

## ***Descriptive Practices for Electronic Records: Deciding What is Essential and Imagining What is Possible***

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### ***Résumé***

Les défis soulevés par les archives électroniques présentent une occasion de définir les buts essentiels de la description, c'est-à-dire réévaluer ses objectifs, ses représentants et sa fréquence, et d'imaginer de nouvelles approches qui, bien qu'étroitement rattachées au pouvoir de la technologie de l'information, n'en respectent pas moins les principes de l'archivistique. Cet article examine comment la description archivistique doit soutenir le besoin d'identifier, d'avoir accès, de comprendre la signification, d'interpréter le contenu, déterminer l'authenticité, et gérer les archives électroniques afin d'en assurer l'accès de manière permanente. La gestion de la méta-information est proposée comme une stratégie alternative aux pratiques descriptives actuelles.

### ***Abstract***

The challenges raised by electronic records present an opportunity to define the essential purposes for description: to reassess its objectives, agents, and timing; and to imagine new approaches that harness the power of information technology while respecting archival principles. This article discusses how archival description must support the need to identify, gain access, understand the meaning, interpret the content, determine authenticity, and manage electronic records to ensure continuing access. Management of metadata is proposed as an alternative strategy to current descriptive practices.

### ***Introduction***

Archivists are increasingly aware of the need for descriptive practices that encompass all formats of records and all forms of material. Nevertheless, electronic records archivists question whether any of the approaches to description promulgated or proposed by archivists are adequate, relevant, and effective for description of electronic records.<sup>1</sup> David Bearman has challenged the concept of description, especially as presented in the ICA Principles, because of its focus on records, rather than the activity of records-generating institutions or persons, as the object of description.<sup>2</sup> Charles Dollar has suggested that the ICA Principles and the Canadian *Rules for Archival Description (RAD)* require clarification and refinement before they are workable for description of electronic records from systems that do not create analogues of paper

records, such as geographic information systems, multi-media systems, and complex distributed databases.<sup>3</sup> Terry Cook recognizes that theoretically sound and effective descriptive practices for electronic records must account for multiple creators and multiple custodians of records that are not limited to a single arrangement.<sup>4</sup>

The purpose of this article is to explore further these concerns by defining basic requirements for description of electronic records and by assessing the potential to exploit descriptive information (metadata) in automated systems in order to achieve archival objectives.<sup>5</sup> Archivists only recently turned their attention to description of electronic records, while only a few archivists acknowledge that the requirements for description of electronic records may expose the need to transform descriptive practice for all formats of archival records.<sup>6</sup> As long as description is viewed as a process directed towards the holdings of archives, which begins after records have been accessioned and arranged, archival descriptive practices will remain ineffective for electronic records.<sup>7</sup> The challenges raised by electronic records present an opportunity to define the essential purposes for description; to reassess the objects, agents, and timing of description; and to imagine new approaches that harness the power of information technology while respecting archival principles. This process may ultimately lead archivists to descriptive practices that are more theoretically sound, more cost-effective and practical to implement, and that yield far more satisfactory results for the end user.

### *The Descriptive Needs and Requirements for Electronic Records*

Electronic records will force archivists to clarify the distinction between records and all other types of recorded information. In the electronic environment, the physical manifestation of a record, if relevant at all, is secondary to its logical organization and its relationship to the context in which it was created and used. Physically, electronic records exist as streams of binary digits represented as electronic impulses that may or may not be captured on a storage device. There are no clues in the physical manifestation of electronic records to distinguish one record from another, or to distinguish records from electronic information that is not a record. Software provides a structure for data and imposes a basic level of organization on what would otherwise be an undifferentiated stream of bits, but this level of description and control alone is insufficient for interpreting the meaning of the electronic information or managing electronic records.

Description will play a critical role in helping the original creators of records, researchers, and others to identify, understand, and use electronic records. Descriptive practices, based on archival principles and designed to meet archival requirements, must distinguish electronic records from other computer-generated data structures that lack documentary characteristics. Such practices must be grounded in a recognition that electronic records result from corporate functions and activities, carried out by organizations or individuals. They are created to produce evidence of transactions and decisions and to hold individuals and organizations accountable.<sup>8</sup> The record is a byproduct of corporate activity, not a deliberate product of it.<sup>9</sup> Users need to know about the mandates, functions, and activities that gave rise to the creation of records, the circumstances surrounding their creation, and the organizational framework in which records were created and used in order to understand electronic records and derive meaning from them.

Descriptive practices originating in a computer systems environment, as well as the descriptive methods used by data archivists, fall short of what is needed because they focus on data structures and content with insufficient regard for the contextual information needed to define and understand electronic records. Computer systems specialists recognize many of the requirements for describing data structures, and they produce documentation that meets specific user and system requirements to define and control data in systems. Likewise, most data archives have adopted elaborate rules for description that assign authorship, delineate data structures, and provide access to the content of files.<sup>10</sup> Neither approach to documentation provides

essential information about provenance of records, or the context of records creation, sufficient to support their interpretation or use as evidence, or to manage information in electronic form as records.

Electronic records, like all archival records, require sufficient descriptive data to render them available, understandable, and usable for as long as they have continuing value.<sup>11</sup> The types of information needed to describe electronic records will differ from, and may exceed, that needed to describe records in paper formats, but the basic purpose of description remains much the same. Electronic records must have sufficient descriptive information to permit a user to learn that the record exists, *identify* and locate it, and determine the conditions under which it may be used. Once the record is located, the user must have sufficient descriptive information to write a command or instruct a computer to *access* the record or retrieve information from it. The user must be supplied with descriptive information about the provenance of the record and the context in which it was created, sufficient to *understand* its meaning and significance. Users of electronic records also need descriptive information in order to *interpret the content* of the records, especially when abstract schemes are used to represent data values. Descriptive systems must provide sufficient information about the nature, timing, and circumstances under which transactions were recorded, in order to *establish authenticity* of the record. Finally, description must provide sufficient data to *manage* electronic records for continuing access.

The types of descriptive information needed to make electronic records available, and the methods used to disseminate information about archival electronic records, may differ from those employed for traditional formats of records. Traditional descriptive practices have satisfied this requirement for archival holdings by developing repository-level guides to archival materials and, more recently, by contributing bibliographic records to national and international databases such as RILIN, OCLC, and WLN. The desire to add descriptions of archival records to national databases was the fundamental impetus behind the establishment of the USMARC format for Archives and Manuscripts Control (AMC) as the United States standard for cataloguing holdings of archival materials in repositories. Among social science data archives, a similar desire to share descriptive information about their holdings of numeric data files led to the development of a different standard, the USMARC Format for Machine-Readable Data Files (MRDF), for cataloguing machine-readable records.<sup>12</sup> This approach satisfied the need to make holdings known, but it does not address the archival management of electronic records, many of which may never be transferred to the physical custody of an archives.<sup>13</sup>

Electronic records archivists have challenged the timing of description that occurs after records are selected for permanent preservation, transferred to an archival repository, and arranged. Electronic records require description earlier in their life cycle in order to address the descriptive needs for records that may never be transferred to the physical custody of an archives, and to ensure that the standards and procedures for describing electronic records are established when an automated system is designed. To address these concerns, some archivists have begun to explore use of information locator systems and other tools that identify records regardless of their physical location, and that may provide a means for disseminating description information about records earlier in their life cycle.<sup>14</sup> Locator systems generally identify information sources by originator and title, direct users to the custodian of the records, and indicate terms and conditions of access. Such systems have the advantage of describing records at all life cycle stages, including active records that are in frequent demand. Locator systems that point users to information sources are prerequisites for responsible decentralized, non-custodial archives.

Simply locating electronic records will not satisfy user requirements, unless there is also sufficient information about each data structure to instruct a computer to access and retrieve the desired records, display or print them, or subject them to further computer processing. Even the most sophisticated retrieval software will not be able to recognize a data structure or retrieve records from it, without minimal description, such as its type, name, and address on a storage

device. The exact requirements for access and retrieval vary by type of data structure, but may include the names of files, documents, or elements; descriptions of the directory system; addresses on a storage device; and technical specifications for the hardware and software necessary for retrieval. The descriptive requirements for access and retrieval of electronic records exceed those for paper files, because even the simplest machine-readable data structure by definition requires access and retrieval by a device.

Users need a detailed record or file layout in order to access records in a simple "flat file" of structured numeric data. In advanced software-dependent data structures, directory systems store this descriptive information in more readily accessible, computer-readable forms. Most database management systems require a rudimentary description of data content and values before users can build a database. Similarly, office automation systems for textual documents provide directory systems that contain, at a minimum, the name and creation date of each document. Some document tracking systems provide facilities to identify drafts and versions of documents, track transmittal and receipt, and search for content or structural attributes. Most advanced data structures include their own protocols for description of data values, physical layout, and entity relations. Software engineers and data administrators continue to produce more advanced data objects that integrate description of structures, values, and content into complex objects. The descriptive elements imbedded in these data objects are both essential for access and retrieval and rich sources of information about the data, but they rarely include the essential contextual information necessary to retrieve, interpret, and understand archival records.

Advanced software systems may be able to deliver desired electronic documents or data rapidly, yet users will not be able to understand the records without sufficient information about the provenance and the context of their creation. Electronic records share this requirement with other types of archival material, although the contextual information that is essential for the description of electronic records may not be captured at all, or may be structured differently from that of traditional textual records. Provenance and the relationship between context and the content of records have been long-standing pillars of archival theory and practice. In the electronic era they are vital to description, because they provide the key to distinguishing records from non-record material; to understanding why, when, and by whom a document was created; and to determining the context in which the record was created, and hence its value and meaning. Users need rich descriptive information about the record that explains who created it, why it was created, and how it was used to support or document the mission and functions of an organization, in order to understand and use electronic records as meaningful evidence of events, transactions, and activities.<sup>15</sup>

Users will also need sufficient information about the life cycle management of electronic records in order to establish the nature, timing, and authenticity of transactions. Because electronic records can be altered without physical evidence, they present records creators and archivists alike with new challenges for determining authenticity. Moreover, our society has not yet developed cultural habits and practices to authenticate electronic transactions intuitively.<sup>16</sup> Requirements for authentication will be application-specific and based on the degree of precision and security needed by the creating organization. At a minimum, however, users of electronic records need to be assured that security and access procedures were in place and followed, and that procedures for audit trails exist to test the integrity of the system.<sup>17</sup> The unbroken chain of custody, once a fundamental principle of archives, will assume greater significance, oriented towards a documented and unbroken chain of control, in the non-custodial electronic era.

The authenticity of electronic records as historical evidence will require more technical information about system characteristics, and more contextual information about the use of computer systems by organizations and individuals. It will be important, for example, for a future user of electronic records to know whether the database that created the records supported the work of an individual analyst who used it to manipulate data and store results, or whether it

served as the central records repository for an organization that stored the evidence of its decisions there. To understand the meaning and significance of electronic mail messages, future users will need contextual information about an e-mail system, such as who used e-mail and whether an organization considered the e-mail system a mode for official communications, in order to determine whether the electronic messages are authentic reflections of events and transactions.<sup>18</sup>

Descriptive information that identifies electronic records, permits users to retrieve them, and explains their provenance makes the records available and understandable. Electronic records may not be usable unless the description includes definitions of any codes that are used to represent data values. For simple numeric data files, the code-book serves as a catalogue of the representation scheme, while more sophisticated data structures use directories, data dictionaries, or series of tables to store the codes and definitions. The need for linkage between content and representational schemes is not limited to files containing numeric data. The “code-book” for electronic textual records may include pointers or references to larger bodies of contextual information. Take, for example, an electronic record that tracks felony convictions, offenders, and the crimes they committed. Such a record would have as one “code-book” a reference to the penal code under which individuals were convicted, rather than a carefully designed, abstracted coding scheme. The descriptive information for a series of electronic documents might include a reference to the tables that automatically supplied the dates when documents were sent or received. This type of information once existed as an integral part of the document content or as separate documentation in paper form; however, increasingly it is part of an automated system—residing in a data dictionary, separate database tables, or as a set of pointers to different databases—and has a dynamic nature of its own.

These simple examples illustrate the extent to which description of electronic records challenges current archival descriptive practices. Creating or capturing sufficient descriptive information to permit users to identify, access, understand, authenticate, and interpret the meaning of electronic records requires an appreciation of the complexity of modern records systems.<sup>19</sup> Increasingly, descriptive practices must capture data on a web of relations between the creation and use of the records and their content, context, and structure. These relations cannot be encompassed through a single, hierarchical path because electronic records can have multiple creators and multiple users at any single point in time, and indeed throughout their life cycle.<sup>20</sup> Lateral relations link data content to explanatory references, while a separate set of hierarchical relations describe the data structures independently of the contexts in which they are created and used.

A final requirement for description of electronic records is sufficient information to manage the records in order to ensure continuing access. The precise information requirements will vary depending on the structure of the records and who is responsible for their ongoing management. Control information includes technical specifications for the hardware and software needed to access the records, as well as information about maintenance and preservation of the physical medium. Information about the type, age, condition, storage history, and maintenance of the physical medium on which electronic records are stored is an essential descriptive element, whether the records are retained in their native software environment by the original creator or transferred to a repository operating a different hardware and software platform.

Neither the methods used today by systems designers to manage and control information in automated systems, nor the descriptive practices used by archivists to manage records in archives satisfy the requirements for archival description of electronic records. Systems management fails because its object is data, not records. Archival descriptive practices fail because the agent of description is the archivist applying descriptive methods after records have been accessioned and arranged. Successful descriptive practices for archival records must incorporate archival descriptive practices into the design of information systems, so that archival description can exploit the rich descriptive information that is an integral part of many electronic

records systems. To accomplish this, the archival profession must articulate its requirements clearly and convincingly to records creators and the designers of record-keeping systems, or otherwise miss the opportunities for more effective descriptive practices that the electronic era offers.

### *Imagining What is Possible*

Stepping back from current descriptive practice forces archivists to return to fundamental questions about the purpose, objects, agents, and timing of archival description. Setting aside assumptions about who describes archival records, what is described, and when description should occur, will help archivists to imagine possibilities for descriptive systems and practices that are far more effective than the descriptive practices that are in common use today. Archivists can learn much from the organizations and institutions that create electronic records, about the methods that they use to make data in systems available, understandable, and usable. At the same time, archivists can teach records creators about archival methods that will help organizations make the transition to electronic record-keeping without sacrificing their corporate memory. Establishing such partnerships will ensure a more relevant and vital role for archivists in the organizations they serve.

In the electronic era, archivists will need to exploit the metadata (data about data) that organizations generate about their records in order to create inventory and locator systems, to obtain sufficient information about the provenance and context of records creation, and to achieve highly refined access to the contents of records. Increasingly, organizations create extensive directories and data dictionaries to document the data in their systems, because organizations need systematic description of data elements, relations, and systems in order to operate effective information systems for current needs. Information Resource Directory Systems (IRDS), which structure and manage descriptive information about databases; mark-up languages and document architectures, which utilize the structure and format of documents to carry descriptive information about their purpose and content; and message-handling systems, which include electronic "envelopes" for each message—all store rich descriptive information about electronic records.<sup>21</sup>

Archivists in the electronic era will have countless opportunities to capture descriptive information created and maintained by records creators. In "Archival Methods," David Bearman proposed that "archivists should find, not make, the information in their descriptive systems."<sup>22</sup> Electronic records best illustrate the potential for exploiting the metadata that organizations create for archival description as well as the folly of describing electronic records using a separate set of tools and techniques. When archivists download data from databases and preserve electronic records in software-independent form, they lose or destroy the directories and descriptions of database relations that are essential for users to understand the records. An archivist must create a new set of metadata in order to make this data extract-accessible and usable. Likewise, when an archives attempts to save the content of e-mail messages or office documents, but destroys the directories, it must then invest in new descriptive systems to help users find their way through large bodies of textual information. What remains is a large body of text, the documentary character of which has been lost. No amount of arrangement or description can compensate for the loss of the directories and audit trails that provided the essential contextual information about records creation and use. For both practical and conceptual reasons, archivists need to focus attention on approaches and methods that find and capture the descriptive information that forms an integral part of all records systems, rather than attempting to create or recreate it. Such methods must recognize and respect the organic relation between the content of the records and the ways in which organizations structure and describe them.

Electronic records present archivists with the potential for much richer description. In the electronic era, the descriptive paradigm will shift from the current practice of augmenting scarce descriptive information to one of selecting from an abundance of metadata, which could form a complete audit trail of all actions taken to create, update, and modify a record, and of all its uses. Automated systems have the capacity to capture and record far more descriptive information than was technically possible or economically feasible with manual systems. An automated case-tracking system, for example, could include (in addition to the data about each case) definitions of the contents and relations in the database, a complete log of every transaction against the database ranging from substantive updates of the status of the case to error corrections, a "library" of routines to produce standard output reports, and a record of each special view of the database by each user. In a system such as this, the data about each case requires only a tiny portion of the storage and processing capacity of the system. Automated systems can capture not only information about the creator of the record and its content, but also a complete history of its creation and use.<sup>23</sup> Given both technical and resource limitations, archivists must determine what we want systems to document and how much descriptive data is enough.<sup>24</sup> Management of metadata and capture of the contextual data about electronic records also require more advanced descriptive practices and more elaborate archival control systems. As descriptive practices shift from creating descriptive information to capturing description along with the records, archivists may discover that managing the metadata is a much greater challenge than managing the records themselves.

The electronic era will also alter the timing of description and reassign responsibility for carrying it out. Decisions made when systems are procured will determine whether a system has the capacity to record adequate documentation, including sufficient contextual information about provenance, data definitions, and use of the system, to permit secondary use for legal, audit, or research purposes. Decisions made during application development will determine whether and how a particular application utilizes these metadata facilities. Such decisions will be based on organizational needs and requirements for available, understandable, and usable records, with little or no consideration for secondary use of the records and, perhaps, without sufficient concern for long-term access and use by the original creators. End users of systems will be responsible for those aspects of description that are not captured automatically according to procedures and standards for adequate documentation. This approach to metadata creation and management leaves few opportunities for fruitful intervention by the archivist once systems are procured, applications developed, and procedures established.

Archivists will pay less attention to description of the content of electronic records, because detailed description of content will become unnecessary, irrelevant, or beyond the control of archivists. Information systems with sophisticated search and retrieval tools will permit rapid searching through the content of electronic records, while search tools such as "WAIS," "Gopher," and "Veronica," will locate information resources that are resident on large-scale networks.<sup>25</sup> Search and retrieval methods developed by information scientists, which harness the potential of computer processing, could provide users of archival records with access to the content of records on a far more detailed level than is currently feasible for traditional textual records. Organizations that need to share data across organizational boundaries will also develop standardized data definitions and thesauri to make the retrieval of information more predictable. Rather than attempting to create and impose external standards for data content on the creators of records, archivists will benefit from identifying data content standards used by records creators and exploiting them in archival descriptive systems.

In summary, the electronic era holds out the promise of richer, more detailed descriptive systems that are incorporated into the design of automated applications and implemented as records are created. Archivists' attention will shift from creating descriptive information to capturing metadata and managing it to promote access, use, and understanding of archival

records. The arena for descriptive standards development will also change from developing internal standards and guidelines that are endorsed by the archival profession, to participation in the standards development process of others.

### ***Conclusion: Realizing What is Possible***

Imagining what is possible is easy. Realizing the potential of new descriptive practices, on the other hand, presents formidable challenges to the archival profession. There is a large chasm between existing practice and the potential of the electronic era. Proposals for the capture and reuse of metadata in archival systems are predicated on the adoption of information technology standards for database structures, shared applications, document architectures, directory systems, and data interchange. Yet many of these standards are still under development, and vendors have been slow to produce standard-compliant products. In the absence of standards or products that facilitate information interchange, organizations continue to generate electronic records using a wide array of non-standard systems and software.<sup>26</sup> Although tools such as data dictionaries can support better documentation of electronic records, archivists should not ignore the long history of shoddy documentation practices in organizations and a culture that places primary emphasis on system design and application development.

There are also conceptual challenges for the archival profession. Current metadata systems do not account for the provenance and contextual information needed to manage archival records. Archivists and records-generating organizations lack models, systems, and procedures for effective management of metadata about provenance and context. Organizations may not create or capture sufficient contextual information to render their electronic records understandable to users outside the immediate functional group responsible for the records, or to their own organizations over time. Archivists do not know whether the metadata that is deemed *necessary* for description of records by the creating agency is *sufficient* for archival description, because archivists have not clearly defined requirements for the description of electronic records. As a consequence, archivists are not certain which descriptive elements support basic record-keeping requirements and should therefore be part of any record-keeping system, and which descriptive elements belong in archival control systems. Finally, archivists have not tested empirically the retention and use of metadata to support the needs of archival description.<sup>27</sup>

Improving the description of records in the electronic era will demand research into archival requirements for electronic records management, development of software and systems that satisfy those requirements, empirical testing of proposals and models for the preservation and use of metadata, development of data interchange and interoperability standards, and education of archivists in the issues and potential for more powerful approaches to description. Such efforts should begin by building on descriptive standards, practices, and systems that utilize information about record-generating organizations and their mandates, functions, and activities. Archivists can make a unique contribution to the management of information, whether for current or future use, by developing effective descriptive practices and systems that exploit the principle of provenance in order to link the content of records to the context in which they were created and used. Such systems show promise of providing models for descriptive practices that better support the current needs of organizations and ensure that archival records are understandable and usable by current and future users.



## Notes

- \* Revised for publication from an earlier version presented at the Annual Conference of the Association of Canadian Archivists, Montréal, 12 September 1992. The author thanks David Bearman, Terry Cook, John McDonald, Tom Ruller, and Lisa Weber for comments on earlier versions of this article.
- 1 International Council on Archives, "Statement of Principles Regarding Archival Description," *Archivaria* 34 (Summer 1992), pp. 8-16; International Council on Archives, "ISAD(G): General International Standard Archival Description," *Archivaria* 34 (Summer 1992), pp. 17-32; Bureau of Canadian Archivists, Planning Committee on Descriptive Standards, *Rules for Archival Description* (Ottawa, 1990-); and "Report of the Working Group on Standards for Archival Description," *American Archivist* 52 (Fall 1989), pp. 400-57.
  - 2 David Bearman, "Documenting Documentation," *Archivaria* 34 (Summer 1992), pp. 33-49.
  - 3 Charles M. Dollar, *Archival Theory and Information Technologies: The Impact of Information Technologies on Archival Principles and Methods*, Oddo Bucci, ed. (Macerata, 1992), pp. 60-62.
  - 4 Terry Cook, "The Concept of the Archival Fonds: Theory, Description, and Provenance in the Post-Custodial Era," in Terry Eastwood, ed., *The Archival Fonds: from Theory to Practice* (Ottawa, 1992), pp. 62-74.
  - 5 For a detailed discussion of metadata, see the article by David Wallace elsewhere in this issue of *Archivaria*.
  - 6 David Bearman, "Description Standards: A Framework for Action," *American Archivist* 52 (Fall 1989), pp. 515-16; and Victoria Irons Walch, "The Role of Standards in the Archival Management of Electronic Records," *American Archivist* 53 (Winter 1990), pp. 30-43. Both Bearman and Walch point out that descriptive practices for electronic records may present models that can be applied to other types of archival records.
  - 7 Wendy M. Duff and Kent M. Haworth, "The Reclamation of Archival Description: The Canadian Perspective," *Archivaria* 31 (Winter 1990-91), p. 31. The ICA Ad Hoc Commission on Archival Descriptive Standards recognized that description may occur at any stage of the life cycle, but focused its attention on description "at a point after the archival material has been selected for permanent preservation and arranged": International Council on Archives, "Statement of Principles," p. 10. The SAA Working Group on Descriptive Standards defined description somewhat more broadly as "the process of capturing, collating, analyzing, and organizing any information that serves to identify, manage, locate, and interpret the holdings of archival institutions and explain the context and records systems from which those holdings were selected": "Report of the Working Group on Standards for Archival Description," p. 442.
  - 8 David Bearman, "Guidelines for the Management of Electronic Records: A Manual for Policy Development and Implementation," Chapter II, in United Nations Advisory Committee for the Coordination of Information Systems, *Electronic Records Management Guidelines: A Manual for Policy Development and Implementation* (New York, 1990), pp. 19-20. See also Glenda Acland, "Managing the Record Rather Than the Relic," *Archives and Manuscripts* 20 (1992), pp. 57-63.
  - 9 This does not imply that organizations do not take deliberate measures to ensure that records are created. Organizations establish procedures and design systems in order to meet record-keeping requirements. In an electronic environment, it is essential for organizations to identify record-keeping requirements and ensure that systems are designed to meet them. Organizations do not create records for the sake of creating records, unless they are in the business of record-making.
  - 10 Sue A. Dodd, *Cataloging Machine-Readable Data Files: An Interpretive Manual* (Chicago, 1982). The responsible party, producer, and distributors are essential descriptive elements of bibliographic records for data files catalogued according to AACR2 and the USMARC Format for MRDF. The limitations of this approach lead some archivists working in traditional archives to reject descriptive guidelines for MRDF in favour of descriptive practices based on archival principles.
  - 11 The basic requirements that electronic records remain available, understandable, and usable were articulated by the Information Standards and Practices Division, National Archives of Canada. See John McDonald, "Preservation of Corporate Memory," discussion document, June 1992.
  - 12 Library of Congress, Network Development and MARC Standards Office, comp., *U.S. MARC Format for Bibliographic Data: Including Guidelines for Content Designation (UFBD)* (1989), with updates.
  - 13 Some archivists are beginning to question, for both practical and conceptual reasons, the feasibility and the wisdom of transferring electronic records to the custody of archives. See David Bearman, "An Indefensible Bastion: Archives as a Repository in the Electronic Age," in David Bearman, ed., *Archival Management of Electronic Records* (Archives & Museum Informatics Technical Report, No. 13) (Pittsburgh, 1991), pp. 14-24; and Charles Dollar, *The Impact of Information Technology on Archival Principles*, pp. 53-55.

- 14 Charles R. McClure, et al., *Federal Information Inventory/Locator Systems: From Burden to Benefit*, Final Report to the General Services Administration, Regulatory Information Service Center and the Office of Management and Budget, Office of Information and Regulatory Affairs (17 July 1990); New York State Forum for Information Resource Management, *The New York State Sourcebook Pilot Project: A Metadata Approach to Information Management* (Albany, 1992); and Charles Robb, "Information Resource Management in Kentucky State Government," *Archives & Museum Informatics Newsletter* 4, no. 4 (Winter 1991), pp. 2-4. Although these systems seem promising, considerable conceptual and design work remains to be done to distinguish descriptions of information and records in locator systems.
- 15 Dollar, "The Impact of Information Technology on Archival Principles and Methods," pp. 48-51. For the classic discussion of the application of the principle of provenance to archival description, see David A. Bearman and Richard Lytle, "The Power of the Principle of Provenance," *Archivaria* 21 (Winter 1985-86), pp. 14-27.
- 16 For a discussion of the significance of the cultural practices surrounding information handling, see Margaret Hedstrom, "Understanding Electronic Incunabula: A Framework for Research on Electronic Records," *American Archivist* 53 (Summer 1991), pp. 322-24.
- 17 Bearman, "Guidelines for the Management of Electronic Records," p. 29.
- 18 Margaret Hedstrom, "Technology and the Historical Record's Transformation," *OAH Newsletter* (February 1992), pp. 6-7.
- 19 David Bearman, "Records Systems as the Locus of Provenance: Implications for Automation and Archival Control and Management of Electronic Records," paper presented at the Ontario Association of Archivists, 13 May 1993, and published elsewhere in this issue of *Archivaria*.
- 20 Cook, "The Concept of the Archival Fonds," pp. 68-72.
- 21 United States National Archives and Records Administration, Archival Research and Evaluation Staff, *A National Archives Strategy for the Development 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 (June 1990); Margaret H. Law and Bruce K. Rosen, *Framework and Policy Recommendations for the Exchange and Preservation of Electronic Records* [Report prepared by the National Computer Science Laboratory, National Institute of Standards and Technology, for the National Archives and Records Administration] (March 1989); Canada Bureau of Management Consulting, *Data and Document Interchange Standards and the National Archives* [Project No. 1-6465] (Ottawa, June 1987); Protocols Standards and Communications, Inc., *The Application of ODA/ODIF Standards* [prepared for the National Archives of Canada] (Ottawa, 1989); and Protocols Standards and Communications, Inc./National Archives of Canada, *Situation Report on the Information Resource Directory System (IRDS)* (March 1989); Charles Dollar and Ted Weir, "The Role of Standards in Integrated Systems Management: A Requirement of the 1990's," Chapter 3 in *Management of Electronic Records*, pp. 71-86; and Walch, "The Role of Standards in the Archival Management of Electronic Records," pp. 30-43.
- 22 David Bearman, "Archival Methods," *Archives & Museum Informatics Technical Report* 3, no. 1, (Spring 1989), p. 31.
- 23 This problem was presented as one of the key electronic research issues for the archival profession in a report of a recent conference. See *Research Issues in Electronic Records*, Published for the National Historical Publications and Records Commission (St. Paul, 1991), pp. 10-11.
- 24 This is a new dilemma for archivists, not only because the electronic environment creates the potential for much richer description and much more precise access, but also because archivists have never defined criteria for sufficient arrangement and description. Archivists have rarely been satisfied that sets of traditional records have been adequately arranged and described, and the profession generally lacks any measures for the outcome of arrangement and description that would permit one to know definitively when the job is completed.
- 25 Brewster Kahle and Art Medlar, "An Information System for Corporate Users: Wide Area Information Servers," *Online* (September 1991), pp. 56-60. Recent research on large-scale networks draws attention to the potential for using networks to distribute facsimiles of archival records, or their contents, in machine-readable form. For a discussion of the implications of network technology for archives, see Avra Michelson and Jeff Rothenberg, "Scholarly Communication and Information Technology: Exploring the Impact of Changes in the Research Process on Archives," *American Archivist* 55 (Spring 1992), pp. 236-315.
- 26 Walch, "The Role of Standards in the Archival Management of Electronic Records," pp. 41-42.

- 27 Two projects funded by the United States National Historical Publications and Records Commission are examining various aspects of this problem. A project at the University of Pittsburgh is developing a definition of the functional requirements for record-keeping systems. Although the model will not specify how the requirements should be satisfied, it will provide a necessary framework for distinguishing descriptive requirements for archival control systems from functional requirements for record-keeping systems. The "Building Partnerships" project at the New York State Archives and Records Administration is testing the feasibility of capturing metadata and using it to describe electronic records in complex structures.