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Draft for Development

Open Systems Interconnection: transport service definition (ISO/DIS 8072 and DAD 1)

Projet à développer. Interconnexion des systèmes ouverts: Définition de la logistique

Entwurf zur weiteren Ausarbeitung. Kommunikation Offener Systeme: Definition des Transportdienstes

To avoid delay in preparing the content of this publication for printing, it was reproduced from the only available copy of the finally agreed document. The resultant poor print quality is very much regretted. The price has been adjusted accordingly.

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This publication is not to be regarded as a British Standard.

It is being issued in the Draft for Development series of publications and is of a provisional nature because the subject matter is in the process of ongoing development within the International Standards Committee (ISO/TC 97/SC 6 Telecommunications and Information Exchange between Systems).

It should be applied on this provisional basis, so that information and experience of its practical application may be obtained.

A review of this Draft for Development will be carried out

not later than two years after its publication. Notification of the start of the review period, with a request for the submission of comments from users of this Draft for Development will be made in an announcement in the appropriate issue of *BSI News*. Observations which it is felt should receive attention before the official call for comments will be welcomed.

According to the replies received, the responsible BSI Committee will judge whether the Draft for Development can be converted into a British Standard or what other action should be taken.

National foreword

This Draft for Development has been prepared under the direction of the Office and Information Standards Committee. The primary objective of this Draft for Development is to give advance guidance to product and systems designers concerned with the Transport Layer of the Basic Reference Model for Open Systems Interconnection (OSI).

The text of the Draft for Development is identical with the revised text of ISO/DIS 8072 submitted to the International Organization for Standardization (ISO) for publication as ISO 8072. National appendix A is identical with the text of the draft proposed addendum 1 to ISO/DIS 8072 (reference ISO/TC 97/SC 6 N 3221) issued by ISO on 29 August 1984. National appendix A covers connectionless-mode transmission.

For ease of reproduction the ISO text has been reproduced unchanged.

The UK has actively participated through BSI Technical Committee OIS/6 in the development of the Draft International Standard. The Technical Committee will review any agreed amendments or addenda to the ISO text and will, where appropriate, update the text of this Draft for Development via an amendment or revision. When the ISO draft reaches an appropriate level of agreement and stability, this Draft for Development may then be converted to a British Standard.

The revised text of ISO/DIS 8073, i.e. as approved for publication as ISO 8073, together with the proposed draft addendum 1 covering the use of a Network Connection Management Subprotocol, has been published as DD 116.

For information, a list of published British Standards and Drafts for Development (together with those scheduled for publication at the time of publication of this Draft for Development) for OSI, data communications and computer graphics is attached as national appendix B. Press Releases for new OSI, data communications and computer graphics British Standards publications will be issued to the computing press, and details of all new publications will be recorded in full in *BSI News*.

Terminology and conventions. The text of the revised Draft International Standard has been approved as suitable for publication as a Draft for Development without deviation. Some terminology and certain conventions are not identical with those used in Drafts for Development; attention is drawn especially to the following.

Wherever the words 'International Standard' appear, referring to this Draft for Development, they should be read as 'Draft for Development'.

Wherever page numbers are quoted, they are ISO page numbers.

Cross-references

International standards	Corresponding British Standards
ISO 7498-1984	BS 6568 : 1984 Description of basic reference model for open systems interconnection (Identical)
ISO 7498/DAD1	DD 125* Basic reference model for Open Systems Interconnection: connectionless-mode transmission (ISO 7498/DAD 1) (Identical)
ISO/DIS 8073	DD 116 : 1985 Open Systems Interconnection: transport protocol specification (ISO/DIS 8073 and DAD 1) (Identical)
ISO/DIS 8327	DD 112 : 1985 Open Systems Interconnection: basic connection oriented session protocol specification (ISO/DIS 8327) (Identical)
ISO/DIS 8509	DD 108* Open Systems Interconnection: service conventions (ISO/DIS 8509) (Identical)
ISO/DIS 8348	DD 119 : 1985 Open Systems Interconnection: connection-mode network service definition (ISO/DIS 8348) (Identical)
ISO/DP 8602	DD 137* Open Systems Interconnection: protocol to provide the connectionless-mode transport service utilizing either the connectionless-mode or the connection-oriented network service (ISO/DP 8602) (Identical)

* In preparation.

0 Introduction

This International Standard is one of a set of standards produced to facilitate the interconnection of computer systems. It is related to other 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 standards for Transport Service, Transport Protocol, Network Service, and Session Protocol is illustrated in figure 1.

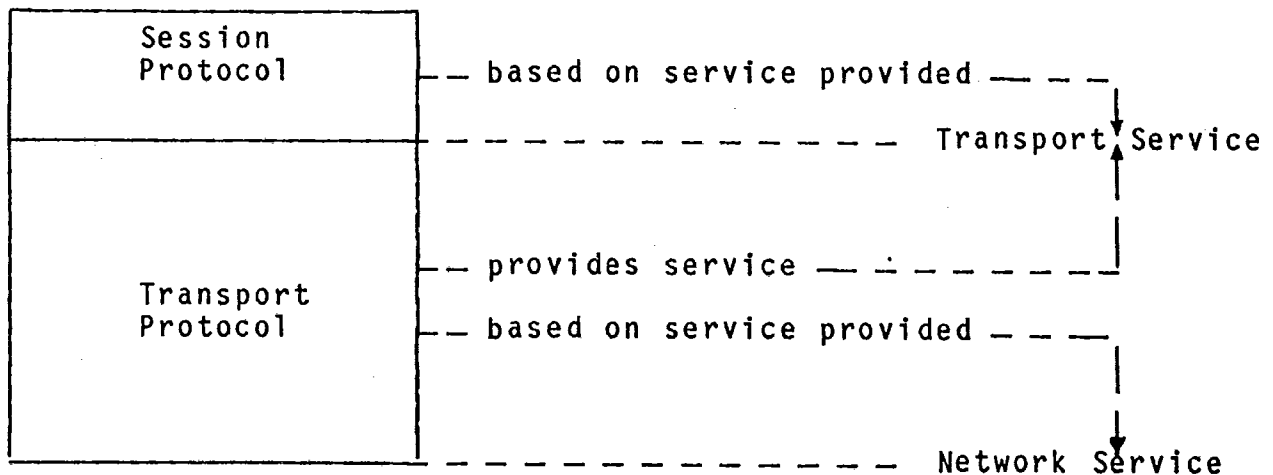


Figure 1 - Relationship of this International Standard to other OSI standards

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 accross 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 standard at a later time which reflects further Quality of Service development and integration.

[ISO page 2]

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 standard.

2 References

- | | |
|----------|--|
| ISO 7498 | Information Processing Systems - Open Systems Interconnection - Basic Reference Model |
| ISO 8327 | Information Processing Systems - Open Systems Interconnection - Connection Oriented Session Protocol Specification |
| ISO 8073 | Information Processing Systems - Open Systems Interconnection - Connection Oriented Transport Protocol Specification |
| DIS 8509 | Information Processing Systems - Open Systems Interconnection - Service Conventions |
| ISO 8348 | Information Processing Systems - Data Communications - Network Service Definition |

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 in that standard:

[ISO page 3]

- 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;
- j) Network Layer;
- k) Network Service;
- m) network-connection;
- n) interface flow control.

3.2 Service Convention Definitions

This International Standard also makes use of the following terms defined in DIS 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.

[ISO page 4]

4 Abbreviations

TS : Transport Service
 TC : transport-connection
 TSAP: transport-service-access-point
 TSDU: transport-service-data-unit
 QOS : Quality of Service

5 Conventions

5.1 General Conventions

This International Standard uses the descriptive conventions given in DIS 8509.

5.2 Parameters

The available parameters for each group of primitives are set out in tables in clauses 12 to 14. Each "X" in the tables indicates that the primitive labelling the column in which it falls must 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) a parameter specific constraints:

(=) 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.

[ISO page 5]

b) Independence of underlying communications 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 neither 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 standard uses the abstract model for a layer service defined in A.3. 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.

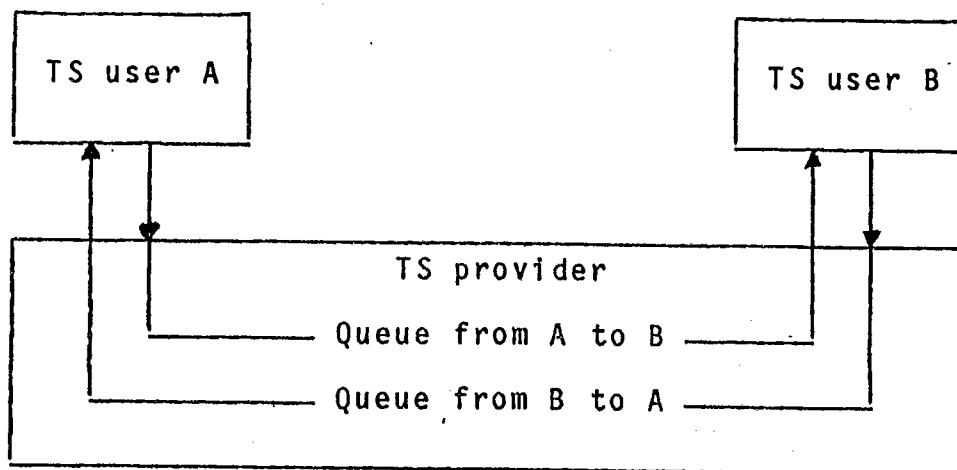


Figure 2 - Abstract Model of a Transport Connection

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.

[ISO page 7]

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).

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 11-14. 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 clause 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 of 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 meets 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 its 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).

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).

TABLE 1 - Precedence Table

the queue object x has precedence over queue object y	connect object	octets of normal data	end-of-TSDU indication	expedited TSDU	disconnect object
connect object	-	-	-	-	yes (see g,h above)
octets of normal data	-	no	no	yes (see g above)	yes (see g,h above)
end-of-TSDU indication	-	no	no	yes (see g above)	yes (see g,h above)
expedited TSDU	-	no	no	no	yes (see g,h above)
disconnect object	-	-	-	-	yes (see h above)

Key: - : not applicable
 no : no precedence exists
 yes: precedence exists

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.

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2 A TC endpoint identification mechanism must be provided locally if the TS user and the TS provider need to distinguish between several TCs at a TSAP. All primitives must 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 must not be confused with the address parameter of the T-CONNECT primitives.

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 made poorer 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 so 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.

[ISO page 11]

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 (misconnection/TC refusal)
Data Transfer	Throughput Transit Delay	Residual Error Rate (corruption, duplication/loss) Resilience of the TC Transfer Failure Probability
TC Release	TC Release Delay	TC Release Failure Probability

10.1 TC Establishment Delay

TC establishment delay is the maximum acceptable delay between a T-CONNECT request and the corresponding T-CONNECT confirm primitive.

NOTE - This delay includes TS user dependent components.

10.2 TC Establishment Failure Probability

TC establishment failure probability is the ratio of total TC establishment failures to total TC establishment attempts in a measurement sample.

A TC establishment failure is defined to occur when a requested TC is not established within the specified maximum acceptable TC establishment delay as a result of misconnection, TC refusal, or excessive delay on the part of the TS provider. TC establishment attempts which fail as a result of error, TC refusal, or excessive delay on the part of a TS user are excluded in calculating the TC establishment failure probability.

10.3 Throughput

Throughput is defined, for each direction of transfer, in terms of a sequence of at least 2 successfully transferred TSDUs. Given such a sequence of n TSDUs, where n is greater than or equal to 2, the throughput is defined to be the smaller of:

- a) the number of TS user data octets contained in the last $n-1$ TSDUs divided by the time between the 1st and last T-DATA request in the sequence, and
- b) the number of TS user data octets contained in the last $n-1$ TSDUs divided by the time between the 1st and last T-DATA indication in the sequence.

Successful transfer of the octets in a transmitted TSDU is defined to occur when the octets are delivered to the intended receiving TS user without error, in the proper sequence, prior to release of the TC by the receiving TS user.

Throughput is only meaningful for a sequence of complete TSDUs and each specification is based on a previously stated average TSDU size.

Throughput is specified separately for each direction of transfer on a TC. In each direction specification of throughput for one direction will consist of a "maximum throughput" and an "average throughput" value. The "maximum throughput" value represents the maximum rate at which the TS provider can continuously accept and deliver TSDU's, in the absence of sending TS user input delays or flow control applied by the receiving TS user. Thus, the sequence of TSDUs in the calculation above is defined to be presented continuously at the maximum rate. The "average throughput" value represents the expected transfer rate on a TC including the effects of expected user-attributable delays (e.g., non-continuous TSDU input, receiving TS user flow control). Thus, the sequence of TSDUs in the calculations above is defined to be presented at the rate which includes components representing "average" user delays.

It is possible for either the input or the output of a sequence of TSDUs to be excessively delayed by the TS users. Such occurrences are excluded in calculating "average throughput" values.

For each direction of transfer, and for each of the "maximum throughput" and "average throughput" specifications, the throughput QOS for a particular TC will be negotiated among the TS users and the TS provider. (See clause 12.2.2).

10.4 Transit Delay

Transit delay is the elapsed time between a T-DATA request and the corresponding T-DATA indication. Elapsed time values are calculated only on TSDUs that are successfully transferred.

Successful transfer of a TSDU is defined to occur when the TSDU is transferred from the sending TS user to the intended receiving TS user without error, in the proper sequence, prior to release of the TC by the receiving TS user.

Transit delay is specified independently for each direction of transfer. In general, each transit delay specification will define both the average value and the maximum value expected for a TC. Each specification will be based on a previously stated average TSDU size.

The transit delay for an individual TSDU may be greatly increased if the receiving TS user exercises interface flow control. Such occurrences are excluded in calculating both average and maximum transit delay values.

10.5 Residual Error Rate

Residual error rate is the ratio of total incorrect, lost and duplicate TSDUs to total TSDUs transferred across the TS boundary during a measurement period. The relationship among these quantities is defined for a particular TS user pair, as follows:

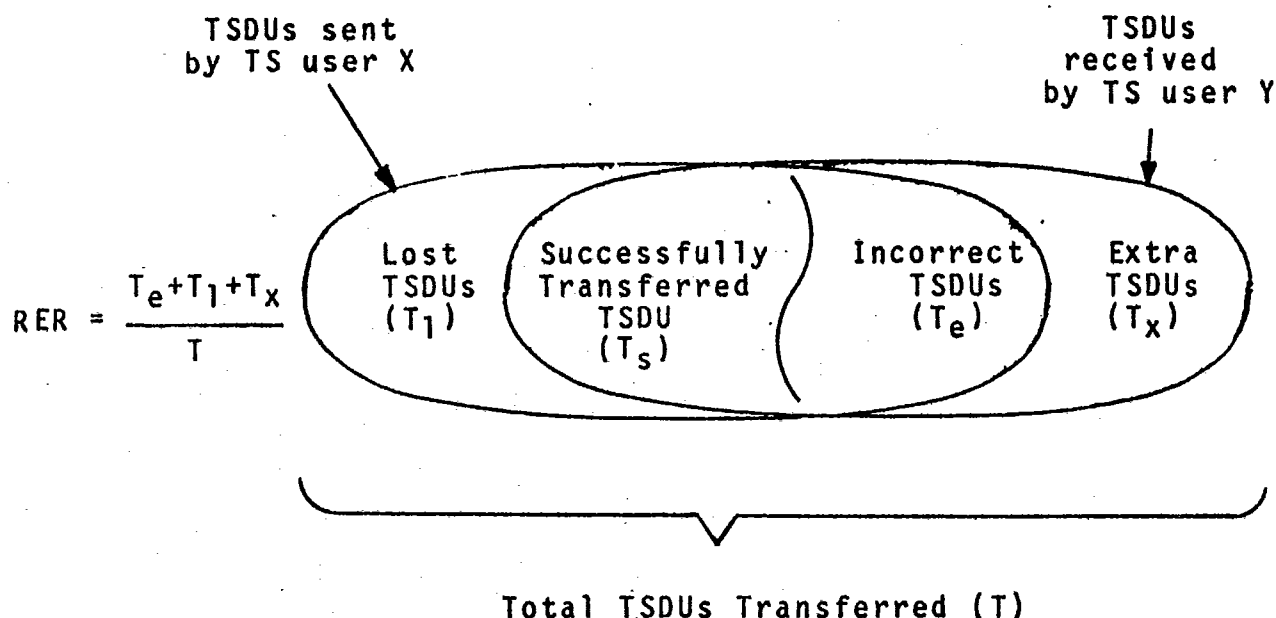


Figure 3 - Components of Residual Error Rate.

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10.6 Transfer Failure Probability

Transfer failure probability is the ratio of total transfer failures to total transfer samples observed during a performance measurement.

A transfer sample is a discrete observation of TS provider performance in transferring TSDUs between a specified sending and receiving TS user. A transfer sample begins on input of a selected TSDU at the sending TS user boundary, and continues until the outcome of a given number of TSDU transfer attempts has been determined. A transfer sample will normally correspond to the duration of an individual TC.

A transfer failure is a transfer sample in which the observed performance is worse than a specified minimum acceptable level. Transfer failures are identified by comparing the measured values for three supported performance parameters with specified transfer failure thresholds. The three supported performance parameters are throughput, transit delay, and residual error rate.

In systems where Transport Service QOS is reliably monitored by the TS provider, transfer failure probability can be estimated by the probability of a TS provider initiated release during a transfer sample.

10.7 TC Release Delay

TC release delay is the maximum acceptable delay between a TS user initiated T-DISCONNECT request and the successful release of the TC at the peer TS user. TC release delay is normally specified independently for each TS user. TC release delay does not apply in cases where release is initiated by the TS provider.

Issuance of a T-DISCONNECT request by either TS user starts the counting of TC release delay for the other user. Successful release is signalled to the TS user not initiating the T-DISCONNECT request by a T-DISCONNECT indication.

10.8 TC Release Failure Probability

TC release failure probability is the ratio of total TC release requests resulting in release failure to total release requests included in a measurement sample. TC release failure probability is normally specified independently for each TS user.

A release failure is defined to occur, for a particular TS user, if that user does not receive a T-DISCONNECT indication within the specified maximum TC release delay of the TS user issuing the T-DISCONNECT request (given that the former TS user has not itself issued a T-DISCONNECT request).

[ISO page 15]

10.9 TC Protection

TC protection is the extent to which a TS provider attempts to prevent unauthorized monitoring or manipulation of TS user originated information. TC protection is specified qualitatively by selecting one of four TC protection options:

- a) no protection features;
- b) protection against passive monitoring;
- c) protection against modification, replay, addition or deletion;
- d) both b and c.

10.10 TC Priority

The specification of TC Priority is concerned with the relationship between TCs. This parameter specifies the relative importance of a TC with respect to:

- a) the order in which TCs are to have their QOS degraded, if necessary and
- b) the order in which TCs are to be broken to recover resources, if necessary.

This parameter only has meaning in the context of some management entity or structure able to judge relative importance. The number of priority levels is limited.

10.11 Resilience of the TC

Probability of a TS provider initiated TC release (i.e. issuance of a T-DISCONNECT indication with no prior T-DISCONNECT request) during a specified time interval (e.g.: 1 sec).

SECTION TWO - DEFINITION OF PRIMITIVES

11 Sequence of Transport Service Primitives

This clause defines the constraints on the sequences in which the TS primitives may occur. The constraints determine the order in which TS primitives occur, but do not fully specify when they may occur. Other constraints, such as flow control of data, will affect the ability of a TS user or TS provider to issue a TS primitive at any particular time.

Clauses 12-14 describe the TS primitives which are associated with one of the three phases of a TC, establishment, data transfer, or release. A complete listing of TS primitives appears in table 3.

TABLE 3 - Transport Service Primitives

Phase	Service	Primitive	Parameters
TC establishment	TC establishment	T-CONNECT request	(Called Address, Calling Address, Expedited Data option, Quality of Service, TS User-Data)
		T-CONNECT indication	(Called Address, Calling Address, Expedited Data option, Quality of Service, TS User-Data)
		T-CONNECT response	(Quality of Service, Responding Address, Expedited Data option, TS User-Data)
		T-CONNECT confirm	(Quality of Service, Responding Address, Expedited Data option, TS User-Data)
Data transfer	Normal data transfer	T-DATA request	(TS User-Data)
		T-DATA indication	(TS User-Data)
	Expedited data transfer (1)	T-EXPEDITED-DATA request	(TS User-Data)
		T-EXPEDITED-DATA indication	(TS User-Data)
TC Release	TC Release	T-DISCONNECT request	(TS User-Data)
		T-DISCONNECT indication	(Disconnect Reason, TS User-Data)

(1) User Option: Provided only upon TS user request