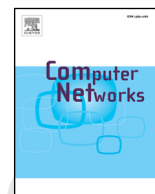




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## Green data center with IoT sensing and cloud-assisted smart temperature controlling system

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## ABSTRACT

With the growing shortage of energy around the world, energy-efficiency is one of the most performances for data center. In this paper, we propose a green data center air conditioning system assisted by cloud techniques, which consists of three sub-systems: data center air conditioning system, cloud management platform. Data center air conditioning system includes environment monitoring, air conditioning, communication, ventilation, and temperature control, while cloud platform provide data storage, big data analysis and prediction, and up-layer application. Moreover, the detailed design and implementation are presented, including dispatch algorithm of temperature control, topological structure of sensor network, framework of environment monitoring node. Based on the feasibility evaluation, it verifies that the proposed system can significantly reduce the data center energy consumption without a degradation in cooling performance.

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### 1. Introduction

In recent years, Internet of Things (IoT), cloud computing and big data techniques have made remarkable progress in information technology, it has become an important engine of economic growth around the world [1–5]. Furthermore, with the rapid growth of mobile network [6,7], the number of various devices connected to Internet is increasing, and the explosion of data generated by these devices raises great challenges to for data computing and storage [8,9]. The booming big data industry accelerate the development of technological evolution and application innovation, and gov-

ernments have realized that big data plays an important role in economic development, public services, national security, etc. As the core infrastructure of big data, Data Centers (DC) will become more essential [10].

DC is a complex infrastructure, which includes not only the computer, networking and storage systems but also includes redundant communication, control, monitoring and safety devices [11]. DC plays a critical role in ensuring the continuity of IT infrastructure and providing necessary guarantees for information security [12]. Fig. 1 illustrates a practical DC in Internet Service Provider (ISP) consisting of power, cooling, fire protection, security and other subsystems.

In order to maximize energy efficiency and minimize environmental impacts, green DC has been proposed in recent years, and it is regarded as the inevitable development trend of DC [13]. Reducing energy consumption is the prior concern of green DC, which mainly refers to power supply of IT devices and air conditioning system [14]. For reducing the

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