Service Value Broker Patterns: Integrating Business Modeling and Economic Analysis with Knowledge Management

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Abstract—As an emerging interdisciplinary subject which crossects business modeling, knowledge management and economic analysis, service engineering is increasingly demanded to take care of various stakeholders‘ profiting goals of the short run vs. long run. We propose to work towards a value driven design based solution through introducing a form of service design patterns: the service value broker (SVB) patterns to shorten the distance from economical analysis to IT implementation. SVB patterns allow us to not only study the value added in terms of functional and business aspects, but also reason about the need for brokerage across various domains.

Keywords—Business Value, Design Patterns, Value Driven Design, Knowledge Management

I. INTRODUCTION

Service design patterns[6] may yield a standard for composing services dependent on improvement in functional, Quality of Service (QoS) or business contractual aspects. “Value Driven Design”[1] promotes a movement that is using economic theory to transform systems engineering to better utilize optimization to improve complex design. We work towards the foundation of integrating the IT implementation, business modeling and economic analysis through introducing the Service Value Broker (SVB) [3] pattern. SVB will support the development of higher level applications[10] which directly cater the core value of service applications where providers‘ side profitability and growth depend more directly on customer satisfaction[9] in short run and customer loyalty in long run[7] of E-Service Economics. We study the increments provided to various concepts of value from a service value perspective [8]: Functional value $\mathbb{D}_F$, QoS value $\mathbb{D}_Q$, Security value $\mathbb{D}_S$, Business value $\mathbb{D}_B$. Normal design patterns is fully related to $\mathbb{D}_F$ and $\mathbb{D}_Q$, and partially related to $\mathbb{D}_S$. SVB is fully compatible with the advantage of traditional design value and at the same time fully covers all of the four listed items.

II. TOWARDS THE FOUNDATION OF SVB

A. Value and value transfer

In Fig. 1, value and value added are modeled along a conceptual route of “Ontological level $\rightarrow$ Implementation level $\rightarrow$ Business level”. “exchange” implements elementary “value” of business requirement which demands “difference” among exchanged goods. Based on this, optimization like “reuse” will be developed which demands “same/equal” among exchanged goods to implement.

Figure 1. Simplified model of Value vs. Value added.

forms of value added either as (a) original requirement or as (b) newly identified usage. Following a simple grammar called NEF [5], we formalize the concept(value) as:

\[
\text{semantic\{value\}} = \{\text{difference\{observation\}}(\text{object(x)}), \text{existence\{object(x)\}}\}
\]

The positiveness of the observed “difference” including all four value items in Section I either tangible or intangible motivates a business exchange. Only when from the perspectives of both ends of source(A) and target(B) a positive difference on values of the goods owned by each other can be observed will a transaction be possible. It is formalized as follows:

\[
\text{semantic\{business\{exchange\}\} = state\{positive\{value\{object\{target(x)\}\}\}\} - \text{subtract\{value\{object\{source(y)\}\}\}} | \text{view\{role\{source(A)\}\}}\}
\]

B. Brokerage

We have introduced the concept of the service value broker (SVB) in [3]. Here we give the definitions as follows:

- **Service Value Broker (SVB):** driven by a value based goal, when a direct service composition cannot meet some required constraints from the service contract [2] or service level agreement (SLA) such as response time, location, license area, available period, currency format. If an introduction of an intermediate service is a SVB.

- **Direct Service Value Broker (DSVB):** direct SVB is a special type of SVB which is in the form of a composition of services. The composition of the service
of DSVB features with the characteristics that it will bring in more profit to the stakeholder who introduces the DSVB during the business transaction than the previous situations. By value we mean not only monetary value but also non-monetary such as reputation and brand value, etc.

III. Demonstrative scenarios

We denote the contract on the source end of an exchange as CS, on the target end of an exchange as CT, the input of SVB/DSVB contract as iSVB and the output of a SVB/DSVB contract as oSVB.

- **Trust limit** ($TL \in D_S$): The service provider is with a trust grade of “4 stars” while the customer service demands “5 stars”.
  
  **Problem**: $TL_{|CS} > TL_{|CT}$
  
  **SVS** = $(0, \delta(TL_{|CT}, TL_{|CS}))$

  **Trust broker**: as the trust level of a service provider might be based on the outdated data which will reflect a capability upgrade based on trustworthy technology transfer, etc. A friend authority service with a satisfying trust grade can help to convince the customers by building the link.

  **Solution**: $(TL_{|CS} < TL_{(task)|iSVB})$ AND $(TL_{|oSVB} > TL_{|CT})$

- **Price** ($PR \in D_B$): the price of a service located in Japan is put as “20-25 euro/month for Italian users” and “10-12 euro/month for Asia user” while a customer in Italy want “17 euro/month”.

  **Problem**: $PR_{|CS} > PR_{|CT}$
  
  **SVS** = $(0, \delta(PR_{|CT}, PR_{|CS}))$

  **Price broker**: the price broker can be implemented with various strategies such as requesting a location broker which demands less than “5 euro/month” in Asia to convey the request from Asia to Italy.

  **Solution**: $(PR_{|CS} = PR_{|iSVB})$ AND $(PR_{|oSVB} = PR_{|CT})$

Fig. 2 shows that SVB enables the strategic extension of business solution space from technology oriented to value driven in business domain. Theoretically all possibilities of service compositions should be considered including those excluded situations by simple technological operations such as matchmaking.

Fig. 3 demonstrates a scenario where mismatching situations of security, net traffic and IP between two services represented by E-Contracts are bridged by SVB: Security broker, Network traffic broker and IP broker; the optimization for deployment is fulfilled by DSVB of Deployment broker. It also shows that brokers can be composed for complex functionalities. For a service transaction of more that two parties, there will be the chance of introducing DSVB of Composition broker to optimize the organization. More cases of SVB can be referred to [4].

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