Making data centers green

November 14 2016

The value and scale of information grows unstoppably and data centers must size-up if they are to adequately meet their operational requirements.

The widespread use of cloud computing and Big Data comes hand-in-hand with the need for data storage, computing and networking facilities capable of ensuring a reliable and secure infrastructure for information systems to operate on. Due to the high energy demands of data centers and their corresponding networks, resource consumption has become a challenging concern that may hinder further development of network and data center systems. At present, typical resource utilization is about 5% to 25% according to some statistics. Future data center design, management, and applications must tackle the need for sufficient energy efficiency if their growth is not to be associated to environmental damage.

In view of the above scenario, an international cooperation ICT research project has been established and is supported by the National Natural Science Foundation of China. The objective of this research is to reduce currently high and inefficient energy consumption on data centers from the perspective of job scheduling and resource management.

The international research team already at work includes scientists from the Chinese Academy of Sciences and Huazhong University of Science and Technology in China, IMDEA Networks Institute in Spain, and Temple University as well as University of California, Riverside in the USA.

Initial investigations made on the characteristics of power consumption by data center servers have yielded results to be applied to the energy-efficient technical design of data centers. The team has also developed routing schemes for data center networks that increase energy savings. Furthermore, a carbon-aware online control model for geographically distributed datacenters is being developed, where electricity costs, service level agreement (SLA) requirements, and an emission reduction budget are taken into consideration.

This internationally coordinated research project will last 5 years. Its findings and developed techniques aim to achieve a double objective: make data centers greener, thanks to reduced energy consumption and lesser CO2 emissions, whilst maintaining satisfactory service levels. The team of researchers hopes that, thanks to this work, we can all continue to enjoy the convenience of using data centers, without diminishing our enjoyment of a clean and cared for environment.

More information: Biyu Zhou, Fa Zhang, Lin Wang, Chenying Hou, Antonio Fernandez Anta, Athanasios Vasilakos, Youshi Wang, Jie Wu, Zhiyong Liu. "HDEER: A Distributed Routing Scheme for Energy Efficient Networking". IEEE Journal on Selected Areas in Communications (JSAC), 34(5):1-1, 2016.

Zhi Zhou, Fangming Liu, Ruolan Zou, Jiangchuan Liu, Hong Xu, Hai Jin, "Carbon-aware Online Control of Geo-Distributed Cloud Services", IEEE Transactions on Parallel and Distributed Systems, Volume 27, Issue 9, September 2016.

Jordi Arjona Aroca, Antonio Fernández Anta, Miguel A. Mosteiro, Christopher Thraves, Lin Wang: Power-efficient assignment of virtual machines to physical machines. Future Generation Comp. Syst. 54: 82-94 (2016).

Dawei Li, Jie Wu, Zhiyong Liu, Fa Zhang. "Towards the Tradeoffs in Designing Data Center Network Architectures". IEEE Transactions on Parallel and Distributed Systems, (in press).

Provided by IMDEA Networks Institute