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A Survey on Virtualization Data Centers For Green Cloud Computing

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Abstract —Due to trends like Cloud Computing and Green cloud Computing, virtualization technologies are gaining increasing importance. Cloud is a atypical model for computing resources, which intent to computing framework to the network in order to cut down costs of software and hardware resources. Nowadays, power is one of big issue of IDC has huge impacts on society. Researchers are seeking to find solutions to make IDC reduce power consumption. These IDC (Internet Data Center) consume large amounts of energy to process the cloud services, high operational cost, and affecting the lifespan of hardware equipments. The field of Green computing is also becoming more and more important in a world with finite number of energy resources and rising demand. Virtual Machine (VM) mechanism has been broadly applied in data center, including flexibility, reliability, and manageability. The research survey presents about the virtualization IDC in green cloud it contains various key features of the Green cloud, cloud computing, data centers, virtualization, data center with virtualization, power – aware, thermal – aware, network-aware, resource-aware and migration techniques. In this paper the several methods that are utilze to achieve the virtualization in IDC in green cloud computing are discussed.
Key words: Green Cloud Computing, Virtualization, Cloud Computing, Data centers, quality of service, power – aware, thermal – aware, network-aware, resource-aware, migration.

I. INTRODUCTION

Recently, *cloud computing Environment* has its considerable attention. It is one of the most eye-catching future computing paradigms. It delivers powerful provisioning of various services and delivers the infrastructure, platform, and software as services available to customers in a pay per basis manner [3]. Such an essential commercial service providers are *Amazon*, *Google*, and *Microsoft*.

Internet Data Center (IDC) is a emerged as a back-bone infrastructure, housing large number of IT equipments such as servers, storage, network, power and cooling devices etc. That expedite the evolvement of broad range of services[1] Presently, several service contributors such as Google, Yahoo, Amazon, Microsoft, IBM and Sun, have their own data centers to facilitate the scalable services to the consumers[2].With the fast development of IT industry and increasing demand, the data centers became large in size. The power consumptions increased by 10 times over the early history of ten years [1].

Green Cloud is an data center architecture which goal is to lower the power consumption in data centers, during at the same time guarantee the performance and leveraging virtual machine (VM) migration. A big issue in *Green Cloud* is to consequently make the scheduling decision on migrating / dynamically consolidating VMs.

Need of green computing in clouds is Modern IDC, under the computing standard model are hosting a wide range of applications.

To address this problem, data center resources need to be managed in an energy efficient behavior [6] to drive Green computing. In particular, Cloud assets share not only to satisfy QoS requirements specified by users via Service Level Agreements (SLA), but also to cut down energy usage. Architecture of a green cloud computing

Fig: 1 presents the architecture helps for energy efficient service in Green Cloud infrastructure [7]. There are essentially four main entities involved:

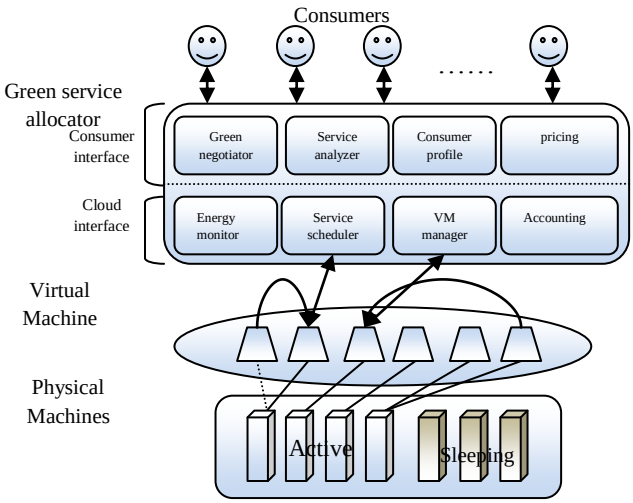

Fig.1: Architecture of a green cloud computing environment

a) ***Brokers /Customers:*** Cloud consumers/brokers submits the service application sends from anyplace in the world.

b) ***Resource Allocator Role*****:** Acts as the mediator among the Cloud and consumers.

c) ***Accounting:*** Preserve the actual usage of resources to compute the costs.

d) ***VMs:*** Multiple Virtual Machines runs dynamically started /stopped on a single machine to meet requests.

e) ***Physical Machines:*** it provide s hardwar e infrastructure for creating virtualized resources.

The ***virtualization*** facilitates atypical model such as personalized virtual environments could be generated upon the physical infrastructure [8]. The use of virtualization techniques provides great flexibility [9].

II. GREEN CLOUD FRAMEWORK

We exposed a typical framework applied to the Cloud computing in order to reducing the power. This framework is meant to define resource management and Green computing technologies can be and implemented to the systems.

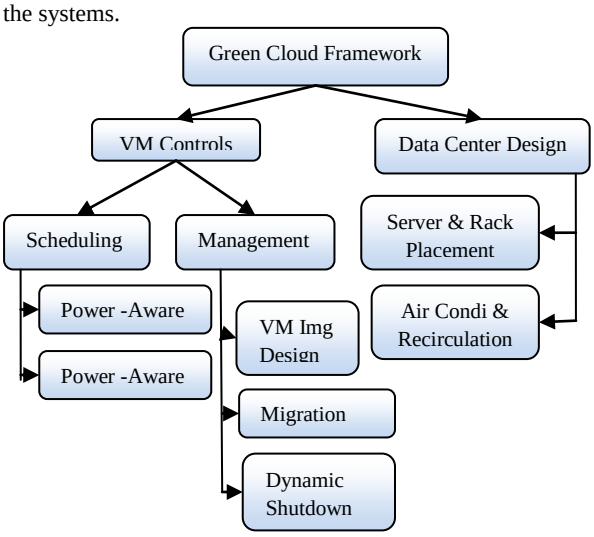

Fig 2: Green Cloud frame-work

Fig 2 illustrates a frame-work for improve the performance. There are two prominent areas, first, we can expand upon the baseline functioning of virtual machines and deriving a more efficient scheduling system for Virtual Machines. Due to the inherent disposability and mobility of VMs within a semi-homogeneous data center, we can leverage the ability to move and manage the VMs to additionally improve efficiency. The Virtual image management attempts to control and manipulate the size and location of VM

2.1Green Computing Techniques to Managing Power in Computing System

These techniques can be classified at different levels:
1) Firmware Level & Hardware and
2) Operating System Level
3) Virtualization Level
4) Data Center Level

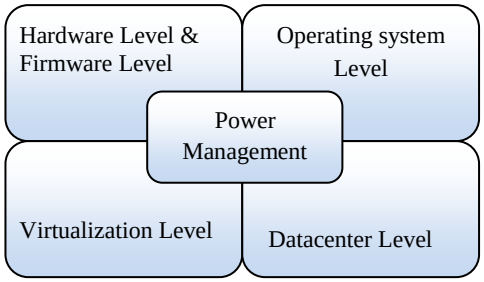

Fig.3: Power Controlling Techniques in Green Computing

Firmware level & Hardware level techniques that are implemented at the manufacturing point of a machine. These techniques contain all the optimization methods that are applied at the logic, circuit, architecture and system levels. Operating System level techniques include programs at operator level. Virtualization level techniques used the approach of VM to manage power.

D. ***Data Center Level Techniques-***

Data Centers contains a computer system and its telecommunication, data storage systems. It also requires backup power, cooling system and security. It has an efficient management and less power consumed environment. The approaches based on workload consolidation by entering requests for servers or applications, or virtual machines. The goal is to designate request of VM to turn off/sleep. The problem of the allocation is twofold: first its mandatory to allocate new requests; second one is, the performance of existing applications Data Center Level approaches further separated into two parts:-

- Non-Virtualized Systems
- Virtualized Systems

E. ***Virtualization-***

It is the abstraction of physical assets can be separated into a no of logical slices called Virtual Machines.

III. TAXONOMY ON VIRTUALIZED DATA CENTER FOR GREEN CLOUD COMPUTING

In this section, we proposed the discussion of this survey paper in the field of virtualization data center and green Cloud.

3.1 Power based Management in IDC

We categorized these diagnostic solutions into four separation in accordance with their different features [20]. The *first* focus on management of power deals with the tradeoffs between performance and the energy, such as whether transient power budget is allowed/not, with/without additional constraints. The *second*ly its keep be opportunity and granularity. Some solutions are more effective at the rack or IDC level. The *third* one is described by the approaches utilized.

Such as distribution scheduling and the VM consolidation. The *last* type of the solutions is DVFS is turning On/Off/ sleep. it is one of the fundamental to controls server power states. *Heo et al. [13]* proposed coordinated the DVFS with server ON/OFF [12], In *Barrsos et al[16*] presented how to use Chip Multi-Processor (CMP) to accomplish the power management.

3.2 Power -Aware Resource Allocation

Energy consumption becomes critical parameter in data centers, it's directly impacts both the power and operational cost. *Krioukov et al. [17]* proposed an energy cluster with power and exposure of slack. *Zhu et al. [5*] [resented several power based storage algorithms and online power aware algorithm. *Petrucci et al. [4]* proposed a powerful configuration and deploying power management policies.

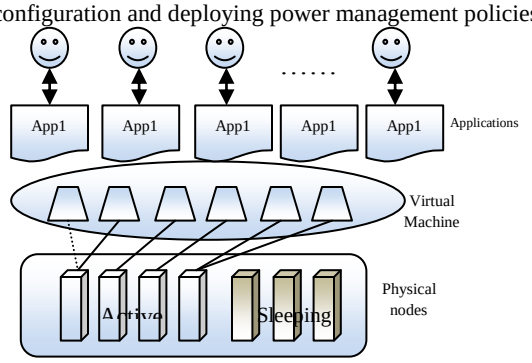

Figure 3: Data center architecture

Table 1: Lago Allocator Algorithm

Algorithm	Lago Allocator Algorithm
Techniques	The algorithm were organized with small, medium, and large datacenters having heterogeneous and homogeneous hosts
Work	It is constructing to handle Non-federated datacenters, so it is pretended that all centers are in the same cloud.
Uses	1.Doesnt need any information about the workload weight 2. Checks the processing needs and optimizes energy consumption on-the-fly.
Time	Minimizing energy and time consumption

Table2: DVFS (Dynamic Voltage and Frequency Scaling Algorithm)

Algorithm	DVFS (Dynamic Voltage and Frequency Scaling Algorithm)
Techniques	**1.**Energy efficient **2.**Adoptability of services
Work	**1.** Solution to decrease power consumption. **2.**Lowering the processor clock speed and supply voltage during the trivial time period
Uses	**1**.lower energy consumption **2**.No need to adapt applications or services to use it. **3**.Control the CPU temperature.
Time	Its Reduce Time

3.3 Thermal Management

Thermal management is an increasingly important architectural for high-speed computing Environment. It presents challenges that can apply to servers, racks, chips, and IDC[8].

3.3.1 Thermal based Management in Internet Data Centers

As we knew in Cloud, to store large amount of data large data center consumes power. So, it is necessary to equate the power of the IDC. *K. Sharma et al. [47]* presented the powerful thermal management for IDC. They describe small PDC (Programmable Data Centre) architecture in which a CRAC units. As shown in Fig.4 the cool freeze enters the room over the floor vent tiles in interchanging aisle s between the rows of racks.

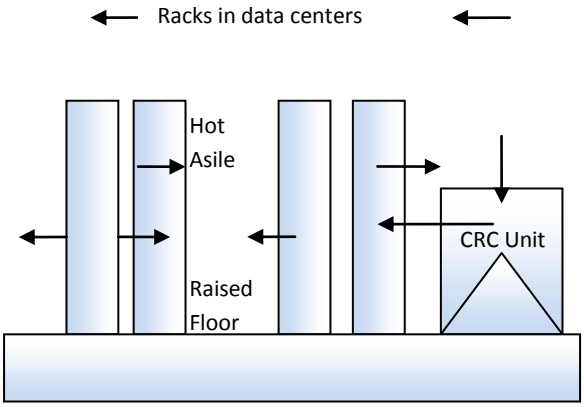

Fig 4: IDC Cooling System

Therefore, purpose of thermal workload scheduling is to reducing both the maximum temperature and the imbalance of the thermal aware distribution in IDC. Thermal-aware scheduling algorithms are in this session.

Table 3: TASA (Thermal Aware Scheduling Algorithm)

Algorithm	TASA(Thermal Aware Scheduling Algorithm)
Techniques	1-Job Sorting, 2- Resource Allocation
Work	**1**. It Categories Incoming Jobs In A Decreasing Order of Predicted Increased **2.** Control heats and Allocate work to Resources with Low Temperatures.
Uses	**1**.It Reduces The Temperature **2.**Update Resource Information Using Temp Sensors
Time	Its Reduce Time

3.4 Virtualization Based Migration

In the early research [18], VM migration tool to produce mobility to users work on distant physical machines. *Zap [20]*, implements the partial virtualization technology empower the migration to modified Linux Kernel.[14]. The research of live migration organized by *Clark*, the latest version of Xen now foundation the live migration of VM [19][17].

3.5 Virtualization-Based Resource Management

A enormous number of researchers deals with virtualization established resource for cloud. *Iqbal et al. [15*] proposed each VM scales up the operation to pacify the SLA. *Maniymaran and Maheswaran [24]* presented a concenter heuristic to figure out the VM establishment and location problem. *Campegiani [23]* implemented a genetic algo to catch the feasible allotment of virtual machines. *Almeida et al. [41]* proposed an open chain and applied SLA violation possibility.[21].

These are the authors presented various methods to discovered a solution to the different situations. Resource-aware scheduling algorithms are explained in the session

Table 4: Min Min Algorithm

Algorithm	Min Min Algorithm
Techniques	Minimum accomplishment time for each task in min-min is evaluated for all machines. Its selected and allocated to respective machine.
Work	Min-min schedules "best case" works first generating best schedules. Smaller tasks are finished first and then few larger tasks are executed while many machines are idling, resulting in poor machine use..
Uses	lower completion time for unscheduled jobs. Min-min is a easy and fast algorithm capable of best performance.
Time	Smaller tasks executed quickly

Table 5: Max-Min Algorithm

Algorithm	Max-Min Algorithm
Techniques	Max-min heuristic is same as to min-min algorithm. The lowest completion times set is calculated for every task and that with overall maximum completed time is selected and allocated to a corresponding machine
Work	This algorithm does better than min-min algorithm where when short tasks outnumber long ones. For e.g. if there is one long time consuming task, this algorithm executes small time consuming tasks parallel with long task. Max-min is similar to min-min
Uses	**1**. Max Min done short tasks concurrently with long task **2**. It calculates each resource's submitted tasks expected completion time.
Time	Concurrent and fast execution

Table 6: RASA (Resource Aware Scheduling Algorithm)

Algorithm	RASA(Resource Aware Scheduling Algorithm)
Techniques	Combination of Two classic Scheduling Algorithms Max-Min And Min-Min.
Work	The timelimit Of Each Task, Arriving Rate, Cost Of Execution On Each Of The Resource, Cost Of Communication are not taken into account.
Uses	**1**.It Used in Distributed Systems **2**.Clustering Works - Same Nodes Together and performing on these Groups
Time	Its Reduce Time

3.6 Network Aware in IDC

In this approaches considered network features for established the energy-efficient schedulers and identify the problem with existing multi-path scheduling protocols in classical fat tree network topologies. Network-aware scheduling algorithms are discussed in the session.

Table 9: RR (Round Robin Algorithm)

Algorithm	RR (Round Robin Algorithm)
Techniques	Easiest scheduling technique that utilizes the matter of time slices
Work	Time is separted into multiple slices and each node is given a particular time slice
Uses	Scheduler choose the first process from the chain, sets a timer to interrupt after one quantum, and delivers the process.
Time	Its Reduce Time

Table 7: Green Scheduling Algorithm

Algorithm	Green Scheduling Algorithm
Techniques	Server Load Balancing, Server four states-OFF, RESTARTING, ON, and SHUTTING.
Work	Servers system should be switch off/on. It will switch on the server when the workload increases and vice versa. Server to come to full operation-turned on before it is needed.
Uses	Efficient use of server. Reduce the wasting time and power
Time	Its Reduce Time

Table 8: DENS (Data Center Energy-Efficient Network-Aware Scheduling)

Algorithm	DENS(data center energy-efficient network-aware scheduling)
Techniques	Data center scheduling methodology. Combines energy efficiency and network awareness.
Work	Goal is to achieve the balance between separate job performances, job QoS requirements, traffic demands, and energy utilizes by the data center
Uses	**1.** Low computational load. **2**.designed to skip hotspots **3.**minimizing the computing servers
Time	Its Reduce Time

IV. CONCLUSION

The cloud IDC are important infrastructure for facilitates of its services. The energy consumption has emerged a critical problem from both the economic and environmental standpoints. Though our research presented we proposed virtualization data center on *Green Cloud*, which can help to consolidate workload and accomplish energy saving for cloud environment. We present the different techniques to optain the virtualization IDC and save energy.

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