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Automating Business Processes with Web Services

Web Services were intended to let systems communicate with each other across company and firewall boundaries as a network of services running with little or no human interaction.

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With business process languages and XML-based security mechanisms, Web Services are increasingly viewed as a valuable technology for integrating applications into orchestrated business workflows. But real world business requires user interactions creating de-facto a new challenge. Choreography, an old idea in a new light, seems to show ways of how to deal with the complexity inherent to human participation in processes.

Today, the basic architectural concepts of Web Services, namely SOAP (Simple Object Access Protocol) and WSDL (Web Services Description Language) have been accepted and the software industry has committed to them by integrating them with existing products. Furthermore, numerous service providers in different domains such as American Express, AT&T or T-Mobile have begun offering interfaces to their core services on a Web Service basis. However, these implementations are still limited to very basic services, which do not require business process integration, a unified common document standardisation, a deeper security level or even a specific asymmetric user interaction. While some of these aspects are being addressed by standardisation bodies like W3C (World Wide Web Consortium) or OASIS (Organisation for the Advancement of Structured Information Standards), other aspects such as user interaction remain an open challenge with a set of proposals that end up in quite proprietary solutions. For an integrated communication service provider such as Swisscom, the development in the area of processes promises some interesting benefits.

Processes and Business Processes

A process is basically a model that roughly represents a more complex flow, taking place in the real world. Processes normally consist of sequences of actions and concurrent actions, which are synchronised at termination. Sequential events and synchronised actions also require means to map outputs of previous steps to inputs of following ones. In addition, it must be clear who is responsible for which part of the whole process, i. e. actors must be defined and, if necessary, interaction rules must be in place and considered while going through the process. These few statements already give a superficial feeling of how complicated processes can be. Today, many business processes are described on paper and executed by humans, who in turn perform their respective process actions by interacting with

computers. This situation particularly applies in inter-company processes, where a homogenous system landscape no longer exists.

Web Services were intended to let systems communicate with each other across company and firewall boundaries as a network of services running with little or no human interaction. The problem was to find a simple and efficient way to bundle Web Services together to form a complete business process. In 1999, ebXML (electronic business eXtensible Markup Language) started identifying the basic steps of structured processing using XML (eXtensible Markup Language). Unfortunately, the time consuming task of creating an overall standard for every aspect of B2B interactions led to huge paperwork and very few implementations of it, most of it fragmentary. A very important distinction between ebXML and Web Services is that the first was, and still is, focused purely on business transactions, while the second is open for every kind of process. This noble target of Web Services was given up, at least from a terminological point of view. Some of the first XML-based process languages were called XLANG (Microsoft) or WSFL (Web Services Flow Language, IBM). After some confusion between the Web Services Choreography Interface (WSCI) under the lead of W3C and the promoters of BPEL4WS (Business Process Execution Language for Web Services), some big players in the industry (Microsoft and IBM) gave the latter a strong impulse, delivering the proposed standard as royalty-free open source to OASIS for further development and standardisation. The new process language called BPEL (Business Process Execution Language) found rapid adoption and industry support and is now being implemented in existing products of most industry players, such as Microsoft's Biztalk server, IBM's Web Sphere or BEA's Web Logic server. Other players have also implemented BPEL in their products or are planning to do so (for example Collaxa and WebMethods).

The Challenge of Document Unification

One of the most important requirements for dynamic, computer-based B2B to happen is the existence of generally accepted common business document syntax and semantics. For this a common understanding and a standardised way of structuring business data into documents is needed. For this purpose, UBL, the Universal Business Language was created. UBL is an OASIS TC (Technical Committee) aimed at providing the basis for a full featured set of XML schemas for business documents. At the moment UBL is not actually as universal as its name might suggest. It covers the full procurement cycle from order to invoice. Interestingly, UBL designers have since the beginning based their work on building blocks (an idea taken from ebXML) that, put together, make up complex document types. UBL builds on a set of core and reusable components. It additionally provides extension mechanisms to customise documents to industrial sector's specific needs. The task is extremely complex and it will take some time to achieve all the targets announced by the UBL TC. It will be important to keep a close look at the development of UBL – its promise is very interesting and less controversial than other standards in the XML and Web Services world. The conformance to UBL will allow small and middle enterprises to also participate in electronic business with relatively small investments.

The Security Aspect of Web Services

Security is another critical requirement for enabling business transactions. On April 20, 2004, WSS (Web Services Security) was officially released as an OASIS standard. From a technical point of view security mechanisms have been available for a long time. The XML-based framework defined by WSS offers a real alternative to more traditional technologies such as SSL (Secure Socket Layer) and enables enterprises to get into business without the uncertainty that is usually associated with Internet and Web Services. In addition to encryption, WSS supports standard digital signature technologies. The requirements of data integrity, data confidentiality and non-repudiation can therefore be implemented using WSS. Unfortunately, digital signatures still have no legal recognition, but it is a fact that many governments are undertaking efforts in this direction.

The Human Challenge

We have now seen that Web Services can be used to do business in a secure way. It is possible to organise sets of services into processes and let them work – but one point is still missing and currently represents one of the biggest challenges. Business processes can be very complex and require decisions by human beings. This means that a process usually cannot be fully automated. It is possible however, to use electronic means to support humans in their decisions. Naturally, humans differ in a number of aspects from machines: They do not work 24 hours a day, 7 days a week and for many tasks their response time is slower than that of a computer. If response to certain process requests takes hours or days to be submitted, the need for asynchronous processing arises. Unfortunately, today's Web Services do not support asynchronous messaging, at least not in a standardised way. For example, if an employee receives an order and is required to make a few phone calls and send back an acknowledgement, it is clear that some kind of call back mechanism must exist. Standardised concepts for such mechanisms in Web Services are still missing. Furthermore, humans need information in a readable form. Of course, XML consists of plain text and is readable, but human experts cannot be expected to scan through XML to find out the information they are in need of. This issue can be easily solved by using transformations of XML documents (for example UBL documents) into a format which can be read by humans (for example HTML or PDF). However, when documents must be signed, the process of signing the visible and readable part of a document and then resending the signed document via a Web Service is far from trivial. Swiss law states that a signature only applies and is binding for the part of the document that has been visually verified by the signer. In this case the employee signs a transformation of an XML document, which complicates the process even more. Clearly, integrating humans into electronic processes is not easy but will be necessary if business transactions should be performed using Web Services throughout the value chain.

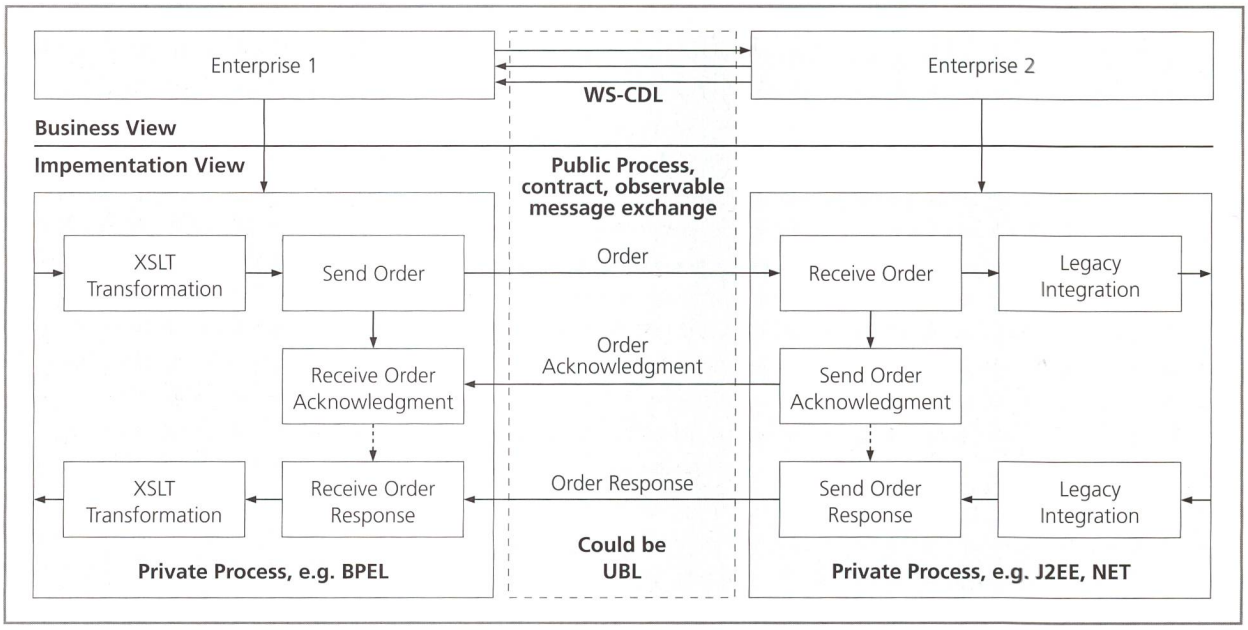

Fig. 1. A possible integration scenario with different process technologies and WS-CDL (Choreography Description Language) and UBL as common factors.

In the next paragraph, we will take a look at an upcoming proposed standard that could solve some of the problems mentioned above without giving up the flexibility and simplicity of Web Services. A possible scenario is depicted in figure 1.

Outlook

The W3C published a first working draft of WS-CDL (Web Services Choreography Description Language) at the end of April 2004. WS-CDL is meant to specify interoperable peer-to-peer collaboration and contracts between participants. With WS-CDL, it makes no difference whether the participants rely on a business execution language such as BPEL, a general purpose programming language like Java, C# or a human controlled software agent. Choreography is understood as a complementary technology to business processes. While BPEL describes the flow of activities, i. e. the execution logic of applications based on Web Services, choreography takes a more abstract view and concentrates on the messages and the agreements between participants. With WS-CDL, participants are always in a particular state, which must be synchronised after a message exchange, i. e. the states of participants are aligned. A particular state has one or more possible follow-up states, similar to real world business situations.

Some experts in the Web Services Community (Guus Ramackers, Oracle Corp.) define BPEL as a way of describing "private processes" that are implemented within an enterprise and WS-CDL as the description of "public processes" which take place across enterprises. A classic example is the handling of a purchase order. In this case BPEL would describe steps like sending the order, receiving the order acknowledgement and the order response. WS-CDL would then concentrate on the order request, i. e. on the format, conditions and restrictions that apply to the message exchange between the enterprise sending the order and the one receiving it. Additionally, the state of both enterprises would be aligned, resulting in identical expectations concerning the set of subsequent messages. An enterprise thus has the possibility to encapsulate its business logic with BPEL and only expose that part of the required interaction which must be publicly observable in order to engage in business transactions.

To what extent could WS-CDL be able to solve some of the problems of B2B based on Web Services? WS-CDL does not require BPEL for each enterprise involved. Since participants can implement the published Web Services either with general purpose programming languages or human controlled software agents it could become a lot easier to also integrate user interfaces in a workflow. Furthermore, the use of state alignment and message-oriented Web Services could contribute as well to the integration of human experts and enable long lasting transactions throughout complex business situations.

WS-CDL, like all other Web Services technologies, does not make specific assumptions about its surroundings. It is not relevant which kind of processing languages are involved in the choreography – hence WS-CBL continues to provide interoperability between platforms, one of the main advantages of Web Services architectures. The second half of 2004 will show whether or not the potential that we assume in the combination of existing standards and CDL really can turn to a working reality. ■

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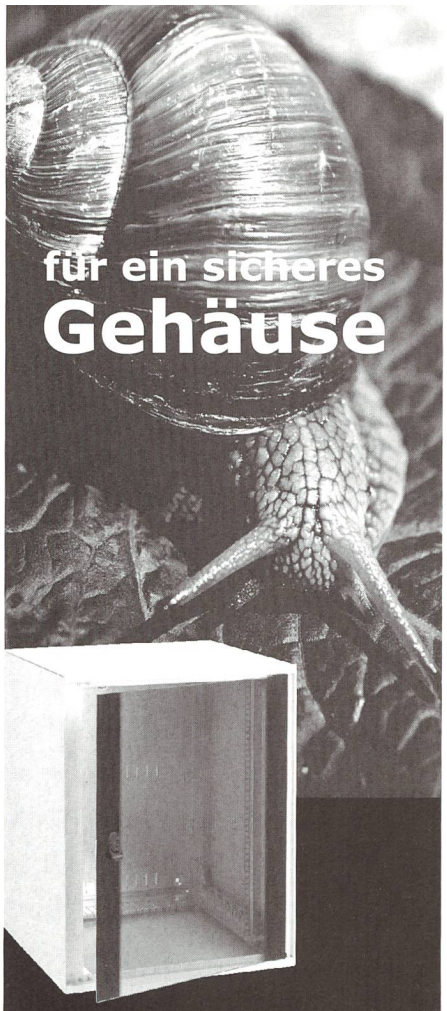

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