

Intelligent Brokering on the Web

Chris van Aart , Bob Wielinga , Wouter Jansweijer and Anjo Anjewierden
Department of Social Science Informatics, University of Amsterdam, The Netherlands
email: {aart, wielinga, jansweijer, anjo} @swi.psy.uva.nl

The goal of the IBROW project¹ is to develop technologies for (semi-) automatic selection and configuration of components for new applications. These components range from simple information access to knowledge and knowledge-based components, including web services. Web services are already deployed in various domains, but many of these tend to be inflexible: it is not possible to modify the underlying system, nor to configure it for other domains, nor to integrate different services to produce new functionalities. The aim is developing services for flexible configuration and execution of knowledge intensive components. Such components take the form of problem-solving methods (PSMs) for knowledge-based systems (KBSs) that decompose the reasoning task for a KBS in a number of subtasks and inference actions that are connected to knowledge roles in a domain knowledge base. Although PSMs are mostly used to describe the reasoning part of KBSs at the knowledge level, they can be linked to software components that implement the reasoning part. Several PSM libraries with corresponding operational components are now available. This gives the possibility for the Web to change the nature of using software from a centralistic compositional approach to a distributed plug and play process. This requires a new way of managing available software components by intelligent software brokers. For this a brokering service has been designed that configures dedicated applications based on a goal given by a user. It selects, combines and configures PSMs from on-line PSM libraries. An execution environment has been developed that executes the configuration and that takes care of dataflow from and to users. These two environments are integrated into an architecture based on intelligent agents, which enables collaboration between the various actors and services involved.

We foresee a new electronic market place consisting of provider agents, customer agents and broker agents. The broker agents deliver an intelligent service that enables third party knowledge-component reuse, where suppliers provide libraries of knowledge components adhering to some standard, and customers can consult these libraries to configure a knowledge system suited to their needs by selection and adaptation. A customer in this context is a person/company that wants to solve a particular problem. Users who use the brokering services simply get results for their requests, re-

gardless of whether the results require a "simple" lookup in a digital database or a complex and distributed inference process involving heterogeneous entities. The main features of the IBROW approach are PSM libraries and a Brokering Service, where the Brokering Service interacts with a user to establish the goal to be realized through a new application. On the basis of the goal of the user specification PSMs are selected from one or more libraries and are configured into an executable application. The broker can select PSMs from PSM libraries in order to configure a KBS using strategies such as *keyword match*, *simple task-PSM matching* (on the basis of specification), and *theorem proving based matching of competence*. After a successful matchings process the broker will produce a dataflow structure describing the sequence of PSM to be used. Currently we have available a library of PSMs that can do weak-classification and a large number of PSMs that have various competences in the analysis of documents (DA), including components that unravel the layout structure of documents (blocks of text, headers, footers) , PSMs that analyse the logical structure of documents (paragraphs, sections) and PSMs that work on the words and punctuation of text to find concepts and phrases on the basis given domain ontologies, dictionaries and lexicons. The agent based approach provided a natural way describing distributed heterogeneous components as a collection of separate agents. and it is a metaphor to reason about processes and coordination, using the notion of separation of concerns. The agents are wrapped around actors, components and services and framed into the IBROW architecture. In the sense of the available applications, like PSMs library and PSMs servers, agents form the front end of those applications. Every developed agents offers its own expertise, in the form of PSM provider (i.e. library agent), invoker of PSM (i.e. operator agent), coordinator (i.e. manger agent) and configurator (i.e. broker agent). The vision of the semantic web is integrating new and existing technologies into a network, to make them accessible to people in a transparent way. We believe that IBROW technology can be applied for this in five ways: (1) describing competence of PSMs, (2) deployment of PSM, (3) finding competences of PSMs, (4) configuring competences and (5) wrappers around components and services. The message to end-users is that our technology hides the complexity (i.e. service discovery, data-flows, control flows and service invocation) to them and providers of PSMs.

¹Intelligent Brokering on the Web, <http://www.ibrow.org>