

# Investigating Service-Oriented Business Architecture

Elisah Lemey  
Supervised by: Geert Poels

Center for Service Intelligence,  
Faculty of Economics and Business Administration,  
Ghent University,  
Tweeckerkenstraat 2, 9000 Gent, Belgium  
Elisah.Lemey@UGent.be

## 1 Context and Problem Statement

Enterprise Architecture (EA) is a term used in Information Management to refer to the joint design of an organization's business infrastructure and the information technology (IT) infrastructure. EA is a major instrument to achieve business/IT alignment, i.e. the strategic and operational integration of an organization's business and IT domains, which in turn contributes to effective enterprise governance of IT, i.e. the responsible investment in and management of IT resources such that IT delivers business value.

Organizations' IT infrastructures are becoming increasingly service-oriented. Information processing functionality is provided through interfaces (called service descriptions) that hide the underlying implementation. Service consumers do not depend on the actual binding of service implementation to description such that implementations can be changed or replaced without effect for the consumers. The collection of standards, methodological principles and technological frameworks that enable this highly flexible architectural view on IT infrastructures is known as Service-Oriented Architecture (SOA).

However this flexibility on the IT side is not always paired with flexibility on the business side (i.e. agility). Currently, Information Management research is investigating how service-orientation can also be applied to the business infrastructure of an organization [1]. A service-oriented business architecture would describe the individual steps to be executed within the organization's business processes as services delivered to these processes. These business services can then be matched with IT (or other) services that deliver the required functionality and business processes can be reconfigured by changing their mapping onto business services.

Foundational concepts underlying the idea of Service-Oriented Business Architecture (SOBA) have been pioneered by IBM's Research Division in its desire to lift service thinking from the IT to the business domain [2]. A motivating factor for introducing a distinctive Service Science research discipline was IBM's own successful transformation of hardware manufacturer into service business. Service

Science has grown into an interdisciplinary academic initiative called Service Science, Management and Engineering (SSME) [3], which studies the service systems resulting from the ‘servitisation’ of business and society in general.

## 2 Research Objectives and Questions

The goal of the research project is to design a method for developing business architectures that are service-oriented. SOBA is a new concept that still has to be explored in-depth and further defined. Therefore our research is problem-centered [4]. The first two (groups of) research questions (RQ) aim at clarifying and analyzing the principles and characteristics of SOBA. The answer to these questions will provide a list of design criteria for the intended SOBA method, whose development and testing is the subject of the third RQ.

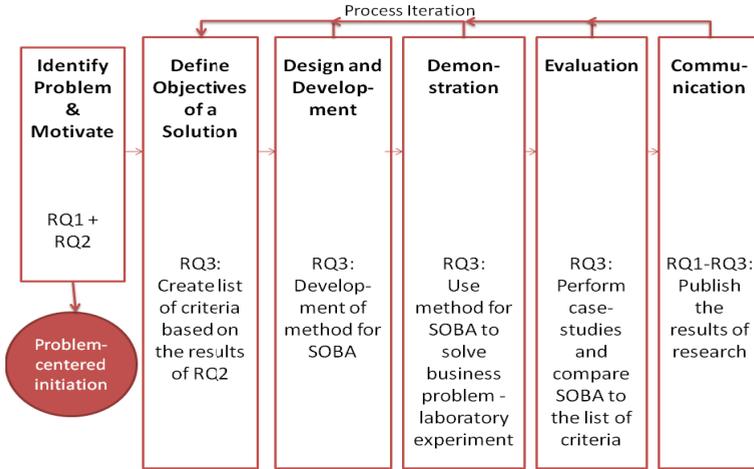
**RQ1.** The idea of SOBA originates in SOA and thus is an IT perspective on business architecture where architectural principles that work well for the IT domain are transferred to the business domain. What remains to be investigated is what service-orientation for business really means and how this service-orientation is or should be reflected in the way a business organizes itself (i.e., its business architecture). Foundational concepts of service-orientation are getting shape in the new discipline of SSME. RQs addressed by our research are: To what extent are these foundational concepts based on various business/management conceptual frameworks and theories of service? Can the relationships between these foundational concepts be uncovered by analyzing their mapping onto the concepts from these service theories? Can the concepts be integrated in a service system conceptualization or ontology?

**RQ2.** The result of RQ1 is a theory-based conceptual model that needs to be applied to architectural ideas for business. To this end, we need to get a better view on what service-orientation means in the context of business architectures. Starting from current SOBA literature and the developed service system model, we will investigate real business architectures and assess their service-orientation. RQs in this group are: Do companies that communicate to be service-oriented extend this service-orientation to the processes and structures within the company? Is service-orientation on the outside (i.e., towards the customer) always paired with service-orientation on the inside (i.e., the internal organization of the business)? How can service-orientation at the inside be characterized? Can a degree of service-orientation be defined and measured? Are there opportunities to improve the degree of service-orientation?

**RQ3.** RQ1 leads to a number of theoretical insights about the foundational concepts of a service system. RQ2 will provide us with empirical insights on how to model business architectures as service systems. It also allows assessing the difference between real-life practice and research on SOBA. This brings us to a third group of research questions: Can the knowledge of the problem domain gained from RQ2 be formalized into a list of design criteria for a service-oriented business architecture development method? Can such a method be designed? Will such a method improve the degree of service-orientation of business architectures?

### 3 Methodology

To achieve the research objectives, a Design Science approach will be taken, which is an accepted research methodology in the field of Information Management (see e.g. [5]). The primary Design Science artifact intended by our research is a method. To achieve this objective, a proper scientific approach will be taken based on the methodological guidance provided by Peffers et.al. [4]. Figure 1 shows which steps should be conducted in this Design Science research.



**Fig. 1.** Design Science Research Model: Process model (Source: [4])

First, the research problem should be identified and motivated. The research required for RQ1 has been completed and is discussed in section 6. The approach to solve RQ2 is twofold. On the one hand, a thorough literature study will be performed. The goal is to examine if and how service-orientation on the inside of companies can be realized as described in literature. Therefore we will analyse both EA literature as service management literature. On the other hand, we will execute interviews with domain experts in companies. For these interviews we will compose a questionnaire based on problems, challenges, and other findings of the literature study. The interviews will provide us with primary data that will give insight in the state of the practice of implementing SOBA.

Second, the objectives of the solution should be defined in RQ3. Therefore we will compose a list of design criteria based on the results of RQ2. These criteria will help to design and evaluate an EA method for business architecture development that can be used for implementing SOBA.

Third, to further tackle RQ3, we can start from an existing EA method, preferably a method with sufficient modeling support – at this moment TOGAF in combination with the ArchiMate EA modeling language seems to be the most likely candidate. Usually EA methods are used for the joint development of an application, IT and

business architecture. The part of the method that focuses on business architecture development will first be evaluated against our design criteria. Next we try to improve the service-orientation of business architecture development by mapping the conceptual model of RQ1 onto the constructs used by the EA method for business architecture modeling and changing or enhancing the EA method accordingly such that business architectures can be modeled as service systems. These changes should provide a better answer to the needs, problems and challenges defined based on the literature study and expert interviews from RQ2. A final step in the design process is to define the relationships between the concepts, structures and laws of the new (or transformed) business architectural model and those of the other architectural models prescribed by the EA method. The aim of this step would be to ensure that the changed/enhanced business architectural model still integrates with the application and IT architectural models, in particular when these are based on SOA principles.

Fourth, demonstration and evaluation of the new method will take place in two phases. First a laboratory experiment will be set up with a group of Information Management students. This experiment will demonstrate how the method can be used and will provide us with some feedback which can be used to evaluate and improve the method. The improved method will next be used in case-studies in companies, preferably companies that participated in the expert interviews. The case-study findings will hopefully prove the advantages of the developed method in terms of improved service-orientation of business architectures (or service-orientation at the inside) and resulting effects on service-orientation at the outside. We aim at a qualitative assessment of the new method.

## 4 Research Plan

Work Package	Research Activity	X = 01/09/2010
1.1	RQ1: Literature study of SSME and business/management theories of service. Development of conceptual model of service system	$X + 0 - X + 8$
1.2	RQ2: Literature study on SOBA and EA. Preparing conduct of field studies	$X + 8 - X + 14$
1.3	RQ2: Field studies - Observation of (service-oriented) business architecture in practice	$X + 14 - X + 18$
2.1	RQ3: Develop design criteria for SOBA method	$X + 18 - X + 20$
2.2	RQ3: Design, development and demonstration (pilot testing) of SOBA method	$X + 20 - X + 32$
3.1	RQ3: Evaluation of SOBA method (case studies and/or laboratory experiments)	$X + 36 - X + 42$
3.2	RQ1-3: Communication of research results and finalize/defend PhD dissertation	$X + 42 - X + 48$

## 5 Innovative Aspects and Scientific Contributions

The first scientific contribution is one to the new SSME discipline. The emerging theories that account for ‘servitisation’ and explain the dynamics of service systems have not yet been formalized in ontologies that can be used for modeling and simulating service systems [6]. The first work package in which RQ1 is analyzed can be viewed as a first step towards a service system ontology for service science. Furthermore, the results will also be used as a theoretical foundation for the design of a method for the development of service-oriented business architectures.

The second contribution is the additional knowledge of EA and more specifically of SOBA. The results of this PhD research will originate both from theory as from practice. First, an elaborate literature study on the service-orientation of business architectures and the confrontation of the results of this study with actual practice (RQ2) will enable researchers to better understand business as service systems. Second, the results of RQ3 will help companies to ensure that their outward service-oriented focus is mirrored in the activities and processes within the company. The research therefore contributes to the EA domain as well as to SSME (calling specifically for modeling and simulation tools for service systems [7]).

## 6 Preliminary Results

The results of RQ1 were summarized in a first conference paper which is accepted at the ICSOC 2011 conference.<sup>1</sup> In this paper we clarify the service systems worldview proposed by Service Science researchers Spohrer and Kwan [8] by investigating its foundational concepts from the perspective of established service theories and frameworks. By mapping the proposed service system concepts on the selected service theories and frameworks, we investigated their theoretical foundations, examined their proposed definitions and possible conflicting interpretations, discovered their likely relationships and general structure, and identified a number of issues that need further discussion and elaboration. This conceptual analysis resulted in a conceptual model which is shown in figure 2.

Our research points out that more or less all of the foundational concepts and their proposed specialisations are covered by one, many or in some cases even all reviewed service theories or frameworks. We identified a couple of issues that need further discussion and elaboration, e.g., because of conflicting views when mapping foundational concepts to the concepts of different service theories. Overall, however, our analysis shows that there is evidence of theoretical support for the proposed service systems worldview. All service theories and frameworks provide information on how the different service concepts are related to each other. Based on this knowledge we have drawn the relationships in the conceptual model represented in figure 2.

---

<sup>1</sup> Elisah Lemey and Geert Poels: Towards a Service System Ontology for Service Science. Full paper accepted for the 9th International Conference on Service Oriented Computing (ICSOC 2011), Paphos, Cyprus, 5-8 December 2011.

The conceptual model developed in this paper can be used as a basis for the further formalisation of the service systems worldview into a service systems ontology. The availability of a consensually agreed ontology could take Service Science a big step forwards as the integrative nature of the research intended by this interdisciplinary field requires a common ground to succeed.

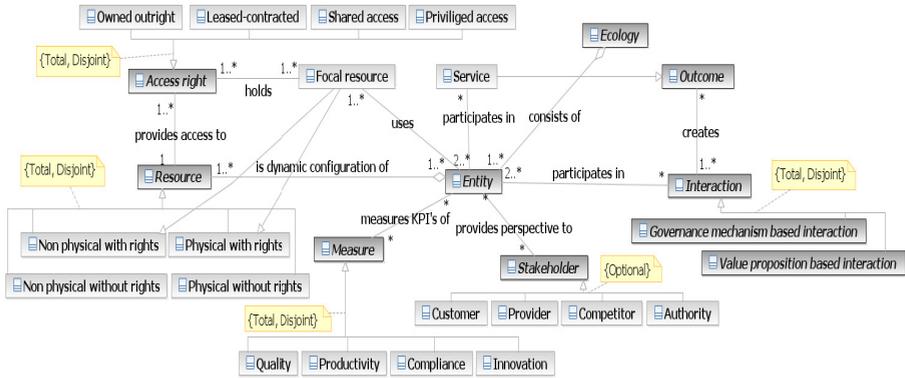


Fig. 2. Conceptual model of service systems worldview (UML Class diagram)

## References

- Cherbakov, L., Galambos, G., Harishankar, R., Kalyana, S., Rackham, G.: Impact of service orientation at the business level. *IBM Systems Journal* 44, 653–668 (2005)
- Walker, L.: IBM business transformation enabled by service-oriented architecture. *IBM Systems Journal* 46, 651–667 (2007)
- Spohrer, J., Maglio, P.P., Bailey, J., Gruhl, D.: Steps toward a science of service systems. *Computer* 40, 71–77 (2007)
- Peffer, K., Tuunanen, T., Rothenberger, M.A., Chatterjee, S.: A design science research methodology for information systems research. *Journal of Management Information Systems* 24, 45–77 (2007)
- Hevner, A.R., March, S.T., Park, J., Ram, S.: Design science in information systems research. *Mis Quarterly* 28, 75–105 (2004)
- Wild, P.J.: A systemic framework for supporting cross-disciplinary efforts in services research. *CIRP Journal of Manufacturing Science and Technology* (2010)
- IfM, IBM: Succeeding through service innovation: a service perspective for education, research, business and government. University of Cambridge Institute for Manufacturing, Cambridge (2008)
- Spohrer, J., Kwan, S.K.: Service Science, Management, Engineering, and Design (SSMED): An Emerging Discipline-Outline & References. *International Journal of Information Systems in the Service Sector (IJISSS)* 1, 1–31 (2009)