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PERFORMANCE EVALUATION OF TRUST MODAL WITH INVASIVE WEED OPTIMIZATION

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ABSTRACT

In the recent decade, the tremendous growth in IT venture had evolved a new term known as Cloud Computing. Cloud computing is the concept of sharing the environment and in turn sharing the infrastructure which may lead to the risk of illicit access of data. As the cloud computing involves sharing of infrastructure, scheduling plays the vital role. Another big challenge is providing Trust to the users in the commercial cloud environments. In the available heterogeneous infrastructure, users tend to opt of the best viable resources only based on the trust. Invasive Weed Optimization (IWO) is a population-based algorithm inspired from the process of weeds colonization and distribution. In this study, it is demonstrated that, with trust modal –IWO performs better results than other techniques.

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KEY WORDS

Cloud computing, Scheduling, Trust, Invasive Weed Optimization (IWO)

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INTRODUCTION

Cloud computing enables the centralized storage of data and access from anywhere using mobile device or thin client. It provides the easy access of data and resilience. In case of individuals, rather than data storage, data security is expensive. In cloud computing, the cloud provider is affordable to endow state of art security techniques than the individuals can. Nevertheless, as the cloud computing keeps the data control away from the data owner, data security issues are anticipated.

In cloud computing, significant facets of security of the associated technologies [1] are observed from the statements of the existing users and researchers. Security plays a vital part in adopting a service provider. As cloud computing involves the accessing the computing resources through internet, the data stored or transferred are prone to the security risks such as data confidentiality, reliability and accessibility which are the common threats of internet. In addition to these widespread risks, cloud computing is done globally and hence the users and service providers should act with bound to the international rules and regulations.

Most of the security risks of computing such as design of the architecture, access control privileges, malware attacks, surface attacks are common in the cloud computing too. Providing secure Cloud computing includes all these aspects. Data stored in cloud are exposed to the attacks irrespective of its storage layout. Apart from these most general risks, there are few specific security features are that explicit for cloud computing domain [2, 3]:

- Many tenants (Sharers) use one cloud and normally one tenant can be the attacker for the other.
- Cloud computing includes the service providers, subcontractors and employees who can access the data.
- Data stored in the cloud may be prone to be lost or modified by the cloud service provider.
- As the cloud in globally accessible by the tenants, the data may travel through various protocols and public networks which are widely insecure.

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Cloud computing is the imminent technology being grown radically. As cloud computing involves the task of sharing the common available resources, it is important to achieve the effective resource utilization, quick response for the queries and optimum minimal time for the task completion. These intentions could be attained through a proper sequencing of jobs called job scheduling [4] which is a primary activity in the computing environments. Job scheduling is the most popular solution for optimization problems which enhances the integrity and flexibility of the system. Specific to cloud computing, to increase the efficiency and maximize the profit, an appropriate job scheduler is required. The main purpose of the job scheduling is to assign the jobs to the available resources without time delay and also in the proper sequence such that the jobs are executed in the exact transaction logic constraint. The effective attainment of this purpose will lead to the situation where the processors are equally loaded and their utilization is maximum by cutting the idle time and also the total execution time is minimized. In order to attain these objectives, a new scheduling algorithm need to be proposed that is applied for the task scheduler to surpass suitable allocation design of tasks on the available resources.

Max-min strategy is organized such that it selects the large task for executing first and hence it is noted that the small tasks are made to wait for long time.

It is demonstrated that trying to solve NP-hard scheduling problem [5] with a single objective is a complex task. At the same time solving the problem with more objectives is also difficult. Unlike the single objective optimization which has the evidently defined optimal solution, multi-objective optimization problem clasps a set of best conciliated solution called as Pareto optimal solution. Solution such devised from the Pareto optimal solution is considered to be of better quality than any other available solution in the search space. For multi-objective optimization, it is predicted that Invasive Weed Optimization (IWO) matches appropriately

Trust plays a vital role in the commercial cloud setting. Managing the Trust of the users define the commercial success of the cloud technology [6,7]. Performance trust could be achieved through the belief. Software as a service (SaaS), Platform as a Service(PaaS), and Infrastructure as a Service(IaaS) are the service models supported by cloud infrastructure. Cloud Service providers are expected to offer Trust and financially worthy services in all the three aspects such as software, platform and infrastructure.

In this study techniques such as with trust modal –IWO are proposed. Section 2 explains the literatures, section 3 explains in detail about the techniques used in methodology, section 4 discusses about the obtained results and finally section 5 concludes the work.

RELATED WORKS

In the fast growing internet usage era, cloud computing is the best hopeful way to access the widely spread resources. Younis&Kifayat [8] investigated the issues related to probable security risks and in turn to construct a secure cloud infrastructure. The investigation emphasized on the security confronts related to the cloud and highlighted the requirements to be established for the construction of safe and secure cloud infrastructure by the service providers.

Swift scaling of data, remote storage and sharing of services in vibrant environment appears to be the advantage of cloud computing but at times they become disadvantage of cloud as these aspects tend to decrease the level of confidence in the imminent customers. The conventional mechanisms devised to solve these security and privacy issues are no longer effective in providing the rapid solution. Pearson [9] assesses the privacy, trust and security risks that are tend to occur and also thrash out the ways and means that could be used to handle them in the cloud environment.

Enhancement of the number of cloud deployments requires to root out the cloud related specific issues in addition to the consecutive risks exposed in the regular usage of Internet. Fernandes et al [10] surveyed the cloud security issues, and made the absolute review of related literature. The survey includes a comprehensive review of major aspects related to the security of the cloud environments, predicts that the key concepts of security such as open access of data, malware threats, pervasive attacks, categorization of the data and also confers various futuristic research topics.

Existent scheduling algorithms are brushing off the individual dependent and independent tasks. BrarRao [11] in his study proposes on Max- Min algorithm that could be implemented and focused for scheduling of job sequencing of dependent and independent jobs and ensures the profit of minimal computation time by enabling the parallel processing of independent tasks.

Fister et al [12] proposes a cloud model based Invasive Weed Optimization (IWO) algorithm. In this algorithmic model the weeds are categorized into excellent group, the normal group and the poor group. Through CR the algorithm fine tunes the standard deviation and each subgroup adopts diverse standard deviations to disperse. The group with modest standard deviation that recognizes the fine-grained search is the excellent group. The normal group recognizes the adaptive search as it applies cloud model's fuzzy logic and uncertainty to correct the standard deviation dynamically. Finally, as the poor group is liable to do the global search, it gets the higher standard deviation. This methodology brings better convergence rate, evade the trapping of

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algorithm in local optimum search and also improves the equilibrium between the global and local search. New devised algorithm is experimented on various test functions and its performance proves to be better optimal.

Enhanced Invasive Weed Optimization (EIWO) algorithm is formulated to address the issues related to feasible rework, transfer time with an transmitter between the consecutive stages and predictive sequence of tasks. The ultimate criterion for the optimization is to minimize the task span. In the previous researches, Invasive Weed Optimization (IWO) is proved to be a proficient meta-heuristic algorithm, in view of enhancing its competence, Jolai et al [13] included mutation operation which improves the exploration of the global optimum instead of local optimum.

Added to this, a similarity function is enclosed to hinder impulsive junction. IWO exploration and exploitation could be balanced with this. An investigational methodological design named Response Surface Method (RSM) is applied to determine the performance of the proposed algorithm EIWO. The proposed algorithm is assessed primarily by the generation of random test problems and the results obtained are compared with three well known bench mark algorithms and the result analysis is done with the help of various statistical tools. Finally it is proved that the proposed EIWO (Enhanced Invasive Weed Optimization) algorithm provides better solution to the problem.

Modified invasive weed optimization (IWO) algorithm is proposed by Mkeni&Fayech [5]. The algorithm proposed by them is designed to optimize the multi-objective flexible job scheduling problems(FJSSPs). Its performance is based on the three criteria, viz., Minimization of maximum completion time (makespan), the workload distributed to the machines, and workload on the specific decisive critical machine in the cloud. IWO, which is a well known bio-inspired meta-heuristic algorithm that imitates the weed behavior of inhabiting in a right ecological atmosphere which is best suited for its growth and reproduction. Unlike other algorithms IWO is specifically designed and developed to solve continuous optimization problems. Hence the discrete job sequences are converted in to continuous position values by using Smallest Position Value (SPV). Successful achievement of these performance criteria using this proposed Modified invasive weed optimization algorithm demonstrates the highest competence of the algorithm to discover the best optimal solution when compared with other existing algorithms.

METHOD

Max-Min Scheduling

The situation where there exists a distributed environment that commences with a sequence of impulsive unscheduled jobs, generally there the Max-min algorithm is deployed. The deployment of this Max-min algorithm is followed by the estimation of the expected execution flow matrix and the maximum and minimum expected time of individual task completion in the available existing resources. As a next step of action, among the entire task, the task which has maximum overall expected time of completion is selected and it is assigned to the other source which has minimum overall time of execution. Finally, the task which is scheduled recently is removed from the set of meta-tasks, and the calculated times are updated. These steps are repeated until the meta-tasks set are empty [14].

In max-min protocol, as given in **[Figure 1]**, r_j denotes the ready time of resource R_j for executing a job, and C_{ij} as well as E_{ij} denote the anticipated completion as well as execution time correspondingly. As displayed, T_k with maximal anticipated completion time is selected to be designated for related resource R_j which provides minimal execution time.

$For\ every\ job\ in\ meta\text{-}jobs;\ T_i$

$\quad For\ every\ resource\ R_j$

$\qquad C_{ij} = E_{ij} + r_j$

$While\ meta\text{-}job\ is\ not\ empty$

$\quad identify\ job\ T_k\ that\ takes\ up\ \max imal\ completion\ time$

$\quad designate\ T_k\ to\ resource\ R_j\ that\ provides\ \min imal\ execution\ time$

$\quad discard\ T_k\ from\ meta\text{-}jobs\ set$

$update\ r_j\ for\ chosen\ R_j$

$update\ C_{ij}\ for\ i$

Fig:1. Pseudo code for Max-Min Algorithm

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Trust in Cloud Computing

In the recent decades, apart from various other fields, health care service has emerged as one of the service that is extended globally. At the same time, it is the field which contains the most sensitive data too. Hence, the global health care providers are in search of an appropriate and well secured cloud provider available in the market. In spite of the assurance of all the cloud providers who describe themselves as the best secured environment, and declare to act as per the requirements of the health care provider's, the health care provider's need to do the burden task of comparing the quality of the services offered by various cloud service providers to choose the trust worthy. The process of this comparison involves the procedure of analysis of SLAs and recording the clauses as per the requirement and legal follow ups of the audit standards regarding the security task [15].

Another significant process of security conformity in cloud is audit. Generally the term refer to secretarial. Actually, audit is the process of evaluating a person, system, firm, company or development of a product.In the context of cloud, auditing could be used to ensure the reliability of the data that is stored in the cloud. Corresponding audit and the Field audit are the two types of audit that are commonly taken in the process of execution. Audit is used to categorize the received data for storage, evaluate and authenticate the level of integrity of the data. On these basis the user would be responded. File Storage: Once the files are received by the cloud for storage it can be stored first and then the above mentioned audit process is performed on the file. The advantage of this file storage method are (i) Save Time: This is because the conventional methods of auditing are time consuming which involves large number of interferences and includes many manual method for the further proceedings of the storage of data.(ii) Savings: The main aim of any business to have cost cutting technique which leads to the economical savings while looking for the data storage in the cloud is attained with this type of audit process [16].

In a dynamic multi-owner environment of cloud, the secured storage of data is ensured by the utilization of a new proposed scheme based on code generation and public auditing. This scheme assures the data integrity of fresh and renewal data by the establishment of a third party auditor and an individual proxy on the data owner's behalf. Data owners are liberated from the online burden towards the renewal of spoiled blocks by the implementation of High Availability Proxy servers. This High Availability Proxy server can also find and block the unauthenticated activity on the data by any individual or group.

This technique could be made clear with the following example:

The public and private keys are generated by the staff; authenticator regeneration is given to a proxy through sharing of private keys partially. Thus generated encoded blocks and authenticators are uploaded and distributed by the staff on the cloud servers. On any detection of data corruption, the information is sent to the readily existing High Availability Proxy which will regenerate the data blocks and equivalent authenticators by itself in a high secure method. This technique overlay the way to make certain that a team of staff can be under one project and in turn there can be subgroups to access or modify the data.

Invasive Weed Optimization (IWO)

In 2006, Mehrabian and Lucas[17] proposed an original stochastic optimization model, invasive weed optimization algorithm. This algorithm got motivated and well identified from agricultural experience: invasive weed colonization. It provides easy understanding, straight forward programming technique and also robustness to the process. These advantages have made the programmers to pertain this algorithm in various field of modern engineering [18].

The existing traditional IWO, Weeds and the Population refers to the feasible solutions to the particular problem and the set of such weeds respectively. Thus generated weeds are spread over the complete search area. As per the agricultural concept, which is the root proposal for IWO, each weed would produce new weeds based on its fitness function. Such reproduced weeds are disseminated over the search space using the distributed random number whose mean is ensured to be equivalent to zero. The regeneration iteration process goes on till it reaches the maximum number of weeds or otherwise maximum population. In the regeneration competition, as per the survival of the fittest theory, those weeds which are with best fitness will survive and the remaining will get terminated. This process will proceed till the maximum numbers of iterations are reached. With this apparent process, the weed with better fitness function which falls very near to the best optimal solution is achieved.

The procedure is detailed thus:

- **Step 1: Initialize a population**A set of arbitrary solutions are distributed over the D dimensional search space with arbitrary positions.
- **Step 2: Reproduction** Greater the weed fitness, more seeds it yields. The equation of weeds yielding seeds is:

$$weed_n = \frac{f - f_{\min}}{f_{\max} - f_{\min}}(s_{\max} - s_{\min}) + s_{\min}$$

  Wherein f refers to the current weed's fitness. $f_{\max}$ as well as $f_{\min}$ correspondingly denote maximal as well as worst fitness of current population. $S_{\max}$ as well as $S_{\min}$ correspondingly denote maximal as well as worst value of weeds.
- **Step 3: Spatial dispersal** The created seeds are arbitrarily spread across D dimensional search space through arbitrary numbers that have normal distribution and mean zero, but with differing variance. This guarantees that the seeds are arbitrarily spread such that they abide close to parent plant.

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- **Step 4: Competitive exclusion** Once a certain number of iterations are done, the quantity of weeds in the colony reach their maximum (P MAX) through rapid reproduction. During this time, all weeds are permitted to yield seeds. The yielded seeds are permitted to distribute themselves across the search space. When every seed has discovered its position in the search space, they are ranked together with their parents as a colony of weeds. Then, weeds with least fitness are discarded for reaching maximal permissible population in the colony. In this manner, weeds as well as seeds are ranked and those with greater fitness live and are permitted to duplicate. [Figure -2] shows the pseudo code for IWO.

```
Start{
• Set up population of weeds, set variables; • Current_iteration=1;
  While (Current_iteration<Max_iteration) do
  {
• Calculate the greatest and least fitness in the population
• Calculate the standard deviation stdon the basis of iteration
    For all weeds w in the population W
    {
• Calculate the quantity of seeds for w on the basis of its fitness
• Choose the seeds from the potential solutions near the parent weed w in a neighbourhood with normal distribution possessing mean=0 as well as standard deviation=std;
• Append seeds yielded to the population W
If (|W|>Max_SizePopulation)
{
• Rank the population W as per their fitness
• W=SelectBetter(weed,seed,Max_SizePopulation)
}End if
}End for
Current_iteration=Current_iteration+1;
}End while
}End
```

Fig: 2. Pseudo code for IWO

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The IWO was originally formulated for solving continuous optimization issues, but it is not capable of being employed to discrete issues in a direct manner. Individuals are to be coded adequately for solving scheduling issues. In the current work, coding which considers all restraints as well as specifics of the issue is implemented. For (n jobs, m machines, O operations) FJSSP, all plants are denoted by four aspects: every aspect consists of $2 \times O$ quantity of dimensions.

RESULTS AND DISCUSSION

For experiments, the number of tasks taken are 200, 400, 600, 800 and 1000. The methods such as without trust model- max min and with trust model- max min are used for obtaining the average schedule length and ratios of successful execution. [Table -1], [Table -2] and [Figure -3],[Figure -4]shows the average schedule length and ratios of successful execution respectively.

Table: 1. Average Schedule Length

Number of tasks	Without Trust Model - Max Min	With Trust Model Max - Min	Without Trust Model - Invasive Weed Optimization	With Trust Model- Invasive Weed Optimization
200	359	341	357	338
400	1129	1074	1101	1042
600	1902	1805	1854	1764
800	2610	2484	2611	2479
1000	3374	3201	3300	3118

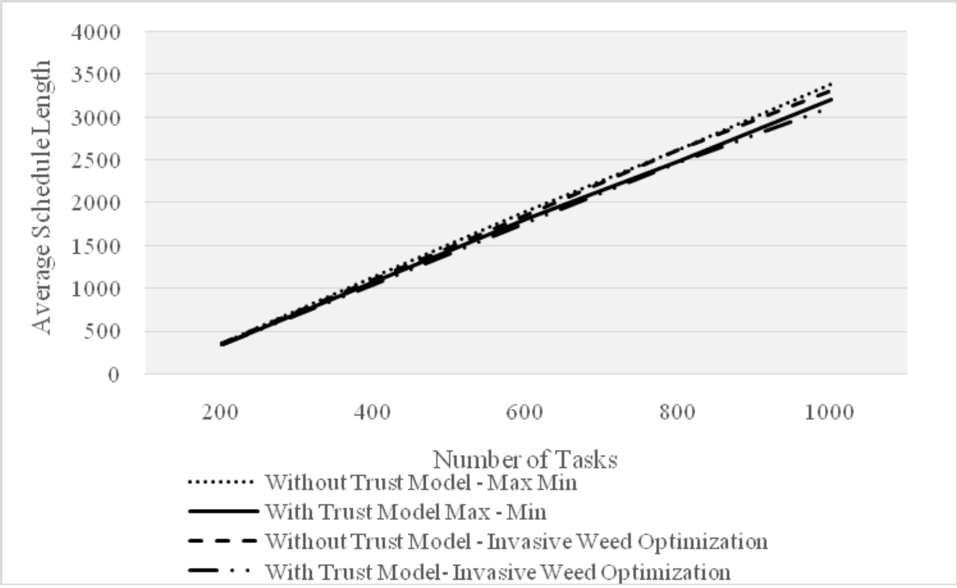

Fig: 3. Average Schedule Length

Table- 1 and **Figure- 3** shows that the average schedule length of with trust model Invasive Weed Optimization (IWO) performs better by 6.03% than without trust model max min, by 0.88% than with trust model max min and by 5.47% than without trust model Invasive Weed Optimization (IWO) for number of tasks is 200. For number of tasks 1000, the average schedule length of with trust model Invasive Weed Optimization (IWO) performs better by 7.89% than without trust model max min, by 2.63% than with trust model max min and by 5.67% than without trust model Invasive Weed Optimization (IWO).

Table: 2. Ratios of Successful Execution

Number of tasks	Without Trust Model - Max Min	With Trust Model Max - Min	Without Trust Model - Invasive Weed Optimization	With Trust Model- Invasive Weed Optimization
200	0.89	0.91	0.92	0.94
400	0.87	0.89	0.89	0.92
600	0.85	0.87	0.87	0.9
800	0.83	0.85	0.86	0.89
1000	0.83	0.84	0.85	0.87

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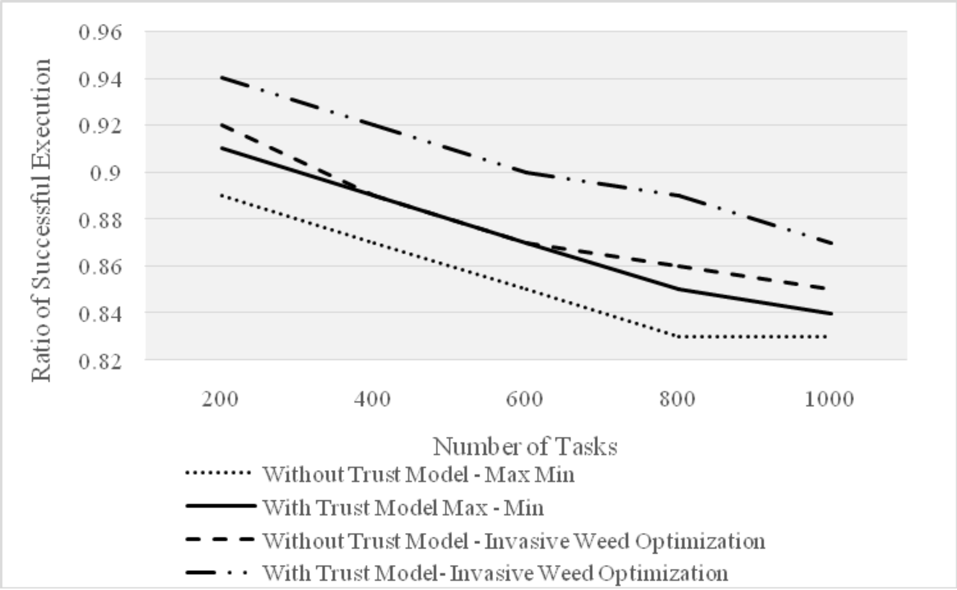

Fig: 4. Ratios of Successful Execution

[Table -2], [Figure -4] shows that the Ratios of Successful Execution of with trust model Invasive Weed Optimization (IWO) performs better by 5.46% than without trust model max min, by 3.24% than with trust model max min and by 2.15% than without trust model Invasive Weed Optimization (IWO) for number of tasks is 200. For number of tasks 1000, the Ratios of Successful Execution of with trust model Invasive Weed Optimization (IWO) performs better by 4.71% than without trust model max min, by 3.51% than with trust model max min and by 2.33% than without trust model Invasive Weed Optimization (IWO).

CONCLUSION

Cloud computing presents a rising optimistic expectation among the service providers and data owners in using this highly developed technology. As cloud computing is engaged in decentralization of data, where it is stored in the resources spread globally and also disseminated to the users through various different geographically located data centers, trust is believed to be the most significant concern. The implementation of Max-Min algorithm directly benefits in minimizing computation time.

Results show that the Ratios of Successful Execution with trust model Invasive Weed Optimization (IWO) performs better by 5.46% than without trust model max min, by 3.24% than with trust model max min and by 2.15% than without trust model Invasive Weed Optimization (IWO) for number of tasks is 200. For number of tasks 1000, the Ratios of Successful Execution of with trust model Invasive Weed Optimization (IWO) performs better by 4.71% than without trust model max min, by 3.51% than with trust model max min and by 2.33% than without trust model Invasive Weed Optimization (IWO). The average schedule length for proposed method id reduced than other existing works.

CONFLICT OF INTEREST

The authors declare no conflict of interests.

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