



**Integration Broker for
Heterogeneous Information Sources**
A Collaborative EPSRC Computing
Research Project in Healthcare

Using Web Service Technologies to create an Information Broker: An Experience Report

IBHIS: the cast & context

- ❖ Began in January 2002
- ❖ A collaborative project between:
 - The **Pennine Group** of software engineers from Durham, Keele & UMIST
 - Keele's **Centre for Health Planning & Management**
- ❖ Funded by EPSRC's *Distributed Information Management* (DIM) programme
- ❖ Domain interaction provided through the staff of
 - **Solihull Primary Care Trust**

May 2004

ICSE -2-

Why services?

- ❖ The over-arching hypothesis for IBHIS is that
 - a **service-based model is a more appropriate way to handle information integration in a dynamic, distributed context than 'traditional' database models**
- ❖ Service architectures offer:
 - independence from platform and language constraints
 - the ability to perform late bindings to accommodate rapid evolution of both data sources and their schemas
 - scope to extend protocols for domain-specific needs
- ❖ But have not been demonstrated for significantly large applications — hence this project

May 2004

ICSE -3-

Why healthcare?

- ❖ Healthcare provides an excellent exemplar of a dynamic distributed context, with:
 - many **autonomous, distributed information sources** (GPs, hospitals, social services,...)
 - the need to draw information together for many very different purposes (child protection, intermediate care...) using a **different mix of sources** for each query
 - **access to information** being based upon characteristics relating to individuals and their roles, team membership and context
- ❖ A **broker** model is able to encompass these needs

May 2004

ICSE -4-

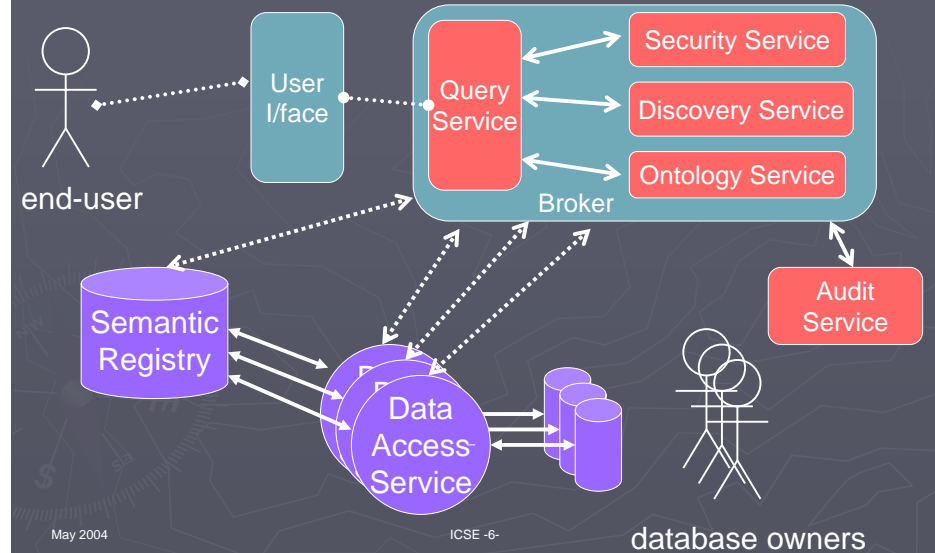
This presentation...

- ❖ The published paper is mainly focused on the experiences obtained from the **first prototype** in which the data services were approximated by using an underlying federated database schema
- ❖ Since then, we have progressed considerably with the **second prototype**, using a full-blown service form, so report on some experiences from this.

May 2004

ICSE -5-

The IBHIS architecture



May 2004

ICSE -6-

database owners

Prototype 1: realisation

- ❖ Main purpose of this was
 - to explore the available technologies
 - to explore some architectural design issues
 - to refine our understanding of the role of the broker
- ❖ Focus was therefore largely on the service elements *within* the broker itself
- ❖ Data access therefore employed a federated database schema

May 2004

ICSE -7-

Prototype 1: outcomes

- ❖ **Implementation** choices:
 - J2EE as platform (support for multiple platforms)
 - IBM's **Websphere** toolset as IDE and for servers
 - Mix of database technologies across the sites
- ❖ Use of **RPC web services**:
 - some problems with data transfer between services
 - overhead of proxy creation/re-creation
- ❖ By-passed UDDI for the registry
- ❖ WSDL adequate, but limitations

May 2004

ICSE -8-

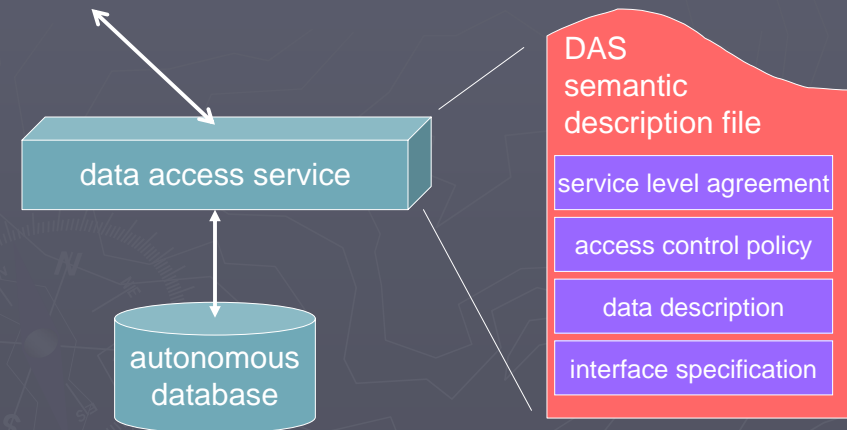
Prototype 2: what changed?

- ❖ Key aspect has been the creation of the **data access service** model (DAS), providing a service-oriented 'front-end' to a database containing source information
- ❖ Now employs a model of **distributed access control**
- ❖ Providing **semantic matching** to replace the use of a federated schema

May 2004

ICSE -9-

Data Access Service



May 2004

ICSE -10-

Distributed Access Control

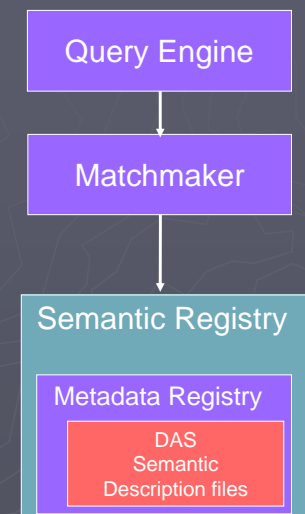
- ❖ First prototype used **role-based access control** with a central policy implemented by the broker
- ❖ Second prototype uses a new conceptual model that extends RBAC and integrates features from other models, such as emergency over-ride:
 - uses a distributed form, with '**associated control information**' giving the local access policy in each DAS
 - additional centralised policy deals with '**inference**'
 - **cross-domain authorisation** mapping details are placed in the SLA of each DAS

May 2004

ICSE -11-

Semantic Interoperability

- ❖ Organised as three elements:
 - data description using WSDL plus **semantic metadata** (in OWL-S) that use the domain ontologies
 - a **semantic registry** that is based upon UDDI, enhanced to store semantic descriptions and to accept semantic queries
 - a **query engine** employing the domain ontology to formulate queries using description logics (OWL-QL)



May 2004

ICSE -12-

Some conclusions

- ❖ **First prototype** demonstrated that the basic service technologies were capable of delivering the full IBHIS architecture, but were chiefly concerned with interoperability in terms of system, structural and syntactic heterogeneity.
- ❖ **Second prototype** is reinforcing this, but also requiring that we extend the basic forms to include semantic content — which is made more tractable by the well-defined ontology used in the domain