



## **SemanticMining**

*NoE 507505*

### **Semantic Interoperability and Data Mining in Biomedicine**

## **Deliverable 16**

### **Workshop on the EHCR**

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Lead contractor:

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## Administrative information

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## Summary

This deliverable provides a summary report of a workshop on Electronic Health Records that was organised and delivered as the main focus of Workpackage 16 of the Semantic Mining project.

The workshop was held as day three of a three-day series of events held in Brussels in late November 2004, under the umbrella and with kind support of the EUROREC organisation.

This report provides a brief summary of that event, and includes in Annex 1 the complete delegate pack as printed and issued to all persons attending the event. This delegate pack included printed copies of all slides and screenshots used throughout the day.

The workshop was well attended, and in particular the organisers are pleased to report that some very productive discussions took place that will act as the stimulus for new threads of research collaboration between various Semantic Mining partners, under the work plan of Workpackage 26.

The organisers are grateful for the support of the EUROREC organisation in facilitating the organisation of this workshop and for lending their support to it through their web site and a personal endorsement of the event.

## 1 Overview

### 1.1 Objectives

<i>Objectives</i>	<i>Progress towards achieving objectives</i>
To enable the wide range of informatics partners within Semantic Mining consortium, and other leading informatics experts in Europe, to gain a rich understanding of EHR research background, interoperability standards, and contemporary work on semantic representation within the EHR	The partners believe this objective was largely met through the workshop

### 1.2 Milestones

<i>Milestone</i>	<i>Planned date</i>	<i>Actual date</i>	<i>Comments</i>
Preliminary arrangements for workshop	June 2004	August 2004	
EHR Workshop		27 November 2004	Successfully held in Brussels

### 1.3 Project meetings

<i>Milestone</i>	<i>Planned date</i>	<i>Actual date</i>	<i>Comments</i>
None – this event was organised through electronic collaboration			

### 1.4 Deviations from Plan

<i>Causes and Description</i>	<i>Corrective actions</i>
The workshop had to be rescheduled from October to November, in a different location, due to insufficient initial registrations for the October date	The workshop was linked with the main 2004 EUROREC conference and a satellite Ontology Workshop, to give delegates an opportunity to attend three continuous days of events.



## 2 Main Results

Although the field of health informatics may appear to be a very narrow one in comparison with other areas of research and development, it is internally compartmentalised into highly specialised niche areas with limited interfaces to each other. As a consequence, it is not uncommon to find threads of research that have progressed for many years in apparent ignorance of others, even though any higher-level review would indicate that a considerable opportunity exists for cross-fertilisation. One such pair of threads is the generic representation of electronic health record information and the representation of concepts and terms within the medical domain.

The Semantic Mining consortium is in the majority a collection of partners with a strong research background in the latter of these research threads, including the design and development of terminology systems, the analysis of language and texts, and methodologies to represent systems of concepts (ontologies). However, only a few of the partners have grounding in the representation of EHR information (and, of course, those such partners have limited expertise in concept representation).

In recognition of this awareness gap, and in recognition of the importance to future research of closing it, the original Semantic Mining work plan includes a specific workpackage to organise and run a workshop on electronic health records for the Semantic Mining consortium. In practice, it was agreed that the workshop should not have closed access: it was advertised on the public website hosted by the EUROREC organisation, and was therefore also attended by other health informatics experts. This wider attendance added to the overall richness of the event, particularly to the discussion sessions.

This report is deliberately sparing in describing the details of the workshop itself, as these facts are largely of circumstantial relevance after the event.

In summary, the workshop was held on 27<sup>th</sup> November 2004, the day after the EUROREC 2004 annual conference, in the same venue: Salle Magdalene, Brussels, a conference centre owned by the Belgian Ministry of Health. EUROREC kindly offered to badge the event as a satellite workshop of EUROREC, so that it gained publicity and endorsement including a web page linked from the EUROREC registration page. Registration for the EHR workshop was made simple (an e-mail request to the main organiser) and with no fees. The whole cost of the event has been borne by the lead partner of Workpackage 16 as part of the resources for that workpackage.

The Commission had organised a one-day satellite conference on ontologies the day before EUROREC 2004 (on 25<sup>th</sup> November). Many delegates were therefore able to attend three continuous days of health informatics events at the same location.

The EHR workshop was attended by around sixty delegates, fifty of whom had pre-registered and around ten had come having heard about the event during the EUROREC conference the day before. Just under half were Semantic Mining partners.

The main content of the day was divided into two main parts.

- 1) The morning was allocated to providing delegates with an understanding of the generic representation of EHR data: this included a summary of research work in the field, a detailed review of the forthcoming CEN standard for EHR communication (prEN13606), a comparison with HL7, and a summary of example implementation work on generic EHRs including the work of the *openEHR* Foundation.
- 2) The afternoon was used to present work on archetypes: the semantic constraint specifications used to combine and configure the generic EHR information model classes in order to construct EHR data structures for particular clinical domains. This work exists at the interface between the formalisms used for generic EHR representation, terminologies, and ontologies.

The full delegate pack, including copies of all slides and screen captures used throughout the day, is included in Annex 1 of this deliverable. The materials may also be accessed from: <http://www.openehr.org/education/SemanticMiningNov2004.htm>

The main goal of the workshop was to enable those delegates with a health informatics background in concept representation to understand the tremendous richness already embodied within information models representing the EHR, and to recognise the inevitable limitations of semantic coherence with such an approach. The EHR favours faithfulness over consistency, and therefore has to be complemented by mappings and transformations that enable a consistent interpretation of heterogeneously represented data. Such mappings are at an early stage of research. The discussion session, particularly the final hour of the afternoon, began to explore the relationships that are needed between archetype systems and ontologies.

From feedback received during and after the workshop it is clear that this event did indeed enrich the understanding of many delegates of the interface issues between EHRs and ontologies.

The Semantic Mining work plan includes a further EHR related workpackage: WP26, in which many of these ideas will be formalised as research threads over the coming year or two.

The Semantic Mining consortium has proposed a workshop for 2005 that will focus on one major interface between record architectures and terminology systems: the representation of compound clinical concepts.



## Annex 1

The information pack provided in printed form to delegates attending the EHR workshop is included below.

(Please note that some blank pages are included, to enable the pack to be printed double sided and paginate appropriately).

The materials may also be accessed from:

<http://www.openehr.org/education/SemanticMiningNov2004.htm>



## **EUROREC 2004 Satellite Workshop on Electronic Health Records**

**Saturday 27th November 2004**

*Held at the venue of the EUROREC 2004 conference:  
Magdalenazaal (Magdalena Room)  
Duquesnoystraat 14  
1000 Brussels, Belgium*

### Workshop Programme

9.15 - 9.45	Coffee and registration
9.45 - 10.00	Overview of the Semantic Mining project
10.00 - 10.30	Summary of EU research and development on the EHR Requirements for the representation and communication of EHR data Standards pertinent to the EHR
10.30 - 11.15	Review of the (draft) forthcoming CEN EHR Communications standard
11.15 - 11.30	<i>Short coffee break</i>
11.30 - 11.45	Comparison with the HL7 RIM and Clinical Document Architecture (CDA)
11.45 - 12.00	The <i>openEHR</i> Foundation
12.00 - 12.20	Short presentations of contemporary implementation experience
12.20 - 12.45	Reflections from the Ontology satellite conference held on 25/11/04
12.45 - 13.30	<i>Buffet lunch</i>
13.30 - 14.00	Introduction to archetypes, the benefit of the dual model approach Requirements and information models for representing archetypes
14.00 - 14.30	Authoring an archetype - demonstration of an archetype editor
14.30 - 15.00	Introduction to Archetype Definition Language (ADL)
15.00 - 15.15	<i>Short coffee break</i>
15.15 - 15.45	Archetypes and dictionary of concepts in the context of the EHR of the G. Pompidou University Hospital (HEGP)
15.45 - 16.15	Discussion: the interaction of EHRs with inference and ontology services
16.15 - 16.30	Summing up: challenges to achieving richly interoperability of EHRs candidate solutions and identified collaborations areas for further work, harmonisation and standards
16.30	Close





# WP16 Workshop on EHR

NoE No. 507505

Semantic Interoperability and Data Mining in  
Biomedicine [SemanticMining]

*Coordinator*

Hans Åhlfeldt - *Linköping University, Sweden*



## WP16 Workshop on EHR

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Semantic Interoperability and Data Mining in  
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WP16 Workshop on EHR, Brussels, November 27, 2004

SemanticMining No.507505



Integration

- ... to bridge gaps in the European research infrastructure and to facilitate cross-fertilisation between disciplines ...
  - Computer science (computer linguistics, natural language processing etc.) [6 partners]
  - Bio- and medical informatics [11 partners]
  - Health care organisations, standardisation bodies [6 partners]
  - SMEs [2 partners]

WP16 Workshop on EHR, Brussels, November 27, 2004

SemanticMining No.507505



Research Areas

- Principles in ontology engineering
  - examples: FMA, GO
- Evaluation of SNOMED CT
  - strategies and experiences from evaluation and translation
- Concept systems in laboratory medicine
  - communication between bioinformatics, laboratory medicine and the EHR
- Multi-lingual medical dictionaries
  - English, German, French, Portuguese, Spanish, Swedish ...
- Data/text mining in bioinformatics
  - NLP, IR applied in biomedicine (at EBI)
- The semantic-based electronic health record
  - contribution to standards, information models and concept systems
- What can ontologies do for health statistics?
  - information quality versus aggregation level
  - use of SNOMED CT as aggregation system

WP16 Workshop on EHR, Brussels, November 27, 2004

SemanticMining No.507505



Summer School 2004

- One week in July at the lake Balaton, Hungary
- Over 80 participants from 18 partners + 10 non-NoE PhD-students
- Tutorials and workshops
  - Ontology engineering (organised by IFOMIS)
  - The Semantic Web (organised by LiU)
  - Health statistics (organised by LiU)
- Assembly meeting
- Social events

WP16 Workshop on EHR, Brussels, November 27, 2004

SemanticMining No.507505



Some highlights ...

- Foundations of Ontology by Barry Smith
- Practical Ontology Building in OWL by Alan Rector
- Anatomy matters – the Foundational Model of Anatomy by Cornelius Rosse
- How ICD10, SNOMED-CT and GO can benefit from the FMA by Anand Kumar
- Classifying Medical Ontologies by Stefano Borgo
- Introduction to the Semantic Web by Magnus Bång
- Panel on Health Care Statistics by Håkan Petersson
- ... ..

WP16 Workshop on EHR, Brussels, November 27, 2004

SemanticMining No.507505



Theory and Practice

Core "concepts" discussed: **Concept** and **Ontology**

Different views: "a window on reality" or "a model"

What can ontologies do for:

- the electronic health record
- health statistics ~ reuse of clinical information

WP16 Workshop on EHR, Brussels, November 27, 2004

SemanticMining No.507505



- Summer School 30 June – 5 July, Balaton, Hungary
- Symposium on Text Mining and Information Retrieval in Bioinformatics - April 10-13, at the EBI, UK
- Ontology and Biomedical Informatics - IMIA WG6, Rome, 29 April – 2 May
- Human-factor problems in handling large-scale ontologies - AIME-meeting in Aberdeen, July 24-27
- The "boundary problem" between information models (HL7 RIM) and terminology systems (SNOMED CT) – Summer School
- and much more ...



- CEN / ISO
  - Gunnar Klein (TC 251 Chairman )
  - Anders Thurin (Vocabulary for Terminological Systems Project leader )
  - Magnus Fågelberg (European Terminology Group Convenor )
  - Dipak Kalra (TC 251)
- IUPAC
  - Urban Forsum (C-NPU, IFCC-IUPAC Chair)
- HL7
  - Dipak Kalra - Electronic Health Records
  - Jeremy Rogers, Alan Rector – terminfo.org
- W3C / Semantic Web / OWL
  - Robert Stevens, Jeremy Rogers
- SWISS-PROT, Gene Ontology de facto standards
  - EBI
- OMG Life Sciences Research Domain Task Force
  - EBI



[www.semanticmining.org](http://www.semanticmining.org)







# Dr Dipak Kalra



## CEN prEN 13606 *draft standard for* Electronic Health Record Communication

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Dr Dipak Kalra



**CEN prEN 13606**  
*draft standard for*  
**Electronic Health Record Communication**

Clinical Senior Lecturer  
Centre for Health Informatics and Multiprofessional Education (CHIME)  
University College London

d.kalra@chime.ucl.ac.uk

## Contents

- Purpose and scope of CEN 13606
- On what basis has the present draft been developed?
- How does this fit in with other standardisation activities?
- The five parts of 13606
- Overview of the main 13606 concepts
- Correspondence with HL7 and CDA
- Conclusion

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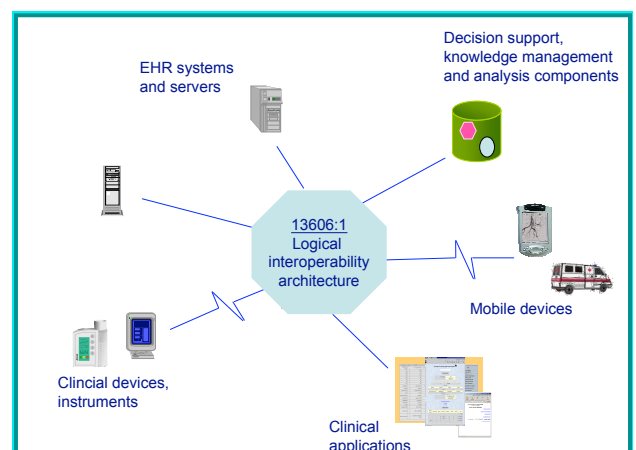
## Why standardise EHR communication?

- Patient care requires access to longitudinal health information
  - to manage complex health care safely
  - to share care between teams and enterprises
- Patients wish to play an active role in their health management
- Much of the necessary fine grained clinical information cannot yet be exchanged between heterogeneous systems
- Conventional data-sets and messages do not deal with the requirement to exchange parts or whole EHRs between systems

## Distributed access to EHRs is now part of many national strategies

### For example:

- England: National Programme for IT (NPfIT)
- Australia: HealthConnect
- Canada: Infoway
- USA: National Health Information Infrastructure (NHII)
- ... and probably 60+ other countries



## Scope of EN 13606

- To produce a rigorous and durable information architecture for communicating the EHR
- in order to support the interoperability of systems and components that need to interact with EHR services
  - as discrete systems or as middleware components
  - to access, transfer, add or modify health record entries
  - via messages or distributed objects (services)
  - preserving clinical meaning
  - protecting confidentiality

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## Content of EN 13606

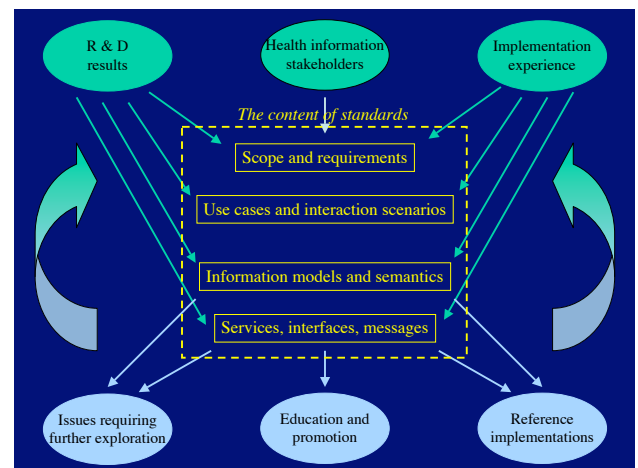
- A generic reference model of an EHR “extract”
- A mechanism for representing and communicating the clinical organisational structure of EHRs : archetypes
- A framework for communicating the EHR disclosure wishes of patients
- Interfaces between requesting and responding processes or systems to enable EHR communication

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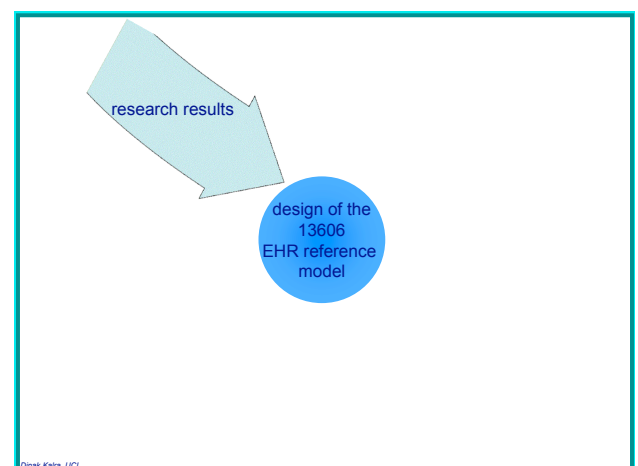
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## On what basis has the present draft been developed?

- Research results: 12 years
  - implementation experience including
    - vendor inputs
    - openEHR Foundation
- Requirements: ISO, European R&D, HL7
- Previous EHR standards: CEN 1995, 1999
- Vendor experience
- The RFC process of the previous draft: 2003

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## Example EHR research projects 1991-2004

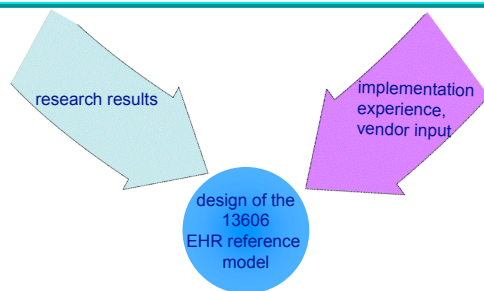
- GEHR requirements and architecture
- EHCR SupA recommendations to CEN
- Synapses and SynEx federated health record services
- HANSA and its ancestors (RICHE, Nucleus, EDITH)
- InterCare and PICNIC tele-health record systems
- I4C integrated cardiac records, based on ORCA
- Domain specific work: DIABCARD, TELENURSE, MEDICATE
- HARP security and record components
- PROREC - EHR requirements, vendor and user networks
- New research projects in bio-informatics and genomics
- Many other projects....

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## Research inputs related to the EHR 1991-2004

- clinical and ethical requirements
- comprehensive EHR architectures
- federated health record services
- middleware components relating to guidelines and terminology services
- distributed tele-monitoring, decision support, alerting systems
- interaction with security services
- widely distributed services, wireless, IPv6, the Grid
- clinical data repositories, public health and research
- bioinformatics, genomics and clinical trials

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## Examples of vendor experience/input

### Based on ENV13606 (1999-2003)

- DocuLive (Siemens, Norway)
- Integrated Care Systems France (France)
- Systematic (Denmark)
- Ethidium (US)

### Generic EHR systems

- Health.one (Belgium): most recently used as the EHR for the Special Olympics
- Microdata (Luxembourg)
- Distributed Systems Technology Centre (Australia)
- Ocean Informatics (Australia)
- Royal Marsden Hospital (UK)

### Academic implementations of ENV13606 with live clinical use

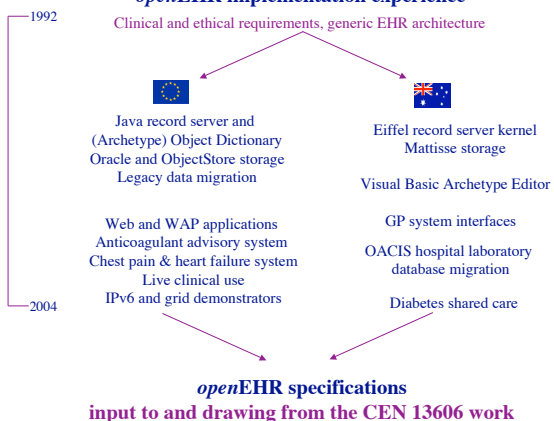
- University College London: Java record server: cardiology
- University of Athens: Janaemia system
- Trinity College Dublin: intensive care monitoring
- University Hospital of Geneva (DIOGENE: main record cache server)

### Plus many national projects

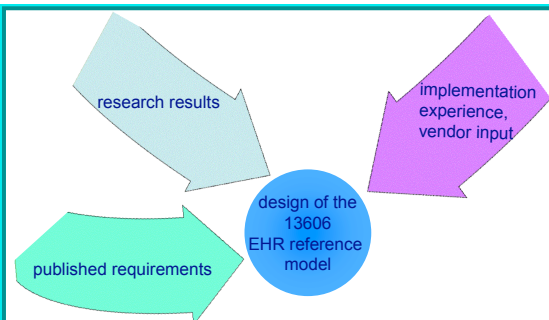
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## openEHR implementation experience

Clinical and ethical requirements, generic EHR architecture



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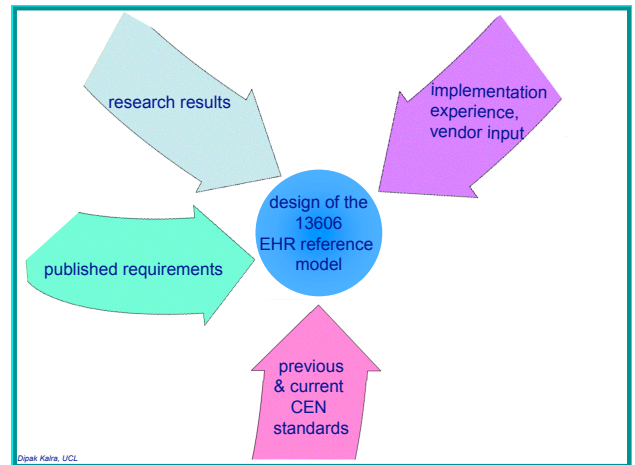


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## Requirements specifications

- ISO TS 18308 has been the main requirements basis of 13606
- Complementary requirements have been reviewed from published literature
- HL7 EHR Functional Specification
  - The Infrastructure Requirements are most pertinent to the core EHR Reference Model

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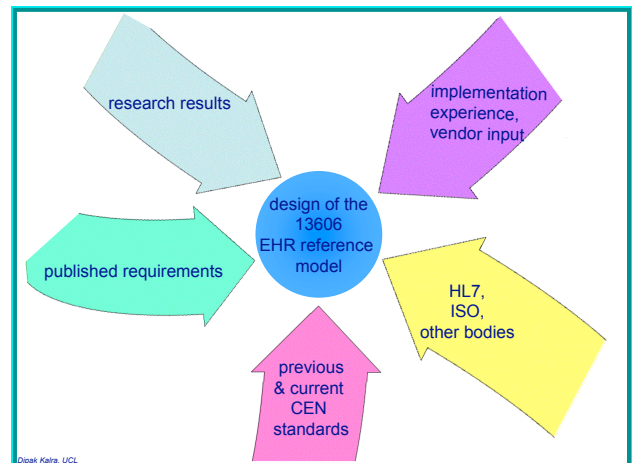


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## CEN standards inputs

- 2 generations of CEN EHR interoperability standard
  - ENV12265 (1995)
  - ENV13606 (1999)
- Other CEN standards
  - Healthcare Information Systems Architecture (HISA)
  - Systems of concepts for continuity of care (CONTSYS)
  - General Purpose Information Components (GPICs)
  - CEN data types

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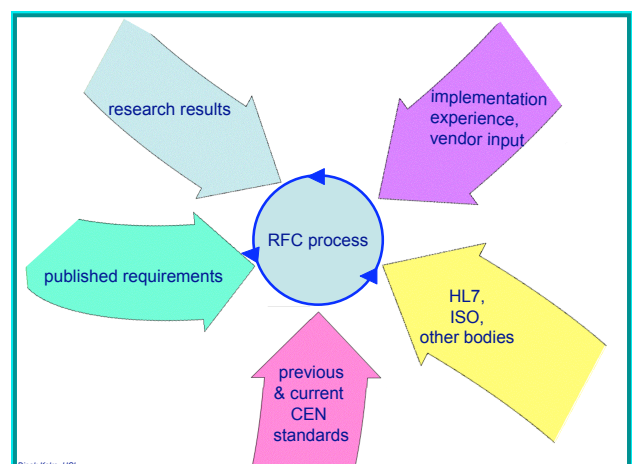


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## Wider standards inputs

- HL7
  - Clinical Document Architecture (Release 2)
  - Clinical Statement model (recent drafts)
  - Template requirements, representations, registry
- ASTM: CCR
- CORBAMED: COAS
- ISO
  - PMAC, 17799 revision

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## CEN 13606:1 First Working Draft

### *RFC process June - October 2003*

- Sent out for comment to all European national standards bodies
- Formal response also obtained from Standards Australia
- Informally shared with members of the HL7 Structured Documents TC
  - mainly oral comments received
- Has also been presented to and shared with ISO TC/215 WG1, at previous meetings

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## Types of RFC responses

DOC	Documentation improvement	70
EXP	Explanation	45
DEP	Dependent on other work concluding	43
CORR	Uncontested correction of the model	38
DISC	Needs further discussion	25
GA	General agreement with sentiment expressed	11
TYPO	Uncontested correction of the document	10
CR	Received as a Change Request	6
?	Please Clarify	4
NO	Disagree	4
NS	Not in scope	2
UML	Modelling convention	2
DUP	Duplicate comment	1
<b>TOTAL</b>		<b>261</b>

Reflected in the current draft

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## Collaboration with other standardisation efforts related to the EHR

### Main areas of complementary activity

- HL7
  - Clinical Document Architecture: detailed cross-mapping
  - Templates: working together on a joint CEN/HL7 archetype specification
  - Clinical Statement model: contributing to its design
  - A formal 13606-1 HL7 D-MIM has been produced
  - Ongoing harmonisation refinement: modelling, templates, vocabulary
- IHE
  - XDS specification: mapping to registry metadata

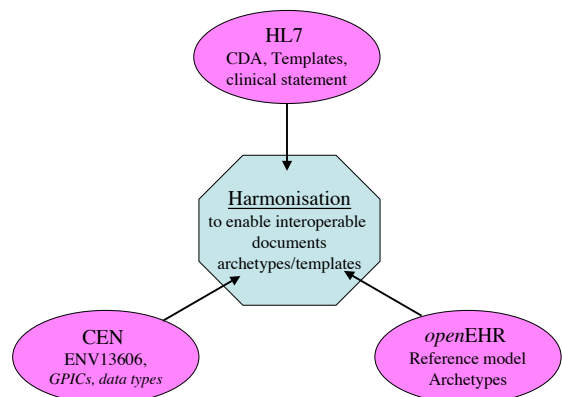
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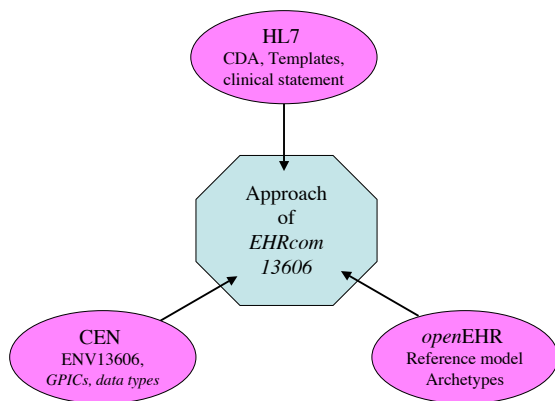
## Collaboration with other standardisation efforts related to the EHR

### Main areas of complementary activity

- ISO
  - ISO TS 18308 requirements adopted as the official requirements basis for the standard
  - 13606 has been related to concepts defined in ISO DTR 20514
  - Access control approach maps to PMAC draft standard
- Within CEN
  - cross working group activities on information models, concept representation (archetypes) and security

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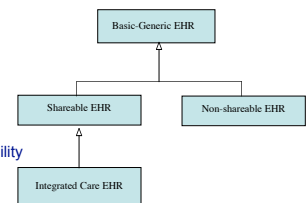
## Correspondence with ISO DTR 20514

CEN 13606:1 is  
4.1 a shareable EHR  
supporting functional interoperability  
and some degree of semantic interoperability

4.2 by defining  
a standardised EHR reference model  
a standardised service interface  
a formalism to communicate/share sets of domain-specific concept models  
(not standardising terminologies)

4.5 shareable level 3 = across all EHR nodes

5.2 a core EHR, not an extended EHR



Scope diagrams

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## Mapping to ISO TS 18308 defined within Annex E

prEN 13606-1:2004 (E)

### Annex E (Informative)

Mapping to statements of requirement, common to prEN 13606-1:2004 (E)

	Recording dates and times	
MEL1.1	The EHRA shall support measures to ensure an accurate reflection of the chronology of clinical events and information availability in the EHR. (6.3)	Composition.Audit.Info.time.committed, Composition.Audit.Info.contribution.id, Record.Component.Audit.Info.time.committed
MEL2.7	The EHRA shall support measures which ensure that every record entry is dated, and its author identified. (6.1.6)	Composition.Audit.Info.time.committed, Composition.Audit.Info.contribution.id, Record.Component.Audit.Info.time.committed
STR3.15	The EHRA shall support the recording of contextual data associated with the date/time the event was committed to the record	Composition.Audit.Info.time.committed, Record.Component.Audit.Info.time.committed
STR3.14	The EHRA shall support the recording of contextual data associated with the date/time the event occurred	Composition.Clinical.Session.session.time
	The Amendment of Health Record Entries	
PRO2.1	The EHRA shall support clear and consistent rules for entry, each version is a new Composition instance, with amendment, verification, transmittal, receipt, translation, and obsolescing/superseding of data. This requirement does not imply that it is necessary for a given implementation to allow deletion of EHR content. Local data retention rules will apply. (3.3.1)	Whole set of committed entries must be re-attested if parts of content are revised. Version attestations point to data within a single Composition version, and are not automatically redirected to a revised one
MEL7.1	The EHRA shall support versioning at the granularity at which information is attested (6.8)	

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## Parts of EN 13606

### Part 1: Reference Model

- comprehensive, generic EHR model drawing on 12 years of R&D and 2 previous CEN standards
- mapped to HL7 RIM and CDA

### Part 2: Archetype Interchange Specification

- adopting the openEHR archetype approach
- compatible with HL7 Template specification

### Part 3: Reference Archetypes and Term Lists

- initial archetypes for Europe, and repository specification
- micro-vocabularies for the Part 1 model

### Part 4: Security

- measures to support access control, consent and auditability of EHR communications

### Part 5: Exchange Models

- messages and service interfaces to enable EHR and archetype communication

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## EN 13606 Part 1

### Part 1: Reference Model

- A generic information model for communicating the electronic health record of any one patient, as a refinement of ENV13606 Part 1
- CEN ENQuery version approved in June 2004
- includes an HL7 D-MIM, closely mapped to CDA Release 2
- approach to mapping CONTSYS concepts now in progress
- approach to mapping HISA concepts also in progress

*Overview of 13606-1 model*

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## EN 13606 Part 2

### Part 2: Archetype Interchange Specification

- A generic information model and language for representing and communicating the definition of individual instances of Archetypes
  - Interoperability testing through HL7 suggests that archetypes might in future be specified using ADL or OWL, and maybe OCL
  - Therefore adopting a UML model as the main normative specification
  - Including the ADL specification as an annex
    - as it is the only complete specification at present
  - Harmonise with HL7 Templates group
  - First working draft planned for publication in Dec 2004

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## EN 13606 Part 3

### Part 3: Reference Archetypes and Term Lists

- A range of Archetypes reflecting a diversity of clinical requirements and settings
  - as a "starter set" for adopters
  - to illustrate how other clinical domains might similarly be represented (e.g. by health professional groups)
- plus relevant enumerated lists (normative or informative) in support of the other parts of this standard e.g. for certain attributes in Part 1
- This will draw on ENV13606 Part 2, HL7 vocabularies and other standards
- First working draft planned for publication in December 2004

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## EN 13606 Part 4

### Part 4: Security Features

- The information model concepts that need to be reflected within individual EHR communications to enable suitable interaction with the security components
- Much of the original ENV13606 Part 3 Distribution Rules scope now being taken forward in ISO
  - PMAC, 17799 revision
  - enumerated lists of Functional & Structural roles, clinical settings etc.
- Main provisions of this Part will be:
  - access policy model
  - EHR request and provision audit log model

*Overview of security approach*

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## EN 13606 Part 5

### Part 5: Exchange Models

- A set of message models and interfaces that build on the other parts and can form the basis of message-based or service based communication
  - fulfilling the same role as ENV13606 Part 4
- Work started in summer 2004

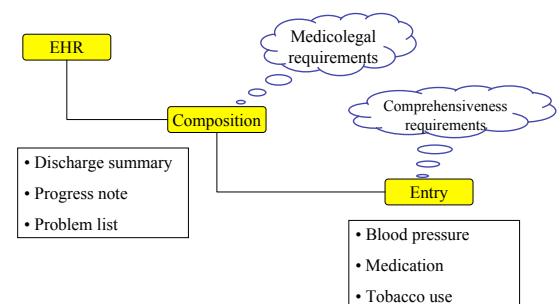
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## Contents

- Purpose and scope of CEN 13606
- On what basis has the present draft been developed?
- How does this fit in with other standardisation activities?
- The five parts of 13606
- **Overview of the main 13606 concepts**
- Correspondence with HL7 and CDA
- Conclusion

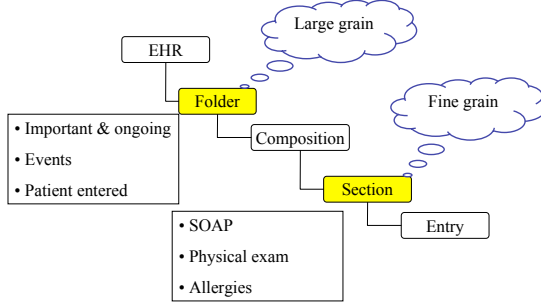
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## Content

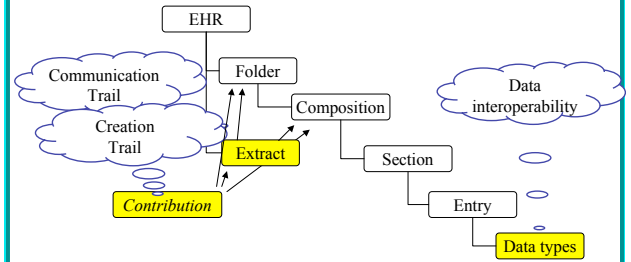


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## Organisation



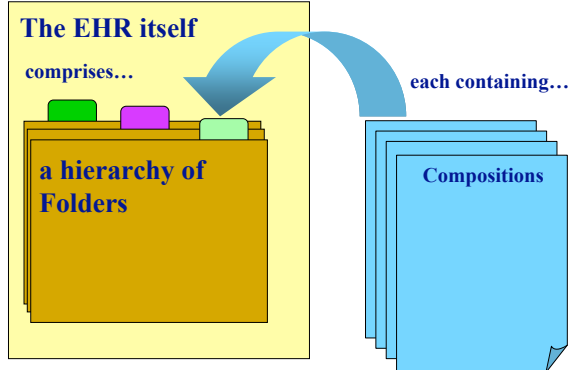
## Technical



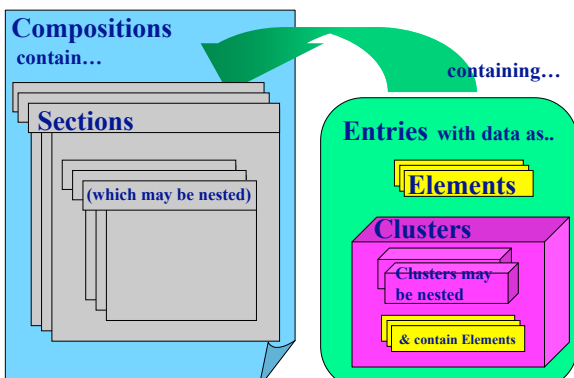
## Logical building blocks of the EHR

<b>EHR</b>	The electronic health record for one person
<b>Folders</b>	High-level organisation of the EHR e.g. per episode, per clinical speciality
<b>Compositions</b>	A clinical care session, encounter or document e.g. test result, letter
<b>Sections</b>	Clinical headings reflecting the workflow and consultation process
<b>Entries</b>	Clinical "statements" about Observations, Evaluations, and Instructions
<b>Clusters</b>	Nested multi-part data structures (tables and interval time series) e.g. audiogram
<b>Elements</b>	Leaf nodes with single data values e.g. reason for encounter, body weight
<b>Data values</b>	Date types for instance values e.g. coded terms, measurements with units

## Logical building blocks of the EHR



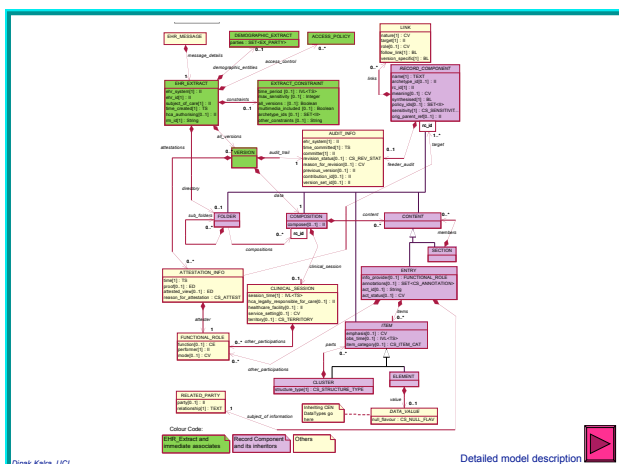
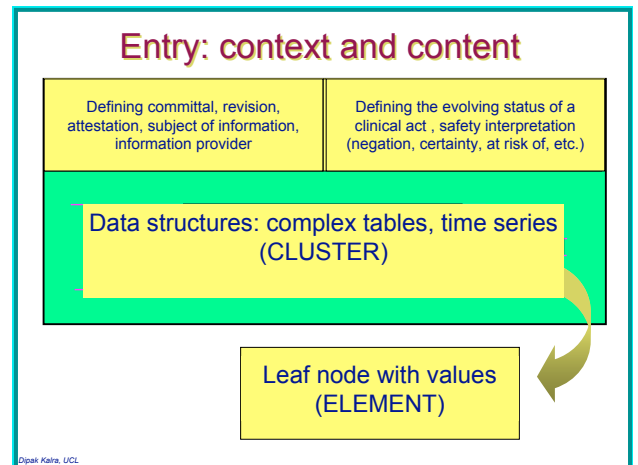
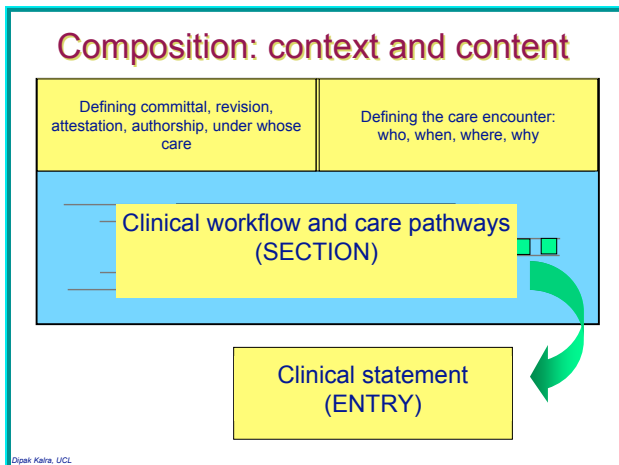
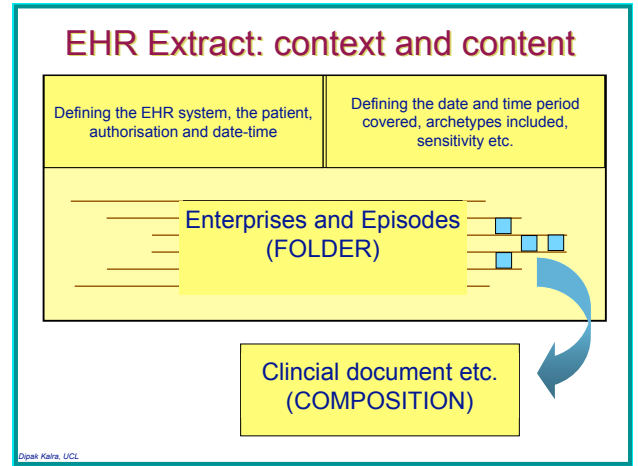
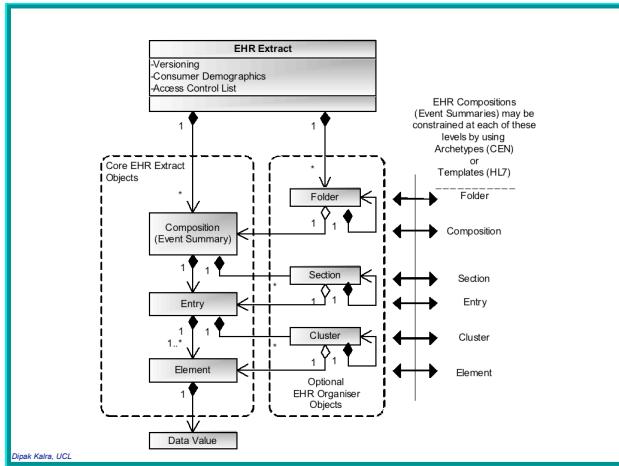
## Logical building blocks of the EHR

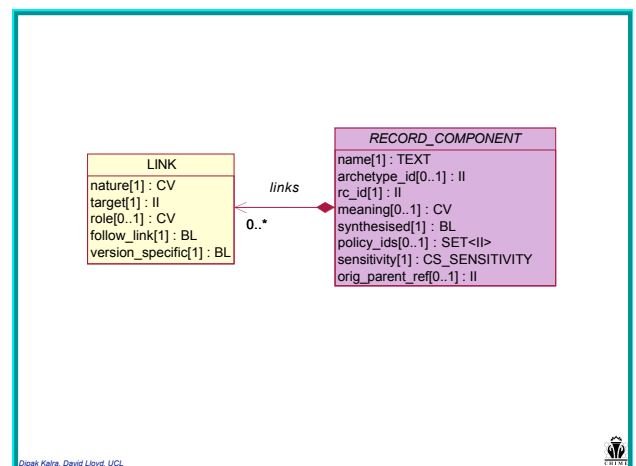
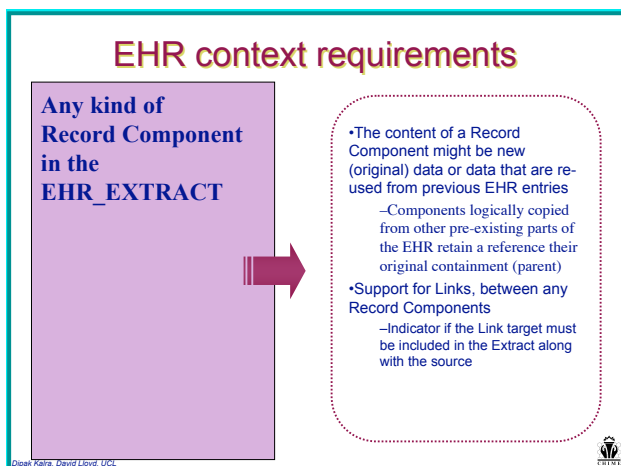
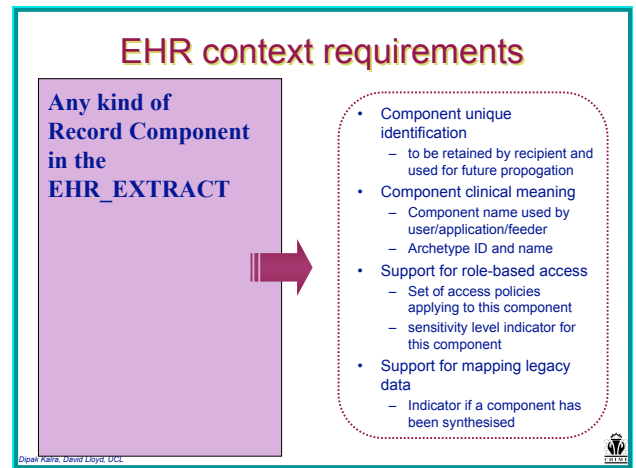
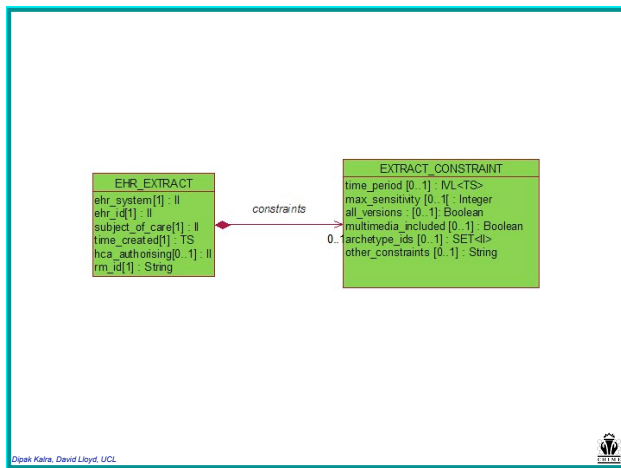
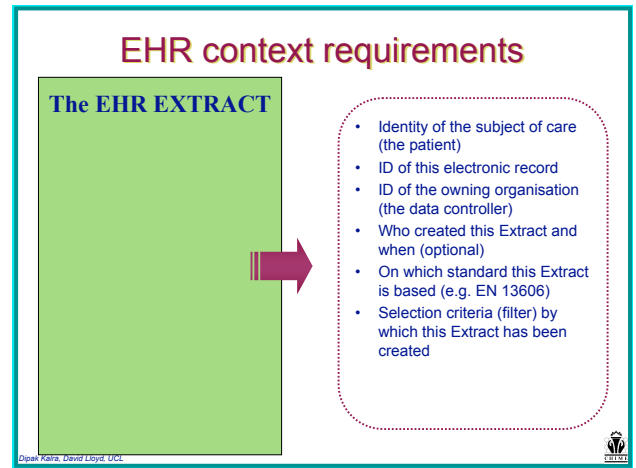
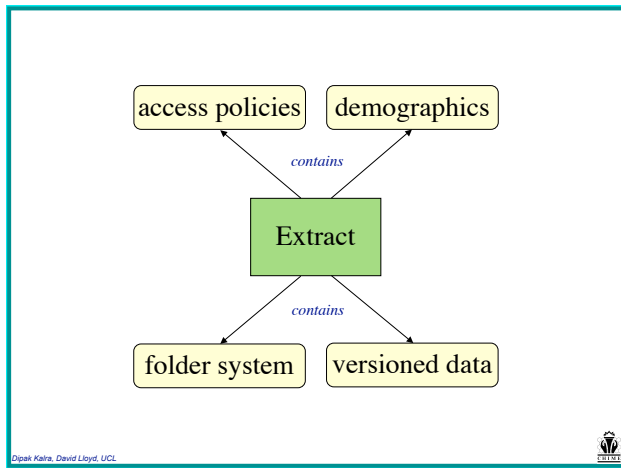


## Logical building blocks of the EHR

### Elements

have a single value of one of a predefined set of data value types





## EHR context requirements

### Any kind of Record Component in the EHR\_EXTRACT

- Representation of the meta-data about:
  - committal, revision, attestation
  - these data might exist at any hierarchical level in the EHR provider system
- Each version states
  - revision status and why revised
  - ID of preceding version
  - common attribute linking all versions
- Attestations include
  - attesting party and functional role
  - reason for attestation
  - optional digital "proof"
  - optional "image view" of what was seen and signed
  - any number of attestations may be added at or after committal

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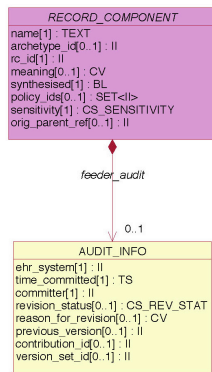


## EHR context requirements

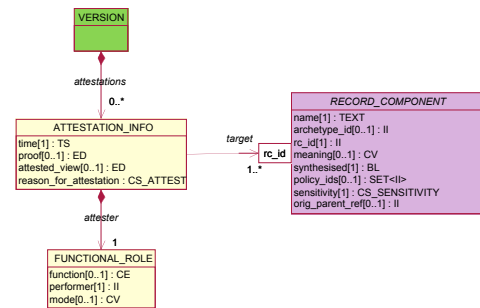
### The Contribution

- All of the Record Components created or amended at one record interaction session
  - irrespective of the Compositions they are contained in
  - references all changes and updates made in that EHR during that session. e.g.
    - addition of a new consultation
      - (add a new Composition)
  - and
    - correction of a drug prescription elsewhere in the EHR
      - (revise a pre-existing Composition)

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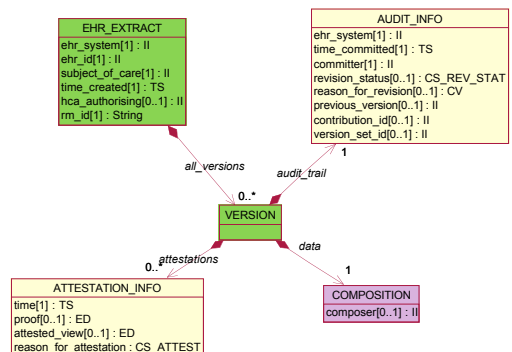
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## EHR context requirements

### Version control within the EHR Extract

- The EHR Extract contains a set of versioned data, comprising
  - EHR data, as Compositions
    - the consistent building block of the Extract
    - the wrapper class for additions to and revisions of EHR data within the Extract
  - Attestations, referencing any Record Components within that Composition



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## EHR context requirements

### Folder

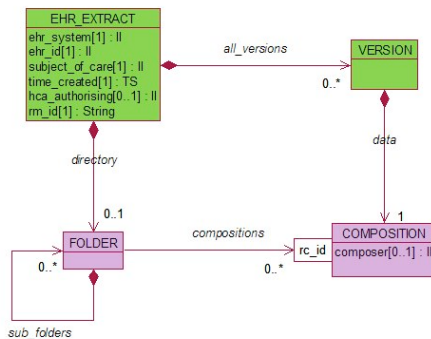
- The high-level organisation of Record Components within an EHR Extract
- An optional hierarchy
  - Folders may contain other Folders
- Permitting many to many containment by reference
  - e.g. a Composition might be contained by more than one Folder
- Folders might need to be constructed specifically for the Extract, to help organise the Compositions being sent
- Folders may be attested, and marked as having a fixed content, if appropriate

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## Folder use cases supported

- complete optionality and a freedom not to use them
- to use them for informal navigation and filing, with many-to-many containment
- the ability for EHR\_EXTRACTS to have FOLDERS that are created specifically for the communication purpose and are not representative of the underlying system data
- for FOLDERS in the EHR\_EXTRACT to contain only some of the data within the corresponding FOLDERS in the EHR Provider's system
- for FOLDERS to represent the original containment context of one or more COMPOSITIONS, faithfully to the EHR system creating the Extract
- for FOLDERS to represent the original containment context of one or more COMPOSITIONS that were committed together or in close proximity of time, as part of a single clinical care session
- for FOLDERS to be communicated together with attestations of their existence and content

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## EHR context requirements

### Composition

- Corresponding to a single clinical session or record interaction
- Corresponding to an HL7 CDA document
- The conventional unit of committal, attestation and revision within an EHR system
- The unit of version control within the EHR Extract

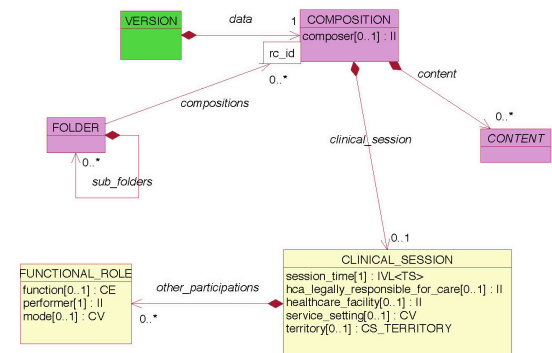
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## EHR context requirements

### Composition

- Clinical session context
  - when and when the care activity took place
  - at which care facility, as part of what service and at which location
  - under what legal jurisdiction (territory)
  - which clinician was in charge of the care
  - optionally describe any other participants in the care process
- Basic medico-legal data set about a clinic contact
- Composer is optional, to cater for scanned documents
- Placeholder for work with CONTSYS

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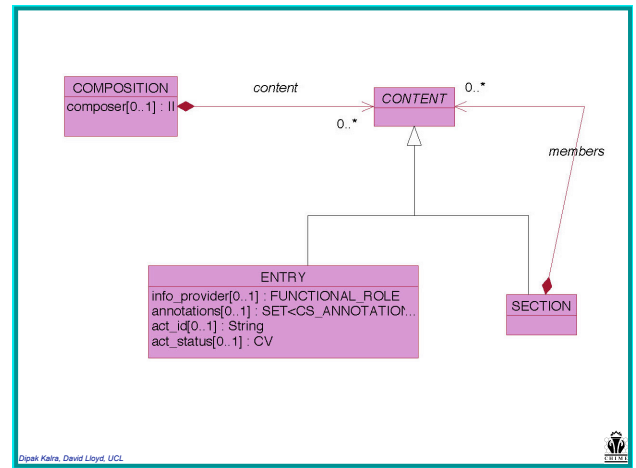


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## EHR context requirements

### Section

- Optional hierarchy
- Informal containment for human navigation, filtering and readability
- Corresponding to the clinical understanding of headings



## EHR context requirements

### Entry

#### Elements

#### Clusters

- An Entry corresponds to a single clinical "statement"
- May contain one or more Elements and/or one or more Clusters
- Represents the data structure of clinical observations, inferences and intended actions
  - which may be simple or multi-part (lists, tables etc.)
  - which may be time series



## EHR context requirements

### Entry

#### Elements

#### Clusters

- Information in an entry may be about someone other than the patient (e.g. relative)
- Information in an entry may have been provided by someone other than the patient/clinician
- Other participants might need to be identified with the Entry
- The Entry may represent the evolving status of a clinical Act (e.g. requested, performed, reported, cancelled)
- Support for HL7 mood code and safety Component Annotations



## EHR context requirements

### Entry

#### Elements

#### Clusters

- Representing different kinds of Entry data:
- the clinical reasoning process
  - if an observation or conclusion is uncertain
  - if an observation or conclusion is unusual, abnormal or unexpected
  - if an observation or conclusion is not the actual state of the patient
    - e.g. at risk of, goal, prognosis, negated, excluded
  - explanation of reasoning/actions
  - guideline reference
  - reference to published knowledge



## EHR context requirements

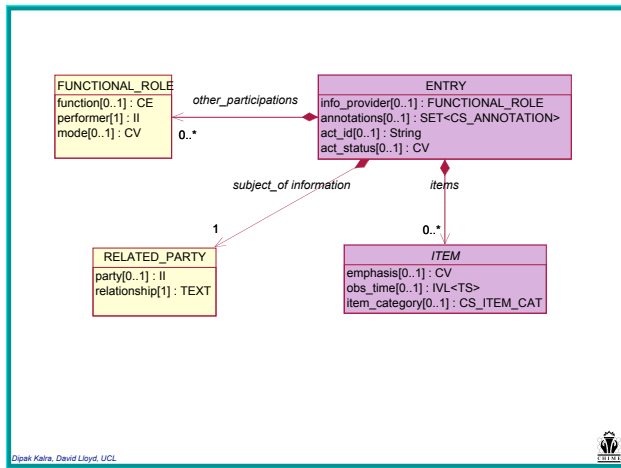
### Entry

#### Elements

#### Clusters

- Representing different kinds of Entry data:
- the state of the patient for the observation e.g.
  - fasting
  - standing
  - after exercise
  - 20 minutes after taking bronchodilator medication
- settings (or other context) for the observation e.g.
  - cuff size
  - frequency of stimulation
  - measurement device used

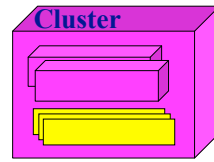




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## Structured data

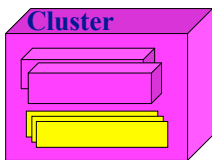


- Complex entries may, for example, be measurements, test results or treatment instructions
- These may need to be represented as a list, table, a tree or a time series
- Time series might be absolute times or relative to an origin
  - the data at each time point might themselves be complex
- Some time series might have regular intervals, or be intermittent 'bursts'

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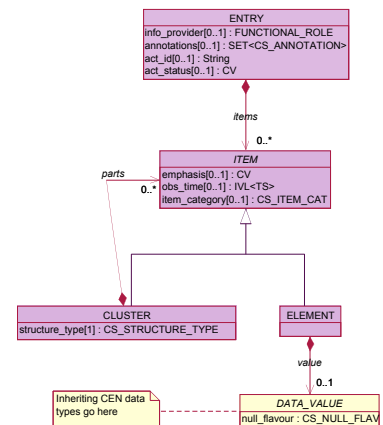


## Structured data



- Information in an Item (a Cluster or Element) might have originated at a date/time different from the care activity or its recording
- Information in an Item might be emphasised by the author as being exceptional or noteworthy

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## Representing Structure

- In this model, Lists, Tables, Trees are represented by specific configurations of the Cluster Class.
- Encoding rules will be defined, to ensure that the organisation of the data within tables etc. can be consistently communicated (e.g. defining which components will contain row and column headings)

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## Representing Time Series

- In principle, any time-related sequence of simple or complex data can be represented by the Cluster, with suitable Elements to represent the time points and data value parts.
- In this model, it is recognised that time-series of simple values will be a common occurrence, so the attribute **obs\_time** has been provided. Without this attribute, even a simple time series would require a Cluster of Clusters.
- The attribute **obs\_time** also provides a way to meet the requirement for the separate recording of the originating date time of the data.

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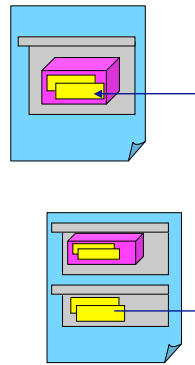
## Element



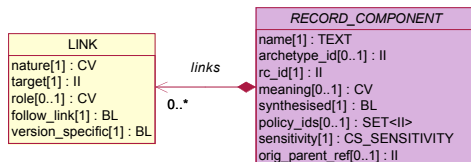
- An Element may have a null data value
  - for example if a value is not known



## Links between components



- Links may be required between any two record components
  - e.g. to indicate cause and effect
  - e.g. to track the evolution of orders from request to completion
- These might need to form linkage networks
  - e.g. for clinical problems
  - e.g. for clinical or service episodes



## Linkage nets

- Networks of links, for example to implement a problem-oriented view of the record, are expected to use an Element to represent the "hub" of the network, with suitable naming and value
  - e.g. **name** = "Problem" and **value** = "dizzy spell".
- All other components (including future components) that are considered to be related to this problem will have their LINK class instantiated with:
  - the **target\_rc\_id** attribute pointing to the "hub" element
  - the **nature** attribute set to "problem"
  - the **target\_role** attribute set e.g. to "cause" or "contributing factor".



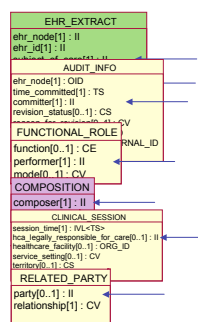
## Data types



- The Element is the leaf node containing a single data value, which may be
  - text
  - numeric
  - date/time
  - person/software/agent ID
  - graphical
  - other MIME type
    - e.g. image, signal
- Each of these data types has its own context model
- EHRcom uses the new CEN data types



## Identifying parties



- Several attributes identify parties that play a role in the EHR
- The data type of these is II (Instance Identifier)
- These identifiers will reference a party whose basic demographic data is provided in a distinct part of the Extract model
  - requiring each party to be defined only once per Extract
- The demographic model uses the CEN GPICs
  - General Purpose Information Components
    - (derived from the HL7 RIM)





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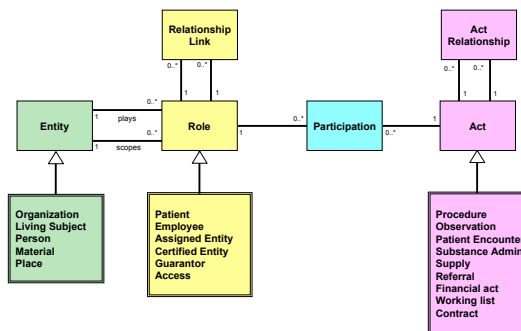
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## HL7 v3 RIM - a reminder

- Every happening is an **Act**
  - Procedures, observations, medications, supply, registration, etc.
- Acts are related through an **Act\_relationship**
  - composition, preconditions, revisions, support, etc.
- **Participation** defines the context for an Act
  - author, performer, subject, location, etc.
- The participants are **Roles**
  - patient, provider, practitioner, specimen, specimen, etc.
- Roles are played by **Entities**
  - persons, organizations, material, places, devices, etc.

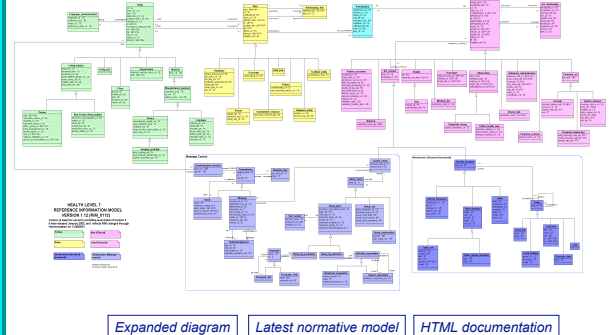
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## HL7 v3 RIM class overview



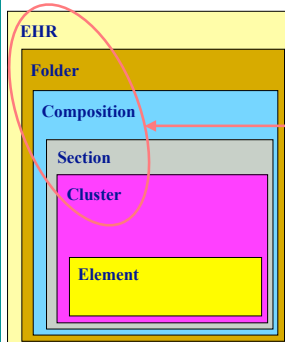
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## HL7 v3 RIM (v1.12)



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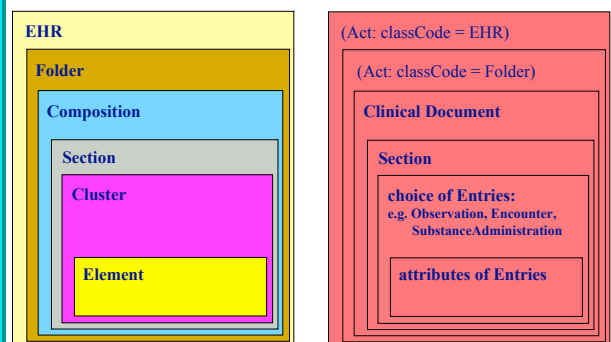
## 13606 correspondence with HL7 & CDA



All of the 13606 container classes now have a corresponding Act classCode

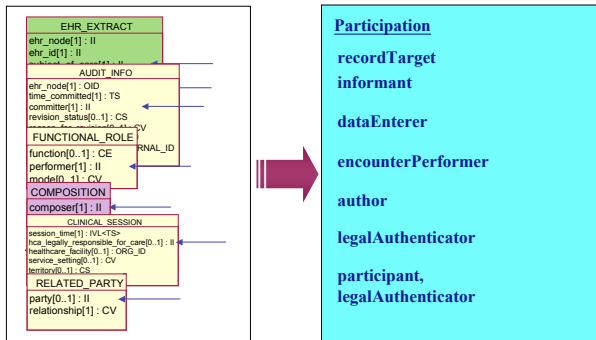
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## 13606 correspondence with HL7 & CDA



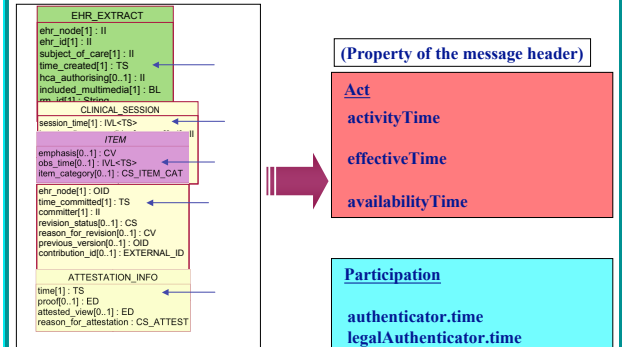
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## 13606 correspondence with HL7 & CDA: parties



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## 13606 correspondence with HL7 & CDA: dates and times



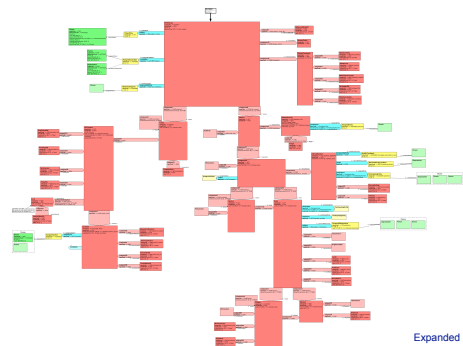
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## Correspondence with CDA

- Correspondence has also been mapped for:
  - dates and times
  - version management, unique identifiers
    - some changes to the RIM are being proposed
  - clinical context (negation, certainty etc.)
  - (data type mapping via CEN data types -> ISO)
- But, the scope of 13606 is broader than CDA (i.e. not just documents)
  - CDA documents can be represented in 13606
  - most of a 13606 Composition can be represented in CDA

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## Representation of 13606 as an HL7 D-MIM



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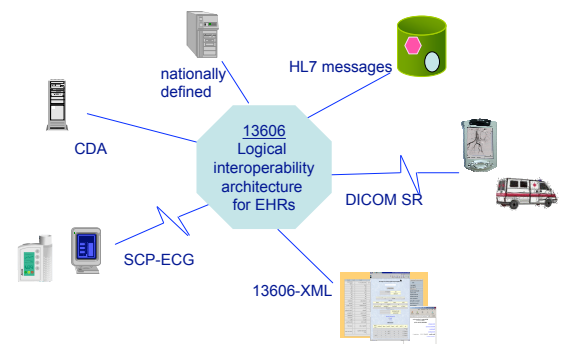
Expanded diagram

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## A generic logical EHR reference model is needed



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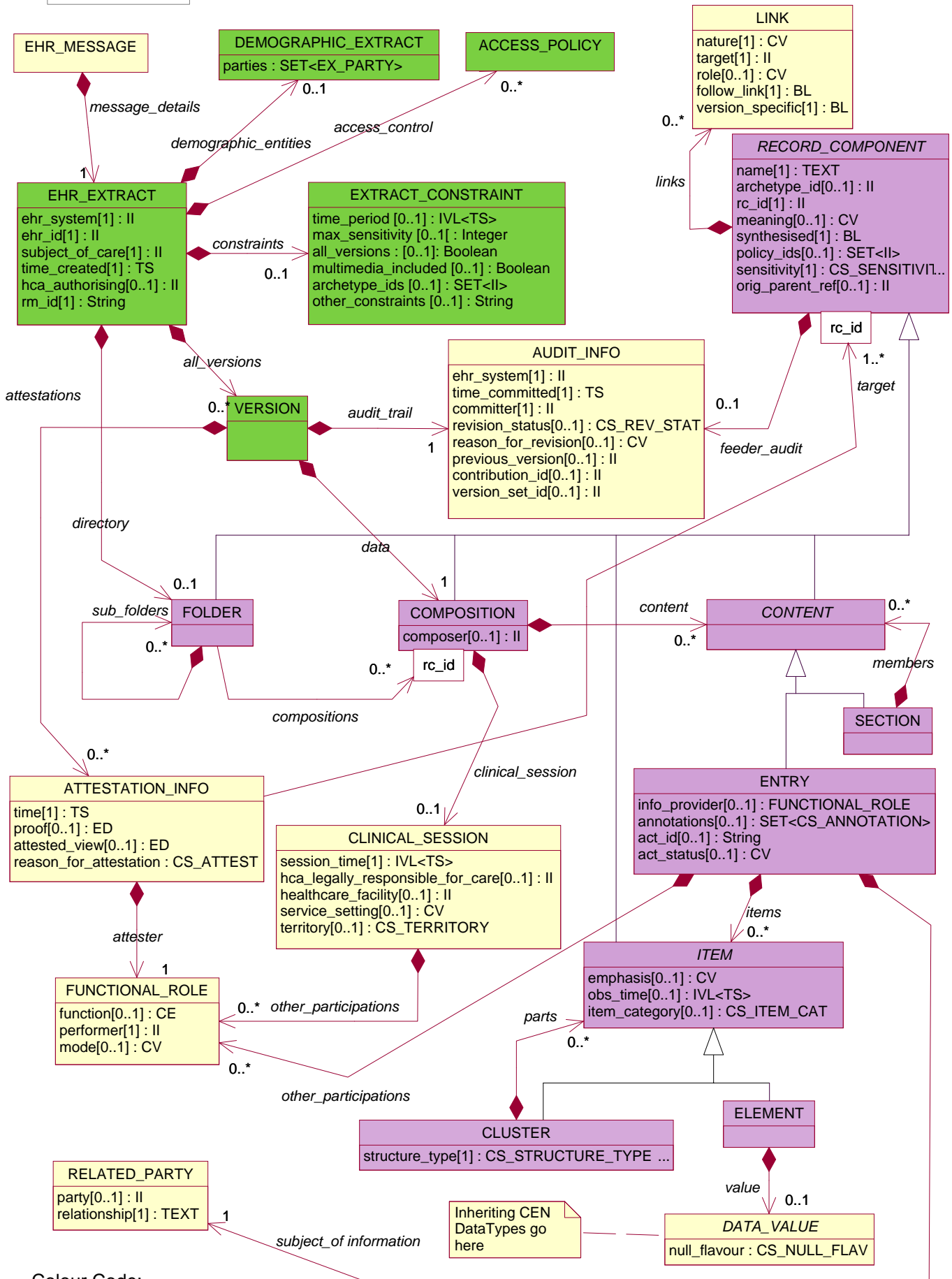
## The present 13606-1 CEN Enquiry draft

- defines a logical model for the core EHR
  - supporting interoperability between heterogeneous systems
  - providing a common view across message paradigms
- meets published EHR requirements
- draws on 12 years of significant R&D
  - including multi-national implementation experience
- draws on two generations of CEN EHR standard
- has been presented to ISO WG1
  - overview October 2003
  - detailed model presentation May 2004
  - plenary (Washington) has supported a NWIP on the basis of 13606-1

# EXTRACT Package

## EN13606 Extract Reference Model

EN13606-1\_ENQ\_v1\_1  
2004-06-02  
DL/DK

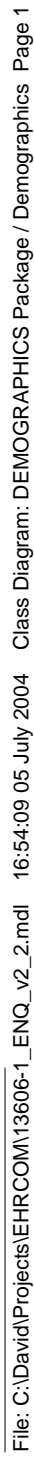


Colour Code:

EHR\_Extract and immediate associates

Record Component and its inheritors

Others

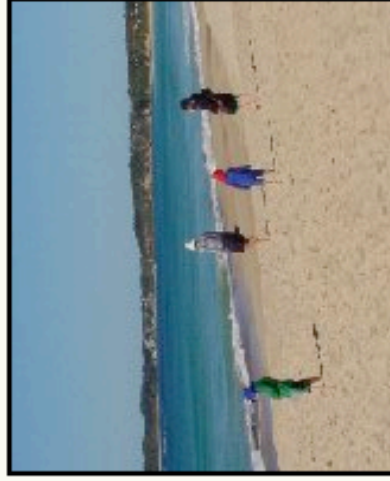
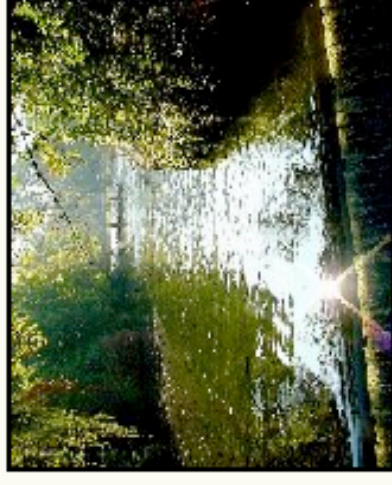


# Welcome to the *openEHR* Community

## Electronic Health Records for better Shared Care

*openEHR* is an international not-for-profit Foundation, working towards:

- Interoperable, life-long electronic health records, proven in practice
- Understanding the social, clinical and technical challenges of electronic records for health care in the information society.



**It does this by:**

- developing open-source specifications, software and knowledge management resources
- engaging in clinical implementation projects
- participating in international standards development
- supporting health informatics education

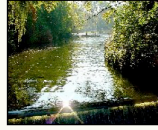


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## *openEHR* Foundation

[www.openehr.org](http://www.openehr.org)

- a non-profit organisation
  - jointly formed by UCL and Ocean Informatics
- uniting an international community working towards the realisation of electronic health records which are:
  - clinically comprehensive and ethico-legally sound
  - interoperable and standards-based
  - implemented as open-source, standards-based components
- to support seamless and high quality patient care

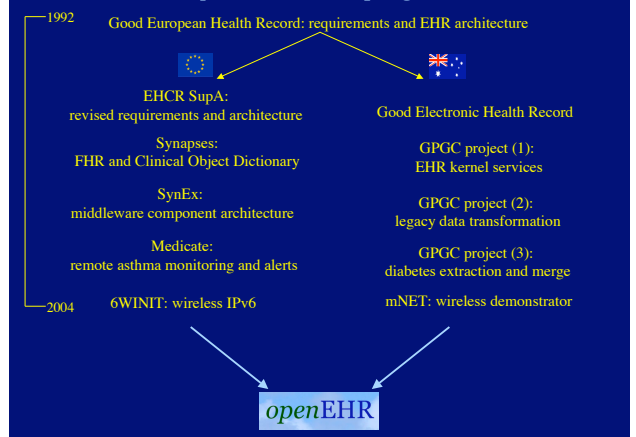


## *openEHR* supports

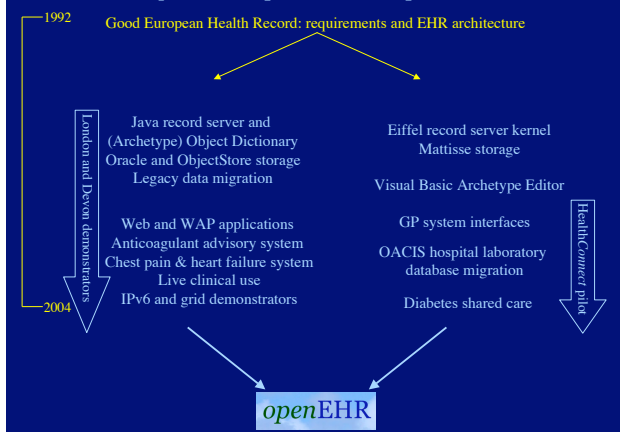
- **well-formulated clinical requirements**, moving towards international consensus;
- **rigorous development methodology** of systems;
- **common information models**, where requirements dictate that this is necessary;
- **diversity of models and approaches**, where this will enrich experience of a variety of approaches and systems and thereby promote quality and cost-effectiveness of solutions offered;
- **empirical evaluation** of systems performance against consensus clinical requirements;
- **convergence** between disparate EHR-related standards.



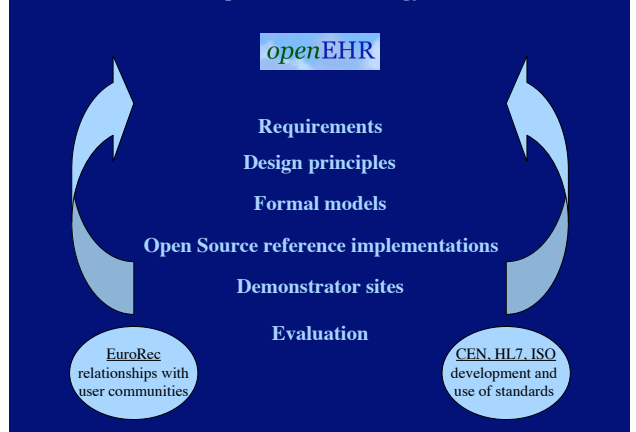
### *openEHR* research pedigree



### *openEHR* implementation experience



### *openEHR* methodology



## openEHR is...

- *open*, standardisable EHR platform
- *open*, quality-oriented engineering process
- designed by clinicians, engineers, community
  - In primary, secondary, community care
- introduces the innovative separation of technical architecture and medical knowledge
  - Reference model and archetypes
- Interoperable with other standards
  - HL7, CEN, ISO
  - actively participates in these organisations



## Where are we now?

- Community of nearly 500 international members
  - Active discussion lists
- Published specifications and tools
  - Design principles
  - Reference Model, including demographics and data types
  - Archetype Model, language, editor, parser
  - Exchange formats and interfaces
- Formal document and source code repository
- Changes overseen by Architecture Review Board
- Increasing wealth of publications and educational materials



## Who is using the *openEHR* specifications?

- Australian *openEHR* trial for federal HealthConnect project
- Canadian Infoway investigating *openEHR*
- US Veterans Health Administration reviewing the specifications
- CEN TC/251 has incorporated archetypes into EN13606
- Many developers have expressed interest in joining in the open source engineering
- Several SMEs have indicated they will use *openEHR* software inside their next clinical systems



## Next steps: deliverables for 2005

- Full reference implementation (Java)
  - EHR server
  - Demographics service
  - Archetype service
  - Archetype repository
  - Security and access control components
  - Grid enabled infrastructure
- To be published under the Mozilla triple licence
- International developer community is gathering momentum
- Several demonstrator sites are emerging

More input is welcome



## Membership of *openEHR*

- Membership of *openEHR* implies a commitment towards realising the vision of high quality, interoperable EHRs, and a willingness to share ideas and experience
- Membership is free
- Visit [www.openEHR.org](http://www.openEHR.org)
  - and join in our discussion lists !





# EUROREC 2004 Satellite Workshop on EHRs

## Introduction to Archetypes

David Lloyd

*Technical Consultant  
Centre for Health Informatics and Multiprofessional Education (CHIME)  
University College London*

*[d.lloyd@chime.ucl.ac.uk](mailto:d.lloyd@chime.ucl.ac.uk)*



## EUROREC 2004 Satellite Workshop on EHRs

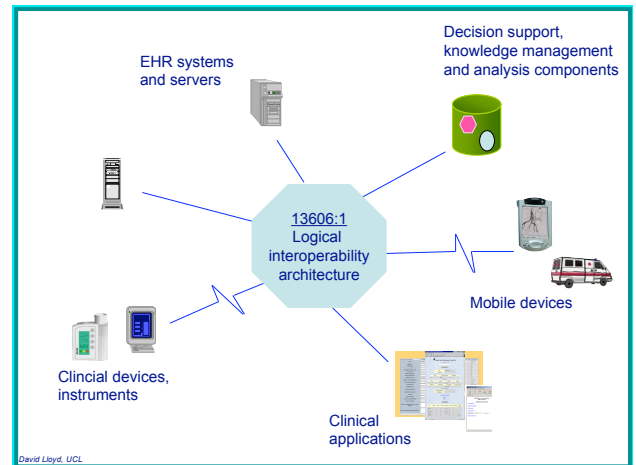
### Introduction to Archetypes

David Lloyd

Technical Consultant  
Centre for Health Informatics and Multiprofessional Education (CHIME)  
University College London  
d.lloyd@chime.ucl.ac.uk



David Lloyd, UCL



David Lloyd, UCL

## Why is it so hard to represent EHR data comprehensively/rigorously?

- Complexity - cross-links
- Breadth - many concepts
- Diversity - not the same in all locations/specialties/professions etc
- Evolving nature - change over time: new advances, culture

David Lloyd, UCL

## Realising the Electronic Health Record

### Principal challenges:

- the diversity and complexity of clinical data
  - making it difficult to capture and to store
- the diversity and the limitations of current healthcare record data architectures
  - making it difficult to share the data between computer systems or to transfer data between sites
- the ethical and legal requirements of good clinical practice

David Lloyd, UCL

## Why are EHR standards so difficult?

- Comprehensive models are
  - difficult to agree and difficult to maintain
- System designers need to respond to specialist needs, but systems need to remain interoperable
- It is difficult to standardise the information requirements of one health domain
  - without becoming too prescriptive
  - whilst permitting the future evolution of health care
- Rigorous ethical and legal requirements must be met

David Lloyd, UCL

## What is missing?

- Sharing EHRs among different vendor products
- Ability to define portable queries (since queries usually relate to db schemas, and db schemas are local)
- Thus we are prevented from having a real patient-centred EHR – which allows integration of data from multiple source systems
- => Hard to set up care networks
- => Hard to re-use software and systems outside original context of use

David Lloyd, UCL

## EHR and other informatics standards are vital

- to enable the exchange of health records between systems
- to enable interoperability with modern terminology systems and medical knowledge databases
- to enable the integration of protocols and guidelines electronically



David Lloyd, UCL

## So, we've adopted a dual model approach

- Reference Information Model
- + Archetypes (with an Archetype Model)

David Lloyd, UCL

## The Reference Information Model

### Goals:

to represent the common information properties of any health record entry

### Design approach:

make the model as generic as possible (domain independent)

to represent the generic characteristics of health care record entries:

- hierarchical record structure
- medico-legal properties
- core context properties
- meeting published requirements
- avoiding domain-specific clinical concepts

to aim for long-term stability of the Reference Model

David Lloyd, UCL

## Sets of archetypes

Forming a shared library of domain-specific record structures

- uses classes defined in the Reference Model
- maps to the specific information in each feeder system local schema
- allows constraints to be placed on the organisation and content of record entries

### Goals:

to represent the diverse and evolving information properties of healthcare records

to empower clinicians to define the way records are structured for different clinical domains:

David Lloyd, UCL

## Why archetypes?

- Usually, domain knowledge is part of the software itself – part of the information models...(bad)
- In today's clinical information systems, terminology is separate...(a start)
- We have to systematically separate knowledge from the software and databases to better handle changes in:
  - New research, equipment, tests, drugs, therapies...
  - Sociological factors in the practice of medicine and community involvement
- We need systems which self-adapt continually

David Lloyd, UCL

## What is an Archetype?

- A formal model of a domain concept, e.g. "blood pressure", "discharge summary", "vaccination history"
- Used at runtime:
  - To validate data creation (GUI, legacy db)
  - To do intelligent querying
  - To enable knowledge-level interoperability
- Basis of standardisation of domain concepts

David Lloyd, UCL

## ADL – Archetype Definition Language

- An abstract constraint syntax for clinical models
- Can express archetypes for any information model
- Natural Language and Terminology independent
- Allows clinicians to build definitions of their data, using friendly tools
- Provides a bridge between standards – HL7, CEN, EDI, XML....
- Openly available from <http://www.openEHR.org>

David Lloyd, UCL

## Ontologies

- Working definition:
  - A set of concepts and relationships between them for a given purpose or from a given perspective.

David Lloyd, UCL

## Definitions

- **Data** : echocardiogram of Mina Tanenbaum
- **Information**: Statements about specific individuals. For example, the statement "Mina Tanenbaum (2y) has an atrial septal defect, 1 cm x 3.5 cm" is a statement about Mina Tanenbaum, and no-one else.
- **Knowledge** : statements about classes of entities, e.g. the statement "a hole in the atrial septum can lead to dilatation, cardiac insufficiency and pulmonary hypertension".

Archetypes & templates  
mediate between knowledge  
& information

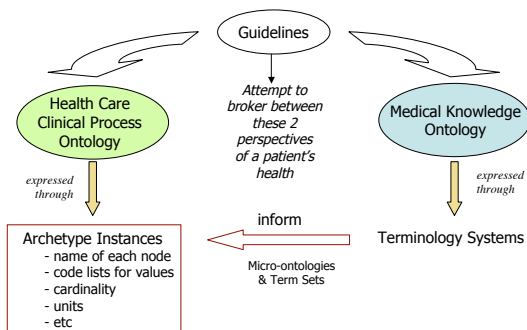
David Lloyd, UCL

## The rôle of domain knowledge in information systems

- Clinical knowledge examples:
  - Models of "clinical statements":
    - BP measurement
    - ECG result
    - Discharge summary
  - Workflow process descriptions
  - Protocols / Guidelines
  - Terminologies, ontologies, e.g. Galen, Snomed
- Knowledge must be directly usable in clinical information systems

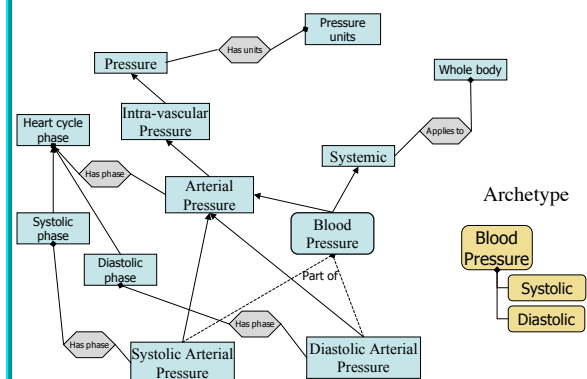
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## Bridging the Ontologies



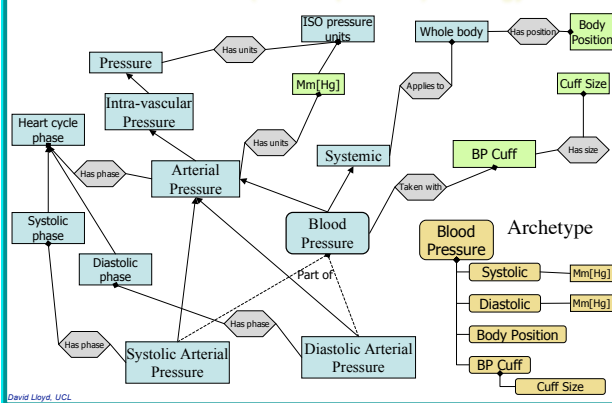
David Lloyd, UCL

## Medical Knowledge Ontology



David Lloyd, UCL

## Health care (clinical process) ontology



## Fuller list of BP 'characteristics'

- Systolic Arterial Pressure
- Diastolic Arterial Pressure
- Units of measurement
- Physiological ranges
- Exercise state
- Body Position
- Measuring Instrument, details
- Number of times the BP was taken
- Optionality
- Cardinality
- (Why this measurement was taken)
- Other context is not specific to BP so not included here
  - e.g. who took the measurement, on whom, who recorded it, when...

## Constraint Model

- Archetypes thus allow Constraints to be placed on the instances of features in the Reference Information model to:
  - represent health-related phenomena in agreed (good) ways
  - enforce clinical, professional, and enterprise policies

## Formal Model

- but.. in order to express these constraints across the whole of health care, in a rigorous and interoperable way, we need a formal model.

## Archetype Model - General

- This is **not** a data model but essentially a **Constraint** model.
- Describes **generic** ways of specifying and managing Archetypes.
- This is a model applying to **all** archetypes

## Main parts (packages)

- Archetype Identification
- Meta data for Archetype description and management
- Constraints
- Ontologies
- Primitive types
- Domain-specific types



## Archetype Identification

- Identification
- Concept
- Parent
- Language

David Lloyd, UCL

## Meta data

- Audit
  - Committers and organisations
  - Revision
- Description
  - Authors and organisations
  - Lifecycle details
  - Use, misuse
  - Where to find this archetype
  - Copyright and other details

David Lloyd, UCL

## Specifying Constraints

- UML but we are modelling constrained Objects
- Any archetype description = instance of C\_COMPLEX\_OBJECT, which represents a tree structure of any depth. Has features and invariants.
- Generic structure in triangle of C\_COMPLEX\_OBJECT, C\_OBJECT, and C\_ATTRIBUTE.
- Here 'Attribute' can be 'normal' attribute or an association in UML terms.
- Single, Multiple attributes
- Primitive types and leaf nodes
- Archetype slots (with assertions) to support 'building block' approach
- Internal Ref, Constraint Ref.
- Special extensions to data types for Clinical Domain.

David Lloyd, UCL

## Ontologies

- Available terminologies
  - With term or constraint bindings
- Specialisation depth
- All codes for EHR hierarchy node names
- All constraint codes
- 'Attribute' names in ontology terms
- Owning archetype.

David Lloyd, UCL

## Primitive types

- Boolean
- String
- Numeric
- Times, dates, durations

David Lloyd, UCL

## Domain-Specific Extensions

- A small number of domain types

David Lloyd, UCL

## Formal Archetype Model

UML Representation  
From *openEHR*)



David Lloyd, UCL

## Archetype model

- Designed to be independent of the EHR reference model used
  - So that CEN, HL7 and *openEHR* can share a common model
  - archetypes for other (non-EHR) models will be compatible
  - needed to underpin the design of archetype services, supporting EHR services at "run-time"

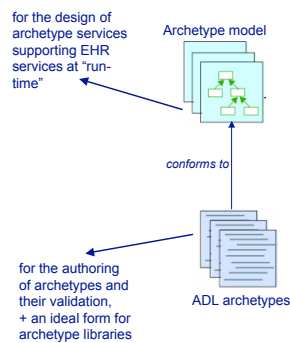
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## Archetype repositories

- A test ebXML repository has been set up at the Mayo Clinic for archetypes
- the standard ought to remain technology-independent
- Aim: a set of meta-data to describe each archetype in a repository will be included in an informative annex

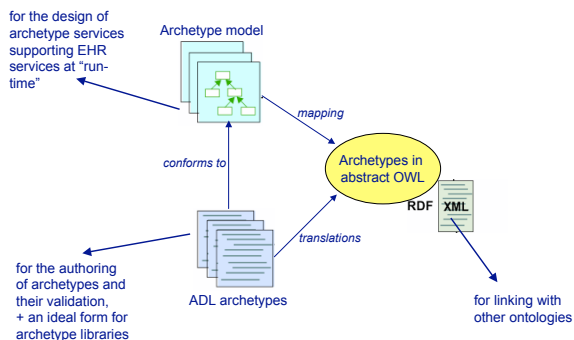
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## Archetype formalisms



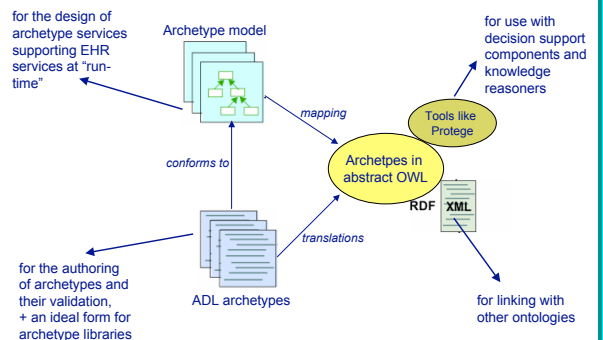
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## Archetype formalisms



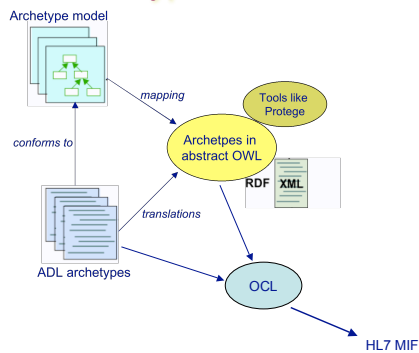
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## Archetype formalisms



David Lloyd, UCL

## Archetype formalisms



David Lloyd, UCL

## Archetype formalisms

- ADL remains the only complete specification to represent the constraints required for archetypes
- OWL is likely to be revised to meet the same requirements within 12-18 months
- An OCL specification for templates/archetypes will be developed over the next several months, by HL7
- Aim: to include ADL a Normative annex in 13606-2 FWD
  - specifying the way in which *ADL-archetypes* are to be communicated
  - (keep open the option of including OWL and OCL as additional informative annexes if specifications become complete enough in the near future)

David Lloyd, UCL

## 13606-2 planned structure

1. Scope
  2. Introduction
  3. Definitions
  4. Abbreviations
  5. Archetype requirements
  6. Archetype model
- Annex 1. Archetype repository meta-data  
 Annex 2. ADL specification  
 (Annex 3. OWL specification)  
 (Annex 4. OCL specification)

David Lloyd, UCL

## Added value in Archetypes

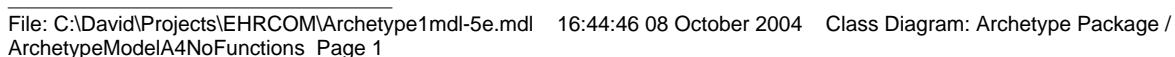
- Empowerment of healthcare professionals to define domain-specific concepts with guaranteed conformance to the EHR reference model.
  - specifying which constructs are to be used
  - defining constraints, limits on values, terminologies etc
- EHR carries the identity of each Archetype used with the data created using it
  - aids future interpretation, analysis, computation

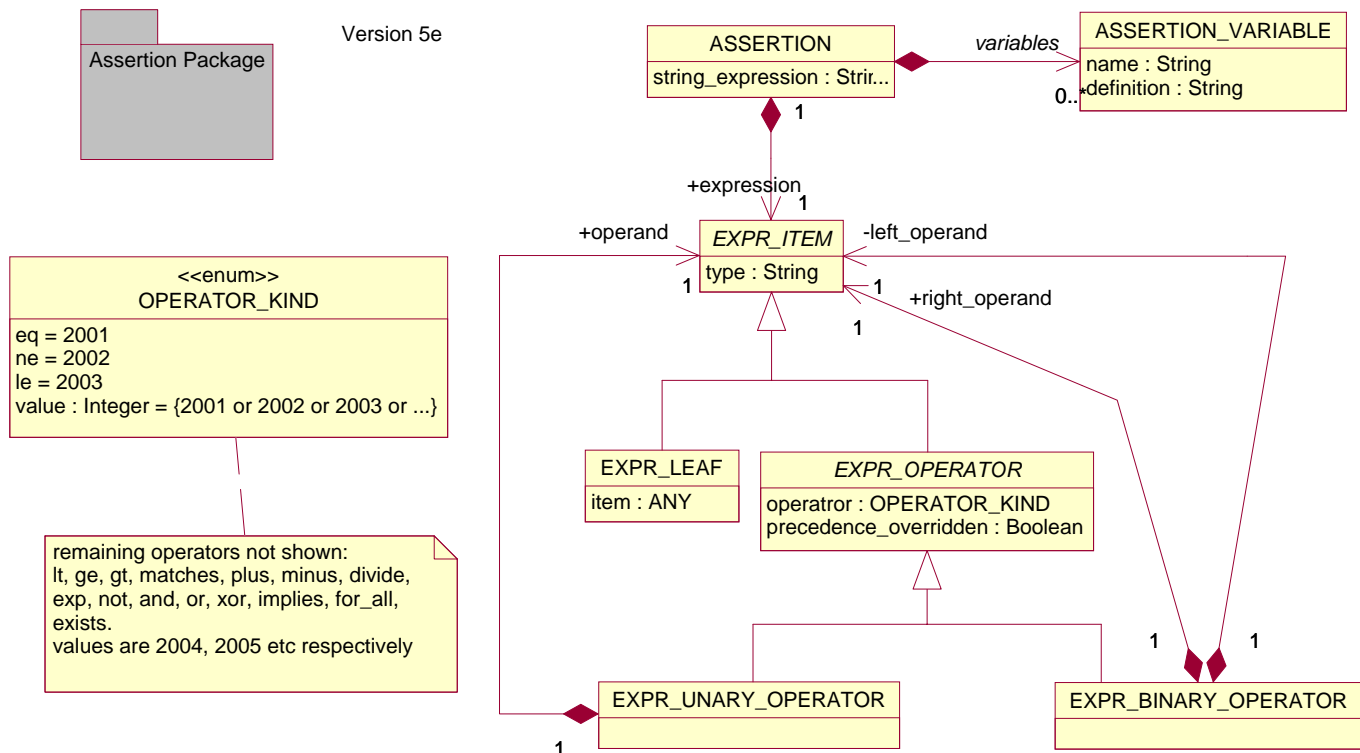
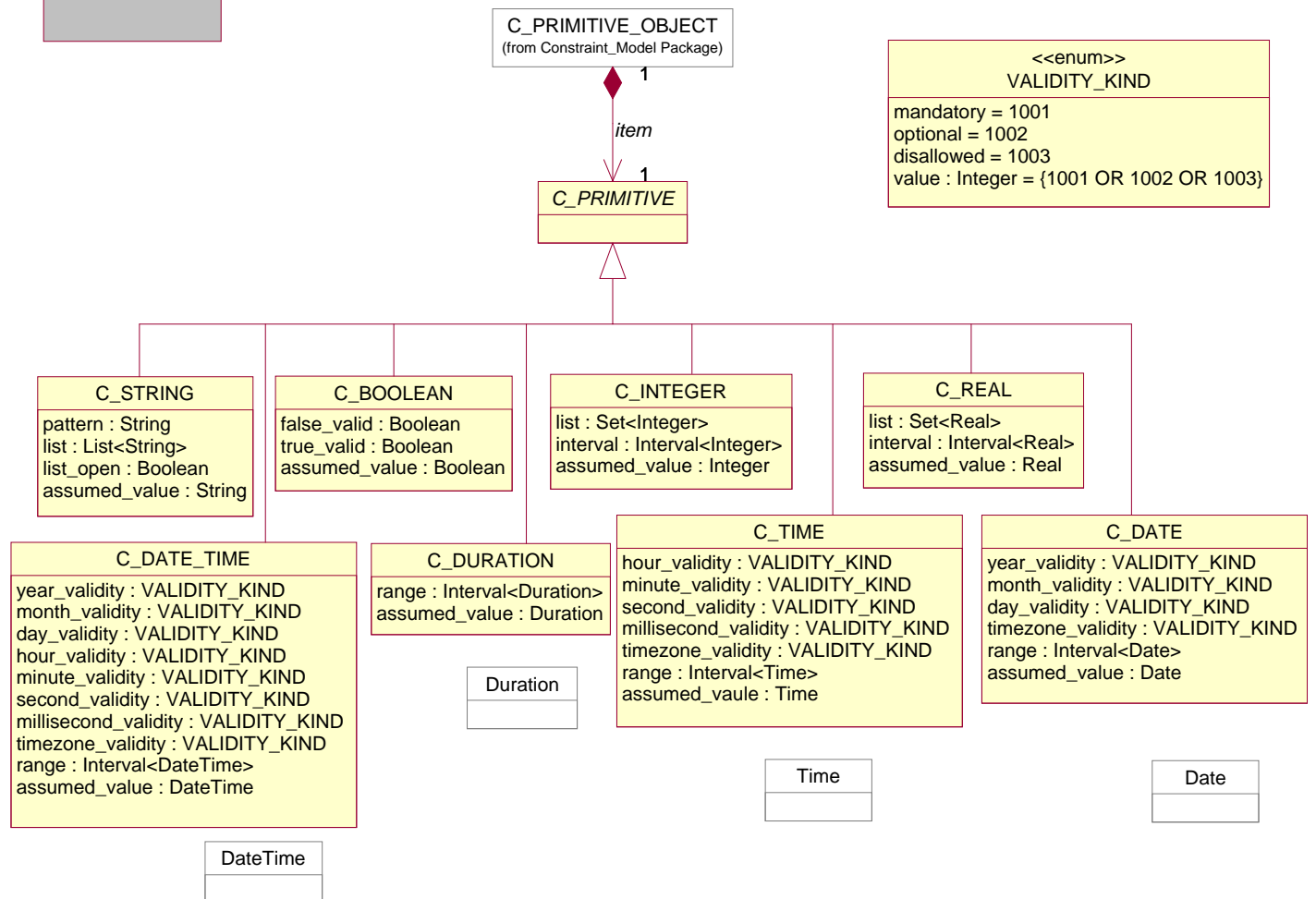
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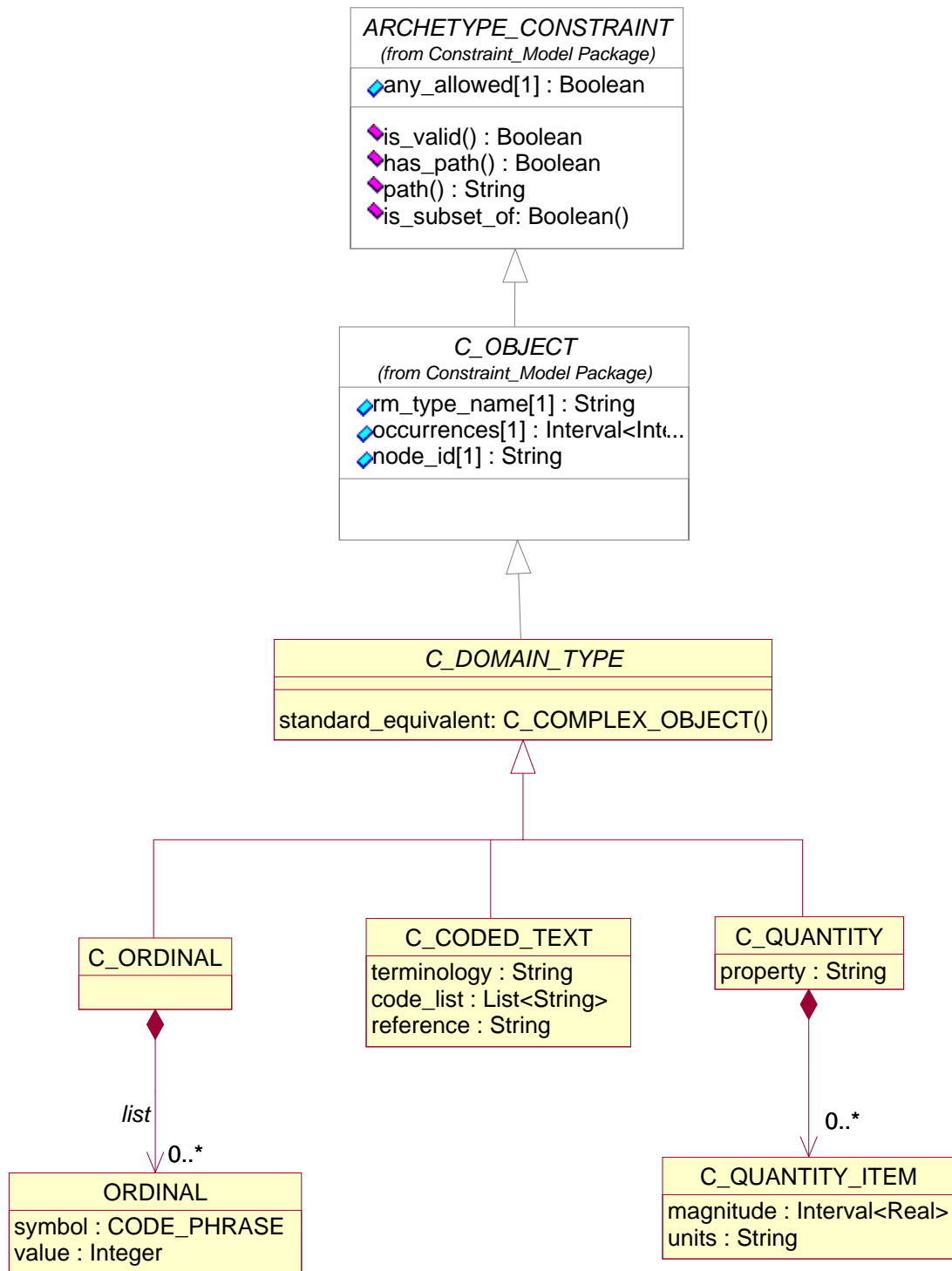
Thank You

Questions?

David Lloyd, UCL











## Archetype editor

Project Leader:  
Sam Heard

Contributors:  
Thomas Beale  
Peter Schloeffe  
Heath Frankel

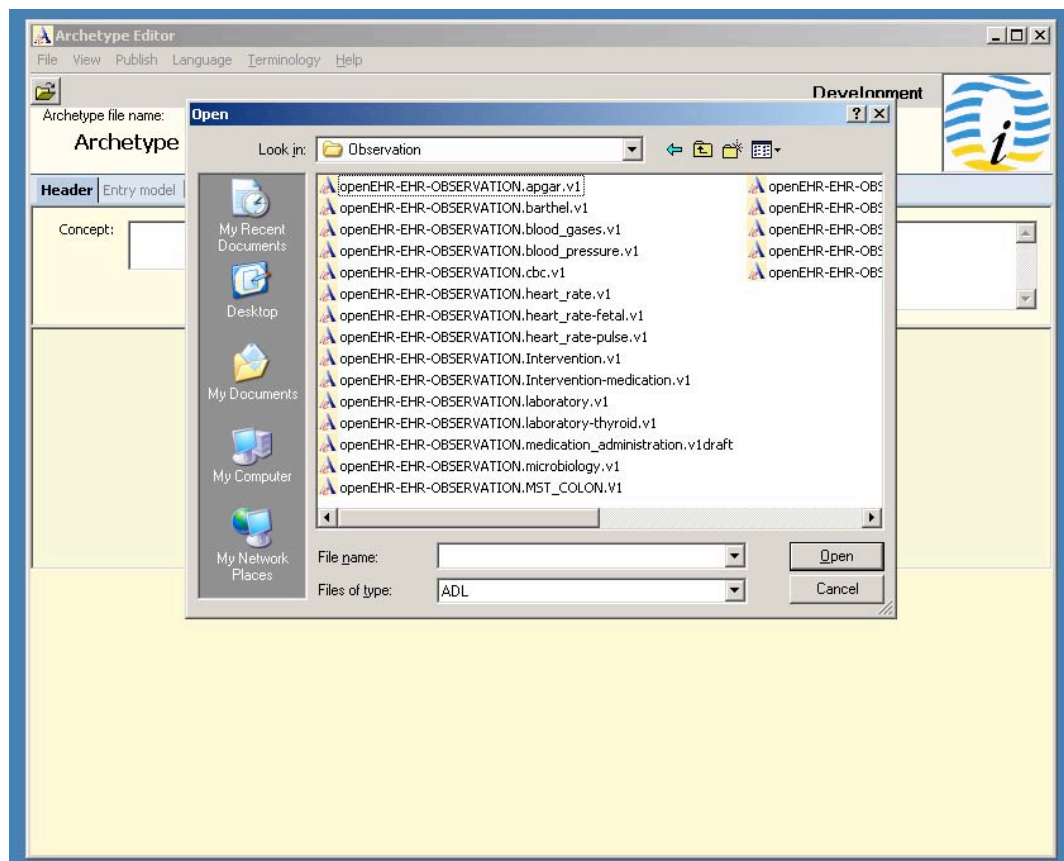
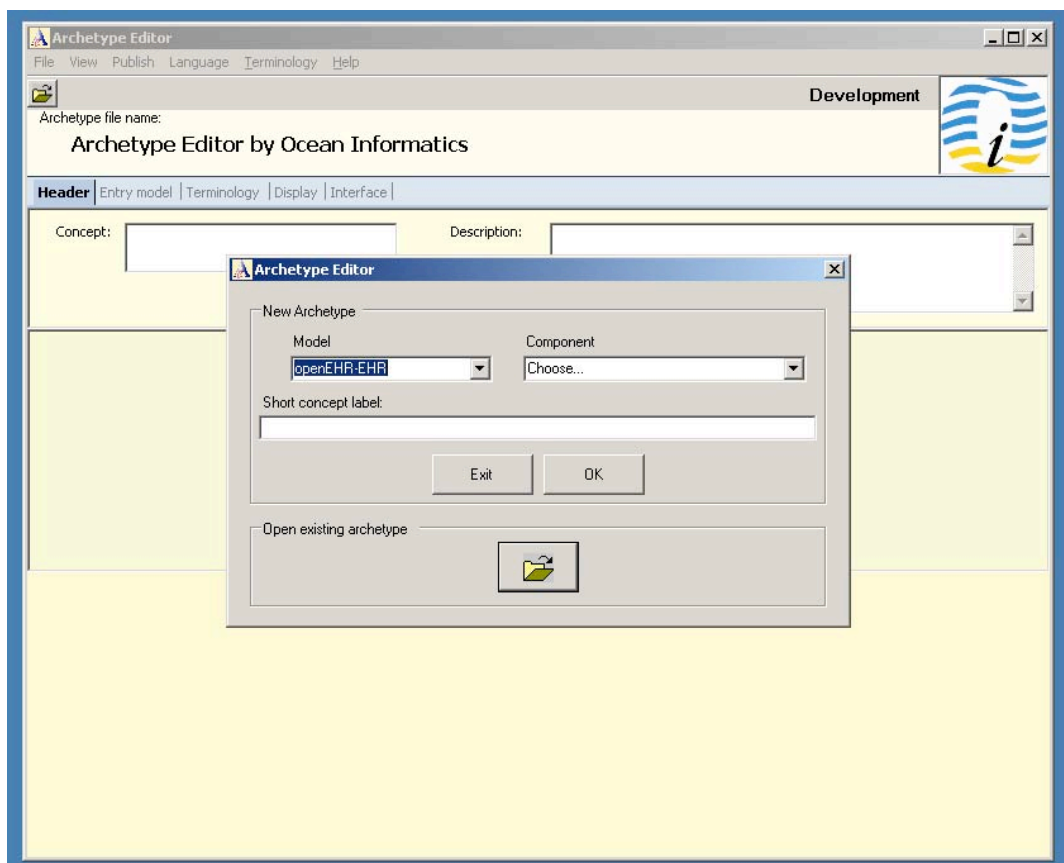
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Government of Australia and the General  
Practice Computing Group

Utilising the Magic Library tab control from Crownwood at [www.dotnetmagic.com](http://www.dotnetmagic.com)








**Ocean Archetype Editor [blood pressure measurement]**

File View Publish Language Terminology Help

Archetype file name: **openEHR-EHR-OBSERVATION.blood\_pressure.v1**

Development 

**Header** | Entry model | Terminology | Display | Interface |


Concept:  Description:

Subject of data  
☒ Unrestricted ☐ Restricted

**Ocean Archetype Editor [blood pressure measurement]**

File View Publish Language Terminology Help

Archetype file name: **openEHR-EHR-OBSERVATION.blood\_pressure.v1**

Development 

**Header** | **Entry model** | Terminology | Display | Interface |

☒ Protocol

**Data** | Protocol |

☒ Event History ☒ Person State

**List** | Events | Person state |

☒ Ordered ☒ Fixed

Occurrences -Min:  Max:  ☐ Unbounded

Description:

Runtime name constraint:

**Quantity**

Property:

Units:

**Unit Values**

☒ Set min. value

☒ Set max. value

**Q** systolic  
**Q** diastolic

**Ocean Archetype Editor [blood pressure measurement]**

File View Publish Language Terminology Help

Archetype file name: openEHR-EHR-OBSERVATION.blood\_pressure.v1

Development

Header **Entry model** Terminology Display Interface

☒ Protocol

Data Protocol

☒ Event History ☒ Person State

List Events Person state

☒ Ordered ☒ Fixed

Occurrences -Min: 0 Max: 1 ☐ Unbounded

Description: the systemic arterial blood pressure in systolic phase

Runtime name constraint: systolic

Quantity

Property: Pressure

Units: Momentum, Angular  
Power  
Power Density  
Power Flux  
Power, Linear  
Pressure  
Qualified real  
Resistance

Unit Values

☒ Set min. value 0

☒ Set max. value 1,000

**Ocean Archetype Editor [blood pressure measurement]**

File View Publish Language Terminology Help

Archetype file name: openEHR-EHR-OBSERVATION.blood\_pressure.v1

Development

Header **Entry model** Terminology Display Interface

☒ Protocol

Data Protocol

☒ Event History ☒ Person State

List Events Person state

☒ Ordered ☒ Fixed

Occurrences -Min: 0 Max: 1 ☐ Unbounded

Description: the systemic arterial blood pressure in systolic phase

Runtime name constraint: systolic

Quantity

Property: Pressure

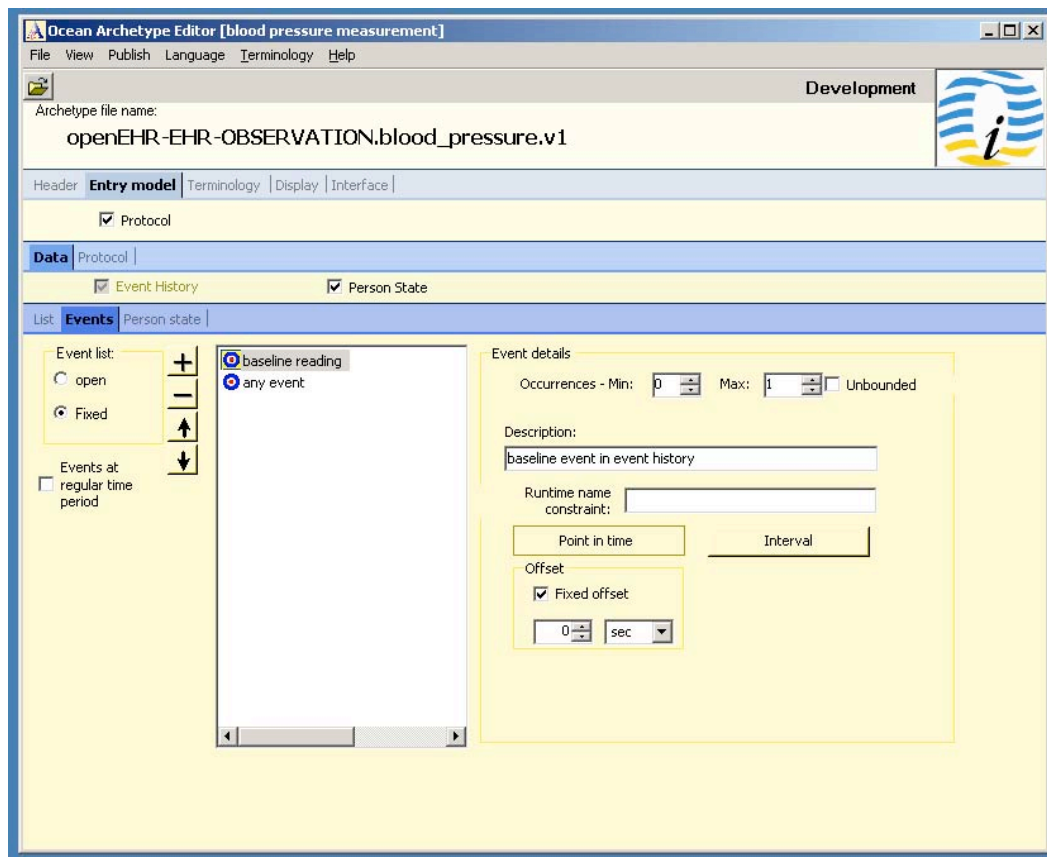
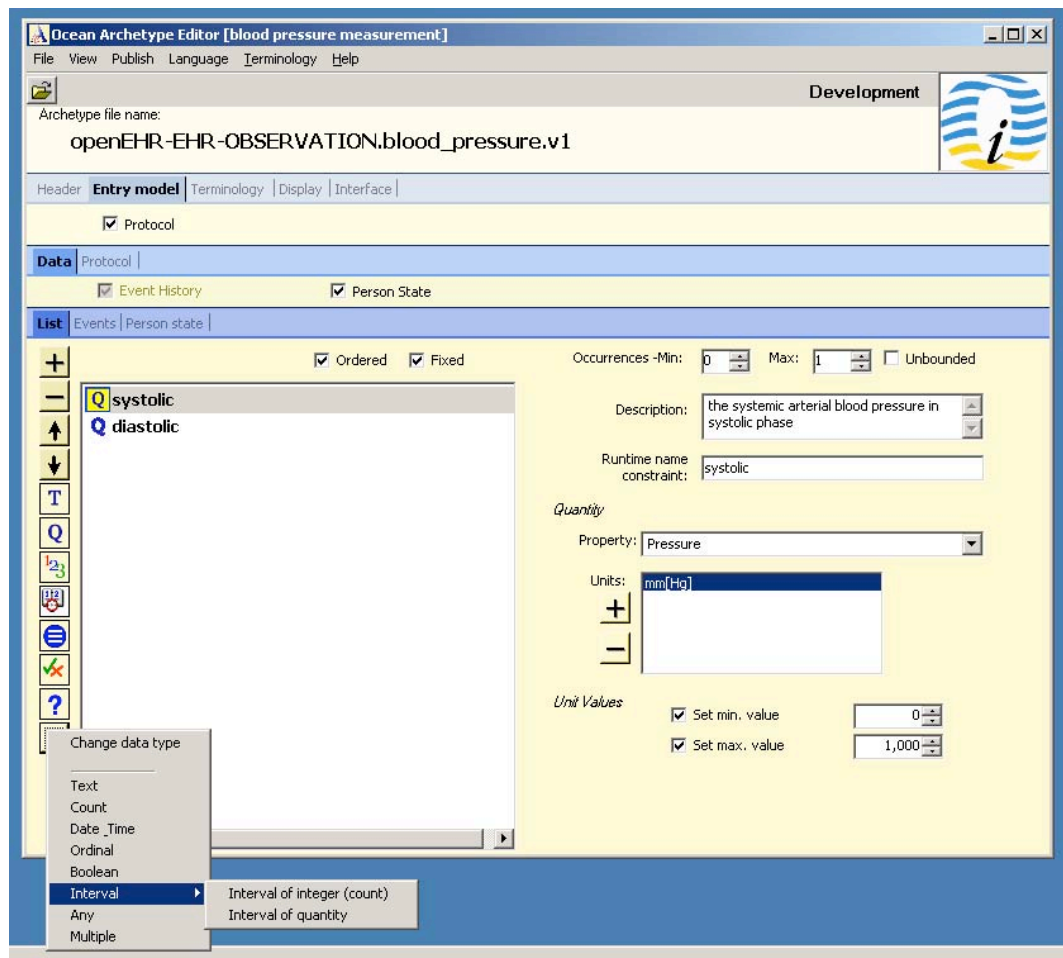
Units: mm[Hg]

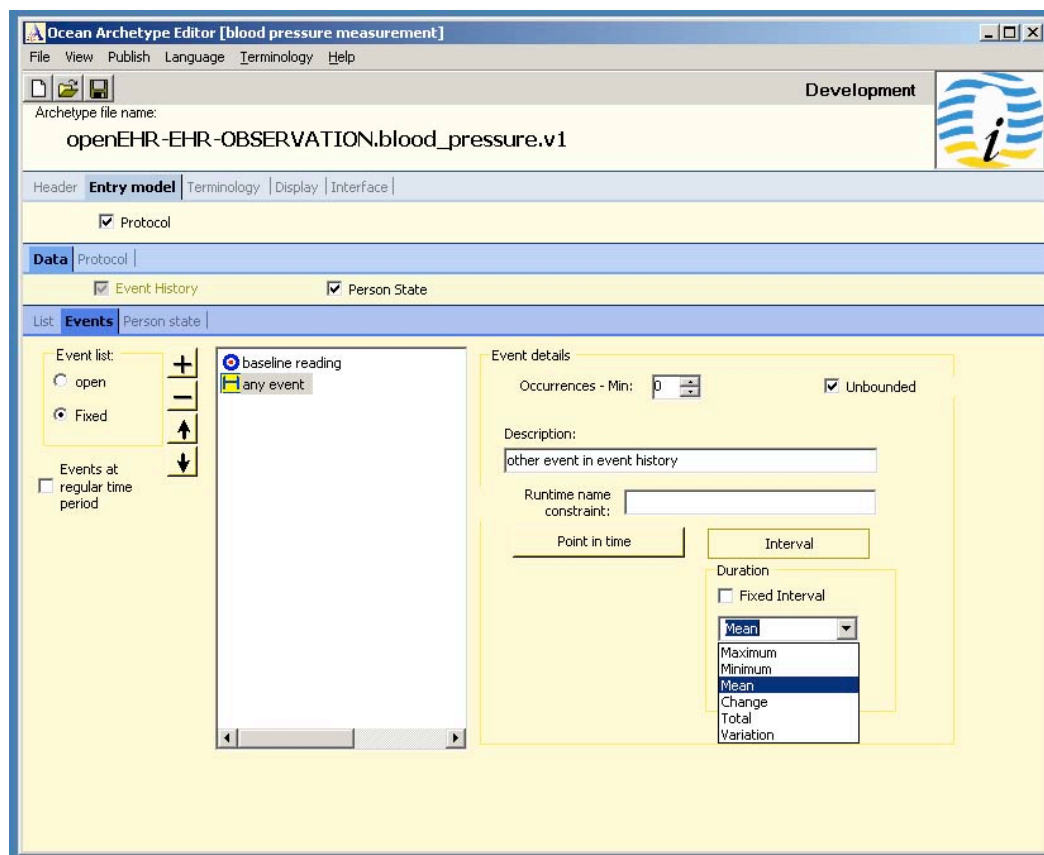
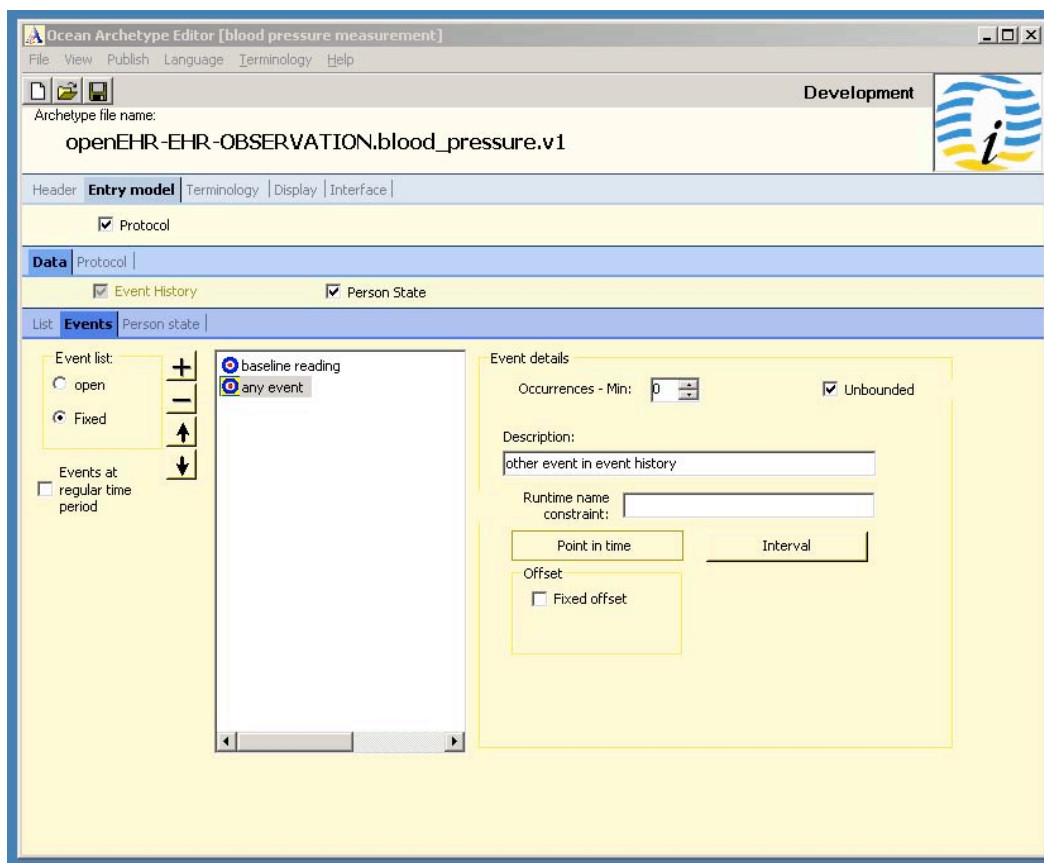
Unit Values

☐ Set min. value 0

☐ Set max. value 1,000

bar  
cm[H2O]  
dyn/cm^2  
ft H2O  
in H2O  
in Hg  
kg/m^2  
kPa  
lb/ft^2  
lb/in^2  
mbar  
N/m2  
Pa  
pdl/ft^2  
std. atm  
ton/in^2





**Ocean Archetype Editor [blood pressure measurement]**

File View Publish Language Terminology Help

Archetype file name: openEHR-EHR-OBSERVATION.blood\_pressure.v1

Header **Entry model** Terminology Display Interface

☒ Protocol

**Data** Protocol

☒ Event History ☒ Person State

List Events **Person state**

☒ Ordered ☒ Fixed

Occurrences -Min: 0 Max: 1 ☐ Unbounded

Description: The position of the patient at the time of measuring blood pressure

Runtime name constraint:

☐ Text ☒ Internal codes ☐ Terminology

Standing  
 Sitting  
 Reclining  
 Lying

**Ocean Archetype Editor [blood pressure measurement]**

File View Publish Language Terminology Help

Archetype file name: openEHR-EHR-OBSERVATION.blood\_pressure.v1

Header **Entry model** Terminology Display Interface

☒ Protocol

**Data** Protocol

☒ Event History ☒ Person State

List Events **Person state**

☒ Ordered ☒ Fixed

Occurrences -Min: 0 Max: 1 ☐ Unbounded

Description: The level of exertion at the time of taking the measurement

Runtime name constraint:

Quantity

Property: **Work**

Units: **l/min**

Unit Values


☒ Set min. value   
☒ Set max. value



**Ocean Archetype Editor [blood pressure measurement]**

File View Publish Language Terminology Help

Archetype file name: **openEHR-EHR-OBSERVATION.blood\_pressure.v1**

Development 

Header: **Entry model** Terminology Display Interface

☒ Protocol

Data: **Protocol**

☒ Event History ☒ Person State

List | Events: **Person state**

☒ Ordered ☒ Fixed

Occurrences -Min: 0 Max: 1 ☐ Unbounded

Description: The classification of the exercise level

Runtime name constraint:

☐ Text ☒ Internal codes ☐ Terminology


At rest  
 Post-exercise  
 During exercise

T Position  
 Q Exersion level  
 T Exercise

**Ocean Archetype Editor [blood pressure measurement]**

File View Publish Language Terminology Help

Archetype file name: **openEHR-EHR-OBSERVATION.blood\_pressure.v1**

Development 

Header: **Entry model** Terminology Display Interface

☒ Protocol

Data: **Protocol**

☒ Ordered ☒ Fixed

Occurrences -Min: 0 Max: 1 ☐ Unbounded

Description: the instrument used to measure the blood pressure

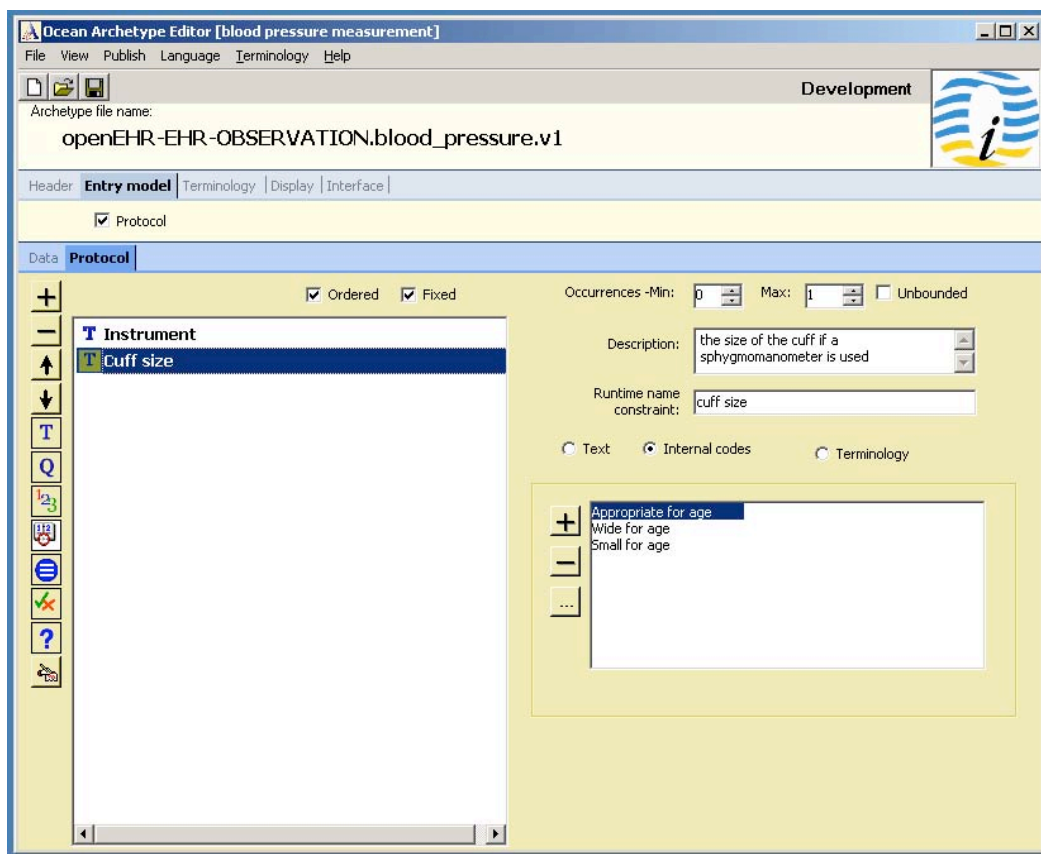
Runtime name constraint: instrument

☐ Text ☐ Internal codes ☒ Terminology

Constraint: instrument type

Description: any valid instrument for the measurement of blood pressure

T Instrument  
 T Cuff size



Ocean Archetype Editor [blood pressure measurement]

File View Publish Language Terminology Help

Archetype file name: openEHR-EHR-OBSERVATION.blood\_pressure.v1

Header Entry model Terminology Display Interface

Terms Term Bindings Constraints Languages & Terminologies


Term definitions			
	Code	Text	Description
▶	at0000	blood pressure measurement	the measurement of systemic arterial blood pressure which is deemed to represent the a
	at1000	blood pressure	systemic arterial blood pressure
	at1100	systolic	the systemic arterial blood pressure in systolic phase
	at1200	diastolic	the systemic arterial blood pressure in diastolic phase
	at2100	patient state	the state of the patient during the measurement(s)
	at2200	position	the position of the patient at the time of measuring the blood pressure
	at3100	Instrument	the instrument used to measure the blood pressure
	at3300	Cuff size	the size of the cuff if a sphygmomanometer is used
	at9000	new item	undescribed new item
	at9001	history	history Structural node
	at9002	baseline reading	baseline event in event history
	at9003	any event	other event in event history
	at9004	list structure	list structure
	at9005	Sitting	The patient is in a sitting position
	at9006	Standing	The patient is standing upright
	at9007	Lying	The patient is lying
	at9009	Position	The position of the patient at the time of measuring blood pressure
	at9010	Standing	Patient standing at the time of blood pressure measurement
	at9011	Sitting	Patient sitting at the time of blood pressure measurement
	at9012	Reclining	Person reclining at 45 degrees at the time of blood pressure measurement
	at9013	Lying	Patient lying flat at the time of blood pressure measurement
	at9014	Exersion level	The level of exetion at the time of taking the measurement
	at9015	Exercise	The classification of the exercise level
	at9016	At rest	The person is at rest and not in the recovery phase from exersion
	at9017	Post-exercise	Measurement is taken immediately after exercise
	at9018	During exercise	The measurement is taken during exercise
	at9019	Appropriate for age	A cuff that is standard for this person's age
	at9020	Wide for age	A cuff that is wider than usual for this age
	at9021	Small for age	A cuff that is small for age



**Ocean Archetype Editor [blood pressure measurement]**

File View Publish Language Terminology Help

Archetype file name: **openEHR-EHR-OBSERVATION.blood\_pressure.v1**

Development 

Header | Entry model | **Terminology** | Display | Interface |

Terms | **Term Bindings** | Constraints | Languages & Terminologies |

Binding terminology: **SNOMED International Clinical Terms, 2002**

**blood pressure measurement**

- history
  - any event
    - blood pressure**
      - diastolic
      - systolic
    - baseline reading
      - blood pressure**
        - diastolic
        - systolic
  - list structure
    - Instrument**
    - Cuff size**
  - [state structure]
    - Position
    - Exercise
    - Exersion level

**Bindings**


**Criteria**

Code: N 163031004

**Ocean Archetype Editor [blood pressure measurement]**

File View Publish Language Terminology Help

Archetype file name: **openEHR-EHR-OBSERVATION.blood\_pressure.v1**

Development 

Header | Entry model | **Terminology** | Display | Interface |

Terms | Term Bindings | **Constraints** | Languages & Terminologies |

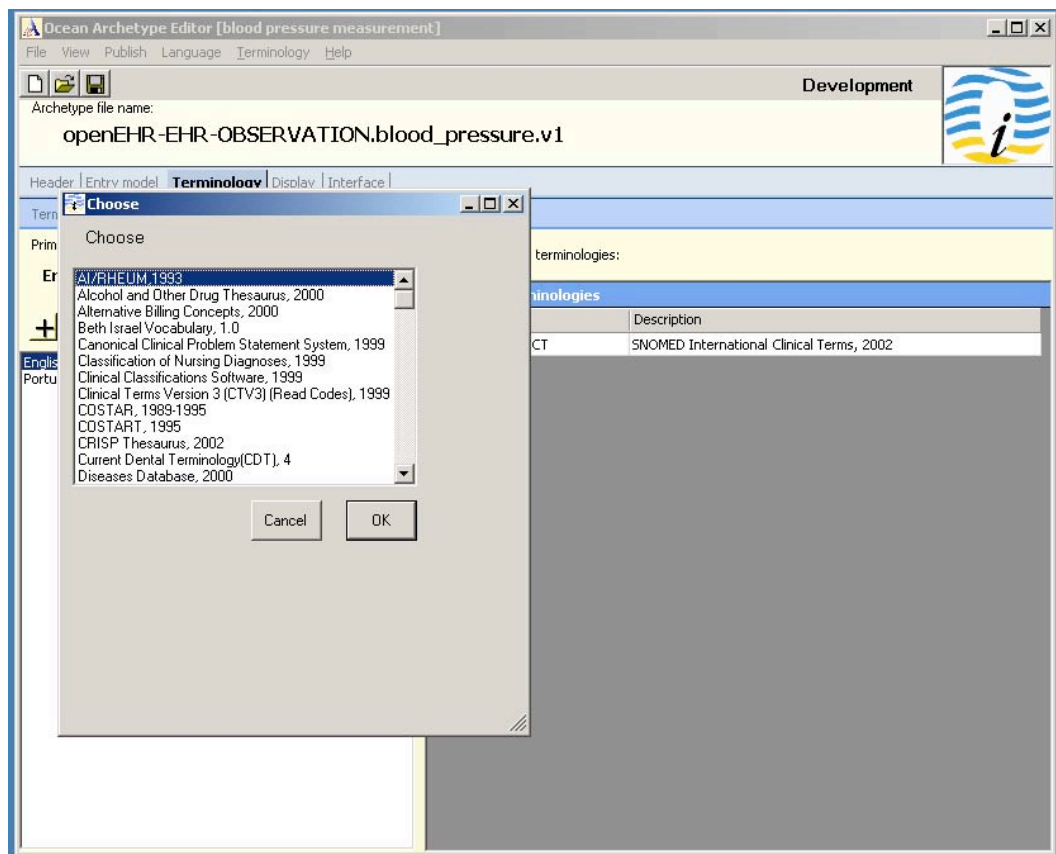
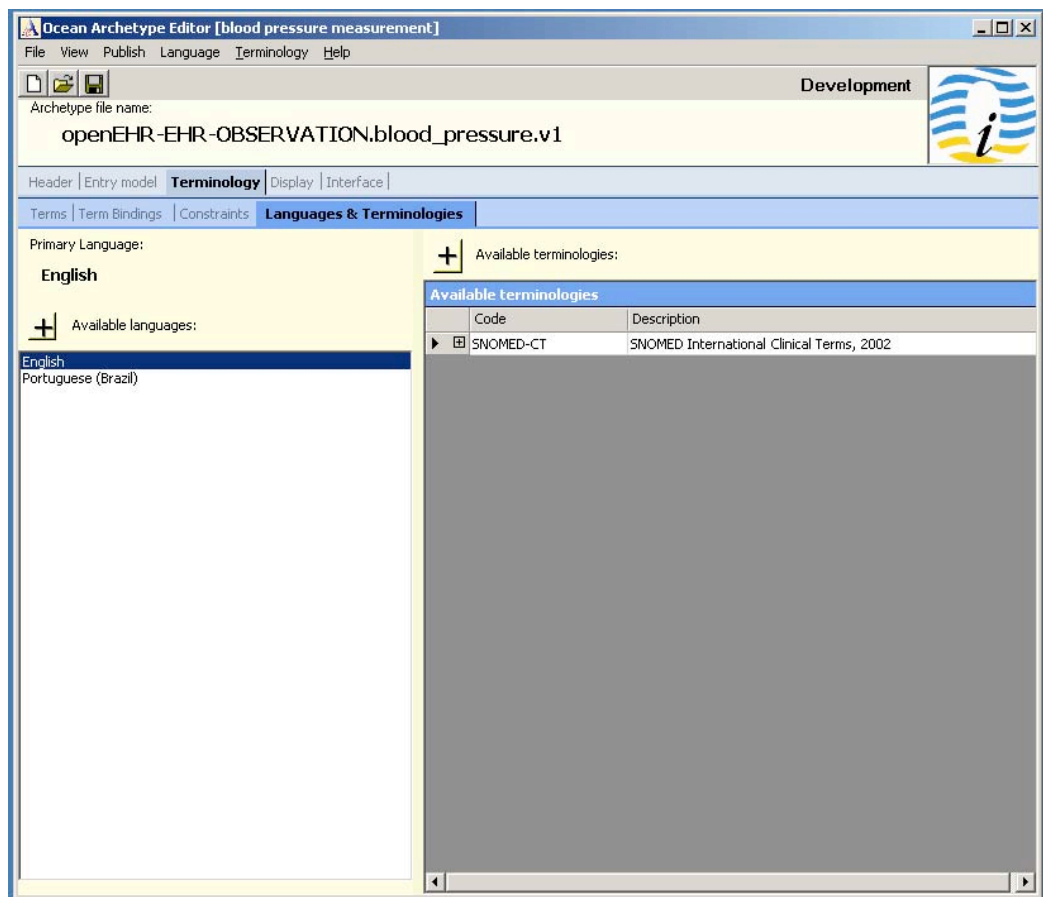
**Constraint definitions**

	Code	Text	Description
▶	ac0001	BP	any synonym of systemic blood pressure
	ac0002	systolic	any synonym of systolic
	ac0003	diastolic	any synonym of diastolic
	ac0005	instrument	any synonym of of instrument
	ac0006	instrument type	any valid instrument for the measurement of blood pressure
	ac0007	position	any synonym of patient position
	ac0008	patient position	lying, reclining, sitting, standing
	ac0009	cuff size	any valid cuff type
	ac0010	BP cuff type	neonatal, infant, child, adult, large adult
*			

**Constraint statements**

Terminology	Query or Group	Release

Constraint statement:



**Ocean Archetype Editor [blood pressure measurement]**

File View Publish Language Terminology Help

Archetype file name: **openEHR-EHR-OBSERVATION.blood\_pressure.v1**

Development

Header | Entry model | Terminology | Display | **Interface**

History

baseline reading

systolic: 0.00 mm[Hg]

diastolic: 0.00 mm[Hg]

State

Position: Sitting

Exersion level: 0.00 3/min

Exercise: At rest

Protocol

Instrument: instrument type

Cuff size:

**Ocean Archetype Editor [blood pressure measurement]**

File View Publish Language Terminology Help

Available languages

Add language

Change language

English

Portuguese (Brazil)

Archetype file name: **openEHR-EHR-OBSERVATION.blood\_pressure.v1**

Development

Header | Entry model | Terminology | Display | **Interface**

History

baseline reading

systolic: 0.00 mm[Hg]

diastolic: 0.00 mm[Hg]

State

Position: Sitting

Exersion level: 0.00 3/min

Exercise: At rest

Protocol

Instrument: instrument type

Cuff size:

**Ocean Archetype Editor [medida da pressão arterial]**

File View Publish Language Terminology Help

Archetype file name: **openEHR-EHR-OBSERVATION.blood\_pressure.v1**

Development

Header | Entry model | Terminology | Display | **Interface**

History

leitura basal

sistólica: 0.00 mm[Hg]

diastólica: 0.00 mm[Hg]

State

posição: sentado

grau de exercício: 0.00 1/min

exercício: em repouso

Protocol

instrumental: tipo de instrumento

dimensão do manguito:

**Ocean Archetype Editor [medida da pressão arterial]**

File View Publish Language Terminology Help

Archetype file name: **openEHR-EHR-OBSERVATION.blood\_pressure.v1**

Development

Header **Entry model** Terminology | Display | Interface |

☒ Protocol

**Data** | Protocol |

☒ Event History ☒ Person State

List | Events **Person state**

☒ Ordered ☒ Fixed

Occurrences -Min: 0 Max: 1 ☐ Unbounded

Description: posição do paciente durante a medida

Runtime name constraint:

☐ Text ☒ Internal codes ☐ Terminology

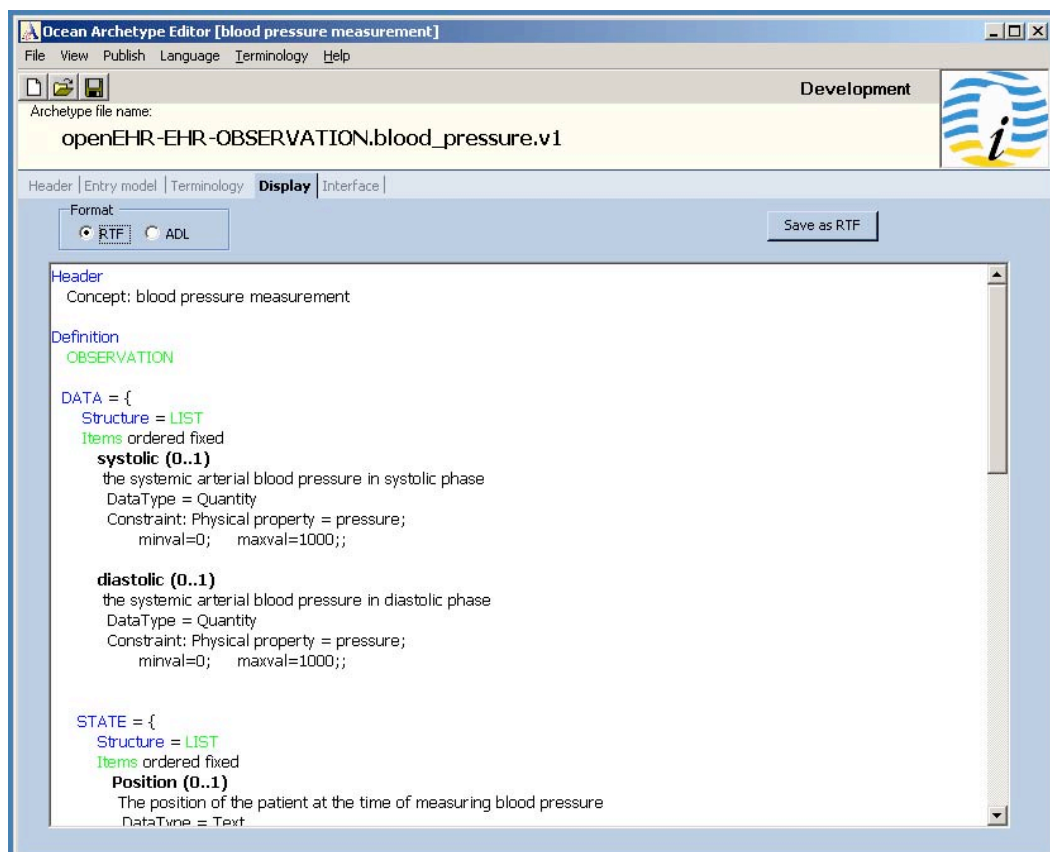
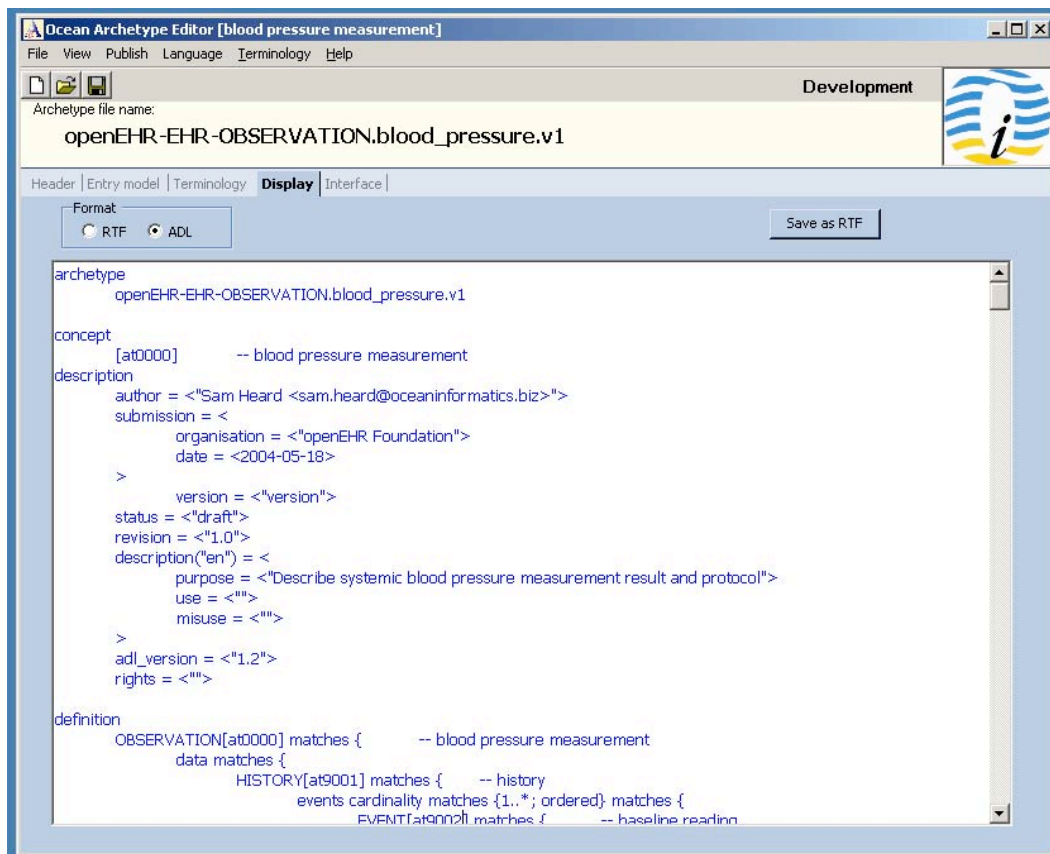
de pé  
sentado  
reclinado  
deitado

Set assumed value: **sentado**

posição

Q grau de exercício

T exercício



```

Header
Concept: blood pressure measurement

Definition
OBSERVATION

DATA = {
  Structure = LIST
  Items ordered fixed
  systolic (0..1)
    the systemic arterial blood pressure in systolic phase
    DataType = Quantity
    Constraint: Physical property = pressure;
    minval=0;    maxval=1000;;

  diastolic (0..1)
    the systemic arterial blood pressure in diastolic phase
    DataType = Quantity
    Constraint: Physical property = pressure;
    minval=0;    maxval=1000;;

  STATE = {
    Structure = LIST
    Items ordered fixed
    Position (0..1)
      The position of the patient at the time of measuring blood pressure
      DataType = Text
      Constraint: Internal; 'Standing', 'Sitting', 'Reclining', 'Lying'

    Exersion level (0..1)
      The level of exetion at the time of taking the measurement
      DataType = Quantity
      Constraint: Physical property = work;
      minval=0;    maxval=1000;;

    Exercise (0..1)
      The classification of the exercise level
      DataType = Text
      Constraint: Internal; 'At rest', 'Post-exercise', 'During exercise'

  } -- end State

  HISTORY = {
    baseline reading (1..1)
      - baseline event in event history
      Offset = 0 sec
      Reference = PointInTime

    any event (0..*)
      - other event in event history
      Reference = PointInTime

  } -- end History

} -- end Data

PROTOCOL = {
  Structure = LIST
  Items ordered fixed
  Instrument (0..1)
    the instrument used to measure the blood pressure
    DataType = Text
    Constraint: Terminology; instrument type

  Cuff size (0..1)
    the size of the cuff if a sphygmomanometer is used
    DataType = Text
    Constraint: Internal; 'Appropriate for age', 'Wide for age', 'Small for age'

} -- end Protocol

```

```

archetype
openEHR-EHR-OBSERVATION.blood_pressure.v1

concept
[at0000] -- blood pressure measurement
description
author = <"Sam Heard <sam.heard@oceaninformatics.biz>">
submission = <
  organisation = <"openEHR Foundation">
  date = <2004-05-18>
>
  version = <"version">
status = <"draft">
revision = <"1.0">
description("en") = <
  purpose = <"Describe systemic blood pressure measurement result and protocol">
  use = <" ">
  misuse = <" ">
>
adl_version = <"1.2">
rights = <" ">

definition
OBSERVATION[at0000] ∈ { -- blood pressure measurement
  data ∈ {
    HISTORY[at9001] ∈ { -- history
      events cardinality ∈ {1..*; ordered} ∈ {
        EVENT[at9002] ∈ { -- baseline reading
          offset ∈ {P0s}
          data ∈ {
            List[at1000] ∈ { -- blood pressure
              items cardinality ∈ {0..1; ordered} ∈ {
                ELEMENT[at1100] occurrences ∈ {0..1} ∈ { -- systolic
                  runtime_label ∈ {
                    CODED_TEXT ∈ {
                      code ∈ {[ac0002]} -- systolic
                    }
                  }
                  value ∈ {
                    C_QUANTITY <
                      property = <"pressure">
                      list("1") = <
                        units = <"mm[Hg]">
                        magnitude = <[0.0..1000.0]>
                      >
                    >
                  }
                }
              }
            }
          ELEMENT[at1200] occurrences ∈ {0..1} ∈ { -- diastolic
            runtime_label ∈ {
              CODED_TEXT ∈ {
                code ∈ {[ac0003]} -- diastolic
              }
            }
            value ∈ {
              C_QUANTITY <
                property = <"pressure">
                list("1") = <
                  units = <"mm[Hg]">
                  magnitude = <[0.0..1000.0]>
                >
              >
            }
          }
        }
      }
    }
  }
  EVENT[at9003] occurrences ∈ {0..*} ∈ { -- any event
    data ∈ {
      use_node List [at0000]/data[at9001]/events[at9002]/data[at1000]/
    }
  }
}
}

state ∈ {
  List[at9008] ∈ { -- state structure
    items cardinality ∈ {0..1; ordered} ∈ {
      ELEMENT[at9009] occurrences ∈ {0..1} ∈ { -- Position
        value ∈ {
          CODED_TEXT ∈ {
            code ∈ {
              [local::
                at9010, -- Standing
                at9011, -- Sitting
                at9012, -- Reclining
                at9013] -- Lying
            }
            assumed_value ∈ {"at9011"}
          }
        }
      }
    }
  }
  ELEMENT[at9014] occurrences ∈ {0..1} ∈ { -- Exersion level
    value ∈ {
      C_QUANTITY <
        property = <"work">
        list("1") = <
          units = <"J/min">
          magnitude = <[0.0..1000.0]>
        >
      >
    }
  }
}
}

```





```

>
items("at9004") = <
  description = <"list structure">
  text = <"list structure">
>
items("at9005") = <
  description = <"The patient is in a sitting position">
  text = <"Sitting">
>
items("at9006") = <
  description = <"The patient is standing upright">
  text = <"Standing">
>
items("at9007") = <
  description = <"The patient is lying">
  text = <"Lying">
>
items("at9008") = <
  description = <"@ internal @">
  text = <"state structure">
>
items("at9009") = <
  description = <"The position of the patient at the time of measuring blood pressure">
  text = <"Position">
>
items("at9010") = <
  description = <"Patient standing at the time of blood pressure measurement">
  text = <"Standing">
>
items("at9011") = <
  description = <"Patient sitting at the time of blood pressure measurement">
  text = <"Sitting">
>
items("at9012") = <
  description = <"Person reclining at 45 degrees at the time of blood pressure measurement">
  text = <"Reclining">
>
items("at9013") = <
  description = <"Patient lying flat at the time of blood pressure measurement">
  text = <"Lying">
>
items("at9014") = <
  description = <"The level of exertion at the time of taking the measurement">
  text = <"Exertion level">
>
items("at9015") = <
  description = <"The classification of the exercise level">
  text = <"Exercise">
>
items("at9016") = <
  description = <"The person is at rest and not in the recovery phase from exertion">
  text = <"At rest">
>
>

items("at9017") = <
  description = <"Measurement is taken immediately after exercise">
  text = <"Post-exercise">
>
items("at9018") = <
  description = <"The measurement is taken during exercise">
  text = <"During exercise">
>
items("at9019") = <
  description = <"A cuff that is standard for this person's age">
  text = <"Appropriate for age">
>
items("at9020") = <
  description = <"A cuff that is wider than usual for this age">
  text = <"Wide for age">
>
items("at9021") = <
  description = <"A cuff that is small for age">
  text = <"Small for age">
>
>
term_definitions("pt-br") = <
  items("at0000") = <
    description = <"medida considerada representativa da pressão arterial sistêmica">
    text = <"medida da pressão arterial">
  >
  items("at1000") = <
    description = <"pressão arterial sistêmica">
    text = <"pressão arterial">
  >
  items("at1100") = <
    description = <"pressão arterial sistêmica na fase sistólica">
    text = <"sistólica">
  >
  items("at1200") = <
    description = <"pressão arterial sistêmica na fase diastólica">
    text = <"diastólica">
  >
  items("at2100") = <
    description = <"condições do paciente durante a medida">
    text = <"condições do paciente">
  >
  items("at2200") = <
    description = <"posição do paciente durante a medida">
    text = <"posição">
  >
  items("at3100") = <
    description = <"tipo do instrumento utilizado para medir a pressão">
    text = <"instrumental">
  >
  items("at3300") = <
    description = <"dimensão do manguito se o esfigmomanômetro foi utilizado">

```

```

    text = <"dimensão do manguito">
  >
  items("at9000") = <
    description = <"item novo ainda não descrito">
    text = <"novo item">
  >
  items("at9001") = <
    description = <"nodo estrutural do histórico">
    text = <"histórico">
  >
  items("at9002") = <
    description = <"leitura basal no evento histórico">
    text = <"leitura basal">
  >
  items("at9003") = <
    description = <"**">
    text = <"qualquer evento">
  >
  items("at9004") = <
    description = <"estrutura de lista">
    text = <"estrutura de lista">
  >
  items("at9005") = <
    description = <"**">
    text = <"sentado">
  >
  items("at9006") = <
    description = <"**">
    text = <"de pé">
  >
  items("at9007") = <
    description = <"**">
    text = <"deitado">
  >
  items("at9008") = <
    description = <"**@ internal @(en)">
    text = <"*state structure(en)">
  >
  items("at9009") = <
    description = <"posição do paciente durante a medida">
    text = <"posição">
  >
  items("at9010") = <
    description = <"paciente de pé durante a medida">
    text = <"de pé">
  >
  items("at9011") = <
    description = <"paciente sentado durante a medida">
    text = <"sentado">
  >
  items("at9012") = <
    description = <"paciente reclinado a 45 graus durante a medida">
    text = <"reclinado">
  >
  items("at9013") = <
    description = <"paciente em decubito dorsal durante a medida">
    text = <"deitado">
  >
  items("at9014") = <
    description = <"grau de exercicio durante a medida">
    text = <"grau de exercicio">
  >
  items("at9015") = <
    description = <"classificação do nível de exercicio">
    text = <"exercicio">
  >
  items("at9016") = <
    description = <"o paciente está em repouso e não em fase de recuperação">
    text = <"em repouso">
  >
  items("at9017") = <
    description = <"medida tomada imediatamente após o exercicio">
    text = <"pós-exercicio">
  >
  items("at9018") = <
    description = <"medida tomada durante exercicio">
    text = <"durante o exercicio">
  >
  items("at9019") = <
    description = <"manguito apropriado para a idade">
    text = <"padrão para a idade">
  >
  items("at9020") = <
    description = <"manguito muito longo para a idade">
    text = <"longo para a idade">
  >
  items("at9021") = <
    description = <"manguito muito curto para a idade">
    text = <"curto para a idade">
  >
  >
constraint_definitions("en") = <
  items("ac0001") = <
    description = <"any synonym of systemic blood pressure">
    text = <"BP">
  >
  items("ac0002") = <
    description = <"any synonym of systolic">
    text = <"systolic">
  >
  items("ac0003") = <
    description = <"any synonym of diastolic">
    text = <"diastolic">
  >
  items("ac0005") = <

```

```

        description = <"any synonym of of instrument">
        text = <"instrument">
    >
    items("ac0006") = <
        description = <"any valid instrument for the measurement of blood pressure">
        text = <"instrument type">
    >
    items("ac0007") = <
        description = <"any synonym of patient position">
        text = <"position">
    >
    items("ac0008") = <
        description = <"lying, reclining, sitting, standing">
        text = <"patient position">
    >
    items("ac0009") = <
        description = <"any valid cuff type">
        text = <"cuff size">
    >
    items("ac0010") = <
        description = <"neonatal, infant, child, adult, large adult">
        text = <"BP cuff type">
    >
>
constraint_definitions("pt-br") = <
    items("ac0001") = <
        description = <"qualquer sinônimo para a pressão arterial sistêmica">
        text = <"PA">
    >
    items("ac0002") = <
        description = <"qualquer sinônimo para a pressão sistólica">
        text = <"sistólica">
    >
    items("ac0003") = <
        description = <"qualquer sinônimo para a pressão diastólica">
        text = <"diastólica">
    >
    items("ac0005") = <
        description = <"qualquer sinônimo para o instrumento">
        text = <"instrumento">
    >
    items("ac0006") = <
        description = <"qualquer instrumento válido para a medida da pressão arterial">
        text = <"tipo de instrumento">
    >
    items("ac0007") = <
        description = <"qualquer sinônimo para a posição do paciente">
        text = <"posição">
    >
    items("ac0008") = <
        description = <"deitado, reclinado, sentado, de pé">
        text = <"posição do paciente">
    >
>

    items("ac0009") = <
        description = <"qualquer tamanho válido de manguito">
        text = <"tamanho do manguito">
    >
    items("ac0010") = <
        description = <"neonatal, bebê, criança, adulto de compleição medio, adulto de compleição acima da média">
        text = <"tipo de manguito para PA">
    >
>
term_binding("SNOMED-CT") = <
    items("at0000") = <[SNOMED-CT(2003)::163020007]>
    items("at1000") = <[SNOMED-CT(2003)::364090009]>
    items("at1100") = <[SNOMED-CT(2003)::163030003]>
    items("at1200") = <[SNOMED-CT(2003)::163031004]>
    items("at2200") = <[SNOMED-CT(2003)::246273001]>
    items("at3100") = <[SNOMED-CT(2003)::57134006]>
    items("at3300") = <[SNOMED-CT(2003)::246153002]>
>
constraint_binding("SNOMED-CT") = <
    items("ac0001") = <query("terminology", "terminology_id = SNOMED-CT; synonym_of [163020007]")>
    items("ac0002") = <query("terminology", "terminology_id = SNOMED-CT; synonym_of [163030003]")>
    items("ac0003") = <query("terminology", "terminology_id = SNOMED-CT; synonym_of [163031004]")>
    items("ac0005") = <query("terminology", "terminology_id = SNOMED-CT; synonym_of [57134006]")>
    items("ac0006") = <query("terminology", "terminology_id = SNOMED-CT; has_relation [102002] with_target [57134006]")>
    items("ac0007") = <query("terminology", "terminology_id = SNOMED-CT; synonym_of [246273001]")>
    items("ac0008") = <query("terminology", "terminology_id = SNOMED-CT; has_relation [102002] with_target [246273001]")>
    items("ac0009") = <query("terminology", "terminology_id = SNOMED-CT; synonym_of [246153002]")>
    items("ac0010") = <query("terminology", "terminology_id = SNOMED-CT; has_relation [102002] with_target [246153002]")>
>

```

# Archetype Definition Language (ADL) - an Introduction

Slides prepared by Thomas Beale  
Ocean Informatics, Australia  
*www.OceanInformatics.biz*



Presented by David Lloyd  
Chime at UCL  
*www.chime.ucl.ac.uk*

*openEHR* Foundation – <http://www.openEHR.org>



## Archetype Definition Language (ADL) - an Introduction

Slides prepared by Thomas Beale  
Ocean Informatics, Australia  
[www.OceanInformatics.biz](http://www.OceanInformatics.biz)

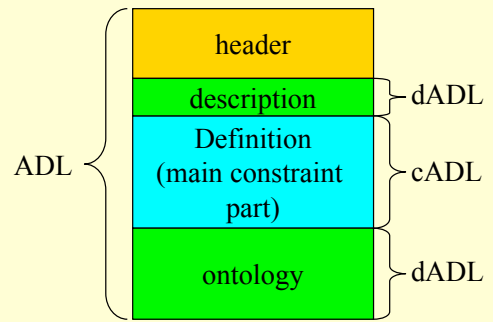


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openEHR Foundation – <http://www.openEHR.org>

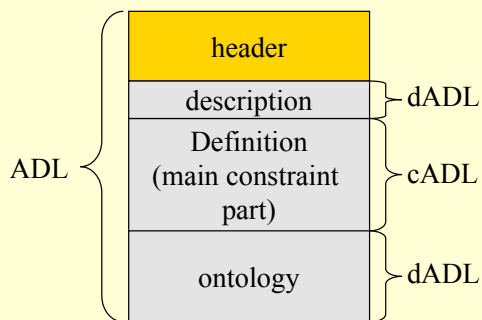


## ADL Document Structure



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## ADL Header



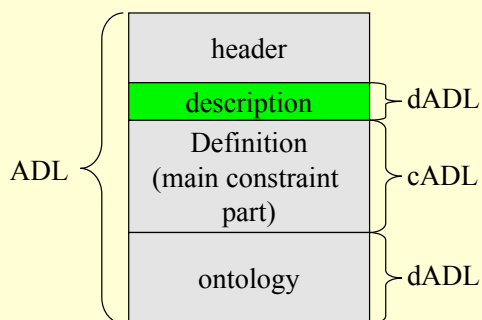
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## Header

```
archetype
    some.archetype.id
specialises
    some.parent_arch.id
concept
    [at0000] -- term
```

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## ADL Description



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## Description (the meta-data)

```
description
author = <"Sam Heard <s.heard@littlerock.com>">
submission = <
    organisation = <"WHO">
    date = <2003-12-20>
>
version = <"1.0">
status = <"draft">
revision = <"1.0">
description("en") = <
    purpose = <"Problem diagnosis evaluation">
    use = <"diagnosis description ..">
    misuse = <"differential diagnosis">
>
adl_version = <"1.0">
rights = <"© 2004 World Health Organisation">
```

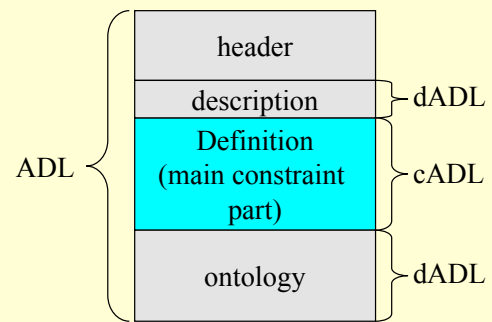
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## Description continued...

- Actual model will conform to HL7 templates meta-data / Dublin Core, except that languages are supported properly
- ADL does not dictate the meta-data model

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## ADL Definition



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## Definition Section

- Main constraint definition of archetype
- Based on some reference model
- Syntax based on sets
- Completely compatible with UML object meta-model
- Convertible to various formats
- Uses OCL for invariants

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## Definition - overview

### definition

```
TYPE_1 ∈ {
  attr_1 ∈ {
    TYPE_2 ∈ {
      attr_a ∈ {yyyy-mm-??}
      attr_b ∈ {|0.5..0.75|}
    }
  }
}
```

- Each occurrence of  $XXXX \in \{\text{constraint}\}$  is a specification of an *instance space* that the constrained data must fit into at runtime

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## Definition – node identifiers

```
TYPE_1[at0002] ∈ {
  attr_1 ∈ {
    TYPE_2[at0005] ∈ {
      attr_a ∈ {yyyy-mm-??}
      attr_b ∈ {|0.5..0.75|}
    }
  }
}
```

- Node identifiers:
  - provide the domain meaning to each node
  - Are the basis of paths (multi-lingual & machine-processable)
  - Enable archetype nodes to be recorded in data
  - Defined in the ontology

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## Definition – existence

```
ELEMENT[at0002] ∈ {
  value existence ∈ {0..1} ∈ {
    QUANTITY ∈ {...}
  }
}
```

- Specify existence for attributes: 0..1, 1..1 (I.e. optional or mandatory)
- Defaults to 1..1

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## Definition – cardinality

```
LIST[at0002] ∈ {
  items cardinality ∈ {2..*} ∈ {
    ELEMENT[at0005] ∈ {..} -- systolic
    ELEMENT[at0006] ∈ {..} -- diastolic
    ELEMENT[at0099] ∈ {..} -- any
  }
}
```

- Specify cardinality to indicate container attributes
- Existence possible as well: means – does container exist at all (even empty)?

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## Definition – occurrences

```
LIST[at0002] ∈ {
  items cardinality ∈ {2..*} ∈ {
    ELEMENT[at0005] occurrences ∈ {1..1} ∈ {..}
    ELEMENT[at0006] occurrences ∈ {0..1} ∈ {..}
    ELEMENT[at0099] occurrences ∈ {0..*} ∈ {..}
  }
}
```

- Occurrences indicates how many times a data element conforming to an archetype block may occur
- Default: 1..1

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## Definition – basic leaf constraints

```
TEST[at0002] ∈ {
  string_attr1 ∈ {"something"}
  string_attr2 ∈ {/this|that|something else/}
  string_attr3 ∈ {/cardio.* /}

  string_attr4 ∈ {[ac0045]} -- see ontology

  boolean_attr1 ∈ {True}
  boolean_attr2 ∈ {False}
  boolean_attr3 ∈ {True, False}
}
```

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## Definition – basic leaf constraints

```
TEST[at0002] ∈ {
  integer_attr1 ∈ {55} -- treated as an interval
  integer_attr2 ∈ {55, 75, 100}
  integer_attr3 ∈ {|0..100|}
  integer_attr4 ∈ {|>= 10|}

  real_attr1 ∈ {0.0}
  real_attr2 ∈ {1.0, 2.0, 3.0}
  real_attr3 ∈ {|0.0..100.0|}
  real_attr4 ∈ {|>= 10.0|}
  real_attr5 ∈ {|-10.0..-5.0|}
}
```

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## Definition – date/time leaf constraints

```
TEST[at0002] ∈ {
  date_attr1 ∈ {yyyy-mm-dd}
  date_attr2 ∈ {yyyy-?-??}
  date_attr3 ∈ {yyyy-mm-??}
  date_attr4 ∈ {yyyy-?-XX}
  date_attr5 ∈ {1983-12-25}
  date_attr6 ∈ {2000-01-01}

  time_attr1 ∈ {hh:mm:ss}
  time_attr2 ∈ {hh:mm:XX}
  time_attr3 ∈ {hh:?:XX}
  time_attr4 ∈ {hh:?:??}
  time_attr5 ∈ {22:00:05.0}
}
```

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## Definition – date/time leaf constraints

```
TEST[at0002] ∈ {
  date_time_attr1 ∈ {yyyy-mm-dd hh:mm:ss}
  date_time_attr2 ∈ {yyyy-mm-dd hh:mm:??}
  date_time_attr3 ∈ {yyyy-mm-dd hh:mm:XX}
  date_time_attr4 ∈ {yyyy-mm-dd hh:?:XX}
  date_time_attr5 ∈ {yyyy-?-?? ??:?:??}
  date_time_attr6 ∈ {1983-12-25 22:00:05.0}

  duration_attr1 ∈ {P0s}
  duration_attr2 ∈ {P1d}
  duration_attr3 ∈ {P2h5m}
  duration_attr4 ∈ {|P1h55m..P2h5m|}
  duration_attr5 ∈ {|<= P1h|}
}
```

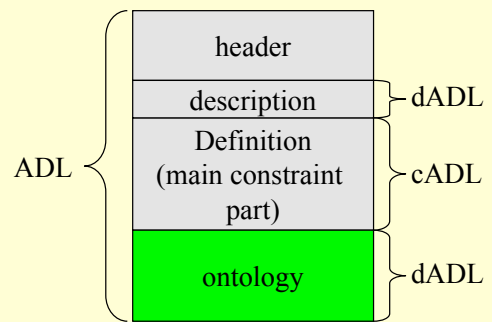
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## Definition – invariants

```
TEST[at0002] ∈ {
  attr1 ∈ {
    QUANTITY ∈ {
      value ∈ {0..100}
    }
  }
  attr2 ∈ {
    QUANTITY ∈ {
      value ∈ {0..100}
    }
  }
  invariant
    attr1/value >= attr2/value
}
```

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## ADL Ontology



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## Ontology Section

- Contains local term definitions and bindings
- Managable in size
- Translations can be added without affecting main constraint definition
- Cost-effective to translate (cf all of snomed)
- Optional bindings, but not necessary

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## Ontology - overview

```
primary_language = <"en">
languages_available = <"en", "de">
terminologies_available = <"snomed-ct", "loinc">

term_definitions("en") = <...>
constraint_definitions("en") = <...>
term_binding("en") = <...>
constraint_binding("en") = <...>
```

- Archetype authored in one language
- Translations have to be with respect to primary language (basis of translation)
- Bindings to multiple terminologies supported

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## Ontology – term definitions

```
term_definitions("en") = < -- english
  items("at3121") = <
    text = <"Localised">
    description = <"Extent">
  >
  items("at3122") = <...>
>
term_definitions("tr") = < -- turkish
  items("at3121") = <
    text = <"Lokalize">
    description = <"Yayýlým">
  >
  items("at3122") = <...>
>
```

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## Ontology – constraint definitions

```
constraint_definitions("en") = < -- english
  items("at0005") = <
    text = <"patient position">
    description = <"patient position during BP measurement">
  >
  >
>
```

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## Ontology – term bindings

```
term_binding("loinc") = <
  items("at1000") = <[loinc::700-0]>
items("at1001") = <[loinc::718-7]>
items("at1002") = <[loinc::718-7]>
...
>
term_binding("snomed") = <
  items("at0005") = <[snomed::20093944]>
...
>
```

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## Ontology – constraint definitions

```
constraint_binding("snomed") = <
  items("ac0010") = <query("terminology",
"terminology_id = snomed_ct;
has_relation [102002] -- is-a
with_target [246153002]"-- auto-immune disease
>
```

- Connection between constraints and underlying ontologies
- Language of query not yet defined (others will define it)
- Typically only approximate
- Almost always partial coverage

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## Summary

- ADL Formalism is simple and consistent
- Minor additions for Templates nearly complete
- Tools
  - OS Parsers for ADL, cADL, dADL exist
  - OS GUI archetype editor nearly complete

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# Archetypes and dictionary of concepts in the context of the EHR of G.Pompidou University Hospital (HEGP)

Le Bozec C., Marie E., Ouagne D., Delebecke E., Marin L., Frandji B, P.  
Degoulet  
INSERM ERM 202

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## Plan

- Part 1 The HEGP system
- Part 2 Limits and perspectives
- Part 3 Discussion

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## Context

- Electronic Health Record (EHR)
  - Becoming widely available for clinical storage and data retrieval
- Current limitations
  - Quality of clinical information
  - Availability, understandability
  - Ability to support knowledge-based clinical decision-support, data retrieval and aggregation
- Structuration, standardization, interoperability
  - Semantic interoperability

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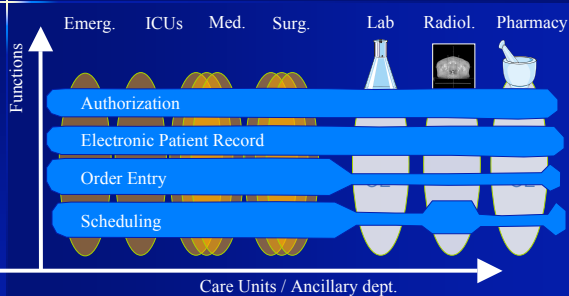
## Georges Pompidou European Hospital (HEGP) : Key figures

- Number of staffed acute beds 730
- Mean number of inpatient admissions/month 4,000
- Number outpatients visits/month 20,000
- Number of nurses 1,200
- Number of physicians 400
- Number of care units using HIS 40
- Number of units producing digital images 7
- Number of PCs 1,800
- Number of wireless PCs 80
- Number of modalities connected to the PACS 35

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## HEGP : A component based HIS



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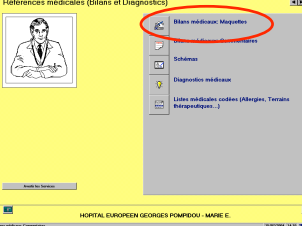
## HEGP : A component based HIS

Client	Patient Portal : DOM-H® - (Thales®)	CCOW Manager : (Thales®)
<b>Care Components</b> ADT : IMS® - (Medasys®) OE / EHR : DxC@re® (Medasys®) Scheduling : One-Call® (PerSé Technologies®) Image Viewer : Web 1000® - (Agfa®)	<b>Generic Components</b> Security : THALIS- Sec.® (Thales®) References : THALIS Ref.® (Thales®) Supervision : THALIS-Supervisor® (Thales®) Data asynchronous exchange CORBA (Iona®)	<b>Ancillary Dept.</b> RIS : RADOS® (Philips®) PACS : IMPAX® (Agfa®) Labs : NetLab® - APIX® (Medasys®) Pharmacy : Phedra (SIB)

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EHR : DxC@re® (Medasys)  
Questionnaire editor



- Questionnaire editor
- Free commentary editor
- Schemas editor
- Diagnoses
- Coded reference terminologies

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## Questionnaire editor

[illegible]

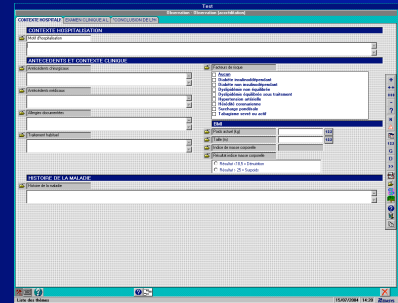
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Questionnaire editor  
IHM designer



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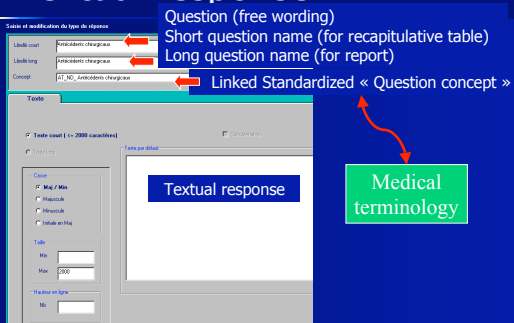
Questionnaire editor  
IHM preview



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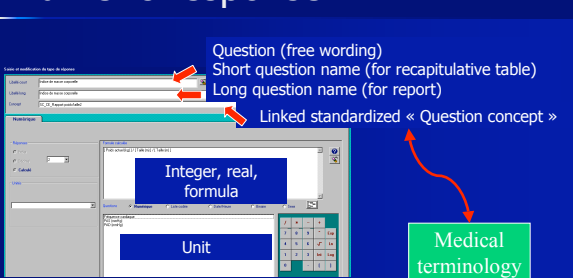
## Questionnaire editor

### Textual response



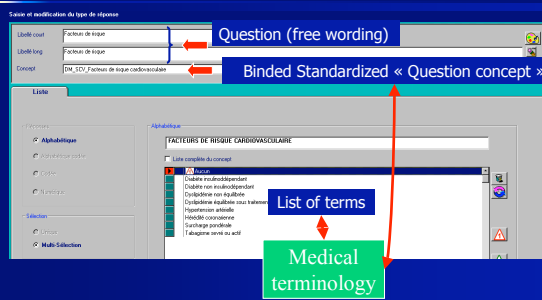
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Questionnaire editor  
Numeric response



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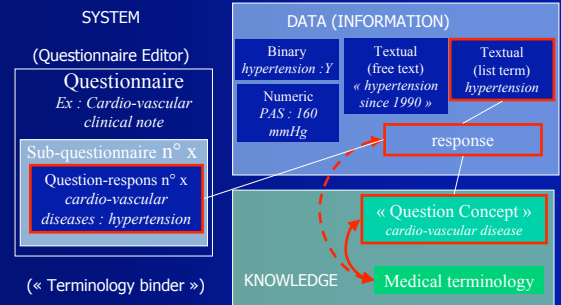
## Questionnaire editor Textual response : list



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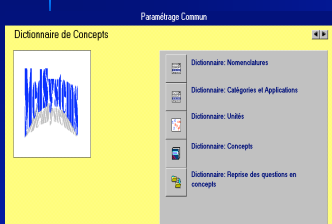
## Questionnaire editor Link information/knowledge



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## EHR : DxC@re® (Medasys) Dictionary of question-concept

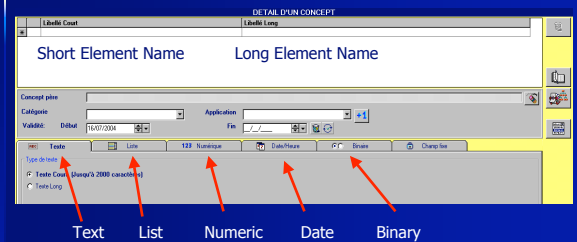


- Reference terminologies
- Main categories of concepts
- Units
- Concept dictionary
- Binding question and concepts

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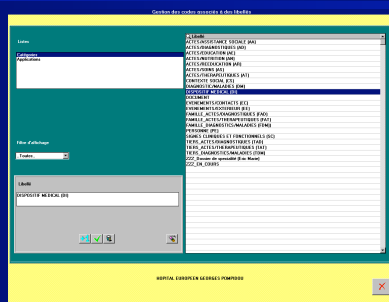
## Concept definition



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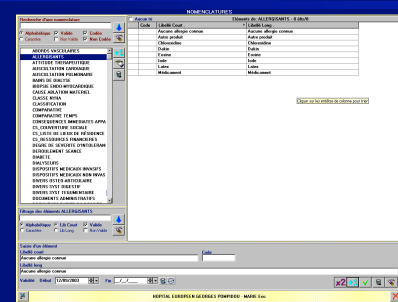
## 22 main categories of concepts (SNOMED)



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## Shared reference terminologies References: THALIS Ref® (Thales)



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## Questionnaires Key figures

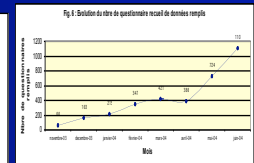
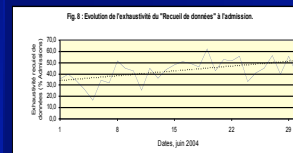
- Questionnaires : 463
  - Medical :
  - Other healthcare providers :
- Questions : 4700
- Question-concepts : 2087
  - 33% binary, 28% free text, 17% list, 12% numeric
  - reused question-concepts : 10%

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## Questionnaires : utilization

- Questionnaire-based documents
  - Medical : 51 947
  - Other healthcare providers : 35 789
- Exhaustiveness : from 45 to 100%



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## Plan

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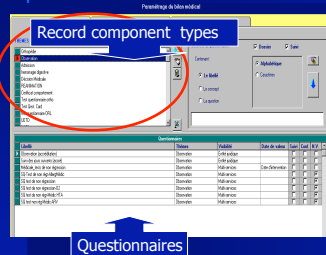
## Objectives

- Interoperability oriented Structured data
  - Questionnaires based on archetypes (Questionnaire Editor)
- Linked to terminologies
  - Extending an existing concept dictionary for questions (Concept Editor)
  - Reference terminologies
    - SNOMED CT, FMA
- Data retrieval

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## Questionnaire editor Questionnaires grouped by record component type



- Extract
- Composition
- Section
- Entry
  - Evaluation
  - Observation
  - Instruction

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## Questionnaire editor/dictionary of concepts - Limits

- Interoperability
  - No reuse of sub-questionnaires
  - No questionnaire sharing between sites
  - No questionnaire specialization
- Link to terminology
  - Link question concept – terminology
  - Link data (responses) to terminology ?
    - List element : OK
    - Binary : +/-
    - Text, numeric ?

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## Link data (responses) to terminology

Type	Question	response	Data	Medical concept	Perspective
List	e.g : « Cardio-vascular disease »	- Angor - IDM - HTA etc	HTA	Hypertension (response)	
	e.g « Pain degree »	- Important - Moderate - Low	Pain degree : important	Important degree of pain (question-response)	Question-response
Binary	e.g « HTA ? »	- Yes - No	HTA : No	No hypertension	Question-response

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## Link data (responses) to terminology

Type	Question	response	Data	Medical concept	Perspective
Numeric	Ex : «Diastolic Blood Pressure »	105 mmHg	DBP : 105 mmHg	Hypertension (response)	Rules ?
Text	Eg : « Cardio-vascular disease »	Free text Ex : « HTA since 1990 »	HTA	Hypertension (element of the response)	NLP?

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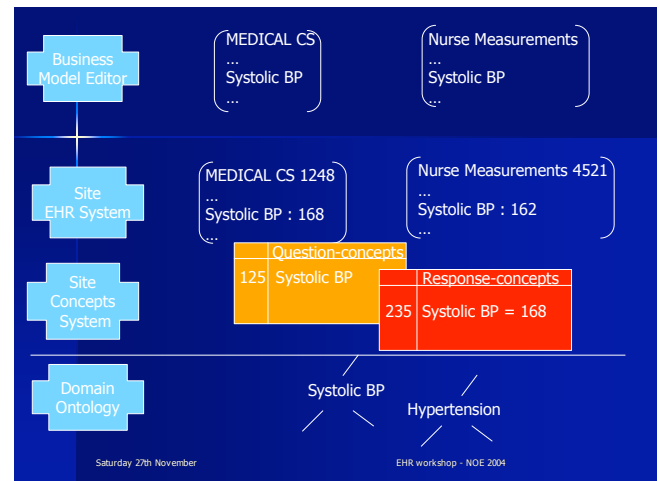
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## Part 3 Discussion

- Wide live exploitation of EHR in George Pompidou University Hospital
  - Concepts include “Question concepts” and “Response concepts”
  - Dictionary of “Question concepts”
- Limits of actual system
  - Link with ontologies
  - Questionnaire’s based EHR vs Interoperability Archetypes

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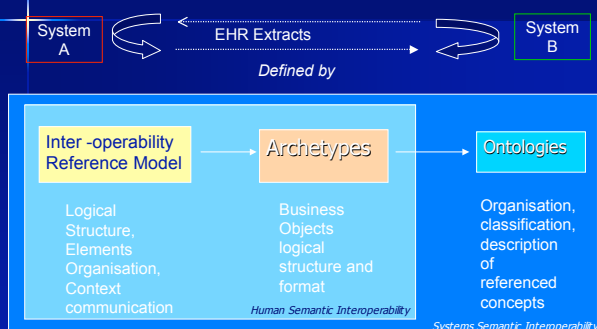
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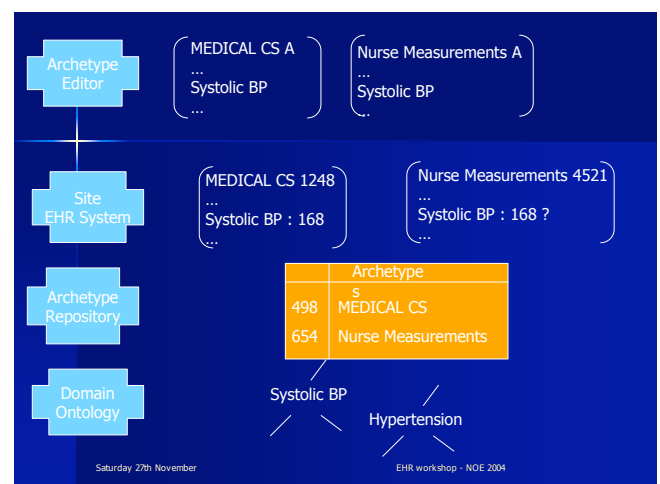
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## EHR interoperability :



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**[www.openehr.org/education/SemanticMiningNov2004.htm](http://www.openehr.org/education/SemanticMiningNov2004.htm)**