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An Improved Novel Energy Efficient Method for Resource Allocation in Clouds Based on Ant Theory

Ashmita[1], Dr. Dinesh Kumar[2]
[1]M.Tech Student , Department of Computer Science and Engg.
Guru Kashi University, Talwandi Sabo
[2]Associate professor, Department of Computer Science and Engg.
Guru Kashi University, Talwandi Sabo

Abstract— *Cloud computing is the development of distributed computing, parallel computing and grid computing, or defined as the commercial implementation of these computer science concepts. The allocation of cloud computing resource is a hot topic. Many scholars have done some research in this area. This implementation have the intention of achieving the establishment of performance qualitative analysis on VM migration and process according to their deadline, then implemented in Cloudsim with Java language. A previous study also indicates change of instruction size (MIPS) will affect the response time and increase in instruction size (MIPS) versus VM decreases the response time. When metaphor size of VM is implemented against the VM bandwidth then no significant effect is found on response time and it remains constant for which these parameters are carried out for research. But in case of Cloudlet long length versus PM bandwidth a pattern is observed in which response time increases in proportionate manner. Using the modified approach the reduction in the down time and increase in efficiency of the various processes are resolved as shown in conclusion.*

Keywords— Cloud Computing,task scheduling, virtual machine, Ant Colony Optimization, Resource Allocation.

I. INTRODUCTION

As the no. of IT industries increasing, cloud computing also rising due to its features of flexibility, elasticity, and scaling etc. For eg., These Amazon, Google, IBM and Microsoft IT infrastructure which takes resources from cloud providers. The process by which an organization produces cloud services known as virtualization technology. In virtualization, customer's application mapped on one or more VM's, having low operations cost due to mapping of multiple VM's onto a single physical node, and shifting of VM's takes place across physical machines. There is one challenge for cloud provider that optimally and effectively utilized the virtualized resources. During utilization, also require assessing its throughput, availability, and consumption of energy. The workload changes over time so requirements to be re-configured dynamically. Whenever inefficiencies in no. of resources occur, the system has to face two problems i.e. over-provisioned means wastage of money and under-provisioned means QoS violated. Experimentally determined that Amazon losses its 1% sales as 100ms delay in response time occur. Thus, an effectively utilized resource is very important. Experimental and analytical modeling proposed for utilization of resources. Analytical modeling evaluates large no. of allocation which is time-consuming during changes in workload. Cloud computing, a long-held dream of computing as a utility which has potential to transform a large part of information technology industry making s/w as a service. Cloud computing is a new paradigm, where large amount of resources are shared in plug and play model. Resources are shared in any of the deployment model i.e. in public or private network to provide elasticity and flexibility for application, data and also for file storage. The programming main goal is to balance the load on distributed system, most utilization of the resources with minimum completion time. Amid this we have a tendency to study programming parameters like performance, time interval, waiting time, throughput, crosses over etc.[1]

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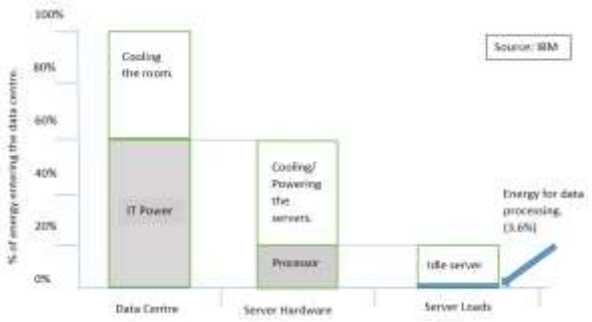

Fig1. Energy Consumed in Various Parts of Datacenter[2]

As Cloud computing becomes more scattered, these increasing data storage and computation needs raise the energy consumption of their large infrastructures. In cloud computing the main reason behind the large energy consumption is an idle system. These low utilized systems remain switched on even if they are not used. The users can access all these services of cloud through the internet from anywhere and anytime. This waste of energy could be eliminating by using number of methods:

- **Jobs' Consolidation**: The consolidation of jobs is the process of minimizing total number of low utilization servers. The migration is technique to move the Virtual Machines among servers. Consolidation considers under-utilized server's virtual machines to which the jobs to be allocated and migrates all of them. After empting a particular server; turn it off to save certain amount of energy.
- **Dynamic voltage and frequency scaling (DVFS):** The DVFS technique is used to reduce the heat generated by idle or low-utilized systems. A Dynamic Voltage scaling approach is proposed that actively adjust resource based on the CPU-Utilization. In general, the under-utilized system migrate the work-load to heavily loaded machines and adjust its voltage at lower. It increases the resource-utilization and minimizes the energy-wastage.
- **Powering on/off nodes:** This is the process to turn off the entire system that are currently not in working state or idle. Then again power them on when workload increases on the system. This can be a key area of Energy Aware Computing [9].
- **Scalability of resource:** In this approach the minimum numbers of resources are allocated to the set of jobs to perform it in particular time limit. In this way, the server can complete the task before the deadline to minimize the energy. But these energy prevention methods may cause hazardous loss in the performance of system. Due to the powered off systems, workload may be increased on currently functional-system. The system might be go into hot-spot conditions. This over-utilization causes the response-delay and violates the SLA which is must in cloud environment. For example, Amazon found that every 100 ms of latency cost them 1 percent in sales, and Google found that an extra 0.5 seconds in search page generation time dropped traffic by 20 percent. An efficient resource allocation is a way to maintain the performance of data-center. There are some more challenges in cloud environment. Gradually, the expectations and trust of users on cloud increases. So, provided solutions should scale in multiple aspects and service providers of cloud must also deal with the users' requirements which are being more complicated day by day. Hence, we should be taken into account the problem of resource allocation to scale with both of the Cloud evolution and new user's requirements. One last important dimension at which we are interested in this work is the resource provisioning plan. Cloud providers could work over two types of resource provisioning: on-demand and reservation based resource allocation. Reservation based allocation concept has many advantages especially for the co-allocation for resources. It provides simple means for resource planning and reservation in the future and offers an increased expectation that resources can be allocated when demanded. Although advance reservation of resources in cloud is very advantageous, the focus has been mostly on the on-demand plan. There are lots of challenges in efficient resource allocation in Cloud computing environment that optimize the system performance and preserves energy as well. These physical resources area unit virtualized therefore on share them among multiple cloud users. jointly there area unit following four cloud preparation models that show the means that through that cloud services area unit utilized by its users [13]. Cloud computing is a collection of services, which can be provided by using three layers architecture:

1. SaaS:- It is abbreviated as Software-as-a-Service, which is shown on top of the stack. SaaS is the top most layer in cloud that allows users to run applications remotely. It means that if you are using SaaS then there is no need to install and run the special software on your computer. It provides Pay as you go model and minimize the total operational cost..
2. IaaS:- It is abbreviated as Infrastructure-as-a-service that offers the computing resources as a service. Our thesis work is oriented around this layer to allocated the sufficient number of resource like storage ,

bandwidth ,processing power exacta dynamically and on demand to the virtualized computers.

3. Paas:--It is the Platform-as-a-Service layer. PaaS is alike a IaaS layer in the terms of custom software stack for the given application. This layer is act as an interface between IaaS/hardware and PaaS layer /application. Examples of platform-as-a-services are Google App Engine and Microsoft's Azure Services Platform [6].

Deployment Models in cloud:

Clouds can also be classified based upon the underlying infrastructure deployment model as Public, Community, Private or Hybrid clouds.

Private cloud: Private cloud acts as a personal data center of a business or
other organization and general public has no privilege to access this data center. In a Private cloud, users work on dedicated server to take the advantages of the services
The cloud infrastructure is operated solely for an organization. It may be managed by the organization or a third party.

Community Cloud: The Cloud infrastructure is shared by several organizations and supports a specific community that has shared concerns (e.g., mission, security requirements, policy, and compliance considerations). It may be managed by the organizations or a third party and may exist on premise or off premise

Public cloud: Public cloud is a Cloud whose can be openly access by the general public in a pay as much you use manner. The cloud infrastructure is made available to the general public or a large industry group and is owned by an organization selling cloud services.

Hybrid cloud: A hybrid cloud is the mishmash of multiple deployment models. The cloud infrastructure is a composition of two or more clouds (private, community, or public). Both combined clouds have unique entities but are bound together by standardized or proprietary technology that enables data and application portability.

II. LITERATURE REVIEW

Ant colony algorithm is proposed when people are inspired by real ants' behavior. Exchange of information among ants is through a substance called pheromone. This substance is left in its path when the ant moves and in motion the ants can perceive the presence and intensity of this substance to guide their action. Therefore, the travel behavior of a large number of ants forms a positive feedback process. More ants walked on a path, then the path is selected with the greater probability later[20-22].

DejaVu: Accelerating Resource Allocation in Virtualized Environments [18] the key idea behind DejaVu is to cache and reuse the results which are produced from previous allocation decisions of resources. In its framework. It looks up in cache in which VM's identification and workload stored according to intervals of time. A metric is prepared to define the characteristics of workload and also current allocation of resource. It stores the information about new allocations of resources for further use which is generated with the help of modeling and analytical techniques and sandbox experiments. The cache can be reused. For example: In daily routine, with lower no. of requests on weekend days, same pattern is repeated for the workload amount of network services for multiple VM's having same use and roughly performed on same type of workload. To summarize, it gives result that minimizes the overhead by categorizing workload into groups and evaluates their resource allocation decision with one of the workload in workload cluster. It quickly adapts the workload changes and store cache at run-time. On this closure, speed up increase 10x for dynamic workload and saves 35-45% scale up and 55-60% scale out in victual cost to assure SLO.

Dynamic Resource Allocation using VM for Cloud Computing Environment[19] a system that uses virtualization technology to allocate datacenter resource which are variable in nature according to application demands and also support green computing by efficient no. of server in cloud computing environment. To manage the interleaving between VM's and PM's, Usher framework is used. In Usher framework, working set prober is used on each Xen and estimate the size of VM running on it. The problem is "What is the best way to multiplex virtual resources of cloud service provider onto physical machine by avoiding overloading?" To surmount this problem, a new concept "Skewness" is introduced to measure the irregularity in utilization of server. Skewness actually defines the status of resources, whether the server is overloaded and under loaded with utilization of resources. The prediction of future usage of resource can be calculated by exponentially weighted moving average(EWMA) and fast-up slow-down(FUSD) algorithms.Green computing algorithm is used to save energy by switching off some of the idle server without affecting the performance. By minimizing

irregularity in resources of server's, that means preventing system from overloading and under loading.

Aggressive Resource Provisioning for Ensuring QoS in Virtualized Environment[3]

Elasticity plays an important role in cloud computing due to its capacity to add or remove VM instances as varying nature according to demands. Slow adjustment processes and lack of adaption decision are the main reasons for insufficient resource provisioning. Because of these insufficiencies, QoS decreases and also SLO (service level objective) violated. The main challenge is to make effective and efficient virtualized resource management. To overcome this one, SPRNT architecture is used to assure high QoS for resources. During increase in workload, reconfiguring of resources is not applying which causes decrease in performance, QoS and also SLO violated.For example: Amazon, there is decrease 1% in sales with 100ms latency and Google, drop 20% traffic in findings with occurrence of 0.5 sec extra. Basically, SPRNT focus on QoS for resource management while suffering from flash crowd and changing workload continuously. The QoS is accurate upto 98.7% and SLO violations only 1.3% as compared to RiB and Auto scaling.

OptimisingResource Costs of Cloud Computing for Education[4]

In cloud computing, there is rising attentionday-by-day in utilization of resources. But budget restriction is the problem faced by organization which are associated with cloud computing. By using traditional methods i.e. appraise the pinnacle usage and allocate resources results over- allocation which causes wastage of large amount of non-desirable resources, which is not cost-effective. To make a system cost-effective, cost-optimization mechanism "Maximum likelihood estimation" is introduced which is based on probalistic method.MLE defines as heterogeneity of IT infrastructure in order to design resource allocation plans which used to maximize the utilization. This paper shows that no. of allocated resources should be minimum to retain QoS at level of accepting with the help of two factors i.e. demand unsteadiness based on cloud infrastructure limitations, and safety margin adjusted according to predictions. The probalistic resource allocation method improves utilization of a system by optimizing allocation of resources from real digital teaching environment and also reduces allocation cost upto 30% at a small level loss of QoS as compared to other resources allocation strategies. This method is used where fluctuations of data communication occur commonly.

More than bin packing: Dynamic resource allocation strategies in cloud data centers[7]

In dynamic environment, Combination of placement controllers & periodic reallocation results high energy efficiency in different types of workload environments. To find the best solution two approaches (DSAPP, KM & T control) to create a schedule of reallocation of resources over time. DSAPP recomposes the schedule in every 60 sec whereas KM & T control takes 5 minutes to recompose it. In DSAPP, The main point is to reduce the total cost of a server. By applying DVS (dynamic voltage scaling), one can minimize more than 20% of energy demand according to application used. In this paper, results shown on basis of MRR ranking, that means highest value of MRR represent better ranking. It concludes that demand based placement controllers' deal with actual demand of a server, not with the reserved capacity. It shows that combination of demand based placement and reallocation controller follow less no. of migrations or placements as compared to reservation based placement controllers. Also lower down the demand of physical machine while retaining QoS. Energy efficiency using combination of demand based placement and reallocation controllers is about 20% - 30% as compared to placement only control techniques.

Energy-aware resource allocation heuristic for efficient management of data centers for cloud computing[10]

In this paper, a new concept "the green grid" introduces to minimize the environmental impact. It is not only providing optimize utilization of resources but also minimize energy overcome. This paper has focus on manage energy consumption of CPU mainly because utilization of CPU directly proportional to load of the system. To minimize the total energy usage, turn off the idle servers which consume 70% of power. To minimize the no. of migrations, MM algorithm, HPG (high potential growth) and RC (random policy) are used. In the power model, a host uses 175W of power with 0% utilization of CPU and 250W with 100% utilization. The result of MM policy is best due to less SLO violations as well as no. of migrations are less. At the end of this paper, it shows that dynamic reallocation policies results higher amount of energy save as compared to static allocation policies. With the help of T-test, this paper concludes that MM(55-

90%) policy prompt 0.48Kwh less in average energy usage and also 10 times less in VM migrations as compared to ST(60%) while having SLA violations at equal level. In this work, it helps in improving the operational cost of DC with minimization of energy consumption upto 66% and also reduces the environmental impact.

Energy-Aware Service Allocation[11]

In this paper, three non-polynomial hard problems are defined: (i) Maximize performance under energy consumption conditions. (ii) Minimum energy usage under performance conditions. (iii) And best combination of energy and performance. The author's objective is to maximize the yield. This paper contributes the problem of resource allocation as multi-objective optimization problem with yield and energy usage. This paper deals with off-line allocation of resources having constant resource demand due to fix set computing tasks. The task is neither use large share of resource nor run with smaller share. To make an allocation successful is that assign each task to host according to its capability. If only one allocation is not placed properly then algorithm fails.The goal of this paper is to maximize yield and minimize power consumption. For this, Algorithms are explained to overcome these problems:- Greedy Algorithm, EA_ResAlloc algorithm. The execution time moves from 67ms to 1sec for EA_ResAlloc_BOUND_Y and for GREEDY algorithm. At the end of paper, To compute allocation in few seconds, GREEDY algorithms are used. For large instances, EA_ResAlloc algorithm is used to compute allocation very fast which gives best allocation of resource and optimize power consumption with performance conditions having hundreds of thousands of servers and tasks.

Dynamic Resource Management using virtual machine migration[12]

In this paper, the author describe that Virtual machine has characteristics like flexibility in resource provisioning and placement of VM which helps to make a system resource efficient while changes in resource demand. To predict the requirements of resources, a 'sizzing' process is introduced which gives brief discussion about expected resource required. During dynamically change in workload, the system becomes either in hot-spot or cold-spot condition. The resources should be effectively managed to reduce energy consumption and maximize the resource utilization. To avoid unevenness in system, load should be balanced properly.The goal of the server is consolidate the PMs, balance the load of resources, and relief hot spot server. To achieve these goals, VM migrations take place. This paper explains when, which, and where VM triggered.

Agent Based Dynamic Resource Allocation on Federated Clouds[14]

The Federated clouds means in these, it include no. of resources from different- different providers requested by the user. All they need the information about cloud providers and current status. Both the service provider and the consumer want to maximize their benefits. But the user does not have any knowledge about the dynamic cost of the resources in all of the different clouds. So they use interface between them as broker based multi- agent system. The broker agent, all the time updates itself with latest information about cost and feedback from the consumers. The broker agent provides resources to consumer from which they can get more benefit at lowest price. At the end of this paper, the conclusion is that the consumers do not know who are providing resources to them and providers do not know about consumers. The broker agent acts as interface between both. The resources provide to the consumer at lowest price and fulfill their demands. They do not know where the providers actually reside.

A Dynamic Resource Management with Energy Saving Mechanism for Supporting Cloud Computing[15]

In this paper, the author has measured CPU utilization and record it once at every 5sec and maintain records for period of time after dynamically changing voltage(voltage adjustment is determined every 15sec). The measurement of CPU utilization helps whether the migration is required. When utilization of CPU is less than 30% and voltage is greater than minimum operating voltage then to lower down the voltage DVFS (Dynamic voltage frequency scaling) method is applied. On the other hand, when utilization of CPU is more than 80% and voltage is less than the rated voltage then DVFS (Dynamic voltage frequency scaling) method is applied to speed-up the voltage. With the increase of number of virtual machine on the same host, numbers of migrations are increased and system performance decreased. When the voltage is decreased, the system performance is decreased. The conclusion of this paper is that, 24-33% of energy consumption saved by applying resource adjustment

mechanism, and by applying DVFS method with live migrations.

A Multi-Objective Ant Colony System Algorithm for Virtual Machine Placement in Cloud Computing[16]

These days deployment and adaption of cloud computing has number of benefits like scalability, elasticity, QoS and robustness. From cloud provider's view, the main issue is to maximize the benefits and minimum the operational cost. Due to large number of DC in clouds, it has another serious issue like carbon dioxide. To minimize the power consumption and maximize the resource utilization, optimal migration is to take place. To solve the virtual machine placement problem, four approaches are defined: (i)Linear Programming (ii) Genetic Algorithm (iii) Constraint Programming (iv) Bin Packing.In this paper, for VM migration problem, a modified version of ant colony is designed as multi objective optimization to optimize total resource wastage and power consumption for large data centers. Ant colony optimization is used as single objective optimization algorithm. ACO algorithm has extensions such as Ant Colony System, Ant system, and Max-Min Algorithm System. These algorithms behave differently w.r.t. these three points:-Pheromone update, Definition of pheromone and heuristic information, Pheromone and heuristic aggregation. It is devise to prevent CPU and memory usage of server from reaching at 100% utilization which results the performance decreases. The conclusion of this paper, the multi objective ant colony system (VMPACS) algorithm performs better than MGGA (multi-objective grouping genetic algorithm) which is used benchmark (an efficient and effective method) to solve multi-objective VM placement problems. When compared with two single-objective algorithm FFD and SACO (extension of MMAS algorithm), results that VMPACS has less resource wastage and power consumption as compared to FFD and SACO.

III. EXTANT INNOVATION

The following task designing innovation space unit presently enacted among the cloud environments.

i. Hymenopteran Colony improvement Ant Colony Optimization (ACO)-inspired: a replacement Cloud hardware supported hymenopteran Colony improvement is that the one resented by Cristian Mateos. The goal of our hardware is to attenuate the weighted flowtime of a gaggle of PSE jobs, whereas collectively minimizing Makecrosses over once using a Cloud. among the ACO formula, the load is calculated on each host taking into consideration the equipment utilization created by all the VMs that unit of measurement punishment on each host. This metric is helpful for Associate in Nursing hymenopteron to choose the tiniest quantity loaded host to assign its VM.Parameter Sweep Experiments (PSE) may well be a spread of numerical simulation that involves running Associate in Nursing outsized sort of freelance jobs and frequently desires lots of computing power. These jobs ought to be with efficiency processed among the utterly totally different computing resources of a distributed setting like those provided by Cloud. Consequently, job designing throughout this context therefore plays a basic role. throughout this formula, Makecrosses over and flowtime unit of measurement evaluated. analysis results of this metrics show that ACO performance more than two totally different (Random and Best effort) algorithms.[8].

ii. Max-Min Algorithm: Max-Min is kind of same as a result of the min-min formula except the following: throughout this once looking for the completion time, the minimum execution times unit of measurement famed for each and every task. Then among these minimum times the most value is chosen that's that the most time among all the tasks on any resources. Then that task is regular on the resource on it it takes the minimum time and thus the on the market time of that resource is updated for all the alternative tasks. The modification is finished among a similar manner as for the Min-Min.

iii. Particle Swarm optimization (PSO) Algorithm: Particle Swarm improvement (PSO) as a meta-heuristics technique may well be a self-adaptive international search based totally improvement technique introduced by Kennedy and Eberhart [5]. The PSO formula is alike to totally different Populace-based algorithms like Genetic algorithms (GA) but, there is not any direct recombination of individuals of the Populace . The PSO formula focuses on minimizing the worth of computation of Associate in Nursing application advancement. As a live of performance, Authors used worth for complete execution of application as a metric. the target is to attenuate the worth of execution of application workflows on Cloud computing environments. Results show that PSO primarily based task-resource mapping square measure ready to do a minimum of thrice worth savings as compared to Best Resource selection (BRS) based mapping for our application advancement. in

addition, PSO balances the load on cipher resources by distributing tasks to on the market resources.[5]

IV. Genetic Algorithm: Genetic formula may well be a way of coming up with among that the tasks unit of measurement assigned resources per individual solutions (which unit of measurement called schedules in context of scheduling), that tells regarding that resource is to be assigned to it task. Genetic formula relies on the biological construct of Populace generation.

V. RESEARCH RIFTS

Out ages have you ever been unable to access your email due to your provider being down? Now, imagine if you needed a document for an important business meeting or presentation and your storage prov. Remote server security makes it harder, but not impossible, for hackers to reach your data. If there is a compromise of the server(s) where your data is stored, your personal information may be exposed to the world. There's also a good chance that more than just your information may be affected ider's site was down. Believe me it happens, and it happens at the most inconvenient times.

- Storage ceiling. While your local hard drive may be able to hold 500GB or more of data, unfortunately a remote server may only allow you to freely store about 5GB. If you want more room, you'll have to pay. Still, even with a paid account, it can't begin to touch the amount of room you have locally. There also may be a limit on the size of the data that can be stored.
- Limited features. If you use remote software that's provided by the storage service to manipulate and modify your data, it usually lacks the features of a program running locally.It is one of the simplest scheduling techniques that utilize the principle of time slices. Here the time is divided into multiple slices and each node is given a particular time slice or time interval i.e. it utilizes the principle of time scheduling.
- Strangulated: In this algorithm the client first requests the load balancer to find a suitable Virtual Machine to perform the required operation.The process first starts by maintaing a list of all the VMs each row is individually indexed to speed up the lookup process. If a match is found on the basis of size and availability of the machine, then the load balancer accepts the request of the client and allocates that VM to the client. If, however there is no VM available that matches the criteria then the load balancer returns -1 and the request is queued.
- Execution Load: It is spread spectrum technique in which the load balancer spread the load of the job in hand into multiple virtual machines. The load balancer maintains a queue of the jobs that need to use and are currently using the services of the virtual machine. The balancer then continuously scans this queue and the list of virtual machines. If there is a VM available that can handle request of the node/client, the VM is allocated to that request [17]. If however there is a VM that is free and there is another VM that needs to be freed of the load, then the balancer distributes some of the tasks of that VM to the free one so as to reduce the overhead of the former VM. The jobs are submitted to the VM manager, the load also maintains a list of the jobs, their size and the resources requested. The balancer selects the job that matches the criteria for execution at the present time.

The existing methods will evenly distribute the traffic, but does not take into account the current load or responsiveness of the nodes. The existing methods are intelligent, but also do not consider the current load or responsiveness of the nodes. This can be a problem if you need to add power quickly, but can be beneficial if you have a server that is experiencing problems keeping up with its inbound traffic.

VI. METHODOLOGY

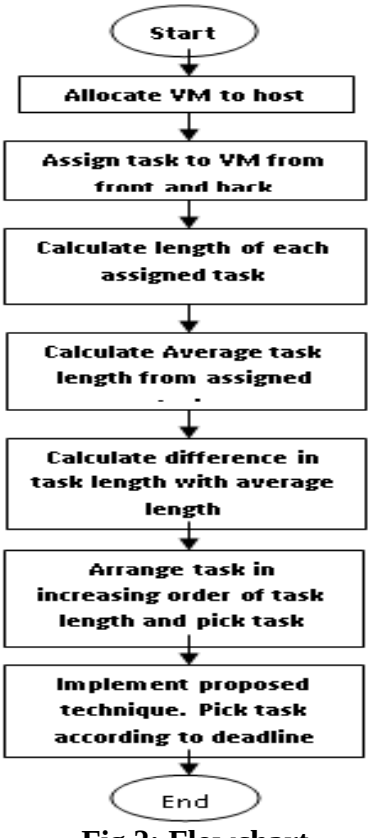

Fig 2: Flowchart

1) In the very first step the vm are to be placed on the host according to the resource vector and assign privileges to vm.
2) Assign task lost on the virtual machines from both sides front and back.
3) Then one has to calculate the task length of each task and then calculate the average value of each task.
4) Calculate the difference of average value and individual task length for each task that is assigned to each vm.
5) Arrange task from the middle of the queue generated after calculating the difference.
6) Add the task deadline and calculate the priority of each task.
7) Generate and validate results for both approach with deadline and without deadline.

VII. RESULTS AND DISCUSSION

Fig3. Shows the comparison chart between VM Amplitude variation and placement ratio. According to Ant theory, it migrates VM to that host which has highest cloud length. Which means decreases in downtime and increases in efficiency. To make an system energy efficient, migrations should be minimum.

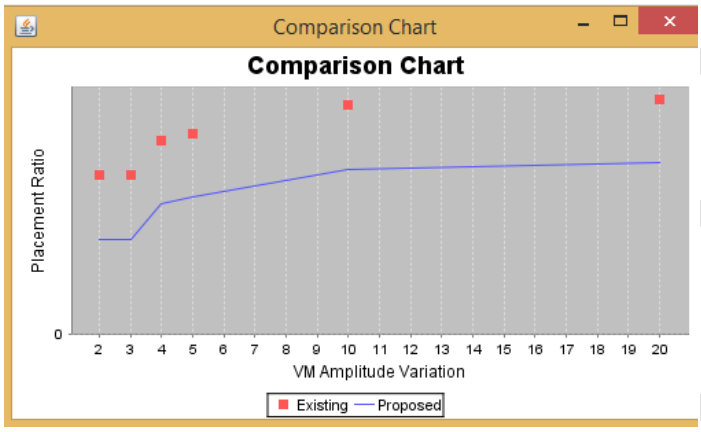

Fig3. Comparison chart of migrated VM's

It is clear from the above figure that an energy aware resource allocation in cloud using ACO gives better results.

VIII. CONCLUSION

This implementation aims towards the establishment of performance qualitative analysis on make crosses over in VM task allocation and process according to their deadline, then implemented in CloudSim with Java language. Here major stress is given on the study of dead line based task scheduling algorithm with heterogeneous resources of the cloud, followed by comparative survey of other algorithms in cloud computing with respect to scalability, homogeneity or heterogeneity and process scheduling. A previous study also indicates change of MIPS will affect the response time and increase in MIPS versus VM decreases the response time. When metaphor size of VM is implemented against the VM bandwidth then no significant effect is found on response time and it remains constant for which these parameters are investigated. But in case of Cloudlet long length versus Host bandwidth a pattern is observed in which response time increases in proportionate manner. Using the modified approach the reduction in the down time and increase in efficiency of the various processes are achieved as shown in results. From the results it is clear that the proposed system used the task deadline as input parameter to improve results.

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