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Partie 1: Système de résolution d'identificateur d'objet

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This document was prepared by ITU-T as ITU-T X.672 and drafted in accordance with its editorial rules, in collaboration with Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 6, *Telecommunications and information exchange between systems.*

This second edition cancels and replaces the first edition (ISO/IEC 29168-1:2011), which has been technically revised.

A list of all parts in the ISO/IEC 29168 series can be found on the ISO and IEC websites.

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INTERNATIONAL STANDARD ISO/IEC 29168-1
RECOMMENDATION ITU-T X.672

Information technology – Open systems interconnection – Object identifier resolution system

Summary

Recommendation ITU-T X.672 | International Standard ISO/IEC 29168-1 specifies the object identifier (OID) resolution system (ORS). This enables (arbitrary) information to be associated with any ORS-supported OID node (of the international OID tree defined in Rec. ITU-T X.660 | ISO/IEC 9834-1). This associated information is identified by an application specification that may have a requirement for instances of that application (running on any computer system) to obtain the associated information by an ORS search, using an Abstract Syntax Notation One (ASN.1) OID-internationalized resource identifier value to identify the node.

Currently defined application information for a node includes the canonical form of an international OID, child node information, registration information about the owner of the node, a reference to an ASN.1 module identified by the node, information supporting tag-based applications and information supporting cybersecurity.

History

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Object identifier resolution system, object identifier, OID, ORS.

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FOREWORD

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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.

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Introduction

This Recommendation | International Standard specifies the object identifier (OID) resolution system (ORS). This provides the return (using an ORS client) of information associated with an OID node.

It uses a mapping of the International OID tree naming scheme (using OID-internationalized resource identifier (OID-IRI) values) on to the domain name system (DNS) naming scheme (see 7.3).

This Recommendation | International Standard specifies requirements for the management of DNS zone files that are mapped from ORS-supported OID nodes to provide (standardized) information related to an international OID tree node for a variety of applications, and on the behaviour of an ORS client that interacts with the DNS system to obtain that information and provide it to an application.

Six requirements emerged in the mid/late-2000s:

- an application to be able to translate any OID-IRI value into a canonical OID-IRI (a unique string of numeric Unicode labels that would identify a node): the canonical OID (COID) ORS service, supporting IRI comparison of names in the IETF "oid" IRI scheme (see Annex B);
- an application to determine child information (CINF) from an OID node: the CINF service (see Annex C);
- an application to obtain registration information (such as contact information about the owner of the OID node and how to request a child node; RINF): the RINF service (see Annex D);
- an application to obtain a reference to the Abstract Syntax Notation One (ASN.1) module (if any) associated with a node: the module information (MINF) service (see Annex E);
- support for access to multimedia information (triggered by tag-based identification) using the ORS;
- support for access to information contained in an OID node that relates to cybersecurity features.

Three requirements emerged in 2019-2020:

- enhancement of the local performance of OID resolution to reduce the response time;
- high availability of the ORS;
- resolution of ORS-supported OID nodes for which not all superior OID nodes are ORS supported.

There are probably other applications that will require further information (specified by an application standard) contained in an ORS-supported OID node and accessible by the ORS.

To meet these needs, it was decided to map the OID tree into a part of the DNS tree (see IETF RFC 1035), with the root of the international OID tree mapped into .oid-res.org (see 7.3).

The mapping is from any OID-IRI value that identifies an international OID node into a DNS name (in the ORS domain). The information about an ORS-supported OID node is inserted into DNS zone files and can then be retrieved by any ORS client (running on any computer system with DNS access), using any of the OID-IRI identifications for that international OID tree node.

The associated information is specified by those applications that choose to use the ORS. The requirements on such applications are included in this Recommendation | International Standard. Some application specifications are included as normative annexes to this Recommendation | International Standard. Others are specified externally.

All DNS zone files for the ORS domain correspond to ORS-supported OID nodes, but not all DNS names algorithmically mapped from an OID-IRI are present in the DNS. All DNS zone files in the ORS domain are required to conform to this Recommendation | International Standard.

Information for an international OID tree node (for each application) is specified by the owner of that node, and determines the appropriate configuration of DNS zone files, in accordance with the specification for each ORS service (see Annex A), and would be retrieved by an application using a local ORS client implementation interacting with a local DNS client (see clause 7). The information would be included in naming authority pointer (NAPTR) resource records, qualified by the ORS service type.

An ORS client takes as input any OID-IRI value, together with an ORS service type. It will return node information for that OID-IRI value and ORS service type (based on the configuration of the DNS zone files, and particularly of NAPTR resource records). Each resource record will consist of one or more pieces of information together with the requested ORS service type.

The procedures for the appointment of the ORS operational agency are contained in ISO/IEC 29168-2. These procedures involve only ISO/IEC for appointment and contractual purposes. They do not have any ITU-T involvement.

Clause 5 provides an overview of the ORS architecture and its interaction with the DNS.

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Clause 6 specifies the requirements and restrictions on DNS zone files in the ORS domain in order to support navigation to DNS names mapped from the international OID tree (including the use of long arcs) and the provision of information needed for the ORS resolution process using any specified ORS service type.

NOTE – This Specification relates only to the use of delegation name (DNAME) DNS resource records and NAPTR resource records using a service field commencing "ORS+". Use of other DNS resource records lie outside the scope of this Recommendation | International Standard, and are neither forbidden (except when they would conflict with the use for the ORS) nor are they required.

Clause 7 specifies the operation of an ORS client, including the mapping of an OID-IRI value into a DNS name.

Clause 8 specifies the requirements for an ORS application specification, including specification of NAPTR information and recommendations on ORS application processing.

Security considerations are discussed and specified in 5.2.3 to 5.2.6, 6.4, 7.5 and 8.2.2.

Annex A (normative) specifies the assigned ORS service types at the time of publication of this Recommendation | International Standard.

Annex B (normative) specifies the COID service.

Annex C (normative) specifies the requirements for the CINF service.

Annex D (normative) specifies the requirements for the RINF service.

Annex E (normative) specifies the requirements for the MINF service.

Annex F (informative) provides a description of the use cases for the ORS, referencing each application that has a specified ORS service type (see Annex A).

Annex G (informative) provides examples of possible DNS zone files to support the ORS and additional examples of NAPTR resource records.

Annex H (informative) provides implementation guidance for a local cache and copies of ORS zones.

Annex I (informative) provides operational guidance for ORS operators.

Annex J (informative) explains the changes introduced in this edition of this Recommendation | International Standard.

Annex K (informative) provides a short history of the development of the international OID tree.

Annex L (informative) provides bibliographic references.

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INTERNATIONAL STANDARD
ITU-T RECOMMENDATION

Information technology – Open systems interconnection – Object identifier resolution system

1 Scope

This Recommendation | International Standard specifies the object identifier (OID) resolution system (ORS), including the overall architecture and a resolution mechanism based on the domain name system (DNS).

This Recommendation | International Standard specifies the means for inserting any application-defined information associated with an OID node into the DNS (see clause 6) and the means of retrieval of that information using the ORS (see clause 7).

This Recommendation | International Standard does not restrict the number of applications it can support.

This Recommendation | International Standard specifies the required operation of an ORS client (see clause 7), including the mapping of an OID-IRI value by the ORS client into a DNS name to produce a DNS query for the specified application information and the processing of any returned information. The ORS has no role in the allocation or registration of OID nodes.

The required behaviour of an ORS client is specified, but the interfaces to it are specified only in terms of the semantics of the interaction. A bit-level application program interface is platform and software dependent, and lies outside the scope of this Recommendation | International Standard.

A special behaviour of an ORS client is specified to cache OID information in order to reduce the response time of OID resolution. This Recommendation | International Standard also specifies a mechanism to resolve an OID node when one of its superior OID nodes is not ORS supported.

This Recommendation | International Standard does not include a tutorial or complete specification on the management of DNS zone files (for that, see IETF RFC 1035 and IETF RFC 3403); it specifies (only) the DNS resource records (see 6.3) that need to be inserted in the zone files in order to support ORS access to the information associated with an OID node.

This Recommendation | International Standard specifies required DNS zone file resource records, and prohibits the use of other resource records of a similar form but with different semantics (in DNS zone files in the ORS domain) – see 6.2. It does not otherwise restrict the general use of DNS zone files.

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

– Recommendations ITU-T X.660 (2011) | ISO/IEC 9834-1:2012, *Information technology – Procedures for the operation of object identifier registration authorities: General procedures and top arcs of the international object identifier tree*.

– Recommendation ITU-T X.693 (2021) | ISO/IEC 8825-4:2021, *Information technology – ASN.1 encoding rules: XML Encoding Rules (XER)*.

2.2 Additional references

– Recommendation ITU-T X.675 (2015), *OID-based resolution framework for heterogeneous identifiers and locators*.

– IETF RFC 1034 (1987), *Domain names – Concepts and facilities*.

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- IETF RFC 1035 (1987), *Domain names – Implementation and specification*.
- IETF RFC 3403 (2002), *Dynamic delegation discovery system (DDDS) – Part Three: The domain name system (DNS) database*.
- IETF RFC 3490 (2003), *Internationalizing domain names in applications (IDNA)*.
- IETF RFC 3492 (2003), *Punycode: A bootstring encoding of Unicode for internationalized domain names in applications (IDNA)*.
- IETF RFC 4033 (2005), *DNS security introduction and requirements*.
- IETF RFC 5155 (2008), *DNS security (DNSSEC) hashed authenticated denial of existence*.

NOTE – It is recommended that the IETF RFC index be consulted for updates to its entries listed in this clause.

- IETF RFC 7564 (2015), *PRECIS framework: Preparation, enforcement, and comparison of internationalized strings in application protocols*.
- Unicode Consortium (2021). *Unicode standard*, Version 14.0.0. Mountain View, CA: Unicode Consortium. Available [viewed 2022-07-27] at: https://www.unicode.org/versions/Unicode14.0.0/UnicodeStandard-14.0.pdf.

3 Definitions

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

3.1 Imported definitions

This Recommendation | International Standard uses the following terms defined in Rec. ITU-T X.660 | ISO/IEC 9834-1:

a) object identifier;
b) integer-valued Unicode label;
c) international object identifier tree;
d) long arc;
e) OID-internationalized resource identifier;
f) Registration Authority;
g) Unicode label.

3.2 Additional definitions

3.2.1 application-specific OID resolution process: Actions by an application to retrieve application-specific information from the information returned by the general OID resolution process.

3.2.2 AXFR: DNS zone transfer protocol.

NOTE – See IETF RFC 5936.

3.2.3 canonical form (of an OID-IRI): A form which uses only integer-valued Unicode labels.

NOTE – An OID-IRI is an ASN.1 type defined in Rec. ITU-T X.680 | ISO/IEC 8824-1. The term OID-IRI value refers to the ASN.1 value notation that is the same as the Internet Assigned Numbers Authority (IANA) "oid:" internationalized resource identifier/uniform resource identifier (IRI/URI) scheme, with the omission of the initial "oid:".

3.2.4 delegation name (DNAME): A DNS resource record used to create an alias for a domain name and all of its subdomains.

3.2.5 DNS delegation: The process to create a separate zone in the DNS name space beneath the top name of a given domain.

NOTE 1 – See IETF RFC 7719.

NOTE 2 - Delegation happens when a name server RRset is added in the parent zone for the child origin, which is the domain name that appears at the top of the child zone.

3.2.6 DNS-mapped name: The result of transforming an OID-IRI value to an FQDN.

NOTE 1 – See 7.3.

NOTE 2 – The DNS-mapped name may not exist in the DNS. If it does not, then an ORS query will result in an error message (see 7.4) and the node identified by the OID-IRI is not ORS supported.

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3.2.7 DNS name server (NS): A DNS resource record providing the authoritative name server for a domain.

3.2.8 DNS resource record: A component of a DNS zone file.

3.2.9 DNS zone file: A text file that describes a portion of the DNS.

NOTE – The format of a DNS zone file is specified in section 5 of IETF RFC 1035 and section 3.6.1 of IETF RFC 1034.

3.2.10 fully qualified domain name: The name used in a DNS look-up operation.

NOTE – See IETF RFC 1594.

3.2.11 general OID resolution process: That part of the ORS where an ORS client obtains information from the DNS (recorded in a zone file) about any specified OID and returns it to an application.

3.2.12 local cache: A DNS cache server which synchronizes and hosts an ORS zone locally, based on a local configuration.

3.2.13 local resolution: ORS resolution using a local cache.

3.2.14 NAPTR resource record: A DNS resource record used to store rules which can be retrieved by a DNS look-up for use by an application.

3.2.15 OID resolution process: Process which provides information associated with an OID.

NOTE – This information can be application-specific (see Figure 1 and the annexes).

3.2.16 OID resolution system: Implementation of the OID resolution process in accordance with this Recommendation | International Standard.

3.2.17 operational agency procedure: The specification of an action required by the .oid-res.org operational agency.

3.2.18 ORS client: Entity that interfaces between an application and a DNS client.

3.2.19 ORS domain: The .oid-res.org domain.

3.2.20 ORS root: OID resolution system hosted at the ORS domain.

3.2.21 ORS root operational agency: Organization that manages the DNS server for the ORS root and some subordinate nodes.

3.2.22 ORS service: A character string (used in NAPTR resource records) that identifies an ORS service.

NOTE – see Annex A.

3.2.23 ORS-supported OID node: An OID node for which the DNS-mapped names for all of the OID-IRI values that identify the OID node exist in the DNS, and have all necessary DNS zone files configured as specified in this Recommendation | International Standard, including mandatory requirements for all ORS services.

NOTE 1 – See Annex A.

NOTE 2 – The canonical OID service specified in Annex B requires the presence of a NAPTR record in the associated DNS zone file.

NOTE 3 – The ORS root operational agency is required by the operational procedures to provide ORS support for all the OID nodes listed in those procedures. ORS support for nodes beneath these depends on agreements between that OID node and its parent or one of its superior OID nodes, which is able to set up a delegation for that OID node.

3.2.24 ORS zone: Part of a DNS zone containing authoritative information about one or more OID nodes.

NOTE 1 – For DNS zone, see section 2.4 of IETF RFC 1034.

3.2.25 parent OID node: The OID node that is immediately above an OID node towards the root of the international object identifier tree.

3.2.26 resource record set (RRset): A set of resource records with the same label, class and type, but with different data.

NOTE 1 – See IETF RFC 7719.

3.2.27 secondary server (slave): An authoritative server which uses zone transfer to retrieve the zone.

NOTE – See section 2.1 of IETF RFC 1996.

3.2.28 superior OID node: Any OID node that is above an OID node (including its parent OID) towards the root of the international object identifier tree.

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