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Integrating MBSE and PLM to enhance System Engineering Processes

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Towards smarter and more autonomous systems

CSD&M PARIS

Agenda



1	Aras at a glance
2	Introduction & Context
3	Integrating MBSE and PLM - Benefits
4	Demo
5	Conclusion

Aras at a Glance

Aras overview



THE PRODUCT INNOVATION PLATFORM TO POWER THE BUSINESS OF ENGINEERING

- **Global Operations | Veteran PLM Team**
- North America, Europe and Asia

Focus on markets with complex products and processes

- Automotive & Industrial
- Aerospace & Defense
- High Tech Electronics
- Consumer Goods
- Life Sciences
- Energy

Business Results

Ranked PLM Leader by Forrester

- Over 300 subscribers worldwide
- More than 100 partners
- Most growing PLM solution in the Market 65% growth average/year for past 3 years
- 96%+ renewal rate on Subscriptions
 Best customer experience
- Over 1,000 open users

Innovating in our Technology, Deployment and Business Model

Introduction & context

Product/System Design Challenges

- Product/System complexityDisconnected processes & tools
- Legacy PDM fail
- Excel hell



No MBSE, SysML, RFLP – and PLM

Systems Engineering Process Major Improvements



Source: VPE TU Kaiserslautern (modified)

Systems Engineering Evolution





Today: Standalone models related through documents. Future: Shared system model with multiple views, and

Future: Shared system model with multiple views, and connected to discipline models. Reusable, model-based engineering with virtual product development and simulation capability.

MBSE and PLM



 « Model-Based Engineering (MBE) – an approach to engineering that uses models as an integral part of the technical baseline that includes the requirements, analysis, design, implementation, and verification of a capability, system, and/or product throughout the acquisition life cycle »

Final Report, Model-Based Engineering Subcommittee NDIA (February 2011)

• Model-based engineering (MBE) – the combination of PLM and MBSE – is the enabler for the Internet of Things and Industrie 4.0 »

GfSE PLM4MBSE Working Group

Need to break the Traceability wall in PLM



Integrating MBSE and PLM

Integrating MBSE and PLM

- Systems Engineering needs PLM
 - System Architecture is at the core of product developme
 - PLM brings engineering domains together
- RFLP as an abstraction of SysML
 - RFLP is bigger than SysML
 - Allows to map between product domains
 - Neutralizes local SysML tool database architectures
 - Open to all via API
- PLM already has the data & processes
 - Reusable domain parts and assemblies ("carry over")
 - Model Lifecycle Management
 - Digital Thread that connects Digital Twins

RFLP and **Design** Domains

- Logical block a hierarchical structure
 - Critical to reuse of PLM content ("carry over")
 - PLM: <u>Mechanical</u> logical Part (with options and variants)
 - PLM: <u>Electronic</u> hierarchical schematic block
 - PLM: <u>Software</u> functional block
 - PLM: Parameters allow to <u>negotiate</u>
- Port a semantic network
 - Critical to negotiate "contracts"
 - PLM: Ports define connections (vs structures)
 - PLM: Port Functions define what and how

Aras Approach

Extending the Core Model of PLM Platform

MBSE - PLM Use cases

1 Top/Down – System model first, then detailed Product design

Design everywhere at once – System model is collaborated with on-the-fly as needed

Redesign – Field driven change

3

MBSE – PLM Benefits for Trade-off Study

MBSE – PLM Benefits for Trade-off Study

Automated "P" Allocation along changes

MBSE – PLM Benefits for Trade-off Study

Trade-off Study as part of the digital thread – available for all

→ Modeling tool executes a series of simulations that <u>identify all combinations of the parts</u> that meet the brake model behavioral targets – <u>and</u> <u>returns results to PLM</u>

Demo

Aras – No Magic Integration Demo

Business Goals

- Use a previous car platform in PLM to create the next car platform – brake for an electric car
- Maximize "carry over" through reuse of existing designs, parts, and assemblies

Process Goals

- Improve productivity of Systems Engineers that use SysML tools
- Leverage PLM processes of change management, configuration control and life cycle management

Aras – No Magic Integration Demo

Aras PLM Platform

Individual R, F, L, and P items as libraries of reusable IP – accumulated over time

System Platforms as specific RFLP structures – including related SysMLlike diagram view

A new Product Platform specification by copying and editing existing RFLP 3 structures

Aras updates RFLP structure of the Product Platform including Parts, and trade study results

No Magic SysML Tools

A new SysML model <u>automatically</u> created from the RFLP structures in Aras

Systems Engineer (SE) evolves the model and focusses on the brake system

Aras dynamically returns the list of existing brake parts that match SysML parameters

MagicDraw runs study to <u>identify sets</u> of parts that meet targets – and returns results to Aras

Aras – No Magic Integration Demo

Aras PLM Platform

Engineers collaborate on the results, select the best option, and finalize the RFLP model

Final RFLP is committed to a Report a complete specification of the new Product Platform

No Magic SysML Tools

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Conclusion

Conclusion

MBSE – PLM Integration benefits

- Flexible Use Cases
- Synchronization of SysML and PLM product platforms
 - Engineering development process vs formal configuration, revision and release control
- Simplifies Reuse (SySML Library, Platform,)
- Structures Design Collaboration for all Domain Disciplines
- Bridges Architectural and Domain Specific Decisions
- Design Justification as part of the Digital Thread and Available for All
- Supports IoT feedbacks and continuous engineering

Aras is collaborating with users, tool vendors, academia, standards organizations

Aras White Paper: integrating MBSE and PLM

MBSE and the Business of Engineering The Case for Integrating MBSE and PLM

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English Version: <u>http://aras.com/plm/003421</u>

French Version: http://aras.com/plm/003530