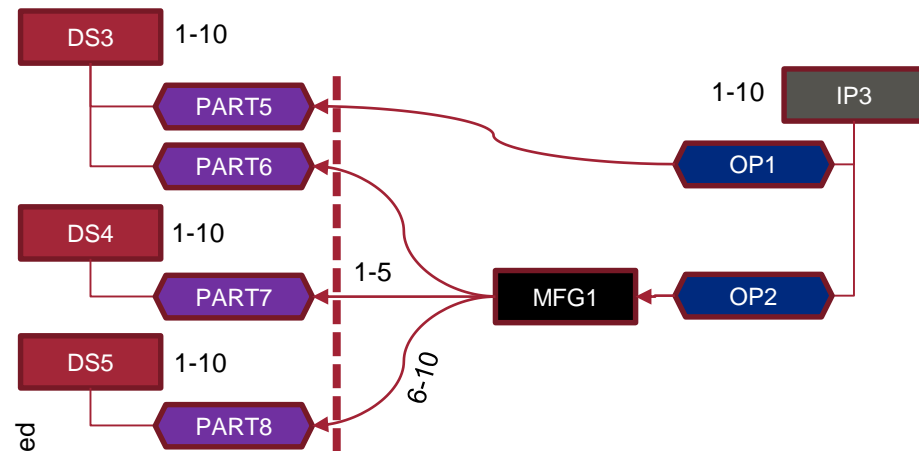
Superset



Part Number controlled



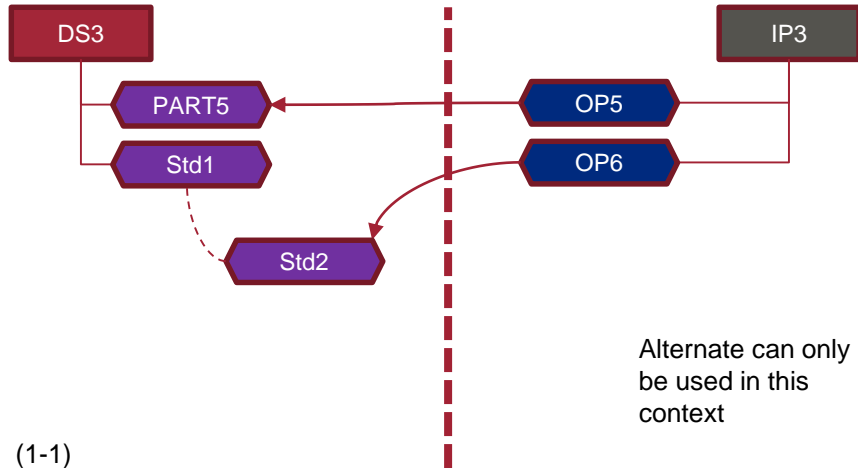
Unitized



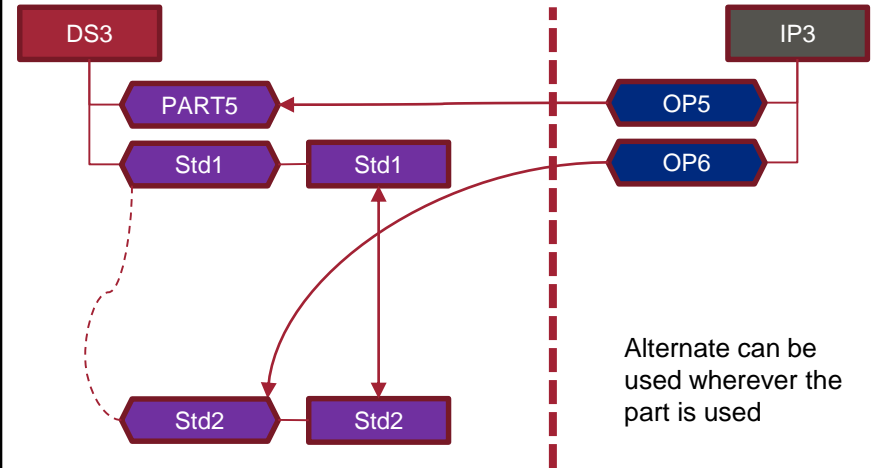
Restructuring use cases

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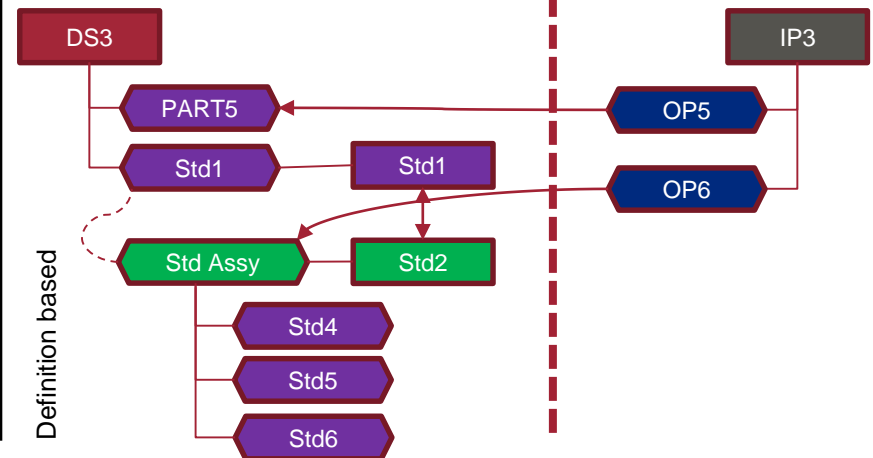
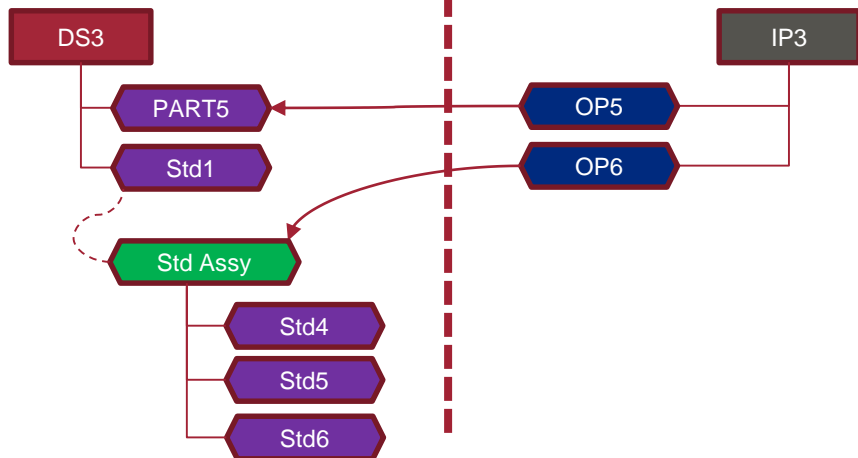
Alternate



(1-1)



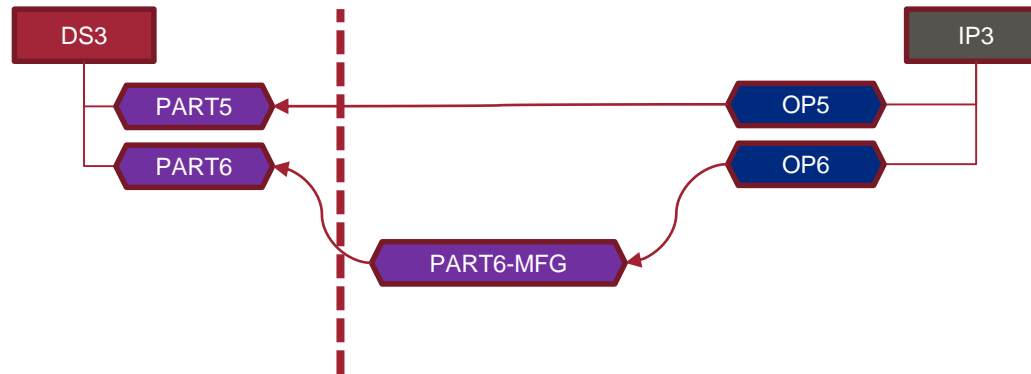
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Restructuring use cases

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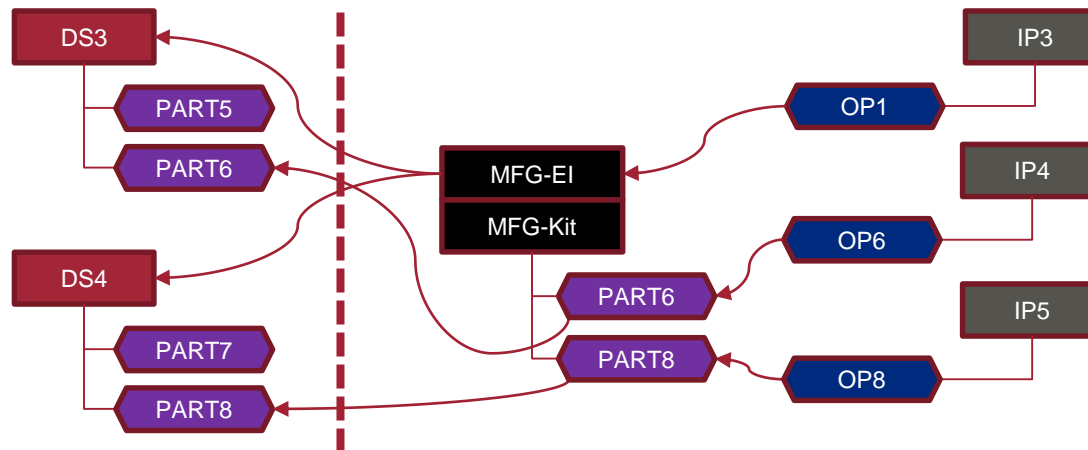
Condition of Supply



Typical use case: omit holes

Part definition replacement

Kitting and End Items



Typical use case: End item shipped from supplier with boxed kit for final assembly

Manufacturing End Item consumes Configured Items instead of occurrences

Similar to Manufacturing Assembly but can be split across Installation plans

Product structures

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- **Single structure**
 - Both upstream and downstream are constrained to a single structure (e.g. design as built)
- **Independent data sets**
 - The upstream and downstream structures are independent and can deviate independently of each other
- **Projected transient views**
 - Both upstream and downstream structures are projected views from a single authoritative graph structure
 - The views are not persistent and not configuration managed
 - Configuration management occurs on the authoritative structure
- **Projected persistent views**
 - A hybrid between “Projected transient views” and “Independent data sets”
 - The independent data sets are generated from the single structure
 - Configuration management occurs on the projected persistent views

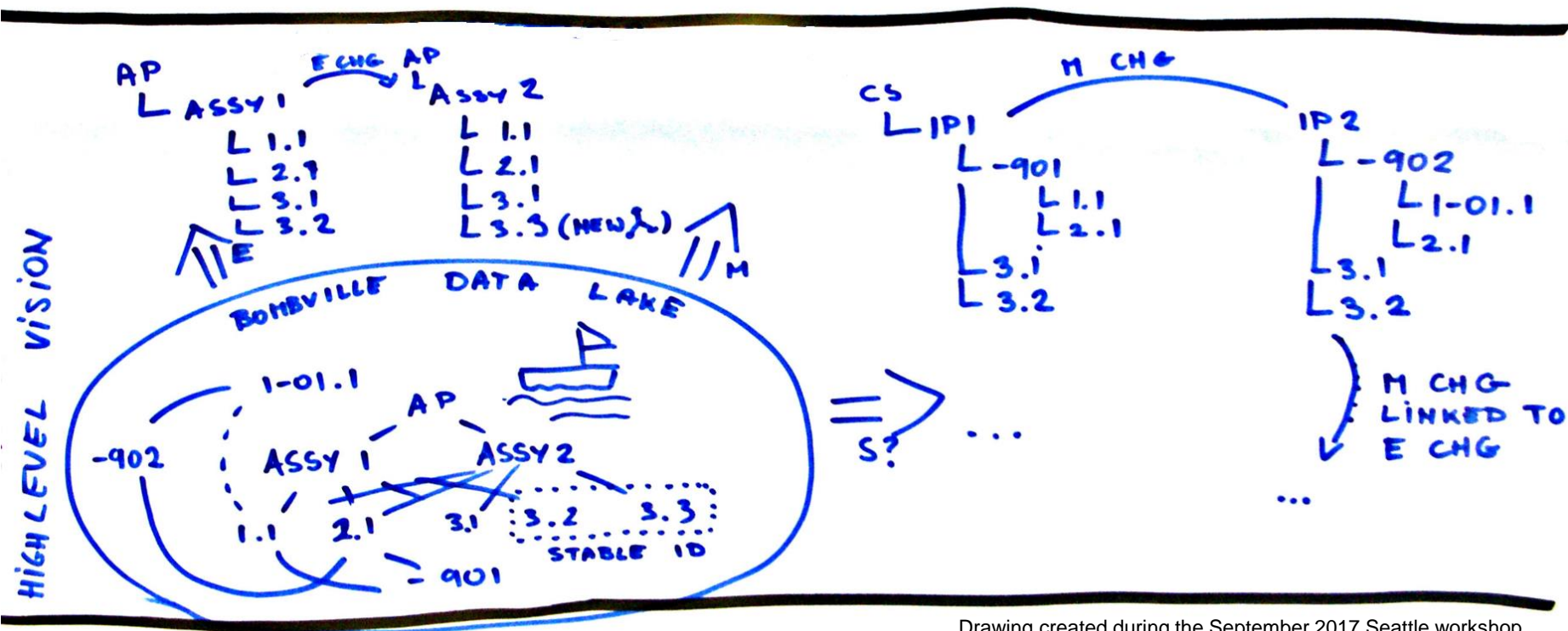
Accountability methods

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- **Report based**
 - Reports are executed periodically (automatically or on demand)
 - Reports generate lists of under or over consumed nodes
- **Change based**
 - For each upstream change, a delta is computed
 - Each node in the delta has to be consumed before the change is incorporated in the downstream structure
 - Assignment assistant verifies coherence of manufacturing change based on engineering change prior to release of manufacturing
- **Accountability map**
 - An additional structure is added which manages an node assignments
 - The map corresponds to the upstream structure and maps each node to a downstream container

Projected persistent views

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Drawing created during the September 2017 Seattle workshop

Product structure vs Accountability method Matrix

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	Report based	Change based	Accountability map
Single Structure	N/A		
Independent Structures	Current		
Projected Transient Views			N/A
Projected Persistent Views		Preferred	Preferred

Key takeaways

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- **It's the first time that competitors in the A&D industry come together and agree to share information**
- **The workshops have been immensely valuable and productive**
- **We all agree that there is a need for standardization of accountability processes, not just standardization of data elements**
- **We are still struggling with finding the best way to involve the vendors**

Main takeaway

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As each OEM has created homegrown processes and systems to manage internal production of configured structures, the common suppliers we share struggle with the wide range of variation that is necessary. This industry group has openly shared how each OEM manages configured structure with effectivity.

The complexity and cost is significant when the supplier must create unique BOM translators, effectivity converters and configuration management differences. Each supplier typically uses dedicated personnel to manage each OEM unique work package for this reason.

These costs are ultimately driven back to the OEMs.

What's next

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- **Publishing of Position paper appendices on**
 - Engineering and assembly requirements
 - Supplier collaboration
 - Evolving configuration for specific AIN
- **Gathering Vendor responses**
- **Additional workshop on**
 - Effectivity management
 - Vendor specific implementations
- **Establishing ongoing relationship with vendors**

Questions?

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