ORIGINAL ARTICLES

Ali Taei [alitae@gmail.com]Appropriate Service Identification Methods and Elements for SMEs

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ABSTRACT

Implementing SOA in large enterprises is subjected to serious challenges such as a lack of comprehensive service governance roadmap and appropriate service identification method(SIM) in spite of the overall number of successes in service oriented solutions is increasing. Small medium enterprises (SME) on the other hand have specific challenges and problems that are peculiar to their nature particularly at service modeling. Lack of researches in Service Identification is the first problem that an SME encounters when starting to the SOA migration. Although a number of service identification methods have been proposed but they did not consider the SME challenges in those methods. Also the majority of those methods only considered the technical point of view without considering a deep business oriented view. In this paper important challenges for service identification in SMEs are discussed. In order to collect the suitable elements in existing methods, an analysis of compatibility level of these methods with SMEs challenges is shown. These elements are considered in the first step to design an appropriate method for SMEs

Key words: service identification methods, SOA, SME

Introduction

Service-oriented architecture (SOA) is an architectural approach to fill up the gap between the Information Technology (IT),and the business domains. The main SOA enhancements are the agility in process and building compatible information systems that supports the business changing frequency. This makes the enterprise enough power to be competitive (Bieberstein, 2005, ErLT, 2005). SMEs have many strong and deep influences in the economy at both quantity and quality aspects. Moreover, the SMEs situational variables potentially support some SOA implementation prerequisites. A study of 134 research paper has mentioned that the majority of SMEs have simple systems and processes, which allows flexibility, immediate feedback, short decision-making chain, better understanding and quicker response to customer needs than larger organizations(Rajesh K. Singh, 2008). These types of properties potentially accelerate the SOA adaptation in SMEs. The most important factor in SOA success implementation is the service modeling life cycle. This phase of modeling development defines specification of services as a main building block of the organization information system. The service identification as the first step of modeling development identifies the size of each service that effect on the reusability and cohesion intensity (ErLT, 2005).

SOA governance frameworks define all tasks and activities in a service oriented solutions such as design, control mechanism, SOA metrics, and security rules(Niemann, 2008). Many of the SOA governance frameworks consider the design services as the first phase. Therefore, other layers of SOA governance frameworks will be affected by the service identification results in service modeling step. Several service identification approaches has been proposed and each discusses about the selecting and extracting the services in a special point of view with different criteria and method used by them. On the other hand, many identification approaches are based on the business views and ignore the technical views. As the result, the translation from their output to enterprise executable environment is always ambiguous.

Moreover, the adopted identification approach for SMEs should clearly consider economic aspects whilst it is less considered and often ignored in the proposed methods. Consequently, in order to achieve a suitable identification model for SMEs the following questions should be answered:

• What services are suitable and appropriate to be derived from an identification method for SMEs?
• What metrics should be considered in service identification method that is acceptable to all business and technical domain?

This paper is focused on evaluating the existing service identification methods based on SME requirements and specifications as well as extracting the key criteria in SMEs. To answer the abovementioned questions and
achieve the objectives, a precise literature review is carried out and a framework is introduced to compare existing identification methods.

The reminder of this paper is organized as follows. The related works as the next section focuses on the elements and techniques of the existing service identification methods. It is followed by the discussion of the suitable criteria for service identification methods for SMEs in the section of the criteria of service identification methods. Next, the complementary requirements of SIM elements to support the SME situation within existing SIMs are evaluated and the result is presented at the SME requirement situations section. Eventually, the conclusion is provided at the last section.

Related Works:

There are more than 50 works in service identification methods both in academic or industrial researches. Most of them are published in last four years that shows increasing attention to this area. Because of the nature of SOA that acts as a bridge between IT and business, a large number of researches focuses on the business views while others concentrate on the technical views. Hubberset al. (2007) proposed ten common ways for identifying the services. The categorization is comprehensive and most of service identification methods use one of those ways. However, some of them are not used by any service identification method (for example see: Gü and Lago, 2010). Many others that are more popular are based on the business process views and therefore, the focus is only on the top-down approaches and as the result the bottom-up approaches are ignored as well as providing poor details about the implementations. On the other hand, the understanding the services is not similar.

A service as an independent object representsentire business process or sub-process (Herrmann et al., 2005, Bellissard et al., 1999). On the other hand, Arsanjani et al. (2008) believe that a service represents a granular business task whether it is a whole process or a part of it. The scope of services is a challenge in most of service identification methods as well and it is related to granularity that domain of business processes inside each service (Gu and Lago, 2010). Besides, the granularity has also relationship with the reusability, flexibility, and complexity (Boerner and Goeken, 2009). The right granularity and boundaries between services are not fixed. It depends on the tolerant of complexity and intensity of tendency to the reusability. Table 1 shows a categorization of SIMs point of view about the lack points of the existing SIMs. Table 2 categorizes the existing SIMs in their delivery strategy (i.e. business-oriented, meet in middle, and bottom-up) and the SOA motivation.

Table 1: Existing SIM Related Lacks and Challenges

<table>
<thead>
<tr>
<th>SIM Research</th>
<th>Lacks and Challenges Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Klose et al. (2007), and Kohlbom et al. (2009)</td>
<td>Lacks in unifying the SIM: Necessity of SIM comprehensive to address the issues of business domains and technical domains</td>
</tr>
<tr>
<td>Börner et al. (2012), Kohlbom et al. (2009), Azevedo et al. (2009), and Börner et al. (2009)</td>
<td>Lacks in clear guidelines and details in HOW to apply the method</td>
</tr>
<tr>
<td>Börner et al. (2012), Börner et al. (2010), and Simanta et al. (2009)</td>
<td>Lacks in situational appropriateness and considering context factors</td>
</tr>
<tr>
<td>Trkman et al. (2011), and Dwivedi &amp; Kulkarni (2008)</td>
<td>Lack of skill to implement a method due to its technical aspects and properties</td>
</tr>
</tbody>
</table>

Table 2: SIMs Categorization According to Different Criteria

<table>
<thead>
<tr>
<th>Attributes</th>
<th>SIM Research</th>
<th>Descriptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delivery Strategy</td>
<td>Klose (2007), and Azevedo et al. (2009)</td>
<td>Top-down: business-oriented SIM</td>
</tr>
<tr>
<td></td>
<td>Arsanjani et al. (2008), and Erradi et al. (2006b)</td>
<td>Meet in the middle: covering both technical and business aspects</td>
</tr>
<tr>
<td></td>
<td>Baghdadi (2006), and Mani et al. (2008)</td>
<td>Bottom-up: technical-oriented SIM</td>
</tr>
<tr>
<td>SOA Motivation</td>
<td>Erradi et al. (2006a), Sheikh et al. (2011), O’Brien (2009), Arsanjani et al. (2008), and Erradi et al. (2006b)</td>
<td>Integration of applications which often proposed on reusing legacy systems as well as increasing agility</td>
</tr>
<tr>
<td></td>
<td>Börner et al. (2009), Börner et al. (2012), Trkman et al. (2011), and Taei-Zadeh et al. (2012)</td>
<td>Flexibility of information systems, Business-IT alignments</td>
</tr>
</tbody>
</table>

Nach & Lejeune (2008) introduced some challenges including the lack in the budget and expertise, the absence of long-term strategic planning, and the flaws in SME organizational structures. However, there were not any applicable and practical instructions to resolve theses issues presented by them. Moreover, the environmental uncertainties are another SME challenges (Nach and Lejeune, 2008) which could be solved by implementing the services through integrations.

The Lack of research in adopting the SOA for SMEs leads to the high rate of failure in major SOA project for SMEs. In fact, it causes high level of precautions in using the SOA altogether in spite of the fact that the most
of SME challenges could be addressed by applying the SOA and recognizing their IT and business processes-based in them.

Criteria Of Service Identification Methods:

In the process of transition to service-oriented solution for SMEs, a set of challenges should be considered to propose any solution. It includes the lack of expertise, reusability of legacy systems, interoperability, service boundaries, business process supporting, economic issues, etc. Table 3 categorizes these challenges in three sets for better understanding. Some of these set of challenges are mentioned in related works (Gu and Lago, 2010) and others are proposed next here in this paper as new and complementary SIM criteria.

The Lack of expertise criterion effects on all SOA migration steps. The nature of service-solutions is tied with the need of the IT and business experts. In addition, for resuming the SOA governance in an organization, experts’ involvements are required. On the other hand, SMEs conditions do not allow expert participation in all steps of SOA migration. Hence, the maximum steps should be automated and expert’s involvement needs should be decreased to as minimum as possible. Such characteristics confirm the identified services, service interdependent, improve or adjust the business processes.

The Service boundaries criterion depends to some subjects such as gaining maximum reusability as an important element for SMEs to decrease both technical and economic difficulties. But generally it is related to the service definition, legal software, degree of interconnections between processes, etc. (Jamshidi et al., 2008).

The Service delivery strategy criterion is ignored in most of the existing service identification approaches. It helps to make a clear view and generating guidelines for the SOA identification phases which reduces the risks of implementation.

Table 3: Service Identification Challenges and Requirements in SMEs

<table>
<thead>
<tr>
<th>Challenges</th>
<th>Descriptions</th>
<th>Required Capabilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>General</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lack of Expertise</td>
<td>The need of having employees equipped with knowledge in both business and technical aspects</td>
<td>Using maximum automation approaches</td>
</tr>
<tr>
<td>Service Identification Roadmap</td>
<td>Lack of clear strategies to implement service identification method</td>
<td>Present quantitative measurable performance indicators instead of qualities goals</td>
</tr>
<tr>
<td>SOA Delivery Strategy</td>
<td>Selection between top down, bottom up or mix delivery strategy</td>
<td>Identifying the business goals, processes, and technical issues</td>
</tr>
<tr>
<td>Business</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Business IT Alignment</td>
<td>Gap between IT and business services</td>
<td>Considering the bridge services between IT and business services</td>
</tr>
<tr>
<td>Economic Issues (Implementation and Maintenance Costs)</td>
<td>Lack of budget in SMEs and strong competence</td>
<td>Extract services with value creation, Decreasing inter dependencies to external sourcing or shared services</td>
</tr>
<tr>
<td>Lack of Long-term Planning and Strategy</td>
<td>High Rate of process changing and difficulties in maintenance and updating identified services</td>
<td>Special solutions for maintenance and updating methods</td>
</tr>
<tr>
<td>Technical</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stability</td>
<td>Economic and technical aspects lead to less stability</td>
<td>Providing stable infrastructure with considering economic challenges</td>
</tr>
<tr>
<td>Specifying Services</td>
<td>Difficulties in determining specification of services</td>
<td>Dynamically discovering service specifications</td>
</tr>
<tr>
<td>Complexity</td>
<td>increasing in number of services</td>
<td>Fine grained services,</td>
</tr>
<tr>
<td>Service Boundaries</td>
<td>increase in complexity, decrease in reusability, decrease in flexibility</td>
<td>Fine grained services based on the situation</td>
</tr>
<tr>
<td>Interoperability</td>
<td>Heterogeneous hardware and software</td>
<td>Using General protocols</td>
</tr>
</tbody>
</table>

The SOA delivery strategy is discussed by many authors and it possesses a fix place at any governance framework. Most of researches prefer the top-down delivery strategy to leverage the business aspect against IT aspect that represented by the bottom-up approach (Terlouw et al., 2009). Lack of long-term planning and strategy in SMEs is one of the lacks. It has undesirable negative effects on the maintenance quality. The risk property increases the business processes change frequency in SMEs. Therefore, more than big enterprises, the SMEs are required to be focused for providing the solutions for the maintenance and the update for the identified processes. Nonetheless, the delivery strategy is emphasized in all existing approaches including two major viewpoints of business views and technical views.

In some approaches the attention is to answer the business challenges and consider the enterprise goals as the highest priority. Therefore, the top-down approach is employed. On the contrary, integration of the legacy systems has gained more emphasize on the bottom-up methods. In addition there are methods that uses mix delivery approach (Gu and Lago, 2010).
The Business-IT alignment is the major challenge of nowadays businesses and in the same time, it is a promise of the SOA. However, the existing SIMs that are business-oriented, attempt to fill up the business-IT gap by offering more significant credit to the business. This is where the update and integration of the legacy systems are the main reasons to apply the technical-oriented methods.

The Economic issues are very important factors and could be considered the most important challenge in SMEs. Obviously, the majority of SMEs’ specific challenges refer to budget problem. Due to the long time and cyclic nature of service identification, it needs enough budgets that SMEs cannot afford. Consequently, SMEs need for tools and approaches that make this process shorter. The interoperability is needed to support a heterogeneous environment in SMEs that often do not use ERP systems. The stability becomes as challenge especially when the SMEs task are related to third parties. The weak infrastructure of SMEs encourages providing a solution for generating the stable services. The complexity is related to the service identification nature as well as some other challenges. Implementing and updating the identified process of which are specially designed for SMEs increase the complexity. The specifying services are a common phase in all service modeling methods. That determines the attributes of every service such as service ownership, service collaboration and etc. The requirements of this phase are difficult to gather from SMEs. For example, good service abstraction is depending to the high-level business requirements and goals that are rarely found in SMEs before the SOA implementation.

Sme Requirements Situations:

Recent research trend to improve the service identification methods based on the abovementioned challenges criteria. Most of the frameworks that are proposed for service identification and mentioned earlier focus on large enterprises requirements. Because there is no common point of view about the service identification methods, these methods differ. These methods have been compared and the results have been presented in this section. The methods are called by the proposer name and those are Proposed by Klose (2007), Kohlmann (2007), Amsden (2007), Baghdadi (2006), Jamshidi et al. (2009), and Chen et al. (2009).

In fact, a framework that is suitable for SMEs and covers their requirements could encourage them to cooperate in service solutions. We propose appreciate elements extracted from existing service identification methods and new elements based on the SME challenges that discussed in previous sections. As the consequence, a framework to evaluate and to identify the appropriate elements is presented in Table 4.

While the existing approaches discuss the general challenges but they did not support the SMEs requirements. Only Kohlmann (2007) had considered the IT-business alignment by definition of both IT services and business process service to fill the gap between IT and business through integration.

**Table 4: Comparison of Service Identification Methods Based on the SME Challenges**

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>Lack of Expertise</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Service Identification Roadmap</td>
<td>analysis guidelines</td>
<td>analysis without precise description</td>
<td>algorithm</td>
<td>guidelines and focus on company’s goals</td>
<td>pattern without validation</td>
<td></td>
</tr>
<tr>
<td>SOA Delivery Strategy</td>
<td>mix</td>
<td>mix</td>
<td>top down</td>
<td>top down</td>
<td>top down</td>
<td>bottom up</td>
</tr>
<tr>
<td>Business IT Alignment</td>
<td>-</td>
<td>define both IT and business process services</td>
<td>-</td>
<td>-</td>
<td>Service relationships strength</td>
<td>-</td>
</tr>
<tr>
<td>Economic Issues (Implementation and Maintenance Costs)</td>
<td>using legacy systems as input</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Lack of Long-term Planning</td>
<td>business entities interaction &amp; service elements viability</td>
<td>sourcing strategies</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Stability</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Specifying Services</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>limited details about dependencies</td>
<td>CRUD determine their operation and messages</td>
<td></td>
</tr>
<tr>
<td>Complexity</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Algorithm ambiguity</td>
<td>ambiguity in implementation</td>
<td></td>
</tr>
<tr>
<td>Service Boundary</td>
<td>middle</td>
<td>varies from medium to maximum</td>
<td>based on the relations between services</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Interoperability</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>
Economic issues within SOA implementation and maintenance did not considered in most approaches. Klose (Klose, 2007) considers legacy systems and existing software applications that are suitable for SMEs as input because they have the lack in their domain knowledge such as business models, requirements and etc. Economic Issues, lack of expertise, and complexity have direct and strong affecting relationships each other. Therefore, any change in each of them has specific influence on others especially in SMEs. Moreover, the service boundaries that determine the service size have straight relationship with the complexity. Maintaining and managing the high number of granular services is difficult while on the opposite side coarse grain services do not support the SOA goals in maximum reusability, etc. As the result, the comparison shows necessity for service identification method that is compatible with SMEs condition and their requirements. That method should specify necessary elements that cover SOA-SMEs combination. So we addressed the main challenges of SMEs in SOA implementation in this paper. In addition suitable elements of existing service identification methods are extracted.

Conclusion:

Service Oriented Architecture are used by many large enterprises in order to adopt the new business requirements. On the other hand, the SMEs which formed a big sector of the business society have not really involved themselves in service solutions. Service Identification is a first step in entering service solutions and is important for SOA success at achieving its actual benefits. A number of existing SIMs is discussed in this paper and comparison result reveals the main compatibility challenges of SMEs at applying the existing SIMs for them. These requirements of addressing those challenges should be considered at any solution for service identification for SMEs.

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