

# A Pattern Based Approach for Business Service Integration

Jeewanie Jayasinghe Arachchige, Hans Weigand

Tilburg University, P.O.Box 90153,  
5000 LE Tilburg, The Netherlands  
J.JayasingheArachchig@uvt.nl, H.Weigand@uvt.nl

## 1 Introduction

Nowadays companies are rapidly adapting SOA into their information systems, because of its emerging advantages. These organizations dynamically interact as service consumers and service providers making use of a service marketplace to design, offer and consume services [1]. Designing and identifying right services and composing them into the enterprise system, is critical task for the success of the business. Because of the complex nature of their names, it is difficult for non-technical business users to discover services. Papazoglou and Van den Heuvel [2] stated that (web) service design and development is about identifying the right services, organizing them in a manageable hierarchy of composite services and choreographing them together for supporting a business process. Therefore, it is clear that truly service-oriented design mechanism that is founded from the business level, where the real services are lying, is essential need for effective implementation of SOA. Having realized this complexity, we propose a pattern based composition of business services and adapting them to web services.

Pavel Hruby defined business patterns which attempt to provide the knowledge about business domain in the form of object-oriented models [3]. These business patterns are related to software applications, but service science thinking is not in his view. SOA design patterns defined by Thomas Erl[4] provide comprehensive approach starting from design, implementation, and governance of service inventories. His work directly addresses technical aspects of SOA, but business thinking is not his view. Authors of [1] proposed a model based service integration framework which again addresses the application level. Most of the current approaches have an exclusive software engineering perspective. One problem with this approach is that business choices and technical choices are all dealt with together at a technical layer.

Therefore, we come up first, with business service patterns that grasp the domain concepts easily, to facilitate modeling the business services at a conceptual business level, and secondly, propose an integration method of these patterns in web services discovery. Business service patterns are represented using our previous work [5], BSRM (business service and resource modeling) language which is capable to identify and model business services in CIM level. To provide easy identification guidance to the business activities we provide a service typology which is aligned

with Porters value chain analysis [6]. We evaluated this approach using the case study of Global Bike Inc.(GBI). [9]

## 2 Background

### 2.1 BSRM Ontology

Using an MDA approach, we have introduced a new business service and resource modeling language - BSRM based on the Resource-Event-Agent (REA) business ontology in our previous work [5]. BSRM is capable to design the business activities in a company with service perspective at CIM level using simple modeling notation. The constructs of the BSRM language and their relationships are grounded in a meta-model (figure 1) which provides comprehensive specification using UML notation. We distinguish two service specializations: exchange service and conversion service, corresponding to the two basic REA dualities. Each of them corresponds to a group of decrement and increment economic events in REA.

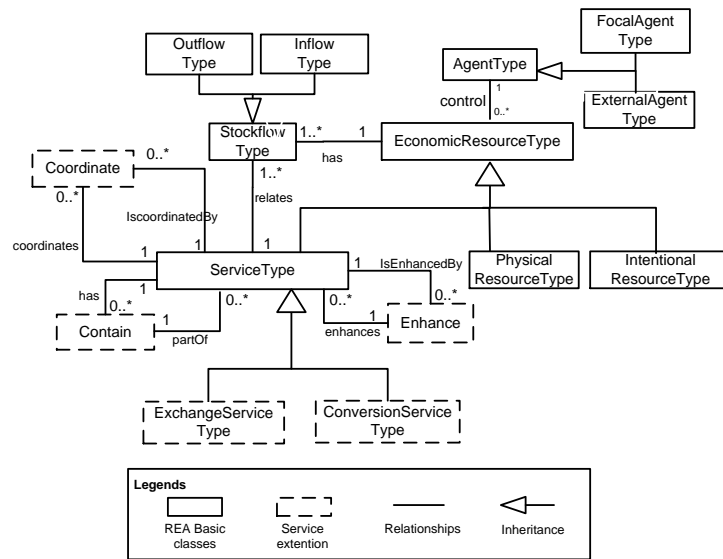


Figure 1

Based on the service classification model [7], we identified two different service roles. The concept of enhancing service which adds value to the any other service is introduced as one of them. Considering the situation where core-service realization involves multiple value activities and it makes sense to view these value activities as independent services that are shared by different contexts, we identified the next category of services as sub-services. Sub- service can be a part-of service of core service which is called core sub-service, or enhancing sub-service which is called coordination service. The former is used somewhere in the realization of the core

service by manipulating physical resources and the later is used somewhere in the realization of the core service by manipulating intentional resources. The relationship between economic resource type and service type is defined as REA stockflow, further specialized as inflow and outflow.

**2.2 Value activities**

Porter’s value chain analysis [6] describes the activities which fall into primary and secondary categories, within and around an organization and he evaluated which value each particular activity adds to the organizations products or services. The primary activities are directly concerned with the creation or delivery of a product or service. They can be grouped into five main areas: inbound logistics, operations, outbound logistics, marketing and sales, and service. Each of the primary activities which are defined by Porter, is linked to support activities which help to improve their effectiveness or efficiency. There are four main areas of support activities: procurement, technology development (including R&D), human resource management, and infrastructure (systems for planning, finance, quality, information management etc.).

**3 Service Typology and Patterns**

The service typology is the general classification of services. This section starts with describing a service typology. In the second part, we describe the parallel business activities defined by Porter with the notion of services, as a guideline for modeling business services. Then we propose a set of business service patterns for each category of the service typology, in section 3.3.

**3.1 Service Typology**

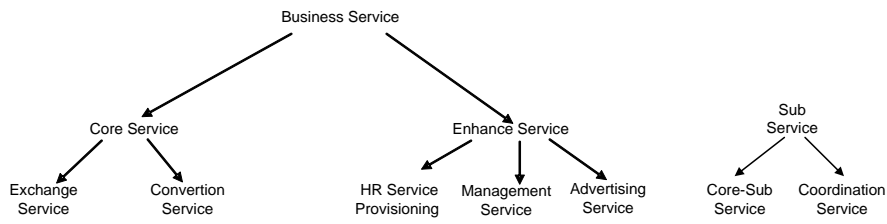


Figure 2a

Figure 2b

The general classification of services which is based on BSRM ontology, are depicted in figure 2a and figure 2b. The core service is the central service. It can be realized in two ways: exchange service and conversion service. BSRM ontology defines different roles of the business service namely core service, enhancing service and sub service. The right branch of the tree (figure 2a) describes the classification of enhancing service. The service provision of human resource is vital to any other

service and it adds value to the company's value creation process [10]. Hence, HR service provisioning is one category of enhancing service. The next category is management services which have been defined in [8] as a kind of enhancing service that adds value to a managing service. Advertising also adds value to a product or service [7], hence we view it as another category of enhancing service. Sub service which has two main categories co-sub and coordination, is defined as a service which has a part of relationship with any other service. The sub-service can be co-located under any of the leaf in figure 2a.

### 3.2 Value Activities with Services

We aligned the services with Porter's value chain analysis. According to Porter, primary activities are directly concerned with the creation or delivery of a product or service. As conversion represents the production and exchange represents the delivery of good or service in return of something valuable, these two concepts are aligning. Hence the core services and the core-sub services belong to the primary activities of a company. Each of the primary activities which are defined by Porter, is linked to support activities which help to improve their effectiveness or efficiency. Similarly, enhancing services help to add value to any other service. These two concepts lie together. Hence we view that all the enhancing services are supporting activities. As coordination services include the properties of both core service and enhancing service, it lies in the both categories of the value activities.

### 3.3 Business Service Patterns (BSP)

Patterns in software design are reusable objects which reduce the design time while providing the template of domain concepts. We developed business service patterns which include the service oriented perspective, covering the Porters value activities. These patterns are modeled with BSRM notation. Figure 2 shows two generic patterns for primary activities specifically *produce* (which relates to conversion) and *delivery* (which relates to *exchange*) activities.

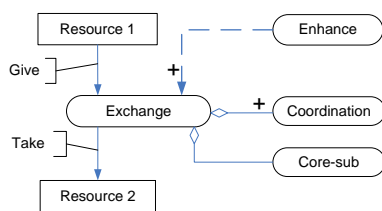


Figure 3a

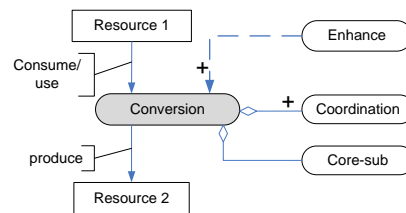


Figure 3b

For any *exchange* service (figure 3a), at least one stock out flow (*give*) and stock in flow (*take*) relationship have to be defined with resource/s. The *conversion* service pattern (figure 3b) has same format except stock out flow represents *consume or use* and stock in flow represents *produce* relationship. Both of the services may have enhancing service/s, coordination service/s and core-sub service/s.

### 4 Adaptation Metamodel

The role of BSP is not limited to design business services. It can also be used in the discovery of the services in service marketplace. Figure 4 shows the metamodel for composing the enterprise model and how these patterns are related in the service discovery. As soft goals (extra-functional requirements) should be optimized, service discovery should address these goals [7]. Hence these goals are represented in the BSPs: some BSP may prioritize efficiency, another customer-intimacy. Between the BSPs and the business processes, a mapping exists, as discussed in our previous work [5]. When using the BSPs in a service marketplace setting, these mappings may also be defined manually. BSPs can be combined using algebraic operators such as “specialize” and “merge”. The enterprise model is a composition of BSPs that starts from a generic model (for trading company, for manufacturing etc). Each time the enterprise model is expanded, using a BSP and BSP operator, the corresponding BPs are integrated as well, so that when finishing the enterprise model, the designer also has an integrated BP (to be more precise: a set of possible BPs as we assume that the enterprise model still leaves room for different process implementations). The adaptation guide lines describe the homeomorphism between BSP operators and BP operators, including conditions and their use and pragmatic guidelines to the designer.

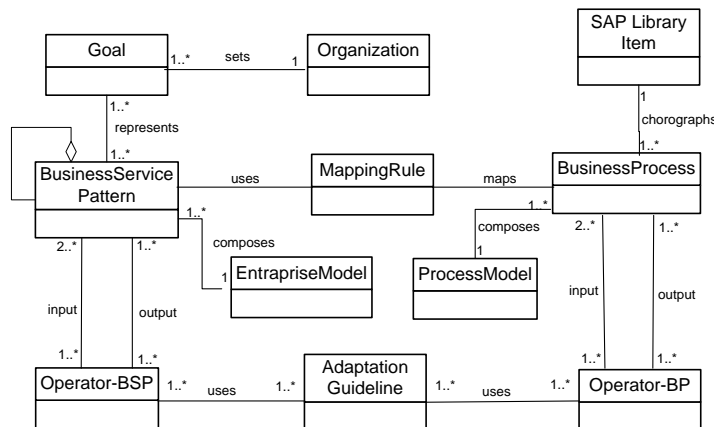


Figure 4

### 5 Conclusion

In this research work we developed BSPs based on BSRM (founded from REA) which are aligned with Porter’s value activities. These patterns facilitate the service design at CIM level. We propose a pattern based approach in service discovery which reduces the complexity for non-technical users. The proposed approach is evaluated using the case study of Global Bike Inc.(GBI) [9].

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