Towards the Semantics for Web Service Choreography Description Language

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Abstract. A choreography is a multi-part contract which describes peer to peer collaboration of services regardless of any specific programming language or supporting platform. WS-CDL, issued from W3C, is the first language for describing choreography. In this paper, we propose a language CDL₀ to capture the important features of WS-CDL, including choreography composition, compensation and exception handling. An adjunctive concept role reference is introduced with the aim of distinguishing multiple participants which provide the same kind of service within a choreography model. The semantics is given by an operational approach to provide a formal base for the choreography language. We believe this formalism work helps to clear ambiguous points in the WS-CDL specification and promote the usage of choreography languages.

Keywords: WS-CDL, choreography, operational semantics, compensation, exception handling.

1 Introduction

The goal of Web Services is to collaborate within or across the trusted domains of an organization resulting in accomplishing a common business goal. Interoperability between services is achieved by standard protocols that provide uniform ways to define the interface a web service exhibits (namely WSDL), to exchange messages (i.e., SOAP), and to look for particular services (i.e., UDDI). However, there still remain open challenges when it comes to the management of complex systems composed by a large number of services, where interactions go far beyond simple sequences of requests and responses. For this purpose, two different although overlapping viewpoints are currently investigated. The first one, referred to as web services orchestration, deals with the description of the interactions in which a given service engages with other services, as well as its internal actions. The second one, referred to as web services choreography, describes the external observable behavior across multiple web services from a global perspective, in which each participant is responsible for adhering to a specific protocol. R.Dijkman and M.Dumas introduces a foundational model, in terms of Petri nets, for describing the viewpoints and their interrelationships.

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A number of standardization proposals that describe web services orchestration have been put forward over the past years (e.g. BPML, XLANG, WSFL), and BPEL4WS \[11\] is the more recent proposal for this viewpoint. On the other hand, the Web Services Choreography Description Language (WS-CDL) \[12\] is the first proposal for describing web services choreography which is recommended by W3C in November 2005. WS-CDL is an XML-based language which is aimed at being able to precisely describe collaborations between any type of service regardless of the supporting platform or programming model used by the implementation of the hosting environment. One feature of WS-CDL is that it supports choreography composition which allows scalable modeling. That is, smaller choreographies are built first and then combined together to form a larger choreography. Another important feature is the ability to deal with long-running transactions. When a failure occurs during the execution, mechanisms are provided to capture such an exception and fire the corresponding compensation activity to recover from errors. The mechanisms are referred to as exception handling and compensation.

At present, WS-CDL is not fully developed and a number of issues remain open \[1\]. One problem is that this language cannot differentiate multiple participants providing the same kind of service in a collaboration so as not able to identify which interaction is related to each participant. In this paper, we propose a language called \(CDL_0\), the “untagged” version of WS-CDL, the syntax of which is written in the BNF format instead of XML. \(CDL_0\) captures many features of WS-CDL, including choreography composition, compensation and exception handling. Moreover, \(CDL_0\) introduces a new concept role reference to distinguish different participants providing the same kind of service within a choreography model. The operational semantics of \(CDL_0\) is carefully studied, through which we clearly illustrate how to deal with scalable modeling and long-running transactions.

This paper is organized as follows. Section 2 provides an introduction of the \(CDL_0\) language. Section 3 presents the operational semantics especially for composition, compensation and exception handling. Some related work is discussed in Sect.4. The last section gives the conclusion and future work.

2 The Language \(CDL_0\)

This section presents an overview of \(CDL_0\). Firstly, the syntax of choreography and activity is presented accompanying with the formal definition of choreography. Secondly, we give a description for the kinds of activities: basic activities, ordering structured activities and workunits. Finally, we talk about choreography life-line which is a key character of choreography.

2.1 The Syntax of \(CDL_0\)

Formally, a system is described by a set of choreographies. A choreography defines re-usable common rules that govern the ordering of exchanged messages, and the provisioning patterns of collaborative behavior, as agreed upon between