Review of Energy Aware Cloud Computing

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ABSTRACT

With the rapid growth of cloud computing developers are being concern about the massive power consumption by the data centres. The huge amount of power consume by the data centres does not only results in high operational cost but also the production of heat and carbon footprints on the environment. Researchers are making efforts to maximize the power efficiency and minimizing energy consumption of Data centres. This paper presents a study of the researches and methods that have been proposed to increase the power efficiency and minimize power consumption of the data.

Keywords: Cloud Computing, Cloud, Virtual Machines, CloudSim, Power Consumption.

1. INTRODUCTION

CLOUD computing has revolutionized the Information and Communication Technology (ICT) industry by enabling on-demand provisioning of elastic computing resources on a pay-as-you-go basis. An organization can either outsource its computational needs to the Cloud avoiding high up-front investments in a private computing infrastructure and consequent costs of maintenance and upgrades, or build a private Cloud data centre to improve the resource management and provisioning processes. The proliferation of Cloud computing has resulted in the establishment of large-scale data centres around the world containing thousands of compute nodes. However, Cloud data centres consume huge amounts of electrical energy resulting in high operating costs and carbon dioxide (CO2) emissions to the environment. As shown in Figure 1 energy consumption by data centres worldwide has raised by 56% from 2005 to 2010, and in 2010 is accounted to be between 1.1% and 1.5% of the total electricity use [7]. Furthermore, carbon dioxide emissions of the ICT industry are currently estimated to be 2% of the global emissions, which is equivalent to the emissions of the aviation industry [5] and significantly contributes to the greenhouse effect. As projected by Koomey [6], energy consumption in data centres will continue to grow rapidly unless advanced energy efficient resource management solutions are developed and applied. To address the problem of high energy use, it is necessary to eliminate inefficiencies and waste in the way electricity is delivered to computing resources, and in the way these resources are utilized to serve application workloads. This can be done by improving both the physical infrastructure of data centres, and the resource allocation and management algorithms. Recent advancement in the data centre design has resulted in a significant increase of the infrastructure efficiency. As reported by the Open Compute project, Facebook’s Oregon data centre achieved a Power Usage Effectiveness (PUE) of 1.08 [8], which mean that approximately 91% of the data centre’s energy consumption is consumed by the computing resources.

A source of energy waste lies in the inefficient usage of computing resources. Data collected from more than 5000 production servers over a six-month period have shown that although servers are usually not idle, the utilization rarely approaches 100% [1]. Most of the time servers operate at 10-50% of their full capacity, leading to extra expenses on over-provisioning, and thus extra Total Cost of Acquisition (TCA) [13]. Moreover, managing and maintaining over-provisioned resources results in the increased Total Cost of Ownership (TCO). In addition, the problem of low server utilization is exacerbated by narrow dynamic power ranges of servers: even completely idle servers still consume up to 70% of their peak power [4]. Therefore, keeping servers underutilized is highly inefficient from the energy consumption perspective. This thesis focuses on the problem of energy-efficient resource management in Cloud data centres, i.e., ensuring that computing resources are efficiently utilized to serve application workloads to minimize energy consumption, while maintaining the required Quality of Service (QoS).

Power Consumption

2. EXISTING TECHNIQUES

Andrew J. Younge, et.al have proposed a current framework is providing has economical inexperienced enhancements among a climbable Cloud computing vogue. Practice power-aware programming techniques, variable resource management, live migration, and a token virtual machine vogue, overall system potency unit of measurement on the
brick of be immensely improved throughout a data centre primarily based Cloud with token performance overhead. To demonstrate the potential of our framework, new energy aware programming, VM system pictures, and image management elements which conserve power. Future opportunities could explore a programming system that is each power-aware and in addition thermal-aware to maximize energy savings each from physical servers and additionally the cooling systems used. Such hardware would collectively drive the need for higher knowledge centre styles, each in server placements among racks and closed-loop cooling systems integrated into every rack.

Pinal Salot, et.al have proposed that in cloud, there is a high communication is worth that stops task schedulers to be applied in massive scale distributed setting. Today, researchers commit to build job programming algorithms that are compatible and applicable in Cloud Computing setting. Job programming is most vital task in cloud computing setting as a results of user ought to get of resources used based mostly upon time, so economical utilization of resources need to be vital and for that programming plays an enormous role and this paper finds out varied programming rule and problems associated with them in cloud computing.

Dr. Rahul Malhotra, et.al have proposed that cloud computing may even be a hot topic everywhere the globe presently, through that customers will access information and notebook computer power via an online browser. As results of the adoption and activity of cloud computing increase, it’s necessary to keep a track of the performance of cloud environments. Modeling and simulation technologies area unit acceptable for evaluating performance and security problems. Cloud simulators area unit needed for cloud system testing to decrease the standard and separate quality issues. CloudSim permits modeling, simulation, experimentation of cloud computing and application services. This paper initial defines CloudSim then explores it’s all variants offered in CloudSim among the last, it Compares all CloudSim Variant with reference to networking, platforms and varied languages.

Peng Rong, et.al have proposed an answer to minimizing energy consumption of a ADPS taking part in tasks with precedence constraints, the development drawback is developed as associate variety programming draw back. Next, a three-phase heuristic resolution, that integrates power management, task bobbing up with and task voltage assignment, is provided. Results show that the planned approach outperforms existing strategies by a mean of eighteen in terms of the system energy savings. The goal of low-power vogue for powered physics is to increase the battery service life whereas meeting performance needs. Unless optimizations unit of measurement applied at altogether utterly completely different levels, the capabilities of future systems unit of measurement severely restricted by the load of the batteries needed for academic degree acceptable quantity of service. Reducing power dissipation could be a goal even for non-portable devices since excessive power dissipation finishes up in exaggerated packaging and cooling prices. Dynamic power management (DPM) and dynamic voltage scaling (DVS) have each tried to be very effective techniques for reducing power dissipation in such systems. This paper addresses minimizing energy consumption of a ADPS subject area periodic time tasks with precedence constraints at intervals the planned approach Experimental results demonstrate potency of the planned approach.

Qi Zhang, et.al have proposed the next understanding of the challenges of cloud computing. Cloud computing has recently emerged as a replacement paradigm for hosting and delivering services over the net, the increase of cloud computing is apace ever-changing the scope of information technology, and ultimately changing the long-held promise of utility computing into a reality. However, despite the various blessings offered by cloud computing, this technologies aren't matured enough to know its full potential. Several key challenges throughout this domain, additionally as automatic resource provisioning, energy management and security management, are alone getting down to receive attention from the analysis community. Therefore, we have a tendency to tend to believe there's still tremendous chance for researchers to form contributions throughout this field.

Andreas Berl, et.al has proposed that energy potency is a lot of of and a lot of of vital for future knowledge and communication technologies (ICT). This paper has reviewed the potential impact of energy saving ways that within which for the management of integrated systems that embraces microcomputer systems and networks. We’ve got a bent to tend to propose that cloud computing with virtualization as but forward to establish the foremost sources of energy consumption, and additionally the vital trade-offs between performance, QoS and energy potency and (ii) give insight into the style among that energy savings area unit getting to be achieved in large-scale microcomputer services that integrate communication needs, specific plug-ins and energy-control centres for networked large-scale hardware and package area unit getting to be enforced that they are getting to have vital impact, including:(i) reducing the package and hardware connected energy price of single or federate knowledge centres that execute ‘cloud’ applications;(ii) rising load reconciliation so QoS and performance of single and federate knowledge centres;(iii) reducing energy consumption as a results of communications;(iv) saving GHG and gas emissions succeeding from knowledge centres and networks therefore on give computing power that is ‘environment protecting/conserving’. Such enhancements will have more impact by reducing energy
In contrast Dzmitry, et.al dynamic power ranges of all the other server components are much narrower: less than 50% for Dynamic Random Access Memory (DRAM), 25% for disk drives, 15% for network switches, and negligible for other components. The reason is that only the CPU supports active low-power modes, whereas other components can only be completely or partially switched off. However, the performance overhead of a transition between the active and inactive modes is substantial. For example, a disk drive in the deep-sleep mode consumes negligible power, but a transition to the active mode incurs latency 1000 times higher than the regular access latency. Power inefficiency of the server components in the idle state leads to a narrow overall dynamic power range of a server on the order of 30%. This means that even if a server is completely idle, it still consumes up to 70% of its peak power.

Andreas Berl1, et.al one method to improve the utilization of resources and reduce energy consumption, which has been shown to be efficient is dynamic consolidation of Virtual Machines enabled by the virtualization technology. Virtualization allows Cloud providers to create multiple VM instances on a single physical server, thus improving the utilization of resources and increasing the Return on Investment (ROI). The reduction in energy consumption can be achieved by switching idle nodes to low-power modes (i.e., sleep, hibernation), thus eliminating the idle power consumption (Figure 2). Another capability provided by virtualization is live migration, which is the ability to transfer a VM between physical servers (referred to as hosts, or nodes) with a close to zero downtime. Using live migration [3] VMs can be dynamically consolidated to leverage fine-grained fluctuations in the workload and keep the number of active physical servers at the minimum at all times. Dynamic VM consolidation consists of two basic processes: migrating VMs from underutilized hosts to minimize the number of active hosts; and offloading VMs from hosts when those become overloaded to avoid performance degradation experienced by the VMs, which could lead to a violation of the QoS requirements. Idle hosts are automatically switched to a low-power mode to eliminate the static power and reduce the overall energy consumption by the system. When required, hosts are reactivated to accommodate new VMs or VMs being migrated. However, dynamic VM consolidation in Clouds is not trivial since modern service applications often experience highly variable workloads causing dynamic resource usage patterns. Therefore, unconstrained VM consolidation may lead to performance degradation when an application encounters an increasing demand resulting in an unexpected rise of the resource usage. If the resource requirements of an application are not fulfilled, the application may face increased response times, time-outs or failures. Ensuring QoS defined via Service Level Agreements (SLAs) established between Cloud providers and their customers is essential for Cloud computing environments. Therefore, Cloud providers have to deal with the energy-performance trade-off minimizing energy consumption, while meeting QoS requirements. etc.

3. COMPARISON BETWEEN EXISTING TECHNIQUES

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4. CONCLUSION

This paper provides the unique list of software metrics and Maximizing the energy efficiency is one of the most challenging tasks faced by the cloud providers. We have reviewed various energy efficiency techniques at the data center level. The main focus in all method is to maximize the power efficiency of data centers while there are some other components like memory, storage and bandwidth that also consumes energy and must be taken under consideration while making energy efficient policies.

5. REFERENCES