The DIP project: semantic web services systems and solutions for processing digital data

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Abstract

This poster introduces an ongoing research project within semantic web and web services technology – DIP project (Data, Information and Process Integration with Semantic Web Services). Research challenges are introduced, real-world case studies are presented, potential impact highlighted and expected results are listed.

1 Introduction

Current web services are based on – if not limited to – the interaction between humans and computer systems. Their extension to similar transactions between computers requires machine-processable semantics of data and information. The Semantic Web, initiated by World Wide Web inventor Tim Berners-Lee [Berners-Lee, 2005], has the goal of developing adequate solutions for these problems. Through the use of ontologies and metadata – information about information – the Semantic Web enables the computer to query, retrieve and manage semi-structured information. A range of mark-up frameworks and languages have already been developed, notably the revised Resource Description Framework (RDF) [RDF] and the Web Ontology Language (OWL) [OWL] which mark the emergence of the Semantic Web as a broad-based, commercial-grade platform. However, much work remains to be done for upper layers of the Semantic Web, which are considerable research challenges. Complementary to the Semantic Web is Web Services, a new breed of application. These are self-contained, self-describing, modular applications that perform anything from simple requests to complex business processes, which can be accessed across and via the Web. The next step to Web Services is a fusion of Semantic Web and Web Service technologies - called Semantic Web Services. Semantic Web Service technology will allow structural and semantic definitions of documents, providing completely new possibilities in Knowledge Management, Enterprise Application Integration, and e-Commerce.

2 The DIP project

The EU-funded DIP [DIP, 2004] (Data, Information, and Process Integration with Semantic Web Services) project has the mission is to make Semantic Web Services a reality by providing the required infrastructure, i.e. an open source architecture and a set of exploitable tools. The successful creation of such an infrastructure could potentially change the way electronic co-operation and business is conducted in the same way that the original Web revolutionized access to electronic information. Furthermore, a combination of Semantic Web and Web Services technology may well deliver the killer application for the Semantic Web. Semantic Web Services can provide an infrastructure that would not only revolutionize the processing of digital information but also the way we access computational resources in general. This is considered today to be the major bottleneck for realizing the full potential of electronic co-operation and business. Studies estimate that up to 30% of IT budgets and resources are currently spent on EAI activities within one company and to other ones. DIP aims to get these integration or mediation activities performed automatically and dynamically and therefore develop Semantic Web Services as a scaleable and cost effective solution to existing integration problems. Eighteen partners, consisting of European Universities and leading IT focused companies are working together for three years to accomplish these results.

3 Research challenges and real world case studies

There are several research challenges that DIP is addressing as follows:

Information Management challenge: DIP will address and employ Semantic Web Service technology to allow structural and semantic definitions of documents providing completely new possibilities: Intelligent search instead of keyword matching, query answering instead of information retrieval, document exchange between departments via ontology translations, definition of views on documents providing personalization and contextualization of information. Ontologies specify the make-up of domain knowledge in a formal logic designed for automated processing by machines. Through the introduction of semantic attributes, they make digital content more readily accessible, understandable and usable to ontology-aware services and systems

Enterprise Application Integration challenge. DIP will address develop a successful integration strategy that com-

bines the advantages of ad-hoc and global integration strategies. In consequence, DIP will adopt the following goals, which are essential ingredients for successful integration:

- **Purpose-driven** Business needs should drive the integration process. We need to identify the major integration needs in terms of business processes and available information sources. We structure our integration efforts around these needs and employ integration techniques that avoid the disadvantages of ad-hoc integration, i.e., we care about extensibility and reusability.
- **Extendable**. We will use ontologies to avoid ad-hoc integration. We will use ontologies for publishing information regarding data sources and for aligning it with business needs. By using ontologies for the purpose of making information explicit, we will ensure that our integration efforts can be extended in response to new and changed business needs.
- **Reusable**: We will use Web Service technology to reflect further integration needs based on standardization. Ontologies provide extendable integration solutions. We must ensure that our chosen software architecture enables their actual reuse in new business context.
- **Flexibility**: We will use Semantic Web Services for ad-hoc integration on the fly in accordance with changing demands. Current integration efforts reflect fixed integration needs that are always behind the actual needs. The next logical step is the integration of data and processes between different organizations.
- **eCommerce challenge: The huge potential of "modern" Commerce.** Web-enabled eCommerce needs to be available to large numbers of suppliers and buyers. Its success is closely related to its ability to mediate a large number of business transactions. "Modern" eCommerce needs strong support in three aspects in order to avoid being yet another unsuccessful hype in the IT field:
- **Openness** of eCommerce cannot be achieved without standardization. This lesson can be learnt from the success of the Web. But the standardization requirements for eCommerce will be much more stringent. This will require standardization of the actual content and business logics that are exchanged, which goes far beyond the requirement of standardizing protocols and document layouts. DIP is developing significant contributions to this area..
- **Flexibility**: Flexibility of eCommerce cannot be achieved without multi-standard approaches. It is likely that no one standard will arise that covers all aspect of eCommerce that will be acceptable in all vertical markets and all cultural contexts, nor would such a standard free us from the need to provide user specific views relating to it and the content it represents.
- **The Dynamics** of eCommerce will require standards that develop almost as 'living entities'. Products, services, and trading modes are subject to high turnover rates. DIP will develop electronic trading devices that reflect the dynamic nature of the processes they are supposed to support. In business environments DIP will enable automatic co-operation between enterprises.

Real world case-studies: DIP also addresses one of the critical success factors in the market take-up of Semantic Web Services by using Semantic Web Services as an infrastructure to create practical solutions to real-world business challenges. Case studies are an integral part of the project and involve many different aspects including, business problem definition, technology development, evaluation, and demonstrations. The three case studies addressed in DIP project are in e-Banking (Bankinter), e-Government (Essex County Council) and in Telecommunication, B2B case study (BT).

4 Expected results and potential impact

In addition to the real-world case study applications, DIP aims to deliver the following results:
Open source Semantic Web Services Architecture. One of the key public deliverables of DIP is the open source Semantic Web Service Architecture that is WSMX [WSMX, 2005].
Exploitable tools. The tools used in implementing and realizing parts of the overall architecture will become exploitable on a large scale for the DIP partners. This approach ensures real impact - there will be a big demand for tools in combination with the WSMX open source architecture.
Standards. A major standards proposal in the area of Semantic Web Services has been submitted to W3C that is WSMO [WSMO, 2005] standard. DIP will generate major input to the work of the Semantic Web Services Initiative (SWSI), where project results are expected to significantly influence SWSI work.

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