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A Multimedia Cloud Computing Model for Combinatorial Virtual Machine Placement

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Abstract: Cloud computing, which allows users to access subscription-based services on a pay-as-you-go basis, has recently transformed IT departments. Today, a variety of media services are offered through the Internet owing to the development of multimedia cloud computing, which is based on cloud computing. However, as multimedia cloud computing spreads, it has a negative influence on greenhouse gas emissions due to its high energy consumption and raises expenses for cloud users. Therefore, while still providing consumers with the resources they require and maintaining a high level of service, multimedia cloud service providers should make every effort to consume as little energy as possible. This proposal proposes residual usage-aware (RUA) and performance-aware (PA) methods for virtual machine placement. To save energy, find a suitable host to switch off. These two techniques were merged and applied to cloud data centers in order to complete the VM consolidation process. The outcomes of the simulation demonstrate a trade-off between energy consumption and SLA violations. Additionally, during VM deployment, it can manage shifting workloads to prevent host overload, dramatically lowering SLA breaches.

Keywords : Multimedia Cloud Computing, Performance-Aware (PA), Virtual Machine (VM) Migration, Energy Consumption.

I. INTRODUCTION

The potential of the cloud computing paradigm to provide pay-as-you-go subscription-based services to users in recent years has caused it to quickly acquire popular awareness. The cloud services known as Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service are easily consumable by users everywhere. What cloud computing is all about is the fact that these developers no longer have to make significant financial investments in the hardware and software infrastructure required to introduce their services or hire personnel to carry out their ideas.It is yet another benefit of using the service, 1.

The possibility of dynamically consolidating virtual machines is made possible by large data center virtualization technologies. Dynamic VM Consolidation technology uses real-time VM migration to cram as many virtual machines (VMs) as feasible onto a single host in order to minimize power consumption and increase data center host utilization to increase, 2. With technology, dynamic VM consolidation might worsen QoS and potentially increase power consumption. However, adding migrations reduces quality of service (QoS) and raises a number of factors relating to response times, failures, timeouts, and energy consumption since the workloads of applications operating on VMs vary. and VM migration expenses can rise.

Selection of virtual machines, identification of underutilized and over utilized hosts, efficient VM placement techniques that establish new mapping links between ideal hosts and transferred VMs Create a machine selection strategy for the VM integration framework, 3. Ensure QoS in your cloud data center while achieving the lowest energy consumption, virtual machine migration counts, and SLA breaches. Creating a hybrid predictive model based on the ARIMA and Gray models to calculate CPU usage across all hosts and determine whether it is too high or too low. In order to choose the virtual machine with the lowest cost, the suggested VM selection technique, known as AUMT, combines average CPU utilization and migration time. Target hosts with the greatest rewards are chosen using the CUE CC suggested heuristic approach to virtual machine placement, along with real-time changes in CPU utilization and power consumption.

To maintain better operating conditions and assure data center quality of service, VMs are specifically transferred to better hosts when a host gets overcrowded. It doesn't necessarily need to move all low-load hosts as frequently as feasible in order to save power because extra power is used when hosts go from idle to low power, 4. Since CPU usage has the most influence on energy consumption, indications of the present and future CPU utilization are thought to be accurate predictors of overloaded and under loaded hosts. It may assess the health of a host by forecasting near-term CPU utilization based on historical data, and it can turn off underused hosts to conserve power.

II. LITERATURE SURVEY

A thorough analysis of data center energy efficiency has been conducted. Due to the widespread use of virtualization technologies, EVM consolidation has been extensively employed in prior research as a useful strategy for lowering data center energy consumption, 5-6. This method periodically turns off idle hosts while consolidating existing EVMs onto a limited number of hosts via real-time migration. Dynamic EVM consolidation may generally be broken down into a number of smaller concerns. Earlier approaches in this field have typically concentrated on minor issues within larger processes as shown in figure 1.

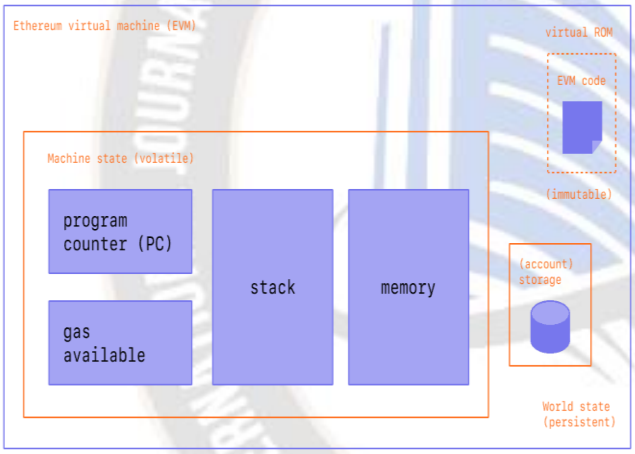

Figure 1: Ethereum Virtual Machine (EVM)

2.1 An energy- and migration-aware virtual machine

Energy efficiency has risen to the top of the list of issues for today's cloud data centers. Virtual machines (VMs) can be dynamically combined, which is a promising method for data centers to utilize resources and energy more effectively. However, the live migration technology on which VM hardening depends is intrinsically expensive, and the cost of this relocation is frequently as variable as that of data centers. The two linked target improvement challenges are examined in this proposal, 7-8. In summary, it examine how to significantly consolidate VMs in heterogeneous cloud datacenters to cover restricted relocation expenses and save as much energy as possible .In order to balance these two opposing goals, the Union Score Paper tries to provide an overall evaluation based on the transfer cost assessment methodology and a thorough maximum savings assessment technique. In order to increase the combined score, it describes the trading activity and gluttony heuristics and suggests an extended aggregate inheritance computation (IGGA) for each.

The evaluation results demonstrate that IGGA outperforms the present VM composite method after a thorough examination has been conducted. Reducing energy consumption has become a top priority for cloud providers due to the rise in the number of physically active devices in data centers that consume a lot of electricity. The VM-Union, which is high performance and energy aware, offers a promising way to save energy use in cloud data centers. The test makes an effort to highlight the top pupils by taking heterogeneity and relocation expenses into account, 9. The consolidation score is meant to give a comprehensive evaluation of two competing aims for power and travel cost savings. The integrated score based on greedy heuristic trading activity was improved using a specially modified aggregate inheritance computation known as IGGA. Reproducible experiments have demonstrated that, when compared to conventional solidification techniques, IGGA consistently produces the greatest scores, 10-15. It intends to create a comprehensive solution for virtual machine consolidation, and the schedule of activities is decided by customer requirements. Additionally, it's critical to think about how to effectively design a subset of agents for the best Pareto placement when data center vendor trends are only known from the past.

One of the top issues for today's cloud data centers is lowering energy usage. There are two elements that led to the current circumstance. First of all, data centers need a ton of electricity. This is anticipated to be the major expense driver for data center vendors. The most recent study by Koomey shows that data centers used between 1.1% to 1.8% of the world's total electricity in 2014 and 6% of the total in 2008.

2.2 Cloud task using DVFS for energy efficiency

Sambit Kumar and co-authors of this work Mishra contends that the capacity consumed must be kept to a minimum in order for the rising cloud computing platforms of today to be functional and profitable. Both industry and academia have given cloud server farms a lot of attention since they use a lot of energy and raise running expenses. One of the most crucial energy-saving techniques in cloud server farms is allocation planning, 16. The significance of this NP-hard problem involving company allocation in a heterogeneous environment drives specialists to propose a number of heuristic solutions. A solution based on special voltage cyclic scaling (DVFS) has been suggested to reduce the complexity of energy usage in cloudy environments. The primary goal is to handle the trade-off between energy usage and the structure's manufacturing margins. Here, it explicitly describes a model that consists of numerous subsystems and assess how well the calculations worked in a diverse setting. An in-depth examination of power-conscious scaling in distributed computing settings is provided in this article. In order to test the use of Force in cloud server farms, this proposal integrates the Force model with important internal work techniques, including enrollment, iterative reconfiguration, and DVFS for enterprise-specific voltage adjustments and iterations, 17. It put out a framework model with a number of sub-models for heterogeneous cloud frameworks. A variety of computational (arbitrary fraction and FCFS) displays are also examined using the suggested DVFS-based planning method. The suggested MEEDTSA tends to result in large energy savings over other conventional approaches, as was described in the previous stage. This proposal is an energy-based innovation in the field of green distributed computing, where it is required to take into account the assignment of tasks with complex needs, and it is currently necessary to further improve this model due to specific situations. It is effective. Distributed computing is another feature that makes on-demand management possible, 18. Customers don't need to register or meet any quotas in order to access the material they require from anywhere in the world. In distributed computing, virtualization, circular processing, and framework registration are the fundamental building blocks. In a distributed computing environment, resources are kept in pay-as-you-go cloud server farms. Dropbox and Google Apps are a couple of his more SaaS applications. Customers don't need to download or install additional software to create and deploy web apps using PaaS.

2.3 Scheduling algorithm for cloud data centers using clustering, duplication, and DVFS techniques

According to this proposal by BehnamBarzegar et al., performance and energy metrics fundamentally hinder the ability to reserve identical task-based applications in advanced computing frameworks like cloud data centers. Replication and grouping systems, together with DVFS procedures, are each independently created to minimize power usage and make performance restrictions like throughput and manufacturing margins simpler. In this proposal, it suggests two-step EATSDCD computation, which saves time and energy. The computation uses DVFS to assign the job diagrams to the required priority on the data center processors using a combination of duplicating and grouping techniques. In order to run a directed acyclic graph (DAG) and still fulfill performance demands, replication and bundling techniques must be carefully balanced in the initial stage. The main goal of EATSDCD was to reduce the amount of energy used in the subsequent stages, 19. Following the allocation of play time to neighboring errands for each assignment of a non-basic technique, the number of basic routes and station activities were determined. Then, without increasing the project's length, decrease the DVFS-enabled processor iterations to conduct non-critical tasks concurrently with the idle and readiness phases. It was also compared to calculations based on overlaps and bundles as well as DVFS-based estimates. The results demonstrate that, when compared to calculations using Power Aware List-based Scheduling (PALS) and Power Aware Task Clustering (PATC), the suggested calculation can save 9.3% and 30% energy in terms of energy consumption and manufacturing margin, respectively. Organize and duplicate homogeneous/heterogeneous cloud data center processors. EATSDCD can be utilized to apply DAGs like STG to boost energy productivity and fulfill throughput and production margin requirements. Scheduling increases initial throughput while consuming less communication energy. This is generated by computing attribute groups and overlaps that take energy into account, 20. The following level concentrates on DVFS procedural particle execution per CPU. As a result, the amount of power used by the DAG during idle, communication, and task-related buffer times is reduced together with the clock repetition and supply voltage. Additionally, it was compared to estimations based on overlaps and bundling as well as estimates based on DVFS. According to the findings, the proposed computation can reduce power consumption by 8.3% and 20%, respectively, when compared to the PALS and PATC computations, without sacrificing performance. Compared to RASD and HEFT calculations, execution time was shorter in heterogeneous conditions. Three zones can be identified for further research. Negotiations to get green SLAs on the percentage rise in manufacturing margins will start right away with the assistance of customer and expert collaborations.

2.4 A decoupling of data center growth and electricity consumption

Arman Shehab et al. developed an application for this proposal. In order to satisfy the increasing demands of industrialized economies, data centers, which are energy-intensive buildings, are expanding in size and number. In order to gauge interest in powering US server farms in the long run, this proposal examines observed and anticipated power consumption trends related to employment in server farms. Increase, 21. The findings indicate that although interest in electricity greatly rose in the new century, it has virtually decreased since then to a nearly constant yearly consumption of roughly 70 billion kWh. Although employment in server farms is expanding quickly, a comparable rise in power demand has been prevented by careful energy management. Model calculations show that server farms could use various amounts of power. Depending on the proper speed of productivity-enhancing activities during this decade, the predicted 2020 US server farm liability motion asks for total energy use to vary by about 135 billion kWh. Although recent increases in server farm energy productivity have been beneficial, there is a need to advance in 2020 and beyond since patterns indicate that past skill sharing may not be appropriate for future server farm jobs. It is unclear how the server farm's power usage will vary. The findings indicate that, in order to further decouple power issues, server farm power regulation effectiveness needs to be greatly increased. Mapping the energy consumption of server farms is a challenging endeavor due to the quick expansion of computerized services, the quick turnover of IT equipment, and the constrained perspective of this financial sector. The surprising patterns produced by the DOE server farm model in 2016 are covered in this proposal with the most recent data and knowledge. The relationship between server farm interest and energy productivity performance over time and across various server farm types can be discerned using FPE measures. Furthermore, a fictitious scenario is shown to show how energy efficiency helps distinguish between energy and server farm service concerns as well as how further advancements in the established competency measures are conceivable. Make a model of a DOE server farm. This will show approaches to address energy issues while taking into account numerous innovations and analyses of future energy variability amongst practices. In 2020, there will be roughly the same interest in server farms (as reported by FPE), but there will be a difference in public power usage of about 135 billion kWh. Three scenarios' model findings show significant effects of performance measures, 22. Since 2010, improved performance scaling, higher processor utilization, and the impact of specific power productivity openings to achieve PUE reduction have resulted in a significant increase in the range of power consumption needed to support specific attention to processor utilization across U.S. server farm inventory. Furthermore, colocation and distributed computing offer an alternative to small, ineffective server farms, which frequently have underutilized workers and ineffective cooling. The utilization pattern of energy in post-2000 server farms serves as an illustration of how to overcome energy inefficiencies. Energy-related interest increased as the new century got underway, and the course of events shifted, resulting in the adoption of cutting-edge methods for energy efficiency while reducing energy growth. The server farm needed to expand further. After 2020, it's unclear whether server farm power consumption will rise. This is due to the possibility that historical productivity shares won't be enough to sustain interest in server farms in the future, thus emphasizing the necessity for fresh server farm innovation.

2.5 Dynamic Energy-Aware Scheduling in Cloud Computing

A new trend in software engineering seeks to minimize the energy and carbon dioxide used when a PC is transmitted through platforms like clouds, groups, frameworks, etc. Traditional booking techniques try to cut down on preparation time without taking astronomical fees into account. One of his methods for lowering energy use is by offering scheduling algorithms that specify allocation to particular assets, controlling processing time and energy consumption, 23. This proposal provides a continuous and reliable scheduling system for successfully executing task-based applications in a distributed registry layer in order to reduce power usage. Errand planning on multiprocessors turns become a significant NP-hard problem as a result of the impossibility of completely solving these challenges. By integrating energy use and execution time in accordance with the equipment supplier's or client's energy performance key parameters, as well as the continuous dependent order time between jobs, order time, and virtual machine, the suggested computation constrains the multifunctional task. And power characteristics of different models.

The planner has been put to the test using both his COMPS system and a variety of arbitrary built DAG kinds. To find the combination that offered the optimum location and power reserve, it tested the framework using examples of various sizes and important variables, 24. For various amounts of errands, it also assessed the likelihood of receiving a reservation answer in order to evaluate the overhead offered. A framework for task-based application planning that considers energy. Energy consumption and make span are integrated because the scheduler restricts work to the two typical aims. These data are combined using significance coefficients so that customers and professional groups can decide whether performance or energy savings is more crucial to their objectives. It has created a model to determine how much energy is used when a specific application is operating across various resources. This model gathers information on how Information Transfer, Virtual Machine Executive, and Hub Foundation Administration are employed as different program execution components. The optimal scheduling placement can be found using a polynomial-time multi-heuristic resource allocation (MHRA) algorithm. A directed acyclic graph (DAG) of procurement terms that contribute to the MHRA computation is how the application is handled by COMPS. For various purposes, a set of heuristics was assessed using various kinds of his DAGs, including EP, MT, ST, and GT. It has observed the scheduler's behavior in relation to the chosen relevant variables and their applicability to manufacturing and energy use, 25. According to the computational outcomes, it can save a significant amount of energy depending on the magnitude of the event and the type of DAG. The planner will decide to use as many VMs as the framework can support in terms of resource utilization, with robust VM build responsiveness, if a make span-focused architecture is chosen, 25. It's interesting to note that selecting a high power significance factor causes longer run durations because it aims to employ as few hubs and as many VMs per hub as possible. The suggested compelling model will be combined with COMPS in future work, and the level of detail will be increased to calculate the costs and timeframes related to employing VMs to boost sales and profit for specialized businesses. Pertaining to operating.

III. CLOUD-BASED MODEL FOR VIRTUAL MACHINE ALLOCATIONS AND PLACEMENTS

3.1 Green Computing

Green processing has similar objectives to green science. This entails decreasing the usage of dangerous ingredients, improving energy efficiency during the course of the product, and enhancing the ability of dead materials and plant matter to be recycled or composted. For all types of frameworks, from tiny server farms to mobile frameworks, green statistics are crucial. Many corporate IT departments

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employ Green Registration Initiatives to lessen the natural impact of IT-related duties are explained in figure 2.

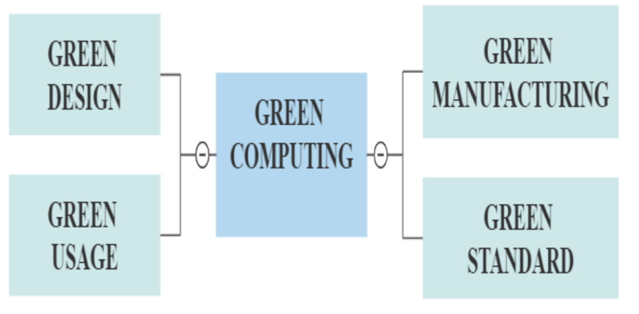

Figure 2: Green Computing

3.2 Resource Allocation

Data can be sent to server farms with less power costs using computation. Calculations for power distribution were examined by specialists from MIT, Carnegie Mellon University, and Akamai. It successfully directs traffic to the area with the least amount of energy consumption. If their calculations were followed, experts claim that up to 40% of reserve cash might be used to pay for energy bills. This strategy, meanwhile, only lowers expenses for the businesses that employ it. It doesn't truly utilize less energy as a result of it. Similar techniques can be applied in each case to guide traffic toward the usage of energy produced in a more efficient or environmentally friendly way. Larger worker habitats could be found in areas where land and energy are inexpensive and easily accessible. Green sheet location selections may take into account accessibility to green energy, the use of outside air for cooling, or the utilization of heat produced for a variety of purposes. Proper board system construction and equipment evaluation are effective techniques to lower the energy consumption of office equipment.

3.3 Virtualization

PC virtualization is the concept of taking computer resources into account. Ability to utilize a single set of physical hardware to operate at least two reliable computer architectures. The idea was first presented in the IBM Central Server operating system in the 1960s, but it wasn't until the 1990s that it was sold for x86-capable personal computers. In order to save resources, a system administrator can use virtualization to merge several real systems into virtual systems on a single, high-performance system, obviating the need for initial equipment and cutting down on power and cooling requirements. With the use of virtualization, it may divide up the work among the staff members to keep them busy or in a low-power idle state. The transition to virtual registries is now made possible by programming packages provided by a few for-profit businesses and open source organizations. Intel Corporation and AMD also developed their own virtualization extensions for the x86 instruction set embedded into their respective CPU product lines to allow virtual computing. Utilizing cutting-edge virtual advancements like framework-level virtualization can also help reduce energy consumption. These enhancements will lessen the plan's energy usage by increasing facility utilization. The integration of virtualized technologies is additionally more effective than those operating in virtual machines, enabling the same physical computer to provide more services while using less equipment.

3.4 Cloud Computing

Distributed computing has a significant impact on two key ICT factors connected to green thinking: energy consumption and resource use. Dynamic provisioning, multiple occupancy, and green server farm technologies are made possible by distributed computing, which lowers the overall amount of energy used as well as the by-products of fossil fuels. Large projects and private businesses can cut their short-term energy use and fossil fuel emissions by up to 30% and 90%, respectively, by transferring some on-premises programs to the cloud. Online shopping is one popular example. It can purchase goods and services online without using up gas driving to a physical location. The ozone layer-harming chemical emissions from transportation are decreased as a result.

3.5 Hybrid Cloud

Cloud infrastructure is made up of various clouds of various types, but thanks to the interfaces, clouds may share data and applications. To satisfy the need to offer cloud services and the want to keep some data inside an organization, it blends private and public clouds. Utilizing resources to the fullest potential is one of the main objectives of cloud computing platforms. The optimization method heavily depends on scheduling techniques. To efficiently organize user chores are described in figure 3.

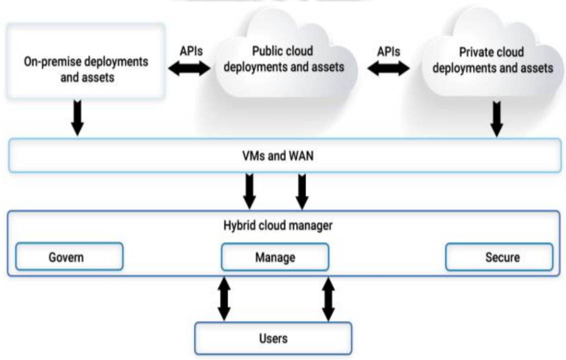

Figure 3: Architecture of Hybrid Cloud

Scheduling methods frequently aim to reduce overall execution time, maximize processor utilization, and distribute workload across the available processors. Task scheduling is one of the most well-known issues in combinatorial NP-completeness. Planning's fundamental objective is to organize tasks in a way that allows them to be carried out within the restrictions of the current challenge. This work offers a task scheduling optimization strategy to reduce overall computing time.

IV. PROPOSED SYSTEM

A new VM placement method based on real-time CPU utilization and variable power consumption is suggested when a new VM is deployed to the target host, taking into account both previous CPU utilization and migration time. The fact that VMs have different CPU consumption is one of the primary justifications for altering host CPU utilization in a cloud datacenter VM selection technique. When it notices that the host is overloaded, the VMM module responds. For VM placement, this proposal uses residual usage-aware (RUA) and performance-aware (PA) methods based on the VM's typical CPU utilization and migration time. The suggested approach for migrating VMs intends to decrease the amount of migrations, decrease energy usage in cloud data centers, and enhance QoS.The average CPU utilization of a virtual machine (VM) is a measure of how well it performs on the host. Low CPU VM utilization does not significantly affect performance during migration where length is the duration of the VM's history CPU usage is the VM's average respectively. The VM with the lowest value is chosen when VM migration is initiated. Select the VM with the lowest value and migrate VMs from overloaded hosts and off of hosts. In order to resolve relationships between hosts and VMs, choosing the optimal host is crucial during the VM consolidation process. In order to avoid recurrent migrations when VMM triggers the migration, it is important for this research to ascertain whether the host is overloaded when VMs are put on it. Figure 4 illustrates a combinatorial virtual machine model using multimedia cloud computing. As a result, the host's power consumption and CPU utilization increased.

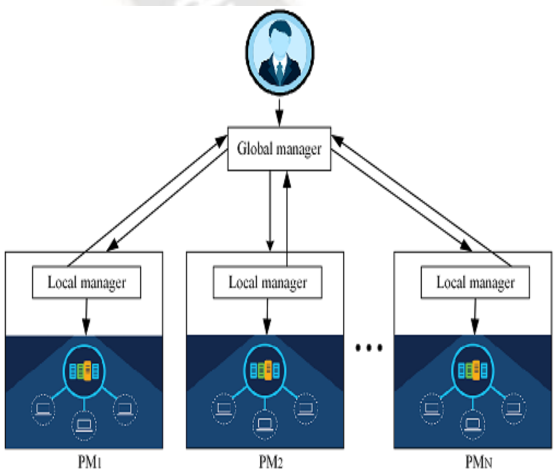

Figure.4 Combinatorial Virtual Machine Model Using Multimedia Cloud Computing

To achieve the goal of lowering energy consumption and migration times, pick the ideal host. The data center hosts' operational status is gathered by GM. The GM sends instructions to each VMM to migrate in accordance with the host's present and anticipated CPU utilization when the LM notices that a host's status is underutilized or over utilized. Before going into sleep mode to conserve energy, the host that is least loaded moves all virtual machines to a small number of hosts. To avoid SLA violations, overloaded hosts use migration engines to move some virtual machines to better hosts. Another multidimensional bin-packing and NP-hard challenge is how to map interactions between virtual machines and hosts the virtual machines in decreasing order of CPU utilization after obtaining a list of those to allot. It predicts CPU utilization for a list of hosts using the combined predictive model up until the remaining hosts are either overburdened or not. The VM cannot be installed on the host in any other case. Whether the host has MIPS CPU capacity available at the time the VM is provisioned. Placement Allocation Using Multimedia Cloud Computing in figure 5 illustrates how the target host decides which host has the highest score, then migrates to that host.

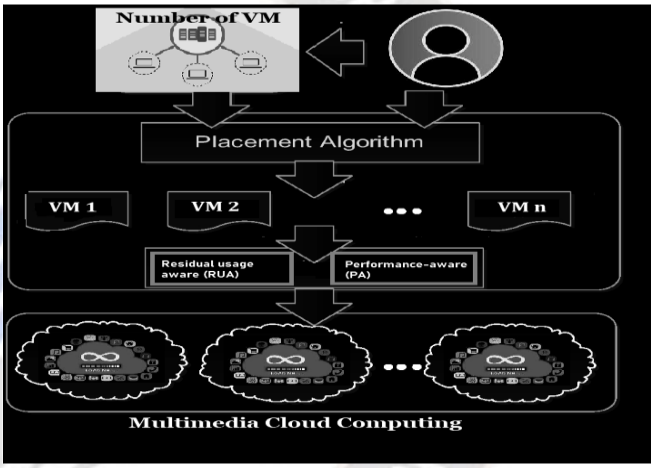

Figure.5 Placement Allocation Using Multimedia Cloud Computing

V. SIMULATION RESULTS

The simulation model is based on the construction of two data centers, each with two hosts that meet the parameters of a genuine blade server. Customers utilize the data center to submit tasks (cloudlets) to run on virtual machines that are housed there. They function according to predetermined criteria such size, data transfer rate, and command duration in millions of cycles per second. Utilizing one of the three available scheduling policies, it enables cloudlets to make use of the computational capacity of deployed virtual machines. A room-wide scheduling plan directs virtual machines to carry out tasks in order. All other cloudlets are in standby mode when a cloudlet is active. A time-sharing scheduling approach allows virtual computers to do several activities concurrently. A time-sharing strategy gives each job a specific period of time to use the virtual machine before granting it access to the resources for the following task. While Cloudlet is utilizing the virtual computer, all additional activities are put on hold. The term "dynamic usage" describes how virtual machine resources are used.

Each cloudlet comes with a VM that is equipped with resources that can be accessed in accordance with this policy. 20 virtual machines in all are running on single core processors with 1000 MIPS performance and 512 MB of RAM in two data centers. Figures 6, 7, and 8 show CPU usage, network performance, and power utilization for a virtual machine.

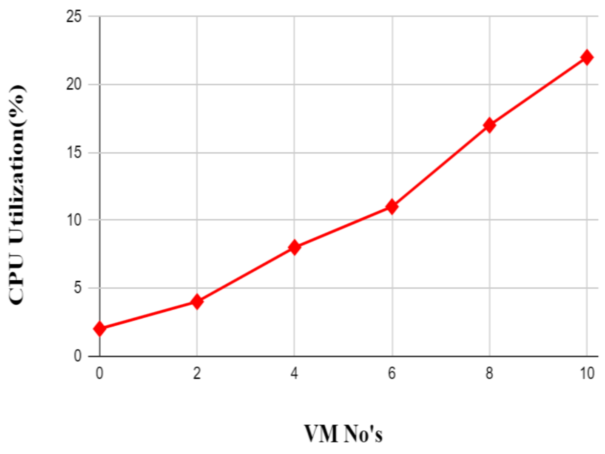

Figure.6 CPU Utilization based on VM

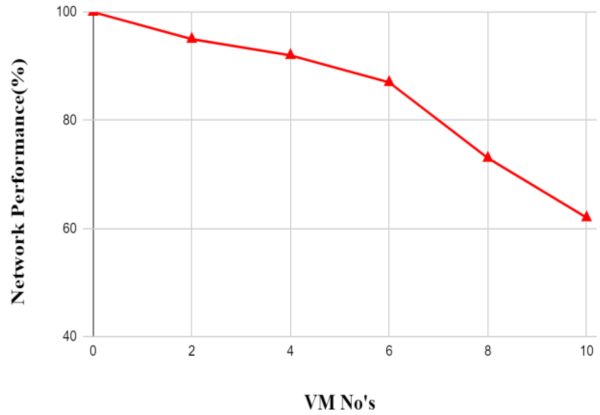

Figure.7 Network Performance based on VM

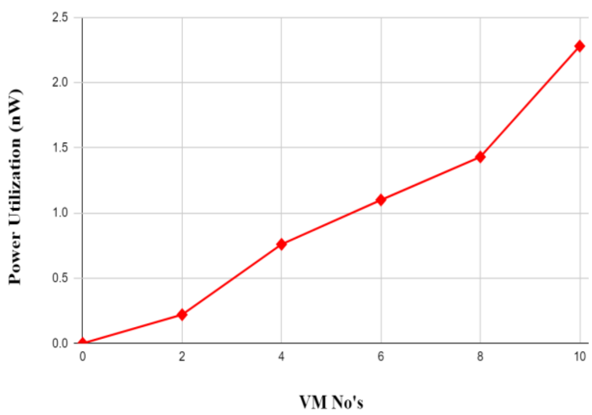

Figure.8 Power Utilization based on VM

VI. CONCLUSION

The procedure from Evaluating Server Virtualization Efficiency on Cloud Platforms is offered through technological investigation and analysis in virtualization and multimedia cloud computing. The importance of data centers has considerably expanded as a result of the rising use of cloud services. The energy usage of corporations developing cloud data centers is rising as a result of the increased competition among those businesses. The nature of existing VM load balancing solutions is changing from static to dynamic due to the efficient and optimum performance of dynamic methodologies. The importance of developing the ideal virtual machine migration model persists due to the technological difficulties of the migration process. According to the proposal, sequential migration minimizes costs for apps operating on migrated VMs while parallel migration enhances performance of CPU usage, network performance when migrating numerous VMs. There are several migration techniques available to maximize performance, however long-term VM migration performance may have a detrimental influence. It explores migration cost models for various hardware platforms and virtualization technologies in order to generalize and assess the outcomes of these platforms and technologies.

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