INTERNATIONAL STANDARD

ISO/IEC 10026-3

Second edition
1996-08-01

Information technology — Open Systems Interconnection — Distributed Transaction Processing —

Part 3: Protocol specification

Technologies de l'information — Interconnexion de systèmes ouverts (OSI) — Traitement transactionnel réparti —
Partie 3: Spécification du protocole

Reference number
ISO/IEC 10026-3:1996(E)

Contents

Foreword xiii

Introduction xiv

1 Scope 1

2 Normative references 2

3 Definitions 3

4 Abbreviations 3

5 Conventions 3

6 Model of the PM 4
6.1 Overview 4
6.1.1 Principles of association usage 4
6.1.2 Dialogue establishment 5
6.1.3 Channel management 6
6.1.4 Channel utilization 6
6.1.5 Token control 7
6.1.6 Concatenation/separation 7
6.1.7 Embedding 8
6.2 OSI TP Protocol structure 8
6.2.1 Components of the PM 8
6.2.1.1 The TPPM 10
6.2.1.2 The CPM 11

7 Execution Rules 11
7.1 Operation of the PM 11
7.1.1 Relationship of SAO(s) to MACF(s) 11
7.1.2 Input events to the PM 12
7.1.3 Action sequences 12
7.1.4 SACF queuing 12
7.1.5 Input event blocking at the PSAP 13
7.1.6 PM error conditions 13
7.2 Procedure rules 14
7.3 Definitions 16
7.4 Log records used by the PM 21
7.4.1 Log-ready record 21
7.4.2 Log-commit record 22
7.4.3 Log-heuristic record 22
7.4.4 Log-damage record 22
7.5 Recovery-context-handle 22

8 Use of ACSE, CCR and the Presentation Layer 23
8.1 Introduction 23
8.2 Use of ACSE Service primitives 23
8.2.1 Use of the A-ASSOCIATE parameters 23
8.2.2 Use of the A-RELEASE parameters 24
8.2.3 Use of the A-ABORT and A-P-ABORT parameters 24
8.3 Use of CCR Service primitives 25
8.4 Use of the Presentation Layer 26

8.4.1 Use of Presentation Service primitives 26
8.4.2 Mapping of C-ROLLBACK-RI to Presentation 27
8.5 Association Management 27
8.5.1 Introduction 27
8.5.2 Association/dialogue compatibility 27
8.5.3 Association/channel compatibility 27
8.5.4 Initiating an association establishment 28
8.5.5 Receiving an association establishment indication 29
8.5.6 Responding to association establishment 29
8.5.7 Receiving confirmation of association establishment 30
8.5.8 Initiating an association release 31
8.5.9 Aborting an association 31

9 TP-ASE description 31
9.1 Introduction 31
9.2 AF Service Definition 32
9.2.1 AF-BEGIN-DIALOGUE 32
9.2.2 AF-BID 32
9.2.3 AF-END-DIALOGUE 32
9.2.4 AF-U-ERROR 32
9.2.5 AF-ABORT 33
9.2.6 AF-GRANT-CONTROL 33
9.2.7 AF-REQUEST-CONTROL 33
9.2.8 AF-HANDSHAKE 33
9.2.9 AF-HANDSHAKE-AND-GRANT-CONTROL 33
9.2.10 AF-DEFER 33
9.2.11 AF-PREPARE 33
9.2.12 AF-HEURISTIC-REPORT 33
9.2.13 AF-ABORT-AND-HEURISTIC-REPORT 34
9.2.14 AF-RECOVER 34
9.2.15 AF-TOKEN-GIVE 34
9.2.16 AF-TOKEN-PLEASE 34
9.3 AF-Services and TP APDUs: parameters and field mappings 34
9.3.1 AF-BEGIN-DIALOGUE request/indication/response/confirm, TP-BEGIN-DIALOGUE-RI/-RC APDU 34
9.3.2 AF-BID request/indication/response/ confirm, TP-BID-RI/-RC APDU 37
9.3.3 AF-END-DIALOGUE request/ indication/response/confirm, TP-END-DIALOGUE-RI/-RC APDU 37
9.3.4 AF-U-ERROR request/indication/ response/confirm, TP-U-ERROR-RI/-RC APDU 38
9.3.5 AF-ABORT request/indication, TP-ABORT-RI APDU 38
9.3.6 AF-GRANT-CONTROL request/ indication, TP-GRANT-CONTROL-RI APDU 39
9.3.7 AF-REQUEST-CONTROL request/ indication, TP-REQUEST-CONTROL-RI APDU 39
9.3.8 AF-HANDSHAKE request/indication/ response/confirm, TP-HANDSHAKE-RI/-RC APDU 39
9.3.9 AF-HANDSHAKE-AND-GRANT-CONTROL request/indication/response confirm, TP-HANDSHAKE-AND-GRANT-CONTROL-RI/-RC APDU 40
9.3.10 AF-DEFER request/indication, TP-DEFER-RI APDU 40
9.3.11 AF-PREPARE request/indication, TP-PREPARE-RI APDU 40
9.3.12 AF-HEURISTIC-REPORT request/ indication, TP-HEURISTIC-REPORT-RI APDU 41
9.3.13 AF-ABORT-AND-HEURISTIC-REPORT request/indication 41
9.3.14 AF-RECOVER request/indication, TP-RECOVER-RI APDU 42
9.3.15 AF-TOKEN-GIVE request/indication, TP-TOKEN-GIVE-RI APDU 42
9.3.16 AF-TOKEN-PLEASE request/ indication, TP-TOKEN-PLEASE-RI APDU 43
9.4 Procedures 43

9.4.1 AF-BEGIN-DIALOGUE request 43
9.4.2 TP-BEGIN-DIALOGUE-RI TP APDU 43
9.4.3 AF-BEGIN-DIALOGUE response 44
9.4.4 TP-BEGIN-DIALOGUE-RC TP APDU 44
9.4.5 AF-BID request 44
9.4.6 TP-BID-RI TP APDU 44
9.4.7 AF-BID response 44
9.4.8 TP-BID-RC TP APDU 44
9.4.9 AF-END-DIALOGUE request 44
9.4.10 TP-END-DIALOGUE-RI TP APDU 44
9.4.11 AF-END-DIALOGUE response 44
9.4.12 TP-END-DIALOGUE-RC TP APDU 44
9.4.13 AF-U-ERROR request 44
9.4.14 TP-U-ERROR-RI TP APDU 44
9.4.15 AF-U-ERROR response 44
9.4.16 TP-U-ERROR-RC TP APDU 45
9.4.17 AF-ABORT request 45
9.4.18 TP-ABORT-RI TP APDU 45
9.4.19 AF-GRANT-CONTROL request 45
9.4.20 TP-GRANT-CONTROL-RI TP APDU 45
9.4.21 AF-REQUEST-CONTROL request 45
9.4.22 TP-REQUEST-CONTROL-RI TP APDU 45
9.4.23 AF-HANDSHAKE request 45
9.4.24 TP-HANDSHAKE-RI TP APDU 45
9.4.25 AF-HANDSHAKE response 45
9.4.26 TP-HANDSHAKE-RC TP APDU 45
9.4.27 AF-HANDSHAKE-AND-GRANT-CONTROL request 45
9.4.28 TP-HANDSHAKE-AND-GRANT-CONTROL-RI TP APDU 45
9.4.29 AF-HANDSHAKE-AND-GRANT-CONTROL response 46
9.4.30 TP-HANDSHAKE-AND-GRANT-CONTROL-RC TP APDU 46
9.4.31 AF-DEFER request 46
9.4.32 TP-DEFER-RI TP APDU 46
9.4.33 AF-PREPARE request 46
9.4.34 C-PREPARE indication 46
9.4.35 AF-HEURISTIC-REPORT request 46
9.4.36 AF-ABORT-AND-HEURISTIC-REPORT request 46
9.4.37 AF-RECOVER request 46
9.4.38 C-RECOVER indication 46
9.4.39 A-ABORT indication 46
9.4.40 C-ROLLBACK indication 47
9.4.41 C-ROLLBACK confirm 47
9.4.42 C-COMMIT indication 47
9.4.43 C-COMMIT confirm 47
9.4.44 C-RECOVER confirm 48
9.4.45 P-TOKEN-GIVE (sync-minor) indication 48
9.4.46 AF-TOKEN-GIVE request 48
9.4.47 P-TOKEN-PLEASE (sync-minor) indication 48
9.4.48 AF-TOKEN-PLEASE request 48
9.5 Mapping 48

10 SACF description 49
10.1 Introduction 49
10.2 SACF states 50
10.3 Service definitions for SAF-DETACH-ASSOCIATION and SAF-ASSOCIATION-LOST 51
10.3.1 SAF-DETACH-ASSOCIATION request 51
10.3.2 SAF-ASSOCIATION-LOST indication 52
10.4 Procedure for SAF-DETACH-ASSOCIATION request 52

10.5 Procedures for TP-ASE, CCR, ACSE, and Presentation Service Primitives 53
10.5.1 AF-BEGIN-DIALOGUE request 53
10.5.2 AF-BEGIN-DIALOGUE indication 54
10.5.3 AF-BEGIN-DIALOGUE response 55
10.5.4 AF-BEGIN-DIALOGUE confirm 56
10.5.5 AF-BID indication 56
10.5.6 AF-BID confirm 57
10.5.7 AF-END-DIALOGUE request 57
10.5.8 AF-END-DIALOGUE indication 58
10.5.9 AF-END-DIALOGUE confirm 58
10.5.10 AF-U-ERROR request 58
10.5.11 AF-U-ERROR indication 58
10.5.12 AF-U-ERROR confirm 58
10.5.13 AF-ABORT request 59
10.5.14 AF-ABORT (provider, abortRI) indication 59
10.5.15 AF-ABORT (user, dataRI) indication 59
10.5.16 A-ABORT request 59
10.5.17 A-RELEASE (Result=affirmative) response 60
10.5.18 A-[P-]ABORT indication or A-RELEASE (Result=affirmative) confirm 60
10.5.19 AF-GRANT-CONTROL request 60
10.5.20 AF-GRANT-CONTROL indication 60
10.5.21 AF-REQUEST-CONTROL request 60
10.5.22 AF-REQUEST-CONTROL indication 60
10.5.23 AF-HANDSHAKE request 61
10.5.24 AF-HANDSHAKE indication 61
10.5.25 AF-HANDSHAKE confirm 61
10.5.26 AF-HANDSHAKE-AND-GRANT-CONTROL request 61
10.5.27 AF-HANDSHAKE-AND-GRANT-CONTROL indication 61
10.5.28 AF-HANDSHAKE-AND-GRANT-CONTROL confirm 62
10.5.29 AF-DEFER request 62
10.5.30 AF-DEFER indication 62
10.5.31 AF-PREPARE request 62
10.5.32 AF-PREPARE indication 62
10.5.33 AF-HEURISTIC-REPORT (commitRC) indication, or AF-HEURISTIC-REPORT (recoverDoneRC) indication 62
10.5.34 C-BEGIN request 62
10.5.35 C-BEGIN indication 63
10.5.36 C-BEGIN confirm 63
10.5.37 C-READY indication 64
10.5.38 C-COMMIT indication or C-COMMIT+C-BEGIN indication 64
10.5.39 AF-ABORT (user, commitRI) indication or AF-ABORT (user, commitRC) indication 64
10.5.40 C-COMMIT confirm 64
10.5.41 AF-ABORT-AND-HEURISTIC-REPORT (commitRC) indication 64
10.5.42 C-ROLLBACK request 64
10.5.43 C-ROLLBACK indication 64
10.5.44 AF-ABORT-AND-HEURISTIC-REPORT request or AF-HEURISTIC-REPORT request 65
10.5.45 AF-ABORT (rollbackRI) indication, AF-ABORT-AND-HEURISTIC-REPORT (rollbackRI) indication, or AF-HEURISTIC-REPORT (rollbackRI) indication 66
10.5.46 C-ROLLBACK confirm, AF-HEURISTIC-REPORT (rollbackRC) indication, AF-ABORT (user/provider, rollbackRC) indication or AF-ABORT-AND-HEURISTIC-REPORT (rollbackRC) indication 66
10.5.47 AF-RECOVER indication 67
10.5.48 C-RECOVER request or AF-RECOVER request 67
10.5.49 C-RECOVER indication 67

10.5.50 C-RECOVER confirm 67
10.5.51 U-ASE request 67
10.5.52 U-ASE indication 67
10.5.53 AF-TOKEN-GIVE (regular) indication 68
10.5.54 AF-TOKEN-GIVE (keep) indication 69
10.5.55 AF-TOKEN-GIVE (two-way-recovery) request 69
10.5.56 AF-TOKEN-GIVE (two-way-recovery) indication 69
10.5.57 P-TOKEN-GIVE (sync-minor) indication 70
10.5.58 AF-TOKEN-PLEASE request 70
10.5.59 AF-TOKEN-PLEASE indication 70
10.5.60 P-TOKEN-PLEASE indication 71
10.5.61 Protocol error 71
10.5.62 Other service primitives 71
10.6 SACF internal events 71
10.6.1 Unsolicited BID reject 71
10.7 Concatenation 72
10.7.1 Mapping precedence 72
10.7.2 Concatenation rules 72
10.8 Routeing 74

11 MACF description 74
11.1 Introduction 74
11.2 CAF service definition 74
11.2.1 CAF-PLEASE request 74
11.2.2 CAF-GIVE indication 75
11.2.3 CAF-FAIL indication 76
11.2.4 CAF-DETACH request 76
11.2.5 CAF-RECOVER indication 76
11.3 Main procedures 77
11.3.1 TP-BEGIN-DIALOGUE request 77
11.3.2 AF-BEGIN-DIALOGUE indication (TPPM and CPM) 78
11.3.3 TP-BEGIN-DIALOGUE response 79
11.3.4 AF-BEGIN-DIALOGUE (accepted) confirm on a Dialogue 80
11.3.5 AF-BEGIN-DIALOGUE (rejected, dataRI) confirm on a Dialogue 81
11.3.6 AF-BEGIN-DIALOGUE (rejected(user), rollbackRI) confirm 82
11.3.7 AF-BEGIN-DIALOGUE (rejected(user), rollbackRC) confirm 82
11.3.8 AF-BEGIN-DIALOGUE confirm (CPM) 83
11.3.9 SAF-ASSOCIATION-LOST indication 83
11.3.10 SAF-ASSOCIATION-LOST indication (CPM) 84
11.3.11 TP-END-DIALOGUE request 84
11.3.12 AF-END-DIALOGUE indication 85
11.3.13 AF-END-DIALOGUE indication (CPM) 87
11.3.14 TP-END-DIALOGUE response 87
11.3.15 AF-END-DIALOGUE confirm 87
11.3.16 TP-U-ERROR request 87
11.3.17 AF-U-ERROR indication 87
11.3.18 AF-U-ERROR confirm 88
11.3.19 TP-U-ABORT request 88
11.3.20 AF-ABORT (user, dataRI) indication 90
11.3.21 Protocol error, internal error, A[-P]-ABORT indication, AF-ABORT (provider, abortRI) indication, A-ABORT request, A-RELEASE (Result=affirmative) response, or A-RELEASE (Result=affirmative) confirm on a dialogue 91
11.3.22 Protocol error, internal error, A[-P]-ABORT indication, AF-ABORT (provider, abortRI) indication, A-ABORT request, A-RELEASE (Result=affirmative) response, or A-RELEASE (Result=affirmative) confirm on a channel 93

11.3.23 Protocol error, internal error, A[-P]-ABORT indication, AF-ABORT (provider, abortRI) indication, A-RELEASE (Result=affirmative) response, or A-RELEASE (Result=affirmative) confirm (CPM) 94
11.3.24 TP-GRANT-CONTROL request 94
11.3.25 AF-GRANT-CONTROL indication 94
11.3.26 TP-REQUEST-CONTROL request 94
11.3.27 AF-REQUEST-CONTROL indication 95
11.3.28 TP-HANDSHAKE request 95
11.3.29 AF-HANDSHAKE indication 95
11.3.30 TP-HANDSHAKE response 96
11.3.31 AF-HANDSHAKE confirm 96
11.3.32 TP-HANDSHAKE-AND-GRANT-CONTROL request 96
11.3.33 AF-HANDSHAKE-AND-GRANT-CONTROL indication 96
11.3.34 TP-HANDSHAKE-AND-GRANT-CONTROL response 96
11.3.35 AF-HANDSHAKE-AND-GRANT-CONTROL confirm 97
11.3.36 TP-BEGIN-TRANSACTION request 97
11.3.37 C-BEGIN indication 97
11.3.38 C-BEGIN confirm 98
11.3.39 TP-DATA request 98
11.3.40 U-ASE indication 99
11.3.41 TP-DEFERRED-END-DIALOGUE request 99
11.3.42 TP-DEFERRED-GRANT-CONTROL request 99
11.3.43 AF-DEFER indication 99
11.3.44 TP-PREPARE request 100
11.3.45 TP-COMMIT request 100
11.3.46 AF-PREPARE indication 101
11.3.47 C-READY indication 101
11.3.48 C-COMMIT indication or C-COMMIT+C-BEGIN indication 101
11.3.49 AF-ABORT (user, commitRI) indication 102
11.3.50 TP-DONE request 102
11.3.51 C-COMMIT confirm or AF-HEURISTIC-REPORT (commitRC) indication 103
11.3.52 AF-ABORT (user, commitRC) indication or AF-ABORT-AND-HEURISTIC-REPORT (commitRC) indication 104
11.3.53 TP-ROLLBACK request 104
11.3.54 C-ROLLBACK indication or AF-HEURISTIC-REPORT (rollbackRI) indication 104
11.3.55 AF-ABORT (user/provider, rollbackRI) indication or AF-ABORT-AND-HEURISTIC-REPORT (rollbackRI) indication 105
11.3.56 C-ROLLBACK confirm or AF-HEURISTIC-REPORT (rollbackRC) indication 107
11.3.57 AF-ABORT (user/provider, rollbackRC) indication or AF-ABORT-AND-HEURISTIC-REPORT (rollbackRC) indication 108
11.3.58 CAF-RECOVER (ready) indication 109
11.3.59 C-RECOVER (ready) indication or AF-RECOVER (ready) indication (CPM) 111
11.3.60 CAF-RECOVER (commit) indication 111
11.3.61 C-RECOVER (commit) indication 113
11.3.62 C-RECOVER (commit) indication or AF-RECOVER (commit) indication (CPM) 113
11.3.63 C-RECOVER (done) confirm or AF-HEURISTIC-REPORT (recoverDoneRC) indication 114
11.3.64 C-RECOVER (unknown) confirm 114
11.3.65 C-RECOVER (unknown) confirm (CPM) 114
11.3.66 C-RECOVER (retry-later) confirm 114
11.3.67 C-RECOVER (retry-later) confirm (CPM) 114
11.3.68 AF-TOKEN-GIVE (two-way-recovery) indication on a channel (TPPM) 115
11.3.69 AF-TOKEN-GIVE (two-way-recovery) indication (CPM) 115
11.3.70 AF-TOKEN-PLEASE indication on a channel (TPPM) 115
11.3.71 AF-TOKEN-PLEASE indication (CPM) 115

11.3.72 CAF-PLEASE request (CPM) 115
11.3.73 CAF-GIVE indication 116
11.3.74 CAF-FAIL indication 117
11.3.75 CAF-DETACH request (CPM) 117
11.4 Internal event procedures 117
11.4.1 Delay recovery 117
11.4.2 Heuristic damage compensation for subtree 117
11.4.3 Restart after node crash (CPM) 118
11.4.4 Retry recovery 118
11.4.5 Taking a heuristic decision 118
11.4.6 Terminating a channel (CPM) 119
11.4.7 TPPM creation after node crash 119
11.4.8 TPPM-initiated rollback 119
11.5 Common Procedures 119
11.5.1 Completing commitment 119
11.5.2 Entering READY state 122
11.5.3 Fail an outstanding CAF-PLEASE request 123
11.5.4 First request/response 123
11.5.5 Initiating a transaction branch 124
11.5.6 Initiating rollback at TPPM 124
11.5.7 Initiating transaction after rollback 126
11.5.8 Making commitment decision 127
11.5.9 Receiving commit order 128
11.5.10 Recording the heuristic condition 128
11.5.11 Reporting rollback to superior 129
11.5.12 Rollback next transaction 131
11.5.13 Sending commit order 132

12 Structure and encoding of TP APDUs 133
12.1 Abstract syntax of the TP-ASE APDUs 133
12.2 Rules of extensibility 138

13 Conformance 138
13.1 Static conformance requirements 138
13.1.1 Conformance classes 138
13.1.1.1 General requirements 138
13.1.1.2 Application transaction branches class 138
13.1.1.3 Chained provider-supported transaction branches class 138
13.1.1.4 Unchained provider-supported transaction branches class 139
13.1.2 Capabilities 139
13.1.2.1 General capabilities 139
13.1.2.2 Constraints 140
13.1.3 Functional units 140
13.1.3.1 Definition 140
13.1.3.2 Description of recovery functional unit 140
13.1.3.3 Requirements on TP APDUs 140
13.1.4 Dependencies on other standards 142
13.2 Dynamic conformance requirements 143
13.2.1 General requirements 143
13.2.2 Specific requirements 143
13.3 Protocol Implementation Conformance Statement 143
13.4 Receiving TP APDUs 143

14 Compliance 143

15 Precedence statement 144

16 Index of Actions and Events 145

Annexes

A OSI TP protocol — State tables 150
A.1 General 150
A.2 Introduction 150
A.2.1 State tables 150
A.2.2 PM state machines 150
A.2.2.1 PM instance 150
A.2.2.2 TPPM 150
A.2.2.3 CPM 151
A.2.3 Events 151
A.2.4 States 152
A.2.5 Variables and predicates 154
A.2.6 Actions 155
A.2.7 Notation 155
A.2.8 Conventions 156
A.2.9 Processing of events 157
A.2.9.1 Evaluating predicate expressions 157
A.2.9.2 Processing valid events 157
A.2.9.3 Processing invalid events 157
A.3 Processing rules 157
A.4 MACF state tables 159
A.4.1 MACF states 159
A.4.1.1 TPPM States 159
A.4.1.2 CPM states 162
A.4.2 MACF variables 163
A.4.2.1 Overview 163
A.4.2.2 Definitions of MACF types 166
A.4.2.3 Definitions of MACF variables 166
A.4.2.4 Initialization of MACF variables 171
A.4.3 MACF events 171
A.4.3.1 Internal events 171
A.4.3.2 Synchronizing events 172
A.4.4 MACF actions 173
A.4.4.1 Functions 173
A.4.4.2 Actions on services 174
A.4.4.3 Actions on variables 178
A.4.4.4 Actions with free-form names 178
A.4.4.5 Actions after node crash 190
A.5 TPASE 191
A.5.1 TPASE states 191
A.5.2 TPASE variables 191
A.5.3 TPASE events 191
A.5.4 TPASE actions 191
A.6 SACF 193
A.6.1 SACF states 193
A.6.2 SACF variables 194
A.6.2.1 Overview 194
A.6.2.2 Definitions of SACF variables 195
A.6.2.3 Initialization of SACF variables 196
A.6.3 SACF events 197
A.6.3.1 Internal events 197
A.6.3.2 Synchronizing events 197
A.6.4 SACF actions 197
A.6.4.1 Actions on services 197
A.6.4.2 Actions on variables 198

A.6.4.3 Actions with free-form names 198
A.6.5 Notational conventions 200
A.7 Predicates 200

B Requirements for writing U-ASEs and application contexts 350

C Scenarios 351
C.1 Introduction 351
C.1.1 Scenarios with a single dialogue (successful cases) 351
C.1.2 Scenarios with a single dialogue (unsuccessful cases) 352
C.1.3 Scenarios with a single dialogue (failure case) 353
C.1.4 Collision scenarios on a single dialogue 353
C.1.5 Tree with multiple dialogues (successful cases) 353
C.1.6 Tree with multiple dialogues (unsuccessful cases) 354
C.1.7 Heuristic decisions and reporting 354
C.1.8 Scenarios for SACF 354
C.1.9 Scenarios for CPM 354
C.2 Scenarios with a single dialogue (successful cases) 356
C.2.1 Application supported transactions. 356
C.2.2 Provider-supported chained transactions 359
C.2.3 Provider-supported unchained transactions 359
C.2.4 TP-PREPARE scenarios 362
C.2.4.1 TP-PREPARE with Data-Permitted="false" in Polarized Control 362
C.2.4.2 TP-PREPARE with Data-Permitted="true" in Polarized Control 363
C.2.4.3 TP-PREPARE in Shared Control 364
C.2.5 Handshake services: illustration of Confirmation-Urgency parameter 365
C.2.6 Deferred End Dialogue service 367
C.3 Scenarios with a single dialogue (unsuccessful cases) 368
C.3.1 Negative response to a TP-HANDSHAKE 368
C.3.1.1 Negative response to a TP-HANDSHAKE in Polarized Control 368
C.3.1.2 Negative response to a TP-HANDSHAKE in Shared Control 370
C.3.2 TP-ROLLBACK scenarios 372
C.3.2.1 TP-ROLLBACK with Chained Transactions 372
C.3.2.2 TP-ROLLBACK with Unchained Transactions 373
C.3.3 Rejection of a TP-BEGIN-TRANSACTION request 373
C.3.4 TP-U-ERROR collision with TP-DATA 374
C.3.4.1 TP-U-ERROR collision with TP-DATA in Polarized Control 374
C.3.4.2 TP-U-ERROR Collision with TP-DATA in Shared Control 375
C.3.5 TP-ROLLBACK with TP-U-ABORT 376
C.3.6 TP-DEFERRED-END-DIALOGUE with TP-ROLLBACK 377
C.3.6.1 TP-ROLLBACK request issued during the active phase 377
C.3.6.2 TP-ROLLBACK request issued after a TP-PREPARE indication 378
C.3.7 Dialogue Establishment Scenarios 379
C.3.7.1 Rejection of the dialogue establishment request 379
C.3.7.2 TP-BEGIN-DIALOGUE (Confirmation="negative") scenarios 381
C.3.7.3 TP-BEGIN-DIALOGUE (Confirmation="always") scenarios 386
C.4 Scenarios with a single dialogue (failure cases) 396
C.4.1 TP-P-ABORT 396
C.4.1.1 TP-P-ABORT during active phase 396
C.4.1.2 TP-P-ABORT during the first phase of commitment 397
C.4.1.3 TP-P-ABORT during the second phase of commitment 398
C.5 Collision scenarios on a single dialogue 401
C.5.1 Collisions of TP-U-ERROR with TP-COMMIT 401
C.5.2 Collisions with TP-U-ERROR in Polarized Control 402
C.5.3 Collisions with TP-U-ERROR in Shared Control 404
C.5.4 TP-END-DIALOGUE Collision Scenarios 412

C.5.4.1 Collision of a TP-END-DIALOGUE (Confirmation="true") and a TP-END-DIALOGUE (Confirmation="false") 412
C.5.4.2 Collision of a TP-END-DIALOGUE (Confirmation="true") and a TP-END-DIALOGUE (Confirmation="true") 412
C.5.4.3 Collision of a TP-END-DIALOGUE (Confirmation="true") and a TP-U-ERROR 413
C.5.4.4 Collision of a TP-END-DIALOGUE (Confirmation="true") with a TP-REQUEST-CONTROL 415
C.5.4.5 Collision of a TP-END-DIALOGUE (Confirmation="true") and a TP-BEGIN-TRANSACTION 415
C.5.4.6 Collision of a TP-END-DIALOGUE (Confirmation="true") and a TP-HANDSHAKE 416
C.5.5 Other collisions 417
C.5.5.1 Collision of a TP-COMMIT and a dialogue establishment rejects. 417
C.5.5.2 Collision of a TP-COMMIT and TP-DATA 419
C.6 Tree with multiple dialogues (successful cases) 420
C.6.1 The committing phase driven by TP-COMMIT 420
C.6.2 The committing phase with TP-PREPARE and TP-READY 420
C.7 Tree with multiple dialogues (unsuccessful cases) 420
C.7.1 Rollback from the root during the active phase 420
C.7.2 Rollback from a subordinate during the active phase 420
C.7.3 Dialogue abort during phase I of commitment 426
C.7.4 Rollback-related actions 426
C.7.5 Dialogue abort during the active phase 429
C.7.6 Dialogue abort during the active phase, transaction tree above the failure disbanded 429
C.7.7 Dialogue abort during the second phase of commitment 432
C.7.8 Dialogue abort during the second phase of commitment, subordinate of the failed dialogue aborts its other dialogues 432
C.7.9 Dialogue abort with the superior after TP-COMMIT indication has been issued 432
C.7.10 Dialogue abort with the superior after TP-COMMIT indication has been issued, node subordinate to the failed dialogue aborts its other dialogues 436
C.7.11 Dialogue abort with the superior after TP-COMMIT indication has been issued, node superior to the failed dialogue aborts its other dialogues 436
C.7.12 Dialogue abort with the superior after TP-COMMIT-COMPLETE indication has been issued, node superior to the failed dialogue aborts its other dialogues 436
C.8 Heuristic decisions and reporting 440
C.8.1 Heuristic decisions when the outcome of the transaction is commit 440
C.8.1.1 Subordinate rolls back, mix detected 440
C.8.1.2 Subordinate commits, no damage 441
C.8.1.3 Subordinate rolls back but is able to compensate, no damage 442
C.8.1.4 Subordinate TPSUI commits, TPSP rolls back, mix detected 443
C.8.2 Heuristic decisions when the outcome of the transaction is rollback 444
C.8.2.1 Subordinate commits, heuristic-hazard reported 444
C.8.2.2 Subordinate rolls back, no damage, heuristic-hazard reported 445
C.8.2.3 Subordinate rolls back, no damage, heuristic-hazard reported 446
C.8.3 Heuristic decisions in trees with multiple dialogues 446
C.9 Scenarios for SACF 450
C.10 Scenarios for CPM 452
C.10.1 Scenarios for channel establishment 452
C.10.2 Scenarios for two way recovery 455
C.10.3 Scenarios for recovery collision on separate one way channels 457
D Summary of assigned object identifier values 458
E Recovery from destruction of atomic action data 459

E.1 Introduction 459
E.2 Recovery actions 459
E.2.1 Actions after a system has been destroyed 460
E.2.2 Actions of a node which has lost recovery records 460
E.2.3 Actions of a node which can not complete recovery 460

F TPPM transaction states 461
F.1 TPPM transaction states 461
F.1.1 State transitions of a root TPPM 461
F.1.2 State transitions of an intermediate TPPM 462
F.1.3 State transitions of a leaf TPPM 463

G Estelle description of the TP protocol 466
G.1 Introduction 466
G.2 Structure of the TPPM 466
G.3 Structure of the CPM 467
G.4 SACF Modules 468
G.5 File Structure of the OSI-TP Estelle Specification 468

H LOTOS description of the TP protocol 470
H.1 Electronic distribution of LOTOS description 470

I Changes from First Edition 471
I.1 Changes from first edition to produce the second edition 471

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 10026-3 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 second edition cancels and replaces the first edition (ISO/IEC 10026-3:1992), 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*

Annexes A and B form an integral part of this part of ISO/IEC 10026. Annexes C to I are for information only.

Introduction

ISO/IEC 10026, Distributed Transaction Processing (OSI TP), 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 7498). 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 (OSI) 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 identifiable information which can be related as transactions, which may involve two or more Open Systems.

ISO/IEC 10026 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, nor does it specify an application programming interface within the local system.

Information technology - Open Systems Interconnection - Distributed Transaction Processing -

Part 3:
Protocol specification

1 Scope

This part of ISO/IEC 10026 provides

a) a statement (clauses 6 to 11) of the nature of the automaton giving the necessary behaviour of each of the participating entities which are providing the OSI TP Service, covering

1) the actions to be taken on receiving request and response primitives issued by a TP Service user invocation;

2) the actions to be taken on receiving indication and confirm primitives issued by the presentation service-provider;

3) the actions to be taken as a result of certain events within the local system;

4) the actions to be taken as a result of interactions with other ASEs;

b) the definition (clause 12) of the abstract syntax required to convey the TP protocol control information;

c) the conformance requirements to be met by implementations of this protocol (clause 13).

The scope of this part of ISO/IEC 10026 is limited to the interconnection of systems; it does not specify or restrict the implementation of possible interfaces within a computer system.