ARCHIVAL PERSPECTIVES ON THE EVOLUTION AND ORGANIZATIONAL IMPACT OF E-MAIL SYSTEM TECHNOLOGIES.

BY

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A Thesis
Submitted to the Faculty of Graduate Studies
in Partial Fulfilment of the Requirements
for the Degree of

Master of Arts

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A Thesis/Practicum submitted to the Faculty of Graduate Studies of The University of Manitoba in partial fulfillment of the requirements of the degree

of

MASTER OF ARTS

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Abstract

This thesis examines published literature concerning electronic mail (E-mail) from a wide variety of sources, to assist archivists in: i) determining the feasibility of acquiring legacy electronic mail systems; ii) assessing the recordkeeping potential of currently available E-mail systems; iii) identifying technological trends that may either challenge or promote the archival management of the records produced by E-mail systems in the future.

A historical perspective of E-mail systems development is adopted that analyzes the evolution of its hardware, software, network architecture, communications, data transmission and message handling components. This greatly assists archival appraisal because it provides a means to understand the somewhat bewildering array of E-mail systems based on quite distinct messaging architectures that produce markedly different types of records. It also serves as a contextual framework for identifying the major trends in systems development that hold out great promise — and challenges — for corporate recordkeeping and records management.

An evolutionary view of E-mail systems technology development is also essential for the critical analysis of media and social science research into this form of communication, most of which have not been assayed by the archival literature. While recent research provides valuable insights into the impact of E-mail systems on organizations about which archivists and other information specialists should be cognisant, earlier findings have become timeworn in the wake of new advancements in E-mail development. Yet, these findings continue to be widely held. This thesis identifies certain aspects of E-mail technologies requiring further study and research by archivists and other information specialists.

Acknowledgements

I would like to express my appreciation to the National Archives of Canada, particularly to Gabrielle Blais, Director of Government Archives Division (GAD), and Jacques Grimard, Director General of Archives Development and Preservation Branch, for generously permitting me to use the substance of a report I wrote on E-mail systems for the Government Archives Division (GAD) in 1997 as the basis for my thesis. While this report is the property of the National Archives of Canada, I alone accept responsibility for the views expressed therein. My thanks to Pat Burden, then responsible for supervising GAD operations at the Winnipeg Federal Records Centre, for suggesting me for the special E-mail project; Yvette Hackett, the GAD project supervisor and resident electronic records expert, for pointing out fruitful avenues to explore; and Danielle Lacasse, my GAD section chief at the time, for all her guidance and support.

Finally, I would like to acknowledge the tremendous debt of gratitude I owe to Tom Nesmith, professor of Archival Studies at the University of Manitoba, for all his work on my behalf. In addition to editing this thesis, Professor Nesmith's lectures have inspired my interest in archival issues, and I am especially appreciative of all the encouragement he has given me over the years.

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1.0 Introduction

Literature from a wide variety of sources pertaining to electronic mail (E-mail) is evaluated to assist archivists in determining the feasibility of acquiring legacy electronic mail systems, assessing the recordkeeping potential of currently available E-mail systems, and identifying technological trends that may either challenge or promote the archival management of the records produced by E-mail systems in the future.

1.1 The Archival Response to Electronic Records: A Review

This thesis examines various issues concerning Electronic Mail (E-mail) systems from archival perspectives. In order to better situate these perspectives in relation to archival theory and practice, a brief review of archival experience with electronic records and recordkeeping systems is presented here.

Writing in the early 1990s, Terry Cook characterized the periodization of the archival profession's response to electronic records in the United States and Canada as consisting of two distinct "generations."[1] The "first generation" of pioneers of computerized archives emerged in the 1970s and early 1980s. It was more affiliated with its social science research clients than with "traditional" archivists. The computer media orientation of these early electronic archives programs tended to reinforce their isolation — physical, as well as intellectual — from the archival mainstream, and imparted to them an approach that was concerned more with the special technical problems of computerized records rather than a theoretical analysis of electronic communications.

The procedures developed by the "first generation" programs were practical solutions for the archival treatment of the "product" most easily identified during this period — batch produced, mainframe created numeric statistical data-files resulting from simple, short-term government-sponsored research projects. The appraisal of electronic records during this period was guided by two components: *technical analysis* focused on the technical, "special" characteristics of the medium, whereas *content analysis* concentrated on its potential research value as a source of "pure" information.[2] Preservation of electronic records entailed their conversion to a software-independent flat-file structure, while description and reference were based on a "data library" approach that emphasized informational content rather than evidential context.[3]

By the beginning of the 1980s, this approach was being seriously challenged by advancing computer systems technology. Newer and more complex forms of electronic records were being produced in on-line relational databases and networked office automation systems. Data base management systems (DBMS) relied on system software to manage the very complex structural links between records to access and retrieve data. Conversion of these systems to a software-independent sequential file format for preservation necessarily meant sacrificing essential functionality.[4] And as more "traditional" documents such as letters, memoranda, policy summaries, case files, spreadsheets, photographs and maps were being produced electronically by personal computers and networked office systems, archivists were compelled to see beyond their "informational" content and to consider the documents in relation to such basic archival terms as evidential value and context of their creation.[5] At the same time, the "first generation" practice of converting electronic records

to a flat-file, software independent format was seen as totally inadequate for preserving the complex interrelationships between data elements in such unfamiliar records as hyper-linked multimedia electronic documents.[6]

A consequence of these developments was the emergence of the "second generation" archival response to electronic records which reappraised the tenets of archival theory to take the new information technologies into account. The "power" of provenance — the intellectual foundation of archival work — was "rediscovered" by David Bearman and Richard Lytle as *the* means to appraise, describe, and retrieve the vast quantity of electronic records made intelligible only by the information technology generating them. In particular, provenance information about the records-creating structures, functions and activities within organizations, was an archivist's best tool for identifying records — in all media — of archival value.[7]

Although the "second generation" reaffirmed the centrality of archival theory and principles to an understanding of electronic records, it was critical of some archival assumptions and methods that were rooted in the "age of paper." One target was the notion of the "life cycle" of records, which conceives records as passing through various stages — active, semi-active, dormant, and the "end" stage of their organizational lives when they are either destroyed if non-archival, or transferred to archival custody if they have "historical" value. To many commentators, this model was too passive to be applicable to electronic records which required pro-active involvement at the "front-end" of systems design to ensure that archival records were identified and a strategy devised for their preservation.[8]

Among the first archival institutions to adopt a pro-active approach to electronic records management was the National Archives of Canada (NAC). In the late 1980s it led a study of corporate information management and the automated office called IMOSA, or Information Management and Office Systems Advancement.[9] A prototype application was developed that permitted users to file, browse, search and retrieve documents while the system maintained consistent corporate control and management functions for both electronic and hard copy holdings, and even included a file profile for attributes such as archival value. Based on the IMOSA experience, a draft set of functional requirements for automated records management and information retrieval systems was developed.

The IMOSA experience also convinced the NAC of the need for an institutional body to develop standards and practices for and offer advice on managing the corporate memory of Canadian government institutions. To fill this need, NAC created the Information Management Standards and Practices (IMSP) Division in the early 1990s. The division came to the conclusion that to develop standards and practices for records management in automated office systems, working definitions of the essential qualities of records were required. The program emphasized the need for organizations to maintain records — in all media — which are *available* (accessible and retrievable), *usable* and *understandable* (i.e. have contextual information and documentation), and are of high *quality* (integrity, currency, relevancy).[10]

On a theoretical level, David Bearman was developing a framework for the analysis of electronic records and recordkeeping systems like that envisaged in the IMOSA prototype. Bearman argues that archivists must reexamine the characteristics that define a record as well

as firmly grasp the underlying principles of recordkeeping before participating in the design and implementation of electronic recordkeeping systems.[11] The most significant feature of records, he concludes, is that they are evidence of transactions. In order to preserve the evidentiality of electronic records, recordkeeping systems must be able to maintain their *content*, *structure* and *context* in a manner that makes them *accurate*, *understandable*, *meaningful*, and *coherent* throughout their existence. Based on these criteria, he asserts that most computer-based information systems today lack the necessary characteristics of recordkeeping systems. Therefore, archivists must be able to articulate the functional requirements for electronic recordkeeping.[12]

The work of David Bearman inspired the University of Pittsburgh to establish a Recordkeeping Project in 1993 to determine the functional requirements for electronic recordkeeping systems "so that they [archivists] can intervene in organizational policy, systems design, and program implementation to ensure the creation of records, preserve their integrity and provide for access."[13] The Pittsburgh Project shares the view that records are evidence of transactions, and that recordkeeping systems must satisfy the functional requirements it describes to ensure the preservation of evidence in electronic form.

The following functional requirements are identified by the Pittsburgh Project: 1) the organization must be **compliant** with applicable legal and administrative requirements for recordkeeping; 2) the recordkeeping system must be **accountable** by being routinely *implemented* in a *consistent* fashion; 3) records must be **captured** that are *comprehensive*, *identifiable* and *complete* and originate from an *authorized* records creator; 4) records must be **maintained** that are *preserved* over time within any system in such a manner that they

remain *inviolate*, *coherent*, *auditable* and *removable*; and 5) records must be **usable** by being *exportable*, *accessible*, *available*, *renderable*, *evidential* and *redactable*.[14]

The Pittsburgh Project has already had an effect on the establishment of standards, guidelines, and policies for electronic records and recordkeeping, especially in Australia. There, the Archives of Australia has promulgated the definition of a record as evidence of a transaction in its *Policy on Managing Electronic Messages as Records* and *Guidelines on Managing Electronic Messages as Records*. The Archives Authority of New South Wales has done likewise in its policy paper, *Documenting the Future: Policy and Strategies for Electronic Recordkeeping in the New South Wales Public Sector*.[15]

The Pittsburgh Project also helped provide the impetus for a research project carried out by the Master's Program in Archival Studies at the University of British Columbia (UBC) on making and keeping trustworthy records in electronic form.[16] The UBC Project derived conceptual requirements for guaranteeing the authenticity, reliability and completeness of records in electronic systems from archival principles and diplomatics. Templates were developed to represent the concepts and then translated into activity and entity models using a standard modeling technique (IDEF). The UBC Project specifies rules for the creation, handling, and preservation of active and semi-active records in electronic records management systems.[17]

The challenges posed by electronic records have not only obliged archivists to re-examine the applicability of archival theory and principles to the new information technology and develop models for recordkeeping, but they have also stimulated a debate concerning the "reinvention" of the role of archives. David Bearman and others have argued that the

custodial function of traditional archives is no longer tenable as the costs of retaining, describing and preserving the vast amounts of electronic records being generated will severely outstrip the resources — physical and intellectual — of archives. This is especially the case in the wake of constantly changing storage and retrieval technologies, the requirements of software systems to retrieve the data, and the need to migrate data from one generation of technology to another. Consequently, they argue that electronic records will be better preserved if they remain within the organizations that created them as they already have the technical staff, storage facilities and security procedures in-place. In this new "post-custodial" age, archives must find new but necessary roles as planning, advisory and regulatory agencies charged with ensuring that organizations are creating, managing and retaining evidence of their functions, activities and mandates.[18]

While this literature on "reinventing" archives is provocative, it is still very much future oriented and will require much planning and negotiation. Similarly, Paul Marsden has noted a tendency in the archival literature on electronic records "for theory to be such a distance ahead of method and practice as to disconnect the two entirely." And he observes, although the Pittsburgh and UBC projects have brought fundamental archival issues to the fore, there will not be *one* model for electronic recordkeeping as records creators will choose whatever model meets their business requirements. Marsden also brings up the important question of what is to be done with electronic records created in systems lacking the archival requirements for recordkeeping identified in these models. Are they to be consigned to neglect or destruction, or might they yet yield valuable evidence upon careful examination?[19]

This thesis on electronic mail (E-mail) represents an effort to bridge the distance between theory and practice noted above by exploring the feasibility of acquiring legacy E-mail systems, assessing the recordkeeping potential of currently available E-mail systems, as well as by identifying technological trends that may either challenge or promote the archival management of the records produced by E-mail systems in the future. In doing so, it draws not only upon archival theory, but also the actual experiences of the National Archives of Canada and the National Archives and Records Administration of the United States with legacy E-mail systems, and on information in computer trade articles as well as social science literature.

At this point, I would like to clarify the definition of "legacy E-mail systems" adopted in this thesis. It is logical to conclude that eventually all systems will be legacy systems no longer supported by their manufacturers with the necessary hardware and software components. However, to avoid any possible confusion and misunderstanding, this thesis will define the term "legacy E-mail systems"as first generation mainframe and PC-LAN systems characterized by ASCII text-based messaging as described in Chapter 2, "History, Evolution of E-mail Messaging Architectures."

1.2 Objectives

Several objectives were established for the study:

1. To obtain from the available literature information on the patterns of use of E-mail technology in corporations and government departments that would be useful in an archival appraisal. (Examples given were average volume of messages per employee per day; patterns of use; time frame to maturation as a work tool). In addition to collecting whatever statistics were available, information concerning the impact of E-mail systems

on the organizational structures of corporations and government departments was also important.

2. To collect information about the E-mail system in use at the National Archives, including statistical information relating to the concerns mentioned in 1. above.

3. To identify and describe those technical variables which must be reviewed during archival appraisal (i.e., breakdown of address components; backup cycles; sources of messages on back-ups; how messages are deleted; how forwarded messages are handled; how multi-recipient messages are handled, etc.).

4. To place the development of functionality of the 5-6 major E-mail applications used in the federal government along a historical continuum. To identify future trends in the evolution of E-mail systems.

5. To identify any technological capabilities of current E-mail systems that assist users in controlling/selecting/ retaining messages, as well as other developments which may have archival implications for the management of E-mail messages.

6. To review the archival literature (if any) on E-mail systems to identify information helpful to the study.

1.3 Literature Review

The information for the study was obtained by an extensive literature search on several CD-ROM databases available at the University of Manitoba. Initially, the literature search pertaining to electronic mail systems was general in nature with the view that after careful examination, information could be obtained that would relate to the objectives mentioned above. The extent of literature obtained from searching these databases was vast. In fact, a wealth of research concerning the impact of E-mail on organizational structure and studies

on the media characteristics of E-mail was obtained that, to my knowledge, has not been evaluated by archival literature.

Articles relating to the evolution of E-mail systems and trends in their future development were also plentiful, as were reviews of the technological capabilities of the major currently available E-mail systems. There were also several sources of statistical information relating to patterns of use of E-mail technology in corporations and government departments. Unfortunately, no such information was available for patterns of off-line and on-line storage of messages by senders and receivers.

In terms of information pertaining to the breakdown of address components, backup cycles, sources of messages on back-ups, etc., referred to in objective 3 above, this kind of information was unavailable even in systems manuals, and was therefore only likely to be obtainable from network administration manuals or perhaps site-specific documentation unavailable to the researcher.

Consequently, reference to this information only pertains to the Banyan Vines Network operated by the National Archives of Canada in Ottawa, of which network administration manuals and documentation were made available, and additional information was obtained in an interview with the network administrator, Gordon Belyea. Unfortunately, statistical information on E-mail use at the National Archives of Canada was not available at this time, and the researcher subsequently became too immersed in the analysis of the research literature to pursue this further.

There is a growing body of records management and archival literature pertaining to E-mail systems, but the emphasis has either been on the worrisome aspects of managing

electronic mail systems for current operational purposes, or on theoretical technology- or policy-based strategies for capturing evidential and provenancial information for current and future implementations. There have been no articles written about accessioning records from legacy E-mail systems apart from the work done on the Trade Negotiation Office reported in the National Archives of Canada's *Machine Readable Records Bulletin.*

However, some of the concepts relating to the provenancial and evidential information required to establish the "recordness" of transactional records in electronic recordkeeping systems provide a useful framework for the archival examination of the records created by E-mail systems. Not only are these concepts helpful when evaluating trends in E-mail messaging technology that may have significant potential for corporate recordkeeping purposes, but they also provide archivists with a gauge for determining the limitations concerning the reliability, authenticity, and evidentiality of the records produced by legacy E-mail systems.

1.4 Organization of the Thesis

The thesis recognizes that E-mail messaging is an evolving computer-mediated communications technology. As this description implies, E-mail messaging consists of many components: computer hardware, systems and messaging applications software, network architecture, communications, data transmission and message handling devices.

All these components are continuously under development, shaping the direction of E-mail evolution. It is not merely the functionality of these systems that is advancing, but also the complexity of the records being created, as well as the breadth of their information

gathering and dissemination capabilities. Chapters two to four analyze significant trends and developments relating to these various components of E-mail messaging technology. Their potential for corporate recordkeeping purposes is examined, as well as their influence on records creation.

Chapter five looks at E-mail messaging applications that promise to have a major impact on organizations. As this computer-mediated communications technology is evolving, so too are perceptions concerning the media characteristics of E-mail, as well as E-mail's influences on organizational structure, processes, and culture. There is a growing body of research into these areas by media and social science researchers, but not much has been assayed by the archival literature. This is surprising, considering the fact that archivists have long been interested in the media of communication, and that organizational structures, processes, and culture have long been recognized by archivists as elements that shape the process of records creation. However, it is apparent that some old conceptions concerning E-mail's influence on organizations die hard (including those shared by many archivists!), even in the wake of new advancements in E-mail development that render them out-of-date.

After considering the corporate recordkeeping potential of E-mail messaging technology, it is necessary to address questions relating to the preservation of records created or captured in these systems. Chapter six examines the issues confronting archivists as they seek to preserve the evidentiality of records produced by current and future implementations of E-mail messaging systems. It also addresses problems associated with the preservation of the records created by legacy E-mail systems, and suggests procedures and tools to assist archivists in this kind of "high-tech" diplomatics.

Finally, the concluding chapter summarizes the major points dealt with concerning E-mail technology, including aspects requiring further study by archivists and records managers.

Notes to Chapter 1

1. Terry Cook, "Easy to Byte, Harder to Chew: The Second Generation of Electronic Records Archives," *Archivaria* , n.33, Winter 1991-92, pp. 202-216.

2. Katherine Gavrel and John McDonald, *Appraisal Guidelines in the Machine Readable Archives Division*. (Ottawa: Public Archives of Canada, 1981).

3. Harold Naugler, "The Machine-Readable Archives Program at the Public Archives of Canada: The First Five Years," in Carolyn L. Geda, Erik W. Austin, Francis X. Blouin, Jr., eds., *Archivists and Machine-Readable Records*. (Chicago: The Society of American Archivists, 1980), pp.67-78; Charles M. Dollar, "Machine-Readable Records of the Federal Government and the National Archives," in Geda, et al., eds., pp. 79-87.

4. John McDonald, "An Approach to the Archiving of Data Managed in a Data Base Environment," in J. Raben and G. Marks, eds., *Data Bases in the Humanities and the Social Sciences*. (New York: North-Holland Publishing Company, 1980), pp.73-78; see also John McDonald, *The MRA and System 2000 Data Bases. A Report of a Special Project Undertaken in the Machine Readable Archives Division*. (Ottawa: Public Archives of Canada, 1980).

5. Harold Naugler, *The Archival Appraisal of Machine-Readable Records: A RAMP Study with Guidelines*. (Paris: UNESCO, 1984), preface, pp. 37-38. Margaret L. Hedstrom, *Archives and Manuscripts: Machine Readable Records*. (Chicago: Society of American Archivists, 1984), pp. 7, 18, 41.

6. David Bearman, "Multisensory Data and its Management," in Cynthia Durance, ed. *Management of Recorded Information: Converging Disciplines*. (München: K.G. Saur, 1990), pp.111-120.

7. David Bearman and Richard Lytle, "The Power of the Principle of Provenance," *Archivaria* , n.21, Winter 1985-86, pp.14-27. The idea that provenance was "rediscovered " by archivists in North America is explored by Tom Nesmith, "Introduction: Archival Studies in English-Speaking Canada and the North American Rediscovery of Provenance," in Tom Nesmith, ed., *Canadian Archival Studies and the Rediscovery of Provenance*. (Metuchen, N.J.: Society of American Archivists and Association of Canadian Archivists, 1993), pp. 1-28.

8. For an alternative to the records life-cycle model, see Jay Atherton, "From Life Cycle to Continuum: Some Thoughts on the Records Management-Archives Relationship," *Archivaria*, n.21, Winter 1985-86, pp. 43-51; a classic "second generation" view of electronic records management is expressed by Catherine Bailey in her article,

"Archival Theory and Electronic Records," *Archivaria*, n.29, Winter 1989-90, pp. 180-196.

9. National Archives of Canada, *The IMOSA Project, Phase 1 Report.* (Ottawa: unpublished report, 1991).

10. John McDonald, *Information Disciplines - An Armada or Passing Ships in the Night. Paper presented to the Records Management Society, Reading England, September 1991.* See also National Archives of Canada, *Strategic Framework for the Information Management Standards and Practices Division.* (Ottawa: unpublished report, 1991).

11. In 1993-4, David Bearman published a series of articles that best articulate his perspective on the relationship of archival theory and the analysis of electronic records and recordkeeping systems. See, "Archival Principles and the Electronic Office," in Angelika Menne-Haritz, ed., *Information Handling in Offices and Archives*. (München, New York: K.G. Saur, 1993), pp. 177-193; "Record-Keeping Systems," *Archivaria*, n.36, Autumn 1993, pp.16-36; "Archival Data Management to Achieve Organizational Accountability for Electronic Records," *Archives and Manuscripts*, v.21 n.1, 1993, pp. 14-28; "Managing Electronic Mail," *Archives and Manuscripts*, v.22 n.1, 1994, pp. 28-50.

12. These topics are discussed in more detail in chapter six of this thesis, "Preservation Issues of E-mail Records."

13. David Bearman, "Introduction," in *Electronic Evidence: Strategies for Managing Records in Contemporary Organizations*. (Pittsburgh: Archives and Museum Informatics, 1994), pp.2-3.

14. The University of Pittsburgh Recordkeeping Project has published its *Functional Requirements for Evidence in Recordkeeping*. It is available on the world wide web at http://www.lis.pitt.edu/~nhprc/prog1.html.

15. Australian Archives, *Managing Electronic Records: A Shared Responsibility.* (Canberra:1995) and *Keeping Electronic Records: Policy for Electronic Recordkeeping in the Commonwealth Government.* (Canberra:1995), both available at www.aa.gov.au .

16. Luciana Duranti and Heather MacNeil, "The Protection of the Integrity of Electronic Records: An Overview of the UBC-MAS Research Project," *Archivaria* n.42, Fall 1996, pp.46-67.

17. Luciana Duranti, Heather MacNeil and William E. Underwood, "Protecting Electronic Evidence: A Second Progress Report on a Research Study and Its Methodology," *Archivi & Computers*, v.1, 1996, pp.37-69; Luciana Duranti and

Heather MacNeil, "Protecting Electronic Evidence: A Third Progress Report on a Research Study and its Methodology," in *Archivi & Computers*, v.5, 1996, pp.343-404.

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19. Paul Marsden, "'When is the Future?' Comparative Notes on the Electronic Record-Keeping Projects of the University of Pittsburgh and the University of British Columbia," *Archivaria*, n.43, Spring 1997, pp. 158-173.

2.0 History, Evolution of E-mail Messaging Architectures

Electronic Mail (E-mail) is an evolving technology, and consequently at some time or another, archivists will be confronted with a somewhat bewildering array and variety of E-mail systems based on quite distinct messaging architectures that produce markedly different types of records.

There are now three major kinds of E-mail messaging architectures, each roughly corresponding to a stage in the historical evolution of messaging technology. E-mail systems development began on mainframe host-based computer networks in the early 1960s, later followed by PC LAN (client-based) E-mail systems in the mid 1980s, and client/server architectures in the early 1990s.

PC and client/server LAN E-mail are the fastest growing segments of the global messaging market, believed to have overtaken host-based systems by the end of 1994. Figure 1 below compares growth rates between LAN- and host-based E-mail systems over the last decade. In 1993, there were 16.9 million LAN mail users worldwide, including 12.7 million in North America and three million in Europe. The total is expected to rise to 38.8 million by 1998. Canadian users represent about 20 per cent of LAN users in North America, and it is estimated that there will be approximately 5 million LAN users in Canada by 1998.[1]

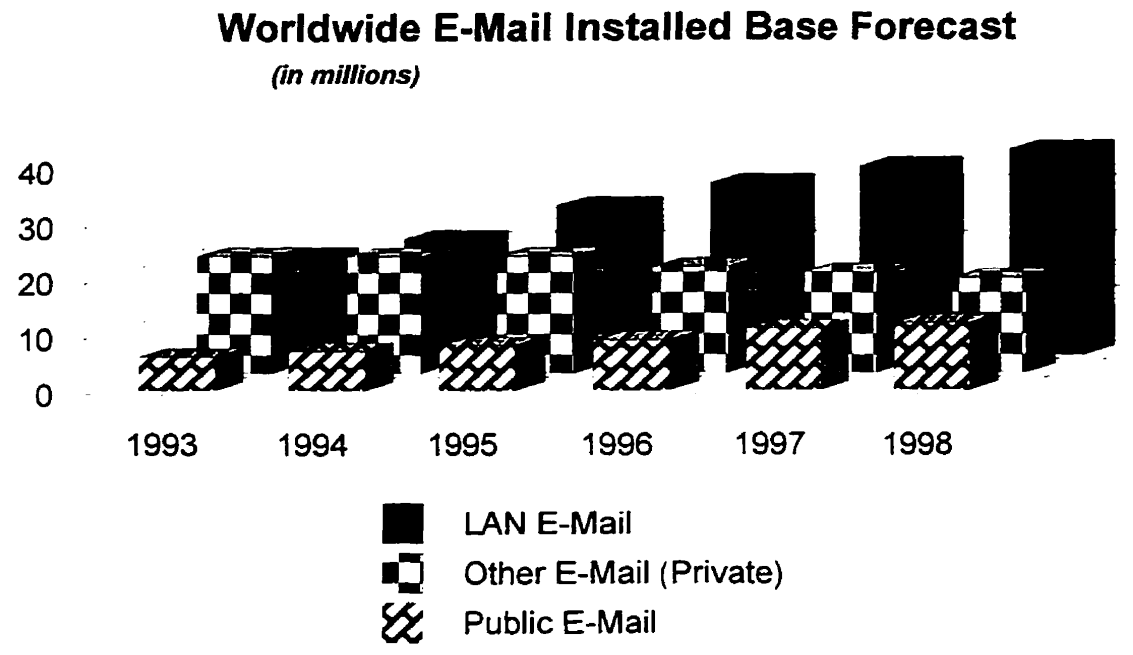

Figure 1. Comparisons in Growth Between LAN- and Host-Based E-Mail Systems (Source: BIS Strategic Decisions, October 1994)

New E-mail messaging architectures have historically developed in response to the perceived technological limitations and constraints of its immediate predecessor. As such, E-mail has promised different solutions, as well as posed different challenges, for data management and administration at each stage of its development. PC LAN E-mail systems developed primarily to substitute the increasingly powerful, user-friendly and inexpensive PC client for the prohibitively expensive and cumbersome mainframe used in host-based messaging systems. Client/server messaging systems development utilized improvements in server hardware, messaging software and telecommunications infrastructure to address the network management problems encountered when the user-base of PC LANs began to grow beyond its limits.

This is not to suggest that the emergence of a new E-mail messaging architecture immediately renders its predecessor obsolete. Messaging technologies survive by becoming adapted to a particular "niche." A messaging technology comes to be perceived as a "legacy" system by users and IT professionals when the technological environment has become so altered that it is no longer being supported by products offering features comparable to competing messaging architectures.

But just as the evolution of E-mail technology reveals differences in data management and administration, so too it demonstrates a heterogeneous influence on electronic records creation and recordkeeping. Thus, in order to make informed decisions regarding strategies about E-mail that further archival goals, archivists must understand the relationship between the evolution of a communications technology, the kinds of records it creates, and the recordkeeping capabilities it affords.

2.1 Host-based Messaging Architectures

E-mail began in the early 1960s as text messaging systems developed by manufacturers of mainframe computers. Messages were composed at dedicated terminals, stored briefly, and then delivered to another user's terminal. E-mail system development received a major impetus in the late 1960s from the U.S. Defense Department's Advanced Research Project Agency Network (ARPANET) created to link communications between defense contractors and research institutions. Using a file transfer protocol and computer programs, messages could be read and sent to a simulated post office mailbox.

Later refinements were added that gave each user an identity separate from their physical terminal, as well as a reply to, forward, or store message features. The E-mail "store-and-forward" program saved a copy of the message created by the sender to the recipient's mailbox — residing on the mainframe, or host — to which only the latter had full access rights.[2] Figure 2 below shows an example of a host-based E-mail system architecture.

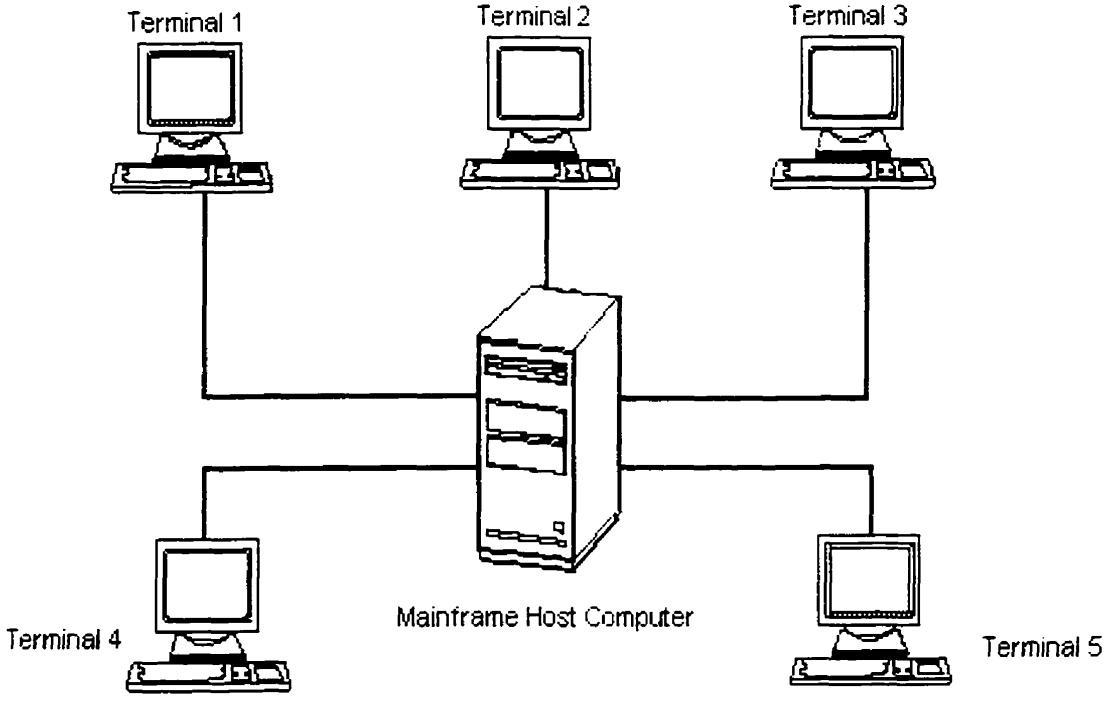

Figure 2. Example of Host-Based E-Mail System Architecture

Host-based E-mail communicated plain ASCII text messages between users. File attachments were a later addition so that binary program data and lengthy formatted documents prepared by word processors, could be transferred via E-mail. As the technology of E-mail developed, the logical structure of the mail message took on its now familiar form, consisting of an envelope and body. The envelope data structure contains various fields entered by the user composing the mail message. (To:, Cc:, Bcc:, From:, Forwarded:, Subject:, Date:, Certify:,

and Attach:). The body data structure contains the message text typed-in by the user and the contents of the attachment files.

Because all E-mail software resided on the mainframe computer, centralized directory management of user lists was possible, and consequently the system could be made scalable for a huge populations of users. Another benefit of mainframe-based E-mail systems is that they are usually maintained and operated by large centralized computer departments responsible for their administration as well as their backup and security, making these environments very stable and reliable.[3]

The major problem with host-based E-mail was that the high costs associated with mainframe messaging was prohibitive for most companies. In the late 1960s and early 1970s, a mainframe computer might cost several million dollars, while a single teletype terminal cost up to $3,000.[4] The costs associated with the administration, backup, and security of data were also substantial, so that only the few largest companies could afford their own internal E-mail systems. Two of the most popular mainframe host-based E-mail systems were IBM's PROFS (Professional Office System) and DEC's All-in-1.

While internally-built and managed E-mail systems were too expensive for most companies, some were attracted to the prospect of being able to use a messaging network to link their operations as well as receive electronic information from their clients. Private communication services companies sprang up to provide E-mail services to businesses, charging them according to various schemes based on on-line time or the volume of data sent or received, or a combination thereof.[5]

2.2 PC LAN (Client-based) Systems

By the mid 1980s, expensive mainframe computers were being supplanted in more organizations by emerging technologies making it possible to offer E-mail on less expensive PC-based local area networks (LANs). Figure 3 below shows an example of a PC LAN E-mail system architecture. Lotus's cc:Mail and Microsoft Mail are PC LAN E-mail packages that use a shared file access model where most of the message processing power resides in the user's PC software (client), while the file server is a single flat file or post office limited to holding messages until users retrieve them.[6]

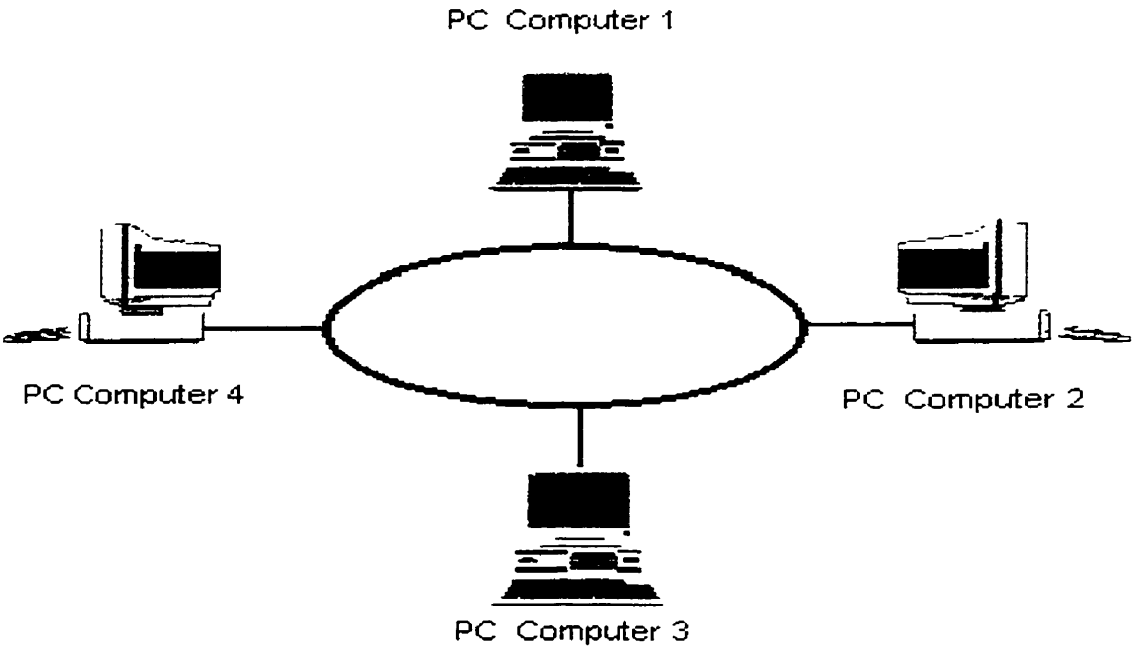

Figure 3. Example of PC-Based LAN E-Mail System Architecture

Originally, PC LAN E-mail systems were DOS-based, and like host-based systems, utilize store-and-forward programs to communicate Plain-ASCII text messages. Unlike the cumbersome logon, messaging procedures, and system commands characteristic of

mainframe host-based systems, PC LANs came to rely on an innovative graphical user interface (GUI) that offered a menu option for a wide variety of user-friendly software applications, as well as E-mail. Users were able to compose messages on their desktop computers and send them to colleagues on the same LAN. In contrast, most mainframe host-based systems could only connect to PCs with special terminal emulator circuit boards that did not permit concurrent use of desktop applications.[7]

By the late 1980s, it was becoming increasingly apparent that mainframe host-based E-mail were "legacy systems" because of their high data processing costs and the trend towards distributed end-user processing and desktop functionality. In contrast, a rapidly expanding range of PC LAN applications such as work group software were developed. This range became even more pronounced with the growth of Windows-based PC LANs. Messages offering boldface, italics, and choice of fonts could be composed utilizing Rich Text Format (RTF). Other Windows-based messaging standards such as MAPI, DDE and OLE made it possible to dynamically link and automatically update information in a wide variety of mail-enabled and messaging-centric applications. These applications utilize E-mail technology as an integrated communications infrastructure for exchanging data between them.[8]

PC LANs are very easy to set up, at a minimum requiring that some PCs be used as dedicated servers. This quick end-user implementation allowed many departments to easily and rapidly deploy E-mail without waiting for an integrated, corporate information technology (IT) plan.[9]

The ease in implementing PC LANs obscured the difficulties of managing resources as the network expanded. Typically, the capacity of servers on a PC LAN was less than 100 users, so as the user population grew, the increasing volume of network traffic could drastically slow the system response time. As more servers were added to address this problem, so too did the number of routers — devices allowing post offices to talk to each other. Synchronizing user directories and managing network administration became ever more difficult. As PC LANs grew beyond their limits, so did the probability of system failure arising from the rapidly multiplying number of network components.[10]

A study on the cost of LAN downtime (primarily client-based) in the late 1980s and early 1990s, found that while 94 percent of all LANs function properly at any given time, 6 percent do not. Companies averaged 23.6 network failures a year, each with an average downtime of 4.9 hours.[11] By 1996, the estimated costs of productivity lost annually by U.S. companies to down time were still very high, at $684 per user.[12]

The very real concerns about the manageability and reliability of PC LAN E-mail systems ensured that mainframe host-based E-mail, with its proven and dependable data and network administration, survived in many companies with large user-installed bases. This explains why some of these host-based legacy E-mail systems continue to exist in organizations well beyond the average four to six year life span of an information system.[13]

Nevertheless, in small networks (less than 200 users), PC LAN's advantages in terms of ease of use, ease of implementation, and the rapid growth of software applications, continues to make it attractive. Yet as the trend towards network expansion continues, PC LAN

messaging may be reaching its limits in many organizations. This has led many observers to believe that this architecture will shortly become the legacy systems of tomorrow.[14]

As organizations increasingly rely on E-mail systems for vital business, they look for a more reliable technology combining the GUIs and ease of use of PC LAN E-mail with the scalability, reliability and manageability associated with mainframe host-based systems.

2.3 Client/Server Systems

In the 1990s, second generation E-mail messaging systems such as IBM Work Group, Microsoft Exchange Server, Lotus Notes and Novell GroupWise were developed based on client/server LAN architectures similar to the example shown in Figure 4 below.

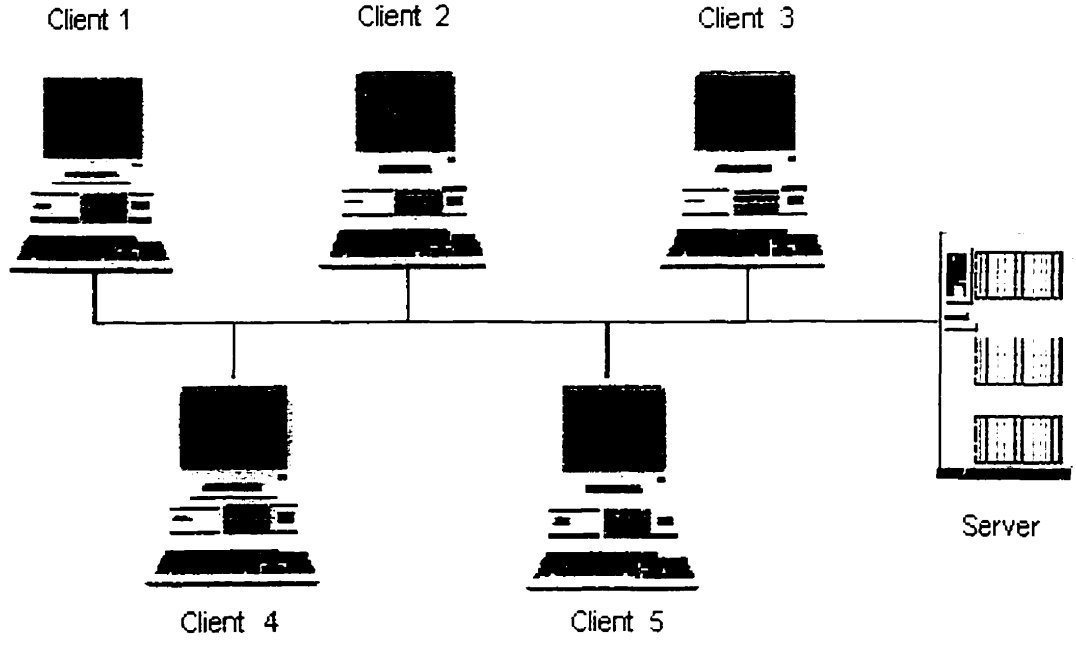

Figure 4. Example of Client/Server-Based E-Mail System Architecture

These systems offload most of the work to a multitasking server which can handle groupware and workflow applications in the background. The server for these systems provides a robust engine for message processing and routing functions. Central network administration and diagnostic tools greatly reduces the complexity of network management while improving its reliability. Because message processing is handled on the server and not the client, network traffic is significantly reduced.

Like PC LANs, client/server based messaging systems utilize user-friendly graphical user interfaces (GUI's), offer even more sophisticated groupware features such as E-mail, scheduling, workflow, real-time conferencing, and document management. If platformed on host-based servers, client/server LANs could be scaled to several hundred users, thus reducing the need for message routers and gateways. They offer ease of management and directory administration, improved reliability, remote administration tools, more preventive diagnostic tools, and security services.[15]

Client/server messaging architectures provide many of the desirable features of both PC LANs and mainframe host-based systems, and it is likely to replace these other mail clients in most larger enterprise environments very soon. Migrations from "legacy" host-based systems will become increasingly urgent in organizations because the most important developments such as mail-enabled and messaging-centric applications are not being developed for mainframe architectures, leaving organizations still employing them at a competitive disadvantage.[16]

At these junctures, organizations will be under considerable pressure to migrate from a "legacy" system to a new messaging architecture. System migration is a complicated process

that exposes the organization to the risk of data and systems incompatibility.[17] To help address these concerns, tools such as Hewlett Packard's OpenTime, OpenMail and OpenView Operations Center were created to provide a smooth migration path for moving OfficeVision/VM (PROFS) to client/server platforms.[18] Similarly, DEC's PostMaster for WANs on OpenVMS was developed to migrate the ALL-IN-1 "legacy" E-mail system to client/server messaging systems such as Windows NT.[19]

Periods characterized by the high frequency of systems migration pose potential challenges to institutional archives. It is possible that in some cases, organizations unable (or unwilling) to migrate from an outmoded legacy system to a new messaging architecture, may call upon archives to "acquire" it. These topics will be discussed in the chapter, "Preservation Issues of E-mail Records."

2.4 Electronic Mail, Messaging Architectures, and Recordkeeping

As the preceding discussion has demonstrated, E-mail has promised different solutions, as well as posed different challenges, for data management and administration at each stage of its development. Similarly, an examination of the evolution of E-mail system development reveals that records creation and recordkeeping are affected in distinct and different ways.

Since its inception as a text-based messaging system in the early 1960s, the defining characteristic of E-mail is that it is a communications medium, like telephone, fax, and telex, rather than being an application like conventional information systems.[20] While it is computer-mediated, E-mail is essentially a communication utility, like mail delivered by the

postal system or circulated inter-office, because it carries undifferentiated types of communications and records.[21]

Consequently, E-mail exposes organizations to a form of communication that creates "clutter," in the sense that amongst all the information being handled, there is actually crucial data.[22] From a records management and archival perspective, a major problem becomes how to identify, preserve, and ensure records of continuing value are accessible to the organization amongst all this information "clutter."

Until recently, E-mail systems messaging architectures were designed in such a way that while they might create records, they did not function as corporate recordkeeping systems. This stemmed from the fact that most E-mail systems utilize a traditional store-and-forward message approach in which messages are sent from, and copied to, a user's mailbox. Consequently, recordkeeping functions such as the storage and filing of messages were available only at the level of the individual user's mailbox, and not at the corporate or institutional level.[23]

Statistics on message handling in organizations help us to visualize what this entails in terms of the individual user's processing of E-mail. The typical E-mail user in a Fortune 500 and mid-size company sends about 10 E-mail messages and receives about 14 messages per day.[24] The average time spent by users processing E-mail (reading, deleting, sending, replying, filing, etc.) is approximately 40 minutes per day.[25] The velocity of electronic mail exchanges (the time between a message and the response) in many organizations is 2-3 times per day.[26] On a typical LAN consisting of 1 server and 53 workstations, the cost lost to users

backing up and copying their own files (on the average of 30 minutes a week) is $30,000 (U.S.) a year. In a 300-workstation network, this cost exceeds $200,000 (U.S.) a year.[27]

As these statistics indicate, the time, effort, and expense involved in processing E-mail by individual users is considerable. Yet the organization does not benefit in terms of corporate recordkeeping. Typically, users are free to save or delete messages unilaterally, and to organize their messages according to whatever scheme they wanted, including none at all. And in the case of PC LAN E-mail, if any E-mail of record value was "archived," it was most often stored on the user's local hard drive, thereby making it inaccessible or liable to loss from a corporate perspective.[28]

True, all E-mail messages and system-generated data (as well as all system software, applications and configuration files) were captured on the backup cycles adopted by organizations for disaster recovery purposes. However, backup tapes are inadequate for corporate recordkeeping purposes. The backup is merely a "snapshot" of all the data residing on the network at the time of the cycle. It does not distinguish program files from data files, nor organize records for ongoing operational purposes, such as access and information retrieval. Furthermore, it does not identify or schedule records for disposition.[29]

Aware of the inadequacy of both system backups and traditional store-and-forward E-mail systems for corporate recordkeeping purposes, records managers have usually resorted to issuing directives that make users responsible for identifying the record copies of correspondence, and for printing out a hard copy for incorporation into the existing, paper-based corporate recordkeeping system.[30]

Two major problems stem from this approach. The first problem relates to placing the ultimate responsibility for recordkeeping with individual users, as it gives users too much discretion about which E-mail to preserve, and consequently "cannot satisfy the tenets of accountability because it allows records creators to make decisions about which transactions to document."[31]

The second problem relates to printing out a hard copy of E-mail messages for ongoing corporate recordkeeping purposes. An archival consensus is emerging worldwide on the inadequacy of printing out the content of E-mail messages without the associated system-generated structural and contextual data crucial to establishing its "recordness."[32] Besides, printing out E-mail messages to paper for filing, and applying traditional ground rules for handling the "copy of record," entails increasingly high and unnecessary human and facilities resources costs to the organization.[33]

In contrast to these recordkeeping problems stemming from the traditional store-and-forward model of E-mail messaging, records managers and archivists should pay special attention to new client/server messaging products developing around a database-centric architecture that provides a corporate "store" of messages and data. Some of these products offer document management features that may have significant potential for corporate recordkeeping purposes.[34]

For example, Lotus Notes and Novell's GroupWise work group client/server messaging systems have a database-centric architecture in which documents, views, text, and images can be retrieved or routed around the organization, making data available enterprise-wide. Public folders and discussion databases can be created, facilitating document conferencing.

This ability is due to a process called *replication*. In order to make data accessible to other users, regardless of where they are physically located on the network, users copy E-mail messages or documents to a discussion database or public folder on their server. Another server located elsewhere on the network then makes a replica of this database or public folder, and a schedule is created so that the machines contact each other at certain times and exchange documents and views they don't have in common.

In addition, the database-centric architecture of these systems uses *object store technology*, which is an advanced document relationship design that manages not only indexing but complex relationships that exist between documents as well. Documents can be browsed in a view that presents field values in a column format, or in a hierarchy that shows their relationship to one another. A variety of querying tools for access and information retrieval are available to determine the whereabouts of enterprise-wide data.

Some database-centric messaging systems support version control capability (the management of multiple versions of a document to protect the original's integrity). GroupWise, for example, has version control capabilities for single documents, folders, and multifolders that lock documents when checked out by other users. Notes lacks this capability, but some of Lotus's products, such as Lotus 1-2-3 for work groups, utilizes a Version Manager model for its spreadsheet that lets users import and export cell ranges into the Notes database as objects with attached properties such as version number, author name, and assumptions. The Version Manager model may soon be applied to other Lotus products designed for work groups, such as Ami Pro (word processing) or Freelance Graphics.

Version control of documents, item-level indexing, sophisticated query tools, coupled with replication's document conferencing and public folder capability, offer significant potential for corporate recordkeeping. In particular, the ability to create shared files is an especially important advancement over traditional store-and-forward technology, where all E-mail is filed at the level of the user's mailbox. Records managers and archivists should explore the corporate recordkeeping potential that client/server replication affords.

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3.0 E-mail Messaging: The Evolution From Text-Based Systems to Multimedia, Mail-Enabled Communications Backbones

The technology of E-mail messaging is another example of the evolving nature of this medium, changing from being merely a carrier of ASCII based text messages and binary program attachments in the 1970s and 1980s, to a full-fledged communications backbone for multimedia documents and mail-enabled and messaging-centric programs in the 1990s. The consequences of the evolution of messaging technology on records creation is enormous, and archivists and records managers will soon be facing novel and unfamiliar record types, some of which will be discussed here.

But a discussion of the evolution of E-mail messaging technology serves another purpose: it illustrates that many well-worn assumptions concerning the media characteristics of E-mail and its impact on organizations — topics of potential interest to archivists — are, in fact, rather hidebound. In fact, most research was conducted on legacy mainframe, host-based systems utilizing "plain vanilla" ASCII text-based messaging.

In hindsight, it is not surprising that the technological limitations of these (now legacy) E-mail systems imposed real constraints on E-mail's effectiveness as a medium for organizational communications, and consequently that certain assumption were drawn about its impact on organizations. What is astonishing is that the findings of this research continue to influence opinions as to the records creating capabilities of E-mail (as well as its impact on organizations, as we shall see in a later section). Consequently, records managers and archivists should be aware that some of the findings of this research does not reflect the evolving nature of this medium.

3.1 The Limitations of ASCII Text-Based Messaging For Organizational Communications

Up to the end of the 1980s, the first generation of E-mail messaging systems — host-based and DOS-based PC LANs — used seven-bit ASCII (American Standard Code for Information Interchange) as the lingua franca for exchanging E-mail messages. With only 128 slots assigned to the symbols on the old type-writer keyboard, there was little room for stylistic niceties beyond upper case and lower case.[1]

Given the limitations of ASCII text-based E-mail messaging lacking bold or italic fonts for highlighting and emphasis, users often found it difficult to convey mood or tone in their messages. Consequently, the content of E-mail messages in these legacy systems often appear impersonal, task-oriented, or even blunt.[2]

Media analysts and researchers in the 1980s used *information richness theory* to explain these observations. Adherents argued that E-mail was not a "rich" communication method because it lacked the social context cues available to face-to-face or telephone conversations like vocal inflection and body language to resolve ambiguities in messages.[3] Consequently, most adherents to the theory felt that E-mail was more appropriate for simple and routine exchanges, and that face-to-face meetings or telephone exchanges were more suitable for more ambiguous and complex messages.[4]

In an attempt to compensate for the lack of visual cues in plain ASCII text-based messaging, early users of E-mail — particularly on the Internet — adopted their own symbols, called *emoticons*, for expressing various moods or the tone of a message, by using

a combination of keyboard characters. However, the variety of these symbols are quite limited, and their use never became a common practice in most E-mail communications.[5]

Others researchers during the 1980s observed a kind of "shoot from the hip" mentality of uninhibited expression in E-mail communications. Citing *social presence theory*, researchers suggested that conventional norms that guide communication behaviour were weak amongst E-mail users. To the sender, the recipients were not socially and psychologically "present" at the time of communication. This "pseudo-anonymity" tempted users to "speak" more freely through E-mail.[6]

From an organizational perspective, this could have both positive and negative results. On the one hand, issues might be discussed more frankly and honestly than in face-to-face meetings, where frequently groups appear to be more influenced by prominent individuals rather than the merits of the arguments presented during the discussions.[7] On the other hand, the informality and uninhibitedness of E-mail communications could result in messages that were easily misinterpreted by recipients. In extreme cases, this could lead to heated and angry E-mail exchanges, referred to as "flaming."[8]

Researchers also attributed many of the problems observed in the message content of E-mail to the speed of the medium, and particularly to its *perceived* ephemerality — some users simply assumed that most messages were not saved or even printed out once received, but simply deleted. Consequently, users were quick to send and respond to messages, and were not overly concerned about whether their messages were poorly written or misspelled.[9]

Another "characteristic" of E-mail noticed during this period was the frequent absence of information that provided the context of the message, such as the quotation of relevant text

in a reply or a description of the message in the subject area. Studies on E-mail use suggested that the lack of these contextual clues stemmed from the novelty of the medium and the immaturity of norms in computer mediated communications. However, as familiarity with the technology increased, and norms and procedures were recognized, users were able to adapt both the style and structure of their messages to the demands of the medium in ways that preserved their context and coherence.[10]

Indeed, it seems that many of the problems associated with E-mail messages during the 1980s, variously attributed to "lack of social context cues," "pseudo-anonymity," "perceived ephemerality," etc., and "explained" by information richness theory or social presence theory, were more likely simply the result of a lack of familiarity with the technology, as well as the immaturity of norms and conventions for its use.

While some organizations eventually adopted E-mail policies that prohibited non-authorized use and established the monitoring of corporate E-mail systems for infractions, few responded to problems relating to the actual composition of corporate messages.[11] Recognizing a void that has cried out to be filled, a market "niche" has only recently emerged for various guides on the intricacies of E-mail text messaging. These including primers on E-mail's technical features, "etiquette," ethics, and guidelines for stylistic composition that stress clear and concise writing and the importance of establishing context for E-mail communication.[12]

3.2 Are Legacy E-mail Messages Records?

Given the lack of established norms and the limitations of ASCII text-based legacy E-mail messaging during the 1980s, it is not surprising that it was widely regarded as electronic "chatter," and therefore of no importance to the organization.[13] Many archivists and records managers came to share this belief as well, and were convinced that the "tenor of E-mail" itself encouraged a kind of communications "garbage" that hindered the sufficient development of ideas between contributors.[14] Accordingly, many saw E-mail as simply an alternative communication option for informal messages that reduced "telephone tag."[15]

Nevertheless, even though corporate E-mail systems in the 1980s seemed to mostly contain a great deal of "clutter," they also created significant records. The impression that E-mail systems in the 1980s produced very little information of value to the organization came as a result of the attention focussed on their heavy use for relaying brief administrative messages, passing on small items of information, and handling routine items.[16] However, that was clearly not the whole story. A study conducted at the United States Director of Navy Laboratories in the mid 1980s revealed that 12.6% of total agency E-mail documented policy, assignments, and significant changes in agency.[17]

Improvements in electronic transport permitted the attachment of larger documents created on word processing files, to E-mail messages. Subsequently, some records managers began noticing an increase in the volume of formal information being communicated.[18] And in some organizations, E-mail messaging was replacing typed memoranda.[19]

As a result, some archivists and records managers took a closer look at some of the information being created in E-mail systems. They found that some E-mail messages

provided valuable information as to what happened in an organization and who was accountable for it, documented policy and project debates, the options discussed, and the decisions taken. Further, some of this information was simply unavailable in formal, written documents such as memoranda or committee minutes.[20]

For example, in 1989 the National Archives of Canada (NAC) acquired the E-mail backup tapes of the Trade Negotiations Office (TNO), the Canadian government body created to negotiate Free Trade with the United States. Archivists initially assumed that the E-mail messages would not be of much importance, but subsequent comparisons with the TNO's paper records indicated that in some cases, the E-mail system provided the only documentation of some activities concerning the Canadian government's negotiations with the United States.[21]

Perhaps the most famous example of the dichotomy of views concerning the record value of electronic mail is exemplified in the case of Armstrong vs. Bush (Executive Office of the President).[22] In 1989, the plaintiffs — a coalition of scholars and citizens groups — took the White House and the National Archives and Records Administration (NARA) to court to protect the back-up tapes of the Reagan White House PROFS (IBM's Professional Office System) E-mail after they discovered that the tapes were due for imminent destruction.

The White House, supported by NARA, argued in court that the E-mail had no substantive value and fell into the same "nonrecord" category as telephone message slips, and should therefore be destroyed. To the contrary, the plaintiffs argued — and the Court eventually agreed in 1993 — that the White House E-mail system was used to relay lengthy

substantive (even classified) "notes" that, in content, were often indistinguishable from letters and memoranda, and should be under the protection of the Federal Records Act.

The record value of E-mail was only officially recognized by NARA after the 1993 Court rulings in the Armstrong vs. Bush (Executive Office of the President) case.[23] Its 1995 guidelines for government E-mail established that The Federal Records Act also applied to E-mail records.[24]

As a consequence of this case, several types of E-mail messages were identified in the PROFS system that would qualify as federal records, and served as the basis of NARA's 1995 guidelines for government agency E-mail management. These included messages documenting official agency business, programs, communications, policies, and decisions. Not only were messages used in writing position papers, reports, and studies also recognized as records, but also those documenting oral discussions in planning and policy meetings.[25]

NARA's 1995 guidelines identified other components of E-mail besides messages as federal records: electronic calendars, E-mail directories, mail distribution lists, attachments such as word processing documents, and messages sent or received over the Internet or commercial networks.[26]

The significance of both the TNO and PROFS cases should not be lost on archivists. When examined, significant records documenting official agency business were identified in both these legacy E-mail systems. These findings were contrary to the predictions of information richness theory ascribed to by most media analysts, as well as many of the archivists' own preconceptions. Nevertheless, there are acknowledged limitations to the

degree of evidentiality and reliability of legacy E-mail records, which will be discussed later in the section on the "recordness" of E-mail messages.

3.3 Second-Generation E-mail Messaging Systems and Multimedia Convergence: The New Electronic Mail Record.

The records that will soon be encountered by archivists in second-generation E-mail messaging systems will be a far cry from the simple text-based messages and attached binary programs produced by legacy systems. And so will the E-mail systems. In the 1990s, E-mail messaging has evolved into a communications infrastructure for mail-enabled (or mail-aware) programs and messaging-centric programs built specifically around E-mail transports and store-and-forward messaging.[27] Second-generation E-mail messaging systems are now capable of conveying encapsulated files of various types, like audio and full-motion video clips, graphics files, and scanned facsimiles of documents.[28]

These developments permit messages to contain the social context cues that earlier legacy E-mail systems supposedly lacked. Second-generation multimedia E-mail messaging support added fonts, colour, clip art, pictures, and sound bytes to add social cues and tone to messages.[29] As such, the records capable of being produced by second-generation E-mail systems are markedly different from first-generation legacy E-mail systems.

Windows-based PC LANs were the first to utilize such de facto industry standards such as RTF, OLE, MAPI, and DDE to create multimedia documents and messaging-centric programs, but later these and similar open standards would become incorporated into the more sophisticated client/server messaging networks.

Rich Text Format (RTF) capability allows messages to utilize different text fonts, styles and colour settings to highlight and emphasize text. Compound and multimedia documents consisting of text, spreadsheets, graphics, image, and sound files can now be incorporated into the body of E-mail messages, using object component architectures such as Microsoft's Object Linking and Embedding (OLE) and the multi-vendor OpenDoc object model.[30]

In contrast to the plain ASCII text messages of legacy E-mail systems, second-generation messaging systems are capable of producing new forms of multimedia records that do not have any paper analogues. As such, they must be maintained electronically to remain viable.[31] Archivists have begun to think out the strategies required to preserve archival electronic records, and aspects of this thought will be discussed later in the section dealing with preserving electronic mail systems.

Mail-enabled and messaging applications based on Vendor Independent Messaging (VIM) and Microsoft Application Program Interface (MAPI) permit the quick development of applications that automatically send messages to a mailbox, to each other, to middleware components, or to peripheral devices, in order to route information through the corporate mail system. These standards, most encountered at the desktop level, encourage developers to use E-mail as a framework on which nearly every message-oriented application can be built. Similarly, Microsoft's Dynamic Data Exchange (DDE) protocol allows virtually all Windows applications to share data with Windows-based E-mail.[32]

The most common mail-enabled programs are versions of shrink-wrapped word processing, spreadsheet and graphics packages in which Mail can be selected from the File menu in the same way as Print. When the message is sent, the spreadsheet or word

processing file is automatically attached. Recipients can then launch the creating application directly from the mail attachment, or use a document viewer if the application isn't available. And mail-enabled programs are also able to communicate with each other by tapping into messaging transports.[33]

3.4 Multimedia Convergence

Alongside these advancements in mail-enabled and messaging applications have been innovations in electronic data transport that have greatly increased the bandwidth of digital communications. Increasing bandwidth capabilities have facilitated the convergence of fax, E-mail and voice mail communications media into unified messaging products capable of creating multimedia documents.[34]

Some predict that second generation E-mail, with its ability to incorporate graphic images, scanned facsimiles of documents, and a wide variety of document architectures, will soon effectively replace FAX-type communications.[35] Desktop video conferencing products like Asymetrix permit users to save and clip video, and attach an .AVI file to an E-mail message.[36] And using voice recognition technology, E-mail and voice-mail systems will become fused into integrated systems.[37] According to a 1995 survey from the consulting firm BIS Strategic Decisions, as fax and voice-mail become more and more computer-based and integrated with E-mail, these hitherto separate communications media will soon start to be replaced in users' minds with the more generalized notion of "messaging."[38]

The convergence of these communication technologies into a single desktop will be managed through a single mailbox interface. Users can view a list of everything that is sent

to them, screen calls, forward voice messages and employ voice to text and text to voice technology to have their E-mail read to them.[39]

An integrated mailbox for E-mail is a feature included with Microsoft's Windows 95 operating system, and third party companies such as Claris, ConnectSoft, and Delrina also have product offerings. These client-based integrated mailboxes have a major drawback: users are locked into the integrated mailbox's interface, thus losing some of the special features of the resident E-mail system. And while these client-based mailboxes simplify access to multiple mail sources, they do so "inelegantly" — all client software must still be installed on the users' desktop.[40]

However, some client/server-based messaging systems such as Novell's GroupWise and Microsoft's Exchange Server are being bundled with a universal mailbox that integrates E-mail, voice-mail, fax, and information services seamlessly.[41] Other major suppliers of client/server messaging systems such as Lotus and IBM are expected to soon follow suit.[42]

An important aspect of the convergence of these computer-based communications media from a records management and archival perspective is that new compound, multimedia electronic records are being created, and audit trails are documenting exchanges which did not previously exist, particularly for computer-mediated telephony and audio-visual communications.[43]

But while potentially more records are being created by messaging technology than was hitherto possible, the complexity of ensuring its preservation means that they are also subject to a significant risk of loss. This and other issues will be subsequently discussed in the section on preserving electronic mail systems.

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4.0 E-mail Communications and Connectivity

As mentioned previously, E-mail is a communications medium — albeit computer-mediated — rather than an application, like a conventional information system. In order to be sent or received, messages must pass through the various software layers and hardware connections of the mediating computers. Consequently, communications issues are inseparable from an analysis of E-mail systems.

Questions of network management, as well as the dependability, security and integrity of data transmission, have a direct bearing on records creation. So too does the trend towards greater network connectivity, especially evident as more and more individuals and organizations communicate information and exchange documents via the Internet and the World Wide Web.

Related to the overarching trend of network connectivity, the impact of "teleworking" and the "virtual office" is just beginning to be felt by organizations, but promise to have far-reaching consequences on corporate culture, organizational structure, and the nature of work. Therefore, these phenomena merit the consideration of archivists and records managers.

Connectivity also brings with it the danger of "infoglut" — vast amounts of data that threaten to overwhelm E-mail users. E-mail messaging systems have begun to incorporate sophisticated rules engines for filtering electronic junkmail and for automating aspects of mail management. In addition, rules are being used with automated forms to speed information routing, task automation, and decision support. Archivists and record managers should assess the potential of rules and forms technologies for recordkeeping purposes.

4.1 Network Connectivity

While much attention has recently been paid to external connectivity, especially to the Internet and the World Wide Web, the importance of this phenomenon should not distract us from the primary purpose of E-mail messaging systems: internal communications — ie. communications within organizations.

In an organization, the E-mail system may be connected to users locally — i.e., in the same building, or to users dispersed over a wide geographical area, depending on the size and scope of the organization. 82% of Fortune 500 companies and 64% of mid-size companies use E-mail for internal purposes, with users sending the average of about 10 E-mail messages per day, while receiving about 14 messages.[1] And in the U.S., government organizations are heavier users of E-mail than the private sector, with 83% of government workers using E-mail, compared to 62% of corporate employees.[2]

Over the past decade, the user base of E-mail systems has been increasing remarkably, requiring organizations to expand their networks to accommodate the new users. In 1985, there were believed to be 300,000 E-mail users in the U.S. A decade later, there were close to 20 million E-mail users within the Fortune 2000 companies alone.[3] In Canada, there were an estimated four to five million E-mail users in 1994.[4] Globally, the messaging market is estimated to grow from 43.4 million mailboxes in 1993 to 67 million mailboxes by 1998.[5] The volume of E-mail messages is also increasing at a dramatic rate. An estimated 25 billion E-mail messages were sent in the U.S. in 1995, more than twice as many as were sent in 1993.[6]

When networks expand to accommodate more users, they require more than one fileserver, and each server must be able to communicate with the other in order to emulate a single post office. As was shown in the previous chapter, the scalability and manageability of expanding networks depends to a great extent on the messaging architecture. But a major complicating factor in network expansion is that large organizations are unlikely to have standardized on a single mail system, let alone a messaging architecture.

Instead, "islands" of disparate systems have sprung up at the department or even the division level, reflecting the needs and preferences of end users in a distributed environment, but without regard for the electronic communication needs of the organization as a whole.

Organizations also face the same situation when connecting to external networks for interorganizational communications. Integrating these diverse E-mail systems — each with their own proprietary directory, mail transport, message store, and file format — is a challenging task.[7] Organizations may choose several different options for this task, depending on the size and "mix" of the systems being connected.

4.2 Gateways

To connect a small number of heterogeneous E-mail systems, gateways are a relatively inexpensive option, and have become very common as networks expand. Nevertheless, gateways have important limitations, because a separate one is needed for each connection to a different type of mail system. As the number of these connections increase, there is a corresponding number of user directories to manage. And as the user base expands, keeping

the address lists for each system up to date and synchronized between multiple systems becomes increasingly difficult.[8]

In addition, linking an internal E-mail system to an external network necessitates that the connected systems have some way of identifying aspects of provenance and contextual information about messages, such as who wrote it, when and where it was posted, to whom and with what instructions. This data is declared to the software system carrying the message and carried in an 'envelope' when the message is posted outside the originating system.[9]

Thus, message handling between multiple gateways easily becomes very complicated. Serious problems can occur when changes are made to gateways, such as inconsistencies with how replies are handled and messages routed, resulting in error messages and/or message format incompatibilities.[10] Another significant limitation to using gateways to connect multiple networks is the inverse correlation between the speed of message traffic and the number of gateways used.[11]

4.3 Problems with E-mail Connectivity: The Popularity of Fax

When E-mail is exchanged over different networks and gateways, the lack of standardized information exchange formats and addressing mechanisms for external connections create problems that undermine the reliability of transmission.[12] Some tests have shown that 91% of properly addressed E-mail messages either sent from one company to another or from one individual to another over commercial on-line services reached their destination (many experiencing lengthy delays getting there). The "lost" mail and frequent delays in receiving mail are the major reason why users choose fax for intercompany communications. The

study showed that fax was more reliable for external communications, with 96% of faxes arriving at their intended destination.[13]

Intercompany faxes accounted for nearly two-thirds of all faxes sent, especially urgent documents or those headed overseas. Daily fax users sent an average of 41 documents per day, with each document averaging five pages. Mid-size company daily users send an average of 35 documents daily, each averaging four pages.[14]

Yet there are also limitations to fax usage for many communications purposes: the print quality of fax is low compared to electronic mail, but is slowly improving; it is difficult, time-consuming and costly to transmit large documents such as spreadsheets over fax lines; and documents are difficult to edit.[15]

4.4 Message Switching and Messaging Backbones

Consequently, organizations that rely on E-mail for data exchange but have experienced problems integrating disparate E-mail systems, now look to message switching as a solution that provides a more efficient way of handling message exchanges. Mail switches convert the message to an internal or intermediate format, and then to a destination format. In this way, no more than two conversions are made, which makes a switch more reliable than going through multiple gateways. These message transport systems transfer messages between post offices as well as synchronise accounts so that users added in one post office automatically appear on the user-list of other post offices. An example of an open system is Novell's Message Handling System (MHS).[16]

For the integration of heterogeneous E-mail systems with a very large installed user-base dispersed over a wide geographical area, a common messaging backbone is considered the best option. Backbones use gateways to convert proprietary mail messages to standard message formats like X.400 or SMTP, and then rely on gateways to convert from the standard message format to the destination mail system.[17]

Mail backbones utilizing the mail and messaging standards X.400 and X.500 will be able to provide better manageability, scalability, interoperability, reliability and flexibility than gateways or switches. X.400 — a mail and messaging exchange standard — provides compatibility between heterogenous systems and the many formats used in a variety of addressing schemes, as well as support many different data types (spreadsheets, wordprocessing files, databases, multimedia).[18]

X.500 will provide a central method for synchronizing or updating entries in the directories of different mail systems. Protocols defining the interaction between the user agent and the directory will permit users to perform intelligent searches across various platforms. The X.500 standard specifies strict security routines such as cross-referencing and access control lists.[19]

Because mail backbones are very expensive to install, only the very largest organizations with huge installed user bases can afford to build their own. For organizations unable to afford these up-front costs, mail backbones are available through a variety of business communications services.[20]

4.5 The Internet and the World Wide Web

Another alternative is for organizations to utilize the capabilities of the Internet as a mail backbone and exploit the possibilities of the World Wide Web (WWW). Internet standards like Simple Mail Transfer Protocol (SMTP) and the Multipurpose Internet Mail Extensions (MIME) make interoperable mail systems possible at the fraction of the cost of an X.400\X.500 mail backbone. SMTP gateways are the easiest Internet on-ramps. and handle the way in which messages are transmitted from one system to another. MIME lets users of different operating systems and E-mail applications exchange multiformat documents.[21]

A 1995 survey conducted in the U.S. on corporate communications and the Internet found that 77% of companies will be on the Internet by 1997 (38% polled were already on the Internet in 1995, and 39% will be on the Net by 1997).[22] The U.S. Government was an even bigger user of the Internet and the World Wide Web than business. Fifty-seven percent of government agencies reported that their E-mail system already had links to the Internet, and new Internet gateway installations were rapidly being developed.[23]

The rush to get on the "Web" has led many vendors of E-mail systems to develop products that have connectivity features. Examples of SMTP gateways for E-mail systems include those for Lotus cc:Mail, Lotus Notes, Microsoft Mail, and Novell GroupWise.[24] Some vendors like Banyan systems have added Internet connectivity to their existing proprietary E-mail product lines. Products such as Eudora use such Internet standards as MIME to permit messages to include non-ASCII text, images, video, and other sorts of data.[25]

One of the most interesting effects of the ubiquity of E-mail in business and personal use via the Internet is that more individuals and organizations are communicating information and exchanging documents at an unprecedented level, leaving a record trail of these transactions which did not previously exist.[26]

An especially important potential source of archival records available from the Internet are the academic E-mail bulletin boards and listservers used by the scientific community. In the place of the verbal exchanges characteristic of the past that would have either left an inaccurate record or perhaps none at all, the messages on academic bulletin boards and listservers on the Internet may record important discussions — including all the different accounts and editions — resulting in changes in theory and practice. And because of the global access available to these bulletin boards and listservers by scientists and academics through the Internet, the quality, volume and completeness of these E-mail scientific discussions could prove to be unparalleled.[27]

4.6 Connectivity and the Need for Security, Privacy, and Authenticity

While organizations are increasingly embracing connectivity with external networks, this exposes them to the risk of security glitches and privacy leaks, pointing out the need for corporate policies for addressing these issues. This need was illustrated by a 1995 survey of mid- to large-size (1000 to 10000 employees) U.S. companies. 72% of the organizations were connected to WANs, and 27% had Internet access. Only a little more than a third of respondents said their companies had E-mail policies on proper use and security issues, but in reality, the number was far less because most were later found to be mistaken. More than

half of respondents were using the corporate E-mail system for personal and non-business use. This finding demonstrates the vulnerability of organizations, because statements made by individual employees are often taken by "outsiders" to be company policy.[28]

Of the 23% of companies polled that did not foresee being on the Web by 1997, 16 % were so mindful about the potential leaking of confidential and sensitive data that they ranked this as the number one reason preventing them from connecting their internal E-mail systems with external networks like the Internet.[29]

To help ensure the security of data, network administrators in "connected" organizations use "firewalls" to screen system access and to shield their networks from intrusions. Data encryption — the transformation of data into a form unreadable by anyone without a secret decryption key — is also being utilized as a means of ensuring the privacy of data by keeping the information hidden from anyone for whom it is not intended. And to authenticate documents, digital signatures are being used to verify that the document originated from the individual whose signature is attached to it and that it has not been altered since it was signed.[30]

4.7 Remote Network Access and Teleworking: Pushing the Organizational Envelope

The trend towards greater network connectivity extends beyond the physical confines of the organization, and is leading to the creation of the so-called "virtual office." Remote dial-in user access capabilities are supported by most E-mail packages, and office and computer technology — PCs, copiers, fax, answering machines, voice mail services, and word processors — enables "teleworkers" to take work out of an organizational setting and to

bring the "virtual office" into the home. Business considerations such as reducing overhead costs (primarily office space), along with demonstrated increases in teleworker productivity and job satisfaction. is sufficient for many organizations to consider work-at-home alternatives.[31]

Although the actual number of teleworkers is unknown, the number is definitely increasing. A 1993 study by the U.S. Department of Transportation, for example, found that 8.4 million employees telework at least eight hours a week, up from fewer than 1 million in 1985. The Yankee Group, a consulting firm on technology issues, estimated that there was 10 million teleworkers in the U.S. in 1996, and that teleworkers were growing at a compound annual rate of 15 percent. Another information technology advisory firm, Gartner Group Inc., predicts there will be more than 30 million U.S. teleworkers by the year 2000. The firm estimates that by 1999, 80% of all organizations will implement teleworking for about half of their workforce.[32]

However, teleworking challenges aspects of corporate culture in ways which might limit its scope. For example, perks and incentives, discipline, and ways of instilling a corporate identity, need to be different for teleworkers. It is expected that teleworking will have a profound psychological and social effect on the meaning of work, which in the past was so closely associated with the company office, but will become "a thing you do, not a place you go to." Teleworking will not be encouraged by organizations that do not embrace these changes.[33]

Another aspect of teleworking that bears watching is its effect on the workload of those personnel engaged in it. The aim of the new communications tools is to improve employee

productivity as well as to facilitate an easier and more flexible workload, allowing teleworkers to work anywhere at any time. Conversely, it could result in blurring the distinction between work and private life, essentially tethering workers to their jobs. This would lead to employee resistance unless organizations help to control the balance between the two.[34]

4.8 Infoglut, Rules, Forms, and Recordkeeping

The increasing integration of E-mail, voice-mail and fax into unified messaging products, coupled with the trend towards greater connectivity to external networks — particularly the Internet and World Wide Web, enormously multiplies the volume of information individuals and organizations have access to. Honeywell, a large international corporation, found that E-mail traffic increased to 500,000 messages a month from 30,000 when it improved Internet access for its worldwide users.[35]

The vast amounts of data threatening to overwhelm E-mail users on the information super-highway is referred to by observers as "infoglut." Infoglut can negate whatever productivity gains networked messaging initially promised, as reading and responding to messages becomes a full-time job.[36] To reduce and manage infoglut, many E-mail messaging applications incorporate rules-based software with filtering and routing capabilities. Rules allow users to set up automatic responses to incoming mail without user-intervention. These features are worthy of consideration by records managers and archivists for their potential relevance to electronic recordkeeping.

PC LAN E-mail systems such as Lotus' cc:Mail and Banyan's BeyondMail, and client/server LAN E-mail systems like Novell's GroupWise and Microsoft's Exchange Server, have powerful built-in rules engines that automate certain mail management tasks, such as automatically deleting junk mail as soon as it arrives, priortizing mail and moving messages to specified folders, or "tickling" messages at specified times. They can forward and print messages, as well as create and send out messages on a regular basis. Rules can search folders for specific messages, looking for keywords in a message or a header field. Rules can be very sophisticated to automate complex tasks, but some packages, like BeyondMail, also offer a MailMinders feature — a kind of rule template for most routine mail management.[37]

Records managers and archivists should explore the possibilities afforded by rules engines for automated recordkeeping, particularly the classification and filing of E-mail messages into appropriate folders, as well as the potential it offers for automatic scheduling and disposition actions.

A major limitation with rules engines for PC LAN based E-mail systems such as cc:Mail, Microsoft Mail, and BeyondMail arises from the fact that most of the messaging features are client-based. Rules for PC LAN E-mail is user-defined, rather than corporate-wide, and users must be logged into the system for the rules to work. In addition, the store-and-forward nature of PC LAN E-mail mentioned earlier means that folders are defined (and accessible) at the user level, not at the corporate level. Consequently, even though some client-based packages can create "virtual users" in the mail system that receive messages and act on them according to rules, the folders are not accessible to other users.

Client/server-based rules engines, coupled with replication capabilities, offer more promise for automated recordkeeping and management. For example, in Novell's GroupWise, the rules are server-based and are applied by the system whether users have logged on or not. This arrangement also makes it easier to produce rules that apply to groups, rather than individual workstations.[38]

With replication, public folders and discussion databases are accessible enterprise-wide. If these public folders can be organized according to corporate recordkeeping guidelines, and if rules engines can be applied to automate some or all of the classification, filing, scheduling, and disposition of the contents therein, substantial progress will have been made towards corporate recordkeeping of E-mail messages. Furthermore, the rules database could automatically reply with warnings to a forwarded message that fails to identify either the subject of the message or additional contextual information in either the envelope or the body of the message. This would help determine the proper classification and filing of records, as well as ensure the "recordness" of the communication.

Rules engines are also being used with a new kind of record — automated forms riding on E-mail transports — for a variety of tasks, such as information routing, task automation, and decision support.[39]

Client-based PC LAN E-mail systems, such as cc:Mail, Microsoft Mail (with Microsoft's add-on Electronic Forms Designer) DaVinci eMail, and Banyan's BeyondMail, each have a number of different message form *types* that serve as electronic templates corresponding to basic office tasks, such as the basic memo, phone message, request, meeting notice, and

routing slip. In addition, custom forms can be created using Banyan Beyondmail's Form Designer option.[40]

Unlike the header fields in the generic message envelope of legacy E-mail systems (To:, Cc:, Bcc:, From:, Forwarded:, Subject:, Date:, Certify:, and Attach:), each form type is *designed* to support a specific office task or function, and so have their own unique header and action fields, as well as text/message boxes.

The use of automated forms, especially in conjunction with rules engines, provides some interesting recordkeeping possibilities that deserve further investigation. A potential advantage of forms — as opposed to the generic E-mail body type — is that (using an add-on forms builder package) it can be "customized" to a very high degree to contain whatever information is considered a requirement for a specific record function.

In the following scenario, a customized form might be used as a kind of "template" for a specific type of record, such as a report, memorandum, official correspondence, committee minutes, or a specific type of business transaction. Each type would be standardized, with their own unique header and action fields, as well as text/message boxes. Rules, based on corporate recordkeeping policy, could be specified for each form type, and might be designed to ensure that each form type had been filled out properly, with pertinent data identified in their respective headers (ie, subject), as well as automate the filing, scheduling and disposition of each form type.

While the use of rules and automated forms may offer promising prospects for corporate recordkeeping, other trends in the near-future may soon eclipse them. Though not widely available in commercial products at the moment, object-oriented E-mail will have functions

such as the ability to apply properties automatically to messages, including deletion dates, and logical document groupings.[41] Combined with client/server messaging architectures with replication capability, object-oriented E-mail promises to revolutionize document management, and so this technology should be examined closely by records managers and archivists for its electronic recordkeeping implications.

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5.0 E-mail Messaging: Workflow, Work Groups, and Impact on Organizations

Evolving E-mail messaging technology is leading to the development of applications with the potential to change the way that organizations operate, work, and how they are structured: workflow management tools and work group messaging systems.

Workflow management tools are potentially capable of re-engineering business processes by using sophisticated computer monitoring devices to analyze them and break them down into their component tasks. Diagnostic tools are used to evaluate opportunities for streamlining and efficiency, and rules are specified and automated to govern their operation.

Work group systems permit people from various departments, positions, and locations to collaborate on projects, or participate in electronic conferences. Some believe that work group systems will become the norm for the way work is conducted in the 21st century, and thus have an important impact on organizational structure.

These subjects are naturally related to the wider issue of the impact of messaging technology on organizations. The widely held view that E-mail use invariably leads to a flattened hierarchical structure is critically examined, as well as the nature of the relationship between messaging technology and organizational factors that influence organizational re-engineering and restructuring.

5.1 Rules + Forms = Workflow: Re-engineering The Organization

The use of rules engines along with automated forms is being used to digitally replicate business processes that involve document routing. An advanced type of this messaging application — workflow management — is being touted as a means to reinvent business processes and create new structures to affect them.[1]

The foundation of workflow systems — intelligent routing of automated forms and data — is based on a combination of rules, events (processes), and time. A messaging system such as Lotus Notes can easily duplicate business forms, but is fundamentally passive: it lacks rules engines to specify who gets what information, and is unable to track what they do with it.[2]

Workflow applications require organizations to carefully describe business procedures and refine and apply corporate rules. Once all the steps and rules have been identified in a process, workflow applications can be used to monitor operations such as measuring how long a process takes and how much time the average employee needs to perform a certain task. Good workflow applications provide diagnostic tools for pointing out problems, allowing developers to formulate solutions. For example, several processes, once under the domain of several different organizational jurisdictions, may be "collapsed" into a smaller number of operations, and re-assigned to a new area. In this way, re-engineering is the primary result, but organizational re-structuring is a by-product.[3]

There are three basic architectures for workflow systems: user or client-based; object- or agent-based; and server-based. E-mail systems such as cc:Mail, Microsoft Mail (with the add-on Electronic Forms Designer) DaVinci eMail, and Banyan's BeyondMail typify the first

type of workflow system architecture: user or client-based. Having pioneered the use of rules engines, BeyondMail is a good example of client-based tools that allow individuals to automate interactions with other people and applications. While Beyond doesn't use a centralized model, it can create virtual users in the mail system that receive messages and acts on them according to rules.[4]

Beyond's rules engine for filtering and sorting E-mail is the basis for its bottom-up, ad hoc approach to workflow automation. Using BeyondRules scripting language and add-on Forms Designer, users set up their own rules for tasks ranging from personal mail management to complex forms routing. BeyondMail typifies the weakness of client-based workflow applications. Precisely because it is user-controlled, it lacks the corporate-wide, top-down approach required for re-engineering business.[5]

The second type of workflow system is object- or agent-based, exemplified by Reach Software's Workman. Workman treats data as objects, so forms carry the intelligence that each client needs to process it correctly. Each form has active fields that can invoke specific actions, and form design decides which fields are active or even visible to each user. Workman's routing engine is client-based and is programmed through a combination of graphics tools and scripts. Information about the status of each form is reported back to a database for tracking and reporting. Supporting graphical tools for diagramming workflow, Workman utilizes a top-down approach in which processes are targeted for automation and then workflows are engineered.[6]

Action Technologies' Workflow Management System represents the third type of workflow architecture — server-based systems that actively monitor the status of tasks

throughout the system to track workflow. Beyond simply routing forms, the Work flow server stores information about the status of workflows in a central database, and a reporting tool lets administrators manage workflows and inspect performance. Because workflow and task status are monitored and controlled by a server-based central database, it provides far more control mechanisms than client-based products that rely on rules-based routing of forms only. It also comes with a workflow designer and applications builder for connecting workflows into external applications, such as E-mail or databases.[7] Action Analyst, an add-on product that integrates with the Workflow Management System, analyzes the business processes underlying workflow.[8]

There are a number of reasons why the use of workflow technology has been relatively limited to date, with the typical workflow-enabled application consisting of less than 100 users. The upfront costs of workflow applications are quite high, typically costing $3,500 U.S. a desktop. There are technical reasons as well, with many workflow products capable of supporting only one server at a time, severely limiting the number of people who can use the system simultaneously. But one of the major obstacles to more widespread use of workflow technology is that it requires a great deal of up-front thinking in order to be effective. Before processes can be automated, they first must be evaluated and streamlined. Added to this is the difficulty of defining business rules for a large, complex organization.[9]

Despite these obstacles, the number of users of workflow software is growing, from 514,000 licenses in North America and Europe in 1994, to a projected 5.8 million by 1998.[10] Records managers and archivists must assess the potential impact that workflow messaging

applications on this scale will pose to organizational re-engineering and restructuring if they live up to their promise.

5.2 Work Group Messaging and the Documentation of Group Communications

Work group applications, based on the integration of E-mail, networking and multimedia technologies, are intended to create a shared work space that supports dynamic collaboration capable of overcoming space and time constraints. Besides E-mail messaging, collaborative applications include calendar-, scheduling-, and project-management. Add-on groupware products include computer and video teleconferencing.[11]

The leading PC LAN based messaging systems supporting work groups are Windows for Work groups, and On Technologies' Meeting Maker — an add-on program for its own Da Vinci eMail that also works with Microsoft Mail and Lotus's cc:Mail. Lotus Notes and Novell's GroupWise are based on client/server architectures. Both architectures have an integrated graphical, menu-based user interface, and allow users to schedule and discuss topics via E-mail. PC LAN applications feature bulletin boards for sharing work group information among members and posting topics. Client/server based work group applications such as Notes and GroupWise have advanced features such as distributed databases, replication, public folders, document management, and various applications development tools.[12]

Work group messaging can improve intellectual collaboration for a variety of project- and policy- related tasks, especially by making coordination among members easier through the elimination of the time and space limitations that constrain face-to-face meetings. Work

group systems permit people from various departments and geographical areas to participate in electronic meetings. Members can even collaborate in projects asynchronously, allowing minimal disruptions to individual work schedules. In addition, work group messaging can extend the number of participants beyond the confines of a small meeting room. More people can potentially be consulted, and thereby more alternatives considered.[13]

Research indicates work group messaging does not eliminate the need for face-to-face communications, but serves as its complement. For example, group communication can be made more effective when face-to-face meetings are used to build or share an interpretive context, after which members use the speed and efficiency of work group messaging for project-related tasks.[14]

Alternatively, work group messaging can be employed for electronic brainstorming to create an idea pool prior to face-to-face discussions, leveraging both the productivity of individual work and the motivating properties of group interaction.[15] Other studies of work group messaging in large organizations found it to be more effective in the administrative stages of a project, rather than in the initial conceptualizing stages or the final project wrap up.[16] The exact way in which work group messaging is used may differ from one group to another, depending on the task it is being used for.

From a records management and archival perspective, work group messaging may therefore document significant project and policy meetings, providing an account of debates, alternatives considered, decisions made, and accountability for outcomes, all to a degree of detail and precision simply unavailable from conventional records like memoranda or committee minutes. Furthermore, utilizing the integrated communications features common

to second-generation E-mail messaging systems, work group applications will create multimedia records that do not have a paper analogue. In the near future, work group messaging applications will even be incorporating automated procedural mechanisms modelled on Robert's Rules of Order! In other words, they will be *the* record of such meetings in many organizations in the near future, and must be preserved.[17]

5.3 E-mail and Organizational Structure: The Cliché of the Flattening Effect

E-mail's so-called "flattening effect" on organizational structure is a cliché so long and widely held by many, including records managers and archivists, that it has almost come to be taken as self-evident.[18] Implicit in such a view is that there is a kind of technological imperative underlying E-mail that inevitably alters organizational structures in this direction.[19]

Early research on legacy E-mail systems suggested this effect, principally for two reasons. The first was that E-mail messages typically lacked indications of organizational position and hierarchical status, so these factors would not influence the judgement of a message's content. Consequently this would have a "levelling effect" on corporate communications. The second was the "equalizing effect" of E-mail: because users have equal chances of access to other people in a network, lower-echelon employees should in principle be able to communicate directly with the most senior corporate executives, and vice-versa.[20] Consequently, many observers suggested that E-mail obviated the need for multiple layers of management in a hierarchical organization — especially at the middle level.[21]

As we have already seen, the absence of the social and visual cues in E-mail, held to be partly responsible for this so-called "flattening effect," is not an inherent characteristic of the medium, but only of a specific stage of its development — i.e., of first-generation legacy E-mail systems. Second-generation E-mail messaging systems are capable of sophisticated messages incorporating graphics, video, sound, and other tools to assert the rank and status of the sender.

And other studies cast doubts on the "equalizing effect" of E-mail. While these studies do not dispute the potential of E-mail to extend the number of people users "talk" to, their findings indicate that communications do not necessarily leap across many hierarchical boundaries. These studies suggest that the information flow in E-mail systems is mostly lateral — i.e., user communication is with others at or close to the same level in the organization.[22] Even for E-mail systems linked to offices worldwide like IBM's PROFS, 83% of messages were sent within a division, and 93% of messages were *not* addressed to a recipient more than one job level above or below that of the sender.[23]

5.4 E-mail, Re-engineering, and Restructuring: Organizational Factors

This is not to suggest that E-mail messaging systems cannot be used as a means for corporate re-structuring and re-engineering, but only if these changes are the objectives of a planned approach to its introduction and implementation. For example, organizations seeking to promote work group systems for group interaction must adopt polices that encourage group collaboration rather than individual competition, as well as take measures to ensure that everyone has access to information.[24]

Furthermore, E-mail messaging systems can effectively promote organizational change if both formal and informal pressure is exerted by the organization to induce nonusers to adopt it.[25] This is particularly true when its use is advocated both by management and peers at the department-level.[26] And in the case of business process re-engineering, the successful deployment of workflow technology requires high-level strategic planning involving a thorough analysis and evaluation of business processes, structures, and procedures to identify opportunities for effectual change.[27] Usually E-mail messaging technology successfully assists the achievement of these objectives when there are powerful external economic, political, and technological pressures that require organizational adaptation.[28]

Conversely, E-mail messaging systems fail to achieve corporate re-structuring and re-engineering within organizations for a number of reasons. The organization may lack a well-planned strategy for using an E-mail messaging system to alter organizational structure or to re-engineer business processes.[29] For example, its introduction is simply unplanned. E-mail messaging may come "bundled" with other information technology, such as a Management Information System (MIS) package. Under these circumstances, the "informal" mode of E-mail communication seems to coexist with traditional, formal routines, leaving the hierarchical structures intact.[30]

On the other hand, actual resistance to E-mail implementation may occur in some organizations at various levels of the hierarchy. In some settings, using E-mail for increased vertical communication may not be encouraged. Middle managers may worry their role as relayers of information may be usurped, while senior managers may feel exposed to unwanted communication from the lower ranks.[31]

In other instances, researchers have found that E-mail is actually used to support ongoing hierarchical relations, particularly in Europe. One such E-mail system was expressly designed to maintain "teamwork between non-equals" that reinforce a hierarchical organization in which the flow of orders is rigidly defined.[32]

Thus, the technological imperative view of E-mail messaging systems that is frequently encountered in the literature and finds its way into records management and archival works, must be tempered with the recognition that, while E-mail can act as an agent for change, it is not a cause of it.[33] The impact of E-mail on organizational change, or the lack of it, depends on the specific social context of each organization implementing it. Field research indicates that each organizational setting appears to have different norms, policies, and cultures regarding E-mail use.[34] Ultimately, the ways in which E-mail is implemented in an organization is dependent on the presence or absence of policies, designs, and vision for its use.[35]

Notes to Chapter 5

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6.0 Preservation Issues of E-mail Records

In this thesis, many topics relating to the evolution of E-mail systems and messaging technology have been discussed that relate to records creation and/or to corporate recordkeeping. While archival implications have been discussed throughout, the emphasis has usually been on ongoing records creation and recordkeeping concerns.

The central question that remains to be examined is this: how do we preserve records from E-mail systems? The question is not at all unrelated to these topics, but simply looks at them from a different angle. To answer this question, however, we must first examine some elemental archival notions such as the definition of a record, and the characteristic attributes that establish its "recordness." These characteristics function as a kind of measuring stick to ensure that what is preserved in these systems is indeed the object of our goal — records — and not some kind of documentary artifact.

And when we look at the functional requirements for recordkeeping that have been developed, we must recognize that they relate to archiving, and not the kind of recordkeeping purposes concerning records collection, classification, and organization that have been discussed in this thesis. The point of making this distinction is merely to highlight the fact that while trends in messaging technology might have a significant impact on records creation and/or potential for corporate recordkeeping purposes, they must also be assessed in terms of how they relate to the satisfaction of functional recordkeeping requirements.

Functional recordkeeping requirements for E-mail systems are necessary for current and future implementations that are potentially capable of corporate recordkeeping. However,

they are not practicable to legacy E-mail systems which may have created records, but were not designed as corporate recordkeeping systems.

Recognizing the limitations of the records from legacy E-mail systems, it is still possible to obtain evidential information relating to their content, context and structure by using document viewers to analyze the system data captured in network backup tapes, very likely the only source of legacy E-mail records.

6.1 E-mail Messages and "Recordness"

Luciana Duranti defines a record as "a document made or received in the course of activity...[and] seen as evidence of it."[1] Similarly, David Bearman's conception of a record emphasizes its purpose as being evidence of a business transaction, but he stresses that the transaction, or activity being documented, must be communicated.[2]

In the case of electronic records of the kind produced by E-mail systems, communication can take place between humans, computers, or any combinations thereof, but information that remains in a user's personal computer without being communicated is by definition excluded from consideration.[3] This stipulation, while perhaps not without controversy, is certainly not problematical when applied to E-mail systems. Recall that E-mail systems have been referred to in various parts of this thesis as a computer-mediated communications utility. Consequently, if an E-mail communication documents an activity or business transaction, it is by definition a record.

Both Duranti and Bearman judge that the essence of records creation is to ensure that records constitute evidence of the transaction or activity being documented. Duranti argues

that the value of this evidence is dependent on its *reliability,* which she associates with its completeness and the degree to which the procedure of its creation is controlled. She distinguishes this concept from that of *authenticity*, which implies that the record is guaranteed to be intact and what it purports to be, due to controlled procedures of transmission and preservation. According to Duranti, records that are authentic are not necessarily reliable, but that reliability always carries with it a presumption of authenticity.[4]

In the context of this thesis, we have seen that historically, most E-mail system implementations to-date have not been able to create reliable records as defined by Duranti, because of the lack of procedures for their creation or for their subsequent collection, classification, or organization according to corporate recordkeeping requirements.

However, we can see that E-mail systems may create authentic records when steps are taken to ensure their integrity by the adoption of stringent measures for proper network security, as well as the use of data encryption and digital signatures for E-mail systems connected to external networks.

However "imperfect" the records produced by E-mail systems both in the past and the present, they nonetheless possess qualities that make them records. Consequently, we can therefore see the flaw in the argument advanced by some records managers that an E-mail message is a form of non-record because it does not allow for the creation of a legal document that can establish clear evidence of its own authenticity.[5]

That view is also contrary to the way courts of law in the U.S. have interpreted the value of E-mail as evidence. Because E-mail has become part of the normal business practice of many organizations, the rules of evidence, business practice, and case law combine to assure

that E-mail is admissible in legal and administrative proceedings.[6] Consequently, E-mail has been successfully used by litigants in U.S. courts as evidence to prove culpability or corporate responsibility for activity documented therein.[7]

David Bearman, on the other hand, believes that the "evidential historicity" or "recordness" of communicated information (such as those produced by E-mail systems) derive from the relationship between a record and an accountable transaction, established by certain constituent elements of records. The elements that must be joined for a record to be evidence, are: content (or data), structure, and context.[8] From the perspective of this thesis, these elements are useful as a framework for understanding what it actually is about records that needs to be maintained or "preserved" by archival strategies.

The *content* of the record is the words, numbers, images and sounds actually made by its creator. The content of E-mail messages is defined by Bearman as "what is received." In order to ensure its integrity, it must be maintained inviolably once received by the addressee.

The *structure* of the record is the relationships between elements of the content data implicitly revealed by the creator. The structural links of electronic records produced by E-mail systems consist of the functionality to link items of correspondence with replies, forwarded materials, and enclosures. In more advanced systems, it may also include the active relationships in 'dynamic ' or 'multimedia' documents, supported by system software or by the underlying Application Program Interface (API) layer. In order to establish meaningful business transactions, these structural links must be managed and preserved over time, presenting considerable challenges in terms of the software and hardware dependency of these systems.

The *context* of the record is the information provided about its creation (who created it? how it was created?), its use and about how it appeared and behaved in a particular setting. Bearman points out that the contextual information from which records derive their evidential value is obtained from the record system, not from individual records, which explains why archivists place such value in the "original order" of paper based systems.

Together, all these elements must be preserved to establish the "recordness" of E-mail communications. According to Bearman and others, to merely "archive" the content of E-mail messages, without preserving crucial structural and contextual data, is tantamount to destroying the record. However, in the case of second-generation multimedia E-mail messages, just preserving the content is not easy in light of the fact that they are highly software and hardware dependent.

6.2 Preserving the "Recordness" of E-mail Messages

For first-generation legacy E-mail systems, preserving the content of a message is not difficult, as it is based on plain ASCII text, which is designed specifically to be both hardware and software independent. However, for the multimedia records created by second-generation E-mail messaging systems, preserving content that may include moving images and sounds outside their originating environment is much more problematical.

This is also the case with the structure of electronic records produced by E-mail systems. Outside of the creating system, it is difficult to replicate the functionality to link items of correspondence with replies, forwarded materials, and enclosures. At another level, the relationships between the content and structural links within messages must also be

preserved. This is not an issue for first generation legacy E-mail messages because they are composed solely of ASCII text. Attachment files, however, may be compound documents consisting of formatted text, spreadsheets, graphics, etc. If these contain 'dynamic' links, then any changes made in one of the applications will affect output in the document. These links can only be maintained electronically. Printing out the record to paper or micrographics merely represents the state of the object at that precise moment.

In second-generation E-mail systems, messages themselves may be 'multimedia' documents, consisting of text, graphics, sound, or video. Furthermore, these objects may be linked or embedded (OLE) in 'dynamic' relationships to external software applications. In order to establish meaningful business transactions, these structural links must be managed and preserved electronically over time, presenting considerable challenges in terms of the software and hardware dependency of these systems.

In terms of contextual and provenancial information, most E-mail systems automatically date-stamp, as well as indicate ownership, of messages. In addition, an audit trail of E-mail communications can be created to show the message flow from sender to recipient(s), and subsequent uses.[9] Unfortunately, some of the contextual information captured by E-mail systems, such as when and where a message was posted, and to whom and with what instructions, is only carried in an 'envelope' when the message is posted outside the originating system.

In addition, because historically most E-mail systems have not functioned as corporate recordkeeping systems, the evidential information archivists normally derive from the way

in which organizations methodically collect, classify, and organize records is simply not available, as users were usually free to adopt any organizing scheme, or none at all.

This last point particularly illustrates the significance of corporate recordkeeping practices for retaining the context of records. Actually, the retention of all three elements — content, structure and context — are necessary for establishing the evidentiality of records, and for ensuring that they are complete and understandable, important goals of recordkeeping.

NARA's 1993 draft guidelines for government E-mail have been criticized precisely because they did not recognize that the retention of the content, structure and context of records are necessary for complete and understandable records.[10] Criticism was also levelled at NARA's revised 1995 guidelines for its failure to define any functional recordkeeping requirements for E-mail systems. According to this view, transferring E-mail records to a recordkeeping system without satisfying such requirements is not much better than simply leaving the records in the originating E-mail system.[11]

6.3 Recordkeeping Features and Recordkeeping Requirements

Recordkeeping requirements for the management of E-mail records are necessary for current and future implementations that possess the potential for corporate recordkeeping, but are not practicable to legacy E-mail systems which may have created records, but were not designed as corporate recordkeeping systems. This is not to suggest that the records from some of these systems lack some archival value, but that they require special consideration due to

acknowledged limitations concerning their creation and maintenance, discussed later in the section on preserving records from legacy E-mail systems.

The functional requirements proposed for recordkeeping by David Bearman and his colleagues at the University of Pittsburgh relate to a specific business application: archiving. As such, they presuppose that other business applications relating to the collection, classification, and organization of records, have been implemented as part of a corporate recordkeeping system.[12]

As we have seen throughout this thesis, various trends in E-mail messaging technology have potential significance for corporate recordkeeping purposes that archivists and records managers should examine. These include:

- Client/server database-centric messaging architectures with replication capability.
- Rules-Engines
- Automated Forms
- Version Control.
- Search Engines.

These components must be highly integrated to fashion a coherent and practicable corporate recordkeeping system for second generation E-mail messaging systems. In some cases, such as Novell's Groupwise, these components come already "bundled" as part of the messaging system. In others such as Lotus Notes, these components are available from third-party vendors as add-ons. The challenge posed by such complex electronic systems will be to manage the various components of the messaging architecture as they become affected by changes in hardware and software that take place over time.

And in terms of the functional requirements for archiving records, the hardware and software dependence of these systems have major implications for records creation, maintenance, and access.[13]

The new technologies with potential for corporate recordkeeping purposes discussed in this thesis, do not by themselves have the capability to satisfy the functional recordkeeping requirements identified by Bearman et al. Rather, Bearman argues that these may be satisfied by strategies that are either policy- or technology-based, and that the choice of "solutions" is based as much on organizational variables as on technological factors.[14]

Consequently, whatever the actual value of these E-mail technologies for corporate recordkeeping purposes, they must also be evaluated in terms of how they may further or impede the goal of satisfying the functional recordkeeping requirements for archiving. The degree to which these technologies may be proprietary, for example, constitute a major obstacle to the objective of the continuing maintenance and accessibility of E-mail records to users over succeeding software and hardware generations.

6.4 E-mail Records from Legacy Systems

Imposing recordkeeping requirements for the management of E-mail onto legacy E-mail systems is not practicable. Most legacy systems, whether host- or PC LAN- based , will soon be migrated to a second generation messaging architecture (client- or client/server- based), so the cost and effort of imposing these requirements on the superseded system cannot be justified to the organization.

To minimize disruption, a parallel strategy of migration usually occurs, so that for a time, both the legacy E-mail system and the new messaging system coexist until the former is completely phased out. Typically, this period of "coexistence" is not very long, because it is expensive to maintain and administer two systems. And, depending on the value the organization places on the information contained within the legacy system, only the most current messages will be migrated to the new system.[15]

The implication of this scenario for archivists is that the only likely source of records from these legacy systems — backup tapes — will not be maintained too much beyond the cutover to the new messaging system. It is therefore possible that archives might feel some pressure to accept custody of the backup tapes of legacy systems without having had sufficient time to consider the "recordness" of the messages contained therein.

As mentioned earlier, messages documenting a business transaction or activity produced by a legacy E-mail system, however "imperfect," possess qualities that make them records. Historically, the degree of *reliability* of these records must be questioned, due to the lack of corporate-wide procedures or mechanisms for their creation or for their subsequent collection, classification, or organization. Yet, in my opinion, it is a matter of degree, and so this consideration alone should not prevent archives from examining the records of legacy E-mail systems.

However, the question of the *authenticity* of the records of legacy E-mail systems is very important to this issue. Relevant concerns revolve around whether the organization took stringent measures to ensure record integrity by enforcing proper network security, data encryption, and digital signatures. It can be argued that network security procedures, such as

userids and passwords, are sufficient for E-mail systems used specifically for intraorganizational communications on dedicated lines. The adoption of data encryption and digital signatures are especially relevant for externally connected, interorganizational communications.

In addition, I would also argue that the *dependability* of data transmission is also relevant to the quality of the records of legacy E-mail systems. By this I mean measures taken by an organization to ensure that data could indeed be sent and received over the network, both internally, and externally, without risk of loss or transmission errors. Measures to ensure the dependability of data transmission include proper data management and administration and satisfactory data transmission through appropriate message handling systems. These issues were discussed in sections dealing with the evolution of messaging architectures and with E-mail network connectivity, respectively.

Certain conditions can act as "flags" to alert archivists about the quality of data security, administration, and transmission that affect the authenticity of E-mail records or the dependability of their transmission: PC LAN systems that have outgrown their limits; interconnection to external networks through an overly complex array of gateways, known breaches of network security, etc. Clearly, where there are doubts about the authenticity of records or the dependability of their transmission because of poor data administration, network management, message transmission, or security, then these records should not even be considered for examination.

If archivists can be relatively assured about the authenticity of E-mail records, then the concepts of content, structure, and context can provide a useful framework for determining

the degree of evidentiality of the records, or perhaps more accurately, their limitations. This is particularly important, considering that it is likely that the primary source of records from legacy E-mail systems will be from network backups.

It has been noted earlier that network backups are a complete "snapshot" of all data and programs residing in the network, including messages in message store, maintained for disaster recovery purposes. While this makes it unsuitable for ongoing recordkeeping purposes such as access and information retrieval, it can become an advantage for archival examination, since data relating to the content, structure, and context of E-mail records will presumably also be captured.

In order to avoid giving the wrong impression, it must be once again stressed that backups are not a surrogate for the proper electronic records management of E-mail systems. However, they are usually the means of last resort for obtaining records from legacy systems that were not designed for corporate recordkeeping.

My contention is that using advanced tools that are available today, some of the evidential information relating to the content, context and structure of the records produced in these systems can be identified from the data captured on backup tapes in a kind of analysis that I whimsically refer to as "high-tech diplomatics."

Elements of this kind of analysis are already familiar to the National Archives of Canada from their experience with the E-mail records of the TNO. I merely review the procedure and some of the problems encountered, and suggest some solutions. New technological developments, such as document viewers with advanced indexing and searching capabilities, are considered as part of the toolkit. Finally, using the backup cycles of NAC's own Banyan

Vines E-mail system as an example, I point out how some evidential information concerning the context and structure of the records can be identified, as well as problems arising from the choice of the backup cycle retained as the electronic archive.

6.5 Accessioning Procedures For Legacy Records: NAC'S TNO Experience

When NAC acquired the network backup tapes of the Canadian government's Trade Negotiations Office (TNO) in 1989, it copied the data — including not just the E-mail messages, but also all the software and program files on the network — onto "WORM" (Write Once Ready Many) cartridges. The copying process preserved the structure of the servers and sub-directories of the originating system as well as such system information as file dates and access rights, considered important for their evidential value of how the organization functioned and how staff used the records.[16]

At the completion of the initial copying, NAC had 18 WORM cartridges of 800 Mb capacity each. However, some problems were encountered during the copying process, and because the WORM cartridges were read only, errors could not be corrected.

Eventually the data was recopied onto a large capacity hard disk for data manipulation to substantially reduce the volume of files. Using file management utility software, the first cartridge was copied in its entirety, but then only new files or those that were changed or modified from the preceding backups were copied to the hard disk, eliminating those that had remained unchanged in users' directories for long periods of time.

Moreover, all program files that had been copied during system backups were subsequently removed by deleting files ending in .com, .exe and .arc during the copying

process, thus ensuring that NAC would not violate software copyright and licensing agreements. Consequently, the volume of files was reduced to 20 Mb. then copied back to WORM as a "working copy." Then NAC experimented with a number of software packages for automatically recognizing and printing the TNO files, as well as examined their searching capabilities.

Some of the problems that NAC encountered while processing the TNO records could now be avoided. In 1989, it was difficult for NAC to obtain a personal computer with the requisite high storage capacity hard drive, and so it was forced to copy the data directly to WORM cartridges. The result was that errors made during the copying process could not be corrected. Now, not only are personal computers with high storage capacity hard drives readily available and relatively inexpensive, there are also cheap portable high storage disk drives available, making it possible to begin with the file management process prior to copying the data onto WORM cartridges.

In addition to the E-mail records, TNO had also created a very large volume of word processing electronic records. Taken together, the appraisal of these records occupied two analysts for six months. At one man-year, the cost of this appraisal was estimated at $50,000 and reduced the total volume from 8 GB to 800 MB. David Bearman estimated that the cost of simply retaining all the data would have been $45.00, and would represent a continuing cost of $5.00 per annum at current prices. He also concluded that if NAC had chosen index enhancement as a tactic instead of reducing the volume, not only would the cost have been minimal ($500.00), but the time required for locating a document or conducting a search

string for specific words or phrases would be drastically improved (from 1 minute to 10 seconds for a document search, and from 10 minutes to 10 seconds for a word search).[17]

On the basis of this persuasive reasoning, it does seem to be counter-productive to attempt to "weed-out" the non-archival records from legacy E-mail systems. On another level, a valid argument could be made that all messages should be retained, simply because researchers, especially those interested in communications media and their impact on organizations, appear to be equally interested in both "official" and "personal" communications.[18]

6.6 Document Viewers and Legacy E-mail

One promising technology that can be exploited for dealing with messages and/or attachments from legacy E-mail systems are document viewers that create "universal" files that can be read by any user, regardless of what format or software was used to make the document — a capability of obvious benefit when dealing with the wide variety of E-mail systems and applications that could possibly be encountered. Examples of document viewers include Adobe Acrobat, Common Ground, Novell's Envoy, Folio's Views and Farallon Computing's Replica. E-mail messages, word processing, spreadsheet, graphics, or database files are converted into a special image format for document viewing, printing, or saving to file.[19] Note that viewers are not of much use with second-generation E-mail messages containing sound and/or video clips — an illustration of the challenges facing attempts to preserve these kinds of records outside of their originating environment.

Some useful features of document viewers include: the ability to "zoom" or magnify pages; to make "thumbnails" — miniature views of each page — which are useful both for viewing and navigating around a document; OLE support for embedding objects such as graphics, video or audio in the image file; navigational tools, allowing users to browse through a document a page at a time, or to jump from the beginning of a document to the end, or to move to a specific page.

One of the most important features of document viewers is their range of search capabilities. While most products perform limited searching on message text, Adobe Acrobat has a highly sophisticated search engine. Users can perform searches not only on the basis of message text, but also on envelope header fields, as well as document creation and modification dates. Searches can be made for word stems, and Acrobat also supports proximity searching. Acrobat can create an index (or "inverted word list") for a collection of documents for a full-text search on CD-ROM, or dynamically build an online index for all documents on a LAN file server.

One drawback of document viewers occurs when the original file is converted to the special image format. Depending on the complexity of the original file's structure, the image file can become much larger than the original file, especially with the viewer attached. This not only increases storage requirements, but may also significantly increase the amount of time needed to search for information, particularly when this involves a large number of image files.

This concern is especially relevant to complex E-mail messages containing rich text format fonts and compound documents consisting of embedded or linked spreadsheets,

databases, graphics or other application objects. If these messages were converted to an image file, the resulting volume would be enormous. And if there were a great deal of these kinds of messages in the E-mail system, then the access and retrieval times would be very slow indeed. Another major problem with these document viewers is that they cannot replicate records that do not have paper analogues, such as second-generation multimedia E-mail messages incorporating sound or video.

Where document viewers are most valuable is examining the records produced by legacy E-mail systems. Because messages in such systems are ASCII-based text, when converted to an image file, the size increase would not be too appreciable. Attachment files may be more complex, produced by word processing, spreadsheet, or database applications, and so will take up more volume when converted to an image file. However, in most E-mail systems, typically the number of messages with attached binary files is slight compared to the total number of messages.

A major critique of these kinds of free-text searching techniques is that they do not uncover all the relevant records related to a particular function, activity, or transaction, nor do they preserve the context of, or reason why, a record was created.[20] This is undoubtedly true. Yet when backup tapes are the only source of records from legacy E-mail systems, these types of tools are probably the best available at the current time. The U.S. Department of Defense, after completing a number of tests on Adobe Acrobat in 1995, was sufficiently impressed to endorse its use as a cost-efficient method for converting massive amounts of legacy documents to industry-standard digital formats. It plans to use Acrobat Capture to

convert approximately 20 million pages of technical manuals and orders currently maintained in legacy systems to the Adobe .PDF format over a two to three year period.[21]

6.7 The Evidential Value of Backup Tapes: Banyan Vines Network System Data

As mentioned previously, the function of network system backups is to provide a means for disaster recovery, not for ongoing recordkeeping or archiving purposes. Backups capture a "snapshot" of all programs and data residing in the system at a particular time, including system software, E-mail programs, applications and configuration files, etc.

Having said that, backup tapes were the source of electronic records from E-mail systems for both the National Archives of Canada's Trade Negotiation Office (TNO) accession, and the White House PROFS (Professional Office System) acquired by the U.S. National Archives and Records Administration. It is very likely that backup tapes will prove to be the only source of legacy E-mail records that document significant activities that are simply unavailable elsewhere. This was certainly the case with the E-mail records from the NAC's TNO system, as well as NARA's White House PROFS.

Consequently, should archives decide to acquire more E-mail records from legacy systems, it is necessary to be able to identify the system data captured on backup tapes that provide evidential information relating to context and structure. Thus, it is absolutely crucial to obtain network data administration documentation, such as manuals and guides, that fully explain the system data, file structures, and folder directories. File management utilities can be used to examine this system data, while document viewers are viable tools to analyse the actual content of E-mail messages.

Using NAC's Banyan VINES Network as an example, the E-mail system data typically captured on backup tapes consists of the Unix directory structure (user folders), as well as the physical message structure and message life cycle data (mail message files).

The Banyan VINES E-mail system uses the StreetTalk format for user names and addresses based on items, groups, and organization (Item@Group@Organization). The author's StreetTalk address is David Horky@GAD AGRB@NA-AN. Thus, the StreetTalk address reveals the division, branch, and organization to which the user belongs. This information makes locating the user's position from other sources, such as organization charts or divisional listings, much easier.

The operating system of the Banyan VINES E-mail system is Unix-based, so file and directory names are 14 characters. A unique directory is created for each user of the mail service. User folders map one-to-one to UNIX directories, so each folder is a subdirectory of the user directory. An examination of the directory structure therefore indicates the filing scheme (if any) employed by the user for E-mail messages.

The network system maintains a database called "ms.db" that contains entries for each user of the mail service on a specified server. This database could be retained to serve as a kind of finding aid to each user's directory (folder) name, as it indicates the association between the user's StreetTalk name and the UNIX directory name under which the user's various folders (subdirectories) are located.

The logical structure of an E-mail message consists of an envelope and body. The envelope data structure contains various fields entered by the user composing the mail message (To, Cc, Bcc, From, Subject, Date, Attach, Certify, Forwarded by) as well as several

internal fields (Message-Id, Message Size). Each of these fields can be the subject of sophisticated queries using the search engines of document viewers.

File management utilities can also be used to examine the life cycle information assigned by the system to each E-mail message. The E-mail system allocates a particular suffix to a message filename to identify its components, such as the envelope, message, and attachment(s). Suffixes also indicate its status — ie, whether messages were read, unread, or deleted — at the time of the backup. Consequently, it is possible to determine the status of the message quite easily.

The Banyan Vines E-mail message is comprised of one or more UNIX files. Each mail message is identified by a unique message ID (Combination of server serial number and current date and time, ex: C897+5TBjd.E). When a user sends a message, it consists of 2 separate physical files — the envelope (C897+5TBjd.E) and the message (C897+5TBjd.m). Each attachment is maintained in sequential order in a separate file (ex: #1 = C897+5TBjd0.a, #2 = C897+5TBjd1.a, etc.). One physical copy of each attachment file is maintained per server, and each recipient has a UNIX link pointing to the actual physical copy residing on each server.

When a recipient first receives a mail message, both the envelope and message text are contained in a single file (C897+5TBjda.E), and a linked filename with a suffix "u" for unread (C897+5TBjda.u) is also created. When the message is read, the filename with the suffix "u" is unlinked from the "E" file, and then the "E" file is expanded into 2 separate physical files with suffixes "E" (Envelope) and "m" (message), as in the sender's original file (C897+5TBjda.E, C897+5TBjda.m).

When a mail message is deleted, the various files, including attachments, are moved to the Wastebasket folder. When the "janitor" program runs the next time after the user deletes the mail message, the "E" suffix is removed and replaced with an "i" (C897+5TBjda.i), but the other files are immediately deleted. The next time the janitor runs, the "i" file is deleted.

Note that when E-mail messages are "deleted," they are not necessarily erased. In order to shed light on legal disputes, computer experts can use special programs to recover "deleted" messages as well as various drafts of documents from the daily file and system back-ups made by the main computer. In addition, many software programs are designed to make several copies of files, all tucked in different places, for system recovery purposes. These can also be exploited by consultants hired to find incriminating E-Mail messages for lawsuits against companies.[22]

The most famous example of deleted files being "recovered" occurred at the end of the Reagan era. When Oliver North and John Poindexter deleted most of their E-mail messages relating to the Iran-Contra scandal, they did not take into account that some of the weekly computer backup tapes were being set aside by systems staff pending the investigation. Consequently, by comparing backups previous to and following the deletion, it was possible to determine precisely which messages North and Poindexter had deleted.[23]

A clear understanding of the file structure and directories of E-mail systems captured on backups thus provides a level of contextual and evidential information about the status of E-mail messages captured during the backup cycle. In addition, an understanding of how the E-mail system performs certain actions on messages — such as ANSWER or FORWARD — is helpful to knowing how to identify linkages between messages.

For example, with the ANSWER function, the E-mail system automatically puts the sender's name in the "To:" field of the new message and then puts the respondent into the system's edit mode to write the reply. The system automatically assigns the same words used in the Subject field of the original to the Subject field of the reply, although this may be edited by the respondent. Therefore while not foolproof, most replies to a particularly interesting E-mail message might be identified by using a document viewer to search the Subject field of all E-mail envelopes at the time of the backup for the specific words used in the originating message.

The FORWARD function puts the user into the system's editor so that a comment can be attached to the message being forwarded and also brings up the To:, cc:, and Subject: fields as well. FORWARD results in the text of the original message being sent along with the comment by the new sender. Accordingly, a text-string search of the message could be conducted using a document viewer to determine what replies were made by various recipients when sent a circulating memo for general comment.

Thus, to a certain degree, contextual and evidential information concerning the records of legacy E-mail systems are captured by the backup cycle, and can be examined using such tools as document viewers and file management utilities. However, one consideration of using backup tapes as a source for legacy E-mail records relates to an important functional requirement of recordkeeping postulated by David Bearman, that records in an E-mail system must be *comprehensive*, meaning that all records produced by the system must be accounted for, a necessary condition for records to retain their value as evidence.[24] While not a perfect

comparison, a corollary of comprehensiveness in terms of E-mail backup tapes might involve the question of the intervals between backup cycles that have been preserved.

For example, the National Archives of Canada makes daily backups of its network system, but keeps only 12 monthly backup tapes for long-term retention. The volume of data on each backup tape is approximately 4 gigabytes, so it is easy to see why daily backups are not retained. However, the E-mail system data and messages captured by each backup represent a very small proportion of the total volume, most of which consist of program files, various network applications, etc. There has been no attempt by NAC to "hive off" the E-mail component of the network and keep a more comprehensive electronic archive.[25] If only a monthly "snapshot" is kept, is this sufficient to understand much of the flow of correspondence in the system, or are the gaps too huge to make it comprehensible? And how reliable does it make the "surviving" records if related messages (antecedent and/or subsequent) necessary for establishing their context were not "captured" as well?

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7.0 Conclusion

Although important, the identification of the issues associated with the preservation of *legacy* E-mail records is only one dimension of E-mail messaging technologies that archivists must consider. Viable procedures and tools are available to perform a kind of "high-tech" diplomatic analysis of the records of first generation E-mail systems. File management software can be employed to identify and transfer data from network backups crucial for preserving the contextual, provenancial, and evidential information generated by legacy E-mail systems, and "document viewers" can be used to examine the records themselves.

In addition, archivists must also seek to preserve over time the contextual, provenancial, and evidential information of records created by *current* and *future* implementations of E-mail messaging systems. Requirements for E-mail recordkeeping systems are needed to ensure that such attributes as the content, structure, and context of records are captured. In addition, the reliability and authenticity of the records produced in E-mail recordkeeping systems must be guaranteed.

But in order to provide direction and support to the users of E-mail messaging technology, archivists will need to be conversant with the major trends in systems development that hold out great promise for corporate recordkeeping and records management. This thesis has identified the following that bear more in-depth examination by archivists and records managers: i) client/server database-centric messaging architectures with replication capability; ii) rules-engines; iii) automated forms; iv) version control; and v) search engines.

Furthermore, archivists — long aware that communications technologies interact with organizational structures, processes, and culture in ways that influence records creation and recordkeeping — should look closely at E-mail messaging technologies such as work group and workflow applications that portend great changes in the way organizations operate, work, produce and make use of records.

Finally, in order to consider strategies about E-mail messaging technologies that further archival goals, archivists must understand the evolutionary development of this communications technology. As this thesis has hopefully demonstrated, E-mail systems must be understood as a suite of interdependent and interrelated component technologies consisting of computer hardware, systems and messaging applications software, network architecture, and communications, data transmission and message handling devices. All these components are continuously under development, and the consequent evolution of E-mail technologies has a profound effect on the records creation and recordkeeping capabilities of E-mail systems. An historical framework for E-mail technology evolution and systems development provides a useful means to understand the somewhat bewildering array and variety of E-mail systems based on quite distinct messaging architectures that produce markedly different types of records.

Adopting such an historical perspective on E-mail messaging technology evolution also accustoms archivists and the institutions they serve to be adaptable to changing organizational, technological, social, and economic conditions. It is also hoped that this thesis has helped to identify some of the next steps and areas requiring further study and research concerning E-mail messaging technologies.

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IMAGE EVALUATION
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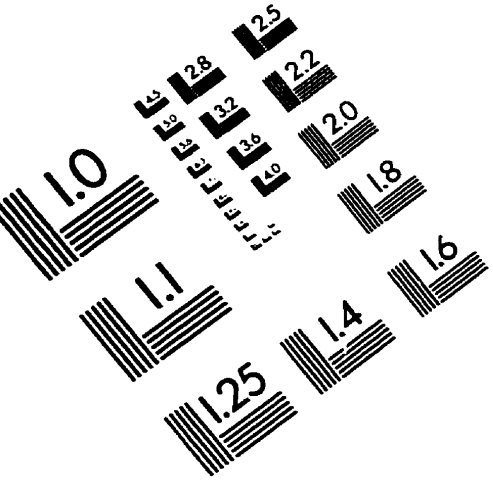

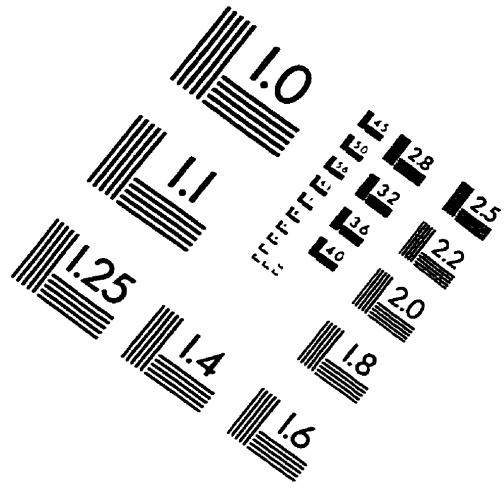

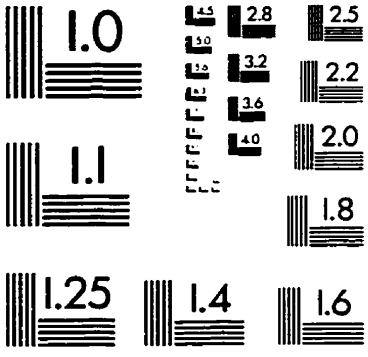

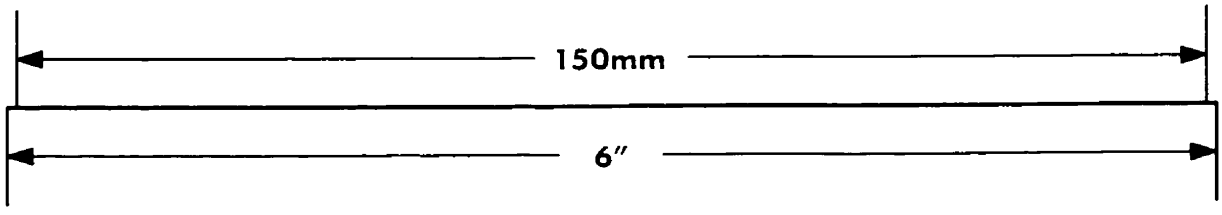

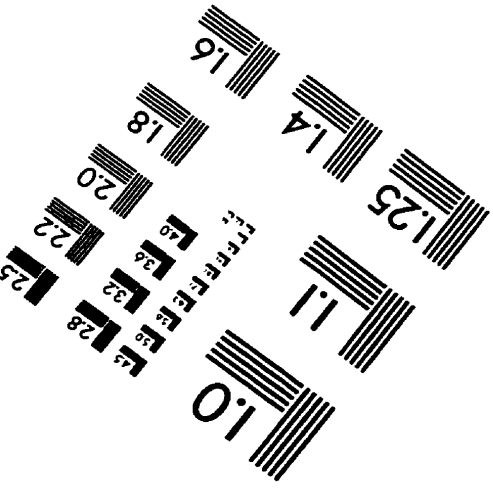

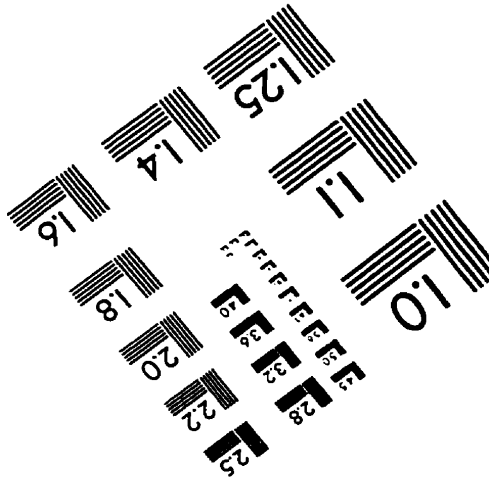

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