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PALP-Power Aware Load Prediction Algorithm to Enhance Energy Efficiency in Green Cloud Computing

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***Abstract*—** The drastic growth in cloud computing model has led to establishment of large scale virtualized data centers. Data centers consume enormous amount of electrical energy resulting in high operating costs and carbon-di-oxide emissions. The energy efficiency issues of data centers are of major importance as costs of power and cooling make up a significant part of their operational costs. Energy efficiency is an important issue. It is needful to reach a green solution to address all trends that affects Cloud energy consumption. There are number of ways of reducing power usage in data centers. There are four approaches of increasing energy efficiency, hardware level energy optimization, energy aware scheduling in grid systems, server consolidation by means of virtualization and power minimization. Among these techniques server consolidation is one of the main applications of virtualization technology in data centers. In this research work introduces Power Aware Load Prediction algorithm (PALP) for server consolidation providing efficient energy usage in Cloud computing making it greener is proposed. The virtualization has benefits of reducing total cost, increasing availability and agility to use this feature in Cloud computing environment. The PALP algorithm predicts the load in the host and act accordingly to minimize resource usage. The load prediction method is proposed which performs the classification of host overloading and under loading. This system improves energy efficiency rate and reduces power usage using PALP algorithm. The average energy efficiency rate is 87.93 kWh and time complexity is O (n) MHz which is considerably appreciable compared of existing analyzed algorithms.

***Keywords*—** PALP algorithm, Green cloud, virtualization, dynamic provisioning, energy efficiency.

I. INTRODUCTION

Cloud computing applications host their data in data centers consume huge amount of energy leading to high operational costs and carbon footprints to the environment we live. The power consumption of data centers has become a key issue. There is a need to create an efficient cloud computing system that utilizes the strength of the cloud while minimizing its energy footprint. Therefore, it is imperative [1] to enhance the efficiency and potential sustainability of large data centers. One of the most important technologies is the use of virtualization. It is way too abstract the hardware and system resources from an operating system. In order to face this issue, Green cloud computing is very useful for enhancing the efficiency and potential sustainability of large data centers. As the prevalence of cloud computing continues to raise, the need for power saving mechanisms also raises.

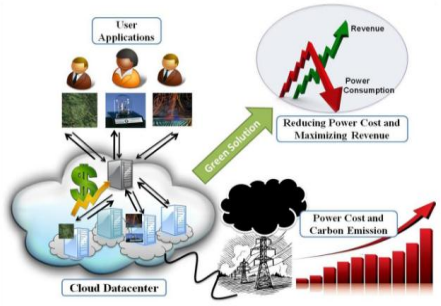

Fig 1.1 Cloud and Environmental Sustainability

In order to meet the goal of reducing power consumption, [2] a novel green cloud computing frameworks is developed. This framework is meant to define efficient computing resource management and green computing technologies, can be adopted and applied to cloud systems.

The use of live migration features within Cloud systems can be applied to Green computing in order to migrate away machines, VMs can be shifted from low load to medium load servers when needed low load servers are subsequently shutdown when all VMs have migrated away, thus

conserving the energy required to run the low load idle servers. This framework meets with the major areas of VM scheduling, VM image management, and advanced data center design. Due to the inherent disposability and mobility of VMs within a data center, ability to move and manage the VMs improve the efficiency, The integrated components of the Green cloud framework provide a sustainable development platform which has the largest potential impact factor to drastically reduce power requirements within a Cloud data center.

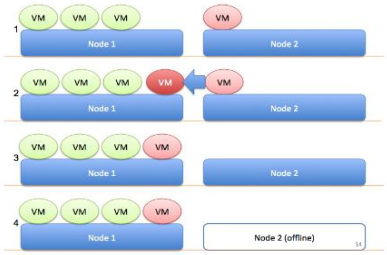

Fig 1.2 Virtual machine management dynamic consolidation technique

Research studies identified that energy consumption of server scales linearly with resource utilization of the processor. This encouraging fact further advocates the significant contribution of task consolidation to the reduction in energy consumption. However; task consolidation [3] can also lead to the freeing up of resources that can sit idling yet still drawing power. There have been some noticeable efforts to reduce idle power draw, typically by putting computer resources into some form of sleep/power-saving mode however, this mode of switching is not possible when utilization is low.

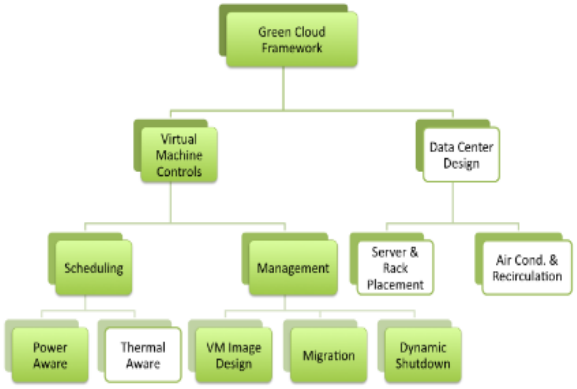

Fig 1.3 Green Cloud Frameworks

Some works also propose frameworks to enable the energy efficiency of Clouds from user and provider perspectives. Green Cloud architecture is designed to reduce energy consumption of virtualized datacenter by supporting optimized VM migration and VM placement.

II. PROPOSED METHODOLOGY

The base research by Chung-Cheng Li [3] and Yi Lua [4] helps us to conclude the proposed algorithm and architecture which is basically combination of two methodologies. The steps are as follows:

- Servers will be receiving a client request for some resources (cloudlets) on the cloud.
- Cloudlets will be allocated by the broker to the virtual machines in virtual machine list with the minimum execution time and threshold value.
- On the basis of total number of cloudlets and number of virtual machines threshold value is decided which further helps to maintain minimum queue length.

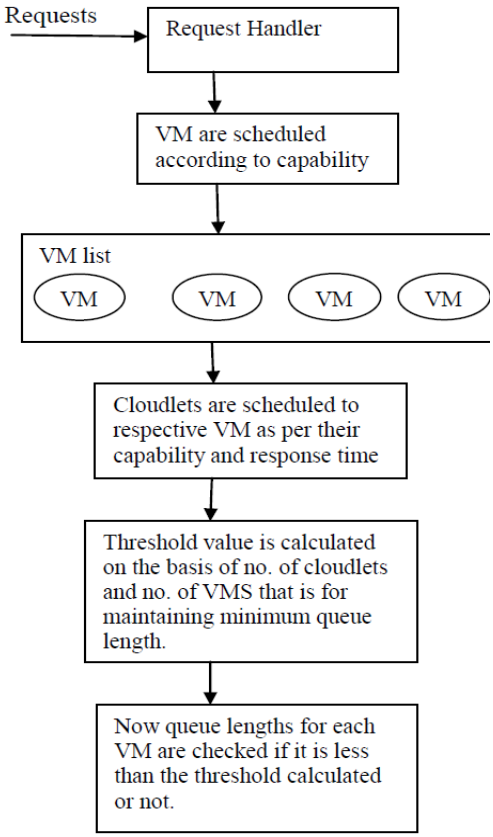

Fig 1.4 Architecture of Proposed methodology

III. NEED OF GREEN CLOUD COMPUTING

Data center resources are allocated based on their peak load characteristics, therefore maintaining isolation and performance guarantees. Until recently, high performance

has been the sole concern in data center deployments and this demand has been fulfilled without paying much attention to energy consumption. These data centers are expensive to maintain, and also unfriendly to the environment. Due to high energy costs, lowering the energy usage of data centers is a challenging and complex issue because computing applications and data are growing so quickly that increasingly larger servers and disks are needed to process them fast enough within the required time period. Green Cloud computing is envisioned to achieve not only efficient processing and utilization of computing infrastructure, but also minimize energy consumption.

PALP-*POWER AWARE LOAD PREDICTION ALGORITHM*
1.Input:hostlist,vmlist Output: allocation of VM's
2.vmlist sortDecreasingUtilization()
3.foreach vm in vmlist do
4.minPower←MAX
5.allocated Host←NULL
7.if host hasenoughresources for vm then
8.power ←estimatePower(host,vm)
9.if power<manpower then
10.allocatedHost←host
11.minPower←power
12.If allocatedHost≠NULL then
13.allocation.add(vm,allocatedHost)
14.return allocation

Comparative study of algorithms

ALGORITHM	TIME COMPLEXITY	ENERGY EFFICIENCY (kWh)
SERCON	$O(n^4)$MHz	89.92
FFD	$O(n^2)$MHz	88.17
PROPOSED ALGORITHM PALP	O(n)MHz	87.93

Table-1

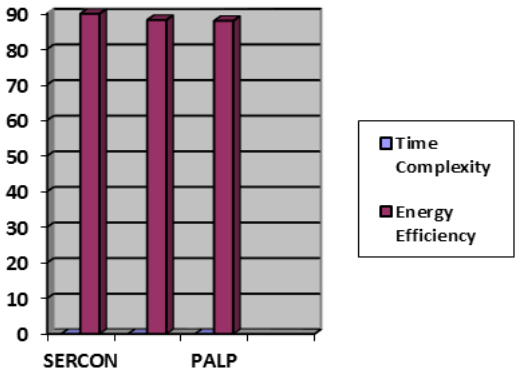

Figure-1.5

IV. CONCLUSION

In this research work a newly defined methodology PALP algorithm is proposed through which energy optimization is obtained. The dynamic consolidation of virtual machines using live migration and switching idle nodes to sleep mode is taking place. The proposed model is best in performing dynamic resource allocation through predicting the load in homogenous environment. Virtualization is the most effective way towards energy efficiency. The proposed methodology suits well for predicting the load in a homogenous environment and act accordingly. PALP algorithm has increased the energy efficiency in the Cloud data centers. This algorithm applies a prediction mechanism to historical loads for predicting the future loads and then makes decisions based on them. This approach leads to a substantial reduction of energy consumption in Cloud data centers. This load predictor algorithm is exploited to predict future load demand based on collected historical demand. In future, PALP algorithm can be extended further for heterogeneous environment. The system model could be extended to deal with a more diversity of workloads and application services for a better simulation of Cloud environments. A deployment of the algorithm in real server farms to show its efficiency in a real setting is also worth considering.

The proposed PALP algorithm which predicts the load in the host and act accordingly to minimize resource usage. The virtual machines are dynamically allocated in order to minimize the use of physical machines. The load prediction method is proposed which performs the classification of host overloading and under loading. This paper work follows the virtual machine allocation and consolidation method in order to minimize the resource usage. This intelligent system improves the energy efficiency rate and reduces power usage using PALP algorithm. The average energy rate is 87.93 kWh.

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Dr.R.Anbuselvi pursued Bachelors, Masters, Master of Philosophy and Ph.D in Computer Science from Bharathidasan University .She is a Research Supervisor. She has published more than 15 research papers in reputed International journals. Her research areas includes Artificial Intelligence, Cloud Computing, and Data Mining. She has more than 15 years of teaching experience, currently working as Associate Professor in Bishop Heber College and 8 years of research experience.

