LOAD BALANCING IN DATA CENTRE OF CLOUD COMPUTING

PATEL AKSHAY, DR. RAJESH PATEL

COMPUTER ENGINEERING & Sankalchand Patel College of Engineering, Visnagar

FACULTY OF ENGINEERING & TECHNOLOGY & Sankalchand Patel College of Engineering, Visnagar

---***---

Abstract - The internet is expanding its viewpoint into each conceivable part of the cutting-edge economy. Unshackled from our web programs programs today, the internet is characterizing our way of life, regardless of whether it's sitting in front of the TV or driving an independent car.

Cloud computing which is an on violently expanded our computerized lives, through, there have been critical improvement as far as accessibility fluc-tution, time and quality in administration are concerned, the unbounded development of our computerized way of life requires monstrous measures of power especially for the data centres that fill in as the mind of the advanced economy.

All things considered, the move by clients toward cloud, will exceeding any energy productivity increase, which has record for wer 70% os data centre development in 2018.

Many research advancements are already made in this domain for minimizing the energy utilization of the computing types of gear included; for effificient power energy consumption, decrease of carbon impression and e-squander. These procedures are supporters of green cloud computing, which are focused on planning and advancing energy-profificient activities to contain inordinate energy utilization in data centers. Cloud computing is a commercial and economic paradigm that has gained traction since 2006 and is presently the most signifificant technology in IT sector. From the notion of cloud computing to its energy effificiency, cloud has been the subject of much discussion. The energy consumption of data centres alone will rise from 200 TWh in 2016 to 2967 TWh in 2030.

The data centres require a lot of power to provide services, which increases CO2 emissions. In this survey

paper, software based technologies that can be used for building green data centers and include power management at individual software level has been discussed. The paper discusses the energy effificiency in containers and problem-solving approaches used for reducing power consumption in data centers.

The cloud computing revolution is redesigning modern networking, and offering promising environmentalprotection prospects as well as economic and technological advantages.

These technologies have the potential to improve energy effificiency and to reduce carbon footprints and (e-)waste. These features can transform cloud computing into green cloud computing. In this survey, we review the main achievements of green cloud computing. First,an overview of cloud computing is given.Then, recent studies and developments are summarized, and environmental issues are specifically addressed. Finally, future research directions and open problems regarding green cloud computing are presented. This survey is intended to serve asup-to-date guidance for research with respect to green cloud computing.

Key Words: Server, Memory, Data center, Load balancing, Workload categorization, Energy effificiency ,Green information and communication technologies.

1.INTRODUCTION

The last decade internet services like cloud computing and web 2.0 have changed the entire architecture of the internetecosystem. The web, which began as a worldwide hypertext system, has developed into a distributed applicationplatform with distinct entities for application logic and userinterface. The web is the principal interface (medium) via which cloud computing distributes or makes its servicesavailable to everyone. Since time immemorial, the defifinition of the term web has evolved. Now web encompasses a slew of technologies and services that enable interactivesharing, collaboration, user-centred design, and application

International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 07 Issue: 04 | April - 2023 Impact Factor: 8.176 ISSN: 2582-3930

development. Cloud computing is currently ubiquitous from the fifields of spilling music, recordings, document sharing, web and messages, to the incipient of ''Internet of Things''. The offlfline world is quickly changing to the online world with a 20% expansion in data for each year. The expansion in volume of big data is expected to develop hugely, with therise of modest advanced cells. By a wide margin and away, the greatest driver for purchaser internet data is online video. Netflflix, YouTube, Hulu and other video gushing administrations have turned into a staple sustenance making up to over 60% of buyer internet activity, which was expected to increase to 76% by 2018.

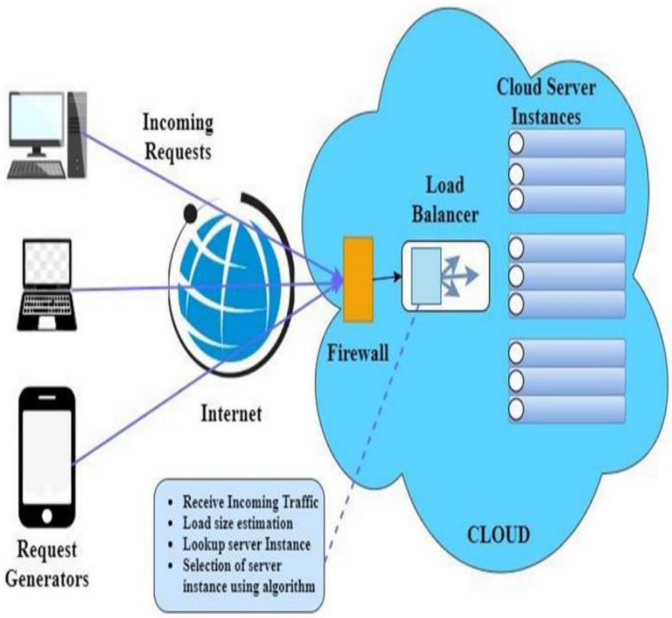
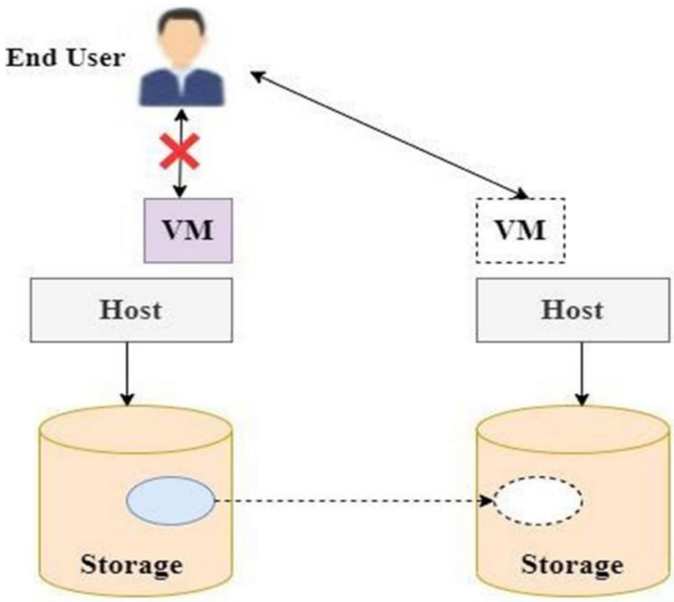


Fig -1: Figure

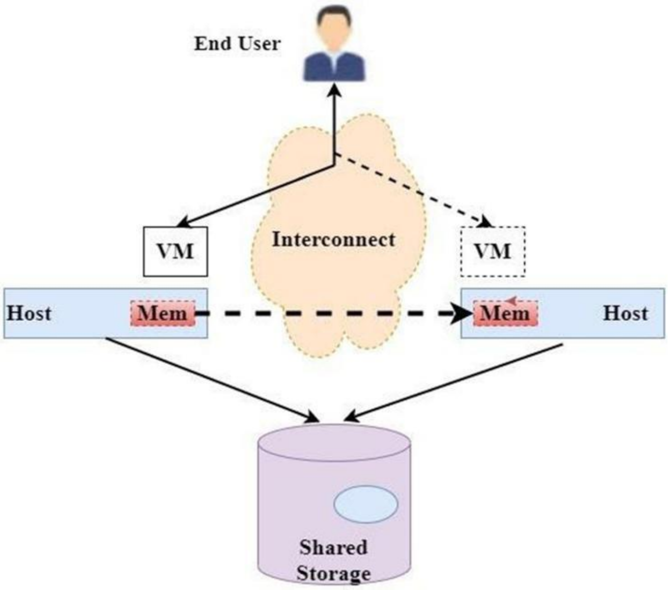
1. Load balancing in cloud data center.

An efficient cloud computing model is the one that utilizes its resources efficiently. The management of resources in cloud data centers can be done by scheduling of resources and powerful resource scalability techniques former. It is also important to be considered that moving these workloads on few machines should not cause contention of resources leading to degradation of performance. Switching off the under-utilized servers can make signifificant energy savings as servers in idle mode consume 70% of their peak power. The virtual machine migration based on DVFS and server consolidation helps in minimizing the CPU clock rate and co locating the virtual machines respectively, to get the power effificiency inside the data center at the cost of performance of application degradation. The virtual machine migration also helps in sharing of resources, maintenance of system, load balancing and fault tolerance by migrating the virtual machines from hardware thatis prone to failure to the hardware that is steady, with no modifications observed by customers.

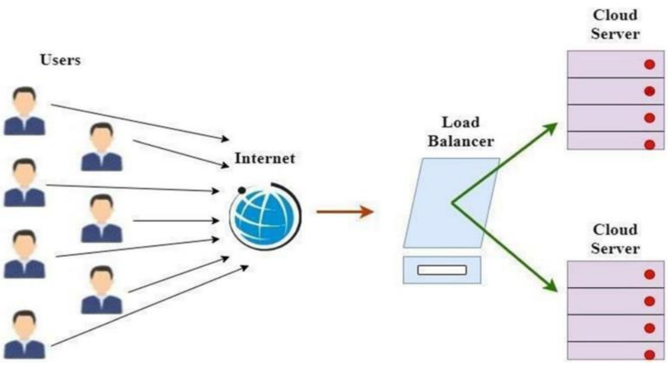
2. Non-Live VM migration



3. Live VM migration



4. Load Balancing mechanism in cloud computing environment



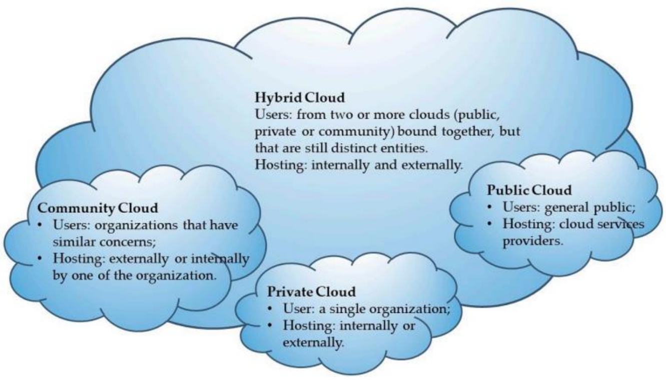
Virtual machine migration can be defifined as sending the VM from one host to another by remaining connected with the application or client. The Virtual Machine Migration (VMM) can be categorized as live migration and non-live migration of virtual machine as shown in Figs. 2 and 3 Live VM migration refers to the moving of VMs from one server to another when the host system stays active. There are two forms of live virtual machine migration: precopy live VMM and post-copy live VMM. Non-live virtual machine migration is defifined as migrating a VM from one server to another by turning off the virtual machine on the host server. Non-live migration stops or shuts down the VM prior to transfer, depending on whether it wants to continue running services after transfer. When a virtual machine is terminated, its operating states are wrapped and transferred to the destination location. Live migration is the process of migrating a functioning VM or application among PMs without interrupting the client or service. Consolidation of virtual machines (VMs) is a typical technique for lowering energy usage based on peak, offpeak, or average CPU use of VMs in order to execute them on the least number of servers while preserving service quality (QoS).

There are different techniques for the live migration like pre copy migration, post copy migration, hybrid VM migration, dynamic self-ballooning, Adaptive Worst Fit Decreasing, Check pointing/recovery and trace/replay technology, Composed Image Cloning (CIC) methodology, Memory management based live migration, Stable Matching, Matrix Bitmap Algorithm, Time Series based PreCopy Approach, Memory Ballooning, WSClock Replacement Algorithm, Live Migration using LRU and Splay Tree. Apart from these,

the various machine-learning approaches are also used to migrate the VM from one host to other.

The techniques like autoregressive integrated moving average, support vector regression, linear regression, SVR with bootstrap aggregation were also used for VM migration. These approaches are used to forecast and manage resources effectively in the data center, as well as to calculate the energy consumption. Moreover, metaheuristics are also used for the migration of virtual machines. The techniques like Fireflfly Optimization, Particle Swarm Optimization, Ant Colony Optimization, BiogeographyBased Optimisation, Discrete Bacterial Foraging Algorithm are also used for the migration of virtual machines. These approaches optimise energy usage, QoS, resource use, or all three. The purple box in (8) represents a VM that has been shut down or terminated on the originating host.

5. Types of cloud computing



A typology of cloud computing should consider the degree of accessibility it offers so that it can be ranked as private, public, hybrid, and/or community According to Kliazovich et al & with regard to the topic of this paper, from the energy effificiency perspective, a cloud computing data center can be defifined as a pool of computing and communication resources organized in the way to transform the received power into computing or data transfer work to satisfy user demands. This defifinition refers to the energy efficiency of the IaaS model.

SaaS also provides benefits for environmental protection: through centralization of processing and service sharing, it consolidates data center operations in order to use less equipment. SaaS providers could offer green software services deployed on green datacenters with less replications or they could use algorithms that improve software energy effificiency without violating Service Level Agreements (SLAs). The cloud providers have more resources and more motivation thanindividual users have to invest in environmental protection. In the case of PaaS, the providers could offer facilities such as green schedule and green compilers. To help environmental protection through green cloud computing, both SaaS and PaaS providers have methods and tools to achieve software-level energy optimization. The increase in the popularity of cloud technology was due to the benefits it brought to individual consumers and companies. These benefits include: flflexibility, disaster recovery, reduced investment in ICT resources, optimized collaboration between members of an organization, and automatic updates. Cloud computing is attractive to business owners, due to the possibility of dynamically increasing the resources accessed to match increases in the company's activities. For the environment, the advantages of cloud computing are: better strategies for energy efficiency, and reduced equipment requirements and lower CO_2 emissions, with, consequently, less e-waste. In order to switch to cloud computing, enterprises might also face the challenges of a change of software/hardware architecture, obstaclesto data transfer, and concerns about interoperability.

These technologies carry some risks, mainly related to security issues. In spite of this, cloud computing technologies are constantly growing as a result of the major benefits they offer to companies, access to high-performance computing resources and high-capacity storage together with lower costs. With regard to the inflfluence on the environment, the sections below present in detail the main problems identified in both

the academic and the non-academic studies.

RESEARCH CHALLANGES

Research challenges and solutions in hardware aspects for building green

data centers.

Processors

Multicore processors are continuously exerting signifificant impact on software evolution. When the multicore processors were not in use, software was optimized for single core processors. Therefore, deploying the same software for multicore processors is a major challenge. The software vendors should optimize their software with the requirement of the system with the evolution of multicore systems. The major problem is that most companies do not share their hardware details and make connections only with some software vendors. So, there are not many types of software available for hardware which causes big problems to the consumers. The restriction of using the software worsens when using multicore systems because a specifific multicore system has different cores that are implementing different tasks. Developing software for each hardware module in itself is a big challenge.

Storage

The most important key challenges as the amount of data is ever increasing. Though, clustering and virtualization technology handle huge amounts of storage but managing large numbers of storage devices is very diffificult.

The continuous tracking of a large number of fifiles also leads to challenges like how to effificiently manage and change the metadata of a fifile. Applications work with both types of data, be it transient or permanent.

A trade-off between storage and computation can be utilized while dealing with both types of data. Less used

data can be stored in compressed form and can be recovered when required. However, the aforementioned

trade-off between storage and computation requires addressing the issues like: storage power consumed vs cpu power consumed, data migration and placement across storage devices and performance of the techniques used for storing data.Network The large data centers are generally placed far from the users causing high cost of communication and sub optimal services in terms of jitter, throughput and delay. Edge data centers known as the small data centers near the network edge appear to provide benefifits like better QoS, reduced communication network cost, lowered construction cost and are envisioned as the future in cloud infrastructures. They are growing at a rapid speed complementing existing data centers. Edge data centers also require network virtualization and pose research challenges like:-

• Managing services across multiple data centers.

Many edge and centralized data centers.

• Dividing the services across centralized and edge

data centers to get optimal trade-off between

operational cost and performance.

Environmental protection

All efforts are important and could lead to constructive results. The final winner is the entire society and the next generation. Green ICT is very important in this field, and it is seen as solution and problem for the environment. Green cloud computing is an important component of this field. A significant part of research was focused on cloud computing security and on quality of services. This quality has to include both customer satisfaction and meeting the requirement of environmental protection.The design of a green cloud has two types of challenges: technical and non-technical. Some of the technical aspects related to green cloud computing are software design, virtualization techniques, and thermal-aware management techniques.Software design is important for green cloud computing. Applications can improve energy efficiency and resource management. The communication between software components has to be efficient.

The typology has to be dynamic: resources should be automatically added or removed based on server loading. Some of the open problems are: the dynamic allocation of resources and energy,the reduction of execution costs and time of the tasks, and the reduction of energy consumption. Software design is important for green cloud computing. Applications can improve energy efficiency and resource management. The communication between software components has to beefficient. The typology has to be dynamic: resources should be automatically added or removed basedon server loading. Some of the open problems are: the dynamic allocation of resources and energy,the reduction of execution costs and time of the tasks, and the reduction of energy consumption.

3. CONCLUSIONS

As a result of the investigated literature review, we concluded that the previous techniques and approaches lack several features like QoS and performance against energy efficiency.Additionally, the time complexity and the reduction of the energy consumption are not highly effective. Based on our literature review we realized that the lack of and need for an integrated data center energy efficiency framework which consider the social network applications as a vital related factor in elevating energyconsumption, as well as high potential for energy efficiency. The framework provides a platform on top of which the Green Cloud could be built. The framework practices from Energy Aware Computing will improve the efficiency of Cloud systems and their data centers and Clouds themselves will produce naturally efficient and focused centers of computation, advancing the pursuit of green computing. The required integrated data center energy efficiency framework should be also applicable in different types of data centers including public, private and hybrid. The existence of such framework will offer a great powerful capability to deal with service levels and resources management. The required data center Energy Efficiency framework will offer improved in scalability, elasticity, simplicity for management, delivery of cloud services and better reduction in data centers energy consumption taking into consideration the QoS for the user services.

REFERENCES

(1) Fiona, B., Ballarat, C, :International Review of Energy Efficiency in Data Centres Acknowledgements. (2021)

(2) Koot, M., Wijnhoven. :Usage impact on data center electricity needs: A system dynamic forecasting model. Appl. Energy. 291, 116798 (2021)

(3) Avita katal, Susheela dohiyal, Tanupriya chaudhry. :Energy effificiency in cloud computing data center: a survey on hardware technologies (2022) https://www.researchgate.net/publication/355474123

(4) Yiliu Zhang, and Jie Liu. :Prediction of Overall Energy Consumption of Data Centers in Different Locations (2022) https://doi.org/10.3390/ s22103704

(5) Miller, R. The Sustainability Imperative: Green Data Centers and Our Cloudy Future, 2021. Available online: https:// datacenterfrontier.com/green-data-center-imperative (accessed on 25 March 2022)

(6) Analysts, G.I.: I. Internet Data Centers - Global Market Trajectory & Analytics. (2021)

[7] Hariharan, U. & Kotteswaran, Rajkumar & Pathak, Nilotpal. (2020). The Convergence of IoT with Big Data and Cloud Computing. 10.1201/9781003054115-1

[8] Qi, Lianyong & Khosravi, Mohammad & Xu,Xiaolong & Zhang, Yiwen & Menon, Varun. (2021).

[9]https://crmtrilogix.com/CloudBlog/CloudModels/Cloud-Deployment-Models-and Hybrid-Cloud Computing/132

[10] Ahmed E. Youssef-Exploring Cloud Computing Services and Applications, Journal of Emerging Trends in Computing and Information Sciences, VOL. 3, NO.