ITEA

INFORMATION TECHNOLOGY FOR EUROPEAN ADVANCEMENT

INNOVATION REPORT

Web Services
A NOMADIC MEDIA perspective

The ITEA project NOMADIC MEDIA aimed to enhance consumer flexibility in the use of services and content at the places they wish, and to enable the movement of content between their preferred devices according to their needs and circumstances. Implicit in this vision is the need for consumers to configure services and content in the ways that suit their particular circumstances and thus enjoy the benefits of a personalised environment.

To reach this objective, NOMADIC MEDIA explored different use scenarios: the Airport, On-the-Go, at Home and Healthcare. Healthcare was the scenario in which the concept of Web Services (WS) was investigated. For this scenario, a technological architecture was investigated that was able to:

- Connect a variety of related services into a coherent set and thereby improve the process of, for example, ordering prescriptions, making patient appointments and scheduling laboratory tests by healthcare professionals;
- Enhance doctor productivity with real-time access to information via a variety of preferred devices; and
- Allow collaborative access for different users such as insurance companies, healthcare providers, pharmaceutical companies and patients.

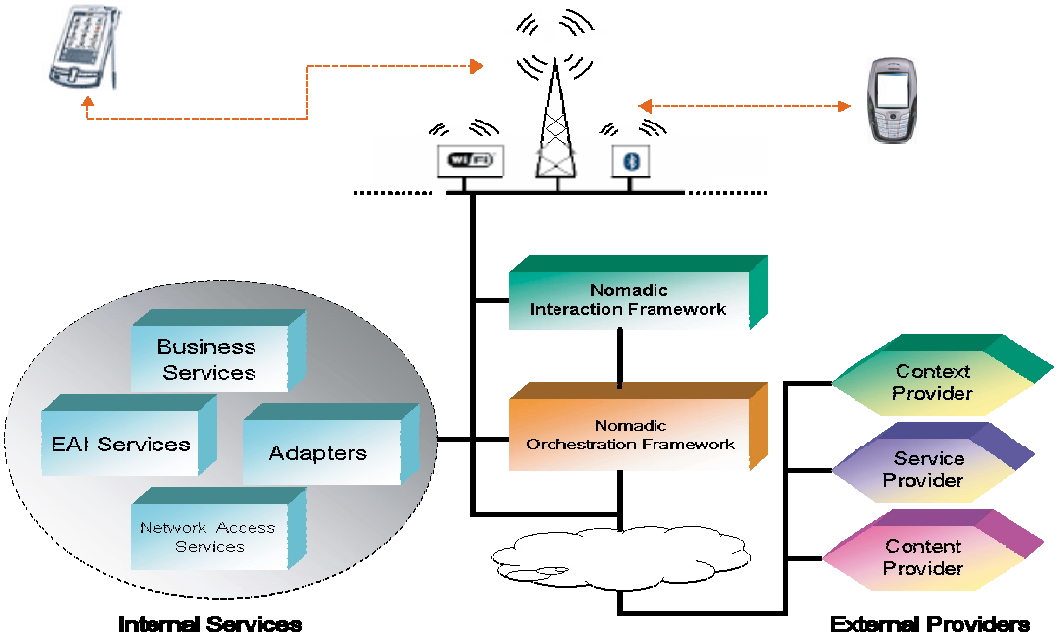
As a result of this investigation, it was realised that the healthcare context shares many characteristics common to numerous complex and distributed applications. This resulted in the following summary of the key problems:

- Services should be composed at runtime, based on a multiparty business process model, using an orchestration framework;
- To enhance the choices and to compose the services dynamically, advanced techniques should be used to advertise and discover them; and
- Content should be adapted in relation to context, situation and user preferences.

This led to a service-oriented architecture (SOA), that is to say an architecture where functionalities are implemented, essentially, as a collection of services communicating with each other. A service is a function that is well defined, self contained and does not depend on the context or state of other services. SOA is not new, but is an alternative model to the more traditionally tightly-coupled object-oriented models that have emerged in the past decades. Web Services represent a set of specifications defining the details needed to implement services and interact with them. Although WS is a technology in development and standardisation efforts are not complete, robust enterprise toolsets are available. Serious WS-based solutions can be developed in specialised areas using such toolsets. One of the main areas explored in NOMADIC MEDIA was service composition. It allows complex tasks to be executed as sequences of processes written using standard specifications.

In the NOMADIC MEDIA Healthcare scenario, the need to exchange information between different providers – services, content and context – was clearly identified. WS standards were used to solve the problem of obtaining robust multiparty interaction. Standards also helped to solve the interoperability problems at a syntactic level. But the strength of WS technologies is that they enable heterogeneous systems to be built in a semantic way. To achieve semantic interoperability, information systems must

be able to exchange data in a way that allows ready accessibility to the precise meaning of the data, and the data itself can be translated by any system into a form that it understands. This was achieved by describing services functionally and operationally in a formal, machine-readable way.



Web Services

Examples of automated procedures obtained are:

- Web Service discovery: the action of matching available service descriptions to a requester's candidate service query and returning the resulting matches;
- Web Service invocation: the principle of automatically interacting with an atomic service by using the semantic description to understand how to access it;
- Web Service selection and composition: the action of choosing the most suitable service from a set of known services and running a composite service by invoking WS, in the correct order, overcoming syntactic, structural, semantic and process heterogeneity, and handling errors and exceptions; and
- Web Service execution monitoring: the principle of tracking what is happening to some described aspects of a service and its component services.

One possible way to proceed toward semantic interoperability is to provide semantics using metadata and ontologies.

The two major efforts in defining a semantic web-services language [1] are: SWSL, developed by the Web Ontology Language for Services (OWL-S) committee in the USA; and the Web Service Modelling Language (WSML), developed by the Web Service Modelling Ontology (WMSO) [2] project in the EU. A table presented by WSMO [3] summarises the comparison between OWL-S and WSMO.

[1] See: http://www.w3.org/Submission/SWSF-SWSL/

[2] See: http://www.wsmo.org

[3] Web Service Modeling Ontology (WSMO), Roman, D., H. Lausen, and U. Keller, 2004

However, the approach to semantic web services involves not only the language problem but also the architecture. Since the WSMO project also proposes a framework (WSMF) to solve semantic interoperability, this approach was chosen in the project. Its philosophy is based on two complementary principles: maximum decoupling of its components, and a scalable mediation service.

One of the important points found in WSMO was the possibility of enabling support for static and dynamic composition. The composition approach chosen was defined as orchestration – i.e. the one that defines how the overall functionality is achieved by the co-operation of more elementary services. In the orchestration approach, a workflow process invokes a number of different services in a specific order because they have data and control dependencies between each other. Infrastructure based on this approach requires just one central service: the workflow engine controlling and executing the entire workflow process. The engine used executes an XML-based script language: Business Process Execution Language for Web Services (BPEL4WS) [4]. BPEL4WS provides a language for the formal specification of business-processes and business-interaction protocols. In this way, it extends the WS interaction model and enables it to support business transactions.

One of the lessons learnt from application of the technology to WS in NOMADIC MEDIA was the importance of using machine processable data to deal with dynamic content and services. To enable interoperability between systems, it is necessary to build a framework using machine-processable data rather than more human-oriented data. Process ontologies, rule-based agent environments and ontology bridging are suggested as possible avenues for integrating automation and orchestration. Therefore, NOMADIC MEDIA concluded that the technology required to make web services more ‘intelligent’ should be explored, based on work in the field of Semantic Web. In this way, it should be possible to reach the condition that Tim Berners-Lee described as the ‘Next Generation Web’. [5]

[4] See: http://www-128.ibm.com/developerworks/library/specification/ws-bpel/

[5] See: http://www.w3.org/Talks/1998/0318-Seybold-timbl/overvies.htm