Chapter 2
Transactional Properties of Complex Web Services

Li Li  
_Southwest University of China, China_

Chengfei Liu  
_Swinburne University of Technology, Australia_

Xiaohui Zhao  
_Swinburne University of Technology, Australia_

Junhu Wang  
_Griffith University, Australia_

ABSTRACT

Web services have become a dominating technology for business integration. For operation reliability and robustness, transactional support is an important issue for Web service system design and development. Yet, most existing Web services protocols, like WS-BPEL which sticks to the compensation-based recovery strategy, only provide very limited supports for Web services in certain circumstances. As Web service systems are scaling up, more advanced transactional supports beyond traditional compensation-based solutions are required to catch up with the increasing complexity of composite Web services. This chapter looks into the problem of transactional support for composing and scheduling those Web services that may have different transactional properties. The transactional properties of workflow constructs, which are fundamental to the composition of Web services, are thoroughly investigated. The concept of connection point is introduced to derive the transactional properties of composite Web services. The scheduling issue of composite Web services is also discussed.

INTRODUCTION

Web services have been emerging as a promising technology for business process integration. Transactional support to business integration via composing individual Web services is a critical issue. Several transaction relevant Web service standards have been proposed. Among them are WS-BPEL (Andrews et al., 2003), WS-Coordination (Cabrera et al., 2003), _Web Services Transactions Specifications_, 2005 (including WS-AT
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(Cabrera, Copeland, Feingold, Freund, Freund, Johnson et al., 2005) and WS-BA (Cabrera, Copeland, Feingold, Freund, Joyce et al., 2005), and Web Service Choreography Interface (WSCI) (Arkin et al., 2002). These Web services protocols have been proposed to deal with this issue on a strong assumption that each Web service is compensatable for a recovery purpose. In other words, compensation is the basic mechanism adopted by all of these standards for backward recovery. However, it is arguable that Web services composition requires more transactional support beyond the compensation-based solution.

Investigating transactional properties of composed Web services is becoming more important in long-running systems as exclusively locking resources is impossible or impractical, given Web services are distributed and independent applications running on heterogeneous platforms. Intuitively, Web services infrastructures should provide comprehensive transaction support so that Web services can compose other Web services in a transactional manner. Unfortunately, the current Web services efforts (e.g., WS-BPEL, WS-Coordination, WS-Transaction) only provide limited support without giving much thought to the transactional features (Liu & Zhao, 2008). The need for transactional handling mechanism in complex Web services is obvious. Rather than assume that a Web service is compensatable for a recovery purpose, which is a very strong assumption in the business integration scenario, this chapter will discuss how to relax this constraint and provide a mechanism to derive transactional properties within composite Web services. The contributions of this chapter are twofold. First, we discuss transactional properties of atomic services (building blocks) in the presence of three transactional features. Second, we discuss how to derive transactional properties of a composite Web service based on these building blocks.

To this end, transactional features of workflow constructs in a Web service environment. Ultimately, transactional scheduling issues will be targeted to guarantee consistent outcomes and reliable business processes. As such, this chapter aims to contribute in deriving transactional properties and scheduling transactional business process for complex Web services on the basis of our previous work in (Li, Liu, & Wang, 2007).

WORKS ON WEB SERVICE TRANSACTIONS

Ensuring reliability of composite services is challenging. In addition to the latest release of WS-BPEL (the latest successor of the arguably de facto standard WS-BPEL 1.1) (Andrews et al., 2003), there are several other known proposals to extend the Web service with transaction-processing capabilities. They include the following emerged proposals, which define transaction protocols between composed services: the Web Services Transactions Specifications, 2005, the OASIS Business Transactions TC, 2004, the Tentative Hold Protocol Part 1: White Paper, 2001 and Tentative Hold Protocol Part 2: Technical Specification, 2001 from W3C, and the OASIS Web Services Composite Application Framework (WS-CAF) TC, 2004, which is designed to be used independently or together with other transaction protocols. The WS-CAF is the superset of WSC, WS-T, and WS-BA. Other main lines of research have attempted to extend some aspects of these proposals, or propose better strategies to cope with transactional issues in complex business activities. The following are some details.

Web Service Transaction Protocols

The current Web services specification, WS-BPEL, has been proposed to deal with transactional Web services. However, WS-BPEL only offers a limited support for recovery and there is no discussion of recovery actions (Vaculin, Wiesner,
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