SERVICE-ORIENTED ARCHITECTURE AND PROCESS MODELING

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Abstract: Nowadays, uncertainties in business environment enforced enterprises to utilize innovative patterns for the interpretability and integration of the processes and services. Therefore, enterprises have, throughout time, shifted to IT-based business processes based on Service-oriented Architecture (SOA) to augment the agility, integration, and flexibility of IT-based applications in enterprise networks. Thus enterprises have embarked on the implementation of integrated information systems to support their business processes. To this effect, SOA, as a highly capable paradigm in IT, has been increasingly used in Business Process Management (BPM) and enterprise information systems using the Web service technologies. This has helped the attainment of required agility and flexibility for inter-organizational networks. The aim of this paper is to review the underlying concepts of SOA and to identify how SOA business process.
Key words: Service-oriented Architecture, Service-oriented modelling, Process modelling

1. INTRODUCTION

The 21st century business environment has to face the challenge of ever-increasing uncertainties in business process management. These uncertainties have enforced enterprises to utilize information systems. In this challenging context, business administrators prioritize more novel business processes and IT requirements, which, in turn, lead into more complicated business processes. Information Systems

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have, throughout time, shifted to IT-based business processes based on SOA to augment the agility, integration, and flexibility of IT-based applications in enterprise networks. Thus enterprises have embarked on the implementation of integrated information systems to support their business processes. To this effect, SOA, as a highly capable paradigm in IT, has been increasingly used in enterprise information systems which, using the Web service technologies, produce innovative patterns for the interpretability and integration of the processes and services. This has helped the attainment of required agility and flexibility for inter-organizational networks [1,2,4].

The aim of this paper is to review the most common features and underlying concepts of SOA in order to identify how SOA can support information system in the development stage. The second section reviews the common features of SOA. The third section discusses the underlying concepts of SOA in terms of enterprise business process. The section four explains how SOA can be applied in business process with a scenario example. Finally, the last section concludes the paper.

2. SERVICE-ORIENTED ARCHITACTURE

A well-defined architectural style is required for building web-based IS. However, the existing architectural styles, for example, Enterprise Application Integration (EAI) approaches and Object-oriented Architecture, do not have adequate capability to produce a flexible IT-architecture which is able enough to adapt itself to the ever-increasing pace of business needs [1-3]. This problem can be addressed by SOA, as a fast growing paradigm for designing a flexible enterprise IS to enhance agility [4-6].

SOA, in comparison with the existing architectures and approaches, initially permits business partners to share their internal information by incorporating the acquired data into individual service units, which are available across the network. SOA-based systems perform two tasks: (1) they allow the transference of information along the enterprise boundaries;(2) they make possible the implementation of various applications through those service components that increase the ease of, and flexibility for, business process reconfiguration [7]. Table 1 illustrates the comparison of most important features of traditional approach and SOA.

Table 1. Comparison of SOA and Traditional approach [3, 8, 9]

SOA	Traditional approaches
Cost effective communication	Costly communication
Focusing on Business logic	Focusing on Business task
Gradual development	Long-term structure
Related to specific software	Large-scale software
Independent platform	Dependent platform
Loosely couple	Tightly couple
Easy to implement the changes	Constructing for long time
Message-based interaction	Object-oriented

IT and business utilize diverse languages, yet SOA expects IT and business to work in as cooperative and as intelligible a manner as possible. To this end, there has to exist a body for the supervision of alignment between IT and business as well as a shift in SOA paradigm toward IT-based business environment [6]. In business and technology domains, [3] defines SOA as follows:

"SOA is a conceptual business architecture where business functionality, or application logic is made available to SOA users, or consumers, as shared, reusable services on an IT network."

Within SOA, a number of tasks are performed: a standardized style service description, service registration, and consumer's service discovering and invoking [10]. The three basic components of SOA are service consumer, service broker, and service provider. The publication of service description and the provision as well as the implementation of the services are among the tasks of service providers. Service description has to be found by a service requester in the service registry provided by service broker; next, the service consumer binds and invokes the services. However, it should be mentioned that the service consumer can invoke the services directly without the task performed by the service broker [11]. Figure 1 shows the conceptual model of SOA architectural style.
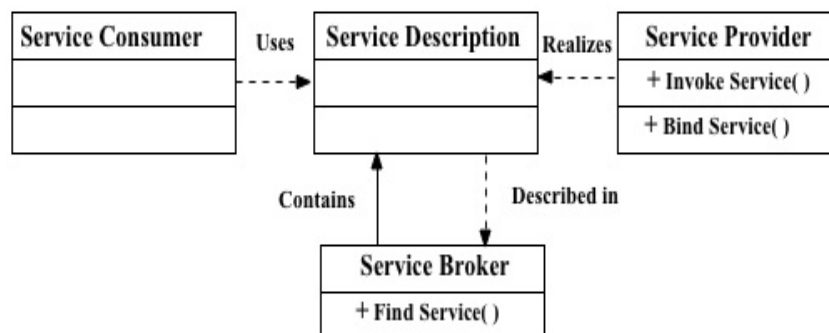

Figure 1. The conceptual model of a SOA architectural style [11]

A conspicuous privilege of SOA over BPM is that services have the capacity to be made available to others within the business process. In particular, SOA can break business applications into process as service [12] in such a way that services can share their capability [13]. Services can encapsulate varying amounts of logic [14]. Services communicate with each other by passing data from one service to another [14], or by coordinating an activity between two or more services. Service can be reused or replaced between business processes [4]. Followings illustrate these common features of SOA.

- ***Shared Service***

In service oriented computing, the breaking of the silo business process creates the capability for recyclable and shared services (Figure 2) [13].
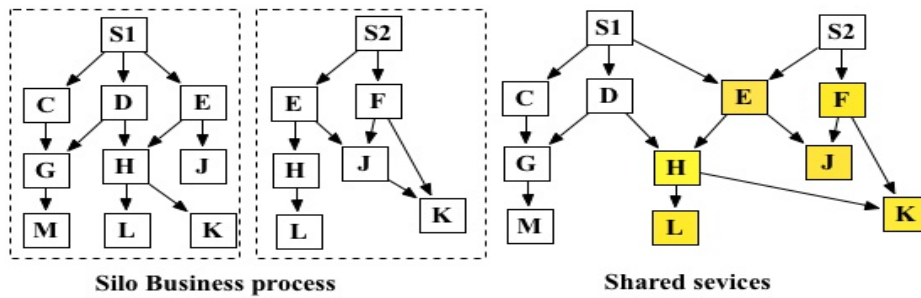
Figure 2. The shared capability by shared services [13]

-   ***Service Encapsulation***

Business services have to encapsulate business logic into a precisely determined context so as to sustain their independence. This context is defined by business entity, logical groupings, and business tasks. Figure 3 highlights that the encapsulation of each task by a business service is done by taking an individual step or by taking a subsidiary process, which consists of a number of steps. In Figure 3 the larger scope of business logic which is represented by service A (which contains sub-processes) is in turn encapsulated by services B and C [14].
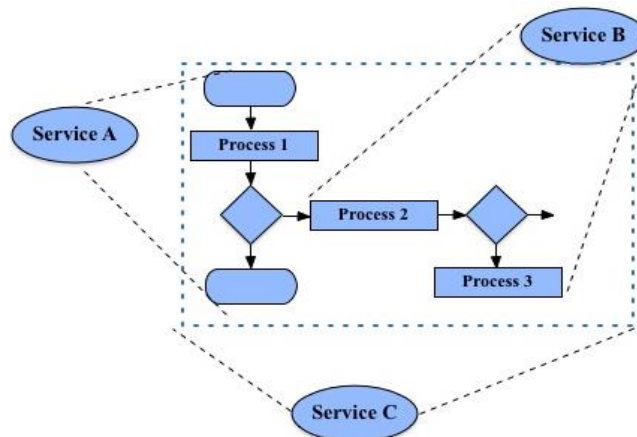

Figure 3. Service encapsulation [14]

-   ***Service Communication***

A basic architecture takes shape by those services that describe services and communicate through messages [14]. Figure 4 shows the three core components (services, descriptions, and messages) in service communication.
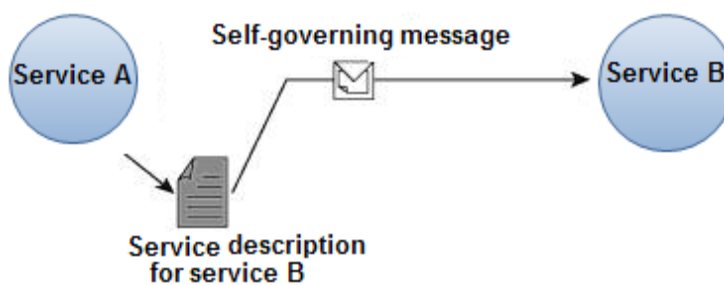

Figure 4. Service communication [14]

- ***Reusing Service***

Service can be replaced, added or re-used within a business logic (Figure 5) [4]. Applications can be constructed by the composition of reusable business services [15].
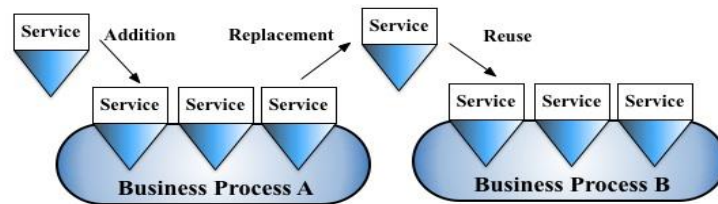

Figure 5. Service reusing [4]

3. ENTERPRISE ARCHITECTURE AND SOA

Enterprises aim to organize their business process based on SOA not only to manage business process more efficiently but also to have a more flexible interaction with their partners' information systems. To attend to business needs, processes, and strategies, it is necessary that both SOA and Enterprise Architecture (EA) are capable of alignment with IT systems. Furthermore, to achieve success, SOA has to possess the same set of EA concepts, which have to be included into information architecture [3]. The relationships between SOA and EA are portrayed in Figure 6 with the major components of SOA located within the right part and EA's major perspectives within the left.
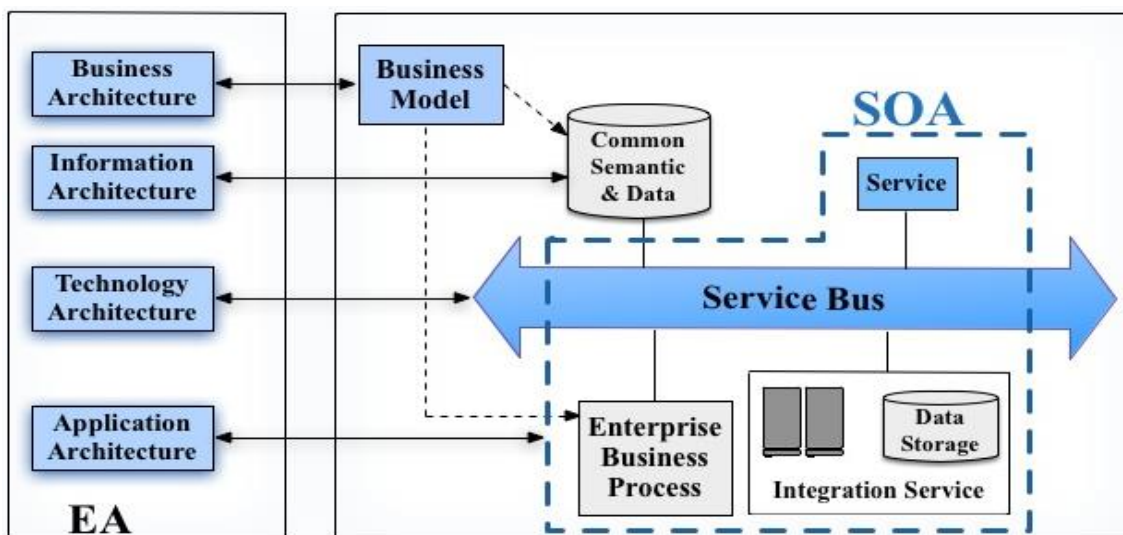

Figure 6. The relationship between EA and SOA [3]

SOA, in Figure 6, illustrates the interrelations among a number of concepts: service and integration, service bus, Enterprise Business Process (EBP), common semantics, and business model. EA includes four sub architectures: Business

Architecture, Information Architecture, Technology Architecture, and Application Architecture.

SOA performs a number of tasks. It must define the kinds of services (enterprise business processes and business services), their granularities, and the ways services can be constructed and utilized. Business functionality is a vital component of SOA in an enterprise and the ways it can be exposed to other services as well as connected to the service bus are crucial. Yet it is worth mentioning that some of the business functionality is not achieved by a service [3, 16].

SOA—by connecting services to enterprise business process—makes possible the reuse of services within an organization, aimed to support diverse business applications. Services Infrastructure, methods, and instruments are to be defined in SOA in order to incorporate services into broader business process [3, 17].

To integrate service communication and service composition there must exist a technical infrastructure within a service bus. Further, a common semantic environment has to be defined in SOA. In such environment a number of services are designated, for instance, the interoperability and consistency within an enterprise to create consistent business processes [3, 16, 18].

To design a business model, one has to have an estimation of the needs within a common environment as well as of the information and services, which are required to support that environment. SOA must consider the ways via which varied services comply with each other across business processes so that the reuse of services is made possible. To this end, business architecture must be able to provide a inclusive definition for the entire scope of service landscape. Business architectures define service groups to support business process and have effects on business strategies and goals [3, 6].

The explanation of SOA common semantics, the manner of operability and data analysis are incorporated into information architecture. SOA service bus, its explanation, and the manner services are provided by service infrastructure is incorporated within technology architecture [3, 19].

The application architecture provides solutions related to SOA, defines the construction of services, and explains the relations between services and applications style such as web portals and Business-to-Business (B2B) applications. Interoperability in BPM pertains to common semantics issues in diverse contexts and at various levels of abstraction, which requires aligning strategic perspectives articulated in EA with IT-based Business Process [20, 21].

In the domain of SOA (which supports BPR and Data Analytics), one can find that there is a straight nexus between service definition and business requirement. Further, in SOA the definition of business service is gaining a soaring importance in the development of service metrics and policies [22]. In this regard, one can observe that SOA meets certain requirements: for instance, it can deal with those independent or detached business-aligned services which have the capacity to be combined with meaningful high level business processes which affect business environment; but this is not a challenge for today's SOA-based information systems [3]. It must be noticed

that diverse terminology is applied in business and IT sectors. For example, whereas business professionals utilize market segmentation and sales pipeline, IT experts apply such terms as XML and J2EE. This semantic variety creates confusion for most people except for enterprise architects [6]. Therefore, as stated by [23], in applying SOA, the most amount of focus should be laid on business context instead of technology.

4. APPYING SOA FOR BUSINESS PROCESS

Regarding to what has been discussed, the focus of the present research is on Application Architecture and SOA. In the following discussions a brief survey of all the concepts and their relations are presented which is illustrated in Figure 7.
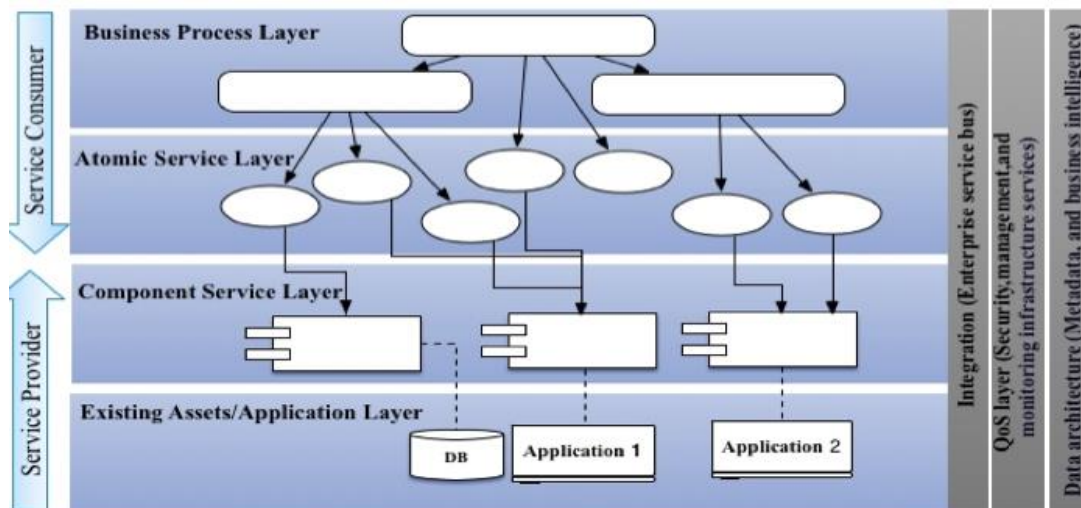

Figure 7. SOA layers [20, 33].

As depicted in Figure 7, a bridge between two compartments, that is, application architecture and SOA, must be established which together constitute the entire Service-oriented modeling approach. From the service specification's point of view, there are four main layers, as illustrated in Figure 7, are (1) business process layer, (2) service layers, (3) service component layer, and (4) application layer.

The first layer defines the process and activities of application in the form of a flow of orchestration and choreography. The second layer indicates the atomic and composite layer of services, which act as an interface between both business process and service component layers. The third layer demonstrates a combination of atomic services that act as an interface between service layer and application layer. The application layer, also termed legacy systems, is an existing operational system such as ERP and CRM [33,34]. Interoperability between diverse technical architectures is an important privilege of utilizing service-oriented integration, for it facilitates the

detachment of an organization's IT architecture from its business. The detachment or decoupling makes flexible the implementation of specific business potentials [14, 20].

Figure 8 illustrates how SOA can be applied in business process. This case study is the procurement process of Sapura Brake Technology (SBT) that supply and sale of brake systems for the automotive industry in Malaysia. There are four main processes in the business process layer, namely, order management, sourcing, supplier, and purchasing. In the application layer, the existing operational systems (business application) of the procurement are SRM, Order DRMS, Finance and ERP, Inventory management, and MRP. The relations of the business processes and identified services among four layers in service-oriented approach are shown in Figure 8.
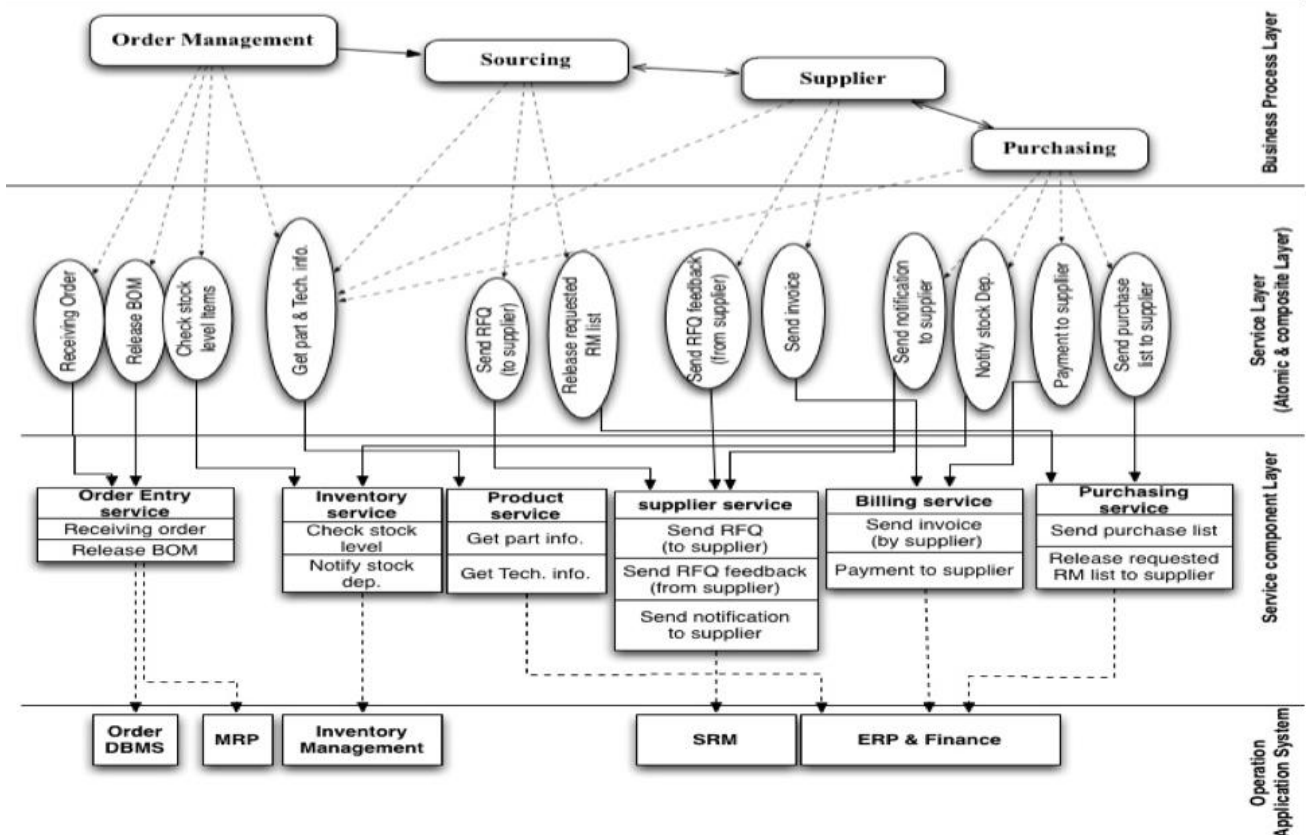

Figure 8. Service-oriented view

4. CONCLUSION

In the domain of SOA, it can be found that there is a straight nexus between service definition and business requirement. In this regard SOA meets certain requirements: for instance, it can deal with those independent or detached business-aligned services which have the capacity to be combined with meaningful high level business processes which affect business environment; but this is not a challenge for today's SOA-based information systems. It must be noticed that diverse terminology is

applied in business and IT sectors. For example, whereas business professionals utilize market segmentation and sales pipeline, IT experts apply such terms as XML and J2EE. Therefore, in applying SOA, the most amount of focus should be laid on business context instead of technology [14, 35-36].

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