شبكة المعلومات الجامعية
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بسم الله الرحمن الرحيم

HANAA ALY

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جامعة عين شمس

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قسم

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها
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HANAA ALY

AIN SHAMS UNIVERSITY
FACULTY OF ENGINEERING
Computer and Systems Engineering

Resource Management Techniques in Fog and Mist Computing

A Thesis submitted in partial fulfillment of the requirements of
Doctor of Philosophy in Electrical Engineering
Computer and Systems Engineering Department

by

Ragaa Ahmed Abu Shehab Abd Allah
Master of Science in Electrical Engineering
(Computer Engineering Department)
Faculty of Engineering, Cairo University, Year 2005

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Cairo, 2021

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Statement

This thesis is submitted as a partial fulfillment of Doctor of Philosophy in Electrical Engineering, Faculty of Engineering, Ain Shams University. The author carried out the work included in this thesis, and no part of it has been submitted for a degree or a qualification at any other scientific entity.

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Thesis Summary

Summary

Towards the fourth industrial revolution (industry 4.0), IoT enriches the e-health market by valuable applications (i.e. remote patient monitoring). Enhancing the IoT health monitoring systems used in various environments such as smart homes and smart hospitals, imply lively analyzing the patient's critical streams (i.e. ECG stream). Conducting these tele-health applications over the traditional cloud violates the deadline constrains of the stream analytics applications due to network congestion, which results not only in performance degradation but also in inaccurate analytics results due to patient's stream loss. Fog computing can take place within the patient's vicinity, and is considered as the best candidate for critically analyzed stream applications. Due to fog nodes geo-distribution and lack of resources, a scalable and fault tolerant resource management platform for stream analytics in fog computing is a must. Current stream analytics schedulers are designed for massive resource nodes, which degrades the fog infrastructure utilization. Innovative stream analytics schedulers in fog computing are needed. This study presents live big data analytics resource management techniques in fog and mist computing for tele-health applications. It proposes a Fog Assisted Resource Management (FARM) platform based on Apache Hadoop2 (YARN). FARM provides compatible short-term and long-term big data analytics. Static FARM (S-FARM) represents YARN schedulers in per-user and per-module modes. Results indicate that per-user S-FARM scheduler overcomes the mist nodes' lack of resources, enhances the fog infrastructure utilization, and allows for safer system expansion than per-module S-FARM scheduler. In addition, differentiated S-FARM scheduler is studied to allow per-user control to the analytics results accuracy and speed.Stream CardioVascular Disease (S-CVD) application is modeled and simulated to test the proposed YARN schedulers. S-CVD lively analyzes the patient's ECG streams to conduct the patient's state using a linear classifier. IFogSim simulator has been used to judge the application and fog infrastructure performance under various scenarios. The research is a pioneer in solving the lack of computing resources issue of the mist nodes, supporting per-user control to live big data analytics IoT applications, and utilizing iFogSim to implement and evaluate the performance of a stream analytics platform resource manager.

Key words:

Fog/cloud computing, big data analytics, stream processing, Apache Hadoop2 (YARN), resource management, module placement, fog infrastructure, per user control, smart hospital, remote patient monitoring, health informatics, critical control applications, application QoS.

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