REVIEW ON "SERVICE GRANULARITY IN SERVICE ORIENTED ARCHITECTURE"

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Abstract

Most of the organizations are still predicated on the client server paradigm. Major crack of these systems is inflexibility regarding to extension and habituating changes. As the IT developing, customer's demand changes dynamically. Therefore, the enterprise should have systems that are able to adapt new business scenarios. To fulfill this requisite, Service Oriented Architecture (SOA) is come into existence and becoming more popular nowadays. As SOA becomes more popular the consequentiality of finding optimization in service granularity increases day by day. This paper represents review on service granularity in Service Oriented Architecture which consists of many approaches and tools for measuring service granularity. In this paper we discuss about features, benefits and challenges of SOA adopted in business enterprises and also define many issues which arise due to improper service granularity measurement approaches.

Keywords: *SOA service granularity, metrics.*

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1. INTRODUCTION

In the last decade clients requisites were not as complex, this was easily achieved by or consummated by one or only handful of services. However, in current decade the scenario has change exponentially. Business enterprises [20] have transmutation in leaps and bounces and processes are rapidly incrementing. Due to change in client's requisites and their complexity one or handful of services are not enough. Therefore need of a service oriented architecture arises.

SOA [4], [6], [14], [17] sanctions companies to reuse available components/services and build flexible systems that implement changing business processes expeditiously. SOA guarantee efficacious business-IT alignment, amended business suppleness and lower integration costs through greater interoperability and reuse of shared business services [4]. For the solidification of data and the elimination of redundancy SOA is used in organizations. With the help of ready-witted and flexible SOA, we can also erect new functionality from the existing systems in lesser time. REST and web services are the most famous technologies used to implement SOAs. Mostly web services are used by the large number of corporations for the implementations of SOA.

SOA is an architecture that utilizes open-standards to describe software components. The most known standards in use for a SOA today are WSDL (Web Service Description Language), SOAP (Simple Object Access Protocol), BPEL (Business Process Execution Language), WS-CDL (Web Service Choreography Description Language) and UDDI (Universal Description, Discovery and Integration) which became de facto standards for a service oriented architecture[17].

This paper does not act as a torchbearer for any of the service granularity measurement methods, rather analyzes these methods. Hence the key concern is "Survey of optimum service granularity methods." The survey proceeds as shown in Fig-1

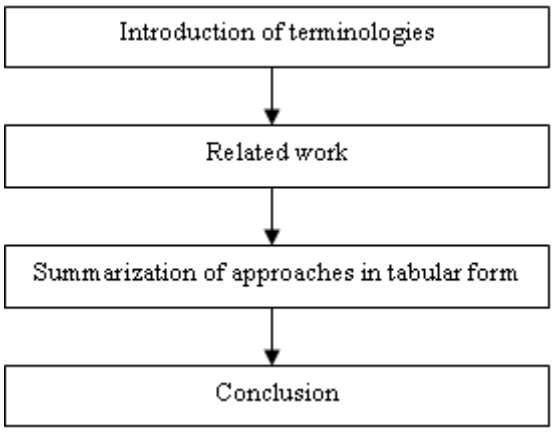

Fig-1: Flow of the research paper.

SOA provides a standard way for describing and interacting between software components. Concrete software components become basic blocks and they can be reused to build other applications. Service Orientation has gained momentum as a fundamental design paradigm for developing distributed enterprise applications. However, comprehensive and quantitative metrics for estimating the appropriateness of the service designs are still destitute.

SOA utilizes the publish-find-bind-execute paradigm. In this paradigm by utilizing standard called the Universal Description, Discovery, and Integration (UDDI) service provider publishes its contract the in the service registry. Then, service consumer searches the service registry for finding an opportune service. Once the service found, service consumer binds and execute the service by sending SOAP request [19], [21], [23], [25].

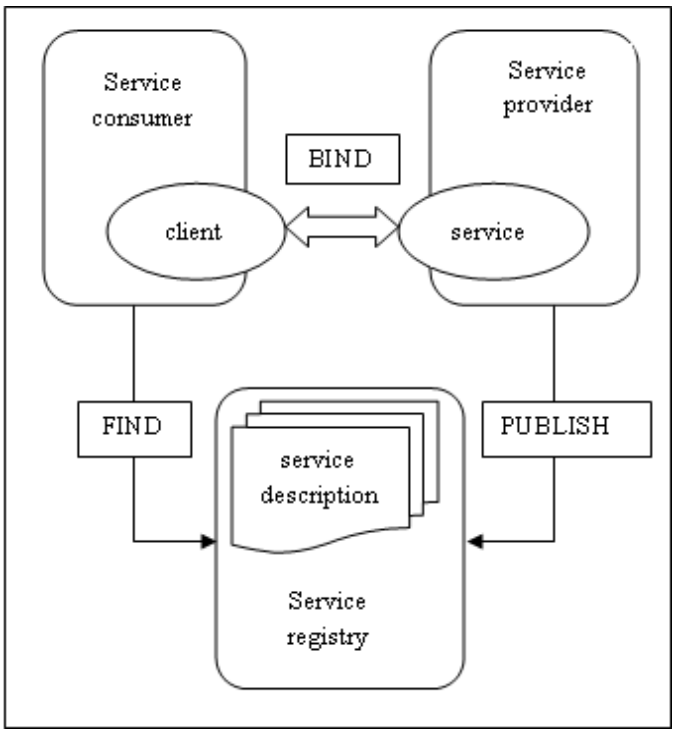

Fig- 2: Publish-Find-Bind-Execute Paradigm [19], [21], [23], [25].

What is service?

Services act as the linchpin of SOA. Services are useful in the implementation of service oriented architecture. Services are well-defined, reusable, stateless, distinctive, loosely coupled units of functionality that are self-contained.

Capgemini identified seven basic principles for services, namely services must: have a clear identity, an understandable function, be trustable, be shared, have a safe and reliable interface, be of the right quality, and have business value [22].

What is granularity?

Granularity is a term that reflects the degree of modularity of a system. In other words, the extent to which either a system itself or its description is broken down into diminutive components is termed as granularity.

What is service granularity?

Service granularity refers to the size of function which one service contains. According to the service's function and the data volume of sending-receiving, service divided into two parts: fine-grained service and coarse grained service [4].

What is the meaning of optimum methods?

Methods that are incline to provide us the best results with the least investment of resources irrespective of any field. In a typical optimization quandary the goal is to find the factor that determines the deportment of the system that maximizes the productivity or minimizes the waste.

What is optimum service granularity?

Optimum service granularity is essential for cost reduction and for reliability of system. Today, researchers determine different methods and frameworks for finding the optimal service granularity to reduce cost and engender reliable architecture.

Some issues arises due to improper service granularity [5]-

- Service duplication
- Maintenance problem
- Service governance difficult
- Service reusability suffers
- Difficulty in business alignment causes redundancy
- Audit operation become unavailable

Some features and benefits of SOA are –

Table -1: Features and benefits of SOA [19], [24]

FEATURE	BENEFITS
Service	Better flow of information Ability to expose internal functionality Flexibility
Reusability	Minimize software development and management costs
Service composition	Ability to develop new function combinations rapidly
Service discovery	Optimization of functionality,cost and Performance Easier introduction of system upgrades
Message security	Data integrity and confidentiality
Encapsulation	Greater efficiency
Standardization	Reduce skill requirement
Interoperability	Lower overhead or development cost
Abstraction	Hide complexity of business process

Challenges [18] of SOA are-

- Business Service Security
- Auditing & Business Service Governance
- Service Level Compliance
- Business Service Lifecycle Management
- Improper service granularity

2. RELATED WORK

Service granularity refers to the size of a service or size of the function encapsulated in one service. Many questions arises in our mind when we talk about service granularity in SOA like-

- What is service granularity?
- What are the concepts and determinants of service granularity?
- What methods or metrics are available for the measurement of service granularity?
- What models are used to express service granularity?
- What is a proper level of service granularity?

Many researchers [1], [2], [8], [16] tried to answer these questions few of them are-

In [9], [22] authors identified aspects that influence the level of granularity chosen and drew them on different types of services shown in Table -2.

Table -2: Service granularity aspects in Service Types [9], [22]

	TYPES OF SERVICES		
SERVICE GRANULARITY ASPECTS	Business Service	Informati-on System Service	Software Service
Functionality	√	√	√
Flexibility	√	√	≈
Complexity	√	√	√
Reusability	√	√	√
Composability	√	√	√
Sourcing	√	√	≈
Genericity	√	√	√
Context-independence	√	√	√
Performance	√	√	≈

√–considered , ≈– not considered

N. Kulkarni et al. [5] analyze the role of service granularity in a successful SOA realization by a case study in financial domain. They presented InSOAP, an architecture-centric framework to define, design and realize service oriented enterprise architecture. InSOAP describes eight types of services which can be utilized by different person. The main aim of this process is identification of services, deciding optimal service granularity along with proper layering of services. The service identification process required domain analysis and decomposition to identify precious and reusable shared services. InSOAP comprises solidification of services (an iterative process for optimal service composition) through classification and layering. InSOAP is time consuming process because it involves many factors that affect it at each step.

Hong Ying et al. [10] determined the principles of service granularity (i.e reusability, flexibility, performance and usability).Based on above principles they decomposed the services into three types, namely basic services, synthesis services and composite services. Afterwards, they presented an idea of service design that embodies the idea of top-down SOA design methodology. With the help of an example of pharmaceutical supply system they showed the relationship between three types of services. This paper shows only the necessity of balance between the service granularity to obtain lower cost and flexibility. Inspite the fact, the paper is not presenting any methodology or approach for obtaining optimal service granularity.

R. Haesen et al. [3] discussed about the service granularity and its impact on architectural qualities such as performance ,reusability and flexibility .They divided the service granularity into three types, namely data granularity, functionality granularity and business value granularity .By looking at interface of services , they further classified these service granularity. From the above discussion the authors concluded that defining service granularity is quite complex and it is hard to measure granularity in terms of absolute numbers. This paper not shows any method for achieving right service granularity.

Haiqing Bu [22] have considered the problem of finding appropriate granular version of services. For this author classified services into unambiguous groups and recognized many aspects that influence the level of granularity for each type of services. AHP [7], a quantitative tool which constitute three principles decomposition, comparative judgment and priority are used for weighting the attributes and draw a set of pairwise comparison metrics. Finally, the result of this comparison is used to obtain the more appropriate level of granularity.

Xie et al. [4] proposed a division rule to decide the appropriate level of granularity of services in RISP (Railway Information Sharing Platform). For this rule authors followed some guidelines which was helpful in defining acceptable level of granularity and divide the services into three types i.e basic services, combination services and integrated services. An application example is taken for the illustration of division method. In future we can propose a division method for the other systems.

Wang Xiao-jun [2] proposed design- time metrics that cater to the service design principles concerning loosely-coupled and well- chosen granularity. By considering former one author proposed a metric for service coupling between services and client and by considering later one author measure the common use of service operations. A case study is performed that shows the applicability of proposed metric in which different design decisions are considered having the same clients. The future scope will involve the metrics that consider other design principles and empirical evaluation of these metrics.

Jinlei Jiang et al. [13] analyze the business process by a case study and got the statistical information about business process which is helpful in the determination of service

granularity. They proposed an assistant based approach based on business process analysis. Firstly, they presented a formal model defining various concepts such as business process, activity, operation and receiver which are provided the basis for proposed approach. Then the authors given a process for determining the appropriate service granularity which is divided into three phases, namely preprocessing phase, analyzing phase and post analyzing phase. In future we will measure the importance of activity/operation.

Bernd Heinrich et al. [8] presented an economic decision model for the service granularity optimization. Authors illustrated the prototypical implementation of decision model in a software tool which was based on Eclipse Modeling Framework and carried out in java. Afterwards, a case study of financial service provider is debated to demonstrate the benefits of software tool. Three granularity metrics, namely distance oriented metric, scope oriented and size oriented metric were also introduced which was mathematically defined.

Bernd Heinrich et al. [15] presented different metrics for the realization of different perspective on service granularity. Then, compared the granularity metrics on the basis of their values, criteria, interpretability and comparability. Finally , the application of metrics in a real world is illustrated by a case study in financial domain.

T. Karthikeyan et al. [1] analyzed the proposed metrics for quantitative measurement of service granularity in service oriented architecture by a case study and also theoretically validates the proposed metrics with the help of weyuker's properties. Proposed metric considered different attributes for the measurement of service granularity like number of atomic services, business logic function, CRUD function, input parameters, output parameters, weight value of parameter etc. In this paper, optimal level of granularity changes according to the type of services. The limitation of this paper is that the proposed metric only affects flexibility and reusability of services. In future we can also propose metrics by considering other characteristics of services.

Alahmari S.et al. [11] with the help of optimal service granularity proposed architectural framework collaborate service definition, identification and realization for migracy legacy systems. The framework is based on portfolios that are obtained from UML and BPMN analysis and consists of functional and non–functional elements that affect the migrated legacy systems.

J.Geetha et al. [12] presented a tool for the evaluation of service granularity at the design time. This granularity measurement tool was taken into account three measures that are composite level of service, functional richness of service and interface granularity of services. Java and net beans were used in the development of tool. The tool consists of various phases like first one is the data retrieved from the pseudo code that has been originated by the class diagram of UML. Second, services were analyzed for the evaluation of service. Third, by considering various parameters estimated granularity of services and lastly report is generated which consist granularity of different services. By evaluating correct granularity we are able to detect reusable services.

Table -3: Summarization of different methods in a table

Author	Year of Development	Method	Validation Type	Description
J.Geetha and T. Karthikeyan,[12]	2012	Tool	None	Proposed tool evaluates granularity of the service at design time
Wang Xiao-jun[2]	2009	Metrics	Case study	Measure coupling and service granularity by considering service design principles
Jinlei Jiang , Yongwei Wu and Guangwen Yang[13]	2011	Assistant approach	Case study	Assistant approach used for making service granularity right.
T. Karthikeyan and J.Geetha[1]	2012	Metrics	Case study	Proposed metric used for measuring granularity of a service by considering its composite level, functional richness and its interface granularity.
Krammer, A., Heinrich, B., Henneberger, M. and Lautenbacher, F.[8]	2011	Distance oriented metrics	Case study	The metric measures service granularity considering the position of the implemented functionality in the FSG: distance of the path from a process to the implemented functionality in relation to the distance of the complete path.

		Scope oriented metrics		The metric measures service granularity by the number of directly and indirectly following functionalities
		Size oriented metrics		The metric measures the granularity of a service by its size (e.g., measured in LOC)
Alahmari S. and Zaluska E[11]	2009	Architectural framework	None	Assist service identification, definition and realization for migrated legacy systems with optimal granularity and it is based on portfolios that are derived from UML and BPMN analysis.
Bernd Heinrich and Steffen Zimmermann[15]	2012	Width metric	Real world case study	Based on number of basic functions that are directly and indirectly realized by a service.
		Depth metric		Defined by the length of path from the process to the realized function in relation to the length of the complete path
		Combined width and depth metric		Improve measurement by integrating benefits of width and depth metrics.
		Size metric		Measure the size of software function.
Saad Alahmari , Ed Zaluska and David C De Roure[16]	2011	Operation Data Granularity (ODG) metric	Case study and theoretical validation framework	Measures the degree to which an operation uses 'excessive' data. and based on fined-grained and coarse-grained parameters.
		Operation Function Granularity (OFG) metric		It consists of both business logic and CRUD (create, read, update and delete) functions.
		Average Service Operation Granularity (ASOG)metric		Measure service granularity of all services.
Xie Zhengyu, Dong Baotian[4]	2009	Division method	Application example	Proposed for railway information sharing platform (RISP) according to which divide the services of system into three parts based on their functionality.
Khoshkbarforoushha, A., Tabein, R., Jamshidi, P., and Shams, F[7]	2010	WGLA metric	None	WGLA metric is used for quantitative measurement of service granularity by utilizing service granularity attributes i.e business value , context-independency, reusability and complexity.

3. CONCLUSIONS

We presented existing work on service granularity measurement in SOA that offers ample scope of expanding existing approaches or metrics. We examined the available methods and tools that are subsidiary for quantifying service granularity in SOA. In the survey we found that there are many service granularity attributes but available approaches considering only some service granularity attributes. In future, methods can be proposed by considering those service granularity attributes that couldn't be included in the existing work.

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