Aligning NASA SWEET sciUnits Ontology with COSMO

First Look at Prefixes

June 2009

Patrick Cassidy

NASA SWEET Units Ontology

- Uploaded to the OOR repository:
  http://oor-01.cim3.net/ontologies

Name of original file in OOR “SWEETunits”

Modified file: SWEETunits_Mod1

47 owl:Classes

25 Object Properties

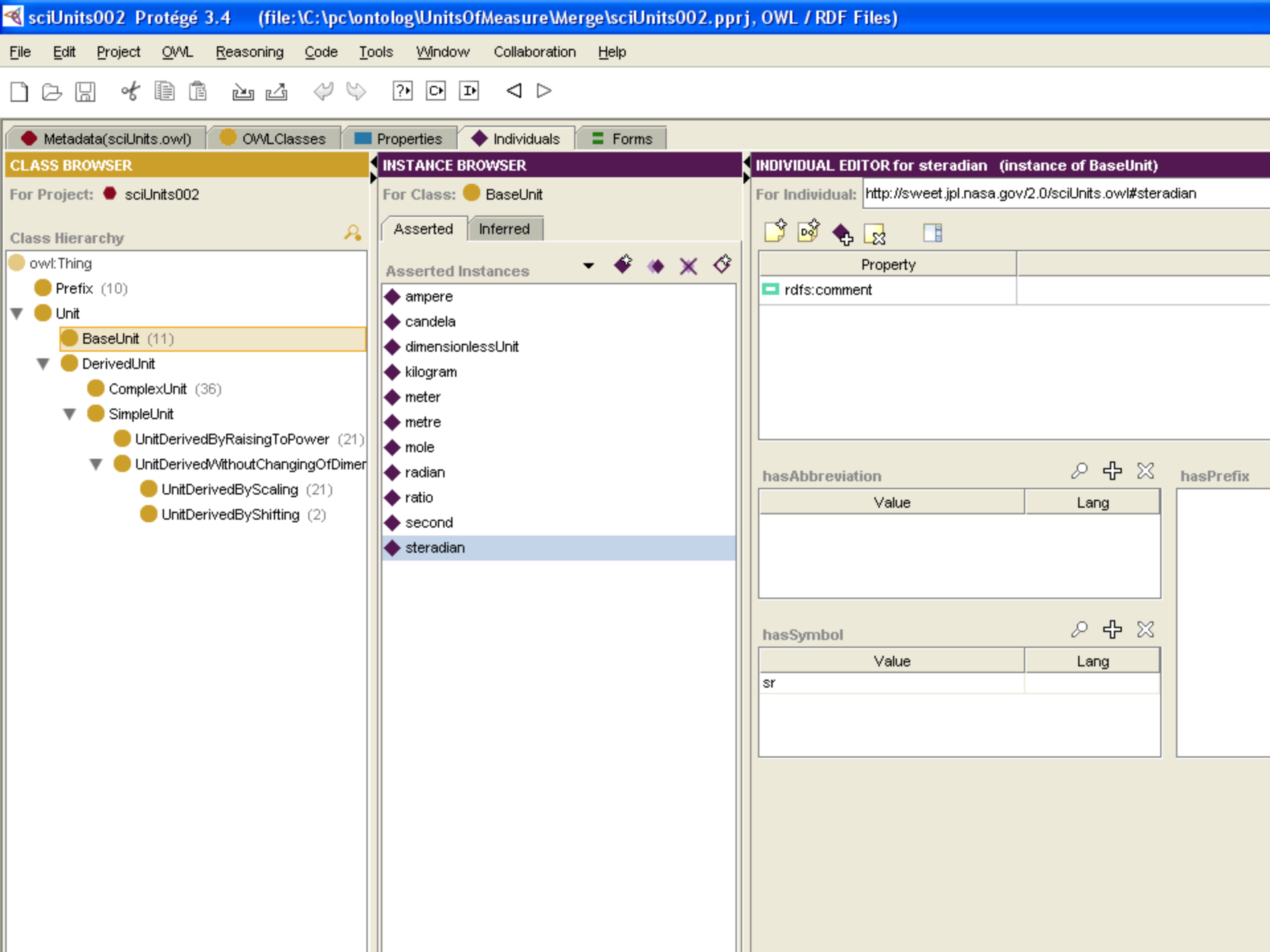
16 Datatype Properties

91 instance of unit (11 Base, 35 Complex, 44 derived (as by scaling with prefixes)

Units Ontology without Math

10 owl:Classes (was 47)
5 Object Properties (25)
6 Datatype Properties (16)

91 instance of unit (11 Base, 35 Complex, 44 derived (as by scaling with prefixes)


sciUnits002 Protégé 3.4 (file:\C:\pc\ontolog\UnitsOfMeasure\Merge\sciUnits002.pprj, OWL / RDF Files)
File Edit Project OWL Reasoning Code Tools Window Collaboration Help
Metadata(sciUnits.owl) OWLClasses Properties Individuals Forms
CLASS BROWSER
For Project: sciUnits002
Class Hierarchy
owl:Thing
Prefix (10)
Unit
BaseUnit (11)
DerivedUnit
ComplexUnit (36)
SimpleUnit
UnitDerivedByRaisingToPower (21)
UnitDerivedWithoutChangingOfDimer
UnitDerivedByScaling (21)
UnitDerivedByShifting (2)
INSTANCE BROWSER
For Class: BaseUnit
Asserted Inferred
Asserted Instances
ampere
candela
dimensionlessUnit
kilogram
meter
metre
mole
radian
ratio
second
steradian
INDIVIDUAL EDITOR for steradian (instance of BaseUnit)
For Individual: http://sweet.jpl.nasa.gov/2.0/sciUnits.owl#steradian
Property
rdfs:comment
hasAbbreviation
Value Lang
hasPrefix
hasSymbol
Value Lang
sr

Prefix representation

- sciUnits: ‘Prefix’ is a top-level class (type), intended as specific for units of measure
  - milli, micro, centi.kilo, etc.

COSMO:

distinguishes AbstractString from datatype String.

Related by :

AbstractString – hasStringDatatype - &xsd;string

As an AbstractString, a generic “Prefix” may be a prefix for any kind of word. The subtype ‘UOMprefix’ is specifically a prefix for Units of Measure, but still a first-class ontological type (owl:Class) , not a datatype.

Representation of Prefixes in COSMO

- Why represent a prefix as a first-class entity rather than as a datatype string?
  - So that the entity can be given a meaning
  - e.g. that ‘milli’ represents 1/1000

    (not just that millimeter is 1/000 of a meter)
    - In SUMO, a UOM prefix is represented as a function
    - In COSMO UOMprefix is an type of string (owl:Class):
    - . . .
- Tuple

  List

  AbstractString

  Prefix

  UOMprefix

Representation Of Units of Measure in COSMO

- UOM is a subtype of ‘AttributeValue’
- AttributeValue
- QuantitativeAttributeValue
- MeasurableQuantity
- PhysicalQuantity
- UnitOfMeasure

Symbols and Abbreviations

- In sciUnits the datatype relation ‘hasSymbol’ relates a Unit or Prefix to its abbreviated symbol; e.g. {‘kilo’ hasSymbol “k”}
- But the string “kilo” itself is a symbol of the Prefix ‘kilo’ – the distinction between the labels for ontology elements and the lexical strings that symbolize them is not explicitly accommodated in sciUnits.
- Recommendation:

  Distinguish a generic ‘hasSymbol’ for pointer to lexical strings, and ‘hasAbbreviation’ for pointers to abbreviations.

Concatenations

For a human-level understanding of the way scaled units (kilo-meter) are composed of Prefix and BaseUnit, a string concatenation function is needed.

Generally, arithmetic as well as string manipulation are required for proper understanding of units. These must be implemented procedurally, and therefore some arrangement within the ontology must be included for agreement on procedural implementation issues.

Parting Thoughts

- A ‘Units of Measure’ ontology deals with issues that are well-understood and widely agreed on. Nevertheless ontological representation rapidly reaches a point where consideration of procedural implementation is necessary (scaling, symbol concatenation).
- It will be best to identify an open application that can use a Units of Measure ontology, and develop the ontology with that application as a test bed.

NIST UnitsML

- http://unitsml.nist.gov/
- Described in xsd file:
  - http://unitsml.nist.gov/Schema/unitsmlSchema-0.9.17.xsd