A Survey on Power Management in Cloud Data Centers

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Abstract— Cloud computing is the emerging technology for storing and processing the large amount of data. It is used to access resources owned and operated by a third party provider. Cloud also involves servers and data centers for the users to access hardware and software resources. Power management plays a vital role in data centers because it consumes huge amount of energy. The most power consuming components are processors, RAM, hard disk and various executable components. This paper describes a survey about various techniques in power management for improving efficiency and performance.

Key words: Power management, Data centers, Resources

I. INTRODUCTION

Cloud computing is the web based application in which the resources are hosted in the cloud server. It is the utility based computing where the resources and services are provided by the servers on demand to the users. There are several components in the cloud: Client, Service, storage, applications. The servers in the data center have hardware and software called as cloud. Cloud resources are continuously provided to the users. It is the virtual machine model because there is no exact location available for the stored data on the servers. The cloud applications are hosted on the server from which the available resources are assigned to the users.

There are several techniques available for managing the power consumption to reduce the cost for the data centers. Due to the large amount of power consumption several techniques should be proposed to maintain the essential energy and cost efficiency. Power management plays an effective role in the economic point of view to improve the operation efficiency and the performance. It is also necessary and sufficient condition to maintain the temperature of the system to avoid node failures. Today, the most important requirement is to reduce power consumption and the simplest way to do this, is to change the mode of idle changes or servers from active to sleep state. To do this various power management techniques has been developed which may uses the various methods such as consolidation, migration, and merging of traffics.

II. RELATED WORKS

In modern centuries, power consumption by network equipment's has been become as the most crucial issue toward its development to reduce the power consumption.

Xin Zhan (2015) [1] proposed the Self-Consistent Total Power Budgeting algorithm to partition the total power budget among the cooling and computing infrastructure. Throughput predictor technique is used for servers with heterogeneous workload sets. Task scheduling is not integrated with data center.

Abdulla M.Al-Qawasmeh(2015) [2] proposed the power consumption and temperature which are controlled in the data center operations. Resource allocation and optimization techniques are used to manage the Computer Room Air Conditioning (CARC) unit and computers. Budget based task scheduling process is not supported.

YunNi Xia(2015) [3] proposed the Dynamic Voltage Scaling(DVS) technique which is adapted to control power supply in data centers. Green cloud computing technology is used to manage the energy consumption and operation cost. Resource allocation and cooling power management factors are not considered.

Chien-An Chen(2015) [4] proposed the system which supports data storage and processing with node failure and availability factors under mobile cloud environment. K-out-of-n computing solution scheme is used to access resources in remote servers. Data center operations are not supported.

Jia-Chun Lin(2015) [5]proposed the map reduce techniques which is used to perform the job execution with minimum delay end energy consumption levels. Data replication and task assignment policies are used to improve the job completion reliability with minimum energy. Network component roles are not considered.

III. POWER MANAGEMENT TECHNIQUES IN CLOUD

There are various Power Management techniques has been proposed and applied in various cloud mockup tools. In this survey, we will provide an overview of few techniques for power management to improve the efficiency and performance.

A. Link State Adaptation

In this technique, the power controller uses information about traffic on each link and update The performance can be improved by dynamically changing the rate and adaptation of the link. The network traffic interfaces can be made to sleep for the short period of time. This basic scheme describes that the traffic can be worked without performance and availability[7].

B. Network Traffic Consolidation

The network traffic consolidation technique is created upon a traffic related approach to route traffic such that it is consolidated on fewer links, while some of the non-utilized links can be disabled. This approach reduces energy consumption by removing all idleness in the network. The amount of energy consumed is the minimum requirement to support the obtainable network load, but it comes at a huge budget to reliability, as there are no jobless paths in the network topology. This case can be used to show the adjustments between power investments and availability[7].

C. Server Load Consolidation

It is an indirect way to combine network traffic into fewer links and allow the controller to turn off non-utilized port to transfer the jobs, so a less number of servers are being used. In this technique, we need to confirm that server resources such as CPU and memory are acceptable to handle the

assigned tasks by the user. After performing server load consolidation, we can additionally reduce the energy consumption by resorting to network traffic consolidation as well[7].

D. DVFS

Dynamic voltage frequency scaling (DVFS) is a method which is used to reduce the power and energy consumption during the working of microprocessors. The proposed dynamic voltage frequency scaling (DVFS) loop, is used to vary or set the supply voltage and frequency for the operation according to the desired frequency which is predicted via the operating system and circuit to control the speed. This technique is widely accepted now a days, as it provides high performance due to exactness in improvement, and can significantly improve processor energy efficiency[6].

E. DNS

The name describes itself the Dynamic Network Shutdown (DNS) technique which allows to maintain or control the status of the server to dynamically shutdown the servers or switches, whenever it is possible. By shutting down any component of data center at any time helps in reduction of considerable amount of power consumption.

F. Merge Network For Traffic

This technique uses a methodology for integration of traffic from multiple links and feeding the merged flow to a switch with fewer ports. In this network, number of packets are dynamically switched to follow some path through the merge network. This network ensures very small latency, the energy cost of the merge network is minimal and this design allows us to make the merge network comparatively translucent to the PHY and MAC layer protocols.

G. Server Virtualization

Virtualization allows multiple operating systems to run concurrently on one server. Finally, we can shut down the servers during the sleep state which become idle due to the creation of VM and helps in minimizing the energy consumption.

H. Traffic Correlation

Traffic correlation technique consolidates traffic flows based on correlation analysis among flows in a DCN. Another feature is to integrate correlation-aware traffic consolidation with link rate adaptation for maximized energy savings.

IV. Appraisal of Pre-eminent Technique

In today's technology, DVFS is the widely used technique, and also we can operate in cloud simulation tools such as CloudSim and GreenCloud. The only technique which fit in all the before discussed technique in the situation and is accepted as a technique to reduce power or energy consumption of processors. Power management strategies used in enterprise servers based on Dynamic Voltage Frequency Scaling (DVFS). It allows the server to transition the processor from high-power states to low-power states. The processors are assigned to sleep states to reduce energy consumption. In deep sleep the server can be configured to use Direct Memory Access (DMA) to place incoming packets into memory buffers for processing in the active state.

V. Conclusion

Nowadays the usage of internet is required and also data storage space for processing the data centers has increased to a greater extent. By analyzing the various power management techniques, it has been found that each technique has a capacity to diminish the power consumption to some amount with some of their own limitation. The DVFS technique energetically switches the datacenter module states by increasing or decreasing the voltage and frequency. We consider that our survey will enable the new way for researchers to obtain new knowledge about the various techniques and motivate to propose the solutions for the power management problems in data centers to increase the performance and efficiency.

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