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Information technology — Open Systems Interconnection — Distributed Transaction Processing —

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Part 2:

OSI TP Service

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Technologies de l'information — Interconnexion de systèmes ouverts (OSI) — Traitement transactionnel réparti

Partie 2: Service OSI TP

Reference number
ISO/IEC 10026-2:1996(E)

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Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) for 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.

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International Standard ISO/IEC 10026-2 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology,* Subcommittee SC 21, *Open Systems Interconnection, data management and open distributed processing.*

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This second edition cancels and replaces the first edition (ISO/IEC 10026-2:1992), which has been technically revised.

ISO/IEC 10026 consists of the following parts, under the general title *Information technology – Open Systems Interconnection – Distributed Transaction Processing:*

- *Part 1: OSI TP Model*
- *Part 2: OSI TP Service*
- *Part 3: Protocol specification*
- *Part 4: Protocol Implementation Conformance Statement (PICS) proforma*
- *Part 5: Application context proforma and guidelines when using OSI TP*
- *Part 6: Unstructured Data Transfer*
- *Part 7: Message queuing*

Annex A forms an integral part of this part of ISO/IEC 10026. Annex B is for information only.

Introduction

ISO/IEC 10026 is one of a set of 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 (ISO/IEC 7498-1). The Reference Model subdivides the area of standardization for interconnection into a series of layers of specification, each of manageable size.

The aim of Open Systems Interconnection is to allow, with a minimum of technical agreement outside the interconnection standards, the interconnection of computer systems

a) from different manufacturers;

b) under different management;

c) of different levels of complexity; and,

d) of different technologies.

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ISO/IEC 10026 defines an OSI TP Model, an OSI TP Service and specifies an OSI TP Protocol available within the Application Layer of the OSI Reference Model.

The OSI TP Service is an Application Layer service. It is concerned with information which can be related as transactions, which may involve two or more open systems.

This part of ISO/IEC 10026 defines a basic OSI TP Service. It provides sufficient facilities to support transaction processing, and establishes a framework for coordination across multiple TP resources in separate open systems.

ISO/IEC 10026 does not specify the interface to local resources or access facilities that are provided within the local system. However, future enhancement of the standard may deal with these issues.

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Part 2:

OSI TP Service

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1 Scope

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This part of ISO/IEC 10026 defines in an abstract way the Distributed Transaction Processing Service within the Application Layer in terms of

a) the actions and events of the service primitives;

b) the parameter data associated with each service primitive's action and event; and,

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

It does not specify individual implementations or products, nor does it constrain the implementation of entities or interfaces within a computer system.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO/IEC 10026. At the time of publication, the editions indicated were valid. All standards are subject to revision, and the parties to agreements based on this part of ISO/IEC 10026 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 7498-3:1989, *Information processing systems - Open Systems Interconnection - Basic Reference Model - Part 3: Naming and Addressing.*

ISO 8649:1988, *Information processing systems - Open Systems Interconnection - Service definition for the Association Control Service Element.*

ISO/IEC 10026-1:1992, *Information technology - Open Systems Interconnection - Distributed Transaction Processing - Part 1: OSI TP Model.*

ISO/IEC 10026-3:1996, *Information technology - Open Systems Interconnection - Distributed Transaction Processing - Part 3: Protocol specification.*

ISO/IEC 10731:1994, *Information technology - Open Systems Interconnection - Basic Reference Model - Conventions for the definition of OSI services.*

3 Definitions

For the purposes of this part of ISO/IEC 10026, the definitions of ISO/IEC 10026-1 and the following definitions apply.

3.1 dialogue establishment indication outstanding: A dialogue state in which a TP-BEGIN-DIALOGUE indication with the Confirmation parameter set to "always" has been issued but has not yet been responded to by a TP-BEGIN-DIALOGUE response.

3.2 dialogue establishment request outstanding: A dialogue state in which a TP-BEGIN-DIALOGUE request with the Confirmation parameter set to "always" has been issued but has not yet been responded to by a TP-BEGIN-DIALOGUE confirm.

3.3 dialogue termination indication outstanding: A dialogue state in which a TP-END-DIALOGUE indication with the Confirmation parameter set to "true" has been issued while there is no *user error request outstanding*, but has not yet been responded to by a TP-END-DIALOGUE response, or by a TP-U-ERROR request.

3.4 dialogue termination request outstanding: A dialogue state in which a TP-END-DIALOGUE request with the Confirmation parameter set to "true" has been issued, but has not yet been responded to by a TP-END-DIALOGUE confirm, or by a TP-U-ERROR indication.

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3.5 handshake indication outstanding: A dialogue state in which one of the following service primitives:

- TP-HANDSHAKE indication;
- TP-HANDSHAKE-AND-GRANT-CONTROL indication;

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has been issued while there is no *user error request outstanding*, but has not yet been responded to by one of the following service primitives (respectively):

- TP-HANDSHAKE response;
- TP-HANDSHAKE-AND-GRANT-CONTROL response;

or by a TP-U-ERROR request, or, if the coordination level of the dialogue is "commitment", by any *rollback-initiating service primitive*.

3.6 handshake request outstanding: A dialogue state in which one of the following service primitives:

- TP-HANDSHAKE request;
- TP-HANDSHAKE-AND-GRANT-CONTROL request;

has been issued, but has not yet been responded to by one of the following service primitives (respectively):

- TP-HANDSHAKE confirm;
- TP-HANDSHAKE-AND-GRANT-CONTROL confirm;

or by a TP-U-ERROR indication, or, if the coordination level of the dialogue is "commitment", by any *rollback-initiating service primitive*.

3.7 rollback-initiating indication: An indication or confirm that triggers a rollback; it is one of the following service primitives:

- TP-ROLLBACK indication;
- TP-U-ABORT indication with the Rollback parameter set to "true";
- TP-P-ABORT indication with the Rollback parameter set to "true";
- TP-BEGIN-DIALOGUE confirm with the Rollback parameter set to "true".

3.8 rollback-initiating request: A request that triggers a rollback; it is one of the following service primitives:

- TP-ROLLBACK request;
- TP-U-ABORT request for a dialogue with a coordination level of "commitment" not issued during the *termination phase of a transaction*.

3.9 rollback-initiating service primitive: A service primitive that triggers a rollback; it may be either a *rollback-initiating request* or a *rollback-initiating indication*.

3.10 subordinate dialogue: A dialogue with a subordinate.

3.11 subordinate subtree: A subtree of a subordinate.

3.12 superior dialogue: The dialogue with the superior.

3.13 termination phase of a transaction: The phase of a transaction between initiation of commitment or rollback and the end of the transaction.

This phase is entered, for a given TPSUI, upon issuance of a TP-COMMIT request or any *rollback-initiating service primitive*.

For a TPSUI which does not have a *dialogue establishment indication outstanding*, this phase is exited upon issuance of a TP-COMMIT-COMPLETE indication or a TP-ROLLBACK-COMPLETE indication.

For a TPSUI which does have a *dialogue establishment indication outstanding* when the termination phase is entered (this can only happen when a TP-ROLLBACK indication is issued), this phase is exited by a TP-BEGIN-DIALOGUE response with the Result parameter set to "rejected(user)" or by a TP-P-ABORT indication for the dialogue; if the dialogue is accepted during the termination phase, the termination phase is exited by the subsequent TP-ROLLBACK-COMPLETE indication.

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3.14 transaction tree constraint: A constraint that cannot be checked at a single node.

3.15 user error indication outstanding: A state of a dialogue with the Polarized Control functional unit selected. In this state, a TP-U-ERROR indication, issued while the recipient had control of the dialogue and has neither a *handshake request outstanding* nor a *dialogue termination request outstanding*, has not yet been responded to by a TP-GRANT-CONTROL request, or, if the coordination level of the dialogue is "commitment", by any *rollback-initiating service primitive*.

3.16 user error request outstanding: A state of a dialogue with the Polarized Control functional unit selected. In this state, a TP-U-ERROR request, issued without having control of the dialogue and without having either a *handshake indication outstanding* or a *dialogue termination indication outstanding*, has not yet been responded to by a TP-GRANT-CONTROL indication, a TP-HANDSHAKE indication, a TP-HANDSHAKE-AND-GRANT-CONTROL indication, a TP-END-DIALOGUE indication with the Confirmation parameter set to "true", or, if the coordination level of the dialogue is "commitment", by any *rollback-initiating service primitive*.

4 Abbreviations

Abbreviations used in this part of ISO/IEC 10026 are defined in ISO/IEC 10026-1 (OSI TP Model), except for the following which are used in some tables:

cnf	confirm service primitive;
ind	indication service primitive;
req	request service primitive;
rsp	response service primitive.

5 Conventions

5.1 Service conventions

This part of ISO/IEC 10026 defines services for Distributed Transaction Processing guided by the descriptive conventions defined in ISO/IEC 10731.

However, the terms "request" and "indication" are sometimes used in the following ways:

a) a single request may result in multiple indications (an example is that a single TP-COMMIT request may result in TP-PREPARE indications to each direct subordinate TPSUI);

b) several requests may result in a single indication (an example is that a single TP-COMMIT-COMPLETE indication may be issued to a superior TPSUI only after TP-DONE requests have been issued by this TPSUI and by all subordinate TPSUIs in the transaction tree);

c) the convention that a request primitive results in an indication primitive of the same name, is not always followed (for example, the issuance of a TP-COMMIT request will cause a TP-PREPARE indication to be issued).

NOTE - In this part of ISO/IEC 10026, requests and responses are described as being issued by the TPSUI whereas indications and confirms are described as being issued by the TPSP.

For a given primitive, the presence of each parameter is described by one of the following values:

blank:	not applicable;
M:	presence is mandatory;
U:	presence is a user option;
O:	presence is a provider option; and,
C:	presence is conditional.

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In addition the notation (=) indicates that a parameter value is semantically equal to the value of the parameter of the preceding primitive in the table.

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5.2 Usage of the term transaction

In this part of ISO/IEC 10026, the term "transaction" is used to denote a distributed provider-supported transaction.

5.3 Usage of italics for notations

In this part of ISO/IEC 10026, the following notations, defined in clause 3, appear in italics:

- *dialogue establishment indication outstanding;*
- *dialogue establishment request outstanding;*
- *dialogue termination indication outstanding;*
- *dialogue termination request outstanding;*
- *handshake indication outstanding;*
- *handshake request outstanding;*
- *rollback-initiating indication;*
- *rollback-initiating request;*
- *rollback-initiating service primitive;*
- *subordinate dialogue;*
- *subordinate subtree;*
- *superior dialogue;*
- *transaction tree constraint;*

- *termination phase of a transaction;*
- *user error indication outstanding;*
- *user error request outstanding.*

6 Overview of the OSI TP Service

The Distributed Transaction Processing Service and its supporting protocol are concerned with creating an environment in which two or more users may interact to

a) establish dialogues;

b) invoke services of specific user application service elements, subject to the constraints of the TPSP;

c) delimit provider-supported transactions;

d) coordinate work for application-supported transactions or provider-supported transactions;

e) prepare for commitment, and commit or rollback a provider-supported transaction;

f) heuristically place bound data either in the final or initial state;

g) report errors;

h) terminate dialogues allowing all resources allocated to these dialogues to be freed;

i) terminate dialogues abnormally;

j) synchronize processing by handshaking;

k) support chained or unchained sequences of provider-supported transaction branches for a dialogue.

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A node crash may result in the TPSP issuing certain TP service primitives more than once (i.e., TP-COMMIT indication, TP-ROLLBACK indication, and TP-HEURISTIC-REPORT indication). The TPSP and the TPSUI are both aware of the node crash through local means.

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7 Service facilities

7.1 Functional unit descriptions

The following functional units are defined:

a) **Dialogue**: the Dialogue functional unit supports the basic services required to establish a dialogue between two TPSUIs within which U-ASE primitives may be invoked, signal user-initiated errors and terminate the dialogue. The user or the provider may signal abnormal termination;

b) **Shared Control**: the Shared Control functional unit supports both TPSUIs having control of the dialogue at the same time and allows them to issue request primitives subject only to the normal sequencing constraints of the primitives. For example, data may be transferred by both TPSUIs at the same time;

c) **Polarized Control**: the Polarized Control functional unit allows only one TPSUI to have control of the dialogue at any point in time. Many request primitives may be issued only by the TPSUI which has control of the dialogue. This restriction is in addition to the normal sequencing constraints for the primitives. For example, a handshake may only be requested by the TPSUI which has control of the dialogue;

d) **Handshake**: the Handshake functional unit allows the TPSUIs to synchronize their processing with one another;

e) **Commit**: the Commit functional unit allows reliable commitment and rollback of transactions;

f) **Chained Transactions**: the Chained Transactions functional unit supports coordination of both TPSUIs with a chained sequence of transaction branches. The coordination level of the dialogue will always be "commitment". The subordinate TPSUI will always be a participant in the same transaction as the superior TPSUI;

g) **Unchained Transactions**: the Unchained Transactions functional unit supports coordination of both TPSUIs with an unchained sequence of transaction branches. The superior determines when the coordination level of the dialogue is "commitment". At a given point in time, the two TPSUIs may be participants in the same transaction, in different transactions, or one or both TPSUIs may not be involved in a transaction.

The Dialogue functional unit shall always be selected.

For a given dialogue, the Shared Control and Polarized Control functional units are mutually exclusive. One and only one of these two functional units shall be selected.

For a given dialogue, the Chained Transactions and Unchained Transactions functional units are mutually exclusive. If the Commit functional unit is selected, one and only one of them shall be selected. If the Commit functional unit is not selected, neither one shall be selected.

7.2 Services contained in functional units

Table 1 lists the functional units and the associated services.

Table 1 - Functional units and their services

Functional Unit	Services
Dialogue	TP-BEGIN-DIALOGUE TP-END-DIALOGUE * TP-U-ERROR TP-U-ABORT TP-P-ABORT
Shared Control	(no associated services)
Polarized Control	TP-GRANT-CONTROL TP-REQUEST-CONTROL
Handshake	TP-HANDSHAKE TP-HANDSHAKE-AND-GRANT-CONTROL **
Commit	TP-DEFERRED-END-DIALOGUE TP-DEFERRED-GRANT-CONTROL ** TP-PREPARE TP-READY TP-COMMIT TP-DONE TP-COMMIT-COMPLETE TP-ROLLBACK TP-ROLLBACK-COMPLETE TP-HEURISTIC-REPORT
Chained Transactions	(no associated services)
Unchained Transactions	TP-BEGIN-TRANSACTION
* This service shall not be used if the Chained Transactions functional unit is selected. ** This service may be used only if the Polarized Control functional unit is also selected.	

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7.3 Service for modelling data transfer

Table 2 shows the service for modelling data transfer.

Table 2 - Service for modelling data transfer

Data Transfer	TP-DATA

TP-DATA is not a service in the normal sense. It represents the capability of a TPSUI to invoke specific U-ASE services on a dialogue, constrained by the TPSP.

7.4 Structure of service descriptions

7.4.1 "Purpose" subclause

The "Purpose" subclause describes, in a few words, the purpose of the service.

7.4.2 "Service and parameters" subclause

The "Service and parameters" subclause describes the service primitives and their parameters.

The constraints or conditions on the presence or values of these parameters are described in this subclause.

7.4.3 "Sequences of primitives" subclause

The "Sequence of primitives" subclause is included for certain services; it shows the relationship in time between the service request and the resulting indication, and, if applicable, the subsequent response and the resulting confirm.

7.4.4 "TPSUI conditions" subclause

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The "TPSUI conditions" subclause applies to certain requests and responses only; it specifies prerequisites for the respective request or response to be issued by the TPSUI. TPSUI conditions cannot be monitored by the TPSP, nevertheless it is vital for orderly cooperation of the TPSUI and for atomicity that they are obeyed.

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TPSUI conditions include

- the state of bound data;
- the success of synchronization.

7.4.5 "TPSP constraints" subclause

The "TPSP constraints" subclause applies to all service primitives. For request and response service primitives, it specifies prerequisites for issuance by the TPSUI that are enforced by the TPSP. For indication and confirm service primitives, it specifies constraints on the issuance of the service primitives by the TPSP. Constraints on the values of parameters for service primitives are described separately in the "Service and parameters" subclause for each service.

In general, the constraints are based on information associated with the state of the TPSUI at the time the service primitive is issued. Constraints for service primitives that are associated with a particular dialogue relate only to that dialogue unless the constraints explicitly reference other dialogues or attributes that are not related to a particular dialogue.

Information on which constraints are based includes

- functional units selected for a dialogue;
- superior or subordinate status;
- control of the dialogue;
- coordination level;
- state of bound data;
- transaction state;
- sequence of service primitives and associated parameter values.

7.4.6 "Effects of a service primitive" subclause

The "Effects of a service primitive" subclause describes any effects on the characteristics of the dialogue or the transaction resulting from the issuance of a service primitive.

Effects include

- initiating or terminating the dialogue or the transaction;
- control of the dialogue;
- superior or subordinate status;
- change of the coordination level;
- issuance of resulting service primitives.

NOTE - Effects of a service primitive on certain lower layers facilities (e.g. Session tokens) are described in ISO/IEC 10026-3.

7.4.7 "Collisions" subclause

There is a collision of two requests if the requests have been issued:

- on opposite sides of the same dialogue; and
- before the indication resulting from the request issued on the other side is either issued or suppressed.

The "Collisions" subclause describes any effects on a service request or response caused by collision with a service primitive issued by the partner TPSUI.

In general, the effects of a collision involving a particular service are described in the "Collisions" subclause for that service.

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These effects include

- suppression of an indication;
- generation of a different indication.

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7.5 Effects of dialogue termination

Whenever a dialogue is terminated for a particular TPSUI, no further service primitives are issued to the TPSUI for the dialogue, except TP-HEURISTIC-REPORT indication, which may be issued during the *termination phase of the transaction*.

For a particular TPSUI, a dialogue is terminated by one of the following service primitives:

- TP-END-DIALOGUE request with the Confirmation parameter set to "false";
- TP-END-DIALOGUE indication with the Confirmation parameter set to "false";
- TP-END-DIALOGUE response;
- TP-END-DIALOGUE confirm;
- TP-BEGIN-DIALOGUE response with the Result parameter set to "rejected(user)";
- TP-BEGIN-DIALOGUE confirm with the Result parameter set to "rejected(provider)" or "rejected(user)";
- TP-U-ABORT request;
- TP-U-ABORT indication;
- TP-P-ABORT indication;
- TP-COMMIT-COMPLETE indication when a TP-DEFERRED-END-DIALOGUE request or indication has been issued.

Suppression of subsequent service primitives is not described in the collisions subclauses.

8 Service primitives and their parameters

The OSI TP Service is invoked using a sequence of OSI TP service primitives.

Table 3 lists

a) the service primitives of the OSI TP Service;

b) for each service primitive, whether the service primitive is associated with a particular dialogue or with the TPSUI as a whole;

c) the subclause in which the service primitive is described; and,

d) the parameters associated with each service.

Blanks in the parameters column indicates that the service primitive has no parameters.

Table 3 - OSI TP service primitives

Services	Primitives	Scope	Subclause	Parameters
TP-BEGIN-DIALOGUE	req/ind/rsp/cnf	Dialogue	10.2	Initiating-AP-Title Initiating-API-Identifier Initiating-AE-Qualifier Initiating-AEI-Identifier Initiating-TPSU-Title Recipient-AP-Title Recipient-API-Identifier Recipient-AE-Qualifier Recipient-AEI-Identifier Recipient-TPSU-Title Functional-Units Quality-of-Service Application-Context-Name Begin-Transaction Confirmation Result Diagnostic Rollback User-Data
TP-END-DIALOGUE	req/ind/rsp/cnf	Dialogue	10.3	Confirmation
TP-U-ERROR	req/ind	Dialogue	10.4	
TP-U-ABORT	req/ind	Dialogue	10.5	Rollback User-Data
TP-P-ABORT	ind	Dialogue	10.6	Diagnostic Rollback
TP-GRANT-CONTROL	req/ind	Dialogue	12.2	
TP-REQUEST-CONTROL	req/ind	Dialogue	12.3	
TP-HANDSHAKE	req/ind/rsp/cnf	Dialogue	13.2	Confirmation-Urgency
TP-HANDSHAKE-AND-GRANT-CONTROL	req/ind/rsp/cnf	Dialogue	13.3	Confirmation-Urgency
TP-BEGIN-TRANSACTION	req/ind	Dialogue	14.5	
TP-DEFERRED-END-DIALOGUE	req/ind	Dialogue	14.6	
TP-DEFERRED-GRANT-CONTROL	req/ind	Dialogue	14.7	
TP-PREPARE	req	Dialogue	14.8	Data-Permitted
TP-PREPARE	ind	Dialogue	14.9	Data-Permitted
TP-READY	ind	Dialogue	14.10	
TP-COMMIT	req	TPSUI	14.11	
TP-COMMIT	ind	TPSUI	14.12	

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