SEVENPRO – Semantic Virtual Engineering Environment for Product Design

PROJECT PRESENTATION

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Presentation overview

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

Industrial context

- **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

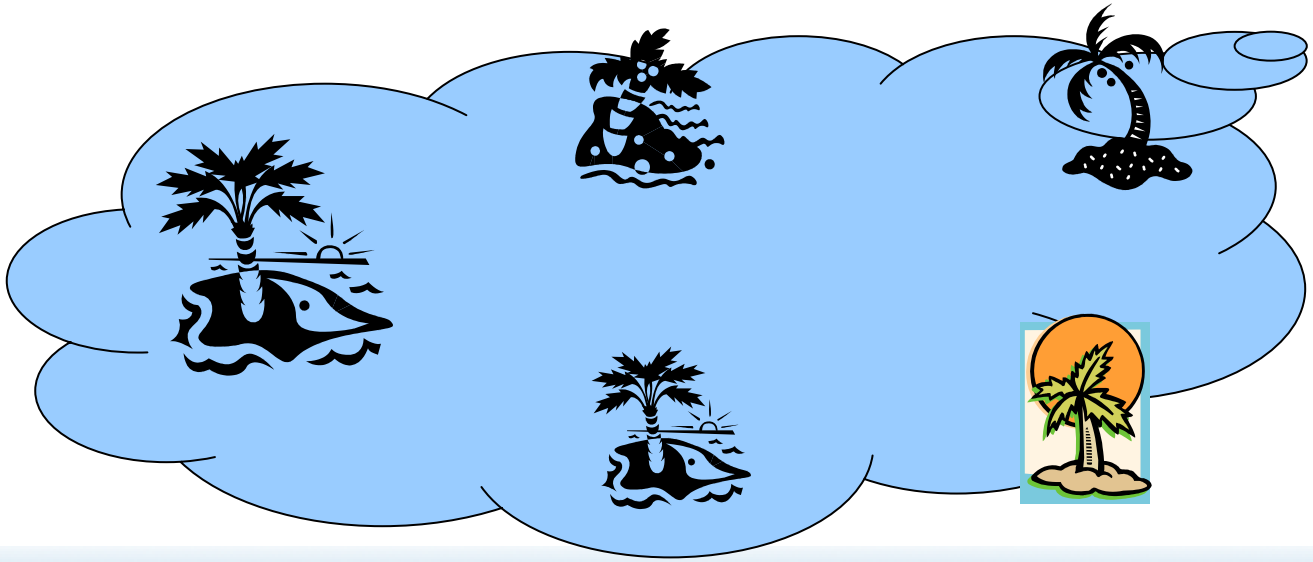
Challenges

Huge amount of information

Distributed among different human groups and ...

… different computing infrastructures and supports

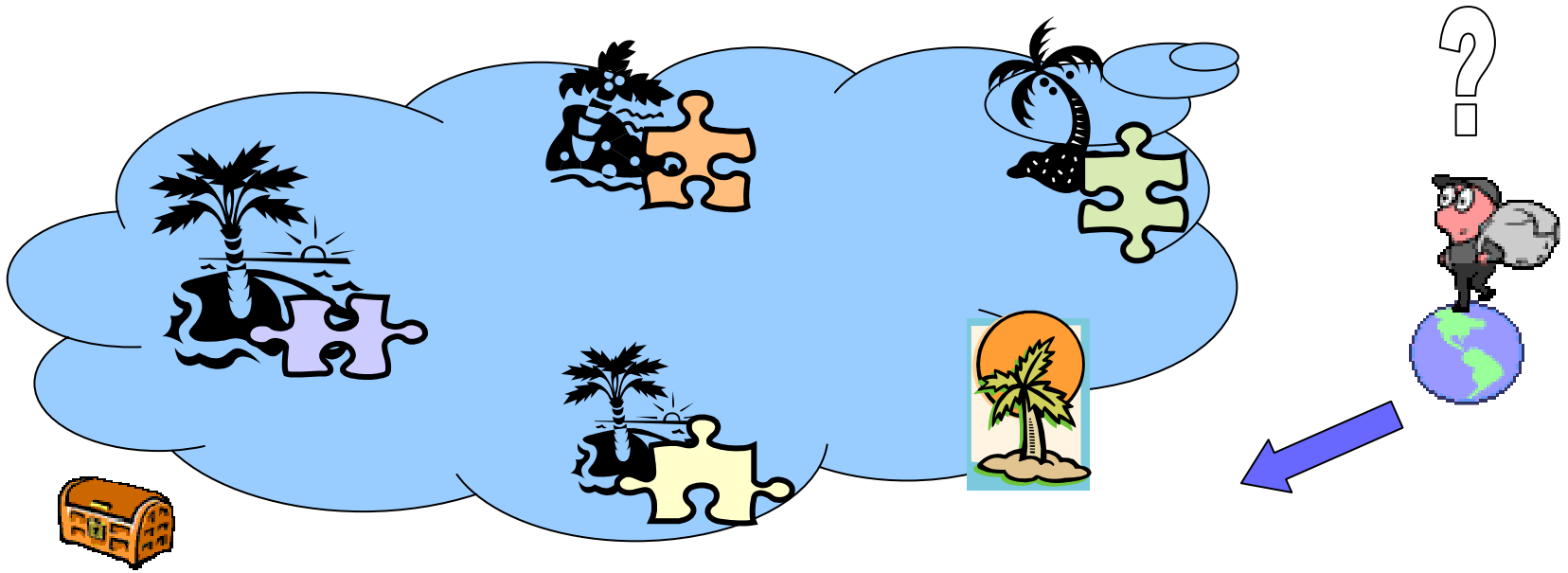
Sometimes, knowledge has no “computer form”



Heterogeneous and unconnected islands of information

From information to knowledge

Getting from information to knowledge is complicated



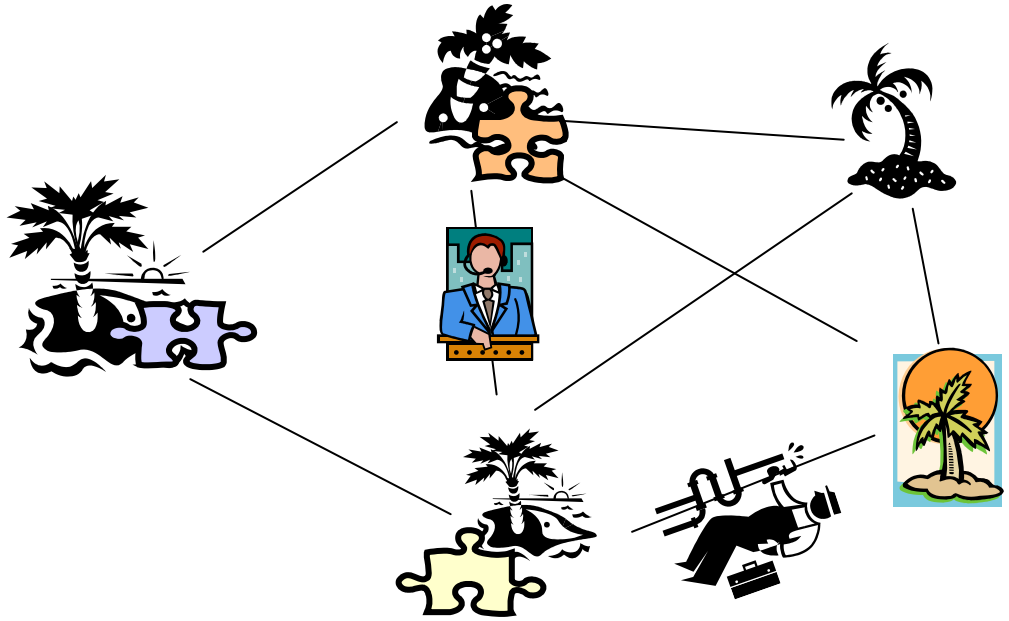
Knowledge is hardly re-used because access is difficult (many times based on personal relationships)

Work and efforts often repeated in different islands

Partial and not up-to-date solutions

Traditional 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

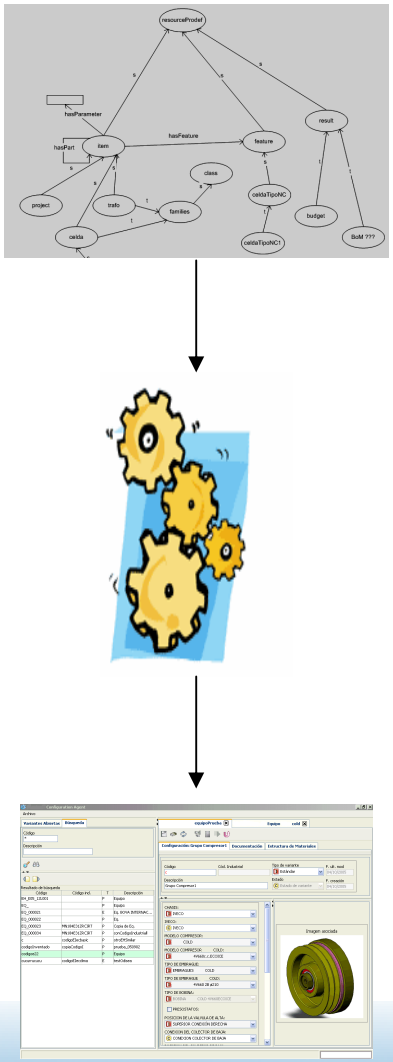
Applications have a hard time keeping the pace

SEVENPRO objectives

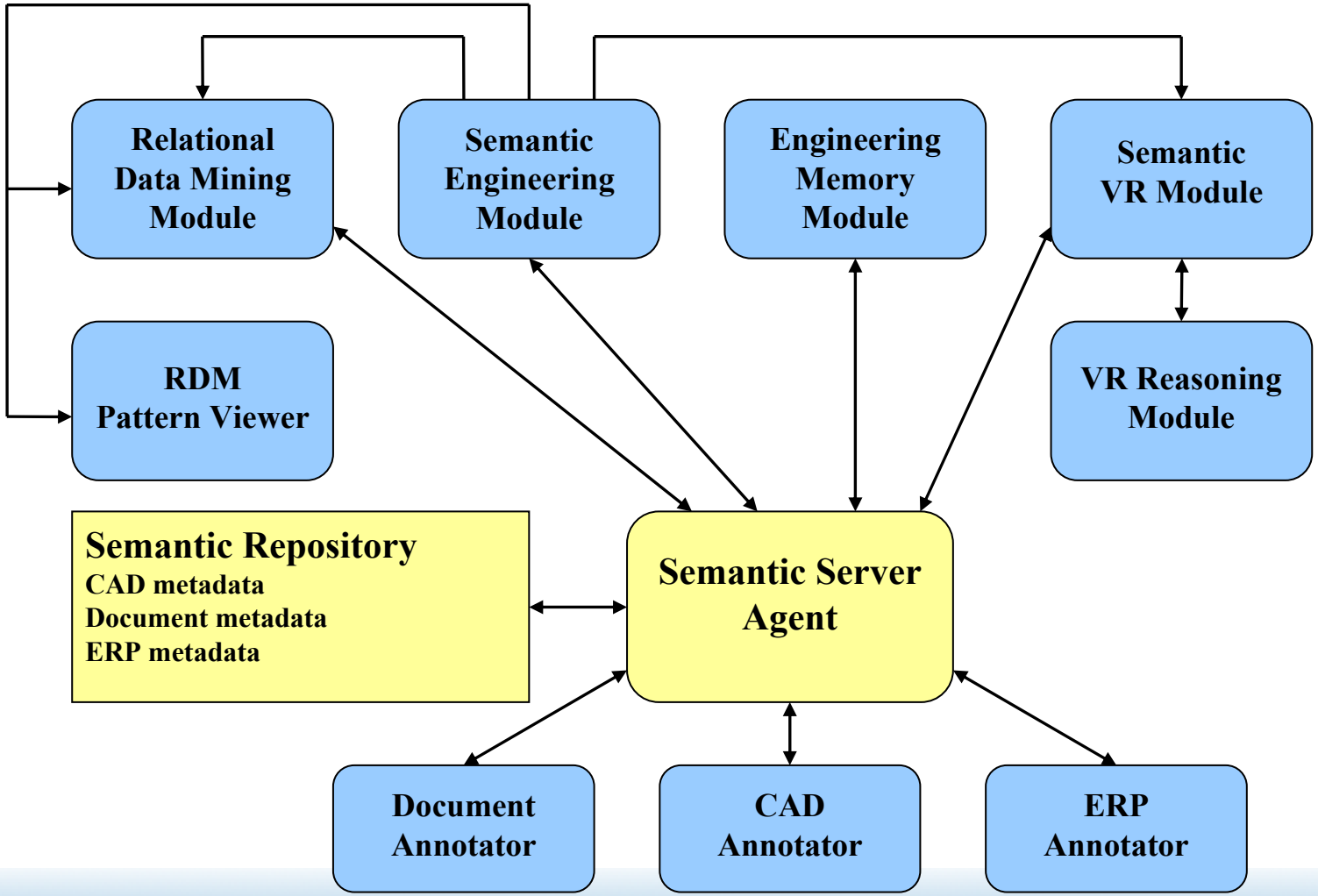
- **The** objective **of SEVENPRO is to develop technologies and tools supporting** deep mining of product engineering knowledge **from multimedia repositories and** semantically enhanced 3D interaction with that knowledge **in integrated engineering environments. CAD designs, documental repositories 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**.**

Approach

- **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.**



SEVENPRO modules



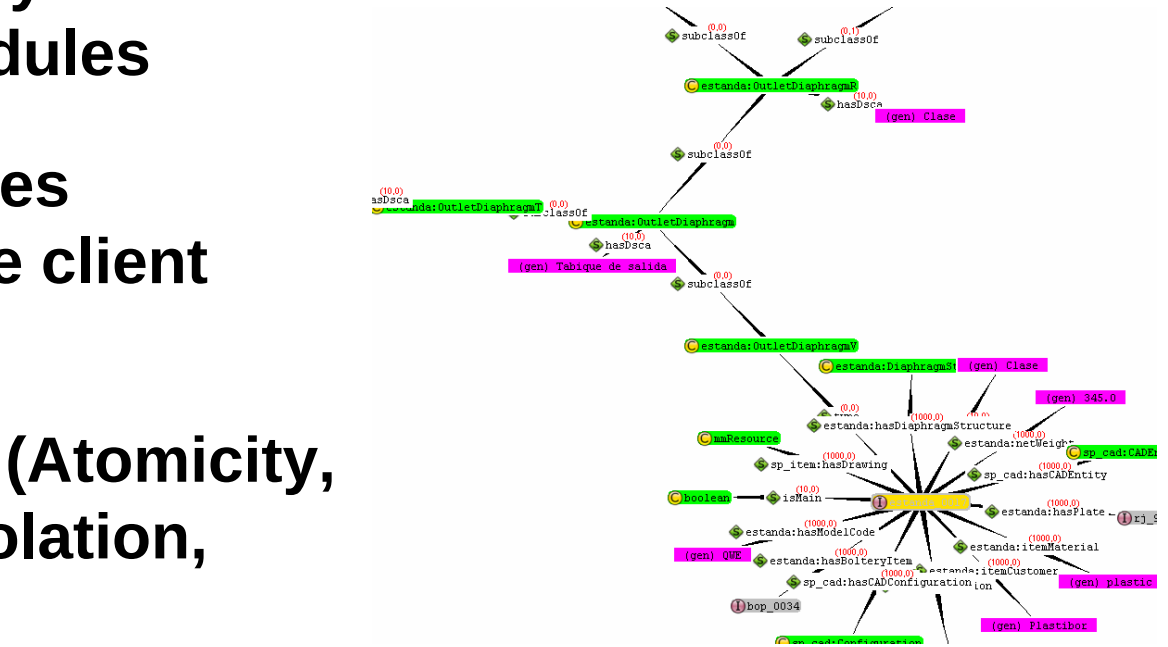
Semantic server agent

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)



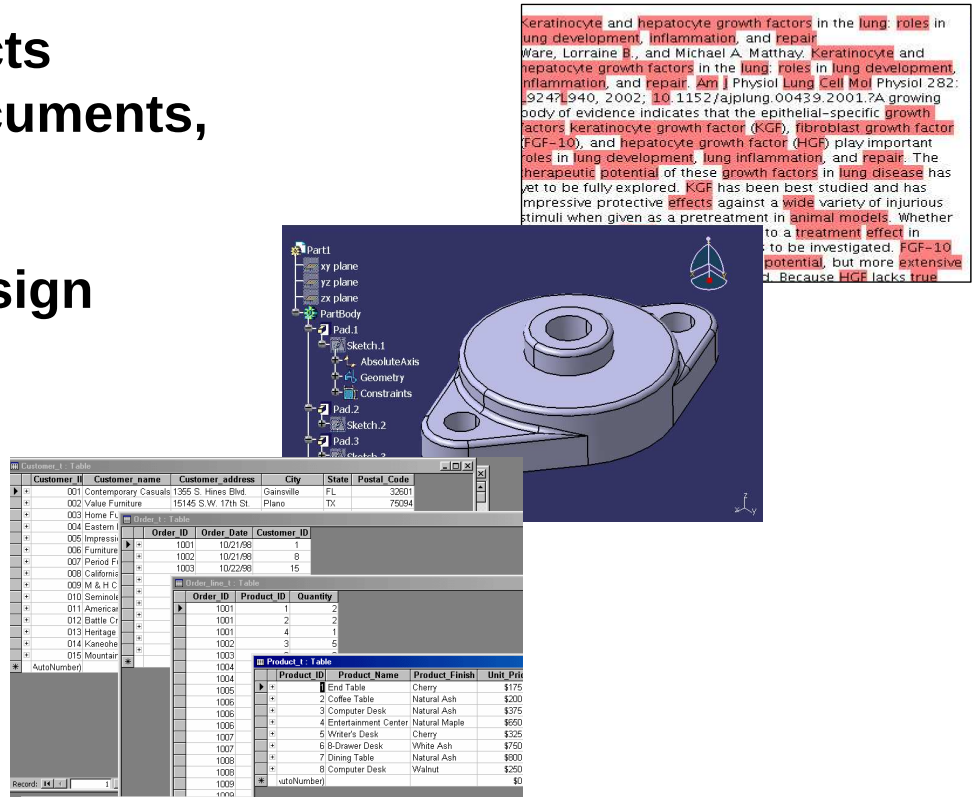
Annotators

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



Semantic engineering tool

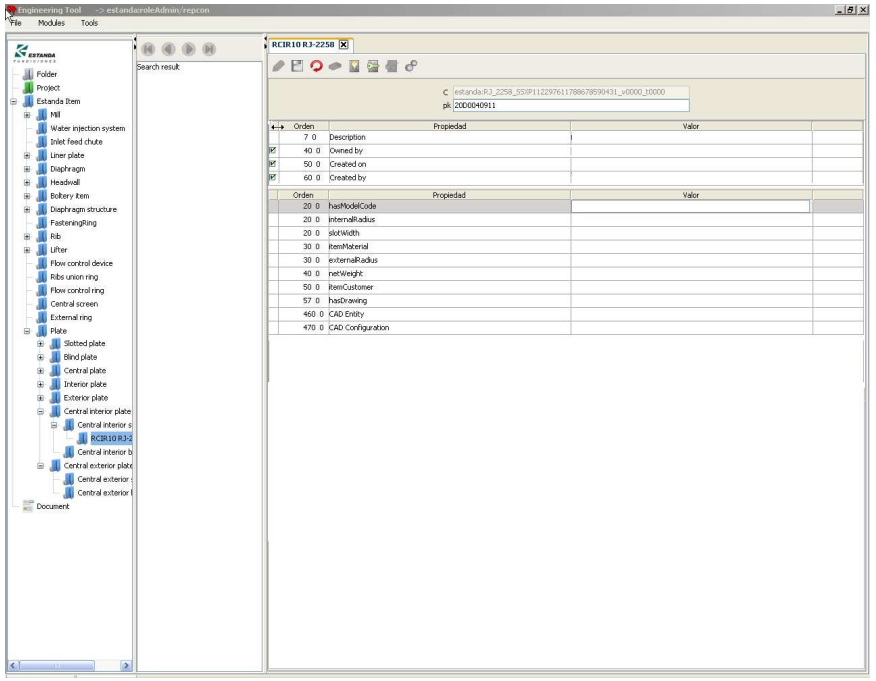
Main entry point for end-users, allows to navigate through product knowledge, with an ontology-driven user interface

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



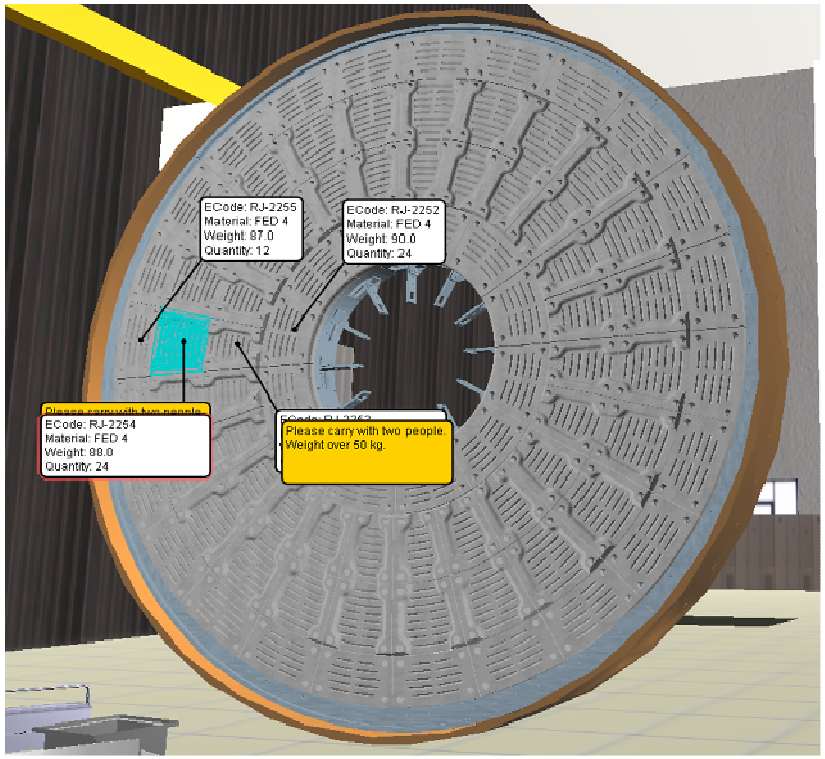
Semantically enhanced VR

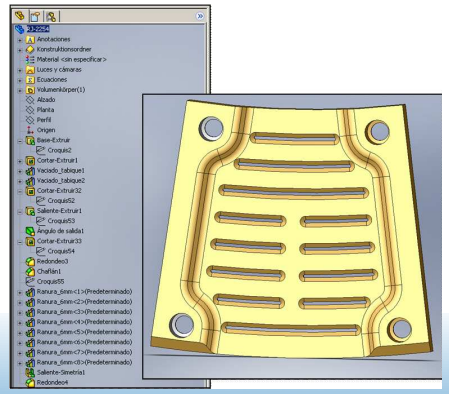
Another way to intuitively search and retrieve all item-related information present in the knowledge base

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





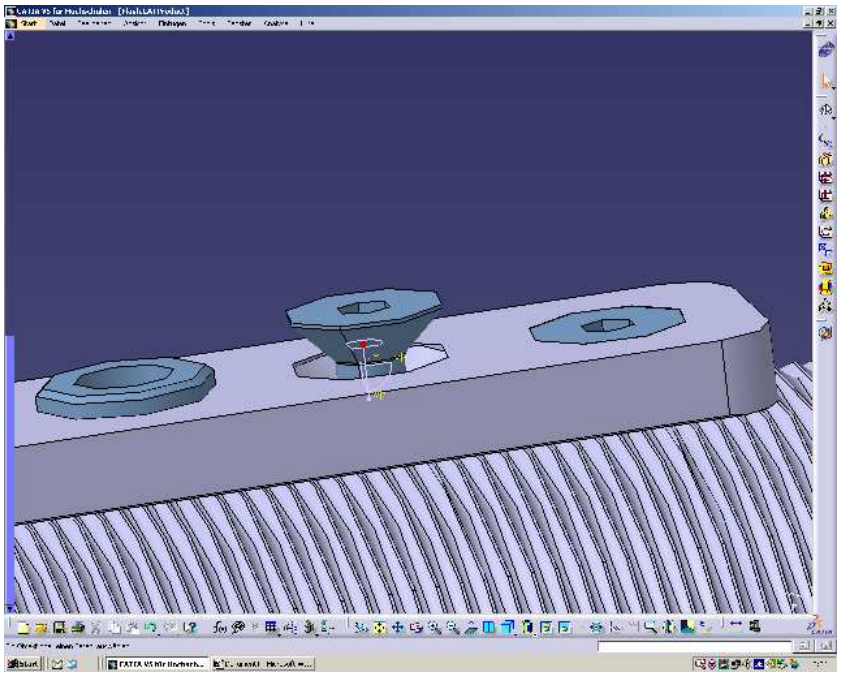
Semantically enhanced VR

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)



Relational data mining

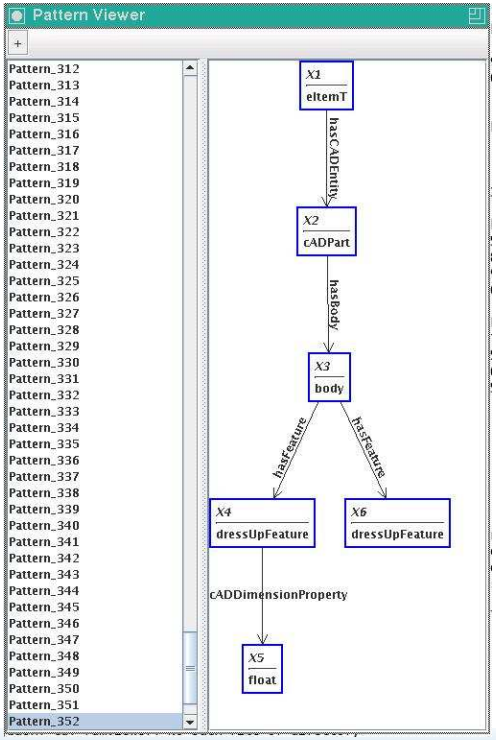
The knowledge base describes large amount of items, along with their associated information: documents, design sequences, etc

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.**



Key ideas

- 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