CAD/PLM Integration, Data Exchange and Collaborative Engineering in Distributed Teams

ProSTEP Symposium 2007
<table>
<thead>
<tr>
<th><strong>Established:</strong></th>
<th>1&lt;sup&gt;st&lt;/sup&gt; of April 2005 (as an independent company)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Foundation:</strong></td>
<td>xPLM Solution is self-funded. Separation from Agile Software (formerly Eigner Germany)</td>
</tr>
<tr>
<td><strong>Shareholders:</strong></td>
<td>All shareholders are employees</td>
</tr>
<tr>
<td><strong>Headquarters:</strong></td>
<td>Dresden</td>
</tr>
<tr>
<td><strong>No. of Employees:</strong></td>
<td>23 (Q1 2007)</td>
</tr>
<tr>
<td><strong>Revenue 2006:</strong></td>
<td>€ 2.6 Million</td>
</tr>
<tr>
<td><strong>Business Relations:</strong></td>
<td>250+ customers</td>
</tr>
<tr>
<td><strong>Experience:</strong></td>
<td>More than 20 years experience of developing &amp; deploying CAD, PLM &amp; ERP Integrations</td>
</tr>
<tr>
<td><strong>Knowledge:</strong></td>
<td>Deep know-how in all relevant PLM, CAD, DMU systems</td>
</tr>
<tr>
<td><strong>Product:</strong></td>
<td>J2xPLM Integration Platform launched in 2006 (co-funded from a EU development sponsorship)</td>
</tr>
</tbody>
</table>
Mission

- We are an independent supplier of PLM add-on and integration technology and services
- We provide integration solutions for CAD, PLM, ERP and VR/DMU

Target Markets

xPLM Solution focuses on industries with complex engineering processes and companies which require deep integrations between authoring systems and production planning solutions (e.g. CAD, PLM, ERP, . . .).

- Automotive
- Industrial Manufacturing
- High Tech & Electronic
- Aerospace & Defense
J2xPLM Integration Platform

Generic Architecture for Integration of CAD-, PLM-, ERP- and CRM Applications
J2xPLM Integration Platform

Dialog components for GUI definition

Integrated Batch Server (Printing, format conversion, etc.)

Script engine for definition of Integration specific processes and workflows. Usage of multiple scripting languages (VB, Python, JavaScript, others).
Supported Connectors & Application Integration Scenario

PLM / ERP Connectors
mySAP PLM, SSA PLM, Teamcenter Engineering, Agile 9, Agile e5, Pro/INTRALINK, SmarTeam

MCAD Connectors
CATIA V5 & V4, UG NX, Pro/Engineer, SolidWorks, Solid Edge, Inventor

ECAD/EDA (partner cooperation)
Cadence, Mentor, OrCAD, Veribest, Pads, Viewlogic, Zuken, e3-Series, ESCAD, Elcad, Eplan, Ruplan

Software Lifecycle Management
Rational ClearCase and ClearQuest, PVCS Dimensions, SCCS, RCS

Other Connectors
MS Office, VR, Requirements Management, CRM

Multiple MCAD, ECAD, VR system environment integrated with SAP & additional PLM system
J2xPLM Integration Platform Functionality (Extract)

Deep Integration with PLM Objects

- Documents, Files, Materials and Bill of Materials
- Change and Release Management Integration
- Bidirectional exchange of properties

CAD Configuration Management

- Management of all relevant CAD files, objects (part, assembly, drawing, etc.) references and configurations
- Versioning and copying without naming conflicts
- Team Collaboration without concurrent conflicts
- Save preview and “Concurrent Check” before final saving
J2xPLM Integration Platform
Business Process Integration (1)

Business Process Integration
Applications, Composed Services, Business Logic, UI

Technical Services
Business Components
User Interaction
Supported Services
Web Service, Client/Server, XML File (SOAP), etc.
Business Process Integration
Applications, Composed Services, Business Logic, UI

Business Logic Definition

S1.1  S1.2  S3.1  S1.3
S2.1  S2.2
J2xPLM Integration Platform
CAD Integrations
CATIA® - SmarTeam® – mySAP® PLM Integration

Developed by ECS Magna Powertrain based on J2xPLM® Integration Platform v1
J2xPLM Integration Platform
PLM-CAD-VR/DMU Integration

Cave and Power-Wall Integration
Integrated Workplace
PLM – VR / DMU – CAD
J2xPLM Integration Platform

Features

Integrations can be deployed in direct mode using Client/Server or an indirect mode using a Web Application Server!

CAD Centric user dialogs deliver higher user acceptance!

Important features such as versioning and copying of structures are performed within the CAD system.

Save preview and concurrent checks allow user interaction prior to final saves.

Increased configurability delivers customer specific integration without the high cost of customized development – yielding lower cost of ownership!

Script-based Process Definition Language

J2xPLM Integration Platform can access multiple applications in parallel

One integration technology for multiple CAD & PLM applications provides higher synergy and lower TCO!

Batch service supports viewable file generation, file conversion and data exchange operations
J2xPLM Integration Platform

J2xPLM
Integration Platform

Cross Enterprise Engineering
Cross Enterprise Engineering (2) Overview

Cross Enterprise Collaboration between OEM and suppliers
All partners are working within one PLM instance!!!
Project driven design including administrating portal for access control & privileges of objects & structures!
SAPGUI not needed.
Web access via http protocol (Firewall)
Optional file encryption
Cross Enterprise Engineering (1)
Architecture

J2xPLM Integrationsplattform v1

Cross Enterprise Engineering
SAP NetWeaver WAS
WebDynpro, Portale, J2EE DB
Business Components,
WebServices

Business Processes
Web-Dialogs
Project Data

http: Internet
SAP WAS
JCO
BAPI
SAPGUI

MCAD
ECAD
PLM

VR / DMU
MS Office

SAP ABAP
Cross Enterprise Engineering (3)
Administration Portal
Cross Enterprise Engineering (4)
Setting of Permissions
Cross Enterprise Engineering (5)
Workspace / Assembly Comparison
Thank You Very Much For Your Time!

Karl “Charly” Wachtel
xPLM Solution GmbH
karl.wachtel@xplm.com
www.xplm.com

CAD, PLM, ERP, DMU Integrations
PLM Management Consulting Services
PLM Implementation Consulting Services
PLM Implementations
Client Specific Support for PLM
PLM Training Courses
CAD/PLM Integration, data exchange and collaborative engineering in distributed teams

Josef Reichweger, Magna Powertrain
Karl Wachtel, xPLM Solution GmbH
Magna International Inc. which is the most diversified automotive supplier in the world designs, develops and manufactures automotive systems, assemblies, modules and components, and engineers and assembles complete vehicles, primarily for sale to Original Equipment Manufacturer (OEMs) of cars and light trucks in North America, South America, Mexico, Europe and Asia.

- Total Revenues 2005: 22.8 (US$ Billion)
- Ranking in Revenues: No. 3
- Total employees: over 82,000 (as of January 2006)
- 222 manufacturing divisions and 58 product and engineering centers
- Stock listed
  - NYSE: MGA
  - TSX: MG.A, MG.B
In 6 Design & Engineering Centers in the U.S., Canada, Europe and Asia, Magna Powertrain employs nearly 850 engineers providing the know-how for innovation, concepts and design.
Engineering Center Steyr St. Valentin

- **St. Valentin:**
  - Engineering Center
  - Commercial Vehicle Engineering
  - Engine & Drivetrain Engineering
  - Technology Center
    - Simulation and Testing Services
    - FEA & Durability
    - Thermal Management
    - CAD/CAM
    - Software Development and Sales
- Low Volume Production of Components
- Headcount: 330 (Jan 2007)
<table>
<thead>
<tr>
<th>Company</th>
<th>Product Description</th>
</tr>
</thead>
</table>
| **FEMFAT** | Fatigue Life Prediction based on FEA  
- multi-axial fatigue  
- welded structures and spot joints / rivets  
- thermomechanical fatigue  
- load data management and engine dynamics /acoustics |
| **KULI** | Vehicle Thermal Management Optimization  
- fluid and air flow network simulation  
- design and optimization of cooling system concepts  
- transient simulation |
| **KABI** | Integration CAD- and Manufacturing System for Vehicle Electric  
- electric engineering for the vehicle industrie (cars, trucks, busses, ...)  
- reduced process time from design to manufacturing  
- 3D-design manager with interfaces to CATIA V4/V5  
- cable harness manufacturing |
| **VANC** | CAM System for Turning, Drilling and Milling  
- 3D-Integration  
- Tool Resource Planning  
- „Navigator“  
- ... |
| **ALSIM** | CAD based dynamic Simulation of Dip Painting  
- early definition and optimization of process fluid drainage  
- avoids modifications  
- suitable for complex surface and solid models |
Initial situation

• SAP PLM is used as companywide PLM-system
• The use of SAP-PLM within the mother company MPT includes direct interfaces to CAD systems
• The request is different within the concern
  – ECS: Focus engineering und production
    • Flexible operating in customer projects is necessary – processes are specified by the customers
  – MPT: Focus production - engineering for the own production
    • processes within the company
• CATIA V5 data are administrated by the system SmarTeam at Magna ECS.

Advantages of this system:
  – Release compatibility with CATIA V5, as they are from Dassault
  – Ideal administration of links and object types used by CATIA V5
  – Acceptance of the system by design engineers

• At the market available SmarTeam Ÿ SAP interfaces do not fulfill the requirements of ECS, as the engineering support for leading OEMs is very complex and demanding.
Demands on the system out of the view from ECS

- Ideal assistance of the engineering process for:
  - Concept
  - Reconnaissance
  - Serial development
- Supporting functionality
  - Import
  - Export
  - Digital Mock Up
  - Cost and mass management
- High flexibility of projects and CAD system versions

⇒ High integration between PLM and CAD systems is necessary
⇒ Development of a flexible and neutral data exchange platform
concept - solution

CUSTOMER

CUSTOMER-SYSTEM I
CUSTOMER-SYSTEM II
CUSTOMER-SYSTEM III
CUSTOMER-SYSTEM IV

SAP-Connector

Applications-Interfaces

Engineering Integration Base

I/O-Processor

SAP

CUSTOMER

CATIA

PRO/Engineer
UG-NX
SolidWorks

ALSIM
EB-Cable
KABI
VANC

CATIA-NC
EdgeCAM
EXAPTplus

SmarTeam
PDMLink
AGILE

CAD/CAM/PDM - APPLICATIONS
Components of the SmarTeam-SAP Connector

- ECS.dll
- EIB-Libraries (DLL) registered
- EIB -configuration (XML)
  - Project-configuration.XML
  - Resource.XML
- \ldots
- xPlm-Libraries (DLL) registered
- xPlm -configuration (XML)
- BAPIs
- RFC components

Call-Engine

SAP-Connector

Engineering Integration Base

Applications-Interface

CATIA

EIB

SmarTeam

Transformation
Applications – specific objects in neutral applications-interface objects

Scripts Event (VB)
ECS.BS
Overview – Interface principle

SmarTeam CATIA V5 BAPI

SmarTeam APIs CATIA V5

J2xPLM Integrationsplattform

J2xPLM Ausführungsschicht (Call Interface)

Funktionssammlung

xml Files

Konfiguration

Library • Datentypen • Fieldcollection ...

Library • Datentypen • Fieldcollection ...

xPLM ECS
Incorporate themes - Implementation ECS

- PDM basic functionalities
- SAP Object connection
- SmarTeam Connector
- Import/Export Connector
- Advanced functionality
- CAD document administration
- Material
- Bidirectional integration to SAP
- CAx-data import / export from SAP
- Plot management
- Object classification CAD objects
- Bill of material D-BOM, E-BOM
- Mapping of the customer input
- CAx-data import / export from ST
- Converting server
- Changing / Release process
- Changing log
- Mapping of attributes
- Documentation of I/O-Parameter within SAP
- Copy PLM Lannach For ECS
- Project separation
- Administration / Traceability of versions
- Universal validity Magna Powertrain
- Viewing neutral format 2D + 3D
- Authority concept
- Integration of existing User Exits

- Authority concept
- Integration of existing User Exits
Bidirectional integration to SAP

• Delivery of configured data (fields, connections…) from SmarTeam to SAP

• Delivery of configured data (field content) from SAP to SmarTeam

• Configuration possibilities
  – Field mapping
  – Connection configuration (object connection to material, PSP-elements…)
  – Dependences
  – Controlling of function triggers (e.g.: filling of the title-block)

• Example: By constructing parts there is a DIS created in SAP – the identifying characteristics are returned to SmarTeam and inscribed and saved in fields.
EIB-SAP communication in ECS

• **Standard actions in SmarTeam without data file action**
  – Communication EIB-SAP via CPIC-user
    • User without Gui components und without login dialogue in SAP
    • User information will be uploaded from the configuration

• **Standard actions in SmarTeam with data file action**
  (e.g.: Release with Tiff-connection)
  – Communication EIB-SAP for Gui-user in SAP
Goals I/O Connector

- Data export only if a defined document state is available
- Warranty of a documented and logged data exchange
- Data exchange with customers and distributors
- Claim is a high degree of automation for data exchange including sending the data to the partner
- Mapping between internal and customer style
- Order for data exchange from CAD or SAP and production log in SAP
- Handling within batch processing
- Standardized workflow for different CAD-systems
I/O-Processor – Overview functionalities/advantages

• Call of export is as well from SmarTeam as from SAP possible

• Export of data is controlled by SAP
  – Only one configuration is necessary

• Project specific configuration for the export partner within SAP
  – Registration of the export partner as DIS
  – Document structure with the export partner as bill of material position

• Traceability of the export
• Logging within SAP
Release Smarteam with Phase „Export“

- Carry out workflow-action „Release“ in phase „Export“
- Connection to SAP
- Carry out status update to status „70“ in SAP
- Trigger of a functionality component
- Input possibility documentation field
- Choosing possibility export partner
- Output of the export-meta data to text files
- Subsequent processing within external programs (Batch…)
Advantages: EIB with SmarTeam-SAP-Connector

- The design engineer works in his usual entourage
- No additional effort for the design engineers
- Flexibility because of flexible configuration possibilities
- Release-Elasticity +/- 2 releases for CATIA
- Less SAP-User for design engineers necessary (costs)
- Flexibility within the use of SAP-relevance - Y/N also later changeable
- Absolute CATIA V5 assistance
- Only SAP–relevant data get into SAP
- Automated Roll Out to the workstations
Future Steps - Integration E/E and mechanics

- System Plan
- Topology Concept
- Wiring

- EB (Engineering Integration Base)
  - incl. Connectors

- CATIA
  - 3D Designmanager
  - ECS

- Functional Design

- Topologie manager
  - incl. Database

- Topologieplan

EIB (Engineering Integration Base)
Future steps

- Increasing process security
- Connection of further systems with EIB (PRO/E, UG)
- Further development of the Input/Output Connector
- Integration of further locations (India)
- Pilot project optimization vehicle electrical systems with integration electrics (EB Cable), mechanics (CATIA) and simulation of functionalities (CAPEMASTER)