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Modeli, standardi, kataložna pravila / Models, Standards, Cataloguing Rules

IFLA *LIBRARY REFERENCE MODEL* (IFLA *LRM*)
HARMONISATION OF THE *FRBR* FAMILY[1]

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***FRBR** Family, harmonisation, IFLA **Library Reference Model** (IFLA LRM)*

Abstract

In 1998, the FRBR *model* (***Functional Requirements for Bibliographic Records***) *was developed under the auspices of the International Federation of Library Associations and Institutions (IFLA). The library domain finally developed its conceptual model of the bibliographic universe and thus the basis for the development of novel bibliographic information systems. In 2017, the IFLA **Library Reference Model** (Riva, LeBœuf and Žumer, 2017) was formally accepted as an IFLA standard. The* FRBR *Family of models as well as LRM all start from the user tasks that need to be enabled and supported by bibliographic information systems. The consolidation process included a detailed analysis of all entities, attributes and relationships defined by the **FRBR** Family. In this paper, the main features of the model are presented and described. With IFLA **LRM**, we finally have a modern model, compatible with the semantic web.*

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Introduction

In 1998 the *FRBR* model (IFLA *FRBR*, [1998] 2009) was developed under the auspices of International Federation of Library Associations and Institutions (IFLA). The library domain finally developed its conceptual model of the bibliographic universe and thus the basis for the development of novel bibliographic information systems – such as library catalogues and bibliographies – which would better suit the changing environment. While several previous important theoretical works about catalogues and cataloguing have been published over time, their underlying conceptual models were not explicitly formulated. Consequently, the first computer catalogues were designed as a mere replica of a card catalogue and we still see this paradigm in the majority of current OPACs. *FRBR* was a revolutionary step forward, influencing the foundations of cataloguing theory and practice. In the following years two complementary models were developed, focusing on authority data: *Functional Requirements for Authority Data* (IFLA *FRAD*, 2009), dealing with name authority and *Functional Requirements for Subject Authority Data* (IFLA *FRSAD*, 2011), focusing on the subject relationship. The three models, usually referred to as the *FRBR* Family of models, were developed over a rather long period by different working groups. It is therefore not surprising that some different modelling decisions were made, resulting in some incompatible details. While relatively minor, these differences still present a major barrier for the development of implementations.

The FRBR Review Group, the IFLA body responsible for the development and maintenance of the *FRBR* Family, started the consolidation process in 2011 and, in 2013, formally established the Consolidation Editorial Group (CEG). The task of CEG was to systematically and consistently combine the three models and thus create a unified model of the bibliographic universe.

In the beginning of 2016, CEG finished the first stable draft of the *LRM* model, which was issued for a two-month world-wide review, according to IFLA practice. All comments were collected and discussed, and subsequently the CEG incorporated the revisions into the draft, which was then reviewed 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. IFLA Professional Com-

mittee formally adopted IFLA *LRM* on August 18, 2017. All figures in this article are from the IFLA *LRM* document.

Principles of the consolidation process

The task of the CEG (Riva and Žumer, 2017) 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; and,
- Consider implementation in the Semantic web.

The development of *LRM* was informed by user research (such as Pisanski and Žumer, 2010a, 2010b), the work of FRBR/CRM Harmonisation Group (IFLA FRBR/CRM, 2016) and the resulting *FRBRoo* (2016), experiences of *FRBR*/*FRAD*/*FRSAD* implementations and the semantic web and linked data environment. The resulting model is described as (Riva, LeBœuf and Žumer, 2017, 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.

User tasks

The *FRBR* Family of models as well as *LRM* all start from the user tasks that need to be enabled and supported by bibliographic information systems. These user tasks provide the boundaries of the model and serve as the starting point for

definitions of entities, attributes and relationships. Bibliographic and authority data are of interest to a broad user group – from library users (readers, researchers, students, etc.) to librarians and other members of the information chain, such as publishers and booksellers. These user groups have different needs and different priorities. *LRM* follows *FRBR* in the choice of its primary user group: end-users and librarians acting on their behalf. Librarians creating and maintaining metadata may occasionally perform the same tasks as part of their work activities; they are included in this sense. On the other hand, the model does not cover administrative data important for library operations, such as intellectual rights data, preservation data or acquisitions processes. It also has to be mentioned that in this sense the scope of *FRAD* is different from the other two models, because it also models the cataloguing process, which is reflected in the tasks, particularly "justify".

LRM defines five user tasks (Table 1) and explains what users want to accomplish by performing them. The term "resource" is used in its broadest sense, as an instance of any entity defined in the model. The first four tasks are listed in a typical order; most users start by finding and continue with identification and selection to finally obtain the resource(s). While this is the most common order, users may omit some tasks or change the order (for example identify resources directly from exploration or move to finding from identification, when a user realizes that the search statement needs to be modified). Particularly *identify* and *select* often occur in parallel and in interaction.

Table 1. A summary of user tasks

Find	To bring together information about one or more resources of interest by searching on any 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 the same as in *FRBR*, with slightly modified and broader definitions, *explore,* on the other hand, was first introduced by *FRSAD*. The need for "navigation" was already mentioned in *FRBR* and in the following years researchers often emphasised that a modern bibliographic information system needs to support browsing and, consequently, serendipitous discovery of relevant resources.

Entities

In an entity-relationship model, entities are defined as key objects of interest. They are abstract categories (also called classes) of conceptual objects, connected by relationships, and their characteristics are described by attributes.

The consolidation process included a detailed analysis of all entities defined by the *FRBR* Family, since they include virtually identical entities across models (*work, expression, manifestation, item*), similar entities (*FRSAD nomen* and *FRAD name*) or completely different ones (*person* in *FRBR* and in *FRAD*). The decision was made to include only the entities with specific attributes and relationships. What is new in *LRM* is also the hierarchical structure of classes and subclasses, usually expressed with the "isA" relationship in formal modelling. This is a powerful mechanism enabling considerable simplification: attributes and relationships, declared on a higher level, are inherited by all subclasses and do not have to be repeated on lower levels.

The entities of the *FRBR* Group 1 remain the same; there are some minor differences in definitions and scope notes, though (Table 2).

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

By declaring the superclass *agent*, a hierarchical structure is introduced in the former *FRBR* Group 2 of entities. Since they are clearly subsumed in the entity *collective agent* and have no specific attributes and relationships, *corporate body* and *family* are not included as entities in *LRM* (Table 3).

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 showing the basic relationships (Figure 1).

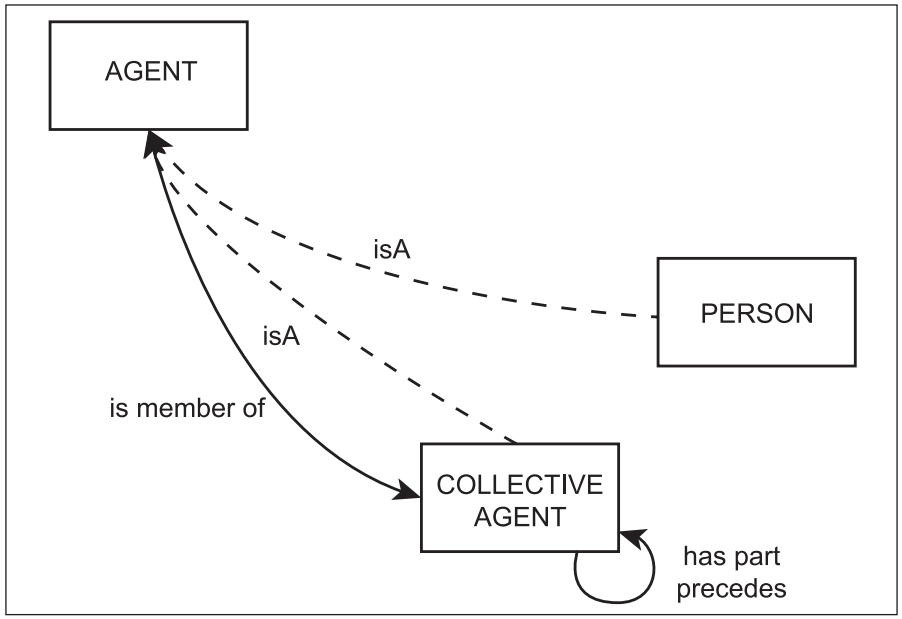

Figure 1 Relationships between *agent*, *person* and *collective agent*

Agent, therefore, includes only entities *person* and *collective agent* and not any other named groups. *LRM* here follows *FRBR* in limiting *person* to living persons and those who are assumed to have lived. Fictional, literary and legendary persons are therefore not included. They may be subjects of *works*, but when they seem to appear as creators, it is in fact a real person or collective agent using this appellation in the context of the creation process. The name used does not change the nature of this person or collective agent.

The *FRSAD* model introduced two basic entities, *thema* and *nomen* to model the appellation relationship. *LRM* keeps both of them, with a change in label. *Res* is used instead of *thema* to avoid the implicit restriction to the subject relationship.

Res is the superclass of all entities in the model and *nomen* is the appellation used to refer to an instance of *res*. Modelling *nomen* as an entity enables us to assign specific attributes such as script, language or source vocabulary to appellations and establish relationships between them, such as the relationship between former and later name of a *person* (Table 4).

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

In order to model more precisely the temporal and spatial aspects, *LRM* introduces two additional entities, *place* and *time-span* (Table 5).

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

Attributes

Attributes enable assigning values to characteristics of entities. The *FRBR* Family of models treated attributes with various levels of detail. Since *LRM* has to cover all types of library materials, the decision was made to include only the most frequent and general attributes; the list is therefore not exhaustive and none of the attributes are mandatory. In an implementation, attributes may be added to record additional relevant characteristics or add more detail to the existing attributes. Cataloguing rules determine how the attributes values are determined and their values: from a controlled vocabulary, as free text in a particular language and script, as a numeric value. Multiple values of attributes are possible.

Category and *note* are the two attributes declared for *res* and are therefore inherited by all entities of the model.

As an illustration, Tables 6 and 7 show attributes of *expression* and *manifestation* respectively.

Table 6. Attributes of *expression*

Extent	A quantification of the extent of the *expression*
Intended audience	A class of users for which the *expression* is intended
Use rights	A class of use restrictions to which the *expression* is submitted
Language	A language used in the *expression*
Key	A pitch structure (musical scale, ecclesiastic mode, raga, maqam, etc.), that characterizes the *expression*

Medium of performance	A combination of performing tools (voices, instruments, ensembles, etc.) stated, intended, or actually used in the *expression*
Cartographic scale	A ratio of distances in a cartographic *expression* to the actual distances they represent

Table 7. Attributes of *manifestation*

Category of carrier	A type of material to which all physical carriers of the *manifestation* are assumed to belong
Extent	A quantification of the extent observed on a physical carrier of the *manifestation* and assumed to be observable on all other physical carriers of the *manifestation* as well
Intended audience	A class of users for which the physical carriers of the *manifestation* are intended
Manifestation statement	A statement appearing in exemplars of the *manifestation* 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 *manifestation* are likely to be obtained
Use rights	A class of use and/or access restrictions to which all carriers of the *manifestation* are assumed to be submitted

Two attributes need to be mentioned in particular: *representative expression attribute* (*work* attribute) and *manifestation statement* (*manifestation* attribute).

Representative expression attributes are the attributes that are considered essential in identifying the *work* and whose values are taken from a representative or canonical *expression* of the *work*. According to user studies the key characteristics of a *work* are associated with the original or canonical *expression*, which is considered to be the best representation of the *work* (Pisanski and Žumer, 2010a, 2010b). The values of these attributes are inferred either from a particular, usually original, *expression*, or from characteristics abstracted from set of similar *expressions*. The advantage of this approach is that there is no requirement to identify the particular *expression* that served as source, nor does that *expression* need to be recorded in the system.

Manifestation statement provides a mechanism to record information found on a *manifestation*, which is important to understand how the resource represents itself. Typical examples are responsibility statements; not always complete, sometimes even fictitious, but nonetheless important to identify a *manifestation*. *LRM* thus enables both the transcription from the *manifestation* itself and relationships to creators (e.g., publishers), places (of publication) and time spans (dates of publication).

Relationships

Relationships are an essential component of the model, connecting entities and placing them in context. Some relationships were carried to *LRM* virtually unchanged, others differ particularly in the level of detail. In line with other modelling decisions, relationships in *LRM* are modelled on a general and abstract level. Again, for an implementation, additional relationships may be added within the general framework when needed. Since relationships support exploration, they are essential in every implementation and should be recorded as much as possible. Relationships between *works, expressions, manifestations* and *items* remain the core of the model and are in essence required. It is also important to mention, though, that while relationships are declared between entity types, they really occur between instances.

Formally a relationship is declared between its domain and range and always in both directions. If the domain and range are the same, the relationship is recursive. When a relationship is the same in both directions, it is called symmetrical.

Cardinality is another term that needs to be explained: it specifies the number of instances of the domain and range for each relationship. The cardinality 1 to M (meaning "many") means that one instance of domain is related to many instances of range and, consequently for the reverse relationship, many instances are related to one and only one instance of the range. The relationships between *works, expressions, manifestations* and *items* are shown in Figure 2.

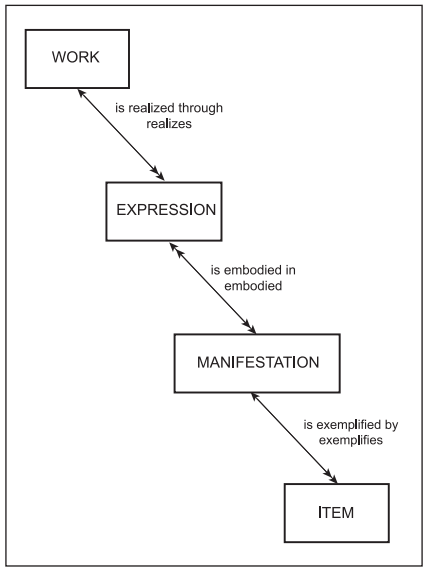

Figure 2 Relationships between *works, expressions, manifestations and items*

Additionally: As an example, all work-to-work relationships are shown in Table 8.

Table 8. 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

Each instance of an entity in the model has one or more appellations, the relationship between entities *res* and *nomen* has to be established (Table 9).

Table 9. Appellation relationship

Domain	Relationship name	Inverse name	Range	Cardinality
Res	has appellation	is appellation of	Nomen	1 to M

Agent as a new entity enabled a considerably simplified model of responsibility relationships (Table 10).

Table 10. Responsibility relationships

Domain	Relationship name	Inverse name	Range	Cardinality
Work	was created by	created	Agent	M to M
Expression	was created by	created	Agent	M to M
Manifestation	was created by	created	Agent	M to M
Manifestation	was manufactured by	manufactured	Agent	M to M
Manifestation	is distributed by	distributes	Agent	M to M
Item	is owned by	owns	Agent	M to M
Item	was modified by	modified	Agent	M to M

Modelling of the subject relationship, introduced by *FRSAD*, remains essentially the same (Figure 3).

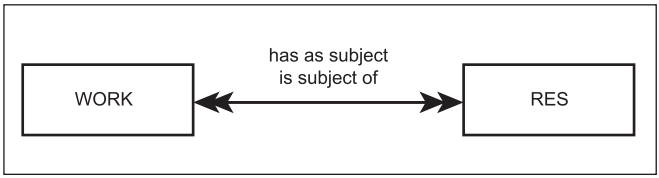

Figure 3 Subject relationship

Since *place* and *time-span* were introduced as entities and any entity in the model may have a temporal and/or spatial component, two general relationships are necessary (Table 11).

Table 11. Temporal and spatial relationships

Domain	Relationship name	Inverse name	Range	Cardinality
Res	has association with	is associated with	Place	M to M
Res	has association with	is associated with	Time-span	M to M

An overview of all *LRM* relationships is shown in Figure 4. The implicit *isA* relationships between all entities and the entity *res* is not shown. For the sake of simplicity, relationships are shown in one direction only and cardinality is not specified.

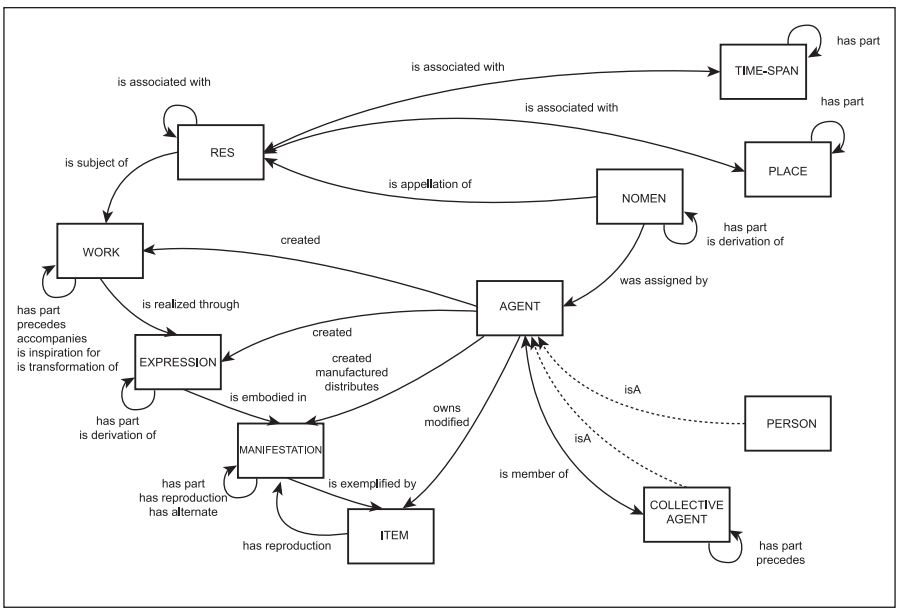

Figure 4 Overview of LRM relationships

Aggregates

Aggregates are *manifestations,* embodying multiple *expressions.* The *FRBR* model does not provide clear guidance on how to model such publications, which in general are quite common. According to the final report of the IFLA Working Group on Aggregates (2011), three types of aggregates exist:

- Aggregate Collections of Expressions
  Aggregate collections are *manifestations* embodying independently created *expressions* of the same type or genre. Typical examples include collected and selected works and anthologies, but also journals (aggregates of articles), monographs with independently created chapters, compilations of music recordings on a CD, several essays published in a book, etc.
- Aggregates resulting from augmentation
  This type of aggregates occurs when additional content is added to a distinct *expression*, such as illustrations, forewords, notes, commentaries.
- Aggregates of parallel expressions
  Aggregates of parallel expressions occur, when two or more *expressions* of the same *work* are embodied in a *manifestation*. Typical examples are multilingual manuals and official publications, an original published with a translation, but also multilingual websites.

Cardinality of the "*expression* is embodied in *manifestation*" relationship, which is many-to-many, explicitly indicates that a *manifestation* may include several *expressions*. Research (O'Neill, Žumer and Mixter, 2015) shows that aggregates are, even as identified from existing bibliographic records, very common. Considering that current cataloguing practice does not particularly encourage systematical recording of components of collections and augmentations such as illustrations or forewords, the actual occurrence of aggregates is likely much higher.

Modelling of aggregates as *manifestations* embodying several *expressions* is straightforward, since *works* and their respective *expressions* are completely independent of the *manifestations* they are published in. An *expression* does not change when embodied on its own or with other *expressions* in a *manifestation.*

When modelling aggregates, we need to consider not only the aggregated *expressions*, but also the intellectual contribution of selecting and arranging the *expressions*. This intellectual contribution should be considered a *work* on its own

right and it is called "aggregating work" in the model. It may be rather insignificant in the case of combining two recordings on a CD, but it may also be essential for a publication like an anthology. It has to be emphasized that the aggregating work does not include the *works* being aggregated. When an aggregating work is not significant enough, it is typically not recorded. The same is true for minor augmentations such as a brief foreword. But if such a foreword is republished as an independent essay, it should also be recorded in the aggregate. The model of aggregates is shown in Figure 5.

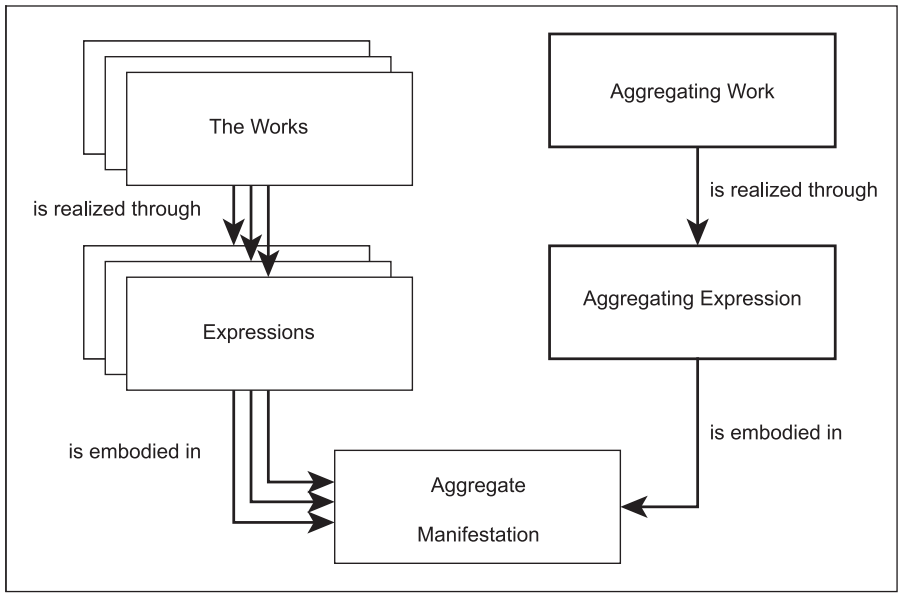

Figure 5 Aggregates

Conclusion

This is a short presentation of the IFLA *LRM* model. It does not include all the necessary details and is not complete in any way. To understand the model in full, the readers should consult the full model description as published on the IFLA website (IFLA LRM, 2017).

IFLA *LRM* presents an important step forward; we now finally have a complete model of the bibliographic universe, which can and should serve as the foundation for the development of cataloguing rules and bibliographic formats. The next steps include the declaration of namespaces, which will enable semantic

web compliant implementations and mapping to existing namespaces. Important future tasks include extensions for specific material types, different target audiences and other circumstances important for the design of bibliographic information systems.

With IFLA *LRM*, we finally have a modern model, compatible with the semantic web. Only with an immediate development of new library catalogs we can hope to exploit fully the wealth of library data and stop the trend of decreasing use (or even avoidance) of current catalogues.

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IFLA-in *KNJIŽNIČNI REFERENTNI MODEL* (IFLA LRM)
USKLAĐIVANJE OBITELJI *FRBR*

Ključne riječi:
*obitelj **FRBR**, usklađivanje, IFLA-in **Knjižnični referentni model** (IFLA **LRM**)*

Sažetak

*Godine 1998. IFLA (International Federation of Library Associations and Institutions) je objavila model **FRBR** (**Uvjeti za funkcionalnost bibliografskih zapisa**). Područje knjižničarstva konačno je dobilo konceptualni model bibliografskog svijeta i time osnove za razvoj novih bibliografskih informacijskih sustava. Godine 2017. IFLA-in Knjižnični referentni model (IFLA **Library Reference Model – LRM**) (Riva, LeBœuf i Žumer, 2017.) službeno je prihvaćen kao IFLA-in standard. Obitelj modela **FRBR** i **LRM** polaze od korisničkih zadataka koje trebaju omogućiti i podržati bibliografski informacijski sustavi. Proces konsolidacije uključivao je detaljnu analizu svih entiteta, atributa i odnosa definiranih u obitelji FRBR. U ovom su radu predstavljene i opisane glavne karakteristike modela. S IFLA **LRM-om** konačno imamo suvremeni model, koji je kompatibilan sa semantičkim webom.*