

A generic model of corporate memory: application to the industrial systems

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Abstract:

This paper presents an industrial system model and a model of corporate memory supporting these models of systems. The corporate model sees the latter through two types of knowledge. Skill Knowledge, which constitutes the main capital knowledge of the company and refers to its basic skill. Theme Knowledge represents a specialized knowledge or a knowledge relating to a given field.

The objective of the corporate memory model, named ReCaRo, is to capitalize knowledge by allowing its systematic re-use. ReCaRo builds corporate memories which have a multi memory architecture. This architecture means that every memory will be made up of five communicating memories. We will answer to two questions: 1) how can we model an industrial system? and 2) how can we implement the re-use principle in such systems.

Key words: Corporate memories, meta-model, re-use, ReCaRo

1. INTRODUCTION

This work was motivated by the observation of the strong tendency of the today's company to be specialized. To be effective, the company standardizes its processes and its resources. It, often, handles the same entities for different actions. These entities can be physical objects, rules, processes, etc. Progressively and using these entities, the company constitutes, in the long run, a capital knowledge. However, this capital knowledge is often scattered on the experts of the company and in documents. It is very volatile. The objective is to collect it, organize it and preserve it for re-use purposes. This preservation is done, very often, through the concept of corporate memory (Brooking, 2000; Pomian, 1996; Vanheijst, 1996). This capital is then re-used in different situations in order to reduce the costs and the times of development. It is the concept of the company

learning (knowledge creating company) (Nonaka, 2002) and the working knowledge (Davenport, 2000).

In this paper, we propose a corporate model and a generic corporate memory model supporting it. The corporate memory model is named ReCaRo which is the acronym of REsource, CAse and ROle which are the main concepts of the memory. We emphasize, particularly, the re-use problem of the knowledge contained in the corporate memory.

To build the corporate memory, we propose an approach in two stages. In the first stage, the objective is to propose a modelling of the company (in this research, we are interested in the industrial companies which we will call industrial systems) which supports the development of corporate memories allowing the easy and systematic re-use of capital knowledge. In a second stage, the objective is to propose a generic corporate memory deduced from the industrial system.

This paper is divided into four main parts. The first one presents the concept of knowledge and its reuse. The second one presents the model of the industrial system, the third presents the proposed generic model of the corporate memory and, finally, the last one presents the application of the ReCaRo model for the conception of a corporate memory in the design of industrial systems for liquid hydrocarbons transportation.

3. THE INDUSTRIAL SYSTEM MODEL

In this section, we will answer the following question: how can one model an industrial system from a point of view of a corporate memory?

The model of the company that we propose sees the company through the entities it re-uses. Any industrial system, therefore, will be modelled as a system constituted of, or handling, two types of components:

The skill components: They represent every physical or logical object which constitutes the basic skills of the company.

The theme components: They represent all that is necessary to operate the system, such as the consumed resources, the inputs and the outputs of the system etc.

4. THE CORPORATE MEMORY MODEL

The corporate memory model that we propose as a support to the model of the industrial system handles two types of knowledge and has a multi-memory architecture. In this model, every memory is built around three main ones that we present below:

Reusable resources' memory (R. R. Memory): In the first stage, it is necessary to take an inventory of the capital corporate knowledge and the capital skill and theme knowledge.

Roles' memory: In a second stage, it is necessary to build the memory of the roles. A role describes an element of the reusable resource context. The objective of the roles is to ensure the connection of a resource's use to its context of use.

Cases' memory: A case of use represents the description of the use or the re-use of a reusable resource in a given context. It is defined by a reusable resource, to which it was decided to add a set of roles.

According to this, every corporate memory will be made up of those three memories. These memories are connected according to the logic described by figure 1.

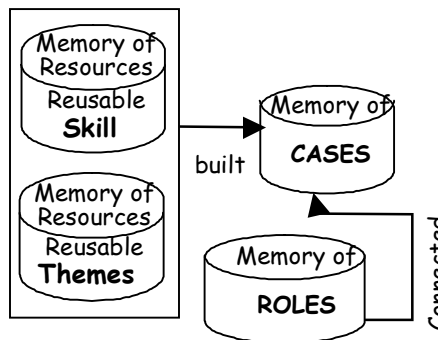


Figure 1 : General architecture of the corporate memory

5. TESTS AND RESULTS, APPLICATION OF THE MODEL TO THE SH_TRC PROJECT

The goal of this section is to validate the proposed model on a real case of corporate memories' modelling. We will present the SH_TRC project as well as the built corporate memory.

This project aims to set up a corporate memory of all the capital experience and knowledge acquired during the design, the renovation, the maintenance or the extension of the transportation of liquid hydrocarbons. Each one of these actions is done through a study which gives rise to a specification, describing for example the requirements and the technical features of the future industrial system. This specification constitutes for us, in addition to the experts, one of the main sources of knowledge.

5.2. The industrial model of the SH_TRC project

As described in section 3, the industrial system of the SH_TRC project is seen through two types of components:

Skill components: we have listed two types of skill components. The component of type product which represents any physical element entering in the composition of an industrial facility (for example: pump, circuit breaker, pipe etc.) and the component of type process which represents all the dynamics of the industrial system.

Theme components: Among the themes studied in the project SH_TRC, the topic retained is the conception of the specification draft. The development of the latter offers to the users an assistance in the specification of future installations. In this theme, we have found two types of components: the component of type portion of text and the component of type graphic element.

5.3. Architecture of the proposed memory in the SH_TRC project

In accordance with the generic architecture proposed in section 4, the memory of the SH_TRC project will be made up of five memories that we will present below:

5.3.1. Reusable Resources' memory

This memory gathers the four types of reusable resources: product type, portion of test type, graphic element type and process type.

In this article, we are, particularly, interested in the first three reusable resources' types. The reusable resource of process type is described in (Admane, 2004).

Memory of the reusable resources of type product: The product is regarded as the element of the finest granularity. It can be used in the composition of an industrial facility, or in the composition of another product. The model of figure 2 describes the product isolated from any use.

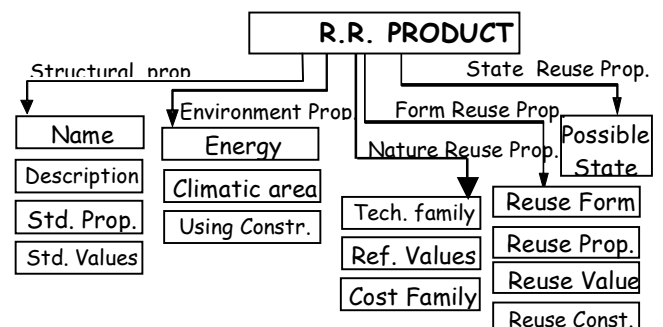


Figure 2 : Model of reusable resource type Product

Each instance of a component's model will become an element of the memory of the reusable resources of type product.

The example of figure 3 is an element of this memory. We represent this component as a record. This example describes a programmable pump. The characteristics of the re-use inform that this pump can be used as an amplifier of flow. It can also be used in manual or automatic mode.

Reusable Resource Product: pompe P217	
Name:	ZPHMP2002-1
Description:	Programmable Hydraulic pump
Std Prop.:	Double pumping, ...
Standard Values	Max Power: 100 bars, diameter of entry: 300 mm, ...
Energy:	Fuel
Clim. Zone:	Arid, tropical
Reuse Constr.:	Product not corrosive
Tech. Fam.:	Pumping, amplification flow ...
Cost Family:	High
Ref. value:	
Reuse Form :	Amplifier of flow
Reuse Prop. :	Flow parameters, modification section ...
Reuse Val.:	
Reuse Constr.	
Poss. State:	Automatic, manuel ...

Figure 3 : Example of a reusable resource of type PRODUCT

The reusable resources' memory of type portion of text : It is a resource of the theme resources' memory. This resource represents any portion of text that seems interesting. It is described by figure 4.

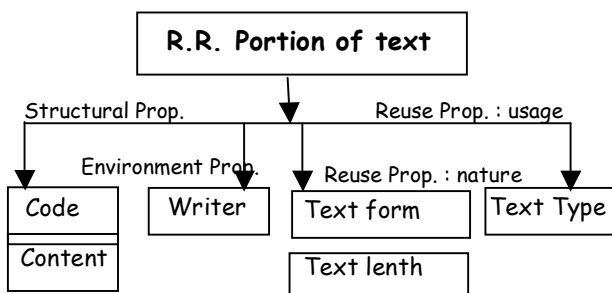


Figure 4 : Model of reusable resource of type PORTION OF TEXT

The example of figure 5 describes a reusable resource of type potion of text. It is an assembly notice of a reusable resource. It is a short technical text which describes a process. The text itself is in the Content property.

Reusable resource PORTION of TEXT : note of assembly	
Name :	Notice 111
Description :	Note of assembly of the programmable hydraulic pump
Content :	<Text >
Writer :	Name of the writer
Text Form :	Technical Text
Text Lenth :	Short
Text Type :	Processus

Figure 5 : Example of a reusable resource of type PORTION OF TEXT

The reusable resources memory of type graphic element : The reusable resource of type graphic element is, also, a resource of the theme resources memory. This resource represents any graphic element extracted from the specification which seems interesting. It is described in figure 6.

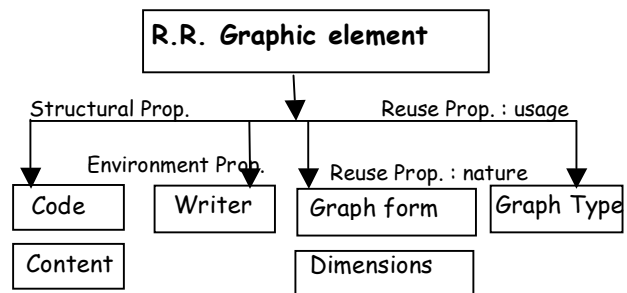


Figure 6 : Model of reusable resource of type GRAPHIC

A reusable resource of graphic type can be modelled exactly like a reusable resource of textual type.

5.3.2. Roles' memory

The roles serve to describe all or a part of a reusable resource within a particular use. All the semantics carried by the role relates to the evoked reusable resource. The model of roles is described by figure 7.

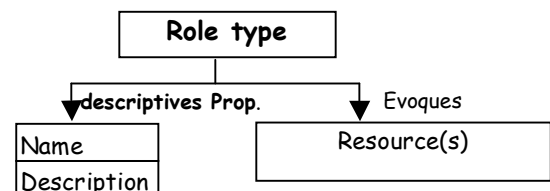


Figure 7. Role's model

In the SH-TRC project, we have proposed three models of roles.

Internal model of role: These roles implement only one reusable resource: the current resource. The global model of this role is described in figure 7.

Model of connection's role: The roles of the type connection are roles which are used to describe all the interaction that the called upon reusable resource can have with another reusable resource.

Model of mediation's role: The roles of mediation type are used to describe the way with which the called upon reusable resource comes between two dependent reusable resources.

The table of figure 8 presents some elements of the roles' memory .

Internal Roles : Physical Obj, obj Informational, machine, module, hydraulic, mechanics, electric, location, make modification, section reduction, descriptif text, operating mode Position-fonction, Modify- characteristic, suppress -compoant, (joint), etc.
Connection's Roles : Adapt on, connected to, connectable with, non compatible with, used in, described by, describe, schematized by, schematize, Add-component, Obligatory composition, Optionel Composition, Specialization, Generalization, Reuse, Derivation, Equivalence, Obligatory need, Optional need, Induction, precede, following, before, after, etc.
Mediation Roles : To assemble, to adapt, annotate, informs, etc.

Figure 8. Extraction from the roles' memory

5.3.3. Models of contexts memory

We thought of contexts' models which make it possible to describe situations in the form of texts. Practically, we built a single model of context. This model is illustrated in figure 9.

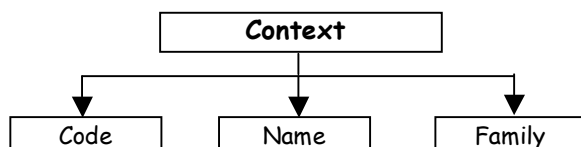


Figure 9 : Model of context

It represents the context as being a portion of text described by the context code, context name, and a family of context. We define for example the contexts:

Desert : knowledge is valid for desert regions,
Renovation : knowledge is valid in a situation of renovation,
Reduction of section: which means that the

described knowledge is valid for problems of conducts section reduction.

5.3.4. Models of cases memory

The goal of these models is to represent the cases of use of reusable resources. Each model describes a type of a well defined case. A model of case is composed of the triplet: reusable resource, role and context. It is described by figure 10. The reusable resource: represents the resource implemented in this particular case. The roles: are used to document the manner with which the reusable resource was used in this case. The context: describes the context in which the case was built;

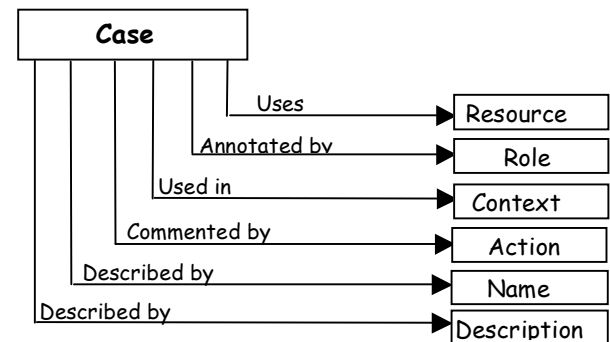


Figure 10 : Model of cases

The example of figure 11 describes a case of use of a programmable pump like a regulator of pressure.

Case: amplification of pressure	
Description	<Description of the case>
Reuse Res.	pump P217
Role:	Position-fonction, Modify-characteristic, Add-component (joint)
Context:	Increase power
Actions:	Position the pump in automatic mode, increase its section, remove the joint of origin and replace it by a hermetic one.

6. CONCLUSION

In this article, we presented a meta-model of corporate memories based on the re-use principle. Two ideas were developed.

The first relates to the architecture of the corporate memory. We chose an architecture multi memories which means that every memory developed according to the ReCaRo model will be made up of three communicating memories.

The second idea relates to the implementation on industrial cases. The main problem that we had to solve was that of the definition of the concept of reusable resource in the field of the hydrocarbon transport. For that, we proposed a modelling of the industrial system through two classes of components: skill knowledge and theme knowledge.

The memory of corporate knowledge offers to the technicians all the help with the industrial systems design. The connection of the corporate memory to the documentary theme memory offers to them the assistance with specification when designing new installations.

We chose to implement the corporate memory as a data base. The set of models and reusable resources was implemented as a set of data bases. Admane & Al. (2002), Admane & Al. (2002a) and Admane & Al. (2003) give all the details for this modelling.

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