The interest and the demand for the Web services technology and the service-oriented architecture (SOA) are currently at an all-time high. By all measures, the Web services technology is marching in full force in the computer software industry. Most IT companies now have some product offerings on supporting Web services standards, including SOAP, WSDL and UDDI. Many software industry leaders (such as IBM, Microsoft, Oracle, SAP, Sun Micro, etc.) are enthusiastically involved in the definition of new and advanced Web service standards, ranging from service security (WS-Security), business process (BPEL), to interoperability (WS-I). The market for SOA, including software, services and hardware, is expected to reach $21 billion by 2007, according to IDC. Use of Web services is also expected to increase dramatically, with 80% of businesses expected to have projects underway by 2008. In a recent industry report, most of the IT professionals working for large corporations consider the migration from legacy applications to Web services as the top priority for the next 12 to 18 months.

Although many consider SOA to be a well-known idea, dating back even before CORBA and DCOM were invented and adopted, SOA, based on established Web services standards, is not just another old technology in disguise. SOA offers an evolutionary approach to distributed computing that provides greater flexibility and agility while allowing enterprise systems to use heterogeneous resources efficiently and effectively. It is set to fundamentally change business thinking as enterprises transition to the next-generation Web computing. By using an open standard that is platform-neutral, Web services provides application-to-application interoperability. By defining open protocols that manage business processes, transactions, and collaborations, SOA encourages business-to-business integration and outsourcing. By having all major market players adopting and following common standards, SOA with Web services may finally provide a universal platform for all software vendors and application users to integrate and to share service components globally.

On the other hand, we are just seeing the first wave of Web services adoption and only collecting some early experience on using the new technology. While some companies have deployed full-scale Web services capabilities, most users are using them only for non-essential tasks. Much like early
online shoppers, users are still cautious about adopting the technology for their main services or offering Web services as their only business interfaces. Early adopters are still testing the water even though they believe this is the right path to travel. We need to learn from these precious early experiences, to continue the development of essential advanced technologies, and to explore new application domains that are beyond business applications out there on the digital frontiers. We need to continue this endeavor so that the Web services technology and the SOA paradigm may become mature, powerful and complete.

It is with this vision that a group of researchers and engineers met in Taipei, Taiwan during March 28-31, 2004 in the First IEEE International Conference on e-Technology, e-Commerce and e-Service (EEE 2004). As stated by the program co-chairs, Drs. Soe-Tsyr Yuan and Jiming Liu, in the preface of the proceedings, the mission of the conference was “… to be the world’s primary forum on broad, crosscutting issues for the next e-themes enabling technologies, attracting an international participation of researchers and practitioners.” The conference intended to “… chart the future course of the e-themes technology revolution.” The e-theme topics included, but were not limited to, e-commerce, e-business, e-industry, e-government and the driving forces of e-technology and e-services. In the conference, research results covering the following areas were presented:

- Business processes
- Business services
- Business intelligence
- E-commerce technologies
- Intelligence and agents
- P2P/grid computing
- Mobile technologies
- Internet technologies
- Web service
- Security and trust

Four of the distinguished papers on Web services from EEE 2004 and the fifth one from a regular submission pool have been selected to appear in this issue of International Journal on Web Services Research. The papers cover important issues on: developing Web services, matching Web services, admitting Web services, replicating Web services, fine-tuning Web services, and composing Web services. Indeed, these papers have covered most of the major system engineering issues in using the Web service technology.

The first article, “Model-driven Web Service Development” by Grønmo et al., explores how to develop Web services. It presents a model-driven development approach for Web services. By using the Unified Modeling Language (UML) to express the content and the behavior of Web services, authors believe that it is easier to understand and to reason than using WSDL, the standard service definition language. The first step of the development process is to convert WSDL into UML using some transformation rules to reverse engineer the WSDL description. Once the UML document is ready, a developer then uses a UML tool to review and integrate the imported models to form a model of a composite Web service. Both interface modeling and workflow modeling can be performed on the composite service. After that, the resulting UML document can be used to generate the WSDL description of the composite service. In this way, the workflow of the composite service can be much better defined and implemented.
The second article, “Matchmaking for Business Processes based on Choreographies” by Wombacher et al., discusses issues on Web services matchmaking. It presents a formal semantics to business process matchmaking based on finite state automata (FSA) extended by logical expressions associated to states. One of the most important goals of the Web service technology is the simplicity of service discovery and integration. However, services must be formally defined so that they can be correctly matched for the functionality requested and provided. The semantics of business processes cannot be identified by the interfaces alone. The authors present an annotated deterministic FSA to describe business processes and study the intersection of annotated FSA. Algorithms and an implementation have been reported in this article.

Business transactions often have QoS constraints. The most significant constraint is the service processing delay experienced by users. The next article, “The Design of QoS Broker Algorithms for QoS-Capable Web Services” by Yu and Lin, investigates how Web services should be executed. It presents a broker based service admission architecture where a broker is used to make admission decisions on service requests to a server. By granting services to requests only when a server has a sufficient amount of resource, users can be guaranteed with an acceptable service level so that they may receive service results in a well-defined time interval. The decision is what service level should be granted to maximize the server utility. On the other hand, when a server becomes overloaded with new requests waiting, it may be necessary to adjust the existing service level to make room for new waiting requests. The system, however, should minimize the service adjustments (causing service instability) for those requests already admitted. Two broker algorithms are presented in the article. Both algorithms try to achieve a good server utilization while reducing the number of resource adjustments.

To improve service availability, some Web services may be replicated in different servers. The article, “A Preliminary Study of Suppressing Redundant Nested Invocations from a Web Service with Active Replication” by Fang et al., presents a study of implementing replicated Web services. The system under study, FT-SOAP, has been proposed and built using active replications for higher resilience to failure. A redundant nested invocation (RNI) problem arises when a group is serving a client invocation and replicas in this active replication group all make the same (redundant) nested invocations to another server. A mechanism to perform auto-suppression of redundant nested invocation in an active replication FT-SOAP is presented in this article. The performance data, however, show some performance overhead for SOAP invocations.

With the popularity of Web services technology, more and more software systems’ functionalities become available by being published and registered as Web services. Registered Web services need to be dynamically combined to form “composite services” when individual “simple services” fail to meet service requestors’ complex service needs. The fifth article, “A Semi-Automatic Approach to Composite Web Services Discovery, Description and Invocation,” by Liang, Chakarapani, Su, Chikkamagalur, and Lamwe, proposes a semi-automatic approach to composite Web
services discovery, description and invocation. They present an intelligent registry with constraint matching capabilities to support composite service discovery and description. It provides a user interface to interactively compose a service request. It then uses a semi-automatic mechanism and a search algorithm to construct a composite service template that satisfies the request. The operations of the template are bound to registered service operations by constraint matching subsequently. The resulting composite service is specified in the Web services flow language.

The next meeting EEE 2005 is scheduled to take place in Hong Kong in March 2005. We expect to have another great meeting and to present many new research results on Web services. We hope to see you there!

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