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

Falk Kohlmann; Rainer Alt

Information Systems Institute
University of Leipzig
Marschnerstraße 31, 04109 Leipzig, Germany
kohlmann@wifa.uni-leipzig.de
rainer.alt@uni-leipzig.de

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 modelling and aligning it towards (business) process management as well as sourcing strategies. For this purpose, this research discusses techniques for service modelling and presents an extended service modelling concept for the business-driven discovery of services. The banking industry which currently faces profound transformation challenges was chosen to motivate and demonstrate the applicability of the suggested model.

Keywords

Service-oriented Architecture, service modelling, interorganizational integration, financial networks, business process management

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 to the business world. This necessity is recognized by many packaged software providers which have positioned their new SOA platforms in the 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 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 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 for the identification and clustering of business-driven services (cf. section 3) will be presented, which extends existing strategies of service-modelling (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 for 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 modelling 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 view of a missing accepted service definition (see [FS05, 756]), the present paper adopts a working definition whereas services are independent usable and extensive 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 (see e.g. services are believed to align business and IT [St05]). To provide some structure to this spectrum, layer approaches have been used previously, e.g. the rapid service development from 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 intermediate layer between the process and systems layer, 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 and a technological perspective. The former describes a business concept which is independent from 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-modelling 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 on an overall view 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 of a any SOA. Therefore, business cuts, a domain analysis and the illustration of services within service maps are further criteria for service modelling. The comparison in Table 1 emphasizes a lack of methodologies, which support an overall approach for service modelling connecting business-driven and technology-driven service modelling

(identification and clustering). Also, there is no overall approach including the alignment of the service architecture towards 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 / maps	□	□	▪	■	□	□
Service clustering	■	■	□	▪	■	▪
Service specification	□	▪	▪	■	□	▪
Alignment with process model	□	▪	▪	□	▪	■
Alignment with sourcing strategy	□	□	□	□	□	□
criterion fulfilled						■
criterion fractional fulfilled						▪
criterion not fulfilled						□

Table 1: Existing approaches for service modelling

The generic concept, which is presented in section 3 extends the existing approaches and combines technical and business view as well. 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 towards the applications below, a verification of the technical feasibility is necessary. Simultaneously with a business-driven approach legal requirements e.g. in the finance sector such as allocation of customer master data can be complied. Table 2 provides a short overview of the different phases of the two approaches, which support a comprehensive business-driven service modelling as analysed in Table 1.

approaches	Ar04	KK07
phases for service modelling	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 fall short on 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 one for clustering the obtained services. 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 proof 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 on a high granularity of an enterprise. Furthermore specified business processes within the enterprise model are required. The third mandatory model is a financial network model, covering the area which is analysed. The network model with its described roles is necessary in order to assess the service cut.

After service identification is selected and the required process and network is provided, the *analysis phase* can start. During this second phase the services are deducted top-down through the activities of the reference process. Besides the roles within the inter-organizational network, service criteria and design principles are the basis for the analysis. The four design principles introduced in the previous chapter have been chosen: interface orientation, interoperability, loose coupling as well as requirements orientation. Additional service criteria have been extracted: 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 order to the companies guidelines and its function has to be 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 starts. The second step of the verification phase is an assessment of the service candidate. It examines if the service candidate fulfils the mentioned criteria and design principles and if the service fits the business needs of the process and the role. It has to be ensured that overlapping of functionality is avoided.

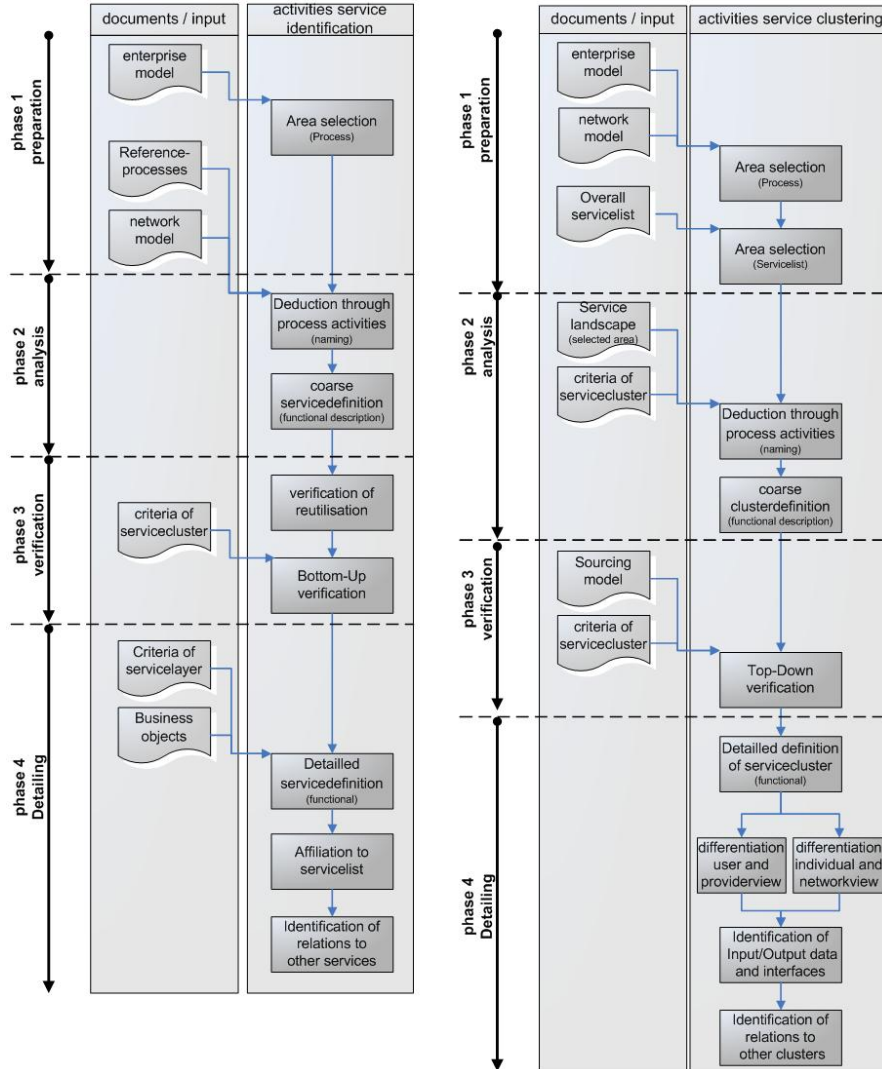


Figure 1: Four-tier Process Model for service identification and service clustering

The *detailing phase* specifies the service in detail and allocates 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 possess a 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 on a fine granularity to support transportation of information on data level are not in the scope of this paper. Criteria for these service layers and specified business objects are provided. 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 e.g. if the functionality of a process service is supported by a rule service.

3.2 Service Clustering

During the *preparation phase* two of the three models in the service identification process are compulsory as well: the enterprise model and the inter-organizational network model. After the area has been selected, the overall service list with the identified and specified services is needed. 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 the usability and reduces the complexity.

The deduction in the *analysis phase* requires a service landscape, which shows the relations between the services of the three different layers. Since that 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 incurred (e.g. customer master data must remain on the distribution side). After a cluster candidate is deducted, the candidate has to be named in accordance to the companies or network guidelines and briefly described. For the *verification phase*, which is based on a top-down approach, detailed sourcing models are necessary for considering process cuts within these models. The different roles of the analysed inter-organizational network and its value performance may be used to avoid an overlapping of services and consider legal requirements. If 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, a differentiation between user and provider view on one hand and individual and network view on the other hand is necessary. 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 connected to a bank's architecture are application integration and value chain reconfiguration [Ba05]. Application integration is one of the most pressing challenges in Swiss banking like stated also in several interviews with Swiss bank officials during our research, due to the fact that mainframe-based and monolithic systems were developed since decades [HRW04] and modern banks have to deal with product proliferation [Kn06]. The high

amount of individual interfaces between the great amounts of applications raises the complexity and therefore the expenditures which have to be made in order to fulfil the customer expectations. A second major challenge is value chain reconfiguration due to an ongoing cost and profitability pressure as well as the 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 who bundle functionality from existing IT systems. Specialists such as clearinghouses have emerged and offer confined services focusing on economies of scale [TS04]. Examples would be Swiss Postfinance concentrating on payment execution and realizing economies of scale in Switzerland as well as Clearstream focusing on services within the field of central securities depositories. These confined services can be used by relatively small private banks to provide a broader product portfolio to their customers [KH04]. The following paragraphs will focus on fees and booking activities within the investment process as application of the described models. Simultaneously two interviews will give a first insight on general conditions in the finance industry concerning SOA and service modelling.

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 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 as printing, reporting and archiving. Since this paper focuses on booking and fee service clusters, the functionality of both clusters is provided but there's 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 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 modelling approach presented in this paper would provide the flexibility and modularity, which is 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 modelling.

ZKB is currently developing a fee service cluster, which will be reused in different activities within 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 presented models would provide services and service clusters on a consistent granularity throughout the bank, matching with the banks strategy of separating business functionality from rules and entity objects and linking services via BPM towards the strategy.

4.3 Application of Service identification and clustering

After the process models for service modelling have been described, the practicability will be illustrated using the investment process. As enterprise model a banking model is used, which was designed evolutionary during a two years competence centre with practitioners of twelve Swiss universal as well as private banks after an analysis of existing models. Part of the used banking model is several processes, which cover the three main areas of banking: investments, payments as well as loans and mortgages.

Due to the fact that the investment process covers a high amount of activities and therefore dozens of services on the different layers a limitation has been made towards the process steps: *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. Afterwards the *order support service* was chosen to demonstrate the verification and detailing phase. At the bottom-up verification step one of the design principles and one of the service criteria are illustrated. In order to the service categorization derived above, the *order support service* is determined as data service and therefore constituted as *order data service*. Phase 4 shows an extract of the detailed description and especially refers to the reutilization and service users.

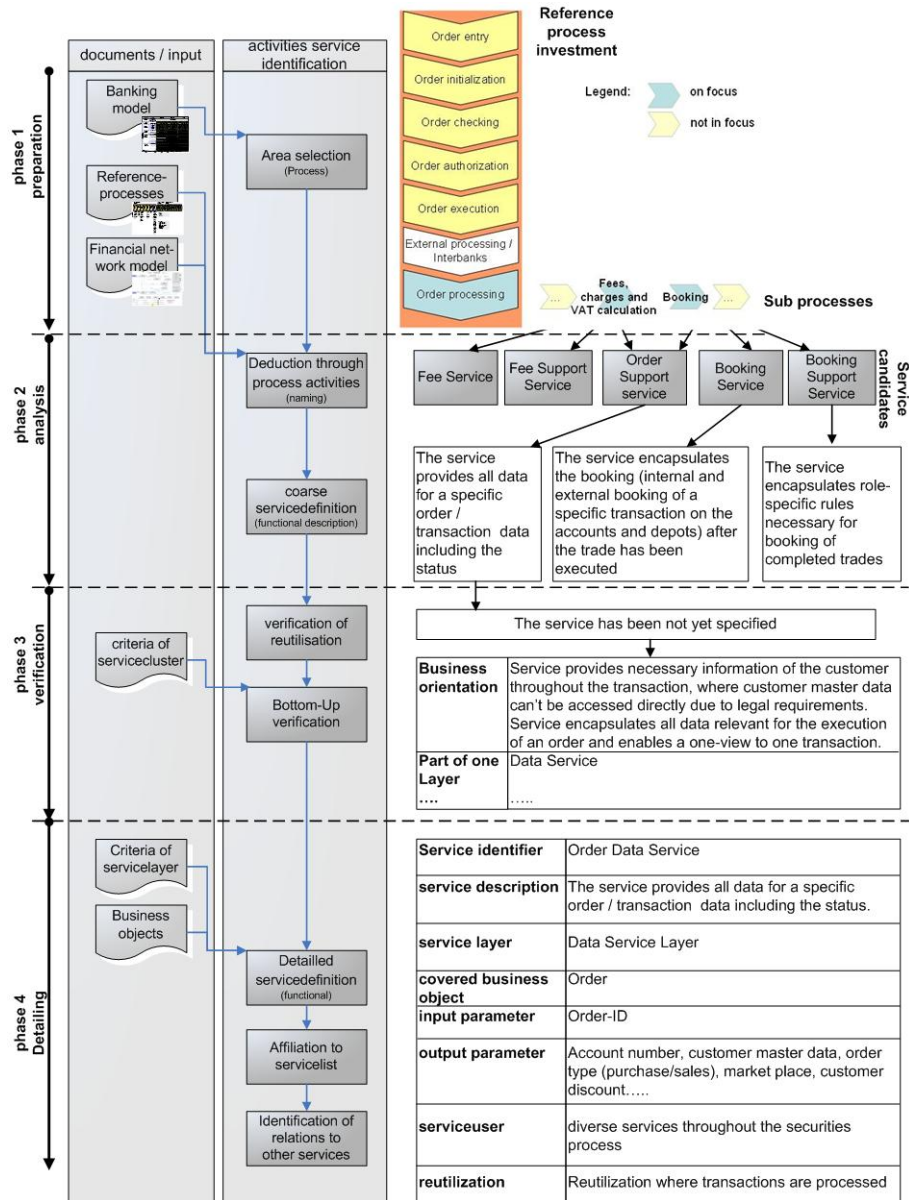


Figure 2: Service identification within the investment process

In analogy to the banking model and its three core processes there is one core service list for each 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 afterwards specified. These specified services, covering the two analysed process steps, are the base for the deduction of the service clusters in Figure 3.

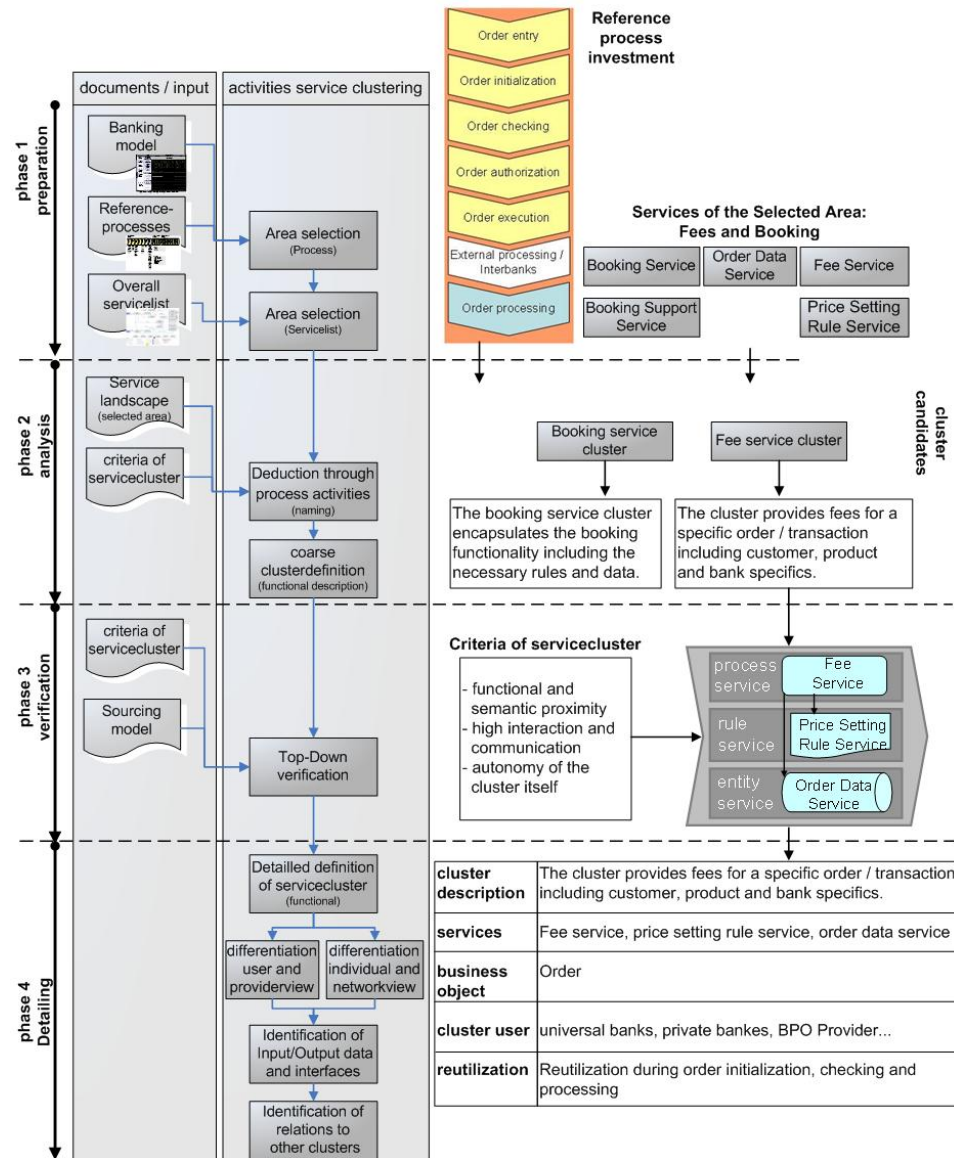


Figure 3: Service clustering within the investment process

It is shown, how one of the two identified clusters: *Fee service cluster* is verified by the derived cluster criteria and afterwards 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. During several workshops over the last six months practitioners from banks and providers proved the applicability of the granularity, cut and the alignment of the services and clusters towards existing BPM.

5 Summary and Outlook

In many Swiss banks the investment process is undergoing a redesign from highly integrated towards more networked structures. A common understanding of the investment process, the interlinked model of possible roles 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 towards 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 short cases in section four have shown that the general conditions in the finance industry require coherent process models for service identification and clustering. Although SOA initiatives have started yet, a process model for service modelling is still missing in order to achieve a consistent view on services and clusters throughout the network. The interviews as well as the model's application in Figure 2 and 3 indicate that they may 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 the loans process. 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. Afterwards 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 BPM towards existing application landscapes and to analyze different sourcing strategies.

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