ACTA UNIVERSITATIS LODZIENSIS
FOLIA LIBRORUM 2 (29), 2019
ISSN 0860-7435

KATEDRA
INFORMATOLOGII
i BIBLIOLOGII
Uniwersytet Łódzki

Marek Nahotko
Institute of Information Studies
Jagiellonian University
e-mail: marek.nahotko@uj.edu.pl

Do (union) library catalogues are still necessary? OPAC in the infotopia

Translated from Polish by Paulina Adamus, Andrzej Jarosiński, Justyna Malinowska & Mikołaj Deckert

DOI: http://dx.doi.org/10.18778/0860-7435.29.03

Abstract: The article presents the basic function of union catalogues: ensuring interoperability of library metadata. The problem of metadata interoperability was defined as an element of cooperation of information systems, especially functioning in the network. The methods used to ensure interoperability were presented. Three technologies were described that should facilitate metadata interoperability in the future: NoSQL databases, cloud applications and Linked Open Data.

Keywords: metadata interoperability, union catalogues, OPAC, big data, Linked Open Data

Introduction

In libraries, for many years the main metadata resources have been functioning in an electronic version, which allows their mass sharing on the Internet. Card catalogs have been closed a long time ago, either after full cataloging of collections, or after preparing various types of "prostheses", such as, for example, a set of catalog card scans which enable us to search images by password. Experience shows that documents whose descriptions have not been placed in OPAC become "dead" because they are not ordered by users anymore (Su, 1994, p. 136). Librarians noticed the need for cooperation in creating and sharing metadata long time before the use of electronic tools has started. The beginning of this tendency was the work carried out in the second half of the 19th century by Panizzi, Cutter, Dziatzko and other librarians. The computerization of libraries, and in particular the transfer of a large part of information activities to the Internet, significantly deepened developed, strenghted the need for cooperation to the point, that libraries functioning individually rather than cooperating, lose the point of existence (this applies in particular to scientific libraries).

This cooperation has two complementary dimensions. The most obvious od those is the collaboration between computerized libraries. The fastest and best implemented idea is the exchange of bibliographic (descriptive) metadata between libraries at different stages of creating descriptions according to different principles. It's more complicated with other types of metadata, e.g. administrative, because libraries do not have a tradition of exchanging them, and they could become the basis for interesting, new functionalities of cooperating information systems. This applies, for example, to data on ordered novelties, readers or statistics on the use of information resources.

The second dimension is the need for libraries to cooperate not only with each other, but also with other institutions of the global information universe created via the Internet. It is about cooperation with all institutions and services that support our current and potential users. At one time in the librarian community there were lively discussions about the dangers that Google Books might have. Critical voices prevailed in relation to this projects. Meanwhile, librarians should treat these types of initiatives as allies and collaboration opportunities, unlike publishers for which they can be competitors. Google Books is of course just an example; our users also use Facebook, YouTube, Flickr, Spotify (digital objects contain not only text!) and LibraryThing type services, also cooperation with publishers and database developers, data analysis and visualization service providers and many others brings benefits.

Interoperability

Interoperability is a very important issue related to the functioning of information systems in a heterogeneous Internet environment. (Kienzler, 2003, p. 126; Nahotko, 2013, p. 63). It concerns the possibility of cooperation between various systems (and more broadly – organizations using these systems) at all levels. Striving to cooperate requires combining different standards in joint operation, thanks to which it is possible to aggregate many data resources and metadata, enabling the creation of new and better products and services. It can be understood very differently depending on the level at which cooperation is considered.

The most important feature of cooperation is the existence of some kind of relationship between information systems, which is treated as a form of communication, exchange and dissemination of information, enabling the cooperation of people: the creators and users of these systems. The result is a system of cooperating information systems (Carney, Smith & Place, 2005, p. 2). Usually, differences in the definitions of interoperability result from different descriptions of these relationships and system elements. The authors of some definitions focus on system and hardware problems, others on information delivery and dissemination services, and others on the possibilities of using the information exchanged without the need for additional work. Organizations managing information policy pay attention to aspects of processes necessary for the exchange and multiple use of information (Manso-Callejo, Wachowicz & Bernabé-Poveda, 2009).

Interoperability of information systems can be understood in different ways. This is reflected in the formulated definitions, whose authors understand cooperation as:

- a field of knowledge and practice dealing with the cooperation of independently built (heterogeneous) systems, especially in computer networks (Subieta, 1999, p. 201);
- the ability to exchange data with minimal loss of content and functionality between many systems that differ in the use of hardware and software, data structures and interfaces (NISO, 2004, p. 15);
- the ability of two or more systems or parts to exchange and use this information without the need for additional work on these systems (Nilsson, 2010, p. 12);
- compatibility of two or more systems allowing them to exchange information and data between them and use them without performing additional manipulations (Taylor & Jourdrey, 2008, p. 269).

These definitions show that interoperability is a feature of all computer systems, including information systems, since each of them consists of at least two elements, hardware and software which must closely cooperate with each other. However, this problem does not only apply to computer technology applications. Pre-computer information systems, such as library systems, also often interacted with each other, which was facilitated by commonly used standards such as cataloging regulations. Systems not primarily used for information processing, such as energy or transport (e.g. rail) must also consist of interacting elements. One of the elements of information systems, necessary for ensuring interoperability are metadata. Therefore, they play an important role in every model representing the issues of interoperability of information processing systems (Nahotko, 2013, p. 62).

Interoperability, understood as in the definitions presented, means such "use" of information or data (including metadata) in information/data importing systems which is consistent with the purposes of the system in which the information/data was created. In the case of metadata, which represent the formal and content features of a bibliographic object, this means that their interpretations should be consistent. By this we mean that the metadata created by the indexer (human) in one information system and then exported to another system, will be processed in the importing system in a manner consistent with the goals and intentions of the creator of the metadata.

The definition by Arlene Taylor and Daniel Joudrey, presented above, compares the interaction with system compatibility. There is also a distinction in literature between interoperability and system compatibility (Pacek, 2010, p. 84). Compatibility in information technology is understood as the ability of computer hardware and software to function as a coherent whole. In this sense, compatibility is achieved through the interaction of all system components, so interoperability is a way to achieve compatibility. Harmonization of metadata is another phenomenon associated with collaboration (Nilsson, 2010, p. 14). This process allows information systems to work together when multiple metadata schemas are used. In this case, metadata created in different systems and standards is processed in every cooperating IT system. Processed metadata ensures correct operation of the systems in the sense of achieving their planned functionality. Such harmonization can be regarded as a kind of cooperation at the metadata level, which will be discussed later in the article.

Applying the definition of interoperability of information systems, presented earlier, to metadata problems, allows the following definition of metadata cooperation to be presented:

> Metadata interaction is the ability of two or more systems or their components to exchange descriptive data about objects (bibliographic and other) and to interpret descriptive data that has been exchanged in a manner consistent with the interpretation of the data creator (Nilsson, 2010, p. 13).

The most important element of the presented definition is the exchange of information or data, while the use of exchanged data should be in line with the intentions of the creators of the system in which the data was created. In the case of metadata, there is a requirement for consistency in the interpretation of data as a description of various types of objects. This means that the metadata created by the librarian in one system and then transferred to another will be processed in the other system in a manner consistent with the intentions of the metadata creator.

The ability of metadata to cooperate is treated as one of the most important features enabling their usage, in addition to simplicity, modularity, reusability and expansion (Zeng & Qin, 2008, p. 268). These features should be the basic determinants of the design and implementation of metadata systems and projects. The IFLA publication (2005) emphasizes the role of collaboration in both, traditional and electronic systems, and the use of standards to achieve interoperability. In fact, the vast majority of standards used in connection with the creation and use of metadata in one way or another serve to achieve their interoperability.

Interoperability of metadata can be assured in many ways, at all stages of their creation and application, using many tools. Figure 1 shows the tools used to achieve metadata interoperability before creation (Chan & Zeng, 2006) and after the metadata record (catalog record) has been created (Zeng & Chan, 2006). Linked Data tools, as highlighted in blue, will be discussed later in the article. As can be seen in the figure, in both stages of the metadata application it is possible to use appropriate methods of achieving interoperability. These methods have also been used for many years in Polish librarianship. To ensure interoperability, co-cataloging (within Nukat) takes place before the record is created, which means the use of common, pre-prepared standards, cataloging rules and regulations, used by all collaborating libraries. The common authority file system is also significant, including a common system of material analysis.

When the need for interoperability of metadata appears after they are created, other methods of providing it are used, such as conversion from one format to another or the use of standard protocols such as Z39.50 and OAI-PMH (Open Archives Initiative Protocol for Metadata Harvesting). The latter method is also used in Polish information systems; Z39.50 is the basis for the functioning of the KARO catalog, while OAI-PMH will probably be used in the OMNIS system.

Support for collaboration, both before and after the creation of metadata, has its advantages in specific situations of the information environment, so one method cannot be seen as universally optimum. There is no way to ensure one hundred percent of interoperability. Usually there are smaller or larger losses in the semantics of interacting metadata.

Table 1. Metadata interoperability tools

<table>
<tr><th colspan="7">Interoperability of metadata</th></tr>
<tr><th colspan="3">Before creating the record</th><th colspan="4">After creating the record</th></tr>
<tr><td>Unification</td><td colspan="2">Cooperation of schemas</td><td colspan="2">Cooperation of records</td><td colspan="2">Cooperation of repositories</td></tr>
<tr><td rowspan="3">Common standard:
E.g. MARC, Dublin Core, MODS</td><td>Derivation:
MODS based on MARC, DC extension</td><td>Application profiles:
DC-Library AP, DC-Government AP</td><td rowspan="3">Conversion:
E.g. from MARC to DC, from DC to MODS.
When converting from a richer scheme to the poor, data is lost</td><td rowspan="3">Linked Data:
Allows multiple use of data and decentralized integration, e.g. METS, RDF</td><td rowspan="3">Exchange protocols:
E.g. Z39.50, OAI-PMH</td><td rowspan="3">Aggregation:
Combining multiple resources to enrich metadata</td></tr>
<tr><td>Transition tables:
Mapping elements of one schema to elements of another schema</td><td>Switch diagrams:
Mapping between many schemes at the same time</td></tr>
<tr><td>Parent structure:
E.g. ADN, OAIS</td><td>Registry of metadata:
E.g. UKOLN, OMR, LOV</td></tr>
<tr><td>Not practical in a heterogeneous environment</td><td colspan="3">Lossy conversion bringing metadata to the lowest common denominator: loss of data semantics instead of its enrichment</td><td colspan="3">Modular solutions integrating different standards into one structure: metadata in different standards for different resources can be combined</td></tr>
</table>

Based on: http://commons.wikimedia.org/wiki/File:Metadata-interoperability.png

New methods to ensure metadata interoperability

As Karen Coyle writes, libraries, along with other similar organizations, have always been innovative institutions in the field of information organization. However, in the 20th and early 21st centuries, library technologies are a secondary implementation of technologies previously used elsewhere for non-library organization of information. From around the 1980s, library catalogs went beyond the walls of these institutions: as OPAC, they were initially made available at terminals in local networks, and later in global networks. Since then, OPAC has gained many new features, such as integrated search (central catalogs), Web 2.0 related characteristics (OPAC 2.0) and the inclusion of metadata for information genres previously absent from catalogs, e.g. magazine articles. Despite these changes, used information technology remained unchanged, the library systems were based on the use of relational databases with structures designed in the 1960s. (Coyle, 2017).

Information technology has evolved enormously since the first OPAC appeared. There were changes that were only superficially considered in library information systems and in their OPAC. After the appearance of XML (Extensible Markup Language), a version of the MARC format was prepared in this language, but it was only a change in metadata synthesis, the format (semantics) and the data model remained unchanged. This even resulted in claims about the end ("death") of the MARC format (Tennant, 2002, p. 26), which was one of the reasons for the development of work on new formats, such as Dublin Core. These claims were premature because they did not consider that metadata are the greatest wealth of the library information system, its most valuable part. So, it is impossible to give up millions of MARC records created overnight. Information technologies are changing and metadata remains. However, this does not change the fact that they should also be adapted to the possibilities of new technologies, hence the problem of cooperation is so important.

According to Heather Moulaison Sandy, the working environment of cataloging librarians has become larger and more complicated since 2000 by the increase in the number of standards for working with electronic objects, with the standards themselves being increasingly available in electronic form (Sandy, 2019, p. 384). There is a possibility to point to entire sets of standards and tools for specialized activities which a modern librarian must know and use. Many of them were created and used internationally. The technologies of NoSQL database, cloud computing and Linked Open Data, described briefly below, are examples of standards developed outside libraries that penetrate library applications. Each of them requires the use of many tools previously unknown to librarians (e.g. editors, programming tools) and standards, which requires acquiring new skills.

One of the elements of the new IT environment are non-relational databases. "NoSQL". This abbreviation is used to indicate the difference in new technologies in relation to the query language SQL (Structured Query Language), treated as a symbol of the peak achievements in the field of relational databases. It is also translated as "not only SQL", which indicates the symbiosis of relational and other databases in the area of information retrieval. NoSQL databases are associated with the phenomenon of so-called big data, although data sets organized using SQL-typical relationships also function there. We can also talk about "big metadata" – metadata is also data, which, however, differs in many features from the metadata collected in libraries. Big data metadata can be collected on schedule, just like in a typical library, but can also be collected passively "just in case". Often, the alternative options for their subsequent use are not yet known, but the low cost of obtaining and collecting data provides economic justification for doing so; it is reasonable to assume that the data will find some (currently unknown) use in the future. The phenomenon of collecting data on everything "just in case" is sometimes referred to as "datafication". Until recently, the usefulness of data ended when the purpose for which it was collected was achieved. Currently collected data can still be a raw material for business (including production), public administration and science.

Big Data is a very large amount of data, the processing of which requires the use of new technologies and architectures so that it is possible to extract the values flowing from these data through data collection and analysis processes (Katal & Wazid & Goudar, 2013, p. 405). Due to the mass of data, it is necessary to use new analytical techniques. Big Data is a term used for such data sets, which at the same time are characterized by large volume, diversity, streaming in real time, variability, complexity, as well as require the use of innovative technologies, tools and IT methods to extract new and useful knowledge from them. The analysis of big data sets differs from the usual statistical analysis in that we examine data correlations rather than cause-and-effect relations. Analyzes are performed on the entire data set, instead of precise determination and analysis of a representative sample. These analyzes are mainly used to search for real-time data patterns in a poorly ordered (structured) set, often called a "data lake" (as opposed to strictly structured SQL relational databases).

Libraries are one of those places where we find mass data, millions of records regarding information objects, their users and the transactions they make. Library metadata from typical data in big data differ in their strict structuring. Another difference is that big data methods relate to correlations in a data set, not individual objects such as books, sentences and words. Correlations include sophisticated objects in their contextual environment, along with the relationships they enter in that environment. Thanks to the accounts recorded in OPAC and AUTHORITY FAIL, it can be argued that OPAC contains a phenomenological description of the surroundings of the described object created in order to reach the representation of the interior (content) of this object (Krajewski, 2017, p. 227).

OPAC can be used as a big data tool in two ways. First, it counteracts information overload thanks to content structuring and information localization and retrieval functions. Secondly, it contains new information created by librarians specifically to organize various objects using common elements of their content taken from notes, abstracts and other paratexts. Metadata, treated as big data, used to determine the correlation between information objects, statistics of their sharing, citing, (co) occurrence of words, allow you to easily determine the frequency of searching for each object, indicating those parts of the text that are most read (or marked, as in Amazon Kindle), determining the similarity of the texts. This information, in turn, can lead to the use of OPAC in a new role – a consultant proposing a new reading based on the correlation algorithm between behaviors on subsequent pages (screens) of the text, mouse movements, time spent reading. This again allows you to create correlations between those objects that have been used (not necessarily read) and the entire big data set at OPAC, or rather a global network of cooperating OPACs: the global central catalog.

Cloud applications are another information technology that is the future of information systems. The development of computer networks, an increase in their speed, bandwidth and reliability, has become a premise for local – distributed data sets to work better together. It caused that it became reasonable to transfer local library servers together with software (including OPAC) to specialized companies that care for their trouble-free operation, of course for an appropriate fee. Librarians, like other users, have access to the cloud library system via the Internet. As Aleksander Radwański writes (2015, p. 33), placing information systems in the cloud not only allows the most widely understood users to communicate with them, but also the systems themselves (their algorithms) with each other, which creates a new quality in the functioning of these systems.

The widespread use of this technology allows OPAC to obtain new functionalities for the library. The user should be able to receive the material he needs, knowing any of its features (metadata), including the image of the cover, e.g. photographed. After finding the information object you need, it should be directed to the nearest place where the object is available (printed version) or directly to the electronic version (if it exists). Also, opening a reading account (valid in all libraries in the cloud) should not be more difficult than in any web application that can be accessed through a Google or Facebook account. Thanks to these functions, the user can reach the object of interest in the fastest possible way in the most useful, accessible form. It is also worth noting that such a cloud library would be a source of data (big data) for many different analyzes and building correlations.

The universal cloud service designed this way reveals the need for interoperability of library systems not only with each other, but also with other information systems created in other environments. Such cooperation could, for example, combine geolocation data with copy availability data (where is the library where the copy of the book you are looking for is available?). To achieve this effect, it is necessary to be able to access all library data (bibliographic record, copy, authority record) without the need to use the information system interface. Information should also be available on all relationships in the metadata set, e.g. links between the authority record and bibliographic records, or copy records and user records. This makes it possible to search by all elements of the description and other metadata and any combination thereof, not only those that were designed by the creator of the library system interface for a standard local user.

To achieve the described goals, library systems must become mutually open systems. Then it can be expected that from a functional point of view they will work as one system. This can be achieved in two ways:

- the use of one common commercial system in which individual libraries can act as integrated parts of a larger whole. This is how new types of systems work, the so-called Library Services Platform, such as the WorldShare Management Services OCLC system, enabling the unification of procedures for managing all information objects (printed and electronic). In this cloud application, the resource of each local library and resource records are combined with the WorldCat World Central Catalog record. Alma works similarly, but only within libraries with this system (the central directory is created for libraries using Alma),
- the use of interoperable open systems (Open Source), for which there are no licensing problems hindering full cooperation (issues remain with technical aspect and user attitude).

Cloud-based applications of commercial systems tend to close metadata and relationships between them in a local data cloud, which is somewhat reminiscent of new housing estates built in our cities, carefully separated from similar, neighboring settlements. Doing so gives a false sense of security while not improving the interoperability of systems and their metadata, just as fences do not facilitate neighborly integration.

The technology that fundamentally changes this situation is Linked Open Data (LOD), associated with work on the Semantic Web (Nahotko, 2014, p. 5). In particular, it concerns the use of RDF (Resource Description Framework) and the results of work on metadata modeling with its use (Dunsire, 2012, p. 4). Linked Data is intended to create data on all objects, not only bibliographic, but also for example people, organizations, processes and concepts. This is data created and published in such a way as to enable connections between data sets and dictionaries. The latter are understood more broadly than it was previously adopted in librarianship, since the name covers both dictionaries used at the pragmatics level, containing metadata values, also called controlled dictionaries (authority files, information language dictionaries, lists of language names, geographical names, etc.), as well as sets of concepts used at the semantic level, previously called formats or diagrams (lists of metadata elements, fields and sub-fields of metadata formats with their definitions). In this way, both semantic and pragmatic metadata dictionaries, coded using standard coding languages, are sent to the cloud of data, and therefore available for direct computer processing. Each element of the dictionary is uniquely identified by means of an identifier; URI (Uniform Resource Identifier) is generally used because of its openness.

The relationships between identified elements (for bibliographic data: works, materializations, copies, people, institutions, places, content elements, etc.) are described using languages such as RDF and OWL (Web Ontology Language), whose expressions can be processed directly through computers. These relations allow navigation between data contained in sources published on the Web, which causes their integration facilitating technical cooperation at the level of syntax. Organizational (legal) cooperation is obtained by opening data. Data openness is not necessary to achieve technical interoperability but enables the full effectiveness of the technologies used.

From the point of view of the interoperability of metadata created in this environment, it is important to separate semantics from metadata syntax. In Linked (meta) Data, the meaning of metadata (semantics) is separated from their syntax, so that changing structures does not modify the meaning. The only seeming difference is the replacement of some standards with others. In fact, the new standards have one, but very important new feature – both semantics and pragmatics are coded using the same syntax (mainly XML / RDF, although there are other serializations), and what's more, it is a syntax that allows automatic processing data (thanks to its "understanding" by computers), without human intervention. Currently, all large, universal classifications are available in the Linked Data version using SKOS (Simple Knowledge Organization System). Former metadata schemas are still in use (including MARC 21 field and subfield structure), but these structures are encoded in RDFS (RDF Schema) or OWL (syntax has changed), which can become ontologies placed in the data cloud. To each classification symbol and to each relationship expressed by the MARC structure (and thus to the label of each field of this format) and between these symbols and labels, a qualified link can be drawn, i.e. one that identifies and names the relationship between the connected elements.

The metadata environment organized in this way enables two types of metadata interaction. The first way to ensure interoperability is related to the existence of dictionaries of the two types described, useful especially when we want to combine data from various areas (fields of knowledge, practical applications). The Web user can view his resources without the need for knowledge of constantly changing technologies and the resulting structures that form the basis of the Web. When browsing, boundaries between resources are freely crossed, regardless of their physical distance. In the same way, you can browse data sets in Linked Data by following links from one resource to another, even when they are physically placed in different places and saved in different formats (Bermes, 2011).

The resources of the linked data are also the contents of dictionaries of the two types mentioned above. They enable cooperation because they act as a switch center, placed in a data cloud, combining data expressed according to various data semantics. Such a center enables Linked Data to navigate from one set of metadata to another, by following links, i.e. URIs, even if the data connected to the center is heterogeneous. Imagine, for example, that there are two metadata resources, which structures include UDC symbols. Regardless of where in the various metadata structures (fields, elements) these symbols are placed, they refer using URI to UDC ontology, made in SKOS and available on the Internet. Thanks to this, firstly, the meaning (semantics) of the data is unified, and secondly, it is possible to search for similar data by simply following the URI references. This method allows to avoid heterogeneity of semantics due to ontological agreement (Heath & Bizer, 2011, p. 24).

Linked Data is a distributed system. There is no single main data center, but any number of such centers connected with links. Any resource shared in this technology can function as a switching center in Linked Data. Finding information may involve following from one data center to another center following links which connect data that is there. The advantage of this is that the process is done intuitively. This is the second method of ensuring metadata interaction, called "following your own nose". All linked resources built using RDF and URI standards are a global information graph, available for unlimited manual browsing by users (people) and automatic scanning by applications following URI links. These links describe the relationships that characterize each element of the data it enters with other elements. A data element identifying a person can, for example, be characterized by objects, places, other people, etc. attached to it, using links indicating the relationship with being an author, employee, place of birth or stay, father / mother, resident, fan and any other. This form of activity is sometimes graphically called "toURIsm" (from tourism).

Linked Data is still an intention remaining in the sphere of ideas rather than running applications, although the work to create new standards gives the first positive results. In the near future, the described solutions may become the basis for the creation of library software providers of new generation integrated library systems (Wilson, 2012, p. 110). Integration is understood here differently or not just as it has been in integrated library systems, as an integration of software modules and processes implemented within the library system. In new systems, integration is to consist in close interaction of the library system with the outside world, which may be a condition for the survival and further development of these systems. According to Marshall Breeding (2012, p. 14), these types of systems will soon create most of the metadata as an LOD resource, resulting in a snowball effect. Every success achieved in the practical application of Linked Data technology will cause further progress in the development of libraries and users' access to linked metadata and information resources. The openness of technology and resources may reduce the dependence on commercial solutions, which is already observed to some extent (Nahotko, 2014, p. 18).

Thanks to LOD technology, libraries gain such opportunities as:

- sharing own data as LOD for other information systems, not only, and not even primarily library,
- downloading and using LOD from other external resources of all kinds to enrich their own data,
- using LOD to create a completely new Web Infrastructure, independent of existing suppliers, as a basis for creating metadata, which is the goal of the BIBFRAME (Bibliographic Framework Initiative) project.

These goals simply and directly lead to the creation of an environment in which cooperation at all levels of information systems will be ensured.

Conclusion

The article presents the technological aspects of OPAC development, including central catalogs. This is a very important issue, because library catalogs have always functioned thanks to the use of currently innovative technologies, ranging from clay tablets and papyrus rolls to the latest electronic technologies. However, there is an additional aspect of information system design that is not of a technical nature. They are users of information systems – people (as opposed to users – computer programs). The needs of users should be the main factor in the implementation of information technologies and a determinant of the construction of standards such as the FRBR (Functional Requirements for Bibliographic Records) model and RDA (Resource Description and Access) cataloging principles that bring libraries closer to LOD. Even though the needs and tasks of the user have been discussed since the time of Panizzi and Cutter, through the Paris Principles up to FRBR, this problem has not been finally resolved. If the integrated information systems would work as presented in the article, then their functionality cannot end with providing the requested information objects. On the contrary, it is only on this basis that further information resource exploration services should be built.

The use of new technologies means that OPAC, including central catalogs, become part of the universal information environment of global computer networks. From this, however, it follows that instead of (or maybe next to) traditional care for the quality of metadata that are the result of intellectual work, librarians must also care for their interaction with structures used in other environments. An example of this care is efforts to ensure interoperability of standards such as ONIX (book industry) and MARC (Mitchell, 2013, p. 299). It is even more desirable that our users, whose needs were just mentioned in the article, function in these other environments (Facebook, YouTube, Instagram, Amazon...), spending much more time there than in the library. Using the frequently cited analogy, we should break down the wall around the manicured rebates of our OPAC, opening them to the action of people outside this wall, even if we expose the rebates to trampling while providing much more extensive information services than before.

This means that the features of OPAC should predispose it to function less as an inventory, constituting an inventory of the institution's assets, and more as an information system – a bibliography, and maybe even an internet search engine, offering users everything that meets their information needs, regardless of where they are found requested materials, in what form (printed, electronic) and in what ways of access. Therefore, it turns out that our OPAC will face further changes, and the only thing that can be considered unchanging in this respect is the constant need to create new solutions.

Bibliography

Bermes, E. (2011). Convergence and interoperability: a Linked Data perspective. In: *World Library and Information Congress: 77th IFLA General Conference and Assembly*. Puerto Rico, 13–18 August 2011. Accessed 28.05.2019, from: https://www.ifla.org/past-wlic/2011/149-bermes-en.pdf

Breeding, M. (2012). Current and future trends in information technologies for information units. *El profesional de la información, 21*, 9–15.

Carney, D.J., Smith, J. & Place, P.R. (2005). *Topics in interoperability: infrastructure replacement in a system of systems. Report nr CMU/SEI2005-TN-031*. Pitsburgh: Carnegie Mellon Univ.

Chan, L.M. & Zeng, M.L. (2006). Metadata interoperability and standardization – a study of methodology part I. Achieving interoperability at the schema level. *D-Lib Magazine, 12* (6). Accessed 25.05.2019, from: http://www.dlib.org/dlib/june06/chan/06chan.html

Coyle, K. (2017). *Creating the catalog, before and after FRBR*. Accessed 15.06.2019, from: http://kcolyle.net/mexico.html

Dunsire, G. et al. (2012). Linked Data vocabulary management: infrastructure support, data integration, and interoperability. *Information Standards Quarterly, 24*, 4–13.

Heath, T. & Bizer, Ch. (2011). *Linked Data. Evolving the Web into a Global Data Space.* San Rafael, CA: Morgan & Claypool Publ.

IFLA (2005). Sharing of bibliographic information and resources. Accessed 12.06.2019, from: http://archive.ifla.org/VII/d4/pub/InteroperabilityStandards.pdf

Katal, A., Wazid, M. & Goudar, R.H. (2013). Big data: issues, challenges and good practices. In: M. Parashar (Ed.), *Sixth International Conference on Contemporary Computing (IC3)*, Noida, India 8–10 Aug. 2013 (pp. 404–409). Piscataway, NJ: IEEE.

Kienzler, I. (2003). *Słownik terminologii komputerowej angielsko-polski i polsko-angielski*. Gdynia: IVAX.

Krajewski, M. (2017). Tell data from meta: tracing the origins of big data, bibliometrics, and the OPAC. *OSIRIS, 32* (1), 224–240.

Manso-Callejo, M., Wachowicz, M. & Bernabé-Poveda, M-A. (2009). Automatic metadata creation for supporting interoperability levels of spatial data infrastructure. Accessed 12.05.2019, from: http://www.gsdi.org/gsdiconf/gsdi11/papers/pdf/194.pdf

Mitchell, E. (2013). Programmatic tools and the implications of automation in the next generation of metadata. *Technical Services Quarterly*, *30*, 296–310.

Nahotko, M. (2013). Współdziałanie metadanych w systemach informacyjnych. *Zagadnienia Informacji Naukowej*, *1*, 61–83.

Nahotko, M. (2014). Współdziałanie metadanych w chmurze. *Przegląd Biblioteczny*, *1*, 3–24.

Nilsson, M. (2010). *From interoperability to harmonization in metadata standardization*. Stockholm: KTH School of Computer Science and Communication.

NISO (2004). *Understanding metadata*. Bethesda: NISO Press.

Pacek, J. (2010). *Bibliografia w zmieniającym się środowisku informacyjnym*. Warszawa: Wydawnictwo SBP.

Radwański, A. (2015). System biblioteczny jako powszechna usługa sieciowa i baza danych. In: M. Odlaniecka-Poczobutt (Ed.), *Systemy biblioteczne nowej generacji. Platformy usług* (pp. 31–38). Gliwice: TYPO Usługi Wydawnicze.

Sandy, H.M. (2019). Explaining cataloging to a six year old? *Technical Services Quarterly*, *36*, 379–390.

Su, S-F. (1994). Dialogue with an OPAC: how visionary was Swanson in 1964? *The Library Quarterly*, *64*, 130–161.

Subieta, K. (1999). *Słownik terminów z zakresu obiektowości*. Warszawa: Akademicka Oficyna Wydawnicza PLJ.

Taylor, A. & Joudrey, D. (2008). *The Organization of information*. Westport: Libraries Unlimited.

Tennant, R. (2002). MARC must die. *Library Journal, October 15*, 26–28.

Wilson, K. (2012). Introducing the next generation of library management systems. *Serials Review*, *38*, 110–123.

Zeng, M.L. & Chan, L.M. (2006). Metadata interoperability and standardization – a study of methodology part II. Achieving interoperability at the record and repository levels. *D-Lib Magazine, 12*. Accessed 5.06.2019, from: http://www.dlib.org/dlib/june06/zeng/06zeng.html

Zeng, M.L. & Qin, J. (2008). *Metadata*. New York: Neal-Schuman Publ.

The text is a translation of the article:
Nahotko, M. (2019). Czy (centralne) katalogi biblioteczne są jeszcze potrzebne? OPAC w infotopii. *Acta Universitatis Lodziensis. Folia Librorum, 2*(29), 43–59.
DOI: http://dx.doi.org/10.18778/0860-7435.29.03