

Powertrain Component Commonality and Reuse

A Solution Approach using Classification Management with Controlled Workflow

Humayun Khalid

C3PNG Implementation Specialist

Mechatronics Inc. (Contract to Ford Motor Company)

hkhalid2@ford.com

www.mechatronics-us.com

Sassan Khoubyari

Chief Program Manager

Global Powertrain C3PNG Methods & Deployment

Ford Motor Company

skhoubya@ford.com

www.ford.com





Evolution of the Ford Product Creation Process

1985



Concept to Customer

MBJ#1* 72 MBJ#1



1992



World Class Timing

68 MBJ#1



1993



World Class Process

65 MBJ#1



Since 1996



Ford Product Development System

43 MBJ#1



2005+



Global Product Development System

An Enterprise-wide process built from Global Best Practices



For Joint Programs

* <KO> equivalent timing for S4/P4 program

Key Business Drivers – Commonality

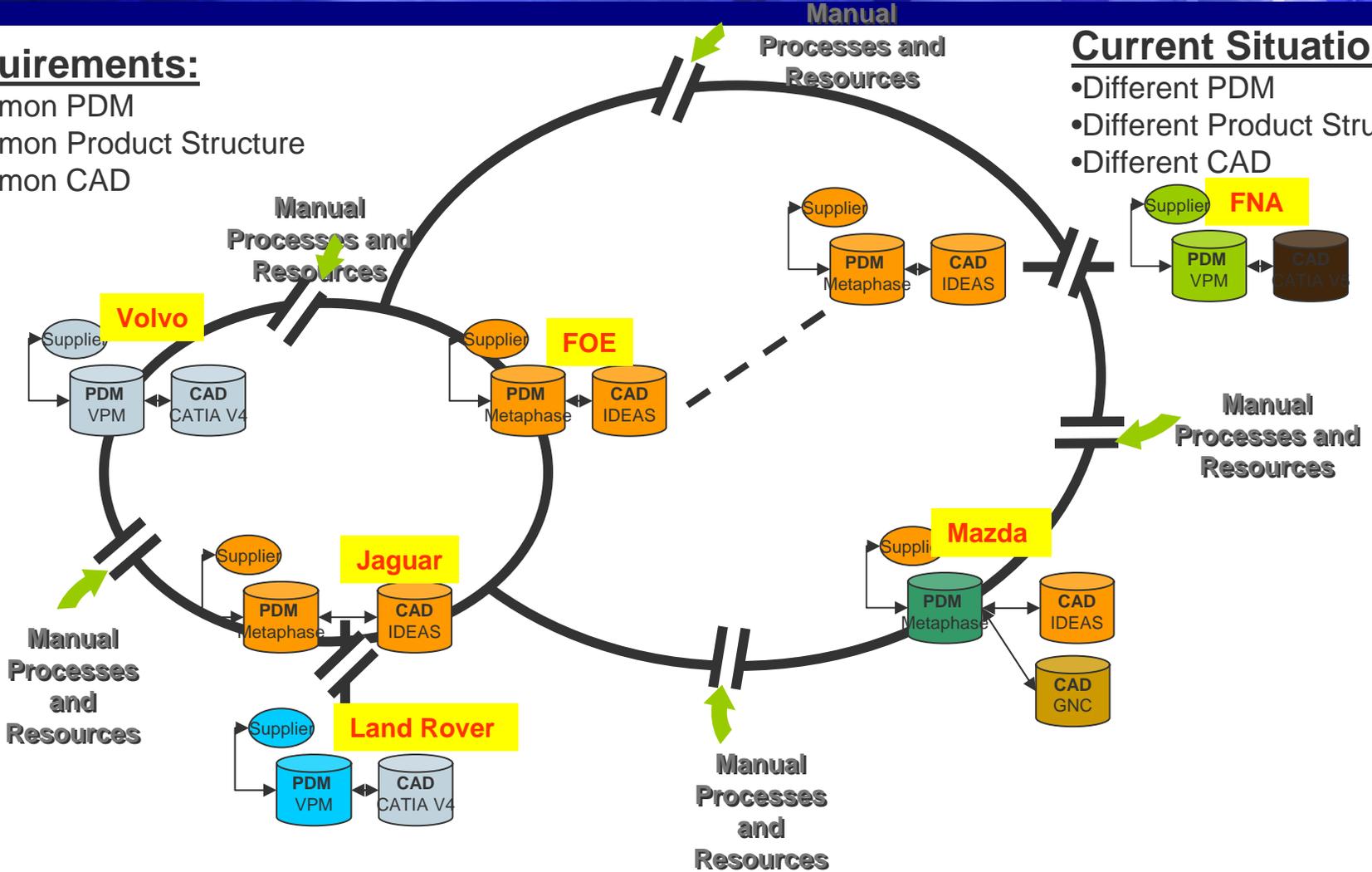
(Before C3PNG)

Requirements:

- Common PDM
- Common Product Structure
- Common CAD

Current Situation:

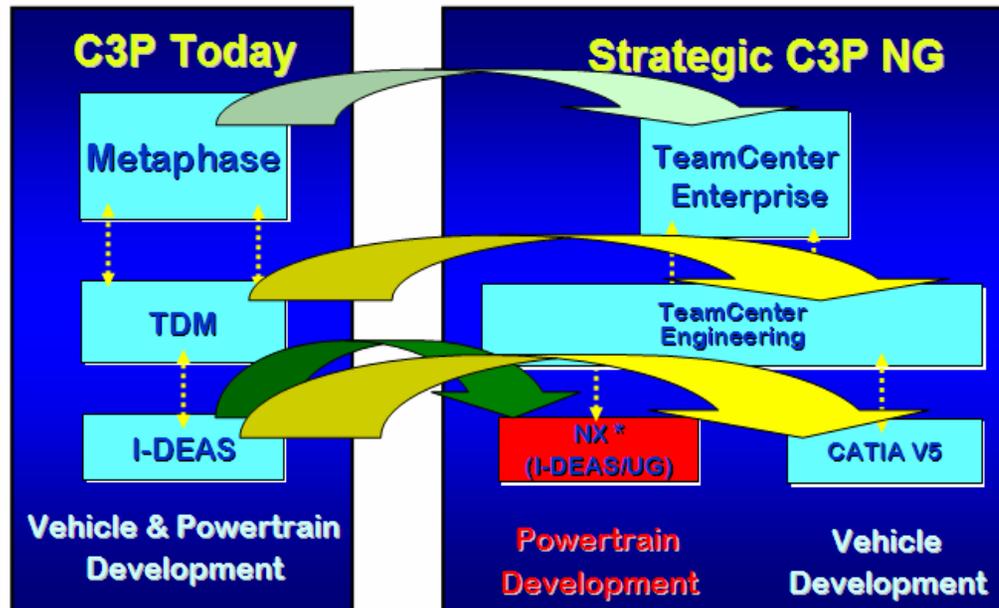
- Different PDM
- Different Product Structure
- Different CAD



Our current Methods/Tools/Data environment inhibits cross brand programs

C3P-Next Generation (Ford PLM Initiative)

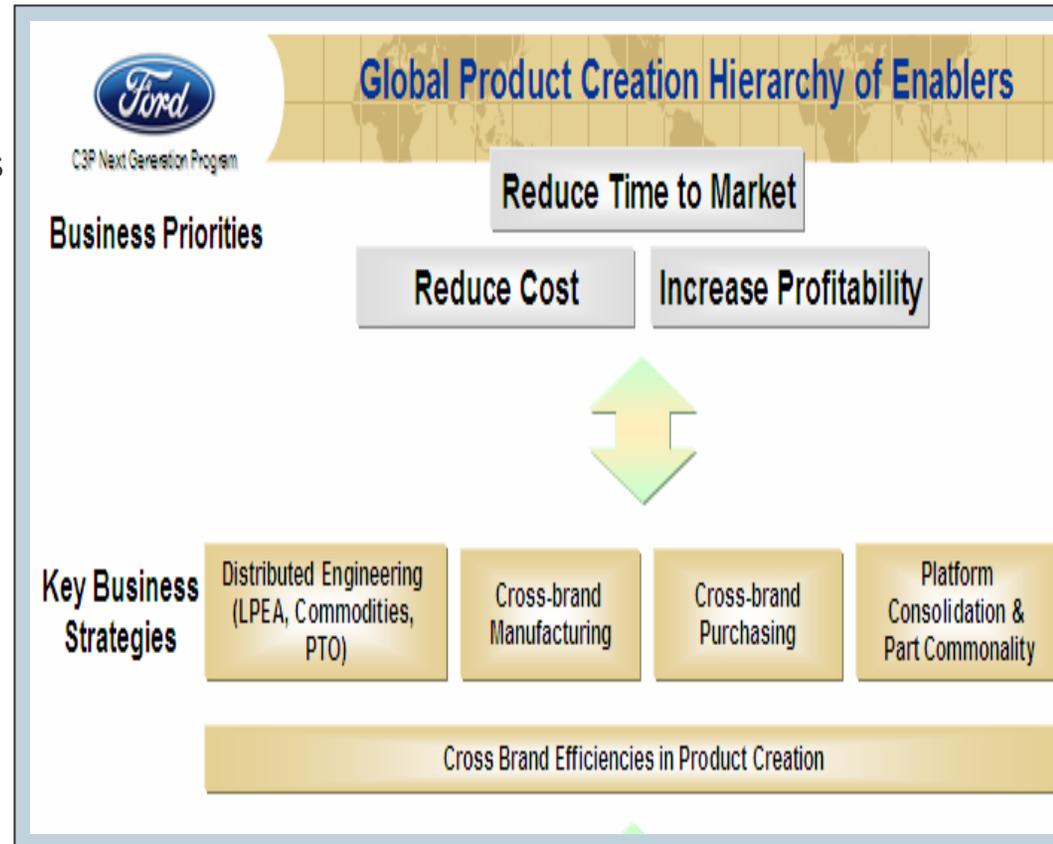
- **C3P-NG** (CAD/CAE/CAM/PIM)
- CATIA V5 (excluding PT), IDEAS Teamcenter Engineering(TCe) & Teamcenter Manufacturing (TCm) AVBOM, Vismock, Tecnomatics, etc....



* under evaluation

The Business Need/Challenge

- Fierce **competitive** environment for time to market in large production system, and in particular Automotive Industries
- Major requirements from the customers are **Quality** and **Economy**
- **Complexity** of automotive product development and manufacturing with **variants** product configuration has been always challenging to maximize the quality, cost and time equation
- Disciplined approach of **knowledge base re-use** across all product development & manufacturing activities requires proven supporting tools and methods
- Keeping track of all components and making it available in the entire enterprise with **managed BOM** has been always challenging



The Competitive Environment

Time, Cost, and Quality equation is no longer sufficient

Globalization

Design anywhere
Build anywhere
Maintain anywhere
at any time

Product Complexity

Increased part counts
Use of standard parts
Build-to-order and mass
customization

**Reduced
time**

**Lowered
costs**

**Improved
product
quality**

Competition

Increasing globally
The need to differentiate
Consolidation while focusing
on core competencies
Need to innovate product
and processes

Pricing Pressure

Demand for global pricing
Price it right the first time
You must know your costs
Decreased product margins

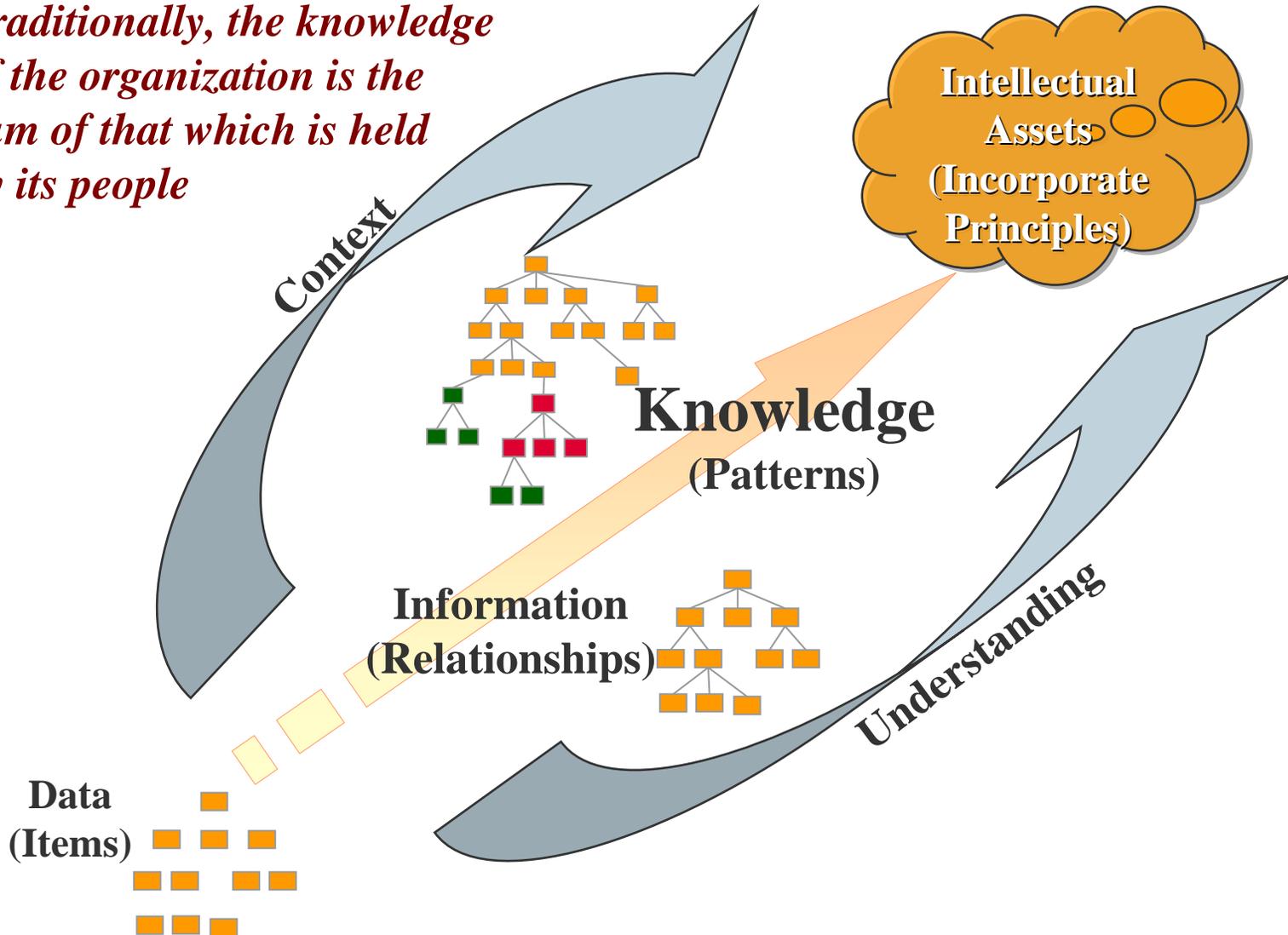
Innovation



So Where's the Starting Point?

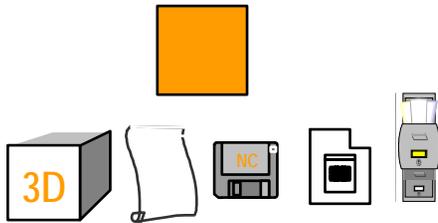
Creating and managing intellectual assets to enable innovation

Traditionally, the knowledge of the organization is the sum of that which is held by its people



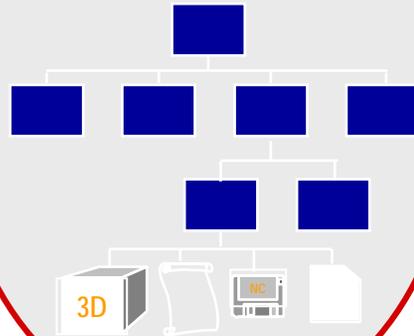
The Foundation: Applications and Business Solutions

Data Vault & Document Management

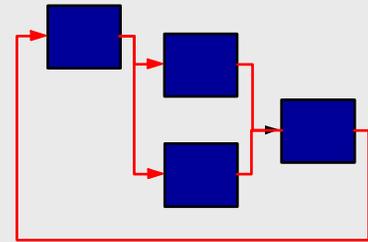


Data Authoring (CAx)

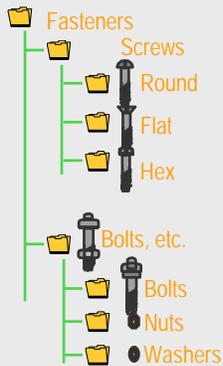
Structure Management



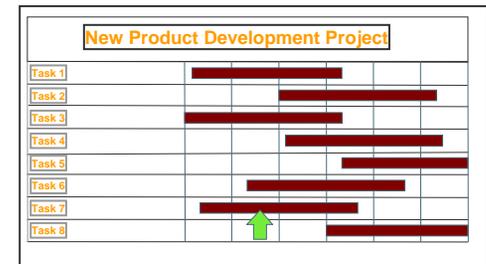
Workflow & Process Mgmt.



Classification Management



Program & Project Management



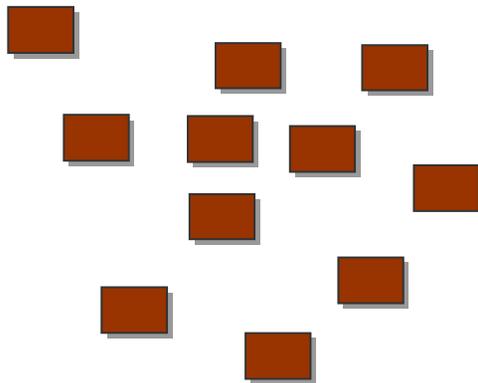
Key for Part Commonality Implementation

Classification Management?

A controlled disciplined processes of classifying, managing and reusing the knowledge base throughout the enterprise with controlled reuse workflow

·Are You Re-Inventing the Wheel?
 ·“Up to 80% of the work done in an engineering department is identical or very similar to work done previously” from research by: Arthur D. Little

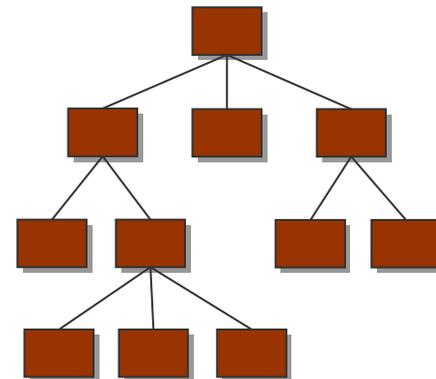
Unclassified Items



Classification Management



Classified Items



Benefits

- Increase reuse of existing components, processes and resources
- Limit part number proliferation by commonizing purchased parts and consolidate suppliers
- Improve product quality by reducing variation and noise in the process
- By product - Part/process standardization for PDPD
- Configuration management with maximize variety and minimize number of parts

Current PT Solution

- **Standard Component Library (SCL):** A system developed in PT Engineering-IT to facilitate PT engineers and designers in reusing powertrain standard components and features
- The tool is being deployed in product and design groups
- The system is deployed as a web portal and can be accessed by engineers and designers through thin web client
- The system is populated with preferred components for engine programs reuse
- The system has browse and attribute based search capabilities

Current System - Key Features

- Lightweight web portal interface for both PC and UNIX platforms
- Attribute based search for components and features
- Component relationship based on key attribute match
- CAD model availability through Metaphase location information and web download of Ideas program files and universal files
- Session management for program assumptions for selecting standard components

SCL System – Tool Snapshot

Standard Component Library

Home | Browse Library | Create Session | Edit Session | Admin | Help | Feedback

View All

Total Item Found: 10

Idle Air Bypass Valve

Item ID	General Information	Parameters
1F1E-9F715-AA	<p>General Information: ---</p> <p>CAD Model: Stored in Metaphase</p> <p>Flow Rate: Medium (> 2.0 PPM and < 2.5 PPM)</p> <p>Opening Shape: Circular</p> <p>Connector Type: Straight</p> <p>Connector Angle: 0 degree</p>	
1F1E-9F715-BA	<p>General Information: ---</p> <p>CAD Model: Stored in Metaphase</p> <p>Flow Rate: High (> 2.5 PPM)</p> <p>Opening Shape: Trapezoidal</p> <p>Connector Type: Bend</p> <p>Connector Angle: 0 degree</p>	
1F2E-9F715-AA	<p>General Information: ---</p> <p>CAD Model: Stored in Metaphase</p> <p>Flow Rate: High (> 2.5 PPM)</p> <p>Opening Shape: Trapezoidal</p> <p>Connector Type: Bend</p>	

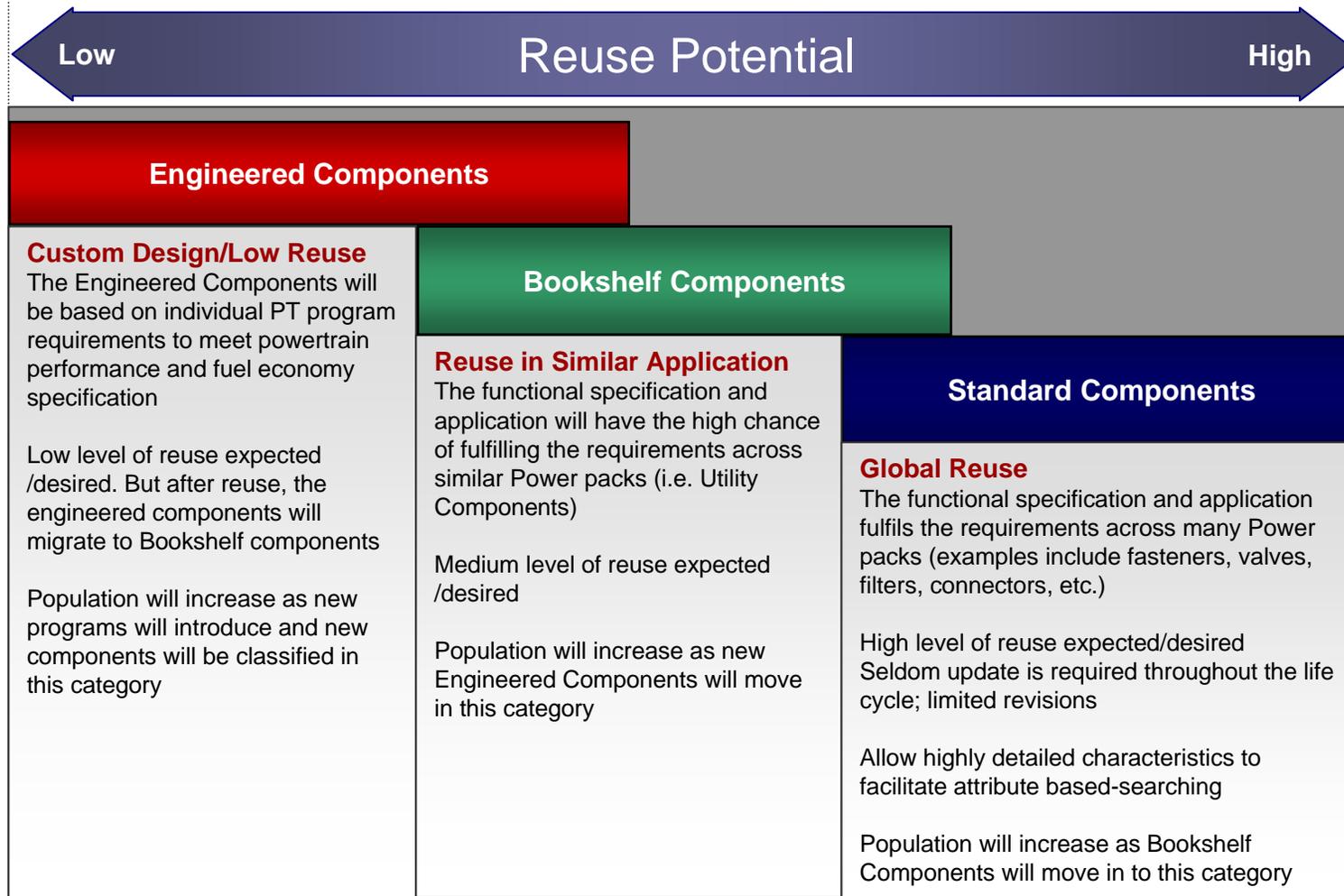
Categories

- INTAKE SYSTEM
 - Components
 - Idle Air Bypass Valve
 - Idle Air Bypass Valve Gasket
 - Fasteners
 - Bolts
 - Pin Studs
 - TF Screws
 - Throttle Body
 - Throttle Body Gasket
 - EGR System Module
 - IMTV
- Geometric Features
 - Metal Tube End
 - SAE J1231
 - SAE J2044

Parameters

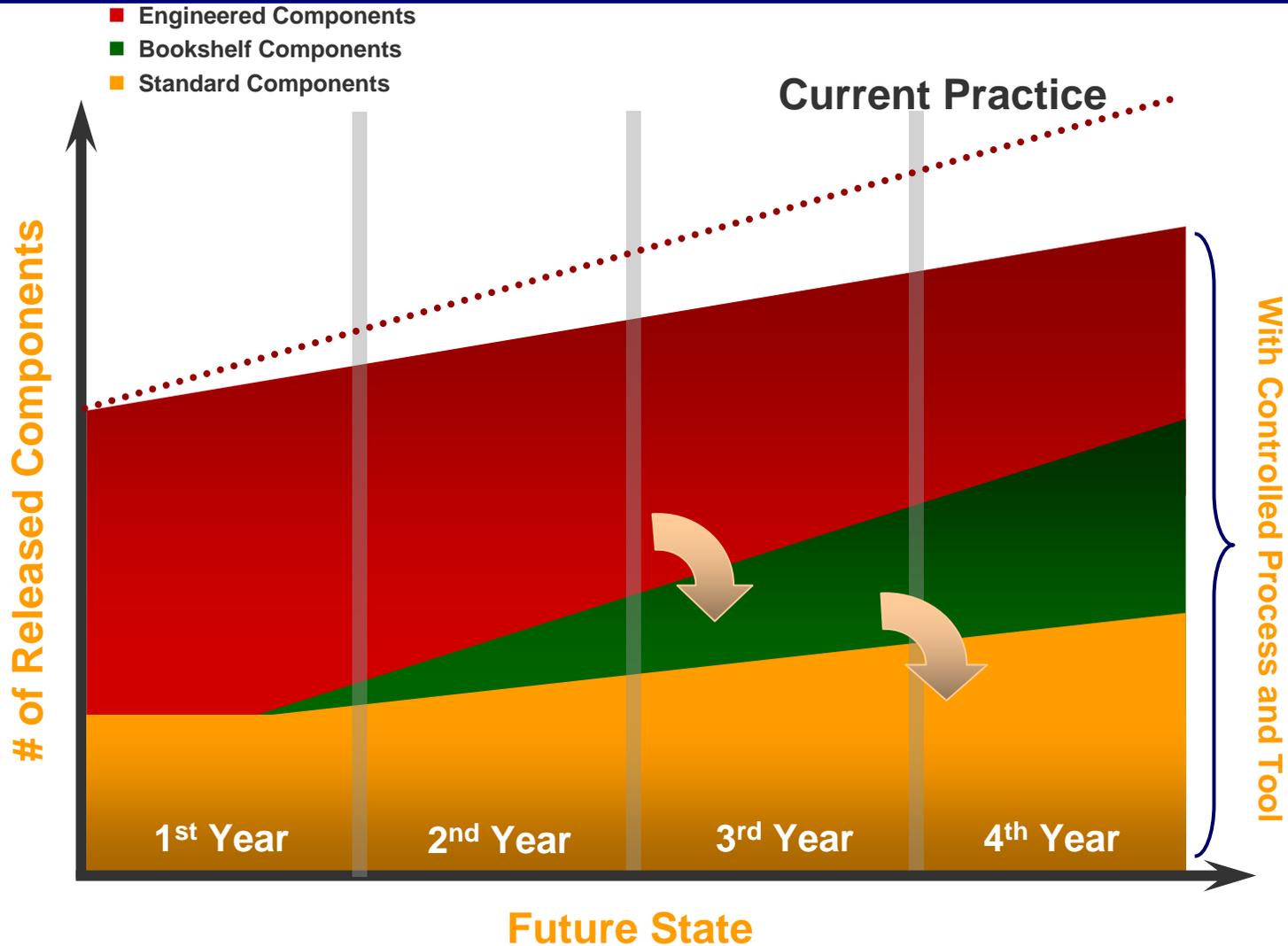
Relationship with other components

Classification Groups – Reuse Potential



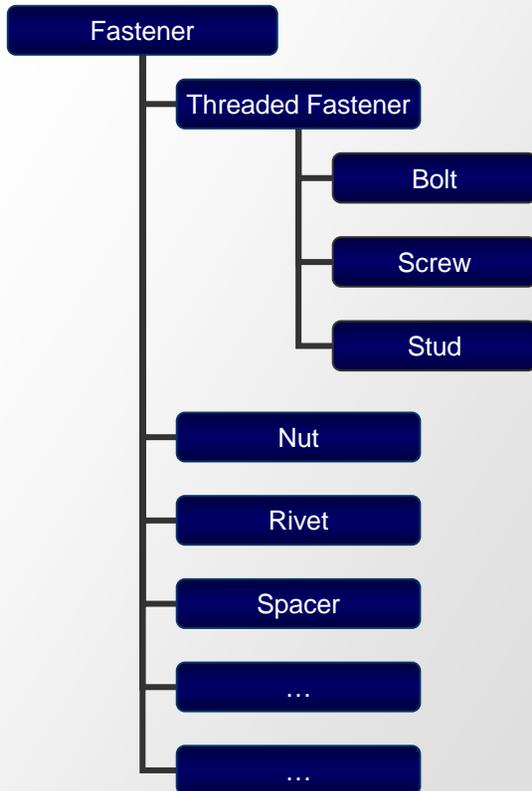
Future Trends in Part Proliferation

(After Part Commonization Deployment with Controlled Workflow)



Standard Components – An example

Hierarchy



Characteristics/Attributes

Fastener

Name	Type
Weight	Cost*
Supplier	Unit of Measure
CAD Master	Extra Description

Common/Inherited Attributes

Bolt

Subtype	Thread Length
Diameter	Thread Pitch
Length	Head Dia
Head Type	...

Rivet

...
...
...

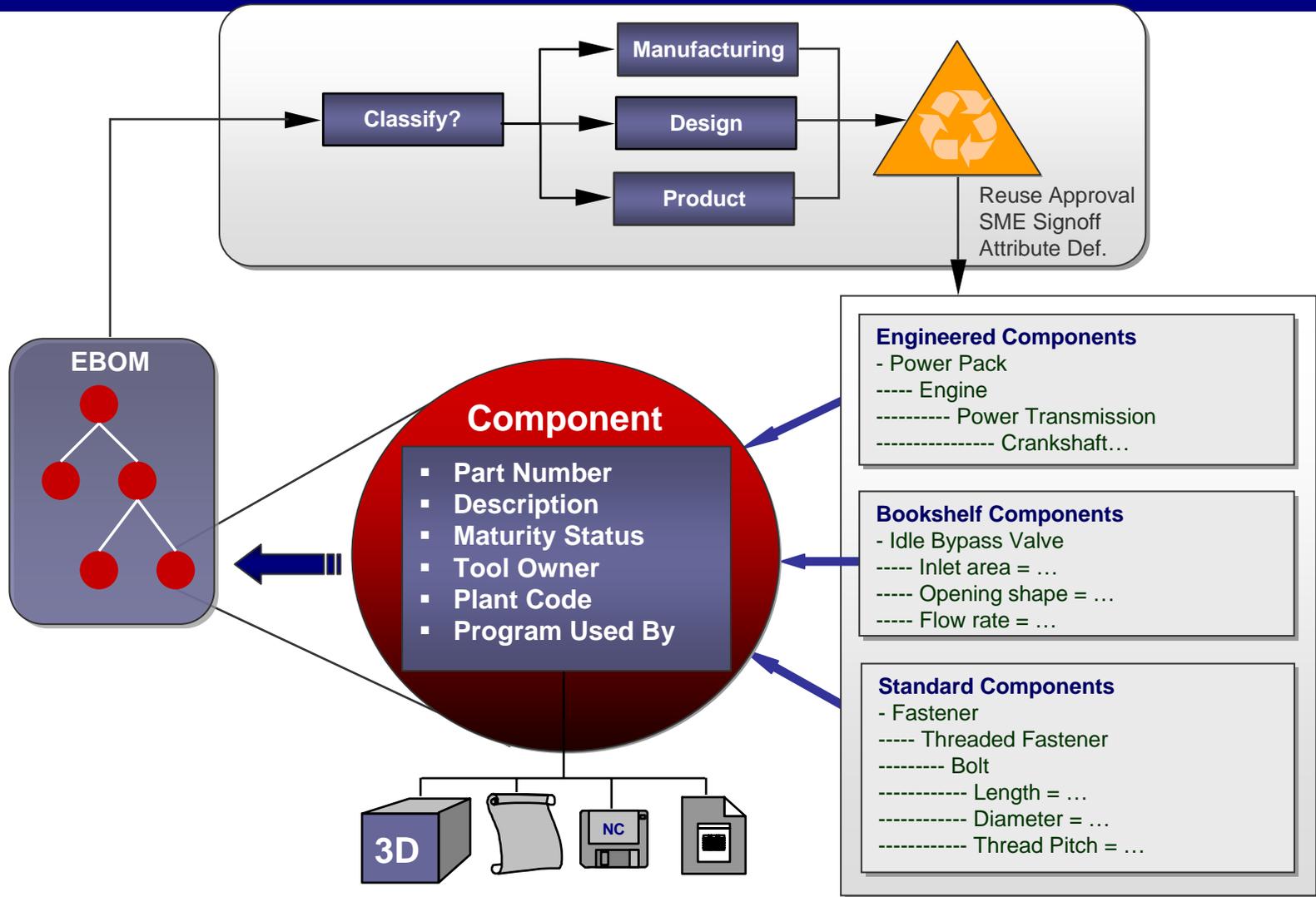
Nut

Subtype	Torque Range
Diameter	Thread Pitch
Height	...

Spacer

...
...
...

Product Classification Process



Product Classification – Guidelines

- All forward, current and past model, aftermarket, and manufacturing in-process part will be considered for classification
- All potential components will be reviewed by respective SME's
- The classification levels (depth) will be created based on commodities. For ease of search, the number of levels will limit to maximum **4**
- A workflow will be in placed for managing the classification and will be enforced in the entire life cycle of the development
- The product classification hierarchy will not intend to duplicate the eBOM structure or Referencer; instead, it will be used to group components with similar set of characteristics
- Classification attributes will be chosen based on product functional requirements and application
- The classification scheme will not uniquely define the component. It will facilitate search to a finite number of desired components

Classification Creator – A snapshot

(A tool to create/manage/integrate classification structures)

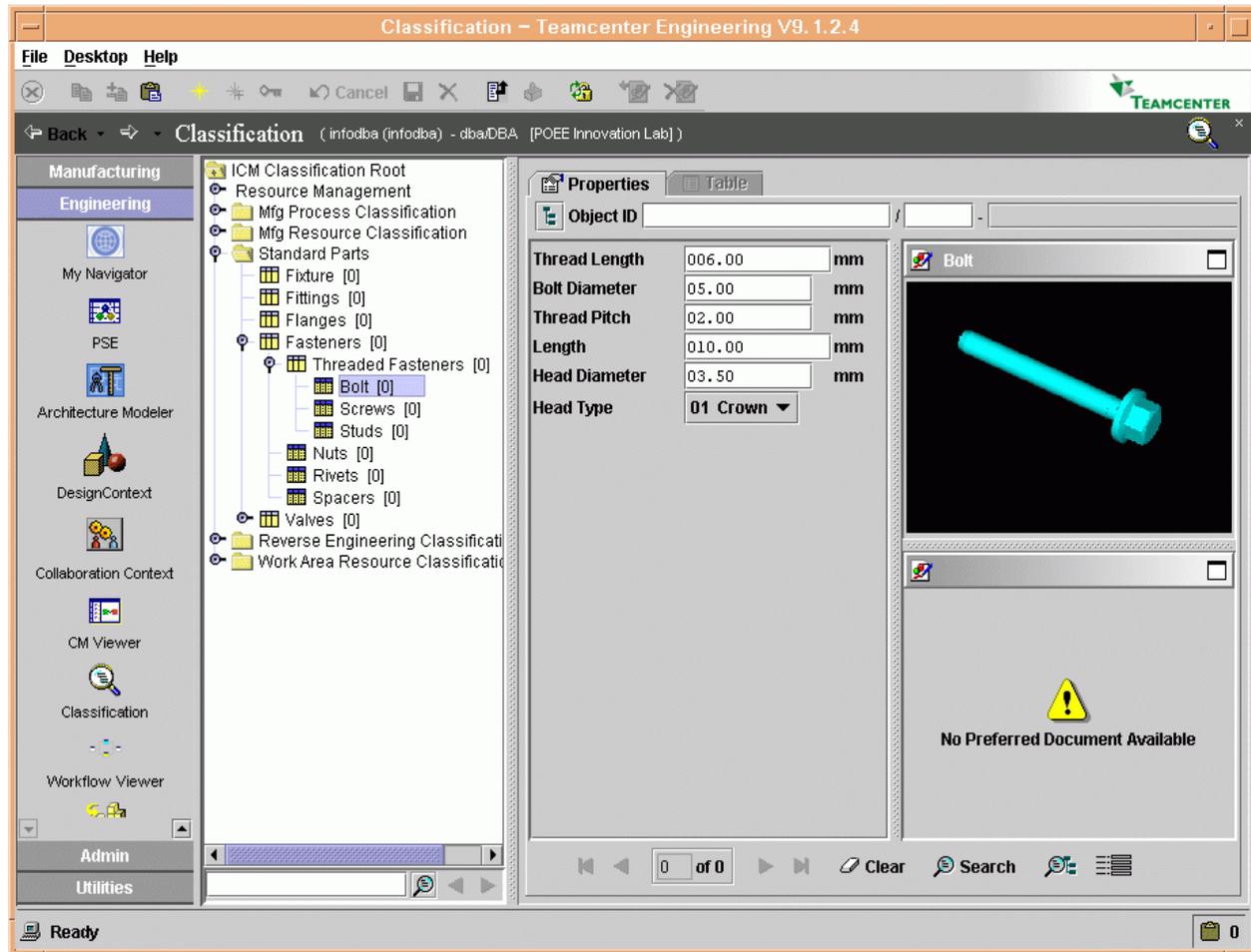
The screenshot shows the 'Classification Creator' application window. The title bar reads 'Classification Creator'. The menu bar includes 'File', 'Edit', 'Configure', 'Option', and 'Help'. The main window title is 'Classification Creator'. Below the menu bar is a toolbar with various icons. The interface is divided into several sections:

- Class Hierarchy:** A tree view showing a classification structure. The path is 'PTO Standard Part Catalog.Fastener.Bolt.Starter Bolt'. The 'Starter Bolt' class is selected and highlighted in blue. Other classes include Oil Pump Drive Bolt, Oil Pump to Block Bolt, Oil Strainer Bolt, Rear Seal Housing Bolt, Rocker Arm Bolt, Starter Motor Bracker Bolt, Timing Belt Inner Cover Bolt, Timing Belt Tensioner Bolt, Upper Timing Cover Bolt, Valve Cover Bolt, Water Pump Pully Bolt, Clamp, Clip, Nut, O-Ring, Screw, Snap Ring, Filter, Air Filter, Fuel Filter, Oil Filter, Flexible Hose, Breather Hose, and Fuel Hose.
- Class Parameters:** A table showing parameters for the selected 'Starter Bolt' class.

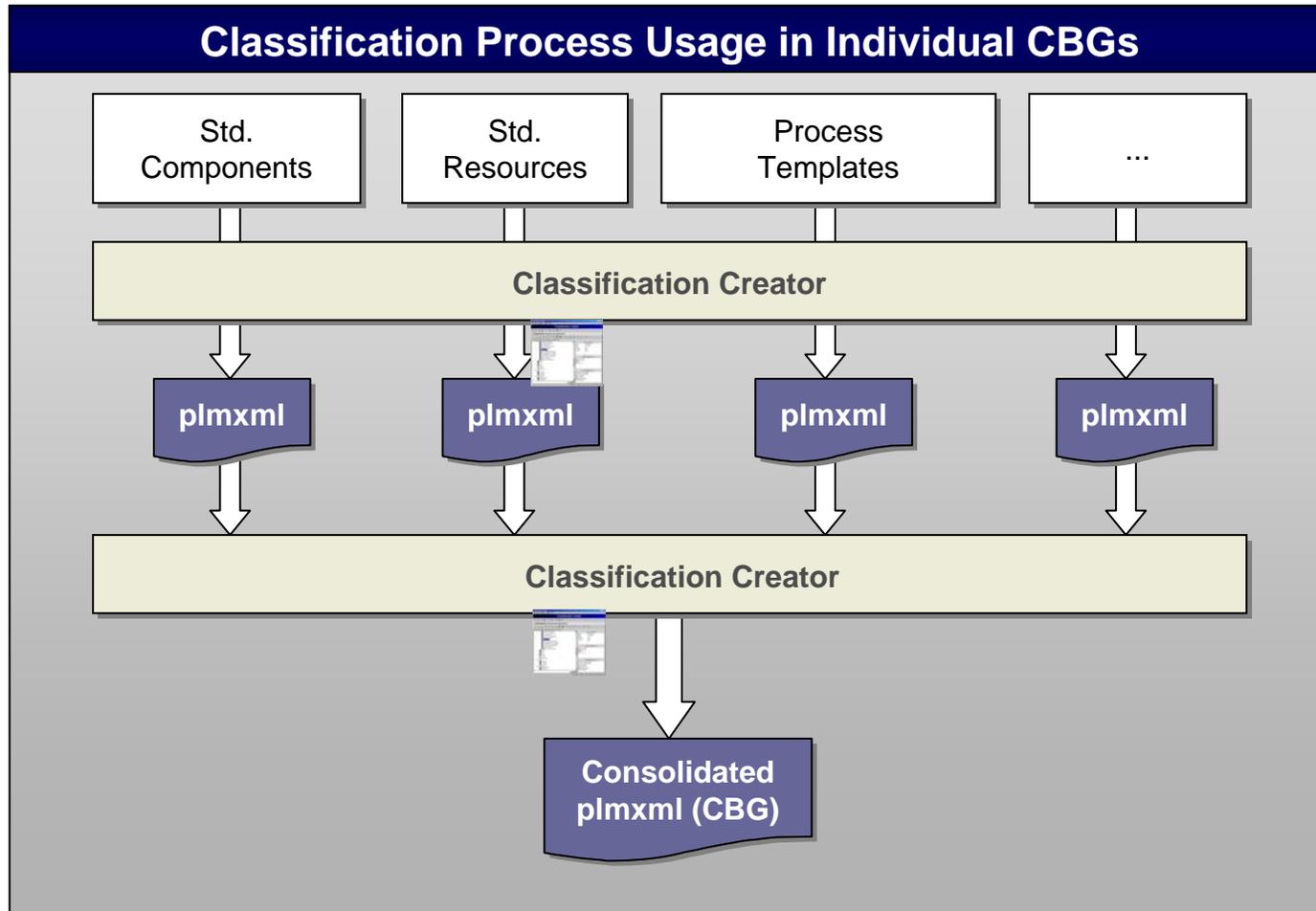
Class Parameters	
Name	Starter Bolt
Type	STORAGE
Parent	Bolt
Is Abstract	false
Is Group	false
- Attached Attributes (4):** A list of attributes attached to the class.
 - Diameter (Max)
 - Impact Rated
 - Style
 - Thread Size
- Inherited Attributes (6):** A list of attributes inherited from parent classes.
 - Bolt Size Max (mm) (Bolt)
 - Bolt Size Min (mm) (Bolt)
 - Diameter (Bolt)
 - Length (Bolt)
 - Manufacturer (Bolt)
 - Material (Bolt)

At the bottom of the window, a status bar displays: '255 Classes 148 Attr 70 Lovs Admin HUMAYUN KHALID'.

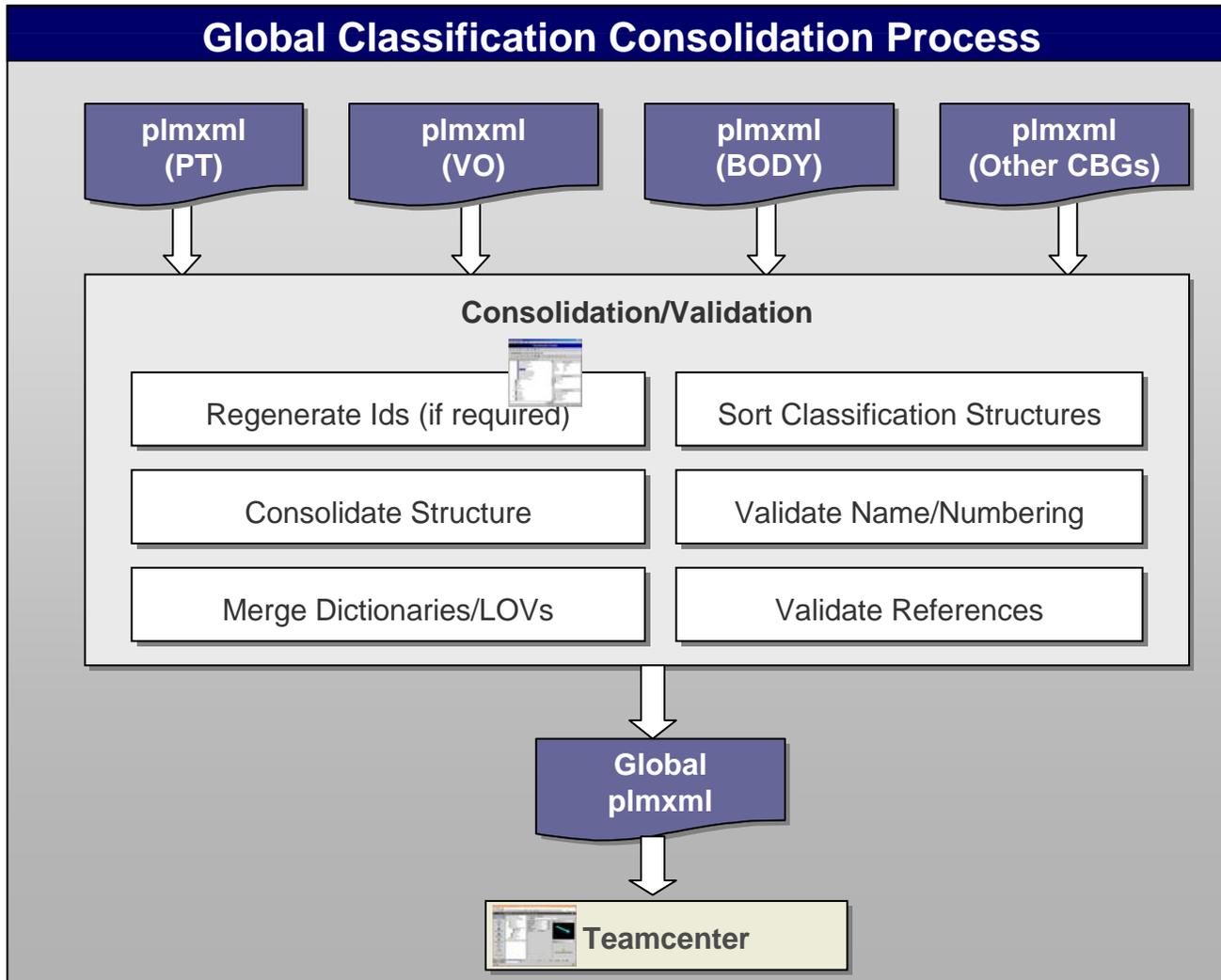
Classification Structure – Example in Teamcenter



Classification – Structure Creation Process



Classification – Structure Integration Process



Powertrain Component Commonality and Reuse



Q & A

