Modelling of business services in service oriented enterprises

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Abstract

The idea of on demand business combines information technology and business to make the companies more rapid, responsible and profitable. Today, the most important thing that can be considered for an enterprise is flexibility, which, in this context, means having more flexibility in responding to new demands of the market and grasping the opportunities. In order to increase its flexibility, first of all, business enterprise takes a look at its interrelated activities and then specifies which activity is distinct and axial and which can be outsourced. If the companies can combine and coordinate these activities as they desire, then they will enjoy remarkable excellence in market. Extraordinary alignment between information technology and business is a result of Service Oriented Architecture (SOA) approach, which has made the organizations have a special look at this approach for execution of software projects.

Business processes are used for modeling internal and external operations of the organizations for several decades and accidentally such a modeling has rapidly become a standard modeling in businesses, companies and enterprises, booming outsourcing market and making the enterprises and companies grow by such modeling and benefit from remarkable savings. But, there is a serious need for new methods for modeling enterprises operations in order to identify and use the common features between companies and enterprises for decrease the costs and enjoy more savings. In this paper, an approach is introduced that is based on business services for service orientation of enterprises. Molding the business services is one of the innovative methods for achieving the objectives concerned in the business

1- Introduction: Challenges and Problems in Service Oriented Projects in Iran

Service oriented attitude is seen in high percentage of IT projects in Iran during recent years, which are organized through tender between experts and IT companies. In these projects, service oriented view has been emphasized by the employer as a "requirement" and the term "SOA" is seen in the text of request for proposal (RFP) prepared for these projects, which are not used correctly in many cases (For example, using service oriented architecture instead of RUP). Against these requests, in most suggestions presented by IT experts, execution of the project according to service oriented architecture is positively replied without considering nature of such projects and perhaps many of these projects are not service oriented in nature at all.

By investigating IT projects with service oriented approach, it can be said that the main problem in execution of such projects is lack of a standard methodology for execution of SOA projects. The fact that the companies and organizations have a correct architecture in place is not enough, and the architecture should work properly. Modelling also plays a vital role in properly working of service oriented architecture. Although SOA have known components, but these components have new elements that increase flexibility, for example service choreography. These elements need new design techniques. Therefore, it can be said that those modelling techniques are needed that ensure all SOA requirements are met from the beginning of work and all advantages of a flexible technology infrastructure are used. It can be said that an approach for modelling by creating a relationship between technology model and business ensures that each element of information technology infrastructure is designed in such a way

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that it supports business objectives, which is the same full definition of flexibility and accountability sought by organizations. Having a comprehensive model for service oriented architecture design process can save us from corrections and costly future additions.

In design of high quality service oriented architecture for companies and enterprises, there are some problems that we are still at the outset of solving them. This is here that we can understand the importance of service oriented methodologies as a solution for using service oriented architecture in business of companies and enterprises. Need for identification of a modelling method or algorithm for responding to method of conclusion of appropriate services from high level requirements of business and business process models is completely felt. What made organizations have a special look at this approach can be investigated from several viewpoints:

- **Alignment of IT and Business Objectives**: Creation of an extraordinary alignment between information technology and business objectives is a result of service oriented architecture approach, which has made the organizations have a special look at this approach for execution of software projects. From the viewpoint of business layer, service oriented architecture establishes the connection between business and information technology processes so that technology is easily coordinated by changing the processes. Rapid changes in business is another fundamental issue that preoccupied executors of information technology and service oriented architecture, as one of the strategies of information technology, meets the need for rapid coordination with the changes in business.

- **Service Oriented Architecture (Principle of Business Dynamism)**: Business experienced remarkable changes. Competition between novices and veterans, increased limitations and demand for higher flexibility and celerity influence business. This growth is originated from instructions of senior directors of big companies and enterprises and most of them expect to yield more profit when their enterprises become more responsible to the changes. Demand for innovation, flexibility and decreased marketing time for new products and tendency for creating new income resources have led to renewed thinking and attitude in structure of the industry. Service oriented architecture is an ideal way for flexibility of companies and enterprises against changing conditions of market and achieving a dynamic request oriented business.

- **Integration of Inherited Technology and Programs**: If there was no way for achieving and using inherited technologies and programs, it was not possible to shift towards service oriented architecture. Integration of the existing systems and achieving inherited data is one of the earliest capabilities of SOA. Many big companies are characterized with various accumulated applied programs and systems. Integration of inherited technology and programs is the objective of those businesses that seek more dynamism in global market. Service orientation architecture that uses universal standards such as web services is the ideal solution for establishing link between the existing systems with each other and with modern technologies. Using universal standards enables the experts, enterprises and companies to market components of the existing software packages. It means that the integration is achieved more rapidly and easily. Universal standards also make the experts to effectively and rapidly develop innovation in one of sections of their organizations and spread it throughout the organization. So, reworking is avoided, innovation is increased in the business and motivation for innovation is created.

One of the characteristics of service oriented modelling is that such modelling is easily integrated with analytical techniques of inherited programs so that the services used in service oriented architecture are identified, specified and executed. So, applications of each programs existing in the business are extracted and candid services are identified, which can be used for realization of the objectives of the business. Furthermore, problematic and important domains are identified and new services should be developed and/or external servicing should be used.

- **Achieving Flexibility and Decreased Risk**: Increased flexibility of business and decreased risk are among the other objectives of service oriented architecture and modelling. This objective is achieved through confirmation of various aspects of service oriented architecture design- from objectives of the business to execution of service. Flexibility means being flexible in meeting new demands of market and grasping the opportunities. In order to achieve such extent of flexibility, the companies need the same extent of flexibility in activities of their business in their technology environment.

### 2- Expression of Problem

Concept of service is not a new one. Today, service oriented architecture and web services and effort for standardization of services are well-known concepts. However, this focus of the existing modelling approaches on integration of IT systems is meant for enhancing associability. These modelling approaches do not sufficiently meet high level needs of business in service oriented operations and relating the service oriented ecosystems. For success of service oriented architectures in software solutions, service oriented architectures should be recruited at high levels of enterprises so that a service oriented business is developed. In all existing service oriented models, service orientation has been provided on the basis of the solutions in the field of technology. For dynamic and active interactions with customers, suppliers, partners and employees, the companies seek what business services should be provided by them and how they are rapidly developed to meet the needs and increase the profit. Business services provide a new sample of standardization and componentization of business level. If
The performance of business is designed as well-defined services, emergence of service-oriented organizations can be witnessed. In changing an organization to service-oriented organization, some challenges are encountered in business, which are very difficultly overcome than technical challenges in implementation of SOA. Concept of service-oriented business may be understood easily. Realization of service-oriented business is complicated and needs research and innovation in various fields. In the suggested approach, the steps required for realization of a service-oriented organization have been provided. Challenges and problems that we intended to answer in this paper include:

1- How service-oriented modeling aligns objectives of information technology and business?
2- How all aspects of service orientation of business can be covered through a comprehensive modeling pattern?
3- What are key elements for service orientation of enterprises?
4- How appropriate services are extracted from high-level requirements of business?
5- How the distance between technology and business can be removed through service-oriented modeling?

In this paper, we discuss the following:
- Identification of key elements in activation of service-oriented organization
- Providing a suggested model for service orientation of business
- Identification and introduction of main phases and steps of the model suggested for service orientation of business
- Identification and introduction of input and output of each step for easiness of using the suggested model in service-oriented businesses
- Identification and introduction of accurate criteria for appropriately diagnosing components of business as initial elements of service orientation of business
- Identification and introduction of accurate criteria for appropriately diagnosing business services as secondary elements of service orientation of business

3. Business Services as a New Operation Model in Service-Oriented Business

While web services and service-oriented architecture provided a valuable view on modeling of enterprises based on interactions of information systems, but modeling of business needs higher abstraction than level of business. Realization of such objectives as standardization, modulation, and flexibility inside and outside of enterprise through business services creates a new and interesting landscape.

Modelling of business operations in the enterprise needs correct level of granularity of a company or enterprise. Furthermore, in order to identify the initial elements of model, appropriate selection of elements of business architecture is required. Fine granularity like web services leads to excessive details and if the selected pattern for modelling is sophisticated in nature, then valuable features of the model is deteriorated. On the other hand, selection of some business architectures may become an impediment. If only behavioral entities are selected, e.g., business processes, then modularity is lost, because main processes cover a lot of activities located in big sections of the enterprise. For success of service-oriented architectures in software solutions, service-oriented architectures should be used at high levels of the enterprise so that a service-oriented business is developed. The enterprises can be considered as big components that provide a set of business services for other enterprises. Business services is a very desirable method for modelling business level operations in companies and ecosystems, which provide a correct level of granularity by capsulation of remarkable part of the activities of an enterprise and the interactions occurring among them. In the suggested approach, a modelling is introduced that is based on business services.

4. Related Models in the Field of Business Service Orientation

The aim is to achieve a business that can identify pending changes influencing the business, lead to progress in market and coordinate the speed of enterprise with the demands of customers. In order to achieve such condition, the business is required to use the most complete technologies. Such business is called "On Demand Business". Achieving on demand business is equal to achieving the most complete business flexibility. Two important activators that direct the enterprise in achieving an on demand business are componentization and service orientation. Component Business Model (CBM), which is a model used by Business Consultant Association of IBM, is used as an organized set of business components for creating a structured representation. CBM is a framework for analyzing and modeling the business for organization of objectives and includes grouping of business activities in the components. CBM helps analyze business and create a componentized view of enterprise. The existing modeling methods are concentrated on either the business aspects or IT implementation aspects in general. Unified Service Model (USM) allows modeling of services at all granularity levels of business. This model allows specification of wide range of services, whether they are business oriented or technology oriented, and also expresses the relationships between service consumer and provider at all hierarchical levels of service. In CBM, only business models are dealt with. In this model, there is no specific method for identifying business services and modeling operations of these services and USM deals with specification of business services and it is ignored how
services and modelling of operations of these services interact. In the suggested approach, it was tried that an abstraction higher than business level is considered for identifying business services and all business aspects are predicted in the suggested modelling so that the modelling can be coordinated with the changes in business. We seek a unified model that covers identification of business components, extraction of business services and modelling of operations of these services.

5- Suggested Approach for Service Orientation of Enterprises

Concept of service oriented business may be understood easily. Realization of service oriented business is complicated and needs research and innovation in various fields. In this paper, an approach has been suggested for modelling service oriented enterprises. It has been tried to provide executive steps of the suggested method with specific inputs and outputs so that the experts could easily services of the concerned enterprise through these steps. The approach suggested for modelling business services is used in service oriented business. The approach suggested for realization of service orientation of business includes two phases:

- Phase 1: Componentization of Business
- Phase 2: Service Orientation of Business

Componentization and service orientation are two activators for converting the enterprises to on demand business. Two important elements that play a key role in componentization and service orientation are business components and business services, which vary from their similar concepts in information technology, i.e. IT components and services, and we aim to identify this gap and clarify SOA domain. The approach suggested for modelling business services, which is used in service oriented business, includes 5 executive steps as shown in figure 1. Each step includes some output/result, which can be as a document, report or frame or architectural model.

- Step 1: Business Component Identification
- Step 2: Business Component Modelling
- Step 3: Business Service Identification
- Step 4: Business Service Specification
- Step 5: Business Service Realization

Steps 1 and 2 are used in componentization of business phase and steps 3, 4 and 5 in service orientation of business phase. In figure 1, phases of changing business of enterprise to on demand business are shown.

![Figure 1: The approach suggested for modelling service oriented business](chart.png)

5-1 Phase 1: Componentization of Business

The idea of deconstruction is widely accepted in enterprises and companies, because the enterprises and companies can achieve main capabilities of business through deconstruction of their business and focus on them and as a result progress in competition market. Componentization allows companies and enterprises to deconstruct business. Therefore, deconstruction and reconstruction process is realized through business components, which correspond with business performance. The aim of componentization of business is to decompose business of the enterprise to the components with specific boundaries, which helps correctly understand sophistication of business of the enterprise and facilitate realization of business objective through IT solutions. While componentization of business, it should be tried to realize the following objectives:

1- Finding sensible groups of interrelated activities that can be optimized as a unit.
2- Understanding and optimizing interaction of components with each other for meeting a business objective.
Componentization phase includes two executive steps. Step 1 is called business component identification and its output is a specification of main features of business component. Step 2 is called business component modelling. In step 2, main elements of business component are represented as a formal model and these elements are extracted from component specification (output of Step 1).

5-1-1 Step 1: Business Component Identification

- **Input:** Business Value Model and Business Structure Model
- **Output:** Business Component Specification
- **Method:** Component Business Method (CBM)

**Business Architecture**

Business architecture introduces key elements required for expression of business and these elements are used in various evolution programs in business through technology solutions. Business architecture in a service oriented enterprise is expressed by the following 5 models:

- **Business Value Model:** value model describes method of cooperation of enterprise with other enterprises and method of development of value. In addition, this model specifies what constitutes the base of strategic decisions in relation with offering portfolio and relationships between business partners.
- **Business Structure Model:** Structure model expresses how an enterprise organizes its activity to non-overlapping functions. Analysis of structure model helps make decision on finding resources for business activities and business investments.
- **Business Behaviour Model:** Behaviour model expresses how to determine the operations inside the business and shows behaviour of business partners inside an ecosystem. Business services are an external look at operations of service oriented enterprise.
- **Business Policy Model:** This model includes policies of business in supervising and leading all aspects of business architecture. Policies are an effective way for controlling operations of the business.
- **Business Performance Model:** Performance model described the elements required for evaluation of performance of the enterprise based on performance indices.

Business strategy is not considered as part of business architecture, but it is used as an input that influences all business architecture models. Strategy is a comprehensive and complete program based on which achievement of basic objectives of the enterprise is ensured.

**Input of Step 1: Business Value Model, Business Structure Model**

Business value model and business structure model are input of Step 1 for identification of business components and extraction of main features of the component.

- **Business Value Model:** most economists believe that the aim of business is increasing the economic values produced by that business. Value of a complete set of product or service provided to customer can be assessed by the price the customer wants to pay for that product or service. Business value elements in business architecture include economic entity, offering and value. The relationship among these elements is shown in figure 2.

![Chart 2: Parts Of Business Value Model](image)

- **Economic Entity:** Economic entity is a term used for each unit or enterprise in society such as municipality, hospital and company. In business value model, economic entity provides value through its offerings.
- **Offering:** For each economic entity, there is a set of offerings that are provided or consumed by the entity, including product, service and etc. in a service oriented enterprise, business services is a main part of its offering portfolio. In preparing these business services, design of business structure model and behaviour model and value model are effective.
Value: The value provided by an enterprise is mainly due to offerings of the enterprise. One of the advantages of value modeling in the enterprise is separation of value turnover from financial turnover.

Business Structure Model: Business structure model describes how to organize work of the enterprise to non-overlapping business functions through business components. This structure model can be developed for various analyses (for example, understanding distribution of work inside the enterprise, preparing a list of business components and etc.). As shown in figure 3, business structure model includes business components, component-related artifacts, offered services and strategic capability, which can be concluded through cooperation between business components.

Figure 3: Elements of business structure model

- **Business Component**: If grouped by a reasonable framework of business components, the work done inside the enterprise helps understand structure of enterprise and method of allocation of various resources throughout the enterprise. A framework that is based on business components helps make decision on finding resources for business services- For example, which service is created inside the enterprise and which service is created outside of the enterprise.

- **Business Artifact**: Business artifact is a sensible identifiable entity of business information such as forms, documents and messages and its aim is to follow up progress toward an operational objective of the business inside the enterprise. Each business component in management of lifecycle of business artifacts should ensure that these artifacts are related to the work inside of the component.

- **Business Service**: By componentization of business, the work done inside of a component can be offered as a service. Therefore, there is a strong relationship between business component and business service. So, business services of an economic entity are a set of services offered by components of this entity. In business structure model, it is only discussed what the service does, and how business service is activated is described in business behaviour model.

- **Strategic Capability**: Strategic program is a comprehensive and complete program based on which achievement of objectives of the enterprise is ensured. Strategic capability means capabilities that enable meeting operational objectives of the enterprise.

Output of Step 1: Business Component Specification
Business component is output of Step 1. In the following section, some definitions of business component are provided.

- Business component is part of the enterprise that can be activated independently.
- Business component is a reasonable look at part of the enterprise that include resources, human, technology and knowledge.
- Each business component uses a unique objective in the enterprise and cooperates with other components in the enterprise.
- A business component uses a single objective and provides one or more business services to be consumed by other components.
- Deconstruction process converts an enterprise to a set of automatic and small components (business components), which interact with the similar entities in business of ecosystem. This conversion is componentization of business.

The best output that can be considered for the step of business component identification is business component specification, so that the elements required for business component modeling can be extracted through such
specification (business component features). In the table below, general features of business component for providing business component specification is provided and these features can be extracted from business value model and structure model.

<table>
<thead>
<tr>
<th>Business Component Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business Purpose</td>
</tr>
<tr>
<td>Definition of basic values provided by a component/ reasons for existence of component</td>
</tr>
<tr>
<td>Activities</td>
</tr>
<tr>
<td>A set of activities done within the scope of business component</td>
</tr>
<tr>
<td>Resource</td>
</tr>
<tr>
<td>Human, knowledge ad all tangible and intangible assets used by a business component</td>
</tr>
<tr>
<td>Governance</td>
</tr>
<tr>
<td>Management mechanism required by business components for automation operations, measurements and procedures for motivation, efficiency and accountability.</td>
</tr>
<tr>
<td>Services</td>
</tr>
<tr>
<td>All services provided and consumed by business components are called service.</td>
</tr>
</tbody>
</table>

5-1-2 Step 2: Business Component Modelling

**Input:** Business Component Specification, Business Value Model, Business Structure Model

**Output:** Business Component Modelling

After identification and extraction of business components and specification of main features of the components, it is time to model the components. For modelling business components, a formal model is used that indicates the relationships between elements of business components. Figure 4 depicts various elements constituting business component.

- **Business Component:** A reasonable part of an enterprise with well-defined boundaries that can be the owner of the business of its side.
- **Business Service:** A business service is a well-defined value provided by a component to other components or external partners.
- **Business Operation:** What, in fact, the business does is described by business operation, which includes business artifacts, the activities that work on these artifacts, and topology of communication among these activities, resources, persons and technologies supporting these activities.
- **Business Activity:** what the business does at a granularity level selected by the business is business activity.
- **Business Artifact:** A sensible identifiable value of business information such as forms, documents and messages.
- **Business Service Invocation:** A business activity that needs invocation of a business service.

Figure 4: Model of elements constituting a component.

5-2 Phase 2: Service Orientation of Business

For service orientation of business, only componentization is not enough. Interaction between business components needs integration throughout the value network. Service orientation is the key for integration between business components. A business component uses a single objective and provides one or more business services to be consumed by other components. The component that consumes a business service provided by another component ignores method of development of this service by the provider. Service interactions between business components are controlled business agreements and contracts. Therefore, Phase 2 in the suggested approach is named service orientation of business. In service orientation phase of the suggested approach, initial idea derivates from USM of
IBM Co. and the modelling used in this phase focuses on business aspect of service. The modelling used in this phase supports design of all service oriented business operations and also expresses the relationship between service consumer and provider at all hierarchical levels of service. Objective of this phase is achieved by three executive steps: 1- business service identification, 2- business specification of services, 3- operational modelling of services

5-2-1 Step 3: Business Service Identification

- **Inputs:** Business Component Model, Business Behaviour Model, Business Structure Model
- **Output:** Business Service
- **Method:** Unified Service Model (USM)

After extraction of business components and specification of the elements constituting each component, it is time to extract business services. Definitions provided for business services are as follows:

- A business service is a well-defined value in the business that is provided by a component to other components or external partners.
- A set of value added functions prepared by service provider and valuable for service consumer.
- Business services are an external look at operations of service oriented enterprise.
- Concept of componentization of business is that the work done inside a component can be provided as a service. Therefore, there is a strong relationship between business component and business service
- All services provided and consumed by business components are called service. Business components interact with other components through services to realize a business objective.
- Business service is an entity of business architecture that indicates the result of "part of operation" in the enterprise.

Figure 5 depicts the elements constituting business service, and a summarized definition has been provided for each element:

- **Business Service:** A set of value added functions prepared by service provider and valuable for service consumer. Method of using these service functions is controlled by a service contract between the consumer and provider.
- **Service Consumer:** A person or enterprise that concludes a service contract with a service provider for using service functions
- **Service Provider:** A person or enterprise responsible for providing service according to service contract.
- **Service Customer:** An entity related to service consumer that activates service transaction for using service functions through service provider. Such activation will be subject to service contract.
- **Service Transaction:** A unit for using service function, which is controlled by service contract.
- **Service Contract:** A contract concluded between service consumer and service provider, which controls service transactions and specifies how to use the provided service. This commitment is a business commitment between the provider and consumer.
- **Service Monitor:** An entity that interprets terms and conditions of service contract (monitoring of using service by special methods) that can be related to consumer, provider and/or a third party.

![Diagram of Business Service](chart5.png)
- **Business Behaviour Model**: In service oriented enterprises, business services provide a bed for business behaviour model, which describes business operation both from inside and outside of the enterprise. This model can be reviewed through two scenarios. The first scenario is related to realization of service functions and the second scenario is related to using these functions in interrelated processes. For modelling business behaviour, it is necessary to know how business services are modelled. There is a lot literature on service models, but all of them discuss about technical issues and integration of programs and associability between heterogeneous systems, which are not appropriate for business behaviour modelling. For business behaviour modelling, some business service models are needed that are designed by business persons.

### Step 4: Business Service Specification
- **Inputs**: Business Value Model, Business Structure Model, Business Behaviour Model
- **Outputs**: Business Specification of Service

For modelling business services, the following two aspects should be considered:
1. Business features of service
2. Operational model of service

Business specifications describe a service from the viewpoint of business-related persons. Business specifications include what the service does, how the service is used, how its efficiency is measures and how it is managed. Some business specifications can be described by service provider (service features) and some by service consumer (service needs) and create a base for adaptation of needs of consumer with services of the provider (through service contract between them).

<table>
<thead>
<tr>
<th>Business Specification of Service</th>
<th></th>
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<tbody>
<tr>
<td><strong>Introduction of Service</strong></td>
<td>Includes name of service and general features such as capabilities, usage locations and information of provider.</td>
</tr>
<tr>
<td><strong>Service Functions</strong></td>
<td>The functions provided by services, which are offered to the consumer with interaction details. Providing input and output artifacts for each function will help well understand service capabilities.</td>
</tr>
<tr>
<td><strong>Service Using Terms</strong></td>
<td>Includes such elements as deliver terms, financial terms and etc. Delivery terms is related with method of delivery of service, which include service duration, method of delivery, investigation of exceptions and etc. Financial terms is related to method of service measurement, which includes such elements as discount schedule, payment schedule, exchange rate, currency, cancellation fees, rebates.</td>
</tr>
<tr>
<td><strong>Service Efficiency Terms</strong></td>
<td>Service efficiency terms includes such elements as efficiency criteria, reporting, non-execution errors and etc. Efficiency criteria describe the least expected efficiency of service.</td>
</tr>
<tr>
<td><strong>Service Management Terms</strong></td>
<td>Service management terms include such elements as monitoring policies, exceptions management procedures and etc.</td>
</tr>
</tbody>
</table>

### Step 5: Business Service Realization
- **Input**: Business Structure Model, Business Behaviour Model, Business Policy Model, Business Performance Model
- **Output**: Business Service Operational Model

Service operational model describes realization of various service functions from the viewpoint of business architecture. For making sure that the service provider fulfils its commitments according to service contact, business specifications should be used. Main elements (figure 6) if service operational model include:
- **Business Functions**: Business functions are related to business services and serve as an initial means for achieving operational objectives of service. Business functions are a visible part of service operation, which can be developed inside the company.

There are two ways for operation service model: 1-**Business service choreography**: partnership between services shows the market manner in an organized form between provider and costumer and that special service.

2-**Process orchestration**: this pattern shows market manner by the performed duties of different parts such as programs, people and etc.

-**Business product**: A known existence of business information such as documents and messages.
-**Business task**: Each business task is apart that affects the result product.
-**Resources**: Use business task in order to reach to their own business goals.
Conclusion

For a long time matching business services and IT has been an important concern. Suggested ways in this article concentrates on business parts of organizations and has a great look in order to know the service-oriented organizations. To get a better result for service-oriented we need to have a look from higher level to lower one, high systemic view and at last using business services.

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