Simplicity does not precede complexity, but follows it…

— Alan Perlis
Landscape Maturation
Terminology & Transport Standards

• Native Standards with local extensions are now a viable alternative in internally curated terminology that is mapped to standards for external consumption

• HL7 FHIR (Fast Health Interoperable Resources)

  • Support post-coordination from the native standards that populate the FHIR Object
Terminology Standards acceptance by numerous organizations

- **SNOMED**
  - Ownership changed to international consortium of countries, now acceptable license terms and availability. Part of Meaningful Use standards

- **RxNorm**
  - Freely available from NLM, part of meaningful use standards

- **LOINC**
  - By joint agreement, being made interoperable with SNOMED through use of Description Logic definitions of LOINC codes against SNOMED primitives
Why we can **simplify** now?

- Licensing models have changed so we can implement native standards
- DL classifiers are now available under Apache open source licenses
- LOINC and SNOMED are integrating content via a shared DL model
- RxNorm can be extracted into a shared DL model
- SNOMED + LOINC + RxNorm + post-coordination provides comprehensive coverage for typical clinical data representation requirements
Lloyd McKenzie says:
October 28, 2013 at 3:05 am

You can already use the post-coordination syntax as defined by SNOMED. The syntax of the code is defined by the code system. For post-coordinating code systems like SNOMED and UCUM, any valid expression is a legal string for code.

That said, when sending SNOMED codes, the display names should be excluded from the string. They make computation a lot more difficult, given that many systems will process SNOMED codes as strings with no parsing. If you have some need to send the SNOMED code with embedded human readable display names, that should be done using an extension.
FHIR Observation
FHIR Condition
The SOLOR System

- SNOMED
- LOINC
- RxNorm
SOLOR Benefits

• Normalize structure and form of clinical terminology
  • Improve software reuse
  • Shared tooling
  • Reduce learning curve
  • Shared post-coordination model
  • Simplified data analysis
SNOMED, LOINC, and RxNORM
Overlap Details

LOINC:
1L: Gentamicin is a component loinc (GENTAMICIN)
2L: Gentamicin is a component of a laboratory tests in loinc (Gentamicin^peak)

SNOMED:
1S: Gentamicin is a substance in SNOMED CT (a component in LOINC)
2S: Gentamicin is a component of a laboratory test in SNOMED (gentamicin peak)
3S: Gentamicin is a PRODUCT in SNOMED CT (a substance manufactured and sold)
4S: Gentamicin is an ALLERGEN in SNOMED CT
5S: Gentamicin is a presented in Prescribable/Dispensable forms in SNOMED (Gentamicin bone cement; Gentamicin 0.3% preservative-free eye drops)
6S: Gentamicin is specified in SNOMED administration and removal procedures (Insertion of Gentamicin beads into bone; Removal of Gentamicin beads from bone)
7S: Gentamicin is specified in poisonings/overdoses
8S: Gentamicin allergic reactions are defined clinical situations
9S: Acute drug-induced renal failure is a disorder in SNOMED

RxNorm:
1R: Gentamicin is an ingredient in RxNorm (GENTAMICIN SULFATE)
2R: Gentamicin is a basis of strength in RxNorm (GENTAMICIN)
3R: Gentamicin is linked to Human Prescription Drug Labels
4R: Gentamicin is a presented in Prescribable/Dispensable forms in RxNorm (gentamicin sulfate 0.3 % Ophthalmic Solution)
5R: Gentamicin is a PRODUCT in RxNorm (a substance manufactured and sold)
Logical Informatics Architecture
Occam's Razor

- Pluralitas non est ponenda sine neccesitate
- Entities should not be multiplied unnecessarily
- **SIMPLICITY** by another name
Build the foundation first

- An architectural approach
  - Description-logic terminologies are foundational
  - Additional models are built on top—not independent of—the foundation
CIMI is already using many of these principles

- SNOMED CT is the primary reference terminology
- LOINC is also approved as a reference terminology
- CIMI will propose extensions to the reference terminologies when needed concepts do not exist
- SNOMED relationship concepts will be used to define the parent-child relationships in the models

From: http://opencimi.org/policies_cimi
Assertions

• Observable
• Provenance
• Timing
• Value
Example

- Systolic blood pressure of 130 measured via automated blood pressure cuff from the right brachial artery

- Systolic Blood Pressure
  some (measurement-location
    some (brachial-artery (some laterality right)
    some (measurement-device automated-bp-cuff)
FHIR Observation
In XML using Postcoordination

<assertion>
  <observation>
    Systolic Blood Pressure
    some (measurement-location
      some (brachial-artery (some laterality right)
      some (measurement-device automated-bp-cuff)
    )
  </observation>
  <provenance>obtained during examination</provenance>
  <timing>May 27, 2014 08:32:04</timing>
  <value>130</value>
</assertion>
Expressions Normalized to Single Codes

Systolic Blood Pressure
some (measurement-location
   some (brachial-artery (some laterality right)
   some (measurement-device automated-bp-cuff))

EL++ Classifier

998
Normalized Expressions
In XML

<assertion>
  <observation> 998 </observation>
  <provenance> 124 </provenance>
  <timing>May 27, 2014 08:32:04</timing>
  <value>130</value>
</assertion>

Can be persisted in relational or nosql databases