

Overview and Navigation of Electronic Health Records

The start of a PhD journey...

Erik Sundvall, 3rd year PhD student in a 5 year programme

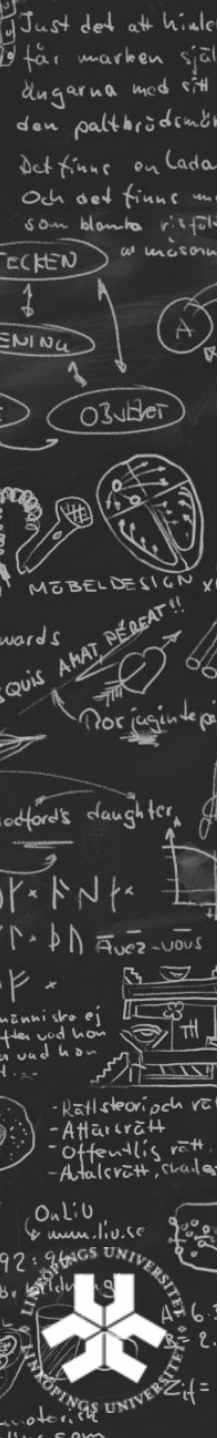
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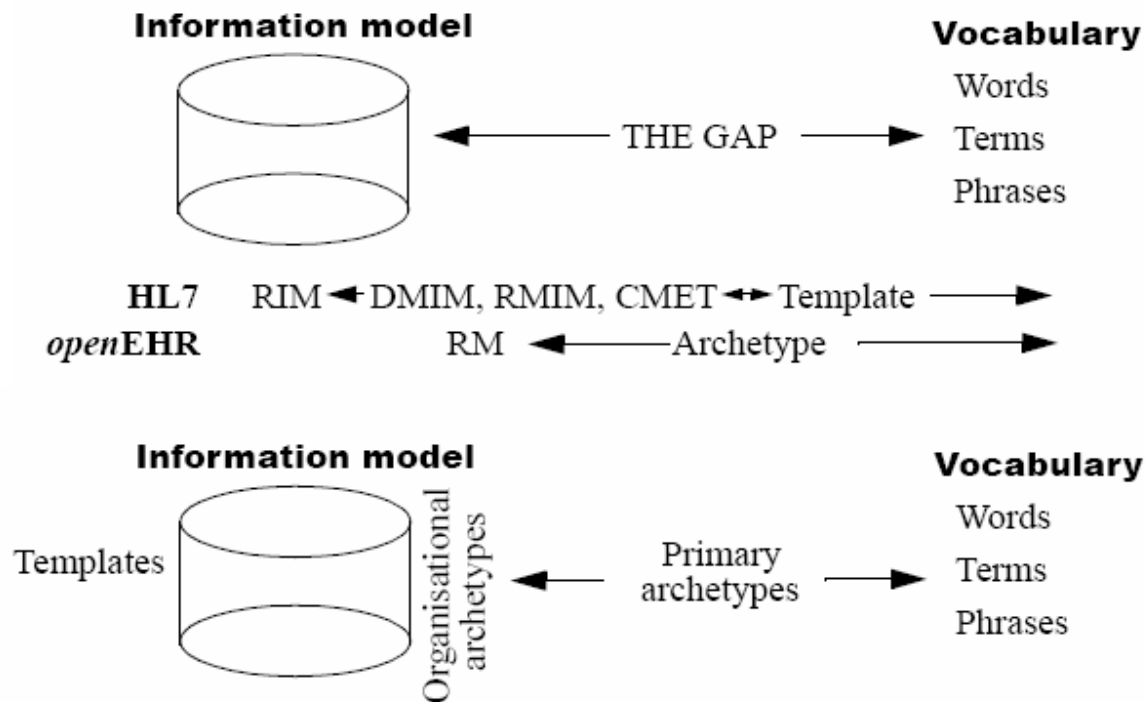
EHR = Electronic Health Record
(documenting healthcare sessions etc.)



The boundary problem & terminology binding

- General well known problems: What kind of information and structures should be implemented as software and what should be in ontology-like structures and do we need something in-between?
- Partial contribution to tools for creating and recording “boundary contracts” in the form of archetypes.

Paper [2]: Integration of Tools for Binding Archetypes to SNOMED CT



- Illustrations from: *Templates and Archetypes: how do we know what we are talking about?* Sam Heard, Thomas Beale, Gerard Freriks, Angelo Rossi Mori, Ognian Pishev Version 1.2, 12th February 2003 http://openehr.org/publications/archetypes/templates_and_archetypes_heard_et_al.pdf

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The screenshot shows a software interface for managing terminology bindings. The interface is divided into several sections:

- Term Bindings**: A tree view of terms. The selected node is "diastolic (3 SNOMED)".
- Terminologies**: A table showing the active terminology. The table has columns for "Code" and "Terminology". The row "SNOMED-CT06" is selected, with "SNOMED Clinical Terms, 2006" in the "Terminology" column. There are "Add terminology" and "Remove" buttons.
- Bindings for node 'diastolic'**: A table for binding codes to paths. The table has columns for "Code binding" and "Path binding". The row "163031004" is selected. There are "Remove" buttons.
- Manual Entry**: Buttons for "Code Binding" and "Path Binding".
- Terminology Services**: A table showing service codes and concepts. The table has columns for "Code" and "Concept". The row "163031004" is selected, with "O/E - Diastolic BP reading" in the "Concept" column. A tooltip is visible for this row, showing the definition: "On examination - blood pressure reading (context-dependent category)".

Code	Terminology
SNOMED-CT06	SNOMED Clinical Terms, 2006

Code binding	Path binding
163031004	

Code	Concept
163031004	O/E - Diastolic BP reading
271650006	Diastolic blood pressure
67726005	

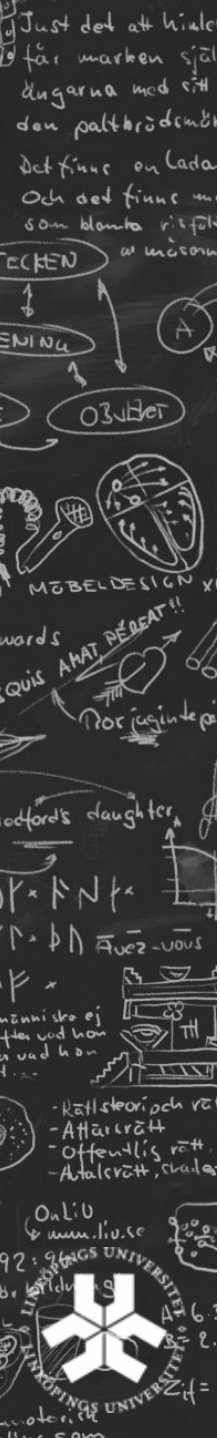
O/E - Diastolic BP reading
Definition
is a
On examination - blood pressure reading (context-dependent category)
Subject relationship context
Subject of record (person)
Associated findings

Problems

(Last slide...)

- Going from explorataion and prototyping focus to evaluation focus
- Finding suitable
 - "facets" (information categories)
 - aggregation levels & methods

...probably needs to be strongly evaluation based to be practically useful
- The scope of the thesis still needs to be narrowed down
- - -
- Question regarding future:
What information form genomics, proteomics etc regarding individual patients does one want to present, and how?
- Contact information again...
Erik Sundvall, erisu@imt.liu.se
<http://www.imt.liu.se/~erisu/>

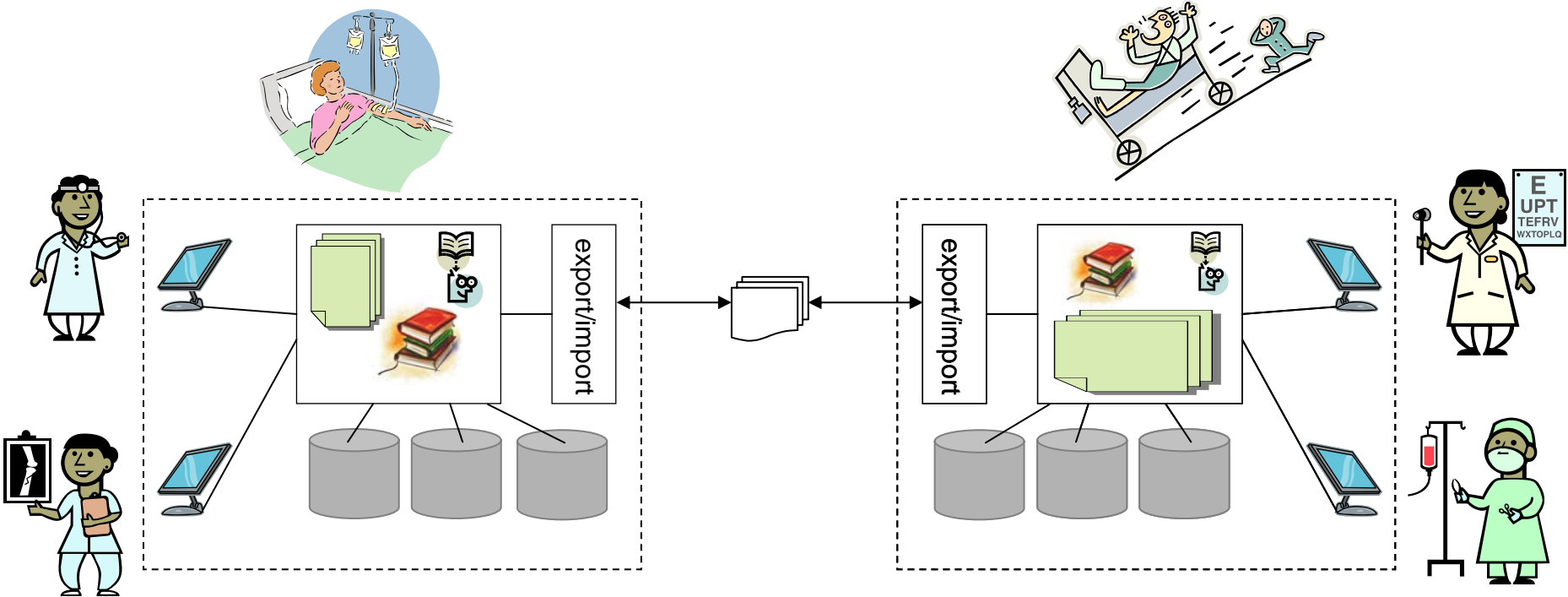


Innehåll

- Välkommen (HÅ)
- Grunder & teori (20 min, ES)
 - Vad är en arketyper?
 - Referensmodell (13606, openEHR)
- Verktyg & arketypsamlingar (15 min, MN)
 - Arketypeditorer, "Archetype workbench"
 - Var hittar man "färdiga" arketyper?
- Scenario 1: Årlig diabeteskontroll
 - Vårdokumentation (30 min, MN)
 - Detaljstruktur: Element, Cluster
 - Designmönster 1: Evaluation, Observation
 - Sammanhang: Section, Composition
 - Terminologibindningar (15 min, DK)
 - Processer och aktiviteter (30 min, ES, DK)
 - Processmodellering
 - Designmönster 2: Instruction + Action
- Scenario 2: VGR samordnad vårdplanering (30 min, MF)
- Framtid & Tillämpningar (20 min, HÅ, DK)
 - Igår, idag, imorgon? -- Inmatad data blir stabil och väldefinierad
 - Övergång från "gamla" till "nya" system
 - Erfarenheter från NHS
 - Arketyper + SNOMED CT
 - Nationell samordning
- Diskussion & Frågor (60 min, HÅ moderator)

Semantisk interoperabilitet?

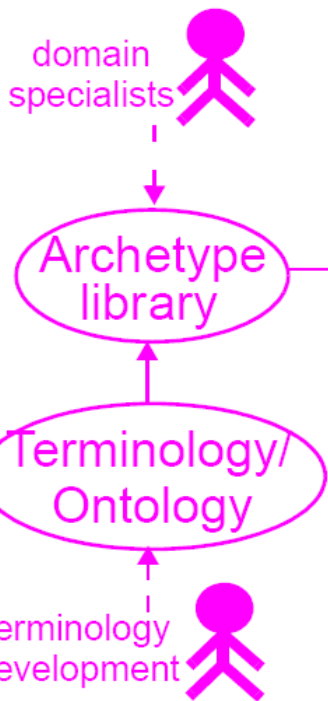
Meddelanden eller systemarkitektur i fokus för normering?



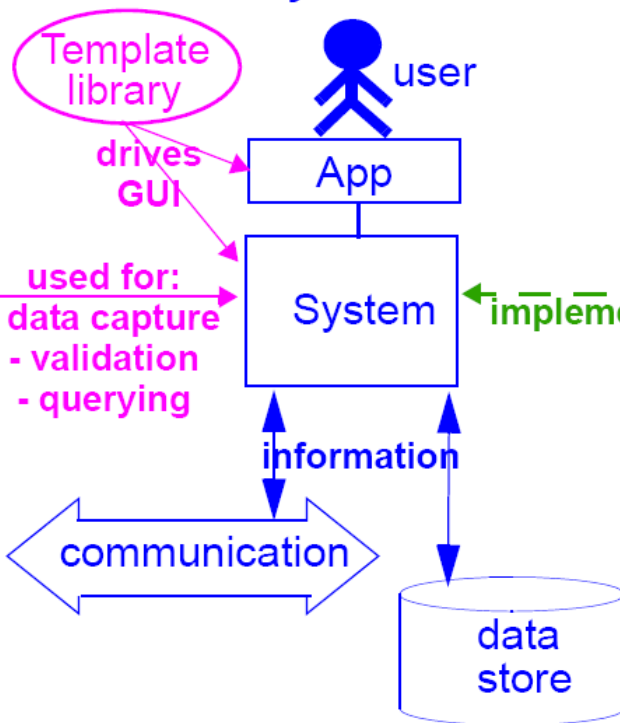
- Störningar uppstår vid översättning/transformering mellan
 - "verklighet" och tanke (observation)
 - tanke och dokument/it-system
 - (o)likheter mellan bedömare? Relevanta, uppdaterade konsensus-modeller?
 - mellan (ev.) olika modeller i it-systemen
- Undvik översättning/mappning om möjligt!

Systemutveckling vid tvålayersmodellering

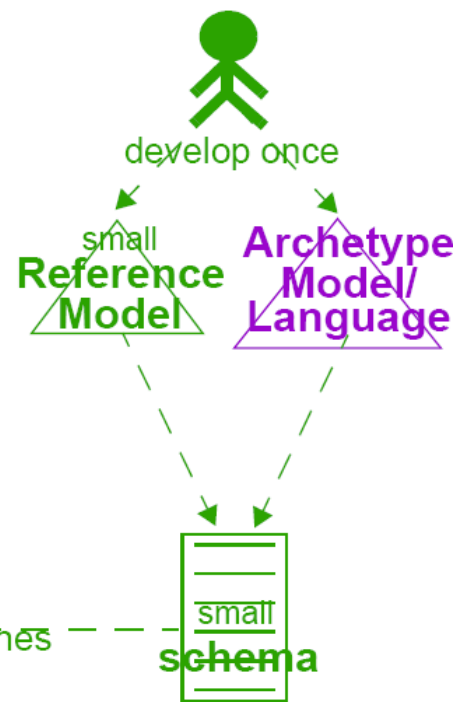
domain knowledge environment



runtime system



technical development environment



implemented in

Övergripande struktur

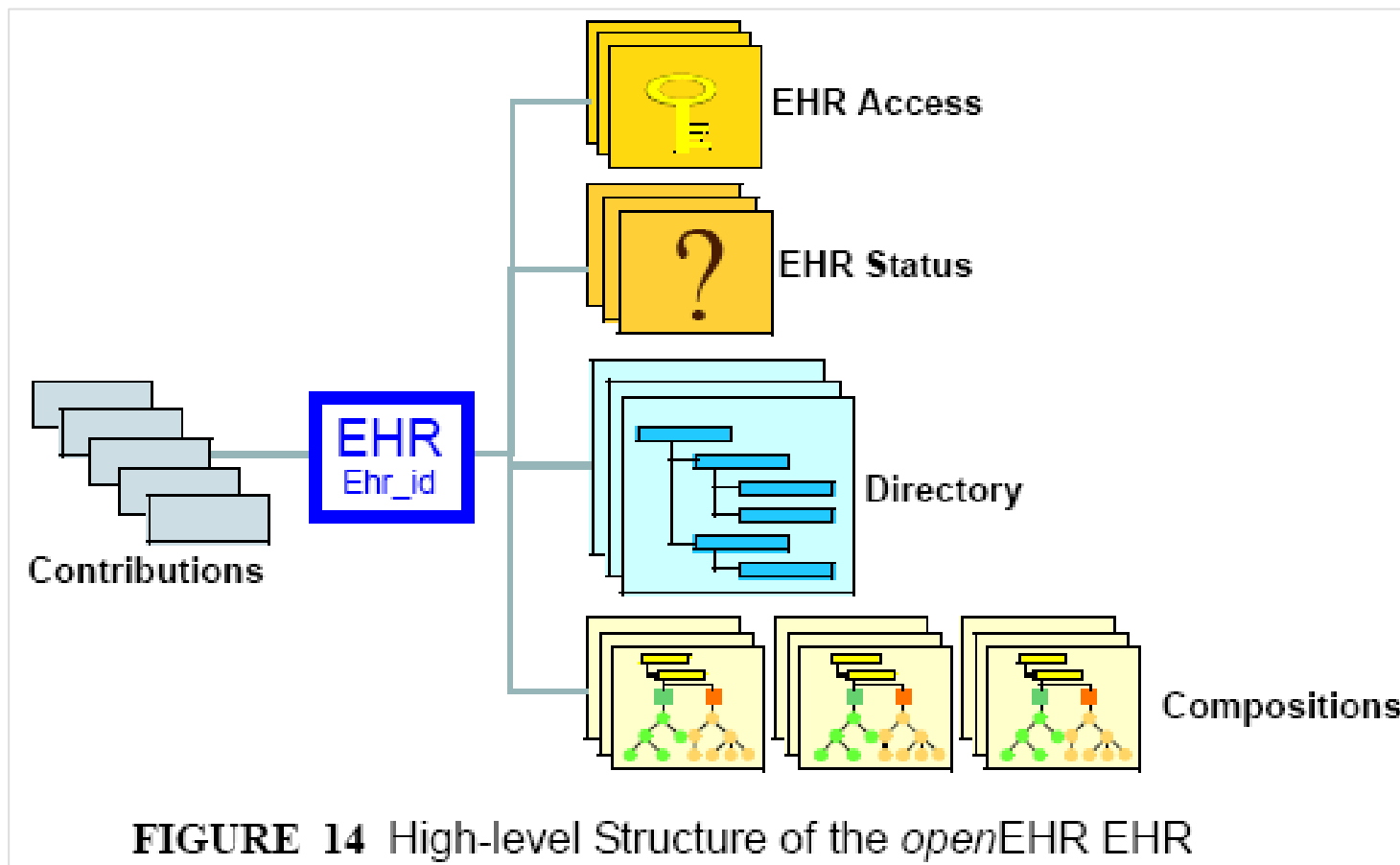


FIGURE 14 High-level Structure of the *openEHR* EHR

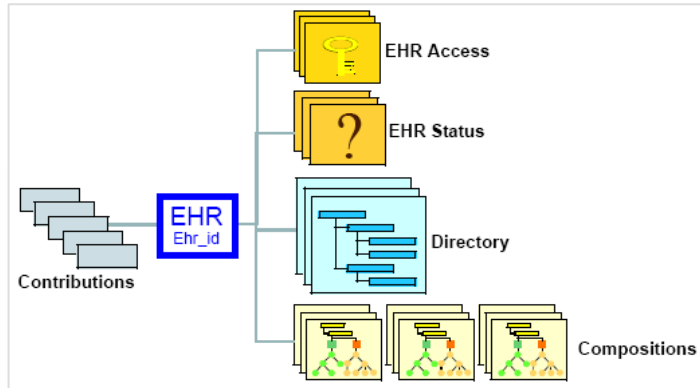


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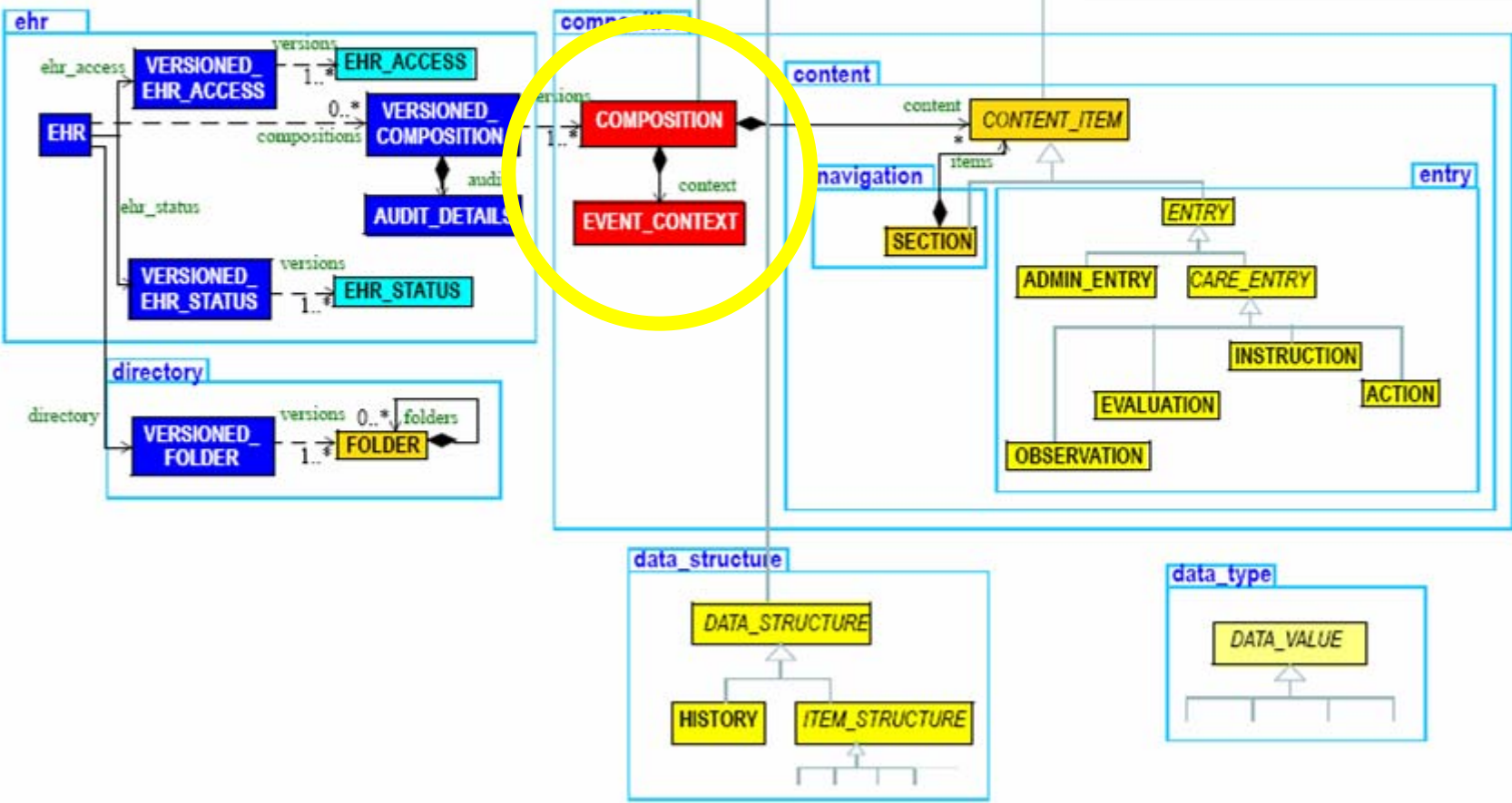
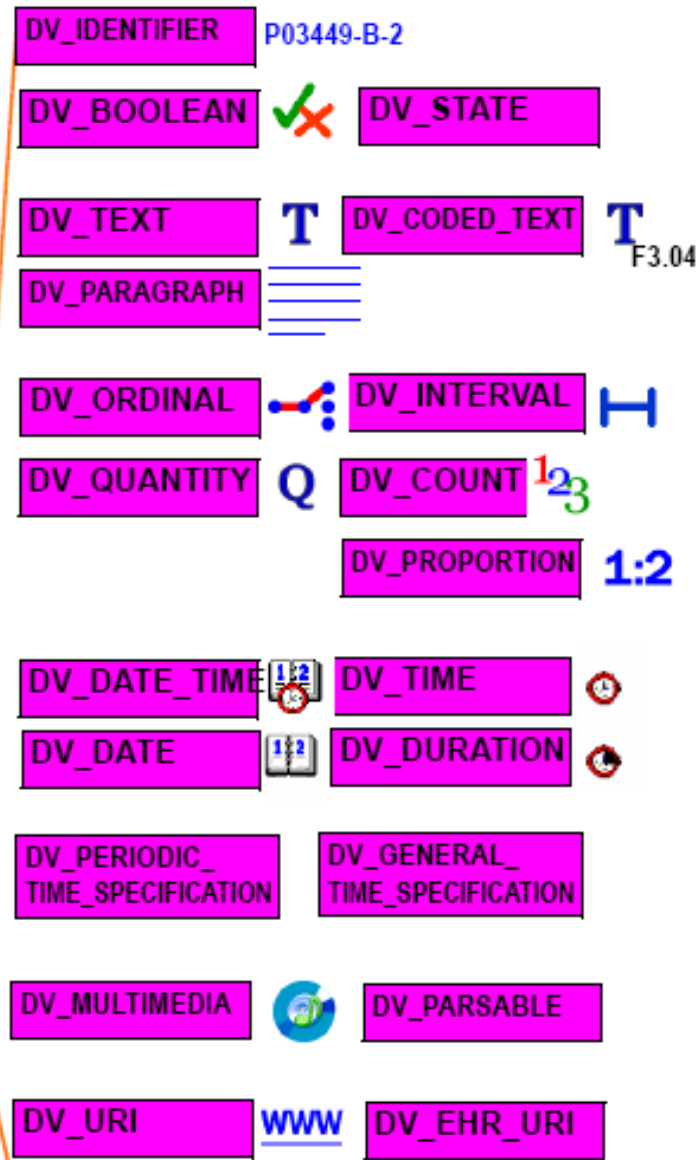
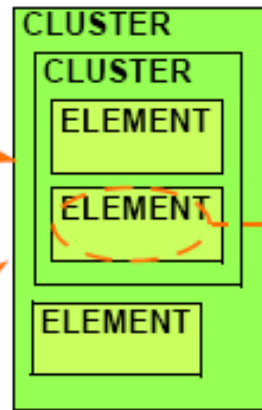
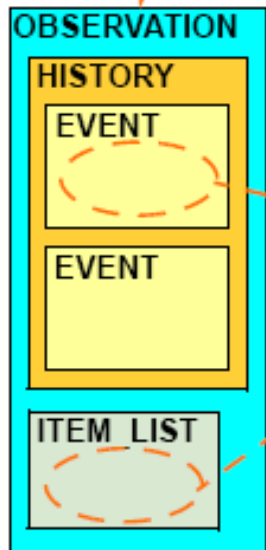
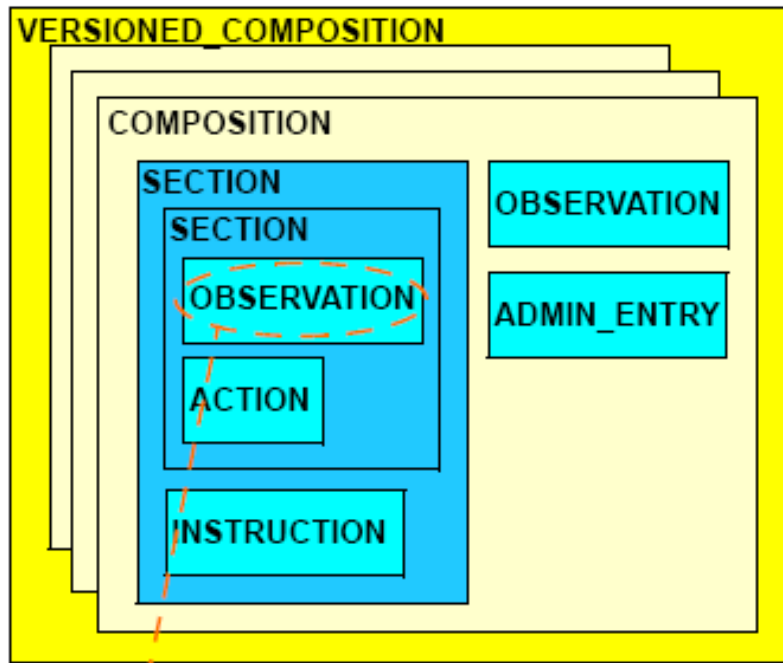


FIGURE 2 openEHR and EHR Extract Information Model Overview



openEHR Data Types

FIGURE 15 Elements of an openEHR Composition

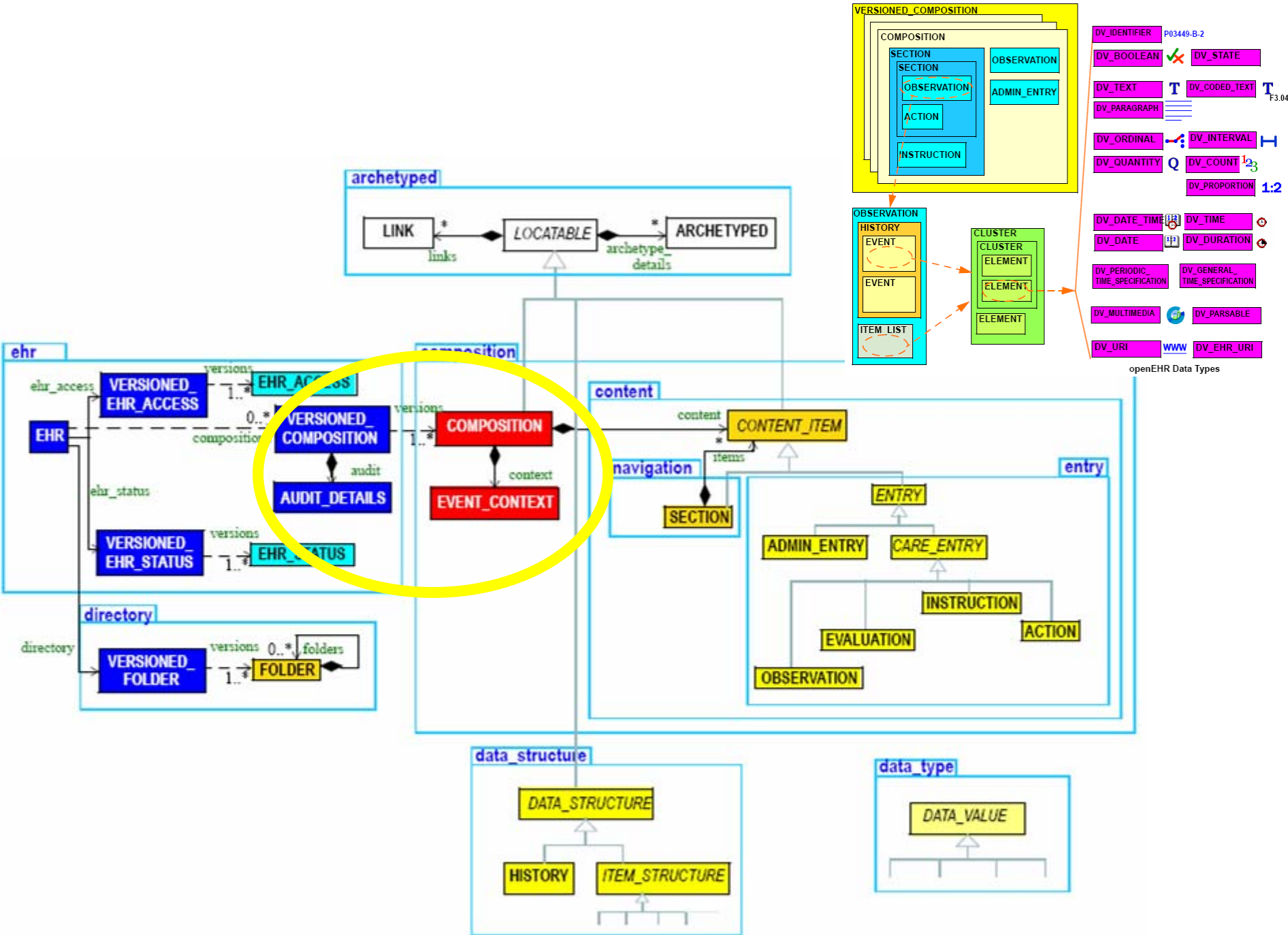
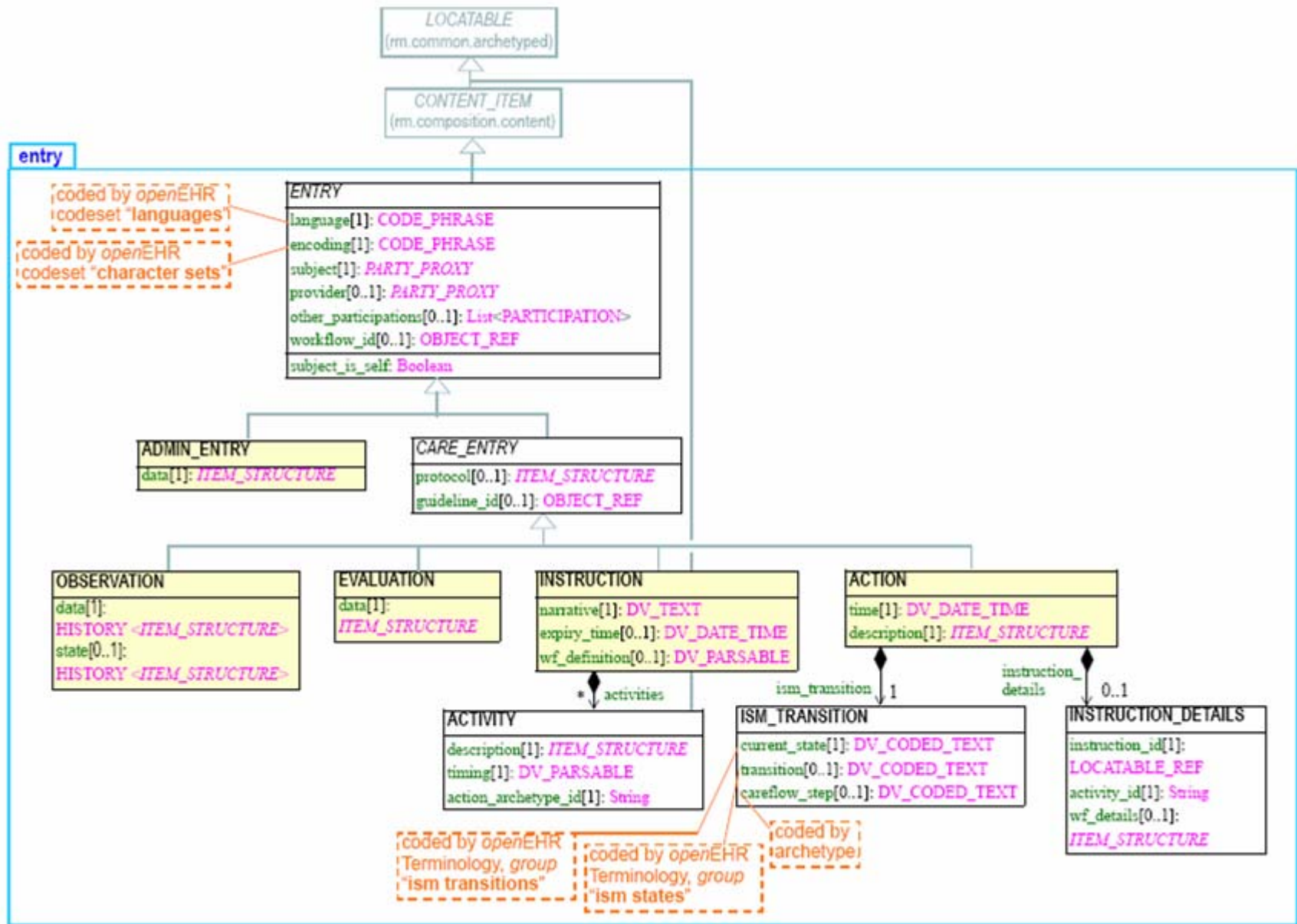


FIGURE 2 openEHR and EHR Extract Information Model Overview



Meta-model for entry types

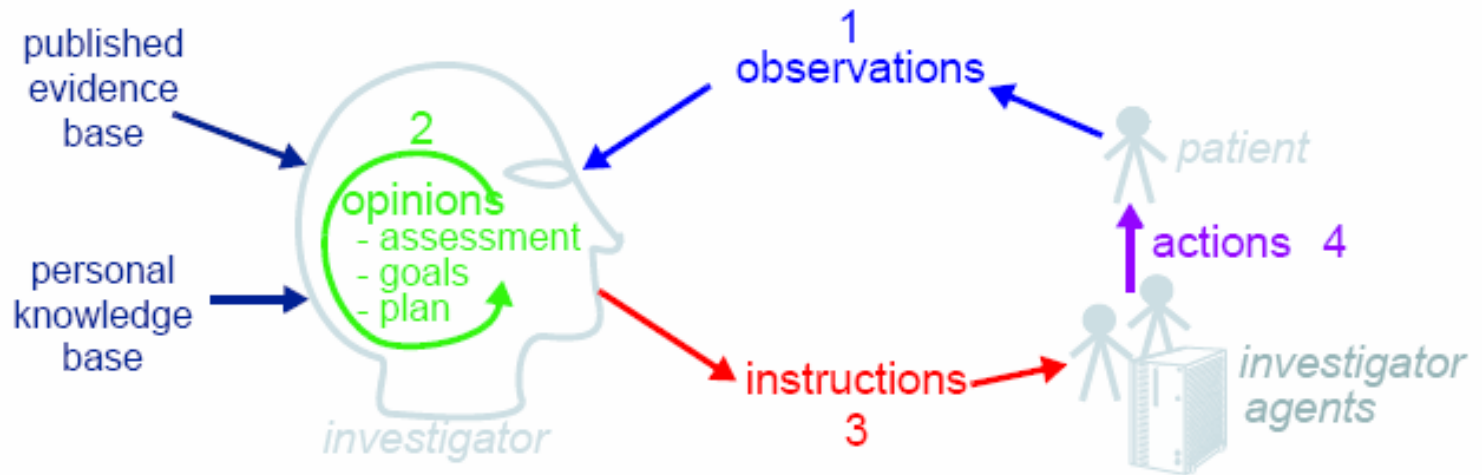


FIGURE 17 Relationship of information types to the investigation process

- Denna metamodell är inget openEHR-påfund utan bygger på andras tidigare forskning (ref. se openEHR-dokumentationen)
- Mycket läsvärd FAQ om detta publicerades nyligen på: http://www.openehr.org/FAQs/t_entry_types_FAQ.htm

History & Event

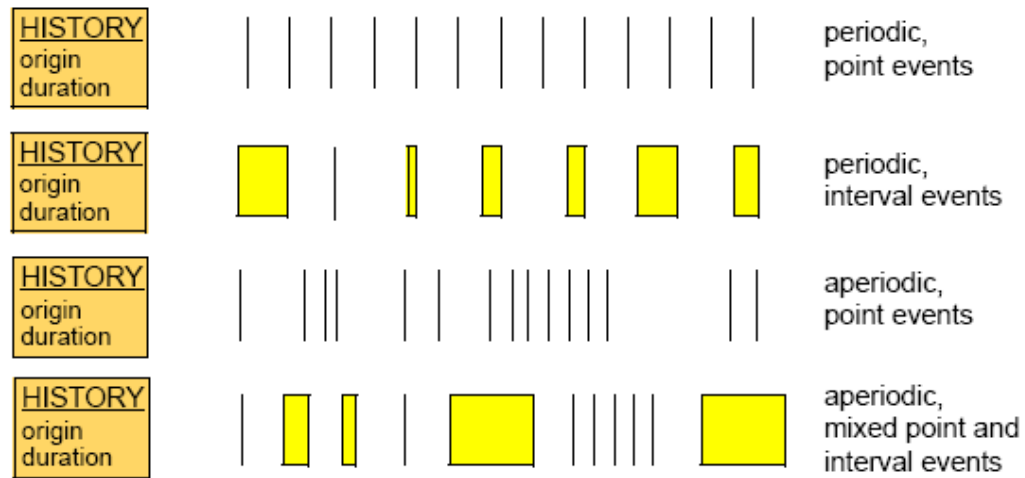
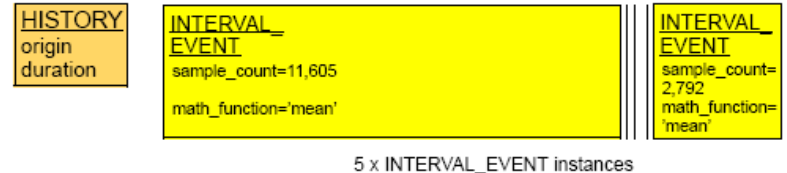
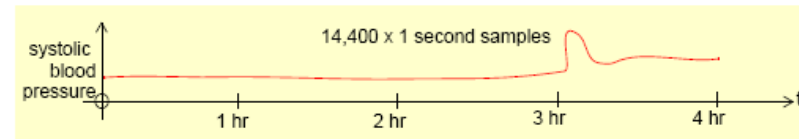
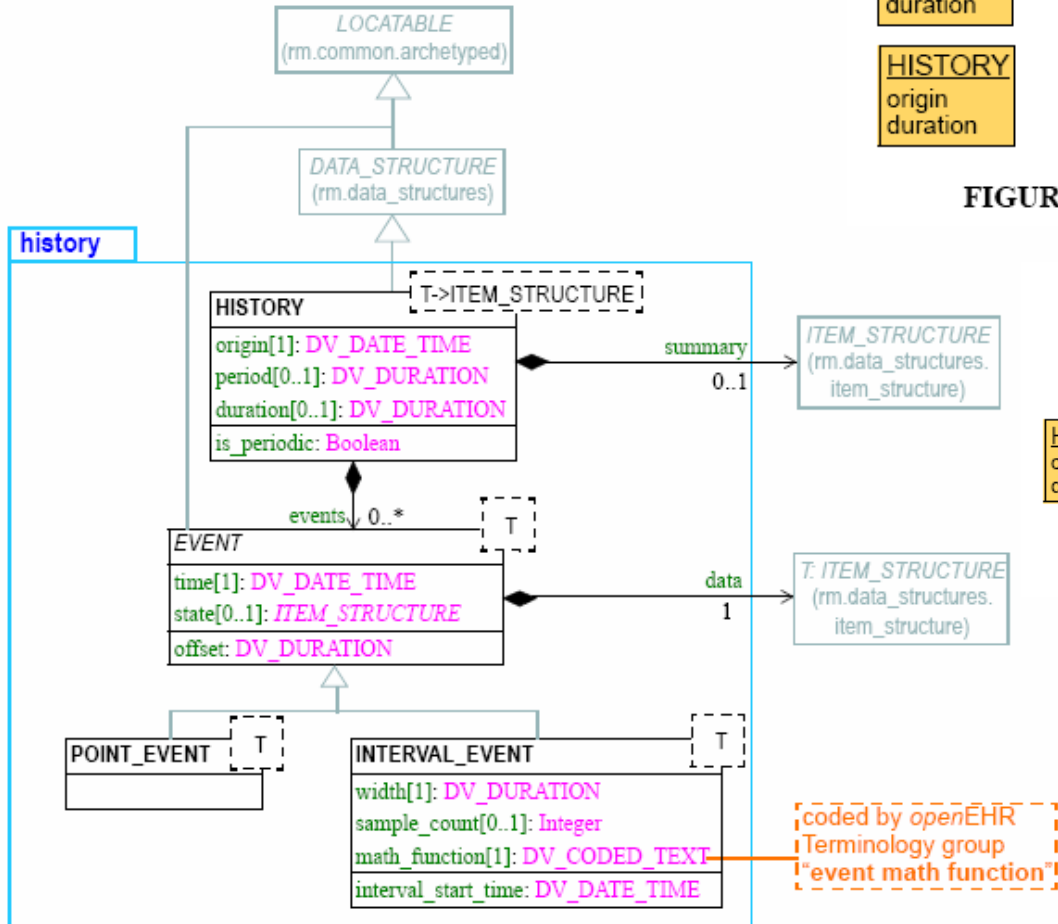


FIGURE 9 Variation in History periodicity and Event width



- RM Data structures, chapter 6

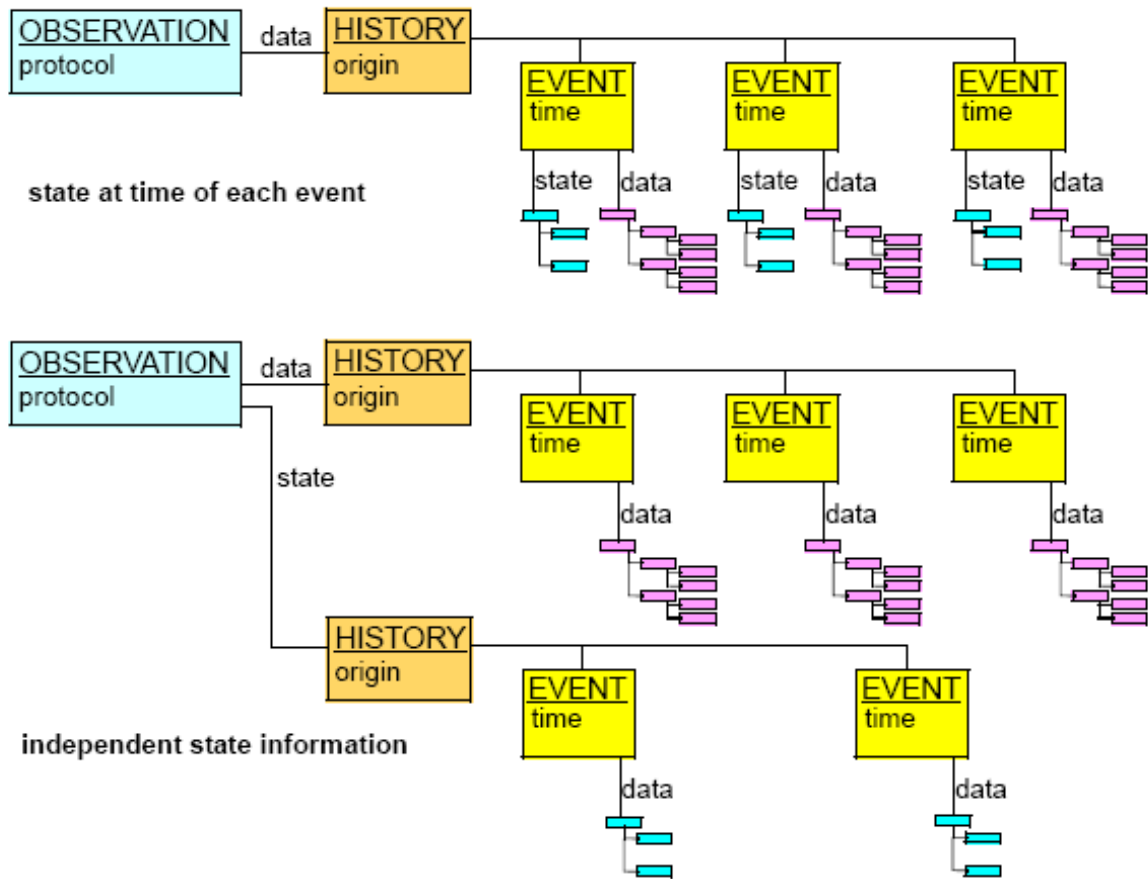
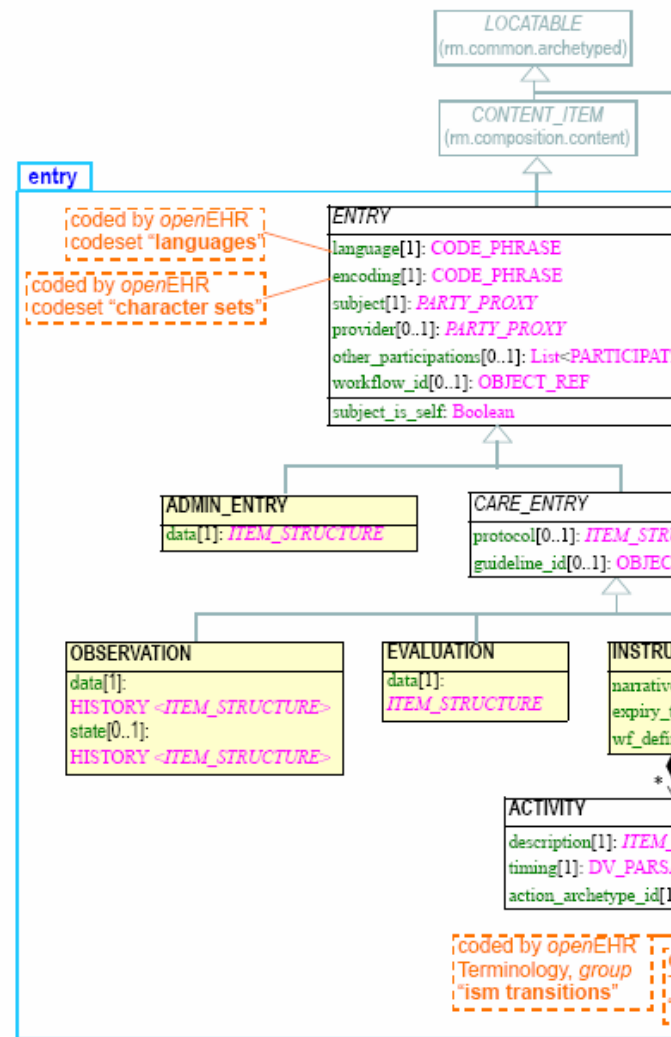


FIGURE 21 Alternative ways of recording state



Tid i journalen

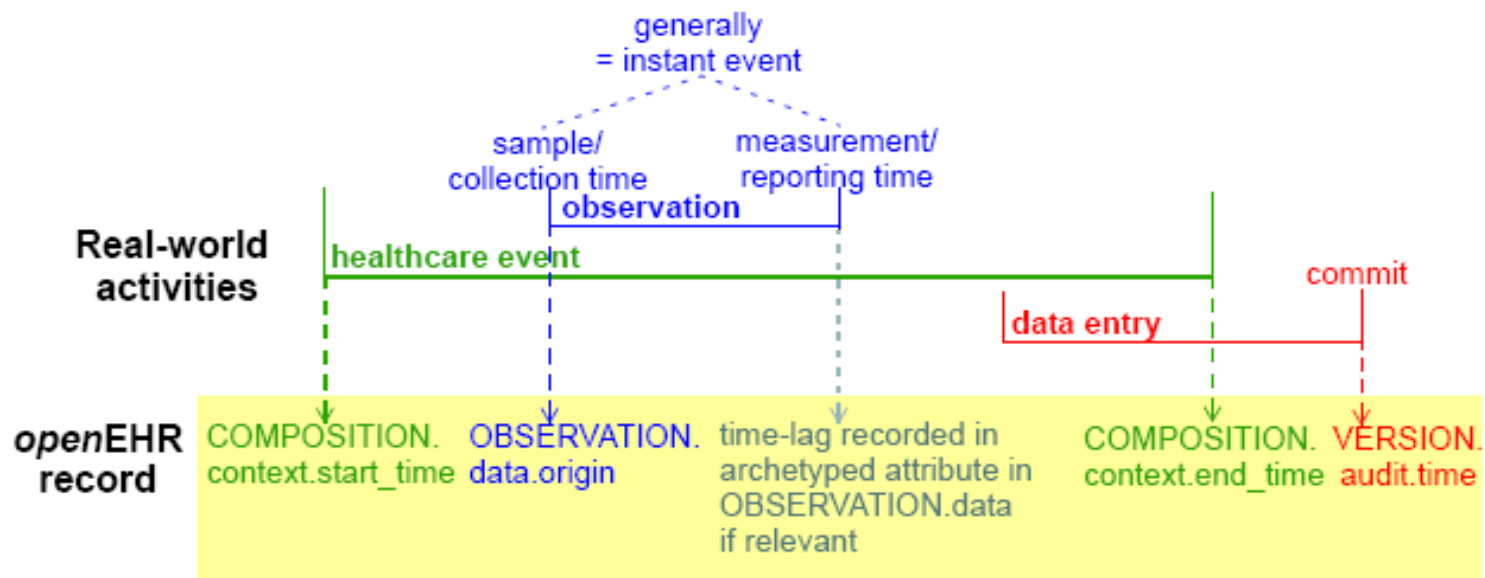
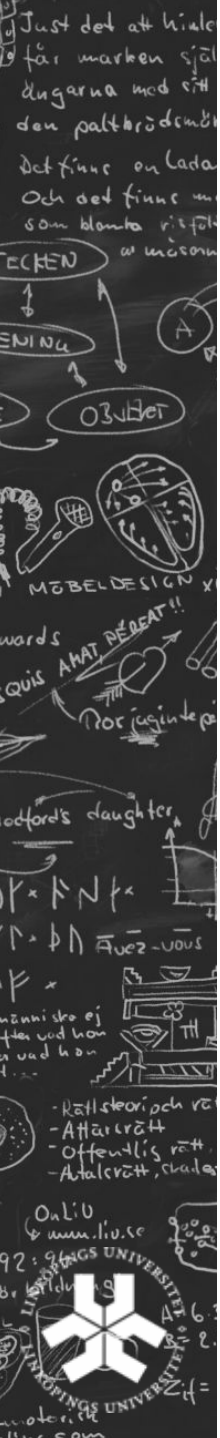


FIGURE 20 Time in the EHR



Vad är en arketypp? – Tekniskt sett?

health Information Standards Manifesto

Revision 2.5

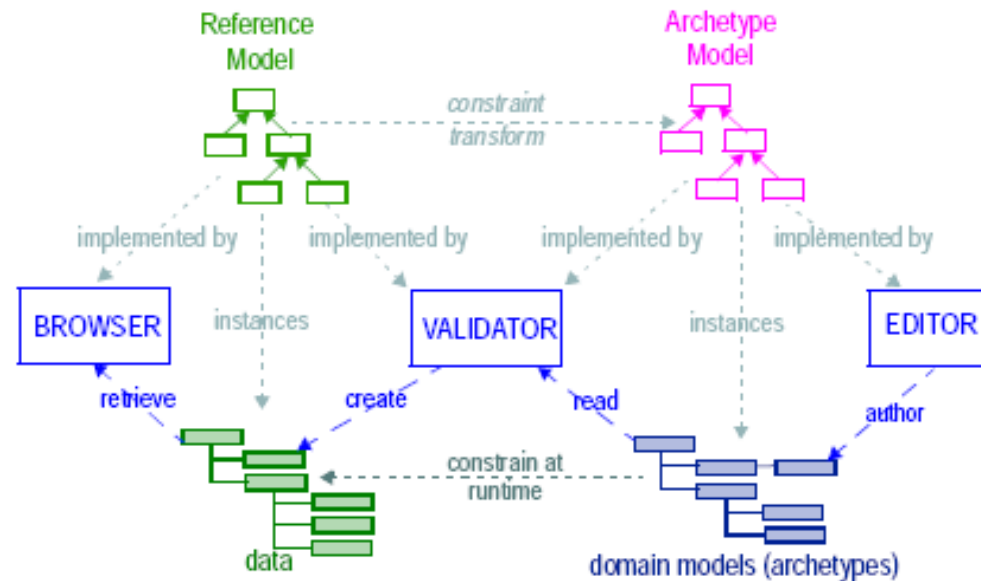


FIGURE 5 Archetype Meta-architecture

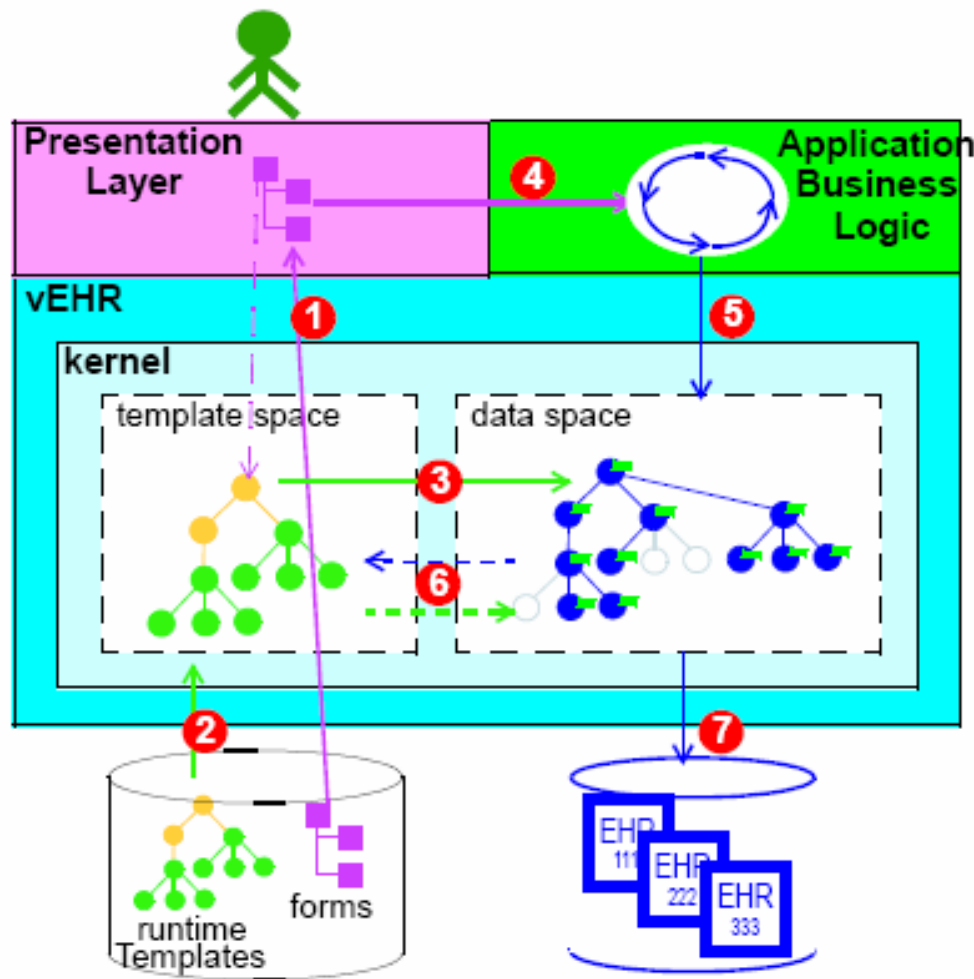
In FIGURE 5, several processors (implemented as software) are shown, being based on the reference and/or archetype models. These are:

Domain Model Editor: a GUI application for creating new domain concept definitions, based on the constraint model.

Validator: any component which creates or manipulates valid data using archetypes. This is based on the reference and archetype model classes.

Browser: a generic browser can be built, based solely on the RM, although a smarter browser can be built using the archetype model as well.

Arketypanvändning? – Tekniskt exempel.



Legend

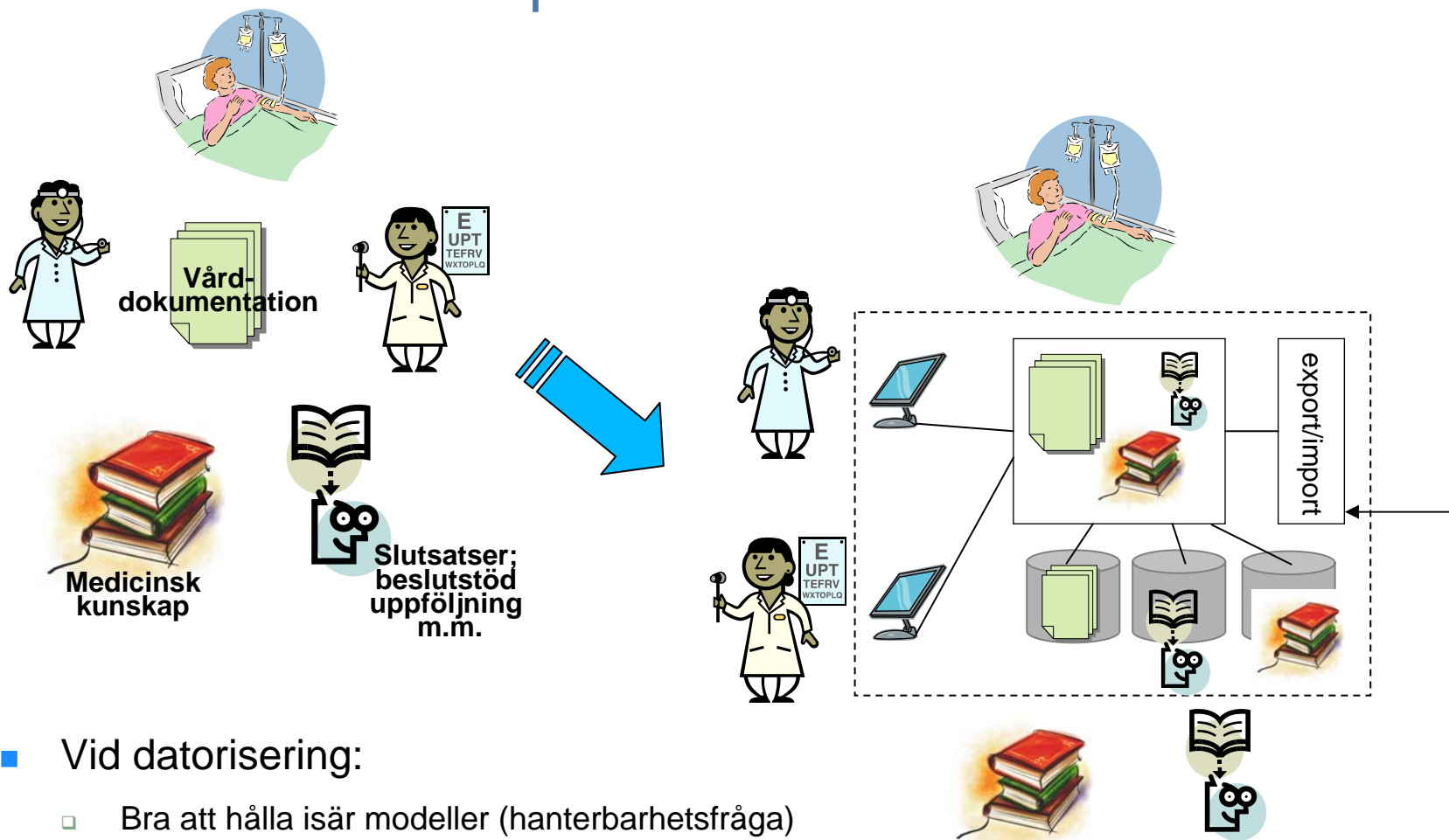
Sequence of Events

- 1 user requests form
- 2 form link to template causes template retrieval
- 3 default create of data based on template
- 4 user input causes calls into application logic
- 5 application changes data via kernel calls
- 6 each change attempt causes archetype checking
- 7 data committed only when valid with respect to archetypes in template

● → = object containing archetype node identifier
● ← template part
● ← archetype part

FIGURE 33 Templated Archetypes at Runtime

Vad datoriseras helt respektive delvis? (repris) Var finns processer och flöden?



■ Vid datorisering:

- Bra att hålla isär modeller (hanterbarhetsfråga)
- Gränsdragningar & konflikter blir förtydligade

■ Vilken del av processerna skall gör avtryck i själva journalhandlingarna? Bör hanteras av openEHR? Arkivbeständighet?

■ Vad skall IT-stöd för processer klara av?

Just det att hiale
får marke själ
dagar med ett
den paltbrödcu
det finne en lada
Och det finne m
som blanda riefö
a mösonu
ECKEN
ENINU
OBJET
MÖBELDESIGN
words
QUIS AMAT DÉBAT!!
Norjginde p
odford's daughter
Y x T N T x
T x b l Auez -vous
F x
människo ej
fies, vad hon
in vad hon
- Rätt teori och va
- Ättärrätt
- Offentlig rätt
- Ättärrätt, chala
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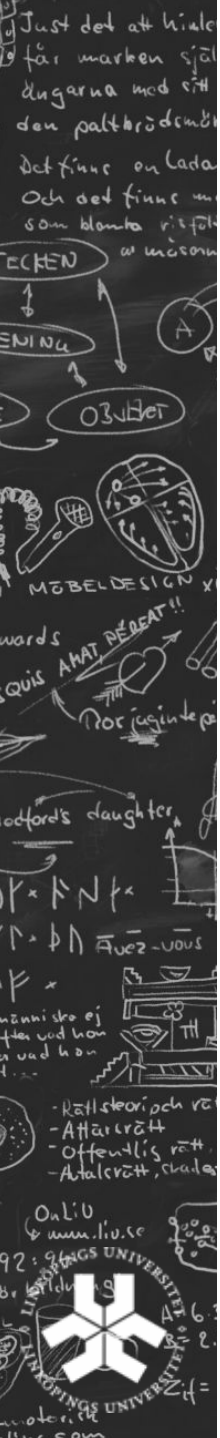
openEHR & "workflow"

- “Regarding automation of Instructions, the goal is to enable *openEHR* to **support workflow automation without re-inventing it**. The EHR is treated as a **memory device available to a workflow engine**, but does not try to replicate its functionality, nor oblige any automatic workflow processing to be done at all”
- Journalen som långtidsminne och faktabank för flödeshantering (både manuell och datorstödd)
- Eftersom RM är en vanlig objektmodell kan den vid senare tillfälle byggas ut till att omfatta fler delar om så önskas, t.ex. mer omfattande processtöd. Detta utan att redan existerande journaldata berörs.

Processer och flöden kommer i många varianter...

- Olika omfattning och komplexitet
 - Olika mängd interaktion med omgivande processer
 - Olika syften
 - Kan beskrivas på väldigt olika sätt
- ...olika sätt att att impemetera i it-system kan vara lämpade för olika typer.

Vi börjar vid forskningsfronten i den "tyngsta" änden...



Forskningsexempel...

Workflow Modelling of Coordinated Inter-Health-Provider Care Plans.

by

Eric Donald Browne

School of Computer and Information Science
University of South Australia
Adelaide



http://www.openehr.org/publications/workflow/t_browne_thesis_abstract.htm

Läsning av åtminstone kap 10 (7 sidor) inger respekt för områdets komplexitet.

Forsknings exempel...

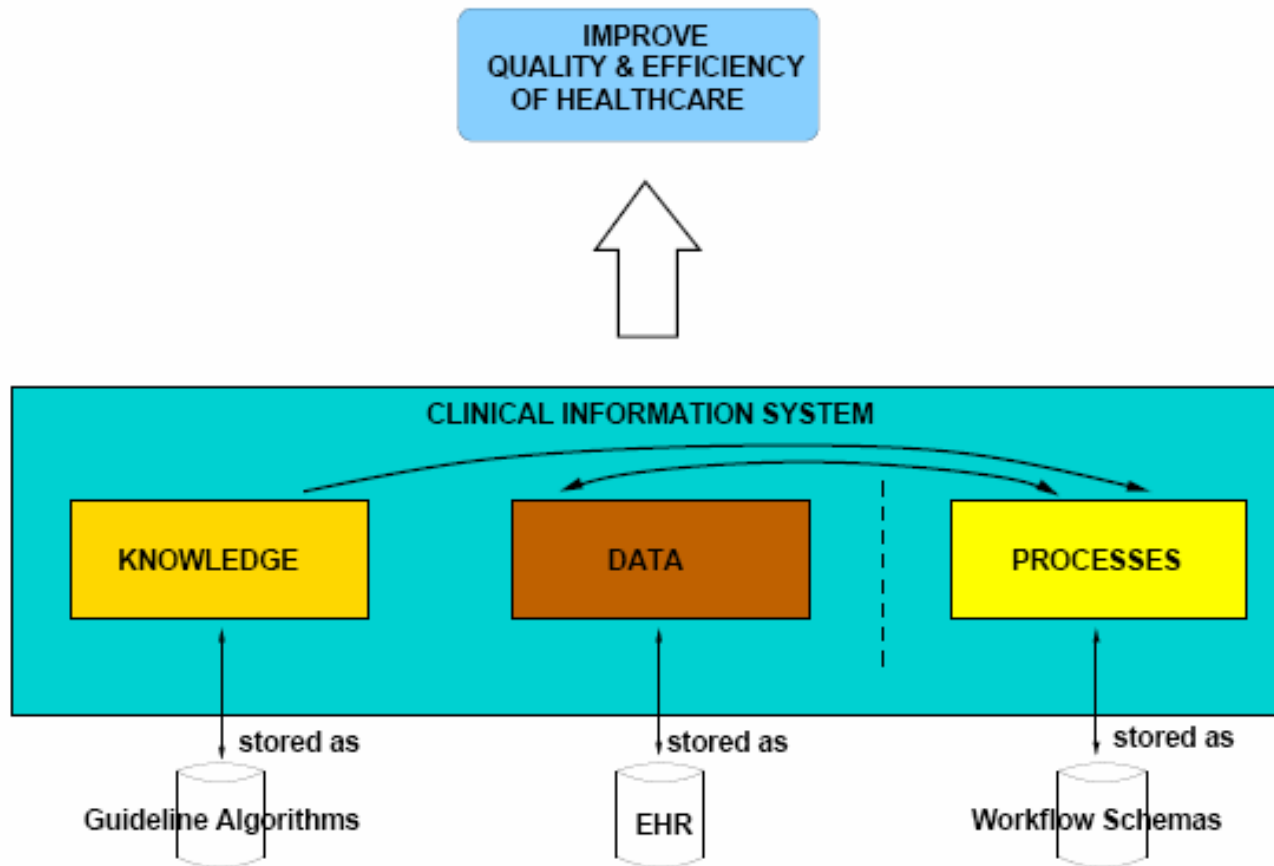


Figure 2.1: Interplay of knowledge, data and process to improve healthcare.

Forskningsexempel...

Aspect	Clinical Guidelines	Care Plans	Workflow Systems
Clinical Knowledge	High	Moderate	Low
Condition-specific	Yes	Mainly	Not usually
Patient-specific	No	Yes	Rarely
Single case	Yes	Yes	No
Security	Low	Low	High
Active/Passive	Mainly passive	Mainly passive	Mainly active
Built-in audit/statistics	No	No	Yes
Inter-provider communication	Little	Moderate	High
Focus	Condition	Patient	Process
Notification support	No	No	Yes
Role-participant support	Low	Medium	High

Table 2.1: Comparing Clinical Guidelines, Care Plans and Workflow Systems

- Traditionella "workflow systems" inte självklart lämpade för patienters individuella vårdplaner
- Ytterligare försvårande faktorer: individanpassningar, många aktörer, icke-determinism, komplexitet, ofullständiga specifikationer.

Forskningsexempel...

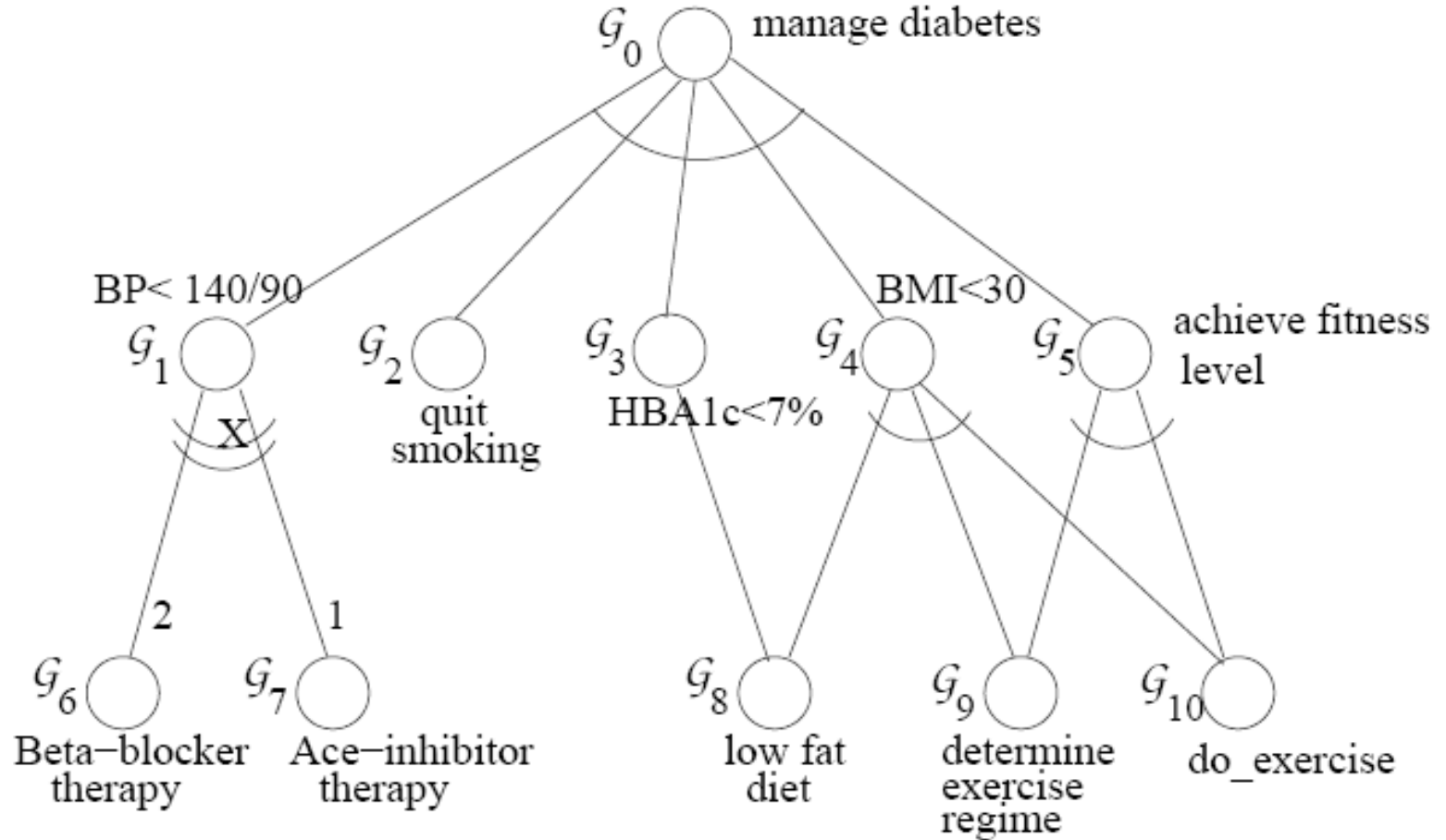


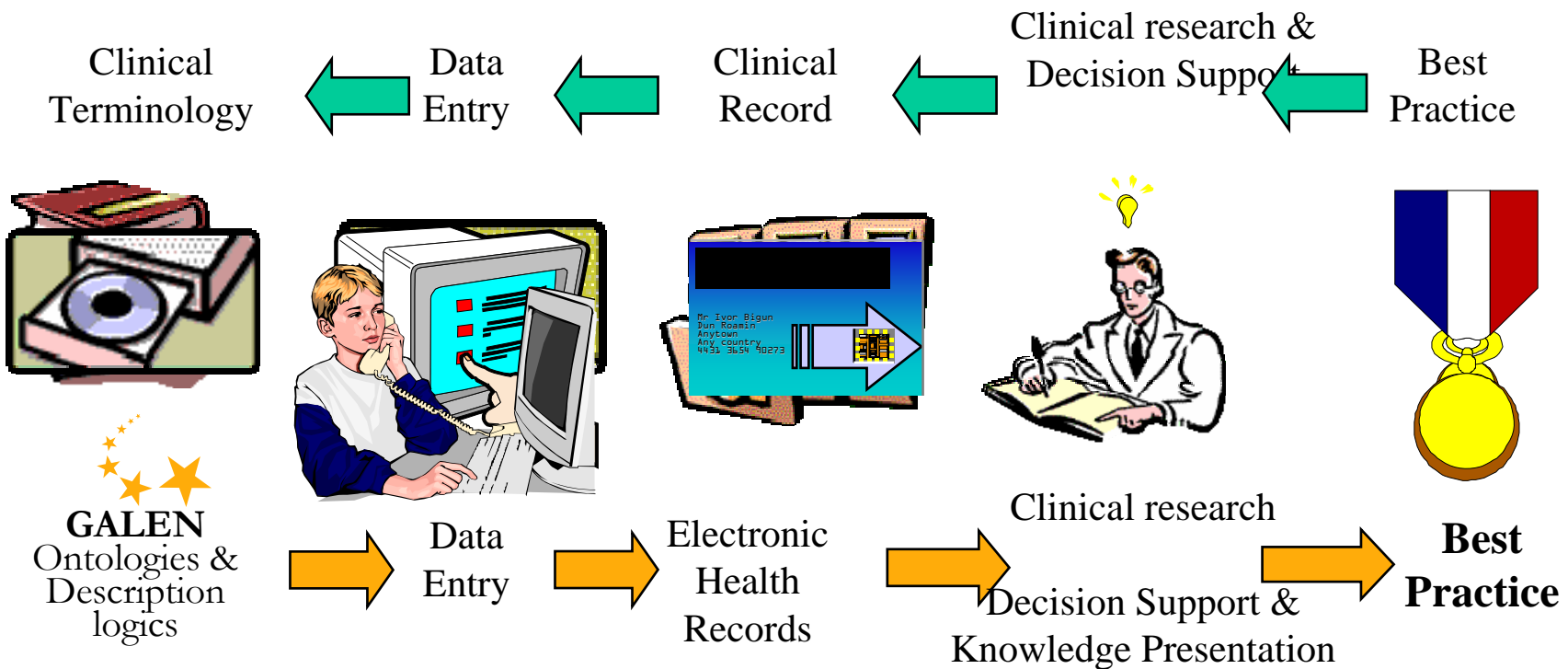
Figure 5.1: Goal-graph for Diabetes Management (simplified).

- Målstyrd processmodellering/hantering intressant för interagerande processer (icke-trivialt...)

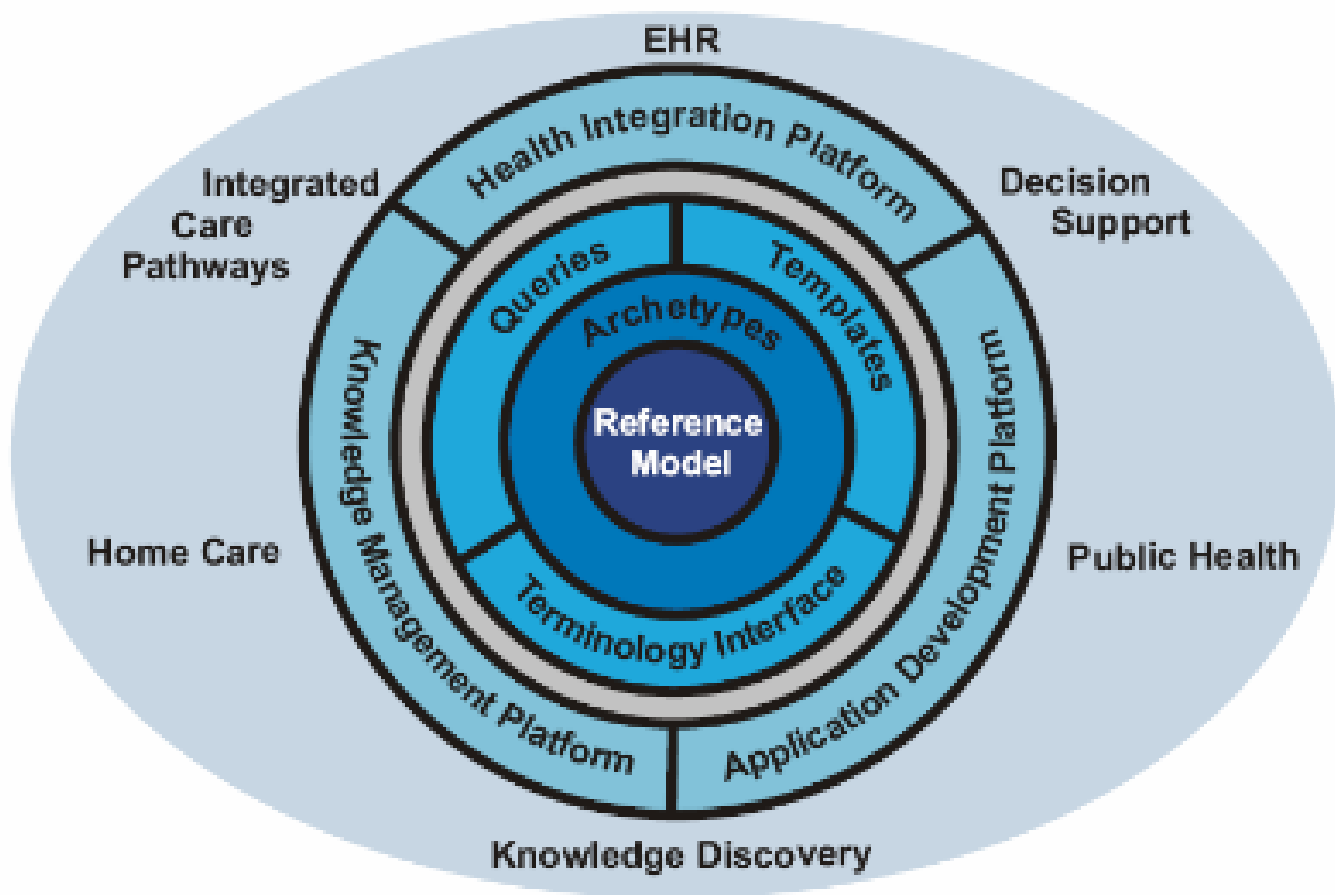
Framtid, tillämpningar, diskussion

Hans åhlfeldt

Where I come from (Alan Rector)

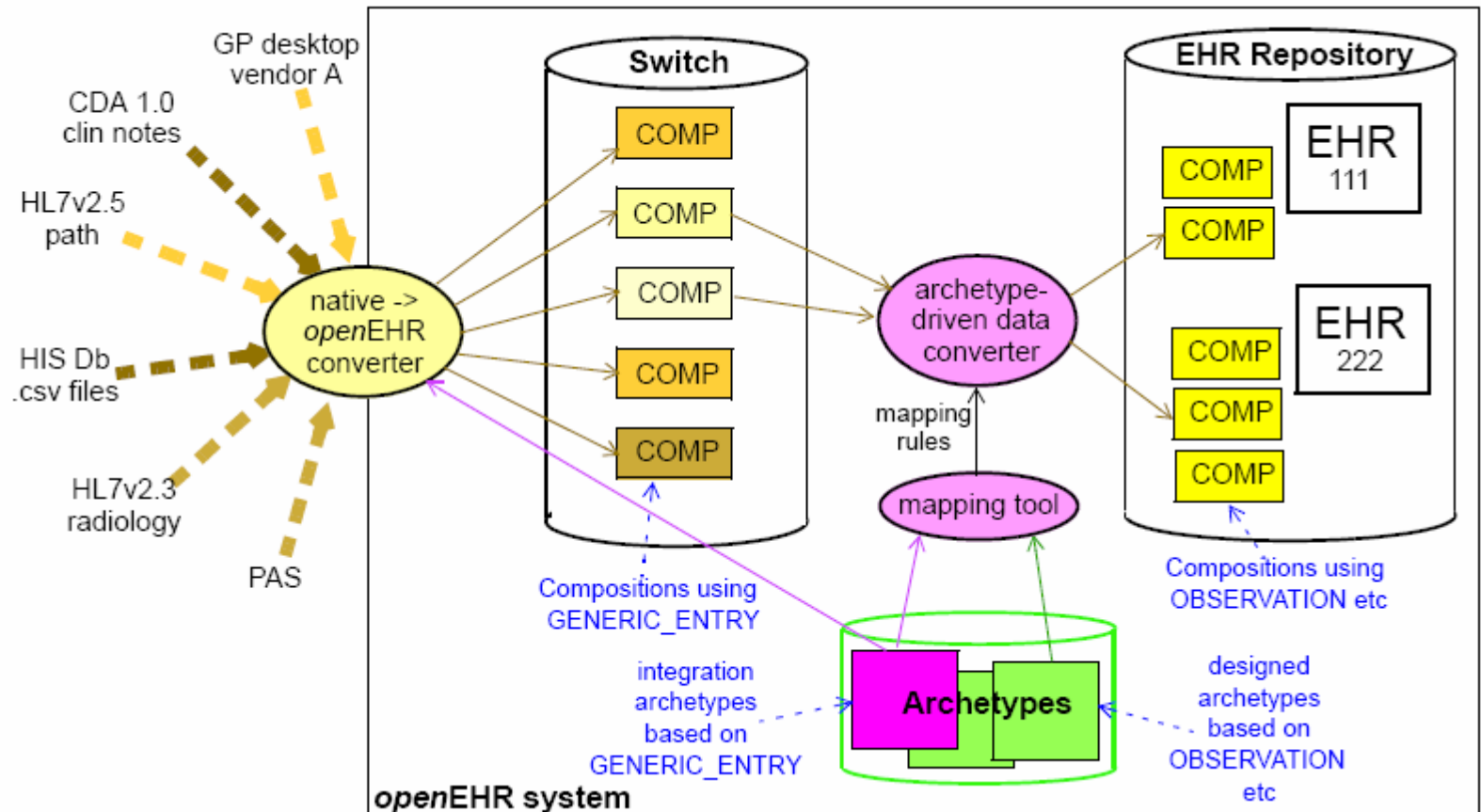


openEHR-hybris?



- I och för sig intressant och mer substans än i vissa konkurrerande världsbilder...

Integration



- Syntactic + semantic conversion
- Risk när de blandas ihop och görs innan de når målsystemet (Jfr fara i beskrivet fast XML-format, inkl semantik, för import)
- Semantisk omvandling fortfarande farlig (!) men mycket original-lik data finns i alla fall lätt tillgängligt vid tveksamheter.
- Från: http://svn.openehr.org/specification/TAGS/Release-1.0.1/publishing/architecture/rm/integration_im.pdf

Spårbarhet, feeder audit (common_im.pdf)

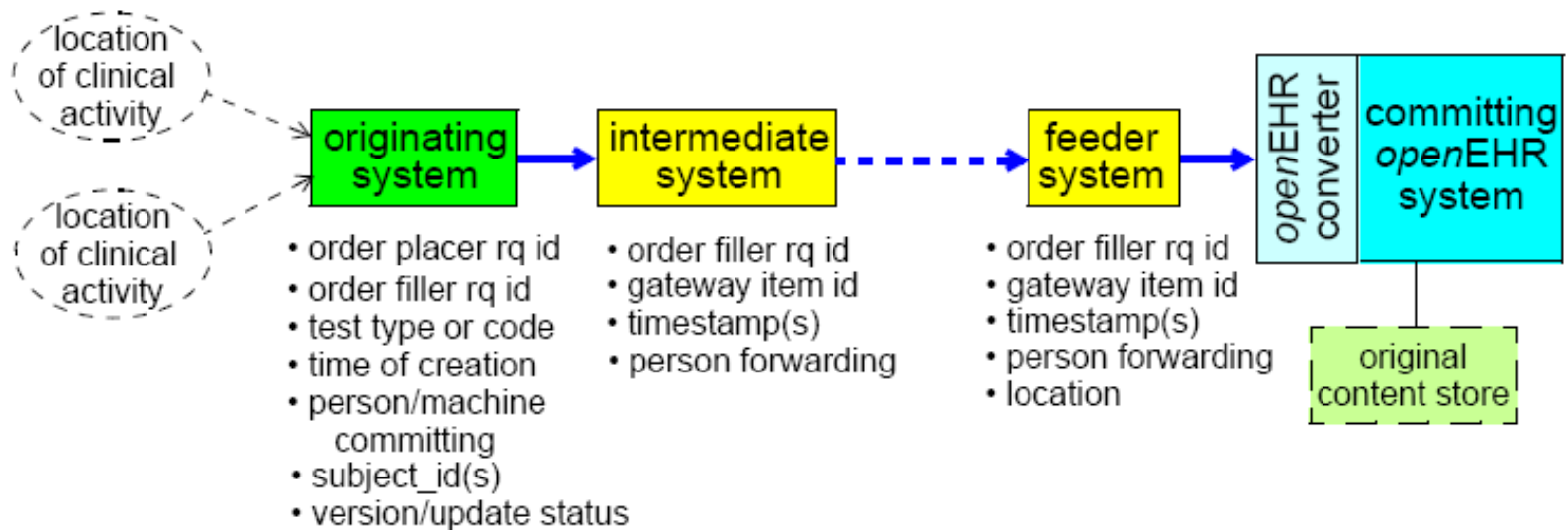


FIGURE 3 Abstract model of feeder chain