EXISTING AND RELEVANT METHODOLOGIES FOR ENERGY EFFICIENT CLOUD DATA CENTERS

Sanjay Patel
Department of Computer Engineering, LDRP-ITR, Gandhinagar, Gujarat, India

Abstract: Cloud computing is a novel paradigm which defines a new style of deploying systems. It realizes the vision of delivering Computing as a Utility. These results in heightened cost of ownership, reduced return on investment, narrowed profit margin, decreased reliability and availability of datacenter resources, and above all it adversely affects the environment by increases carbon footprint. While meeting with the QoS constraints provider needs to provide services to the users with the green criteria. In the data centers servers consumed most part of energy and also cooling systems required. So it is of utmost importance to optimize energy utilization in datacenter servers. For achieve this, we can consume less the power of virtualization which is in Cloud Computing. Virtualization is the one of the techniques which is very useful for VM consolidation. In this paper, give the detailed explanation of existing and relevant methodologies for energy efficient cloud data centers. Also explain limitations of existing methodologies and techniques.
Keywords: Cloud computing, Green Computing, Green IT, VM consolidation, VM Placement, VM Selection, Host Underload Detection, Host Overload Detection

I. INTRODUCTION

Several methods and methodologies have slowly evolved for consolidation of VM for Heterogeneous work methods in cloud computing atmosphere. Its embrace completely different reasonably work, it's having completely different parameters like numbers of CPUs needed, buffer size of input and output files and length. To manage heterogeneous work there square measure varied type of methods describe below [1] [2]:

- Dynamically modify Heterogeneous workload on same physical h/w: In this section how to manage heterogenous workloads in various virtualized data centers has been explored. To compare the performance of different workloads the various utility functions used in this method. To improve the performance of heterogenous workloads these methods used.
- Cooperative resource provision and management policies: In the same organization to manage heterogenous workload Zhan et al.[1] proposed Phoenix cloud. These methods result in increased number of completed jobs which is run using various simulation kit. In this methods provide cooperative management and resource provision policies has been introducing.
- Map Reduce model to manage the Heterogeneous workload: For managing heterogeneous workloads Tiant al. [2] proposed new model which is directly working with map reduce. As per map reduce model the workload divide into three main parts like I/O bound, CPU-bound without shuffle and CPU-bound. As per methods, simulation results it has been proved by using triple queue scheduler mechanism the throughput of Hadoop by 30%.
- Automatically manages the data centers using real and simulation: To manage the datacenters running the heterogeneous workloads automatically Steinder et al. [1] have been introducing the new method. By using this method the heterogeneous workloads on any server collocate, using resource allocation the high-performance goal achieves and without heterogeneous workload it has been achieved. In this methods, implementation author has used both methods like real-time environments and simulation methods.
- Scheduling methods for HPC jobs and web-based applications: To manage heterogeneous workloads like web-based application and HPC jobs on the virtualized datacenters methods has been proposed by Goiri et al. [2], which gain maximum benefits to the cloud providers. The main aim is to provide energy efficiency to the clients or consumers, SLA violation penalties, and fault tolerance. In this techniques, the simulation results show the improved performance and energy efficiency at providers side is 15%.

II. ENERGY-AWARE RESOURCE UTILIZATION REQUIREMENT

A migration mostly depends on 3 things: the complexness of the appliance architecture; however Loosely coupled your application is; and the way a lot of effort you're willing to place into migration. Optimization issues within which the input is received in on-line a web manner and within which the output should be made online area unit referred to as online issues. Algorithms that area unit designed for on-line issues area unit referred to as on-line algorithms [3] [4].

Single VM Migration:
In this method for host various VMs, single physical server and host allocated. In this methods or techniques the time is split into N time frames and time should be decreased, the time of each frame is less than 1 second. The cloud provider or resource give to users the physical server consumed energy the resource provider responsible for the cost. It is counted by t1pC1p, where t1p is the is a time period and C1p consider as total power and energy cost (power and energy

per given unit time). Using the single parameter of the CPU performance resource usage and host capacity by various VMs. The dynamic workload was given to each and every VMs, The as per time period the CPU usage varies by VMs. The host is under loaded or overloaded. For accessing the CPU performance the all available VMs requested by the users, the capacity of the CPU demands will available. We define some methodologies for CPU demands of the performance of available capacity, between users and resource provider the SLA violation can happen. The provider side the SLA violation incurred, which is counted by Cvtv, where Cv the cost or penalty of SLA violation, and tv is generally referred to a duration of time SLA violation. The generality without, authors define Cp = 1 also Cv = s, where s 2 B+. This is same as defining Cp = 1:0=sand Cv = 1 [6].

Dynamic VM Migration:
Dynamic migration of generally support the various VMs moments between physical nodes from which VMs created. sometime VMs not used resources from provided by the server, also VMs can be resized as logically and a minimum number of resources from physical nodes consolidation, while unused resources off mode or switched off to reduce the power consumption and also its consume the less energy power to the cloud data center. To provide the high-performance power using the resource utilization with providing the SLAs without focusing the VMs allocation to the process for energy consumption [7] [8].
There are three main issues must be defined while exploring the energy efficiency and performance.

- First issues is, Server could reduce the QoS parameters like reliability it's cycling the excessive.
- Second one, sometimes required resource turn off in risky dynamic environments the workload may be variable and consolidation aggressive as point view of random workload, due to workload some VMs may not get required number of resource from the physical server, and due to this provider fail to meet required QoS.
- Third one, in virtualized environment SLA, provide or bring the performance parameters accurate as normal resources. As per users requirement of QoS, these all policies and mechanism minimize the energy and power efficiency can be helpful without compromising performance requirements [9].

III. HEURISTICS FOR DISTRIBUTED DYNAMIC VM CONSOLIDATION

Dynamic consolidation of VMs will be done supported the study of historical information of resource utilized by VMs.
This problem will separate using four parts [10]:
1) Host will be verified as limited number of process it ends up in be either migrated or host should be in off or sleep mode;
2) Host will verify as overladen, for reducing the load it requiring one or more migration or additional host provide various VMs.
3) From overloaded host selecting VMs must be migrated;
4) From various VMs from the host select one placement or finding a new one.

IV. HOST UNDERLOAD DETECTION

Using full host detection formula 1st realize all the full nodes. Then the system realizes minimum utilization compared with different hosts and provides them to VMs. If such system placement is feasible, Once migration is finished the supply the host should off or sleep aim of energy saving. If all the VMs from the supply cannot be attainable to place it may be kept active [11] [12].

V. HOST OVERLOAD DETECTION

To avoid performance degradation associated SLA violation every VMs figure host sporadically the host overload detection algorithm rule to VMs which is de-consolidate once required.
Methods for many heuristics planned for detection of the host overload [13].

- A Static processor Utilization Threshold: Using easy processor utilization threshold characteristic the both of overload and not overload various states of a host.
- A Markov process Model Host Overload detection: It is a mathematical framework for applied mathematics modeling of universe Processes.
- An adjusting Utilization Threshold: Median Absolute Deviation: -The planned adaptive-threshold algorithmic rule adjusts the worth of the processor utilization threshold counting various strength deviation of the processor utilization. the lower worth of the higher threshold for utilization purpose. This is often explain by associate that a better deviation will increase the probability of processor utilization reaching maximum associated inflicting a violation of SLA
- An adjusting Utilization Threshold: Interquartile Range: -In descriptive statistics, the Interquartilevary (IQR), additionally known as the midstream or middle fifty, may be a life of applied mathematics dispersion. Unlike the (total) vary, the interquartile vary may be a sturdy datum, for the breakdown purpose for 25%, and thus, commonly most popular entire vary. In the shake, cruciate energy and power distribute, half IQR are similar to the MAD.
- Local Regression Methods: The main plan for native local regression methodology fitting easy techniques localized subsets knowledge to make up a system curve approximates first data.
- Robust native Regression: This methodology is generally used for estimate successive identification. If the equalities are not same square measure glad, the physical host is identified to overladen. Given host algorithmic rule is denoted native robust native regression.

VI. EXISTING VM CONSOLIDATION STRATEGIES

VM consolidation is divided into main four problems as illustrated by the figure, along with the algorithms and strategies in each subdivision. In this section discuss about the VM placement strategies [14] [15].

This issues basically to improve the quality of the system, the host underload or overload and VM placement algorithm can be used. This can follow that computer code and also it's a layer of the system is layer native and managers of the systems (Figure). The managers which are native can reside in each and every module of the VMM layer. The main objective or aims of this too continue the monitor the VMs and also detect the host overload and underload detection. In a scenario of host overload detection, a manager run and initiate physical host selection algorithm for the VM selection. The another part of the system is global manager its reside the top of the system and its function to view the all local manager which manage all VMs. Whatever the decision was taken by the local manager, For optimized VM placement the global manager

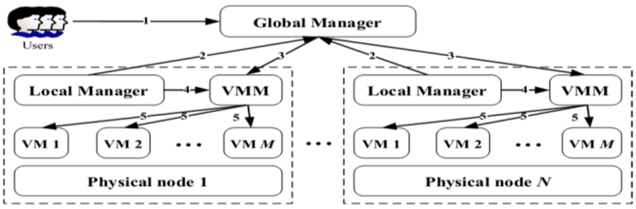

Figure 1. The System Model [16]

Assign the commands the local manager. VMM layer main role is to preform actual VM migration and all power modes node [17].

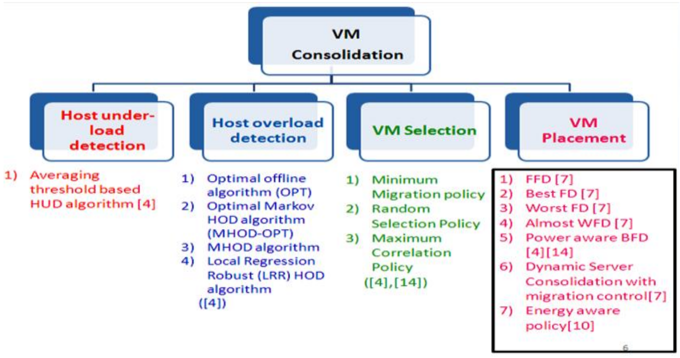

Figure 2. Subdivision of VM Consolidation Problem and Related Algorithms [18]

The VM placement refers to as the or mapping as the multidimensional bin packing problem. To mapping, the several items are main aim, where each available item on the tuple containing the smallest number of bins possible. In our case, we always consider as the

- Physical machines as bins with fixed capacity vector
- The main aim of the virtual machine must place into the physical machine representing the physical server capabilities

General steps of VM placement algorithms are:

Step 1: All VM requirements by the clients sorted in manners of decreasing order.

Step 2: Mapping of each VM to PM is performed according to the heuristic definition. Heuristics Techniques for VM placement are:

(A) First Fit Decreasing (FFD): The VM is mapped to the first PM with available capacity

(B) Best Fit Decreasing (BFD): In this scenario the VMs mapped with all available PMs left over the least the mapped to the obtained PMs

(C) Worst Fit Decreasing (WFD): In this techniques the biggest left over during VM mapped with PM to the obtained the PMs

(D) Almost Worst Fit Decreasing (AWFD): In this mapping techniques all VMs are mapped with the second best PM for least over the space between all

(E) Power Aware Best Fit Decreasing (PABFD): Each VM should be allocated to a specified host and this increases the number of power consumption lesser and lesser

(F) Dynamic consolidation with migration control for steady demands it's give the guarantee

for providing more stability to the VMs. Ensures that VMs with steady requirement do not migrate at any cost.

VII. LIMITATIONS OF EXISTING ALGORITHMS AND METHODOLOGIES

Based on literature survey there are so many limitations and disadvantages of existing algorithms and methodologies. Below mention all limitations of existing algorithms and methodologies [22].

- Energy efficient scheduling of virtual machines in a cloud with deadline constraint: This algorithm does not applicable for I/O intensive or network intensive VMs [8].
- Efficient Multi-Tenant Virtual Machine Allocation in Cloud Data Centers: In this technique optimization goal is obtained by the tedious task. It also integrates LP-MKP algorithm into various open source cloud computing platforms such as open stack and cloud stack [8].
- Real-Time Tasks Oriented Energy-Aware Scheduling in Virtualized Clouds: The maximum number of CPU cycles assigned to available virtual machines various tasks must be updated dynamically [9].
- Optimized task scheduling and resource allocation on cloud computing environment using Improved Differential Evolution Algorithm (IDEA): The major disadvantage of this techniques is the processing time of each and every sub-task depends on a resource, means in this method Pre-emption is not allowed [9].
- An Energy-Aware Fault Tolerant Scheduling Framework for Soft Error Resilient Cloud Computing Systems: This technique's major disadvantage is it does not give guarantee to execute within deadlines and it has compatibility issues when more than two VMs runs [9].
- Dynamic resource allocation strategies in cloud data centers: The reservation based resource needs more migration and therefore systems get highly overloaded [10].

- Energy-Efficient Resource Allocation and Provisioning Framework for Cloud Data Centers: Day by day dynamic requests received for that must work with improving the workload prediction module and it is required to test in other architecture also [10].
- Resource Allocation Optimization in a Data Center with Energy Storage Devices: In this method, it is required to address analysis of power hierarchy in data center and also complex power models required to be addressed [11].
- Dynamic Resource Allocation Using Virtual Machines for Cloud Computing Environment: Based on predicted future resource demands of VMs the evaluation of resource allocation status gets updated, also it is not provide efficient prediction for dynamic request and efficient request [11].
- A green energy-efficient scheduling algorithm using the DVFS method for cloud datacenters: The system model is very complicated to implement in real time cloud environments and heterogeneous servers. Whatever servers are chosen for a executing a job must have to satisfy the QoS requirements [11].
- Quality of Service Based Efficient Resource Allocation in Cloud Computing: In this method proposed algorithm implemented in cloudsim toolkit. It's required to implement in other cloud simulators and real-time cloud environments [12].

VIII. CONCLUSION AND FUTURE DIRECTIONS

From the paper it is concluded that the energy efficiency is important for data center. To enabling the VM consolidation the virtualization is very important techniques. In current work, I have considered network topology information only to reduce energy consumption incurred by network components when the VM has migrated far away from the source. In future work, to further reduce energy consumption by considering topology formed by the communicating VMs. The communicating VMs may physical nodes providing costly data transfer between each other. From the paper also concluded that there so many limitations and disadvantages of the existing methodologies.

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