Chapter 26
A Taxonomy of Green Information and Communication Protocols and Standards

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ABSTRACT

Due to increased awareness of human's adverse effect on the environment, many new technologies to mitigate the environmental damage are under development. Although innovative, many of these technologies are often developed in isolation and consequently incompatible with each other. From the viewpoint of Systems Engineering, this presents an enormous challenge since compatibility among different elements of a system is crucial in achieving an optimal operational state that minimizes energy consumption. Therefore, standardization in the form of protocols is a key to accomplishing the goal of green Information and Communication Technology (ICT). In this chapter, the authors examine the existing green ICT technologies and their protocols to identify both obvious and subtle strengths and weaknesses. Particularly, the authors scrutinize the interoperability of the existing green ICT protocols and provide insights on how to improve the status quo. In addition, information on emerging governing bodies of green ICT protocols is provided.

DOI: 10.4018/978-1-61692-834-6.ch026

INTRODUCTION

Green Information and Communication Technology (ICT) refers to a collection of environmentally friendly information and communication technologies that help individuals and organizations conserve energy and reduce their adverse effect on the environment. It is also a way of utilizing ICT in an eco-friendly way. The use of ICT is rapidly growing and their influence on the environment is much farther reaching than one might think. For example, many households (especially, in the developed world) today have Personal Computers (PCs) and peripherals coming with them. A lot of these computers are constantly running and consume a significant amount of electricity. Furthermore, the upgrade cycles for these computers are relatively short (around three years as of this writing), and discarding them is becoming increasingly problematic due to many toxic materials used to manufacture PCs. The problem is even worse for organizations since the scale of their use of computers far exceed that of household use. Data centers housing tens of thousands of servers are commonplace and their energy consumption easily rivals what an entire town may require.

As consumers become more aware of the negative consequences of inefficient ICT resource utilization, they tend to be more selective about their choice of ICT products. Governments are encouraging this positive change in consumer by rating both goods and service according to their energy efficiency. For example, the U.S. government agencies such as Environmental Protection Agency (EPA) and Department of Energy (DOE) introduced Energy Star labels since 1992 to promote energy-efficient products (EPA and DOE, 2010).

Although standards such as Energy Star are indispensable in greening the ICT industries, a lack of coordination is an area of concern. Many of the standards are being developed in an isolated manner, which makes the overall greening effort through the development of standards less than optimal. For instance, the Energy Star standard does not consider how much energy is required to dispose of an electronic appliance appropriately and to recycle it. However, a private sector company (an online store called buygreen.com) has developed a scoring system that considers the cost of disposal and recycling. From the perspective of consumers who attempt to make consciously green purchasing decisions, having to check two numbers (i.e., Energy Star rating and recycling/disposal score) provided by two different organizations instead of one combined number is undesirable. Even if the consumer is willing to use multiple sources (standards or protocols) to make an informed decision, the information may not always be available to them. Therefore, it is necessary to have a comprehensive framework that clearly shows how the existing green ICT standards/protocols relate to each other to provide a global view of what is addressed and what is not by a particular standard or protocol and to ultimately accomplish the common goal of encouraging the production and consumption of environmentally friendly ICT products (Choi et al., 2009). This chapter is one of the first such attempts. It goes even further by discussing the organizations (both governmental and non-governmental) that develop and maintain the green ICT standards/protocols.

BACKGROUND

In this chapter, the terms, protocols and standards are used interchangeably. They both refer to formal ways to either enhance or assess the energy efficiency of an ICT technology. We categorize the green ICT protocols into green networking protocols, green computing protocols, and other miscellaneous protocols. Networking and computing protocols are in different categories because they deal with different problems. Networking protocols makes it possible for hosts (or computing devices) to exchange data while computing protocols focuses on processing the data. The