भारतीय मानक
Indian Standard

IS 16789 : 2018
ISO 13008 : 2012

सूचना और प्रलेखन — डिजिटल अभिलेख रूपांतरण और प्रवास प्रक्रिया

Information and Documentation — Digital Records Conversion and Migration Process

ICS 01.140.20

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NATIONAL FOREWORD

This Indian Standard which is identical with ISO 13008 : 2012 'Information and documentation — Digital records conversion and migration process' issued by the International Organization for Standardization (ISO) was adopted by the Bureau of Indian Standards on the recommendation of the Documentation and Information Sectional Committee and approval of the Management and Systems Division Council.

The text of ISO Standard has been approved as suitable for publication as an Indian Standard without deviations. Certain conventions are however not identical to those used in Indian Standards. Attention is particularly drawn to the following:

a) Wherever the words 'International Standard' appear referring to this standard, they should be read as 'Indian Standard'.
b) Comma (,) has been used as a decimal marker while in Indian Standards, the current practice is to use a point (.) as the decimal marker.

In this adopted standard, reference appears to certain International Standards for which Indian Standards also exist. The corresponding Indian Standards, which are to be substituted in their places, are listed below along with their degree of equivalence for the editions indicated:

International Standard	*Corresponding Indian Standard*	*Degree of Equivalence*
ISO 23081-2 : 2009 Information and documentation — Managing metadata for records — Part 2: Conceptual and implementation issues	IS 15994 (Part 2) : 2012 Information and documentation — Managing metadata for records: Part 2 Conceptual and implementation issues	Identical
ISO 15489-1 : 2001 Information and documentation — Records management — Part 1: General	IS 16787 (Part 1) : 2017 Information and documentation — Records management: Part 1 General	Identical with ISO 15489-1 : 2016

Introduction

This International Standard provides guidance for the conversion of records from one format to another and the migration of records from one hardware or software configuration to another. It contains applicable records management requirements, the organizational and business framework for conducting the conversion and migration process, technology planning issues, and monitoring/controls for the process. It also identifies the steps, components and particular methodologies for each of these processes, covering such topics as workflow, testing, version control and validation.

The development of this International Standard was derived from Reference [13].

With the rapid pace of technological change, many records in digital form will, at some point, need to be converted from one format to another, or migrated from one system to another to ensure their continued accessibility and processability.

This is not to suggest that conversion and migration are the only approaches to preserving digital records. Other methods, such as emulation, do exist or are under development. Conversion and migration are, however, two of the more prevalent methods of digital preservation at this time. While this International Standard does not address digital preservation per se, the conversion and migration processes can have an impact on a digital preservation strategy. How an organization chooses to set up the conversion and migration processes (which format to employ, the level of control needed, and so on) largely influences its view of the record. At the time of the development of this International Standard, no single preferred preservation method had been identified. However, institutions recognize the benefit of standardized procedures; many test beds and task forces have been established to explore and research conversion, migration, emulation and refreshment, among other preservation procedures, to determine what should work best.

Conversion and migration represent separate approaches to preserving digital records. It is important to implement them in a managed way to prevent any degradation or loss in the authenticity, reliability, integrity and usability of the records, thus ensuring an “authoritative record” as described in ISO 15489-1:2001, 7.2.2 to 7.2.5. This International Standard outlines the program components, planning issues, recordkeeping requirements and procedures for performing the conversion and migration of digital records so as to preserve their authenticity, reliability, integrity and usability so that they continue to act as evidence of business transactions.

From the outset, note that it is not necessary to adopt all of the procedures recommended in this International Standard to ensure that records management requirements are met. The decision regarding which procedures to adopt depends on such factors as the type of conversion or migration to be performed and the level of risk the organization is willing to accept. In addition, organizations would be well advised to incorporate future planning for further conversion and/or migration of records among requirements for managing enterprise electronic recordkeeping systems.

Before starting a conversion or migration project, individuals designated as “key” to the process need to be aware of records management requirements. The term “recordkeeping criteria/requirements” in records and information management means an adherence to a set of principles that relate to record integrity, authenticity, reliability and usability. Adherence to these principles ensures that record content, context and structure are maintained and that a given record’s standing as evidence of business activity is not compromised. The principles apply regardless of how long the record is retained.

This International Standard does not specifically address conversions and migrations as a routine, ongoing business-as-usual work.

Indian Standard

INFORMATION AND DOCUMENTATION — DIGITAL RECORDS CONVERSION AND MIGRATION PROCESS

1 Scope

This International Standard specifies the planning issues, requirements and procedures for the conversion and/or migration of digital records (which includes digital objects plus metadata) in order to preserve the authenticity, reliability, integrity and usability of such records as evidence of business transactions. These digital records can be active or residing in a repository.

These procedures do not comprehensively cover:

— backup systems;

— preservation of digital records;

— functionality of trusted digital repositories;

— the process of converting analogue formats to digital formats and vice versa.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 15489-1, *Information and documentation — Records management — Part 1: General*

ISO 23081-2, *Information and documentation — Managing metadata for records — Part 2: Conceptual and implementation issues*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 15489-1 and the following apply.

3.1
access
right, opportunity, means of finding, using, or retrieving information

[ISO 15489-1:2001, definition 3.1]

3.2
attribute
characteristic of an object or entity

NOTE Adapted from ISO/IEC 11179-3:2003.

3.3
authenticity
record that can be proven to be what it purports to be, to have been created or sent by the person purported to have created or sent it, and to have been created or sent at the time purported

NOTE This term is further described in ISO 15489-1:2001, 7.2.2.

3.4
content
subject information of a document

[IEC 82045-1:2001, definition 3.2.2]

3.5
conversion
⟨record⟩ process of changing records from one format to another while maintaining the characteristics of the records

3.6
data cleansing
process of reviewing and correcting data to ensure data are in a standardized format

NOTE Correction may be carried out for incompleteness, incorrect formatting, obsolescence, duplication, etc. It is often done prior to merging data sets or converting data from one system/database to another.

3.7
data object
discrete data, considered as a unit, representing an instance of a data structure that is known or assumed to be known

[ISO/IEC 2382-17:1999, definition 17.01.11]

3.8
emulation
use of a data processing system to imitate another data processing system, so that the imitating system accepts the same data, executes the same programs, and achieves the same results as the imitated system

NOTE Adapted from ISO/IEC 2382-1:1993.

3.9
encryption
(reversible) transformation of data by a cryptographic algorithm to produce ciphertext, i.e. to hide the information content of the data

NOTE Adapted from ISO/IEC 18033-1:2005.

3.10
file format
encoding of a file type that can be rendered or interpreted in a consistent, expected and meaningful way through the intervention of a particular piece of software or hardware which has been designed to handle that format

NOTE A file may (or may not) be a container containing zero or more files of various formats. File formats may be defined by a specification, or by a reference software system. Many file formats exist in forms with minor variations and many also in more than one version. Typing of file formats should be interpreted generously rather than strictly, but sufficiently precisely to distinguish versions where such distinctions have significant interpretive consequences.

[PRONOM]

3.11
integrity
quality of being complete and unaltered

NOTE This term is further described in ISO 15489-1:2001, 7.2.4.

3.12
metadata
⟨records⟩ data describing context, content, and structure of records and their management through time

[ISO 15489-1:2001, definition 3.12]

3.13
migration
⟨records⟩ process of moving records, including their existing characteristics, from one hardware or software configuration to another without changing the format

3.14
originating
initial manifestation of something

3.15
preservation
processes and operations involved in ensuring the technical and intellectual survival of authentic records through time

[ISO 15489-1:2001, definition 3.14]

3.16
preservation metadata
metadata that supports the viability, renderability, understandability, authenticity and identity of digital objects in a preservation context

[PREMIS Data Dictionary for Preservation Metadata, version 2.0, March 2008]

3.17
record
information created, received, and maintained as evidence and/or as an asset by an organization or person, in pursuance of legal obligations or in the transaction of business, regardless of medium, form or format

NOTE Adapted from ISO 15489-1:2001.

3.18
refreshment
data migration where the media is replaced with equivalent media such that all storage hardware and software functionality is unchanged

NOTE Adapted from ISO 14721:2003.

3.19
reliability
measure of the completeness and accuracy of the representation of transactions and activities, or of the facts to which they attest

NOTE This term is further described in ISO 15489-1:2001, 7.2.3.

3.20
replication
digital migration where there is no change to the packaging information, the content information, and the preservation description information

NOTE The bits used to represent these information objects are preserved in the transfer to the same or new media instance.

NOTE Adapted from ISO 14721:2003.

3.21
usability
⟨records⟩ property of being able to be located, retrieved, presented and interpreted

NOTE This term is further described in ISO 15489-1:2001, 7.2.5.

3.22
validation
confirmation, through the provision of objective evidence, that the requirements for a specific intended use or application have been fulfilled

NOTE Adapted from ISO 9000:2005.

4 Organizational and business framework

4.1 General

This clause addresses the drivers that often prompt the need for the conversion or migration of digital records, the issues that organizations should consider when evaluating the need for conversion or migration of their records, and the steps taken in developing a conversion and migration program. It discusses the decision making and resource allocation associated with the conversion or migration within the organizational framework, as well as the technical infrastructure that supports the conversion and migration processes and which shall be used to ensure the records' authenticity and integrity for as long as they are needed.

4.2 Conversion and migration drivers

4.2.1 General

A variety of drivers can compel an organization to convert or migrate its digital records. Some records have longer retention requirements than a software application or storage medium can sustain, prompting organizations to convert or migrate their records while supporting systems are still viable. Organizations might also choose to convert or migrate records proactively on the basis of operational factors relating to record volume, access, storage efficiency, business and technology cycles, or organizational change (such as mergers and acquisitions). In extreme circumstances, organizations might be compelled to convert or migrate records in response to regulatory or legal actions.

4.2.2 Conversion drivers

Conversion is defined as the process of changing records from one format to another. Some examples of drivers that could require digital conversion include the following.

a) Format change: for example, records stored in a closed format are converted to an open file format, such as a conversion of a Word file to PDF/A.

b) Format obsolescence: for example, records stored in an obsolete but still readable word processing format are converted to a current word processing format.

4.2.3 Migration drivers

Migration is defined as the process of moving records from one hardware or software configuration to another without changing the format. Some examples of drivers that could require digital migration include the following.

a) There may be a need to migrate records from one structure to another. For example, records existing in several legacy databases might be restructured into a new consolidated database (e.g. from Oracle to SQL Server).

b) The platform in which the records were created is changing and the records need to be migrated to the new platform. For example, records might need to be moved from a Microsoft Windows platform to a UNIX platform.

c) A migration is prudent from a business perspective (e.g. to introduce a new system with improved functionality). For example, a migration of records might be needed to support a change from a physical business presence to a web-based storefront or to move records from a shared drive to an electronic document and records management system (EDRMS).

Organizations have an obligation to assess, document and manage their records in the normal course of business. Ongoing accessibility and compliance of digital records with a dynamic regulatory and technical environment demand rigorous, coordinated efforts and sustained funding.

Decisions related to conversion and migration shall be based on analysis of the importance of the organization's digital records and the impact of technology infrastructure and investments during the records' existence, as well as on knowledge about standards and best practices relating to conversion and migration of digital records.

4.3 Planning for the conversion and migration process

4.3.1 General

Records conversion and migration planning falls into the domain of the organization's information governance protocols and systems. As with more traditional asset (capital, facilities, human resources) management, established policies and procedures regarding the acquisition, management and disposition of information assets should be established, followed, documented and periodically audited for compliance and efficacy. Business managers (and their respective IS/IT support officers) should know where and how their record assets are being created, managed and stored, and should therefore be able to plan and justify the case for conversion or migration.

In a given organization, conversion or migration might take place as a one-time project or regularly as an ongoing activity in response to any of the above-mentioned situations. However, for effective preservation of digital records, conversion or migration shall be performed as part of an ongoing, well-planned and structured program. In all cases, it is preferable to plan, execute and validate the records conversion or migration process proactively, with adequate time and resources and with the least disruption to stakeholders and their respective business cycles and functions. During an unplanned event (natural or human-made), conversion or migration may have to be undertaken under extreme and therefore less than ideal conditions, which make it more costly and disruptive.

4.3.2 Risk management

Significant costs can be associated with the conversion and migration of digital records. As a result, an organization shall decide whether to convert or migrate some, all, or no records, based upon its level of acceptable risk. Records shall be analysed to determine their importance to the organization and the risk associated with their potential loss or corruption. Part of the organization's records management program should be to conduct an evaluation of records for retention purposes and assess the risks associated with them. Normally, the organization's records retention policies document these decisions.

An organization's records management practices are based on operational and other needs and perceptions of risks. Operational needs (e.g. fulfilling regulatory requirements, product development, providing access or documenting financial transactions) determine the strategies and levels of effort an organization undertakes to ensure the trustworthiness of a record. Risk assessment and risk mitigation, along with other techniques, are used to establish both management controls for and documentation requirements of activities. These risk assessments can also be used to establish records management controls. Risk assessments shall be conducted to establish appropriate levels of management controls prior to undertaking new initiatives.

From a records management perspective, two main risks are assessed when considering digital records:

1) challenges to the trustworthiness of the records (e.g. legal challenges) that can be expected over the life of the records;

2) loss, including loss of access to or unauthorized destruction of records.

Consequences are measured by the degree of loss that the organization or its customers would suffer if the trustworthiness of the records could not be verified or in the event of unauthorized loss or unauthorized destruction of records.

4.3.3 When to convert or migrate

Conversion or migration of records shall be performed before the technology and media (e.g. magnetic disks such as floppy disks, magnetic tape, and optical disks such as CDs and DVDs) upon which they depend become obsolete. Depending on factors such as volume and access requirements, it may be desirable to convert or migrate the records as soon as the target or end environment is known. If the perceived value of and/or risk to the records are sufficiently low, organizations might choose to wait until some other driver (e.g. software upgrade, system replacement, acquisition or merger) triggers the justification to convert or migrate.

4.3.4 Conversion and migration activities

In the digital environment, conversion and migration of an organization's records will be a routine activity, and therefore the organization should have a program, plans, and directives as necessary to ensure this activity is conducted in accordance with standards and business practices. Document obligations and interdependencies related to records preservation shall be acknowledged as early as possible in the analysis and requirements definition phase of both business process planning and technology investment planning.

When deciding whether internal or external resources, or a combination, will execute the conversion and migration activities (project-based), the following factors shall be taken into account.

— Skill sets: whether the organization has staff with the experience and knowledge to perform conversion and migration activities.

— Availability of human and technical resources: whether staff members with the appropriate skill sets are available during the project timeframe.

— Equipment: whether the organization has the right environment and tools to perform conversion and migration activities.

— Cost and timeline: whether the organization has the resources (budget and time) to perform conversion and migration activities.

— Capability to perform quality assurance/quality control: whether the organization has personnel with the experience and knowledge to perform quality assurance and quality control activities.

— Data sharing/data stewardship/ownership: which person(s) or business unit(s) in the organization will lead the conversion and migration activities.

— Validation: whether the organization has staff with the experience and knowledge needed to validate conversion and migration activities.

— Business cycles: which person(s) or business unit(s) in the organization will decide when conversion and migration activities shall occur.

4.4 Establishing a conversion and migration program

4.4.1 General

Organizations that maintain digital records for such periods that necessitate regular and ongoing conversion or migration shall establish a conversion and migration program before carrying out major digital records conversions or migrations.

This implies that the requirement to convert or migrate the digital components making up the organization's records is recognized, and a governance structure with direct or delegated executive authority is in place. The corporate policies of the organization shall authorize the establishment of a conversion and migration program.

The conversion and migration program governance structure authorizes when and how conversions and migrations occur and who is to carry them out. Normally, records professionals are responsible for authorizing the conversion and migration process with assistance from IT, the owner(s) of the business and the legal staff. The conversion and migration program governance structure also authorizes whatever audit process is to be implemented and identifies who is responsible for performing it.

Setting out the authorization and business area(s) responsible is essential to establishing conversion and migration as a normal and routine business activity for an organization.

To minimize risk in larger organizations, the conversion and migration program shall include authorization for:

— a limited number of events that trigger conversion or migration;

— the types of conversions and migrations to be done, and their intervals;

— the method of recording (and certifying if necessary) that the above activities are carried out as required.

The organization's policy or procedures document shall list these authorizations.

4.4.2 Development of procedures manuals

The process of converting and migrating digital records interferes significantly with the records' existence, creating risks to their authenticity, integrity, reliability and usability. To mitigate these risks, it is important to control the process by applying approved and documented procedures.

The approach to the development of a conversion and migration procedures manual is at the discretion of the individual organization. There could be separate manuals that address each type of conversion and migration, or a single manual with appropriate subsections for each type. At a minimum, the conversion and migration procedures manual shall address all phases of the conversion and migration process. Conversion and migration may be executed at the same time.

The manual shall also describe the procedures for disposition of source records or media; the unconverted records/media shall be removed from the active environment and maintained according to established disposition provisions, which shall always be documented. If additional types of conversions or migrations are encountered, specific manuals shall be developed for them.

All revisions to procedures should be documented in the manual with appropriate authorizations. Ad hoc manual entries should be avoided as they can destroy the credibility of the program in the event of an investigation or regulatory inquiry in which the method of conversion or migration underpins the establishment of the integrity of digital records as evidence.

Conversion and migration procedures manuals shall address all phases of the process as follows.

— Planning: the procedural steps, methods, people and other resources needed to execute a successful conversion/migration of the target digital records.

— Testing: the tests needed to verify that the planned procedures and methods will yield a successful conversion/migration of the records.

— Conversion and/or migration: the procedural steps to be performed in carrying out actual conversion and/or migration of the target digital records.

— Validation: the procedural steps and methods to be used to verify that the target digital records have been successfully converted or migrated. This will enable third parties to be certain that the authenticity of the records has been maintained through the use of a documented procedure to record the conversion or migration process. Quality assurance procedures shall enumerate the steps needed to ensure a controlled and secure conversion and migration process. Lastly, the content and format of error reports shall be generated once the conversion or migration is complete.

— Sign-off: the authorizations needed to verify that the conversion and migration process has been successfully performed in compliance with approved policy and procedures.

— Documentation: detailed records of the conversion and migration process during and after each conversion and migration project.

Clause 7 outlines additional details of the procedures that constitute each phase of the conversion and migration process.

5 Recordkeeping requirements

5.1 General

This clause includes those issues associated with the management of the records to be converted and migrated so that complete, accurate, reliable and authentic records can be produced once the conversion and migration process has been completed.

5.2 Conversion and migration requirements

The following activities shall be completed for a successful digital conversion or migration process, to ensure that recordkeeping requirements outlined in this clause can be met.

— Perform all conversion and migration process testing on a sample copy of the records. In case problems arise, do not undertake any irreversible activities. When performing conversion or migration activities, make sure the originating file is not deleted until the result is verified, and any jurisdictional legislative and policy requirements are met.

— Establish a methodology for comparing the content, context and structure of the converted/migrated records with those of the source records so that problems can be identified, corrected and validated. The source records may be disposed of once the validation is complete and all problems are fixed, and such decisions are documented and validated. In addition, ensure that all jurisdictional legislative and policy requirements are met before any source records are destroyed.

— Document all conversion and migration activities to ensure that the organization continues to possess complete, accessible and authentic records throughout their full retention period. This documentation shall demonstrate that all records, including those created while the conversion/migration activities were in progress, have been converted/migrated.

— Ensure that processes applied to the new format will yield consistent results compared to the same or similar processes applied in the originating format.

— It is possible that some of the digital information may be lost or corrupted prior to the conversion or migration. If this happens, document the damage. A conversion and migration plan should aim to reduce the risk of further degradation of the content, context and structure of the records to an absolute minimum.

— Consider physical and logical security when conversion or migration is undertaken. Physical security means access control to IT suites; logical security means access control to the platform in which the conversion or migration is being undertaken. The conversion and migration process shall not affect existing access rights to the data.

— Define what metadata and data are needed to retain the ability to reproduce a complete and authentic record so that this data can be protected during the conversion or migration.

— Define what metadata are needed in order to identify and use the record so that the record can be searched for and accessed after the conversion or migration.

— Document any attributes of the record that should not be converted to the new format, or migrated to the new system, and state the reason.

— The conversion or migration of digital records from one technology environment to another can alter the content, context or structure of the records. If this occurs, the organization might risk non-compliance with recordkeeping requirements through loss of the records' reliability and authenticity. An effective digital conversion and migration plan can be used to identify all of the characteristics of the records that shall be preserved after the records have been converted or migrated.

— Consult a records retention and disposition schedule prior to initiating a digital conversion or migration project in order to ensure that resources are not wasted on converting or migrating digital records that are to be destroyed.

— Identify records that are relational or linked and establish whether existing relationships or links could be compromised by the conversion or migration. Establish safeguards to protect these links during the conversion or migration.

— Determine whether the appearance of the record contributes to its meaning as a digital record (considering such things as formatting, colours, fonts, etc.). If appearance is integral to the meaning, the plan shall address how to maintain it. Once conversion or migration is complete, document any changes to the appearance of the record.

— Digital records (e.g. text documents, e-mail messages, databases, spreadsheets, web pages) are created using the technology (hardware and software) that is available at the time of their creation. The targeted format of the records shall be defined, and conversion or migration shall occur as quickly as possible before the current format of the digital information becomes obsolete so that new technology can be used for the conversion or migration procedures.

— Recordkeeping process metadata are essential to prove authenticity and reliability (see 5.3). A formal evaluation of the extent of the process metadata is required prior to deciding whether some or all of this metadata should be converted or migrated.

5.3 Conversion/migration process metadata

See ISO 23081-2, which specifies metadata requirements for managing records. Metadata documenting the conversion and/or migration process provide the information that allows one to demonstrate that a record, having gone through the conversion or migration process, continues to be authentic and reliable. Therefore, the creation, maintenance and preservation of this information is extremely important.

For the purposes of documenting the processes of conversion and migration, the event history metadata are crucial. During conversion/migration, the existing event history metadata shall be migrated with the record in order to ensure the ability to make assertions on the authenticity of the record. Every conversion or migration process shall create event history metadata for every individual record converted or migrated.

Relationships documented in metadata shall be maintained during conversion/migration. Relationships of particular concern may be:

— internal relationships, i.e. within the document, such as a document containing a linked spreadsheet or images;

— functional relationships, for example between records documenting related aspects of the business;

— aggregational relationships, for example documents aggregated to files/folders;

— structural relationships, for example between records and creating agents, or business;

— systematic relationships between records and control tools, such as business classification schemes, disposition authorities, access and security controls, and mandates (these control tools contain contextual information which informs the meaning of the record).

Conversion and migration processes shall ensure that the metadata about the records continues to be persistently linked to the converted or migrated record.

5.4 Recordkeeping process metadata implementation issues

As noted above, recordkeeping process metadata about the conversion and migration actions provide the information that allows one to demonstrate that a record, having gone through the conversion or migration process, continues to be authentic and reliable. Therefore, the creation, maintenance and preservation of this information are extremely important.

As records may go through multiple conversions, each conversion or migration shall create its own accompanying volume of event history. In this scenario, the metadata linked to the records will exponentially increase to document each conversion and/or migration the records undergo. The authenticity, reliability, integrity and usability of the records depend on the validity of each successive set of event history metadata.

Sometimes the value of the metadata elements within a record changes as a result of the conversion or migration process. If this occurs, every change in the metadata value shall be recorded in the event history metadata accompanying the record, in order to ensure that the records can be understood.

Compound documents and relationships between records also present issues at the time of conversion and/or migration. Assuming the related record is needed for the authenticity and reliability of a record, it is best to preserve the related record as an independent record within the recordkeeping system itself. In other words, bring the information into the system one controls rather than relying on maintaining a link to information outside the system. The related record shall have its own set of metadata that also documents the history of actions taken on that record.

6 Conversion and migration planning

6.1 General

This clause addresses the technology planning for the conversion and migration process. It is not intended to provide a comprehensive guide to technology planning and acquisition, but rather it identifies those key infrastructure issues and technology elements that ensure a successful conversion/migration project.

For the purpose of using generic terms, the description of the project refers to two systems:

a) the existing records system, on which the records are currently kept;

b) the new system, which may be:

- in the case of conversion of format, the existing system in which specific capabilities for handling a different records format are either activated or added;
- in the case of migration to another storage solution, the existing system in which new storage devices are either activated or added;
- in the case of migration from one records system to another, a completely different records system.

Technology planning involves assessment of current technological capabilities as well as specification development for new hardware and software that may be needed to successfully manage the conversion/migration process and operate the new system. New hardware and software may be needed for handling a different records format in the existing system, managing different storage devices, or migrating the records from one records system to another. In addition, technology planning shall address the organization's infrastructure and the sustainability of that infrastructure to support file formats, access and integrity.

If organizations do not already have technology development tools in place, records professionals and others assigned the responsibility of technology planning may find it helpful to develop planning templates, a methodology for identifying requirements and linking resources, and a traceability matrix. Individuals conducting the planning process shall also consider any organizational business operation rules that may apply.

6.2 Business requirements

An understanding of the requirements given in this subclause will be crucial for the specification development process and for ensuring that the technology planning process meets existing organizational policies and procedures for such activities.

- Identify and define the business needs and benefits of the anticipated conversion/migration project.
- Identify the legal and regulatory requirements.
- Ensure that all stakeholders, including users of the records system, have been contacted and sufficiently involved in the project.
- Ensure that all personnel with assigned duties in the conversion/migration project are given their tasks and their participation is secured and documented.

— Comply with non-technical requirements for hardware/software acquisition within the organization, i.e. project management objectives and timelines, price and contractual issues, purchasing procedures (e.g. request for proposal, bid development). These requirements may vary with the type of organization.

— Ensure that, if the conversion or migration process is carried out by an outside vendor, all business needs of the organization, technology compatibility issues, customization needs, testing, validation, training and provision of other services are thoroughly specified in the contractual agreement.

— Capture requirements and analysis of business needs in terms that can be measured and tested.

— Translate business requirements into a set of functional requirements.

— Evaluate and review the conversion/migration project at various stages to ensure that it will support the business needs and requirements of the organization.

— Address and incorporate training and education requirements.

— Plan for testing and parallel operation of existing and new systems. This may include providing access to both systems through user access applications or providing parallel interfaces to both systems for any IT application requiring it.

— Maintain the replaced system in order to provide for a roll-back plan in the event of failure of the conversion/migration process.

— Address and define quality control needs and objectives.

— Provide for a post-implementation review audit of the conversion/migration procedures and documentation in order to ensure compliance with business governance needs. This may include the need to provide industry-specific certification requirements.

6.3 General administrative planning

Administrative planning requires the development of tools and resources to ensure a smooth transition to the new system. Potential vendors shall be prepared to provide the same documentation and to indicate how they will do it. Even if the conversion/migration project will be managed totally in-house, attention to these administrative planning documents ensures that the transition from one system to another will be completed on schedule with all obligations met. The administrative planning of the conversion/migration project includes personnel resources, time and competencies. The documents given in the following list shall be created, except in cases of in-house projects, when some may not be necessary.

— Project management plan.

— Roles and responsibilities. Identify all internal and external personnel involved in the project and identify their expected roles.

— Terminology list.

— Delivery and installation schedule.

— Test plan of the conversion/migration in the new system.

— Maintenance plan during the conversion/migration.

— Training plan for the use of the converted/migrated records.

— Procedures manual.

— Conversion/migration documentation. Documentation includes any manuals, software guidance, table structure, mapping tools, operations procedures, hardware configuration and types of equipment required. It includes software and hardware to perform the conversion/migration, monitor the progress of the conversion/migration, report new system performance, log transactions and manage user access.

— Qualifications and experience of the vendor(s). If using an outside vendor, request a list of references or recent projects.

— Contracts and licence agreements.

6.4 Technology planning requirements

The capabilities and operation of the current system shall be assessed and described. It can be very helpful to gather information about the current system to aid the project team in addressing the technology requirements as part of a requirements document which defines exactly what the conversion/migration solution needs to do. Document the results of the assessment and distribute them to the project team and management.

The assessment process shall address the following areas.

— Detailed description of the current system.

— Compliance with organizational requirements for technology acquisition.

— Functional needs and capabilities of the current system.

— Data structures and elements.

— Identification (including location) of the actual records to be converted/migrated:

  — check whether the records are within their retention period (they do not require conversion/migration if they are due for destruction in the near future).

— Methodology for the conversion/migration. The methodology shall ensure:

  — maintenance of the integrity of the records;

  — that each record is completely converted/migrated;

  — that the authenticity of the converted/migrated records can be demonstrated;

  — that all necessary metadata/audit trails are retained (and converted/migrated where necessary);

  — that all legal and regulatory requirements are met.

— Ensuring that all approving stakeholders, including the person responsible for the records within the business, have approved the methodology and will validate at the appropriate time the conversion/migration of the records into the new system.

— Review and documenting of any risks associated with the conversion/migration.

— Quality control.

— Security and privacy.

7 Conversion and migration procedures

7.1 General

The purpose of this clause is to apply the recordkeeping requirements established in Clause 5. The conversion and migration procedures are composed of four key steps: planning, testing, converting and validating.

Each organization or institution is unique and has differing needs and objectives for establishing a conversion and migration program. Further, not all records within an organization will necessarily require the application of all conversion and migration procedures and requirements outlined in this International Standard in order to fulfil records management requirements. These requirements and procedures are meant to serve as a guide and a template. It is up to the organization's records professionals and legal staff to understand its

records management requirements, and to determine to what level to apply the requirements described in this International Standard.

7.2 Procedures

7.2.1 General

This clause specifies the requirements for conversion and migration by linking them to the procedures involved. These procedures become the controls which ensure the maintenance of authenticity, reliability, integrity and usability of the records to be converted or migrated.

Not all digital records in an organization will merit the full application of these controls. The organization shall determine the controls that the particular records may or may not merit during the conversion or migration project.

A conversion/migration project shall ensure the following in relation to the converted/migrated records:

— completeness of content;

— integrity;

— authenticity;

— completeness and accuracy of recordkeeping metadata (all required metadata shall be included and accurately populated, for example, the date of creation of the record is not to be replaced by the date of conversion/migration or the originating creator is not to be replaced by the operator conducting the conversion/migration);

— transparency of implementation (this control can be critical if the records are required for litigation purposes);

— fulfilment of legal requirements, such as retention requirements or the requirements of legislation covering the legal admissibility of digital records;

— maximization of platform flexibility;

— business flexibility;

— technical feasibility.

7.2.2 Guidance on selecting appropriate procedures

Each procedure outlined in this clause is designed to establish an element of control aimed at preserving the integrity, authenticity, reliability and usability of records as evidence of business transactions following a conversion or migration procedure. As noted previously, an organization need not follow all of the procedures outlined in this International Standard. Most organizations have to strike a difficult balance between following all the procedures (i.e. “perfect maintenance”) and such limiting factors as cost and time. The procedures an organization should follow, and the level of control they establish, depend on the organization’s own estimation of the risk/return ratio, that is, the cost of losing the records’ integrity, or losing them altogether, versus the cost of converting them following the procedures outlined in this International Standard. A number of factors, such as the retention requirement of the records, whether they are likely to be required as evidence in litigation, and the type of conversion or migration being undertaken, should have a bearing on how the risk/return ratio is calculated. Table 1 summarizes the main decision points to consider when choosing the extent to which the procedures described in this clause should be followed. The intention is to assist an organization in striking the right risk/return balance.

7.2.3 Maintaining the records’ characteristics

Conversion projects typically involve a change of file format, thus enabling the records to be used in newer systems. With migration projects, the file format of the digital record is not changed in any way. The digital record shall be copied or moved without change to the file format. For procedural aspects related to maintaining the records’ characteristics, see Table 1.

In order to demonstrate that a conversion or migration project has been successful, the following steps shall be taken:

— confirm that the file format has not changed (migration projects);

— ensure that all the necessary information is included in the converted or migrated records;

— where there are differences in the presentation of the information (such as differing fonts and/or page layouts), ensure that the integrity of the new presentation can be demonstrated;

— identify any conversion/migration errors and document those instances;

— confirm that all records have been converted or migrated (or identify those that have not been converted/migrated);

— update the records metadata to include details of the conversion or migration process;

— create a record of the conversion or migration process, including an audit report.

It may be appropriate to keep samples of records before and after conversion or migration, along with samples of extracts (such as prints or image files) that can be used to demonstrate the continuing authenticity, integrity, usability and reliability of the records.

Table 1 — Conversion/migration procedures decision points

Procedure	Decision point	Comments
Planning: all steps	Recommended for all conversions and migrations.	The amount of planning that needs to be done depends on the nature of the records, the amount of information that is already available about them, and the complexity and type of conversion or migration.
Testing: all steps	Is maintenance of integrity, authenticity, reliability and usability of the records of high importance?	The continuing relevance of the records, or whether they are likely to be required for legal or compliance purposes, may establish the degree to which their integrity, authenticity, reliability and usability are important to an organization. If less important than other factors, such as cost or business flexibility, the testing phase can be skipped in favour of moving directly to conversion or migration.
Testing step 1: planning	What are the size/scope and type of the conversion or migration?	Smaller conversion or migration projects and those that are less complex, e.g. refreshment versus other types of conversions or migrations, should require less planning.
Testing step 2: configuration of the test environment	Is the technology infrastructure already in place?	The level of work involved should vary with the type of conversion or migration being undertaken and the degree to which the technology infrastructure is already in place.
Testing step 3: testing	What is the type and complexity of conversion or migration?	The level of work involved should vary with the type of conversion or migration being undertaken.
Testing step 4: assessment of test results	What is the type and complexity of conversion or migration?	The level of work involved should vary with the type of conversion or migration being undertaken.
Testing step 5: reporting of test results	What is the retention status (value) of the records? Are they of high legal/compliance value?	Careful documentation is essential for establishing the integrity of records, particularly those that may need to be produced as evidence in court. If the records are unlikely to be required as evidence in courts of law, documentation is of less importance in the conversion or migration process.

Table 1 *(continued)*

Procedure	Decision point	Comments
Conversion/migration step 1: preparing for the conversion or migration	What are the size, scope, and type of the conversion or migration? To what extent has preparation already been done as part of other phases?	The level of work involved should vary with the size and scope of the conversion project and the type of conversion being undertaken. Permission for IT resources may already have been obtained at the testing phase.
Conversion/migration step 2: defining records for conversion or migration	Is sufficient information for undertaking conversion or migration already available (e.g. gathered during planning or testing)?	The level of work involved should vary with the size and scope of the project and the type of conversion or migration being undertaken. Much of the necessary data may already have been gathered during testing.
Conversion/migration step 3: configuring the conversion or migration environment	Is the technology infrastructure already in place?	This step should not be necessary if the technology infrastructure pre-exists or has been set up during the testing phase.
Conversion/migration step 4: conducting conversion or migration	Recommended for all conversions/migrations.	The level of work involved should vary with the size and scope of the project and the type of conversion or migration being undertaken.
Conversion/migration step 5: error checking and correction	Is maintenance of integrity, authenticity, reliability and usability of the records of high importance? What are the size, scope and type of the conversion or migration?	The retention status of the records, or whether they are likely to be required for legal or compliance purposes, may establish the degree to which their integrity, authenticity, reliability and usability are important to an organization. the level of work involved should vary with the size and scope of the project and the type of conversion or migration being undertaken.
Validating: all steps	Are the records likely to be required in legal proceedings?	Review and verification of the conversion and migration process is essential for establishing the integrity of records that are likely to be needed as evidence in court. If the records are likely to be required in legal proceedings, independent validation of the conversion/ migration may be considered.
Authorization: all steps	Are the records of continuing importance to the organization?	This step is recommended for all conversions and migrations; however, the level and formality should vary with the long term retention requirements of the records. Records that may be required as evidence in court shall require formal sign-off.

7.3 Conversion/migration project planning

7.3.1 General

A clearly defined conversion and migration plan is extremely important, as it can mean the difference between a successful project (i.e. one that maintains the availability and integrity of the target records) and an unsuccessful project which may result in the compromising of records' authenticity, integrity, reliability and usability or in the ultimate loss of the record. To increase the chances of success, the conversion or migration plan shall not be carried out in isolation, and shall consider input from records professionals and IT and business representatives.

Regardless of whether a conversion or migration project is a one-time exercise or is carried out as part of an ongoing program, the following steps shall be taken:

7.3.2 Step 1: Understand the source records and their organizational environment

It is important to gain a thorough understanding of the records to be converted or migrated in order to formulate an effective plan. One aspect of understanding the source records involves understanding their importance to the organization. To do so, answer the following questions.

— What is the authorized retention period for the source records? If there is no authorized retention period, one shall be established.

— Will staff need immediate access to the records, or can they be stored offline?

— Are the records required for business continuity purposes?

Another key aspect of understanding the source records entails determining their technical structure; for example, which parts of the records represent “content information” versus “representation information.” This can be done through a series of steps, as follows.

a) For content information, identify bits constituting the data object.

b) Identify a representation information object that, in some way, addresses all the bits of the content data object and converts them into more meaningful information.

c) For the representation information object identified, examine its content to identify whether it requires other representation information objects. If it does, obtain the required representation information objects. Repeat this step until no additional representation information objects are identified.

d) For each representation information object addressed in c) that is held as a digital object, identify any required representation information object and repeat c) and d) until no new representation information objects are identified.

e) The content information consists of the content data object and each of the representation information objects identified in b) to d).

7.3.3 Step 2: Choose the desired state of the target records

To provide a clear picture of the work to be done, create a model of the structure of the target state desired for the records undergoing conversion or migration. This may involve conducting some research to make appropriate choices regarding format (conversion) or media (migration).

7.3.4 Step 3: Choose/develop the conversion method and activities

Once the current and target states of the source records have been identified, choose or develop a method of converting or migrating the records from their current state to their target state, together with identifying or developing the appropriate tools and/or software needed to achieve the conversion or migration objectives. Questions to consider when choosing or developing the conversion or migration method include the following.

— Will descriptive information about the records (e.g. a finding aid or index) have to be updated as part of the process?

— Will the records have to be decompressed or unencrypted prior to conversion or migration?

— Will conversion or migration into the target state require compression of the records?

— What will be the conversion or migration pathway?

— Will data need to be extracted for the conversion or migration? If so, how? Many commonly available programs have tools for exporting data in standard formats such as CSV, PDF, JPG and TIFF. Alternatively, the target application may have translators or wholesale importers of flat files. There are also conversion and migration extraction tools that claim to be able to move data from any source to another.

— Will data cleansing need to be carried out as part of the process? In some cases (e.g. HTML), the originating format of the source data may present a conversion or migration challenge because it reflects how the old

system operated. These formats may require that formatting information be removed, tags stripped, lines rewritten, and poorly written code cleaned up, usually through a vendor-approved or custom script (see Reference [21]). During the actual conversion or migration, the organization should consider whether to carry out data clean-up or to load data into the target system without cleansing. This may be particularly necessary with conversions or migrations involving records stored in older content management systems, which often store longer pieces of content as separate pages, while newer systems store the whole document as one object, splitting it up at the display stage. A conversion or migration project may choose to clean up these records by converting or migrating them into a single digital object, or it may leave the data as is and build transformation rules into the target system (see Reference [21]). If the data cleansing process is undertaken, it shall be carefully documented to avoid jeopardizing the data integrity.

NOTE In many instances, conversion and migration cannot be separated. In other words, merely moving from one hardware platform to another may not be sufficient to retain the integrity of the records, and some conversion actions may be required.

— Will the records have to undergo multiple conversions or migrations? Records may undergo a multiple conversion or migration process at the same time, for example, a record content (transformation) coinciding with a replication, or moving records from online storage to removable media. In such cases, it is advisable to handle the conversions or migrations separately.

7.3.5 Step 4: Choose/develop a method of testing the conversion/migration method and activities

Testing the chosen conversion or migration method is critical to ensure that no data are lost, corrupted or unexpectedly altered during the process. During the planning phase, choose an appropriate testing methodology and document the procedures required to execute it as part of the conversion/migration process.

See 7.4 for additional requirements with respect to testing conversions/migrations.

7.3.6 Step 5: Choose/develop a method of validating the conversion/migration and activities

Validation of the conversion or migration in order to ensure that the process has worked according to plan is essential for establishing the continued trustworthiness of digital records. The next step is to develop a plan for effectively validating the process. The validation plan shall include actions to address any remediation work (i.e. to recover lost or corrupted data), should such work be required.

To ensure the integrity of the validation results, the person or team responsible for actually performing the conversion or migration and the person or team responsible for validating the process shall be different. Conduct an audit of a sample of the converted data, representative of the entire scope of the conversion, and of any errors or corrections made to the new platform. If necessary, establish new procedures.

See 7.6 for additional requirements with respect to validating conversions/migrations.

7.3.7 Step 6: Decide on disposal of the source records

Views differ as to whether source records should be disposed of once they have been converted or migrated. The approach should be based on the organization’s business and legal context, its mandate, and the importance of the records to the organization.

If a decision is made to dispose of source records, disposal shall take place as part of “business as usual” practices and shall follow a set of well-defined procedures. ISO 15489-1, which provides detailed guidance on good practice with respect to records disposal, should be used to design the procedures to be followed.

7.3.8 Step 7: Identify the required resources

Having worked out a detailed plan for testing, converting/migrating, and validating, the person or team responsible for the project should identify the resources (people, equipment, and budget) required to complete the exercise.

Once the specific individuals who will participate in and support the phases of the process have been identified, obtain any special permissions or access rights they will require to carry out their assigned tasks.

As appropriate, conduct an evaluation of the cost of doing a conversion or migration in-house or on an outsourced basis. One factor to consider when exploring outsourced arrangements is whether the data can leave a facility or should remain on-site. Discuss and document worst-case scenarios of data being lost during conversion or migration using either method. Evaluate the expertise of existing staff. It may turn out that the conversion or migration has to be outsourced if in-house staff with the requisite knowledge and/or skills are not available.

Having thoroughly explored all available options for completing the conversion or migration, the responsible person shall consider whether the cost of conversion outweighs the cost of not being able to access the information in the future. In addition, a risk assessment and legislative requirements shall be considered in deciding whether to complete a conversion or migration project.

7.3.9 Step 8: Document the conversion/migration process

Track and document the entire process. For small or limited scope projects, the process may be documented in a spreadsheet. Conversions and migrations undertaken as part of a routine program may be better tracked and documented using a database application.

All conversion/migration processes shall be documented in recordkeeping process metadata persistently linked to the record itself.

7.3.10 Step 9: Document and obtain approval for the conversion/migration plan

The responsible officer or team shall document all elements of the conversion or migration plan. The plan shall specify:

— the target of the conversion/migration (i.e. the digital records to be converted/migrated);

— the trigger or rationale for the conversion/migration;

— the current state of the target records;

— the planned state of the target records;

— the method and technologies to be used to convert or migrate the records;

— the persons and/or groups responsible for performing the conversion or migration;

— the method to be used to test the conversion or migration method;

— the method to be used to validate the conversion or migration and the party responsible for validation;

— the disposition of the source target records;

— the authorization required to sign off on completion of the conversion or migration;

— the documents to be retained in relation to the conversion or migration process and their method of retention and period of retention;

— the time-lines for deliverables of key conversion or migration process milestones (e.g. start/end date of the process).

Obtain approval of the conversion or migration plan from the authorized person or body.

7.4 Testing

7.4.1 General

The purpose of testing is to develop a process that transfers the existing file (migration) or transforms the existing file format into the target file format (conversion) without loss of data or access to it. The purpose

of testing conversions/migrations is to develop a process of moving records from one hardware or software configuration to another without changing the format, again, without loss of data or access to it. Testing requires:

— knowledge of the existing file format (conversion), or knowledge of the initial hardware or software configuration (migration);

— a determination of the target file format (conversion) or a determination of the target hardware of software configuration (migration);

— a strategy for making that change or move;

— a means of confirming the degree of success.

Specific knowledge of whatever is to be converted/migrated is necessary in order to find tools and define procedures to govern the actual conversion or migration, as well as to establish criteria for acceptable outcomes. Such knowledge will also help assess the resources required (e.g. file servers or staff time) for implementing the conversion or migration.

In many ways, testing a conversion or migration is like conducting a laboratory experiment. It has a purpose and objective, it requires some equipment, it has procedures in a clear sequence, and its results are documented. Above all, it shall be repeatable.

7.4.2 Step 1: Plan the test

Begin to establish the baseline for the test by recording the existing state of the records. Include information about what will be converted or migrated, such as details on what will stay the same and what will change. Indicate the purpose for the conversion or migration (e.g. to recover/maintain record accessibility by converting an obsolete format or migrating records to new media). Unless the conversion or migration is regularly scheduled, document the reason it is being undertaken at this time.

Describe the target state for the test by recording the desired outcome for the conversion or migration. This will focus only on what is designated to change from the existing state. Also, indicate whatever requirements the records will be expected to fulfil in their target state. This description sets out the anticipated result of the conversion or migration.

Record the strategy that will be implemented to achieve the conversion or migration. Focus on the available resources and include a description of hardware and software as well as requirements for the staff administering the test. In effect, this step shall list the materials used and procedures followed within the “experiment”. If hardware and software need to be selected, include the reasons for their selection here. If the test will be performed on a representative sample of the total body of data that are to be converted or migrated, record the method by which the sample is derived.

Finally, set out how the outcome of the test conversion or migration will be examined. This examination shall relate directly to the results anticipated when the test was set up. The examination shall be undertaken to allow unanticipated results to be discovered and reported. For example, an examination may reveal that the choice of converting or migrated emails using an offline system (the selection of an offline system being based on a need for security) has resulted in a conversion failure of certain emails that have embedded HTML code to “call in” graphics.

7.4.3 Step 2: Configure the test environment

Ensure that the required operators are trained and that the equipment and tools are prepared to conduct the testing. Create a test file on which the tests will be run.

7.4.4 Step 3: Conduct the test

Execute the test conversion as planned. Run tests only on a copy of the source target record in a test file, not on the actual data.

If the execution deviates from the plan, record these deviations. Record the results of the test and the analysis of the results in a report.

7.4.5 Step 4: Assess test results

Focus the assessment of results on whether the test achieved the results anticipated. Determine whether any unanticipated results have affected the desired outcome of the conversion or migration. That is, the test may have achieved the results anticipated, but additional, unanticipated results may render the process undesirable.

7.4.6 Step 5: Report results

If the test is deemed to be a success, the results report becomes part of the context for the records that are to be converted or migrated as it documents a key event in the existence of those records. Retain it for at least as long as the converted or migrated records are retained, or for the time period specified for records retention of results reports in your jurisdiction. If the test shows that the anticipated result is not satisfactorily achieved, retain the report to document either a revision of the anticipated result or a change in strategy.

The report forms part of the background for the next plan, whether the test produced satisfactory results or not. If the test was not satisfactory, the report provides background information for the testing of a revised conversion or migration methodology. If the test was satisfactory, the report sets out the basis for validating the actual conversion or migration. For example, the test may meet the anticipated results but it may also illustrate that certain errors are generated. This knowledge ensures that the validation phase will include the correction of those errors.

7.5 Conversion/migration

7.5.1 General

Actual conversion or migration of the source records shall proceed according to the overall plan, with any revisions that have been made following analysis of the test results.

7.5.2 Step 1: Prepare for the conversion/migration

Obtain all permissions to allocate the resources needed to perform the conversion or migration.

Ensure the source records are duplicated prior to commencing the process. These duplicates provide a set to use in the event of the conversion or migration resulting in the loss or corruption of the records.

Perform any “data cleansing” identified in the planning stage (see 7.3.4).

7.5.3 Step 2: Define the records for conversion/migration

A detailed definition of the content and format of computer files constituting the records and their relationships is crucial to the successful completion of conversions or migrations, so that reliable information about the records is available if a conversion or migration is later necessary. It is also useful for protecting the records’ qualities as evidence of business transactions.

All digital records exist as data objects. It is critical that all the data objects or components that make up the record be identified and gathered together for conversion or migration. Note that digital records exist in a one-to-one, a one-to-many, or a many-to-one relationship with the data objects of components. That is, it is possible to have:

a) a single record that may relate to a single data object (e.g. a letter might exist as a single digital text file);

b) a single record comprising many data objects (e.g. a web page containing text and four images might consist of five data objects);

c) many records in a single data object (e.g. a database is a data object that can contain many records).

Define the content of what is to be converted or migrated by describing the records, including factors such as date range, provenance, and so on, as well as the data objects and their location(s).

EXAMPLE 1 The records to be converted or migrated consist of the CEO's emails from 1990 to 1995. Each email record comprises text-based data elements and attachments, predominantly slide presentations.

All data objects exist in some kind of format. Knowing the format provides information about the structure of the data object and is necessary for properly representing the record. It is also frequently necessary to know what the data objects, when properly presented, mean. Gather information about the format and meaning of the objects and add it to their description.

Determining the format of the data objects may be as simple as naming the application used to create and maintain them. Additional information describing the format may be necessary particularly, for example, when the data objects:

— were created using uncommon (e.g. custom or obsolete) applications;

— exist as a database with defined field sizes;

— have some functional or behavioural aspect (e.g. a website or CAD file).

Information (i.e. metadata) necessary to explain the meaning of any represented data objects is also required. This information pertains to understanding the data object itself and how it relates to other data objects (if any) that form the complete record.

EXAMPLE 2 A database containing demographic data will need information that explains that a "1" in the gender column means the individual is a man, while a "2" indicates a woman.

EXAMPLE 3 A web page requires not just that an image be produced but that it is produced on a certain place on the page in relation to specific text, e.g. a caption.

To expand on Example 1, the email application used by the CEO to create and maintain the records was Eudora, version 6.0. The email application was used as a recordkeeping system, which means that relationship of any attachments to emails is the only way to establish their time of receipt or dispatch. Email messages having record value have a file classification code indicated that relates to the corporation's 1992 file classification plan.

Finally, collect information that:

1) uniquely identifies for future reference the body of records selected for conversion or migration;

2) shows the relationship of the records to be converted or migrated to other, related records or workflow;

3) describes the origin or source of the data objects, any changes that have been made to them, and who has had custody of them;

4) provides or establishes data integrity or verification processes for the objects, e.g. digital signatures or other encryption that was, or continues to be, in place.

To conclude Example 1, the CEO email for 1990 to 1995 is referred to as 2005-001 in the Conversions Logging database. The email is related to other records of the organization through the business activity classification scheme. The email was maintained on a corporate server until 1996, after which it was transferred to tape, using a verified process, and stored with the IT section. Some outgoing emails were encrypted for transmission using PGP but not stored in encrypted format. Access to the tape was limited to IT unit staff.

7.5.4 Step 3: Configure the conversion/migration environment

Acquire and configure the hardware and software needed to carry out the conversion or migration according to the plan. Ideally, the test environment will match that used for the actual conversion or migration.

Audit logging of all conversion or migration activities shall be available in the conversion or migration environment.

7.5.5 Step 4: Conduct conversion/migration

The activities to be performed to complete the conversion or migration will vary depending on the complexity of the process. For example, some types of conversions or migrations will involve extraction of the data.

7.5.6 Step 5: Check and correct errors

Perform quality assurance to check for any inadvertent errors that may have affected data integrity during the conversion or migration process. Such assurance shall be carried out continuously throughout the process with a final check at the end. Continuous quality assurance will make it easier to identify and correct problems, and will provide a better audit trail.

Quality assurance may be achieved through the use of cyclic redundancy checks, checksums associated with each data file, hashing algorithms, or the use of system logs to record and identify any file transfer.

Correct any errors that have been identified. This may involve carrying out a reconciliation of data, manual corrections, or a complete rerun of the operation until the results match the planned target state.

7.6 Validating

7.6.1 General

The purpose of the validation process is to verify that the target digital records have been successfully converted or migrated, so that a third party could be reasonably sure that the authenticity, reliability, integrity and usability of the records have been maintained.

Specific objectives of validation include:

— verifying that no unacceptable or unanticipated changes were introduced during the conversion or migration and that the authenticity, reliability, integrity and usability have been preserved;

— assessing and resolving any differences in content, context, structure and behaviour that were introduced.

Ideally, validation will take place continuously throughout the conversion or migration process, with a final validation of the entire process at the end. This approach will make it much easier to correct any serious deficiencies in the process early on, which will make correcting problems much easier and, ultimately, save resources.

7.6.2 Step 1: Assign responsibility

Assign responsibility to individual(s) who will validate the process. This shall not be the same individual(s) who carried out the conversion or migration of the records. One means of ensuring the separation of conversion or migration and validation duties is to establish a validation team and, if required, a validation steering team.

7.6.3 Step 2: Determine the validation activities

Initiate the validation effort by identifying the scope of the specific systems, components, or data to be validated.

Outline the exact details or activities required for each of the steps in the validation process, as well as for any remediation work necessary to address any problems identified with the data during the validation exercise. The output from this activity will be a validation plan. The plan defines validation steps that apply to various operational states and scenarios that progressively build confidence in the conversion process and assist in the identification of any discrepancies.

7.6.4 Step 3: Establish the system in the validation environment

Ensure that the required operators are trained and the equipment and tools are prepared to conduct the validation. Agree on a schedule to validate the conversion process and its output in terms of delivery, installation and system specification.

7.6.5 Step 4: Conduct validation

After conversion/migration, inspect the output to ensure that the conversion/migration of the data files(s) is complete, and that the data files(s) described and identified in the conversion/migration plan have been transferred as directed.

Ensure that the validation is carried out consistently with the plans, processes and procedures, and in a manner guaranteeing the replication of validation actions, conditions and outcomes.

7.6.6 Step 5: Analyse results

Analyse the validation data to detect trends and patterns of failure, acceptance and evidence that requirements have been met, and errors and potential threats to operational suitability. Document and track recommendations on process status and corrective actions.

Use an issue log to track any file transfer or media read/write errors. Log and describe issues according to the following categories:

— issue number;

— description;

— probability (high-medium-low);

— impact (high-medium-low);

— containment action and owner;

— due date;

— resolution date.

7.6.7 Step 6: Report results of the validation

Complete a quality assurance report or form stating that the converted/migrated source records were inspected, that the metadata information was compared to the originating records and is intact in its entirety, that the described records were properly converted, and that all necessary control procedures were applied during the process. The report shall state that a visual inspection of randomly selected conversion/migration records (at least a minimum percentage of the converted data, representative of the entire scope of the conversion, and of any corrections made to new platform is recommended) was performed and that there was no reason to believe that any source data was omitted. The individual(s) responsible for the validation shall sign and date it.

Examples of details to include are:

— what was done and the results that were obtained;

— any special considerations;

— whether the validation procedure was followed;

— a summary of all documentation that was generated;

— the location of the validation documentation;

— the retention period for the conversion and validation documentation.

7.6.8 Step 7: Update descriptive information about the records

Once the conversion/migration has been validated and the new, converted/migrated version of the records can be used additionally and/or in place of the originating version, it is time to update information pertaining to:

— the identification of the records;

— the content, context, structure and behaviour of the records;

— the changes to the records, including those affecting authenticity, reliability, integrity and usability (see 7.5.3 for information on where the originating descriptive information was collected).

Normally, the reference identifier and relationship information of the new version of the records will remain unchanged from the originating version.

7.6.9 Step 8: Manage the originating version

Determine the disposition of the originating version of the records. At a minimum, they will be removed from the operational environment and retained until the new version of the records has been integrated into the operational environment. Whether this version continues to be maintained for a specified or indefinite period or destroyed is a matter for organizational records policy, informed by an appropriate risk assessment.

7.6.10 Step 9: Operationalize the new version

Schedule the integration of the new, converted/migrated records into the operational environment. A period of operational use may be incorporated into the validation process, with a parallel effect on the disposition of the originating version of the records.

7.6.11 Step 10: Authorization

An organization shall be prepared to produce its records of the conversion/migration process as evidence for as long as these records are required. To meet evidentiary requirements, include statements that the particular equipment used in the conversion/migration was in good operating order at the time the conversion was performed. Audit logs that track transactions during the conversion/migration of the records shall be used to provide evidence of the effective operation of the equipment. In addition, conversion/migration hardware and software shall be properly authorized for use, and proof shall exist that the conversion/migration and any disposal of source records were carried out as part of the usual and ordinary course of business.

An organization shall certify the conversion/migration process if the target records are of high legal importance.

The documentation above shall be maintained in a manner that will preserve its longevity as an authoritative record for as long as required.

8 Monitoring

Controls and monitoring plans ensure that the conversion or migration process proceeds in accordance with business requirements, that it continues along the specified timeline, that it is being conducted in accordance with established criteria, that periodic oversight checks are done, and that reporting and communication within the organization occur on a regular basis. Develop these plans before the project begins and address the selection, implementation and use of application, as well as the conversion/migration of the data. It is not enough to establish controls and monitoring during and following the conversion and/or migration. To demonstrate the controls and monitoring confirmed during the conversion/migration of the data, it may be necessary to demonstrate the diligence of selecting and implementing the end solution.

Controls and monitoring ensure that:

— traceability to the requirements is tested and documented;

— system design (overview, configuration, design specification) is documented;

— application software source code is reviewed and documented;

— the application is tested (test plan, test cases, test scripts, test results, test problem reports, installation records, summary reports and traceability to requirements are documented);

— a report of all activities and approval to implement is generated and signed.

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