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# THE VIRTUAL INTERNATIONAL AUTHORITY FILE - VIAF AND AGGREGATION OF VALUES BY AUTHORITY METADATA

O VIRTUAL INTERNATIONAL AUTHORITY FILE – VIAF E A AGREGAÇÃO DE VALORES POR METADADOS DE AUTORIDADE

EL VIRTUAL INTERNATIONAL AUTHORITY FILE – VIAF Y LA AGREGACIÓN DE VALORES AUTORIDAD PARA METADATOS

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**JITA:** IE. Data and metadata structures.

**RESUMO:** O Virtual International Authority File (VIAF) é um consórcio de cooperação internacional entre agências e bibliotecas nacionais em diversas localidades do mundo, por meio do qual tem sido estabelecida a agregação de vocabulários de valor e disponibilização de arquivos de autoridade publicados em Linked Open Data. O consórcio foi idealizado a partir de fundamentos, conceitos e tecnologias estabelecidos na catalogação que, diante de limitações tecnológicas, têm sido convertidos a partir das recomendações do World Wide Web Consortium para a publicação de dados vinculados, o que proporciona infraestrutura para o intercâmbio, o compartilhamento e a vinculação de dados de autoridade na Web de dados, além da construção de vocabulários de valor de alto nível. Este estudo tem por objetivo apresentar os fundamentos, os conceitos e as tecnologias envolvidas no desenvolvimento do VIAF. O estudo, realizado por meio de pesquisa bibliográfica e documental, apresenta como resultados a relação entre os conceitos de controle de autoridade, controle de bibliográfico, Linked Data, Linked Open Data, entre outros, com a infraestrutura estabelecida no VIAF, assim como a contribuição do consórcio na unificação de variações nacionais nas descrições de valor, por meio da formação de clusters que proporcionam controle terminológico de valores que contemplam diversidade linguística e cultural. Conclui-se que o VIAF representa uma iniciativa democrática de cooperação em nível internacional e que pode ser utilizado tanto como uma fonte confiável de arquivos de autoridade para instituições bibliotecárias, quanto para as comunidades da Web de dados.

**PALABRAS CHAVE:** Virtual International Authority File – VIAF. Controle de autoridade. Metadado. Vocabulários de valor. Catalogação.

**ABSTRACT:** The Virtual International Authority File (VIAF) is an international cooperation consortium, which has established cooperation between national bibliographic agencies and libraries in several parts of the world and has added value and availability of authority files in Linked Open Data. The consortium was designed based on bases, concepts and technologies established in cataloging, which due to technological limitations, have been converted through World Wide Web Consortium recommendations to publish linked data. It provides infrastructure for the exchange and sharing of authority data in Web of data, in addition to the construction of value vocabularies of high level. This study aims to present and describe the bases, concepts and technologies involved in the development of VIAF. The study was accomplished through of literature documentary and shows, as a result, the relationship between concepts of authority control, bibliographic control, linked data, among others, with the established infrastructure in VIAF. Furthermore, it shows the contributions of the consortium to the unification of the national variations in descriptions of value, through cluster formation, which provides terminological control in the values that include linguistic and cultural diversity. In conclusion, the VIAF is a democratic initiative of international cooperation and can be used as a reliable source of authority files for librarian institutions, as well as to the Linked Data community.

**KEYWORDS:** Virtual International Authority File – VIAF. Control authority. Metadata. Vocabularies value. Cataloging.

**RESUMEN:** El Virtual International Authority File (VIAF) es un consorcio de cooperación internacional, entre agencias y bibliotecas nacionales en diversas localidades del mundo, a través del cual ha sido establecida la agregación de vocabularios de valor y la disponibilidad de archivos de autoridad publicados en Linked Open Data. El consorcio fue idealizado desde fundamentos, conceptos y tecnologías establecidos en la catalogación que, delante de limitaciones tecnológicas, han sido convertidos a través de recomendaciones del World Wide Web Consortium para la publicación de datos vinculados, lo que proporciona infraestructura para el intercambio, y la vinculación de datos de autoridad en la Web de datos, además de la construcción de vocabularios de valor de alto nivel. Este estudio tiene como objetivo presentar los fundamentos, los conceptos y las tecnologías involucradas en el desarrollo de VIAF. El estudio, realizado por medio de investigación bibliográfica y documental, presenta como resultados la relación entre los conceptos de control de autoridad, control bibliográfico, Linked Data, Linked Open Data (datos vinculados), entre otros, con la infraestructura establecida en VIAF, así como la contribución del consorcio en la unificación de las variaciones nacionales en las descripciones de valor, por medio de la formación de clúster que proporciona control terminológico de valores que incluyen la diversidad lingüística y cultural. En conclusión, VIAF representa una iniciativa democrática de cooperación a nivel internacional y que se puede utilizar tanto como una fuente confiable de archivos de autoridad para las instituciones bibliotecarias, como para las comunidades de la Web de datos..

**PALABRAS CLAVE:** Virtual International Authority File – VIAF. Control de autoridades. Metadato. Vocabularios de valor. Catalogación.

## INTRODUCTION

Virtual International Authority File (VIAF) is an international cooperation consortium established between national libraries and agencies that contribute mutually to provide authority files in international range. Launched as a project in 1998, the consortium was formalized in 2003 among Library of Congress (LC), Deutsche Nationalbibliothek (DNB) institutions and the Online Computer Library Center (OCLC) (ONLINE COMPUTER LIBRARY CENTER, 2015). From 2012, VIAF started to be offered by OCLC.

The authority data files are available in the Linked Open Data project, and the data sets released by VIAF are regarded as authority data sets with greater value in the data cloud (PASTOR SANCHEZ; MARTINEZ MENDEZ; RODRIGUES MUNOZ, 2012). In Linked Open Data project, set up in 2007, the international community has gathered efforts to release open data linked in the data Web because the effective operation of the concept established for the Semantic Web requires the backup of a huge amount of data structured in a standard and relatable format (WORLD WIDE WEB CONSORTIUM, 2014).

The infrastructure set in VIAF for data sharing and cooperation is in accordance with the Universal Bibliographic Control (UBC) idealized by the International Federation of Library Associations and Institutions (IFLA) and adopted by the United Nations Educational, Scientific and Cultural Organization (UNESCO) during the 70's. UBC Project was developed between 1970 and 1990 and aimed at promoting the sharing and exchange of bibliographic and authority registers in order to organize the production of bibliographic and quality control data in a universal scale, through shared responsibility, which brings benefits in relation to the reworking and elaboration of registers (ANGJELI; MAC EWAN; BOULET, 2014).

The Universal Bibliographic Control Project follows two rules: 1) each country is responsible for the bibliographic control of its publication; 2) each country is responsible for elaborating and making available to other countries the bibliographic and authority registers of these publications (TILLET, 2000).

The technological advances developed and implanted in libraries during 1980 and 1990 contributed not only to improve the cataloguing process in the automatized range but also to develop the bibliographic networks. Therefore, it is possible to notice “[...] the effort of the Library Science towards the improvement in accessing the worldwide bibliographic production and the representation by the development of information networks, resulting from the application of computer science to the process of bibliographic organization” (CAMPELLO, 2006, p. 2).

In this context, Information Science is responsible for investigating information properties and behavior involving the origin, collection, organization, storage, recovery,

interpretation, transmission, transformation and use of information (BORKO, 1968) and, by means of cataloguing, Information Science mediates the user's need for information and the documents.

Among the descriptions elaborated by the cataloguing process, the focus of this paper is the authority control, which was a fundamental subject during the 80's, when libraries started to automatize their catalogues aiming at sharing and exchanging data. The authority control is performed from the authority work, which comprises: 1) compilation, register and maintenance of authority data; 2) data verification; and 3) the use of established and authorized ways to access the library catalogue (JIMENES PELAYO; GARCIA BLANCO, 2002). This set of actions promotes consistency and establishes relation among names, books and themes (TAYLOR, 2006).

The authority work can be performed individually or cooperatively. According to Burke and Shorten (2010), small libraries tend to perform the work locally, while big libraries are more likely to take part in cooperation networks and international consortium

In this scenario, metadata standards are considered essential tools to represent and access international resources (ALVES; SANTOS, 2013) and to make data exchange and sharing possible in cooperation networks and international consortium, mostly in a social and technological context in which the popularization of information and communication technologies have expressively increased the contents available and generated the necessity of integrating bibliographic and authority registers in the Web.

Metadata standards have influenced a new infrastructure perspective towards the exchange of bibliographic registers and universal bibliographic control, as well as the creation of conditions for bibliographic metadata to be used by other Web communities through Linked Open Data (LOD) project.

This new technological application environment reported a greater complexity about the principles of bibliographic and authority registers exchange because "A metadata pattern can present a good description scheme, but it can provide an unsatisfying representation if coding schemes are not used to unify data and values [...]" (ALVES; SANTOS, 2013, p. 126).

By means of describing data values from metadata elements, value vocabularies are set providing precision, consistency, coherence, completeness and more quality to the registers if compared to the description elaborated by lay users (WILLER; DUNSIREE, 2013).

In this context, the international community of cataloguers developed projects aiming at developing a service that covers aggregation of authority registers and harmonization of

cataloguing codes and metadata standards with the premise that “The access control of the future will account for differences within the same languages as well as for the need for different languages and scripts and will enable users to display the scrip and form of a heading that they expect” (TILLET, 2000, p. 168).

The international community has worked on the harmonization of representation patterns in web environments by means of converting bibliographic and authority registers in structure and description languages, such as eXtensible Markup Language (XML) and Resource Description Framework (RDF). Among the main initiatives, the International Federation of Library Associations and Institutions (IFLA) has worked on the publication of value vocabularies for the international patterns, codes and guidelines of cataloguing such as Resource Description and Access (RDA) and International Standard Bibliographic Description (ISBDs) guidelines, and the conceptual model Functional Requirements for Bibliographic Records (FRBR) and its extensions, which comprise FRBRer, FRBRoo, FRAD and FRASD. These vocabularies are available through the managing system Open Metadata Registry.<sup>1</sup>

For data conversion, the best practice recommendations Linked Data and Web Semantics Technologies are adopted. These recommendations consist in better practices defined by the international community World Wide Web Consortium (W3C) for the publication of data sets that include four principles: 1) Use URIs as names for the resources; 2) Use URIs HTTP as localization of these resources; 3) In order to improve information recovery, adopt patterns in the description and recovery of these resources such as RDF and SPARQL; and, 4) Set links among the URIs so that other resources can be recoverable (BERNERS LEE, 2006).

The authority files available in VIAF are established through the unification of values adopted in the description by each cooperative Institution, in order to build a set of values, which identifies and preserves linguistic and national variations. Value vocabularies are established in the representation of authority elements at international level through data clusters formation.

During cataloguing, principles, codes, guidelines and patterns are adopted, developed and improved according to international agreements and foundations. According to Silveira (2007, p. 11, our translation), “[...] the patterns and concepts should be shared and respected by all countries, since the universal bibliographic control depends on the global consensus about cataloguing”

This context highlights the services established by VIAF consortium, when it provides the cooperation, exchange and the authority file entailment at international level. This paper

<sup>1</sup> Fonte: <http://metadataregistry.org/>

is characterized as a qualitative study with exploratory intent performed through bibliographic survey and literature review, with the aim to present the concepts and foundations related to the development, maintenance and operation of VIAF consortium.

## AUTHORITY CONTROL IN CATALOGUING

During 1980, the technological evolution strengthened the catalogue automation. In this period, authority control became essential to cataloguing. The same can be seen through descriptive treatment of information as a process adopted to define access points, whereby the description of formal elements of the physical object is performed and presents as final product the bibliographic and authority register. (CATARINO; SOUZA, 2012).

Authority control is performed through authority work, which consists of establishing relations among different controlled access points identified in table 1, in order to unify access points and the proper association with its respective variation terms (PASCUAL, 1999).

**Table 1.** Typology of access points

Access points	
Not controlled	Controlled
<ul style="list-style-type: none"><li>• Own titles</li><li>• Key-words</li></ul>	<ul style="list-style-type: none"><li>• Names of people</li><li>• Names of entities</li><li>• Geographical Names</li><li>• Constant titles</li><li>• Series</li><li>• Materials</li></ul>

Source: Adapted from Sandín Enriquez (2011).

With the automation of the catalogue functions, cooperation networks were established for the bibliographic registers exchange according to Santos and Pereira (2014, p. 126, our translation)

The cooperation and sharing of catalog and bibliographic information among several institutions in the automatized environment became possible with the development and adoption of MARC, the format of data exchange developed and tested by LC, in the 1960's.

In this context, the services established by National Libraries and Agencies are featured towards the Universal Bibliographic Control (UBC), idealized by IFLA and adopted by UNESCO in 1970, which predicts the formation of an international control and bibliographic information exchange network. (MACHADO, 2003). However, its accomplishment requires a National Bibliographic Control, through which National Libraries and Agencies perform the compilation of national bibliographies and take measures for the legal deposit, as well as require the use of pattern sets, codes and international guidelines that

allow the registers exchange.

The interoperability can be defined as “The capacity of a hardware or software system to effectively communicate and work on data exchange with another system usually of a different type, projected and produced by a different provider” (SAYÃO; MARCONDES, 2008, p. 136, our translation). In relation to the interoperability and the matters mentioned earlier, there are multiple stages of the interoperability that need to be met. According to Sayão and Marcondes (2008) the stages of interoperability are: 1) Technical Interoperability – responsible for keeping the information systems interoperable; 2) Semantic Interoperability – comprises the adoption of similar tools or tools that have a correspondence in the information representation; 3) Political/Human Interoperability – it is related to the decision of promoting or not the access to informational resources; 4) Intercommunity Interoperability – it is bound to the necessities linked to the research, access to information which comes from different sources; 5) Legal Interoperability – relies on the legal aspects and their implications on the dissemination of informational resources; 6) International Interoperability – involves the communication complexity in an international scale in face of linguistics and cultural aspects. Metadata and metadata patterns are found in synthetic and semantic stages of interoperability.

## **INFRASTRUCTURE FOR VALUE VOCABULARY BUILDING**

According to Breitman (2006), there is not a universal definition for the metadata concept, and for Alves and Santos (2013) it represents a problem of discursive plurality of meaning. The reason is that different areas that work with information treatment and processing adopt the term.

In Information Science area, Alves (2010, p. 47, our translation) defines metadata as “data that describes other data in an information system with the aim at identifying an entity (informational resource) for its later recovery”. Metadata patterns, for their turn, specify the elements for resources description and are defined as “[...] description structures constituted by a predetermined set of metadata (coded attributes or identifiers of an entity) methodologically built and standardized” (ALVES, 2010, p. 47, our translation).

Metadata patterns are adopted in the elaboration of bibliographic registers with the specific purpose of register exchange, which requires the use of rich metadata format that, according to Alves (2005, p. 140, our translation) “[...] provides a complete and detailed representation of an informational resource”.

Rich metadata patterns are composed of descriptive metadata structure standard and content standard. Descriptive metadata structure patterns define sets of elements considered important to describe the resource, its repeatability and order, and the content patterns establish entry rules in a metadata field by the syntax (CARLOS; ZAFALON, 2013).

Willer and Dunsiree (2013) consider that the metadata schemes provide consistency and structure because they determine which aspects of a resource should be described and how data should be stored, while the cataloguing rules offer consistency and coherence to the metadata content.

Bibliographic and authority registers can be interoperable, since they are based on proper technologies. So, the International Federation of Library Associations and Institutions (IFLA) has worked so that metadata patterns adopted by libraries and institutions of the cultural heritage have infrastructure compatible to the Semantic Web technologies in which the study presented by Willer and Dunsiree (2013) talks about the difficulties found in establishing bibliographic metadata in RDF format. The main difficulty presented by Willer and Dunsiree (2013) involves technological and representational aspects presented by Alves and Santos (2013, p. 120, our translation), in a way that integration is established among:

Conceptual Modeling of the system, determination of functional requirements, mapping of essential elements, determination of the scheme description structure, determination of value spaces and determination of coding schemes for the standardization of value spaces.

The conceptual model Functional Requirements for Bibliographic Records (FRBR), translated to Portuguese as Requisitos Funcionais para Registros Bibliográficos, also developed by IFLA between 1992 and 1998, defines entities, attributes and the possible relationships between bibliographic and authority registers from the conceptual model Entity-Relationship (TILLET, 2007). Entities are identified in three groups:

Group 1: Work, expression, manifestation and item;

Group 2: People and organizations;

Group 3: Concept, object, event, place and entities from group 1

The new cataloguing code Resource Description and Access (RDA), which should replace the Anglo-American Cataloguing Rules (AACR2), provides instructions on how register data from the conceptual model Functional Requirements for Authority Data (FRAD) (SALGADO; SILVA, 2013, our translation), projected to

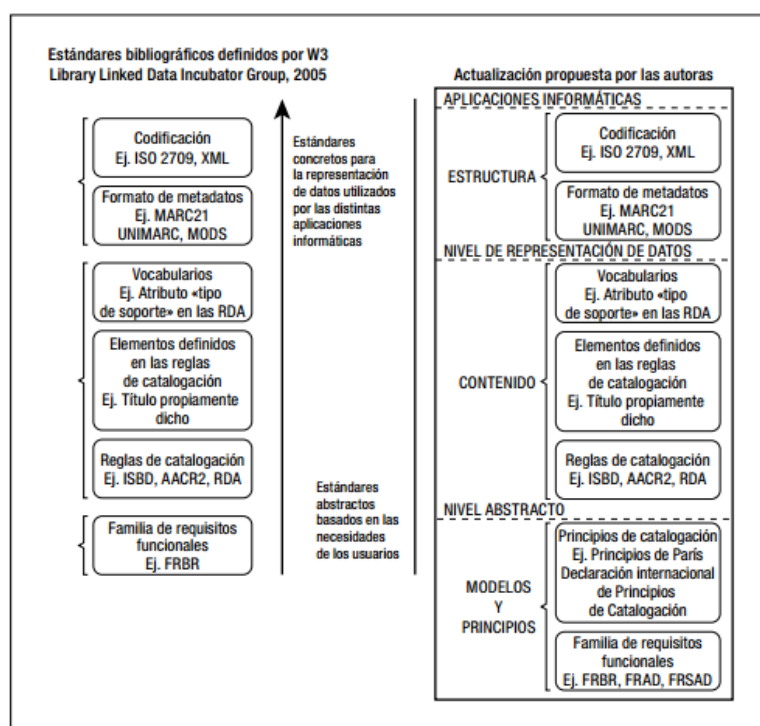
[...] create a reference framework clearly defined and structured, to relate authority register data to the users' needs for such data; as well as assist in the evaluation of the potential of international sharing of authority data, not restricted to the bibliographic universe (MEY; SILVEIRA 2009, p. 38).

One of the fundamental issues for the national and international bibliographic control is the authority control that establishes, from control access points, the identification of names of people, names of entities, geographic names, constant titles, series and materials, because according to the Declaration of Principles (INTERNATIONAL FEDERATION OF LIBRARY ASSOCIATIONS AND INSTITUTIONS, 2009) authority registers are adopted in



order to allow the control of authorized forms and variations in the identification of access points. This way, we can understand that authorized, variant and related forms of name should coexist through relationships that establish uniformity to the access, and the representation of access points should consider linguistic and cultural variations (INTERNATIONAL FEDERATION OF LIBRARY ASSOCIATIONS AND INSTITUTIONS, 2004).

As with the bibliographic control, the authority control is established through the common use of specific tools that provide structure, content, models and principles to the information system as illustrated in figure 1.



**Figure 1.** Patterns for the implementation of bibliographic control

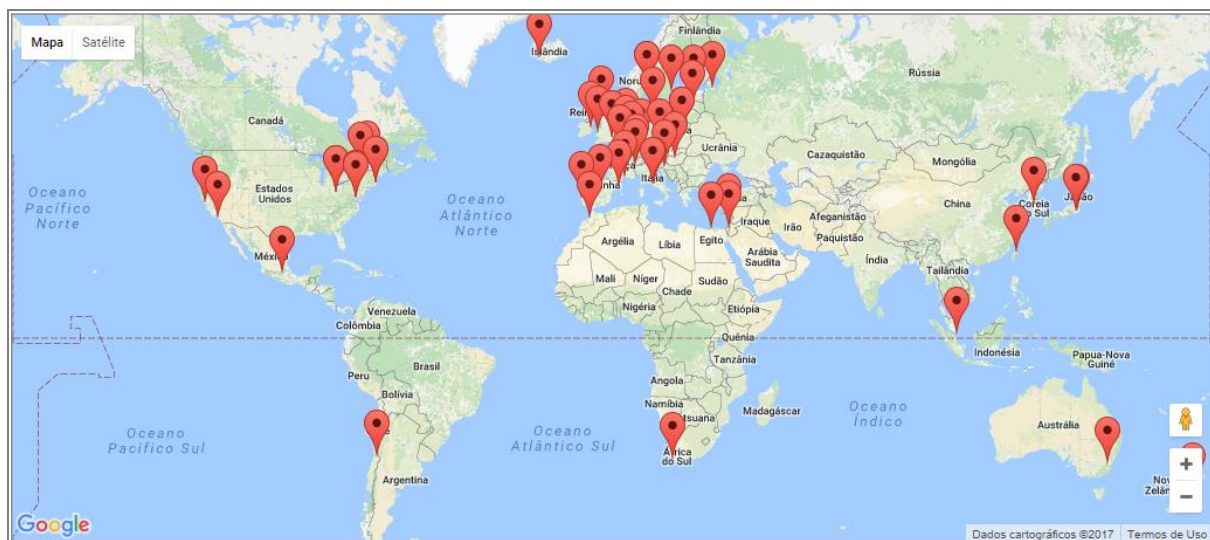
**Source:** Picco and Ortiz Repiso (2012, p. 149).

The infrastructure presented in the figure makes possible that the data exchange and sharing are performed consistently and are liable to be used and reused in the representation and recovery of information.

## INTERNATIONAL COOPERATION AND UNIFICATION OF VALUES BY CLUSTER IN VIAF

In VIAF, the international cooperation is set from the formation of registers by cluster, which identify national, linguistic and cultural variations in the form of value description, from the aggregation of authority elements that compose metadata patterns. .

Currently, VIAF counts on 46 cooperative national libraries and agencies located in different countries (VIRTUAL INTERNATIONAL AUTHORITY FILE, 2017) presented in figure 2.



**Figure 2.** Map of countries that participate in the VIAF consortium

Source: Virtual International Authority File (2017).

Since metadata is elaborated in National Libraries and Agencies sphere, the registers integrating VIAF consortium are structured from MARC exchange format for authority data. According to Isaac et al. (2011), registers of libraries consist of declarations about the books, in which each declaration is made of an entity element and its respective value, including patterns of descriptive metadata structure and content patterns. It also requires the use of value vocabularies.

Value vocabularies are adopted in the elaboration of metadata because they provide more consistency when describing the content of information recovery systems (NATIONAL INFORMATION STANDARDS ORGANIZATION, 2005). These vocabularies can be defined as a controlled list of values permitted to an element, providing terminological control during description (ISAAC et al., 2011).

The search interface of the system allows searches to be performed by fields named as follow:

- All fields;
- All titles;
- Corporative names;
- Geographic names;
- Personal names;
- Books;

- Expressions;
- Preferential titles;
- Bibliographic titles.

In VIAF, registers are grouped automatically through a comparison algorithm between national registers and the WorldCat base, based on FRBR (FARINOS, 2014). This grouping establishes the registers formation by cluster of authority elements, which contains the entities description and the variations with the identification of the country where the institution is from, where metadata was elaborated. For each register, metadata is presented by fields according to table 2.

**Table 2.** Metadata presentation fields adopted in VIAF

Field	Description
Preferred form	Presents the authorized entry adopted by each cooperative unity.
Form of alternative name	Identifies variations and alternative forms of description adopted by each cooperative unity.
Related name	Presents names related to authority register in the bibliographic register. Example: co-authors; affiliation institutions; among others.
Work	Identifies the types of resource represented in the bibliographic register related to the authority register.
Selected co-authors	Presents the co-authors names.
Country of publication	Presents the identification of the place of publication informed in the bibliographic register.
Publication Statistics	Presents the graphic representation of publication statistics.
Selected editors	Presents information about the editor.
About	Describes personal information by nationality and idiom, and presents external links.
Registers	Provides access to the registers in MARC record format; VIAF Cluster XML; RDFS; and, JSON.
ID history in VIAF	Presents registers added and excluded by each cooperative unity, with information about date and time.

Source: Adapted from Virtual International Authority File (2017).

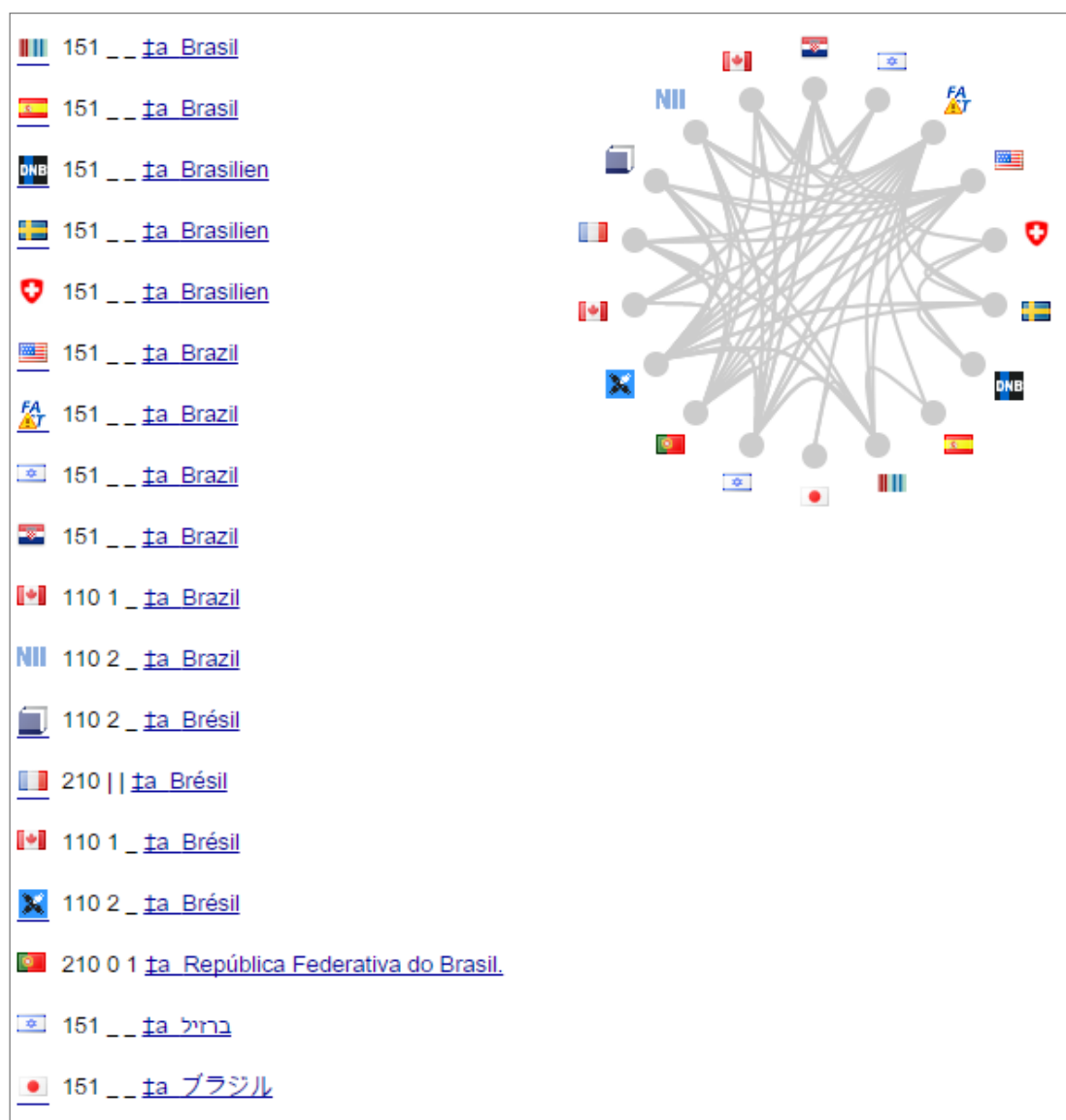
At each cluster generated by the system, a Uniform Resource Identifiers (URI) and a permanent link are attributed, offering more consistency and integrity to the registers presented in figure 3. According to Marcondes (2012), the URIs identify informational resources available in digital format and real resources, when they are not in digital format and are replaced by their representation.



**Figure 3.** Cluster VIAF for Geographic Name  
Source: Virtual International Authority File (2017).

The interface for registers consult provides files in MARC-21 record format, VIAF Cluster in XML, RDF record and Just Links in JSON, which establish syntactic and semantic relations in which the register of the files in RDF structure available in VIAF allows the authority MARC metadata elements to be mapped and interoperable with other patterns. The correspondence among different elements defined by different standards of metadata can be possible by conversion, as presented by Library of Congress (2008) and Chan and Zeng (2006) who describe methods to establish correspondence between elements in MARC 21 format and Dublin Core elements.

When aggregating the elements, the visualization of similarities and differences in authorized entry description format adopted by each cooperative unity is identified by the flag of the country, as presented in figure 4.

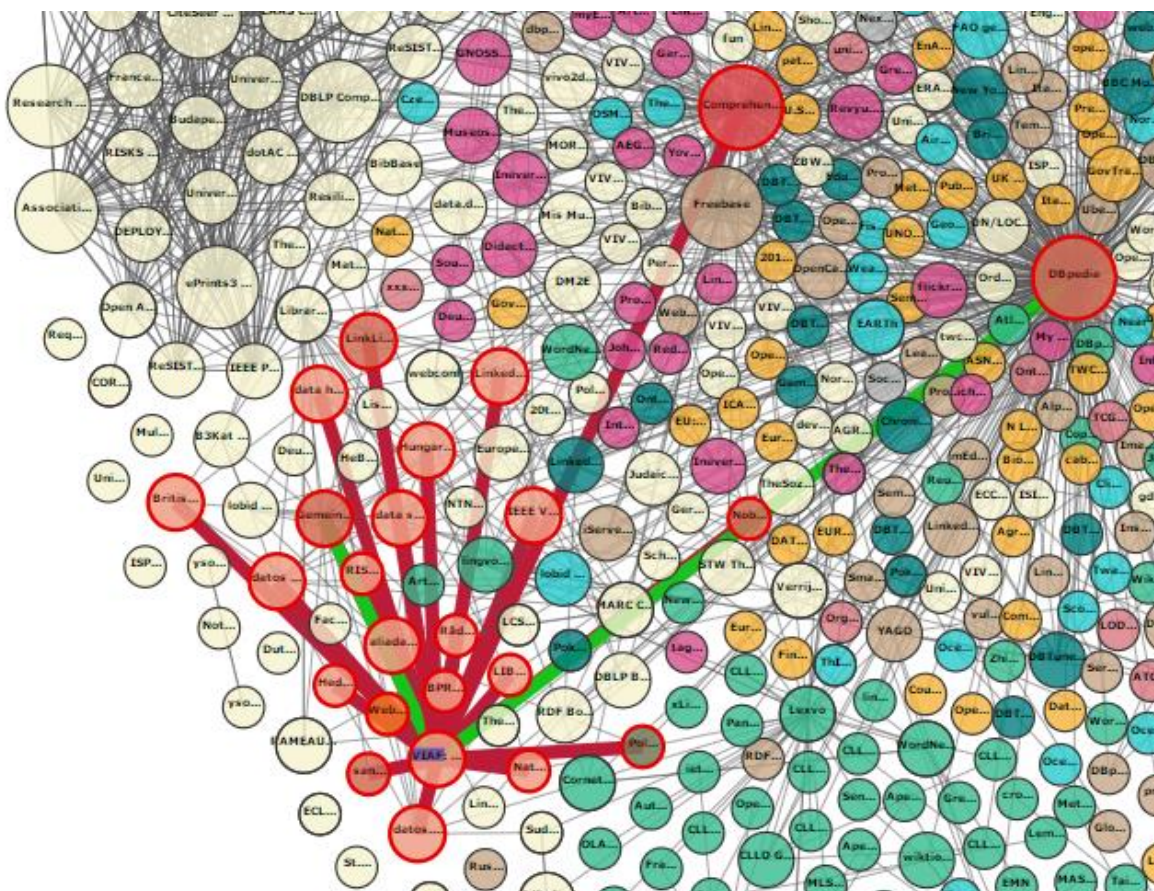


**Figure 4.** Cluster VIAF Geographic Name  
 Source: Virtual International Authority File (2017).

The graphic representation presented in figure 4 is established through a net of data, which, besides providing a better visualization of semantic relations, allows the identification of the entry or description way of the value adopted in each country.

VIAF data sets are integrated to the Linked Open Data Project. In the Project, the international community has worked on the publication of open access data. In figure 5, it is possible to identify that the VIAF data are near *DBpedia*<sup>2</sup>, data, which is a set of Wikipédia structured data considered the main set of data in the cloud.

<sup>2</sup> Fonte: <<http://wiki.dbpedia.org/>>.



**Figure 5.** Linked Open Data Diagram

Source: Adapted from Linked Open Data (2017, not numbered).

Data sets are available in the cloud from its infrastructure and the entailment to other data sets. However, the graphic representation of data sets in the LOD diagram requires quality criteria, indicating the quality and consistency of authority files in the data net.

## FINAL CONSIDERATIONS

Information and communication technology (ICT) has caused deep changes on the information descriptive treatment techniques. For descriptive cataloguing, the technological evolution strengthened the improvement of work tools, originating a new perspective of technological infrastructure for metadata exchange, which has been applied to the new metadata standards in developing, as well as to the standard mapping already adopted in the bibliographic domain, creating conditions for performing the unique cataloguing idealized by Charles Jewett and the Universal Bibliographic Control by IFLA.

In the bibliographic domain, according to Willer and Dunsiree (2013), since the creation of Panizzi 91 rules for the British Museum catalogue, libraries have accumulated for

more than 150 years a wide amount of bibliographic registers elaborated from techniques of information descriptive treatment, which until a short time ago were restricted to Library environment and to catalogue functions. This way, the attribution of value adopted in the identification of access points, even when based on international rules, can present incompatibility in the description of values.

The authority control consists in an important tool of standardization and terminological control of great contribution to the quality of information search and recovery systems operation, in which the unification of values established from the Virtual International Authority File (VIAF) consortium contributed for aggregating values covering linguistic and cultural variations, as well as adding metadata elaborated by institutions that work on national bibliographic control, providing a wider coverage on publication in each country.

This way, VIAF can be considered as a reliable source of authority registers as value vocabulary for the entire bibliographic domain, since it integrates registers elaborated by institutions recognized in each country and comprehends linguistic variations at international level, following the principles of unique cataloguing. It also extend its perspective to the use of registers to other Web data communities.

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