Service Interoperability for Enterprise

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Abstract

Interoperability has several definitions and meaning to different people from different sectors and domains. A number of interoperability frameworks have been developed and implemented, mostly depending on different standardization methods. This paper proposes service interoperability for enterprise by validating the SOEA framework capability to remove or control technical and organizational interoperability barriers in intra- and inter-enterprises. After identifying the basic dimensions and concerns for service interoperability, the solution of service interoperability for enterprise to control and remove the barriers using SOEA framework has been tested.

SOEA framework is chosen as a reference framework for this paper because of the capability of controlling or removing major interoperability barriers and strategically aligning business and technological services from the bigger picture till service level execution. It is a new way of achieving interoperability by delivering software as a service, infrastructure as a service, platform as a service, and business as a service; in short everything as a service.

A case study to demonstrate problems of insurance companies due to the lack of service interoperability is conducted. As validating the framework, the proposed insurance company business processes and technological services have been testified and examined. The need of this experimental testing has been examined for more operational flexibility and increased information sharing, in addition reducing the pressure to enable more efficient processing which are internal IT challenges. The solution will also help the industries to focus their efforts on areas that can help make differentiation such as improving customer satisfaction, time and cost reduction, straight through processing, service integration with stakeholders, eliminating redundancy and rework and real-time access to information to create seamless integrated of companies. In general, the solution assists to reduce challenges of insurance companies such as increased pressure to become more innovative both in terms of their business model and their operations.

Keywords: Interoperability Framework; Service Oriented Enterprise Architecture Framework; Service Interoperability; Enterprise Interoperability

1. Background

In the current globalized environment, market forces are pushing enterprises to have a closer collaboration with their stakeholders. For an enterprise to be successful in achieving its strategic goals, the enterprise should seamlessly interoperable with other modern enterprises and also be able to adopt the current continuous and rapid changes.

Though interoperability is considered as a broad concept, some simplified definitions which are relevant for academic and industry use have been proposed based on its context. Some of the relevant definitions of interoperability are stated below:

Interoperability is *a state and a condition in which two or more systems have the ability to share and reuse resources like information in a meaningful manner* [1].

Interoperability is *central to any form of collaboration between organizations, as it enables information and knowledge sharing by cooperating entities within and across organizational boundaries* [2].

Interoperability has *significance for an organization to facilitate consistent business transactions and information sharing within and across organizations. Interoperability supports fast*

and reliable decision making process and to have a common "language" to exchange information among organizations [3].

Interoperability is defined as, "*the ability of systems, units or forces to provide services to and accept services from other systems, units or forces and use services to enable them to operate effectively together* [5]*."*

Of all the above, the last definition has been found more preferable and sufficiently broad to cover all aspects of service interoperability for enterprise and meeting considering the objective of this paper, "proposing a solution for service *interoperability for enterprise.*"

Currently, enterprise interoperability should be much more than an easy access to information and communication infrastructure. It should be able to empower enterprise to innovate by creating new business value in collaboration as well as in competition with other enterprise [4].

In today's competitive market, enterprise should not only prepare to provide simple information exchange but also on business process interoperability among collaborative businesses. Due to this, researchers have done various works to identify the critical challenges of enterprise interoperability

Chen [8] has identified the three critical challenges of enterprise interoperability. In his paper, major interoperability barriers are: *conceptual interoperability barrier, technical interoperability barrier, and organizational interoperability barrier.*

Service is generally defined as a functionality that aligns business service and technology service together that facilitate interoperability to make common framework for sharing, accessing, modifying, and transferring of documents, messages, and applications.

While relating is to business, business services are services, which directly support business processes which can also be developed dynamically for a given business domain. Business interoperability is, therefore, the organizational and operational capability of an enterprise to cooperate with its business partners and efficiently establish, conduct, and develop IT-supported business relationships with the objective to create value [6].

According to Benguria *et al*. [7], there are two major benefits of service orientation approach for interoperability. The first benefit is *the service concept applied well to the business as it does to software application because it has "outside" and "inside" approaches from the developer point of view*. The second benefit of *service orientation could offer a level of flexibility far more exceeding that of component-based development (CBD)*.

Enterprise interoperability emerges from the increasing need for collaboration within and among enterprises in the delivery of services [8]. Service Oriented Enterprise Architecture (SOEA) has thus emerged as a key enabler to these strategic enterprise goals. SOEA is about how people, organizations, and systems work together to achieve some mutual business goals [9].

Researchers have identified major interoperability barriers within and across enterprises' boundaries. Enterprise interoperability is a subject that *deals with interoperability between organizational units or business processes either within a large (distributed) enterprise or within an enterprise network* [8].

Most enterprise decision making processes and fast delivery of services are not highly supported by the existing interoperability approach since enterprise interoperability could not be able to align technical aspect with business aspect. The different types of interoperability barriers and the fact that lack of linking business perspectives have made enterprises unable to be flexible, sharable, and interoperable within and among enterprises.

In order to fill such existing gap with service interoperability for enterprise, identifying capabilities of the newly emerging SOEA framework through the evolution of SOA and EA is important. SOEA framework has a solution for service interoperability for enterprise effectiveness by giving special attention to control or remove interoperability barriers.

This paper attempts to provide a solution for service interoperability for enterprise by empirically validating capabilities of SOEA framework. SOEA framework, has now become a new way of achieving

service interoperability for enterprise by delivering software as a service, infrastructure as a service, platform as a service, and business as a service; in short everything as a service.

In this regard, the main contribution of this work is proposing service interoperability solution for enterprise by experimentally validating or showing capability of SOEA framework. It identifies appropriate enterprise interoperability solutions that will address existing interoperability problems emanating from lack of controlling the barriers and business and IT alignment. This work further extends to have benefits to deliver services with lower cost.

2. Related Work

Enterprise competing methods like capital or materials are possible to be easily copied. One way of taking advantage for an enterprise that can't be imitated easily is delivering high quality of service and being interoperable [10].

The service structure as explained by the execution layer of the framework in [9] verifies the enterprise business demand or functional segments and the anticipated benefits of seamless interoperability, lower cost of ownership and enables users' choice. Reuse of business process and other common capabilities can be attained throughout the multiple business segments of an enterprise. This will avoid redundancy across the stakeholders and it is important to adhere to service orientation principle in modeling those services and their capabilities.

This service identification structure is assessed, approved, and managed through SOE lifecycle, governance, and change management processes. After approval within the SOE lifecycle, governance processes, this service structure is also reflected in the delivery layer where it gets designed, implemented, deployed, and managed.

The major architectural approaches that support service interoperability are Service Oriented Architecture (SOA) and Enterprise Architecture (EA) [11].

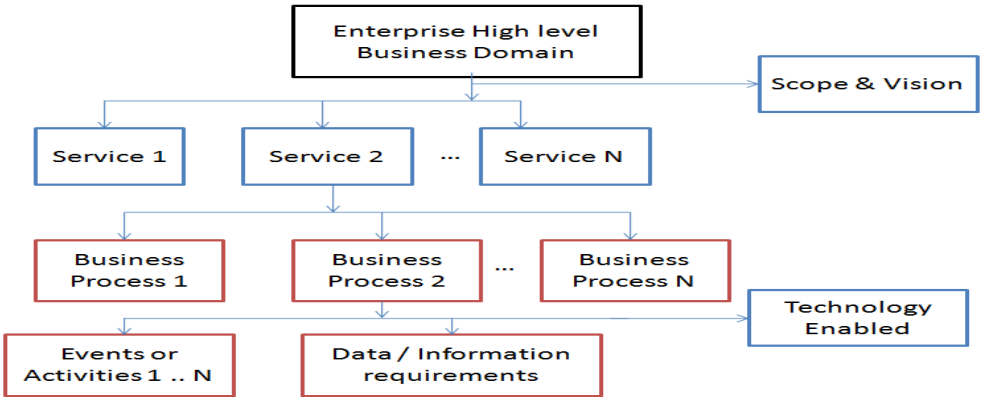

Figure 1: Service structure sources

Interoperability concerns on data, service, process, and business define the content of interoperation that may take place at various levels of the enterprise [8].

An integrated, unified, and federated interoperability approach represents the different ways in which barriers can be removed [8].

Different interoperability barriers have their own impact on full achievement of interoperability and removing these barriers as a whole or partially will have an impact on improving the performance of interoperability.

Therefore, using SOEA as a newly emerging reference architecture with different capabilities will eliminate the technical interoperability barriers as well as minimizing organizational interoperability barriers depending on the type of organization, that is, whether it has traditional organizational structure or service oriented organizational structure.

Service Oriented Enterprise Architecture Framework applies service orientation principle to

the traditional EA frameworks and allows for service orientation concept to be applied at all architecture levels. Large and complex systems can be analyzed, partitioned, and provided as service [9]. Therefore, this framework is the other major input for creating service interoperability framework for an enterprise.

Among the three enterprise interoperability barriers (conceptual, technological, and organizational), technological barrier is automatically inherited in a service that tends to avoid the technical barrier. Technological barriers refers to information technology (architectural and platform, infrastructure barriers).

The emerging of SaaS as an effective software delivery mechanism creates an opportunity for information technology to change the focus from deploying and supporting application to managing the services that those applications provide [12].

"We believe that the future of enterprise computing is not going to be purely on-premise or in-the-cloud. Instead, they will exist in a symbolic harmony" [14].

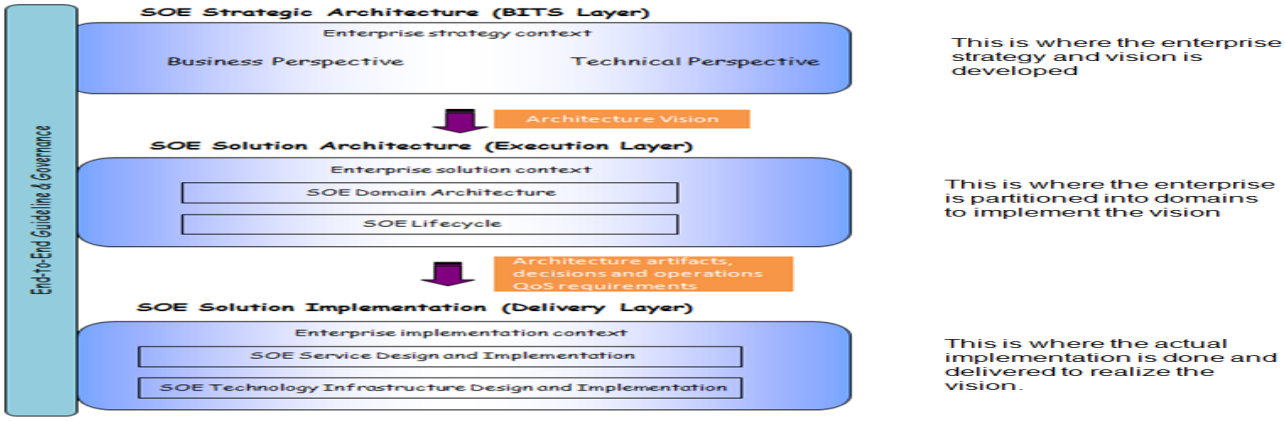

Figure 2: SOEA Frameworks

SOEA framework has already been developed as shown in Figure 2 [13] and this framework can be one of the major inputs to give a solution to service interoperability for enterprise. Three layers of this framework are SOE Strategic Architecture (BITS Layer), SOE Solution Architecture (Execution Layer) and SOE Solution Implementation (Delivery Layer) where the actual implementation is done and delivered to realize the vision.

Service interoperability helps enterprises to be interoperable within and across enterprises. Aligning business service and IT service is still a challenging issue for the achievement of service interoperability. Different literatures considered different dimensions, perspectives, and levels of interoperability to achieve meaningful interoperability within or across enterprises.

Service as part of an enterprise architecture is more and more seen as a paradigm supporting between a service provider and an actively involved consumer.

After analyzing the capability of SOEA and the three basic dimensions of enterprise interoperability (barriers, approaches, and concerns), service interoperability solution for enterprise is able to remove the technical barriers totally and minimize the organizational barrier depending on the type of organization whereas the organization barriers can be minimized if the enterprise implements SOIS and SOOS in place.

The ordinary approach gives emphasis to organizational structure which mainly shapes enterprises with the essence of mere functionalities or positions based on roles and responsibilities on the business side and technology.

The different aspects of inter-organizational design that go beyond the technical aspects have also to take into account that interoperability requirements may differ between organizations. Since value chain or industry structure may impact the required level of interoperability, the highest level of business interoperability does not always constitute the optimum level [15].

Service interoperability solutions for enterprise are capable of reducing from the existing three interoperability barriers into only one barrier by

removing technical and organizational interoperability barriers.

Moreover, there is a possibility of minimizing or controlling the organizational barrier depending on the organizational structure and human capability. The four interoperability concerns are Data, Service, Process, and Business. In an enterprise, data is used by services (or functions to provide a service).

Services (functions/activities) are employed by processes to realize business of the enterprise. Also there are three basic interoperability approaches, namely: integrated, unified, and federated approaches [8].

Those identified and mentioned interoperability barriers are the major obstacles for enterprise interoperability and most of the literatures in this respect show how enterprises can be interoperable using standardization and other methods instead of solving them using different SOEA capability. This work as discussed above, however, shows how it is possible to remove and control the two major interoperability using SOEA features.

3. Validating Service Interoperability Solution

The newly emerging SOEA, as a discipline through the evolution of SOA and EA, contributes a lot to solve enterprise's interoperability critical challenges.

By extending services to be accessed and flexible directly to the customer, it is possible to create significant differentiation and competitive advantage. The objectives are simply creating an environment in which insurance services are available when, where, and how customers want them [16]. To do this, removing existing major interoperability barriers, especially technological and organizational ones, is very essential.

Insurance industry services are delivered and linked with different stakeholders. The delivery increases in both distance and complexity. Many companies are faced with the challenges of providing fast response to customers and operating with lower cost. This is a challenge that needs a solution beyond the simple exchange of messages and documents through the Internet [17]. Service interoperability for enterprise issues in the insurance industry is, therefore, important because of the complexity, variety, and distance of service delivery.

3.1 "As-Is" Technical and Organizational Interoperability

As per the case study in this work, insurance company customers have to take a huge amount of cash and paper forms within or outside the boundaries of enterprises. Such challenges create a lot of delayed or anger on the side of customers, in general, reduces stakeholders' satisfaction.

Removing these interoperability barriers, enterprises have to use SOEA's four layer of service facilities, SaaS, BaaS, IaaS, and PaaS, which have the capability of delivering services just like as cloud services. Third party solution providers can handle the four layers to remove the challenge of using ICT to communicate and exchange information [18].

3.2 "To-Be" Technical and Organizational Interoperability

In traditional interoperability methods, software is deployed and run in a data center at the customer's premise. For instance, SaaS software is run at a SaaS hosting provider and can be accessed via the Internet. Therefore, stakeholders do not worry about the challenges for the platform difference, software integration challenges, and infrastructure.

The SaaS offers many advantages for software customers, instead of software licenses, maintenance and operational costs that occur in the traditional on-premise, companies that utilize IT-services in the SaaS model can use the software on demand, like other utility such as electricity or water. SaaS users pay only according to their usage of the software.

SOEA capability has four layers and as cloud computing process that helps an enterprise to be service interoperable without worrying technological interoperability barriers (infrastructure, storage, systems, applications, and others) in heterogeneous systems environment and also helps to reduce organizational interoperability barriers depending on the type of organization.

Degree of interoperability compatibility matrix (DC) can be computed as follows (where i takes values from 1 to 4 and j takes values from 1 to 6):

$$DC = 1 - \sum (\frac{dc_{ij}}{24})$$

According to M. Bader and Bounabat, if criteria in an area marked satisfactory the value 0 is assigned; otherwise the value 1 is assigned. There is no any value to be assigned other than these values.

Referring each interoperability concern and interoperability barrier, the objective is empirically validating capability of SOEA framework for service interoperability.

To validate the framework, two cases of enterprise compatibility matrix are discussed since worst and best cases of enterprise interoperability can be easily inferred. The two cases are case 1: controlling both technological and organizational barriers with compatibility matrix of Chen value 66.6%, and case 2: controlling technological and minimizing organizational barriers with compatibility matrix of Chen value 50%.

The two cases illustrated above show the capability of SOEA framework to provide a solution for controlling and removing interoperability barriers by increasing significantly the degree of interoperable compatibility among enterprises.

4. Conclusion and Future work

The main focus of this work, in general, is to remove or control one or more of the existing interoperability barriers and how enterprises can achieve it in their implementation process. In order to analyze the importance of service interoperability among enterprises, enterprises should use SOEA for their better interoperability performance.

As per the case study in this work, insurance company customers have to take a huge amount of cash and paper forms within or outside the boundaries of enterprises. Such challenges create a lot of delay or anger on the side of customers, in general, and reduces stakeholders' satisfaction. Hence, researchers have tried to solve such challenges in various ways. The challenges that cause problem for service interoperability for enterprise are identified by different researchers.

According to the empirical validation of the capabilities of SOEA framework, among the three critical barriers of enterprise interoperability, only technical and organizational interoperability challenges can be controlled or minimized using SOEA.

This work emphasizes on removing and controlling interoperability challenges instead of putting recommendation on interoperability using a standard that has its own limitation to improve service quality.

In the future, there is a need to emphasize on other empirical validating mechanisms that are capable of showing the application of SOEA framework in the enterprise interoperability arena. Applying other architectural methods to solve remaining interoperability barriers (conceptual barrier) and also a more investigation on security and governance with reference to service interoperability for enterprises are also issues that need further considerations.

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