



**Integration Broker for
Heterogeneous Information Sources**

A Collaborative EPSRC Computing
Research Project in Healthcare

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

**Professor Michael Rigby
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The Health Context Need for a Broker

Professor Michael Rigby

**Centre for Health Planning and Management
Keele University, United Kingdom**

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

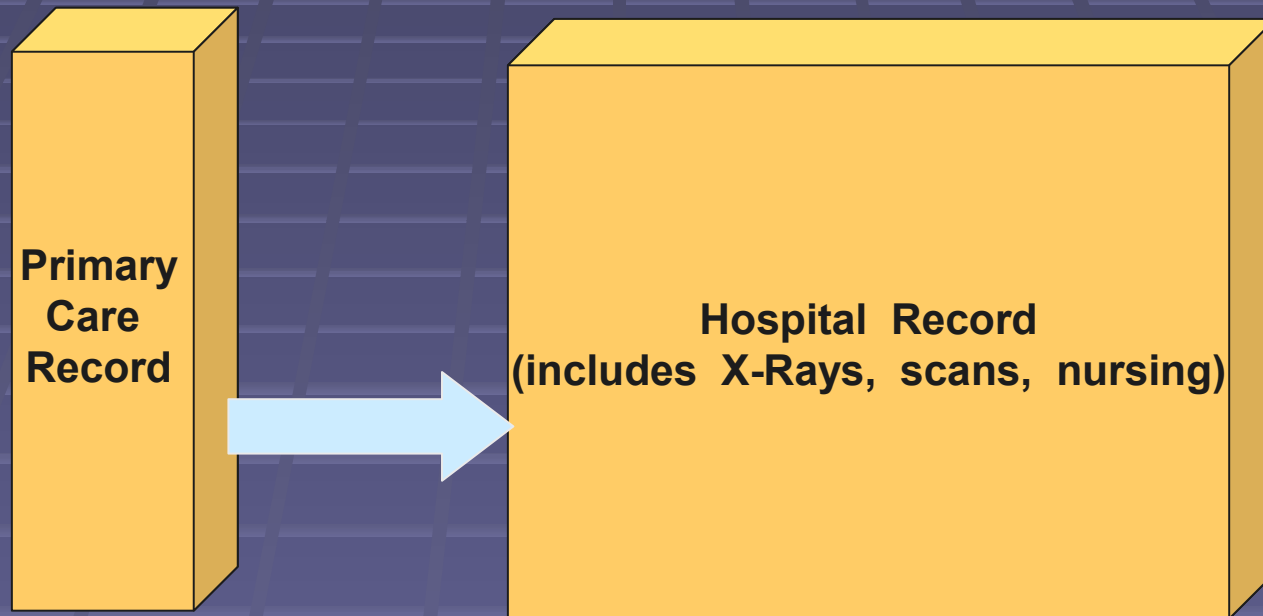
Exponential increase in the Record size

Little thought on viability or practicality

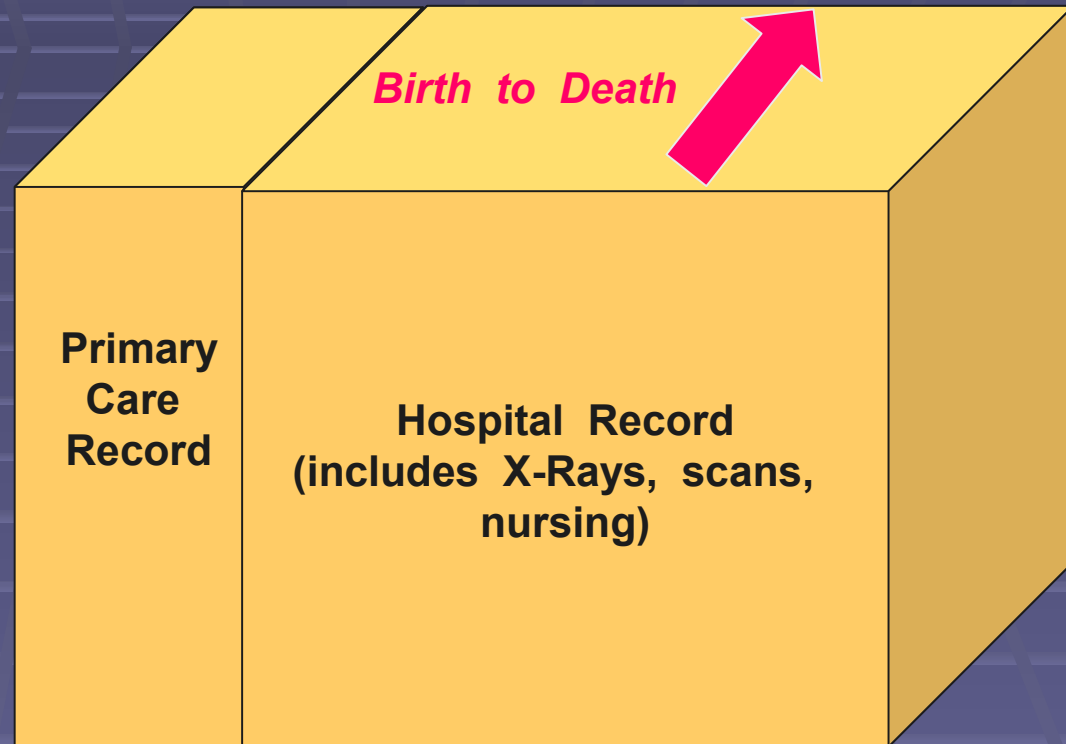
Expansion to Un-sustainability?

- 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.)

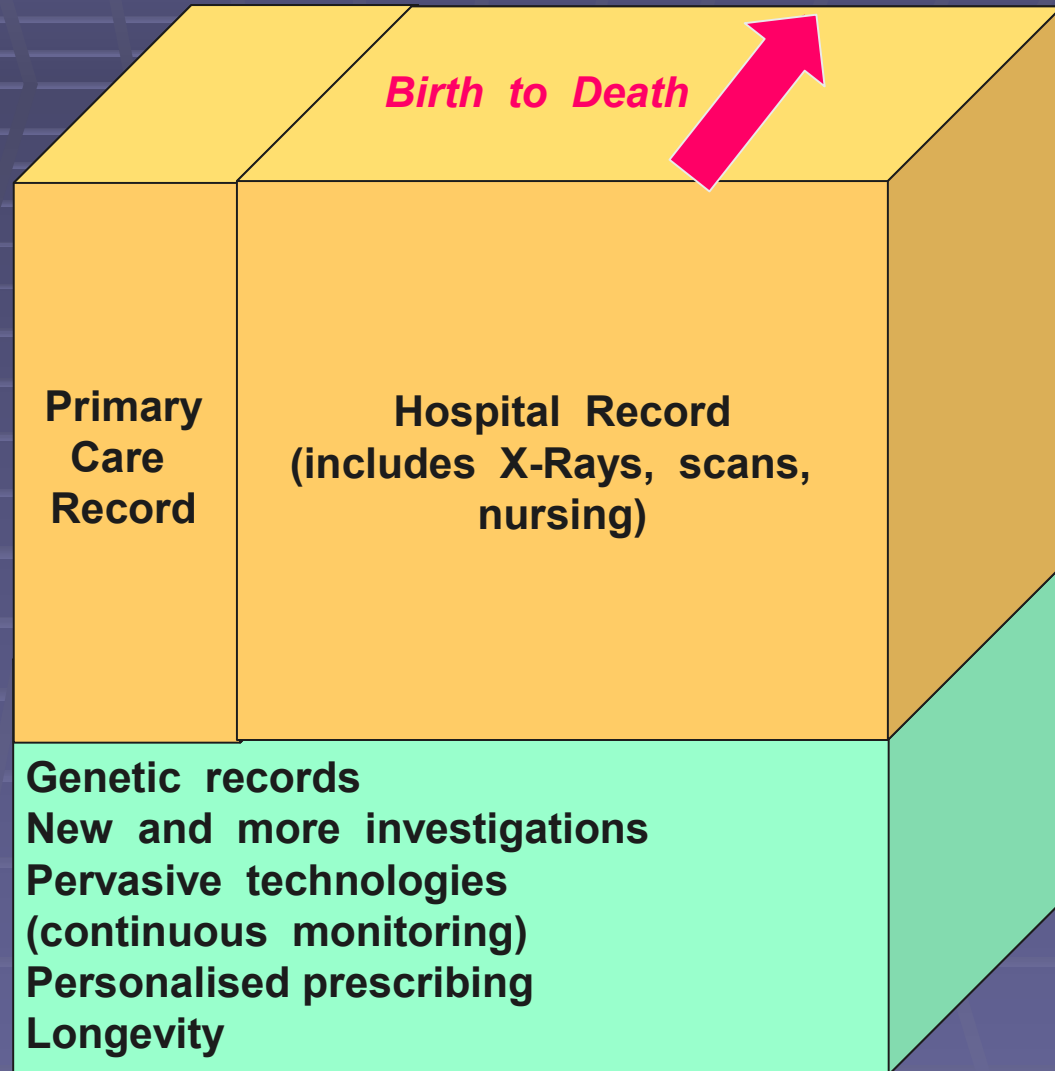
Integration



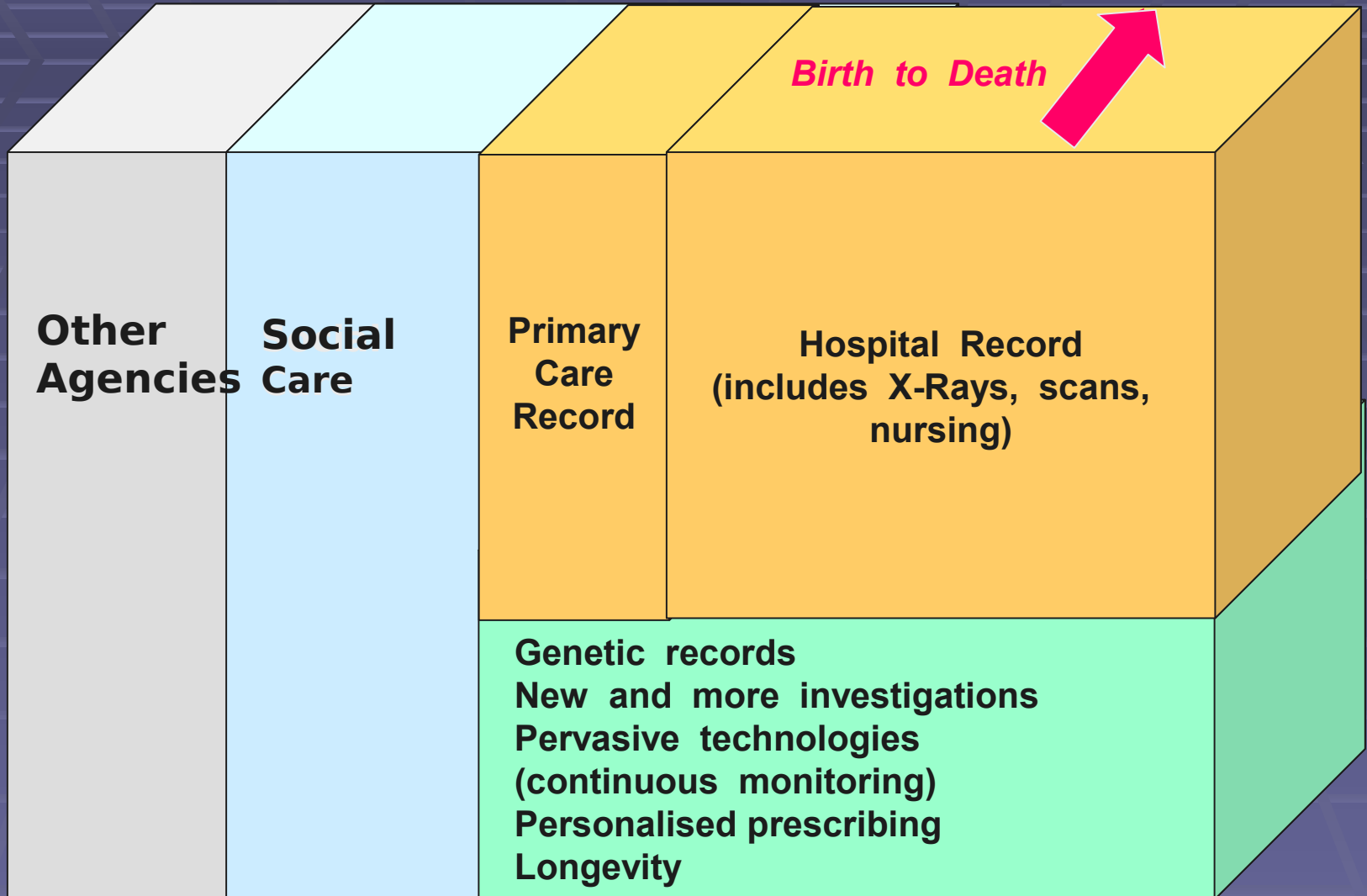
Temporal Growth



More Growth



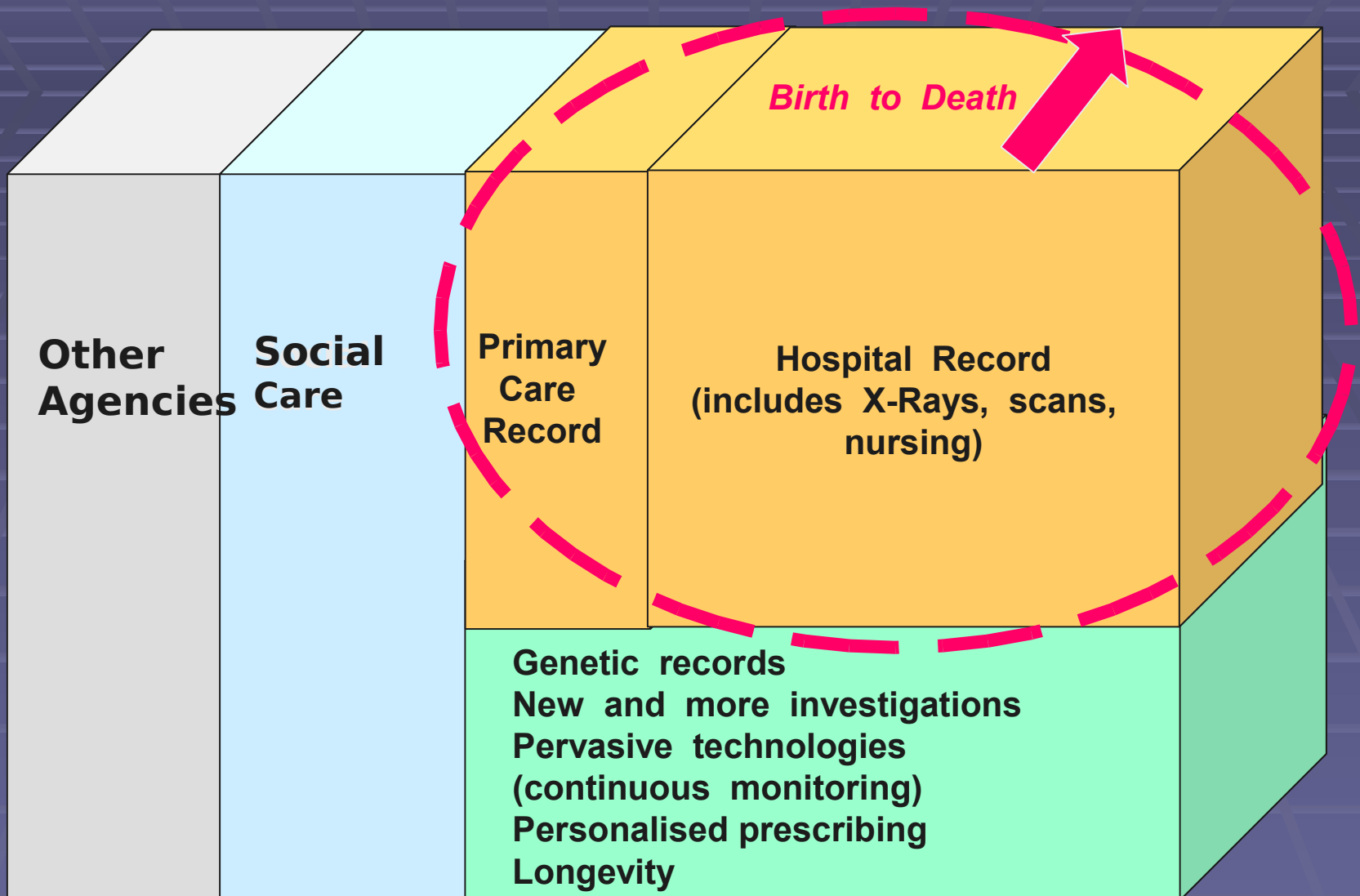
And More Growth



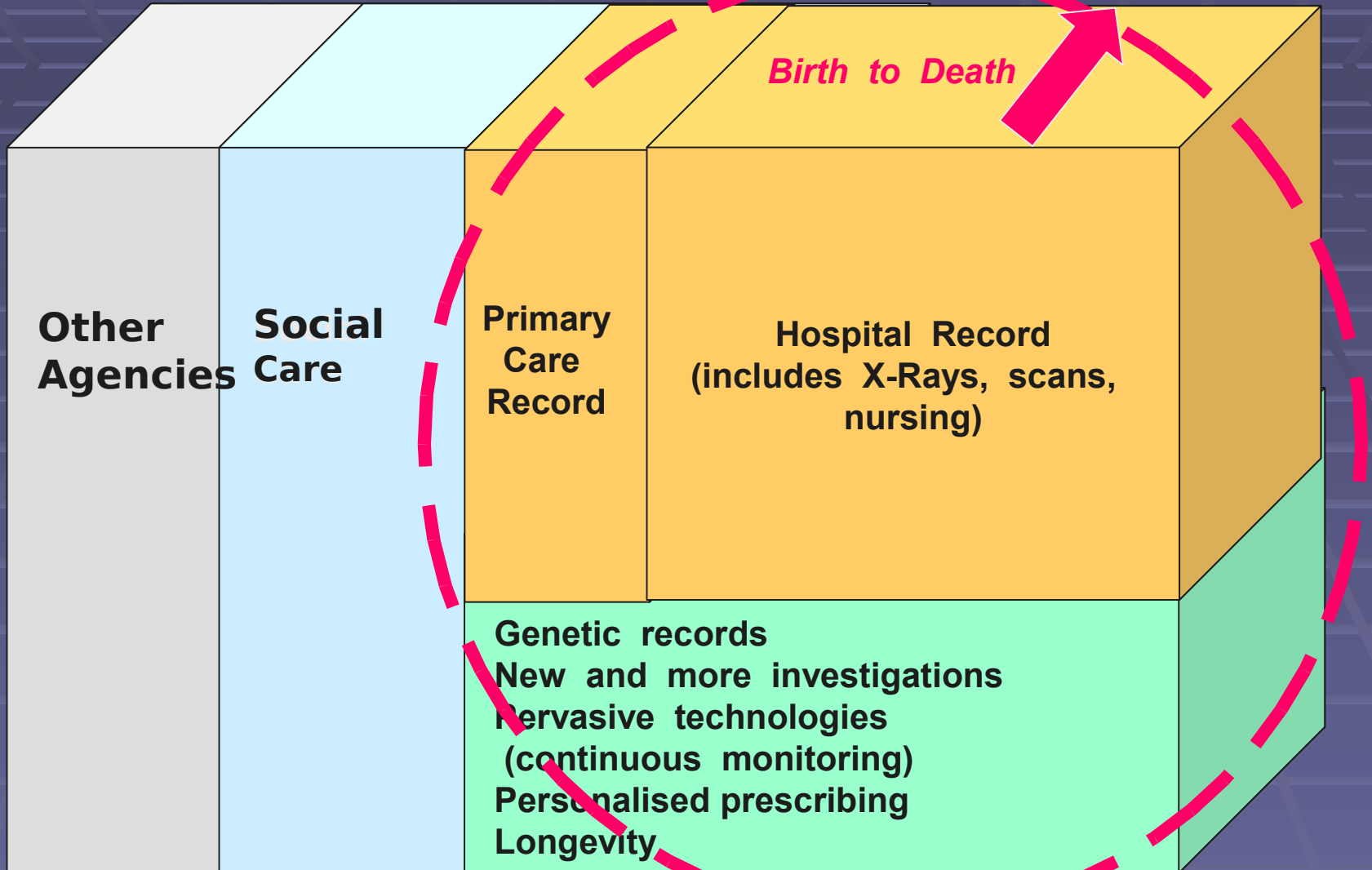
The Concerns

- 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

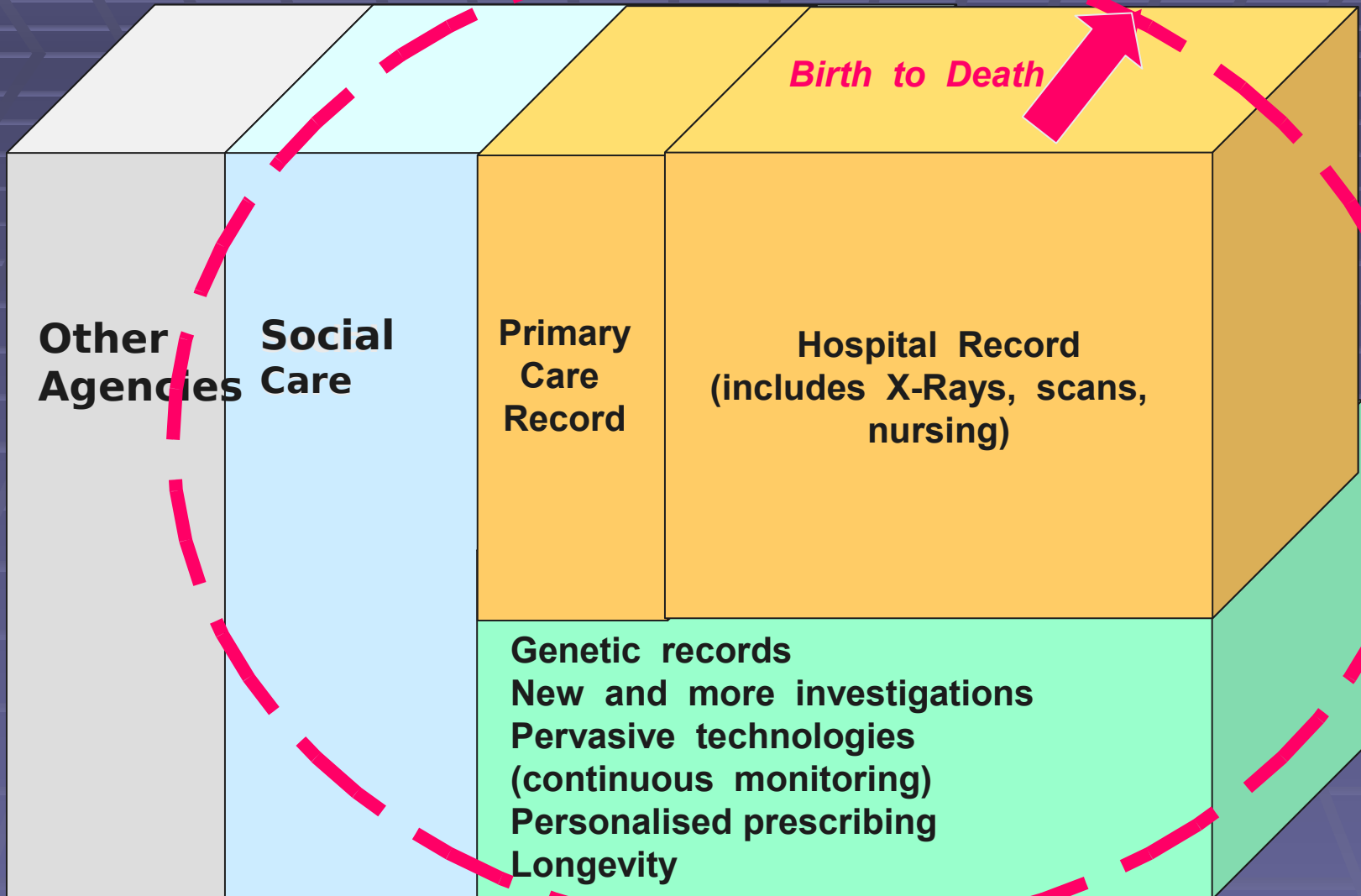
Boundaries are Inevitable



Boundaries are Inevitable



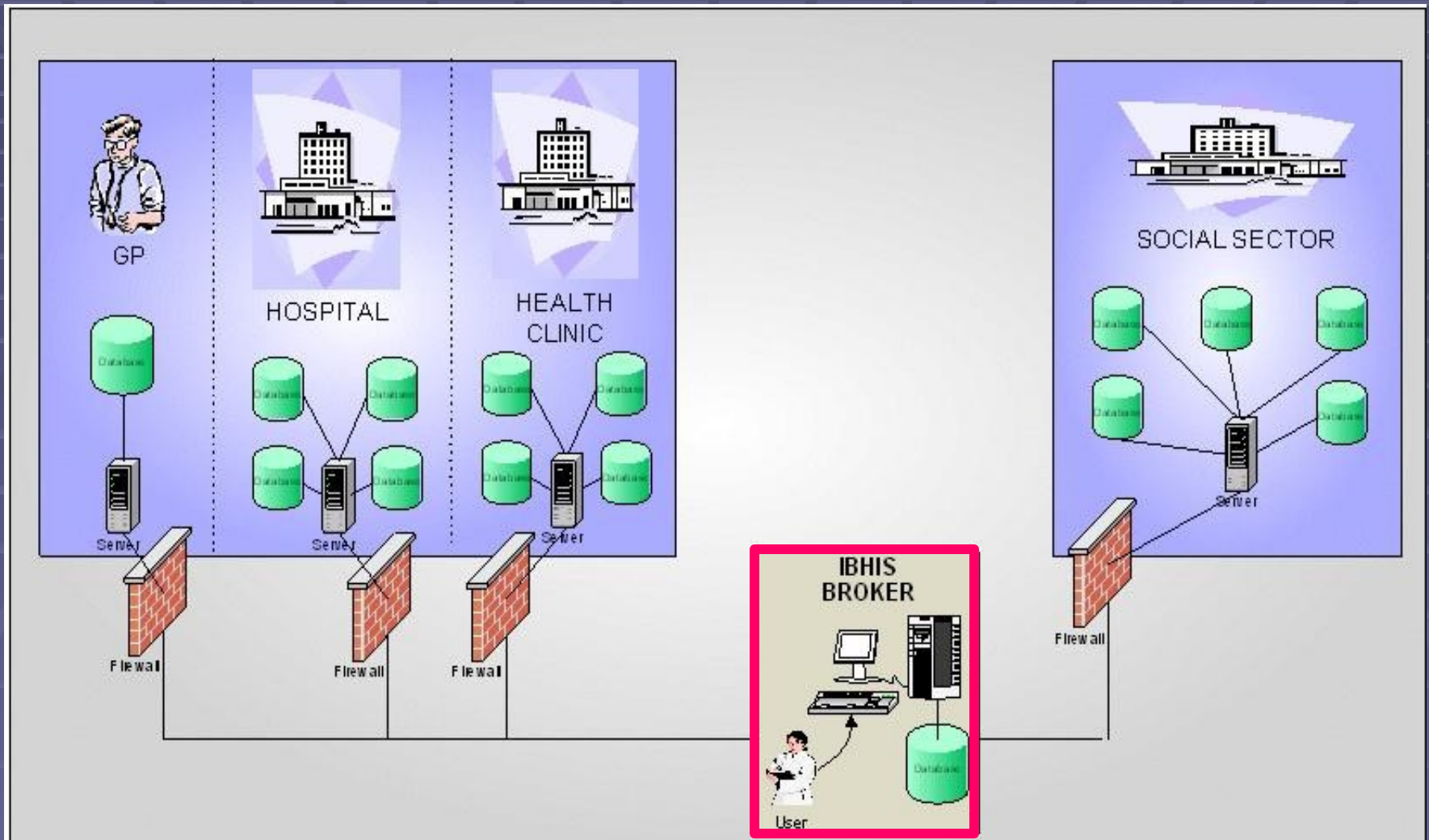
Boundaries are Inevitable



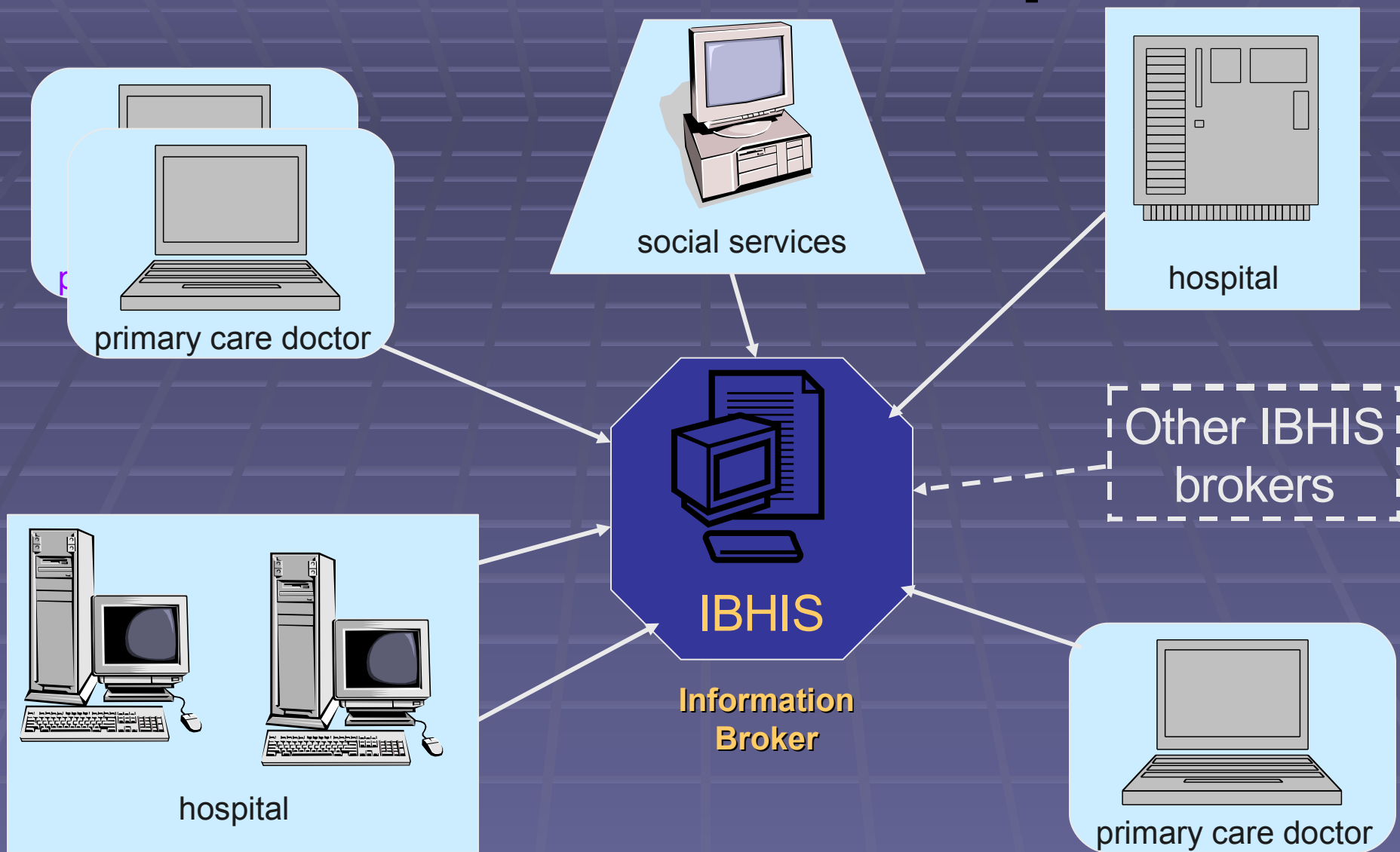
The IBHIS Vision

- 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



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
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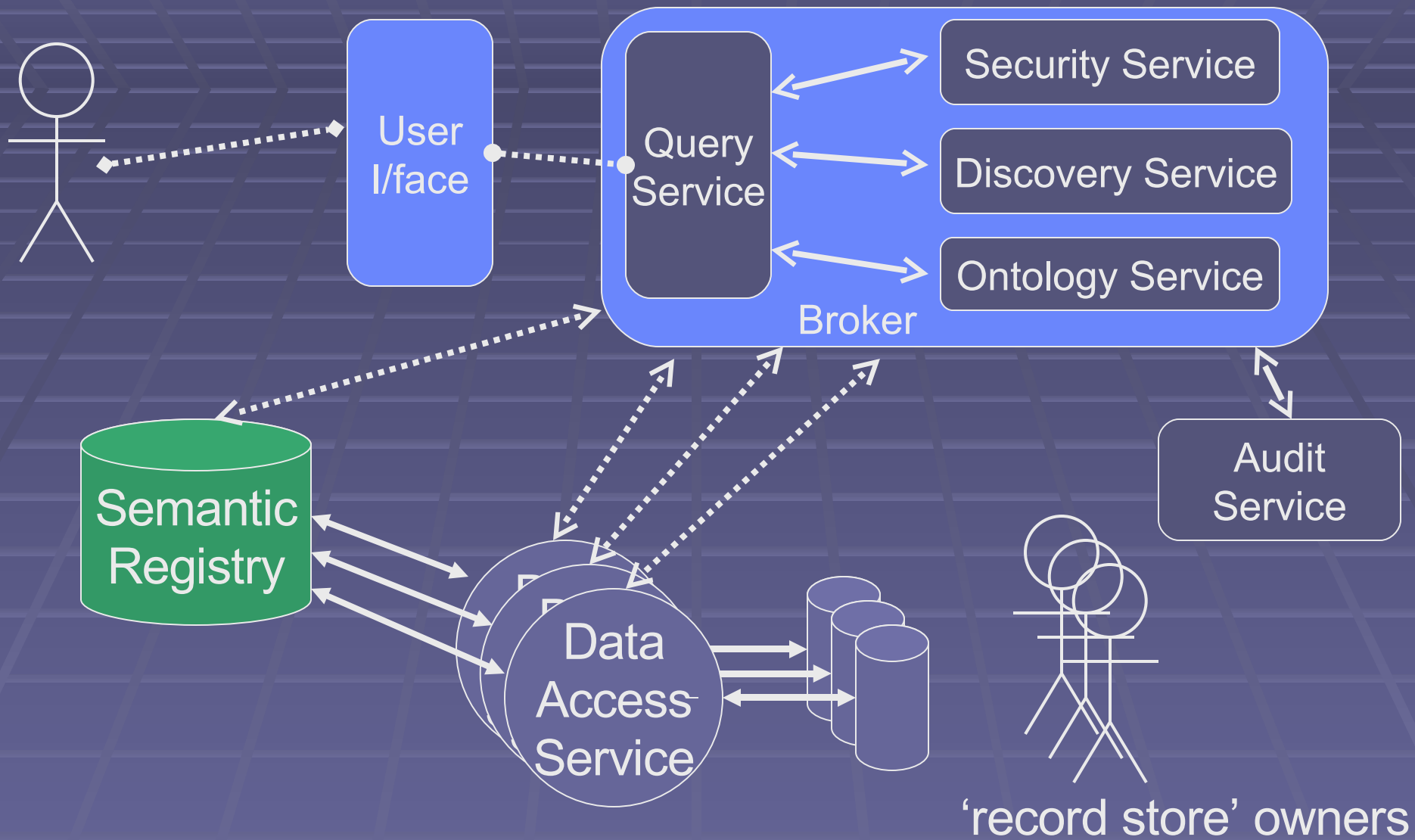
What issues does the IBHIS broker need to address?

- 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

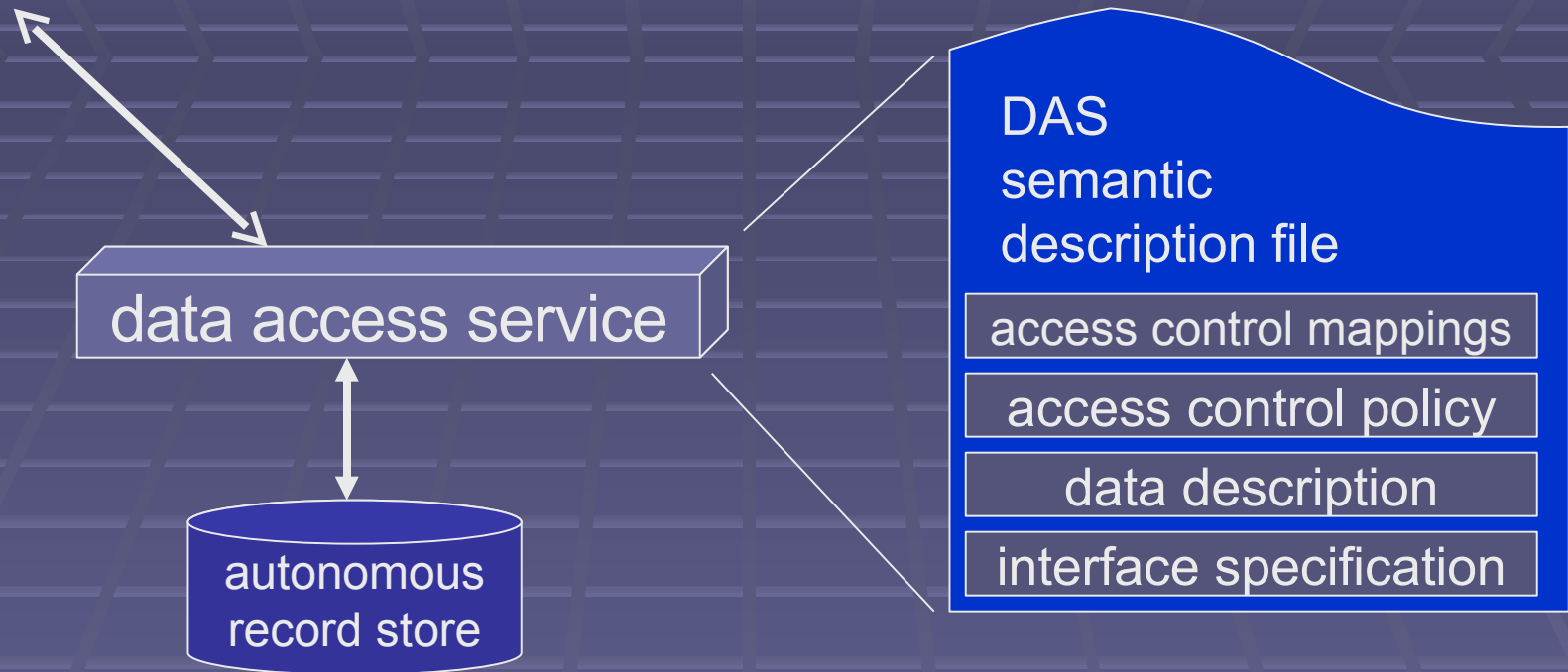
Service-based Architecture

- 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



Data Access Service



- 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

IBHIS Prototype v2 - Query Formulation - Mozilla Firefox

File Edit View Go Bookmarks Tools Help

http://160.5.92.19:9080/xacPolicyP2Client/sample/QueryServiceGuiProxy/Validator.jsp

Disable CSS Forms Images Information Miscellaneous Outline Resize Validation View Source Options

In this ontology, the chosen class (**Person**) has the following properties:

1. FinancialNotes
2. Date_Of_Birth
3. MaritalStatus
4. referrersRelationship
5. First_Name
6. Surname
7. Home_Telephone_No
8. ReasonForRequest
9. Occupation
10. CurrentHospital
11. ReferrerName
12. Address
13. RiskAssessment
14. ReferralSource

Your Current Query is:

Class Name:
Person

Please Select your Query Criteria:

Property Name: Please Enter Property Value:

FinancialNotes
Date_Of_Birth
MaritalStatus
referrersRelationship
First_Name

Please select which properties you want to search for:

FinancialNotes
Date_Of_Birth
MaritalStatus
referrersRelationship
First_Name


Done

IBHIS Prototype v2 - Query Results - Mozilla Firefox

File Edit View Go Bookmarks Tools Help


http://160.5.92.19:9080/xacPolicyP2Client/sample/QueryServiceGuiProxy/queryResults.jsp

Disable CSS Forms Images Information Miscellaneous Outline Resize Validation View Source Options

 **IBHIS - Healthcare Information Broker**

The results from the query :

Social Services (Keele)

clientNumber	dateOfBirth	maritalStatus	referrersRelationship	clientImage	familiarForename	telephoneNumber	propertyNo
7899561	1998-04-28	child	Consultant		Mandy	01782 345678	10
5687458	2002-07-12	child	GP		Stuart	01538 5478152	125
4572244	1998-12-12	child			Philip	01782 456871	158

Old Forrest Hospital (Manchester)

PID	NAME	TELNO	HOSPITAL	ADDRESS
7.864587852E9	Amanda	not known	Heartlands	10 Lanford Road

Done

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://>

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