

# OpenWEMI

by Karen Coyle

kcoyle@kcoyle.net

## Abstract

This article introduces the concept of a version of the FRBR objects *work*, *expression*, *manifestation*, and *item* (WEMI) with minimal semantic commitment. Evidence already exists for uses of WEMI in metadata communities beyond libraries. These uses are hindered, however, by specific constraints in the original design. openWEMI would provide the flexibility needed for these and more varied uses.

## Introduction

A model for the bibliographic entries in library catalogs was developed in 1998 that included a view of creative endeavors having varying levels of abstraction, from the most abstract, “work,” to the actual physical instance.[IFLA] This model, called "Functional Requirements for Bibliographic Records" (FRBR), that was developed within the library community for library catalog entries has found adherents among metadata practitioners in other communities. These non-library communities present significantly different use cases both among themselves and against the library use case the model was designed to address. These new uses were however constrained by the original definitions in the model. The question to be addressed is what capabilities a less constrained model could offer to metadata developers. I am proposing a such a model of the primary elements of FRBR: *work*, *expression*, *manifestation*, *item*, on which specific metadata needs can be built. A preliminary vocabulary for the proposed classes and properties can be found at <https://github.com/kcoyle/openWEMI/blob/master/openWEMI.ttl>.

## WEMI beyond libraries

There is evidence that metadata designers outside of the library data silo are drawn to the concepts first introduced in FRBR and in particular to the WEMI entities because for the first time these provide a model of created “things” that acknowledges the abstract planes that we interact with separately from the physical embodiments.[Coyle 2016] The treatment of levels of abstraction, while not used consciously in common practice, does come forth often in metadata use cases.

## FRBR as code

The original FRBR was declared to be a conceptual model, and was not offered as actionable code. In 2004, library systems developers Ian Davis and Richard Newman created FRBR Core [frbrcore] (revised in 2006), an RDF vocabulary defining all of the FRBR entities as RDF classes and expressing the relationships between them (e.g. "revisionOf", "expressionOf", "ownerOf") as RDF properties. FRBR Core was fairly faithful to the description of FRBR as given in the 1998 document except that it added superclasses for two FRBR groups and to the FRBR model as a whole: a top-level class, *Endeavor*, to which the four entities of WEMI are sub-classed; and super-class, *ResponsibleEntity*, for the two entities of group 2, *corporate body* and *person*. [Dunsire 2019]

In the absence of an official IFLA vocabulary for FRBR, FRBRcore became the default for developers wishing to employ FRBR concepts in their metadata.

## Uses outside of libraries

Of the many uses of FRBR concepts, in particular WEMI, outside of libraries, here I will give four brief examples: The FRBR Aligned Bibliographic Ontology (FaBiO); Functional Requirements for Information Resources (FRIR); the Imperial Fashion Vocabulary; and the Akoma-Ntoso vocabulary for legal documents.

### FaBiO

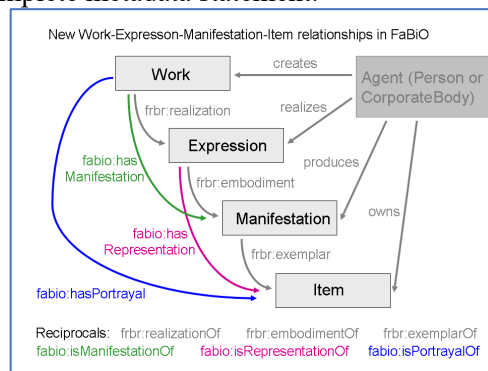
FaBiO is a module of the Semantic Publishing and Referencing (SPAR) ontologies. [Peroni, 2018] SPAR defines metadata for the description of documents and the publication work flow in the scholarly publishing domain, as well as a vocabulary for citations, references, and agents. FaBiO subclasses its own *work*, *expression*, *manifestation* and *item* to the main classes of FRBR Core. For example, *fabio:Work* is subclassed to *frbr:Work* from FRBR Core. FaBiO then gives each *work* type a sub-class relationship to *fabio:work*, such as this one for *Essay*:

```

fabio:Essay a owl:Class ;
  rdfs:label "essay"@en ;
  rdfs:comment "A piece of non-fiction writing on a particular subject, usually of moderate length and without chapters."@en ;
  rdfs:subClassOf fabio:Work .

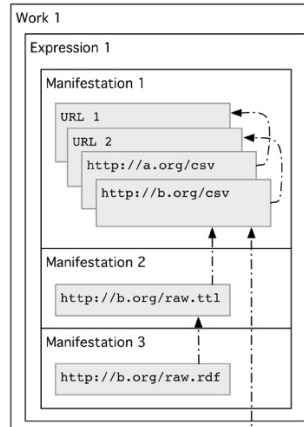
```

FaBiO also provides additional relationship properties between the members of the WEMI classes, such that descriptive metadata can be created that does not enforce the FRBR requirement that all members of WEMI must be present for a complete metadata statement.



### FRIR

FRIR is a proposal for data files that can be algorithmically assigned to WEMI classes through computation on files that would reveal exact sameness (FRBR:item), format differences with semantic sameness (FRBR Manifestations), and generations (versions) of the data file (FRBR:expression). Together these would define a work, that is a set of data files that taken together have the same information. [Mccusker 2012]



## Imperial Fashion

This is a vocabulary developed for a fast-fashion industry application. It defined the initial creative design effort, *style* (FRBR:work), which was followed by a sketch of the design idea, *item* (FRBR:expression), a concrete manufactured product, *stock-keeping unit* (FRBR:manifestation) with individual sales units, piece (FRBR:items). [Peroni 2017].

## Akoma-Ntoso

There are multiple efforts using WEMI for legal documentation. This reflects the need in that community to keep a strict account of the versions of documents as they develop in the juridical and legislative processes, and to make these available in a consistent way across jurisdictions. [Boer 2002] Versions can vary greatly in their degree of change from the original but the whole is usually known by a single name or identifier. In the Akoma Ntoso schema, WEMI metadata is embedded in the XML document itself, in a section called "Identification." [Vitali 2008] The Akoma Ntoso schema defines a number of custom elements. For example, there are some properties, such as `FRBRdate` and `FRBRuri`, that are common to each WEMI entity, while other properties, such as `FRBRcountry` and `FRBRformat`, are defined only for the appropriate entities. Here is an extract from a full record:

```
</FRBRWork>
  <FRBRExpression>
    <FRBRthis value="/akn/us/act/2011-11-29/112-61/eng@/!main"/>
    <FRBRuri value="/akn/us/act/2011-11-29/112-61/eng@"/>
    <FRBRdate date="2012-05-09" name="Generation"/>
    <FRBRauthor href="#palmirani" as="#editor"/>
    <FRBRlanguage language="eng"/>
  </FRBRExpression>
  <FRBRManifestation>
    <FRBRthis value="/akn/us/act/2011-11-29/112-61/eng@/!main.xml"/>
    <FRBRuri value="/akn/us/act/2011-11-29/112-61/eng@.akn"/>
    <FRBRdate date="2012-05-09" name="Generation"/>
    <FRBRauthor href="#palmirani" as="#editor"/>
    <FRBRformat value="xml"/>
  </FRBRManifestation>
```

## What is "Open" in "openWEMI"?

The elements *work*, *expression*, *manifestation* and *item* are defined in FRBR and in and its successor, the Library Reference Model (LRM) [Riva 2017], as objects. These objects are defined as disjoint which means that they should be restricted from sharing attributes. They also have a strict set of relationships between

them such that any metadata description consisting of a FRBR:work and its FRBR:item requires the intervention of both FRBR:expression and FRBR:manifestation to connect them.

In openWEMI, *work*, *expression*, *manifestation* and *item* are defined as RDF classes.[RDF working group 2014] RDF classes are conceptual but do not determine metadata structure. The classes of openWEMI are not defined as disjoint so this allows a kind of fluidity in how the classes are employed in actual metadata. When a metadata model is developed using openWEMI some data points can be defined as belonging to more than one class or even to none. Classes may not be inherent in the vocabularies used in the metadata but can be imposed later as one or more views over the metadata.

The relationships that are proposed for openWEMI allow relationships from any broader class member to any narrower one, that is, from members of the class openWEMI:Work to each of openWEMI:Expression, openWEMI:Manifestation and openWEMI:Item, from members of the class openWEMI:Expression to both openWEMI:Manifestation and openWEMI:Item, and from members of the class openWEMI:Manifestation to openWEMI:Item. This is similar to the design developed in FaBio.

## Why "open"?

The interesting question is what might be the advantages of metadata modeled on FRBR but on a less restrictive basis? Removing the constraints that exist in FRBR and the LRM you allow uses in metadata environments where the concepts for created entities differ from those of the bibliographic model. Imagine an art gallery that wishes to catalog its works of art. Each piece is a unique item. They could possibly be represented by a description of the *work* (creator, title, date of creation) and a description of the physical *item* (size, date received, price, location of storage). There is no need to consider concepts for *expression* or *manifestation* if those aren't useful for this purpose. The gallery is free to make use of the WEMI concepts but can use them in its own way.

In another example, a bibliography can be interpreted as consisting solely of *manifestations*. Should there be a desire to later combine some entries together as being of the same *work*, information about the work that brings them together can be added at a later date when needed. These entries might contain elements for some data points that the library model would delegate to the *expression*, but if that distinction is not needed it would be convenient to assign them to the *manifestation* class.

An actual example from current library metadata would involve a system intending to use the LRM-based Resource and Description and Access (RDA) vocabulary, where WEMI is defined with many of the constraints of FRBR, and BIBFRAME data. [Baker 2014] The RDA vocabulary follows a strict interpretation of WEMI with distinct objects; BIBFRAME has its own model that has bf:work, which combines properties that would be in *work* and *expression* in FRBR or LRM; bf:instance, more or less equivalent to FRBR:manifestation; and bf:item, for FRBR:item. In a strict model that obeys the disjointness of the WEMI classes, these two metadata models are in conflict. With a more open model that does not define the classes as disjoint, a system could reinterpret the properties in the BIBFRAME work as belonging to either the openWEMI:work class or the openWEMI:expression class without having to do a prior mapping from one format to another as long as they are both in RDF where they are stored. Classes can cross graph boundaries and therefore do not require that each metadata entry is structured exactly the same.

## openWEMI Vocabulary

The vocabulary below is a strawman presentation of the concepts in this paper. A downloadable version can be found on github at <https://github.com/kcoyle/openWEMI/blob/master/openWEMI.ttl>. It is best to consider this at best an alpha version intended to stimulate discussion of this idea. It includes the classes

for an open definition *work*, *expression*, *manifestation* and *item*, and the properties for the primary relationships between them.

```

@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
@prefix rdfs: <http://www.w3.org/2000/01/rdf-schema#> .
@prefix owl: <http://www.w3.org/2002/07/owl#> .
@prefix skos: <http://www.w3.org/2004/02/skos/core#> .

<http://example.org/openWEMI/> a owl:Ontology ;
  rdfs:label "openWEMI ontology" .

<http://example.org/openWEMI/Endeavor>
  a owl:Class ;
  rdfs:label "endeavour"@en ;
  skos:definition "The conceptual or intellectual aspect of a creation."@en ;
  rdfs:isDefinedBy <http://example.org/openWEMI/> .

<http://example.org/openWEMI/Work>
  a owl:Class ;
  rdfs:label "work"@en ;
  skos:definition "An abstract notion of an artistic or intellectual creation."@en ;
  rdfs:isDefinedBy <http://example.org/openWEMI/> ;
  rdfs:subClassOf <http://example.org/openWEMI/Endeavor> .

<http://example.org/openWEMI/Expression>
  a owl:Class ;
  rdfs:label "expression"@en ;
  skos:definition "An expression of a work in signs."@en ;
  rdfs:isDefinedBy <http://example.org/openWEMI/> ;
  rdfs:subClassOf <http://example.org/openWEMI/Endeavor> .

<http://example.org/openWEMI/Manifestation>
  a owl:Class ;
  rdfs:label "manifestation"@en ;
  skos:definition "The physical embodiment of one or more expressions."@en ;
  rdfs:isDefinedBy <http://example.org/openWEMI/> ;
  rdfs:subClassOf <http://example.org/openWEMI/Endeavor> .

<http://example.org/openWEMI/Item>
  a owl:Class ;
  rdfs:label "item"@en ;
  skos:definition "An exemplar of a single manifestation."@en ;
  rdfs:isDefinedBy <http://example.org/openWEMI/> ;
  rdfs:subClassOf <http://example.org/openWEMI/Endeavor> .

<http://example.org/openWEMI/ResponsibleEntity>
  a owl:Class ;
  rdfs:label "responsible entity"@en ;
  skos:definition "One responsible for the creation, production, distribution or
maintenance of a created entity."@en .

<http://example.org/openWEMI/relatedEndeavor>
  a rdfs:Property ;
  rdfs:label "related endeavor"@en ;
  skos:definition "Another endeavor that is related in some way to an endeavor."@en ;
  rdfs:isDefinedBy <http://example.org/openWEMI/> .

<http://example.org/openWEMI/expresses>
  a owl:ObjectProperty ;
  rdfs:label "expresses"@en ;
  skos:definition "An endeavor that expresses a work."@en ;
  rdfs:isDefinedBy <http://example.org/openWEMI/> ;

```

```

rdfs:subPropertyOf <http://example.org/openWEMI/relatedEndeavor> ;
rdfs:domain <http://example.org/openWEMI/Expression> ;
rdfs:range <http://example.org/openWEMI/Work> .

<http://example.org/openWEMI/manifests>
  a owl:ObjectProperty ;
  rdfs:label "expresses"@en ;
  skos:definition "An endeavor that manifests an expression or a work."@en ;
  rdfs:isDefinedBy <http://example.org/openWEMI/> ;
  rdfs:subPropertyOf <http://example.org/openWEMI/relatedEndeavor> ;
  rdfs:domain <http://example.org/openWEMI/Manifestation> ;
  rdfs:range [
    a owl:Class ;
    owl:unionOf (
      <http://example.org/openWEMI/Work>
      <http://example.org/openWEMI/Expression>
    )
  ] .

<http://example.org/openWEMI/instantiates>
  a owl:ObjectProperty ;
  rdfs:label "expresses"@en ;
  skos:definition "An endeavor that instantiates a manifestation, an expression or a
work."@en ;
  rdfs:isDefinedBy <http://example.org/openWEMI/> ;
  rdfs:subPropertyOf <http://example.org/openWEMI/relatedEndeavor> ;
  rdfs:domain <http://example.org/openWEMI/Item> ;
  rdfs:range [
    a owl:Class ;
    owl:unionOf (
      <http://example.org/openWEMI/Work>
      <http://example.org/openWEMI/Expression>
      <http://example.org/openWEMI/Manifestation>
    )
  ] .

```

## References

- [baker] Baker, T., Coyle, K. and Petiya, S. (2014), "Multi-entity models of resource description in the Semantic Web: A comparison of FRBR, RDA and BIBFRAME", *Library Hi Tech*, Vol. 32 No. 4, pp. 562-582. <https://doi.org/10.1108/LHT-08-2014-0081>
- [boer] Alexander Boer, Rinke Hoekstra and Radboud Winkels, 'METALex: Legislation in XML' in T. Bench-Capon, A. Daskalopulu and R. Winkels (eds.), *Legal Knowledge and Information Systems. Jurix 2002: The Fifteenth Annual Conference*. Amsterdam: IOS Press, 2002, pp. 1-10
- [coyle] Coyle, K. (2016). *FRBR, before and after: a look at our bibliographic models*. Chicago : ALA Editions, an imprint of the American Library Association, 2016.
- Dunsire, Gordon. Declaring FRBR entities and relationships in RDF. <https://www.ifla.org/files/assets/cataloguing/frbrrg/namespace-report.pdf> (accessed November 18, 2019)
- [ifla] IFLA Study Group on the Functional Requirements for Bibliographic Records. (2009) *Functional Requirements for Bibliographic Records*. Den Haag. [http://archive.ifla.org/VII/s13/frbr/frbr\\_2008.pdf](http://archive.ifla.org/VII/s13/frbr/frbr_2008.pdf)
- [frbrcore] Davis, I., Newman, R. (2005) *Expression of Core FRBR Concepts in RDF*. <http://vocab.org/frbr/core.html>. Accessed December 16, 2019
- McCusker, J. P., Lebo, T., Chang, C., McGuinness, D. L., & da Silva, P. P. (2012). Parallel identities for managing open government data. *IEEE Intelligent Systems*, 27(3), 55. [http://tw.rpi.edu/media/2012/02/07/d641/EX\\_ISSI-2011-09-0138.R1\\_McCusker.pdf](http://tw.rpi.edu/media/2012/02/07/d641/EX_ISSI-2011-09-0138.R1_McCusker.pdf)

- Peroni S., Shotton D. (2018) The SPAR Ontologies. In: Vrandečić D. et al. (eds) The Semantic Web – ISWC 2018. ISWC 2018. Lecture Notes in Computer Science, vol 11137. Springer, Cham
- [peroni & vitali] Peroni, S., and Vitali, F. (2017) Interfacing fast-fashion design industries with Semantic Web technologies The case of Imperial Fashion. *Journal of Web Semantics* Volume 44, May 2017, Pages 37-53 <https://doi.org/10.1016/j.websem.2017.06.001>
- [riva] Riva, P., Le Boeuf, P., Žumer, M. (2017) IFLA Library Reference Model: A Conceptual Model for Bibliographic Information. Den Haag, IFLA.
- [vitali] Vitali, F., Palmirani, M., Lima, J. A. O. (2008) "Moving in the Time: An Ontology for Identifying Legal Resources " in: Casanovas P., Sartor G., Casellas N., Rubino R. (eds) *Computable Models of the Law*. Lecture Notes in Computer Science, vol 4884. Springer, Berlin, Heidelberg.
- [RDF] RDF working group. Resource Description Framework. 2014. <https://www.w3.org/RDF/>