INTERNATIONAL STANDARD

ISO/IEC 9594-1

Second edition
1995-09-15

Information technology — Open Systems Interconnection — The Directory: Overview of concepts, models and services

Technologies de l'information — Interconnexion de systèmes ouverts (OSI) — L'Annuaire: Présentation générale des concepts, modèles et service

Reference number
ISO/IEC 9594-1:1995(E)

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Foreword

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

In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.

International Standard ISO/IEC 9594-1 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 21, *Open systems interconnection, data management and open distributed processing,* in collaboration with ITU-T. The identical text is published as ITU-T Recommendation X.500.

Implementors should note that a defect resolution process exists and that corrections may be applied to this part of ISO/IEC 9594 in the form of technical corrigenda. A list of approved technical corrigenda for this part of ISO/IEC 9594 can be obtained from the subcommittee secretariat. Published technical corrigenda are available from your national standards organization.

This second edition technically revises and enhances ISO/IEC 9594-1:1990. Implementations may still claim conformance to the first edition of this part of ISO/IEC 9594. However, at some point, the first edition will no longer be supported (i.e. reported defects will no longer be resolved). It is recommended that implementations conform to this second edition as soon as possible.

ISO/IEC 9594 consists of the following parts, under the general title *Information technology — Open Systems Interconnection — The Directory*:

— *Part 1: Overview of concepts, models and services*

— *Part 2: Models*

— *Part 3: Abstract service definition*

— *Part 4: Procedures for distributed operation*

— *Part 5: Protocol specifications*

— *Part 6: Selected attribute types*

— *Part 7: Selected object classes*

— *Part 8: Authentication framework*

— *Part 9: Replication*

Annex A forms an integral part of this part of ISO/IEC 9594. Annex B is for information only.

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Introduction

This Recommendation | International Standard together with other Recommendations | International Standards, has been produced to facilitate the interconnection of information processing systems to provide directory services. A set of such systems, together with the directory information which they hold, can be viewed as an integrated whole, called the *Directory*. The information held by the Directory, collectively known as the Directory Information Base (DIB), is typically used to facilitate communication between, with or about objects such as application entities, people, terminals and distribution lists.

The Directory plays a significant role in Open Systems Interconnection, whose aim is to allow, with a minimum of technical agreement outside of the interconnection standards themselves, the interconnection of information processing systems:

- from different manufacturers;
- under different managements;
- of different levels of complexity; and
- of different ages.

This Recommendation | International Standard introduces and models the concepts of the Directory and of the DIB and overviews the services and capabilities which they provide. Other Recommendations | International Standards make use of these models in defining the abstract service provided by the Directory, and in specifying the protocols through which this service can be obtained or propagated.

This second edition technically revises and enhances, but does not replace, the first edition of this Recommendation | International Standard. Implementations may still claim conformance to the first edition.

This second edition specifies version 1 of the Directory service and protocols. The first edition also specifies version 1. Differences between the services and between the protocols defined in the two editions are accommodated using the rules of extensibility defined in this edition of X.519 | ISO/IEC 9594-5.

Annex A, which is an integral part of this Recommendation | International Standard, describes the types of use to which the Directory can be applied.

Annex B, which is not an integral part of this Recommendation | International Standard, lists the amendments and defect reports that have been incorporated to form this edition of this Recommendation | International Standard.

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ITU-T RECOMMENDATION

INFORMATION TECHNOLOGY – OPEN SYSTEMS INTERCONNECTION – THE DIRECTORY: OVERVIEW OF CONCEPTS, MODELS, AND SERVICES

1 Scope

The Directory provides the directory capabilities required by OSI applications, OSI management processes, other OSI layer entities, and telecommunications services. Among the capabilities which it provides are those of "user-friendly naming", whereby objects can be referred to by names which are suitable for citing by human users (though not all objects need have user-friendly names); and "name-to-address mapping" which allows the binding between objects and their locations to be dynamic. The latter capability allows OSI networks, for example, to be "self-configuring" in the sense that addition, removal and the changes of object location do not affect OSI network operation.

The Directory is not intended to be a general-purpose database system, although it may be built on such systems. It is assumed, for instance, that, as is typical with communications directories, there is a considerably higher frequency of "queries" than of updates. The rate of updates is expected to be governed by the dynamics of people and organizations, rather than, for example, the dynamics of networks. There is also no need for instantaneous global commitment of updates; transient conditions where both old and new versions of the same information are available, are quite acceptable.

It is a characteristic of the Directory that, except as a consequence of differing access rights or unpropagated updates, the results of directory queries will not be dependent on the identity or location of the inquirer. This characteristic renders the Directory unsuitable for some telecommunications applications, for example some types of routing.

2 Normative references

The following Recommendations and International Standards contain provisions which, through reference in this text, constitute provisions of this Recommendation | International Standard part. 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 editions 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.501 (1993) | ISO/IEC 9594-2:1995, *Information technology – Open Systems Interconnection – The Directory: Models.*
- ITU-T Recommendation X.511 (1993) | ISO/IEC 9594-3:1995, *Information technology – Open Systems Interconnection – The Directory: Abstract service definition.*
- ITU-T Recommendation X.518 (1993) | ISO/IEC 9594-4:1995, *Information technology – Open Systems Interconnection – The Directory: Procedures for distributed operation.*
- ITU-T Recommendation X.519 (1993) | ISO/IEC 9594-5:1995, *Information technology – Open Systems Interconnection – The Directory: Protocol specifications.*
- ITU-T Recommendation X.520 (1993) | ISO/IEC 9594-6:1995, *Information technology – Open Systems Interconnection – The Directory: Selected attribute types.*
- ITU-T Recommendation X.521 (1993) | ISO/IEC 9594-7:1995, *Information technology – Open Systems Interconnection – The Directory: Selected object classes.*
- ITU-T Recommendation X.509 (1993) | ISO/IEC 9594-8:1995, *Information technology – Open Systems Interconnection – The Directory: Authentication framework.*

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- ITU-T Recommendation X.525 (1993) | ISO/IEC 9594-9:1995, *Information technology – Open Systems Interconnection – The Directory: Replication*
- ITU-T Recommendation X.880 (1994) | ISO/IEC 13712-1:...[1], *Information technology – Remote Operations: Concepts, Model and Notation*

2.2 Paired Recommendations | International Standards equivalent in technical content

- CCITT Recommendation X.200 (1988) *Reference Model of Open Systems Interconnection for CCITT Applications.*

  ISO 7498:1984, *Information Processing Systems – Open Systems Interconnection – Basic Reference Model.*

3 Definitions

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

3.1 OSI Reference Model definitions

The following terms are defined in Rec. X.200 and ISO 7498:

a) *application-entity;*

b) *Application Layer;*

c) *application-process;*

d) *application protocol data unit;*

f) *application service element;*

e) *Network Service Access Point.*

3.2 Directory model definitions

The following terms are defined in Rec. X.501 | ISO/IEC 9594-2:

a) *access control;*

b) *Administration Directory Management Domain;*

c) *alias;*

d) *attribute;*

e) *attribute type;*

f) *attribute value;*

g) *authentication;*

h) *Directory Information Tree (DIT);*

i) *Directory Management Domain (DMD);*

j) *Directory System Agent (DSA);*

k) *Directory User Agent (DUA);*

l) *distinguished name;*

m) *entry;*

n) *name;*

o) *object (of interest);*

p) *Private Directory Management Domain;*

q) *relative distinguished name;*

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r) *root;*

s) *schema;*

t) *security policy;*

u) *subordinate object;*

v) *superior entry;*

w) *superior object;*

x) *tree.*

3.3 Distributed Operation definitions

The following terms are defined in ITU-T Rec. X.518 | ISO/IEC 9594-4:

a) *uni-chaining;*

b) *multi-chaining;*

c) *referral.*

3.4 Replication definitions

The following terms are defined in ITU-T Rec. X.525 | ISO/IEC 9594-9:

a) *caching;*

b) *cache copy;*

c) *entry copy;*

d) *master DSA;*

e) *replication;*

f) *shadow consumer;*

g) *shadow supplier;*

h) *shadowed information;*

i) *shadowing agreement.*

3.5 Basic directory definitions

The following terms are defined in this Recommendation | International Standard:

3.5.1 **the Directory**: A collection of open systems cooperating to provide directory services.

3.5.2 **directory information base (DIB)**: The set of information managed by the Directory.

3.5.3 **(directory) user**: The end user of the Directory, i.e. the entity or person which accesses the Directory.

4 Abbreviations

ACI Access Control Information

ADDMD Administration Directory Management Domain

DAP Directory Access Protocol

DIB Directory Information Base

DISP Directory Information Shadowing Protocol

DIT Directory Information Tree

DMD Directory Management Domain

DOP Directory Operational Binding Management Protocol

DSA Directory System Agent

DSP Directory System Protocol

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DUA	Directory User Agent
NSAP	Network Service Access Point
OSI	Open Systems Interconnection
PRDMD	Private Directory Management Domain
RDN	Relative Distinguished Name

5 Conventions

With minor exceptions this Directory Specification has been prepared according to the "Presentation of ITU-T/ISO/IEC common text" guidelines in the Guide for ITU-T and ISO/IEC JTC 1 Cooperation.

The term "Directory Specification" (as in "this Directory Specification") shall be taken to mean ITU-T Rec. X.500 | ISO/IEC 9594-1. The term "Directory Specifications" shall be taken to mean the X.500-Series Recommendations and all parts of ISO/IEC 9594.

This Directory Specification uses the term "1988 edition systems" to refer to systems conforming to the previous (1988) edition of the Directory Specifications, i.e. the 1988 edition of the CCITT X.500-Series Recommendations and the ISO/IEC 9594:1990 edition. Systems conforming to the current Directory Specifications are referred to as "1993 edition systems".

6 Overview of the Directory

The *Directory* is a collection of open systems which cooperate to hold a logical database of information about a set of objects in the real world. The *users* of the Directory, including people and computer programs, can read or modify the information, or parts of it, subject to having permission to do so. Each user is represented in accessing the Directory by a Directory User Agent (DUA), which is considered to be an application-process. These concepts are illustrated in Figure 1.

NOTE – The Directory Specifications refer to the Directory in the singular, and reflects the intention to create, through a single, unified, name space, one logical directory composed of many systems and serving many applications. Whether or not these systems choose to interwork will depend on the needs of the applications they support. Applications dealing with non-intersecting worlds of objects may have no such need. The single name space facilitates later interworking should the needs change.

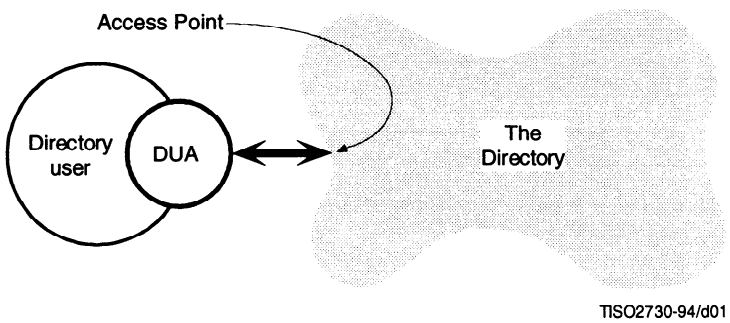

Figure 1 – Access to the Directory

The information held in the Directory is collectively known as the *Directory Information Base* (DIB). Clause 7 overviews its structure.

The Directory provides a well-defined set of access capabilities, known as the abstract service of the Directory, to its users. This service, which is overviewed in clause 8 provides a simple modification and retrieval capability. This can be built on with local DUA functions to provide the capabilities required by the end-users.

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It is likely that the Directory will be distributed, perhaps widely distributed, both along functional and organizational lines. Clause 9 overviews the corresponding models of the Directory. These have been developed in order to provide a framework for the cooperation of the various components to provide an integrated whole.

The Directory exists in an environment where various administrative authorities control access to their portion of the information. Access control is overviewed in clause 10.

When the Directory is distributed, it may be desirable to replicate information to improve performance and availability. The Directory replication mechanism is overviewed in clause 11.

The provision and consumption of the directory services requires that the users (actually the DUAs) and the various functional components of the Directory should cooperate with one another. In many cases this will require cooperation between application processes in different open systems, which in turn requires standardized application protocols, overviewed in clause 11, to govern this cooperation.

The Directory has been designed so as to support multiple applications, drawn from a wide range of possibilities. The nature of the applications supported will govern which objects are listed in the Directory, which users will access the information, and which kinds of access they will carry out. Applications may be very specific, such as the provision of distribution lists for electronic mail, or generic, such as the 'inter-personal communications directory' application. The Directory provides the opportunity to exploit commonness among the applications:

- A single object may be relevant to more than one application: perhaps even the same piece of information about the same object may be so relevant.

- To support this, a number of object classes and attribute types are defined, which will be useful across a range of applications. These definitions are contained in ITU-T Rec. X.520 | ISO/IEC 9594-6 and ITU-T Rec. X.521 | ISO/IEC 9594-7.

- Certain patterns of use of the Directory will be common across a range of applications: this area is overviewed further in Annex A.

7 The Directory Information Base (DIB)

NOTE – The DIB, and its structure, are defined in ITU-T Rec. X.501 | ISO/IEC 9594-2.

The DIB is made up of information about objects. It is composed of (*directory*) *entries*, each of which consists of a collection of information on one object. Each entry is made up of *attributes*, each with a type and one or more values. The types of attribute which are present in a particular entry are dependent on the *class* of object which the entry describes.

The entries of the DIB are arranged in the form of a tree, the Directory Information Tree (DIT) where the vertices represent the entries. Entries higher in the tree (nearer the root) will often represent objects such as countries or organizations, while entries lower in the tree will represent people or application processes.

NOTE – The services defined in the Directory Specifications operate only on a tree-structured DIT. The Directory Specifications do not preclude the existence in the future of other structures (as the need arises).

Every entry has a distinguished name, which uniquely and unambiguously identifies the entry. These properties of the distinguished name are derived from the tree structure of the information. The distinguished name of an entry is made up of the distinguished name of its superior entry, together with specially nominated attribute values (the distinguished values) from the entry.

Some of the entries at the leaves of the tree are *alias* entries, while all other entries are object entries. Alias entries point to object entries, and provide the basis for alternative names for the corresponding objects.

The Directory enforces a set of rules to ensure that the DIB remains well-formed in the face of modifications over time. These rules, known as the *Directory schema*, prevent entries having the wrong types of attributes for its object class, attribute values being of the wrong form for the attribute type, and even entries having subordinate entries of the wrong class.

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