InterPARES 3 Project

International Research on Permanent Authentic Records in Electronic Systems

TEAM Italy

The Preservation of Digital Records: the InterPARES approach (on the basis of its findings)

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The Goal of InterPARES

To develop the body of theory and methods necessary to ensure that digital records can be created in accurate and reliable form and maintained and preserved in authentic form, both in the long and the short term, for the use of those who created them and of society at large, regardless of technology obsolescence and media fragility; and to develop methods of implementations that can achieve such purposes regardless of the available resources and in respect of organizational culture.

The risk of the technological focus of the national legislators

- The rules approved at national and multi-national levels have generally created more risks and complexities than the technologies themselves,
- The infrastructures based on the bits control and on public key systems are expensive and not always necessary,
- The relevance of qualified record making, record managing and record keeping systems is often ignored even for public sectors
- The preservation of digital archives is considered a question to delegate to the final custodians

The risk of the technological focus of the national legislators (cont)

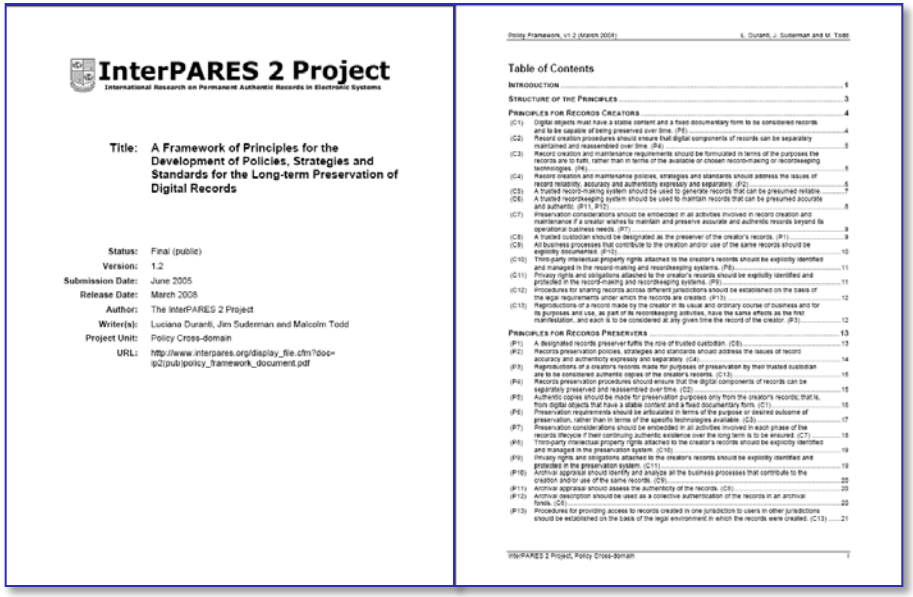
- The legislators have rarely understood all the implications of the principles of authenticity and integrity and have reduced the solutions to a large use of digital signatures and timestamps.

- Fundamentally, they have handed the maintenance of our memory to a sort of an interrupted chain of technological controls and devices, while the main question is – not so differently than in the past – the capacity to build in new and sustainable forms an uninterrupted chain of verifiable responsibilities and trustworthy custodians

Key IP 1 & 2 Final Products

Policy Framework

A framework of principles guiding the development of policies for records creating and preserving organizations



InterPARES 2 Project
International Research on Permanent Authentic Records in Electronic Systems

Title: A Framework of Principles for the Development of Policies, Strategies and Standards for the Long-term Preservation of Digital Records

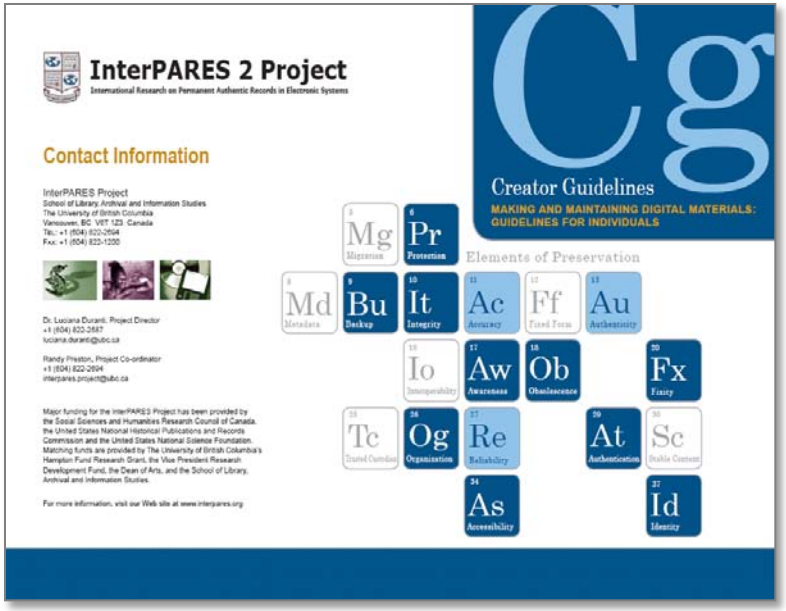
Status: Final (public)
Version: 1.2
Submission Date: June 2005
Release Date: March 2008
Author: The InterPARES 2 Project
Writer(s): Luciana Duranti, Jim Suderman and Malcolm Todd
Project Unit: Policy Cross-domain
URL: http://www.interpares.org/display_file.cfm?doc=ip2(pub)policy_framework_document.pdf

Table of Contents

Key IP 1 & 2 Final Products (cont)

Creator Guidelines

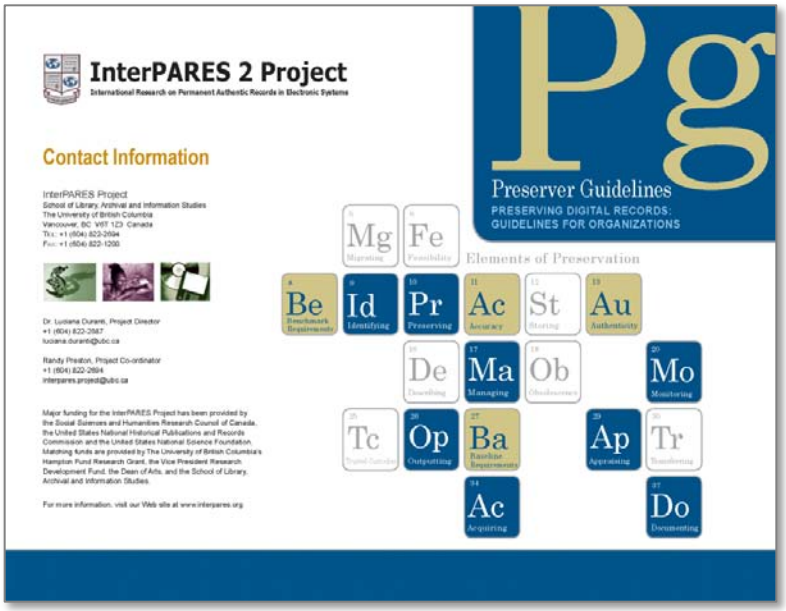
Recommendations for making and maintaining digital materials for individuals and small communities of practice



Key IP 1 & 2 Final Products (cont)

Preserver Guidelines

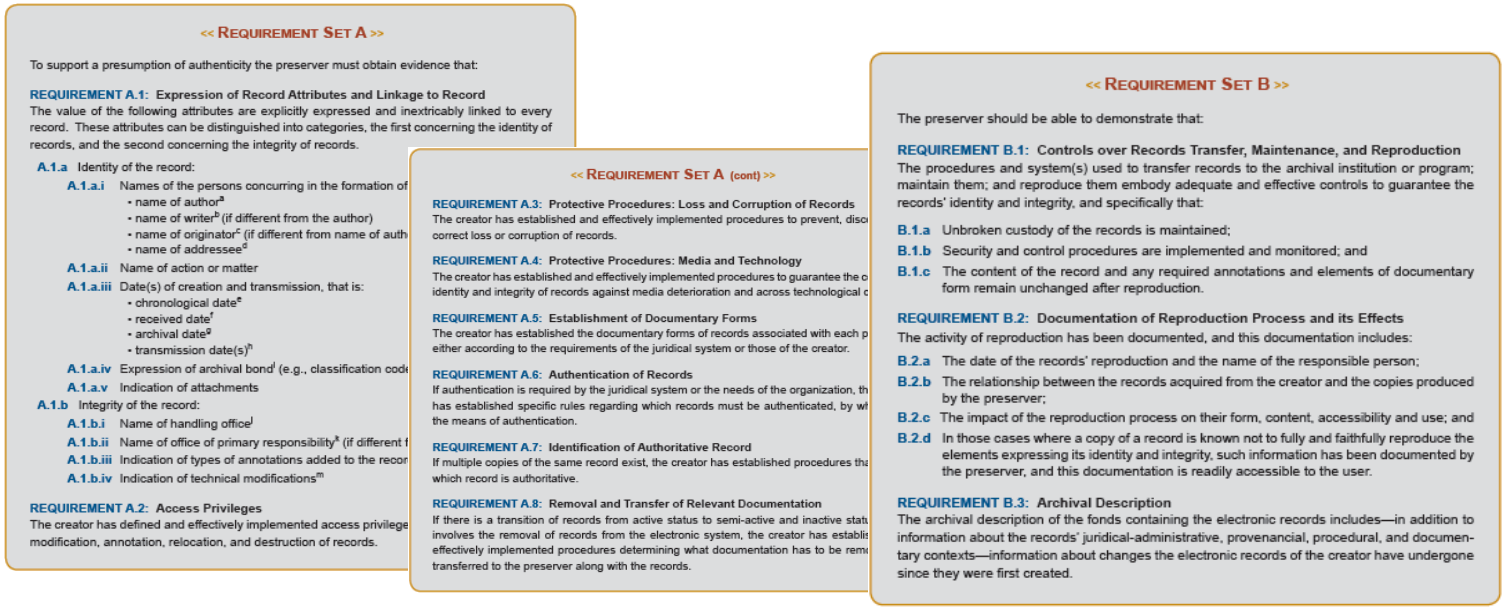
Recommendations for digital preservation for archival institutions



Key IP 1 & 2 Final Products (cont)

Benchmark and Baseline Requirements

Authenticity requirements for assessing and maintaining the authenticity of digital records



<< REQUIREMENT SET A >>

To support a presumption of authenticity the preserver must obtain evidence that:

REQUIREMENT A.1: Expression of Record Attributes and Linkage to Record
The value of the following attributes are explicitly expressed and inextricably linked to every record. These attributes can be distinguished into categories, the first concerning the identity of records, and the second concerning the integrity of records.

A.1.a Identity of the record:
- A.1.a.i Names of the persons concurring in the formation of
  - name of author[a]
  - name of writer[b] (if different from the author)
  - name of originator[c] (if different from name of auth
  - name of addressee[d]
- A.1.a.ii Name of action or matter
- A.1.a.iii Date(s) of creation and transmission, that is:
  - chronological date[e]
  - received date[f]
  - archival date[g]
  - transmission date(s)[h]
- A.1.a.iv Expression of archival bond[i] (e.g., classification cod
- A.1.a.v Indication of attachments

A.1.b Integrity of the record:
- A.1.b.i Name of handling office[j]
- A.1.b.ii Name of office of primary responsibility[k] (if different f
- A.1.b.iii Indication of types of annotations added to the recor
- A.1.b.iv Indication of technical modifications[m]

REQUIREMENT A.2: Access Privileges
The creator has defined and effectively implemented access privilege
modification, annotation, relocation, and destruction of records.

<< REQUIREMENT SET A (cont) >>

REQUIREMENT A.3: Protective Procedures: Loss and Corruption of Records
The creator has established and effectively implemented procedures to prevent, disc
correct loss or corruption of records.

REQUIREMENT A.4: Protective Procedures: Media and Technology
The creator has established and effectively implemented procedures to guarantee the c
identity and integrity of records against media deterioration and across technological c

REQUIREMENT A.5: Establishment of Documentary Forms
The creator has established the documentary forms of records associated with each p
either according to the requirements of the juridical system or those of the creator.

REQUIREMENT A.6: Authentication of Records
If authentication is required by the juridical system or the needs of the organization, th
has established specific rules regarding which records must be authenticated, by wh
the means of authentication.

REQUIREMENT A.7: Identification of Authoritative Record
If multiple copies of the same record exist, the creator has established procedures tha
which record is authoritative.

REQUIREMENT A.8: Removal and Transfer of Relevant Documentation
If there is a transition of records from active status to semi-active and inactive statu
involves the removal of records from the electronic system, the creator has establis
effectively implemented procedures determining what documentation has to be rem
transferred to the preserver along with the records.

<< REQUIREMENT SET B >>

The preserver should be able to demonstrate that:

REQUIREMENT B.1: Controls over Records Transfer, Maintenance, and Reproduction
The procedures and system(s) used to transfer records to the archival institution or program; maintain them; and reproduce them embody adequate and effective controls to guarantee the records' identity and integrity, and specifically that:

- B.1.a Unbroken custody of the records is maintained;
- B.1.b Security and control procedures are implemented and monitored; and
- B.1.c The content of the record and any required annotations and elements of documentary form remain unchanged after reproduction.

REQUIREMENT B.2: Documentation of Reproduction Process and its Effects
The activity of reproduction has been documented, and this documentation includes:

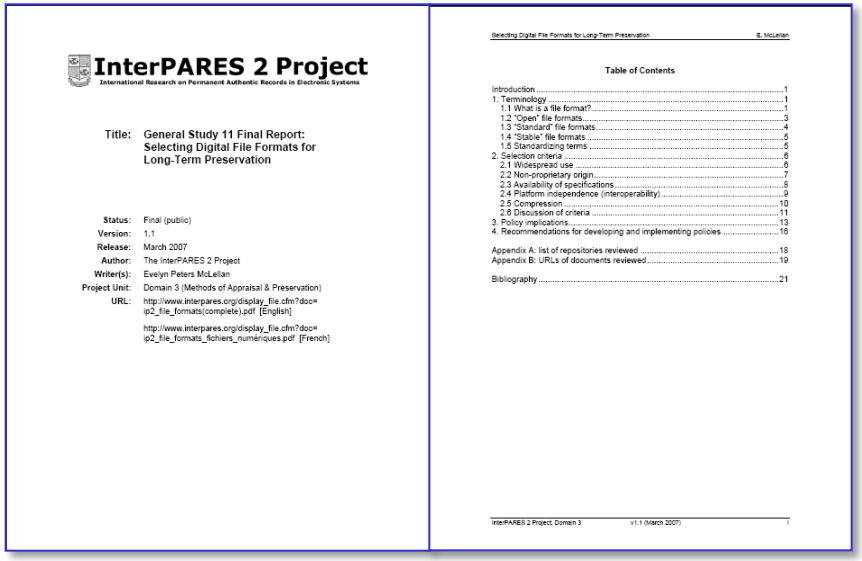
- B.2.a The date of the records' reproduction and the name of the responsible person;
- B.2.b The relationship between the records acquired from the creator and the copies produced by the preserver;
- B.2.c The impact of the reproduction process on their form, content, accessibility and use; and
- B.2.d In those cases where a copy of a record is known not to fully and faithfully reproduce the elements expressing its identity and integrity, such information has been documented by the preserver, and this documentation is readily accessible to the user.

REQUIREMENT B.3: Archival Description
The archival description of the fonds containing the electronic records includes—in addition to information about the records' juridical-administrative, provenancial, procedural, and documentary contexts—information about changes the electronic records of the creator have undergone since they were first created.

Key IP 1 & 2 Final Products (cont)

File Format Selection Guidelines

Principles and criteria for adoption of file formats, wrappers and encoding schemes



InterPARES 2 Project
International Research on Permanent Authentic Records in Electronic Systems

Title: General Study 11 Final Report: Selecting Digital File Formats for Long-Term Preservation

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Author: The InterPARES 2 Project
Writer(s): Evelyn Peters McLellan
Project Unit: Domain 3 (Methods of Appraisal & Preservation)
URL: http://www.interpares.org/display_file.cfm?doc=ip2_file_formats(complete).pdf [English]
http://www.interpares.org/display_file.cfm?doc=ip2_file_formats_fichiers_numériques.pdf [French]

Selecting Digital File Formats for Long-Term Preservation — E. McLellan

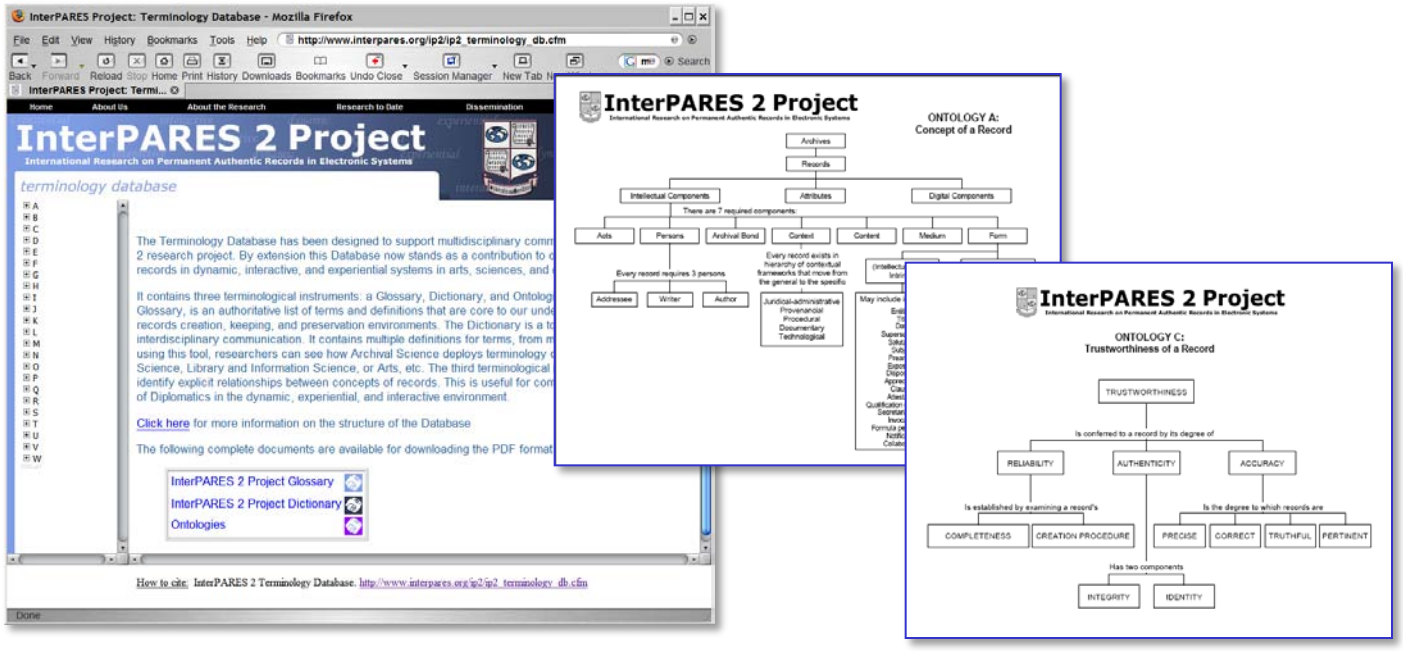
Table of Contents

InterPARES 2 Project, Domain 3 — v1.1 (March 2007) — i

Key IP 1 & 2 Final Products (cont)

Terminology Database

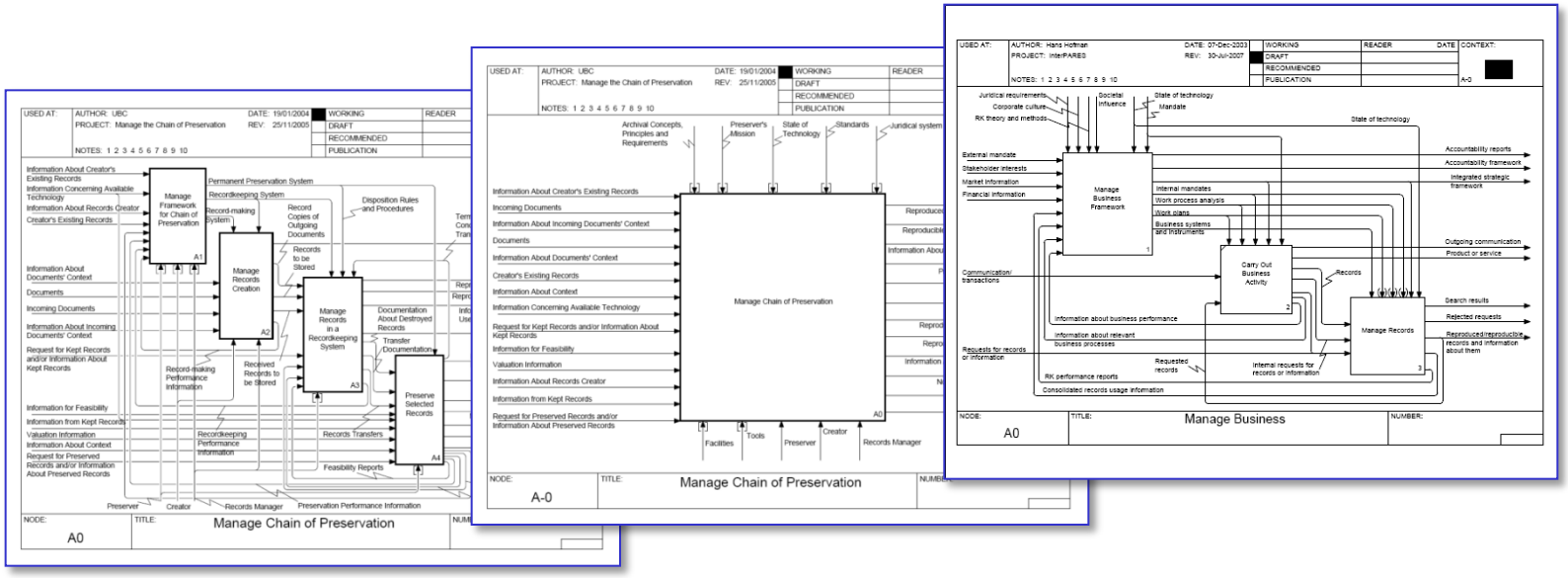
Including a glossary, a dictionary and ontologies



Key IP 1 & 2 Final Products (cont)

Two Records Management Models

Chain of Preservation (COP) Model (lifecycle)
Business-driven Recordkeeping (BDR) Model (continuum)



Key IP 1 & 2 Final Products (cont)

Two books:

Luciana Duranti, ed. *The Long-term Preservation of Authentic Electronic Records: Findings of the InterPARES Project* (San Miniato: Archilab, 2005). Available on line at http://www.interpares.org/book/index.cfm

Luciana Duranti and Randy Preston, eds. *InterPARES 2: Experiential, Interactive and Dynamic* (Padova: ANAI, 2008). Available on line at http://www.interpares.org/ip2/book.cfm

Most Important Findings

- **Conceptual**
  - The Concept of Record
  - The Concept of Chain of Preservation
  - The Concept of Trustworthiness
- **Methodological**
  - Appraisal
  - Preservation
- **Strategic**
  - Relationship Creator-Preserver
  - The Role of the Archivist

The Concept of Record

- **Record**: any document created (i.e., made or received and set aside for action or reference) by a physical or juridical person in the course of activity as an instrument and by-product of it
- **Document**: recorded information (i.e., information affixed to a medium in an objectified and syntactic form)
- **Information**: a message intended for communication across time and space
- **Data**: the smallest meaningful piece of information

Digital Record Characteristics

- **Medium**: necessary part of the technological context, not of the record
- **Stable Content and Fixed Form**
- **Archival Bond**: explicit linkages to other records inside or outside the system
- **Five Necessary Persons**: author, writer, originator, addressee, and creator
- **Act**: an action in which the records participates or which the record supports
- **Five Necessary Contexts**: juridical-administrative, provenancial, procedural, documentary, technological

Fixed Form

- An entity has fixed form if its binary content is stored so that the message it conveys can be rendered with the same documentary presentation it had on the screen when first saved (different digital presentation: Word to .pdf)
- An entity has fixed form also if the same content can be presented on the screen in several different ways in a limited series of possibilities: we have a different documentary presentation of the same stored record having stable content and fixed form (e.g. statistical data viewed as a pie chart, a bar chart, or a table)

Stable Content

- An entity has stable content if the data and the message it conveys are unchanged and unchangeable, meaning that data cannot be overwritten, altered, deleted or added to

- **Bounded Variability:** when changes to the documentary presentation of a determined stable content are limited and controlled by fixed rules, so that the same query or interaction always generates the same result, and we have different views of different subsets of content, due to the intention of the author or to different operating systems or applications

The Parts of a Digital Record

- **Formal Elements:** constituent parts of the record documentary form as shown on its face, e.g. address, salutation, preamble, complimentary close
- **Metadata:** the attributes of the records that demonstrate its identity and integrity
- **Digital Components:** stored digital entities that either contain one or more records or are contained in the record and require a specific preservation measure

Stored and Manifested Record

- **Stored record:** it is constituted of the digital component(s) used in re-producing it, which comprise the data to be processed in order to manifest the record (content data and form data) and the rules for processing the data, including those enabling variations (composition data)

- **Manifested record:** the visualization of the record in a form suitable for presentation to a person or a system. Sometimes, it does not have a corresponding stored record, but it is re-created from fixed content data when a user's action associates them with specific form data and composition data (e.g. a record produced from a relational database)

Static and Interactive Records

- **Static Records:** They do not provide possibilities for changing their manifest content or form beyond opening, closing and navigating: e-mail, reports, sound recordings, motion video, snapshots of web pages
- **Interactive Records:** They present variable content, form, or both, but the rules governing the content and form of presentation are fixed. Ex. Interactive web pages, online catalogs, records enabling performances

Interactive Entities

- **Not-dynamic**: the rules governing the presentation of content and form do not vary, and the content presented each time is selected from a fixed store of data. Ex. Interactive web pages, online catalogs, records enabling performances—they are records
- **Dynamic**: the rules governing the presentation of content and form may vary—they are potential records

New Concept of Records Life-Cycle

Based on the recognition that we cannot maintain or preserve digital records, but only the ability to re-produce or re-create them, and that re-productions and re-creations of digital records

- if made by the creator in the course of and for the purposes of its business, are **records of the creator**, while
- if made by the preserver in the course and for the purposes of archival functions, are **authentic copies of the records of the creator**

As a Consequence…

- The preserver can only preserve what it receives from the creator by making an authentic copy of it, and has no right to stabilize it or alter its documentary form—only its digital presentation, or format
- Whether the stabilized record of the creator and its authentic copy made by the preserver are to be considered trustworthy depends on the context in which they are created and used but also on the capacity to document the preservation processes

Trustworthiness

Reliability

The trustworthiness of a record as a statement of fact,

based on:

- the competence of its author
- the controls on its creation

Accuracy

The correctness and precision of a record's content

based on:

- the competence of its author
- the controls on content recording and transmission

Authenticity

The trustworthiness of a record that is what it purports to be, untampered with and uncorrupted

based on:

- identity
- integrity

Authenticity: Identity

The whole of the attributes of a record that characterize it as unique, and that distinguish it from other records.

Identity metadata:

- names of the 5 persons concurring in its creation
- date(s) and time(s) of issuing, creation and transmission
- the matter or action in which it participates
- the expression of its archival bond
- documentary form
- digital presentation
- the indication of any attachment(s)
- digital signature
- name of the person responsible for the business matter

Authenticity: Integrity

A record has integrity if the message it is meant to communicate in order to achieve its purpose is unaltered.

Integrity metadata:

- name(s) of handling persons over time
- name of person responsible for keeping the record
- indication of annotations
- indication of technical changes
- indication of presence or removal of digital signature
- time of planned removal from the system
- time of transfer to a custodian
- time of planned deletion
- existence and location of duplicates outside the system

Authentication

A means of declaring the authenticity of a record at one particular moment in time -- possibly without regard to other evidence of identity and integrity.

Example: the **digital signature**. Functionally equivalent to medieval seals (not signatures):

- verifies origin (identity)
- certifies intactness (integrity)
- makes record indisputable and incontestable (non-repudiation)

The analogy is not perfect, because the medieval seal was associated exclusively with a person, while the digital signature is associated with a given person and a specific record, and because the former is an expression of authority, while the latter is only a mathematical expression.

Digital Records Preservation

1. Establish a digital preservation program
2. Appraise digital records
3. Transfer digital records to the preserver's custody
4. Process digital records
5. Create archival description
6. Store digital records
7. Convert and migrate digital records

Establish a Digital Preservation Program

- Establish scope and objectives
- Acquire resources
- Offer advice (for creators)
- Set a good example:
  - preservers must establish, within their own organization, a record-making and a recordkeeping environment; ensure hands-on training to archivists; develop a test-bed where upgrades and innovations can be introduced and evaluated and a working prototype that can be used in demonstrations

Establish a Digital Preservation Program (cont.)

- Develop procedures: controls over records transfer, maintenance and reproduction to ensure that
  - unbroken custody of the records is maintained;
  - security and control procedures are implemented and monitored;
  - the content of the records and the required information, including metadata, remain unchanged after reproduction

Establish a Digital Preservation Program (cont.)

- Implement maintenance strategies, including
  - A1. Clear allocation of responsibilities
  - A2. Provision of appropriate technical infrastructure
  - A3. Implementation of a plan for system maintenance, support and replacement
  - A4. Implementation of a plan for the transfer of records to new storage media on a regular basis
  - A5. Adherence to appropriate storage and handling conditions for storage media
  - A6. Redundancy and regular backup of the digital objects
  - A7. Establishment of system security
  - A8. Disaster planning

Appraise Digital Records

1. As early as possible in the life of the records, assess their continuing value to the creator (after having identified multiple owners) and/or the designated preserver
2. Assess the authenticity of the records considered for continuing preservation, and document the process
3. Determine the feasibility of their preservation (after having identified all digital components) by the designated preserver (creator and/or delegated archives); and,
4. Constantly monitor all the records of the creator and, if warranted by the changes that they have undergone through time, revise the appraisal decision

Document the Authenticity Assessment

- When appraising records created in a digital environment, the assessment of the authenticity of records must become a more overt, visible process performed and documented by the preserver with reference to :
  - unbroken chain of custody,
  - knowledge of recordkeeping practices
- The appraisal report should document the controls put in place by the creator to guarantee the identity and integrity of the records and thus the presumption of their authenticity.

Document the Authenticity Assessment (cont)

The controls documented in the report include:

- A.1 Expression of Record Attributes and Linkage to Record (e.g., identity and integrity metadata)
- A.2 Access Privileges
- A.3 Protective Procedures against Loss and Corruption of Records
- A.4 Protective Procedures against Media Deterioration and Technological Change
- A.5 Establishment of Documentary Forms
- A.6 Authentication of Records
- A.7 Identification of Authoritative Record
- A.8 Removal and Transfer of Relevant Documentation

Determine the Feasibility of Preservation

- It means deciding whether the digital components (to be carefully identified) embodying the essential elements that confer identity and ensure the integrity of the records can be preserved, given the preserver's current and anticipated capabilities: a careful investigation of the technical preservation requirements for preservation is required with reference to the costs analysis
- A digital component is a digital object that contains all or part of the digital record, and/or data or metadata necessary to order, structure, or manifest its content, and that requires specific methods for preservation
- Digital components are to the stored record what elements of form are to the manifested record.

Determine the Feasibility of Preservation: an Example

- One common digital component is the library of fonts, any number of which can be selected by the creator to be used in the presentation of a word-processed document.
- In Windows, the fonts are stored in '.dll' (or dynamic link library) files.
- For the preserver to be able to reproduce this record to reflect the creator's original intentions, both the digital component containing the text and the digital component containing the font must have been preserved, as well as the link between them established in such a way that the software attempting to display the content of the text file can find the appropriate font library.

Monitor the Records

- All the records (not only those appraised for continuing preservation) and all the digital components must be checked on a regular basis
- This involves looking for changes both in their technological context and in their use
- In some cases it may be necessary to repeat the appraisal because of changes that can affect the feasibility of preservation or because the records result from other functions or present different characteristics
- In most cases, monitoring produces minor revisions to the documentation on the selection and to the terms and conditions of transfer

Acquire Selected Digital Records

- Develop shared plan for transfer:
  - a plan agreed upon by both parties is required (including – if applicable – a common decision on the physical and logical formats for transfer)
- Enforce standardised procedures:
  - See the ICA draft standard for digital records transfer (Record Exchange Standard BRS (Business Requirements Specification)

Acquire Selected Digital Records (cont.)

- Keep the oldest available logical format:
  - the original format should, whenever feasible, be maintained by the preserver, in addition to any preservation or reference copies generated after the transfer.
- Avoid duplicates

Acquire Selected Digital Records (cont.)

- Document all processing:
  - why certain processes were applied to the records;
  - what records were processed;
  - the date when the process was performed;
  - the names of persons performing and documenting the various steps of the process(es);
  - the impact of the process performed on the records' form, content, accessibility and use; and
  - the description of any damage, loss or other problems encountered as a result of the processing, including any effect on the elements expressing the records' identity and integrity

Preservation

It involves the creation of authentic copies of the records of the creator. Their authenticity is guaranteed by:

- a controlled process of migration of the acquired records to the archives technological environment (always keeping the records in the format in which they were acquired)
- the accurate documentation of any change that the records undergo during such process and every time that the archives technological environment is upgraded
- the implementation and monitoring of privileges concerning the access, use and reproduction of the records within the archives

Preservation (cont.)

- the establishment of procedures to prevent, discover, and correct loss or corruption of records, as well as
- procedures to guarantee the continuing identity and integrity of the records against media deterioration and across technological changes (ongoing conversion and migration) also by maintaining proper storage; and
- if authentication of individual records is required, by the existence of rules determining responsibility for and means of authentication.

Archival Description

Archival description acquires a primary authentication function

- The function of archival description is to provide an historical view of the records and of their transformations while maintaining the bond of their common provenance and destination
- It should include the information about the records (and the relationships among digital components) and their contexts collected during the appraisal and processing stages, including the documentation related to the transfer and all the preservation processes

What Else Is Needed?

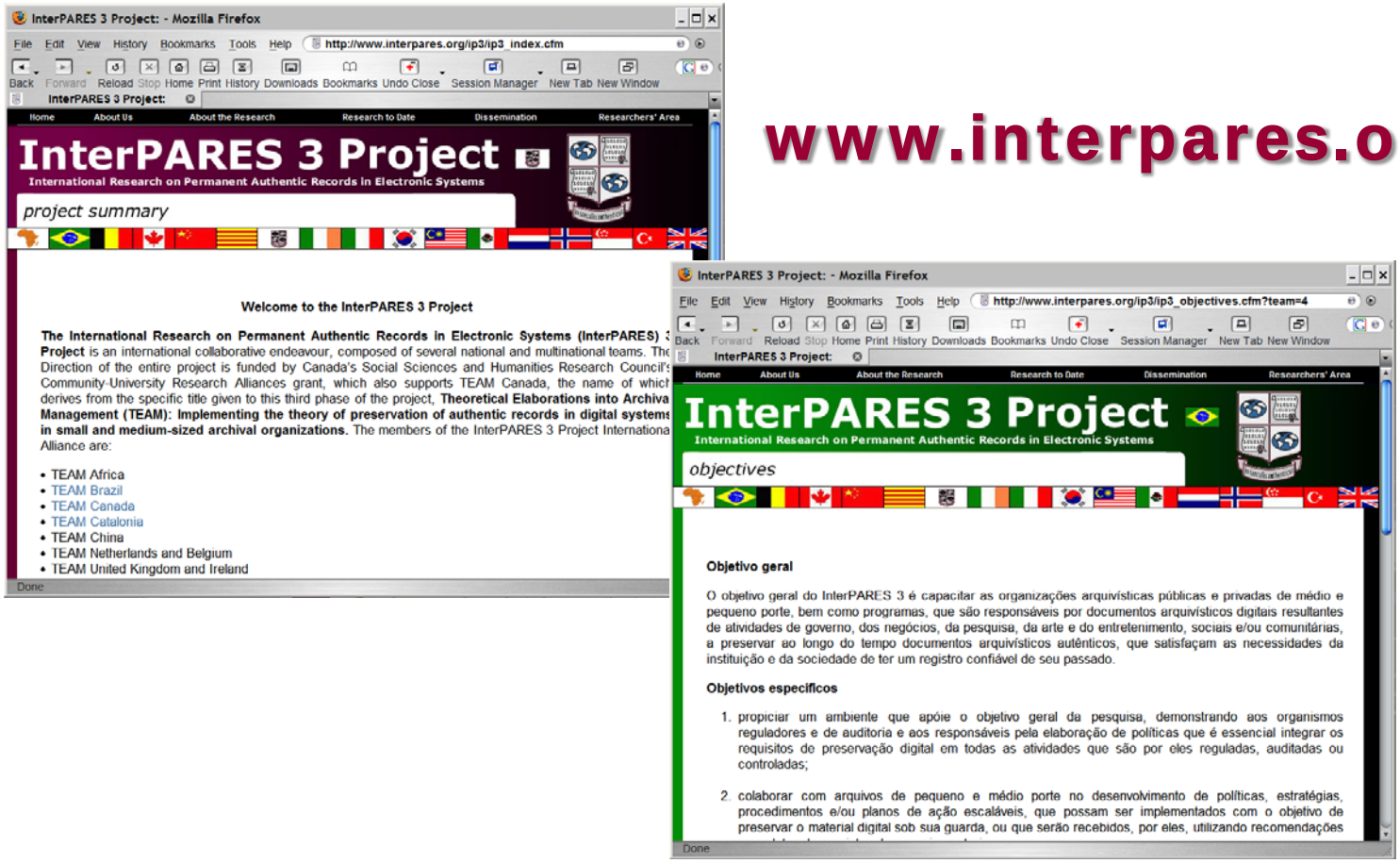
- The unbroken chain of preservation must begin at creation and continue from the record-making system to the recordkeeping system and the record preservation system
- Keeping in mind that solutions to digital preservation are always specific, respect the organizational culture: the collection of values and norms that are shared by people and groups in an organization and that control the way they interact with each other and with stakeholders outside the organization
- The new emphasis on accountability allows the archives to fulfill these needs by presenting itself as the trusted custodian

Archivist as Trusted Custodian

The trusted custodian is a person who

- acts as a **neutral third party**, i.e., demonstrates that he/she has no stake in the content of the records and no reason to alter records under his/her custody, and that he/she will not allow anybody to alter the records either accidentally or on purpose,
- is equipped with the **knowledge and skills** necessary to fulfil its responsibilities, which should be acquired through formal education, and
- establishes a **trusted preservation system** that is capable of ensuring that accurate and authentic copies of the creator's records are acquired and preserved

InterPARES 3 Web Site



www.interpares.org