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Canada

Toward a Canadian Digital Information Strategy:

Mapping the Current Situation in Canada

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Executive Summary

1. Background

The information technology revolution over the past three decades has provided Canadians with tools that are transforming the way they interact with one another, carry out their day-to-day activities, secure goods and services, and learn about themselves and the world they live in. The de facto means by which these activities are being carried out and by which the information associated with these activities is being recorded is electronic. Canadian society has migrated to a digital world and on an increasing scale digital information is becoming the raw material that is fueling the Canadian experience.

The digital asset, like any other valuable asset, must be managed strategically. While individual organizations are developing their own strategic plans for the management of digital information, a national level strategy would be of considerable benefit. In line with its mandate to preserve the country's documentary heritage and to support those involved in preserving it and making it available, Library and Archives Canada (LAC) has assumed a lead role in establishing the groundwork for the development of a national strategy. In undertaking this role, LAC recognizes that a collaborative approach involving key Canadian organizations responsible for the management of digital information is required. It also recognizes that it is important to have a clear understanding of the digital information landscape, both in Canada and abroad, as well as the issues and potential opportunities that need to be addressed through such a strategy.

Based on this recognition, a study was commissioned by LAC to map the digital information landscape across the country and to identify key issues that should be addressed by a national strategy. The findings will be used to support a range of thematic discussions among stakeholders and a planned national summit on digital information to be held in the Fall 2006.

2. Objectives

The major objective of the study was to identify and describe **key** organizations that are:

- Involved in the management of digital information (planning, organizing, controlling the resources required for the creation/capture, organization, description, access/retrieval/use, and preservation of digital information);
- Involved in providing a service role (e.g. funding) or other kinds of support to digital information initiatives; and/or,

- Involved in building the components of the infrastructure (i.e. the combination of policies, standards and practices, systems and technologies, and people) required to manage digital information;
- Expected to play a role in or contribute to the development of a Canadian Digital Information Strategy.

The criteria that were used to determine if an organization was **'key'** were as follows:

- The degree of cultural/knowledge relevance of either the digital information being managed by the organization, or the component of the infrastructure supporting the management of digital information, or the nature and significance of the services or role supported by the organization.
- The perceived long-term value of the digital information being managed.
- The scope and potential impact of the initiative or organization.
- The extent to which the initiative or organization fell within the scope of the role of the LAC.

3. Methodology

The information was gathered from existing surveys and inventories, internet searches, and contacts with relevant organizations and experts in the field. Considerable reliance was placed on the personal knowledge of the two consultants commissioned to undertake the study. Their combined knowledge of records management, librarianship, archives, and government information management coupled with the research undertaken in support of the study shaped the scope and depth of the final result. The survey was not intended to be a comprehensive or authoritative source of information on all digital information initiatives and organizations across the country. Rather, the aim was to provide a general description of the digital landscape in Canada and identify the information required to support decisions on the objectives and scope of a National Summit on Digital Information in Canada. As a result, no external validation of the information gathered was conducted.

4. Findings

The survey identified key initiatives and organizations involved in the management of digital information. These were used to provide general descriptions of the various sectors, which have been organized and described according to the categories listed below (content managers, service providers, infrastructure, leadership):

4.1 Content Managers: initiatives/organizations responsible for the management of digital content, in particular, its creation, collection, access, and preservation. These were the primary focus of the survey. The content managers are organized according to sector (government, private, cultural, education and other) and types of content (ie. websites, monographs, data, etc.)

Government Sector

- Data in application systems

- Office documents and records
- Government publishing and communications
- Government libraries
- Government archives

Private Industry

- Databases
- Office documents and records
- Private archives

Cultural Sector

- Museum Content
- Monographs
- Newspapers
- Magazines
- Audio/Visual and Other Multimedia

Education Sector

- Learning Objects
- Academic Journals
- Statistical and Research Data
- Geographic Information

Other

- Websites
- Personal Digital Collections

4.2 Service Providers: initiatives/organizations that offer a service related to digital content, but do not own the rights to manage or distribute content.

Aggregators and Portals
Registries
Digital Hosting
Digitization
Digital Rights Management
Metadata Services
Preservation
Search and Retrieval
Metadata Harvesting

4.3 Infrastructure: initiatives/organizations that focus on the development of all or selected components of the infrastructure (laws and policies, standards and practices, education and training and human development, and technological infrastructure) that enable the management of digital content.

Laws and Policies
Standards and Practices
Education, Training and Human Development
Technology Infrastructure

4.4 Leadership: initiatives/organizations that are involved in providing funding, coordination, and strategic planning or development planning for digital content and/or services and/or infrastructure.

Funding Role
Coordinating Role
Strategic Planning Role

5. Trends and Issues

The survey identified a number of major trends and issues in the creation, access, and preservation of digital information in Canada as well as the design, development and implementation/maintenance of the infrastructure required to enable these activities. A summary of the trends and issues identified are as follows:

5.1 Digital Information Activities

- Digital information, in its many forms, has become a major and important asset to Canada and Canadians and its significance is growing dramatically.
- The stewardship of digital information produced in Canada is disparate and uncoordinated, the sharing of experiences is rare, and expertise in managing digital information is scattered.

5.1.1 Creation of and Access to Digital Content

- The volume, diversity and complexity of digital information is growing exponentially.
- The technologies, standards and practices that will better ensure the ongoing accessibility and integrity of digital information are not yet consistently applied.

5.1.2 Preservation of Digital Content

- No specific digital content type is being preserved in a comprehensive way.
- There is a growing sense of urgency with respect to the preservation of digital information.
- Regardless of the sector, no organization is in a position to claim that it has solved the digital preservation problem.
- Issues from preserving digital records in complex unstructured office environments to dealing with related legal issues have yet to be addressed.

5.2 Digital Information Infrastructure

5.2.1 Laws and policies

- Laws and policies are beginning to catch up to the requirements of the digital environment.

- The attributes of authenticity for digital information objects subject to a given law or policy have yet to be established.
- Few organizations have implemented effective policies for the long-term preservation of their digital information objects.

5.2.2 Standards and best practices

- Some Canadian organizations have published standards or best practices for the management of sector specific content.
- The level of application of standards and practices varies across Canada.
- Metadata interoperability across sectors is rare.

5.2.3 Human resource capacity

- Human resource capacity, especially in the area of digital preservation is lacking and there is a general lack of training and awareness.

5.2.4 Leadership and governance

- Inter-jurisdictional partnerships are growing, through pan-Canadian, international initiatives, and cross-sector initiatives such as InterPARES.
- In many organizations, the roles and responsibilities for the management of digital information (especially the collection and preservation of digital content) have yet to be defined and accountability is unclear, poorly assigned or non-existent.
- Many inter-disciplinary and enterprise-wide initiatives suffer from a lack of leadership and an absence of effective governance and management frameworks.

6. Conclusions and Next Steps

The most pressing issue facing Canadian organizations with respect to the management of digital information is their ability to preserve the authenticity, accessibility, and understandability of their digital assets over time. While the study accepts that there are challenges surrounding the creation of and access to digital information, it found that these challenges are generally being addressed. On the other hand, the challenges of ensuring the long-term availability and integrity of the growing body of digital information have yet to be addressed in any significant manner. All organizations, regardless of sector, are facing these challenges.

Furthermore, the management of digital information requires an inter-disciplinary approach that draws on the strengths of disciplines such as records management, library science, data management, etc. As organizations move towards greater information sharing and collaboration, there will be an increased need to develop enterprise-wide, cross-sector, interoperable metadata, architectures, and standards. Clearly, the issues are national in scope, and a national strategy involving all concerned groups and organizations is warranted.

However, in establishing such a strategy, a mechanism will be required to ensure the collaboration and commitment of all relevant organizations and stakeholders. As such, it is proposed that the appropriate mechanism for developing a national strategy be in the form of a national summit. Recommended steps for planning and organizing the summit as well as suggestions for possible topics to be addressed at the summit are described in the report. The summit and the collaboration and inter-disciplinary work that are expected as a result will set the course for the development of a national digital information strategy that is comprehensive, inclusive and dedicated to enabling the on-going availability of Canada's documentary heritage in digital form.

1. Introduction

On an increasing scale, digital information is becoming the raw material that is fueling the Canadian experience. The digital environment has become central to nearly everything Canadians do in their day-to-day lives, from communicating with one another, to engaging in commercial or government transactions, to delivering cultural content. Information in digital form is being created, captured, organized, described, accessed, retrieved, used, and preserved in a wide range of contexts. As the digital universe expands, there is a growing imperative that it is managed strategically.

A Canadian Digital Information Strategy is envisioned to help Canada maximize the value of its digital information assets and ensure that such assets are created, preserved and accessible through time. Library and Archives Canada (LAC) is well positioned to assume a leadership role in facilitating the development of such a strategy. The agency has the legislative mandate, "to preserve for future generations the documentary heritage… (and) to provide professional, technical and financial support to those involved in the preservation and promotion of the documentary heritage and in providing access to it" (Section 8(1).i).

LAC recognizes that if such a strategy is to be effective, then a collaborative approach including key organizations involved in the management of digital information is required. As well, it is important to have a clear understanding of the digital information landscape, both in Canada and abroad, along with the issues and opportunities that could be addressed through such a strategy.

In carrying out this leadership role, Library and Archives Canada has launched an initiative with the following steps:

- Review digital information strategies of other countries.
- **Undertake a 'mapping' of digital information initiatives and organizations across Canada** (the focus of this project).
- Organize a small initial working meeting of a few potential partners who could contribute to shaping and scoping the development of a Canadian Digital Information Strategy.
- Prepare a discussion paper on the scope and objectives of a national digital information strategy.
- Organize consultative workshops
- Hold an invitational summit.
- Develop a digital information strategy and action plan in collaboration with partners.
- Seek/contribute resources to achieve this work.

With the completion of the review of digital information strategies in other countries, attention has turned to the 'mapping' of digital information initiatives and organizations in Canada. This report presents the results of a survey that was undertaken to map the digital information landscape across the country.

2. Objectives and Methodology

The objective of the survey was to identify and describe key organizations that were:

- Involved in the management of digital information (planning, organizing, controlling the resources required for the creation/capture, organization, description, access/retrieval/use, and preservation of digital information);
- Involved in building the components of the infrastructure (i.e. the combination of policies, standards and practices, systems and technologies, and people) required to manage digital information;
- Involved in providing a service role (e.g. funding) or other kinds of support to digital information initiatives; and/or,
- Expected to play a role in or contribute to the development of a national digital information strategy.

The survey was based on four key steps:

1. Defining the scope and parameters of the survey to identify which organizations and initiatives would be included and which would be excluded from the survey.
2. Identifying the information about each organization and initiative that would be acquired and defining the structure and schema of the database that would be used to manage and analyze the captured information.
3. Gathering the required information.
4. Analyzing the results and preparing the final report.

The following sub-sections describe each of these steps in greater detail:

2.1 Defining the scope

In the electronic age, where nearly every activity performed by society is in digital form, setting boundaries around what would be included (or not!) in this type of survey was a major challenge. After careful consideration, it was determined that, in line with the stated objectives for the project, the survey would focus on '**key organizations**' involved in some aspect of digital information with a priority placed on those organizations who's digital information activities or roles were in some way related to the mandate of Library and Archives Canada: "to provide professional, technical and financial support to those involved in the preservation and promotion of the documentary heritage and in providing access to it" (Section 8(1).i). The criteria that were used to determine if an organization was **'key'** were as follows:

- The degree of cultural/knowledge relevance of either the digital information being managed by the organization, or the component of the infrastructure supporting the management of digital information, or the nature and significance of the services or role supported by the organization.
- The perceived long-term value of the digital information being managed.

- The scope and potential impact of the initiative or organization.
- The extent to which the initiative or organization fell within the scope of the role of the LAC.

The organizations included in the survey range from the public, academic and private sectors.

2.2 Categories of digital information initiatives and organizations

The survey targeted initiatives involved in the management of digital information, components of the digital infrastructure, services provided, and leadership roles. Four categories of organizations/initiatives were identified: content managers, service providers, infrastructure initiatives, and leadership organizations.

Content Managers
This category represents those that are responsible for the management of digital content, in particular, its creation, collection, access, and preservation. These types of organizations were the top priority for this project and were the primary focus of the survey.

Service Providers
This category comprises those that offer a service related to digital content, but do not own the rights to manage or distribute content. These include, but are not restricted to services such as digitization, hosting, aggregation, metadata creation, search and retrieval, and licensing.

Infrastructure Initiatives
This category comprises those focused on the development of all or selected components of the **infrastructure** that enables the management of digital content. The infrastructure is not considered to be just technical, but was defined broadly to encompass a combination of laws and policies, standards and practices, education and training and human development, and technological infrastructure.

Leadership Organizations
This category comprises those that are involved in providing funding, coordination, and strategic planning or development planning for digital content and/or services and/or infrastructure. These organizations may not be directly involved with the management of content, services, or infrastructure, but provide some level of strategic vision, coordination or funding with respect to digital information.

The categories presented here are not mutually exclusive and a number of organizations fall into more than one category.

In addition to identifying key initiatives and organizations, the survey also aimed to understand the extent to which these initiatives and organizations address three specific information activities in the digital environment. These activities were defined as follows:

- **create** (a 'handle' for the things individuals and organizations do to **manifest** digital information - generate, create, produce, publish, etc.),
- **access** (a 'handle' for the things individuals and organizations do **with** information - access, retrieve, exchange, disseminate, analyze, share, transfer, etc.), and
- **preserve** (a 'handle' for the things individuals and organizations do **to** information to ensure that it is authentic, available, understandable and usable for as long as required - describe, acquire, retain, protect, store, migrate (to account for technology obsolescence), secure, etc.).

In order to facilitate the mapping of the digital environment in Canada, each initiative/organization was categorized according to the type of information activity they performed or facilitated.

Microsoft's Access software was used to create a database to capture the information gathered as a result of the survey. The database was designed to serve as both a source of reference of the key digital information initiatives and organizations across the country, as well as the basis for an analysis of the digital information environment in Canada. As much as possible, a controlled vocabulary was used to better and more consistently map the digital information environment in Canada. The following areas of information were identified: sector; information activity; type of initiative; type of digital content; current status of project; content jurisdiction; geographic location. For each organization or initiative recorded, nine basic information fields were collected. These fields were the same for each of the four categories of initiatives, with the exception of the 'type' and 'description' fields. The database fields for each category of initiative/organization are described in Appendix A.

2.3 Information gathering

The information was gathered in accordance with the criteria described in section 2.1 using the following methods:

- Existing surveys and inventories of digital information initiatives and organizations were consulted.
- Extensive searches of the web were undertaken beginning with the more obvious 'target' sites.
- Contacts were made with those organizations (or grouping, sectors, etc.) that would be expected to have an ongoing interest in monitoring digital information initiatives and organizations in Canada.
- Contacts were made with various officials (as required) to obtain additional information not readily available through available documentation or the relevant web sites.

Considerable reliance was placed on the personal knowledge of the two consultants commissioned to undertake the survey. Their combined knowledge of records management, librarianship, archives, and government information management coupled with the research undertaken in support of the survey shaped the scope and depth of the final result. The survey was not intended to be a comprehensive or authoritative source of information on all digital information initiatives and organizations across the country. Rather, the information gathering exercise and the analysis of the results were directed to providing the information required to support decisions on the objectives and scope of a National Summit on Digital Information in Canada. No extra effort was made to validate the information obtained through public sources (i.e. it was based on available information drawn from web sites, documents, and contacts with various individuals).

2.4 Analysis of the results and preparation of the report

One of the key objectives of the survey was to identify those organizations that were "expected to play a role in or contribute to the development of a national digital information strategy". The objectives, scope and development of the strategy will be based on the outcomes of consultative workshops and presented as a draft strategy at the National Summit which itself is to be designed by the members of a small planning group organized for that purpose. As such, the report aims to enable the identification of a cross-section of key players who could serve on the planning group and as potential candidates for the summit. Collectively, and based on their representation of a broad, yet core range of societal interests, it was expected that they would be in an excellent position to advise on a methodology for the development of a national digital information strategy that would be inclusive and comprehensive. Nevertheless, although the survey was designed to ensure the broad coverage of the digital information environment in Canada and represent a spectrum of digital information activity, it was recognized that not every aspect of the digital environment in Canada could be represented at a summit. As such, the survey focused on those initiatives/organizations defined as ***key*** in Section 2.1.

In order to facilitate understanding of the digital information environment, the information gathered as a result of the survey was collated into sector descriptions organized according to type of content, type of service, type of infrastructure, and type of leadership organization.

The following section, Chapter 3, presents these sector descriptions. Each sector description identifies key initiatives that are described in greater detail in the database. Chapter 4 describes the patterns, themes, inter-relationships, and gaps that were identified in the survey and that may be addressed at a Digital Information Summit and through the Canadian Digital Information Strategy. The final chapter offers some concluding remarks and suggestions concerning the immediate next steps that should be taken in the development of a National Digital Summit. Two appendices contain the list of titles of the digital information initiatives contained in the database, and the design specifications of the database itself.

For more information about the results of this study as well as access to the data in the survey database please contact:

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3. Canada's Digital Information Initiatives

This chapter describes the findings of the survey of digital information initiatives. It is based on reviews of existing sources, searches of the web, consultation with key contacts and the personal knowledge of the two consultants responsible for undertaking the survey. The results have been summarized according to sector and type of organization: The first section provides a descriptive account of the digital environment for a number of different content types. The second section covers service providers and the third addresses those organizations that are a responsible for the underlying infrastructure. The fourth section presents an overview of those organizations that are responsible for providing some form of leadership in the area of digital information across the country. The sections are not mutually exclusive and in many cases, initiatives/organizations fall within the scope of one or more sections. Each section description offers examples of the key digital initiatives/organizations. Not all initiatives are included in the descriptions. A complete list of initiatives identified through the survey can be found in Appendix A.

3.1 Content Managers

The first category of initiatives/organizations represents those that are responsible for the management of digital content, in particular, its creation, collection, access, and preservation. This section is organized according to sector (government, cultural, education, and other) and content type. These types of organizations were the top priority for this project and were the primary focus of the survey.

3.1.1 The Government Sector (federal, provincial/territorial, municipal)

3.1.1.1 Data in application systems

For the purposes of this survey, an application system is a collection of related transactions (i.e. a business process) supported by computer technologies and people that are designed to support one or more specified business activities. Their design, development, implementation and maintenance are normally based on generally accepted systems development methodologies applied to highly structured and precisely defined process steps, the integrity of which is based on the assignment of accountability (including accountability for the integrity of the data in the databases that underpin the systems).

The databases supported by application systems managed in all three levels of government contain a range of information types. These types are generally in line with the nature of the programs and services each jurisdiction is required to deliver. For instance, at the **federal level** databases can be found supporting applications such as:

- Veterans Registration Database
- Civil Aviation Registration System
- Canadian Criminal Records System
- Benefit delivery

- Licensing
- Grants and contributions
- Law enforcement
- Taxation
- Unemployment insurance
- Old Age security
- Passport On-line
- Strategis
- Life Sciences Gateway
- Global Case Management System
- Business incorporation
- National Land & Water Information System
- Land Status Automated System
- Marine Environment Data Service

At the **provincial/territorial** level the databases and their digital content are aligned according to the mandates of the individual ministries and of the government as a whole. Major databases can be found in applications supporting programs such as the following:

- The management of health care
- The provision of education support
- The licensing of various industry sectors (e.g. transportation)
- The management of buildings and lands
- The monitoring of the environment

Similarly, at **the municipal level** databases are in place to support application systems such as the following:

- Buildings and Lands Management
- Licensing and inspection
- Property taxation
- Community programs registration
- By-law administration including the payment of tickets

Among the key drivers behind the design of government application systems and databases are the migration to on-line government, the enhancement of services to citizens, and public service modernization. All of these drivers are causing governments to explore how the information normally used to support program specific business lines can be harnessed to support new horizontal requirements that stretch across individual programs. Examples of these requirements are as follows:

- The desire by citizens to search across government databases in order to respond to complex research and other enquiries.
- The requirement by senior government managers for 24/7 management reports supporting planning and reporting across multiple business lines.

- The need to consolidate government functions (e.g. administrative functions such as personnel, etc.) into single entities supporting multiple organizations.
- The requirement by auditors and others for management data to support modern comptrollership and cross program audits and reviews.

Increasingly all three levels of government are entering into inter-jurisdictional partnerships either among themselves and/or with the private sector and the academic sector. These new inter-jurisdictional arrangements are having a profound impact on the nature of the applications and the kinds of digital information they contain. Examples include:

- The Integrated Justice System
- The Canadian Health Information Network
- The Air and Sea Rescue Network
- The Canada Centre for Remote Sensing
- The GeoConnections

In addition to partnering with themselves governments at all three levels are partnering with other governments at the international level. Systems associated with the security of the country, including customs administration systems, and FINTRAC (financial tracking application responsible for supporting the control of money laundering and terrorism financing) are examples of applications supporting inter-jurisdictional cooperation.

3.1.1.2 Office Documents and Records

Unlike the applications systems environment, the 'office documents and records' environment is an environment where business processes and workflow are not clearly defined, the user has relative autonomy over what information is created, sent and stored, and accountability for the management of information is unclear. This is an environment dominated by e-mail and other electronic and paper-based documents that are generated without the benefit of structured work processes or rules of the road. Typically it is a user-driven world where the user has autonomy concerning what is created, how it is transmitted and how it is stored and otherwise managed. The absence of workflow within which information (often in the form of records/documents) could otherwise be placed in a context is presenting a substantial challenge to organizations at all three levels of government.

The types of activities that generate digital information in government offices include (among others) the following:

- The development of policies and related documents that confirm government direction.
- The preparation of briefing notes and other related documents that advise senior officials on topics of tactical and strategic importance and that provide the foundation for decision-making.
- The preparation of reports on a wide range of topics pertaining to the delivery of government programs and services. These can range from complex statistical

reports and reports involving wide ranging and complex consultation processes to reports describing the results of monitoring and assessment activities.
- The communication of ideas, requests for information, etc. Electronic mail is the vehicle of choice for communicating and sharing information. From its origins in passing along ephemeral information and requests to its central role in government decision-making it has become a powerful tool in a world that demands 24/7 time and location independent decision support.

The nature of office documents and records in digital form is increasing in complexity. From the basic text memo and simple two to three line email message the types of documents and records generated in this environment reflect a host of complex forms including the following:

- Compound documents reflecting embedded graphics or updatable spreadsheets
- Email messages with attachments recorded in multiple formats.
- Video and other multi-media.
- Logos and moving images embedded within the message format.
- Documents with hyper-links to other documents.
- Documents recorded in proprietary formats and/or formats that have been discontinued.

In this highly unstructured and autonomous environment documents and records are typically held in shared drives or in the hard drives of desk top computers. As mobile and wireless computing and communication (best characterized by the 'Blackberry') take hold and the virtual office becomes a reality, digital documents and records can be found in a host of locations including the handhelds belonging to office staff.

In the past office documents and records in digital form were seen as intermediaries to a paper output (i.e. the 'record'). Today most organizations recognize that the records of their actions and decisions are in the form of email and other electronic documents. The growing understanding of the shift in record keeping from paper to electronic has been accelerated by high profile events where the electronic rather than the paper-based record has been the focus of attention. Examples are as follows:

- The Blood Enquiry in which electronic records that might otherwise have been pertinent to the case involving the tainting of the Canadian blood supply with HIV/Aids were destroyed under questionable circumstances.
- The Somalia case in which electronic communications were altered in order to distort the reality of a military action carried out by Canadian forces in Somalia.
- The Gomery Commission, the report of which is stimulating renewed interest in the role of records in supporting government accountability.
- The promulgation of the US Sarbanes-Oxley law which has had a spill-over effect in Canada and caused heightened interest and concern in the way in which electronic mail and other related documents are managed.

3.1.1.3 Government Publishing and Communications

From communications activities producing facts sheets and brochures to the drafting, formatting and production of government publications, the processes for developing these materials has shifted dramatically from a paper to a digital environment. The production of hardcopy reports, brochures and other published material is giving way to electronic publishing. And central to this shift has been the Internet and the use of web-based technologies and techniques.

Web sites are becoming the location of choice for the posting of information that needs to be broadcast widely. Although all levels of government support communications functions, the nature of the content published on the web varies according to the mandate and the functions of the government. Typically, there are two avenues for government digital publications. The first is the Internet in the case of information to be made available to the public and the second is the intranet for information that is of specific interest to government employees.

The kinds of digital information typically generated in communications functions supported in all three levels of government are as follows:

- Brochures announcing or describing government programs and services.
- Guides, procedures and forms for securing government services.
- Reports, fact sheets and other vehicles for communicating information of relevance to specific groups, communities, etc.
- Announcements of new government decisions, policies, etc.
- Information on recent and upcoming events.
- Information on where to get additional information (i.e. directories, catalogues, contact lists, links to other sites, etc.).

The production of digital content destined for publication on the web is based on the use of content development tools and techniques employed by specialists trained in web content design and development. Increasingly web sites are no longer being seen as merely publishing vehicles as their use evolves to support on-line government initiatives involving on-line transaction processing, etc.

The Depository Services Program (DSP), which supplies Canadian federal government publications to a network of more than 790 libraries in Canada and to another 147 institutions around the world holding collections of government publications, is now administering digital publications. These depositories must make their DSP collections available to all Canadians and for interlibrary loans. In the case of digital publications, the DSP libraries do not collect the electronic editions, but rather are provided access to these publications in the electronic library maintained by the Depository Services Program

3.1.1.4 Government Libraries

Government libraries are no longer viewing their world from a ‘bricks and mortar’ perspective. The concept of the virtual library, in which internet-based services are provided to users on a 24/7 basis regardless of their location, is becoming a reality. In the

Canadian federal government, the Foreign Affairs department is pursuing this concept as it seeks to enhance the services it provides to foreign service officers overseas. Other departments and agencies such as the Canadian International Development Agency are collaborating in this initiative and the Treasury Board Secretariat is examining its implications for other parts of government.

Libraries are in place in departments, agencies, and ministries at all levels of government. While their role is to support the information requirements of their parent organizations and to serve as a repository of the published materials generated by their parent organizations, the virtual library concept is opening the door to reviews of the extent to which library services can be consolidated and centralized. Inter-jurisdiction cooperation, again using the Internet and the opportunities provided through digital publications, is on the increase. Today the typical government library acquires and makes available hardcopy publications but it also acquires and makes available digital publications, provides advisory services to users who are increasingly being offered on-line self service facilities, arranges for the licensing of on-line products and services, and undertakes increasingly sophisticated search and retrieval services for information that is normally in digital form. In some cases, the recognition that libraries are capable of managing multiple types of important digital objects has led to their role being expanded to include the acquisition of multimedia files and statistical data. The types of digital information normally found in government libraries are as follows:

- Government reports and other published material generated either within their own parent organization or by other governmental organizations.
- Published information pertinent to the roles and responsibilities and overall mandate of the parent organization.
- Semi-published or grey literature (e.g. research reports with limited distribution).
- Directories and catalogues dsigned to facilitate access to information, information sources, expertise, etc.
- Relevant multi-media publications such as films, video, voice recordings, etc.
- Other published materials containing content relevant to activities of the organization and, in some cases to the wider community supported by the organization (e.g. Canadian Agricultural Library).

3.1.1.5 Government Archives

Archives are recognizing the significance of electronic records and documents and the role they play in contributing to the documentary heritage of the nation, the province/territory and the municipality. Increasingly archives, together with concerned organizations in their respective governments are joining forces to address the issue of how to manage the valuable electronic records that are documenting the programs and activities of their respective governments.

At the federal level Library and Archives Canada (LAC) serves as the archives for the records of the Government of Canada and the repository for copies of government publications that document the published history of the country. It has been actively

involved in addressing the issues associated with the acquisition, preservation and ongoing accessibility of the digital information of archival value that forms the documentary heritage of the country. In partnership with the Treasury Board Secretariat and Public Works and Government Services, it has also been responsible for facilitating the management of government information (including information in digital form) generated in federal government departments and agencies. While the LAC has been lauded for taking the lead in these areas its impact has yet to be felt to the extent required to address the enormous challenges being faced in individual departments and agencies where growing volumes of increasingly unorganized digital information are hindering government decision-making and operations.

Archives at the provincial level are in the process of gaining experience in appraising and acquiring electronic records of archival value. For the most part the experience remains at the level of testing and understanding the issues rather than implementing comprehensive electronic records program. In many respects they are no different from most other archives in developed countries around the world. Most keep in touch with developments underway in the large national archives in Canada and abroad (e.g. innovative approaches such as macro-appraisal and the establishment of transfer agreements and disposition authorities, standards and guides such as exchange format standards, etc.). Many of those involved in electronic records also keep in touch with one another through various means including the Internet, conferences, research projects such as InterPARES and through forums such as the Electronic Records Section of the Association of Canadian Archivists.

From another perspective, most archives at the federal, provincial and local levels are involved in facilitating the management of electronic records in government departments, agencies, and ministries. Based on the assumption that archival interests can best be reflected at the front end of the systems and information life cycle, many are working with central and lead agencies in their respective governments to establish policies, develop guidelines and otherwise build capacity for the effective management of electronic records especially in the modern office environment. They are also helping to strengthen the communities of information management practitioners who are responsible for advancing the more effective management of digital information across their governments. For instance, at the level of the federal government, LAC has been a lead supporter of government-wide forums such as the IM Forum and the Council on Federal Libraries. Again, however, when seen in light of the scope and depth of the issues being faced by creating departments and agencies much work remains to be done to elevate the role of archives to a level where its efforts are having the desired impact. In the area of preservation, for instance, there are few examples where substantial connections have been established between the interest of an archives in digital preservation and the concerns of ministries, departments and agencies in the management of valuable digital information over the long term. The Government of Alberta's initiative to develop a digital preservation strategy based on collaboration among several concerned ministries including the provincial archives is a rare example.

In terms of the types of digital information as well as the content being acquired by archives across the country, most resides in Library and Archives Canada. However,

several specific collections also reside in some provincial archives. The kinds of digital information acquired by archives varies considerable in comparison to what was acquired in the 1970's when the focus was on historically significant statistical data files. Examples of the content acquired by archives are as follows:

- Statistical datasets containing the results of significant surveys, research projects, commissions, etc.
- Office documents generated in government office networks and reflecting significant government decision-making processes.
- Geo-spatial data such as the Canada Land Inventory within the Canadian Geographic Information System.
- Data in highly structured government application systems such as the Indian registration system originally managed by the Department of Indian and Northern Affairs.
- Web sites supporting programs of high historical interest such as the web site supporting the Office of the Prime Minister during the term of office of Jean Chretien.

3.1.2 Private Industry

3.1.2.1 Databases

Large volumes of case information are managed by a wide spectrum of private sector interests, ranging from banks, to insurance companies, to the retail sector, to the manufacturing industry, to the transportation industry, to a host of other Canadian 'industries'. Sensitivity to the management of digital information assets is directly in line with the degree of significance of the assets to the business of the organization. There are four perspectives.

The first perspective is the requirement of an organization to deliver goods and services in fulfillment of a financial arrangement or agreement. Digital information is critical to everything from the basic transaction involved in purchasing a good or service to the tracking of goods and services (e.g. overnight express packages) to the management of the customer relationships associated with the goods and services. The significance of digital information has been manifest as a result of the work underway in the 1990's to foster electronic commerce. The migration to electronic rather than paper-based transactions in commercial activities has led to an exponential growth in the appreciation of the value of digital information in support of Canadian business.

The second is the perspective of accountability or, in other words, the ability to produce records as evidence in a court of law or in response to a client request such as that which might be directed to a bank. The Personal Information Protection and Electronic Documents Act (PIPEDA) is an example of a law where commercial organizations are required to manage and protect personal information in digital form and to be able to account for their management practices to the public. The results of the work underway to develop standards for what constitutes an electronic record under the Electronic Documents Act and how it can serve as evidence (based on the conditions under which it

is managed) will magnify the importance of digital information under the law and in the eyes of those in Canadian business who recognize their obligations under the law.

The third perspective is based on the management of data necessary for achieving a competitive advantage. Increasingly Canadian businesses are establishing mechanisms for drawing data from multiple sources, analyzing data and packaging it in a time-sensitive manner and format that facilitates rapid decision-making. The 'knowledge bases' of digital information coupled with the knowledge and experiences of staff are fostering knowledge management environments that are helping organizations to stay ahead of their competitors.

A fourth perspective that is beginning to emerge is where digital information becomes critical as private sector organizations partner with one another. Partnerships are based on trust and trust is based on openness. Openness is based on the ability of an organization involved in the partnership to be able to demonstrate that their recorded information (much of which will likely be in digital form), is authentic, complete, accurate and reliable. While the need for effective data management is being recognized private sector organizations, similar to organizations in other sectors, are being challenged by the lack of standards (especially those supporting inter-operability) and the absence of qualified staff (especially those who have the knowledge and skills required to architect the relationships between often diverse application systems supported in the multiple organizations that comprise the partnership).

3.1.2.2 Office Documents and Records

The private sector is no different from any other sector of society with respect to the management of office documents. Increasingly the transaction of business is being accomplished through emails and other electronic documents. Mobile computing is accelerating the migration to 24/7, location independent communication involving the transaction of multiple forms and types of information. Canadian business is increasingly international and as a result the information generated through business transactions is international in scope (which itself is raising a host of issues ranging from privacy to sovereignty and stewardship).

In light of events south of the border such as the Enron and Microsoft cases, and the promulgation of Sarbanes-Oxley, many Canadian firms are beginning to become concerned about the ongoing management and tracking of electronic mail and other electronic documents containing highly sensitive information. This marks a shift from the past where such sensitivity appeared to be restricted to the government sector. Today, private sector interest in finding records management solutions to solve electronic records issues (including those connected with potential liability and litigation) have become equal to the interest expressed by government in finding the same kinds of solutions to respond to its issues of public trust, transparency and accountability.

3.1.2.3 Private Archives

Several larger private sector organizations have established archives programs to appraise and preserve those information holdings of the organization that document its history and

its role in Canadian business and society in general. Some archives, especially in banks, insurance companies, large retail stores, and large regulated companies such as those involved in transportation, have extended mandates for facilitating the management of records in the organization. However, few are involved in the management of electronic records of archival value or in advising on the management of electronic records.

Some business archivists/records managers are involved in supporting the introduction of electronic document and records management software but this is still in its embryonic stages. A very few (e.g. Vigi Guruusprad of the Royal Bank) are involved in standards development work that involves the management of digital information.

While the involvement of business archives in electronic records is still in its infancy, steps are being taken through the Association of Canadian Archivists to re-establish the business archives section of the association.

3.1.3 The Cultural Sector

3.1.3.1 Museum Content

The digital collections of museums in Canada range from small, focused collections of digital images on CDROM to large web-based virtual exhibitions. For the past several years, Canadian Heritage, through the Virtual Museum of Canada Investment Program (VMCIP), has provided significant funding support for the creation of virtual exhibitions at Canadian museums. As a result, there is a significant amount of digital content available online from Canadian museums and other heritage organizations, much of which is made accessible through the *Virtual Museum of Canada* gateway. The aim of the VMCIP is not just to provide access to digital images of museum collections, but also to contextualize the material through the design of a website describing the images. The program began in 2001 and is ongoing.

Canadian Heritage has also been active in providing important information to heritage organizations about best practices in the digital environment. Much of this support comes via the Canadian Heritage Information Network (CHIN), which is a Centre of Excellence for the development, presentation and preservation of Canada's digital heritage content. In 2002, the CHIN commissioned a study on best practices for digital preservation with a specific focus on museums in Canada. The study focused on surveying existing literature and identifying common themes for best practices. It also sets out a number of recommendations and a digital preservation policy checklist. Two important documents produced from this study are: *Digital Preservation: Best Practice for Museums* and *Digital Preservation for Museums: Recommendations.* The CHIN also acts as a clearinghouse for information about management of digital content, standards, and intellectual property issues.

The support offered through these programs has hastened the adoption of the digital environment by Canadian museums and other heritage organizations and has also resulted in the more comprehensive use of common standards. As of early 2006, there

were 1140 organizations that held membership in the CHIN, representing a significant proportion of Canada's heritage institutions.

3.1.3.2 Monographs

While digital monographs are not yet as prolific as other types of digital publications, they are likely to be one of the fastest growing sectors in the near future (OCLC, 2003). In discussions about digital monographs, a distinction must be made between born-digital and digitized monographs. For born-digital monographs, the publication processes, such as manuscript submission, editing and type setting have for the most part moved to the electronic environment. However, the majority of current monographs are still being produced in print format only, since many readers still prefer to read print to electronic versions. In 2001, Library and Archives Canada published an "Electronic Publishing Guide to Best Practices for Canadian Publishers". The document, which LAC plans to update this year, provides publishers with an introduction to the pros and cons of various approaches to electronic publishing.

One of the first Canadian initiatives to provide access to born-digital monographs in Canada is through the Canadian Electronic Library. The Library, produced by Gibson Library Connections inc., provides collections of academic monographs through a subscription-based service. They currently offer access to three collections: Canadian Publishers Collection, Canadian Health Researchers Collection, and Canadian Public Policy Collection.

Library and Archives Canada collects Canadian digital monographs as part of its "Electronic Collection: A Virtual Collection of Monographs and Periodicals". The collection consists of Canadian websites, books and periodicals published online. It includes more than 16,000 titles and more than 64,000 serial issues published by both the commercial publishing sector and the government publishing sector, but primarily the latter. It is unclear from the website what percentage of the collection are monographs.

The Canadian National Institute for the Blind (CNIB) manages a collection of about 10,000 online monographs and others that can be ordered in Braille, CD-ROM or other formats.

There is tremendous momentum right now for the digitization of print monographs, as seen by several large-scale projects such as the Google initiative and the European Union digitization strategy. In Canada, the Canadian Association of Research Libraries has recently announced a major effort to digitize millions of books and other documents from the collections of academic research libraries in Canada. Known as "Alouette Canada", the project will begin in 2006 and focus on works in the public domain.

Many Canadian libraries are already involved in more modest initiatives, digitizing selective monographs from their collections. Several research libraries, including the University of Toronto Libraries and Library and Archives Canada, have partnered with the Internet Archive to digitize out-of-copyright monographs in their collections and make them available through the Internet Archive website. Other monograph digitization

projects in Canada include the “Our Roots/Nos Racines” project which has been digitizing selective Canadian historical content; as is the “Our Future, Our Past: The Alberta Heritage Digitization Project”.

Canadiana.org (formerly the Canadian Institute for Historical Microreproductions), a nonprofit organization, has produced an online digital library of early Canadiana material including monographs. The Early Canadiana Online (ECO) project involved the scanning of text taken from the CIHM microfiche collection. Some of the collection is available free of charge to the general public, while other parts of the collection are available to all registered ECO members.

3.1.3.3 Newspapers, Magazines and Trade Publications

The major newspaper publishers in Canada such as CanWest, Osprey Media Group, Quebecor, Rogers, and Torstar provide a significant amount of news content on their websites, although access models to this content differ amongst the publishers. In many cases, for example the Globe and Mail, some content is available free of charge to the general public, while premium content is available to subscribers of the website only, and access to web-based archives of the website content is available on a pay per view basis. Several of the larger newspapers also maintain an electronic archive of the back issues of the articles that were published in the paper edition of the newspaper. For example, the Toronto Star has an html archive of articles (excluding obituaries, classified ads, and other non-article content) from 1985 to the present. Most of the larger papers also make their back issues available through full-text newspaper indexing services. Micromedia ProQuest’s Canadian Newsstand, the most comprehensive full-text database of Canadian English newspaper content, offers online access to the full text of over 190 Canadian news sources. Repère provides this service for several French newspapers.

Canadian newspapers are also participating in retrospective digitization projects of their content. In Alberta, the Alberta Heritage Digitization Project has also digitized numerous Alberta newspapers spanning from 1885 to 2001. These have been digitized mainly from microfilm and microfiche. Cold North Wind Inc. is a Canadian company that provides retrospective digitization services of microfilm copies through its Paper of Record service. This service has digitized the back issues of a significant number of Canadian newspapers, including the “Globe and Mail: Canada’s Heritage from 1844”, which is now a product licensed by Micromedia ProQuest. A list of the extensive collection of Paper of Record newspaper archives is available on their website.

There are a huge number of trade and popular magazines that are published on the Internet. Many of these, which are born digital, have been published only since the advent of the Internet. Others are print magazines that provide some or all their content in digital format. While models differ, the trends for magazines that have both print and electronic editions does mirror to a large extent that of newspapers. Many offer a percentage of their content for free on the Internet, and subscribers to the print editions are offered access to more extensive amounts of online content. Like newspapers, some magazines are made available through indexing services, while other, less renowned ones are not. The long-term accessibility of digital magazine content is, for the most part, dependent on the publishers' willingness to maintain an archive of back issues, although LAC is collecting and archiving some of them on a selective basis.

3.1.3.4 Audio/Visual and Multimedia Resources

Music is another domain in the digital environment that has exploded over the last several years, particularly digital music files that can be purchased and downloaded over the Internet (according to the International Federation of the Phonographic Industry (IFPI), legal music downloads rose by 900% in 2004). In Canada, most of the major online music distributers are large multinational companies such as Apple's iTunes, Sony's Connect, Napster, RealNetwork's Rhapsody and Amazon, although, there are some smaller Canadian companies who sell digital music (ie. Puretracks Music Store).

An overwhelming preoccupation for the music industry in the digital domain is the unauthorized sharing of music. The digital format along with widespread Internet access has made it possible for virtually anyone to make unlimited digital copies and distribute them over the Internet. As such, producers of digital music are using digital rights management systems to control the use of digital files. There are is also growing concern that these Digital Rights Management (DRM) technologies, could lead to 'digital lock out' in the future, and inhibit efforts to preserve and provide access to this content over the long-term. Furthermore, standards in the digital music industry vary considerably and digital audio comes in numerous different formats, many of which are not open. A recent international study conducted by Shelley Taylor & Associates entitled *Click Here Commerce: Digital Downloading,* accuses many of the existing digital music services of trying to enslave digital downloaders by using proprietary formats, closed systems media players and proprietary portable devices." While many Canadians are building their own personal collections of digital music, there exist only small-scale initiatives to acquire and preserve music in digital format for the long-term, mainly involving the digitization of analogue works no longer in copyright. Two examples of these discrete collections are the *Enregistrements Sonores*, maintained by the Bibliotheque National de Quebec and *The Virtual Gramophone: Canadian Historical Sound Recordings* at Library and Archives Canada.

The situation with digital images is similar to that of digital music: the sheer volume is staggering and will continue to grow. And, like other types of content, digital images can be born digital or digitized. Canadians are building and maintaining their own collections of born-digital images. And many large digitized image collections are being maintained

by all types of organizations, ranging from the *Hudson's Bay Company Archives Photograph Collection*, which contains approximately 130,000 images, to the *Canadian Illustrated News* website which contains about 4000 images taken from the popular 19th-century magazine, to the Canadian Heritage Gallery which has an extensive collection of historical photos, original documents, Canadian artwork, maps, and illustrations. Library and Archives Canada hosts Images Canada, a metasearch tool for the image collections of a number of participating Canadian cultural institutions. LAC's ArchiviaNet also provides access to selected digital images from government and private archives.

Much of the film content now produced in Canada is in digital format (DVD), but despite some notable exceptions, these films are not yet available directly to users over the Internet. The NFB is running a pilot project, entitled CineRoute, which makes available 800 online films at no charge to students and professors at Canadian teaching and research institutions. These films are available through streaming instantly, but are not downloadable. The National Film Board (NFB) also provides a catalogue of the complete NFB collection with two-minute clips of each film. The CBC/Radio Canada Archive also contains a significant amount of archival content and provides access to a selection of radio and television clips over the Internet. Smaller collections of digitized films can be found at LAC and other libraries and archives across Canada. As formats for digital moving images evolve, there is a risk of existing formats becoming obsolete over time. There is a need for greater collaboration between creators and archives in order to ensure that this content is collected and preserved into the future.

A multimedia object is a digital artifact in which multiple media are integrated into an interactive artistic whole. As with other types of digital content, new media and multimedia content such as digital TV, 3-D objects, computer games, etc. continue to grow at a rapid rate. In Canada, multimedia content is being created in all sectors: government, education, cultural and commercial. The Canadian Culture Online program has set up a New Media Fund to support the development, production, and marketing/distribution of high-quality, original, interactive or on-line Canadian cultural new media works. While it is hard to generalize about such diverse content types, created with different purposes in mind, the survey found that these newer types of digital content were much less likely to be acquired and preserved in any organized way. The development of standards and practices is not keeping up with the creation of new and innovative multimedia content. While the LAC is collecting and preserving a small portion of the multimedia content available, the survey found no specific or comprehensive initiatives involved in the long-term preservation of this material.

3.1.4 The Education Sector

3.1.4.1 Learning Objects

A digital learning object is any digital resource with a demonstrated pedagogical value, which can be used, re-used or referenced to support learning (Friesen, 2001). It may constitute text and/or images along with Web sites, videos, animation, audio, photographs, projections, or other presentations. In Canada, there have been several

large-scale projects aimed at improving access to digital learning objects, most of which have been funded through the CANARIE E-Learning funding program. The program was established in September 1999 with funding from Industry Canada and supported the development of broadband applications that promote learning at all levels by making effective use of advanced networks for education and training.

Edusource, one CANARIE funded initiative, maintains a web site containing an inventory of the tools, systems, protocols and practices for collection and preservation of learning objects, and has also provided some of the funding for the development of learning object repositories in Canada.

EduSpecs, a project also funded by Industry Canada, provides a gateway to information on interoperability specifications and standards for on-line learning, digital learning objects, and learning object repositories. EduSpecs also coordinates Canadian participation on international specifications and standards bodies and disseminates information about specifications and standards, digital learning objects, and learning object repositories to Canada's e-learning community. In regards to metadata for learning objects, the IEEE Learning Object Metadata (LOM) Standard, have been widely adopted in Canada and internationally. However, because LOM is thought to be somewhat difficult to implement, a Canadian group has developed a set of guidelines on the best way to implement the LOM standard, called the “CanCore metadata application profile.”

There are several small learning object repositories across Canada, housed mainly at universities. One of the larger ones is CAREO (Campus Alberta Repository of Educational Objects). CAREO is actually an ongoing research prototype, but it also acts as a live repository for learning objects in higher education. CAREO is supported by Alberta Learning and CANARIE, and has developed a searchable, web-based collection of multidisciplinary teaching materials for educators across the province and beyond.

3.1.4.2 Academic Journals

The growth of electronic journals internationally has been profound over the past five years. In fact, the Canadian Association of Research Libraries recently reported that in 2003 – 2004 for the first time, electronic serials expenditures have exceeded print serials expenditures at Canada’s research libraries. This growth has been accompanied by the adoption of a significantly different service model for e-journals. Electronic journals are often licensed through regional or national consortia, such as the Canadian Research Knowledge Network, on behalf of academic institutions. While this licensing model has greatly improved access to electronic journals for many Canadian academic institutions, it does not always allow subscribers to preserve the content into the future. Libraries, which have traditionally formed a preservation safety net for academic materials are now essentially "renting" these resources by providing subscription access to the resources on the publishers website for users. This places much of the onus for the preservation of academic journal content on to the publisher, rather than the library and “the issue of how

to archive and preserve Web-based periodicals is widely felt to have reached a critical state."[1]

Most of the academic periodicals that are published in Canada are done so by university presses, trade associations, or individual academic departments. The largest publisher of electronic journals in Canada at this time is the National Research Council (NRC) Research Press. The NRC Research Press currently publishes 15 electronic journals as well as monographs and conference proceedings, and provides free access for Canadians to the electronic versions of these journals. University of Toronto Press also produces a number of journals in digital format, as does the Canadian Medical Association, among others.

The transition to digital format in Canada by academic publishers, in particular the small publishers, is not yet widespread, due mainly to economic constraints of small publishers. To assist publishers, the Public Knowledge Project at Simon Fraser University (SFU), has developed the Open Journal Systems (OJS), an open source platform that can be used by any publisher to publish their journals in electronic format. The software helps publishers manage the journal editing process along with the technical aspect of digital publishing. Some journals are also engaging in retrospective digitization of their content.

There are also a number of e-journal hosting services in Canada. These services are not publishers, but rather, provide digitization, hosting, and other services that aid publishers with publishing in the electronic environment. The four major e-journal hosting services in Canada are Érudit, the International Consortium for the Advancement of Academic Publishing (ICAAP), the NRC Research Press, and the University of New Brunswick Electronic Text Centre. Although these hosting services use different technologies, they provide similar types of services for journal publishers, such as server space, digitization services, graphic design, metadata creation, and search and retrieval services. Some also provide table of contents and alert services.

No organization is acquiring and preserving Canadian e-journals in a comprehensive way at this time. Library and Archives Canada is collecting some Canadian electronic journals on a selective basis through the Electronic Collection of Library and Archives Canada. And, while a number of Canadian university libraries have implemented institutional repositories with the aim of collecting the research output from their faculty, these repositories have not yet collected much content.

3.1.4.3 Statistical and Research Data

Statistical data may be acquired using a variety of means: collected through responses to questionnaires or other survey instruments (i.e. through opinion polls), derived from databases supporting government application systems, obtained from other statistical sources, or generated through technical measurements or some other data gathering techniques.

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[1] Library of Congress (2002) *Plan for the National Digital Information Infrastructure and Preservation Program: A Collaborative Initiative of the Library of Congress,* Appendix 2. pg. 34.

In many organizations statistical data are generated, analyzed, packaged, and presented by specialists trained in using statistical software and analytical techniques. Their ongoing preservation is often under the responsibility of either the organizations generating the statistics or an archives that may be in the form of a government archives or a data library/archives hosted at a Canadian university (though many Canadian statistical data sets may also be held in foreign repositories). 'Datamarts', 'data warehouses', 'data cubes' and other terms are well known and familiar to many working in the field. In many respects this is a specialized field supporting its own set of concepts, philosophies, professional values, tools, techniques and technologies (e.g. the software products SPSS and SAS are the mainstays of those in the statistical field). It is supported by its own professional organization called the International Association of Social Science Information Services and Technology (IASSIST).

Statistical data are generated for a variety of reasons. Policy areas draw on it for the identification of trends to support new policy development efforts. Communications areas use it to assess client needs (i.e. customer relationship management or CRM). Program areas use it for planning purposes. Senior executives use it to assess current program capabilities and determine future direction in light of organizational priorities.

Some parts of the private sector have acquired considerable experience in gathering, analyzing, and harnessing the data extracted or derived from multiple sources - all of which is designed to give them a competitive edge. In the academic sector statistical data are generated to support a wide range of research and development activities.

In the government sector the most commonly known statistical database and the one that comes to the minds of most Canadians is the census managed by Statistics Canada. However, governments at all levels support a multitude of statistical databases that support just about every activity that is undertaken by a given government. Statistics Canada itself supports a large number of statistical databases ranging from the results of small opinion polls to large statistical databases supporting the labour market, agriculture, and other segments of Canadian society. Similar to other statistics organizations in other levels of government its role goes beyond the collection and management of statistical data to the provision of advice on statistical methods and techniques, the disclosure of personal information, and the development of standards.

Other government agencies support the generation of large volumes of highly significant research data. The so-called 5 natural resources departments in the federal government (Environment Canada, Natural Resources Canada, Fisheries and Oceans Canada, Health Canada, and Agriculture and Agri-Food Canada) support large databases generating valuable statistics that support a wide range of societal interests from the production of weather reports to the measurement of water and soil quality to the assessment of the marketplace for Canadian agricultural and other natural resource products. Other government organizations manage large volumes of statistical econometric and social information necessary to assess current situations and to plan for the future.

Many of the data sets and databases containing statistical information are of considerable value to those who wish to use the data to undertake secondary research. In this respect and in light of the objectives of this survey, an area of special interest to Library and Archives Canada is the work that has been underway to address the management of research statistical data. As early as 1975 the Machine Readable Archives Division of the then National Archives was responsible for the appraisal, acquisition and preservation of nationally significant social science research datasets. The experience it gained through this program has been shared with other archives across the country and around the world.

More recently the former National Archives, in partnership with the Social Sciences & Humanities Research Council, completed two studies to assess the need for the creation of a national data archive for social science and humanities research data. The National Data Archive Consultation Working Group completed a needs assessment report in May of 2001 and an infrastructure report in June 2002. Both reports stressed the current and growing need for the creation of a national research data archive service as a solution to problems related to the continual loss of research data that are being created in the support of government and academic research activities.

Similarly, the National Research Council of Canada (NRC), in partnership with the Canada Foundation for Innovation (CFI), the Canadian Institutes of Health Research (CIHR), and the Science and Engineering Research Council of Canada (NSERC), held a forum for a National Consultation on Access to Scientific Research Data (NCASRD) in November 2004. The forum consisted of a group of Canadian researchers who were invited to explore ways to help Canada maximize the value received from its publicly funded natural sciences, health and engineering research data. The purpose of the Forum was to recommend an appropriate framework and develop a strategy that will facilitate open and long-term access to research data that are produced in Canada. A report was released in February 2005 and it recommended the creation of a task force to prepare a full national implementation strategy, and mount a pilot project to show the value and impact of multi-person and multidisciplinary access to research data.

3.1.4.4 Geographic Information

According to Statistics Canada's 2000 survey of the mapping and surveying services industry, there are over 2,000 companies in Canada that generate $1.5 billion worth of annual revenues from geomatics based activities.[2] From the design of roads, to the location of work places, nearly every facet of everyday life is touched, in some way, by geospatial data. Geospatial data are being produced by all levels of government and in the private sector at an unprecedented rate.

The GeoConnections program is a Government of Canada funded program to develop the Canadian Geospatial Data Infrastructure (CGDI), with the objective of harmonizing

[2] Statistics Canada. (2000). *2000 Survey of Service Industries: Surveying and Mapping,* North American Industrial Classification Systems (NAICS) codes 54136 and 54137.

Canada's geospatial databases and making them accessible on the Internet[3]. The impetus for the CGDI came from the Inter-Agency Committee on Geomatics (IACG), a committee created to coordinate geomatic activities in the Canadian federal government. Through partnerships with federal, provincial and local governments, the private sector and academia, the GeoConnections program is promoting the use of standards and protocols to facilitate access to Canadian geospatial data. Extensive consultation with the Canadian Council on Geomatics (CCOG), which is a federal-provincial consultative committee for geomatics, and the Geomatics Industry Association of Canada (GIAC) is guiding GeoConnections' activities.

Five policy thrusts or themes drive the delivery of GeoConnections' programs and activities: access, framework data, standards, partnerships, and policy. The Policy Advisory Node focuses on creating a supportive policy framework to promote the sharing and distribution of data by reviewing and harmonizing existing policies. It has made several recommendations for the government to change data pricing policies and it is now addressing the need to harmonize distribution and user licensing policy. The Policy Node is also attempting to provide guidance to data producers on geospatial data archiving and preservation policies.

Although cartographic and geomatic materials will not be explicitly covered by the Regulations of Legal Deposit until January 2007, in 1995 the former National Archives and the National Library entered into an agreement whereby the National Archives acquired and preserved both published and unpublished cartographic materials consisting of separately produced single sheet and series maps, atlases, globes and geomatic information.

3.1.5 Other

3.1.5.1 Websites

Almost all organizations and many individuals in Canada have produced and maintained a website. Innumerable services are available to assist creators in producing websites and many others to guide users to Canadian-based websites. The World Wide Web Consortium (W3C), an international consortium, develops and disseminates interoperable technologies (specifications, guidelines, software, and tools) and open (non-proprietary) standards for Web languages and protocols. W3C has members from around the world including Canada. The federal government and several provincial governments also maintain standards for the web content under their jurisdiction, for example, the Government Canada's Common Look and Feel Standards.

Websites are a challenge to preserve, because in many cases they are updated frequently (some every day). Few organizations keep old versions of their own websites. Furthermore, websites are fleeting; it is estimated that a Web object has an average life expectancy of 100 days (Weiss 2003). The Internet Archive maintains an archive of

[3] Much of the information in this section was derived from ,"Management and Preservation of Geospatial Data", by David Brown, Library and Archives Canada, April, 2004

publicly accessible Web pages from around the world, including Canadian websites. They have developed an automated system that crawls the web every few months, and archives new websites or those that have changed since the previous crawl. They also offer a service for users to browse through the archive, called the Wayback Machine. The LAC also archives some Canadian web content on a selective basis. Despite these initiatives, no perfect solution has yet been devised to address the technical challenges of collecting and preserving website content.

3.1.5.2 Personal Digital Collections[4]

As increasingly powerful and user friendly computer technologies fall into the hands of family members of all ages and as more and more information is generated in the form of emails, documents, digital images, and audio and video recordings, the family memory base is shifting from paper to electronic. Concern is only just beginning to emerge about how this growing volume of complex information can be managed and preserved, especially when so much of it is managed in an ad hoc manner subject to the idiosyncratic approaches of each family member. Likewise, there has been relatively little research into the impact of the computer on the way in which individuals in the home communicate with one another and with others (and what happens to the information associated with these communications) and how decisions are made concerning the way in which the computer is used to store, retain and ensure the continued accessibility of information. In this regard, the impact of these developments on the nature of the services (e.g. repository management services) that could become available to support digital family memories have yet to be understood.

3.2 Service Providers

The second category of initiatives/organizations comprises those that offer a service related to digital content, but do not own the rights to manage or distribute the content. These include, but are not restricted to services such as digitization, hosting, aggregation, metadata creation, search and retrieval, and licensing. The list of service providers included here is not comprehensive and is based on what was discovered through the survey of digital initiatives in Canada. However, it does give an indication of some of the more common services in use.

3.2.1 Aggregators and Portals

Content aggregators are those services that collect and provide access to content created and produced by others. Examples of content aggregators are services such as full-text databases, digital repositories, and other types of digital collection. Content aggregators usually collect content in a given discipline or content type (for example, newspapers). Canada has numerous content aggregators. Among the larger content specific aggregators in Canada is Early Canadiana Online (ECO). ECO is a digital library providing digital access to 2,159,724 pages of Canada's printed heritage. One of the largest

[4] see, “Plenty of Room at the Bottom? Personal Digital Libraries and Collections, Neil Beagrie, D-Lib Magazine, June 2005, Volume 11 Number 6.

multidisciplinary collections is Library and Archives Electronic Collection, which consists of Canadian websites, books and periodicals published online. It includes more than 16,000 titles and more than 64,000 serial issues published by both the commercial publishing sector and the government publishing sector. Institutional, e-theses, and learning objects repositories are all aggregator service being implemented in the education/research sector. Institutional repositories, for example, collect the research output from their affiliated institutions and provide open access to the content. There are at least 13 working IRs at Canadian academic libraries in Canada and several more in the planning stages.

Portals are web sites that act as gateways to other resources on the Internet or intranet (in the case of enterprise information portals). Unlike aggregators, portals do not house content, but link to content held elsewhere. These types of services assist users in navigating the large amount of content on the web. As with aggregators, there are numerous portal services in Canada. One of the important value-added activities inherent in portal services is that they have done some level of assessment of the resources that they link to. The Canadian Health Network (CHN), for example, which provides access to e-health information only links to resources that pass a rigorous quality assurance process to ensure that the information is timely, accurate, and relevant.

3.2.2 Registries

Similar to portals, are registry services. Registry services for print publications are common in the library world. Individual library catalogues, such as AMICUS at LAC and regional union catalogues, such as SUNCAT in Saskatchewan or NOVANET in Nova Scotia, are used to find out what books and serial publications are in a participating library collection. As libraries create and acquire all kinds of digitized resources, we are beginning to seen the creation of digital registry services. Registries promise to provide a very valuable service in the digital realm, where content resources are widely dispersed. For example, a registry of digitized material in Canada would help libraries and other organizations avoid duplication. Furthermore, these registries could also record other pertinent information about items, such as format and usage terms. One example of a very valuable international registry service is the Registry of Digital Masters being implemented by the Digital Library Federation and the OCLC. The registry will contain key information regarding digitization, preservation, and access and will also include information about rights management, technical specification of the digitization process, and other related information. In Canada, the Canadian Initiative of Digital Libraries (CIDL) maintains an inventory of Canadian digital initiatives. This inventory records information on web-based digitization projects in Canada. However, the information is submitted on a voluntary basis by the initiatives themselves and is not comprehensive.

3.2.3 Digital Hosting

Digital hosting services provide server space and technical support for producers to publish content, often academic journals, in the digital environment. They are an important resource for publishers who wish to go online, but do not have the technical expertise to do so. The four major e-journal hosting services in Canada are Érudit, the University of New Brunswick Electronic Text Centre, NRC Research Press and

International Consortium for the Advancement of Academic Publishing (ICAAP). Not only do these initiatives provide server space, but also offer a number of other services including digitization; document conversion (from one format to another); aggregation of journals; search and retrieval (for example using Optical Character Recognition for searching PDF documents); indexing; compliance with technical standards; back up and archiving; user statistics; and metadata creation.

3.2.4 Digitization

Digitization refers to the conversion of non-digital material into digital format. Digitization involves the scanning the analogue content to create high quality digital images of the original page format. The cost of digitization has decreased significantly over the past several years, and this in part explains the growing interest in digitizing print monographs, both in Canada and internationally. Digitization services, such as those offered by the Cold North Wind Company, also digitize other types of content, such as journals, newspapers, microfilm, recorded sound, etc.

3.2.5 Metadata Services

These services assign metadata to digital content on behalf of content owners in order to make them more accessible. One such service in Canada is provided by Library and Archives Canada for government departments. Initially created to provide subject descriptors and other metadata for the Culture.ca program, LAC Metadata Service was expanded in 2001 to provide metadata for Web resources on behalf of Canadian government departments. Metadata services are often bundled with digitization, digital publishing or digital hosting services.

3.2.6 Digital Rights Management

Digital copies are easy to create, modify and manipulate, and extremely easy to distribute widely over networks. Many in the creator community are concerned about the ease with which works can be reproduced and transmitted in the digital environment, while others at the other end of the spectrum would like to ensure that their content is shared as widely as possible. Digital rights management services help copyright holders manage access to their digital content. These types of services may include technologies that protect files from unauthorized use, but also licenses that assign various rights to users. Several copyright licenses that can be applied to Canadian digital content were identified through the survey. For example, the Creative Commons licenses, which enable creators to share their work under certain conditions, by tagging works as free to copy and share, and were recently been translated for the Canadian environment by the Canadian Internet Policy and Public Interest Clinic (CIPPIC) at the University of Ottawa. There are also some Canadian based companies who have developed DRM technologies. For example, RightsEnforcer, developed by an Alberta company called RightsMarket, allows you to selectively grant permissions to individuals or groups of users, and control how they can use your information, (copy/paste, print, screen capture, save as, etc.)

3.2.7 Preservation

Digital Preservation encompasses a whole range of activities designed to extend the usable life of digital information and protect them from media failure, physical loss, and

obsolescence. Preservation services can include a number of discrete activities such as the development of preservation metadata; the use of durable media; the implementation of standardized formats; the creation of multiple copies and backup copies; and emulation and/or migration services. In Canada, there are several organizations that provide some level of digital preservation service for content providers. Preservation services are also provided by some of the content aggregators and digital hosting initiatives mentioned above, such as the OCLC Preservation Service Centers and the Ontario Consortium of University Libraries. However, preservation services in Canada to date tend to focus on activities such as the creation of back-up copies and use of standardized formats, but do not yet offer the more involves processes such as migrating content over time or the collection of software and emulators in order to read obsolete formats. While archives typically do not provide digital preservation services to other organizations, many do provide advice on various approaches that have been developed either based on their own experience or the experiences of other organizations.

3.2.8 Search and Retrieval

The continuing increase in volumes of digital content has led to information overload. Users are faced with the daunting task of locating a few relevant items from within a sea of available content, akin to the old adage of finding a needle in a haystack. Search and retrieval services have become increasingly important to assist users in finding the content they are looking for. Thanks to the commercial lure of web searching, many new technologies have been developed to improve searching on the web, such as Google. These technologies employ tools such as information filtering which attempts to extract items based on matches with a user interest profile, and methods for other types of digital objects such as images, speech, video, and music. At the collection level, most archives or repositories have services to search within the collection, and there are also large search and retrieval services, like Google, that search at the Macro level across collections and content. Archives and libraries provide search and retrieval services based on cataloguing and classification tools supported by special-purpose technologies, for example the AMICUS catalogue supported by Library and Archives Canada.

3.2.9 Metadata Harvesting

Metadata harvesting is the aggregation of metadata records from multiple content providers into a single database- while the full-text files remain at the originating archives. Metadata harvesting services were developed to improve the exposure of certain types of resources that present special retrieval problems, specifically, content that is stored in a databases or repositories that cannot be penetrated by the spiders and robots employed by search engines. Metadata harvesting services often employ the Open Archives Initiative Protocol for Metadata Harvesting (OAI-PMH), which allows repositories to expose their metadata to these harvesters. There are a growing number of these types of services, most of which reside outside of Canada. The few services in Canada include the Canadian Association of Research Libraries institutional repository harvester, managed by Simon Fraser University Libraries, and the Theses Canada Harvester, managed by LAC. Although these types of services have been used mainly for harvesting journal articles (e-prints and pre-prints), it is expected that they will become

more popular in helping expose other types of resources, especially multimedia resources.

3.3. Canada's Digital Infrastructure

This category of organization/initiative comprises those that focus on the development of all or selected components of the **infrastructure** that enable the management of digital content. The infrastructure is not considered to be just technical. For the purposes of this survey the concept of 'infrastructure' is very broad and encompasses a combination of **laws and policies**, **standards and practices**, **systems and technologies**, and **human resources**.

3.3.1 Laws and policies

Digital information creation, access and preservation are subject to a number of Canadian laws. In many governments, the development of laws is the responsibility of a Justice ministry or department. Implementation of the laws falls to management boards (e.g. Treasury Board Secretariat for the federal government) and lead agencies (e.g. Library and Archives Canada) which develop policies and guidelines to direct the way in which the laws should be implemented within individual government departments, agencies, ministries, etc. In the Canadian federal government the key policy having the greatest impact on the management of digital information is the Treasury Board Secretariat's Management of Government Information (MGI) policy. As well as providing government departments and agencies with a framework for complying with laws such as the Access to Information Act and the Privacy Act, the MGI policy positions information management (including the management of digital information) as an instrument that is directly supportive of government program and service delivery and the achievement of the government's priorities (i.e. Government On-line, service transformation, etc.). In this respect it requires information to be managed as an asset. It also requires government departments and agencies to establish accountability frameworks designed to ensure that the policy requirements are met and that their implementation is measurable.

In the post-9/11 world, there are growing concerns of society about the protection and responsible management of personal information generated in an increasingly digital environment. The "Privacy Act" provides Canadians with the right of access to information about them held by federal government institutions. Very importantly, it is one of the only statutes that obliges federal government departments and agencies to manage personal information throughout its life cycle. The "Protection of Personal Information and Electronic Documents Act" extends the provisions of the Privacy Act to the commercial sector. Again the information covered by the law includes information in digital form. In fact the Electronic Documents segment of the Act, which contains amendments to the Evidence Act, essentially enables organizations to enter digital information into a court of law as 'records' subject to certain conditions.

In another arena, the Copyright Act is being amended to include provisions that will have an impact on the obligations of both producers and consumers concerning the

reproduction and use of digital information. A key feature of all of these laws is the recognition that digital information is a valued societal asset. At the same time, however, it is also raising expectations that such a valued asset should be capable of being preserved in a form that is authentic and reliable for as long as it is required. Aside from ongoing work to develop standards to guide organizations in establishing the conditions under which electronic records can serve as evidence, little attention has been paid to the application of the standards and procedures required to enable the authenticity and reliability of digital information that is to be retained through the long term.

Other policies such as the Communications policy, the security policy, and policies concerning the use of the Internet, illustrate the breadth of the information management policy landscape and, in this context, the breadth of the policy framework that governs the creation, access and preservation of digital information. The "Access to Information Act" provides the right of access by Canadians to information, including information in digital form, under the control of the Government of Canada.

Similar policy frameworks exist in other jurisdictions across the country. The Government of Alberta has a comprehensive information management policy and provincial governments such as British Columbia, Ontario and Quebec have specific policies addressing specific topics such as records management, communications, privacy, etc.

Running as a theme across all of the jurisdictions is the substantial challenge of seeing many of these policies actually implemented. Lack of awareness (especially at the senior executive levels), fragmented accountability frameworks, and the absence of compliance measures and mechanisms are inhibiting efforts by information management disciplines to facilitate implementation of key aspects of these policies, especially those focusing on the life cycle management of information.

3.3.2 Standards and practices

Tools and techniques for the management of digital information are emerging that range from new approaches to establishing data architectures to data format standards for the exchange and retention of digital information. These standards and practices, when taken in combination comprise an essential component of the underlying infrastructure for managing digital information.

A number of organizations and groups are responsible for developing and issuing standards and practices. At the national level the Canadian National Standards Board approves and issues standards that have wide applicability. It also maintains ties with the International Standards Organization and coordinates the adoption of international standards such as XML in Canada. It is also responsible for standards development activities such as the development of standards for establishing records as evidence pursuant to the Electronic Documents Act. In many respects the standards employed by Canadian organizations have their roots in the international arena. The Open Archival Information System (OAIS), Anglo American 2 Resource Description Access

(AA2RDA), and MARC, as well as a wide range of international data format standards have either been applied by or are receiving considerable attention from Canadian organizations.

The federal government is also responsible for developing standards in the field. Many of the standards and practices that are related directly to the creation, access and preservation of digital information are developed by Library and Archives Canada (through the Government Information Management Office) and the Treasury Board Secretariat (through the Information Management Division). Examples of such standards, practices, and guides are as follows:

- Information Management Capacity Check (a self assessment tool for departments and agencies to identify levels of maturity in the management of information).
- Business Activity Structure Classification Systems (a standardized structure for the classification of all types of government records including those in digital form).
- Information and records life cycle (a standard for describing the stages of the life cycle of information).
- Guidelines for Computer File Types, Interchange Formats and Information Standards.
- Electronic Publishing: Guide to Best Practices for Canadian Publishers.

At the provincial and municipal levels, similar standards and best practices have been developed. Many such as the Governments of British Columbia, Alberta, Ontario, and Newfoundland and Labrador, have focused on the issuance of email guidelines. Some, such as Ontario and Alberta have issued guidelines on the requirements for electronic document and records management systems. In the area of digital preservation, the Government of Alberta has released a Digital Preservation Resources Guide (2004). From the perspective of web content it has also released a Web Content Management Resources Guide (2004).

Professional organizations are also involved in the development of standards and practices. Many are specific to the professional group rather than cross sector. For instance the Canadian Health Information Management Association has released a Data Quality Handbook to assist its members in assessing and improving the quality of data pertaining to patients and related health information. Chapter 9 of the Rules for Archival Description was developed by the Association of Canadian Archivists to help archivists describe electronic records of archival value.

Finally, the academic sector has also been involved in the development of standards and practices. One of the most notable examples is the InterPARES Project (International Research on Permanent Authentic Records in Electronic Systems), a two year international, inter-disciplinary research project at the University of British Columbia that is exploring the preservation of the authenticity of digital information. In addition to the development of standards and practices, the InterPARES project represents one of only a few research projects currently underway in Canada to address the management of digital information. The lack of research is particularly acute in the area of digital information preservation. Beyond the University of British Columbia, the only other universities in

the country that appear to be addressing this issue are the University of Toronto and the Université de Montréal.

Other sector specific metadata initiatives of note are:

- Library and Archive Canada's Metadata Strategy Catalytic Initiative, which focuses on innovative ways of enhancing user access to LAC's holdings of published and unpublished information resources by leveraging the power of descriptive standards.
- The CanCore Metadata Application Profile, which is a set of guidelines developed by a Canadian group outlining the best way to implement the Learning Object Metadata Standard.
- The Canadian Association of Research Libraries (CARL) is developing a metadata profile for Canadian institutional repository content. This application profile will allow the metadata from these repositories to incorporate elements that will extend the functionality of the search service to better suit users' needs and to enhance access to the harvested records.

3.3.3 Education, Training, and Human Development

There are many different occupations involved in the management of digital information, from records management and librarianship to data management and information management. Each abides by its own policies, uses distinct tools and techniques, supports cultures that promote insularity, and reference professional associations and groups that rarely interact with one another. This phenomenon appears to exist regardless of the sector, the level of government, the type of organization, etc.[5]

Nevertheless, in some organizations convergence appears to be taking place and in a few organizations steps are being carried out to foster closer cooperation and even integration. One example includes the federal government's Office of Organizational Readiness at the Treasury Board Secretariat where a Learning Framework for the Information Management community has been developed and courses are currently being designed to foster holistic approaches to the management of information in a digital environment. Another example is the work undertaken through the Alliance for Archives, Libraries, and Records Managers (ALARM), a Human Resources Development Canada initiative to develop competencies for the information management specialist. This trend to the gradual convergence of communities such as records management, data management and library services will need to be taken into account when developing proposals for a national summit where each community will be interested in being represented but where such representation should also reflect the emerging convergence.

Within the specific disciplines responsible for the management of digital information, the curricula, and the levels and quality of education and training vary considerably. While training opportunities are relatively numerous for all levels of librarianship, data management, software engineering, and business information system, they are less

[5] An exception might be in certain parts of the private sector where the point has been made that records management is such an integral part of the business of the organization that it is not treated as a separate entity but rather as an integrated component within the design and development of application systems.

frequent and available for the records management community. Education and training opportunities for web content managers, while still in their infancy, are growing rapidly. In the geomatics field, education and training is available but it is generally highly specialized and resident within the geo-cartographic and geo-spatial communities.

Canada has many programs in software engineering and computer science at the university and college level. These programs contribute to Canada's capacity to maintain and develop its technological infrastructure and the creation of tools to organize and retrieve digital information. As well, most management faculties offer an information systems track, which contribute to the development of skills in managing organizational information systems. Within the library, archives and records management communities (i.e. the communities that tend to be most closely involved in managing digital information that could contribute to the documentary heritage), the library and information studies graduate programs offering education opportunities that touch on the creation, access and preservation of digital information are as follows:

- Dalhousie University, School of Information Management, Faculty of Management
- McGill University, Graduate School of Library and Information Studies
- Université de Montréal, École de bibliothéconomie et des sciences de l'information.
- University of Alberta, School of Library and Information Studies
- University of British Columbia, School for Library, Archives and Information Studies.
- University of Toronto, Faculty of Information Studies.
- Univeristy of Western Ontario, Faculty of Information and Media Studies, Library & Information Science

A few organizations provide training opportunities at the community college level. Most are discipline specific with some providing library technician courses alongside courses offering instruction in web content development. Others, such as Algonquin College in Ottawa, offer courses in records management and archives. It appears that very few if any offer multi-disciplinary courses focusing on digital information management and there was no evidence that courses existed on the preservation of diverse forms and formats of digital information.

Private sector organizations and professional associations also provide some training in digital information management. These are normally in the form of stand-alone workshops or seminars offered either on their own or as part of other events such as at conferences, etc. Private sector courses tend to be oriented to digital information activities that organizations are most likely to focus on such as information creation (i.e. content development, packaging, etc.) and information access (i.e. dissemination, transmission, access and retrieval, classification and cataloguing, etc.). Digital information preservation does not appear to be a topic that private-sector training organizations see as having high marketability[6]. The situation is somewhat better in the

[6] Rare examples are the ½ day workshop on developing digital preservation strategies which is being offered by Verny Inc. on September 16th in Ottawa and the 2 day 'traveling' workshop on digital preservation which is offered by Cornell University.

case of professional groups and organizations where workshops and seminars on digital preservation have been offered either as stand-along events or as part of annual conferences. Examples of professional associations include the Association of Records Managers and Administrators, the Association of Canadian Archivists, and the Canadian Library Association.

Finally, some organizations are recognizing that the identification of education and training requirements must begin with a clear understanding of the knowledge and skills required to undertake the work. And this can only occur if one first understands what knowledge, skills and abilities are required to manage digital information. It is only when this is determined that assessments can be conducted of the gaps in existing knowledge, skills and abilities and the kinds of strategies that should be employed to close the gaps either through education and/or training or through recruitment. Once the required knowledge, skills and abilities are in place then performance measures must be established to ensure that potential future gaps can be identified. Only a very few organizations are recognizing that the effective management of digital information should be based on the need to address human resources development and management in a comprehensive manner. The Government of Alberta, Information Management Branch, the federal Department of National Defence, and the Treasury Board Secretariat's Office of Organizational Readiness, are among the examples.

3.3.4 Technological infrastructure

It is beyond the scope of this report to provide an exhaustive and comprehensive overview of the technological infrastructure that has had an impact on digital information creation, access and preservation. However, a number of important trends were observed during the survey. The Internet now plays a central role in the lives of most Canadians. Canada has one of the highest proportions of broadband penetration with almost a quarter of Canadian households currently having broadband access. The Government of Canada has committed $110 million to CANARIE towards the design, deployment, and operation of the next generation of broadband network for research institutions called CA*net 4. CA*net 4 will interconnect provincial research networks, and through them universities, research centres, government research laboratories, schools, and other eligible sites, both with each other and with international peer networks. These trends are situated within the context of a broader societal and technological environment driven by the following:

- The speed at which digital information can be retrieved, assembled, distilled, packaged and made available to a clientele that has come to expect they will receive 24/7, location-independent service for information that is timely, accurate, authentic, complete, and relevant.
- There is a growing prevalence of on-line service delivery is having an impact on the supplier-client (e.g. government-citizen) relationship and there clients expect to be able to access timely, complete and trusted information from a variety of sources and services.
- There is a need for the IM/IT infrastructure to be nimble and flexible in the face of ongoing changes in the environment.

- There have emerged much improved collaboration and business intelligence tools which are transforming the way in which digital information is being transmitted, shared, exchanged, and disseminated across groups and organizations and beyond.

These trends are augmented by trends identified through a review of information produced by Gartner Inc.[7] In many respects they add shape and context for the individual initiatives identified through this survey. Among some of the major trends mentioned by Gartner and that have a bearing on the technology landscape are the following:

- The substantial miniaturization of media devices and the ability to compress more and more information into smaller spaces is allowing the use of information regardless of time and location. It is also improving the convergence and of computer technology and content in devices ranging from portable music devices, to mobile phones, to the automobile.
- The emergence of wireless, mobile computing and communications is having a profound impact on consumers and especially organizations (from the private sector to the academic and government sectors) to manage the business-critical digital information they require to support decision-making and their business activities.
- The concept of the trusted institutional repository is no longer the purview of archives and libraries. It is a technological trend that has been born out of the concern by a rising number of organizations that they can continue to demonstrate to their citizens and clients that the information they hold can be trusted, that it is authentic and reliable, and that it can remain in that state for as long as required. While the criteria and standards for defining what constitutes a trusted institutional repository are still being developed the trend towards the establishment of vast networks of increasingly inter-connected trusted repositories is clear.
- User interfaces, from those on the desktop to those on cell phones and in the car or on kitchen appliances are increasing in sophistication and functionality. In addition to the usual static text in a document, users expect to see graphics, moving images, and dynamic content that will enhance the value of their increasingly web-based experience. They also expect a user interface that is flexible, adaptable, and personalized to their own environment and that interface to guide them into a host of information-based services ranging from transaction-based applications. The trend in user interfaces is important because enhancements made at the level of the user interface will have a ripple effect through the entire technology and information infrastructure that lies behind the interface.

Finally, it is important to note that Canadian-developed technologies designed to enhance the ability of organizations to manage their digital information holdings are finding their way into the international marketplace. For example most of the electronic document and records management software products in use around the world have their roots in Canadian companies. This is an important aspect of digital information that should be kept in mind as steps are taken to advance the development of a national strategy for

[7] The information in this section was based on a presentation by Sandy Foote as delivered to the participants in the CIDA-sponsored Strtaegic Information Management Program, September, 2005.

digital information. Regardless of the direction taken by the strategy (i.e. from supporting cultural objectives, to improving economic performance, to enhancing government accountability) consideration should be given to determining how the outcomes of such a strategy might benefit the advancement of relevant segments of the Canadian information technology industry.

3.4. Leadership

This category of organizations comprises those involved in providing coordination, governance, and funding for digital content and/or services and/or infrastructure. These organizations may not be directly involved with the management of content, services, or infrastructure, but they do provide some level of strategic vision and direction or other type of leadership role with respect to digital information. The three types of roles carried out by leadership organizations are: funding, coordinating, and strategic planning.

3.4.1 Funding Role

Funding support for digital information initiatives is provided by a host of organizations. However the level of funding support is dependent upon the nature of the digital information initiative. In large-scale initiatives such as the development of new application systems containing highly significant data responding to a major business or governmental priority, funding can be substantial. In other cases, such as the conduct of low-level research of a very specific nature, funding may be less or difficult to secure.

Private industry has been the major driver in the creation and production of digital content in Canada. From e-books, to computer games, to digital TV, the sale of digital content continues to grow and there are plenty of economic incentives for content providers.

The federal government has also played a key funding role in the creation, access and preservation of digital information. These funding initiatives tend to be aligned by sector. In the research sector, for instance, digital information initiatives may be supported by NSERC, CIHR, or SSHRC or some other government organization. InterPARES is an example of research on digital information that has been funded through these research funding agencies. The Canada Foundation for Innovation (CFI) also funds a number of initiatives to strengthen the digital infrastructure at Canada's academic institution, for example, Canada's National Site Licensing Project, the Text Analysis Portal for Research (TAPoR) Project, and the Infrastructure for Electronic Publishing and Analysis of Humanities Source Material. Research funding can also be obtained through the private sector. Industry Canada has funded projects aimed at improving the presence of educational content on the web, whereas Canadian Heritage has directed significant funds towards the development of cultural content in digital format.

Funding is also directed to either the development of content or the delivery of services or the development of the infrastructure for managing digital information. CANARIE and

Industry Canada are examples of funding organizations that sponsor the development of specific components of the digital information infrastructure. Through the Virtual Museum of Canada (VMC) Investment Program and the VMC Community Memories Program, Canadian Heritage funds the production of digital content in the cultural sector.

3.4.2 Coordinating Role

A number of organizations perform a coordinating role in the management of digital information by offering forums and conferences for improving skills and capacity levels, coordinating collaborative initiatives, or developing mechanisms that promote the exchange of information. Again, coordination in the management of digital information is usually sector specific. Professional and industry associations play an important coordination role at the sector level. Some of these include:

- The Canadian Association of Research Libraries
- The Association of Canadian Archivists
- The Association of Records Managers and Administrators (Canada)
- The International Association of Social Science Information Services and Technology
- The Information Technology Association of Canada
- The Canadian Information Processing Society
- The Canadian Library Association

Specific government organizations also offer a coordinating role. At the national level, for instance, Industry Canada supports coordination of Canadian businesses involved in some aspect of the infrastructure supporting the management of digital information. Similarly, Library and Archives Canada coordinates national and international activities involving the management of digital information that contributes to the documentary heritage of the country. Canadian Heritage and the Treasury Board have also played a coordination role in their respective sectors, cultural content and government information. The Public Policy Forum is an example of a quasi-governmental organization, which hosts workshops, conferences, and other meetings designed to facilitate communication among those who have an interest in pursuing a specific topic including the management of digital information.

At the provincial and municipal levels, government and quasi-governmental organizations offer similar services. Provincial and municipal archives and libraries serve as coordinating bodies for government initiatives that focus both on the cultural role of digital content and the role of the digital environment in the delivery of government programs and services. For instance, like LAC, some provincial archives have established government forums for the exchange of information on various aspects of digital information.

3.4.3 Strategic Planning

Some organizations go beyond funding and coordination to offer leadership through the establishment of strategic direction, including the development of strategic plans for various facets of digital information management. These initiatives bring key stakeholders together, undertake assessments of current situations, set strategic visions

and directions, and mobilize both the internal and external resources required to turn the visions into a reality. They are a catalyst for action.

At the national level, Library and Archives Canada performs this role and has undertaken a number of initiatives designed to set strategic direction for digital information. This current study which is part of a plan to develop a National Strategy for Digital Information is one cogent example. Canadian Culture Online**,** part of the Heritage Canada's strategy, encourages a uniquely Canadian presence on the Internet. The Canadian Association of Research Libraries has launched a National Digitization Strategy for Canada. These are a few of the national initiatives aimed at the strategic planning in the digital environment

4. Trends and Issues

The trends and issues described in this chapter are based on survey findings, and include discussions held during the survey with key contacts as well as the personal knowledge of the authors of this report. While the major focus of the survey was on identifying '**key organizations**' that are involved in some aspect of digital information in Canada (see section 2.1), a number of trends and issues became apparent as the survey information was collected and analyzed. This chapter contains a discussion of some of these major trends and issues, and sets the stage for the next chapter of the report, in which suggestions are offered concerning how these trends and issues can inform the development of a 'way forward' strategy for the organization of a national summit on digital information.

4.1 Digital Information Activities

Increasingly the information generated to support every aspect of Canadian life is being recorded in digital form. Digital information is no longer restricted to data in large applications systems. It can be found everywhere - from the email messages connecting Canadians with each other and others around the world, to the photos documenting everyday life, to the valuables documents that protect rights and entitlements, to the published and unpublished forms of information that contribute to a knowledge-based society, to the computer games, films, and music that serve as sources for Canadian entertainment.

Twenty to thirty years ago, Canadians were less concerned about the management of digital information simply because they were rarely exposed to it. Today, Canadians enjoy one of the highest broadband penetrations in the world[8] and are harnessing the power of the Internet to deliver unprecedented amounts of content. Many segments of Canadian society have wholeheartedly embraced the digital environment and the

[8] OECD. (2005) OECD Broadband Statistics, June 2005.
http://www.oecd.org/document/16/0,2340,en_2825_495656_35526608_1_1_1_1,00.html

implications of this are profound. Digital information, in its many forms, has become a major and important asset to Canada and its significance is growing exponentially. From farmers accessing agricultural information, to seniors securing their benefits through online application to government benefits programs – from the purchase of digital music over the Internet, to the cyber-laboratories used by Canadian researchers, digital information is transforming every aspect of our lives as Canadians.

The challenges of managing the growing body of digital information, which comprises more and more of Canada's social interactions, knowledge base, and cultural artifacts, are immense. Currently, the stewardship of digital information produced in Canada is disparate and uncoordinated. Planning for what is created and used is specific to the organization and its interests. The sharing of experiences in managing digital information (including identifying common interests and issues) is rare, and expertise in digital information is scattered. Digital information is extremely transient and acquisition strategies are dispersed and uncoordinated. Furthermore, there are significant technical and legislative hurdles unique to managing content in the digital realm. In the area of digital preservation, which involves extremely complex processes at both the organizational and technical levels, comprehensive strategies are not yet being employed. Many feel that much of the digital information being created today will be lost forever.

These and other issues will shape the objectives and program for the proposed National Summit and inform the nature of a National Strategy for Digital Information which should emerge from the Summit. Given their breadth and complexity, these issues must be clearly identified, defined and understood if the objectives and program for the Summit are to be relevant. The following sections list key issues and trends affecting the creation, access and preservation of digital information as well as its underlying infrastructure.

4.1.1 Creation of and Access to Digital Content

The volume and the diversity of digital information being generated is growing exponentially and the digital environment is on its way to becoming the principal medium for the creation and distribution of documents, articles, newspapers, music, websites, moving images, recorded sound, games, images, books and much more. Digital objects are becoming more complex and may contain a wide and mixed-range of formats and be composed of dynamic or distributed elements.

The availability of digital content varies significantly depending on the type of creator/publisher (ie. commercial, cultural, private sector, etc.), the type of access model employed (subscription based, pay per view/download, free access, etc.), and the content management system in use. A whole range of services is present to assist content providers with the creation, access, and preservation of their content. Examples of the types of services being offered are digital hosting, metadata, digitization, preservation, etc. Content aggregators, whose role is to collect digital content and provide an access point for these resources, are plentiful and can be found in virtually all sectors. There has

also been a growth and improvement in search and retrieval services, portals, and registries to aid users in finding the information they are looking for.

The growing number and complexity of digital objects, along with the variety of economic and access models applied to these digital resources presents a significant challenge for those who wish to ensure their long-term preservation. Content creators, for the most part, are concerned with issues of immediate accessibility, rather than permanence, and thus have not undertaken to employ the technologies and standards and practices that will better ensure a long-life span for their content.

4.1.2 Preservation of Digital Content

There is a growing sense of urgency with respect to the preservation of digital information. Many organizations have begun to recognize that preservation involves more than simply placing the information on durable media. Preservation in the digital environment is an active management issue, as much as a technological one. Media storage and the storage of digital information in environmentally controlled facilities are important. But equally important is the need to store the information in formats that account for changes in technology; the need to ensure that sufficient metadata is associated with the digital information to enable its continued access and understandability. And, above all, there is a need for an accountability framework to ensure that roles and responsibilities for digital information preservation are clearly assigned. In most Canadian organizations such active management frameworks have yet to be designed and implemented. Preservation in the digital environment requires management throughout the lifecycle of the digital object, demanding a cooperative approach from all actors: producer, consumer, and archive.

While it is difficult to generalize across sectors, the survey found that no specific digital content type was being preserved in a comprehensive way. Regardless of the sector or the progress made towards preserving digital information, no organization is in a position to claim that it has solved the digital preservation problem. Internal documents and records are particularly neglected, while “published content” such as academic articles, newspapers, monographs, web sites, music, and government documents are being acquired and preserved on an ad hoc basis. Canadian libraries and archives are the organizations most active in this area. The Electronic Collection of Library and Archives Canada probably maintains and preserves the most comprehensive cross-sector collections of Canadian digital “published content”. There are also large collections of digital information in some Government of Canada databases, such as those maintained by Statistics Canada and natural resources agencies such as Fisheries and Oceans Canada and Environment Canada that are also being preserved. Individual libraries (academic, public and private) are digitizing and collecting digital material, but have avoided anything that is not out of copyright.

Preservation issues are of particular significance in the modern office where there are few controls over the creation, transmission and filing of electronic documents and records. The absence of such controls coupled with the general lack of assigned accountability,

effective policy direction, and relevant and effective standards, practices, and technologies are leading to an information management crisis in many organizations. Within this environment, there are rising fears that the continued relevancy, currency and trustworthiness of critical electronic documents, records and published materials may be at risk.

On another front, there appears to be a general lack of clarity about the legality of copying, collecting, providing access to, and preserving digital objects that are covered by Canadian copyright legislation. For example, libraries that license digital materials are unsure about whether they have the contractual right to preserve those materials. Preservation agencies may need to copy publications repeatedly over time, yet the law specifies that only one copy may be made for preservation purposes. And, publishers who protect their publications with technological measures may be preventing them from being copied at all. Numerous issues surrounding copyright in the digital environment need to be clearly articulated and resolved if responsibility for collecting and preserving digital information is to be assumed by organizations other than the copyright holder. These and other issues seriously hamper any efforts made towards a comprehensive approach to digital preservation in Canada.

4.2 Digital Information Infrastructure

4.2.1 Laws and Policies:

Laws and policies are finally catching up to the requirements of the digital environment. The best examples are the "Personal Information Protection and Electronic Documents Act" (PIPEDA) and the federal government's "Management of Government Information" (MGI) policy, both of which focus on information in digital form. The shift to media neutral laws and policies that are oriented to the digital environment is having an impact on the status accorded to this form of information. No longer is digital information viewed as an ephemeral output from paper-based processes where the 'official record' is in paper form. Digital information carries the same status under law and policy as its paper counterparts.

Questions remain, however, about the ability of organizations to respect all of the provisions of these laws and policies. There are two critical issues: One relates to the challenges of establishing the attributes of authenticity for digital information objects subject to a given law or policy; and the second relates to the ability of organizations to preserve the authenticity of digital information objects for as long as they are required to be retained. While research is underway through initiatives such as InterPARES and standards are beginning to emerge such as those made available through ISO, generally accepted criteria, standards and practices have yet to be established to enable organizations to know with confidence that they are capable of preserving an authentic object in an electronic environment. This can have significant implications for organizations subject to laws such as PIPEDA (where the authenticity and integrity of personal information must be retained according to formal retention standards that may reflect lengthy retention periods).

Other laws are also having an impact on the management of digital information. For instance the extension of the legal deposit legislation in Canada to include digital publications will presumably assign greater responsibility for the collection of digital content to LAC. Although it is not clear to what extent this legislation will cover non-traditional types of material, such as digital television and radio, and other multimedia content. Similarly the legal requirement for government organizations to establish retention and disposition authorities for digital information will have an impact on the ability of archives to secure digital records of archival value.

Preservation policies are in their infancy at the organizational or inter-organizational level in Canada. The survey found that few digital initiatives had comprehensive preservation policies in place, with the notable exception of the federal government, Library and Archives Canada, and a few other organizations (ie. Government of Alberta: Digital Preservation Strategy; Stewardship of Scholarly Resources in a Digital World - A CARL Position Statement). If the preservation of Canada's digital heritage is to occur, the creators and publishers of digital information will have to begin to implement preservation policies as well.

4.2.2 Standards and Best Practices

In general, standards and best practices for digital preservation have been developed outside of Canada. Examples include the OAIS model, standards set out in the Research Libraries Group-OCLC Report "Trusted Digital Repositories: Attributes and Responsibilities", and migration, emulation, and other approaches to digital preservation that are being tested by national archives in several countries (e.g. The UK National Archives, the National Archives of Australia, etc.).

The survey found a few instances in which Canadian organizations have published standards or best practices for sector specific content. For example, the Canadian Heritage Information Network has published a paper setting out best practices for the digital preservation activities for museums. Library and Archives Canada has published a best practice aid for the management of digital information in government, and standards for describing and managing geomatics information have been developed and published.

The InterPARES Project has contributed usefully to the current body of standards and practices surrounding digital preservation. Results of the first phase of InterPARES have been published in the book: "The Long-term Preservation of Authentic Electronic Records: Findings of the InterPARES Project". The second phase of the project, which was launched in 2002, focuses on the development of model policies, strategies and standards aimed at ensuring the longevity of a wide variety of content types. So far, the project team has released "The Chain of Preservation Model", which illustrates the relationship among activities of records creators and records preservers. Work is also continuing on case studies that are examining the preservation of records produced in complex digital environments ranging from artistic and scientific to e-government and e-commerce.

Despite the existence of standards and best practices, their level of application in the Canadian context has not been comprehensive. This is especially true with respect to the preservation of digital information. In general, the library, archives and museum communities have taken the lead in addressing digital preservation issues. However, they have not taken on the kind of comprehensive approach outlined in models such as the Open Archival Information System (OAIS). The survey found that preservation activities in Canada are restricted to the use of standardized formats, the creation of back-up copies, and the use of durable physical formats. There is no certification process to establish that a digital repository can be 'trusted' which means that there is always the risk that institutional repositories may not be capable of preserving digital information even though their specifications may suggest that they can. Preservation metadata is rarely being assigned and even specialized preservation services do not provide the full range of management activities required to ensure the long-term preservation of digital objects.

Meanwhile, existing models for digital preservation may not even be sufficient to address the preservation of all types of digital material. For instance, the OAIS model addresses the management of objects as individual entities and does not account easily for the management of the relationships among objects (i.e. records) that document decision-making. Nor does it account for the governance and management frameworks that need to be in place to ensure that the underlying infrastructure (the focus of the OAIS model) continues to be relevant and effective.

4.2.2.1 Metadata and Interoperability

The issue of metadata deserves special attention because of its importance to all stages of the life cycle of digital information from creation and collection, to access and use, to retention and preservation. The effective organization of digital information to support both access and preservation depends on the management and organization of metadata. Metadata interoperability, in particular, takes on an important significance when building large collections, with diverse content types and metadata schemas. Metadata can make it possible to search across multiple collections or to create virtual collections from materials that are distributed across several repositories. Metadata also enables access to and understanding of the relationships among digital objects, such as the records that document important decisions and actions, and the functional and organizational context within which they were generated and used. Incompatible or incomplete metadata, on the other hand, impedes resource discovery and access. Although differences between metadata records can be reconciled using metadata crosswalks that "translate" between different metadata element sets, the use of disparate standards exacerbates the silo effect and is likely to hamper effective searching or database management. Further exacerbating the silo effect are the varies metadata models, standards, and tools employed by various information management disciplines - file classification schemes for records managers, cataloguing for librarians, data models and data architectures for data managers, etc. - each reflecting distinct (but ultimately highly relatable) principles, requirements, and techniques.

The rapid growth of digital information has been accompanied by a proliferation of metadata schemas, each of which has been designed to fulfill the requirements of a particular user community and content sector. A plethora of custom-designed metadata standards and applications are currently available for use by content managers, such as MARC, NISO Z39.87-2002 Technical Metadata for Digital Still Images, the DIG35 Specification for digital images, the MPEG-7 standard for audio and video content, CanCore Application Profile for Learning Objects, and many more. That being said, the use of Dublin Core metadata seems to be on the rise. It has been adopted by a number of sectors including by the Government of Canada for its web resources as well as many in the scholarly and cultural communities. The Open Archives Initiative Protocol for Metadata Harvesting, which uses Dublin Core metadata, and has a fairly high profile has likely had the affect of increasing the use of the Dublin Core metadata in many instances.

The survey identified various initiatives aimed at improving interoperability within certain sectors (e.g. EduSource and the CARL Institutional Repositories Project), but interoperability across sectors is still quite rare. Records management classification schemes for digital documents are incompatible with data architectures and standards established for data in applications systems. These in turn are incompatible with those developed by the geomatics or learning objects communities, which have developed their own highly sophisticated approaches to defining metadata standards and architectures. As organizations move towards greater information sharing and collaboration, there will be an increased need to break down the silos and develop enterprise-wide, cross sector, inter-operable metadata architectures and standards.

4.2.3 Human Resources Capacity

There was a growing recognition among the organizations surveyed that human resource capacity in the areas of digital information management and digital preservation is lacking. The capacity of content producers, in particular, appears to be quite low. In many sectors, information managers lack training in the processes of digital preservation and awareness of the responsibilities required for managing digital information.

The issues connected with awareness and training relate very strongly to the broader issue of human resources management. A shared perspective on the nature of the work required to manage digital information and to build and maintain the comprehensive infrastructure required for its effective management has yet to be established. It is only after establishing a clear understanding about the nature of the work, that steps can be taken to develop job descriptions, define accountability relationships, and identify competencies. Unlike human and financial resources, the roles and responsibilities for managing the digital information resources have yet to be reflected in job descriptions. Aside from the work of ALARM (Alliance of Libraries, Archives and Records Management), a competency framework for the management of digital information has yet to be defined and there is no mechanism in place for ensuring that whatever competency profiles are developed have authority and can be maintained. These factors inhibit the development of comprehensive, relevant and effective education and training programs (not to mention recruitment programs) to fill identified gaps, rewards and recognition programs that are consistent in their design, and performance measures that are applicable and measurable across information management disciplines and domains.

An issue of particular concern is the capacity required to address the preservation of digital information. Currently education and training for digital preservation in Canada is targeted at libraries and archives. Library and information studies schools across Canada have begun to incorporate courses that touch on the issue of digital preservation into their curriculum (ie. the Electronic Records stream at the University of Toronto's Faculty of Information Studies). Some community colleges are also addressing digital information but their courses are few and poorly coordinated. Professional associations such as ARMA and the ACA offer training but these are often restricted to specific workshops and training sessions offered at conferences or as special events. Overall, current university and community level education and training in the preservation of digital information appears to be inadequate. An inter-disciplinary approach to education and training is needed, as is the establishment of educational standards in this area.

4.3 Leadership and Governance

As with other activities surrounding the creation, access, and preservation of digital information, leadership and governance efforts are, for the most part, sector specific. For example, Canadian Heritage has a strategy to support and develop Canadian cultural resources on the Internet. Through the Canadian Culture Online program and the

Canadian Heritage Information Network, Canadian Heritage administers funding programs, policy initiatives, and R&D activities aimed at developing a critical mass Canadian cultural content on the Internet. Likewise, in the education sector, Industry Canada has a played a strong leadership role in its support of the development of standards and best practices, as well as R&D. Other sectors, especially private industry, lack any discernable coordinated leadership.

The survey found no existing mechanisms (e.g. committees, etc.) in place to address digital information issues at the national, multi-sector level. While inter-jurisdictional partnerships are growing, through pan-Canadian, international initiatives, and cross-sector initiatives such as InterPARES, there are still large gulfs between sectors regarding the preservation of digital information. The silo analogy probably most accurately portrays the current environment. This is especially evident in the case of digital preservation. Content creators are often not aware or interested in developing their resources so that they can be preserved in the long-term, and digital content is being acquired and preserved by stewardship organizations in an ad hoc manner. There is a need for a governance structure to coordinate the digital information environment in order to ensure that digital information will be available and accessible in the future.

Exacerbating the situation is the fact that each discipline (records management, library services, etc.) and sector (newspaper, music, broadcasting, etc.) supports its own approach to the management of digital information. There is little sharing of standards and practices and experiences across sectors. With some exceptions, disciplines such as data management, records management, library services, and web content management tend to work in isolation from one another. This isolation has led to distinct cultures, philosophies, professional values, as well as policies, standards and practices and even technologies. It has even led to distinct vocabularies as each discipline builds its own definitions of key concepts (e.g. ‘record’, ‘publication’, ‘digital object’, digital content’, etc.). The lack of clarity and a shared understanding of key concepts are huge inhibitors to cross-disciplinary and cross-sector communication.

The lack of inter-sector approaches can be extrapolated to individual organizations where the management of digital information is often scattered, discipline-specific and viewed from the perspective of the individual program or business line rather than as a valued corporate asset that could benefit the organization as a whole. Often issues concerning the creation, access and preservation of digital information are subsumed under the information technology area of a given organization. Appropriate roles and responsibilities for the management of digital information (especially the collection and preservation of digital content) have yet to be defined and accountability is unclear, poorly assigned or non-existent. Any inter-disciplinary and enterprise-wide initiatives that might be established are often hampered by the lack of leadership, poorly assigned accountability and the absence of effective governance and management frameworks.

Digital information must be managed throughout its lifecycle and this requires the involvement of multiple stakeholders. This means that decisions regarding access and preservation of digital content are distributed across a number of different stakeholders

with diverging interests. Some are concerned with the immediate commercial value of their resources, others are interested in their preservation, and others with access to and re-use of material. It is little wonder that a national vision or strategy for digital information has yet to be established in Canada. However, if Canada is to maintain and preserve the digital information that contributes to its documentary heritage, then an inclusive and comprehensive approach to managing digital information is crucial. Strong leadership by key stakeholders is needed to navigate Canada in the ever increasingly digital universe.

5. Conclusions/Next Steps

Drawing on the issues and trends discussed in the previous section, this chapter articulates some conclusions and sets out the justification and next steps for the organization of a National Summit for Digital Information in Canada. The chapter is divided into two parts: The first part addresses key conclusions that follow from an analysis of the issues and trends described earlier. The second part presents the argument for a National Summit and recommends a number of next steps for achieving this goal.

5.1 Conclusions

Organizations involved in various aspects of digital information management are facing a wide range of issues, many of which are shared across multiple and diverse sectors of society. Based on the patterns emerging from the survey, conversations with contacts in various sectors, and the authors' personal experience, knowledge, and intuitive understanding of the issues being faced by many of the organizations identified through this survey, it appears that the concern of greatest significance is that of managing digital information through time.

The role of Canada's libraries and archives in the emerging digital environment should not be underestimated. The survey found that, despite the many technological and legislative hurdles, libraries and archives are the organizations most actively involved in the preservation of digital information. And, it is the library and archive communities that are raising the alarm about the urgent need for action in regards the preservation of digital information.

The management of digital information through time is a ongoing concern, not only for libraries and archives but for all stakeholders involved in the management of digital information, including the creators. While there are challenges surrounding the creation of and access to digital information in a variety of contexts, these challenges are being addressed through the development of the underlying infrastructure supporting information creation, access, and retrieval and the establishment of models, including economic models, designed to harmonize various approaches to digital information access and retrieval. On the other hand, the challenges of preserving the growing body of digital information into the future are looming large on the horizon.

Digital information is sensitive to loss or destruction because of the fragility of the media upon which the information is recorded, its dependence on technologies that change through time, the inadequacy of the metadata required to render the information understandable, and the absence of effective accountability frameworks to ensure that the

'People don't know what they don't have or, even worse, people don't know what they know'

Comments made by an interviewee to describe her feelings about the management of digital information within a major federal government department (i.e. the need to determine which information has longer-term value and the steps that need to be taken to ensure its preservation).

authenticity and integrity of the information is preserved for as long as required.

The preservation of digital information requires a management response, not just a technological response. The response must be active and sustained through time and it must address the preservation of digital information from both the strategic and tactical perspectives and within the context of the management frameworks that govern the businesses of organizations themselves. It must also be comprehensive and address all facets of the required preservation infrastructure: the **policies** that assign accountability, the **standards, practices, procedures** and **technologies** that enable the implementation of preservation strategies, and the **people** that make it all happen. These issues present a tremendous challenge and must be addressed in an inclusive and collaborative manner.

While the issues surrounding the capacity of Canadian organizations to preserve their digital information assets are becoming critical, there is room for optimism:

- Digital preservation concepts, strategies and processes are being developed and tested, and expectations are high that effective solutions will be found (but only if the relevant organizations cooperate with one another).
- Policies, standards and practices, and technologies are emerging to support the development of the comprehensive infrastructures that will be required to ensure that all facets of digital information preservation are addressed. Management frameworks that are capable of governing the tactical and strategic implementation of these frameworks are also emerging.
- The traditional stewards of digital information are beginning to work together. There is recognition that they are facing a common issue the resolution of which will require common approaches that build on the strengths that each can bring to the table.
- Awareness of the importance of digital preservation is growing outside of the traditional stewardship organizations. Creator communities are discovering that their digital information holdings have value, which can increase over time *if preserved*.
- As interest in digital preservation expands beyond libraries and archives, the potential for establishing powerful partnerships and bringing the issue into the mainstream is growing.
- Organizations such as Library and Archives Canada and others are prepared to step forward to offer leadership in the development of consistent and effective approaches to the preservation of digital information regardless of the sector in which it is generated.

> "A strategy for digital preservation is part and parcel of any national information policy and it should be integral to any investment in digital libraries and information superhighways."
>
> From *The Preservation of Digitised Collections: An Overview of Recent Progress and Persistent Challenges Worldwide,* by Marie-Thérèse Varlamoff and Sara Gould

Despite the progress being made, it is apparent that digital preservation has not penetrated all sectors equally and capacities are lacking, particularly amongst the creators of digital information. A wide range of challenges still needs to be addressed, including the division of responsibilities, selection of material, funding, and skills development. The resolution of the issues of digital preservation will require multi-sector collaboration.

All stakeholders will need a clear understanding of the issues, the goals, and the means by which these goals can be achieved - in other words a national strategy for digital preservation must be established.

However, a national strategy will not be successful without the collaboration and input of all stakeholder communities. Steps must be taken to establish a mechanism by which a strategy can be developed. This involves a process and venue by which concerned parties can work together to establish a shared understanding of the issues and a strategic 'way forward' based on collaboration and trust. A national summit on the preservation of digital information is not only warranted, it has become a necessity.

5.2 Next Steps

The steps suggested in this section are based on the following assumptions derived from the analysis of issues and trends discussed in the previous chapter:

- The most pressing issue facing Canadian organizations with respect to the management of digital information is their ability to preserve the authenticity, accessibility, and understandability of digital information over time.
- There is a growing recognition that cross-sector, multi-disciplinary approaches are required to address a set of shared issues concerning the preservation of digital information.
- The digital preservation issues are national in scope, and therefore a national strategy, involving all concerned groups and organizations should be developed.
- A national strategy requires a mechanism to foster collaboration and commitment amongst stakeholders.

Based on these assumptions, it follows that a National Summit would be an appropriate and expedient component in the development of a Canadian Digital Information Strategy. The following next steps are recommended for the development of such a National Summit:

1. Identify key players to serve as a planning group. This group would not necessarily be the organizing committee, but rather would be responsible for establishing the objectives, scope and outcomes of a National Summit for Digital Information, as well as how it should be organized and who should organize it, etc.

2. Organize consultation sessions with relevant sectors to confirm the objectives and agenda for the Summit.

4. Publicize the national summit widely, including the objectives, scope and agenda, to ensure that all sectors involved in digital information are aware of and have an opportunity to contribute.

5. Consider organizing pre-summit workshops on issues that might be raised at the summit.

6. Consider organizing a two-part summit similar to the approach adopted for the World Summit on the Information Society (WSIS). Such an approach would respect the breadth and depth of stakeholder interests in digital information and the wide range of issues associated with its creation, access and preservation. The first part would enable diverse groups to understand the digital information landscape and identify and confirm the critical multi-disciplinary, multi-sector issues. The second part, held perhaps held a year later, would focus on the establishment of a framework and plan for the development of a national digital information strategy. Inter-disciplinary and inter-sector workshops could be held between the first and second parts of the 'summit'. These would build on the results of the first part and set the stage for the agenda and outcomes established for the second part.

7. Consider establishing a network similar to the model established by ERPANET. ERPANET was successful in serving as a virtual clearinghouse and knowledge-base that focused on the preservation of cultural heritage and scientific digital objects. The dominant feature of ERPANET was the exchange of knowledge on state-of-the-art developments in digital preservation and the transfer of expertise among individuals and institutions. It also provided commentaries on recent publications, articles, etc., and case studies in organizations. The network could be established as a result of the National Summit and could be a valuable instrument in advancing the proposed national strategy.

Although objectives for a National Summit will ultimately be determined by stakeholders, participants may want to consider adopting the following objectives:

- To enhance awareness of the importance of digital preservation.
- To establish a shared understanding of the issues facing organizations involved in the management of digital information.
- To identify the requirements for and components of a National Digital Information Strategy.
- To determine the steps for developing a National Digital Information Strategy.

Some possible topics to be covered in a National Summit are outlined below:

- What are the key issues involved in the management of digital information?
- What is the nature of the current digital information landscape and from which perspective(s) should it be defined?
- Do we need a vision for digital information in Canada, and if so, what should that be?
- Given where we are now, what are the activities involved in achieving this vision?
- Who should be involved?
- What are the immediate next steps to be taken?

The stakeholders involved in the management of digital information are many and varied and it is not possible to include all stakeholders in a planning group for a National Summit. Based on the review of digital initiatives conducted for this report, and an identification of the emerging patterns, it is proposed that the planning group for the National Summit comprise individuals representing a wide range of organization types as well as a broad spectrum of professional disciplines that have a specific interest in or concern about the preservation and ongoing accessibility of digital information. A number of these same individuals and organizations should also be considered as participants in the Summit itself. Collectively, they will ensure that Canadians benefit from a Canadian Digital Information Strategy that is comprehensive in scope and dedicated to enabling the on-going availability of Canada's documentary heritage in digital form.

Appendix A

List of Key Digital Initiatives

Government Sector
Alliance of Libraries, Archives and Records Management (ALARM)
Association of Public Sector Information Professionals
Atlas of Canada
Canada Centre for Remote Sensing
Canadian Criminal Records Information Services
Canadian Health Information Association
Canadian Health Infoway
Canadian Health Network
Canadian Soil Information System
Centre For Health Evidence
Civil Aviation Registration System
Council of Federal Libraries
Depository Services Program Electronic Library
Energy, Mines and Metals Information Centre
Executive Correspondence Management System (ECMS)
Federal Science eLibrary
GCMS (Global Case Management System)
Geological Survey of Canada
Geo-Portal
Government and Technology Week
Information Management Community Development Initiative
Information Management Forum
Knowledge Management Forum
Land Negotiations Records
Land Status Automated System (LSAS).
Life Sciences Gateway
Management of Government Information Policy (2003)
Marine Environment Data Service
Meteorological Service of Canada
National Land & Water Information System
Our Missing Children Database
Passport on-line
PRISM
Strategis
Vancouver City: Licenses and Inspections
Vanmap
Veterans Registration Database
Youth Café

Education Sector
Alberta Library

BC Electronic Library Network
Canadian Initiative on Digital Libraries
Canadian Medical Association Journals
Canadian Research Knowledge Network
CANARIE
CanCore Application Profile for Learning Objects
CARL Institutional Repository Project
CISTI Source
Council of Prairie and Pacific University Libraries
EduSource Canada
EduSpecs
eLibrary Canada
Érudit
International Consortium for the Advancement of Academic Publishing
Internet Archive's Library Digitization Project
InterPARES (International Research on Permanent Authentic Records in Electronic Systems)
JSTOR
NRC Research Press
Ontario Scholars Portal
Open Journal System
Our Roots/Nos Racines
Paper of Record
reSearcher
SchoolNet
Stewardship of Scholarly Resources in a Digital World - A CARL Position Statement
Text Analysis Portal for Research (TAPoR)
Theses Canada
UNB Electronic Text Centre
University of Toronto Press Online

Cultural Sector
Alberta Heritage Digitization Project
Association of Canadian Archivists
Audio Visual Preservation Trust
Bibliotheque National Quebec—Enregistremments sonores
Canada-France Archives
Canada's Digital Collections
The Canadian Art Database
Canadian Business and Current Affairs
Canadian Century Research Infrastructure
Canadian Electronic Library
Canadian Heritage Information Network
Canadian Newstand
Canadian Newswire
Canadian Research Index

CBC Archives
Cinéroute
CoRIMedia
Culture.ca
Digital Cultural Content Forum
Digital Preservation for Museums: Recommendations
e-Content Institute
Early Canadiana Online
Electronic Collection: A Virtual Collection of Monographs and Periodicals
The Entertainment Software Association of Canada
Globe and Mail: Canada's Heritage from 1844
HearsayMusic.ca
Images Canada
Multicultural Canada Project
NewsDesk
OnDisC
Repère
Virtual Museum of Canada

Cross-Sector Initiatives/Organizations
Canadian Copyright Act
Canadian Internet Registration Authority
Communications Research Centre Canada
Computer Research Institute of Montreal
Creative Commons Licences
Digital Copyright Licences
Graduate School of Library and Information Studies - McGill University
International Internet Preservation Consortium
Internet Archive Wayback Machine
McGill University, Graduate School of Library and Information Studies
RightsEnforcer
Université de Montréal, École de bibliothéconomie et des sciences de l'information.
University of Alberta, School of Library and Information Studies
University of British Columbia, School for Library, Archives and Information Studies.
University of Toronto, Faculty of Information Studies.
Univeristy of Western Ontario, Faculty of Information and Media Studies
World Intellectual Property Organization

*Although individual libraries, archives and museums are not named in this list, it was found that these organizations are actively involved in the management of digital information and play a key role in the creation, provision of access to, and, in particular, the preservation of digital information in Canada

Appendix B

Database Design
(Access-generated DB design specs to be included)

Category I: Content Managers

1. Name of the organization
2. Title of the initiative
3. Sector (government, academic, commercial, etc.)
4. Information activity (creation, access, or preservation)
5. Type of initiative (*Content manager*, service provider, infrastructure, leadership)
6. Description:

    6.1 Subject matter of digital content.
    6.2 Type of digital content (statistical data, documents/records, images, video, 3D, GIS).
    6.3 Time frame covered by the content.
    6.4 Content jurisdiction (Canadian, non-Canadian, mix).
    6.5 Purpose of the initiative/organization.
    6.6 Current status (planned, underway, completed).
    6.7 Geographic location (local, provincial, federal, regional, inter-jurisdictional, nation-wide).
    6.8 Time frame of the initiative (i.e. how long underway).

7. Funding source(s)
8. Issues and opportunities being addressed by the initiative/organization.
9. Intended users or audience for the initiative/organization.
10. Relevant contact information: name, address, website, email

Category II: Service Providers

1. Name of the organization
2. Title of the initiative

3. Sector (government, academic, commercial, etc.)

4. Information activity (creation, access, or preservation)

5. Type of initiative (Content manager, *service provider*, infrastructure, leadership)

6. Description:

    6.1 Type of digital content targeted by service
    6.2 Purpose of the initiative/organization
    6.3 Current status (planned, underway, completed)
    6.4 Geographic location (local, provincial, federal, regional, inter-jurisdictional, nation-wide
    6.5 Time frame of the initiative (i.e. how long underway)

7. Funding source(s)

8. Issues and opportunities being addressed by the organization

9. Intended users or audience for the organization

10. Relevant contact information: name, address, website, email

Category III: Infrastructure Initiatives

1. Name of the organization.

2. Title of the initiative

3. Sector (government, academic, commercial, etc.)

4. Information activity (creation, access, or preservation)

5. Type of initiative (Content manager, service provider, *infrastructure (*laws and policies, standards and practices, technological infrastructure, education and training, research and development, human development), leadership

6. Description:

    6.1 Type of digital content supported by the initiative
    6.2 Purpose of the initiative
    6.3 Current status (planned, underway, completed)
    6.4 Geographic location (local, provincial, federal, regional, inter-jurisdictional, nation-wide)

6.5 Time frame of the initiative (i.e. how long underway)

7. Funding source(s)
8. Issues and opportunities being addressed by the initiative/organization.
9. Intended users or audience for the initiative/organization.
10. Relevant contact information: name, address, website, email.

Category IV: Leadership Organizations

1. Name of the organization
2. Title of the initiative (if applicable)
3. Sector (government, academic, commercial, etc.)
4. Information activity (creation, access, or preservation)
5. Type of initiative: content manager, service provider, infrastructure, *leadership*
6. Description of initiative

    6.1 Description of leadership role
    6.2 Purpose of organization
    6.3 Current status
    6.4 Geographic location
    6.5 Time frame of the initiative

7. Funding source(s)
8. Issues and opportunities being addressed by the initiative/organization.
9. Intended users or audience for the initiative/organization.
10. Relevant contact information: name, address, website, email.