SERVICE-ORIENTED ARCHITECTURE PARADIGM: MAJOR TREND OR HYPE FOR THE GERMAN BANKING INDUSTRY?

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Abstract

Although Service-orientation is based on known concepts like autonomy and loose coupling of software components, the standardization of Web Service technologies has led to a rising adaptation of service-orientation in the research community as well as in the software industry over the past years. While Service-oriented architectures (SOA) are widely accepted as a new enterprise systems architecture paradigm, the current impact of the SOA paradigm on certain industries (including the German Banking Industry) has not been surveyed yet in detail. This paper describes a survey we conducted among business/IT architects from Germany's 1020 largest banks. The subject of this survey was to identify if SOA is regarded as a major trend or as hype. Thus, we propose nine hypotheses from three areas regarding the impact of SOA on the German Banking Industry which are the foundation for the questionnaire used in the survey. Furthermore, we present intermediary results from our survey and briefly present preliminary conclusions from the available data.

Keywords: Service-oriented architecture, German Banking Industry, Service-oriented collaboration, IT value creation

Introduction

The Service-oriented architecture (SOA) paradigm is widely accepted in the research community as a new enterprise systems architecture paradigm and many activities are applied to this field of research (e.g., Papazoglou et al. 2006). Furthermore, software vendors like IBM and SAP adopt service-oriented technologies in their products. Quotes like

> *"By 2008, SOA will be a prevailing software engineering practice, ending the 40-year domination of monolithic software architecture (0.7 probability)."* (Natis 2003)

push the hype around the SOA paradigm. Even though analysts announce that SOA is regarded to be the most efficient software architecture in order to consolidate enterprise systems architectures, the adaptation of SOA is only slowly growing (Experton Group 2007).

In this paper, we present a survey we conducted among business/IT architects from Germany's 1020 largest (w/r to balance sheet) banks. The subject of this survey was to assess the impact of SOA on the German banking industry in order to identify if SOA is regarded as major trend or hype. Because of our work in different projects in the banking industry, we are espe-

cially interested in this industry. However, due to the dynamic changes in the German banking industry, the results can be transferred to industries with a similar fast-paced business environment

To the best of our knowledge, this survey is the first to investigate the impact of SOA on the German banking industry in detail. Nevertheless, there are surveys that resemble our survey in parts. So far, the most similar study has been conducted by ibi research at the University of Regensburg, Germany. ibi research has interviewed almost 30 IT architecture experts from German credit institutions and consulting agencies about SOA and financial service providers (Koch and Rill 2005). The main difference to our study is the used approach (questionnaire based survey instead of interviews). Besides, ibi research focused on the biggest banks in Germany (i.e., mostly banks from the Top 20 w/r to balance sheet) while we invited representatives from all three pillars (i.e., public banks, mutual saving banks and big banks) of the German banking industry to participate in our study. As regards the content of the studies, we asked more questions about IT architectures in general and added questions about Service-oriented collaboration.

Furthermore, there are different SOA surveys like (Infoworld 2005) (Gartner Group 2007) that investigate aspects of SOA among other topics. Our survey can be distinguished from the mentioned surveys by its approach, scope, and/or target audience. Our study addresses the integrative character of SOA in companies. In addition, we focus on contributions of SOA on outsourcing and on Service-oriented collaboration.

The remaining part of this paper is structured as follows. In the next section, basics and common benefits of SOA are introduced. Based upon these observations, we develop nine hypotheses from three areas in the successive section. In the fourth section, the used methodology is described. Following this, we present some intermediary results. The paper closes with a short summary of the findings of this paper and an outlook on our future work.

Basics

Even though many SOA projects are realized with Web Service technologies, there is a great difference between the actual implementation of a SOA with a certain technology (i.e., Web Services) and the underlying concepts that constitute the SOA paradigm. SOA is not a technology but a holistic approach to implement an enterprise systems architecture. Furthermore, SOA has an impact on the business level. In order to accomplish the potential benefits of a SOA, it should be recognized that apart from adapting service-oriented technologies it is necessary to regard the effects on the business level as well.

According to Channabasavaiah et al. (2003), a SOA is "*an application architecture within which all functions are defined as independent services with well-defined invokable interfaces which can be called in defined sequences to form business processes*". This definition addresses the architectural part of the SOA paradigm: First of all, all functions (e.g., business functions or technical infrastructure functions) are defined as services. Secondly, all services are independent and can be used without paying regard to the actual service implementation. Thirdly, services can be accessed by an invokable interface without further knowledge where the service is located.

Even though all functions are defined as services, the focus of a SOA is more on the functional infrastructure and its business services and less on the infrastructure and its technical services. In particular, business-oriented services are usually used to map exactly one (major) aspect of the business (Krafzig et al. 2004). If using business services to map (parts of) business processes, it is possible to make a company's processes available to new users (i.e., software systems or human beings), replace certain business functions, reorganize processes, or build completely new business processes from existing services.

These characteristics of SOA lead to its biggest advantage over other IT architectures: With SOA, it is possible to build highly agile software architectures which are able to support the business faster and more flexible. The adaptation and active application of service-oriented technologies is the foundation for the transformation of a company's business model (e.g. by realizing new outsourcing strategies) (Krafzig et al. 2004).

Hypotheses development

In the following we will introduce nine hypotheses regarding the impact of SOA on the banking industry. Even though our survey aims at the 1020 largest German banks, the hypotheses are applicable to similar industries as well. Therefore, we will keep the following propositions mostly generic instead of specifying the statements to the banking industry.

We identified three major areas where SOA might have an impact on companies:

1. Long-term changes in business behavior
2. Short-term impact
3. Cost reductions

The first area concerns the long-term impact of SOA on the business, more precisely on:

- Competitiveness in general and continuous growth
  Innovation
- Flexible and agile business processes
- Departments that will be affected by SOA

The short-term impact of SOA regards the need for companies and software developers to deal with SOA today:

- Need for action in companies that might adopt a SOA in the future
- System development

Cost reduction has several impacts on companies, which should be observed individually:

- Outsourcing
- Protection of investments
- Cost savings in general

Based on the identified subjects, we developed nine hypotheses, which will be introduced in the following subsections.

Long-term changes in business behaviour

Enterprises need to be flexible in order to stay competitive and achieve continuing growth. If changes in the business strategy or in particular products and services cannot be adopted fast enough by the given enterprise systems architecture, a loss in market share and profits is possible. Services have to be changed, composed and resolved permanently in order to meet customers' needs and keep up with competitors (Orriens and Yang 2005). This is especially the case if the enterprise is acting in a fast pace business environment like the banking industry.

One of the biggest issues of today's enterprise systems architectures is the lack of alignment between IT and business (e.g., Luftman et al. 1999). Reich and Benbasat (2003) define alignment "*as the degree to which the information technology mission, objectives, and plans support and are supported by the business mission, objectives and plans.*"

To achieve the goal of Business-IT alignment, several authors have proposed the use of Service-oriented (enterprise) architectures because of the ability of services to be adapted quickly to new business factors (e.g., Steen et al. 2005). As Business-IT alignment is a key success factors for organizations, a SOA could be of high value for a company. In this context, we hypothesize that a company has to adopt a SOA in order to achieve high competitiveness and continuing growth.

H1: A company has to adopt a SOA if it wants to stay competitive and achieve continuing growth.

Particular with regard to innovation, speed and flexibility are crucial for a company. If a new product should be delivered to the customer with little time to market or if the business processes of a company should be changed, the IT systems have to reflect the desired changes in the company's structures. Unfortunately, today's enterprise application systems are often not able to fulfil these requirements and become a bottleneck for the company's further development. A SOA is able to reduce this bottleneck as workflows/processes can be mapped directly to services (Erl 2005).

Going one step further, Woods and Mattern (2006) argue that IT will change its role from managing the complexity and innovation of technology to managing the complexity and promote innovation of business processes. E.g., this could be done by composing new products out of existing services. Apart from technological issues, the whole organization and its business model will have to be transformed to accomplish these goals (IBM 2006).

As it was stated before, the SOA paradigm cannot be reduced to a certain technology but is a holistic approach to an enterprise systems architecture. Hence, the implementation of service-based IT systems will not necessarily lead to innovation if the non-IT capabilities are not utilized. Regarding all these aspects, we propose our second hypothesis:

H2: The active adaptation and use of a SOA enforces innovation in a company's processes and products.

According to Aguilar-Savén (2004), understanding the business processes of an organization is the first step to build a successful (IT) system. In past years, activities and approaches regarding business processes have been summarized under the term Business Process Management (BPM). BPM is a miscellaneous management topic that focuses on the strategic as well as on the operational aspects of process orientation in a given business area or domain. Using BPM, business processes are mapped onto BPM models which in turn have to be mapped onto an IT landscape (Krafzig et al. 2004).

The SOA paradigm allows the representation of BPM models through the coordinated composition of business-centric services and is therefore suitable to manage flexible and agile business processes (Erl 2005). Basic services (core business logic) and process-oriented services (actual business process logic – most likely implemented by a BPM engine) provided by a SOA is the backend functionality needed by a BPM system to implement the desired process functionality (Krafzig et al. 2004).

Combining these aspects with the ability of SOA to reduce the complexity of an enterprise systems architecture contributes to our third hypothesis:

H3: Flexible and agile business processes are only possible if a SOA is adopted.

Even though SOA is a paradigm which is mostly used on the IT level, SOA is not limited to the IT perspective. If applying SOA as the company's enterprise systems architecture, the architecture is tightly coupled with the company's internal organization, processes, and business model (Krafzig et al. 2004). Hence, a SOA has to deal with large numbers of different requirements, including the business process flow and business events.

To design SOA components it is necessary to identify and understand the business components of an enterprise (Cherbakov et al. 2005). Thus, the IT perspective of SOA is strongly related to the business side. But on the other hand, there is also a strong relationship between the business side and SOA. As we have mentioned before, SOA enhances the agility and flexibility of companies, making it possible to offer new products and services and reducing time to market (cp. H2). It is possible that the business side has to adapt itself in order to enable the potentials offered by service-oriented technologies (Woods and Mattern 2006). Regarding this, we propose the hypothesis that service-orientation is not limited to the IT department:

H4: The SOA paradigm is a holistic approach not limited to the IT or business level.

Short-term impact of the SOA paradigm

A need for action regarding SOA can arise from different circumstances. According to the Experton Group (2007), Germany's IT decision makers consider the elimination of heterogeneity as one of the most essential means to achieve improvements in the IT landscapes of their companies; SOA is deemed the most efficient approach to accomplish this target.

The adaptation of the SOA paradigm is most likely the result of a huge number of small steps instead of a "big-bang" replacement of the existing system architecture. Different aspects have to be taken into account if adopting service-oriented technologies for the first time. As the SOA paradigm affects the business at different levels, a company has to fulfil various prerequisites in order to adopt a SOA. This includes the ability to convert legacy systems, non-functional requirement capabilities, and an organizational structure that is capable to enforce the evolution of the enterprise (Bieberstein et al. 2005). All this prerequisites have to be tested prior to the actual implementation of the new enterprise systems architecture, making it necessary to start the tests early.

Summarized, the need for action regarding SOA arises from different reasons, e.g., the decrease of heterogeneity in existing IT landscapes. In most cases the adaptation of service-orientation is a process of long range and huge impact on the organization; hence the planning has to start as soon as possible. With our fifth hypothesis, we want to show that companies already have a need for action regarding SOA:

H5: Companies have a need for action regarding SOA.

The mentioned attributes and benefits of SOA reveal that SOA might have a big impact on Business-IT Alignment and Business Process Management. Especially companies that offer software in these domains will have to consider service-oriented

technologies in future developments. Software vendors like SAP, IBM and Oracle have already started SOA initiatives or are members of SOA collaborations (e.g., Open SOA Collaboration: www.osoa.org).

Furthermore, if SOA will become the new architecture standard for enterprise systems architectures, organizations that provide custom software will have to adapt to service-oriented technologies. According to Maron and Pavlik (2006), the adaptation of SOA will signal a shift in the external facing aspects of application design as the exchange of self-describing XML documents lifts the network interface of business functions in SOA to a higher level than in traditional distributed software systems. Because of the modularization of business services, development efforts will focus on the exchange of information. With our sixth hypothesis, we want to show that the SOA paradigm will have an impact on the development of custom software and on standard enterprise software:

H6: The SOA paradigm will have an impact both on the development of custom software and standard software.

Cost reductions

The impact of SOA on future outsourcing activities arises from different aspects. First of all, service-orientation facilitates the outsourcing of whole business processes or discrete services as SOA encapsulates business services. Using a common business process language like BPEL, it is possible to join and disjoin services to and from processes. Instead of outsourcing a service to a special partner, the usage of a service repository like UDDI enables the flexible selection of service implementations (Berbner et al. 2005). In scenarios where this approach is applicable, the need for long-time outsourcing contracts decreases.

Additionally, outsourced processes need to be integrated into the IT ecosystem of the outsourcing company. If this company operates a SOA, it is crucial for the contractor to make their software available via service interfaces. Apart from these reasons why SOA might have an impact on future outsourcing activities, the same reasons that are relevant for software development (cp. H6) apply to outsourcing as well. Our seventh hypothesis claims that the mentioned factors cause service-orientation to be a critical success factor for future outsourcing activities:

H7: Service-orientation is a critical success factor for future outsourcing activities.

Even though the adaptation of the SOA paradigm introduces a new system architecture into an enterprise application landscape, it is not necessary to replace legacy systems. Quite contrary, by encapsulating existing functions or systems, it is possible to use these systems in new IT environments. In addition, services uncouple implementation and functionality, making it possible to apply services in different domains without adjustments (Erl 2005). If generally accepted standards for the implementation and description of services are used, it is possible to employ services long-term even if new systems are established in the company's IT ecosystem. Thus, we hypothesize that a SOA offers the protection of investments in systems and software components:

H8: SOA offers the protection of investments.

Apart from expanding to new markets (both geographically and by offering new products and services), cost reduction by introducing new technologies and skills is the main driver for competition (Hodgson 2003). Thus, a company has to expand to new markets or reduce costs if it wants to stay competitive. As we proposed in H2, SOA is a means to achieve innovation in a company's processes and products, but furthermore it is possible to reduce costs with SOA.

In the introduction phase, the implementation of a SOA will generate costs as new software has to be acquired, staff members have to be trained and services have to be implemented, i.e. by refactoring legacy systems (cp. H8), or purchasing and implementing services (Perepletchikov et al. 2005). On the other hand, SOA can help to reduce costs medium to long-term both at the business and the IT level. Major reasons at the business level are the easier recomposition and reuse of business services and processes and improved financial reporting. At the IT level, easier implementation and deployment of new software, easier maintenance of existing systems and the further use of legacy systems will lead to reduced costs (Krafzig et al. 2004). With our last hypotheses, we want to ask if the adaptation of service-oriented technologies will generate overall cost reductions:

H9: The adaptation of service-oriented technologies leads to cost reductions.

Even though our nine hypotheses show a number of potential benefits of SOA, it should be noted that the adaptation of the SOA paradigm implies some possible drawbacks as well. First of all, establishing a new IT architecture paradigm will generate costs which have to be refunded by its future benefits. So far, there are only a few large SOA projects in the banking in-

dustry (e.g., by Credit Suisse), making it more difficult to estimate the return on investment of such projects. Secondly, from a technological perspective, the adaptation of service-oriented technologies adds an additional layer to an enterprise systems architecture. This additional layer has to be integrated and maintained and will most likely lead to extra administrative efforts.

Methodology

This study employs an enquiry of primary data in the form of an online questionnaire. In 2006, invitations to participate in the survey were mailed to chief IT/business architects of Germany's 1020 largest banks, leading to a response rate of 5,2%. The group of participants included CIOs, CTOs, chief software architects, and enterprise software architects of the participating banks.

In the following subsections, we will briefly introduce the major topics of our survey and its actual realization.

Major topics

The questionnaire is grouped into the following sections:

1. Introducing questions
2. IT architectures
3. Service-oriented architectures
4. Service-orientation and Service-oriented collaboration
5. Process-orientation and Business-IT Alignment
6. Operating figures
7. Closing questions

The first section measures the knowledge of the participant about certain service-oriented concepts. Section 2-5 address different questions from the concerning subjects. The last two sections cover company-specific questions.

Realization

Based on the classification for marketing research design by Malhotra (1996), we characterize the design of our study as follows:

- Conclusive
- quantitative
- descriptive and
- single-cross-selectional design.

To measure the level of agreement with a statement, we use "non-comparative scales" (e.g., Likert Scale).

Intermediary results

The survey introduced in this paper has recently finished. As the data analysis is still in progress, we will present the final results of our study in a future publication. Anyhow, we want to present some intermediary results of our study in this paper. In the following subsections, we will present outcomes of two different questions from our survey.
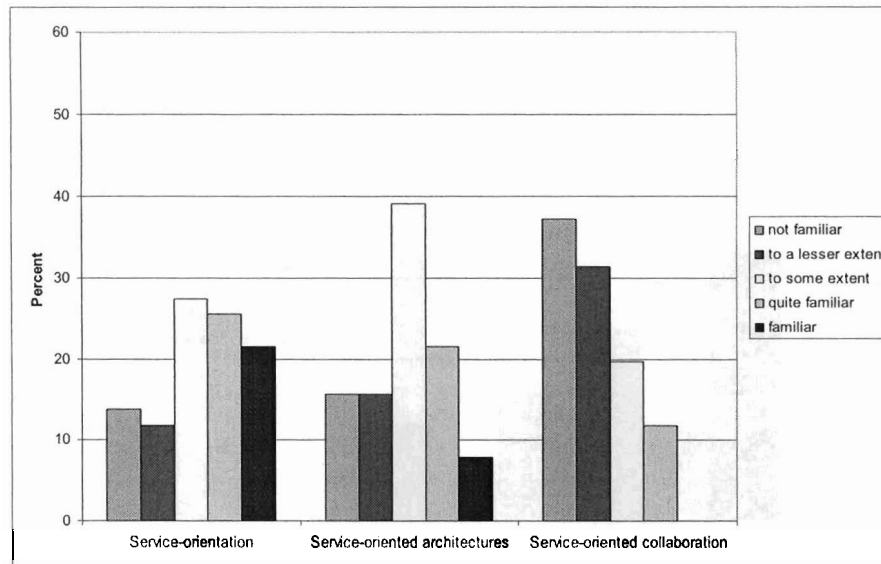
Are software architects in the German banking industry familiar with service-oriented concepts?

Figure 1. To what extent are you familiar with the following concepts?

In this question, we asked the participant to estimate to what degree they are familiar with the concepts/terms "service-orientation", "Service-oriented architectures" and "Service-oriented collaboration". The participants were provided with the following definitions of the three concepts:

- *Service-orientation* describes the mapping of a company's business processes on services. Processes can be composed from distinct services. The coupling between these services is loose, i.e., service compositions can be resolved and changed easily.
- A *Service-oriented architecture (SOA)* is an architecture which utilizes services as building blocks. SOA provides the implementation of service-orientation in a company. A fundamental aspect of a SOA is the selection of a suitable IT architecture to present the service-orientation. Services within such an IT architecture can be implemented with a multitude of technologies, including XML or Web Services.
- *Service-oriented collaboration:* Based upon active service-orientation, it is possible to simplify the cooperation between companies or departments. Thereby, service attributes like the definition of given functionalities or loose coupling are utilized. One specification of Service-oriented collaboration is the outsourcing of single services.

As it can be seen in Figure 1, almost 75% of the participants are to some extent familiar with the concept "service-orientation", about 47% are even quite familiar or familiar with this concept. Examining the results for the concept "Service-oriented architectures", the figures are just a little bit lower, with nearly 69% of the participants being familiar with this concept to some extent. Nearly 30% are quite familiar or familiar with the concept "Service-oriented architectures".

Asked for "Service-oriented collaboration", only 31% were familiar to some extent with this concept. The percentage of participants who are quite familiar or familiar with this concept is less than 12%.

Do you have plans to implement a SOA or do you have already implemented a SOA?

In this question, we wanted to know if the participating banks consider an adaptation of a SOA interesting or if they are already planning or performing a SOA implementation. Six answers were possible: With the first answer, the participants could specify that the SOA concept is not interesting at all for their company. The second answer addresses that a SOA *implementation* is not interesting (even though the participant specified earlier, that the SOA *concept* is at least interesting for the company). With the remaining answers, the participant could state that a SOA implementation is interesting, planned, in progress or finished.

The results of this question can be observed in Figure 2. On the one hand, one third of those surveyed stated that the SOA concept is not interesting at all for their companies, but on the other hand, more than 31% of the examined companies are

planning an implementation, the implementation is in progress or already finished. Further 23% deem a SOA implementation as interesting.
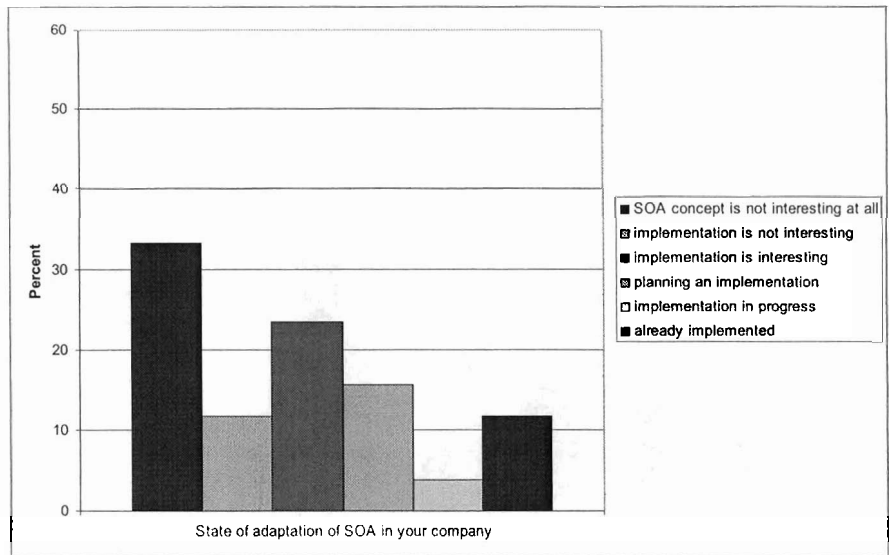

Figure 2. Do you have plans to implement a SOA or do you have already implemented a SOA?

Conclusions

Our intermediary results show that service-orientation and SOA are well-known and regarded in the German banking industry. Almost 75% of the participants are to some extent familiar with the concept of service-orientation, nearly 69% are familiar to some extent with the SOA concept. However, the concept of Service-oriented collaboration is only known to 31% of those surveyed. The question regarding the implementation status shows that almost one third of the participating banks plan a SOA implementation, currently perform an implementation or have already implemented a SOA.

Thus, the results provide an indication that the subject SOA is more than just hype for the German banking industry. Regarding the high percentage of banks currently active in this area, the question from the title of this paper should most likely be answered with "Yes" – the SOA paradigm has got an impact on the German banking industry. Nevertheless, it should be noted that these results are only provisional. In our future work, which we will present in the final section of this paper, we will examine the results of our survey more precisely.

Summary and future work

In this paper, we introduced a survey we conducted among business/IT architects from Germany's 1020 largest banks. The subject of this survey was to identify if SOA is regarded as a major trend or as hype. Thus, we proposed nine hypotheses from the areas "long-term changes in business behavior", "short-term impact" and "cost reductions" – all areas referred to the impact of SOA on Germany's banking industry. The hypotheses constituted the foundation for the questionnaire used in the survey.

Based on intermediary results, we interpreted that SOA is a well-known and regarded topic in the German banking industry with a certain impact on this industry. Even though the intermediary results lead to some interesting results, the final analysis of our data is still in progress and will be presented in a future publication. We will also compare the results of our study with similar studies like (Koch and Rill 2005).

In order to monitor the future acceptance and adaptation of the SOA paradigm in the German banking industry, we will repeat this study in future years. Because of our work in different projects in the banking industry, we are especially interested in this industry. However, in follow-up executions of this survey, it might be interesting to compare the results with other

industries. Yet, as the German banking industry is a fast-pace industry that has gone through massive changes over the last years, it is possible to transfer the results to other markets which are also highly competitive.

Furthermore, the different views of IT and business departments should be observed in order to analyze which departments push the adaptation of service-orientation. This observation will be conducted by interviewing representatives from the regarded departments.

Acknowledgements

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