ACO Based Dynamic Resource Scheduling for Improving Cloud Performance

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Abstract— **Cloud computing becomes relatively popular among cloud users by contribution a variety of resources. This is an on insist service because it offers dynamic flexible resource allocation and guaranteed services. Cloud computing is a recent advancement wherein IT infrastructure and applications are provided as "services" to end- users under a usage-based payment form. They are using virtualized services necessities varying with time.**

To overcome these challenges using CloudSim tool. CloudSim is an extensible simulation toolkit that enables modeling and simulation of Cloud computing systems and application provisioning environments.

Several researchers from organizations are using CloudSim in their investigation on Cloud resource provisioning and energy-efficient management of data center resources. The usefulness of CloudSim is confirmed by a case study involving dynamic provisioning of application services in hybrid federated clouds environment. We have various types of resource scheduling algorithm but ACO(Ant Colony Optimization) is more promising algorithm as compared to other.ACO is a type of Resource Scheduling algorithm. In proposed study the proposed method is Ant Colony Optimization Algorithm (ACO). ACO adapt genetic operations to enhance ant movement towards solution state. [1][2].

***Index Terms*—Resource Scheduling, virtualization, ACO algorithm, CloudSim tool, Resource allocation methods.**

I. INTRODUCTION

Rapidly increasing demand of efficient computing increases the use of cloud computing. In this context cloud servers are loaded most of the time. In order to achieve efficient and computing resource management and scheduling techniques are helpful. Therefore in this study the resource scheduling techniques are investigated and new method for resource management is provided. The proposed study is intended to investigate different cloud computing resource management and resource provisioning techniques and proposes a new technique for improving the cloud scheduling [3].

The concept of "skewness" to measure the unevenness in the multi-dimensional resource consumption of a server. By minimize skewness, they can join different types of workloads nicely and improve the overall utilization of server resources. Finally they develop a set of heuristics that prevent overload in the system effectively while save energy used. Outline motivated simulation and experiment results demonstrate that algorithm achieves good performance. There are a large number of applications where the efficient resource scheduling helps to improves productivity and efficiency. Cloud resource scheduling: In order to satisfy the huge amount of resources requirements for executing the requests the resource management algorithm helps to minimize the resource consumption and maximizing the efficiency.

A. Cloud resource scheduling: In order to satisfy the huge amount of resources requirements for executing the requests the resource management algorithm helps to minimize the resource consumption and maximizing the efficiency.

B. Grid computing resource scheduling: In grid computing the resource is also distributable and sharable, therefore in order to maximize the efficiency of computational grid the proposed technique can help to improve the performance of grid resource management.

C. VM scheduling for obtaining Green Computing Green computing is a branch of cloud and grid computing where the VM resources are scheduled for achieving low power consumption

II. BACKGROUND

This section provides the overview of the technology and the background of the studying domain. That may help in understanding the environment, the issues and challenges and recently developed solutions for the cloud computing domain. The cloud makes it feasible for you to access your information from anywhere at any time.

Techniques of Resource Scheduling

There are a rich amount of methods are available for efficient resource scheduling some of them frequently used techniques are discussed in this section.

1 Particle Swarm Optimization (PSO)

Particle Swarm Optimization (PSO) is a swarm-based intelligence algorithm [4] influenced by the social behavior of animals such as a flock of birds finds a food source or a school offish protecting them from a predator. A particle in PSO is analogous to a bird or fish-flying through a search (problem) space. The movement of each particle is co-ordinate by a velocity which has both magnitude and direction. Every particle location at any instance of time is influenced by its best position and the position of the best particle in a problem space [4].

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2 Genetic Algorithm

Genetic algorithm is a method of scheduling in which the tasks are assign resources according to individual solutions, which tells about which resource is to be assigned to which, task. Genetic Algorithm is base on the biological concept of population generation. The main terms used in genetic algorithms are Initial population, fitness function, selection, crossover, mutation [5].

3. Bee's algorithm

Bee's algorithm in nature tracks the actions of bee to get their foodstuff. Primarily they pick scout bee to a search food areas, if that bee find the area with large foodstuffs informs the place and direction to the other bees to find the area. Some other elected bee's and scout bee's collected honey as a foodstuff from diverse places. Identically some other set of scout bees inform the location of foodstuffs from different direction. Bee's algorithm for resource scheduling is as given below. The proposed algorithm for resource scheduling based on bees concept. Which sends autonomous task to various nodes present in it group. Initially, the task is submitted to scheduler [6].

4. Bin-Packing algorithm

Bin packing problems involve the packing of objects of given sizes into bins of given capacity. In the case of one-dimensional bin packing the size of each object is a real number between 0 and 1, and each bin is of same capacity. It is required that the sum of the objects packed into any given bin may not exceed 1. The problem of finding a packing using a minimum number of bins is known to be NP-hard [7].

5. Priority algorithm

In priority based scheduling algorithm is modified by the scheduling heuristic or executing highest priority task with advance reservation by pre-empting best-effort task as done in. Algorithm shows the pseudo codes of Priority Based Scheduling Algorithm (PBSA).

III. PROPOSED WORK

Cloud resource management has scheduling issues for efficient resource management. The associated problem domain and an optimum method for study are provided in this section. In addition of that for solving issues a new architecture is also discussed in this section.

Domain Description

Cloud computing is a distributed computing environment, in this system various computing resources associated together and provide an effective computational solution. But in this context the resource management and resource scheduling provide essential contribution for managing the computational resources. In order to provide the effective resource scheduling recently various algorithms and techniques are proposed and implemented. These concepts provide a partial solution for the scheduling. Additionally the recent techniques are not much efficient there concerning issues and challenges are listed in further section.

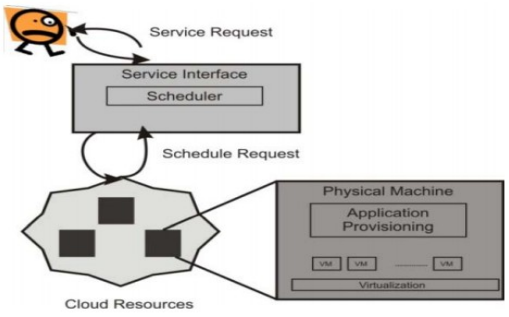

Figure of resource management

Basically when a client made a service request for their job execution then a scheduler implemented for schedule the job and resources. According to the available resources and management techniques as given in Figure the jobs are scheduled for execution. The proposed study is focused on computational resource management and scheduling. Therefore, the problem and solution is desired to simulate using a discrete event simulator namely CloudSim.

Proposed solution

In order to simulate the resource scheduling need and the effectiveness of ACO algorithm based resource scheduling algorithm.

Resource manager: the resource manager is an internal resource monitor which evaluates entire computational resources and gathers the information about the available resources.

Scheduler: that contains intelligent algorithms which first ask about the resources available and then compute the resource requirements for executing the given tasks. In the given simulation there are three main scheduling techniques are implemented

Which are discussed as :

Time shared: Time sharing is a technique which enable lots of people, situated at a variety of terminals, to use a particular computer system at the similar moment. Time-sharing or multitasking is a reasonable expansion of multiprogramming. Processor's time which is shared between several users simultaneously is termed as time-sharing.

Space shared: Distributed systems use multiple central processors to serve multiple real time application and multiple users. Data processing job are scattered between the processors accordingly to which one can perform each job most efficiently.

ACO Algorithm: The ACO Algorithm uses a Colony of Artificial Ants that behave as co-operative agents in a mathematical space were they are allowed to search and reinforce pathways (solutions) in order to find the best one. Solution that satisfies the constraint is reasonable. After initialization of the pheromone trails, ants create reasonable solution, initial from random nodes, then the pheromone trails are updated. At each step ants calculate a set of feasible moves and select the best one (according to some probabilistic rules) to carry out the rest of the tour. The transition probability is

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based on the heuristic information and pheromone trail level of the progress. The high value of the pheromone and the heuristic in order, the more beneficial it is to select this move and continue the explore. In the beginning, the initial pheromone level is set to a small positive constant value $\tau 0$ and then ants update this value after completing the construction stage [9].

Proposed Algorithm

A general ACO (Ant Colony Optimization) is discussed in previous section, this algorithm is implemented with the cloud model for efficient resource scheduling for minimizing the computational cost of CPU consumption. Therefore the given algorithm is slightly modified.

I. Initialization

In this phase two basic works is performed first initializing the random sequences of the resources which are satisfying the task, and a task matrix which consist the task and the resource requirements. Thus that can be done by the following set of steps:

//generating random sequence

Proposed algorithm:

Step1. Find unique resources R[n]

Step2. Find total Task T[n]

Step3. for i=0; i<=n; i++

Step4. R[j] =random(R[n]);

Step5. End for

II. Solution development

In this phase the ants are initialized with a flag 0 and for each solution that is improved with their score values. The higher score results optimum solution, which can be given as:

Step1. For each random generated solution steps

Step2. If T[n] → satisfies(R[n])

Step3. Update F=F+1;

Step4. Else

Step5. Update F=F;

Step6. End if

Step7. Store FT →{F, R[n]}

Step8. End for

Step9. maxF=0;

Step10. For j=0 to FT.length()

Step11. If FT[j] >= maxF

Step12. Update maxF= FT[j];

Step13. End if

Step14. End for

The above given process results the most optimum fitness solution for resources allocation for targeted task list.

The main aim of the proposed study work is finding the solution for scheduling the computational resources for optimizing the CPU consumption

IV. PERFORMANCE ANALYSIS

Performance analysis includes the hardware and software resources, simulation parameters, simulation scenario, and the implementation using code.

cloudsim

The CloudSim toolkit supports both system and performance modeling of Cloud system components such as data centers, Virtual Machines (VMs) and resource provisioning policies it exposes custom interfaces for implementing policies and provisioning methods for allocation of VMs under inter-networked Cloud computing circumstances [8].

Simulation Setup

Simulation of the cloud system and the simulation of the desired scenario are described in this section. The simulation parameters of the system are given in two modules.

Cloud Infrastructure

The simulation of the cloud environment using CloudSim discrete event simulator requires configuring first the cloud infrastructure, then after the simulation scenarios are required to be write using codes.

Table Cloud Infrastructure Parameters

Simulation Parameters	Values
Number of Virtual	20
Number of Cloudlets	40
VM image size	10000 MB
RAM	512 MB
Number of instruction	1000 MIPS
Processing Units	1

Network Parameters

After finalizing the cloud infrastructure required to design simulation scenario, for that purpose some network parameters are also required to utilize, the network setup is given using the below given table.

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Table Network Parameters

Network parameters	Values
Resource length	*1000*
File Size	300 MB
Host memory	2048 MB
Storage	1000000MB
Band width	10000
Output size	300 MB
instruction per second for Host	1000

Simulation Scenario

The simulation of the cloud platform is prepared to provide the load over the cloud host for execution of a sequence of real time domain workload, the work load generation is obtained from a file which is found in [http://www.cs.huji.ac.il/labs/parallel/workload/logs.html]. Here a log is provided as input, which contains the real time work of actual cloud host for 24 hours. The complete simulation involves three different scenarios for simulating the problem and solution.

A. **Time Shared:** here the operating system is considered as a time shared basis, in this kind of system the resources are shared for time basis, here the elapse time is increased if the number of jobs in queue is increasing.

B. **Memory Shared:** in this scenario type of operating system is considered as the memory shared system. That is a high efficient system type, that increases the resource consumption, but the time required to execute a job is too few with respect to the time shared system.

III. **Proposed Algorithm:** in this system the jobs are scheduled with the ACO (Ant Colony Optimization) Algorithm, which is modified in order to utilize with the cloud host load scheduling. This method guarantees to provide the efficient resource scheduling to avoid the deadlock condition on the cloud hosts.

System Performance

The proposed ACO (Ant Colony Optimization) is implemented with the CloudSim in order to optimize the job scheduling capability. To justify the effectiveness of the proposed approach the system is compared with two different job scheduling strategies namely time shared and shared space. The comparative performance of the strategies is given using Figure 4.8. In the above given diagram time shared algorithm usage more time with CPU in order to execute a job, that is represented using the red line in the above diagram. Secondly the blue line represents a space shared system which consumes the CPU efficiently and consumes less time with respect to the time shared system, finally the green line represents proposed ACO based scheme which consumes too few CPU resources in order to schedule the jobs. According to the given results ACO based scheme is much more efficient than other two default methods of job scheduling associated with the CloudSim simulation tool.

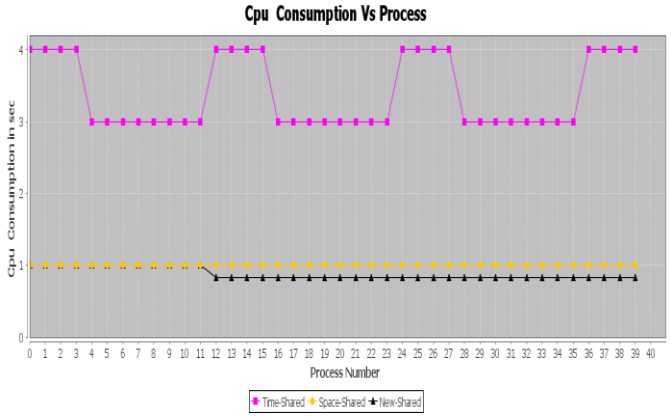


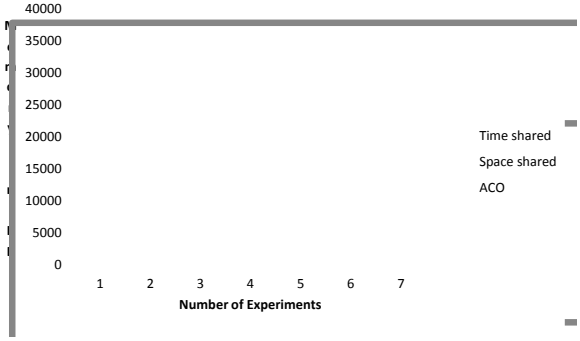
Figure Comparative Performance

Algorithm Performance

In this section performance of the algorithm is evaluated, that is given using memory consumption and time consuming. Both parameters are evaluated during different experimentation and workload files, only best results are considered for results representation.

Memory consumption

The total amount of memory resources consumed during the execution of the job scheduling algorithm is denoted as the memory consumption of the system. Figure provides the memory uses of all the systems. According to the obtained results the performance of the proposed ACO based resource scheduling algorithm consumes less memory during the processing the tasks as compared to the traditionally implemented resource provisioning algorithm.



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Time Consumption

Time amount of time required to get a resource request and provides the schedule of job execution is denoted as the time consumption for the algorithm.

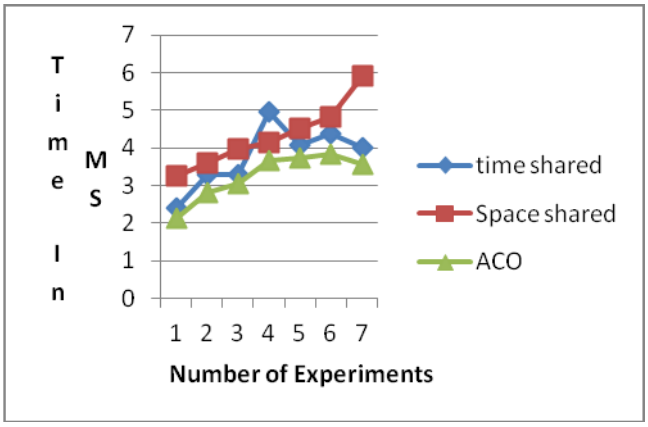

Figure Amount of Time required (consumption) to get a Resource request

Scheduling efficiency

Figure provides the Scheduling Efficiency uses of all the systems. According to the obtained results the performance of the proposed ACO based resource scheduling algorithm efficiency is high.

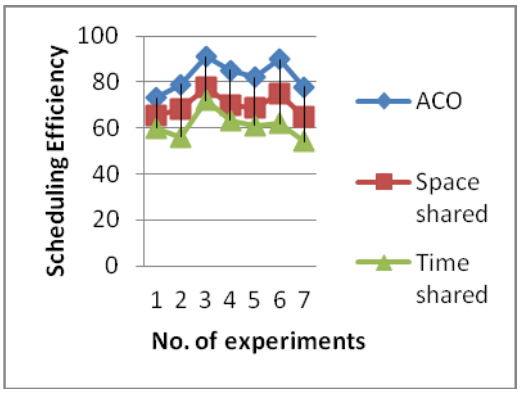

Figure Scheduling Efficiency in percentage

Conclusion and Future Work

The proposed study for enhancing the performance of computational cloud is performed.

Conclusion

The presented work is a study of cloud computing, that is a new generation technology used for high performance computing with low cost and plug and play methodology. Due to these properties that is a popular among industries and organizations. For providing the efficient computing at the client end, the most of the organization consumes the services of cloud computing. As the number of request for processing is increases the load on cloud host is increases respectively. In this context for efficient computing and providing the outcomes at the client the available resources are helpful. But increasing load can affect the performance of cloud servers and processing in request can delay due to this.

For that purpose a new solution is suggested for resource scheduling in computational cloud environment. The proposed resource scheduling algorithm utilizes the ACO (Ant Colony Optimization) algorithm for resource scheduling and management. The presented resource scheduling algorithm optimizes the performance of computational cloud and provides the efficient resources scheduling strategy in execution. The implementation of the desired resource scheduling technique is performed using JAVA environment, with the help of CloudSim simulator. After implementation of desired technique the performance of algorithm is computed in terms of computational efficiency and algorithm performance. The computation efficiency is calculated for demonstrating the resource scheduling performance and the algorithm performance indicates the time and space complexity of the system. The evaluated results demonstrate the effective outcomes form the system. The commutated performance of the system is compared with the previously available techniques of time based resource scheduling method and memory based scheduling technique. The evaluated performance of the system is summarized using a performance summary Table.

Table Performance Summary

Parameters	Proposed	Time	Space
Memory	Less	Avg	High
Time	Less	Avg	High
Scheduling	High	Less	Avg

The proposed system is successfully implemented with the resource scheduling methodology and provides efficient results during performance evaluation. In addition of that that is adoptable due to less resource consumption.

Future Work

The Proposed study on cloud resource scheduling is successfully performed and in outcomes a new genetically inspired algorithm is available for resource scheduling. The performance of the system is optimum and produces efficient computing. The proposed study is extended in near Future for enhancing more resource scheduling efficiency using the predictive resource scheduling methodology. We can also include the concept of energy domain in our future work.

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