Journal of Soft Computing and Decision Support Systems

Self-Healing in Web Services Using Genetic Algorithm

Faezeh Yousefianarani [a], Eslam Nazemi [b,*]

[a] Department of Computer Engineering, Qazvin Branch, Islamic Azad University, Qazvin, Iran
[b] Faculty of Science & Computer Engineering, Shahid Beheshti University, Tehran, Iran

* Corresponding author email address: nazemi@sbu.ac.ir

Abstract

In addition to monitoring, analysis, plan and execution phases in self-healing cycle, represents the knowledge base consumed and produced by all four previously mentioned tasks. In proposed approach, by using genetic algorithm, the required knowledge is prepared for healing operation. Healing operation takes place when the response time of the web service exceeds its threshold. In this case, using genetic algorithm, healing sequence is created to save response time and even to reach optimum state. Healing sequence causes the transition of service oriented systems from degraded state to healthy state as well as healing the error in web service and in this case lost time is recovered. To make healing sequence, healing approaches such as substitution, replication and skip is used which not only prevents process operation to be in no-response state but also results in optimization of response time. To provide healing sequence, execution of proposed plan benefits from consequent web services and is able to reduce response time and show the saved time.

Keywords: Self-healing, Web service, Response time, QoS

1. Introduction

A self-healing system should recover from the abnormal or unhealthy state and return to the normative healthy state, and function as it was prior to disruption (Harald and Schahram, 2010). The specification to which a system has been built is usually not fully known to those who maintain it. It is difficult to draw a discrete difference between healthy and unhealthy states of a system as the transition in between the two states is not abrupt. What generally obtains is a gradual transition from one state to another (Debanjan et al., 2006). Also, because web services are dynamic and unpredictable, one of their big challenges - quality of service- is in attention. Response time is one of the qualities of service parameters of which its increment is in inverse proportion to system performance. In degraded transition, response time increases continuously until it is not able to respond. There are several approaches that have been developed to achieve self-healing service-oriented systems. Some approaches implement self-healing after the detection of failures. When an error occurs, it stops currently running services and repairs or replaces the malfunctioned ones. A major issue with these reactive approaches is that they cause long disruptions of currently running service systems, which in most cases will incur high revenue cost or risk to lose a large number of customers (Hongbing et al., 2009).

In proposed approach, to diagnose the probable states of the system such as error and failure, an index is considered by which we can examine the quality of response time and can make healing sequence to continue their operation using proposed healing policies.

In Section 2, the related work is presented. In Section 3, we try to present proposed approach architecture in web services which named as Healing Sequence Creation Algorithm (HSCA). After that a brief description of implementation is shown and in Section 5 the results of execution of sample web services are given. In last section, we discuss about the results of Insurance Registration Example as a case study.

2. Related works

In (Yu et al., 2009), a self-healing approach is an integration of backing up in the selection and reselecting in the execution. In (Poonguzhali et al., 2011), a self healing approach which substitutes the alternative web service which provides the same service as that of failed service by considering the interrelationship between the component web services. In (Aziz et al., 2012), authors proposed a QoS-driven transactional service reselection model for reliable replacement. In (Ying et al., 2010), this paper proposed a T-QoS service selection model, a self-healing replacement model and designed related simulated environment. In (May and Judith, 2009), having a full