International Standard 8072

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Information processing systems — Open Systems Interconnection — Transport service definition

Systèmes de traitement de l'information — Interconnexion de systèmes ouverts — Service de transport en mode connexion

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Foreword

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Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

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International Standard ISO 8072 was prepared by Technical Committee ISO/TC 97, *Information processing systems*.

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Users should note that all International Standards undergo revision from time to time and that any reference made herein to any other International Standard implies its latest edition, unless otherwise stated.

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Information processing systems — Open Systems Interconnection — Transport service definition

0 Introduction

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

The purpose of this International Standard is to define the service provided to the Session Layer at the boundary between the Session and Transport Layers of the Reference Model. The Transport Service is provided by the Transport Protocol making use of the services available from the Network Layer. This International Standard also defines the Transport Service characteristics which the Session Protocol may exploit. The relationship between the International Standards for Transport Service, Transport Protocol, Network Service, and Session Protocol is illustrated in figure 1.

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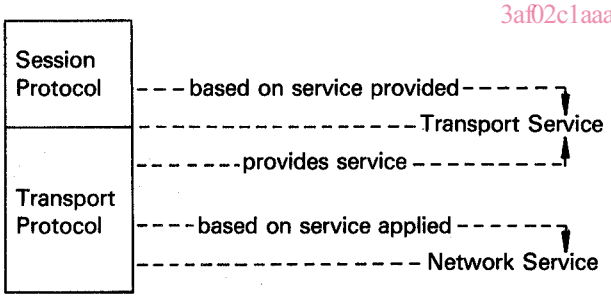

Figure 1 — Relationship of this International Standard to other OSI standards

It is recognized that with respect to Transport Quality of Service, described in clause 10 of this International Standard, work is still in progress to provide an integrated treatment of Quality of Service across all layers of the OSI Basic Reference Model and to ensure that the individual treatments in each layer service satisfy overall Quality of Service objectives in a consistent manner. As a consequence an addendum may be added to this International Standard at a later time which reflects further Quality of Service development and integration.

1 Scope and field of application

This International Standard defines in an abstract way the externally visible service provided by the OSI Transport Layer in terms of

a) the primitive actions and events of the service;

b) the parameter data associated with each primitive action and event;

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

The service defined in this International Standard is that which is provided by all OSI Transport Protocols (in conjunction with the Network Service) and which may be used by any OSI Session Protocol.

This International Standard does not specify individual implementations or products, nor does it constrain the implementation of entities and interfaces within a computer system. There is, therefore no conformance to this International Standard.

2 References

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

ISO 8073, *Information processing systems — Open Systems Interconnection — Connection oriented transport protocol specification.*

ISO 8327, *Information processing systems — Open Systems Interconnection — Basic connection oriented session protocol specification.* [1]

ISO 8348, *Information processing systems — Data communications — Network service definition*

ISO/TR 8509, *Information processing systems — Open Systems Interconnection — Service conventions.* [1]

1) At present at the stage of draft.

Section one : General

3 Definitions

3.1 Reference model definitions

This International Standard is based on the concepts developed in the Basic Reference Model for Open Systems Interconnection (OSI), ISO 7498, and makes use of the following terms defined therein :

a) Expedited transport-service-data-unit;

b) Transport-Connection;

c) Transport-Connection Endpoint;

d) Transport Layer;

e) Transport Service;

f) Transport-Service-Access-Point;

g) Transport-Service-Access-Point address;

h) Transport-Service-Data-Unit;

i) Network Layer;

j) Network Service;

k) Network-Connection;

l) Interface flow control.

3.2 Service convention definitions

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

a) service-user;

b) service-provider;

c) primitive;

d) request;

e) indication;

f) response;

g) confirm.

3.3 Transport service definitions

For the purpose of this International Standard, the following definitions also apply :

3.3.1 calling TS user : A Transport Service user that initiates a transport-connection establishment request.

3.3.2 called TS user : A Transport Service user with whom a calling TS user wishes to establish a transport-connection.

NOTE — Calling TS users and called TS users are defined with respect to a single connection. A Transport Service user can be both a calling and a called TS user simultaneously.

3.3.3 sending TS user : A Transport Service user that acts as a source of data during the data transfer phase of a transport-connection.

3.3.4 receiving TS user : A Transport Service user that acts as a sink of data during the data transfer phase of a transport-connection.

NOTE — A Transport Service user can be both a sending and a receiving TS user simultaneously.

4 Abbreviations

TS :	Transport Service
TC :	Transport-Connection
TSAP :	Transport-Service-Access-Point
TSDU :	Transport-Service-Data-Unit
QOS :	Quality of Service

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5 Conventions

5.1 General conventions

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

5.2 Parameters

The available parameters for each group of primitives are set out in tables 5, 6, 7 and 8. Each "X" in the tables indicates that the primitive labelling the column in which it falls shall carry the parameter labelling the row in which it falls, unless further qualified [see a) below].

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

a) indications that the parameter is optional in some way :
(U) indicates that the inclusion of the parameter is a choice made by the user.

b) specific constraints of a parameter :
(=) indicating that the value supplied in an indication or confirm primitive is always identical to that supplied in the previous request or response primitive issued at the peer service access point.

6 Overview and general characteristics

The Transport Service provides transparent transfer of data between TS users. It relieves these TS users from any concern about the detailed way in which supporting communications media are utilized to achieve this transfer.

The Transport Service provides for the following :

a) Quality of service selection :
The Transport Layer is required to optimize the use of available communications resources to provide the QOS required by communicating TS users at minimum cost. QOS is specified through the selection of values for QOS parameters representing characteristics such as throughput, transit delay, residual error rate and failure probability.

b) Independence of underlying communication resources :
The Transport Service hides from TS users the difference in the QOS provided by the Network Service. This difference in QOS arises from the use of a variety of communications media by the Network Layer to provide the Network Service.

c) End-to-end significance :
The Transport Service provides for the transfer of data between two TS users in end systems.

d) Transparency of transferred information :
The Transport Service provides for the transparent transfer of octet-aligned TS user-data and/or control information. It does not restrict the content, format, or coding of the information, nor does it ever need to interpret its structure or meaning.

e) TS user addressing :
The Transport Service utilizes a system of addressing which is mapped into the addressing scheme of the supporting Network Service. Transport-addresses can be used by TS users to refer unambiguously to TSAPs.

7 Features of the Transport Service

The Transport Service offers the following features to a TS user :

a) The means to establish a TC with another TS user for the purpose of exchanging TSDUs. More than one TC may exist between the same pair of TS users.

b) Associated with each TC at its time of establishment, the opportunity to request, negotiate, and have agreed by the TS provider a certain QOS as specified by means of QOS parameters.

c) The means of transferring TSDUs on a TC. The transfer of TSDUs which consist of an integral number of octets is transparent, in that the boundaries of TSDUs and the contents of TSDUs are preserved unchanged by the TS provider and there are no constraints on the TSDU content imposed by the TS provider.

d) The means by which the receiving TS user may control the rate at which the sending TS user may send octets of data.

e) The means of transferring separate expedited TSDUs when agreed to by both TS users. Expedited TSDUs transfer is subject to a different flow control from normal data across the TSAP.

f) The unconditional and therefore possibly destructive release of a TC.

8 Classes of Transport Service

No distinct classes of Transport Service are defined.

9 Model of the Transport Service

9.1 Model of the Transport Service

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

The primitives are abstract representations of TSAP interactions. They are solely descriptive and do not represent a specification for implementation.

9.2 Model of a Transport Connection

The operation of a TC is modelled in an abstract way by a pair of queues linking the two TSAPs. There is one queue for each direction of information flow (see figure 2). Each TC is modelled by a separate pair of queues.

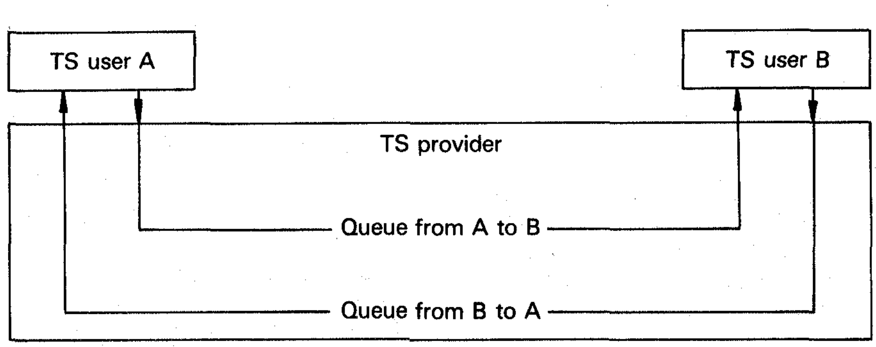

Figure 2 — Abstract model of a Transport Connection

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The queue model is used to introduce the flow control feature. The ability of a TS user to add objects to a queue will be determined by the behaviour of the TS user removing objects from that queue and the state of the queue. Objects are entered and removed from the queue as a result of interactions at the two TSAPs.

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

The objects which may be placed in a queue by a TS user (see clauses 12, 13 and 14) are

a) connect objects (each representing all parameters contained in a T-CONNECT request or T-CONNECT response primitive);

b) octets of normal data;

c) indications of end-of-TSDU (completion of a T-Data primitive);

d) expedited TSDUs (representing all parameters of a T-EXPEDITED primitive);

e) disconnect objects (each representing all parameters contained in a T-DISCONNECT primitive).

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NOTES

1 Normal and expedited TSDU transfer will result in different objects being entered into the queue.

2 The description of flow control requires a less abstract description than that used for describing sequences of primitives in clauses 11 to 14. Each TSDU associated with a T-DATA primitive is here subdivided conceptually into a sequence of octets of data followed by an end-of-TSDU indication. The T-DATA request primitive occurs when the end-of-TSDU indication is entered into the queue. The T-DATA indication primitive occurs when the end-of-TSDU indication is removed from the queue. This does not imply any particular subdivision in any real interface.

The only objects which can be placed in a queue by the TS provider are disconnect objects (representing T-DISCONNECT primitives and their parameters).

TS user A who initiates TC establishment by entering a connect object (representing a T-CONNECT request primitive) into the queue from A to B, is not allowed to enter any other object than a disconnect object into this queue until after the connect object representing the T-CONNECT confirm has been removed. In the queue from TS user B to TS user A objects other than a disconnect object can be entered by TS user B only after TS user B has entered a connect object corresponding to a T-CONNECT response. The insertion of a disconnect object represents the initiation of the release procedure. The release procedure may be initiated at the times permitted in clause 14 and in the manner described in 11.2. The release procedure may be destructive with respect to other objects in the two queues.

A queue relates an ordered set of distinct objects in the following ways :

a) queues are empty before a connect object has been added and can be returned to this state, with loss of their contents, by the TS provider under the circumstances as described in h) below;

b) objects are added to the queue, subject to control by the TS provider;

c) objects are normally removed from the queue, subject to control by the receiving TS user;

d) objects are normally removed in the same order that they were added [but see g) and h) below];

e) a queue has a limited capacity (initially greater than zero), but this capacity is not necessarily either fixed or determinable, and shall meet the requirements of f);

f) the management of the queue capacity shall be such that normal data and end-of-TSDU indications cannot be added to the queue when their addition would prevent addition of an expedited TSDU or disconnect object. Similarly expedited TSDUs cannot be added if their addition would prevent the addition of a disconnect object.

In addition the TS provider may manipulate pairs of adjacent objects in the queue to allow

g) reordering :
The order of any pair of objects may be reversed if, and only if, the following object is of a type defined to take precedence over the preceding object. Expedited TSDUs take precedence over octets of normal data and end-of-TSDU indications, and disconnect objects take precedence over any other object (see table 1).

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h) deletion :
Any object may be deleted by the TS provider if, and only if, the following one is a disconnect object. If a connect object associated with a T-CONNECT request primitive is deleted in this manner, the disconnect object is also deleted. If a connect object associated with a T-CONNECT response primitive is deleted, the disconnect object is not deleted.

Whether the TS provider performs actions of types g) and h) or not, will depend on the behaviour of the TS users and on the agreed QOS. In general, if the objects are not removed from the queue due to flow control expressed by the receiving TS user, the TS provider shall, after some unspecified period of time, perform all permitted actions of types g) and h).

NOTES

1 The internal mechanisms which support the operation of a queue are not visible in the Transport Service. A queue is one particular way of expressing the mutual interaction between primitives at different TSAPs. There may also be, for example

a) constraints on the local ability to invoke primitives;

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

2 A TC endpoint identification mechanism should be provided locally if the TS user and the TS provider need to distinguish between several TCs at a TSAP. All primitives should then make use of this identification mechanism to identify the TC to which they apply. This implicit identification is not shown as a parameter of the TS primitives, and should not be confused with the address parameter of the T-CONNECT primitives.

Table 1 — Precedence table

Has precedence over queue object Y / The queue object X	Connect object	Octets of normal data	End-of-TSDU indication	Expedited TSDU	Disconnect object
Connect object	—	—	—	—	yes [see 9.2 g) and h)]
Octet of normal data	—	no	no	yes [see 9.2 g)]	yes [see 9.2 g) and h)]
End-of-TSDU indication	—	no	no	yes [see 9.2 g)]	yes [see 9.2 g) and h)]
Expedited TSDU	—	no	no	no	yes [see 9.2 g) and h)]
Disconnect object	—	—	—	—	yes [see 9.2 h)]

Key :

— : not applicable

no : no precedence exists

yes : precedence exists

10 Quality of Transport Service

The term "Quality of service" QOS refers to certain characteristics of a TC as observed between the TC endpoints.

QOS is described in terms of QOS parameters.

These parameters give TS users a method of specifying their needs, and give the TS provider a basis for protocol selection.

The QOS is normally negotiated between the TS users and the TS provider on a per TC basis, using the T-CONNECT request, indication, response, and confirm TS primitives defined in clause 11. The QOS requested by the calling TS user may be lowered either by the TS provider following the T-CONNECT request, or by the called TS user, following the T-CONNECT indication. In applying this to some QOS parameters this may mean that

a) a delay becomes longer;

b) a throughput becomes lower;

c) the error rate becomes higher;

d) the priority becomes lower;

e) the failure probability becomes higher.

However the TC protection parameter remains unchanged by the TS provider.

The negotiated QOS values then apply throughout the lifetime of the TC.

The view of QOS at each end of an established TC is always the same.

This section does not specify particular values, or classes of values, for the QOS parameters. Possible choices and default values for each parameter will normally be specified at the time of initial TS provider installation. The values for any or all parameters may be fixed for a given TS provider, in which case QOS negotiation on a per TC basis is not required. When a QOS value is specified, the TS user may also indicate whether the request is an absolute requirement or whether a degraded value is acceptable.

The QOS parameters include parameters which express TS performance and parameters which express other TS characteristics.

The QOS parameters specified in this clause are defined below. A classification of the performance QOS parameters is shown in table 2.

Table 2 — Classification of performance QOS parameters

Phase	Performance criterion	
	Speed	Accuracy/reliability
TC establishment	TC establishment delay	TC establishment failure probability (misconnexion/TC refusal)
Data transfer	Throughput	Residual error rate (corruption, duplication/loss)
	Transit delay	Resilience of the TC Transfer failure probability
TC release	TC release delay	TC release failure probability

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