INTERNATIONAL STANDARD

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Information technology — Open Systems Interconnection — Data link service definition

Technologies de l'information — Interconnexion de systèmes ouverts (OSI) — Définition du service de liaison de données

Reference number
ISO/IEC 8886:1996(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*, Subcommittee SC 6, *Telecommunications and information exchange between systems,* in collaboration with ITU-T. The identical text is published as ITU-T Recommendation X.212.

This second edition cancels and replaces the first edition (ISO/IEC 8886:1992), which has been technically revised.

Introduction

This Recommendation | International Standard is one of a set of Recommendations | International Standards produced to facilitate the interconnection of information processing systems. It is related to other Recommendations | International Standards in the set as defined by ITU-T Rec. X.200 | ISO/IEC 7498-1, OSI Reference Model – The Basic Model. The reference model described by ITU-T Rec. X.200 | ISO/IEC 7498-1 subdivides the area of standardization for Open Systems Interconnection (OSI) into a series of layers of specification, each of a manageable size.

This Recommendation | International Standard defines the services provided by the Data Link Layer to the Network Layer at the boundary between the Data Link and Network Layers of the OSI Reference Model. It provides for the designers of network protocols a definition of the Data Link Service existing to support the network protocol and for the 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 illustrated in Figure Intro. 1.

Throughout the set of OSI Recommendations | International Standards, the term "service" refers to the abstract capability provided by one layer of the OSI Reference Model to the layer immediately above. Thus, the Data Link Service defined in this Recommendation | International Standard is a conceptual architectural service, independent of administrative divisions.

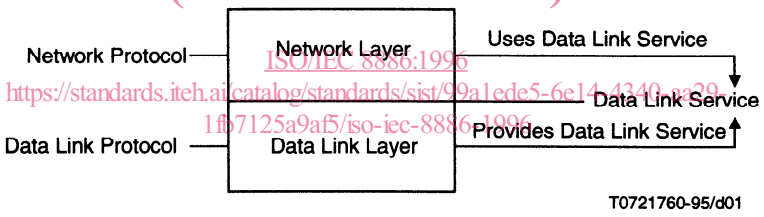

Figure Intro. 1 – Relationship of this Recommendation | International Standard to other OSI Recommendations | International Standards

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INTERNATIONAL STANDARD

ITU-T RECOMMENDATION

INFORMATION TECHNOLOGY – OPEN SYSTEMS INTERCONNECTION – DATA LINK SERVICE DEFINITION

1 Scope

This Recommendation | 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 that they take; and

c) the interrelationship between, and the valid sequences of these actions and events.

The principal objective of this Recommendation | International Standard is to specify the characteristics of a conceptual Data Link Service and thus, supplement the OSI Reference Model in guiding the development of Data Link Protocols.

This Recommendation | 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 Recommendation | International Standard. Instead, conformance is achieved through implementation of conforming Data Link Protocols that fulfil the Data Link Service defined in this Recommendation | International Standard.

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 International 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 maintains a list of currently valid ITU-T Recommendations.

2.1 Identical Recommendations | International Standards

– ITU-T Recommendation X.200 (1994) | ISO/IEC 7498-1:1994, *Information technology – Open Systems Interconnection – Basic Reference Model: The Basic Model.*

– ITU-T Recommendation X.210 (1993) | ISO/IEC 10731:1994, *Information technology – Open Systems Interconnection – Basic Reference Model: Conventions for the definition of OSI services.*

PART 1 – GENERAL

3 Definitions

3.1 OSI Reference Model definitions

This Recommendation | International Standard is based on the concepts developed and makes use of the following terms defined in ITU-T Rec. X.200 | ISO/IEC 7498-1:

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 Recommendation | International Standard makes use of the following terms defined in ITU-T Rec. X.210 | ISO/IEC 10731, as they apply to the Data Link Layer:

a) Data Link Service Users;

b) Data Link Service Provider;

c) Primitive;

d) Request;

e) Indication;

f) Response;

g) Confirm.

3.3 Data Link Service definitions

This Recommendation | International Standard makes use of the following terms:

a) **data-link-connection**

An association established by a Data Link Layer between two or more Data Link Service Users for the transfer of data, which provides explicit identification of a set of Data Link data transmissions and agreement concerning the Data Link data transmission services to be provided for the set.

NOTE – This definition clarifies the definition given in ITU-T Rec. X.200 | ISO/IEC 7498-1.

b) **data-link-connection-mode data transmission**

The transmission of a Data-link-service-data-unit within the context of a Data-link-connection that has been previously established.

c) **data-link-connectionless-mode data transmission**

The transmission of a Data-link-service-data-unit not in the context of a Data-link-connection and not required to maintain any logical relationship among multiple invocations.

4 Abbreviations

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

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 Recommendation | International Standard uses the descriptive conventions given in ITU-T Rec. X.210 | ISO/IEC 10731.

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 (see ITU-T Rec. X.210 | ISO/IEC 10731), 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-duplex 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 1 – Detection of duplicate or lost DLSDUs may be performed by DLS users.

d) *Quality of Service 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 2 – 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 Data Link Service:

a) a connection-mode service (defined in Part 2); and

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

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

PART 2 – DEFINITION OF THE 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 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 contents 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 ITU-T Rec. X.200 | ISO/IEC 7498-1, 7.6.3.5.2).

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 Recommendation | International Standard uses the abstract model for a layer service defined in clause 4 of ITU-T Rec. X.210 | ISO/IEC 10731. 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 must 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 Recommendation | 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 entities that are used to provide the DLS. No attempt to specify or constrain DLS provider 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 an 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 1).

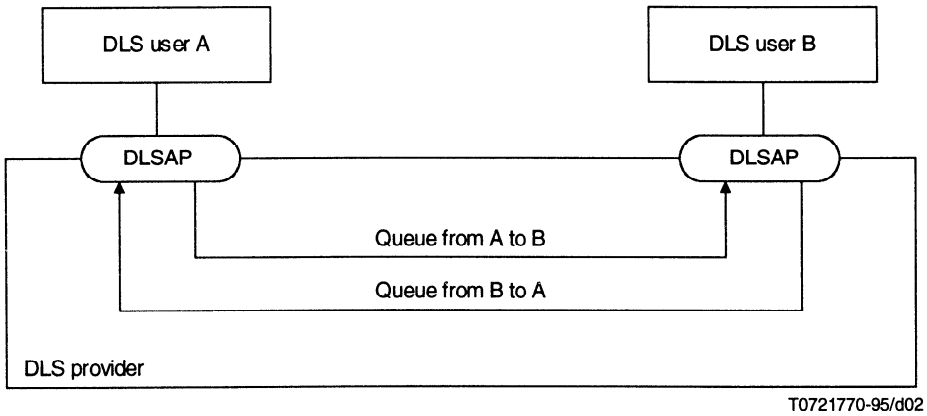

Figure 1 – Queue model of a DLC

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. 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 12-14):

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

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

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

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

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

1) a reset object;

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

3) a disconnect object.

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 request or indication primitive is either entered or removed, respectively, 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 data 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 an object may prevent 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 in 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, 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 the 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.

Table 1 – Relationships between queue model objects

Following object y is defined / with respect to the preceding object x	Connect	Data	Reset	Synchronization mark	Disconnect
Connect	N/A	–	–	N/A	DES
Data	N/A	–	DES	N/A	DES
Reset	N/A	–	DES	–	DES
Synchronization mark	N/A	–	DES	N/A	DES
Disconnect	N/A	N/A	N/A	N/A	DES

N/A x will not precede y in a valid state of a queue

– Not to be destructive nor to be able to advance ahead

DES To be destructive to the preceding object

9.2.4 Reset

In order to accurately model the reset service a synchronization mark object is required. The synchronization mark object exhibits the following properties:

a) it cannot be removed from a queue by a DLS user;

b) a queue appears empty to a DLS user when a synchronization mark object is the next object in the queue;

c) a synchronization mark object can be destroyed by a disconnect object (see Table 1);

d) when a reset object is immediately preceded by a synchronization mark object, both the reset object and the synchronization mark object are deleted from the queue.

The initiation of a reset procedure is represented in the two queues as follows:

i) initiation of a reset procedure by the DLS provider is represented by the introduction into each queue of a reset object followed by a synchronization mark object;

ii) a reset procedure initiated by a DLS user is represented by the addition of a reset object into the queue from the reset initiator to the peer DLS user and the insertion of a reset object followed by a synchronization mark object into the other queue by the peer DLS user.