Integrating CAD, PLM and LCA: a new architecture & integration proposal
Dassault Systèmes Brands

Product Lifecycle Management

Virtual Design CAD
3D Mechanical CAD

Realistic Simulation CAE
Digital Manufacturing & Production
Collaborative Innovation PLM
Lifelike Experience
DS EcoDesign Tools

4 directions by Dassault Systèmes

1. Material Compliance

2. Recycling

3. Product Eco-Profile

4. Site Footprints

Materials Compliance

ELV RoHS REACH Packaging

GaBi

Environmental Data Workbench

EU ELV/RSS (ISO 22628)

Collect

Validate

Publish

Eco Design

Eco Collaborate

Eco Social Communities
CAD/PLM & LCA current situation

- OEM
- Supplier
- Supplier Portal
- Supplier
- Supplier
- Supplier
- Supplier
- Supplier
- Supplier
- Solidworks Sustainability
- Bilan Produit de l’ADEME
- ATEP du CETIM
- Pas d’outil

Integration

Standard
SolidWorks Sustainability (SWS) vs EDW

**SWS**
- For SMB & Designers
- Easy & Quick to use
  - 4 dynamic indicators
- GaBi only
- GaBi embedded in SolidWorks (not available)
- Can’t add new Material nor new Process

**EDW**
- For any Users
- Integrated in ENOVIAv6
- Can connect to any LCA tools
  - EIME
  - SimaPro
  - GaBi
  - OpenLCA...
- Can connect to other tools
  - ENOVIA Material Compliance
  - ENOVIA Cost Analytics
Existing interface & generic architecture

CAD : CATIA v5
PLM : Smarteam
LCA : EIME

By University of Grenoble, CODDE & UT Troye (2007)

<table>
<thead>
<tr>
<th>Data Type</th>
<th>Description</th>
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<tr>
<td>Data needed in EIME available from SmartTeam</td>
<td>• Product architecture: part name and level</td>
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<tr>
<td>Data needed in EIME and available from documents embedded in SmartTeam (type of application or file where data is encapsulated)</td>
<td>• Part material, part weight (in CAD) • Physical links among parts (in expert application) • Manufacturing process (in expert applications) • Data on other product life cycle stage, for example:   - Information on packaging (in Expert application or Word Document)   - Distribution modes and distance (in Word Document)   - Energy consumption of the product (in Word Document)   - Life duration of the Product (in Word document)   - Probable end-of-life treatment (in Word document)</td>
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EDW: Existing Concepts

From the engineering Bill of Materials (eBOM)...

The eBOM describes the final product’s components, as well as their respective quantities (or proportion)

The mBOM describes the order of assembly

and the manufacturing BOM (mBOM)
EDW: New Concepts (1/2)

... To the Bill of Substances (BOS)
...To the Bill of Processes (BOP)

The BoP introduces the operations – transformation processes - all along the Product Lifecycle and for all the used resources (materials, energy, water, soil...), emissions & wastes.
EDW: PPR Data Model

- **Product**
  - Part
  - Part Life Cycle

- **Process**
  - Macro Process 1
    - Process11
  - Macro Process 2
    - Process12

- **Resource**
  - Machine
  - Raw Materials
  - Tools
  - Ancillary Material
**EDW: macro-process oriented**

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<th>Requirement</th>
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<td>F1</td>
<td>Functional Product</td>
<td>Physical Process</td>
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<td>Macro Process 1</td>
<td>Process 11</td>
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EDW Use Cases & Demonstrators

**UC #1 Ease data Collection to build Product System in the LCA tool**
- Data Collection (CATIA, Product)
- Data Collection (DELMIA, Processes & Resources)
- Other data sources to ENOVIA (Transportation, usage, end of live)
- Validation of the Bill of Processes
- XML export to LCA Tool
  - Demonstrator with CATIA/DELMIA/ENOVIA v6r2010x

**UC #2 Quick LCA analysis**
- Existing Product Systems database
- Synchronous interface with the LCA tool
  - Demonstrator with OpenLCA

**UC #3 Consolidate Product & Site data**
- Allocate Site Impacts (plant) to the Product Lines
EDW : Business Scenarios

Different Business Scenarios in the Supply Chain

- **Compliancy Regulations**
  - Need: check the Product Compliancy to the Materials (restricted substances usages), Recycling or End of Life EU regulations
  - Targets: EU REACH, RoHS, ELV/RRR, WEEE…

- **Product Environmental Profile Declaration (EPD)**
  - Need: communicate the environmental performance of the Product to Customers (B2B) or to End-Users (B2C)
  - LCA targeted tools: GaBi, SimaPro, EIME (E&E), OpenLCA…

- **Product EcoDesign**
  - Need: design a better « eco-friendly » product, reduce environmental impacts all along the lifecycle & energy costs, ease recycling at the end of life
  - Approach: integrate ecological indicators & innovation in the Design Process
Perspectives

**On going R&D collaborative project with**
- G-SCOP Laboratory (Grenoble), BIO Intelligence Services (Paris)
- Pemexas & GreenDelta (Germany)
- Funded by DGCIS / French Ministry of Economy
- 2010-2012

**ENOVIA EDW prototype**
- **CAD**: CATIA v5 / v6
- **PLM**: ENOVIA VPM / ENOVIA MatrixOne
- **Manufacturing**: DELMIA
- **LCA**: OpenLCA (existing), EIME, GaBi, Simapro
- **Material Compliance**: ENOVIA MCC
- **Recycling**: MCC for Automotive (RRR), ReSICLED for High Tech (WEEE)

**Looking for Business Cases in**
- High Tech
- Aerospace
- Automotive
- Rail Train
Questions?

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DS Innovation & EcoDesign