

openEHR

openEHR Architecture and Model



Thomas Beale

Copenhagen
May 19/20 2008



openEHR

Our Message

Without an integrated, adaptive engineering design framework, our efforts to solve e-health problems by choosing standards, using terminology and buying solutions will probably fail.

What are the characteristics of this framework?

Can it be implemented?

Can we afford to use it?

Can we afford not to use it?



© Ocean Informatics 2007



We need to think a little bit...



© Ocean Informatics 2007



Requirements

There are 100s of clinical requirements...

What are the key ones today?

In much of Europe:

- Shared care (shared information)
- Mobile patients (web-available information)
- Preventative & personalised health (computable information, longitudinal EHR)
- Wellness (EHR target for new data sources)
- Patient access to EHR
- Medical research (computable information)



© Ocean Informatics 2007



The Key Technical Requirements

Semantic interoperability:

how do *different pieces of software* know what the data mean?

Patient-centric view: how to build a patient-centric longitudinal EHR *across enterprises*?

- For decision support, Care pathways, Medical research

Continual change and complexity:

how to build systems that *keep up with reality* and don't cost too much?



© Ocean Informatics 2007



1 - Semantic Interoperability

An e-health environment needs to establish *common meaning* of data everywhere

It's no use knowing what the meaning is in *one* place; it must be known from data capture to *all* users, and *all the plumbing* in between...

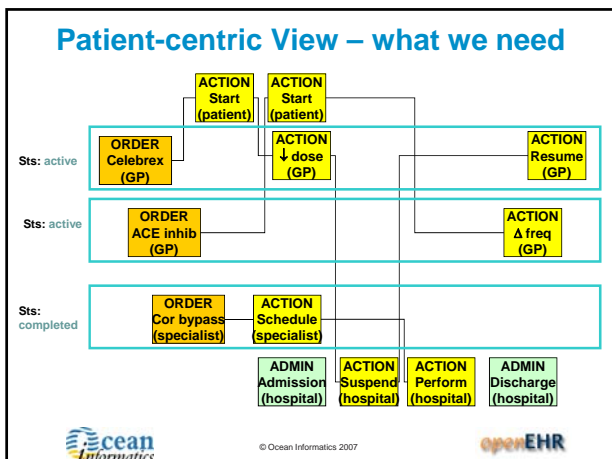
We need *end-to-end semantic coherence*

Meaning = structure + context + semantics



© Ocean Informatics 2007





Main Challenge

Information distributed across enterprises:

- Medications list & status of each
- Problem list
- Allergies & alerts

Getting these aggregated and synchronised is a challenge... relying on the patient is unsafe, so the ICT needs to do it

Which means a framework that supports auditing, versioning and assisted merging

© Ocean Informatics 2007

- ### 3 - Change and Complexity
- Snomed-ct has 500,000 concepts & 1,000,000 relationships.... *and is under continual heavy revision*
 - ICD10 has 75,000 conditions... *and ICD11 is on the way...*
 - There are *no standards for questions* on most hospital forms
 - There are *500 common lab tests*, many changing, new ones emerging
 - Hospital *business processes* changing...
- © Ocean Informatics 2007

Challenge

The need here is to find a framework that is based on the assumption that the information and workflows keep changing over time, in ways we cannot predict today.

Therefore we have to have a platform – something that supports any specific architecture for information, workflow, distribution, business rules, privacy and so on...

© Ocean Informatics 2007

What not to do...

Specify a whole lot of standards (and hope for the best)

Buy a whole lot of solutions (and hope for the best)

Why?

We get an inflexible, non-integrated environment, same as today...

© Ocean Informatics 2007



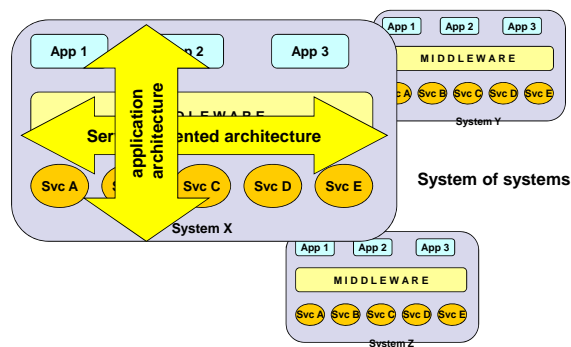
The openEHR Architecture (it's a meta-architecture)



© Ocean Informatics 2007



Overview



© Ocean Informatics 2007



Service & System architecture

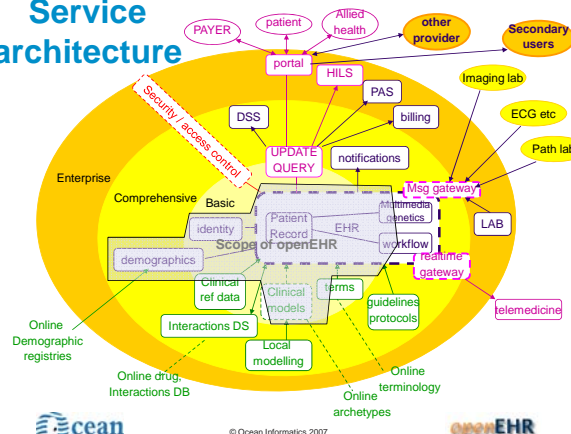
- Service interfaces being defined with HSSP
- Distributed versioning and merging
- Digital signing
- Distributed access control rules CEN 13606



© Ocean Informatics 2007



Service architecture



© Ocean Informatics 2007



Flexible Application Architecture

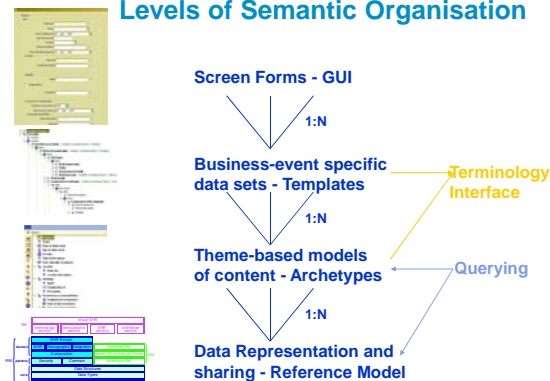
- 4 levels of organisation of information sharing same semantics:
- The cognitive user interface – flexible approach to data capture and viewing
 - The data capture sets for each event in a business process, e.g. patient journey through ED
 - Standardised semantics of the data points in data capture sets
 - Standardised data representation, enabling interoperability
- Standardised querying capability
Standardised interface to terminology for inferencing
... 'BP' must have the same meaning everywhere!



© Ocean Informatics 2007



Levels of Semantic Organisation



© Ocean Informatics 2007



In other words....

It is not just about what is 'on the wire' between two systems....

A message-based approach to semantic interoperability will be largely deficient in the semantics of data capture, definition, re-use and querying.

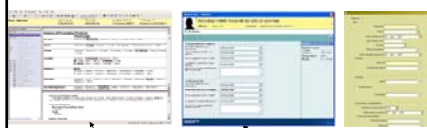
We must think about what is in the application 'stack'



© Ocean Informatics 2007



GUI & Templates



The cognitive User interface: Different ways of Presenting & Capturing the Same information



Logical data-sets: Achieved by templates That re-use and Organise underlying Standardised data Points according to Business process event



© Ocean Informatics 2007



Templates & Archetypes



Logical data sets: Templates – using only Selected items from a Number of archetypes

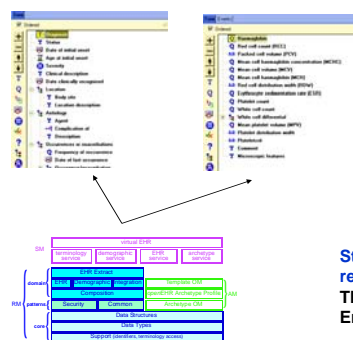
Standardised models of The data: Achieved by archetypes Organised by topic, Independent of use



© Ocean Informatics 2007



Archetypes and Reference Model



Standardised clinical models of the data: Archetypes – all based On same reference model

Standardised technical representation of the data: The reference model – Enables interoperability



© Ocean Informatics 2007



Why Current Health Information Systems don't solve the problem



They have a form-builder



Possibly a library of 'elements'



And only SQL, against The proprietary database

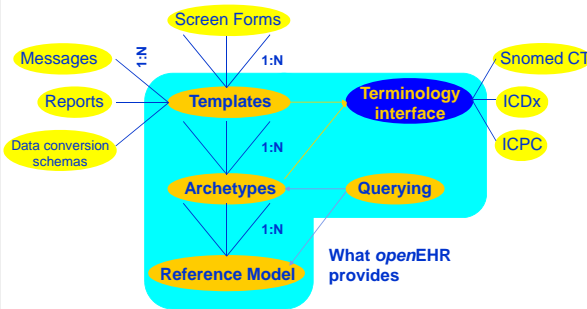
And a proprietary database



© Ocean Informatics 2007



openEHR Semantic architecture



What openEHR provides



© Ocean Informatics 2007



Queries based on archetypes - Archetype Query Language (AQL)

SELECT

```
o/data[at0001]/events[at0002]/time,
o/data[at0001]/events[at0002]/data[at0003]/items[at0013.1]/value
```

FROM

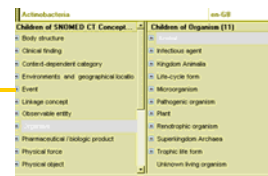
```
Ehr[uid=@EhrUid] CONTAINS Composition
c[openEHR-EHR-COMPOSITION.encounter.v1]
CONTAINS Observation o[openEHR-EHR-OBSERVATION.laboratory-lipids.v1]
```



© Ocean Informatics 2007



Interface to terminology



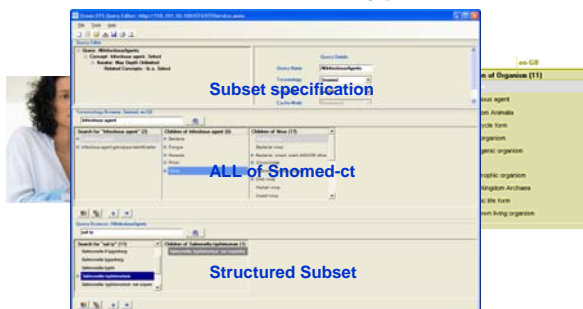
Direct Snomed Connection
-> lexical matching (errors)
-> slow (whole of Snomed)



© Ocean Informatics 2007



A Solution – Structured subsets, built into archetypes



© Ocean Informatics 2007



The result...

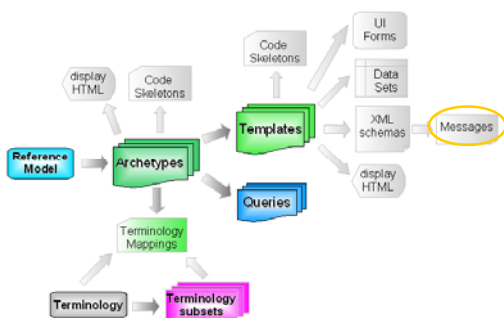
- *Semantic coherence* in the application stack (all layers of software know what the data mean)
- A *high level of re-use* of artefacts – define once, reuse many times
- A *single, stable reference model* for sharing clinical and related information
- A standardised query language for writing *portable queries*
- A standardised, re-usable way of connecting to *terminology*



© Ocean Informatics 2007



The openEHR artefact ecosystem



© Ocean Informatics 2007

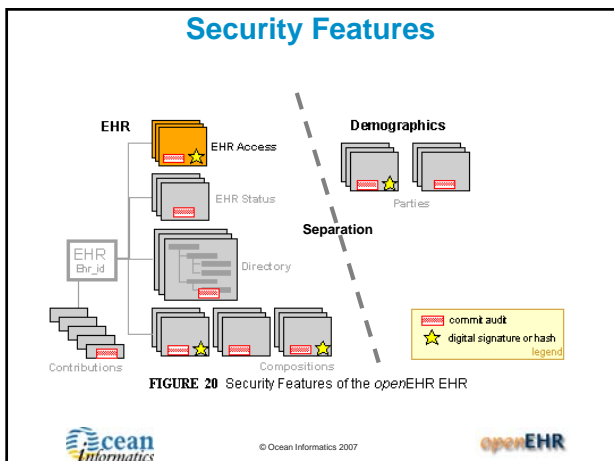
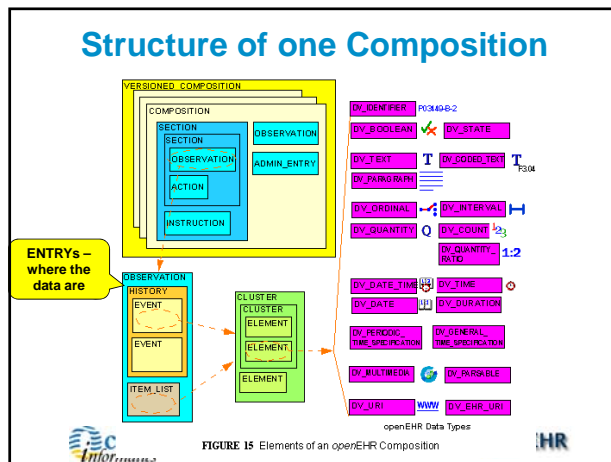
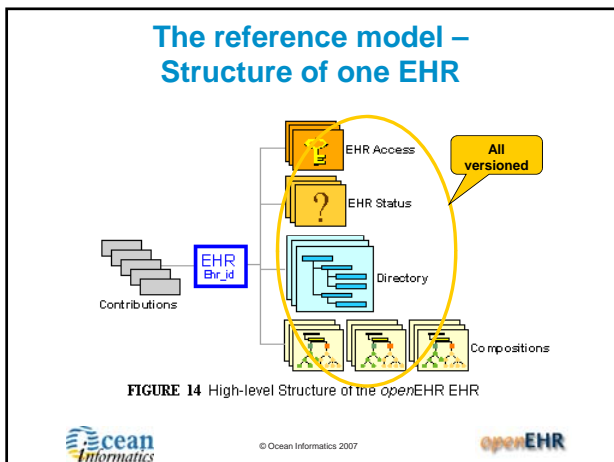
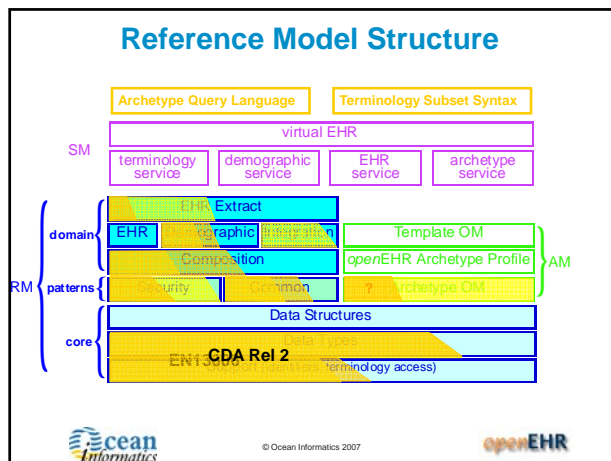
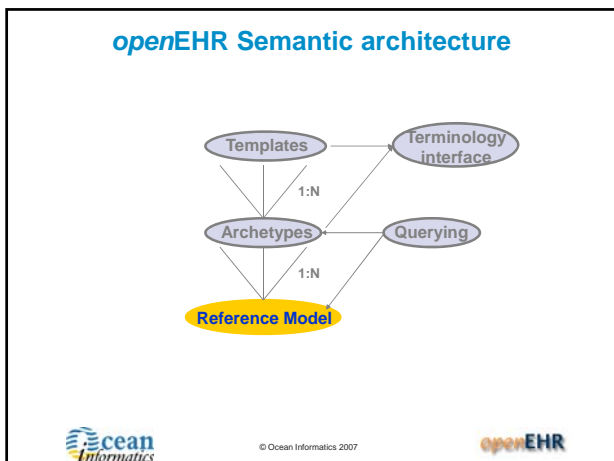


The openEHR Reference Model



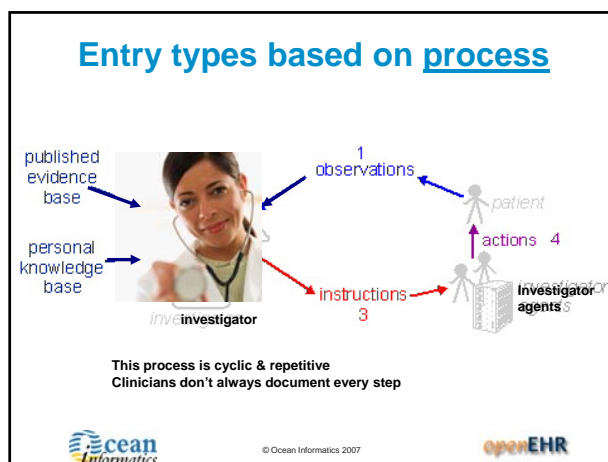
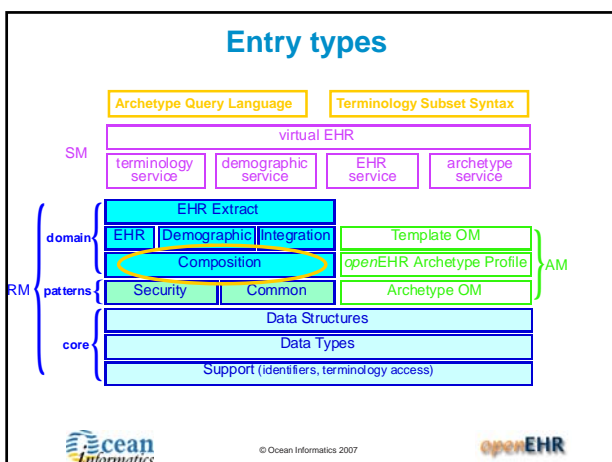
© Ocean Informatics 2007





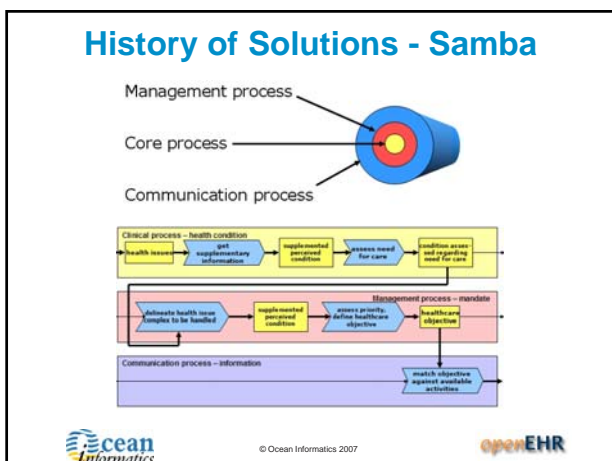
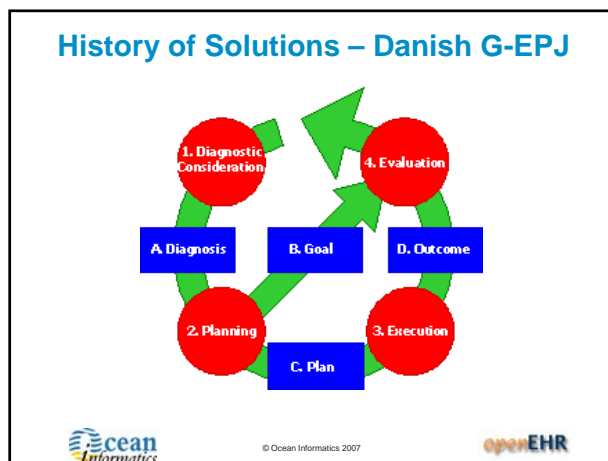
Entries – the clinical information

© Ocean Informatics 2007



History of Solutions

GeHR Australia – early version of Entry types based on information categories in philosophy + problem-solving



History of Solutions – Act-based

Includes

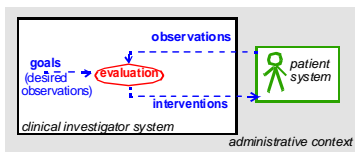
- RICHE
- HL7v3 RIM
- Many others

Problems

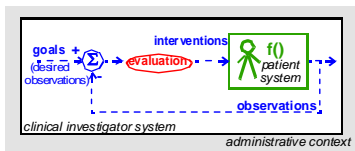
- Everything is an act – good for tracking business process steps, but not natural to physicians
- Hard to model typical clinical recordings

Our approach – ‘Clinical Investigator’

Based on clinical process
MedInfo 2007 paper



a) problem-solving metaphor



b) control system metaphor



© Ocean Informatics 2007



Entry types based on process



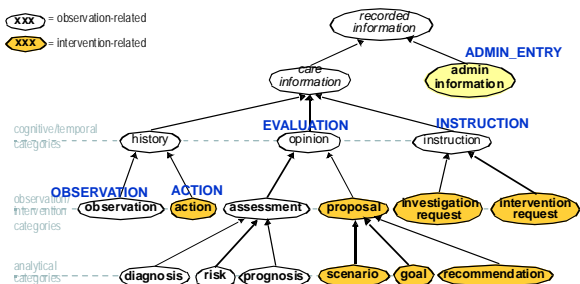
This process is cyclic & repetitive
Clinicians don't always document every step



© Ocean Informatics 2007



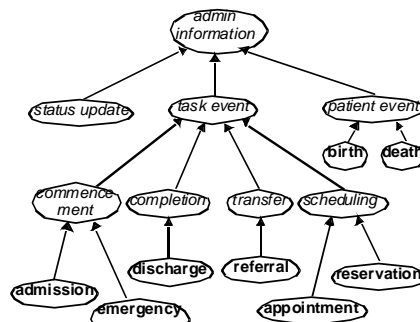
Leading to an Ontology



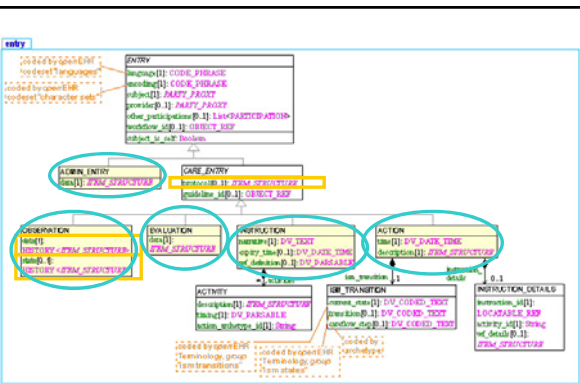
© Ocean Informatics 2007



(with a speculative part for Admin)



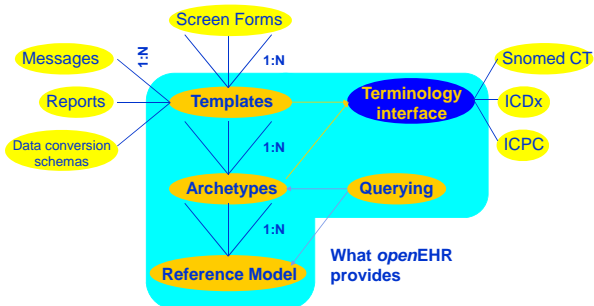
© Ocean Informatics 2007



© Ocean Informatics 2007



openEHR Semantic architecture



© Ocean Informatics 2007



Providing a basis for...

Selecting standards (maybe not the ones we thought...)

Supplier products to interoperate

Suppliers and governments to agree on:

- Models of content
- Use of content in health service events
- Structure of data for querying and re-use
- How/when/where to use terminology

Clinicians to be empowered



© Ocean Informatics 2007



It's all about the framework



© Ocean Informatics 2007

