



Archetypes/Structure in HL7 Version 2.x

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The first important question



- Why do we want to do this?

Why more structure is desirable

- HL7 V2 is a proven & supported standard
- We have reliable name=value pairing
- It is capable of transmitting atomic data
- It lacks clear structure within the atomic Data
- Modern terminologies have complex relationships between concepts
- Archetypes describe structure “Metadata”
- Archetypes provide structure where terminology does not exist

What use is this structure?



- SNOMED-CT post co-ordinated terms
- Decision support
- Arden/Gello/vMR
- Graphing
- Analysis
- Provides guidelines for uniform data collection
- Allows reports from different institutions to be compared
- Lossless serialization of structured data between HL7 and non HL7 systems

Where do we want more structure?



- ORU messages
- REF messages
 - Basis of Patient Summary
 - ?vMR
- ORM messages
 - Registry notification

Desirable outcomes



- Do not break existing infrastructure
 - Should not require software update if not used
- No limits on complexity
- Ability to use any Archetypes
 - OpenEHR
 - ?Registry reporting
- Represent Snomed-CT abstract logical model
- Lossless transmission of structure
- Usage within the Standard

Existing Structure



- Current structure of messages at segment level mostly
- Messages are a serialised tree structure already
- Significant structure already available within OBX via use of SubID
 - Grouping
 - Tree structures
- To serialise Archetypes
 - Encoding rules are needed to ensure uniformity
 - No additions to standard required
 - dotted SubID



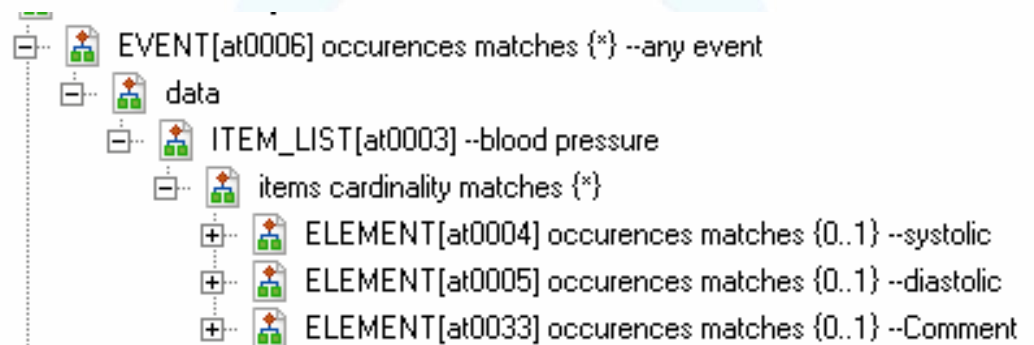
We suggest the use of a dot and a string (similar to the Dewey Decimal system) when users wish to distinguish each of the repeats within one type, or results within a cell for editing and correction purposes. Using this system, *Figure 7-7* would become *7-8*. If there are cases where such nesting occurs at even deeper levels, this approach could be extended.

Figure 7-8. Example of sub-identifier usage

```
OBX|1|CE|880304&ANT|1|T57000^GALLBLADDER^SNM...
OBX|2|TX|880304&GDT|1|THIS IS A NORMAL GALL BLADDER...
OBX|3|TX|880304&MDT|1|MICROSCOPIC EXAMINATION SHOWS HISTOLOGICALLY
NORMAL GALLBLADDER TISSUE...
OBX|4|CE|880304&IMP|1|M-00100^NML^SNM...
OBX|5|CE|880304&ANT|2|T57000^APPENDIX^SNM...
OBX|6|TX|880304&GDT|2|THIS IS A RED, INFLAMED APPENDIX...
OBX|7|TX|880304&MDT|2|INFLAMMATION WITH MANY PUS CELLS-ACUTE INFLAMMATION...
OBX|8|CE|880304&IMP|2.1|M-40000^INFLAMMATION NOS^SNM...
OBX|9|CE|880304&IMP|2.2|M-30280^FECALITH^SNM...
```

Use a null or 1 when there is no need for multiples.

Example Archetype to embed



Archetype Driven User experience



Blood pressure measurement

Options

5 minute reading

systolic Units

diastolic Units

Comment

State

Position

Exertion level Units

Exercise

Protocol

Instrument

Cuff size

Location of measurement

Use the SubID to indicate tree structure



```
OBR|1||3F203BFE^Unassigned^8D9FE669
OBX|1|CE|ARCHETYPE^^OpenEHR|1|at000
  OBX|2|CE|ITEM_LIST^^OpenEHR|1.1.
    OBX|3|NM|163030003^systolic^SNO
    OBX|4|NM|163031004^diastolic^SNO
    OBX|5|ST|at0033^Comment^openEHR
  OBX|6|CE|at0008^Position^openEHR
  OBX|7|CE|at0010^Exercise^openEHR
  OBX|8|ST|57134006^Instrument^SNO
  OBX|9|CE|246153002^Cuff size^SNO
  OBX|10|CE|at0014^Location of mea
```

Users view of 2 archetypes



Examination

Blood pressure measurement

baseline reading

systolic	150	mm[Hg]
diastolic	90	mm[Hg]

Position **Sitting**

Exercise **At rest**

Cuff size **Appropriate for age**

Location of measurement **Left arm**

Heart rate

Rate 80 /min

Rhythm **Regular**

Position **Sitting**

Snomed –CT



- Abstract logical Model under development
 - Conflicts/overlaps with some HL7 V3 structures
- HL7 V2 has administrative models
 - Limited clinical model (Medication mainly)
- It is possible to represent Snomed-CT Abstract Logical Model in HL7 V2
- Requires tree structures within groups of OBX segments

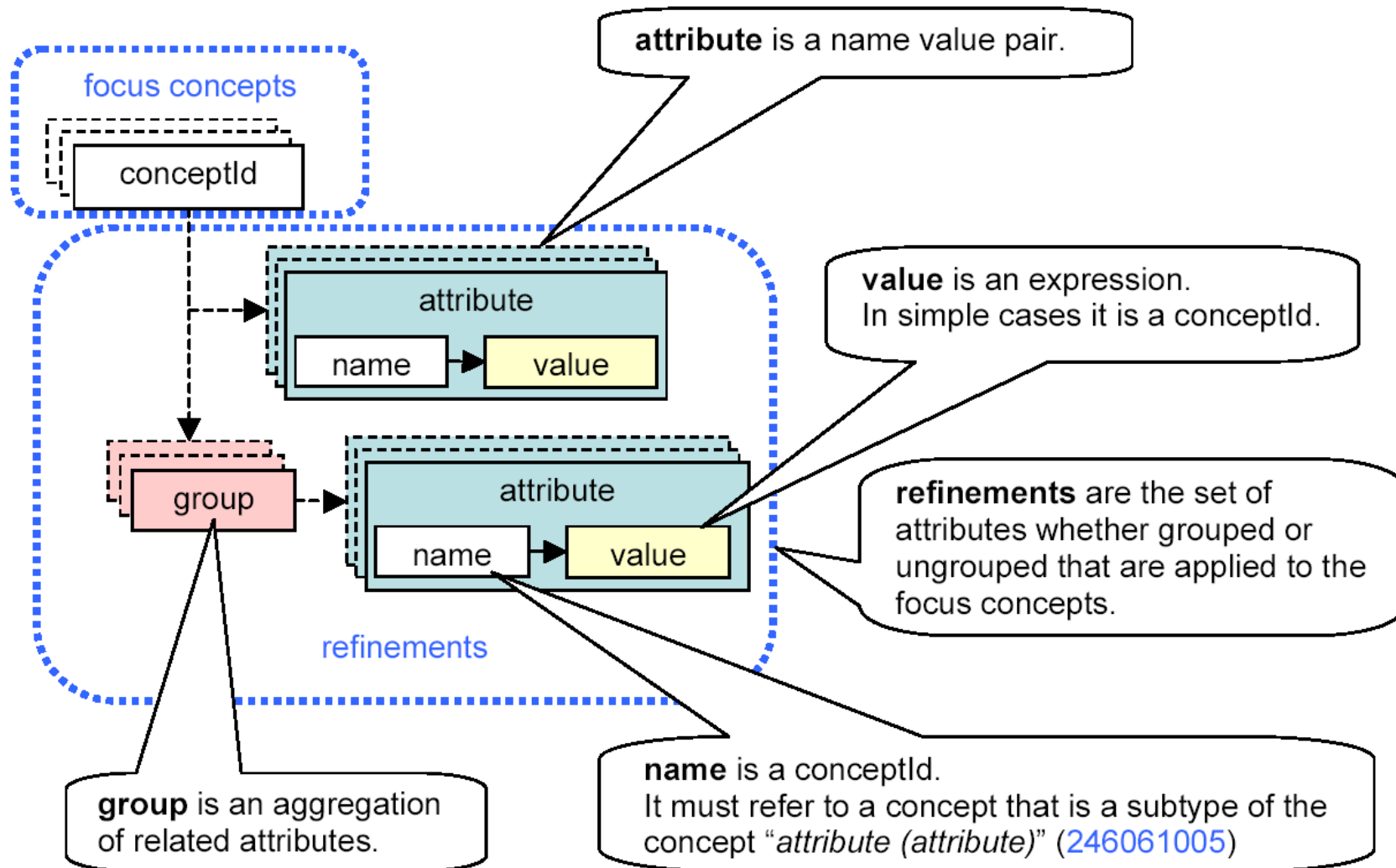
Snomed-CT Model



- Snomed Grammar

```
243796009|context-dependent categories|:  
{363589002|associated procedure|  
  =(397956004|prosthetic arthroplasty of the hip|  
    :363699004|direct device|=304120007|total hip replacement prosthesis|  
    {363704007|procedure site|  
      =(24136001|hip joint structure|:272741003|laterality|=7771000|left|)  
      ,260686004|method|=257867005|insertion - action|})  
  ,408729009|finding context|=410515003|known present|  
  ,408731000|temporal context|=410512000|current or specified|  
  ,408732007|subject relationship context|=410604004|subject of record|  
}
```

Focus Concept



Attributes = Post Co-Ordination



- Attributes are defined by model
 - Vary depending on type of statement
 - Qualify concepts



Context of Statements



- Past History
- Family History
- Planned
- Possible etc
- Every statement needs context
 - Default context
 - Known present
 - About patient
 - Current or specified

Context added to statements



- Removes much ambiguity

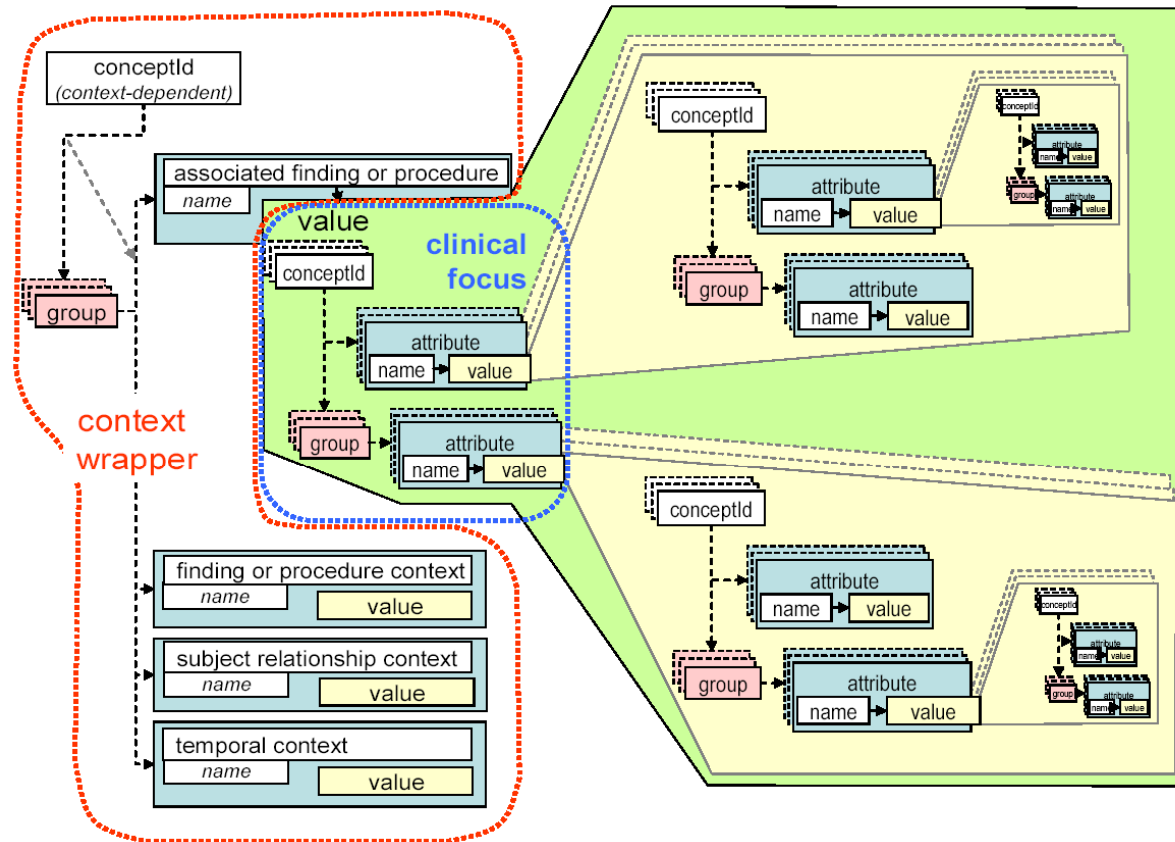


Figure 3. Illustration of the names used to refer to parts of an expression that represent context

Representing a Clinical Summary



- An example

Medical History example encoded in Snomed

Level	Name		Value	
	Code	Meaning	Code	Meaning
Past Medical History				
1	116680003	IsA(Attribute)	417662000	Past Medical History(Context Dependant)
1.1.1	246090004	Associated finding(Attribute)	9713002	Prostatitis(Clinical Finding)
1.1.1.1	260908002	Course	255318003	Relapsing(Qualifier)
Past Surgical History				
2	116680003	IsA(Attribute)	416940007	Past Surgical History(Context Dependant)
2.1.1	363589002	Associated Procedure(Attribute)	80146002	Appendectomy(Procedure)
2.1.1.1	260870009	Priority(Attribute)	25876001	Emergency(Qualifier)
Family History				
3	116680003	IsA(Attribute)	57177007	Family History(Context Dependant)
3.1.1	246090004	Associated finding(Attribute)	414545008	IHD (Disorder)
3.1.1.1	408732007	Subject relationship Context(Attribute)	34871008	GrandFather(Person)
3.1.2	408729009	Finding Context(Attribute)	415684004	Suspected(Qualifier)
Social History				
4	160476009	Social History(Observable Entity)	FT	Free Text
Presenting complaint History				
5	84100007	History taking(Procedure)	FT	Free Text
Systems Review				
6	415300000	Review of Systems(Procedure)	FT	Free Text
Examination				
7				Archetypes/Snomed data
Interpretation				
8	243814003	Interpretation of Findings(Observable Entity)	FT	Free Text
Plans				
9.1	116680003	IsA(Attribute)	129125009	Context Dependant Procedure
9.1.1	363589002	Associated Procedure(Attribute)	73761001	Colonoscopy
9.1.1.1	408730004	Procedure Context(Attribute)	397943006	Planned(Qualifier)
Provisional Diagnosis				
10.1	116680003	IsA(Attribute)	413350009	Context Dependant Finding
10.1.1	246090004	Associated finding(Attribute)	12063002	Rectal Bleeding(Clinical Finding)
10.2	116680003	IsA(Attribute)	413350009	Context Dependant Finding
10.2.1	246090004	Associated finding(Attribute)	34000006	Crohns Disease(Clinical Finding)
10.2.2	408729009	Finding Context(Attribute)	415684004	Suspected(Qualifier)

Some detail



- Nested Name=Value pairs
 - Consistent with Snomed-CT Model
 - HL7 V2.x can encode this

	Code	Meaning	Code	Meaning
Past Medical History				
1	116680003	IsA(Attribute)	417662000	Past Medical History(Context Dependant)
1.1.1	246090004	Associated finding(Attribute)	9713002	Prostatitis(Clinical Finding)
1.1.1.1	260908002	Course	255318003	Relapsing(Qualifier)
Past Surgical History				
2	116680003	IsA(Attribute)	416940007	Past Surgical History(Context Dependant)
2.1.1	363589002	Associated Procedure(Attribute)	80146002	Appendectomy(Procedure)
2.1.1.1	260870009	Priority(Attribute)	25876001	Emergency(Qualifier)
Family History				
3	116680003	IsA(Attribute)	57177007	Family History(Context Dependant)
3.1.1	246090004	Associated finding(Attribute)	414545008	IHD (Disorder)
3.1.1.1	408732007	Subject relationship Context(Attribute)	34871008	GrandFather(Person)
3.1.2	408729009	Finding Context(Attribute)	415684004	Suspected(Qualifier)

In HL7 V2.3.1



- OBX segments are designed to carry NAME=VALUE pairs with date
- Relatively simple display rules –linear display is possible

```
OBX|1|CE|116680003^^SNOMED-CT|1|417662000^Past Medical History^SNOMED-CT|||||F
OBX|2|CE|246090004^^SNOMED-CT|1.1.1|9713002^Prostatitis^SNOMED-CT|||||F|||1986
OBX|3|CE|260908002^Course^SNOMED-CT|1.1.1.1|255318003^Relapsing^SNOMED-CT|||||F
OBX|4|CE|116680003^^SNOMED-CT|2|416940007^Past Surgical History^SNOMED-CT|||||F
OBX|5|CE|363589002^^SNOMED-CT|2.1.1|80146002^Appendectomy^SNOMED-CT|||||F|||199006
OBX|6|CE|260870009^Priority^SNOMED-CT|2.1.1.1|25876001^Emergency^SNOMED-CT|||||F
OBX|7|CE|116680003^^SNOMED-CT|3|57177007^Family History^SNOMED-CT|||||F
OBX|8|CE|246090004^^SNOMED-CT|3.1.1|414545008^IHD^SNOMED-CT|||||F
OBX|9|CE|131195008^Relationship^SNOMED-CT|3.1.2|34871008^Grandfather^SNOMED-CT|||||F
OBX|10|CE|408729009^Certainty^SNOMED-CT|3.1.3|415684004^Suspected^SNOMED-CT|||||F
```

An example



- Putting it together in a REF message

Associated Providers				
Dr. Melissa White	Referring Provider	139 King Street, Duderim QLD 4556		
Dr. Andrew McIntyre	Consulting Provider	102 Wises Road Duderim QLD 4556		
Allergies				
Substance	Reaction Type	Severity	Reaction(s)	Date
Penicillin	Drug Allergy	Severe	Anaphylaxis	2000
History and Physical Examination				
Past Medical History				
Prostateitis		1986		
Course		Relapsing		
Past Surgical History				
Appendectomy		6,1990		
Priority		Emergency		
Family History				
IHD				
Relationship		Grandfather		
Certainty		Suspected		
Social History				
Lived for three months in a paper bag in a septic tank. Used to have to get up at six in the morning, clean the paper bag, eat a crust of stale bread, go to work down to mill, fourteen hours a day, week-in week-out, for sixpence a week, and when gets home his dad would thrash him to sleep w/ his belt.				
Presenting Complaint				
Rectal bleeding and tiredness. Having trouble working 27 hrs a day.				
Systems Review				
Short of Breath on Exertion Crampy Abdo pain Recent arthralgia				
Examination				
Blood pressure measurement				
baseline reading				
systolic		150		mm[Hg]
diastolic		90		mm[Hg]
Position		Sitting		
Exercise		At rest		
Cuff size		Appropriate for age		
Location of measurement		Left arm		
Heart rate				
Rate		80		/min
Rhythm		Regular		
Position		Sitting		
Interpretation				
Rectal bleeding with no recent investigation means colonoscopy is required There is a possibility of Inflammatory Bowel Disease In my day they would call his workload "Light Duties". And you try and tell the young people of today that they won't believe you				
Plans				
Colonoscopy				
Qualifier		Planned		
Provisional Diagnoses				
Rectal Bleeding				
Crab Disease				
Qualifier		Suspected		
Medication				
Drug	Dose	Frequency	Route	Start date
Norovin	400 mg	BD	PO	1996

Linear display



SubID can be used for indentation

Snomed-CT and OpenEHR Archetypes can be combined in the same message

Message remains AHML Compliant

Comment OBX segments can be used to improve display if need be

Can extract the Snomed-CT model or Archetyped data from the message

History and Physical Examination:

Past Medical History

Prostatitis

1986

Course

Relapsing

Past Surgical History

Appendectomy

6.1990

Priority

Emergency

Family History

IHD

Relationship

Grandfather

Certainty

Suspected

Other Context Wrapper abilities



- ?Moods in V2.x
 - Some non displaying segments
 - Context wrapper allows moods to be encoded using SNOMED-CT structures

Plans

Colonoscopy

Qualifier

Planned

Provisional Diagnoses

Rectal Bleeding

Crohns Disease

Qualifier

Suspected

Context Example



- Procedure Context
- These are “Values”

- [-] Context values for actions (qualifier value) (288532009) Status: csCurrent
 - [-] Action status unknown (qualifier value) (410537005) Status: csCurrent
 - [-] Contraindicated (qualifier value) (410536001) Status: csCurrent
 - [-] Indicated (qualifier value) (410535002) Status: csCurrent
 - [+] Not done (qualifier value) (385660001) Status: csCurrent
 - [-] Not indicated (qualifier value) (410534003) Status: csCurrent
 - [-] Post-starting action status (qualifier value) (410523001) Status: csCurrent
 - [-] Ended (qualifier value) (385656004) Status: csCurrent
 - [-] Discontinued (qualifier value) (410546004) Status: csCurrent
 - [+] Done (qualifier value) (385658003) Status: csCurrent
 - [+] Stopped before completion (qualifier value) (410545000) Status: csCurrent
 - [+] In progress (qualifier value) (385651009) Status: csCurrent
 - [-] Pre-starting action status (qualifier value) (410522006) Status: csCurrent
 - [+] Being organized (qualifier value) (385649005) Status: csCurrent
 - [-] Not to be done (qualifier value) (410521004) Status: csCurrent
 - [-] Cancelled (qualifier value) (89925002) Status: csCurrent
 - [-] Not needed (qualifier value) (410529002) Status: csCurrent
 - [-] Not offered (qualifier value) (410530007) Status: csCurrent
 - [-] Not wanted (qualifier value) (410528005) Status: csCurrent
 - [-] Rejected by performer (qualifier value) (385647007) Status: csCurrent
 - [-] Rejected by recipient (qualifier value) (385648002) Status: csCurrent
 - [-] Organized (qualifier value) (385650005) Status: csCurrent
 - [-] Schedule rejected (qualifier value) (385646003) Status: csCurrent
 - [-] To be done (qualifier value) (385643006) Status: csCurrent
 - [+] Under consideration (qualifier value) (385642001) Status: csCurrent
 - [+] Was not started (qualifier value) (410524007) Status: csCurrent

Summary



- Embedding archetypes
 - is legal within current HL7 standard
 - Preserves current functionality – backward compatible
 - Does not require mass software updates
 - Allows use of existing V2 administrative functionality/model
 - Clear separation of admin model from Clinical Ontology model
 - Is compatible with REF, ORU, ORM, ORF messages
 - Has no limits on complexity
- Requirements
 - logical archetype structure for linear display
 - Snomed-CT Abstract logical Model
 - OpenEHR Archetype Models
- Opens door to more Semantic interoperability