

# Rollback Recovery Approach for Complex Composite Web Services to Enhance Reliability of Service

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**Abstract**--The composition of existing services plays an important role to fulfill user requirement which creates an attention towards Web Service Composition technology in current era. Existing works focus on the rollback recovery process in composing web services in a complex way; but the limitations of those works lie on the methods or operators which are used for composing web services and execute them in serial – parallel manner. By implementing complex operator for composing web services, proposed method increase throughput of service composing process and at the same time provide more choice in front of service consumer. Use of AND operator and OR operator may lead failure possibilities. To overcome that failure possibilities, an auto checkpoint creation algorithm is used which serves both as rollback recovery mechanism and enhancing the reliability of service.

**Keywords:** Service Composition, Rollback Recovery, Checkpoint, Quality of service.

## I. INTRODUCTION

Web service is a self-contained, modular application that can be described, published, located, and invoked over the Web [1]. It is platform-neutral and based on open standards. Web services can be combined with each other in different ways to create business processes that enable us to interact with consumer, developer, and provider [2] [3].

Web service is a technology that allows applications to communicate with each other in a platform-independent and programming language-independent manner [4]. It is a software interface that describes a collection of operations that can be accessed over network through standardized XML messaging. It uses protocols based on the XML language to describe an operation to execute or exchange of data with another Web service.

The web services are described using the Web Service Description Language (WSDL) and the described web services are stored in the repository called Universal Description, Discovery and Integration (UDDI) [5].

Web as a platform is used to establish integration among applications by web services. Web Service gives input to the

business process and receives output after performing interaction between those processes. A Web Service can be invoked by any application, irrespective of language, platform, and operating systems due to its standalone characteristic [6][7].

To reduce the complexity, Web Service encapsulates business processes into reusable components. Also improves interoperability by working as a wrapper around platform-specific applications. Web Service can improve developing process of application much faster than before [4][5]. A Web Service provides simple and reliable way to accommodate existing systems with new applications and services.

Syntax based search works on phrase matching concept, which will produce result by comparing given phrase or words with documents or services exists in repository, which may produce some irrelevant output to the user's request. Semantic based search [8] produce appropriate output, because searching procedure performed according to user's intention.

## II. RELATED WORK

H. Elfawal Mansour and T. Dillon has developed a service-oriented reliability model that dynamically calculates the reliability of composite webservices with rollback recovery based on the real-time reliabilities of the atomic web services of the composition. They have performed web service composition using OR, XOR operator separately and used rollback recovery approach for that composed model [1].

Witold Abramowicz, Monika Kaczmarek and Dominik Zyskowski, describe in detail about the composition structure or Web services and parameters required to measure Quality of Service of any web service composition [2].

Jia Zhang and Liang-Jie Zhang, describe criteria of reliability of Web services-oriented systems, and discuss

how to design and generate test cases to conduct tests over Web services. They developed prototype system to test the effectiveness and efficiency of their algorithms. The preliminary results show that their approach facilitates the testing of services-oriented systems [7].

Jiannong Cao, G.H. Chan and Tharam S. Dillon and Weijia Jia, propose a novel approach to designing Checkpointing and rollback algorithms using mobile agents as an aid. Using mobile agent leads to a reduction of the total amount of communication and allows us to design algorithms that take the advantage of the most up to date system information for decision making. It also allows developing algorithms to implement flexible and adaptive policies. A mobile agent enabled hybrid algorithm combining independent and coordinated Checkpointing is proposed. A prototype of the algorithms is developed using IBM's Aglets [9].

### III. METHODOLOGY

Proposed method implements rollback recovery approach on web service composition [1][9], which composed web services using complex operators [2][3]. An algorithm namely auto checkpoint creation developed to implement rollback recovery approach. Proposed work mainly concentrates on the reliability of web service composition to enhance reliability of service [2][7].

Web services defined and published in the repository or UDDI (Universal Descriptive Discovery and Integration). When a service consumer requests for a web service, a semantic based search performed in the UDDI to find out related web services. It generates appropriate services to fulfill user requirement because of semantic based search [8] rather than syntactic search.

Matched web services (based on user request) are composed using AND operator and OR operator [2][3]. AND operator is used because proposed system work on the principle that if we need to combined more than one web services together to process an user's request then all web service must be executed successfully. If any one of them fails to execute then total composition must stop execution. OR operator is used to provide flexibility of the web service. If one of the services in the composition fails to execute then it will replace that service with its substitute. Fig-1 describes over all web service composition process.

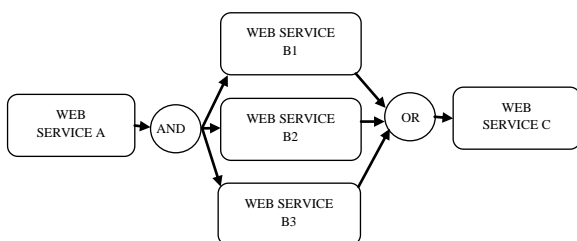


Fig 1: Web service composition process using AND operator and OR operator.

In the Fig-1, three web services namely web service A, web service B and web service C, are participated in the composition. Web service B has its three substitutes B1, B2 and B3. If any one of them fails then other replaced that failed one. So, according to proposed composition process, AND operator used to combined web service A with web service B, but web service B has three substitutes, among those services any one successful one selected using OR operator and then combined with next web service C.

The use of AND operator may lead failure possibility. This problem solved by developing an auto checkpoint creation algorithm [1][9], which used to mark previous successful web service of current one. If current web service fails to execute then no need to go for new composition, rather it will ask user to choose an alternative for that failed one, and start execution from that checkpoint. Using this concept proposed method save execution time, execution cost, increase performance, and enhanced reliability of web services. Fig-2 describes implementation of auto checkpoint creation algorithm in proposed method.

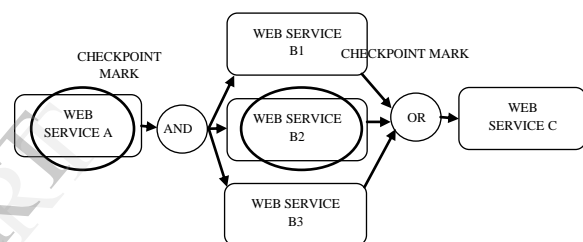


Fig 2: Implementation of auto checkpoint creation algorithm in web service composition method.

Let's assume that the whole composition includes air ticket booking, taxi booking and a hotel booking of a consumer. The whole composition needs a proper execution process which must be carried out sequentially, that means without booking of air tickets, the process of booking a taxi or hotel should not be performed by the service provider. This type of functional behaviour of each web service is called the web service choreography.

### IV. ARCHITECTURE OF PROPOSED METHOD

The overall architecture mainly divided into three processes. First one deals with describing and publishing web services by the service provider. In this process a service provider describe a web service using WSDL and then publish it or stored that web service in the repository or UDDI.

Second process deals with service discovery. In this work we use semantic based [8] service discovery method. Based on service consumer request for web service this module finds out appropriate matched services from the repository. Due to use of semantic based search procedure it will generate result according to consumer intension.

Finally the third process performs composition web services discovered in second process to meets consumer

requirement. In this process composition of web services performed using AND operator and OR operator [2][3]. To make this composition consistent and fault tolerant, a rollback recovery mechanism [1][9] used which basically worked based on auto checkpoint creation algorithm [9]. Fig-3 describes over all architecture of proposed work.

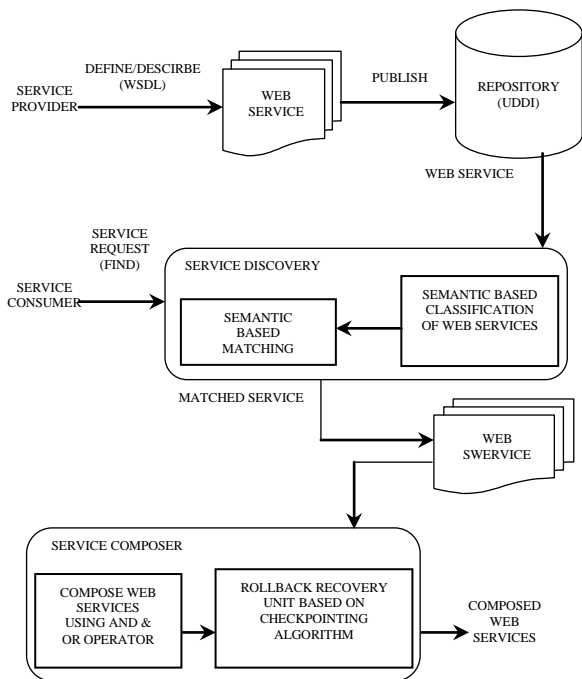


Fig 3: System Architecture for Web service composition.

V. EXPERIMENTAL RESULT

To implement our work practically, mainly three services namely airline booking, taxi booking and hotel booking are defined in the repository. According to the consumer requirement, using these three services main composition performed. The main focus of this composition technique is: if a web service of the composition, execute successfully then only it will go for execution of next service. Otherwise it will ask consumer to select an alternative service of the failed one and then processed with execution of that new web service.

For example a service consumer want to travel from Chennai to Kolkata, the following are the steps involved in the web service composition:

(i) At first the service consumer goes for required airline booking service by selecting one airline service from the given list of service. The list generated based on flight's departure time and the cost per person i.e. by default cheapest airline comes first in the list. The user also can go with either cost constraint or time constraints according his/her need. Service discovery unit generated list shown in Table 1.

Table1: Airlines services retrieved from repository.

Flight No.	Flight Name	Time of Departure	Price Per Person
IA024	Indian Airlines	10:05	5800
KA428	Kingfisher Airlines	13:20	4200
JA768	Jet Airways	18:10	3750

(ii) If the consumer wants to book a taxi from airport to the hotel the following information will be displayed by fetching taxi service from the repository which is shown in the Table 2.

Table2: Taxi services retrieved from repository.

Car Name	Price Per KM
Scorpio	30
Audi	45
Mercedes Benz	60

(iii) Further, if the consumer wants to book hotel then he/she can choose the feasible hotel form the list generated by the service discovery unit (Table 3).

Table3: Hotel services retrieved from repository.

Hotel Name	Star	Facility	Price Per Day
The Taj Bengal	5	In the heart of the city	2000
The Grand Oberoy	7	Near to Airport	3000
Hotel Kohinoor	3	Near to Temple	1800

After completion of selecting web services by the service consumer, the service composer performed service composition by booking all the services selected by the consumer.

VI. CONCLUSION

Finally conclude that proposed work concentrated on semantic based service discovery and complex composite web services composition using two operators: AND operator and OR operator. Use of these two complex operators may responsible for failure in composition; we have introduced the rollback recovery mechanism based on auto checkpoint creation algorithm to avoid it. Basically, we are concentrating on a flawless service composition to enhance reliability of service.

## VII. FUTURE WORK

As a future enhancement of this work more parameters regarding QoS issues, more parameters like latency time, robustness, charging method etc. may take in account in this system and implemented to enhance QoS. Moreover, other complex operators can be used to compose web services to produce accurate result.

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