

The EHR

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History of Medical Records

- BC - papyri records from Egypt
- 1123 AD St Bartholomew's Hospital records
- 19th C - chronologically in a physician record
- 1907 - Unit record developed at St. Marys in London.
- 1916 - Unit record adopted at Presbyterian Hospital in New York
- Legal use of medical records
- 1969 - Weed's Problem orientated medical record
- 1970s - Computerised medical records
- Nursing care plans
- Situation specific flow charts...

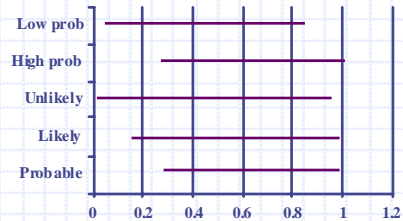


Purpose of Medical Records

- Improve patient care
 - Faithful account of events
 - support communication
 - Inform health professionals, improve efficiency
 - Identifies deviations from expected trends
 - *Supports self care*
- Ensure accountability
 - provides a legal account
- Demonstrate competence



Certainty and precision



Bryant and Norman 1980 NEJM 302:411



Competence

- deliver curative and rehabilitative care
- promote health
- organise preventative activities
- plan, organise and evaluate health education activities
- collaborate with other agents of community development
- participate in research
- manage services and resources
- train other members of the health care team
- participate in and sometimes lead this team
- engage in self directed learning
- engage in self evaluation and quality assurance



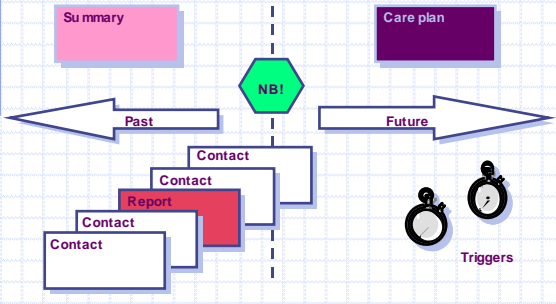
Audience for Medical Record

- Health professionals on site and in other settings
 - Curative and treatment role
 - Preventive and anti-dpastry role
- Clerical and research staff
- The patient or their representative
- Legal advisers
- Medical students
- Health economists
- Insurance companies





Contents and context



What is an EHR?

"an electronic longitudinal collection of personal health information, usually based on the individual or family, entered or accepted by health care professionals which can be distributed over a number of sites or aggregated at a particular source including a hand-held device. The information is organised primarily to support continuing, efficient and quality health care. The record is under the control of the consumer." *HealthConnect*

1935



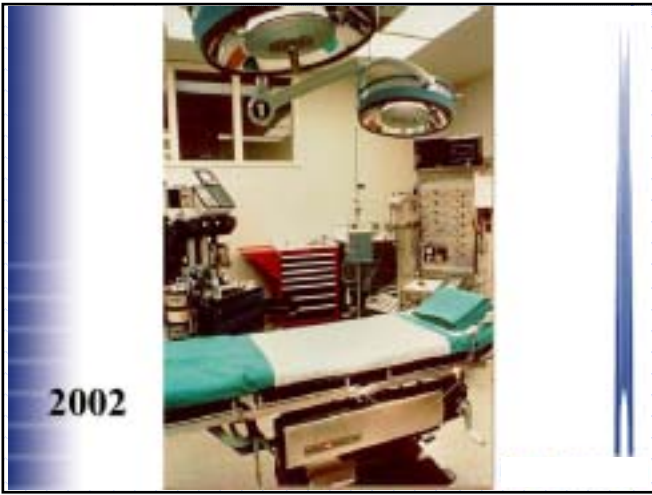
2002



1935



2002





Changing landscape

- Chronic diseases are the national health priority
- One unnecessary test can cost \$1000
- Clinicians spend 25% of time seeking information
- Negligence claims are most often caused by poor communication
- Self management of ongoing problems often leads to better outcomes
- Self monitoring of many common diseases is superior to professional monitoring

Some things remain the same: HL7 version 3 is nearly ready




Name	Date	Frequency	Substitution
Aspirin	1/1/01	1x	100%
Paracetamol	1/1/01	1x	100%
Health Monitor	1/1/01	1x	100%
Health Monitor	1/1/01	1x	100%
Health Monitor	1/1/01	1x	100%



EHR as a functional system

HL7 Functional model draft standard for trial use.

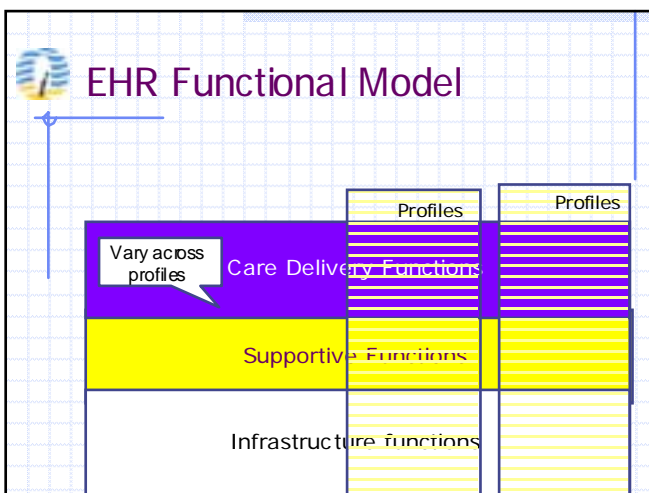


HL7 Functional model

- CMS – Medicare and Medicaid
- Veterans Affairs – 23 million people!
- AHRQ - Agency for Healthcare Research and Quality (DHHS)
- HIMSS - Health Information Management Systems Society
- NHII – National Health Information Infrastructure

Motivation

- Define the EHR functionally
 - Binary – do you have one or not?
 - Graded – do you have a good one?
- Financial incentives
 - Reward functionality
 - Reward use
- Business transactions



Functions: Medication

- Manage medication list
- Manage allergy and adverse reaction list
- Order medication
- Manage medication formularies
- Manage medication administration
- Prescribing
 - Drug, food, allergy interaction checking
 - Patient specific dosing and warnings
 - Medication recommendations
 - Support for medication administration

Health record as technical artefact

Proposed European standard CEN 13606 rev.



Logical building blocks of the EHR

EHR	The electronic health record for one person
Folders	High-level organisation of the EHR eg. per episode, per clinical speciality
Compositions	Set of entries comprising a clinical care session or document eg. test result, letter
Sections	Clinical headings reflecting the workflow and consultation/reasoning process
Entries	Clinical "statements" about Observations, Evaluations, and Instructions
Clusters	Compound entries, test batteries eg. blood pressure, full blood count
Elements	Element entries: leaf nodes with values eg. reason for encounter, body weight
Data values	Date types for instance values eg. coded terms, measurements with units

Logical building blocks of the EHR

The EHR itself

comprises...

a hierarchy of Folders

each containing...

Compositions

Logical building blocks of the EHR

Compositions

contain...

Sections

(which maybe nested)

containing...

Entries with data as...

Elements

Clusters

Clusters may be nested

& contain Elements

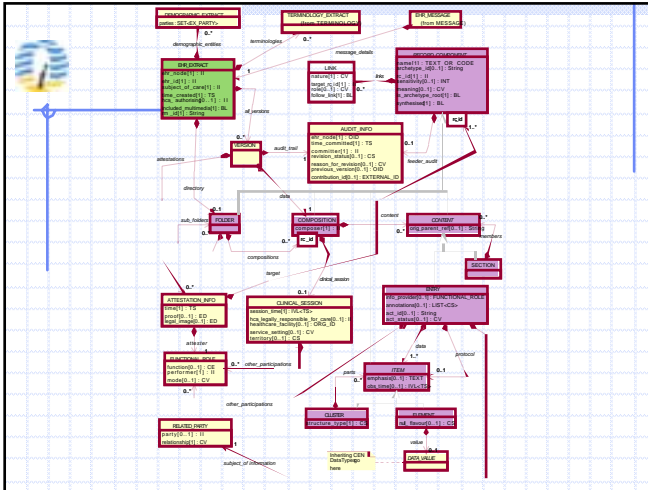
Logical building blocks of the EHR

Elements

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

EHR context requirements

- The EHR Extract reference model needs to meet published requirements to be faithful to the original clinical context and to ensure meaning is preserved when records are communicated
- The following slides show the key EHR contextual requirements, related to the logical building blocks proposed by CEN (for EN 13606)
- They indicate which attributes are needed at each level in the EHR Extract hierarchy



EHR context requirements

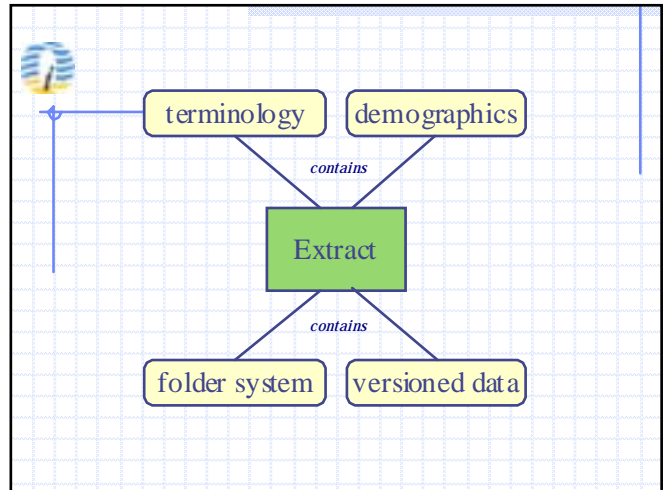
The EHR EXTRACT

- Identity of the subject of care (the patient)
- ID of this electronic record
- ID of the owning organisation (the data controller)
- Who created this Extract and when (optional)
- If multimedia data has been excluded (to limit the data volume)
- On which standard this Extract is based (e.g. EN 13606)

EHR_EXTRACT

ehr_node[1] : II
 ehr_id[1] : II
 subject_of_care[1] : II
 time_created[1] : TS
 hca_authorising[0..1] : II
 included_multimedia[1] : BL
 rm_id[1] : String

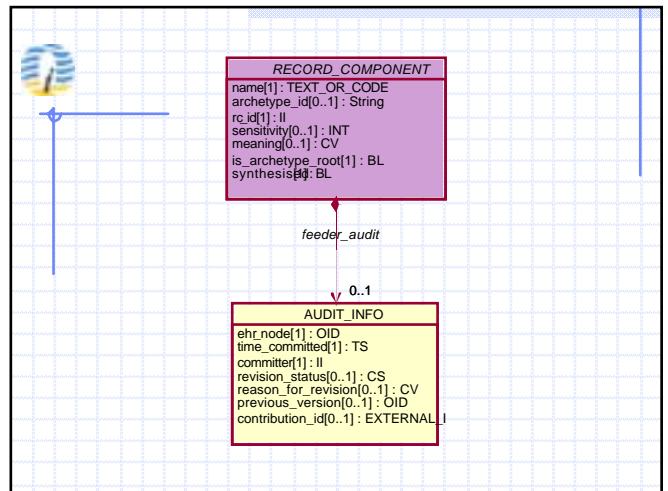
With access to externally-provided Terminologies and Demographic Entities

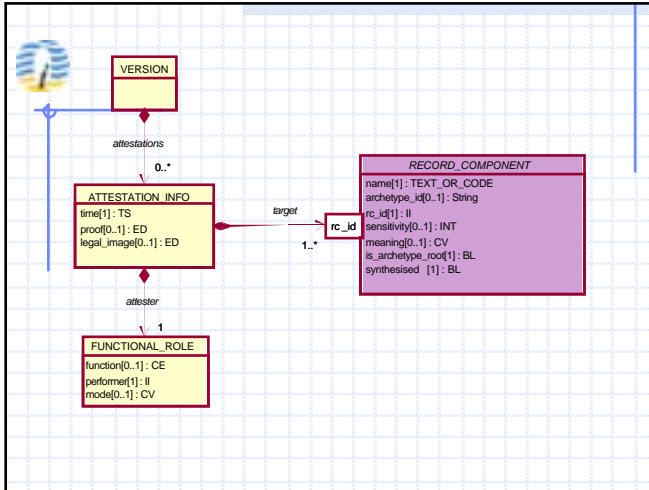


EHR context requirements

Any kind of Record Component in the EHR_EXTRACT

- Representation of the meta-data about:
 - commital
 - revision
 - attestation (optional)
 - that might exist at any hierarchical level in the clinical systems contributing to the Extract
- Each version states
 - revision status and why revised
 - ID of preceding version
- Attestations include
 - attesting party and functional role
 - optional digital "proof"
 - optional "image view" of what was seen and signed
 - any number of attestations may be added at or after commital

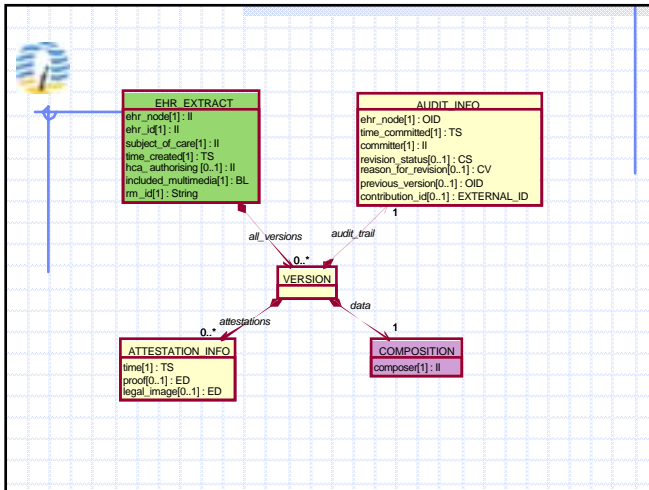




EHR context requirements

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 and revisions of EHR data *within the Extract*
- Metadata about the commit and revision of Compositions
- Attestations, referencing any Record Components within that Composition



EHR context requirements

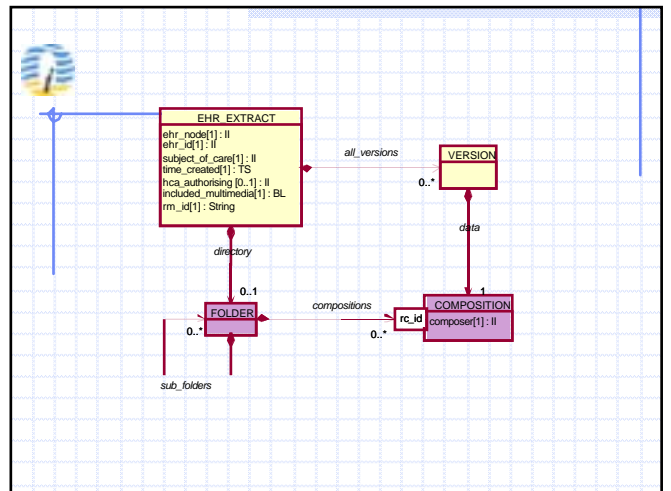
The Contribution

- 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
 - AND
 - update to a repeat medication list elsewhere in the EHR

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



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*

EHR context requirements

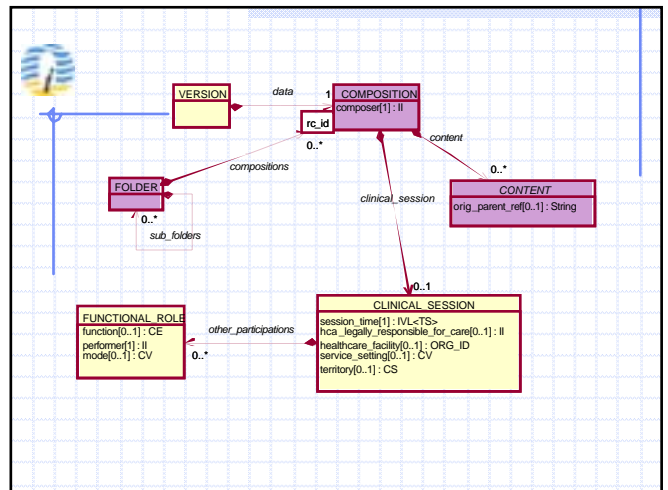
Composition

- 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

EHR context requirements

Composition

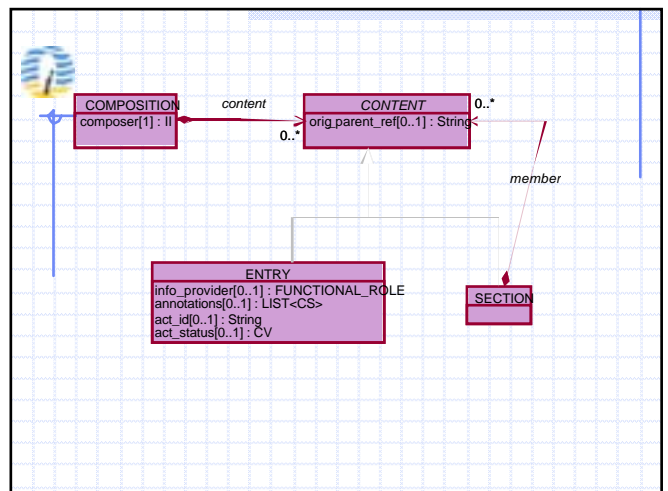
- The content of a Composition might be new (original) data or data that are re-used from previous EHR entries
 - components logically copied from other pre-existing parts of the EHR retain a reference to their original container (parent)



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

- 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

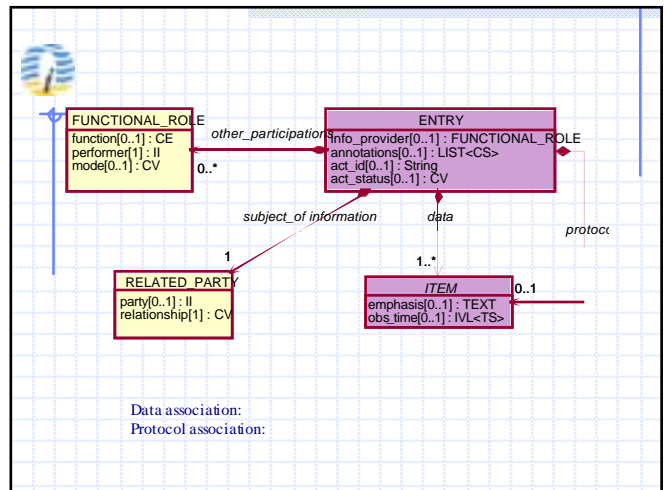
Entry

- 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

- Representing 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)



Structured data

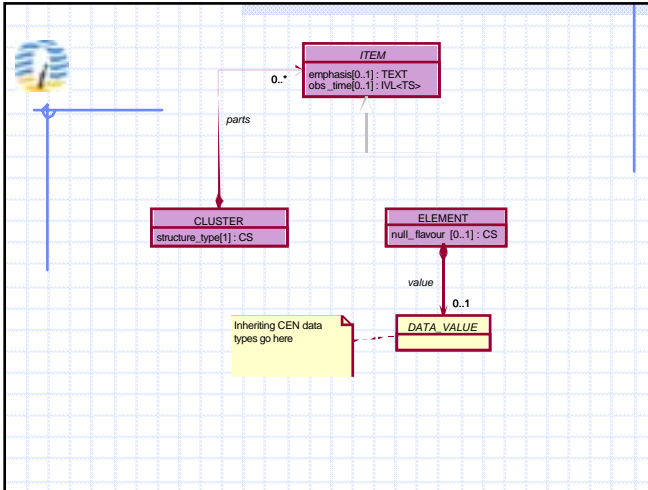
Cluster

- 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"

Structured data

Cluster

- 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

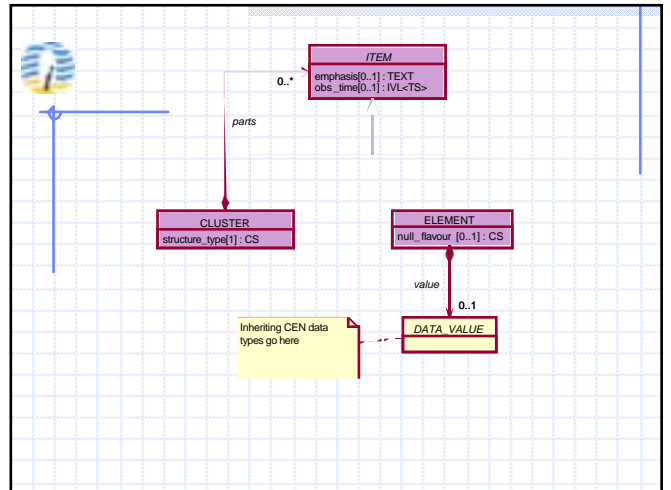


Representing Structure

- In this model, Lists, Tables, Trees are represented by specific configurations of the Cluster Class.
- Normative Archetypes will be developed to provide the necessary constraints to ensure interoperability.

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.



Element

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

