POSITION PAPER

Service Oriented Enterprise Engineering

Viewing the enterprise as a service ecosystem

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1. Service Oriented Enterprise

In today's enterprises, service orientation can be applied to transform the business domain (teleological/functional model) as well as the organization domain (ontological/constructional model) of the enterprise in order to respond to several important trends such as globalization, deconstruction, sharing, insourcing and outsourcing, offshoring and collaborating in value nets. Since the business environment is undergoing rapid changes, transforming the traditional enterprise model is one of the best solutions for an organization to simultaneously attain all three imperatives of today's economy: differentiation (focusing on key differentiators and relying on a network of expert partners for non-differentiating operations), responsiveness (responding rapidly to customer needs, marketplace changes and external threats), and efficiency (maintaining productivity and reducing risk by adapting cost structures and business processes in a flexible manner) (IBM, 2004). To address these attributes, IBM introduced two new enterprise models namely: On Demand Business and the Specialized Enterprise. While On Demand Business is a new functional model for an enterprise, the Specialized Enterprise is a new construction model for the organization domain an enterprise. More specific IBM defines the On Demand Business as a business of which the processes—integrated end-to-end across the company and with key partners, suppliers and customers—can respond rapidly to any customer demand, market opportunity or external threat (IBM, 2003a). Similarly, IBM defined the Specialized Enterprise as an enterprise organized into components that delivers best-in-class performance through internal excellence and external partnerships (IBM, 2005). Furthermore, according to IBM a *service oriented* enterprise is a kind of Specialized Enterprise with seamless integration of its business components. Consequently componentization and service orientation are two key enablers to realize a *service oriented* enterprise. Componentization is a way of deconstructing an enterprise in order to reconstruct it into value nets with key partners whereas service orientation is a way of seamless integration of business components both internally and across the enterprise's boundaries with best-of-breed components provided by external partners (Cherbakov et al., 2005).

2- Problem statement and proposed solution: a way to study and develop the Service Oriented Enterprise

The only meaningful way to study and develop an enterprise is viewing it as a system (Bertalanffy, 1969). A system can be defined as "a set of different elements so connected or related as to perform a unique function not performable by the elements alone" (Maier, Rechtin, 2002) or "a set of elements standing in interrelation among themselves and with the environment" (Bertalanffy, 1969). Based on these system definitions, there are two different system notions, each with its own value, its own purpose, and its own type of model: the teleological and the ontological one. The teleological system notion is about the function and the (external) behavior of a system. The corresponding type of model is the black-box model. Ideally, such a model is a relation between a set of input variables and a set of output variables, called the transfer function. Knowing the transfer function means knowing how the system responds to variations in the values of the input variables by changing the values of the output variables. Otherwise said, through manipulating the input variables, one is able to control the behavior of the system. The teleological system notion is adequate for the purpose of using or controlling a system. It is therefore the dominant system concept in e.g., the social sciences, including the organizational sciences. For the purpose of building and changing a system, one needs to adopt the ontological system notion. It is about the construction and operation of a system, and therefore the dominant system notion in all engineering sciences. The relationship with function and behavior is that the behavior of a system is brought about, and consequently explained, by its construction and operation. The corresponding type of model is the white-box model. (Dietz, 2006)

To apply the teleological and ontological system notions for a *service oriented* enterprise, it is our position that the service system construct of Service Science can be applied to introduce a system perspective on *service oriented* enterprise. The service system abstraction allows studying an *service oriented* enterprise's business domain (teleological perspective) and its organization domain (ontological perspective). Our reasoning is as follows: First, the construct of service system has been defined as a configuration of resources (people, technologies, organizations and shared information) that is able to create and deliver value to other interested entities, through service (Spohrer et al, 2008). Second, a business component is a key concept of componentization and service orientation. It has also been defined as a part of an enterprise that has the potential to operate independently - even as a separate company, or as a part of another company. Furthermore, each business component contains purpose, activities, resources and also business services, which form the interfaces to other business components (IBM, 2003b). Consequently this proves the similarity between the concept service system and a business component as a key element of a *service oriented* enterprise. Therefore, the service system abstraction introduces as a meaningful way to study and develop a *service oriented* enterprise from teleological and ontological perspectives.

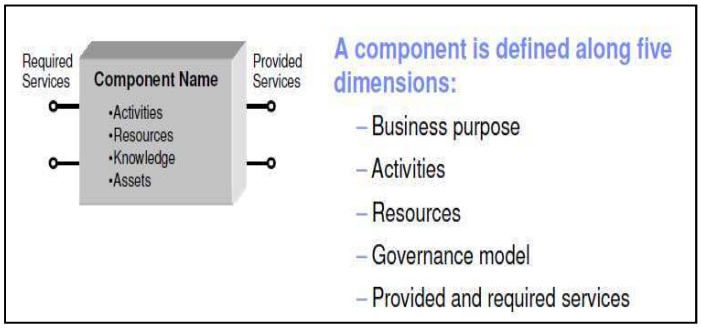

Fig 1: Business Component

3- Rethinking about enterprise design (an independent view)

Based on our definition of *service oriented* enterprise and viewing enterprise as a service ecosystem, firstly, componentization offer a proven approach to driving a specialized focus, both internally and externally. Internally, componentization help firms rethink the leverage they can achieve with the assets and capabilities they own. Externally, componentization help firms source specialized capabilities that they cannot feasibly create themselves. Combining these types of componentization allows firms to redefine their competitive positions in the face of the sweeping changes in their industries, while simultaneously achieving the competing benefits of scale, flexibility and efficiency.

Internal componentization: In this phase, firms invest in the virtual centralization of cross-company activities to gain economies of scale across the business. Key activities are centralized into discrete business areas. Duplication of activities is reduced, and the enterprise operates as a networked "federation" of focused performance centers. In this phase, the aggregation of cohesive activities transforms the firm into a network of individual business modules, each encompassing a coherent set of activities supported by appropriate assets, including people, processes and technology. Each of these modules serves a unique purpose within the organization but could also, in principle, operate as an independent entity. One advantage of this "federation of modules" design is that it makes the process of deciding whether an activity should be internally or externally sourced more responsive. (IBM, 2005)

External componentization: By a standards-driven internal componentization, firms gain the ability to leverage the benefits of lower transaction costs by engaging with external partners through collaborative networks. The flexibility afforded by interoperable business components allows enterprise-optimized firms to loosely couple with focused external specialists – be they independent providers or outward-facing components within larger organizations. In the phase of external componentization, firms leverage the low transaction costs of the global connectivity platform to build connections to multiple external specialists. These networked enterprises focus on an area of expertise while transforming their organizations to play in a coordinated ecosystem. The networked firm concentrates heavily on core activities while simultaneously

orchestrating a value network that includes a mix of industry-specific and cross-industry specialists, as these best-in-class providers gain scale around their particular area of expertise. (IBM, 2005)

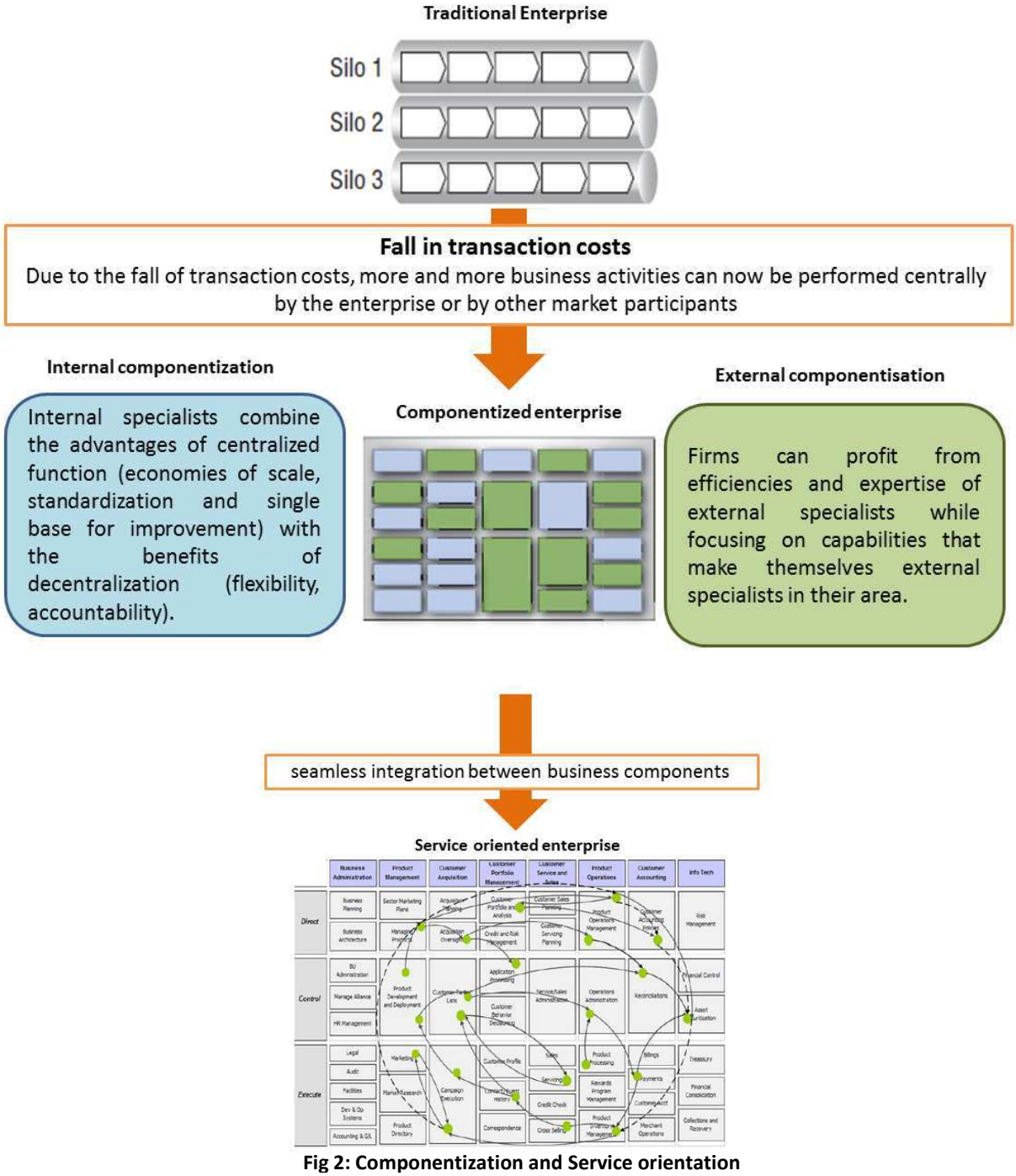

Fig 2: Componentization and Service orientation

Secondly, companies are beginning to recognize the importance of service orientation as a prerequisite to becoming competitive. for a on demand interaction with their external partners in a collaborative network, companies are beginning to explore actively what business services to

provide and how to develop them rapidly in order to be responsive, innovative and grow margins. Service orientation provide a very useful paradigm for extended enterprise level standardization, modularity and specialization. Nonetheless, componentization by itself is not sufficient. Interactions between business components need to be seamlessly and tightly integrated across the value net. The need for flexibility across the value net requires that the component network be flexible; that is, the enterprise can ‘‘in-source’’ an outsourced component and vice versa; replace, on demand, a current partner with a different partner; change the terms of the contract between the two components, and so on. The key to seamless integration between business components is service orientation. (Cherbakov et al., 2005)

Finally, optimizing at the enterprise level requires a new way of thinking about enterprise design (in both of business domain and enterprise domain). Componentization and service orientation are two trends which cause rethinking about enterprise design. For componentization and then service orientation of enterprise, it is needed an independent (neutral) view to business and organization domain of owner and its external partners in a collaborative network. This view point is necessary for viewing enterprise as a service ecosystem. Corresponding this independent viewpoint, it is needed introducing a new modeling language and also new (enterprise) models like shared services models, outsourcing models and joint venture models to support componentization and service orientation of enterprise in the right way.

4- Introducing GSDP as an Enterprise Engineering framework (basis for our solution)

Enterprise Engineering combines (relevant parts from) the traditional organizational sciences and the information systems sciences, and develops appropriate theories and associated methodologies for the analysis, design, and implementation of enterprises (Dietz, 2008). The Generic System Development Process (GSDP) has been introduced as a framework for Enterprise Engineering. In the GSDP framework, Enterprise Architecture and Enterprise Ontology are two crucial notions, which ensure that the engineering of the enterprise as a system is performed coherently and consistently and that the resulting system is a truly integrated whole (Dietz and Hoogervorst, 2007). In other words, the GSDP framework distinguishes two processes: 1) a design process which describes an enterprise and has functional and constructional models of the enterprise as result. In this process, Enterprise Architecture - conceptually as the normative restriction of design freedom and practically as a consistent and coherent set of design principles that embody general requirements - guides how the design must be accomplished and 2) an engineering process for creating the enterprise by constructing the implementation model of enterprise from its ontological model. In this process, DEMO's ontological models (Enterprise Ontology) are introduced as the highest construction models of an enterprise that are founded on the Ψ-theory. This is a fundamental theory about the operations of an enterprise focused on the use of language to achieve agreement and mutual understanding (Dietz, 2006).

5- Introducing SSDP as a Service Oriented Enterprise Engineering framework (the proposed solution)

In order to transform the *general* enterprise model to a *service oriented* enterprise model, we need to adapt the GSDP to a Service System Development Process (SSDP) and thus create a Service Oriented Enterprise Engineering framework. In our proposed solution (Figure 3), firstly, the design process of SSDP applies service oriented architectural principles to address the functional and constructional requirements to develop the functional (teleological) and constructional (ontological) models of a Service Oriented Enterprise. Secondly, the engineering process of SSDP applies a service oriented conceptualization (Service Oriented Enterprise Ontology) to develop the implementation model of a *service oriented* enterprise. We posit that the SSDP framework can be used as a framework for the analysis, design and development of a *service oriented* enterprise, if its concepts and principles are founded on the service system abstraction of Service Science.

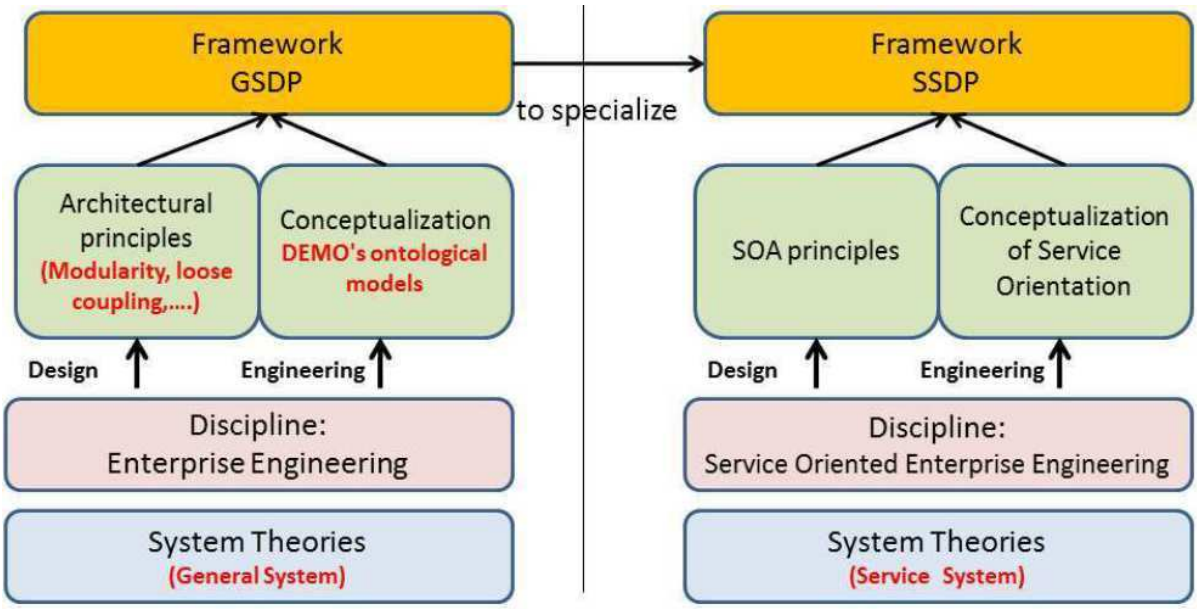

Fig 3- the proposed solution: a framework for Service Oriented Enterprise Engineering

5-Our research objectives

Based on this analysis, we propose two research objectives:

1- Proposing a conceptualization of service oriented enterprise by extracting core concepts and relations from service system ontologies and conceptualizations (Mora et al, 2011;

Lemey and Poels, 2011; Poels, 2010a; Poels, 2010b), which are based on the fundamental concepts of service system (Lusch, 2008).

2- Formulating service oriented architectural principles that can be taken into account during the design process to address requirements and to develop functional and constructional model of a *service oriented* enterprise.

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