Renewable and Sustainable Energy Reviews
Volume 51, 3 August 2015, Pages 1553-1563

Evaluating power efficient algorithms for efficiency and carbon emissions in cloud data centers: A review (Review)

Uddin, M.[a], Darabidarabkhani, Y.[b], Shah, A.[c], Memon, J.[d]

[a] College of Engineering, Department of Information System, Effat University, Kuantan, Jeddah, Saudi Arabia
[b] Faculty of Computing, Asia Pacific University, Kuala Lumpur, Malaysia
[c] Kulliah of Information Communication Technology, International Islamic University Malaysia, Malaysia

View additional affiliations

View references (94)

Abstract

A Data center comprises of servers, storage devices, cooling and power delivery equipment to support other components, exchange data and information to provide general services such as software-as-a-service (SaaS), platform-as-a-service (PaaS), and Internet-as-a-service (IaaS). Data centers require massive amount of computational power to drive complex systems. In return these massive systems bring many challenges and concerns including power dissipation and environmental sustainability. Higher power demand in data centers and changes in computing technology together to maximize data center performance has led to deploying multitude methods to estimate power intensity. Energy cost increment, global economic downturn, and global warming and other concerns have resulted in new research in achieving power efficient data centers. The research proposed in this paper evaluates three task scheduling algorithms RASA, TPPC, and PALB to get the most energy efficient task scheduling algorithm to be used in data centers for measuring their performance and efficiency. The three algorithms are evaluated for performance using three parameters; power efficiency, cost effectiveness, and amount of CO2 emissions. On top of that data center location and climate conditions are also considered and analyzed as parameters as they directly effect the operating costs, the amount of power consumption and CO2 emission. To minimize the power wasted by data center cooling systems is directly related to data center location and climate change. CloudSim simulator is used to implement the algorithms on an IaaS cloud infrastructure, to calculate the power consumption, and to analyze each algorithm's behavior for different parameters. The results generated clearly shows that TPPC is the most efficient algorithm due to less amount of power consumption and low volume of CO2 emission; however its implementation cost is bit higher compare to PALB and RASA.

Author keywords

Carbon emissions; Cloud data centers; Environmental sustainability; Green computing; Power efficiency

Indexed keywords

Engineering controlled terms: Algorithms; Climate change; Cooling systems; Cost effectiveness; Costs; Digital storage; Electric power transmission; Electric power utilization; Global warming; Infrastructure as a service (IaaS); Multitasking; Operating costs; Parameter estimation; Platform as a Service (PaaS); Scheduling algorithms; Software as a service (SaaS); Sustainable development; Virtual storage; Web services

Carbon emissions; Cloud data centers; Environmental sustainability; Green computing; Power efficiency

Engineering main heading: Energy efficiency

ISSN: 13640321 CODEN: RSERF Source Type: Journal Original language: English
DOI: 10.1016/j.rser.2015.07.061 Document Type: Review