



Semantic interoperability, information analysis, data use, DCM standard development in historical perspective

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Results 4 Care
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Content

- Semantic Interoperability
- Data for different uses
- Information analysis
- Overview of developments
- Clinical Templates
- 13606 RIM and archetypes
- Clinical Statements HL7 v3
- Multiple representation formats
- Conclusion



Semantic Interoperability

- property of a combined system containing two (or more) information systems such that specific aspects of the meaning of information passed from one to the other are invariant over the data exchange that carries the information.
- is thus the engineering property that enables the need to be met, but typically for engineering properties of systems, semantic interoperability is not absolute.
- Semantic interoperability is about the unambiguous understanding of stored, used and communicated data.



Data for different uses

- Primary process
- Continuity of care
- Management information
- Quality of care / indicators
- Epidemiology: prevalence and incidence
- Clinical trails: CDISC
- Accountability: HIPAA



Structure characteristics:
service items
environment
context

**Layer 5
international MDS**

Layer 4:
MDS:
national
purposes

Layer 3:
Use of
Minimum Data Set NMDS
on Institutional level

Layer 2: documentation of:
diagnoses
interventions
Outcomes of care

Layer 1: Facts:
- Demographical data
- Observations: signs & symptoms
- Aetiology: facts causal relations / data
other disciplines etc.

Standard terminology
for
comparable
data:
ICD,
Snomed CT

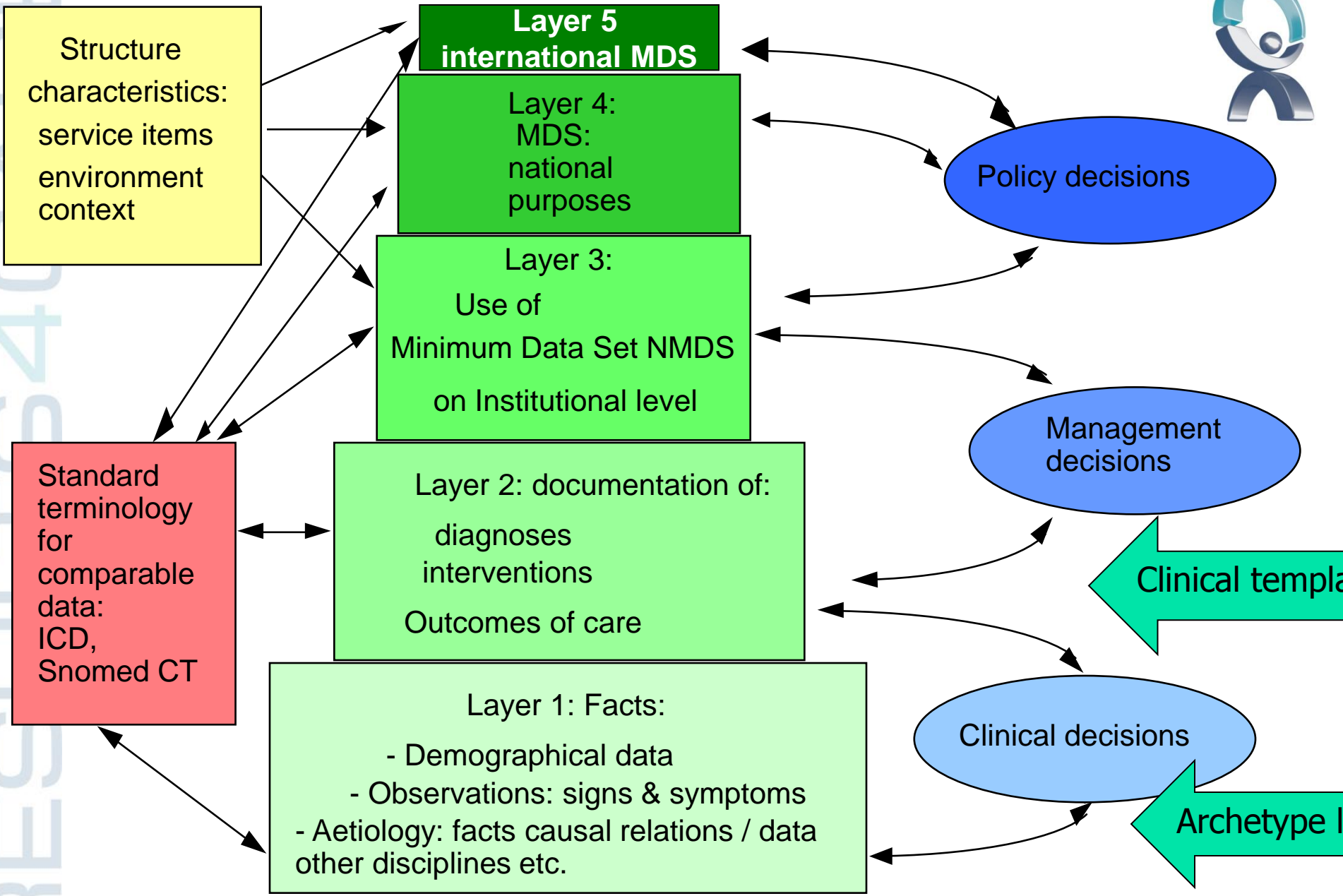
Policy decisions

Management decisions

Clinical decisions

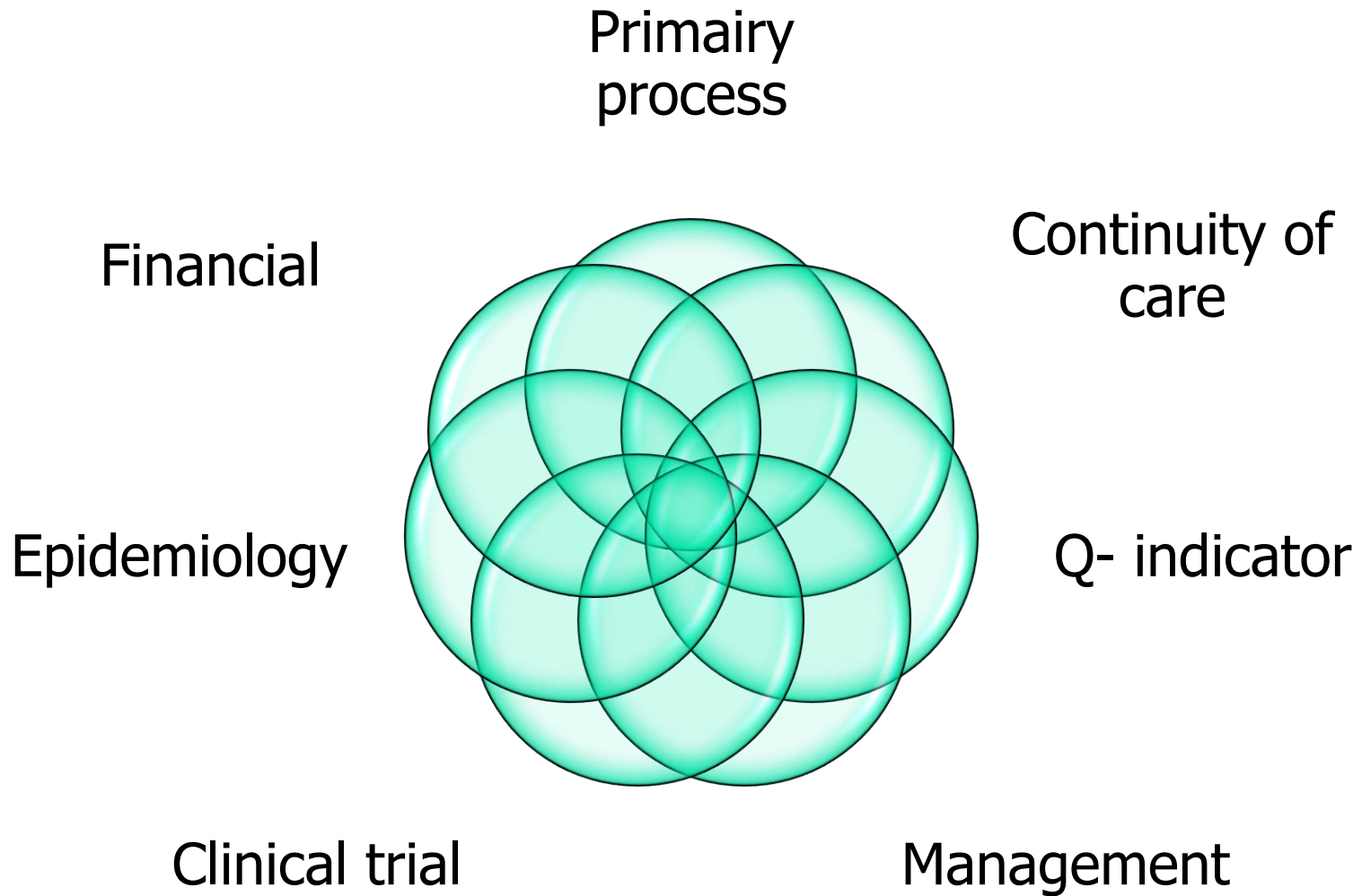
Clinical template

Archetype I





Requirements of DCM





Continuity of care

- Follow the route of the patient all the way
- Beyond borders in healthcare delivery
- This means sharing of data
- Often by electronic message exchange
- Exchange data based on standardised terminologies.





Information analysis

Information analysis is the collection of required data that will systematically be entered, transferred and communicated in an information system by a professional.

Business analysis



- *Functional perspective*: what to support with IT for which purpose?
- *Process perspective*: who does which action when and why, which care processes?
- *Interaction perspective*: who interacts with whom in the processes and moments of communication?
- *Structure perspective*: which information is needed in the processes and interactions, use cases, data set?
- *Resource perspective*: which resources will be deployed and how will they be used, including knowledge?
- *Business rules*: rules that apply to health care

Data collection



- Baseline: where exactly will the information system be used for
- The requirements that are described as use cases, clinical pathways, or storyboards
- Means: records, forms, observations, interactions, guidelines, protocols, literature
- Consultation of clinicians/care providers
- Result of this phase: a large collection of data, to be systematically organized as a set of requirements
- Characteristics of the data can be made explicit
- Use of formalised methods, e.g., HL7 DAM



Examples clinical models

- Many developments
- No full review available
- Examples shown next are absolute incomplete!

example of assessment form

template

Nature of wound *group*

- Type *nominal_list*
 - *pressure ulcer*
 - *leg ulcer*
 - *diabetic ulcer*
 - *surgical wound*
 - *traumatic wound*
 - *other*
- Location *freetext*
- Course *nominal_list*
 - *undermining*
 - *tracking*
- Description *freetext*



forms and fragments

`clinical forms'

- **nursing assessments**
- **elderly shared assessments**
- **gold standards palliative care forms**

made up of `clinical fragments'

- **blood pressure**
- **carer details**
- **lifestyle, smoking, alcohol**

templates and archetypes

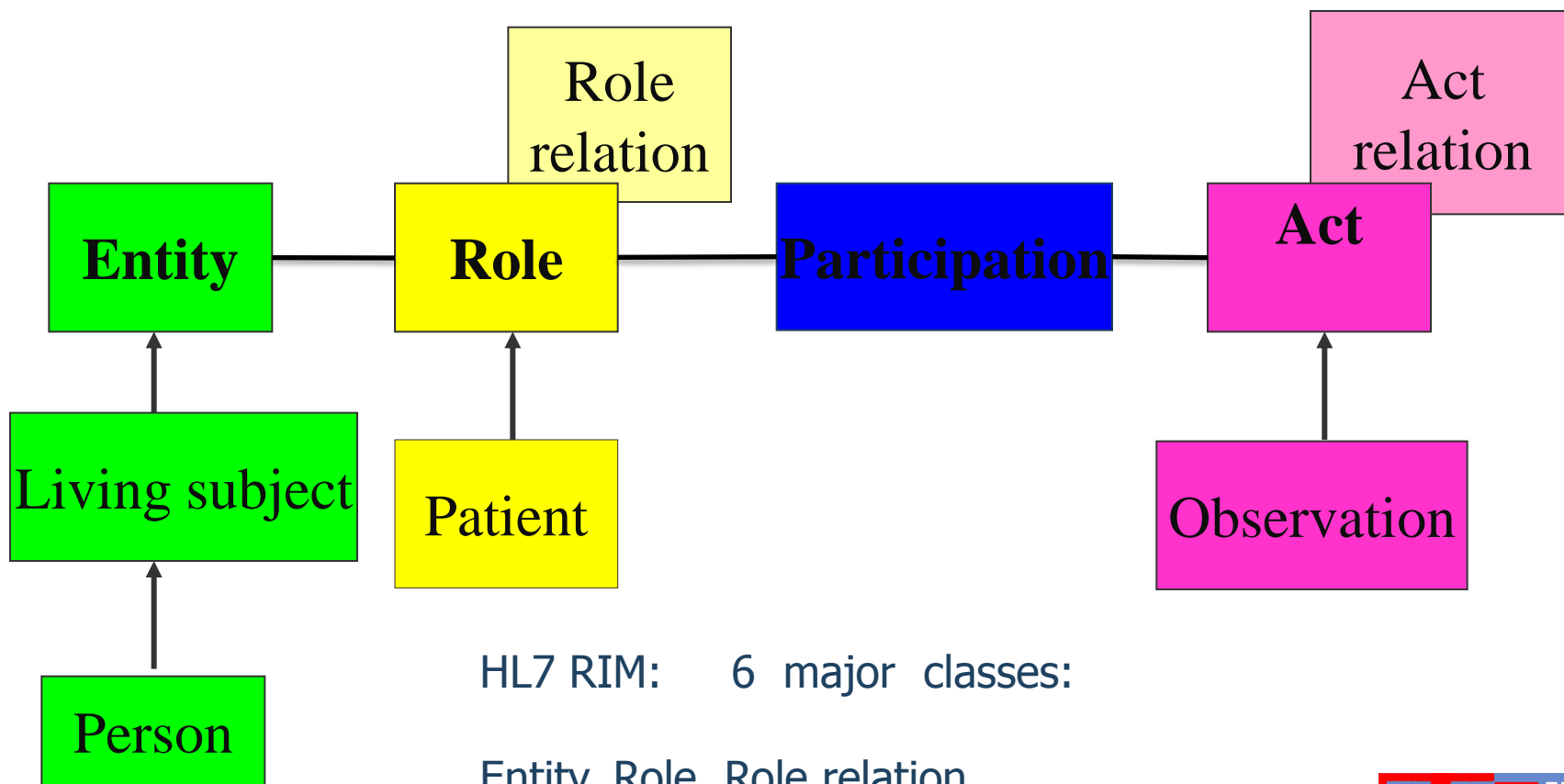
templates = clinical forms

- **form-level data entry pages**
- **consensus more difficult across professional, geographical groups**
- **ownership ... clinical groups**

archetypes = clinical fragments

- **more granular**
- **consensus easier**
- **extensible**
- **ownership ... data standards groups**

HL7 v3 Reference Information Model



HL7 RIM: 6 major classes:

Entity, Role, Role relation,
Participation, Act and Act relation

© HL7 inc.





Observation Class as example

Any Observation

classCode*: <= *OBS*

moodCode*: <= *EVN*

id: SET<II> [0..*]

code: CD CWE [0..1] <= *ActCode*

derivationExpr: ST [0..1]

effectiveTime: GTS [0..1]

value: ANY [0..1]

methodCode: SET<CE> CWE [0..*] <= *ObservationMethod*

Clinical content: code

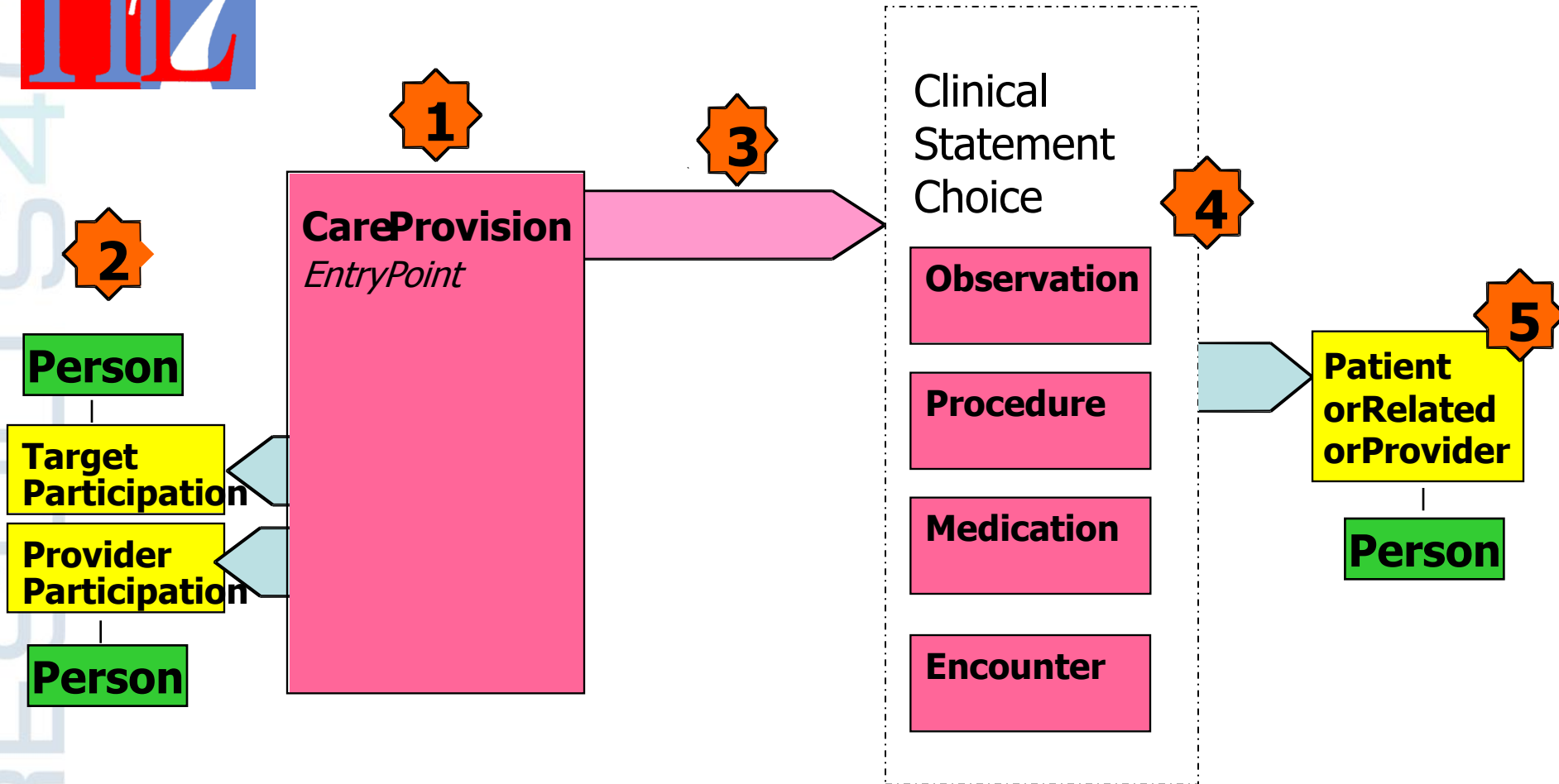
Clinical content: text,
number or code

HL7 v3 Clinical Statement



- HL7 creates messages for interoperability
- These are created for different clinical domains
- In v3 a generic re-usable pattern is developed with a choice box to put in what is needed in a message or taken out what is not needed in a message

HL7 v3 Care Provision model summary





Care information models

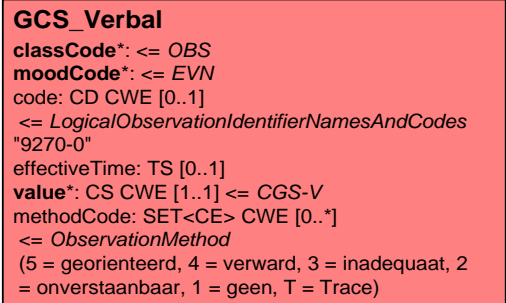
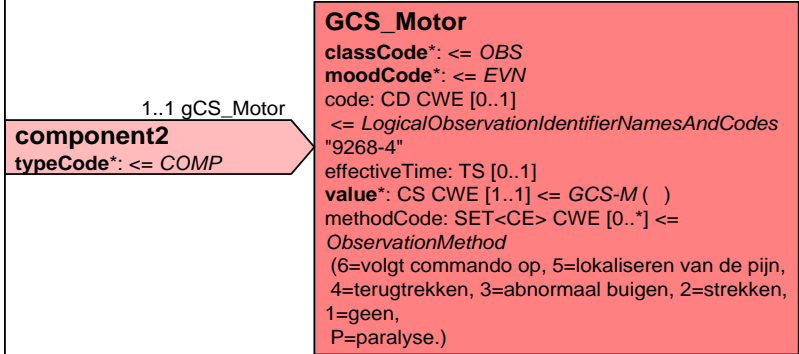
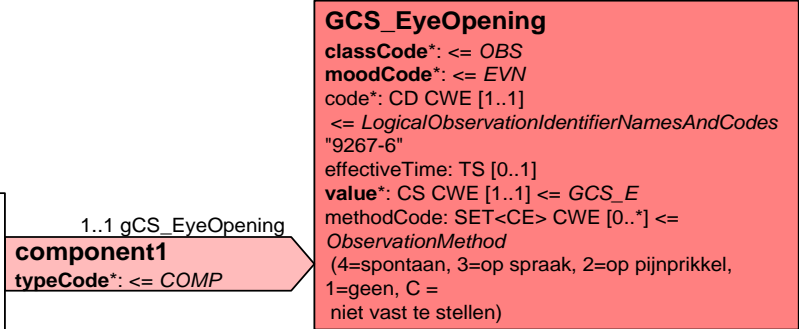
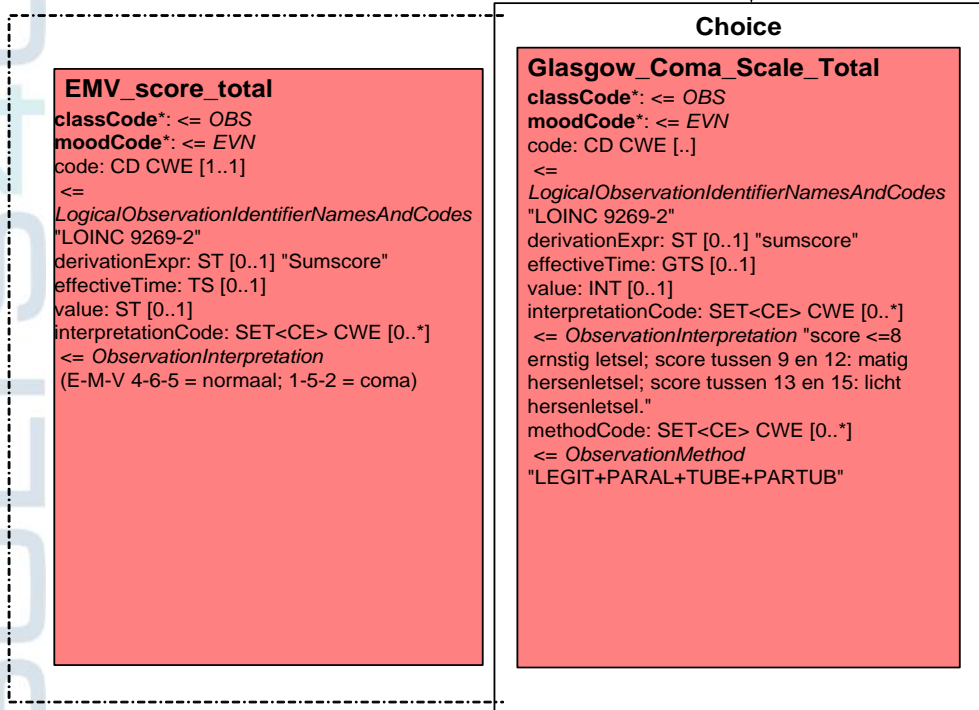
- “Reusable bits”
- Clinical information
- Taken from one domain to the other
- Or if new information in other domain: modeled the same way
- Brought to HL7 PC WG
- However, in HL7 v3 these need XML serialization: the enormous amount of variations cause a combinatorial explosion in messages: hence do it different!

HL7 v3 R-MIM GCS



Geharmoniseerd met
NICTIZ trauma project
en LOINC 22 juni
2005 WG

GlasgowComaScale
((NICTIZ_2004_GCSrev0.94June05))
Glasgow Coma Scale v.0.95



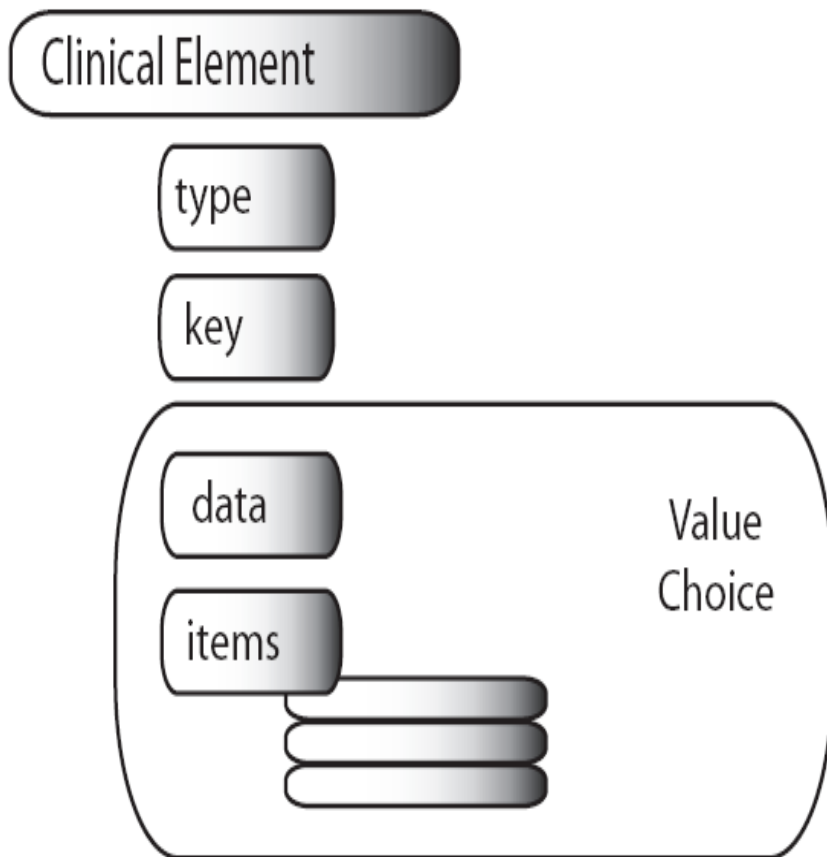


IntermountainSM Healthcare



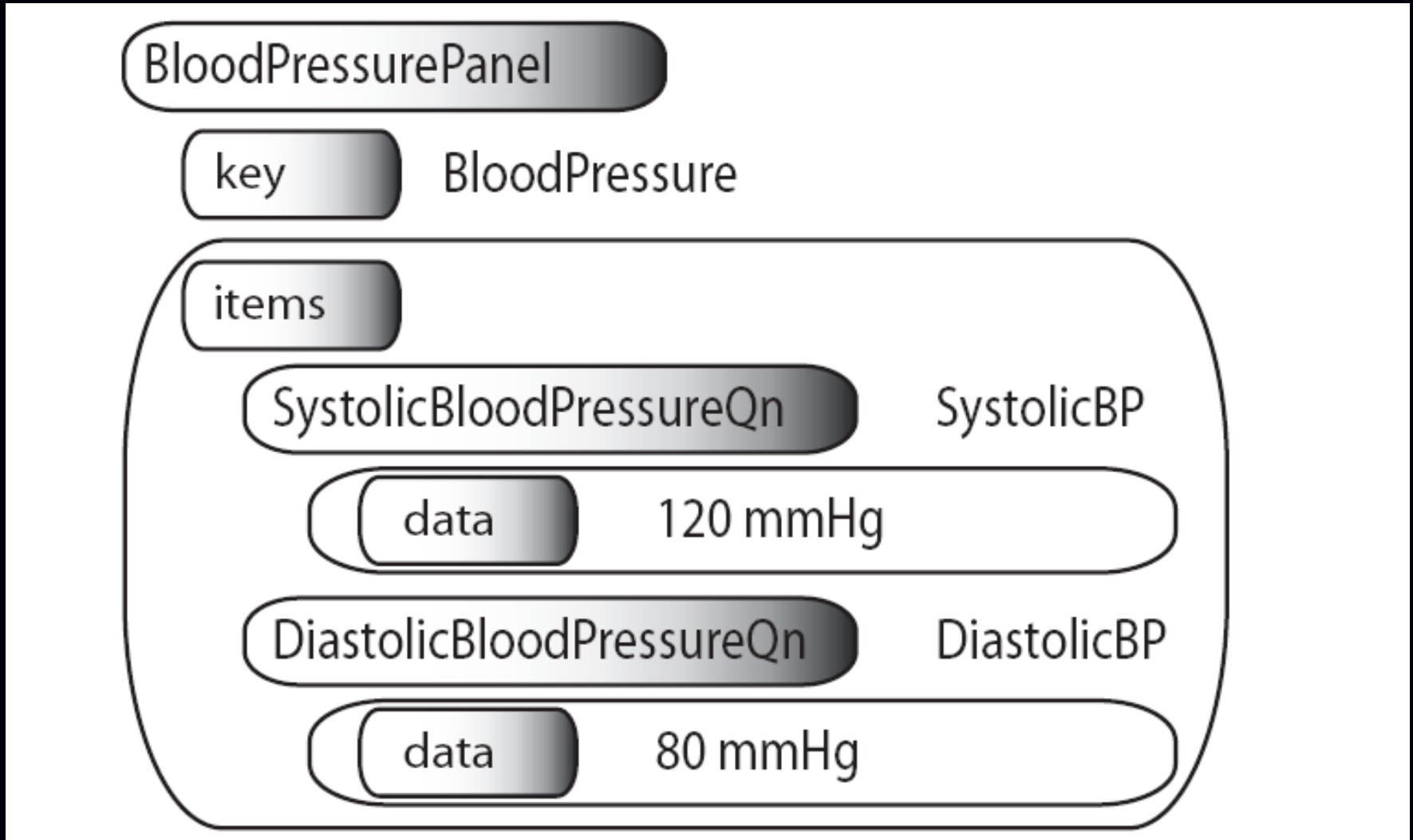
- Pioneer work on Detailed Clinical Models
- XML representation
- Used for defining content, user interface, database storage, terminology linkages, decision support, data aggregation for quality reports, studies, communication among others
- Medinfo 2004 publications

Basic elements of the core model



- **Type** - The name of a particular model
- **Key** - Links the model to a concept in an external coded terminology.
- **Value Choice** - Possible ways to convey the model's value.

A diagram of a simplified clinical model





Korea CCM

- The Center for Interoperable EHR (CiEHR) is a research and development institute that develops core technologies necessary to implement lifetime Electronic Health Records (EHR) which enable the public to securely access and practically use their own medical record anytime and anywhere, when necessary, from the cradle to the grave.



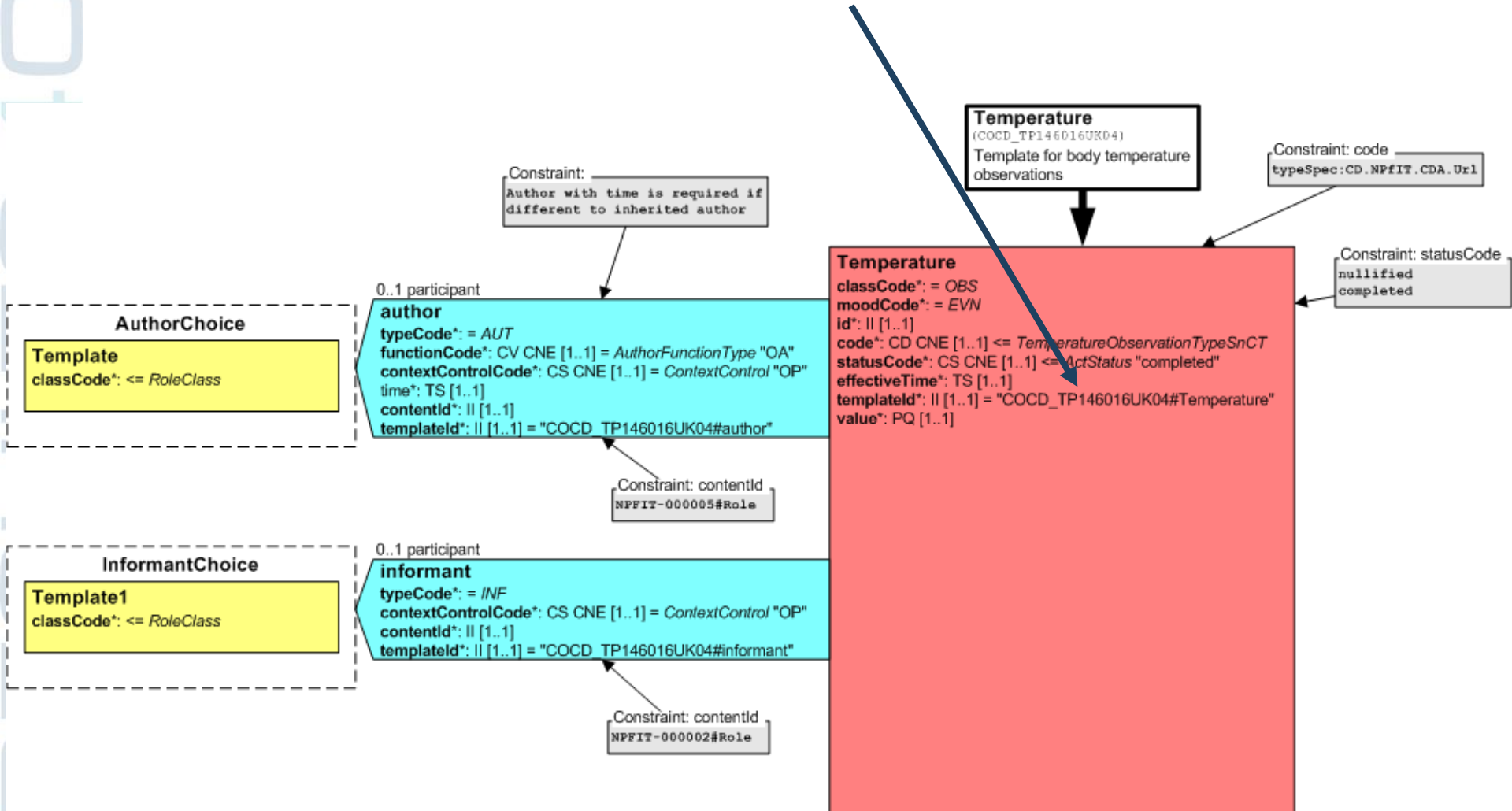
Clinical Contents Model

- The CiEHR is conducting the development of Clinical Contents Model (CCM) to support semantic interoperability and reusability of EHR data.



Example format NHS

Unique ID for template



OpenEHR table format



Body temperature - Mozilla Firefox

Bestand Bewerken Beeld Geschiedenis Bladwijzers Extra Help

file:///R:/1Results4Care2007Projecten/CareInformationModels2007/ComparisonJuly2007/Temperature

Google

HL7 Version 3 Standa... ICON login - The Univ... PubMed 2008 Annual HIMSS C... Verkeer Hotmail World Markets WebCT Minnesota Postbank.nl > Postba...

Body temperature: *Observation*

Requires [Ocean Archetype Editor](#) Build 1.0.1235 or above

Comments to [Laura Sato, Project Lead](#)
[What do the symbols mean?](#)

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Concept	Archetype Id	Structure
An estimate of the core temperature of the body	<i>Id:</i> openEHR-EHR-OBSERVATION.body_temperature.v1 <i>Reference model:</i> EHR ADL , (ADL)	<pre> graph LR History[History] --- Data[Data] History --- State[State] Protocol[Protocol] </pre>

Data: SINGLE

Concept	Description	Type	Cardinality	Values	Terminology (SNOMED-CT)	Comment
Q Temperature	The core body temperature	<i>Quantity</i>	mandatory 1..1	<i>Property</i> = TEMPERATURE <i>Units:</i> °C °F		

Klaar

GCS archetype (fragment)



```
archetype (adl_version=1.4)      openEHR-EHR-OBSERVATION.glasgow_coma.v1
concept      [at0000]      -- Glasgow Coma Scale
language     original_language = <[ISO_639-1::en]>
description  original_author = <
    ["name"] = <"Heather Leslie">  ["organisation"] = <"Ocean Informatics">
    ["date"] = <"13/03/2007">
> details = < ["en"] = < language = <[ISO_639-1::en]>
    purpose = <"Used to collect clinical observations regarding the level of consciousness">
    use = <""> misuse = <"">
    keywords = <"response", "motor", "verbal", "eye", "stimulus">    >>>> Snip 8<8<8<8<
definition
OBSERVATION[at0000] matches { -- Glasgow Coma Scale
    data matches { HISTORY[at0001] matches    >>>> Snip 8<8<8<8<
    data matches { ITEM_TREE[at0003] matches >>>> Snip 8<8<8<8<
    ELEMENT[at0009] occurrences matches {0..1} matches - Best eye response
    value matches {
        1|[local::at0010],      -- No eye opening
        2|[local::at0011],      -- Eye opening in response to pain
        3|[local::at0012],      -- Eye opening to speech
        4|[local::at0013]      -- Eyes opening spontaneously}
    ELEMENT[at0007] occurrences matches {0..1} matches - Best verbal response
    value matches {
        1|[local::at0014],      -- None
        2|[local::at0015],      -- Incomprehensible sounds
        3|[local::at0016],      -- Inappropriate words
        4|[local::at0017],      -- Confused
        5|[local::at0018]      -- Oriented}
```

What is a Detailed Clinical Model?



- Method for technology independent specification of clinical content and to maintain this. From this specification different technical implementations are possible that can be semantic interoperable.
 - Organises, formalises and standardises clinical knowledge and data
 - Models data elements
 - Contains bindings to vocabulary like SNOMED CT, LOINC, ICNP.
 - Contains Metadata



Why a DCM

- A DCM is independent of technical implementation
- Are applicable in different technical applications like EHR and repository
- Use of standards
- Is useable as a building brick for the clinical content of an EHR.



Purpose of DCM

- To specify precise semantically consistent data and terminology specifications, which are comparable and interchangeable between health professionals, health care facilities and standards based health care information technology.

DCM use



The specification of clinical content for:

- Use in logical models like HL7 DIM and the technical representation in HL7 messages, Services & CDA.
- User Interface
- Use in medical devices
- Use as parameter for cost determination
- Use for quality measures and national registries.

DCM use



- Use in guidelines and protocol for health care delivery
- Use of data in research including epidemiological and statistical studies.
- Use in systems for decision support.

This such that the DCM specifications remain consistent for all supported functions and uses.



DCM issues

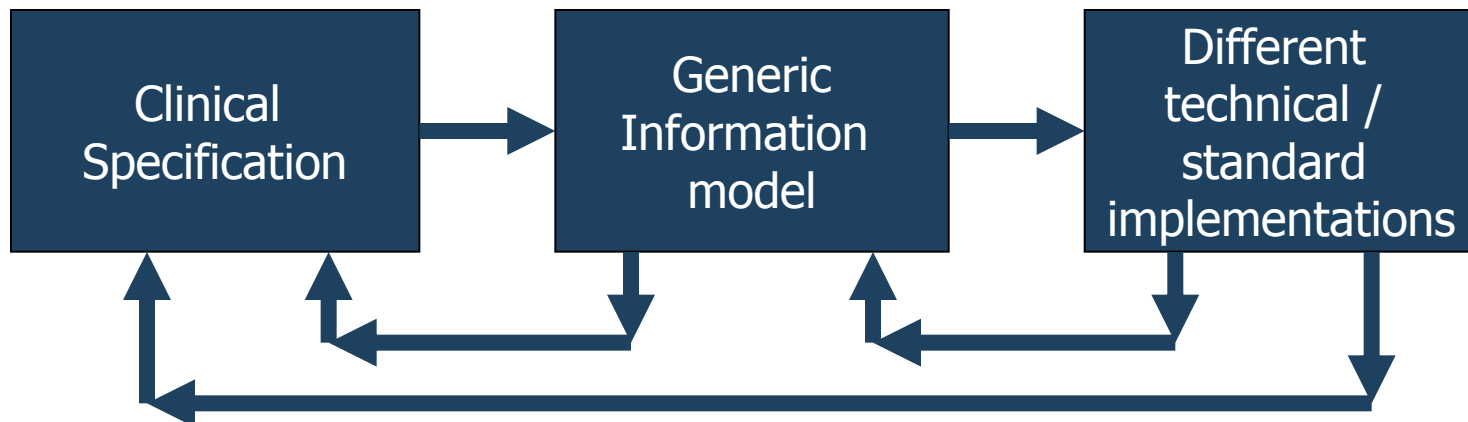
- Overlapping between allergy, hypersensitivity, contra-indications
- DCM development in UMCG (university hospital in Groningen), supplemented with content from the project of exchange of medication data, supplemented with data from the e-Diabetes project
- Inconsistencies in few data elements or relations between data elements
- Different presentation for different target g
- Generic or specific?
- Repository?
- Feedback care providers?
- Ownership / stewardship





Assumption

- From the clinical perspective: the technical format is not that important, thus: *OpenEHR* archetypes = HL7 v3 template = HL7 v3 R-MIM = clinical data definition = 13606 archetype = XML representation = detailed clinical model, **if conceptual level is addressed**
- In other words: medically it should be equivalent.
- Of course from technical viewpoint – the level 2 modelling – it is not (completely) true, but an approach to work with.





Core: reusability!

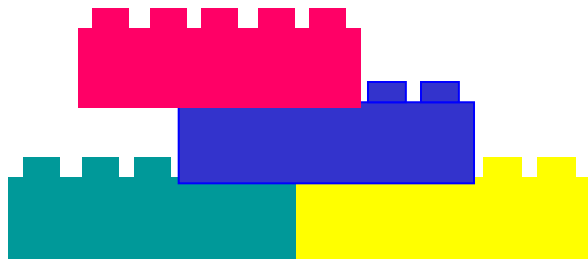
- Cost control for development of EHR and electronic messages
- Care providers have a limited availability for standardization proceedings
- Need to optimally use the employment of care providers.



Thank you for your attention!



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