## Standards for Archival Description

# The Role of Standards in the Archival Management of Electronic Records

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**Abstract:** Technical standards developed by national and international standards-setting organizations to facilitate the exchange of data among computer systems could provide archivists with mechanisms for ensuring long-term access and use of information stored in electronic form. Staff at the Canadian and United States national archives and the United Nations have conducted several valuable studies in this area as well as contracting for additional investigations by outside experts. The author digests the findings of several of these studies, describing the organization of and processes followed by the principal national and international standards developers and summarizing the elements of thirteen standards identified as having the greatest potential for archival use.

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ELECTRONIC RECORDS PRESENT MANY challenges to archivists who are currently exploring a variety of strategies for ensuring long-term access to and use of information they contain. Of direct interest to the Working Group on Standards for Archival Description are a number of recent archivally sponsored reports on electronic records which suggest that standards developed and implemented by the information industry to facilitate the exchange of data among computer systems may also provide a key to archival management of electronic records.

National and international standards-setting organizations have established "data exchange standards" to make it possible for one machine to understand and use the information created by or stored in another machine. These standards are applied by the records creators, generally at the time the records or systems containing the records are created.[1] The information may move because old equipment or software is being replaced by new technology, or because two or more people need to communicate electronically, or because data from multiple files in several locations are being merged. Whatever the reason, the hardware and the software may come from different manufacturers or may have other technical characteristics that make direct exchange of data impossible. However, if the components of all data systems adhere to industry-wide standards, then the information contained in one presumably can be filtered through a standard-based intermediary and used by any other system whose equipment and programs/applications use those same standards.

One way that archivists have commonly addressed these exchange problems is by accessioning electronic data files in software and/or hardware independent formats, often by converting them into ASCII files. ASCII is a very simple form of data exchange standard that works only for very simple data, "flat files" of census statistics, for example. It is not possible to preserve and represent complex relationships among data elements using this method so that many databases, particularly the growing number of "relational" ones, cannot be satisfactorily converted. Systems combining both text and graphics also require a more sophisticated approach. Additionally, the "context" of the original application (e.g., the appearance of the documents on the screen, the search and retrieve protocols) may be archivally significant but could prove especially difficult to recreate when data is moved from one environment to another.[2]

The challenge to archivists is to make sure that the standards being applied to electronic records systems today are adequate to ensure the long-term preservation and use of the information contained in the systems. As Charles Dollar and Thomas E. Weir, Jr., point out in their analysis for the National Archives, "archival storage and re-use is simply data exchange over time."[3]

[1]From archivists' perspective, these are *external* standards. Outside the scope of this paper but also of significant interest to archivists handling electronic records are *internal* standards that relate to the description of electronic records, especially in the choice of cataloging manuals. The application of those internal data structure standards is discussed elsewhere, most extensively in Marion Matters's background paper (pp. 76–93).

[2]See John McDonald, "Data and Document Interchange Standards: A View from the National Archives of Canada," unpublished paper presented at the Society of American Archivists annual meeting (1987), 1-3; [David Bearman], "Guidelines for the Management of Electronic Records," chapter II in U.N. Advisory Committee for Co-ordination of Information Systems, *Management of Electronic Records: Issues and Guideliness* (New York: United Nations, 1990), 23-25; [Charles M. Dollar and Thomas E. Weir, Jr.,] "The Role of Standards in Integrated Systems Management," chapter 3 in *Management of Electronic Records*, 73-75.

[3]Charles M. Dollar and Thomas E. Weir, Jr., "Archival Administration, Records Management, and

The manufacturers and users who are developing and adopting data exchange standards are largely concerned with the here-and-now. At most, their attention extends to a three- to five-year obsolescence cycle after which their data must be able to "migrate" to new equipment or software. Analysis of the existing and developing standards has revealed that many can be exploited to serve archival needs. Some cases call for an insistence that an existing standard be followed consistently; other cases require the modification or insertion of a few elements that have particular utility for archival management.

Of special interest to this Working Group, some of the standards can serve descriptive needs. As noted in the discussion of specific standards below, some of them can make electronic record systems "self-referential," meaning that the data includes imbedded elements that describe the system itself or the information it contains: when it was created, how many records it contains, how it is structured, and how various parts of the system interrelate. "Document profiles" specified by some standards contain information on each document's title, subject, author, size, revision history, and security attributes.[4] Standards being developed for Information Resource Dictionaries may hold particular value as archival descriptive tools; among other uses, in a real sense they are "finding aids," designed to help users locate needed information by identifying and defining data elements in one or more systems.

Several institutions—the National Archives of Canada, the [U.S.] National Archives and Records Administration, the United Nations, and the New York State Archives and Records Administration—have been particularly active during the last three to four years in assessing the value of standards for managing electronic records. Figure 1 provides a list of the major reports produced during these studies, from which much of the information in this paper is drawn.

## Standards-Setting Organizations

Information standards, including those governing data exchange, are developed by national and international organizations, some private and some public. Sometimes national and international organizations will work on a particular standard concurrently and publish identical versions simultaneously. In other cases a national standard might be forwarded to the international organization for its adoption, or an international standard might become the basis for the development of a national standard.[5] In any case, there is a great deal of interplay up and down the organizational hierarchy of standards development.

**International organizations.** Three major international organizations develop and publish standards for information systems, processing, and exchange.

The **International Organization for Standardization** (ISO) is an independent organization that coordinates the efforts of national standards bodies from eighty-seven member nations including the American National Standards Institute (United States)

Computer Data Exchange Standards: An Intersection of Practices," unpublished typescript, 15; Dollar and Weir, "Role of Standards," 76.

[4]Protocols Standards and Communication, Inc., *The Application of ODA/ODIF Standards* (Ottawa: March 1988), 26.

[5]*Data and Document Interchange Standards and the National Archives* (1987), a report prepared for the National Archives of Canada, provides an excellent summary from an archival perspective of the structures and processes of international and national standards organizations in both the U.S. and Canada (pp.3-18). Two other sources are also invaluable for their detailed explanations of national and international standards organizations: Carl F. Cargill, *Information Technology Standardization: Theory, Process, and Organizations* (Bedford, MA: Digital Press, 1989), and Walt Crawford, *Technical Standards: An Introduction for Librarians* (White Plains, NY: Knowledge Industries Publications, Inc., 1986).

and the Standards Council of Canada. ISO is organized into some 164 technical committees (TCs) and thereunder into subcommittees. A study undertaken for the National Archives of Canada recommended following the work of four TCs most closely, with particular concentration on the first two:

- **TC 46, Documentation,** which is responsible for practices relating to libraries, documentation, information centers, archives, information science, indexing and abstracting services, and publishing;
- **TC 97, Information Processing,** which was, until 1987, responsible for all standardization in "the area of information processing that can be considered an independent function"; TC 97's work has been taken up by the ISO/IEC Joint Technical Committee 1 (see below);
- **TC 154, Documents & Data Elements in Administration, Commerce, and Industry**; and
- **TC 184, Industrial Automation Systems.**[6]

A second international standards organization, the **International Electrotechnical Commission** (IEC), is a nontreaty, voluntary organization concerned with electrical and electrotechnical standards. Until recently its focus on hardware and physical matter had generated only limited interest among archivists and records managers.[7] The IEC has achieved greater archival significance, however, since 1987 when ISO and IEC agreed to form the **Joint Technical Committee 1** (JTC 1). The JTC 1, whose secretariat is ANSI, now handles standards development for both ISO and IEC in the area of information technology, including the work previously assigned to ISO's TC 97. Several of its subcommittees bear watching as data exchange standards evolve: SC 6, Telecommunication and Information Exchange Between Systems; SC 15, Labeling and File Structure; SC 18, Text and Office Systems; and SC 21, Open Systems Support Services.

The third major organization for international information standards is the **International Telephone and Telegraph Consultative Committee** (CCITT). CCITT is a one of four permanent committees of the International Telecommunications Union (ITU) which in turn is part of the United Nations Organization. The principal members of CCITT are the government agencies in each of the 160 member countries that administer each nation's postal, telegraph, and telephone services. However, the U.S. representative is the State Department because of CCITT's affiliation with the U.N. and its status as a treaty organization. Individual companies can also belong to the CCITT as non-voting members.

CCITT is chartered to study and issue "recommendations" (equivalent to ISO "standards") on technical, operating, and tariff questions relating to telegraphy and telephony. It is organized into study groups that in turn are split into working parties. The 1987 Canadian study identifies six study groups (SGs) of particular interest to archivists and records managers.[8] Corresponding subgroups in ISO and CCITT work in close, voluntary cooperation on standards of mutual interest. For instance, all of the international standards related to Open Systems Interconnection (OSI) that are dis-

[6]Canadian Bureau of Management Consulting, *Data and Document Interchange Standards* (Ottawa, June 1987): 3-4; see also discussion in McDonald, "Data and Document Interchange Standards."

[7]IEC technical committees of potential interest to archivists and records managers include: TC3, Graphics; TC74, Product Safety; TC83, Information Technology Equipment; and TC86, Fiber Optics.

[8]The six CCITT study groups of special interest to archivists and records managers are: SG I, Operational Aspects Telematic Services; SG VII, Data Communication Networks (whose work intersects with JTC 1, SC21); SG VIII, Terminal Equipment for Telematic Services; SG X, Languages and Methods for Telecommunications Applications; SG XI, ISDN & Telephone Network Switching and Signaling; and SG XVIII, Digital Networks.

cussed below are being developed jointly by ISO and CCITT.

**National organizations.** The major national standards body in the United States is the **American National Standards Institute** (ANSI). ANSI is a nongovernmental, voluntary organization that coordinates the development of national standards by more than two hundred standards-producing organizations that meet ANSI accreditation standards. ANSI is the official U.S. representative to ISO and the IEC and supports the secretariat and several subcommittees for the JTC 1. Within ISO, ANSI is somewhat unusual because it is an independent organization, not a government agency, as are the Standards Council of Canada and representatives from most other countries.

ANSI has more than 1,250 members including corporations, government agencies, and professional and trade associations. ANSI does not itself develop standards but manages and coordinates their development in the more than two hundred ANSI-accredited organizations and committees. Anyone in the United States wishing to influence the development or adoption of technical standards would work through the appropriate ANSI-accredited organization or its relevant subgroup.

Among the accredited organizations are trade and professional associations for which standards development is only one of many activities, including the Institute of Electrical and Electronic Engineers (IEEE), the Association for Information and Image Management (AIIM), and the Association of Records Managers and Administrators (ARMA). Other accredited organizations exist solely to create and promote standards, such as the ASC X3: Accredited Standards Committee for Information Processing Systems and the National Information Standards Organization (Z39) (NISO).

The work among the various ANSI-accredited organizations is coordinated by eight standards boards within ANSI. Two of particular interest to archivists are the Information Systems Standards Board (ISSB), which oversees the work of some thirty standards developers including ASC X3, NISO (Z39), and AIIM, and the Image Technology Standards Board (ITSB) which oversees standards development for photography, micrographics, and television studio practices.

Most of the work on data exchange standards within ANSI falls within the jurisdiction of the following organizations.

The **Institute of Electrical and Electronics Engineers** (IEEE), one of the largest professional organizations in the world, develops voluntary technical standards covering electronic and electrical components, communications bus connectors, and Local Area Network (LAN) standards. LAN standards have been a special focus of IEEE Project 802, begun in 1980, to ensure compatibility between equipment made by different manufacturers. Most IEEE standards focus on devices rather than systems.

**ASC X3: Accredited Standards Committee for Information Processing Systems** is concerned with OSI, data communications, data representation, computer languages, and databases, particularly as they affect the operators or users of machines. Its secretariat is managed by the Computer and Business Equipment Manufacturers Association (CBEMA). Out of the more than seventy-five technical committees and task groups in ASC X3, many of which closely parallel those in JTC 1, five hold particular interest to archivists: X3H4, Information Resource Dictionary Systems; X3S3, Data Communications; X3T1, Data Encryption; X3T5, Open Systems Interconnection; and X3V1, Text: Office and Publication Systems. The voting membership of ASC X3 is largely composed of manufacturers of data processing equipment, although the American Library

Association is one of a handful of associations that also belongs. In 1990 the National Archives and Records Administration (NARA) began sending staff representatives to meetings of X3H4 and X3V1.

Archivists are probably most familiar with, and have the strongest ties to, the **National Information Standards Organization** (**Z39**) (NISO), which is primarily responsible for library, publishing, and related standards. Among NISO's more than fifty voting members are several organizations that might be expected to be sympathetic and effective representatives for archival concerns, including NARA, the Library of Congress (LC), the American Library Association (ALA), the Research Libraries Group, Inc., OCLC, the Association for Research Libraries, and the Special Libraries Association, along with many other specialized library professional associations. In fact, many of the technical standards that the Working Group is considering, other than the data exchange standards of concern in this paper, fall under NISO's domain. Unfortunately, NISO has little involvement with the data exchange standards that are necessary for the archival management of electronic records. The Standard Generalized Markup Language (SGML) is the only standard discussed in this paper that falls, even in part, under NISO's jurisdiction (ASC X3 also deals with SGML). NISO is also the U.S. representative to ISO TC 46, Information and Documentation, whose subcommittee SC4, Computer Applications, deals with data element dictionaries, character sets, and communication protocols and formats.

**Government agencies.** The U.S. and Canadian governments both have active standards-setting bodies. The driving force behind many of the government-generated standards is the need to make procurement easier and cheaper for federal agencies. The **National Institute of Standards and Technology** (NIST, known as the National Bureau of Standards until 1988) is the principal U.S. government agency for establishing government standards in all areas of science and technology.

NIST's National Computer Systems Laboratory oversees the development and publication of Federal Information Processing Standards (FIPS), specifications which must be met by any data processing equipment purchased by the federal government. Because the government is such a dominant consumer in the marketplace, FIPS requirements are incorporated into many new products that are also sold to private customers. As such, they become de facto standards in many nongovernment settings. Many of the more than 150 FIPS standards now in effect parallel or cite existing ANSI or ISO standards or have been developed in cooperation with them.

NIST holds frequent "user/vendor workshops" that bring together designers and potential purchasers to discuss how international standards should be incorporated in new products. As a result of these workshops, manufacturers approve "vendor agreements" that specify the features, options, and parameter values that should be present in all product implementations of a particular standard.

**Private industry.** Private industry has also attempted to address standards through consortia of vendors and users, one example being the **Corporation for Open Systems** (COS). Although intended as an international organization, current COS members are largely U.S. computer vendors, telecommunications product and service providers, and large corporate users of telecommunication services. One of its major efforts is in the area of OSI conformance testing. Single corporations have also been responsible for the development of certain "functional profiles," a selective approach that identifies which groups of existing standards are necessary to perform

an actual task or process. The Manufacturing Automation Profile (MAP) was initiated by General Motors and the Technical and Office Profile (TOP) by Boeing Computer Services.

**The limited potential for archival influence.** Any realistic hope of participating directly in the standards development process, especially in those organizations concerned with data exchange standards, has to be very slim. As David Bearman and others explained during the working group discussions, corporations with a stake in standards development often have at least two or three full-time staff positions devoted to standards work, accompanied by substantial travel budgets to enable effective participation in the process. It is unlikely that any archival budget will provide enough support for meaningful participation in national or international organizations. Unfortunately, there are few existing members of these organizations who might be expected to speak for archivists, with the possible exception of ALA's membership and NARA's participation in ASC X3.

## Data Exchange Standards of Value for the Archival Management of Electronic Records

Several points must be understood in approaching a discussion of actual standards and how they can be profitably applied to the archival management of electronic records.

First, many of the standards described below are fairly new or still under development. Only a few have been implemented in any broad way. As such, they currently bear more *potential* than *verified* value. Archivists can only speculate at this point about how some of these standards might operate in a real working records system.

Second, several of the more significant standards are actually *frameworks* for the development of other standards and not something detailed or specific enough to be "implementable" in and of themselves. OSI and ODA/ODIF are the most notable examples of these frameworks and will be discussed in more detail below.

Third, implementation of most if not all of these standards is not an "all-or-nothing" proposition. More often "profiles" evolve, usually through structured interchanges between manufacturers and users. A typical profile might provide for implementation at one of four levels. Level 1 would require the product to accommodate only the most important elements of the standard while Level 4 would require implementation of the entire standard. Most of the products or systems developed under this kind of profile would fall somewhere between the two extremes and meet Level 2 or Level 3 requirements.

The discussion below summarizes the broad concepts involved in the development and application of these standards and then describes thirteen specific standards that have been identified by Canadian and U.S. archivists as having the greatest potential value for ensuring long-term access and use of information in electronic form. It focuses especially on the Open Systems Interconnection (OSI) and related standards because of their current dominance in the evolution of data exchange standards.

**Open Systems Interconnection (OSI) and related standards.** The Open Systems Environment is a collective term covering Open Systems Interconnection (OSI) and a number of other standards. Proponents of the Open Systems Environment are seeking to standardize computer processes so that it is possible to physically connect equipment manufactured by different companies and so that the data contained in one machine or system can be transferred or communicated easily to another. Ideally, such communications or data transfers should be accomplished "invisibly" without the user

having to intervene or manipulate the data before or after transfer.[9]

When ISO undertook the development of OSI, its first step was to design a basic "reference model" (ISO 7498) to provide an overall framework for the development of specific standards. The reference model contains seven layers, which represent the functions/processes through which data must move in leaving one system and entering another.

More than one hundred standards have been developed or are under development to establish the protocols for the functions in each of the seven OSI layers. In the lowest OSI layer, layer 1, the standards concern the purely physical aspects of electronic transmission. At the top, layer 6 performs conversions of data formats while layer 7 provides the necessary interface to communicate with the user's applications. It is in layers 6 and 7, those closest to the user, where most of the archivally significant OSI standards are being developed.

The reports listed in Figure 1 point to the following six OSI standards as having the greatest potential value to archives and records management.

The **Office Document Architecture/Office Document Interchange Format** (ODA/ODIF) is a multi-part standard that encompasses ISO 8613 and the identical CCITT T.411, 412, 414, 415, 416, 417, 418. It was developed jointly by ISO and CCITT and approved in 1987-88. ODA/ODIF is an "extension" standard of OSI Layer 7 that facilitates the interchange of electronically stored documents (e.g., letters, memos, forms, reports) between systems from different manufacturers by means of data communications or exchange of storage media. The exchange may take place in three forms: (1) formatted (i.e., image or final) form, so that the document can be viewed in human-readable form by the receiver; (2) processable (i.e., revisable) form, allowing the receiver to edit or reformat the document; or (3) formatted-processable form, permitting the receiver to view and process the document.

The Office Document Architecture (ODA) part of the standard defines the structural components of a document while associated "content architectures" define the structure and presentation of contents within the architecture. The ODIF provides a standard format for the "data stream" that moves ODA-structured documents between systems. Each ODA document has a document profile containing such information as title, subject, author, size, abstract, keywords, revision history, size, and can even specify such attributes as fonts and character sets. The National Archives of Canada has taken seriously a recommendation that ODA/ODIF could be "one member of a suite of national and international standards on which a National Archives program to acquire, store, and manage information electronically is based."[10]

The **File Transfer, Access, and Management** (FTAM) standard, ISO 8571, is an OSI application layer protocol that enables the exchange of data files, remote access and manipulation of file attributes and contents, and remote file management.

[9]OSI is more fully discussed in *Data and Document Interchange Standards and the National Archives*, 27-31; Dollar and Weir, "Archival Administration," 12-15; Dollar and Weir, "Role of Standards," 75-84; and *Commitment to Standards: An OSI Guide for Management* (Bedford, MA: Digital Equipment Corporation, 1988). Also of interest in the realm of description standards, librarians are using OSI protocols as the basis for enabling communications among the several national bibliographic networks through the Linked Systems Project, a joint effort of LC, RLG, OCLC, and the Western Library Network; see Judith G. Fenly and Beacher Wiggins, *Linked Systems Project: A Networking Tool for Libraries*, OCLC Library, Information Science, and Computer Science Series, Monograph 6 (Dublin, OH: Online Computer Library Center, 1988).

[10]*The Application of ODA/ODIF Standards* (Ottawa, March 1988), 2.

**Figure 1**

## Recent Reports on Electronic Records and the Applicability of Standards

**National Archives of Canada**

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| June 1987 | **Data and Document Interchange Standards and the National Archives.** Prepared by the Canadian Bureau of Management Consulting (Project No. 1-6465). |
| March 1988 | **The Application of ODA/ODIF Standards.** Prepared by Protocols Standards and Communication, Inc. |
| | **ODA Product Survey**. Prepared by Protocols Standards and Communication, Inc. |
| | **Status of ODA Conformance Testing.** Prepared by Protocols Standards and Communication, Inc. |
| Dec. 1988 | **Application Portability.** Prepared by Protocols Standards and Communication, Inc. (PSC-ARC003-1). |
| 1989 | **Situation Report on the Information Resource Dictionary System (IRDS).** Prepared by the Protocols Standards and Communication, Inc. (PSC-ARC002-1). |
| April 1990 | **Managing Information in Office Automation Systems: Final Report on the FOREMOST Project.** Prepared for the National Archives of Canada. |

**National Archives and Records Administration**

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| Jan. 1989 | **The Effects of Electronic Recordkeeping on the Historical Record of the U.S. Government: A Report for the National Archives and Records Administration**. Prepared by the National Academy of Public Administration. |
| Feb. 1989 | **Archival Administration, Records Management, and Computer Data Exchange Standards: An Intersection of Practices.** Unpublished draft prepared by Charles M. Dollar and Thomas E. Weir, Jr., a significant portion of which also appears in Chapter III of the U.N. *Management of Electronic Records: Issues and Guidelines* (1990). |
| March 1989 | **Framework and Policy Recommendations for the Exchange and Preservation of Electronic Records**. Prepared by the National Computer Systems Laboratory, National Institute of Standards and Technology; Margaret H. Law and Bruce K. Rosen. Appendix A includes Document Interchange Standards: Description and Status of Major Document and Graphics Standards, prepared by Judi Moline (Report no. NISTIR 88-3851, September 1988). |
| June 1990 | **A National Archives Strategy for the Development and Implementation of Standards for the Creation, Transfer, Access, and Long-Term Storage of Electronic Records of the Federal Government.** National Archives Technical Information Paper No. 8. Prepared by Charles M. Dollar and Thomas E. Weir, Jr., Archival Research and Evaluation Staff, NARA. |

**United Nations**

1990 **Management of Electronic Records: Issue and Guidelines.** Prepared by the U.N. Advisory Committee for Co-Ordination of Information Systems. Includes Chapter II, "Guidelines for the Management of Electronic Records: A Manual for Policy Development and Implementation," prepared by David Bearman; and Chapter III, "The Role of Standards in Integrated Systems Management: A Requirement of the 1990s," prepared by Charles M. Dollar and Thomas E. Weir, Jr.

**New York State Archives and Records Administration**

Aug. 1988 **A Strategic Plan for Managing and Preserving Electronic Records in New York State Government: Final Report of the Special Media Records Project.** Prepared by Margaret Hedstrom

National Historical Publications and Records Commission

March 1990 **Electronic Records Issues: A Report to the Commission.** Commission Reports and Papers, No. 4. Prepared by Lisa B. Weber.

Currently applicable to sequential, indexed, hierarchical, and stream file types, future enhancements to FTAM are expected to incorporate relational and network databases.

The **Document Transfer, Access, and Manipulation** (DTAM) standard, also part of the OSI application layer, comprises the CCITT T.400 Series of Recommendations. DTAM is still in the early stages of development but is intended to support the retrieval and manipulation of ODA documents in a distributed database.

Two OSI standards are very specific to the description of documents and have particular applicability to their archival management. One, the **Message Handling System** (MHS), has gained wide acceptance as an electronic mail standard. Comprising jointly developed and identical standards from CCITT (X.400 Series of Recommendations) and ISO (ISO 8505, 8883, and 9065), MHS operates in the OSI application layer. An MHS message is comprised of two parts: the "envelope" and the "body" of the message itself. The envelope carries information about the transmission, including delivery and nondelivery notification, submission and delivery time stamps, and grade of delivery selected (e.g., urgent, normal). The InterPersonal Message (IPM), part of the body of the message, provides a standardized message header that includes identification of originator, primary recipient, and copy recipients; obsoleting and expiry date indications; and a "typed body indication" that identifies the form of the content.

A second document-description standard, the proposed **Document Filing and Retrieval** (DFR) standard (ISO/IEC JTC1/SC18/WG4 N1264 and N1265), is designed to enable multiple users to communicate with a remote document filing and retrieval server. DFR defines an "attribute set" for each document that contains such information as previous and next versions, owner, and title. Extensions of the attribute set include subject, keywords, creation date and time, purge date and time, author, status, and languages. Documents may be grouped and groups may be nested, thereby supporting hierarchical relationships among documents.

The **Computer Graphics Megafile** (CGM) is currently the only graphics standard referenced by ODA/ODIF. Its range of applicability is underscored by its adoption internationally (ISO 8632), nationally (ANSI X3.122), and by the U.S. federal government (FIPS Pub 128). The 1987 report to the National Archives of Canada (NAC) asserted that CGM was likely to become a dominant international standard for graphics information, despite some current barriers to use within OSI environments. CGM is also cited as a potential key standard in NAC's long-term strategy for graphics information.[11]

Two "functional profiles" that use OSI standards have been developed by private industry, the **Manufacturing Automation Profile** (MAP) by General Motors to identify standards for automated manufacturing, and the **Technical and Office Protocol** (TOP) by Boeing to identify standards for office and engineering design systems. They specify specific standards, mostly existing ISO standards, that are required to perform each function. Both protocols have been slower to gain acceptance than their developers had hoped, although MAP has been somewhat more successful than TOP.

**Other data exchange standards.** The **Standard Generalized Markup Language** (SGML), ISO 8879, and its similar but not identical U.S. counterpart, **Electronic Manuscript Preparation and Markup** (Z39.59-1989), define tags that can be inserted into a document to mark and identify each part by generic type (e.g., document title, chapter title, running head, paragraph). SGML also provides for a "Document Type Declaration," a header that identifies an agreed upon document type (e.g., article, report, book) and includes information on how to process that type of document. SGML is used widely by the publishing industry to create final formatted documents. The U.S. Treasury Department and American Association of Publishers have adopted SGML for document interchange, although the U.S. Government Printing Office is developing its own mark-up language. In comparison with ODA/ODIF, SGML is simpler to implement but has more limited uses because it cannot handle graphics.

The **Specifications for a Data Descriptive File for Information Interchange** (DDF), ANSI/ISO 8211 and FIPS Pub 123, was adopted by ISO in 1985 and by ANSI and the U.S. government in 1986. It consists of a data descriptive record (DDR), which is a header, followed by one or more data records. It provides for the exchange of most data structures and user file structures (e.g., sequential, indexed, hierarchical, relational). Dollar and Weir note that "Although this standard could meet many of the needs of archivists and records managers concerned with the long term storage of electronic information, it has not been implemented despite having been a standard for several years."[12]

The **CCITT Group 3 and Group 4 Facsimile Transmission Standards** (CCITT T.4 and T.6) enable the transmission of a document by means of raster scanning via the ubiquitous FAX machines. Group 3 facsimile is used for analog transmission of documents over telephone lines while Group 4 facsimile covers the digital transmission of documents over public data networks. Group 4 standards are compatible with OSI, but Group 3 does not make use of higher level OSI services and will probably continue to operate independently of OSI.

The **Information Resource Dictionary System** (IRDS) standard (ISO TC97/SC21/WG3 N166R1, ANSI X3.138-1988, FIPS

[11]*Data and Document Interchange Standards and the National Archives* (Ottawa, June 1987), 38.

[12]Dollar and Weir, "Archival Administration," 28; Dollar and Weir, "Role of Standards," 86.

Pub 156) offers one of the most archivally promising and intriguing standards in terms of exploiting the ability of automated files to "describe" themselves and for providing the finding aids of the future. Essentially, the data dictionary systems (often referred to as data *directory* systems) defined in IRDS are specialized databases containing information about other information systems, or "meta-data," including "the data they hold, the views and reports they provide, the functions they perform and the users they serve."[13] Bearman asserts that traditional archival descriptive systems are actually subsets of these "metadata" systems. IRDS can provide for recording such information as field definitions, field length, and data formats, and may also contain information about the system's hardware and software and associated records stored in non-electronic form (including paper files). The Information Resource Dictionary could be a powerful tool if used by archivists and records managers to automatically capture documentation about each system and the records it contains. Data dictionaries can also be used as descriptive tools in repositories to identify identical data elements contained in different data files.[14]

### So What Do Archivists Do Now?

While consensus can easily be established that data exchange standards offer a wealth of *potential* benefits, there are also a number of real barriers to implementation that make the road ahead for archivists a very bumpy one.

First are the real limitations in archival resources that can be devoted to the effort to influence the development of or adherence to technical standards. Few institutions, perhaps not even the National Archives, have the staff or funds to commit at the level necessary to have any real effect within international standards organizations.

Second, even if archivists had the wherewithal to make an impact, they do not yet have a clear idea of what specific changes or additions they would ask for to meet archival requirements. Some fundamental concepts need to be explored in depth, for example, "when it is important . . . to have the original representation of documents, when it is sufficient to have the informational content of these documents, and when both are necessary."[15] Some excellent groundwork has been provided in the various reports from Bearman, McDonald, Dollar, Weir, et al., but a great deal more must be done to analyze archival needs and enumerate appropriate responses before archivists go knocking on ISO's door.

Other limitations have to do more with the standards themselves. Currently none of the international standards discussed here are universally implemented. At least one offering special promise, the Data Descriptive File (DDF), was approved several years ago but implementation has never begun. Others provide frameworks but, because there are few accompanying standards prescribing what to put in the framework, have limited value in their current stage of development.

Technical standards offer promise to archivists concerned with long-term preser-

[13]Bearman, "Guidelines for Management of Electronic Records," 37.

[14]The archival applications of Information Resource Dictionary Systems are addressed in Protocol Standards and Communication, Inc., *Situation Report on the Information Resource Directory System (IRDS)* (Ottawa: National Archives of Canada, 1989); Bearman, "Guidelines for Management of Electronic Records," 37, 52; Dollar and Weir, "Archival Administration," 19-20; Dollar and Weir, "Role of Standards," 82-83; and Archival Research and Evaluation Staff, *A National Archives Strategy for the Development and Implementation of Standards for the Creation, Transfer, Access, and Long-Term Storage of Electronic Records of the Federal Government*. National Archives Technical Information Paper No. 8 (Washington: NARA, 1990), 9-12.

[15]Archival Research and Evaluation Staff, *National Archives Strategy*, 14.

vation and use of electronically stored records. But we must learn enough about standards and how they are developed and applied to make certain that these powerful tools can be used effectively.

### Recommendations that the Working Group Could Make

- **NARA and NAC must provide leadership and continue to be the primary sites for research on electronic records issues on behalf of the entire North American archival community.**

The National Archives of Canada (NAC), the National Archives and Records Administration (NARA), and the United Nations should be commended for the work each has accomplished to date. We should urge the broadest possible dissemination of the results of their studies and publicize their availability ourselves. Especially in the case of NARA, we should stress its responsibility to (1) provide leadership in this area for the archival community in the U.S., (2) make its work more broadly known, and (3) actively promote the availability of information and assistance through the Archives Library Information Center (ALIC), the Records Administration Information Center (RAIC), and other sources.

- **This working group (or its successor) should prepare an introductory handbook on standards for archivists that would describe the functions and types of standards, the standards development and implementation process, and the participants in that process.**

Such a handbook would probably concentrate more on those standards applied directly by archivists than those incorporated during the creation of records, but it would lay the necessary foundation for those who need to extend their work to include the archival management of electronic records. To the uninitiated archivist approaching technical standards for electronic records systems, the most daunting aspect is being confronted by an enormous number of new terms and finding old terms used in new ways. Acronyms fly in every direction, inevitable perhaps in a forum dominated by computer jocks and government bureaucrats. This handbook could help cut through some of the jargon and make archivists familiar enough with the definitions and syntax to enable them to discuss these issues with records creators in their own language.

- **A working group should be constituted to analyze and define archival requirements for managing electronic records.**

GM and Boeing have defined "functional profiles" (MAP and TOP respectively) that identify specific standards needed to accomplish certain tasks or functions. At some point, it should be possible to review existing standards and develop an "archival profile" that will specify what standards, or elements within certain standards, are necessary to meet archival requirements. The fact that many of the most applicable standards are still in the developmental stage means that this goal cannot be accomplished tomorrow. But the National Archives of Canada has already begun to identify which standards it will use to underpin its long-range plans for the acquisition, storage, and management of electronic records.[15] Perhaps its experience can be applied to the development of similar definitions for other types of repositories.

- **The SAA Committee on Automated Records and Techniques (CART) should be encouraged to continue its research and educational activities in**

[16]In addition to its work on ODA/ODIF, the National Archives of Canada has drafted "functional requirements" which incorporate archival management considerations for controlling documents in offices. See *Managing Information in Office Automation Systems: Final Report on the FOREMOST Project* (Ottawa: National Archives of Canada, April 1990).

**the area of electronic records and to incorporate standards considerations when appropriate.**

CART's 1988-89 workplan includes an item to "identify college and university organizations and associations whose members create and maintain automated records, and develop guidelines for preserving machine-readable records in colleges and universities." We should encourage CART to include a consideration of the relevant standards that should be implemented in automated systems as part of these guidelines.