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A HYBRID APPROACH FOR DYNAMIC QOS WEB SERVICE COMPOSITION BASED ON TRUSTWORTHY USER PREFERENCE

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ABSTRACT

Web Service composition (WSC) is a technology used in Service Oriented Architecture (SOA) for building application. To satisfy users' requirements, the groups of atomic or single Web services integrated together in WSC. Because of the proliferation in number of Web services along with the same functionality and variety of Quality of Services (QOS), it is not easy to identify a suitable Web service that satisfies the functional requirements, as well as enhancing QOS. This pays the ways to the rise of QOS-aware WSC. In this paper, the proposed idea is a hybrid approach which utilizes ant colony optimization algorithm as well as artificial bee colony algorithm to provide an optimal and reliable QOS concerned web service composition. Here the critical QOS attributes that are similar to both the algorithms are taken and optimization is done to provide an effective and reliable web service composition to the End users .The greatest challenge here is choosing critical QOS attributes similar to both the algorithms and satisfying the needs and requirements are difficult to provide an optimized web services.

Keywords: Quality of service, Web service composition, Ant Colony algorithm, Artificial Bee colony algorithm, Critical QOS parameters.

INTRODUCTION

Service Oriented Architecture (SOA) is an architectural approach implemented by web service in order to construct distributed systems which provide an application's functionality as services that are autonomous of various languages and platforms.[7] .By purchasing Web services in Internet many corporations and organizations have established their core applications. Yet, if an atomic or single Web service cannot satisfy a user's required functionality, there must be existing Web services collected together to fulfill it. Web Service Composition (WSC) is the process of incorporating atomic Web services together to satisfy users' requirements. The satisfaction of users' requirements is the main purpose of construction of WSC . Hence, the serious phase of WSC could be measured within the scope of Requirements Engineering (RE). RE is the engineering discipline of initiating the goals and objectives of a system. Requirements are divided into Functional Requirements (FR) and Non-Functional Requirements. [8] FR organize the functionality of a system or component (i.e., what the system does). NFR states the quality criteria that is mainly used to determine a system such as Quality of Services (QOS), cost, scalability, usability, maintainability, etc. FR being denoted by functions, NFR is operationalized by quality constraints. If Functional and Non- functional Requirements are not done in a proper manner, User requirements cannot be fully satisfied by the remaining parts of WSC.

Web service selection is chief part of WSC that denotes to identify one service to device each abstract service to satisfy client's requirements. For each and every abstract Web service, the service selection process is pleased to one of its corresponding concrete services and meeting the QOS constraints. QOS attributes is used to differentiate Web services with its same functionality. WSC has converted QOS-aware, which is to find the best service from each abstract Web service and combine such kind of services to achieve the functional requirement as well as to improve QOS requirements. The present Web service QOS standards follow various attributes, such as availability, execution time, cost, response time, throughput, reliability, security, etc. In order to obtain the users' requirements, how to choose and collect multiple services together as a concrete service composition plan is still a dispute because identifying an optimal solution is an NP-hard problem.

Ant colony optimization (ACO) algorithm can be used for finding an optimal solution. This approach is mainly used in travelling sales person (TSP) problems. It uses

pheromone and ants to search the path for finding an optimal solution. Although ant colony algorithm has many advantages, it is suffering from slow convergence which is a delay for the updating new path.

Artificial Bee colony (ABC) algorithm is determined as the swarm intelligence algorithm that have been stimulated by foraging behavior of honey bees in colony and also used for finding optimal solution. It can be easily hybridized with other optimization algorithms and also overcomes certain drawbacks of ACO algorithm and provides high efficiency. Artificial Bee Colony Algorithm is recognized as easy to implement and helps in solving complex problem.

1. RELATED WORKS

There are various approaches used for resolving QOS aware web service composition. Chen -Yang zhao et al [1] projected an approach of combining Genetic algorithm and ant colony algorithm for web service composition. In this they used weighted acyclic graph with some QOS attributes such as reputation, price and response time for finding best optimal service composition. In this they are intended to map the multidimensional attributes into a single value attribute for finding the optimal service using ranking and sorting mechanism. They have designed an improved ant colony and genetic algorithm for finding an optimal service composition by comparing attribute values of QOS of the hybrid algorithms.

Zainudin zukhri et al [2] introduced an hybrid optimization algorithm on the basis of Genetic algorithm and Ant colony optimization algorithm by adopting to the design of natural evolution process model and foraging ant species behavior in finding an optimal path and the experiment combining two gives the time complexity in fairly equal rate. In this hybrid approach they have eliminated the drawbacks of both the genetic algorithm and ant colony algorithm. Computation is done based on the comparison of population size in GA and number of ants in ACO algorithms for solving TSP problems.

Cristina Bianca et al [3] proposed a new technique called bee inspired approach for selection of optimized web service composition. In this technique they use bee behavior for providing automatic web service and they used Enhanced AI planning graph and semantic matrix link to find optimal composition satisfying user requirements both functional and non -functional requirements. They measured four QOS attributes such as availability, reliability, and cost and response time for evaluation of selecting optimal web services.

Xianzhi wang et al [4] have introduced an enhanced Artificial Bee Colony approach for selecting QOS–aware web services and it is made to achieve optimal continuity using greedy neighborhood approach. The experiments resulted in good stability and accuracy is maintained at a certain level and convergence speed is also fairly low.

Haifang wang et al, [5] have proposed a configuring study of Artificial Bee colony Algorithm (ABC) based on QOS web service composition. Analysis and study of ABC is done and he gave seven configurable points which are used for optimizing the algorithm for effective composition of web services .The seven configurable points includes key parameter assignments which gives the food sources numbers and the maximum limit of iterations done on the algorithm, food source generation strategies for searching capability and convergence speed of service oriented framework. They designed a tool to implement and generate the algorithm automatically.

Shilpa veerabhadrappa [6] have classified different methodologies for QOS-aware web service composition such as Heuristic algorithms, Meta-Heuristic algorithms and Non-Heuristic algorithms. Heuristic algorithms are generally inferred from the experience of particular optimization problems and also called as Trial and error method and it may or may not find the ideal solution to the problem. Meta-Heuristic algorithms are useful for solving high level complex and optimization problems. Non-Heuristic algorithm is used for solving optimization problems optimally using exhaustive search methods based on the size of instances the problems takes for finding optimal solutions.

Doaa H.Elsayed et al [7] have proposed an hybrid approach of integrating Genetic Algorithm and Q-Learning algorithm for QOS-aware Web service composition .Q-Learning algorithm used in enhancing initial population in Genetic algorithm instead of generating it randomly. This involves in creation of Q value matrix from the Q-learning algorithm and the initialization of population is done and then applying various genetic operations and computation of reward

function is done for each QOS attributes executed for each and every services that are provided.

Hongbing Wang et al [8] have introduced a new composite web service optimization model which involves reflecting both the quantitative and qualitative preference based on the user requirements. Qualitative is computed using violation degree and quantitative analysis is done using relaxation degree satisfying the needs of users based on their requirements and for integrating trust we use trust computation algorithm for global optimization for Quality of service composition.

Yamina Hachemi et al [9] have introduced an effective and complete case based planning approach to support the composition of semantic web services with user preferences. It includes case representation, retrieval algorithm, case adaptation and planning new compositions. As to case retrieval, we used the retrieval algorithm with two main steps (search and select), and we proceed by decomposing the goal. Our approach can not only retrieve the most similar cases with the new request based on the semantic descriptions of them, but also to select the best cases based on user's preferences.

Pablo Rodriguez-Mier et al [10] have presented a hybrid algorithm that helps in building the input and output compositions by reducing the total number of services with optimal QOS automatically. The described approach thereby integrates a set of graph and local search to extract the optimization from the evaluated data sets in a graph, that the randomly generated datasets attains a good tradeoff in between quality and execution time.

Serial Rayene Boussalia and Allaoua Chaoui [11] have suggested an approach in order to resolve web services composition problem. So, they have projected a new approach based on utilizing the quantum inspired cuckoo search algorithm. The approach is recognized by the contribution of representing an appropriate definition for quantum solutions, and to randomly evaluate using heuristic techniques. The results obtained gives high feasibility and effectiveness of using this approach.

Chandrashekar Jatoth and G.R. Gangadharan [12] proposed an approach to solve QOS-aware web service composition. They have used QIPSO based web service for QOS that helps in combining the principles of quantum computing and Particle Swarm Optimization to optimize the QOS. The proposed approach provides high optimality rate and good computation time when compared with other existing approaches.

Fadl Dahan [13] has introduced a new bee-inspired algorithm called Enhanced Artificial Bee Colony (EABC). This approach takes the main and basic features of artificial bee colony algorithm and used one more variable compared to ABC. Enhanced ABC provides better performance in the quality of service and execution time for some group of datasets. As a future work, they have planned to apply a new algorithm to work with other problems such as travelling salesperson problem, and the multi-objective optimization problems.

Liu Hui et al [14] have proposed an ACO algorithm for web service selection. The algorithm is used in such a way to select the web services along with some QOS properties to provide a large scale of services for different users based on the preferences. The different QOS properties used in selecting the services includes reliability, execution time, cost and bandwidth and the proposed algorithm works effectively.

Serial Rayene Boussalia, Allaoua Chaoui, and Aurelie Hurault [15] have proposed a new approach named BA-WSC. This approach is utilizing an Extended Bat Inspired Algorithm. The objective is to find an optimal web service composition that satisfies all the requirements of the user. The main functionality of this algorithm is its simplicity, flexibility and its effectiveness. Initially this approach is to be made to extend the services with multiple inputs and outputs and then considering them to be optimized in semantic form. The results obtained are efficient when compared to other approaches.

Dac-Nhuong Le and Gia Nhunguyen [16] have proposed a new approach to solve the E2E QoS constraint issue for composite services that are built using the Web service framework. The objective is to increase the user defined service to high end performance of QOS constraints the author proposed a MMAS algorithm to solve the problem in which computation is done based on its efficiency and time to give a best fitness value solution. The result obtained provides greater performance when compared to other approaches in solving the problems.

2. EXISTING SYSTEM

The existing system focuses on the optimal web service composition by choosing the attributes and satisfying the requirements and needs of the user preferences. They have used many approaches to obtain an ideal composition of web services. The selection of an optimal web service is tedious one because there is more number of service providers who provides services to the customers or end users based upon the requirements needed by them. There are some drawbacks available in the existing system. In existing system user preferences are calculated by only based on qualitative analysis.

a) Satisfying the needs and requirements of end users or customer is tedious.

b) Choosing the QOS attributes is important to satisfy the needs.

c) To find an optimal web service composition algorithm or approach needed must be identified correctly and make use of it.

A. Ant Colony Algorithm

ACO is determined as probabilistic procedure carried out to solve computational problems which can be reduced to finding good paths through graphs. The algorithm is used to search an optimal path using behavior of ants that seeks the path between the source of food and the colony. This idea can be used for solving wide and some simple numerical problems on the basis of behavior of ants. ACO can be used for performing estimation and similarities in some distribution algorithms. ACO mainly used in travelling sales problems.

Begin:

Initialize the pheromone trails and parameters;

Generate the population of m solutions (ants);

For each individual ant k belongs to m;

Calculate fitness (k);

For each ant determine its best position;

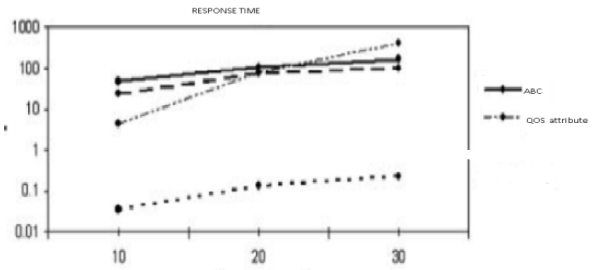
Determine the best global ant;

Update the pheromone trail;

Check if termination=true;

End;

Response Time



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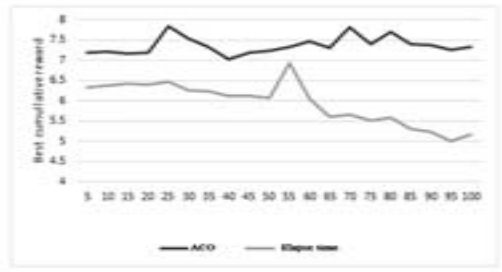

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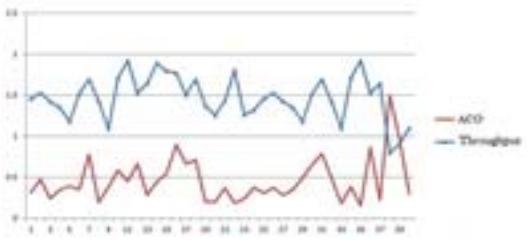


Figure 1 QOS attributes of ACO algorithm

B. Artificial Bee Colony Algorithm

ABC algorithm is an optimization method that uses the foraging behavior of honey bees, to find an optimal solution. ABC can be applied to solve some complex problems and it belongs to the group of swarm intelligence algorithms that is used for finding an optimal solution.

A set of honey bees, called swarm, that are accompanied with some tasks with social cooperation.

ABC algorithm consists of three bees which are intended to do different tasks to achieve an optimal path or solution. The employee bees used for searching a food source from their own memories, employee bees share the information to bees known as onlooker bees. The onlooker bees rate the food resources from the employee bees. The food source which has highest fitness function will be having a large chance to be selected by the onlooker bees than the lower quality. The scout bees have taken from a few employed bees, which take their food sources and search for new food sources.

The ABC algorithm involves the below mentioned steps.

a) Initialize the food source positions.

b) Evaluate the nectar (fitness) amount of food sources

c) repeat

d) Employed Bees phase

e) Onlooker Bees phase

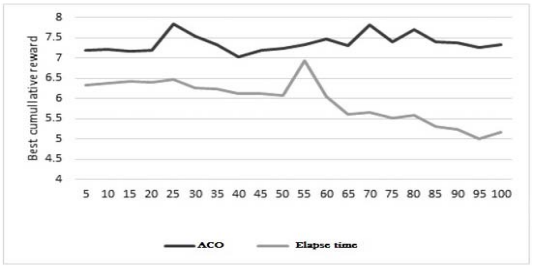
f) Scout Bees phase

g) Memorize the best solution achieved so far

h) UNTIL (Cycle = Maximum Cycle Number or a Maximum CPU time)

Therefore we integrate Ant colony optimization algorithm and Artificial Bee colony algorithm collectively called as Hybrid algorithm to provide a reliable and effective Quality of composition of web service

Elapse Time



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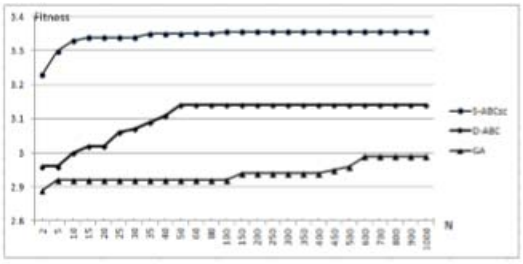

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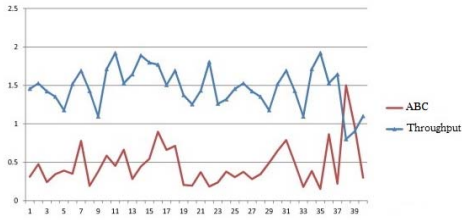


Figure 2 QOS attributes for ABC algorithm

3. PROPOSED WORK

In this proposed system, we have deployed a hybrid ABC- ACO algorithm to optimize the selection of reliable web service which also provides QOS to the end user. The implementation of this algorithm proved its efficiency and providing a reliable web service composition for the end users. Web service is mainly used for communication between the service providers and end users. WSC is defined as the process of building a new value added services to the existing systems to two or more composite web services. As the number of service providers increases day to day choosing optimal web service composition that satisfies all the needs and requirements is a great challenge and this has led to the emergence of QOS-Aware web service composition. To overcome the drawbacks of selecting an optimal web service composition we are proposing a new amalgam approach that combines the usage of Ant Colony Optimization algorithm (ACO) and Artificial Bee colony Algorithm (ABC).The idea behind this approach is taking a Critical QOS attributes that are common to Ant colony optimization algorithm and Artificial bee colony algorithm and then optimizing the attributes to provide a reliable and effective composition of web services. The Hybrid algorithm provides an effective web service

composition satisfying the needs and requirements of the End users.

The Hybrid algorithm is implemented using the following set of modules which are intended for different set of tasks.

a) User Requirements
b) Critical QOS attributes Selection.
c) Finding an Optimal web service composition.

These three modules are assigned for different set of tasks and then the results are recorded and shown as a graph.

A. User Requirements

In this module we create a website for Login page of customers or end user to login into their respective accounts and they can have a request for the requirements that are needed to be satisfied are mentioned in the websites and the website owned by them will see the request and then make the requirements according to the needs of end user to provide a composite web service with the QOS attributes such as reliability, scalability, cost, response time, throughput, etc., according to the specification and then it is made to be satisfied from choosing the attributes for reliable Quality of Service for web service composition.

User preferences are calculated on the basis of both the Functional and non-functional requirements of QOS that satisfy the needs and requirements of end users .we use both Qualitative and Quantitative analysis for user preferences to provide an effective web service composition.

B. Critical QoS Attribute Selection

In this module we select the critical Quality Of Service attributes that are common to both Ant colony optimization algorithm and Artificial Bee colony algorithm. Choosing must be done based on the efficiency that both the algorithms should satisfy the needs and requirements of end users are taken into an account.

By using Hybrid algorithm that have been proposed we choose and select the critical parameters or critical QOS attributes and then it is taken and optimized further to provide an effective and reliable web service composition.

C. Finding an Optimal Web Service Composition

This module is used for finding an optimal web service composition by choosing and selecting QOS attributes that are common to both ACO and ABC algorithms. Finally we get the result of choosing the attributes and the result shows the efficiency of selected QOS attributes and the graph is drawn showing the effective and reliable QOS Web service composition. The graph obtained can be compared with other algorithms which provide high efficiency and reliable web service composition and satisfy the requirements of End user providing a quality of services.

D. Hybrid Algorithm Steps

The various steps involved in the hybrid algorithm are given as follows:

Step 1: Starting the process

Step 2: Initialization of ants and the pheromone trails and its parameters

Step 3: Initialization of swarm bees and its parameters are done

Step 4: Searching of food source positions by the ants and update the path of pheromone trails.

Step 5: Determination of best ant global path

Step 6: Repeat the process until the requirements and optimal path or solution is obtained

Step 7: Employee bees searches the food source positions and finds feasible solutions

Step 8: Onlookers bees used for searching the food source positions and finds a nearest solutions or path

Step 9: Scout bees searches the food source positions and finds an optimal solution or path

Step 10: End the Process.

E. Proposed Algorithm

Begin

Initialize the ant and bees for finding the food sources;

Repeat

For each finding of food sources update the pheromone trails and its parameters;

Determine the global search path;

Employees bees searches the food source and finds feasible solutions;

Onlookers bees searches and finds a nearest solution;

Scout bees searches the food source and finds an optimal solution;

Until (optimal solution and requirements are met)

End

The proposed algorithm works by means of ants and bees to find an optimal path, Firstly, ants and bees are initialized for finding the food sources and if the ant finds a path it will update the pheromone trails of the previously identified path. There are three bees involved such as employee's bees, onlooker's bees and scout bees. Employee bee searches the food source path by finding all the feasible solutions, Onlookers bees searches the food source path by finding nearest solution and scout bees searches the food source path by finding an optimal solution path and the steps are repeated until it satisfies all the conditions or requirements of the end user, otherwise it will be terminated.

Using this hybrid algorithm we can easily find an optimized path by satisfying all the requirements of the end users. This algorithm provides an effective and optimized composition of web services.

F. Flow Diagram

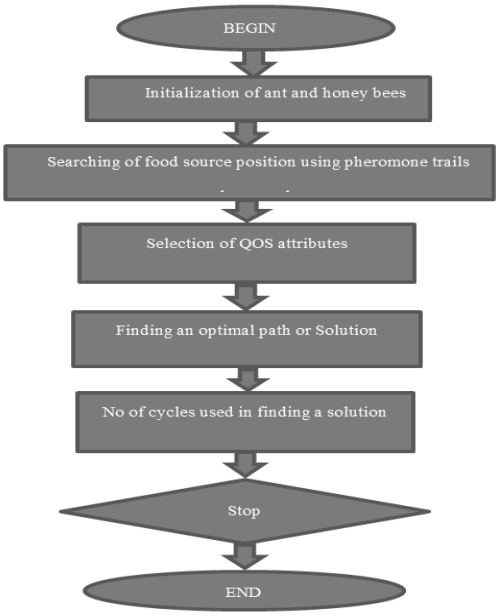


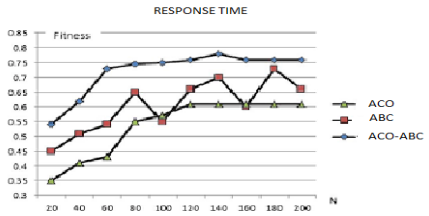
Figure 3 Algorithmic Flow of the System

4. RESULT ANALYSIS

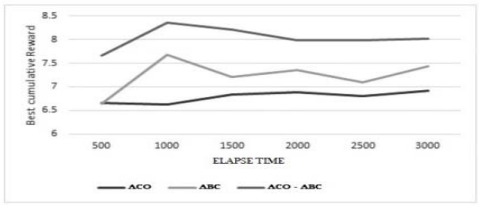
The result analysis is done after finding an optimal web service composition by selecting a critical QOS attributes that is similar to Ant colony optimization algorithm as well as artificial bee colony algorithm .The critical QOS attributes chosen for effective and optimal web service composition is shown with efficiency it has attained using hybrid approach. The values in a graph are compared with others algorithms the efficiency is more and it provides an effective composition of web services. The efficiency of response time in Ant colony optimization algorithm is around 70 percent and efficiency of response time in Artificial bee colony algorithm is 75 percent .The efficiency of Hybrid approach when combining ant colony optimization algorithm and artificial bee colony algorithm gives more efficiency around 80 percent when compared with other algorithms.

Hybrid approach provides a greater efficiency when compared to others and provides an optimal and effective composition of web services.

Response Time



Elapse Time



Throughput

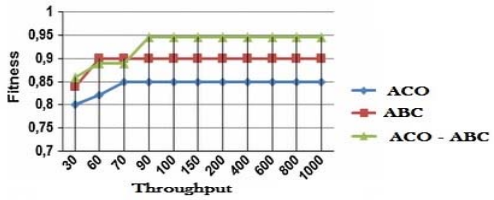


Figure 4 QoS Attributes Of Hybrid Algorithm

5. CONCLUSION AND FUTURE WORK

This paper describes an idea of combining the features of Ant colony Optimization algorithm and Artificial Bee colony Algorithm as an Hybrid methodology for reliable Quality of Service composition for web services and in this approach critical attributes of QOS that are common to both the algorithms are taken and then optimization is done to get a reliable quality of web service composition on the basis of user satisfying their requirements. This approach resolves the drawback of convergence speed in Ant colony optimization algorithm (ACO) and it increases the effective searching solution for optimized web service composition.

In future we take the concept of violation along the websites where only the authorized persons alone are able to view those set of data and are able to access the data when they are required.

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