



# Operational RDF in the Virtual Observatory

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# Virtual Observatory?

The Virtual Observatory is a global infrastructure for finding, accessing, and investigating astronomical data.

It is built on a set of standards (<https://ivoa.net/documents/>):  
Formats, search protocols, job management and auth, a resource registry, semantics, IPC. . .

# Vocabularies

Interoperable terminologies and their management are defined in <https://ivoa.net/documents/Vocabularies/>.

Basically: Our vocabularies are available in RDF, HTML, and a custom, trivial-to-use format (“Desise”, Dead Simple Semantics) from <http://www.ivoa.net/rdf>.

## Usable with a Browser

Our RDF URIs look like

<https://www.ivoa.net/rdf/product-type#spectrum>. You can resolve them with a browser:

<a href="#">resolved-dataset</a>	Resolved	intended for retrieval. To annotate datasets, use a narrower term.		Narrower
<a href="#">spectrum</a>	Spectrum	Flux or magnitude as a function of a spectral coordinate.	<a href="#">#spectrally-resolved-dataset</a>	Narrower
<a href="#">temporally-</a>	Temporally	A dataset with a time axis. This term is mainly		Narrower

0% Javascript required here.

Non-Browser clients do content negotiation to retrieve Turtle, RDF/X, or Desise.

What are we doing with these vocabularies? Here are a few examples:

- Subject keywords and query expansion
- Mapping subjects for interdisciplinary search engines
- Machine-readable linking between datasets and associated artefacts
- Humanising machine responses
- Linking data resources and publishing services
- ... and all that with minimal code.

## Brief Closer Look: Subject Keywords

In our resource registry ( $\sim 30'000$  records), there are keywords from the Unified Astronomy Thesaurus <http://ivoa.net/rdf/uat>.

When re-publishing our records to the EOSC, these detailed keywords (“virgo-cluster”) are too much detail for the downstream keyword schema. That only contains our top-level terms.

We can figure these out by skos:broader relationships; in this case, that’s galactic-and-extragalactic-astronomy:

.. \_SMAKCED: <http://smakced.net> .. \_resulting decompositions:  
<http://smakced.net/data.html>

dwarf galaxies    early type galaxies    galactic and extrag...

infrared photometry    observational astro...

surface photometry    virgo cluster

**Identifier**

## Non-Magic Code without RDF tooling

The keyword coarsification contains no high RDF magic. It looks basically like this:

```
def get_roots_for(term, uat_terms):
    roots, seen = set(), set()

    def follow(t):
        wider = uat_terms[t]["wider"]
        if not wider:
            roots.add(t)
        else:
            seen.add(t)
            for wider in uat_terms[t]["wider"]:
                follow(wider)

    follow(term)
    return roots

uat = request.get("https://www.ivoa.net/rdf/uat",
    http_headers={"accept": "application/x-desise+json"})
for term in uat["terms"]:
    mapping[term] = get_roots_for(term, uat["terms"])
```

## It's still RDF

If you don't need full RDF, you don't have to use it in our scheme (and that really helped adoption). More examples with code:

- <https://wiki.ivoa.net/internal/IVOA/InterOpMay2021Semantics/voc-action.pdf>
- <https://blog.g-vo.org/a-new-constraint-class-in-pyvo-s-registry-api-uat.html>
- <https://blog.g-vo.org/semantics-cross-discipline-discovery-and-down-to-earth-code.html>

But if you do have RDF tooling, it's still all there: RDF/X, Turtle, Cool URIs. . .