ISSUES AND CHALLENGES IN CLOUD COMPUTING AND COMPARISON OF ALGORITHMS FOR ALLOCATING RESOURCE IN CLOUD ENVIRONMENT

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Abstract: Cloud computing is becoming very popular technology in the computer field. Its services are preferred in various fields. Many service composition processes are enacted and executed in this environment. The resource selection and minimizing the time to complete the work are being the main consideration to provide the quality of service. There are number of resources are used to serve the tasks and their utilization efficiency. Tasks are competing with other task in order to access the resource first, to complete the work, but the task may face problem sometimes. One of the problems in accessing resource in distributed environments is dead lock. This is similar to cloud environment also. The objective of this work, analyzing the situations for sharing the resource and its techniques for the cloud environment and suggesting the solution for it. This paper provides four algorithms for resource allocation in cloud environment with its merits and demerits

Index Terms: **Cloud Computing, Service Provider, Resource Allocation, Algorithm**

1. Introduction

Due to the unprecedented success of internet in last few years, computing resources is now more ubiquitously available. And it enabled the realization of a new computing concept called Cloud Computing. Cloud Computing environment requires the traditional service providers to have two different ways. These are infrastructure and service providers. Infrastructure providers manage cloud platforms and lease resources according to usage. Service providers rent resources from infrastructure providers to serve the end users. Cloud Computing has attracted the giant companies like Google, Microsoft, and Amazon and considered as a great influence in today's Information Technology industry. Business owners are attracted to cloud computing concept because of several features.

These are as follows:

- Lower initial investment
- Easier to manage
- Scalability
- Deploy faster
- Location independent
- Device independent
- Reliability
- Security

Although cloud computing has shown considerable opportunities to the IT industry of today's world, but still there are number of challenges that requires to be carefully addressed. In our paper, we present a survey of cloud computing and state-of-the-art research challenges. Our aim is to provide a better understanding of cloud computing and focus on the research ongoing in this tremendously flourishing arena of computer science.

2. Types of cloud computing

2.1 Service Models

Cloud computing services may be classified into three types as Infrastructure-as-a-service (IaaS), Platform-as-a-Service (PaaS) and Software-as-a-Service (SaaS). IaaS refers to providing hardware equipment such as CPU, memory and storage as a service, PaaS refers to providing platforms such as software development frameworks, operating systems or multi-tenant application supports as a ser- vice and SaaS providing software and applications as a service (Kan Zheng, 2015).

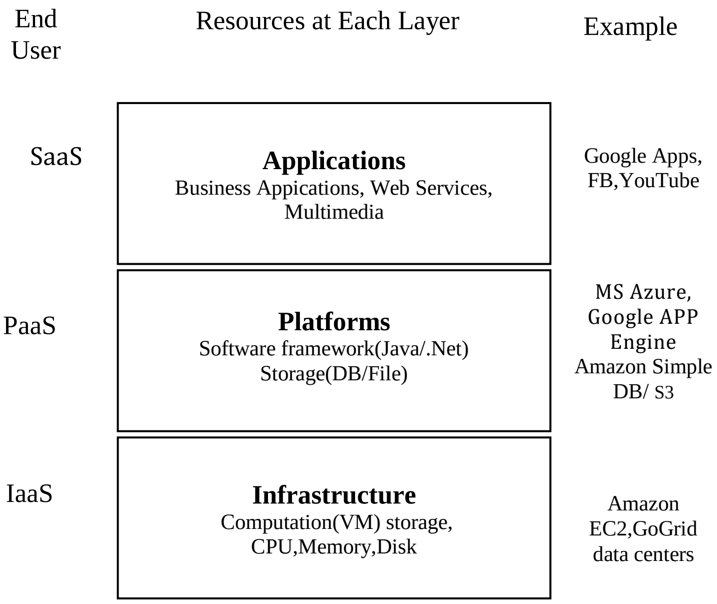

Figure 1. Service Architecture of Cloud Computing

2.2. Deployment Models of Cloud Computing

Three types of cloud could be presented: Public cloud, Private cloud and hybrid cloud.

a. Public cloud: the services are delivered to the client via the Internet from a third party service provider
b. Private Cloud: these services are managed and provided within the organization. There are less restriction on network bandwidth, fewer security exposures and other legal requirements compared to the public Cloud.
c. Hybrid Cloud: there is a combination of services provided from public and private Clouds
d. Community Cloud:This type of Cloud involves sharing the computing infrastructure in between organizations of the same community. For example, all Government organization within the state of tamilnadu may share the computing infrastructure on the cloud to manage data related to citizens residing in tamilnadu

3. Scope of Cloud Computing Resource Management

We introduce the actors in a cloud ecosystem, focusing on their role(s) in the resource management process and the kinds of management objectives they are likely to pursue. We discuss the resource types that comprise a cloud environment and briefly introduce the key technologies that enable their management. Finally, we introduce our conceptual framework for cloud resource management, outlining the key resource management functions and their inter-relations. Cloud offerings are generally marketed as IaaS, PaaS or SaaS, but there is a spectrum of interpretations of these terms, which have made clear comparisons and cloud interoperability difficult. Cloud Provider, Cloud User ,End User are the main actors in the cloud environment. (Amazon EC2 pricing, 2012,Google AppEngine, 2012, Google AppEngine pricing, 2012, T. Ibarraki, 1988).

3.1. Resource Type

3.1.1. Compute Resources

Compute resources are the collection of Physical Machines (PMs), each comprised of one or more processors, memory, network interface and local I/O, which together provide the computational capacity of a cloud environment.

3.1.2. Networking Resources

Compute resources (on PMs) within a data center are packaged into racks and are typically organized as clusters of thousands of hosts for resource allocation purposes. The first is network topology, the design of which significantly impacts performance and fault tolerance.

3.1.3. Storage Resources

Public Cloud Providers, such as Amazon, offer persistent storage services of different types, ranging from virtual disks and database services to object stores, each service having varying levels of data consistency guarantees and reliability.

3.1.4. Power Resources

Data centers account for a significant portion of worldwide energy usage and energy costs, both direct costs to power utilities and associated power distribution and cooling costs, account for a significant portion of the overall cost base for a data center operator.

3.2 Enabling Technologies

We now outline the main technologies that enable cloud computing environments and that are directly or indirectly harnessed by cloud resource management processes.

3.2.1 Infrastructure Scaling

The main reason why Cloud Providers can offer application hosting at relatively low cost is the economies of scale they achieve through the concentrated deployment of large numbers of Commercial-of-the-Shelf (COTS) PMs connected via high speed networks, also realized via COTS equipment.

3.2.2 Virtualization

Virtualization refers to the process of creating an emulation of a hardware or software environment that appears to a user as a complete instance of tha environment. Virtualization software is commonly used in cloud environments to create virtual machines.

3.2.3 Virtual Machine Migration

A consequence of server virtualization is that VM data and execution state can be readily embodied in a set of files. Thus, a VM can have its execution externally suspended, be transferred to another physical server, and restarted with the same state-a process termed live migration. .

3.2.4 Equipment Power State Adjustment

Energy use minimization has become an important objective for cloud providers. Responding to this, processor manufacturers and equipment vendors have developed energy efficient hardware and provide software interfaces that can be used to configure the energy consumption profiles of data center equipment.

3.3 Issues in the Resource Allocation

Resource Allocation Strategy is integrating cloud provider activities for utilizing and allocating resources within the limit of cloud environment so as to meet the needs of the cloud application. (I. Foster, 2008, M. Armbrust, 2009).

An optimal RAS should avoid the following criteria.

3.3.1 Resource conflict:

it may arise if two or more applications try to access the same resource at the same time.

3.3.2 Lack of resources:

It will occur if there are limited resources.

3.3.3 Resource Separation:

It will occur when the resources are separated. There will be enough resources but not able to allocate to the needed application.

3.3.4 Extra- provisioning:

It will arise when the application gets more resources then the demanded.

3.*3.5 Less-provisioning:*

This situation will arise when the application is assigned with less number of resources than the requested.

3.4 computing capacities from a cloud provider

3.4.1 Advance Reservation (AR):

Resources are reserved in advance. They should be available at a specific time

3.4.2 Best-Effort:

Resources are provided as soon as possible. The Resources should be accurate as per the User Request. If many users sends the request, and then all are placed in a queue.

3.4.3 Immediate:

When a user sends a request, either the resources are provisioned immediately, or the request is rejected, based on the resource availabilities. Because all the users are using the cloud services by paying the money. Since all are business oriented and valuable for them, they cannot wait for long time. They may wish what is happening if they not able to get immediate response.

3.4.4 Deadline Sensitive:

Assumed to be pre-emptible but there is a limitation to their preemptibility. It is pre-emptible only if the scheduling algorithms assure that it can be completed before its deadline.

4. Suggested Algorithms for Allocating Resources in cloud Environment

4.1 PSO Algorithm

Particle Swarm Optimisation (PSO) is a swarm-based intelligence algorithm (X. Wen, 2012) influenced by the social behavior of animals such as a flock of birds finding a food source or a school of fish protecting themselves 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-ordinated by a velocity which has both magnitude and direction. Each particle position at any instance of time is influenced by its best position and the position of the best particle in a problem space. The performance of a particle is measured by a fitness value, which is problem specific.

The PSO algorithm is similar to other evolutionary algorithms. In PSO, the population is the number of particles in a problem space. Particles are initialized randomly. Each particle will have a fitness value, which will be evaluated by a fitness function to be optimized in each generation. 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 by the particle, whereas gbest is the best particle in terms of fitness in an entire population. In each generation the velocity and the position of particles will be updated.

4.2 SL-PSO Algorithm

As analyzed earlier, the best strategy for a particular particle is determined by its local fitness landscape. Therefore, the optimal strategy for a particle may change in accordance with the change of its position during the evolution process. In this section, we will achieve two objectives. The first is to provide a solution to how to choose the optimal strategy, and the other one is to adapt this learning mechanism to the local environmental change for a particular particle during the evolutionary process.

From another point of view, the four operators in SL-PSO (Ran Cheng, 2015) actually represent four different population topologies, which, in turn, allow particles to have four different communication structures. Each population structure determines a particle’s neighborhood and the way it communicates with the neighborhood. By adaptively adjusting the population topology, we can adaptively adjust the way particles interact with each other and, hence, can enable the PSO algorithm to perform better in different situations.

4.3 Lion Algorithm

The lion algorithm (B. R. Rajakumar, 2012) based on lion’s social behaviour. Lions are the most socially inclined of all wild cat species which display high levels of cooperation and antagonism (K. Mccomb, 1993) Lions are of particular interest because of their strong sexual dimorphism in both social behaviour and appearance. The lion is a wild felid with two types of social organization: residents and nomads. Residents lives in groups, called pride (G.B. Schaller, 1972) A pride of lions typically includes about five females, their cubs of both sexes, and one or more than one adult males. Young males are excluded from their birth pride when they become sexually mature (G.B. Schaller, 1972) As mention before, the second organizational behaviour is called nomads, who move about sporadically, either in pairs or singularly. Pairs are more seen among related males who have been excluded from their maternal pride. Notice that a lion may switch lifestyles; residents may become nomads and vice versa (G.B. Schaller1972).

Unlike all other cats, Lions typically hunt together with other members of their pride. Several lionesses work together and encircle the prey from different points and catch the victim with a fast attack. Coordinated group hunting brings a greater probability of success in lion hunts. The male lions and some lionesses usually stay and rest while waiting for the hunter lionesses to return from the hunt (D.Scheel 1991) Lions do mate at any time of the year, and the females are polyestrous (when females not rearing their cubs are receptive) A lioness may mate with multiple partners when she is in heat (S.B.Hrdy 2006) In nature, male and female lions mark their territory and elsewhere, which seems a good place with urine.

Lion Optimization Algorithm (LOA), an initial population is formed by a set of randomly generated solutions called Lions. Some of the lions in the initial population (%N) are selected as nomad lions and rest population (resident lions) is randomly partitioned into P subsets called prides. S percent of the pride′s members are considered as female and rest are considered as male,while this rate(sex rate (%S)) in nomad lions is vice versa.

For each lion, the best obtained solution in passed iterations is called best visited position, and during the optimization process is updated progressively. In LOA, a pride territory is an area that consists of each member best visited position. In each pride, some females which are selected randomly go hunting. Hunters move towards the prey to encircle and catch it. The rest of the females move toward different positions of territory. Male lions in pride, roam in territory. Females in prides mate with one or some resident males. In each pride, young males are excluded from their maternal pride and become nomad when they reach maturity and, their power is less than resident males.

Also, a nomad lion (both male and female) moves randomly in the search space to find a better place (solution). If the strong nomad male invade the resident male, the resident male is driven out of the pride by the nomad lion. The nomad male becomes the resident lion. In the evolution, some resident females immigrate from one pride to another or switch their lifestyles and become nomad and vice versa some nomad female lions join prides. Due to many factors such as lack of food and competition, weakest lion will die or be killed. Above process continues until the stopping condition is satisfied.

4.4 E-LION Algorithm

Lion algorithm is inspired by the Lions unique social behavior (B. R. Rajakumar, 2012) The lion optimization algorithm has the advantage of solving the continuous optimization problems. The main idea is the survival of the fittest (B. R. Rajakumar2012) In this algorithm, behaviour and strategies of the lion pride are employed to the design the evolution strategies. Here we develop an exponential lion algorithm by modifying the lion algorithm with EWMA (Saccucci, 1992) for the optimized resource allocation approach which increases the profit of the cloud provider.

In E-Lion algorithm (J. Devagnanam, 2018) each lion pride represents the tasks in the search space and based on the fitness evaluation; the lion solution is used to allocate the task to the private cloud of the EC's cloud. The exponential theory is integrated with lion optimization algorithm to reduce the convergence problem arising in the presence of a large number of the initialized solutions and also to increase the speed in the optimal solution reachability. The adaptation of the exponential theory in the solution generation of the algorithm updates the solution in the intriguing algorithmic procedure increasing the speed of the optimal solution reach

Table 1 Comparative discussion of the proposed method with the existing methods, such as PSO, SL-PSO, and LION for problem instance 1

	PSO	SL-PSO	LION	E-LION
Profit	9.19	9.4	9.54	9.65
CPU utilization	0.0128	0.01	0.09	0.1
Memory utilization	0.002	0.008	0.05	0.09

5. Research Challenges

Based on our analysis, we identify five challenges (T. Ibarraki, 1988) we believe specifically merit future investigation. 1. Achieving Predictable Performance for Cloud-hosted Applications, 2.Achieving Global Manageability of Cloud Environments, 3.Engineering Scalable Resource Management Systems, 4.Economic Behavior and Pricing Strategies

6. Conclusion

In this paper we surveyed research into resource management for cloud environments. To clarify the discussion and better place individual contributions in context, we outlined a framework for cloud resource management and few issues in the allocating various resource in the cloud environment. This paper suggested four algorithms as solution for the resource allocating issues. The last algorithm ,"E-lion algorithm" is proved as best among other algorithms. In further works, people may add security issues with this algorithm to make more efficient.

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