Accepted Manuscript

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PII: S0167-739X(18)30071-2
DOI: https://doi.org/10.1016/j.future.2018.04.044
Reference: FUTURE 4122

To appear in: *Future Generation Computer Systems*

Received date : 10 January 2018
Revised date : 10 April 2018
Accepted date : 14 April 2018

Please cite this article as: M. Amiri, L. Mohammad-Khanli, R. Mirandola, An online learning model based on episode mining for workload prediction in cloud, *Future Generation Computer Systems* (2018), https://doi.org/10.1016/j.future.2018.04.044

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ACCEPTED MANUSCRIPT

An online learning model based on episode mining for workload prediction in cloud

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Abstract

The resource provisioning is one of the challenging problems in the cloud environment. The resources should be allocated dynamically according to the demand changes of the applications. Over-provisioning increases energy wasting and costs. On the other hand, under-provisioning causes Service Level Agreements (SLA) violation and Quality of Service (QoS) dropping. Therefore the allocated resources should be close to the current demand of applications as much as possible. Thus, the prediction of the future workload of applications is an essential step before the resource provisioning. In our previous work, we proposed a Prediction mOdel based on SequentIal paTtern mINinG (POSITING), which considers the correlation between different resources and extracts behavioural patterns of applications independently of the fixed pattern length explicitly. Although POSITING provides reliable results, it is not able to adapt according to the workload variations. The application behaviour might change and drift due to the dynamical nature of cloud. For this purpose, we investigate the capabilities of online learning for POSITING. This paper proposes a Prediction mOdel based on epIsode miNing with the capabiliTy of onlIne learNinG (RELENTING) based on POSITING. Thus, in addition to the accuracy, adaptability, one of the most important characteristics of the application prediction models, is fulfilled. The performance of the proposed model is evaluated based on both real and synthetic workloads. The experimental results show that the proposed model adapts to the behavioural changes of the application and learns the new behavioural patterns rapidly in comparison to the other state-of-the-art methods such as moving average, linear regression, neural networks and hybrid prediction approaches.

Keywords: Cloud Computing, Prediction, Application, Workload, Episode Mining, Online Learning.

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