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EHEROS: Energy Aware Load Balancing in Green Cloud using Heterogeneous Data Centers

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ABSTRACT: Now a days, data center's energy consumption accounts for a significantly large piece of operational expenditure that are used as backend computing communications for cloud computing. Heterogeneous architecture have developed into more popular and large spread in the modern years with growing recognition of general idea processing on graphics processing units , low power systems on a chip. The design and execution of cloud computing data centers must adjust to these changes although targeting intention of improving system performance, energy efficiency and consistency. This paper presents load balancing algorithm for energy efficient resource allocation in heterogeneous system. EHEROS takes into explanation the heterogeneity of a system through decision making procedure. Servers have resources of many types (computing, memory, storage and networking) and these resources need to be optimized efficiently in heterogeneous environment.

KEYWORDS: Cloud Computing, Data Center, Energy Efficient, Load Balancing, Green Cloud Simulator.

I. INTRODUCTION

Cloud Computing is incoming our lives and considerably change the mode people parse in order. Cloud provides platforms to work which enabling a big range of terminal, devices owned by individual. Green cloud simulator is a packet point of cloud computing which focus on communication and energy capability of cloud [1]. Cloud services are typically implemented in one or additional multiple data centers where a huge number of servers are provisioned. Cloud computing has risen as a new computing example to carry unparallel elasticity and to contact shared and scalable computing resources [2]. Heterogeneity is a increasing in fashion for distributed systems, including cloud computing. The increasing developed capabilities collecting with the need for high performance and high computational mass result in increasing and specialization of hardware. [3]

Data center are more suitable and fashionable for the provisioning of computing resources. Data center are mainly essential of the information and communication skill division organizations. Huge data center with thousands of servers have been deployed by popular ICT organizations like IBM, Microsoft, Amazon to afford cloud computing services [4]. Energy consumption is a grave problem for data center. In order to reduce energy efficiency, whether in a system or over company of systems, users and data center operators want to know the bond between resource usage and system level power use [5].

The energy efficiency working at data center can be classified into virtualization. Virtualization is the mainly adopted energy efficient method in data center environments. It aims to combine data center workload on an amount of physical servers using virtual machine exists migration in order to classify and offer energy efficiency [6].

II. ENERGY EFFICIENCY AND LOAD BALANCING IN DATA CENTER

The test of Load balancing in data center is critical and reviews a selection of the most important and agent works. [7] Load balancing in data center networks can be achieved with VM position algorithms VM migration may be the

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greatest option of optimization for some applications and workflows, but it has large overheads in terms of time and bandwidth supplies, especially in case of big system reconfiguration. [8]

A basic strategy to treat with heterogeneous setting is to only select the main energy efficient server. It contributes to this advancement by presenting a focused scheduler to excel in heterogeneous settings. [9] Simply an element of the energy consumed by the data center gets delivered to computing servers openly. A key part of the energy is utilized to preserve interconnection links and network tools operations.

The efficient utilization of virtualized servers and computing resources requires thoughtful expenditure in energy consumption and throughput, mainly on high-demanding High Performance Computing [HPC] platforms. [10]

S.Saha, J.Deogun et al. [11] Presented energy model at server and at the network part in data center .In this paper, at the server site temperature and voltage energy are distributed. They proposed green routing scheme for minimization of total combined energy consumption at both server and network site.

D.Kliazovich, S.U.Khan etal. [12] Describes energy efficiency and job scheduling which focus on job distribution between servers based on computational demands, but in which communication demands are ignored.

To conclude, we proposed new technique named EHEROS which combines the top features of HEROS and contributes with a new heterogeneity that creates aware decision. It tolerates any usual network topology as it operates on the rack stage. Still, the network load is objective amongst various racks. To maximize ease energy consumption, server selection job promotes DNS and DVFS. HEROS allocates responsibilities to the server with maximum attain. [13]

III. EHEROS- ENHANCED HETEROGENEOUS ENERGY EFFICIENT RESOURCE ALLOCATION OPTIMIZING SCHEDULER

In previous HEROS algorithm, it comprises complete experimentation with non regular task size and task generation patterns and simulations of additional complex virtualized work. HEROS might be improved by extension of the position of optimized objectives, integration of extra data sources and substitute of information by scheduler in a particular data center. HEROS could allow success of scalable and dynamic workflow portion in cloud system.

HEROS algorithm improves energy efficiency and response time. But response time is elevated. HEROS allocate the job of server into tasks. These tasks can be dynamically and linearly executed and response time becomes very elevated. Power function is actually linear. Still, figure of tasks failures on servers i.e. servers identify that the tasks cannot be completed before deadline. So it makes them go down. [13]

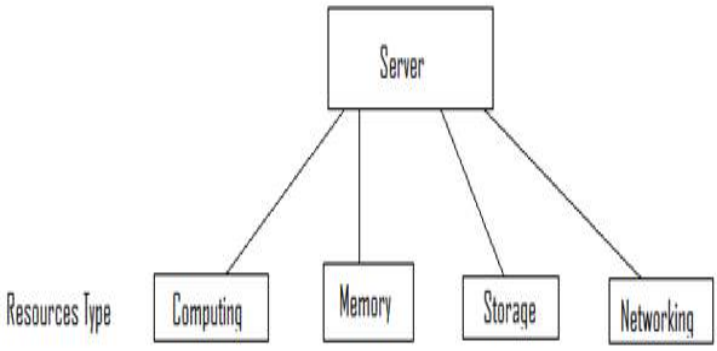

Figure 1: Server with its mechanism

The proposed result for the optimization problem is called EHEROS (Enhanced Heterogeneous Energy Efficient Resource Allocation Optimizing Scheduler) algorithm. The EHEROS method is based on HEROS .EHEROS uses the binary search algorithm. We consider the problem of task scheduling on distributed computing infrastructures. Tasks are due to servers, both virtualized and physical. In previous work tasks are due to servers and linearly executed and at times tasks are dropped by them. The proposed solution takes tasks that are allocated to servers to see the priority of task. In which first of all those tasks are executed first which one's priority is high as shown in figure 2 :

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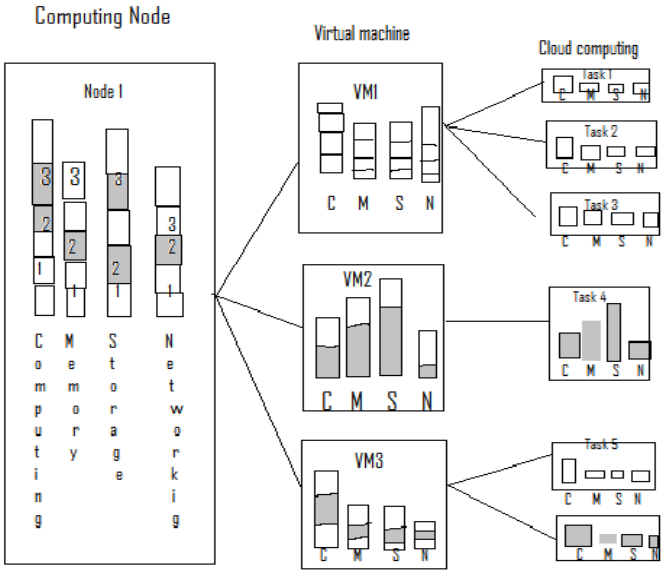

Figure 2: Resource allocation lying on a join with heterogeneous resources

A . Binary search algorithm

Binary search algorithm is well identified as half interval search is a search algorithm that finds the location of a target value, whether only or part of a proof within a sorted array. Among slight extra gap , binary search runs in at worst logarithm time creation O[log n] where n is the number of elements in an array and log is the binary logarithm.

Binary search simply works on sorted arrays . Binary search begins by comparing the center element of the array with the goal value. If the goal value matches the center element its location in the array is returned. If the goal value is less or more than the center element the search continues the minor or high half of the array correspondingly with a new center element , eliminating the other half from kindness .[14]

B. Three tier architecture

In general , the data center network architecture is tree based and might be two tiered , three tiered and three tiered elevated speed .In general , network switches are interlinked crossways other tiers and also connected with switches in the similar tier . The servers are linked to the access layer using Top-of-rack switches. The access layer is linked to the core layer which provides connectivity to the backend network. The three tiered network architecture have aggregate layer between access and core networks. The aggregate layer provides content switching, load balancing and different security procedures such as firewall capacity. Three tiered elevated speed architecture provides 10 times new bandwidth at all layers through elevated speed transceivers .The variation Sin the uplink and downlink capacities of a switch leads to oversubscription that reduces the existing irritated sectional bandwidth of a server.[15]

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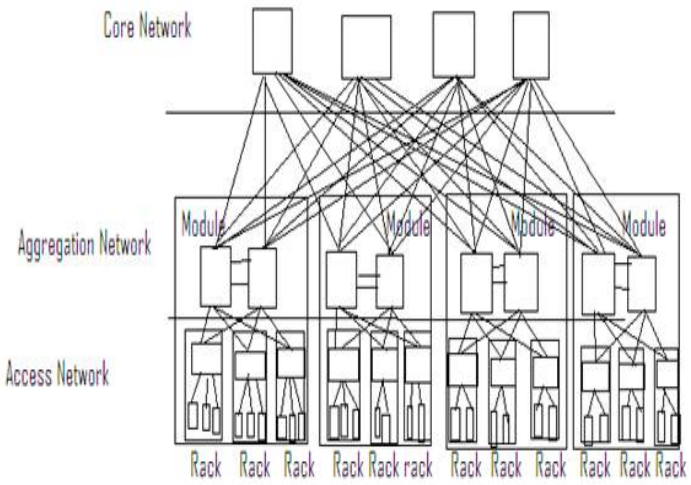

Figure 3: Three tier architecture

IV. EXPERIMENTS

A. Green cloud simulator

Green cloud is a fine identified simulation tool which offers fine-grained simulation of new cloud computing environments focusing on data center communications and energy efficiency[16]. Green cloud is based on ns-2 simulation platform[17]. It appears as exhaustive modeling of the energy consumed next to the element of the data center, such as computing server , switches , and network links . It also locates tools in the form of energy efficient metrics[18]. Green cloud wires have conventional three tier data center architecture as well as new data center architectures such as D Cell, B Cube, D Pillar. The three tier architecture used in this study consists of the topmost core tier, the aggregation tier that is responsible for routing and the access tier to hold the group of computing servers set into racks. The Green cloud simulator was complete with functionalities compulsory to model heterogeneous servers to allow the performance of the proposed scheduler[19].

B. Results of simulations

The affectivity of the EHEROS algorithm is validated with position of benchmarks. HEROS algorithm is ordinary indication schedulers implemented in the green cloud simulator. EHEROS algorithm create uniformed decisions , each cyclically allocating tasks to machines or selecting a machine from a random division, which is uniform by default. The simulation scenarios for validating proposed work are chosen to different conditions. This benchmark scenario exists in the table. Size is the primary attribute of every scenario, whereas heterogeneity is the other attribute. Moreover, little size scenarios have bigger oversubscription of the links, including 144 servers in each of the racks, in comparison to 3 hosts apiece of rack. The servers have both DVFS and DNS mechanisms enabled, and their power models are linear, definite by the minimum and maximum powers.

Dynamic Voltage and frequency scaling (DVFS) is the correction of power and speed settings on a computing devices having different processors, controller chips and secondary devices to optimize resource allocation for tasks and exploit power saving when individual resources are not needed. Multimedia requires extra power, so the device reaches a high power state and creates extra heat during heavier processing such as video and gaming.[20]

In every scenario, the data center load is located to 30% of the total data center power capability. The simulation time is set to 65.5% and the data center is clear in the creation. Tasks have 300000 instructions, 8500B of input data and 250KB of data, and important requirements for memory. The internal server deadline for task execution is set to 1.2s because of the big quantity of micro servers with low computational capacities; the heterogeneous scenarios create fewer tasks.

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Table I. Three tier configurations

	HEROS	EHEROS
Core Switches	1	1
Aggregation Switches	2	2
Access Switches	3	3
Servers in a rack	48	144
Simulation time	60 s	65.5 s

The mean value allocation as value indicators is described in Table I while having the equivalent relative values. Each relative value is computed as the ratio of charge for a scheduler .The key aim for judgment of schedulers are server energy consumption and mean response time, both of these objectives should be minimized. Additionally, it is advantageous if the response time is low.

Table II: Results

	HEROS	EHEROS
Total Energy(w* h)	306.8	182.8
Switch Energy(core) (w* h)	51.4	51.4
Switch Energy (Aggregation) (w* h)	102.8	102.8
Switch Energy(Access) (w* h)	9.1	9.1
Server Energy(w* h)	143.5	19.5

The relative values for this setting are graphically presented in fig.3-7.The proposed scheduler has the top mean response time and total energy consumption, followed by HEROS. It proves that the proposed server collection function can smoothly outperform the HEROS. The especially good energy score of the green scheduler is discredited by its better response time and a great number of unfinished tasks.

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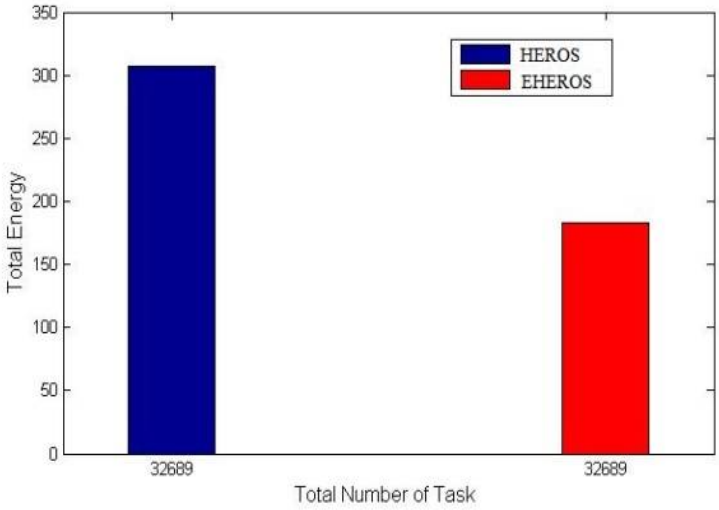

Figure 3: Calculating the Total energy of EHEROS algorithm

In the heterogeneous scenarios data center have less computational resources in estimate with the homogeneous scenarios, although the networking topology is the same, so there is no blocking in the network.

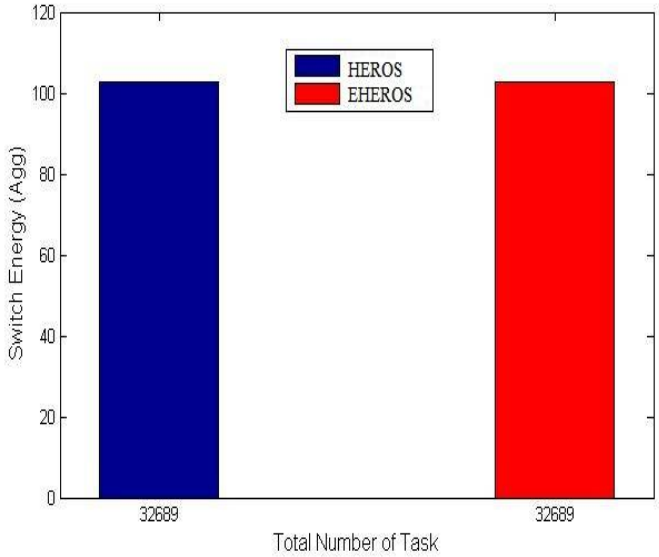

Figure 4: Calculating the Aggregation switch energy of EHEROS algorithm

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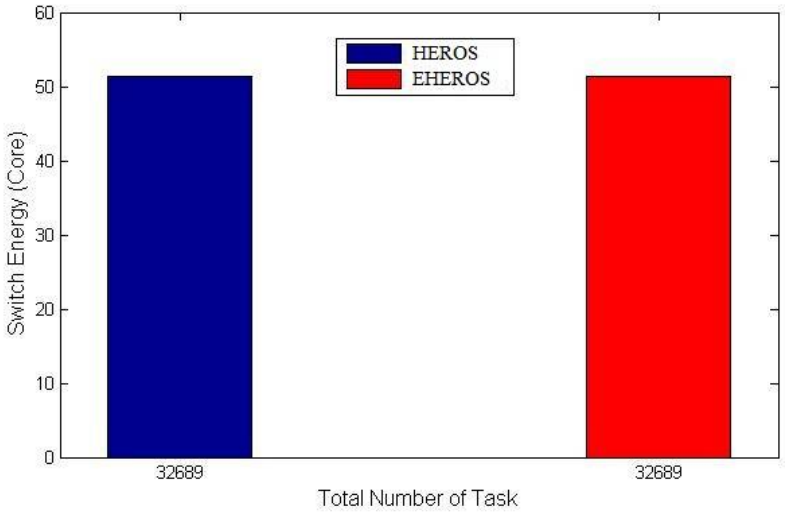

Figure 5.Calculating the core switch energy of EHEROS algorithm

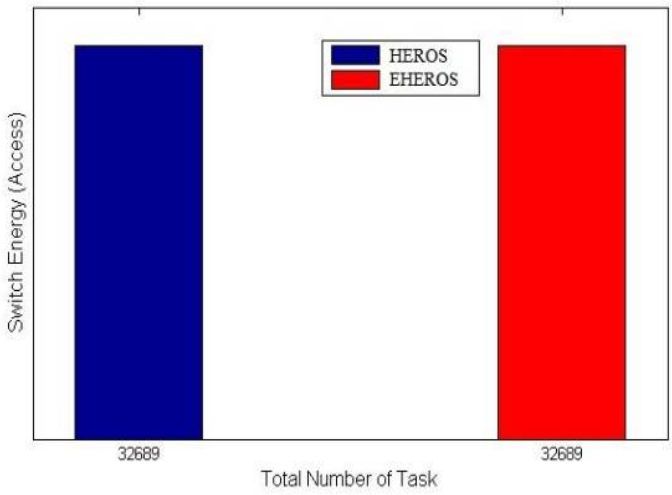

Figure 6: Calculating the Access switch energy of EHEROS algorithm

The proposed scheduler affectivity is improved consuming 72% fewer server energy than the green scheduler.

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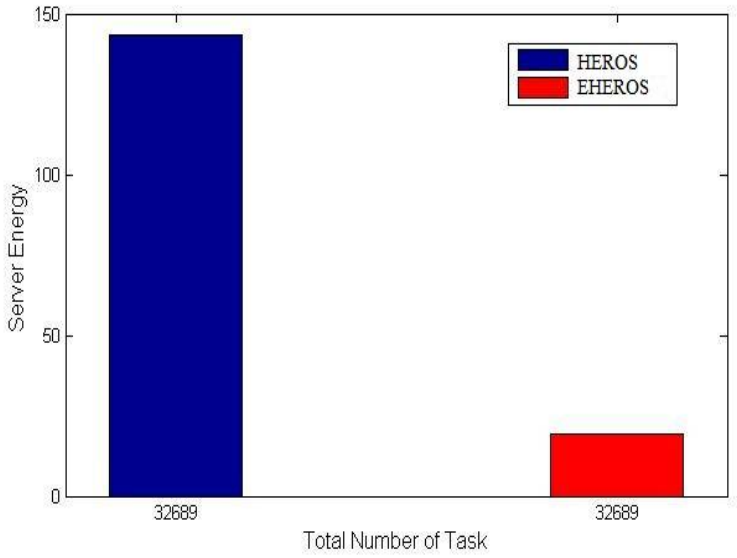

Figure 7: Calculating the Server energy of EHEROS algorithm

V. CONCLUSION AND FUTURE SCOPE

The novel EHEROS scheduler is an expansion of the state-of-art network and energy aware schedulers. EHEROS is particularly intended to operate in heterogeneous systems. It is based on the aggregation of utilization and network links. EHEROS is implemented in the green cloud simulator, proving its affectivity in connection with position scheduling approaches in heterogeneous systems somewhere it saves up to 72% of server's energy .The result of EHEROS, affectively simplifies explanation of heterogeneous servers. It also normalizes capacities and power functions of servers, creative the scheduler extensible and adaptive to novel settings.

The correct decision creation method could be additional elaborated. In this paper, the complexity of the algorithm is O [log n] in case of scanning all listing of machines in order to find the finest place. More elaborated schemes may contain a distributed association optimized to minimize network traffic whereas providing the essential information.

Future scope comprises performing comprehensive experimentation with non regular task size and task creation patterns and simulations of extra complex, virtualized, multi-tenant environments. EHEROS algorithm might be enhanced by expansion of the output of optimized objectives, addition of other data sources and allocation of EHEROS algorithm using a multi-agent framework to facilitate cooperation and exchange of information by schedulers in a particular data center or between multiple cloud computing systems. EHEROS algorithm canss also be improved by reaching of scalable and dynamic workflow allowance in cloud systems.

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