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Support of Data Preparation in Model Build Process for Crash Analysis

Jens Philippeit, Siemens Industry Software GmbH & Co. KG

DYNAmore SDM-Infotag: Prozessautomatisierung und Simulationsdatenmanagement
28. Juni, 2010

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Industry Sector Organization

Industry Automation

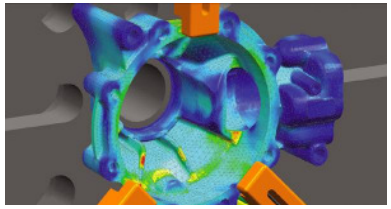
CEO
Anton S. Huber

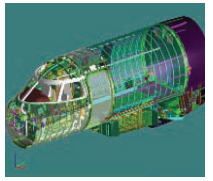
CFO
Miguel-Angel Lopez

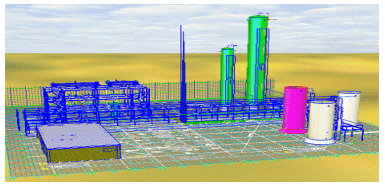
PLM Software

Industry Software Solutions

Industrial Software







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Siemens PLM Software Profile

Organization
- Siemens PLM Software
- Business Unit within Industry Automation
- HQ – Plano, Texas
- Workforce of 7,600

Products
- Product Lifecycle Management Software & Services

Market presence
- 63,000 customers
- 6.7 million licensed seats of software

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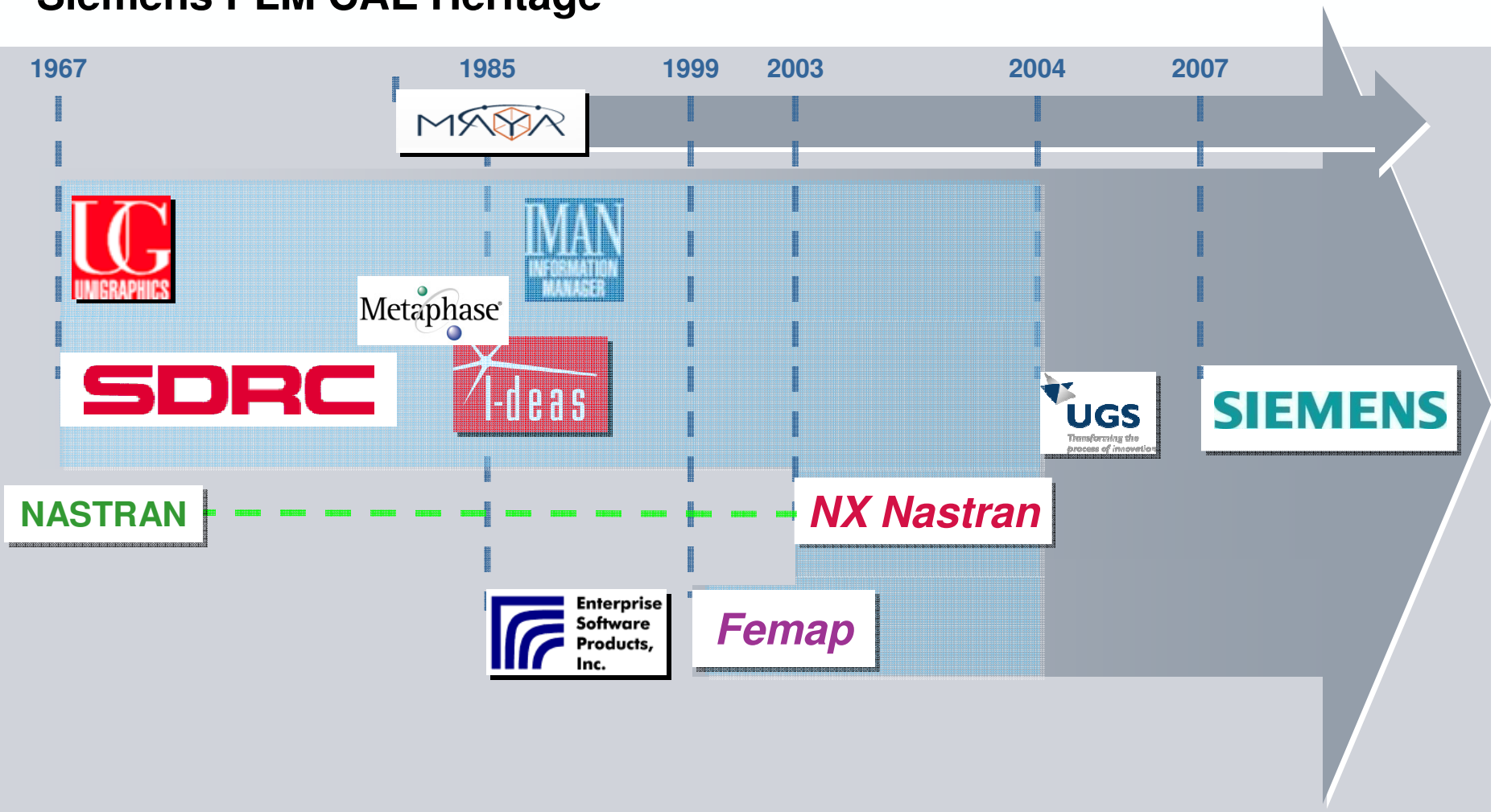
Siemens PLM CAE Heritage



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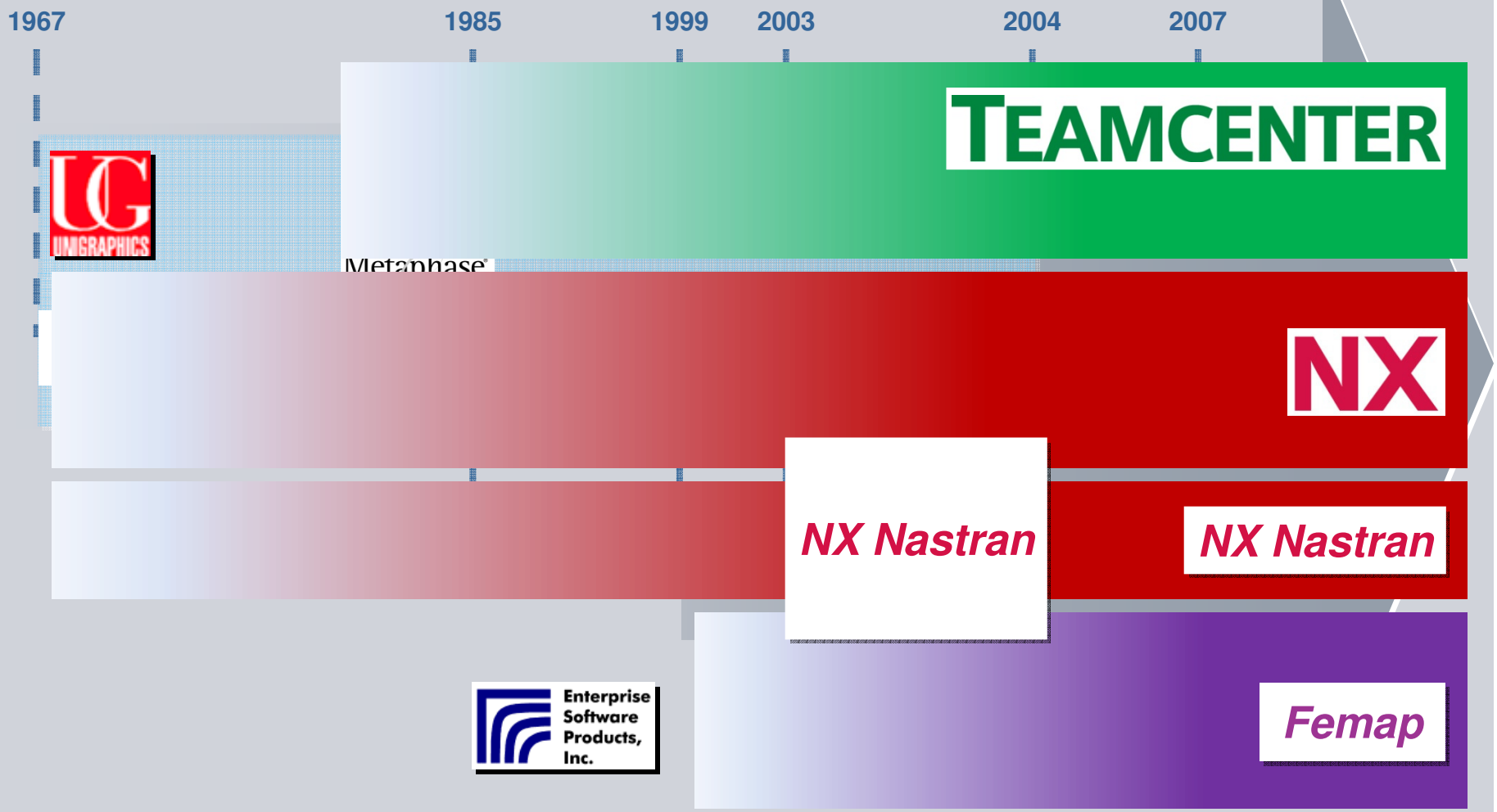
Siemens PLM CAE Heritage



Motivation
Supporting the Model Build Process

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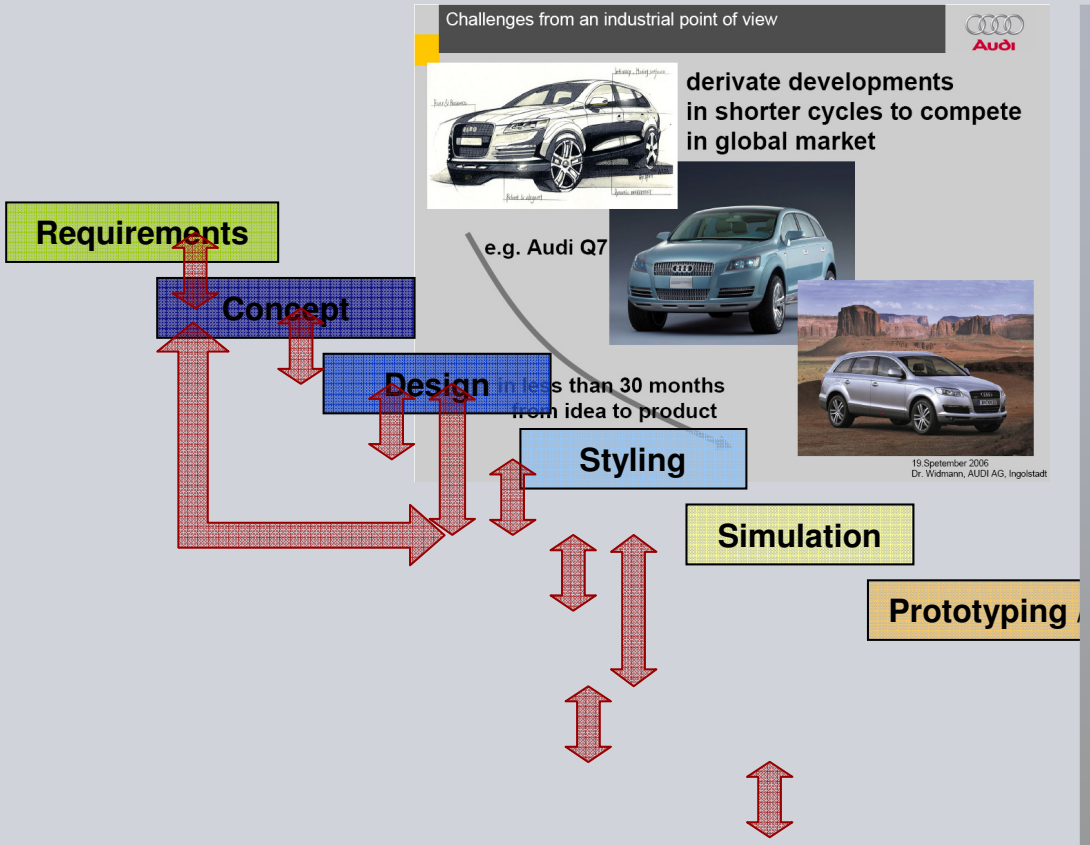

What does it mean for … ?
(Social) Networking:

Systems/Processes:

- Integrated Platforms
- Data Synchronization
- Manage change and complexity
- Reuse knowledge
- Automation

Enable Program Visibility for Simulation
Challenges

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- Bring simulation data in context with product configurations, variants and requirements
- Manage CAE tasks in context of overall program
- Initiate workflows with re-usable templates
- Compare simulation model with latest design
- Reuse model instances to build FE assemblies
- Easily locate simulation data, results, and reports in context with design
- Share results easily across disciplines

Are you confident simulation results will be ready when you need them?

Integrate assembly and change management with simulation data and simulation workflows.

Engineering Simulation Cycle
Status Quo - Automotive Industry

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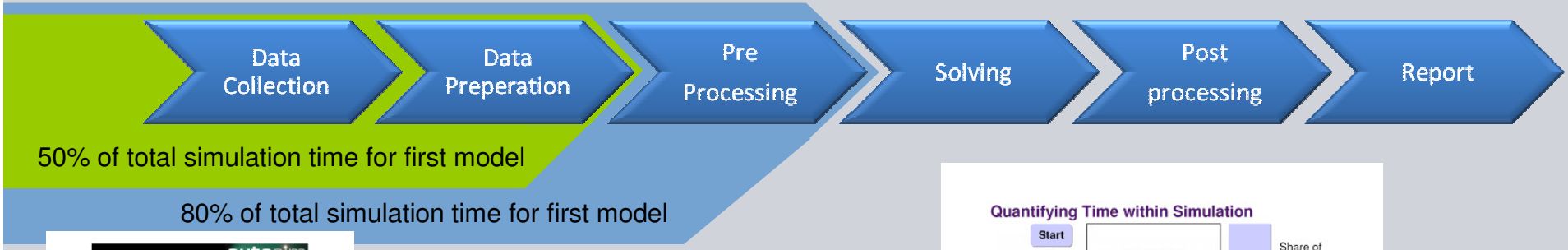
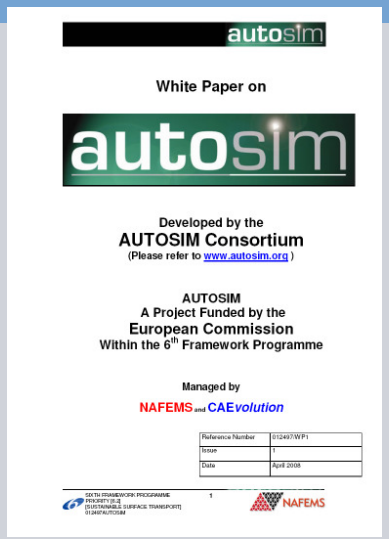



autosim

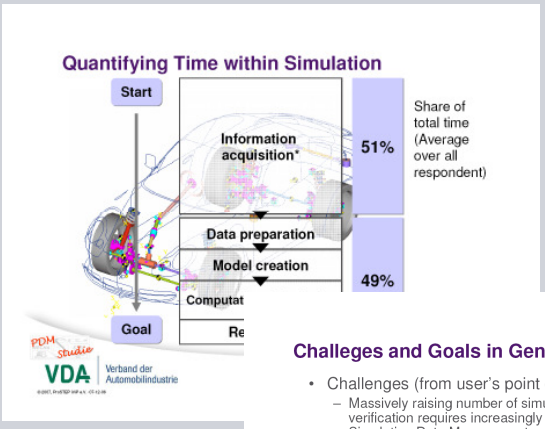
White Paper on

autosim

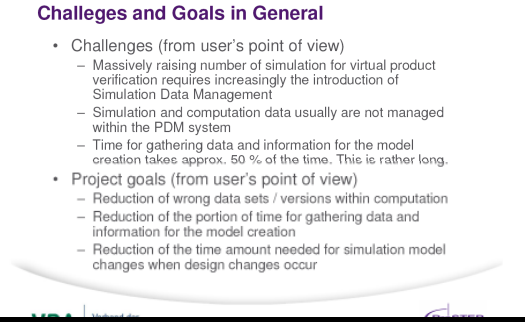
Developed by the
AUTOSIM Consortium
(Please refer to www.autosim.org)

AUTOSIM
A Project Funded by the
European Commission
Within the 6th Framework Programme

Managed by
NAFEMS and CAEvolution



- „We are maintaining 14 digital prototypes for different analysis. The challenge is to organize the data allocation.“
- „40% of CAD data for simulation cannot be used for automated CAE data preperation. Rework is necessary to prepare the data“.



Simulations should be managed as an integral part of the overall product development process. Ad-hoc or isolated solutions are not sufficient.

Simulation Process Support:
Organization in Simulation Projects

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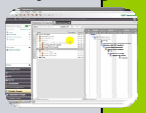
Project Mgmt.


Schedule


Workflow

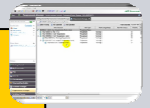
Time and Ressources

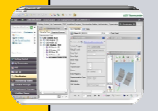
- Create Project Team
- Plan Tasks
- Plan Utilization
- Time Schedule
- Start Simulations
- Monitor Timeline
- Finalize Results and Documentation

Two different views to the project outline

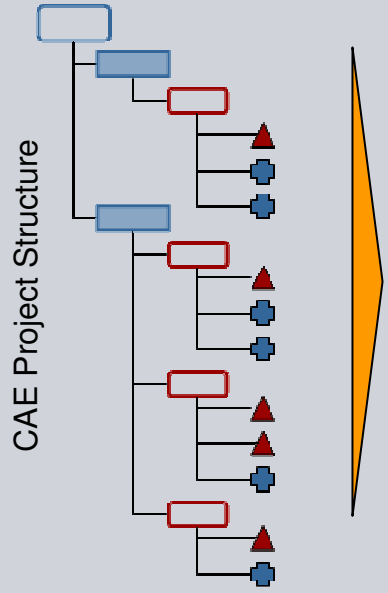
Data and Structure

- BOM Structure
- Functional Data
- Simulation Structure
- Load Case Structure (project specific)
- Simulation Results (validation)


Requirements


Classification


Workflow



Project | Sub-Project, i.e. Dev. Phase | Simulation-Task, i.e. NVH | Simulation Input, Targets, Values | BOM wildcard | Assembly | Part

Simulation Process Support:
Organization in Simulation Projects

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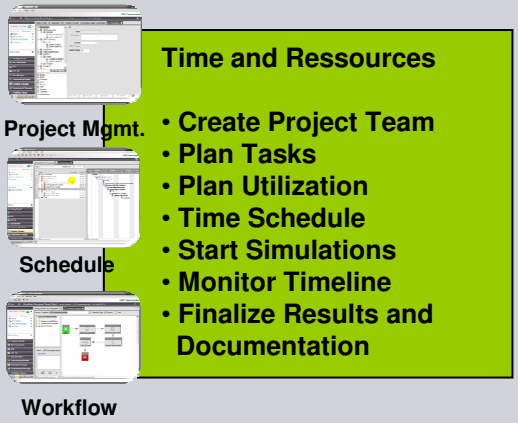

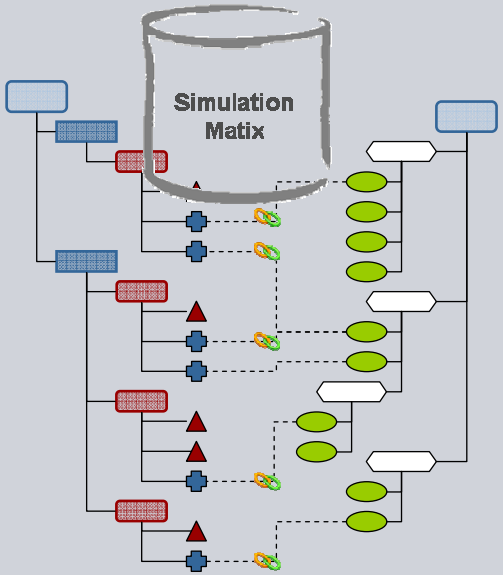

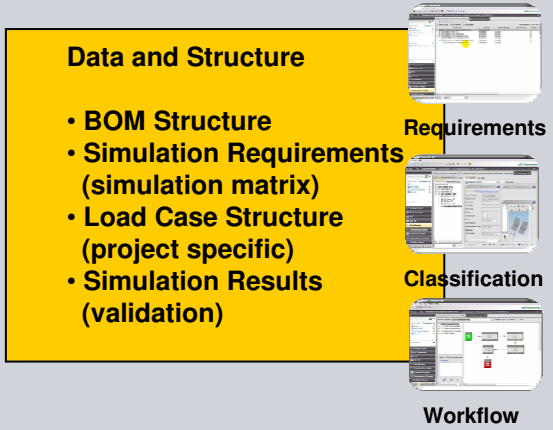

- **Simulation Matrix** is the interface between PDM and SDM as well as Engineers and Physical Prototyping
- **Simulation Matrix** predefines the simulation needs/disciplines, schedule and ressources
- **Simulation Matrix** holds Status and Dependencies (cross-domain relations) of Simulations tracked down to Part Level

Simulation Process Support:
Data Collection

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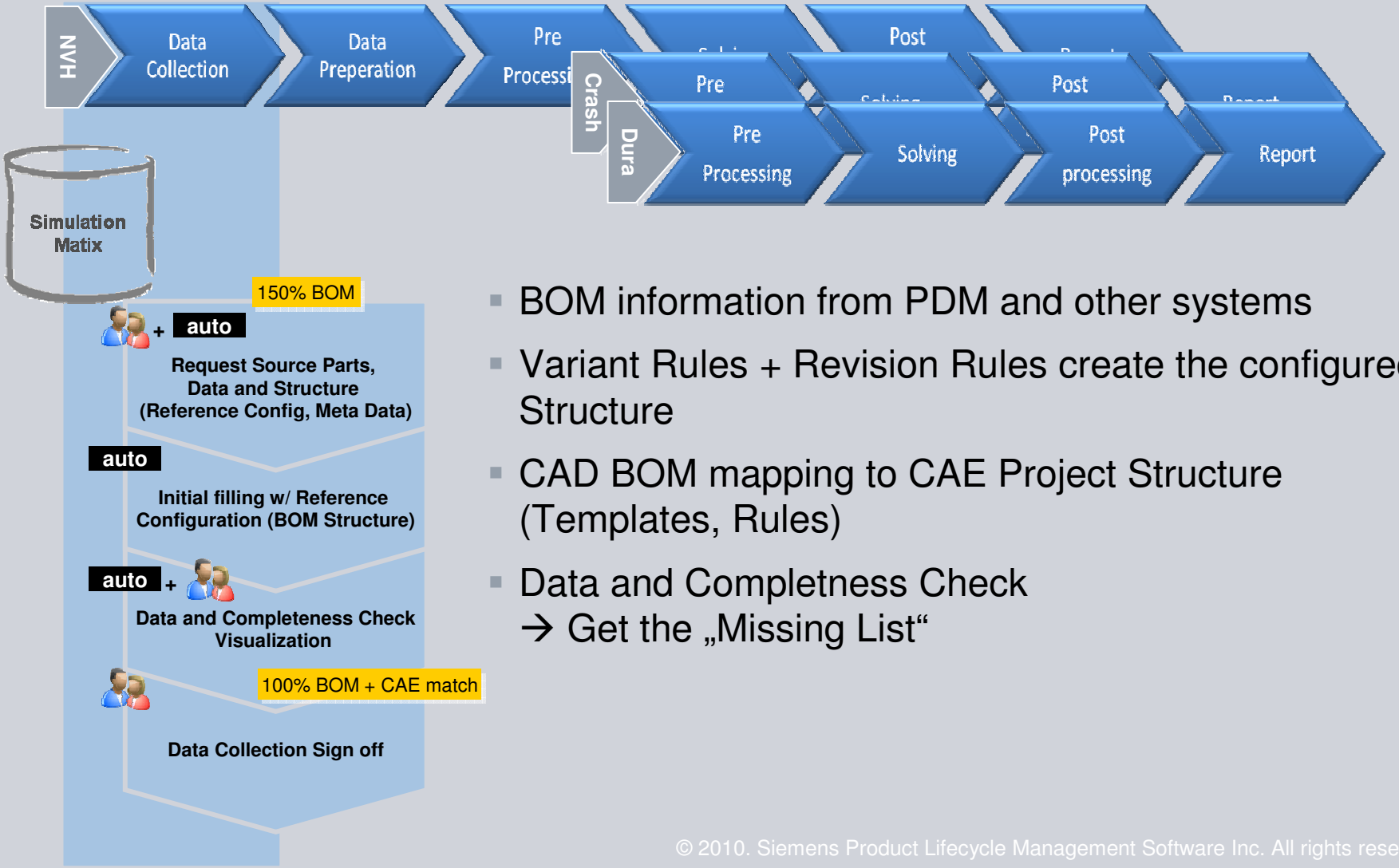

- BOM information from PDM and other systems
- Variant Rules + Revision Rules create the configured Structure
- CAD BOM mapping to CAE Project Structure (Templates, Rules)
- Data and Completness Check
  → Get the „Missing List“

Simulation Process Support:
Data Preperation

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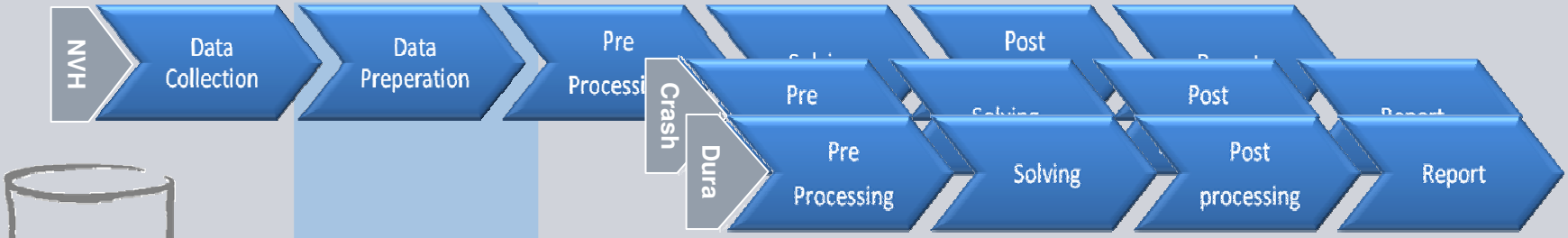

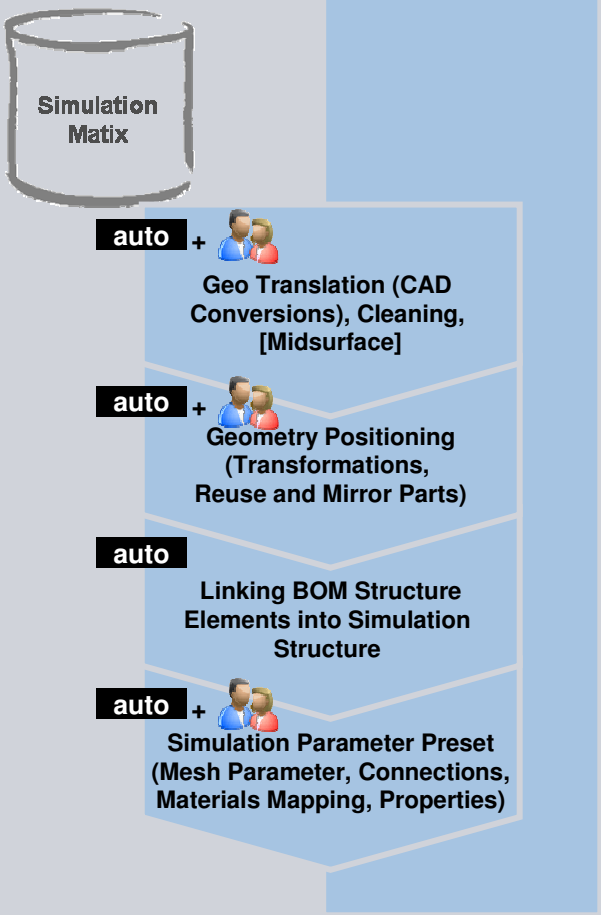

- Geo-Translations, Batch CAD cleaning and mid-surface extraction for all panels
- (Visual) Check of Completness and Quality
- Linking to Simulation Matrix (Simulation View)
  - CAD models
  - Connection data, e.g. weld spots, weld lines
  - Non-geometric data, e.g. materials and properties
- Automatically flag parts rule-based for multiple mesh variants
- Apply individual Parameters (i.e. parts to be re-used from NVH to Safety, Predfine Properties, Material Mapping …)

Simulation Process Support:
Supplier Integration and Pre Processing

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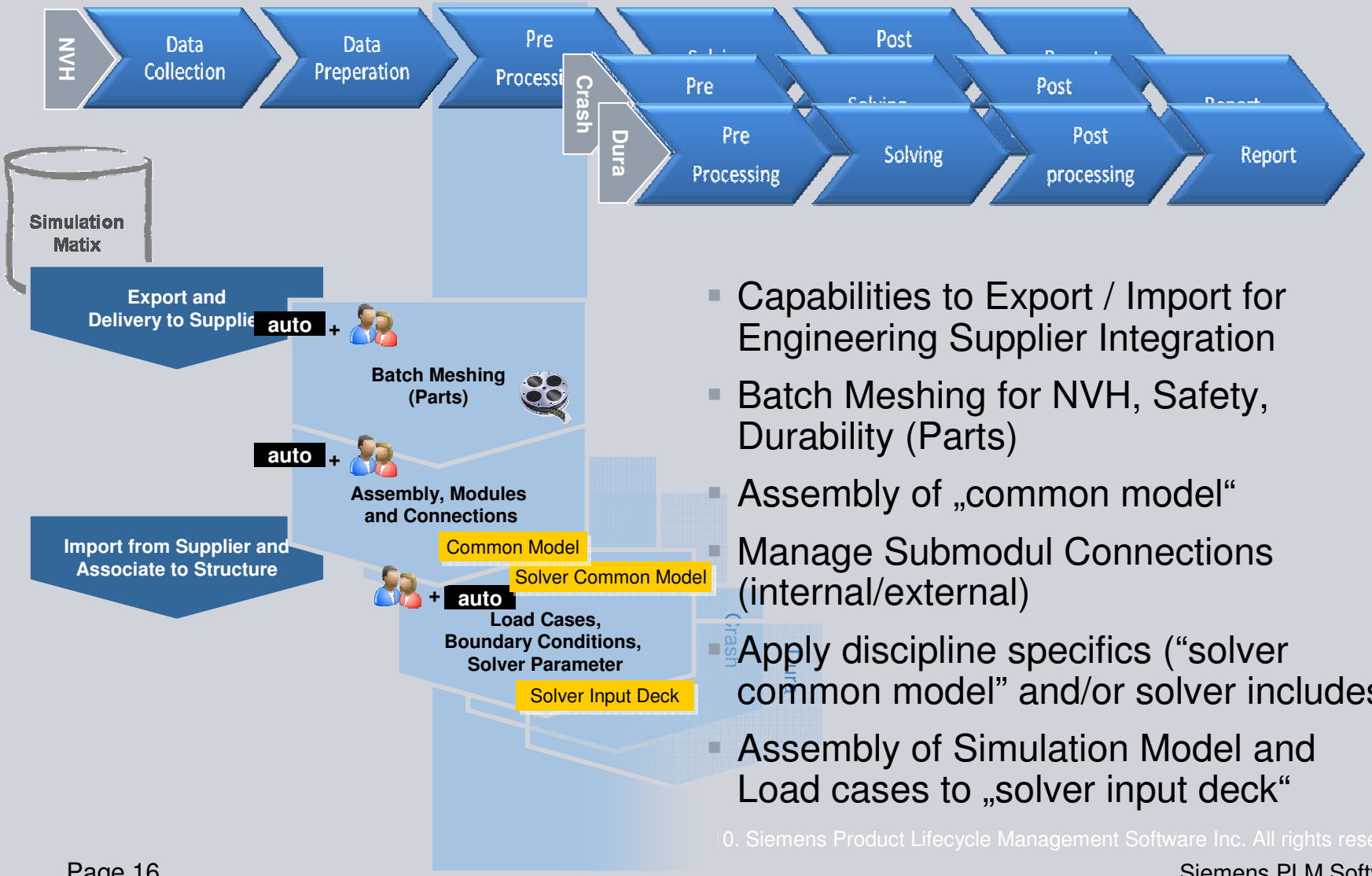

- Capabilities to Export / Import for Engineering Supplier Integration
- Batch Meshing for NVH, Safety, Durability (Parts)
- Assembly of „common model“
- Manage Submodul Connections (internal/external)
- Apply discipline specifics (“solver common model” and/or solver includes)
- Assembly of Simulation Model and Load cases to „solver input deck“

External Application Integration
PreProcessor ANSA

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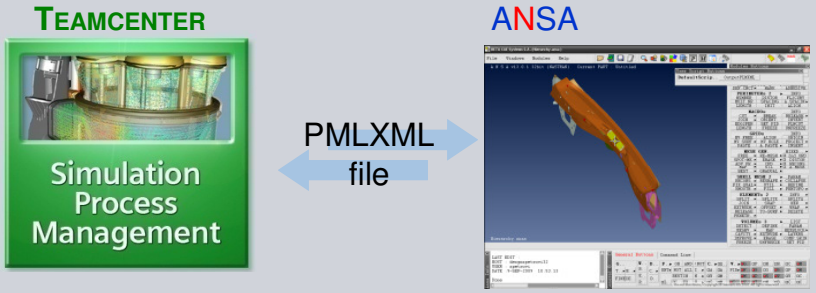

Interaction Points:

Point 1 – Component meshing
- Translation of CAD components
- Batch meshing of components

Point 2 – Create CAE sub-assemblies
- Translation of CAD components
- Application of sub-assembly connections

Point 3 – Create complete CAE assembly
- Build-up from sub assemblies and components
- Application of model connections

Capabilities within each interaction point
- Process new data
- Handle component updates
- Re-use existing data
- Re-use common content

Summary of ANSA Integration:

- Input for each step is a configured CAE structure
- Each step can save monolithic file (containing complete assembly) or individual component levels
- No process modifications necessary to handle component updates as well as re-use of existing data
- All cases are handled inherently either by Teamcenter or by the intelligence of ANSA PLMXML interface.

Applikation Integration

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Philosophy: Provide a generic and flexible environment where customers can integrate codeless their CAE applications into managed processes.

Framework:

- CAE spezific Data Modell
- Environment to configure external Applications
- PLM XML for Data Exchange

Dataset Mode

Pre/Post:
Ansa
FEMAP
(AMESim)

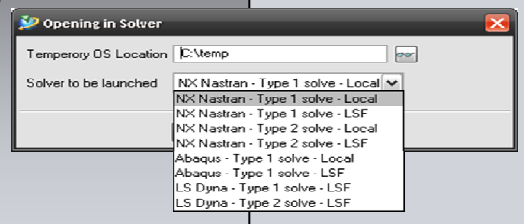
Item Revision Mode

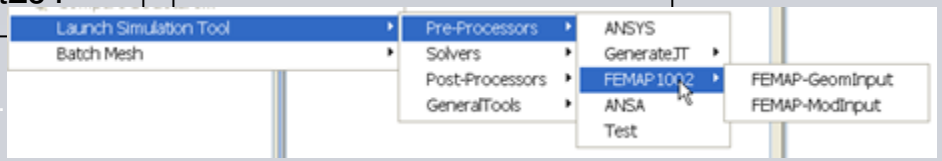
Pre/Post:
ANSA
FEMAP
(ANSYS)
(Hypermesh)
(Medina)
(StarCD)

Solver / Konverter:
Batchmesher
NX Nastran
Abaqus
LSDyna
NasResult2JT
AbaqusResult2JT
AnsysResult2JT

Item Revision Structure Mode

Pre/Post:
Ansa
Hypermesh
(Medina)





Simulation Process Support:
Model Update from CAD

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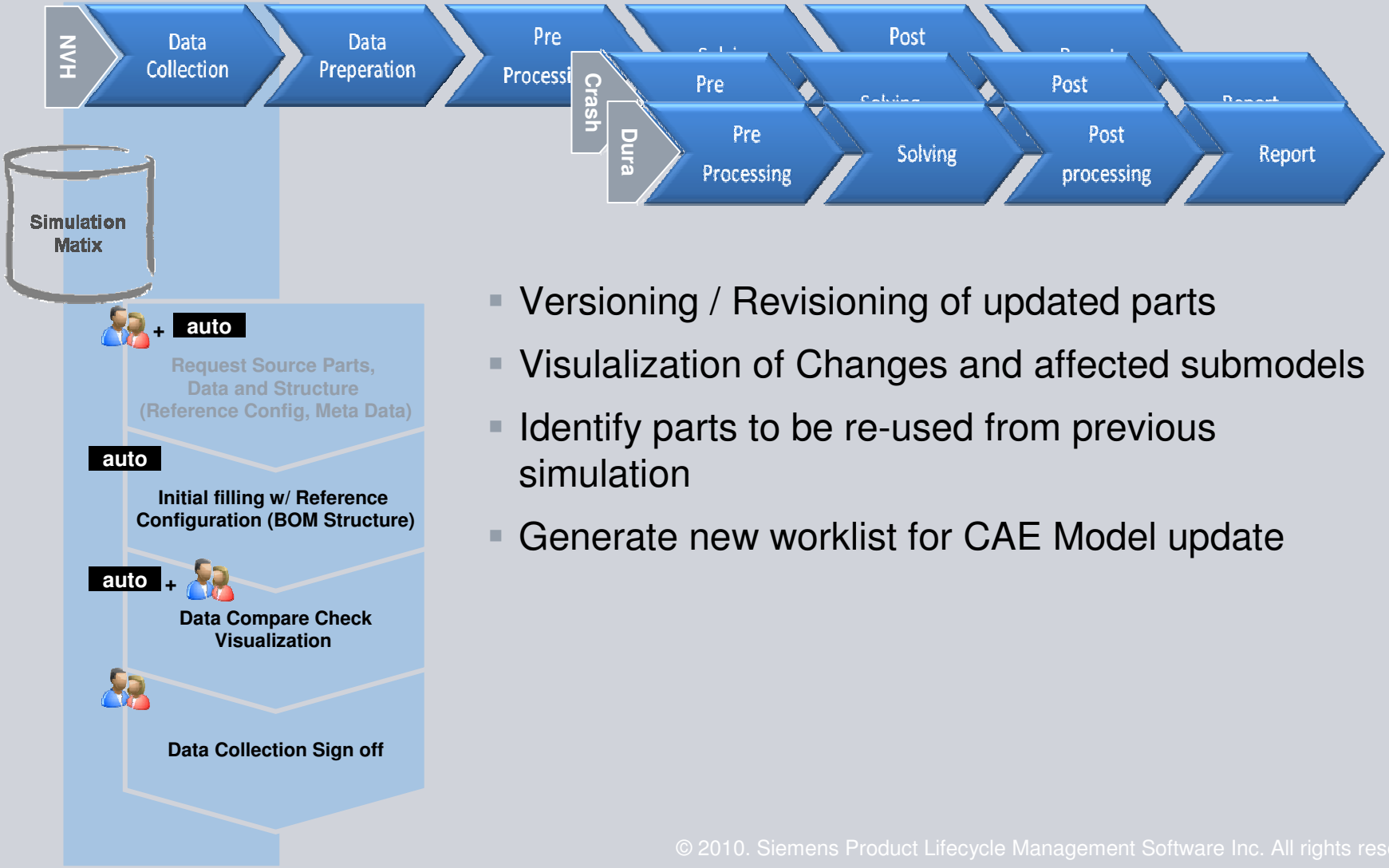

- Versioning / Revisioning of updated parts
- Visulalization of Changes and affected submodels
- Identify parts to be re-used from previous simulation
- Generate new worklist for CAE Model update

Simulation Progress Monitoring with Simulation Matrix

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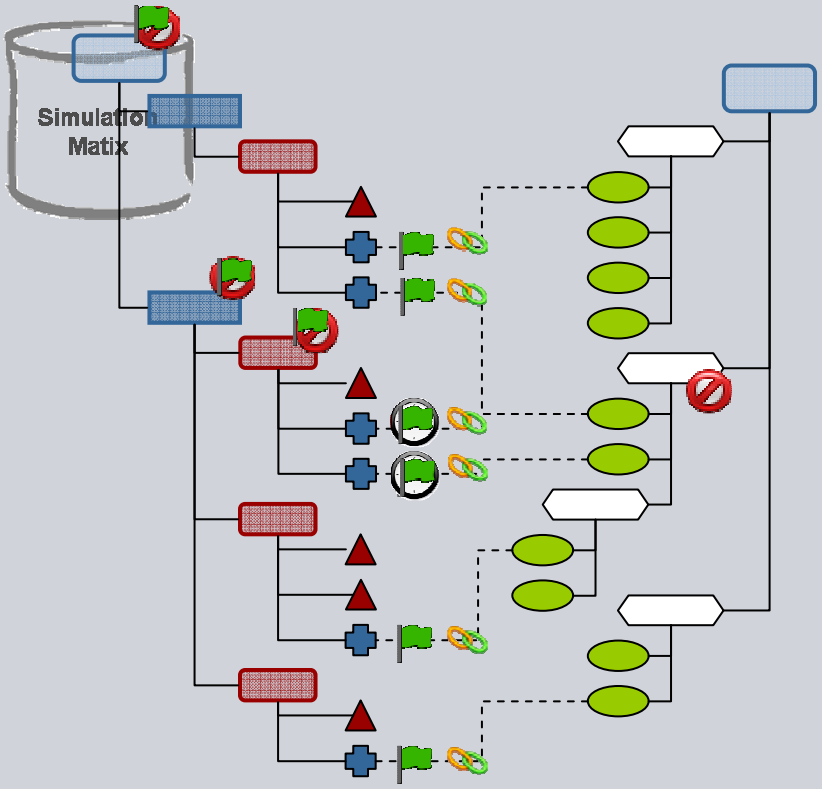

- CAD BOM mapping to CAE Project Structure and identify leaks
- Sign off first Completness Check
  or
  Sign off Simulation Results
- Request Design Data / Change
- Track CAD Model Updates
- Model Assembly / Quality Report
- Run/Rerun Simulations and PostProcessing
- Sign off Simulation Results

Project | Sub-Project, i.e. Dev. Phase | Simulation-Task, i.e. NVH | Simulation Input, Targets, Values | BOM wildcard | Assembly | Part

Model Build Process
Simulation Matrix Solution Elements

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1. User Access, Roles, Permissions
   → discipline and role specific

2. CAD/CAE Structure Mapping
   → Data Model, Mapping Templates

3. Workflow Definition
   → Templates

4. Application Integration
   - Pre/Post
   - Solver
   - Scripts

Simulation Process Support:
Summary of Process Gains at Automotive OEMs

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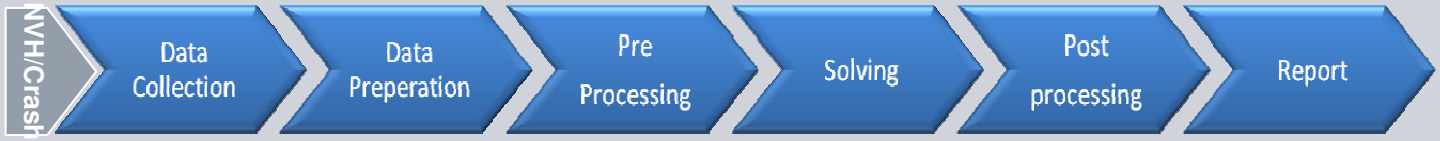

15-20% 15-20% 10-15%	Estimate on Time Savings with model build process support (European Premium OEM)
From 200 work hours down to 100 work hours	Realized time reduction for a BIW model setup (European OEM)

- manual steps have been reduced to a well defined sequence of actions
- overall improvement of the process well recognized
- Executives noted this step towards a rolling model build on a daily basis compared to gated model builds after CAD freeze once a quarter per program
- Standard Solution “Teamcenter for Simulation” Out-of-the-Box with some customization

Optimize Collaboration between Simulation Disciplines and Suppliers through IT technology.

Solution Elements

To manage the CAE data in a common PLM environment

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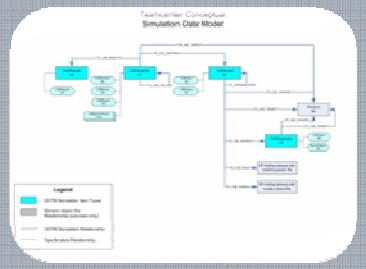
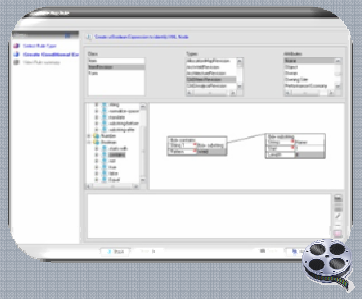
Teamcenter Simulation Process Management



CAE Data Model
OOTB CAE data model: CAE Model, CAE Geometry, CAE Analysis, CAE Results, …



Structure Mapping
Create automatically CAE structure from a product structure using filter and reuse rules.

External Processes
Exchange CAE data with external applications: pre-processor, solver and post-processor. CAE data model fully supported by PLMXML.

Additional Solution Elements:

HD3D Vision

Addressing Decision Support Challenges

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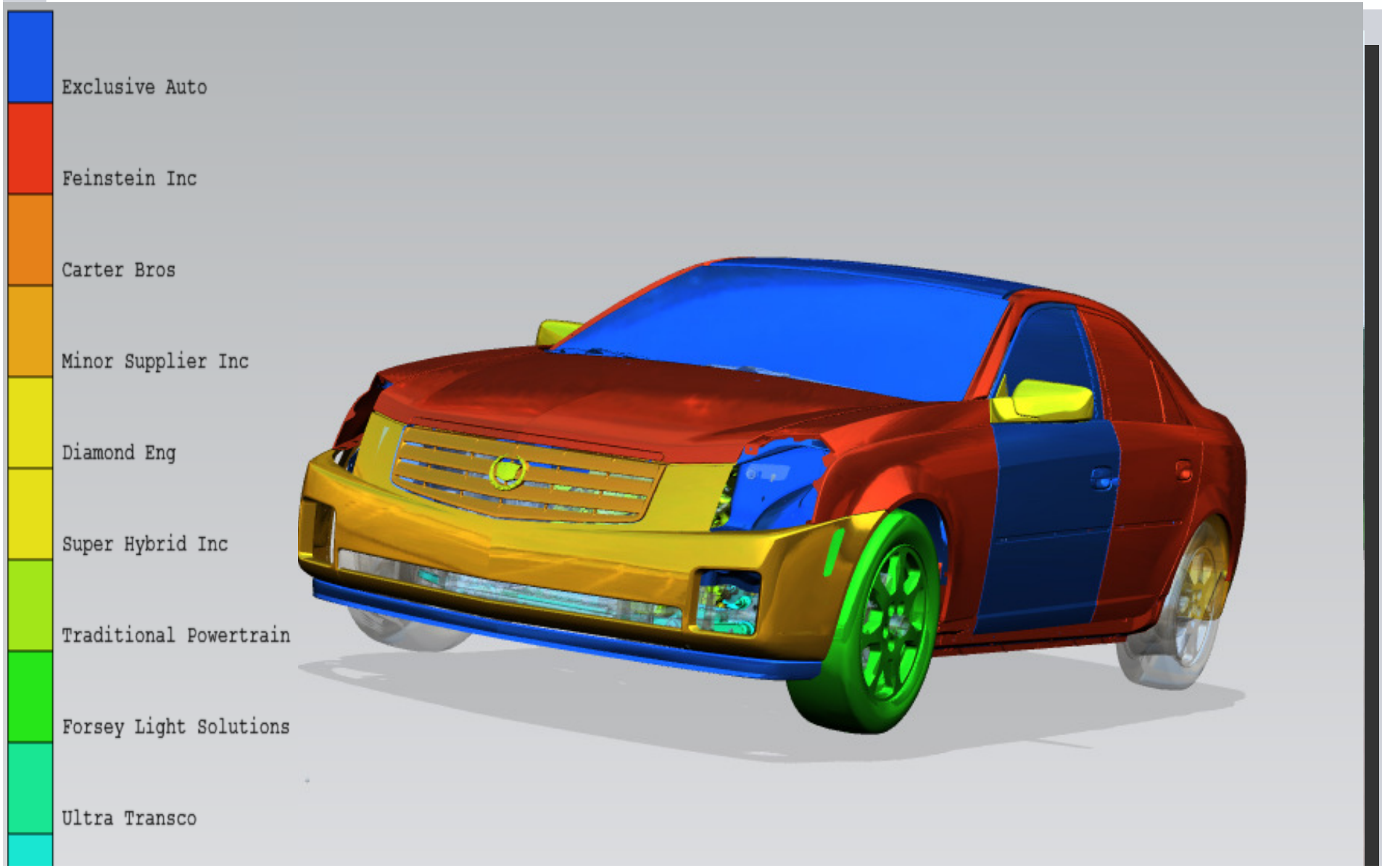

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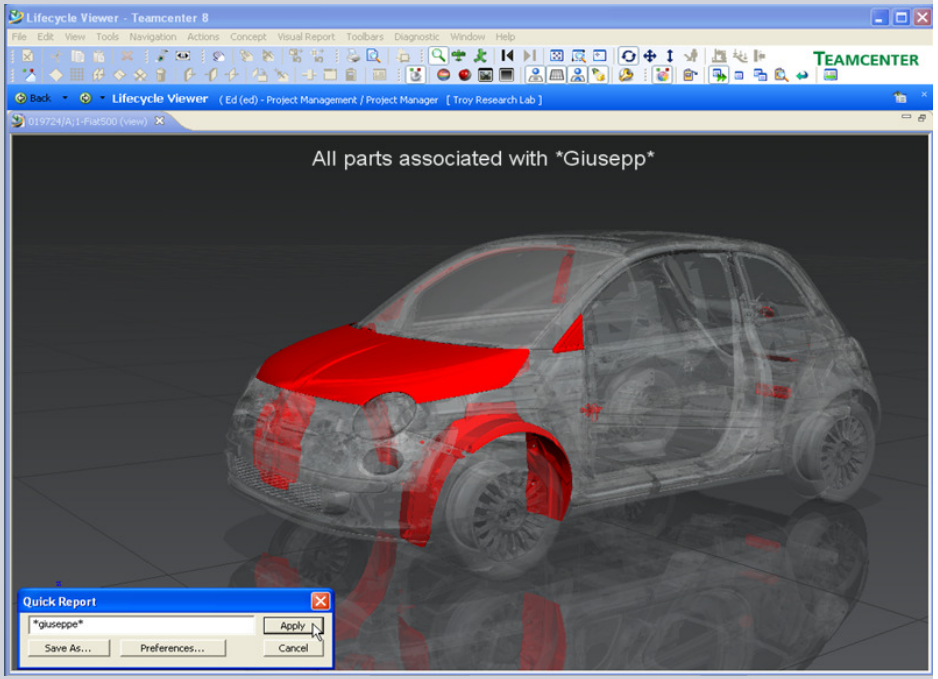
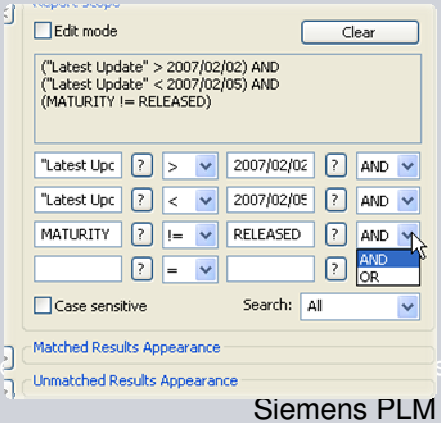
Teamcenter Visual Reporting Capabilities

- Information source(s)
- Visual Report definition
  - Rule definition Capabilities
- Visual Report execution
  - Quick reports
  - Single Rule Reports
  - Multiple Rule Reports
- Visual Reporting for advanced Material definitions
- Visual Reporting Roll-up & drill down
- Visual Reporting – result actions





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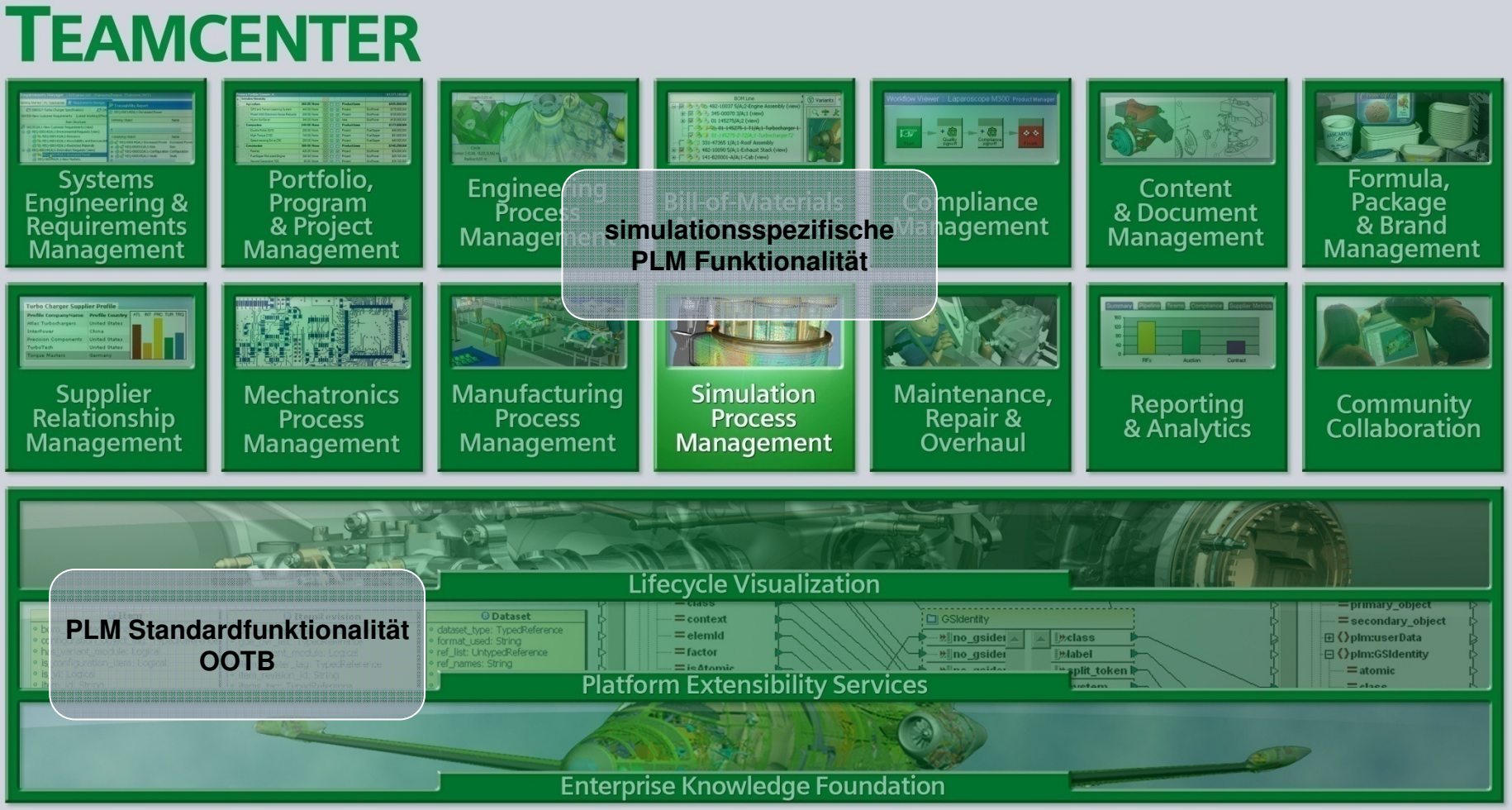
Simulation Process Management



Thank you!

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http://www.plm.automation.siemens.com/en_us/Images/20591_tcm1023-93687.pdf

Questions?