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TECHNICAL SPECIFICATION

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Digital publishing — EPUB3 preservation —

Part 1: Principles

Publications numériques — EPUB3 preservation —

Partie 1: Principes

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Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents) or the IEC list of patent declarations received (see http://patents.iec.ch).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

This document was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 34, *Document description and processing languages*.

A list of all parts in the ISO/IEC TS 22424 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

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Introduction

0.1 General

This document facilitates the long-term preservation of EPUB publications by specifying in general level EPUB features which are mandatory for long-term preservation (such as font embedding) and features which should be avoided if possible.

This document can be seen as a stepping stone towards a detailed specification which would be related to EPUB in the same way as PDF/A, specified in ISO 19005-1 to ISO 19005-3, is related to the Portable Document Format (PDF). If and when the EPUB community develops detailed guidelines for the production of archivable EPUB publications, this document could be used as one of the starting points.

Long-term preservation in general requires two things:

— making the object such as EPUB publication fit for preservation – including features to be used and features to avoid;

— packaging the object (and any metadata related to it) together with any additional data such as other versions of the object and other documentation into an Open Archival Information System (OAIS) submission information package (SIP).

Packaging is covered in ISO/IEC TS 22424-2.

0.2 EPUB

The EPUB standard

defines a distribution and interchange format for digital publications and documents. The EPUB® format provides a means of representing, packaging and encoding structured and semantically enhanced Web content — including HTML, CSS, SVG and other resources — for distribution in a single-file container.[17]

EPUB format was developed by the International Digital Publishing Forum, IDPF, which merged with the World Wide Web Consortium, W3C, in January 2017. Ongoing technical development of the standard, related extension specifications and ancillary deliverables are the responsibility of the W3C EPUB 3 Community Group[1], which published its charter in February 2017. According to the charter,

work on any future major revision of EPUB, e.g. an EPUB 4, is initially out of scope on the presumption that this will be taken up by a new W3C WG as a W3C Recommendation Track *activity. The EPUB 3 CG will coordinate its work with such new WG, and meanwhile with the existing W3C* Digital Publishing Interest Group *(DPUB IG).*[23]

The International Digital Publishing Forum, IDPF, has ceased operations as a membership organization in January 2017, and its website[2] is now an archive. The latest version of the standard and information about future EPUB developments is available at the Publishing@W3C webpage, https://www.w3.org/publishing/.

The specification at hand covers EPUB 3 versions up to EPUB 3.0.1[3]. EPUB 3.1[4] was the first major revision of EPUB 3.0.1, but there are no implementations of version 3.1 and therefore it is not covered in this document. The most widely used version of the standard is still 3.0.1. EPUB 3.2, was published in May 2019[5]. Unlike 3.1, it is fully backwards compatible with 3.0.1. It will be covered in the next edition of this document.

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1) https://www.w3.org/publishing/groups/epub3-cg/

2) http://idpf.org/

3) http://idpf.org/epub/301

4) https://www.w3.org/Submission/epub31/

5) https://w3c.github.io/publ-epub-revision/epub32/spec/epub-spec.html

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Differences between EPUB specifications 2.0.1-3.2 are well documented:

— EPUB 3 Changes from EPUB 2.0.1[6)]

— EPUB 3.0.1 Changes from EPUB 3.0[7)]

— EPUB 3.2 Changes from EPUB 3.0.1[8)]

All EPUB specifications are available in the Web; 2.01 at http://idpf.org/epub/201, EPUB 3.0.1 at http://idpf.org/epub/301 and 3.2 at https://w3c.github.io/publ-epub-revision/epub32/spec/epub-spec.html.

All EPUB publications, including ones using version 3.2, can be validated using EPUBCheck version 4.2.0, which was released in March 2019.

From long-term preservation point of view, lack of backward compatibility between successive versions of a file format would be a problem because it makes migration more challenging. In addition, EPUB 3.1 has at least one feature which would have been problematic. In EPUB 3.1 foreign resources do not require fallbacks if they are not in the spine and not embedded in EPUB Content Documents. In EPUB 3.0.1, fallback guarantees that there is a version of the document that can be rendered; in 3.1 such guarantee no longer exists.

EPUB 3.0.1 was prepared by the IDPF. It consists of six interlinked documents:

— EPUB 3 Overview

— Publications 3.0.1

— Canonical fragment identifiers

— Content documents 3.0.1

— Media overlays 3.0.1

— Open Container Format 3.0.1

There are several extension specifications to these EPUB base standards. The list below is incomplete, as it contains mainly specifications that are relevant from the long-term preservation point of view. Some of them are still drafts:

— EPUB Accessibility specification 1.0[9)] addresses evaluation and certification of accessible EPUB publications, and discovery of the accessible qualities in such publications.

— EPUB Previews 1.0[10)] describes how content previews can be included in EPUB publications.

— EPUB Distributable Objects 1.0[11)] is a draft specification that defines a method for the encapsulation, transportation, and integration of distributable objects in EPUB publications.

— EPUB Scriptable Components 1.0[12)] provides an interoperable publish and subscribe (pubsub) pattern by which interactive content can be created and incorporated into EPUB publications. Same as EPUB Distributable Objects, it is as of 2019-05-13 a draft.

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6) http://www.idpf.org/epub/30/spec/epub30-changes-20111011.html

7) http://www.idpf.org/epub/301/spec/epub-changes-20140626.html

8) https://w3c.github.io/publ-epub-revision/epub32/spec/epub-changes.html

9) http://www.idpf.org/epub/a11y/accessibility.html

10) http://www.idpf.org/epub/previews/epub-previews-20150826.html

11) http://www.idpf.org/epub/do/

12) http://www.idpf.org/epub/sc/api/

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— EPUB Scriptable Components Packaging and Integration 1.0[13] is a draft that defines a method for the creation and inclusion of dynamic and interactive components in EPUB publications.

— EPUB Multiple-Rendition Publications 1.0[14] defines the creation and rendering of EPUB publications consisting of more than one rendition of the same publication.

— EPUB Dictionaries and Glossaries 1.0[15] provides a means for expressing dictionary and glossary semantics in EPUB publications.

These extensions are not widely used and they have not been explicitly taken into account in this document. As regards accessibility, all EPUB publications are supposed to be accessible. However, accessibility features as such do not have an impact on long term preservation of EPUB publications and therefore this document does not make accessibility-related requirements.

EPUB 3 core media types have been listed at https://www.w3.org/publishing/epub3/epub-spec.html#sec-core-media-types. As of 2019-05-13, the latest change has been made on April 1, 2018. Starting from EPUB 3.2, core media types are part of the standard.

In 2014, EPUB 3.0 specifications were republished as ISO/IEC TS 30135-1 to ISO/IEC TS 30135-6. Each of these six ISO specifications is identical to its IDPF equivalent, for example ISO/IEC TS 30135-1 has exactly the same content as the EPUB 3.0 Overview.

ISO/IEC TS 30135-7 entitled "Part 7: EPUB3 Fixed-Layout Documents" is from EPUB 3.0.1 (EPUB 3.0 does not have fixed layout specification). ISO/IEC TS 30135 (all parts) is therefore a combination of EPUB 3.0 and Fixed-Layout Documents specification from 3.0.1.

ISO/IEC JTC 1/SC 34 is currently updating the ISO standard to match fully the version 3.0.1.

EPUB is a rich document format with a lot of features. From the digital preservation point of view this is a challenge, not least because long-term preservation has not been a priority in the development of the standard. Preserving all aspects and features of EPUB publications may be difficult, since there are features which are difficult to preserve. Moreover, EPUB reading systems usually do not support all features of the specification and finding tools supporting rare features can be difficult.

In spite of these challenges EPUB is generally regarded as a suitable format for digital archiving. For instance, the Finnish National Digital Library initiative has selected just eight archivable file formats for text, EPUB being one of them. The selection criteria were openness/transparency, adoption as a preservation standard, degree of forward/backward compatibility, degree of protection against file corruption, frequency of version releases, dependencies/interoperability, and standardization. EPUB got an A, the best grade, from everything else except the second and third criterion. For those, the grade was the second best, a B (see Reference [19], p.40). Based on these generic criteria, EPUB seems to provide a good basis for long-term preservation, although additional guidelines on how to use the standard are needed to guarantee EPUB files can be preserved efficiently.

The British Library's Digital Preservation Team has published an assessment of EPUB as a preservation format[15]. It covers EPUB versions 3.0.1 and 2 and the overall view of EPUB is positive (Reference [15], p.2):

EPUB 3 is currently the closest thing available to an open standard for e-books. In 2013, Bläsi and Rothlauf concluded that EPUB 3 had the "highest expressive power" of all formats in the e-book ecosystem, and that it included the superset of all features used in proprietary formats like KF8, Fixed Layout EPUB, and iBooks.

EPUB long-term preservation issues uncovered in the assessment of the British Library are discussed in Annex A.

EPUB is enjoying reasonable support in the e-book market. Many suppliers, publishers, and application developers who have supported EPUB 2 have implemented version 3.0.1. According to the EPUBTest web

13) http://www.idpf.org/epub/sc/pkg/

14) http://www.idpf.org/epub/renditions/multiple/

15) http://www.idpf.org/epub/dict/

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site[16], EPUB 3 support in reading systems is far from exhaustive, but market coverage is good – in January 2018, there were 59 reading systems supporting at least some of the features specified in EPUB 3.0.

E-book suppliers have produced EPUB 3 based formats that incorporate digital rights management (DRM), and EPUB modifications that may restrict using the format on other than the suppliers' own platforms. For example, the Kindle Fire eReader, released in 2015, uses a new format called Kindle Format 8 (KF8), which is partly based on EPUB 3, with Amazon's DRM. See Reference [15], 3. Publisher/supplier specific DRM often restricts the use of e-books to that publisher's/supplier's rendering devices and/or applications, and is therefore a major obstacle to digital preservation (see Reference [15], p.7).

The EPUB specification does not enforce a particular digital rights management scheme, but DRM may be layered on top of the EPUB specifications. A producer can, for instance, use one of the three major rights management systems in the market (Amazon DRM, Apple FairPlay DRM for books bought from iBooks, and Adobe DRM), or some other DRM system along with some additional platform-targeting.

DRM protection should be removed from EPUB publications during pre-ingest by the producer or as a part of the ingest process by the OAIS archive. In practice, only national libraries may be able to do this, provided that legal deposit act and / or copyright act guarantee them such privilege. If migration is the chosen preservation strategy, existing EPUB publications will be converted into more modern EPUB versions when rendering tools for old versions are no longer available, and (eventually) migrated into other formats.

If preserved EPUB publications are not directly accessible by the public, removing DRM, digital watermarking, and other protection mechanisms from the archived documents is not a risk. When publications are delivered to the customers as dissemination information packages (DIPs), the archive shall use a combination of administrative and technical means to protect the documents as required in the submission agreement. These means may include adding DRM protection mechanism into the DIP submitted to the user according to the requirements of the submission agreement. The agreement may also specify the customers the archive is entitled to serve; for instance, it is possible to require that the preserved documents can only be disseminated to the producer, and the producer will serve the end-users who do not have direct access the OAIS archive.

0.3 Digital preservation

The information society is dependent on successful long-term digital preservation. When an increasing percentage of information is produced and published only in a digital format, it is important to make sure that this information remains available in the distant future.

Digital preservation is not about preserving just bits, but about preserving access. The "business logic" is as follows:

— we need software and hardware to render content for human users;

— software changes over time; there are new versions from old applications, and entirely new applications;

— new or updated applications may not be able to render outdated file formats or format versions correctly

— digital preservation makes an effort to have all archived content in stable formats. Publications should also contain the smallest possible amount of features which are not commonly supported in software packages used to render the content in these formats, and also avoid adding links to external resources since then the long-term access to the publication requires also persistence of these external resources.

— when necessary, data in old formats may be migrated into more modern formats or updated versions of the same format. For instance, an e-book in EPUB 3.0.1 format may be migrated to EPUB 3.2. when version 3.0.1 is no longer widely supported by reading systems.

16) http://epubtest.org/results

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— since the aim is to preserve the content, not the bits, the bits may change as a result of version updates and format migrations.

— Many OAIS archives preserve successive versions of archives publications, because migration may change the look and feel of the original document, or even its intellectual content.

In many countries, national libraries are responsible for preserving the published cultural heritage for the future generations, while national archives take care of governmental publications, irrespective of which format they are available in. All of these resources have to be preserved for decades, centuries even. Then again, publishers may guarantee continuous access to the subscribers of electronic serials and other licensed content. If this is so, either the publisher or a third-party should look after the publications and make sure they remain accessible or at least available.

Ordinary digital asset management systems are not suitable for long-term preservation; therefore it is a normal practice to separate short-term and long-term information management into different systems. However, this does not mean that digital archiving is independent of the routine life cycle of documents. Digital preservation is a long process that begins when publications are created.

Preservation metadata, which allows the publication to be found, rendered and authenticated correctly, is a prerequisite for digital preservation. Some preservation metadata elements can or should be provided by the original creator of the publication. It is also important to keep preservation requirements in mind when preparing a publication, if it is known that it has to be preserved for a long time. Any feature in a file format can be either essential, useful, neutral, questionable, or even downright counterproductive from a long-term preservation point of view. However, publishers are likely to use the features that let them achieve their own goals, and preservation may not be among them.

There are archivable versions of some file formats. PDF/A (ISO 19005-1:2005) is probably the best known example. It specifies how to use the PDF for long-term preservation. An example of a counterproductive feature for preservation in PDF is font referencing; therefore in PDF/A all fonts shall be embedded in order to guarantee that the document can be rendered correctly.

PDF/A forbids also the use of encryption, because encryption is generally regarded as a risk for long-term preservation. But storing unencrypted documents is a risk as well, because if they are stolen, non-authorized usage is easy. Therefore, according to the Digital preservation handbook[25]:

Information security methods such as encryption add to the complexity of the preservation process and should be avoided if possible for archival copies. Other security approaches may therefore need to be more rigorously applied for sensitive unencrypted files; these might include restricting access to locked-down terminals in controlled locations (secure rooms), or strong user authentication requirements for remote access.

In order to guarantee the correct processing of PDF/A files, there are specific requirements for PDF/A reading systems, such as support for embedded fonts. There are three versions of the specification: PDF/A-1 is based on PDF 1.4, PDF/A-2 adds features from PDF 1.5, 1.6 and 1.7, and PDF/A-3 contains all the features of PDF/A-2 as well as allows the embedding of other file formats into PDF/A conforming documents[21].

The TI/A (Tagged Image for Archival) standard initiative intended to create an ISO recommendation to optimize the format specification for archival purposes. Unfortunately the project was disbanded in 2016, and the TI/A draft the initiative completed in September 2016 is only available in the project Intranet. However, the original TIFF/A (later TI/A) draft from February 2015 is a public document available on a PREFORMA project web site[17]. Although this TIFF/A specification is only a draft, it is probably a good idea to use in archival TIFF images features specified mandatory in the specification, and avoid the ones which are forbidden.

The motivation behind the TI/A initiative can be applied to other image formats as well, and there are also points the EPUB community might agree with Reference [22]:

17) http://www.preforma-project.eu/dpf-manager.html

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The versatility of the TIFF format has made it very attractive for memory institutions for long-term archival of their digital images. However, since the TIFF format offers such a great flexibility, it is not guaranteed that in the future a standard TIFF reader will be able to read some TIFF images.

The limitations of the baseline TIFF are too severe for many applications in digital archiving. It is important that, besides crucial technical metadata such as ICC color profiles (in case of color images) also important descriptive metadata is stored within the image file. Having descriptive metadata available (such as content description, iconography, copyright and ownership information etc.) is crucial for every archive. Having this information in the same file as the image data guarantees that this information will always be associated with the image.

TIFF is not an EPUB core media type, but four other image types have been listed; GIF, JPEG, PNG, and SVG. It is significant from a digital preservation point of view how these formats and other core media types are used in the EPUB context. Image and audio files embedded in an EPUB publication may require migration before the EPUB publication itself has to be migrated into a more modern file format, if commonly available EPUB reading systems no longer support these file formats. This document does not provide guidelines for creating archivable files in EPUB 3 core media types, due to the magnitude of such task. But EPUB community should follow the archival file format lists of national archives or libraries (for example the Library of Congress file format list[18] and the U.S. National Archives list[19]) when the core media file format list is updated. Publishers should also consider the persistence of file formats used when creating EPUBs for which the need for long-term preservation is foreseen.

This document does not require any changes to be made to the EPUB versions in production now or to any future versions of it. However, with each new EPUB standard version it is necessary to check if the ISO 22424 (all parts) needs to be revised, since any new EPUB features can be either useful, counterproductive, or irrelevant from a long-term digital preservation point of view. A similar approach is already in place for PDF/A: ISO 19005-1 applies to PDF 1.4, and ISO 19005-2 covers the subsequent PDF versions up to 1.7.

0.4 OAIS and related standards

ISO 22424 (all parts) provides guidance on how to utilize the OAIS and current practices of OAIS archives in preservation of EPUB publications. The OAIS (ISO 14721) is equally relevant to both parts of the ISO 22424 series.

OAIS is a reference model for long-term data storage systems. It is used by memory institutions (libraries, archives, and museums) and many other organizations that need to preserve digital resources in the long-term. Although an ISO standard, the OAIS was originally developed by the Consultative Committee for Space Data Systems (CCSDS)[20], which still maintains the specification.

The model has five functional units (Ingest, Archival Storage, Access, Data management and Administration) as shown in Figure 1.

18) http://www.loc.gov/preservation/digital/formats/

19) https://www.archives.gov/records-mgmt/policy/transfer-guidance-tables.html

20) https://public.ccsds.org/default.aspx

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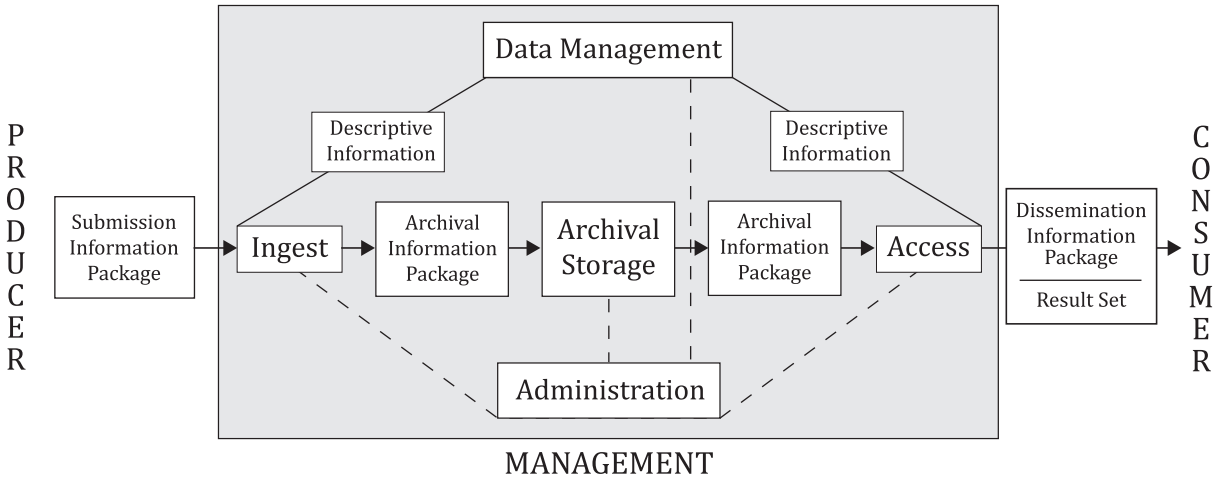

Figure 1 — OAIS model[20]

In the model, the *ingest function* is responsible for receiving information from producers and preparing it for storage and management within the OAIS archive. The ingest accepts information – in this case, EPUB publications – from producers in the form of SIPs, performs quality assurance checks on the SIP, and generates an archival information package (AIP) from one or more SIPs (or multiple AIPs from a single SIP). Finally, the ingest function transfers the new AIPs to Archival Storage and the associated descriptive information (metadata) to Data Management.

Modifying an EPUB publication so that it is suitable for digital archiving is from the OAIS point of view a part of pre-ingest and as such not a part of the OAIS model. The importance of the OAIS to ISO 22424 (all parts) is that the model provides a terminology, information package data model and an overall framework within which digital preservation can be performed.

Neither OAIS nor this document describe the interface between a repository system used by the archive and systems used by producers. The Producer-Archive Interface Methodology Abstract Standard, also known as PAIMAS (ISO 20652), covers the first stages of the ingest process defined by the OAIS. It provides a basis for detailed specifications on how production systems communicate with OAIS archives. One such specification is DEPIP, the Data Exchange Protocol for Interoperability and Preservation (ISO 20614). The DEPIP is intended for systems used by libraries, archives, and museums. Other domains are likely to create their own API specifications.

Of all the functional units of the OAIS model, this document covers only the ingest unit. In addition there are tasks that are part of non-OAIS unit Pre-ingest, or things a producer shall take care of when preparing a SIP. Other OAIS units are beyond the scope, and therefore archival or dissemination related functions such as migration or creation of dissemination information packages are discussed only in passing. It is assumed that ingest does not require any major changes, although if EPUB for some reason were no longer approved as preservation format, the archive would be obliged to migrate the EPUB publications into eligible file format. Even then the submission agreement might require the archive to disseminate the publication back to consumers in the original EPUB format.

OAIS submission agreements specify the principles of how documents should be prepared and submitted to the repository system. If the archive uses migration as the preservation method[21], submission agreements should specify file formats (and metadata formats) suitable for submission and/or archival, or refer to external documents listing these formats. File formats suitable for submission but not for archival are migrated during the ingest process, although the original files may be included in the AIP.

21) In this document, preservation method is assumed to be migration. In practice, emulation can also be applied if it is important to preserve the original look and feel of the publication. In an ideal world such migrations between the file formats would be lossless; in practice that is not the case. Migrated document could look different even if the content is the same, and in the worst case semantics changes as well. Therefore archives often preserve also the original version of the archived resource, alongside more modern versions.

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Therefore archives often preserve also the original version of the archived resource, alongside more modern versions.

The submission agreements may also refer to SIP schema specifications, which provide more guidelines for document producers. Schemas may utilize long-term preservation standards such as METS (Metadata Encoding and Transmission Standard). Together the submission agreement and related documents should give a producer a clear idea on when and which publications should be sent to the repository system, which file formats and metadata specifications should be used, means of data transfer available etc. These requirements should cover both ingest and dissemination; that is, submission of documents to the repository system by the producer, and retrieval of the archived documents by customers.

This document outlines the general principles for the submission of EPUB publications from digital asset management systems to repository systems. The principles of archival storage or dissemination of archived documents are not covered here, because OAIS archives may apply various methods and processes to meet the requirements of submission agreements. Bit level preservation is also out of scope; the purpose of this document is to make it easier for producers and OAIS archives to preserve access to EPUB documents.

ISO/IEC TS 22424-2 provides a technical basis to meet the principles listed in this document by specifying metadata required for long-term preservation, and a method for packaging this metadata with the original EPUB container.

This document is applicable to EPUB versions 3 and 3.0.1 and as such it should be used cautiously with other (previous or later) versions of the standard. If there is a need to preserve documents that are in earlier EPUB versions, they do not need to be migrated, provided that a) submission agreement specifies those EPUB versions as archivable formats, and b) there are reading systems for these EPUB versions. Additional features in future EPUB versions should be analyzed from a long-term preservation point of view. If such an analysis reveals that they may constitute a risk, they should be avoided in submitted EPUB publications, or removed during ingest.

Annex A in this document provides a summary of issues and recommendations related to the EPUB standard and its usage from long-term preservation point of view.

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Digital publishing — EPUB3 preservation —

Part 1: Principles

1 Scope

The ISO/IEC TS 22424 series supports long-term preservation of EPUB publications via a dual strategy. This document considers EPUB features from a long-term preservation point of view. Some EPUB features are forbidden and some others required, depending on how they relate to a long-term preservation. EPUB publications constructed according to these guidelines are suitable for preservation.

ISO/IEC TS 22424-2 makes EPUB compliant with Open Archival Information System (OAIS) and current practices of OAIS archives.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 14721, *Space data and information transfer systems — Open archival information system (OAIS) — Reference model*

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