

Chapter 8

Cloud-Based IoT Architecture in Green Buildings

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ABSTRACT

The development and expansion of mankind in addition to the advancement of technology have a substantial impact on the environment. The construction, design, and operation of buildings account for a large consumption of natural resources. Due to the exploitation of natural resources on a large scale through these buildings, it has become necessary to have a better-designed building for the efficient use of resources. The concept of “green building” solves the aforementioned issues apart from promoting eco-friendly activities. IoT makes the idea of having buildings that are energy sufficient possible through networked sensors that not only help in managing the assets better but also reducing harmful impacts on human health and the environment. This chapter talks about the concept of the green building and the smart automation achieved through IoT as well as cloud architecture for the green building also referred to as green cloud. While it explains the basic cloud architecture in green building, it also proposes future challenges for the aforementioned subject.

INTRODUCTION

With the growth of demand for internet data and high-speed network in the current world scenario, there is a need for large-scale data storage providers which is being met by the high-processing data center's which in turn consists of a large number of servers along with organized and structured facilities. Various multi-national organizations such as Amazon, eBay, Google and Yahoo run these enormous data

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center's throughout the world. Numerous business enterprises traditionally invested an immense amount of resources and capital in making such massive data center's for data storage (Kumar & Buyya, 2012). With the advancement in technology and the formation of the network in IoT, there is a desperate need to store all the data in an efficient manner and process it optimally. Cloud computing is an ideal architecture for data hosting, computing and storage infrastructure which eventually makes it cost-effective. The highly scalable, dynamic field of ICTs can be converted into green cloud computing by working to improve energy efficiency and reducing carbon emissions and electronic waste.

The history of cloud computing traces back its roots from the 1960s (Mohamed, 2018). However, the aforementioned term became popular worldwide in recent years due to its ability to overcome the drawbacks of data center's such as high-maintenance cost, proximity challenges, huge infrastructure expenditures, etc. Even though various business corporations are migrating from data center services to cloud computing for its ease of use but there remains a considerable amount of companies that still prefers the traditional data center services. The advancement in the technologies has in various cases led both producers as well as the users to neglect the environmental issues (Radu, 2017). For instance, there are about 44 million servers incorporated in various data center's that consume about 0.5 percent of all the electricity (Forrest, Kaplan, & Kindler, 2008). It is interesting to note that the data center's or server farms alone stood for 14% of the global CO₂ emission (Uddin, Abdul Rahman, & Memon, 2011). Considering the aforementioned harmful effects of technology, it is, therefore, the need of the hour to use green technologies. Green technology is defined as the technology which can perform the same functions as any other technology, but is energy efficient while executing its task. While taking into the account, the increase in energy consumption it can be inferred that Information Communication Technology or ICT is largely accountable for it. This expansion of the mobile phone network and ICT services lead to an increase in energy consumption. Since the internet has become a large part of the humankind, cloud computing has surfaced a useful tool to keep up with the rising demand for data storage. Since cloud computing emerged around the world, it becomes a necessity to come up with green computing (Prashant, 2017). The idea of the green building goes along with the need of the hour that is low power consumption and being environment-friendly.

This chapter focuses on cloud computing architecture via IoT in green buildings. The remaining chapter is structured as- Section 1 explains the three main concepts of the chapter, i.e. green building, IoT devices, and green cloud computing. In section 2, the smart automation in green building and methods to minimize energy consumptions are discussed. Section 3 & 4 covers the IoT architecture in green buildings and the basics of green cloud computing. Finally, the last section i.e. section 5 explains the green cloud architecture in green building.

BACKGROUND

It is a well-known fact that data center's consumes a large amount of electricity. Also, most of the electricity is produced by fossil fuels and therefore causes carbon emissions, which is harmful to the environment. Thus, many companies are moving toward building a "green" data center like Apple (Bostic, 2013) and McGraw-Hill (Miller, 2014) constructed 20MW and 14MW solar arrangement for their organizations, respectively. There some cloud providers that use solar or wind farms to power their data center's ("Wind-Powered Data Centers", n.d.). Since the production of electricity depends upon fossil fuels, which causes carbon emissions the idea of the green building is getting popular all over the world.

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