

Energy saving Mechanism in cloud computing by using multi core architecture

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Abstract: Energy efficiency is more and more essential for upcoming information and communication technologies (ICT), for the reason that the enlarged usage of ICT, jointly with growing energy expenses and require to decrease green house gas emissions call for energy-efficient technologies that reduce the overall energy utilization of computation, storage and communications. Cloud computing is becoming an opportunity for industry to permit a high level of communication expertise, scalability, and usability of computing resources. The optimization of Cloud computing has grows in the industry of huge-scale data centres over the globe have various nodes. We can keep energy by CPU Utilization and using DVFS, live migration of VM and virtualization by using multi –core architecture. This paper presents analysis of cloud computing features, issues and software for dynamic resource saving mechanism with Virtual Machines (VMs) and multi-core architecture is used to hold multi-virtual machines in Cloud data centres.

Keywords: Cloud Computing, DVFS, Data centre, Virtualization, multi-core architecture, virtual machine.

INTRODUCTION: current resource-intensive activity and scientific applications construct rising demand for high performance computing infrastructures. This has led to the production of huge-scale computing data centres consuming vast amounts of electrical power. In spite of the improvements in energy efficiency of the hardware, overall energy consumption continues to rise due to growing need for computing resources. Other critical problems that occur from high power consumption, is that the infrastructure leads to large carbon dioxide (CO₂) emissions causative to the greenhouse effect. Cloud computing possesses the accessibility and the scalability, but due to the multi-level, distributed, and virtualized systems, the efficiency of energy be faced with new challenges . Thus, how to keep the energy of the data centres without moving together the financial competence and system performance is a main problem.

A digit of practices can be useful to find energy efficiency, such as upgrading of applications' algorithms, power aware energy saving mechanism, pack algorithm , energy efficient hardware, Dynamic Voltage and Frequency Scaling (DVFS) multi-core architecture, terminal servers and thin clients, and virtualization of computer resources. Virtualization technology allows one to constructs various Virtual Machines (VMs) on a physical server and, therefore, decreases sum of hardware in use and improves the utilization of resources By applying the virtualization technology, in agreement with the needs of users to organize a virtual machine, together the computing environment and resource organization problems can be solved. If the right voltage regulation can be applied, the energy efficiency and

the system transparency would be enhanced .This paper proposes a mechanism to regulate the system voltage based on the CPU utilization, and migrating tasks in a heavy loaded machine to idle machines, therefore as to get better the resource utilization and decrease the energy consumption.

Cloud computing logically leads to energy-efficiency by given that the following characteristics:

- i. Economy of scale due to removal of redundancies.
- ii. Enhanced utilization of the resources.
- iii. Position independence – VMs can be stimulated to a place where energy is cheaper.
- iv. Scaling up and down – resource usage can be used to present needs.
- v. Capable resource management by the Cloud supplier.
- vi. Cloud Sim provides a policy to run new algorithm.

The energy utilization is not only resolute by the competence of the physical resources, but it is also dependent on the resource management system deployed in the infrastructure and competence of applications running in the system.

- I. **VIRTUALIZATION:** Virtualization allows various operating system instances to run simultaneously on a solitary computer; it is a means of separating hardware from an only operating system. Virtualization structural design consists of three components, hardware, Virtual Machine Monitor (VMM), and Virtual Machine (VM). VMM is one of the core performances of virtualization, and is dependable for as long as virtualization and control

hardware resources. There are various virtual machines exist, such as Xen and KVM.

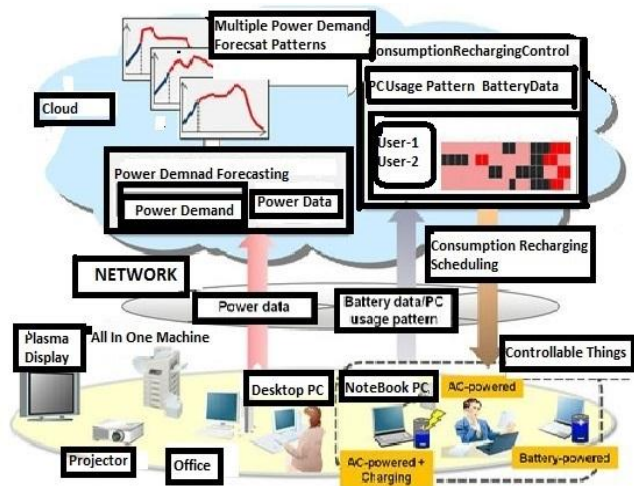


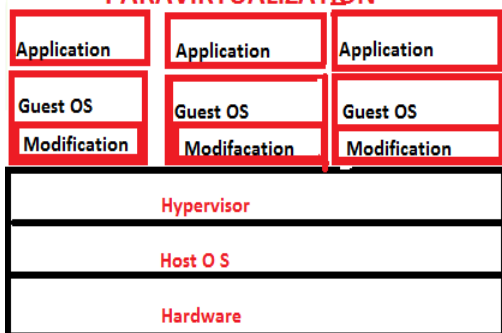
Figure 1: Energy Consumption At different Level

Types of Virtualization:

Full virtualization: The benefit of full virtualization is that it can retain reliable compatibility in spite of hardware environments, however, will raise a larger system loading of the physical machine moderately.

- i. *Para virtualization:* whereas the advantage of para-virtualization is that it may distribute hardware resources with the unique operating system, but the system kernel is essential to be customized. In terms of performance, the Para-virtualized is better than that of the full virtualization, but the related hardware support is unsatisfactory.

PARAVIRTUALIZATION



FULL VIRTUALIZATION

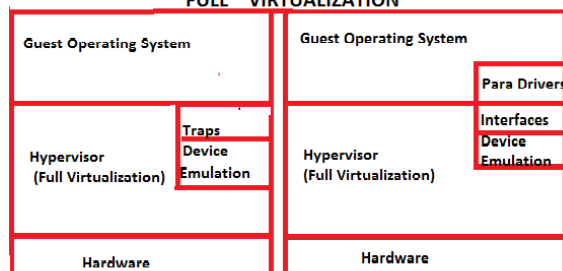


Figure 2.1 Para virtualization
Figure 2.2 Full Virtualization

CLOUDSIM: Cloud Sim is used to calculate the show of the energy saving mechanism. It is a cloud computing simulation software and developed by the University of Melbourne. CloudSim can maintain the structure of the large-scale cloud computing environment for simulation and the data center, service agent, development, and resource distribution stage can also be constructed automatically. It provides a virtualization mechanism that can be used to set up and control a diversity of virtualization services in the nodes of the data center.

Whereas distributing processors for virtualization services, resources involvement in sequential and spatial can be switched flexibly. CloudSim applies fully grown virtualization technology, according to the needs of users; the data center can distribute correct resources to every user. CloudSim provides resource management and monitoring as well as the mapping of the host and virtual machines. It also provides the function for communication in data center and users can build their own algorithms to be processed in CloudSim.

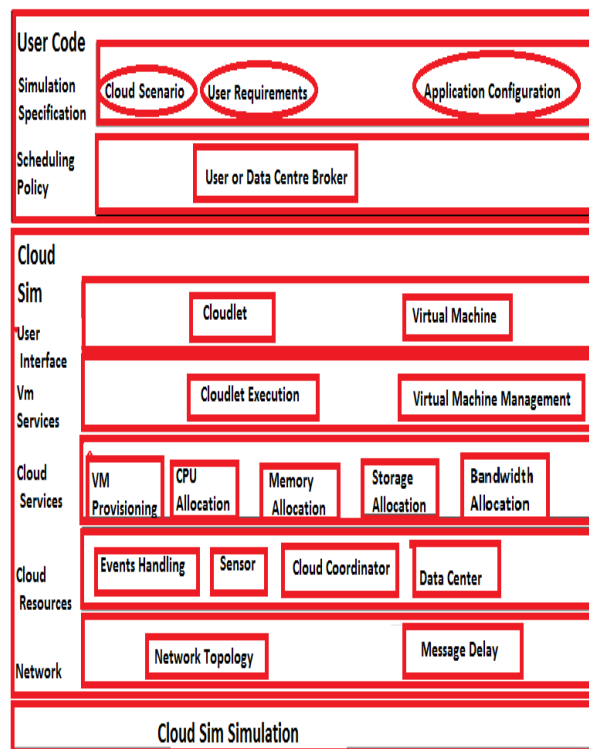


Figure 3: Cloud Sim

- ii. **VIRTUAL MACHINE MIGRATION:** Virtual machine migration method allows a virtual machine running on a physical machine to be migrated to a different physical machine. Migration can be classified into two types.

- i. **offline migration**
- ii. **real-time migration**

For offline migration, the present user's position must be suspended or shut down before the migration can be done, and users will not be capable to get any action.

For real-time migration, it is not essential to shut down the real virtual machine and the job can be

migrated at the user uninformed condition. The advantages of the real-time migration consist of

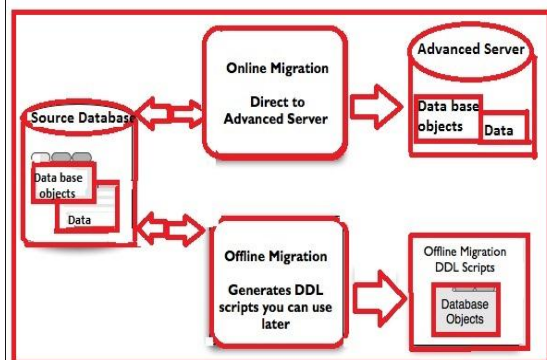


Figure 4: Migration

Load balancing, power efficiency.

III. **DYNAMIC VOLTAGE FREQUENCY SCALING (DVFS):** Dynamic voltage frequency scaling is a hardware technology that can dynamically regulate the voltage and frequency of the processor in execution time. By applying DVFS technology, without having to restart the power supply, system voltage and frequency can be adjusted in agreement with the requirement of the real CPU design into a changed working voltage. Whereas CPU works in lower voltage, the energy consumption can successfully be saved. The power utilization of the CPU is calculated by multiplying the voltage square with the system frequency.

$$P = V^2 * F * C$$

Where V is the voltage,

F is the frequency and

C is the capacitive load of the system.

The DVFS is the power reduction technology by dropping the voltage supply. The dropping of CPU frequency means that the voltage can also be dropped, however it will effect in the degradation of the system performance and lead to prolong the execution time .The overhead of the voltage adjusting should also be measured. The aim of the DVFS is to permit the degradation of the execution speed of a task by decreasing the CPU frequency and voltage to decrease the power utilization. This technology is frequently used in real-time systems.

By the above equation we can observe that if only decreasing the frequency, energy cannot be saved effectively. In the system, C is the capacitive load of the

system, only in lowering the frequency and as well reducing the voltage, the power consumption can be saved successfully.

IV. **SYSTEM OVERVIEW:** A mechanism by applying Cloud Sim to simulate a huge size cloud data center for power saving has been planned in this paper. The system consists of three parts: the CPU utilization monitoring, DVFS modification, and real-time migration. CPU utilization at every host is monitored in the system. According to the considered CPU consumption, a proper procedure will be performed for saving energy consumption.

In CloudSim, MIPS (million instructions per second) is used to current the capability of the host machine, the capacity of VM, and the workload requested by the user. Each workload will be circulated to VMs on dissimilar hosts. VMMIPS is the quantity of MIPS necessary for the VM and HostMIPS current the quantity of MIPS the host can maintain. The utilization of the virtual CPU of a virtual machine, Vcpu, can be calculated by the given equation and the typical utilization of CPUs can be calculated.

$$V_{cpu} = \frac{VM_{MIPS}}{Host_{MIPS}}$$

$$CPU_{Utilization} = \frac{\sum_{i=1}^n V_{CPUi}}{n}$$

V. EXPERIMENTAL RESULTS AND ANALYSIS :

In the experiment, the computer is using Intel® Core™2 Quad Q9500 CPU, running at 2.83GHz, 4GB DDR3 memory, and 500GB SATAII hard drive. Experimental platform is the CloudSim software with Windows 7 operating system. Both host and VM are Multi-core architecture. Generally use the KVM, the compiler uses the IDE the Eclipse. A huge scale cloud computing environment is simulated in the experiment. The number of tasks is 400, the resources essential for every tasks are from 5 to 250 MIPS which are generated arbitrarily. The voltage adjustment is determined every 15 seconds. Entire run time is considered at the time all works finished. The experiment is performed 10 times for calculating the average value and total power consumptions.

Conclusion: This paper proposed a Multi-core processor with dynamic resource management energy-saving mechanism in the cloud computing environment to decrease

the energy consumption Multi-core processor is not only a solution for CPU speed but also decrease the power consumption because various cores in a lower frequency simultaneously produce less heat dissipation than one core with their total frequency. Therefore, multi-core processor is regarded as the upcoming generation of microprocessor design. Multi-core processor with DVFS technique can be applied by monitoring the CPU utilization. Once the workload is heavy, multi-core architecture can be provided for achieving other successful usage of resources below the user unaware condition. The experimental result shows that the energy consumption can be saved considerably by applying the planned multi-core architecture with dynamic resource management mechanism. In the future, ThrRs (Static Threshold (THR) VM allocation policy and Random Selection (RS) VM selection policy) will be used.

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