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A Particle Swarm Optimization based Technique for Scheduling Workflow in Cloud DataCenter

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ABSTRACT
Live virtual migration is a way for achieving system load balancing in a cloud environment by transferring an active VM from one physical host to another. This way has been developed to decrease the downtime for migrating overloaded VMs, but it still consumes time- and cost, and a huge amount of memory is involved in this migration process. To overcome these drawbacks, we propose a Load Balancing method using Particle Swarm Optimization (LBPSO) that achieves system load balancing by only transferring extra tasks from an overloaded VM instead of migration of the entire overloaded VM. We have designed an optimization model to migrate these extra tasks to the new host LB-PSO by applying Particle Swarm Optimization (PSO), where PSO will randomly find the suitable VM so as to transfer the load. To evaluate the proposed method, we have extended the cloud simulator (Cloudsim) package with the use of PSO in its task scheduling model. The simulation results show that the proposed LB-PSO method has significantly reduced the time taken by the load balancing with live migration on heterogeneous environment as compared to traditional load balancing approaches with live migration.
Keywords:- LB-PSO, LB-PSO

I. INTRODUCTION

[1] With the rapid development of technology and the Internet, computing resources have become cheap, more powerful and more ubiquitously available than ever before. This technological trend has allowed the realization of a new computing model called cloud computing, in which resources (e.g., CPU and storage) are provided as general utilities that can be leased and released by users through the Internet in an on-demand fashion. In a cloud computing environment, the traditional role of service provider is divided into two categories: First one is the infrastructure providers who basically manage cloud platforms and lease resources according to a usage-based pricing model, and second one is the service providers, who basically rent resources from one or many infrastructure providers to serve the end users. It totally relies on sharing of resources so as to achieve economic scales as well, similar to a utility over a network. Sharing of resources can be achieved by balancing the load on cloud itself.**[2]** Cloud load balancing is the process of distributing workloads across various computing resources. Cloud load balancing basically reduces the costs linked with document management systems and also maximizes availability of resources. In order to improve load balancing of cloud computing and to make it more productive, Live migration technique is used.**[3]** Live migration technique is basically the process of moving a running virtual machine or application between different physical machines without any disconnection between the clients or application. Memory, storage, and network connectivity of the virtual machine are basically transferred from the original machine to the destination

There are two techniques for moving the virtual machine's memory state from the source to the destination. One is pre-copy memory migration and another is post-copy memory migration.

The whole migration process occurs in following steps

1The monitoring node calculates the load by considering parameters such as memory usage network bandwidth total number of processes and classifies the physical host into lightly loaded and heavily loaded. Whenever any node becomes overloaded then process of load balancing starts and performs the VM migration.

2Live migration of VM from one physical host to another is done with pre-copy or post-copy method by following steps:

a. Reservation of resources on destination side.

b. Transferring of memory pages of virtual machine from source to destination.

c. Transferring the modified memory pages from source side to destination.

d. Activation of execution of virtual machine on destination side.

II. STATIC LOAD BALANCING

In static load balancing performance of the processors is determined at the beginning of execution. Then depending upon their performance the work load is distributed in the start by the master processor. The slave processors calculate their allocated work and submit their result to the master. A task is always executed on the processor to which it is assigned that is static load balancing methods are non-preemptive. The goal of static load balancing method is to reduce the overall execution time of a concurrent program while minimizing the communication delays.[9]

III. LITERATURE SURVEY

[4]William Voorsluys et.al says that Virtualization has become common in computing clouds. The capability of virtual machine live migration has brought benefits such as improved performance, manageability and fault tolerance, along with allowing workload movement with a short service downtime. However, service levels of applications are likely to be negatively affected during a live migration. For this reason, a better understanding of its effects on system performance is essential. The evaluation of the effects of live migration of virtual machines on the performance of applications running inside Xen VMs is done. Results show that, in many of the cases, migration overhead is accepted especially in systems where availability and responsiveness is governed by Service Level Agreements. Despite that, there is a high potential for live migration applicability in data centers with modern Internet applications.

[5]Haikun Liu et.al says that live migration of virtual machine provides good benefits for virtual server mobility without disconnection of service. It is used for system management in virtualized data centers. Whereas, migration costs varies significantly for different workloads because of the variety of VM configurations and workload characteristics. To consider the account of migration overhead in migration decision making, it is to be investigated the design methodologies to predict the migration performance as well as energy cost. It is to be thoroughly analyzed the key parameters those have affect the migration cost from theory to practical. Two application-oblivious models for the cost prediction by using learned knowledge about the workloads at the hypervisor level are constructed. It was first kind of work to estimate VM live migration cost in terms of both performance as well as energy in a quantitative approach. Evaluation of the models with five representative workloads on a Xen virtualized environment was also done.

[6]Mayank Mishra et.al says that Virtualization is a key concept in enabling the computing-as-a-service vision of cloud-based solutions. Virtual machine featuring with flexible resource provisioning, and isolation and migration of machine state has improved efficiency of resource usage and dynamic resource provisioning capabilities. Live virtual machine migration transfers state of a virtual machine from one physical machine to another and also overload conditions are migrated with uninterrupted maintenance activities. Outlining of the components required to use virtual machine migration for dynamic resource management in the virtualized cloud environment is done with the presentation of categorization with details of migration heuristics aiming at producing server sprawl, minimizing power consumption. Balancing load across physical machines has been also done.

[7]Dulcardo Arteaga says that Host-side flash caching has emerged as a promising solution to the scalability problem of virtual machine storage in cloud computing systems, but it still facing serious problems in capacity as well as endurance. Cache management solution has been developed to meet VM cache demands along with minimize cache wear-out. To support on-demand cache allocation, a new cache demand model has been proposed, Reuse Working Set (RWS) in order to capture only the data with good temporal locality as well as uses the RWS size (RWSS) to model a workload's cache demand. By predicting the RWSS online and admitting only RWS into the cache, Cloud Cache satisfies the workload's actual cache demand and minimizes the induced wear-out. Secondly in order to handle situations where cache is insufficient for the VMs' demands, a dynamic cache migration approach has been developed in order to balance cache load across the hosts by live migrating cached data along with the VMs. It includes both on-demand migration of dirty data and background migration of RWS in order to optimize the performance of the migrating VM.

IV. PROPOSED ALGORITHM

The algorithm starts with random initialization of particle's position. The particles are the task to be assigned and the dimension of the particles is the number of tasks in a workflow. The value assigned to an each dimension of particles is the resources available. Thus the particle represents a mapping of resource to a task. In our workflow each particle is tasks and the content of each dimension of the particles is the compute resource assigned to that task. The evaluation of each particle is performing by the fitness each particle knows its best position pbest and the best position so far among the entire group of particles gbest. The pbest of a particle is the best result (fitness value) so far reached the tasks is not mapped to a single compute resource. Distribute tasks to all resources

1. Set particle dimension as equal to the size of ready tasks

2. Initialize particles position randomly from cloud

3. For each particle, calculate its fitness value

4. If the fitness value is better than the previous best pbest, set the current fitness value as the new pbest

5 After Steps 3 and 4 for all particles, select the best particle as gbest

6. For all particles, calculate best resource and update their positions

The algorithm work on live migration along with particle swarm optimization and it updates the resource allocation (based on average communication time between resources) in every scheduling loop. It also recomputed the task-resource mapping so that it optimizes the load balancing of resources computation, based on the current network and resource conditions

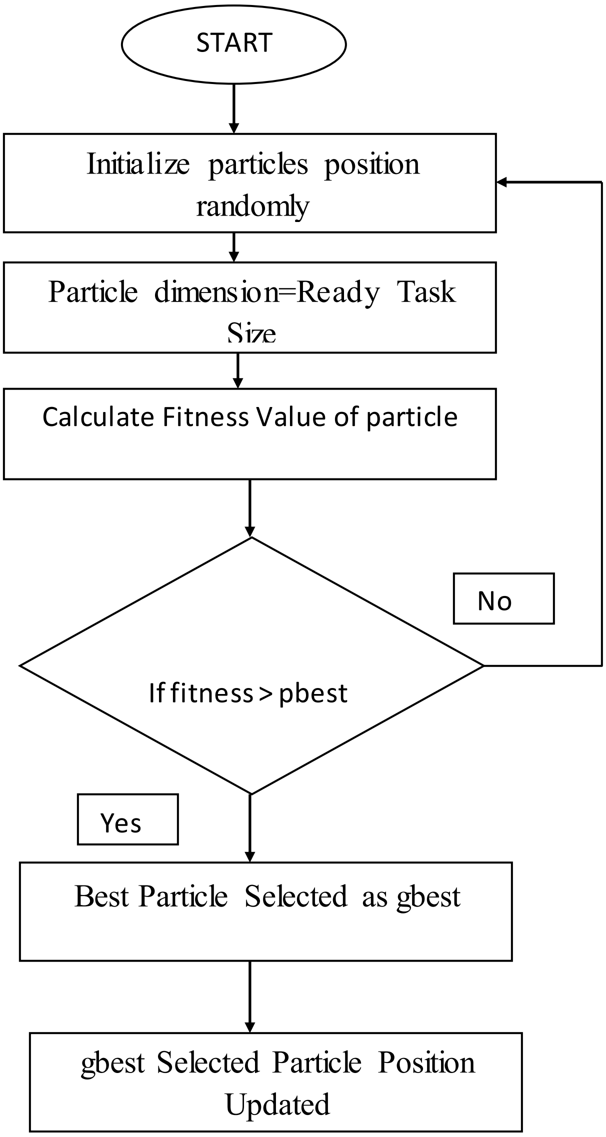

Fig1 Data Flow Diagram PSO

.V. EXPERIMENTAL SETUP

In experimental set we have used cloudsim simulator with an extension of PSO package. CloudSim has various classes for solving number of purposes. Datacenter presents in simulator instantiates components that implements a set of policies for allocating bandwidth, memory, and storage devices. Datacenter Broker is responsible for acting as intermediate between users and service providers depending on users' QoS requirements and deploys service tasks across Cloud. Virtual Machine class models an instance of a VM is the responsible of the Host component. Cloudlet models the Cloud-based application services (content delivery, social networking, business workflow), are commonly deployed in the Data Center Broker .Cloud Coordinator class is responsible for communicating with other Cloud

Coordinator services and Data Center Broker also for monitoring the state of a data center that plays integral role in load-balancing/application scaling decision making. This is further extended with the PSO (Particle Swarm Optimization) which evaluates problem by having number of different solutions, which are known as particles, and moving these particles around in the search-space fitting to simple mathematical formulae over the particle's position. The movement of each particle is affected by its local best known position and is also guided as to the best known positions in the search-space, these are updated as better positions and then they are found by other particles. This is expected to move the best particle termed as swarm toward the best solutions

VI. CONCLUSION & FUTURE SCOPE

In this work, scheduling based on Particle Swarm Optimization (PSO). The heuristic in order to minimize the total time of execution of whole workflows process on Cloud computing environments, total time of execution is decreased by varying the communication between resources and the execution time of compute resources using the "Best Resource Selection"(BRS) heuristic. We have found that PSO based task-resource mapping can achieve better results based on mapping for our application workflow. In addition, PSO balances the load on compute resources by distributing tasks to available resources. It can be used for any number of tasks and resources by simply increasing the dimension of the particles and the number of resources, respectively. As part of our future work, we would like to integrate PSO along with the cloudsim environment for our workflow management system to schedule workflows of live migration effectively in order to tackle the various issues of the live migration in load balancing of cloud computing datacenter.

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