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Quality of Service Based Impact Provider Model for Composition of Web Services

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ABSTRACT: To execute a single task for a problem there may be n number of solutions but if we have a combination of subset of these n solutions then the task can be performed in more optimized way. Same holds true behind the concept of Web service composition. A service requester may ask for a service which is complex in nature and can't be served by a single web service then a composition model should provide a way to combine best selected web services to form a combination of web services that performs the task execution. Various composition algorithms and models have been discovered in the past decades for the best utilization of composite web services. In this research paper we'll discuss a "Quality Of Service Impact Provider Model" (QoS IPM) for web service composition.

KEYWORDS: Composition, Aggregation, SOA QoS, Web Services, Publisher

I. INTRODUCTION

The World Wide Web provides a common platform for all the applications to communicate on a specific protocol. Similarly a client and server applications can communicate to each other using HTTP (or other standard protocols) over the web. Web services are extensible, interoperable (platform independency) and secured. It communicates with the world in XML format. SOAP and Restful webservices will be discussed in subsequent sections**.**

Message transmission in the old world was processed using Electronic Data Exchange (EDI). World Wide Web Consortium (W3C) takes care of the management of web services. Web services contains a machine-process able interface which is known as Web Service Description (WSDL) file. This WSDL file is the key to communicate any type of web services (SOAP based or REST based). Web services picked up shape as per advancement in Java developments over the last decades. Introduction to XML for web service communication has dictated the monarchy of the web services in the always on web world. Some quick points about web services are:

- Application components can be treated as webservices Open protocols like HTTP/SOAP are used for communication
- All the web services are self-describing
- UDDI can be used to discover a webservice
- Any application can utilize web service
- Basic communication language for a web service is a mix of HTTP and XML.

Composition of various different webservices is for creating an advanced level business development. The method of composition of webservices comprises of making different functionality webservices work together in real environment irrespective of their platforms. For example a user might require many different functions his application should perform, for that a single webservice would not be sufficient for him as it is not necessary that a single webservice offers all functionalities to his client. The result of this composition is the emergence of new functionality webservice which fulfills the user needs. It is the method of reusing the components that already exists.

In continuation of research work demonstrated on Web service selection based on Quality of Service Impact Based Entropy (QoS IBE) we'll discuss here our new proposed model for web service composition based on QoS IPM.

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II. RELATED WORK

Liu *et al.* [1] present a technique of web service composition and optimization to meet Quality-of-Service (QoS) needs of users. An algorithm is introduced which is based on the preliminary business process configuration for QoS oriented web service composition and optimization. The algorithm mainly consists of three parts. First part is business process analysis, in which processes gets transformed into a composition tree where the structure activities serves as the branch nodes and basic activities as the leaf nodes. Second part is business processes and services evaluation. Utility function is introduced to measure different QoS attributes with uniform standard formal method to evaluate the web services. Single-utility and multi-utility functions for QoS attributes such as response time, throughput and success rate are designed at this stage. Third part is service composition and optimization, which gets done by performing lengthways optimization and breadthways optimization. Blum *et al.* [2] propose management of SOA based Next Generation Network (NGN) service exposure, discovery and composition. The authors discuss a policy based mechanism for service exposure, discovery and composition to offer chargeable services and service building-blocks to 3rd party in a customized way. Furthermore, an automatic fault management solution for NGN service compositions offers self-healing mechanisms for SOA-based service compositions. SOA-based NGN also provide rapid service discovery, creation, composition and deployment. Furthermore, semantics with more improved policy mechanisms provides user oriented NGN services, with individually customized service compositions. The papers showed firm basis for the requirements of an appropriate management of NGN‟s with respect to IMS processes. Moreover, it also provides self-healing mechanisms for its processes. The paper, however, does not discuss dynamic composition.

Do we need to provide any composition implementation for getting an aggregate or composition web service? Definitely: Assertive.

Let's suppose you are working on telecom model and the list of best service provider is already selected. Now to cater the multi-channel mobile networks, typically complex business requirements a single provider can't work. Thus a combination of best selected providers is required to complete the task which can't be accomplished by an individual service. Take another example of an ATM channel where you can withdraw money using different debit cards (assuming that ATM machine caters to multiple banks along with home bank.) There you just need to insert your card and that's it! The ATM channel is intelligent enough to provide you the desired operation result. The main techniques is used there is the composition by orchestration of various banking transaction methodologies which are composited on a single portal to provide a single service to you.

III. WEB SERVICES

Webservices are 2 tier (requestor-provider) applications which commute above WWW's HTTP as per Oracle Statement. Webservices offers interoperability amongst software apps running on multiple platforms & frameworks, as described by the W3C. Webservices are distinguished because of their immense interoperable and extensive nature. Webservices can be joined in freely attached means to attain composite operations. Applications which provide plain services are related with one another so that they can deliver complicated value-add on services.

QOS Factors

Due to the fast progress in webservices area, Quality factors have become significant factors which help clients in distinguishing success of providers of service [15]. Few aspects of quality factors are: accuracy, reliability, integrity, interoperability, response time, throughput, availability, success ability, exception handling, accessibility, security etc.

(1) Availability (in %):

Availability is calculated as one minus the result of division of down time by unit time. It is the chance that the system is up and ready for instant use when invoked.

(2) Response Time (in ms):

Response Time is that time which is taken to complete the response minus the time it takes to get a request from user. It gives how quick a web service services user requests.

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(3) Throughput (invokes per sec):

Throughput is calculated by dividing maximum completed requests by unit time. It tells how many invocations of a web service are there per unit time.

(4) Successability (in %):

Success ability is computed as the number of responses by number of requests.

(5) Reliability (in %):

Reliability is how well a webservice performs its functions in certain conditions at a given time. Reliability is a function of six features: Tolerance due to fault (F), Accuracy (C), Test-Ability (T), Availability (A), Inter-Operability (I), and Webservice performance (P).
Webservice reliability = f(eA,fP,aC,cT, bF, dI) E, f, a, c, b, d are weights.

(6) Smart Service Factor

It is the ability of the web service to act as a requester for any other webservice.

In this project web services are worked upon for their selection, composition and security which are discussed in the following sub sections.

IV. THE COMPOSITION MODEL

Now days distributed applications are based on web services. Daily many web services are integrated in the distributed system. This is one of the most important and promising feature of the web service is that you combine and link the related web services together to create a new composite web service according to the given requirement. Web services provide in interoperability for any Business-to-Business channel. Whenever we interconnect two or more web services

to cater a specific business requirement then this concept is known as web service composition. In other words it is kind of aggregation of web services. Dynamic composition of web services is very popular among various applications to make it more scalable. Its main advantage is to dynamically discover to web services and invoke it on demand basis. But in static composition you need to perform static binding before its vbcvb execution and even discovery step. Some ontological and semantic techniques have been introduced in which clients can invoke the web services dynamically, compositing it and that is done without knowing the origin of other prior knowledge about the web service. These concepts allow you to dynamically discover and compose the web service at run time.

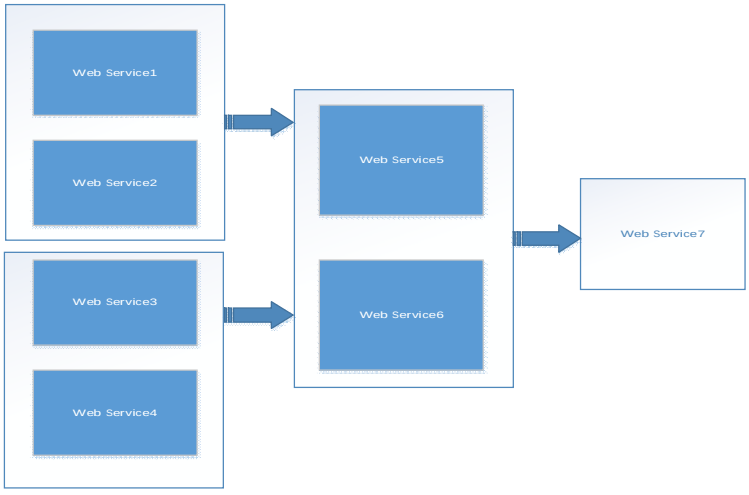

Figure 1 - Web Service Composition

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In the figure WS1 and WS2 are composed into a composite service WS5, and web services WS3 and WS4 are composed into a composite service WS6. Finally WS5 and WS6 are combined to get the composite webservice

a) Web Service Composition model

First we‟ll discuss about how a composite system works between a Service Requester and Service Provider.

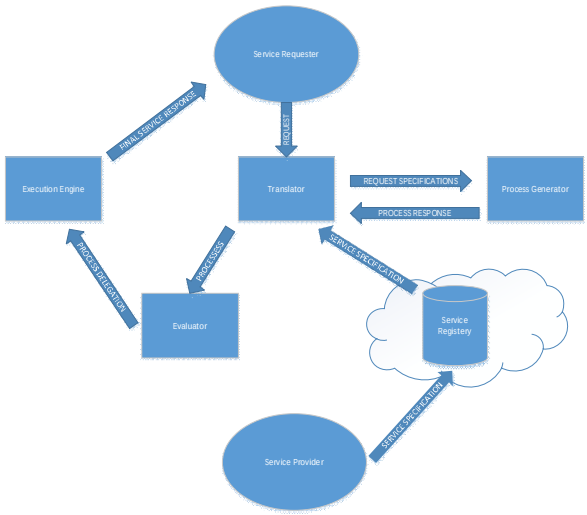

Figure 2 - Web Service Composition Framework

In this figure a sample framework of web service composition system is described. In this composition system there are two actors, Service Requester and Service Provider. As we know system providers produces web services for consumption. And the service requesters consume these services exposed by respective service providers. Apart from that this system contains one Process Generator (PG), a Translator (T), Evaluator Manager (EM), one service repository (SR) and an execution engine (EE). To begin with PG generates an execution plan which tries to compose the best selected webservices in the service repository so that the incoming request can be satisfied. In case of multiple execution plans the PG has the intelligence to evaluate the execution plans and choose the best among them. Now EE jumps in and executes the execution plan which results the response to the service requester.

b) Existing Business Model

Telecommunication Information Networking Architecture (TINA) [8] has proposed a business model in telecommunication domain. A common architecture has been defined in TINA which is built on telecommunication and information technology domains. It provides a starting model for defining roles and interfaces. A simplified business model is shown in below figure.

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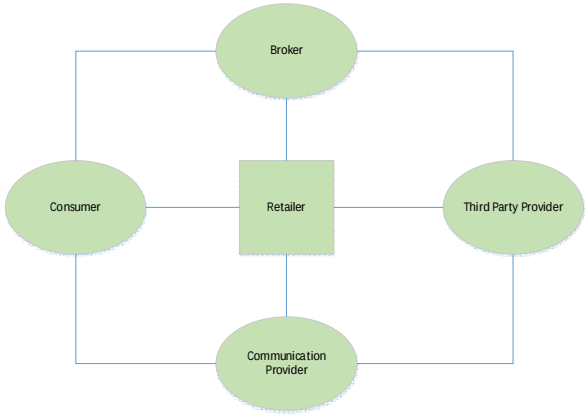

Figure 3- TINA Business Model

Business roles defined by this model are: Service provider (third party), broker, retailer, and consumer and communication provider. Reference points are the interactions that take place among the roles. These interactions are often termed as set of interfaces. The service provider (publisher) needs to provide its services to the consumers (subscribers) .The broker could be simply an agent who knows the publishers and subscribers so that they can approach him service registry/subscription. A third party provider supports the various publishers and other third parties for services. There is always a lawful business agreement with the publisher. A specialized role should be identified as a special category of an existing business role which born a specific list of responsibilities which are relativity non-comparable to its general roles and responsibilities. If we talk about the specialized role in TINA, then content provider is the right one. Content provider gives the specialization provided by a third party which is completely focused on the generation of contents (for example a media advisor company).

c) Standard Web Service business Models

Web service business models are basically derived from SOA architecture model. Common Picture Exchange Environment (CPXe) provides the low level information which can't be provided by standard UDDI model. CPXe is fairly an extension of Web service business model. Let's suppose a request is kind of "I need an investment plan which accepts my salary as 20000, dependents as 2 kids + 2 parents and the maturity amount should be 1 crore for each member with minimum premium but that policy must be applied after when I join a new company with increased remuneration". Obviously this type of request can't be fulfilled by UDDI. Because UDDI can't give you fine grained information.

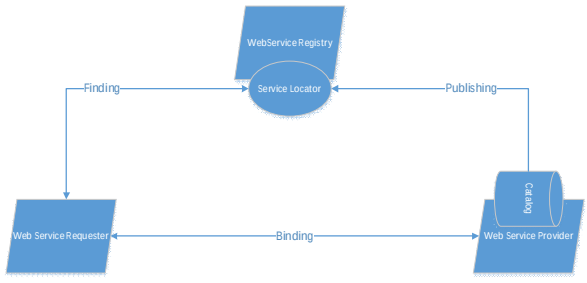

Figure 4 - CPXe Business Model

It shows two new entities, Catalog and the Service locator. To find specific services service locator interacts with UDDI and this catalog.

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Now to describe how to handle advanced functionalities like management, storing and composition of the web services we can analyze the xSOA[9] model. xSOA[10] model is an extended version of SOA model. Service provider and requesters are same. It claims that sometimes to cater specific requirements service providers can act as the service registries or brokers. Market-maker, Service Aggregator and Service operators are three new components introduced in this model.

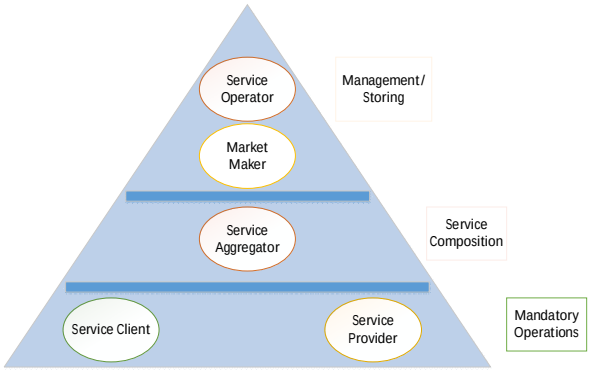

Figure 5 - xSOA Model

The service aggregator does the aggregation of services provided by various service providers and composite them into one combinational group. Other advantages of aggregate service are that it can be reused to create other composite web services.

d) Comparison of Existing Business Models

For few requirements the existing models are compared. It is shown that TINA is satisfying only one requirement. TINA model doesn't support static or dynamic composition.

Statistics	CPXe	xSOA	TINA
Support for Dynamic Composition	No	No	No
Support For Static Composition	Yes	Yes	No
Provides motivators of composition	No	Yes	No
Possibility of Adding new components	Yes	Yes	Yes
Asks for the services which are not present in the repository	No	No	No

Figure 6 - Comparison of Business Models

It's hard to find in this model that by whom the composition is provided and where it is analyzed. Also the requesting of the service is not allowed in TINA model. Also if we talk about standard Webservice and SOA based models, both don't support dynamic web services composition. CPXe does not allow new component's' entities to do the composition. xSOA does add some service aggregators to do the composition but still it lags behind to provide a solution for dynamic composition. Even it does not provide the services which are not found in its registry. As a result we

can state that these service modals can't provide all the statics discussed in the above table. .

V. PROPOSED BUSINESS MODEL: QOS IPM (IMPACT PROVIDER MODEL) FOR WS COMPOSITION

In this section we'll discuss the proposed business model suitable for web service composition. Its interaction with the business roles will be discussed

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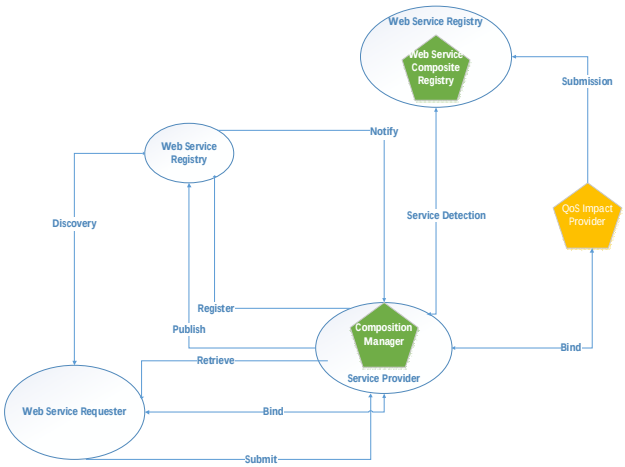

Figure 7 - Proposed Business Model

.Our proposed model is extending the standard Web Service Model. Our model will fulfill the on-demand requests from the client requesting for a hybrid service. Our business model is more or less inspired by the standard TINA base business model in which we specify six different callbacks and three roles. As per the study done on TINA we analyzed that it specifies a third party service provider and few specialized roles which are extensively leveraged in information technology and telecommunication joints. In our proposed business model we provide one specialized role as QoS Impact Provider along with general roles Composer Manager and Composition Registry. In our diagram all of these roles and callbacks can be easily identified. Note: Specialized roles are encircled with generalized roles.

In this scenario the Web Service Provider business role is working in the capacity of web service composer. This is a specialized role which takes care of static and dynamic composition. In contrast to TINA business model we noted that 'content provider' is a specialized role. The same role is here being played by Composition Manager. Now in our business model we introduce 'QoS Impact provider' whose sole goal is to support 'Composition manager'. In this proposed model the services are created and deployed by the third party vendors. These third party vendors are responsible for the composition of composite services. Any base service which is built by more than one service is call as composite service. Main difference between QoS Impact provider and Service provider is that it does not provide services to the requester. Moreover, QoS Impact provider services to the composition managers. Composition managers have a business contract with QoS Impact provider to suggest the best services qualifying for composite service group. QoS Impact provider extracts the QoS Factors of the service and analyzes them against conditional behavior of the service. It then identifies the factor which has the most impact on the service behaviors. The analysis goes to Composition Service and it then filters out and combines the web services to create one or more composition groups.

VI. SIMULATION AND RESULTS

Webservices are combined together and are shown in the research simulation. To understand this composition let's take an example of a tour package provider company. This company offers tour packages to its customer based on the fly demands of their customers. For instance a customer wants a sophisticated tour package which comprises of three to four days plan. This plan should include three to four travel spots and the transportation mode should be by train, by road and by ship only. The hotel must lie in the given budget of the customer. Now the tour operator needs to analyze all the requirements and select the best service providers which promise best experience within budget for the customer. This process would involve selecting the best among available service providers in that region than find the best one (selection) to cater the requested service. Similarly hotels and transport mode service providers should be selected. Now these best service providers are clubbed under one package (composition) which fulfills all the travel requirement of the customer. Now the customer have the best package suggested by that tour operator. In his further

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search the customer may want to compare these types of similar tour packages provided by all the tour operator companies. The comparison could be done on a portal. Real life examples are makemytrip, yatra, trivago, trip advisor etc.

In our Composition Simulation after we had the best selected web service, the providers for the selected service are composite under one package from where the client can choose the best provider of the service with best quote by analyzing amongst the providers based on Cost, Brand Value and Availability.

Figure 8 – Composition

Comparison graph which shows the comparison among various Quality Standards are shown below :

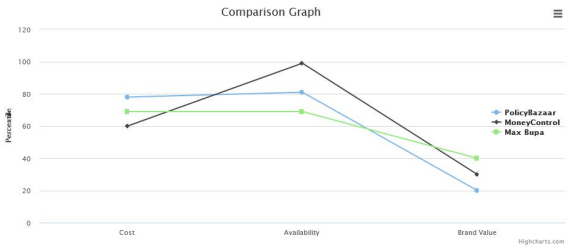

Figure 9 - Comparison of Different Providers

VII. CONCLUSION AND FUTURE SCOPE

In this paper we discussed over various web service business models for composition. After showing its comparison for specific requirements we proposed our enhanced composition model which is based on standard web service TINA model with few changes. Through the simulation we were able to get the composition of the selected web services. TINA could provide a composition capability in our research work. We had to enhance the TINA based business model with adding QoS impact provider which will help the service provider to composite the best selected web services.
For the composition study a business model is proposed in which we provided one specialized role as QoS Impact Provider along with general roles Composer Manager and Composition Registry. In our business model we introduce 'QoS Impact provider' whose sole goal is to support 'Composition manager'. The services in the proposed model are

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created and deployed by the third party vendors. These third party vendors are responsible for the composition of composite services. Any base service which is built by more than one service is call as composite service. The simulation for composition was done using java and the results were analyzed.

Web service composition and selection had been very interesting research work over the years because of its robustness and complexity to provide the best optimal solution to various business hubs which deal with each segment of customers. Surely we'll enhance our proposed composition model to provide an overall new architecture design which will be based on standard web service model but should be pretty much reusable, scalable, flexible enough to provide perfect throughput to businesses.

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