

The Linked Data collection “Rainis and Aspazija” (RunA) and the potential of IFLA FRBR LRM key entities for annotating textual documents

Anita Rašmane

Bibliography Institute, National Library of Latvia, Riga, Latvia, anita.rasmane@lnb.lv

Anita Goldberga

Bibliography Institute, National Library of Latvia, Riga, Latvia, anita.goldberga@lnb.lv



Copyright © 2017 by Anita Rašmane, Anita Goldberga. This work is made available under the terms of the Creative Commons Attribution 4.0 International License: <http://creativecommons.org/licenses/by/4.0>

Abstract:

Work on the development of the Linked Data collection RunA (Rainis and Aspazija — two famous Latvian poets, writers and opinion leaders) by the National Library of Latvia (NLL), the National Archives of Latvia, the Institute of Literature, Folklore and Art of the University of Latvia, the Association of Memorial Museums and the Literature and Music Museum is in progress. In June 2016 the pilot collection RunA was publicly launched as a virtual collection accessible via URL link: <http://runa.lnb.lv/>.

Authors address the problem of named entity identification by annotating textual documents (unstructured data), e.g. correspondence. The collection development team has identified key entities: works, expressions, manifestations; agents: persons, institutions; concepts, places, events as the “glue” for reflecting simple or hierarchical relationships between different objects of the collection. In current development stage mainly local URIs are provided for identification of entities. This paper will address potential to employ IFLA FRBR LRM key classes in annotating textual documents of RunA collection by using special annotation tool.

Keywords: Data standards, Linked Data, IFLA FRBR LRM entities

INTRODUCTION

Work on the development of the Linked Data collection RunA (Rainis and Aspazija — two famous Latvian poets, writers and opinion leaders) by the National Library of Latvia (NLL), the National Archives of Latvia, the *Institute of Literature, Folklore and Art* of the University of Latvia, the *Association of Memorial Museums and the Literature and Music Museum* is in progress. In June 2016 the pilot collection RunA was publicly launched as a virtual collection¹.

¹ <http://runa.lnb.lv/>

The initial collection provides opportunity to navigate through works of both poets (34 by Aspazija and 49 by Rainis) linking them with other textual, visual and audiovisual objects of collection: small part of their correspondence, archival documents, photos, posters, audio and video files. The mutual correspondence of two poets (2499 letters in Latvian, Russian, German) is also included in the Latvian national register of the UNESCO “Memory of the World” programme². All letters were written in different periods of the poets’ lives in Latvia, Lithuania, Russia and Switzerland and reflect the role of both poets in Europeanization of national culture. The correspondence of Rainis and Aspazija represents a unique cultural value both on national and a global scale.

At the time when the Web provides increasingly new capabilities for publishing, RunA pilot collection is intended as a single access point to content in various forms from several stakeholders. It is a small collection, accessible at any time and from any place, not yet perfect, but it allows RunA team to identify main problems with data linking of cultural heritage and directions for future development.

RunA:

- is a co-operation project, which started in 2014;
- is an attempt to implement Linked Data principles;
- puts together heritage objects in different formats as well as data and metadata; all metadata are accessible in Turtle RDF or RDF/XML;
- evaluates new publishing approaches and the re-use of authority and bibliographic data in Web environment in practise, linking them with entities from other present metadata sets (e.g. in Dublin Core (DC)) and textual documents;
- allows experimenting with emerging data models and standards;
- contains unstructured data with a big number of entities to identify and relate, with the aim to provide them with additional content (enrichment);
- links different entities semantically allowing users to explore new and unexpected relationships between objects;
- discovers drawbacks in identification of NLL’s authority and bibliographic data semantic levels.

1. IFLA entity-relationship models in the context of RunA

The library world is well known for a huge amount of detailed and very sophisticated models and standards. Most of them never became popular and used as de facto standards in other cultural heritage institutions (Goldberga, 2008, 6).

When FRBR³ first appeared in 1998, even librarians were reluctant to accept it, not to mention representatives of other related domains. The level of abstraction in FRBR did not come to accord with the way of thinking of librarians. A number of librarians, for instance, refused to recognize *Expression* entity, which still is not defined as a separate important entity in models like BIBFRAME⁴ (*Work + Expression = Work*). The conceptual model of FRBR seemed too complicated and there was no certainty how to put it into practice regarding to serials and other aggregates. On the other hand, FRBR raised a question: what data elements are absolutely

² <http://www.atmina.unesco.lv/page/79>

³ <http://www.ifla.org/files/assets/cataloguing/frbr/frbr.pdf>

⁴ <https://www.loc.gov/bibframe/docs/bibframe2-model.html>

essential for user (especially related to national bibliographic agencies). Most libraries continued and still continue to create MARC records without marking the hierarchy of entity semantic levels stimulated by IFLA conceptual models. Other formats like Dublin Core and others were used instead for making descriptions of digital resources and collections. And questions ‘Why?’ and ‘How?’ FRBR entity-relationship model can be put into practice remained. Substantial contribution of IFLA in the sphere of Linked Data was publication of FRBR namespaces⁵.

Almost after 20 years, in 2017, data specialists know much more about differences of publishing data into the Web comparing to OPAC. They are much more informed about the principles of Linked Data and why the information in library records has to be divided into smaller units — RDF triples (atomization of records); why entities, their attributes and relations have to be identified and linked by forming the basis of Linked Data.

While conducting research on development of IFLA data conceptual models from FRBR to FRBR LRM (further in text — LRM), the development can be clearly seen. For example, from defining the role of simple *Person* and *CorporateBody* in FRBR to hierarchical definition of *Agent* in LRM; from static entity modeling in FRBR to process modeling in LRM.

LRM is using the same entities as FRBR: *Person-E7*, *Work-E2*, *Expression-E3*, *Manifestation-E4*, *Item-E5*, *Place-E10* (by changing the aim). Defined new entities: *Agent-E6* (*Superclass*) — as *Person-E7* and *Collective Agent-E8* also include *Family* and *CorporateBody*; *Nomen* — *LRM-E9* entity (a designation by which the entity is known), as well as new super-entity *RES* — *LRM-E1* (any entity in the universe of discourse), which includes both material and physical matter, and conceptual objects, which also could be *Work* topic, as well as *Concept*, *Object*, *Event*.

In FRBR entity *Event* was reflected as a subject. In CIDOC CRM and LRM temporal entities are significant, as they connect physical or conceptual objects with *Time-span*, *Place* and *Agent*.

If a comparison is to be made between LRM with FRBRoo⁶ and CIDOC CRM, the former is more universal and easier to comprehend. It shows hierarchical relationships as superclass and subclass relations defined clearly as 11 main or key entities, which, with the exception of *Manifestation* and *Item*, are tied with library authority data. They can be used as nodal points for entity identification, semantic connection and networking in digital collections including unstructured data sets.

It is important to note that new concepts of LRM and entities are also incorporated into RDA model.

Catalogues in Latvia are still not FRBRized and MARC21 is still being used, although since 2014 some changes have been implemented in order to create preconditions for Linked Data. Implementation of RDA is happening step by step, beginning with authority data.

One of the main objectives of RunA collection is to provide users with more intelligent search possibilities based on identity management (marked entities) not only free text search.

⁵ http://metadataregistry.org/schemaprop/list/schema_id/5.html

⁶ https://www.ifla.org/files/assets/cataloguing/FRBRoo/frbroo_v_2.4.pdf

Another objective of this project is to obtain new experience for annotating and semantic linking of textual data, i.e. employing hierarchial linking of entities and fostering data networking.

Collection contains textual materials (unstructured data) — plain text data enriched with semantically related data. Collection development team realizes that the scope of named/ marked entities in textual documents is much broader than in the authority data of NLL.

It is significant for RunA collection to refer to objects/things, their attributes and relationships with other objects mentioned in texts unequivocally. The main aim of that is to link relevant contextual information using global identifiers.

2. Analysis of RunA entities in textual documents and directions for future development

The correspondence between Rainis and Aspazija is a collection of documents in the format of letters and notes. Originally texts were written in German and Latvian languages, although occasionally one can run into fragments written in other languages like Hebrew or Russian. Texts of all letters were digitized and translated into Latvian. Besides that, Jānis Zālītis, a literary expert, added his commentaries.

In order to connect entities in these letters, first of all the “head” of the text receives an annotation, then the body of the text in Latvian and commentaries are annotated as well.

A fragment of the letter from Aspazija to Rainis:

Aspazija_{1} Rīgā_{2} 1894. gadā, ap 23. septembri (5. oktobri)_{3}
Es_{4} tagad uz pāris dienām izbraukšu uz Liepāju_{5}, kur man ļoti laipni ielūdz turienes biedrība_{6} uz „Zaudētu tiesību”_{7} izrādi_{8}; gribu arī redzēt Liepāju_{9}. Sestdien_{10} izbraukšu un pirmdien_{11} būšu atpakaļ. Debesbraukšanas_{12} dienā_{13}, kā Tu_{14} zini, uzveda_{15} arī „Zaudētas tiesības”_{16}. ...

Direct translation:

Aspazija_{1} in Riga_{2} 1894, around September 23 (October 5)_{3}
I_{4} will be off to Liepāja_{5} in a few days time, as I was invited kindly by local Society_{6} to a “Lost Rights”_{7} performance_{8}; want to see Liepāja_{9} also. I will depart on Sunday_{10} and be back on Monday_{11}. On Ascension_{12} day_{13}, as You_{14} know, performed_{15} was also “Lost Rights”_{16}. ...

This fragment has 16 annotations, which represent 7 entity classes: *Person*, *Organization*, *Event*, *Work*, *Place*, *Concept*, *Time*. The table below (see Table 1) includes the information on all the annotations from the text as well as their analysis for entity identification.

Table 1. The list of annotations from the fragment of the letter with entities unspecified

Nr.	Text fragment	Class	Commentary
{1}	Aspazija	Person	Aspazija
{2}	Rīgā	Place	Rīga
{3}	1894. gadā, ap 23. septembri (5. oktobri)	Time	1894-09-23 (Julian calendar), 1894-10-05 (Gregorian calendar)
{4}	Es	Person	Aspazija
{5}	Liepāju	Place	Liepāja
{6}	turienes biedrība	Organization	Liepāja Latvian Charitable society? Liepājas Relief Society?
{7}	„Zaudētu tiesību”	Work	“Lost Rights” (a play)
{8}	izrādi	Event	“Lost Rights” (performance) ... in theatre Date? Theatre?
{9}	Liepāju	Place	Liepāja
{10}	Sestdien	Time	Date?
{11}	pirmdien	Time	Date?
{12}	Debesbraukšanas	Concept	Ascension Day (Christian holiday)
{13}	dienā	Time	The date of Ascension Day in 1894 is?
{14}	Tu	Person	Rainis
{15}	uzveda	Event	“Lost Rights” (performance) ... in theatre Theatre?
{16}	„Zaudētas tiesības”	Work	“Lost Rights” (a play)

Table 2. The list of annotations from the fragment of the letter with information on entities specified

Nr.	Text fragment	Class	Standard form	RunA primary URI
{1}	Aspazija	Person	Aspazija (1865-1943)	LNC10-000000612
{2}	Rīgā	Place	Rīga (Latvija)	LNC10-000042006
{3}	1894. gadā, ap 23. septembri (5. oktobri)	Time	1894-10-05	–
{4}	Es	Person	Aspazija (1865-1943)	LNC10-000000612
{5}	Liepāju	Place	Liepāja (Latvija)	LNC10-000041529
{6}	turienes biedrība	Organization	Liepājas Latviešu labdarības biedrība	LNC10-000220308
{7}	„Zaudētu tiesību”	Work	„Zaudētas tiesības” (luga) / Aspazija	LNC04-000413814
{8}	izrādi	Event	„Zaudētas tiesības” (uzvedums), Liepājas Latviešu labdarības biedrība, 1894-10-07, Liepāja (Latvija)	– LNC10-000220308 – LNC10-000041529
{9}	Liepāju	Place	Liepāja (Latvija)	LNC10-000041529
{10}	Sestdien	Time	1894-10-06	–
{11}	pirmdien	Time	1894-10-08	–

<i>Nr.</i>	<i>Text fragment</i>	<i>Class</i>	<i>Standard form</i>	<i>RunA primary URI</i>
{12}	Debesbraukšanas	Concept	Debesbraukšanas diena (kristiešu svētki)	LNC10-000138146
{13}	dienā	Time	1894-05-26	–
{14}	Tu	Person	Rainis, Jānis (1865-1929)	LNC10-000003165
{15}	uzveda	Event	„Zaudētas tiesības” (uzvedums), Jelgavas Latviešu biedrība, 1894-05-26, Jelgava (Latvija)	– LNC10-000094706 – LNC10-000040785
{16}	„Zaudētas tiesības”	Work	„Zaudētas tiesības” (luga) / Aspazija	LNC04-000413814

Information on named entities is enriched by external information sources.

The list of authority sources for **Person** entity “**Aspazija (1865-1943)**” is reflected in the table below (see Table 3).

Table 3. Authority source list for “Aspazija (1865-1943)”

<i>Authority source</i>	<i>Identifier</i>
NLL Authority data	LNC10-000000612
VIAF	12431977
ISNI	0000000117431825
LV Wikipedia	Aspazija
Wikidata	Q257872
The Library of Congress authority data	n83146089
FAST Authority File	115805
German National Library	121291448
National Library of France	cb12745905w
data.bnf.fr Lab	12745905/aspazija

Authority source list for **Place** entity “**Liepāja (Latvija)**” is presented in the table below (see Table 4).

Table 4. Authority source list for “Liepāja (Latvija)”

<i>Authority source</i>	<i>Identifier</i>
NLL Authority data	LNC10-000041529
VIAF	140516339
LV Wikipedia	Liep%C4%81ja
Wikidata	Q167668
The Library of Congress authority data	n84120308
FAST Authority File	1229159
GETTY Thesaurus of Geographic Names (TGN) online	7006474

The list of authority sources for **Organization** entity “**Liepājas Latviešu labdarības biedrība**” is reflected in the table below (see Table 5).

Table 5. Authority source list for “Liepājas Latviešu labdarības biedrība”

<i>Authority source</i>	<i>Identifier</i>
NLL Authority data	LNC10-000220308
VIAF	452144782720378880729
LV Wikipedia	Liep%C4%81jas_v%C4%93sture#19.gadsimts

The list of authority sources for Work entity “„Zaudētas tiesības” (luga) / Aspazija” is reflected in the table below (see Table 6).

Table 6. Authority source list for “„Zaudētas tiesības” (play) / Aspazija”

<i>Authority source</i>	<i>Data type</i>	<i>Identifier</i>
NLL catalogue	metadata	LNC04-000413814
National bibliography	metadata	NBA02-000187535
gramatas.lndb.lv	full text (FRBR manifestation)	g_001_0309046667
letonika.lv	full text (FRBR manifestation)	287
dom.lndb.lv	full text (FRBR manifestation)	60973

The list of authority sources for a complex Event entity ‘production’ qualifier (synonym ‘performance’) can be seen in the table below (see Table 7).

Table 7. Authority source list for ‘production’

<i>Authority source</i>	<i>Identifier</i>
tezaurus.lv	izrāde
thesaurus.com	performance
UNESCO thesaurus	concept1314
Wikidata	Q35140

Fragment from Aspazija’s “Lost rights” introduction in RunA (with marked FRBR main entities and Time entities):

Aspazija “Zaudētas tiesības” (1895)

Differently from the play “Vaidelote” (The Vestal), a story told in “Zaudētas tiesības” (Lost Rights) concerns a life of people living at that time, and aims to solve problems of the place and role of women in society. The idea to write the play can be traced to a time when Aspazija was working as a home tutor. The author changed original title of the play “Lupatu karaliene” (Rag Queen) to “Antonijā” and sent the script to a competition organized by the theatre committee of Riga Latvian Society. In 1893 she receives a message saying that the play will win the nomination on condition that she has to rework some of the scenes. The new version becomes “Zaudētas tiesības”, and appears on stage of Riga Latvian theatre on the third of April 1894, only a few months after the premiere of “Vaidelote”. The leading actor was Jūlija Skaidriete. The book was published in 1895.

Table 8. Literary work: „Zaudētas tiesības” — a play written by Aspazija

	<i>As highlighted in text</i>	<i>Entity</i>
Person	Aspazija	Aspazija
Work	Zaudētas tiesības	Zaudētas tiesības (play)
FRBR expression (manuscript)	Lupatu karaliene	Zaudētas tiesības (play) Lupatu karaliene (play)
Time	a time when Aspazija was working as a home tutor	1891/1892
FRBR expression (manuscript)	Antonijā	Zaudētas tiesības (play) Antonija (play)
Time	1893	1893

FRBR expression (production)	Zaudētas tiesības	Zaudētas tiesības (play)
Time	third of April 1894	1894-04-03
FRBR manifestation (book)	The book was published in	Zaudētas tiesības (play)
Time	1895	1895

The analysis of entities in pilot collection indicates that unstructured texts also contain FRBR key entities, i.e. the same types of key entities (*Works, Expressions, Manifestations, Persons, Corporate Bodies, Concepts, Places, Events*) that are identified in the object metadata. It is problematic to refer to these entities due to:

- lack of related context, except bibliographic and authority data, Wikipedia and digitized full texts;
- lack of *Work/Expression* authority data in the authority database of NLL;
- drawbacks in identification and linking of *Time/Event* entities and *Place* entities with geographic location. At present these entities are not used to create RunA collection timeline;
- limitations in identification and linking of abstract entities/subjects;
- unsolved problem with identification of entities in connection to global URIs.

3. Identification of entities in unstructured data and potential of FRBR LRM key entities

Bibliographic data (bibliographic universe) belong to the scope of LRM. RunA collection includes not just bibliographic data, but also, for instance, documents containing entities from the real world, which are not directly connected to literary processes.

The strengths and weaknesses of LRM were evaluated by RunA team to get an impression of LRM potential in identification of key entities within the unstructured data. A special attention was dedicated to the new super-entity *Res* and the entity *Nomen*.

Realized LRM strengths:

- defines entity superclasses, classes and subclasses of bibliographic universe;
- reflects hierarchy of key entities (*Res, Agent*);
- provides wider opportunities for contextualization and reflection of relations between entities;
- secures unique identifiers for entities (in letter and number format), which provide unambiguous reference;
- the vast scope of entity subclasses allows to apply them to a specific task (possibility for detalization), because LRM is “only indicative in terms of the attributes and relationships that are defined”⁷;
- can be compatible with other conceptual data models, but is more general than others.

⁷ https://www.ifla.org/files/assets/cataloguing/frbr-lrm/frbr-lrm_20160225.pdf (p.5)

Realized LRM weaknesses:

- the release of final version of LRM is to be announced*;
- LRM entity namespaces are not yet published in the Open Metadata Registry*;
- the vast scope of *Res* entity, but at the same time quite restricted possibilities to shape entities outside library metadata, as well as to provide reciprocal references to entities mentioned in unstructured data**.

* at the time of writing this article.

** *Res* scope is very vast. It relates to both material and physical objects, and to conceptual objects, that is, to all the things that can be considered as the topic/subject of *Work*. NLL uses subject controlled vocabularies such as LCSH and FAST to display them.

That is why the only meaningful application of *Res* to RunA if it is used together with *Nomen*, which identifies a specific *Res* with URI, ID or literal etc.

URI "... makes it possible to refer to meanings more accurately than using literal expressions." (Hyvönen, 2012, 7)

VIAF and ISNI systems were created with the purpose to advance entity identification globally. In order to refer to objects (literary works or other documents, their authors etc.) mentioned in text more precisely while annotating textual documents, linking them with contextual information from other data sets including controlled vocabularies, it is significant to identify works, authors, events, places and other named entities mentioned in text with global URIs and store them.

"The entities mentioned in annotations are associated with one or more URIs representing other resources about this entity. One of the challenges in developing this system [RunA] was how to maintain information about entities mentioned in annotations. Due to the limitations [...] we chose a simple approach where annotations are stored as links in HTML files and the information about entities is maintained in a table containing object type and related URIs." (Bojārs, 2016, 23).

All RunA entities have a unique and persistent URIs but they are not global.

Using LRM would solve the problem mentioned by Hyvönen (Hyvönen, 2012, 18): "URI identifiers used for concepts (e.g., persons and places) in different datasets are typically different, and the data mappings are not complete or contain errors."

The table below shows an example of how marked entities can be identified using LRM classes (URI from Open Metadata Registry in future) in a specific text on page 4.

Table 9. Specified entities with a name in standard form, URI of entity and a plausible FRBR-LRM class

Nr.	Text fragment	Class	Standard form	Entity	LRM
{1}	Aspazija	Person	Aspazija (1865-1943)	e1	E7 Person
{2}	Rīga	Place	Rīga (Latvija)	e2	E10 Place
{3}	1894. gadā, ap 23. septembri (5. oktobri)	Time	1894-10-05	e3	E11 Time-span
{4}	Es	Person	Aspazija (1865-1943)	e1	[E7 Person]
{5}	Liepāju	Place	Liepāja (Latvija)	e4	[E10 Place]
{6}	turienes biedrība	Organization	Liepājas Latviešu labdarības biedrība	e5	[E8 Collective Agent]

<i>Nr.</i>	<i>Text fragment</i>	<i>Class</i>	<i>Standard form</i>	<i>Entity</i>	<i>LRM</i>
{7}	„Zaudētu tiesību”	Work	„Zaudētas tiesības” (luga) / Aspazija	e6	[E2 Work]
{8}	izrādi	Event	„Zaudētas tiesības” (uzvedums), Liepājas Latviešu labdarības biedrība, 1894-10-07, Liepāja	e7	[E3 Expression, E8 Collective Agent, E11 Time-span, E10 Place]
{9}	Liepāju	Place	Liepāja (Latvija)	e4	[E10 Place]
{10}	Sestdien	Time	1894-10-06	e8	[E11 Time-span]
{11}	pirmdien	Time	1894-10-08	e9	[E11 Time-span]
{12}	Debesbraukšanas	Concept	Debesbraukšanas diena (kristiešu svētki)	e10	[E9 Nomen]
{13}	dienā	Time	1894-05-26	e11	[E11 Time-span]
{14}	Tu	Person	Rainis, Jānis (1865-1929)	e12	[E7 Person]
{15}	uzveda	Event	„Zaudētas tiesības” (uzvedums), Jelgavas Latviešu biedrība, 1894-05-26, Jelgava	e13	[E3 Expression, E8 Collective Agent, E11 Time-span, E10 Place]

In total 16 annotations were created for 13 entities. Entity classes enclosed in square brackets inside the LRM column would possess entities identified in text, if LRM model would handle relationships of *Work* content to other LRM entity classes.

For example, LRM *Agent* class is suitable for identifying entity in metadata that describes and identifies resource, but not entity within the content of resource. In the case of RunA, the author of letters is *Agent-Person*, but the receiver of letters is no longer *Agent-Person*, but *Res*, which is identified by *Nomen* (with URI). Entities of *Res-Nomen* type lose their specific class and do not support semantic framing adequately.

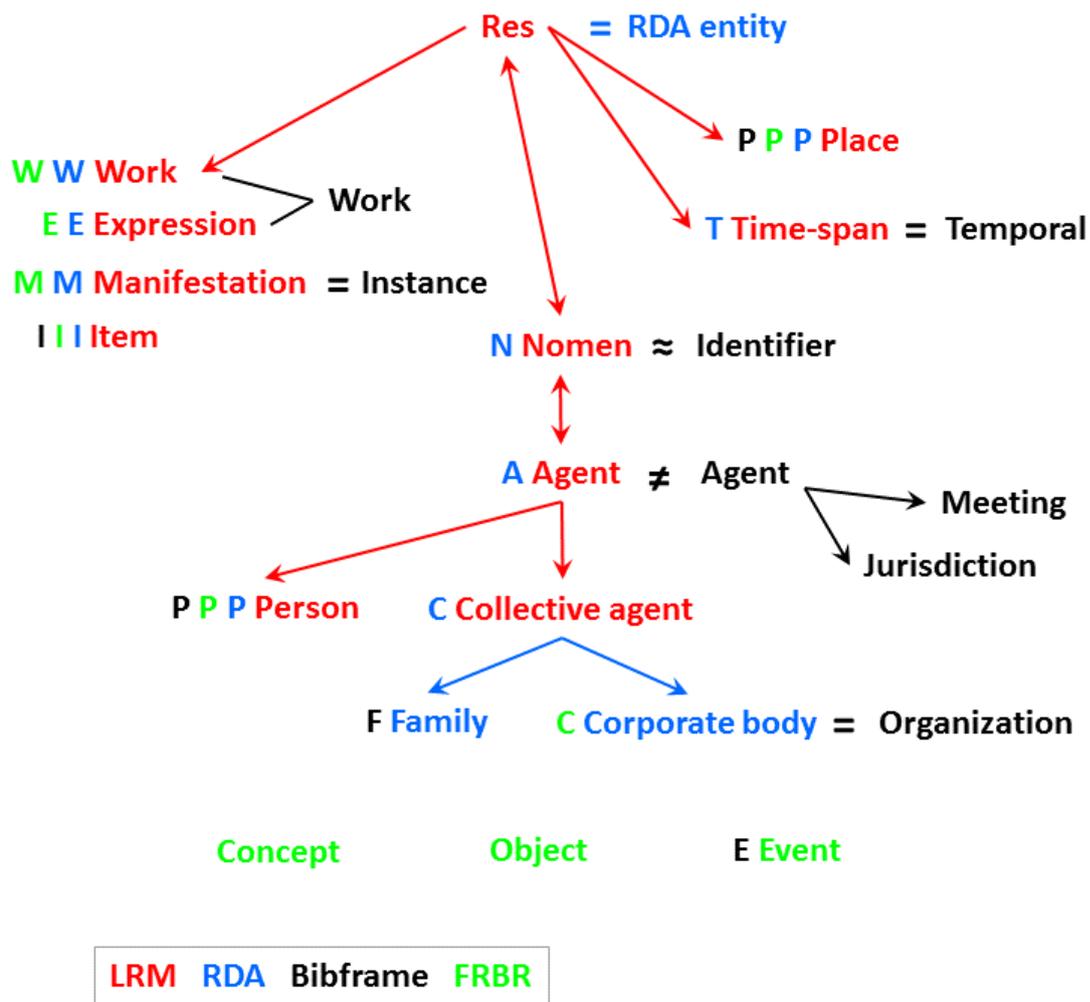
Library users are often confused by the usage of Concept/Subject entity, specifically because it can represent both *Subject* and *Agent* (author) simultaneously. It would be more correct to indicate a relationship designator (using RDA relationship designators) that defines link directions in RunA, as in a collection of Linked Data.

More precise definition of subclass level can happen also by defining a specific role of *Agent* as a type of link using RDA relationship designators, for instance, “has addressee”, “is described in (person)” etc.

Conclusions

While working on RunA and researching conceptual data models, its team of developers came to a conclusion that for a collection, which involves different institutions, and for a project where textual documents play a significant role, LRM 11 key entities and its ID can be used for annotating purposes.

Figure 1. LRM key entities and their relationships with FRBR, RDA and BIBFRAME



Why? The answers:

1. LRM key entities correspond to specifics of collection and aims of their developers;
2. 11 or less key entities ensure that annotation is done properly and key entities are linked to the authority data of NLL;
3. 11 key entities can be accepted for further development of the collection and used by those researchers, who lack specific knowledge in data modeling;
4. 11 key entities and their relationships is quite a sufficient amount to identify in unstructured data like textual documents;
5. New entity *Res* and its subclasses *Concept* and *Event* can be introduced by using subject authority data values from LCSH or FAST (from controlled vocabularies). The specific role of *Agent* entity can be defined as a RDA relationship designation.

Future objective of this collection is to reflect objects, their attributes and relationships using key entity classes, subclasses and their relationship hierarchy according to FRBR LRM semantic levels.

Therefore an ongoing work on development of special annotation tool and a separate data storage for entities, including all related contextual information and unique identifiers, is in-progress.

Acknowledgments:

Viktorija Moskina, Senior Specialist of the International Cooperation of the NLL

References

Bojārs, U. (2016). Case study : Towards a linked digital collection of Latvian cultural heritage. In *CEUR Workshop Proceedings* (pp. 21-26).

Goldberga, A. (2008). A. Synergy towards shared standards for ALM (archives libraries, museums). Latvian scenario. In IFLA:

<http://www.nlc.cn/newen/fl/iflanlc/iclc/IFLAds/201012/P020101210600511513605.pdf>

Hyvönen, E. (2012). Publishing and Using Cultural Heritage Linked Data on the Semantic Web. Morgan & Claypool, 159 pages. (DOI:10.2200/S00452ED1V01Y201210WBE003); ISBN 9781608459971.