

Theory vocabularies

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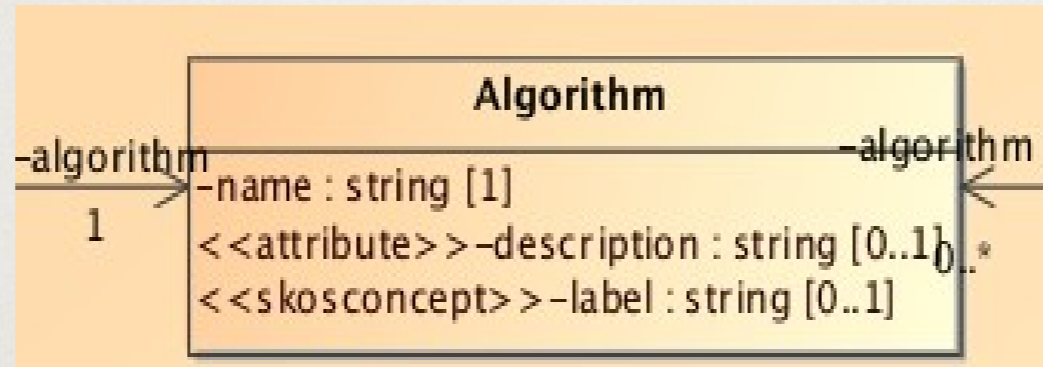
Vocabularies developed for the Simulation DM

- Simulation Data Model (SimDM) is a data model to describe numerical simulations
- As simulations are very diverse, it is a meta-model: observables, parameters, properties are not explicitly defined
- SimDM / SimDAL primary goals is to help scientists to discover simulations through queries on various quantities :
 - Simulated processes
 - Input parameters
 - Code output
 - Algorithms
 - ...
- Each development team used its own naming conventions

Example: velocity Vs speed

Vocabularies developed for the Simulation DM

- In the Simulation Data Model some classes have a **SkosConcept** attribute



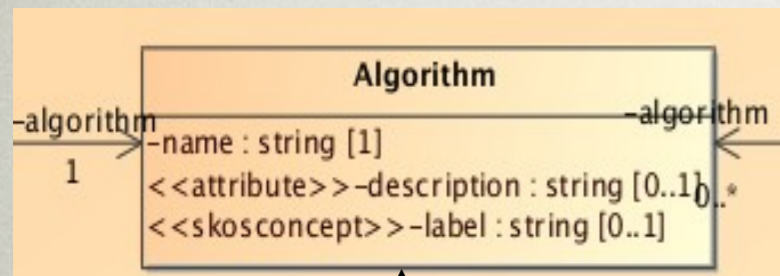
- This attribute contains the semantic information
- SKOS (Simple Knowledge Organization System) is a W3C standard using the Resource Description Framework (RDF)
- Particularly well-suited to create vocabularies (thesauri, classification schemes ...)
- Recommended by the semantic IVOA WG

SKOS

- A SKOS vocabulary is composed of concepts (algorithm, an astronomical object, a code parameter ...)
- Concepts can be linked to others through various relations
 - Broader
 - Narrower
 - Related
- Each concept has at least one prefLabel which is the standard way to name it (the language used is an attribute)
- Each concept can have altLabels which are alternative way to name it
- Each concept has a unique identifier

Vocabularies developed for the Simulation DM

- In the Simulation Data Model some objects have a SkosConcept attribute



Forward-Time Central-Space

Finite difference method used to solve parabolic partial differential equations. The method is first-order, explicit and conditionally stable ("Computational Fluid Mechanics and Heat Transfer 2nd ed.", John C. Tannehill, Dale A. Anderson, Richard H. Pletcher, 1997).

<http://purl.obspm.fr/vocab/Algorithms/ForwardTimeCentralSpace>

AltLabels

FTCS (en)

Broader concepts

[Algorithm](#)

[Finite Difference](#)

Broader Transitive concepts

[Algorithm](#)

[Finite Difference](#)

Related concepts

[Lax-Friedrichs](#)

<http://purl.obspm.fr/vocab/Algorithms/ForwardTimeCentralSpace>

Pref: Forward-Time Central Space
 ALT: FTCS
 Broader: Finite Difference
 Related: Lax-Friedrichs

Type of vocabularies

- Numerical simulations are complex and we can find:
 - general concepts accepted by everybody
 - code specific concepts

① Official vocabularies

- SimDM requires concepts for:
 - Algorithms
 - AstronomicalObjects
 - DataObjectTypes
 - PhysicalProcesses
 - PhysicalQuantities
- They can be used by anyone
- Their content is :
 - Centralized
 - Evolutive (Semantics W.G / Theory I.G)

Present general vocabulary

- Algorithms (122 concepts)
- AstronomicalObjects (308 concepts)
Derived from IVOA Ontology of Astronomical Object Types
- DataObjectTypes (17 concepts)
- PhysicalProcesses (110 concepts)
- PhysicalQuantities (147 concepts)

Total: 704 concepts

Type of vocabularies

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② Specific vocabularies

- Other vocabularies are specific to a given code
- Any team can host its own vocabulary
- A term can be adopted in a general when it becomes widespread

This service is dedicated to scientists and VO developers who wish to publish theoretical services described by [the Simulation DataModel](#).

As described in the [IVOA](#) standard, Simulation Data Model, registrations of theoretical services, require to provide several URIs corresponding to semantics keywords describing services and simulations. VO-Theory concepts are based on SKOS description as recommended by [the IVOA Semantic Working Group](#).

Example of a VO-Theory URIs : <http://purl.obspm.fr/vocab/Algorithms/GaussSeidel>

This website is dedicated to the discovery of these URIs. Navigate through the broader, narrower, related terms to discover the most precise concept you wish.

To suggest new concepts or corrections, contact : support.votheory@obspm.fr.

Search concepts

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IVOA vocabularies | [Specific vocabularies](#)

They are high level metadata necessary to describe the astrophysical theoretical data and parameter sets. These vocabularies are accepted by IVOA.

Astronomical objects

Vocabulary that defines numerical methods in use to obtains the data results.

Concepts

Quick search

[3+1 Formalism](#)

[8-Wave Scheme](#)

[Accelerated Lambda Iteration](#)

[Adaptive Mesh Refinement](#)

[Advection Upstream Splitting Method](#)

[Algorithm](#)

[Alternating Direction Implicit](#)

[BiConjugate Gradient](#)

[BiConjugate Gradient Stabilized](#)

[Block Based AMR](#)

[Bulirsch-Stoer](#)

[Cell Based AMR](#)

[Cell Centred](#)

[Central Difference Scheme](#)

[Chebyshev Iteration](#)

[Conjugate Gradient Method](#)

[Conjugate Gradient Squared Method](#)

[Constrained Transport](#)

[Coupled Escaped Probability](#)

[Crank-Nicolson](#)

[Discontinuous Galerkin](#)

They are high level metadata necessary to describe the astrophysical theoretical data and parameter sets. These vocabularies are accepted by IVOA.

Astronomical objects

Vocabulary that defines astronomical objects such stars, comet...

Concepts

Quick search

A Star AGB Star AGN AM Herculis Absolute Magnitude

Accreting White Dwarf Accretion Disk

Accretion-powered Pulsar Algol Eclipsing Binary

Alpha2 Canum Venaticorum Variable Association of Stars

Asteroid Astronomical Object Astronomical object

Atomic Element B Star BLLac BY Draconis Variable

Barred Spiral Galaxy Be Star Beta Cephei Variable

Beta Lyrae Eclipsing Binary Blazar Blue

Blue Compact Galaxy Blue Object Blue Supergiant

Bok Globule Brilliant Giant Brown Dwarf

CH Envelope-type Star Carbon Star

Cataclysmic Variable Centimetric Radio Source Cepheid

Chromosphere Chromospheric Activity Class

Classical Cepheid Classical TTauri Close

Gamma-ray Source

<http://purl.obspm.fr/vocab/AstronomicalObjects/GammaRaySource>

Narrower concepts

[Magnetar](#)

[High-mass X-ray Binary](#)

[Low-mass X-ray Binary](#)

```
-<rdf:RDF>
  -<skos:Concept rdf:about="http://purl.obspm.fr/vocab/AstronomicalObjects/GammaRaySource">
    <skos:prefLabel xml:lang="en">Gamma-ray Source</skos:prefLabel>
    <skos:inScheme rdf:resource="http://purl.obspm.fr/vocab/AstronomicalObjects/Scheme"/>
    <skos:narrower rdf:resource="http://purl.obspm.fr/vocab/AstronomicalObjects/Magnetar"/>
    <skos:narrower rdf:resource="http://purl.obspm.fr/vocab/AstronomicalObjects/HighMassXrayBinary"/>
    <skos:narrower rdf:resource="http://purl.obspm.fr/vocab/AstronomicalObjects/LowMassXRayBinary"/>
    <astroontology rdf:resource="http://eurovotech.org/objects-structure.owl#GammaRaySource"/>
    <simbad>gam</simbad>
  </skos:Concept>
</rdf:RDF>
```

PURL

Concept IDs are persistent URLs

- Until 2016, we used purl.org
- Service was not maintained anymore, we could not edit the vocabularies
- Major issue with persistent URLs : they must be persistent
- We have created our own PURLS :
–purl.obspm.fr
- Current pattern is :

–<http://purl.obspm.fr/vocab/VocabularyName/ConceptName>
- ConceptName is prefLabel value

PURL Evolution

- We will change concept URL pattern
- New pattern is :
 - <http://purl.ivoa.net/ConceptName>
- No namespace to remove semantic from URL
- Will redirect to Paris Observatory hosted vocabularies
- Can be easily redirected
- A generic contact address is used to ask for vocabulary update
- List of recipients behind it has to be defined

To do

- Adding a vocabularies access on IVOA website (ucd, skos)
- Updating SimDM document with new concept IDs