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DATA NETWORKS AND OPEN SYSTEM COMMUNICATIONS

OSI MANAGEMENT

INFORMATION TECHNOLOGY – OPEN SYSTEMS INTERCONNECTION – APPLICATION CONTEXT FOR SYSTEMS MANAGEMENT WITH TRANSACTION PROCESSING

ITU-T Recommendation X.702

(Previously “CCITT Recommendation”)

FOREWORD

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NOTE

In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized private operating agency.

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DATA NETWORKS AND OPEN SYSTEM COMMUNICATIONS

(February 1994)

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Summary

This Recommendation | International Standard provides an application context for an association in the systems management environment. The application context provides a basic Systems Management context with Transaction Processing (see X.860-Series) defining the rules for association and interaction of TP with CMIS. This application context will provides a basis for synchronized operations across network elements in a TMN environment and may be part of a family of contexts as additional requirements are defined for Systems Management.

INTERNATIONAL STANDARD

ITU-T RECOMMENDATION

INFORMATION TECHNOLOGY – OPEN SYSTEMS INTERCONNECTION – APPLICATION CONTEXT FOR SYSTEMS MANAGEMENT WITH TRANSACTION PROCESSING

1 Scope

The application context, defined in this Recommendation | International Standard, is available for an association in the systems management environment. The application context provides a basic Systems Management context with TP and may be part of a family of contexts as additional requirements are defined for systems management.

The application context, defined in this Recommendation | International Standard, satisfies the following requirements:

- support for grouping CMIS requests so that consistency constraints can be satisfied by coordinated changes that, if done individually, would not satisfy the constraints, without requiring provisions for rollback or recovery; and
- support for atomic synchronization of a set of CMIS requests with provisions for commitment, rollback, and recovery so that either all the CMIS requests are satisfactorily performed or none are performed.

2 Normative references

The following Recommendations and International Standards contain provisions which, through reference in this text, constitute provisions of this Recommendation | International Standard. At the time of publication, the editions indicated were valid. All Recommendations and Standards are subject to revision, and parties to agreements based on this Recommendation | International Standard are encouraged to investigate the possibility of applying the most recent edition of the Recommendations and Standards listed below. Members of IEC and ISO maintain registers of currently valid International Standards. The Telecommunication Standardization Bureau of the ITU maintains a list of currently valid ITU-T Recommendations.

2.1 Identical Recommendations | International Standards

- ITU-T Recommendation X.207 (1993) | ISO/IEC 9545:1994, *Information technology – Open Systems Interconnection – Application Layer structure*.
- CCITT Recommendation X.701 (1992) | ISO/IEC 10040:1992, *Information technology – Open Systems Interconnection – Systems management overview*.

  NOTE – The Systems management overview defines a systems management application context which is adequate when only SMASE and CMISE facilities are needed.
- ITU-T Recommendation X.851 (1993) | ISO/IEC 9804:1994, *Information technology – Open Systems Interconnection – Service definition for the commitment, concurrency and recovery service element*.
- ITU-T Recommendation X.852 (1993) | ISO/IEC 9805-1:1994, *Information technology – Open Systems Interconnection – Protocol for the commitment, concurrency and recovery service element*: *Protocol specification.*

2.2 Paired Recommendations | International Standards equivalent in technical content

- CCITT Recommendation X.208 (1988), *Specification of Abstract Syntax Notation One (ASN.1)*.

  ISO/IEC 8824:1990, *Information technology – Open Systems Interconnection – Specification of Abstract Syntax Notation One (ASN.1)*.
- CCITT Recommendation X.209 (1988), *Specification of basic encoding rules for Abstract Syntax Notation One (ASN.1)*.

ISO/IEC 8825:1990, *Information technology – Open Systems Interconnection – Specification of Basic Encoding Rules for Abstract Syntax Notation One (ASN.1)*.

– CCITT Recommendation X.217 (1992), *Service definition for the Association Control Service Element*.

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

– CCITT Recommendation X.219 (1988), *Remote Operations: Model, notation and service definition*.

  ISO/IEC 9072-1:1989, *Information processing systems – Text communication – Remote Operations – Part 1: Model, notation and service definition*.

– CCITT Recommendation X.227 (1992), *Association Control Protocol Specification for Open Systems Interconnection for CCITT Applications*.

  ISO 8650:1988, *Information processing systems – Open Systems Interconnection – Protocol specification for the Association Control Service Element*.

– CCITT Recommendation X.229 (1988), *Remote operations: Protocol specification*.

  ISO/IEC 9072-2:1989, *Information processing systems – Text communication – Remote Operations – Part 2: Protocol specification*.

– CCITT Recommendation X.710 (1991), *Common management information service definition for CCITT applications*.

  ISO/IEC 9595:1991, *Information technology – Open Systems Interconnection – Common management information service definition*.

– CCITT Recommendation X.711 (1991), *Common management information protocol specification for CCITT applications*.

  ISO/IEC 9596-1:1991, *Information technology – Open Systems Interconnection – Common management information protocol – Part 1: Specification*.

– CCITT Recommendation X.860 (1992), *Open Systems Interconnection – Distributed Transaction Processing: Model*.

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

– CCITT Recommendation X.861 (1992), *Open Systems Interconnection – Distributed Transaction Processing: Service definition*.

  ISO/IEC 10026-2:1992, *Information technology – Open Systems Interconnection – Distributed Transaction Processing – Part 2: OSI TP Service*.

– ITU-T Recommendation X.862 (1993), *Open Systems Interconnection – Distributed Transaction Processing: Protocol specification*.

  ISO/IEC 10026-3:1992, *Information technology – Open Systems Interconnection – Distributed Transaction Processing – Part 3: Protocol specification*.

2.3 Additional references

– ISO/IEC 10026-5:...[1)], *Information technology – Open Systems Interconnection – Distributed Transaction Processing – Part 5: Application context proforma and guidelines when using OSI TP*.

3 Abbreviations

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

ACSE	Association Control Service Element (see CCITT Rec. X.217 | ISO 8649 and CCITT Rec. X.227 | ISO 8650)
AEI	Application Entity Invocation
APDU	Application Protocol Data Unit
ASE	Application Service Element
ASN.1	Abstract Syntax Notation One (see CCITT Rec. X.208 | ISO/IEC 8824)

1) To be published.

ASO	Application Service Object
BER	Basic Encoding Rules (see CCITT Rec. X.209 | ISO/IEC 8825)
CCR	Commitment Concurrency and Recovery (see ISO/IEC 9804-1 and 9805-1)
CMIP	Common Management Information Protocol (see CCITT Rec. X.711 | ISO/IEC 9596-1)
CMIS	Common Management Information Service (see CCITT Rec. X.710 | ISO/IEC 9595)
CMISE	Common Management Information Service Element (see CCITT Rec. X.710 | ISO/IEC 9595 and CCITT Rec. X.711 | ISO/IEC 9596-1)
ISP	International Standard Profile
MACF	Multiple Association Control Function
MIS	Management Information Service
OSI	Open Systems Interconnection
RO	Remote Operations (see CCITT Rec. X.219 | ISO/IEC 9072-1 and CCITT Rec. X.229 | ISO/IEC 9072-2)
ROSE	Remote Operations Service Element (see CCITT Rec. X.219 | ISO/IEC 9072-1 and CCITT Rec. X.229 | ISO/IEC 9072-2)
SACF	Single Association Control Function
SMAE	Systems Management Application Entity
SMASE	Systems Management Application Service Element
SMFU	Systems Management Functional Unit
SMO	Systems Management Overview (see CCITT Rec. X.701 | ISO/IEC 10040)
TP	Transaction Processing (see CCITT and ITU-T Recs. X.860/861/862 | ISO/IEC 10026)
TPASE	Transaction Processing Application Service Element
TPSU	Transaction Processing Service User
TPSUI	Transaction Processing Service User Invocation
TPSP	Transaction Processing Service Provider

4 Application context name

The Application Context Name of the application context, defined in this Recommendation | International Standard, shall have the following object identifier value:

{joint-iso-ccitt(2) ms(9) applicationContext(4) systems-management-with-tp(3) version1(0)}

and an object descriptor of:

“Systems management application context with TP Version 1”

5 Component ASEs and ASOs

The application context, defined in this Recommendation | International Standard, consists of the following ASEs:

5.1 ACSE

Reference	CCITT Rec. X.217 | ISO 8649 and CCITT Rec. X.227 | ISO 8650
Version number	1
Brief Description	Association Control Service Element

5.2 ROSE

Reference	CCITT Rec. X.219 | ISO/IEC 9072-1 and CCITT Rec. X.229 | ISO/IEC 9072-2
Version number	1
Brief Description	Remote Operations Service Element
NOTE – ROSE versions are specified indirectly as part of CMISE.	

5.3 CMISE

Reference	CCITT Rec. X.710 | ISO/IEC 9595 and CCITT Rec. X.711 | ISO/IEC 9596-1
Version number	2
Brief Description	Common Management Information Service Element

5.4 SMASE

Reference	CCITT Rec. X.701 | ISO/IEC 10040 (SMO)
Version number	1 (of SMASE UserData)
Brief Description	Systems Management Application Service Element

5.5 TPASE

Reference	CCITT and ITU-T Recs. X.860/861/862 | ISO/IEC 10026
Version number	1
Brief Description	Transaction Processing Application Service Element

5.6 CCR

Reference	ISO/IEC 9804-1 and 9805-1
Version number	2
Brief Description	Commitment Concurrency and Recovery
NOTE – CCR is used only when required by the functional units of TP selected on a dialogue.	

6 Persistent application context rules

Rules that concern information that has a lifetime that is greater than the lifetime of an association apply to the application context, defined in this Recommendation | International Standard, and are specified in ITU-T Rec. X.862 | ISO/IEC 10026-3.

7 Control function (SACF/MACF) rules

Besides the rules already specified in the standards for the component ASEs, the rules of this clause apply to the application context, defined in this Recommendation | International Standard. This includes the rules for the determination of the common set of SMFUs as specified in CCITT Rec. X.701 | ISO/IEC 10040.

7.1 Objectives/summary

SMASE provides service to the user of the Systems Management Application Entity (SMAE); that user is also both an MIS user and a Transaction Processing Service User (TPSU). SMASE uses CMISE which, in turn, uses ROSE. The SMAE includes the MACF that supports TP. The SACF provides the management association services to the SMAE and uses ACSE.

SMASE, CMISE, and ROSE share a single abstract syntax that is defined in CMIP.

Presentation services that cannot be shared (such as Resynchronize) are used only by TPASE, CCR, and ACSE. CCR services are used only through TP services. ROSE services are used only through CMIS.

The TP Dialogue functional unit and the CMIS kernel functional unit are always available.

NOTE – The services actually used within the CMIS kernel depend on the needs of the CMIS user and may be a subset of the CMIS kernel services.

In the application context, defined in this Recommendation | International Standard, any interaction can be attempted, but an attempt to use an interaction not supported by both management systems shall result in an error. If an unsupported interaction is attempted, the following error values, as defined in CMIS (see CCITT Rec. X.710 | ISO/IEC 9595), shall be used to report the failure of the interaction:

- "unrecognized operation: The operation is not one of those agreed between the CMISE-service-users", if the attempted interaction was an operation.
- "no such event type: The event type specified was not recognized", if the attempted interaction was a notification.

Requests made with coordination level of "none" are neither blocked nor synchronized. All CMISE requests (such as M-GET requests) that are requested with coordination level of "commitment" (that is, within a transaction) shall make the specified management information bound data.

7.2 Temporal ordering rules

The TP service models any user-ASE service primitive as TP-DATA. SMASE, CMISE, and ROSE are user-ASEs as documented in CCITT Rec. X.861 | ISO/IEC 10026-2 and the TP Service Provider (TPSP) constraints on TP-DATA request and on TP-DATA indication apply to each SMASE, CMISE, and ROSE request/response and indication/confirm.

NOTE 1 – RO-REJECT-U and RO-ERROR requests and indications are modelled as TP-DATA requests and indications and do not cause TP-initiated rollback. It is the user's decision whether such requests or indications justify rollback.

ACSE service indications and confirms shall be made visible through the SACF to both CMISE and TP simultaneously, so each ASE can process them.

When a TP-HANDSHAKE indication is received, if there are any remaining responses to be sent, they must be sent before sending the TP-HANDSHAKE response.

After the subordinate receives a TP-PREPARE indication, if responses to CMIS requests are outstanding and the subordinate is not permitted to send data, then the subordinate makes a TP-ROLLBACK request.

NOTE 2 – Usually, the agent should not initiate rollback when it has no knowledge of the scope of the transaction (i.e. the agent does not know if the manager can get what it needs to complete the transaction successfully from some other agent), when it can report its failures via CMISE responses. However, there are cases where the agent will need to initiate rollback (e.g. internal error, deadlock resolution), or knows enough about the transaction to initiate rollback itself rather than reporting failure to the manager who in turn initiates rollback.

The A-RELEASE service is not used in the middle of a dialogue. Association release can only occur when the SACF is in the TP SACF FREE state. Associations shall be kept in a pool as described in ITU-T Rec. X.862 | ISO/IEC 10026-3, and released according to a local decision. Therefore, a request by a CMISE service user to release the association will not necessarily be heeded.

CMISE use of an association without TP may take place if the association is withdrawn from the TP pool of associations. When CMISE is finished with the association, it may re-introduce the association into the pool.

7.3 Concatenation rules

Concatenation rules of TP are optionally used for sending when TP is in use; the concatenation rules are mandatory for receiving. SMASE/CMISE/ROSE APDUs are treated as user-ASE APDUs.

7.4 References to base standard rules

CCITT Rec. X.227 | ISO 8650, CCITT Rec. X.711 | ISO/IEC 9596-1, and ITU-T Rec. X.862 | ISO/IEC 10026-3 apply to the application context, defined in this Recommendation | International Standard.

7.5 Other rules

CMISE and SMASE functional units are negotiated as described in SMO, A.3.2. The A-ASSOCIATE User information includes:

- CMIPUserInfo;
- SMASEUserData;
- TP-INITIALIZE RI/RC APDU;
- C-INITIALIZE RI/RC APDU.

The A-ABORT User information may include:

- CMIPAbortInfo;
- TP-ABORT RI APDU.

M-EVENT-REPORT primitives related to a transaction should not be sent outside the boundaries of the transaction.

NOTES

1 M-EVENT-REPORT primitives inside transactions have the status of “possible” notifications because the reported occurrence has not occurred if the transaction completes by rollback.

2 M-EVENT-REPORT primitives generated outside a transaction should not be sent on any of the dialogues for that transaction because of effects described in Note 1.

The CMIS Synchronization parameter has the same meaning within a transaction as outside a transaction.

8 Optional features

The application context, defined in this Recommendation | International Standard, permits the support of any valid combination of TP, CMISE, and SMASE functional units.

9 Error handling

Whenever a violation of rules and constraints of the application context, defined in this Recommendation | International Standard, is detected, an A-ABORT request shall be made with the value of the Abort source parameter set to “CMISE-service-provider”.

10 Conformance

An open system claiming conformance with the systems management with transaction processing application context shall comply with the following static and dynamic requirements in addition to those specified in the component ASE standards.

Static conformance

The open system shall support the transfer syntax derived from the encoding rules specified in CCITT Rec. X.209 | ISO/IEC 8825 and the set of encoding rules named {joint-iso-ccitt(2) asn1(1) basic-encoding(1)} for interpreting:

- the User-data parameter in the TP-BEGIN-DIALOGUE RI/RC APDUs;
- the User information parameter in the A-ASSOCIATE APDUs; and
- the User information parameter in the A-ABORT APDUs,

with abstract syntax defined in these modules:

- {joint-iso-ccitt(2) ms(9) smo(0) negotiationAbstractSyntax(1) version(1)} in SMO, A.3.4;
- {joint-iso-ccitt(2) ms(9) cmip(1) modules(0) aAssociateUserInfo(1)} in CMIP, 7.3.1;
- {joint-iso-ccitt(2) ms(9) cmip(1) modules(0) aAbortUserInfo(2)} in CMIP, 7.3.2;
- {joint-iso-ccitt(2) transaction-processing(10) modules(1) apdus-abstract-syntax(1) version1(0)} in TP protocol, 12.1; and
- {joint-iso-ccitt(2) ccr(7) module(1) ccr-apdus(1) version2(2)} in CCR protocol, A.3.

Dynamic conformance

The open system shall support the application service elements and protocol implications of the rules defined in this Recommendation | International Standard.

Annex A

Commentaries

(This annex does not form an integral part of this Recommendation | International Standard)

This informative annex lists questions posed by National Bodies during the development of this Recommendation | International Standard and records the approved commentary that has been agreed to resolve each question.

A.1 Should the use of deadlock timeouts be specified? Should any deadlock detection or avoidance mechanism be specified?

The TP Model, in Annex B, states “local deadlock detection via timers, an 'imprecise' mechanism, is assumed.” The use of timeouts is a local matter. However:

– It is difficult, if not impossible, to find an optimal timeout value:

  • a short timeout has a consequence that many processes are rolled back when they only had some delay in processing;

  • a long timeout has a consequence that delays increase and more TPSUs become blocked on resources during this period.

  An optimal timeout period maximizes the throughput. It is however very likely this period is changing during the transaction.

– TPSUIs which wait for each other can execute a timeout at the same time. This can be prevented by choosing the timeout period randomly within certain limits.

– This does not prevent the possibility of cyclic restarts by ever returning deadlock situations.

An ISP may specify the timeout algorithm to be used.

A.2 Should an application context that includes TP satisfy requirements (like the blocking of a group of CMIS requests) that do not require provisions for rollback and recovery?

Adequate provisions have been made by the rules defined for TP-HANDSHAKE in 7.2.

A.3 How are collisions avoided between CMIP APDUs and TP-BEGIN-DIALOGUE RI/RC APDUs?

While the association is in a pool of associations that TP can use, CMISE is prohibited from using the association without TP even when association is in TP SACF FREE state. (Refer to 7.2.)

A.4 When is CMIPAbortInfo provided in A-ABORT User information? May the abortSource value of cmiseServiceProvider be used when the source is not CMISE (for example, when the source is SACF)?

If the MIS user (the TPSU) initiates the abort, the details of CMIPAbortInfo are per CMISE specifications. If the abort is because of a violation of these rules, then the Abort source parameter shall have the value “CMISE-service-provider”. (Refer to clause 9.)

A.5 What is the meaning of M-EVENT-REPORT inside transactions?

An M-EVENT-REPORT inside a transaction is subject to the ACID properties of a transaction. (Refer to 7.5.)

A.6 When should the agent be allowed to initiate rollback? Should the agent defer the decision to rollback to the manager whenever possible?

Usually, the agent should not initiate rollback when it has no knowledge of the scope of the transaction (i.e. the agent does not know if the manager can get what it needs to complete the transaction successfully from some other agent), when it can report its failures via CMISE responses. However, there are cases where the agent will need to initiate rollback (e.g. internal error, deadlock resolution), or knows enough about the transaction to initiate rollback itself rather than reporting failure to the manager who in turn initiates rollback. (Refer to 7.2.)

A.7 What combinations of TP functional units are required for support of the application context to be claimed?

This is determined by negotiation, conformance, and ISPs, and not in the application context. (Refer to clause 8.)

A.8 Is Chained Transaction functional unit or Unchained Transaction functional unit required with the TP Commit functional unit?

See question A.7.

A.9 Is A-ABORT the appropriate response to a SACF rule violation? When something "below" the MACF (like the SACF) is responsible for terminating the association, do MACF rules describe or model this? If so, how?

A-ABORT is an appropriate response to any rule violation. (Refer to clause 9.)

A.10 Should Polarized Control or Shared Control or both be specified?

See question A.7.

A.11 Is there a requirement for a dialogue superior to have both manager and agent roles in a single dialogue?

Yes, there are recognized requirements for such dual roles. Rules to satisfy restrictions on role reversal have been copied from SMO to 7.1.

A.12 If, after the agent receives a TP-PREPARE indication, responses to CMIS requests are outstanding and the agent is not permitted to send data, should the agent make a TP-ROLLBACK request?

Yes, there is some problem with the applications if the manager enters the termination phase of the transaction not allowing outstanding requests to be answered. (Refer to 7.2.)

A.13 Is it necessary to have diagnostic reasons for rollback? If so, is it necessary that the reason for the rollback be propagated up the transaction tree? What form should that reason take? How far up the transaction tree should it be propagated?

Diagnostic reasons for rollback are not necessary because the use of TP has not precluded the use of normal management facilities such as alarms and logs.

A.14 Are long-term or nested transactions supported?

Support for long-term transactions and for nested transactions has not been explicitly included in the application context, defined in this Recommendation | International Standard, since such support has yet to be standardized by the transaction processing group of SC 21/WG 8.

A.15 Is the application context, defined in this Recommendation | International Standard, restricted to use with a single version of each of the component ASEs or can later versions be "compatible"?

It is possible for later versions of ASEs to be compatible with earlier versions but how this is achieved is beyond the scope of this Recommendation | International Standard.

Annex B

Scenarios

(This annex does not form an integral part of this Recommendation | International Standard)

These are informative examples of the use of TP functional units.

B.1 Example use of Handshake and Shared Control functional units

This combination of TP functional units, together with systems management functional units, provides support for grouping CMIS requests so that consistency constraints may be satisfied by coordinated changes that, if done individually, would not satisfy the constraints, without requiring provisions for rollback or recovery.

The manager initiates the dialogue, sends a group of CMIS requests, and then sends a TP-HANDSHAKE request to show the end of the group.

The agent processes CMIS requests that it identifies as unconstrained (e.g. all M-GET requests) as they arrive but defers processing other requests until it receives a TP-HANDSHAKE indication. When a TP-HANDSHAKE indication is received, deferred CMIS requests are processed. The agent may decide (application rule) to issue a TP-HANDSHAKE request to one or more subordinates and not send a TP-HANDSHAKE response until all TP-HANDSHAKE confirmations have been received. After performing all deferred CMIS requests, the agent sends the TP-HANDSHAKE response.

After receiving the TP-HANDSHAKE confirm, the manager may send another group of CMIS requests.

B.2 Example use of Commit functional unit for provider-supported transactions

This combination of TP functional units, together with systems management functional units, provides support for atomic synchronization of a set of CMIS requests with provisions for rollback and recovery so that either all CMIS requests are satisfactorily performed or none are performed.

The manager initiates the dialogue with Begin-Transaction = “true” (or with chained transaction functional unit selected), sends a group of CMIS requests, receives all responses to all requests, and then makes either a TP-COMMIT or a TP-ROLLBACK request (depending on whether the responses received were satisfactory).

When an agent receives a CMIS request within a transaction, it makes any managed objects affected by the CMIS requests part of the bound data of the transaction (i.e. it becomes isolated), responds to the CMIS requests, and waits for the manager to determine if the transaction commits or rolls back. In performing the requested operations, the agent may request that subordinate agents perform operations for it. When the agent receives a TP-PREPARE indication, it makes sure all bound data is “ready for commitment” and, if so, makes a TP-COMMIT request; otherwise it makes a TP-ROLLBACK request.

If any subordinate has rolled back or if the manager decides not to commit, the transaction is rolled back; otherwise the transaction is committed. After the transaction has terminated, another transaction may be initiated with a TP-BEGIN-TRANSACTION request (or automatically when the chained transaction functional unit is selected).

B.3 Another example use of Commit functional unit for provider-supported transactions

This combination of TP functional units, together with systems management functional units, provides support for atomic synchronization of a set of CMIS requests with provisions for rollback and recovery so that either all CMIS requests are satisfactorily performed or none are performed. The criteria of satisfaction in this example are determined by the manager.

The manager initiates the dialogue with Begin-Transaction = “true”, sends a group of CMIS requests, and then sends a TP-PREPARE request to show the end of the group.

To reduce the period while resources are “ready for commitment” or to reduce the number of blocked M-GET requests from outside the transaction, the agent may defer processing CMIS requests until it receives a TP-PREPARE indication. When a TP-PREPARE indication is received, if the agent is also a transaction branch superior, the agent propagates the TP-PREPARE request to all of its subordinates. When a TP-PREPARE indication is received and all subordinates are ready and all responses from subordinates have been satisfactory, the agent prepares responses to the CMIS requests and sends the responses to the manager as though the transaction were committed and makes all managed objects affected by the CMIS requests “ready for commitment” (the manager may decide whether to commit or rollback) and then makes a TP-COMMIT request. If the agent was not able to do this, for example a subordinate rolled back, the agent rolls back all managed objects affected by the CMIS requests (returns them to their “initial” state before this transaction) and then makes a TP-ROLLBACK request.

When all the manager’s subordinates are ready, the manager may determine, after examining all the responses to its CMIS requests, whether to commit or rollback the transaction. If a subordinate has rolled back or if the manager decides not to commit, the manager makes a TP-ROLLBACK request; otherwise, the manager makes a TP-COMMIT request. After the transaction has terminated, another transaction may be initiated with a TP-BEGIN-TRANSACTION request.