A Review of QoS Driven Optimal Selection of Web Services for Compositions

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Abstract. Web services technology promises to enable rich, flexible and dynamic interoperation of highly distributed and heterogeneous applications using Web standards. The providers of composite Web services involving composition plan with different flow patterns need to discover and select suitable candidate Web services for each task of the composition plan at runtime. The dynamic nature of Web services prompts a need for the mechanism to enable the frequent editing of QoS offers of composite Web services by the Composite Service Providers (CSP). In this paper, the authors present a detailed survey of literature in QoS based selection for Web service compositions. The paper also presents different architectures for QoS aware Web service compositions and evaluates various QoS aware selection techniques. The authors classify QoS aware selection techniques for composition based on the nature of composition plan, complexity of QoS requirements and nature of techniques/methodology used in the selection and QoS aggregation.

Keywords: Web Services, Compositions, Aggregation, Quality of Service, Service Selection, Broker Architecture.

1 Introduction

A Web service is defined as an interface which implements the business logic through a set of operations that are accessible through standard Internet protocols. The eXtensible Markup Language (XML) based protocols namely Universal Description, Discovery and Integration (UDDI), Web Service Description Language (WSDL) and Simple Object Access Protocol (SOAP) are the *three* major building blocks of Web services. The conceptual Web services architecture facilitates both atomic (elementary) and composite Web services to be published into the service registry for discovery without any implementation distinctions. The composite Web services involving composition plan normally select Web services for the individual tasks at runtime which satisfy local (task level) or global (end-to-end) QoS constraints. The QoS offers of such composite Web services are dependent on individual Web services selected for each task of the

composition plan. The dynamic nature of Web services enforces the providers of composite Web services to estimate and update (publish) the QoS offers regularly. The frequent editing of QoS offers of composite Web services is necessary since the provider of composite Web service has to compete with other Web services offering same set of functions/operations.

In order to update the QoS and service offers of composite Web services regularly, the provider requires a tool to estimate QoS of composite Web service and to advertise a competitive service offer based on his requirements. In literature, the QoS of composition is evaluated based on the requirements involving single QoS property [2] or combinations of multiple QoS properties [3]. While evaluating QoS of composition, the Web services are selected for the tasks based on either local [2] or global [3] QoS constraints. As the service offers play a role in selection of business Web services, the composite business Web service has to be created by selecting good quality and profitable services for all the tasks which satisfy both QoS and service offer requirements of the composite service provider. Publishing of composite Web services involve publishing of its functional, QoS and service offer specific information into the repository (registry) [4]. Therefore, QoS and service offer for the composite Web service need to be estimated prior to the publishing activity. To obtain estimation on QoS and service offers, QoS and service offer aggregation schemes are required for the composite Web services involving different composition patterns. A selection mechanism has to be defined to select the most suitable Web service for the tasks of composition plan based on the provider's requirements and preferences.

2   QoS Driven Selection for Compositions

The selection of most suitable (best in terms of quality, compatibility and service offers) Web service for the various tasks is a crucial issue in Web service composition. In order to update the QoS and service offers of composite Web services regularly, the provider requires a mechanism to estimate the QoS of composite Web service and to advertise a competitive service offer based on his requirements and preferences. As a motivating example, consider the conference (or symposium) arrangement scenario. Assume that, there exists a single service, which caters to the requirements of conference arrangement involving various tasks. The different tasks are: booking of hall or hotel for presentations (or discussions), catering service for food on conference days, vehicle for local travel, a service provider to decorate the venue, city tour (night or day) arrangement service, conference bag and conference kit providers. Fig.1 represents the composition plan involving composition patterns of the conference arrangement service. The rectangles represent individual task nodes and ovals represent composition pattern nodes.

Over the Internet, many service providers are available for the atomic activities like hotel booking, vehicle hiring etc. The provider of the conference arrangement service tries to arrange the conference with low costs, expects good response from the reputed service providers for atomic activities and would like