INTERNATIONAL JOURNAL OF COMPUTER SCIENCE
Scholorly Peer Reviewed Research Journal - PRESS - OPEN ACCESS
ISSN: 2348-6600
Since 2012
www.ijcsjournal.com Volume 14, Issue 1, No 24, 2026 ISSN: 2348-6600
REFERENCE ID: IJCS-691 PAGE NO: 020-022
Special Issue - Innovative Commerce: Bridging Business and Computer Applications (ICBBCA-2026)
PG Department of Commerce with Computer Applications, Mannar Thirumalai Naicker College, Madurai – March 2026

ENERGY OPTIMIZATION TECHNIQUES FOR TASK SCHEDULING IN CLOUD COMPUTING

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Abstract

Cloud computing provides scalable computing resources through the internet. However, large cloud data centers consume a significant amount of energy, which increases operational costs and environmental impact. Efficient task scheduling plays an important role in reducing energy consumption while maintaining system performance. This paper discusses energy optimization techniques used in task scheduling in cloud computing environments. Various approaches such as energy-aware scheduling, dynamic voltage and frequency scaling, and resource consolidation are analyzed. These techniques help improve energy efficiency and ensure better utilization of cloud resources.

Keywords: Cloud Computing, Task Scheduling, Energy Optimization, Green Computing, Resource Management.

Introduction

Cloud computing is a technology that allows users to access computing resources such as servers, storage, and applications through the internet. It provides flexibility, scalability, and cost efficiency. However, cloud data centers require a large amount of energy to operate servers and cooling systems.

Task scheduling is an important process in cloud computing. It determines how tasks are assigned to available computing resources. Inefficient scheduling can lead to higher energy consumption and poor system performance. Therefore, energy optimization techniques are required to reduce power usage and improve system efficiency.

The aim of this paper is to study different energy optimization techniques used in task scheduling in cloud computing environments.

Review of Literature

- Many researchers have proposed methods to reduce energy consumption in cloud computing.

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- Some studies focus on energy-aware scheduling algorithms that allocate tasks based on energy usage. Other approaches use dynamic resource allocation to adjust computing resources depending on workload. Researchers have also suggested virtual machine consolidation, where multiple tasks are assigned to fewer servers to reduce power consumption.
- These studies show that proper task scheduling can significantly reduce energy usage in cloud data centers.

Task Scheduling in Cloud Computing

Task scheduling refers to the process of assigning tasks to computing resources such as virtual machines or servers. The main objectives of task scheduling include:

- Efficient resource utilization
- Reduced task completion time
- Balanced workload distribution
- Lower energy consumption

Different scheduling algorithms are used in cloud computing, such as:

- First Come First Serve (FCFS)
- Round Robin Scheduling
- Priority-based Scheduling
- Energy-aware Scheduling

Among these, energy-aware scheduling focuses on minimizing energy usage while maintaining performance.

Energy Optimization Techniques

Several techniques are used to reduce energy consumption in cloud computing systems.

Dynamic Voltage and Frequency Scaling (DVFS)

DVFS adjusts the processor's voltage and frequency based on workload. When the workload is low, the system reduces processor speed to save energy.

Virtual Machine Consolidation

In this method, multiple virtual machines are placed on fewer physical servers. Idle servers can be turned off, which reduces power consumption.

Energy-Aware Task Scheduling

Energy-aware algorithms assign tasks to resources that consume less energy. This helps improve system efficiency and reduce operational costs.

Resource Provisioning

Efficient allocation of computing resources ensures that resources are not overused or underutilized, leading to better energy management.

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Advantages of Energy Optimization

Energy optimization techniques provide several benefits:

- Reduced power consumption
- Lower operational costs
- Improved resource utilization
- Environment-friendly cloud computing
- Better system performance

Conclusion

Energy consumption is a major challenge in cloud computing environments. Efficient task scheduling plays a key role in reducing energy usage while maintaining system performance. Techniques such as DVFS, virtual machine consolidation, and energy-aware scheduling help improve energy efficiency in cloud data centers. Future research can focus on developing advanced scheduling algorithms that further optimize energy usage and enhance cloud system performance.

These advantages make energy-efficient scheduling an important research area in cloud computing.

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