



# SEVENPRO – Semantic Virtual Engineering Environment for Product Design

## PROJECT PRESENTATION

**Mikel RENTERIA**

**Cyril MASIA**



# Presentation overview

- **Challenges of information management in industrial context**
- **Semantic representation of knowledge**
- **SEVENPRO overview**
- **SEVENPRO modules and functionalities**
- **Key ideas**

- ❑ **Ever more complex and customised products**
- ❑ **Shorter product development cycles**
- ❑ **Strong competition in a global market**

⇒ **Need for:**

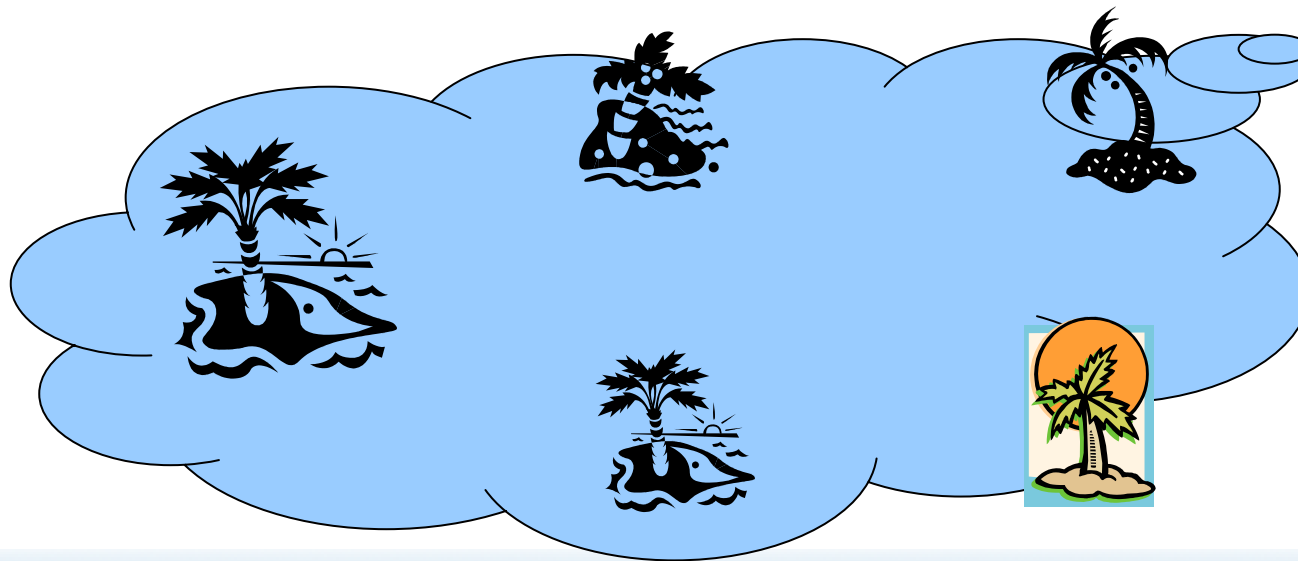
- More efficient product engineering in time and cost
- More added value and personalisation in products
- Integration among engineering tools.
- Integration of knowledge not only inside engineering teams but within the whole organisations
- Better management of knowledge -> reuse

**Huge amount of information**

**Distributed among different human groups and ...**

**... different computing infrastructures and supports**

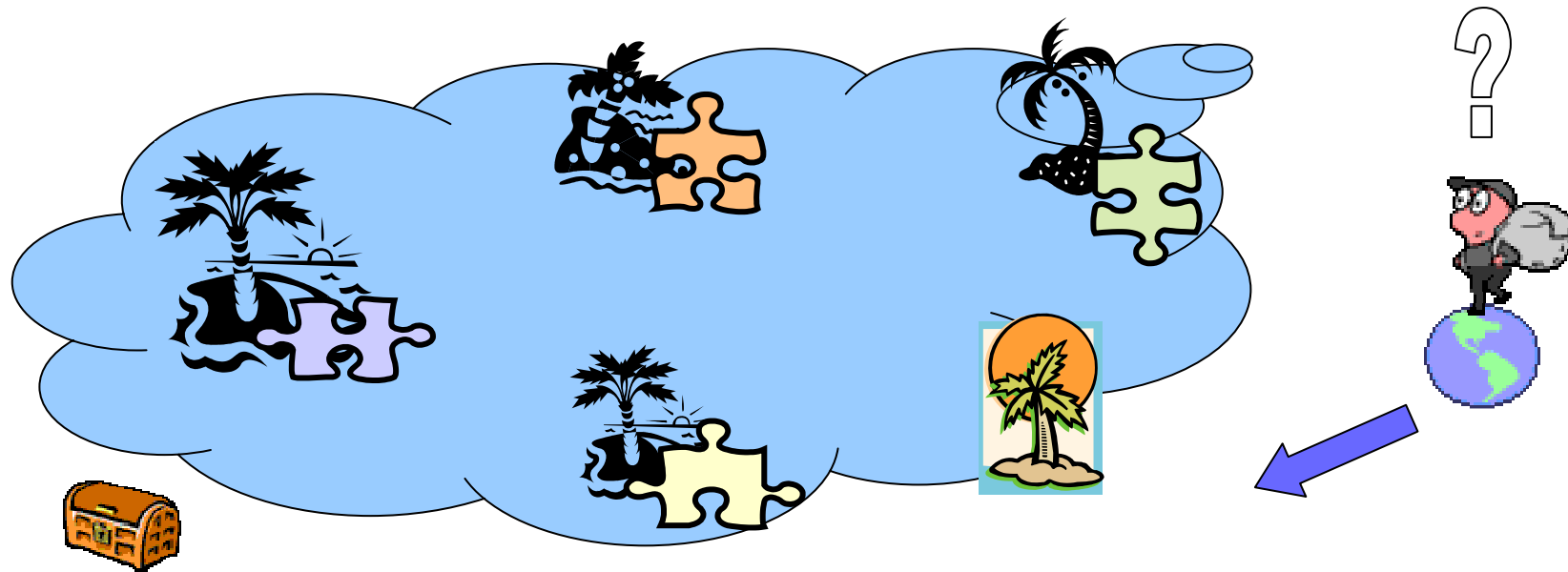
**Sometimes, knowledge has no “computer form”**



**Heterogeneous  
and unconnected  
islands of  
information**

# From information to knowledge

**Getting from information to knowledge is complicated**

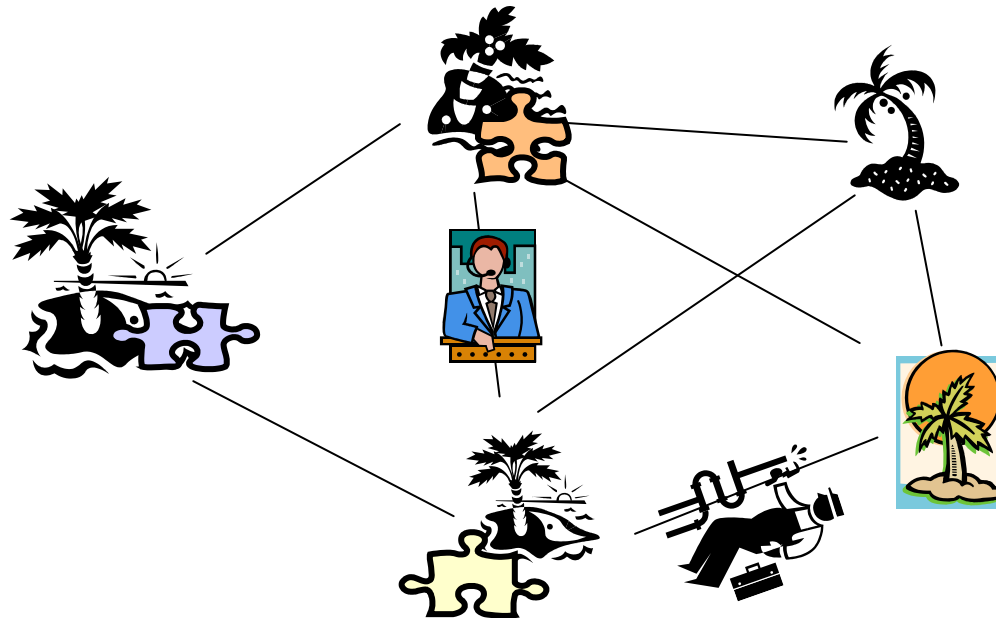


**Knowledge is hardly re-used because access is difficult (many times based on personal relationships)**

**Work and efforts often repeated in different islands**

**Partial and not up-to-date solutions**

Each puzzle part is in a different **COMPUTING** language involving database tables, arrays, XML ...



**Gap between field knowledge and the programmers**

Programmer ends up being a field expert or vice-versa

**Additional problem: knowledge and needs do evolve**

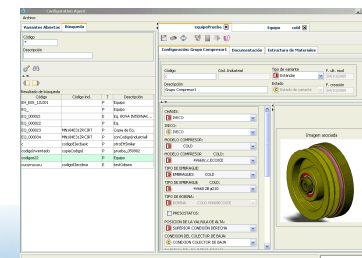
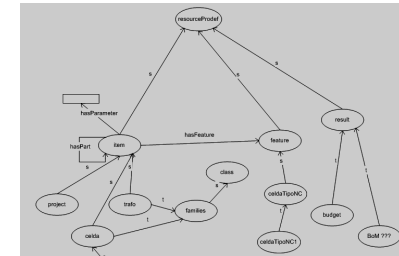
Applications have a hard time keeping the pace



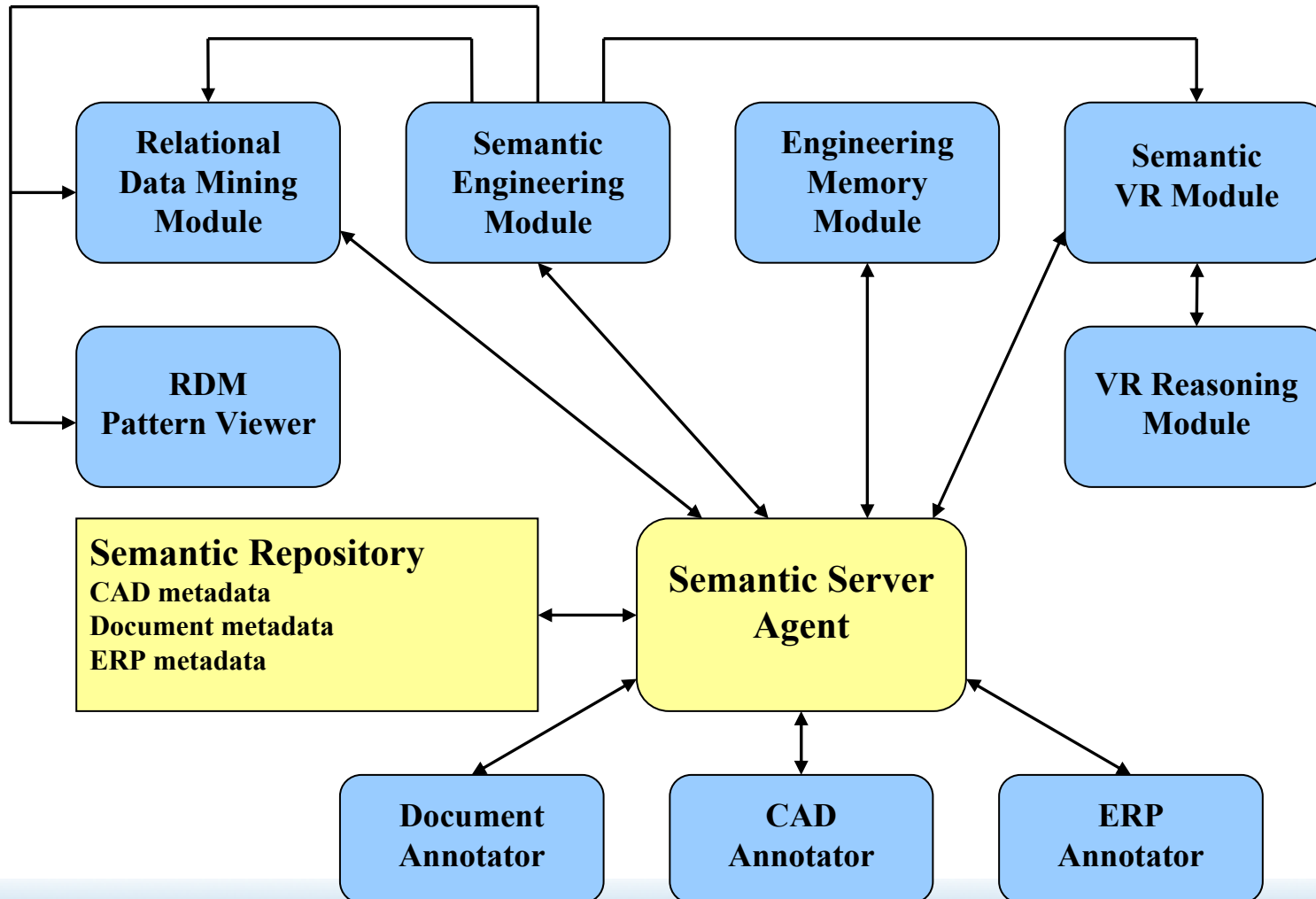
# SEVENPRO objectives

- ❑ **The objective of SEVENPRO is to develop technologies and tools supporting deep mining of product engineering knowledge from multimedia repositories and semantically enhanced 3D interaction with that knowledge in integrated engineering environments. CAD designs, documental repositories and ERP/corporate Databases will be the main data&knowledge sources supported.**
- ❑ **The project aims to develop technology and software components to be integrated in product engineering environments.**

- Product, projects, documents, etc, are defined by user-written ontologies
- Engineering data repositories are annotated: knowledge is extracted from inside data repositories (CAD, ERP, docs)
- This structured information can be accessed by users
- This semantically represented knowledge data can be data-mined to discover non explicit knowledge.





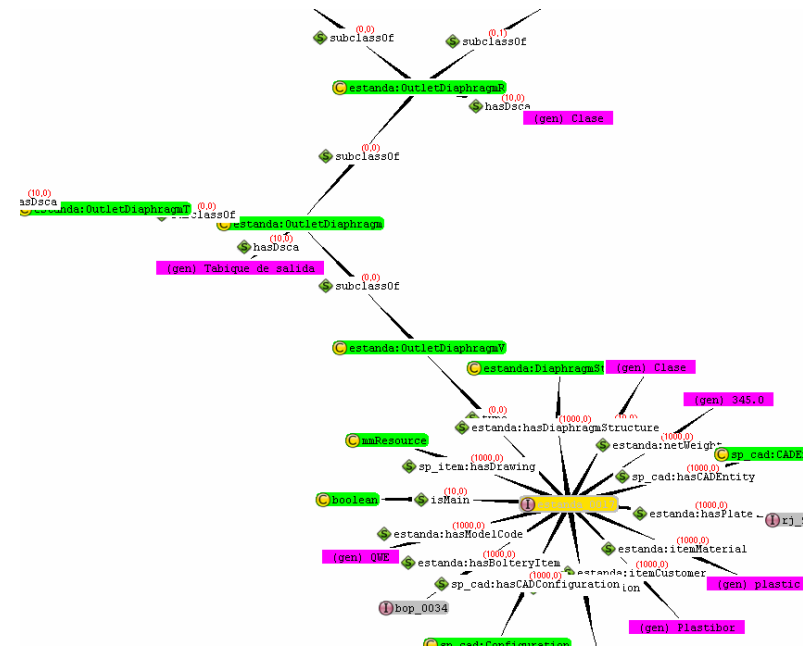


**Gateway to the Corporate Knowledge Repository that holds the semantically represented knowledge**

**Dispatches query results to the client modules**

**Performs changes requested by the client modules**

**ACID compliant (Atomicity, Consistency, Isolation, Durability)**



## Semi-automatic extraction of relevant knowledge from corporate repositories

**Document annotator: extracts statements from textual documents, guided by the ontology**

**CAD annotator: extracts design sequence and assembly information from CAD files**

**ERP annotator: accesses legacy tabular data**

Keratinocyte and hepatocyte growth factors in the lung roles in lung development, inflammation, and repair. Ware, Lorraine B., and Michael A. Matthay. Keratinocyte and hepatocyte growth factors in the lung: roles in lung development, inflammation, and repair. *Am J Physiol Lung Cell Mol Physiol* 282: L9247-L940, 2002; 10.1152/ajplung.00439.2001. A growing body of evidence indicates that the epithelial-specific growth factors keratinocyte growth factor (KGF), fibroblast growth factor (FGF-10), and hepatocyte growth factor (HGF) play important roles in lung development, lung inflammation, and repair. The therapeutic potential of these growth factors in lung disease has yet to be fully explored. KGF has been best studied and has impressive protective effects against a wide variety of injurious stimuli when given as a pretreatment in animal models. Whether to be investigated. FGF-10 to a treatment effect in potential, but more extensive. Because HGF lacks true

The CAD interface shows a 3D model of a mechanical part with a tree view on the left. The tree view includes: Part1, xy plane, yz plane, zx plane, Part1Body, Part1, Sketch.1, AbsoluteAxis, Geometry, Constraints, Part1.2, Sketch.2, Part1.3, and Part1.Sketch.2.

Customer ID	Customer name	Customer address	City	State	Postal Code
001	Contemporary Casuals	1355 S. Hines Blvd.	Gainesville	FL	32601
002	Value Furniture	15145 S.W. 17th St.	Plano	TX	75034
003	Home Furnishings				
004	Eastern Furniture				
005	Impressions				
006	Furniture				
007	Period Furniture				
008	California				
009	M & H Co.				
010	Siermole				
011	Americar				
012	Battle Creek				
013	Heritage				
014	Kanooche				
015	Mountair				
AutoNumber)					

Order ID	Order Date	Customer ID
1001	10/21/98	1
1002	10/21/98	8
1003	10/22/98	15

Product ID	Product Name	Product Finish	Unit Price
1	End Table	Cherry	\$175
2	Coffee Table	Natural Ash	\$200
3	Computer Desk	Natural Ash	\$375
4	Entertainment Center	Natural Maple	\$650
5	Writer's Desk	Cherry	\$325
6	8-Drawer Desk	White Ash	\$750
7	Dining Table	Natural Ash	\$300
8	Computer Desk	Walnut	\$250
AutoNumber)			



# Semantic engineering tool

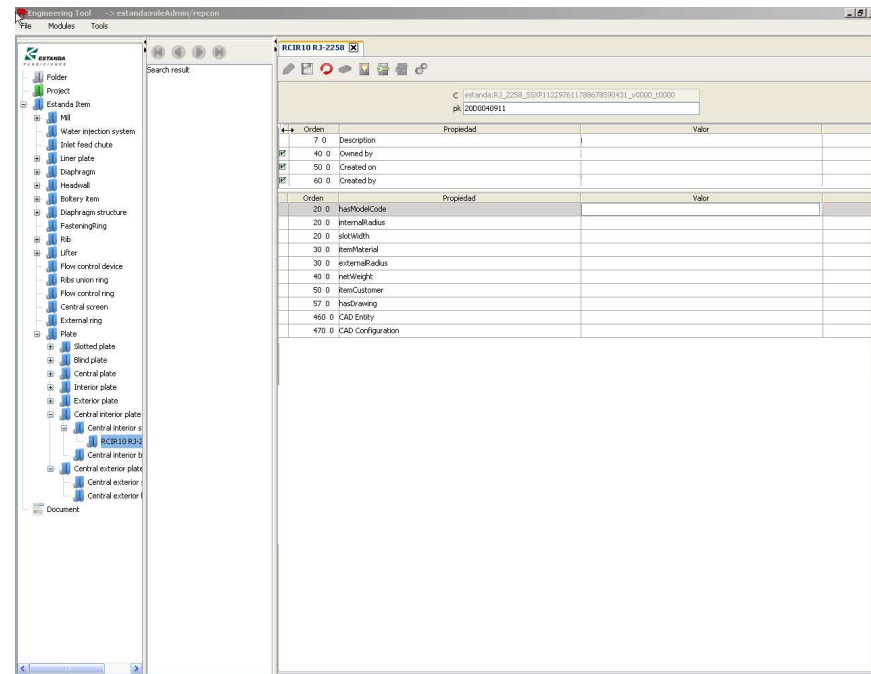
**Main entry point for end-users, allows to navigate through product knowledge, with an ontology-driven user interface**

**Navigation by product structure, projects, documents, etc**

**Maintenance of all product-related information and documents, with version management for items and documents**

**Access to the annotations**

**Creation of concepts and links between concepts**





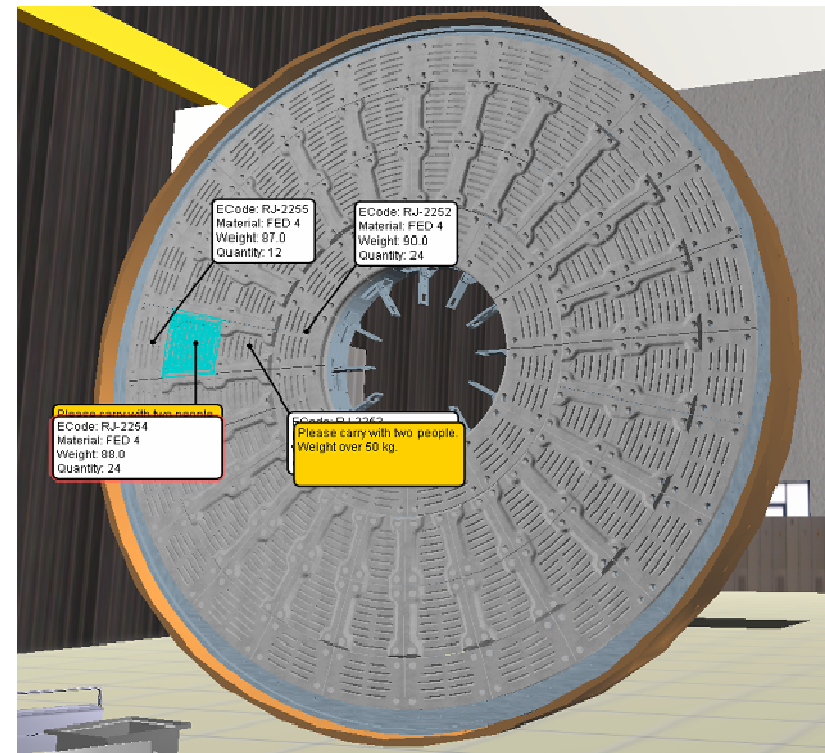
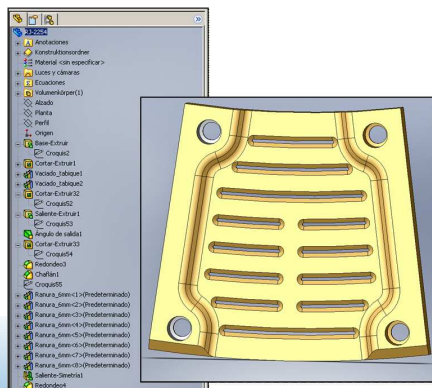
# Semantically enhanced VR

Another way to intuitively search and retrieve all item-related information present in the knowledge base

VR is a privileged medium to access the knowledge base

Information displayed immersed in the 3D scene

Navigation through product structure, associated documents, item versions and revision

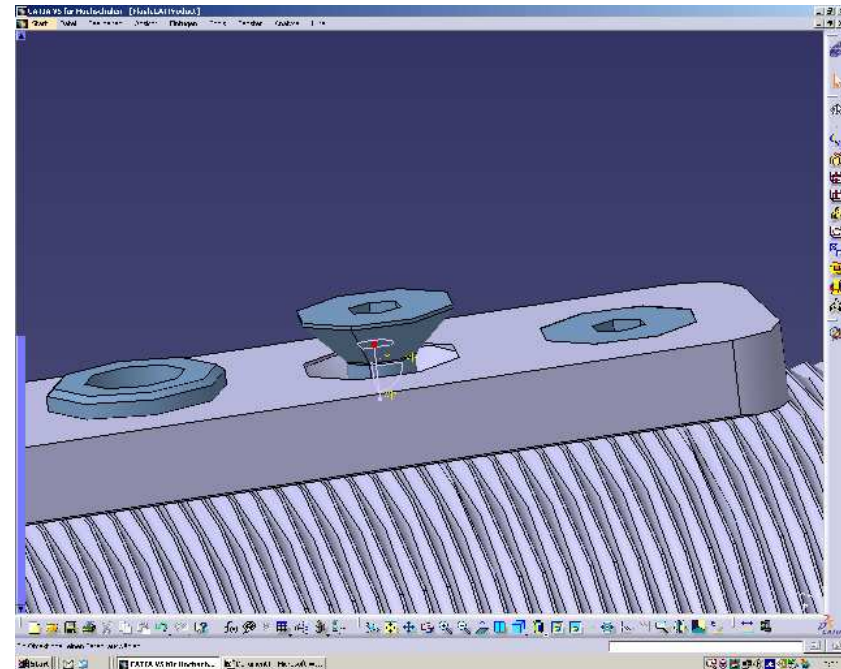


**Extension: ease authoring tasks by using information available in the knowledge base**

**Automatically access item related information and documents**

**Infer and propose animation based on part type, relations between parts, assembly information (position, orientation, degrees of freedom)**

**Embedded inference engine (CORESE)**



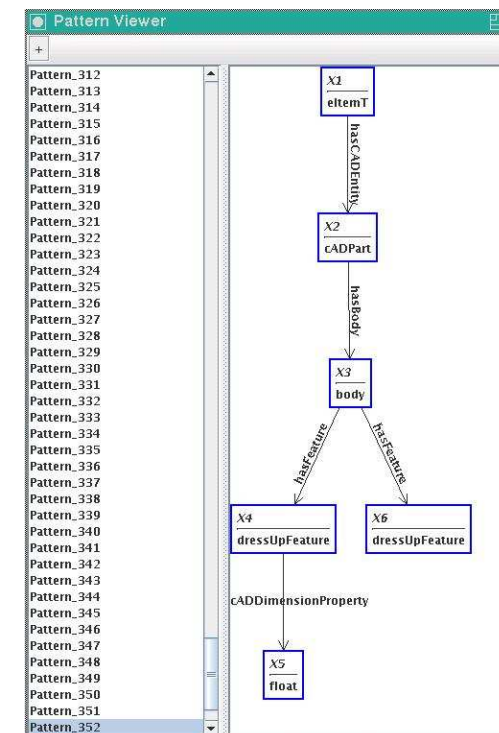
The knowledge base describes large amount of items, along with their associated information: documents, design sequences, etc  
**Structured engineering data about the company products**

**RDM algorithms are aimed to find non-trivial relations between these data, making implicit knowledge explicit**

**For now, focused on design data: sequences of operations in part design**

**Discovery of:**

- frequent design patterns
- classification and/or association rules
- design clusters.



- **Knowledge based management**
- **Knowledge evolved by users, no programmers needed and the applications are automatically configured**
- **Relevant knowledge and information is accessible for all**
- **Automatic extraction of info and knowledge**
- **Integration of islands of info - systems**
- **Reuse of knowledge -> Productivity**