Business-Driven Service Modeling - A Methodological Approach from the Finance Industry

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Abstract: Service-orientation is recognized as an important enabler for increasing the efficiency of transformation processes in business. Improved flexibility is becoming a necessity in many competitive industries when companies are forced to quickly meet dynamic customer needs and when organization concepts are increasingly based on networking with partners. A key requirement for the flexible bundling of individual tasks in business processes are service models that have a clear link to how business is conducted and that are shared within a specific community. However, there is a lack of methodologies for combining technical and business-driven service modeling and aligning it with (business) process management as well as sourcing strategies. For this purpose, this research discusses techniques for service modeling and presents an extended service modeling concept for the business-driven discovery of services. The banking industry which currently is facing profound transformation challenges was chosen to motivate and demonstrate the applicability of the suggested model.

1 Introduction

Following the tradition of object- and component-oriented architecture models, the service-oriented architecture (SOA) concept promises to improve the integration of heterogeneous application environments as well as the sourcing of entire or fractional business processes in a business network by combining individual application components. In many contributions and discussions SOA is attributed a ‘silver bullet’ status to reach these goals. However, SOA primarily is a technological concept which needs adequate integration into the business world. This necessity is recognized by many packaged software providers which have positioned their new SOA platforms in a first step from a technological perspective. It was only in a second phase that many SOA initiatives were also linked to the business processes.

Both goals, the integration of applications and the networking among companies (business networking), are apparent in the financial industry. Contrary to other industries, such as the automotive industry, most European banks developed proprietary applications over the last few decades. Time and cost-consuming modifications of these applications are necessary when regulatory or customer-based requirements are changing. Among the results were complex, heterogeneous and monolithic application landscapes with numerous proprietary interfaces which increased the total cost of ownership dramatically [HRW04]. Therefore, many banks aim at introducing standardized application architectures which may also be maintained by a third party. This links up to the second goal, which is the growing need to reduce vertical integration and the necessity to tap the potential of specialization effects in business networking. Again, other industries such as engineering and manufacturing have introduced networked strategies for some time already. As this industrialization is now occurring in the finance industry, adequate application architectures are required to manage the growing complexity [Kn06].

This paper aims to show how services may be identified and designed to enhance the business flexibility of banks. It argues that SOA and BPM need to be aligned to reach the promises in terms of efficiency and flexibility which both frameworks ultimately can provide. First of all, a process model will be presented for the identification and clustering of business-driven services (cf. Section 3), which extends existing strategies of service-modeling (cf. Section 2). This model will be applied to an investment case from the financial industry in Section 4. The entire development process was conducted in close collaboration with practitioners of Swiss and German banks as well as of providers of core banking solutions such as Avaloq and Finnova in Switzerland and SAP in Germany.

2 Layers of Service-oriented Architectures

Before looking at design principles, criteria and types of services, existing service definitions will be reviewed and a working definition will be provided. According to many existing frameworks, services are contained in a separate layer between business processes and information systems. Finally, existing approaches of service modeling will be compared.

2.1 Design principles and service classification

One of the many different definitions denotes SOA as a “paradigm that supports modularized exposure of existing application functionality to other applications as services” ([Na04], 41). For the definition of services two directions exist. One is technical in nature and features a fine granularity of services (see [FS05]). The other is broader and conceives SOA 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” [SW04, 3]. In the absence of an accepted service definition (see [FS05, 756]), the present paper adopts a working definition where services are independently usable and extensively specified functional components, which support the value performance of process activities. The latter provide a link to BPM which describes the ability of defining, simulating and analyzing business process models by using methods, techniques and software [WAV04], to improve, manage and automate the underlying business processes [Ha06]. Moreover, BPM allows the execution and monitoring of these business processes.

To comply with this service definition, four design principles were derived from prior research ([Ba05], [Fr04] and [Pa03]): interface orientation, interoperability, autonomy and modularity (loose coupling) as well as requirements orientation (business orientation). Additional criteria are the defined service context, reusability as well as defined status before and after a request (see [SW04]). Besides these design principles, services describe a broad spectrum ranging from business to more technological services. In doing so, many authors believe that SOA improves the alignment of IT and business (for instance, services are believed to align business and IT [St05]). To provide some structure to this spectrum, layer approaches were used previously, e.g. the rapid service development by the Telematica institute [JSF02] and the business engineering model (BE) [Ös95]. The latter has been used in this research to structure services along the three layers strategy, process and (information) systems. Services are regarded as an intermediate layer between the process and systems layers, providing the necessary link between business processes and applications.

2.2 Comparison of existing research approaches

As mentioned above, SOA may be defined from a business perspective and a technological perspective. The former describes a business concept which is independent of technological implementations and platforms (see [Ar04] and [KKB07]). The latter focuses on technologies, which establish service-oriented platforms in organizations and which links services to existing application functionality (see [ZLY05], [KSR04] and [Na04]). However, there is no sharp boundary and many approaches cover aspects of both views, e.g. business-driven service-modeling is used to redesign applications (see [QDS04]). Both directions may be used to distinguish a top-down (via process models) and a bottom-up (via applications) approach to identify services.

Flexible orchestration of business processes as described in [LRS02] can be supported from an overall viewpoint by service clusters, which aim at reducing complexity by grouping services. From a business perspective, these service clusters may also be linked to sourcing models which specify a procurement or value chain strategy. Well-known examples are the outsourcing of IT-operations or business functions, such as payroll processing. Service clusters also reflect business cuts, which are necessary preconditions for any SOA. Therefore, business cuts, a domain analysis, and the illustration of services within service maps are further criteria for service modeling. The comparison in Table 1 emphasizes a lack of methodologies, which support an overall approach for service modeling connecting business-driven and technology-driven service modeling (identification and clustering). Also, there is no overall approach including the alignment of the service architecture with the business process model as well as the sourcing strategy.

Approaches / Criteria	ZLY05	Ar04	QDS04	KSR04	Na04	KKB07
Business-driven service identification	□	■	▪	□	▪	■
Technical-driven service identification	■	▪	▪	■	■	□
Examination of service cut	■	▪	□	□	■	▪
Domain analysis	■	■	□	□	■	□
Visualization with service landscapes /	□	□	▪	■	□	□
Service clustering	■	■	□	▪	■	▪
Service specification	□	▪	▪	■	□	▪
Alignment with process model	□	▪	▪	□	▪	■
Alignment with sourcing strategy	□	□	□	□	□	□
Caption: ■ given, ▪ partially fulfilled, □ not given						

Table 1: Existing approaches to service modeling

The generic concept presented in section 3 extends the existing approaches and also combines technical and business viewpoints. Furthermore, sourcing strategies in inter-organizational networks are incorporated in the service identification. As the business-driven view itself can hardly materialize the potentials without establishing a link to the applications below, verification of technical feasibility is necessary. At the same time, a business-driven approach enables legal requirements to be complied with, e.g. access to customer master data in the finance sector. Table 2 provides a short overview of the different phases of the two approaches, which support comprehensive business-driven service modeling as analyzed in Table 1.

Approaches	Ar04	KK07
Phases for service modeling	1. identification 2. specification 3. realization	1. project preparation 2. process based service analysis 3. service categorization

Table 2: Process model of business-driven approaches

3 Methodology for Service Identification and Clustering

This section describes two techniques for deriving and clustering services. As mentioned above, sourcing models are part of business strategy and require business-driven service identification. Although approaches exist to identify services based on business process models, these fail to provide an explicit link towards BPM on the process layer and sourcing models on the strategy layer as well as the combination of identification and clustering which is the basis for business process orchestration. Two four-tier models are shown in Figure 1, one for service identification and the second for clustering the services obtained. The differentiation of the four phases was made based on the classification of existing process models ([Ar04], [KKB07]) as shown in Table 2. In order to verify the granularity of services and to prove the concept presented in this paper, participatory action research is used. The approach via participatory action research allows to "combine theory and practice (…) through change and reflection" [Av99].

3.1 Service identification

During the *preparation phase,* the required models are selected and the area for service identification is identified. There are three compulsory models, first of all, an enterprise model, which describes all existing processes of an enterprise at a high level of granularity. Furthermore, specified business processes within the enterprise model are required. The third mandatory model is a financial network model, covering the area analyzed. The network model with its described roles is necessary in order to assess the service cut.

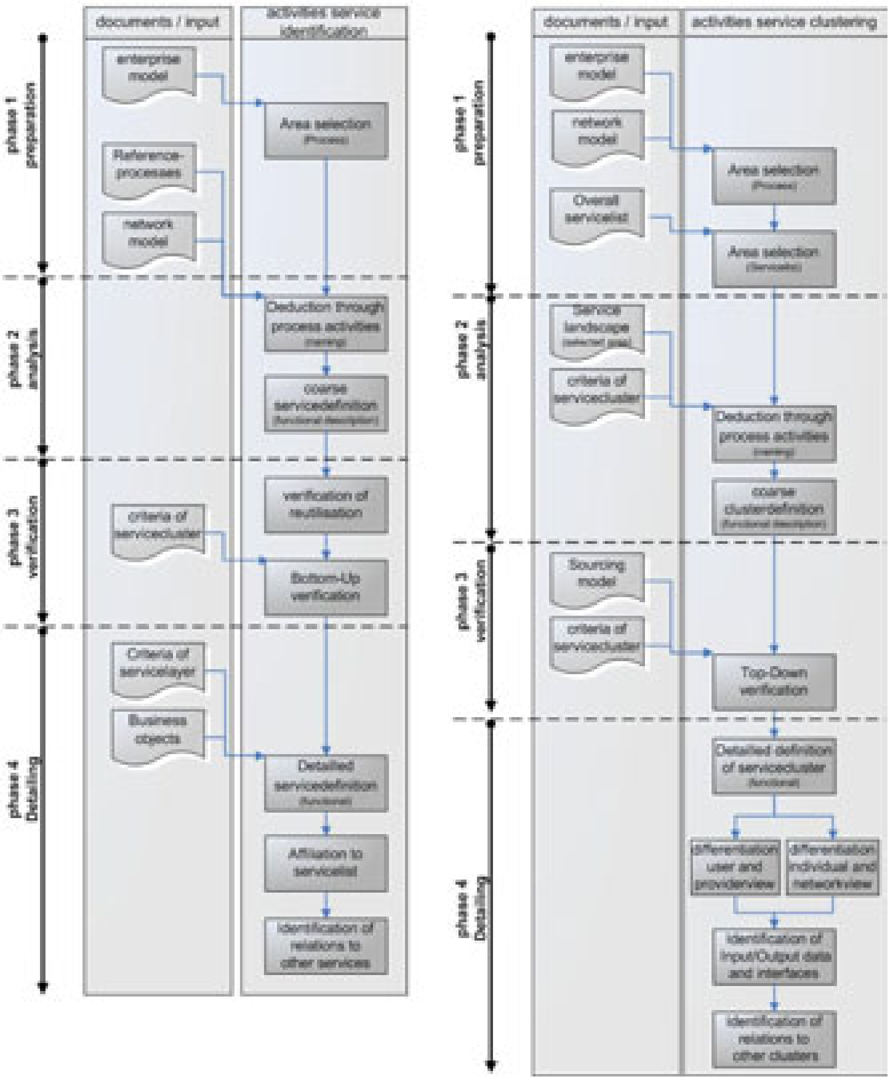

Figure 1: Four-tier process model for service identification and service clustering

After service identification has been selected and the required process and network provided, the *analysis phase* can start. During this second phase, the services are deduced top-down through the activities of the reference process. Besides their roles within the inter-organizational network, it is the service criteria and design principles that are the basis for the analysis. The four design principles introduced in the previous chapter have been chosen, viz. interface orientation, interoperability, loose coupling as well as requirements orientation. Additional service criteria have been extracted, viz. defined service context, part of one of the service layers described above, reusability and defined status before and after a request.

After a service candidate has been identified, the service candidate has to be named in the company's guidelines and its function described to facilitate the verification phase. The *verification phase*, which consists of two steps, analyzes whether the function of the service candidate is already provided by another service. If so, the service can be used and the analysis for the next service candidate started. The second step of the verification phase is an assessment of the service candidate. This is to examine whether the service candidate fulfils the criteria and design principles established and whether the service fits the business needs of the process and its role. It is crucial to ensure that overlapping of functionality is avoided.

The *detailing phase* specifies the service in detail and assigns the candidate to one of three service layers. This layer model is based on prior research (see [AGL05], [Sa05], [Ta05], and [Mi04]) and comprises (1) process services which support activities of the core processes of a company and includes some reference to at least one activity of a business process, (2) rule services which encapsulate business and validation rules used by process services, and (3) entity services which encapsulate core entities and business objects, such as contract, partner or order. Infrastructure services providing services of a fine granularity to support transportation of information at data level are outside the scope of this paper. Criteria are provided for these service layers and specified business objects. Before completing the service identification process the service is affiliated to the service list and necessary relations to other services are specified. Such relations occur, for instance, if the functionality of a process service is supported by a rule service.

3.2 Service clustering

In the *preparation phase,* two of the three models in the service identification process are also compulsory, viz. the enterprise model and the inter-organizational network model. After the area has been selected, an overall service list with all identified and specified services is necessary to provide a structured overview. Accordingly, the service list for this part has to be extracted from the overall service list. Breaking down the overall service list according to the core business processes enhances usability and reduces complexity.

Deduction in the *analysis phase* requires a service landscape showing the relations between the services of the three different layers. Since the clustering approach is bottom-up, design principles of clustering are indispensable as well. Three essential design principles are suggested for service clustering: functional and semantic proximity, high interaction and communication between the services plus autonomy of the cluster itself. Furthermore, legal requirements have to be heeded (e.g. customer master data must remain on the distribution side). After a cluster candidate has been deduced, the candidate has to be named and briefly described in line with the company's or network's guidelines. In the *verification phase*, which is based on a top-down approach, detailed sourcing models are necessary to consider process cuts within these models. The different roles of the inter-organizational network analyzed and its value performance may be used to avoid overlapping of services and to heed legal requirements. Once the cut of the service cluster is approved, the *detailing phase* can start. Otherwise the analysis recommences. After specifying the functionality and value performance of the service cluster in detail, differentiation is necessary between user and provider viewpoints on one hand and individual and network viewpoints on the other hand. These steps are followed by specifying the overall input and output data of the cluster and its interfaces. At the end of this process, relations towards other, already specified, clusters have to be identified and described.

4 Application of Methodology in the Investment Process

4.1 Current challenges and particularities of the finance industry

Though the strategic value of SOA within the banking industry has been discussed before (see [Ba05], [PG03] and [HRW04]), the two main challenges involved in a bank's architecture are application integration and value chain reconfiguration [Ba05]. Application integration is one of the most pressing challenges in Swiss banking: this was manifest in several interviews with Swiss bank officials during our research the reason being that mainframe-based and monolithic systems have been developed for decades [HRW04] and modern banks are forced to cope with product proliferation [Kn06]. The host of individual interfaces between the vast number of applications increases complexity and, therefore, expenditures required to fulfil customers' expectations. A second major challenge is value chain reconfiguration in view of the ongoing cost and profitability pressure as well as customer-based price consciousness in the finance industry in Europe, especially in Switzerland and Germany underlined by current studies ([GD05]). One result is that banks are "focusing on their individual core capabilities while exploring different sourcing options for non-core capabilities" [HRW04].

Specialists such as transaction banks, distribution banks and product banks are emerging to bundle transaction volume. This decomposition of the banking value chain requires flexible business processes, which need to be supported by flexible IT-services that bundle functionality from existing IT systems. Specialists such as clearinghouses have emerged and offer confined services focusing on economies of scale [TS04]. Examples include Swiss Postfinance which is concentrating on payment execution and realizing economies of scale in Switzerland and Clearstream which is focusing on services in the field of central securities depositories. These confined services can be used by relatively small private banks to offer a broader product portfolio to their customers [KH04]. The following paragraphs will focus on fees and booking activities in the investment process as applications of the models described. Simultaneously two interviews will provide a first insight into the general conditions in the finance industry concerning SOA and service modeling.

4.2 Interviews: Zurich Kantonalbank and RBA Services

Both, Zurich Kantonalbank (ZKB) as a full-service bank and RBA Service (RBAS) as BPO provider, are dealing with a distributed and reconfigured value chain within a financial network. 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. In the investment process, RBAS offers a modular service range including client custody, execution and several additional services such as printing, reporting and archiving. Since this paper focuses on booking and fee service clusters, the functionality of both clusters is provided but there is still a lack of full service orientation. The result of a concept phase for a booking engine is a central booking service, supported by different services on a level of finer granularity providing functionality for calculating foreign currencies, bundling access to the underlying data and allocating rules for the different instruments. Rule-services as accentuated by the service classification and modeling approach presented in this paper would provide the flexibility and modularity demanded by the affiliated banks of RBAS such as ZKB. RBAS interviewees state that service clusters such as the booking or fee cluster reduce the complexity in service orchestration as basis for the process orchestration within BPM. Coherently identified service clusters are therefore expected by a process model, covering the field of service modeling.

ZKB is currently developing a fee service cluster, which will be reused in different activities in the investment process. The fee service accesses information via an entity service through different data warehouses and provides functionality for calculating fees for transactions and orders. It encapsulates functionality of different existing applications. The cut of the service cluster is clearly business-driven and derived from an enterprise model and its business processes. ZKB like RBAS is aiming to accentuate rules by encapsulating them. A reliable process model for service identification and clustering is yet missing and the interviewees clearly indicated that the models presented would provide services and service clusters on a consistent level of granularity throughout the bank, matching with the banks strategy of separating business functionality from rules and entity objects and linking services via BPM to the strategy.

4.3 Application of service identification and clustering

After the process models for service modeling have been described, the practicability will be illustrated using the investment process. A banking model is used as an enterprise model, which was designed evolutionarily during a two years competence centre with practitioners from twelve Swiss universal as well as private banks after an analysis of existing models. The banking model used encompasses several processes covering the three main areas of banking, viz. investments, payments, as well as loans and mortgages.

In view of the fact that the investment process involves a host of activities and, therefore, dozens of services on the different layers, the process steps have been limited to two: *Fees* and *Booking*. Figure 2 shows how five service candidates are identified and deduced from the two process steps and how three of these candidates are described. Then the *order support service* is used to demonstrate the verification and detailing phases. At the bottom-up verification step, one of the design principles and one of the service criteria are illustrated. In addition to the service categorization derived above, the *order support service* is determined as a data service and, therefore, constituted as the *order data service*. Phase 4 shows an extract of the detailed description and specifically refers to the reutilization and service users.

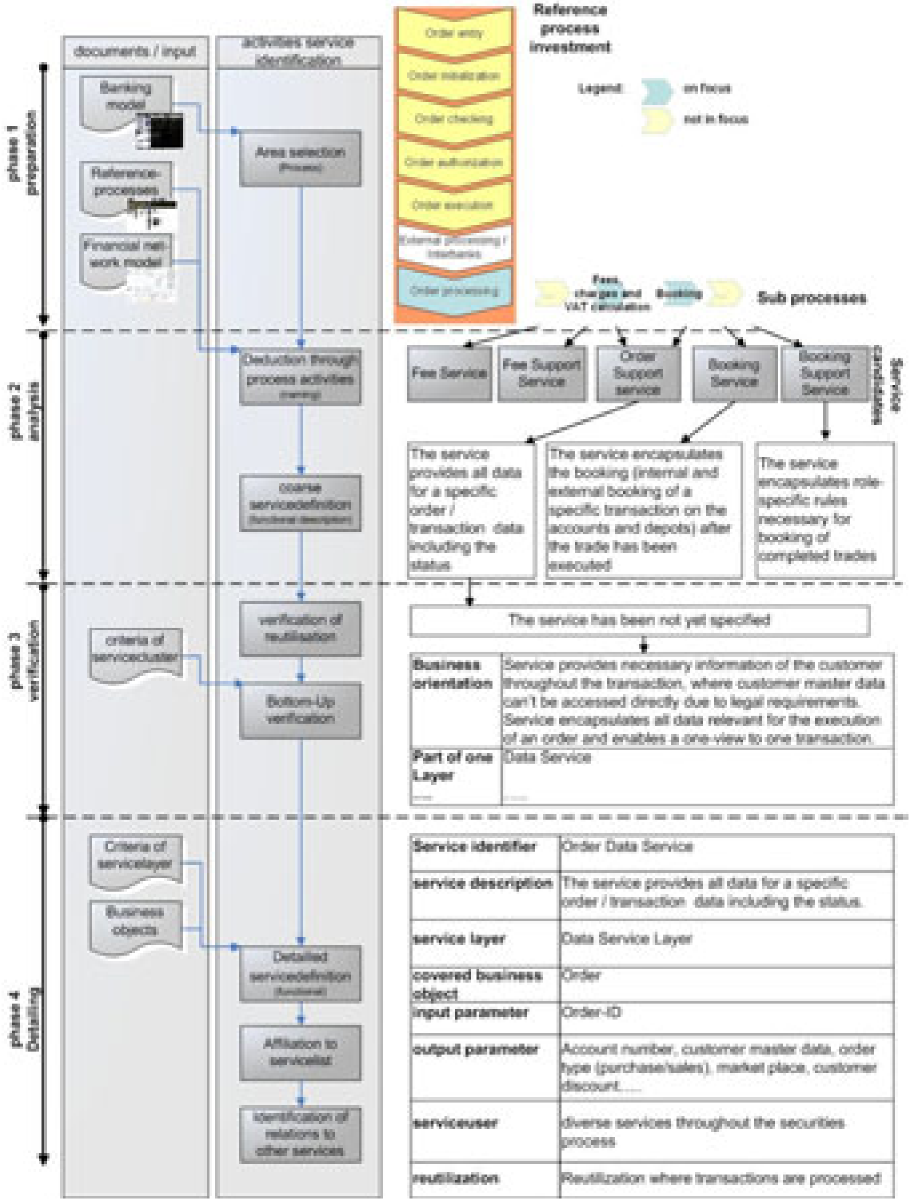

Figure 2: Service identification within the investment process

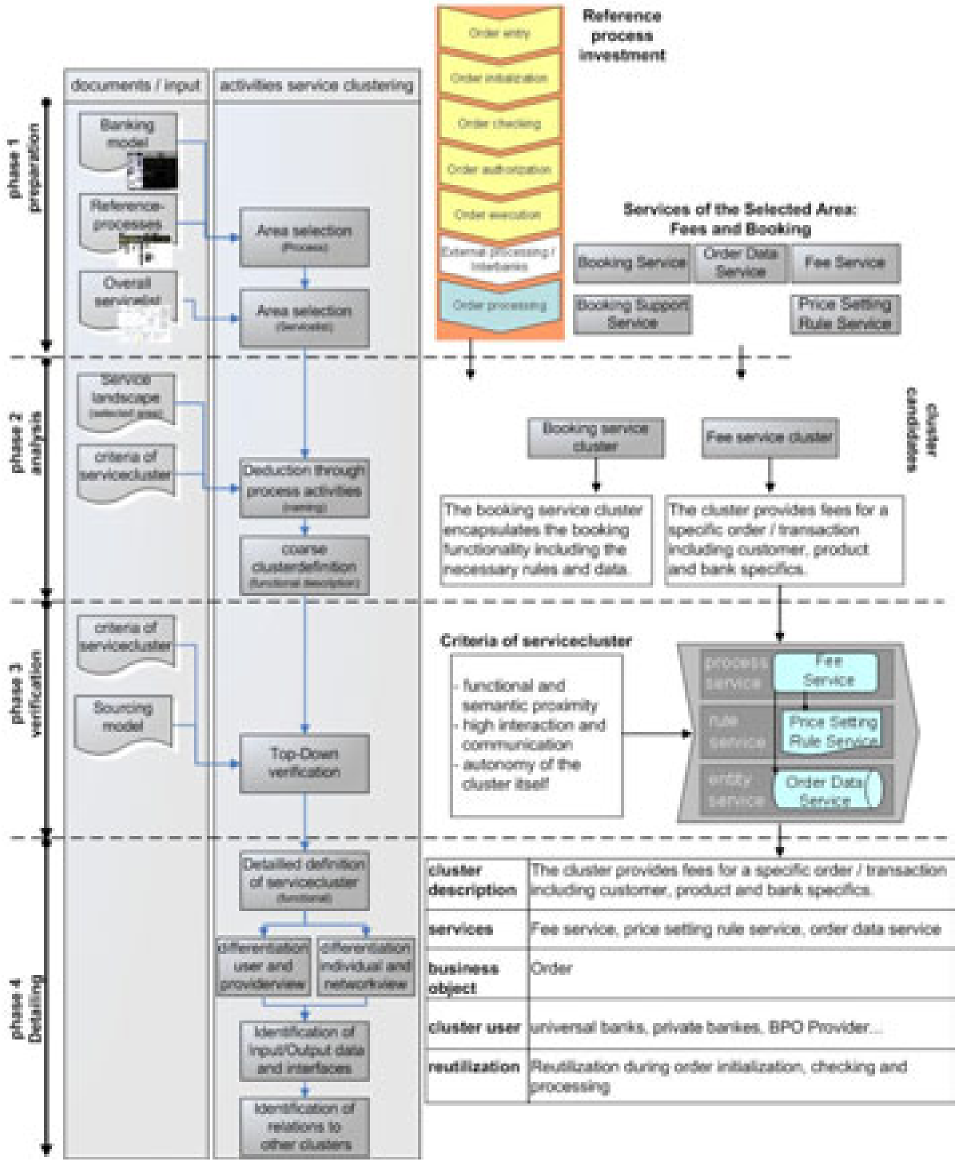

Figure 3: Service clustering within the investment process

Analogous to the banking model and its three core processes, there is a core service list per area: investments, payments as well as loans and mortgages. A total of 66 services were identified for the investment process. Using the process steps *Fees and Booking* for the application of the process model service clustering, Figure 3 shows how a service cluster is identified and specified. The five service candidates in Figure 2 where verified and subsequently specified. These specified services, covering the two analyzed process steps, form the basis for the deduction of the service clusters in Figure 3.

It is shown how one of the two identified clusters, the *Fee service cluster,* is verified by the cluster criteria derived and then described in an explicit manner. The result of the process model ‘service clustering’ for the specified five services is two clusters: Fees and Booking. In total, 17 clusters were identified and specified for the 66 services of the investment process. In several workshops held over the last six months, practitioners from banks and providers proved the applicability of granularity, cut and the alignment of the services and clusters with existing BPM.

5 Summary and Outlook

In many Swiss banks, the investment process is undergoing a redesign replacing highly integrated structures by more networked structures. A common understanding of the investment process, the role model in a network as well as the supporting services and service clusters are enablers to analyze value chain redesign and to assess strategic positioning options. As Swiss banks aim to redesign their application landscapes for more standardization and modularization, an open architecture with exchangeable business partners is important, but still in its infancy. Currently, sourcing offerings often rely on proprietary interfaces. Though service orientation may be used as an instrument, there is a lack of methodologies (cf. Section 2), which combine business-driven and technology-driven service identification and provide a link to BPM. This paper has described two four-tier process models for service modeling, which consolidate the two directions and extend the existing research approaches (cf. Section 3).

The two cases discussed briefly in Section 4 have shown that the general conditions in the finance industry require coherent process models for service identification and clustering. While SOA initiatives have already started, there is no process model for service modeling yet that would permit a consistent view of services and clusters throughout the network. The interviews as well as the model’s application in Figure 2 and 3 go to show that they are apt to support business-driven and technology-driven service-orientation for financial institutions. However, these are early results and future research is needed in the fields of the payment and loans processes. Services and service clusters have to be identified and described. In addition, case studies need to be reviewed to prove the practicability and refinement in flexibility in comparison to the existing methods. Subsequently, an overall service model can be specified and the service clusters can be used in existing and emerging financial networks for optimization and value chain reconfiguration. Ultimately, it may also serve to link up BPM to existing application landscapes and to analyze different sourcing strategies.

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