

## Chapter 16

# Green Cloud Architecture to E-Learning Solutions

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### ABSTRACT

*Electronic learning or e-learning is the use of technology to enable learners to learn from anywhere and anytime. The delivery involves the use of electronic devices in some way to make available learning contents. Today, e-learning has drastically changed the educational environment. The e-learning methodology is a good example of green computing. Green computing refers to the study and practice of using computing resources in an eco-friendly manner. It is the practice of using computing resources in an energy efficient and environmentally friendly manner. In order to reduce costs, education services can be provided using cloud technology. The green cloud computing solutions save energy, reduce operational costs, and reduce carbon footprints on the environment. Hence, the objective is to provide a green cloud architecture to e-learning solutions. This architecture is addressing the issues such as improving resource use and reducing power consumption.*

### INTRODUCTION

Higher education institutions (HEIs) have been looking for new ways to respond to the changing professional field (Mircea, M. & Andreescu, A. I. 2011). The traditional teaching will be substituted by individual project-orientated and self-organized learning. The modern educational methods enable self-paced and self-directed learning with flexibility on time and site. The existing concept of self-contained study courses will be replaced by the concept of continuing professional development.

In an age determined to generate new paths to quality education, Information and Communications Technology (ICT) brings forward countless benefits, enabling learners with the right skill. ICT makes many ordinary tasks uncomplicated and facilitates communications from virtually any part of the globe. ICT in education has been linked with a shift in the quality of people's lives by improving teaching and learning. This is why a number of educational institutions are increasingly integrating ICT in their education system. Through this unique teaching method, learners gain a genuine learning experience, collaboratively constructing their own knowledge and applying their learning's in a real-world context.

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The use of ICT techniques in teaching and learning has a very positive influence on a student's learning capabilities as well. It is established that students reflect in a very positive manner towards work and education when they are using computers to complete tasks given to them, encouraging and motivating them to soak in the knowledge. Students or learners who used technology to learn in educational institutions have self-esteem and self-confidence. Education with the help of technology has crossed borders and has opened up a world of opportunities for learners. From easy sharing of information to collaboration with the help of e-Mail and cloud applications to instant access to learning programmes anytime, anywhere. The technologies that alter the education sector are virtual reality, gamification, data analytics, cloud computing, machine learning, artificial intelligence, etc.

Cloud computing platform enables enterprises or educational institutions to consolidate computing resources, reduce management complexity and speed the response to business dynamics. Improving resource utilization and reduce power consumption are key challenges to the success of operating a cloud computing environment. To address such challenges, it is designed the Green cloud architecture to e-Learning systems. Green cloud [Kaur, G. & Kumar, P, (2013)] computing is envisioned to achieve not only efficient processing and utilization of computing infrastructure, but also minimize energy consumption. It is essential for ensuring that the future growth of Cloud computing is sustainable.

Hence, the objective of this chapter is to design a Green cloud architecture to e-Learning solutions. The proposed Green cloud architecture to e-Learning solutions helps to decrease the energy consumption of Clouds without affecting the service providers' objectives. This architecture is designed in a way to provide incentives to both e-Learning users and providers in order to utilize and deliver the greenest services respectively. The Green cloud architecture provides the security and quality of service to the clients. This architecture includes emission directory, which measures the best suitable service, which gives less carbon emission so straight away it indicates that energy will also decrease energy consumption. Therefore, Green cloud architecture reduces unnecessary power consumption in an e-Learning environment.

This chapter is sorted out as takes after: Section 2 presents about different specialized points of interest that required composing this chapter. Section 3 studied different designs, for example, benefit arranged, cloud-situated and Green-oriented. The proposed architecture is portrayed in section 4 and finally, section 5 concludes this chapter with future enhancements.

## **BACKGROUND**

This section introduces state of art required to write this chapter. This includes cloud computing, e-Learning, the impact of e-learning in cloud computing, cloud computing, and energy usage, various energy efficiency models, features of clouds enabling green computing, and finally green computing in e-Learning applications.

### **Electronic Learning (or E-Learning)**

The world has entered into the digital age, and technology has touched every part of human life, whether it is business, communication, travel, health, or education. The global education system has taken it hands-on and the implications of advanced technology have created wonders in this field. The increasing influence of technology in education is offering us a glimpse into a gradually evolving realm of

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