Scheduling Tasks in the Cloud Computing Environment with the Effect of Cuckoo Optimization Algorithm

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Abstract
Cloud computing is a new computing way that has emerged recently in the commercial market. Increased processor speed, storage technology growth and success of the Internet in the computing resources cheaper, more powerful and more accessible, make a new type of service on the Internet is called cloud computing. Big companies like Google, Amazon and Microsoft moved to this technology for more advantages.

In this research will be discussed tasks scheduling optimization in cloud by cuckoo algorithm. Cuckoo optimization algorithm is a new way that can find the global optimum. This is one of the newest and most powerful optimization methods that have been introduced. This study aimed to minimize the overall execution time or cost time and improve load balancing and application resources with cloud computing is an algorithm for scheduling problem.

The research is divided into two parts. In the first part will be reviewed a comprehensive study in the field of cloud computing in various aspects of job scheduling procedures Then in the second part to be evaluated the proposed methods to solve scheduling problems and to implement algorithms.

Keywords: *Cloud computing, Cuckoo algorithms, optimization, scheduling tasks*

Introduction

Cloud computing refers to the future that the computing will not run on local computers but it will be done on centralized facilities and storage facilities by the server. Cloud computing computational approach is based on reducing costs, increasing reliability and increased flexibility. In recent years, cloud computing which combines distributed computing, grid computing and utility computing is highlighted (Wang et al., 2012, Armbrust et al.,2010).

Cloud computing environments have large amounts of different types of resources that are offered the various services based on user requests. Cloud computing environment can store data securely, convenient and easy. The cloud environment provides the ability to provision computing power via the Internet. Virtualization, dynamic expansion of distribution and accessibility of the cloud are integral characteristics (Dillon et al., 2010). Cloud computing offers three types of services to their users: Infrastructure as a Service (IaaS), platform as a service (PaaS) and Software as a Service (SaaS). This service will be available to users in exchange for the payment.

Resource scheduling problem in a cloud computing environment is very important. In the cloud computing environment, each user may have to perform any task, faced with hundreds of virtual resources. In this case, the allocation of tasks to virtual resources by the user is impossible. The purpose of using cloud computing is to minimize costs by service providers and to maximize revenue from services to applications consumers (Saadatjoo et al., 2012 and Mell et al., 2010).

Optimize energy consumption, increase performance and allocate resources among the objectives that the timing of virtual machines in the cloud computing environment will be pursued. Scheduling distributed virtual machines to complete all the cores are processing efficiency within each node. This schedule will significantly reduce power consumption. Physical resources are divided in many hosts that have the need for load balancing using multiple resources such as CPU and network at the same time (Garg et al., 2009 and Qian et al., 2009).

Scheduling tasks in the cloud system increase completion rates and increasing the efficiency of resources and thus increase the computing power controls. Cloud computing relies heavily on virtualization. We can say that clouds are virtual branches. The scheduling task in multiple heterogeneous physical machines is a critical issue and in this research, provides a method that can be addressed (Saadatjoo et al., 2012 and Marston et al., 2011).

1. History, importance and necessity of research

In a distributed computing system, different scheduling algorithms for resource allocation required tasks (Mark et al., 2011, Kemp et al., 2010). When we face a computational system with a large number of processes, the processes to obtain resources for implementation are in competition with each other. It is clear that in this case system requires a management system for optimal processing of the resource and computing systems solutions to solve this problem that is named 'Timing pattern' and usually scheduling algorithms are part of Scheduler in distributed computing systems (Saadatjoo et al., 2012). As mentioned, cloud computing system has a lot of resources to provide services to users and is implementing its tasks. In such a system with the number of sources and users who request their services, the absence of the scheduler causes confusion and quickly reduced efficiency and resource efficiency, so cloud computing systems associated with the scheduler to perform scheduling is necessary.

Saving energy scheduling approach is presented based on private a cloud that by Jiandun Li in April 2012 is based on the previous techniques. Private clouds have unique characteristics and the challenging problems which are scheduling virtual machine computing nodes. In this study, two virtual machines scheduling problem is discussed. Previous techniques can be used to reduce the response time and the ideal algorithm uses the original value.

This algorithm can be balanced workload. The benefit of load balancing algorithms is to distribute load on resources. Energy consumption and improves runtime and the disadvantage is to have not been met fully justice and cost-effective (Ling et al., 2011).

Optimal scheduling policy that Sarah Kumar has proposed in September 2009 behaves for a divergence between multiple data centers for cloud providers. A number of factors such as energy costs, workload and effective power CPU that different data centers vary depending on location, have been proposed. Here an architectural design and management system is intended. The advantage of this is that the scheduling algorithm, several factors are considered in terms of cost-effectiveness and load balancing. Its disadvantages include high response time and lack of reliability (S. K. Grag et al., 2009).

Scheduling algorithm works with the dynamic transfer. This method uses a threshold value when the node is free. The remaining capacity is used to set the expected range. To wake up the sleeping nodes of the "Turn" is used. The advantage of this algorithm is that efficiency will be improved considerably and the disadvantage is the lack of scalability and high cost (Jiandun Li et al., 2013).

Ant colony algorithm that is presented by Chang Xing presented has the appropriate legal randomly for load balancing system uses input by completing all tasks. If possible, behaves according to the situation. To use the resources, ant algorithms have been proposed to balance that out with a small workload balancing its completion. The advantage of this approach is that time is on balancing resources and to distribute the load also considers the state of the environment. The completion time is low and the disadvantage of this algorithm can be no justice and scalable runtime outlined (Chang et al., 2014).

A scheduling algorithm to achieve efficiency and equity has been proposed by Gunho Lee in 2012. Reduce costs and increase efficiency must be developed along heterogeneous environment. Data analysis systems report the heterogeneous workload and situation. The algorithm works when multiple shared between the justices of their branches has been developed. In this sense, architecture proposes to allocate resources to the branch data analysis in the cloud. Response time and low cost and justice are the advantages of this algorithm and also the disadvantage would be lack of confidence and high energy expenditure outlined (Lee et al.,2012 and Ranjan et al., 2010).

A scheduling algorithm of dynamic level is called Clooud-DLS by Wang in 2013. Because of the characteristics of cloud computing, cloud computing is difficult to achieve success. The research is discussed on trust in cloud computing environments.

Two types of reliability with subjects direct degree of certainty and recommendation degree of certainty has been raised by DLS to obtain reliable schedule trust and old algorithm improves the reliability of nodes. This algorithm takes into account the needs of the user in confidence and schedule tasks based on acyclic graph makes a reasonable place. The advantage of this algorithm is its reliability and its disadvantages can be pointed to the lack of justice and scalable runtime (Wang et al., 2013 and Toroghi et al., 2012).

A new way cuckoo optimization algorithm is more capable of finding the global optima. This algorithm is one of the newest and most powerful evolutionary optimization methods that have already been introduced. Algorithm is inspired cuckoo based on the way of life of cuckoo bird in 2009 by Shin Ouyang and Deb Savsh and later in 2011 by Rajabioun fully extended (Koochaki et al., 2009 and Rajabioun et al., 2011)

2. Research method

The research is divided into two parts. In the first comprehensive study are checked cloud computing and in various aspects of job scheduling and job scheduling methods. Then in the second part of the proposed methods to implement algorithms to solve scheduling problems and evaluated. In this study, the cuckoo optimization algorithm is used and an algorithm has been finalized to evaluate cloud computing by Cloudsim simulation using software. This software package is actually a series of classes and pre-prepared examples. For the implementation and use of these files need software or a special compiler such as Netbeans and Eclips and more.

2.1. Research objective

This study aimed to minimize the overall execution time or cost time with an algorithm for scheduling problem in cloud computing.

2.2. Research questions

Can an algorithm for scheduling problem of cloud computing with the aim of optimizing work time using Cuckoo algorithms be provided?

2.3. Research hypothesis

It can be provided an algorithm for scheduling problem of cloud computing with the aim of optimizing time using Cuckoo algorithms.

3. The nature of cloud computing

Cloud computing helps to decrease the design time of a program and it is the combination of cloud computing and virtualization, deployment of on-demand, providing Internet services, and software open source code. In a sense, cloud computing is nothing new, because the approaches and concepts existed previously handled. On the other hand, everything is new because cloud computing style of development, installation, scalability, updates, maintenance and pay for user programs and infrastructures that run on it has changed (Wu et al ., 2014, Akbari et al., 2009).

Cloud computing is not a computational grid. In computational grid, programs or documents hosted on a server are available through a network. Cloud computing is much more than this, including multiple networks and multiple server. Moreover, in contrast to normal network, cloud services and cloud storage from anywhere in the world and due to Internet connection is possible (Yuan et al, 2011 and Saadatjoo et al., 2012).

The key point in the definition of cloud computing is the term "Cloud". Here, a large group of computers are connected together. These computers can be networked PCs or servers. They also can be public or private. For example, Google's cloud hosting that includes both PCs and larger servers. Google's cloud is a private cloud that Google only owned but publicly (Akbari et al., 2009).

The cloud of computers goes beyond a company or organization. Applications and data are hosted in the cloud, by a variety of users, are provided between the enterprises and between different platforms and are accessible via the Internet. Any authorized user can documents and applications from any computer with an Internet connection access any issue. It is important for end users, IT infrastructure and cloud underside is hidden (Wu et al., 2014 and Akbari et al., 2009).

4. Cloudsim software

In future, cloud computing in the development of Internet services will become an important technology. Internet service providers are planning to meet the needs of users, some cloud computing systems to remove bottlenecks and to conserve energy; they impose new energy efficiency mechanisms and observing the effects on data center needs.

New mechanisms cloud computing testing in a real environment, it is difficult and researchers often fail to work in a true cloud environment, so the simulation to model mechanisms and evaluation of results is essential. Simulation of a data center, the time and effort to configure a real test environment, prevent. In addition, actual machine is not used for test purposes and their computing power can be allocated to the most critical applications. In this study, Cloudsim software is used to simulate cloud computing environment.

With the popularity of cloud computing in academic and research environments, and many challenges in testing algorithms and methods and the high cost of testing in a real environment, simulation software Cloudsim by University of Melbourne was designed. This application is actually a Java platform is presented for open source. In other words, to overcome the challenges of cloud computing, software simulations have been developed, one of them is Cloudsim software. Cloudsim is an extensible simulation tool that enables the modeling and simulation of cloud computing systems and preparing applications provide.

Today Cloudsim is the first choice for researchers to simulate and test algorithms. There are unique features such as simulated data centers, virtual

machines, job scheduling, load balancing and the measurement of comparison important parameters, such as response time and cost of the possibilities of this simulator is strong in the cloud. Software Cloudsim is able to make a model for behavior and system components of cloud computing such as data centers, virtual machines (VMs) and policy resources provides. This software, provide techniques generally for the application that can be developed with ease and little effort. The application of modeling and simulation Cloudsim support of cloud computing and Federation of Clouds. In addition, Cloudsim provide interfaces to implement policies and techniques and allocate resources among virtual machines in cloud computing scenarios provides network.

Library of Cloudsim provide some classes for defining data centers, virtual machines, applications, users, computing resources and policies to manage the various parts of a system. These components put together to operate by users to evaluate new strategies in the clouds. Cloudsim also can be used to evaluate the effectiveness of strategies from different points of view to be used, the cost/benefit analysis to accelerate application runtime. Cloudsim also supports Green IT policy assessment.

There are no restrictions on the use of Cloudsim, Classes can be extended or replaced, new policies can be added and new scenarios can be written. Cloudsim like blocks remain constructive simulation that lets you build your own cloud environment. So, Cloudsim is not a ready-to-use solution that you set the parameters and then collect the results for use in your project. Cloudsim is a library, and you must write a Java program that uses Cloudsim components, so you can design custom scenarios.

To use Cloudsim need Java and some basic knowledge about cloud computing and also some software such as NetBeans and Eclipse would be useful. Cloudsim does not require to installation, just unzip the downloaded package and put in a directory, then output to the Java class path. If use Eclips or NetBeans for a project, it is possible to add Cloudsim as a project and then will be available again. In this study, tasks scheduling algorithm is presented by Cloudsim software.

4.1. Cloudsim architectural

The main part of Cloudsim includes:

- ✓ **Datacenter:** Core that is proposed by providers of cloud model. Set the host password, which can be processed is homogeneous or heterogeneous.
- ✓ **Cloud information service:** Cloud data services. An entity that registers the existence of the data center, and resources are discovered.
- ✓ **Data center broker:** Broker Data Center
- ✓ **VM allocation:** Allocation VM
- ✓ **Host:** Host
- ✓ **VM scheduler:** An abstract class that is implemented by a host policies required for the allocation of cores to VMs models, which run on any host in the data center.
- ✓ **Cloudlet scheduler:** Abstract class that is extended by implementing various policies share the processing power of the piece clouds.
- ✓ **Cloudlet:** That is making a model of services applications

5. Optimization concept

Optimization is an important and decisive action. Designers will be able to produce better designs when they can be saved with optimization methods in the time and cost of designing. Many optimization problems in engineering are naturally more complex and more difficult with conventional methods such as using mathematical programming and optimization are so soluble. Combinational Optimization is the search for the optimum point of Discrete Variables functions. Many combinatorial optimization problems, often including issues with non-polynomial degrees are approximated by computers could be resolved. Among the solutions available in dealing with such problems is the use of approximation algorithms or initiatives. These algorithms do not guarantee optimal answer is obtained and only by spending much time can be achieved fairly exact answer. In fact, depending on the time taken to accurately answer will change.

The purpose of optimization is to find the best answer acceptable, according to the constraints and needs of the problem. For one thing, there may be different solutions to compare them and choose the optimal solution; a function called objective function is defined. Select this function depends on the nature of the problem. For example, travel time or cost, including common objectives to optimize transportation networks. However, the selection of appropriate objective function optimization is one of the most important steps.

Sometimes simultaneously consider the multi-objective optimization; these optimization problems that involve multiple objective functions are called multi-objective problems. Each independent variable optimization problem has a number of design variables is called the n-dimensional vector x will be shown.

The goal of optimization is to determine the design variables, so that the objective function is minimum or maximum. Optimization problems are divided into two categories:

A) Without constraint optimization problems: In these problems, the purpose is to maximize or minimize the objective function without any restrictions on its design variables.
B) Optimization problems with constraints: Optimization occurs often in practical problems due to the limitations, restrictions on the behavior and performance of behavioral constraints. Limitations exist in physics and geometry, geometric constraints or side are called.

Restrictions equations may be equal or unequal, in each case, is different optimization methods. However, these constraints are given the acceptable the area of design (Tasgetiren et al., 2007 and Wu et al., 2014) .

5.1. Combinatorial Optimization concept

Combinatorial Optimization is a branch of optimization problems to discus in general problem those seem to solve difficulty. Combinatorial optimization is a branch of applied mathematics and computer science and operations research and computational complexity theory at the confluence of several disciplines including artificial intelligence, mathematics and software engineering.

In the past two decades, the use of optimization in different areas such as industrial engineering, electrical, computer, communications and transportation have been developed. Linear and nonlinear optimization in the fifties and sixties century was the main aspects due to optimization.

Combinatorial optimization is to search for discrete variables and functions point in the 70 important results in this field. Today, many problems such as NP-hard could be solved by the computers. Combinatorial optimization problem can be ordered pair R, C show that R is set of possible solutions and C is objective function that has a certain amount for each answer (Tasgetiren et al., 2007 and Wu et al., 2014 and Toroghi et al., 2012).

The issue is considered as follows:

- ✓ Find the answer in a way that C is at its lowest.
- ✓ The optimum solutions satisfy i_0 criteria:

$C_{opt} = C(i_0 \in R) = Min_{i \in R} C(i)$

- ✓ And C_{opt} is optimum value and our task is to find $i_0 \in R$.

5.2. Combinatorial optimization problems solving way

It is clear that the method of counting, ultimately leads to the exact answer. But due to the large number of possible solutions, it is ineffective. To be clearer, it is better to consider the famous traveling salesman problem (TSP).

It has been one of the most famous in the field of combinatorial optimization problems is as follows:

Defining the route of a seller to make each city only once between N city pass over the entire path is minimized, is highly desirable. The total number of responses is $\frac{1}{2}(n-1)$. Suppose there is one computer that can examine the question of the twenty cities in one hour. Based on what was brought, to solve the problems with 21 cities is required 20 hours, and so the time required for the issue of 22 cities is 17.5 days and for the issue of 25 cities is 6 centuries! Because of this exponential growth of computing time, complete blood count method is totally inappropriate. Due to the problems of enumeration technique has always been focused on creating methods more effectively. In this regard, there have been various algorithms. The algorithm is no guarantee that the obtained solution is optimal, there is a fairly exact answer can only be achieved with time; in fact, due to the time taken to accurately answer will change (Tasgetiren et al., 2007 and Wu et al., 2014 and Toroghi et al., 2012 and Xing et al., 2014).

6. Cuckoo optimization algorithm

Cuckoo Algorithm optimization algorithm is one of the newest and most powerful evolutionary optimization methods that have already been introduced (Rajabioun, 2011).

As other algorithms, Cuckoo optimization algorithm (COA) work with an initial population, a total of Cuckoos. The population of cuckoos in the nest egg that they will have a host birds. Some of these eggs that are more similar to bird eggs host more chance to grow and become mature to be cuckoo. Other eggs were identified and destroyed by the home bird. Nest eggs grow the suitability of the area show. The more eggs in one area to be able to live and survive as much profit is more devoted to that area. Thus a situation where the largest number of eggs will be saved parameter COA plans to optimize it.

Cuckoos follow best place to maximize save their eggs. After the chicks hatched came into cuckoo matured, communities and groups, make some region. The best places of residence all groups is next

destination in the other groups. All parties to the best of existing migrate. Each group remains near the present situation. Considering the number of seed that the cuckoo will and are doves of the optimal current for the settlement of some radius egg calculated and shaped.

Cuckoos in the nest were then start laying eggs within a radius of themselves. The process to achieve the best placement location continues. The optimal location is where the highest number of cuckoos gathers in it (Deb et al., 2002 and Kemp et al., 2010 and cloud et al., 1997 and Gong et al., 2013 and Gupta et al., 2013)

6.1. Cuckoo method for laying

Each cuckoo randomly laid eggs in the nest of host birds. Then some eggs less similar to hosts bird eggs are detected and thrown out of the nest. So after each egg p% of all eggs (usually 10%) of the amount of earnings function is less, destroyed. The remaining chickens were fed and grow in a host nest. Another interesting point about chicks is that only one egg per nest Cuckoo has possibility to growth. Because when the cuckoo chicks are hatched, are thrown host birds eggs from the nests and if the host bird chicks are hatched earlier than the cuckoo, cuckoo eat the largest amount of food and a few days, host bird chicks die of starvation and only the cuckoo chick survives (Rajabioun, 2011).

6.2. Migrating cuckoos

By the passage of time cuckoos grew and matured with living in their own environment and groups. When the time eggs come, they migrate close to the habitat where is more safe. After establishing environmental groups Cuckoo in different areas, one group with the best position is selected as the target point for migration.

When mature cuckoos live all over the environment, recognizing that each cuckoo belong to which group is very difficult. To solve this problem, the classification by K-means clustering is done (K between 3 to 5 will usually suffice). When the groups were formed the profit average of group is calculated to obtain the optimum relative habitat that group. Then, a group with the highest average earnings is selected as target groups for other groups to migrate towards it. When cuckoos migrate to the target point they pass just just part of the path and the path has deviates (Deb et al., 2002 and Kemp et al., 2010 and cloud et al., 1997)

6.3. Cuckoo optimization algorithm

✓ Solving complex non-linear optimization problems with reliability and high accuracy
✓ Training the ANN Easy and reliable PID controller design for MIMO systems
✓ Find out the equilibrium point for games
✓ Optimal design of antennas
✓ Use Segment improved for images
✓ Which can be used in any optimization problem is formulated as an objective function

6.4. Advantages cuckoo optimization algorithm

✓ Faster convergence
✓ More speed
✓ Even higher accuracy
✓ Local Search capability along with general search
✓ Much less chance of getting stuck in local optimum points
✓ Search by variable population
✓ Overall movement towards better with the destruction of the poor response
✓ The ability to quickly solve optimization problems with high dimensions (Rajabioun, 2011 and Chen et al., 2009)

6.5. The main steps of the algorithm Cuckoo

The main steps of the algorithm used in this study include:

✓ Specify Cuckoo current location randomly.
✓ Assign to each cuckoo eggs.
✓ Specify each cuckoo eggs the radius.
✓ Cuckoos lay eggs in the nests of hosts that they are in range.
✓ Eggs that are detected by the host birds are destroyed.
✓ Seeds that have not been identified are bred.
✓ Assess the Cuckoo's new location.
✓ Cuckoo K-means clustering method with the best groups Cuckoo specifies the purpose as places of residence.
✓ New population Cuckoo moves to the target location.
✓ If you stop condition established stop, otherwise go to the next step.
✓ Cuckoo in the simulation algorithms
✓ At this stage of the benchmarking study Cuckoo algorithm, task scheduler delivers. Makespan reduction work is the main goal.
✓ Input: A list of cloud Cloudlet (tasks) and a list of the VM.
✓ Output: best solution for the allocation of work to the VM.

Cuckoo algorithm is an algorithm that is inherently used to maximize the objective function. The cuckoos move to the point compatibility with the most profitable for life. Minus sign in front of assessments is the cost function for the minimization algorithm.

Notably, the cost function is writing. Most methods to implement algorithms so does the cost function takes a number of population and for the crowd to show you cost but the COA program cost function algorithm should be written as a matrix that has the same population receive their habitat and show us cost equal to the size of the population.

When you start using the program, the number of parameters has to be cleared. That is how many we want to optimize.
Public static int npar=10;
Public static int varLo=-32;
Public static int varHi=32;

COA parameters used:

```
Public static int numCuckooS=5;
Public static int minNumberOfEggs=2;
Public static int maxNumberOfEggs =4;
Public static int maxIter=200;
Public static int knnClusterNum=1;
Public static int accuracy=0;
Public static int maxNumOfCuckooS =10;
Public static int radiusCoeff=5;
```

The concept of defined parameters includes:

✓ At the beginning the number of cuckoo with high fertility and mortality are low because population is variable.
✓ Minimum number of eggs that can affect.
✓ The maximum number of eggs that can affect.
✓ The maximum number of iterations to optimize
✓ The number of clusters that use.
✓ Parameter that determines when to stop the optimization of the cost function.
✓ The maximum number of COA who cannot live here at any moment.
✓ This is the total of population it is important to search for some.
✓ Specifies the maximum radius of laying eggs. It depends on the top and bottom of the problem.

Because the cuckoo optimization algorithm works better than other evolutionary algorithms in multi-operator function cuckoo optimization algorithm, such as spawning and migration is implicit.
In other evolutionary optimization algorithms encountered by operators that are responsible for a particular purpose but the cuckoo optimization algorithm, simultaneous operations defined several goals.

Initializing the algorithm begins and ends as follows:

```
Input: incoming Cloudlets and VMs List
Output: "print" finishing
Starts
Set cloudlets List=null and temp_ List_ of_ Cloudlet=null
Put any incoming Cloudlets in Cloudlet List in order of their Arriving time
Do COA_P while cloudlet List not empty or there are more incoming Cloudlets
Set N=Size of VMs List
If (Size of Cloudlet List greater than N)
Transfer the first arrived N Cloudlets from Cloudlet list
And put them on temp_ List_ of_ Cloudlet
Else
Transfer all cloudlets from cloudlet list and put them on temp_ List_ of_ Cloudlet
End if
Execute COA procedure with input temp_ List_ of_ Cloudlet and N
End Do
"Print" finishing
Stop
```

7. Results and discussion

Let us assume that there are things in two independent bidirectional, For example, there is no limitation of priority between things that are not exclusive, they cannot get a break or transferred to the processor during execution. The tests on the three algorithms Round Robin (RR) and ant colony algorithm (ACO) and Cuckoo algorithm (COA) has been implemented in the context of Cloudsim software.

The experiment with 10 data centers with 50 VMs and 500-100 simulation is run under the platform. The duration of work is from 1000 MI (Million Instructions) to the 20000 MI. Set the simulation parameters are shown in Table 1.

Table1. The simulation parameters

Entity type	Parameters	Value
Task (Cloudlet)	Length of task	1000-20000
	Total number of task	100-500
Virtual Machine	Total number of VMs	50
	MIPS	500-2000
	VM memory (RAM)	256-2048
	Bandwidth	256-1024
	Cloudlet Scheduler	Space_shared and Time_shared
	Number of Pes requirement	1-4
Datacenter	Number of Datacenter	10
	Number of Host	2-6
	VM Scheduler	Space_shared and Time_shared

Each cloudlet or work in Cloudsim has a length which means it is the number of internal guidelines and MI are displayed.

- Bandwidth class: This class is for the bandwidth requirements of virtual machines.
- MIPS: Millions of Instructions Per Second
- Makespan: at the time of completion of the last job

Makespan mean compared with a sum of different things. The average Makespan are shown in the COA and RR and ACO algorithms in the following figure. It is seen that by increasing the amount of work, time of implementation will be decreased in COA in compared with two another algorithms and this shows that this algorithm works best.

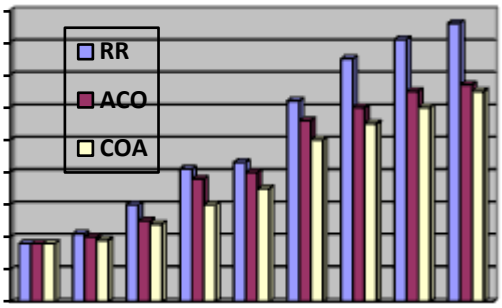

Figure1. Makespan mean

The imbalance between the VM is calculated by the following equation:

$$D_{\mathrm{i}} = \frac{Tmax + Tmin}{Tavg}$$

Where T-min and T-max and T-avg are maximum and minimum and time mean of VMs. The degree of disequilibrium each algorithm has a number of things vary from 100to 1000that is shown in Figure 2. It can be seen that the COA can load balance system better than the other algorithms.

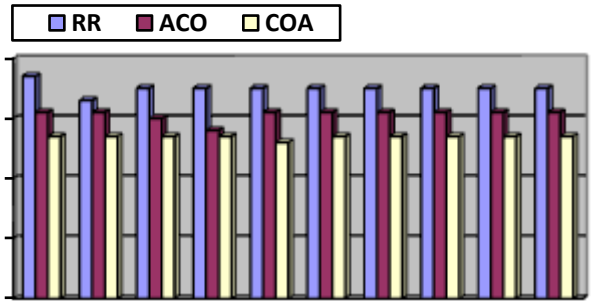

Figure 2. Degree of disequilibrium each algorithm

8. Conclusion

The results after comparing Cuckoo algorithm with two algorithms of ant colony and Round Robin show that the Cuckoo algorithm works by having certain characteristics lowers the overall execution time. To claim the best method of solving an optimization algorithm is not very accurate because every year newer algorithms flaws in their previous approaches emerged. Maybe when genetic algorithm and particle swarm algorithm is further optimized algorithms were considered the best of its kind. Although it still can be seen in the large number of articles, of these methods are sometimes as measures for comparing performance used in new ways.

Some researchers believe that there is no reason that an evolutionary optimization method is better than the other because each method because of evolution should be able to find the right answer. The point is that in the meantime there are some ways similar to their real models have evolved in nature are slow. For example, in genetic evolution that is inspired by fairies real change and evolves slowly over many years done, maybe it's because the genetic algorithm requires a more reps to find the right answer is. In contrast, particle swarm algorithm for birds to feed your inspiration from groups operates much faster than genetic algorithms to solve problems faster action. Whatever the real reason, however, what can be seen in practice is that a number of algorithms is inherently more quickly than the others and this makes users more willing to use evolutionary optimization algorithms faster and more accurate. This is also true about the cuckoo optimization algorithm and test applications so far, this algorithm has done much better than other algorithms. It would be a good incentive for the cuckoo optimization algorithm to solve a lot of problems with high and very complex.

Because the cuckoo optimization algorithm works better than other evolutionary algorithms is implicit in multi-operator function cuckoo optimization algorithm, such as spawning and migration. In other evolutionary optimization algorithms encountered by operators that are responsible for a particular purpose but the cuckoo optimization algorithm for simultaneous operations defined several goals a reality. For example clustering algorithm helps optimize the dove into the environment quickly divided into several parts and the best area for a specified time. This area is likely to contain global optimum point. Then all the cuckoos migrate to the region and within the region for a better search. This leads to much faster convergence algorithm is cuckoo.

9. Suggestion

- Evaluation of optimization tasks by other optimization algorithms have been proposed to focus more on existing algorithms to identify the barriers and benefits of each.
- The cuckoo optimization algorithm may be used to find solutions other issues to expand the scope of application of this algorithm.

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