VAQoS: Architecture for End-to-End QoS Management of Value Added Web Services

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ABSTRACT

During the last few years, Value Added Web Services (VAWS) are increasingly becoming a hot issue in both research and industry. With the abundance of VAWS providers, Quality of Service (QoS) is a key factor to allow potential clients to differentiate between providers. In this paper, we propose a new architecture, called VAQoS, for managing and assuring QoS provision for VAWS. This architecture performs management of QoS by: (1) allowing providers to extend the service description with QoS-centered annotations, (2) including a validation process that enables providers to test their service interfaces as well as the level of QoS they can provide prior to publishing the service, (3) allowing clients to express their required functionalities with QoS requirements; (4) providing support for QoS negotiation between clients and providers, (5) allowing monitoring of the agreed QoS between clients and providers, and therefore, detecting any QoS violation; (6) providing an application programming interface that shields the application of the provider and client from the complexity of managing QoS specification, QoS publication, and QoS discovery. A first prototype of VAQoS is developed.

Keywords: QoS broker for Web services; QoS management; QoS monitoring; QoS negotiation; Web services

INTRODUCTION

With the rapid spread of internet technologies such as Internet-based video conferencing (VCoIP) applications, and especially with the emergence of Web services technology, Value Added Web Services have become an attractive topic of interest in both research...
and industry. VAWS are Web services that add value to existing Web services available on the Internet in terms of performance guarantee. Therefore, they will be consumed by more potential clients than by those of basic Web services. This will increase the profit of VAWS providers’ and return on investment (e.g., teleconferencing Web services, multimedia Web services, composed Web services). Since VAWS have stringent requirements on the Quality of Service (QoS) (e.g., response time, availability, and throughput), they have to support QoS management operations for both clients and providers of these VAWS. However, include QoS management operations in VAWS will generate significant challenges.

Delivering QoS to clients is highly affected by the Web service performance itself, by the hosting platform (e.g., Application Server) and by the underlying network (e.g., Internet). Thus, even if Web services together with hosting platform provide acceptable QoS, they also require sufficient available network resources to deliver end-to-end QoS.

In this paper, we propose a solution approach to the problem of end-to-end QoS support for Web services. Our approach relies on the utilization of a Web service, called QoS broker, to take care of QoS support at the provider end point. Also, it makes use of another Web service to ensure the QoS in the network connecting the client host and the corresponding Web service location. This Web service either relies on the network QoS capabilities (e.g., Integrated Services, Differentiated Services, Multiprotocol Label Switching), if any, or uses a measurement-based scheme to estimate the quality that can be delivered between the two locations. One of the key differentiator of our solution is that it does not require any changes to the currently used infrastructure by the users and Web services providers.

The remainder of this paper is organized as follows: the next section presents related work on QoS management of VAWS. Following that section, a background about Web services and Service Oriented Architecture (SOA) is provided, and QoS attributes for VAWS are described. The section thereafter details our proposed VAQoS architecture for QoS management of VAWS. Next, there is a description of the main operations supported by the architecture. It also presents our prototype of VAQoS. The following section addresses the implementation issues engendered from the integration of mechanisms to guarantee QoS at both server and network layer in the VAQoS architecture. Finally, there is a summary of the paper and presents future research directions.

**RELATED WORK**

There has been little research on VAWS and most works focuses on developing architectures and frameworks without considering many important features such as performance guarantee, and service selection assurance (Zhang & Chung, 2003; Karunamurthy, Glitho, & Khendek, 2005; Dasilva, Hassan, Glitho, & Khendek, 2004; Benharref,