



eArchiving – Reference Curriculum

The eArchiving Initiative

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1. INTRODUCTION

The case for a dedicated eArchiving curriculum is multi-faceted. First, there is a community need. User needs analyses conducted by E-ARK4ALL, and the eArchiving Building Block indicate that many organisations struggle to find staff with the appropriate skills to deliver eArchiving effectively and at scale. This creates high barriers to entry, which are proving problematic for some organisations. One key element of this is the lack of appropriately trained graduates leaving universities and other higher education establishments.

There is also an academic need. Research by the eArchiving Initiative indicates that there are relatively few dedicated eArchiving courses across Europe. Despite the plethora of digital curricula available, most consider eArchiving only tangentially. Yet, eArchiving is a focused discipline in its own right. Thus, this curriculum has been developed to address these issues.

2. THE ACADEMIC EARCHIVING REFERENCE CURRICULUM

This master's level reference curriculum aims to equip students to work as eArchivists/digital preservation specialists in the public or private sectors. The intention is to provide students with the opportunity to critically engage with the technology and techniques at the forefront of eArchiving with particular emphasis placed on the individual's ability to define, implement, evaluate and reflect on subject-related issues. Technological expertise and critical interrogation within their subject areas will combine to locate successful graduates at the forefront of contemporary eArchiving practice. From a student perspective, the eArchiving master's course provides:

- a challenging, stimulating, and self-rewarding study environment, which, in turn, provides an advanced educational experience that develops the student's intellectual and practical skills.
- an opportunity for students to develop as critically reflective practitioners in eArchiving.
- the opportunity to develop research in a critical framework of enquiry.
- for student needs in relation to maximising their career potential or progress to higher postgraduate study by enabling them to develop knowledge, critical understanding and advanced skills in their chosen subject area, as well as related professional and career management skills.

Graduates of specialised/advanced study master's typically have:

Subject-specific skills and attributes

- In-depth knowledge and understanding of the discipline informed by current scholarship and research, including a critical awareness of current issues and developments in the subject.
- the ability to complete a research project on the subject, which may include a critical review of existing literature or other scholarly outputs.

Generic skills and attributes (including skills relevant to an employment setting)

- use initiative and take responsibility
- solve problems in creative and innovative ways
- make decisions in challenging situations
- continue to learn independently and to develop professionally

- communicate effectively with colleagues and a wider audience in a variety of media.

This overall combination of subject-specific and generic skills maps closely to the user needs recorded during research by the eArchiving Initiative in 2023. We are also very aware that within the digital archiving sphere, we are looking for a broad range of skills, but we also require very specific skills which a digital archivist in the business domain will need to deploy¹. Business skills are thus a key element to be included within the curriculum.

2.1. Curriculum characteristics

The curriculum is being developed for **master’s level** study because eArchiving is a focused, specialist study area requiring considerable background knowledge. Undergraduate study is too generic for the specificity of eArchiving, but it is the foundation on which a master’s level course can be built.

A modular structure has been adopted to accommodate differing academic structures across Europe. The modular structure also allows institutions to adopt the entire curriculum or pick specific modules pertinent to their requirements.

If an institution adopted the full curriculum, it would include recommended and elective modules. The elective modules will allow institutions to ‘shape’ the course for their specific contexts, thereby encouraging greater adoption. An initial proposal has been made for a minimum of six core (recommended) modules (M1–6). These are ‘An introduction to eArchiving’, ‘eArchiving standards and specifications’, eArchiving software tools; ‘eArchiving data and documents’, ‘Legal and Regulatory Compliance’, and an ‘Independent project or placement/internship’. The recommended modules are heavily praxis-led, and upon successful completion of the recommended modules, students will have a solid grounding in the core principles of eArchiving. This foundation will be complemented by the elective modules.

2.2. Recommended modules

The curriculum should include both recommended (core) and elective (optional) modules. The recommended modules (M1–6) are:

2.2.1. *M1. Introduction to eArchiving*

Students attending a master’s course on eArchiving will come from a variety of backgrounds. The admissions criteria would be subject to the rules of the host institution; however, candidates would have various levels of experience in eArchiving. Therefore, any eArchiving curriculum must begin with an introductory module to lay the foundations and set the scene.

Course title:	eArchiving
Module title:	Introduction to eArchiving
ECTS	See section 3.1 Credits

Goals

¹ From an interview on 7th July 2023 with John Sheridan, Digital Director, UK National Archives, who heads a team of 50 digital archiving staff. The semi-structured interview was conducted by Dr Jaime Kaminski, Dr Janet Anderson and Dr David Anderson.

On completion of this module, students should be able to:

Identify

- The fundamental principles of electronic archiving and digital preservation as an independent discipline.
- The core tenets and principles that define electronic archiving and digital preservation, emphasising its unique requirements and methodologies.
- The essential components of a digital archiving system:
- The key elements that constitute a digital archiving system, covering hardware, software, processes, and metadata management.
- The prevalent legal and regulatory obligations for digital record retention, specifically within the **EU-wide** context (e.g., GDPR, eIDAS, CEN TC 468 mapping), while acknowledging the variability across different countries and understanding their national/local laws.

Understand

- The differences between electronic and paper-based archiving.
- The distinctions between electronic and paper-based archiving methods, emphasising the advantages and limitations of each.
- The significance of electronic archiving and digital preservation in the preservation of organisational knowledge
- How electronic archiving and digital preservation play a critical role in safeguarding and maintaining an organisation's knowledge assets, ensuring accessibility and longevity.
- The risks and challenges involved in electronic archiving and digital preservation, covering issues like data integrity, security, and format obsolescence.
- The pertinent principles from archival theory:
- The key principles from archival theory that underpin effective digital archiving, highlighting concepts such as provenance, original order, and authenticity.

Analyse

- Analyse the distinctions and potential synergies between digital archiving and its interconnected disciplines.

Syllabus

1. **Defining eArchiving and the Digital Archiving Landscape:** We will explore the concept of eArchiving, highlighting the nuanced differences between electronic and digital archiving. We will also provide a comprehensive overview of the digital archiving scenario, discussing its lifecycle, interoperability considerations, and providing a clear definition of the field.
2. **Exploring Related Disciplines:** We will delve into the various disciplines that intersect with eArchiving. We will briefly introduce each discipline, showcasing how they intersect with eArchiving. The related fields to be discussed include Archival Science, Information Management, Digital Preservation, Records Management, Information Security, Legal and Regulatory Compliance, Information Technology, Metadata Management, Digital Forensics, Library and Information Science, Cultural Heritage Preservation, Information Governance, Archiving by Design, eGovernment, and Digital Humanities. We will start with a general discussion before delving into a closer examination of these disciplines from both national and local perspectives.

3. **Tracing the Historical Context of European eArchiving:** We will delve into the historical backdrop that led to the development of European eArchiving. This will encompass the catalysts for eArchiving prior to 2011, including the Archive Research Support (ARS) and Network of Archives in the European Union (NAE), initiatives like E-ARK, the eArchiving Building Block, and other noteworthy digital archiving endeavours. We will also touch upon key outcomes from scoping exercises and education programs, such as courses offered by the International Council on Archives (ICA), providing a comprehensive overview of the landscape.
4. **EU Country-by-Country eArchiving Overview and Cross-Border Initiatives:** We will offer an in-depth exploration of eArchiving practices in European Union member countries, providing insights into how each nation approaches digital archiving. Additionally, we will examine cross-border collaborative initiatives like INSPIRE and Venice Time Machine that contribute to the collective efforts in preserving European digital heritage.
5. **Foundations of Digital Archival Theory:** Traditionally, archival practices revolve around safeguarding records originating from organisational or individual activities with evidential value related to their functions, authorities, and obligations. Notably, this section will underscore the importance of records expected to be reused, especially in legal proceedings, as they serve as essential evidence for actions taken, ensuring legal security for individuals and organisations.

At the core of archiving lies the aspiration that preserved records will serve future needs, providing valuable information to users. The essence and purpose of archiving revolve around ensuring future access to archived information.

Among the foundational principles of traditional archival practice, the concept of 'provenance' holds a paramount position. This principle often involves preserving and consolidating records generated during the operations of an individual or a group (referred to as 'fonds'). Additionally, the primary arrangement or structure of records, as established during their creation, is another fundamental aspect to consider. Equally important is the principle of 'context,' which entails preserving information about the circumstances surrounding the creation and utilisation of records. This context is vital for enabling the most authentic interpretation of archived records. It is worth noting that records within archives are typically organised into logical units, such as fonds, collections, series, sub-series, cases, and items, which are then subject to cataloguing and description. This process results in finding aids designed to facilitate user access to preserved records.

The advent of digitisation initially had a profound impact on archival description. While the General International Standard Archival Description (ISAD(G)), the second edition of which was adopted by the International Council on Archives (ICA) in 2000, primarily focused on physical records, the Encoded Archival Description (EAD) XML standard, developed in the United States and adopted in 2002, aimed at encoding archival aids to transform content into metadata sets. 'Records in Contexts' (RiC), a standard for archival description adopted by the ICA in 2016, has, in many ways, revolutionised the traditional approach to archiving and describing archives, as it is based on a linked data approach.

At the heart of modern digital content archiving, or more precisely, digital records preservation, stands the Reference Model for an Open Archival Information System (OAIS) - ISO 14721. This foundational model was developed by the Consultative Committee for Space Data Systems (CCSDS) in 2009, and its second issue (Magenta Book) was published in 2012. A draft for the third edition has been in development since 2019. OAIS has established the

fundamental principles that guide digital archivists globally. These principles encompass the definition of a record as materialised information, the concept of an Information Package (IP), and the foundational framework of OAIS Functional Entities.

Much like traditional archiving, OAIS strongly emphasises the end-user. Ensuring the usability of archived digital content remains a core imperative in digital archiving. Usability encompasses key facets such as findability, accessibility, interoperability, and reusability, collectively known as the FAIR principles.

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Winn, S. (ed) (2022) *SAA Trends in Archives Practice: Module 24-26. Born-Digital Design Records*. ISBN 978-1-945246-87-6

<https://mysaa.archivists.org/productdetails?id=a1B5a00000kGyrXEAS>

Support bibliography:

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Digital Preservation Handbook (2nd Edition) <https://www.dpconline.org/handbook>

Library of Congress Digital Preservation Resources <https://www.loc.gov/preservation/digital/>

Society of American Archivists (SAA) – Electronic Records Section

<https://www2.archivists.org/groups/electronic-records-section>

Assessment

It is recommended that assessment should either be in the form of:

- (1) Self-directed (but tutor supported) problem-based individual coursework to develop the skills and knowledge of students, or
- (2) Time-constrained examinations.

A suggested assessment is provided below; however, this is for guidance only as the nature of the assessment is determined by institutional and national requirements.

- Coursework - compare and contrast paper-based and digital archiving, with reference to other relevant fields of study (60%).
- An examination to test the understanding of eArchiving basics (40%).

2.2.2. M2. eArchiving standards and specifications

Standards are the foundation of eArchiving. All the user needs analysis results point to a need to study standards in an eArchiving curriculum. Consequently, this module would introduce students to standards and specifications.

Course title	eArchiving
Module title	M2 eArchiving standards
ECTS	See section 3.1 Credits

Goals
On completion of this module students should be able to:
Identify
<ul style="list-style-type: none">• Key aspects of standardisation and the different types of standardisation and standardisation bodies: International ISO/IEC, European CEN/ETSI, national standardisation bodies (to address according to the local country), others (especially those that are community or domain focused).• Key categories of standards relevant to electronic archiving and digital preservation: reference models and principles, processes and functional requirements, information packaging and metadata definitions, and auditing tools.• Major standards and frameworks in each category of the electronic archiving and digital preservation challenge: For example, ISO 14721 as a reference model, PREMIS and Dublin Core as vocabularies, METS and the E-ARK Specifications for information packaging, and ISO 16363 for auditing.• Related technological components standards with specific impact in electronic archiving and digital preservation: For example, format standards (PDF, XML, JPEG, etc.), digital signatures standards by ETSI, security standards such as the ISO 27000, etc.• Essential components and functions of each standard: Main elements and functionalities provided by each standard, covering their applications in various electronic archiving and digital preservation contexts.
Understand
<ul style="list-style-type: none">• and elaborate on the importance of standards in ensuring electronic archiving and digital preservation quality.• and explain how adherence to standards enhances the reliability, authenticity, and longevity of digital archives.• and explain how adherence to standards enables the interoperability of digital archives.• categories of standards and differentiate their applicability.• the distinctions and overlaps between different standards, emphasising their specific roles and applications.• the impact of the use of standards on electronic archiving and digital preservation workflows and policies.
Analyse
<ul style="list-style-type: none">• the implementation of standards in real-world electronic archiving and digital preservation projects:

- and evaluate case studies or examples of how different standards have been applied in practice, identifying successes and challenges.

Syllabus

1. Introduction: the value of standards and the barriers to their adoption. The value: by embedding standards within an electronic archiving and digital preservation strategy, organisations can achieve a more robust, efficient, and future-proof preservation system. This approach fosters consistency, interoperability, and reliability, ensuring digital materials remain accessible and usable over the long term. The need for standards to be part of a suite of preservation strategies, not the sole focus. The other advantages of standards: future proofing, efficiency and compliance. The barriers to standards: rapid change, competitive pressures, complexity and resources and the flexibility required.
2. Overview of key standards in electronic archiving and digital preservation: This section will cover the most important standards in the domain, including their development history, core components, and use cases. This must comprise a focus on ISO 14721 (OAIS) as the universally accepted reference model, complemented by references to other fundamental specific standards in other categories, especially in the information packaging and metadata definitions (E-ARK specifications, PREMIS, METS, Dublin Core, etc.).
3. Standards for specific domains/content types. Standards for electronic archiving and digital preservation can vary by domain to address the unique challenges and requirements of each field (in some cases resulting in solutions not aligned with OAIS). For example, preserving audio-visual materials demands standards like IASA-TC 04 and SMPTE for format and quality consistency, while the aerospace industry has developed LOTAR for CAD data integrity. Scientific data requires specific standards for electronic archiving and digital preservation due to the unique needs of various scientific fields. For instance, astronomy uses specialised formats like FITS to preserve vast amounts of observational data. Genomics relies on formats like FASTQ and BAM to maintain the integrity of genetic sequences. Climate science uses NetCDF for climate models and datasets. These specialised standards ensure that data in each scientific area remains accurate, accessible, and usable over time
4. Evaluating and Selecting Standards: Overview of key considerations for selecting electronic archiving and digital preservation standards.
 - This will include basic criteria for evaluating standards based on organisational needs and the type of digital materials.
 - It also can comprise in-depth case studies and decision-making frameworks for selecting and implementing standards in complex electronic archiving and digital preservation scenarios, involving critical evaluation of the standards' effectiveness in long-term preservation and strategy alignment.
 - Practical guidance on how to identify requirements and implement electronic archiving and digital preservation standards within a specific context, including tools

and techniques for compliance and best practices for integration into existing workflows.

- Address the most common contexts: a public organisation, a business organisation, a scientific community, etc.

5. Case Studies and Examples: Real-world examples of how organisations have successfully implemented electronic archiving and digital preservation standards. This will include detailed analyses of the challenges faced and solutions developed.
6. The Future of Electronic Archiving and Digital Preservation Standards. Exploration of emerging trends and potential future developments in the realm of standards for electronic archiving and digital preservation, including new standards under development and evolving best practices.

NOTE: If the program where this module is being used contains a dissertation, the subject of the future of the standard for electronic archiving and digital preservation can be a very relevant motivation for research projects.

Bibliography

NOTE: Standards for digital preservation is a very specialised subject, where, besides a small set of standards of global relevance, the relevance of each of the other standards depends on the specific case; there are no generic bibliographic references for this. Therefore, the existing bibliography for this subject includes direct references to the standards themselves or to online sites that provide an overview of those:

- E-ARK Specifications: <https://dilcis.eu/specifications>
- Reference Model for an Open Archival Information System (OAIS)
 - ISO 14721:2012 – Space data and information transfer systems – Open archival information system (OAIS) – Reference model:
ISO 16363:2012 – Space data and information transfer systems – Audit and certification of trustworthy digital repositories.
 - General introduction to OAIS: <http://www.oais.info/>
 - For a complementary focus on Space Data standards:
 - Consultative Committee for Space Data Systems (CCSDS):
<https://public.ccsds.org>
- ISO Management Systems for Records (MSR):
 - <https://committee.iso.org/sites/tc46sc11/home/projects/published/management-systems-for-records-i.html>
 - ISO 30300:2020 Information and documentation – Records management – Core concepts and vocabulary
 - ISO 30301:2019 Management systems for records – Requirements
 - ISO 30302:2022 Management systems for records – Guidelines for implementation
 - Others related:
 - ISO 15489 – Part 1: 2016 Records management: Concepts and principles
 - ISO 16175: Principles and functional requirements for records in electronic office environments.

- Library of Congress (USA)
 - <https://www.digitalpreservation.gov/>
 - Sustainability of Digital Formats
 - <https://www.loc.gov/preservation/digital/formats/index.shtml>
 - <https://www.loc.gov/librarians/standards>
 - METS (Metadata Encoding and Transmission Standard): A standard for encoding descriptive, administrative, and structural metadata regarding objects within a digital library
 - <https://www.loc.gov/standards/mets/>
 - PREMIS (Preservation Metadata Implementation Strategies): A standard vocabulary for preservation metadata
 - <https://www.loc.gov/standards/premis/>
- Academy of Motion Picture Arts and Sciences
 - **Digital preservation** Forum
 - <https://academydigitalpreservationforum.org/>
- Digital preservation
 - NDSA Levels of **Digital preservation**: <https://ndsa.org//publications/levels-of-digital-preservation/>

Assessment

It is recommended that assessment should either be in the form of:

- (1) Self-directed (but tutor supported) problem-based individual coursework to develop the skills and knowledge of students, or
- (2) Time-constrained examinations.

A suggested assessment is provided below, however, this is for guidance only as the nature of the assessment is determined by institutional and national requirements.

- Coursework – compare and contrast the evolution of standards in two distinct fields (e.g., Healthcare and geospatial data) (60%).
- An examination to test the understanding of eArchiving standards and specifications (40%).

2.2.3. *M3. Software tools for eArchiving*

While standards may be the glue that binds eArchiving, software tools allow for the practical implementation of eArchiving.

Course title:	eArchiving
Module title:	eArchiving lifecycle and tools
ECTS	See section 3.1 Credits

Goals

On completion of this module, students should be able to:

Identify

- The key components of the eArchiving lifecycle using the OAIS Reference model as a guide.
- The essential components of a digital archiving system.
- The types of software tools needed for each stage in the lifecycle.
- The key principles of the data lifecycle and how software tools are applied to this.
- How software tools can ensure that data is available over the long-term, potentially without the originating system.

Understand

- The difference between proprietary and open source software, and the advantages and limitations of each.
- The perspective of users in and nature of originating systems and how this influences (pre) ingest and subsequent lifecycle stages.
- Understand the range of software tools available to support key lifecycle stages such as create, (pre) ingest, store, access/use and reuse.
- Understand how to identify file formats with tools such as DROID, FIDO, or Siegfried.
- Understand the use of PDF validation tools such as JHOVE and VeraPDF to check conformance to published PDF specifications and metadata standards or MediaConch for audiovisual files.

Analyse

Analyse the distinctions and potential synergies between digital archiving and its interconnected disciplines.

Syllabus

1. The foundation of electronic archiving and digital records preservation is the Reference Model for an Open Archival Information System (OAIS) – ISO 14721. OAIS has established the fundamental principles that guide digital archivists globally. These principles encompass the definition of a record as materialised information, the concept of an Information Package (IP), and the foundational framework of OAIS Functional Entities. This unit will explore the software ecosystem that supports electronic archiving and digital preservation, using the OAIS framework as a guide.
2. Such software can include large-scale applications that can manage multiple processes, such as complete repository systems, storage management software, and workflow management systems for implementing potentially complex processes. There are also a variety of smaller tools that carry out particular functions, which can be smaller-scale processes or a step in larger processes such as validation, normalisation, migration, etc.
3. The module will consider the range of software tools available to support key lifecycle stages such as create, (pre) ingest, archival storage, access/use and reuse. Although the 'create' process takes place using originating systems outside the archive, it is necessary to understand how data is exported from these systems in a known format (e.g. using a Submission Information Package – SIP). Students will explore this process from the perspective of the depositor. (Pre) Ingest (receiving digital information from the organisation that produced it) requires a variety of software tools for format identification, validation, and normalisation. Students will learn how tools such as DROID, FIDO, or Siegfried can be used to identify file formats and understand how validation tools such as JHOVE, VeraPDF or MediaConch can check conformance to published specifications and metadata standards. They will explore the key proprietary

and open source tools for ingest. Archival storage (storing and maintaining information over a long time period) will be assessed.

4. Data management (storing and maintaining metadata and descriptions of the stored information). Records within archives are typically organised into logical units, such as fonds, collections, series, sub-series, cases, and items, which are then subject to cataloguing and description. This process results in finding aids designed to facilitate user access to preserved records.
5. Access (retrieving information for an end user) describes the process of making content easy to find and accessible for users.

NOTE: Module 4 eArchiving data and documents considers the tools required to archive and preserve specific data and document types. There is a limited overlap between the tools described in these modules.

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eArchiving Initiative Reference Architecture 2.0 <https://kc.dlmforum.eu/earchiving-ra20>

Library of Congress Digital Preservation Resources <https://www.loc.gov/preservation/digital/>

Society of American Archivists (SAA) – Electronic Records Section
<https://www2.archivists.org/groups/electronic-records-section>

Assessment

It is recommended that assessment should either be in the form of:

- (1) Self-directed (but tutor supported) problem-based individual coursework to develop the skills and knowledge of students, or

(2) Time-constrained examinations.

A suggested assessment is provided below; however, this is for guidance only as the nature of the assessment is determined by institutional and national requirements.

- An examination to test the understanding of eArchiving software tools (100%).

2.2.4. *M4. eArchiving data and documents*

With both the 'eArchiving standards and specifications' and the 'software tools for eArchiving' modules as a foundation, students can progress onto the practical application of standards and tools to archiving the most common digital data types.

Course title:	eArchiving
Module title:	eArchiving data and documents
ECTS	See section 3.1 Credits

Goals
On completion of this module, students should be able to:
Identify
<ul style="list-style-type: none">• Assess the digital preservation needs for a range of digital objects and data types.• Critically evaluate the digital preservation techniques as deployed in a variety of memory institutions.• Assess the digital preservation needs for a range of digital objects against the available technology.• When to deploy hybrid digital preservation techniques when appropriate.• Evaluate the legal, ethical, and professional context in which different data types are archived.
Understand
<ul style="list-style-type: none">• How to develop a critical and analytical approach to research and development practices and methods relevant to or at the forefront of digital preservation.• To develop a critical and analytical approach to assessing digital preservation needs for a range of digital data types and objects, including text, databases, images, e-mail, video, websites and audio.• To develop a critical and analytical approach to assessing digital preservation needs for a range of digital objects against the available technology.• To develop a critical and analytical approach to assessing digital preservation techniques as deployed in a variety of memory institutions.• To develop a critical and analytical approach to assessing when to deploy hybrid digital preservation techniques.
Analyse
<ul style="list-style-type: none">• Analyse a range of digital preservation models and techniques as applied to different data types.

Syllabus

1. This unit introduces the student to the wide range of digital data types and objects that archives and memory institutions may have to preserve. It also covers the technical environments connected with these data types, as well as related transfer media, tools, techniques and methodologies. Suitable methodologies for researching all of the above are covered, together with appropriate ethical and professional issues.
2. The indicative data and document types are text, databases, images, e-mail, video, websites, geospatial and audio. Emphasis will be placed on the:
 - characteristics of each data type
 - The challenges of eArchiving each data type
 - the appropriate standards and specifications for electronic archiving and preservation
 - the applicable tools for electronic archiving and preservation

Text. Text-based ‘documents’ can include many file formats. They can be born digital or digitised and may exist as final versions, drafts, or copies. Challenges to electronic archiving and digital preservation may include but are not limited to legacy (sometimes proprietary) formats, which can cause formatting issues or may not open. Digital rights management (DRM) which may hinder preservation and reuse. Poor or absent records management can impact the ability to transfer documents to an archive. Embedded digital objects may not be rendered correctly if opened in software that is different from the document-creating application. References to other external digital resources and objects may be lost, potentially losing the full context and meaning of a document. Missing or incorrectly substituted fonts. Finally, cloud-based document files, which are widely used to support collaboration, are particularly complex objects to preserve.

Potential file formats include Plain text, Rich text, Portable Document Format (PDF), Portable Document Format/Archive (PDF/A), Electronic Publication (EPUB), OpenDocument Text Document Format (ODT), TeX, Microsoft Word Document (.docx).

Databases. Databases are collections of data objects and their links that are structured to allow access by different application programs. These can be managed by database management systems (DBMS). The relational model, first defined by E. F. Codd in 1970, organises data into one or more tables of columns and rows, with a unique key identifying each row. Other elements allow data to be added, deleted, modified, saved, and interpreted. Relational databases, which are queried using SQL (Structured Query Language), are the most widely used databases (other database types, such as flat databases, and non-tabular databases, do not use related tables). The challenges associated with database archiving are considerable. Databases can be complex. Electronic archiving and digital preservation require preserving the data in a specific format, the database structure and the logical structure of information into archival packets. Databases can also be changed or updated frequently, and the potential legal implications related to the retention and reuse of personal data may be considerable. The file format selected for electronic archiving and preservation of databases depends on the functionality to be preserved and the future use cases. These could include SIARD 2.0, SQLite, and Delimiter-Separated Values.

e-mail. An email message is a text document structured according to the Internet Message Format (IMF) and Multipurpose Internet Mail Extensions (MIME) standards. E-mail messages typically include a body and header and may contain embedded objects such as images. An e-mail may include attachments. Challenges associated with eArchiving and digital preservation include: Potential issues in gaining access to the originating system. As there is no native

preservation format extraction of e-mail messages requires some form of transformation. The presence of attachments may require preserving large volumes of digital content in various formats, whilst maintaining the relationships between them. The volume of e-mails presents a challenge, with messages often being duplicated. Both e-mail texts and their attachments may contain personally identifiable information (PII). This has considerable legal implications (cross-reference Module 5).

Geospatial. The geospatial data describe features on the earth and include a wide range of information types. Content types can include geographic information systems (GIS) data, remote sensing imagery, 3D representations and location-based information. Geospatial data is particularly challenging for eArchiving and digital preservation due to the complexity and range of data formats, including the extensive use of proprietary formats; the need to preserve the technical and social contexts of the data; and the increasing importance of dynamic data and web services. There are also significant legal issues associated with preserving access to and reuse of geospatial data. Awareness of coordinate reference systems, topology, data packaging, and cartographic representations is also critical.

Case Studies and Examples: Real-world examples of how organisations have successfully implemented electronic archiving and digital preservation of specific data types. This will include detailed analyses of the challenges faced and solutions developed.

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Assessment

Assessment should either be in the form of:

- (1) Self-directed (but tutor supported) problem-based individual coursework to develop the skills and knowledge of students, or
- (2) Time-constrained examinations.

A suggested assessment is provided below, however, this is for guidance only as the nature of the assessment is determined by institutional and national requirements.

- Coursework - compare and contrast eArchiving of two different data types (60%).
- Examination to test the understanding of eArchiving of different data types (40%).

2.2.5. M5. Legal and Regulatory Compliance

This module would encompass managing an organisation's legal and regulatory compliance in relation to eArchiving. The module would emphasise the relevance and importance of information rights in both the public and private sectors. Indicative elements could include:

Course title:	eArchiving
Module title:	Legal and regulatory compliance
ECTS	See section 3.1 Credits

<p>Goals</p> <p>On completion of this module, students should be able to:</p> <p>Identify</p> <ul style="list-style-type: none"> • Identify and recall the fundamental principles of administrative procedure, e-government and its link to electronic archiving. • Identify the concept of Fourth Generation Rights and the importance of the archival function plays in them. • Identify the European (GDPR, Transparency Directive) and local legislation and regulations relevant to digital archiving. • Identify the principles of legal compliance. <p>Understand</p> <ul style="list-style-type: none"> • Elaborate on the legal significance of Archiving and its importance and change in a more digital environment. • Explain how legislation has adapted to the digital world and how this also affects the archival function. • Understand the legal obligations of the preservation of cultural heritage and the legal role of the archival function. • Acquire a basic understanding of the concept of legal and regulatory compliance. • Summarise the basic actions of legal and regulatory compliance in electronic archiving. • Provide a concise overview of the legal risks and challenges of electronic archiving, covering issues like data protection, loss, and transparency obligations. <p>Analyse</p> <ul style="list-style-type: none"> • Analyse the role digital archiving plays in the digitisation of public administrations and their governance.
<p>Syllabus</p> <ol style="list-style-type: none"> 1. Introduction to Administrative Law and Administrative Procedure. We will explore the basic concepts of administrative and constitutional organisation in the respective country, contextualising them with the process of administrative procedure. This will be followed by a presentation of the basics of EU law, exploring the structure and organisation of the EU and the procedures of its functioning. 2. Law in the Digital Era. We will offer a brief analysis of how digital society is treated by the law and how this has developed new sets of rights and obligations, the so-called Fourth Generation Rights and obligations. Following this will be a presentation of the current relevant legislation and regulations. 3. Law and digital archiving. We will explore the legal and regulatory framework behind digital archiving. This includes an overview of archival and cultural heritage legislation, administrative procedural laws (especially when related to the digitisation of administrative procedures), privacy and data protection legislation, transparency regulation, and information security regulation.

4. Introduction to legal and regulatory compliance. We will explore the concepts behind legal and regulatory compliance in order to understand the basic compliance framework of digital archiving.

The archival function requires a sound knowledge of the basic organisational processes and legal framework. This framework has been traditionally circumscribed to the national sphere, but it has required a more transnational approach in an ever-changing, globalised, and digitised world.

This globalised and more digitised world presents new challenges, opportunities, and ideas on how citizens should relate to public powers in this era. This has led to the birth of a new set of rights and obligations, the so-called Fourth Generation human rights, which includes rights fundamental to digital archiving such as privacy, transparency, digital security and *habeas data*.

The appearance of new rights and obligations has led to an increasing number of laws and regulations to which organisations must adapt. For this reason, organisations are increasingly adopting consolidated and harmonised sets of compliance controls. This approach ensures that all necessary governance requirements can be met without the unnecessary duplication of effort and activity from resources.

This module will present the basic legal framework and functioning of public sector organisations from a national to European perspective, linking it to the growing digitisation of administrative procedures and the importance of preserving them over the long term.

We will also explore the role archiving plays in the consecution of fourth-generation rights, how these rights affect archives, and the challenges they face.

Finally, the basics of regulatory compliance and how to adapt to the archival world will be presented to allow future digital archivists to participate in the complex procedure of digital archiving.

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Assessment

Assessment should either be in the form of:

- (1) Self-directed (but tutor supported) problem-based individual coursework to develop the skills and knowledge of students, or
- (2) Time-constrained examinations.

A suggested assessment is provided below, however, this is for guidance only as the nature of the assessment is determined by institutional and national requirements.

- Coursework - compare and contrast European archival law with the national archival law in your country (60%).
- An examination to test the understanding of legal and regulatory compliance in the EU (40%).

2.2.6. M6. Independent project

The ability to complete a research project on a subject is a widely used criterion for master's-level research. In the case of the eArchiving curriculum, the independent project offers students the opportunity to apply the taught material from the earlier stages of the course in addressing a client-led practical, creative, or research problem directly related to eArchiving. The project also supports students to enhance their intellectual and technical skills in research methods, scholarship and critical analysis, as well as considering the professional issues related to their work. The choice of topics would be guided by the host institution and be determined in part by their context; however, it would be hoped that some projects could be based on real-world challenges in organisations.

Course title:	eArchiving
Module title:	Dissertation or placement/internship
ECTS	See section 3.1 Credits

<p>Goals</p> <p>On completion of this module students should be able to:</p> <p>Identify</p> <ul style="list-style-type: none"> • Analyse a significant practical, creative or research problem and assess the utility and limitations of proposed solutions. • Critically evaluate and synthesise research and other material required to effectively solve the problem. • Justify choices of approach to the solution of their problem, be they creative, methodological or technological. • Professionally plan, manage, evaluate and critically reflect upon a significant project over an extended period of time. • Evaluate the legal, ethical, and professional context in which the project is conducted and justify how these issues are resolved in the solution. • Synthesise appropriate material and critically reflect on and contextualise the final resolution of the project and its challenges, which may be at the forefront of the discipline. • Evaluate and respond professionally to questioning and the judgement and evaluation of others from an informed position and through reasoned argument. <p>Understand</p> <ul style="list-style-type: none"> • To promote the critical evaluation and appreciation of the context of digital preservation projects. • To expose students to a significant client-led project that needs management under real-world resource constraints. • To develop the student’s knowledge of, and skills in, research or development practices and methods relevant to or at the forefront of their disciplines. • To apply a range of intellectual skills in self-directed, original and challenging ways to the final resolution of the project programme and articulate that resolution to an audience of peers. • To articulate ideas and information about the resolved project programme to demonstrate reflection, evaluation and independent judgement. <p>Analyse:</p> <ul style="list-style-type: none"> • Analyse the distinctions and potential synergies between digital archiving and its interconnected disciplines.
<p>Syllabus</p> <p>1. Dissertation A client-specified, problem-based, independent project approach provides students with a three-phase structure to assist in the development of their</p>

ideas from project specification through development critique to the final report. This requires students to engage (in conjunction with supervisor support and direction) in all aspects of research and development, scholarship, ethical and professional issues, together with a range of communication skills that will underpin their project. As a formative activity for the final submission, the student will offer an initial draft of the report at a peer critical reading session, an internal peer critique organised by staff but attended and conducted by peers. Questions and comments about the evaluation process and the depth of analysis raised during this session will inform the reflective written work, in addition to supervisor comments. The initial activities of this unit, including preparations for conducting empirical research, will build on skills developed in the masters. In addition, more general employability and pastoral events will be also organised (such as Career Management Skills, and personal tutorials).

2. **Placement/internship** A relevant placement or internship may be considered as an alternative to the dissertation. Curricular internships and placements are academic activities integrated into the curriculum corresponding to a module. One of the core objectives of the academic curriculum is to prepare students for professional practice. This preparation involves getting as close as possible to the reality of the work environment while still maintaining high academic standards.

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Assessment

As the summative unit in a master's programme, formative assessment opportunities are reduced to encourage higher-level skills (such as independent working) and also to facilitate the reduced staffing load available over the summer period where applicable. However, peer support and evaluation should be increased, for example, via a peer critical reading session, an internal peer critique organised by staff but attended and conducted by peers. Questions and comments about the evaluation process, and the depth of analysis raised during this session will inform the reflective written work, in addition to supervisor comments.

Dissertation (100%) – a 10,000-word project review that will include a formal literature review and will comprise an evaluation of a Preservation System in a given archival context, including design, methodology and suitable test plan.

In preparing for the assessment of the unit, students should bear in mind the following points:

- The report must show clear evidence of how critical reading of the literature is directly relevant to the defined project and how the wider contextual literature informs the project requirements and design.
- The report must demonstrate that the student has explored a range of approaches relating to the defined project and identified and determined the viability of any necessary digital preservation techniques.
- The student must demonstrate that an appropriate empirical or evaluation scheme has been applied and that subsequent data collection and analysis meaningfully inform the project programme.
- The final project resolution must demonstrate the student's informed reflection on the work. This should include recommendations on how the work could have been improved and, where appropriate, recommendations for future work if a digital preservation idea is not fully resolved.
- The student should demonstrate the ability to communicate the project findings in a way that is accessible to peers and subject experts.

A reflective review of the success of the development or empirical study in meeting the project's aims will demonstrate critical cognitive skill, whilst the project plan and Ethical Approval will be expected as indicators of a professional approach. This will be submitted alongside the project with a covering statement describing how formative 'editorial suggestions' have been addressed, along with any materials developed.

If the student undertakes a placement/internship a 'placement report' should be produced.

Placement Report (100%) – The purpose of the internship/placement report is to document and reflect upon the experiences and learning outcomes of the internship. It should demonstrate the practical application of academic knowledge and the development of professional skills.

The following structure is suggested:

- **Background:** Provide context about the internship organisation, industry, and relevant academic background.
- **Objectives:** Clearly state the goals and objectives of the internship/placement.
- **Scope:** Outline the scope of work and the specific tasks undertaken during the internship/placement.
- **Literature Review:** Review relevant literature and theories that relate to the internship/placement. This should demonstrate the academic grounding of the internship/placement work.
- **Methodology:** Describe the approach and methods used during the internship/placement to achieve the objectives.
- **Description of Tasks:** Provide a detailed description of the tasks and projects undertaken during the internship/placement.
- **Learning Outcomes:** Discuss the skills and knowledge gained. Relate these to your academic studies.
- **Challenges:** Outline any challenges faced and how they were overcome.
- **Present the findings and results of the internship/placement tasks.**

- Analyse and discuss these results in the context of the initial objectives and academic literature.

2.2.7. *Sample optional module on Sustainable digital archiving*

Course title	eArchiving
Module title	Sustainable digital archiving/carbon footprint reduction (optional module)
ECTS	See section 3.1 Credits

<p>Goals</p> <p>On completion of this module students should be able to:</p> <p>Identify</p> <ul style="list-style-type: none"> – the different scopes to consider for calculating the carbon footprint – the lifecycle of the tools used (computer, laptop, data centre) (criteria: energy consumption, software development, network, software licensing, and technical infrastructure) – keys aspects to know the environmental benefits of electronic archiving – new technologies (AI, data, etc.) and their positive or negative impacts on the carbon footprint of archiving software – the indicators and measures for calculating the carbon footprint <p>Understand</p> <ul style="list-style-type: none"> – how to explain digital carbon footprint – what sustainable electronic archiving is, and discuss its benefits – the environmental impact of digital technology at the European level – how to establish a responsible archiving policy and explain the concrete differences from a traditional archiving policy <p>Analyse</p> <ul style="list-style-type: none"> – analyse the lifecycle of the document, from creation to archiving, to identify its environmental impact with the goal of reducing the carbon footprint – calculate the carbon footprint of your electronic archiving – evaluate case studies or examples of implementation of responsible archiving policies
<p>Syllabus</p> <p>1. This module provides an exploration of responsible electronic archiving, emphasising environmental sustainability and carbon reduction. Students will learn about the digital carbon footprint, its calculation, and the lifecycle of tools used in</p>

electronic archiving (computer, laptop, data centre) and parameters to consider: energy consumption, software development, network, software licensing, technical infrastructure, electricity source, and data storage solutions. The module also covers the environmental benefits of electronic archiving, the impact of new technologies on the carbon footprint, and the indicators and measures for calculating it.

2. This module provides a comprehensive understanding of responsible electronic archiving, focusing on its environmental impacts and benefits. Students will learn to explain the digital carbon footprint, sustainable electronic archiving, and the environmental impact of digital technology at the European level. Additionally, the module will cover how to establish a responsible archiving policy and distinguish it from traditional archiving practices.
3. This module is designed to equip students with the analytical skills necessary for responsible electronic archiving, focusing on reducing the carbon footprint. Students will learn to analyse the lifecycle of documents, calculate the carbon footprint of electronic archiving, and evaluate case studies of responsible archiving policies.
4. Case Studies and Examples: examples of how an organisation calculated its carbon footprint (with which indicators) and how it reduced its environmental impact through electronic archiving.

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Assessment

Assessment should either be in the form of:

- (1) Self-directed (but tutor supported) problem-based individual coursework to develop the skills and knowledge of students, or
- (2) Time-constrained examinations.

Below is a suggested assessment; however, this is for guidance only, as the nature of the assessment is determined by institutional and national requirements.

Coursework – produce a written report based on the following question (100%). You are hired as an archivist at a company with the following resources:

- File Server: Over 1 TB of unsorted documents.
- Electronic Document Management System (EDMS): 500 GB of documents.

Tasks:

1. Determine the carbon footprint of your organisation's document storage and paper archives over 10 and 50 years.
2. Suggest ways to reduce your organisation's carbon footprint.
3. Highlight sustainable archiving methods and best practices.

3. MODULE DEPENDENCIES

	Proposed module (recommended)	Dependencies
M1	Introduction to eArchiving	
M2	eArchiving standards and specifications	M1
M3	eArchiving software tools	M1, M2, M6

M4	eArchiving data and documents	M1, M2
M5	Legal and Regulatory Compliance	M1
M6	Independent project	M1–5
M7 opt	Sustainable digital archiving (optional module) / Reduction of carbon footprint	M1–5

Table 1: Module dependencies.

3.1. Credits

The credits relevant or appropriate for a course depend on various factors, such as the specific requirements of the academic institution, the standards of the field of study, and accreditation guidelines. In this recommendation, we use this scale of credits as a reference:

- 3 Credits (Informative Level – Typically suitable for seminars, workshops, or short courses that provide foundational or supplementary information. Relevant for elective courses or those aimed at broadening general knowledge.)
- 6 Credits (Introductory Level – Appropriate for introductory courses that lay the groundwork for more advanced study. Usually covers fundamental theories, principles, and concepts of the subject area.)
- 7.5 Credits (Intermediate Level – Suitable for courses that provide a more in-depth understanding than introductory courses but are not as demanding as advanced courses. It is often used for intermediate courses that build on the basics and prepare students for advanced study.
- 10 Credits (Advanced Level – Fits well with advanced courses that require significant engagement and mastery of complex topics. These courses typically involve extensive coursework, projects, and assessments.)
- 30 Credits (Research Level – Common for thesis work, dissertations, or major research projects. Reflects the substantial effort, time commitment, and original contribution to the field that research entails.)

In this context, the curriculum can serve as a guideline for academic programs, with the modules addressed as follows (NOTE: This table indicates the appropriate levels at which each module can be individually addressed; it does not account for scenarios where the credits of preceding modules may influence the credits of subsequent modules within the same programme):

	3	6	7.5	10	30
M1. Introduction to eArchiving	✓	✓			
M2. eArchiving standards and specifications	✓	✓	✓	✓	✓
M3. Software tools for eArchiving		✓	✓	✓	✓
M4. eArchiving data and documents	✓	✓	✓	✓	✓
M5. Legal and regulatory compliance	✓	✓	✓		✓

Table 2: The proposed scale of credits.

3.2. Learning outcomes

Upon successful completion of the complete eArchiving curriculum, students will have:

Knowledge and Understanding of:

- The key standards and specifications relevant to eArchiving.
- The key software tools and best practice for eArchiving strategies.
- Long-term curation of digital data and documents.
- Issues and techniques pertaining to access and re-use digital assets, including trustworthiness, authenticity and relevance for digital assets.
- Research methodologies, including data collection and analysis.
- The legal and regulatory environment in relation to eArchiving, especially legal issues, copyright, IPR, GDPR, etc., from a European perspective.
- Ethical considerations and professional practice about eArchiving.

Cognitive (Intellectual or Thinking) Skills, able to:

- Critically deploy eArchiving technology-related intellectual, analytical, and problem-solving skills.
- Critically evaluate eArchiving needs for a range of digital objects against the available technology.
- Make appropriate decisions regarding relevant eArchiving techniques and technologies to use in situations.
- Critically appraise eArchiving planning methods and technologies to use in given situations.
- Plan, manage, undertake and report on a significant eArchiving project.

Practical (Professional or Subject) Skills, able to:

- Carry out an extended piece of independent research by acting autonomously in planning and implementing tasks.
- Initiate, develop and realise distinctive work in complex, unpredictable and specialised contexts and hence demonstrate adaptability and development of new skills for new situations.
- Demonstrate, to a high level, appropriate approaches to solving an eArchiving problem in a particular context, be they creative, methodological, or technological.
- Write and present materials suitable for use in eArchiving institutions or for academic research and publication.
- Professionally present a reasoned perspective on an advanced eArchiving problem to an informed audience and be able to respond appropriately to critical review.

Transferable (Graduate and Employability) Skills:

- Communication: communicate effectively in writing, speaking and in appropriate forms of presentation.
- Communication: read and understand complex documents, including those related to complex digital objects and their technical environments.
- Information Technology: use IT to assist in presentations, demonstrations and communications.

- Problem Solving: explore complex domains and delineate viable solutions.
- Improving Self Learning: build on previous achievements in order to generalise.
- Personal Skills Development: strategically plan, successfully manage and resolve dynamically complex work.
- Career Management: Reflexively pursue academic, professional and career aspirations.

4. CONCLUSIONS

The eArchiving Initiative’s Academic Curriculum Working Group continues to develop the eArchiving Course Curriculum. The working group has engaged with the eArchiving community to understand its needs using a questionnaire, panel discussions/audience participation at conferences, and semi-structured interviews with key respondents. This iterative process is continuing. Mapping the results of the user needs research onto an academic framework has generated an evidence-based outline of an academic curriculum in eArchiving developed within the framework of a European master’s degree.

The curriculum is based on modules allowing institutions to adopt the entire curriculum or pick specific modules pertinent to their requirements. An institution adopting the full curriculum would include recommended and elective modules. The elective modules will allow institutions to ‘shape’ the course for their specific contexts, thereby encouraging greater adoption. An initial proposal has been made for six recommended modules (M1–6). These are An introduction to eArchiving, eArchiving standards and specifications, eArchiving lifecycle and software tools, eArchiving data and documents, Legal and Regulatory Compliance, and Independent projects. Upon successfully completing the recommended modules, students will have a solid grounding in the core principles of eArchiving. The elective modules will complement this foundation.

The curriculum provides an opportunity to support the eArchiving community with a European-focused course that has had real input from the community and will benefit the community.

APPENDIX 1: GLOSSARY OF TERMS

Glossary of terms
E-ARK vocabs: http://evoc.dlmforum.eu/E-ARK/group/5568370c3448e76821b3942f/list