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SERIES X: DATA NETWORKS, OPEN SYSTEM COMMUNICATIONS AND SECURITY

OSI networking and system aspects – Naming, Addressing and Registration

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Information technology – Open Systems Interconnection – Procedures for the operation of OSI Registration Authorities: General procedures and top arcs of the International Object Identifier tree

ITU-T Recommendation X.660

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INTERNATIONAL STANDARD ISO/IEC 9834-1
ITU-T RECOMMENDATION X.660

Information technology – Open Systems Interconnection – Procedures for the operation of OSI Registration Authorities: General procedures and top arcs of the International Object Identifier tree

Summary

ITU-T Recommendation X.660 | ISO/IEC 9834-1 defines a generic registration-hierarchical-name-tree (RH-name-tree) and a specific form of this RH-name-tree that supports international object identifiers (OIDs). It includes registration of the top-level arcs of the OID tree. It also specifies procedures for the operation of an International Registration Authority for use, when needed, by other Recommendations and/or International Standards.

For easy reference, and to emphasize that this tree is an extended form of the original OID tree (defined in earlier versions of this Recommendation | International Standard), this specific RH-name-tree can be referred to as "the international OID tree", or more commonly as just "the OID tree".

The OID tree (defined as the International Object Identifier Tree) specified in this edition is a superset of the original OID tree, which did not support Unicode labels (names of arcs in any language, using the Unicode character set).

The original OID tree required all arcs to be unambiguously identified by a primary integer value, with the use for human readability of (not necessarily unambiguous) secondary identifiers (restricted to the Latin alphabet). Secondary identifiers were not normally carried in protocols or used for machine identification. The International Object Identifier tree extends this by allowing an arc to also be unambiguously identified by a Unicode label (a string of Unicode characters) that can be carried in protocols and can be used for machine identification.

The primary integers and secondary identifiers of the International Object Identifier tree continue to be used in encoding (primary integers only) and value notation (primary integers and secondary identifiers) of the ASN.1 **`OBJECT IDENTIFIER`** type, which is unchanged. The Unicode labels can only be used in encodings and value notation of the ASN.1 **`OID-IRI`** type, and in the specification of an IRI or URI (see IETF RFC 3987).

It also provides recommendations on an appropriate fee structure for registration of lower level arcs (see clause 11).

Source

ITU-T Recommendation X.660 was approved on 29 August 2008 by ITU-T Study Group 17 (2005-2008) under the ITU-T Recommendation A.8 procedure. An identical text is also published as ISO/IEC 9834-1.

FOREWORD

The International Telecommunication Union (ITU) is the United Nations specialized agency in the field of telecommunications, information and communication technologies (ICTs). The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of ITU. ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

The World Telecommunication Standardization Assembly (WTSA), which meets every four years, establishes the topics for study by the ITU-T study groups which, in turn, produce Recommendations on these topics.

The approval of ITU-T Recommendations is covered by the procedure laid down in WTSA Resolution 1.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

NOTE

In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

Compliance with this Recommendation is voluntary. However, the Recommendation may contain certain mandatory provisions (to ensure e.g., interoperability or applicability) and compliance with the Recommendation is achieved when all of these mandatory provisions are met. The words "shall" or some other obligatory language such as "must" and the negative equivalents are used to express requirements. The use of such words does not suggest that compliance with the Recommendation is required of any party.

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As of the date of approval of this Recommendation, ITU had not received notice of intellectual property, protected by patents, which may be required to implement this Recommendation. However, implementers are cautioned that this may not represent the latest information and are therefore strongly urged to consult the TSB patent database at http://www.itu.int/ITU-T/ipr/.

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INTERNATIONAL STANDARD
ITU-T RECOMMENDATION

Information technology – Open Systems Interconnection – Procedures for the operation of OSI Registration Authorities: General procedures and top arcs of the International Object Identifier tree

1 Scope

This Recommendation | International Standard:

a) specifies a registration-hierarchical-name-tree (RH-name-tree) which is a generic tree structure for allocations made by a hierarchical structure of Registration Authorities, and the specific form of this that supports the ASN.1 **OBJECT IDENTIFIER** type and the ASN.1 **OID-IRI** type (see ITU-T Rec. X.680 | ISO/IEC 8824-1);

b) registers top-level arcs of the international object identifier tree;

c) specifies procedures which are generally applicable to registration in the context of any RH-name-tree;

d) provides guidelines for the establishment and operation of International Registration Authorities for use, when needed, by other Recommendations and/or International Standards;

e) provides guidelines for additional Recommendations | International Standards which choose to reference the procedures in this Recommendation | International Standard;

f) provides a recommended fee structure for lower-level Registration Authorities;

g) records the information provided to IETF and the registration with IANA of the "oid" IRI scheme (see Annex F).

NOTE 1 – This Recommendation | International Standard does not exclude or disallow the use of any syntactic form of names or naming domains for registration purposes. This Recommendation | International Standard is intended to cover those cases where a registration-hierarchical-name is an appropriate form of identification.

NOTE 2 – Information about registration for specific objects is contained in separate Recommendations | International Standards.

This Recommendation | International Standard applies to registration by Recommendations and/or International Standards, by International Registration Authorities (see clause 8), and by any other Registration Authority.

2 Normative references

The following Recommendations and International Standards contain provisions which, through reference in this text, constitute provisions of this Recommendation | International Standard. At the time of publication, the editions indicated were valid. All Recommendations and Standards are subject to revision, and parties to agreements based on this Recommendation | International Standard are encouraged to investigate the possibility of applying the most recent edition of the Recommendations and Standards listed below. Members of IEC and ISO maintain registers of currently valid International Standards. The Telecommunication Standardization Bureau of the ITU maintains a list of currently valid ITU-T Recommendations.

2.1 Identical Recommendations | International Standards

– ITU-T Recommendation X.207 (1993) | ISO/IEC 9545:1994, *Information technology – Open Systems Interconnection – Application layer structure.*

– ITU-T Recommendation X.500 (2008) | ISO/IEC 9594-1:2008, *Information technology – Open Systems Interconnection – The Directory: Overview of concepts, models and services.*

– ITU-T Recommendation X.501 (2005) | ISO/IEC 9594-2:2005, *Information technology – Open Systems Interconnection – The Directory: Models.*

– ITU-T Recommendation X.520 (2005) | ISO/IEC 9594-6:2005, *Information technology – Open Systems Interconnection – The Directory: Selected attribute types.*

– ITU-T Recommendation X.650 (1996) | ISO/IEC 7498-3:1997, *Information technology – Open Systems Interconnection – Basic Reference Model: Naming and addressing.*

– ITU-T Recommendation X.662 (2008) | ISO/IEC 9834-3:2008, *Information technology – Open Systems Interconnection – Procedures for the operation of OSI Registration Authorities: Registration of object identifier arcs beneath the top-level arc jointly administered by ISO and ITU-T.*

– ITU-T Recommendation X.680 (2008) | ISO/IEC 8824-1:2008, *Information technology – Abstract Syntax Notation One (ASN.1): Specification of basic notation.*

– ITU-T Recommendation X.681 (2008) | ISO/IEC 8824-2:2008, *Information technology – Abstract Syntax Notation One (ASN.1): Information object specification.*

– ITU-T Recommendation X.690 (2008) | ISO/IEC 8825-1:2008, *Information technology – ASN.1 encoding rules: Specification of Basic Encoding Rules (BER), Canonical Encoding Rules (CER), and Distinguished Encoding Rules (DER).*

– ITU-T Recommendation X.722 (1992) | ISO/IEC 10165-4:1992, *Information technology – Open Systems Interconnection – Structure of management information: Guidelines for the definition of managed objects.*

2.2 Paired Recommendations | International Standards equivalent in technical content

– ITU-T Recommendation F.400/X.400 (1999), *Message handling system and service overview*.

ISO/IEC 10021-1:2003, *Information technology – Message Handling Systems (MHS) – Part 1: System and service overview*.

2.3 Additional references

– ITU-T Recommendation X.121 (2000), *International numbering plan for public data networks.*

– IETF RFC 3987 (2005), *Internationalized Resource Identifiers (IRIs).*

– ISO 3166-1:2006, *Codes for the representation of names of countries and their subdivisions – Part 1: Country codes.*

– ISO 3166-3:1999, *Codes for the representation of names of countries and their subdivisions – Part 3: Codes for formerly used names of countries.*

– ISO/IEC 6523-1:1998, *Information technology – Structure for the identification of organizations and organization parts – Part 1: Identification of organization identification schemes.*

– ISO/IEC 6523-2:1998, *Information technology – Structure for the identification of organizations and organization parts – Part 2: Registration of organization identification schemes.*

– ISO 8571-1:1988, *Information processing system – Open Systems Interconnection – File transfer, Access and Management – Part 1: General introduction.*

– ISO/IEC 10646:2003, *Information technology – Universal Multiple-Octet Coded Character Set (UCS).*

NOTE – ITU-T Rec. T.55 [3] recommends the use of ISO/IEC 10646 for the representation of the languages of the world.

– W3C XML Namespaces:2006, *Namespaces in XML, W3C Recommendation, Copyright © [16 August 2006] World Wide Web Consortium, (Massachusetts Institute of Technology, Institut National de Recherche en Informatique et en Automatique, Keio University),* http://www.w3.org/TR/2006/REC-xml-names-20060816.

3 Definitions

For the purposes of this Recommendation | International Standard, the following definitions apply.

3.1 Organization definition

This Recommendation | International Standard uses the following term defined in ISO/IEC 6523-1:

a) organization.

3.2 OSI reference model terms

This Recommendation | International Standard uses the following terms defined in ITU-T Rec. X.650 | ISO/IEC 7498-3:

a) name;

b) naming authority;

c) naming domain;

d) synonym.

3.3 Application layer structure terms

This Recommendation | International Standard uses the following terms defined in ITU-T Rec. X.207 | ISO/IEC 9545:

a) application-entity-title;

b) application-process-title.

3.4 ASN.1 terms

3.4.1 This Recommendation | International Standard uses the following terms defined in ITU-T Rec. X.680 | ISO/IEC 8824-1:

a) (ASN.1) identifier

b) object;

c) object descriptor type;

d) (ASN.1) object identifier type;

e) OID internationalized resource identifier type.

3.4.2 This Recommendation | International Standard uses the following term defined in ITU-T Rec. X.681 | ISO/IEC 8824-2:

a) information object.

3.5 Directory terms

3.5.1 This Recommendation | International Standard uses the following terms defined in ITU-T Rec. X.500 | ISO/IEC 9594-1:

a) Directory;

b) Directory name.

3.5.2 This Recommendation | International Standard uses the following terms defined in ITU-T Rec. X.501 | ISO/IEC 9594-2:

a) attribute;

b) attribute type;

c) attribute value;

d) attribute value assertion;

e) object class;

f) relative distinguished name.

3.6 Unicode terms

This Recommendation | International Standard uses the following terms defined in ISO/IEC 10646:

a) coded character;

b) graphics character.

3.7 Additional definitions

3.7.1 additional secondary identifier: A secondary identifier for a top-level arc of the international object identifier tree that is assigned from time to time by a simple Resolution of both the relevant ITU-T study group and the relevant ISO/IEC JTC 1 Sub-Committee, without requiring any change to this or any other Recommendation and/or International Standard (see A.6.4).

3.7.2 additional Unicode label: A Unicode label for one of the top-level arcs of the international object identifier tree that is assigned from time to time by a simple Resolution of both the relevant ITU-T study group and the relevant ISO/IEC JTC 1 Sub-Committee, without requiring any change to this or any other Recommendation | International Standard (see A.6.4).

3.7.3 administrative role (of a Registration Authority): Assigning and making available unambiguous names according to the Recommendation | International Standard defining the procedures for the Registration Authority (at whatever depth).

3.7.4 integer-valued Unicode label: A Unicode label for an arc that is the character representation (with no leading zeros) of the primary integer value of that arc.

NOTE – An arc of the international object identifier tree can have no other Unicode label that is the character representation (with or without leading zeros) of an integer value (see 7.2.4).

3.7.5 International Registration Authority: A Registration Authority (see 3.7.17) acting at the international level where the procedures for its operation, defined in a relevant Recommendation and/or International Standard, declare it to operate as an International Registration Authority (see clause 8).

3.7.6 International Object Identifier tree: A specific form of an RH-name-tree whose root corresponds to this Recommendation | International Standard and whose nodes correspond to registration authorities responsible for allocating arcs from a parent node.

3.7.7 IRI/URI value: A value that identifies a resource using one of the schemes registered with IANA for URIs.

3.7.8 Joint ITU-T | ISO/IEC JTC 1 Collaborative Team for object identifiers: A group established in accordance with ITU-T Rec. A.23, Annex A and ISO/IEC JTC 1 Directives Edition 5 Version 2.0, subclause 2.6.4 and Annex K, clause 8 to progress work on Joint Text in relation to object identifiers (OIDs).

3.7.9 long arc: A Unicode label from a superior node in the international object identifier tree that identifies a node that is not immediately beneath the superior node.

NOTE 1 – The long arc (in addition to normal arcs) has to satisfy the unambiguity requirements for all arcs from that superior node (see 7.2.8).

NOTE 2 – The only property of a long arc (see 3.7.15) is its Unicode label. It does not have a primary integer value or a secondary identifier. It is essentially a short-cut for a series of arcs, each of which has a primary integer value and its own Unicode labels.

NOTE 3 – The long arc can therefore not be used to define the value of an (ASN.1) object identifier type. It can only be used in an OID internationalized resource identifier (see 3.7.12).

3.7.10 object (of interest): Anything in some world, generally the world of telecommunications and information processing or some part thereof,

a) which is identifiable (can be named); and

b) which may be registered.

NOTE – Examples of objects are ASN.1 modules (see ITU-T Rec. X.680 | ISO/IEC 8824-1), information objects (see ITU-T Rec. X.681 | ISO/IEC 8824-2), managed objects (see ITU-T Rec. X.722 | ISO/IEC 10165-4), XML namespaces (see W3C XML Namespaces) and any other object that can be identified by an OID, URI or IRI.

3.7.11 object identifier: An ordered list of primary integer values from the root of the international object identifier tree to a node, which unambiguously identifies that node (see 7.2.8).

3.7.12 OID internationalized resource identifier: An IRI/URI value constrained to the IANA "oid" IRI/URI scheme (see Annex F)

NOTE 1 – This is semantically an ordered list of Unicode labels, from the root of the international object identifier tree, that unambiguously identifies the node for a resource (see 7.2.8)

NOTE 2 – The ASN.1 `OID-IRI` type (see ITU-T Rec. X.680 | ISO/IEC 8824-1) is the set of all OID international resource identifier values, and provides value notations for all OID international resource identifiers based on the international object identifier tree. Corresponding encodings are specified in the ITU-T Rec. X.690 series | ISO/IEC 8825 multipart Standard.

3.7.13 primary integer value: A primary value of type integer used to unambiguously identify an arc of the international object identifier tree.

NOTE – An arc of the international object identifier tree has precisely one primary integer value, apart from long arcs, that have only Unicode labels.

3.7.14 primary value: A value of a specified type assigned to an arc of the RH-name-tree that can provide an unambiguous identification of that arc within the set of arcs from its superior node.

3.7.15 properties of an arc: The primary integer value and the Unicode labels and secondary identifiers assigned to that arc.

NOTE – Long arcs (see 3.7.9) have only Unicode labels. All other arcs have precisely one primary integer value.

3.7.16 registration: The assignment of an unambiguous name to an object in a way which makes the assignment available to interested parties.

3.7.17 Registration Authority: An entity such as an organization, a standard or an automated facility that performs registration of one or more types of objects (see also 3.7.5).

NOTE – For this Recommendation | International Standard, the above definition of registration authority extends the term to cover registration by organizations acting at international, regional and national levels and by other means.

3.7.18 registration-hierarchical-name: A name which is unambiguous within the registration-hierarchical-name-tree and which is assigned by registration. The semantic form of this name is structured according to the rules in clause 6.

3.7.19 registration-hierarchical-name-tree: A tree whose nodes correspond to objects that are registered and whose non-leaf nodes may be registration authorities.

3.7.20 registration procedures: The specified procedures for performing registration and amending (or deleting) existing registrations.

3.7.21 relevant ITU-T study group: The ITU-T study group that is responsible for the Joint ITU-T | ISO/IEC JTC 1 Collaborative Team for object identifiers.

3.7.22 relevant ISO/IEC JTC 1 Sub-Committee: The ISO/IEC JTC 1 Sub-Committee that is responsible for the Joint ITU-T | ISO/IEC JTC 1 Collaborative Team for object identifiers.

3.7.23 root arc: One of the three arcs from the root of the international object identifier tree.

3.7.24 secondary identifier: A secondary value restricted to the characters forming an (ASN.1) identifier (see ITU-T Rec. X.680 | ISO/IEC 8824-1), assigned either in an ITU-T Recommendation, an International Standard or by some other Registration Authority to an arc of the OID tree.

NOTE – An arc of the international object identifier tree can have zero or more secondary identifiers.

3.7.25 secondary value: A value of some type associated with an arc that provides additional identification useful for human readers, but that does not in general unambiguously identify that arc, and is not normally included in computer communications.

3.7.26 sponsoring authority: An organization recognized to receive proposals for registration and to submit applications to an International Registration Authority as defined by a given Recommendation and/or International Standard (see 8.2 and 8.3).

3.7.27 technical role (of a registration authority): Verifying that these definitions are in accordance with the Recommendation and/or International Standard defining the form of the definition.

3.7.28 top-level arcs (top arcs): The subset of arcs of the international object identifier tree that are assigned identifiers in this Recommendation | International Standard (supplemented by references to the ITU-T Rec. X.660 series | ISO/IEC 9834 multipart Standards, or by a Resolution from time to time of both the relevant ITU-T study group and the relevant ISO/IEC JTC 1 Sub-committee).

3.7.29 Unicode character: A character from the Unicode character set.

3.7.30 Unicode character set: The set of coded characters specified in ISO/IEC 10646.

NOTE – This is the same character set as that defined by the Unicode Consortium in [4].

3.7.31 Unicode label: A primary value that consists of an unbounded sequence of Unicode characters that does not contain the **SPACE** character (see 7.2.5 for other restrictions) used to unambiguously identify an arc of the ASN.1 tree.

NOTE 1 – Unicode labels are always case sensitive for matching purposes and when determining unambiguity.

NOTE 2 – An arc of the international object identifier tree can have multiple Unicode labels.

NOTE 3 – Joint action by ITU-T and ISO/IEC can also allocate a Unicode label for a long arc that identifies a node which is two levels beneath the root (see A.7).

4 Abbreviations

For the purposes of this Recommendation | International Standard, the following abbreviations apply:

ACSE	Association Control Service Element
ASN.1	Abstract Syntax Notation One
DCC	Data Country Code
DIT	Directory Information Tree
DNIC	Data Network Identification Code
DSA	Directory System Agent
DUA	Directory User Agent
FTAM	File Transfer, Access and Management
IANA	Internet Assigned Numbers Authority
ICD	International Code Designator
IRI	Internationalized Resource Identifier
ISP	International Standardized Profile
MHS	Message Handling Systems
OID	Object Identifier
OID-IRI	OID Internationalized Resource Identifier
OSI	Open Systems Interconnection
RA	Registration Authority
RDN	Relative Distinguished Name
RH-name	Registration-Hierarchical-name
RH-name-tree	Registration-Hierarchical-name-tree
ROA	Recognized Operating Agency
TSB	Telecommunication Standardization Bureau
URI	Uniform Resource Identifier

5 Notation

5.1 Unicode characters are specified in two ways. For a single character, it is normal to use the Unicode name in a special font followed by the word "character". For example:

SPACE character

5.2 For a range of characters, it is normal to use the letter U followed by eight hex digits for the start and end of the range (both in a special font) in accordance with the notation defined in ISO/IEC 10646. For example:

U0000F900 to **U0000FDCF**

6 Registration

6.1 Overview

6.1.1 Many Recommendations | International Standards define certain objects for which unambiguous identification is required. This is achieved by registration.

NOTE – Examples of these objects are given in 3.7.10.

6.1.2 Registration is the assignment of a name to an object in a way which makes the assignment available to interested parties. It is carried out by a registration authority.

6.1.3 Registration can be effected by a Recommendation | International Standard, by publishing in the Recommendation | International Standard the names and the corresponding definitions of object. Such a mechanism requires amendment of the Recommendation | International Standard for each registration, and hence is not appropriate in cases where the registration activity is high.

6.1.4 Alternatively, registration can be effected by permitting one or more organizations to act as registration authorities to perform registration on a flexible basis.

6.1.5 The form of name used (see 7.1.5) and the management of the registration naming domain ensure independent assignment of unambiguous names by different registration authorities.

6.2 Management of the registration naming domain

6.2.1 The management of the entire registration naming domain is accomplished by a process of delegation of authority. In this process, the registration authority responsible for a given naming domain may partition that naming domain. In doing so, it may or may not delegate the registration responsibility for the naming domain formed by each partition to a subordinate registration authority. The naming of a partition does not necessarily imply authority to register objects under that partition. This delegation of registration responsibility can be applied repeatedly with a subordinate registration authority partitioning further the naming domain for which it is responsible and delegating responsibility for those partitions to the registration authorities subordinate to it.

6.2.2 The registration authority responsible for a given naming domain must assign a name to the partition of that naming domain that a given sub-authority will manage. The name assigned shall be globally unambiguous, and shall be concatenated as a prefix to all names assigned by that sub-authority. The repeated application of this process through a hierarchy of registration agents ensures the generation of unambiguous names. The generation of names for registration purposes is discussed further in clause 7.

NOTE – An organization, a Recommendation | International Standard or an automated facility can be the registration authority for more than one partition of a naming domain.

6.3 Operation

6.3.1 A registration authority may concern itself only with unambiguous assignment of names (the administrative role) or may in addition need to concern itself with recording definitions of objects and verifying that these definitions are in accordance with the Recommendation | International Standard defining the form of the definition (the technical role).

6.3.2 The criteria for registering an object may vary among registration authorities. It is the responsibility of each authority to establish those criteria. A registration authority may also choose to define criteria for any authorities which are subordinate to it.

NOTE – Among the criteria to be considered in the registration of an object is the level at which registration is appropriate. For example, it may be that the definition of an object registered by a particular registration authority may find wide use beyond the community serviced by that registration authority. Although the assigned name is globally unambiguous and can be used outside that community, it may be desirable to restate the definition in the style acceptable to the larger community of interest. If so, the restated definition should be registered with the registration authority appropriate for that larger community.

6.3.3 Synonyms are created when an instance of a type of object is registered more than once. There may be valid reasons for creating synonyms, e.g., the Directory aliases. It is difficult to detect occurrences of synonyms. In case where synonyms are undesirable, it may be possible to reduce the number by such means as technical review or administrative fees (in the case of registration authorities). It must be decided in each case whether this is necessary and practical.

NOTE – There is no practical way to ensure that the same object has not been registered by multiple registration authorities and the procedures in this Recommendation | International Standard do not ensure that only a single name is assigned to an object.

7 Registration-hierarchical-names

7.1 The generic RH-name-tree

7.1.1 The RH-name-tree is a generic concept that applies to any form of hierarchical naming in which a name is constructed by the concatenation of values of arcs starting from the root of a tree and proceeding to one of its leaves. RH-name-trees differ in the sort of values assigned to arcs (typically names or numbers or attribute type-value pairs). All of Directory names, MHS names, ASN.1 object identifiers and OID internationalized resource identifiers are hierarchical names that are supported by a specific form of RH-name-tree.

7.1.2 The introduction here of the RH-name-tree concept is intended to make it possible to specify procedures that are applicable to registration authorities related to all three naming conventions. The use of this term should be restricted to standards that address at least two of the specific naming structures that the term RH-name-tree encompasses.

7.1.3 All currently defined RH-name-trees (the OID tree, and trees supporting Directory names and MHS names) are trees whose root corresponds to this Recommendation | International Standard and whose leaf and non-leaf nodes correspond to objects that are registered. Non-leaf nodes correspond to registration authorities where registration responsibility has been delegated to them by a superior node.

7.1.4 The arcs from a given node to its immediate subordinates are unambiguously identified within the scope of the node by each of one or more primary values of different types. These primary values are assigned by the registration authority corresponding to the superior node. Thus, any path from the root to a node provides an unambiguous name for that node by concatenating (in order) the primary values of a given type for the arcs on the path. An arc may also have secondary values associated with it that are not necessary for the unambiguous identification of the arc, but that can appear in human-readable notation (in addition to the primary values) in order to describe more clearly the nature of an object identified by a path through the RH-name-tree.

NOTE – If any arc is not assigned a primary value of a given type, then the node identified by the arc and all of its subordinates can only be referenced using names constructed with primary values of a different type.

7.1.5 In general, the types of values assigned by a registration authority can include integer values, alphanumeric values and other types of values, but specific forms of the RH-name-tree generally restrict the types of values to be used. The contents of character sets and composition rules for values formed at subordinate arcs should be defined in registration authority procedure standards. The contents of character sets and composition rules may be further constrained or extended by subordinate registration authorities taking into consideration the expected use of the resulting values in different forms of name.

7.1.6 Where a given set of registration authorities assigns values of more than one type, the significance, if any, of the relationship between the resultant names (generated as defined in 7.1.4) is outside the scope of this Recommendation | International Standard.

7.1.7 The generation of some specific forms of name for registration purposes is defined in the normative annexes to this Recommendation | International Standard. The generation of other forms of name is also defined in other registration authority documents or in relevant Recommendations | International Standards.

7.2 The specific RH-name-tree for OIDs

7.2.1 The ASN.1 object identifier (**`OBJECT IDENTIFIER`**) and OID internationalized resource identifier (**`OID-IRI`**) types, as specified in ITU-T Rec. X.680 | ISO/IEC 8824-1, are ASN.1 types whose abstract values are associated with a specific form of RH-name-tree (the OID tree). The semantics of the values of these types are defined by reference to the OID tree.

NOTE 1 – The ASN.1 **`OID-IRI`** type is more friendly for human reading, but the ASN.1 **`OBJECT IDENTIFIER`** type is more efficient for binary transfers. Protocol designers will choose when to use an ASN.1 **`OBJECT IDENTIFIER`** type or an ASN.1 **`OID-IRI`** type.

NOTE 2 – For all objects in the OID tree, both ASN.1 **`OBJECT IDENTIFIER`** types and **`OID-IRI`** types are available for their identification. This is because all arcs are required to have a primary integer value that automatically defines an integer-valued Unicode label (see 7.2.4). The former can be used in OID values and the latter in OID-IRI values, even if there are no other Unicode labels and no secondary identifiers.

7.2.2 Each arc of the OID tree shall be labelled with a primary integer value that automatically defines an integer-valued Unicode label (see 7.2.4). It may also have zero or more non-integer Unicode labels, and zero or more secondary identifiers. Some of the non-integer Unicode labels and secondary identifiers may be additional Unicode labels or additional secondary identifiers.

NOTE – ITU-T Recommendations | International Standards (including this ITU-T Recommendation | International Standard) assign a primary integer value (that defines an integer-valued Unicode label), a Unicode label that is not integer-valued, and a secondary identifier to all top-level arcs. Additional Unicode labels and additional secondary identifiers are assigned from time to time in accordance with A.6 (by a simple Resolution of the relevant ITU-T study group and of the relevant ISO/IEC JTC 1 Sub-Committee).

7.2.3 The integer-valued Unicode label shall contain no characters other than those in the range from the **`DIGIT ZERO`** character to the **`DIGIT NINE`** character and shall not commence with a **`DIGIT ZERO`** character unless it has only a single character and the primary integer value of the arc is zero.

7.2.4 The integer-valued Unicode label, when treated as the representation of an integer value in accordance with normal conventions for the decimal representation of an integer value, shall produce the value of the primary integer value.

7.2.5 A non-integer Unicode label shall satisfy the following constraints.

7.2.5.1 It shall contain at least one character that is not in the range **`DIGIT ZERO`** character to the **`DIGIT NINE`** character.

7.2.5.2 It shall contain only the following characters, subject to 7.2.5.3:

HYPHEN-MINUS character
FULL STOP character
LOW LINE character
TILDE character
DIGIT ZERO to **DIGIT NINE**
LATIN CAPITAL LETTER A to **LATIN CAPITAL LETTER Z**
LATIN SMALL LETTER A to **LATIN SMALL LETTER Z**
U000000A0 to **U0000DFFE**
U0000F900 to **U0000FDCF**
U0000FDF0 to **U0000FFEF**
U00010000 to **U0001FFFD**
U00020000 to **U0002FFFD**
U00030000 to **U0003FFFD**
U00040000 to **U0004FFFD**
U00050000 to **U0005FFFD**
U00060000 to **U0006FFFD**
U00070000 to **U0007FFFD**
U00080000 to **U0008FFFD**
U00090000 to **U0009FFFD**
U000A0000 to **U000AFFFD**
U000B0000 to **U000BFFFD**
U000C0000 to **U000CFFFD**
U000D0000 to **U000DFFFD**
U000E1000 to **U000EFFFD**

NOTE 1 – This allows all the characters that are not reserved in IETF RFC 3987.

NOTE 2 – The forbidden characters arise from their use (or reservation) for special purposes in ISO/IEC 10646.

7.2.5.3 Characters within the above ranges that are identified by ISO/IEC 10646 as "(This position shall not be used)" are excluded from the range.

NOTE – Tool implementers should note that this designation may be removed in future versions of ISO/IEC 10646 and may choose to be tolerant of violations of this constraint.

7.2.6 Primary integer values for arcs (and the corresponding integer-valued Unicode label) are unbounded, except that:

a) the root arcs are restricted to three arcs with primary integer values **0** to **2**; and

b) the arcs beneath the root arcs **0** and **1** are restricted to forty arcs with primary integer values **0** to **39**.

NOTE – This enables optimized encodings to be used in which the primary integer values of the top-level arcs under root arcs **0** and **1**, and arcs **0** to **47** under root arc **2** encode in a single octet in an ASN.1 object identifier encoding (see ITU-T Rec. X.690 series | ISO/IEC 8825 multipart Standard).

7.2.7 An arc may (but need not) also have assigned to it zero or more secondary identifiers and zero or more additional secondary identifiers that are human-readable values but are not necessarily unambiguous. The secondary identifiers and additional secondary identifiers of an arc are required to commence with a lowercase letter, and to contain only letters, digits, and hyphens. The last character shall not be a **HYPHEN-MINUS** character, nor shall there be two consecutive **HYPHEN-MINUS** characters in the name (see ITU-T Rec. X.680 | ISO/IEC 8824-1).

NOTE – It is recommended that the same secondary identifier should not be used for two different arcs beneath a given node.

7.2.8 From any given node, the primary integer value and all Unicode labels assigned to an arc (including long arcs) from that node are required to be distinct from all those assigned to other arcs (including long arcs) from the same node.

NOTE 1 – No requirement is placed on the secondary identifiers (but see 7.2.13).

NOTE 2 – In the case of the root arc with primary identifier 2, it is possible to allocate a Unicode label from the root to a node directly beneath arc 2. The above requirement for Unicode labels from a node to be unambiguous applies to these labels in addition to labels to nodes directly beneath the root.

NOTE 3 – Two Unicode labels are distinct if and only if they contain a different set of Unicode characters. Unicode characters that may sometimes be considered "similar" (e.g., upper and lower case letters, or numbers in different languages, different forms of space) are distinct for the purposes of this Recommendation | International Standard. However, there is no concept of style or font, which relates to display and printed representations. All that matters is the Unicode character code.

7.2.9 Each object to be identified is allocated precisely one node (normally, but not necessarily, a leaf), and no other object (of the same or a different type) is allocated to that same node. Thus, an object is uniquely and unambiguously identified by the sequence of primary integer values of the arcs in the path from the root to the node allocated to the object. It is also unambiguously (but not necessarily uniquely) identified by a sequence of Unicode labels (one for each arc) for the arcs in the path from the root to the node allocated to the object.

NOTE – The authorities allocating primary integer values (which define an integer-valued Unicode label), secondary identifiers, and additional secondary identifiers to the top-level arcs are identified in Annex A.

7.2.10 Arcs beneath the root arc with primary identifier 2 are allocated by joint agreement between ITU-T and ISO/IEC. The allocation of Unicode labels to root arcs is also determined by joint agreement between ITU-T and ISO/IEC.

NOTE – It is also possible for a Unicode label to be allocated which directly identifies a path consisting of two arcs from the root to an arc beneath the root arc that has a primary integer value 2 (Unicode label **"Joint-ISO-ITU-T"** – see A.7).

7.2.11 An ASN.1 OID value is semantically an ordered list of OID components. Starting with the root of the OID tree, each OID component identifies an arc in the tree using the primary integer value for that arc. The last OID component identifies an arc leading to a node to which the object has been assigned. It is this object that is identified by the ASN.1 **OBJECT IDENTIFIER** value.

NOTE – ITU-T Rec. X.690 series | ISO/IEC 8825 multipart Standard defines encodings of **OBJECT IDENTIFIER** values that can be used in computer communication.

7.2.12 An **OID-IRI** value is semantically an ordered list of OID-IRI components. Starting with the root of the OID tree, each OID-IRI component identifies an arc in the tree using one of the Unicode labels for that arc. The last OID-IRI component identifies an arc leading to a node to which the object has been assigned. It is this object that is identified by the **OID-IRI** value.

NOTE – ITU-T Rec. X.690 series | ISO/IEC 8825 multipart Standard defines encodings of **OID-IRI** values that can be used in computer communication.

7.2.13 The ASN.1 value notation for an **OBJECT IDENTIFIER** type can contain secondary identifiers.

7.2.14 It is recommended that, whenever a Recommendation, International Standard or other document assigns primary integer values, Unicode labels and/or secondary identifiers to identify objects, there should be an appendix or annex which summarizes the assignments made therein, using either or both of **OBJECT IDENTIFIER** or **OID-IRI** value notation, and recording all the variants of the names that can be used to identify that object (using some appropriate convention if there are many variants).

7.2.15 It is also recommended that an authority assigning an **OBJECT IDENTIFIER** value or an **OID-IRI** value to identify an object should also assign a value of the ASN.1 object descriptor type (see ITU-T Rec. X.680 | ISO/IEC 8824-1) to describe that object.

7.2.16 The ASN.1 value notation for an **OID-IRI** can be used outside of an ASN.1 module to identify an object. The ASN.1 value notation for an **OBJECT IDENTIFIER** value can be used outside of an ASN.1 module to identify an object, provided it does not contain an ASN.1 value reference.

8 International Registration Authorities

NOTE – Although this clause applies only to International Registration Authorities defined by other Recommendations and/or International Standards, other registration authorities may wish to implement similar rules for their operation. The concept of sponsoring authorities applies only in the case of an International Registration Authority.

8.1 Requirement for an International Registration Authority

The identification of, and formal agreement on the need for, an International Registration Authority is established in the Recommendation | International Standard which defines the type of object. Procedures which are generally applicable to the operation of International Registration Authorities are defined in this clause. Procedures which are specific to the type of object are defined in a separate Recommendation and/or International Standard developed for that purpose.

NOTE – The identity of the organization operating any specific International Registration Authority can be obtained from the ITU TSB or ISO Central Secretariat.

8.2 Operation of International Registration Authorities

8.2.1 Each International Registration Authority shall maintain a register of the names assigned to objects and (where the registration authority performs a technical role) the associated definitions of the objects. The form of name to be used and the form of register entry are defined in a separate Recommendation | International Standard.

8.2.2 With regard to the initial assignment of names and definitions to objects and of subsequent additions to the register, the responsibilities of an International Registration Authority shall be as follows:

a) to receive from Sponsoring Authorities (see 8.3) proposals for register entries;

b) to process proposals for entries according to the procedures specified in the applicable Recommendation | International Standard;

c) to record names for each register entry that is accepted, in accordance with the procedures specified in the applicable Recommendation | International Standard;

d) to promulgate the register entries according to the procedures specified in the applicable Recommendation | International Standard; and

e) to convey the results in a specified form to the appropriate Sponsoring Authority when the processing of a proposal has been completed.

8.2.3 With regard to deletions from the register, the responsibilities of an International Registration Authority shall be as follows:

a) to receive proposals from Sponsoring Authorities (see 8.3);

b) to process the proposals for deletion, according to the procedures specified in the applicable Recommendation | International Standard;

c) to promulgate the register deletions according to the procedures specified in the applicable Recommendation | International Standard; and

d) to convey the results in a specified form to the appropriate Sponsoring Authority when the processing of a proposal has been completed.

NOTE – The name of a deleted object should not be reused.

8.3 Sponsoring Authorities

8.3.1 A Sponsoring Authority is the ITU TSB, any ISO/IEC JTC 1 Sub-Committee, an ISO Technical Committee, an IEC Technical Committee, a national Administration of an ITU Member State, an ISO National Body, an IEC National Committee or a liaison organization.

8.3.2 The responsibilities of a Sponsoring Authority shall be as follows:

a) to receive proposals concerning objects from within their respective countries or organization;

b) to effect any necessary rationalizations or coordination of these proposals and to forward them to the International Registration Authority; and

c) to make known within their respective countries or organizations the decisions taken on their proposals as transmitted to them by the International Registration Authority.

9 Contents of registration procedures for objects of a particular type

9.1 Registration procedures for objects of a particular type may be specified in a separate Recommendation | International Standard. A clear distinction shall be made in these registration procedures between those procedures which apply in general to registration for the type of object, and those which apply to the specific International Registration Authority (if any) established by a given Recommendation and/or International Standard.

9.2 The contents of each Recommendation | International Standard shall include:

a) the justification of the need for the registration;

b) a statement of the scope of objects to be registered;

c) references to the Recommendation | International Standard in which the type of object is defined and to any other applicable Recommendations | International Standards, together with identification of the ITU-T study group | ISO/IEC JTC 1 Sub-Committee responsible for the definition of the type of object;

d) definitions and abbreviations used in the registration procedures;

e) a statement whether the registration requires a registration authority to perform a technical role;

f) a specification of the contents of register entries, including at least:

   1) the types used for the specification of primary and secondary values, and the way they are combined;

   2) the name of the organization that proposed the entry;

3) the dates of submission/registration;

4) the definition of the object (where the registration authority performs a technical role);

g) identification of those clauses of this Recommendation | International Standard which apply together with the specification of any necessary amendments to be applied to those clauses for the purposes of the specific registration;

h) for an International Registration Authority, a complete specification of the procedures (manual or automated) to be applied to create, interrogate, modify, delete or audit registered items. This includes any access restrictions imposed on these operations. In particular, the following are specified:

1) the method used to determine whether a request for registration or deletion should be accepted;

NOTE 1 – The following criteria for rejection of a proposal may be relevant:

i) incomplete or incomprehensible definition;

ii) existence of an identical or similar entry in the register;

iii) the proposed entry is not one of the permitted entries;

iv) the proposed entry does not conform to a Recommendation | International Standard listed in the References of the appropriate Recommendation | International Standard;

v) the justification for inclusion in the register is not adequate.

2) how rejections shall be resolved;

3) whether modification of register entries or reuse of the names of register entries is allowed and (if so) a specification of mechanisms to allow this to happen; and

4) the procedures to be applied to determine whether and how the register shall be updated to include relationships to further Recommendation | International Standards;

i) identification of any propagation/notification requirements associated with registered items;

NOTE 2 – For example, there should be a statement on whether the registered information is to be made available to users through a Recommendation | International Standard or an International Standardized Profile (ISP), or by application to the International Registration Authority; and, in the case of application to the International Registration Authority, a description of the procedure to be followed by people or organizations which need to obtain registered information.

j) examples of register entries (in one or more annexes to the Recommendation | International Standard).

9.3 Each Recommendation | International Standard shall specify the form of RH-name to which it applies.

NOTE – Some individual Recommendations | International Standards apply to the registration of objects that are to be accessible using the Directory Service (see Annexes B and C). In order for this to be possible, in some cases it may be necessary to identify, and possibly specify, an appropriate object class to define what information is held in the Directory entry for an instance of each object class.

10 Progression of registration procedures for objects of a particular type

The registration procedures for objects of a particular type may be specified in a separate Recommendation | International Standard. The progression of such a Recommendation | International Standard follows the procedures defined below:

a) identification and formal agreement that a new Recommendation | International Standard is required, and identification and agreement on the requirements for registration shall be stated in any International Standard or prospective Recommendation | International Standard which gives rise to the need for registration.

NOTE 1 – A Recommendation | International Standard is normally appropriate for any object where either (see also Annex D):

1) an explicit International Registration Authority is needed because of the expected frequency of new or amended registrations at the international level; or

2) a number of Recommendations | International Standards have identified the need for registration for a type of object, but, because of the complexity of the information necessary to define instances of the type, it is judged to be desirable to specify this information in a separate document; or

3) registration procedures to be used by organizations requiring registration for their own purposes cannot be adequately described by a reference only to this Recommendation | International Standard from another Recommendation | International Standard.

b) assignment of the development of a new Recommendation | International Standard to a specific ITU-T study group | Working Group of an ISO/IEC JTC 1 Sub-Committee;

c) generation and approval of a New Work Item proposal using normal ISO/IEC JTC 1 procedures, or, if necessary, the generation and approval of a new Question using normal ITU-T procedures;

d) progression of the Recommendation | International Standard to become a Recommendation | International Standard according to normal procedures.

NOTE 2 – Where an International Registration Authority is necessary for the operation of a base Recommendation and/or International Standard, the base Recommendation and/or International Standard normally receives final approval only when the relevant Recommendation and/or International Standard specifying the procedures for the registration authority is at least a consented (or determined) Recommendation and/or at the Draft International Standard ballot stage, and an organization has been nominated to act as the registration authority. Where an International Registration Authority is not necessary, this constraint does not apply.

NOTE 3 – The criteria to be applied in the choice of a body which is proposed for an International Registration Authority are determined by ITU-T and/or ISO/IEC JTC 1 as appropriate. The proposal of an organization to the ITU-T and/or ISO/IEC JTC 1 to act as an International Registration Authority requires at the same time the provision by the submitter of the proposal of an estimate of the activity expected at the international level (e.g., volume of requests for registration per year).

NOTE 4 – In cases where modification of the operation of a Registration Authority requires modification to a Recommendation | International Standard, this modification must follow normal procedures for changing Recommendations | International Standards.

11 Recommended fee structure

11.1 An organization providing an RA in accordance with this Recommendation | International Standard should do so on a cost-recovery basis. The fee structure should be designed to recover the expenses of operating the RA, to cover Web publication of registrations (which is strongly encouraged), to support enquiry requests, and to discourage frivolous and multiple requests.

11.2 The fee values should be determined by the RA, subject to the approval of any superior RA. Fees can apply to:

a) registration;

b) inquiry request;

c) request for update.

11.3 For an RA operating internationally, fees should be independent, subject to the exchange rate fluctuations of the country that the application is made from.

11.4 Once the fee associated with making an initial register entry has been charged, there should be no further charges for the maintenance of that entry or its Web publication.

Annex A

The top-level arcs of the OID tree

(This annex forms an integral part of this Recommendation | International Standard)

A.1 General

A.1.1 This annex specifies all the root arcs and some of the top-level arcs of the OID tree. Other top-level arcs are specified by other ITU-T Recommendations in the X.660 series | parts of ISO/IEC 9834 that are referenced by this annex.

A.1.2 This annex also specifies the assignment of Unicode labels (by joint ITU-T | ISO agreement) to long arcs from the root that directly identifies any node immediately beneath the node from the root arc that has a primary integer value 2 (Unicode label **"Joint-ISO-ITU-T"** – see A.7 and A.8).

NOTE – Currently, this is the only permitted use of long arcs.

A.2 Assignment of primary integer values, Unicode labels and secondary identifiers to root arcs

A.2.1 This clause specifies the three root arcs of the OID tree, and assigns primary integer values, Unicode labels and secondary identifiers to them. Additional Unicode labels and secondary identifiers are assigned in accordance with A.6 and published in accordance with A.8.

A.2.2 There are (only) three root arcs. The assignment of primary integer values, Unicode labels, secondary identifiers, and the authority for subordinate arcs, is as follows:

Primary integer value	Resulting integer-valued Unicode label	(Non-integer) Unicode label	Secondary identifier(s)	Authority for subordinate arcs
0	**"0"**	**"ITU-T"**	**itu-t** (**ccitt** – see A.2.4)	Administered by ITU-T (see A.3)
1	**"1"**	**"ISO"**	**iso**	Administered by ISO (see A.4)
2	**"2"**	**"Joint-ISO-ITU-T"**	**joint-iso-itu-t** (**joint-iso-ccitt** – see A.2.4)	Jointly-administered by ISO and ITU-T (see A.5)

NOTE – The ASN.1 encoding of ASN.1 object identifier values specified in ITU-T Rec. X.680 | ISO/IEC 8824-1 requires that there be only three arcs allocated from the root node (with primary integer values of **0**, **1**, and **2**), and at most forty arcs from the first two of these arcs (with primary integer values of **0** to **39**).

A.2.3 The secondary identifiers **itu-t**, **iso** and **joint-iso-itu-t**, assigned above, may each be used without their associated primary integer value as a "NameForm" of an ASN.1 object identifier value (see ITU-T Rec. X.680 | ISO/IEC 8824-1) and identify the corresponding primary integer value.

NOTE – The use of the "NameAndNumberForm" of an ASN.1 object identifier value (see ITU-T Rec. X.680 | ISO/IEC 8824-1) in new specifications for these and for subordinate arcs is nonetheless recommended where additional secondary identifiers (see A.6) have already been assigned to the arc.

A.2.4 For historical reasons, the secondary identifiers **ccitt** and **joint-iso-ccitt** are synonyms for **itu-t** and **joint-iso-itu-t**, respectively, and thus may appear in ASN.1 object identifier values, and also identify the corresponding primary integer value.

NOTE – These names are not assigned as Unicode labels, as the international object identifier concept post-dates the change of name from CCITT to ITU-T.

A.3 Assignment of primary integer values, Unicode labels and secondary identifiers to arcs administered by ITU-T

A.3.1 Arcs beneath the root arc with the primary integer value **0** (Unicode label **"ITU-T"** and secondary identifier **itu-t**) are administered by the ITU-T. All decisions related to these arcs will be recorded as amendments to this Recommendation | International Standard, but such changes to the joint text will be regarded as editorial changes by ISO/IEC.

NOTE – The assignment of additional secondary identifiers or additional Unicode labels to the root arc with the primary integer value **0** (Unicode label **"ITU-T"** and secondary identifier **itu-t**) – see A.6 – requires joint agreement between the relevant ITU-T study group and the relevant ISO/IEC JTC 1 Sub-Committee, as there is a requirement that all secondary identifiers and all Unicode labels are distinct across all three root arcs.

A.3.2 Six arcs are specified from the node with the primary integer value **0** (Unicode label **"ITU-T"** and secondary identifier **itu-t)**. The assignment of primary integer values, Unicode labels and secondary identifiers, and the authority for subordinate arcs, is as follows:

Primary integer value	Resulting integer-valued Unicode label	(Non-integer) Unicode label	Secondary identifier	Authority for subordinate arcs
0	"0"	"Recommendation"	recommendation	See A.3.3
1	"1"	(see A.3.4)	question	See A.3.4
2	"2"	"Administration"	administration	See A.3.5
3	"3"	"Network-Operator"	network-operator	See A.3.6
4	"4"	"Identified-Organization"	identified-organization	See A.3.7
5	"5"	"R-Recommendation"	r-recommendation	See A.3.8

The first five secondary identifiers (for arcs with primary integer values **0** to **4**) may be used without their primary integer value in an ASN.1 object identifier "NameForm" (see ITU-T Rec. X.680 | ISO/IEC 8824-1, 32.3) and identify the corresponding primary integer values. The secondary identifier **r-recommendation** shall not be used in an ASN.1 object identifier "NameForm", but the corresponding Unicode label can (of course) be used in the value notation for an ASN.1 **OID-IRI**, or in a W3C IRI/URI specification (see Annex F).

NOTE – The restriction on the use of **r-recommendation** is because only secondary identifiers that were present in the initial version of this Recommendation | International Standard can be used in an ASN.1 object identifier "NameForm", in order to avoid backward compatibility problems for related software.

A.3.3 The arcs below **"Recommendation"** are specified in A.3.3.1 to A.3.3.5.

A.3.3.1 The arcs below the arc with the primary integer value **0** (Unicode label **"Recommendation"** and secondary identifier **recommendation)** have the primary integer values of **1** to **26** (and hence the integer-valued Unicode labels of **"1"** to **"26")** and also have (non-integer) Unicode labels of **"A"** to **"Z"** and secondary identifiers of **a** to **z**. The secondary identifiers **a** to **z** may be used in a "NameForm", and identify the corresponding primary integer value.

A.3.3.2 Arcs below each of the arcs specified in A.3.3.1 have primary integer values (and hence integer-valued Unicode labels) that are the numbers of the ITU-T (and CCITT) Recommendations in the series identified by the letter.

A.3.3.3 The Editor of the identified Recommendation may, subject to the approval of the ITU-T study group responsible for development or maintenance of that Recommendation, determine the addition of one or more Unicode labels to the arc that identifies the Recommendation. These Unicode labels shall consist of the number of the Recommendation followed by any string of Unicode characters chosen by the Editor that does not start with a digit, and such that the result forms a valid Unicode label for that arc. This is called an acronym for the Recommendation, and shall be chosen by the Editor and approved by the study group. Such allocations shall be published in the applicable Recommendation.

NOTE – Best efforts should be used to ensure that a chosen acronym is not used for other ITU-T Recommendations or International Standards. The OID repository, currently at http://www.oid-info.com, can assist in this task.

A.3.3.4 Secondary identifiers for the arcs specified in A.3.3.2 are not assigned in this Recommendation | International Standard, but authority is given for the Recommendation identified by these arcs to contain text that allocates one or more secondary identifiers to the arc identifying it (see A.3.3.3). Such allocations shall be published in the applicable Recommendation.

A.3.3.5 Arcs below the arcs specified in A.3.3.2 are determined as necessary by the corresponding ITU-T (or CCITT) Recommendation.

A.3.4 Arcs below the arc with the primary integer value **1** (secondary identifier **question**) have primary integer values corresponding to ITU-T study groups, qualified by the study period. The value is computed by the formula:

Study Group number + (Study Period * 32)

where "Study Period" has the value 0 for 1984-1988, 1 for 1988-1992, etc., and the multiplier is 32 decimal. The arcs below each study group have primary integer values corresponding to the Questions assigned to that study group. Arcs below this are determined as necessary by the group (e.g., Working Party or special Rapporteur group) assigned to study the question.

NOTE – The arcs beneath the arc with the primary integer value `1` have never been used and are of historical interest only. A non-integer Unicode label has not been assigned to these arcs.

A.3.5 Arcs below the arc with the primary integer value `2` (Unicode label **`"Administration"`** and secondary identifier **`administration`**) have primary integer values (and hence integer-valued Unicode labels) that are the values of data country codes (DCCs) as defined in ITU-T Rec. X.121. Arcs below this are determined as necessary by the national Administration of the country identified by the DCC. These arcs have a non-integer Unicode label and a secondary identifier, both consisting of the two-letter alpha-2 code element (see ISO 3166-1) for the corresponding country.

A.3.6 Arcs below the arc with the primary integer value `3` (Unicode label **`"Network-Operator"`** and secondary identifier **`network-operator`**) have primary integer values (and hence integer-valued Unicode labels) that are the values of data network identification codes (DNICs) as defined in ITU-T Rec. X.121. Arcs below this are determined as necessary by the national Administration or ROA identified by the DNIC. These arcs have no non-integer Unicode labels and no secondary identifiers assigned by default.

A.3.7 Arcs below the arc with the primary integer value `4` (Unicode label **`"Identified-Organization"`** and secondary identifier **`identified-organization`**) are assigned primary integer values (and hence integer-valued Unicode labels), non-integer Unicode labels, and secondary identifiers by the ITU TSB in accordance with the registration and publication procedures specified in ITU-T Rec. X.669. Arcs below this are determined as necessary by the identified organization.

NOTE – Organizations which may find this arc useful include:

- recognized operating agencies not operating a public data network;
- scientific and industrial organizations;
- regional standards organizations; and
- multi-national organizations.

A.3.8 Arcs below the arc with the primary integer value `5` (Unicode label **`"R-Recommendation"`** and secondary identifier **`r-recommendation`**) are determined by the ITU-R in accordance with procedures defined by ITU-R.

NOTE – An additional Unicode label of "**`ITU-R`**", and an additional secondary identifier, of **`itu-r`** have been allocated to the root arc with the primary integer value `0` (Unicode label **`"ITU-T"`** and secondary identifier **`itu-t`**, see A.2.2), for use with the **`r-recommendation`** arc. This allows ASN.1 **`OBJECT IDENTIFIER`** values such as **`{itu-r(0) r-recommendation(5) ...}`** and ASN.1 **`OID-IRI`** values such as **`"/ITU-R/R-Recommendation/..."`**.

A.4 Assignment of primary integer values, Unicode labels and secondary identifiers to arcs administered by ISO

A.4.1 Arcs beneath the root arc with the primary integer value `1` (Unicode label **`"ISO"`** and secondary identifier **`iso`**) are administered by the ISO. All decisions related to these arcs will be recorded as amendments to this Recommendation | International Standard, but such changes to the joint text will be regarded as Editorial changes by ITU-T.

NOTE – The assignment of additional secondary identifiers or additional Unicode labels to the root arc with the primary integer value `1` (Unicode label "**`ISO`**" and secondary identifier **`iso`**) requires joint agreement between ITU-T and ISO/IEC, as there is a requirement that all secondary identifiers and all Unicode labels are distinct across all arcs from the root.

A.4.2 Four arcs are specified from the node with the primary integer value `1` (Unicode label **`"ISO"`** and secondary identifier **`iso`**). The assignment of primary integer values, Unicode labels and secondary identifiers, and the authority for subordinate arcs, is as follows:

Primary integer value	Resulting integer-valued Unicode label	(Non-integer) Unicode label	Secondary identifier	Authority for subordinate arcs
`0`	`"0"`	`"Standard"`	`standard`	See A.4.3
`1`	`"1"`	`"Registration-Authority"`	`registration-authority`	See A.4.5
`2`	`"2"`	`"Member-Body"`	`member-body`	See A.4.6
`3`	`"3"`	`"Identified-Organization"`	`identified-organization`	See A.4.7

These secondary identifiers may be used without their primary integer value in an ASN.1 object identifier "NameForm" (see ITU-T Rec. X.680 | ISO/IEC 8824-1, 32.3) and identify the corresponding primary integer values.

A.4.3 Arcs below the arc with the primary integer value **0** (Unicode label **"Standard"** and secondary identifier **standard**) have primary integer values (and hence integer-valued Unicode labels) that are the number of an International Standard published by ISO or IEC (see A.4.4 for non-integer Unicode labels). Where the International Standard is multipart, there shall be an additional arc for the part number, unless this is specifically excluded in the text of the International Standard. Arcs below this are determined as necessary by the corresponding International Standard.

NOTE – If a non-multipart International Standard allocates subordinate arcs, and subsequently becomes a multipart International Standard, it shall continue to allocate subordinate arcs as if it were a single part International Standard.

A.4.4 The Editor of the identified International Standard may, subject to agreement with the ISO Committee or Sub-Committee responsible for the development or maintenance of that International Standard, determine the addition of one or more Unicode labels to the arc that identifies the Standard. These Unicode labels shall consist of the number of the Standard followed by any string of Unicode characters chosen by the Editor that does not start with a digit, and such that the result forms a valid Unicode label for that arc. This is called an acronym for the Standard, and shall be chosen by the Editor and approved by the Committee or Sub-Committee. Such allocations shall be published in the applicable Standard.

NOTE – Best efforts should be used to ensure that the chosen acronym is not used for other International Standards or ITU-T Recommendations. The OID repository, currently at http://www.oid-info.com, can assist in this task.

EXAMPLE 1: The "FTAM PCI" abstract-syntax information object, defined in ISO 8571-1, has been assigned the ASN.1 **OBJECT IDENTIFIER** value:

```
{iso(1) standard(0) ftam(8571) abstract-syntax(2) pci(1)}
```

EXAMPLE 2: A future revision of ISO 8571-1 could also assign (with the agreement of the ISO/IEC JTC 1 Sub-Committee responsible for the maintenance of ISO 8571-1) the following value of the ASN.1 **OID-IRI** type:

```
"/ISO/Standard/8571_FTAM/Abstract-Syntax/PCI"
```

A.4.5 Arcs below the arc with the primary integer value **1** (Unicode label **"Registration-Authority"** and secondary identifier **registration-authority**) are determined by those International Standards that, in one or more of their parts, specify the procedures for the operation of a registration authority. Arc numbers with primary integer values from **1** to **10** (and hence integer-valued Unicode labels **"1"** to **"10"**) are reserved to identify a part of the ISO/IEC 9834 multipart Standard, and the primary integer value is the number of that part. For other International Standards, the primary integer value is the number of the International Standard. In all cases, the identified International Standard or part of the ISO/IEC 9834 multipart Standard allocates subsequent arcs.

A.4.6 Arcs below the arc with the primary integer value **2** (Unicode label **"Member-Body"** and secondary identifier **member-body**) are assigned the primary integer value (and hence integer-valued Unicode labels) of a numeric country code (without the leading zeros), as specified in the column labelled "Numeric code" in the table in ISO 3166-1, clause 9, that identifies the ISO National Body in that country. Each arc for a country is also assigned by default non-integer Unicode labels which are the corresponding two-letter alpha-2 code element (in capitals) in the column labelled "Alpha-2 code" in the table in ISO 3166-1, clause 9. The "NameForm" of an ASN.1 object identifier component is not permitted for these arcs. Arcs below the "country code" are allocated by the identified ISO National Body.

NOTE – The existence of a country code in ISO 3166 does not necessarily imply that there is an ISO National Body representing that country or that the ISO Member Body for that country administers a scheme for the allocation of subordinate arcs.

A.4.7 Arcs below the arc with the primary integer value **3** (Unicode label **"Identified-Organization"** and secondary identifier **identified-organization**) have primary integer values (and hence integer-valued Unicode labels) that are the values of an international code designator (ICD) allocated by the Registration Authority for ISO/IEC 6523-2 that identifies an issuing organization specifically registered by that authority as allocating international object identifier components (see Notes 1 and 2). The arcs immediately below the ICD have primary integer values (and hence integer-valued Unicode labels) that are the values of an "organization code" allocated by the issuing organization in accordance with ISO/IEC 6523-2. They have no non-integer Unicode labels associated by default, but secondary identifiers and Unicode labels for arcs beneath the ICD can be assigned by the identified organization.

NOTE 1 – The requirement that issuing organizations are recorded by the Registration Authority for ISO/IEC 6523 as allocating international object identifier components ensures that only numerical values in accordance with this International Standard are allocated.

NOTE 2 – The declaration to the Registration Authority for ISO/IEC 6523 that an issuing organization allocates international object identifier components does not preclude the use of the ICD code for the allocation of Unicode labels. This is to avoid the need to modify the registration with the Registration Authority for ISO/IEC 6523 when Unicode labels are, in addition, to be allocated.

A.5 Assignment of OID components jointly administered by ISO and ITU-T

A.5.1 The allocation of arcs under the jointly-administered root arc with the primary integer value **2** (Unicode label **"Joint-ISO-ITU-T"** and secondary identifier **joint-iso-itu-t**) is determined by resolution of the relevant ITU-T study group and of the relevant ISO/IEC JTC 1 Sub-Committee.

NOTE – The jointly agreed assignment of one or more arcs, and responsibility for the nodes beneath those arcs to an organization may result in joint agreement on the allocation of additional Unicode labels or additional secondary identifiers for the top-level arc with the primary integer value **2** (Unicode label **"Joint-ISO-ITU-T"** and secondary identifier **joint-iso-itu-t**). Such additional Unicode labels and secondary identifiers are allocated in accordance with A.6 and A.7.

A.5.2 Arcs under the jointly-administered root arc with the primary integer value **2** (Unicode label **"Joint-ISO-ITU-T"** and secondary identifier **joint-iso-itu-t**) have values that are assigned and agreed from time to time by a simple Resolution of the relevant ITU-T study group and the relevant ISO/IEC JTC 1 Sub-Committee, and are recorded and published in accordance with A.8 in the *Register of arcs beneath the root arc with primary integer value 2*. These allocations can provide OID and IRI namespace to other international standards organizations, to areas of joint work, or to other bodies requiring object identifiers or OID internationalized resource identifiers. For details of the information content of the registration entries and the application and approval process, see ITU-T Rec. X.662 | ISO/IEC 9834-3.

NOTE – Unicode labels (long arcs) can also be allocated that directly identify these nodes from the root node – see A.7.

A.5.3 Arcs beneath each arc allocated by A.5.1 shall be allocated in accordance with the mechanisms established when the arc is allocated.

NOTE – It is expected that this will involve delegation of authority to the joint agreement of ITU-T Rapporteurs and ISO Conveners (advised by the respective Editors) for a joint area of work, or to an international organization.

A.5.4 (For information) An arc beneath **joint-iso-itu-t** has been allocated to the area of joint work on registration procedures by ITU-T and ISO/IEC, with a primary integer value of **17** and a non-integer Unicode label of **"Registration_Procedures"** and a secondary identifier of **registration-procedures**. Arcs are assigned beneath this to Recommendations | International Standards concerned with joint ITU-T | ISO/IEC registration procedures. Where a Recommendation | International Standard specifies the operation of an International Registration Authority it will, in general, assign the use of the arcs for which it is responsible to that authority.

EXAMPLE: ISO/IEC 9834-2 assigns the use of arcs for which it is responsible to the International Registration Authority for Document Types. Thus the ASN.1 **OBJECT IDENTIFIER** value for the third registered instance of the Document Type information object is:

```
{joint-iso-itu-t(2) registration-procedures(17) document-types(2) binary(3)}
```

and the corresponding **OID-IRI** value would be:

```
"/Joint-ISO-ITU-T/Registration-Procedures/Document Types/Binary"
```

A.5.5 (For information) The area of joint registration within a country has been assigned (as specified in ITU-T Rec. X.662 | ISO/IEC 9834-3) an arc which produces the ASN.1 **OBJECT IDENTIFIER** value:

```
{joint-iso-itu-t(2) country(16)}
```

and the corresponding **OID-IRI** value:

```
"/Joint-ISO-ITU-T/Country"
```

The primary integer values (and hence the integer-valued Unicode labels) assigned to arcs under this object-identifier are the values of the numeric-3 codes of ISO 3166-1 (without leading zeros), and non-integer Unicode labels and secondary identifiers are assigned that are the (two-letter) alpha-2 code elements of ISO 3166-1 in capitals. ISO 3166-3 identifies historical numeric-2 codes that can still appear in old OIDs.

The nodes identified by these arcs may be used to assign subordinate arcs (and hence **OBJECT IDENTIFIER** and **OID-IRI** values) within a country. The administration of nodes identified by these arcs is not prescribed by ITU-T Rec. X.662 | ISO/IEC 9834-3, but it is recommended that a single national Registration Authority be determined by the joint decision of the country's ITU Member State and the ISO National Body (and, if necessary, the IEC National Committee for the country). The assignment of registration responsibilities within a country is a national decision.

A.6 Assignment of additional Unicode labels and secondary identifiers to the root arcs

A.6.1 Assignment of additional Unicode labels and secondary identifiers to the root arcs shall be made from time to time (only) by Resolutions of the relevant ITU-T study group and of the relevant ISO/IEC JTC 1 Sub-Committee, in accordance with the following subclauses.

NOTE 1 – It will be normal to assign such additional Unicode labels and secondary identifiers when an international organization is given responsibility for one or more nodes beneath the root arc with the primary integer value **2** (Unicode label **"Joint-ISO-ITU-T"** and secondary identifier **joint-iso-itu-t**), but this is not a requirement. Assignment of additional Unicode labels and secondary identifiers to root arcs with the primary integer values **0** or **1** (Unicode labels **"ITU-T"**, **"ISO"** and secondary identifiers **itu-t** and **iso**) are expected to be rare, and to reflect the need for additional names to correctly reflect the organizations responsible for some lower-level arcs, or the needs of changing organization names.

NOTE 2 – Examples of where the assignment of additional Unicode labels and secondary identifiers for these arcs might be appropriate would be the sharing of a number-space for lower-level arcs between, for example, ISO and IEC standards.

A.6.2 Additional secondary identifiers shall not be used in an ASN.1 object identifier "NameForm" (see ITU-T Rec. X.680 | ISO/IEC 8824-1, 32.3), nor shall an ASN.1 object identifier "NameForm" be used in the specification of any subordinate arcs if these additional secondary identifiers are used.

NOTE 1 – This condition is imposed to avoid the need for frequent updates to software that needs to know the primary integer value, for example, for inclusion in an encoding of the ASN.1 object identifier.

NOTE 2 – Most top-level arcs have additional Unicode labels corresponding to currently defined secondary identifiers. The use of these in ASN.1 **OID-IRI** values and in IETF IRIs is, of course, allowed. Software that does not recognize a Unicode label (which may be an additional Unicode label added after the software was written) in an **OID-IRI** should normally give a warning error message, and take appropriate action, depending on the context.

A.6.3 Assignment of additional Unicode labels and secondary identifiers shall require a resolution for the addition of the following register entry to the *Register of additional Unicode labels and secondary identifiers for root arcs* and shall be recorded and published in accordance with A.8.

(1)	The root arc with primary integer value (and Unicode label) **0** (**"ITU-T"**), **1** (**"ISO"**) or **2** (**"Joint-ISO-ITU-T"**) to which the additional Unicode label or secondary identifier is to be assigned. Example: **0** (**"ITU-T"**)	(2a) (2b)	The additional Unicode label (if any) that is to be assigned to that root arc. Example: **"Org-X"** The additional secondary identifier (if any) that is to be assigned to that root arc. Example: **org-x** NOTE – It is expected to be normal for the same additional names to be added as both an additional Unicode label and as an additional secondary identifier, but this is not required.
(3)	Contact (officer) of the international organization identified. Example: **Standards liaison officer**.	(4)	Conditions for use of the additional Unicode label and/or secondary identifier. (For examples, see the notes below.)

NOTE 1 – It is expected that the relevant ITU-T study group and the relevant ISO/IEC JTC 1 Sub-Committee will ensure that all Unicode labels and secondary identifiers allocated under this subclause and under A.7.2 are unique across all arcs from the root. (This is required for Unicode labels.)

NOTE 2 – The conditions for use of the additional Unicode labels and secondary identifiers are expected to relate to arcs in which specified lower-level arcs are included (see A.3.8).

EXAMPLE: An additional Unicode label "**ITU-R**" and secondary identifier **itu-r** is permitted for the root arc with the primary integer value **0** (Unicode label "**ITU-T**" and secondary identifier **itu-t**) if and only if the object being identified has an ASN.1 **OBJECT IDENTIFIER** value that begins with **{0 5 x}**, where **x** is a primary integer value assigned to a series of ITU-R Recommendations (see A.3.8). This permits ASN.1 object identifier value notations of:

```
{itu-r(0) r-recommendation(5) br(101) ...}
```

and **OID-IRI** value notations of:

```
"/ITU-R/R-Recommendation/BR/..."
```

EXAMPLE: An **"IEC"** additional Unicode label and secondary identifier might be permitted for the top-level arc with primary integer value **1** if and only if the object identified has an ASN.1 **OBJECT IDENTIFIER** value that begins with **{1 0 x}**, where **x** is the number of an IEC Standard and not an ISO Standard. This would permit values of the ASN.1 **OBJECT IDENTIFIER** type of:

```
{iec(1) standard(0) 2579 ... }
```

and values of the ASN.1 **OID-IRI** type of:

```
"/IEC/Standard/2579/..."
```

EXAMPLE: An additional Unicode label **"Org-X"** and secondary identifier **org-x** might be permitted for the root arc with the primary integer value **2** (Unicode label "**Joint-ISO-ITU-T**" and secondary identifier **joint-iso-itu-t**) if and only if the object identified has an ASN.1 **OBJECT IDENTIFIER** value that begins with **{2 x}**, where **x** is a primary integer value on an arc identifying organization ORG-X. Assuming that the registration in accordance with

ITU-T Rec. X.662 | ISO/IEC 9834-3 had assigned the additional Unicode label "**Tech-com**" and secondary identifier **tech-com**, this would permit ASN.1 **OBJECT IDENTIFIER** value notations of (for example):

```
{org-x(2) tech-com(x) web-services(0) ... }
```

and ASN.1 **OID-IRI** value notations of (for example):

```
"/Org-X/Tech-com/Web-services/..."
```

NOTE 3 – These examples do not imply that the additional Unicode labels and secondary identifiers have been assigned. They are for illustration only.

A.6.4 Approval of additional Unicode labels and secondary identifiers for the root arcs with the primary integer values **0**, **1**, and **2** (Unicode labels "**ITU-T**", "**ISO**" and "**Joint-ISO-ITU-T**", and secondary identifiers **itu-t**, **iso** and **joint-iso-itu-t**) shall be made as follows:

a) determination in ITU-T that a register entry be added for the root arc with the primary integer value **0** (Unicode label "**ITU-T**" and secondary identifier **itu-t**) in accordance with A.6.3, with approval in ISO for the assignment of the additional Unicode label and/or secondary identifier (by simple resolution of the relevant ISO/IEC JTC 1 Sub-Committee); or

b) determination in ISO that a register entry be added for the root arc with the primary integer value **1** (Unicode label "**ISO**" and secondary identifier **iso**) in accordance with A.6.3, with approval in ITU-T for the assignment of the additional Unicode label and/or secondary identifier (by simple resolution of the relevant ITU-T study group); or

c) determination as part of (or following) the allocation of one or more arcs to an international organization that an additional Unicode label and/or secondary identifier be assigned to the root arc with the primary integer value **2** (Unicode label "**Joint-ISO-ITU-T**" and secondary identifier **joint-iso-itu-t**) (by simple resolution of both the relevant ITU-T study group and the relevant ISO/IEC JTC 1 Sub-Committee after discussion and agreement in the Collaborative Team for Object Identifiers).

A.7 Assignment of additional Unicode labels from the root to lower-level arcs (long arcs)

A.7.1 Assignment of additional Unicode labels from the root that identifies directly nodes beneath the node identified by the root arc with primary integer value **2** (Unicode label **"Joint-ISO-ITU-T"** and secondary identifier **joint-iso-itu-t**) shall be made from time to time (only) by resolutions of the relevant ITU-T study group and the relevant ISO/IEC JTC 1 Sub-Committee, in accordance with the following subclauses.

NOTE – It will be normal to assign such additional Unicode labels and secondary identifiers when it is appropriate to provide an **OID-IRI** that directly identifies the joint work or international body or other organization without the use of the Unicode label **"Joint-ISO-ITU-T"**.

A.7.2 Assignment of these Unicode labels shall require a resolution for the addition of the following register entry to the *Register of Unicode labels from the root to nodes beneath the root arc with integer value 2* and shall be recorded and published in accordance with A.8:

(1) The node that the additional Unicode label or secondary identifier is to be assigned, using either ASN.1 **OBJECT IDENTIFIER** or ASN.1 **OID-IRI** notation. Example: **{2 41}** or **"/Joint-ISO-ITU-T/BIP"**	(2) The additional Unicode label (if any) that is to be assigned from the root to that node. Example: **"BIP"**

NOTE – It is expected that the ITU-T study group and the ISO/IEC JTC 1 Sub-Committee will ensure that all Unicode labels allocated under this clause and under clause A.6.3 are unique across all arcs from the root.

A.7.3 Approval of additional Unicode labels from the root under this subclause shall be made as follows:

a) determination in ITU-T that a register entry be added, with approval in ISO for the assignment of the additional Unicode label (by simple resolution of the relevant ISO/IEC JTC 1 Sub-Committee); or

b) determination in ISO/IEC that a register entry be added, with approval in ITU-T for the assignment of the additional Unicode label (by simple resolution of the relevant ITU-T study group).

A.8 Publication of register entries requiring joint ITU-T and ISO approval

A.8.1 General

A.8.1.1 Specification of many top-level arcs and their properties (primary integer identifier, Unicode labels, secondary identifiers) are statically determined by this Recommendation | International Standard and the Recommendations | International Standards that it references.

A.8.1.2 Allocation of arcs at lower levels is the responsibility of a hierarchy of RAs, each of which determines independently whether to publish allocations, and if so how and to what community of interest. However, all RAs are encouraged to provide information about registrations using the OID repository, currently at http://www.oid-info.com.

A.8.1.3 Other top-level arcs and additional associated information for top-level arcs are determined from time to time by simple resolutions of both the relevant ITU-T study group and the relevant ISO/IEC JTC 1 Sub-Committee. These are:

a) the assignment of arcs (and their properties) beneath the root arc with primary integer value `2` (see A.5);

b) the assignment of additional secondary identifiers and non-integer Unicode labels to the root arcs, including the root arc with primary integer value `2` (see A.6);

c) the assignment of Unicode labels for long arcs (see A.7).

These are called "jointly administered registers".

A.8.1.4 Jointly administered registers are maintained on a website provided by the relevant ITU-T study group, and are updated by the ISO/IEC JTC 1 Collaborative Team for Object Identifiers when there are changes to the register entries. The OID repository, currently at http://www.oid-info.com, is also updated as necessary.

A.8.2 Application for an entry to a jointly administered register

A.8.2.1 Such applications shall be submitted to either the relevant ITU-T study group (via ITU-T TSB) or to the relevant ISO/IEC JTC 1 Sub-Committee (via the Sub-Committee Secretariat), or both, with the information specified in A.8.3.

A.8.2.2 It is expected that such applications will be initially discussed at the next meeting of the Joint ITU-T | ISO/IEC JTC 1 Collaborative Team for Object Identifiers, and progressed to the appropriate Resolutions in a timely manner.

A.8.2.3 Following approval, publication of additional top-level arcs and additional properties shall be via a Web page on a website of the ITU-T study group maintained by TSB. The new contents of this page shall be provided by the Joint ITU-T | ISO/IEC JTC 1 Collaborative Team for Object Identifiers whenever the status of assignments for top-level arcs changes.

A.8.2.4 There is no fee for this activity.

A.8.3 Information to be recorded on the Web page for the jointly administered registers

A.8.3.1 *Register of additional Unicode labels and secondary identifiers for root arcs*: See A.6.3 for the information to be recorded for each entry.

A.8.3.2 *Register of arcs beneath the root arc with primary integer value 2*: See ITU-T Rec. X.662 | ISO/IEC 9834-3 for the information to be recorded for each entry.

A.8.3.3 *Register of Unicode labels from the root to nodes beneath the root arc with integer value 2*: See A.7.2 for the information to be recorded for each entry.

Annex B

Derivation of Directory names

(This annex forms an integral part of this Recommendation | International Standard)

B.1 In accordance with the provisions of clause 7, Directory names for registration purposes are generated by a set of registration authorities when:

a) the values assigned to the arcs of the RH-name-tree are relative distinguished names (RDN), as defined in ITU-T Rec. X.501 | ISO/IEC 9594-2; and

b) the top level arcs of the RH-name-tree are assigned RDN values with the "countryName" attribute type as defined in ITU-T Rec. X.520 | ISO/IEC 9594-6 and with attribute values taken from the country codes defined in ISO 3166, in full accordance with ITU-T Rec. X.520 | ISO/IEC 9594-6.

NOTE – Attribute types and values for top level arcs which do not represent countries are not assigned by this Recommendation | International Standard but may be assigned in the future. The assignment of additional attribute types is not to be taken to imply support by the Directory for these new attribute types.

B.2 The Directory name for a node is obtained by taking the RDN values, in order, as Directory name components, as specified in ITU-T Rec. X.501 | ISO/IEC 9594-2.

EXAMPLE: The Directory name form of an Application-process-title for an analysis package run by the Reading Design Office of XYZ Fastening plc in the UK could be:

```
{countryName = "GB", organizationName = "Superstitch Fastenings plc",
organizationalUnitName = "Reading Design Office", commonName = "Analysis Package"}
```

B.3 The administration of the registration authority identified by a "countryName" arc is not prescribed by this Recommendation | International Standard. While it is preferred that a single national registration authority determine the country's ITU Member State and the ISO National Body (and, if necessary, the IEC National Committee for the country), the assignment of registration responsibilities within a country is a national decision.

B.4 The existence of multiple name forms does not imply their support by the Directory nor does it imply any requirement to map from one name form to another.

B.5 There are some circumstances in which it is appropriate for ASN.1 object identifiers to be transformed into Directory names and used for Directory access. This annex defines three attribute types, an object class and a name form for this purpose.

B.6 The attribute types are:

a) An attribute type for the first component of an ASN.1 object identifier:

```
oidC1 ATTRIBUTE ::= {
      WITH SYNTAX INTEGER
      EQUALITY MATCHING RULE integerMatch
      ID {id-oidC1}}
```

Integer match is defined in ITU-T Rec. X.520 | ISO/IEC 9594-6.

b) An attribute type for the second component of an ASN.1 object identifier:

```
oidC2 ATTRIBUTE ::= {
      WITH SYNTAX INTEGER
      EQUALITY MATCHING RULE integerMatch
      ID {id-oidC2}}
```

c) An attribute type for the remaining components of an ASN.1 object identifier:

```
oidC ATTRIBUTE ::= {
            WITH SYNTAX INTEGER
            EQUALITY MATCHING RULE integerMatch
            ID {id-oidC}}
```

B.7 The following definition provides an alias object class for a "country level" alias entry:

```
oidRoot OBJECT-CLASS ::= {
            SUBCLASS OF alias
            MUST CONTAIN {oidC1 | oidC2 | oidC }
            ID {id-oidRoot}}
```

B.8 The following definition provides a name form to permit "country level" entry directly subordinate to the root:

```
oidRootNf NAME-FORM ::= {
            NAMES oidRoot
            WITH ATTRIBUTES {oidC1 | oidC2 | oidC }
            ID {id-oidRootNf}}
```

B.9 The use of the attribute types is illustrated in Annex D.

B.10 The following ASN.1 module **OidDirectoryNameDef** includes all of the ASN.1 type and value definitions contained in this annex.

```
OidDirectoryNameDef {joint-iso-itu-t registration-procedures(17) module(1)
oidDirectoryNameDef(1)}

DEFINITIONS ::=

BEGIN

-- EXPORTS All --

IMPORTS

      ATTRIBUTE, MATCHING-RULE, OBJECT-CLASS, NAME-FORM, alias
            FROM InformationFramework {joint-iso-itu-t ds(5) module(1)
                        informationFramework(1) 4}

      integerMatch
            FROM SelectedAttributeTypes {joint-iso-itu-t ds(5) module(1)
                        selectedAttributeTypes(5) 6};

-- Attribute types --

oidC1 ATTRIBUTE ::= {
            WITH SYNTAX            INTEGER
            EQUALITY MATCHING RULE integerMatch
            ID                id-oidC1}

oidC2 ATTRIBUTE ::= {
            WITH SYNTAX            INTEGER
            EQUALITY MATCHING RULE integerMatch
            ID                id-oidC2}

oidC ATTRIBUTE ::= {
            WITH SYNTAX            INTEGER
            EQUALITY MATCHING RULE integerMatch
            ID                id-oidC}

-- Object class definition --

oidRoot OBJECT-CLASS ::= {
            SUBCLASS OF       {alias}
            MUST CONTAIN      {oidC1 | oidC2 | oidC}
            ID          id-oidRoot }

-- Name form --

oidRootNf NAME-FORM ::= {
            NAMES       oidRoot
            WITH ATTRIBUTES  {oidC1 | oidC2 | oidC}
            ID          id-oidRootNf }

-- Object identifier assignments --

id OBJECT IDENTIFIER ::= {joint-iso-itu-t registration-procedures(17) module(1)
directory-defs(2)}

id-oidC1 OBJECT IDENTIFIER ::=    {id 0}

id-oidC2 OBJECT IDENTIFIER ::=    {id 1}

id-oidC OBJECT IDENTIFIER ::=     {id 2}

id-oidRoot OBJECT IDENTIFIER ::=  {id 3}

id-oidRootNf OBJECT IDENTIFIER ::={id 4}

END
```

Annex C

Derivation together of object identifiers and Directory names

(This annex forms an integral part of this Recommendation | International Standard)

C.1 In accordance with the provisions of clause 7, ASN.1 object identifiers and Directory names are generated together for registration purposes by a set of registration authorities when:

a) the provisions of both Annexes A and B are met; and

b) the ASN.1 object identifier form of name is generated under the **{joint-iso-itu-t(2) country(16) *country-name*}** arc.

EXAMPLE:

RH-name (alphanumeric value)	*RDN (Distinguished Name)*
countryName = US	C = US (C = US)
stateOrProvinceName = Hawaii	SP = Hawaii (C = US,SP = Hawaii)
organizationName = Gregory'sDolphins	O = Gregory's Dolphins (C = US,SP = Hawaii, O = Gregory's Dolphins)
organizationalUnitName = Shipping Department	OU = Shipping Department (C = US,SP = Hawaii, O = Gregory's Dolphins, OU = Shipping Department)

RH-name (integer value)	*Object identifier*
joint-iso-itu-t(2)	**{joint-iso-itu-t(2)}**
country(16)	**{joint-iso-itu-t(2) country(16)}**
country-name(840)	**{joint-iso-itu-t(2) country(16) us(840)}**
state-or-province(46)	**{joint-iso-itu-t(2) country(16) us(840) hawaii(46)}**
organization(3125)	**{joint-iso-itu-t(2) country(16) us(840) hawaii(46) gregorysDolphins(3125)}**
organizational-unit(3)	**{joint-iso-itu-t(2) country(16) us(840) hawaii(46) gregorysDolphins(3125) shippingDepartment(3)}**

C.2 The existence of multiple forms of names does not imply their support by the Directory nor does it imply any requirement to map from one form of name to another.

Annex D

Object identifier based Directory names

(This annex does not form an integral part of this Recommendation | International Standard)

D.1 Transformation of object identifiers into Directory names

D.1.1 The transformation of an ASN.1 object identifier into a Directory name involves the creation of the Directory name as a sequence of object identifier components. All three attribute types defined in B.6 are used for the formation of an RDN for the first level of the DIT (identifying a country) from the first three components of an object identifier; subsequent RDNs are formed from single components of the object identifier taken in sequence. Thus an ASN.1 object identifier such as:

```
{iso(1) member-body(2) fr(250) type-org(1) abc(9999) marketing-department(999)}
```

would be transformed into the following Directory name:

{{oidC1=1, oidC2=2, oidC=250}, {oidC=1}, {oidC=9999}, {oidC=999}}

D.1.2 It should be noted that it is the responsibility of the user of the Directory to carry out the transformation into a Directory name of an object identifier that is to be used for Directory lookup, and for the presentation of the Directory name to a DSA via a DUA. Similarly, it is the responsibility of the user of the Directory to derive an object identifier from an object identifier component based name retrieved from the Directory. The only requirement on DSAs is that they are configured to support the attribute types for object identifier component.

D.2 The use of object-identifier-based Directory names

D.2.1 The object identifier based Directory name can be used as the distinguished name for an object. Alternatively, where an object has a conventional distinguished name as well as an object identifier (e.g., an application-process), it can be assigned both forms of Directory name through the use of Directory alias naming. This is illustrated in Figure D.1.

D.2.2 In principle, each entry below the root of the DIT may have an alias name. Such an alias name establishes an object identifier component based RDN that can be used in Directory access. Thus, Figure D.1 shows an alias name for a country entry ("FR") that is an RDN composed of three object identifier components.

D.2.3 It is thus possible to create entries for objects that have:

a) only a conventional distinguished name, e.g., *Albert Durand* in Figure D.1;

b) only an object identifier component based name form, e.g., *(application context definition)* in Figure D.1;

c) dual name forms, e.g., in Figure D.1 *organization ABC* has the distinguished name:

{C=FR, O=ABC}

with the corresponding alias name:

{{oidC1=1, oidC2=2, oidC=250}, {oidC=1},{oidC=9999}}

NOTE – The construction of distinguished names consisting of RDNs of object identifier form followed by conventional RDNs may be considered by some organizations as not retaining the user friendly nature of conventional distinguished names.

D.2.4 It should be noted that it is not necessary to generate aliases for all intermediate nodes in a path traversing the tree (e.g., see OU = XY in Figure D.1). Conversely, it is not necessary for all object entries in the alias environment to be actual alias entries (e.g., see node below OIDC = 1 in Figure D.1).

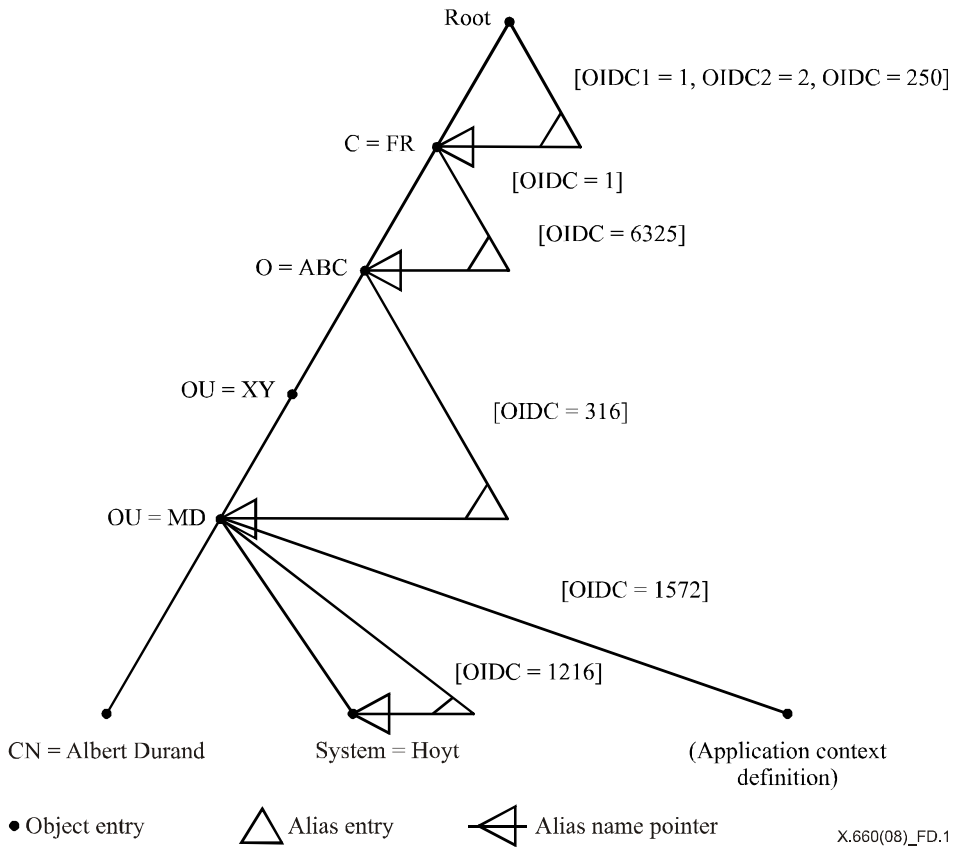

Figure D.1 – The use of alias names

Annex E

References to this Recommendation | International Standard

(This annex does not form an integral part of this Recommendation | International Standard)

E.1 Where a Recommendation | International Standard defines types of objects for which unambiguous identification of instances of the type are required, then it establishes a requirement for registration.

E.2 The writers of the Recommendation | International Standard determine, for each such name, the appropriate forms of registration. There are four main options which arise:

a) registration in the Recommendation | International Standard which defines the type of object;

b) registration in Recommendations | International Standards referencing the Recommendation | International Standard which defines the type of object;

c) registration by any International Registration Authority;

d) registration by any organization which requires to act as a registration authority.

E.3 Registration in the Recommendation | International Standard which defines the type of object is generally only appropriate if the number of registrations is small and likely to be changed infrequently. (A current example is the definition of names for FTAM constraint-set fields which, if necessary, will be extended by amendment). If this is the only registration considered appropriate, the following text should be included in the applicable Recommendation | International Standard:

> "The names to be used in this field are specified in Annex... An International Registration Authority covering this type of object is not currently intended."

There would be no reference to ITU-T Rec. X.660 | ISO/IEC 9834-1.

E.4 Registration in Recommendations | International Standards referencing the Recommendation | International Standard which defines the type of object is appropriate if the names and corresponding definitions are closely tied to those Recommendations | International Standards. (A current example is ACSE application-context fields and presentation abstract syntax fields). If this is the only registration considered appropriate, the following text should be included in the applicable Recommendation | International Standard:

> "The names to be used in this field are specified in the Recommendations | International Standards referencing this Recommendation | International Standard. The name shall be defined in accordance with ITU-T Rec. X.660 | ISO/IEC 9834-1. An International Registration Authority covering this type of object is not currently intended."

The referencing Recommendation | International Standard will assign a name in accordance with ITU-T Rec. X.660 | ISO/IEC 9834-1, but need not reference ITU-T Rec. X.660 | ISO/IEC 9834-1.

E.5 Registration by an International Registration Authority requires the development of a new Recommendation and/or International Standard. If this is the only registration considered appropriate, the Recommendation and/or International Standard which defines the type of object should contain the text:

> "This Recommendation | International Standard requires an International Registration Authority for... The procedures governing the Authority and the form of register entries are specified in ITU-T Rec. X... | ISO/IEC..."

NOTE – In this case, the Recommendation and/or International Standard which defines types of objects will not normally receive final approval until the applicable Recommendation and/or International Standard is a consented (or determined) Recommendation and/or Draft International Standard at ballot stage, and an organization has been nominated as the registration authority.

E.6 Where registration by any organization which has a need is considered appropriate, two further criteria need to be examined. These are:

a) are there any special relationships (requiring explanation) between these names and other names?

b) is a more detailed specification (beyond that which can be inferred from the Recommendation | International Standard which defines the type of object) needed of the information which would constitute registration?

E.7 Examples where E.6 a) would be true is AE-title, AP-title, etc. in ACSE. In this case, a Recommendation | International Standard in the ITU-T Rec. X.660 series | ISO/IEC 9834 multipart standard would normally be appropriate, with text in the Recommendation | International Standard which defines the type of object saying:

"ITU-T Rec. X... | ISO/IEC 9834-... specifies requirements for the assigning of names to..."

E.8 There are no current examples where E.6 b) is considered to be true, but, in such cases, the Recommendation | International Standard which defines the type of object contain text saying:

"ITU-T Rec. X... | ISO/IEC 9834-... specifies the information which is needed for registration of..."

E.9 If neither E.6 a) nor E.6 b) is true, and this is the only form of registration proposed, then the Recommendation | International Standard which defines the type of object would contain the text:

"The assignment of names for ... shall be in accordance with the general procedures and of the form specified in ITU-T Rec. X.660 | ISO/IEC 9834-1.

Organizations wishing to assign such names shall find an appropriate superior in the naming tree of ITU-T Rec. X.660 | ISO/IEC 9834-1 and request that an arc be assigned to them.

NOTE – This includes ITU Member States, ISO/IEC National Bodies, organizations with international code designators (ICDs) assigned in accordance with ISO 6523, telecommunications administrations and ROAs."

A separate Recommendation | International Standard is not required.

E.10 Where more than one form of registration is considered appropriate, combinations of the above texts should be included. In particular, in cases where registration can be allowed by any organization which requires to act as a registration authority, but public international (or national) registration is nevertheless desirable, a Recommendation | International Standard should be developed which sets out the options and specifies the operation of an International Registration Authority (if it is established). In this last case, the Recommendation and/or International Standard which defines the type of object should contain the text saying:

"ITU-T Rec. X.... | ISO/IEC 9834-... specifies registration of..."

Annex F

The IETF "oid" URI/IRI scheme

(This annex does not form an integral part of this Recommendation | International Standard)

F.1 General

F.1.1 The International Object Identifier tree provides a hierarchically based identification scheme for objects/resources, using almost all Unicode/ISO/IEC 10646 characters. The first identifier in the sequence can be the name of any standards body or any other organization that requests an unambiguous identification of that organization, with subsequent identifications in the hierarchy being allocated by that organization. The OID tree has been in existence since about 1984 in a numerical form, but the ability to have arcs identified by Unicode labels to identify arcs of the International Object Identifier tree was only standardized in 2008.

F.1.2 A repository of current allocations of OIDs is available at http://www.oid-info.com.

NOTE – This repository is not exhaustive, but it contains close on 100'000 OIDs at the time of publication of this Recommendation | International Standard.

F.1.3 The International Object Identifier tree is the basis for a URI/IRI scheme (see IETF RFC 3987), registered with IANA[1)] (see F.2). This form of URI/IRI commences with "**oid:/**" and is followed by a series of Unicode labels separated by the **SOLIDUS** character, identifying a node in the hierarchical International Object Identifier tree.

NOTE – The **SOLIDUS** character is not permitted in Unicode labels.

F.1.4 An IRI can contain most of the Unicode characters, and, in particular, can contain all the characters allowed in a Unicode label (see 7.2.4 and 7.2.5). A URI is restricted to the ASCII character set, but IETF RFC 3987, clause 3.1, specifies the conversion of the characters allowed in an IRI into the characters allowed in a URI, enabling both an IRI and a URI to carry the same semantics for the identification. This mapping is an integral part of the "oid" URI/IRI scheme. This enables names based on the Unicode labels in the OID tree to be used wherever an IRI or a URI is required.

NOTE – The mapping is based on the use of the **PERCENT SIGN** character (which is not permitted in Unicode labels), followed by the hexadecimal value of the Unicode character that is present in the IRI and is to be included in the URI.

F.1.5 The syntax of an "oid" IRI is specified in F.3 (using ASN.1 BNF) and F.4 (using IETF RFC 4234 [2] ABNF).

F.1.6 The semantics of an "oid" IRI is specified in F.5, based on the International Object Identifier tree.

F.2 Information provided to IANA for registration of the "oid" scheme name

NOTE – This information is provided in accordance with the requirements for the registration of a permanent URI/IRI scheme, as specified in IETF RFC 4395 [1].

F.2.1 Declared registrant of the namespace

```
J. Larmouth
Rapporteur, ITU-T SG17 ASN.1 & OID
Convenor, ISO/IEC JTC1/SC6 WG9
International Telecommunication Union (ITU)
Telecommunication Standardization Bureau
Place des Nations
CH-1211 Geneva 20
Switzerland

E-mail: tsbmail@itu.int
```

F.2.2 URI scheme name

oid

F.2.3 Status

permanent

F.2.4 URI/IRI scheme syntax

See F.4

---

1) Registration pending.

F.2.5 URI/IRI scheme semantics

See F.5

F.2.6 Encoding considerations

The internationalized resource identifier is specified as an abstract sequence of Unicode/ISO/IEC 10646 characters. The encoding of those characters depends on the specification of the protocol in which they are carried, but will normally be UTF8.

F.2.7 Applications/protocols that use this scheme

F.2.7.1 Any specification (including ASN.1 modules and XSD specifications) requiring an IRI or URI to identify that specification.

F.2.7.2 Any protocol defined using the ASN.1 OID-IRI or RELATIVE-OID-IRI types.

F.2.7.3 Any protocol or identification scheme (such as RFID applications) that requires a resource identification based on the International Object Identifier tree.

F.2.8 Interoperability considerations

Matching rules are based on exact equality of the sequence of abstract Unicode characters forming the IRI. There are no other known interoperability issues.

F.2.9 Security considerations

F.2.9.1 URI/IRIs using the "oid" scheme provide worldwide unambiguous hierarchical identification of a resource from a variety of top-level arcs that can encompass use by any organization. The identification of that resource is not necessarily unique within the scheme.

F.2.9.2 The matching rules are based on exact equality of the sequence of Unicode characters forming the IRI.

F.3 Syntax of IRIs in the "oid" IRI scheme, specified using ASN.1 BNF

F.3.1 This subclause uses the ASN.1 BNF notation specified in ITU-T Rec. X.680 | ISO/IEC 8824-1, clause 5 and the lexical items "integerUnicodeLabel" and "non-integerUnicodeLabel" specified in ITU-T Rec. X.680 | ISO/IEC 8824-1, clause 12. It also uses the lexical item:

Name of lexical item – "**`oid-iri-prefix`**"

This lexical item shall consist of the sequence of characters:

`oid:/`

NOTE – This sequence does not contain white-space.

F.3.2 An IRI is composed of a sequence of abstract Unicode characters that are the contents of the lexical items in the production "oidIRI" with no white-space between the lexical items.

F.3.3 The "oidIRI" production is:

```
oidIRI ::=
    oid-iri-prefix
    FirstArcIdentifier
    SubsequentArcIdentifier

FirstArcIdentifier ::=
    ArcIdentifier

SubsequentArcIdentifier ::=
        "/" ArcIdentifier
    |   empty

ArcIdentifier ::=
        integerUnicodeLabel
    |   non-integerUnicodeLabel
```

F.3.4 The "FirstArcIdentifier" identifies an arc (possibly a long arc) from the root of the International Object Identifier tree.

F.3.5 Each "SubsequentArcIdentifier" identifies an arc from the preceding "ArcIdentifier".

EXAMPLE

With identifiers assigned as specified in ITU-T Rec. X.660 | ISO/IEC 9834-1 and ISO/IEC 19785 [5], the TLV-encoded CBEFF Patron Format would have an IRI/URI of:

```
"oid:/ISO/Registration_Authority/19785.CBEFF/Patron-formats/TLV-encoded"
```

F.4 Syntax of IRIs in the "oid" URI/IRI scheme using ABNF

F.4.1 This subclause uses the ABNF notation commonly used in IETF RFCs (see IETF RFC 4234 [2]). This is not quite the same as the BNF notation normally used in ASN.1 specifications (see ITU-T Rec. X.680 | ISO/IEC 8824-1, clause 5).

F.4.2 An IRI in the "oid" scheme is syntactically the ABNF (see IETF RFC 4234 [2]) construct "oidiri" defined as follows (with the semantics specified in F.5), and with no white-space between lexical items:

```
oidiri = "oid:/"  firstarcid  subsequentarcid

firstarcid = unicodelabel

subsequentarcid = "/" unicodelabel [susequentarcid]

unicodelabel = iunreserved
```

where "iunreserved" is defined in IETF RFC 3987, clause 2.2.

F.4.3 When used as a URI, then the transformations specified in IETF RFC 3987, clause 3.1, are applied.

F.5 Semantics of IRIs in the "oid" IRI scheme

F.5.1 The "FirstArcIdentifier" ("firstarcid" for ABNF) is required to be a Unicode label assigned to one of the arcs from the root of the International OID tree specified in ITU-T Rec. X.660 | ISO/IEC 9834-1 (including long arcs) that identifies a node in the OID tree (see ITU-T Rec. X.660 | ISO/IEC 9834-1).

F.5.2 The next "SubsequentArcIdentifier" (the "unicodelabel" in the "subsequentarcid" for ABNF) is required to be a Unicode label that identifies an arc from that node, and hence a lower level node.

F.5.3 This repeats until the final Unicode label identifies an arc, and hence a node of the OID tree, that is the referenced resource.

NOTE – The last identified node is not necessarily a leaf of the tree, but is the identified resource.

Bibliography

[1] IETF RFC 4395, T. Hansen, T. Hardie and L. Masinter, *Guidelines and Registration Procedures for New URI Schemes*, February 2006.

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[4] The Unicode Standard, Version 3.2.0:2002, *The Unicode Consortium*, Reading, MA, Addison-Wesley.

[5] ISO/IEC 19785-3:2007, *Information technology, Common Biometric Exchange Formats Frameworks – Part 3: Patron format specifications*.

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