Design and Analysis Distributed Directed Scheduler for GreenCloud Simulator (DDSGS) in Cloud Computing

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Abstract: Heterogeneous architectures are becoming more popular and commonly used in the latest years with the increasing popularity of general-purpose processing. However, cloud computing data centers consist of design and management and looking the purpose of improving the performance of a system , reliability, and energy efficiency. Cloud computing is a method through which resources are provided by a local client according to their need, by means of internet. DDSGS, Distributed Directed Scheduler for GreenCloud Simulator is a novel load balancing algorithm which is used to allocate the resources in heterogeneous systems for energy-efficiency. Greencloud simulator is used to check the amount of energy used by the heterogeneous data centers.

Keywords- Cloud Computing; Load Balancing; Scheduling; Energy Efficiency.

1. Introduction

Cloud computing is a commonly used technique nowadays which uses the internet and central remote servers to maintain data and applications. It is a construct that allows the user to access applications that actually reside at a location other than user's computer or other internet connected device. With the advancement in the technology, the cost of computation is decreased. It allows the users to store and access their data and programs on the internet rather than the usage of computer's hard drive. Energy efficiency has always been an important concern in the cloud computing systems. However, it is essential in the case of heterogeneous data centers to consume the energy that is used while performing different tasks.

Load Balancing is performed in cloud computing to distribute the tasks in the cloud in order to meet the requirements of the users. The workloads are divided among multiple computing resources. It helps to save energy in the cloud and improves the performance in a reliable way. However, with the use of load balancing the availability of resources is increased and work in the cloud is done more effectively. It also helps to satisfy the customers by providing the specified tasks done within time. It uses different techniques and algorithm and allows the cloud to scale up the demands of users.

The goal of this paper is to present a new simulator named as DDSGS (Distributed Directed Scheduler for GreenCloud Simulator) which has been designed to achieve even more energy efficiency in heterogeneous data centers.

The parameters used were Total Energy, Servers Energy, Mean Response Time, Response Time, Task Failure, Unfinished Tasks to analyze the performance of various heterogeneous data centers which are using cloud computing. During the evaluation of improved strategies on the cloud, the performance of various access categories was the determining factor. The scenarios for implementing existing strategy and improved strategy were created in the GreenCloud Simulator to obtain the results. The results show that the performance of improved strategy is better as compared to existing one.

The main focus of the proposed work is to increase the energy efficiency of the cloud. As the current demand of the time is to create data centers that are efficient in terms of the energy, so the energy efficiency in the cloud will help to create such heterogeneous data centers. For this, an energy efficient simulator is used in order to analyse the performance. Based on the simulation results and comparison with the existing scheduler, it is observed that the proposed scheduler is more efficient in terms of the energy consumption.

The remainder of the paper is organized as follows: section 2 briefly describes the related work. Section 3 describes the proposed work and section 4 provides its simulation results. Section 5 finally concludes the paper.

2. Related Work

In this literature, an algorithm named HEROS is introduced in order to improve the energy consumption. However, it is designed to operate in the heterogeneous data centers and has used GreenCloud simulator in order to show the results. There were different parameters used in the paper

and each parameter of HEROS algorithm is compared with different existing algorithms. To conclude, HEROS algorithm proved better than the existing algorithms. [1] A simulated environment is used in cloud computing data centers with the motive of energy consumption. The result consists of the different simulator which is obtained for distinct leveled data centers and also demonstrate the architecture of the simulator which signifies the utilization powered scheme. However, GreenCloud simulator in used to test the efficiency of the components used in data centers. [2] Different energy consumption accounts have been determined through which data is processed in large operational expenses. However, the existing work focuses on the distribution of job among different servers which are based on workloads. There is a focus on the role played in the data center by the communication fabric and also provides the attention towards a scheduling approach which consists of energy efficiency as well as network awareness, which is named as DENS. [3] Energy is consumed by high performance computing platform is increasing day by day, so the research efforts towards the green approaches in order to improve the energy. The authors have supervised the usage of hypervisors in a high performance computing. However, the improved model has finished the tasks in less time and consumed less energy than the existing ones. [4] There were efforts designed in cloud technologies in order the users with different methods and policies for managing the cloud infrastructures effectively. However, CloudSim simulator is used so as to meet the requirements of the users. To meet the parameters based on users necessity, so CloudSim toolkit is developed. The toolkit is used to support the modeling which is used on a node that is simulated included in a data center. [5] Energy efficiency is important for future information and communication technologies (ICT), due to increased usage of ICT. Andreas Berl and Erol Gelenbe reviews the usage of technologies and methods that are currently used for operations of energy efficiency. So there is a way to analyse, implement and identify overall energy savings in a system to earn truly "green" computing services and also improved the load balancing and the performance of single data centres. [6] There were different challenges faced by the cloud users while working on the multiple infrastructures in a network. In order to overcome challenges, there can be multiple actions performed but GreenCloud simulator is the best one. A new model is proposed so that these can be performed in a convenient way. The model works with the help of virtual machine through which it can run on a platform. This experiment proves the scalability and reliability of the proposed model. [7] In data centers, there are energy consumption accounts occupied for a large percentage of the

expenses which are used in cloud computing in the backend. The work is emphasized on the role of communication fabric and also presented a solution to scheduler named e-STAB. The results have been obtained by using GreenCloud simulator for the three-tier cloud center architecture. Although, the model has improved the scheduling by assessing through the internet. [8] There is a discussion on different methods for predicted computation performance. There was a problem that how to distribute tasks among modern high end computing network. It introduced scheduling strategies to distribute different tasks among cores according to a count of required and available cores. Task aggregation process is followed by the authors to overcome this problem which allowed the network to distribute the available cores according to their need and to save energy. [9] The high performance of the network and data center depends on the speed but computing commonly depends on the performance of the systems. In order to achieve the better performance on the systems per compute node, then the number of transistors and power densities need to be doubled in order save energy and provide reliability. [10]

3. Distributed Directed Scheduler for GreenCloud Simulator (DDSGS)

The idea of the proposed work, Distributed Directed Scheduler for GreenCloud Simulator (DDSGS) is to improve the load balancing on the cloud in a heterogeneous data centers. DDSGS is specifically implemented to operate in the heterogeneous data centers. The decisions are based on the aggregation of utilization and energy saved by performing different tasks simultaneously on a cloud in heterogeneous systems. It allows to assign the components in the cloud in an effective way and increases the performance of the cloud as well as saves the energy. The energy consumed during the task is measured in terms of Kilowatt per Hour and shows the results in a better way. This algorithm reflects light on energy consumed by performing different tasks on the cloud and shows that the level energy consumption is improved than the existing scheduler. The fraction of the total amount of tasks processed in the heterogeneous data centers with the cloud reflects the energy consumed by the infrastructures used in the simulator.

4. Simulation Results and Evaluation

The simulation of the existing load balancing strategy and the improved load balancing strategy for assigning the resources in the heterogeneous data

centers have been shown in the form of pie graphs and to evaluate this simulation some data parameters are also used.

4.1. Simulation Scenario

The first step is to make a simulation scenario which is equivalent to real world scenario. In this process, the cloud model consists of heterogeneous data centers. However, algorithms are used to improve the consumption of energy in the cloud so that components can be used in a better way. The scheduler processings are carried out using GreenCloud simulator.

4.2. Simulation Method

There are different parameters used to compare the performance of existing algorithm and improved algorithm. It consists of different factors which are used as a benchmark to configure different ways. The performance evaluation is done by both algorithms one by one in GreenCloud simulator and then comparing the outputs that are obtained.

4.3. Results

After choosing data parameters, the simulation is done, and then results are gathered.

4.3.1. Analysis of Improved Load Balancing Strategy: In this load balancing strategy, it is implemented to operate in the heterogeneous data centers. The decisions are based on the aggregation of utilization and energy saved by performing different tasks simultaneously on a cloud in heterogeneous systems. It allows to assign the components in the cloud in an effective way and increases the performance of the cloud as well as saves the energy. The energy consumed during the task is measured in terms of Kilowatt per Hour and shows the results in a better way. This algorithm reflects light on energy consumed by performing different tasks on the cloud and shows that the level energy consumption is improved than the existing scheduler. The fraction of the total amount of tasks processed in the heterogeneous data centers with the cloud reflects the energy consumed by the infrastructures used in the simulator. The result obtained for this improved load balancing strategy is as follows:

The given figure 1 shows the output of the improved scheduler named DDSGS which shows the results by verifying the values with different parameters. The

pie graph shows the amount of energy used in the cloud in form of KiloWatt per Hour. Simulation duration is also shown which is calculated as the time taken to finish the tasks. It includes task storage, task memory, task size, task output size and total tasks performed during the workflow done on the cloud.

Figure 1. Output of New Scheduler (DDSGS)

4.3.2. Analysis of Existing Load Balancing Strategy: Heterogeneous Energy-efficient Resource allocation Optimizing Scheduler is validated with GreenCloud simulator which is an extended version of Network Simulator 2 and enables the users to simulate heterogeneous data centers. The methodology of HEROS is based on DENS and e-STAB. This algorithm is introduced in order to improve the energy consumption. However, it is designed to operate in the heterogeneous data centers and has used GreenCloud simulator in order to show the results. Moreover, cloud computing data centers consist of design and management and looking the purpose of improving the performance of a system , reliability, and energy efficiency. There are different parameters which are used to verify the output and each parameter of HEROS algorithm is compared with different existing algorithms. It is differentiated with previous algorithms by using the algorithm in large and small topologies to show the effectiveness of this algorithm. However, it is based on the previous algorithm so it is easy to compare by using different parameters. Moreover, it has also scanned the complexity of algorithms in different terms. Each component in this algorithm has described with the help of vectors of numbers called capacities. HEROS allocates task to every component by verifying the maximum score of the server. There are three compatible components which are used to allocate a resource named as a computing node, virtual machine and cloud application. The result obtained for the existing load balancing strategy is as follows:

The figure 2 given below shows the output of the existing scheduler named HEROS which shows the results by verifying the values with different

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parameters. The pie graph shows the amount of energy used in the cloud in form of KiloWatt per Hour. Simulation duration is also shown which is calculated as the time taken to finish the tasks. It also includes task size, task output size and total tasks performed during the workflow done on the cloud.
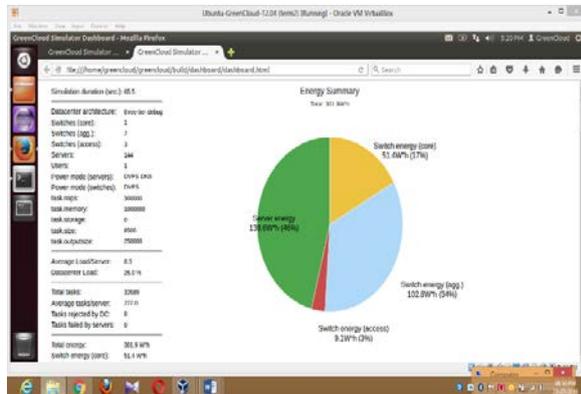

Figure 2. Output of Existing Scheduler (HEROS)

4.3.3. Comparative Analysis of Existing and Improved Load Diversion Strategy

Table 1.

Parameters	HEROS (Existing algorithm)	DDSGS (New algorithm)
TOTAL ENERGY	301.9 W*h	182.8 W*h
SWITCH ENERGY (CORE)	51.4 W*h	51.4 W*h
SWITCH ENERGY (AGGREGATION)	102.8 W*h	102.0 W*h
SWITCH ENERGY (ACCESS)	9.1 W*h	9.1 W*h
SERVER ENERGY	138.6 W*h	19.5 W*h

Table 1 shows the difference between the existing scheduler and the new scheduler through different parameters. The values state that energy is saved by Distributed Directed Scheduler for GreenCloud Simulator. The table defines different values; which explains about the improvement made in the new scheduler. This scheduler is more effective than the HEROS in terms of energy consumption. Moreover, load balancing is done in DDSGS in an effective way. Although, it is more helpful and reliable to use in the heterogeneous data centers.

In the given figure 3, the amount of energy used is shown in the task. It is measured in terms of Kilowatt per Hour. This figure reflects light on energy consumed by performing different tasks on the cloud in the existing scheduler that is HEROS. The fraction of the total amount of tasks processed in the heterogeneous data centers with the cloud reflects the

energy consumed by the infrastructures used in the simulator.
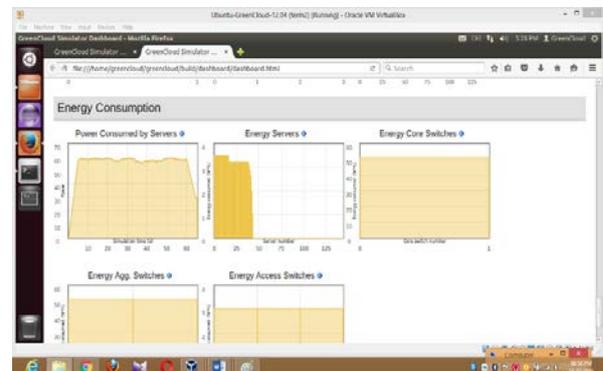

Figure 3. Energy consumed by HEROS

The given figure 4 shows the energy consumed during the task. It is measured in terms of Kilowatt per Hour. This figure reflects light on energy consumed by performing different tasks on the cloud and shows that the level energy consumption is improved than the existing scheduler. The fraction of the total amount of tasks processed in the heterogeneous data centers with the cloud reflects the energy consumed by the infrastructures used in the simulator.
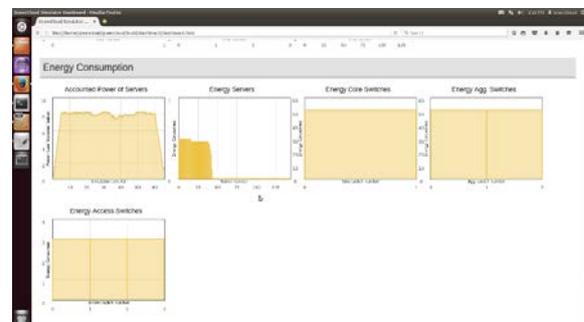

Figure 4. Energy consumed by DDSGS

5. Conclusion and Future Scope

The novel DDSGS is an extended version of HEROS. DDSGS is specifically implemented to operate in the heterogeneous data centers. The decisions are based on the aggregation of utilization and energy saved by performing different tasks simultaneously on a cloud in heterogeneous systems. The results obtained from both the schedulers shows that improved scheduler is much better than the existing one in terms of energy consumption and load balancing strategies. However, HEROS (the existing scheduler) need to be improved in terms distribution of components in a cloud and it was unable to work on multiple cloud computing systems but, these tasks are performed by DDSGS (the new scheduler) in a convenient way. The results of both

the schedulers show the capacity to perform different tasks by using different components on the cloud.

Future work includes multiple tasks performed on similar cloud and with less storage. DDSGS can be improved by the distribution of tasks among different components by using a task manager in single data centers or multiple data centers.

6. Acknowledgements

7. References

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