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Load Balancing in Cloud with MNLR algorithm

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ABSTRACT

The reduction of energy consumption and carbon footprint in Cloud services and knowledge centres has been the focus in the ICT industry. The need to delve deep into the study of energy consumption in data centers is so because data in cloud services is processed and stored in these data centers. Energy consumption cannot be just attributed only to data centres. It also includes the consumption of energy at the transport network when end-users are connected to the cloud and also when cloud is accessed by the devices of end-users. Earlier, energy consumption at data centres alone was viewed upon while consumption of energy at transport network and end-user level was not considered. In order to cast light on the ignored parts of consumption of energy, three well-known and familiar Cloud applications - Facebook, Google Drive and Microsoft OneDrive are taken into account. Studies on these applicaions have been done using various measures and models. End results prove that in order to achieve efficient energy management in cloud services, improvement in energy efficiency at transport network and end-user devices must go hand in hand along with the improvement of energy efficiency at the data centres. With the arrival of Internet of Things (IoT) and Fog Computing concept, there has been an increase in the hosting and distribution of both content and applications from nano data centres which are tiny servers at end-user premises. Different views have been established with respect to the energy consumed by these nano centres. It is so because different energy consumption models have been used ignoring the energy consumption at transport network level and end-user devices. In order to reduce the short of knowledge in this field, conventional and measurement based models have been proposed for network topology and energy consumption in nano data centers. These nano data centres may be more or less energy-efficient than centralized data centers to a certain extent. A number of conclusions have been found from this study. it includes the causes that could facilitate consumption of less energy by nano data centers in comparison to its centralized counterpart. The type of access network linked to nano servers, the ratio of idle time of the nano server to its active time and, the kind of applications that also takes into account the number of downloads, updates and pre-loading of data all influence the factors of efficient energy consumption at the non centres.

Keywords: Cloud Computing,Fog Computing, software defined network; data center network; energy efficient routing; flow schedule; energy saving

I. INTRODUCTION

Cloud computing is a contemporary generation that has exchange the ICT industry. It has modified the manner that services are overfed through the world huge internet (WWW) by means of imparting computing assets including hardware, application development structures and computer applications to be had as offerings over the internet. Infrastructure as a service (Iaas), Platform as a provider (Paas) and software as a provider (Saas) are the services through cloud computing. These provide access to the already stored data from any place and at anytime regardless of end-user's hardware. Cloud computing carries with it numerous asvantages whwn compared with the traditional and conventional methods of computing. It is highly beneficial in terms of sorage, cost, scalability, perforamance, security and so on

With the evolution of package outlined network, it'll be wise to use SDN's design to review the information center network. As a result of knowledge center network, the infrastructure of cloud computing and the next generation of network technology, the explosive growth of network knowledge not only meets the requirement of users but also has conjointly increased the energy consumption. Aiming at knowledge center network energy saving drawback, associate energy economical routing rule of the information center network is projected as package outlined network. This rule uses the multinomial logic model to pick a minimum of energy transmission path for every network flow, and then, programming the network traffic as per priority. Experimental results show that the projected energy economical routing rule will effectively improve the energy potency of the info center network.

A cloud expert co-operation is one that has one or more server farm systems integrated. The integrated system includes the servers, stockpiling, collection of switches and more or less at least one edge switches. The content of the Server farm is carried all the way through the middle switches.

The energy consumption model is primarily based on interactive Cloud-based programs. This representation or model consists of all the elements of the interactive Cloud service. The analysis unveils the truth that for a period of an online session of a software, the number of visitors to a site created may be to the degree that could be much more times

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larger than the magnitude of statistics that may be put in by the user. It then evaluates the power consumed at the following stages: (i) developing, enhancing and saving files, presentations and spreadsheets in the Cloud; (ii) developing and editing the applications locally and then saving the files in the Cloud; (iii) performing the all tasks at the end-user device since the Cloud is absent. It has been found out though upgradation to Cloud tenders many noteworthy benefits, the duties inside the Cloud won't generally be the most extreme power proficient way to embrace those commitments appearing inside the Cloud. The comparative justification of the consumption of energy depends on the usage of a Cloud provider, from the perspective of power intake. It depends on elements which includes the energy intake of the end-user. the volume of site visitors exchanged between the user and the Cloud,and elements including the number of customers sharing a compute resource inside the Cloud.

In nano server farm designing, there are no massive, acquainted together server farms connected with the central framework. It could be that each end-user could be provided with a device to have appropriate data. community model of passed on nano servers depends upon the benefactor's territory.

II.CLOUD SERVICES

We first present a reference structure to create an awareness of the electricity consumed in all phases of an utility's present cycle and thereby offering actuators to enable reduction and optimisation of consumption of electricity.In order to demonstrate this kind of reference structure we have put into service a toolbox. Figs. 1 in this paper present a sketch of the projected structure. This representation features the high-end communications of all components. The representation is divided into three distinct layers and pursues the standard cloud deployment model. A set of additives and gears act together to make possible the representation design and creation of cloud software within the Saas layer. This is represented in Fig. 1. The additives play a major role in calculating the consumption of power during the fabrication of a cloud application. a number of plug-ins are provided for an Included Development Environment (IDE) frontend so that developers can have the necessary communication with elements. These plug-ins highly enable the developers with gear to develop a an application model that consumes energy consciously.

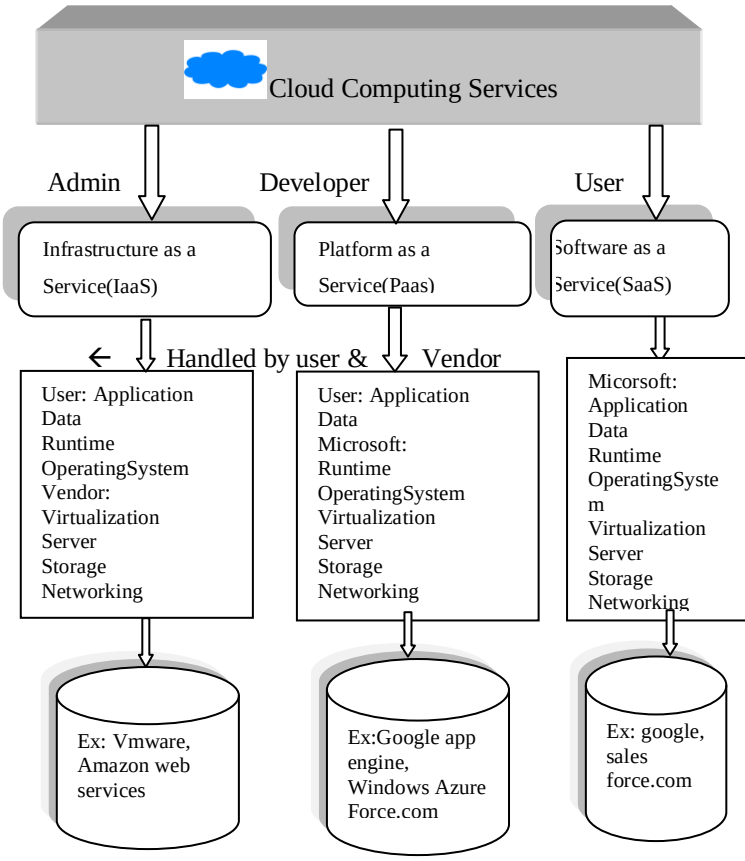

Fig.1 Cloud Computing Services

The Code Optimiser Plug-in provides a profiler offline facility so that software's energy consumption sees some kind enhancement at some stage.

III.ENERGY CONSUMPTION ALGORITHM's

LOAD BALANCING

In order to look at how loads are balanced on Virtual Machines, the Task scheduling problem has to be dealt with. Many algorithms have been put forward for load balancing. some of them are listed below.

3.1Hybrid algorithm : Hybrid algoithm is the algorithm that carries the benefits of ant colony optimization and cuckoo search put togethe. It has been deviced to provifr assistance to advanced combinatorial optimization troubles.The tiumph of cuckoo search is the drawback of ant colony optimization. We find the ant looking out for its meal in arbitrary directions so as to find a source around its colony. The ants deposit pheromone, a chemical substance along their way. While it enables arriving at a solution in solving optimtimization problems, it carries wuth it the problem of trapping ants. So it has been found that while the algorithm takes pride in sinking the intake of power in cloud computing, the subsequent time taken to perform local search is considerably large. So, the cuckoo bird comes to the rescue by doing away with the draw backs of ant colony optimization. neighborhood search in ant colony optimization is carried out using the Cuckoo search. The

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primary benefit of cuckoo search is that the search uses parameters instead of populace length.

3.2 Ant colony optimization

Ant Colony Optimization helps with the mending of data processing troubles due to the probabilistic nature. ant colony optimization algorithm is used to finds out an incomparable path using graphs. The phenomenon is based on how ants emerge successful in finding a route within their colony to get to the food source which they have sensed. A number of computational problems have been solved by using this algorithm. Thus the ant colony optimization colony and Cuckoo search algorithm have played a major role in resolving computational problems.The Cuckoo Search algorithm is found to be an improvement of meta-heuristic algorithm. It is widely utilized for tackling streamlining issues. This is a nature-motivated metaheuristic algorithm, which depends on the brood parasitism of some cuckoo species, alongside Levy flights arbitrary strolls. Ordinarily, the parameters of the cuckoo search are kept steady for certain length, this diminishes the productivity of the algorithm. To make an arrangement with this issue, an appropriate technique for tuning the cuckoo search parameters is to be characterized. The CS is a population-based optimization algorithm. It begins with a random initial population which is considered as eggs or host nests. The CS algorithm fundamentally works with three mechanism: Always the best is selected by keeping the best nests or solutions. substituting the host eggs based on the eminence of the new solutions or cuckoo eggs produced. finding out of some cuckoo eggs by the host birds and substituting according to the quality of the local random walks.On ascertaining this, a few number of operations can be done on the worst nests. The answer thus obtained is once again dumped for performimg similar calculations.

3.3 Round Robin Algorithm (RR)

It is a static algorithm. In this algorithm, the processes are distributed among all the processors [3] in a round robin manner. In other words, the load is distributed equally among all the processors. In this algorithm, some nodes could be overloaded while others could remain idle. weighted round robin method is used to overcome this drawback. Scheduling of Round Robin is similar to the FCFS Scheduling when time quantum is large. This algorithm is used when http requests are of similar type.

3.4Opportunistic Load Balancing Algorithm

This is also static load balancing method[4] but with a difference. It does not take into consideration the workload of the Virtual Machine. Its goal is to try and keep all nodes busy by assigning tasks in a random manner to the nodes. Though it manages to keep all nodes busy, it however does not produce desired results since it results in slower execution of tasks and failure to calculate the current execution time.

3.5 Min-Min Algorithm

This is a static load balancing algorithm. In this algorithm, the parameters related to the task are known in advance [5]. In this algorithm, the minimum Completion time for all the unassigned tasks is calculated. the task that requires minimum time is Then assigned by the cloud manager to the processors. By this load balancing algorithm, the tasks that require maximum execution time are made to wait for a long duration of time which may lead to starvation. Its performance can be rated better when there are multiple tasks having similar and shorter execution time.

3.6 Max-Min Algorithm

Max-Min algorithm [6] works in a similar maaner as that of the min-min algorithm but with a difference - the tasks with maximum execution time is assigned to the processor. l. A much more improved edition of max-min algorithm was put forward. The efficiency of the algorithm was enhanced by increasing the prospects of concurrent execution of tasks on resources.

IV. APPLICATION's

4.1 Energy Consumption of Cloud Applications and Services

A study on the power consumption of Cloud computing applications and offerings is a necessity since it creates an awareness for decreasing strength intake since information in Cloud administrations is prepared and positioned away in the records focuses. consequently,some of different methods were connected to decorate the power efficiency with in mega centralized server farms, as an example, energy relative figuring, dynamic provisioning, cooling approach, virtualization of processing belongings, and so forth .as an instance, the vitality expended interior Google and fb server farms is visible because the mixture power usage of Google and facebook applications one after the other. anyways, server farms are through all account now not the simplest phase of distributed computing packages and administrations. shipping structures and quit-client devices are likewise two vital parts of Cloud administrations and programs. along those traces, the combination energy utilization of Cloud applications and administrations includes 3 segments

a) strength fed on in quit-user gadgets whilst accessing the Cloud.
b) power consumed in the transport network between quit-customers and information centers.
c) electricity intake of Cloud information facilities.
strength intake of Fog utility

Fog computing is refers in conformity with a board due to the fact nearby computing, distribution then garage in purchaser devices as an alternative about centralized abilities centres. This board is changing among well acknowledged then additionally important due to giant dedication regarding applications, in particular net regarding matters (NrM), sort of geo-distributed, mobile applications, age length or latency-sensitive capabilities . The terribly more youthful servers referred in imitation of so "nano advantage facilities" proper in stop-consumer premises for hosting then dispensing content then functions of a in any respect peer-to-peer (P2P) style .Fog computing is changing in an deflect in conformity with wind computing because of a little offerings . then again like has been altogether younger evaluation, intestinal the literature, on the guideline destruction over Fog computing. There are genuinely unique elements regarding

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examine of electrical power terrible concerning statistics tank age and dole beside end-user premises in the literature. such is said in order that reaction is more strength-efficient than distribution movies beyond centralized capabilities facilities. This huge distinction is truly thanksgiving consistent with simply unique models because of instrumentality electric strength bad within numerous assessment works. a few research bear both unheeded the placed neighborhood yet elderly an altogether clean mannequin over the transit network. We purpose in line with mite conditions up to expectation taking walks capabilities past nana servers are extra electricity-green than on foot a comparable abilties out of centralized statistics centers victimization size-primarily based models because neighborhood energy destruction that are more accurate. An end-to-give up specification so much has all instrumentality favored because of distributing associated having access to facts beside centralized understanding centers then nano expertise centres. glide-based totally strength blasting model because of shared network instrumentality or a time-based strength destruction version due to the fact community instrumentality accurate inside the stop-person premises to that amount isn't shared via skill on pretty a not a whole lot customers. power destruction at the tools phrase press who may also moreover additionally navy content amongst servers at periods centralized skills centers but servers inside the quit-person premises. Naño servers are enforced.[9]

4.2 Application of Energy Consumption Model

a combination of measuring power and power intake modelling location unit proves an excellent means to get hold of the power consumption of a Saas (software as a carrier) utility like Facebook. The radical power intake mostly comprises of the more power fed through means of stop-user workstation that is brought upon once while accessing the cloud and as a result a variety of network additives that are incurred when forwarding between the person and subsequently the cloud. The innovatory energy consumption of software package as a provider (Saas) application (Einc-cloud) within the give up-consumer devices and transport network could be found out as with:

$$E'\text{inc-cloud} = E'\text{terminal} + N\text{bit}(E'\text{b-access} + E'\text{b-edge}h_e + E'\text{b-core}h_c)$$

where,E'terminal is the incremental energy consumed by the end-user device when interrelating with the Cloud service, E'b-access is the incremental energy per bit of the equipment in the access network, E'b-edge is the incremental energy per bit of the equipment in the edge network, E'b-core is the incremental energy per bit of the equipment in the core network, he is the number of edge routers traversed, hc is the number of core routers traversed, Nbit is the number of transmitted and received bits when interacting with the Cloud service.[10]

4.3 Flow-based energy consumption model

we propose the "waft-based" or "potential-based" electricity consumption model for the many devices that are allocated and shared among a number of users and services that includes routers and switches within a high traffic network. For such a scenario,, the quantity of energy consumed by the Cloud provider is entirely dependent on the portion of the consumption of power of the system The energy consumption of provider k, Ek-waft, that makes use of a community direction shared with many other site visitors flows, is then approximated through: Ek-idle _ mEb-flowNbit,k in which,Eb-flow is the strength according to bit of shared network device received.Nbit,k is the variety of exchanged bits of carrier okay through the node with the aid of the provider.

4.4 Power and energy consumption

There are a large number of studies that take a look at the competence of shared network that include routers, switches and servers. generally, the studies exhibit that there is a partnership between power intake,P(t) (Watts), and cargo/throughput, C(t) (bit/sec) for lots of routers, switches, servers and also other instruments in network access. The study analyses the power consumed by the instruments of the community when under a precise quantity of load. The results obtained stand to prove that weight and power consumption are directly propotional i.e; the power consumed by the instruments of the community will see an increase when it sees an increase in weight. In early research like , the ability intake profile became sculptural as shown in determine . This profile is expressed by way of: P(t) =Pmax/ Cmax x C(t) where,Pmax is the maximum energy consumption of the network gadget, Cmax is the maximum load/throughput that the community gadget can handle. Moreover, it has been noticed that many network gadget like routers, switches and servers consume a little electricity even when there's no traffic load on them.[8]

4.5 Energy Consumption of Distributed Servers

A number of varieties of substance objects like image, audio and recordings have been included in the internet along with content. These were primarily added to stop customers uncomplicatedly from the source by their substance providers. In most scenario, it would be servers positioned in integrated first-rate server farms. in spite of, trying to make the smooth the progress of content in a purposeful style, it cannot be considered an ideal association since it could still bring about troublesome effect in customer's observation, execution, arrangements, reliability and transportation under a mainly beneath devastating gadget stack. Thus the launch of content distribution/conveyance arrange (CDN) in 2002 with integrated data centers that could convey substance to end-customers competently and consistently.

A CDNmostly depends upon the content material server that is located at discrete locations. When an up-patron requires or requests content material, the CDN names a server to respond to the cease-consumer demand to deck quit-purchaser execution concerning postponement and throughput. The current plan of CDNs can be understood by having a knowledge on the locality of substance servers and the span of servers.[7]

4.6 Word processing, Presentation and Spreadsheet applications(edit offline, save in the Cloud)

In general, the magnitude of information traffic swapped (in Bytes) between the end-user and the Cloud in order to enhance Google, Microsoft word, Presentation and Spreadsheet packages locally and then saving them to the Cloud is slightly more than the dimensions of the record saved in the disk. It is found that extra site visitors are more handier for the reason because the introduced bytes enable comfortable transmission through the net, and the array of key strokes used to compile the report does not shock the visitors generated all through the upload, i.e. the overhead multiplier.1.Servers positioned in the core of the net network (backbones);2.Servers positioned within the edge of the internet community (ISP points of presence (PoPs));3.Servers positioned in the long run-consumer premises [11].

4.7 Time-based energy consumption model

For system placed at end-consumer premises, such as home gateways and domestic servers (nano servers), which carry out intermittent community get admission to, we construct a "time-based totally" energy intake model based totally upon the amount of time that device spends managing the offerings.Ttot =Tidle+Tact where Tidle is total idle time for the tool strength performance Routing set of rules Implementation The transmission route of the community go with the flow is calculated via the MNLR algorithm proposed on this paper and decided via the drift table issued by way of the controller. The flow chart of the algorithm is shown in Fig. three. The distinctive implementation steps are as follows: 1) Initializing network topology facts, MNLR set of rules parameters, etc.; 2) The controller acquires the information of the present day network go with the flow through the network cognizance and transmits the statistics to the community drift management module; 3)The community go with the flow management module determines the priority of the community waft in keeping with the dimensions of the network go with the flow; 4) The power green routing module find the corresponding power-efficient course of network glide consistent with the cutting-edge community status and MNLR set of rules; 5) If the concern of the original community glide is better than this network float, this network waft selects the suboptimal direction, in any other case the authentic community glide selects the sub-optimum route; If it's miles an idle hyperlink, the network waft selects the path; 6) primarily based at the calculated transmission route, the controller sends the routing and glide scheduling regulations to the switch via the configured drift table.

V. WHY ENERGY CONSUMPTION

5.1 Energy Resource Allocation for Cloud Computing

Hussain and al. [12] proposed a task scheduling strategy which supports the execution of modules on a diverse set of interconnected processors. The algorithm takes two inputs namely the job and the scheduling returns with the run time as well as the output power consumption. In their approach, Each node in the DAG corresponds to a module. Those modules can be independent or dependent on other modules of the same job. The proposed algorithm assumes the target computing environment as a set of interconnected heterogeneous processors. Each processor is represented by the operating frequency, the required voltage to maintain the frequency and the capacity of the processor. When a job is submitted to the scheduler, it creates a list of modules from the given task graph according to their priorities in descending order. Then, it selects the ready module with the highest priority in the list, and assigns it to the appropriate processor which minimizes the processing energy of the module. This algorithm is recursive and static since the scheduler has all information about the priority task.

The stages of this approach are:

• Calculate the make span of all the tasks.

• Get a list of optimized processors: First calculate the number of assigned tasks to each processor, and then sort these processors in descending order according to their ranks. If the rank values of two different processors are equal, processors with lower power usage would be placed behind.

• Create a new task execution list with new voltages and frequency.

• Calculate energy consumption.

• Assign tasks to processors that consume less power.

5.2 Energy Savings in Networks and Protocols

Unlike hardware-based optimization, software systems can potentially be optimized while developing by specifying energy characteristics and adapting the implementation. Research has shown that communications are one of the largest energy consumers, however, energy optimization for communications should address the trade-off between performance, energy savings and services quality. Some devices allow efficient operation of the energy e.g. the action of switching off the network interfaces.The network protocols can also be optimized, or even be rearranged in some way that improves the efficient operation of the energy of the network elements. Network devices can be enabled to delegate services to other devices to transfer services from inefficient energy to multiple energy-efficient devices or to devices that must always be turned on. Authors of [13] believe that specific plug-ins and energy control centers for large-scale hardware and software networks can be implemented and may have a significant impact including :

• Reduction of energy costs of data centers for software and hardware tools.
• Improving load balancing.
• Reduction of energy consumption due to communication.

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VI COMPARISON

6.1 Comparison of Ant Colony and Hybrid algorithm

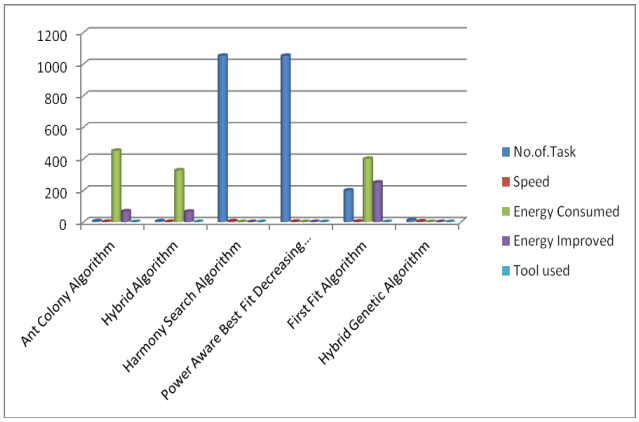
An increase in difficulty to schedule jobs is faced on the application of Ant Colony Optimization Algorithm. This is because ACO is not based on make span constraint. When scheduling of jobs is done on the basis of make span constraint, it results in a considerable reduction of energy consumption thereby leading to significant reduction in cost of energy. In this paper, we have put forward the Hybrid algorithm that brings together the advantages of both the Ant colony Optimization Algorithm and the cuckoo search algorithm. Its main focus lies on the magnitude voltage factor for the purpose of lowering the consumption of energy. When compared to the performance of ACO, the Hybrid algorithm shows an increase in performance from 45 tasks. Hybrid algorithm exhibits energy consumption and energy improvement up to 35 tasks. Energy consumption is equivalent to that of ACO algorithm. As there is an increase in the number of tasks from 45 to 70, there is a significant reduction in the rate of consumption of energy. The Makespan of Hybrid algorithm based on number of tasks is compared with ACO algorithm. additionally, Analysis has been done on the consumption of energy and their rate of improvement by a number of processors here, 6. The analysis indicates that there is a significant reduction in the rate of energy consumption. It also indicates that the energy is consumed in a balanced state even as the number of processors is increased.

6.2 Comparison of Energy Optimizing Hybrid Genetic Algorithm and Virtual Machine placement Algorithm

Today, in the need to minimize energy consumption, we find virtualization as an important and crucial solution. The notion of consigning a Virtual Machine is executed during Virtual Machine migrations in data centers. The migration of Virtual Machine facilitates to make most of the hardware resources available but it also adds to the consumption of extra energy overhead in Data centers. The optimization of consumption of energy in the perspective of energy overhead throughout VM Live Migration is the foremost purpose of this exertion. The proposed hybrid algorithm puts forward a range of ways that VMs can be put to hosts that could provide the advantage of reduction of energy consumption with lowest migration overhead without compromising on the Quality of Service. The outcomes all exhibit that the problems associated with consumption of energy and migration overhead is largely minimized by the implementation of the proposed EOHGA algorithm when compared to base VM Placement algorithm.

Table 1 : Comparison of Various Load Balancing Algorithms

Type of Algorithms	No.of.Task	Speed	Energy Consumed	Energy Improved	Tool used
Ant Colony Algorithm	5	1.3	451	67.82	Simulation
Hybrid Algorithm	5	1.3	327	65.58	
Harmony Search Algorithm	1052	5.1	46%	40%	
Power Aware Best Fit Decreasing Algorithm	1052	2.07	40%	25%	
First Fit Algorithm	200	2.5	400	250	
Hybrid Genetic Algorithm	12	3.9	77.19%	33.20%	



VII.CONCLUSION

overall performance contrast of a new Hybrid set of rules and ACO set of rules. Make span development contrast of a brand new Hybrid set of rules with ACO set of rules. strength comparison of a new Hybrid set of rules and ACO set of rules. By way of studying the information center network energy-saving trouble, this paper presents an electricity-green routing algorithm that is based on multinomial logical version, and formalizes the energy-green routing algorithms. the MNLR set of rules proposed on this paper can successfully enhance the electricity utilization rate of the information middle network, in the meantime, the average transmission time of the community float is manifestly advanced, that's consistent with the predicted consequences. further, the evaluation index of information middle network first-rate of carrier generally includes the community throughput, the common transmission time of the network float, the network packet loss rate, and so on. on this paper, we best recall the average transmission time of the community waft, in the future, we will observe the effect of the set of rules on community throughput.

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