



# ISBD and the Semantic Web

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## Introduction and background

The Internet and World Wide Web have made a strong impact on library processes and services that encompasses reconsideration of the very concept and physicality of the bibliographic resource itself, the standards, rules and procedures used to describe it and eventually archive it, as well as the ways metadata is displayed and designed for use on the assumed part of the user. Although libraries and library professionals have responded to these challenges by updating their processes and services to meet new requirements, the thinking and therefore practices behind them have remained basically the same.

One obvious reason for this is the availability of library information systems which could not be changed so drastically, and which, due to economical, technological and institutional reasons, have been forced to develop along a continuous, sustainable course.

Another, equally obvious reason is the fact that the ground for a more revolutionary leap has not yet been prepared. It is, in fact, the promise of the Semantic Web that lures us into thinking, and in fact, envisioning that the real change has just only started, that the real challenges have not yet even been fully spelled out, let alone begun to be mastered. Or is it the case that what is ahead of us is just a new technological gadget imposed on a blueprint that has been



laboriously designed layer upon layer over the decades and, indeed, centuries?

This paper, therefore, aims to expose facts and describe arguments encountered in the process of preparing the IFLA standard for bibliographic description for the Semantic Web, in order to give the reader the opportunity to form their own opinion on the “illusion of change”.

Dunsire and Willer in their paper Initiatives to make standard library metadata models and structures available to the Semantic Web, presented at the IFLA 2010 World Library and Information Congress in Gothenburg, Sweden (Dunsire and Willer), describe in detail recent initiatives and projects that have started to prepare the ground for library metadata to be represented in the Semantic Web. We will mention here only those relevant to the International Standard Bibliographic Description (ISBD), the topic of this paper.

The impetus for IFLA’s work can be traced to the Data Model Meeting held at the British Library in London in 2007<sup>1</sup> between representatives of Resource Description & Access (RDA)<sup>2</sup>, the Dublin Core Metadata Initiative (DCMI)<sup>3</sup>, IEEE Learning Object Metadata (IEEE LOM), and Simple Knowledge Organization System (SKOS).<sup>4</sup> The meeting “recommended several activities that would provide benefits including the library community getting “a metadata standard that is compatible with the Web Architecture and that is fully interoperable with other Semantic Web initiatives”, “and resulted in the creation of the DCMI RDA Task Group<sup>5</sup> to investigate options

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<sup>1</sup>British Library. Bibliographic Standards. Data Model Meeting. <http://www.bl.uk/bibliographic/meeting.html>.

<sup>2</sup>Joint Steering Group for Development of RDA. RDA: resource description and access. Available at: <http://www.rda-jsc.org/rda.html>.

<sup>3</sup>Dublin Core Metadata Initiative. <http://dublincore.org>.

<sup>4</sup>W3C. SKOS Simple Knowledge Organization System. <http://www.w3.org/2004/02/skos>.

<sup>5</sup>DCMI/RDA Task Group wiki. <http://dublincore.org/dcmirdataskgroup>.

for representing bibliographic concepts and metadata in Resource Description Framework (RDF),<sup>6</sup> the data model of the Semantic Web. Several months later, during the 2007 World Library and Information Congress in Durban, South Africa, the IFLA Functional Requirements for Bibliographic Records (FRBR) Review Group took up the initiative and started a project "to define appropriate namespaces for FRBR (entity-relationship) in RDF and other appropriate syntaxes", while during the next IFLA congress in Quebec in 2008, the Cataloguing Section's ISBD Review Group formed the ISBD/XML Study Group.

The impetus for this action was the recommendation from its Material Designation Study Group to develop an XML schema for ISBD, and to start researching into "reviewing ISBD concepts and the standard itself by the application of web technologies, and eventually of evolving the standard into a tool open to the Semantic Web technologies and services". Following the IFLA congress in Milan in August 2009, the IFLA Namespaces Task Group was formed in late 2009, with support by the IFLA Bibliography, Cataloguing, and Information Technology Sections. That was yet another important step in IFLA's intention to actively support the representation of its standards in formats suitable for use in the Semantic Web.

At the same time, what was felt as still missing from this "movement" within IFLA was a focal point or co-coordinating body that would gather all these initiatives and make a strong brand of IFLA's models and standards within the Semantic Web community. In December 2009, a new IFLA Working Group was appointed to review the role of IFLA in setting and monitoring bibliographic standards. It is hoped that its recommendation made to the IFLA Governing Board and Professional Committee during the IFLA conference in 2010, to create a general IFLA Bibliographic Standards Program

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<sup>6</sup>W3C. RDF. Available at: <http://www.w3.org/RDF>.

(Core Activity) to oversee bibliographic standards activities within IFLA, will result in forming (or reviving) a long needed platform for placing Universal Bibliographic Control in the new environment.

## **ISBD/XML Study Group activities: 2008-2010**

As already mentioned, the ISBD/XML Study Group<sup>7</sup> was formed during the 2008 IFLA World Library and Information Congress.<sup>8</sup>

The proposal for the two year Project Development of ISBDXML Schema was made in October 2008, and subsequently accepted by Professional Board at its meeting of the same year.

The main goals of the project were:

- to build a consensus on the *raison d'être* of moving the ISBD into the web environment, and define possible uses of such a product;
- to develop ISBDXML schema;
- to ensure the interoperability of the product with similar ones such as MARC/DCXML schemas, at least at the conceptual level, within the current Semantic Web technologies and services,
- to liaise with relevant constituencies in the field, and
- to propose further development of software tools and services.

The proposal ascertained also the following:

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<sup>7</sup>IFLA. Cataloguing Section. ISBD Review Group. ISBD/XML Study Group. <http://www.ifla.org/en/node/1795>

<sup>8</sup>The text that follows is cited from this source.

«Due to the fact that it will not be possible to develop appropriate software tools and services within the proposed two-year project, and due to the rapid changes of web technologies, the primary objective of the ISBDXML Study Group to be met with in this project is to position the ISBD as a relevant factor in assessing structured bibliographic information in the global information environment».

The methodology proposed for the project was based on the above goals as follows:

1. build consensus and define uses of ISBDXML set of tools;
2. identify and contact a consultant, preferably the one who would liaise between ISBDXML SG and Semantic Web communities;
3. identify and contract an XML expert for the purposes of building the ISBDXML schema;
4. identify and define bibliographic and/or related XML schemas to verify the possibilities of interoperability, and
5. identify necessary procedures to position ISBD within the Semantic Web environment.

The proposal also had to identify the anticipated beneficiaries and stakeholders, which was met by the following commitment:

«It is anticipated that the result of the project will be primarily the (re)positioning of the IFLA standard and its values of enabling provision and (re)use of authoritative structured bibliographic information in the Internet environment. The anticipated beneficiaries and stakeholders will be all interested in producing/sharing/(re)using authoritative bibliographic information in the web environment».

That was defined in concordance with IFLA Statutes defined core values, article 6: "b) the belief that people, communities and organizations need universal and equitable access to information, ideas and works of imagination for their social, educational, cultural, democratic and economic well-being". The expected outcomes were

1. document on the use and application of the ISBDXML,
2. ISBDXML schema, and
3. document on the directions of further actions to position ISBD within the Semantic Web environment, while its contribution to IFLA priorities was seen as one to be attached to IFLA's profession pillar, IFLA-CDNL Alliance for Digital Strategies (ICADS) which focus was on digital library issues and standards.

What was, however, at the core of the project, was its positioning as a constituent part of the Cataloguing Section's Strategic Plan 2007-2009: "3.2 Begin the work on the first revision to the consolidated ISBD for publication in 2009" (See also Escolano Rodríguez et al.).

The year that followed turned out to be a formative one as much for the project, as for the Study Group members' understanding of the task's scope.

The first meeting of the ISBD/XML Study Group was held on 25 August 2009 in Milan, Italy, during the 75<sup>th</sup> IFLA General Conference and Assembly, and at the very outset strongly supported the proposed direction of the project presented by the consultant to the group, Gordon Dunsire. Dunsire reported on

«the discussions led during IFLA [2009] to create a task force/alliance working group that would bring together representatives of different sections in the newly established Division III and other interested individuals with the aim of estab-

lishing a mechanism of enabling the incorporating and branding of IFLA standards in the Semantic Web environment, in line with the objectives of universal bibliographic control».

The following sections/groups were contacted: Cataloguing, Classification and Indexing, Bibliography, Knowledge Management, Information Technology, FRBR Review Group, ISBD Review Group and Permanent UNIMARC Committee.<sup>9</sup>

These discussions led to the initiative that was seminal to the production of the aforementioned recommendation to create a general IFLA Bibliographic Standards Program (Core Activity).

The second major decision made by the meeting was acceptance of a re-direction of the project goal. Namely, the Study Group had been charged with defining an XML schema for ISBD, but, based on Dunsire's recommendation (Dunsire, "Report to the ISBD/XML Task Group") it was agreed to bypass the general XML mark-up and go directly to an RDF/XML environment which would situate ISBD within the Semantic Web framework.

That issue was closely linked to Dunsire's work as a the Group's liaison with the VMF: Vocabulary Mapping Framework Project<sup>10</sup> in order to incorporate ISBD in the model and tools of VMF, and his discussion paper on IFLA namespaces ("Declaring FRBR entities and relationships in RDF"). The result of the project would be an ISBD RDF/XML schema.

The decision was supported by the ISBD Review Group and Cataloguing Section Standing Committee, as well as by the Professional Board which also financially supported the revised Project's plan for its second year activities.

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<sup>9</sup>IFLA. Cataloguing Section. ISBD Review Group. ISBD/XML Study Group. Minutes of the 1st Meeting of the ISBD/XML Study Group, 25 August 2009, Milan, Italy, 75<sup>th</sup> IFLA General Conference and Assembly. [http://www.ifla.org/files/cataloguing/isbdrg/isbd-xml-sg-meeting\\_2009.pdf](http://www.ifla.org/files/cataloguing/isbdrg/isbd-xml-sg-meeting_2009.pdf).

<sup>10</sup>VMF: Vocabulary Mapping Framework Project. <http://cdlr.strath.ac.uk/VMF>.

The Project's redefined main objectives are now:

1. build a consensus on the *raison d'être* of moving the ISBD into the web environment, and define possible uses of such a product;
2. develop an ISBD RDF/XML schema;
3. ensure the interoperability of the product with similar ones such as MARC/DCXML schemas,<sup>11</sup> at least at the conceptual level, within the current Semantic Web technologies and services;
4. liaise with relevant constituencies in the field, and
5. propose further development of software tools and services.

This decision was further discussed and analyzed during an ad hoc meeting held in November 2009 (IFLA. Cataloguing Section. ISBD Review Group. ISBD/XML Study Group, "Meeting of 25 November 2009, Rovinj, Croatia"), while the objectives were formally accepted at the second Group's meeting held in August 2010 in Gothenburg, Sweden during the 76<sup>th</sup> IFLA General Conference and Assembly.

The second meeting pushed the project significantly further along its action plan ("Meeting of 11-13 August 2010, Gothenburg, Sweden, draft minutes"). The documentation prepared by Dunsire<sup>12</sup> for the Group's second meeting was the following:

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<sup>11</sup>The objective was further detailed with the tasks of analysing and defining the functionalities of ISBD elements in relation to FRBR, (UN)MARC, and DC/XML schemas, new cataloguing rules such as RDA, REICAT and the Finnish cataloguing rules, analysing and supporting the concept of linked data, and promoting its relevance to vendors in support of the development of new generation library information systems. For further analysis, see: ("UNIMARC, RDA and the Semantic Web")

<sup>12</sup>Except for the fourth mentioned comment that was prepared by M. Willer.



- analysis of content and carrier designators in the ISBD consolidated edition with respect to the RDA/ONIX Framework: This analysis identifies interoperability issues that arise when linking the ISBD designators to RDA/ONIX Framework for Resource Categorization, version 1.0 (ROF) in a Semantic Web environment, through the Vocabulary Mapping Framework (VMF) matrix or other mechanism, and to other content and carrier vocabularies based on ROF. The principal examples of such other vocabularies come from RDA: resource description and access;
- report on the preliminary representation of ISBD elements in RDF for the IFLA ISBD/XML Study Group: This report was based on work to represent appropriate elements of the ISBD consolidated edition, draft of 2010-05-10 sent to worldwide review. The preliminary representation of ISBD elements was built on the approach used by projects to develop RDF representations of the entity-relationship model of Functional Requirements for Bibliographic Records (FRBRer) and RDA: Resource Description and Access, using the Open Metadata Registry to create and maintain records for classes, properties, and value or content terms, which can be output in RDF/XML;
- comments on the International Standard Bibliographic Description (ISBD) Consolidated Edition, draft of 2010-05-10, arising from the preliminary registration of ISBD elements in RDF: These comments arise from work to identify and register ISBD classes and properties in Resource Description Framework on behalf of the ISBD/XML Study Group;
- comments on International Standard Bibliographic Description (ISBD). Consolidated edition. Draft as of 2010-05-10 (worldwide review).

The following summarizes the discussions, decisions and recommendations to the ISBD Review Group that took place during two formal and two ad hoc meetings:

- the representation of ISBD elements in RDF: the meeting discussed the representation and usage constraints, such as mandatory/optional, order and repeatability of elements, and accepted to: (a) express ISBD elements as RDF properties and vocabularies, (b) express the metadata record structure as a Dublin Core Application Profile (DCAP),<sup>13</sup> and (c) express metadata output format, including punctuation, as an XSLT;
- interoperability with other domains: recommend to the ISBD Review Group to accept the concept of super-properties as links to other domains or external namespaces as far as it will not influence the original ISBD document, liaise with JSC concerning Area 0, particularly as it relates to RDA and the RDA/ONIX Framework, and liaise with W3C, specifically the W3C Library Linked Data Incubator Group,<sup>14</sup> in order to inform the Review Group of the discussions and decisions taken in regard to modelling ISBD, as well as to report back on discussions within and recommendations by the Incubator Group;
- language interoperability and modelling issues: as part of the current scope of the project, test the controlled vocabularies of Area 0, and liaise with, monitor and report on development and implementation of MulDiCat (*Multilingual dictionary of cataloguing*) in SKOS/RDF in the IFLA namespace;

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<sup>13</sup>DCMI. Guidelines for Dublin Core application profiles. <http://dublincore.org/documents/profile-guidelines>.

<sup>14</sup>W3C Library Linked Data Incubator Group. <http://www.w3.org/2005/Incubator/llid>.

- ISBD/RDF Representation Report: RDF registration of ISBD elements in the Open Metadata Registry: based on detail discussion and analysis of the list of ISBD elements, edit and approve the list of the preliminary representation of ISBD elements in RDF, in order to send a final version to the ISBD Review Group to allow it to update or revise the naming and/or definition of elements as found appropriate through the process of representation of ISBD in RDF, as well as recommend to the ISBD Review Group to include the list of elements in the consolidated edition;
- the representation of UNIMARC bibliographic format content designation in RDF: as part of the Study Group charge under (point 3, page 220) to ensure the interoperability of the product with similar ones such as MARC/DCXML schema, and monitor the development of representing UNIMARC in RDF, with possible collaboration to benefit from the experience gained and decisions taken for ISBD, and meet requirements for interoperability between the two;
- the extension of the project: extend the Study Group work to a third year in order to finalize the representation of the ISBD final consolidated edition (to be published in 2011) in RDF, subsequently update the application profile and the XSLT display format for punctuation. The issue of the implementation of an IFLA registry, as part of the tasks to be undertaken by the Namespaces Technical Group or some other IFLA body was discussed, and agreed that time should also be scheduled for integrating the ISBD RDF representations with the IFLA infrastructure.

All of the decisions and recommendations mentioned were adopted by the ISBD Review Group and Cataloguing Section Standing Com-

mittee at their meetings during the 2010 IFLA congress.

## Modelling and representation of ISBD

### RDF representation of ISBD elements

RDF categorizes metadata elements as either classes or properties. A class is a type of thing that is described by a metadata statement; a property is a specific aspect of such a thing or a relationship between one thing and another. The only type of thing described by ISBD is a bibliographic resource, labelled in the ISBD text simply as "resource". ISBD does not cover relationships between resources, so there are no RDF properties corresponding to relationships. All of the ISBD attributes, however, are specific aspects of a resource, so each attribute is represented as a property in RDF. An example is the attribute "content form", which is represented by the property labelled "has content form". This labelling convention, of adding the verb "has" to the attribute name, is used consistently in the RDF representations of ISBD to improve the readability of labels and indicate the "direction" of the property. Some properties can be inverted, for example "is content form of" is the inverse property of "has content form".

The most basic form of metadata statement is a single value assigned to a single aspect of a specific resource. In RDF, this becomes a single value of a property associated with a specific instance of a class, expressed in the form of a "triple": subject (of the statement, a class instance) – predicate (the property) – object (the value of the statement). A metadata record is a set of such triples, all with the same subject.

A partial example ISBD record is:

```
This Resource - has content form - 'image'
```

This Resource - has title proper - ''Photograph of Rome''  
etc.

The purpose of using RDF to represent metadata statements is to allow efficient machine-processing of triples. To this end, RDF specifies that the subject and predicate parts of any triple must consist of a machine-processable identifier in the form of a Uniform Resource Identifier (URI) which is similar in appearance to the familiar Uniform Resource Locator (URL) of the World-Wide Web. In other words, each ISBD class and property needs to have an associated URI.

ISBD is using the Open Metadata Registry to define its classes and properties and to assign URIs.

Every URI is based on a base URL registered as an IFLA namespace; for ISBD this is  
<http://iflstandards.info/ns/ISBD/elements/>.

A running number is added to this base to create a unique URI for each class and property; the number is preceded by a letter for compatibility with XML (ISBD uses its own convention of "C" for a class and "P" for a property). For example, the URI of the "has content form" property is  
<http://iflstandards.info/ns/ISBD/elements/P1001>.

Although it is not mandatory, the object or value of a triple can also be something with a URI. This might be an instance of a class (as required for the subject of a triple), or a term from a controlled vocabulary. ISBD specifies controlled vocabularies to be used for the content or values of the Area 0 elements, including terms for content form. These vocabularies have also been represented in the Open Metadata Registry, so each term has its own URI. For example, the URI for the content form term "image" is  
<http://iflstandards.info/ns/ISBD/terms/contentform/1002>.

Note that the base URL is slightly different from the one used

for classes and properties; this is for administrative purposes. For machine-processing purposes, however, there is no need for regularity in the URIs; they just need to be unique and assigned to only one class, property, or term (although any one class, property, or term may have more than one assigned URI).

An RDF property can have a declared domain and range. The domain is a specific class indicating the type of object of the property: the object of a triple using the property can be inferred to be an instance or member of that class. All ISBD properties have the class "Resource" as the domain, so that any triple using an ISBD property can be inferred to be an instance of a (bibliographic) resource, and not, for example, an instance of a person. Similarly, the range indicates the type of subject of the property by specifying a class. The range can, alternatively, indicate the type of value of the subject of the property, for example whether it is a free-text string, a structured string, number, date, etc., or a term taken from a controlled vocabulary. None of the ISBD properties are assigned a range, because the ISBD text does not specify any type of value for the attributes. Instead, the Dublin Core Application Profile for ISBD will specify ranges for specific properties, as discussed below.

## **Aggregated statements**

An aggregated statement is a set of basic metadata statements, usually with a specified order, mandatory status, repeatability, etc. Each of the nine ISBD areas (0-8) is an aggregated statement with a structure given by the order, mandatory status, repeatability, and punctuation of a set ISBD attributes. For example, Area 0 is composed of the attributes "content form", "content qualification", and "media type" expressed as controlled terms cited in a specific sequence with specific punctuation. An aggregated statement can be defined in RDF as a syntax encoding scheme (SES) using an ap-

proach developed for the representation of aggregated statements in RDA (Hillmann et al.). The SES is a component of the Dublin Core Abstract Model,<sup>15</sup> which is also the basis of the DCAP.

The ISBD areas have therefore been represented in RDF as encoding schemes which are sub-classes of a generic ISBD SES. The URI for a specific ISBD encoding scheme can therefore be referenced in an appropriate way in the DCAP for ISBD. Multiple levels of granularity can be represented in the same way. The ISBD areas themselves are presented within a record in a specified order with specified punctuation. Variations in punctuation may be allowed for certain types of record display, for example paragraph blocks instead of in-line chaining, so there may be alternative SESs at the record level. ISBD also specifies inter-area levels of aggregated statements, such as "other physical details" in Area 5. All such statements identified in a first-pass through the ISBD text have also been represented in the ISBD namespace.

## Other namespaces

All of the ISBD elements have been explicitly represented in the namespace. There has been no attempt to avoid duplication with similar elements in other namespaces for several reasons:

- there are few exact equivalents with the same definitions and context in other namespaces. The namespaces most likely to have equivalent classes and properties are those for FRBR and RDA; both are also in development, and the formal relationships between these standards and ISBD are not strong enough to guarantee exact equivalence;
- all URIs in the namespace carry the brand of the IFLA namespace. This provides a powerful signal of trustworthiness for

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<sup>15</sup>DCMI abstract model. <http://dublincore.org/documents/abstract-model>.

any triples derived from ISBD records and using ISBD properties;

- it is important that IFLA is able to maintain the ISBD as a core component of universal bibliographic control. This requires full powers to manage attributes in areas of definition, translation, and approved relationships with related namespaces. It is the international aspect of IFLA's activities that leads to the use of a running number to specify a URI in the ISBD namespace, rather than a human-readable string in a specific language and script. These so-called opaque URIs also allow alternative labels and translations of labels to be declared without confusing them with the URI itself.

The project is aware that classes and properties at a higher level than ISBD elements have been represented in RDF in namespaces such as DCMI metadata terms (DCT)<sup>16</sup> and SKOS. The project intends to declare triples which define ISBD elements as sub-properties of, or equivalent to, properties in other namespaces, as appropriate after the ISBD namespace is given final approval by the ISBD Review Group and related IFLA bodies. This will allow triples based on ISBD properties to be interoperable with metadata statements from many other sources.

The project has identified a potential need to use high-level properties to gather together ISBD elements of a similar nature. These include titles and notes, so the potential use of the "title" property from the DCT and "note" property from the SKOS namespaces respectively will be investigated.

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<sup>16</sup>DCMI metadata terms. <http://dublincore.org/documents/dcmi-terms>.



## **Dublin Core Application Profile for ISBD records**

The specific needs of metadata communities are very different which results in many diverse metadata formats. It is a good idea to have only one metadata application with metadata elements regardless of the originating format, together with rules for their use. An Application Profile is such a metadata application; in fact, it is a mechanism which allows a combination of many different metadata elements to be used in a single metadata application. Thus, an application profile can be defined as a generic construct for creating metadata records without emphasis on particular elements from different source metadata formats.

In this regard the Dublin Core Application Profile (DCAP) designed by the DCMI represents a framework which provides such a mechanism and allows metadata interoperability with other systems or applications with specifically defined vocabularies. The DCAP does not imply that the Dublin Core metadata terms, defined by the same organization, must be used. This allows the use of ISBD elements within an application profile (AP).

Following the general recommendation from the DCAP Guidelines, the AP for ISBD records (ISBD-AP) includes considerations and decisions on the following issues:

- the functional requirements for ISBD-AP can be taken from ISBD/XML SG goals, mostly from the ISBD specification itself;
- the domain model for the ISBD-AP is the class Resource; ISBD: Resource is the only type of thing specified in the ISBD text as the subject of a metadata statement, although there are references to possible sub-types such as "multipart monograph". It may be necessary to represent these sub-types as RDF subclasses in order to model the "mandatory if applicable" status of some ISBD attributes;

- the description set profile for ISBD records (DSP-ISBD) therefore contains only one main Description Template for the single entity in the domain model of ISBD-AP. Rules that constrain the use of the RDF properties representing ISBD attributes, such as value types or repeatability of the attribute in an ISBD record are defined in appropriate Statement Templates;
- ISBD-AP usage guidelines include rules for assigning values (i.e. metadata content) specified by ISBD, one or more minimum record specifications, and punctuation specifications (as text and/or XSLT). It is planned to develop and assign usage guidelines to ISBD-AP at general and property-specific levels.

The information to support this analysis of functional requirements, the domain model, and usage guidelines is quite simple and easy to find in ISBD itself and the RDF representation of the element set.

## Description set profile

The Description Set Profile (DSP) is the backbone of an application, and requires additional explanation.

A DSP is an XML document using pre-defined markup tags and qualifiers. Before creating the DSP-ISBD XML document an auxiliary table of the ISBD elements (see Table 1) will be developed to identify the content of the tags and qualifiers.

Such a table is recommended in the DCAP Guidelines as the basis of the DSP.

| Property       | Range   | Value String | SES (Syntax Encoding Scheme) URI | Value URI      | VES (Vocabulary Encoding Scheme) URI | Related description |
|----------------|---------|--------------|----------------------------------|----------------|--------------------------------------|---------------------|
| hasTitleProper | literal | YES          | NO                               | not applicable | not applicable                       | not applicable      |
| etc.           | ...     | ...          | ...                              | ...            | ...                                  | ...                 |

**Table 1:** The auxiliary table for the construction of the DSP-ISBD XML document

The range is declared as literal (alphanumeric characters) for all of the properties for basic ISBD attributes.

The range is declared as non-literal for properties representing aggregations of attributes.

All properties are likely to have a value string for the literal range. Non-literal ranges cannot have value strings.

A SES is a simple list of text strings identified by a URI, which "makes the list citable and available for use in many application profiles". With the exception of aggregated elements, it is unlikely that any of the basic elements will have a SES in the ISBD-AP.

A Vocabulary Encoding Scheme (VES) is a list of strings which "may be interpreted as labels for a list of concepts".

Only the elements of Area 0 of ISBD will have a VES in the ISBD-AP; the scheme will be the appropriate SKOS vocabulary already declared in the Open Metadata Registry. A VES can only be applied to a property with a non-literal range.

The table will be extended with columns for indicating if a property is mandatory, if it is repeatable, and its sequence in an ISBD record.

A mandatory attribute is modelled with the value "1" for the minOccurs property of the Description statement.

An optional attribute has the value "0" for the minOccurs property. Non-repeatable attributes are modelled with the value '1' in the maxOccurs property of the Description statement. For repeatable elements, the property is not assigned.

For example, the ISBD attribute "title proper" with RDF property label "has title proper", listed in Table 1, is not repeatable and not mandatory: there can only be one title proper for a resource, but a resource which is a collection of multiple works without a common title does not have a title proper.

The attribute will be represented in the DSP-ISBD something like:

```
<?xml version='1.0' encoding='UTF-8'?>
<DescriptionSetTemplate
  xmlns='http://dublincore.org/xml/dc-dsp/2008/01/14'
  xmlns:xsi='http://www.w3.org/2001/XMLSchema-instance'
  xsi:schemaLocation='http://dublincore.org/xml/dc-dsp/2008/
  01/14 descriptionSetTemplate.xsd'>
  <DescriptionTemplate ID='resource' minOccurs='1'
    maxOccurs='1' standalone='yes'>
    <StatementTemplate ID='hasTitleProper' minOccurs='0'
      maxOccurs='1' type='literal'>
      <Property>http://iflastandards.info/ns/ISBD/elements/
      P1004</Property>
    </StatementTemplate>
  </DescriptionTemplate>
</DescriptionSetTemplate>
```

Currently, the only strictly mandatory ISBD elements appear to be those where a default value is specified if the resource itself cannot supply a value. An example is the attribute “place of publication, production, distribution” which contains the default “[S.I]” (or an equivalent in another script). Many elements are indicated in the ISBD text to be mandatory, in the sense of “mandatory if applicable”, and the text will have to be carefully examined to determine the minOccurs value for those attributes in the DSP-ISBD.

There are a number of outstanding issues about the continuing development of the architecture of the Dublin Core Application Profile. These include the embedding of additional constraints on classes and properties expressed in Web Ontology Language (OWL) in a DCAP, which, for example, affects the modelling of conditional aggregated elements (where not all components are mandatory). The project will continue to monitor and contribute to the discussions taking place in DCMI, because further work on ISBD-AP will depend on the resolution of these issues.

## Utility and conclusion

The principle utility of the ISBD-AP is to facilitate the interchange of metadata based on ISBD within the general environment of the Internet and World-Wide Web, and the emerging environment of the Semantic Web. Triples based on ISBD metadata should be of considerable interest to the Semantic Web because they are likely to be of higher quality than those generated by machines and by untrained humans. Triples based on metadata from national cataloguing agencies are also, currently, likely to be of greater granularity and specificity than metadata derived from core or simple records.

Many libraries are investigating the transformation of their catalogues into RDF triples to contribute to, and take advantage of, the Semantic Web. Such triples can be linked to triples from encyclopedias, dictionaries, and other reference works, booksellers, publishers, and other agents in the bibliographic universe to enhance information services. Triples are often referred to as linked-data for this reason. The ISBD is one of the historical bases of Machine Readable Cataloguing (MARC), and continues to be closely aligned with the UNIMARC and, to a lesser extent, MARC21 record encoding formats which are used by many large libraries. The ISBD-AP can be used to parse such records into triples, and to check the integrity of the record itself by identifying missing elements, sequencing errors, etc. Properties from the ISBD namespace can be re-used in other application profiles and mixed with elements from other namespaces. There are already two examples of libraries using draft ISBD properties in their experiments in creating triples from catalogue records. The British Library is currently using three ISBD properties in an experimental representation of British National Bibliography (BNB) records in RDF/XML;<sup>17</sup> these are:

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<sup>17</sup>British Library Metadata Services. Sample data. Available at <http://www.bl.uk/>

- "has edition statement"  
(<http://iflastandards.info/ns/ISBD/elements/P1008>);
- "has note on language"  
(<http://iflastandards.info/ns/ISBD/elements/P1074>);
- "has place of publication, production, distribution"  
(<http://iflastandards.info/ns/ISBD/elements/P1016>).

The University of Mannheim in Germany is also using one of these properties, "has edition statement", in an RDF linked data representation of the catalogue of the university library.<sup>18</sup>

Our work so far indicates that it is possible to apply RDF, the "gadget" of the Semantic Web, effectively to ISBD, a bibliographic metadata record structure developed over many years with the experience of cataloguing professionals world-wide. The Dublin Core Application Profile helps preserve the integrity of that structure, and allows libraries and other bibliographic agencies to exchange metadata at the level of the record. But the application profile approach also allows parts of the record structure, including aggregated and basic statements, to be re-used and mixed with other elements from related communities and their namespaces. And the RDF properties can be used directly by other communities, aggregated into different forms of statement, and interlinked with their own namespaces for their own requirements.

It is difficult not to see this as a pragmatic realization of universal bibliographic control, with RDF the practical gadget that has been eluding IFLA and other organizations for so long. And, like all really useful gadgets such as the computer and the mobile phone,

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[bibliographic/datasamples.html](http://bibliographic/datasamples.html).

<sup>18</sup>Universitätsbibliothek Mannheim. Linked data service documentation.  
[http://data.bib.uni-mannheim.de/dokumentation\\_en.html](http://data.bib.uni-mannheim.de/dokumentation_en.html).

we should expect a revolution in how we continue to develop and use our long-time, traditional expertise and practices.

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