

LRMoo, a high-level model in an object-oriented framework

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Abstract:

The LRMoo model brings the IFLA Library Reference Model (IFLA LRM) into the CIDOC Conceptual Reference Model (CRM) family of models by providing an object-oriented version of the model that is designed as an extension to CIDOC CRM. LRMoo is developed from FRBRoo, which was based on the FR family of models. In comparison to FRBRoo, LRMoo is streamlined and at a higher level of generality, while retaining full expressivity. Aspects of the model have been revised to align more closely with the IFLA LRM model, such as the handling of aggregation and representative expression attributes. Properties have been added to correspond to certain IFLA LRM relationships between works and expressions that were not declared in FRBRoo. The classes that represent the creation events of the main WEMI classes, F27 Work Creation and F28 Expression Creation, were revised. Specialized examples have been replaced with ones chosen to aid in comprehension of the model.

Keywords: IFLA LRM, LRMoo, FRBRoo, CIDOC CRM, conceptual models.

1 INTRODUCTION

Even as the IFLA Library Reference Model (IFLA LRM) was in its final approval stages in 2017, efforts turned to bringing the object-oriented FRBRoo model into alignment with it. FRBRoo version 2.4, approved as an IFLA standard in 2016, reflected the three IFLA entity-relationship models of the FR family of conceptual models (FRBR, FRAD, FRSAD) in a formulation designed as a compatible extension to the museum community's model, the CIDOC Conceptual Reference Model (CIDOC CRM). The goal of the LRMoo project is to establish a similar equivalent for IFLA LRM.

LRMoo is developed from FRBRoo version 2.4, but taking into account decisions made in IFLA LRM, continuing the mutual influence and cycles of development between the models (Riva & Žumer 2018).

CIDOC CRM had a major release (version 7.1) in 2021 which will be used for its next ISO version. LRMoo is also taking the opportunity to integrate this latest CRM release, including modifications to terminology and style that have been recently adopted in the CRM family.

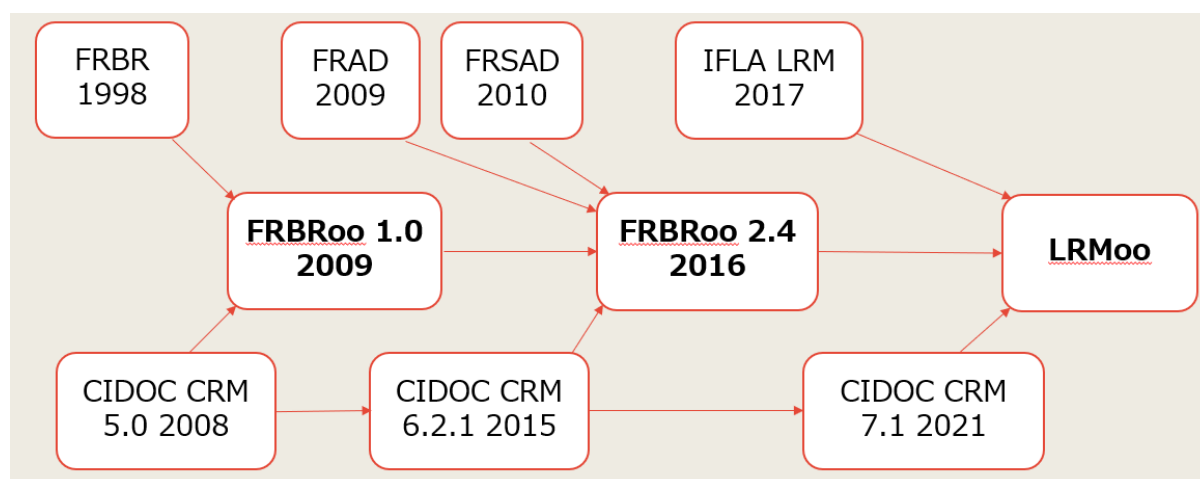


Figure 1. LRMoo development timeline

2 MAIN CHANGES IN LRMoo

IFLA LRM is established in an enhanced entity-relationship modelling structure, using entities, that are characterized by attributes and connected by relationships. In contrast, LRMoo is an object-oriented model, using the terminology of classes, which fill the same role as entities, and properties which connect classes and cover the same ground as both relationships and attributes. In continuity with FRBRoo, classes in LRMoo are numbered sequentially beginning the letter F, while properties are numbered sequentially beginning with R. Once assigned in a published release, the numbers are not reused, even if the previous class or property is deprecated. New classes and properties are assigned numbers at the end of the sequence.

2.1 Reduced complexity

In FRBRoo some aspects were modelled in great detail, for example performing and recording of performances. This level of detail led to a rather lengthy model, with 48 classes and 72 properties, which was deemed too complex. In addition, these specialized subclasses of F1 Work or F2 Expression were redundant as their properties were semantically equivalent to the properties of their superclasses, just declared with different labels. Nor did this level of detail reflect any features of the entity-relationship models. Some entity types and properties were

therefore deprecated, but we need to emphasize that the expressivity of LRMoo is not reduced. All these aspects can be fully represented with more general supertypes in LRMoo or CRM.

The result is that LRMoo has 18 classes and 34 properties, in addition to those used from CIDOC CRM. In comparison, IFLA LRM has 11 entities, 37 attributes and 36 relationships.

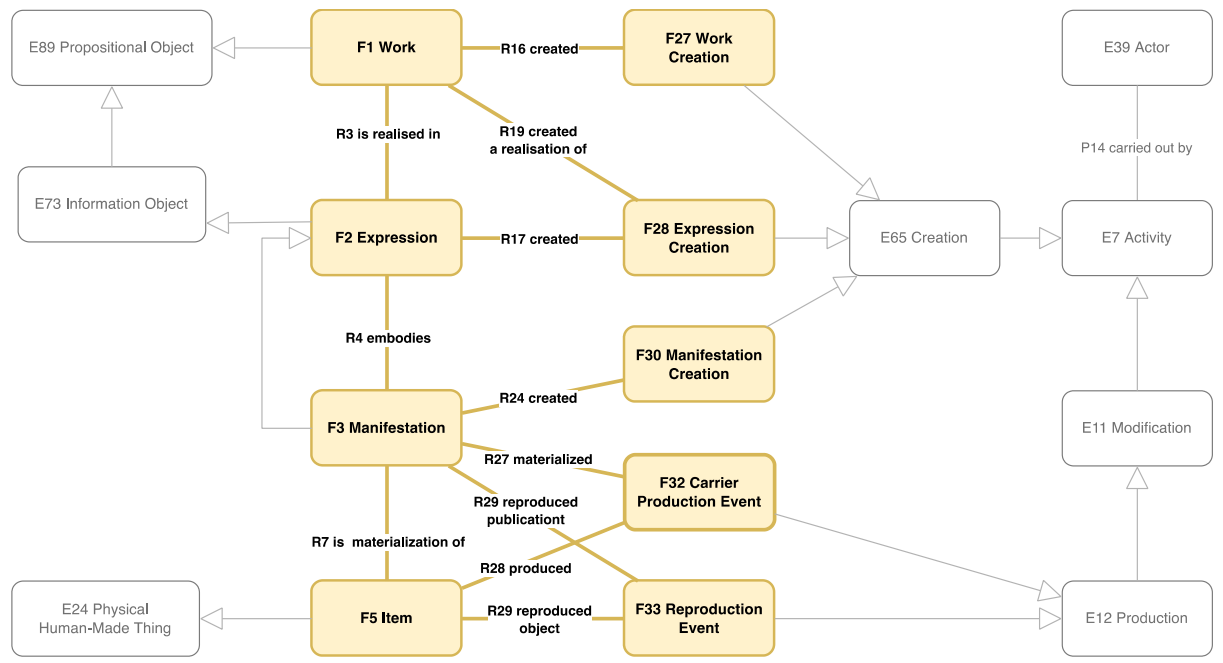


Figure 2. Main LRMoo classes and properties and their connections to CIDOC CRM classes

2.2 Manifestation as subtype of Expression

Inheritance is a construct frequently used in modelling and the is-a (inheritance) relationship is used to define one class as a more specialized version of another. An inherited class also implies a subset, since any instance of class B also counts as an instance of class A. A property that is defined for a class, will also apply on any subtype of this class. It is worth underlining that inheritance is a modelling construct, it is a relationship between types of things. In IFLA LRM, inheritance is used to simplify the modelling of attributes and relationships. Most notably, all IFLA LRM entities inherit the generic LRM-E1 Res entity type, and the entity type LRM-E6 Agent is introduced as a common supertype for LRM-E7 Person and LRM-E8 Collective Agent (which is a superclass of Corporate Body etc.).

In LRMoo, F1 Work is defined as a subtype of CRM E89 Propositional Object, and F2 Expression as a subtype of CRM E73 Information Object. F3 Manifestation is defined as a subtype of F2 Expression (and so implicitly also a subtype of CRM E73 Information Object). The latter is a notable change from FRBRoo where Manifestation (called F3 Manifestation-Product Type) was defined as subclass of CRM E55 Type, which was neither intuitive nor convenient. The main reasoning for inheriting Expression, is that the substance of manifestations is both the content and the form of its presentation. In most cases, we will explicitly state that a manifestation embodies one or more expressions, but there are cases when it is natural to consider the manifestation as an expression that is elaborated with presentation. Advantages of this solution is that it allows for convenient implementation of aggregates and other examples where the manifestation as a whole can be associated with a work, without

introducing redundant additional expressions for the whole. This also aligns well with the direct relationship between manifestation and work that is implemented in some vocabularies for library data. However, this is not intended to replace the use of *R4 embodies (is embodied in)* as the proper mechanism for describing the contents of a manifestation.

This change made it possible to label the properties of F3 Manifestation in a manner more consistent with IFLA LRM. An example is the equivalent of LRM-R3 *is embodied in (embodies)*. In IFLA LRM this is defined with domain: Expression and range: Manifestation. In LRMoo, although the domain and range are reversed, R4 is also labelled *embodies (is embodied in)*. In contrast, in FRBRoo, the same property was labelled *R4 carriers provided by (comprises carriers of)*, sounding very different although the meaning was the same as LRM-R3.

2.3 Revised event for the creation of F1 Work

In the FRBRoo model the entity type F27 Work Conception implicitly put the emphasis on the beginning of the creation process, the ‘spark of inspiration’, which is rarely known and documented. The F27 Work Creation in LRMoo, on the other hand, comprises activities by which instances of F1 Work come into existence and can serve to document the period a work was coming into existence and the circumstances of it, when these are known. In many cases Work Creation coincides with the existence of the first known complete expression of that work. This approach is closer to IFLA LRM, which models the outcomes of creation processes.

The same approach is also used in F28 Expression Creation, which comprises activities that result in instances of F2 Expression coming into existence. An instance of expression is considered to be created when it is captured on a carrier other than the creator’s brain. The creation of an instance of expression coincides with the creation of the first instance of F3 Manifestation that *R4 embodies (is embodied in)* this instance of expression.

2.4 New way to handle integration with R74 and R75

Integration of preexisting expressions into expressions of new works is an aspect missing from IFLA LRM and will have to be addressed. Examples include poems put to music or reusing music in new compositions. In LRMoo this is covered by two properties, *R74 uses expression of (has expression used in)* and *R75 incorporates (is incorporated in)*. The latter is a relationship between expressions, where the first expression includes as an integral part the second expression (which is a realisation of a different work). *R74 uses expression of* deals with the work level: all expressions of the first work will include some expression of the second. A well known example is Beethoven’s 9th Symphony, which uses an expression of ‘An die Freude’ by Friedrich Schiller (but it can be any language version).

2.5 New way of handling representative attributes

The work attribute LRM-E2-A2 Representative expression attribute was introduced in IFLA LRM to enable specifying essential characteristics of a work (such as original language, original instrument, intended audience), associated with the canonic expression, most often the

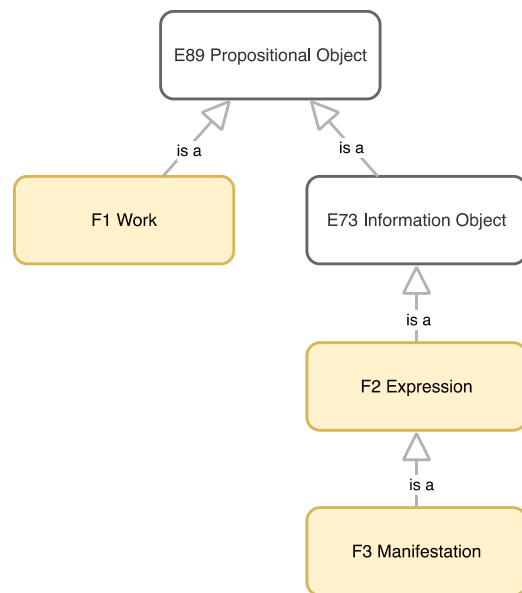


Figure 3. Class hierarchy

one considered original. In LRMoo, this is achieved with the property *R73 takes representative attribute from (bears representative attribute for)*, which associates a work with the representative expression, the one that the attributes are taken from.

2.6 New Work properties

Some properties were added to LRMoo to enable full mapping to IFLA LRM relationships. *R68 is inspired by (is inspiration for)* was added as a direct equivalent of the IFLA LRM inspiration relationship LRM-R21 between two works. *R76 is derivative of (has derivative)* is declared as the equivalent to the IFLA LRM relationship LRM-R24. This property is connecting two expressions and it enables recording the exact derivation chain, when known. It is an important addition to the more general work-to-work derivation relationship, *R2 is derivative of (has derivative)*, which was already declared in FRBRoo and corresponds to the IFLA LRM transformation relationship LRM-R22.

The work-to-work property *R67 has part (forms part of)* is a new property, equivalent to IFLA LRM relationship LRM-R18, subproperty of *R10 has member (is member of)*. It allows modeling structural composition of works as opposed to R10, which also covers alternative content.

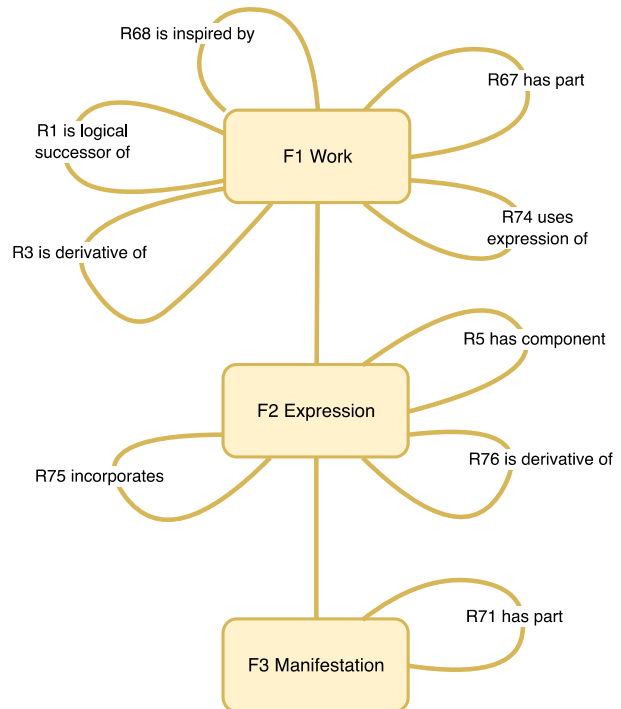


Figure 4. LRMoo WEM properties

3 OTHER FEATURES

3.1 Revised examples

Examples are essential in the documentation of models, as they demonstrate and exemplify the proper interpretation of classes and properties. In LRMoo, the set of examples has been revised. Many “familiar” examples from IFLA LRM have been reused and the examples are more systematically reused across classes and properties. Examples are intended to cover typical cases in literature, music, and art with an emphasis on cases that hopefully are familiar to a broad audience.

3.2 Transition information

To assist implementations that have used FRBRoo with updating to LRMoo, the LRMoo model definition document will include a section on transition information. This section will set out the final disposition of all classes and properties that were declared in FRBRoo, stating whether they are deprecated, substantially modified, simply renamed, or retained essentially as is in LRMoo. For the deprecated classes and properties, the relevant superclass or superproperty that should be used instead will be given, which may in some cases be a CIDOC CRM class or property.

4 RELATIONSHIP WITH OTHER MODELS

4.1 PRESSoo

The PRESSoo model (version 1.2, 2016) is an extension of both CIDOC CRM and FRBRoo, specific to the modelling of continuing resources, and serial works in particular. In its next iteration of development, PRESSoo will need to be brought into alignment with LRMoo. PRESSoo links up into FRBRoo primarily through the F18 Serial Work class, which is a subclass of F1 Work. Since one of the changes made in the development of LRMoo has been to deprecate specific subclasses of F1 Work, for consistency, the intention is to transfer F18 Serial Work into PRESSoo, where it will remain a subclass of F1 Work in LRMoo. Until that time, F18 Serial Work, and its property *R11 issuing rule (is issuing rule of)*, will remain in LRMoo with the annotation that they do not need to be implemented unless in conjunction with an implementation of PRESSoo.

4.2 Other CIDOC CRM family models

FRBRoo had developed the modelling of name use in detail with the classes F52 Name Use Activity and F51 Pursuit, and several related properties. FRBRoo had also expanded on some concepts around literary characters mentioned incidentally in FRAD to create the F38 Character class. In recent years, work has begun on an extension within the CIDOC CRM family of models to cover social phenomena, named CRMsoc, and the intention is that these three classes and their related properties will be transferred to that model. As CRMsoc is still in development, and since these classes and properties have appeared as fully approved in the soon-to-be superseded FRBRoo model, they will appear in a separate section of LRMoo. An implementation of LRMoo does not need to implement them to cover the same scope as IFLA LRM. The end result is an LRMoo model that aligns tightly with the IFLA LRM entity-relationship model, and draws on other models in the CIDOC CRM family for expansion into additional areas.

5 CONCLUDING REMARKS

After five years of development and iterative improvements, LRMoo is in its final stages of consultations before beginning the formal standards approval process.

The object-oriented models are jointly held between IFLA and ICOM/CIDOC, requiring dual approval processes and compromise between different approaches to styles and formatting. The importance of interoperability within the broader heritage sector makes this additional effort worthwhile.

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