



providing intuitive access to federated healthcare records -
securely

London Demonstrator Site

Marketing Situation & Exploitation Plans

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Deliverable Reference Information

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Introduction

The key ingredients of the SynEx-UCL software components are:

1. A comprehensive and federated electronic healthcare record that can be used to reference or to store all of the necessary healthcare information acquired from a diverse range of clinical databases and patient-held devices.
2. A directory service component to provide a core persons demographic database to search for and authenticate staff users of the system and to anchor patient identification and connection to their federated healthcare record.
3. A clinical record schema management tool (Object Dictionary Client) that enables clinicians or engineers to define and export the data sets mapping to individual feeder systems.
4. An expansible set of clinical management algorithms that provide prompts to the patient or clinician to assist in the management of patient care.

CHIME (UCL) has built up over a decade of experience within Europe on the requirements and information models that are needed to underpin comprehensive multi-professional electronic healthcare records. The resulting architecture models have influenced new European standards in this area, and UCL has designed and built prototype EHCR components based on these models.

The demonstrator systems described in the London SynEx Demonstrator Final Site Report and the UCL SynEx Component Manual utilise a directory service and object-oriented engineering approach, and support the secure, mobile and distributed access to federated healthcare records via web-based services.

UCL has been active throughout to project to promote the broad aims of SynEx and its EHCR components in particular, based on sound antecedents in a number of previous EU R&TD projects. These promotion activities, effectively a pre-marketing phase including presentations and papers, are summarised in this report.

UCL anticipates taking its SynEx component work forward in five broad areas.

- As an open standard
- As a platform for ongoing research
- As a platform for collaborative research inside UCL
- As a tool for education
- Through commercial adoption

Each of these aspects is discussed in the rest of this report.

Promotion and Dissemination

UCL has developed a set of promotion materials, reflecting the project aims and workplan as a whole, the specific components developed by UCL, and the deployment scenario at the London Demonstrator Site. These include:

- several MS PowerPoint slide presentations
- A1 and A2 sized posters
- a local SynEx web site, with information about SynEx Consortium presence at national and international conferences, and links to the Co-ordinator's SynEx site
- flyers and leaflets
- a component brochure
- a component manual (presently for restricted circulation)
- software demonstrations with illustrative clinical scenarios

Several pages from the UCL Component Brochure are reproduced in Annexe A of this report.

SynEx Presentations made by the UCL team

| <u>Date</u> | <u>Subject</u> | <u>Location</u> | <u>Comments</u> |
|--------------|--|--|--|
| 12-Sep-98 | The SynEx Project | Downing College, Cambridge | Primary Health Care Specialist Group of the British Computer Society AGM |
| 7-Oct-98 | Relating Clinical Headings to an EHCR Architecture | International Conference Centre, Rotterdam | ToMeLo Project Workshop (EU Health Telematics Programme) |
| 8-Oct-98 | Synapses In Use | International Conference Centre, Rotterdam | IMIA International Working Conference on Electronic Patient Records in Medical Practice |
| 23-Oct-98 | The Electronic Health Record of the Future | Whittington Hospital | GP Presentation |
| 15-Oct-98 | EHCR Architectures | Cumberland Hotel, London | Workshop Presentation at Towards an Electronic Health Record Europe '98 |
| 24-Mar-99 | The SynEx Project | Healthcare Computing 99, Harrogate | Main auditorium presentation |
| 26-Mar-99 | Synapses In Use | City University | Hospital Without Walls Conference '99 |
| 1-May-99 | Marriage of an image information system and an electronic patient record | Berlin | Conference hosted by GE Medical Systems |
| 30-Jun-99 | SynEx demonstration | Whittington Hospital | Co-ordination of a team software demonstration to a wide national and international audience |
| 10-11-Sep-99 | The London SynEx Demonstrator | Downing College, Cambridge | Primary Health Care Specialist Group of the British Computer Society AGM |
| 12-Nov-99 | Implementing EHCR Architectures | Cumberland Hotel, London | Workshop Presentation at Towards an Electronic Health Record Europe '99 |
| 15-Mar-2000 | A seamless anticoagulant service | London | Presentation to the UK Expert Panel for Anticoagulation |
| 30-Aug-2000 | Image information systems and distributed EHCRs delivering seamless patient care | Amsterdam | Co-chair of meeting of European Cardiology Congress |

SynEx Publications including UCL authors

Dr. D. Kalra, Mr. A. Austin, Dr J. Milan, Prof. D. Ingram, Dr D. Patterson, Prof. J. Fox, Mr F. Ferrara, Mr P Sottile, Dr W. Grimson et al. The SynEx Project. Proceedings of the Annual Conference of the Primary Health Care Specialist Group of the British Computer Society. 1998; 49-57.

Dr. D. Kalra, Dr J. Milan, Mr. A. Austin, Prof. D. Ingram, Mr. D. Lloyd, Dr D. Patterson, Prof. J. Grimson, Dr W. Grimson. Synapses in Use: Supporting Cardiac Care at the Whittington Hospital. *Conference Proceedings - Towards an Electronic Health Record Europe '98*. Medical Records Institute for the Centre for Advancement of Electronic Records Ltd.1998; 306-312.

Dr. D. Kalra, Mr. A. Austin, Prof. D. Ingram, Dr D. Patterson, Mr F. Ferrara, Mr P Sottile, Dr W. Grimson, Mr D Solomon. The SynEx Project. *Conference Proceedings - Towards an Electronic Health Record Europe '98*. Medical Records Institute for the Centre for Advancement of Electronic Records Ltd.1998; 290-297.

Dr. D. Kalra, Dr J. Milan, Mr. A. Austin, Prof. D. Ingram, Mr. D. Lloyd, Dr D. Patterson, Prof. J. Grimson, Dr W. Grimson. The Synapses Federated Healthcare Record Server. *Conference Proceedings - Hospitals Without Walls '99*. City University. 1998.

Dr. D. Kalra, Mr. A. Austin, Prof. D. Ingram, Dr D. Patterson, Mr F. Ferrara, Mr P Sottile, Dr W. Grimson, Mr D Solomon. The SynEx Project. *Conference proceedings - Current Perspectives in Healthcare Computing '99*. BJHC Books. 1999: Part 1; 60-70

Dr. D. Kalra, Mr. A. Austin, Mr A. O'Connor, Prof. D. Ingram, Dr D. Patterson. The London SynEx Demonstrator - federated records in action. Proceedings of the Annual Conference of the Primary Health Care Specialist Group of the British Computer Society. 1999. [Poster Abstract]

Mr P Sottile, Mr F. Ferrara, Dr W. Grimson, Dr. D. Kalra, Prof. JR Scherrer. The Holistic Healthcare Information System - A Middleware-based Solution for Supporting Operational, Managerial and Healthcare Record Needs. *Conference Proceedings - Towards an Electronic Health Record Europe '99*. Medical Records Institute for the Centre for Advancement of Electronic Records Ltd.1998; 259-266.

Dissemination

UCL members have had formal meetings with senior figures within:

- UK NHS Information Authority
- UK NHS Policy Unit
- UK Medical Royal Colleges

to present SynEx and the London Demonstrator Site.

A high profile has been given to this project within the Health Authority and NHS Trust Hospitals in north London. This has now resulted in UCL materials (including an outline of Synapses, GALEN and SynEx) being included within the Local Implementation Strategy of Camden & Islington Health Authority. North London has successfully bid to develop a cancer-focused EHCR, with UCL included as advisors on the design strategy.

Towards Standardisation

The market success of SynEx components will depend on conformance to relevant standards, to meet the procurement regulations of Europe's member states and to enable interoperability with other non-SynEx computing components. Standards often reflect a quality benchmark, and conformance to these can also provide a kind of QA evaluation of the SynEx products.

UCL has sought to share openly the information models (architecture) and service interfaces of its components with other R&D groups and standards bodies internationally. The UCL components build on the antecedent published work of GEHR, EHCR SupA and Synapses and CEN ENV 12265 (Electronic Healthcare Record Architecture). The implementation experience gained during SynEx has been offered as feedback to the groups taking forward those activities.

The UCL team has provided input to CEN/TC 251 Project Teams 26, 27 and 29, based on longstanding experience of EHCR and FHCR architectures and their implementation. This input has included core team membership of PT 27 and membership of WG1 itself, and has led to a SynEx compatible approach reflected within CEN ENV 13606.

Other input at a national level includes SynEx-related contributions to two UK Standards Mirror Panels.

UCL is in the process of establishing an international foundation (OpenEHR), co-ordinated by UCL and with specific collaborating centres in Australasia and the US. This will operate as a non-profit body to foster high quality electronic healthcare records amongst the purchaser, vendor and user communities. The plans for OpenEHR are presently being discussed within UCL and will be taken forward later this year.

Exploitation for Research & Education

As a platform for ongoing research

Several healthcare enterprises and communities in the UK, including north London and specifically the Whittington Hospital, have expressed interest in extending the original demonstrators to cover new clinical domains and sites. Modest funding has been identified by these sites to enable the extended design work to be undertaken at CHIME and for our research team to partner other local software engineers to manage each deployment and its ongoing support. These extended clinical demonstrators will provide valuable opportunities for further evaluation of the core record server and will provide the funds needed to refine the software toolkits to facilitate wider application. Many of these demonstrators build on growing collaborations within the UCL Medical School, and will provide a basis for future joint research proposals and postgraduate teaching opportunities.

As a platform for collaborative research inside UCL

CHIME is already involved in a collaborative project with the Department of Primary Care and Population Sciences within the Medical School in the area of bio-informatics (clinical genetics). The APoGI project, funded by the Wellcome Trust, has developed a web-based information and education resource for patients and clinicians about Thalassaemia. The departments plan to develop and evaluate a dynamic interconnection between electronic healthcare records of patients and families with inherited disorders and an array of clinical genetics databases, to inform clinical management and to issue healthcare alerts. Various funding sources are being considered for this work, including EU IST funding within Framework V with other established European groups in this field.

An EU Framework V proposal, which has already had a favourable review in Brussels, involves a partnership with UCL Department of Computer Science in the field of mobile computing in medicine. The CHIME EHCR Server is well placed to deliver a demonstrator site for this project showing access to clinical information via hand-held devices.

Other collaborative opportunities arise from the UCL Complex Bioinformatics Centre and the UCL Medical Physics IRC in medical data analysis.

Educational exploitation

CHIME is now running its second year of a new MSc programme in Health Informatics. This course places a strong emphasis on clinical information and systems, including a module on Electronic Healthcare Records. The work of the research group over ten years, coupled with an awareness of parallel work internationally, provides the basis for this taught module and for the development of teaching materials used within it. A number of companies are now linked to this graduate programme through an EPSRC Masters Training Package bid and the UK Institute of Health Informatics.

Commercial Exploitation

CHIME is well connected to a set of industrial companies, with a view to:

- a) contributing technology products to the London SynEx demonstrator site
- b) potential utilisation of SynEx products once these are available

Whilst a number of the CHIME industrial links are long standing, the contribution of SynEx to these relationships is still being explored. Further work on the SynEx component map and on their specification will help to refine the exploitation pathway. Specific exploitation-oriented contacts have included:

- a GP-Hospital communications supplier
- an International multi-media equipment provider
- a US/European HIS supplier

The UCL SynEx components have been selected by South West Devon for the development of a cardiovascular EHCR connecting local hospitals and GPs. This work, to commence in autumn 2000, will aim to replicate and extend the Whittington implementation of the record server to suit the requirements of a regional network of collaborating hospitals and general practices.

UCL and the London Demonstrator site is part of a consortium that has successfully won funds in the Fifth Framework to deliver federated healthcare records through mobile communications.

Extending the London Demonstrator Site

The core technologies installed and demonstrated at the Whittington Hospital place UCL in a good position now to extend the initial scope of the demonstrator. This is vital to provide sufficient profile for the work accomplished to generate industrial confidence in this overall approach to delivering comprehensive and shareable electronic healthcare records.

Three commercial companies with an interest in the development of distributed web based record services, including General Electric, have now committed funds to strengthen the London Demonstrator Site. National Health Service core funding for the demonstrator is also being explored, and some revenue has already been committed by the Whittington Hospital itself and by Camden & Islington Health Authority through its Local Implementation Strategy. Additional resources will come from the European Commission through its Fifth Framework IST Programme.

These sponsoring parties will help establish the site as a showcase for distributed federated records and cardiovascular expert decision support services. The resulting (expanded) demonstration site will provide the opportunity to display the functionality and end-user acceptance of a number of SynEx components, those developed by UCL and others to be included under licence from across the consortium.

These will together provide the opportunity to continue to build the demonstrator site post-SynEx, and provide an extended marketing opportunity for the SynEx components deployed in it.

The specific strands of further development planned for the medium term are:

- to provide distributed access to anticoagulant records and decision support services to GPs and community pharmacists (expected to commence in October 2000);
- the extension of the cardiology clinical scenario to include angina and myocardial infarction for which both clinical guidelines and established data sets are at an advanced stage;
- collaborative work with General Electric/Marquette to incorporate multi-media investigation reports (in particular, bio-signals) within the federated record;
- component integration work with other consortium members, under SynEx Consortium licences being drafted at present;
- the extension of distributed access to include mobile users, through a new approved Fifth Framework project expected to start in January 2001.

Prospects for future commercial adoption

The EHCR server and tools have been demonstrated within research consortia that include a range of commercial partners. The team have also demonstrated the prototypes to other software vendors involved in local healthcare sites. Although a number of these, including HBOC, General Electric, MediDesk (UK), have expressed an informal interest in exploring how the prototypes might be used in future demonstration settings, they have indicated that the costs of assimilating a new technology such as ours cannot easily be reconciled within a business case appropriate for their sector of the healthcare systems market.

There is both a product gap and a skills gap within vendor organisations and a lack of awareness amongst purchasers that together have slowed the progress towards a wider-scale adoption of EHCR systems in everyday healthcare, notwithstanding the international priority given to this goal. These problems are likely to diminish as the health service market for electronic healthcare record solutions increases, as envisaged for example by the UK NHS White Paper Information for Health". Healthcare expenditure on information technology products is expected to double over the next five years, with a significant proportion of this investment anticipated in clinical end-user focused systems.

We believe that we now have, within CHIME, the combination of research expertise, graduate programme, engineering skills and demonstrator test-beds and prototypes to offer value to one or more industrial partners in this field. Other colleagues in CHIME have complementary experience in the design of decision support software and in medical knowledge databases.

Annexe A:

UCL SynEx Component Brochure

The following pages are taken from the Component Brochure produced part way through the project to provide an overall awareness across the consortium of the work being undertaken by UCL and its subcontractor. The brochures were widely distributed at national and international fora to promote the SynEx project as a whole. Other SynEx partners were invited to contribute additional material on their own components, but an alternative folder has now been designed as a generic carrier of such detail.

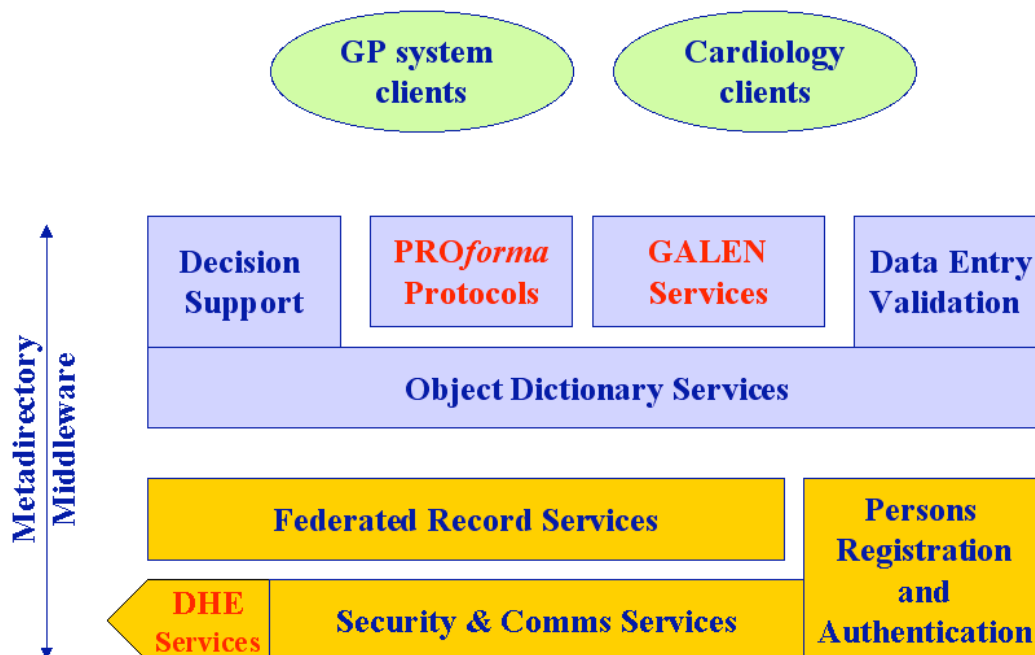
UCL will continue to disseminate the brochure as a whole, and in part as single-sheet enclosures within the new SynEx folder.

The University College London SynEx Component Set

*integrated within a platform-independent and standards-based
distributed middleware environment
providing*

- *a comprehensive, multi-media, multi-professional electronic healthcare record system*
- *the secure and seamless federation of disparate record systems within and between sites*
- *clinically-oriented tools to facilitate the creation, navigation and analysis of patient records*
- *integrated terminology, protocol and decision support services*
- *links to a range of clinical knowledge and educational databases*

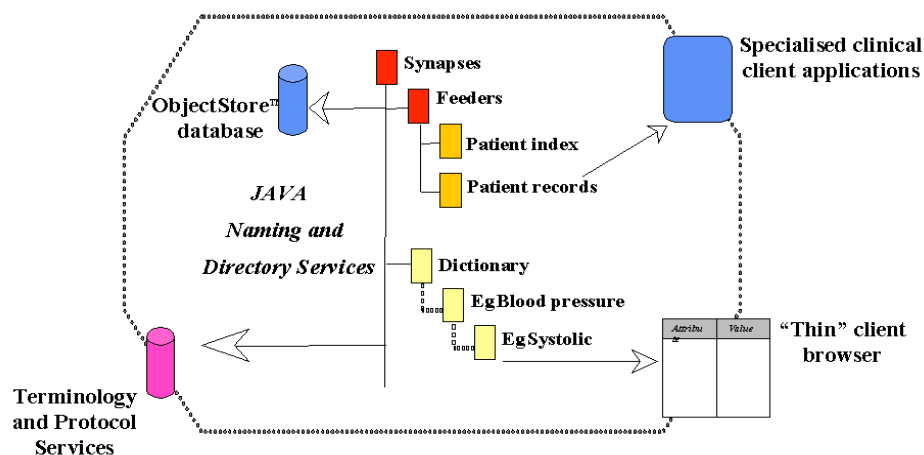
The main components are written in Java™ and deployed within a middleware environment managed through directory services. This will allow the development of flexible and portable applications that can inter-operate across diverse architectures and infrastructures.



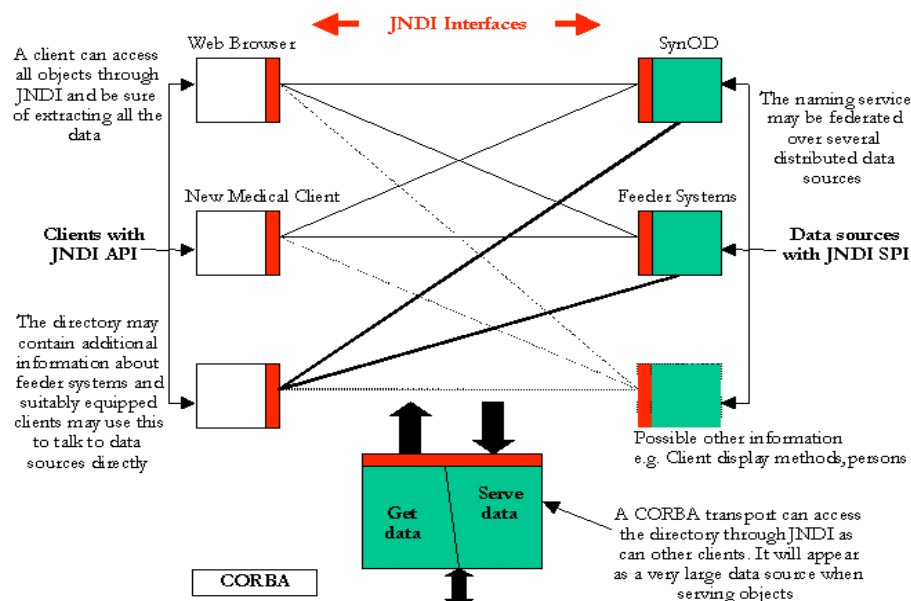
These components have been developed by UCL or other SynEx Consortium members, and demonstrated in north London through the provision of seamless cardiology shared care, initially for patients requiring anticoagulant therapy.

Directory Service Middleware Computing Environment

- The heart of the London SynEx demonstrator is a set of directory services accessed through the Java Naming and Directory Interface (JNDI), utilising Novell NDS.
- This provides run-time access to:
 - ♦ the Synapses Object Dictionary
 - ♦ a set of legacy data feeder systems
 - ♦ an EHCR Object Repository
 - ♦ a dictionary of persons and devices
 - ♦ a dictionary of access permissions
 - ♦ access to other data services (e.g. terminology, protocols)



Many object sources can be attached to a hierarchy within the SynEx federation, and can return objects and attributes from a lookup. Any authorised client that can see the directory automatically has access to the whole SynEx Object Dictionary and patient record databases. The demonstrator site will utilise the JNDI service SPI and probably Enterprise Java Beans as the methodology for supporting the uniform distributed access to all SynEx data component services.



Federated Record Service Component Set

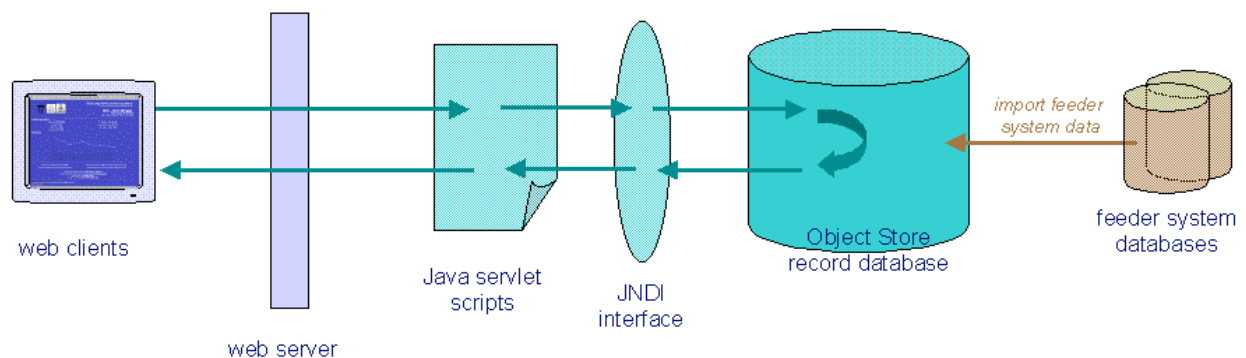
faithfully combining records from diverse feeder systems

building on the work of Synapses and CEN/TC251

A comprehensive electronic healthcare record repository utilising a directory service and object-oriented engineering approach

- to store any healthcare record information acquired from a diverse range of clinical databases and patient-held devices
- to support the secure, mobile and distributed access to federated healthcare records via web-based services

request and retrieve record components



Technical Features:

- » A comprehensive and medico-legally rigorous reference model for the federation, based on research within Synapses, GEHR, EHCR-SupA and CEN/TC251, implemented using Java classes and XML DTDs.
- » A pure object oriented EHCR database (Object Store, from Object Design Inc.) to store record components in a form native to the federation architecture, offering superior performance for storage, selection and retrieval.
- » Tools to facilitate the decommissioning of feeder systems and/or the presentation of their data as XML objects.
- » Web Servlet extraction methods, generating generic record clients to provide a base-level approach to the presentation of FHCR data.
- » Generic data entry clients to provide basic templates to allow users to create new record instances.

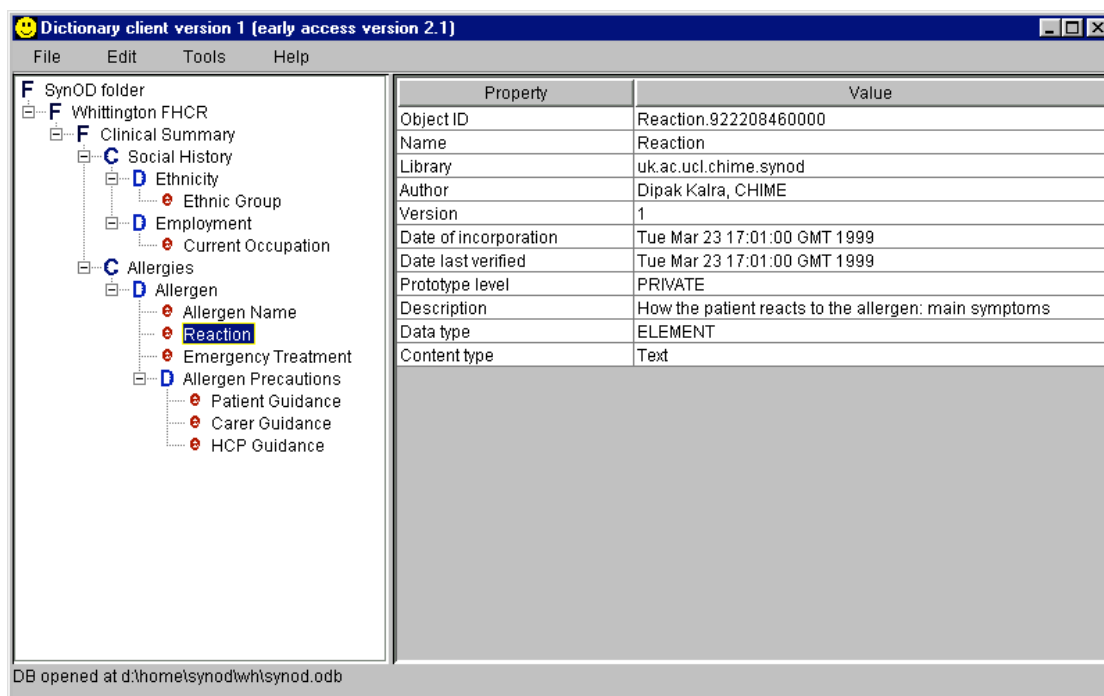
Object Dictionary Service Component Set

*managing and mapping the domain-specific user objects
required to deliver clinical care*

The Object Dictionary identifies the object sets to be retrieved from federated feeder systems in response to a client request, and incorporates references or access methods to the underlying FHCR feeder system data.

➤ Authoring Component

- allows end-users to author clinician defined “user objects”
- enables mapping to the underlying feeder system schemata
- written using Java, with Swing/JFC as the visual sub-component
- a hierarchical (tree) display supported by search and management functions
- object definitions stored in PSE Pro object database (Object Design Inc.)
- XML generator and parser facilities
- replication function allows for the synchronisation of object dictionaries within a distributed environment

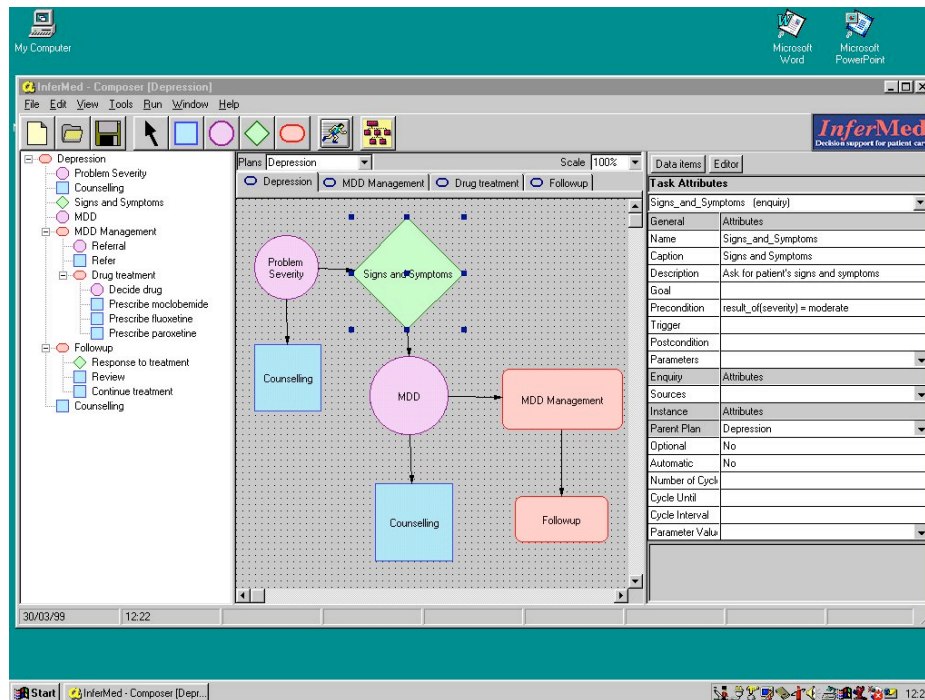


➤ Future versions will incorporate:

- synonyms, customised for users' preferred terms and preferred language
- clinical concepts, knowledge tags, links to GALEN services
- qualifiers, CEN/TC251 standard component name categories and annotations
- data entry validation criteria and links to PROforma protocols
- terminology system browsers
- links to a public domain (XML) library of standard objects

Protocol Components

PROforma is a set of guideline authoring and run-time software products developed at the Imperial Cancer Research Fund and marketed (as Arezzo™) by Infermed. The authoring tool allows users to create a wide range of nested clinical management guidelines, which are represented in a candidate pre-standard interchange format.



The run-time components are presently being re-authored in Java, to be delivered using web-based services. These products will be deployed the north London, inter-operating seamlessly with the record and object dictionary services.

For further information PROforma about please contact Prof. Jon Fox: jf@acl.icnet.uk

The North London Demonstrator

seamless cardiology services

The SynEx London demonstrator comprises a set of primary and secondary care sites in north London working in partnership with University College London.

- The Department of Cardiovascular Medicine at the Whittington hospital, integrating:
 - ♦ anticoagulant clinical management system
 - ♦ cardiology investigation and monitoring devices (Marquette/General Electric)
 - ♦ atrial fibrillation specialist systems
 - ♦ coronary artery database and display application
- A consultant-led community cardiology service offering integrated ambulatory patient care, requiring:
 - ♦ a comprehensive EHCR system
 - ♦ links to electronic guidelines and educational libraries
- 2-4 community-based consultant cardiology clinics
 - ♦ communicating within the federation through secure telecommunications links
- Several GP practices in north London
 - ♦ integrating data from GP-CARE (UK NHS accredited GP computer system)

Decision Support Components

- based on a clinically validated algorithm for warfarin dosage control
- engineered as a specific service using Java agent
- called from a dedicated client and returning data to this client

Whittington Hospital Cardiology Department Anti-Coagulant Client - Netscape

File Edit View Go Communicator Help

Back Forward Reload Home Search Netscape Print Security Stop

| | | |
|----------|--------------------------|------------------|
| INR Test | Treatment Control Status | High Risk Status |
| 3.0 | Maintenance | yes |

Present Health

| | | | |
|---------|-----------|-------------|-----------|
| DS Dose | Accepted? | DS Interval | Accepted? |
| 5.5 | yes | 28.0 (Days) | yes |

| | | | |
|---------------|-------------------|------------------|---------------------------|
| Override Dose | Override Interval | Next Appointment | Days of Anticoag. Control |
| ~ | ~ | 14 October 1998 | ~ |

Decision Support & Treatment

| | |
|----------------------------|---|
| Authors Comment (private): | ~ |
| Patient Instructions: | ~ |

[Illness Event Details](#) [Referral Letters](#)

[Previous](#) [Next](#)

[1](#) [2](#) [3](#) [4](#) [5](#) [6](#)

Recent Past Readings

| Date | INR Test | DS Dose | Accepted ? | DS Interval | Accepted ? | Override Dose | Override Interval |
|-------------------|----------|---------|------------|-------------|------------|---------------|-------------------|
| 02 September 1998 | 2.3 | 5.5 | yes | 14.0 (Days) | yes | ~ | ~ |
| 26 August 1998 | 2.1 | 6.0 | yes | 7.0 (Days) | yes | ~ | ~ |
| 19 August 1998 | 1.5 | 6.0 | yes | 7.0 (Days) | yes | ~ | ~ |
| 14 August 1998 | 1.0 | ~ | no | ~ | no | 5.0 | 1.0 (Days) |
| ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ |

Document: Done

about CHIME

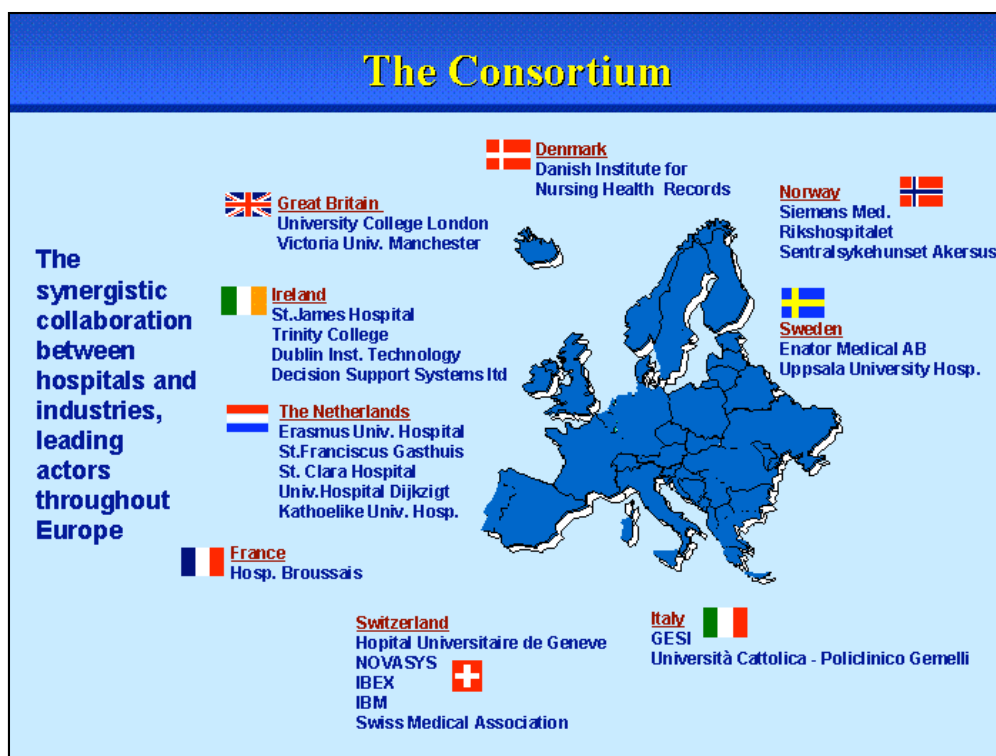
The Centre for Health Informatics & Multiprofessional Education (CHIME) was established in 1995 to develop and integrate initiatives in health informatics, education and health services research. CHIME is a collaborative venture between University College London, renowned for its work in biomedical research, and the Whittington NHS Trust, with a reputation for clinical practice and education. CHIME seeks to respond innovatively to local challenges and to changing healthcare needs.

Key activities undertaken by the informatics team at CHIME include the Good European Health Record, EHCR-SupA and Synapses projects within the EU Health Telematics Programme, and representation on CEN TC/251 in the domains of Electronic Healthcare Records and Medical Imaging.

the SynEx Consortium

co-ordinating partner: **GESI, Rome, Italy**

project main web site: <http://www.gesi.it>



for further information

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