A business case of the use of ontologies for knowledge capitalization and exploitation.

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Abstract. Arcelor is currently involved in the industrial trial of ontologies for its necessities of knowledge management. In order to develop knowledge based systems that can be maintained and rolled out, a knowledge modelling phase is rather indispensable. It is a platitude to point out that knowledge acquisition (KA) is bottleneck to perform these operations and so the issue is to maximise the reuse of the KA investment. Ontologies are naturally the technology to model this knowledge and the topics that are currently addressed are the following: how to use ontologies for knowledge capitalization? How to make them user-friendly for the end-users? How to use them for software integration? How can we be able to develop large ontologies with the level of quality that can be achieved in the development of large software? How can we represent dynamic knowledge?
The current studies aim to give operational answer that can be applied in industrial environments for industrial needs. To that extent, OWL appears as a necessity – since it is standardised – more than a choice for the basic ontological language.

Keywords: capitalization, integration, modelling, use of ontologies.

1. Knowledge Management Necessities

Arcelor Mittal, the world's number one steel company, with 320,000 employees in more than 60 countries [1], has a long tradition of development of knowledge based systems. Since the '90 ([2], [3]), it is admitted that to develop such systems that can be maintained it is worth going through a modelling phase (Figure 1).

Being a *specification of a conceptualization* [3], ontologies can naturally play the role of the Conceptual Model (CM) in the KADS abstraction cycle.
The major interest that is targeted from the industrial viewpoint is the reuse of the conceptual model, which comprises the sharing capacities (to human and machines).

Therefore we are looking for a process and a tool that allow our company to capitalize each conceptual model, defined for its own necessities (often a decision-making support system), which means:

- Accessible to any end-user that needs it
- Connected to other conceptual models
- Able to use other ontologies as resources

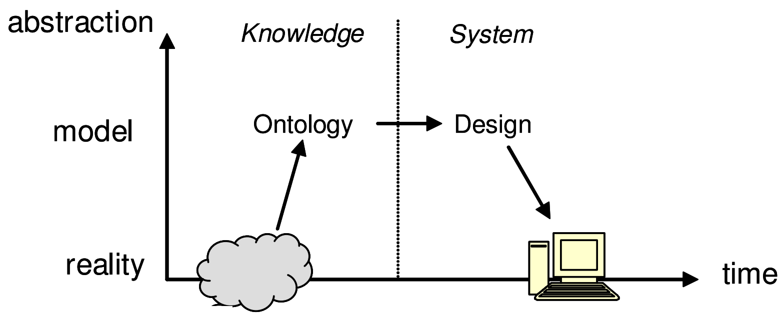

Figure 1: abstraction cycle of KADS

2. Business Necessities

To effectively use ontologies in the development of Knowledge Based Systems (KBS) with a capitalization effect (with the meaning above), some conditions must be satisfied.

The access to the conceptual model must be user-friendly. If the first objective of the CM is to improve the design of the KBS (better covering and maintainability), one wishes to use it for other purposes when it is available: basically for consultation purposes. Therefore any end-user without any classes / instances culture who could take advantage of the knowledge in the ontology should easily access it. The ontology should be relatively complete for that purpose, sometimes more than for only the conceptualization necessities.

The tools must support the knowledge engineering process. Building industrial ontologies have similarities with building industrial software: version and configuration management, use of libraries (or basic KBs), integration and merge facilities, verification and validation facilities, response-time of the framework and the applications, etc. To that extent, the powerful of the knowledge representation is not the main criteria of applicability in the industrial field.

There should not be a heavy extra-time to model with the ontology tool.
Once again, the CM is developed for the necessities of the project and requires a given time to be made. Adding the reusability and accessibility constraints thanks to ontologies, should not imply a great extra-time supported by the project, pushing a risk to jeopardize the project itself.

3. Business Case

We chose a business case compound of two sub cases: a structural model of production lines and a functional one for defect capitalization.

The first aims at providing a **unified description of lines** in order to be able to consult, compare and exploit the data of each line. A meta model, under development and test, ensures that the basic concepts such as process, line, equipment, tool and product are defined in their relationship and used accordingly. The hierarchical and taxonomy-oriented knowledge representation available in ontologies seems rather suitable to represent production lines and their associated process.

The second one is for **defect modelling**. The purpose is to describe the defects, their possible causes and the means to prevent them. The main difficulty encountered so far is to represent the dynamic knowledge in the diagnosis network.

Both models share links together through the concept of Product (the purpose of a line is to produce and defects appear on products) and localization (defects are generated in a given place of the line).

We meet also in this case the issue of large knowledge bases organization since (a) equipments can apply for various types of line (f.i. pyrometers, furnaces, coilers), (b) various line apply the same general pattern (f.i. lines that transform the coil), (c) they all use the same meta model (basically, a line implants a process and produces steel products according to client specifications). In order to correctly (re)use the ontologies, the general KB architecture must be looked at carefully and the underlying tools must produce the adequate features to handle it.

4. Working axes

The development of the ontology began with Protégé [5] in the RDF format edition.

The Arcelor team looked for user-oriented web-based consultation tool. The team did not found any adequate tool, which constituted a surprise. All of those found spoke of classes and instances, what does not mean a lot for an end-user.

An HMI was therefore developed [4] that has (or should have) the following properties:
It presents only business vocabulary (and no underlying modelling one)
Its use and contents are supposed to be immediately understandable to a non frequent end-user.

This HMI comprises some features to enhance the quick access to knowledge: points of view; filters and full text and semantic SPARQL based search.
To do so, the team needed to pass to the OWL format of Protégé.

With the concourse of the CTIC foundation [6] a first prototype of this ontology visualization for end-users is ready for first tests with the users.

The team expects that the scientific community concludes with the **standardization of dynamic knowledge representation** as it is for the static one.

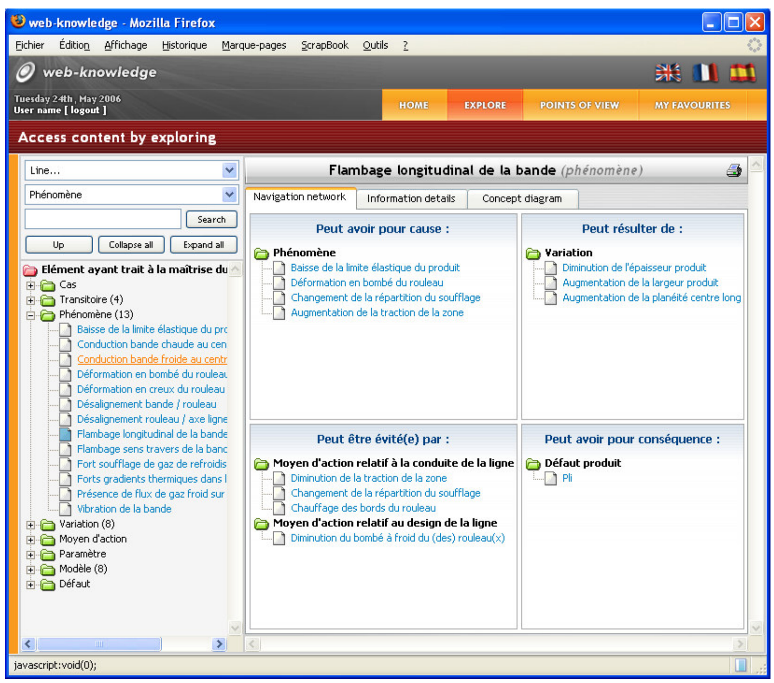

Figure 2 : Visonto interface to access capitalized knowledge in an ontology

A first architecture for linking the knowledge bases together is also prepared, through the *use* feature inside Protégé. We are currently facing the difficulties that the use-networks is a graph and not a tree and that the use links are semantically different. For instance, the same *use* link applies for using the meta model (relationship definition of process, product, phenomenon, defects etc.) and libraries ontologies (equipment ontology f.i).

After the proof of interest from the end-users, the next phases will be to establish a **process to develop ontologies**, to link them with the development of KBS (cf. Figure 1) in a consistent and maintainable way.

5. Conclusion

The attempt to use ontologies for capitalization purposes is still ongoing. Compared to the linguistic capitalization widely spread in the industry, ontologies tools should allow multipurpose usages thanks to their high level formalization capacities: capitalization, man-machine and machine-machine interaction. The capitalization ambition needs user-oriented tools and will eventually require a standardised dynamic knowledge representation format.

6. References

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