Poster

Interoperability Workbench – Collaborative Tool for Publishing Core vocabularies and Application Profiles

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Introduction

The lack of semantic interoperability has been noted as an obstacle to the digital economy. As one of the solutions, the European Commission has recommended to use highly reusable metadata (EIF, 2010). In order to minimize the duplication of effort and support the interoperability in the sector of Higher Education and Research a project was established by the Ministry of Education and Culture to build a framework and tools for metadata modelling. Motivation to improve semantic interoperability comes from the need to standardize metadata management that is performed by multiple organizations in the same domain. The number of interoperability problems increase with the total number of involved parties according to Ralyté et. al. (2008). The conceptual modelling of business, services and processes, defining and maintaining terminologies, reference data and data models for multiple information systems in the same sector should no longer be seen as separate activities. The developed Semantic Information Framework (Fig. 1) describes high level architecture for linking Controlled Vocabularies, Core Vocabularies, Application Profiles and Physical Data Models. The developed framework is now also being adopted by the public administration in Finland (JHS, 2016).

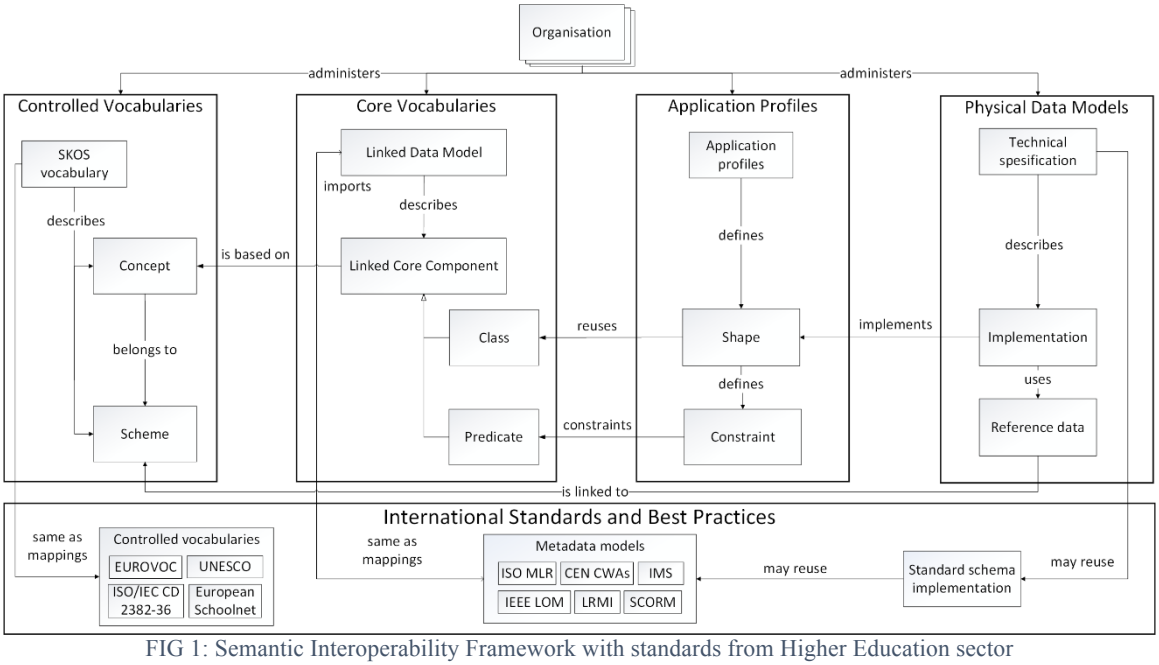

FIG 1: Semantic Interoperability Framework with standards from Higher Education sector

Semantics of information entities should be based on the terminologies that are built using systematic and formalized methods (ISO, 2009). Terminologies e.g. Vocabulary of Education (OKSA, 2016) that are typically used in interpersonal communication situations should be

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published as Controlled Vocabularies in the SKOS format (SKOS, 2016) to enable them be used as a solid foundation for the semantics of the Core vocabularies and Application Profiles.

Core Vocabularies (ISA,2016) are re-usable information components that can be used to build interoperable data models. Core Vocabularies should be published as Linked Data models that are linked to the concepts in the terminology. Use of Core vocabularies and standards such as Metadata for Learning Resources (ISO/IEC 19788-1) or Metadata for Learning Opportunities (CEN/CWA 15903) should be documented as Application profiles for exposing the intended use of the metadata and to enable the measurement of the metadata quality as argued by Hillman and Phipps (2007).

Machine readable Application Profiles are used to describe data models by defining used classes, properties and constraints in RDF. However, the use of Application Profiles is not limited to documenting Linked Data models. Existing data standards and best practices may restrict the use of Linked Data in favor of other data representations. In the Semantic Interoperability Framework, we propose Application profiles to be used as technology independent documentation for all type of data representations and to create a mapping between the Universal Resource Identifiers and the local identifiers used by other type of Physical Data models.

2. Interoperability workbench

One of the challenges in reusing existing linked data models has been the lack of sophisticated tools. The envisioned synthesis of terminology work and metadata modelling also requires new workflows (Fig 2.) and tools supporting the automatic use of the controlled vocabularies.

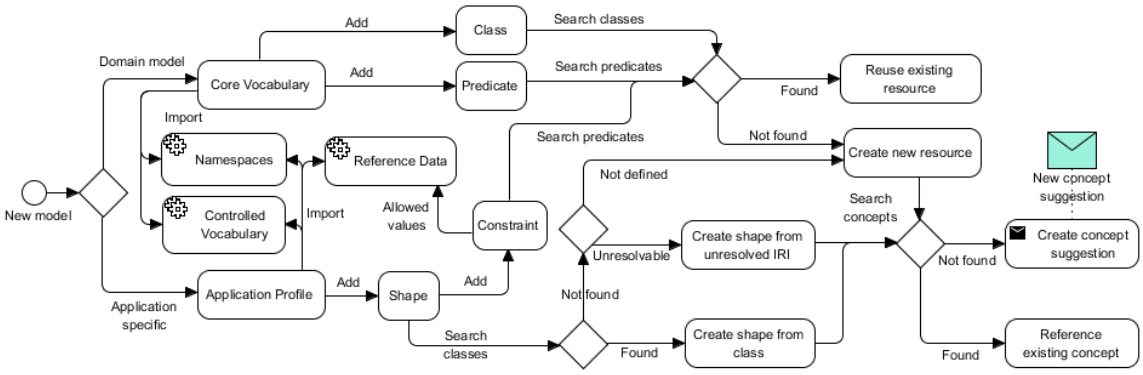

FIG 2: Simplified workflow for creating Core vocabularies and Application profiles based on shared concepts

The Interoperability Workbench (IOW, 2016) is a metadata modelling tool based on the presented workflow. The workbench is aimed for content specialists who are not experienced with RDF. The terminology used in data modelling and the data models are localized to the language preferred by the users. This allows the content specialist to collaborate with data modelers and focus on the semantics of the domain specific information structures and not the technical details of the workbench. Information structures are modeled as Core Vocabularies and Application Profiles reusing the terms and definitions from existing Controlled Vocabularies.

Core Vocabularies and Application Profiles can import existing Linked Data models by dereferencing the given namespaces. Selected controlled vocabularies are imported from the Finnish Ontology Service (Finto, 2016) and new classes and predicates are created based on the preferred terms and the definitions of the referenced concepts. Classes and predicates can also be defined based on new concept suggestions that are then forwarded to the terminology working groups. Shapes created to the Application Profiles can be based on the abstract shapes imported from the Core Vocabularies or generated from the imported Linked Data models. Shapes can also be created manually from any IRI to support the use of the unresolvable namespaces. Reference Data can also be imported to Application Profiles from various integrated sources to document the allowed values for the data.

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Models are created as JSON-LD objects in JavaScript frontend and persisted to RDF database with Graph Store protocol based API. Data model of the Interoperability Workbench is documented within the workbench as an Application Profile (IOW AP, 2016). The profile extends CEN/CWA 15248 with selected SHACL (SHACL, 2016) features to support multiple class definitions and constraints. Support for additional SHACL features may also be included when needed. The Interoperability Workbench (Fig 3.) is an early prototype, but it has already been used to develop Core vocabularies in the field of Higher Education in Finland. Several application profiles also reuse the metadata models from standards and best practices (eg. EMREX, 2016 and ATT, 2016).

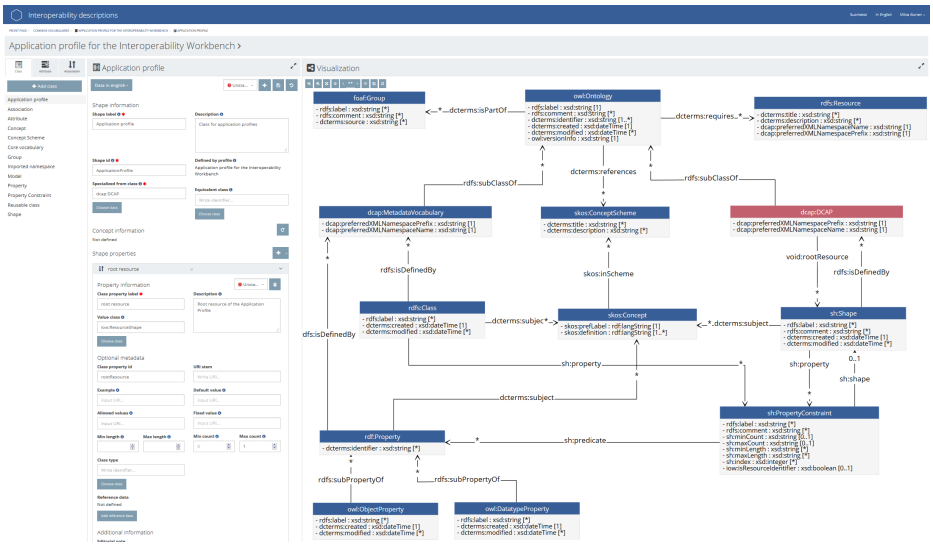

FIG 3: Screenshot of the workbench showing edit mode in Application Profile for the Workbench (IOW AP, 2016)

The Future development of the workbench will include data validation service based on the application profiles, support for URL re-direction services such as w3id.org and versioning of the data models. Development of the Interoperability Workbench and the Semantic Interoperability Framework are now putted into action as part of one of the Government Programme's key projects, *Public services will be digitalised.* A one-stop-shop service model will be developed for client-oriented usage of the key national databases and to support this, a metadata governance solution in the public administration will be implemented (Valtioneuvosto 2016*)*.

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