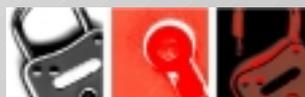


# Implementing the STEP PDM Schema

## PDMConnect



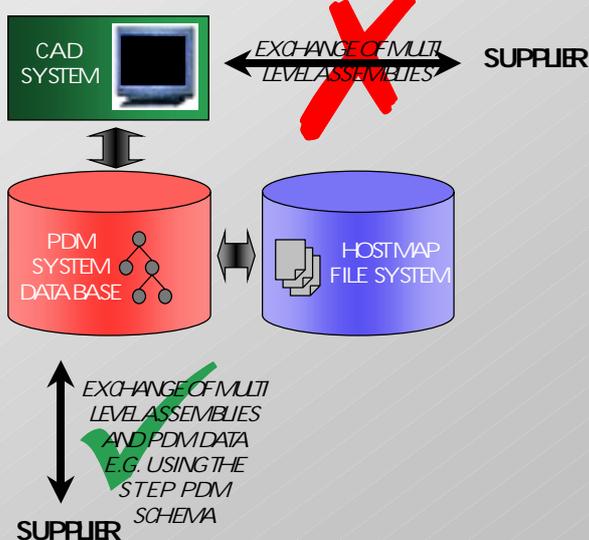
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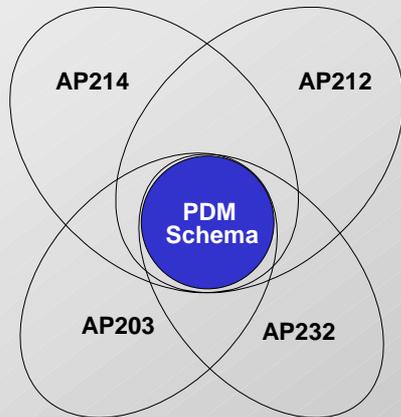
NASA STEP Workshop, Pasadena, CA, January 16/19, 2001



## Exchange of PDM and Structure Data using STEP – Example Scenario



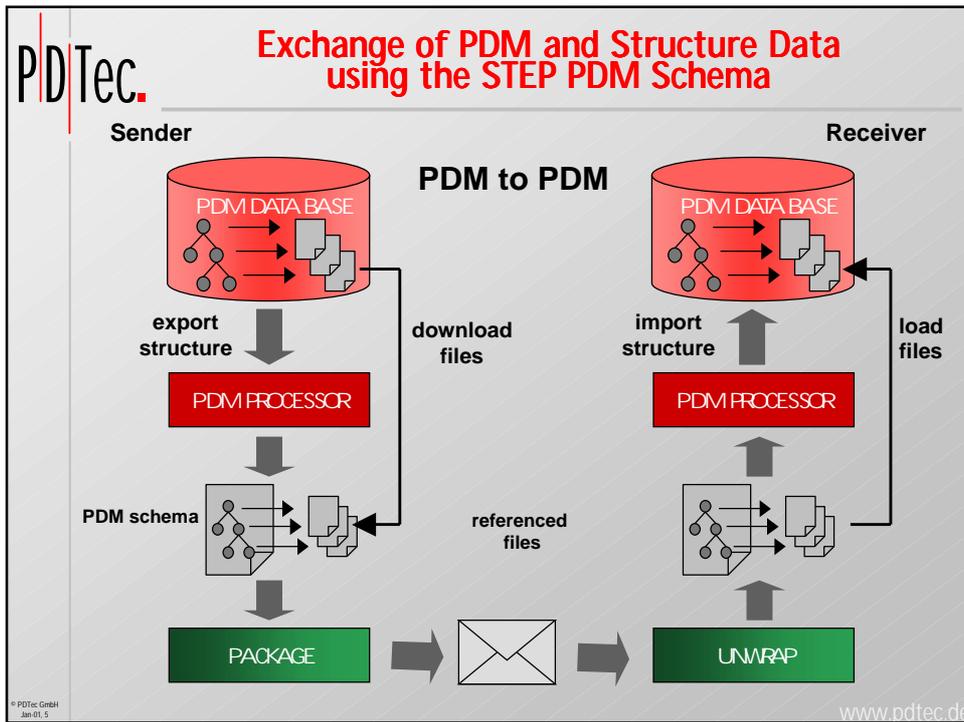
## The STEP PDM Schema



- 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

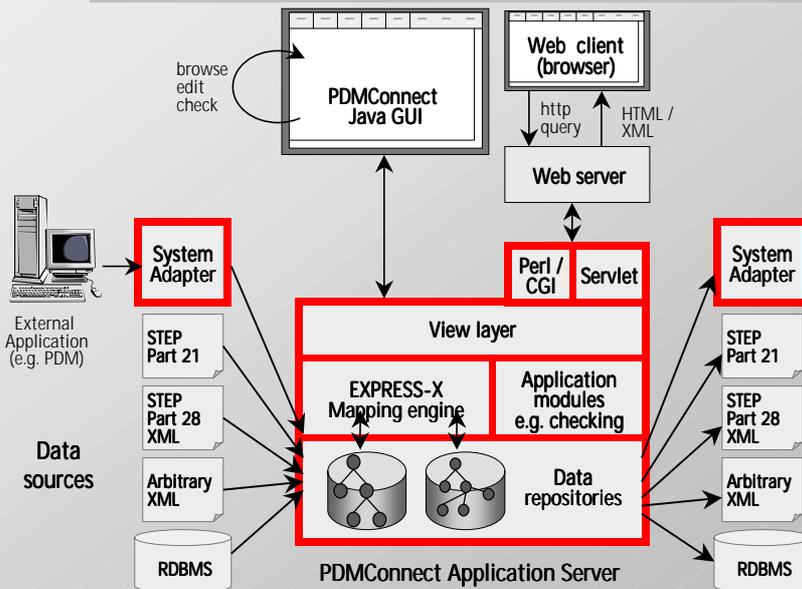
## PDM schema - Units of Functionality

- Part Identification,
- Part Classification,
- Part Properties,
- Part Structure and Relationships
- Document Identification,
- Document Classification,
- External Files,
- Relationships Between Documents and Constituent Files
- Document and File Properties,
- Document and File Association to Product Data,
- Document and File Relationships,
- Alias Identification,
- Authorization,
- Configuration and Effectivity Information,
- Work Management Data.



- PDTEC.** Challenges
- **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
    - 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
- © PDTEC GmbH Jan-01, 7 www.pdtec.de

- 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

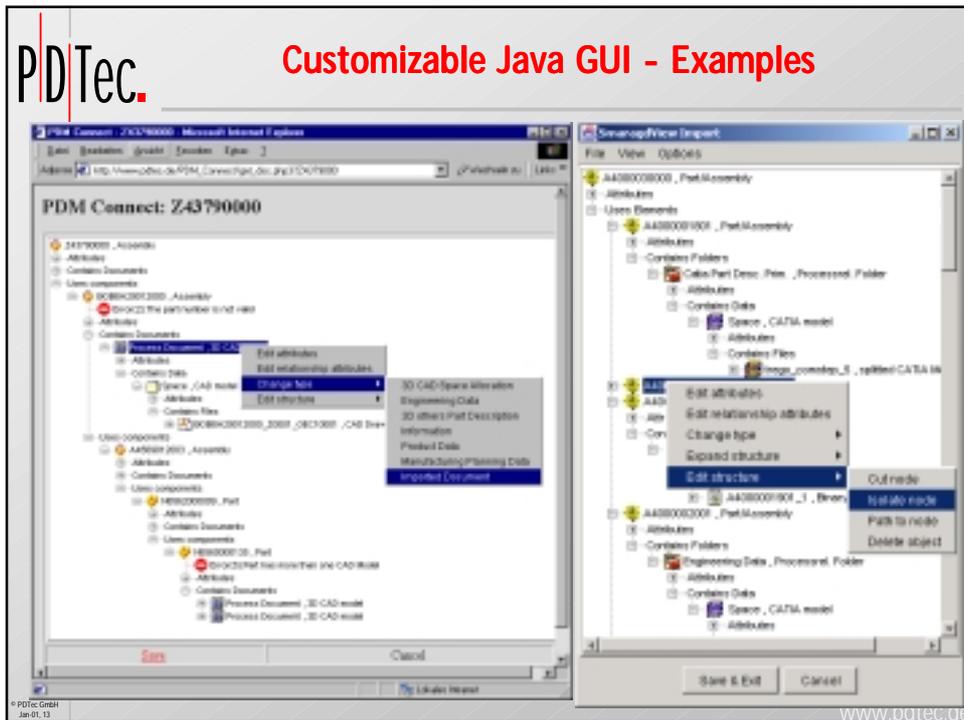


- **Visualization of Data**
  - Configurable tree views on data
  - Different tree views on same data set
  - PDM like presentation format
- **Editing Data**
  - Attribute Value Changes
  - Structural Changes
- **Customizable**
  - Configuration files
  - API of application server/Mapping Engine
- **Standalone 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





- 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, ..)

- **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**
- **Support of different mapping „variations“ and target data models**
  - Dynamic loading of mapping libraries
  - Dynamically loading of configuration files

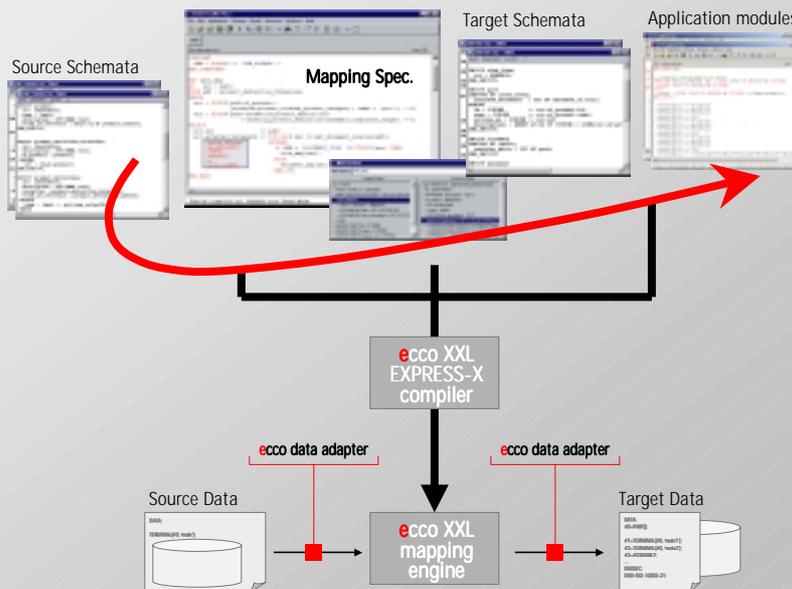
- **A (customized) PDM system data model usually defines specific constraints**
  - Constraints on attribute values, e.g. context dependent part numbers
  - Structural constraints, e.g. max. depth of document structure
  - Lifecycles and approval processes
- **Strategies how to deal with constraints**
  - Mapping engine creates only target data which are conformant with PDM system constraints
    - danger of loss or misinterpretation of data
  - Mapping engine creates target data which might violate PDM system constraints
    - + loss/misinterpretation of data can be avoided in many cases
    - + problem is displayed in user interface
    - + user can fix the problem

## PDMConnect – Checking Modules

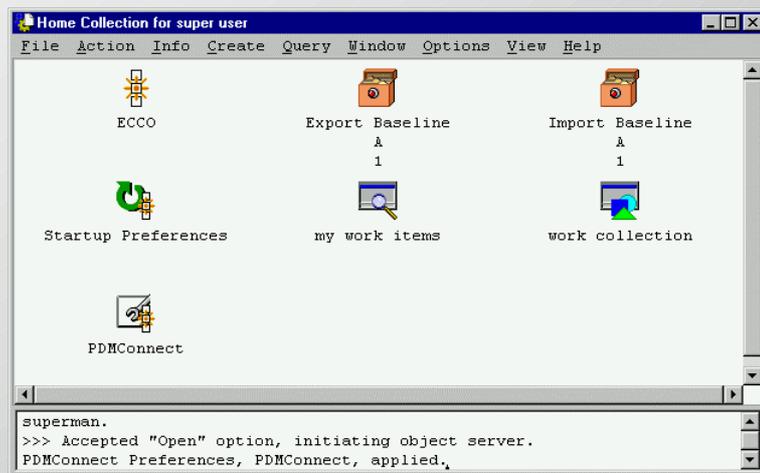
- Automatic or interactive checking of data according to PDM system constraints
- Problems are displayed as errors or warnings
- Errors are displayed when the check-in process will fail due to system constraints violations
  - Data cannot be saved until all errors are fixed
- Warnings are displayed
  - if data will get lost during the check-in process
  - if „strange“ data has been detected



## Application Server Generation using ECCO XXL



- **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**
- **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
- **Easy integration with packaging tool or web based mechanism for external file transfer**



## Example for a PDMConnect System Adapter (2)

The screenshot shows a software window titled 'Home Collection for super user'. It contains three buttons: 'ECCO', 'Export Baseline A', and 'Import Baseline A'. Below these is a 'Part Objects' tree view. A sub-window titled 'ExportBaseline.A Has Members' is open, displaying a table of object members:

Item Identifier	Class	Seq	Frozen?	Supersed
A5000000011	Assembly	1	False	False
Tree Part Masters (tree)	Assembly	1	False	False
Tree Part Masters (tree)	Component Master	---	---	---
A5000000011	Component	1	False	False
Is Described By (d)	General Document	1	False	False
CATIA model14	General Document	1	False	False
A5000000011	General Document	1	False	False

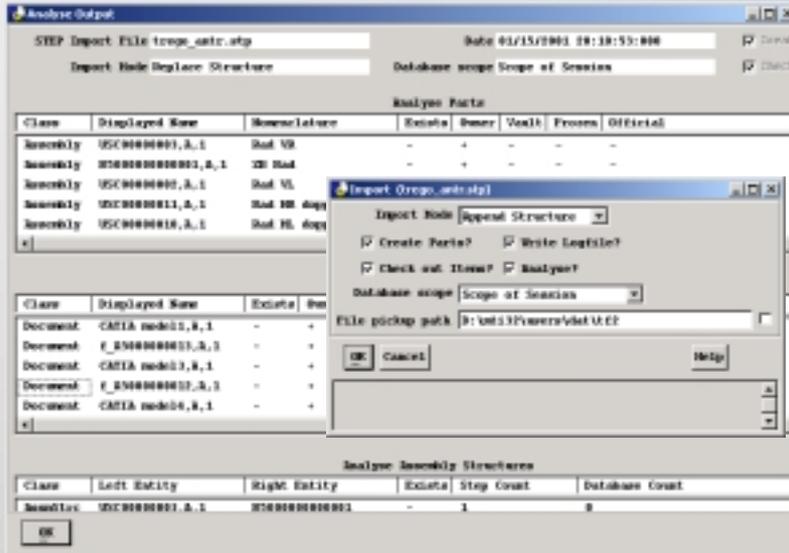
At the bottom, a status bar indicates: 'Query Complete. Objects found by t'. A message box says: 'One object found. >>> Accepted "Is Described By" option, initiating object server. 2 objects found.'

## Example for a PDMConnect System Adapter (3)

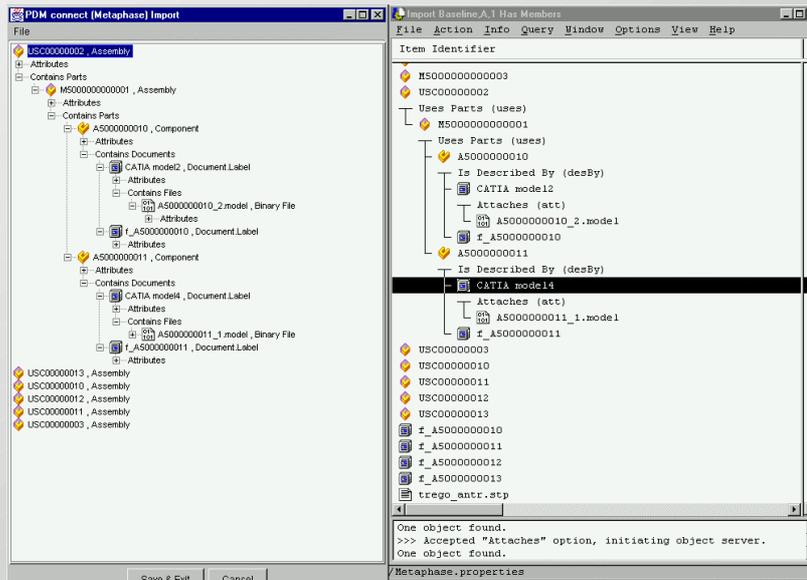
The screenshot shows an 'Export-elog - Editor' window with a log of export operations. The log entries are as follows:

Timestamp	User	Action	Object	Left	Right
2000/09/28-10:54:06	supernan	<228> Exported	Component	(HXV9998880122,A,1,Component)	
2000/09/28-10:54:06	supernan	<228> Exported	Component Master	(HXV9998880122,CmpnMstr)	
2000/09/28-10:54:06	supernan	<228> Exported	Item Revision	Left: (HXV9998880122)	Right: (HXV9998880122,A,1)
2000/09/28-10:54:06	supernan	<228> Exported	Independent Binary	File (hxy_2_constep_11,1)	
2000/09/28-10:54:07	supernan	<228> Exported	Attach Relation	Left: (HXV9998880122,A,1)	Right: (hxy_2_constep_11,1)
2000/09/28-10:54:07	supernan	<228> Exported	Assembly Structure	Left: (HXV9998880020,A,1)	Right: (HXV9998880122)
2000/09/28-10:54:07	supernan	<228> Exported	Component	(HXV9998880121,A,1,Component)	
2000/09/28-10:54:07	supernan	<228> Exported	Component Master	(HXV9998880121,CmpnMstr)	
2000/09/28-10:54:07	supernan	<228> Exported	Item Revision	Left: (HXV9998880121)	Right: (HXV9998880121,A,1)
2000/09/28-10:54:07	supernan	<228> Exported	Independent Binary	File (hxy_2_constep_13,1)	
2000/09/28-10:54:07	supernan	<228> Exported	Attach Relation	Left: (HXV9998880121,A,1)	Right: (hxy_2_constep_13,1)
2000/09/28-10:54:07	supernan	<228> Exported	Assembly Structure	Left: (HXV9998880020,A,1)	Right: (HXV9998880121)
2000/09/28-10:54:07	supernan	<228> Exported	Assembly Structure	Left: (HXV999888010,A,1)	Right: (HXV9998880020)
2000/09/28-10:54:07	supernan	<228> Exported	Assembly Structure	Left: (HXV999888010,A,1)	Right: (HXV999888010)
2000/09/28-10:54:08	supernan	<228> Exported	Component	(HXV9998880110,A,1,Component)	
2000/09/28-10:54:08	supernan	<228> Exported	Component Master	(HXV9998880110,CmpnMstr)	
2000/09/28-10:54:08	supernan	<228> Exported	Item Revision	Left: (HXV9998880110)	Right: (HXV9998880110,A,1)
2000/09/28-10:54:08	supernan	<228> Exported	Independent Binary	File (hxy_2_constep_15,1)	
2000/09/28-10:54:08	supernan	<228> Exported	Attach Relation	Left: (HXV9998880110,A,1)	Right: (hxy_2_constep_15,1)
2000/09/28-10:54:08	supernan	<228> Exported	Assembly Structure	Left: (HXV9998880100,A,1)	Right: (HXV9998880110)
2000/09/28-10:54:09	supernan	<228> Checked out	Assembly	(HXV9998880030,A,2)	
2000/09/28-10:54:09	supernan	<228> Exported	Assembly	(HXV9998880030,A,2,Assembly)	
2000/09/28-10:54:09	supernan	<228> Exported	Assembly Master	(HXV9998880030,AssMstr)	
2000/09/28-10:54:09	supernan	<228> Exported	Item Revision	Left: (HXV9998880030)	Right: (HXV9998880030,A,2)
2000/09/28-10:54:10	supernan	<228> Checked out	Independent Binary	File (hxy_2_constep_2,2)	
2000/09/28-10:54:10	supernan	<228> Exported	Independent Binary	File (hxy_2_constep_2,2)	
2000/09/28-10:54:10	supernan	<228> Exported	Attach Relation	Left: (HXV9998880030,A,2)	Right: (hxy_2_constep_2,2)
2000/09/28-10:54:11	supernan	<228> Exported	Component	(HXV9998880131,A,1,Component)	
2000/09/28-10:54:11	supernan	<228> Exported	Component Master	(HXV9998880131,CmpnMstr)	
2000/09/28-10:54:11	supernan	<228> Exported	Item Revision	Left: (HXV9998880131)	Right: (HXV9998880131,A,1)
2000/09/28-10:54:11	supernan	<228> Exported	Independent Binary	File (hxy_2_constep_3,1)	
2000/09/28-10:54:11	supernan	<228> Exported	Attach Relation	Left: (HXV9998880131,A,1)	Right: (hxy_2_constep_3,1)
2000/09/28-10:54:11	supernan	<228> Exported	Assembly Structure	Left: (HXV9998880030,A,2)	Right: (HXV9998880131)
2000/09/28-10:54:11	supernan	<228> Exported	Component	(HXV9998880132,A,1,Component)	
2000/09/28-10:54:11	supernan	<228> Exported	Component Master	(HXV9998880132,CmpnMstr)	
2000/09/28-10:54:11	supernan	<228> Exported	Item Revision	Left: (HXV9998880132)	Right: (HXV9998880132,A,1)
2000/09/28-10:54:11	supernan	<228> Exported	Independent Binary	File (hxy_2_constep_4,1)	
2000/09/28-10:54:12	supernan	<228> Exported	Attach Relation	Left: (HXV9998880132,A,1)	Right: (hxy_2_constep_4,1)
2000/09/28-10:54:12	supernan	<228> Exported	Assembly Structure	Left: (HXV9998880030,A,2)	Right: (HXV9998880132)
2000/09/28-10:54:12	supernan	<228> Exported	Assembly Structure	Left: (HXV9998880100,A,1)	Right: (HXV9998880030)
2000/09/28-10:54:13	supernan	<228> Exported	Assembly Structure	Left: (HXV9998880100,A,1)	Right: (HXV9998880030)
2000/09/28-10:54:14	supernan	<228> Exported	Assembly Structure	Left: (HXV9998880100,A,1)	Right: (HXV9998880030)
2000/09/28-10:54:15	supernan	<228> Exported	Assembly Structure	Left: (HXV9998880100,A,1)	Right: (HXV9998880030)

### Example for a PDMConnect System Adapter (4)



### Example for a PDMConnect System Adapter (5)



- PDM Connect is a framework to connect arbitrary data sources
- 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 PDM Connect user interface is a powerful tool to
  - Control data exchange
  - Select data
  - Detect and correct invalid data