

Implementing the STEP PDM Schema

A Summary of a PDTnet Application Project



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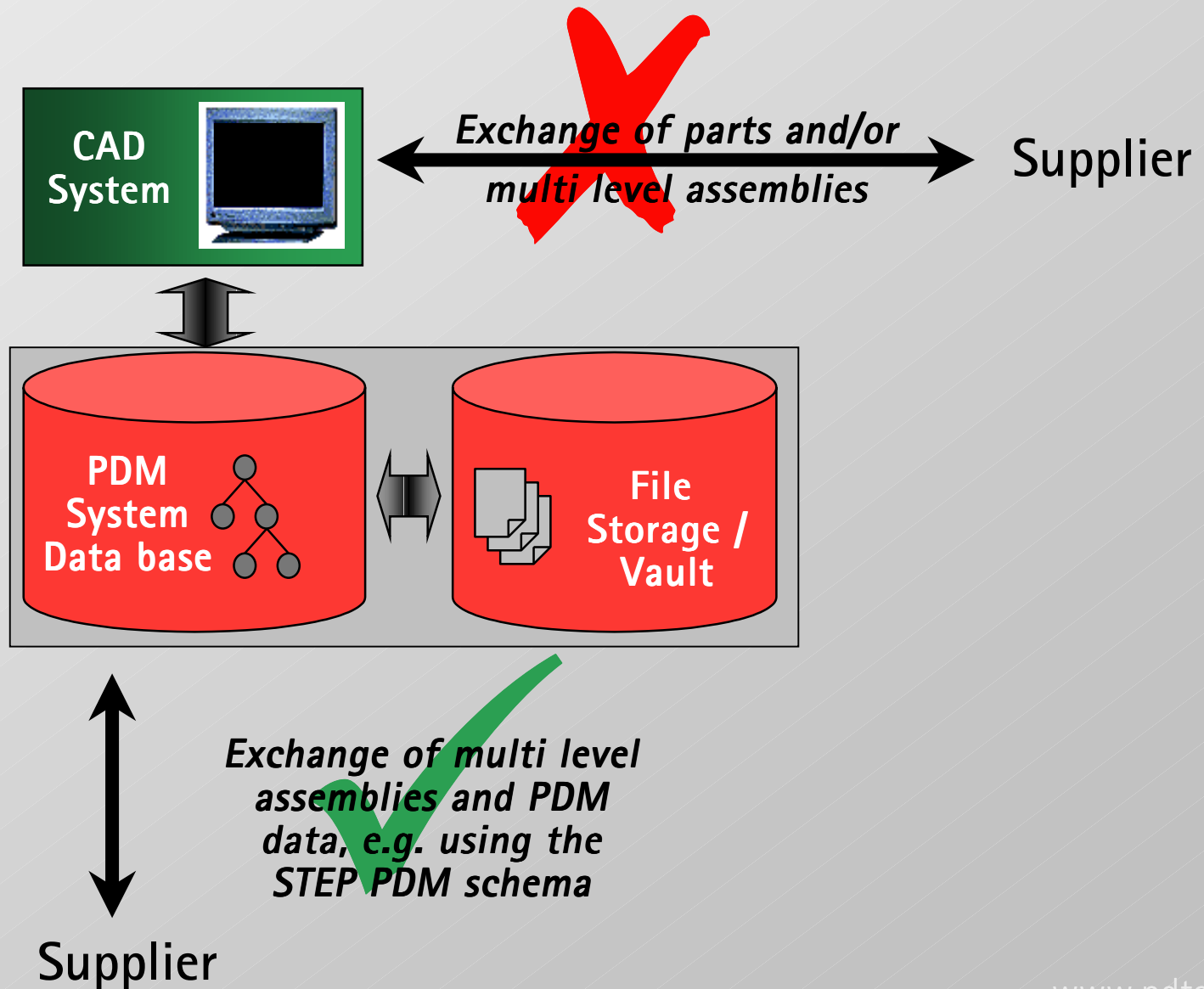


Background of the Project (1/2)

- Application Project part of the overall PDTnet project
 - PDTnet spans the frame for several application projects
 - Driven by Automotive Industry – organized within ProSTEP
 - Duration: 3 Years (May 2000 – April 2003)
- Application project launched in November 2000
- Goals of the Application project
 - Exchange of multi-level Assemblies with associated Documents (geometry models) between different PDM Systems using PDM Schema 1.2 / AP214 CC6
 - Management of OEM and Supplier IDs at both sites
 - Management of different Assembly structures at OEM and supplier site (e.g. OEM want to receive typically a less detailed Assembly structure – spare part structure instead of design structure)
 - Delta Exchange (mark-up of data that did not changed since last data exchange)

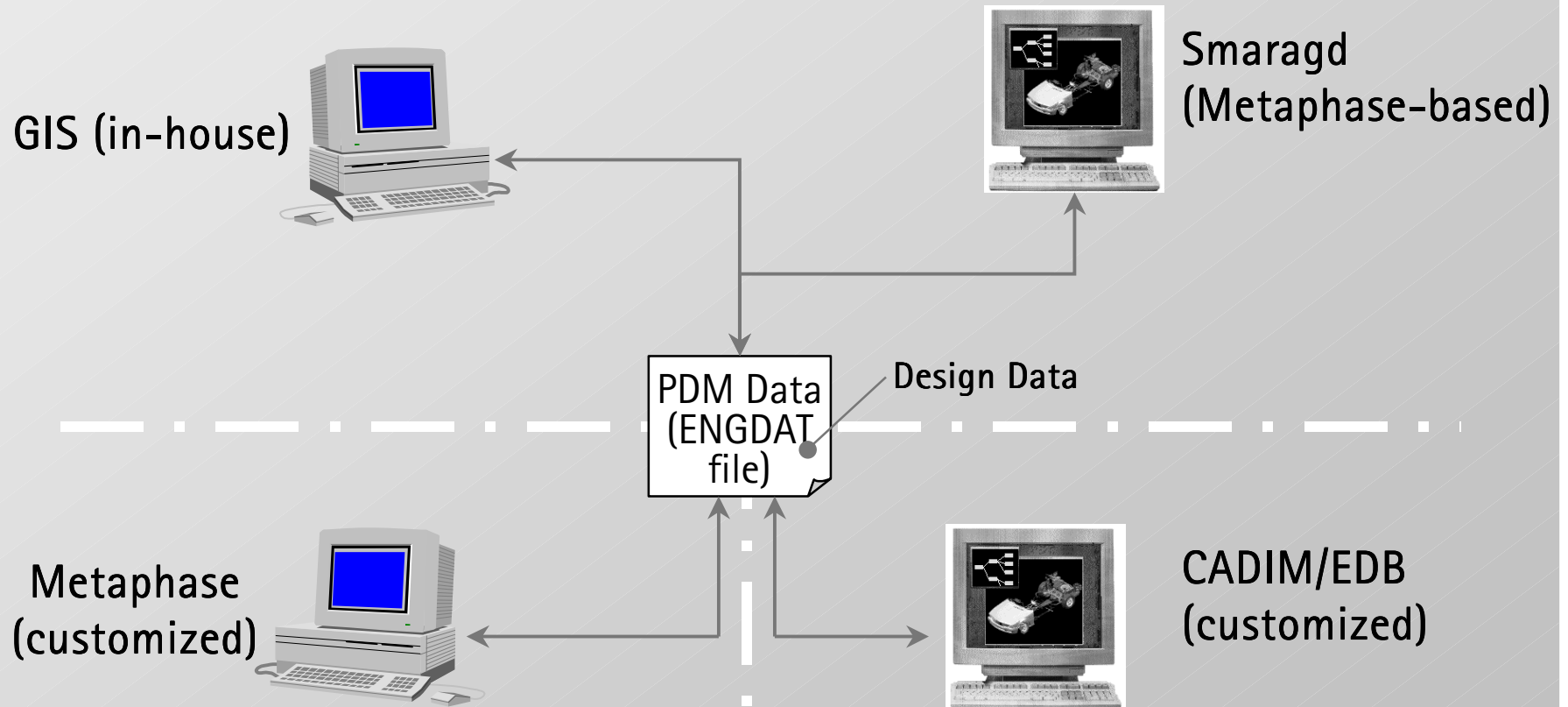
- Companies actively involved in the Application project
 - DaimlerChrysler AG (OEM)
 - Keiper GmbH & Co KG (Supplier)
 - Behr Group (Supplier)
 - PDTec GmbH (IT Solution Provider)

Exchange of PDM Data – in the past and nowadays



Involved Systems (simplified)

DaimlerChrysler (OEM)



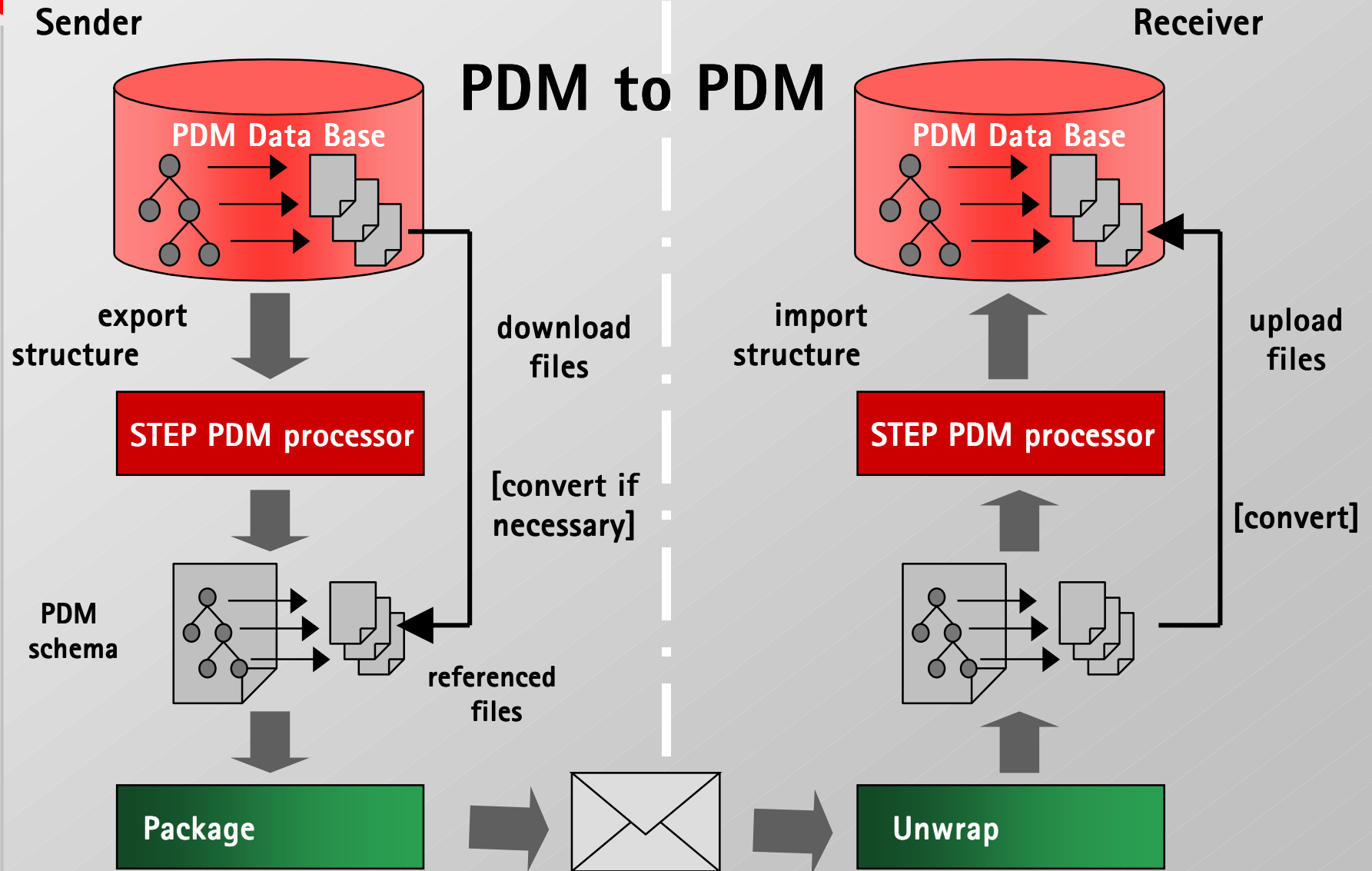
Behr (Supplier)

(designs and manufactures coolers, air condition systems, etc.)

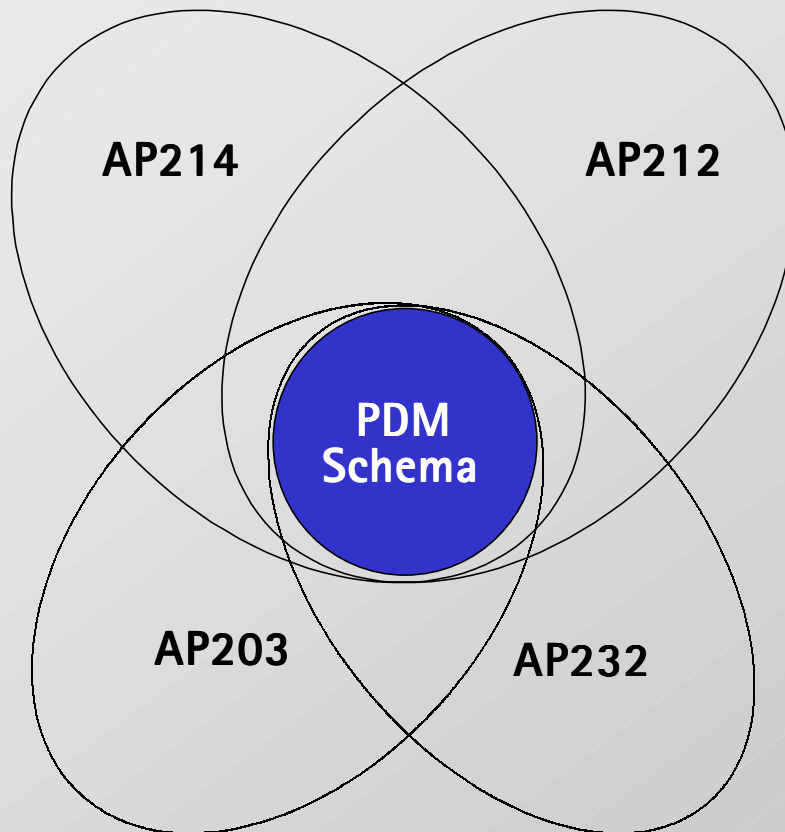
Keiper (Supplier)

(designs and manufactures car seats)

Principle Approach for the Exchange of PDM Data



The STEP PDM Schema



- Common PDM data schema generated and maintained by PDES Inc., ProSTEP, and JSTEP
- Subset of PDM relevant STEP AP's (AP203, AP212, AP214, AP232)
- Fulfills main requirements for PDM data exchange. Main functionality for parts and documents include
 - identification and versioning
 - structures incl. transformations
 - approvals and authorization
 - project, work order, work request
 - effectivities
 - classification and properties
- Test implementations via demos, pilots, and roundtables

- PDM systems are usually customized
 - Customer specific data model
 - Customer specific scope and constraints
 - structural requirements
 - attribute value domains
 - Customer specific business practices and processes
 - Continuous evolution and change
- Continuous evolution and change of implementations and surrounding IT-environments
 - Integration with packaging tool for data exchange (e.g., ENG DAT messages)
 - Migration to web-based technology
- Data management issues
 - Danger of checking 'trash data' into system
 - No possibility to check what happens during the mapping/check-in process
 - Data may get lost or be invalid

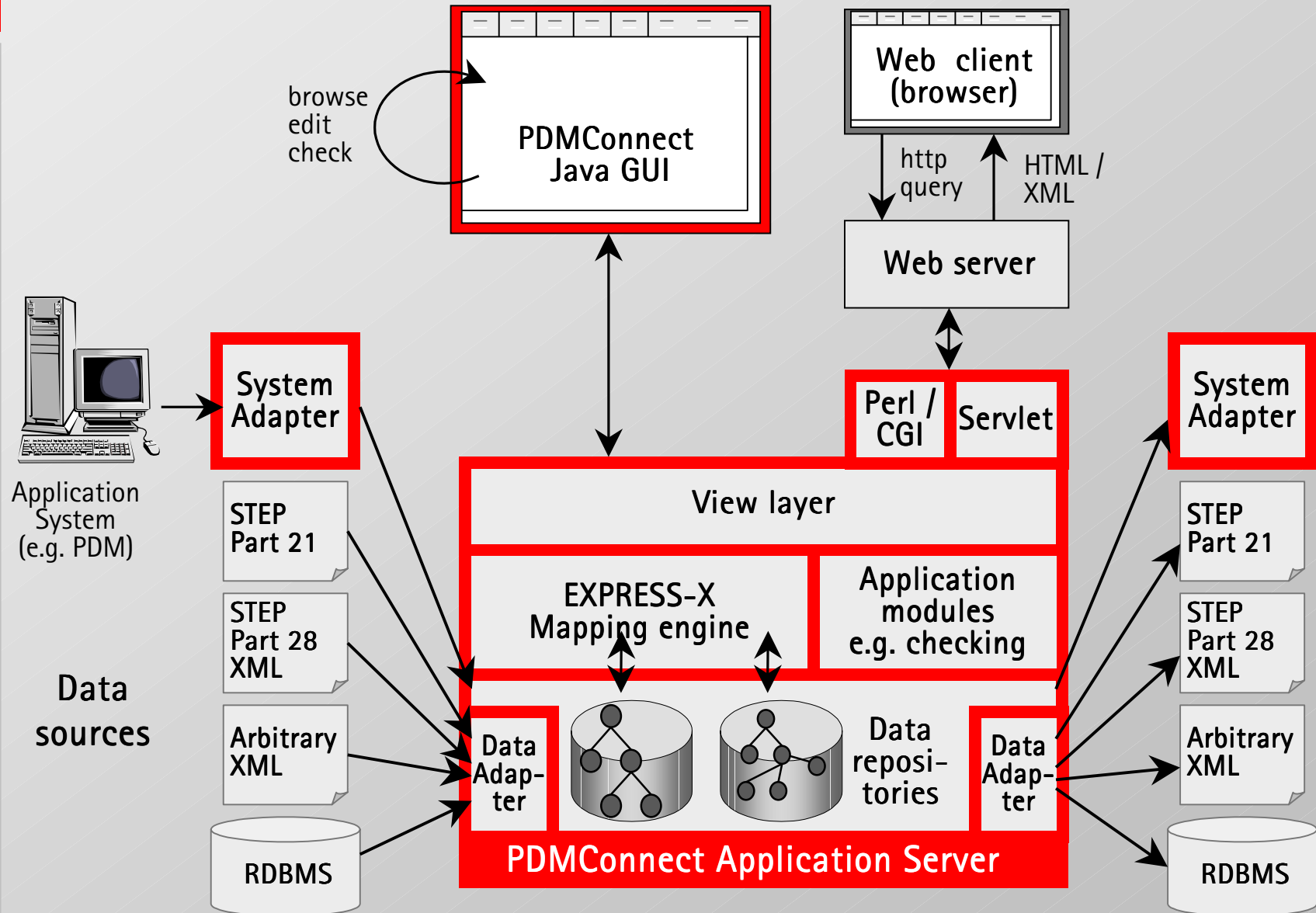
=> STEP PDM Processor needs to be easily customisable

How to overcome these Challenges?

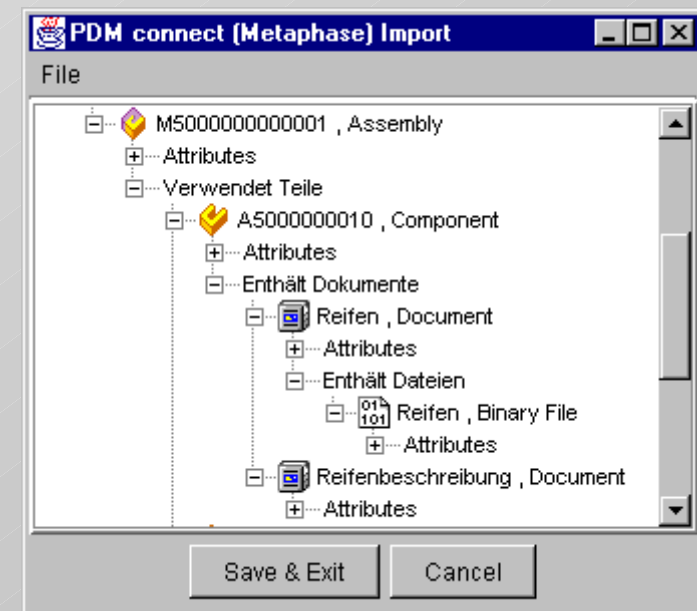
- Consortia of the Application Project has chosen to base the work on PDMConnect
- PDM Connect provides
 - ... a standard mapping to AP214 CC6 / PDM Schema
 - ... adapters to leading PDM and ERP systems
 - ... a GUI to control/check data that is being im- and/or exported
 - ... an interface to Data Exchange Tools (DDX, SWAN, ...)
- Remaining work
 - Adjustment of the
 - ... mapping to the customized PDM systems in use at OEM/Supplier site
 - ... GUI and the checking modules to reflect the actual engineering process
 - ... system adapter to reflect the customized PDM systems
 - Testing

- Flexible framework for PDM-related communication
- Communication platform to integrate development partners, OEMs and suppliers
- Easily customizable due to flexible combination of modules and underlying mapping technology
- System specific PDM- and ERP-Adapters
- Database adapter for direct access to objects in relational databases
- Current standards and implementation technologies
 - XML
 - STEP
 - Java

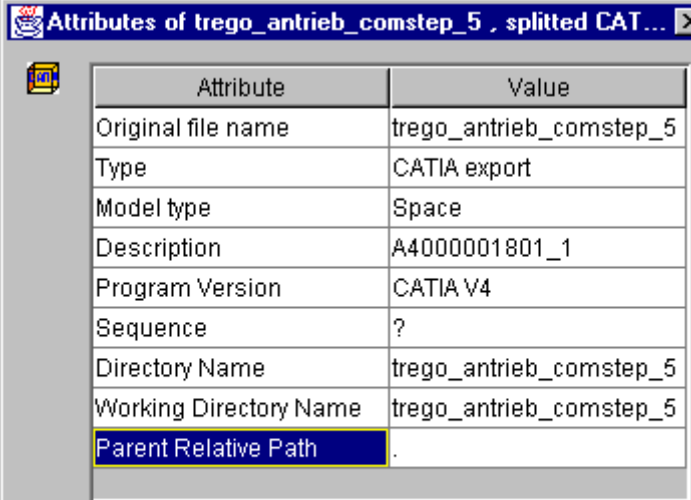
PDMConnect Components



- Visualization of Data
 - Configurable tree views on data
 - Different tree views on same data set
 - PDM like presentation format
- Editing Data
 - Attribute Value Changes
 - Structural Changes
- Customizable
 - Configuration files
 - API of application server/Mapping Engine
- Standalone or web-browser
 - Alternative use of JNI or RMI for communication with application server

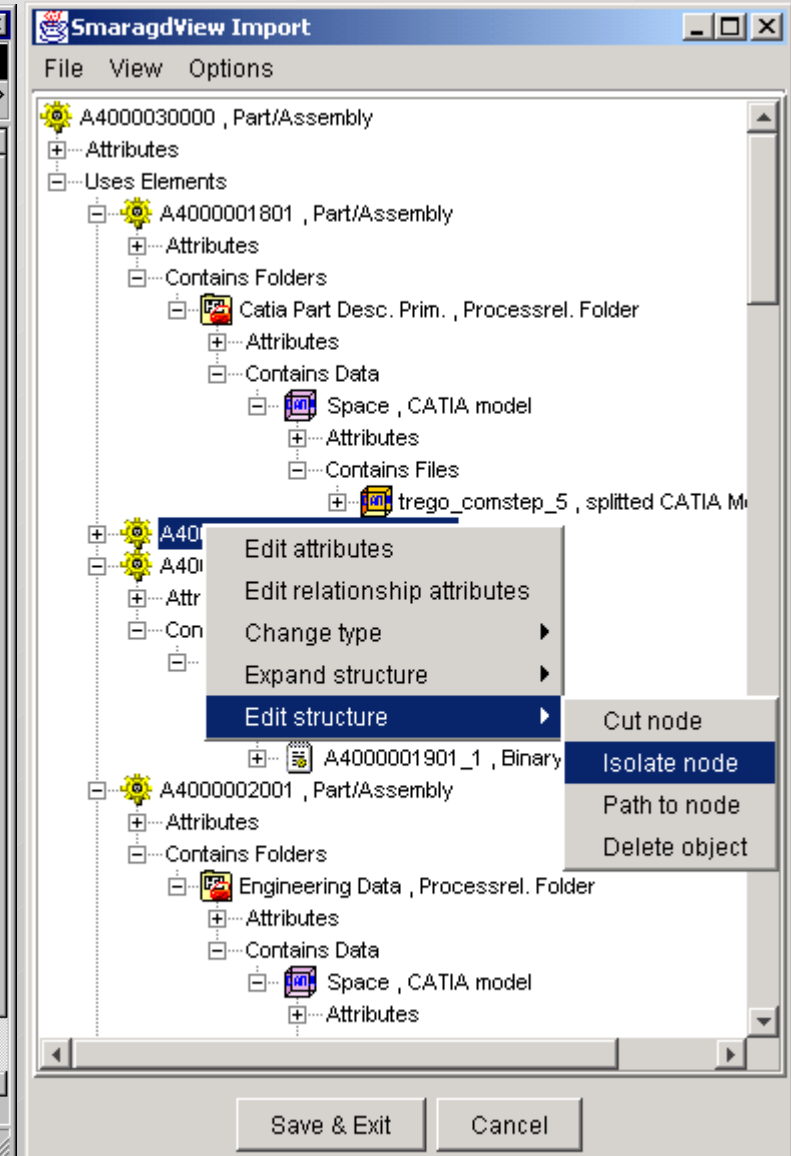
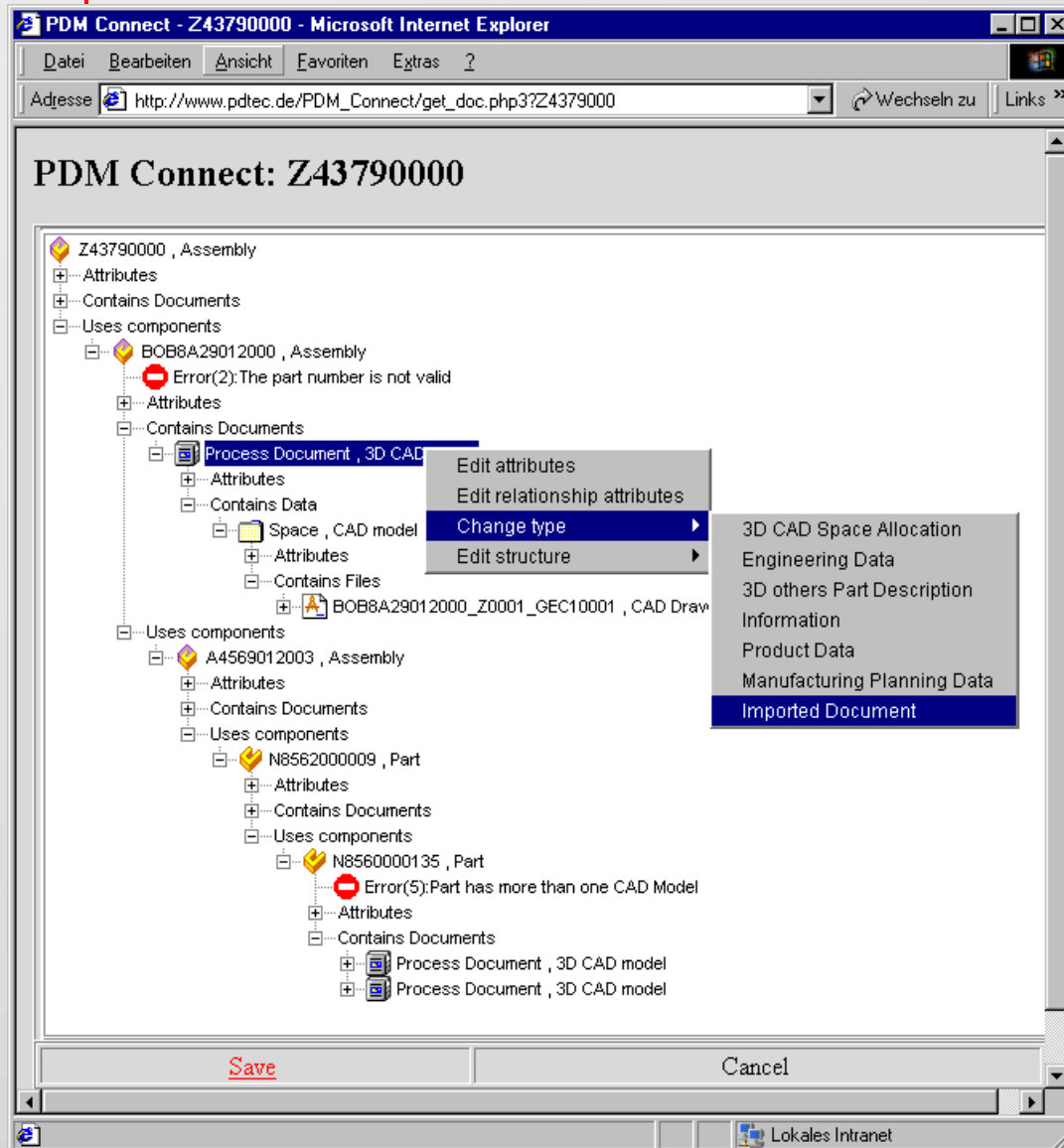


- Editing of Node and Relation Attributes
- Various Configuration Options
 - Selection of Attributes
 - Object and Attribute Names
 - Read-Only Attributes
 - Attribute Values
 - Language
- Structural Editing
 - Cut Node
 - Delete Node
 - Isolate Node
 - Path to Node
 - Merge objects (e.g. folders) and their contents



Attribute	Value
Original file name	trego_antrieb_comstep_5
Type	CATIA export
Model type	Space
Description	A4000001801_1
Program Version	CATIA V4
Sequence	?
Directory Name	trego_antrieb_comstep_5
Working Directory Name	trego_antrieb_comstep_5
Parent Relative Path	.

OK Apply Reset Cancel



- Implementation of all methods available in the Java GUI
- EXPRESS-X mapping engine to execute mapping between PDM data structures
- Additional methods, e.g.
 - Adapt attribute values, change types and structures
 - Check and edit data to be exported
 - Adapt to specific restrictions applying at receiver side
 - Built-in check-functions specific for particular PDM installation
 - Restrictions on data structures and formats
 - Restrictions on attribute values
 - Analysis mode to simulate data import
- Automatically generated from the ECCO development environment
- Can be linked to other applications through API (Java, C, C++, Tcl, Perl, Visual Basic, ..)

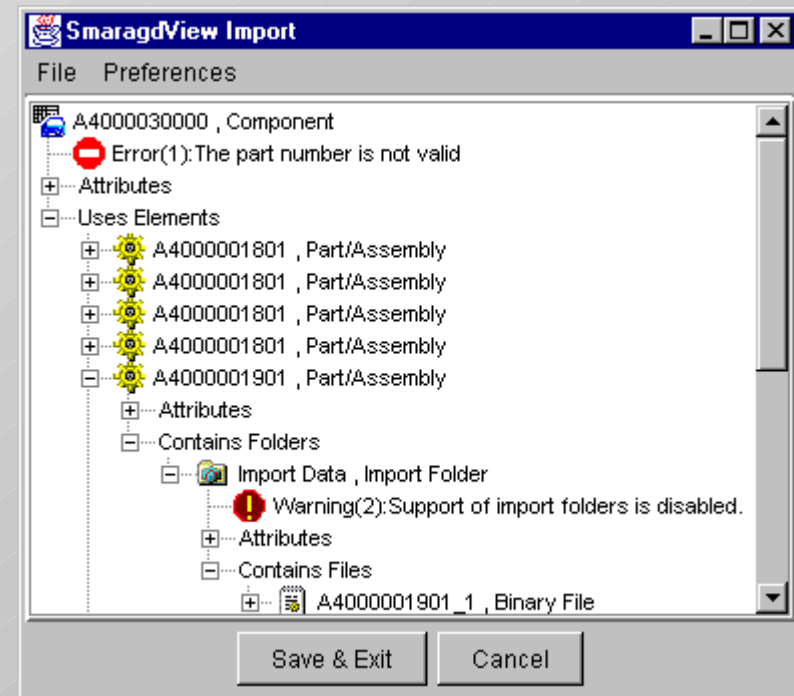
- Based on latest version (CD) of the EXPRESS-X mapping language
 - Declarative approach
 - Readability
 - Same level of abstraction as mapped data models
 - Independence of execution order
 - Procedural extensions allow easy integration of additional methods
 - Multiple source and target schemata
- Easy development and customization of mappings
- Support of different mapping „variations“ and target data models
 - Dynamic loading of mapping libraries
 - Dynamically loading of configuration files

PDMConnect – Checking Modules

- A (customized) PDM system data model usually defines specific constraints
 - Constraints on attribute values, e.g. context dependent part numbers
 - Structural constraints, e.g. max. depth of document structure
 - Lifecycles and approval processes
 - Automatic or interactive checking of data according to PDM system constraints

- Problems are displayed as errors or warnings
 - Errors are displayed when the check-in process will fail due to system constraints violations
 - Data cannot be saved until all errors are fixed

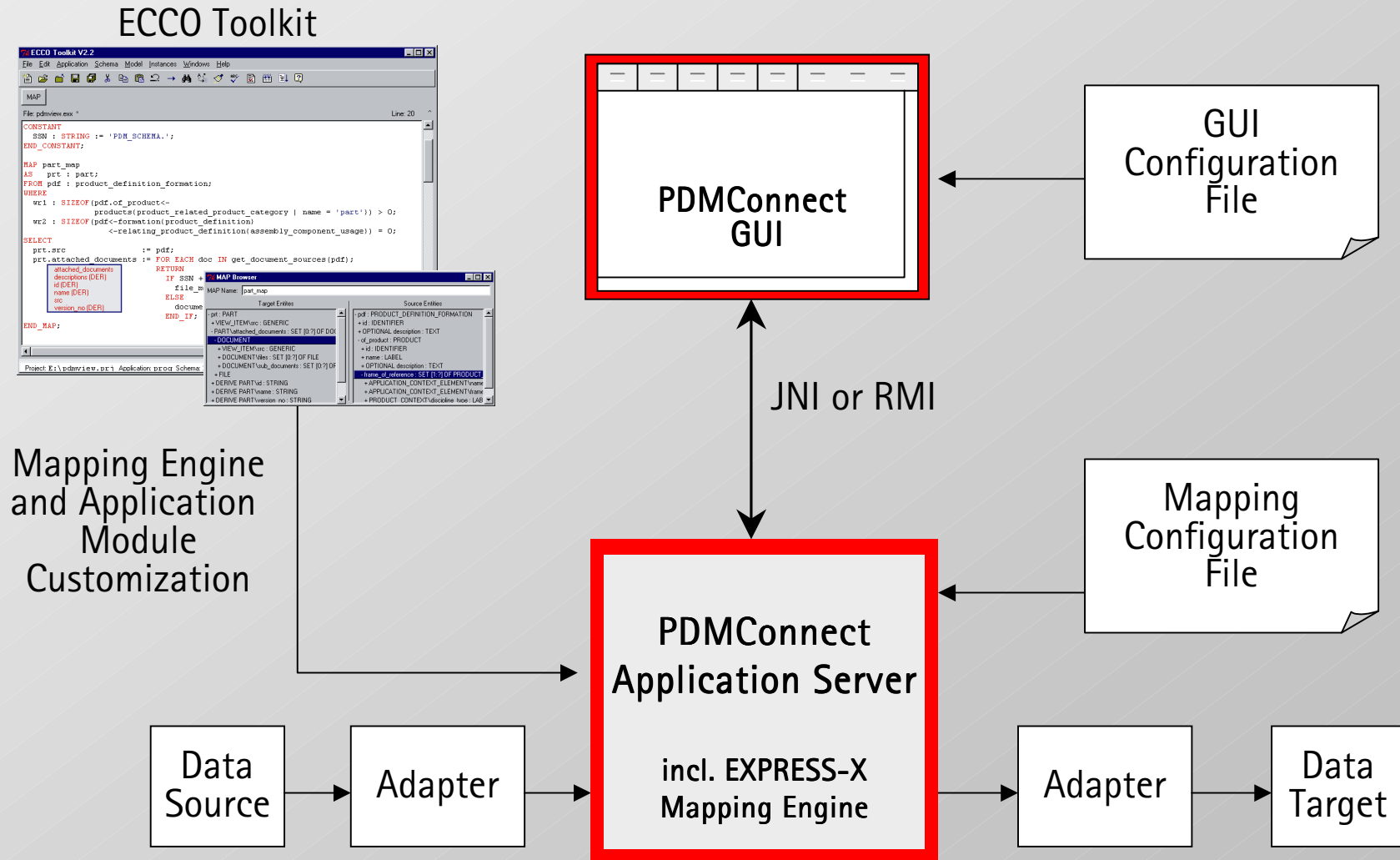
- Warnings are displayed
 - if data will get lost during the check-in process
 - if „strange“ data has been detected





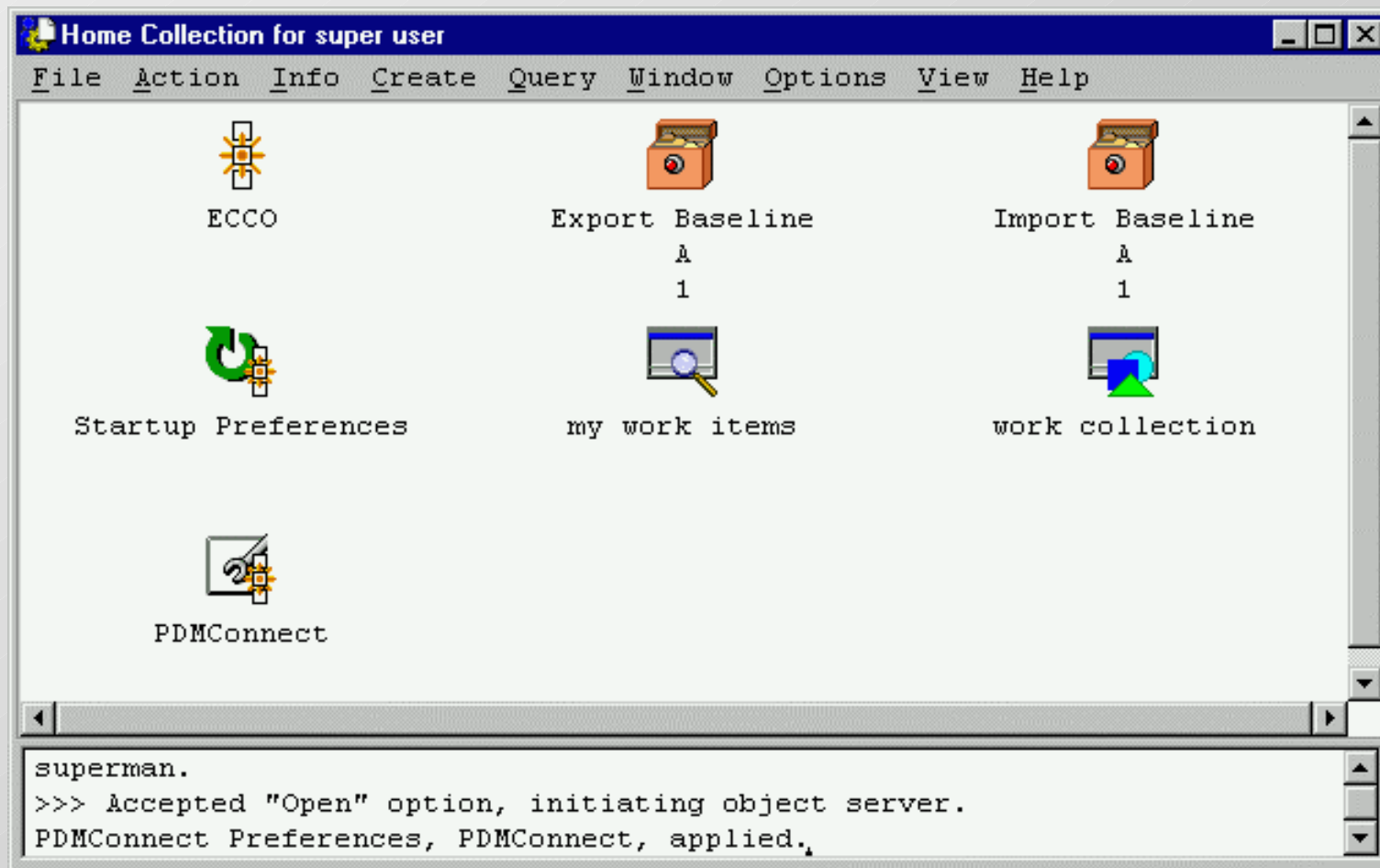
- Adaptable to support
 - Specific data and structure requirements / restrictions
 - Specific coding of attribute values
 - Specific system environment, e.g. Network, Client-Server
 - Specific functionality of user interface
- Automatic generation of customized PDM data model
- EXPRESS-X mappings to/from standard data models (e.g. AP214 CC6, PDM Schema)
- Ability to use and support different exchange scenarios
 - Support of different business practices
 - Flexibility to perform certain actions on import and export (e.g. check-in/-out, replace, add, etc.) depending on specific user settings
- Available for major PDM Systems

PDMConnect Customization - Summary



- PDMConnect is a framework to connect arbitrary data sources
 - Pre-existing components (mapping, adapter, GUI, ...) allows for reuse
 - Components are highly configurable and customizable
 - By external configuration files
 - EXPRESS-X mapping configuration
 - New methods on the data (e.g. checking, structural editing) can be easily added
 - The PDMConnect GUI is a powerful tool to
 - Control data exchange
 - Select data
 - Detect and correct invalid data
- First goals of the Application project was reached rather quickly due to the usage of PDMConnect

Example for a PDMConnect System Adapter (1)



Example for a PDMConnect System Adapter (2)

Home Collection for super user

File Action Info Create Query Window Options View Help

ECCO Export Baseline A Import Baseline A

Part Objects

File Action Info

Item Identifier
A50000000010
A50000000011
A50000000012
A50000000013
M50000000000001
M50000000000002
M50000000000003
USC000000002
USC000000003
USC000000010
USC000000011
USC000000012

sup
>>>
PDM

Query Complete.
Objects found by t

ExportBaseline,A,1 Has Members

File Action Info Query Window Options View Help

Item Identifier	Class	Seq	Frozen?	Supersec
USC000000003	Assembly	1	False	False
Uses Part Masters (uses)				
M50000000000001	Assembly	1	False	False
Uses Part Masters (uses)				
A50000000010	Component Master	---	---	---
A50000000011	Component Master	---	---	---
Has Revisions (has)				
A50000000011	Component	1	False	False
Is Described By (d				
CATIA model14	General Document	1	False	False
f_A50000000011	General Document	1	False	False

One object found.
>>> Accepted "Is Described By" option, initiating object server.
2 objects found.

Example for a PDMConnect System Adapter (3)

```

Export.elog - Editor
Datei Bearbeiten Suchen ?

2000/09/28-10:54:06 superman <228> Exported Component (HXV9998880122,A,1,Cmponent)
2000/09/28-10:54:06 superman <228> Exported Component Master (HXV9998880122,CmpnMstr)
2000/09/28-10:54:06 superman <228> Exported Item Revision Left: (HXV9998880122) Right: (HXV9998880122,A,1)
2000/09/28-10:54:06 superman <228> Exported Independent Binary File (hxy_2_comstep_11,1)
2000/09/28-10:54:07 superman <228> Exported Attach Relation Left: (HXV9998880122,A,1) Right: (hxy_2_comstep_11,1)
2000/09/28-10:54:07 superman <228> Exported Assembly Structure Left: (HXV9998880020,A,1) Right: (HXV9998880122)
2000/09/28-10:54:07 superman <228> Exported Component (HXV9998880121,A,1,Cmponent)
2000/09/28-10:54:07 superman <228> Exported Component Master (HXV9998880121,CmpnMstr)
2000/09/28-10:54:07 superman <228> Exported Item Revision Left: (HXV9998880121) Right: (HXV9998880121,A,1)
2000/09/28-10:54:07 superman <228> Exported Independent Binary File (hxy_2_comstep_13,1)
2000/09/28-10:54:07 superman <228> Exported Attach Relation Left: (HXV9998880121,A,1) Right: (hxy_2_comstep_13,1)
2000/09/28-10:54:07 superman <228> Exported Assembly Structure Left: (HXV9998880020,A,1) Right: (HXV9998880121)
2000/09/28-10:54:07 superman <228> Exported Assembly Structure Left: (HXV9998880010,A,1) Right: (HXV9998880020)
2000/09/28-10:54:07 superman <228> Exported Assembly Structure Left: (HXV9998881000,A,1) Right: (HXV9998880010)
2000/09/28-10:54:08 superman <228> Exported Component (HXV9998880110,A,1,Cmponent)
2000/09/28-10:54:08 superman <228> Exported Component Master (HXV9998880110,CmpnMstr)
2000/09/28-10:54:08 superman <228> Exported Item Revision Left: (HXV9998880110) Right: (HXV9998880110,A,1)
2000/09/28-10:54:08 superman <228> Exported Independent Binary File (hxy_2_comstep_15,1)
2000/09/28-10:54:08 superman <228> Exported Attach Relation Left: (HXV9998880110,A,1) Right: (hxy_2_comstep_15,1)
2000/09/28-10:54:08 superman <228> Exported Assembly Structure Left: (HXV9998881000,A,1) Right: (HXV9998880110)
2000/09/28-10:54:09 superman <228> Checked out Assembly (HXV9998880030,A,2)
2000/09/28-10:54:09 superman <228> Exported Assembly (HXV9998880030,A,2,Assembly)
2000/09/28-10:54:09 superman <228> Exported Assembly Master (HXV9998880030,AssmMstr)
2000/09/28-10:54:09 superman <228> Exported Item Revision Left: (HXV9998880030) Right: (HXV9998880030,A,2)
2000/09/28-10:54:10 superman <228> Checked out Independent Binary File (hxy_2_comstep_2,2)
2000/09/28-10:54:10 superman <228> Exported Independent Binary File (hxy_2_comstep_2,2)
2000/09/28-10:54:10 superman <228> Exported Attach Relation Left: (HXV9998880030,A,2) Right: (hxy_2_comstep_2,2)
2000/09/28-10:54:11 superman <228> Exported Component (HXV9998880131,A,1,Cmponent)
2000/09/28-10:54:11 superman <228> Exported Component Master (HXV9998880131,CmpnMstr)
2000/09/28-10:54:11 superman <228> Exported Item Revision Left: (HXV9998880131) Right: (HXV9998880131,A,1)
2000/09/28-10:54:11 superman <228> Exported Independent Binary File (hxy_2_comstep_3,1)
2000/09/28-10:54:11 superman <228> Exported Attach Relation Left: (HXV9998880131,A,1) Right: (hxy_2_comstep_3,1)
2000/09/28-10:54:11 superman <228> Exported Assembly Structure Left: (HXV9998880030,A,2) Right: (HXV9998880131)
2000/09/28-10:54:11 superman <228> Exported Component (HXV9998880132,A,1,Cmponent)
2000/09/28-10:54:11 superman <228> Exported Component Master (HXV9998880132,CmpnMstr)
2000/09/28-10:54:11 superman <228> Exported Item Revision Left: (HXV9998880132) Right: (HXV9998880132,A,1)
2000/09/28-10:54:11 superman <228> Exported Independent Binary File (hxy_2_comstep_4,1)
2000/09/28-10:54:12 superman <228> Exported Attach Relation Left: (HXV9998880132,A,1) Right: (hxy_2_comstep_4,1)
2000/09/28-10:54:12 superman <228> Exported Assembly Structure Left: (HXV9998880030,A,2) Right: (HXV9998880132)
2000/09/28-10:54:12 superman <228> Exported Assembly Structure Left: (HXV9998881000,A,1) Right: (HXV9998880030)
2000/09/28-10:54:13 superman <228> Exported Assembly Structure Left: (HXV9998881000,A,1) Right: (HXV9998880030)
2000/09/28-10:54:14 superman <228> Exported Assembly Structure Left: (HXV9998881000,A,1) Right: (HXV9998880030)
2000/09/28-10:54:15 superman <228> Exported Assembly Structure Left: (HXV9998881000,A,1) Right: (HXV9998880030)

```

Example for a PDMConnect System Adapter (4)

Analyse Output

STEP Import File **trego_antr.stp** Date **01/15/2001 20:10:53:000** ☒ Create

Import Mode **Replace Structure** Database scope **Scope of Session** ☒ Check

Analyse Parts

Class	Displayed Name	Nomenclature	Exists	Owner	Vault	Frozen	Official
Assembly	USC00000003,A,1	Rad VR	-	+	-	-	-
Assembly	M5000000000001,A,1	ZB Rad	-	+	-	-	-
Assembly	USC00000002,A,1	Rad VL					
Assembly	USC00000011,A,1	Rad HR dop					
Assembly	USC00000010,A,1	Rad HL dop					

Import (trego_antr.stp)

Import Mode **Append Structure**

☒ Create Parts? ☒ Write Logfile?

☒ Check out Items? ☒ Analyse?

Database scope **Scope of Session**

File pickup path **D:\mti32\users\dat\tf2**

OK **Cancel** **Help**

Analyse Assembly Structures

Class	Left Entity	Right Entity	Exists	Step Count	Database Count
AssmStrc	USC00000003.A.1	M5000000000001	-	1	0

OK

Example for a PDMConnect System Adapter (5)

PDM connect (Metaphase) Import

File

- USC00000002 , Assembly
 - Attributes
 - Contains Parts
 - M50000000000001 , Assembly
 - Attributes
 - Contains Parts
 - A50000000010 , Component
 - Attributes
 - Contains Documents
 - CATIA model2 , Document.Label
 - Attributes
 - Contains Files
 - A50000000010_2.model , Binary File
 - Attributes
 - f_A50000000010 , Document.Label
 - Attributes
 - A50000000011 , Component
 - Attributes
 - Contains Documents
 - CATIA model4 , Document.Label
 - Attributes
 - Contains Files
 - A50000000011_1.model , Binary File
 - Attributes
 - f_A50000000011 , Document.Label
 - Attributes

- USC000000013 , Assembly
- USC000000010 , Assembly
- USC000000012 , Assembly
- USC000000011 , Assembly
- USC000000003 , Assembly

Import Baseline.A.1 Has Members

File Action Info Query Window Options View Help

Item Identifier

- M50000000000003
- USC000000002
 - Uses Parts (uses)
 - M50000000000001
 - Uses Parts (uses)
 - A50000000010
 - Is Described By (desBy)
 - CATIA model2
 - Attaches (att)
 - A50000000010_2.model
 - f_A50000000010
 - A50000000011
 - Is Described By (desBy)
 - CATIA model4
 - Attaches (att)
 - A50000000011_1.model
 - f_A50000000011
- USC000000003
- USC000000010
- USC000000011
- USC000000012
- USC000000013
- f_A50000000010
- f_A50000000011
- f_A50000000012
- f_A50000000013
- tregio_antr.stp

One object found.
 >>> Accepted "Attaches" option, initiating object server.
 One object found.

/Metaphase.properties

Product Data
Technology



PD|Tec.



Key to global
Competitiveness

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