Standard ECMA-176
3rd Edition - December 1998

ECMA

Standardizing Information and Communication Systems

Private Integrated Services Network (PISN) - Inter-Exchange Signalling Protocol - Path Replacement Additional Network Feature

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(QSIG-PR)

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Brief History

This Standard is one of a series of ECMA Standards defining services and signalling protocols applicable to Private Integrated Services Networks (PISNs). The series uses ISDN concepts as developed by ITU-T and conforms to the framework of International Standards for Open Systems Interconnection as defined by ISO/IEC. It has been produced under ETSI work item DE/ECMA-00055.

This particular Standard specifies the signalling protocol for use at the Q reference point in support of the Path Replacement additional network feature. The protocol defined in this Standard forms part of the PSS1 protocol (informally known as QSIG).

This Standard is based upon the practical experience of ECMA member companies and the results of their active and continuous participation in the work of ISO/IEC JTC1, ITU-T, ETSI and other international and national standardization bodies. It represents a pragmatic and widely based consensus.

This ECMA Standard is technically aligned with the 2nd Edition International Standard ISO/IEC 13874 to be published by ISO/IEC.

Adopted as 3rd Edition of Standard ECMA-176 by the General Assembly of December 1998.

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1 Scope

This Standard specifies the signalling protocol for the support of the Path Replacement additional network feature (ANF-PR) at the Q reference point between Private Integrated Services Network Exchanges (PINXs) connected together within a Private Integrated Services Network (PISN).

ANF-PR is a feature which applies to an established call, allowing that call's connection between PINXs to be replaced by a new connection.

The Q reference point is defined in ECMA-133.

Service specifications are produced in three stages and according to the method specified in ETS 300 387. This Standard contains the stage 3 specification for the Q reference point and satisfies the requirements identified by the stage 1 and stage 2 specifications in ECMA-175.

The signalling protocol for ANF-PR operates on top of the signalling protocol for basic circuit switched call control, as specified in ECMA-143, and uses certain aspects of the generic procedures for the control of supplementary services specified in ECMA-165.

This Standard also specifies additional signalling protocol requirements for the support of interactions at the Q reference point between ANF-PR and other supplementary services and ANFs.

This Standard is applicable to PINXs which can interconnect to form a PISN.

2 Conformance

In order to conform to this Standard, a PINX shall satisfy the requirements identified in the Protocol Implementation Conformance Statement (PICS) proforma in annex A.

3 References (normative)

The following standards contain provisions which, through reference in this text, constitute provisions of this Standard. All standards are subject to revision, and parties to agreements based on this Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below.

In the case of references to ECMA Standards that are aligned with ISO/IEC International Standards, the number of the appropriate ISO/IEC International Standard is given in brackets after the ECMA reference.

ECMA-133 Private Integrated Services Network - Reference Configuration for PISN Exchanges (PINX) (International Standard ISO/IEC 11579-1)

ECMA-142 Private Integrated Services Network - Circuit-mode 64 kbit/s Bearer Services - Service Description, Functional Capabilities and Information Flows (International Standard ISO/IEC 11574)

ECMA-143 Private Integrated Services Network - Circuit-mode Bearer Services - Inter-Exchange Signalling Procedures and Protocol (International Standard ISO/IEC 11572)

ECMA-165 Private Integrated Services Network - Generic Functional Protocol for the Support of Supplementary Services - Inter-Exchange Signalling Procedures and Protocol (International Standard ISO/IEC 11582)

ECMA-175 Private Integrated Services Network - Specification, Functional Model and Information Flows - Path Replacement Additional Network Feature (International Standard ISO/IEC 13863)

ECMA-178 Private Integrated Services Network - Inter-exchange Signalling Protocol - Call Transfer Supplementary Services (International Standard ISO/IEC 13869)

ECMA-225 Private Integrated Services Network - Inter-exchange Signalling Protocol - Transit Counter Additional Network Feature (International Standard ISO/IEC 15056)

ISO/IEC 11571 Information Technology - Telecommunication and information exchange between systems Numbering and sub addressing in Private Integrated Services Network

ETS 300 387	Private Telecommunication Network (PTN); Method for the specification of basic and supplementary services (1994)
ITU-T Rec. I.112	Vocabulary of terms for ISDNs (1993)
ITU-T Rec. I.210	Principles of telecommunication services supported by an ISDN and the means to describe them (1993)
ITU-T Rec. Q.950	Digital Subscriber Signalling System No. 1 (DSS 1) - Supplementary services protocols, structure and general principles (1993)
ITU-T Rec. Z.100	Specification and description language (1993)

4 Definitions

For the purposes of this Standard, the following definitions apply.

4.1 External definitions

This Standard uses the following terms defined in other documents:

- ANF-PR user (ECMA-175)
- Application Protocol Data Unit (APDU) (ECMA-165)
- Basic Service (ITU-T Rec. I.210)
- Call, Basic Call (ECMA-165)
- Connection (ECMA-175)
- Incoming Gateway PINX (ECMA-143)
- Interpretation APDU (ECMA-165)
- Network Facility Extension (NFE) (ECMA-165)
- New Connection (ECMA-175)
- Old Connection (ECMA-175)
- Originating PINX (ECMA-143)
- Outgoing Gateway PINX (ECMA-143)
- Private Integrated Services Network (PISN) (ECMA-133)
- Private Integrated Services Network Exchange (PINX) (ECMA-133)
- Signalling (ITU-T Rec. I.112)
- Supplementary Service (ITU-T Rec. I.210)
- Supplementary Services Control Entity (ECMA-165)
- Terminating PINX (ECMA-143)
- Transit PINX (ECMA-143)
- Trombone Connection (ECMA-175)
- User (except in the context of ANF-PR user) (ECMA-142)

4.2 Other definitions

4.2.1 Branching PINX

The Transit PINX at which the retained connection finishes and the new connection starts.

4.2.2 Cooperating PINX

The end PINX which initiates the establishment of the new connection towards other end PINX involved in the call.

4.2.3 End PINX

Within the context of a call, a PINX which is not acting as a Transit PINX, i.e., an Originating PINX, a Terminating PINX, an Incoming Gateway PINX or an Outgoing Gateway PINX.

4.2.4 Preceding PINX

The adjacent PINX in the direction of the Cooperating PINX, relative to a particular PINX involved in the old connection.

NOTE 1

This can be the Cooperating PINX itself or a Transit PINX.

4.2.5 Replaced connection

That part of the old connection which is not retained and is replaced by the new connection.

4.2.6 Requesting PINX

The end PINX which invokes ANF-PR and towards which the new connection is routed.

4.2.7 Retained connection

That part of the old connection which is retained and not replaced by the new connection.

4.2.8 Subsequent PINX

The adjacent PINX in the direction of the Requesting PINX, relative to a particular PINX involved in the old connection.

NOTE 2

This can be the Requesting PINX itself or a Transit PINX.

4.2.9 Inviting PINX

Any PINX in the connection that is associated with the ANF-PR user and able to request either end PINX to invoke ANF-PR.

5 List of acronyms

ANF	Additional Network Feature
ANF-PR	Path Replacement additional network feature
APDU	Application Protocol Data Unit
ASN.1	Abstract Syntax Notation no. 1
ISDN	Integrated Services Digital Network
NFE	Network Facility Extension
PICS	Protocol Implementation Conformance Statement
PINX	Private Integrated Services Network Exchange
PISN	Private Integrated Services Network
SDL	Specification and Description Language
SS-CT	Call Transfer supplementary service

6 Signalling protocol for the support of ANF-PR

6.1 ANF-PR description

ANF-PR is invoked by an established call, allowing that call's connection through the PISN to be replaced by a new connection. Optionally, the direction of the new connection may be decided by the ANF-PR user. If the new connection is required to satisfy certain criteria, ANF-PR should be used in conjunction with other supplementary services and/or ANFs. In the absence of specific criteria, the new connection should be established using the routeing rules which apply to basic call establishment.

NOTE 3

Annex A of ECMA-175 gives examples of the circumstances under which ANF-PR can be used and criteria which can govern the selection of the new connection.

ANF-PR may be initiated locally at the Requesting PINX or optionally from an Inviting PINX. The Requesting PINX shall request the Cooperating PINX to attempt the establishment of a new connection from the Cooperating PINX to the Requesting PINX. If successful, the new connection shall replace the old connection.

NOTE 4

The Requesting PINX can be either end PINX involved in a call, i.e., the Originating PINX or the Terminating PINX or, in the case of interworking with another network, the Incoming Gateway PINX or Outgoing Gateway PINX.

Optional procedures and coding are specified for allowing the retention of one or more elements of the old connection, starting from the Cooperating PINX and continuing as far as a Transit PINX, subject to any given criteria being achievable in that way. A new connection is established from the Transit PINX to the Requesting PINX instead of from the Cooperating PINX to the Requesting PINX.

6.2 ANF-PR operational requirements

6.2.1 Requirements on the Cooperating PINX

ANF-PR shall be applicable to a call whose protocol control state, as defined in ECMA-143, is Active.

NOTE 5

State Active will have been reached as a result of ECMA-143 call establishment procedures, possibly in conjunction with supplementary service and/or ANF procedures.

ECMA-143 protocol control procedures for call establishment at the outgoing side of an inter-PINX link shall apply to the establishment of the new connection. ECMA-143 protocol control procedures for call clearing shall apply to the release of the old connection in the event of successful switch over to the new connection.

Generic procedures for the call-related control of supplementary services, as specified in ECMA-165 for an end PINX, shall apply.

6.2.2 Requirements on the Requesting PINX

ANF-PR shall be applicable to a call whose protocol control state, as defined in ECMA-143, is Active.

NOTE 6

State Active will have been reached as a result of ECMA-143 call establishment procedures, possibly in conjunction with supplementary service and/or ANF procedures.

ECMA-143 protocol control procedures for call establishment at the incoming side of an inter-PINX link shall apply to the establishment of the new connection. ECMA-143 protocol control procedures for call clearing shall apply to the release of the old connection in the event of successful switch over to the new connection.

Generic procedures for the call-related control of supplementary services, as specified in ECMA-165 for an end PINX, shall apply.

6.2.3 Requirements on a Transit PINX

6.2.3.1 Transit PINX involved in the replaced connection

ANF-PR shall be applicable to a call whose protocol control state, as defined in ECMA-143, on each of the two links (incoming and outgoing) is Active and whose call control state, as defined in ECMA-143 is TCC_Call_Active.

NOTE 7

State Active will have been reached as a result of ECMA-143 call establishment procedures, possibly in conjunction with supplementary service and/or ANF procedures.

ECMA-143 protocol control and call control procedures for call clearing at a Transit PINX shall apply to the release of the old connection in the event of successful switch over to the new connection.

Generic procedures for the call-related control of supplementary services, as specified in ECMA-165 for a Transit PINX, shall apply. For ANF-PR the requirements are limited to the passing on of Facility information elements for which the destination, as indicated in the Network Facility Extension (NFE), is not the Transit PINX.

6.2.3.2 Transit PINX involved in the new connection

ECMA-143 protocol control and call control procedures for call establishment at a Transit PINX shall apply to the establishment of the new connection.

ECMA-143 protocol control and call control procedures for call clearing at a Transit PINX shall apply to the release of the new connection in the event of failure to complete ANF-PR successfully.

Generic procedures for the call-related control of supplementary services, as specified in ECMA-165 for a Transit PINX, shall apply. For ANF-PR the requirements are limited to the passing on of Facility information elements for which the destination, as indicated in the Network Facility Extension (NFE), is not the Transit PINX.

6.2.3.3 Transit PINX involved in the retained connection

The procedures below are applicable only if the optional procedures for retention of part of the old connection (55) are supported.

ANF-PR shall be applicable to a call whose protocol control state, as defined in ECMA-143, on each of the two links (incoming and outgoing) is Active and whose call control state, as defined in ECMA-143 is TCC_Call_Active.

NOTE 8

State Active will have been reached as a result of ECMA-143 call establishment procedures, possibly in conjunction with supplementary service and/or ANF procedures.

Generic procedures for the call-related control of supplementary services, as specified in ECMA-165 for a Transit PINX, shall apply.

6.2.3.4 Branching PINX

The procedures below are applicable only if the optional procedures for retention of part of the old connection (55) are supported.

ANF-PR shall be applicable to a call whose protocol control state, as defined in ECMA-143, on each of the two links (incoming and outgoing) is Active and whose call control state, as defined in ECMA-143 is TCC_Call_Active.

NOTE 9

State Active will have been reached as a result of ECMA-143 call establishment procedures, possibly in conjunction with supplementary service and/or ANF procedures.

ECMA-143 protocol control procedures for call establishment at the outgoing side of an inter-PINX link shall apply to the establishment of the new connection. ECMA-143 protocol control procedures for call clearing shall apply to the release of the replaced connection in the event of successful switch over to the new connection.

Generic procedures for the call-related control of supplementary services, as specified in ECMA-165 for a Transit PINX, shall apply.

6.2.4 Requirements on the Inviting PINX

ANF-PR shall be applicable to a call whose protocol control state, as defined in ECMA-143, is Active. Generic procedures for the call-related control of supplementary services, as specified in ECMA-165 for an end PINX, shall apply.

6.3 ANF-PR coding requirements

6.3.1 Operations

The operations defined in Abstract Syntax Notation number 1 (ASN.1) in table 1 shall apply.

Table 1 - Operations in support of ANF-PR

```
Path-Replacement-Operations
                    {iso standard pss1-path-replacement (13874) pr-operations (0)}

DEFINITIONS EXPLICIT TAGS ::=

BEGIN

IMPORTS             OPERATION, ERROR FROM Remote-Operation-Notation
                        {joint-iso-ccitt(2) remote-operations(4) notation (0)}
                    Extension FROM Manufacturer-specific-service-extension-definition
                        {iso standard
                        pss1-generic-procedures (11582) msi-definition (0)}
                    notAvailable, supplementaryServiceInteractionNotAllowed
                        FROM General-Error-List
                        {ccitt recommendation q 950 general-error-list (1)}
                    PartyNumber FROM Addressing-Data-Elements
                        {iso(1) standard(0) pss1-generic-procedures(11582)
                        addressing-data-elements(9)};

PathReplaceInvite   ::=  OPERATION
                        ARGUMENT DummyArg
                        ERRORS {
                            notAvailable,
                            temporarilyUnavailable,
                            supplementaryServiceInteractionNotAllowed,
                            criteriaPermanentlyUnachievable,
                            criteriaTemporarilyUnachievable,
                            invalidRerouteingNumber,
                            unrecognizedCallIdentity,
                            establishmentFailure,
                            collision,
                            unspecified
                            }

PathReplacePropose  ::=  OPERATION
                        ARGUMENT PRProposeArg
                        ERRORS {
                            notAvailable,
                            temporarilyUnavailable,
                            supplementaryServiceInteractionNotAllowed,
                            criteriaPermanentlyUnachievable,
                            criteriaTemporarilyUnachievable,
                            invalidRerouteingNumber,
                            unrecognizedCallIdentity,
                            establishmentFailure,
                            collision,
                            unspecified
                            }
```

Table 1 - Operations in support of ANF-PR (continued)

```
PathReplaceSetup        ::=  OPERATION
                             ARGUMENT        PRSetupArg
                             RESULT          DummyResult
                             ERRORS {
                                  criteriaPermanentlyUnachievable,
                                  criteriaTemporarilyUnachievable,
                                  invalidRerouteingNumber,
                                  unrecognizedCallIdentity,
                                  temporarilyUnavailable,
                                  unspecified
                                  }

PathReplaceRetain       ::=  OPERATION
                             ARGUMENT        PRRetainArg
                             RESULT          DummyResult
                             ERRORS {
                                  notAvailable,
                                  temporarilyUnavailable,
                                  supplementaryServiceInteractionNotAllowed,
                                  criteriaPermanentlyUnachievable,
                                  criteriaTemporarilyUnachievable,
                                  invalidRerouteingNumber,
                                  unrecognizedCallIdentity,
                                  establishmentFailure,
                                  unspecified
                                  }

PRProposeArg            ::=  SEQUENCE {
                                  callIdentity          CallIdentity,
                                  rerouteingNumber      PartyNumber,
                                  extension   CHOICE {
                                       [1] IMPLICIT Extension,
                                       [2] IMPLICIT SEQUENCE OF Extension
                                  } OPTIONAL
                             }

PRSetupArg              ::=  SEQUENCE {
                                  callIdentity       CallIdentity,
                                  extension CHOICE {
                                       [1] IMPLICIT Extension,
                                       [2] IMPLICIT SEQUENCE OF Extension
                                  } OPTIONAL
                             }
```

Table 1 - Operations in support of ANF-PR (continued)

```
PRRetainArg             ::=     SEQUENCE {
                                        callIdentity            CallIdentity,
                                        rerouteingNumber  PartyNumber,
                                        extension     CHOICE {
                                                [1] IMPLICIT Extension,
                                                [2] IMPLICIT SEQUENCE OF Extension
                                        } OPTIONAL
                                }

DummyResult             ::=     CHOICE {
                                        NULL,
                                        [1] IMPLICIT Extension,
                                        [2] IMPLICIT SEQUENCE OF Extension
                                }

DummyArg                ::=     CHOICE {
                                        NULL,
                                        [1] IMPLICIT Extension,
                                        [2] IMPLICIT SEQUENCE OF Extension
                                }


CallIdentity            ::=     NumericString (SIZE(1..4))


pathReplacePropose      PathReplacePropose ::=  4
pathReplaceSetup        PathReplaceSetup ::=    5
pathReplaceRetain       PathReplaceRetain ::=   6
pathReplaceInvite       PathReplaceInvite::=    86

temporarilyUnavailable
                        ERROR ::= 1000
                                -- used when the operation is temporarily not available and none of
                                -- the other errors applies - a later attempt could be successful

collision               ERROR ::= 1001
                                -- used when a pathReplacePropose invoke APDU is received by a PINX
                                -- which has sent a pathReplacePropose invoke APDU

criteriaPermanentlyUnachievable
                        ERROR ::= 1002
                                -- used when the special criteria requested cannot be achieved
                                -- because the necessary resources are permanently unavailable

criteriaTemporarilyUnachievable
                        ERROR ::= 1003
                                -- used when the special criteria requested cannot be achieved
                                -- because the necessary resources are temporarily unavailable
                                -- a later attempt could be successful
```

Table 1 - Operations in support of ANF-PR (concluded)

```
invalidRerouteingNumber
                        ERROR ::= 1004
                            -- used when the establishment of the new connection fails because the
                            -- Called party number information element is not a valid number for
                            -- routeing the new connection to

unrecognizedCallIdentity
                        ERROR ::= 1005
                            -- used when establishment of the new connection fails because it could
                            -- not be associated with the old connection at the Requesting PINX

establishmentFailure
                        ERROR ::= 1006
                            -- used when establishment of the new connection fails and no other error
                            -- applies

Unspecified             ::= ERROR PARAMETER Extension
unspecified             Unspecified ::= 1008
                            -- used to convey a manufacturer specific error, possibly with other information
                            -- of Path-Replacement-Operations

END
```

6.3.2 Information elements

6.3.2.1 Facility information element

APDUs of the operations defined in 6.3.1 shall be coded in the Facility information element in accordance with ECMA-165.

When conveying the invoke APDU of operation pathReplaceInvite, the NFE shall be included and the destinationEntity data element of the NFE shall contain value endPINX.

When conveying APDUs of operations pathReplacePropose and pathReplaceSetup, the NFE shall be included.

When conveying the invoke APDU of operation pathReplacePropose, the destinationEntity data element of the NFE shall contain value endPINX.

When conveying the invoke APDU of operation pathReplaceSetup, the destinationEntity data element of the NFE shall contain value endPINX.

When conveying the invoke APDU of operation pathReplaceRetain, the NFE shall be omitted.

When conveying the invoke APDU of operation pathReplaceSetup, the Interpretation APDU shall be included and shall have the value clearCallIfAnyInvokePduNotRecognised. When conveying any other Remote Operations APDU, the Interpretation APDU shall either be omitted or have the value rejectAnyUnrecognisedInvokePdu.

6.3.2.2 Other information elements

The following information elements used during establishment of the new connection and release of the old connection shall be coded as specified in ECMA-143:

- Bearer capability
- Called party number

– Cause

– Sending complete

The following information element shall be coded as specified in ECMA-225:

– Transit Counter

6.3.3 Messages

Except for cases where a basic call message is to be conveyed at the same time, the Facility information shall be conveyed in a FACILITY message as specified in ECMA-165.

The following messages used during establishment of the new connection and release of the old connection shall be as specified in ECMA-143:

– CALL PROCEEDING

– CONNECT

– CONNECT ACKNOWLEDGE

– DISCONNECT

– RELEASE

– RELEASE COMPLETE

– SETUP

6.4 ANF-PR state definitions

6.4.1 States at the Requesting PINX

The procedures for the Requesting PINX are written in terms of the following conceptual states existing within the ANF-PR functional entity in that PINX in association with a particular call.

6.4.1.1 State PR-Req-Idle

ANF-PR is not operating.

6.4.1.2 State PR-Req-Initiated

A pathReplacePropose invoke APDU has been sent to the Cooperating PINX.

6.4.1.3 State PR-Req-Completing

The new connection has been established and a pathReplaceSetup return result APDU has been sent to the Cooperating PINX.

6.4.2 States at the Cooperating PINX

The procedures for the Cooperating PINX are written in terms of the following conceptual states existing within the ANF-PR functional entity in that PINX in association with a particular call.

6.4.2.1 State PR-Coop-Idle

ANF-PR is not operating.

6.4.2.2 State PR-Coop-Establishment

A pathReplaceSetup invoke APDU has been sent in conjunction with the establishment of the new connection.

6.4.2.3 State PR-Coop-Retain

A pathReplaceRetain invoke APDU has been sent to the subsequent PINX.

6.4.3 States at a Transit PINX on the retained path, including the branching PINX

The procedures for a Transit PINX on the retained path are written in terms of the following conceptual states existing within the ANF-PR functional entity in that PINX in association with a particular call.

6.4.3.1 State PR-Transit-Idle

ANF-PR is not operating.

6.4.3.2 State PR-Transit-Establishment

A pathReplaceSetup invoke APDU has been sent in conjunction with the establishment of the new connection.

6.4.3.3 State PR-Transit-Retain

A pathReplaceRetain invoke APDU has been sent to the subsequent PINX.

6.4.4 States at the Inviting PINX

6.4.4.1 State PR-invite-Idle

ANF-PR is not operating.

6.5 ANF-PR signalling procedures

The signalling procedures specified below are in support of replacement of the entire connection. Additional optional procedures for retention of part of the old connection are specified in 6.6.

Examples of message sequences are shown in C.1 to C.4 of annex C.

6.5.1 Actions at the Requesting PINX

The SDL representation of procedures at the Requesting PINX is shown in D.2 of annex D.

6.5.1.1 ANF PR initiated by the Requesting PINX

The procedures of 6.5.1.3 and 6.5.1.4 shall apply.

6.5.1.2 Optional support of a request from an Inviting PINX

On receipt of a FACILITY message containing a pathReplaceInvite invoke APDU, the Requesting PINX shall apply the procedures of 6.5.1.3 and 6.5.1.4 with the following additions.

If the Requesting PINX is unable to act on the pathReplaceInvite invoke APDU while in state PR-Req-Idle, a FACILITY message containing pathReplaceInvite return error APDU may be returned. No state change shall occur.

While in state PR-Req-Initiated or PR-Req-Completing, a FACILITY message containing a pathReplaceInvite invoke shall be ignored.

On receipt of a FACILITY message containing a pathReplacePropose return error while in state PR-Req-Initiated, a pathReplaceInvite return error APDU may be returned to the Inviting PINX.

6.5.1.3 Normal procedures

Examples of message sequences are shown in C.1 and C.3 of annex C.

The Requesting PINX shall send a pathReplacePropose invoke APDU in a FACILITY message to the Cooperating PINX and enter state PR-Req-Initiated. Within the argument, the rerouteingNumber data element shall contain a number from one of the native number plans of the PISN (see ISO/IEC 11571). The number, when used as the contents of information element Called party number in a SETUP message, shall be sufficient to cause routeing of the new connection to the Requesting PINX. The callIdentity data element shall contain a number which, in conjunction with the rerouteingNumber data element, identifies the particular ANF-PR entity, and therefore the call on which ANF-PR is being invoked. This number need not have significance outside the Requesting PINX.

NOTE 10

The number in the callIdentity data element should be sufficient to distinguish the call concerned from any other call for which the PINX is acting as an ANF-PR Requesting PINX at that time.

Having agreed the B-channel and sent back a CALL PROCEEDING message in response to an incoming SETUP message, in accordance with the procedures of ECMA-143, if the SETUP contains a pathReplaceSetup invoke APDU the Requesting PINX shall proceed as follows. If the callIdentity data element in the argument of pathReplaceSetup, in conjunction with the number information in the Called party number information element, identifies an ANF-PR entity in state PR-Req-Initiated, the Requesting PINX shall associate the new connection (as requested by the SETUP message) with the call on whose behalf that ANF-PR entity is acting.

The Requesting PINX shall connect the calling / called user to the B-channel of the new connection and terminate the B-channel of the old connection in a suitable manner (pending its release).

NOTE 11

The method of terminating the old connection's B-channel is an implementation matter. Annex B of ECMA-175 contains more information on this.

A pathReplaceSetup return result APDU shall be sent in a CONNECT message using the call reference of the new connection and state PR-Req-Completing shall be entered.

NOTE 12

On sending CONNECT, the protocol control state for the new connection will become Active.

While in state PR-Req-Completing, if a DISCONNECT message is received using the call reference of the old connection, the Requesting PINX shall complete the release of the old connection in accordance with the procedures of ECMA-143, and enter state PR-Req-Idle. The call shall continue as an active call using the new connection.

6.5.1.4 Exceptional procedures

Examples of message sequences are shown in C.2 and C.4 of annex C.

Receipt of a FACILITY message containing a pathReplacePropose return error APDU or reject APDU during state PR-Req-Initiated shall cause entry to state PR-Req-Idle, thereby abandoning ANF-PR. The call shall continue to use the old connection.

NOTE 13

Depending on the error, it may be appropriate to invoke ANF-PR again later. If the error is collision, steps should be taken to reduce the probability of a further collision, e.g., by using a random delay before invoking again.

Failure to associate an incoming SETUP message containing a pathReplaceSetup invoke APDU with an ANF-PR entity in state PR-Req-Initiated shall result in the sending of a DISCONNECT message to initiate the clearing of the new connection. Depending on implementation, the DISCONNECT message shall contain either:

- a suitable cause number in the Cause information element, e.g., 1 "unallocated (unassigned) number"; or
- cause number 29 "facility rejected" in the Cause information element and a return error APDU containing error invalidRerouteingNumber; or
- cause number 29 "facility rejected" in the Cause information element and a return error APDU containing error unrecognizedCallIdentity.

If the incoming SETUP message containing a pathReplaceSetup invoke APDU is successfully associated with an ANF-PR entity in state PR-Req-Initiated but the new connection is unsuitable for some reason, e.g., criteria not satisfied, a DISCONNECT message shall be sent to initiate clearing of the new connection. The DISCONNECT message shall contain cause number 29 "facility rejected" in the Cause information element and a return error APDU containing an appropriate error. The ANF-PR entity shall remain in state PR-Req-Initiated.

NOTE 14

Receipt of a pathReplacePropose return error APDU can be expected.

On receipt of a FACILITY message containing a pathReplacePropose invoke APDU while in state PR-Req-Initiated, a pathReplacePropose return error APDU containing error collision shall be returned. No state change shall occur.

NOTE 15

Receipt of a pathReplacePropose return error APDU containing error collision can be expected.

While in state PR-Req-Completing, if a DISCONNECT message is received using the call reference of the new connection, the Requesting PINX shall complete the release of the new connection in accordance with the

procedures of ECMA-143, reconnect the calling / called user to the B-channel of the old connection, and enter state PR-Req-Idle.

6.5.2 Actions at the Cooperating PINX

The SDL representation of procedures at the Cooperating PINX is shown in D.3 of annex D.

6.5.2.1 Normal procedures

On receipt of a FACILITY message containing a pathReplacePropose invoke APDU while in protocol control state Active and ANF-PR state PR-Coop-Idle, the Cooperating PINX shall determine whether it can proceed with ANF-PR. If so, it shall attempt to establish a new connection by selecting an outgoing B-channel on a route determined by the contents of the rerouteingNumber data element within the received argument. If a B-channel is available, a SETUP message shall be sent using a new call reference in accordance with the procedures of ECMA-143. The SETUP shall contain a new call reference and the following information elements.

- Bearer capability, containing bearer capability information as for the old connection;
- Called party number, containing the number received in the rerouteingNumber data element within the - received argument;
- Sending complete;
- Facility;
- Optionally, Transit Counter with the transit count field set to zero.

The Facility information element shall contain a pathReplaceSetup invoke APDU. Within the argument, data element callIdentity shall have the same contents as the corresponding data element in the argument of the received pathReplacePropose invoke APDU.

The Cooperating PINX shall terminate the new connection's B-channel suitably.

NOTE 16

The method of terminating the new connection's B-channel is an implementation matter. Annex B of ECMA-175 contains more information on this.

State PR-Coop-Establishment shall be entered.

The protocol control procedures of ECMA-143 shall apply during the establishment of the new connection.

NOTE 17

Initially protocol control will enter state Call Initiated. On receipt of a CALL PROCEEDING message, state Outgoing Call Proceeding will be entered and on receipt of CONNECT, state Active will be entered.

On receipt of a CONNECT message (using the call reference of the new connection) containing a pathReplaceSetup return result APDU, the Cooperating PINX shall disconnect the B-channel of the old connection and connect the calling / called user instead to the B-channel of the new connection. A DISCONNECT message shall be sent using the call reference of the old connection, thereby initiating the clearing procedures of ECMA-143 for the old connection. State PR-Coop-Idle shall be entered. The call shall continue as an active call using the new connection.

6.5.2.2 Exceptional procedures

If the Cooperating PINX is unable to comply with the pathReplacePropose invoke APDU, it shall send back a FACILITY message containing a pathReplacePropose return error APDU with a suitable error.

If the new connection fails to be established for any reason, the Cooperating PINX shall send using the old connection a FACILITY message containing a pathReplacePropose return error APDU with a suitable error. Reasons can include:

- unable to select a B-channel for the new connection;
- receipt of a call clearing message using the new connection's call reference without a pathReplaceSetup return error APDU or reject APDU;

– receipt of a call clearing message using the new connection's call reference with a pathReplaceSetup return error APDU or reject APDU;

– timer expiry at the Cooperating PINX.

In each case state PR-Coop-Idle shall be entered and the call shall continue as an active call using the old connection.

On receipt of a FACILITY message containing a pathReplaceInvite invoke APDU while in state PR-Coop-Retain or PR-Coop-Establishment, a FACILITY message containing a pathReplaceInvite return error APDU may be returned to the Inviting PINX. No state change should occur.

6.5.3 Actions at a Cooperating/Requesting PINX in the case of a trombone connection

On receipt of a FACILITY message containing a pathReplacePropose invoke APDU, the Cooperating PINX can determine from the rerouteingNumber data element in the argument whether the Requesting PINX is the same as the Cooperating PINX, i.e., whether a trombone connection exists.

In the case of a trombone connection, establishment of the new connection and switching over to it will be intra-PINX matters. The only further signalling which will occur at the Q reference point will be the clearing of the old connection.

6.5.4 Actions at a Transit PINX

No special actions are required in support of ANF-PR.

6.5.5 Actions at Inviting PINX

The SDL representation of procedures at the Inviting PINX is shown in D.1 of annex D.

6.5.5.1 Normal procedures

On determining that ANF-PR is to be invoked during a call whose protocol control state is Active, the Inviting PINX shall send a pathReplaceInvite invoke APDU in a FACILITY message to the Requesting PINX. If the old connection is cleared it shall be interpreted as ANF-PR is successful.

6.5.5.2 Exceptional procedures

On receipt of a FACILITY message containing a pathReplaceInvite return error or reject APDU the action shall be implementation dependent.

NOTE 18

Depending on the error, it may be appropriate to invoke ANF-PR again later or invoke ANF-PR in the other direction. If the error is collision, steps should be taken to reduce the probability of a further collision, e.g., by using a random delay before invoking again.

6.6 ANF-PR optional signalling procedures for retention of part of the old connection

Examples of message sequences are shown in C.5 to C.7 of annex C.

6.6.1 Actions at the Requesting PINX

The procedures of 6.5.1 shall apply, with the following addition.

If the Requesting PINX receives a FACILITY message containing a pathReplaceRetain invoke APDU from the preceding PINX, it shall send back a FACILITY message containing a pathReplaceRetain return result APDU and enter state PR-Req-Idle.

6.6.2 Actions at the Cooperating PINX

The SDL representation of procedures at the Cooperating PINX, including optional retention of part of the old connection, is shown in D.3 of annex D.

6.6.2.1 Normal procedures

On receipt of a FACILITY message containing a pathReplacePropose invoke APDU while in protocol control state Active and ANF-PR state PR-Coop-Idle, the Cooperating PINX shall determine whether it can proceed with ANF-PR, and whether it can retain that part of the old connection as far as the subsequent PINX while still meeting any given criteria. If so, it shall send a FACILITY message containing a pathReplaceRetain invoke APDU to the subsequent PINX and enter state PR-Coop-Retain. The rerouteingNumber and

callIdentity data elements shall have the same contents as the corresponding data elements received in the pathReplacePropose invoke APDU.

NOTE 19

The omission of the NFE from the Facility information element ensures that the APDU will be processed by the subsequent PINX. If the subsequent PINX does not support these optional procedures it will send back a reject APDU.

If it cannot retain that part of the old connection as far as the subsequent PINX it shall proceed according to the provisions of 6.5.2.

On receipt of a FACILITY message containing a pathReplaceRetain return result APDU from the subsequent PINX, the Cooperating PINX shall enter state PR-Coop-Idle.

6.6.2.2 Exceptional procedures

On receipt of a FACILITY message containing a pathReplaceRetain return error APDU or reject APDU from the subsequent PINX while in state PR-Coop-Retain, the Cooperating PINX shall either, depending on the reason for the error or reject APDU:

- proceed according to the provisions of 6.5.2, as if there had been no attempt to retain part of the old connection; or
- send back a FACILITY message containing a pathReplacePropose return error APDU with a suitable error to the Requesting PINX and enter state PR-Coop-Idle.

6.6.3 Actions at a Transit PINX on the retained connection

The SDL representation of procedures at a Transit PINX on the retained Connection is shown in D.4 of annex D.

On receipt of a FACILITY message containing a pathReplaceRetain invoke APDU from the preceding PINX while in protocol control state Active and ANF-PR state PR-Transit-Idle, the Transit PINX shall determine whether it can retain that part of the old connection as far as the subsequent PINX while still meeting any given criteria.

6.6.3.1 Able to retain old connection as far as subsequent PINX

6.6.3.1.1 Normal procedures

If the Transit PINX determines that it can retain that part of the old connection as far as the subsequent PINX, it shall send a FACILITY message containing a pathReplaceRetain invoke APDU to the subsequent PINX and enter state PR-Transit-Retain. The rerouteingNumber and callIdentity data elements shall have the same contents as the corresponding data elements in the received pathReplaceRetain invoke APDU.

NOTE 20

The omission of the NFE from the Facility information element ensures that the APDU will be processed by the subsequent PINX. If the subsequent PINX does not support these optional procedures it will send back a reject APDU.

On receipt of a FACILITY message containing a pathReplaceRetain return result APDU from the subsequent PINX while in state PR-Transit-Retain, the Transit PINX shall send a pathReplaceRetain return result APDU to the preceding PINX and enter state PR-Transit-Idle.

6.6.3.1.2 Exceptional procedures

On receipt of a FACILITY message containing a pathReplaceRetain return error APDU or reject APDU from the subsequent PINX while in state PR-Transit-Retain, the Transit PINX shall either, depending on the reason for the error or reject APDU:

- proceed according to the provisions 6.6.3.2, as if there had been no attempt to retain the old connection as far as the subsequent PINX; or
- send a pathReplaceRetain return error APDU to the preceding PINX and enter state PR-Transit-Idle.

6.6.3.2 Unable to retain old connection as far as subsequent PINX

6.6.3.2.1 Normal procedures

If the Transit PINX determines that it is unable to retain that part of the old connection as far as the subsequent PINX, it shall attempt to establish a new connection by selecting an outgoing B-channel on a route determined by the contents of the rerouteingNumber data element within the received argument. If a B-channel is available, a SETUP message shall be sent using a new call reference in accordance with the procedures of ECMA-143. The SETUP shall contain a new call reference and the following information elements.

– Bearer capability, containing bearer capability information as for the old connection;

– Called party number, containing the number received in the rerouteingNumber data element within the received argument;

– Sending complete;

– Facility;

– Optionally, Transit Counter with the transit count field set to zero.

The Facility information element shall contain a pathReplaceSetup invoke APDU. Within the argument, data element callIdentity shall have the same contents as the corresponding data element in the argument of the received pathReplaceRetain invoke APDU.

The Transit PINX shall terminate the new connection's B-channel suitably.

NOTE 21

The method of terminating the new connection's B-channel is an implementation matter. Annex B of ECMA-175 contains more information on this.

State PR-Transit-Establishment shall be entered.

The protocol control procedures of ECMA-143 shall apply during the establishment of the new connection.

NOTE 22

Initially protocol control will enter state Call Initiated. On receipt of a CALL PROCEEDING message, state Outgoing Call Proceeding will be entered and on receipt of CONNECT, state Active will be entered.

On receipt of a CONNECT message (using the call reference of the new connection) containing a pathReplaceSetup return result APDU, the Transit PINX shall disconnect the B-channel of the replaced connection and connect the B-channel of the retained connection instead to the B-channel of the new connection. A DISCONNECT message shall be sent using the call reference of the replaced connection, thereby initiating the clearing procedures of ECMA-143 for the replaced connection. The Transit PINX shall send a FACILITY message containing a pathReplaceRetain return result APDU to the preceding PINX and enter state PR-Transit-Idle. The call shall continue as an active call using the new connection.

6.6.3.2.2 Exceptional procedures

If the Transit PINX is unable to comply with the pathReplaceRetain invoke APDU, it shall send back to the preceding PINX a FACILITY message containing a pathReplaceRetain return error APDU with a suitable error.

If the new connection fails to be established for any reason, the Transit PINX shall send back to the preceding PINX a FACILITY message containing a pathReplaceRetain return error APDU with a suitable error. Reasons can include:

– unable to select a B-channel for the new connection;

– receipt of a call clearing message using the new connection's call reference without a pathReplaceSetup return error APDU or reject APDU;

– receipt of a call clearing message using the new connection's call reference with a pathReplaceSetup return error APDU or reject APDU;

– timer expiry at the Transit PINX.

In each case state PR-Transit-Idle shall be entered and the call shall continue as an active call using the old connection.

6.6.4 Actions at a Transit PINX on the new connection or replaced connection

No special actions are required in support of ANF-PR.

6.6.5 Actions at Inviting PINX on the retained connection

The SDL representation of procedures at the Inviting PINX is shown in D.1 of annex D.

6.6.5.1 Normal procedures

If the Inviting PINX is on the old part of the connection that is not retained 6.5.5.1 shall apply.

If the Inviting PINX is on the retained part of the connection and receives a FACILITY message containing a pathReplaceRetain return result APDU that shall be interpreted by the Inviting PINX as ANF-PR is successful.

6.6.5.2 Exceptional procedures

6.5.5.2 shall apply.

6.7 ANF-PR impact of interworking with public ISDNs

When interworking with a public ISDN which does not support an equivalent feature, the incoming or outgoing gateway PINX can act as the Cooperating PINX, Requesting PINX or Inviting PINX in order to perform ANF-PR within the PISN.

NOTE 23

At the time of publication of this Standard, no equivalent feature in public ISDNs was envisaged.

6.8 ANF-PR impact of interworking with non-ISDNs

When interworking with a non-ISDN which does not support an equivalent feature, the incoming or outgoing gateway PINX can act as the Cooperating PINX, Requesting PINX or Inviting PINX in order to perform ANF-PR within the PISN.

When interworking with a non-ISDN which supports an equivalent feature, the two networks may cooperate in the operation of ANF-PR. In this case, either Cooperating PINX functionality or Requesting PINX functionality will be provided in the non-ISDN. The incoming or outgoing gateway PINXs on the old and new paths shall provide conversion between the signalling specified in this Standard and the signalling protocol of the non-ISDN.

When interworking with a non-ISDN which supports an equivalent feature, the Requesting PINX shall be able to limit the length of the value of element callIdentity in accordance with the capabilities of the non-ISDN.

6.9 Protocol interactions between ANF-PR and other supplementary services and ANFs

This clause specifies protocol interactions with other supplementary services and ANFs for which stage 3 standards had been published at the time of publication of this Standard. For interactions with supplementary services and ANFs for which stage 3 standards are published subsequent to the publication of this Standard, see those other stage 3 standards.

NOTE 24

Additional interactions that have no impact on the signalling protocol at the Q reference point can be found in the relevant stage 1 specifications.

NOTE 25

Simultaneous conveyance of APDUs for ANF-PR and another supplementary service or ANF in the same message, each in accordance with the requirements of its respective stage 3 standard, does not, on its own, constitute a protocol interaction.

6.9.1 Interaction with Calling Name Identification Presentation (SS-CNIP)

No protocol interaction.

6.9.2 Interaction with Connected Name Identification Presentation (SS-CONP)

No protocol interaction.

6.9.3 Interaction with Completion of Calls to Busy Subscriber (SS-CCBS)

No protocol interaction.

6.9.4 Interaction with Completion of Calls on No Reply (SS-CCNR)

No protocol interaction.

6.9.5 Interaction with Call Transfer (SS-CT)

The following protocol interaction shall apply if SS-CT is supported in accordance with ECMA-178.

6.9.5.1 Actions at an ANF-PR Requesting PINX

6.9.5.1.1 Invocation of Call Transfer

For the purpose of the requirements below, the following events shall be considered as invocation of SS-CT:

- receipt of callTransferComplete invoke APDU;
- receipt of callTransferIdentify invoke APDU;
- receipt of callTransferInitiate invoke APDU;
- invocation of Call Transfer by the local user.

SS-CT shall be allowed to proceed normally if invoked while the PINX is acting as a Requesting PINX for ANF-PR. If SS-CT is invoked while in ANF-PR state PR-Req-Initiating, all signalling for SS-CT shall occur on the old path. If SS-CT is invoked while in ANF-PR state PR-Req-Completing, all subsequent signalling for SS-CT shall be sent on the new path and received SS-CT signals shall be accepted from either path.

A pathReplaceSetup invoke APDU shall be responded to with a return error APDU containing error temporarilyUnavailable if, since sending the pathReplacePropose invoke APDU, SS-CT has been invoked.

NOTE 26

This will prevent switching over to the new path, so that all signalling for SS-CT can take place on the old path without risk of loss during switch over.

6.9.5.1.2 Initiation of ANF-PR during Call Transfer

ANF-PR shall not be initiated while the PINX is acting as a Transferring PINX, a Primary PINX or a Secondary PINX during SS-CT.

6.9.5.2 Actions at an ANF-PR Cooperating PINX

6.9.5.2.1 Invocation of Call Transfer

On receipt of a callTransferComplete, callTransferIdentify or callTransferInitiate invoke APDU while acting as an ANF-PR Cooperating PINX in ANF-PR state PR-Coop-Establishment or PR-Coop-Retain, SS-CT shall be allowed to proceed normally using the old path for further signalling.

As an exceptional procedure, if after receipt of a callTransferComplete, callTransferIdentify or callTransferInitiate invoke APDU while acting as an ANF-PR Cooperating PINX in ANF-PR state PR-Coop-Establishment or PR-Coop-Retain, the old path is released as a result of successful ANF-PR before SS-CT signalling is complete, SS-CT shall be allowed to proceed normally using the new path for further signalling.

NOTE 27

The Requesting PINX will normally abandon ANF-PR by sending back a pathReplaceSetup return error APDU because SS-CT has been invoked. Therefore switch over to a new path will not normally occur.

While acting as an ANF-PR Cooperating PINX in ANF-PR state PR-Coop-Establishment, an SS-CT invocation request from the local user shall be treated in one of the following ways:

- reject the request for SS-CT; or
- wait until ANF-PR is complete before processing the request for SS-CT; or

– abort ANF-PR and proceed with SS-CT.

To abort ANF-PR while in state PR-Coop-Establishment, the Cooperating PINX shall send a DISCONNECT message using the call reference of the new connection, thereby initiating the clearing procedures of ECMA-143 for the new connection, send a pathReplacePropose return error APDU with error value supplementaryServiceInteractionNotAllowed using the call reference of the old connection, and enter state PR-Coop-Idle.

While acting as an ANF-PR Cooperating PINX in ANF-PR state PR-Coop-Retain, an SS-CT invocation request from the local user shall be treated in one of the following ways:

– reject the request for SS-CT; or

– wait until ANF-PR is complete before processing the request for SS-CT.

6.9.5.2.2 Initiation of ANF-PR during Call Transfer

On receipt of a pathReplacePropose invoke APDU while acting as a Transferring PINX, a Primary PINX or a Secondary PINX during SS-CT, a pathReplacePropose return error APDU shall be sent. The error shall be temporarilyUnavailable.

6.9.6 Interaction with Call Forwarding Unconditional (SS-CFU)

No protocol interaction.

6.9.7 Interaction with Call Forwarding Busy (SS-CFB)

No protocol interaction.

6.9.8 Interaction with Call Forwarding No Reply (SS-CFNR)

No protocol interaction.

6.9.9 Interaction with Call Deflection (SS-CD)

The protocol interaction with Call Deflection Immediate shall be as specified in 6.9.6 for interaction with SS-CFU.

The protocol interaction with Call Deflection from Alert shall be as specified in 6.9.8 for interaction with SS-CFNR.

6.10 ANF-PR parameter values (timers)

6.10.1 Timer T1

Timer T1 shall operate at the Requesting PINX during state PR-Req-Initiated. Its purpose is to protect against the absence of a response to the pathReplacePropose invoke APDU. A response can be either a pathReplacePropose return error APDU or a pathReplaceSetup invoke APDU.

Timer T1 shall be started on entering state PR-Req-Initiated and stopped on leaving that state.

On expiry of timer T1, the Requesting PINX shall return to state PR-Req-Idle. The call shall continue as an active call using the old connection.

Timer T1 shall have a value not less than 30s.

6.10.2 Timer T2

Timer T2 shall operate at the Requesting PINX during state PR-Req-Completing. Its purpose is to protect against failure to release the old connection.

Timer T2 shall be started on entering state PR-Req-Completing and stopped on leaving that state.

On expiry of timer T2, the Requesting PINX shall initiate clearing of the old connection by sending a DISCONNECT message with cause number 31 "normal, unspecified" and return to state PR-Req-Idle. The call shall continue as an active call using the new connection.

Timer T2 shall have a value not less than 15s.

6.10.3 Timer T3

Timer T3 may optionally operate at the Cooperating PINX or a Transit PINX during state PR-Coop-Establishment or PR-Transit-Establishment respectively. Its purpose is to protect against failure to establish the new connection.

NOTE 28

Alternatively an implementation can rely on basic call timers for this protection.

Timer T3 shall be started on entering state PR-Coop-Establishment or PR-Transit-Establishment and stopped on leaving that state.

On expiry of timer T3, the PINX shall clear the new connection using the procedures of ECMA-143, and continue according to the procedures of 6.5.2.2 or 6.6.3.2.2 of this Standard respectively.

Timer T3 shall have a value not less than protocol control timer T310.

6.10.4 Timer T4

Timer T4 shall operate at the Cooperating PINX or a Transit PINX during state PR-Coop-Retain or PR-Transit-Retain respectively. Its purpose is to protect against the absence of a response to the pathReplaceRetain invoke APDU.

Timer T4 shall be started on entering state PR-Coop-Retain or PR-Transit-Retain and stopped on leaving that state.

On expiry of timer T4, the PINX shall continue according to the procedures of 6.6.2.2 or 6.6.3.1.2 of this Standard respectively.

Timer T4 shall have a value not less than 30s.

Annex A

(normative)

Protocol Implementation Conformance Statement (PICS) proforma

A.1 Introduction

The supplier of a protocol implementation which is claimed to conform to this Standard shall complete the following Protocol Implementation Conformance Statement (PICS) proforma.

A completed PICS proforma is the PICS for the implementation in question. The PICS is a statement of which capabilities and options of the protocol have been implemented. The PICS can have a number of uses, including use:

- by the protocol implementor, as a check list to reduce the risk of failure to conform to the Standard through oversight;
- by the supplier and acquirer, or potential acquirer, of the implementation, as a detailed indication of the capabilities of the implementation, stated relative to the common basis for understanding provided by the Standard's PICS proforma;
- by the user or potential user of the implementation, as a basis for initially checking the possibility of interworking with another implementation - while interworking can never be guaranteed, failure to interwork can often be predicted from incompatible PICS's;
- by a protocol tester, as the basis for selecting appropriate tests against which to assess the claim for conformance of the implementation.

A.2 Instructions for completing the PICS proforma

A.2.1 General structure of the PICS proforma

The PICS proforma is a fixed format questionnaire divided into sub-clauses each containing a group of individual items. Each item is identified by an item number, the name of the item (question to be answered), and the reference(s) to the clause(s) that specifies (specify) the item in the main body of this Standard.

The "Status" column indicates whether an item is applicable and if so whether support is mandatory or optional. The following terms are used:

m	mandatory (the capability is required for conformance to the protocol);
o	optional (the capability is not required for conformance to the protocol, but if the capability is implemented it is required to conform to the protocol specifications);
o.<n>	optional, but support of at least one of the group of options labelled by the same numeral <n> is required;
x	prohibited;
c.<cond>	conditional requirement, depending on support for the item or items listed in condition <cond>;
<item>:m	simple conditional requirement, the capability being mandatory if item number <item> is supported, otherwise not applicable;
<item>:o	simple conditional requirement, the capability being optional if item number <item> is supported, otherwise not applicable.

Answers to the questionnaire items are to be provided either in the "Support" column, by simply marking an answer to indicate a restricted choice (Yes or No), or in the "Not Applicable" column (N/A).

A.2.2 Additional information

Items of Additional Information allow a supplier to provide further information intended to assist the interpretation of the PICS. It is not intended or expected that a large quantity will be supplied, and a PICS can be considered complete without any such information. Examples might be an outline of the ways in which a (single) implementation can be set up to operate in a variety of environments and configurations.

References to items of Additional Information may be entered next to any answer in the questionnaire, and may be included in items of Exception information.

A.2.3 Exception information

It may occasionally happen that a supplier will wish to answer an item with mandatory or prohibited status (after any conditions have been applied) in a way that conflicts with the indicated requirement. No pre-printed answer will be found in the Support column for this. Instead, the supplier is required to write into the support column an x.<i> reference to an item of Exception Information, and to provide the appropriate rationale in the Exception item itself.

An implementation for which an Exception item is required in this way does not conform to this Standard. A possible reason for the situation described above is that a defect in the Standard has been reported, a correction for which is expected to change the requirement not met by the implementation.

A.3 PICS proforma for ECMA-176

A.3.1 Implementation identification

Supplier	
Contact point for queries about the PICS	
Implementation Name(s) and Version(s)	
Other information necessary for full identification, e.g., name(s) and version(s) for machines and/or operating systems; system name(s)	

Only the first three items are required for all implementations; other information may be completed as appropriate in meeting the requirement for full identification.

The terms Name and Version should be interpreted appropriately to correspond with a suppliers terminology (e.g., Type, Series, Model).

A.3.2 Protocol summary

Protocol version	1.0
Addenda Implemented (if applicable)	
Amendments Implemented	
Have any exception items been required (see A.2.3)?	No [ ] Yes [ ] (The answer Yes means that the implementation does not conform to this Standard)

Date of statement	

A.3.3 General

Item	Question/feature	References	Status	N/A	Support
A1	Behaviour as Cooperating PINX for ANF-PR		o.1		Yes [ ] No [ ]
A2	Behaviour as Requesting PINX for ANF-PR		o.1		Yes [ ] No [ ] Conditions for invoking ANF-PR should be given as Additional Information
A3	Behaviour as Transit PINX for ANF-PR		o.1		Yes [ ] No [ ]
A4	Behaviour as gateway PINX to another network which provides Cooperating PINX functionality	6.8	o.1		Yes [ ] No [ ]
A5	Behaviour as gateway PINX to another network which provides Requesting PINX functionality	6.8	o.1		Yes [ ] No [ ]
A6	Procedures for retaining part or all of the old connection		o		Yes [ ] No [ ]
A7	Behaviour as Inviting PINX for ANF-PR	6.5.5	o		Yes [ ] No [ ]
A8	Are methods of avoiding “loss of user information” (as described in annex B of ECMA-175) supported at the Requesting PINX?		o		Yes [ ] No [ ] Please provide information regarding which methods are supported and for which basic services these methods are applicable.
A9	Are methods of avoiding “loss of user information” (as described in annex B of ECMA-175) supported at the Cooperating/Branching PINX?		o		Yes [ ] No [ ] Please provide information regarding which methods are supported and for which basic services these methods are applicable.

A.3.4 Procedures

Item	Question/feature	References	Status		Support
B1	Support of relevant ECMA-143 and ECMA-165 procedures at a Cooperating PINX	6.2.1	A1:m	[ ]	m: Yes[ ]
B2	Support of relevant ECMA-143 and ECMA-165 procedures at a Requesting PINX	6.2.2	A2:m	[ ]	m: Yes[ ]
B3	Support of relevant ECMA-143 and ECMA-165 procedures at a Transit PINX	6.2.3.1, 6.2.3.2	A3:m	[ ]	m: Yes[ ]
B4	Support of relevant ECMA-143 and ECMA-165 procedures at a Transit PINX on a retained connection	6.2.3.3, 6.2.3.4	c.1	[ ]	m: Yes[ ]
B5	Signalling procedures at a Cooperating PINX	6.5.2	A1:m	[ ]	m: Yes[ ]
B6	Signalling procedures at a Requesting PINX	6.5.1.3, 6.5.1.4	A2:m	[ ]	m: Yes[ ]
B7	Signalling procedures at a Cooperating/-Requesting PINX in the case of a trombone connection	6.5.3	c.2	[ ]	m: Yes[ ]
B8	Additional signalling procedures at a Requesting PINX when whole of old connection is retained	6.6.1	c.4	[ ]	m: Yes[ ]
B9	Additional signalling procedures at a Cooperating PINX for retention of part or all of the old connection	6.6.2	c.3	[ ]	m: Yes[ ]
B10	Additional signalling procedures at a Transit PINX for retention of part or all of the old connection	6.6.3	c.1	[ ]	m: Yes[ ]
B11	Signalling procedures at Inviting PINX	6.5.5	A7:m	[ ]	m: Yes[ ]
B12	Additional procedure for support of request from an Inviting PINX	6.5.1.2	A2:o		o: Yes[ ], No [ ]
B13	Additional signalling procedure at Inviting PINX on retained part of the old connection	6.6.5	A7:m	[ ]	m: Yes[ ]

c.1 if A3 and A6 then m
else N/A

c.2: if A1 and A2 then m
else N/A

c.3 if A1 and A6 then m
else N/A

c.4 if A2 and A6 then m
else N/A

A.3.5 Coding

Item	Question/feature	References	Status	N/A	Support
C1	Sending of pathReplacePropose invoke APDU and receipt of return error APDU	6.3.1, 6.3.2.1	c.1	[ ]	m: Yes[ ]
C2	Sending of pathReplaceSetup invoke APDU and receipt of return result and return error APDUs	6.3.1, 6.3.2.1	c.2	[ ]	m: Yes[ ]
C3	Sending of pathReplaceRetain invoke APDU and receipt of return result and return error APDUs	6.3.1, 6.3.2.1	c.3	[ ]	m: Yes[ ]
C4	Receipt of pathReplacePropose invoke APDU and sending of return error APDU	6.3.1, 6.3.2.1	c.2	[ ]	m: Yes[ ]
C5	Receipt of pathReplaceSetup invoke APDU and sending of return result and return error APDUs	6.3.1, 6.3.2.1	c.1	[ ]	m: Yes[ ]
C6	Receipt of pathReplaceRetain invoke APDU and sending of return result and return error APDUs	6.3.1, 6.3.2.1	c.4	[ ]	m: Yes[ ]
C7	Receipt of pathReplaceInvite invoke APDU	6.3.1, 6.3.2.1	A2:o		o: Yes[ ], No [ ]
C8	Sending of pathReplaceInvite return error	6.3.1, 6.3.2.1	C7:o		o: Yes[ ], No [ ]
C9	Sending of pathReplaceInvite invoke APDU and receipt of errors	6.3.1, 6.3.2.1	A7:m	[ ]	m: Yes[ ]

c.1: if A2 or A5 then m
else N/A

c.2: if A1 or A4 then m
else N/A

c.3: if (A1 or A3 or A4) and A6 then m
else N/A

c.4: if (A2 or A3 or A5) and A6 then m
else N/A

A.3.6 Timers

Item	Question/feature	References	Status	N/A	Support
D1	Support of timer T1	6.10.1	A2:m	[ ]	m: Yes[ ]
D2	Support of timer T2	6.10.2	A2:m	[ ]	m: Yes[ ]
D3	Support of timer T3	6.10.3	c.1	[ ]	o: Yes[ ] No [ ]
D4	Support of timer T4	6.10.4	c.2	[ ]	m: Yes[ ]

c.1: if A1 or (A3 and A6) then o
else N/A

c.2: if (A1 or A3) and A6 then m
else N/A

A.3.7 Protocol interactions with SS-CT

Item	Question/feature	References	Status	N/A	Support
E1	Support of SS-CT		o		Yes [ ] No [ ]
E2	Interactions between SS-CT and ANF-PR at an ANF-PR Requesting PINX	6.9.5.1	c.1	[ ]	m: Yes [ ]
E3	Interactions between SS-CT and ANF-PR at an ANF-PR Cooperating PINX	6.9.5.2	c.2	[ ]	m: Yes [ ]

c.1: if E1 and A2 then m, else N/A

c.2: if E1 and A1 then m, else N/A

Annex B

(informative)

Imported ASN.1 definitions

This annex shows ASN.1 definitions of types and values that are imported from other ISO/IEC or ITU-T publications. However, definitions that are specified or reproduced in ECMA-165 are omitted.

Table B.1 is an extract from module General-Error-List in ITU-T Recommendation Q.950 showing the definition of imported error values.

Table B.1 - Imported ASN.1 definitions of error values

notAvailable	ERROR ::= 3
supplementaryServiceInteractionNotAllowed	ERROR ::= 10

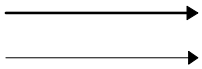
Annex C

(informative)

Examples of message sequences

This annex describes some typical message flows for ANF-PR. The following conventions are used in the figures of this annex.

1. The following notation is used:



Basic call messages containing ANF-PR information

Basic call messages without ANF-PR information

xxx.inv	Invoke APDU for operation xxx
xxx.rr	Return result APDU for operation xxx
xxx.re	Return error APDU for operation xxx

2. The figures show messages exchanged via Protocol Control between PINXs involved in ANF-PR. Only messages relevant to ANF-PR are shown.

3. Only the relevant information content (i.e., remote operation APDUs) is listed below each message name. The Facility Information elements containing remote operation APDUs are not explicitly shown. Information with no impact on ANF-PR is not shown.

C.1 Example message sequence for normal operation - invocation by Requesting PINX

Figure C.1 shows an example of normal operation of ANF-PR. The old connection and the new connection are each shown passing through two Transit PINXs.

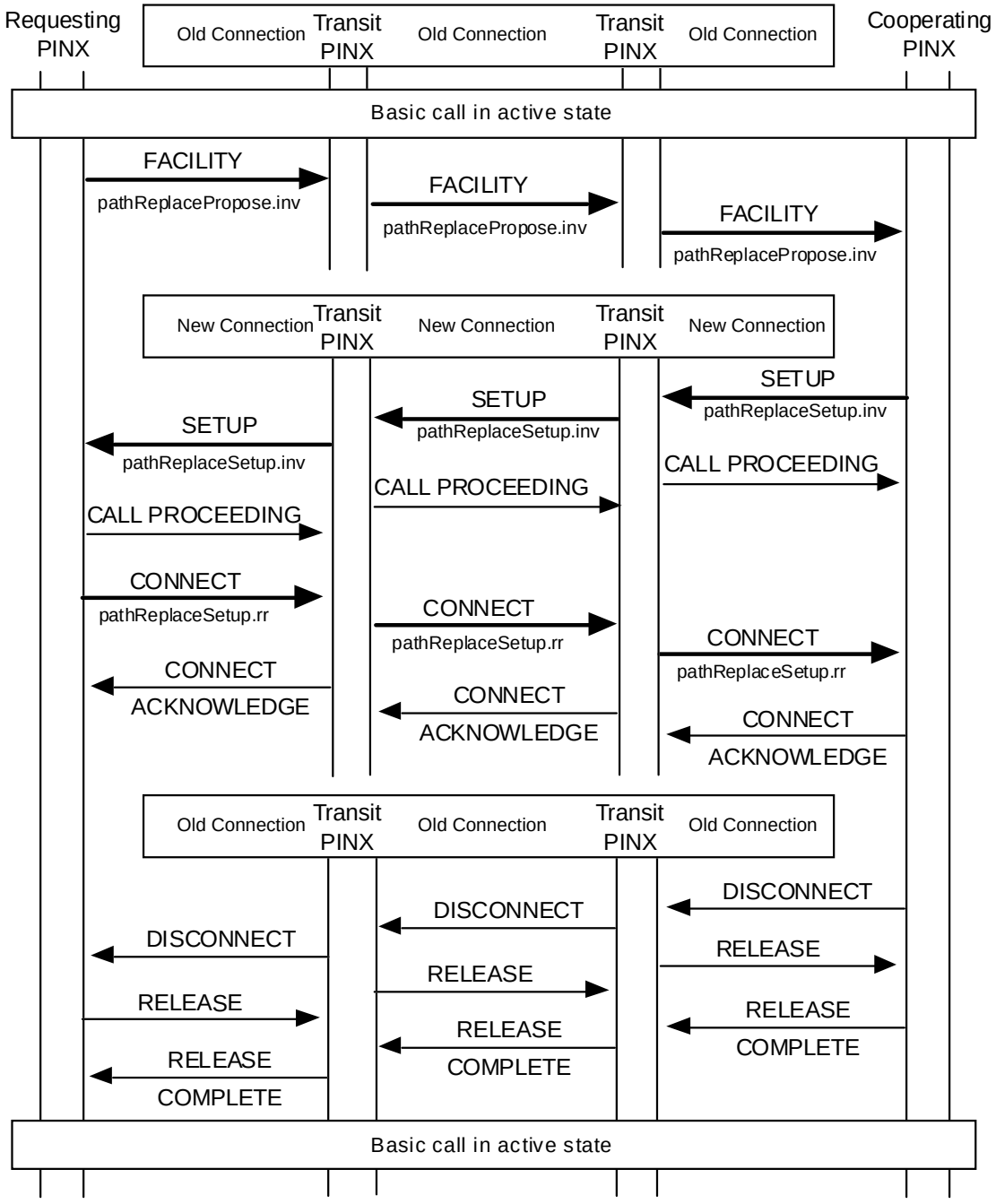


Figure C.1 - Message sequence for normal operation of ANF-PR - invocation by Requesting PINX

C.2 Example message sequence for case of congestion encountered at Transit PINX - invocation by Requesting PINX

Figure C.2 shows an example of the operation of ANF-PR for the case where a Transit PINX on the new connection is unable to proceed with connection establishment, e.g., because of congestion. Consequently ANF-PR fails.

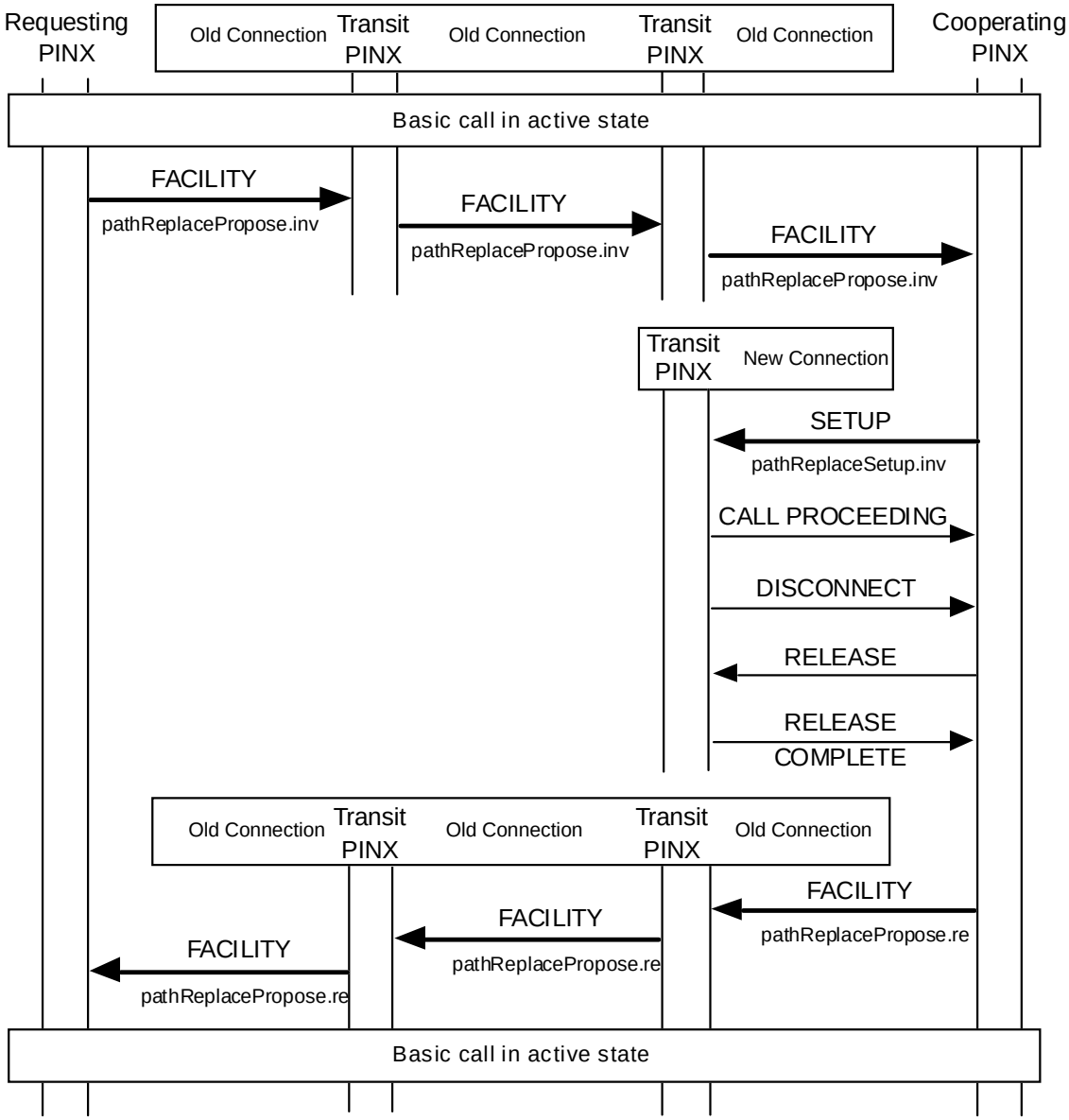


Figure C.2 - Message sequence for congestion case of ANF-PR - invocation by Requesting PINX

C.3 Example message sequence for normal operation - invocation by Inviting PINX

Figure C.3 shows an example of normal operation of ANF-PR when it is invoked by an Inviting PINX. The old connection and the new connection are each shown passing through two transit PINXs, in which one is also an Inviting PINX.

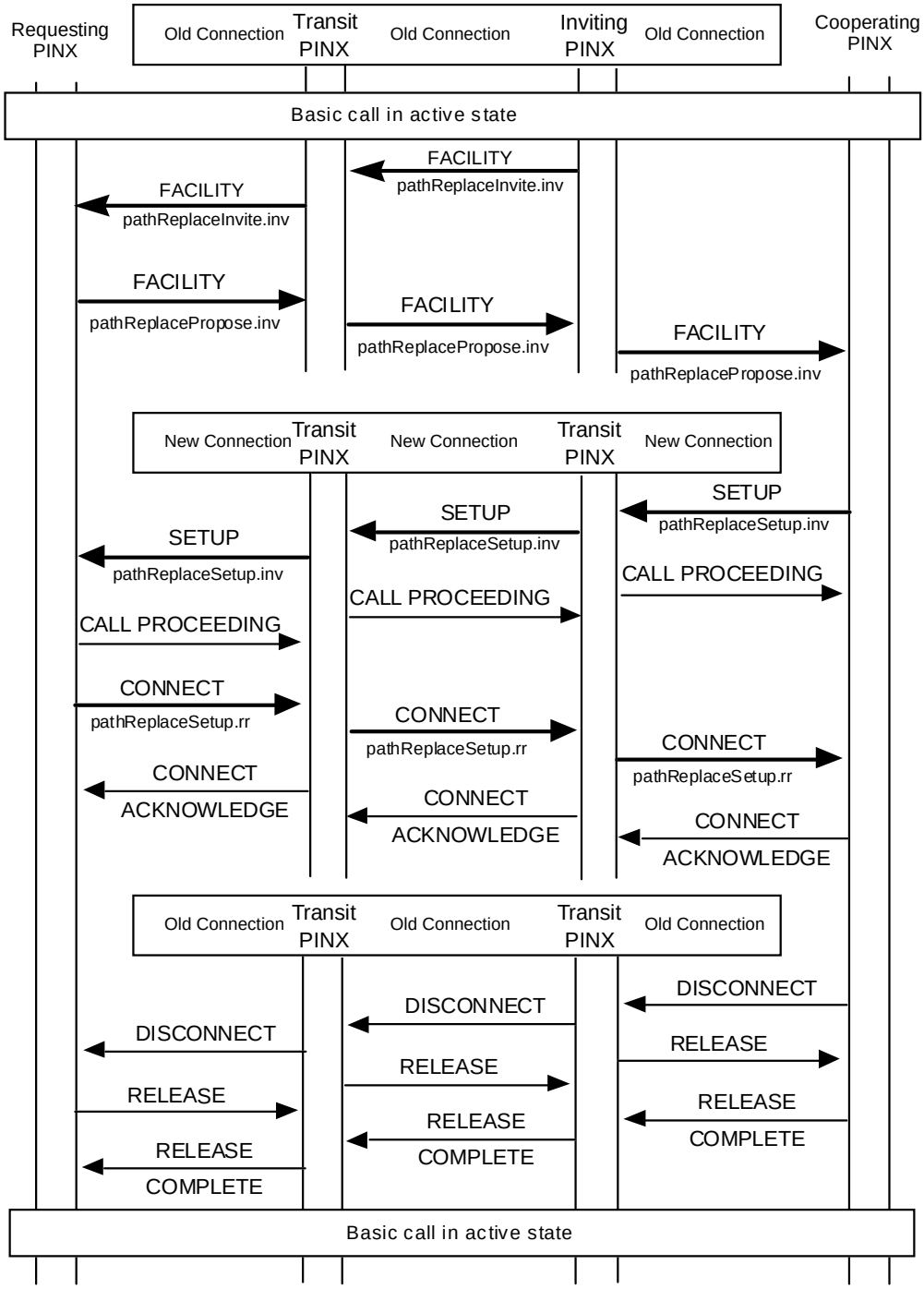


Figure C.3 - Message sequence for normal operation of ANF-PR - invocation by Inviting PINX

C.4 Example message sequence for case of congestion encountered at transit PINX - invocation by Inviting PINX

Figure C.4 shows an example of the operation of ANF-PR when a transit PINX on the new connection is unable to proceed with connection establishment, e.g., because of congestion. Consequently ANF-PR fails.

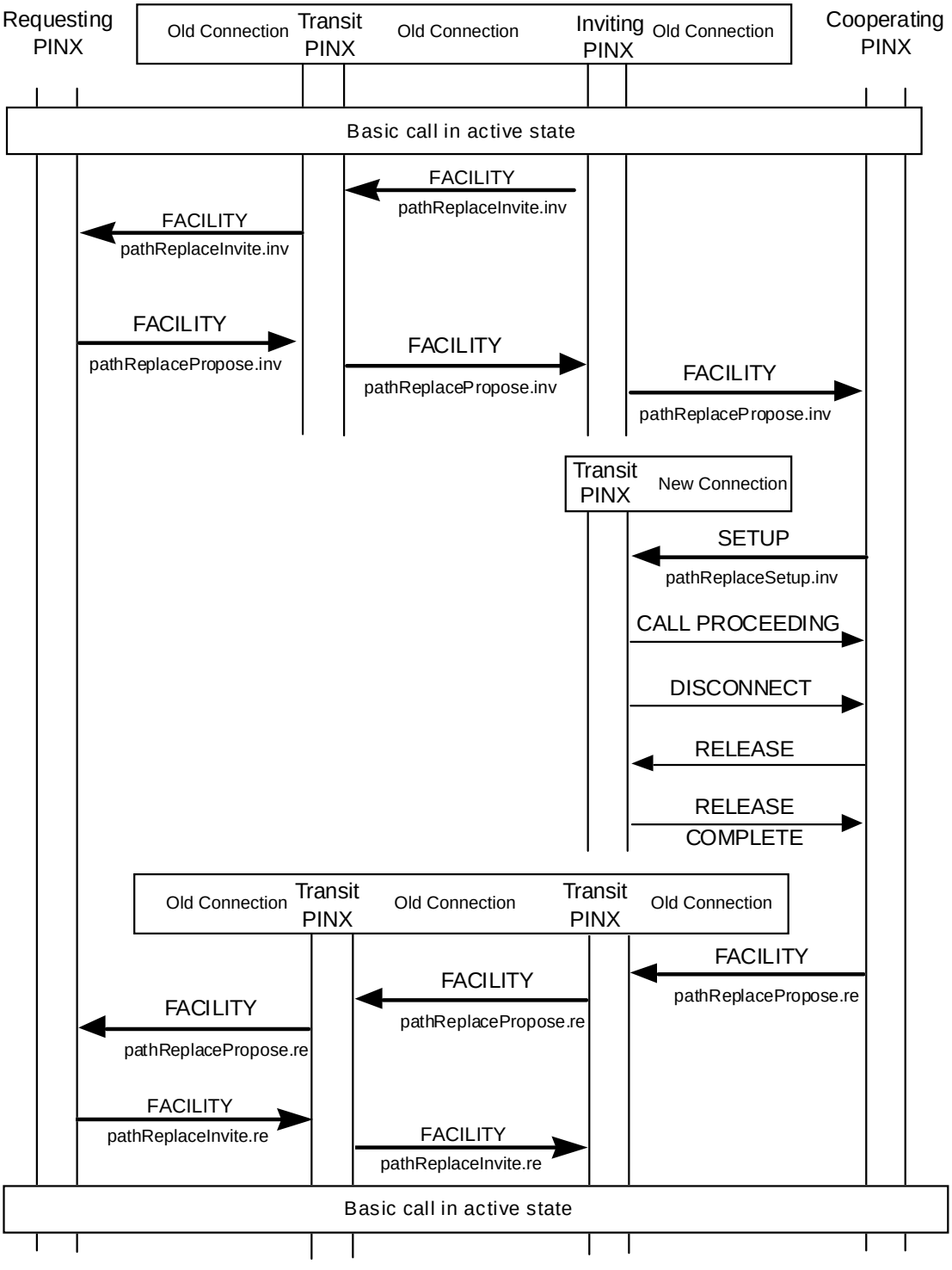


Figure C.4 - Message sequence for congestion case of ANF-PR - invocation by Inviting PINX

C.5 Example message sequence for normal operation, retaining part of the old connection

Figure C.5 shows an example of normal operation of ANF-PR with elements of the old connection retained as far as the first Transit PINX. The old connection and the new connection are each shown passing through one Transit PINX.

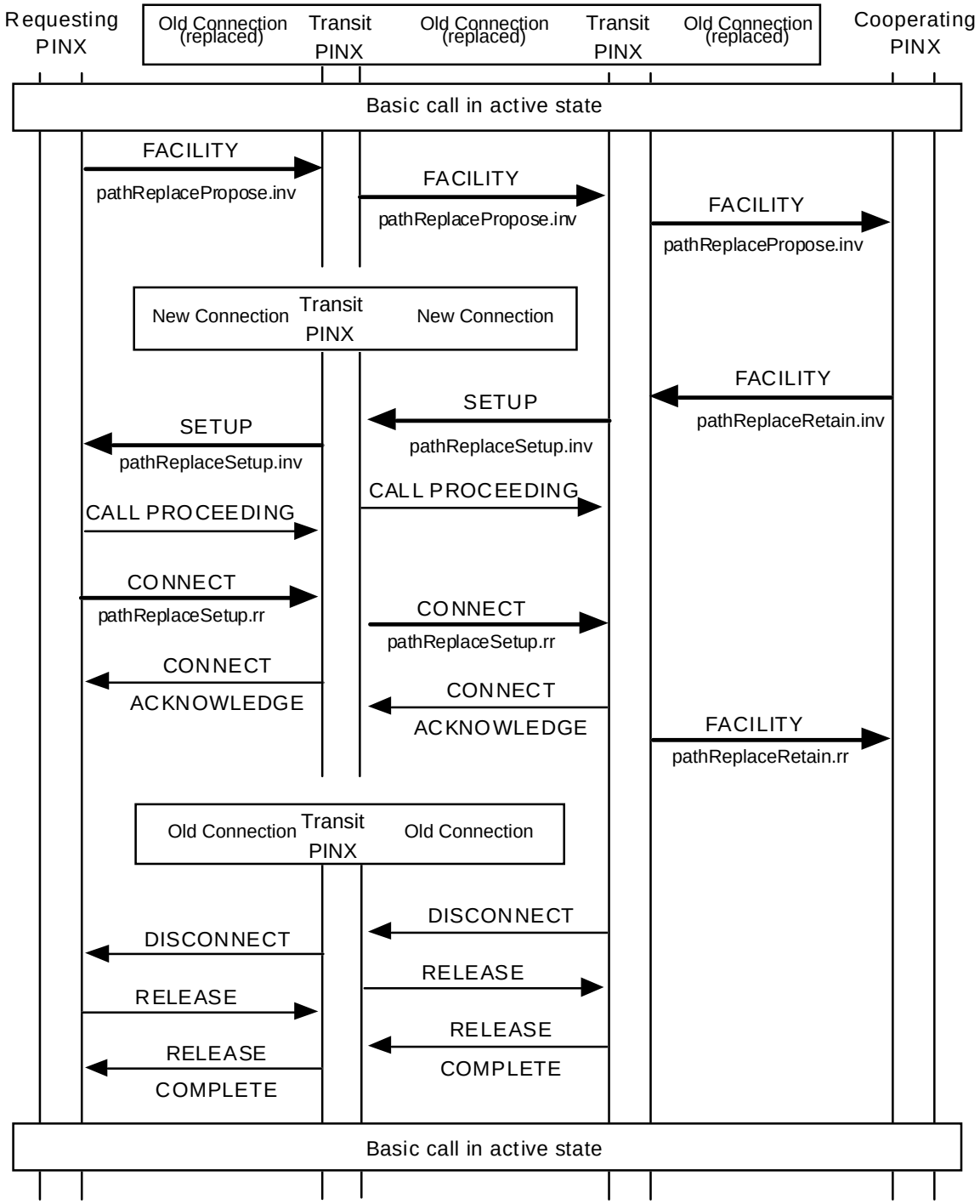


Figure C.5 - Message sequence for normal operation of ANF-PR, retaining part of the old connection

C.6 Example message sequence for case of congestion encountered at Transit PINX, after attempting to retain part of the old connection

Figure C.6 shows an example of the operation of ANF-PR with elements of the old connection retained as far as the first Transit PINX (branching PINX), but with failure to establish the new connection beyond the second Transit PINX, e.g., because of congestion. The Cooperating PINX does not re-attempt ANF-PR using a completely new connection, and therefore ANF-PR fails.

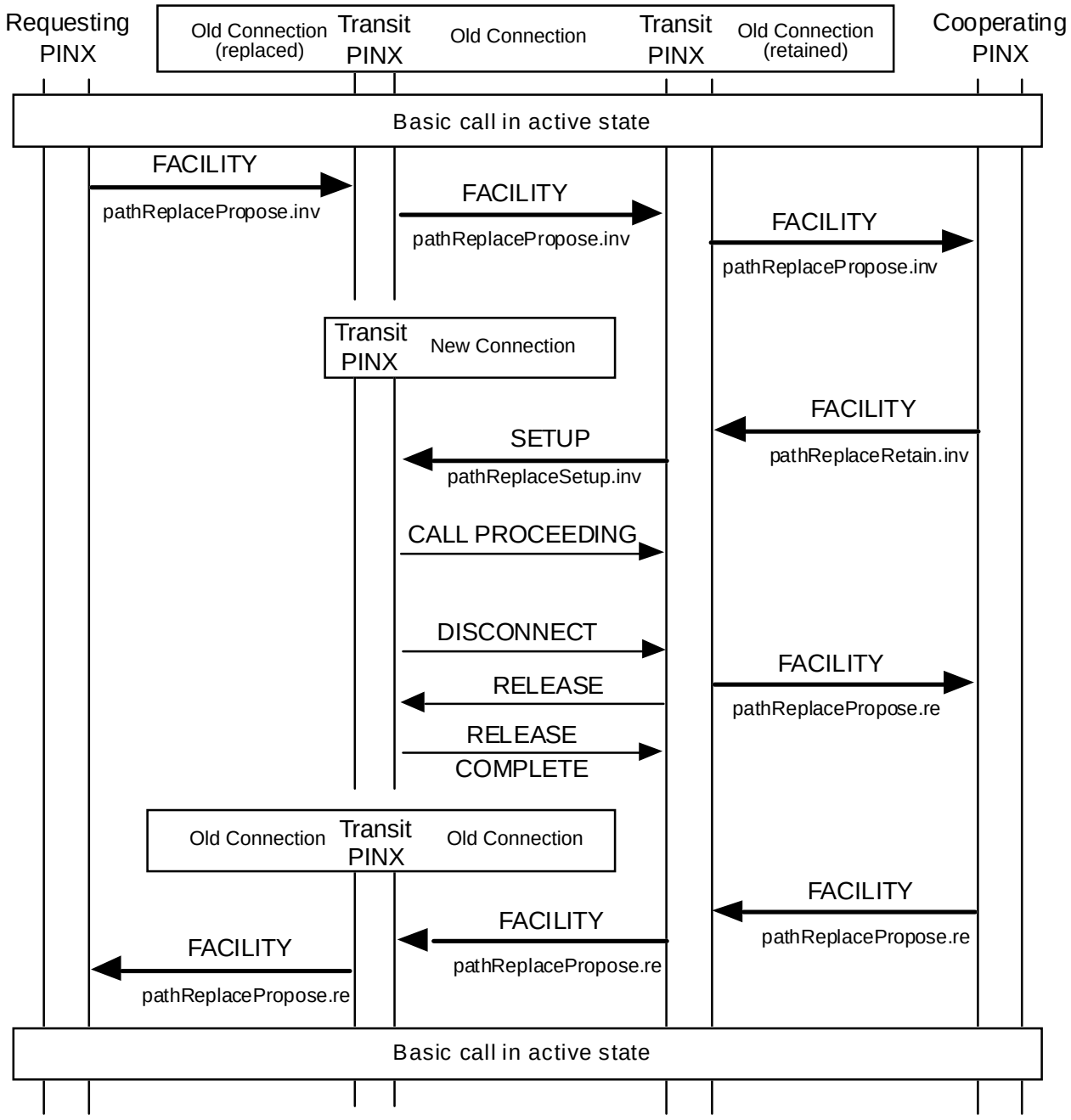


Figure C.6 - Message sequence for congestion case, retaining part of the old connection

C.7 Example message sequence for normal operation, retaining all of the old connection

Figure C.7 shows an example of normal operation of ANF-PR with the whole of the old connection retained.

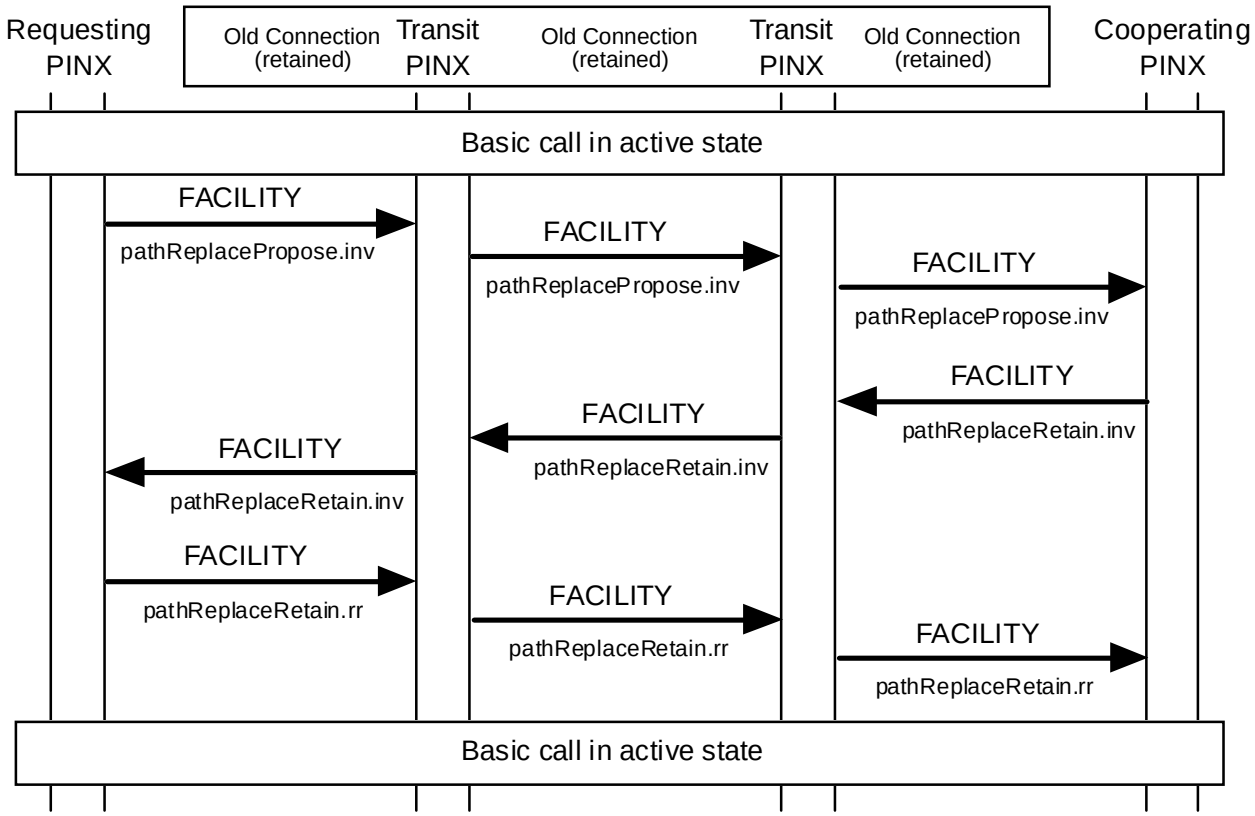


Figure C.7 - Message sequence for normal operation of ANF-PR, retaining all of the old connection

Annex D

(informative)

Specification and Description Language (SDL) representation of procedures

The diagrams in this annex use the Specification and Description Language defined in ITU-T Recommendation Z.100 (1993).

Each diagram represents the behaviour of an ANF-PR Supplementary Service Control entity at a particular type of PINX. In accordance with the protocol model described in ECMA-165, the Supplementary Service Control entity uses, via the Coordination Function, the services of Generic Functional Transport Control and Basic Call Control.

Where an output symbol represents a primitive to the Coordination Function, and that primitive results in a message being sent, the output symbol bears the name of the message and any remote operations APDU(s) or notification(s) contained in that message. In the case of a message specified in ECMA-143, basic call actions associated with the sending of that message are deemed to occur.

Where an input symbol represents a primitive from the Coordination Function, and that primitive is the result of a message being received, the input symbol bears the name of the message and any remote operations APDU(s) or notification(s) contained in that message. In the case of a message specified in ECMA-143, basic call actions associated with the receipt of that message are deemed to have occurred.

The following abbreviations are used:

inv.	invoke APDU
res.	return result APDU
err.	return error APDU
rej.	reject APDU
prPropose	pathReplacePropose
prSetup	pathReplaceSetup
prRetain	pathReplaceRetain
rN	rerouteingNumber
cI	callIdentity

D.1 SDL representation of ANF-PR at the Inviting PINX

Figure D.1 shows the behaviour of an ANF-PR Supplementary Service Control entity within the Inviting PINX.

Input signals from the right and output signals to the right represent primitives to and from the Coordination Function in respect of messages sent and received. Also protocol timer expiry and indications from basic call control are indicated by input signals from the right.

Input signals from the left and output signals to the left represent stimuli between the ANF-PR Supplementary Service Control entity and the ANF-PR user.

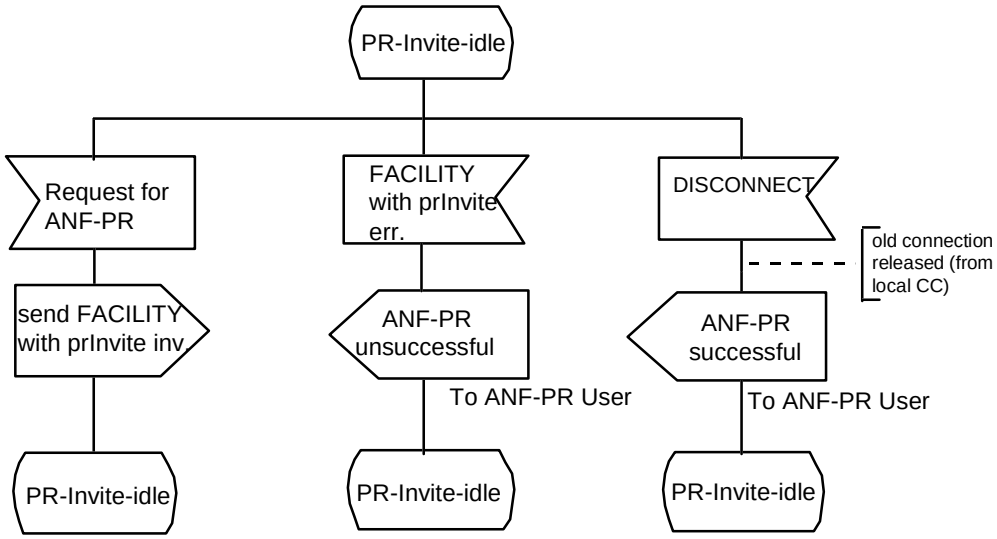


Figure D.1 - Inviting PINX SDL

D.2a SDL representation of ANF-PR at the Requesting PINX - invocation by Requesting PINX

Figure D.2a shows the behaviour of an ANF-PR Supplementary Service Control entity within the Requesting PINX.

Input signals from the right and output signals to the right represent primitives to and from the Coordination Function in respect of messages sent and received. Also protocol timer expiry and indications from basic call control are indicated by input signals from the right.

Input signals from the left and output signals to the left represent stimuli between the ANF-PR Supplementary Service Control entity and the ANF-PR User.

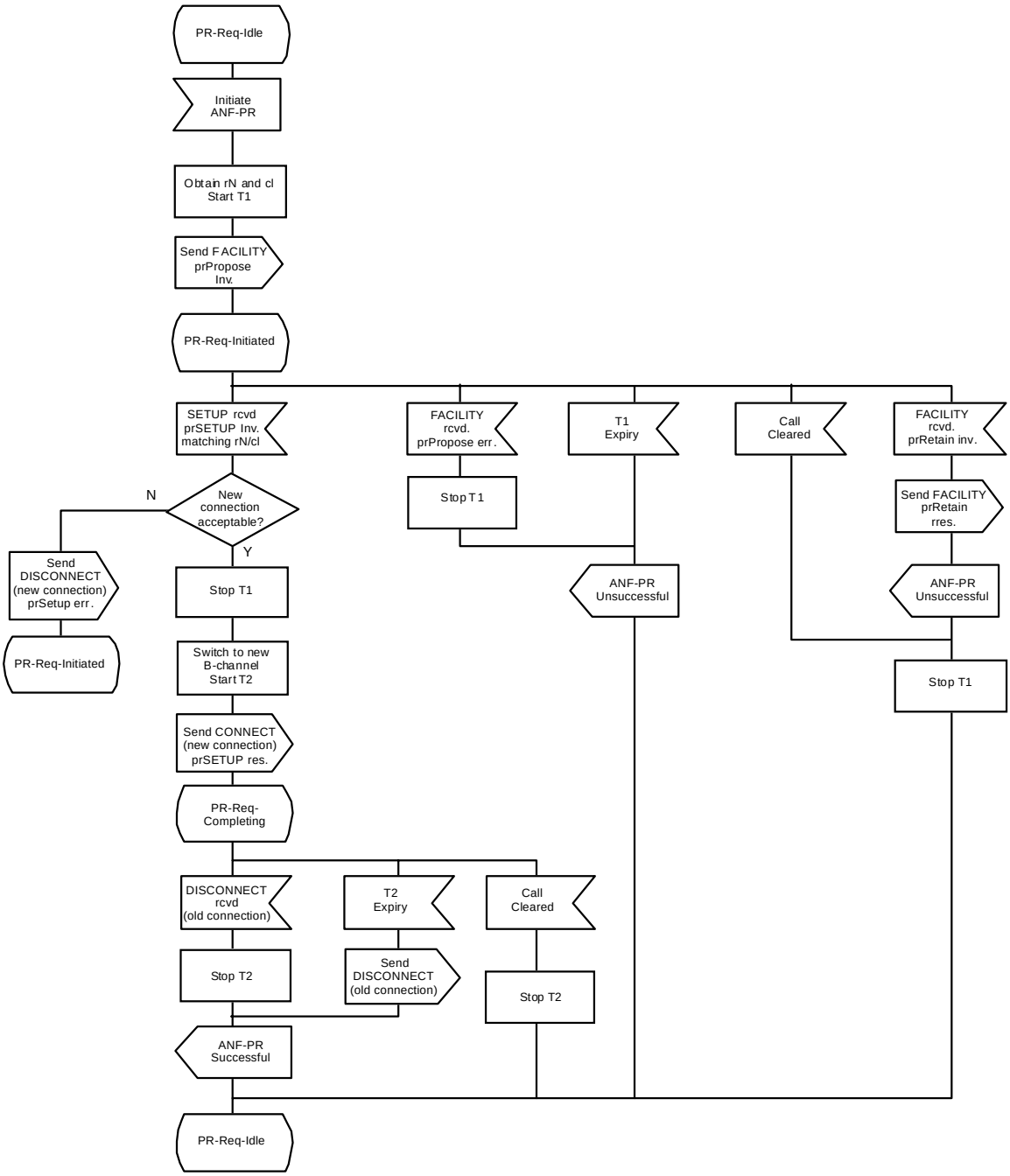


Figure D.2a - Requesting PINX SDL

D.2b SDL representation of ANF-PR at the Requesting PINX - invocation by Inviting PINX

Figure D.2b shows the behaviour of an ANF-PR Supplementary Service Control entity within the Requesting PINX being invoked by a Inviting PINX.

Input signals from the right and output signals to the right represent primitives to and from the Coordination Function in respect of messages sent and received. Also protocol timer expiry and indications from basic call control are indicated by input signals from the right.

Input signals from the left and output signals to the left represent messages between the ANF-PR Supplementary Service Control entity and the Inviting PINX.

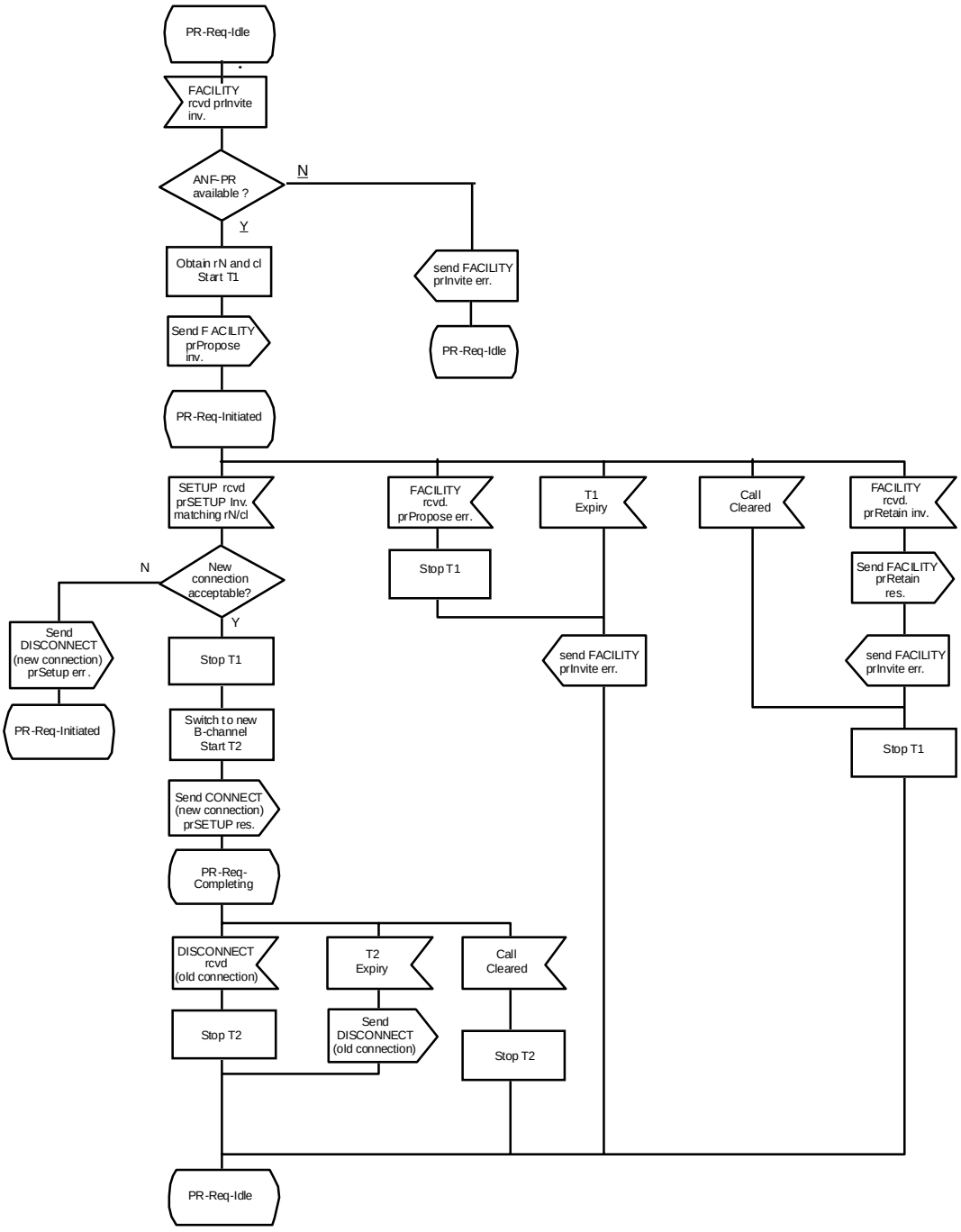


Figure D.2b - Requesting PINX SDL

D.3 SDL representation of ANF-PR at the Cooperating PINX

Figure D.3 shows the behaviour of an ANF-PR Supplementary Service Control entity within the Cooperating PINX.

Input signals from the left and output signals to the left represent primitives to and from the Coordination Function in respect of messages sent and received. Input signals from the right represent protocol timer expiry and indications from basic call control.

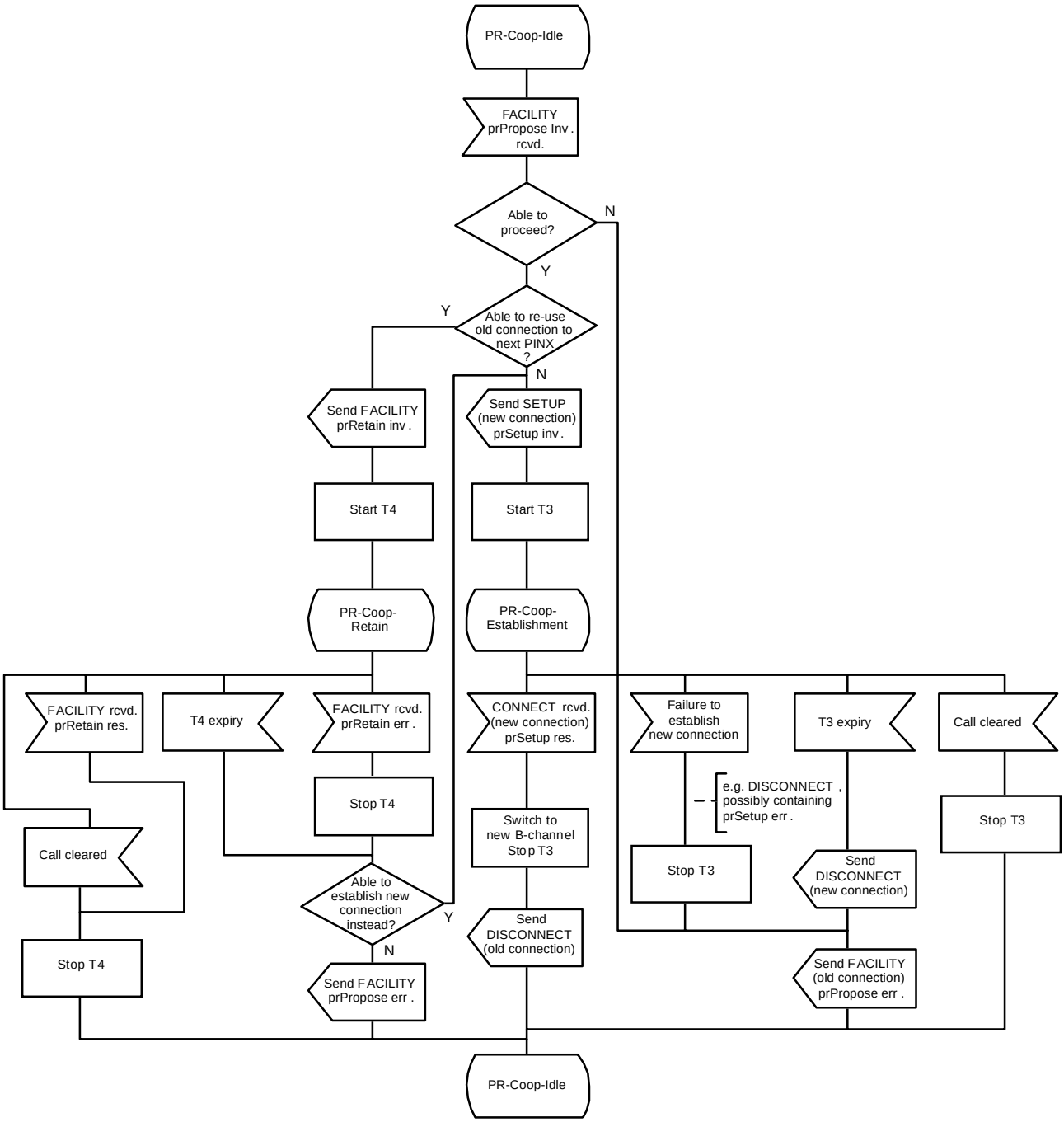


Figure D.3 - Cooperating PINX SDL

D.4 SDL representation of ANF-PR at a Transit PINX on the retained connection

Figure D.4 shows the behaviour of an ANF-PR Supplementary Service Control entity within a Transit PINX on the retained connection.

Input signals from the left and output signals to the left represent primitives to and from the Coordination Function in respect of messages sent to and received from the subsequent PINX.

Input signals from the right and output signals to the right represent primitives to and from the Coordination Function in respect of messages sent to and received from the preceding PINX. Also protocol timer expiry and indications from basic call control are indicated by input signals from the right.

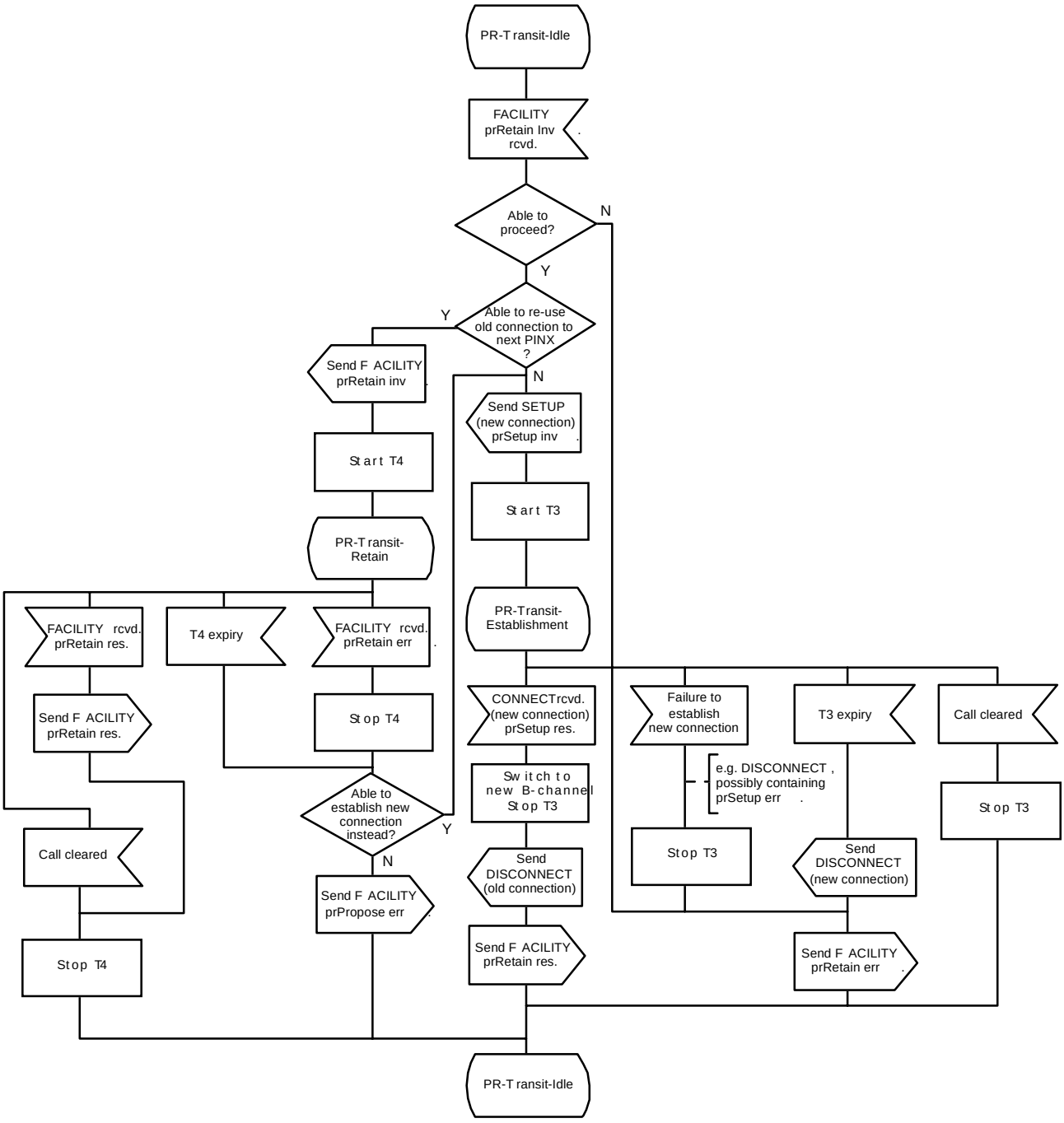


Figure D.4 - Transit PINX SDL

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