December 2003

Integration of Web Services for Establishing Virtual Enterprises: An Agent-Based Perspective

Zakaria Maamar
Zayed University

Ghazi Alkhatib
Qatar College of Technology

Integration of Web Services for Establishing Virtual Enterprises: An Agent-based Perspective

Zakaria Maamar
Zayed University
zakaria.maamar@zu.ac.ae

Ghazi Alkhatib
Qatar College of Technology
alkhatib@qu.edu.qa

Abstract

Web services are nowadays emerging as a major technology for achieving automated interactions between distributed and heterogeneous applications. Various technologies are behind this achievement including WSDL (Web Service Definition Language), UDDI (Universal Description, Discovery and Integration (, and SOAP (Simple Object Access Protocol). These technologies aim at supporting the definition of Web services, their advertisement, and their binding for triggering purposes. The advantages of Web services have already been demonstrated and highlight their capacity to be composed into high-level business processes. Usually, composite services denote these business processes. Users who have needs to satisfy can trigger composite services.

A Web service is an accessible application that can be automatically discovered and invoked by other applications (and humans). A Web service has the following features: independent as much as possible from specific platforms and computing paradigms; developed mainly for inter-organizational situations rather than for intra-organizational situations; and easily composable (its composition with other Web services does not require the development of complex adapters). For the purpose of this research, a Web service is specified with a Service Chart Diagram (SCD). A SCD leverages an UML state chart diagram, putting the focus on the context surrounding the execution of a Web service rather than only on the states that a Web service takes. Indeed, a SCD wraps the states that a Web service takes into four perspectives namely flow, business, information, and performance.

The increasing demand of users for high quality and timely information is putting businesses under the pressure of continuously adjusting their know-how and seeking for more support from other businesses. A potential strategy that implements such a support consists of merging business processes. This has resulted into the deployment of Virtual Enterprises (VE). A VE is a temporarily network of independent businesses that decide to join their efforts until certain objectives are reached. Outsourcing operations between businesses is a good illustration of the operating of a VE. Reasons for outsourcing are multiple including cost-effectiveness and expertise-availability.

In our work, we aim at establishing VEs through the combination of composite services and Software Agents (SAs). This combination occurs at two levels. The first level is reserved to Web services and takes care of the following aspects: identify which businesses of the VE will provision Web services, when and where the provisioning of Web services will happen, how the Web services from separate businesses will coordinate their activities and exchange information, what back-up strategies will be used in case the execution of Web services fails. The second level is reserved to agents and consists of identifying what types of agents will be needed for searching for the businesses that have the capacity to meet the outsourcing requirements, tracking the execution of the Web services, and implementing corrective actions according to the back-up strategies.

Since it is expected that a VE will be joined by an unspecified number of businesses providing Web services, their composition is deemed appropriate to the creation of sub-domains of Web services capable of satisfying customers' requests. Each participant in the VE will provide the needed data and chronology of operations as specified in the SCD of each Web service. At any instance during the execution of the composite service, an outsourcing procedure may delegate the execution of certain Web services to other businesses.