

A Web/Grid Services Approach for Integration of Virtual Clinical & Research Environments

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Abstract

Clinicians have responsibilities for audit and research, often participating in projects with basic scientist colleagues. Our work in a regional teaching hospital setting involves collaboration with the medical school computer services and builds upon work developed in computer science department as part of the Collaborative Orthopaedic Research Environment (CORE) project[1]. This has established a pilot study for proof of concept work. Users are mapped to a personal profile implemented using XML and a service oriented architecture (SOA)[2,3]. This bridges the e-Health and e-Science domains, addressing some of the basic questions of security and uptake.

Introduction

e-Scientists and e-Clinicians working together in an ideal shared environment is the utopian goal. With differences in language and conflicting agendas resolved, the harmony would be palpable. In reality this transit of ideas to reality from bench to bedside and back to bench is often tortuous, with false dawns and failed demonstrations. Pragmatic accommodation of legacy technologies is in part responsible, as is legacy working practice. Operating tools over a service oriented architecture and the Grid is a potential solution for users without the heartache of relearning or the cost of major reengineering.

This relationship between the Integrated Health Record, e-Health and e-Science agendas is not just a hypothetical mix of experience and motive, it is an everyday challenge. Many of the issues of inter-organisational coordination of requirements capture, work practice, data sets, data quality measures and coding schemas were addressed by prior projects[4].

Methodology

Our present focus is upon the transition toward Service Oriented Architecture, supporting user empowerment through profiling whilst ensuring responsibility for the consistency of data collection through data management and schemas. This is supported by the shared working environment by providing tools for communication, collection of data, collation of data and unbiased semi-automatic reporting[4]. This offers extensibility and scalability.

The process mapping addresses the normal workflow for medical and nursing staff from operating theatres and ward based environments, providing a software environment which ensures security and confidentiality whilst offering a component library[5] so that the service tools can evolve independently and then be offered to users once tested using a thin client. The evaluation techniques used were user discussion groups and survey.

Results

Trials of data collection are ongoing. They are needed for clinical everyday practice and the need to minimise duplication of data entry. Running for a 6 month trial period to achieve adequate numbers for full data analysis techniques to be applied, they have been reviewed by a multidisciplinary team of 20 orthopaedic surgeons, theatre and ward staff in order to assess the interface and potential issues of workflow. The first month of data is collected alongside the conventional paper records, for Beta testing. Analysis will be included in one of the national audits of departmental throughput. As larger quantities of data are collected the opportunity arises for both 'antegrade and retrograde' analysis of data through the establishment of focused trials based around schemas that are generated to collect specified data using validated scoring systems. By starting with simple analyses, the bugs relating to the interface are removed before introducing this to the bone laboratory team of basic scientists[6] who will depend upon the GRID tools via SOA for their analyses.

Dealing with patient specific potentially sensitive data requires registration as both a clinical and research data controller. Users are securely logged on using a unique password protected system serving so that;

1. Prototype research tools can be applied to solve clinical problems.
2. Security and software are managed through the University School of Medicine firewall.
3. Patients undergoing orthopaedic procedures are consented for records to be used for research as routine.
4. No patient information is released to individuals beyond those who are currently authorised to access this information as part of their routine clinical practice.

Discussion

Our strategy employs open middleware[7] and Microsoft *.net*TM. Processes are being refined to run over a portlet[8,9] architecture separating security from applications. This offers analysis of the clinical record keeping practice but still has implications for data protection. This work represents the initial roll-out. Once implementation involves multicentre clinical trials, it will necessitate data flow directly to the NHS, thence to research, avoiding registration of each user as a data controller and ensuring that every patient is covered by the individual consent forms when only anonymised data will be investigated.

This current approach allows us to develop research tools using anonymized data with only those users with qualified clinical profiles being able to access patient specific data.

Any change in work practice needs to be implemented with the users being informed and made aware of the potential advantages. User profiling started in Adaptive Hypermedia (AH) as a way of mapping the user's ontology onto the workflow process[10]. As this evolves, it offers the following advantages;

1. Focused effort increasing efficiency
2. Accommodation of users' limitations *e.g.* 1st language adaptation.
3. Targeting driven work *e.g.* learning objectives.
4. User 'ownership' of data with selective authorisations for data release.
5. Updating as user profiles change converting the e-Portfolio into a truly dynamic C.V. which is particularly relevant as the modernisation of medical careers will provide a new structure for training.

Conclusions & Future Work

The political tussle between maintaining the status quo and expediency in changing clinical practice demands that for clinicians, Continuing Professional Development will need to accommodate these approaches. Usability analysis suggests that the innovative pathway includes

cyclical implementation and testing to keep users in the iterative design loop.

It is the authors experience that the online form completion for feedback helps to address the time delay in seeking the necessary opinions and is not overly intrusive. Within the context of CORE, the need to build and sort data for analysis across the e-Science, e-Health bridge is fundamental to developing multidisciplinary research potential. This depends also upon the potential resources available to build a Bioinformation Multilayer GRID technology service industry (BioMultiGrid) which will represent the transition to semantic web technologies integrating multiscale modelling. This will assist with expansion [11,12] including ontology mapping, modelling, multimedia, and assist non-repudiation through the clear ownership of data.

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