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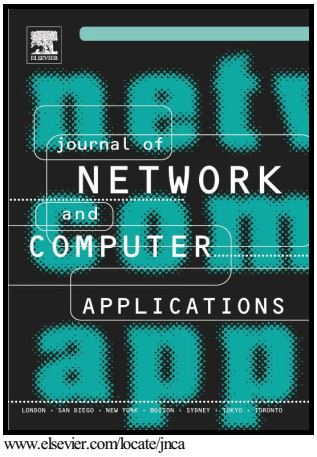

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Resource-utilization-aware energy efficient server consolidation algorithm for green computing in IIOT

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Abstract

Cloud computing has become an indispensable infrastructure that provides multi-granularity services to support large applications in the Industrial Internet of Things(IIOT), Cloud data centers have been built or extensively enlarged to cope with the growing computation and storage requirements of IIOT. The energy consumption of cloud data centers is dramatically increasing, which has created a lot of problems with greenhouse gas emissions and service costs. Server consolidation is a popular approach to reduce cloud data centers' energy consumption by minimizing the number of active physical machines. Most of the extant research has focused on server reduction in the consolidation process, but unbalanced resource utilization among different physical machines can cause the waste of physical resources. This paper proposes a resource-utilization-aware energy efficient server consolidation algorithm(RUAEE) that can be used to improve resource utilization while reducing the number of virtual machine live migrations. Experimental results show that RUAEE can reduce the energy consumption and service-level agreement(SLA) violation in cloud data center.

Keywords: Industrial Internet of Things (IIOT); resource-utilization-aware; energy efficient; server consolidation.

1. Introduction

The cloud computing paradigm[1] has significantly promoted the rapid development of the Industrial Internet of Things(IIOT) [30] and currently provides flexible, extensible services to its subscribers through a pay-as-you-go model. Cloud users are free from the regular configuration of hardware and software systems, and have no geographic restriction in accessing cloud services; they can freely access Infrastructure-as-a-Service(IaaS), Platform-as-a-Service(PaaS) and Software-as-a-Service (SaaS) over the internet[2]. The computing and storage provided by cloud computing allow for many useful applications such as decision-making systems and IIOT intelligent optimization, which serve control systems and the manufacturing industry. The rapid development of IIOT has also supported further advancements in cloud computing.

The number of cloud data centers worldwide has dramatically increased in recent years. In 2010, the energy consumed by cloud data centers almost accounts for 1.1-1.5% of the world's[3]. The huge power consumption not only increases greenhouse gas emissions contributing to global