**ISO/IEC 29500-2:201x**

 **Office Open XML File Formats — Open Packaging Conventions**

**Working Draft WD3.6**

2018-09-19

**Reviewer Instructions:**

1. Please report each new issue on the following site: (<https://github.com/sc34wg4/opcRevision/issues>) as a separate entry whose title starts with the relevant document clause number. For example, “8.5.2.1, Relationships Part: Problem with …”
2. Before creating a new issue check to see if one like it has already been created, and if so, add to that.
3. On 2018-11-01 at 13:00 GMT, there will be a 2-hour Zoom-based teleconference for reviewers to ask questions regarding this specification. To join that conference, go to [www.xxx.yyy](http://www.xxx.yyy).
4. This document contains a number of Comments starting with “Attention Reviewers:” for which we’d especially like feedback**.**
5. Following these instructions is rationale as why this specification is being revised.

Rationale for the OPC Revision

2018-08-15

MURATA Makoto (WG4 convenor)

**1. Part names, references, pack URIs, base URIs, resolution of relative references, and non-ASCII characters**

The biggest motivation for revising OPC is to address issues around part names, references, pack URIs, base URIs, resolution of relative references, and non-ASCII characters. Numbers/Preview/QuickLook of Apple did have a bug (see [this bug report](https://bitbucket.org/openpyxl/openpyxl/issues/677/cant-read-multi-sheet-file-in-macos) for openpyxl) due to these issues.

**1.1 Defect Reports**

|  |  |  |
| --- | --- | --- |
| [09-0280](https://onedrive.live.com/view.aspx/Public%20Documents/2009/DR-09-0280.docx?cid=c8ba0861dc5e4adc) | OPC: Non-ASCII characters in Part Names | Clause 4 and Annex A disallows non-ASCII characters in part names, while 9.1.1.1 allows them. |
| [09-0283](https://onedrive.live.com/view.aspx/Public%20Documents/2009/DR-09-0283.docx?cid=c8ba0861dc5e4adc) | OPC: Inconsistencies between Clause 9.1 and Annex A | There are duplications in §9.1 and §A. Furthermore, the terminology in §9.1 and that in §A are slightly different. For example, "Part IRI" and "Part URI" in §9.1 are never used in §A. |
| [09-0284](https://onedrive.live.com/view.aspx/Public%20Documents/2009/DR-09-0284.docx?cid=c8ba0861dc5e4adc) | OPC: part-URI and part-IRI grammar productions | It is not clear where in the BNFs in RFC 3986, RFC 3987, or Appendix A the non-terminals part-URI and part-IRI occur. |
| [09-0285](https://onedrive.live.com/view.aspx/Public%20Documents/2009/DR-09-0285.docx?cid=c8ba0861dc5e4adc) | OPC: Use of Terms “Part URI” and “Part IRI” | The term "Part IRI" is very misleading. It sounds like a particular type of IRI, but it actually means those parts of IRIs which specify OPC part names. Likewise, the term "Part URI" is also misleading. |
| [09-0286](https://onedrive.live.com/view.aspx/Public%20Documents/2009/DR-09-0286.docx?cid=c8ba0861dc5e4adc) | OPC: The syntax of "references" | The syntax of "references" is never clearly stated. What is a reference? Is it a part of relative LEIRI, IRI, or URI references? |
| [09-0291](https://onedrive.live.com/view.aspx/Public%20Documents/2009/DR-09-0291.docx?cid=c8ba0861dc5e4adc) | OPC: Use of term "Unicode string" | It is not clear why the term "Unicode string" has to be introduced here. Moreover, its syntax is quite unclear. |
| [09-0292](https://onedrive.live.com/view.aspx/Public%20Documents/2009/DR-09-0292.docx?cid=c8ba0861dc5e4adc) | OPC: Space characters in part names | It is not clear whether the space character is allowed as part of OPC part name. |
| [09-0293](https://onedrive.live.com/view.aspx/Public%20Documents/2009/DR-09-0293.docx?cid=c8ba0861dc5e4adc) | OPC: pack URI scheme | Although the pack URI scheme has been registered as a provisional scheme at IANA, its definition appears in an Internet Draft rather than an RFC. The latest Internet Draft has expired in August 2009. Furthermore, the registration of the pack scheme at IANA has been changed from "provisional" to "historical" since the Internet Draft mistakenly allowed ":" as part of an authority. |
| [10-0015](https://onedrive.live.com/view.aspx/Public%20Documents/2010/DR-10-0015.docx?cid=c8ba0861dc5e4adc) | OPC: Relationship Markup | It is not clear how relative URIs (which are values of the Target attribute) are resolved. |

**1.2 History**

[**Harmonizing OPC with Web Addresses and ZIP**](https://isotc.iso.org/livelink/livelink?func=ll&objId=16691699&objAction=Open&viewType=1)**, SC34/WG4 N0148 (2010-09)**

This personal contribution by Murata studies the use of non-ASCII characters in OOXML, IETF URI/IRI RFCs, and W3C LEIRI Note.

[**Improving Part 2 in reply to DRs**](https://isotc.iso.org/livelink/livelink?func=ll&objId=16688470&objAction=Open&viewType=1)**, SC34/WG4 N0207 (2011-09)**

This Japanese national body contribution studied relevant DRs including those listed above and asserted that a revision is needed for addressing them.

[**Minutes of the Bellevue WG4 meeting**](https://isotc.iso.org/livelink/livelink?func=ll&objId=16682967&objAction=Open&viewType=1)**(2013-06-17/20)**

In the Bellevue meeting (2013-06-17/20), WG4 extensively discussed these DRs and even studied MS Office and .Net implementations. Chris Rae, John Haug, Jim Thatcher, and original OPC designers were involved in this discussion. The current OPC draft is based on consensus in this meeting.

**1.3 Difficulties**

Why is this topic so hard? There are several reasons:

* RFC 3986, RFC 3987, and WHATWG URL Spec are not as good as we hope.
* Relative references in non-Relationships parts and those in Relationships parts need different base URIs (when the target mode is not external).
* OOXML documents and XPS documents use different conventions for referencing parts.
* MS Office and .Net exhibit different behaviors.
* The first edition of ISO/IEC 29500-2 specifies behaviors different from any of those mentioned above.
* Non-ASCII characters were introduced after the DIS ballot in a hurry.

**1.4 Solutions and Remaining Issues**

WG4 has addressed most of the problems identified by the above DRs by thoroughly rewriting the clause for the Abstract Package Model. In particular, 1) a new subclause "Resolving Relative References" has been added; 2) part Relationship parts and package Relationship parts are distinguished; 3) base IRIs are clearly defined for part Relationship parts and package Relationship parts depending on the target mode; and, 4) Pack URIs are defined in Clause 8 rather than an annex.

However, DRs 09-0286 and 09-0291 have not been completely addressed, since WG4 does not know the behaviors of all implementations of OPC. DR 09-0293 requires further work at IANA after the publication of the revised OPC.

**2. Addressing conformance issues (leftover from the BRM)**

In the BRM, it was agreed that OPC conformance is purely syntactical. However, for the lack of time, many requirements in OPC were *not* rewritten as requirements on data, as implied by this sentence in the published 29500-2: “Conformance requirements written as requirements for package implementers (e.g., M1.1) are document conformance requirements”.

**2.1 Defect Reports**

|  |  |
| --- | --- |
| [13-0002](https://onedrive.live.com/view.aspx/Public%20Documents/2013/DR-13-0002.docx?cid=c8ba0861dc5e4adc) | OPC: Issues with Conformance Guidelines |
| [14-0001](https://onedrive.live.com/view.aspx/Public%20Documents/2014/DR-14-0001.docx?cid=c8ba0861dc5e4adc) | OPC: Annex H Cleanup |

**2.2 Solutions**

Wherever possible, WG4 has rewritten requirements on programs as those on data.

The informative annex for summarizing guidelines for meeting conformance has been dropped.

The clause for conformance was moved from Clause 2 to Clause 6, since ISO/IEC editing directives require that Clause 2 be "Normative References".

**3. Clarifications**

**3.1 Terminology**

WG4 removed terms that are not used by any normative clauses and then reorganized the remaining terms by subclauses.

**3.2 Physical Package Model**

The clause for physical packages has been renamed as "Clause 9 Physical Package Model". Interleaving is introduced before logical item names. Percent-encoding and un-percent encoding of non-ASCII characters are explicitly introduced in Subclause 9.3.

**3.3 Core Properties**

Diagrams are replaced with normative prose, which clearly specifies requirements.

**3.4 Digital Signatures**

As part of this revision, the addition of XAdES digital signatures was planned. However, WG4 finally decided that this revision does not introduce any new features. Lots of clarifications were made though, as requested by DRs:

|  |  |
| --- | --- |
| [10-0043](https://onedrive.live.com/view.aspx/Public%20Documents/2010/DR-10-0043.docx?cid=c8ba0861dc5e4adc) | OPC: Non-ambiguity of DC identifiers |
| [10-0048](https://onedrive.live.com/view.aspx/Public%20Documents/2010/DR-10-0048.docx?cid=c8ba0861dc5e4adc) | OPC: Processing model for handling ZIP encryption |
| [11-0029](https://onedrive.live.com/view.aspx/Public%20Documents/2011/DR-11-0029.docx?cid=c8ba0861dc5e4adc) | OPC: Do not copy text or schemas from W3C XML Signature |
| [11-0030](https://onedrive.live.com/view.aspx/Public%20Documents/2011/DR-11-0030.docx?cid=c8ba0861dc5e4adc) | OPC: Obsolete version of W3C XML Digital Signature 1.0 |
| [11-0031](https://onedrive.live.com/view.aspx/Public%20Documents/2011/DR-11-0031.docx?cid=c8ba0861dc5e4adc) | OPC: Use official RELAX NG schemas from W3C |
| [12-0001](https://onedrive.live.com/view.aspx/Public%20Documents/2012/DR-12-0001.docx?cid=c8ba0861dc5e4adc) | OPC: Correct Spelling of “relationship part” |
|  |  |

Note: The relationship type for digital signatures in MS Office documents and that in the currently-published 29500-2 are different. The ongoing revision fixed this problem by updating the relationship type.

**4. Misc**

The clause for acronyms and abbreviations was dropped since it does not make sense to for an ISO/IEC standard to define "ISO" and "IEC".

Schemas are not incorporated but rather referenced by URI.

Contents

[Foreword xiii](#_Toc525123059)

[Introduction xv](#_Toc525123060)

[1 Scope 1](#_Toc525123061)

[2 Normative References 2](#_Toc525123062)

[3 Terms and Definitions 4](#_Toc525123063)

[4 Notational Conventions 8](#_Toc525123064)

[5 General Description 9](#_Toc525123065)

[6 Conformance 10](#_Toc525123066)

[7 Overview 11](#_Toc525123067)

[8 Abstract Package Model 12](#_Toc525123068)

[8.1 General 12](#_Toc525123069)

[8.2 Parts 12](#_Toc525123070)

[8.2.1 General 12](#_Toc525123071)

[8.2.2 Part Names 12](#_Toc525123072)

[8.2.3 Media types 14](#_Toc525123073)

[8.2.4 Growth Hint 14](#_Toc525123074)

[8.2.5 XML Usage 15](#_Toc525123075)

[8.3 Part Addressing 15](#_Toc525123076)

[8.3.1 General 15](#_Toc525123077)

[8.3.2 Pack Scheme 16](#_Toc525123078)

[8.3.3 Resolving a Pack IRI to a Resource 17](#_Toc525123079)

[8.3.4 Composing a Pack IRI 18](#_Toc525123080)

[8.3.5 Equivalence 19](#_Toc525123081)

[8.4 Resolving Relative References 19](#_Toc525123082)

[8.4.1 General 19](#_Toc525123083)

[8.4.2 Base IRIs 19](#_Toc525123084)

[8.4.3 Examples 20](#_Toc525123085)

[8.5 Relationships 22](#_Toc525123086)

[8.5.1 General 22](#_Toc525123087)

[8.5.2 Relationships Part 23](#_Toc525123088)

[8.5.3 Relationship Markup 24](#_Toc525123089)

[8.5.4 Examples 26](#_Toc525123090)

[8.5.5 Support for Versioning and Extensibility 30](#_Toc525123091)

[9 Physical Package Model 31](#_Toc525123092)

[9.1 General 31](#_Toc525123093)

[9.2 Physical Mapping Guidelines 31](#_Toc525123094)

[9.2.1 Using Features of Physical Formats 31](#_Toc525123095)

[9.2.2 Mapped Components 31](#_Toc525123096)

[9.2.3 Mapping Media Types to Parts 31](#_Toc525123097)

[9.2.4 Interleaving 35](#_Toc525123098)

[9.2.5 Mapping Part Names to Physical Package Item Names 37](#_Toc525123099)

[9.3 Mapping to a ZIP file 38](#_Toc525123100)

[9.3.1 General 38](#_Toc525123101)

[9.3.2 Mapping Part Data 39](#_Toc525123102)

[9.3.3 ZIP Item Names 39](#_Toc525123103)

[9.3.4 Mapping Logical Item Names to ZIP Item Names 39](#_Toc525123104)

[9.3.5 Mapping ZIP Item Names to Logical Item Names 40](#_Toc525123105)

[9.3.6 ZIP Package Limitations 40](#_Toc525123106)

[9.3.7 Mapping the Media Types Stream 41](#_Toc525123107)

[9.3.8 Mapping the Growth Hint 41](#_Toc525123108)

[10 Core Properties 42](#_Toc525123109)

[10.1 General 42](#_Toc525123110)

[10.2 Core Properties Part 43](#_Toc525123111)

[10.3 Core Properties Markup 43](#_Toc525123112)

[10.3.1 General 43](#_Toc525123113)

[10.3.2 coreProperties element 44](#_Toc525123114)

[10.3.3 Property elements from Dublin Core Metadata Element Set, Version 1.1 44](#_Toc525123115)

[10.3.4 Property Elements from DCMI Metadata Terms 45](#_Toc525123116)

[10.3.5 Property Elements defined in this Document 45](#_Toc525123117)

[10.4 Support for Versioning and Extensibility 48](#_Toc525123118)

[11 Thumbnails 49](#_Toc525123119)

[12 Digital Signatures 50](#_Toc525123120)

[12.1 General 50](#_Toc525123121)

[12.2 Overview of OPC-Specific Restrictions and Extensions to “XML-Signature Syntax and Processing” 50](#_Toc525123122)

[12.3 Choosing Content to Sign 50](#_Toc525123123)

[12.4 Digital Signature Parts 50](#_Toc525123124)

[12.4.1 General 50](#_Toc525123125)

[12.4.2 Digital Signature Origin Part 51](#_Toc525123126)

[12.4.3 Digital Signature XML Signature Part 51](#_Toc525123127)

[12.4.4 Digital Signature Certificate Part 52](#_Toc525123128)

[12.5 Digital Signature Markup 52](#_Toc525123129)

[12.5.1 General 52](#_Toc525123130)

[12.5.2 Signature Element 52](#_Toc525123131)

[12.5.3 SignedInfo Element 52](#_Toc525123132)

[12.5.4 CanonicalizationMethod Element 52](#_Toc525123133)

[12.5.5 Reference Element 53](#_Toc525123134)

[12.5.6 Transform Element 53](#_Toc525123135)

[12.5.7 RelationshipReference Element 54](#_Toc525123136)

[12.5.8 RelationshipsGroupReference Element 54](#_Toc525123137)

[12.5.9 DigestMethod Element 54](#_Toc525123138)

[12.5.10 Object Element 55](#_Toc525123139)

[12.5.11 Manifest Element 55](#_Toc525123140)

[12.5.12 SignatureProperty Element 55](#_Toc525123141)

[12.5.13 SignatureTime Element 55](#_Toc525123142)

[12.5.14 Format Element 55](#_Toc525123143)

[12.5.15 Value Element 56](#_Toc525123144)

[12.5.16 XPath Element 56](#_Toc525123145)

[12.6 Relationships Transform Algorithm 56](#_Toc525123146)

[12.7 Digital Signature Example 57](#_Toc525123147)

[12.8 Generating Signatures 60](#_Toc525123148)

[12.9 Validating Signatures 60](#_Toc525123149)

[Annex A (informative) Preprocessing for Generating Relative References 62](#_Toc525123150)

[Annex B (normative) Constraints and Clarifications on the use of ZIP Features 64](#_Toc525123151)

[B.1 General 64](#_Toc525123152)

[B.2 Archive File Header Consistency 64](#_Toc525123153)

[B.3 Data Descriptor Signature 64](#_Toc525123154)

[B.4 Table Key 64](#_Toc525123155)

[Annex C (normative) Schemas - W3C XML Schema 75](#_Toc525123156)

[C.1 General 75](#_Toc525123157)

[C.2 Media Types Stream 75](#_Toc525123158)

[C.3 Core Properties Part 75](#_Toc525123159)

[C.4 Digital Signature XML Signature Markup 75](#_Toc525123160)

[C.5 Relationships Part 75](#_Toc525123161)

[Annex D (informative) Schemas - RELAX NG 76](#_Toc525123162)

[D.1 General 76](#_Toc525123163)

[D.2 Media Types Stream 76](#_Toc525123164)

[D.3 Core Properties Part 76](#_Toc525123165)

[D.4 Digital Signature XML Signature Markup 76](#_Toc525123166)

[D.5 Relationships Part 76](#_Toc525123167)

[D.6 Additional Resources 76](#_Toc525123168)

[D.6.1 XML 76](#_Toc525123169)

[D.6.2 XML Digital Signature Core 76](#_Toc525123170)

[Annex E (normative) Standard Namespaces and Media Types 77](#_Toc525123171)

[Annex F (informative) Physical Package Model Design Considerations 79](#_Toc525123172)

[F.1 General 79](#_Toc525123173)

[F.2 Access Styles 80](#_Toc525123174)

[F.2.1 General 80](#_Toc525123175)

[F.2.2 Direct Access Consumption 80](#_Toc525123176)

[F.2.3 Streaming Consumption 80](#_Toc525123177)

[F.2.4 Streaming Creation 80](#_Toc525123178)

[F.2.5 Simultaneous Creation and Consumption 80](#_Toc525123179)

[F.3 Layout Styles 81](#_Toc525123180)

[F.3.1 General 81](#_Toc525123181)

[F.3.2 Simple Ordering 81](#_Toc525123182)

[F.3.3 Interleaved Ordering 81](#_Toc525123183)

[F.4 Communication Styles 81](#_Toc525123184)

[F.4.1 General 81](#_Toc525123185)

[F.4.2 Sequential Delivery 81](#_Toc525123186)

[F.4.3 Random Access 81](#_Toc525123187)

[Annex G (informative) Differences Between ISO/IEC 29500-2 and ECMA-376:2006 82](#_Toc525123188)

[G.1 General 82](#_Toc525123189)

[G.2 XML Elements 82](#_Toc525123190)

[G.3 XML Attributes 82](#_Toc525123191)

[G.4 XML Enumeration Values 82](#_Toc525123192)

[G.5 XML Simple Types 82](#_Toc525123193)

[G.6 Part Names 82](#_Toc525123194)

[Annex H (informative) Package Example 83](#_Toc525123195)

[H.1 General 83](#_Toc525123196)

[H.2 Abstract Package 83](#_Toc525123197)

[H.3 Physical Package 84](#_Toc525123198)

[Bibliography 85](#_Toc525123199)

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. In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of the joint technical committee is to prepare International Standards. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75% of the national bodies casting a vote.

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.

ISO/IEC 29500-2 was prepared by ISO/IEC JTC 1, Information technology, Subcommittee SC 34, Document description and processing languages.

This fourth edition cancels and replaces the third edition (ISO/IEC 29500-2:2012).

The major changes from the previous edition include:

* Removed the allowance for media type to be an empty string, as this conflicts with the definition of media type in RFC 2046 and the existing regular expression defined in Annex C.
* Dropped requirements around streaming consumption.
* xx

The major changes in the third edition include:

* Added new terms byte, id, relationship type, source part, target part, and unique identifier, and removed the term well-known part.
* Removed subclause §9.2.2, “Fragments”
* Added subclause §C.2, “Data Descriptor Signature”
* Applied changes to resolve numerous Defect Reports

There were no major changes in the second edition.

ISO/IEC 29500 consists of the following parts, under the general title Information technology — Document description and processing languages — Office Open XML File Formats:

* Part 1: Fundamentals and Markup Language Reference
* Part 2: Open Packaging Conventions
* Part 3: Markup Compatibility and Extensibility
* Part 4: Transitional Migration Features

This Part of ISO/IEC 29500 includes two annexes (Annex C and Annex D) that refer to data files provided in electronic form.

The document representation formats defined by this Part are different from the formats defined in the corresponding Part of ECMA-376:2006. Some of the differences are reflected in schema changes, as shown in Annex G of this Part.

Introduction

ISO/IEC 29500 specifies a family of XML schemas, collectively called Office Open XML, which define the XML vocabularies for word-processing, spreadsheet, and presentation documents, as well as the packaging of documents that conform to these schemas.

The goal is to enable the implementation of the Office Open XML formats by the widest set of tools and platforms, fostering interoperability across office productivity applications and line-of-business systems, as well as to support and strengthen document archival and preservation, all in a way that is fully compatible with the existing corpus of Microsoft Office documents.

Information technology — Document description and processing languages — Office Open XML File Formats

Part 2:
Open Packaging Conventions

Scope

This document defines a set of conventions for packaging one or more interrelated byte streams (parts) as a single resource (package). These conventions are applicable not only to Office Open XML specifications as described in Parts 1 and 4 of this Standard, but also to other markup specifications.

# Normative References

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

American National Standards Institute, Coded Character Set — 7-bit American Standard Code for Information Interchange, ANSI X3.4, 1986.

ISO 8601, Data elements and interchange formats — Information interchange — Representation of dates and times.

ISO/IEC 9594-8 | ITU-T Rec. X.509, Information technology — Open Systems Interconnection — The Directory: Public-key and attribute certificate frameworks.

ISO/IEC 10646, Information technology — Universal Coded Character Set (UCS).

ISO/IEC 29500-3, Information technology — Document description and processing languages — Office Open XML File Formats, Part 3: Markup Compatibility and Extensibility.

ISO 15836-1, Information and documentation — The Dublin Core metadata element set, Part 1: Core elements

Dublin Core Terms Namespace. <http://purl.org/dc/terms/>

RFC 2046, Multipurpose Internet Mail Extensions (MIME) Part Two: Media Types, The Internet Society, N. Freed and N. Borenstein, 1996, <http://www.ietf.org/rfc/rfc2046.txt>.

RFC 3986 Uniform Resource Identifier (URI): Generic Syntax, The Internet Society, Berners-Lee, T., R. Fielding, and L. Masinter, 2005, <http://www.ietf.org/rfc/rfc3986.txt>.

RFC 3987 Internationalized Resource Identifiers (IRIs), The Internet Society, Duerst, M. and M. Suignard, 2005, <http://www.ietf.org/rfc/rfc3987.txt>.

RFC 5234 Augmented BNF for Syntax Specifications: ABNF, The Internet Society, D. Crocker and P.Overell, (editors), 2008, <http://www.ietf.org/rfc/rfc5234.txt>.

RFC 7231 Hypertext Transfer Protocol (HTTP/1.1): Semantics and Content, The Internet Society, R. Fielding and J. Reschke, 2014, <http://www.ietf.org/rfc/rfc7231.txt>.

The Unicode Consortium. The Unicode Standard, <http://www.unicode.org/standard/standard.html>.

XML, Tim Bray, Jean Paoli, Eve Maler, C. M. Sperberg-McQueen, and François Yergeau (editors). Extensible Markup Language (XML) 1.0, Fourth Edition. World Wide Web Consortium. 2006. <http://www.w3.org/TR/2006/REC-xml-20060816/>. [Implementers should be aware that a further correction of the normative reference to XML to refer to the 5th Edition will be necessary when the related Reference Specifications to which this International Standard also makes normative reference, and which also depend upon XML, such as XSLT, XML Namespaces and XML Base, are all aligned with the 5th Edition.]

XML Namespaces, Tim Bray, Dave Hollander, Andrew Layman, and Richard Tobin (editors). Namespaces in XML 1.0 (Third Edition), 8 December 2009. World Wide Web Consortium. <http://www.w3.org/TR/2009/REC-xml-names-20091208/>

XML Base, W3C Recommendation, 28 January 2009. <https://www.w3.org/TR/2009/REC-xmlbase-20090128/>

XML Schema Part 1: Structures, W3C Recommendation, 28 October 2004. <https://www.w3.org/TR/xmlschema-1/>

XML Schema Part 2: Datatypes, W3C Recommendation, 28 October 2004. <https://www.w3.org/TR/xmlschema-2/>

XML-Signature Syntax and Processing, W3C Recommendation, 12 February 2002. <http://www.w3.org/TR/2002/REC-xmldsig-core-20020212/>

ZIP File Format Specification from PKWARE, Inc., version 6.2.0 (2004), as specified in <http://www.pkware.com/documents/APPNOTE/APPNOTE_6.2.0.txt>, hereinafter referred to as “ZIP Appnote”. [Note: The supported compression algorithm is inferred from various tables in Annex B. end note]

# Terms and Definitions

For the purposes of this document, the following terms and definitions apply. Other terms are defined where they appear in italic typeface. Terms explicitly defined in this Part of ISO/IEC 29500 are not to be presumed to refer implicitly to similar terms defined elsewhere.

The terms base URI, relative reference, URI scheme, authority, fragment, path, query, and segment are used in accordance with RFC 3986. The term media type is used in accordance with RFC 2046.

**3.1** **Basics**

**3.1.1**byte
sequence of 8 bits treated as a unit

**3.1.2**stream
linearly ordered sequence of bytes

**3.1.3**behavior
external appearance or action

**3.1.4**behavior, implementation-defined
behavior, application-defined
unspecified behavior where each implementation shall document that behavior, thereby promoting predictability and reproducibility within any given implementation

**3.1.5**behavior, unspecified
behavior where this document imposes no requirements

**3.2** **Abstract package model**

**3.2.1**part
stream with a name, a MIME media type and associated common properties

**3.2.2**package, abstract
logical entity that holds a collection of parts and relationships

**3.2.3**relationship
a package relationship or a part relationship

**3.2.4**relationship, package
connection from a package to a specific part in the same package, or to an external resource

**3.2.5**relationship, part
connection from a part in a package to another part in the same package, or to an external resource

**3.2.6
source**part or package from which a connection is established by a relationship

**3.2.7
target**part or external resource to which a connection is established by a relationship

**3.2.8
relationship type**absolute IRI for specifying the role of a relationship

**3.2.9**Relationships part
part containing an XML representation of relationships

**3.2.10**package model, abstract
abstract model that define abstract packages

**3.2.11**growth hint
suggested number of bytes to reserve for a part to grow in place

**3.2.12**
pack scheme
URI scheme that allows IRIs to be used as a uniform mechanism for addressing parts within a package

**3.2.13**pack IRI
IRI that conforms to the pack scheme

**3.2.14**part name
string that uniquely identifies a part within a package

**3.2.15
relationship identifier**string that consists of XML name characters and uniquely identifies a relationship among those from the same source

**3.2.16
target mode**mode of resolution of relative references to targets

**3.3** **Physical package model**

**3.3.1**physical format
specific file format, or other persistence or transport mechanism

**3.3.2
physical package**the result of a mapping an abstract package to a physical format

**3.3.3**physical package model
a pair of a physical format and a mapping between the abstract package model and that physical format

**3.3.4**piece
portion of a part

**3.3.5**logical item
a non-interleaved part, a non-interleaved Media Types stream, a piece of an interleaved part, or a piece of an interleaved Media Types stream

**3.3.6
physical package item**an atomic set of data in a physical package

**3.3.7**ZIP item
an atomic set of data in a ZIP file that becomes a file when the archive is uncompressed

**3.3.8**ZIP file
ZIP file as defined in the ZIP file format specification

**3.3.9**simple ordering
defined ordering for laying out the parts in a package in which all the bits comprising each part are stored contiguously

**3.3.10**interleaved ordering
defined ordering for laying out the parts in a package in which parts are broken into pieces and “mixed-in” with pieces from other parts

**3.4** **Digital signature and thumbnail**

**3.4.1**signature policy
application-defined policy that specifies what configuration of parts and relationships shall or might be included in a signature and what additional behaviors are required for generating and validating signatures following that signature policy

**3.4.2**thumbnail
small image that is a graphical representation of a part or the package as a whole

**3.5** **Implementations**

**3.5.1**package implementer
software that implements physical input-output operations on a package according to the requirements and recommendations of this document

# Notational Conventions

The following typographical conventions are used in ISO/IEC 29500:

1. The first occurrence of a new term is written in italics. [Example: The text in this document is divided into normative and informative categories. end example]
2. In each definition of a term in §3 (Terms and Definitions), the term is written in bold. [Example: behavior — External appearance or action. end example]
3. The tag name of an XML element is written using a distinct style and typeface. [Example: The bookmarkStart and bookmarkEnd elements specify … end example]
4. The name of an XML attribute is written using a distinct style and typeface. [Example: The dropCap attribute specifies … end example]
5. The value of an XML attribute is written using a constant-width style. [Example: The attribute value of auto specifies … end example]
6. The qualified or unqualified name of a simple type, complex type, or base datatype is written using a distinct style and typeface. [Example: The possible values for this attribute are defined by the ST\_HexColor simple type. end example]

References to items in the Bibliography have the form “[*n*]”, where *n* is the Bibliography item number).

# General Description

This document is divided into the following subdivisions:

1. Front matter;
2. Overview;
3. Main body;
4. Annexes

Examples are provided to illustrate possible forms of the constructions described. References are used to refer to related clauses. Notes are provided to give advice or guidance to implementers or programmers. Annexes provide additional information and summarize the information contained in this document.

Normative and informative sections of this document are marked accordingly.

Except for whole clauses or annexes that are identified as being informative, informative text that is contained within normative text is indicated in the following ways:

1. [Example: code fragment, possibly with some narrative … end example]
2. [Note: narrative … end note]
3. [Rationale: narrative … end rationale]

# Conformance

A document is of conformance class OPC if it obeys all syntactic constraints specified in this Part of ISO/IEC 29500.

OPC conformance is purely syntactic.

# Overview

This clause is informative.

This document describes an abstract package model (§8) and a physical package model (§9) for the use of XML, Unicode, ZIP, and other available technologies and specifications to organize the content and resources of a document within a package. The package structure is intended to support the organization of constituent resources for various applications and categories of content. An example package is shown in Annex H.

In addition, this document defines common services that can be included in a package, such as Core Properties and Digital Signatures.

The abstract package model is a package abstraction that holds a collection of parts and relationships. The parts are composed, processed, and persisted according to a set of rules. Parts can have relationships to other parts or external resources, and the package as a whole can have relationships to parts it contains or to external resources. The abstract package model specifies how the parts of a package are named and related. Parts have MIME media types and are uniquely identified using the well-defined naming rules provided in this document.

The physical package model defines the mapping of the components of the abstract package model to the features of a specific physical format, namely a ZIP file.

This document also describes certain features that might be supported in a package, including core properties for package metadata, a thumbnail (term 3.4.2) for graphical representation of a package, and digital signatures of package contents. Because this document might evolve, packages are designed to accommodate extensions and to support compatibility goals in a limited way. The versioning and extensibility mechanisms described in ISO/IEC 29500-3 support compatibility between software systems based on different versions of this document while allowing package creators to make use of new or proprietary features.

This document specifies requirements for packages. Conformance requirements are identified throughout this document. A formal conformance statement is given in §6.

End of informative text.

# Abstract Package Model

## General

This subclause is informative.

This clause introduces abstract packages (term 3.2.2) in terms of parts (term 3.2.1, §8.2) and relationships (term 3.2.3, §8.5). It also introduces the pack scheme (term 3.2.12, §8.3.2).

The purpose of the abstract package is to aggregate constituent components of a document (or other type of content) into a single object. For example, an abstract package holding a document with a picture might contain an XML markup part representing the document and another part representing the picture.

An example abstract package is shown in H.2.

End of informative text.

## Parts

### General

This subclause is informative.

Parts (term 3.2.1) are analogous to a file in a file system or to a resource on an HTTP server.

End of informative text.

### Part Names

#### General

A part shall have a part name, which shall uniquely identify a part within an abstract package.

#### Syntax

A part name shall be a Unicode string that matches the following production rules in the ABNF syntax defined in RFC 5234

part\_name = 1\*( "/" isegment-nz )

isegment-nz = <isegment-nz, see RFC3987, Section 2.2>

and that further satisfies the constraints listed below,

* No I18N segments shall contain percent-encoded forward slash (“/”), or backward slash (“\”) characters.
* No I18N segments shall contain percent-encoded characters that match the non-terminal iunreserved in RFC 3987.
* No I18N segments shall end with a dot (“.”) character,

The part name “/\_rels/.rels” shall be reserved (§8.5.2.2). Part names in which the second-to-last I18N segment is equivalent to ‘\_rels’ and the final segment is equivalent to any string ending with ‘.rels’ shall be reserved (§8.5.2.3).

[Example: The part name “/hello/world/doc.xml” contains three path segments, namely, “hello”, “world”, and “doc.xml”. end example]

[Example: The part name “/é” contains a path segment “é” where é is 'LATIN SMALL LETTER E WITH ACUTE' (U+00E9). end example]

[Note: Path segments are not explicitly represented as folders in the abstract package model, and no directory of folders exists in the abstract package model. end note]

A package implementer is not required to support non-ASCII part names, although doing so is recommended.

#### Part Name Equivalence and Integrity in an Abstract Package

Equivalence of part names shall be determined by ASCII case-insensitive matching. Such matching compares a sequence of code points as if all ASCII code points in the range 0x41–0x5A (A–Z) were mapped to the corresponding code points in the range 0x61–0x7A (a–z). See Character Model for the World Wide Web: String Matching and Searching [1].

The names of two different parts within an abstract package shall not be equivalent.

[Example: If an abstract package contains a part named "/a", the name of another part in that abstract package must not be "/a" or "/A". end example]

For each part name N and string S, let the result of concatenating N, the forward slash, and S be denoted by N[S]. A part name N1 is said to be derivable from another part name N2 if, for some string S, N1 is equivalent to N2[S].

[Example: "/a/b" is derivable from "/a", where N is "/a" and S is "b". end example]

The name of a part shall not be derivable from the name of another part.

[Example: Suppose that an abstract package contains a part named "/segment1/segment2/…/segmentn". For it not to be derivable, other parts in that abstract package must not have names such as "/segment1", "/SEGMENT1", "/segment1/segment2", "/segment1/SEGMENT2", or "/segment1/segment2/…/segmentn-1". end example]

This subclause further introduces recommendations, so that Unicode Normalization Form C (NFC) or Unicode Normalization Form D (NFD) of part names do not cause part-name collisions. [Note: Some implementations of directory structures always apply NFD normalization. end note]

The application of NFC or NFD normalization to the names of two different parts within an abstract package should not yield equivalent strings.

[Example: If an abstract package contains a part named "/é", where é is 'LATIN SMALL LETTER E' (U+0065) followed by 'COMBINING ACUTE ACCENT' (U+0301), the name of another part in that abstract package should not be "/é", where é is 'LATIN SMALL LETTER E WITH ACUTE' (U+00E9), or "/É", where É is 'LATIN CAPITAL LETTER E WITH ACUTE '(U+00C9). end example]

[Example: If an abstract package contains a part named "/Å", where Å is 'ANGSTROM SIGN' (U+212B), the name of another part in that abstract package should not be "/Å" where Å is 'LATIN CAPITAL LETTER A WITH RING ABOVE' (U+00C5) because U+212B and U+00C5 are normalized to the same character sequence. end example]

A part name N1 is said to be weakly derivable from another part name N2 if, for some string S, the result of applying NFC or NFD to N1 is equivalent to the result of applying NFC or NFD to N2[S].

[Example: Consider a part name "/é", where é is 'LATIN SMALL LETTER E WITH ACUTE' (U+00E9). Another part name "/é/a", where é is 'LATIN SMALL LETTER E' (U+0065) followed by 'COMBINING ACUTE ACCENT' (U+0301) is weakly derivable from "/é". Another part name "/É/a", where É is 'LATIN CAPITAL LETTER E' (U+0045) followed by 'COMBINING ACUTE ACCENT' (U+0301) is also weakly derivable. end example]

The name of a part should not be weakly derivable from the name of another part.

[Example: Suppose that an abstract package contains a part named "/é/ Å /foo", where é is 'LATIN SMALL LETTER E WITH ACUTE' (U+00E9) and Å is 'ANGSTROM SIGN' (U+212B). For it not to be weakly derivable, no other parts in that abstract package should have names such as "/É" and "/É/Å", where É is 'LATIN CAPITAL LETTER E' (U+0045) followed by 'COMBINING ACUTE ACCENT' (U+0301) and Å is 'LATIN CAPITAL LETTER A WITH RING ABOVE' (U+00C5). end example]

### Media types

Each part shall have a MIME media type, as defined in RFC 2046, to identify the type of content in that part, consisting of a top-level media type and a subtype, optionally qualified by a set of parameters. Media types of OPC-specific parts defined in this document shall not contain parameters.

Media types for parts defined in this standard are listed in Annex E.

### Growth Hint

The growth hint (term 3.2.11) is an optional common property of a part.

[Rationale: Sometimes a part is modified after it is placed in a physical package. Depending on the nature of the modification, the part might need to grow. For some physical formats, this could be an expensive operation and could damage an otherwise efficient physical package. To allow the part to grow in place, moving as few bytes as possible, the growth hint might be used to reserve space in a mapping to a particular physical format. end rationale]

### XML Usage

XML content in parts and streams defined in this document (specifically, the Media Types stream, the Core Properties part, Digital Signature XML Signature parts, and Relationships parts) shall conform to the following:

1. XML content shall be encoded using either UTF-8 or UTF-16. If any part includes an encoding declaration, as defined in §4.3.3 of the XML 1.0 specification, that declaration shall not name any encoding other than UTF-8 or UTF-16.
2. The XML 1.0 specification allows for the usage of Document Type Definitions (DTDs), which enable Denial of Service attacks, typically through the use of an internal entity expansion technique. As mitigation for this potential threat, DTD declarations shall not be used in the XML markup defined in this document.
3. Validation of the XML content shall be done only after it is processed by an MCE processor as specified in ISO/IEC 29500-3.
4. XML content shall be valid against the corresponding XSD schema defined in this document. In particular, the XML content shall not contain elements or attributes drawn from namespaces that are not explicitly defined in the corresponding XSD unless the XSD allows elements or attributes drawn from any namespace to be present in particular locations in the XML markup.
5. XML content shall not contain elements or attributes drawn from “xml” or “xsi” namespaces unless they are explicitly defined in the XSD schema or by other means described in this document.

## Part Addressing

### General

This subclause is informative.

This document provides the pack scheme as a way to use IRIs (RFC 3987) to reference part resources inside a package.

Schemes are represented in an IRI by the prefix before the colon. A well-known example is "http".

An example of an IRI in the pack scheme is:

pack://http%3c,,www.openxmlformats.org,my.container/a/b/foo.xml

The substring between the double slash and the first single slash represents an IRI in the http scheme for a package, transformed to allow embedding within an IRI in the pack scheme.

References from outside of a package are absolute IRIs of the pack scheme, while those from inside are relative IRIs, which are resolved to absolute IRIs of this scheme.

End of informative subclause.

### Pack Scheme

This document defines a specific scheme used to refer to parts in a package: the pack scheme. An IRI that uses the pack scheme is called a pack IRI.

[Note: The pack scheme is a historical scheme in the IANA-maintained registry of schemes located at <https://www.iana.org/assignments/uri-schemes/historic/pack>. It was a provisional scheme but was changed to a historical scheme due to a mistake (see the next Note) in the registration proposal. end note]

The syntax of pack IRIs is defined by the EBNF (see RFC 5234) as follows:

pack\_IRI = "pack://" iauthority [ "/" | ipath ]

iauthority = \*( iunreserved | sub-delims | pct-encoded )

ipath = 1\*( "/" isegment )

isegment = 1\*( ipchar )

ipchar = <ipchar, see [RFC3987], Section 2.2>

iunreserved = <iunreserved, see [RFC3987], Section 2.2>

sub-delims = <sub-delims, see [RFC3986], Section 2.2>

pct-encoded = <pct-encoded, see [RFC3986], Section 2.1>

The authority component (iauthority) contains an embedded IRI that points to a package. (See §8.3.4 for the procedure for transforming the IRI for the package to permit embedding in the pack IRI as the authority component.) The authority component shall not reference a package embedded in another package.

[Note: The definition of the authority component requires that the colon character (:) be escaped as %3c. However, in the proposed registration of the pack scheme, an unescaped colon (:) character was mistakenly used. end note]

The optional path component (ipath) identifies a particular part within the package. When the path component is missing, the resource identified by the pack IRI is the package as a whole.

A pack IRI might have a query component (as specified in RFC 3986). A query component in a pack IRI is not used when resolving the IRI to a part.

A pack IRI might have a fragment component as specified in RFC 3986. If present, this fragment applies to whatever resource the pack IRI identifies.

[Example:

**Using the pack IRI to identify a part**

The following IRI identifies the “/a/b/foo.xml” part within the “http://www.openxmlformats.org/my.container” package resource:

pack://http%3c,,www.openxmlformats.org,my.container/a/b/foo.xml

end example]

[Example:

**Equivalent pack IRIs**

The following pack IRIs are equivalent:

pack://http%3c,,www.openxmlformats.org,my.container

pack://http%3c,,www.openxmlformats.org,my.container/

end example]

[Example:

**A pack IRI with percent-encoded characters**

The following IRI identifies the “/c/d/bar.xml” part within the “http://myalias:pswr@www.my.com/containers.aspx?my.container” package:

pack://http%3c,,myalias%3cpswr%40www.my.com,containers.aspx%3fmy.container
/c/d/bar.xml

end example]

### Resolving a Pack IRI to a Resource

The following is an algorithm for resolving a pack IRI to a resource (either a package or a part):

1. Parse the pack IRI into the potential three components: scheme, authority, path, as well as any fragment identifier.
2. In the authority component, replace all commas (“,”) with forward slashes (“/”).
3. Un-percent-encode ASCII characters in the resulting authority component.
4. The resultant authority component shall be a valid IRI for the package as a whole. If it is not, the pack IRI is invalid.
5. If the path component is empty, the pack IRI resolves to the package as a whole and the resolution process is complete.
6. A non-empty path component shall be a valid part name. If it is not, the pack IRI is invalid.
7. The pack IRI resolves to the part with this part name in the package identified by the authority component.

[Example:

**Resolving a pack IRI to a resource**

Given the pack IRI:

pack://http%3c,,www.my.com,packages.aspx%3fmy.package/a/b/foo.xml

The components:

<authority>= http%3c,,www.my.com,packages.aspx%3fmy.package

<path>= /a/b/foo.xml

are converted to the package IRI:

http://www.my.com/packages.aspx?my.package

and the path:

/a/b/foo.xml

Therefore, this IRI refers to a part named “/a/b/foo.xml” in the package at the following IRI: http://www.my.com/packages.aspx?my.package.

end example]

### Composing a Pack IRI

The following is an algorithm for composing a pack IRI from the IRI of an entire package and a part name.

In order to be suitable for creating a pack IRI, the IRI of a package shall conform to RFC 3986 requirements for absolute IRIs.

To compose a pack IRI from the absolute package IRI and a part name, the following steps shall be performed, in order:

1. Remove the fragment identifier from the absolute package IRI, if present.
2. Percent-encode all percent signs (“%”), question marks (“?”), at signs (“@”), colons (“:”) and commas (“,”) in the package IRI.
3. Replace all forward slashes (“/”) with commas (“,”) in the resulting string.
4. Append the resulting string to the string “pack://”.
5. Append a forward slash (“/”) to the resulting string. The constructed string represents a pack IRI with a blank path component.
6. Using this constructed string as a base IRI and the part name as a relative reference, apply the rules defined in RFC 3986 for resolving relative references against the base IRI.

The result of this operation is the pack IRI that refers to the resource specified by the part name.

[Example:

**Composing a pack IRI**

Given the package IRI:

http://www.my.com/packages.aspx?my.package

and the part name:

/a/foo.xml

The pack IRI is:

pack://http%3c,,www.my.com,packages.aspx%3fmy.package/a/foo.xml

end example]

### Equivalence

Two pack IRIs are equivalent if:

1. The scheme components are octet-by-octet identical after they are both converted to lowercase; and
2. The IRIs, decoded as described in §8.3.3 from the authority components, are equivalent (the equivalency rules by scheme, as specified in RFC 3986); and
3. The path components are equivalent part names, as specified in §8.2.2.

[Note: In some scenarios, such as caching or writing parts to a package, it is necessary to determine if two pack IRIs are equivalent without resolving them. end note]

## Resolving Relative References

### General

Relative references in parts shall be resolved as specified in RFC 3986 (§5 Reference Resolution), as extended in RFC 3987 (§6.5 Relative IRI References).

This document introduces no changes to the resolution procedure, but Annex A introduces a preprocessing for generating relative references.

### Base IRIs

This subclause defines a procedure for determining base IRIs for resolving relative references within parts in packages.

[Note: RFC 3986 (§5.1 Establishing a Base URI) provides four general methods, in order of precedence, for establishing base IRIs for resolving relative references.  The procedure in this subclause provides an OPC-specific method corresponding to the second general method (RFC 3986, §5.1.2 Base URI from the Encapsulating Entity). end note]

The base IRI depends on where that reference occurs within the package. This subclause covers the case where a relative reference occurs in a part that is not a Relationships part. §8.5.2 covers the case where a relative reference occurs in a Relationships part.

The base IRI shall be the pack IRI created from the IRI of the package and the name of the part within which the relative reference occurs.

[Example:

Consider a part /a/b/foo.xml in a package available at

http://www.mysite.com/my.package

The base IRI is

pack://http%3c,,www.mysite.com,my.package/a/b/foo.xml

end example]

### Examples

This subclause is informative.

#### General

This subclause shows examples of resolving relative references. For each example, this subclause considers three cases.

Case 1: the base IRI is a pack IRI, "pack://http%3c,,www.mysite.com,my.package/a/b/foo.xml", which is constructed from an absolute IRI of the package and a part name.

Case 2: the base IRI is a pack IRI, "pack://http%3c,,www.mysite.com,my.package/", which is created from an absolute IRI of the package.

Case 3: the base IRI is the absolute IRI of the package, <http://www.mysite.com/my.package>.

#### Leading slash: "/b/bar.xml"

Case 1: The base IRI is "pack://http%3c,,www.mysite.com,my.package/a/b/foo.xml".

Since this relative reference begins with the slash character, the path component of the base IRI ("/a/b/foo.xml") is ignored by the algorithm in §5.2.2 of RFC 3986. The scheme and authority of the resulting IRI are the same as those of the base pack IRI. Thus, the resulting IRI is:

"pack://http%3c,,www.mysite.com,my.package/b/bar.xml"

Case 2: The base IRI is "pack://http%3c,,www.mysite.com,my.package/"

Likewise, the path component of the base IRI ("/") is ignored. The rest is the same.

Case 3: The base IRI is "<http://www.mysite.com/my.package>"

Likewise, the path component of the base IRI ("/my.package") is ignored. Thus, the resulting IRI is:

"<http://www.mysite.com/my.package>/b/bar.xml"

#### No leading slash: "bar.xml"

Case 1: The base IRI is "pack://http%3c,,www.mysite.com,my.package/a/b/foo.xml"

Since this relative reference does not begin with the slash character, the path component of the base IRI ("/a/b/foo.xml") and that of the relative reference ("bar.xml") are merged. The merge routine in §5.2.3 of RFC 3986 first removes "foo.xml" from the path component of the base IRI, and emits "/a/b/bar.xml". Thus, the resulting IRI is:

 "pack://http%3c,,www.mysite.com,my.package/a/b/bar.xml"

Case 2: The base IRI is "pack://http%3c,,www.mysite.com,my.package/"

Likewise, the path component of the base IRI ("/") and that of the relative reference ("bar.xml") are merged. The merge routine emits "/bar.xml". Thus, the resulting IRI is:

 "pack://http%3c,,www.mysite.com,my.package/bar.xml"

Case 3: The base IRI is "<http://www.mysite.com/my.package>"

Likewise, the path component of the base IRI ("/my.package") and that of the relative reference ("bar.xml") are merged. The merge routine first removes "my.package" from the path component of the base IRI, and emits "/bar.xml". Thus, the resulting IRI is:

"<http://www.mysite.com/my.package>/bar.xml"

#### Dot segment: ./bar.xml

Case 1: The base IRI is "pack://http%3c,,www.mysite.com,my.package/a/b/foo.xml"

As in §8.4.3.3, the merge routine removes "foo.xml" from the path component of the base IRI, and emits "/a/b/./bar.xml". But the remove\_dot\_segments routine in §5.2.4 of RFC 3986 further handles this result and emits "/a/b/bar.xml". Thus, the resulting IRI is:

"pack://http%3c,,www.mysite.com,my.package/a/b/bar.xml"

Case 2: The base IRI is "pack://http%3c,,www.mysite.com,my.package/"

The merge routine emits "/./bar.xml" but the remove\_dot\_segments routine removes "./" and emits "/bar.xml". Thus, the resulting IRI is:

"pack://http%3c,,www.mysite.com,my.package/bar.xml"

Case 3: The base IRI is "<http://www.mysite.com/my.package>"

Likewise, the path component of the base IRI ("/my.package") and that of the relative reference ("./bar.xml") are merged. The merge routine first removes "my.package" from the path component of the base IRI, and emits "/./bar.xml". But the remove\_dot\_segments routine removes "./" and emits "/bar.xml". Thus, the resulting IRI is:

"http://www.mysite.com/bar.xml"

#### Dot segment: "../bar.xml

Case 1: The base IRI is "pack://http%3c,,www.mysite.com,my.package/a/b/foo.xml"

The merge routine emits "/a/b/../bar.xml" but the remove\_dot\_segments routine removes "b/..". Thus, the resulting IRI is:

"pack://http%3c,,www.mysite.com,my.package/a/bar.xml"

Case 2: The base IRI is "pack://http%3c,,www.mysite.com,my.package/"

The merge routine emits "/../bar.xml", but the remove\_dot\_segments routine replaces "/../" by "/". Thus, the resulting IRI is:

"pack://http%3c,,www.mysite.com,my.package/bar.xml"

Case 3: The base IRI is "<http://www.mysite.com/my.package>"

Likewise, the path component of the base IRI ("/my.package") and that of the relative reference ("../bar.xml") are merged. The merge routine first removes "my.package" from the path component of the base IRI, and emits "/../bar.xml". The remove\_dot\_segments routine replaces "/.." by "/" and emits "/bar.xml". The resulting IRI is:

"http://www.mysite.com/bar.xml"

End of informative subclause.

## Relationships

### General

This subclause is informative.

Parts may contain references to other parts in the package and to resources outside of the package. These references are represented inside the referring part in ways that are specific to the media type of the part, that is, in arbitrary markup or an application-defined encoding. This effectively hides the links between parts from applications that do not understand the media types of the parts containing such references.

This document introduces a higher-level mechanism to describe references from parts to other parts or external resources, namely, relationships (term 3.2.3). Relationships represent connections from a source part or source package (term 3.2.6) to a target part or target resource (term 3.2.7). Relationships from parts are called part relationships (term 3.2.5), while those from packages are called package relationships (term 3.2.4). Relationships make the connection directly discoverable without looking at the part contents, so they are independent of content-specific schemas and are quick to resolve.

There are two modes (term 3.2.16) to resolve relative references to targets. Resolution in the internal target mode provides parts and that in the external target mode provides external resources.

Relationships have relationship identifiers (term 3.2.15). These identifiers allow relationships to be distinguished from one another. An identifier can also be used to associate the target of a relationship with a specific point in a source part (for example, to represent a hyperlink), by embedding the relationship identifier at that point.

A relationship has a relationship type (term 3.2.8), an absolute IRI for identifying the role of the relationship.

Relationships are represented in XML in a Relationships part. Each part in the package that is the source of one or more relationships has an associated Relationships part. This part holds the list of relationships for the source part. For more information on the Relationships namespace and relationship types, see Annex E.

Relationships have a second important function: providing additional information about parts without modifying their content. [Note: Some scenarios require information to be attached to an existing part without modifying that part, for example, because the part is encrypted and cannot be decrypted, or because it is digitally signed and changing it would invalidate the signature. end note]

End of informative subclause.

### Relationships Part

#### Relationships Part

|  |  |
| --- | --- |
| media Type: | application/vnd.openxmlformats-package.relationships+xml |
| Root Namespace: | http://schemas.openxmlformats.org/package/2006/relationships |

Each set of relationships sharing a common source is represented by a Relationships part. There shall be no relationships from or to a Relationships part.

A Relationships part (term 3.2.9) shall be either a package Relationships part (§8.5.2.2) or a part Relationships part (§8.5.2.3).

#### Package Relationships Part

Every relationship contained in a package Relationships part shall be a package relationship.

The name of a package Relationships part shall be “/\_rels/.rels”.

When a relative reference occurs in a package Relationships part, the base IRI depends on the target mode of the relationship. If the target mode is external, the base IRI shall be the absolute IRI of the package. If the target mode is internal, the base IRI shall be the pack IRI created from the absolute IRI of the package.

[Example:

Consider the package Relationships part for a package available at http://www.mysite.com/my.package.

If the target mode is external, the base IRI is

http://www.mysite.com/my.package

If the target mode is internal, the base IRI is

pack://http%3c,,www.mysite.com,my.package/

end example]

#### Part Relationships Part

Every relationship contained in a part Relationships part shall be a part relationship from the same source part.

The name of a part Relationships part shall be constructed from the name of the source part by adding “.rels” to the end of the last I18N segment and inserting an I18N segment “\_rels” immediately before the last I18N segment.

[Example: If the source part name is “/foo”, the part Relationships part name is “/\_rels/foo.rels”. Conversely, if the name of a part is “/\_rels/foo.rels”, it is a part Relationships part for the source part "/foo". If the source part name is “/foo/bar.xml”, the part Relationships part name is “/foo/\_rels/bar.xml.rels”. Conversely, if the name of a part is “/foo/\_rels/bar.xml.rels”, it is a part Relationships part for the source part "/foo/bar.xml". end example]

When a relative reference occurs in a part Relationships part, the base IRI depends on the target mode of the relationship. If the target mode is external, the base IRI shall be the absolute IRI of the package. If the target mode is internal, the base IRI shall be the pack IRI created from the absolute IRI of the package and the source part name.

[Example:

Consider a part Relationships part /a/b/\_rels/foo.xml.rels in a package available at

http://www.mysite.com/my.package

If the target mode is external, the base IRI is

http://www.mysite.com/my.package

If the target mode is internal, the base IRI is

pack://http%3c,,www.mysite.com,my.package/a/b/foo.xml

end example]

### Relationship Markup

#### General

The content of a Relationships part shall be an XML document. The requirements (including MCE processing before validation and subsequent processing) specified in §8.2.5apply.

After the removal of any extensions by an MCE processor as specified in ISO/IEC 29500-3, a Relationships part shall be a schema-valid XML document against opc-relationships.xsd (see Annex C).

An xml:base attribute shall not exist in the output document resulting from any MCE processing (as specified in ISO/IEC 29500-3) of the Relationships part.

#### Relationships Element

A Relationships element is the root element of a Relationships part. It is the container for zero or more Relationship elements. It has no attributes. [Note: The W3C XML Schema definition of this element’s content model is [CT\_Relationships](https://sc34wg4.github.io/OOXMLSchemas/documentation/Part2/opc-relationships/opc-relationships_CT_Relationships.html). end note]

#### Relationship Element

A Relationship element shall represent a relationship. The source of a relationship shall be either a package or part with which the Relationships part containing this Relationship element is associated. [Note: The target of a relationship is specified by the attributes of the Relationship element. end note]

|  |  |
| --- | --- |
| Attributes | Description |
| TargetMode | This attribute specifies the target mode of a relationship.This attribute is optional, and the default value is Internal.The possible values for this attribute are Internal and External, as defined by the ST\_TargetMode simple type (§C.5). |
| Target | This attribute specifies the target of a relationship.This attribute is required.If the value of the TargetMode attribute is Internal, the Target attribute shall be a relative reference to a part. If the value of the TargetMode attribute is External, the Target attribute shall be a relative reference or an absolute IRI. Base IRIs for resolving relative references are defined in §8.4.The possible values for this attribute are defined by the xsd:anyURI simple type of the W3C Recommendation “XML Schema Part 2: Datatypes”. |
| Type | This attribute specifies the relationship type of a relationship.This attribute is required.Relationship types can be compared to determine whether two Relationship elements are of the same type. This comparison is conducted in the same way as when comparing URIs that identify XML namespaces: the two URIs are treated as strings and considered identical if and only if the strings have the same sequence of characters. The comparison is case-sensitive, and no escaping is done or undone.[Example:Type="[http://schemas.openxmlformats.org/package/2006/relationships/ digital-signature/signature](http://schemas.openxmlformats.org/package/2006/relationships/%20digital-signature/signature)"end example]The possible values for this attribute are defined by the xsd:anyURI simple type of the W3C Recommendation “XML Schema Part 2: Datatypes”. |
| Id | This attribute specifies the identifier of a relationship. The value of the Id attribute shall be unique within the Relationships part. This attribute is required.[Example:Id="A5FFC797514BC"end example]The possible values for this attribute are defined by the xsd:ID simple type of the W3C Recommendation “XML Schema Part 2: Datatypes”. |

[Note: The W3C XML Schema definition of this element’s content model is [CT\_Relationship](https://sc34wg4.github.io/OOXMLSchemas/documentation/Part2/opc-relationships/opc-relationships_CT_Relationship.html). end note]

### Examples

This subclause is informative.

#### Relationships Part Associated with the Entire Package

Consider a package available at <http://www.example.com/ex.opc>. Suppose that the package contains a Relationships part "/\_rels/.rels". This Relationships part is a package Relationships part, which is associated with the entire package.

Also, suppose that the content of this package Relationships part is the XML document shown below:

<Relationships

 xmlns="http://schemas.openxmlformats.org/package/2006/relationships">

 <Relationship

 Target="a.xml"

 Id="IDI1"

 Type="http://example.com/relTypeInt1"/>

 <Relationship

 Target="a.xml"

 TargetMode="External"

 Id="IDE1"

 Type="http://example.com/relTypeExt1"/>

</Relationships>

The two Relationship elements in this package Relationships part specify two relationships. The source of each relationship is the package.

The first relationship:

* The target mode is Internal (default). Thus, the base IRI for resolving "a.xml" is the pack IRI (pack://http%3c,,www.example.com,ex.opc) created from the IRI of the package (http://www.example.com/ex.opc).
* The result of resolving "a.xml" is "pack://http%3c,,www.example.com,ex.opc/a.xml". The target of this relationship is thus the part "/a.xml" in this package.
* The relationship type of this relationship is "http://example.com/relTypeInt1".
* The identifier of this relationship is "IDI1".

The second relationship:

* The target mode is External. Thus, the base IRI for resolving "a.xml" is the IRI ("http://www.example.com/ex.opc") of the package.
* The target of this relationship is thus the resource at "http://www.example.com/a.xml".
* The relationship type of this relationship is "http://example.com/relTypeExt1".
* The identifier of this relationship is "IDE1".

#### Relationships Part Associated with a Part

Consider a package available at <http://www.example.com/ex.opc>. Suppose that the package contains a Relationships part "/foo\_rels/test.xml.rels". This Relationships part is a part Relationships part, the source of which is a part "/foo/test.xml".

Also, suppose that the content of this part Relationships part is the XML document shown below:

<Relationships

 xmlns="http://schemas.openxmlformats.org/package/2006/relationships">

 <Relationship

 Target="b.xml"

 Id="IDI2"

 Type="http://example.com/relTypeInt2"/>

 <Relationship

 Target="b.xml"

 TargetMode="External"

 Id="IDE2"

 Type="http://example.com/relTypeExt2"/>

</Relationships>

The two Relationship elements in this part Relationships part specify two relationships. The source of each relationship is the part "/foo/test.xml".

The first relationship:

* The mode of the first relationship is Internal (default). Thus, the base IRI ("pack://http%3c,,www.example.com,ex.opc/foo/test.xml") is the pack IRI created from the IRI (http://www.example.com/ex.opc) of the package and the part name "/foo/test.xml".
* The result of resolving "b.xml" is "pack://http%3c,,www.example.com,ex.opc/foo/b.xml". The target of this relationship is thus the part "/foo/b.xml" in this package.
* The relationship type of this relationship is "http://example.com/relTypeInt2".
* The identifier of this relationship is "IDI2".

The second relationship:

* The mode of the second relationship is External. Thus, the base IRI is the IRI (http://www.example.com/ex.opc) of the package.
* The target of this relationship is thus the resource at "http://www.example.com/b.xml".
* The relationship type of this relationship is "http://example.com/relTypeExt2".
* The identifier of this relationship is "IDE2".

#### Relationships Parts Related to Digital Signature Markup

The Digital Signature Origin part is targeted by a package relationship, which is stored in the package Relationships part, /\_rels/.rels.

xxx

The connection from the Digital Signature Origin to the Digital Signature XML Signature part is represented by a part relationship, which is stored in a part Relationships part, /\_rels/origin.rels.

The content of /\_rels/origin.rels might be the XML document shown below:<Relationships

 xmlns="http://schemas.openxmlformats.org/package/2006/relationships">

 <Relationship

 Target="Signature.xml"

 Id="A5FFC797514BC"

 Type="http://schemas.openxmlformats.org/package/2006/relationships/

 digital-signature/signature"/>

</Relationships>

#### Relationships Targeting External Resources

Relationships can target resources outside the package at an absolute location and resources located relative to the current location of the package. The following Relationships part specifies relationships that connect a package or part to pic1.jpg at an external absolute location, and to my\_house.jpg at an external location relative to the location of the package:

<Relationships

 xmlns="http://schemas.openxmlformats.org/package/2006/relationships"

 <Relationship

 TargetMode="External"

 Id="A9EFC627517BC"

 Target="http://www.example.com/images/pic1.jpg"

 Type="http://www.example.com/external-resource"/>

 <Relationship

 TargetMode="External"

 Id="A5EFC797514BC"

 Target="images/my\_house.jpg"

 Type="http://www.example.com/external-resource"/>

</Relationships>

end example]

#### Multiple Relationships that have the Same Target

The following Relationships part contains two relationships, each using a unique Id value. The relationships share the same Target, but have different relationship types.

<Relationships

 xmlns="http://schemas.openxmlformats.org/package/2006/relationships">

 <Relationship

 Target="Signature.xml"

 Id="A5FFC797514BC"

 Type="http://schemas.openxmlformats.org/package/2006/

 relationships/digital-signature/signature"/>

 <Relationship

 Target="Signature.xml"

 Id="B5F32797CC4B7"

 Type="http://www.example.com/internal-resource"/>

</Relationships>

end example]

End of informative subclause.

### Support for Versioning and Extensibility

Relationships parts might contain the versioning and extensibility mechanisms defined in ISO/IEC 29500-3 to incorporate elements and attributes drawn from other XML namespaces.

# Physical Package Model

## General

This subclause is informative.

This clause introduces a physical package model (term 3.3.3) in terms of a physical format (such as the ZIP format) and a mapping from the abstract package model to this physical format. See Annex F for additional discussion of physical package model design considerations.

This clause further specifies general guidelines and common mechanisms for physical package models and defines a ZIP-based physical package model. The interleaving mechanism (see §9.2.4) is such a common mechanism.

An example physical package is described in H.3.

End of informative subclause.

## Physical Mapping Guidelines

### Using Features of Physical Formats

Many physical formats have features that partially match components in the abstract package model. A mapping from the abstract package model to a physical format should take advantage of any similarities in capabilities between the abstract package model and the physical format while using layers of mapping to provide additional capabilities not inherently present in the physical format. [Example: Some physical formats store parts as individual files in a file system, in which case, it is advantageous to map many part names directly to identical physical file names. end example]

### Mapped Components

A physical package model is required to represent packages, parts (including Relationships parts), part names, and part media types, but is not required to represent a growth hint.

### Mapping Media Types to Parts

#### General

A physical format may have a native mechanism for associating media types with parts. [Example: The Content-Type field in the header of a MIME entity associates a media type with that MIME entity. end example] For such a physical format, mappings from the abstract package model should use the native mechanism.

For all other physical formats, the package shall include an XML stream that is referred to in this document as the Media Types stream. The Media Types stream shall not represent a part. This stream shall not be URI-addressable. However, it can be interleaved in the physical package using the same mechanisms used for interleaving parts.

#### Media Types Stream Markup

##### General

The content of the Media Types stream shall be an XML document. The requirements (including MCE processing before validation and subsequent processing) specified in §8.2.5apply.

The XML document in the Media Types stream shall have a top-level Types element, and one or more Default and Override child elements. Default elements shall define default mappings from the extensions of part names to media types. Override elements shall specify media types on parts that are not covered by, or are not consistent with, the default mappings. [Note: Default elements can be used to reduce the number of Override elements on a part. end note]

For all parts of the package other than Relationships parts (§8.5.2), the Media Types stream shall specify either:

* One matching Default element, or
* One matching Override element, or
* Both a matching Default element and a matching Override element, in which case, the Override element takes precedence.

There shall not be more than one Default element for any given extension, and there shall not be more than one Override element for any given part name.

The order of Default and Override elements in the Media Types stream shall not be significant.

The Media Types stream may define Default elements even though no parts use them.

##### Types Element

A Types element shall be the root element of the XML document contained in the Media Types stream.

This element shall have no attributes.

[Note: The W3C XML Schema definition of this element’s content model is [CT\_Types](https://sc34wg4.github.io/OOXMLSchemas/documentation/Part2/opc-contentTypes/opc-contentTypes_CT_Types.html). end note]

##### Default Element

A Default element shall specify the default mappings from the extensions of part names to media types.

|  |  |
| --- | --- |
| Attributes | Description |
| Extension | This attribute shall specify a string as a file extension.This attribute is required.A Default element shall match any part whose name ends with a period (“.”) followed by the value of this attribute.The possible values for this attribute are defined by the [ST\_Extension](https://sc34wg4.github.io/OOXMLSchemas/documentation/Part2/opc-contentTypes/opc-contentTypes_ST_Extension.html) simple type shown in §C.2.  |
| ContentType   | This attribute shall specify a media type using the syntax defined in RFC 7231 §3.1.1.1. This attribute is required.The specified media type shall apply to any matching parts (unless overridden by Override elements).The possible values for this attribute are defined by the [ST\_ContentType](https://sc34wg4.github.io/OOXMLSchemas/documentation/Part2/opc-contentTypes/opc-contentTypes_ST_ContentType.html) simple type. |

[Note: The W3C XML Schema definition of this element’s content model is [CT\_Default](https://sc34wg4.github.io/OOXMLSchemas/documentation/Part2/opc-contentTypes/opc-contentTypes_CT_Default.html). end note]

##### Override Element

An Override element shall specify a media type for a part that is not covered by, or is not consistent with, the default mappings.

|  |  |
| --- | --- |
| Attributes | Description |
| ContentType | This attribute shall specify a media type using the syntax defined in RFC 7231 §3.1.1.1.This attribute is required.The specified media type shall apply to the part named in the attribute PartName.The possible values for this attribute are defined by the [ST\_ContentType](https://sc34wg4.github.io/OOXMLSchemas/documentation/Part2/opc-contentTypes/opc-contentTypes_ST_ContentType.html) simple type.  |
| PartName | This attribute shall specify a part name.This attribute is required.An Override element shall match a part whose name is equal to the value of this attribute.The possible values for this attribute are defined by the xsd:anyURI simple type of the W3C Recommendation “XML Schema Part 2: Datatypes. |

[Note: The W3C XML Schema definition of this element’s content model is [CT\_Override](https://sc34wg4.github.io/OOXMLSchemas/documentation/Part2/opc-contentTypes/opc-contentTypes_CT_Override.html). end note]

#### Media Types Stream Markup Example

[Example:

Example 9–1. Media Types stream markup

<Types

 xmlns="http://schemas.openxmlformats.org/package/2006/content-types">

 <Default Extension="txt" ContentType="text/plain" />

 <Default Extension="jpeg" ContentType="image/jpeg" />

 <Default Extension="picture" ContentType="image/gif" />

 <Override PartName="/a/b/sample4.picture" ContentType="image/jpeg" />

</Types>

The Types element is a container for media types used within the package.

The following is a sample list of parts and their corresponding media types as defined by the Media Types stream markup above.

|  |  |
| --- | --- |
| Part name | Media type |
| /a/b/sample1.txt | text/plain |
| /a/b/sample2.jpg | image/jpeg |
| /a/b/sample3.picture | image/gif |
| /a/b/sample4.picture | image/jpeg |

end example]

#### Setting a Part Media Type in the Media Types Stream

When adding a new part to a package, the package implementer shall ensure that a media type for that part is specified in the Media Types stream. The package implementer shall perform the following steps to do so:

1. Get the extension from the part name by taking the substring to the right of the rightmost occurrence of the dot character (“.”) from the rightmost segment.
2. If a part name has no extension, a corresponding Override element shall be added to the Media Types stream.
3. Compare the resulting extension with the values specified for the Extension attributes of the Default elements in the Media Types stream. The comparison shall be ASCII case-insensitive matching.
4. If there is a Default element with a matching Extension attribute, then the media type of the new part shall be compared with the value of the ContentType attribute. The comparison might be case-sensitive and include every character regardless of the role it plays in the content-type grammar of RFC 7231, or it might follow the grammar of RFC 7231.
5. If the media types match, no further action is required.
6. If the media types do not match, a new Override element shall be added to the Media Types stream.
7. If there is no Default element with a matching Extension attribute, a new Default element or Override element shall be added to the Media Types stream.

#### Determining a Part Media Type from the Media Types Stream

To get the media type of a part, the package implementer shall perform the following steps:

1. Compare the part name with the values specified for the PartName attribute of the Override elements. The comparison shall be ASCII case-insensitive matching.
2. If there is an Override element with a matching PartName attribute, return the value of its ContentType attribute. No further action is required.
3. If there is no Override element with a matching PartName attribute, then
4. Get the extension from the part name by taking the substring to the right of the rightmost occurrence of the dot character (“.”) from the rightmost segment.
5. Check the Default elements of the Media Types stream, comparing the extension with the value of the Extension attribute. The comparison shall be ASCII case-insensitive matching.

If there is a Default element with a matching Extension attribute, return the value of its ContentType attribute. No further action is required.

[Note: Given a conformant package, either an Override is found by the third step or a Default element is found by the fourth step. end note]

#### Support for Versioning and Extensibility

The Media Types stream shall not use the versioning and extensibility mechanisms defined in ISO/IEC 29500-3 .

### Interleaving

When mapping an abstract package to a physical package, the data stream of a part or the Media Types stream may be broken into pieces, which can be interleaved with pieces of other parts or with whole parts. Pieces can later be joined together, forming the original stream, based on piece names, as specified in §9.2.5.2. Pieces in physical packages shall occur in their natural order for optimal efficiency.

This document does not require a package implementer to support interleaving.

Pieces exist only in the physical package and are not addressable in the abstract package model. A piece might be empty.

A physical package may contain both interleaved parts and non-interleaved parts. However, it shall not contain both a whole part and a piece of the same part

[Example:

Example 9–2. Performance benefits with interleaved ordering

The figure below contains two parts: a page part (markup/page.xml) describing the contents of a page, and an image part (images/picture.jpg) referring to an image that appears on the page.



With simple ordering, all of the bytes of the page part are delivered before the bytes of the image part. The figure below illustrates this scenario. The image cannot be displayed until the entire page part and the image part have been received. In some circumstances, such as small packages on a high-speed network, this might be acceptable. In others, having to read through all of markup/page.xml to get to the image results in unacceptable performance or places unreasonable memory demands.



With interleaved ordering, performance is improved by splitting the page part into pieces and inserting the image part immediately following the reference to the image. This allows the image to be processed as soon as the reference is encountered.



end example]

### Mapping Part Names to Physical Package Item Names

#### General

A mapping from an abstract package to a physical package shall use logical items as intermediate objects in order to permit interleaving (§9.2.4). If a part or the Media Types stream is interleaved, each piece constructed from it shall be a logical item; otherwise, the part or Media Types stream shall be a logical item.



#### Logical Item Names

Names of logical items shall be Unicode strings. The support of non-ASCII characters is not required.

If a logical item is a piece, its name shall have suffixes of the following syntax:

SuffixName = "/" "[" PieceNumber "]" [".last"] ".piece"

PieceNumber = "0" | NonZeroDigit [1\*Digit]

Digit = "0" | NonZeroDigit

NonZeroDigit = "1" | "2" | "3" | "4" | "5" | "6" | "7" | "8" | "9"

The prefix of a logical item name is the result of removing a suffix, if any, from the logical item name.

Equivalence of prefixes, and of suffixes shall be determined by ASCII case-insensitive matching. Logical names shall be equivalent if their prefixes and suffixes are equivalent. A physical package shall not contain equivalent logical item names.

Logical item names that use suffix names shall form a complete sequence if and only if:

1. The prefix names of all logical item names in the sequence are equivalent, and
2. The suffix names of the sequence start with “/[0].piece” and end with “/[*n*].last.piece” and include a piece for every piece number between 0 and *n*, without gaps, when the piece numbers are interpreted as decimal integer values.

#### Mapping Part Names to Logical Item Names

Names of non-interleaved parts shall be mapped to logical item names that have an equivalent prefix and no suffix.

Names of interleaved parts shall be mapped to the complete sequence of logical item names with an equivalent prefix.

#### Mapping Logical Item Names and Physical Package Item Names

The mapping of logical item names and physical package item names shall be specific to the particular physical package.

#### Mapping Logical Item Names to Part Names

A logical item name without a suffix shall be mapped to a part name with an equivalent prefix, provided that the prefix name conforms to the part name syntax.

A complete sequence of logical item names shall be mapped to the part name that is equal to the prefix of the logical item name having the suffix “/[0].piece”, provided that the prefix name conforms to the part name syntax.

A physical package may contain logical item names and complete sequences of logical item names that cannot be mapped to a part name because the logical item name does not follow the part naming grammar. Such logical items or complete sequences of logical items shall not be mapped to parts.

[Example: A ZIP item name [trash]/0000.dat cannot be mapped to a logical item. Thus, this ZIP item does not represent a logical item or part. end example]

## Mapping to a ZIP file

### General

This document defines a mapping for the ZIP file (term 3.3.8) format. Future versions of this document might provide additional mappings.

A ZIP file representing a physical package shall not have any features of the ZIP file format specification related to encryption, decryption, or digital signatures.

The ZIP format includes a number of features that this document does not use. See Annex B for OPC-specific ZIP information.

Physical package items of ZIP files shall be ZIP items (term 3.3.7). [Note: When users unzip a ZIP-based package, they see a set of files and folders that reflects the parts in the package and their hierarchical naming structure. end note]

Table 9–1, shows the various components of the abstract package model and their corresponding physical representation in a ZIP file.

Table 9–1. Abstract package model components and their physical representations

|  |  |
| --- | --- |
| Abstract package model component | Physical representation |
| Package | ZIP file |
| Part | ZIP item |
| Part name | Stored in item header (and ZIP central directory as appropriate). See §9.3.4 for conversion rules.  |
| Part media type | ZIP item containing the Media Types stream described in §9.2.3.2. See §9.3.7 for details about the ZIP item name. |
| Growth hint | Padding reserved in the ZIP Extra field in the local header that precedes the item. See §9.3.8 for a detailed description of the data structure. |

### Mapping Part Data

Each non-interleaved part shall be represented as a single ZIP item. Each piece of an interleaved part, as described in §9.2.4, shall be represented as a single ZIP item.

### ZIP Item Names

ZIP item names shall conform to the ZIP File Format Specification. A mapping from an abstract package to a ZIP file shall only use ASCII ZIP item names. ZIP item names shall be unique within a given ZIP file.

[Example: A ZIP file might contain the following ZIP item names mapped to part pieces and whole parts:

spine.xml/[0].piece

pages/page0.xml

spine.xml/[1].piece

pages/page1.xml

spine.xml/[2].last.piece

pages/page2.xml

end example]

### Mapping Logical Item Names to ZIP Item Names

The process of mapping of logical item names to ZIP item names shall involve, in order, for each logical item, the following steps:

1. Remove the leading forward slash (“/”) from the logical item name or, in the case of interleaved parts, from each of the logical item names within the complete sequence.
2. Percent-encode every non-ASCII character.

### Mapping ZIP Item Names to Logical Item Names

For all ZIP items, except for MS-DOS ZIP items (as defined in the ZIP Appnote) that are not MS-DOS files, their names shall be mapped to logical item names.

The process of mapping of ZIP item names to logical item names shall involve, in order, for each ZIP item, the following steps:

1. Un-percent-encode every non-ASCII character.
2. Add a forward slash (“/”).

[Note: The ZIP Appnote specifies that ZIP items recognized as MS-DOS files are those with a “version made by” field and an “external file attributes” field in the “file header” record in the central directory that have a value of 0. end note]

### ZIP Package Limitations

This document requires that a file header in the central directory structure within a ZIP file shall not exceed 65,535 bytes (see "F. Central directory structure" in the ZIP Appnote). Each file header contains a zip item name, Extra field (including bytes representing Growth Hint as specified in §8.2.4), File Comment, and 42 more bytes representing miscellaneous fields.

Package implementers should restrict part naming to accommodate file system limitations when naming parts to be stored as ZIP items.

[Example: Examples of these limitations are:

* On MS Windows file systems, the asterisk (“\*”) and colon (“:”) are not supported, so parts named with this character do not unzip successfully.
* On MS Windows file systems, many programs can handle only file names that are less than 256 characters including the full path; parts with longer names might not behave properly once unzipped.

end example]

ZIP-based packages shall not include encryption as described in the ZIP Appnote.

ZIP-based packages shall not use compression algorithms except DEFLATE, as described in the ZIP Appnote.

### Mapping the Media Types Stream

In ZIP files, the Media Types stream shall be stored in an item with the name “[Content\_Types].xml” or, in the interleaved case, in the complete sequence of ZIP items “[Content\_Types].xml/[0].piece”, “[Content\_Types].xml/[1].piece”, …, and “[Content\_Types].xml/[n].last.piece”.

[Note: Bracket characters "[" and "]" were chosen for the Media Types stream name specifically because these characters violate the part naming grammar, thus reinforcing the requirement that the ZIP item names constructed from the Media Types stream are always distinguishable from those constructed from part names. end note]

### Mapping the Growth Hint

The additional space suggested by growth hint (term 3.2.11) is stored in the Extra field, as defined in the ZIP file format specification. If the growth hint is used for an interleaved part, the padding is stored in the Extra field of the ZIP item representing the first piece of the part.

The format of the ZIP item's Extra field, when used for growth hints, is shown in the table below:

Table 9–2. Structure of the Extra field for growth hints

|  |  |  |
| --- | --- | --- |
| Field Component | Size | Value |
| Header ID | 2 bytes | 0xA220 |
| Length of Extra field | 2 bytes | The length in bytes of the remaining components of the Extra field: Signature component length + Padding Initial Length component length + Padding component length |
| Signature (for verification) | 2 bytes | 0xA028 |
| Padding Initial Length | 2 bytes | The length in bytes of the Padding component set by a package implementer when the item is created |
| Padding  | variable | Filled with 0x00 bytes |

# Core Properties

## General

This subclause is informative.

Users can associate core properties with packages. Such core properties enable users to get and set well-known and common sets of property metadata to packages. The core properties and the specifications that describe them are shown in the table below:

Table 10–1. Core properties

|  |  |  |
| --- | --- | --- |
| Property | Specification | Description |
| category | Open Packaging Conventions | A categorization of the content of this package. |
| contentStatus | Open Packaging Conventions | The status of the content.  |
| created | DCMI Metadata Terms | Date of creation of the resource. |
| creator | Dublin Core Metadata Element Set | An entity primarily responsible for making the content of the resource. |
| description | Dublin Core Metadata Element Set | An explanation of the content of the resource. |
| identifier | Dublin Core Metadata Element Set | An unambiguous reference to the resource within a given context.  |
| keywords | Open Packaging Conventions | A delimited set of keywords to support searching and indexing. This is typically a list of terms that are not available elsewhere in the properties.  |
| language | Dublin Core Metadata Element Set | The language of the intellectual content of the resource. [Note: IETF RFC 3066 provides guidance on encoding to represent languages. end note] |
| lastModifiedBy | Open Packaging Conventions | The user who performed the last modification. The identification is environment-specific. |
| lastPrinted | Open Packaging Conventions | The date and time of the last printing. |
| modified | DCMI Metadata Terms | Date on which the resource was changed. |
| revision | Open Packaging Conventions | The revision number.  |
| subject | Dublin Core Metadata Element Set | The topic of the content of the resource. |
| title | Dublin Core Metadata Element Set | The name given to the resource. |
| version | Open Packaging Conventions | The version number. |

End of informative subclause.

## Core Properties Part

A package shall contain at most one Core Properties part.

The content of the Core Properties part shall be an XML document that satisfies the requirements specified in §8.2.5. Its media type shall be the Core Properties part media type, as defined in Annex E.

A Core Properties part within the package shall be referenced by a core properties relationship from the package, as listed in Annex E. A package shall contain at most one core properties relationship.

The namespaces for Core Properties are defined in Annex E.

## Core Properties Markup

### General

Unless specified otherwise, elements representing a Core Properties part shall be of the namespace "<http://schemas.openxmlformats.org/package/2006/metadata/core-properties>".

Core property elements shall be elements representing core properties. Core property elements are non-repeatable. They can be empty or omitted.

[Example:

An example of a core properties part is shown below.

<coreProperties

 xmlns="http://schemas.openxmlformats.org/package/2006/metadata/

 core-properties"

 xmlns:dcterms="http://purl.org/dc/terms/"

 xmlns:dc="http://purl.org/dc/elements/1.1/"

 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">

 <dc:creator>Alan Shen</dc:creator>

 <dcterms:created xsi:type="dcterms:W3CDTF">

 2005-06-12

 </dcterms:created>

 <dc:title>OPC Core Properties</dc:title>

 <dc:description>Spec defines the schema for OPC Core Properties and their location within the package</dc:description>

 <dc:language>eng</dc:language>

 <version>1.0</version>

 <lastModifiedBy>Alan Shen</lastModifiedBy>

 <dcterms:modified xsi:type="dcterms:W3CDTF">2005-11-23</dcterms:modified>

 <contentStatus>Reviewed</contentStatus>
 <category>Specification</category>

</coreProperties>

In this example dc:creator, dcterms:created dc:title, dc:description, dc:language, version, lastModifiedBy, dcterms:modified, contentStatus, and category are core property elements.

end example]

### coreProperties element

A coreProperties element is the root element of a Core Properties part.

This element shall have no attributes.

Children of this element shall be core property elements.

The content of this element is defined by the complex type [CT\_CoreProperties](https://sc34wg4.github.io/OOXMLSchemas/documentation/Part2/opc-coreProperties/opc-coreProperties_CT_CoreProperties.html).

### Property elements from Dublin Core Metadata Element Set, Version 1.1

This standard allows creator, description, identifier, language, subject, and title elements as defined by ISO 15836-1 (The Dublin Core metadata element set, Part 1: Core elements) as core property elements.

[Note: These elements belong to the namespace "http://purl.org/dc/elements/1.1/". end note]

These elements shall not have child elements and shall not have the xsi:type attribute or the xml:lang attribute.

[Example:

The example in §10.3.1 contains four elements from ISO 15836-1.

<dc:creator>Alan Shen</dc:creator>

<dc:title>OPC Core Properties</dc:title>

<dc:description>Spec defines the schema for OPC Core Properties and their location within the package</dc:description>

<dc:language>eng</dc:language>

end example]

### Property Elements from DCMI Metadata Terms

This standard allows created and modified elements as defined by DCMI Metadata Terms as core property elements.

[Note: These elements belong to the namespace <http://purl.org/dc/terms/>. end note]

In this document, these elements shall not have child elements and shall not have the xml:lang attribute. These elements shall have the xsi:type attribute whose value is "dcterms:W3CDTF" (the W3C Note "Date and Time Formats" [2]) and dcterms shall be declared as the prefix of the Dublin Core namespace "<http://purl.org/dc/terms/>".

[Example:

The example in §10.3.1 contains two elements from DCMI Metadata Terms.

<dcterms:created xsi:type="dcterms:W3CDTF">2005-06-12</dcterms:created>

<dcterms:modified xsi:type="dcterms:W3CDTF">2005-11-23</dcterms:modified>

end example]

### Property Elements defined in this Document

#### category Element

A category element specifies the category of the content of the package.

[Example: Example values for this property might include Resume, Letter, Financial Forecast, Proposal, and Technical Presentation. This value might be used by an application's user interface to facilitate navigation of a large set of documents. end example]

This element shall have no attributes.

The content of this element is defined by the xsd:string simple type.

[Note: The W3C XML Schema definition of this element is located in §C.2. end note]

[Example:

A category element is in the example in §10.3.1.

<category>Specification</category>

end example]

#### contentStatus Element

A contentStatus element specifies the status of the content of the package.

[Note: Values might include “Draft”, “Reviewed”, and “Final”. end note]

This element shall have no attributes.

The content of this element is defined by the xsd:string simple type.

[Note: The W3C XML Schema definition of this element is located in §C.2. end note]

[Example:

The example in §10.3.1 contains

<contentStatus>Reviewed</contentStatus>

end example]

#### keywords Element

A keywords element specifies the keywords for the content of the package.

A keywords element shall have an optional attribute xml:lang, as defined by XML 1.0. A keywords element has a mixed content model such that each keyword can be wrapped by a value element having an xml:lang attribute individually.

[Example: The following instance of the keywords element has keywords in English (Canada), English (U.S.), and French (France):

<keywords xml:lang="en-US">

 color

 <value xml:lang="en-CA">colour</value>

 <value xml:lang="fr-FR">couleur</value>

</keywords>

end example]

[Note: The W3C XML Schema definition of this element's content model in [CT\_Keywords](https://sc34wg4.github.io/OOXMLSchemas/documentation/Part2/opc-coreProperties/opc-coreProperties_CT_Keywords.html). end note]

#### value Element

A value element specifies a keyword for the content of the package.

A value element shall have an optional attribute xml:lang, as defined by XML 1.0.

[Note: The W3C XML Schema definition of this element's content model is [CT\_Keyword](https://sc34wg4.github.io/OOXMLSchemas/documentation/Part2/opc-coreProperties/opc-coreProperties_CT_Keyword.html). end note]

#### lastModifiedBy Element

A lastModifiedBy element specifies who modified the content of the content.

[Example: A name, email address, or employee ID. end example]

This element shall have no attributes.

The content of this element is defined by the xsd:string simple type.

[Note: The W3C XML Schema definition of this element is reached via §C.2. end note]

[Example: The example in 10.3.1 contains

<lastModifiedBy>Alan Shen</lastModifiedBy>

end example]

#### lastPrinted Element

A lastPrinted element specifies when the content was printed last time.

This element shall have no attributes.

The content of this element is defined by the xsd:dateTime simple type.

[Note: The W3C XML Schema definition of this element is reached via §C.2. end note]

[Example: The example in §10.3.1 contains

<lastPrinted>2017-01-01</lastPrinted>

Another example is

<lastPrinted>2017-04-17T14:20:10+09:00</lastPrinted>

end example]

#### revision Element

A revision element specifies the revision number of the content of the package.

This element shall have no attributes.

The content of this element is defined by the xsd:string simple type.

[Note: The W3C XML Schema definition of this element is reached via §C.2. end note]

[Example:

<revision>4</revision>

end example]

#### version Element

A version element specifies the version of the content of the package.

This element shall have no attributes.

The content of this element is defined by the xsd:string simple type.

[Note: The W3C XML Schema definition of this element is reached via §C.2. end note]

[Example:

 <version>1.0</version>

end example]

## Support for Versioning and Extensibility

A Core Properties part shall not contain elements or attributes of the Markup Compatibility namespace as defined in Annex E.

[Note: Versioning and extensibility functionality is accomplished by creating a new part and using a relationship with a new type to point from the Core Properties part to the new part. This document does not provide any requirements or guidelines for new parts or relationship types that are used to extend core properties. ISO/IEC TR 30114-1 [4] provides such a guideline. end note]

# Thumbnails

Thumbnail parts shall be image parts identified by either a part relationship or a package relationship. This relationship shall have a relationship type for Thumbnail parts, as defined in Annex E.

[Note: Thumbnail parts may be used to help end-users identify parts of a package or a package as a whole. end note]

# Digital Signatures

## General

A package may include markup specifying that parts of a package have been signed. This clause describes how OPC applies the W3C Recommendation “XML-Signature Syntax and Processing” in the construction of this markup.

## Overview of OPC-Specific Restrictions and Extensions to “XML-Signature Syntax and Processing”

This subclause is informative.

Digital signatures are represented as separate OPC parts. In other words, digital signatures are detached from the content to be signed.

This document introduces markup for specifying when a signature is created.  This markup appears in an Object element.

This document introduces markup (see §12.5.6.2) and a transform algorithm ("Relationships transform", see §12.6) for flexibly defining the relationships to be signed.

This document mandates the use of the Manifest element as a child of an Object element for enumerating parts to be signed.

End of informative text.

## Choosing Content to Sign

It is assumed that there is a signature policy to determine which parts and relationships to sign.

This clause provides flexibility in defining the content to be signed, thus allowing other contents to be mutable. For further information on how to define which content is to be signed, see §12.5.5 and §12.5.6.2.

## Digital Signature Parts

### General

Digital signatures in packages use the Digital Signature Origin part, Digital Signature XML Signature parts, and Digital Signature Certificate parts. Relationship types and media types relating to the use of digital signatures in packages are specified in Annex E. [Note: An example relationship from the Digital Signature Origin part to a Digital Signature XML Signature part is provided in §8.5.4.3. end note]

[Example: Figure 12–1 shows a signed package with signature parts, signed parts, and an X.509 certificate part. The example Digital Signature Origin part has relationships to two Digital Signature XML Signature parts, each containing a signature. The signatures relate to the signed parts.

Figure 12–1. A signed package



end example]

### Digital Signature Origin Part

The Digital Signature Origin part is the starting point for navigating through the signatures in a package. No more than one Digital Signature Origin part shall exist in a package and that part shall be the target of a Digital Signature Origin relationship, as specified in Annex E, from the package. This part shall exist if the package contains any Digital Signature XML Signature parts, and is optional otherwise. The content of the Digital Signature Origin part shall be empty.

### Digital Signature XML Signature Part

A Digital Signature XML Signature part shall contain digital signature markup (see §12.5). Each Digital Signature XML Signature part shall be the target of a Digital Signature relationship, as specified in Annex E, from the Digital Signature Origin part. A package may contain more than one Digital Signature XML Signature part.

[Note: Future versions of this document might specify distinct relationship types for revised signature parts. Using these relationships, packages would be able to contain separate signature information for current and previous versions. For reference validation and signature validation it would be possible to choose the appropriate XML digital signatures. end note]

### Digital Signature Certificate Part

An X.509 certificate is used to validate a signature and can be contained either within a Digital Signature XML Signature part, as a separate Digital Signature Certificate part, or stored outside the package.

If the certificate is represented as a separate part within the package, that certificate shall be the target of a Digital Signature Certificate part relationship, as specified in Annex E, from the appropriate Digital Signature XML Signature part. The part containing the certificate may be signed. The media type of the Digital Signature Certificate part and the relationship targeting it from the Digital Signature XML Signature part are defined in Annex E. A Digital Signature Certificate part may be used to create more than one signature. A Digital Signature Certificate part should be the target of at least one Digital Signature Certificate relationship from a Digital Signature XML Signature part.

## Digital Signature Markup

### General

The following subclauses cover OPC-specific restrictions and extensions to “XML-Signature Syntax and Processing”. Subclauses are provided for elements defined for OPC-specific use or for which OPC introduces restrictions. Elements defined in “XML-Signature Syntax and Processing” (such as X509Certificate) for which no subclause is provided below are allowed in OPC packages without restriction.

OPC-specific elements belong to the namespace for Digital Signatures (see Table E-1 in Annex E). Their schema definitions are reached via Annex C.4.

[Note: For a general example of XML digital signature markup, see Section 2 of “XML-Signature Syntax and Processing”. For a complete example of an OPC-specific digital signature, see §12.7. end note]

### Signature Element

This document introduces further requirements to those defined in §4.1 of “XML-Signature Syntax and Processing”.

A Signature element shall contain exactly one OPC-specific Object element and zero or more application‑defined Object elements.

### SignedInfo Element

This document introduces further requirements to those defined in §4.3 of “XML-Signature Syntax and Processing”

A SignedInfo element shall contain exactly one reference to an OPC-specific Object element.

### CanonicalizationMethod Element

This document introduces further requirements to those defined in §4.3.1 of “XML-Signature Syntax and Processing”.

Packages shall use only the following canonicalization methods:

* XML Canonicalization (c14n)
* XML Canonicalization with Comments (c14n with comments)

### Reference Element

#### General

This document introduces further requirements to those defined in §4.3.3 of “XML-Signature Syntax and Processing”.

#### Reference Element as a Child of a SignedInfo Element

Reference elements within a SignedInfo element shall reference elements only within the same Signature element, and should reference an Object element.

#### Reference Element as a Child of a Manifest Element

Each Reference element that is a child of a Manifest element shall only reference parts in the package. The value of the URI attribute shall be a part name without a fragment identifier.

References to package parts shall include the part media type as a query component. The syntax of the relative reference is as follows:

/page1.xml?ContentType=value

where value is the (case-insensitive) media type of the targeted part.

[Example:

Example 12–3. Part reference with query component

In the following example, the media type is “application/vnd.openxmlformats-package.relationships+xml”:

URI="/\_rels/document.xml.rels?ContentType=application/vnd.openxmlformats-package.relationships+xml"

end example]

### Transform Element

#### General

This document introduces further requirements to those defined in §4.3.3.4 of “XML-Signature Syntax and Processing”.

One of the following transform algorithms shall be specified:

* XML Canonicalization (c14n)
* XML Canonicalization with Comments (c14n with comments)
* Relationships transform (OPC-specific)

#### Transform Element Representing a Relationships Transform

A Transform element represents a Relationships transform if the value of its attribute "Algorithm" is:

http://schemas.openxmlformats.org/package/2006/RelationshipTransform

Such a Transform element shall:

* contain one or more RelationshipReference or RelationshipsGroupReference elements,
* be a descendant element of a Manifest element,
* be followed by a Transform element specifying either XML Canonicalization (c14n) or XML Canonicalization with Comments (c14n with comments)

A Relationships transform describes how the Relationship elements from the Relationships part are selected for signing. Only one Relationships transform shall be specified for a particular Relationships part. For algorithm details, see §12.6.

### RelationshipReference Element

The RelationshipReference element specifies which Relationship element is signed, and shall only occur as a child element of a Transform element representing a Relationships transform (§12.5.6.2). This element is OPC-specific.

|  |  |
| --- | --- |
| Attributes | Description |
| SourceId (Reference to Relationship) | The value of the Id attribute of the referenced Relationship element within the given Relationships part  |

### RelationshipsGroupReference Element

The RelationshipsGroupReference element specifies that the group of Relationship elements with the specified value for the Type attribute is signed. This element shall only occur as a child element of a Transform element representing a Relationships transform (§12.5.6.2). This element is OPC-specific.

|  |  |
| --- | --- |
| Attributes | Description |
| SourceType (Relationship Type) | The value of the Type attribute of the Relationship elements within the given Relationships part  |

### DigestMethod Element

This document introduces further requirements to those defined in §4.3.3.5 of “XML-Signature Syntax and Processing”.

The RSA-SHA1 algorithm shall be specified by a DigestMethod element.

### Object Element

#### General

This document introduces further requirements to those defined in §4.5 of “XML-Signature Syntax and Processing”. An Object element shall be either OPC-specific or application-defined.

#### OPC-specific Object Element

An OPC-specific Object element shall contain a Manifest element followed by a SignatureProperties element, and no other elements. The Id attribute of the OPC-specific Object element shall be specified, and its value shall be "idPackageObject".

The Markup Compatibility namespace, as specified in Annex E, shall not be used within the OPC-specific Object element.

#### Application-Defined Object Element

An application-defined Object element specifies application-defined information. The Id attribute of the application-defined Object element shall be absent or have a value other than "idPackageObject".

The Markup Compatibility namespace, as specified in Annex E, shall not be used within the OPC-specific Object element.

### Manifest Element

This document introduces further requirements to those defined in §4.4 of “XML-Signature Syntax and Processing” only when a Manifest element occurs as a child of an OPC-specific Object element. Reference elements in such a Manifest element shall satisfy requirements defined in §12.5.5.3.

### SignatureProperty Element

This document introduces further requirements to those defined in §5.2 of “XML-Signature Syntax and Processing” only when a SignatureProperty element is a child of a child SignatureProperties element of an OPC-specific Object element. Such a SignatureProperty element shall specify the Id attribute to have the value "idSignatureTime", and shall contain a SignatureTime element and no other elements. The Target attribute value of such a SignatureProperty element shall be either empty or contain a fragment reference to the value of the Id attribute of the root Signature element.

### SignatureTime Element

The SignatureTime element specifies the date/time stamp for the signature. This element is OPC-specific.

### Format Element

The Format element specifies the format of the date/time stamp. This element is OPC-specific. The date/time format shall conform to the syntax described in the W3C Note "Date and Time Formats" [2].

### Value Element

The Value element specifies the value of the date/time stamp. This element is OPC-specific. The value shall conform to the format specified in the Format element.

### XPath Element

Although the XPath element is allowed in “XML-Signature Syntax and Processing”, it is disallowed in this document. [Note: The XPath element is only for XPath filtering, which is disallowed in OPC. end note]

## Relationships Transform Algorithm

The Relationships transform takes the XML document from the specified Relationships part and transforms it to another XML document. This transform shall be supported in generating and validating signatures. [Note: The output XML document is subsequently canonicalized by the specified canonicalization algorithm. end note]

The Relationships part might contain content from several namespaces, along with versioning instructions as defined in Part 3, “Markup Compatibility and Extensibility”.

The Relationships transform algorithm has the following steps:

Step 1: Process versioning instructions

Process the Relationships part as specified in Part 3, §9, where the markup configuration is empty and the application configuration contains the Relationships namespace only.

Step 2: Sort and select signed relationships

1. Remove all namespace declarations except the Relationships namespace declaration.
2. Remove the Relationships namespace prefix, if it is present.
3. Sort relationship elements by Id value in case-sensitive lexicographical order.

Keep only those Relationship elements which either have an Id value that matches a SourceId value or have a Type value that matches a SourceType value specified in the Relationships transform. Matching is ASCII case-insensitive.

[Example: Consider a Relationships part

<?xml version="1.0" encoding="UTF-8" standalone="yes"?>

<rlsps:Relationships xmlns:rlsps="http://schemas.openxmlformats.org/package/2006/relationships" xmlns:foo="http://example.com/foo">

 <rlsps:Relationship Id="rId6" Type="http://../relationships/footnotes" Target="footnotes.xml"/>

 <rlsps:Relationship Id="rId8" Type="http://../relationships/header" Target="header1.xml"/>

 <rlsps:Relationship Id="rId32" Type="http://../relationships/image" Target="media/image1.png"/>

 <rlsps:Relationship Id="rId3" Type="http://../relationships/styles" Target="styles.xml"/>

 <rlsps:Relationship Id="rId21" Type="http://../relationships/image" Target="media/image2.jpeg"/>

 <rlsps:Relationship Id="rId12" Type="http://../relationships/header" Target="header1.xml"/>

</rlsps:Relationships>

Given Id="rId6" and Type=<http://../relationships/image>, Step 2 constructs

<?xml version="1.0" encoding="UTF-8" standalone="yes"?>

<Relationships xmlns="http://schemas.openxmlformats.org/package/2006/relationships">

 <Relationship Id="rId21" Type="http://../relationships/image" Target="media/image2.jpeg"/>

 <Relationship Id="rId32" Type="http://../relationships/image" Target="media/image1.png"/>

 <Relationship Id="rId6" Type="http://../relationships/footnotes" Target="footnotes.xml"/>

</Relationships>

end example]

Step 3: Prepare for canonicalization

1. Remove all text nodes and comments within the document.
2. If the TargetMode attribute is missing from a Relationship element, add it with the default value "Internal".

## Digital Signature Example

This subclause is informative.

Digital signature markup for packages is illustrated in this example. For information about namespaces used in this example, see Annex E. Note that the namespace prefix “pds” refers to the namespace for OPC-specific elements in digital signatures.

There are two Object elements in this example. The first Object element is OPC-specific since the value of its Id attribute is "idPackageObject". The second Object element (at the very end of this example) is application-dependent since the value of its Id attribute is not "idPackageObject".

The OPC-specific Object element contains a Manifest element followed by a SignatureProperties element. The Manifest element specifies a list of parts by its Reference child elements. The first Reference element references a part /document.xml via the value of the URI attribute. The second Reference element references a Relationships part /\_rels/document.xml.rels, the source part of which is /document.xml.

Children of these Reference elements specify which transform and digest method is used and also specify obtained digest values. Note that the first transform for the Relationships part is a Relationships transform.

The SignedInfo element (at the beginning of this example) references the two Object elements. The OPC-specific Object element including its Manifest and SignatureProperties child elements are canonicalized and then signed. The application-defined Object element is also signed.

The SignatureValue element contains a signature, while the KeyInfo element contains an X509 certificate.

<Signature Id="SignatureId" xmlns="http://www.w3.org/2000/09/xmldsig#">

 <SignedInfo>

 <CanonicalizationMethod Algorithm="http://www.w3.org/TR/2001/

 REC-xml-c14n-20010315"/>

 <SignatureMethod Algorithm="http://www.w3.org/2000/09/xmldsig#dsa-sha1"/>

 <Reference

 URI="#idPackageObject"

 Type="http://www.w3.org/2000/09/xmldsig#Object">

 <Transforms>

 <Transform Algorithm="http://www.w3.org/TR/2001/

 REC-xml-c14n-20010315"/>

 </Transforms>

 <DigestMethod Algorithm="http://www.w3.org/2000/09/xmldsig#sha1"/>

 <DigestValue>…</DigestValue>

 </Reference>

 <Reference

 URI="#Application"

 Type="http://www.w3.org/2000/09/xmldsig#Object">

 <Transforms>

 <Transform Algorithm="http://www.w3.org/TR/2001/

 REC-xml-c14n-20010315"/>

 </Transforms>

 <DigestMethod

 Algorithm="http://www.w3.org/2000/09/xmldsig#sha1"/>

 <DigestValue>…</DigestValue>

 </Reference>

 </SignedInfo>

 <SignatureValue>…</SignatureValue>

 <KeyInfo>

 <X509Data>

 <X509Certificate>…</X509Certificate>

 </X509Data>

 </KeyInfo>

 <Object Id="idPackageObject" xmlns:pds="http://schemas.openxmlformats.org/
 package/2006/digital-signature">

 <Manifest>

 <Reference URI="/document.xml?ContentType=application/

 vnd.ms-document+xml">

 <Transforms>

 <Transform Algorithm="http://www.w3.org/TR/2001/

 REC-xml-c14n-20010315"/>

 </Transforms>

 <DigestMethod Algorithm="http://www.w3.org/2000/09/xmldsig#sha1"/>

 <DigestValue>…</DigestValue>

 </Reference>

 <Reference

 URI="/\_rels/document.xml.rels?ContentType=application/

 vnd.openxmlformats-package.relationships+xml">

 <Transforms>

 <Transform Algorithm="http://schemas.openxmlformats.org/

 package/2006/RelationshipTransform">

 <pds:RelationshipReference SourceId="B1"/>

 <pds:RelationshipReference SourceId="A1"/>

 <pds:RelationshipReference SourceId="A11"/>

 <pds:RelationshipsGroupReference SourceType=

 "http://schemas.example.com/required-resource"/>

 </Transform>

 <Transform Algorithm="http://www.w3.org/TR/2001/

 REC-xml-c14n-20010315"/>

 </Transforms>

 <DigestMethod Algorithm="http://www.w3.org/2000/09/xmldsig#sha1"/>

 <DigestValue>…</DigestValue>

 </Reference>

 </Manifest>

 <SignatureProperties>

 <SignatureProperty Id="idSignatureTime" Target="#SignatureId">

 <pds:SignatureTime>

 <pds:Format>YYYY-MM-DDThh:mmTZD</pds:Format>

 <pds:Value>2003-07-16T19:20+01:00</pds:Value>

 </pds:SignatureTime>

 </SignatureProperty>

 </SignatureProperties>

 </Object>

 <Object Id="Application">…</Object>
</Signature>

End of informative text.

## Generating Signatures

Digitally signed packages can be generated by reference generation and signature generation, as described in §3.1 of “XML-Signature Syntax and Processing”, with some modification for OPC-specific constructs.

[Note: The steps below do not apply to the generation of signatures that contain application-defined Object elements. end note]

The signature policy determines which parts and relationships to sign and the transforms and digest methods that are applicable in each case.

Reference generation:

1. For each part being signed, create a Reference element following the steps in §3.1.1 of “XML-Signature Syntax and Processing”.
2. Construct the OPC-specific Object element containing a Manifest element with both the child Reference elements obtained from the preceding step and a child SignatureProperties element, which, in turn, contains a child SignatureTime element.
3. Create a reference to the resulting OPC-specific Object element following the steps in §3.1.1 of “XML-Signature Syntax and Processing”.

Signature generation:

Follow the steps in §3.1.2 of “XML-Signature Syntax and Processing”.

## Validating Signatures

Digitally signed packages can be validated by reference validation and signature validation, as described in §3.2 of “XML-Signature Syntax and Processing”, with some modification for OPC-specific constructs.

[Note: The steps below do not apply to the validation of signatures that contain application-defined Object elements. end note]

The certificate embedded in the KeyInfo element in the Digital Signature XML Signature part shall be used when it is specified.

Reference validation:

First, validate the reference to the OPC-specific Object element following the steps in §3.2.2 of “XML-Signature Syntax and Processing”.

Second, for each reference in the Manifest element:

1. validate the reference following the steps in §3.2.2 of “XML-Signature Syntax and Processing”.
2. validate the media type of the referenced part against the media type specified in the reference query component. References are invalid if these two values are different. The string comparison shall be case-insensitive.

Signature validation:

Follow the steps in §3.2.2 of “XML-Signature Syntax and Processing”.

1. (informative)
Preprocessing for Generating Relative References

Relative references are available for referencing parts. Unicode strings that are similar to but are not strictly relative references are also used to reference parts. [Example: "\a.xml" is not a relative reference since the backslash character is disallowed in RFC 3986/3987.]

Some implementations provide preprocessing of such Unicode strings to replace them with relative references. This preprocessing might involve some of (but is not limited to) the following actions:

* Percent-encode each open bracket (“[“) and close bracket (“]”).
* Percent-encode each space character (U+0020).
* Percent-encode each percent (“%”) character that is not followed by a hexadecimal notation of an octet value.
* Un-percent-encode each percent-encoded unreserved character.
* Un-percent-encode each forward slash (“/”) and back slash (“\”).
* Convert all back slashes to forward slashes.
* If present in a segment containing non-dot (“.”) characters, remove trailing dot (“.”) characters from each segment.
* Replace each occurrence of multiple consecutive forward slashes (“/”) with a single forward slash.
* If a single trailing forward slash (“/”) is present, remove that trailing forward slash.
* Remove complete segments that consist of three or more dots.

Examples of Unicode strings converted to relative references are shown below:

|  |  |
| --- | --- |
| Unicode string | Relative Reference |
|  |  |
|  |  |
| /A B.xml | /A%20B.xml |
| /%41/%61.xml | /A/a.xml |
| /%25XY.xml | /%25XY.xml |
| /%XY.xml | /%25XY.xml |
| /%2541.xml | /%2541.xml |
|  |  |
|  |  |
| /%2e/%2e/a.xml | /a.xml |
| \a.xml | /a.xml |
| \%41.xml | /A.xml |
| /%D1%86.xml | /%D1%86.xml |
| \%2e/a.xml | /a.xml |

1. (normative)
Constraints and Clarifications on the use of ZIP Features
	1. General

The ZIP Appnote includes a number of features that packages do not support. Some ZIP features are clarified in the context of this document.

* 1. Archive File Header Consistency

Data describing files stored in the archive is substantially duplicated in the Local File Headers and Data Descriptors, and in the File headers within the Central Directory Record. For a ZIP file to be a physical layer for a package, the package implementer shall ensure that the ZIP file holds equal values in the appropriate fields of every File Header within the Central Directory and the corresponding Local File Header and Data Descriptor pair, when the Data Descriptor exists, except as described in Table B–5 for bit 3 of general-purpose bit flags.

* 1. Data Descriptor Signature

Packages may contain a 4-byte signature value 0x08074b50 at the beginning of Data Descriptors, immediately before the crc-32 field. Package implementers should be able to read packages, whether or not a signature exists.

* 1. Table Key
* “Yes” — During consumption of a package, a "Yes" value for a field in a table in Annex B indicates a package implementer shall support reading the ZIP file containing this record or field, however, support might mean ignoring. During production of a package, a “Yes” value for a field in a table in Annex B indicates that the package implementer shall write out this record or field.
* “No” — A “No” value for a field in a table in Annex B indicates the package implementer should not use this record or field.
* “Optional” — An “Optional” value for a record in a table in Annex B indicates that package implementers might write this record during production.
* “Partially, details below” — A “Partially, details below” value for a record in a table in Annex B indicates that the record contains fields that might not be supported by package implementers during production or consumption. See the details in the corresponding table to determine requirements.
* “Only used when needed” — The value “Only used when needed” associated with a record in a table in Annex C indicates that the package implementer shall use the record only when needed to store data in the ZIP file.

Table B–1 specifies the requirements for package production, consumption, and editing in regard to particular top-level records or fields described in the ZIP Appnote. [Note: In this context, editing means in-place modification of individual records. A format specification can require editing applications to instead modify content in-memory and re-write all parts and relationships on each save in order to maintain more rigorous control of ZIP record usage. end note]

Table B–1. Support for records

|  |  |  |  |
| --- | --- | --- | --- |
| Record name  | Supported on Consumption | Supported on Production | Pass through on editing |
| Local File Header | Yes (partially, details below) | Yes (partially, details below) | Yes |
| File data | Yes | Yes | Yes |
| Data descriptor  | Yes | Optional | Optional |
| Archive decryption header | No | No | No |
| Archive extra data record | No | No | No |
| Central directory structure: File header | Yes (partially, details below) | Yes (partially, details below) | Yes |
| Central directory structure: Digital signature | Yes (ignore the signature data) | Optional | Optional |
| Zip64 end of central directory record V1 (from spec version 4.5) | Yes (partially, details below) | Yes (partially, details below, used only when needed) | Optional |
| Zip64 end of central directory record V2 (from spec version 6.2) | No | No | No |
| Zip64 end of central directory locator | Yes (partially, details below) | Yes (partially, details below, used only when needed) | Optional |
| End of central directory record | Yes (partially, details below) | Yes (partially, details below, used only when needed) | Yes |

Table B–2 specifies the requirements for package production, consumption, and editing in regard to individual record components described in the ZIP Appnote.

Table B–2. Support for record components

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Record | Field | Supported on Consumption | Supported on Production | Pass through on editing |
| Local File Header | Local file header signature | Yes | Yes | Yes |
| Version needed to extract  | Yes (partially, see Table B–3) | Yes (partially, see Table B–3) | Yes (partially, see Table B–3) |
| General purpose bit flag | Yes (partially, see Table B–5) | Yes (partially, see Table B–5) | Yes (partially, see Table B–5) |
| Compression method  | Yes (partially, see Table B–4) | Yes (partially, see Table B–4) | Yes (partially, see Table B–4) |
| Last mod file time | Yes | Yes | Yes |
| Last mod file date | Yes | Yes | Yes |
| Crc-32 | Yes | Yes | Yes |
| Compressed size | Yes | Yes | Yes |
| Uncompressed size | Yes | Yes | Yes |
| File name length | Yes | Yes | Yes |
| Extra field length | Yes | Yes | Yes |
| File name (variable size) | Yes | Yes | Yes |
| Extra field (variable size) | Yes (partially, see Table B–6) | Yes (partially, see Table B–6) | Yes (partially, see Table B–6) |
| Central directory structure: File header | Central file header signature | Yes | Yes | Yes |
| version made by: high byte  | Yes | Yes (0 = MS-DOS is default publishing value) | Yes |
| Version made by: low byte | Yes | Yes  | Yes |
| Version needed to extract (see Table B–3 for details) | Yes (partially, see Table B–3) | Yes (1.0, 1.1, 2.0, 4.5) | Yes |
| General purpose bit flag | Yes (partially, see Table B–5) | Yes (partially, see Table B–5) | Yes (partially, see Table B–5) |
| Compression method | Yes (partially, see Table B–4) | Yes (partially, see Table B–4) | Yes (partially, see Table B–4) |
| Last mod file time (Pass through, no interpretation) | Yes | Yes | Yes |
| Last mod file date (Pass through, no interpretation) | Yes | Yes | Yes |
| Crc-32  | Yes | Yes | Yes |
| Compressed size | Yes | Yes | Yes |
| Uncompressed size | Yes | Yes | Yes |
| File name length | Yes | Yes | Yes |
| Extra field length | Yes | Yes | Yes |
| File comment length | Yes | Yes(always set to 0) | Yes |
| Disk number start | Yes (partial — no multi disk archives) | Yes (always 1 disk) | Yes (partial — no multi disk archives) |
| Internal file attributes | Yes | Yes | Yes |
| External file attributes (Pass through, no interpretation) | Yes | Yes(MS DOS default value) | Yes |
| Relative offset of local header  | Yes | Yes | Yes |
| File name (variable size) | Yes | Yes | Yes |
| Extra field (variable size) | Yes (partially, see Table B–6) | Yes (partially, see Table B–6) | Yes (partially, see Table B–6) |
| File comment (variable size) | Yes | Yes (always set to empty) | Yes |
| Zip64 end of central directory V1 (from spec version 4.5, only used when needed) | Zip64 end of central directory signature | Yes | Yes  | Yes |
| Size of zip64 end of central directory  | Yes | Yes | Yes |
| Version made by: high byte (Pass through, no interpretation) | Yes | Yes (0 = MS-DOS is default publishing value) | Yes |
| Version made by: low byte | Yes | Yes (always 4.5 or above) | Yes |
| Version needed to extract (see Table B–3 for details) | Yes (4.5) | Yes (4.5) | Yes (4.5) |
| Number of this disk | Yes (partial — no multi disk archives) | Yes (always 1 disk) | Yes (partial — no multi disk archives) |
| Number of the disk with the start of the central directory  | Yes (partial — no multi disk archives) | Yes (always 1 disk) | Yes (partial — no multi disk archives) |
| Total number of entries in the central directory on this disk  | Yes | Yes | Yes |
| Total number of entries in the central directory | Yes | Yes | Yes |
| Size of the central directory | Yes | Yes | Yes |
| Offset of start of central directory with respect to the starting disk number | Yes | Yes | Yes |
| Zip64 extensible data sector  | Yes | No | Yes |
| Zip64 end of central directory locator (only used when needed) | Zip64 end of central dir locator signature | Yes | Yes | Yes |
| Number of the disk with the start of the zip64 end of central directory | Yes (partial — no multi disk archives) | Yes (always 1 disk) | Yes (partial — no multi disk archives) |
| Relative offset of the zip64 end of central directory record | Yes | Yes | Yes |
| Total number of disks | Yes (partial — no multi disk archives) | Yes (always 1 disk) | Yes (partial — no multi disk archives) |
| End of central directory record | End of central dir signature | Yes | Yes | Yes |
| Number of this disk | Yes (partial — no multi disk archives) | Yes (always 1 disk) | Yes (partial — no multi disk archives) |
| Number of the disk with the start of the central directory | Yes (partial — no multi disk archive) | Yes (always 1 disk) | Yes (partial — no multi disk archive) |
| Total number of entries in the central directory on this disk | Yes | Yes | Yes |
| Total number of entries in the central directory | Yes | Yes | Yes |
| Size of the central directory | Yes | Yes | Yes |
| Offset of start of central directory with respect to the starting disk number | Yes | Yes | Yes |
| ZIP file comment length | Yes | Yes | Yes |
| ZIP file comment | Yes | No | Yes |

Table B–3 specifies the detailed production, consumption, and editing requirements for the Extract field, which is fully described in the ZIP Appnote.

Table B–3. Support for Version Needed to Extract field

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Version | Feature | Supported on Consumption | Supported on Production | Pass through on editing |
| 1.0 | Default value | Yes | Yes | Yes |
| 1.1  | File is a volume label | Yes (do not interpret as a part) | No | (rewrite/remove) |
| 2.0 | File is a folder (directory) | Yes (do not interpret as a part) | No  | (rewrite/remove) |
| 2.0 | File is compressed using Deflate compression | Yes | Yes | Yes |
| 2.0 | File is encrypted using traditional PKWARE encryption | No | No | No |
| 2.1 | File is compressed using Deflate64(tm) | No | No | No |
| 2.5 | File is compressed using PKWARE DCL Implode  | No | No | No |
| 2.7 | File is a patch data set  | No | No | No |
| 4.5 | File uses ZIP64 format extensions | Yes | Yes | Yes |
| 4.6 | File is compressed using BZIP2 compression | No | No | No |
| 5.0 | File is encrypted using DES | No | No | No |
| 5.0 | File is encrypted using 3DES | No | No | No |
| 5.0 | File is encrypted using original RC2 encryption | No | No | No |
| 5.0 | File is encrypted using RC4 encryption | No | No | No |
| 5.1 | File is encrypted using AES encryption | No | No | No |
| 5.1 | File is encrypted using corrected RC2 encryption | No | No | No |
| 5.2 | File is encrypted using corrected RC2-64 encryption | No | No | No |
| 6.1 | File is encrypted using non-OAEP key wrapping | No | No | No |
| 6.2 | Central directory encryption | No | No | No |

Table B–4 specifies the detailed production, consumption, and editing requirements for the Compression Method field, which is fully described in the ZIP Appnote.

Table B–4. Support for Compression Method field

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Code | Method | Supported on Consumption | Supported on Production | Pass through on editing |
| 0 | The file is stored (no compression) | Yes | Yes | Yes |
| 1 | The file is Shrunk | No | No | No |
| 2 | The file is Reduced with compression factor 1 | No | No | No |
| 3 | The file is Reduced with compression factor 2 | No | No | No |
| 4 | The file is Reduced with compression factor 3 | No | No | No |
| 5 | The file is Reduced with compression factor 4 | No | No | No |
| 6 | The file is Imploded | No | No | No |
| 7 | Reserved for Tokenizing compression algorithm | No | No | No |
| 8 | The file is Deflated | Yes | Yes | Yes |
| 9 | Enhanced Deflating using Deflate64™ | No | No | No |
| 10 | PKWARE Data Compression Library Imploding | No | No | No |
| 11 | Reserved by PKWARE | No | No | No |

Table B–5 specifies the detailed production, consumption, and editing requirements when utilizing these general-purpose bit flags within records.

Table B–5. Support for modes/structures defined by general-purpose bit flags

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Bit | Feature | Supported on Consumption | Supported on Production | Pass through on editing |
| 0 | If set, indicates that the file is encrypted. | No | No | No |
| 1, 2 |

|  |  |  |
| --- | --- | --- |
| Bit 2 | Bit 1 |  |
| 0 | 0 | Normal (-en) compression option was used. |
| 0 | 1 | Maximum (-exx/-ex) compression option was used. |
| 1 | 0 | Fast (-ef) compression option was used. |
| 1 | 1 | Super Fast (-es) compression option was used. |

 | Yes | Yes | Yes |
| 3 | If this bit is set, the fields crc-32, compressed size, and uncompressed size are set to zero in the local header. The correct values are put in the data descriptor immediately following the compressed data. | Yes | Yes | Yes |
| 4 | Reserved for use with method 8, for enhanced deflating | No | Bits set to 0 | Yes |
| 5 | If this bit is set, this indicates that the file is compressed patched data. (Requires PKZIP version 2.70 or greater.) | No | Bits set to 0 | Yes |
| 6 | Strong encryption. If this bit is set, you should set the version needed to extract value to at least 50 and you shall set bit 0. If AES encryption is used, the version needed to extract value shall be at least 51. | No | Bits set to 0 | Yes |
| 7 | Currently unused | No | Bits set to 0 | Yes |
| 8 | Currently unused | No | Bits set to 0 | Yes |
| 9 | Currently unused | No | Bits set to 0 | Yes |
| 10 | Currently unused | No | Bits set to 0 | Yes |
| 11 | Currently unused | No | Bits set to 0 | Yes |
| 12 | Unused | No | Bits set to 0 | Yes |
| 13 | Used when encrypting the Central Directory to indicate selected data values in the Local Header are masked to hide their actual values. See the section describing the Strong Encryption Specification for details. | No | Bits set to 0 | Yes |
| 14 | Unused | No | Bits set to 0 | Yes |
| 15 | Unused | No | Bits set to 0 | Yes |

Table B–6 specifies the detailed production, consumption, and editing requirements for the Extra field entries reserved by PKWARE and described in the ZIP Appnote.

Table B–6. Support for Extra field (variable size), PKWARE-reserved

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Field ID | Field description | Supported on Consumption | Supported on Production | Pass through on editing |
| 0x0001 | ZIP64 extended information extra field | Yes | Yes | Optional |
| 0x0007 | AV Info | No | No | Yes |
| 0x0008 | Reserved for future Unicode file name data (PFS) | No | No | Yes |
| 0x0009 | OS/2 | No | No | Yes |
| 0x000a | NTFS  | No | No | Yes |
| 0x000c  | OpenVMS | No | No | Yes |
| 0x000d | Unix | No | No | Yes |
| 0x000e | Reserved for file stream and fork descriptors | No | No | Yes |
| 0x000f | Patch Descriptor | No | No | Yes |
| 0x0014 | PKCS#7 Store for X.509 Certificates | No | No | Yes |
| 0x0015 | X.509 Certificate ID and Signature for individual file | No | No | Yes |
| 0x0016 | X.509 Certificate ID for Central Directory | No | No | Yes |
| 0x0017 | Strong Encryption Header | No | No | Yes |
| 0x0018 | Record Management Controls | No | No | Yes |
| 0x0019 | PKCS#7 Encryption Recipient Certificate List | No | No | Yes |
| 0x0065 | IBM S/390 (Z390), AS/400 (I400) attributes — uncompressed | No | No | Yes |
| 0x0066 | Reserved for IBM S/390 (Z390), AS/400 (I400) attributes — compressed | No | No | Yes |
| 0x4690 | POSZIP 4690 (reserved) | No | No | Yes |

Table B–7 specifies the detailed production, consumption, and editing requirements for the Extra field entries reserved by third parties and described in the ZIP Appnote.

Table B–7. Support for Extra field (variable size), third-party extensions

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Field ID | Field description | Supported on Consumption | Supported on Production | Pass through on editing |
| 0x07c8 | Macintosh | No | No | Yes |
| 0x2605 | ZipIt Macintosh | No | No | Yes |
| 0x2705 | ZipIt Macintosh 1.3.5+ | No | No | Yes |
| 0x2805 | ZipIt Macintosh 1.3.5+ | No | No | Yes |
| 0x334d | Info-ZIP Macintosh | No | No | Yes |
| 0x4341 | Acorn/SparkFS  | No | No | Yes |
| 0x4453 | Windows NT security descriptor (binary ACL) | No | No | Yes |
| 0x4704 | VM/CMS | No | No | Yes |
| 0x470f | MVS | No | No | Yes |
| 0x4b46 | FWKCS MD5 (see below) | No | No | Yes |
| 0x4c41 | OS/2 access control list (text ACL) | No | No | Yes |
| 0x4d49 | Info-ZIP OpenVMS | No | No | Yes |
| 0x4f4c | Xceed original location extra field | No | No | Yes |
| 0x5356 | AOS/VS (ACL) | No | No | Yes |
| 0x5455 | extended timestamp | No | No | Yes |
| 0x554e | Xceed unicode extra field | No | No | Yes |
| 0x5855 | Info-ZIP Unix (original, also OS/2, NT, etc) | No | No | Yes |
| 0x6542 | BeOS/BeBox | No | No | Yes |
| 0x756e | ASi Unix | No | No | Yes |
| 0x7855 | Info-ZIP Unix (new) | No | No | Yes |
| 0xa220 | Padding, Microsoft  | No | Optional | Optional |
| 0xfd4a | SMS/QDOS | No | No | Yes |

The package implementer shall ensure that all 64-bit stream record sizes and offsets have the high-order bit = 0.

The package implementer shall ensure that all fields that contain “number of entries” do not exceed 2,147,483,647.

1. (normative)
Schemas - W3C XML Schema
	1. General

This Part of ISO/IEC 29500 includes a family of schemas defined using the W3C XML Schema 1.0 syntax. The normative definitions of these schemas reside in an accompanying file named OpenPackagingConventions-XMLSchema.zip, which is distributed in electronic form.

* 1. Media Types Stream

This schema is available in the file opc-contentTypes.xsd. The [schema documentation](https://sc34wg4.github.io/OOXMLSchemas/documentation/Part2/opc-contentTypes/opc-contentTypes.html) is also available.

* 1. Core Properties Part

This schema is available in the file opc-coreProperties.xsd. The [schema documentation](https://sc34wg4.github.io/OOXMLSchemas/documentation/Part2/opc-coreProperties/opc-coreProperties.html) is also available.

* 1. Digital Signature XML Signature Markup

This schema is available in the file opc-digSig.xsd. The [schema documentation](https://sc34wg4.github.io/OOXMLSchemas/documentation/Part2/opc-digSig/opc-digSig.html) is also available.

* 1. Relationships Part

This schema is available in the file opc-relationships.xsd. The [schema documentation](https://sc34wg4.github.io/OOXMLSchemas/documentation/Part2/opc-relationships/opc-relationships.html) is also available.

1. (informative)
Schemas - RELAX NG
	1. General

This Part of ISO/IEC 29500 includes a family of schemas defined using the RELAX NG syntax. The definitions of these schemas reside in an accompanying file named OpenPackagingConventions‑RELAXNG.zip, which is distributed in electronic form.

If discrepancies exist between the RELAX NG version of a schema and its corresponding XML Schema, the XML Schema is the definitive version.

* 1. Media Types Stream

This schema is available in the file opc-contentTypes.rnc.

* 1. Core Properties Part

The schema is available in the fileopc-coreProperties.rnc.

* 1. Digital Signature XML Signature Markup

This schema is available in the file opc-digSig.rnc.

* 1. Relationships Part

This schema is available in the file opc-relationships.rnc.

* 1. Additional Resources
		1. XML

This schema is available in the file xml.rnc.

* + 1. XML Digital Signature Core

The schema in D.4 relies on two schemas from XML Security RELAX NG Schemas [3], security\_any.rnc and xmldsig-core-schema.rnc.

1. (normative)
Standard Namespaces and Media Types

The namespaces available for use in a package are listed in the table below:

Table E–1. Package-wide namespaces

|  |  |
| --- | --- |
| Description | Namespace URI |
| Media Types stream | http://schemas.openxmlformats.org/package/2006/content-types |
| Core Properties | http://schemas.openxmlformats.org/package/2006/metadata/core-properties |
| Digital Signatures | http://schemas.openxmlformats.org/package/2006/digital-signature |
| Relationships | <http://schemas.openxmlformats.org/package/2006/relationships> |

The media types for the parts defined in this specification a package are listed in Table E–2, Package-wide media types

Table E–2. Package-wide media types

|  |  |
| --- | --- |
| Description | Media type |
| Core Properties part | application/vnd.openxmlformats-package.core-properties+xml |
| Digital Signature Certificate part | application/vnd.openxmlformats-package.digital-signature-certificate |
| Digital Signature Origin part | application/vnd.openxmlformats-package.digital-signature-origin |
| Digital Signature XML Signature part | application/vnd.openxmlformats-package.digital-signature-xmlsignature+xml |
| Relationships part | application/vnd.openxmlformats-package.relationships+xml |

The relationship types available for use in a package are listed in the table below:

Table E–3. Package-wide relationship types

|  |  |
| --- | --- |
| Description | Relationship Type |
| Core Properties  | http://schemas.openxmlformats.org/package/2006/relationships/metadata/core-properties |
| Digital Signature  | http://schemas.openxmlformats.org/package/2006/relationships/digital-signature/signature |
| Digital Signature Certificate  | http://schemas.openxmlformats.org/package/2006/relationships/digital-signature/certificate |
| Digital Signature Origin | http://schemas.openxmlformats.org/package/2006/relationships/digital-signature/origin |
| Thumbnail | http://schemas.openxmlformats.org/package/2006/relationships/metadata/thumbnail |

1. (informative)
Physical Package Model Design Considerations
	1. General

The physical package model defines the ways in which packages are produced and consumed. This model is based on three components: a producer, a consumer, and a pipe between them.

Figure F–1. Components of the physical package model



A producer is software or a device that writes packages. A consumer is software or a device that reads packages. A device is hardware, such as a printer or scanner that performs a single function or set of functions. Data is carried from the producer to the consumer by a pipe.

In local access, the pipe carries data directly from a producer to a consumer on a single device.

In networked access the consumer and the producer communicate with each other over a protocol. The significant communication characteristics of this pipe are speed and request latency. For example, this communication might occur across a process boundary or between a server and a desktop computer.

In order to maximize performance, designers of physical formats consider access style, layout style, and communication style.

* 1. Access Styles
		1. General

The access style in which local access or networked access is conducted determines the simultaneity possible between processing and input-output operations.

* + 1. Direct Access Consumption

Direct access consumption allows consumers to request the specific portion of the package desired, without sequentially processing the preceding parts of the package. For example, a byte-range request. This is the most common access style.

* + 1. Streaming Consumption

Streaming consumption allows consumers to begin processing parts before the entire package has arrived. Physical formats should be designed to allow consumers to begin interpreting and processing the data they receive before all of the bits of the package have been delivered through the pipe.

The earlier editions of this document defined requirements for streaming consumption. This edition dropped them since different applications of OPC require different requirements on streaming consumption.

However, to allow streaming consumption, it is recommended that the Media Types stream have no Default elements and should have one Override element for each part in the package. Each Override element should appear before or in close proximity to the part to which it corresponds.

* + 1. Streaming Creation

Streaming creation allows producers to begin writing parts to the package without knowing in advance all of the parts that are to be written. For example, when an application begins to build a print spool file package, it might not know how many pages the package contains. Likewise, a program that is generating a report might not know initially how long the report is or how many pictures it has.

In order to support streaming creation, the package implementer should allow a producer to add parts after other parts have already been added. A Consumer shall not require a producer to state how many parts they might create when they start writing. The package implementer should allow a producer to begin writing the contents of a part without knowing the ultimate length of the part.

* + 1. Simultaneous Creation and Consumption

Simultaneous creation and consumption allows streaming creation and streaming consumption to happen at the same time on a package. Because of the benefits that can be realized within pipelined architectures that use it, the package implementer should support simultaneous creation and consumption in the physical package.

* 1. Layout Styles
		1. General

The style in which parts are ordered within a package is referred to as the layout style. Parts can be arranged in one of two styles: simple ordering or interleaved ordering.

* + 1. Simple Ordering

With simple ordering, parts are arranged contiguously. When a package is delivered sequentially, all of the bytes for the first part arrive first, followed by all of the bytes for the second part, and so on. When such a package uses simple ordering, all of the bytes for each part are stored contiguously.

* + 1. Interleaved Ordering

With interleaved ordering, pieces of parts are interleaved, allowing optimal performance in certain scenarios. For example, interleaved ordering improves performance for multi-media playback, where video and audio are delivered simultaneously and inline resource referencing, where a reference to an image occurs within markup.

By breaking parts into pieces and interleaving those pieces, it is possible to optimize performance while allowing easy reconstruction of the original contiguous part.

Because of the performance benefits it provides, package implementers should support interleaving in the physical package. The package implementer might handle the internal representation of interleaving differently in different physical package models. Regardless of how the physical package model handles interleaving, a part that is broken into multiple pieces in the physical file is considered one logical part; the pieces themselves are not parts and are not addressable.

* 1. Communication Styles
		1. General

The style in which a package and its parts are delivered by a producer or accessed by a consumer is referred to as the communication style. Communication can be based on sequential delivery of or random access to parts. The communication style used depends on the capabilities of both the pipe and the physical format.

* + 1. Sequential Delivery

With sequential delivery, all of the physical bits in the package are delivered in the order they appear in the. Generally, all pipes support sequential delivery.

* + 1. Random Access

Random access allows consumers to request the delivery of a part out of sequential physical order. Some pipes are based on protocols that can enable random access. For example, HTTP 1.1 with byte-range support. In order to maximize performance, the package implementer should support random access in both the pipe and the physical package. In the absence of this support, consumers need to wait until the parts they need are delivered sequentially.

1. (informative)
Differences Between ISO/IEC 29500-2 and ECMA-376:2006
	1. General
	2. This annex documents the syntactic differences between the versions of the Open Packaging Specification defined in this document and ECMA-376:2006.XML Elements

The following XML elements are included in this document but are not included in ECMA-376:2006:

* The value element (in the Core Properties Part schema)

The following XML elements are included in ECMA-376:2006 but are not included in this document:

* The contentType element (in the Core Properties Part schema)
	1. XML Attributes

No changes.

* 1. XML Enumeration Values

No changes.

* 1. XML Simple Types

No changes.

* 1. Part Names

Non-ASCII part names are allowed in this document but are disallowed in ECMA-376:2006.

1. (informative)
Package Example
	1. General

This annex depicts an abstract package and a physical package representing a WordprocessingML document.

* 1. Abstract Package

This abstract package contains five parts: /\_rels/.rels, /docProps/core.xml, /word/\_rels/document.xml.rels, /word/document.xml, and /word/settings.xml.

Figure H–1. An example abstract package

package Relationships part

<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<Relationships xmlns="http://schemas...org/package/2006/relationships">
 <Relationship Id="rId2"
 Type="http://schemas... "
 Target="docProps/core.xml"/>
 <Relationship Id="rId1"
 Type="http://schemas... "
 Target="word/document.xml"/>
</Relationships>



part Relationships part associated with word/document.xml

<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<Relationships xmlns="http://schemas...org/package/2006/relationships">
 <Relationship Id="rId2"
 Type="http://schemas... "
 Target="settings.xml"/>
</Relationships>

Two of these parts are Relationships parts (/\_rels/.rels and /word/\_rels/document.xml.rels) and three of them are non-Relationships parts (/word/document.xml, /docProps/core.xml, and /word/settings.xml), where \_rels/.rels is a package Relationships part and /word/\_rels/document.xml.rels is a part Relationships part associated with /word/document.xml. The package Relationships part contains two relationships from the package to /docProps/core.xml and /word/document.xml, respectively. The part Relationships part contains a relationship from /word/document.xml to /word/settings.xml.

* 1. Physical Package

This physical package (empty.docx) is a ZIP file. The ZIP items in this ZIP file are \_rels/.rels, docProps/core.xml, word/\_rels/document.xml.rels, word/document.xml, and word/settings.xml, and [Content\_Types].xml.

With the exception of [Content\_Types].xml, these ZIP items represent parts. Note that part names have "/" as the first character. [Content\_Types].xml represents the Media Types stream.

Bibliography

The following documents are useful references for implementers and users of this International Standard, in addition to the Normative References:

[1] *Character Model for the World Wide Web: String Matching and Searching*, W3C Working Draft 07 April 2016, https://www.w3.org/TR/2016/WD-charmod-norm-20160407/

[2] Date and Time Formats, W3C NOTE 19980827, 1997, <http://www.w3.org/TR/1998/NOTE-datetime-19980827>

[3] *XML Security RELAX NG Schemas*, W3C Working Group Note 11 April 2013, <https://www.w3.org/TR/xmlsec-rngschema/>

[4] ISO/IEC TR 30114-1, *Information technology -- Extensions of Office Open XML file formats -- Part 1: Guidelines*