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A Novel Strategy for Performance and Analysis of Web Service Business Activity using Particle Swarm Optimization Technique

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Abstract: Data mining is an interdisciplinary subfield of computer science. The web services business activity developed by the OASIS (Organization for the Advancement of Structured Information Standards) groups. The framework developed had an initiator, a coordinator, and more than one participant. But with increased number of participants and unlimited number of clients and servers the problem of fault recognition became critical. The problem of faulty nodes at either client or server node was detected by lightweight Byzantine Fault Tolerant (BFT) system. The BFT is used for the selection of the appropriate server and client nodes using a Travelling salesman problem. The problem of both client and server node selection was further improved by the use of a heuristic technique known as Particle Swarm Optimization which helps in finding the global best and local best server and client nodes. PSO gives a better and faster method of fault tolerance and enhances the performances than BFT.

Keywords: Data mining, Byzantine Fault Tolerant system, Particle Swarm Optimization and Organization for the Advancement of Structured Information Standards

I. INTRODUCTION

Data mining is primarily used today by companies with a strong consumer focus - retail, financial, communication, and marketing organizations. It enables these companies to determine relationships among "internal" factors such as price, product positioning, staff skills, and "external" factors such as economic indicators, competition, and customer demographics. And, it enables them to determine the impact on sales, customer satisfaction, and corporate profits [5]. For Example: WalMart is pioneering massive data mining to transform its supplier relationships.

A. Data Mining Approaches towards Client/Server

Client/server(C/S) systems have revolutionized the systems development approach [17]. Among the drivers of the C/S systems is the lower price/performance ratio compared to the mainframe-based transaction processing systems. Data mining is a process of identifying patterns in corporate transactional and operational databases. As most Fortune 500 companies are moving quickly towards the client server systems, it is increasingly becoming important that a data mining approaches should be adapted for Client/Server systems.

B. Overview of Web Services

The information sharing can often be referred to as exposure. Generally, online information services are those services, which are available through networks [1]. Web service technology guarantees advances in the vibrant combination of on-line services. Mechanisms are required to support in verifying the value of these services. The end user of a Web service will rapidly identify if the content is handled properly and if the business process rules are being stayed, but repeatedly, many unguaranteed assumptions are made regarding the value of a service.

C. Motivation of Research

Particle Swarm Optimization (PSO) is an Artificial Intelligence (AI) technique that can be used to locate estimated solutions to very complicated or impossible numeric maximization and minimization problems. In particle swarm optimization, simple software agents, called particles, move in the search space of an optimization problem. The position of a particle represents a candidate solution to the optimization problem at hand. Each particle searches for better positions in the search space by changing its velocity according to rules originally inspired by behavioral models of bird flocking. Particle swarm optimization belongs to the class of swarm intelligence techniques that are used to solve optimization problems.

D. Research Objectives

- The objective of the research is to perform the web based applications with high fault tolerant based system.
- The objective is to efficiently reject the faulty nodes of the web based application.
- The byzantine algorithm just checks the energy levels of the nodes to identify the faulty nodes and is applicable only for the small area networks.
- The rate of convergence is very slow and large number of iterations is required.
- When a Byzantine failure has occurred, the system may respond in any unpredictable way, unless it is designed to have Byzantine fault tolerance.
- A BFT is developed here for the web coordination services and an example is shown here for the airline management of ticket booking.

- The BFT algorithm is tested in MATLAB and the fault tolerance is checked for the nodes of the server and the clients. The fault tolerant systems prove effective in case of the fault tolerance when there is multiple numbers of faults in the server or the client port.
- The method took a number of iterations and was tested based upon the energy signature of server or client nodes.
- The methodology of the system was further modified by the application of a heuristic algorithm known as Particle Swarm Optimization (PSO) for the faster and easier sorting of the loyal or the authentic server and client nodes.
- The method proved efficient in the cases of the 3D networks. The run time was optimized and the method of tolerance was efficiently executed

II. LITERATURE SURVEY

This following Literature survey helps to focuses on an overview of the existing website information retrieval system and trustworthiness evaluation techniques proposed by various authors

TABLE I
LITERATURE SURVEY

Method	Technique Used	Limitations
Khac Tuan Huynh [10]	Decision-making for single-unit deteriorating systems operating under indirect condition monitoring	Even if online condition information is available, it is not always clear whether condition-based and dynamic (or predictive) maintenance decision rules are always relevant
Irani, D [9]	Modeling Unintended Personal-Information Leakage from Multiple Online Social Networks	Multiple accounts on different social networks offer various levels of privacy protection, the weakest privacy policies in the social network ecosystem determine how much personal information is disclosed online
Zografos, K.G [20]	Design and evaluation of an online passenger information system for Integrated multimodal trip planning	The provision of integrated urban and interurban multimodal trip planning services covering the travelers' information needs for the entire life cycle of their journey may alleviate the aforementioned shortcomings and contribute to the enhancement of the usability and accessibility of various interconnected public transport systems
Honglei Zhang [8]	Trustworthy Coordination of Web Services Atomic Transactions	Executing Byzantine agreement on every operation is prohibitively expensive and not practical
De Mes [6]	Web service credentials	Is the provider of the service reliable? If not, the consequences will primarily impact the user, who will blame the provider for delivering bad services.
Milanovic, N [15]	Systematic model-based methodology and a tool for service and business process availability assessment	Service and business process availability is of the paramount importance and cannot be compromised
Shangguang Wang et al., [18]	Web service selection based on collaboration reputation in Web Service Collaboration Network (WSCN)	Many trustworthy web service selections simply focus on individual reputation and ignore the collaboration reputation between services.
Mehdi, M et al., [13]	Proposed a framework that will facilitate the growth and evolution of a service-oriented network into a self-organised trustworthy virtual collaboration environment	It is almost impossible to capture and make use of valuable personal service evaluations, e-service composition on the other hand employs intelligent planning for composition plan generation, which fails to scale in a

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		large open environment such as the Web.
Stein, S et al., [19]	Robust Execution of Service Workflows Using Redundancy and Advance Reservations	Some providers may be less trustworthy than others, possibly failing to meet their agreements.
Kirkpatrick, M.S et al., [11]	Role-Based Access Control	Existing approaches assume the server is trustworthy and require complete disclosure of sensitive location information by the user.

III. METHODOLOGY

A. Byzantine Fault Tolerance system

Many researchers found that a Byzantine fault is an arbitrary fault that occurs during the execution of an algorithm by a distributed system. It encompasses both omission failures (e.g., crash failures, failing to receive a request, or failing to send a response) and commission failures (e.g., processing a request incorrectly, corrupting local state, and/or sending an incorrect or inconsistent response to a request). When a Byzantine failure has occurred, the system may respond in any unpredictable way, unless it is designed to have Byzantine fault tolerance.

For example, if the output of one function is the input of another, then small round-off errors in the first function can produce much larger errors in the second. If the second function were fed into a third, the problem could grow even larger, until the values produced are worthless. Another example is in compiling source code. One minor syntactical error early on in the code can produce large numbers of perceived errors later, as the parser of the compiler gets out-of-phase with the lexical and syntactic information in the source program. Such failures have brought down major Internet services.

In BFT algorithm it is used to find the shortest path using Travelling Salesman Problem. Once shortest path is found the process of confirmation of the services takes place by sending confirmation mail to the client for the successful completion of the coordination service. The Byzantine Fault Tolerance Algorithm is given in Fig.1.

Step 1: Initiators start the web services application.
Step 2: The type of services provides by this algorithm are

- Activation service
- Registration service and
- Coordination services.

Step 3: Lieutenants initialize Activation Service Client (ASC).One ASC takes the orders from the Participation Service Server (PSS). The process is like a sending of spike. The ASC checks for the spikes authenticity for the correct PSS which is authentic and loyal.

Step 4: Commencement of registration service: The method of registration is tested by the checking the energy levels of the transmission of spike.

If the energy level of the spike is just higher than the minimum threshold energy level, the particular services is registered Else the particular ASC selects a new PSS for the registration.

Step 5: Commencement of the Coordination services: All the PSS are scanned for the availability of the nodes. A closed loop network is formed using the authentic generals (PSS) nodes.

Step 6: Among the closed loops, shortest path algorithm is applied for the selection of shortest path among the available PSS and the ASCs using the travelling salesman problem.

Step 7: Once the shortest path is found, commence the coordination service. The process of confirmation of the services takes place.

Step 8: Send the confirmation by email to the client and destination server for the successful completion of the coordination service.

Fig.1. Byzantine Fault Tolerance Algorithm

B. PSO based Byzantine Algorithm

In Particle Swarm Optimization technique, Swarm intelligence is a branch of artificial intelligence that studies the collective behavior and emergent properties of complex, self-organized, decentralized systems with social structure. Such systems consist of simple interacting agents organized in small societies (swarms). Although each agent has a very limited action space and there is no central control, the aggregated behavior of the whole swarm exhibits traits of intelligence, i.e., an ability to react to environmental changes and decision-making capacities.

Step 1: Initiators start the web services application.

Step 2: The type of services provides by this algorithm are

- Activation service
- Registration service and
- Coordination services.

Step 3: Activation service: The Lieutenants initialize the Activation Client Service (ASC). The available PSSs are treated as a set of herds in an open coordinate space.

Step 4: Once the position of the available PSSs is checked, the fitness of each of the available PSS is also checked.

Step 5: The position and velocity of the PSS for the global best PSSs selection are updated.

Step 6: Select a group of PSS whose fitness level is near to the global fitness values of the PSS.

Step 7: Registration Services: Form a group of PSS in decreasing order of their fitness for the close loop.

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Step 8: Coordination Services: The coordination services in this closed loop domain are performed and the coordination services across these PSSs are sent.

Step 9: Confirmation Services: The confirmation services by sending the mail to the destination server and the client are performed.

Step 10: If the process takes longer time than the threshold time selected, the global best position and velocity of the PSS are updated.

Fig. 2. PSO based Byzantine Algorithm

Mail sent upon Successful Ticket Booking

A mail is sent to the client upon successful booking of the tickets. The mail is same as given at the time of the booking. The mail which is sent after the confirmation of the booking, the tickets are created in the form of an excel sheet named s2xls.xls.A snapshot of the booking is given below

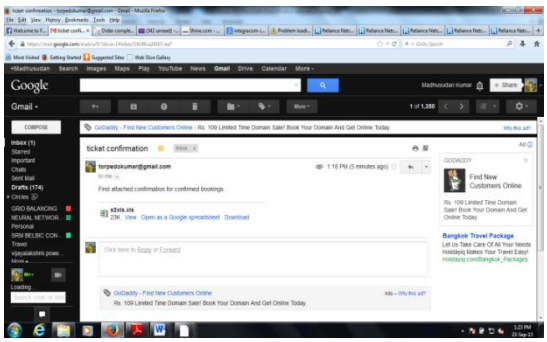

Fig. 3. Mail Confirmation of the Confirmed Booking

IV. RESULTS AND DISCUSSIONS

A. Process of Byzantine Algorithm

The initiator sends a spike with an authentication code at the beginning of the client session activation. Upon successful testing of the spike at the server end and subsequent fault testing the client session is activated. This allows the client to access the databases across the system for the booking of an airline tickets.

Next the servers are accessed by the clients. In any web based systems there are a number of servers and clients. After the client successful signature the servers start a second level check after initiation.

As shown in the Fig.4 a client requests an initiator to request a server. A client sends a number of replica. There could be n number of replicas which act as an initiator spike for the spike testing. A spike is tested for the activation service authentication at the server end. Similar way there could be a number of replicas in server. Each having the designated energy level and level of authentication. The higher the energy level higher is the stringent spike authentication.

The server is selected for the service if and only if it authenticates the spike sent by a client and has the energy level more than that of a threshold energy level. If the spike is not authenticated or the energy level is less than the threshold energy level the particular server is not selected. The server selection or rejection operation is performed by an exchange layer. Once the exchange layer authenticates the requests the bookings are performed.

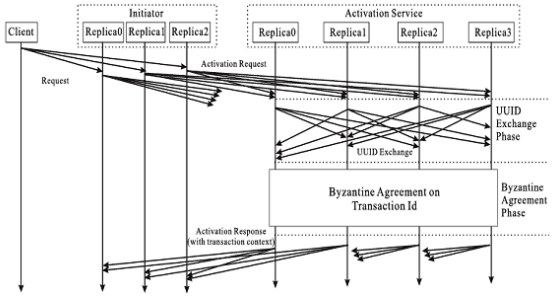

Fig. 4. Byzantine Activation Protocol

B. Particle Swarm Optimization based Byzantine Fault Tolerant System

The fault tolerant system of Byzantine can be made stiffer and more by application of Particle swarm optimization. The optimization can be done by allocating the servers as a herd or group of nodes to be optimized. The fittest server nodes are selected after checking the energy levels and spike authentication for the servers. The fittest server is then selected and sorted in decreasing order of their fitness values. Upon every iteration the position and velocity of the servers are updated. Ultimately the entire global coordinates are searched for the global best position and velocity of the servers.

C. Result of the Existing Method by BFT

WS BA component formation
enter the no of activation, coordination and initiation services from 1 to 51
enter the number of participants from 1 to 10 5
n = 10
first_dead = 875
dist = 60.3978
path = 1 3 5
dist = 60.3978
path = 1 3 5
dist = 60.3978
path = 1 3 5
dist = 60.3978
path = 1 3 5
Cont for iterations
enter the number of clients parallely accessing the system2
client session activation
enter client password'ibi'
paswd = ibi
client session activated enter the details for client 1 passenger
enter the number of passengers upto 41
pass =
Name: 'Anand'
Age: 43
Address: 'Shimla'
x{1,1}: Anand
x{1,2}: 43
x{1,3}: Shimla
enter the details for client 2 passenger
enter the number of passengers upto 42
pass =

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Name: 'Anand'
Age: 43
Address: 'Shimla'
pass =
1x2 struct array with fields:
Name
Age
Address
x{1,1}: Anand
x{1,2}: 43
x{1,3}: Shimla
x{2,1}: Punit
x{2,2}: 49
x{2,3}: Luckhnow

Iterations required for testing the nodes

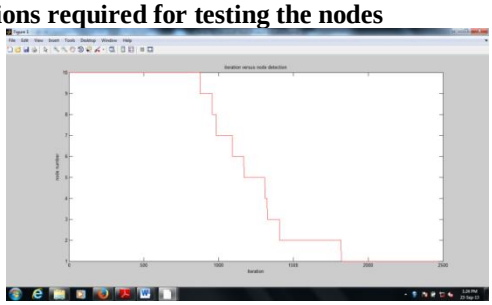

Fig 5: Nodes Testing

Fig.5 shows the number of iterations and the nodes. The x axis has the number of iteration and the y axis has the node number. As shown in the Fig 5the initial nodes take a larger number of iterations for the node authenticity check compared to the intermittent ones. This implies that the initial nodes checks are more stringent than the intermittent ones. Also the receiving end ones where the confirmation is generated has a stringent ones.

D. Results of the Proposed Method by PSO

The proposed method using the PSO based server selection is given in the Matlab window as shown below

enter the number of clients parallely accessing the system1
client session activation
enter client password'ibi'
paswd =ibi
enter the details for client 1 passenger
enter the number of passengers upto 41
pass =
Name: 'Anand'
Age: 43
Address: 'Shimla'
x{1,1}: Anand
x{1,2}: 43
x{1,3}: Shimla

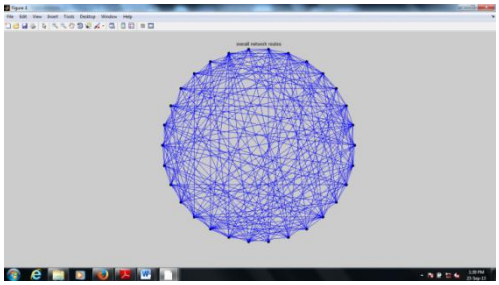

Fig. 6. A 3 Dimensional Network of the Available Nodes of Server and Clients

Fig. 6 shows the set of available network server nodes and the geometry. The upper half is the client nodes and the lower half is the server nodes. The lines show the interconnection between the server nodes and client nodes.

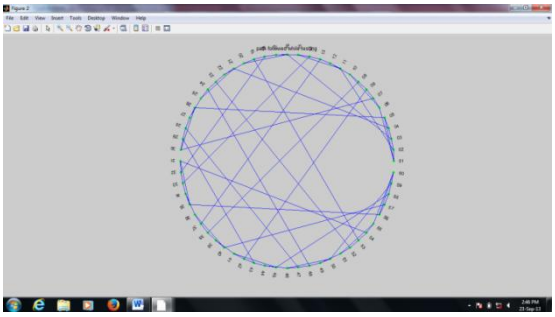

Fig. 7. Path followed for the Server Client Interaction using PSO Optimization

Fig. 7 shows the transfer of the data from the client to server nodes. The path is selected by using the PSO technique for fault tolerance detection and selection of the minimum shortest path.

V. CONCLUSION

The PSO based BFT showed a faster fault tolerant mechanism during the simulation by exhibiting the lesser run time compared to the other lightweight BFT mechanism. The proposed work dealt effectively in finding the shortest path among the server and the clients using the position and velocity update. The system was tested on an airline booking system for demonstrating the airline booking system. The test mail and confirmed mails were sent successfully by the proposed method. The number of iterations required in case of PSO was lesser than the BFT.

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