

Making the Case for a "Quantities and Units of Measure" Ontology Standard

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- Why Q & UM ?
- Why an ontology?
- Why Common Logic?
- Why now?

- Why Quantities & Units of Measure ?
 - Prefer: *quantities, measurements and units*.
 - Important domain with many uses, no comprehensive standard.
 - Demands logical and ontological sophistication.
 - Complex enough to be interesting, but...
 - ...self-contained enough to be tractable (and avoids well-known tarpits such as continuity through time.)

- Why an ontology rather than a(nother) standard?
 - Question answers itself, but also...
 - Various fields have divergent views on the basic ideas (physics vs medical informatics), so no single applied standard will emerge from community uses, nor be universally accepted.
 - Need to provide ontological clarity for some basic concepts, requires 'high-level' distinctions backed up by formal theories. ('maximum temperature' = point on scale, not measurement value.)

- Why Common Logic?

- International ISO standard.
- General ontology needs a semantic-based logic which allows for maximum freedom of expression. ISO CL is the clear winner at present. It is also much simpler than any RDF-based syntax.
- Conventional 'ontology languages' (UML, OWL) are baroque, complex (OWL) or have underspecified semantics (UML) and are insufficiently expressive. OWL constructs can be easily defined in CL when needed.

Mapping other notations to CLIF.

I. Description Logics

Classes are CL unary relations, **properties** are CL binary relations.

So DL operators are *functions* from relations to other relations.

```
(owl:IntersectionOf Person (owl:minCardinality 2 hasSon (owl:values enlistedIn USNavy)))  
(AND Person (MIN 2 hasSon (VAL enlistedIn USNavy)))
```

```
((AND Person (MIN 2 hasSon (VAL enlistedIn USNavy))) Harry)  
(= 2ServingSons (AND Person (MIN 2 hasSon (VAL enlistedIn USNavy))))  
(2ServingSons Harry)  
(NavyPersonClassification 2ServingSons)  
(BackgroundInfo 2ServingSons  
  'Classification introduced in 2003 for public relation purposes.')
```

Dongle vocabulary: terms that carry no meaning, but are there just to make the syntax "look right".

Pat is Human
Human *is* a biological category

(Human Pat)
(BiologicalCategory Human)

Pat *rdf:type* Human .
(*Instance* Human Pat)
(*hasType* Pat Human)
(*AppliesTo* Human Pat)
isa Pat Human
Pat *a* Human

- Why now?
- Why not? But more seriously...
- This seems to be the highest value comparing
payoff = application utility x cost.
- I'd like to get this done before I die.

- *Quantity*. Real physical aspect or **property** of some **physical system** which can be expressed as a single value. (length = **distance** along **a path in 3-space**)
- *Measure*. Function from a physical system to a scale, expressing the actual value of a quantity.
- *Measurement*. Act of taking a measure value, or the result of such an action. Measurements occur in time and space and in general are subject to errors, approximations, etc..
- *Scale*. Set of possible values of a quantity.
- Types of basic scale (SSStevens): ordinal/interval/ratio. (Ordinal: Mohs hardness, Beaufort wind. Interval: Fahrenheit temperature. Ratio: centimeter.)
- (Physical) *unit*. Basic property of a ratio scale: every value in the scale is product of the scale unit with a number.
- *Conversion*. Two metric scales of the same quantity can be converted by multiplication with a linear factor.