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A tool for QoS probability distribution estimation of web service compositions

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A Tool for QoS Probability Distribution Estimation of Web Service Compositions

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1 Introduction

In this paper, we develop a QoS DIstribution Estimation Tool: QoSDIST for service compositions. QoSDIST has the following functions which distinguish it from existing QoS estimation approaches: (1) QoSDIST can generate much more accurate QoS probability distributions for component Web services than existing methods [1]; (2) When estimating the QoS probability distribution for a service composition, QoSDIST does not put any constraints on the representation of the QoSs of component Web services, i.e., the QoS of a component Web service can be in single value, discrete values with frequencies, standard statistical distribution, or any general distribution regardless of its shape, which can not be done by any existing approaches; (3) QoSDIST can deal with commonly used composition patterns, including loop with arbitrary exit points.

2 Proposed Method

2.1 QoS Probability Distribution Generation for Web Services

We adopt Gaussian Kernel Density estimation approach to generate QoS probability distributions for Web services. Compared with existing methods' fitting a QoS sample with a well known QoS probability distribution, the method used in this paper does not rely on assumptions that the data are drawn from a given probability distribution. This property makes this method more robust than existing Web services' QoS generation methods.

2.2 QoS Probability Distribution Estimation for Service Compositions

We design a calculation approach which can compute QoS for service compositions. We assume that the QoS of Web services are independent of each other. The QoS metric for a component Web service can be represented by a constant value or a probability distribution, which can either be a well known statistical probability distribution or a general probability distribution.

3 Evaluation

3.1 QoS Distribution Generation Result for Web Services

In Figure 1, solid lines represent the QoS distributions generated by QoSDIST. It can be seen that QoS distributions obtained by QoSDIST are able to represent

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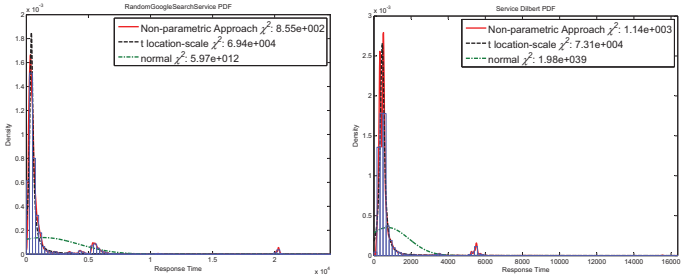


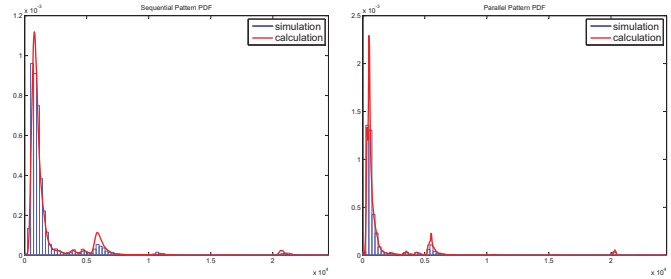
(a) Random Image PDF (b) Dilbert PDF

Fig. 1. QoS Probability Distributions for Web Services

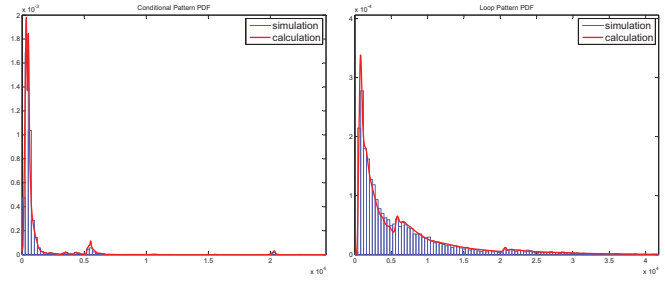
the real QoS distributions for Web services while standard statistical distributions (t location-scale and normal distributions) do not have this ability.

3.2 QoS Distribution Estimation Result for Service Compositions

It can be seen from Figure 2 that the calculated QoS distributions by QoSDIST fit the simulation results quite well for all the four composition patterns. This result indicates that QoSDIST is able to calculate the precise QoS distributions for a service composition even though the QoSs of its component Web services are represented by nonstandard QoS distributions.



(a) Sequential Pattern (b) Parallel Pattern



(c) Conditional Pattern (d) Loop Pattern

Fig. 2. QoS Probability Distributions for Composition Patterns

Reference

1. Rosario, S., Benveniste, A., Haar, S., Jard, C.: Probabilistic qos and soft contracts for transaction-based web services orchestrations. IEEE Transactions on Services Computing 1(4), 187–200 (2008)