INTERNATIONAL STANDARD

ISO/IEC 8886

First edition
1992-06-15

Information technology — Telecommunications and information exchange between systems — Data link service definition for Open Systems Interconnection

Traitement de l'information — Télécommunications et échange d'informations entre systèmes — Définition du service de liaison de données pour l'interconnexion de systèmes ouverts

Reference number
ISO/IEC 8886:1992(E)

Contents

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 8886 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*.

Annex A of this International Standard is for information only.

Introduction

This International Standard is one of a set of International Standards produced to facilitate the interconnection of information processing systems. It is related to other standards in the set as defined by ISO 7498. The Reference Model (ISO 7498) subdivides the area of standardization for Open Systems Interconnection(OSI) into a series of layers of specification, each of a manageable size.

This International Standard defines the service provided by the Data Link Layer to the Network Layer at the boundary between the Data Link and Network Layers of the OSI Basic Reference Model. It provides for the designers of network protocols a definition of the Data Link Service (DLS) existing to support the network protocol and for designers of Data Link Protocols a definition of the services to be made available through the action of the Data Link Protocol over the underlying service. The relationship is shown in figure 1.

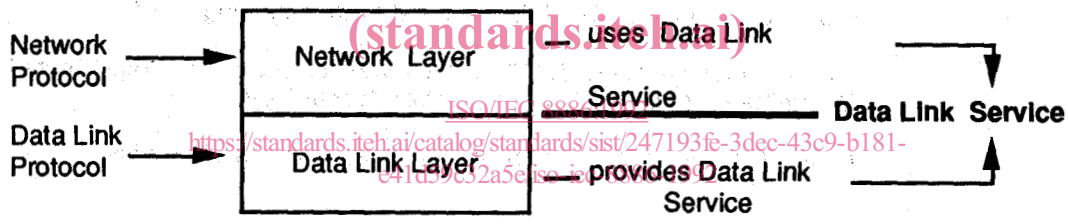

Figure 1 - Relationship of this International Standard to other OSI Standards

Throughout the set of OSI standards, the term "service" refers to the abstract capability provided by one layer of the OSI Basic Reference Model to the layer immediately above. Thus, the Data Link Service defined in this document is a conceptual architectural service, in-dependent of administrative divisions.

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Section 1 : General

1 Scope

This International Standard defines the OSI Data Link Service in terms of

a) the primitive actions and events of the service;

b) the parameters associated with each primitive action and event, and the form which they take; and

c) the inter-relationship between, and the valid sequences of, these actions and events.

The principle objective of this International Standard is to specify the characteristics of a conceptual Data Link Service and thus, supplement the Basic Reference Model in guiding the development of Data Link protocols.

This International Standard does not specify individual implementation or products, nor does it constrain the implementation of Data Link entities and interfaces within an information processing system.

There is no conformance of equipment to this Data Link Service Definition Standard. Instead, conformance is achieved through implementation of conforming Data Link Protocols that fulfill the Data Link Service defined in this International Standard.

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 (see also CCITT Recommendation X.200).*

ISO 7498/Add.1:1984, *Information processing systems - Open Systems Interconnection - Basic Reference Model - Addendum 1 Connectionless-mode data transmission.*

ISO/TR 8509:1987, *Information processing systems - Open Systems Interconnection - Service Conventions (see also CCITT Recommendation X.210).*

3 Definitions

3.1 Basic Reference Model definitions

This International Standard is based on the concepts developed in ISO 7498 and makes use of the following terms defined in it:

a) Data link entity
b) Data Link Layer
c) Data Link Service
d) Data-link-service-access-point
e) Data-link-service-access-point-address
f) Data-link-service-data-unit
g) Reset

3.2 Service conventions definitions

This International Standard makes use of the following terms defined in ISO/TR 8509, as they apply to the Data Link Layer:

a) Data Link Service User
b) Data Link Service Provider
c) Primitive
d) Request
e) Indication
f) Response
g) Confirm

3.3 Data Link Service definitions

This International Standard makes use of the following terms defined in ISO 7498 and ISO7498/Add.1, as they apply to the Data Link Layer:

a) Data-link-connection
b) Data-link-connection-mode data transmission
c) Data-link-connectionless-mode data transmission

4 Abbreviations

DL	Data Link
DLC	Data-link-connection
DLL	Data Link Layer
DLS	Data Link Service
DLSAP	Data-link-service-access-point
DLSDU	Data-link-service-data-unit
OSI	Open Systems Interconnection
QOS	Quality of Service

5 Conventions

5.1 General conventions

This International Standard uses the descriptive conventions given in ISO/TR 8509.

The service model, service primitives, and time-sequence diagrams used are entirely abstract descriptions; they do not represent a specification for implementation.

5.2 Parameters

Service primitives, used to represent service user/service provider interactions (ISO/TR 8509), convey parameters which indicate information available in the user/provider interaction.

The parameters which apply to each group of Data Link Service primitives are set out in tables in clauses 12 to 14 and 19. Each "X" in the tables indicates that the primitive labelling the column in which it falls may carry the parameter labelling the row in which it falls.

Some entries are further qualified by items in brackets. These may be

a) A Parameter specific constraint:

(=) indicates that the value supplied in an indication or confirm primitive is always identical to that supplied in a previous request or response primitive issued at the peer service-access-point.

b) Indication that some note applies to the entry:

(see note X) indicates that the referenced note contains additional information pertaining to the parameter and its use.

In any particular interface, not all parameters need be explicitly stated. Some may be implicitly associated with the DLSAP at which the primitive is issued.

6 Overview of the Data Link Service

The DLS provides for the transparent and reliable transfer of data between DLS users. It makes invisible to these DLS users the way in which supporting communications resources are utilized to achieve this transfer.

In particular, the DLS provides for the following:

a) Independence of underlying Physical Layer - the DLS relieves DLS users from all concerns regarding which configuration is available (e.g., point-to-point connection) or which physical facilities are used (e.g., half-dulpex transmission).

b) Transparency of transferred information - the DLS provides for the transparent transfer of DLS user-data. It does not restrict the content, format or coding of the information, nor does it ever need to interpret its structure or meaning.

c) Reliable transfer of data - the DLS relieves the DLS user from loss, insertion, corruption or, if requested, misordering of data which may occur. In some cases of unrecoverable errors in the Data Link Layer, duplication or loss of DLSDUs may occur.

Note - Detection of duplicate or lost DLSDUs may be performed by DLS users.

d) Quality of Service (QOS) selection - the DLS makes available to DLS users a means to request and to agree upon a quality of service for the transfer of data. QOS is specified by means of QOS parameters representing characteristics such as; throughput, transit delay, accuracy and reliability.

e) Addressing.- The DLS allows the DLS user to identify itself and to specify the DLSAP to which a DLC is to be established whenever more than two DLSAPs are supported by the DLS provider. Data link addresses have only local significance within a specific data link configuration over a single transmission medium (point-to-point or multi-point physical connection) or a group of parallel transmission media (multi-link or splitting function). Therefore, it is not appropriate to define a global addressing structure.

Note - The DLS is required to differentiate between the individual systems that are physically or logically connected to a multi-point data link and to differentiate between connections when the Data Link Layer includes a multiplexing function. For commonality with other service definitions, this mechanism is referred to as addressing and the objects used to differentiate between systems are referred to as addresses.

7 Classes and types of Data Link Service

There are no distinct classes of Data Link Service defined.

There are two types of DLS:

a) a connection-mode service (defined in section 2), and

b) a connectionless-mode service (defined in section 3).

When making reference to this International Standard, a user or provider of Data Link Service shall state which types of service it expects to use or provide.

Section 2 : Definition connection-mode service

8 Features of the connection-mode Data Link Service

The DLS provides the following features to the DLS user:

a) The means to establish a DLC with another DLS user for the purpose of exchanging DLSDUs.

b) The establishment of an agreement between the initiating DLS user and the DLS provider for a certain Quality of Service (QOS) associated with each DLC.

c) The means of transferring DLSDUs of restricted length on a DLC. The transfer of DLSDUs is transparent, in that the boundaries of DLSDUs and the content of DLSDUs are preserved unchanged by the DLS, and there are no constraints on the DLSDU content imposed by the DLS.

Note - The length of a DLSDU may be limited because of internal mechanisms employed by the Data Link Protocol (see sub-clause 7.6.3.2 of ISO 7498).

d) The means by which the receiving DLS user may flow control the rate at which the sending DLS user may send DLSDUs.

e) The means by which a DLC can be returned to a defined state and the activities of the two DLS users synchronized by use of a Reset service element.

f) The unconditional, and therefore possibly destructive, release of a DLC by either of the DLS users or by the DLS provider.

9 Model of the connection-mode Data Link Service

This International Standard uses the abstract model for a layer service defined in clause 4 of ISO/TR 8509. The model defines the interactions between the DLS users and the DLS provider which take place at the two DLSAPs. Information is passed between the DLS user and the DLS provider by service primitives, which may convey parameters.

9.1 DLC endpoint connection identification

If a DLS user needs to distinguish among several DLCs at the same DLSAP, then a local connection endpoint identification mechanism shall be provided. All primitives issued at such a DLSAP within the context of a DLC would be required to use this mechanism to identify this DLC. Such an implicit identification is not described in this International Standard.

9.2 Model of a Data-link-connection

Between the two endpoints of a DLC, there exists a flow control function that relates the behaviour of the DLS user receiving data to the ability of the other DLS user to send data. As a means of specifying this flow control feature and its relationship with other capabilities provided by the connection-mode DLS, the queue model of a DLC, which is described in the following clauses, is used.

This queue model of a DLC is discussed only to aid in the understanding of the end-to-end service features perceived by DLS users. It is not intended to serve as a substitute for a precise, formal description of the DLS, nor as a complete specification of all allowable sequences of DLS primitives. (Allowable primitive sequences are specified in clause 11, see also the note below.) In addition, this model does not attempt to describe all the functions or operations of DL entitles that are used to provide the DLS. No attempt to specify or constrain DLS implementations is implied

Note - The internal mechanisms which support the operation of the DLS are not visible to the DLS user. In addition to the interactions between service primitives described by this model (e.g., the issue of a DL-RESET request primitive at a DLSAP may prevent the receipt of a DL-DATA indication primitive, corresponding to a previously issued DL-DATA request primitive, by the peer DLS user) there may also be:

a) constraints applied locally on the ability to invoke primitives;

b) service procedures defining particular sequencing constraints on some primitives.

9.2.1 Queue model concepts

The queue model represents the operation of a DLC in the abstract by a pair of queues linking the two DLSAPs. There is one queue for each direction of information flow (see figure 2).

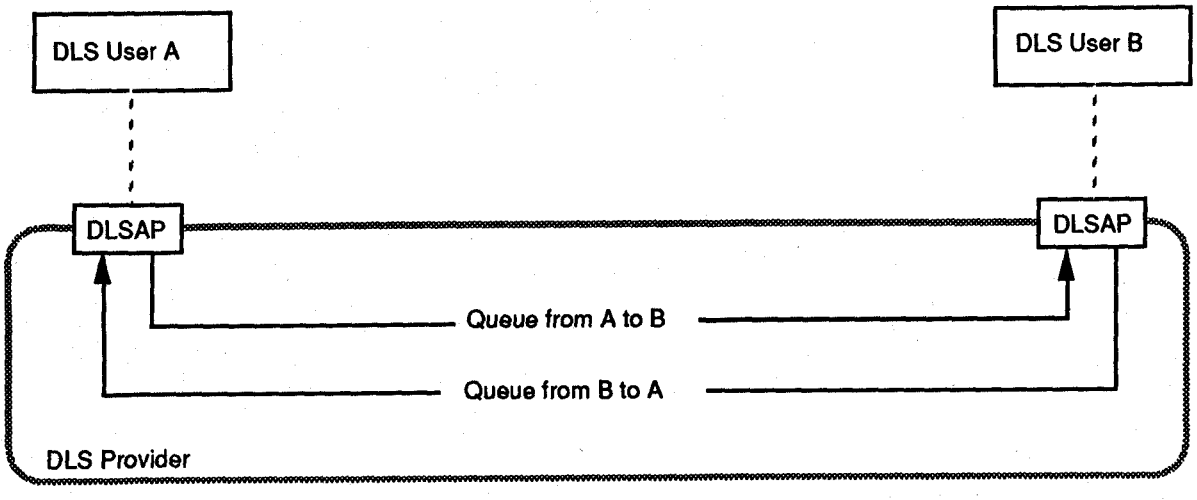

Figure 2 - Queue Model of a DLC

Each queue represents a flow control function in one direction of transfer. The ability of a DLS user to add objects to a queue will be determined by the behaviour of the other DLS user in removing objects from the queue and the state of the queue. Objects are entered or removed from the queue as a result of interactions at the two DLSAPs.

The pair of queues is considered to be available for each potential DLC.

The following objects may be placed in a queue by a DLS user (see clauses 12 to 14):

a) a connect object, representing a DL-CONNECT primitive and its parameters;

b) a data object, representing a DL-DATA primitive and its parameters;

c) a reset object, representing a DL-RESET primitive and its parameters; and

d) a disconnect object, representing a DL-DISCONNECT primitive and its parameters.

The following objects may be placed in a queue by the DLS-provider (see clauses 12 to 14):

1) a reset object, representing a DL-RESET primitive and its parameters;

2) a synchronization mark object (see 9.2.4); and

3) a disconnect object, representing a DL-DISCONNECT primitive and its parameter.

The queues are defined to have the following general properties:

i) a queue is empty before a connect object has been entered and can be returned to this state, with loss of its contents, by the DLS provider;

ii) objects are entered into a queue by the sending DLS user, subject to control by the DLS provider. Objects may also be entered by the DLS provider;

iii) objects are removed from the queue, under the control of the receiving DLS user;

iv) objects are normally removed in the same order that they were entered (however, see 9.2.3); and

v) a queue has a limited capacity, but this capacity is not necessarily either fixed or determinable.

9.2.2 DLC establishment

A pair of queues is associated with a DLC between two DLSAPs when the DLS provider receives a DL-CONNECT request primitive at one of the DLSAPs, and a connect object is entered into one of the queues. From the standpoint of the DLS users of the DLC, the queues remain associated with the DLC until a disconnect object representing a DL-DISCONNECT primitive is either entered or removed from the queue.

DLS user A, who initiates a DLC establishment by entering a connect object representing a DL-CONNECT request primitive into the queue from DLS user A to DLS user B, is not allowed to enter any other object, other than a disconnect object, into the queue until after the connect object representing the DL-CONNECT confirm primitive has been removed from the DLS user B to DLS user A queue. In the queue from DLS user B to DLS user A, objects can be entered only after DLS user B has entered a connect object representing a DL-CONNECT response primitive.

The properties exhibited by the queues while the DLC exists represent the agreements reached among the DLS users and the DLS provider during this connection establishment procedure concerning QOS.

9.2.3 Data transfer

Flow control on the DLC is represented in this queue model by the management of the queue capacity, allowing objects to be added to the queues. The addition of a object may prevent the addition of a further object.

Once objects are in the queue, the DLS provider may manipulate pairs of adjacent objects, resulting in deletion. An object may be deleted if, and only if, the object which follows it is defined to be destructive with respect to the object. If necessary, the last object on the queue will be deleted to allow a destructive object to be entered - they may therefore always be added to the queue. Disconnect objects are defined to be destructive with respect to all other objects. Reset objects are defined to be destructive with respect to all other objects except connect and disconnect objects.

The relationships between objects which may be manipulated in the above fashion are summarized in table 1.

Whether the DLS provider performs actions resulting in deletion or not will depend upon the behaviour of the DLC users and the agreed QOS for DLC. In general, if a DLS user does not remove objects from a queue, the DLS provider shall, after some unspecified period of time, perform all the permitted deletions.