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A Hybrid Model of Internet of Things and Cloud Computing to Manage Big Data in Health Services Applications

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Abstract

Over the last decade, there has been an increasing interest in big data research, especially for health services applications. The adoption of the cloud computing and the Internet of Things (IoT) paradigm in the healthcare field can bring several opportunities to medical IT, and experts believe that it can significantly improve healthcare services and contribute to its continuous and systematic innovation in a big data environment such as Industry 4.0 applications. However, the required resources to manage such data in a cloud-IoT environment are still a big challenge. Accordingly, this paper proposes a new model to optimize virtual machines selection (VMs) in cloud-IoT health services applications to efficiently manage a big amount of data in integrated industry 4.0. Industry 4.0 applications require to process and analyze big data, which come from different sources such as sensor data, without human intervention. The proposed model aims to enhance the performance of the healthcare systems by reducing the stakeholders' request execution time, optimizing the required storage of patients' big data and providing a real-time data retrieval mechanism for those applications. The architecture of the proposed hybrid cloud-IoT consists of four main components: stakeholders' devices, stakeholders' requests (tasks), cloud broker and network administrator. To optimize the VMs selection, three different well-known optimizers (Genetic Algorithm (GA), Particle swarm optimizer (PSO) and Parallel Particle swarm optimization (PPSO) are used to build the proposed model. To calculate the execution time of stakeholders' requests, the proposed fitness function is a composition of three important criteria which are CPU utilization, turn-around time and waiting time. A set of experiments were conducted to provide a comparative study between those three optimizers regarding the execution time, the data processing speed, and the system efficiency. The proposed model is tested against the state-of-the-art method to evaluate its effectiveness. The results show that the proposed model outperforms on the state-of-the-art models in total execution time the rate of 50%. Also, the system efficiency regarding real-time data retrieve is significantly improved by 5.2%.