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Energy Efficient in Cloud Computing

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Abstract: Today, both parallel and distributing computing have became ubiquitous in the forms of clouds and cyber physical systems, The size of cloud data center is growing rapidly. The larger the data center is, the more energy it consumes. Therefore, more and more researchers focus on energy efficient resource management techniques in the data center. In which manage the load factor and cpu utilization. we consider about cloud computing, its working, its problem definition, virtual machine requirements(executing VMs with similar execution time), objectives and future development of cloud computing. This has led to immense usage of energy, power consumption, usage of e-equipment's and so on. To overcome this, efforts and techniques are reinforced to save energy, power consumption and the usage of equipment's to save the planet. Energy efficiency is increasingly important for future ICT. To reduce the power consumption of cloud data centers we aim to reduce the efficient usage of power consumed by IT equipments. EEICC attainable by using eco-friendly computing resources.
Keywords: Cloud computing; Virtual machine; Energy efficiency; Resource management;

I. INTRODUCTION

Recently, cloud computing has attracted considerable attention and is believed to become one of the most important future computing and service paradigm. Everything in cloud computing is regarded as a service, such as IaaS (Infrastructure as aService), PaaS (Platform as a Service), SaaS (Software as a Service), etc. Thesecloud-based services integrate globally distributed resources into seamless computing platforms and make them available on a subscription basis using pay-as-you-use model to customers, regardless of their locations. This new paradigm brings growing demand for high performance computing infrastructures and leads to construction of large-scale computing data center, called cloud data center (abbreviated as CDC).

One of the major causes of energy inefficiency in datacenters is the idle power wasted when servers run at low utilization. Even at a very low load, such as 10% CPU utilization, the power consumed is over 50% of the peak power. Similarly, if the disk, network, or any such resource is the performance bottleneck, the idle power wastage in other resources goes up. In the cloud computing approach multiple data center applications are hosted on a common set of servers.Cloud computing, a new kind of computing model, is coming. This word is a new word that appears at the fourth season,2007. It is an extend of changing with the need, that is to say the manufacturer provide relevant hardware, software and service according to the need that users put forward. With the rapid development of the Internet, user's requirement is realized through the Internet, different from changing with the need. In fact cloud computing is an extend of grid computing, distributed computing, and parallel computing. Its foreground is to provide secure, quick, convenient data storage and net computing service centered by internet. The factors that impel the occurring and development of cloud computing include: the development of grid computing, the appearance of high quality technology in storage and data transportation, and the appearance of Web2.0, especially the development of Virtualization. The beauty of cloud computing is that another company hosts your application (or the suite of applications, for that matter).This means that they handle the costs of servers, they manage the software updates, and—depending on how you craft your contract—you pay less for the service. It's also convenient for telecommuters and traveling remote workers, who can simply log in and use their applications wherever they are. cloud computing is more energy efficient than traditional computing.

It can be said that cloud computing is green. Cloud computing technology uses better solutions to reduce power consumption by data centers. In order to improve the energy efficiency of data centers, cloud computing technology has offered many solutions including network power management, chip multiprocessing energy efficiency, data center power capping, storage power management solution,VMs share the conventional hardware in a secure manner with excellent resource management capacity, while each virtual machine is hosting its own operating system and applications. Hence, virtual machine platform facilitates server-consolidation and co-located hosting facilities. Virtual machine migration, which is used to transfer a virtual machine across physical computers, has served as the main approach to achieve better energy efficiency of data centers. Using virtual machine settingon physical machine on time of execution technology helps to efficiently manage workload, and therefore improves the total data center power efficiency.

II. LITERATURE REVIEW

ExtremeGreen: Extreme Green & Energy Efficiency in Large Scale Distributed Systems (CCGrid 2013) from Energy-aware VM Allocation and Scheduling on An Opportunistic Cloud Environment. International Journal of Advanced Research in Computer Science and Software Engineering Research Paper from Load Balance Based on Scheduling and Virtual Machine.
Energy Efficient VM Scheduling for Cloud Data Centers: Exact allocation and migration algorithms from
This paper investigate the idea of using exact algorithms to solve the problem of energy efficient VM scheduling in cloud data centers. Exact proposed algorithms can achieve significant energy savings while maintaining feasible runtimes.

III. OBJECTIVE OF STUDY

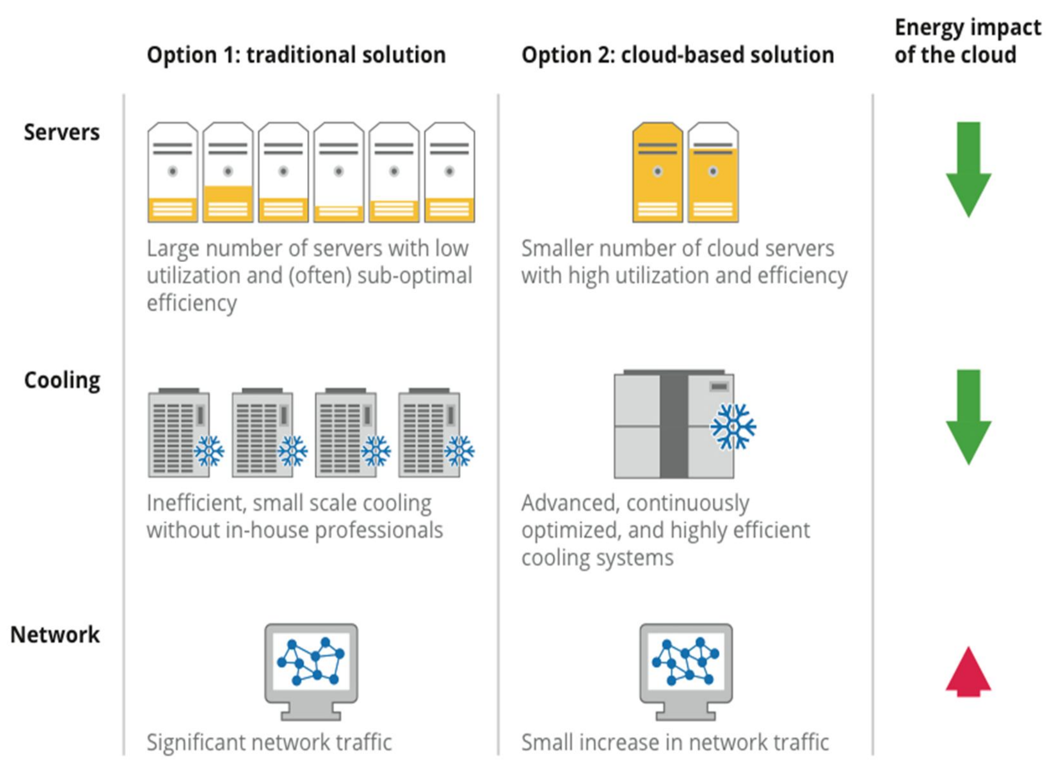
1) Assign to each PM (preferably in idle, hibernated or turned off state) only one VM, avoiding the penalty caused by the execution of multiple VMs on the same PM, and increasing the ECR due to more PMs are in execution.
2) To **as**sign the Set of Virtual Machines (SVM) to the Set of PhysicalMachines (SPM) trying to reduce the Energy Consumption

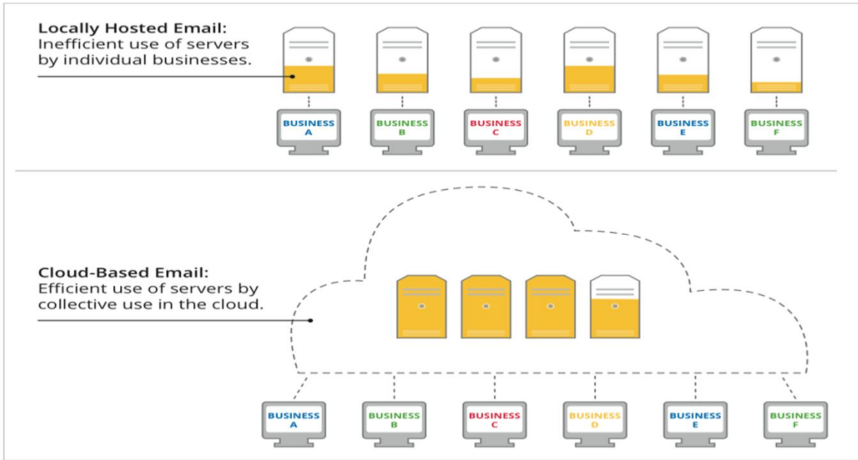
IV. RESEARCH METHODOLOGY

Secondary data is used for our study. Information is retrieved from website forward and newspaper articles.

V. CONTENT

Reduces direct energy for servers by 70–90%.4 Operations now require far fewer servers—and Google's servers are more fully loaded and significantly more efficient. A company that hosts its own IT services must have redundancy to guard against failure and excess server capacity to handle spiky demand. This can result in many times more servers than needed and it's common for companies to have server utilizations of 10% or less [5]. Because servers draw nearly the same amount of energy regardless of how busy they are, this results in a large waste of energy. Google is able to substantially increase utilization by aggregating demand across thousands of customers. In addition, Google data centers use customized, high-efficiency servers, power supplies, and software that need significantly less energy per unit of output than the servers deployed at most customer locations [6].
Why is the cloud more energy efficient?
The chart beloved compares the energy needed to support two models of office computing: the standard model and the cloud-based model enabled by Google Apps. Migration to Google Apps affects energy consumption in three ways:





Energy –aware Techniques: This algorithm is used once the scheduling process (using one of the 3 previous algorithms) has finished. The ECR consumed by every PM is calculated based on the ECR of each VM. The goal of this algorithm is to c a l c u l a t e the total power consumed by the VMs. Here propose three resource allocation algorithms that consider the following assumptions and goals:

Reduce the ECR required to execute a meta task (SVMs). Several VMs can be executed on a PM. The assignation of VMs to PMs is made in batch mode. There are enough CPU cores to supports the CPU requirements of the SVM. It is better to assign a VM to a PM with a user (busy state) or to a PM (with available cores) that is already executing another VM(busy state).

Physical machines are homogeneous.

Set of Virtual Machines (SVM).

Set of Physical Machines (SPM).

1) *Energy-aware VM scheduler:* Responsible for the optimal energy aware VM placement in the data center.
2) *Energy consumption estimator:* Can rely on an energy estimation tool that uses power models to infer power consumption of VMs or servers from resource usage.
3) *Cloud Iaas manager:* (i.e. OpenStack, OpenNebula and Eucalyptus) control and manage cloud resources and handle clients requests, VM scheduling and fetch and store images in storage spaces

Host overload detection: Adaptive utilization threshold based algorithms, Median Absolute Deviation algorithm (MAD), Interquartile Range algorithm (IQR)

Regression based algorithms: Local Regression algorithm (LR),Robust Local Regression algorithm (LRR),

Host under load detection algorithms: Migrating the VMs from the least utilized host

VM selection algorithms: Minimum Migration Time policy (MMT), Random Selection policy (RS), Maximum Correlation policy (MC).

Heuristic for the bin-packing problem – Power-Aware Best Fit Decreasing algorithm (PABFD)

ECR used by a VM executing a CPU-intensive task

Computer state	Execution with VM	ECR for an intensive CPU task (ECR with VM –with VM)
1(idle)	T	f(100-f(0)
2(busy)	$\frac{100*T}{Lfree}$	f(100)+ECRmon-ECRuser
3(hibernation)	T	f(100)-ECRhib
4(turned off)	T	f(100)

AT = Execution Time of a Task

f(x) = Function that return the ECR of a PM given its CPU used

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ECRmon = ECR consumed by the monitor of the PM
ECRuser = ECR consumed by the user using a PM
ECRhib = ECR consumed by the PM when it is hibernated algorithm to Calculate the Energy Consumption Rate of a Meta-task by a Set of Virtual Machine.
Algorithm 1. Custom Round-Robin Allocation
Algorithm 2. Sorting VMs and PMs to Minimize the Use of PMs
Algorithm 3. Sorting VMs and PMs to Minimize the Use of PMs an Executing VMs with Similar Execution Time on the Same PM

a) Custom Round Robin algorithm

Algorithm 1 custom Round robin algorithm
It does not consider the state of the PM.
It does not use a minimum SPM.
VMs with low requirements may be initially assigned to PMs with large CPU
capabilities (blocking VMs with larger requirements).

b) Sorting VMs and PMs to minimize the use of PMs

Algorithm 2: Sorting VMs and PMs to minimize the use of PMs
SVM descending ordered by cores required and execution time.
SPM ordered by (1) PMs running VMs, (2) PMs in busy state and (3) PMs with more available CPU cores.
We identified that if VMs with similar execution times are executed on the same PMs the ECR required to execute the SVM is lower.
Every PMs used to executed the SVM will execute tasks at peak capacity during a similar period of time.

c) Executing VMs with similar execution Time within same PM

Algorithm 3: executing VMs with similar execution Time within same PM
We identified that if VMs with similar execution times are executed on the same PMs
the ECR required to execute the SVM is lower.
Every PMs used to executed the SVM will execute tasks at peak capacity during a similar period of time.

VI. FINDINGS

Reslut1: when 10% of PMs are used

VMs	T. Cores	Alg.	UPMs	En.(kW)	ECR Gain
40	127	1	29	91.2	-
		2	20	80.94	11.35
		3	20	79.25	13.2
50	155	1	36	112	-
		2	23	99.6	11.63
		3	23	98	13.04
60	181	1	42	123.46	-
		2	27	101.18	18.05
		3	27	99.48	19.43
70	219	1	50	161.74	-
		2	31	132.56	18
		3	31	132.35	18.17
80	235	1	55	169.87	-
		2	33	132.6	22.18
		3	33	128	24.83

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Result2: when 50% of PMs are used

VMs	T. Cores	Alg.	UPMs	En.(kW)	ECR Gain
40	127	1	29	96.55	-
		2	16.46	66.63	30.99
		3	16.46	64.9	32.69
50	155	1	36	118.55	-
		2	20	81.52	31.24
		3	20	76.67	32.79
60	181	1	42.2	129.15	-
		2	27	86.7	32.87
		3	27	84.75	34.38
70	219	1	50	168.29	-
		2	36	112.4	33.21
		3	36	113.56	32.52
80	235	1	55	176	-
		2	40.2	117.78	33.08
		3	40.2	115	34.62

For the first scenario, the average gain on ECR by Algorithm 2 is up to 19% and up to 20% by Algorithm 3.In scenario 2, Algorithm 2 and Algorithm 3 save up to 29% and 30% more than Algorithm 1, respectively. Algorithm 3 saves 2% more energy in both scenarios than Algorithm2.

VII. CONCLUSION

In EEICC different energy-aware algorithms to allow Cloud to operate in an energy efficient way. We will implement the new proposed algorithms on the Cloud infrastructure. We will try more Allocation strategies that consider VMs shared resources constraints that can lead to performance on the quality of service. This EEICC investigate the idea of using exact algorithms to solve the problem of energy efficient VM scheduling in cloud data centers. Exact proposed algorithms can achieve significant energy savings while maintaining feasible runtimes.

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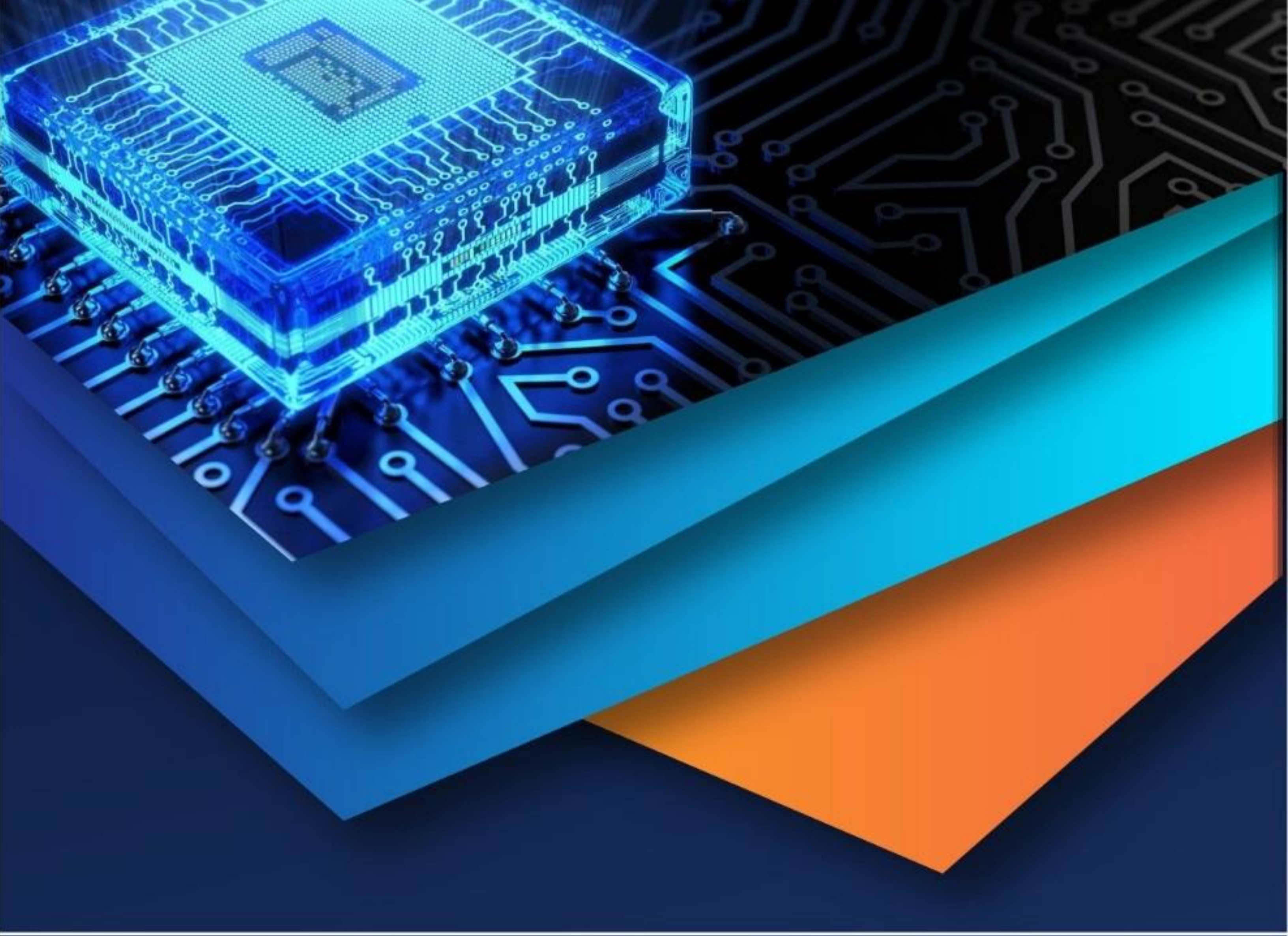

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