



Chapter VI

A Genetic Algorithm-Based QoS Analysis Tool for Reconfigurable Service-Oriented Systems

I-Ling Yen, University of Texas at Dallas, USA

Tong Gao, University of Texas at Dallas, USA

Hui Ma, University of Texas at Dallas, USA

Abstract

Reconfigurability is an important requirement in many application systems. Many approaches have been proposed to achieve static/dynamic reconfigurability. Service-oriented architecture offers a certain degree of reconfigurability due to its support in dynamic composition. When system requirements change, new composition of services can be determined to satisfy the new requirements. However, analysis, especially QoS based analysis, is generally required to make appropriate service selections and service configurations. In this chapter, we discuss

the development of QoS-based composition analysis techniques and propose a QoS specification model. The specification model facilitates QoS-based specification of the properties of the Web services and the requirements of the application systems. The composition analysis techniques can be used to analyze QoS tradeoffs and determine the best selections and configurations of the Web services. We develop a composition analysis framework and use the genetic algorithm in the framework for composition decision making. The framework currently supports SOA performance analysis. The details of the genetic algorithm for the framework and the performance analysis techniques are discussed in this chapter.

Introduction

Reconfigurability is an important feature that is required in many modern application systems (Aksit & Choukair, 2003). For example, avionics systems, intelligent vehicle control systems, and remote monitoring systems frequently require dynamic adaptability so that the system can adapt to changes due to the failure of system components, reduced power level, unexpected operating conditions, and so forth. Also, some systems are multiple-mission and mission-specific, that is, they have to handle a class of missions that have similar system requirements but they also require adaptations to satisfy mission-specific needs.

Service-oriented architecture (SOA) is an ideal vehicle for achieving reconfigurability (Tsai, Song, Paul, Cao, & Huang, 2004). Desired functionalities can be achieved in SOA by dynamically composing appropriate services. Many research works focus on Web service composition (BEA et al., 2002; Hamadi & Benatallah, 2003; Sirin, Parsia, & Hendler, 2004). Most of these investigate various language issues. Business process execution language (BPEL) is an XML-based language for specifying the business processes and interaction protocols. Web services are then composed together to meet the specified functional requirements. The concept of semantic Webs extends the current Web with well-defined meanings for each Web service to facilitate their compositions. Based on semantic Webs, Sirin et al. (2004) have proposed a service composition tool including two main modules, namely, a composer and an inference engine. A user can interact with the composer to generate the composition and filter the results. The inference engine is a Web ontology language (OWL; W3C, 2004a) reasoner. The OWL reasoner searches the related services for the generated composition. Petri net-based algebra has also been used to help the composition by modeling the control flow. These composition methods can be used for adapting a system to new functional requirements (by composing a new set of services to achieve the modified functionalities).

Service composition generally focuses on composition of Web services to achieve some desired functionality. To achieve reconfiguration, new compositions can be derived for the modified functionalities. Actually, many adaptive systems require reconfigurability in terms of quality of service (QoS) behaviors. For example, some unmanned systems allow degraded QoS when some system failures occur. Many systems tradeoff the quality of their outputs versus the execution time to cope with periods of heavy loads or contentions for resources. In SOA-based systems, QoS reconfiguration can be achieved by, for example,

24 more pages are available in the full version of this document, which may be purchased using the "Add to Cart" button on the publisher's webpage: www.igi-global.com/chapter/genetic-algorithm-based-qos-analysis/4859

Related Content

Passenger Condition Based Route-Planning for Cognitive Vehicle System

Hironori Hiraishi (2018). *International Journal of Software Science and Computational Intelligence* (pp. 25-35).

www.irma-international.org/article/passenger-condition-based-route-planning-for-cognitive-vehicle-system/202952

A New Biomimetic Method Based on the Power Saves of Social Bees for Automatic Summaries of Texts by Extraction

Mohamed Amine Boudia, Reda Mohamed Hamou, Abdelmalek Amineand Amine Rahmani (2015). *International Journal of Software Science and Computational Intelligence* (pp. 18-38).

www.irma-international.org/article/a-new-biomimetic-method-based-on-the-power-saves-of-social-bees-for-automatic-summaries-of-texts-by-extraction/140951

How Industry 4.0 Can Benefit From Semantic Web Technologies and Artefacts

Leila Zemmouchi-Ghomari (2021). *International Journal of Software Science and Computational Intelligence* (pp. 64-74).

www.irma-international.org/article/how-industry-40-can-benefit-from-semantic-web-technologies-and-artefacts/287397

An Adaptive Second Order Neural Network with Genetic-Algorithm-based Training (ASONN-GA) to Forecast the Closing Prices of the Stock Market

Sarat Chandra Nayak, Bijan Bihari Misraand Himansu Sekhar Behera (2020). *Deep Learning and Neural Networks: Concepts, Methodologies, Tools, and Applications* (pp. 238-256).

www.irma-international.org/chapter/an-adaptive-second-order-neural-network-with-genetic-algorithm-based-training-asonn-ga-to-forecast-the-closing-prices-of-the-stock-market/237875

Design and Implementation of a Cognitive Tool to Detect Malicious Images Using the Smart Phone

Hiroyuki Nishiyamaand Fumio Mizoguchi (2014). *International Journal of Software Science and Computational Intelligence* (pp. 30-40).

www.irma-international.org/article/design-and-implementation-of-a-cognitive-tool-to-detect-malicious-images-using-the-smart-phone/127012