Global Journal of Computer Science and Technology: C
Software & Data Engineering
Volume 14 Issue 5 Version 1.0 Year 2014
Type: Double Blind Peer Reviewed International Research Journal
Publisher: Global Journals Inc. (USA)
Online ISSN: 0975-4172 & Print ISSN: 0975-4350

A New Framework for Service Identification in SOA

By Ali Mirarab, Najmeh Ghasemi Fard & Abdol Reza Rasouli Kenari

Qom University of Technology, Iran

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GJCST-C Classification : K.6.3

Strictly as per the compliance and regulations of:

A New Framework for Service Identification in SOA

Ali Mirarab [α], Najmeh Ghasemi Fard [σ] & Abdol Reza Rasouli Kenari [ρ]

Abstract- One of most important steps in Service-oriented Architectures (SOA) implementation in enterprise is service identification which plays a vital role in successful implementation of Service Oriented Architecture. Numerous researches have done about service identification to facilitate service identification and several methods have been proposed to do this. In this paper, existing methods are studied. This study also reviews service identification approaches, indices and types of resources that are used as service identification input with service identification strategies and methods are investigated. A new framework for service identification is introduced. Our main idea is develop and automate existing method based on business process in order to covering features and constraints of enterprises. Proposed framework consist business process modelling, calculating and applying service identification quality indicators and Task clustering based on objective function and Bunch algorithm phases. Most important features of our framework is framework implementable and maximizing automatic activities for identification of candidate services.

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I. Introduction

Service oriented architecture is a method for building compatible and flexible organization, because it provide a framework and approach which lead to business environment agility and professional use of information technology to build compatible and flexible systems. Using service oriented architecture in organizations is as a solution for appropriate use of information technology and reducing gap between information technology and business that lead to agility, compatibility and increase responsibility to business changing [1].

In service oriented architecture implementation, service identification is as one of first activities and most important factor in successful service oriented architecture implementation. Numerous methods proposed for service identification which each one has special features and use different resources and elements in order to service identification. Using service Identification approaches, such as top-down, bottom-up, and middle-out, also different strategies like goals modelling, domain decomposition and existing asset analysis or different service identification techniques like Algorithm, Guidelines, Ontology and etc. are examples of diversity in characteristics and elements used in service identification.

In this paper, various approaches and methods of service identification in service oriented architecture have studied and strategies, characteristics and elements which commonly use in service identification are classified. The following questions are addressed in the evaluation of existing methods:

- What are the approaches and indicators of service identification?
- What are the resource and inputs used in service identification methods?
- What are types of generated services and output of existing service identification methods?
- What are service identification strategies and techniques?

II. Basic Concepts of Service Identification

Most of service identification method are published in last five years that shows increasing of SOA and its application as bridge between IT and business [2]. Number of researches focuses on business view and others concentrate on technical view.

a) Software Services / Business Services

In SOA design many research focus on two types of service: business services and software services [3]:

i. *Business Service*

A business service is a comparatively complete business logic provided by service provider. It is abstraction of business process, describing a business function or business goal [4]. A business service is a specific set of actions that are performed by an organization [3].

ii. *Software Service*

Functions of applications that can be reused or combined based on business requirements [3]. A software service is also called an IT service, which describes part of an application system which can be consumed separately by several entities. It realizes some function and can be provoked by other services or components via published interface. Several low-level software services can be composed into a higher-level software service which realizes a business service [4].

Author α σ ρ: Electrical and Computer Department, Qom University of Technology, Qom, Iran. e-mail: mirarabali@gmail.com

Web service is the most frequent technique to implement software services.

b) Service Identification Criteria

In order to implement each method of service identification indicators should be defined for service identification and each service must meet specific criteria [4]. Arsanjani [5] has introduced criteria like: stateless, discoverable, self-describing, composable, loose coupling, governed by policy, Independent location, language, and protocol, coarse-grained and asynchronous as service identification indicators. Different introduced methods for service identification, set base all or some of above criteria for determining and extracting services.

III. Service Identification Methods Features

Service identification methods have different characteristics and features. Approach which use for service identification and the service which are generated as result of these methods, represent the characteristics of each method.

a) Service identification approaches

Analysis and design of service-oriented architecture follows three general approaches for service identification. Top-down approach, start designing of service oriented architecture from business requirements, then based on business modeling and business process model analysis, business services identified and finally business services are mapped to software services. In the bottom-up portion of the process or existing system analysis, existing systems are analyzed and selected as viable candidates for providing lower cost solutions to the implementation of underlying service functionality that supports the business process. The middle-out approach is combination of top-down and bottom-up service identification approaches which services are acquired from compromise between requirements and existing assets [6].

The advantage of top-bottom approach is flexibility in the composition of business functions, high interoperability for business participants and finally IT and business alignment achieved. On the other side bottom-up service identification derived high reusability from existing systems. Only use each method will have disadvantages. Use top-down method alone leads to ignore existing resources and assets which have been supplied over the years with significant cost. Use bottom-up method alone is caused to non-coverage of actual needs of the organization.

b) Types of generated services

As discussed, there are various methods for service identification in Service Oriented Architecture. The general goal of these methods is to identify the services that have worth at the business or IT view. However, each service identification follows specific purpose in identifying specific types of services. Qing Gu [7], by studying a large number of existing techniques for service identification, has identified six types of services which are generated by these methods that shown in table 1.

Table 1 : Type of generated services by SIMs

Type	Description
Business process service (BS)	A service that has the business logic or represents a business process, including task services, process services.
Data service (DS)	A service that represents business centric entities, including information services, entity services
Composite Service (CS)	A composition of multiple services.
IT service (IS)	A service that represents technology specific functionalities, including application services, software services, utility services and infrastructure services.
Web service (WS)	A service that is implemented using the web service technology. This type is orthogonal to the other types
Partner service (PS)	A service that is offered to external partners.

IV. Elements used in Service Identifications Methods

Using different elements in service identification methods has been due to differences approach in considered method design. Also, availability of required resources is another reason of diversity in use of different elements. Select proper input is the first step of service identification and next steps are strategy selection and finally the technique that is used for identification.

a) Input resources of service identification

There are different inputs for service identification process that business process model and analysis of existing systems are widely used. In the choice of input, considering the approach taken for service identification and also conditions of organization that the proposed method should be implemented in it, are important. For example if we use top-down approach, goals model or business model are appropriate inputs and if we use bottom-up, existing system analysis and assess their capabilities and features is proper input for proposed method. Also

make attention to organizational conditions and availability of desired inputs must also be considered.

Most of service identification methods are on the basis of organization domain knowledge (top-down approach) or based on existing systems (bottom-up approach). Implementation of service oriented architecture in organizations rarely starts from the beginning and usually is done in the form of migration from the existing to service oriented architecture that in this case, in addition to covering current systems, generate new services are needed to address new business requirements. In this case, selected input to use in service identification In addition to including analysis of the existing systems status, should cover new business goals and requirements (middle-out approach). Important point in suitable input selection in order to use in service identification methods is make attention to constraints and challenges which organizations face in providing that resources. Types of inputs used in service identification methods shown in Table 2.

Table 2 : Types of inputs used in the SIMs [7]

Type of input	Description
Business process	A collection of related tasks or activities to fulfill a specific business requirement
Application domain	A collection of models or documents that describe the various aspects of an application domain, including enterprise goals or mission, business rules, business processes, business entities, organization structures, etc.
Legacy system	Existing software assets of an enterprise. It can be software systems, source code, or the architecture of the existing systems
Mix	A mix of type legacy system and other types
Data	The information that is processed, exchanged, or produced by business processes
Feature	A set of distinctive attributes or characteristics of software systems
Use case	A sequence of business functions that human actors benefit from

b) Service identification strategies

Arsanjani [8] introduces three main strategies for service identification. Goal-service modeling, domain decomposition, existing asset analysis.

Goal-service modeling, a method that are designed to respond business challenges and opportunities, business strategy and objectives. The second strategy, domain decomposition which includes several techniques for service identification and uses top-down approach and focuses on business process modelling, rules, information and analysis based on changes. The third strategy is analysis of existing assets and supports this fact that most organizations are using applications several years and they have spent a lot of money to implement and update them and organization business is based on these systems, therefore existing systems analysis is very important in order to provide a solution to transfer to service oriented architecture.

An important reason for using Service Oriented Architecture is existing assets management and move them in a way that can support the business requirements. Bottom-up approach by analyzing existing assets includes: software systems, applications, existing rules and standards are used for service identification in organization. As mentioned, top-down approach is used for cover business requirements and respond to business changes and is based on business process. Middle-out approach supports by goal-service modeling that tries by combination of both top and bottom method, make alignment between them.

c) Service identification techniques

Different techniques for service identification can be studied and used. Some such as algorithm, ontology, pattern and information manipulation are more formal, in the sense that they formally codify formulas or rules to specify the way that services are identified. Another technique that proposed less formal is guidelines which offers guidelines and recommendations for service identification and how to determine the conditions of service identification. On the other hand, analysis is a technique that is more abstract and requires its users to deeply understand the problem they face and make motivated decisions. Accordingly, the subjectivity of using the technique is relatively high and different actors may achieve different results. Different types of techniques in service identification, summarized in Table 3.

Table 3 : Techniques used in SIMs [7]

Technique	Description
Algorithm	A formal approach to problem solving, such as heuristic or formalized rules
Guidelines	A set of pre-defined regulations, such as criteria or policies; suggested but not codified
Analysis	A process of studying, interpreting, reasoning and synthesizing data
Ontology	A technique to conceptually represent (domain) knowledge
Pattern	Defined as recurring solution to recurring problems
Information manipulation	A text process techniques for identifying or eliciting useful information, such as information retrieval or textural similarity analysis

V. Overview on Service Identification Methods

Based on studies that Qing Gu [7] have done in 2010 on more than 200 researches in the field of service identification, 30 researches have been identified as main researches that shown in Table 4.

Service identification method	Year	Type of input	Strategy	Technique
Jain, H.K	2004	Application domain	Business Functions Decomposition	Algorithm
Zhang, Z	2004	Mix	Business Functions Decomposition	Algorithm
Wang, Z	2005	Business process	Business Process Decomposition	Algorithm
Chen, F	2005	Legacy system	Existing Systems Functions	Analysis
Zhang, Z	2005	Legacy system	Existing Systems Functions	Algorithm
Baghdadi, Y	2006	Data	Business Entity Objects	Pattern
Klose, K	2007	Application domain	Business Process Decomposition	Guidelines
Chaari, S	2007	Application domain	Business Functions Decomposition	Algorithm
Kohlmann, F	2007	Application domain	Business Functions Decomposition	Guidelines
Inaganti, S	2007	Business process	Business Process Decomposition	Guidelines
Kim, Y	2007	Use case	Business Functions Decomposition	Algorithm
Amsden, J	2007	Business process	Business Process Decomposition	Analysis
Fareghzadeh, N	2008	Mix	Existing Systems Functions	Analysis
Kim, S	2008	Application domain	Goal driven	Guidelines
Mani, S	2008	Business process	Business Process Decomposition	Algorithm
Jamshidi, P	2008	Business process	Business Process Decomposition	Algorithm
Dwivedi, V	2008	Business process	Business Process Decomposition	Algorithm
Lee, J	2008	Feature	Business Functions Decomposition	Analysis
Kang, D	2008	Feature	Business Functions Decomposition	Ontology
Aversano, L	2008	Legacy system	Existing Systems Functions	Analysis
Cho, M.J	2008	Mix	Business Functions Decomposition	Analysis
Kohlborn, T	2009	Application domain	Business Functions Decomposition	Analysis
Bianchini, D	2009	Business process	Business Process Decomposition	Ontology
Yousef, R	2009	Business process	Business Process Decomposition	Ontology
Azevedo, L.G	2009	Business process	Business Process Decomposition	Algorithm
Kim, Y	2009	Business process	Business Process Decomposition	Algorithm
Chen, F	2009	Legacy system	Existing Systems Functions	Ontology
Huayou, S	2009	Use case	Business Functions Decomposition	Guidelines
Yun, Z	2009	Data	Business Entity Objects	Guidelines
Ricca, F	2009	Mix	Business Process Decomposition	Guidelines

VI. New Framework

In this section we proposed a new framework for service identification. Our framework consist multiple components and we use different elements to propose this framework which most important and influential of them are: implementation methodology of service oriented architecture, organization business process model, software and tools of clustering. Our used methodology in this research is service oriented modeling and architecture (SOMA) which presented and developed by IBM. In order to generate organization process model, we use business process model and notation (BPMN) which developed by OMG, and finally software and tools used in this framework includes Bunch clustering software and tools line Visio, Excel and Virtual Architect.

Our method for service identification in this framework is SOMA methodology which presented by IBM in order to implementation and modeling of service oriented architecture. Service oriented architecture implementation activities and processes based on SOMA includes three general phases: identification, specification and realization. Figure 1 shows general structure and activities for each phase in this methodology.

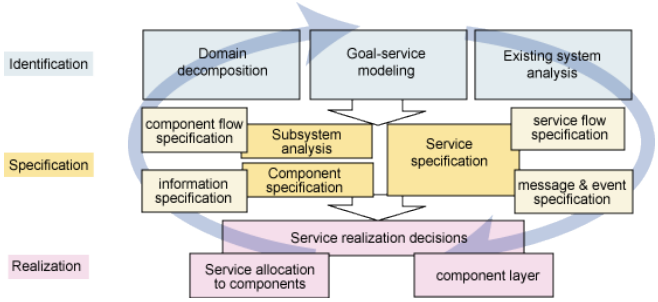

Figure 1 : Service Oriented Modeling and Architecture Methodology [6]

As shown in fig 1, service identification is first and most important step in this framework. Based on defined process in SOMA, different approaches are used for service identification that includes top-down, bottom-up and middle. In this research, first approach means top-down method has been determined for proposing service oriented architecture service identification framework.

First step in defining proposed framework for service identification is defining our approach about service. A service is representative of a repeatable business task. Services are used to encapsulate the functional units of an application by providing an interface that is well defined and implementation independent [9]. Based on this, proposed framework in this paper for service identification is based on business process modeling and relationship between them and also considering the quality indicators for optimizing service identification process. A view of proposed framework includes each steps and activities in each step shown in Fig 2.

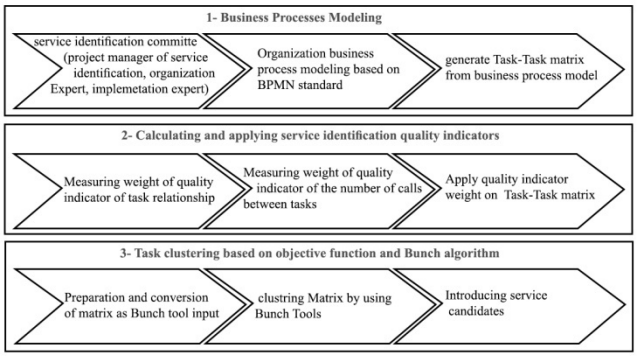

Figure 2 : Automatic Service Identification Framework

a) Proposed framework features

Our framework is for automatic service identification in enterprises. Main approach of this framework is covering business requirements.

i. *Framework domain*

proposed framework domain coverage in service oriented architecture implementation is just identification phase.

ii. *Goals and features*

Our framework has some goals and features that most important of them is framework implementable and other goals of framework are as follow:

- Maximizing automatic activities for identification of candidate services.
- Using available resources in order to service identification
- Helping to decrease gap between business and IT in organization by facilitating service oriented architecture implementation.
- covering business objectives by identifying business services

Based on above goals most important features of our framework are:

- Identification services based on business process model
- Business process model based on BPMN standard
- Implementable and contains detailed instructions and automate most processes
- Determining quality indicators for precise service identification
- Using enterprise business process as basis of service identification
- Using automated clustering algorithm
- Using common standards and protocols

VII. Conclusion

In this paper, existing service identification methods studied and their characteristic and elements identified and explained. Also in this research, existing

service identification methods in term of service identification approaches, type of output services, used resources, strategies and techniques of service identification have been studied and comparative tables for each indicator was created. Review and classification of existing methods for service identification leads to make an overview of the current status among service oriented architecture developers and cause to guide them in the selection and application of existing methods and also providing new approaches for the development and optimization of existing methods.

We introduce a new framework for automatic service identification. Proposed framework can be implement in 3 phases that each step includes special activities. Implementation phases of this framework includes: business process modelling, calculating and applying service identification quality indicators and Task clustering based on objective function and Bunch algorithm which instructions and activities of each phase was expressed. Main approach of this framework is covering business requirements and the most important goal of our framework is framework implementable. In order to achieve our objectives, maximum automation of activities has covered and framework has specific algorithm and instruction.

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