

# Chapter 47

## Green Computing through Virtual Learning Environments

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### ABSTRACT

*As technology has quickly evolved into more sophisticated forms, it is opening the options for educators and business professionals to expand learning opportunities into virtual learning spaces. This chapter discusses a number of technology trends and practices that can promote green computing as a way for organizations and individuals to be efficient in time, currency, and resources. Three technology trends that are disrupting the status quo are Cloud computing, 3D printing, and the analytics associated with Big Data. In addition, trends that appear to be taking hold include digital badges, the Internet of things, and how we are handling recycling and e-waste of our devices. A discussion around issues of energy required for data servers to power the technology is also presented.*

### INTRODUCTION

Virtual learning is evident in many initiatives in both higher education and also in the modern workplace. For instance, *virtual teams* are often used as a teaching tool in online college courses to enhance students' engagement with course material, self-awareness, teamwork, self-discovery, or empathy (Grinnell, Sauers, Appunn & Mack, 2012; Loh & Smyth, 2010; Palloff & Pratt, 2013; Ubell, 2011). Likewise, organizations are also utilizing

virtual teams for learning and for the completion of work tasks (Nafukho, Graham, & Muyia, 2010). Virtual teams have become even more critical in organizations due to rising fuel costs and costly commercial office spaces (Bullock & Klein, 2011). Virtual learning has increased in direct proportion to the growing sophistication of information and communication technology (ICT) and is permeating and blurring our personal and professional lives (McWhorter, 2010; Thomas, 2014).

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## BACKGROUND

As virtual learning has come of age, green computing has been posited as a way for organizations and individuals to be efficient in time, currency and resources. Childs (2008) defined *green computing* as the “study and practice of using computing resources efficiently” (p. 1) that includes the lifecycle of technology: the design, manufacture, use, and disposal of computer hardware and software (Lo & Qian, 2010). In this chapter, the authors will focus on how existing technologies can be utilized efficiently in higher education and within industry to shrink travel time and cost, improve efficiency, and lessen environmental impact.

The following sections of this chapter will highlight various examples of green computing initiatives in higher education and the workplace that are making a real difference in lowering costs and increasing efficiency. Discussions include the use of cloud computing, mobile devices, digital badge technologies, real-time group meetings (RTGMs), and virtual and blended professional conferences. Each will be examined both for their potential for green computing as defined previously.

### Cloud Computing

Across both education and industry, one emergent application changing the computer industry is the use of cloud technology. In a recent issue of *Forbes*, Satell (2014) remarked:

*The cloud is now disrupting every industry it touches. The world's most advanced technologies are not only available to large enterprises who can afford to maintain an expensive IT staff, but can be accessed by anybody with an internet connection. That's a real game changer (para. 19).*

Cloud computing is defined by the National Institute of Standards and Technology as “a model for enabling ubiquitous, convenient, on-demand

network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction” (Brown, 2011, para. 3). Essentially, cloud computing is the storage and access of data (i.e. documents, presentations, photos) over the Internet (see Figure 1).

There are numerous examples of cloud applications available on the Web, each offering different storage volumes at variable costs. See Table 1 for a comparison of five of the most popular and inexpensive cloud applications.

### Cloud-Based Universities

Across universities, cloud computing is being introduced to faculty, students, and staff as a means to supplement or even replace traditional resources. In 2012, over 6.7 million students were enrolled in at least one online course (Allen & Seaman, 2013). In fact, the Babson Survey Group reported that online enrollments have increased more rapidly than overall higher education enrollments (Allen & Seaman, 2010). Part of the reason for this progression is the growing diversity of the U.S. population and greater demand for courses that provide greater flexibility, affordability, and the added convenience to students. Also, with fluctuations in the economy and an uncertain job market, a considerable number of students are pursuing online degrees for reasons of employment (Clinefelter & Aslanian, 2014).

The low cost, flexibility in use, and global accessibility makes cloud technology a suitable contender to level the playing field in education. For example, in December 2013, as part of a social experiment, Sugata Mitra created the first School in the Cloud lab allowing children, “no matter how rich or poor” the opportunity to “engage and connect with information and mentoring online” (Mitra, 2014, para. 1). Also, the Cloud is being utilized as a means to provide online curriculum

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