Development of Ontologies for Semantic Virtual Observatory Frameworks

Fox, P. (1), McGuinness, D. (2,3,4), Cinquini, L. (5)

(1) HAO/NCAR, Boulder CO USA (pfox@ucar.edu), (2) McGuinness and Associates, Stanford CA USA, (3) RPI, Troy, NY, (4) Stanford Univ. CA (5) SCD/NCAR, Boulder CO USA

Our development of a semantic virtual observatory framework that supports interdisciplinary science access to data across the fields of solar physics, space physics and solar-terrestrial physics, has led to the need for ontolgies: a formal, machine understandable representation for concepts, relations and attributes of physical quantities in the domains of interest as well as their underlying data representations. We present our set of solar-terrestrial ontologies as formal encodings of the knowledge in the Ontology Web Language - Description Logic (OWL-DL) format and relate them to mid- and upper-level ontologies such as SWEET and DOLCE.. We also present the balance of knowledge representation and reasoning that is needed to provide virtual access to distributed and heterogeneous sets of data as if all resources appear to be organized, stored and retrieved from a local environment. We discuss the general utility and applicability of our methodology: the combination of use case-driven, small and modular ontology development, coupled with free and open-source software tools and languages and how it provides sufficient expressiveness and capabilities for our implementation.