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Optimizing Energy Consumption & Resource Usage while Executing the Analytics Applications in Data Centers

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Abstract: **- The booming of Big Data industry accelerates the development of techno-logical evolution and application innovation. Governments also realized that Big Data plays an important role in economic development, public services, national security, etc. Core infrastructure of Big Data, the Data Center (DC) is becoming more significant. To reduce the power consumption of IT devices, involved into data centers, various efficient proposals have been successfully deployed, such as virtualization and cloud computing. Energy consumption of air conditioners is expected to be reduced by establishing a low-temperature zone, deploying ventilation and water-cooling systems, etc. Unfortunately, these solutions have limitations in terms of economy and maintainability. We propose a cloud-based approach to effectively reduce DC power consumption through a slight update and simplify and standardize the management of the cooling system by intelligent temperature control algorithm. Also propose resource usage by using resource management algorithm.**

***Index Terms*—analytics, virtualization, power, resources, data.**

I. INTRODUCTION

In recent years, the Internet of Things (IoT), cloud computing and Big Data techniques have made remarkable progress in information technology. These techniques have become an important engine of economic growth around the world [1–3]. Furthermore, with the rapid growth of mobile net-works [4,5], the number of various devices connected to the Internet is increasing, and the explosion of data generated by these devices has led to exponentially increasing requirements of computing and storage capacity [6]. The booming Big Data industry accelerates the development of techno-logical evolution and application innovation. Currently, governments have realized that Big Data plays an important role in economic development, public services, national security, etc. As the core infrastructure of Big Data, the Data Center (DC) is becoming more significant [10].

To maximize energy efficiency and minimize environmental impacts, the green DC has been proposed in recent years, which is regarded as the inevitable development trend of DCs [7]. High efficiency is the primary concern of green DCs, which mainly refers to the power supply of IT devices and air conditioning systems [8]. To reduce the power consumption of IT devices, various novel and efficient proposals have been successfully deployed, such as virtualization and cloud computing [9]. Moreover, the energy consumption of air conditioners is expected to be reduced by establishing a low-temperature zone, deploying ventilation and water-cooling systems, etc. Unfortunately, these solutions have limitations in terms of economy and maintainability.

A cloud-based air conditioning system for DCs. It consists the following contributions: 1) We propose a cloud-based approach to effectively reduce DC power consumption through a slight update and simplify and standardize the management of the cooling system. 2) We propose a intelligent temperature control algorithm to increase the energy efficiency of the cooling system.3) We also propose resource usage by using resource management algorithm.

II. LITERATURE SURVEY

[a] M. Chen, Y. Zhang, Y. Li, M. Hassan, A. Alamri, AIWAC: affective inter-action through wearable computing and cloud technology, Wireless Communications, IEEE 22 (1) (2015) 20–27.

As a new paradigm, cloud gaming allows users to play high-end video games instantly without downloading or installing the original game software. In this paper, we first conduct a series of well-designed active and passive measurements on a large-scale cloud gaming platform and identify the

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significant diversity in the queuing delay and response delay among users. We note that the latency problem largely results from user-specified request routing and inelastic server provisioning. To address latency problem of the cloud gaming platform, we further propose an online control algorithm called iCloudAccess to perform intelligent request dispatching and server provisioning. Our main objective is to cut down the provisioning cost of cloud gaming service providers while still ensuring the user quality-of-experience requirements. We formulate the problem as a constrained stochastic optimization problem and apply the Lyapunov optimization theory to derive the online control algorithm with provable upper bounds. We also conduct extensive trace-driven simulations to evaluate the effectiveness of our algorithm, and our results show that our proposed algorithm achieves significant gain over other alternative approaches.

[b] J. Priyadumkol, C. Kittichaikarn, Application of the combined air-conditioning systems for energy conservation in data center, Energy and Buildings 68 (2014) 580–586.

The dissipation of heat from the server racks is continuously increasing. For this reason, a raised floor cooling system is important to keep the computer system operating to be effective and long lasting. Thus the proper design air conditioning system in data center is concerned in order to avoid disruption that caused by overheat. Nowadays it is not only a raised-floor cooling system that has been used in data center but also a new cooling system called “In-row” has been introduced into the market. This research presents a simulation of cool air flow generated by 3 different air conditioning systems in data center, which are raised floor air conditioning system, In-row air conditioning system and the combined of them, for giving some appropriate guidelines to help the designer to achieve a better and more efficient cooling system. Dimensionless parameters in the form of supply heat index (SHI), heat load of server racks and the volume flow rate from perforated tile were carried out by considering the rack inlet temperature compared with the standard air temperature of ASHRAE. The results show that these parameters provide an effective tool to the improvement of energy efficiency in the data center.

[c] X. Ge, X. Huang, Y. Wang, M. Chen, Q. Li, T. Han, C.-X. Wang, Energy-efficiency optimization for MIMO-OFDM mobile multimedia commu-nication systems with qos constraints, Vehicular Technology, IEEE Transactions on 63 (5) (2014) 2127–2138.

It is widely recognized that, in addition to the quality-of-service (QoS), energy efficiency is also a key parameter in designing and evaluating mobile multimedia communication systems, which has catalyzed great interest in recent literature. In this paper, an energy-efficiency model is first proposed for multiple-input–multiple-output orthogonal frequency-division multiplexing (MIMO-OFDM) mobile multimedia communication systems with statistical QoS constraints. Employing the channel-matrix singular value decomposition (SVD) method, all subchannels are classified by their channel characteristics. Furthermore, the multichannel joint optimization problem in conventional MIMO-OFDM communication systems is transformed into a multitarget single-channel optimization problem by grouping all subchannels. Therefore, a closed-form solution of the energy-efficiency optimization is derived for MIMO-OFDM mobile multimedia communication systems. As a consequence, an energy-efficiency optimized power allocation (EEOPA) algorithm is proposed to improve the energy efficiency of MIMO-OFDM mobile multimedia communication systems. Simulation comparisons validate that the proposed EEOPA algorithm can guarantee the required QoS with high energy efficiency in MIMO-OFDM mobile multimedia communication systems.

[d] J. Luo, L. Rao, X. Liu, Temporal load balancing with service delay guaran-tees for data center energy cost optimization, Parallel and Distributed Systems, IEEE Transactions on 25 (3) (2014) 775–784.

Cloud computing services are becoming integral part of people's daily life. These services are supported by infrastructure known as Internet data center (IDC). As demand for cloud computing services soars, energy consumed by IDCs is skyrocketing. Both academia and industry have paid great attention to energy management of IDCs. This paper studies an important energy management problemâ€”how to minimize energy cost for IDCs in deregulated electricity markets. We propose a novel two-stage design and the eco-IDC (Energy Cost Optimization-

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IDC) algorithm to exploit the temporal diversity of electricity price and dynamically schedule workload to execute on IDC servers through an input queue. Extensive evaluation experiments are performed using real-life electricity price and workload traces at an enterprise production data center. The evaluation results demonstrate that the proposed approach significantly reduces energy cost for IDCs, guarantees a service delay bound, and alleviates workload drop if the service delay bound is sufficiently large.

III. PROPOSED WORK

A cloud-based air conditioning system for DCs. It consists the following contributions: 1) We propose a cloud-based approach to effectively reduce DC power consumption through a slight update and simplify and standardize the management of the cooling system. 2) We propose a intelligent temperature control algorithm to increase the energy efficiency of the cooling system.3) We also propose resource usage by using resource management algorithm.

IV. PROBLEM RELATED WORK

The evolution of the DC has included the following three main stages:

a) ***Distributed DCs***: Continuous improvement of business, the enterprises must establish DCs in different regions according to the information demand of subsidiaries. However, with the increasing demand for data management and services, distributed DCs fail to address data sharing and business continuity.

b) ***Centralized DCs***: To improve the quality of information services, reduce management complexity the originally distributed servers, storage devices and other IT-related devices are centrally managed. Moreover, centralized DCs provide unified security management and disaster recovery.

c) ***Cloud-enabled DCs***: Assisted by advanced cloud computing and virtualization techniques, DCs can flexibly meet the dynamic business demand and reduce energy consumption [12]. Meanwhile, because of the energy crisis [13], cloud-enabled DCs with considerable performance in energy savings have become a preferred approach to establishing green DCs [11].

Therefore, many studies attempt to use cloud-enabled techniques to reduce energy consumption on the premise of guaranteeing Quality of Service (QoS) and Quality of Expe-rience (QoE) [14,15]. In [16], Kashif et al. proposed a novel green DC architecture to provide comprehensive monitor-ing and live migration and optimization of virtual machines. In [17], Jetsadaporn and Chawalit designed a simulation sys-tem to simulate DC cooling systems to provide guidance for reducing energy consumption. Although the existing approaches are able to reduce DC energy consumption, they require massive capital investment and are difficult to deploy in a practical DC. Hence, we propose a smart temperature control system for DCs to address these challenges.

V. OBJECTIVES

Study will carried out with objectives:

1. To study on various technologies which is currently implemented to optimize energy consumption & resource usage on data centers
2. Analyze the experimental results.
3. Produce a performance comparison between traditional methods & cloud-based approach & multilevel intelligent temperature control algorithm.
4. Address applicability of the proposed work to the real-world scenarios.
5. Design a multilevel intelligent temperature control algorithm on large data center.
6. Design a new resource management algorithm for scalable data center.
7. Determine the energy efficiency of data center by applying proposed algorithm.
8. Analyze resource management algorithm on scalable data center
9. Results will compare using the metrics of energy consumption & performance of resources in scalable environment. These metrics include time & cost for deployment.

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VI. METHODOLOGY

System Architecture

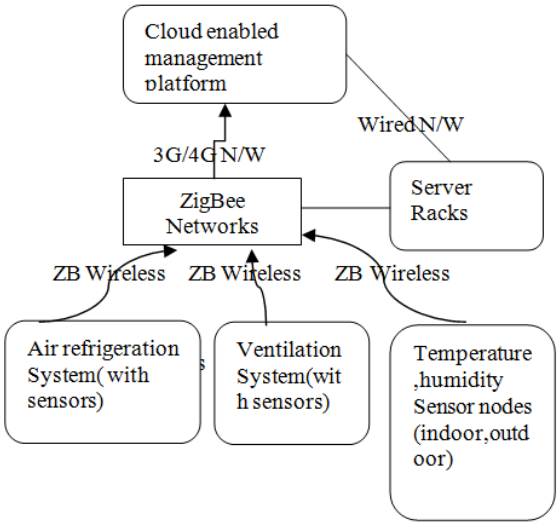

Figure 1.Basic System Architecture

The system architecture consists of the temperature control system and cloud management platform. The temperature control system provides cooling, ventilation, environment signal acquisition and transmission. The cloud management platform is responsible for data storage and query, environmental data monitoring, accessory device management, and Big Data-based system evaluation

Cloud-enabled management platform

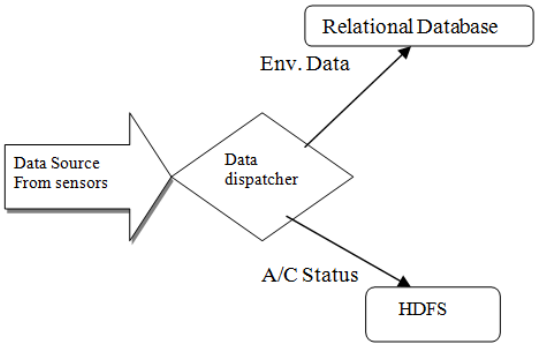

Figure 2. Cloud-enabled management

Cloud-enabled management platform is the control-ling centre of the DC air conditioning system. As shown in fig.2, its core functions include data storage and Big Data analysis. Moreover, various applications can be developed based on this platform to provide monitoring and management for the DC air conditioning system. Real-time monitoring of the environment and air conditioning devices in the DC, the sensors are expected to collect data at short intervals. As shown in fig.2, the sensory data are transmitted to the cloud and stored in a RDBMS and a Big Data storage system i.e., a Hadoop Distributed File System (HDFS) after the classification assisted by the Data Dispatcher

Multilevel intelligent temperature control algorithm

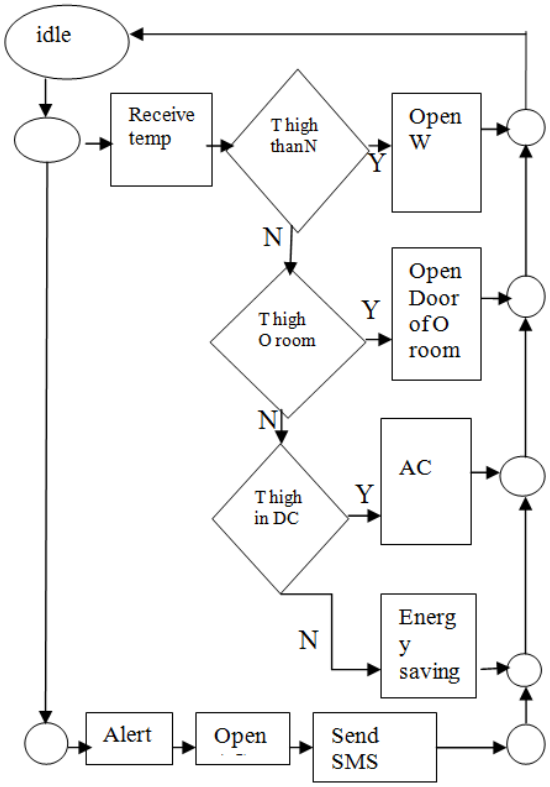

Figure 3. Intelligent temperature control algorithm

Fig 3 shows flow chart of Intelligent temperature control algorithm. It collect input as temperature & alert from the system. Receiving temperature it check three conditions if the temperature is high in DC as compare to nature it opens window. In second condition it checks room temperature if it is high then it opens room door and in third condition if temperature of DC is high then it

start Air conditioning. If the algorithm receives alert from system then it sends SMS to manager on his/her android app.

VII. CONCLUSION

A proposed system applies cloud assisted management system to optimize energy consumption and resource usage .It can effectively reduce the energy consumption. It also scalable and efficient.

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