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Design and Application of Semantic Business Collaboration on the Cloud

Ching-Long Yeh

Department of Computer Science and Engineering, Tatung University, Taipei, 104, Taiwan
chingyeh@ttu.edu.tw

Abstract

In this paper, we combine WSMO with ebXML and move the distributed choreography in a cloud environment to form semantic business collaboration architecture. We employ the information model and service interfaces from ebXML Registry and Repository to design the knowledge portal of the architecture which stores the domain ontology, collaboration protocols, collaboration protocol profile of partners, *etc*. We investigate two cases to apply the use of the semantic business collaboration on the cloud: one is to develop the choreography of electronic official documents and the other is to design the portal service for government open data.

1. Introduction

Web Services provide the fundamental computing basis for service-oriented architecture. The infrastructure of Web Service provides WSDL for describing application program interfaces in XML, UDDI for registering application programs, and SOAP for exchanging XML-based messages between application programs. [1]. EbXML is a service-oriented architecture for conducting business automation among enterprises of various sizes [2, 16]. Instead of aiming at application programs in Web Services, the ebXML infrastructure is concerned with trading partners in business collaborations, including description (CPP/A) [3], registration (ebRR)[4], business process (ebBP)[5], vocabulary definition (ebCC)[6], and message services (ebMS) [7]. The infrastructure of ebXML supports automatic binary or multi-party business collaborations.

Semantic Web Services can be seen as the combination of Web Service and Semantic Web technologies, where the latter is used to enhance the semantic capability of the former. WSMO is an ontology-based conceptual model for Semantic Web Service [8]. WSMO, as viewed from the top, is made up of four components: ontologies, goals, web services and mediators. These components can find their corresponding counterparts in ebXML infrastructure except mediators. The ontology component corresponds to ebCC, where the former can be used as an integration tool for the latter. The goal component provides goal-driven approach to describing the service request from client which is used to match suitable Web Services for solving client's goal. In ebXML side, the requesting role of business collaboration takes its Collaboration Protocol Profile (CPP) to look for suitable responding role by consulting from the Registry (ebRR). Negotiation approach is proposed to achieve common agreement of collaboration protocol (CPA) between both roles. The web service component specifies choreography and orchestration interactions of either human-to-machine or machine-to-machine styles. In ebXML, the choreography part, referred to be the public process is specified using XML schema (ebBP), while the orchestration part, the private processes, is not specified in ebXML.

From the above investigation, we found that WSMO and ebXML have their advantages in conducting human-computer and computer-computer collaborations. In this paper, we aim at integrating both technologies of WSMO and ebXML to design semantic business collaboration architecture on the cloud [15]. We proceed to improve the formal semantics to the ebXML components by using WSMO [10] and Semantic Web [17]. We develop the ontology in OWL for describing the collaboration capabilities of trading partners (CPP) and the agreement of the way carrying out collaboration between trading partners (CPA). As for the vocabulary definition component (ebCC), we employ the result of Liegl, *et. al.* work the ontology for ebCC [9]. The collaboration process in ebXML is specified using XML Schema. The deep structure behind the process schema is similar to the concept of attributed state machine. Therefore, we employ the approach of abstract state machine proposed by WSMO when designing multiple agent choreography as the basis to develop he ontology for the business collaborations as specified in BPSS [10, 18]. The registry information model of ebRR is specified using UML. We use the ontology technology in Semantic Web to implement the information model and provide service interface for user to access the registry.

2. Architecture for Semantic Business Collaboration Cloud

In a previous work, we proposed to move the distributed ebXML business collaborations in a cloud computing platform to create a secure and reliable runtime environment for the public processes as shown in Fig. 1 [11]. In this paper, we follow the technical architecture as shown in Fig. 1 to build up the semantic business collaboration in a cloud. Both the front-end systems of companies A and B in Fig. 1 are implemented as specified in their CPA. The front-end system executes the common business process to interact with the counterpart through the message service interface. The common process is described using the BPSS. We use a declarative approach, the Abstract State Machines methodology [10, 18], to design and implement the BPSS engine as the kernel of the front-end system. The front-end system will be implemented as services using the SaaS model. It provides both user interface (HTTP) and application program interface (SOAP) for users and back-end systems to access the services.

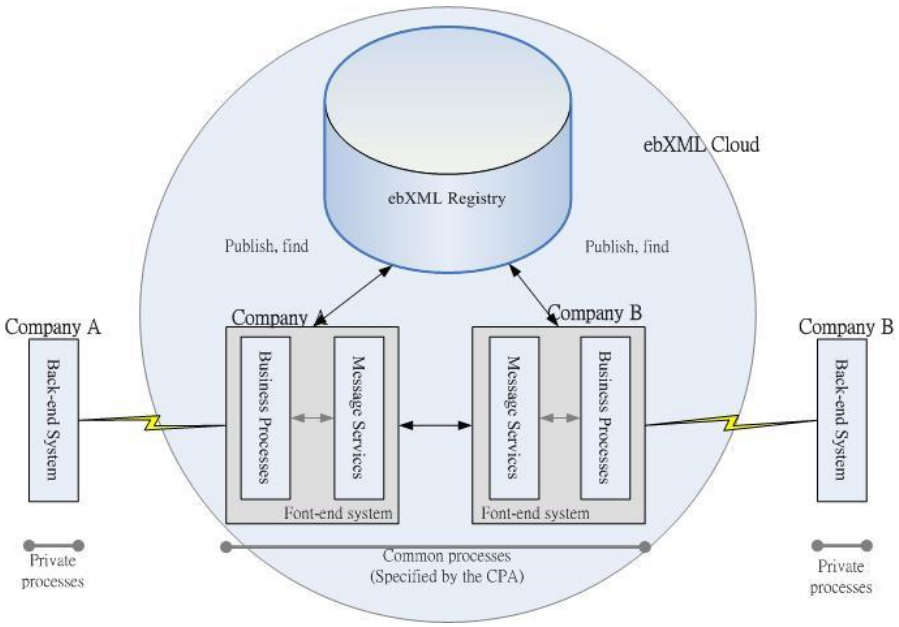

Fig. 1. Technical architecture of business collaboration in the cloud

The registry in Fig. 1 stores entities along with their metadata of business processes specifications, vocabulary, and trading partner's collaboration protocol profiles, which plays the role of information portal for participants on ebXML to discover suitable trading partners, look for business collaboration specifications and business terms, *etc*. We convert the UML schema in the Registry Information Model of ebRR into OWL and then implement ebRR using Semantic Web tool, for example, Drupal 7[1], RDF triple store[2], *etc*. All of the ebXML components in semantic representations, including CPP, CC and BPSS, are then stored in the registry.

3. Applications of the Semantic Business Collaboration Architecture

Both WSMO and ebXML have listed use cases and example scenarios for the reference of developers. In this paper, we take two real life cases, but not complete ones, to be applied on the Semantic Business Collaboration Architecture. First is to develop cloud service for managing the choreography in the electronic official documents. Second provides the portal service as assistant for user to access government open data.

Case 1: Choreography of Electronic Official Documents. Official document is the tool used by civil servants when processing affairs. The flow of official documents can be seen as the reification of government agencies workflow[3]. The current electronic document exchange platform in Taiwan is based on XML technology. The issuing party prepares official document in standard XML format. After being processed successfully by the Certificate Management Server, the document is delivered to the receiving party and is entered the internal process after confirming the certificate.

In this case, we focus on the development of the cloud part in Fig. 1 by carrying out the following tasks.

- We create the ontology for official documents from the standard XML schema. The ontology and the corresponding entities in ebCC are stored in the registry.
- Design the application for creating collaboration protocol profiles for government agencies, business entities, customers, and store in the registry.
- Analysis the document exchange scenarios and implement the BPSS modules as service in the cloud.
- Participants invoke the required document exchange processes in the cloud as their front-end to collaborate with their counterparts. Their back-end systems communicate with the front-end systems using standards application interface or browser.

Case 2: Portal Service Provider for Government Open Data
Open data is a trend for the government agencies in Taiwan. They have their data open in various formats and interfaces. For example, the open data platform of Taipei City Government has its data downloadable through URL and in JSON[4]. Newly open data emerge, in various ranks according to the 5-star ranking system of W3C LOD [12]. In this case, we would like to develop a portal service provider for user to access the various government open data. We follow the use case of Virtual Travel Agency (VTA) from the WSMO tutorial to design the portal service [8]. In addition, we also refer to the scenario of setting up portal service defining business collaborations with external business services,

[1] http://drupal.org/node/1015392
[2] http://www.w3.org/wiki/LargeTripleStores
[3] Go to the official site for reference of electronic official document evolution, exchange and management in Taiwan. http://www.good.nat.gov.tw/G2B2C/portal_2/home/index.jsp
[4] The site for open data of Taipei City Government: http://data.taipei.gov.tw/opendata

here the open data sites [2]. The portal provides interface for users to specify their requests of data and then it choreographs with the respective open data sites based on the BPSS engine.

4. Conclusions

We integrate both technologies of WSMO and ebXML to design semantic business collaboration architecture on the cloud. The semantics of the XML-based ebXML infrastructure is improved by using WSMO and Semantic Web. We choose two real life cases as the goal to be implemented on the semantic business collaboration cloud to see how it works and try to find out more applications.

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