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Information and documentation — Digital object identifier system

Information et documentation — Système d'identifiant numérique d'objet

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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

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

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

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

This document was prepared by Technical Committee ISO/TC 46, *Information and documentation*, Subcommittee SC 9, *Identification and description*.

This second edition cancels and replaces the first edition (ISO 26324:2012), which has been technically revised. The main changes are as follows.

— The requirement that the directory indicator be "10" has been removed.

— The registration authority now has the ability to assign DOI prefixes with a directory indicator other than "10" (including prefixes consisting of a directory indicator alone), allowing existing identification schemes with a compatible syntax to request that those schemes become part of the DOI system.

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

Introduction

The digital object identifier (DOI®[1]) system provides an infrastructure for persistent unique identification of objects of any type.

DOI is an initialism for "digital object identifier", meaning a "digital identifier of an object" rather than an "identifier of a digital object". In this document, the term "digital object identifier" refers to the system defined in this document, unless otherwise stated. The DOI system was initiated by the International DOI Foundation in 1998, and initially developed with the collaboration of some participants in ISO/TC 46/SC 9. Due to its application in the fields of information and documentation and previous collaboration with some ISO/TC 46/SC 9 participants, it was introduced as a possible work item in 2004 and further developed from 2006 to 2010.

The DOI system offers a useful set of functionalities, including:

— persistence, if material is moved, rearranged, or bookmarked,

— interoperability with other data from other sources,

— extensibility by adding new features and services through management of groups of DOI names,

— single management of data for multiple output formats (platform independence),

— class management of applications and services, and

— dynamic updating of metadata, applications and services.

The DOI system is designed to work over the Internet. A DOI name is permanently assigned to an object to provide a resolvable persistent network link to current information about that object, including where the object, or information about it, can be found on the Internet. While information about an object can change over time, its DOI name will not change. A DOI name can be resolved within the DOI system to values of one or more types of data relating to the object identified by that DOI name, such as a URL, an e-mail address, other identifiers and descriptive metadata.

The DOI system enables the construction of automated services and transactions. Applications of the DOI system include but are not limited to managing information and documentation location and access; managing metadata; facilitating electronic transactions; persistent unique identification of any form of any data; and commercial and non-commercial transactions.

The content of an object associated with a DOI name is described unambiguously by DOI metadata, based on a structured extensible data model that enables the object to be associated with metadata of any desired degree of precision and granularity to support description and services. The data model supports interoperability between DOI applications.

The scope of the DOI system is not defined by reference to the type of content (format, etc.) of the referent, but by reference to the functionalities it provides and the context of use. The DOI system provides, within networks of DOI applications, for unique identification, persistence, resolution, metadata and semantic interoperability.

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[1] DOI® is a registered trademark. The Handbook published by the ISO 26324 Registration Authority (see Clause 8) contains information on trademark issues. The name and contact information of the ISO 26324 Registration Authority can be found at https://www.iso.org/maintenance_agencies.html.

Information and documentation — Digital object identifier system

1 Scope

This document specifies the syntax, description and resolution functional components of the digital object identifier system. It specifies the general principles for the creation, registration and administration of DOI names (where DOI is an initialism for "digital object identifier").

This document defines the syntax for a DOI name, which is used for the identification of an object of any material form (digital or physical) or an abstraction (such as a textual work) where there is a functional need to distinguish it from other objects.

The DOI name does not replace, nor is it an alternative for, an identifier used in another scheme, such as the schemes defined by ISO/TC 46/SC 9. This document describes how the DOI system can be used in conjunction with another identifier scheme (for example, to provide additional functionality, such as resolution, where this is not already available), and how the character string of that other scheme can be integrated into the DOI system through the DOI metadata record or the DOI syntax or both.

This document does not specify particular technologies to implement the syntax, description and resolution functional components of the digital object identifier system.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

UNICODE CONSORTIUM *The Unicode® Standard*. Mountain View, California: Unicode Consortium. Latest edition available at: https://www.unicode.org/versions/latest/

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
DOI system
social and technical infrastructure for the assignment and administration of *DOI names* (3.2) as identifiers in computer-readable form through assignment, resolution, referent description, administration, etc.

3.2
DOI name
string that specifies a unique *object* (3.3) within the *DOI system* (3.1)

Note 1 to entry: Names consist of characters in a sequence specified by the *DOI syntax* (3.4).

Note 2 to entry: The terms "identifier" and "number" are sometimes but not always used in the same sense and are to be avoided where ambiguity can arise. The unqualified use of "DOI" alone can also be ambiguous. Therefore "DOI" is always used in conjunction with a specific noun such as *DOI name* (3.2) or *DOI system* (3.1) unless the meaning is sufficiently clear from an earlier mention or the specific context.

3.3
object
entity within the scope of the *DOI system* (3.1) that can be digital, physical or abstract

Note 1 to entry: Digital, physical or abstract forms of an entity can be of relevance in information and documentation (e.g. resources, people or agreements).

Note 2 to entry: A particular object identified by a specific *DOI name* (3.2) is the *referent* (3.16) of that DOI name.

3.4
DOI syntax
rules for the form and sequence of characters comprising any *DOI name* (3.2), specifically the form and character of a prefix element, separator and suffix element

3.5
directory indicator
unique string allocated to a registrant for the purpose of assignment of DOI names, forming part of the prefix element of the *DOI syntax* (3.4) but having no other implied meaning

3.6
registrant code
unique string assigned to a registrant, forming part of the prefix element of the *DOI syntax* (3.4) but having no other implied meaning

3.7
DOI metadata
specific data associated with a referent within the *DOI system* (3.1), based on a structured data model that enables the referent of the *DOI name* (3.2) to be associated with data of any desired degree of precision and granularity to support identification, description and services

Note 1 to entry: DOI metadata is specified in Annex B.

3.8
DOI kernel metadata
subset of *DOI metadata* (3.7) that is common to all DOI name assignments

Note 1 to entry: DOI kernel metadata is specified in Annex B.

3.9
application profile
set of *DOI names* (3.2) that share some common characteristics

Note 1 to entry: A DOI application profile is a grouping mechanism for *DOI names* (3.2); the functional specification of the application profile includes a set of DOI metadata, comprising the DOI kernel metadata and additional information applicable to that particular genre of object and functional requirements. Each DOI name is associated with one or more application profiles.

3.10
data dictionary
repository for all data elements and *allowed values* (3.11) of those elements used in DOI metadata specifications

3.11
allowed value
item which may be used as a value of an element

3.12
opaque string
syntax string that has no meaning discernible by simple inspection

Note 1 to entry: To discover meaning, there is a need to refer to metadata.

3.13
registrant
person or organization that has requested and received the registration of a particular *DOI name* (3.2)

3.14
interoperability
ability of independent systems to exchange meaningful information and initiate actions from each other, in order to operate together to mutual benefit

Note 1 to entry: In particular, interoperability constitutes the ability for loosely-coupled independent systems to be able to collaborate and communicate. See Reference [14] for further information about interoperability.

3.15
resolution
process of submitting a *DOI name* (3.2) to a network service and receiving in return one or more pieces of current information related to the identified object such as metadata or a location of the object or of metadata

Note 1 to entry: This can involve one or more intermediate mapping operations. The resolution might or might not return an instance of the object. Multiple resolution is the simultaneous return as output of several pieces of current information related to the object, in defined data structures.

3.16
referent
particular *object* (3.3) identified by a *DOI name* (3.2)

3.17
unique identification
specification by a *DOI name* (3.2) of one and only one *referent* (3.16)

3.18
persistent
existence, and ability to be used in services outside the direct control of the issuing assigner, without a stated time limit

3.19
first class
having an identity of itself, not as some attribute of an object

Note 1 to entry: An address is an attribute of something, whereas the thing that has this attribute is a first class object. A DOI name references an entity as a first-class object, not simply the place where the object is located. It may then resolve to a location.

4   DOI name

4.1   Syntax

4.1.1   General characteristics

The DOI syntax shall be made up of a DOI prefix and a DOI suffix separated by a forward slash.

There is no defined limit on the length of the DOI name, or of the DOI prefix or DOI suffix.

The DOI name shall be case-insensitive and shall contain only printable characters from the legal graphic characters specified by the Unicode Standard. Further constraints on character use (e.g. use of language-specific alphanumeric characters) can be defined for an application by the ISO 26324 Registration Authority.

The combination of a unique DOI prefix (assigned to a particular DOI registrant) and a unique DOI suffix (provided by that registrant for a specific object) shall be unique. This allows the de-centralized allocation of DOI names. The registration of the combination of the prefix and suffix in the DOI system also serves to validate the DOI syntax for a given DOI name.

The DOI name shall be regarded as an opaque string by users of the DOI system. No definitive information shall be inferred from the specific character string of a DOI name. In particular, the inclusion in a DOI name of any DOI prefix allocated to a specific registrant does not provide evidence of the ownership of rights or current management responsibility of any intellectual property in the referent. The mere assignment of a DOI name to a referent shall not imply endorsement of the referent by any party. Such information may be asserted in the associated DOI metadata.

4.1.2   DOI prefix

4.1.2.1   Elements

4.1.2.1.1   General

The DOI prefix shall be composed of a directory indicator optionally followed by a registrant code. Where a registrant code is present, the two components shall be separated by a full stop (period).

The DOI prefix is a unique string allocated to a registrant.

4.1.2.1.2   Directory indicator

The directory indicator shall be allocated, optionally with a registrant code, to a registrant by the ISO 26324 Registration Authority for the purpose of the assignment of DOI names.

Where a registrant code was allocated to a registrant under a previous edition of this document, the assignment of "10" as the directory indicator shall be assumed.

Information on the implications of allocating a directory indicator other than "10" is contained in Annex D.

A user of the DOI system can determine whether a directory indicator is valid for use in DOI names by consulting the register managed by the ISO 26324 Registration Authority in accordance with the requirement in C.2.

4.1.2.1.3   Registrant code

Where present, the second element of the DOI prefix shall be the registrant code allocated by the ISO 26324 Registration Authority. A registrant code shall always be used with the directory indicator with which it is allocated.

EXAMPLE 1

10.1000   DOI prefix comprising a directory indicator "10" followed by registrant code "1000".

The registrant code may be further divided into sub-elements for administrative convenience if desired. Each sub-element of the registrant code shall be preceded by a full stop. Such subdivision implies no hierarchical relationship; each registrant code, whether subdivided or not, has equal status in the DOI system. However, a subdivided registrant code can have technical resolution implications. It

is recommended that registrants consult the ISO 26324 Registration Authority for further information about assignment of registrant codes.

EXAMPLE 2

10.1000.11   DOI prefix in which the registrant code ("1000.11") has a subdivision "11".

The registrant code shall be omitted where a directory indicator has been assigned without one.

EXAMPLE 3

15434   DOI prefix consisting of only a directory indicator where no registrant code has been assigned.

4.1.2.2 Changes

Once a DOI name has been assigned, it shall not be changed regardless of any changes in the ownership or management of the referent.

NOTE   The original registrant might no longer have any role in maintaining a DOI name and its associated records even though its registrant code remains a permanent element of that DOI name.

4.1.3 DOI suffix

The DOI suffix shall consist of a character string of any length chosen by the registrant. Each suffix shall be unique to the prefix element that precedes it. The unique suffix can be a sequential number, or it might incorporate an identifier generated from or based on another system used by the registrant, such as ISAN[5][6], ISRC[3], ISSN[2], ISNI[10]; in such cases, a preferred construction for such a suffix may be specified by the ISO 26324 Registration Authority as in Example 2. When constructing DOI names from other identifier systems, including schemes where the DOI prefix is affected, the procedures in Annex A shall be followed.

EXAMPLE 1

10.1000/123456   DOI name with the DOI prefix "10.1000" and the DOI suffix "123456".

EXAMPLE 2

10.1038/issn.1476-4687   DOI suffix using an ISSN. According to the construction used here, a DOI suffix is assembled using an ISSN by preceding the ISSN (including the hyphen) with the lowercase letters "issn" and a period. This hypothetical example is a DOI for the electronic version of *Nature*.

4.2 Visual presentation and other representation of DOI names

4.2.1 Screen and print presentation

When displayed on screen or in print, a DOI name shall be preceded by a lowercase "doi:" unless the context clearly indicates that a DOI name is implied. The "doi:" label is not part of the DOI name value.

EXAMPLE

The DOI name "10.1006/jmbi.1998.2354" is displayed and printed as "doi:10.1006/jmbi.1998.2354".

4.2.2 URI presentation

The use of the lowercase string "doi" complies with the syntax of IETF specification, RFC 3986,[13] for representation as a URI (uniform resource identifier), such as "ftp:" and "http:".