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Part 2:
OSI TP Service

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Partie 2: Service OSI TP

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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 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.*

This third edition cancels and replaces the second edition (ISO/IEC 10026-2:1996), which has been technically revised.

This part of ISO/IEC 10026 is technically aligned with ITU-T Recommendation X.861, but is not published as identical text.

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*

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.

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 distributed transactions, which 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.

Information technology — Open Systems Interconnection — Distributed Transaction Processing —

Part 2:

OSI TP Service

1 Scope

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 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/IEC 7498-1:1994, *Information technology - Open Systems Interconnection - Basic Reference Model: The Basic Model.*

ISO/IEC 7498-3:1997, *Information technology - Open Systems Interconnection - Basic Reference Model: Naming and addressing.*

ISO/IEC 8649:1996, *Information technology - Open Systems Interconnection - Service definition for the Association Control Service Element.*

ISO/IEC 10026-1:1998, *Information technology - Open Systems Interconnection - Distributed Transaction Processing - Part 1: OSI TP Model*.

ISO/IEC 10026-3:1998, *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 given in 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.

3.5 exclusive branch: A transaction branch on which one of the following is true:

- the dialogue is with the superior, *ready can be sent*, and either:
  - *ready can not be received*; or
  - there is *tree checking* at the node;
- the dialogue is with a subordinate, *ready can be sent*, *ready can not be received*, and either:
  - the Read-only functional unit is not selected and the Early-exit functional unit is not selected; or
  - there is *tree checking* at the node; or
- the dialogue is with a subordinate and the coordination level is "one-phase commitment" and either:
  - the Read-only functional unit is not selected and the Early-exit functional unit is not selected; or
  - there is *tree checking* at the node;

and if the Unchained Transactions functional unit is selected, none of the following service primitives have been issued during the current transaction: TP-READY indication, TP-READ-ONLY indication, TP-ONE-PHASE indication, or TP-EARLY-EXIT indication.

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

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

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 dialogue is coordinated*, by a TP-EARLY-EXIT request or a TP-EARLY-EXIT indication or any *rollback-initiating service primitive*.

3.7 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 dialogue is coordinated*, by a TP-EARLY-EXIT request or a TP-EARLY-EXIT indication or any *rollback-initiating service primitive*.

3.8 ready can be received (on a branch) if the branch is with a superior and *superior can send ready* on the branch, or the branch is with a subordinate and *subordinate can send ready* on the branch.

3.9 ready can be sent (on a branch) if the branch is with the superior and *subordinate can send ready* on the branch or the branch is with a subordinate and *superior can send ready* on the branch.

3.10 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".

3.11 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 *coordinated dialogue* not issued during the *termination phase of a transaction* and neither a TP-READ-ONLY indication nor a TP-EARLY-EXIT indication has been issued for the dialogue.

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

3.13 static one-phase exclusive branch: An *exclusive branch* on which the coordination level is “one-phase commitment”.

NOTE - this is only defined for a branch to a subordinate.

3.14 subordinate dialogue: A dialogue with a subordinate.

3.15 subordinate can send ready (on a branch) if the branch is with a subordinate and the Commit functional unit is selected and the Dynamic Commit functional unit is not selected, or the Dynamic Commit functional unit is selected and the Subordinate-may-send-ready parameter of TP-BEGIN-DIALOGUE request was set to "true".

3.16 subordinate subtree: A subtree of a subordinate.

3.17 superior can send ready (on a branch) if the branch is with the superior and the Dynamic Commit functional unit is selected and the Superior-may-send-ready parameter of TP-BEGIN-DIALOGUE indication was set to "true".

3.18 superior dialogue: The dialogue with the superior.

3.19 termination phase of a transaction; termination phase: 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 *transaction completion request* or a TP-EARLY-EXIT 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-UNKNOWN-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.

3.20 TPSUI owes a TP-DONE request: This obligation is created by the issuing of certain indications and confirmations during termination of a transaction; the TPSUI must issue a TP-DONE request before the transaction can be completed.

3.21 transaction completion request: A service request which triggers completion (rather than rollback) of a transaction; it is one of the following service primitives:

- TP-COMMIT request;
- TP-READ-ONLY request;
- TP-ONE-PHASE request.

3.22 transaction subordinate: A TPSUI which is the subordinate for a *coordinated dialogue*.

3.23 transaction superior: A TPSUI which is the superior for one or more *coordinated dialogues.*

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

3.25 tree checking: There is tree checking at a node if there is a transaction branch from the superior on which either:

- *ready can be sent* and *ready can be received* and the Check-ready-directions parameter of the TP-BEGIN-DIALOGUE indication or the TP-BEGIN-TRANSACTION indication for the current transaction was absent or set to "true"; or

- *ready can be sent*, and *ready can not be received*.

There may also be tree checking at a node (including at a root node) as the result of a local decision.

NOTE - this would typically occur as the result of configuration information on a real open system.

3.26 two-phase expected branch: A transaction branch on a *coordinated dialogue* with a subordinate, on which *ready can be received* and either:

- none of the One-phase, Read-only, and Early-exit functional units are selected; or

- the Unchained Transactions functional unit is selected, there is *tree checking* at the node, and none of the following service primitives have been issued during the current transaction: TP-ONE-PHASE indication, TP-READ-ONLY indication, or TP-EARLY-EXIT indication.

3.27 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 dialogue is coordinated*, by a TP-EARLY-EXIT request or a TP-EARLY-EXIT indication or any *rollback-initiating service primitive*.

3.28 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 dialogue is coordinated*, by a TP-EARLY-EXIT request or a TP-EARLY-EXIT indication or 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 may 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.

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.

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 or in 10026-1, appear in italics:

- *commitment hinterland;*
- *coordinated dialogue; dialogue is coordinated;*
- *dialogue establishment indication outstanding;*
- *dialogue establishment request outstanding;*
- *dialogue termination indication outstanding;*
- *dialogue termination request outstanding;*
- *exclusive branch;*
- *handshake indication outstanding;*
- *handshake request outstanding;*
- *ready can be received;*
- *ready can be sent;*
- *rollback-initiating indication;*
- *rollback-initiating request;*
- *rollback-initiating service primitive;*
- *static one-phase exclusive branch;*
- *subordinate can send ready;*
- *subordinate dialogue;*
- *subordinate subtree;*
- *superior can send ready;*
- *superior dialogue;*
- *termination phase [of a transaction];*
- *there is tree checking;*
- *TPSUI owes a TP-DONE request;*
- *transaction completion request;*
- *transaction hinterland;*
- *transaction subordinate;*
- *transaction superior;*
- *transaction tree constraint;*
- *two-phase expected branch;*
- *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 roll back 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.

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.

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" or "one-phase 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" or "one-phase 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;

h) **Dynamic Commit**: the Dynamic Commit functional unit allows the reliable commitment of a transaction to be organised in a way which is not limited by the orientation of the supporting dialogue tree;

i) **Unchecked Tree:** the Unchecked Tree functional unit allows the suppression of TPSP checks on the construction of transaction trees when the Dynamic Commit functional unit is selected;

j) **Implicit Prepare:** the Implicit Prepare functional unit allows the signal that the transaction is to be completed to be carried in application semantics such that an explicit TP service indication may not be required;

k) **Read-only:** the Read-only functional unit allows a TPSUI which has completed processing of all work related to a transaction to request that it withdraw from participation in the transaction if it has not modified its bound data;

l) **Early-exit**: the Early-exit functional unit allows a TPSUI to indicate that it is unable to contribute to the work of a transaction, its bound data has not been modified, and that the TPSUI has no preference as to whether the transaction commits or is rolled back;

m) **One-phase Commit:** the One-phase Commit functional unit allows a TPSUI that has no requirement for reliable reporting of the outcome of a transaction to request one-phase termination of that transaction;

n) **Completion Diagnostics:** the Completion Diagnostics functional unit allows a TPSUI to signal information related to the completion of a transaction to its superior TPSUI in the transaction tree, including the severity and reason for a rollback request;

o) **Heuristic Containment Required:** the Heuristic Containment Required functional unit allows a TPSUI to require its subordinate to contain heuristic conditions; as a result the TPSUI will not receive heuristic reports from the subordinate.

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 One-phase Commit functional unit may be selected alone (static one-phase commit) or together with both of the Commit and Dynamic Commit functional units (dynamic one-phase commitment).

For a given dialogue, the Chained Transactions and Unchained Transactions functional units are mutually exclusive. If either or both of the Commit or One-phase Commit functional units are selected, one and only one of the Chained Transactions and Unchained Transactions functional units shall be selected. If neither the Commit nor the One-phase Commit functional unit is selected, neither one of the Chained Transactions or Unchained Transactions functional units shall be selected.

For a given dialogue, if the Commit functional unit is selected, then one or more of the following functional units may also be selected in any combination: Implicit Prepare, Read-only, Early-exit, Completion Diagnostics, Heuristic Containment Required.

For a given dialogue, if the One-phase Commit functional unit is selected and the Commit functional unit is not selected, then one or more of the following functional units may also be selected in any combination: Implicit Prepare, Read-only, Early-exit, Completion Diagnostics, Heuristic Containment Required.

For a given dialogue, only if the Commit and Unchained Transactions functional units are selected may the Dynamic Commit functional unit be selected. If the Dynamic Commit functional unit is selected, then the Unchecked Tree functional unit may also be selected.

NOTE - There are multi-dialogue constraints on functional units, which apply when transaction branches are created by TP-BEGIN-DIALOGUE request or TP-BEGIN-TRANSACTION request. For example, the static one-phase commit capability may be selected for a subordinate transaction branch only if there is no superior transaction branch. Such constraints are defined in the descriptions of the relevant services.

With the rules given above the following dialogue types are valid:

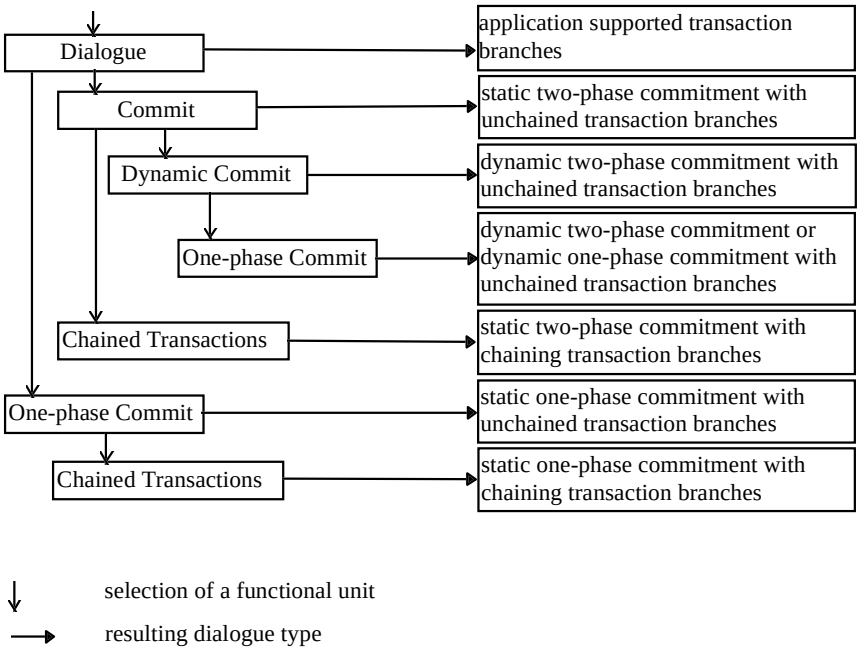

Figure 1 - Combination of functional units and resulting dialogue types

The dialogue functional unit must always be selected. Then, following one of the vertical arrows, if any, means that the selection process is continued. If the selection process stops (i.e. there is no further choice or one chooses not to proceed), then the resulting dialogue type is given on the right hand side.

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
Dynamic Commit	(no associated services)
Unchecked Tree	(no associated services)
Implicit Prepare	(no associated services)
Read-only	TP-READ-ONLY TP-UNKNOWN TP-UNKNOWN-COMPLETE
Early-exit	TP-EARLY-EXIT TP-UNKNOWN TP-UNKNOWN-COMPLETE
One-phase Commit	TP-DEFERRED-END-DIALOGUE TP-DEFERRED-GRANT-CONTROL ** TP-PREPARE TP-COMMIT*** TP-DONE TP-COMMIT-COMPLETE TP-ROLLBACK TP-ROLLBACK-COMPLETE TP-HEURISTIC-REPORT TP-ONE-PHASE TP-UNKNOWN TP-UNKNOWN-COMPLETE
Completion Diagnostics	TP-COMPLETION-REPORT
Heuristic Containment Required	(no associated services)