Greening the Internet/Cloud using Renewable-Energy-Aware Service Migration

Guest Lecture by Biswanath Mukherjee

Abstract

Cloud computing is the new paradigm of operation in today's Internet. While cloud computing infrastructures have benefits, their huge energy consumption is becoming a growing concern. Data centers, which are used to provide the infrastructure and resource pool for cloud computing, consume a large amount of energy. Future energy consumption predictions of these data centers are even larger concerns. To reduce this energy consumption, and hence, carbon footprint and green house gas emission of cloud computing and the Internet, energy-efficient methods of operation have to be investigated and adopted. In addition, renewable-energy usage (such as solar and wind) in place of non-renewables (such as fossil fuel) can also reduce carbon emission.

However, due to its intermittency and volatility, renewable energy cannot be used to its full potential. In this study, we introduce the renewable-energy-aware cloud service and virtual machine (VM) migration to relocate energy demand using dynamic and flexible cloud-resource-allocation techniques and overcome the challenges of renewable energy. Results from a US-wide cloud network infrastructure show that, using simple migration techniques, up to 30% non-renewable energy can be replaced by renewable energy while consuming only a small amount of extra resources and energy to perform demand relocation.