Interoperability in LIS in Digital Era

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Abstract - This paper deals with objectives of interoperability in library science in digital era. The recent trends in electronic publication and availability of e resources made emergency of interoperability. The librarians are using some standards and tools for interoperability in Library and information science field.

Keywords: Interoperability, Semantic web, Ontology, Crosswalk, MARC, XML, METS, MODS, VRA Core, Dublin Core, ONIX, RDF, OAI, MPEG, CDWA, RDA, BIBFRAME, TEI, DDI

1. Introduction:

Interoperability in information science means ability of exchanging information from one system to other system without any restrictions. It means that accessing and transfer of information through one system to other system with understandable standers. The ability of transfer and exchange happens over networking environment and feasible through hardware and software components. The object of Interoperability in library science is information exchange and access without any restriction in different organization. The interoperability in systems uses standards, protocols and metadata standards for encoding and decoding. Interoperability used for specific data transfer and storage purpose.

Interoperability in LIS deals with compatibility, feasibility and crosswalk in information exchange; federated search, metadata harvesting, retrieving in information retrieval; open access initiation, standardization**,** data mining, control, linking and exchange in resource management. It also helps in reducing duplication work. Interoperability required in the Cultural Heritage Institutions like libraries, museums, archives and in Digital Libraries, Repositories and in content management and e-learning platforms.

2. Objectives of Interoperability in LIS:

Federated search: It is a searching method of multiple information resources for information approach. Federated searching enables data records from multiple sources over different platform.

Harvesting: Searching multiple repositories from a single workstation.

Open Access*:* Open Access made interoperability important in networking environment. Compatibility and common standards need for interpretability in open access initiation.

Open archives*:* OAI-PMH Open Archives Initiative Protocol for Metadata Harvesting is a protocol for interoperability between repositories for data transfer.

Multilingualism and cross cultural: interoperability need to understanding and meeting the needs of a global users across different cultures and languages.

Crosswalks: Crosswalk in schema and metadata covers in transfer of data values and elements from one system to other system. Crosswalks help in mapping relationships between schemas with the help of metadata elements. Crosswalks facilitate interoperability between different metadata schemas and serve as the base for metadata harvesting and record exchange. This means mapping of metadata or fields.

Resource description**:** Resource description enables identification, location and retrieval of information resources. Describing resource using metadata to enables the encoding, exchange and reuse of metadata.

Semantic web: Semantic web deals with integration and combination of data and the interchange of documents. It deals with language for recording how the data relates to real world objects. Semantic interoperability deals with the question of how one computer system knows what the terms from another computer system. Semantic interoperability is the ability of computer systems to exchange data to enable machine computable logic, internecine, knowledge discovery, and data federation between information systems. Semantic interoperability deals with the packaging of data and the simultaneous transmission of the meaning with the data.

Ontology: Ontology represents a set of concepts, and the relationships between those concepts, within a specific domain. Ontology defines the vocabulary with which queries and assertions are exchanged among applications. Ontological commitments are agreements to use the shared vocabulary in a coherent and consistent manner.

Objective identifiers: For persistent identification of content on digital networks objective identifiers used for *interoperable* and so useful for management of content on digital networks. DOI (Digital Objective Identifiers) used for identifying content objects in the digital environment.

Encoding and decoding: encoding and decoding in interoperability needs to map the wide range of characters and texts. Encoding and decoding helps in formats and protocols for global interoperability. Text Encoding Initiative (TEI) standard enables libraries, museums, publishers, and individual scholars to represent texts for online research, teaching, and preservation. To map the wide range of characters used worldwide UTF-8 is allows encoding *text messages.*

3. Interoperability Standards and tools in LIS:

Traditionally libraries have exchanged metadata in domain specific formats such as MARC (Machine Readable Cataloging) and offered some limited text based download formats to end users. In the latter case there has been limited standardization although some library OPAC supported personal bibliographic citation management tools such as EndNote**.**
More recently, libraries have begun to offer metadata in less proprietary formats (e.g. RDF), often as part of open data initiatives designed to make their metadata more accessible to wider user communities.

Some of the useful interoperability standard and tools used for library science are:

MARC: MARC (Machine Readable Cataloging) developed by LOC in 1960s to create records to read and share among libraries . MARC standards are a set of digital formats for the description of items catalogued by libraries.

MARC21: Integration of UKMARC, USMARC and CANMARC produced MARC21 for production and exchange fromat. The MARC 21 formats are Bibliographic, Authority, Holdings, Classification and Community Information..

MARCXML: MARCXML is a Document Type Definition (DTD) describing the MARC 21 format in XML. MARCXML is used in many applications at the Library of Congress and in OCLC WorldCat and was designed to assist the evolution of bibliographic formats towards XML, while maintaining compatibility with existing bibliographic data. MARCXML: The Library of Congress' Network Development and MARC Standards Office is developing a framework for working with MARC data in a XML environment. This framework is intended to be flexible and extensible to allow users to work with MARC data in ways specific to their needs. The framework itself includes many components such as schemas, style sheets, and software tools. MARCXML used to represent a complete MARC record in XML, it is an extension schema to METS, to represent metadata for OAI harvesting.

Dublin Core: Dublin core metadata used for resource description. Description of web resources and physical resources using small set of vocabulary terms. Dublin Core Metadata Element Set (DCMES) uses 15 metadata terms to endorse the resources description. Dublin Core metadata may be used for multiple purposes, from simple resource description to combining metadata vocabularies of different metadata standards, to providing interoperability for metadata vocabularies in the linked data cloud and Semantic Web implementations. Dublin core standards are ISO 15836:2009, IETFRFC 5013 and NISO Standard Z39.85 with 15 data elements for resource description. The standard was revised by ANSI/NISO in 2007 (Z39.85-2007) and ISO in 2009.

Extendable Markup Language (XML): Extensible Markup Language (XML) next version of SGML designed to meet the text formatting for electronic publishing and data exchange on web. Standard Generalized Mark-up Language (SGML) was the first markup language used in 1980s for technical and scientific publishing. XML is also derived from SGML used in library archives, publishing and in book trades. XML made easy in interoperability across web. XML used for hierarchical or analytical information to link between bibliographic records and digital resources.

MODS: Metadata Object Description Schema (MODS) is a XML based bibliographic description schema developed by LOC and MARC Standard Office. A MODS is bibliographic description element set designed as a compromise between MARC and Dublin core metadata. MODS is an XML schema is to able to carry data from existing MARC records to create resource description records. MODS used in harvesting, resource description, representing MARC record in XML, packing and repacking fof electronic resources, standards for web contents.

BIBFRAME: BIBFRAME is a bibliographic data model and vocabulary for description of MARC21 formats on the web. BIBFRAME look into rules for description & cataloguing, protocols exchange methods and content models development.

CDWA: CDWA (Categories for the Description of Works of Arts) is a set of guidelines for the description of art, architecture, and other cultural works. CDWA provides a framework to mapping and linking data.

DDI: The Data Documentation Initiative (DDI) is an international standard for describing the data produced by surveys and other observational methods in the social, behavioral, economic, and health sciences. DDI is a free standard that can document and manage different stages in the research data lifecycle, such as conceptualization, collection, processing, distribution, discovery, and archiving. Documenting data with DDI facilitates understanding, interpretation, and use -- by people, software systems, and computer networks. Use DDI to Document, Discover, and Interoperate!

Encoded Archival Description (EAD): EAD is an XML standard for encoding archival finding aids, maintained by the Technical Subcommittee for Encoded Archival Standards of the Society of American Archivists, in partnership with the Library of Congress.

The Federal Geographic Data Committee (FGDC) is a US committee on development to use, sharing and dissemination of geospatial data.

IEEE LOM: IEEE LOM (Learning Object Metadata) is a XML data model to describe a learning object. Its object is to description of learning objects to provide model for LMS (online learning management systems). The IEEE 1484.12.1: 2002 Standard is for LOM open standard.

Indecs: Indecs (Interoperability of data in e-commerce systems) is a metadata for e-commerce initiated by European community. Indecs helps in interoperability of all media, cataloguing, and rights management, metadata, semantic and linguistic. Indecs deals with IP in the area of e commerce content.

MPEG: Moving Picture Experts Group (MPEG), a working group of ISO/IEC to develop standards for coded representation of digital audio and video and related data standards and technologies for enjoyable digital media experience.MPEG-4 Part 14 or MP4 is a digital multimedia container format most commonly used to store video and audio developed ny MPEG. Like most modern container formats, it allows streaming over the Internet. The only official filename extension for MPEG-4 Part 14 files is .mp4. MPEG-4 Part 14 (formally ISO/IEC 14496-14:2003) is a standard specified as a part of MPEG-4.

ONIX: The ONIX for Books is an XML standard for production information to communicate among publishers, retailers and suppliers. It is used for exchanging rich information about their products globally. It is not limited to one language and it is also used for ebook supply chain. ONIX document type definition (DTD) of Product Information Message for representing and communicating book industry product information in electronic form.

ONIX (Online Information exchange): ONIX is a group of related XML standards for books, serials and publishing rights information. ONIX for Books was the first of the standards to be widely adopted by the book trade maintained by the guidance of an International Steering Committee. The ONIX for Books Product Information Message is de facto international standard for the electronic communication book trade product information.

RDA: Resource Description and Access is a cataloguing standard used as replacement of AACR2. It provides instructions and guidelines formulating bibliographic data to be used in libraries. It was published in 2002 to offer how bibliographic data is created and used. The Library of Congress has announced full implementation of RDA for 31 March 2013.

TEI: The Text Encoding Initiative (TEI) develops standard for the representation of texts in digital form. TEI tag sets and rules for encoding methods for machine-readable to texts is an XML based application to encode texts. TEI tags describe the structural hierarchies, divisions, and characteristics of a given document.

VRA Core: The Visual Resources Association (VRA) core is the data description standard for creating, describing, and distributing digital images and other media created by The VRA Foundation and LOC. VRA foundation concerned with creating, describing, and distributing digital images and other media; educating image professionals; and developing standards. The Visual Resources Association Foundation supports research and education in visual resources to the archival and library community and the general public.

Resource Description Framework (RDF): RDF is a data interchange model on the Web. RDF is a general model for conceptual description or modeling of information that is implemented in web resources. It is also used in knowledge management applications. RDF allows structured and semi-structured data to be mixed, exposed, and shared across different applications.

Functional Requirements for Authority Data (FRAD): FRAD is an extension and expansion to FRBR model. The purpose of FRAD is to add a model for the description of authority data and relate that to the user's needs. FRAD formerly known as Functional Requirements for Authority Records (FRAR) is a conceptual entity-relationship model developed by the IFLA for relating the data that are recorded in library authority records to the needs of the users of those records and facilitate and sharing of that data.
The conceptual work and future implementations are aimed at supporting four tasks are
Find: Find an entity or set of entities corresponding to stated criteria;
Identify: Identify an entity;
Contextualize: Place a person, corporate body, work, etc. in context;
Justify: Document the authority record creator's reason for choosing the name or form of name on which an access point is based.

METS: Metadata Encoding Transmission Standard is a data communication standard for encoding descriptive, administrative, and structural metadata regarding objects within a digital library, expressed using the XML Schema Language of the WWW. Metadata encoding and transmission standard is a standard for encoding digital library objective descriptive, administrative and structure to encoding using the XML Schema Language. METS document could be used in the information archival and dissemination.

Open Archives Initiative (OAI): The Open Archives Initiative a organization develops and promotes interoperability standards that aim to facilitate the efficient dissemination of content. OAI has its roots in the open access and institutional repository movements. The OAI aimed to develop and apply technical interoperability standards for archives to share metadata information for archives containing digital content. It also involved in maintaining framework to eprint archives, which make scholarly communications like academic journals available, associated with the open access publishing movement. OAI/PMH, OAI Protocol

for Metadata Harvesting defines a mechanism for data providers to expose their metadata. This protocol mandates that individual archives map their metadata to the Dublin Core, a common metadata set for this purpose.

4. Conclusion:

Interoperability concept is began with MARC initiation in LIS. Networking and web made emergency of interoperability in LIS. Librarian needs to be updates regularly to manage interoperability in libraries. Present situation of electronic information exploration over networking environment needs interoperability standards and tools to access, exchange and control resources.

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