MIAKT

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Abstract. This paper briefly describes the work we have undertaken in the MIAKT project to provide a generic architecture and user interface for distributed multimedia knowledge management with the application of supporting diagnosis of breast-cancer. Most of the domain-specific functionality is provided by web-services and how these are made functionally and practically accessible in a general way is a main concern to the ongoing work in MIAKT, and this is the main focus of this position paper.

The Medical Imaging and Advanced Knowledge Technologies (MIAKT) project is a collaboration of a subset of the partners from the Advanced Knowledge Technologies (AKT) and Medical Imaging and Signals (MIAS) interdisciplinary research collaborations (IRCs). The project is concerned with the management of the knowledge that is produced during breast cancer screening in an attempt to support the collaborative meetings that occur during breast cancer diagnosis. Medical staff from different disciplines come together at a Multi-Disciplinary Meeting (MDM) to discuss cases where symptoms of cancer have already been identified (symptomatic cases). These symptoms are detected using imaging, such as x-rays, magnetic resonance imaging, ultra-sound or microscopic views of the results of a biopsy. Together with historical patient records, interpretation of these provides a diagnosis and therefore identifies the further treatment for the patient.

The MIAKT project currently provides information management in a semantically principled way, accessing knowledge bases through a generic architecture loosely controlled by a generic client application. Functionality of the system is disjoint from the client to provide flexibility and it provided through web-service interfaces which are made available to the client through an enterprise server.

Currently, we have over 20 services available, all providing useful functionality to the MIAKT application of medical imaging. Very briefly, these include retrieval services accessed through the Internet Reasoning Service (IRS) provided by the Open University, and, through a SOAP interface, natural language generation and medical term lookup provided by The University of Sheffield, image analysis provided by The Universities of Southampton and Oxford and King's College London, and Image Registration also provided by King's College London. Further details of these services will be made available at the workshop.

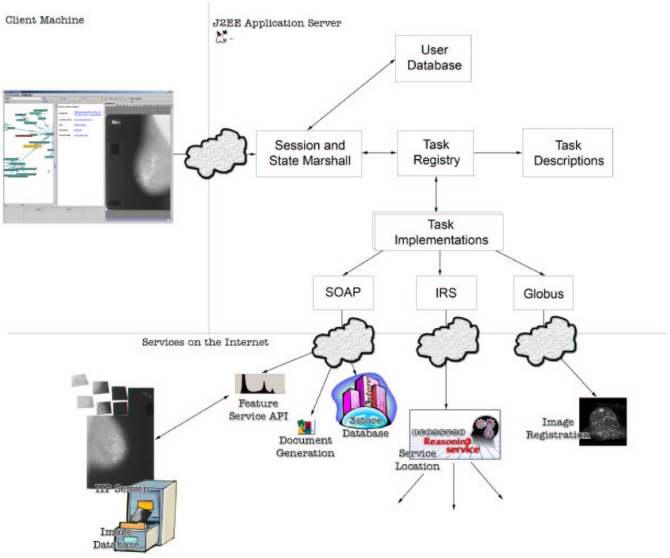

Fig. 1. The MIAKT framework

Trust and security issues are a major concern to medical practitioners who may wish to employ systems such as these, so facing the challenge of providing secure transactions with provenance, with some quality of service on trusted services is a very necessary issue to tackle. Currently, access to the client user interface is governed by username and password databases which means services are available through the enterprise server to the client only if a user has logged in. However, bypassing of both the client and the enterprise server is still possible because access to most of these services is currently unrestricted. The only exception to this are the services provided by King's College London whose firewall is limited to accept connections only from our enterprise server. However, this rather limits flexibility and the general use of the services and was also difficult to negotiate and setup. Both technical and logistical problems made it near impossible to use GRID services directly. Possible ways to tackle this might be with WS-Security [1], as used by the Artemis Project [3], or the extension to that WS-Trust [2]

Once the framework is in place for secure, trusted services to be provided on an ad-hoc basis to different applications, it becomes necessary for these to be described and published in a way that makes it possible for these applications to use them sensibly. Clearly the IRS has some of this functionality already, although having a single point of access to services (that is not the administrating client or server) can be considered a disadvantage. The service's publishing method should ensure that some higher level semantics are provided that in-

dicate a service's role with higher-level tasks (rather than input/output level semantics).

The services in place in MIAKT are all stateless; that is, they all provide a single output from a set of inputs as a black-box. This is important, as the design of the architecture does not currently store state for services. Support for asynchronous web-services currently does not exist, and so there is scope for investigating how these could be implemented and subsequently integrated into the architecture. Currently, expensive GRID services are initiated and return immediately. They are then pinged by the client to retrieve their status once they have started execution. WSGrid [4] has shown that with the addition of client-side services to the architecture, asynchronous services can notify the client on completion, and within a trusted architecture this could be accomplished securely, while retaining programmatic control at the client.

Composition of services may provide a very useful tool for simplifying access to complex services. Assuming the existence of a well described set of atomic services, composition could take place automatically. For example, in the medical domain an automatic suggested diagnosis could be generated from the composition of image segmentation, image analysis and lesion classification algorithms, and the composition could automatically take account of the best-of-breed implementations that are available in each case. It may be necessary for more atomic, less domain-dependent services to be published for this to be actually realised.

Although MIAKT is clearly a flexible architecture, the way in which areas of the system are constructed needs to be addressed in order to realise the architecture as a test-bed for service development; in particular the user interface which currently requires extending to afford the integration of new services (with the exception of image analysis or simple retrieval services). With the further generalisation of this architecture it is possible it could be useful as a general test-bed for the evaluation of service-based solutions.

References

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