TOWARDS A METHOD FOR ENTERPRISE INFORMATION SYSTEMS INTEGRATION

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Abstract: Enterprise information systems integration is essential for organizations to fulfil interoperability requirements between applications and business processes. To carry out most typical integration requirements, traditional software development methodologies are not suitable. Neither are enterprise package implementation methodologies. Thus, specific ad-hoc methodologies are needed for information systems integration. This paper proposes the basis for a new method for enterprise information systems integration in order to facilitate continuous learning and centralized management during all the integration process. This method has been developed based on the ontology defined in ISO/IEC 24744.

1 INTRODUCTION

Nowadays, it is common that enterprises develop specific projects for the integration of both disparate information systems (IS) within one enterprise and between IS from several enterprises. For such a task, it is a good practice that facilitates project success to apply an adequate method. Despite the fact that traditional software engineering methods alone are not adequate for enterprise information system integration (Themistocleous & Irani, 2006), previously published methods, specific for enterprise IS integration, have not yet had a great level of popularity. Therefore, two research lines could be proposed: first, to analyse why these methods are not so popular and second, to define new enterprise IS integration methods more focused on usefulness.

In this paper we propose the bases for a new method for enterprise IS integration, which we are designing with an aim towards continuous learning and with a centralized management as a differential feature. Moreover, we propose explicit evaluation phases to improve the quality of the integration task to be undertaken.

The paper is structured as follows. We begin with an introduction to enterprise IS integration projects. Then, section 3 describes the bases of the proposed method. In section 4 we establish relationships with previous research on integration methods, and in section 5 we present our conclusions and ideas for further work.

2 ENTERPRISE INFORMATION SYSTEMS INTEGRATION

Enterprise IS integration refers, depending on the context, to different concepts as Information Technology Integration, Information System Integration, Application Integration, Business Integration or Data Integration, among others. However, the main task of all of them implies to integrate some element of enterprise. Currently, enterprises have the need to integrate their data, processes, applications or systems. At the end of the 90s, the high development costs, the trust in the reliable operation of robust legacy systems, and the need for the quick integration of new kinds of IS such as eBusiness applications, motivated the rise of Enterprise Application Integration (EAI). In fact EAI was originally defined (Linthicum, 1999) as the unrestricted sharing of data between two or more organization applications, where a group of technologies allow information flow and exchange among different applications and business processes,

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of the same enterprise or between different enterprises. Much more recently, the adoption of web-services technology and Service-Oriented Architectures (SOA), have changed the nature of the IS development and integration paradigm. This new approach supports high levels of system artefact reuse and can frequently result in dramatically reduced coding for new application functionality. This new approach has promoted a new service market, as the convergence of the previously independent tool markets for EAI, Workflows and Document Management, and Business Process Management tools (Meta Group, 2003). By the end of 2006, Forrester defined this new service market as that one of the Integration Centric Business Process Management (IC-BPM) suites (Vollmer & Peyret, 2006).

To carry out an enterprise IS integration project, we could try to adapt and use some prior development approach, such as a more conventional software development methodology or some proprietary enterprise package implantation methodology. However, none of these alternatives fits in a natural and easy way with the situations arising in enterprise IS integration projects. Typical software development methodologies are designed for the bespoke construction of software solutions from anew, while in enterprise IS integration projects we find a varied set of legacy applications that are to be integrated along some pre-existing or newly designed business process. Enterprise IS integration is far different from implementing an enterprise package. Legacy applications are heterogeneous in several ways, while enterprise packages are much more homogenous and their implementation methodologies and tools are adapted to such a state.

3 OUR ENTERPRISE IS INTEGRATION PROPOSAL

To define a new method it is convenient to refer to previous method engineering results. Fortunately, Method Engineering is not a new research area and since the 90s many articles and proposals have been published (Brinkkemper et al., 1999) (Weerd et al., 2007). Our goal is to organize artefacts and activities that can be found in a typical integration project by using an ontology that will allow us to formalize our method in a more straightforward way. To accomplish this goal, we have based our initial proposal on the ontology defined by the ISO/IEC 24744 (González et al., 2007).

The ISO/IEC 24744 standard introduces the Software Engineering Metamodel for Development Methodologies, the aim of which is to define methodologies in information-based domains (ie. areas characterized by their intensive reliance on information management and processing), such as software, business or systems engineering. ISO/IEC 24744 is an instrument that is suited to our needs and that also provides a quality and diffusion framework.

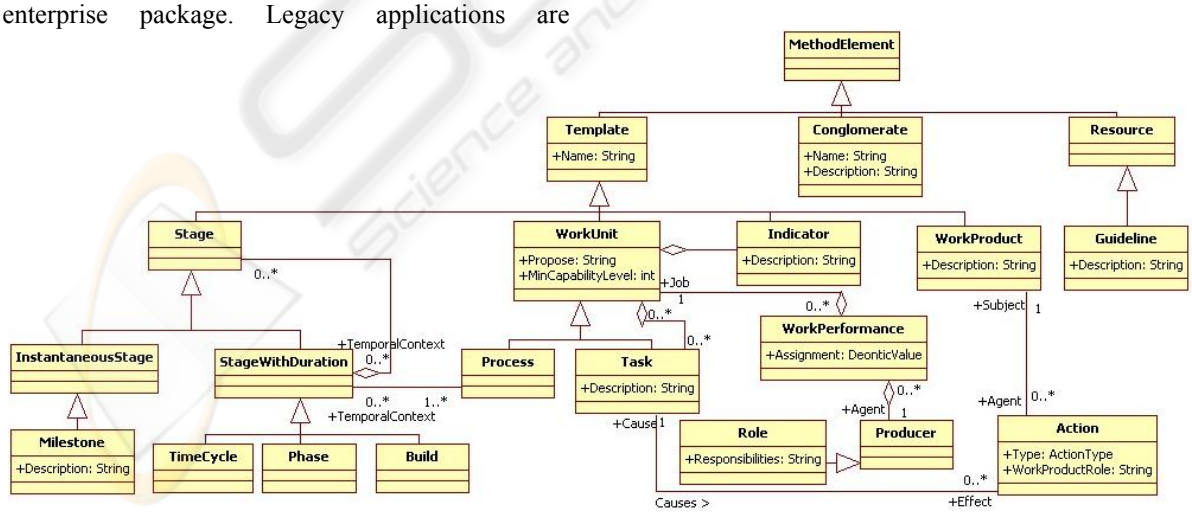

Figure 1: Class diagrams of methodological elements.

Additionally, our method is based on an iterative approach and bears continuous evaluation tasks in the end of each integration stage. It promotes the acquisition of integration knowledge through several evaluation stages. These stages allow us to learn from past successful actions as well as mistakes, and to identify causes of deviations with respect to initially-planned duration, budget or integrated functionality. At the beginning of each new cycle, if necessary, objectives may be adjusted based on results on previous cycles. Moreover, we take also into account several lessons learned from our participation in a real enterprise IS integration project within a big Spanish insurance enterprise.

Figure 1 shows the domain of usual method elements of enterprise IS integration and their relationship. We consider the following four main elements:

- Stages. Different development activities are scheduled in a generic level, through an integration life cycle, where we distinguish its stages and internal phases.
- Work units. Activities which should be done during the integration project.
- Producers. Enterprise roles with the responsibility to do those work units.
- Work Products. Set of artefacts considered during the execution of work units.

Given the ontology described above, we define a life cycle for enterprise IS integration with three basic stages: Procurement, Implementation and Use. For each stage we define four phases (see Figure 2). As central elements in this cycle there are two kinds of artefacts, those that make up the integration (applications, processes, systems, tools) and those that support project management (management tools such as balanced scorecard). In each stage, we distinguish two specific phases that interact with the management artefacts: a first phase that includes planning tasks, and a second one that includes evaluation tasks. Management tools propose initiatives to be considered during planning phases, while evaluation phases generate feedback that is used as data input for these management tools. In this way, our proposal pretends to promote continuous learning.

Next, we describe the main elements of our method: life cycle, integration artefacts, and management artefacts, among other important elements.

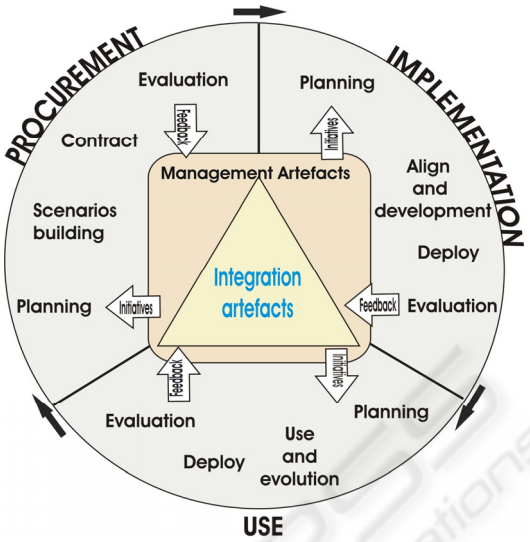

Figure 2: Our Enterprise IS integration life cycle.

3.1 Life Cycle

We propose a life cycle for an enterprise IS integration project defined in terms of three main stages, each one decomposed in four phases (Figure 2). Our life cycle stages are:

- Procurement: Composed by the phases named Planning, Scenarios building, Contract and Evaluation.
- Implementation: Composed by the phases named Planning, Alignment and Development, Deployment and Evaluation.
- Use: Composed by the phases named Planning, Usage and Evolution, Deployment and Evaluation.

3.1.1 Procurement

In this stage, enterprise needs for the development of the future integrated IS are studied and a conceptual integration solution is designed. This solution involves the conceptual description of applications to be integrated and the interfaces between them. Phases of this stage are the following:

Procurement Planning: At this phase, business processes and requirements are analyzed; integration requirements are compiled; risks, benefits and organizational impacts are evaluated; integration strategies are established; available tools and technological alternatives are analyzed; and possible integration developments are identified. Moreover,

perspective and business initiatives are considered; knowledge from integration experience is used.

Scenarios Building and Business Process Reengineering: Possible scenarios are built by considering tools, technologies and architectures. Design and development efforts are forecasted for each scenario. Besides, it is an opportunity to do appropriate business process reengineering. The scenario most convenient is selected. The evaluation of different IC-BPM suites may be done, fir example through a quality model for EAI tools (Silveira & Pastor, 2006). Plus, other non-technical system factors, such as organizational issues (barriers, benefits, costs, etc.), should be considered (Themistocleous & Irani, 2001).

Contracting: Finally, the chosen IC-BPM suite is acquired, the implementation and maintenance team is contracted, and the organizational benefits and impacts are estimated.

Procurement Evaluation: The quality of the procurement process is evaluated. The results are analyzed and stored in a base knowledge.

3.1.2 Implementation

After designing a conceptual solution and having the tools and the technical team to carry on with it, the implementation stage may start with the following phases:

Implementation Planning: According to the business initiatives and strategy of the hosting enterprise or enterprises, the implementation of the solution is planned, the implementation teams are coordinated and the deployment strategy is defined. Moreover, knowledge from integration experience is used.

Alignment and Development: In this phase, the architecture is deployed, the integration tools are customized and the interconnecting code is designed and developed. Unitary and integrated tests are designed, populated and applied.

Deployment: Finally, data migrations are executed, the new applications and interfaces are distributed, the business processes are deployed, and the system operators are trained.

Implementation Evaluation: The quality of the integration process is evaluated. The results are analyzed and stored in a knowledge base.

3.1.3 Use

After the resulting integrated information system is deployed, it begins to be used and eventually will need to be maintained.

Usage Planning: System usage and its evolution (maintenance) are planned taking into account enterprise strategy. Moreover, perspective and business initiatives are considered; knowledge from integration experience is used

Use and Evolution: The system is used and its evolution maintenance strategy is followed.

Deploy Patches and New Versions: New patches and versions are proposed to redress system behaviour when appropriate.

Usage Evaluation: At this phase, the alignment between the system integration and the enterprise strategy is evaluated. The results are analyzed and stored in a knowledge base. Moreover, it is also considered how the system use fulfils the enterprise goals.

3.2 Integration Artefacts

According to our ontology, we can say that integration artefacts are Work Products. A work product is an artefact of interest to the integration effort. Many work products are created during the development effort, but many others are procured outside and are modified during the development. Clearly, the IC-BPM suites are examples of artefacts that are modified or customized during the development while “glue code” is an example of a product that is created during the development. All of these are artefacts that compose the centre of integration and we call them Integration artefacts.

Our method revolves around a group of integration artefacts that compose the integrated IS. These artefacts are the business processes, applications and enterprise systems to be integrated, the tools that simplify integration tasks and the overall architecture where integration is going to be founded.

3.3 Management Artefacts

Apart from integration artefacts, we distinguish another type of work product, which are generated in the development of the project in order to be used as tools in the integration project management. We call them Management artefacts. Over the work products, events are executed through the concrete action of specifics tasks.

In our method, we include the development of a model for the management of the project. For example, management tools as balanced scorecard may be essential to align business strategies with information integration strategies. Moreover, these may be the key in continuous learning through cycles of evaluation and analysis of the results that are used as input for future iterations.

3.4 Others Key Elements

To provide a complete method it is necessary to describe some additional methodological elements that so far we have not described in our domain such as: Work Units and Roles. In this paper, we have not deepened in their description, but we present a brief overview.

Work units describe the main activities that must be done in each phase; these activities can be processes or specific tasks. Typically, a process is described associating it to a set of tasks.

We use "roles" to describe agent responsibilities; in our case, stakeholders are agents, and three groups of responsibilities are identified:

- Responsible people for Business Activities performed by CTO, CEO, among others.
- Responsible people for Technical Activities performed by project managers, end-users, etc.
- Responsible people for Organizational Activities performed by operations staff, maintenance staff, etc.

We call work performance to the assignment of a stakeholder to a work unit, and the type of assignment that is specified there (Mandatory, Recommended, Optional, Discouraged, Forbidden).

4 RELATIONSHIPS WITH PRIOR IS INTEGRATION RESEARCH

In contrast with the relevance of the topic in industry, so far there is not much research on IS integration project management or in IS integration methods. As far as we know, only two contributions have appeared out of academic research: Lam and Shankararaman (2004) and Themistocleous and Irani (2006). Next we present them and compare our proposal with them.

Lam and Shankararaman (2004) were the first who proposed a methodology for enterprise IS integration. Their proposal, called Enterprise Integration Methodology (EIM), consists on five stages (Lam & Shankararaman, 2004). The steps defined in these five stages are also considered in our proposal: *To understand the end-to-end business process* is the first step of the analysis, which we considered in our procurement planning phase. Their tasks named *Map the process onto components and derive the requirements stages*, are considered in our Scenarios Building phase, because of each scenario building we must map the process onto components and we deal with the integration requirements analyzed in previous phases. Their task *Produce the architecture* is one of the steps that we include in our Alignment and Development phase. Finally, their stage named *Plan the integration* corresponds to our beginning phase of the Implementation stage.

The methodology proposed by Lam et al. defines general lines but does not detail or describe specific points in integration projects. They do not deal in their procurement stage with issues such as scenario building and evaluation. Regarding implementation stage, unless they do not identify in early instances the needs of new developments, they do not consider their implementation either. Finally, no usage stage is considered at all, thus leaving out any integration evolution evaluation phases, nor the evaluation of the usage of integrated IS.

The methodology of Lam et al. has some limitations, such as the lack of consideration of systems restructuring or the necessity to develop new software. Trying to cover these limitations, Themistocleous et al. (2006) propose another methodology of eight stages.

The sequence of steps defined by Themeistocleous et al. is distributed over our structure of stages and phases. Their *Planning* stage covers activities that aim towards the study of the factors that affect the process of adopting an IS Integration approach, such as barriers, costs or benefits. We make these studies when evaluating the different scenarios, because costs, barriers, benefits or organizational issues in general affect in different ways each scenario. Their *Scenarios building and evaluation stage*, *Business Process reengineering stage* and *Systems restructuring stage* corresponds with our Scenarios building and business process reengineering phase. While we build our scenarios, we are taking advantage of the opportunity to propose initiatives in business process reengineering and Systems restructuring. We locate their *Requirements analysis stage* in a different position, because we believe that integration requirements must be clear before the building of scenarios. Their *Filling the gap and New systems development stages*

are included in our Align and development phase within the Implementation stage. Their steps of Integration and testing are distributed in our Align and development and Testing and evaluation stages. Finally, their *Operation and maintenance stage* corresponds with our Use and evolution phase.

On the other hand, Themeistocleous et al. do not consider hiring subjects, which we inserted in a phase between the selection of the suitable scenario and the beginning of the planning implementation phase. The results obtained in the *Hiring* stage often affect technically the development of a project, so we considered them sufficiently important to dedicate a phase where we can align the technological strategy with the business strategy. They do not propose any management tool to help manage business initiatives or technical adjustments derived from the continuous evaluation.

5 CONCLUSIONS AND FURTHER WORK

It is not yet usual that important failures in IS integration projects are published, but through interviews with experts in integration, we know several fiasco cases in Spain and other countries. In these cases, often after great investments in integration platforms, at the end they have ended up in great overruns and low satisfaction, with interconnections have ended up being implemented point to point to hide the project failure.

From these observations, we assume that it is not enough to have implemented an integration platform to take advantage of the benefits promoted from IS integration, or from EAI projects.

In this paper we have presented our bases for a new method for enterprise IS integration, constructed on prior research on EAI topics, and from the analysis of mistakes and successes in a real rich experience study (Silveira et al., 2008), from interviews with experts in integration projects, other case studies published, and the analysis of the methodologies previously proposed.

The ideas and artefacts incorporated in our proposal must be formalized within the tenets of prior research from other related areas, such as Method Engineering from software and IS engineering. Similarly, prior results on best practices recognized in the management of other similar projects within information systems, such as ERP, CRM or SCM implementation projects, should be taken into account in the refinement of our method for IS integration projects.

REFERENCES

Brinkkemper, S., Saeki, M., Harmsen, F., 1999. Meta-Modelling based assembly techniques for situational method engineering. *Information Systems,* Vol. 24, No. 3, p. 209-228.

González, C., Larrucea, X., Bediaga, A., Gortazar, A., 2007. Metamodelo para Metodologías de Desarrollo. Retrieved September, 2007, from http://meta.dsic.upv.es

Lam, W. & Shankararaman, V., 2004. An Enterprise Application Methodology, *IT Profesionals*, 6(1): pp. 40-48.

Linthicum, D., 1999. *Enterprise Application Integration*, Addison-Wesley, Massachusetts, USA.

Meta Group, 2003. Enterprise Application Integration METAspectrumSM Evaluation.

Silveira, R. & Pastor, J., 2006. A model for enterprise application integration tools evaluation. *Proceedings of the European and Mediterranean Conference on Information Systems (EMCIS)*.

Silveira, R., Pastor, J., Mayol, E., 2008. Towards a method for enterprise information systems integration (Extended version). *Universitat Politècnica de Catalunya* , Report LSI-08-11-R (http://www.lsi.upc.edu/dept/techreps/buscar.php)

Themistocleous, M. & Irani, Z., 2001. Benchmarking the Benefits and Barriers of Application Integration, *Benchmarking: An International Journal*. Vol. 8. No. 4, 317-331.

Themistocleous, M. & Irani, Z., 2006. Towards a Methodology for the Development of Integrated IT Infrastructures. *Proceedings of the 39th Hawaii International Conference on System Sciences*.

Vollmer, K. & Peyret, H., 2006. The Forrester Wave: Integration-Centric Business Process Management Suites, Q4 2006".

Weerd, I., Brinkkemper, S., Versendaal, J., 2007. Concepts for incremental method evolution: Empirical exploration and validation in requirements management. *Proceedings of CAiSE,* pp. 469-484.