

Resource and Work, Expression, Manifestation, Item

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This paper discusses the semantic relationship between the class *Resource* in International Standard Bibliographic Description (ISBD) and the classes *Work*, *Expression*, *Manifestation*, and *Item* (WEMI) in Functional Requirements for Bibliographic Records entity-relationship model (FRBRer).

Table 1 shows the definitions of the classes.

Table 1: Bibliographic resource classes

Element set	Label	Definition
ISBD	Resource	An entity, tangible or intangible, that comprises intellectual and/or artistic content and is conceived, produced and/or issued as a unit, forming the basis of a single bibliographic description.
FRBRer	Work	A distinct intellectual or artistic creation.
FRBRer	Expression	The intellectual or artistic realization of a work in the form of alphanumeric, musical, or choreographic notation, sound, image, object, movement, etc., or any combination of such forms.
FRBRer	Manifestation	The physical embodiment of an expression of a work.
FRBRer	Item	A single exemplar of a manifestation.

FRBRer semantics

The WEMI classes are based on entities in an Entity-Relationship (E-R) model defined as (real world) "objects of interest to users of bibliographic data". *Work* and *Expression* "reflect intellectual or artistic content"; *Manifestation* and *Item* "reflect physical form".

The FRBRer definitions are connected through internal references to form a chain: *Item* -> *Manifestation* -> *Expression* -> *Work*. This is represented using element set properties with domains and ranges assigned to the appropriate WEMI class:

Table 2: FRBRer properties for primary WEMI relationships and their inverses

Domain class	Property label	Range class
Work	is realized through	Expression
Expression	is embodied in	Manifestation
Manifestation	is exemplified by	Item
Item	<i>is exemplar of</i>	Manifestation
Manifestation	<i>is embodiment of</i>	Expression
Expression	<i>is realization of</i>	Work

The property labels are based on the E-R diagram (Fig. 3.1). The model also indicates the "one-to-many" or cardinality of each property:

- *Item* is exemplar of one and only one *Manifestation*
- *Manifestation* is embodiment of at least one *Expression*
- *Expression* is realization of one and only one *Work*

These conditions are represented by Web Ontology Language (OWL) cardinality constraints.

The WEMI classes and primary properties are also declared to be disjoint; that is, an instance of a *Work* cannot also be an instance of a *Manifestation*.

Discussion

Resource is not equivalent to any individual WEMI class because the definition contains parts of the semantics of each of the WEMI definitions, which are mutually exclusive.

This suggests that *Resource* is disjoint with each WEMI class.

Resource does not have broader scope than the combined WEMI classes because the definition is confined to the semantics of the WEMI definitions.

This suggests that the attributes (intention) of *Resource* have the same intention as the combined attributes of each WEMI class: $Resource = Expression + Item + Manifestation + Work$; the order is unimportant. That is, the aggregation of attributes of WEMI is intended to describe the same kind of object as the attributes of *Resource*.

The basic relationship between *Resource* and WEMI is therefore whole-part/aspect: *Expression*, *Item*, *Manifestation*, and *Work* are partial aspects of *Resource*. An instance of a *Resource* can have a specific *Work* part, a specific *Manifestation* part, and so on:

- *Resource* has-aspect *Expression*; *Expression* is-aspect-of *Resource*
- *Resource* has-aspect *Item*; *Item* is-aspect-of *Resource*
- *Resource* has-aspect *Manifestation*; *Manifestation* is-aspect-of *Resource*
- *Resource* has-aspect *Work*; *Work* is-aspect-of *Resource*

There is additional utility if the has-aspect relationship is sub-categorized to reflect the specific WEMI component:

Table 3: Relationship properties between Resource and WEMI and their inverses

Label	Definition	Domain	Range
has expression aspect	Relates a bibliographic resource to an expression reflected in it.	isbd:Resource	frbrer:Expression
has item aspect	Relates a bibliographic resource to an item reflected in it.	isbd:Resource	frbrer:Item

has manifestation aspect	Relates a bibliographic resource to a manifestation reflected in it.	isbd:Resource	frbrer:Manifestation
has work aspect	Relates a bibliographic resource to a work reflected in it.	isbd:Resource	frbrer:Work
<i>is expression reflected in</i>	Relates an expression to a bibliographic resource that reflects it.	frbrer:Expression	isbd:Resource
<i>is item reflected in</i>	Relates an item to a bibliographic resource that reflects it.	frbrer:Item	isbd:Resource
<i>is manifestation reflected in</i>	Relates a manifestation to a bibliographic resource that reflects it.	frbrer:Manifestation	isbd:Resource
<i>is work reflected in</i>	Relates a work to a bibliographic resource that reflects it.	frbrer:Work	isbd:Resource

Usage

Case study: Publishing linked data from legacy bibliographic records

A common method of assigning a URI to the resource described by legacy, non-FRBRised bibliographic records is to treat the record number as the local part and add it to a base domain to form a global unique identifier. This resource URI is then used as the subject for data triples derived from the record. The predicates of such data triples can use RDF properties from several namespaces, including ISBD and unconstrained namespaces. But the properties from the constrained FRBRer namespace cannot be used because they have WEMI classes as domains, which entail or infer that the subject of a data triple using those properties is a Work, Expression, Manifestation or Item – not a Resource. However, the FRBRer properties can be used if a different URI is assigned to the Work part, the Expression part, and so on. One easy method for doing this is to add "W", "E", etc. to the Resource URI. For example:

ResourceURI = base domain + record identifier (bd/ri)

WorkURI = ResourceURI + "W" = base domain + record identifier + "W"

ExpressionURI = ResourceURI + "E"

ManifestationURI = ResourceURI + "M"

ItemURI = ResourceURI + "I"

The Resource, Work, Expression, Manifestation, and Item URIs for a single bibliographic resource can be related using the proposed properties:

<bd/ri> has-Work-aspect <bd/riW>

<bd/ri> has-Expression- aspect <bd/riE>

<bd/riM> is-Manifestation- aspect -of <bd/ri>

<bd/riE> is-Expression- aspect -of <bd/ri>

etc.

Case study: Aggregation of FRBR-based metadata

Metadata "born FRBR" will usually have specific Work, Expression, Manifestation, and Item records, kept together using the primary FRBR relationships. For example:

WorkURI = base domain + Work record identifier (bd/Wi)

ExpressionURI = bd/Ei

ManifestationURI = bd/Mi

ItemURI = bd/li

bd/Wi is-realized-through bd/Ei

bd/Ei is-embodied-in bd/Mi

bd/Mi is-exemplified-by bd/li

An additional URI for the whole resource (bd/Ri) can be used to identify the super-record aggregation of these four component WEMI records:

<bd/Wi> is-Work-reflected-in <bd/Ri>

<bd/Ei> is-Expression-reflected-in <bd/Ri>

<bd/Mi> is-Manifestation-reflected-in <bd/Ri>

<bd/li> is-Item-reflected-in <bd/Ri>

The *Resource* URI is essentially the identifier for a "named graph" consisting of the WEMI components.

Complications

The case studies use the simplest WEMI structure: one Work, one Expression, one Manifestation, and one Item. The FRBR model allows a Work to have multiple Expressions, an Expression to have multiple Manifestations, and a Manifestation to have multiple Items. It also allows a Manifestation to have multiple Expressions. All combinations can be linked to a Resource using the four proposed properties:

<R1> has-work-aspect <W1>

<R1> has-expression- aspect <E1>

<R1> has-expression- aspect <E2>

<R1> has-manifestation- aspect <M1>

<R1> has-item- aspect <I1>

<R1> has-item- aspect <I2>

The FRBR model does not require a Work to have an Expression, or an Expression a Manifestation, or a Manifestation an Item. The inverse is not true, as described above: an Item must have a Manifestation, a Manifestation must have at least one Expression, and an Expression must have a Work. Thus W, WE, and WEM components can form Resource records. An example is a "lost" Work, say of classical literature, where only the conceptual Work description is known, such as the name of its creator, its subject coverage, and its title. Again, these situations are also accommodated with the proposed properties.

Example

This example substitutes opaque URIs with English labels for readability. Namespace abbreviations include "new", for the proposed properties, and "uncfrbrer" for unconstrained versions of the FRBRer namespace.

```
ex:W1 frbrer:is-created-by ex:A1
ex:W1 new:is-Work-reflected-in ex:R1
ex:W1 frbrer:is-realized-through ex:E1
ex:E1 frbrer:has-language-of-expression "French"
ex:E1 new:is-Expression-reflected-in ex:R1
ex:E1 frbrer:is-embodied-in ex:M1
ex:M1 frbrer:has-title-of-the-manifestation "Hamlet"
ex:M1 new:is-Manifestation-reflected-in ex:R1
```

Entails:

```
Ex:A1 is-a frbrer:Person
Ex:E1 is-a frbrer:Expression
Ex:M1 is-a frbrer:Manifestation
Ex:R1 is-a isbd:Resource
Ex:W1 is-a frbrer:Work
```

An application bringing together data triples based on FRBRer and ISBD properties can create software processes to entail data triples using unconstrained FRBRer and ISBD properties with an ISBD Resource as their subject:

```
If ex:W1 frbrer:is-created-by ex:A1 and ex:W1 new:is-Work-reflected-in ex:R1
Then ex:R1 uncfbrer:is-created-by ex:A1
```

```
If ex:E1 frbrer:has-language-of-expression "French" and ex:E1 new:is-Expression-reflected-in ex:R1
Then ex:R1 uncfbrer:has-language-of-expression "French"
```

```
If ex:M1 frbrer:has-title-of-the-manifestation "Hamlet" and ex:M1 new:is-Manifestation-reflected-in
ex:R1
Then ex:R1 uncfbrer:has-title-of-the-manifestation "Hamlet"
```

The three entailed triples can then be clustered with data triples based on ISBD properties:

```
ex:R1 isbd:has-content-form isbdcontentform:text
ex:R1 isbd:has-dimensions "12 cm"
ex:R1 isbd:has-edition-statement "Ed. 2"
ex:R1 uncfbrer:is-created-by ex:A1
ex:R1 uncfbrer:has-language-of-expression "French"
ex:R1 uncfbrer:has-title-of-the-manifestation "Hamlet"
```

This is only one method of achieving interoperability, and different applications may use different processes based on the proposed and existing ISBD and FRBRer properties.

Recommendations

Recommendations:

- Create the four proposed RDF properties and their inverses with domains and ranges as specified.
- Liaise with the FRBR Review Group to decide which namespace (ISBD or FRBRer) to use for the properties. The properties extend both namespaces.

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