“Exploiting the WWW: Lessons from a UK Research Project on a Health Record Broker”

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The Health Context Need for a Broker

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Inexorable Growth of Expectation

- Vertical Integration
  - Linking Primary and Secondary Care

- Horizontal Integration
  - Linking health providers in a region

- Temporal Integration
  - Linking to Previous Medical History

Exponential increase in the Record size

Little thought on viability or practicality
Expansion to Un-sustainability?

- Digitisation of Investigations
- Volume of Investigations
- Population longevity
- Genetic Analysis
- Personalised Drugs and Prescribing
- Domestic Monitoring
- Continuous *in vivo* Monitoring
- Remote Service Delivery (telemedicine, etc.)
Integration

Primary Care Record

Hospital Record
(includes X-Rays, scans, nursing)
Temporal Growth

Birth to Death

Hospital Record
(includes X-Rays, scans, nursing)

Primary Care Record
More Growth

Primary Care Record

Hospital Record
(includes X-Rays, scans, nursing)

Genetic records
New and more investigations
Pervasive technologies
(continuous monitoring)
Personalised prescribing
Longevity

Birth to Death
And More Growth

Birth to Death

Other Agencies

Social Care

Primary Care Record

Hospital Record (includes X-Rays, scans, nursing)

Genetic records
New and more investigations
Pervasive technologies (continuous monitoring)
Personalised prescribing
Longevity

Other Agencies

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Longevity
The Concerns

- Record Size and Volume of Transactions
- Navigating the Record and Data
- Swamping
- Not Proven (has never been done)
- Enterprise precedents not good
- There will always be boundaries
Boundaries are Inevitable

Other Agencies

Social Care

Primary Care Record

Hospital Record (includes X-Rays, scans, nursing)

Genetic records
New and more investigations
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Personalised prescribing
Longevity

Birth to Death
Boundaries are Inevitable

Birth to Death

- Hospital Record (includes X-Rays, scans, nursing)
- Genetic records
- New and more investigations
- Pervasive technologies (continuous monitoring)
- Personalised prescribing
- Longevity
Boundaries are Inevitable

- Other Agencies
- Social Care
- Primary Care Record
- Hospital Record (includes X-Rays, scans, nursing)
- Genetic records
- New and more investigations
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- Personalised prescribing
- Longevity

Birth to Death
The IBHIS Vision

- The authorised person can get what they need, in real time.
- Records are secure; specific access when it is really needed.
- Data from different records are merged virtually as needed.
- All record searching is audited.
The IBHIS Concept
The IBHIS concept

- **Information Broker**

Connections:
- Primary care doctor
- Hospital
- Social services
- Other IBHIS brokers

IBHIS

**WWW2006 – Impact of the Web on Health**

Michael Rigby and Mark Turner
IBHIS: the cast & context

- A collaborative project involving:
  - The *Pennine Group* of software engineers from Durham, Keele & The University of Manchester (UMIST)
  - Keele’s *Centre for Health Planning & Management*
  - The staff of *Solihull Primary Care Trust* (providing the domain interaction)

- Began in January 2002

- Funded for three years by *EPSRC’s Distributed Information Management (DIM) programme*
The IBHIS Prototype Broker and the WWW

Mark Turner
Research Assistant

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What issues does the IBHIS broker need to address?

- Supporting the user in **formulating** a query.
- **Locating** all relevant sources of information.
- Implementing any **restrictions** that the owners of information may impose upon access and use.

In addition, the broker needs to:

- Maintain an **audit trail** of actions.
- Provide **feedback** in an unbiased manner.
- Must be **available** across all platforms and networks.
Service-based Architecture

- IBHIS is based around a *service architecture*
  - Services can be dynamically discovered/executed
  - A service is *used* and not *owned*

- Many available technologies
  - *Web services* - XML, SOAP, WSDL, UDDI…
  - Use standard Web protocols (TCP/IP, HTTP)

- IBHIS uses two types of ‘service’
  - *Static*
  - *Dynamic*
The IBHIS Architecture

- User Interface
- Query Service
- Security Service
- Discovery Service
- Ontology Service
- Broker
- Semantic Registry
- Data Access Service

Audit Service

'record store' owners

Michael Rigby and Mark Turner
A DAS provides a service-oriented front-end to a data source.

A DAS may be *dynamically discovered* by the broker.

DASs are *autonomous* and owned by the data provider.
IBHIS – Research Areas

IBHIS concentrated on three main research areas

- **Data Access Service (DAS) model**
  - The discovery and binding of distributed data sources

- **Semantic Interoperability**
  - Ontology based query formulation
  - Dynamic mapping of terminologies between system domains

- **Distributed Access Control model**
  - Flexible and decentralised
  - Able to enforce local policies at the most appropriate point
  - Includes roles, teams, identities, contexts, and overrides
The IBHIS Prototype

- Three data sources
  - Distributed sites, running within different DBMSs and platforms

- Broker runs within IBM Websphere server at Keele

- Implemented as set of Java Web services
  - JAX-RPC messaging for internal services
  - SOAP Document style messaging between broker and DASs

- DAS descriptions represented in WSDL/XML/OWL
- Access Control Policies represented using XML/XACL
- Ontology created using OWL
- Semantic registry implemented as XML database
The IBHIS Prototype

Social Services (Kezie)

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Old Forrest Hospital (Manchester)

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IBHIS - Healthcare Information Broker
Conclusions

- The **broker** approach has many benefits:
  - Does not need to **own** the available data, accesses ‘**live**’ data
  - Data owners retain own **access control** rules
  - Does not need **prior knowledge** of data structures
  - Querying in a **common format** using ontologies

- When combined with **services**
  - Allows for **dynamic** discovery and binding of data sources
  - Brings the broker approach to the **Web** as a way of drawing together healthcare data

- Our proof of concept prototype has demonstrated the viability of this approach by making use of current technologies.
More Information

IBHIS Project

http://www.informatics.manchester.ac.uk/ibhis

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