

IFLA LRM – Finally Here

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Abstract

The IFLA Library Reference Model (IFLA LRM) consolidates the three models of the FRBR Family. In this paper, first the differences between the three models are presented as well as the major modelling and presentation issues identified. The main part is the general description of IFLA LRM. Only the most important features are presented, with examples illustrating the modelling approaches.

Keywords: IFLA Library Reference Model, IFLA LRM, conceptual models, FRBR

1. Introduction

With the publication of the *Functional Requirements for Bibliographic Records* (FRBR, 1998) the library community made a leap forward; this first conceptual model of the bibliographic universe provided the necessary foundation for the development of new generations of bibliographic information systems such as library catalogues and bibliographies. The two models that followed further developed the area of authority control: the *Functional Requirements for Authority Data* (FRAD, 2009) focused on agents and works, while the *Functional Requirements for Subject Authority Data* (FRSAD, 2010) developed the subject relationship. The three models, now usually referred to as the FRBR Family of models, were developed over time by different working groups and so some differences in structure and conceptualization between the models were not unexpected. While the differences are mostly in the details, when the three FR models were declared as element sets in the IFLA domain (<http://iflstandards.info/ns/>), the differences resulted in three different namespaces reflecting incompatible definitions of (some) entities, attributes and relationships. These differences constituted a definite barrier to successful and compatible implementations. The decision to harmonize the three models was therefore the logical next step. In 2011, the FRBR Review Group, the body within IFLA responsible for the development and promotion of the FRBR Family of models, started the consolidation process. In 2013, the Consolidation Editorial Group (CEG) was established and assigned the task of combining the three models into a consistent whole and thus preparing a unified view of the bibliographic universe.

LRM incorporates many insights gained through almost twenty years of experience in working with the FRBR Family of models. The development of LRM was viewed as an opportunity to critically assess the existing conceptual models, to identify and fill gaps, and to answer recurring questions. LRM maintained the aspects of the FRBR model that were validated through research carried out on end-user mental models (see Pisanski & Žumer, 2010). LRM offers a single complete model covering all aspects of bibliographic information, removing barriers to adoption due to divergent conceptualizations between the models of the FRBR Family. The approach was to clarify where experience indicated it was needed, such as in the modelling of aggregates and serials, and generally provide a more robust, rigorous model. Additionally, the presentation of the LRM model definition was designed so as to include information needed for the declaration in RDF of an element set reflecting the model. The aspects of the model that make it semantic web-ready were the topic of a recent IFLA congress presentation by the authors (see Riva & Žumer, 2017).

Already in November 2016, the RDA Steering Committee (RSC) adopted LRM, instead of the FRBR Family of models, as its conceptual model to underlie the current major development of *RDA: Resource Description and Access* (see <http://www.rda-rsc.org/ImplementationLRMinRDA>). As RDA is rapidly becoming the most widely used standard for description and access to bibliographic resources, this decision will have major impact in the bibliographic community with far-reaching ramifications. RDA will be the first large-scale application of the LRM model and will be a de facto extension of the model to cover all elements required in resource description. The confidence shown by the RSC in the approach taken in LRM is a strong validation of the consolidation process.

2. Major Differences between FRBR, FRAD and FRSAD

2.1. Style and Focus

While all three models use the same entity-relationship formalism, their presentation is rather different. The specification of FRBR is mostly written using free text and there are no strict boundaries between the definitions and the scope notes; there are also many examples, but they are not specifically explained. As seen from the many discussions following its publication, the components of the model are not always strictly defined and are open to interpretation. While this adds to flexibility, it hinders the interoperability of the systems developed using the model.

FRAD, on the other hand, is already more formal. Tables are used to define the model, but there is no clear boundary between the definitions, the scope notes and the examples, the latter mostly seem to be a part of the scope note. The specification of the relationships is more formalized, but still not presented quite systematically.

The structure of FRSAD, on the other hand, is very simple. Definitions and examples are clearly delimited, and although most attributes have few scope notes, there are no particular issues in interpreting the model.

As to the scope of the models, some differences can be noticed as well. FRBR and FRSAD are primarily end-user focused, which is obvious from the user tasks declared in FRBR: *find*, *identify*, *select*, *obtain*. In FRSAD *explore* is added, while *obtain* is not relevant. FRAD, on the other hand, is to some extent also modelling the cataloging process and, along with *find* and *identify*, introduces two additional tasks, *justify* and *contextualize*, which describe the work of a cataloguer performing authority control.

2.2. Entities

All three models keep the central entities (*work*, *expression*, *manifestation*, *item*, often referred to as WEMI) and their definitions are essentially unmodified. To FRBR's two entities defined to participate in responsibility relationships, *person* and *corporate body*, FRAD adds a new entity, *family*, and changes the definition of *person* to include "a persona or identity established or adopted by an individual or group". There are also major differences in the treatment of appellations: FRBR models them as mere attributes, while FRAD and FRSAD introduce specific entities to enable assigning attributes to an appellation itself. In contrast to FRSAD, which only defines one entity (*nomen*), FRAD defines three for different types of appellations: *name*, *controlled access point*, and *identifier*. In keeping with its scope, FRAD introduced two further entities, *agency* and *rules*, used in modelling the cataloguer's process in assigning *controlled access points*.

2.3. Attributes

In FRBR numerous attributes are defined for the four entities of the first group (*work*, *expression*, *manifestation*, *item*). These were drawn from an examination of the data elements typically included in bibliographic records formulated following ISBD, the IFLA *Guidelines for Authority and Reference Entries*, the IFLA *Guidelines for Subject Authority and Reference Entries*, and the *UNIMARC Manual*, although at a lesser degree of granularity. Using these sources led to the

inclusion of many specialized material-specific attributes, particularly for *expressions* and *manifestations*. The entity to which a data element should be attached was not always clear, with the result that the attribute *medium of performance* was considered both a *work* and an *expression* attribute, and some attachments were later disputed (such as expected regularity and frequency of serials). The close parallels between the attributes and the data elements led to uncertainty between the respective roles of the ISBD and FRBR. FRAD did not list all of the previously defined attributes, but did add certain *work* attributes typically recorded only in authority records. FRAD concentrated on expanding the attributes for *person* and *corporate body*, which were only minimally developed in FRBR, and also on proposing the attributes for *name* and *controlled access point*. FRSAD identified a very similar list of attributes for the *nomen* entity, but only the attributes *type* and *scope note* for *thema*.

2.4. Relationships

In FRBR and FRAD a distinction is made between the “primary” relationships, which are presented in the respective high-level diagrams, and all other relationships of interest, which are presented in tables. Cardinality is indicated in the diagrams illustrating the primary relationships, but is not given explicitly for any of the other relationships. In FRBR only additional relationships among WEMI are defined. Some of the same relationships appear in the tables for work-to-work, expression-to-expression (of different works), and expression-to-work relationships.

FRAD presents the additional relationships in three groups: those between *persons*, *families*, *corporate bodies* and *works* (this section actually covers WEMI, not only *works*), those between various *names* of *persons*, *families*, *corporate bodies* and *works*, and finally, those between *controlled access points*. The presentation of relationships in both FRBR and FRAD at times obscures the intended domain or range of the relationship. An example of this is in the subject relationship in FRBR, where the range is only indicated in a diagram by a box that encompasses all the entities declared in the model. However, this box is not itself named or identified as an actual entity in the model. In FRAD, the relationships are given a term (such as pseudonymous relationship, membership relationship) but not relationship names or inverse names. In each of these models, there are multiple tables of relationships, with no single comprehensive listing of all relationships.

2.5. Summary of Major Differences

The top five differences among the three models in the FRBR Family, in terms of their impact on the semantics of the models, are the following.

- User tasks
Find, identify, select and *obtain* are defined by FRBR. FRSAD adds *explore*, intended to cover browsing and, consequently, serendipitous discovery. FRAD, on the other hand, focuses more on the cataloguing process and defines *justify* and *contextualize*.
- Definition of the *person* entity
In FRBR, the entity *person* is defined as “an individual”, while in FRAD it includes also a “persona or identity established or adopted by an individual or group”.
- Treatment of appellations as attributes or as entities
In FRBR appellations are modelled as attributes of entities, in contrast FRAD and FRSAD introduce appellations as entities. While FRSAD defines only one appellation entity, *nomen*, FRAD lists three distinct entities for different types of appellations: *name*, *identifier* and *controlled access point*.
- Treatment of subjects as an attribute or a relationship

FRBR and FRSAD both define the *has as subject* relationship with the entity *work* as its domain, while in FRAD subject is modelled as an attribute of *work*.

- Relationships

Relationships are modelled at different levels of specificity and, particularly in FRBR and FRAD, are not all declared in both directions and cardinality is not always specified. The domains and ranges indicated for some relationships do not indicate specific entities.

A detailed examination and comparison of the three models in the FRBR Family of models reveals many other points of divergence. In the *Transition Mappings* document, the FRBR, FRAD and FRSAD models are aligned where possible, and the mapping of each user task, entity, attribute and relationship declared in them with LRM is presented in full. This exercise also highlights all of the differences among the FRBR Family models.

3. IFLA Library Reference Model (IFLA LRM)

The task of the CEG was to:

- Prepare a high-level abstract model
- Use the entity-relationship formalism
- Develop a consistent model consolidating all three models of the FRBR Family
- Consider implementation in the Semantic web

The resulting model is described as (LRM, p. 6):

The conceptual model as declared in IFLA LRM is a high-level conceptual model and as such is intended as a guide or basis on which to formulate cataloguing rules and implement bibliographic systems. Any practical application will need to determine an appropriate level of precision, requiring either expansion within the context of the model, or possibly some omissions. However, for an implementation to be viewed as a faithful implementation of the model, the basic structure of the entities and the relationships among them (including the cardinality constraints), and the attachment of those attributes implemented, needs to be respected.

3.1. User tasks

In line with the FRBR Family, in LRM the user tasks are central and form the starting point for model development. The tasks which need to be enabled and supported by a bibliographic information system define the scope of the model and are starting points from which the entities, attributes and relationships are declared. Bibliographic information systems are of interest to varied target audiences, from library users (readers, researchers, students...) to librarians and other actors in the information chain, including publishers and booksellers. These user groups have different needs and different priorities. LRM therefore follows FRBR in defining end-users, and librarians looking for information on behalf of end-users, as its primary audience. Librarians who create and maintain metadata may perform these same tasks as part of their work – they are included in this sense. On the other hand, the model does not include administrative data, which is otherwise essential for library operations, such as preservation or acquisitions metadata.

Five basic user tasks are defined (Table 1). The definitions are phrased by specifying the user's goal when performing each action. The term 'resource' is used in its broadest meaning, standing for any entity defined in the model. The tasks are listed in the order in which they are normally executed, which does not mean that they must all be performed each time a end-user accesses a bibliographic information system or that they cannot be repeated. Particularly *identify* and *select* often occur simultaneously and in interaction.

Table 1: User Tasks Summary	
Find	To bring together information about one or more resources of interest by searching on any

Table 1: User Tasks Summary	
	relevant criteria
Identify	To clearly understand the nature of the resources found and to distinguish between similar resources
Select	To determine the suitability of the resources found, and to be enabled to either accept or reject specific resources
Obtain	To access the content of the resource
Explore	To discover resources using the relationships between them and thus place the resources in a context

The first four tasks are essentially the same as the tasks with the corresponding names in FRBR, while *explore* was first introduced by FRSAD. The need for ‘navigation’ is already mentioned in FRBR and in subsequent years many researchers emphasized that a modern bibliographic information system needs to support browsing and, consequently, serendipitous discovery.

3.2. Entities

The CEG compared the definitions of entities across the three models and identified the semantically identical ones (such as *work*, *expression*, *manifestation*, *item*), the similar ones (FRAD *name* and FRSAD *nomen*) and the very different ones (*person* in FRBR and FRAD). All entities were critically reviewed and evaluated. The decision was to keep only the entities which were required due to having specific attributes or being used in specific relationships. In contrast with the FRBR Family, where all entities are at the same level, a hierarchical structure of entities is introduced in LRM by declaring entities within a structure of superclasses and subclasses. That one entity is a subclass of another entity can be expressed using the isA relationship. This powerful mechanism enables considerable simplification of the model, because attributes and relationships can be declared on the higher level and do not have to be repeated on lower levels.

Entities of the first group (often also called WEMI) remain basically the same conceptually; however, there are some changes in the wording of their definitions.

Table 2: Work, expression, manifestation, item

Work	The intellectual or artistic content of a distinct creation
Expression	A distinct combination of signs conveying intellectual or artistic content
Manifestation	A set of all carriers that are assumed to share the same characteristics as to intellectual or artistic content and aspects of physical form. That set is defined by both the overall content and the production plan for its carrier or carriers.
Item	An object or objects carrying signs intended to convey intellectual or artistic content

On the other hand, some changes were introduced in the second group by declaring a superclass, *agent*, and subsuming both *corporate body* and *family* into a broader entity termed *collective agent*.

Table 3: Agents

Agent	An entity capable of deliberate actions, of being granted rights, and of being held accountable for its actions
Person	Individual human being
Collective agent	A gathering or organization of persons bearing a particular name and capable of acting as a unit

The “agent” entities can best be presented using the basic relationships (Figure 1).

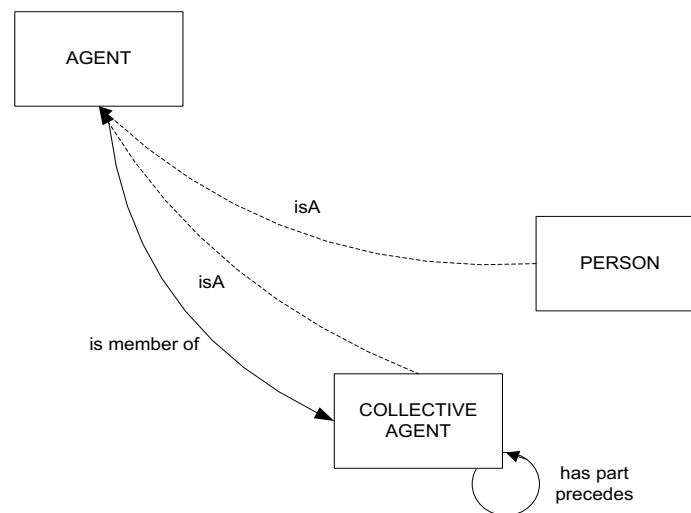


Figure 1: Agent relationships

In LRM, the entity *person* includes only living individuals or those who are assumed to have lived. Figures generally considered fictional, literary or purely legendary are not instances of the entity *person*. They can act as subjects of works. When they seem to be creators, it is in fact a *person* or a *collective agent* using that particular appellation in the context of that act. The name used does not change the nature of the agent. This follows the definition of the *person* entity in FRBR, and is unlike the FRAD approach which conflates real persons with bibliographic identities.

The FRSAD model first introduced the entities *thema* and *nomen* as the mechanism for modelling the appellation relationship. Both entities remain in LRM, with a slight label change; we have the term *res* replacing *thema* to avoid the restriction to the subject relationship implied in the term *thema*. *Res* is, therefore, the superclass of all LRM entities and *nomen* is the appellation used to refer to an instance of *res*. Modelling appellations as entities allows us to assign them attributes such as language, alphabet or controlled vocabulary and to establish relationships between different appellations for the same entity such as between former and later name of a *person*.

Table 4: Res and nomen

Res	Any entity in the universe of discourse
Nomen	An association between an entity and a designation that refers to it

Two new entities were added in order to model in more detail the spatial and temporal aspects: *time-span* and *place*. Using these entities, many characteristics previously modelled as attributes can be modelled as relationships in LRM.

Table 5: Place and time-span

Place	A given extent of space
Time-span	A temporal extent having a beginning, an end and a duration

3.3. Attributes

Attributes provide a mechanism for assigning particular characteristics to instances of entities. While FRBR and FRAD declare an exhaustive list of attributes applicable to particular types of entities, the decision was made to include only the most general and common attributes in LRM. The list of attributes is therefore not a complete inventory of characteristics that might be of interest and none of the attributes are mandatory. An application can define additional attributes to record additional relevant data or to record data at a greater level of granularity than is illustrated. Certain attributes that are important to the model or are frequently relevant in bibliographic systems are included here. However, the listing of an attribute in the model is not intended in any way to imply that these attributes are required for any application.

As illustration, the six attributes of *manifestation* are listed in Table 6. This contrasts sharply with the 38 *manifestation* attributes defined in FRBR.

Table 6: Attributes of *manifestation*

Category of carrier	A type of material to which all physical carriers of the <i>manifestation</i> are assumed to belong
Extent	A quantification of the extent observed on a physical carrier of the <i>manifestation</i> and assumed to be observable on all other physical carriers of the <i>manifestation</i> as well
Intended audience	A class of users for which the physical carriers of the <i>manifestation</i> are intended
Manifestation statement	A statement appearing in exemplars of the <i>manifestation</i> and deemed to be significant for users to understand how the resource represents itself
Access	Information as to how any of the carriers of the <i>manifestation</i> are likely to be obtained
Use rights	A class of use and/or access restrictions to which all carriers of the <i>manifestation</i> are assumed to be submitted

The *category of carrier* attribute is a sub-type of the *category* attribute defined for the entity *res*. Since *category* is defined for the top entity *res*, *category* attributes can automatically apply to any entity, whether declared for that entity or not. Despite this, the *category of carrier* attribute is one of the sub-types of the higher-level attribute that is explicitly declared in the model. This serves to illustrate some of the ways categorization can be used to record significant characteristics of entities, and to draw attention to the way LRM models certain FRBR *manifestation* attributes. The only other attribute of *res* is the *note* attribute, which automatically extends to all the subclasses of *res*, including *manifestation*, even though it is not explicitly declared.

The new attribute *manifestation statement* is a generalization of many FRBR *manifestation* attributes, particularly those drawn from ISBD. Any attribute that consisted of a transcription of a statement found in exemplars of a *manifestation* is actually a sub-type of this new general attribute. Transcription distinguishes a *manifestation statement* from a free-text or cataloguer-composed note, and is something that is specific to the *manifestation* entity. Defining this attribute at this functional level illustrates a mechanism in LRM that makes the model flexible and independent of any specific implementation. LRM does not prescribe the types of *manifestation statements* of interest. The application can sub-type this attribute to the level of granularity that suits the needs of the implementation.

Another significant generalization in LRM relates to the *work* attribute *representative expression attributes*. This is defined as “An attribute which is deemed essential in characterizing the *work* and whose values are taken from a representative or canonical *expression* of the *work*”. This approach resolves the apparent contradiction between the assignment of certain attributes to the *expression* entity (such as *language*, *key*, *medium of performance*, *cartographic scale*) and the impression that values of these attributes are significant in delimiting the boundaries of the *work*. LRM follows the FRBR Family models in not labeling any particular *expression* as more significant and just allowing for the specification of a network of derivative relationships among *expressions*

of the same *work*. However, end-users do in some way consider certain *expressions* to more fully represent the “intent” of the *work*. The *expressions* that are viewed as most canonical or representative are often the original *expression*; however, due to the complexity of derivation networks, this is not always the case. It is the values of certain *expression* attributes that are seen in these representative *expressions* that are parked with the *work* entity via the *representative expression attributes*. Again, LRM allows each implementation to determine which *expression* attributes will function to characterize the *work*. The choice of attributes may depend on the form of the *work*.

3.4. Relationships

Relationships are the core of the model – they link entities and place them in context. Some of the relationships, for example the so-called primary relationships in FRBR, remain virtually unchanged in LRM, others differ primarily in the level of generality. LRM relationships are high-level and general, but they provide a framework for consistent extensions. Any entity can be linked to the entities *place* and *time-span* via the specific distinct association relationships (*res* is associated with *place* and *res* is associated with *time-span*). All relationships are refinements of the top-level relationship (*res* is associated with *res*). When needed, implementers can therefore add more granular relationships.

The relationships between *works*, *expressions*, *manifestations* and *items* are the center of the model and are in essence required. Relationships in general enable and support exploration and should be included as much as possible in implementations.

In LRM all relationships are declared specifying their domain and range, as well as the cardinality. Inverse names are also stated systematically.

Relationships between WEMI are illustrated in Figure 2.

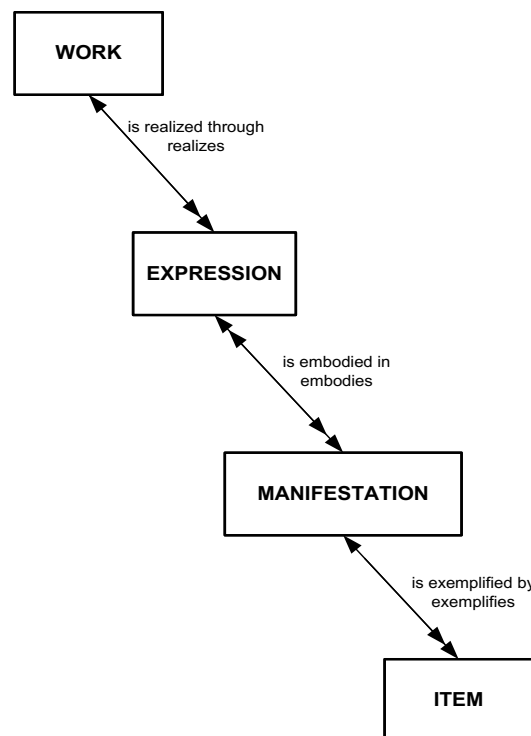


Figure 2: WEMI relationships

As an example, all work-to-work relationships are listed in Table 7.

Table 7: Work-to-work relationships

Domain	Relationship name	Inverse name	Range	Cardinality
Work	has part	is part of	Work	M to M
Work	precedes	Succeeds	Work	M to M
Work	accompanies / complements	is accompanied / complemented by	Work	M to M
Work	is inspiration for	is inspired by	Work	M to M
Work	is a transformation of	was transformed into	Work	M to 1

Agent-to-WEMI relationships have been streamlined as well (Figure 3).

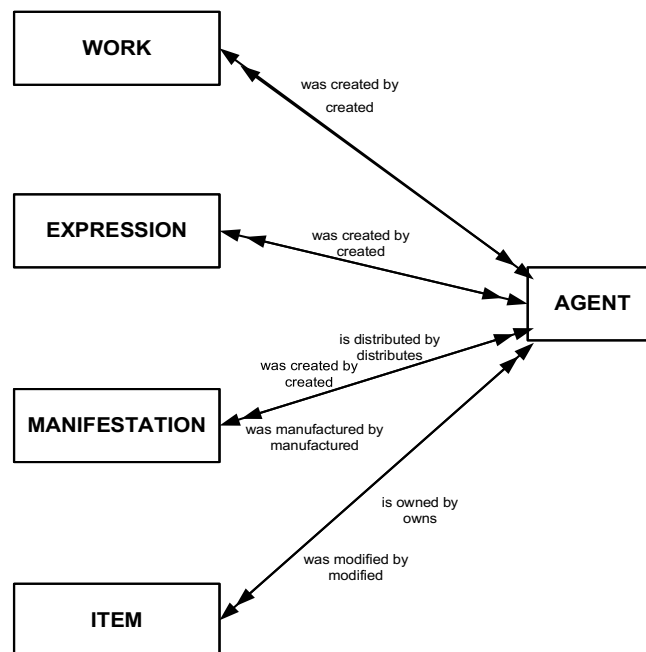


Figure 3: Agent-to-WEMI relationships

LRM declares 36 distinct relationships, as well as the relevant inverse relationships. The overview of all LRM relationships is shown in Figure 4. The isA relationships between all other entities and the entity *res* is not shown. For the sake of simplicity, relationships are shown in one direction only.

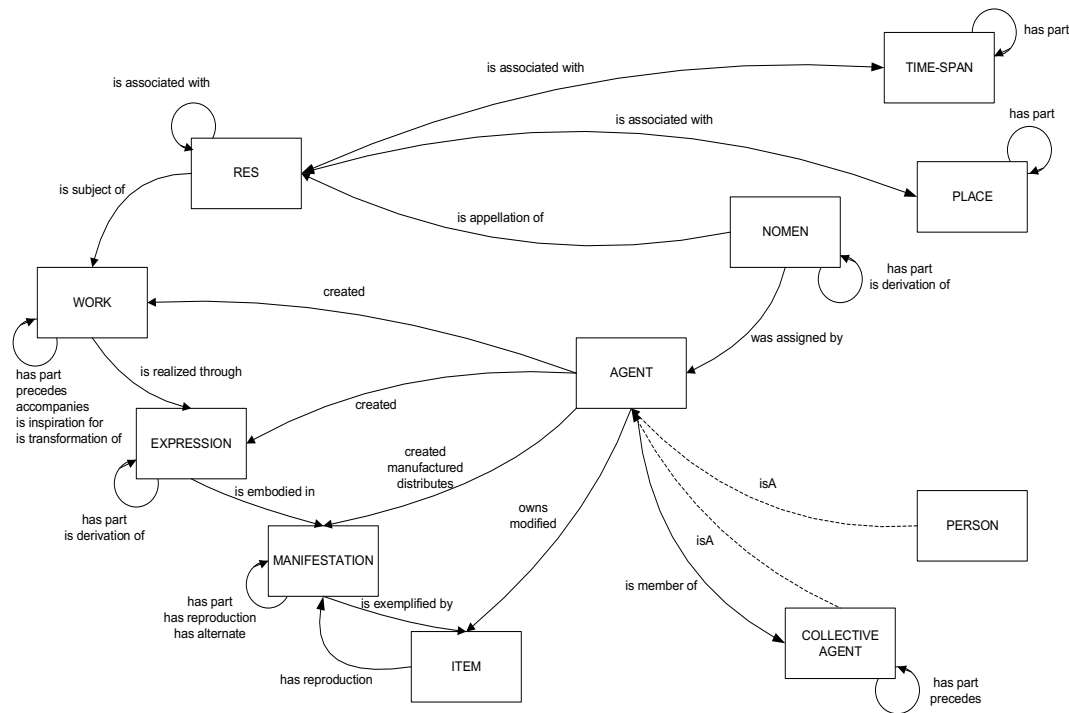


Figure 4: Overview of LRM relationships

4. Current status and future developments

In February 2016, the first stable draft of the LRM model was issued for a two-month world-wide review, according to IFLA practice. Subsequently the CEG incorporated revisions into the draft, which was then discussed by the full FRBR Review Group at its annual meeting in August 2016. The Review Group made decisions on all outstanding issues, leading to a final draft accepted at the FRBR Review Group level by the end of 2016. In accordance with the IFLA standards process, this final draft was submitted for approval to the IFLA Committee on Standards in April 2017 and posted on the IFLA website. The model was formally approved as an IFLA standard by the IFLA Professional Committee at its meeting held on August 18, 2017, prior to the IFLA World Library and Information Conference in Wrocław, Poland.

Several complementary documents have been issued, including a summary of changes in the model definition since the world-wide review draft. A *Transition Mappings* document, detailing the LRM equivalents for all user tasks, entities, attributes and relationships from the three previous models, is offered to guide the transition of any applications.

A working group of the ISBD Review Group has prepared a correspondence from the ISBD element set to LRM, discussed at its meetings in 2017, which is intended to lay groundwork for future revision of ISBD. Further mappings between LRM and other content standards are expected.

FRBRoo ver.2.4 (approved by IFLA in 2016) uses an object-oriented formalism to express the three FRBR Family models. The first steps towards bringing the object-oriented model into conformity with LRM took place in April 2017, at the Joint Meeting of the CIDOC CRM Special Interest Group and FRBR/CRM Harmonisation Working Group. The review, while not changing the nature of the model, will surely permit some simplifications and possibly lead to a “core” model for implementation. This work is ongoing, with a projected completion by the end of 2018.

As a general high-level model, LRM is intended to be expanded for implementation. LRM has already been adopted to guide the revision of *Resource Description and Access* (RDA), as part of the RDA Toolkit Redesign and Restructure (3R) project, which will demonstrate the methodology for extending the model.

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