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Flow distribution-aware load balancing for the data centre over cloud services with virtualization

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ABSTRACT

Data centers over Cloud characterizes with load balancing is a vital step in computing by offering shared computational power of the resources on demand. Being grounded on the fundamental concept of virtualization, it has significantly transformed the manner of delivering the IT services with minimized infrastructural requirements. The virtual environment involves the creation of multiple VMs (or virtual servers) with proper load balancing on a single physical node. In actual context, the multiple operating systems (OSs) can run on a single OS with respect to data centers underlying the migration allowance service platform. The running of virtual servers minimizes the resource idle time over the data centers with proper load balancing using a methodology called virtualization migrant over the cloud with load balancing with threshold(VMOVLBWT)[4][16] with respect to attributes, thus preventing the resource under-utilization . Additionally, the reduction in the amount of required hardware lowers the power needed for operation which consequently cuts down the energy demand. The decentralized service data centre with proper load balancing)[6][9] allocator with virtual machine migration over dynamic data centres.

Keywords—Data centres, Load balancing ,Virtualization

1. Introduction

The diminution in the energy demand by the ICT (Information and Communication Technology) sector is highly appreciated in the current scenario of rising energy crisis. Energy efficiency has thus gained prominence in the ICT data centers that host massive servers resulting in the induced upsurge of energy consumption levels . The emergence of cloud computing and the virtualization support offered by it, has further corroborated the efforts for realizing energy efficient computing. It has been observed that the virtualized cloud data centers require lesser energy as compared to the non-virtualized ICT data centers**[12][14]**. The extended facility of migrating the running VMs without any perceptible downtime with proper load balancing by considering proper dynamic thresholds(energy,bandwidth,capacity), from the heavily-loaded nodes to the lowly-loaded nodes, helps to manage the workload to minimize the energy consumption. The decrease in the consumed energy is due to the improved node utilization that results from a well-adjusted distribution**[2][8]** and execution of workload on the nodes with proper load balancing mechanism. The composed distribution of the workload among the nodes prevents node over-utilization that would have otherwise occurred. The optimally utilized nodes consume less

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energy as compared to the nodes that are over-utilized or under-utilized . The under-utilization of a node indicates that the node is sitting idle while the over-utilization of a node means it is running tasks beyond its capability. The concept of dynamically and transparently migrating the VMs from one host to the other, to find the best target host is known as Live migration. Apart from this, the key benefit of VM migration**[4][16]** is the identification of hotspots in the data centre. The over-utilized nodes are the hot-spots and their identification helps to lower the energy consumption by migrating their load to the less utilized nodes, leading to green cloud data centres. Proper decentralized infrastructure has to be considered in cloud data center's(VM) migration and virtualization.

2. Related Work

2.1 Virtualization

Virtualization**[14][9]** is the fundamental technology that powers cloud computing. This software separates compute environments from physical infrastructures, so you can run multiple operating systems and applications simultaneously on the same machine. For example, if you do most of your work on a Mac but use select applications that are exclusive to PCs, you can run Windows on a virtual machine**[9]** to get access to those applications without having to switch computers.

"Virtualized programming … empowers organizations to diminish IT costs while expanding the proficiency, usage and adaptability of their current PC equipment," said Mike Adams, senior chief of cloud stage item promoting at VMware**[10][13]**. Virtualization has numerous down to earth applications. For programming engineers, virtualization enables them to try out their applications on various situations without setting up a few distinct PCs. On the off chance that the application crashes on thevirtual machine, they can just close and restart the virtual machine to a past state without making harm their PC.One of the greatest advantages of virtualization is separate solidification. Rather than keeping up numerous servers that each have an alternate capacity, server virtualization enables you to part the assets of a solitary server for different purposes. Regularly server assets are underutilized, bringing about organizations spending excessively on server upkeep for a little yield.

2.2 VMMB:Virtual Machine Memory Balancing for Unmodified Operating Systems

Virtualization technology has been widely adopted in Internet hosting centers and cloud-based computing services, since it reduces the total cost of ownership by sharing hardware resources among virtual machines (VMs). In a virtualized system, a virtual machine monitor (VMM) is responsible for allocating physical resources such as CPU**[9][12]** and memory to individual VMs. Whereas CPU**[3]** and I/O devices can be shared among VMs in a time sharing manner, main memory is not amendable to such multiplexing. Moreover, it is often the primary bottleneck in achieving higher degrees of consolidation. In this pap er, we present VMMB (Virtual Machine Memory Balancer), a novel mechanism**[13][1]** to dynamically monitor the memory demand and periodically re-balance the memory among the VMs.

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2.3 Energy-Efficient Thermal-Aware Management of Virtualized HPC Cloud Infrastructure

Virtualized datacenters and clouds are being increasingly considered for traditional High-Performance Computing (HPC) workloads that have typically targeted Grids and conventional HPC platforms. However, maximizing energy efficiency and utilization of datacenter resources, and minimizing undesired thermal behavior while ensuring application performance and other Quality of Service (QoS)**[17][2]** guarantees for HPC applications requires careful consideration of important and extremely challenging tradeoffs. Virtual Machine (VM) migration is one of the most common techniques used to alleviate thermal anomalies (i.e., hotspots) in cloud datacenter servers as it reduces load and, hence, the server utilization. Fig 1 shows the concept of VM migration over three different clouds to balance the load on the server. Here initially the user uploads the file on some virtual machine in a cloud later as the load increases based on the load the virtual machine migrate from cloud which is overloaded to a cloud whose resources are less utilized. In this article, the benefits of using other techniques such as voltage scaling and pinning (traditionally used for reducing energy consumption) for thermal management**[13][9]** over VM migrations are studied in detail.

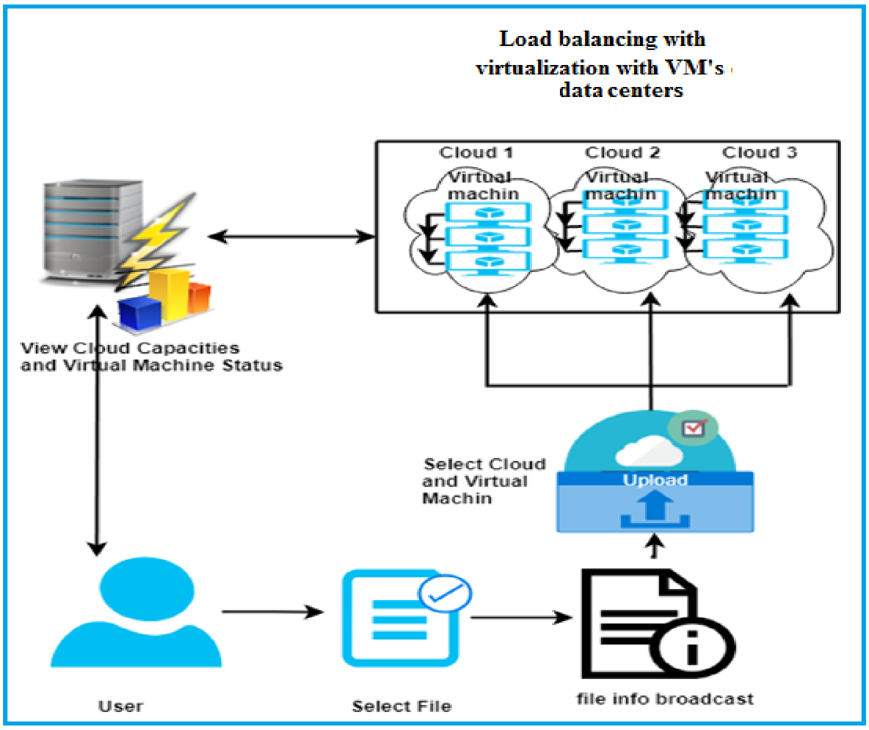

Fig 1:**Flow of a user Uploading a file on to the Cloud equipped with many virtual machines**

As no single technique is the most efficient to meet temperature/performance optimization goals in all situations, an autonomic approach that performs energy-efficient thermal management while ensuring the QoS**[14][12]** delivered to the users is proposed. To address the problem of VM allocation that arises during VM migrations, an innovative application-centric energy-aware strategy for Virtual Machine (VM) allocation is proposed. The proposed strategy ensures high resource utilization and energy efficiency through VM consolidationwhile satisfying application QoS by exploiting knowledge obtained through application profiling

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along multiple dimensions (CPU, memory, and network bandwidth utilization). To support our arguments, we present the results obtained from an experimental evaluation on real hardware using HPC**[7][14]** workloads under different scenarios.

3. Implementation

3.1 Virtualized migrant over the cloud with load balancing with threshold(vmovlbwt) system

Virtualization in cloud computing is a mechanism to abstract the hardware and the system resources from a given operating system. This is typically performed within a cloud environment across a large set of servers using a Hypervisor or Virtual Machine Monitor as simulation that lies in between the hardware and the Operating System.Though Hypervisor one or more virtualized OSs**[7][15]** platforms can be made available, one of the key advantage of cloud computing. Here cloud computing data centres infrastructure is deployed on top of the virtualization technologies for load balancing to exploit the capability to its maximum potential while still maintaining Quality of Service(QoS) to clients. QoS can be defined in terms of Service Level Agreement (SLA) **[9][12]** between the service provider and the client. The concept of consolidation of Virtual Machines (VMs) is applied to decrease energy consumption as it significantly reduces the percentage of idle power in the overall infrastructure. Such a consolidation can be done either statically or dynamically at run time. In the static approach, the mapping of the VMs**[8][6]** to physical infrastructure cannot be changed at runtime. A dynamic consolidation of VMs allows the reassignment of physical resources at runtime, when the load on the virtual machines increases or decreases. In case there is a low load on the VMs less physical resources need to be employed to provide certain performance level. In the other case, if the load on virtual machine increases, more physical resources can be assigned. The VMs can be migrated to another physical host if the current physical**[14][10]** host gets overloaded. A dynamic consolidation of virtual machines mandates the cloud provider to monitor the resource utilization of virtual machines in order to determine how many physical resources have to be assigned for a particular event.The parameters over the cloud with virtual machine migration are Bandwidth,Ram Capacity and Through put.

3.11 Requirements

- Creation of webservices(3) with SOAP using XFIRE API
- Deploymentation of webservices over the glassfish server.
- Dynamic creation of virtual machines with system specifications.
- Resources allocation dashboard with central repository.
- Data migration alerting system with custom instructions.
- Data storage with deployment check and parameters match check.
- Virtualization with deep learning methodology for non repetitive process.
- Process updation log with VM removal and VM enhancement dashboard from central repository

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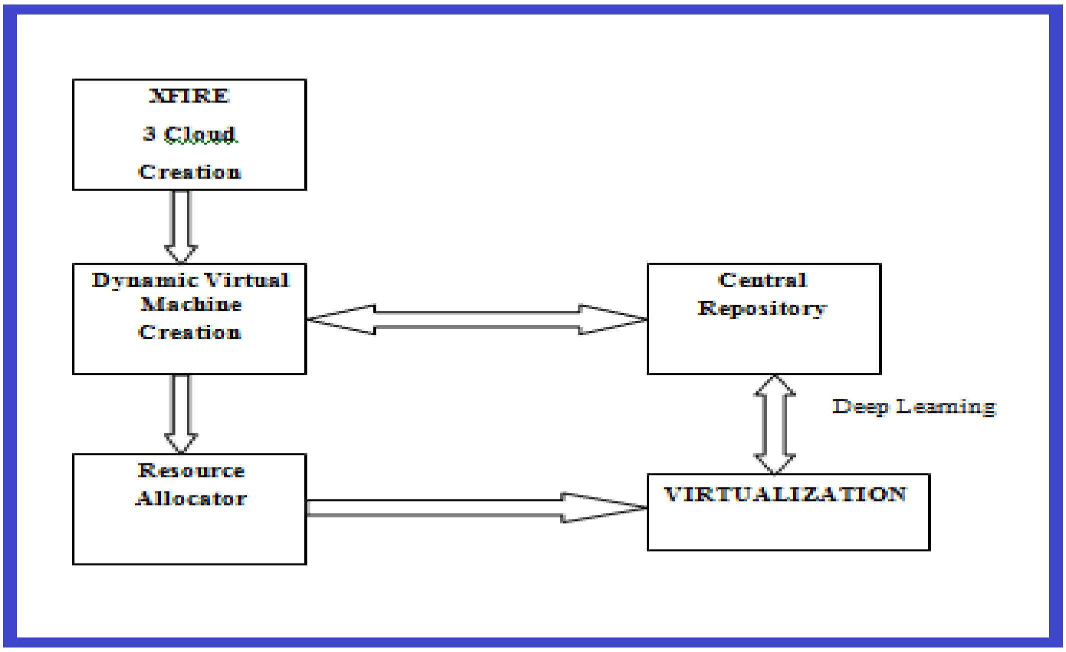

Fig 2**: Organizational Flow diagram**

In Fig 2 Once the users of cloud sends the data over the cloud SOA(Service oriented architecture) which is build using SOAP(Simple object access protocol), it will take the data as round robin passion and among all three available clouds which one will be in the first loop that cloud will take the data and checks with all the virtual machine's capacities(bandwidth, capacity and throughput)**[4][16]** if none of the virtual machines is able to acommadate (load balancing allocator)the data it will migrate the data to neighbouring**[9][10]** cloud and the current virtual machine which was selected by the client will be removed and LOG will be updated. And the data accommodated with proper virtual machine using virtualization mechanism. This will be deep learned with central repository with proper process allocation**[9][12]** by the clouds.

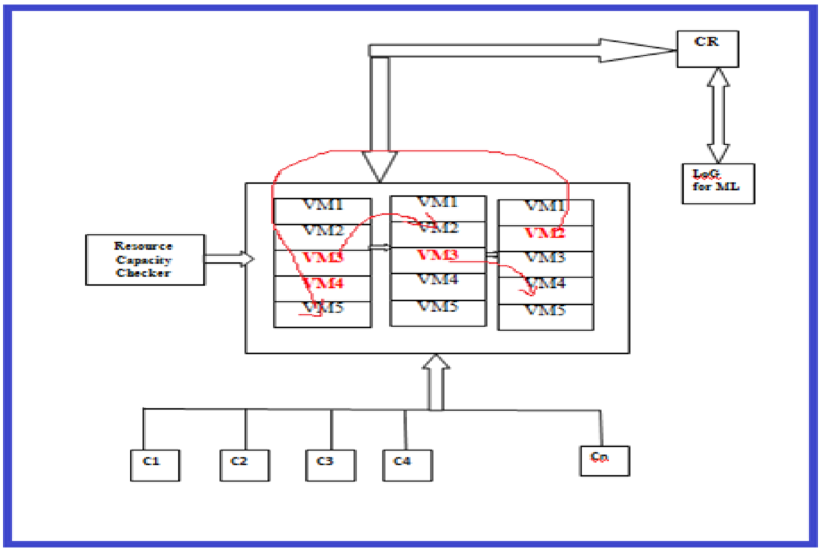

Fig 3**: Migration of Virtual Machines between various clouds**

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Table 1**. Existance of a virtual machine in a particular cloud**

Cloud	Soure VM	Destination VM	Deleted	Process
C2	C2(v4)	C2(v4)	No	96y890
C3	**C3(v2)**	**C1(v5)**	Yes	M96hb9
C1	**C1(v3)**	**C2(v2)**	Yes	8986m7
C2	C2(v4)	C2(v4)	No	7877e3

Fig 3 shows migration of virtual machines from one cloud to another based on the load on each cloud and corresponding updates has been made in the log.In the Table if the process **M96hb9** and **8986m7 [5][17]** repeats the entire **VMOVMBWT** framework and if the same repeats with system next time central repository will ignore that broad cast because of virtual machines were removed with deep leaning and this is the continuous repetition by **VMOVMBWT.**

VMOVMBWT Algorithm Pseudocode:

```
∑CL   ←   Cloud Initialization
∑VM   ←   Virtual Machine Initialization
∫λ    ←   Threshold Initialization
∴ L^DATA  ←  Log Table

CL ← ALLOCATION (VM)     // Virtual Machine Allocation to Clouds
λ = ASSIGN (CL, VM)      // Threshold Allocation by Central Repository


START
CHECK (DATA)
IF
[CL, VM ] = COMPARE (DATA, λ)     // Cloud can Accommodate with Virtual Machine or not
IFNOT
CL=EXTRACT (VM)
L(CL, VM)
CL ~ VM   // Remove Virtual Machine
End IF
End IFNOT
```

4. Discussion

Cloud computing is another example of data benefit arrangement which is raised by Google and IBM, and pushed by other IT gaints. The idea implies giving clients who submit demands with programming and data benefits on request from registering assets that are heterogeneous also, self-governing, which are viewed all in all from the outside. The introduction of this term and its execution on day by day life depends on different ideas and programming projects from the parts of disseminated processing, utility figuring, matrix, arrange, web

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benefit, programming administration, virtualization and different things It is a prevalent saying that arrangement of different sorts of programming and administration by means of Internet is the objective and feeling of distributed computing, which is likewise associated as Utility Computing; while in the meantime, fittings and programming projects that are used to give administrations manage the high society applications as a substance that is called cloud in a word. So it is cloud computing depicted from two layers.

On the upper layer, end clients get to mists by means of Internet to get administration or utilize apparatuses and processing assets gave by the cloud for individual utilize or enterprise business. This kind of administration is contracted as SAAS (Software as a Service). It is suggested that SAAS might be actualized with the assistance of Web2.0. On the lower layer, cloud itself is developed over equipment assets and related foundation programming projects. A cloud is comprised of equipment types and virtual products that are utilized to oversee hardware.

5. Experimental phase

The variation of bandwidth,capacity and throughtput due to migration of virtual machine from C2 to C3,C3 to C1 and C1 to C2 is depicted in the Fig 4.Since lack of bandwidth but capacity and throughput is quite ok with threshold but this indicates c2's one of the virtual machine was removed and assigned process id for this entire virtualization.

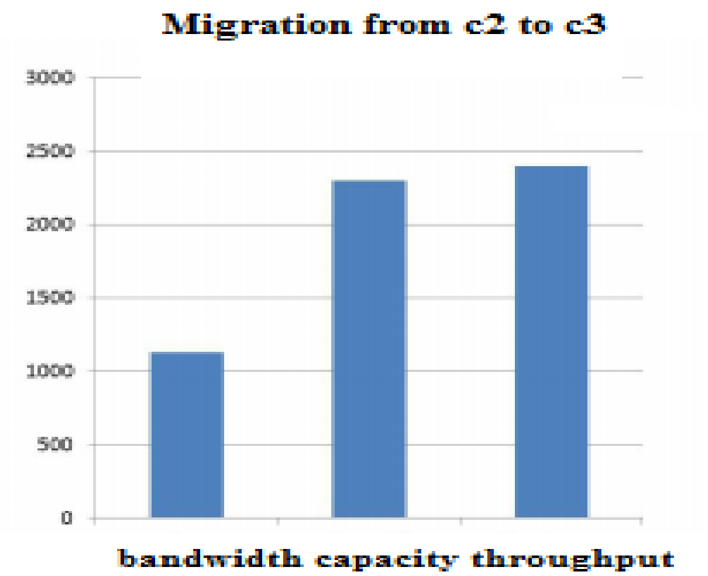

Fig 4:**Variation of Bandwidth,capacity and throughput due to VM Migration**

6. Conclusion & future work

Energy efficiency has appeared as the utmost essential design requirements for the current computing systems, this paper has proposed an energy aware virtual machine migration technique that performs live migration of the VMs from one active node to the other active node. The proposed technique makes use of a bio-inspired Firefly optimization technique to find the best node for the overloaded VMs to be migrated, to achieve energy efficiency in cloud data centres. It maximizes the energy-efficiency through the optimum migration of VMs,

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thereby improving their source utilization levels. The proposed approach can be used as an effective solution for VM Migrations in cloud environment where a large number of nodes are available with the energy restrictions. Improvement in the results with respect to the existing approaches—ACO &FFD, proves the efficacy of the proposed algorithms with higher scalability and lower number of host usage. The proposed technique is better in achieving the energy efficiency as compared to the other techniques as its saves an average of 44.39 % of energy by saving an average of 34.36 % of hosts and by reducing an average of 72.34 % of migrations. Thus, this technique reduces the energy consumption of cloud data centres by saving the nodes and the number of migrations, thereby contributing towards the cloud computing.

In the future the entire framework will checks how many virtual machines were removed will be checked with proper attributes issues and this work will be extended with healing infrastructure and all the virtual machines in the erased pool will be reconstructed and will be acommadated in the clouds to build the entire infrastrucure back to the normal form with proper neutralization methodology.

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