ISSN 22773061

A Scheduling Approach to Achieve Green Cloud Solution Based on Internet of Things

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ABSTRACT

Internet usage is rapidly increasing in every field of life. Internet coverage is wide either it is textile, pharmaceutical or education sectors. In every sectors where internet envisions are exist, there objects must be connected with each other. When we discussed the objects are connected with each other, a word internet of things (IoT) must exist there. IoT covers iPads, mobile phones, digital camera etc. These devices provide us our basic needs when they connected each other. Sharing of services or concept of virtualization is also part of IoT and also called cloud computing. Cloud computing is said to be sharing of services or resources using internet as a connection. Cloud based resources can be distributed all over the world. It is among most popular technology in developed countries and they are trying to made green solution of its resources. Datacenters of cloud computing systems are wasting a terrific amount of energy, hence emits carbon dioxide. Under developed counties like Pakistan where financial and energy issues are common in every sector especially in education where IT utilizations are increasing day by day. Although concept of cloud computing are exist there but there is no awareness of green solution. In this paper, we suggested a scheduling approach for efficient resource management which can be helpful for green solution at universities of Faisalabad, Pakistan. This approach can be helpful to boost up concept of cloud and green cloud computing.

Keyword – internet of things, cloud computing, green cloud computing, datacenters, carbon dioxide, energy issues, scheduling algorithm

Council for Innovative Research
Peer Review Research Publishing System
Journal: INTERNATIONAL JOURNAL OF COMPUTERS & TECHNOLOGY
Vol 9, No 1

editor@cirworld.com
www.cirworld.com, member.cirworld.com

ISSN 22773061

1. INTRODUCTION

Cloud computing is a new innovation towards the globalization of the things. Everyone is demanding to avail these things under one roof without any hassle. It is a new concept of virtualization, grid, parallel and distributed computing. Within limited resources and budget everyone can get benefits of fast growing technology within one umbrella[1]. In this facility different type of applications can be accessed from different locations over the internet to meet the desires which is called internet of things (IoT). Things over the cloud based platform facilitate us to connect anything whenever required in easy manner by using SaaS (Software as Service),PaaS (Platform as Service) and IaaS (Infrastructure as Service) model. In this way cloud performance as a front end to contact Internet of Things (IoT). Every type of modules that communicate with devices like sensors who perform the real time storage of data by using high stream network devices[2].High performance servers, storage media and network resources can be easily accessible based on IoT. There is no issue for huge investment or any maintenance problems. These resources are available as utility resources at door step. End paid to use their desire resources over the IoT[3]. Different type of clouds can provide different type of services and there is no obstacle to the interconnection between them [4].

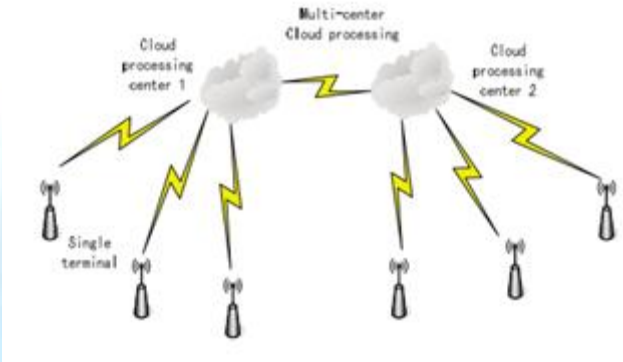

Figure 1: Multi-center, a large number of terminals [4]

A road map is given by IoT so one can use computing, storage and network resources easily instead of purchase them or arrange them[5]. Cloud computing can be beneficial for those small and medium size organizations who have focused on their business rather than to manage IT resources. In this way they can utilize latest and high processing computing, Database services, network infrastructures, web-based services and many more over IoT. A high consumption of energy is used by the data centers and cloud services providers to provide these beneficial services 24/7 and resulting in high emission of carbon dioxide which is ultimately generate pollution on the environment.

Energy usage increased exploitation and outfitted cost of cloud industry [6]. It is projected that USA data center's energy consumption reached 100 billion kWh with cost of $7.4 billion by means of 2011 year. 42% budget of data centers are being consumed by energy. It means consumption of energy effects environment as well operations of cloud computing also. It is expected up to year 2011 consumption of energy will reach 10,000,000,000 kilowatt-hours (kWh) and producing excess of 40,568,000 tons of CO2. Utilization of data centers are only 20-30% and 70-80% of energy is consumed by abundance in active resources, roughly 29,000,000 tons of carbon dioxide emits while no operation is performed at data centers. New cloud computing concepts like auto-scaling, to enhance server exploitation and reduce unused time can be helpful for green solution by overcoming energy consumption factor[7]. One among core issues of cloud computing is load balancing in which workload is divided into different clouds if one cloud going towards overloading and some other are in idle of average working state. Load balancing satisfy user requirements according to utilization hence improve services. It ensures efficiently and comparatively sharing of resources among each request[8].

While providing IoT based cloud services dead-locks can be handled by load balancing. If one center of cloud services fails then through load balancing traffic or request transferred towards other cloud can be managed which resulting safe time and cost. Virtualization of resources and consolidation of work-load can be help for energy consumption of cloud computing. Normally different services are running in datacenters and they responds slowly while over loaded hence result more consumption of energy [9]. Different approaches are being analyzed and some are under process for green cloud computing. In this paper author suggested a scheduling approach for resource allocation. This approach is suggested for local universities of Faisalabad, Pakistan. Suggested scheduling algorithm can be helpful for resource management hence green solution. The rest of the paper is as follows: section 2 describes the related work, section 3 discuss the proposed scheduling algorithm, section 4 simulation results using OPNET and in last section 5 concludes the research work.

2. Related work

An effective survey has been conducted which have eight portions and one portion is especially designed for green clouding. Population of survey was IT administration of four local universities of Faisalabad, Pakistan. Portion that was designed especially for green clouding included questions like common resource availability, current energy consumption of IT resources of each university, impact of non available resources, financial and energy problems etc. The statistical

results are shown in section 3. To validate proposed algorithm we have used OPNET to simulate said scenarios. Simulation results are shown in section 4.

3. Proposed Scheduling Algorithm

An algorithm is suggested to handle resources of four universities intelligently. It will be better choice to use a single resource instead of four common. If users request can be fulfill by using one resource out of four common resources then it will be less energy consumption and it will lead towards green solution. For this purpose an intelligent resource scheduling algorithm is designed and suggested. We are going to design an algorithm for four universities and statistics shows they have 70% same resources and overall IT resources of universities are consuming 41%-60% energy out of total consumption. It means if we shall able to manage common resources intelligently then we can save 28.70% to 42% of energy hence green solution.

Scenario 1: Suppose four universities have common resource R1, R2, R3 and R4 and end user is requesting for only one then what should be the behavior of algorithm. Firstly algorithm has to check availability of resource and then assign required resource as following.

Begin

Ur = 1 (User Request) 0 for no request 1 for request

If Ur = 1 then Start else Exit

Start:

RC R1, R2, R3, R4 (Resource Checking)

If R1 =1 then Assign else Start 0 for not available 1 for available

Assign:

Allocate only one (R1, R2, R3 orR4) to User

Shutdown remaining three

Exit:

Shut down all resources if no demand is pending for any resource

End

Scenario 2: If a resource is already assigned to any user and another user is also requesting for it then what will be the behavior of algorithm. The following algorithm will be assign the same resource to anther user and also perform load balancing for resource. If a resource will unable to lift the load of different users at same time then it will activated the other resource and assign it to other users.

Begin

If Ur1 and Ur2, Ur3……., URn = 1 then Start else Exit

Start

If R1= @@ (@@ for Already assign)

Then

Check LB (Load Balancing)

LB:

If R1 = ^ || **|| $$ (^ for 75% in use, ** for 50% in use and $$ for 25% in use)

Then

Assign else POOR (Power On Other Resource)

POOR:

Generate Power on Signal to R1|| R2||R3||R4

Assign:

Allocate R1 to User 2

Exit:

Shut down all resources if no demand is pending for any resource

End

ISSN 22773061

Scenario 3: If all resources are already shut downed then following algorithm will be executed.

Begin

If =!!## (!!## for shut downed resources)

Then

POOR:

Exit:

End

Scenario 4: If all resources are in 100% usage the following algorithm will be executed.

Begin

If R1|| R2|| R3|| R4 = ~_~_~ (~_~_~ for 100% in usage)

Then

Write

"All desired resources are under maximum utilization try later"

Exit:

End

4. Simulation Results using OPNET

A simulation is being practiced to validate said cases in section three. For this purpose OPNET software is used which is especially developed for simulation purpose and many ongoing researches are utilizing it. Firstly we have designed required scenario in which four universities of Faisalabad, Pakistan are designed as private cloud. A network router can routs out towards any of four datacenters from any four universities as shown in figure 2.

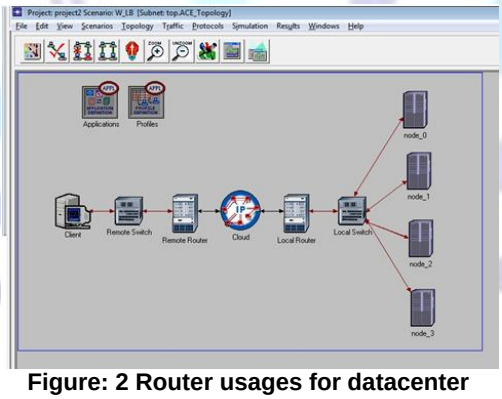

Figure: 2 Router usages for datacenter

We have configured here two applications which are remote login and file sharing. And different profiles are created according to four algorithms designed in section3. Similarly Routers are configured as per required criteria and datacenters of four remote locations are also configured. We have to analyze utilization of datacenters as their utilization is increased hence energy/ electricity will consume more hence omission of carbon. For this purpose we have developed three scenarios for different results.

4.1 1st Scenario

In this scenario utilization of overall datacenters is captured. These results are collected without configured our Algorithms which are developed in section 3. Figure shows results.

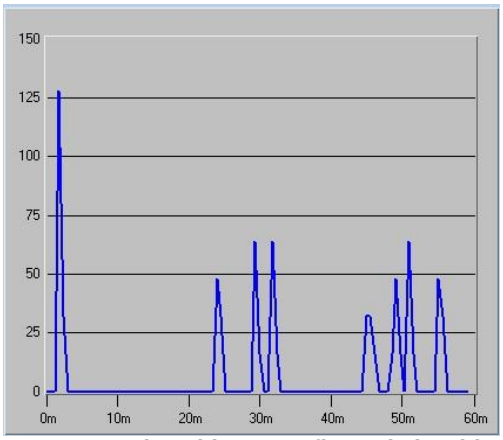

Figure: 3 Results without configured algorithms

Figure shows utilization of four datacenters regarding Remote Access of any location and during file sharing. User have no idea that from where its requirement is fulfilled, so all four datacenters should be kept activated. Statistics shows Utilization is 125% at start of request and then it stabled for 2m to 23m then different variation shows ups and downs in utilization. Average utilization of datacenters is 61% which is very high consumption of energy.

4.2 2nd Scenario

In this scenario we have applied configuration according to our scheduling algorithm and results are as following figure 4.

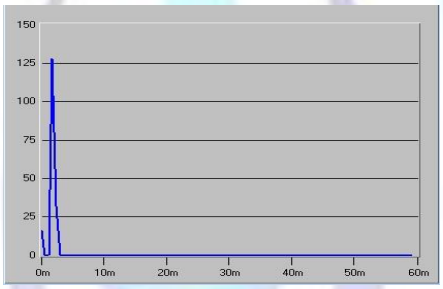

Figure: 4 Results after applying scheduling Algorithm

Utilization of servers is at peaked at the starting of Remote login and files sharing and after it has been stabled. Therefore average utilization is remarkably reduced up to 18%. Which mean it will be reduced 43% of energy.

4.3 3rd Scenario

In this Scenario load balancing algorithm approach is applied and results are in following figure 5.

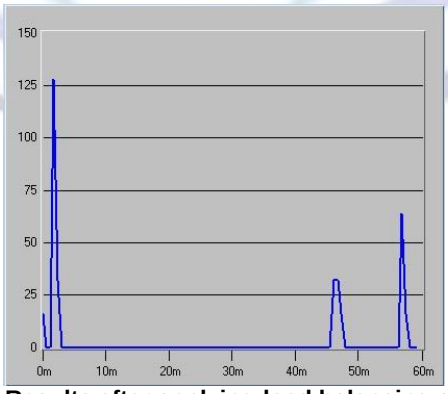

Figure: 5 Results after applying load balancing algorithm

This scenario shows datacenters are 28.50% utilized. It means while requests are on peak and datacenters is idle or halted this scenario is helpful even these condition.

Finally we have compared all three scenarios for some findings. Figure 6 shows comparisons.

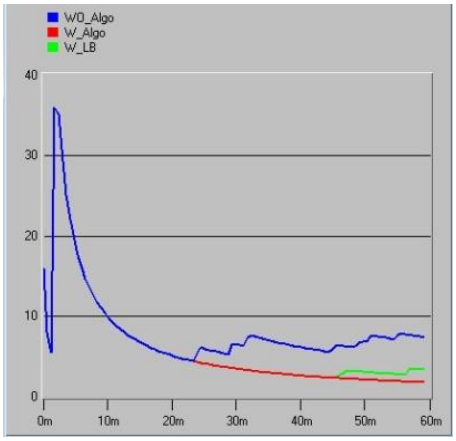

Figure: 6 Comparison of above three scenarios

Blue line shows utilization of datacenters without designed any algorithms while red line is showing after implementation of algorithm and the green line is showing while implementation of load balancing. Difference can be observed easily blue is utilizing more, Load balancing is in between and with algorithm approached less among all energy is utilized.

5. Conclusion

Cloud based resources can be distributed all over the world. It is among most popular technology in developed countries and they are trying to made green solution of its resources. Datacenters of cloud computing systems are wasting a terrific amount of energy, hence emits carbon dioxide. Although concept of cloud computing are exist but there is no awareness of green solution. In this paper, designed algorithms are suggested for local universities of Faisalabad, Pakistan for IoT based green cloud computing solutions and their results showing the variation depends upon the implementation at different location. Results of these algorithms are reducing the power consumption up to 28.50% to 43% of 41%- 60% which is average power consumption of IT resources of four universities. The pasture being infinite, future work is required towards the increase of sample size with more educational institutions. This will bring the picture more clearly and value of IoT based green clod solution.

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