COMPONENT BASED INFORMATION SYSTEM RE-ENGINEERING APPROACH

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Abstract: This paper presents a concept called Component based Information Systems Re-Engineering (CISRE), which lays down the foundation of a new re-engineering approach. CISRE covers all the facets of Information Systems (IS) at three levels: system, collaboration and organization. This approach contains two main phases respectively: the comprehension phase and the renovation phase, which are not disjointed. The main goal of this approach is to converge into a new IS, within a rapid evolving environment. Thus, the new IS will be achieved on stable concepts based on invariants.

1 INTRODUCTION

Information Systems (IS) are recognized as a strategic asset of most mediums and large enterprises, and of public organizations. These IS could be found in many economic sectors and social activities. Most of the time, these organizations have a very important legacy and strategic applications those are essential to deal with their main business activities. Some of them are relatively new while the others are older. This inheritance is often built gradually and based on the heterogeneous technologies, it is also developed for specific needs, at different periods and by different teams. Consequently, it leads to IS with their components and architectural layers. Those components and layers are not always able to communicate with others. In most of cases, these systems became non-adaptive to new requirements after many evolutions. In other words, these organizations should constantly undertake changes in their human and technical environments according to the functional needs.

Facing this increasing evolution, a lot of organizations are brought to rebuild the pre-existing IS and take into account the data-processing support of the new activities related to the various changes.

In fact, the interests to IS rebuilding are mainly explained regarding to their complexity, because of the following particular factors: (i) the defective character of the design and the development of the applications, particularly at the analysis phase of user's needs; (ii) the inability of the systems to evolve; and (iii) the insufficiency in documentation.

In this paper, we present a new approach of IS Re-engineering focused on the concept of Information System Component (ISC). The goal is to develop information systems that can support future improvements in an easy way.

2 OUR APPROACH OF INFORMATION SYSTEMS RE-ENGINEERING

As illustrated in figure 1, our approach of IS Re-engineering composes of two main phases. The first phase consists of comprehension of the legacy information system (LIS). This step aims to produce the basis for the renovation. The second phase consists of defining the process of renovation of LIS. The activities of comprehension and renovation are related.

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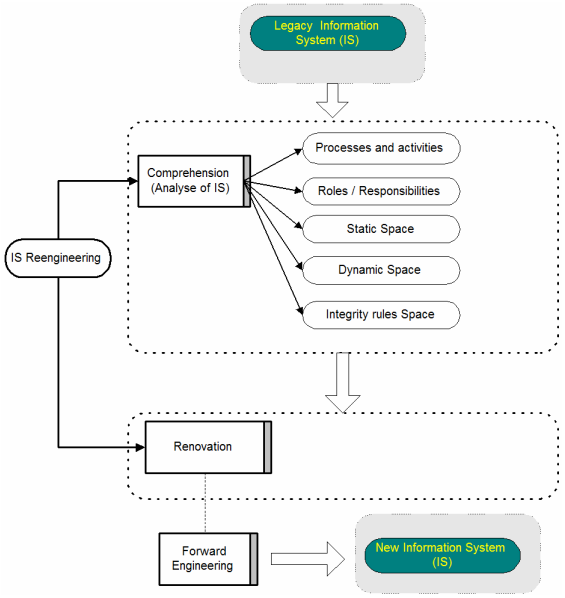

Figure 1: our approach of IS Re-engineering

In the schema of figure 1, the forward engineering concerns to the classical process of developing system. It starts from the specifications of the pre-existed information systems and moves down towards implementation and deployment (Bisbal, and al, 1999).

2.1 The process of comprehension

The process of comprehension basically involves in the analysis of the IS. The purpose of the IS analysis is to identify: (i) activities of the organizations; (ii) roles and responsibilities; and (iii) the static space, the dynamic space, and the integrity rules space of LIS.

As mentioned below, several sources of information are needed to carry out this analysis. In fact, the analysis of the pre-existed IS (figure 2) involves in the three following facets of an IS (De Michelis, and al., 1998):

1. **The organizational facet** that is concerned with work management from a formal organizational perspective. This facet addresses global organizational concerns, including organizational objectives and business goals, policies, regulations, as well as resulting workflow or project plans.

2. **The group collaboration facet** that is concerned with the actors (people) dealing with a common process. These are related to organizational roles or responsibilities working on common business processes;

3. **The systems facet** that is concerned with computerized systems that support business activities.

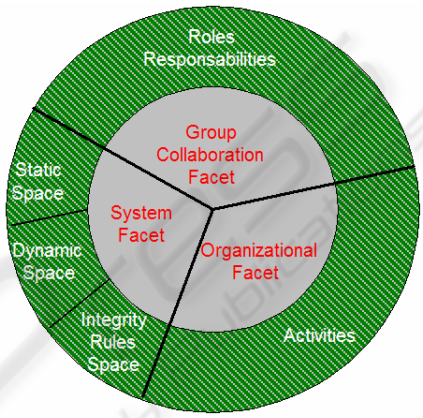

Figure 2: IS analysis

The results of comprehension process are mainly summarized as following:

- To extract the most stable part of LIS;
- To capture the knowledge of the data semantics. This process is useful: (i) if we want to use our current database to supply data to other IS; and (ii) if we want to replace the current IS, we need to acquire a deep knowledge of the data. Their potential migration requires a deep understanding of the meaning of the data, their format and structure, as well as how they are stored in the database.

On the other hand, the process of comprehension LIS also deals with the strategy to be adopted to extract the static space, the dynamic space, and the integrity rules space of LIS.

To capture the knowledge of the data semantics, databases must be reverse engineered but we need to rely the possible information sources, such as: program sources, data, data dictionaries, reports, screens and documentations.

The analysis of the data description language (DDL) code of the database for instance gives precise information, which is easy to analyze. The procedure source code analysis gives also precise information but in contrary, it is quite difficult in terms of analysis cost. Documentation, if up-to-date and carefully written, can be useful and easy enough to analyze. When the documentation is obsolete and /or not structured, its analysis can take time end, even worse, lead to false assumptions (Henrard, 2003).

The extraction of the dynamic and integrity rules spaces is the most difficult process because most of the implicit structure and constraints are buried into the source code of programs that is often the most reliable place where such constraints can be found (Henrard, 2003). Analyzing source codes of programs requires sophisticated techniques pertaining to the program-understanding domain. Therefore, these techniques that seem to be adequate for small systems become useless for medium or large one. For these reasons, in order to extract the three spaces as mentioned above, we need to analyze other sources of information. The process of extraction, applied in the case of an institutional IS, is then facilitated by the development of a cognitive space.

2.2 The process of Renovation

At the level of renovation, the issue is to know how models, tools, analysis and design methods could help to create new Information Systems supporting evolution. The renovation implies that the IS development has focused on the concept of ISC that focuses on the interaction with the organizational environment and the overlaps among IS components.
Figure 3 shows the renovation process:

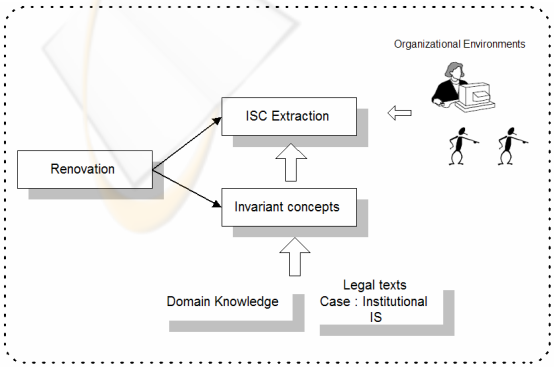

Figure 3: the renovation process

ISC (Information System Component) describes a generic situation in the IS development. In (Léonard, 2003; Le Dinh and Léonard, 2002; Turki, and al., 2003), ISC are defined as a particular IS.

All fundamental aspects of an Information System such as the static, the dynamic and the integrity rules constitute the content of an ISC as described in the following:

- **Static space:** where the data structure of the ISC is defined using the concept of hyperclass with its set of classes and hypermethods,
- **Dynamic space:** where the behavior of the different elements of the ISC is expressed. The bipartite nets are implemented to specify the dynamic space including the object life cycles of the hyperclass classes (Khadraoui, 2002),
- **Integrity rules space:** where rules governing the behavior of the elements of the ISC are specified. Integrity rules (IRs) of an IS represent most often the business rules of an organization. An IR is a logical condition defined over classes, which could be formally described and verified by transactions or methods.

Another level in our approach of Re-engineering, applied in the case of an institutional IS, consists in the development of a cognitive space extracted from the legal texts underlying the activities of an organization (Visentin, 2003; Léonard, 2003b). The legal texts describe in a precise way the field, the rules and procedures of the organization activities. The laws represent a knowledge source of a part of the domain that we want to model. The concepts related to the laws are in general stable, and therefore, do not evolve so much. The result of this level is to identify the most significant concepts called the ***invariant concepts,*** which form the core of the new IS. The cognitive space allows to clarify the links between laws and IS, and in particular between amendments of laws and evolution of IS.

3 CONCLUSION

In this paper we presented, in short, our approach dedicated to IS re-engineering. This approach aims to accompany the evolution of the IS and to capitalize the existing regarding the business, informational and processing point of views.

Additionally to this, it concerns the ability to take into account the new evolution situations. The originality of the presented approach is the fact that it is based on the IS component concepts and IS components recovering. These components have to be expressed regarding to an efficient and unique semantic for a group of actors within the organization. In the other side, we introduced the use of the cognitive space, applied in the case of an institutional IS, which allows the expression of the links between the "legal texts" and the IS. Finally, the exploitation of such space allows the identification invariants concepts that constitute the core of the new IS.

REFERENCES

Akoka, J., and Comyn_wattiau, I., (2001). Réingénierie des Données et des Documents sur le Web . *ISI-NIS*, Paris, Vol. 6, No. 1, pp 9-59.

Albee, K., and Shekleton, J., (1992). Business Re-Engineering and Information Systems: An opportunity for Business Partnership. *Case Outlook* Vol.6, No. 4, pp 25-34.

Bisbal, J., Lawless, D., Bing, W., and Grimson, J., (1999). Legacy Information Systems: Issues and Directions. *In IEEE Software*, Vol. 16, No. 5, pp. 103-111.

Delcroix, C., Thiran, P., and Hainault, J-L. (2001). Approche Transformationnelle de la Réingénierie des Données. *ISI-NIS*, *Hermes Sciences Publications*, Vol. 6, No.1, pp. 61-98.

De Michelis, G., Dubois, E., Jarke, M., Matthes, F., Mylopoulos, J.,Papazoglou, P., Pohl, K., Schmidt, J.W., Woo, C., and Yu, E., (1998). Cooperative information systems: A manifesto. Cooperative Information Systems Trends & Directions. M. Papazoglou and G. Schlageter, Eds. *Academic-Press*, pp. 315–363.

Henrard J., (2003). Program Understanding in Database Reverse Engineering, *Phd Thesis, FUNDP, Institut d'informatique*, Belgium.

Khadraoui, A., (2002). Construction de la structure

Nœuds-Etoiles d'une hyperclasse et d'un cycle de vie d'objet. *Matis report*, CUI, University of Geneva.

Kullbach B:, Winter A.,(1999). Quering as an Enabling Technology in Software Reengineering, *Conference on Software Maintenance and Reengineering* (CSMR'99).

Léonard, M., (2003a). IS Engineering Getting out of Classical System Engineering. *5th International Conference on Enterprise Information Systems*, École Supérieure d'Électronique de l'Ouest, Angers, France, pp. 35-45.

Le Dinh, T., and Léonard, M., (2002). Defining Information System Components. *Proceeding of Confederated International Conferences CoopIS, DOA, ODBASE, Springer*, California, pp. 1359.

Léonard, M., (2003b). La farandole des objets imaginés, conçus et façonnées dans le monde des Systèmes d'Information, *International Workshop On utility, usability and complexity of Emergent IS*, Namur, Belgium.

Turki, S. and Léonard, M., (2002). IS Components with Hyperclasses. Conference of the OOIS 2002 Workshops, *Advances in Object-Oriented Information Systems*, Montpellier, France, LNCS 2426, Springer.

Turki, S., Léonard, M. and Arni-Bloch, N., (2003). From hyperclasses to components for IS development, *ISPE*, Madeira.

Visentin C., (2003). Conceptualisation des lois pour le développement d'une cyberadministration, *Matis report, CUI,* University of Geneva.