DEFENSE TECHNICAL INFORMATION CENTER

DEFENSE VIRTUAL LIBRARY

REPORT ON METADATA SCHEMAS, TOOLS AND PROJECTS WITH RECOMMENDATIONS FOR DEFENSE VIRTUAL LIBRARY BEST PRACTICES

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**Report on Metadata Schemas, Tools and Projects
With Recommendations For DVL Best Practices**

This report provides information about current research on long-term preservation of digital information. It includes references to digital library research projects and applications that are in the forefront of initiatives and developments in standards, theory and methodology. These references provide a preliminary orientation to state-of-the-art practices and principles in use in the United States, Canada, Australia, the United Kingdom, the Netherlands, and other European countries. The report also addresses procedures for handling multi-level description and recommends best practices for the accommodation of preservation metadata.

This report is divided into the following four sections:

I.   Schemas, Tools and Applications
    a. Metadata Schemas
    b. Markup Languages/Tools
    c. Applications/Systems/Frameworks
    d. General Reference
II.   Digital Library Projects
III.   Multi-Level Description
IV.   DVL Recommendations

Section I outlines schemas, tools and applications pertinent to state-of-the-art digital library practice. This section contains references to metadata schemas, markup languages and tools, applications and framework, and other general sources. The references include brief descriptions.

Section II contains a list of current research projects related to digital library applications. Each project is described in a table that summarizes its salient points. The table includes: the project name and acronym if any; the Uniform Resource Identifier; responsible or supporting organization/s; points of contact and email address when available; a general project type; a fuller description of the approach summarizing its primary purposes; general notes; references to publications, standards and other resources available as part of the project; and the date the site was accessed.

Section III addresses procedures for handling multi-level description of complex digital objects. It contains information about multi-level descriptive practices established within libraries managing electronic serials, CD-ROMs, and remote resource cataloging. These practices are used to establish the DVL policy on multi-level description.

Section IV provides recommendations for best practices to be implemented in the DVL to accommodate the required metadata. This section focuses on the selection of an appropriate framework and related metadata tools to maximize long-term capabilities. To

increase possibilities for long-term retention, preservation and management of digital material, the selection of an effective framework and metadata to populate it is crucial. One goal of DVL research and development is to create a system that is extensible and interoperable.   This section addresses the use of MARC for resource discovery and the adoption of the OAIS Reference Model as a framework for technical metadata related to digital preservation.

I. Schemas, tools and applications.

a. Metadata Schemas:

Categories for the Description of Works of Art (CDWA). Getty Art Information Task Force. CDWA and Other Metadata Standards.
http://www.getty.edu/gri/standard/cdwa/index.htm
The CDWA provides a conceptual framework for the description of content in art databases. It creates the structure for object content for art information systems, identifying core categories for data as well as academic/scholarly categories. Advocates use of controlled vocabulary and authority headings.

Consortium for the Computer Interchange of Museum Information (CIMI).
http://www.cimi.org/standards/index.html
CIMI is developing an XML DTD for cultural heritage that builds on SPECTRUM. Another project is called Project MISIIS (Museum Initiative for Digital Information Interchange Standards). Also involved in the Harmony Project.

Core Categories for Visual Resources. Data Standards.
http://www.oberlin.edu/~art/vra/dsc.html
VRA Core Categories, Version 3.0.
http://www.gsd.harvard.edu/~staffaw3/vra/vracore3.htm
The Visual Resources Association Core is a data standard providing guidelines for documenting visual images and works. It provides a template with two categories of elements. There are 19 elements in the Work Description Category and 9 elements in the Visual Document Description Category; the first describes the work and the second describes the surrogate. Use of controlled vocabulary is recommended.

Content Standard for Digital Geospatial Metadata (CSDGM)
http://www.fgdc.gov/metadata/contstan.html
This standard, written by the Metadata Ad Hoc Working Group of the FGDC provides a common set of terminology and definitions for the documentation of digital geospatial data. It establishes the names of data elements and compound elements to be used for these purposes.

Dublin Core Metadata Initiative. http://purl.org/DC/
The Dublin Core (DC) is a set of metadata elements for electronic resource discovery, containing 15 elements; work on qualifiers in progress. DC provides semantics for resource description, and complements RDF structure. This standard was devised to allow for common description of material available electronically.

Federal Geographic Data Committee (FGDC)
http://fgdc.er.usgs.gov/

The FGDC coordinates the development of the National Spatial Data Infrastructure (NSDI). It has created a metadata standard for cartographic description, including a Metadata Workbook that complies with the CSDGM.

Instructional Management Systems Metadata (IMS) ala Harvard. Metadata structure for managing online learning resources. Not yet implemented.
http://www.cdl.edu/html/instmgmt.html

MPEG-7. Moving Pictures Experts Group, a working group of ISO/IEC (International Organization for Standardization/International Electrotechnical Commission) in charge of the development of standards for coded representation of digital audio and video. This working group is determining a standard set of descriptors for audio, video and audio-video materials so multimedia can be searched across formats.
http://www.mpeg.org/MPEG/starting-points.html#mpeg7
http://www.darmstadt.gmd.de/mobile/MPEG7/index.html
http://www.darmstadt.gmd.de/mobile/MPEG7/FAQ.html
MPEG-7 Project, Columbia University.
http://www.ctr.columbia.edu/~ana/MPEG7/MPEG7project.html#MPEG-7_papers
http://www.ctr.columbia.edu/~ana/MPEG7/download/ICJ99.doc.pdf
MPEG-21. MPEG Home Page. Download **mpeg-21_pdtr.zip** from
http://www.cselt.it/mpeg/
MPEG-21 works to build a common multimedia framework for implementing models, rules and procedures, incorporating and extending the MPEG-7 metadata scheme. Identifies seven architectural elements that are essential to the multimedia framework.

National Information Standards Organization (NISO) Draft Standard. Data Dictionary: Technical Metadata for Digital Still Images. Working draft, July 5, 2000.
http://www.niso.org/pdfs/DataDict.pdf
Draft in development of a generalized technical metadata standard applicable to all images.

b. Markup Languages/Tools:

Encoded Archival Description (EAD) Official web site. http://lcweb.loc.gov/ead/
Society of American Archivists Roundtable. EAD Help Pages.
http://jefferson.village.virginia.edu/ead/
EAD is a DTD for archival information that uses SGML. This encoding standard has been used to convert finding aids from paper to electronic, or to create them in electronic form. EAD uses a minimal number of elements in an extensible fashion to aid in searching. It is the basis of the OASIS system at Harvard and Radcliffe.

Extensible Markup Language (XML).
W3C (World Wide Web Consortium). Extensible Markup Language (XML).
http://www.w3.org/XML/

XML is a universal format for structured documents. It defines the content of text instead of its layout. XML uses a Document Type Definition (DTD) to define the structure of the content, including fields and their usage.
XML Cover Pages, online reference work for XML/SGML. http://www.oasis-open.org/cover/sgml-xml.html

Hypertext Markup Language (HTML). Digital Library Toolkit Resources definition: "HTML is a scheme for describing the layout and presentation of a document. It is a derivative of SGML, specialized for its layout function. It is the format in which web pages are defined and transmitted.

MARC Standards Page. Library of Congress. http://lcweb.loc.gov/marc/
Understanding MARC Bibliographic. http://lcweb.loc.gov/marc/umb/
MARC (Machine-Readable Cataloging) provides a standardized format for representing bibliographic information in machine-readable form. Each record contains three elements: record structure, content designation, and data content. MARC is a bibliographic standard that serves as a record framework.

Resource Description Framework (RDF). http://www.w3.org/RDF
RDF uses extensible Markup Language (XML) to define the metadata framework of resources available electronically. It facilitates interoperability by providing a common syntax for expressing metadata, referring to element sets, specific element names, and actual content. The framework provides for varying levels of granularity.

Standard Generalized Markup Language (SGML). University of Virginia Electronic Text Center web page: About Standard Generalized Markup Language.
http://etext.lib.virginia.edu/sgml.html
SGML is the parent for HTML tag-set building rules. It combines ASCII text with information encoded in angle brackets.
Fred, SGML Grammar Builder. OCLC research project to manipulate tagged text, building Document Type Definitions (DTD) from tagged text.
http://www.oclc.org/fred/
XML Cover Pages, online reference work for XML/SGML. http://www.oasis-open.org/cover/sgml-xml.html

Text Encoding Initiative (TEI) Home Page. http://www.uic.edu/orgs/tei/
TEI is a project developing guidelines for preparing and encoding electronic texts for scholarly research. It marks text with SGML encoding that can then produce searchable indexes.

c. Applications/Systems/Frameworks

Online Computer Library Center (OCLC). Cooperative Online Resource Catalog (CORC). http://www.oclc.org/corc/
CORC is OCLC's metadata creation system for bibliographic records and pathfinders (electronic subject bibliographies) describing electronic resources.

Reference Model for an Open Archival Information System (OAIS). Consultative Committee for Space Data Systems. CCSDS 650.0-R-1, May 1999. http://www.ccsds.org/documents/pdf/CCSDS-650.0-R-1.pdf
OAIS provides technical recommendations for archival requirements providing long-term preservation of digital information. It creates a framework of terminology and concepts to be used in developing archival standardization and requirements for digital material. Related White Paper by the OCLC/RLG Working Group on Preservation Metadata, *Preservation Metadata for Digital Objects: A Review of the State of the Art*, http://www.oclc.org/digitalpreservation/presmeta_wp.pdf

University of Pittsburgh. Functional Requirements for Evidence in Recordkeeping Project. http://www.lis.pitt.edu/~nhprc/
Research project to develop framework establishing the recordkeeping functional requirements of electronic information systems. Framework includes Literary Warrant, Functional Requirements, Production Rules, and Metadata Rules. Framework serves as foundation for several digital library projects.

d. General Reference

American Library Association (ALA). Committee on Cataloging: Description and Access (CC:DA). Task Force on Metadata, Summary Report, June 1999. http://www.ala.org/alcts/organization/ccs/ccda/tf-meta3.html

Working group came up with formal working definitions for three terms deliberated and submitted by the task force subcommittee (submitted May 17, 1999): METADATA are structured, encoded data that describe characteristics of information-bearing entities to aid in the identification, discovery, assessment, and management of the described entities INTEROPERABILITY is the ability of two or more systems or components to exchange information and use the exchanged information without special effort on either system. A METADATA SCHEME provides a formal structure designed to identify the knowledge structure of a given discipline and to link that structure to the information of the discipline through the creation of an information system that will assist the identification, discovery and use of information within that discipline.

ALA. CC:DA. Task Force on Metadata and the Cataloging Rules, Final Report, August 21, 1998. http://www.ala.org/alcts/organization/ccs/ccda/tf-tei2.html
This task force evaluated metadata as a source of cataloging, with the purpose of collaborating on the development of standards and mapping AACR2 and MARC with other schemes. The report examines TEI, DC, and EAD, and provides conclusions and recommendations regarding using these schemes for cataloging.

Archiving Metadata Forum (AMF). Proceedings of June 8, 2000. http://www.archiefschool.nl/amf/index.html
Goal of the AMF is to understand major metadata standards initiatives by identifying commonalities, research issues, areas of potential cooperation, and metadata requirements. Proceedings available online.

Getty Standards Program.

Introduction to Metadata: Pathways to Digital Information.
http://www.getty.edu/gri/standard/intrometadata
Metadata Standards Crosswalk
http://www.getty.edu/gri/standard/intrometadata/crosswalk.htm
Introduction to Metadata, edited by Murtha Baca (first reference) is a Getty Standards
Program site that contains information related to metadata including articles, crosswalks
(see second reference), acronyms, URLs, and a glossary.

International Federation of Library Associations and Institutions (IFLA). Digital
Libraries: Metadata Resources. http://www.ifla.org/II/metadata.htm
This site contains a broad range of references and links to metadata schemes and tools
used throughout the library community.

Research Libraries Group (RLG) Working Group on Preservation Issues of Metadata.
http://www.rlg.org/preserv/presmeta.html
Identification of descriptive data elements to associate with digital files for preservation
purposes.

II. Digital Library Projects

Project name	Alexandria Digital Library Project
URI	http://alexandria.sdc.ucsb.edu/
Organization	University of California, Santa Barbara
Point of contact	
Type of project	Cooperative digital library project
Description	Spatial data on the web/geographic references (1994-1999); Alexandria Digital Earth Prototype (ADEPT) project (1999-2004)
Notes	See also California Digital Library.
Resources	
Site accessed	1-29-2001

Project name	American Memory
URI	http://lcweb2.loc.gov/ammem/amhome.html
Organization	Library of Congress (LC)
Point of contact	
Type of project	Digital library
Description	U.S. history and culture through over 1 million items from historical collections within LC and from other libraries through award.
Notes	Thematic organization of material. Includes text, maps, motion pictures, prints and photographs, and recorded sound.
Resources	National Digital Library Program (NDLP) http://lcweb2.loc.gov/ammem/dli2/html/lcndlp.html American Memory technical information: http://memory.loc.gov/ammem/ftpfiles.html NDLP Technical Notes: by Type of Material. http://lcweb2.loc.gov/ammem/dli2/html/document.html AV Metadata Home Page. http://lcweb.loc.gov/rr/mopic/avprot Digital Repository Development. Core Metadata Elements. http://lcweb.loc.gov/standards/metadata.html Arms, Caroline R. *Keeping Memory Alive: Practices for Preserving Digital Content at the National Digital Library Program of the Library of Congress.* RLG DigiNews, June 15, 2000. http://www.rlg.org/preserv/diginews/diginews4-3.html
Site accessed	1-29-2001

Project name	California Digital Library Project (CDLP)
URI	http://www.cdlib.org/
Organization	University of California Office of the President
Point of contact	cdl@www.cdlib.org
Type of project	Digital co-library of UC campuses
Description	Develop, preserve and provide access to shared digital materials and services, including e-journals, databases, text, and finding aids.
Notes	Begun 1997.
Resources	The Online Archive of California (OAC) is a component of the CDLP which provides digital access to primary sources (images, text, and sound) through EAD finding aids, http://www.oac.cdlib.org/ CDLP Architecture Workgroup Homepage, links to documentation, http://www.ucop.edu/irc/cdl/tasw/index.html CDLP Digital Image Collection Standards, http://www.ucop.edu/irc/cdl/tasw/Current/Imaging.Stds-090199/Imaging.Stds-090199.pdf Demonstrates interoperability technology of the InfoBus protocol with the Stanford Digital Library Technologies Project, part of the Digital Library Initiative, phase 2, http://www-diglib.stanford.edu/
Site accessed	1-31-2001

Project name	CAMiLEON (Creative Archiving at Michigan and Leeds: Emulating the Old on the New)
URI	http://129.11.152.25/CAMiLEON/
Organization	Joint Information Systems Committee and National Science Foundation International Digital Library Project
Point of contact	Kelly Russell, Project Manager
Type of project	Research
Description	Project investigating emulation as a strategy for long-term preservation and access to digital materials.
Notes	Joint project with University of Leeds (CEDARS) and University of Michigan. Research papers available online for public comment. See also: CEDARS and Making of America.
Resources	
Site accessed	3-23-2001

Project name	CEDARS (CURL Exemplars in Digital Archives)
URI	http://www.leeds.ac.uk/cedars/
Organization	Consortium of University Research Libraries (CURL) Project, with the United Kingdom Office for Library and Information Networking (UKOLN) and Joint Information Systems Committee
Point of contact	Kelly Russell, Cedars Project Manager at the Edward Boyle Library, University of Leeds, LS8 9JT
Type of project	Research
Description	Research best practice for digital preservation and prepare recommendations and guidelines for long-term preservation of digital materials as well as a framework for data description.
Notes	Project begun 1998, expected completion 2001. Implements OAIS framework.
Resources	Day, Michael. *Issues and Approaches to Preservation Metadata.* (CEDARS). http://www.rlg.org/preserv/joint/day.html
Site accessed	1-29-2001

Project name	Colorado Digitization Project
URI	http://coloradodigital.coalliance.org/
Organization	Multiple
Point of contact	Liz Bishoff, Project Director, bishoffl@concentric.net
Type of project	Cooperative digital library project
Description	Includes multiple formats from institutions throughout Colorado, including born digital material (digital exhibits).
Notes	Uses Dublin Core. Includes online references for standards and guidelines (technical, administrative, metadata, etc.).
Resources	
Site accessed	1-29-2001

Project name	COVAX (Contemporary Culture Virtual Archives in XML)
URI	http://www.covax.org/primera.htm
Organization	Residencia de Estudiantes, Spain; IST funding
Point of contact	Carlos Wert and Francisca Hernandez
Type of project	Digital library project
Description	Global search and retrieval system for primary documents, including manuscripts, prints, graphics, and text.
Notes	Application of DTDs and SGML/XML.
Resources	Cultivate article, http://www.cultivate-int.org/issue3/covax/
Site accessed	2-5-2001

Project name	DESIRE (Development of a European Service for Information on Research and Education)
URI	http://www.ub2.lu.se/desire/
Organization	Joint project, funding in part by EU Telematics Application Programme
Point of contact	Ann-Sofie Zettergren, Ann-Sofie.Zettergren@lub.lu.se
Type of project	Research
Description	Research to build a large-scale research information network, including search services and organizational framework (metadata standards and management).
Notes	Phase I complete; phase II in progress.
Resources	A Virtual Library Model of DESIRE, 1997, http://www.lub.lu.se/tk/demos/Nnet97pr.html
Site accessed	2-1-2001

Project name	Digital Library Federation (DLF)
URI	http://www.clir.org/diglib/dlfhomepage.htm
Organization	Council on Library and Information Resources (CLIR)
Point of contact	dlf@clir.org
Type of project	Digital library consortium
Description	Consortium of libraries and agencies pioneering use of electronic information technologies.
Notes	Site includes links to architecture, preservation, collections, standards, practices, use, responsibilities and publications.
Resources	The Academic Image Cooperative (AIC) is a DLF project working on a database of curriculum-based digital images for art history survey courses. http://www.clir.org/diglib/collections/aic.htm "Towards A Shared Cataloguing Tool for Visual Resource Collections," http://www.clir.org/diglib/collections/toolframe.htm
Site accessed	5-1-2001

Project name	Digital Library Initiative, Phase I and II
URI	http://www.dli2.nsf.gov/
Organization	U.S. multi-agency initiative
Point of contact	info@dli2.nsf.gov
Type of project	Research
Description	Development of digital libraries, networked resources and innovative applications.
Notes	Includes linkage to Phase I, funded projects, agencies, and D-Lib magazine.
Resources	See individual projects described here, including Alexandria, California Digital Library Project, Making of America and PRISM.
Site accessed	2-26-2001

Project name	Digital Performance Archive
URI	http://art.ntu.ac.uk/dpa
Organization	Arts and Humanities Research Board, Nottingham Trent University and University of Salford
Point of contact	Barry Smith, dpa@ntu.ac.uk
Type of project	Research
Description	Research developments in creative use of computer technology in performance.
Notes	Includes searchable database of virtual theater.
Resources	
Site accessed	1-29-2001

Project name	DONOR (Directory of Netherlands Online Resources)
URI	http://www.kb.nl/coop/donor/index-en.html
Organization	Koninklijke Bibliotheek
Point of contact	Titia van der Werf, donor@python.konbib.nl
Type of project	Search interface
Description	Infrastructure for information management and retrieval on SURFnet, including document and metadata management.
Notes	Begun 1998.
Resources	
Site accessed	2-1-2001

Project name	Federal Depository Library Program/Electronic Collections (FDLP/EC)
URI	http://www.access.gpo.gov/su_docs/fdlp/index.html
Organization	Government Printing Office
Point of contact	George Barnum, Electronic Collections Manager, gbarnum@gpo.gov
Type of project	Digital library
Description	Digital library of electronic government publications
Notes	
Resources	Cataloging and processing tools available online, including cataloging guidelines for computer files, http://www.access.gpo.gov/su_docs/fdlp/cip/cgcomp01.html
Site accessed	3-23-2001

Project name	Florida International University Digital Library
URI	http://fiudl.fiu.edu/
Organization	Florida International University
Point of contact	fiudl@fiu.edu
Type of project	Digital library project
Description	Uses Dublin Core and Blue Angel Technologies to provide electronic access to multimedia collections. Various resources and formats (images, sound, video, and text) available online.
Notes	Project begun 1997.
Resources	Digital Library Metadata Manual Metadata Creation and Maintenance Manual http://www.fiu.edu/~diglib/metadata
Site accessed	1-31-2001

Project name	HARMONY
URI	http://www.ilrt.bris.ac.uk/discovery/harmony/
Organization	Digital Libraries Initiative Project (DSTC, JISC, NSF funding)
Point of contact	Dan Brickley, Jane Hunter, Carl Lagoze meta-harmony-request@mailbase.ac.uk
Type of project	Research
Description	International collaboration to study issues in describing complex multimedia resources in digital libraries, including development of metadata standards and investigations about interoperability, models, and mapping.
Notes	
Resources	Harmony Proposal, http://www.ilrt.bris.ac.uk/discovery/harmony/proposal.pdf
Site accessed	2-1-2001

Project name	Indiana University Electronic Records Projects
URI	http://www.indiana.edu/~libarch/ER/NHPRC-2/index.html
Organization	Indiana University Bloomington Libraries
Point of contact	Philip Bantin, bantin@indiana.edu
Type of project	Research
Description	Research and development project to implement functional analysis methodology developed during Pitt project on functional requirements. Project date range: phase I, 1995-1997; phase II 2000-2002.
Notes	Includes function requirements and metadata specifications for I and II (updated July 2000; dated April 1998). Phase I documentation found at: http://www.indiana.edu/~libarch/ER/NHPRC-1/index.html See also: University of Pittsburgh.
Resources	Philip C. Bantin and Gerald Bernbom, *The Indiana University Electronic Records Project: Analysing Functions, Identifying Transactions, and Evaluating Recordkeeping Systems – A Report on Methodology,* from <u>Archive and Museum Informatics</u>, vol. 10, no. 3, 1996, http://www.indiana.edu/~libarche/article1.html
Site accessed	1-29-2001

Project name	InterPARES Project (International Research on Permanent Authentic Records in Electronic Systems)
URI	http://www.interpares.org
Organization	University of British Columbia School of Library, Archival and Information Studies
Point of contact	Luciana Duranti, Project Director, luciana@interchange.ubc.ca
Type of project	Research
Description	International collaboration to learn about requirements for permanent preservation of authentic records created in electronic systems.
Notes	Stems from UBC project "Preservation of the Integrity of Electronic Records"
Resources	Resource page: http://www.interpares.org/resources.htm
Site accessed	1-29-2001

Project name	Multimedia Access for Enterprises across Networks and Domains (MAENAD)
URI	http://www.dstc.edu.au/RDU/maenad.html
Organization	Distributed Systems Technology Centre
Point of contact	Dr. Jane Hunter, jane@dstc.edu.au
Type of project	Research
Description	Develop data model, metadata mapping schemes, generators, repositories, to provide solutions to problems of resource discovery, preservation, delivery and management of multimedia resources
Notes	Project duration, July 1999-June 2002
Resources	Project proposal, 10-15-1999, http://archive.dstc.edu.au/RDU/staff/jane-hunter/Maenad.html
Site accessed	1-29-2001

Project name	Making of America (MOA I and II)
URI	http://moa.umdl.umich.edu/ (I: University of Michigan); http://moa.cit.cornell.edu/moa (I: Cornell University); http://sunsite.berkeley.edu/MOA2/ (II: University of California, Berkeley)
Organization	Digital Library Federation
Point of contact	II: Merrilee Proffitt, Project Manager, mproffit@library.berkeley.edu
Type of project	Research
Description	Create a proposed digital library object standard by encoding defined metadata and content inside a digital object. Create XML DTD.
Notes	
Resources	Making of America II Testbed Project: A Digital Library Service Model. December 1999. Council on Library and Information Resources (CLIR) publication 87. http://www.clir.org/pubs/abstract/pub87abst.html
Site accessed	1-29-2001

Project name	National Archival Information Locator (NAIL)
URI	http://www.nara.gov/nara/nail.html
Organization	National Archives and Record Administration
Point of contact	
Type of project	Working prototype online catalog
Description	Online catalog of archives and microfilm holdings with sample items available online (film, still images, maps, text)
Notes	
Resources	
Site accessed	1-29-2001

Project name	Recordkeeping in the Commonwealth: A New Approach
URI	http://www.naa.gov.au/recordkeeping/overview/summary.html
Organization	National Archives of Australia
Point of contact	Adrian Cunningham, Director, Recordkeeping Standards & Policy
Type of project	Digital library strategy
Description	Uses Designing and Implementing Recordkeeping Systems (DIRKS) model to develop approach to electronic records management.
Notes	
Resources	Recordkeeping Metadata Standard for Commonwealth Agencies, version 1.0, May 1999, http://www.naa.gov.au/recordkeeping/control/rkms/summary.htm
Site accessed	3-23-2001

Project name	Networked European Deposit Library (NEDLIB)
URI	http://www.konbib.nl/nedlib/
Organization	Koninklijke Bibliotheek, National Library of the Netherlands
Point of contact	Titia van der Werf, titia.vanderwerf@kb.nl
Type of project	Research
Description	Collaborative project of European national libraries to create the infrastructure to build a networked deposit library.
Notes	Includes functional requirements, data modeling, technical standards, and long-term preservation issues for electronic publications. Project dates, 1998-2000. Adopted the OAIS data model.
Resources	NEDLIB has a report series (7 titles) available by mail. van der Werf-Davelaar, Titia. *Long-Term Preservation of Electronic Publications* http://www.dlib.org/dlib/september99/vanderwerf/09vanderwerf.html
Site accessed	1-29-2001

Project name	NORDIC Metadata Projects
URI	http://www.lib.helsinki.fi/meta/
Organization	Nordic Council for Scientific Information (NORDINFO)
Point of contact	Juha Hakala, juha.hakala@helsinki.fi
Type of project	Research
Description	Create and enhance basic elements of metadata production, using Dublin Core.
Notes	NORDIC I begun 1996; II begun 1999. Working on a tool to convert between Dublin Core and MARC.
Resources	
Site accessed	1-31-2001

Project name	PADI (Preserving Access to Digital Information)
URI	http://www.nla.gov.au/padi/
Organization	National Library of Australia
Point of contact	PADI coordinator, padi@nla.gov.au
Type of project	Resource
Description	Subject gateway to digital preservation resources, including development of guidelines for preservation and access.
Notes	
Resources	See also PANDORA
Site accessed	1-31-2001

Project name	PANDORA Archive (Preserving and Accessing Networked Documentary Resources of Australia)
URI	http://pandora.nla.gov.au/pandora/
Organization	National Library of Australia
Point of contact	Electronic Unit, elecunit@nla.gov.au
Type of project	Digital library for online publications
Description	Started 1996. Access to online journals, sites, and publications, including policies and procedures for access and long-term preservation.
Notes	Goal is an improved collecting system for gathering Web sites to archive.
Resources	See also PADI, Picture Australia. National Library of Australia. Preservation Metadata for Digital Collections (draft). http://www.nla.gov.au/preserve/pmeta.html
Site accessed	1-29-2001

Project name	Performing Arts Data Service (PADS)
URI	http://www.pads.ahds.ac.uk
Organization	University of Glasgow, Scotland
Point of contact	Tony Pearson, PADS director, A.Pearson@tfts.arts.gla.ac.uk and Catherine Own (cataloging), cath@pads.ahds.ac.uk
Type of project	Digital library
Description	Research and development on the dissemination of electronic performing arts resources (television, film, broadcasting, music, theater and dance), including film, audio, photos, and text.
Notes	Project began 1998.
Resources	Includes the Imagination/Universities Pilot Project Collection and associated documentation at: http://www.pads.ahds.ac.uk/ImaginationPilotProjectCollection
Site accessed	1-31-2001

Project name	Picture Australia
URI	http://www.pictureaustralia.org
Organization	National Library of Australia
Point of contact	pictaust@nla.gov.au
Type of project	Cooperative digital library
Description	Web service based on metadata index, including participating libraries throughout the country.
Notes	Dublin Core format stored in XML, Blue Angel Technology See also PADI, PANDORA
Resources	
Site accessed	1-29-2001

Project name	PRISM (Preservation, Reliability, Interoperability, Security, Metadata)
URI	http://prism.cornell.edu/main.htm
Organization	Cornell University, Digital Library Initiative Phase 2
Point of contact	Sarah Thomas, set9@cornell.edu
Type of project	Research
Description	Collaboration to rethink traditional library integrity requirements.
Notes	
Resources	Project PRISM: Preservation Metadata Research, Oya Rieger, http://www.rlg.org/events/pres-2000/rieger/index.htm
Site accessed	2-1-2001

Project name	ROADS (Resource Organization And Discovery in Subject-based services)
URI	http://www.ilrt.bris.ac.uk/roads/
Organization	Access to Networked Resources section of eLib and JISC
Point of contact	Paul Hollands, Paul.Hollands@bris.ac.uk
Type of project	Research
Description	Development of software tool kit for web-based subject gateways.
Notes	Project concluded
Resources	
Site accessed	2-1-2001

Project name	Scholarly Digital Resources Center
URI	http://sdrc.lib.uiowa.edu/
Organization	University of Iowa Libraries
Point of contact	Carol Hughes, coordinator
Type of project	Digital library
Description	Current initiatives include the Arts & Humanities Digital Resources Center, the Center for Electronic Resources in African Studies, and Virtual Exhibits.
Notes	
Resources	
Site accessed	1-2-2001

Project name	SPIRT Recordkeeping Metadata Project
URI	http://www.sims.monash.edu.au/rcrg/research/spirt/index.html
Organization	Monash University, Australia; Records Continuum Research Group
Point of contact	Sue McKemmish, director, rcrg@sims.monash.edu.au
Type of project	Research
Description	Development of recordkeeping metadata framework for networked electronic records and creating common interfaces.
Notes	Site includes glossary.
Resources	Glenda Acland, Kate Cumming and Sue McKemmish, "The End of the Beginning: The SPIRT Recordkeeping Metadata Project" http://www.sims.monash.edu.au/rcrg/publications/asaq99.html
Site accessed	2-15-2001

Project name	SCRAN (Scottish Cultural Resources Access Network)
URI	http://www.scran.ac.uk
Organization	Millennium Commission, National Museums of Scotland, Scottish Museum Council, and the Royal Commission on the Ancient and Historical Monuments of Scotland
Point of contact	Bruce Royan
Type of project	Cooperative digital library
Description	Searchable resource base of Scottish material culture and human history, documented in photographs, art, movies, audio, and multimedia resources.
Notes	
Resources	Project documentation at http://www.scran.ac.uk/articles/
Site accessed	1-31-2001

Project name	University of Virginia Electronic Text Center
URI	http://etext.lib.virginia.edu/
Organization	University of Virginia Library
Point of contact	David Seaman, Director, etext@virginia.edu
Type of project	Digital library
Description	Online collection of SGML text and images, including work to inform user community.
Notes	Uses Flexible Extensible Digital Object Repository Architecture (FEDORA).
Resources	Standards page, http://etext.lib.virginia.edu/standard.html D-lib article by Staples, http://www.dlib.org/dlib/july00/staples/07staples.html
Site accessed	2-1-2001

Project name	Victorian Electronic Records Strategy (VERS)
URI	http://www.prov.vic.gov.au/gservice/standard/pros9907.htm
Organization	Public Record Office
Point of contact	John Brumby and Howard Quenault, Project Director
Type of project	Digital library strategy
Description	Strategy for the long-term preservation of electronic records. The requirements for managing and preserving electronic records are divided into 3 segments: long term preservation; systems requirements; and metadata requirements.
Notes	
Resources	Standard for the Management of Electronic Records, PROS 99/007, version 1.0, Apr. 2000, http://www.prov.vic.gov.au/gservice/standard/pros9907.htm
Site accessed	3-7-2001

Project name	Virtual Library of Virginia (VIVA)
URI	http://www.viva.lib.va.us/
Organization	
Point of contact	Kathy Perry, VIVA director, George Mason University, kperry@gmu.edu
Type of project	Academic library consortium
Description	Cooperative resource sharing and access to online resources, especially online publications, but also including other text and images.
Notes	
Resources	Cataloging Guidelines for Electronic Collections, July 1, 1998. http://viva.lib.virginia.edu/~ejs7y/vivacat/marc.htm Technical information page: http://www.viva.lib.va.us/viva/tech/vivatech.html
Site accessed	1-29-2001

III.   Multi-Level Description

Many libraries have established policies on how to catalog material that is available in multiple formats and versions. In particular, cataloging rules for electronic publications available over the Internet (like e-journals and serials) have been developed to describe material that exists in several formats. These rules address when to catalog multiple formats and versions of the same material in a single bibliographic record or in multiple records. Examination of such policies can be used as a starting point in determining best practice for DVL multi-level description.

CONSER (Cooperative Online Serials) is a cooperative serials cataloging program that creates documentation and training materials related to electronic serials description. It is part of the Program for Cooperative Cataloging (PCC) at the Library of Congress and is available through the OCLC Online Union Catalog. CONSER cataloging guidelines are used as a standard for many of the libraries whose cataloging policies are available online. The CONSER Cataloging Manual includes Module 31, Remote Access Computer File Serials. A CONSER Working Group has also created a draft document reporting on the single versus separate record issue.[1] They list the positive and negative points for single or separate records according to the following categories: patron convenience, expense, resource sharing, distribution, maintenance, size, change in format and local system considerations.

In cataloging online serials, a single record is recommended in cases where the online version is an equivalent manifestation of the physical version. If the online version contains a selection from the physical version, it should be included in the same record as a relationship. A separate record should be made for the online version if it contains substantial additional content. In any event, linkage between the online and physical version should be established in the bibliographic record. Various libraries have established their own policies either to record all formats on the same bibliographic record or to provide each format with its own record. Others have created rules to determine which option to exercise.[2]

The Florida International University Digital Library maintains a Metadata Creation Manual, with a section devoted to the topic of "When to Create a New Record" (http://www.fiu.edu/~diglib/metadata/newRecord.html). Its practices are to allow multiple items in the same or different formats to be included in a single record, or

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[1] CONSER documents available on the CONSER Home Page, http://www.loc.gov/acq/conser/homepage.html; Module 31, http://www.loc.gov/acq/conser/module31.html; and the working group report, http://wwwtest.library.ucla.edu/libraries/cataloging/sercat/ .

[2] Sources consulted include MIT Cataloging Libraries, http://macfadden.mit.edu:9500/colserv/cat/erescat/erespol.htm; Princeton University Library Cataloging Documentation, http://infoshare1.princeton.edu/katmandu/comp/elecfil.html; Federal Depository Library Program, Government Printing Office Cataloging Guidelines, http://www.access.gpo.gov/su_docs/fdlp/cip/cgcomp01.html; and Northwestern University Library Interactive Electronic Serials Cataloging Aid, http://staffweb.library.northwestern.edu/serials/iesca/formats/single%20vs%20multi.html.

separated into multiple records. It provides the example of a musical score for a symphony and a sound recording of the same symphony, stating that this is a case where a separate record for each would be appropriate. A linking note describing the relationship between the two items is included in each record.

Their practice is to create a **single record** for multiple related objects in the following instances:

a. Items that were originally created as a unit (e.g. chapters in a book);
b. Item that is a commentary on the other item (e.g. audio);
c. Multiple views of the same resource by the same creator (architecture, portraiture, sculpture); and
d. Similar content in related items.

Their practice is to create **separate records** for multiple related objects in the following instances:

a. Items with different creators (except audio commentary);
b. Items with multiple unique segments;
c. Items with distinct content warranting separate titles, subjects or description.

When technically possible, based on the patterns established in these cataloging examples, a single bibliographic record should suffice to provide the information needed to describe complex digital objects. For example, DTIC CD-ROMs that are selected for inclusion in the DVL can be described in a single record, even though multiple directories and files exist within the item. The bibliographic description can provide general information about the CD-ROM as a whole with information pertaining to individual files available through direct review of the material on the part of the user. When it is deemed necessary to analyze the complex digital object in a more detailed fashion, records should be divided into unique segments that best represent the nature of the digital object. These records should follow descriptive patterns outlined in describing multiple component parts. In all cases, linkage needs to be established between all corresponding digital objects.

IV.   DVL Recommendations

MARC has been selected as the best resource discovery tool for populating the DVL. It was implemented at the inception of the project. Although it accommodates bibliographic description, it is not capable of providing the necessary shell for information about technical metadata.[3] Instead, MARC can be used in conjunction with another system that manages and retains technical information that cannot readily fit into the MARC structure. These data elements can be accommodated with the addition of an XML DTD (Document Type Definition) specific to technical metadata. The expectation is that eventually a system will be capable of automatically generating and/or maintaining these data elements. For example, the California Digital Library Project Digital Image Collection Standards demonstrate that much of this data can be defaulted into an automated system.[4] Another option for managing technical metadata is to work with a system capable of extracting technical metadata from file headers or directly from the digital file. Systems like these that can work with the DVL have not yet been identified, but eventually should be available.

The DVL has recently adopted the Open Archival Information System (OAIS) Reference Model as a framework for technical metadata related to digital preservation. The Reference Model defines an OAIS as "an archive, consisting of an organization of people and systems, that has accepted the responsibility to preserve information and make it available for a Designated Community."[5] A goal of the DVL is to create a virtual library application that meets this definition of an OAIS.

The OAIS Reference Model provides technical recommendations for developing archival requirements and standards that will provide long-term preservation of digital information. Technical metadata selected for the DVL will build on the standard terminology and hierarchy developed in the OAIS Reference Model, using these parameters to create the XML DTD. The Reference Model does not specify an implementation strategy; instead it provides guidelines to address digital archiving concepts.

The RLG/OCLC White Paper suggests "the OAIS model may be a useful starting point for developing a preservation metadata framework of general applicability."[6] It outlines several points of convergence among state-of-the-art digital library applications (primarily CEDARS, NLA and NEDLIB) investigating long-term preservation issues.

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[3] The term technical metadata is used in this report to describe administrative, structural and preservation metadata.

[4] CDLP Digital Image Collection Standards, http://www.ucop.edu/irc/cdl/tasw/Current/Imaging.Stds-090199/Imaging.Stds-090199.pdf

[5] Reference Model for an Open Archival Information System (OAIS). Consultative Committee for Space Data Systems. CCSDS 650.0-R-1, May 1999, p. 1-11. http://www.ccsds.org/documents/pdf/CCSDS-650.0-R-1.pdf

[6] White Paper by the OCLC/RLG Working Group on Preservation Metadata, *Preservation Metadata for Digital Objects: A Review of the State of the Art*, p. 10. http://www.oclc.org/digitalpreservation/presmeta_wp.pdf

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Areas of commonality include knowledge or adoption of the OAIS Reference Model, agreement about the need for technical metadata to facilitate management and access to archival objects, and the need for technical metadata to be independent of the object itself to support interoperability and preservation. The DVL project at DTIC shares the concerns expressed in this digital library research and has common goals with these state-of-the-art projects. Comparison and resource sharing with such similar projects will assist the DVL in creating a virtual library application that is both extensible and interoperable over the long-term.