Aligning Service Maps - A Methodological Approach from the Financial Industry

Falk Kohlmann
University of Leipzig
Marschnerstrasse 31
04109 Leipzig, Germany
{Kohlmann}@wifa.uni-leipzig.de

Rainer Alt
University of Leipzig
Marschnerstrasse 31
04109 Leipzig, Germany
{rainer.alt}@uni-leipzig.de

Abstract

Service-orientation is commonly recognized as an important enabler for improved efficiency and flexibility of transformation processes in business. The ability to flexibly bundle heterogeneous services in a homogeneous cross-organizational business process is a key requirement. Shared service models may be one approach to overcome the restrictions of existing approaches which are either business process centric or application centric. Nevertheless applying different design approaches increases the risk of the emergence of service-oriented-architectures (SOA) implying heterogeneous service maps. Especially the design of service maps on different layers leads to significant integration efforts in practice. This paper presents an approach how service maps that differ in scope, granularity and design may be integrated. A case of a Swiss bank has been chosen to demonstrate the applicability of the suggested model.

1. Introduction

1.1. Motivation

Service-orientated architecture (SOA) has been in debate for several years as it promises from a technological view the integration of heterogeneous application environments. From a business view it promises a more flexible allocation of business activities, represented as services, among business partners in a value chain. In order to reach the claim of Steen et al. that SOA "provides better handles for architectural alignment and business and IT alignment, in particular" [32], a SOA combining the business and technological perspective may be one solution to the challenges in several industries. Many contributions and discussions focus on either side the design of services as key requirement for implementing any SOA. However no unified approach for service design has been reached yet [24] and the application of different procedure models for service identification and design may lead to different sets of services.

Service maps structure these services along with their relationships and dependencies. Existing approaches suggest top-down [22], bottom-up [26, 36] or meet-in-the-middle [9, 30] strategies, aiming at different granularity levels and solving various integration goals. Hence the risk of the emergence of heterogeneous service maps is increased (cf. figure 1). Standard software providers design specific and fine-granular services (e.g. GetLoanAgreement may represent one service), in order to construct their applications on a modular basis. Concurrently the affiliated banks are (re)designing their functional models by identifying and specifying services on high granularity to serve standardization efforts in business processes and to provide a bank-wide functional reference (e.g. customer rating may be one service).

Hence service maps on different granularity levels are necessary as they solve different objectives: supporting the analysis and design of business models, providing a comprehensive understanding between IT and business or reducing integration costs of applications. Challenges occur when banks implement the applications from these standard software providers and need to integrate their service map with the services offered by the provider (cf. figure 1). As both sides are using different origins, goals and granularities a formalized procedure is needed to integrate and match the different service maps.

But even though SOA is in debate for several years a methodological approach combining business and technological perspective while addressing the integration of service maps on different granularity levels or domains has not been developed yet. Existing frameworks from Zachmann [35] or Capgemini [7] address the Business/IT Alignment, but don’t incorporate the formalized association of service maps with business-oriented services, which are not
described using common ontologies like OWL. This paper proposes a procedure how different service maps may be integrated from a business context.

Another challenge in the financial industry is the business transformation with its inter-organizational business processes. Business transformation is currently expressed in the financial industry by the integration of applications and the networking among companies (business networking). Contrary to other industries such as the automotive industry most European banks developed proprietary applications over the last decades. This resulted in complex, heterogeneous and monolithic application landscapes with numerous proprietary interfaces and an increased total cost of ownership [16]. As stated in several interviews with bank representatives during our research, many banks therefore aim at introducing standardized application architectures which may be maintained on a modular basis from a third party. The bank of the future will not only seek differentiation via an extended service offering but additionally via decreased vertical integration [16]. Therefore many banks are in the process of (re)defining their core competencies [27] and developing new, more networked business models [1, 14]. Examples would be Vontobel, a Swiss private bank expanding their portfolio by offering securities processing or Swissquote which centralizes access to (non electronic) exchanges as a broker. Tapping the potentials of specialization effects in business networks is necessary in order to cope with increased competition, customer expectations and changing markets [14, 16]. The industrialization of the finance industry as well as the emergence and redesign of networks is currently in progress and requires adequate and business aligned application architectures to manage the growing complexity [23]. In Switzerland e.g. three networks emerged, grouped around the software providers for core-banking applications Finnova, Avaloq and RTC (Real-Time-Center), and were initiated by Swiss cantonal banks [1]. Concerning these business transformations the financial industry and the case of one Swiss bank serves to motivate and demonstrate the applicability of the suggested model.

1.2. Methodology and Structure

By elaborating a methodology/architecture this research adopts a design science approach [15] and presents results which have been elaborated in a multilateral, two-year research program that started in summer 2006 focusing on the management of service-oriented networks in the banking industry. The research team consists of academics from two universities as well as practitioners from 18 companies covering the whole banking value chain (e.g. retail and private banks, outsourcing and software providers). The companies contribute to the research following the paradigm of “emphasizing collaboration between researchers and practitioners” ([3], p.95), by playing an active role in biannual steering committee meetings and quarterly workshops to ultimately enhance the development of the envisioned methodology as well as to verify its applicability. Hence the guidelines proposed by Hevner et al. [15] were applied in order to ensure a structured collaboration with the practitioners and an iterative approach developing the artifacts.

This research paper focuses so far on a procedure to integrate two service maps providing a static structure to describe and visualize services on different granularity levels. The activities are exemplified by using an example from the loans entry domain as part of a project at a Swiss bank. The single case study is based upon the recommendations elaborated by Dubé et al. [8] to ensure the rigor in case research. The central research question concerning the case study focuses on the applicability of the procedure to integrate service maps of diverse granularity in a heterogeneous environment. As data source direct observation in combination with structured interviews supplemented by the documentation of the project was used.

The structure of the paper reflects its goals:

- Section 2 provides the theoretical foundation.
- Section 3 presents an approach for linking different service maps varying in scope and granularity.
• Section 4 applies the approach to the financial industry domain using the case study of a Swiss bank.
• Section 5 summarizes the results and provides an outlook.

2. Foundation

2.1. Enterprise Architecture

Existing enterprise architecture (EA) approaches [12] are focusing on processes, objectives and organizational structures and deduce business requirements for systems design lacking in terms of cross-enterprise processes and business networking. EA is aiming at integrating and consolidating different modeling techniques, models and tools already existing in companies ([11], p.13). ANSI/IEEE [17] is defining EA as the organization of a system implying its components, relationships and governance structures. Lankhorst et. al. are broadening this definition by incorporating information systems and infrastructure ([25], 3). EA frameworks provide Meta models, design methods, common vocabulary and reference models. Fischer et al. ([11], p.12) are clarifying the complexity by enumerating various business and IT related artifacts. In summary, most of the EA frameworks differentiate five layers: business architecture, process architecture, integration architecture, software architecture and technology architecture.

2.2. Service-Oriented Architecture

SOA is recognized as an important concept for business transformation and is discussed from a technological and a business perspective. The technical view conceives SOA as a “paradigm that supports modularized exposure of existing application functionality to other applications as services” ([26], p.41). On a broader scope it can be defined as the “policies, practices, frameworks that enable application functionality to be provided and consumed as sets of services published at a granularity relevant to the service consumer” ([31], p.65ff.). Service-orientation from a business view denotes the ability of reusing tasks and processes by solving them at one location ([21], p.236). SOA presents itself as a suitable option for improving the integration of heterogeneous application environments as well as the sourcing of entire or fractional business processes in a business network. The services, core elements of any SOA, are modelled in general by two approaches: technical-driven (bottom-up) and business-driven (top-down) supplemented by a third: meet-in-the-middle. The top-down identification of services is based upon business processes or business events while applying widespread design principles of SOA (e.g. [4, 29]). Bottom-up refers to service modelling based upon the analysis of existing applications and their IS functionality [26] focusing on consolidating and rationalizing access to IS functionality by using services. For a combination of bottom-up and top-down, the term meet-in-the-middle can be used [2, 22].

Since numerous classification schemes for services as part of a SOA have emerged [5, 9, 28] and a consolidated classification scheme is missing (see [10], p.756), this paper differentiates business services, application services and IT services. Business services are described as representation of a specific business activity and transaction. Coexistent the terms process services [5], content and transaction services [28] or task services ([9], p.43ff.) have emerged. Moreover, composed business services combine other usually finer grained business services of logical and functional proximity. The objective is to provide a user oriented perspective in a business model design scenario. Application services are focusing on independently usable and elaborately specified functional components. In practice and theory also the terms integration services [28] or entity services [9] are used. IT services finally represent reusable basic functionalities and are out of scope within this paper as they are not covering domain specific functionalities.

2.3. Service-Orientation and EA

Following Winter et al. the “integration architecture represents the fundamental organization of information system components in the relevant enterprise context” [34]. It provides the foundation for aligning business and IT as aimed by SOA. The integration architecture will be regarded therefore in this paper as the SOA representing the service model or service layer.

As the presented approach is focusing on the integration of business and technological perspectives and substantiating design potentials of network and sourcing models, the ‘Business Engineering Model’ (BE) (see [27]) has been chosen among other layer approaches such as [20] as foundation, providing consistency across three layers: strategy, process and system aiming at the business model, the process model and the IS model. In terms of EA the IS model combines the software and technology architecture. The service model representing the SOA layer can be regarded as intermediate layer covering aspects from the process and the IS model (see figure 2).
3. Towards Integrated Service Architecture

This section outlines a first proposition of a procedure to integrate service maps covering different granularity levels based upon different design methods.

The analysis of different procedures models as presented in [24] indicated on one side the need for an extended hybrid approach taking sourcing models and legal requirements into account while simultaneously linking the used instruments to instruments on other layers such as the network model. On the other side the analysis signified that service maps can vary when different service identification methods are used. Service maps are regarded as instrument to structure services by visualizing them within a specific domain. Furthermore they can be used to exemplify relationships and dependencies. To prevent often suspected complexity especially in cross-boundary value chains and to contribute to the objectives of EA, these different service maps need to be integrated by taking into account that the functionality and interfaces of business services are usually not described in technological concepts such as WSDL. Where the semantics of the services are not expressed using topic maps and ontologies (e.g. OWL) as proposed in several models [33] these approaches can’t be applied. The approaches using ontologies are aiming at dynamic service integration at runtime, whereas the procedure proposed in this paper will be used for integration at design time. Moreover a procedure for integrating industry-specific service maps would contribute to the standardization efforts, e.g. currently made in the financial industry domain.

The proposed procedure, shown in figure 3, consists of four phases covering preparation, analysis, verification and detailing. The differentiation of the four phases follows common classifications (e.g. [2, 22]) and has been verified in workshops and interviews. Part of the preparation phase is the comparison of the underlying elements of the two service maps in order to reach a comprehensive understanding. The comparison is based upon the Meta models of the service maps and result in an assumed linkage. Following Gehlert [13] three types of comparison conflicts can occur: structural, naming and type conflicts. Structural conflicts arise from different levels of abstraction. Naming conflicts represent synonym and homonym terms. Type conflicts occur by using different constructs of the modelling language for the same fact. The type conflict can be resolved automatically based upon manual inputs preliminarily. Furthermore rules as derived in [6] are applied, describing the requirements of the Meta models for a comparison.

One of the regarded service maps is on a high granularity covering business services focusing on the collaboration in business. It can be summarized as a service map with a clear business view representing the service orientation on a business level close to business processes and network model and will be referred to as ‘business service map’. Composed business services, such as rating, transaction checking or booking are providing the highest granularity within such a service map and can be assigned to certain business roles, such as integrator (e.g. in the investment domain it can be compared to a broker, which centralizes access to exchanges like Swissquote in Switzerland), sales bank or back office specialist (e.g. payments processing offered by PostFinance in Switzerland). The second service map covers a finer granularity focusing on application services, still with a focus on domain specific functionalities, e.g. differentiating numerous services to manage a business partner. As the ‘business service map’ is used to substantiate the analysis and design of financial networks, business models and sourcing alternatives, providing therefore a user-oriented view, the second service map focuses on the realisation still being technology independent.

A further step in the preparation is the linkage towards further models such as a network model, describing the different business roles of a network, the process model of the business processes, the as-are or to-be sourcing models as well as an application model exemplifying the active application landscape. Furthermore the service catalogues underlying the two service maps have to be consolidated providing the basis for the integration as well as the linkage between the two service maps. For that reason a scheme of criteria such as functional result, functional requirements, addressed business objects, input and output, organizational responsibility as well as dependencies of the services has to be reached, taking company specific requirements into account.
Based upon the criteria scheme the information for selected business services and application services have to be gathered in the analysis phase using the service specification provided by the service catalogue. Based upon a representative selection of services a comparison can be made in order to reach a first indication how the services are linked (similar to prototyping in the software engineering process). Following this approach, it’s supported to differentiate various service types within the categories business and application service. After allocating the application towards the business services a top-down and bottom-up verification similar to the mentioned service design strategies has to be made in the verification phase. The top-down verification focuses on the consistency from a business point of view, whereas the bottom-up verification concentrates on the technical and implementation aspects. The fourth phase detailing of the proposed procedure seeks to generalize the founded linkage of the two service maps. The application is again followed by a top-down and bottom-up verification in order to verify the generalizability. Subsequently the assumed Meta model connections have to be updated if necessary and documented. Three results are possible:

- a documented linkage between the Meta models
- an unified core representing the intersection of the Meta models
- an unified Meta model

Building a unified service map is an optional step afterwards as interviews with practitioners have indicated that a documented linkage scheme would meet the requirements in practice and an unified service map provides additional efforts if services are changed or further added especially if the service maps are developed by external providers.
4. Application of the Proposed Procedure

4.1. Application at two initiatives

This section focuses on the instantiation of the proposed procedure to a concrete scenario in the finance industry. The procedure will be applied to a service map (see figure 4) from our research program focusing on the support of the design of financial networks, being therefore on a high granularity level. The service map limits to the transaction specific parts of a bank and elides functionalities like human resources, controlling. It exemplifies the composition of business services. These composed business services can directly be associated to a certain business role in a financial network, such as a rating or digitalization specialist substantiating analytic and design approaches for business network redesign. The second service map (see figure 5) represents an approach from the BIAN (Banking Industry Architecture Network) covering also industry specific business functionalities, however on a finer granularity with a very detailed specification as prerequisite for implementation e.g. in a core banking system such as SAP, Finnova or Avaloq. BIAN replaces the IVN (Industry Value Network) for banks.

Figure 4. Service map covering composed business services for the financial industry

Figure 5. Service map covering application services for the financial industry [19]
support for analyzing and optimizing network positions and sourcing relationships. Furthermore it provides an internal linkage between business and IT via application services. Additionally the reduced service map, shown in figure 5, focuses on business functionalities on a finer granular level. The aim is to further enhance standardization efforts in the finance industry by providing standardized domain specific application services, which can be implemented by providers or banks. For its application services the BIAN is using the term service operations. To provide some structure these service operations are linked within sub domains shown in figure 5. The 52 sub domains, shown in figure 5, contain to this date about 120 service operations verified with more than 30 banks involved in the BIAN. As the service map is still in progress it will reach some hundred service operations, such as CreateLoanContract, ManageBusinessPartnerRole, QuoteCreateFXDeal and CheckLegitimatingControl for the finance industry.

Due to space restrictions loans entry was chosen to apply the proposed approach (cf. section 3). Loans entry is represented by one composed business service (see figure 4), which contains 15 business services. Three business services were chosen to exemplify the linkage to the service operations (application services) of the second service map (cf. figure 7).

Before, the Meta model comparison of the two service maps is summarized. First, all the concerted elements were identified and extracted together with the associated parts. Second, the structural and naming conflicts were resolved by analyzing the description of the elements complemented by expert interviews. The semantic differences of the elements were documented as input for the next phases. By that time a first linkage scheme was resolved as a combined Meta model visualizing solely the concerted elements (cf. figure 6). A composed business service consists of several business services. Simultaneously one business service may be implied in several composed business services as they are used for analytical objectives and external offerings (e.g. as in the case of the mentioned private bank Vontobel offering securities execution as composed business service to other banks). The business service uses several application services. The second Meta model covers the term service operation, which “is a semantically coherent set of functionalities provided by a logical IT system to be consumed by other logical IT systems” [18]. The term service operation covers scope and granularity of the term application service in the first Meta model providing the central linkage.

The variation in the abstraction level on the organizational layer between the two Meta models can coexist by supporting the different intentions: analytical support for business network redesign on one side and enhanced standardization to lower integration costs on the other side. The linkage of the two Meta models was documented but did not result in a unified Meta model. Reasons are unnecessary dependencies and long update cycles of a core Meta model in practice. Instead the transformation rules were formalized.

Following the Meta model comparison the service catalogues were harmonized and criteria extracted to describe business services and service operations. Applying the next steps in the proposed procedure the business services were reassembled by a set of service operations. Figure 7 exemplifies the linkage for three business services: authorization, loans data and partner master data. The loans data business service e.g.
incorporates the functionalities provided by the five service operations: Get Loan Agreement, Close Loan Agreement, Change Loan Contract Partner Assignment, Change Organizational Assignment and Change Loan Borrower encapsulated in the business sub domain loan maintenance of the second service map. The business service partner master data covers service operations from three business sub domains with more than ten service operations.

![Figure 7. Application to loans entry domain](image)

A further advantage for both projects is the implicit verification of functional completeness. The integration of the two service maps indicates missing service operations. Simultaneously the business services receive a deepening towards the IS-layer. Especially enterprises from the banking industry participating in both initiatives benefit from the analysis and the formalized procedure.

4.2. Case of a Swiss bank

The proposed procedure has been applied to a Swiss bank, which aims to develop a bank-wide service model. Services are seen as a possibility for cost and complexity reduction, integration of the existing heterogeneous application landscapes, standardization and enhancement of more individual pricing models.

The objective of the project was the development of a service model representing business services and being the basis for the realization of the described functionalities into technical services. The intention of the service model is to ensure a comprehensive understanding between IT and business of the functionalities and to provide a bank-wide reference (blueprint). Furthermore the service model is used as basis for a to-be IT-architecture. Simultaneously the service model facilitates the identification of redundancies in existing applications and processes. Not-used but maintained functions can be identified as well and would lead to cost reduction. It’s seen as an opportunity to increase standardization and to align existing architectures and models.

As the bank has access to both initiatives besides their own service design activities, it was chosen to analyze a possible integration. The characteristics and goals of the project were: to encapsulate all business functionalities in business services; to consider variations in financial instruments and channels; to leverage from the specified business services of the research project and to ensure that the business services can be assembled by the service operations of the BIAN. Following this characteristics and considering the general conditions some challenges appeared (cf. table 1), which were partly covered by the original procedure.

<table>
<thead>
<tr>
<th>Challenges</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incompleteness of the service maps</td>
<td>The definition of the service operations at BIAN is still ongoing and therefore several business functionalities couldn’t be underlined by service operations. The business service map is focusing on the transaction specific services solely by now.</td>
</tr>
<tr>
<td>Terminology</td>
<td>The terminology of the Meta-models of the two service maps had to be linked to the existing Meta-model of the Swiss bank. Therefore the identified concerted elements (cf. figure 6) had to be adjusted to the elements of the Meta-model in the method guidelines of the bank.</td>
</tr>
<tr>
<td>Enhanced Alignment</td>
<td>Besides the integration of the two service maps, an integration and alignment to existing process and business object models was necessary.</td>
</tr>
<tr>
<td>Existing basic service model</td>
<td>A first effort to specify a service model was made previously by the bank, but didn’t match the objectives above as it was focusing on the application-oriented service identification. Therefore, besides the integration of the two service maps (cf. section 4.1) this service map had to be taken into account: alignment of 2 + 1 service maps.</td>
</tr>
</tbody>
</table>

As the service model had to provide business services for all existing functionalities in the bank the business services of the input service map needed to be extended and not solely aligned with the service operations. Therefore the procedure, presented in this paper, was supplemented by a service identification methodology. Subsequent the further identified business services were aligned with the service operations according the proposed procedure. The 90 business services were enhanced and the service model in the Swiss bank reached about 150 business services in total. The described linkage of the Meta-models in section 4.1 could be verified. Simultaneously the
adoption of the proposed procedure could formalize the alignment of the 2 + 1 service maps and resulted in reduced efforts and higher credibility of the service model within the Swiss bank.

The consolidated service catalogue covers among others the criteria: description, process connection, associated service operations, composed business services, ownership, associated applications, aimed service quality.

Table 2 provides some lessons learned from the project. A next step is the anchoring of the described procedure in the Swiss bank as part of their method-knowledge.

<table>
<thead>
<tr>
<th>Table 2: lessons learned in aligning service maps</th>
</tr>
</thead>
<tbody>
<tr>
<td>The unification of the underlying Meta-models eases the matching procedure and reduces efforts.</td>
</tr>
<tr>
<td>The application of broadly discussed and specified services prevents from encapsulating functionalities solely on the basis of as-is processes and/or applications and enhances the development of to-be models.</td>
</tr>
<tr>
<td>The integration procedure can contribute to verify the services itself as well as the completeness of the service map. E.g, a 80% assembling-rate of a business service calculate customer rating by service operations indicates further service operations.</td>
</tr>
<tr>
<td>The establishment of a functional SOA by integrating the two service maps is the basis for the enhancement of the existing business object models and business process landscapes.</td>
</tr>
</tbody>
</table>

5. Summary and Outlook

As Swiss banks aim to redesign their application landscapes for more standardization and modularization in order to fulfill current challenges such as reduced customer loyalty and globalization (cf. section 1), an open architecture with exchangeable business partners is important, but still in its infancy. Currently, sourcing offerings and networks often rely on proprietary interfaces. Though service orientation may be used as an instrument, there is a lack of methodologies of combining and integrating service maps reached by different approaches. Only by providing a consistent service architecture, which even may rely on services standardized by numerous banks and providers, the goal of enhancing flexibility and efficiency can be reached.

Based on existing analysis such as [24], an approach for integrating existing service maps has not been reached yet (cf. section 2). As a holistic approach for service identification is lacking as well, the possibility of dealing with different service maps in-house and from external providers is increasing. Simultaneously increased business networking and value chain decomposition in the financial industry lead to a growing amount of business partners requiring standardized interfaces and exchangeable services. This paper presented a first approach (cf. section 3) how service maps of different granularity levels may be integrated to reach consistent service architecture. The procedure has been applied to a concrete scenario (cf. section 4) based upon a service map covering business services from a research project and a service map covering application services from the BIAN. It has shown how service maps from independent initiatives can be linked in order to increase credibility, verification and therefore standardization. Section 4.2 then related it to the case of a Swiss bank developing a service model by applying the procedure in order to integrate a basic in-house service map with the two service maps analyzed in section 4.1. The bank benefited from services already discussed with numerous practitioners and verified in workshops and interviews.

The formalized procedure is a first step of the research on the way to a more automated integration of service maps covering business services, designed by banks and providers (cf. figure 8).

Further research will focus on the integration of the proposed procedure in existing BPM-platforms to enhance the integration of different service maps/models. A prototype will verify the practicability of such integration. Secondly our research will analyze how standardized business services can be parameterized in order to achieve different variants. These variants would enhance the differentiation of e.g. sales banks without depreciating the benefits of standardized business services.

References