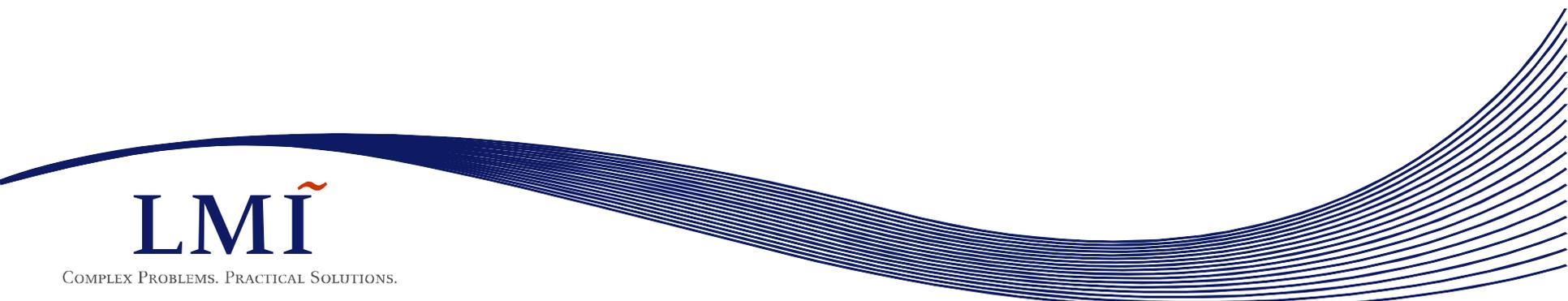


Standards as Digital Data

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PSMC Tools and Data Subcommittee



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COMPLEX PROBLEMS. PRACTICAL SOLUTIONS.

Problem Statement and Solution

- Standards are document-based for the most part
 - Not in machine readable format
- Users of standard parts must ‘manually’ create the part in their local parts library (CAD/PLM)
 - Redundant parts creation (i.e. no enterprise-wide, or poor use of, parts library)
 - Creation process = opportunity for error
- Solution: provide parts standards in a format that is easily imported into a CAD system

Potential Benefits

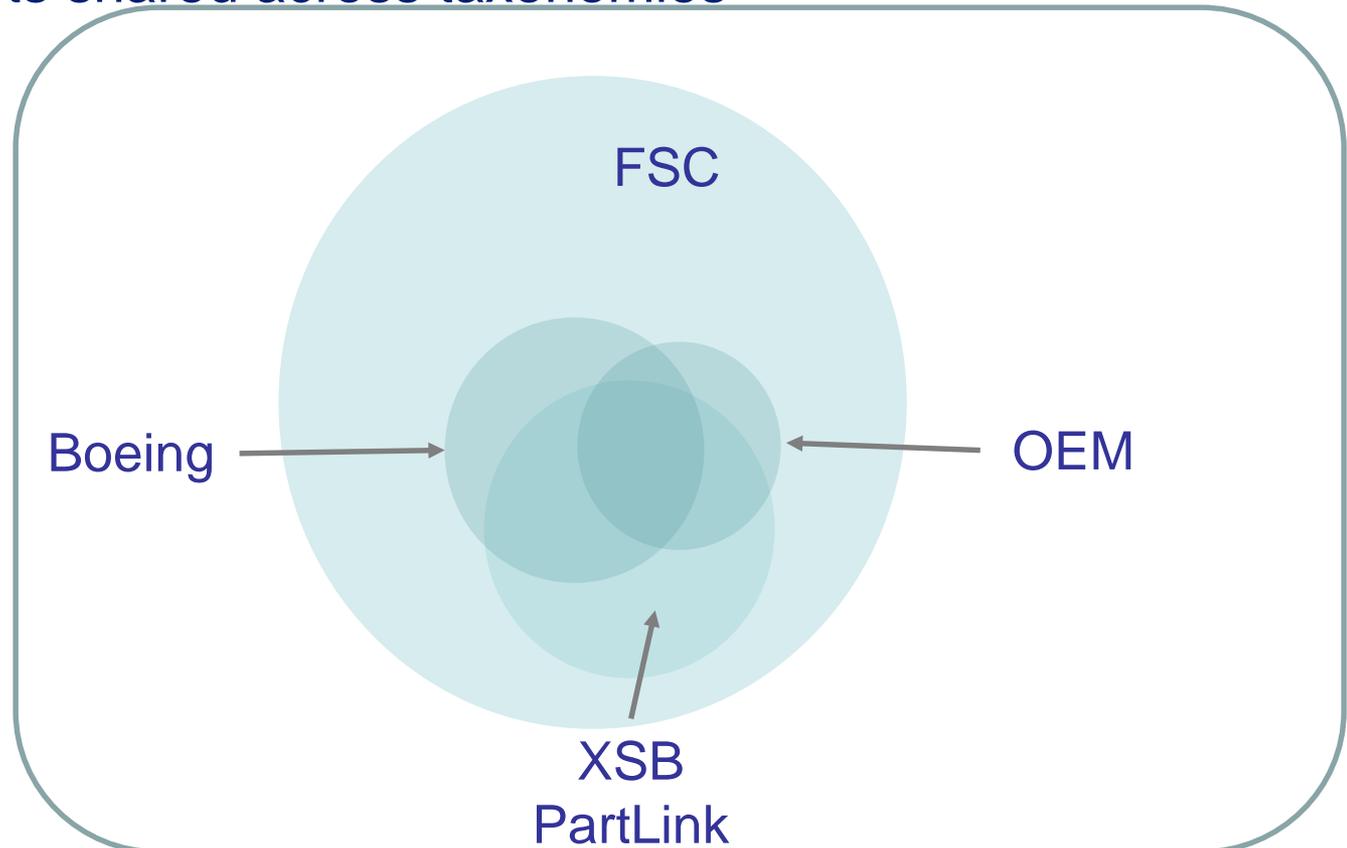
- Benefits of model-based environment from the start
- Time savings
- Less duplication of efforts
- Increased consistency in design and implementation
- Benefits to SDOs and users (e.g. easier purchasing, fewer parts in inventory, etc.)

Consensus on Standards as Importable Data

- To get agreement on a standard to deliver Parts Standards as Importable Data
- All players (SDOs, OEMs, suppliers of parts) must be able to adopt the standard
- Open access: no proprietary software or platform
- Barrier to entry/adoption must be low
- Flexible to describe variety of parts

Approach

- Comparing existing parts taxonomies
 - Degrees of commonality in coverage across taxonomies
 - Identify parts shared across taxonomies



Data

- Could obtain only two taxonomies:
 - Federal Supply Code (FSC)
 - XSB PartLink
- Federal Supply Code (FSC)
 - Classification of parts into 2 levels: Level 1 – 75 groups and Level 2 – 580 subgroups
- XSB PartLink
 - Information on Parts, Materials, and Process Hierarchies
 - Taxonomy has 6 levels: Level 1 – 6 entities; Level 2 – 103 entities; Level 3 – 204 entities; Level 4 – 686 entities; Level 5 – 122 entities; Level 6 – 99 entities

Background on Data (Federal Supply Classification/ FSC)

FSC GROUP	FSC GROUP DESCRIPTION	FSC CODE	FSC DESCRIPTION
53	Hardware and Abrasives	5305	Screws
53	Hardware and Abrasives	5306	Bolts
53	Hardware and Abrasives	5307	Studs
53	Hardware and Abrasives	5310	Nuts and Washers
53	Hardware and Abrasives	5315	Nails, Machine Keys and Pins
53	Hardware and Abrasives	5320	Rivets
53	Hardware and Abrasives	5325	Fastening Devices
53	Hardware and Abrasives	5330	Packing and Gasket Materials
53	Hardware and Abrasives	5331	O-Rings
53	Hardware and Abrasives	5335	Metal Screening
53	Hardware and Abrasives	5340	Hardware, Commercial
53	Hardware and Abrasives	5341	Brackets
53	Hardware and Abrasives	5342	Hardware, Weapon System
53	Hardware and Abrasives	5345	Disks and Stones, Abrasive**
53	Hardware and Abrasives	5350	Abrasive Materials**
53	Hardware and Abrasives	5355	Knobs and Pointers
53	Hardware and Abrasives	5360	Coil, Flat and Wire Springs
53	Hardware and Abrasives	5365	Bushings, Rings, Shims and Spacers

I 78 unique group codes

580 unique parts
 Max - 37 parts in group
 Min - 0 parts in group

Background on Data (XSB PartLink Ontology)

Part Hierarchy	Part Hierarchy Class	
	PART	root class of the part hierarchy
	>N	interior node of the part hierarchy where N is a unique ID string of digits and D is a node description
	>>INC.NAME	five digit INC code and NAME is the item name for the FCS, for example: prod:00014:BEARING_BALL_ANNULAR
	>>>NIIN	nine digit "National Item Identification Number" assigned to this item of supply in the FCS
	ODE_TYPES	root for a hierarchy of target classes for object properties
	ODE_ENUMERATED_TYPES	root of a hierarchy of enumerated type classes
	ODE_PARAMETERIZED_TYPES	root of a hierarchy of parameterized type classes
	Part Hierarchy Individual	
	prod:CAGECAGEPARTPN	individual part that is an instance of some sub class in
Material Hierarchy	Part Hierarchy Properties	
	prod:PROP	property associated to a specific class within the part hierarchy where PROP is the property name, for example: prod:AT
	Material Hierarchy Class	
	mat:MATERIAL	root class for the material hierarchy
	mat:METAL	direct subclass of mat:MATERIAL and is the root of the hierarchy of classes for metals and their alloys
	mat:NONMETAL	direct subclass of mat:MATERIAL and is the root of the hierarchy of classes for nonmetals
	mat:ALLOYING_CONSTITUENT	root of the hierarchy for classes representing alloying elements from which metal alloys are composed
	mat:constituent_percentage_4	subclass of type:ODE_Parameterized_Types
	mat:has_base_element	represents the dominant constituent element in a metal or metal alloy and has a target of mat:ALLOYING_CONSTITUENT
	mat:has_constituent	represents a constituent element in a metal alloy and has a target of mat:constituent_percentage_4
Process Hierarchy	Material Hierarchy Properties	
	mat:has_base_element	represents the dominant constituent element in a metal or metal alloy and has a target of mat:ALLOYING_CONSTITUENT
	mat:has_constituent	represents a constituent element in a metal alloy and has a target of mat:constituent_percentage_4
	Process Hierarchy	
	proc:PROCESS	base class for all manufacturing processes
	proc:NONSHAPING_PROCESS	subclass of proc:PROCESS for processes that do not change the shape of an item, e.g PAINTING or HEAT TREATMENT
proc:QUALITY_PROCESS	subclass of proc:PROCESS for processes related to maintaining production quality, e.g. TESTING or INSPECTION	
proc:SHAPING	subclass of proc:PROCESS for processes that change the shape of an item, e.g DRILLING or FORGING	

Analysis

- Mapping of FSC and PartLink across three dimensions:
 - Traceability – does this part class exist in target taxonomy?
 - Level of Details – at what level of detail does this part class exist?
 - Containment – is the part class fully/ partially contained at that level of detail in target taxonomy?

Analysis Summary

FSC GROUP	FSC GROUP DESCRIPTION	Traceability	Level of Detail	Containment
12	Fire Control Equipment	Level 4, 5	+3	Partially Contained
15	Aircraft and Airframe Structural Components	Level 3	+2	Contained
16	Aircraft Components and Accessories	Level 4, 5	+3	Partially Contained
17	Aircraft Launching, Landing, and Ground Handling Equipment	Level 5	+4	Partially Contained
25	Vehicular Equipment Components	Level 4, 5	+3	Partially Contained
26	Tires and Tubes	Level 3	+2	Contained
28	Engines, Turbines, and Components	Level 2, 3	+1	Contained
29	Engine Accessories	Level 5	+4	Partially Contained
30	Mechanical Power Transmission Equipment	Level 3	+2	Partially Contained
31	Bearings	Level 2, 3	+1	Contained
40	Rope, Cable, Chain, and Fittings	Level 5	+4	Partially Contained
43	Pumps and Compressors	Level 3	+2	Contained
47	Pipe, Tubing, Hose, and Fittings	Level 5	+3	Contained
48	Valves	Level 3	+2	Contained
53	Hardware and Abrasives	Level 3, 4	+2	Contained
59	Electrical and Electronic Equipment Components	Level 3, 4	+2	Partially Contained
60	Fiber Optics Materials, Components, Assemblies, and Accessories	Level 4, 5	+3	Contained
61	Electric Wire, and Power and Distribution Equipment	Level 3, 4	+2	Partially Contained
62	Lighting Fixtures and Lamps	Level 3, 4	+2	Partially Contained
63	Alarm, Signal and Security Detection Systems	Level 3, 4	+2	Contained
80	Brushes, Paints, Sealers, and Adhesives	Level 4	+3	Partially Contained
91	Fuels, Lubricants, Oils, and Waxes	Level 3, 4	+2	Contained

Findings

- Of 75 FSC groups 22 map to PartLink
- Schema levels vary from early stage mapping (+2) to later stage mapping (+4)
 - Earlier stage mapping implies more complete containment
- Of those FSC groups mapped to corresponding Partlink group / entity, about one half are completely contained in PartLink

Next Steps

- Inflow of additional taxonomies
 - Expand coverage
 - Inform schema development
- Develop high level schema
- Determine the best way to deliver schema to stakeholders.

Questions?
