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A STUDY ON ENERGY EFFICIENCY IN CLOUD DATA CENTER

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Abstract-Cloud computing is enormous technologies in the computing paradigms and it also provides the number of services as per the customer requirements passing through the internet. Energy conservation is one of the major concern in cloud computing. The cloud services are requiring to the expenditure. In cloud computing, virtual machines allocation and energy efficient is one of the significant research topics. In order to, virtual machines and energy consumptions are consider decreasing the number of active hosts and minimize the power consumption in data center with the help of virtualization.Live Migration techniques with its various applications are used to balance load in the servers. In this paper Virtual machine consolidation & Server Consolidation comes into scenario in Virtual Machine movement method which itself states that there is low energy consumption.
Keywords: - Cloud data center, Virtual Machine Migration, Energy efficiency, Server Consolidation, Load Balancing.

1. INTRODUCTION

Cloud computing is the dynamic provisioning of its technical capabilities to its users from different sources. virtualization technology is used to allocate resources to customers as they need them [2]. The aim of cloud computing is to use the resources in an efficient way and also gain more profits [3]. The rule behind cloud computing is pay for what you use. In cloud environment, the users can share data and resources among each other through web.The growth of datacenters has also increased the use of computer in each year, which results increase in the consumption of energy which also has negative impact on the environment [4]. Energy efficiency is becoming increasingly important for data centers and clouds. The wider adoption of cloud computing and virtualization technologies has led to cluster sizes ranging from hundreds to thousands of nodes for mini and large data centers respectively. The fact that electricity consumption is set to rise 76% from 2007 to 2030 with data centers [1].

The Data centers are data storage space where huge amount of data is stored centrally.. The service provider and the clients signan agreement for the usage known as SLA (Service level Agreement). In1999, salesforce.com put this idea to an application. Then in 2002, a Cloud based services of web launched by amazon [5].

Virtualization is the main component for cloud. To build up the different strategies such as VM migration, Virtual Machine& Server Consolidation for energy efficient computing for businesses and in addition united logical society includes multiple server farms that consists of many processing components such as Virtual Machines (VM), Physical Machines (PM) or host hubs that devour immense energy sum amid calculation.

2. ISSUES FOR RESEARCH

To reach the extent of CLOUD computing, major aspects have not yet been developed and realized and in some cases not even researched. Many issues are still needs to be known.

2.1 Server Consolidation –

Energy optimization is an important issue in cloud computing environments. To reduce this, an idea is to redeem the idle power going waste by underutilized servers. The fact is that a server even runs a very small workload, then also it consumes over 50% of the peak power [11]. The aim of conserving energy is to turn on as few servers as possible by consolidating the workload which intern is called as server consolidation. It is an approach to better utilize the resources and to redeem the consumption of power.

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2.2 Energy Consumption–

Energy Consumption to reduce the energy consumption in data center's is another issue in cloud computing. It has been found that that a server even runs a very small workload, then also it consume over 50% of the peak power. Energy consumption by Google 2,675,898 MWh in 2011 and it is increasing regularly. Thus there is a need to control the consumption of energy otherwise the cost of cloud computing will increase tremendously. The aim is to reduce the energy consumed in data centers by following the service level agreement. This issue is now started gaining importance. This issues can be addressed by a lot of approach. For example by selectively shutting down the unutilized server the power consumption can be greatly reduced. The utilization of resources can be enhanced by addressing the problem.

2.3 VM Migration–

VM Migration In a cloud environment having more number of datacenters, virtual machines have to be migrated between physical machines located in any(same or diff erent) datacenter in order to achieve better provisioning of resources. Migration of virtual machines which means to transfer a virtual machine from one to another physical machines helps in greatly reducing the energy consumption. The benefits for virtual machine migration is it avoid the hotspots.

2.4 Security of Data–

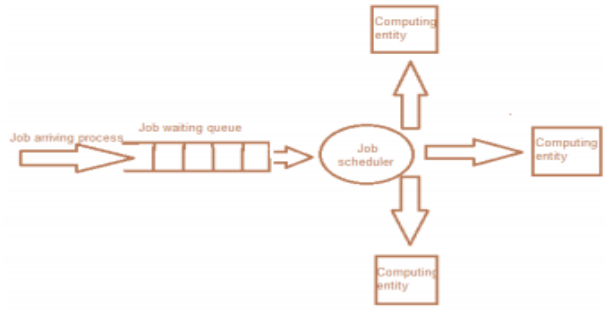
Security of Data Security of data is a vital and important research issue in cloud computing. It hamper the expansion of the cloud. Usually, the services of cloud computing are delivered by a third party known as service provide, who owns the infrastructure. It is hard to make the trust at each layer of the Cloud. Firstly, the hardware layer must be trusted using hardware trusted platform module. Secondly, the virtualization platform must be trusted using secure virtual machine monitors. VM migration should only be allowed if both source and destination servers are trusted.

3. SCHEDULING

In cloud computing, scheduling directly affects some important parameters of cloud environment like energy efficiency. The major components of energy consumption data center are server, cooling system and interconnecting telecommunication [9].

Figure 1. Task scheduling

So to reduce energy consumption of data center is to decrease the number of server which are in active state to receive and



process tasks [10]. Energy consumption of data centers includes many factors, such as servers, load, interconnection network, cooling system, power distribution system, and etc. In this paper we have done study of efficient task scheduling to minimize energy consumption in data centers by reducing the number of servers. The energy consumption of the data center is found with respect to the number of active servers as an integer programming problem with the objective of minimizing data center energy consumption [10].

4. RELATED WORK

Cloud environment consists of large number of heterogeneous servers which performs tasks that are assigned to them and also consumes large amount of power for execution. This occurs due to poor task assignment optimization [7].When there is high power consumption the carbon di oxide emission increases which causes pollution. It is necessary to find an alternative efficient green computing algorithms to minimize the energy consumption on heterogeneous cloud servers [8].

4.1 ESF-ES algorithm:-

Input: number of tasks and servers.

Output: Task Scheduled to servers and Energy consumption in cloud data center.

findthe number of tasks to be performed, number of available servers available to perform tasks, task type of each task and the number of instruction in each task.

a=b=1;

for each task tsk of type t do

for each server ser do

Calculate $Y_{t,\ ser\ =\ Ct\ [pt_{t,ser}]}\ \alpha_{t\ -\ 1}$
Calculate server energy consumption
$E(t,ser) = R_{t,ser} Yt_{,ser}$
if E(t,ser) <= E(a,b) then
a=t, b=ser
end
end
end

Efficient Server First algorithm is developed by combining the hybrid algorithm and most-efficient-server first scheme. group of tasks and servers available to perform tasks are taken as input. The assignment and scheduling of tasks to the servers and the data center server energy consumption is taken output of this algorithm. The user performs computing various types of tasks. the servers are performing different tasks like reading file contents, updating data, uploading files, downloading software, etc. Based on the type of task, the processing time vary. The number of instruction in each task is calculated. Considering processing time energy curve is calculated.. Task allocation is done so that most-efficient-server gets the tasks first. The algorithm is based on greedy approach.

5. PERFORMANCE ANALYSIS AND RESULTS

The execution of ESF-ES green undertaking booking calculation for a server farm with heterogeneous assignments is finished utilizing java which decreases the server vitality utilization to certain degree. This calculation is called as green errand booking calculation is that when the vitality utilization is lessened, the carbon dioxide gas emanation will likewise be diminished bringing about the improvement of green registering innovation. Number of servers which handles heterogeneous undertakings are taken as information. The quantity of servers is accepted as 5. Four distinctive errand sorts are considered to be specific perusing record substance, refreshing information, transferring documents and downloading programming. The execution is done in Java. The handling time (ms) is taken for each errand which is diverse relying on the undertaking sorts. For each reproduction, the handling time (pt) and the quantity of directions for each undertaking (R) are haphazardly produced. The preparing time for the assignment sort perusing record substance extends between $1000 \leq pt \leq 1300$; for refreshing information, $1400 \leq pt \leq 1500$; for document transferring, $1600 \leq pt \leq 1800$; for downloading programming, $1900 \leq pt \leq 2400$. The quantity of guideline for every undertaking is diverse i.e.$1000 \leq R \leq 9000$, $1000 \leq t\ C \leq 1500$ and $3 \leq \alpha t \leq 4$. The examination is made between three calculations in particular crossover calculation, most effective server initially plan and ESF-ES calculation. The vitality utilization of server farm servers is measured in joules (J) and the preparing time is measured in milleseconds (ms). The handling time is utilized for computing the vitality incline which thus utilized as a part of the figuring for vitality utilization.

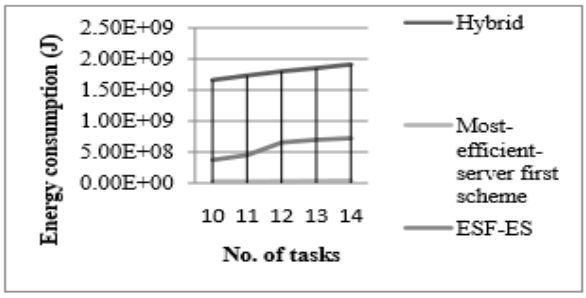


Chart -1: Comparison based on number of tasks

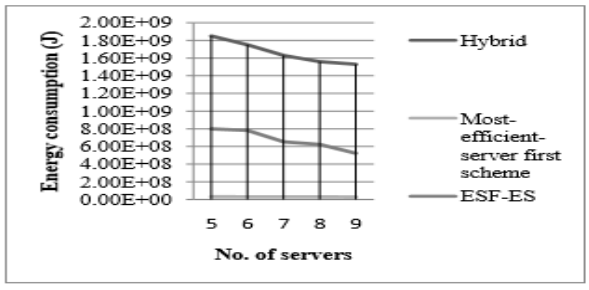


Chart -2: Comparison based on number of servers

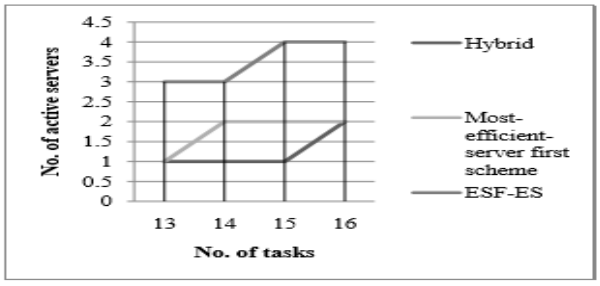


Chart -3: No. of active servers vs. no. of tasks

In the initial two charts, the server vitality utilization is indicated where the quantity of servers is settled to 5 and the quantity of errands is differed from 10 to 14 in the main diagram. As the quantity of undertakings to booked builds, the vitality utilization additionally increments. The mixture calculation is expending more vitality than the other two calculations. New calculation is better in vitality protection when contrasted with half breed calculation. Be that as it may, most-productive server initially conspires still turned out to be the best among the three calculations. In the second chart, the quantity of undertakings is settled to 12 and the quantity of servers changes from 5 to 9. As the quantity of servers builds, the vitality utilization diminishes. Again most productive server initially conspire is superior to the recently created calculation and the half and half calculation. The third chart demonstrates the quantity of servers that are utilized when the quantity of undertakings is changed.

6. CONCLUSION

The different vitality productive energy efficient calculations are examined. The ESF-ES calculation is executed which utilizes an eager assignment planning plan and contrasted and the most productive server initially plot calculation and the cross breed calculations. In the half and half calculation, just the quantity of undertakings is considered. In the most-proficient server initially conspire and the ESF-ES calculation, distinctive sorts of errands are likewise included. At the point when the outcome examination is made, despite the fact that cross breed calculation is the best among numerous other green assignment planning calculations, it devours more vitality when contrasted with the ESF-ES calculation and most-proficient server initially plot. The ESF-ES calculation devours more vitality than the most proficient server initially conspire. By looking at all the three calculations, the outcome got is that the most-effective server initially conspire calculation is best in moderating vitality in servers of cloud server farms. Along these lines, errand booking should be possible in an effective way and the undertakings are allotted to servers such that the vitality utilization is extraordinarily lessened.

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