Renewable-aware Geographical Load Balancing of Web Applications for Sustainable Data Centers

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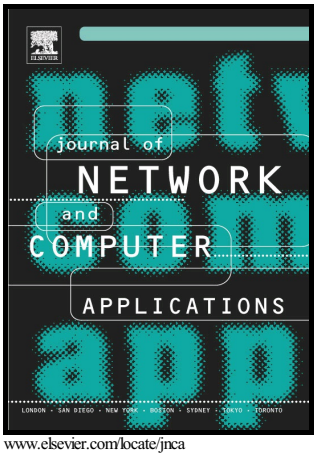

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Renewable-aware Geographical Load Balancing of Web Applications for Sustainable Data Centers

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Abstract

The ever-increasing demand for web applications deployed across multiple data centers results in large electricity costs for service providers and significant impact on the environment. This has motivated service providers to move towards more sustainable data centers powered by renewable or green sources of energy, such as solar or wind. However, efficient utilization of green energy to service web applications is a challenging problem due to intermittency and unpredictability of both application workload and renewable energy availability. One possible solution to reduce cost and increase renewable energy utilization is to exploit the spatio-temporal variations in on-site power and grid power prices by balancing the load among multiple data centers geographically distributed. In this paper, we propose a framework for reactive load balancing of web application requests among Geo-distributed sustainable data centers based on the availability of renewable energy sources on each site. A system prototype is developed, its underlying design and algorithms are described, and experiments are conducted with it using real infrastructure (Grid'5000 in France) and workload traces (real traffic to English Wikipedia). The experimental results demonstrate that our approach can reduce cost and brown energy usage with efficient utilization of green

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