Articles

Record-Keeping Systems

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Résumé

Les cadres de classement des dossiers constituent le contexte dans lequel s'établit la valeur probatoire des dossiers; pour cette raison, leur gestion est cruciale pour la sauvegarde de cette signification. La compréhension des cadres de classement des dossiers est aussi de la première importance pour l'établissement des besoins archivistiques fonctionnels en vue de la gestion des archives informatiques, pour la définition des normes de documentation archivistique, et la conception des systèmes de contrôle archivistique. L'auteur soutient que le cadre de classement des dossiers (plutôt que le fonds, le *record group*, ou la série) doit être admis comme le lieu fondamental de la provenance. Les cadres de classement des dossiers doivent avoir la préférence sur les autres concepts parce qu'ils ont des frontières connues et des propriétés caractéristiques; ils résolvent également des difficultés associées aux concepts de fonds, de *record group*, ou de série dans les pratiques canadienne, américaine, et australienne; et donnent enfin aux archivistes de nouveaux outils avec lesquels ils peuvent jouer un rôle actif à l'âge électronique. De plus, mettre l'accent sur les exigences fonctionnelles des cadres de classement des dossiers a pour effet d'intégrer les archivistes aux vérificateurs, au personnel de la sécurité administrative, aux officiers d'accès à l'information, aux avocats, et à la haute direction, lesquels ont tous une responsabilité envers la mémoire collective et sa gestion. L'auteur soutient que cette intégration est à la fois vitale au plan stratégique et intellectuellement souhaitable.

Abstract

Record-keeping systems are the locus of the evidential significance of records; therefore, their management is critical to the preservation of evidential meaning. Understanding record-keeping systems is critical to formulating archival functional requirements for management of electronic records, defining archival documentation standards, and designing archival control systems. The author argues that record-keeping systems—rather than fonds, record groups, or record series—should be accepted as the fundamental locus of provenance. Record-keeping systems are preferred to these other concepts because they have concrete boundaries and definable properties, solve the problems identified with the concepts of fonds, record groups, and series in Canadian, American, and Australian archival practices, and give archivists new tools with which to play an active role in the electronic age. In addition, the focus on functional requirements for record-keeping sys-

tems allies archivists with auditors, administrative security personnel, freedom of information and privacy officers, lawyers, and senior managers—all of whom have a responsibility for corporate memory and its management. The author argues that this alliance is both strategically critical and intellectually desirable.

I. The Place of Record-Keeping Systems in a Model of Archival Data

Record-keeping systems are a special kind of information system about which archivists should be experts. As the name suggests, record-keeping systems keep and support retrieval of records, while information systems store and provide access to information. Record-keeping systems are distinguished from information systems within organizations by the role that they play in providing organizations with evidence of business transactions (by which is meant actions taken in the course of conducting their business, rather than 'commercial' transactions). Non-record information systems, on the other hand, store information in discrete chunks that can be recombined and reused without reference to their documentary context. Archivists ought to have a special expertise in record-keeping systems, because they are the source of archival records and their context and structure reveal the historical meaning of archives. Nevertheless, the analysis of record-keeping systems from a theoretical or practical perspective is peculiarly absent from archival literature.[1]

In this paper, I extend my earlier analysis of how information about the content, structure, and context of records is required in order to ensure preservation of evidence.[2] I explore what archivists must understand about the nature of record-keeping systems if they are to design and implement systems that capture, maintain, and provide access to evidence. Specifically, I explore how understanding the evidential purpose of record-keeping systems provides critical tools for articulation of workable strategies for the management of electronic records. I also argue that the design of appropriate documentation methods for archives depends upon appreciation of the centrality of record-keeping systems to archival theory and practice and on the concept of records as evidence.[3] Our society recognizes some documents as records, because they carry out or document transactions. Because records are accepted within this social and legal framework as evidence of an act, they are retained in record-keeping systems designed to serve the needs of the people and organizations that created or received them.

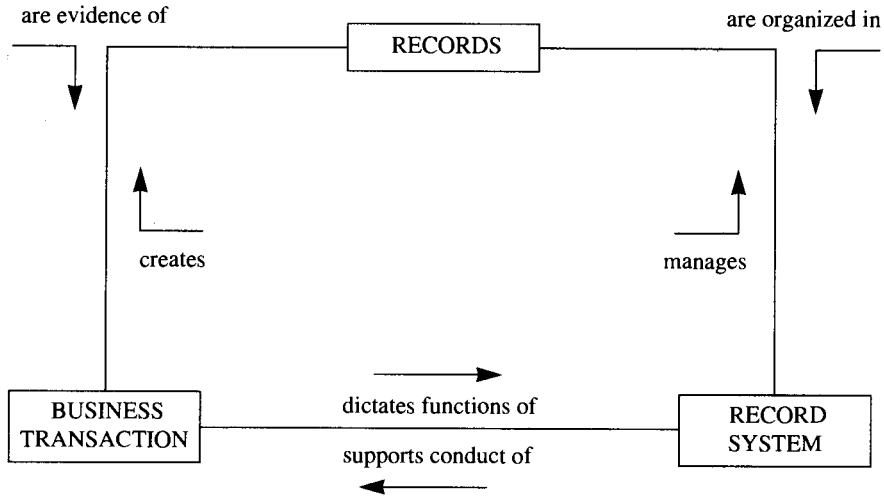
To understand record-keeping systems we must recognize them first as systems, and then, as information systems. Systems consist of interdependent components organized to achieve an end; information systems are organized collections of hardware, software, supplies, people, policies and procedures, and all the maintenance and training that are required to keep these components working together. Record-keeping systems are organized to accomplish the specific functions of creating, storing, and accessing records for evidential purposes. While they may also be able to retrieve records for informational purposes, they are designed for operational staff, not for archivists or researchers, and thus are optimized to support the business processes and transactions of the creating organization rather than generic information retrieval.

Although record-keeping systems are not created for archivists, archivists must appraise record-keeping systems and make decisions to destroy or preserve the records that they contain. Traditionally, archivists have made these decisions based on the examination of records after the records have fulfilled their role of supporting the operational needs of the organization that created them. The advent of electronic records, which are not susceptible to ready examination of the physical documents, has led archivists to seek alternative approaches to appraisal. It was soon realized that if archivists could make such decisions on the basis of analysis of the business functions and the need for evidence of these functions, they could avoid having to review the records themselves. In addition, they could concentrate their efforts on records systems of continuing value, which are relatively few in number, rather than squandering resources on the appraisal of insignificant records systems.

As a matter of principle, when archivists do decide to retain records, they take special care not to disturb the relations defined by the record-keeping system. These relations—which in manual systems are limited to "original order," but which in automated environments may involve many types of relationships—are evidence of how individual records were or could have been used within the record system and thus of what they meant in the context of the business process that they document. In manual systems, accessioning records need not disturb this original order, but in electronic records systems, removing records from the application that supported the relations among records, and between a record and the actions that it documents, runs serious risks of destroying the structure and context information that preserves the evidential significance of the record.

The relationships among records, business transactions, and record-keeping systems are illustrated in **Figure 1**.

Figure 1



Record-keeping systems are established to serve institutional or personal purposes and therefore reflect the functions and activities of the creating organization or individual. For more than fifty years, archivists and records managers have assumed the role of experts who can provide assistance to the organization in setting up record-keeping systems to serve business purposes efficiently and at the same time to satisfy archival functional requirements.[4] Recognizing that not all records systems serve organizational purposes equally effectively, archivists and records managers focused on organizing paper records into series, each of which directly supported the execution of specific business transactions. Guidelines for effective file management issued by the U.S. National Archives in 1968 go so far as to suggest that files that require indexing to provide alternative access points are probably not designed to support a specific function effectively, since a single function, conducted in a specified way, will need to access records in only one—or at most a few—different schemes of arrangement.[5]

This may have been true as long as records systems were designed to support isolated business functions, but the spread of database management systems (DBMS) has been driven by the information management belief that organizational efficiency can be enhanced by reducing data redundancy through organization-wide data integration. In an integrated DBMS, each

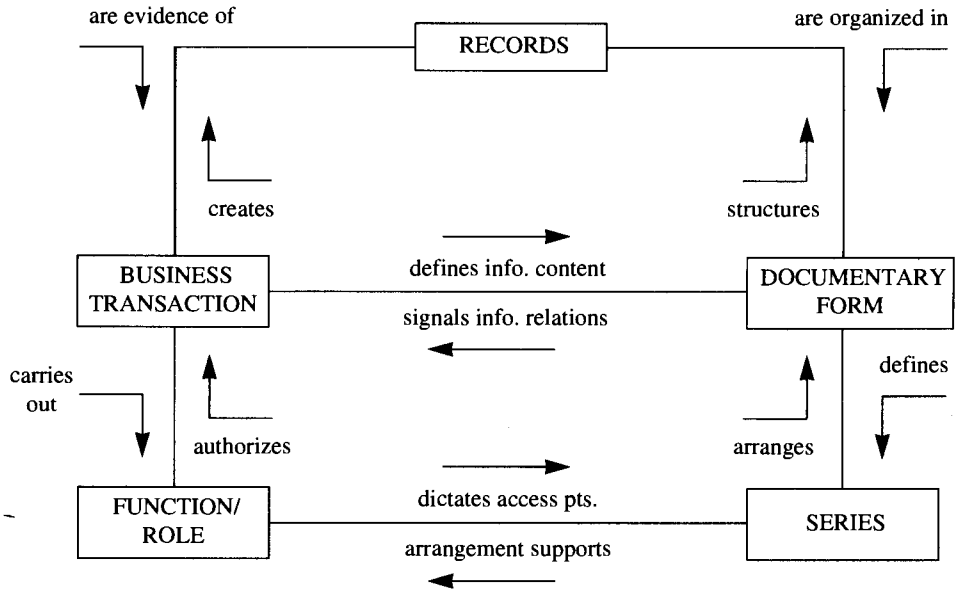
area of functional responsibility within the organization is provided with views of the database that are limited to the data it requires. The software supports the transactions that this functional area conducts but records of these transactions may not be created or maintained if the system was only designed to serve as an organizational data resource (i.e., be an information system) rather than to preserve evidence of business transactions (i.e., be a records system). The possibility that records could be used by bringing information from various sources together in a logical view at the time of making a decision, while not physically creating a record, is new to electronic methods of manipulating data, and presents the first of several serious challenges to corporate memory and operational viability brought about by electronic record-keeping.

Archivists recognize that organizational functions (or "competencies" as the Europeans call them) are the roots of business processes, which in turn dictate the way in which transactions are conducted.[6] The way that the process is conducted is reflected in the organization of records to support a function. In paper systems, the physical records (each document or file) correspond to logical business records (a transaction or case); so the physical organization of the records in the system, within series, relates records to each other and to the way in which work is done in the organization.[7] In automated systems, logical records (representing business transactions) do not necessarily conform to physical records (which are structured to maximize database efficiency); business records may not only involve combining data from more than one logical or physical record (as they typically do in relational database management systems), but may also involve processing this data in ways that are only documented externally to the data itself. Information systems might support the ongoing business of an organization on one level, even though they do not create records essential for accountability.

A second reflection of the nature of activity or transactions is what I once called the "form of material" and which has more recently come to be known as the "documentary form."[8] Documentary forms structure the information internal to the individual record, dictating what data will be present for specific types of transactions, and facilitate its recognition and use by signalling to readers, by means of typography, data structures, and electronic links, where particular information will be located. In the paper world, organizations used particular documentary forms for specific business transactions, but in automated environments the aim is to free the data from the form in which it was created, for use in other ways. At the same time, automated environments have spawned new, virtual, documentary forms such as dynamic documents, multimedia documents, and individuated documents with properties that the organization and the broader culture are only beginning to understand.[9] The novelty of electronic documentary forms means that we cannot make assumptions—common in our dealings with paper records, whose forms we understand—about the relationship between form and content, between form and how the record-keeping system functioned, or between forms and the processes that created them, just as other periods of radical change in documentary forms and methods of business communication have disrupted the relationship between the expression of structure in documents and their interpretation by recipients.

The relationships among records, business transactions, functions, documentary forms, and record series are depicted in **Figure 2**.[10]

Figure 2



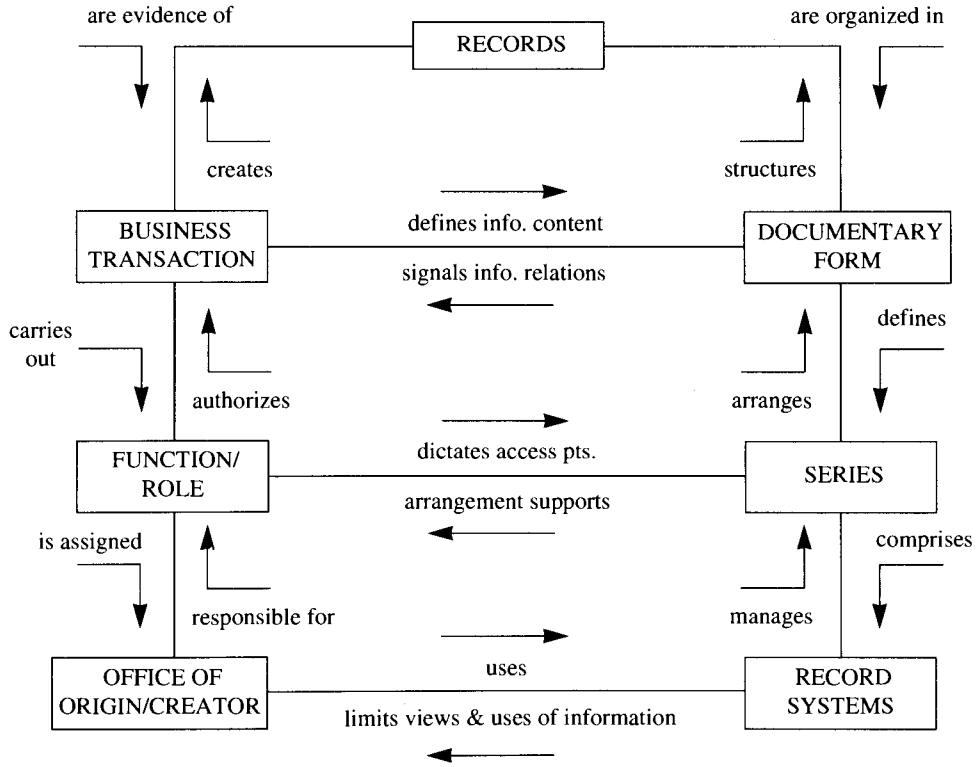
People (as individuals and in their positions as employees), create documents of various types as a consequence of their positions, offices, or roles in life. People also create non-record documents. Information created by people only becomes a record when, and if, it participates in a transaction. Purely private information, not shown to others, is not a record. In modern organizations, if records are created, business practice requires them to be "filed," so that in principle they are available to others. Archivists and records managers instruct filing clerks to create job-, project-, case-, or subject-files around functions of the organizational unit and to file individual records into these structures. In bureaucratic organizations, specific forms of records (often literally numbered and pre-printed forms or "form-letters") are linked to particular business transactions conducted by organizational units. Procedures may dictate that a given type of file will always contain certain of these categories of records. Only specific information is present in each form of record, although the case as a whole contains all the information required for any aspect of the mission of the organization. The same principles apply to records created by individuals in the modern world; different forms such as diaries, correspondence, and subject files of personal "business" will make up the series of records in the home of a private person. When we speak properly of the records of a family, we mean by this that the record system was used by more than one individual, often siblings or multiple generations, of the same family. Otherwise the "family" papers are really an artificial collection, as we call groupings of manuscripts or records made by the collectors rather than the creators.

While the relationship between record-keeping systems and functions is, therefore, always straightforward, the relationship between a record system and organizational units is not. This has been the cause in the past of many of the problems of locating provenance in organizations. Even paper record-keeping systems are not necessarily owned, built, or maintained by the organizational unit that creates the records they contain, although they will be used by that organization. Traditional central registry offices, and the contemporary data processing department which has succeeded them, were assigned the function of maintaining records. The

records they maintain are created and used by numerous, different organizational units. Thus records must be linked not only to the organizations that created them, but also to those that maintained them, used them, and owned them. Each of these organizations may know the same records system by a variety of different names. The views of information held by the organization that are available to a given office of origin are limited by both the record system and their access to it, usually to those views for which they have a business need. Furthermore, it must be remembered that, especially for electronic records systems, record-keeping systems may encompass records physically located in more than one place. Indeed, such distributed logical records systems will become increasingly common during the 1990s, with the acceptance of client-server architectures. Logical records systems are even more radically the norm in object-oriented environments in which the record alone will carry the methods by which it is searched, disseminated, and disposed, and the procedures governing the record-keeping system are distributed to the level of the individual records and do not exist in a higher aggregation.

Figure 3 represents the elements discussed so far and their relations.

Figure 3



Although these relations among elements are the same in manual as in electronic records environments, the character of record-keeping systems is being radically transformed by automation, as is the character of series, forms, and records themselves. Changes that are significant to archivists include the software dependency of record-keeping systems, the existence of

record-keeping systems that serve many different and physically remote offices—each office having its own views of the system and also its own functions—and business processes that do not create records although they use information from dynamic information systems.

Before examining the implications of these changes both for archival automation and for management by archivists of electronic records of organizations, it is useful to establish the relationship between the concept of a record system and the fundamental archival principles.

II. Archival Documentation and Record-Keeping Systems

Provenance, unarguably the most important concept in archival science, dictates that records are to be understood with reference to their origins in activity.[11] As a shorthand, archivists often equate the provenance of records with the organization in which records were created or received, i.e., the "office of origin." However, as the preceding data model makes clear, the provenance of archives is better understood by reference to the function of which they are evidence and the record system in which they were created, stored, preserved, and accessed by the organization. Elsewhere, I have written on why archivists must recognize function, and not organizational setting, as the locus of provenancial meaning.[12] Suffice it to say here that what systems analysts would call the business function being conducted, not the "office of origin," determines the form and content of records and dictates the procedures for their creation and dissemination. As a consequence, when functions are transferred from one office to another, the records that document the function typically are stable and record-keeping systems are usually transferred lock, stock, and barrel with the transfer of responsibility. On the other hand, if a new function is assigned to an office, it will usually require new procedures accompanied by new documentary forms, new series of files, and often entirely new, separate record-keeping systems.

Archives appraise and accession record-keeping systems, not individual records, because record-keeping systems do not just passively reflect how the creating organization used information; they actively determine it. As such, record-keeping systems are an organic whole. Some record-keeping systems, such as central registries or decentralized filing systems operating with a shared classification structure (thereby resulting in "virtual" central registries), may be managed at the corporate level during their active life. Other record-keeping systems, such as subject files, chronological transaction files, or incoming and outgoing correspondence, may be managed at a work unit, or even a work-group level, with or without reference to a larger corporate records system. In North American organizations it is even common for some records to be managed by individuals, either because in the prevailing corporate culture larger-scale systems do not exist or because the individuals want to retain control over the information that the records contain.[13] If information or documents pass across the boundaries between individuals, work groups, formal organizational units, or independent organizations, record-keeping systems should create records. However, the definition of a record-creating boundary is not absolute or fixed and depends on the nature of the transaction, aspects of the organizational culture, and boundary perceptions in process definitions.[14]

Ability to access and use record-keeping systems, rather than employment within the office of origin, determines the role that records play in specific business processes during their active life. Relationships and structures established in record-keeping systems determine the connections that can be made between records they contain both during and after their active life. Although archivists know that record-keeping systems provide evidence of the role that records played in the organization, they have not developed tools or techniques for documenting how record-keeping systems relate to organized activities through established procedures. In traditional paper-based systems, neither archivists nor the operating entity can typically document who accessed record-keeping systems or how the records that they retrieved were used; although, when a record is thus used, it is participating in a new business transaction and

should, in principle, become a record of that transaction.[15] In electronic information systems, tools for representing such relationships as permissions, views, and actual uses of records exist, and data administrators and configuration managers can document the participation of records in concrete transactions over time.

Archivists have not made use of these tools in automated archival control systems. Indeed, the history of archival automation has not been a story of great successes. The relatively early adoption of a data content and interchange standard led not to the development of methods to bring archival documentation from active office settings directly into archival finding aids, but to a species of rigid text editors designed to create databases of MARC AMC records.[16] In so far as archival automation exists, it builds databases that replicate the data that was previously found in paper finding aids and indexes, although it may provide more access points. Data gets into these systems by means of archivists preparing finding aids, and it generally is used by archivists acting as reference intermediaries.[17] Automation—as implemented in archives today—is not integrated record-keeping systems documentation, contributes little if anything to archival productivity, and does not insinuate the archival function into the operating environment of the parent organizations.

Some archivists have been working to analyze archival systems in a way that would generate requirements for archival documentation standards, which would move automated archival information systems beyond their role as fast paper.[18] In a recent effort to define the information architecture of archives in order to provide a framework for more integrated archival automation software, it was consistently found that the need of data archivists to describe the context and structure of records originates in documentation of organizational missions and record-keeping systems.[19] It was also found that current data models and flow diagrams for archival information systems overlook the nexus of records creation and record-keeping in the record system, and that the archival function was being implemented as if it could be logically segregated from the record-keeping systems of the business.

This segregation is impossible except at the expense of total redundancy, because archival information systems have always been information systems about record-keeping systems, or what data administrators call "metadata systems." Although data administrators developed automated systems called Data Dictionaries and Information Resource Directories to document and manage electronic record-keeping systems, archivists have not adopted these automated systems, but have instead tried to employ traditional methods for describing electronic archival holdings.[20] Unfortunately, the prose narrative and the simple data structures that archivists use in traditional finding aids cannot rigorously describe the myriad links of records with each other or transactions that are supported in automated systems. In addition, because they are constructed after the fact from evidence still visible after the records come into the archives, they also do not document the evolution of relations which takes place over the life of a system. When automated, these simplistic representations of information systems fail to help researchers reconstruct archival evidence or permit archivists to achieve operational efficiencies.

By failing to employ techniques of documentation available from the domain of systems design and management, archivists have overlooked a pre-existing source of documentation which would, if properly regulated, mitigate the need for archivists to engage in the post-hoc documentation of accessioned systems.[21] More importantly, archivists have missed the opportunity to maintain systems that serve as the repository of organizational memory of functions, structures, and events, even though such databases are much needed by contemporary organizations and the data is necessarily present in an adequate archival information system.[22]

I know of no archival institutions that serve as repositories of the life-cycle software configuration management documentation essential for establishing evidential context and structure in an adequate archival information system. This is especially unfortunate, as it appears that the data management requirements, and hence the metadata documentation requirements of ar-

chives are identical to those of vital records management, privacy administration, freedom of information, and administrative security. If archivists did their jobs documenting record-keeping systems, they could exploit the often greater political and financial clout of constituencies for these other interests. Such an integrative function speaks directly to strategic opportunities for contemporary archives.

Archivists must find ways to make the data that they manage or create regarding organizational functions and structures sufficiently important to the organization that others will keep it up to date and use it as an official referent. If archivists do not become the authoritative sources of information about which record-keeping systems exist and how they are implemented, they cannot identify the records that should be preserved archivally. Ultimately, archivists will need to design ways to acquire descriptions of individual records, files, and record-keeping systems directly from the self-documenting features of electronic records systems, because they will otherwise never have the resources to obtain this level of detailed documentation.

Documentation of record-keeping systems in metadata systems that contribute to fundamental organizational data management will dictate a very different agenda for standards for archival description. Hints of this agenda were present in the report of the SAA Ad Hoc Committee on Description Practices, which defined archival description 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 contexts and *record systems from which those holdings were selected.*[23]

Careful readers saw a radical shift from "making" description, to capturing it, and from describing records to documenting contexts and record systems. An extension of this shift of focus led to two critiques of the proposed General International Standard Archival Description (ISADG).[24] The critique is equally applicable to the recently-developed Canadian *RAD* framework (which is built around the concept of fonds), the American reliance on record groups, and the Australian primacy of series.[25] I believe that what each framework really needs is the concept of a record-keeping system.[26] Readers will note that in the model in **Table 3**, fonds and record groups are unnecessary theoretical constructs that do not consistently correspond to any combination of other concepts. Series only provide context when they are not part of a multiple-series record system.

Archivists, like Ptolemaic astronomers, are struggling with "very subtle" notions to make reality fit theory. When applied, the theory of fonds leads to inherent contradictions. This is because fonds are defined simultaneously as having what Terry Eastwood calls an external and internal dimension[27] or what Terry Cook describes as the product of a "defined creator" and a "linked record-keeping system."[28] The effort to define fonds as being a theoretical construct that is simultaneously organizational in context and the relations among records needs to be abandoned in favour of what Angelika Menne-Haritz calls functional provenance[29]. Record-keeping systems have the virtue of being the locus of functional provenance and at the same time being real things with concrete boundaries in time and space that do not require philosophy to locate. Their characteristics are precisely the variables that are involved in defining documentary evidence: content, structure, and context.

Record-keeping systems defy the traditional approaches we have taken to documentation, and even resist the more innovative efforts to forge descriptive systems around the concept of series linked to organizational units, which was pioneered by Peter Scott in Australia and explored in North America by Max Evans.[30] Record-keeping systems have complex structures that give meaning to records. Although some manual records systems may consist of a single series, most involve multiple series, with links between them that facilitate the ongoing work of the organization. Changes in either documentary form or arrangement that signal a change in record series are physically revealed in manual record-keeping systems, but are not self-evident in electronic systems, where both format and order are logical constructs. In electronic record-

keeping systems, the documentation that describes what we have come to regard as series (either a "view" or a separate physical file with defined links) may be part of the logic of the software, the content of tables which the software reads, a function of the architecture of the system, or external to the electronic form record system. Of course, in both manual and electronic systems, the documentation itself is a record series that is part of the record system; however, electronic records systems retained without appropriate documentation will hold no evidence. In order to retain evidence, archivists need to ensure that series of records within a record system are retained as they were employed together by the creators and users of the record system. In the process, the separate description of each series, which sufficed for manual systems, becomes inadequate. Record-keeping systems must be documented using data administration techniques for metadata representation, because relations between series are complex data structures with links into elements of the business environment in which they operate. This will become more obvious as MIS offices try to implement "enterprise computing," process control, corporate decision support systems, and object-oriented systems.

Metadata documenting a record system needs to link organizational structure and function, business and archival processes, software procedures, and documentary forms. As such, it needs to be represented in a relational data model supporting processing along connections between the files. In defining what data is needed to describe the record system entity in such a model, it is clear that this data is different from data describing an organization, a records creator, or an accession—although record system documentation is linked to documentation of these entities in the metadata system.[31]

Figure 4 below illustrates the data about records systems that we might need in a metadata system. As laid out in the illustration, it appears to be a flat record of the sort we might "write" in an archival finding aid; however, readers should note that the field names indicate that numerous record types are present and linked, and that other attributes of the entities referenced by the first word in the field label would be present in a fully coherent meta-documentation system. The data values in the working metadata system would not contain the sorts of words used in this example for the purpose of helping archivists to imagine the meaning of these fields, but rather would consist of pointers to other records and data represented in a fashion that enables it to be processed consistently. In this illustration, the data resembles our current archival finding aids more than that found in Information Resource Directory Systems, but is included to introduce archivists to the range of content that is necessary to describe a record system, rather than to suggest an actual data structure for an archival metadatabase on record system entities. Even so, it is noteworthy that these fields of data about record-keeping systems are absent from *RAD*, *MAD*, and *APPM*.

Figure 4

Metadata files partially describing record-keeping systems with descriptive text of the sort found in archival finding aids

System Name: Environmental Disaster Record System

System Owner Name: Health & Public Safety Division

System Owner Business Function: Service Delivery

System Authorized Record Creator Names: State Dept. of Environmental Affairs Health & Public Safety Division, City Police Department, State Department of Highways, State Department of Education, City Welfare Services Division

System Implementation Date: April, 1972

System Abandonment Date: active

System...

User Name:

User **Views**: Accident Report; Service Cost Analysis; Application for Assistance; Application Approval Hearing evidence; Grant Award; Disbursement Authorization; Case File Summation; Geographic Locations Report

User Permission View Files: Accident report file, claim file, hearing file, client file, incident file, agency file

User Permission Update Functions: relief recipient data

User...

Hardware Configuration CPU:

Hardware Configuration **Storage Devices**:

Hardware Configuration...

Data Configuration...

Data Elements ...

Data Output Products: Report 534; Report 9876; Report 46; GIS forms 2,9-14,63,66-87; Stat Report forms 1-231

Data Input Products: Screens 1-56

Data..

Software Configuration...

Documentation Products: Disaster Relief Coordination System Procedures Manual 101; Disaster Response System Software Documentation; System Permission Configuration Audit Trail

Documentation Data Test Set: File 1344

Documentation Data Audit Set: File 87654

Documentation Data Configuration History: File 76

As can be seen from the above list of files and fields, which represents a small portion of what would be required to document a record-keeping system, it is not possible to implement a metadata system in a "flat" format. Such a descriptive approach would not link the views that a given department had with the content of the data in those views, and the state of the software configuration at any time. It would be unable, for example, to determine how the input from the State Department of Environmental Affairs would be acted upon by the system, and thus whether the input files (the case record as retained in the database) or the output in response to particular user queries made as part of certain service delivery processes, would be the evidence required to document the function.

While archivists will not need to create or maintain all of this metadata about electronic information systems by themselves, they will not be able to define what metadata would be required to document record-keeping systems, nor how it would need to be represented, without understanding the functional requirements for archival record-keeping systems. These functional requirements dictate what documentation we actually require in order to preserve the evidential value of records.

III. Functional Requirements of Record-Keeping Systems

In contemporary organizations, electronic records systems create, store, disseminate, and retrieve records. Software applications developed specifically for organizations and generic commercial applications are operating on a wide variety of hardware to support these systems. Archivists would like to ensure that electronic record-keeping systems developed or acquired to support other functions of the organization are implemented and managed in such a way as to ensure that records are captured and preserved. However, electronic records systems differ from their manual counterparts in several ways that are of considerable significance to archivists, including that they are typically designed and operated by people other than either archivists or records creators. In addition, they are typically dependent for functioning on the hardware and software in which they were implemented. The professionals who manage electronic information systems demand that archivists articulate their functional requirements so that decisions can be made whether, to what extent, and how they should be satisfied.

The failure of archivists to understand records systems in their practice with paper records has left them without analytical tools with which to approach electronic records. Instead of defining the functional requirements for archivally sound records systems, archivists have been trying to preserve "machine-readable records" or output products from systems. Instead of defining how systems would self-document the content, structure, and context of records, archivists have tried to document their provenance, their dependencies, their relationships, etc. in descriptive activity. Without understanding the record system in relation to processes and activities of the organization, however, it is not possible to identify what data in the system constitutes evidence of an activity, and which activities and competencies spawned or used the record. From output products it is not possible to reconstruct the record as evidence; in addition, looking at output products has obscured the need for archivists to develop methods that will permit long-term retention of and access to systems. Moreover, the least effective way to document systems is after they have been retired; ongoing documentation, maintained from design specifications onwards, is a much more reliable and effective means of systems control.

Because records systems are a logical construct rather than a physical one, they may span many "volumes" in computer disks and many offices in location; however, a single documentation or description will define the selection of records to the system, their arrangement within it, and the methods of access to it. Such documentation enables systems staff to operate the system, to integrate it with other systems, and to modify its functionality and ultimately "migrate" the data that it contains to a new hardware and software environment. Unfortunately, archivists are not conversant with such documentation or with the formal properties of record-keeping systems. Documentation of record-keeping systems is not easily isolated from documentation of the software application as a whole, because most software applications have historically stored data in their own record system.[32]

Regardless of the implementation environment, the archival management of electronic records is an inseparable component of ongoing data management in electronic record-keeping systems. It should be approached first with a clear definition of what we want "archivally responsible" systems to do. Once we enumerate these functional requirements, we should ask when (in the life of the system) and how (by what means) we could intervene to satisfy the requirements. Then we should test these intervention strategies in installed record-keeping systems in the real world in order to refine heuristics that can be used by others.

In a study based on these premises currently underway at the University of Pittsburgh,[33] we hypothesize that the functional requirements apply to any record-keeping system. They are not unique to electronic record-keeping systems, although the means for satisfying a requirement will be dependent on the way that the system is implemented. The methods available to satisfy functional requirements include policy, procedures, system design, and standards.[34] In electronic systems these are often referred to collectively as "data management practices." We expect that success in using data management practices to satisfy archival functional require-

ments will be a factor in the interaction of the choice of strategies with the features of the business application, the software application, and the corporate culture. Different business applications will have differing levels of risk associated with non-satisfaction of each requirement. Different software applications will have different barriers to use of design, implementation, and standards-based approaches to requirements, and will be correlated with implementation at different levels in the architecture. Different organizational cultures will be correlated with different approaches to satisfying each requirement. A representation of this research project, showing the variables, their anticipated interactions, and the hypotheses of the researchers, is shown in **Figure 5** below.[35]

Figure 5

University of Pittsburgh Electronic Records Study

Archival Functional Requirements 1-n	X	Tactics	Variables: Business Functions/ Applications	Software Applications	Business Sector	Organizational Culture
		[given in proposal]	[to be defined with literature and analysis]	[to be defined with survey/ analysis]	[given in proposal]	[to be defined with literature and experts]
Compliant		Policy			Government	
Accountable		Design		examples may include:		examples may include:
Responsible			examples may include:		Commercial	
Implemented		Implementation		Transaction Oriented		Open/Closed
Reliable					Non-Profit/ University	
		Standards	Financial Management	Document Oriented		Hierarchical/Flat
Capture						
Comprehensive			Service Delivery			Full Bureaucracy/ Market Bureaucracy/ Workflow Bureaucracy Personnel-Bureaucracy
Complete				Data Oriented		
Identifiable			Fulfillment			
Authentic				Intelligent/ Analytic		
Maintain			Production			Central/ Decentralized
Sound				Object Oriented		
Auditable			Research & Development			Micro-managed/ Autonomous
Exportable				Remote Sensing		
Removable			Communication			
Access						
Available			Education & Training	Procedural		
Usable						
Understandable			Personnel Management			
Redactable						
			Policy Formulation and Regulation			

Hypotheses

1a) The functional requirements for archival management of electronic records are the same as for traditional records
1b) Many functional requirements will not be satisfied by traditional records systems
2a) It will be possible to satisfy each of these functional requirements following any of the four tactics
2b) Many requirements will be more fully satisfied for electronic record than they could be for paper records
3a) Different business applications will share different sets of functional requirements, and
3b) Differing degrees of risk are associated with non-satisfaction of requirements in different business applications
4a) Different software applications will not dictate different functional requirements, but
4b) Different packages within application categories will satisfy the functional requirements to different degrees
4c) Software dependent data objects are not records and as evidence will generally be saved in an independent format
5a) Functional requirements will be the same for each business sector, and
5b) Different sectors will not determine choice of tactics as much as different corporate cultures
6a) The best way to satisfy functional requirements will depend heavily on corporate culture
6b) The technological capabilities of the archives and its agents will be less critical in satisfying archival requirements that will be the acceptance of archival responsibility by managers throughout the organization

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These functional requirements were initially identified through a review of the literature on electronic records management, archives, and organizational information systems management. A draft statement of the functional requirements for archiving[36] was then submitted to critique by a group of experts in the field. After two days of deliberations, a revised statement of functional requirements for record-keeping was prepared, as illustrated in **Figure 6** below.

Figure 6

Functional Requirements for Record-Keeping[37]

COMPLIANT ORGANIZATIONS		
ACCOUNTABLE SYSTEMS		
responsible	implemented	reliable
FUNCTIONAL RECORDS		
CAPTURE	MAINTAIN	ACCESS
comprehensive	sound	available
complete	auditable	usable
identifiable	exportable	understandable
authentic	removable	redactable

To understand how these functional requirements relate to the concept of record-keeping systems, it is important to free ourselves from a physical model of record-keeping systems tied to a specific implementation. We need to adopt a conceptual framework in which a system is understood to be the totality of people, policies, hardware, software, and practices surrounding the creation (or acquisition) and the use of information within any organization. The business application for which these particular functional requirements are being specified is archiving. All other business applications of the organization, such as correspondence management or order fulfilment, are presumed to have their own functional requirements in addition to archiving requirements.

The requirements are purposefully stated as outcomes rather than as methods. As mentioned earlier, each requirement could be satisfied through either policy, systems design, systems implementation, or standards—or through a combination of these functions. Indeed, it is assumed that no organization would seek to satisfy all of these requirements using a single strategy. In this the functional requirements depart significantly from the approaches that have been used by archives to achieve these ends in manual record-keeping systems, which have often assumed that all the (unarticulated) functional requirements could be satisfied at once, in the same way, and in the same place in the overall system design.

This has significant implications for the architecture that we envision to satisfy the requirements. Insofar as systems design, implementation, and standards (rather than policy) are employed to satisfy these requirements, the functionality required for archiving may be located within the Application Software, in a service located in the Application Programme Interface, in any of the services of the Application Platform (such as the operating system, user interface, network services, etc.), in the External Environment Interface, or in the External Environment itself (for example, in the communications systems or the telecommunications environment).[38]

Each individual functional requirement may be satisfied by solutions implemented within one or more software layers, and no two functional requirements need be satisfied in the same way. By taking the view that each transaction generates a record—rather than the perspective of the document, which views documents as participating in many transactions—we save ourselves the very complex modelling requirements posited by Richard Barry's work with state transition diagrams.[39]

Except that it is only possible to satisfy functional requirements relating to storage, preservation, and access of evidence insofar as those relating to its creation have been satisfied, there is no presumption that any system would, could, or would want to satisfy all these requirements fully. It is known that these functional requirements are not completely satisfied within existing paper-based information systems, on which we have long relied. For example, few paper-based systems maintain evidence of who used the records in the course of what decision-making (although some registry functions retain this data with files). Virtually no paper-based system can document whether the individuals or offices named in a distribution list for a document actually received it (or who even sent it). In electronic record-keeping systems it may be easier in some cases, and more difficult in others, to satisfy these functional requirements. Always, the decision regarding the degree to which any functional requirement will be satisfied is a business decision grounded in risk assessment. Whether risk management methodology is formally applied or not, costs and benefits, specific liabilities, and organizational needs and priorities will always be taken into consideration. Decisions not to satisfy functional requirements are just that; they do not invalidate the requirement.

It is the intention of the University of Pittsburgh research project, for which this articulation of functional requirements was undertaken, to examine business functions, software applications, and organizational culture variables relating to the satisfaction of these functional requirements, in order to develop heuristics that can guide practice. In **Figure 7** below, we present these requirements as currently articulated. They suggest some of the power of the concept of record-keeping systems, as the locus of provenance, to define effective strategies for electronic records management.

Figure 7

Functional Requirements for Record-Keeping Systems

Record-keeping is a critical function that is performed through the collective action of individuals and systems throughout all organizations. Record-keeping is not the province of archivists, records managers, or systems administrators alone, but an essential role of all employees and of individuals in their private lives.

Record-keeping systems are information systems that are distinguished by the fact that the information they contain is linked to transactions that they document. Records may be consulted for documentation of those transactions or because they contain information that is useful for some completely separate purpose, but record-keeping systems do not just contain data to be reused; they maintain evidence over time.

Record-keeping systems support the corporate memory of organizations by supporting the business functions of the organization. All business functions require records of business transactions in order to continue their day-to-day operations, satisfy administrative and legal requirements, and maintain accountability. The following functional requirements for record-keeping systems define a corporate requirement for any record-keeping system, not the application requirements of archives and records management systems. Archives and records management are only one business application within the organization, just as are manufacturing, sales, service delivery, or personnel management. In designing and implementing information and record-keeping systems, the functional requirements for any particular business applica-

tions must be considered together with various corporate functional requirements. Archives and records management systems have functional requirements specific to their business application—such as storage management, records retention and scheduling, reference management, and access control—which are not discussed in this document. The functional requirements presented below, on the other hand, are universal for any record-keeping system. They may be of special interest to archivists, records managers, security officers, freedom of information and privacy administrators, auditors, lawyers, and others with special obligations towards records, but they should be of value and relevance to programme managers at all levels, from corporate management to line supervisors.

These functional requirements were specifically developed in order to provide guidance for the management of electronic record-keeping systems, although they are equally applicable to manual systems. Information systems professionals should note that business functions, business processes, business transactions, and business records—rather than system functions, system processes, system transactions, or system records—are the consistent focus of record-keeping.

Articulating functional requirements is the first step in effecting adequate control of record-keeping systems. The next step is to determine an organizational strategy for satisfying the functional requirements insofar as is appropriate. Strategies might include adopting policies and procedures, designing new systems, implementing systems in a way that supports satisfying the requirements, or developing standards. Each of these four strategies may be applied separately or in combination to each separate functional requirement. The choice of strategy will depend on the degree of risk involved in failure to satisfy a requirement within the business function that the record-keeping systems is to support, the existing systems environment (including hardware, software, and architecture), and the corporate culture in which the strategy must succeed.

Record-keeping systems capture, maintain, and access evidence of transactions over time, as required by the jurisdiction in which they are implemented and in accordance with common business practices.

Functional Requirements for Record-Keeping Systems

I. Compliant

Record-keeping systems comply with the legal and administrative requirements for record-keeping within the jurisdictions in which they operate, including specific requirements not referred to below.

II. Accountable

Responsible: The organization must have policies, assigned responsibilities, and formal methodologies for management of its record-keeping systems.

Implemented: Records must have been created and maintained in the normal course of business, and documented procedures that were followed should conform to common practices in the industry.

Credible: The system must control quality characteristics of information being input and process information in a fashion that is consistent and accurate.

III. Functional

Record-keeping systems must capture, maintain, and access evidence over time. If they do so, records will be:

Complete: Records accurately capture all information recorded or generated by their creators. Records incorporate or link to, a representation of the software functionality that created them, other versions or views, a data model of relations between elements of information within a record, eye-readable conventions such as placement or font, and other structural information that adds to their meaning. Records incorporate, or are linked to, information about the context of their creation.

Identifiable: A distinctive and bounded record exists for every business transaction.

Authentic: The system must validate records creators and/or authorizers.

Communicated: The system must capture a record of all communication in the conduct of business between two people, between a person and a store of information available to others, or between a source of information and a person.

Sound: The integrity of records is protected from accidental or purposeful damage or destruction, and from any modification after they have been received by anyone other than the creator.

Auditable: Record documentation traces the processes in which records participated, including indexing, classification, filing, viewing, copying, distribution, disposition, use, and destruction, throughout the life of the record. Management controls preserve auditability of interactions external to the system (such as during media migration or transfer).

Understandable: Records documentation should permit stored business records to be logically reconstructed. Information content, plus any structure and context, must be preserved in meaningful and documented relations. For records with functionality, business application procedures must be documented so that they can be correctly associated with the status of the system at the time of record creation and later.

Removable: It must be possible, with appropriate authority, to remove records from the system, leaving only audit trails to document their prior existence.

Exportable: Record content, structural representation, and representation of context must be exportable in standard protocols, if such protocols exist.

Available: The system must document all logical archival records that it contains, indicate the terms under which they are available for research, and retrieve them for authorized users.

Renderable: The system must render records by display or otherwise as they appeared to creators with views in effect at the time any record was used, or retain structural data necessary to determine such views.

Redactable: The system must support delivery of redacted, summarized, or censored copies, and keep records of the version released.

IV. Some Strategic Implications of Focusing on Records Systems

The concept of record-keeping systems as the locus of provenance provides tools for understanding archiving requirements, which are missing if we retain traditional definitions of provenance equating it with records creators or fonds. The recognition that records systems have concrete properties directly related to their ability to capture, maintain, and access records is the first step in directing archival intervention so that evidence can be saved. When archivists understand the concept of record-keeping systems, they are freed from imagining that such intervention only takes the form of a unified policy, an isolated "archival" application, or a universal archival standard. By taking a systems approach, it becomes evident that the satisfaction of each separate archival requirement can be approached separately. Thinking in sys-

tems terms permits us to imagine architectures for satisfying these requirements, in which satisfaction of the overall requirement is achieved by satisfying particular requirements at various different places, and in different ways, within the system of people, procedures, hardware, software, and data.

Record-keeping systems-based strategies may have fundamental implications for archival programme structures.[40] Focusing on functional requirements allows us to emphasize outcomes of archival actions rather than outputs, and suggests a framework for regulation in which the archival function of the organization can require other units to address these functional requirements for those record-keeping systems identified as linked to mission-important functions, but not dictate specific solutions or records that must be saved. The programme units of the organization must then consider the risks and the opportunities, and develop plans for data management that address each functional requirement to the degree required by the business function, and in a way suggested by existing technology applications and the corporate culture.

Archival data management would complement data management requirements of other corporate control functions and of operational managers, and lead to construction of archival information systems that are operationally useful sources of information about record-keeping systems or metadata systems. Because the information that these systems contain about record-keeping systems is inherently part of the documentation of these systems themselves, archivists would less have to "describe" records systems than to "gather descriptions" of them. Archivists will find natural allies in their documentation efforts because the same documentation of record-keeping systems required to support archival needs also supports FOI, security, vital record, and privacy requirements.[41]

With control coming early in the life of the system, responsibility being accepted by line supervisors and senior management, and documentation collated in metadata systems, archivists would have less reason to accession records from record-keeping systems. The existing record-keeping systems would enable archivists to exploit search mechanisms already constructed by programme offices to retrieve records. Patrons could thereby be assured of evidentially reliable records through mechanisms that themselves are evidential, and archivists would eliminate the need to create external search systems that introduce artifacts into the search process, and could retrieve information that is not a record. The methods employed within record-keeping systems can be augmented by information obtained through full-text analysis, statistical analysis, or artificial intelligence, from records maintained by the record system. Such methods could also be employed for retrieval in situations where the user of the archives is interested in information that may be contained in record-keeping systems, rather than in records themselves. Archivists would then be seen as professionals who assist in mining the records of the organization for evidence and information, rather than custodians who oversee the destruction or storage of old documents.

Record-keeping systems-oriented thinking not only gives archivists a tool that supports documentation, appraisal, preservation, and retrieval. It also defines for them a unique role among information professionals as defenders of records, rather than processors of information. It defines special skills that archivists can learn in their educational programmes and apply in their professional lives, and which are not the province of the other information professions. It also levers the most important traditional archival concepts into tools for the information age, making it clear that the record-keeping system is the locus of provenance.

Notes

* A draft of this paper was presented at the Ontario Association of Archivists Conference on Archives and Automation, Toronto, 13 May 1993.

1 The concept of record systems, and especially of filing systems, was present in the United States' archival literature through the 1950s but has disappeared since. The only direct treatment of record-keeping systems that I have discovered was published in *American Archivist* 13 (1950), pp. 259-67).

The author, Helen Chatfield of the United States Bureau of the Budget, discussed "The Development of Record Systems" with attention to the history of chronological, subject, and alphabetic classification schemes in government offices, and the role of self-indexing or separate indexes in each configuration.

2 David Bearman, "Information Technology Standards and Archives," *Janus* (1992), pp. 161-66.

3 This will likely involve considerable rethinking of archives in the United States and Canada. I found the index entry "systems" utterly absent from indexes to the *American Archivist* since its inception. *Archivaria* presents the same picture. It is noteworthy that the Australian literature up to and including the latest edition of *Keeping Archives* is replete with references to record-keeping systems, but (following Peter Scott) nonetheless focuses on the series as the fundamental unit of archival control. Description is linked to records about organizations and their functions rather than to documentation of record-keeping systems. I imagine that recognizing the role of record-keeping systems will be easier for archivists in Australia, who already acknowledge the record-keeping system as an identifiable element in control but have not brought it into a rigorous model of appraisal or documentation.

4 An example of the kind of analysis of record-keeping systems that was once basic to archival practice is found in Howard Crocker and Kenneth L. Brock, "Building a Records Filing System for New York State Schools," *American Archivist* 19 (1956), pp. 249-60.

5 U.S. National Archives and Records Service, *Guidelines For Effective Files Management* (Washington, DC, 1968).

6 Luciana Duranti, "Diplomatics: New Uses for an Old Science," (in six parts), *Archivaria* 28-33 (1988-1992).

7 T.R.Schellenberg, *Modern Archives: Principles and Techniques* (Chicago, 1956), p. 77, quotes Australian archival management guidelines for registry systems, which stated that they should "be planned in relation to the functions and activities of the department" and "as far as possible reflect the organization of the department."

8 I used the term in my draft of the NISTF *Data Dictionary*, but my definition of it appears under the heading "form" alone in Nancy Sahli, ed., *MARC for Archives and Manuscripts: The AMC Format* (Chicago, 1985). For a discussion, see David Bearman and Peter Sigmond, "Explorations of Form of Material Authority Files by Dutch Archivists," *American Archivist* 50 (1987), pp. 249-53 and David Bearman, "'Who about what' or 'From whence, Why and How': Intellectual Access Approaches to Archives and their Implications for National Information Systems," in Peter Baskerville and Chad Gaffield, eds., *Archives, Automation & Access, Proceedings of a Conference held at the University of Victoria, British Columbia, March 1-2, 1985* (Victoria, 1986).

9 Ronald Weissman, "Virtual Documents on an Electronic Desktop: Hypermedia, Emerging Computer Environments and the Future of Information Management," in Cynthia Durance, ed., *Management of Recorded Information: Converging Disciplines* (New York, 1990), pp. 37-59; also David Bearman, "Multisensory Data and Its Management," pp. 111-19.

10 See for example, Barbara L. Craig, "The Introduction of Copying Devices into the British Civil Service, 1877-1889," in Barbara L. Craig, ed., *The Archival Imagination: Essays in Honour of Hugh A. Taylor* (Ottawa, 1992), pp. 105-33; also Frank Burke, "Chaos through Communications: Archivists, Records Managers and the Communication Phenomenon," Ibid., pp. 154-77.

11 "Provenance" is defined in Louis J. Bellardo and Lynn Lady Bellardo, comp., *A Glossary for Archivists, Manuscript Curators and Records Managers* (Chicago, 1992), as "the organization or individual that created, accumulated and/or maintained and used records" — without any reference to record-keeping systems. Eastwood argues for both the external (organizational) and internal (systematic) referent for provenance, but asserts their equality as elements of the fonds: Terry Eastwood, "General Introduction," in *The Archival Fonds: From Theory to Practice* (Ottawa, 1992), pp. 1-14.

12 David Bearman and Richard Lytle, "The Power of the Principle of Provenance," *Archivaria* 21 (Winter 1985-86), pp. 14-27.

13 David Bearman, "Diplomatics, Weberian Bureaucracy and the Management of Electronic Records in Europe and America," *American Archivist* 55, no. 1, pp. 168-180.

14 Jon Harrington, *Organizational Structure and Information Technology* (New York, 1991), discusses the concept of "perceptual" boundaries in organizations and how these can be changed (or not) by implementing electronic information systems. When the perceptual boundary is not changed but the pattern of work is, the system will often fail. One notes that the concept of organizational and perceptual boundaries employed by Harrington conforms to what we are introducing here, e.g., business rules establish how a record-keeping system functions.

15 David Bearman in UN ACCIS, *Electronic Records Management Guidelines: A Manual for Policy Development and Implementation* (New York, 1990), pp. 17-70, 89-107.

16 See the *Directory of Software for Archives and Museums*, 1990-91 edition and 1992-93 edition (Pittsburgh, 1990, 1992), as evidence for the paucity of archival software. In 1979-80, when he was involved in drafting a standard for archival data interchange, the author convinced his colleagues that one of the principal benefits of such a standard would be to increase the availability of archival description software; he was wrong.

17 North Carolina State Archives MARS system is an exception; its very status as the first, and still the only widely available online public access catalogue for archives proves the point. See David Bearman, "MARS: The Archives and Manuscript Reference System," *Archives & Museum Informatics* 4, no. 4 (1990), pp. 10-11.

18 See the reports of the Ad Hoc Committee on Descriptive Standards, *American Archivist* 52, no. 4 (1989) and 53, no. 1 (1990).

19 Archival Information Systems Architecture Working Group, working paper, unpublished, Utah State Historical Society, 1990-93.

20 David Wallace, "Metadata and the Archival Management of Electronic Records: A Review," elsewhere in this issue of *Archivaria*.

21 David Bearman, "Documenting Documentation," *Archivaria* 34 (Summer 1992), pp. 33-49.

22 The AT&T Bell Laboratories archives got itself on the main menu of every employee of the company by establishing a service which reported daily on the important activities in the corporation, including major product announcements, policies, and reorganizations. This function, initiated by archivist Marcia Goldstein and implemented under then-librarian David Penniman, is one of the most successful applications of a suggestion made by Lytle and Bearman (*supra*, note 12), although theirs was an independent invention.

23 Reports of the Ad Hoc Committee on Descriptive Standards, *American Archivist* 52, no. 4 (1989) and 53, no. 1 (1990). (Emphasis added, though present in accompanying explanations.)

24 Bearman, "Documenting Documentation," and David Bearman, "ICA Principles Regarding Archival Description," *Archives & Museum Informatics* 6, no.1 (1992), pp. 20-21.

25 Bureau of Canadian Archivists, Planning Committee on Descriptive Standards, *Rules for Archival Description* (Ottawa, 1990-); Steven Hensen, comp., *Archives, Personal Papers and Manuscript Collections*, 2nd ed. (Chicago, 1990); Judith Ellis, ed., *Keeping Archives*, 2nd ed. (Melbourne, 1993).

26 Interestingly, Bruce Dearstyne observes of Holmes's five levels of description that "modern archives are inclined to add a sixth level, usually below the subgroup, of 'information system'. The term [is] primarily associated with electronic records and databases...": Bruce W. Dearstyne, *The Archival Enterprise: Modern Archival Principles, Practices, & Management Techniques* (Chicago, 1993), p. 132. Unfortunately, when I inquired, Dearstyne was unable to suggest any examples of a sixth level of description in either theoretical papers or actual information systems.

27 Eastwood, *The Archival Fonds: From Theory to Practice*, pp. 1-14.

28 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. 34-85.

29 Angelika Menne-Haritz, "Introduction," in Angelika Menne-Haritz, ed., *Symposium on the Impact of Information Technologies on Information Handling in Offices and Archives* (New York, 1993), pp.9-25.

30 In this I believe Max Evans ("Authority Control: An Alternative to the Record Group Concept," *American Archivist*, 49 [1986], pp. 249-61), may be more at fault than Peter Scott, from whom he borrowed (though he probably had not read the five-part series in *Archives & Manuscripts*, vols. 7-9, published between April 1979 and September 1981, in which the full explanation of Scott's position was laid out). Evans essentially proposed a mechanical data representation solution for linking series to organization, elaborating on Bearman and Lytle, while Scott's model had a place for record-keeping systems even though he did not employ a formal methodology for describing them.

31 The author has been engaged in an effort with the Metropolitan Toronto Archives to define an archival control system that incorporates both *RAD* and the representation of record-keeping systems in order to enable the jurisdiction to utilize metadata created with records during their active life, and integrate it into the records management and archival life cycle control process.

32 In the future, architectures that utilize the "client-server" model of computing will use specialized applications running on servers; these have the sole purpose of filing and retrieving data for other applications (running on "client" machines), which will process, analyze, or disseminate it. When this concept is widely implemented, it will become easier to define record system properties, but it will still be necessary to understand how applications were executed using the record system. Similarly, when

object-oriented systems come into general use, it will be easier to ensure that data objects obey archival retention and access rules, provided archivists learn to articulate explicit requirements that can be translated into object-oriented methods and classes.

33 Richard Cox, "Research Prospectus: Variables in the Satisfaction of Archival Requirements for Electronic Records Management," in *University of Pittsburgh, Electronic Records Management Study* (Pittsburgh, 1993), typescript.

34 See David Bearman, "Archival Principles and the Electronic Office," in Angelika Menne-Haritz, ed., *Information Handling in Offices and Archives* (New York, 1993), pp. 177-93.

35 David Bearman [University of Pittsburgh, Electronic Records Management Study], "Project Methodology Overview," (Pittsburgh, 1993), typescript.

36 Archivists have generally resisted the use of the term *archives* in the form of an active verb "archiving." I am consciously adopting this terminology both because our customers use it, and we must communicate with them, and because the implication of these requirements is that they will be met through active involvement with systems at the level of policy, design, implementation, or standards development — and "archiving" is an active verb.

37 David Bearman, "Functional Requirements for Record Keeping Systems," Version 1.0, 23 May 1993. This draft was prepared following the meeting of an experts advisory panel on 20-21 May and incorporates their recommendations. It was widely circulated for professional critique during the summer of 1993.

38 National Institute of Standards and Technology (NIST), *Application Portability Profile (APP)*: The United States Government's Open Systems Environment Profile (OSE/1 Version 1.0, NIST Special Publication 500-187, Washington, DC.

39 Richard Barry, "Electronic Document and Records Management Systems: Towards a Methodology for Requirements Definition" [typescript draft of a paper for OIS93], examines the concept of a record from the point of view of the document. This reveals that a document may participate in numerous transactions during a life cycle that is not a linear sequence but a peripatetic path. Representing these states of the document requires state-transition diagramming. While ultimately this is equivalent to the result of viewing records from the point of view of transactions, Barry believes that the latter is significantly less complex to model and implement.

40 The author has recently published a series of articles on the possibility of new programme structures and organizational models for electronic records programmes. See David Bearman, "New Models for Management of Electronic Records by Archives," *Cadernos de Biblioteconomia, Aquivistica, e Documentacao* (1992), no. 2, pp. 61-70; "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 13* (Pittsbugh, 1991); and the as yet unpublished introductory essay on alternative programme models co-authored with Margaret Hedstrom, which will appear in *Archives & Museum Informatics Technical Report 18* (forthcoming 1993).

41 David Bearman, "Organizational Accountability in the Evolving Electronic Communications Environment," *Archives & Manuscripts* (forthcoming).