

To: Joint Steering Committee for Development of RDA
From: Kathy Glennan, ALA Representative
Subject: Machine-Actionable Data Elements in RDA: Discussion Paper (2013)
Related: [6JSC/ALA/17](#)

Background

In 2012, ALA submitted a discussion paper to the JSC (6JSC/ALA/17, Machine-Actionable Data Elements in RDA Chapter 3: Discussion Paper [2012]) developed by the Task Force on Machine-Actionable Data Elements in RDA Chapter 3. In general, the JSC and its constituent bodies agreed that the issues raised in the discussion paper were worth further exploration, and offered some comments and concerns.

ALA agreed to continue to work on the concept of adding structured, machine-actionable definitions for the Extent and Dimensions elements and to investigate developing a proposal to add Extent of Expression to the RDA element set. To carry out this effort, ALA reconstituted its Task Force on Machine-Actionable Data: Francis Lapka (chair), John Attig, Dominique Bourassa, Anne Champagne, Karen Coyle, Gordon Dunsire, Diane Hillmann, Peter Rolla, Mark Scharff, and Amanda Sprochi.

After reviewing the responses to 6JSC/ALA/17 and studying the FRBR concept of element of expression, the Task Force created an interim report and presented it to ALA's Committee on Cataloging: Description and Access at ALA Annual 2013.

This discussion paper describes the work of the Task Force during the past year, and proposes a number of questions for JSC comment and discussion.

Recommendations and Questions for Discussion

1. Extent of Expression

Recommendation:

Add Extent of Expression to the RDA element set and consider making it core when the extent is readily ascertainable and considered important for identification or selection.

Question:

Should values for Extent of Expression be based upon the RDA vocabulary for Content Type?

2. Extent of Item

Recommendation:

Add Extent of Item to the RDA element set, to parallel Extent of Manifestation and the proposed Extent of Expression.

Question:

Should an identical machine-actionable model be established for all three of these extent elements?

3. RDA/ONIX Framework

Recommendation:

Extend the RDA/ONIX Framework for Resource Categorization, in order to flesh out fuller sets of types for content and carrier.

Questions:

- a. Should the RDA vocabularies for Content Type (RDA 6.9) and Carrier Type (RDA 3.3) be extended in order to establish more user-friendly terms for extents of expression and manifestation?
- b. If so, should a *separate group* be charged to develop draft category tables, vocabulary values, and label construction patterns for RDA categorization terms?

4. Aspect-Unit-Quantity Model

Recommendation:

Modify the Aspect-Unit-Quantity (AUQ) model, as presented below, to accommodate complex extent data.

Issues under Consideration

In their 2013 report, the Task Force discussed the following issues, which are explored in greater detail below:

- Adding the FRBR element Extent of Expression to RDA
- Adding the element Extent of Item to RDA
- Integrating the Aspect-Unit-Quantity model

Adding the FRBR element Extent of Expression to RDA

In 6JSC/ALA/17, ALA noted that efforts to provide a machine-actionable treatment of Extent (RDA 3.4) were hampered by the fact the guidelines for this element are interspersed with instructions and subelements that, in the estimation of the Task Force, concern content rather than carrier (e.g., “1 map”). The problematic guidelines are found in the subelements of Extent that provide format-specific instructions. All terms currently used to describe extent of carrier for special formats may merit review, for the possibility that they instead describe content:

- **3.4.2 Extent of Cartographic Resource**
 - atlas, diagram, globe, map, model, profile, remote-sensing image, section, view
- **3.4.3 Extent of Notated Music**

For a source of terms, guidelines here refer the cataloger to RDA 7.20.1.3 (Recording the Format of Notated Music):

 - score, condensed score, study score, piano conductor part, violin conductor part, vocal score, piano score, chorus score, part, choir book, table book
- **3.4.4 Extent of Still Image**
 - activity card, chart, collage, drawing, flash card, icon, painting, photograph, picture, postcard, poster, print, radiograph, study print, technical drawing, wall chart
- **3.4.6 Extent of Three-Dimensional Form**
 - coin, diorama, exhibit, game, jigsaw puzzle, medal, mock-up, model, sculpture, specimen, toy

Extent of text (RDA 3.4.5) is the only format-specific extent subelement that, in the *consensus* of the Task Force, prescribes a set of terms that unequivocally describe carrier. For other formats, the Task Force struggled to reach agreement.

If any (or all) of the remaining format-specific guidelines currently included under Extent of Manifestation are declared to actually describe Extent of Expression, several issues are introduced:

- 1) If, for any special format, the determination is made that guidelines currently in Extent of Manifestation are more appropriately placed at Extent of Expression, *new* Extent of Manifestation guidelines may be needed. A reconsidered format may no longer require an Extent of Manifestation *subelement*, but it may still require special *guidelines* to describe the extent of manifestation.
- 2) If extent statements such as “3 maps” and “1 drawing” do not describe extent of manifestation, what do they describe? To which FRBR group 1 entity do they refer?
 - a) Extent of Notated Music (RDA 3.4.3) essentially quantifies Format of Notated Music (RDA 7.20.1.3), an attribute of Expression.

- b) One may argue that some of the terms prescribed for the remaining subelements (extents of cartographic resource, still image, and three-dimensional form) might *generally be* appropriate for Form of Work (RDA 6.3).

One of the recommendations in 6JSC/ALA/17 was to add the FRBR attribute Extent of Expression to RDA for recording those aspects of the extent statement that apply to content. The JSC community was generally supportive of this recommendation, although several constituents requested a more detailed explanation.

FRBR provides the following definition:

4.3.8 Extent of the Expression

The extent of an *expression* is a quantification of the intellectual content of the *expression* (e.g., number of words in a text, statements in a computer program, images in a comic strip, etc.). For *works* expressed as sound and/or motion the extent may be a measure of duration (e.g., playing time).

In RDA, Duration (RDA 7.22) is already included as an attribute of expression, to record the playing time, running time, etc., of the content of a resource. The Task Force proposes that Duration be subsumed as part of an RDA Extent of Expression.

The Task Force has given cursory consideration to the possibility of treating Illustrative Content (RDA 7.15) as extent; the extent-like quality of this element is especially apparent when the option is taken to quantify the illustrative content (e.g. “48 illustrations”). The element currently attempts to cover two functions: to indicate the secondary character of an expression with primary character that is not “image”, and to indicate the extent of that secondary content. Including this element in the extent revision may correct some current inconsistencies (e.g., why is the word “illustration” used for the secondary character when the same character as primary is termed “image”?).

If the element Extent of Expression is added, there is also a need to formulate a vocabulary with which to record this information. For Extent of Manifestation, units of extent are generally based on the vocabulary for Carrier Type. The Task Force suggests a parallel approach for Extent of Expression, employing the vocabulary for Content Type for units of extent. With the *current* RDA vocabulary for Content Type, however, this approach would yield some decidedly unsatisfactory extent descriptions, such as:

- 3 cartographic images
- 6 still images
- 4 [units of?] performed music
- 5 [units of?] notated music
- 1 [unit of?] spoken word

The Task Force recommends renewed work on the RDA/ONIX Framework for Resource Categorization, in order to flesh out fuller sets of types for content *and* carrier, which may in turn be used to offer more user-friendly vocabularies for extent.

RDA and its users would benefit significantly from greater definition, refinement, and expansion of “resource categorization.” This goal could be achieved by using the RDA/ONIX Framework

more consistently, with respect to specification of what might be called specific carrier designations and specific content designations (echoing the SMD concept which they should replace, in the same way that GMD was replaced by the base carrier designations (terms) and the base content designations). For extent of carrier vocabularies, RDA should make explicit the relationship between the carrier subcategories and the carrier types.

The RDA/ONIX Framework allows for the development of carrier and content categories by way of (a) *refinements* to the base categories, by using user-defined sub-values of primary values, and (b) *extensions*, by adding user-defined values in the “open value set” Framework attributes (e.g. “cartographic” in Form/Genre). It is the categories — including base and qualified categories — that are the immediate utility of the Framework.

Thus far, Form/Genre is the only open value set attribute that has been used to extend the RDA/ONIX Framework base categories — to define RDA “cartographic” and “computer” content types. Additional content types could be defined with more Form/Genre terms, or with other non-base attributes with open value sets (e.g. Capture Method or Purpose). The resulting categories can be labeled with user-defined terms, so long as their semantics are specified by values (primary and user-defined) assigned to the base and qualified attribute sets. Users can define the labels of the high-level categories and the values and sub-values of the constituent attributes.

Furthermore, some of the *base attributes* themselves can be refined (sub-valued from a primary value), and/or extended (by adding a new value to the “controlled set” of primary values). The latter requires formal amendment of the RDA-ONIX Framework.

Further development of the RDA/ONIX Framework will allow for the construction of user-defined value vocabularies that can satisfy data content and documentation requirements; that is, they can be more *user-friendly*. At the same time, the Framework ontology (attribute semantics) enables machine-actionability. The separation of labels from value encoding is illustrated in the Framework base category tables, where the category identifier (first column) is machine-actionable and opaque, and the sample label (last column) is similar to current RDA terminology.

Of course, in all cases attributes employed to develop resource categories should not overlap with existing RDA elements (such as Mode of issuance). This systematic approach to further development of resource categorization would fit with RDA’s general methodology of adhering to principles and models.

The Task Force recommends assigning a constituent group to develop draft category tables, vocabulary values, and label construction patterns for the existing RDA terms. Working from the existing RDA/ONIX Framework tables, the development would involve adding extra columns (attributes and their values) and rows (categories), and relating the column values to the row/category label. Those syntactic/linguistic relationships are patterns that may include boilerplate text and label constructor guidance, which is essential for multilingual vocabularies.

It is probably beyond the scope of the present Task Force to declare (a) to what *degree* the content vocabulary could/should be enlarged, and (b) what *labels* RDA would establish for the new content types; however, this would be a worthy endeavor for the RDA community to take up, and an essential complement to the work of the present Task Force.

Table 1 below illustrates combinations of specified primary values used to construct BaseContentCategories that currently have a counterpart in AACR, MARC 21, and/or ONIX. The table is copied from the Appendix C of the RDA/ONIX Framework.

Table 2 below shows an extension of the RDA/ONIX Framework base content categories. The RDA-defined value “cartographic” has been added to the Framework’s Form/genre attribute, and the attribute has been added to the category table. The value is given an internal Framework encoding of 1, and is added as a fifth “facet” to the base category encoding. The sample labels are the actual labels used in RDA. The same approach has been used in RDA for the form/genre value “computer”. Note that the RDA-defined values have not yet been formally added to the Framework.

Table 1

Note: The table below illustrates combinations of specified primary values used to construct BaseContentCategories that currently have a counterpart in AACR, MARC 21, and/or ONIX. The categories shown are illustrative only; they are not intended to exhaust the possibilities for producing valid BaseContentCategories using the specified primary values for the targeted attributes in the Framework. Similarly, the sample category labels are intended simply to illustrate the kinds of labels that might be used to identify a category for a particular community.

BaseContentCategory	Character				SensoryMode						Image Dimensionality			Image Movement			Sample Category Label
	language	music	image	other	sight	hearing	touch	taste	smell	none	two-dimensional	three-dimensional	not applicable	still	moving	not applicable	
	1	2	3	4	1	2	3	4	5	6	1	2	3	1	2	3	
BaseContentCategory 1:1:3:3	■				■								■			■	text
BaseContentCategory 1:2:3:3	■					■							■			■	spoken word
BaseContentCategory 1:3:3:3	■						■						■			■	tactile text
BaseContentCategory 2:1:3:3		■			■								■			■	music notation
BaseContentCategory 2:2:3:3		■				■							■			■	performed music
BaseContentCategory 2:3:3:3		■					■						■			■	tactile music
BaseContentCategory 3:1:1:1			■		■						■			■			still image
BaseContentCategory 3:1:1:2			■		■						■				■		moving image
BaseContentCategory 3:1:2:1			■		■							■		■			three-dimensional object
BaseContentCategory 3:3:2:1			■				■					■		■			tactile image

Table 2

ExtendedContentCategory	Character				SensoryMode						Image Dimensionality			Image Movement			Form / Genre		Sample Category Label
	language	music	image	other	sight	hearing	touch	taste	smell	none	two-dimensional	three-dimensional	not applicable	still	moving	not applicable	cartographic		
	1	2	3	4	1	2	3	4	5	6	1	2	3	1	2	3	1	2	
ExtendedContentCategory 3:1:1:1:1			■		■						■			■			■		cartographic image
ExtendedContentCategory 3:1:1:2:1			■		■						■				■		■		cartographic moving image
ExtendedContentCategory 3:3:2:1:1			■				■					■		■			■		cartographic tactile image

While not treated at length in this report, the Task Force notes that an Extent of Expression element might also introduce/allow *subunits* of content, such as “words” or ”measures” (among many other possibilities).

Implications of introducing Extent of Expression

Values recorded in Extent of Expression will facilitate human and computer-assisted distinctions between expressions of a work. It will also (like other Expression attributes) represent a characteristic that all manifestations of that expression *generally have in common*. This quality will be all the more useful in a post-MARC environment, in which the attribute’s pairing with its proper WEMI entity will be more explicit.

The Task Force recommends that Extent of Expression should be core only if readily ascertainable and considered important for identification or selection.

The Extent of Expression element will provide a suitable destination for any of the exceptional extent subelements that may be currently misplaced under Extent of Manifestation. By removing inappropriate subelements there, the Extent of Manifestation element that remains is simpler and internally consistent. Having similarly structured extent elements for manifestation and expression (and item?) will facilitate the application of the machine-actionable model across each instance of extent, in a consistent manner.

Use cases

Data recorded in Extent of Expression will generally be used to *identify* and *select* a resource that meets the user’s needs in terms of its content, especially the extent of the content, when other attributes otherwise do not distinguish the Expression.

A revised text — lacking changes in other Expression attributes — might be distinguished by a change in the number of words (or chapters?).

Two versions of an atlas might be distinguished by a subtle change in the number of maps therein.

The evolution of a computer program might be distinguished by changes in the number of lines of code.

A performance by one orchestra led by a specific conductor might be distinguished by a different duration than another performance by the same or different orchestras lead by the same or different conductors.

A “deluxe” version of a CD might be distinguished from the standard version by a change in the number of songs (or the addition of bonus tracks).

The “director’s cut” of a film might also be distinguished by having a different duration.

A note on dimensions

The Task Force has considered whether **Dimensions** is an attribute that could also be assigned to an Expression, especially for cartographic material; the present determination is that this is not called for.

Adding the element Extent of Item to RDA

The Task Force also recommends the addition of Extent of Item to the RDA element set. RDA already includes an element for Note on Manifestation or Item, under which exist subelements for Note on Dimension of Item (RDA 3.22.3) and Note on Extent of Item (RDA 3.22.5). Furthermore, some of the situations touched upon in Item-Specific Carrier Characteristics (RDA 3.21) concern item-specific attributes of extent and dimensions.

While the FRBR model does not include extent as an attribute of item, the presence in RDA of elements for *notes* on the dimensions and extent of an item demonstrates the possible utility of an Extent of Item element. Establishing an Extent of Item element would allow application of a machine-actionable version of this element at the item-level, to parallel the potential application at the manifestation and expression levels. One assumes such consistency would be beneficial to the RDA cataloger.

Use cases

Data recorded in Extent of Item will generally be used to *identify* and *select* a resource that meets the user's needs in terms of the copy-specific physical characteristics of the carrier, especially when other attributes otherwise do not distinguish distinct exemplars of a manifestation.

Copy-specific bound-withs: The bound-with consists of a single physical unit comprised of multiple RDA *Items*. The mere act of being bound together (post-issuance) does not change the extent of items bound together (i.e., each of them singly). Rather, as FRBR notes, a *new item* is created – a sole exemplar of a Manifestation Singleton. In some scenarios, it may be useful to record the extent of this *new item*. Doing so might give a quick sense of the size of a volume of tracts bound together, for example.

Copy-specific imperfections: This seems like an obvious use case, although it's arguable that a copy-specific extent in this scenario will sometimes be less useful than noting the imperfection (e.g. recording "Library copy lacks slides 7-9" is more useful than recording "Extent of library copy: 6 slides"). Implementation of an element for Extent of Item might be accompanied by a revision of the guidelines in RDA 3.4.5.6 (Incomplete Volume).

The issue of Dimensions of Item has not been covered sufficiently by the Task Force to merit inclusion in this report. If necessary, it will be addressed in the future.

Integrating the Aspect-Unit-Quantity model

Our present work builds upon 6JSC/ALA/17, which proposed a simple Aspect-Unit-Quantity model at the core of a machine-actionable version of quantifiable extent data. The model is based on three individual pieces: the Aspect being measured, the Unit of measurement, and the numerical Quantity. In this model, the Aspect and Unit can be represented by controlled vocabularies. The following example illustrates the basics of the model:

Currently, and using ISBD punctuation, RDA would describe a printed volume in this way:

245 pages ; 23 cm

The Aspect-Unit-Quantity model would break up that statement into its separate parts:

<i>Aspect:</i>	extent/number of subunits
<i>Unit:</i>	pages
<i>Quantity:</i>	245
<i>Aspect:</i>	height
<i>Unit:</i>	centimeters
<i>Quantity:</i>	23

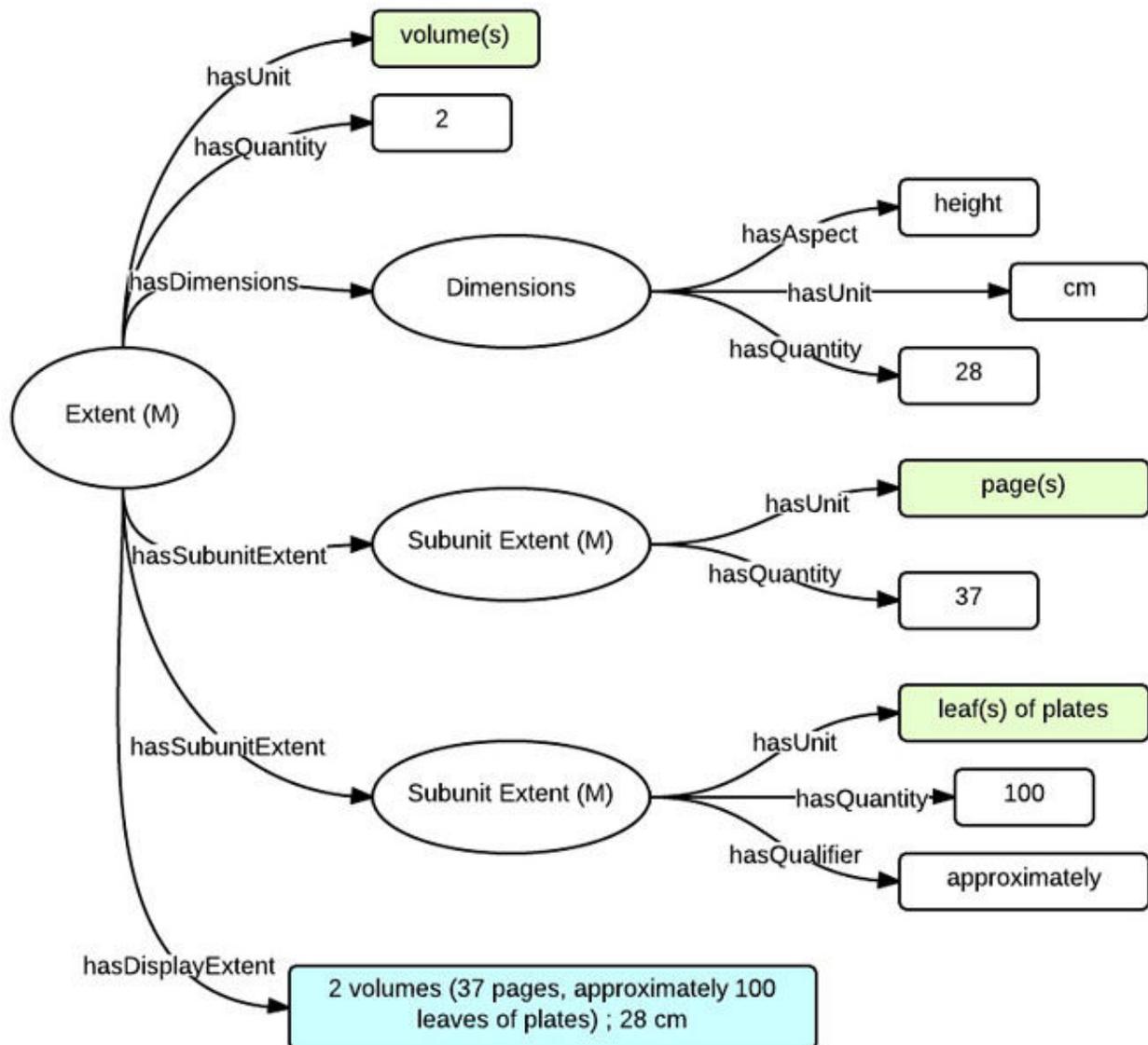
Extent statements of greater complexity introduce new challenges in modeling elements to accurately represent the organization of the resource. A well-structured model of extent should, for example, establish a relationship between extent units and extent subunits, when present, as in the following example:

2 volumes (37 pages, approximately 100 leaves of plates) ; 28 cm

Here, it is desirable to record that the resource comprises 2 volumes *composed of* 37 pages and approximately 100 leaves of plates (paged/numbered continuously), rather than 2 volumes *and* 37 pages and approximately 100 leaves of plates. A distinction must be made between extent units and subunits, and the subunits must be associated with the host unit.

A machine-actionable Extent of Manifestation, comprised of units and subunits, might be diagrammed as follows:

Figure 1



Notes:

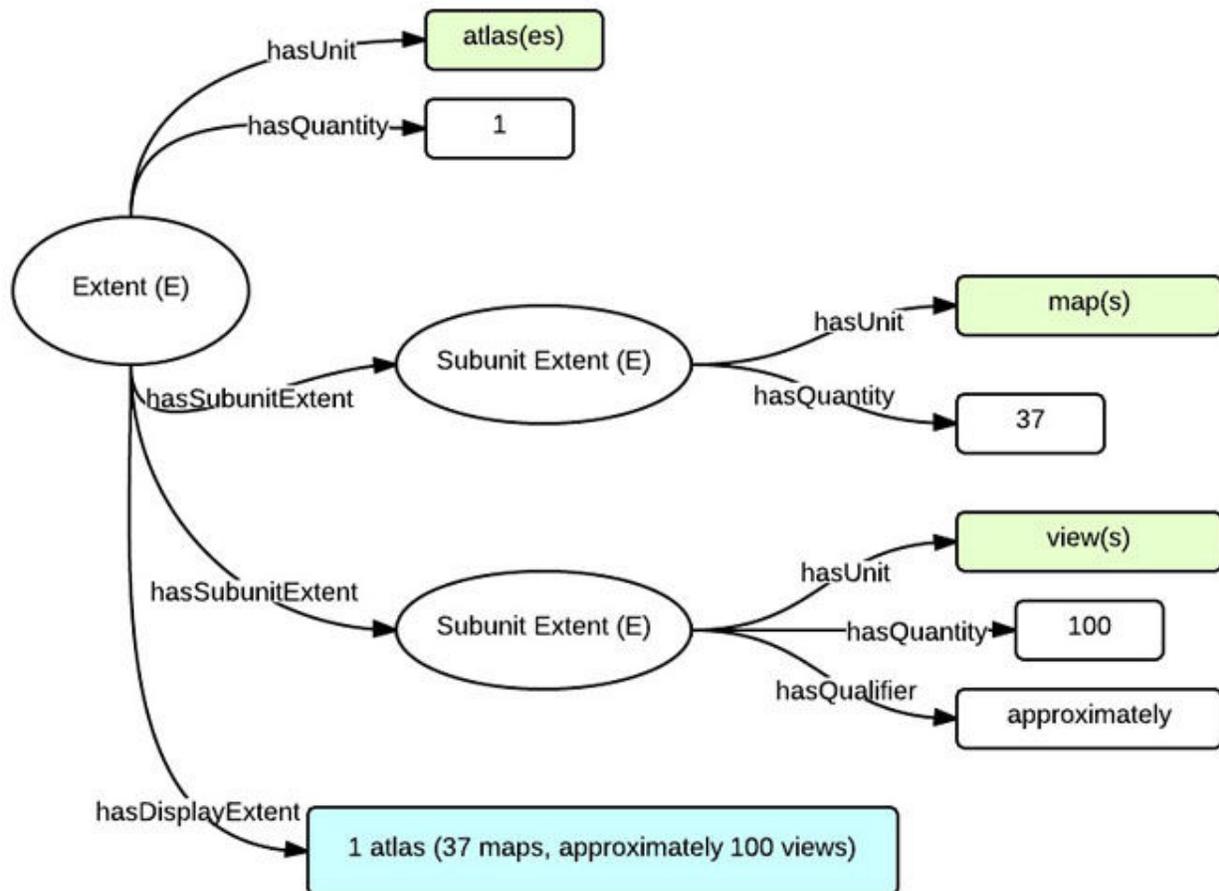
- Dimensions is treated as a subelement of Extent. It appears logical that Dimensions could also be included as a subelement of Subunit Extent (the structures would be parallel).
- Extent and Subunit Extent are both based on a variation of the A-U-Q model in which the Aspect (the count) is implicit.
- In the above example, a qualifier (“approximately”) is also introduced. Such qualifiers could complement the A-U-Q model when necessary.
- An element for Display Extent is offered as an alternative to or complement to the Machine-Actionable Extent. This would be of primary use for legacy data and statements of extent that may be too complex to record in the machine-actionable model.

Our model might employ a similar structure to describe an *Extent of Expression* comprised of units and subunits, as in the following example:

1 atlas (37 maps, approximately 100 views)

It is still to be determined, of course, whether “atlas”, “map”, and “view” would be used to describe extent of expression. This example is not – necessarily – the expression embodied by the manifestation in Figure 1.

Figure 2



It is especially important to account for the structure of the resource when it is comprised of more than one unit — i.e. with multiple carrier types (or, for Extent of Expression, with multiple content types). The machine-actionable model should be robust enough to handle scenarios covered in RDA 3.1.4.2 (Recording Carrier Type, Extent, and Other Characteristics of Each Carrier), from which the following example is derived:

<i>Carrier Type:</i>	slide
<i>Extent:</i>	46 slides
<i>Dimensions:</i>	5 x 5 cm
<i>Carrier Type:</i>	audiocassette
<i>Extent:</i>	1 audiocassette
<i>Dimensions:</i>	10 x 7 cm, 4 mm tape

In MARC, this could be encoded:

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300 __ $a 46 slides ; $c 5 x 5 cm
300 __ $a 1 audiocassette ; $c 10 x 7 cm, 4 mm tape
338 __ $a slide $2 rdacarrier
338 __ $a audiocassette $2 rdacarrier

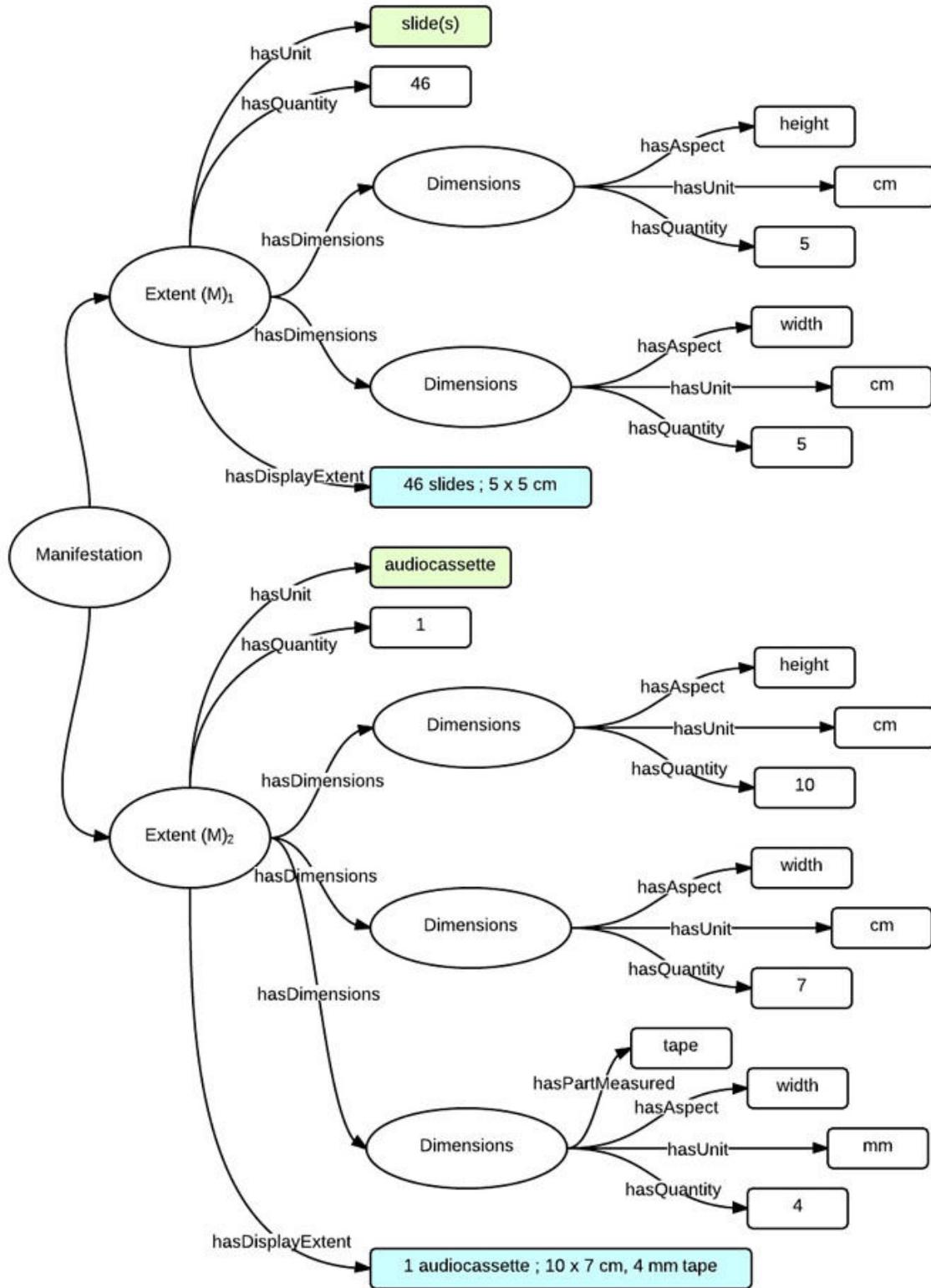
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MARC, in an insufficiently explicit manner, attempts to associate the extent of carrier (where there is more than one) with its corresponding dimensions by offering separate 300 fields for each carrier.

A well-conceived model for machine-actionable extent in RDA should make such relationships explicit.

In a machine-actionable model, our multi-carrier extent might be diagrammed as follows, where the Extent element is repeated for each carrier needing to be articulated separately:

Figure 3



Note that this example introduces an attribute to indicate the specific part of a resource measured, to be used when necessary.

As noted in 6JSC/ALA/17, the present AUQ model is proposed to facilitate better machine manipulation of the data created. Resolving these issues could provide functionality in the following areas:

- Easier matching for the purposes of determining differing content
- Sorting by size, dimension, or other criteria
- More granular faceting for media materials based on extent
- A better path towards automated determination of extent
- Provision of textual values and labels in a variety of languages
- Ability to compress and itemize more complex extent information for particular users (similar to MARC holdings data)
- Validation of data at the time of input

The Task Force has compared the model it proposes for extent with the models and guidelines currently in use in the domain of art cataloging. We are pleased to find a number of commonalities, including the Aspect-Unit-Quantity component at the heart of the model, inclusion of dimensions as part of extent, and the presence of a parallel element for Display Extent. This bodes well for the prospect of data interoperability between our respective communities.

The Task Force acknowledges that there remain aspects of the machine-actionable model that require more work and discussion.

Several responses to 6JSC/ALA/17 worried that the model did not include an approach for sequencing the components of an extent statement. Sequencing might be desired to (for example) provide order to a complex pagination statement, such as: “x, 32, 73 pages”. If the RDA community thinks that stating the sequence of these components is a necessary component of the machine-actionable model for extent, it should not be difficult to introduce an attribute for sort order.

Extent of Text may, in general, require further consideration, to balance needs to convey a *quantification* of extent while still providing (if desired) an approximation of how the resource presents its own extent — which is what is typically recorded in statements of *pagination* and *foliation*. It is unclear whether or not it may be worthwhile to record particularly complex Extents of Text, such as those frequently recorded in cataloging of Early Printed Resources, with machine-actionable components.

The Task Force also acknowledges that there may be an interest in establishing a relationship between an Extent of Content element and its corresponding Extent of Carrier, particularly in situations where a manifestation, in multiple carriers, embodies an expression with multiple content types. The Task Force has yet to discuss this issue in earnest. One possible solution is to establish a generic “extent” aggregated statement, with properties “has extent of carrier” and

“has extent of content”, with ranges of “extent of carrier” aggregated statement and “extent of content” aggregated statement. This generic “extent” statement itself could be composed of multiple sub-extent statements, each of which is composed of a mix of carrier and content statements using syntax patterns like “extent-of-content+” on “+extent-of-carrier or extent-of-carrier+” with “+extent-of-content”, etc. Such patterns can be represented in an extension of the concept of Syntax Encoding Scheme, currently being discussed in linked data communities. The patterns and how they are applied are display issues, and can be incorporated in application profiles.