

Implementation of
ISO/IEC 10028:1993

**Information
technology —
Telecommunications
and information
exchange
between systems —
Definition of the
relaying functions of a
Network layer
intermediate system**

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National foreword

This British Standard reproduces verbatim ISO/IEC 10028:1993 and implements it as the UK national standard.

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- aid enquirers to understand the text;
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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, the ISO/IEC title page, pages ii to iv, pages 1 to 35 and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

**Information technology —
Telecommunications and information
exchange between systems — Definition
of the relaying functions of a Network layer
intermediate system**

*Technologies de l'information — Télécommunications et échange
d'information entre systèmes — Définition de la fonction de transmission
d'un système intermédiaire dans la couche réseau*



Reference number
ISO/IEC 10028:1993(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.

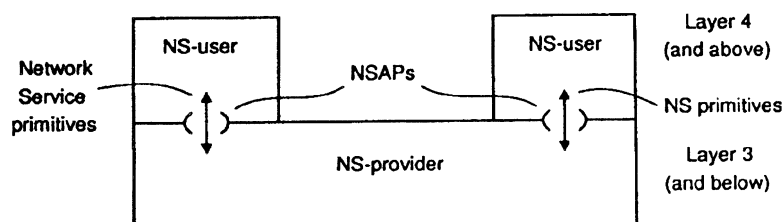
International Standard ISO/IEC 10028 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Sub-Committee SC 6, *Telecommunications and information exchange between systems*.

Annex A, Annex B and Annex C are for information only.

Introduction

This International Standard is one of the set of standards associated with the Network layer of ISO 7498's Reference Model for Open Systems Interconnection (OSI). It has been developed within the architectural framework defined for the Network layer in ISO 8648.

ISO 8348 defines the OSI Network Service (NS) in terms of the behaviour of a single NS-provider operating as a "black box" between correspondent NS-users, in accordance with ISO TR 8509, as illustrated:



ISO 8648 defines an architectural organization that applies to the internal functioning of the NS-provider within the Network layer. In particular, it provides a common set of concepts and terminology for use in Network layer standards which extends and refines those of ISO 7498.

This International Standard provides a further level of detailed refinement of the description of the NS-provider, by defining the operation of intermediate systems in support of the Network service. This definition remains abstract, in the sense that it is independent of the details of particular subnetworks and protocols.

Other standards specify the use of Network layer protocols by an intermediate system in performing the functions defined in this International Standard.

This International Standard complements those defining the Network service and specifying the use of protocols for NS provision in end systems, in order to provide a complete set of Network layer standards covering each segment of the information flow between correspondent NS users. Other standards deal with associated information flows for routing and management.

1 Scope

This International Standard defines the abstract operation of the relaying functions of a Network entity in an intermediate system, as needed to support the OSI connection-mode Network service.

As the principal means for expressing the definition, the concept of the Network Internal Layer Service is used. This is similar to an OSI layer service, but adapted to expressing the invariants of the information flow within and throughout the layer, rather than just the external functionality of the layer provided between two service access points.

The definition includes the invocation of Network routing functions as a necessary element of the Network relaying functions, but it does not specify how those routing functions are to be realized.

The definition of Network relaying functions applies both to a subnetwork supporting all elements of the Network Service (as defined in ISO 8648), and to a Network relay system interconnecting two subnetworks according to any of the three approaches defined in ISO 8648. In the case of the hop-by-hop harmonization approach to interconnection, the definition of Network relaying functions applies to the result of harmonizing the subnetwork service(s) to the level of the Network Service. The harmonization functions, which require protocol mechanisms to be specified, are outside the scope of this International Standard.

This International Standard is intended for use in guiding the design and application of real interworking units and real subnetworks (eg, local area networks and private packet switched networks) which are to support the OSI NS. It is also intended for use in the development of standards for the Network layer, to ensure that the requirements deriving from the need for Network layer relaying are taken into account.

There are no requirements for conformance to this International Standard.

NOTE Conformance requirements relating to Network layer relaying are to be found in the specifications for mappings between the Network Internal Layer Service and Network protocols.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards listed below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 7498:1984, *Information processing systems — Open Systems Interconnection — Basic Reference Model*.

NOTE See also CCITT Recommendation X.200 (1993).

CCITT Recommendation X.213:1992 | ISO/IEC 8348:1993, *Information technology — Open Systems Interconnection — Network service definition*.

ISO/TR 8509:1987, *Information processing systems — Open Systems Interconnection — Service conventions*.

ISO 8648:1987, *Information processing systems — Open Systems Interconnection — Internal organization of the Network layer*.

3 Definitions

3.1 Reference model definitions

This International Standard makes use of the following terms defined in ISO 7498:

- a) Network layer
- b) Network service
- c) Network service access point
- d) Network service access point address
- e) Network entity
- f) Network relay
- g) correspondent Network entities
- h) Network connection
- j) Network connection endpoint
- k) Network function

3.2 Network layer architecture definitions

This International Standard makes use of the following terms defined in ISO 8648:

- a) real subnetwork
- b) subnetwork
- c) interworking unit
- d) Network relay system
- e) intermediate system
- f) end system

3.3 Service conventions definitions

This International Standard makes use of the following terms defined in ISO/TR 8509:

- a) Network service-user
- b) Network service-provider
- c) primitive
- d) request (primitive)
- e) indication (primitive)
- f) response (primitive)
- g) confirm (primitive)

3.4 Network relaying definitions

For the purposes of this International Standard the following definitions also apply:

3.4.1

domain

a subset of those open systems containing Network entities, in which there is a common understanding of values for certain domain-related parameters of NILS primitives

3.4.2

domain-related parameter

a parameter of NILS primitives that does not have a set of values defined by this International Standard — whether directly, or indirectly by reference to ISO/IEC 8348 — to be applicable throughout the Network layer

3.4.3

hop

the communication path supporting the transfer of information by NILS primitives, or by NILS primitives and Network service primitives, for an instance of communication between two Network entities that are adjacent in the modelling chosen for the Network layer interconnection

4 Abbreviations and names of NILS elementary sequences

4.1 General abbreviations

CO	connection-mode
EES	extended end system
ENSDU	expedited Network service data unit
ISB	internal service bearer
N-	Network-
NC	Network connection
NHEP	Network hop endpoint
NILS	Network internal layer service
NISAP	Network internal service access point
NS	Network service
NSAP	Network service access point
NSDU	Network service data unit
OSI	open systems interconnection
QOS	quality of service

4.2 Names of NILS elementary sequences of primitives for N-connections

The following is a summary of the names defined in clause 8 for the elementary sequences of primitives that are used in defining the behaviour of a Network connection according to the Network internal layer service. Each item includes a brief description of the nature of the sequence's function, and a reference to the figure defining the sequence.

ABORT	NC request aborted (Figure 4)
DT	Normal data transfer (Figure 7)
EC	Expedited data confirmation (Figure 7)
ED	Expedited data transfer (Figure 7)
ESTAB	NC confirmed (Figure 6)
FR	Generated flow control, of received data (Figure 7)
FT	External flow control, of transmitted data (Figure 7)
RC	Receipt confirmation (Figure 7)
RELC	NC release, generated collision (Figure 9)
RELF	NC release, forwarded (Figure 9)

RELG	NC release, generated (Figure 9)
RELX	NC release, external collision (Figure 9)
REQ	NC request completed (Figure 4)
RESC	Confirmation of forwarded reset (Figure 8)
RESF	Forwarded reset (Figure 8)
RESG	Generated local reset (Figure 8)
RESX	External local reset (Figure 8)
RETRY	NC establishment retry (Figure 5)
RJ1	NC request rejected (Figure 4)
SD	NC status discarded (Figure 5)
SF	NC status forwarded (Figure 5)
SG	NC status generated (Figure 5)

5 The model of relaying by an intermediate system

5.1 Elements of the relaying model

This International Standard uses ISO 8648's structuring for intermediate systems as the basis for defining the operation of such systems in supporting the OSI connection-mode Network service.

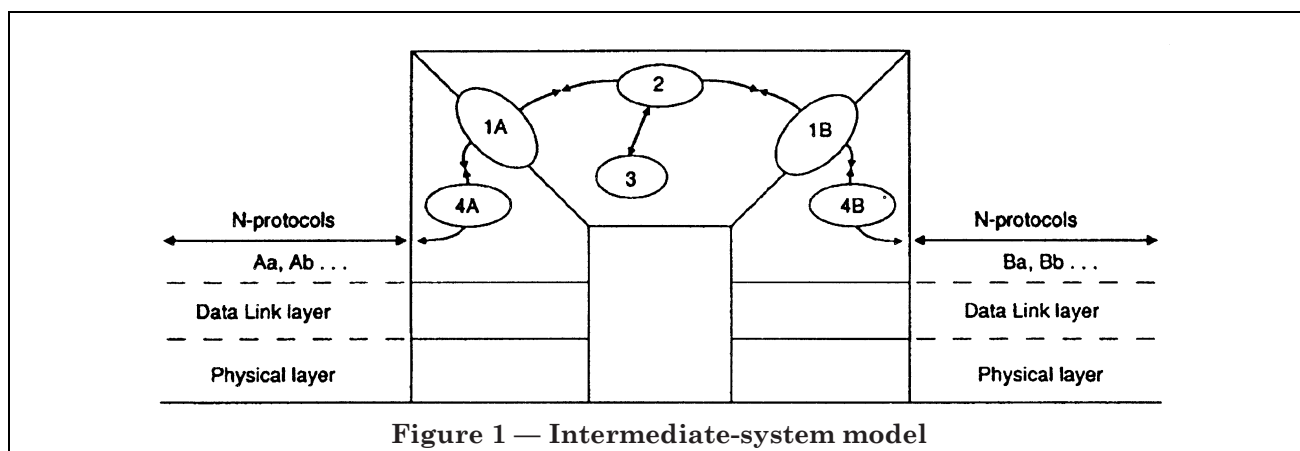
Figure 1 illustrates, in a form adapted from ISO 8648, the general model of an intermediate system and the information flow through it. That flow represents, for each instance of Network layer communication handled by the intermediate system, the use made of the Network service by the NS-users in the end systems connected to the two sides of the intermediate system; the end systems may be connected either directly or through other intermediate systems. The sides of the intermediate system are labelled A and B for convenience in referring to them.

ISO/IEC 8348 defines the Network service in terms of primitives that occur in end systems, across the upper boundary of the Network layer. The first task of this International Standard is to provide corresponding definitions to allow discussion and specification of the information flow that represents those primitives in intermediate systems, and entirely within the Network layer. This is done by defining the Network internal layer service (NILS), including the correspondence between elements of the NILS and those of the Network service. The NILS is defined in terms of primitives with associated parameters, of the four types defined (but for OSI layer services) in ISO TR 8509.

The NILS is an abstraction of the interface in an intermediate system between the protocol support for the Network service and the N-relaying and N-routing functions. It is defined at a level corresponding to ISO 8648's subnetwork independent convergence protocol (SNICP) role. Like the OSI Network service, therefore, it is independent of the details of particular protocols and subnetworks. The definition of the NILS, however, involves less abstraction from the level of detail that is typical of protocols than does the Network service: this reflects the role of the NILS as an expression of general Network layer internal mechanisms, as opposed to just the Network layer functionality that needs to be made visible to an NS user. In Figure 1, the items 1A and 1B represent instances of the NILS. Clauses 7 to 9 contain the definition of the NILS.

Item 2 in Figure 1 represents the N-relaying function, which relates the elements of the two instances of the NILS. The N-relaying function is defined in clauses 8 and 9.

Item 3 represents the N-routing function needed to perform the relaying. The N-relaying function's interface to this is defined in clause 9.



Items 4A and 4B in Figure 1 represent the mappings of the NILS to the protocol combinations used on the two sides of the intermediate system. These mappings for OSI standard Network protocols are specified in other standards.

NOTE 1 The protocol combinations on the two sides of an intermediate system may be different. If there are K such combinations, the relaying model implies that only the K protocol mappings for the NILS need to be specified in order to cover the full set of K-squared interworking possibilities.

NOTE 2 The protocols used on a given side of an intermediate system may be combined “vertically”, as occurs when separate protocols are used in two or more of the roles defined in ISO 8648; or they may be combined “horizontally”, as for instance when an N-routing-protocol exchange is invoked in support of a particular attempt at NC establishment.

NOTE 3 The OSI abstract modelling technique means that the NILS primitives at a given side of an intermediate system are to be considered as a direct abstraction from the NPDUs transmitted and received by the system. Thus items 4A and 4B in Figure 1 truly represent mappings between those NPDUs and NILS primitives: they do not represent, for example, Network protocol implementations, with the implied possibility that these can intervene, below the NILS interface, in the flow of Network-service-level information represented by the NILS. To the extent that such interventions are observable outside the intermediate system, the model ascribes them all — apart perhaps from those resulting from protocol violations — to the relaying function shown as item 2.

5.2 Interconnection of intermediate systems

This subclause considers how the model of a single intermediate system, introduced in 5.1, is used where multiple Network entities are interconnected in supporting an instance of Network layer communication. The concern throughout is with Network layer operation considered at the level of the NILS or the OSI Network service. In particular, this subclause provides the framework for defining the correspondence between the OSI Network service, at end systems, and the operation of the NILS at intermediate systems involved in supporting the Network service.

The simplest interconnection scenario involving relaying is that shown in Figure 2A, where two end systems communicate via a single intermediate system (representing, for example, a real subnetwork).

The concern with the Network layer only, and with the NS and NILS level of abstraction within that layer, is expressed in a diagrammatic representation that is simplified and abstracted from that used in Figure 1 and Figure 2A. Figure 2C is the representation corresponding to Figure 2A, when the relaying function of the intermediate system is isolated for separate consideration.

NOTE 1 Figure 2B is provided purely to clarify the derivation of Figure 2C from Figure 2A, by illustrating an intermediate step.

Figure 3A and Figure 3B show a more complex interconnection scenario and its representation. The new feature here is the communication between two intermediate systems, considered as Network relay systems, via a third intermediate system considered as a subnetwork.

