A Study of Cloud Computing Is Transforming the It World Using Virtualization Technology

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ABSTRACT

Due to its ability to enable the on-demand outsourcing of cloud resources on a pay-per-use basis, cloud computing (CC) has advanced the IT sector. It gives both small and large enterprises the chance to grow, innovate, and develop new values. Users can access cloud-based services from any point in the world and use the applications and data that are managed and administered by others. The rapidly expanding needs of the current resource-demanding business and IT sectors have prompted awareness of cloud data centers (CDCs). The analysts and service providers are persuaded to allocate these resources among different cloud clients in order to ensure adequate consumption and increase the cloud provider's revenue due to the increased demand for IT resources.

KEYWORD: Computer Science, Computer Science, Artificial Intelligence, Engineering and Technology

INTRODUCTION

Amazon Web Services, Google, and Azure are used to deliver utilities in the form of infrastructure, platform, and software in cloud computing [1].Utilizing a pay-as-you-go [3] approach, computing provides hardware and software resources to cloud users over an online network. It includes three models. Platform-as-a-Service (PaaS), Software-as-a-Service (SaaS), and Infrastructure-as-a-Service (IaaS) are three examples. IaaS offers end users storage, servers, networking equipment [4,], and routers. PaaS is a platform that gives cloud users access to editors, compilers, and utility tools [4]. SaaS does away with the requirement for developer sites to have any software installed. Businesses can use the SaaS application programming interface of cloud providers to design and deploy their software systems. System integrators are in charge of tailoring and integrating utility pricing schemes with modest capital expenditures between cloud consumers.

Applications of cloud computing

Cloud computing can execute any applications, and programs like a standard stand-alone computer can run. It offers multiple, cost-free applications. Researchers have analysed cloud computing technology usage in numerous applications such as business, education, social networking, data storage, etc. An overview of a few of these is presented in Figure 1.2. Some of the applications of cloud computing are discussed below:

1. Business Process: Applications from business administration are cloud service provider focused. Enterprises use cloud storage to manage essential data and other pertinent information. This data such as customer personal data, analysed records, etc. The applications such as MailChimp, Chatter, Maropost, etc., make the business process more collaborative and smoother.
2. Backup and recovery: Cloud storage can be used as an alternative to backup files, documents, and other relevant information. When the system crashes, data can be retrieved from the cloud with cloud applications such as Box.com, Mozy, Joukuu, etc.
3. E-commerce application: Using the cloud-based e-commerce application, consumers and e-business will quickly adapt to new opportunities. It enables business leaders to get their business operations done in minimal time. It also helps in evaluating new challenges and business opportunities.
4. File Converters: Many applications require altering the file format of documents from one format to another format like pdf to word and vice-versa. The software for file conversion is available in the cloud and can be accessed using internet connectivity.
5. Anti-Virus Applications: The anti-virus applications stored in the cloud help discover malware and analyse the vulnerabilities that are susceptible to the system. Applications such as Malwarebytes, Webroot, Avast Cloudcare, etc., help in repairing the system online.
6. Storing File Online: Cloud storage offers an advantage to store and access information via internet connectivity. The graphical interface is very simple to use and economical

Challenges of Cloud Computing

Various surveys show that working with a cloud's applications is very difficult because of its uniqueness from previous frameworks. Users that own the applications from vendors have the right to choose the best infrastructure for their applications. The cloud only provides its some components, and users have no right to maintain and manage it. Hence a minimal amount of infrastructure is available for the users. They are not able to modify or construct things. Only primary virtual machines are given by the cloud, where computing strength and the network bandwidth are minimal. People have no right to manage the work of the cloud. Most companies do not disclose any sensitive information for security purposes. Users that are accessing applications are not able to change this infrastructure features. It is assumed that every performance paradigm relies on infrastructure decisions and control. The main issues of cloud computing are presented in Figure 1.3 and are discussed below:

(i) Virtual Machine Migration
(ii) Energy Consumption
(iii) Service Level Agreement
(iv) Resource Management
(v) Job Scheduling

Power Management Requirements in Cloud Data Centers

Cloud computing is transforming the IT world using virtualization technology. Virtualization is a powerful technology that helps in managing constantly ever- an increasing requirement for cloud resources, storage, and computing in cloud data centers. Virtualized cloud data centers consume less electric power as compared to the nonvirtualized [12] cloud. With the aid of virtualization, one can migrate the running VMs from one PM to another PM, which is termed as Live VM migration. Migration of VMs from densely-loaded PMs to lightly-laden PMs helps lowering the energy consumption as it aids in managing the proper distribution of workload on host machines. With the benefit of VM migration, one can reap various objectives like load balancing [13], ubiquitous computing, power management, fault tolerance, server maintenance, etc. Virtual machine migration (VMM) is a resource-demanding practice that regularly needs a CPU cycle, cache memory, and network bandwidth [14]. This mechanism diminishes the performance of the system and detrimentally affects the competence of the cloud environment exclusively when SLA and trade goals are to be met [14]. According to NRDC [15], a report was presented in 2013, United States data centers consume 91 tons kWh of electric power that is equivalent to the energy consumption of all the domiciliary of New York City in approximately two years. This is estimated to escalate approximately up to 140 billion kWh [15] and is liable for the exudation of roughly 150 million CO2 emissions by 2020. Such environmental affairs have persuaded cloud service providers to dwindle their energy usage and reliance on dams, fossil fuels, etc., for producing electricity. Due to high requirements for cloud resources, the esteemed service providers housed large giant-scale CDCs. These CDCs host thousands of servers which depletes an enormous amount of electricity. For assured services, typically 30% of servers persist idle, while only 10-15% of resource abundance is employed for accomplishing the resource demands [4]. Under-utilization of resources results in a substantial increment in power consumption and in-service cost [16][17]. In 2014, it was approximated that the IT industry would subsidize only 25% of the comprehensive cost of administering the CDC, and 75% of the overall cost would devote to the operational cost of the CDC. According to the report of energy consumption of United States (U.S) data centers [18], 61 billion kWh of electricity was devoured in 2006 which is recorded as roughly 1.5% [19] of the overall consumption of electricity in the U.S. In 2014, the U.S CDCs energy utilization [20] raised to higher than 100 billion [20] kWh. The elevation in energy consumption [21] of universal data centers in 2011 is about 1.1 to 1.5% [21] of the total universal energy usage, which is equal to all the 25,000 [21] domiciliary of America.

Virtualization

Virtualization is an elemental technology with the help of which one can take advantage of infrastructure-based services. It creates a protected, estimable, and segregated [1] environment for cloud application execution. This technology provides the capability to a computer system

to imitate the executing environment independent from the computer system itself. It is the contemplation of computer resources. It allows the separation of the computer operating system from its hardware. It allows a single hardware resource to act as numerous virtual resources [9] and various hardware resources to act as a single virtual resource. It has changed the IT world in many ways. It provides increased performance in the computer market's high-end side, where supercomputers give infinite computing power to furnish thousands of VMs. When there is a lack of space to accommodate thousands of physical machines, then virtualization benefits. Also, it provides the extra computing power needed by large-scale applications. With the help of virtualization [26], clouds grant access to essential cloud resources such as hardware and software. Virtualization provided efficient utilization of cloud resources cost-effectively. A hypervisor is a host program that creates numerous guest operating systems known as virtual machines that run on a single host machine as shown in Figure 1.6. A Virtual Machine Monitor (VMM) provides a logical slab between Physical Machines (PM)s and applications.

Benefits of Virtualization

Virtualization helps in the optimization of computing power, cost, and other infrastructure by consolidating cloud servers. It provides access to various resources with minimal effort, risk optimizations [27], and efficient use of resources. Multiple benefits of virtualizations are listed below:

1. Contributing minimal time on VM provisioning, monitoring, maintaining, configuring, etc.
2. Dynamic segregation of substantial resources like RAM, memory, processing power, CPU, etc.
3. On single hardware, numerous virtual machines can run concurrently
4. It helps in the reduction of infrastructure costs in terms of physical servers

Threats and Issues of Live VM Migration

In cloud computing, VM migration is absolutely a new concept and its safety features are not completely explored. The universality of cloud environment captured the heed of the numerous invaders and conceding them to discover different techniques to invade cloud services. These attacks may extend from Man-in-the cloud attacks to service hijacking. These types of attacks in VM migration intimidate many areas like the medical, IT industry, government sectors from obtaining benefits from VM migration technique. The threats of VM migration techniques are described below:

1. Bandwidth Stealing: Invader may abduct the communication bandwidth by obtaining command over source VM and transfer it to the target server.
2. Falsely Advertising: The invader may promote the erroneous data of the cloud resources over the communication network and attempt to captivate the other to transfer their VMs to the invader station.
3. Active Manipulation: The invader attempts to alter the data migrating between two servers.
4. Passive Snooping: The invader attempts to get the illegitimate outburst of information.

VM migration must be consistent to give uninterrupted services to cloud consumers. The modern technique encounters various challenges while transferring memory and data radical applications such as VM downtime, overloaded VMs, higher utilization of network bandwidth, etc. Typical challenges that impede the VM migration process are transfer rate, page resend, missing pages, and resource availability issues. These challenges are described below:

1. Transfer Rate: VM workload is migrated between two servers over the communication network then dirty pages are repetitively imitated from source to destination which causes higher consumption of network bandwidth. It leads to higher migration time and VM downtime.

2. Page Re-Send: When dirty pages are re-copied between two servers iteratively then the page resend problem occurs. Data is transferred in pent bytes during the migration process then VM becomes heavily loaded than usual which causes enormous resource utilization. 3. Missing Pages: When VM is migrated along with VM state then the source server imitates the remaining memory pages to the destination [4] server. The missing page retrieval [4] causes lower communication bandwidth [4] which worsens the performance of cloud applications, called the problem of the missing pages.

4. Resource Availability: Resource availability is very imperative while performing VM migrations over the network as this process continuously requires CPU cycles, communication bandwidth. The total migration time would inflate if there are no adequate CPU cycles are available. Similarly, resource unavailability causes the degradation of cloud applications.
The aim and research objectives of the research work are mentioned as follows:
(1) To study various methods of energy reduction for virtual machine migration in cloud computing
(2) To propose and design an energy efficient mechanism for virtual machine migration in cloud computing
(3) To implement the proposed mechanism using suitable techniqu
(4) To analyse the performance of the proposed energy efficient mechanism using various parameters.

CONCLUSION

Currently, energy competency has emerged as the utmost vital design prerequisite for the present cloud computing model. It expands from single sever to numerous data centers to clouds, which exhaust huge amount of the electricity. So, efficient power management techniques are peculiarly needed for CDCs. This thesis aim, attention at several issues, including number of hosts being utilized, execution time taken by respective PM to complete a job, number of VM migrations, resource abundance, energy usage, migration cost and load balancing in cloud environment. Virtualization is one of the essential technologies through which the sharing of cloud resources can be done. Virtual machine plays a crucial role in cloud data center when a host machine is exhausted due to tremendous network traffic, then load is stabilized by shifting highly loaded PM to the under-utilized host machine. The resources are delivered by dynamic VMs in cloud data centers. The way the VMs assigned to PMs influences the performance of cloud applications and energy proficiency. By utilizing VM migration techniques, it is feasible to migrate the VMs from over-utilized PMs to under-utilized PMs achieving stable load on all physical machines. A firefly optimization-oriented energyaware mechanism for VM migration is proposed to address the issue of VM migrations and try to balance the load across minimal number of host machines hence helps in achieving efficient energy consumption. A R&D-WOA (Re-initialization and Decomposition-Whale Optimization Algorithm is proposed to address the issue of load balancing and to choose optimal VM for VM migration hence trying to diminish energy consumption. It also keeps track of resource usage which helps in ensuring more resources are available for use. Describes the concluding remarks of the research work, by illustrating amelioration concerning the objectives mentioned. It also outlines the outcome and following the contribution of the research. Furthermore, it confers the future research directions.
VM migration is mechanism of migrating an executing VM from one physical machine to another. VMs must be migrated from one server to another uninterruptedly and it is only viable when migration is done with zero VM downtime. Live VM migration has persistently used technique in cloud data centers because it grants load balancing, better service availability, energy management, etc. The inspiration in support of VM migration is dedicated server maintenance, fault tolerance, comprehensive service availability, load balancing, etc. The goal of the research work has been to develop an energy efficient mechanism for VM migration in cloud computing which has been addressed by the proposing a firefly optimization-oriented energy-aware mechanism for VM migration. As examined, efficient resource usage and VM migration are vital aspects in lowering the energy consumption in CDCs. These two aspects are focussed . The described the need for energy efficiency in the CDC and the energy utilization evaluation in data centers from a European, American, and Global aspect. A systematic mapping of VM migration techniques, and research the pertinent to it has also been described. The swarm-intelligence based VM migration techniques and its comparative review has also been conferred. The threats and challenges related to live VM migration are also studied to explore future research directions.

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