DUBLIN CORE: state of art (1995 to 2015)

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artigo de revisão

RESUMO In face of using Communication and Information Technologies in the 90´s, a new setting started to emerge as the availability of resources in Web environment. The necessity of representation, identification, location and access to resources has been widely discussed and has contributed to events and Dublin Core metadata standards. In twenty years of its creation, the Dublin Core has become a consolidated standard that has provided several possibilities for its use. However, the articles that report its history are spread out, making it difficult to gather and reconstitute them. In doing so, the aim is to show the main factors that contributed to the consolidation of the Dublin Core standard and its development. It is a qualitative and theoretical exploratory study that discusses the Dublin Core background. The outcomes identified the DC trajectory since its creation, consolidation and trends.

Palavras-chave: Dublin Core. Historoty. Metadata.

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1 INTRODUCTION

In face of the intensive use of Communication and Information Technologies in the 90´s, a new setting has emerged: the increasing production of digital resources and their availability in several environments in the Web. The necessity of representation, identification, location, dissemination and the access to the resources has been widely discussed in many areas of knowledge.

In this manner, entities linked to areas such as Librarianship, Information Science, Computer Science, among other areas, have started to develop studies and researches related to the representation of resources in the Web, aiming at providing a more adequate access to the resources, a more efficient search and recovery making the data sharing and the interoperability easier.

Due to this issue complexity, it was necessary to question it in a multidisciplinary environment, generating the "OCLC/NCSA Metadata Workshop", the first event to discuss the representation of resources in the Web with researches from several areas. Among the topics discussed, it featured the establishment of a description of enough resources to identify and locate resources in the Web environment, point of origin of Dublin Core.

The research is structured from reports published in scientific journals regarding the events and Dublin Core development during the period from 1995 to 2015, contributing for the knowledge of the evolution and development of Dublin Core that are crucial for using and building an application profile, providing

guidance and further knowledge about Dublin Core. It aims at complementing Weibel´s (2009) and Baker´s (2012) studies.

During twenty years of its creation, Dublin Core has become a consolidated standard that provided several possibilities for its use. However, the articles reporting its stories are spread out in worldwide journals, making it difficult to gather and reconstitute them.

In this manner, this article aims at pointing the main factors that contributed for the consolidation of Dublin Core standard, reconstituting the trajectory for its development and consolidation through the main discussions that had an influence on its evolution in Dublin Core Metadata Initiative (DCMI) events. For the reconstitution, the articles that reported the developments of activities related to the standard and the annals published in DCMI events were used.

It is a qualitative and theoretical exploratory study that discusses the main aspects concerning Dublin Core background, and the analysis and understanding of Dublin Core structure using bibliographic resources available in formal ways of scientific communication.

The timeframe comprised the international publications from 1995, Dublin Core origin, to 2015, using the terms: Dublin Core, Dublin Core Metadata Initiative Conference, DCMI Conference, DC conference, in the following databases: P@rthenon, Capes Journal Portal, Scientific Electronic Library Online (SciELO), Scopus and Web of Science. The terms defined herein were searched in key words, in abstracts and in titles of documents. The search outcome provided articles in English, Japanese, Portuguese and Spanish.

2 DUBLIN CORE: Background

The outcomes presented the Dublin Core background perspective, which can be divided in two moments. The first started in 1995, with the creation and presentation of Dublin Core until 2000, when DC events were Workshops. The second moment starts in 2001, with the change of structure in DC events, from Workshop to Conferences, a format that is currently adopted.

2.1 Dublin core setting from 1995 to 1999

The first "OCLC/NCSA Metadata Workshop" event, organized to discuss the identification of metadata to help locating and describing objects in the Web was in 1995, in the city of Dublin, in the USA. Stuart L. Weibel, Carol Jean Godby, Eric Miller and Ron Daniel presented the outcomes of this event in a report in 1995. The text discussed the principles defined and presented the 13 metadata proposed for Dublin Core. There is also the article published by Stuart Weibel (1995) in D-Lib Magazine.

Although the 13 metadata were not definitive, for both the terms definitions and the quantity of basic metadata were changed later, this was the first initiative to standardize metadata in Web environment. In relation to Dublin Core principles and characteristics defined in 1995, six principles that initially guided its construction are the following: **Intrinsicality**: Dublin Core describes the resource properties, its intellectual content and physical form and it does not preview information that does not belong to the document, like the context in which it is used; **Extensibility**: Possibility of amplifying the metadata set; **Syntax Independence**: Dublin Core does not have a demanded syntax, making it possible to be used in several contexts and applications; **Optionality**: All metadata are optional. No metadata is obligatory because not all the resources will use metadata defined by Dublin Core; **Repeatability**: All Dublin Core metadata can be duplicated, once there is the possibility of inserting more than one subject, relation, contributor, among others; **Modifiability**: Possibility of a qualifier modifying any metadata. This way, the element is modified by the qualifier value. (WEIBEL, 1995).

The name of the standard comes from the city of Dublin, host of the event and Core due to the work with a metadata core (minimal set of elements) to describe and identify a resource and, at the same time, comprehend the several types available in the Web. The name Dublin Core was proposed because it is the case of a standard that seeks to be the most general in the description and still comprehends a metadata core that can identify and locate any resources available in the Web. This event originated the DCMI – Dublin Core Metadata Initiative, an initiative responsible for managing the Dublin Core standard.

Since then, due to the favorable setting that permeated the first Workshop in Dublin, the issues inherent to the description and discovery of resources in the Web have been intensified and until now, new ways of application, use and research concerning the use of Dublin Core are discussed.

In the following year, two events were organized. The first one was held in Warwick, in the United Kingdom entitled "OCLC/UKOLN Metadata Workshop", approaching, among other themes, a definition of the syntax and architecture to add metadata objects, entitled as Warwick Framework. (DEMPSEY; WEIBEL, 1996). The event resulted in the definition of a syntax called "Warwick Framework".

The article of Lou Burnard, Eric Miller, Liam Quin, and C. M. Sperberg-McQueen, published in 1996, considers the application of the Standard Generalized Markup Language (SGML) as syntax for the Dublin Core. Carl Lagoze´s article discussed specifically the Warwick Framework as an architecture to add logic and metadata packages physically distinct. (LAGOZE, 1996). The Warwick Framework model has emerged from the necessity of creating a structure for several communities from different levels of granularity, which were not contemplated in the Dublin Core standard. (DEMPSEY; WEIBEL, 1996).

The term granularity is defended as "[...] the level of detail in which an information object is seen or described." (WOODLEY; CLEMENTE; WINN, 2005). In other words, it is the quantity of details and information with which the informational resource is represented and described and, therefore, the granularity can be thin (elements that are more descriptive) or thick (few elements for description).

This way, the Warwick Framework would support a variety of metadata structures (DEMPSEY; WEIBEL, 1996). It means that it is an architecture for the exchange of metadata records. According to Dempsey and Weibel (1996), the Warwick Framework proposed: **Modular**: with the aim to different objects; **Extensible**: allow new types of metadata; **Distributed**: allow external metadata objects to be a reference; **Recursive**: allow metadata objects to be treated as "information content" and to have related metadata objects.

Warwick Framework was developed with the aim to add diverse sets of metadata, and two components are fundamental: the container and the packages. "A container is a unity of aggregation for sets of typed metadata, which are known as packages." (LAGOZE, 1996). Dempsey and Weibel (1996) explain "[...] a container is a collection of metadata objects, which in its turn, can be packages or other containers." The packages are considered a digital object (LAGOZE, 1996). According to Dempsey and Weibel (1996) "[...] a package is one of a number of separately defined, primitive metadata formats." The packages can vary in three types: metadata set, indirect and containers. The metadata set corresponds to the place where the metadata records are stored, as MARC and Dublin Core records. The indirect type is an indirect reference to other object in the information infrastructure. The container is a package that is the container itself. (LAGOZE, 1996).

Due to some inconsistencies in the model, Warwick Framework did not solve some semantic issues, because it did not guarantee that two sets of metadata could have concepts with different meanings or with the same meaning. (BREITMAN, 2005). However, this structure founded the basis of another architecture, the Resource Description Framework (RDF) published in 1999.

The second Workshop, in 1996, was the "CNI/OCLC Workshop on Metadata for Networked Images", also in Dublin, in the EUA. In this event, discussions were based on the description of images resources, resulting in the amplification of the Dublin Core from 13 to 15 descriptive elements. (WEIBEL; MILLER, 1997).

In 1997, two Workshops were held, one in Australia and the other in Finland. The event in Canberra, Australia, "NLA/DSTC/OCLC Dublin Core Down Under" addressed the discussions to three issues: formalization of the elements structure and the possibility of implanting elements qualifiers; the extensibility issues, which could be extended to specific contexts from this core; and the refinement elements, in which clearer definitions of the semantic content were necessary. (WEIBEL; CATHRO; IANNELLA, 1997). At this time, a work group was created specifically to map with several other metadata standards and to define possible qualifiers.

In June 1997, Stuart Weibel, Warwick Cathro and Renato Iannella published the

report of this event, highlighting two lines of thought, the Minimalists and the Structuralists. According to Weibel, Cathro and Iannella (1997), the researchers who defended the simplicity, besides keeping a general description, were called 'minimalists'. This group believed that it would be easier to achieve the interoperability, especially the semantic one, if a simple and general structure was maintained. The other group, called 'structuralist', defended a thin granularity level. In other words, higher level of details and specificity for informational records. For them, the thin granularity of elements was fundamental in order to have a better identification, location, recovery and access of informational resources.

In the same year, the fifth Workshop, "The 5th Dublin Core Metadata Workshop", was held in Helsinque, Finland and resulted in the first formal standardization of Dublin Core, besides the first evidences of structuring to coding in RDF architecture (WEIBEL; HAKALA, 1998). This event generated two reports, Paul Miller´s and Tony Gill´s in 1997, besides Stuart Weibel´s and Juha Hakala´s, in February, 1998.

After three years of Dublin Core creation, Harold Thiele (1998) presented a review of literature and some considerations about the setting proposed by Warwick Framework. This review identified the literature dynamics associated to the workshops and the contributions from each workshop for discussing the use of Dublin Core. According to Thiele (1998), the most mentioned authors were Stuart L. Weibel, senior researcher in the OCLC Institute of Researches and Projects; Carl Lagoze, head of Cornell Digital Library Research Group at Cornell University and associated professor at Information School at Michigan University; and Renato Iannella, senior researcher at the Distributed Systems Technology Centre in Brisbane, Australia and, founder and main strategist of Semantic Identity in Brisbane. Besides the short time of Dublin Core creation, Thiele´s work (1998) mapped and identified the most mentioned authors that discuss the themes, presenting an overview of studies.

In 1998, "The 6th Dublin Core Metadata Workshop", was held in Washington, USA. In this meeting, many unsettled issues were solved, such as which documents would be standardized and who would do that; how Dublin Core processes would be formalized and evolved; what would be the coding language; if the Dublin Core would implement metadata qualifiers and refiners; if qualifiers would be recommended; what would be the RDF role (WEIBEL, 1999). Concerning the qualification of Dublin Core elements, after many discussions, a work front was responsible for studying the possibilities of proposing a set of refining elements or qualifiers for the standard. With W3C recommendation, the efforts would aim to link Dublin Core to the RDF structure. (WEIBEL, 1999). As an outcome of this event, Stuart Weibel published in D-Lib Magazine the article "The State of the Dublin Core Metadata Initiative", in April 1999, which reported these issues.

It was when the initiative in 1995, called Dublin Core Metadata Initiative (DCMI), took a bigger proportion and was settled as an organization that manages, until today, the Dublin Core standard activities. Other issues were subdivided in work groups that were responsible for proposing new solutions for the challenges. (WEIBEL, 1999). Among the proposed solutions, there are the submissions and formalization of Dublin Core standard in the National Information Standards Organization (NISO) and by the Comité Européen de Normalisation (CEN). (WEIBEL, 1999).

In 1999, the German city of Frankfurt held "The 7th Dublin Core Metadata Workshop", which aimed at developing DC work groups, through experience exchange among participants. The aim was to promote bigger interoperability among heterogeneous metadata systems. (WEIBEL, 2000). The outcome was the integration of work groups to develop and exchange information (GRÁCIO, 2002).

The event started to take on greater international proportions and the "The 8th International Dublin Core Metadata Workshop" was held in Ottawa, Canada, in 2000. Stuart L. Weibel and Traugott Koch published the DCMI mission, the most important points of the eighth Workshop, the DCMI work groups and the projections for the future. Several contributions were in evidence during these five years of Dublin Core creation. This period was characterized by the definition of elements, standard principles, formalization in international rules, structuring of the Dublin Core Metadata Initiative. Currently, the 15-metadata structure is known as Dublin Core Metadata Set. Its elements are Contributor,

Coverage, Creator, Date, Description, Format, Identifier, Language, Publisher, Relation, Rights, Source, Subject, Title and Type. In order to designate the qualified elements of the Dublin Core, the Dublin Core Terms denomination is used. Contributor, Creator, Identifier, Language, Publisher, Source, Subject, Type metadata do not have qualifiers. The metadata with qualifiers are the following: Coverage: spatial, temporal; Date: available, created, dateAccepted, dateCopyrighted, dateSubmitted, issued, modified, valid; Description: abstract, bibliographicCitation, tableOfContents; Format: extent, hasFormat, hasPart, hasVersion, medium; Relation: conformsTo, isFormatOf, isPartOf, isReferencedBy, isReplacedBy, isRequiredBy, isVersionOf, replaces, requires; Rights: accessRights, license; Title: alternative. And the qualifiers: accrualMethod, accrualPeriodicity, accrualPolicy, audience, educationLevel, instructionalMethod, mediator, provenance, rightsHolder are added.

2.2 Dublin core setting from 2001 to 2014: dcmi international conference on Dublin core and metadata applications

From 2001, DCMI events were expanded and became conferences denominated "DCMI International Conference on Dublin Core and Metadata Applications". The first country to hold this new format was Japan, in the capital Tokyo. In this event, many points were discussed and, later, reported by Makx Dekkers and Stuart L. Weibel in February, 2002. Some issues discussed were the following: recommendations for using Dublin Core and Dublin Core Qualified with RDF in syntax in eXtensible Markup Language (XML); publishing of a new guide for Dublin Core application; and the ratification of the DC 1.1 version as standard American National Standards Institute (ANSI) Z39.85. Other discussed issues were related to Multilanguage interoperability and translations in information systems, as well as studies referring to metadata standardization and proposals of profiles of application in educational objects, moving images, digital library collections, agricultural resources, environment health science, digital museum, besides the framework for electronic medias and metadata for journals. (ARAKAKI; SANTOS; ALVES, 2014).

In the following year, the DCMI conference was held in Italy, Florence, with the theme "Metadata for e-Communities: supporting diversity and convergence". The authors Makx Dekkers and Stuart L. Weibel (2003) discussed the development of DCMI organization until 2003. In the article, some themes discussed in the conference were reported, such as the discussion about accessibility and projects for users and RDF developers, the Dublin Core recommendation in RDF/XML and the regulation of the International Organization for Standardization (ISO) rule number 15836 de 2003. These themes establish Dublin Core as cross-domain standard for describing resources, specifically elements used in application profiles.The works presented were related to the proposals of tools to make the interoperability easier; generation and extraction of metadata; application profiles and standardization of e-govern objects, educational objects; metadata in Europe and Italy and the use of metadata by specialist and non-specialist. (ARAKAKI; SANTOS; ALVES, 2014).

In 2003, the event was held in the American city of Seattle in Washington with the theme "Supporting Communities of Discourse and Practice-Metadata Research & Applications". Several themes were discussed concerning metadata, metadata standards and application profiles of the ethic digital Librarian, for cultural and learning objects, virtual museums, besides specific areas as chemistry, geospatial, radio diffusion. It was also discussed the preservation and evaluation of big quantities of metadata; integration of repositories with documents in the Web; markups language; recovery of resources; as well as statistical approaches with location of references and quotes in the Web.

The conversion and mapping of metadata standards and languages characterized the event, as well as the creation of metadata by non-specialists; recommendations and guidelines for professionals; specialists and designers of systems for Dublin Core. The issues concerning the Semantic Web were discussed in the Functional Requirements for Bibliographic Records (FRBR) approach in the semantic field and the implementation of RDF for structuring the Semantic Web. (ARAKAKI; SANTOS; ALVES, 2014). One of the key-themes in the conference according to Johnston (2003) was Dublin Core Abstract Model (DCAM), an abstract

model of Dublin Core proposed by Andy Powell. According to the author, the DCAM provides structure guidelines for the relations between the attributes and their values inside an information system, providing a consistent and structured basis that organizes the system and, among other operations, makes the mapping and the relation among metadata easier in an information system.

The conference was held in China, in Shanghai, in 2004, with the theme "Metadata Across Languages and Cultures". The librarian Mary Wu (2005) highlighted the presentation of the Chinese Digital Library Standards Project development by the head of the Library of Chinese Academy of Sciences, Xiaolin Zhang. The event was divided in three sessions: metadata frameworks; recovery of information; management and harvesting of metadata. The banners were divided in: vocabulary and application profile, models, case studies, and finally, tools and methods.

According to Wu (2005), the most discussed topics were: the interoperability in multiple vocabularies in data bases, languages, application profiles, harvesting, domains and cultures and the Uniform Resource Identifier (URI) issue accessible by humans and machines. Among the main works presented, the themes were related to application profiles and metadata standards for legal librarians; preservation of objects in the Web, besides questionings about a Framework of digital objects based on FRBR. Other standouts presented were related to the collection and extraction of data in articles in the Web; metadata and identification of records; search engines and Open Archive Initiative (OAI) protocol. In the issue of visualization and presentation of metadata, it was discussed which metadata could be visible and which are not necessary to be viewed by the users. Moreover, the standardization of structures, languages and control of vocabularies was also discussed. (ARAKAKI; SANTOS; ALVES, 2014).

Back to the European continent, the ten years of Dublin Core creation were celebrated in the city of Madrid, Spain, where the fifth DCMI conference was held in 2005. The theme in this event was "Vocabularies in Practice" and 36 works were presented with several perspectives of implementation and standardization of controlled vocabularies. Among the approved researches, 14 works were complete and discussed principles, administration, standardization, terminological control of vocabularies and thesaurus. The studies presented significantly contributions for developing semantic Web, RDF, Simple Knowledge Organization System (SKOS), FRBR, standardization of metadata in Italy and in several spheres like legal articles. In relation to the studies that discussed metadata standard and application profiles, the topics addressing the British library and digital libraries and museums were highlighted, discussing the necessity of geometric description for its recovery. Another point was the discussion about anonymous users' profiles in a system with information guidance, besides components necessary for accessing the Web. (ARAKAKI; SANTOS; ALVES, 2014).

Robina Clayphan reported the development of some lectures on the article "DC 2005", published in October 2005, in Ariadne magazine. The author featured four lectures held in the Conference. Thomas Baker, head of DCMI specifications and documentation presented the lecture "Diverse Vocabularies in a Common Model: Dublin Core at 10 Years", which reported the 10 years of Dublin Core and its main modifications. Ricardo Baeza-Yates, from the University of Chile lectured on "From User Queries and Actions to Metadata", which discussed the importance of the context to use the information. The lecture "The Semantic Web in Practice" presented by Eric Miller from W3C, discussed the general aspects of the Semantic Web and the contributions of Dublin Core in the development of several Technologies like the RDF, Simple Knowledge Organization System (SKOS), FRBR with RDF. Eventually, Robina Clayphan and Bill Oldroyd from British Library presented "Using Dublin Core Application Profiles to Manage Diverse Metadata Developments", which discussed the Dublin Core Application Profiles. It is important to highlight that the DCMI has always sought partnerships with W3C, besides other institutions that seek to develop solutions for organization and standardization of the Web.

In 2006, Colima, in México, held the sixth Conference called "Metadata for Knowledge and Learning". It was the first participation of a Latin American country. Several themes were discussed such as the mapping among metadata standard, metadata standardization,

proposals of application profiles related to digital images, educational objects in chemistry area and multimodal virtual reality, besides the use of DSpace Software. Discussion concerning the thematic treatment of information were related to a vocabulary for environmental and geographic system and the review of SKOS Project.

The conversion of records was also discussed in the event as records from Library of Congress Subject Headings (LCSH), MARCXML, Metadata Authority Description Schema (MADS) standard by eXtensible Stylesheet Language for Transformation (XSLT) in RDF; conversation of AGROVOC thesaurus to Ontology Web Language (OWL). Some issues concerning the interoperability and recovery of information were presented. Among them, the Redalyc Initiative; OAI harvesting protocol; information Exchange among libraries, files and museums; and the collection of metadata in the wiki. Additionally, metadata practices in the French community; discussions concerning models like FRBR and DCAM; database for the preservation of cultural patrimonial metadata; authenticity and digital signature of records and the ZETOC Project were also presented. (ARAKAKI; SANTOS; ALVES, 2014).

Following the presentations and the event, Julie Allinson, Rachel Heery, Pete Johnston and Rosemary Russell published in Ariadne magazine the article "DC 2006: Metadata for Knowledge and Learning" in October of the same year. According to authors, Thomas Baker discussed about the vocabularies, highlighting some aspects of SKOS. Other themes, such as interoperability, Resource Description and Access (RDA); metadata for educational objects; besides discussions about implementing and implanting applications profiles; social networks and mark-ups were standouts in the event. (ALLINSON et al., 2006).

In 2007, one more DCMI conference was held in Singapore with the theme "Application Profiles and their Application in Practice". Ann Apps (2007) provided a general view of the event in Singapore in the article "DC 2007", published in Ariadne magazine. In her report, Dr. Vivian Balakrishnan announced an incorporation of a DCMI version from Singapore as an independent nonprofit legal entity in the country, in collaboration with the National Library Board from Singapore (NLB), during the opening lecture.

In the same event, Johannes Keizer from the United Nations Organization FAO discussed the necessity of agricultural metadata and vocabularies standardization by the Food and Agriculture Organization (FAO). Johannes Keizer exposed an application profile based on DC for food and agriculture. The associate director of the National Cultural Information Resource Centre of China, Zhang Xiaoxing, reported the experience of the National Cultural Information Resource Centre of China in order to describe resources using the Dublin Core Application Profile for Collections (APPS, 2007).

In another session, Mikael Nilsson and Tom Baker explored a new definition of a Dublin Core Application Profile (DCAP), aiming to a legible application profile through machine. This DCAP model was proposed according to the DCAM and was called "Singapore Framework". It consists of a document with recommendations for the functional requirements, a model for application domain and simple description profile with obligatory items, besides guidelines on the use and syntactic encoding as optional issues. (APPS, 2007).

When using the Dublin Core in a specific environment, Nilsson, Baker and Johnston (2008) presented a structure with basic components to put information systems together. This structure would guarantee the interoperability with systems that use metadata different from the Dublin Core standard. This way, essential components to guarantee the interoperability were recommended. "The Framework defines a set of descriptive elements necessary or useful to record an application profile and describes how these documental standards are related to domain models standards and Semantic Web foundation rules." (NILSOON; BAKER; JOHNSTON, 2008).

The term ´profile´ is used to refer to a document describing how rules or specifications are implanted in order to meet the requirements of a particular application, the function, the community or context. In metadata community, the term ´application profile´ has been applied to describe the matching of standards for specific applications. (NILSOON; BAKER; JOHNSTON, 2008). Still according to Coyle and Baker (2009), a DCAP is a document (or set of documents) that specifies and describes metadata used for a particular application. It describes what the

community wants to achieve with its application (functional requirements); characterizes what is described by metadata and its relations (domain model); identifies the metadata terms to be used and the rules to use them (Description set profile and usage guidelines); and defines the syntax to be used for encoding data (Syntax guidelines and data formats).

The DCAP has three layers, and in each one, there are specifications of its components. The first layer has the components of the Dublin Core Application Profile; the second layer has the domain standards and the third layer has the foundation standards.

The elements that composes the Application Profile – first layer – are obligatory elements: the functional Requirements, domain Model and the Description Set Profile (DSP). The optional elements are the following: Usage Recommendations and Syntax Orientations. The functional requirements describe the functions and service of a system. This way, they declare how the system must react and behave in certain situations, besides clarifying what should not be done. (SOMMERVILLE, 2007).

Thus, the functional requirements of a DCAP describe the functions that the system can perform. The functional requirements constitute the basis for the profile evaluation, structuring an internal consistency and providing orientations about the application profile adaptation for a specific use. (NILSOON; BAKER; JOHNSTON, 2008). The Domain Model (first layer) illustrates conceptual classes of a domain, representing components of a real world. In face of that, the DCAP domain model defines basic entities and their relations, which can be expressed by a text or by using UML language. (NILSOON; BAKER; JOHNSTON, 2008).

The Description Set Profile (DSP) "[...] defines a set of metadata records that are valid items of an application profile." (NILSOON; BAKER; JOHNSTON, 2008). Based on the DCAM, it offers a simple restriction language for metadata, specifying the resources that can be described according to the application profile, besides the properties that can be used and how the values can be referred. (NILSOON; BAKER; JOHNSTON, 2008).

The usage recommendations are optional and provide guidelines on how to use and apply the application profile. They can contain information referring to the context in which it is used. The last component of the first layer contains orientations on syntax encoding and it is an optional element. Its aim is to describe any specific syntax used by the application profile or some orientation if necessary, to have a better specification of the syntax. (NILSOON; BAKER; JOHNSTON, 2008).

The other parts, intermediary and inferior application profile, present domain standards and foundation standards respectively. The domain standards are characterized by setting specific characteristics of a certain set of types of resources that forms a domain. In Dublin Core application profile these resources are: Models of communities domain; Metadata Vocabulary; DCMI Abstract Model; and DCMI Syntax Guide.

The foundation standards are standards that provide support and basic infrastructure to other components. This structure supports the data transmission among information systems. In the case of Dublin Core application, RDF and RDF Schema (RDFS) are used.

The domain model is built from functional requirements and is used in domain models in communities. Basically, the domain model relies on functional requirements, which depending on the domain presented, can use the FRBR for bibliographic domain or Digital Images for Libraries, Archives and Museums (DILAM), for image domain proposed by Simionato (2015), for example.

The Description Set Profile is built from the Domain Model and the DCMI Abstract Model (DCAM) and can use data syntax as HTML, XML and RDF/XML and it is also used in metadata vocabularies, as the DCMI terms. The metadata vocabularies were built from the RDF Schema or RDFS and, in turn, is built from the RDF.

The orientations on syntax encoding were built based on the DCMI syntax guide and the Description Set Profile. The DCMI syntax guide was based on the DCMI Abstract Model and it was built from the RDF. (NILSOON; BAKER; JOHNSTON, 2008).

Other themes were discussed in the event such as the metadata standardization; controlled vocabularies and agricultural, educational objects and collections in museums application profiles. Other points discussed were the data development, the description of resources in the Web, functional requirements and reuse of

metadata, metadata generation in RDF by non-specialists.

Still in 2007, the RFC 5013:2007 rule was published and it regulated the use of Dublin Core by The Internet Engineering Task Force (IETF). The IEFT is an international community that makes the Internet work better with documents that influence the design and the way people use and manage it.

The capital of German, Berlin, held the DCMI Conference, with the theme "Metadata for Semantic and Social Applications", in 2008. In this year, the conference discussed themes such as the semantic applications for integrating multiple resources and the folksonomy, which stood out among the works presented. The works in the conference discussed themes referring to tools and software, long-term filing and metadata for educational objects. (BAKER, 2008).

Many issues were raised among which, the metadata standardization and application profile in museums and educational objects, as well as the automatic extraction of metadata in museums; metadata quality; standard conversion of metadata besides issues related to the structure of a collection for an item. Other points discussed were the metadata based on tags and the folksonomy; the assistance to the user when generating metadata; the discussion on the creation and preparation of thesaurus automatically and by humans; the ontology state-of-the-art; and the conversion of the LCSH and SKO for the DC in RDF. (ARAKAKI; SANTOS; ALVES, 2014).

At this moment, aiming at identifying the interoperability of each system, Nilsson, Baker and Johnston proposed four levels of interoperability with Dublin Core. The first level is related to the definition of shared terms. The second level is a formal semantic of interoperability. This level corresponds to the semantic of data through the RDF and using URIs, which has a strong connection with the Linked Data. The third level is the Description Set syntactic interoperability. This level requires the total compatibility with the Dublin Core Abstract Model. Eventually, the fourth level is the Description Set Profile interoperability. In this level, the formalization among systems is related to the total compatibility of an application profile. (NILSOON; BAKER; JOHNSTON, 2009).

Once more in the Asian continent, the event in 2009 was held in South Korea, capital of Seoul. At this moment, the main theme was "Semantic Interoperability of Linked Data". The works discussed the conversion of heterogeneous metadata standards based on the crosswalk method; architecture of information; classification in the SKOS system; tags in You Tube; framework for mangas; besides the digital image in the file. (ARAKAKI; SANTOS; ALVES, 2014). In that year, the review of ISSO rule number 15836:2009: Information and documentation - The Dublin Core metadata element set was published.

In order to celebrate 15 years of Dublin Core, the city of Pittsburgh, in the EUA, hosted in 2010, the Conference entitled "Making Metadata Work Harder: Celebrating 15 Years of Dublin Core". The conference presented application profiles based on FRBR and environmental metadata; cooperation of catalogs and interoperability among libraries and publishers; standardization of governmental metadata from Canada; metadata usage guide in Web environment; and the principles of using one-to-one and the mapping of several metadata. (ARAKAKI; SANTOS; ALVES, 2014).

The sequence of the conference in 2011 was held in Holland, in The Hague, and focused on "Metadata Harmonization: Bridging Languages of Description". The works focused on the information sharing. (RYO, 2012). The conference also discussed a method to map metadata, harmonization of the metadata cycle of life with the Open Archival Information System (OAIS), issues referring to the DCAM model and the origin of metadata, the Crosswalk state-of-the-art, and manuscript cataloguing. Other studies were related to the alignment of thesaurus with the Linked Data and the SKOS system with geographic ontology, besides the terminology and labeling of ontologies in the Web. Issues concerning the collection of digital libraries, studies referring to the Europeana library in the Linked Open Data, and statistical methods and the Linked Data were also standouts in the event. (ARAKAKI; SANTOS; ALVES, 2014).

Returning to Asia, in 2012, the DCMI conference was held in Malaysia, in the city of Sarawak, with the theme "Metadata for Meeting Global Challenges". The works presented discussed the automatic generation of semantic in Web pages; connection of the system instance

with DC description profiles; collection of information during the data life cycle; discussion about principles of least effort, infrastructure and portability service. Issues related to Semantic Web were discussed when using Linked Data and ontologies in areas such as Social, Behavior and Economic Science; the description and access of resources in the SKOS system; and the reuse of an infrastructure for cataloguing. It was also presented an archival overview to identify, explore and manage metadata. (ARAKAKI; SANTOS; ALVES, 2014). Still in 2012, there was a review of the American National Standards Institute (ANSI)/ National Information Standards Organization (NISO) Z39.85:2012 - The Dublin Core Metadata Element Set rule.

Eventually, in 2013, the site of the DCMI Conference was in Lisbon, Portugal. The central theme was "Linking to the Future", and the main discussions and exchange of experience were related to the Linked Data and the RDF; metadata mapping and its changes, in special in standardization of dates and times; and the Universal Machine Readable Cataloging (UNIMARC) metadata standard for the International Standard Bibliographic Description (ISBD) and RDF; source of data; combination of vocabularies and method for the creation of application profiles; and evolution of application for educational objects. Moreover, a study referring to the quotes and references of works in the DCMI International Conference on Dublin Core and Metadata Applications from 2001 to 2012; the discussion referring to the Linked Data in musical resources; metadata standards for monuments and archeological sites; and, eventually, the user´s behavior when using metadata were also discussed. (ARAKAKI; SANTOS; ALVES, 2014). The update of the IETF RFC 5013:2013 rule was published in that year.

The theme "Metadata Intersections: Bridging the Archipelago of Cultural Memory", was the backbone of the conference held in Austin,Texas – EUA, in 2014, addressed to the Linked Data and to the issues concerning preservation of information and memory. The main topics discussed were related to the proposal of the Digital Public Library of America (DPLA) of gathering resources and the problems found during the project and the study of the France National Library with the medium term Persistence of Indicator. Another theme discussed was the integration of great quantity of metadata to build an archeological collection and the proposal of metadata for data repository. It was also discussed the problems of changing metadata in catalogs; digital and metadata source approaches; the 1:1 principle in the Linked Data and the metadata Interlink in different languages converted automatically.

Other issues were related to the analysis of requirements and classification in a data bank from several sources with the aim at evaluating and comparing the current approaches for formulation, validation and restriction of RDF. A structure to validate the DSP making the performance in the RDF possible was also related. Due to the diversity of application standards and profiles, a way to extract the structure of application standards and profiles that have DSP with the aim at reducing costs of extraction of metadata standards is proposed. The mapping of metadata coming from different systems for the Linked Data was also discussed.

In 2015, the first South America Dublin Core conference took place in the city of São Paulo in Brazil with the theme "Metadata and Ubiquitous Access to Culture, Science and Digital Humanities" to celebrate 20 years of Dublin Core. Among the main discussions were the research data, tools for describing resources in the Web as Schema.org and the concern about the cultural heritage preservation.

According to Baker (2012) and the research, the second part was characterized by several matters like the Dublin Core Abstract Model (DCAM) development, the guideline proposal for creating a Dublin Core Application Profile (DCAP) and the approach of works which involved themes like Web Semantics, Linked data, interoperability among systems and other matters.

3 CONCLUSION

The identification of Dublin Core state-of-the-art from the bibliographic survey presented the trajectory of the standard development since its creation, consolidation and the perception of its adaptation to new technologies. The article presented an overview of what has been discussed about Dublin Core during these years, providing a further study concerning several

aspects about the standard, besides raising some issues about its development and consolidation, contributing to new investigations.

During this period of development some proposals were made: a metadata core to locate resources in the Web; possibilities of amplification using qualifiers; standardization of systems with DCAM and application profiles with the DCAP; regulation by internationally known rules, providing the interoperability among systems and developing crosswalks of heterogeneous metadata standards in several contexts.

With the proposal of the Semantic Web, new challenges emerged in the Web and were repeatedly discussed and investigated in Dublin Core events, as seen in documents resulting from this survey. Therefore, Dublin Core performed an important role for the Semantic Web as a general theme in several events organized by the DCMI. It is worth mentioning the several researches related to the RDF and ontologies presented in this event. In this perspective, the Linked Data is highlighted with several researches presented and as the main theme in 2013 (Portugal).

Another aspect in the study was the discussion on the interoperability among metadata standards, data life cycle and the concern with preservation of data and memory.

In order to develop a more social Web, issues like the interaction of users in the representation of information were highlighted in the last years. Some DCMI events discussed the following main themes: Folksonomy, use of tags, social tools, among others.

The necessity of understanding Dublin Core in a specific context was one of the biggest issues in the events. All these issues were discussed in the Web context and involved several proposals of metadata and application profile standardization. Among the proposals, some kinds of resources as textual, images, sound, audiovisual in many contexts such as museums, libraries, government, geospace, legal, educational, filing, among others.

In face of that, building an application profile demands knowledge of about the 15 elements and the Dublin Core structure. In order to implement the system, it is necessary the DCAM abstract model domain and the application establishment, the application clarification, mainly the guidelines for building the application profile (DCAP).

As previously discussed, the interdisciplinary environment in which Dublin Core is inserted contributed to propose improvements in several domains as museums, libraries, files, govern, education among others. The main contributions are related to the organization, representation of information, standardization, preservation and usage of metadata; building of application profiles and metadata standards; conceptual models; interoperability with several studies about crosswalk and Linked Data; discussions concerning the Knowledge Organization Systems. These contributions classify the Dublin Core and the DCMI as great contributors for developing the Semantic Web and for the Information Science area.

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DUBLIN CORE: estado da arte (1995 a 2015)

RESUMO: *Diante do uso de Tecnologias de Comunicação e Informação na década de 90, uma nova configuração começou a emergir como a disponibilidade de recursos no ambiente da Web. A necessidade de representação, identificação, localização e acesso a recursos tem sido amplamente discutida e contribuiu para eventos e padrões de metadados de Dublin Core. Em vinte anos de sua criação, o Dublin Core tornou-se um padrão consolidado que forneceu várias possibilidades para seu uso. No entanto, os artigos que relatam sua história estão espalhados, tornando difícil reuni-los e reconstituí-los. Ao fazê-lo, o objetivo é mostrar os principais fatores que contribuíram para a consolidação do padrão Dublin Core e seu desenvolvimento. É um estudo exploratório qualitativo e teórico que discute os fundamentos de Dublin Core. Os resultados identificaram a trajetória DC desde a sua criação, consolidação e tendências.*

Palavras-chave: *Dublin Core. História. Metadados.*

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