Analysis of energy efficient scheduling algorithms in green cloud computing

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Abstract— ***Green Cloud Computing is approach used to improve the utilization of computing resources those we are using in cloud computing network like servers, storage, services, and its applications and reduce energy consumption of these resources which improves power efficiency. In this paper we are implementing virtual migration using Green cloud Simulator under various Scheduling Techniques and analyzing Energy Consumption and the difference between efficiency among them.***

INTRODUCTION

Green cloud computing is a new enhancement and a thinking that is based on cloud computing architecture and focuses on the energy efficiency of device. Cloud computing term was evolved in 1900s .This was evolved on the basis of utilization and consumption of needed computer resources. Application systems that are of cloud computing are executed within the cloud and operated through devices that work on internet. The present availability of networks with high capacity, computers with low costs and storage devices as well as the adoption of hardware and software virtualization, services online and utility computing have grown cloud computing up to a remarkable level.

These characteristics have made an attempt to attracte many IT rooms like Amazon, Google, Yahoo ,Microsoft , VMware , Intel etc. Amazon is at present providing two services first one is Amazon S3 a Simple Storage Service and another is Amazon EC2 Elastic Cloud Computing. Therefore with tihs advancement a lot of new applications are deployed on internet every day and numbers of people using these services are growing day by day. This increase in number of users for accessing applications in public and personal level, personal level like social networking sites which produce a huge work load and public level includes private corporations and public organizations. Load is managed by technology like virtualization had evolved which had made computing more compelling than previous years.

It has been observed that the consumption had been doubled since year 2000. Many surveys has given birth to a new advocacy called green cloud computing which is growing with the aim to make the system energy efficient and efficient utilization of resources. Studies reveals an average utilization of data centers can be nearly 20% and energy consumed by the idle resources is can be as much as 60% of the peak power.Generally, cloud computing focuses on the data computing efficiency; green cloud computing is a new thinking which is based on cloud computing architecture and focuses on the energy efficiency of device.

Virtual Machine Migration is a green computing technique for efficient usage of resources. The VMM technique migrate virtual machines from one machine to another this will help in distributing load from one physical machine to another. After the CPU utilization decreases it will migrate the VM back to the machine and turn off the second machine. This helps in lowering the electricity consumption by physical machines. As the machine will consume energy when there is a need else machine is turned off. Virtual Machine Migration could be done by using different scheduling algorithm like first fit ,monte carlo , round robin etc.

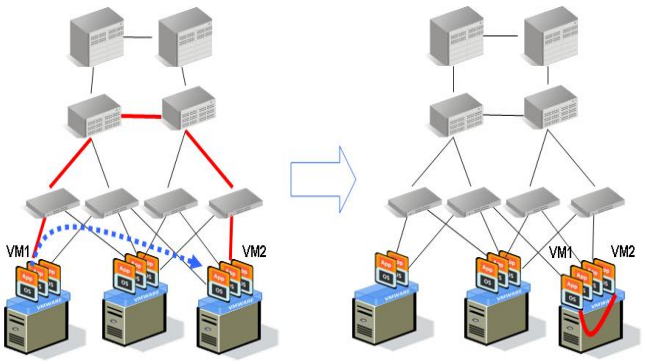


Fig: Virtual Migration of Tasks

A Virtual Machine is an independent server module (Operating System + Application) that generally run in independent servers. But with Server Virtualization, its possible to run many Virtual Machines in a single server(high capacity). In this process, each Virtual Machine assumes that it is running on its own server (with dedicated resources)..But the Virtual Machine moves from one physical server to another (or one group of physical servers to another)thus removes idleness of any server, takes less time to complete a process ,improve power efficiency . Most of the popular Server Virtualization applications support this process.

I. GREEN CLOUD SIMULATOR

Greencloud is a packet-level simulator made for energy-aware data centers in cloud computing with a focus of communications in cloud . It offers a fine-grained modeling(detailed) of the energy consumed by the data center's IT equipment, like computing servers, switches, and connection links.

GreenCloud can be used to get new solutions in resource allocation, monitoring, **workload scheduling** and optimization of communication protocols and network infrastructures. It was released under the General Public License Agreement and is an extension of the NS2 network simulator. GreenCloud offers a overall investigation of workload distributions in different environment. With it a specific focus is given on packet-level simulations of connections in the data center infrastructure, which provides finest-grain control. This is not present in any other cloud computing simulation environment.

LITERATURE REVIEW

a) CALCULATED CONSUMPTION OF ENERGY IN A CLOUD ENVIRONMENT

Authors **Arindam Banerjee, Prateek Agrawal and N. Ch. S. N. Iyengar** have investigated all possible areas in a cloud infrastructure that are responsible for maximum energy consumption in cloud computing and have addressed the methodologies by which power utilization can be reduced without compromising Quality of Services (QoS) and other performance factors.

Author has calculated Consumption of energy in a cloud environment having n number of nodes and m number of switching elements can be expressed as:

ECloud = n (ECPU + EMemory + EDisk + EMainboard + ENIC) +
m(EChassis + ELinecards + EPorts) + (ENASServer + EStorageController + EDiskArray) + EOthers

Energy Efficiency in Cloud Infrastructures can be achieved by using :

- Energy Efficient Hardware
- Energy Efficient Resource Scheduling
- Energy efficient Network Infrastructure in cloud
- Energy Efficient Clusters of Servers

Here It has been shown that few major components of cloud architecture are responsible for high amount of power usage and somewhere wastage in cloud.

b) basic techniques to minimize the energy consumption

Ankita Atrey, Nikita Jain and Iyengar N.Ch.S.N In this survey author have discussed basic techniques to minimize the energy consumption and Carbon di oxide emission that can cause many health issues. Then this paper throw light on green scheduling algorithms that helps to reduction in energy consumption and Carbon do oxide emission in the existing systems. At the same time the various existing architectures related to green cloud also discussed in this paper with their pros and cons.

c) to balance the job operations' execution efficiently

The author**[2]** has proposed An Integrated Green Cloud Architecture that has a Middleware component which enables company's manager to balance the job operations' execution efficiently with least energy consumption to public as well as private clouds or as of user's request. IGCA provides a client based green cloud middleware system which allows the job/operation manager to seperate the job of each department, specifying the related Quality of Service level and the Service Level Agreements involved in it. Energy consumption of job execution on private, public cloud and the local host is pre-determined based on scenario of model. Green cloud computing initiatives will be difficult to overcome when it comes to offload the workload to cloud (public/private) with providing the best energy performance factor.

d) approach for data centers that use low energy

The author **[4]** presents an approach for data centers that use low energy using cloud computing. Such datacenters are specially designed for all developing regions, having source of renewable energy.

Cloud computing saves energy by employing:

1. **Workload diversification**: Because different users will avail themselves of diffrent cloud resources – different applications, feature set preference and different volume of usage – will improve hardware utilization and hence make efficient use of power that is being used anyway to keep a server up and running.
2. **Power-management flexibility**: It is much easier to manage virtual servers than managing physical servers from a power perspective. If anytime hardware fails, the load can automatically be deployed anywhere else.

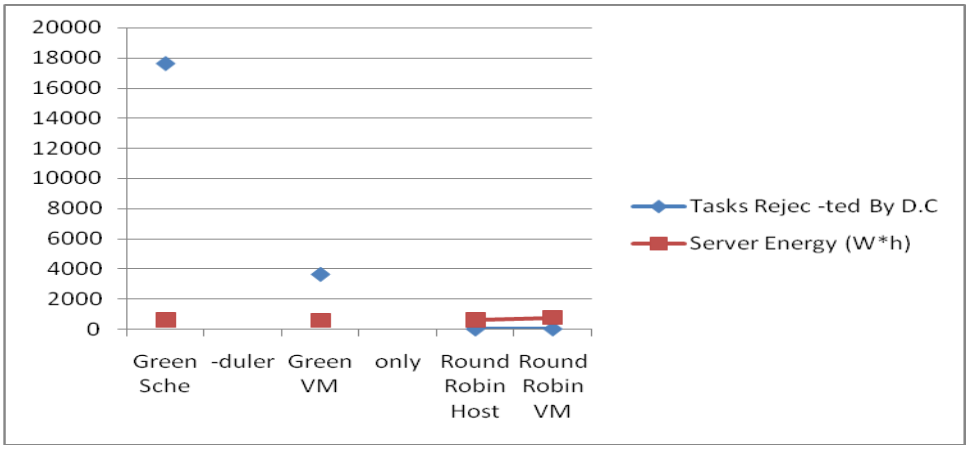
e) Operation of cloud in different scenarios

Authors **Joseph Doyle, Robert Shorten, and Donal O'Mahony** have shown that a cloud can be operated to lower carbon emissions and least operational cost. Simulator used examines the electricity cost, amount of carbon emissions, and average service request time for a number of different scenarios. The decision telling how to balance various factors will depend on Service Level Agreements, government legislations, and the price of carbon on trading techniques. Using all this information and particulars of the cloud, the operator can run the cloud in the desirable trend. The nature of the service will determine if a cloud owner can implement proposed algorithm while accepting service level agreements.

RESULTS

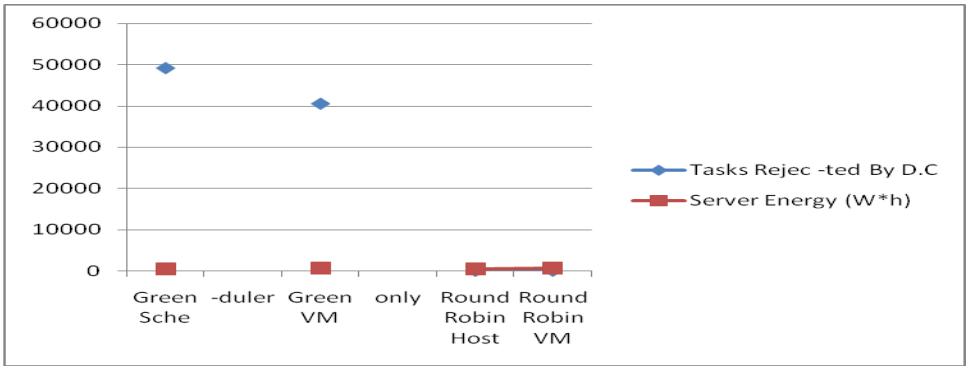
SCENARIO 1

Algorithms	Total Tasks Given	Tasks Completed	Task Rejected By DC	Task failed by server	Total power consumed
RR using VMs	30588	30588	0	0	770.6
RR using host	30588	13154	0	17434	614.1
Green scheduler	30588	12963	17625	0	612.1
Green scheduler using Vms	30588	26963	3625	0	590.0



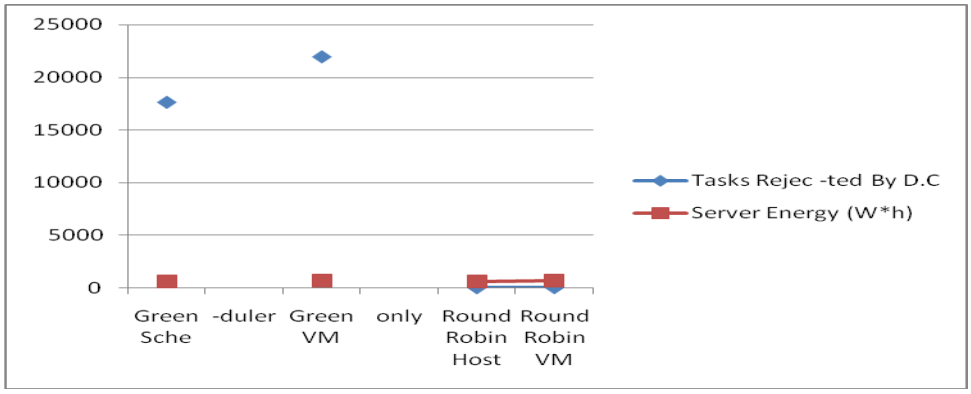
SCENARIO 2

Algorithms	Total Tasks Given	Tasks Completed	Task Rejected By DC	Task failed by server	Total power consumed
RR using VMs	49231	49231	0	0	769.8
RR using host	49231	0	0	49231	521.7
Green scheduler	49231	0	49231	0	49231
Green scheduler using Vms	49231	8643	40588	0	762.6



SCENARIO 3

Algorithms	Total Tasks Given	Tasks Completed	Task Rejected By DC	Task failed by server	Total power consumed
RR using VMs	30588	30588	0	0	676.8
RR using host	30588	13154	0	17434	614.1
Green scheduler	30588	12963	17625	0	612.1
Green scheduler using Vms	30588	8642	21946	0	672.3



CONCLUSION

In our work we have evaluated the energy consumption using various Scheduling algorithms. The consumption of energy varies a lot and moreover we saw two abnormalities as task rejection by data center and task failed on servers which is an issue.

In different scenarios tabulated above we have concluded that round robin scheduling algorithm provides least task rejection and least failure of tasks

In our future work we'll try to rectify these problems and we can formulate strategies to minimize the power consumption, better task allocation policies in future for fine utilization of resources.

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