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New presentation - see History box

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Foreword

This European Telecommunication Standard (ETS) has been produced by the European Computer Manufacturers Association (ECMA) on behalf of its members and those of the European Telecommunications Standards Institute (ETSI).

This ETS is one of a series of standards defining services and signalling protocols applicable to Private Telecommunication Networks (PTNs). The series uses the Integrated Services Digital Network (ISDN) concepts as developed by CCITT and is also within the framework of standards for open systems interconnection as defined by ISO.

This particular ETS specifies the signalling protocol for use at the Q reference point in support of the Call Completion supplementary services.

The ETS is based upon the practical experience of ECMA member companies and the results of their active and continuous participation in the work of ISO, CCITT, ETSI and other international and national standardisation bodies. It represents a pragmatic and widely based consensus.

This ETS was produced by ECMA using the ECMA guidelines for the production of standards and using the ECMA stylesheet. In order to avoid undue delays in the voting process for this ETS it has been agreed that this ETS will not be converted to the ETSI stylesheet.

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1 Scope

This European Telecommunication Standard (ETS) specifies the signalling protocol for the support of the Call Completion supplementary services (SS-CCBS, SS-CCNR) at the Q reference point between Private Telecommunication Network Exchanges (PTNXs) connected together within a Private Telecommunication Network (PTN).

SS-CCBS enables a calling User A, encountering a busy destination User B, to have the call completed when User B becomes not busy, without having to make a new call attempt.

SS-CCNR enables a calling User A, encountering a destination User B that, though alerted, does not answer, to have the call completed when User B becomes not busy again after a period of activity, without having to make a new call attempt.

The Q reference point is defined in Standard ISO/IEC 11579.

Service specifications are produced in three stages and according to the method specified in ENV 41005. This Standard is the output from stage 3, the definition of signalling protocols, for SS-CCBS and SS-CCNR. This Standard satisfies the requirements identified by the stage 1 and stage 2 specifications in ETS 300 365.

The signalling protocols for SS-CCBS and SS-CCNR operate partly on top of the signalling protocol for basic circuit switched call control, as specified in ETS 300 172, and partly independently of a basic call. The protocols use certain aspects of the generic procedures for the control of supplementary services specified in ETS 300 239.

The impact on the protocol of interactions between the Call Completion services and other supplementary services is outside the scope of this Standard.

This Standard is applicable to PTNXs which can interconnect to form a PTN.

2 Conformance

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

3   **References**

ISO/IEC 11579:   Information Technology - Telecommunications and Information Exchange between Systems - Private Integrated Services Network - Reference Configurations for PISN Exchanges (1994)

ETS 300 172:   Private Telecommunication Network (PTN); Inter-exchange signalling protocol; Circuit mode basic services (1994)

ETS 300 196-1:   Integrated Services Digital Network (ISDN); Generic functional protocol for the support of supplementary services; Digital Subscriber Signalling System No. one (DSS1) protocol; Part 1: Protocol specification (1992)

ETS 300 239:   Private Telecommunication Network (PTN) - Inter-exchange signalling protocol; Generic functional protocol for the support of supplementary services (1992)

ETS 300 359-1:   Integrated Services Digital Network (ISDN); Completion of Calls to Busy Subscriber (CCBS) supplementary service; Digital Subscriber Signalling System No. one (DSS1) protocol; Part 1: Protocol specification (1994)

ETS 300 365:   Private Telecommunication Network (PTN); Specification, functional model and information flows; Call completion supplementary services (1994)

ETS 300 171:   Private Telecommunication Networks (PTN); Specification, functional model and information flows; Control aspects of circuit mode basic services (1992)

ENV 41005:   Method for the Specification of Basic and Supplementary Services of Private Telecommunication Networks (1989)

ENV 41007-1:   Definition of Terms in Private Telecommunication Networks (1989)

CCITT Rec. I.112:   Vocabulary of terms for ISDNs (1988)

CCITT Rec. I.210:   Principles of telecommunication services supported by an ISDN and the means to describe them (1988)

CCITT Rec. Z.100:   Specification and description language (SDL) (1988)

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:

− Application Protocol Data Unit (APDU)	(ETS 300 239)
− Basic Service	(CCITT Rec. I.210)
− Busy	(ETS 300 365)
− Call, Basic Call	(ETS 300 239)
− Call Independent	(ETS 300 239)
− Call Independent Signalling Connection	(ETS 300 239)
− Call Related	(ETS 300 239)
− End PTNX	(ETS 300 239)
− Gateway PTNX (Incoming / Outgoing)	(ETS 300 239)
− Interpretation APDU	(ETS 300 239)
− Network Facility Extension (NFE)	(ETS 300 239)
− Originating PTNX	(ETS 300 172)
− Private Telecommunication Network Exchange	(ENV 41007-1)
− Public ISDN	(ENV 41007-1)
− SS-CC Recall	(ETS 300 365)
− Signalling	(CCITT Rec. I.112)
− Supplementary Service	(CCITT Rec. I.210)
− Supplementary Service Control Entity	(ETS 300 239)
− Telecommunication Network	(ENV 41007-1)
− Terminal, Terminal Equipment	(ENV 41007-1)
− Terminating PTNX	(ETS 300 172)
− Transit PTNX	(ETS 300 172)
− User	(ETS 300 171-1)
− User A	(ETS 300 365)
− User B	(ETS 300 365)

4.2 CC Call

The re-initiation, in the course of executing a CC Request, of the previously unsuccessful call from User A to User B on behalf of User A, with or without Path Reservation.

4.3 CC Request

An instance of SS-CCBS or SS-CCNR.

4.4 Connection release

The release of the call independent signalling connection as soon as SS-CC has been initiated and the establishment of further call independent signalling connections for subsequent phases of the service.

4.5 Connection retention

The use of a single call independent signalling connection throughout the lifetime of a particular instance of SS-CC.

4.6 Path Reservation

The reservation of resources prior to the SS-CC Recall, by means of a basic call set up from the Originating to the Terminating PTNX, in order to have a bearer connection through the PTN available when User A accepts the SS-CC Recall.

4.7 Service retention

The optional capability to continue with a CC Request after the CC Call failed due to User B being busy again.

5 List of acronyms

APDU	Application Protocol Data Unit
ASN.1	Abstract Syntax Notation no. 1
CC	Call Completion
ISDN	Integrated Services Digital Network
NFE	Network Facility Extension
PICS	Protocol Implementation Conformance Statement
PTN	Private Telecommunication Network
PTNX	Private Telecommunication Network Exchange
SDL	Specification and Description Language
SS-CC	Supplementary Service Call Completion (i.e. SS-CCBS or SS-CCNR)
SS-CCBS	Supplementary Service Call Completion to Busy Subscriber
SS-CCNR	Supplementary Service Call Completion on No Reply
TE	Terminal Equipment

6 Signalling protocol for the support of SS-CCBS and SS-CCNR

6.1 SS-CCBS/CCNR description

Call Completion to Busy Subscriber (SS-CCBS) is a supplementary service which allows a calling User A, on encountering a busy called User B, to request that the PTN monitors User B and indicates to User A when User B becomes not busy. On response by User A to that indication the PTN will attempt to complete the call to User B.

Call Completion on No Reply (SS-CCNR) is a supplementary service which allows a calling User A, when the called User B does not respond to the call request, to request that the PTN monitors User B and indicates to User A when User B becomes not busy after a subsequent period of activity at User B's TE. On response by User A to that indication the PTN will attempt to complete the call to User B.

NOTE 1

Which activities at User B's TE would result in a 'B not busy' indication to User A is outside the scope of this Standard.

These supplementary services are applicable to all circuit mode basic services defined in ETS 300 171.

6.2 SS-CC operational requirements

6.2.1 Requirements on the Originating PTNX

Call establishment procedures for the outgoing side of an inter-PTNX link and call release procedures, as specified in ETS 300 172, shall apply.

Generic procedures for the call related control of supplementary services, as specified in ETS 300 239 for an End PTNX, shall apply. Additionally generic procedures for the call independent control (connection orientated) of supplementary services, as specified in ETS 300 239 for an Originating and a Terminating PTNX, shall apply.

6.2.2 Requirements on the Terminating PTNX

Call establishment procedures for the incoming side of an inter-PTNX link and call release procedures, as specified in ETS 300 172, shall apply.

Generic procedures for the call related control of supplementary services, as specified in ETS 300 239 for an End PTNX, shall apply. Additionally generic procedures for the call independent control (connection orientated) of supplementary services, as specified in ETS 300 239 for an Originating and a Terminating PTNX, shall apply.

6.2.3 Requirements on a Transit PTNX

Basic call procedures for call establishment and call clearing at a Transit PTNX, as specified in ETS 300 172, shall apply.

NOTE 2

The use of basic call timer T310 at a Transit PTNX can cause premature clearing of a reserved path if the timer value is too short. For this reason this Standard specifies the sending of CCITT progress description no. 8 "in-band information or appropriate pattern now available" by the Terminating PTNX, in order to stop timer T310, even though in-band tones and announcements are not applicable in this situation.

Generic procedures for the call related control and call independent control (connection orientated) of supplementary services, as specified in ETS 300 239 for a Transit PTNX, shall apply.

6.3 SS-CC coding requirements

6.3.1 Operations

```
SS-CC-Operations {        ccitt (0)    identified-organization (3)    etsi (0)
                         qsig-call-completion (366)    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
                         { ccitt (0)   identified-organization (3)   etsi (0)
                           qsig-generic-procedures (239)    msi-definition (0) }

   QSIGInformationElement  FROM   Generic-Parameters-Definition
                         { ccitt (0)   identified-organization (3)   etsi (0)
                           qsig-generic-procedures (239)   qsig-generic-parameters (6) }

   PartyNumber, PartySubaddress, PresentedNumberUnscreened    FROM
                         Addressing-data-elements
                         { ccitt (0)   identified-organization (3)   etsi (0)   196
                           addressing-data-elements (6) }

   supplementaryServiceInteractionNotAllowed   FROM  General-Errors
                         { ccitt (0)   identified-organization (3)   etsi (0)   196
                           general-errors (2)  };

ptnOBJECT IDENTIFIER ::=  {  iso (1)   identified-organization (3)
                             icd-ecma (0012)   private-isdn-signalling-domain (9) }

CcbsRequest       ::=    OPERATION
                         ARGUMENT    CcRequestArg
                         RESULT      CcRequestRes
                         ERRORS      { shortTermRejection, longTermRejection,
                                       supplementaryServiceInteractionNotAllowed,
                                       unspecified }

CcnrRequest       ::=    OPERATION
                         ARGUMENT    CcRequestArg
                         RESULT      CcRequestRes
                         ERRORS      { shortTermRejection, longTermRejection,
                                       supplementaryServiceInteractionNotAllowed,
                                       unspecified }

CcCancel          ::=    OPERATION
                         ARGUMENT    CcOptionalArg

CcExecPossible    ::=    OPERATION
                         ARGUMENT    CcOptionalArg

CcPathReserve     ::=    OPERATION
                         ARGUMENT    CcExtension
```

```
                              RESULT      CcExtension
                              ERRORS      {remoteUserBusyAgain,
                                           failureToMatch,
                                           failedDueToInterworking,
                                           unspecified   }

CcRingout        ::=    OPERATION
                        ARGUMENT   CcExtension
                        ERRORS     {remoteUserBusyAgain,
                                     failureToMatch,
                                     unspecified   }

CcSuspend        ::=    OPERATION
                        ARGUMENT   CcExtension

CcResume         ::=    OPERATION
                        ARGUMENT   CcExtension

Unspecified      ::=    ERROR
                        PARAMETER  CcExtension

CcRequestArg     ::=    SEQUENCE   {
                                numberA        PresentedNumberUnscreened,
                                numberB        PartyNumber,
                                service        QSIGInformationElement,
                                    -- permitted information elements are:
                                    --      Bearer capability;
                                    --      Low layer compatibility;
                                    --      High layer compatibility.
                                subaddrA   [10] PartySubaddress OPTIONAL,
                                subaddrB   [11] PartySubaddress OPTIONAL,
                                can-retain-service    [12] IMPLICIT  BOOLEAN
                                                           DEFAULT  FALSE,
                                retain-sig-connection [13] IMPLICIT  BOOLEAN
                                                                OPTIONAL,
                                    -- TRUE: sign. connection to be retained;
                                    -- FALSE: sign. connection to be released;
                                    -- omission: release or retain sign. conn.
                                extension      CcExtension   OPTIONAL   }

CcRequestRes     ::=    SEQUENCE   {
                                no-path-reservation   [0] IMPLICIT BOOLEAN
                                                            DEFAULT FALSE,
                                retain-service        [1] IMPLICIT BOOLEAN
                                                            DEFAULT FALSE,
                                extension             CcExtension   OPTIONAL   }

CcOptionalArg    ::=
        CHOICE     { fullArg [0] IMPLICIT SEQUENCE {
                                numberA        PartyNumber,
                                numberB        PartyNumber,
                                service        QSIGInformationElement,
                                    -- permitted information elements are:
                                    --      Bearer capability;
```

```
                                                      --      Low layer compatibility;
                                                      --      High layer compatibility.
                                    subaddrA    [10] PartySubaddress OPTIONAL,
                                    subaddrB    [11] PartySubaddress OPTIONAL,
                                    extension   CcExtension  OPTIONAL },
                       extArg  CcExtension   }
CcExtension      ::=
          CHOICE    {  none        NULL,
                       single      [14]  IMPLICIT       Extension,
                       multiple    [15]  IMPLICIT       SEQUENCE OF Extension }
```

ccbsRequest	CcbsRequest	::=	{ ptn ccbs-request (40) }
ccnrRequest	CcnrRequest	::=	{ ptn ccnr-request (27) }
ccCancel	CcCancel	::=	{ ptn cc-cancel (28) }
ccExecPossible	CcExecPossible	::=	{ ptn cc-exec-possible (29) }
ccPathReserve	CcPathReserve	::=	{ ptn cc-path-reserve (30) }
ccRingout	CcRingout	::=	{ ptn cc-ringout (31) }
ccSuspend	CcSuspend	::=	{ ptn cc-suspend (32) }
ccResume	CcResume	::=	{ ptn cc-resume (33) }
shortTermRejection	ERROR	::=	{ ptn 1010 }
longTermRejection	ERROR	::=	{ ptn 1011 }
remoteUserBusyAgain	ERROR	::=	{ ptn 1012 }
failureToMatch	ERROR	::=	{ ptn 1013 }
failedDueToInterworking	ERROR	::=	{ ptn 1014 }
unspecified	Unspecified	::=	{ ptn 1008 }

```
END        -- of SS-CC-Operations
```

6.3.2   Information elements

6.3.2.1   Facility information element

The operations defined in subclause 6.3.1 shall be coded in the Facility information element in accordance with 11.3.3 of ETS 300 239.

The Facility information element shall always contain an NFE. When the Facility information element is sent in a call related message and conveys an invoke APDU the destinationEntity element of the NFE shall contain value endPTNX.

A Facility information element conveying a ccPathReserve invoke APDU shall also contain an Interpretation APDU with value clearCallIfAnyInvokePduNotRecognised. In all other cases the Interpretation APDU shall either be omitted or included with value rejectAnyUnrecognisedInvokePdu.

Within elements of type QSIGInformationElement information elements (e.g. Bearer capability) shall be coded in accordance with ETS 300 172.

6.3.2.2 Other information elements

Any other information elements (e.g. Calling party number, Called party number) shall be coded in accordance with the rules of ETS 300 172 and ETS 300 239.

6.3.3 Messages

The Facility information element shall be conveyed in the messages as specified in Clause 10 of ETS 300 239.

6.4 SS-CC State definitions

6.4.1 States at the Originating PTNX

The procedures for the Originating PTNX are written in terms of the following conceptual states existing within the SS-CC Supplementary Service Control entity in that PTNX in association with a particular CC Request.

6.4.1.1 CC-Idle

This state exists if SS-CC is not active.

6.4.1.2 CC-Wait-Ack

This state exists during SS-CC invocation.

6.4.1.3 CC-Invoked-A-RET

This state exists for an active CC Request while waiting for the indication that User B is not busy, using the connection retention method.

6.4.1.4 CC-Invoked-A-RLS

This state exists for an active CC Request while waiting for the indication that User B is not busy, using the connection release method.

6.4.1.5 CC-Suspended-A

This state exists when a CC Call without Path Reservation has been postponed because User A is busy.

6.4.1.6 CC-Path-Setup

This state exists during Path Reservation.

6.4.1.7 CC-Wait-User-A-Answer-N

This state exists while waiting for SS-CC Recall acceptance from User A if no path has been reserved.

6.4.1.8 CC-Wait-User-A-Answer-R

This state exists while waiting for SS-CC Recall acceptance from User A after a path has been reserved.

6.4.1.9 CC-Ringout

This state exists when User A has accepted the SS-CC Recall but completion of the call to User B is still pending.

6.4.1.10 CC-Wait-User-A-Free

This state exists when Path Reservation is delayed because User A is busy.

6.4.2 States at the Terminating PTNX

The procedures for the Terminating PTNX are written in terms of the following conceptual states existing within the SS-CC Supplementary Service Control entity in that PTNX in association with a particular CC Request.

6.4.2.1   CC-Idle

This state exists if SS-CC is not active.

6.4.2.2   CC-Invoked-B

This state exists while User B is monitored as a result of a CC Request received.

6.4.2.3   CC-Await-Call-Completion

This state exists while waiting for the incoming CC Call after having indicated that User B is not busy.

6.4.2.4   CC-Suspended-B

This state exists when a CC Call has been postponed because User A is busy.

6.4.2.5   CC-Path-Complete

This state exists when a path has been successfully reserved and CC Call completion is pending.

6.4.2.6   CC-Wait-User-B-Alert

This state exists after a CC Call has been extended to User B, while waiting for acceptance (alerting or connect).

6.5   SS-CC signalling procedures

The following procedures are a combination of call related and call independent signalling. The latter uses the connection-oriented APDU transport mechanism specified in ETS 300 239, which provides call independent signalling connections for supplementary service control.

All SS-CC control information is exchanged between Originating PTNX and Terminating PTNX.

Examples of message sequences are shown in Annex B.

6.5.1   Major options

The signalling protocol contains the following major options. These are negotiated between the Originating and Terminating PTNXs at SS-CC invocation time, using specific elements in the argument and result of operations ccbsRequest and ccnrRequest.

6.5.1.1   Path reservation

There are two methods of establishing the CC Call:

- path reservation method - a bearer connection between the Originating and Terminating PTNXs is established before recalling User A, to avoid the possibility of encountering network congestion after User A responds to SS-CC Recall;

- non-reservation method - a bearer connection between the Originating and Terminating PTNXs is established after User A responds to SS-CC Recall and the service is cancelled if network congestion is encountered.

As described in subclause 6.5.2, it is an option of the Originating PTNX which of these methods is used. The procedures specified in subclause 6.5.3 mandate from a Terminating PTNX the support of both methods. In interworking situations, an Outgoing Gateway PTNX can force the use of the non-reservation method if the other network cannot support path reservation; see subclauses 6.6 and 6.7.

6.5.1.2   Retention of signalling connection

There are two ways in which SS-CC uses call independent signalling connections:

- <u>connection retention method</u> - the signalling connection is maintained until completion or cancellation of SS-CC;

- <u>connection release method</u> - the signalling connection is cleared after each phase of call independent signalling and a new signalling connection is established for each subsequent phase of call independent signalling.

If the path reservation method is used, both methods above are possible. The procedures specified in subclauses 6.5.2 and 6.5.3 leave the decision on the method to the Terminating PTNX, but permit the Originating PTNX to ask for the use of the connection release method if possible, in order to avoid occupying network resources for the duration of the service. Similarly, subclause 6.7 permits an Incoming Gateway PTNX to ask for the use of the connection release method for compatibility with other networks.

If the non-reservation method is used connection retention is required. Subclauses 6.6 and 6.7 provide a means by which an Incoming Gateway PTNX or Outgoing Gateway PTNX can force the use of the connection retention method for compatibility with public ISDNs and other networks that operate with a retained connection.

6.5.1.3   Service retention

There are two possible behaviours when User B is found to be busy again after User A responds to SS-CC Recall.

- <u>service retention method</u> - the CC Request remains in force at the Originating and Terminating PTNXs and the Terminating PTNX commences the monitoring of User B again;

- <u>service cancellation method</u> - the CC Request is cancelled at the Originating and Terminating PTNXs.

Either PTNX can force the use of the service cancellation method. The service retention method will be used if both PTNXs agree.

6.5.2   Actions at the Originating PTNX

The SDL representation of procedures at the Originating PTNX is shown in Clause C.1 of Annex C.

6.5.2.1   Normal procedures

6.5.2.1.1   CCBS invocation

If User A requests SS-CCBS and the request is acceptable to the Originating PTNX, the Originating PTNX shall send a ccbsRequest invoke APDU to the Terminating PTNX according to subclause 6.5.2.1.3.

NOTE 3

SS-CCBS can be requested after a call attempt has encountered a busy condition at User B. The release of the original call is beyond the scope of this Standard.

Upon receipt of a ccbsRequest return result APDU the Originating PTNX shall start the service duration timer T2 with a value appropriate for SS-CCBS, enter state CC-Invoked-A-RET (connection retention case) or CC-Invoked-A-RLS (connection release case), and wait for an indication that User B has become not busy.

6.5.2.1.2   CCNR invocation

If User A requests SS-CCNR and the request is acceptable to the Originating PTNX, the Originating PTNX shall send a ccnrRequest invoke APDU to the Terminating PTNX according to subclause 6.5.2.1.3.

NOTE 4

SS-CCNR can be requested after a call to User B has remained unanswered. The release of the original call is beyond the scope of this Standard.

Upon receipt of a ccnrRequest return result APDU the Originating PTNX shall start the service duration timer T2 with a value appropriate for SS-CCNR, enter state CC-Invoked-A-RET (connection retention case) or CC-Invoked-A-RLS (connection release case), and wait for an indication that User B has become not busy after a subsequent period of activity.

6.5.2.1.3   SS-CC invocation - detailed procedure

The Facility information element containing the ccbsRequest or ccnrRequest invoke APDU shall be sent in a SETUP message which establishes a call independent signalling connection between the two end PTNXs, according to subclause 7.3 of ETS 300 239. The SETUP message shall contain User B's number in information element Called party number, and optionally User A's number in information element Calling party number.

The following information shall be included in the argument of the ccbsRequest or ccnrRequest invoke APDU:

- basic call information from the original call:

    - the number of User A, or an indication that it is not available or restricted, in element numberA;

    - optionally and if available, the subaddress of User A, in element subaddrA;

    - the number of User B, in element numberB;

    - if available, the subaddress of User B, in element subaddrB;

    - the information elements Bearer capability, Low layer compatibility (if available) and High layer compatibility (if available), embedded in element service;

- optionally element retain-sig-connection, according to the following rules:

    - if the signalling connection has to be retained because the non-reservation method is going to be used the element shall be included with value TRUE;

    - if the Originating PTNX is going to use the path reservation method and prefers the connection release option the element shall be included with value FALSE;

    - if the Originating PTNX is going to use the path reservation method and has no preference for the connection release option the element shall be omitted;

- optionally element can-retain-service with value TRUE if the Originating PTNX is able to use the service retention method. Otherwise the element shall either be omitted or have the value FALSE.

After sending the ccbsRequest/ccnrRequest invoke APDU the Originating PTNX shall start timer T1 and enter state CC-Wait-Ack.

Upon receipt of a ccbsRequest or ccnrRequest return result APDU the Originating PTNX shall stop timer T1 and store the following information:

- If the result contains element retain-service with value TRUE and element can-retain-service was sent with value TRUE in the argument of the corresponding invoke APDU, the Originating PTNX shall record the fact that the service retention method is to be used; otherwise it shall record the fact that the service cancellation method is to be used.

- If the result contains element no-path-reservation with value TRUE the Originating PTNX shall record the fact that the non-reservation method is to be used. Otherwise it may select either the path reservation method or the non-reservation method.

- If path reservation is to be used, all the information contained in the argument of the ccbsRequest or ccnrRequest invoke APDU.

If the ccbsRequest/ccnrRequest return result APDU was received in a CONNECT message the Originating PTNX shall continue according to the procedures specified for the connection retention method. If the return result APDU was received in a RELEASE message and connection release is permitted, the Originating PTNX shall complete the clearing of the signalling connection in accordance with subclause 7.3 of ETS 300 239 and continue according to the procedures specified for the connection release method.

6.5.2.1.4 **Indication that User B is not busy**

a)   Connection retention case:

If a ccExecPossible invoke APDU is received in a FACILITY message (i.e. on the retained call independent signalling connection) while in state CC-Invoked-A-RET the Originating PTNX shall proceed as described under c) below. Any basic call information, if present in the argument of the ccExecPossible invoke APDU, shall be ignored.

b)   Connection release case:

On receipt of a ccExecPossible invoke APDU in a SETUP message for a call independent signalling connection the Originating PTNX shall process the SETUP message according to subclause 7.3 of ETS 300 239, attempt to associate the APDU with a CC Request that is in state CC-Invoked-A-RLS, and if successful proceed as described under c) below.

The association shall be achieved by comparing all the basic call information received in the argument of the ccExecPossible invoke APDU with the information stored at the Originating PTNX. If less information is received than what is stored, a match shall be deemed to occur if all the elements received match those stored and any missing element belongs to the following group: subaddress of User A; subaddress of User B; High layer compatibility information element; Low layer compatibility information element.

NOTE 5

Information can be missing as a result of the Terminating PTNX discarding part of the optional information at SS-CC invocation time. This need not cause ambiguity provided the Terminating PTNX rejects CC Requests which are duplicates with regard to the remaining information.

NOTE 6

The Originating PTNX with regard to SS-CC is the Terminating PTNX with regard to the call independent signalling connection.

c)   For both cases:

In both cases a) and b) above the Originating PTNX shall proceed in accordance with

- 6.5.2.1.5, if User A is not busy and the non-reservation method is to be used; or

- 6.5.2.1.6, if User A is not busy and the path reservation method is to be used; or

- 6.5.2.1.7, if User A is busy and the non-reservation method is to be used; or

- 6.5.2.1.8, if User A is busy and the path reservation method is to be used.

6.5.2.1.5   **CC Call without Path Reservation**

If User A is not busy and the Originating PTNX chooses the non-reservation method for establishing the CC Call, the Originating PTNX shall indicate the SS-CC Recall to User A, start the recall timer T3 and enter state CC-Wait-User-A-Answer-N.

If the SS-CC Recall is accepted before timer T3 expires the Originating PTNX shall initiate the CC Call in accordance with ETS 300 172 by sending a SETUP message towards the Terminating PTNX, stop timer T3 and enter state CC-Ringout; the SETUP message shall contain a Facility information element with a ccRingout invoke APDU.

If in state CC-Ringout an ALERTING or a CONNECT message is received the Originating PTNX shall stop the service duration timer T2, delete the CC Request and return to state CC-Idle. If a call independent signalling connection for SS-CC still exists it may be released according to subclause 7.3 of ETS 300 239. The CC Call shall continue in accordance with ETS 300 172.

6.5.2.1.6   **CC Call with Path Reservation**

If User A is not busy and the Originating PTNX chooses the path-reservation method for establishing the CC Call, the Originating PTNX shall:

- if the connection release method is used, return a RELEASE message with cause value #16 "normal call clearing" to release the signalling connection; optionally the RELEASE message may also be sent in the connection retention case, if the service retention option does not apply and no further call independent signalling is expected;

- initiate Path Reservation as a basic call request according to ETS 300 172, sending a SETUP message towards the Terminating PTNX; the SETUP message shall contain a ccPathReserve invoke APDU, as well as all the information stored from the original call;

- start timer T4; and

- enter state CC-Path-Setup.

Upon receipt of a ccPathReserve return result APDU while in state CC-Path-Setup the Originating PTNX shall stop timer T4.

If User A is busy the Originating PTNX shall, if the capability exists, indicate to User A that User B is not busy. Either immediately or if the busy condition persists the Originating PTNX shall continue according to subclause 6.5.2.1.9.

NOTE 7

The means of determining whether the busy condition persists is implementation dependent.

If User A is not busy the Originating PTNX shall indicate the SS-CC Recall to User A, start the recall timer T3 and enter state CC-Wait-User-A-Answer-R.

If the SS-CC Recall is accepted before timer T3 expires the Originating PTNX shall stop timer T3, send a call related FACILITY message with a ccRingout invoke APDU to the Terminating PTNX and enter state CC-Ringout.

If in state CC-Ringout an ALERTING or CONNECT message is received, the Originating PTNX shall stop the service duration timer T2, delete the CC Request and return to state CC-Idle. If a call independent signalling connection for SS-CC still exists it may be released according to subclause 7.3 of ETS 300 239. The CC Call shall continue in accordance with ETS 300 172.

6.5.2.1.7 User A busy, non-reservation method

a)   Suspend procedure:

If User A is busy and the Originating PTNX chooses the non-reservation method, the Originating PTNX shall send a ccSuspend invoke APDU to the Terminating PTNX in a FACILITY message on the existing call independent signalling connection, start monitoring User A and enter state CC-Suspended-A.

b)   Resume procedure:

If User A, for whom a CC Request in state CC-Suspended-A exists, becomes not busy the Originating PTNX shall send a FACILITY message with a ccResume invoke APDU on the existing call independent signalling connection and enter state CC-Invoked-A-RET, waiting for another indication that User B is not busy.

6.5.2.1.8 User A busy before Path Reservation

If User A is busy and the Originating PTNX chooses the path reservation method, the Originating PTNX shall release the call independent signalling connection according to subclause 7.3 of ETS 300 239, unless the connection retention method applies, start monitoring User A, and enter state CC-Wait-User-A-Free. Cause #16 "normal call clearing" shall be used when releasing the signalling connection.

The Originating PTNX may also send a ccSuspend invoke APDU to the Terminating PTNX on the existing call independent signalling connection, either in the RELEASE message in case of connection release or in a FACILITY message in case of connection retention.

If User A, for whom a CC Request in state CC-Wait-User-A-Free exists, becomes not busy the Originating PTNX shall initiate a CC Call with Path Reservation according to subclause 6.5.2.1.6.

6.5.2.1.9 User A busy after Path Reservation

If User A is busy on completion of Path Reservation the Originating PTNX shall release the reserved path by sending a DISCONNECT message to the Terminating PTNX, start monitoring User A and enter state CC-Wait-User-A-Free. The DISCONNECT message shall contain a Facility information element with a ccSuspend invoke APDU.

If User A, for whom a CC Request in state CC-Wait-User-A-Free exists, becomes not busy the Originating PTNX shall initiate a CC Call with Path Reservation according to subclause 6.5.2.1.6.

6.5.2.1.10   **CCBS/CCNR cancellation**

a)   Cancellation initiated by the Originating PTNX:

In order to cancel a CC Request, the Originating PTNX shall send a ccCancel invoke APDU to the Terminating PTNX, release any call independent signalling connection by sending a RELEASE message with cause #16 "normal call clearing", release any CC Call by sending a DISCONNECT message with cause #16 "normal call clearing", delete all data stored for that CC Request, stop any timer running, and return to state CC-Idle. Unless cancellation was initiated by user request or the Originating PTNX automatically re-invokes SS-CC, User A shall, if the capability exists, be informed of failure of the service.

If a call independent signalling connection exists the ccCancel invoke APDU shall be sent with argument extArg in the RELEASE message that initiates clearing of the connection.

If no call independent signalling connection exists but a path has been reserved (i.e. after a ccPathReserve return result APDU was received) the ccCancel invoke APDU shall be sent with argument extArg in the DISCONNECT message that initiates clearing of the reserved path.

In all other cases the ccCancel invoke APDU shall be sent in a SETUP message establishing a new signalling connection according to subclause 7.3 of ETS 300 239. The invoke APDU shall include argument fullArg with the same basic call information as previously sent in the ccbsRequest or ccnrRequest invoke APDU, in order to identify the CC Request to be cancelled. When subsequently receiving a RELEASE message, the signalling connection shall be cleared in accordance with ETS 300 239.

b)   Cancellation initiated by the Terminating PTNX:

On receipt of a ccCancel invoke APDU from the Terminating PTNX in the RELEASE message for an existing call independent signalling connection the Originating PTNX shall delete all data stored for the associated CC Request, stop any timer still running, clear the CC Call - if already initiated - in accordance with ETS 300 172, inform User A of the cancellation, if the capability exists, and return to state CC-Idle. Any basic call information, if present in the argument of the ccCancel invoke APDU, shall be ignored.

On receipt of a ccCancel invoke APDU in the SETUP message for a new call independent signalling connection the Originating PTNX shall attempt to associate the APDU with an active CC Request, by comparing the basic call information received in the argument of the invoke APDU with the information locally stored. If the information received is less than what is stored a match shall be deemed to occur if all the elements received match those stored and any missing element belongs to the following group: subaddress of User A; subaddress of User B; High layer compatibility information element; Low layer compatibility information element. If successfully associated, the Originating PTNX shall delete all data stored for that CC Request, stop any timer still running, clear the CC Call - if already initiated - in accordance with ETS 300 172, inform User A of the cancellation, if the capability exists, and return to state CC-Idle. The signalling connection shall be released according to subclause 7.3 of ETS 300 239.

6.5.2.2 Exceptional procedures

6.5.2.2.1 CCBS/CCNR invocation

If establishment of the call independent signalling connection fails, or if after sending a ccbsRequest or ccnrRequest invoke APDU no answer is received from the Terminating PTNX before timer T1 expires, or if the answer is a return error APDU or a reject APDU, a failure indication shall be given to User A, and the Originating PTNX shall return to state CC-Idle. The call independent signalling connection shall be released in accordance with ETS 300 239, if it still exists. Timer T1 shall be stopped if still running.

If a ccbsRequest or ccnrRequest return result APDU is received in a RELEASE message although the connection retention method is required (i.e. element retain-sig-connection was sent with value TRUE in the corresponding invoke APDU, or element no-path-reservation with value TRUE is contained in the return result APDU) the Originating PTNX shall cancel the CC Request according to subclause 6.5.2.1.10.

6.5.2.2.2 Unexpected APDUs

If the Originating PTNX receives a SETUP message for a call independent signalling connection with a ccExecPossible invoke APDU for which no matching CC Request in state CC-Invoked-A-RLS exists the PTNX shall release the signalling connection according to subclause 7.3 of ETS 300 239 and include a ccCancel invoke APDU in the RELEASE message.

A ccCancel invoke APDU for which no matching CC Request exists shall be ignored when received in a SETUP message for a call independent signalling connection, but the signalling connection shall be released according to subclause 7.3 of ETS 300 239.

6.5.2.2.3 Service duration timer expiry

If the service duration timer T2 expires while in state CC-Invoked-A-RET, CC-Invoked-A-RLS, CC-Suspended-A, or CC-Wait-User-A-Free, the Originating PTNX shall cancel the CC Request, using the procedure described in subclause 6.5.2.1.10.

In any other state the Originating PTNX may defer action until reaching one of the states above, or may cancel the CC Request immediately.

6.5.2.2.4 SS-CC Recall timer expiry

If User A does not accept the SS-CC Recall before the recall timer T3 expires the Originating PTNX shall cancel the CC Request, using the procedure described in subclause 6.5.2.1.10.

6.5.2.2.5 Failure of Path Reservation

If a DISCONNECT message with a reject APDU indicating 'unrecognisedOperation' or with a return error APDU indicating 'failedDueToInterworking' is received in response to a ccPathReserve invoke APDU the Originating PTNX shall stop timer T4 and choose one of the following options:

a)   If the signalling connection has been retained, attempt a CC Call without Path Reservation according to subclause 6.5.2.1.5.

b)   Retry Path Reservation on another route.

c)   Cancel the CC Request, using the procedure described in subclause 6.5.2.1.10. The Originating PTNX may then automatically re-invoke SS-CC, forcing the use of connection retention so that the non-reservation method can be used.

If a DISCONNECT message with a return error APDU indicating 'remoteUserBusyAgain' is received in response to a ccPathReserve invoke APDU, the Originating PTNX shall stop timer T4 and return to state CC-Invoked-A-RET (connection retention case) or CC-Invoked-A-RLS (connection release case).

If the error value in the ccPathReserve return error APDU is failureToMatch or unspecified, the Originating PTNX shall delete the CC Request, stop any timer running, and return to state CC-Idle. If a call independent signalling connection still exists the Originating PTNX may release it in accordance with subclause 7.3 of ETS 300 239.

If a Path Reservation attempt fails due to network congestion the Originating PTNX may retry later to establish a path to the Terminating PTNX or cancel the CC Request according to subclause 6.5.2.1.10.

If timer T4 expires, or if a Path Reservation attempt fails for any reason other than network congestion, without a ccPathReserve return error APDU being received, the Originating PTNX shall cancel the CC Request according to subclause 6.5.2.1.10.

6.5.2.2.6   Failure of CC Call presentation

If a DISCONNECT message with a ccRingout return error APDU is received with an error value remoteUserBusyAgain the Originating PTNX shall:

- if the service retention option is effective for that CC Request, return to state CC-Invoked-A-RET (connection retention case) or CC-Invoked-A-RLS (connection release case);

- else, delete the CC Request, stop timer T2, and return to state CC-Idle. If a call independent signalling connection still exists the Originating PTNX may release it in accordance with subclause 7.3 of ETS 300 239. The Originating PTNX shall either indicate the failure to User A or automatically (re-)invoke SS-CCBS according to subclause 6.5.2.1.1.

If the error indicated in the ccRingout return error APDU is 'failureToMatch' or 'unspecified' the Originating PTNX shall delete the CC Request, stop timer T2, indicate the failure to User A, and return to state CC-Idle. If a call independent signalling connection still exists the Originating PTNX may release it in accordance with subclause 7.3 of ETS 300 239.

If the CC Call fails without a ccRingout return error APDU being received the Originating PTNX shall cancel the CC Request according to subclause 6.5.2.1.10.

6.5.3   Actions at the Terminating PTNX

The SDL representation of procedures at the Terminating PTNX is shown in Clause C.2 of Annex C.

6.5.3.1   Normal procedures

6.5.3.1.1   CCBS invocation

If a Facility information element with a ccbsRequest invoke APDU is received (in a SETUP message according to subclause 7.3 of ETS 300 239) the Terminating PTNX shall process the request according to subclause 6.5.3.1.3 and start monitoring User B for becoming not busy, if the CC Request is accepted.

NOTE 8

If User B is already not busy this will result in immediate initiation of the procedures of subclause 6.5.3.1.4.

6.5.3.1.2   CCNR invocation

If a Facility information element with a ccnrRequest invoke APDU is received (in a SETUP message according to subclause 7.3 of ETS 300 239) the Terminating PTNX shall process the request according to subclause 6.5.3.1.3 and start monitoring User B for becoming not busy after a subsequent period of activity, if the CC Request is accepted.

6.5.3.1.3 SS-CC invocation - detailed procedure

If a CC Request can be accepted the Terminating PTNX shall store the basic call information contained in the argument of the ccbsRequest/ccnrRequest invoke APDU. The PTNX may discard any of the following elements, if present: subaddress of User A; subaddress of User B; High layer compatibility information element; Low layer compatibility information element.

NOTE 9

Discarding part of the supplied information can lead to non-identical requests being treated as duplicates, see subclause 6.5.3.2.1.

As an acknowledgement a ccbsRequest/ccnrRequest return result APDU shall be returned to the Originating PTNX. If element can-retain-service was present in the corresponding invoke APDU and had value TRUE and the Terminating PTNX is able to use the service retention method an element retain-service with value TRUE shall be included in the result. In all other cases this element shall either be omitted or have the value FALSE.

The Terminating PTNX shall select either the connection retention or the connection release method in accordance with the following:

- If element retain-sig-connection was present in the ccbsRequest/ccnrRequest invoke APDU and had value FALSE, and if the number of User A is available, the Terminating PTNX shall use the connection release method.

- If element retain-sig-connection was present in the ccbsRequest/ccnrRequest invoke APDU and had value TRUE, or if the number of User A is not available, the Terminating PTNX shall use the connection retention method.

- In other cases the Terminating PTNX is free to select either method.

If the connection retention method is to be used, the Terminating PTNX shall send the ccbsRequest/ccnrRequest return result APDU in a CONNECT message on the call independent signalling connection.

If the connection release method is to be used, the Terminating PTNX shall send the ccbsRequest/ccnrRequest return result APDU in a RELEASE message on the call independent signalling connection and complete the release of the signalling connection in accordance with subclause 7.3 of ETS 300 239. Cause # 16 "normal call clearing" shall be used in the RELEASE message.

In both cases the Terminating PTNX shall enter state CC-Invoked-B.

6.5.3.1.4 Indication that User B is not busy

As soon as User B becomes not busy (in the case of SS-CCNR, after a period of activity subsequent to SS-CC invocation) the Terminating PTNX shall send a ccExecPossible invoke APDU to the Originating PTNX, using call independent signalling, enter state CC-Await-Call-Completion and wait for the incoming CC Call.

If the connection retention method is used the ccExecPossible invoke APDU with argument extArg shall be sent in a FACILITY message on the existing signalling connection.

If the connection release method is used the ccExecPossible invoke APDU with argument fullArg shall be sent in a SETUP message, establishing a new call independent signalling connection according to subclause 7.3 of ETS 300 239. The argument shall contain the basic call information stored by the Terminating PTNX in relation to that CC Request:

- User A's number in element numberA;

- User B's number in element numberB;

- information elements Bearer capability and, if stored, High layer compatibility / Low layer compatibility in element service;

- User A's subaddress, if stored, in element subaddrA - otherwise this element shall be omitted;

- User B's subaddress, if stored, in element subaddrB - otherwise this element shall be omitted.

NOTE 10

The Terminating PTNX should ensure that the sending of the ccExecPossible invoke APDU using a new call independent signalling connection does not occur so soon after the sending of the ccbsRequest or ccnrRequest return result APDU that it will arrive at the Originating PTNX out of sequence.

If subsequently a RELEASE message is received the signalling connection shall be released in accordance with subclause 7.3 of ETS 300 239, and the Terminating PTNX shall remain in state CC-Await-Call-Completion.

NOTE 11

It is the responsibility of the Terminating PTNX to guard against non-receipt of a CC Call and, in the case of Path Reservation, of a subsequent ccRingout invoke APDU.

6.5.3.1.5   CC Call without Path Reservation

If a basic call SETUP message according to ETS 300 172 is received with a ccRingout invoke APDU the terminating PTNX shall attempt to associate the incoming CC Call with a CC Request in state CC-Await-Call-Completion and, if successful and User B is still not busy, extend the CC Call to User B and enter state CC-Wait-User-B-Alert.

The association shall be achieved by comparing the basic call information locally stored with the information elements of the received SETUP message. A match shall be deemed to occur if all the elements stored locally match the corresponding information elements of the SETUP message; any information element in the SETUP message for which no corresponding element is stored shall be ignored during the comparison.

If in state CC-Wait-User-B-Alert an ALERTING or a CONNECT message is sent to the Originating PTNX according to ETS 300 172, the Terminating PTNX shall delete the respective CC Request and enter state CC-Idle. The associated signalling connection shall be released according to subclause 7.3 of ETS 300 239. The CC Call shall continue in accordance with ETS 300 172.

6.5.3.1.6 CC Call with Path Reservation

If a basic call SETUP message according to ETS 300 172 is received with a ccPathReserve invoke APDU the terminating PTNX shall attempt to associate the incoming CC Call (i.e. path reservation request) with a CC Request in state CC-Await-Call-Completion or CC-Suspended-B, by comparing the basic call information locally stored with the information elements of the received SETUP message. A match shall be deemed to occur if all the elements stored locally match the corresponding information elements of the SETUP message; any information element in the SETUP message for which no corresponding element is stored shall be ignored during the comparison.

If the match is successful and User B is still not busy the Terminating PTNX shall return a ccPathReserve return result APDU and enter state CC-Path-Complete. The return result APDU shall be sent in a call related PROGRESS message with CCITT progress description no. 8. The CC Call shall not be extended to User B yet.

NOTE 12

The function of this progress description is to stop basic call timer T310.

Upon receipt of a ccRingout invoke APDU in a call related FACILITY message while in state CC-Path-Complete, and if User B is still not busy, the Terminating PTNX shall enter state CC-Wait-User-B-Alert and extend the CC Call to User B.

If in state CC-Wait-User-B-Alert an ALERTING or a CONNECT message is sent to the Originating PTNX according to ETS 300 172 the Terminating PTNX shall delete the respective CC Request and enter state CC-Idle. If a signalling connection still exists it shall be released according to subclause 7.3 of ETS 300 239. The CC Call shall continue in accordance with ETS 300 172.

6.5.3.1.7 CCBS/CCNR suspension / resumption

If a ccSuspend invoke APDU is received in a call independent FACILITY or RELEASE message according to subclause 7.3 of ETS 300 239 while in state CC-Await-Call-Completion the Terminating PTNX shall enter state CC-Suspended-B.

If a ccSuspend invoke APDU is received in a call related DISCONNECT message while in state CC-Path-Complete the Terminating PTNX shall release the reserved path in accordance with ETS 300 172 and enter state CC-Await-Call-Completion, waiting for another path reservation attempt.

If a ccResume invoke APDU is received in a FACILITY message on the existing call independent signalling connection while in state CC-Suspended-B the Terminating PTNX shall enter state CC-Invoked-B and resume monitoring of User B.

NOTE 13

If User B is already not busy this will result in immediate initiation of the procedures of subclause 6.5.3.1.4.

If a ccPathReserve invoke APDU is received in a SETUP message while in state CC-Suspended-B, subclause 6.5.3.1.6 shall apply.

6.5.3.1.8   CCBS/CCNR cancellation

a)   Cancellation initiated by the Originating PTNX:

If a ccCancel invoke APDU is received in a call independent RELEASE message (connection retention case) the Terminating PTNX shall delete the information stored for the associated CC Request and enter state CC-Idle. Any basic call information, if present in the argument of the ccCancel invoke APDU, shall be ignored. The signalling connection shall be released in accordance with subclause 7.3 of ETS 300 239.

If a ccCancel invoke APDU is received in a call independent SETUP message (connection release case) the Terminating PTNX shall attempt to associate the APDU with an active CC Request, by comparing the information contained in the argument of the ccCancel invoke APDU with the information locally stored. A match shall be deemed to occur if all the stored elements match the corresponding elements received; any received element for which no corresponding element is stored shall be ignored during the comparison. If successfully associated, the Terminating PTNX shall delete the information stored for that CC Request, return a RELEASE message for the call independent signalling connection with Cause #16 "normal call clearing", and enter state CC-Idle.

If a ccCancel invoke APDU is received in a call related DISCONNECT message (after a path was reserved) the Terminating PTNX shall release the CC Call (path) according to ETS 300 172, delete the information stored for the associated CC Request and enter state CC-Idle. Any basic call information, if present in the argument of the ccCancel invoke APDU, shall be ignored. If a signalling connection still exists it shall be released according to subclause 7.3 of ETS 300 239.

b)   Cancellation initiated by the Terminating PTNX:

In order to cancel a CC Request the Terminating PTNX shall send a ccCancel invoke APDU to the Originating PTNX using call independent signalling, delete the CC Request and enter state CC-Idle.

If a signalling connection exists the ccCancel invoke APDU shall be sent with an argument extArg in a RELEASE message on the existing signalling connection. Cause #16 "normal call clearing" shall be used.

If no signalling connection exists the ccCancel invoke APDU shall be sent in a SETUP message establishing a new signalling connection according to subclause 7.3 of ETS 300 239. The invoke APDU shall contain in argument fullArg the basic call information stored by the Terminating PTNX in relation to that CC Request. If subsequently a RELEASE message is received the signalling connection shall be cleared in accordance with ETS 300 239.

6.5.3.2   Exceptional procedures

6.5.3.2.1   CCBS/CCNR invocation

A CC Request may not be accepted if it is a duplicate of an already stored CC Request. Acceptance of duplicate CC Requests may be restricted to cases where the connection retention method can be used.

NOTE 14

Duplicate requests can also be caused by the Terminating PTNX discarding part of the received basic call information.

If a request for SS-CCBS or SS-CCNR cannot be accepted the Terminating PTNX shall return a RELEASE message with a ccbsRequest resp. ccnrRequest return error APDU on the existing signalling connection. Cause #16 "normal call clearing" shall be used.

If the failure condition is persistent (e.g. service not provided for User B) error value longTermRejection shall be included.

If the failure condition is transient (e.g. duplicate CC Request, allowed number of active CC Requests exceeded) error value shortTermRejection shall be included.

6.5.3.2.2 Unexpected APDUs

If a call independent SETUP message is received with a ccCancel invoke APDU which cannot be associated with a CC Request the APDU shall be ignored, but the signalling connection shall be released according to subclause 7.3 of ETS 300 239.

If a call related SETUP message is received with a ccRingout invoke APDU that cannot be associated with a CC Request in state CC-Await-Call-Completion, or with a ccPathReserve invoke APDU that cannot be associated with a CC Request in state CC-Await-Call-Completion or CC-Suspended-B, the Terminating PTNX shall return a DISCONNECT message with a ccRingout/ccPathReserve return error APDU with error value failureToMatch.

6.5.3.2.3 User B busy again on Path Reservation attempt

If User B is busy again on arrival of a SETUP message with a ccPathReserve invoke APDU while in state CC-Await-Call-Completion or CC-Suspended-B, the Terminating PTNX shall return a DISCONNECT message with a ccPathReserve return error APDU with error value remoteUserBusyAgain, resume monitoring of User B and enter state CC-Invoked-B.

6.5.3.2.4 User B busy again on CC Call presentation

If User B is busy again when receiving a ccRingout invoke APDU, either in a FACILITY message while in state CC-Path-Complete or in a SETUP message while in state CC-Await-Call-Completion, the Terminating PTNX shall return a DISCONNECT message with a ccRingout return error APDU with error value remoteUserBusyAgain.

If the service retention option is in use the CC Request shall be retained and monitoring of User B shall be resumed, returning to state CC-Invoked-B.

If the service retention option is not used the CC Request shall be deleted and state CC-Idle shall be entered. If a signalling connection still exists it shall be released according to subclause 7.3 of ETS 300 239.

6.5.3.2.5 Interruption of CC Call

If a DISCONNECT message without any SS-CC invoke APDU is received for a CC Call in progress (e.g. after successful path reservation) the associated CC Request shall be deleted, and state CC-Idle shall be entered. If a signalling connection still exists it shall be released according to subclause 7.3 of ETS 300 239.

6.5.4 Actions at the Transit PTNX

No special actions are required for SS-CC.

6.6 Impact of interworking with public ISDNs

The SS-CCBS procedures specified in this Standard are compatible with the public ISDN procedures for the T reference point, as specified in Clause 10 of ETS 300 359-1. When interworking with the public ISDN, a Gateway PTNX shall perform the procedures specified below.

NOTE 15

Currently the public ISDN does not provide a supplementary service equivalent to SS-CCNR.

6.6.1 Incoming Gateway PTNX procedures: SS-CCBS request from a public ISDN

If a call from the public ISDN encounters a busy User B in the PTN the Incoming Gateway PTNX shall indicate to the public ISDN that SS-CCBS is available, unless it is known that SS-CCBS is not available.

If a CCBS request is received from the public ISDN the Incoming Gateway PTNX shall establish a call independent signalling connection towards the Terminating PTNX, according to subclause 7.3 of ETS 300 239. The SETUP message shall include a ccbsRequest invoke APDU, which shall contain in its argument the data received from the public ISDN, the element retain-sig-connection with value TRUE and optionally element can-retain-service, reflecting the corresponding indication from the public ISDN.

The Incoming Gateway PTNX shall translate the following APDUs received from the Terminating PTNX into corresponding information and send it to the public ISDN: A ccbsRequest return result or return error APDU; a ccExecPossible invoke APDU; a ccCancel invoke APDU.

ccCancel, ccSuspend or ccResume invoke APDUs shall be generated and sent to the Terminating PTNX when the Incoming Gateway PTNX receives corresponding indications from the public ISDN.

All call independent signalling for a particular CC Request shall use the same call independent signalling connection, which shall remain active until that CC Request terminates.

If a CCBS Call is received from the public ISDN it shall be extended by the Incoming Gateway PTNX towards the Terminating PTNX, including a ccRingout invoke APDU in the SETUP message.

When the call independent signalling connection to the Terminating PTNX is released the Incoming Gateway PTNX shall release the call independent signalling association at the T reference point.

NOTE 16

The CCBS Call need not enter the PTN at the same Gateway PTNX as the corresponding call independent signalling connection.

6.6.2 Outgoing Gateway PTNX procedures: SS-CCBS request to a public ISDN

NOTE 17

The Outgoing Gateway PTNX cannot pass on an indication that SS-CCBS is possible when received in a clearing message from the public ISDN.

If a CCBS request is destined for the public ISDN the Outgoing Gateway PTNX shall translate the ccbsRequest invoke APDU and send it to the public ISDN according to the procedures for the T reference point. When receiving a response the Outgoing Gateway PTNX shall generate a ccbsRequest return result APDU (if the CCBS request was accepted) or a return error APDU (if the CCBS request was rejected) and send it to the Originating PTNX in a CONNECT message (return result) or in a RELEASE message (return error). The return result APDU shall contain element no-path-reservation with value TRUE and optionally element retain-service, reflecting the corresponding indication from the public ISDN.

NOTE 18

The sending of the return result APDU in a CONNECT message is in accordance with the connection retention method. This overrides the value FALSE in element retain-sig-connection, if present in the ccbsRequest invoke APDU.

ccExecPossible or ccCancel invoke APDUs shall be generated and sent to the Originating PTNX when the Outgoing Gateway PTNX receives corresponding indications from the public ISDN.

The Outgoing Gateway PTNX shall translate the following APDUs received from the Originating PTNX into corresponding information and send it to the public ISDN: A ccSuspend invoke APDU; a ccResume invoke APDU; a ccCancel invoke APDU.

All call independent signalling for a particular CC Request shall use the same call independent signalling connection, which shall remain active until that CC Request terminates.

When the call independent signalling connection from the Originating PTNX is released the Outgoing Gateway PTNX shall release the call independent signalling association at the T reference point.

A CCBS Call without Path Reservation shall be extended by the Outgoing Gateway PTNX to the public ISDN.

NOTE 19

The CCBS Call need not leave the PTN at the same Gateway PTNX as the call independent signalling connection.

A Path Reservation attempt from the Originating PTNX shall be abandoned by the Outgoing Gateway PTNX by returning a DISCONNECT message with a ccPathReserve return error APDU indicating error value failedDueToInterworking.

6.7 Impact of interworking with non-ISDNs

6.7.1 Incoming Gateway PTNX procedures

If a non-ISDN network offers an equivalent supplementary service, SS-CCBS or SS-CCNR can be invoked on request of that network if the SS-CC options supported by both the Incoming Gateway PTNX and the Terminating PTNX are compatible with the service offered by the non-ISDN network.

When sending a ccbsRequest or ccnrRequest invoke APDU, the Incoming Gateway PTNX shall include an element retain-sig-connection:

- with value FALSE if, for compatibility with the other network or for other reasons, the Incoming Gateway PTNX prefers the use of the connection release method;

- with value TRUE if, for compatibility with the other network, it is necessary to use the connection retention method.

Otherwise the element shall be omitted.

The Incoming Gateway PTNX may also include an element can-retain-service with value TRUE if the other network supports the service retention capability.

If an element retain-sig-connection with value FALSE was sent but the Terminating PTNX uses the connection retention method, sending the return result APDU in a CONNECT message, the Incoming Gateway PTNX shall reject the service request from the other network and initiate cancellation procedures within the PTN if it is unable to interwork using the connection retention method.

6.7.2 Outgoing Gateway PTNX procedures

If a non-ISDN network offers an equivalent supplementary service, SS-CCBS or SS-CCNR can be invoked in that network if the SS-CC options supported by both the Originating PTNX and the Outgoing Gateway PTNX are compatible with the service offered by the non-ISDN network.

When sending a ccbsRequest or ccnrRequest return result APDU, the Outgoing Gateway PTNX shall include an element no-path-reservation with value TRUE if the other network is unable to support the path reservation method. Otherwise the element shall either be omitted or have the value FALSE.

The Outgoing Gateway PTNX may also include an element retain-service with value TRUE if element can-retain-service was sent in the corresponding invoke APDU and the other network indicated support of service retention. Otherwise the element shall either be omitted or have the value FALSE.

If in the invoke APDU element retain-sig-connection was sent with value TRUE, the Outgoing Gateway PTNX shall not employ the connection release method. If unable to interwork using the connection retention method, the Outgoing Gateway PTNX shall respond with a return error APDU.

If in the invoke APDU no element retain-sig-connection was present, the Outgoing Gateway PTNX shall select either the connection retention method or the connection release method, depending on the capabilities of the other network. If the element was present in the invoke APDU with value FALSE, the Outgoing Gateway PTNX should, if possible, use the connection release method.

6.8   Parameter values (timers)

6.8.1   Timers at the Originating PTNX

The Originating PTNX shall implement the following timers.

Timer T1: Request Protection

This timer is started when sending a ccbsRequest or ccnrRequest invoke APDU and stopped on receipt of a response.

If timer T1 expires a failure indication is sent to User A.

Timer T1 shall have a duration in the range 10 - 30 seconds.

Timer T2: SS-CC Service Duration

This timer is started on receipt of the ccbsRequest or ccnrRequest return result APDU and stopped on completion of the CC Call or if the CC Request is cancelled.

If timer T2 expires the CC Request is cancelled.

The duration of timer T2 is implementation dependent.

Timer T3: Recall

This timer is started when the SS-CC Recall is indicated to User A and stopped when User A responds.

If timer T3 expires the CC Request is cancelled.

Timer T3 shall have a duration in the range 10 - 30 seconds.

Timer T4: Path Reservation Protection

This timer is started when sending a ccPathReserve invoke APDU and stopped on receipt of a ccPathReserve return result or return error APDU.

If timer T4 expires the CC Request is cancelled.

Timer T4 shall have a duration in the range 30 - 40 seconds.

6.8.2   Timers at the Terminating PTNX

None.

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 subclauses 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) specifying 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-186

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 supplier's 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 subclause 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	Reference subclauses	Status	N/A	Support
A1	PTNX can act as Originating PTNX		o.1		Yes [ ] No [ ]
A2	PTNX can act as Terminating PTNX		o.1		Yes [ ] No [ ]
A3	Support of CCBS		o.2		Yes [ ] No [ ]
A4	Support of CCNR		o.2		Yes [ ] No [ ]
A5	Incoming Gateway Function		o		Yes [ ] No [ ]
A6	Outgoing Gateway Function		o		Yes [ ] No [ ]
A7	Support of (Path-) Non-reservation method		m		Yes [ ]
A8	Support of Path Reservation method		c.0		m: Yes [ ] o: Yes [ ] No [ ]
A9	Support of Service Retention option		o		Yes [ ] No [ ]
A10	Support of relevant procedures of ETS 300 172 and ETS 300 239	6.2	m		Yes [ ]

c.0:   if A2 then m else o

A.3.4   Procedures at the Originating PTNX

This table shall apply only if item A1 is supported.

Item	Question / feature	Reference subclauses	Status	N/A	Support
B1	CCBS invocation	6.5.2.1.1 6.5.2.1.3	A3:m	[ ]	m: Yes [ ]
B2	CCNR invocation	6.5.2.1.2 6.5.2.1.3	A4:m	[ ]	m: Yes [ ]
B3	Procedures for connection retention method	6.5.2.1	m		Yes [ ]
B4	Procedures for connection release method	6.5.2.1	A8:m	[ ]	m: Yes [ ]
B5	Procedures for receiving indication that User B is not busy	6.5.2.1.4	m		Yes [ ]
B6	Set up CC Call without Path Reservation	6.5.2.1.5	m		Yes [ ]
B7	Set up CC Call with Path Reservation	6.5.2.1.6	A8:o	[ ]	o: Yes [ ] No [ ]
B8	Procedures for User A busy, (path-) non-reservation method	6.5.2.1.7	m		Yes [ ]
B9	Procedures for User A busy, path reservation method	6.5.2.1.8 6.5.2.1.9	A8:m	[ ]	m: Yes [ ]
B10	Cancellation of a CC Request	6.5.2.1.10	m		Yes [ ]
B11	Exceptional procedures except failure of CC Call presentation	6.5.2.2.1 through 6.5.2.2.5	m		Yes [ ]
B12	Failure of CC Call presentation, service retention if User B is busy again	6.5.2.2.6	A9:m	[ ]	m: Yes [ ]
B13	Failure of CC Call presentation, no service retention if User B is busy again, failure indication to User A	6.5.2.2.6	o.1		Yes [ ] No [ ]
B14	Failure of CC Call presentation, no service retention if User B is busy again, automatic re-invocation of SS-CCBS	6.5.2.2.6	o.1		Yes [ ] No [ ]

A.3.5 **Procedures at the Terminating PTNX**

This table shall apply only if item A2 is supported.

Item	Question / feature	Reference subclauses	Status	N/A	Support
C1	CCBS invocation	6.5.3.1.1 6.5.3.1.3	A3:m	[ ]	m: Yes [ ]
C2	CCNR invocation	6.5.3.1.2 6.5.3.1.3	A4:m	[ ]	m: Yes [ ]
C3	Procedures for connection retention method	6.5.3.1	m		Yes [ ]
C4	Procedures for connection release method	6.5.3.1	m		Yes [ ]
C5	Procedures for indicating that User B is not busy	6.5.3.1.4	m		Yes [ ]
C6	Receive CC Call without Path Reservation	6.5.3.1.5	m		Yes [ ]
C7	Receive CC Call with Path Reservation	6.5.3.1.6	m		Yes [ ]
C8	CCBS/CCNR suspension / resumption	6.5.3.1.7	m		Yes [ ]
C9	Cancellation of a CC Request	6.5.3.1.8	m		Yes [ ]
C10	Exceptional procedures except User B Busy again on CC Call presentation	6.5.3.2.1 6.5.3.2.2 6.5.3.2.3 6.5.3.2.5	m		Yes [ ]
C11	Service retention procedure if User B is busy again on CC Call presentation	6.5.3.2.4	A9:m	[ ]	m: Yes [ ]
C12	Procedure without service retention if User B is busy again on CC Call presentation	6.5.3.2.4	m		Yes [ ]

A.3.6   Procedures at a Gateway PTNX

This table shall apply only if item A5 or A6 is supported.

Item	Question / feature	Reference subclauses	Status	N/A	Support
D1	Interworking if CCBS Request comes from a public ISDN	6.6.1	A5:o.1	[ ]	o: Yes [ ] No [ ]
D2	Interworking if CCBS/CCNR Request comes from a non-ISDN	6.7.1	A5:o.1	[ ]	o: Yes [ ] No [ ]
D3	Interworking if CCBS Request goes to a public ISDN	6.6.2	A6:o.2	[ ]	o: Yes [ ] No [ ]
D4	Interworking if CCBS/CCNR Request goes to a non-ISDN	6.7.2	A6:o.2	[ ]	o: Yes [ ] No [ ]

A.3.7   Coding

Item	Question / feature	Reference subclauses	Status	N/A	Support
E1	Sending and receipt of ccbsRequest APDUs	6.3.1	A3:m	[ ]	m: Yes [ ]
E2	Sending and receipt of ccnrRequest APDUs	6.3.1	A4:m	[ ]	m: Yes [ ]
E3	Sending and receipt of ccCancel invoke APDU	6.3.1	m		Yes [ ]
E4	Sending of ccExecPossible invoke APDU	6.3.1	c.1	[ ]	m: Yes [ ]
E5	Receipt of ccExecPossible invoke APDU	6.3.1	c.2	[ ]	m: Yes [ ]
E6	Sending of ccPathReserve invoke and receipt of return result and return error APDUs	6.3.1	c.3	[ ]	m: Yes [ ] o: Yes [ ] No [ ]
E7	Receipt of ccPathReserve invoke and sending of return result or return error APDUs	6.3.1	c.1	[ ]	m: Yes [ ]
E8	Sending of ccRingout invoke and receipt of return error APDU	6.3.1	c.2	[ ]	m: Yes [ ]
E9	Receipt of ccRingout invoke and sending of return error APDU	6.3.1	c.1	[ ]	m: Yes [ ]
E10	Sending of ccSuspend invoke APDU	6.3.1	c.2	[ ]	m: Yes [ ]
E11	Receipt of ccSuspend invoke APDU	6.3.1	c.1	[ ]	m: Yes [ ]
E12	Sending of ccResume invoke APDU	6.3.1	c.2	[ ]	m: Yes [ ]
E13	Receipt of ccResume invoke APDU	6.3.1	c.1	[ ]	m: Yes [ ]

c.1:   if (A2 or A6) then m else N/A

c.2:   if (A1 or A5) then m else N/A

c.3:   if (A1 and A8) then m else if D2 then o else N/A

A.3.8 Timers

Item	Question / feature	Reference subclauses	Status	N/A	Support
F1	Support of timer T1	6.8.1	A1:m	[ ]	m: Yes [ ] Value: ....
F2	Support of timer T2	6.8.1	A1:m	[ ]	m: Yes [ ] Value: ....
F3	Support of timer T3	6.8.1	A1:m	[ ]	m: Yes [ ] Value: ....
F4	Support of timer T4	6.8.1	c.1	[ ]	m: Yes [ ] Value: ....

c.1: if (A1 and A8) then m else N/A

Annex B (informative): Examples of message sequences

This annex describes some typical message flows for SS-CCBS and SS-CCNR. The following conventions are used in the figures of this annex.

1.   The following notation is used:

⟶	Call related message containing an SS-CC APDU
⟶	Call related message without SS-CC APDU
----➤	Call independent message containing an SS-CC APDU
⟶	Call independent message without SS-CC APDU
· · · · · ·➤	Symbolic primitive carrying SS-CC information
· · · · · ·➤	Symbolic primitive without SS-CC information
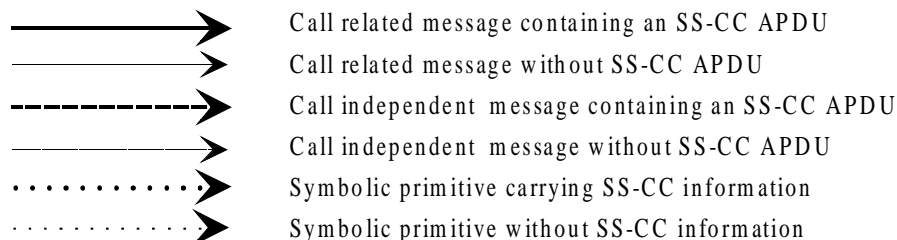
SETUP	Message name
Cx	Number of connection x
xxx.inv	Invoke APDU for operation xxx
xxx.rr	Return reult APDU for operation xxx
xxx.re	Return error APDU for operation xxx

2.   The figures show messages exchanged via Protocol Control between the Originating PTNX (PTNX A) and a Transit PTNX and between a Transit PTNX and the Terminating PTNX (PTNX B). Only messages relevant to SS-CC are shown.

NOTE B.1

Transit PTNXs do not take an active part in the operation of SS-CC.

3.   Only the relevant information content (SS-CC APDUs) is listed below each message name. The Facility information elements containing the SS-CC APDUs are not explicitly shown. Information with no impact on SS-CC is not shown.

4.   Some interactions with users are included in form of symbolic primitives. The actual protocol at the terminal interface is outside the scope of this Standard.

5.   Each end-to-end signalling connection (call related or call independent) is assigned a number (Cx). Every message name is accompanied by the number of the respective signalling connection to which it relates.

B.1   Successful CCBS

B.1.1   With path reservation and connection released

Figure B.1 shows an example message flow of a successful CCBS request and recall with path reservation.
It is assumed that the signalling connection is released during the monitoring phase.
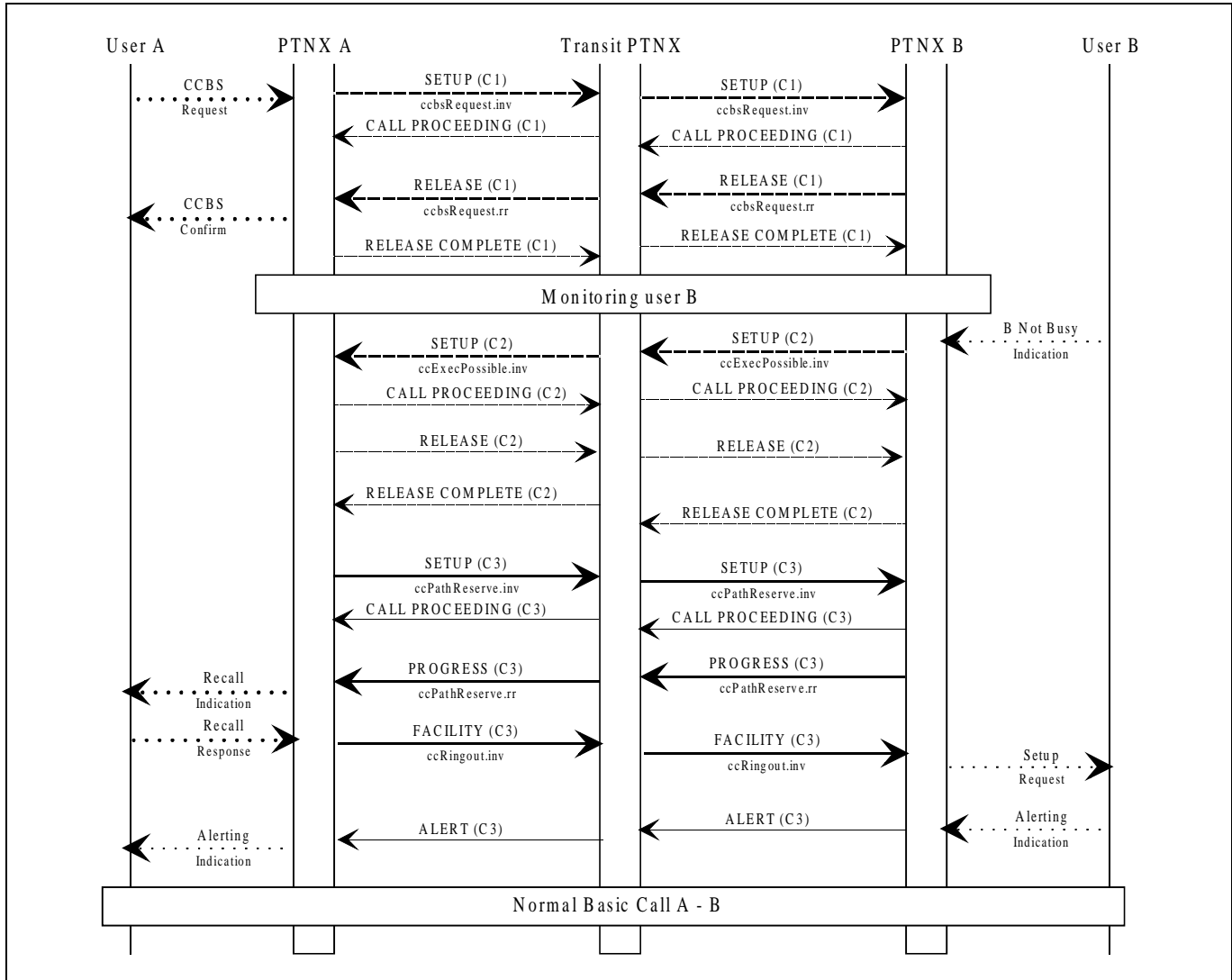
Figure B.1 - Example message flow for successful CCBS with path reservation

B.1.2 Without path reservation

Figure B.2 shows a successful CCBS request and recall without path reservation. The signalling connection is retained during the monitoring phase.
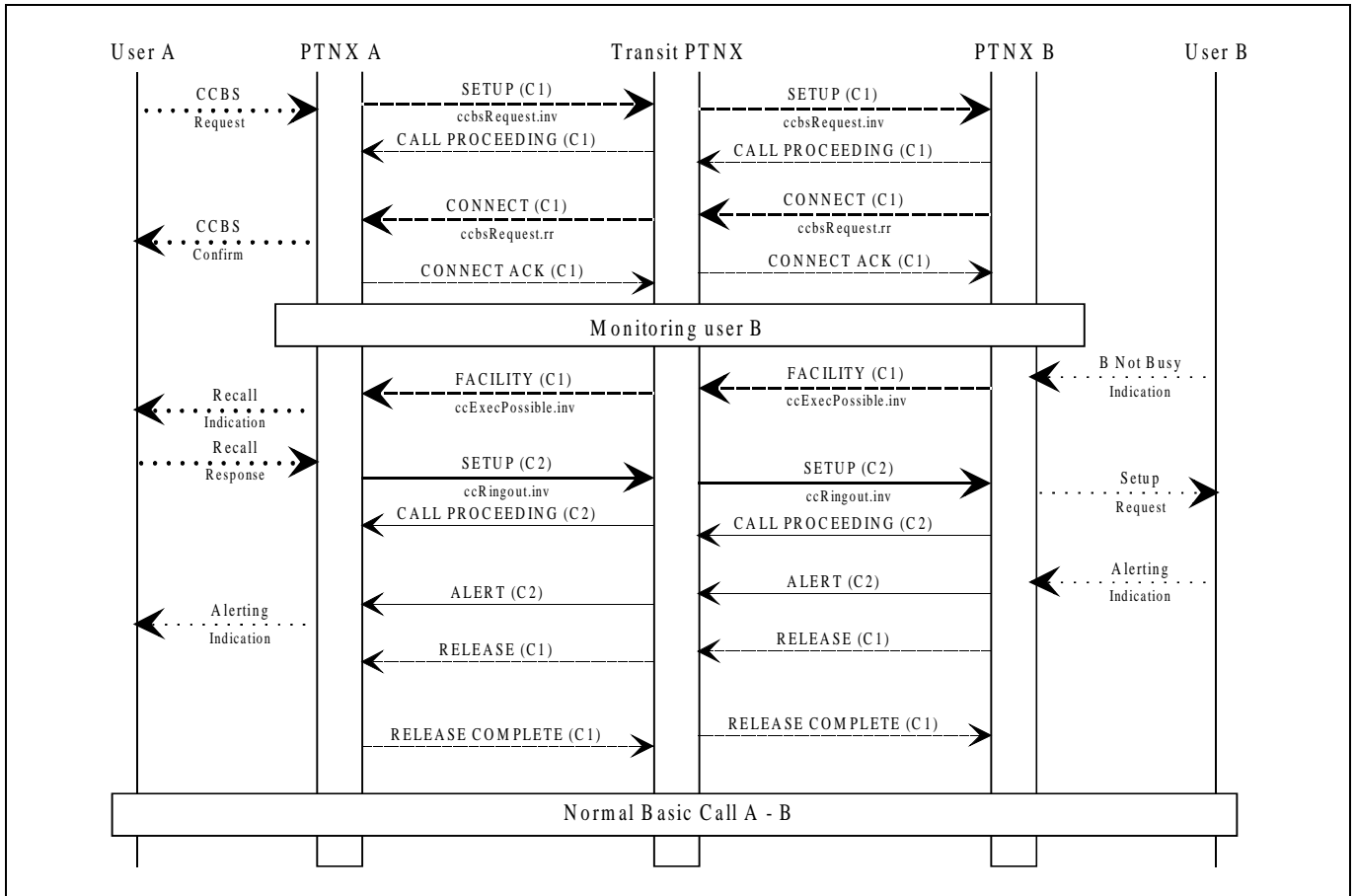
Figure B.2 - Example message flow for successful CCBS without path reservation

B.2 Successful CCNR

Figure B.3 shows a successful CCNR request without connection retention.
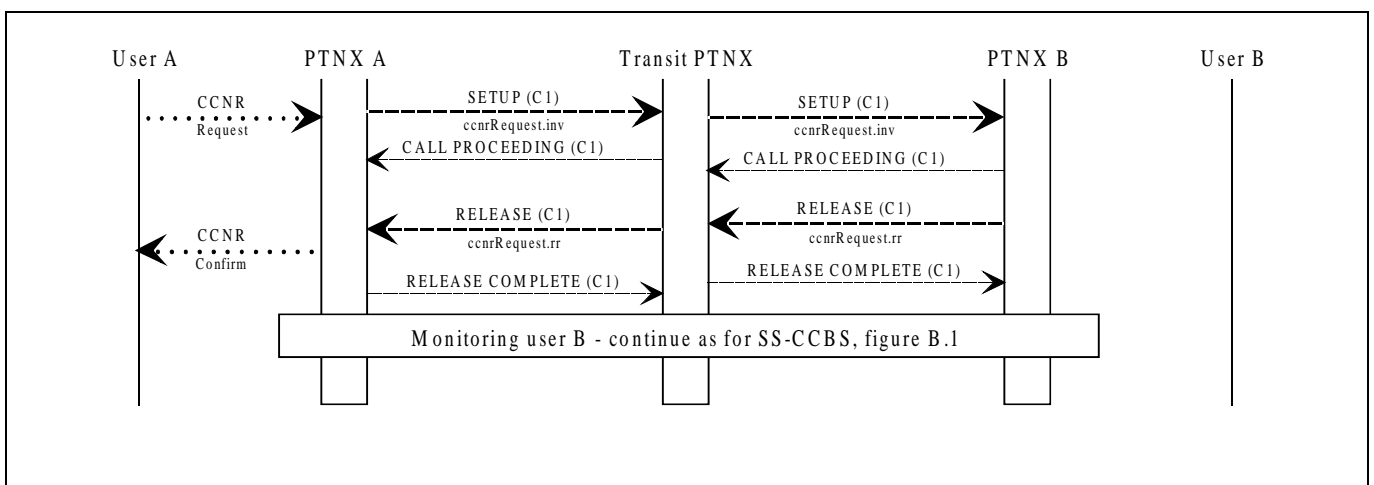
Figure B.3 - Example message flow for successful CCNR

B.3   User A busy

B.3.1   Path reservation case

Figure B.4 shows a CC Request which encounters User A busy when User B is not busy and a subsequent CC Call with path reservation when both users are not busy. It is assumed that the signalling connection has been retained.
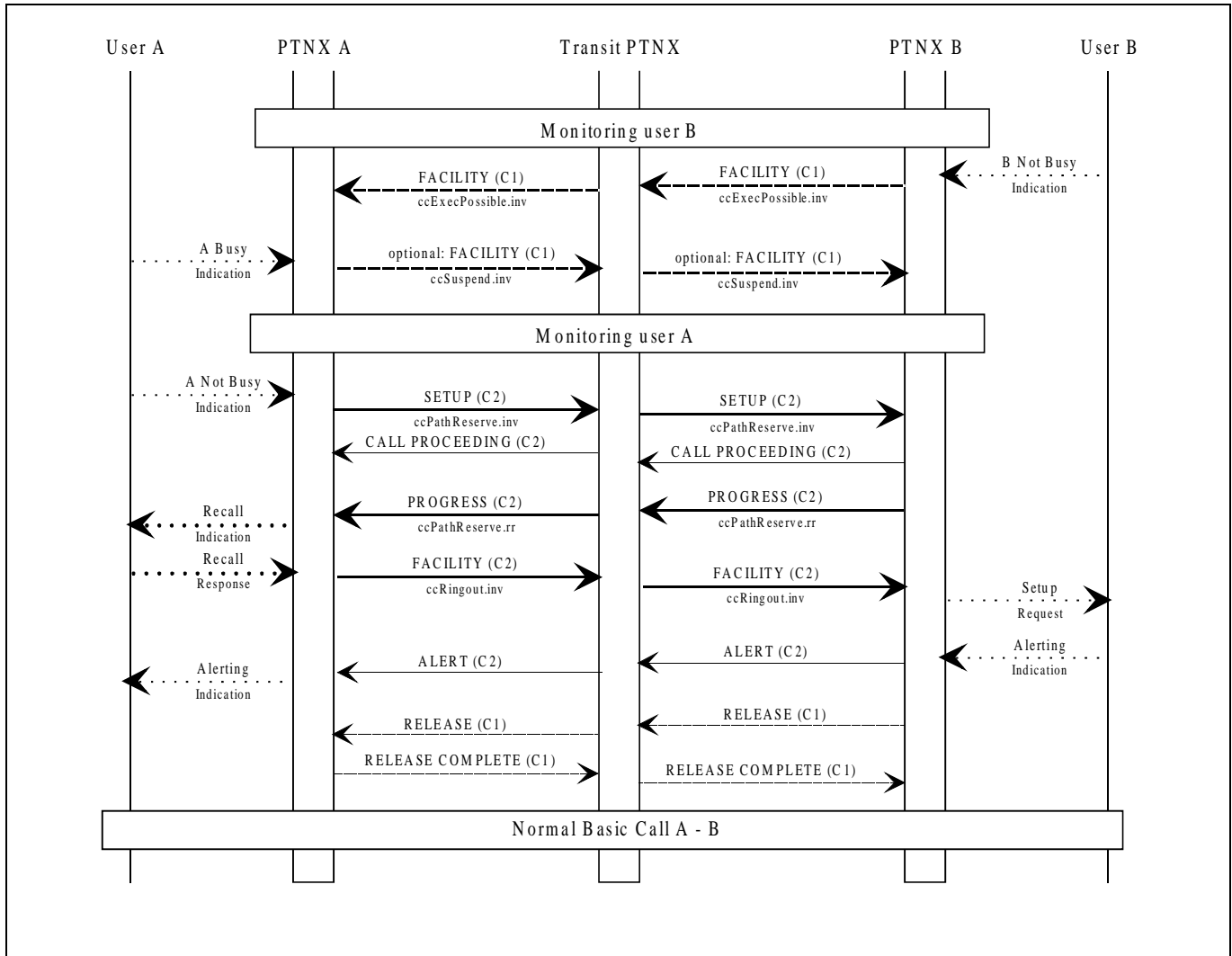
Figure B.4 - Example message flow for User A busy, path-reservation case

B.3.2 Non-reservation case

Figure B.5 shows a CC Request which encounters User A busy when User B is not busy and a subsequent CC Call without path reservation when both users are not busy.
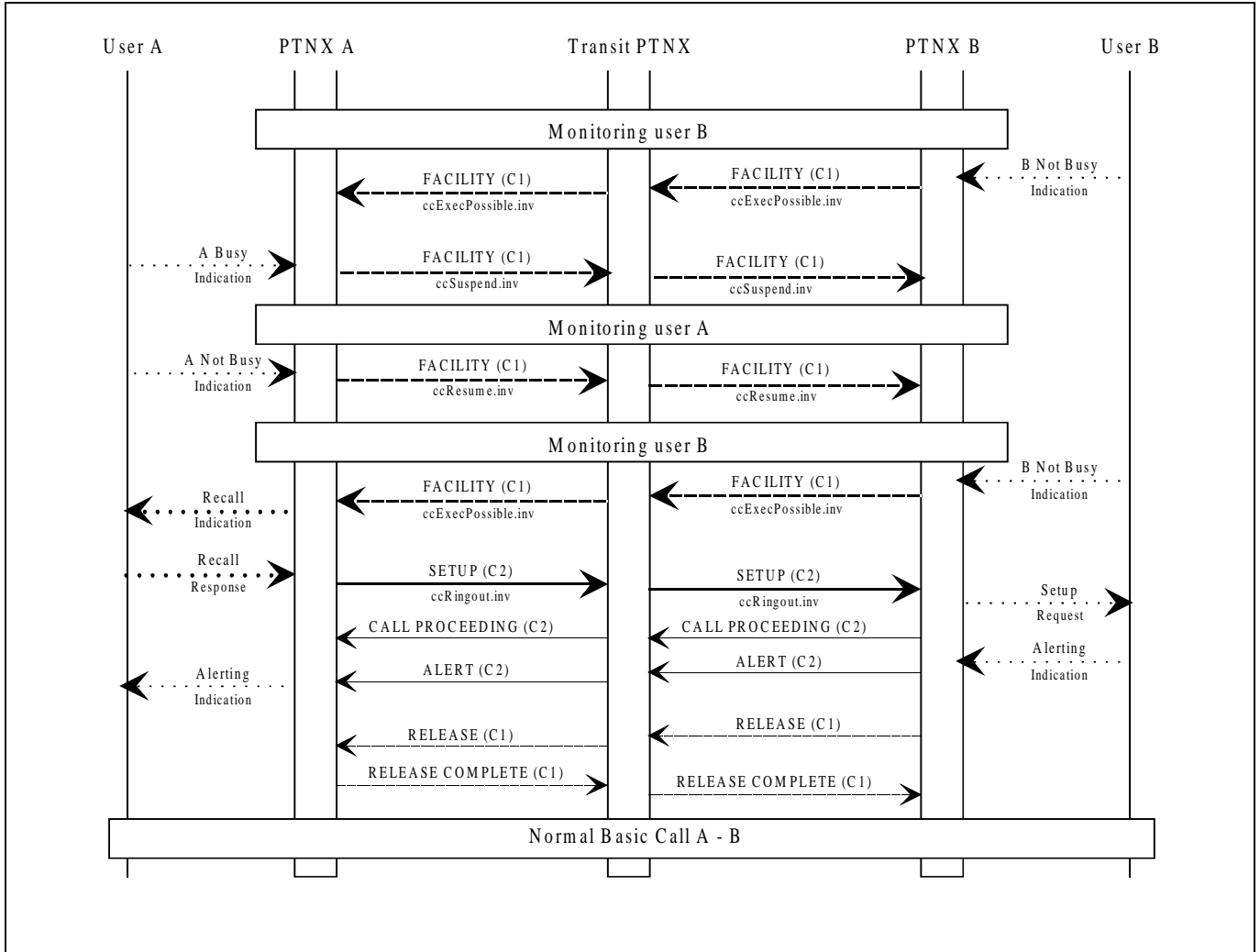
Figure B.5 - Example message flow for User A busy, non-reservation case

B.4 User B busy again

B.4.1 At path reservation

Figure B.6 shows the case that a path reservation attempt encounters User B busy again.
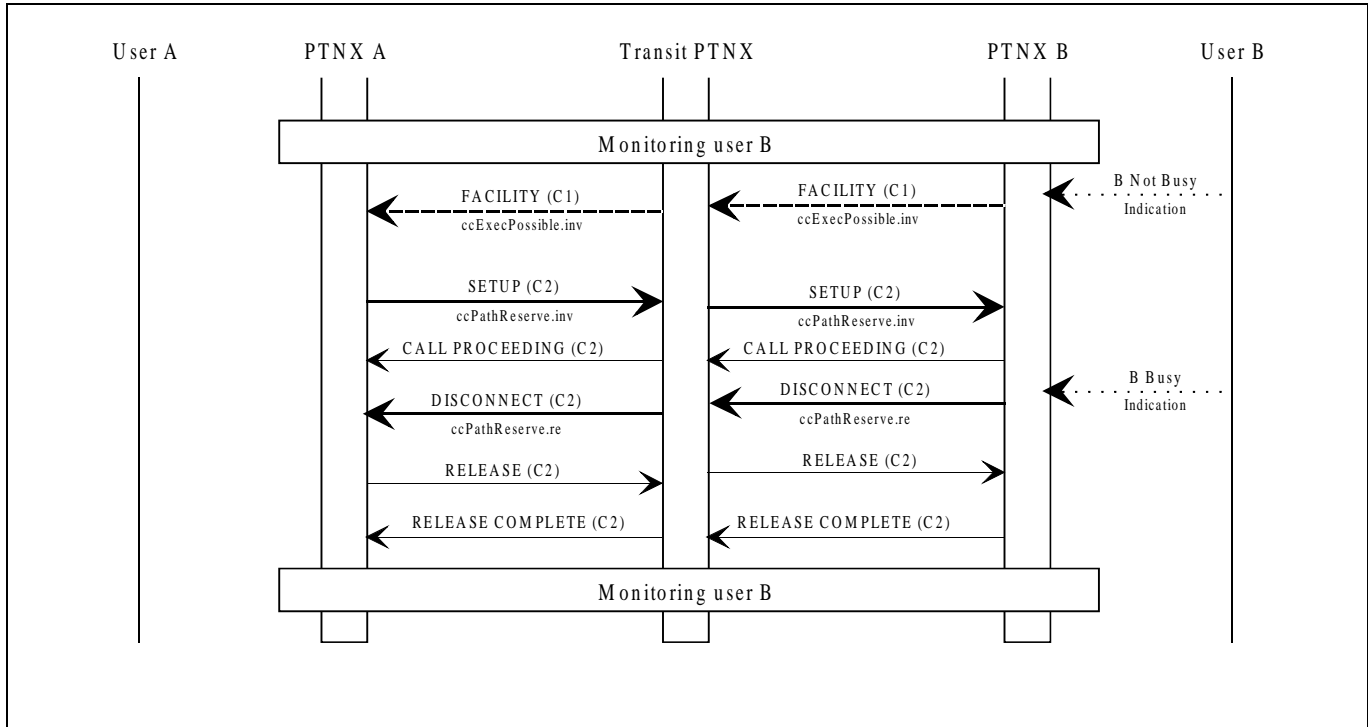
Figure B.6 - Example message flow for User B busy on path-reservation

B.4.2   At CC Call presentation - without path reservation, without service retention

Figure B.7 shows the case that a CC Call without path reservation encounters User B busy again and the service is not retained.
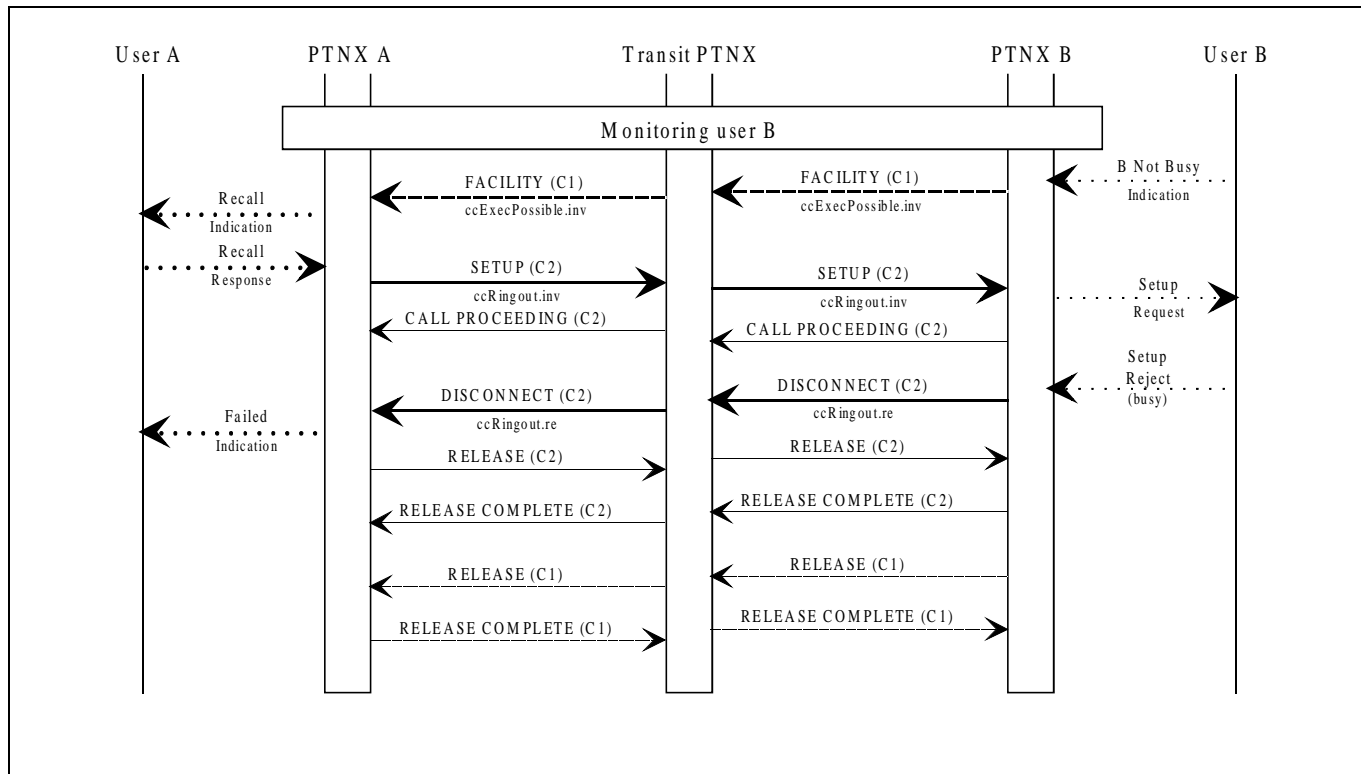
Figure B.7 - Example message flow for User B busy without service retention

B.4.3 At CC Call presentation - without path reservation, with service retention

Figure B.8 shows the case that a CC Call without path reservation encounters User B busy again and the service is retained.
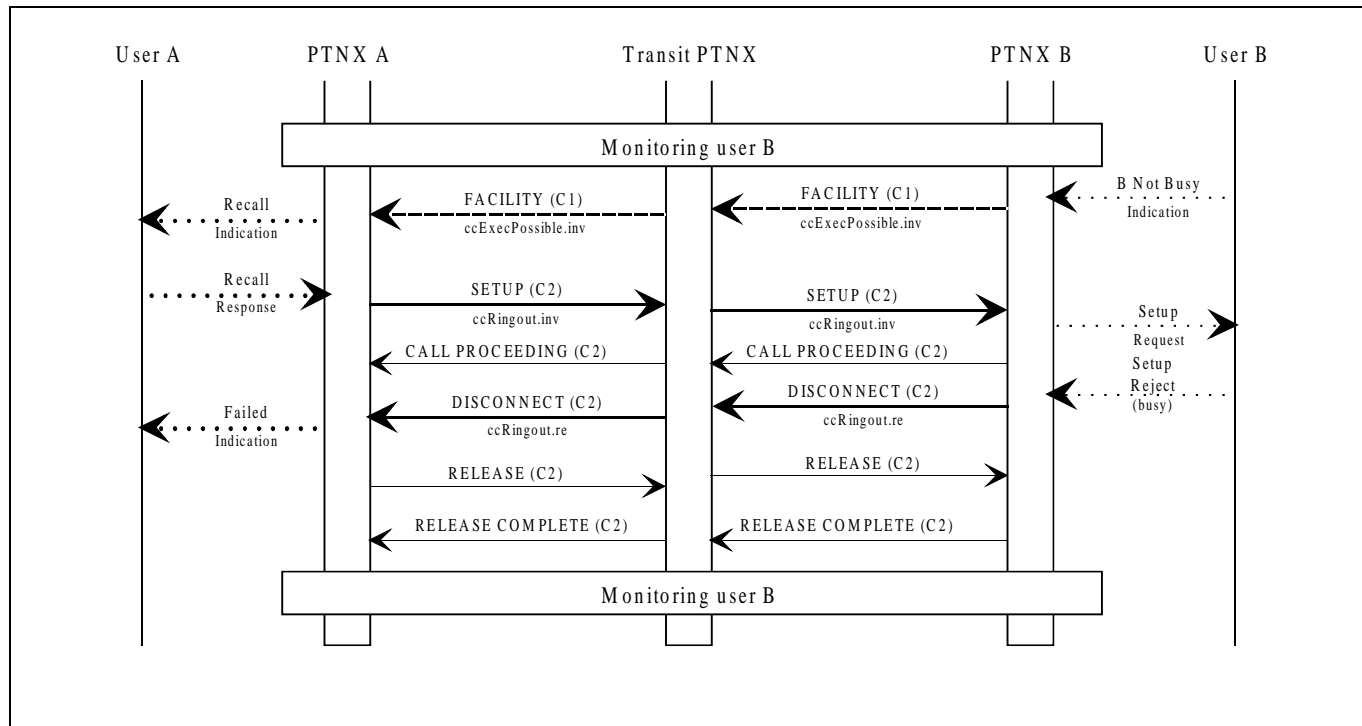
Figure B.8 - Example message flow for User B busy with service retention

Annex C (informative):   Specification and Description Language (SDL), representation of procedures

The diagrams in this annex use the Specification and Description Language defined in CCITT Recommendation Z.100 (1988).

Each diagram represents the behaviour of an SS-CC Supplementary Service Control entity at a particular type of PTNX. In accordance with the protocol model described in ETS 300 239, the Supplementary Service Control entity uses, via the Coordination function, the services of Generic Functional Procedures Control and Basic Call Control.

Where an output symbol represents a primitive to the coordination functions, and that primitive results in a message being sent, the output symbol bears the name of the message and any remote operations APDU(s) contained in that message. In the case of a message specified in ETS 300 172, basic call actions associated with the sending of that message are deemed to occur. In the case of a call independent message, actions associated with the sending of that message according to subclause 7.3 of ETS 300 239 are deemed to occur.

Where an input symbol represents a primitive from the coordination functions, and that primitive is the result of a message being received, the input signal bears the name of the message and any remote operations APDU(s) contained in that message. In the case of a message specified in ETS 300 172, basic call actions associated with the receipt of that message are deemed to have occurred. In the case of a call independent message, actions associated with the receipt of that message according to subclause 7.3 of ETS 300 239 are deemed to have occurred.

The following abbreviations are used:

   inv   Invoke APDU

   res   Return result APDU

   err   Return error APDU

C.1   Behaviour of the Originating PTNX

Figures C.1 through C.10 show the behaviour of the Originating PTNX.

Input signals from the left and output signals to the left represent primitives

   −   from or to the served user (user A);

   −   from or to basic call control; these primitives are indicated by a prefix "BC-";

   −   internal signal, e.g. timer expiry.

Input signals from the right and output signals to the right represent messages to the peer SS-Control entity (i.e. in the Terminating PTNX) which carry SS-CC control information. Messages according to subclause 7.3 of ETS 300 239 (signalling connection) are indicated by 'sc'. Messages not marked 'sc' are call related.

Process Originating_PTNX_Behaviour   Page 1(10)

CC-IDLE

NOTE   NOTE

CCBS-request from user A	CCNR-request from user A	SETUP (sc) cc-ExecPossible.inv	SETUP (sc) ccCancel.inv	RELEASE (sc)

| SETUP (sc) ccbsRequest.inv | SETUP (sc) ccnrRequest.inv | RELEASE (sc) ccCancel.inv | RELEASE (sc) | |

| START TIMER T1 | | CC-IDLE | CC-IDLE | CC-IDLE |

CC-WAIT-ACK

NOTE: This event can only occur in error situations.

CONNECT (sc) ccbsRequest.res/ ccnrRequest.res	RELEASE (sc) ccbsRequest.res/ ccnrRequest.res	sign.conn. failed	RELEASE (sc) ccbsRequest.err/ ccnrRequest.err

| STOP TIMER T1 | STOP TIMER T1 | Timeout T1 | STOP TIMER T1 |

| START TIMER T2 | START TIMER T2 | | |

| STORE CC REQUEST | STORE CC REQUEST | | |

re-invocation? yes

re-invocation? yes

re-invocation? yes   no

no   no

"CC-request accepted" to user A

"CC-request accepted" to user A

CC failed indication to user A

"CC-request rejected" to user A

CC-INVOKED A-RET

CC-INVOKED A-RLS

CC-IDLE

Figure C.1 (sheet 1 of 10) - Originating PTNX Behaviour

Process Originating_PTNX_Behaviour   Page 2(10)

CC-INVOKED A-RET

Timeout T2

CC cancel request from user A

RELEASE (sc) ccCancel.inv

CC cancelled indication to user A

STOP TIMER T2

STOP TIMER T2

RELEASE (sc) ccCancel.inv

CC cancelled indication to user A

FACILITY (sc) cc-ExecPossible.inv

DELETE CC REQUEST

User A busy?   yes

no   CC-IDLE

path reservation?   yes   path reservation?   yes

no   no   suspend option

can sig. conn. be released?   without   with

yes

RELEASE (sc)   can sig. conn. be released?

                                                       no   can sig. conn. be released?

CC recall ind. to user A   SETUP ccPath-Reserve.inv   FACILITY (sc) ccSuspend.inv   no   yes

                                                              yes

START TIMER T3   START TIMER T4   RELEASE (sc)   FACILITY (sc) ccSuspend.inv   RELEASE (sc) ccSuspend.inv

CC-WAIT USER A ANSWER-N   CC-PATH-SETUP   CC-SUSPEND-A   CC-WAIT USER A FREE

Figure C.1 (sheet 2 of 10) - Originating PTNX Behaviour

Process Originating_PTNX_Behaviour   Page 3(10)

Figure C.1 (sheet 3 of 10) - Originating PTNX Behaviour

Process Originating_PTNX_Behaviour   Page 4(10)

CC-SUSPENDED A

| "user A not busy" indication | RELEASE (sc) ccCancel.inv | CC cancel request from user A | Timeout T2 |

STOP TIMER T2   STOP TIMER T2   CC cancelled indication to user A

FACILITY (sc) ccResume.inv   CC cancelled indication to user A   RELEASE (sc) ccCancel.inv

DELETE CC REQUEST

CC-INVOKED A-RET   CC-IDLE

Figure C.1 (sheet 4 of 10) - Originating PTNX Behaviour

Process Originating_PTNX_Behaviour   Page 5(10)

Figure C.1 (sheet 5 of 10) - Originating PTNX Behaviour

Process Originating_PTNX_Behaviour   Page 6(10)

Figure C.1 (sheet 6 of 10) - Originating PTNX Behaviour

Process Originating_PTNX_Behaviour   Page 7(10)

CC-PATH-SETUP

1

to
sheet 8

A

PROGRESS cc-
PathReserve.res

DISCONNECT cc-
PathReserve.err

BC-Failure.ind
(congestion)

to
sheet 8

STOP
TIMER T4

STOP
TIMER T4

STOP
TIMER T4

User A
busy?   yes

B busy?   no

failed due to
interworking?   yes

quit   retry

no

yes

no

CC recall
indication
to user A

sig. conn.
active?   yes

STOP
TIMER T2

SETUP cc-
PathReserve.inv

from
sheet 8

no

sig. conn.
active?   no

START
TIMER T4

DISCONNECT
ccSuspend.inv

2

yes

CC-PATH-SETUP

START
TIMER T3

CC-INVOKED-A-
RET

STOP
TIMER T2

SETUP (sc)
ccCancel.inv

CC-WAIT USER A
ANSWER-R

CC-INVOKED-A-
RLS

yes

sig. conn.
active?no

RELEASE (sc)
ccCancel.inv

CC-WAIT-USER-A-
FREE

RELEASE (sc)

CC cancelled
indication
to user A

DELETE CC
REQUEST

CC-IDLE

Figure C.1 (sheet 7 of 10) - Originating PTNX Behaviour

Process Originating_PTNX_Behaviour   Page 8(10)

from
sheet 7

A

from
sheet 7

Timeout
T2

Timeout
T4

CC cancel
request
from user A

1

defer   cancel

save T2

CC cancelled
indication
to user A

CC Recall
indication
to user A

SETUP cc-
PathReserve.inv

2

CC-PATH-SETUP

to
sheet 7

STOP ACTIVE
TIMERS (T2, T4)

START
TIMER T3

START
TIMER T4

DISCONNECT

CC-WAIT-USER-A-
ANSWER-N

CC-PATH-SETUP

DELETE CC
REQUEST

no

sig. conn.
active?

yes

SETUP (sc)
ccCancel.inv

RELEASE (sc)
ccCancel.inv

CC-IDLE

Figure C.1 (sheet 8 of 10) - Originating PTNX Behaviour

Process Originating_PTNX_Behaviour   Page 9(10)

CC-WAIT USER A
ANSWER-R

CC-recall accept from user A | RELEASE (sc) ccCancel.inv | SETUP (sc) ccCancel.inv | Timeout T3 | Timeout T2

cancel / defer

STOP TIMER T3

RELEASE (sc)

sig. conn. active? — yes

no

save T2

RELEASE (sc) ccCancel.inv

CC-WAIT USER A ANSWER-R

FACILITY cc-Ringout.inv

DISCONNECT | DISCONNECT ccCAncel.inv | DISCONNECT

CC-RINGOUT

STOP ACTIVE TIMERS (T2, T3)

CC failed indication to user A

DELETE CC REQUEST

CC-IDLE

Figure C.1 (sheet 9 of 10) - Originating PTNX Behaviour

Process Originating_PTNX_Behaviour   Page 10(10)

CC-RINGOUT

ALERT or CONNECT

DISCONNECT ccRingout.err

Timeout T2

BC-Failure indication (CC Call)

B busy?   yes

service retention?   no

STOP TIMER T2

STOP TIMER T2

STOP TIMER T2

defer   cancel

save T2

sig. conn. active?   yes

STOP TIMER T2

release sig. conn?   yes

CC-RINGOUT

RELEASE (sc)

sig. conn. active?   yes   no

release sig. conn?   no   release sig. conn?   no   re-invocation

CC-INVOKED-A-RET

DISCONNECT

RELEASE (sc)   RELEASE (sc)   no   yes

CC-INVOKED-A-RLS

sig. conn. active?   yes   no

SETUP (sc) ccbsRequest.inv

DISCONNECT (sc) ccCancel.inv

SETUP (sc) ccCancel.inv

START TIMER T1

RELEASE (sc) ccCancel.inv

CC-WAIT-ACK

DELETE CC REQUEST

CC failed indication to user A

CC-IDLE

DELETE CC REQUEST

CC-IDLE

Figure C.1 (sheet 10 of 10) - Originating PTNX Behaviour

C.2   Behaviour of the Terminating PTNX

Figures C.11 through C.16 show the behaviour of the Terminating PTNX.

Input signals from the left and output signals to the left represent messages from and to the peer SS-Control entity (i.e. in the Originating PTNX) which carry SS-CC control information. Messages according to subclause 7.3 of ETS 300 239 (signalling connection) are indicated by 'sc'. Messages not marked 'sc' are call related.
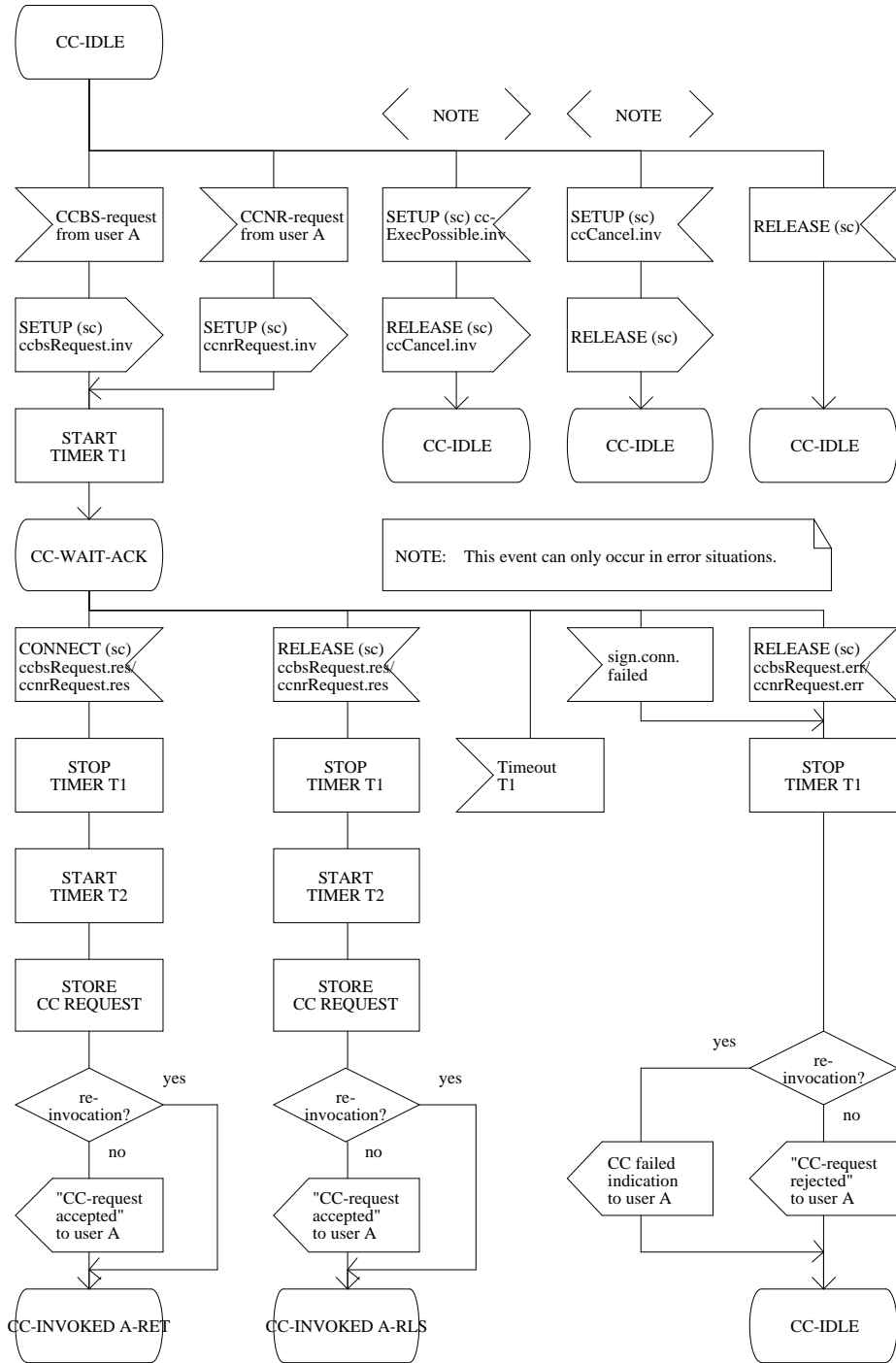
Input signals from the right and output signals to the right represent primitives:

–   from or to the called user (user B);

–   from or to basic call control; these primitives are indicated by a prefix BC-.

Process Terminating_PTNX_Behaviour   Page 1(6)

CC-IDLE

NOTE   NOTE   NOTE

SETUP (sc)   SETUP (sc)   SETUP (sc)   SETUP cc-   SETUP
ccbsRequest.inv   ccnrRequest.inv   ccCancel.inv   PathReserve.inv ccRingout.inv

request   no   request   no   DISCONNECT   DISCONNECT
acceptable?   acceptable?   RELEASE (sc)   ccPathReserve.err ccRingout.err

yes   yes

STORE CC   RELEASE (sc)   STORE CC   RELEASE (sc)
REQUEST   ccbsRequest.err REQUEST   ccnrRequest.err   CC-IDLE

CC-IDLE   CC-IDLE

CC-IDLE

maintain   no
sig. conn?

yes

maintain   no
sig. conn?   NOTE: This event can only
                                                                        occur in error situations.
yes

CONNECT (sc)   RELEASE (sc)   CONNECT (sc)   RELEASE (sc)
ccbsRequest.res ccbsRequest.res ccnrRequest.res ccnrRequest.res

MONITOR USER B   MONITOR USER B
FOR "NOT BUSY"   FOR "NOT BUSY
                                 AFTER ACTIVITY"

CC-INVOKED-B   CC-INVOKED-B
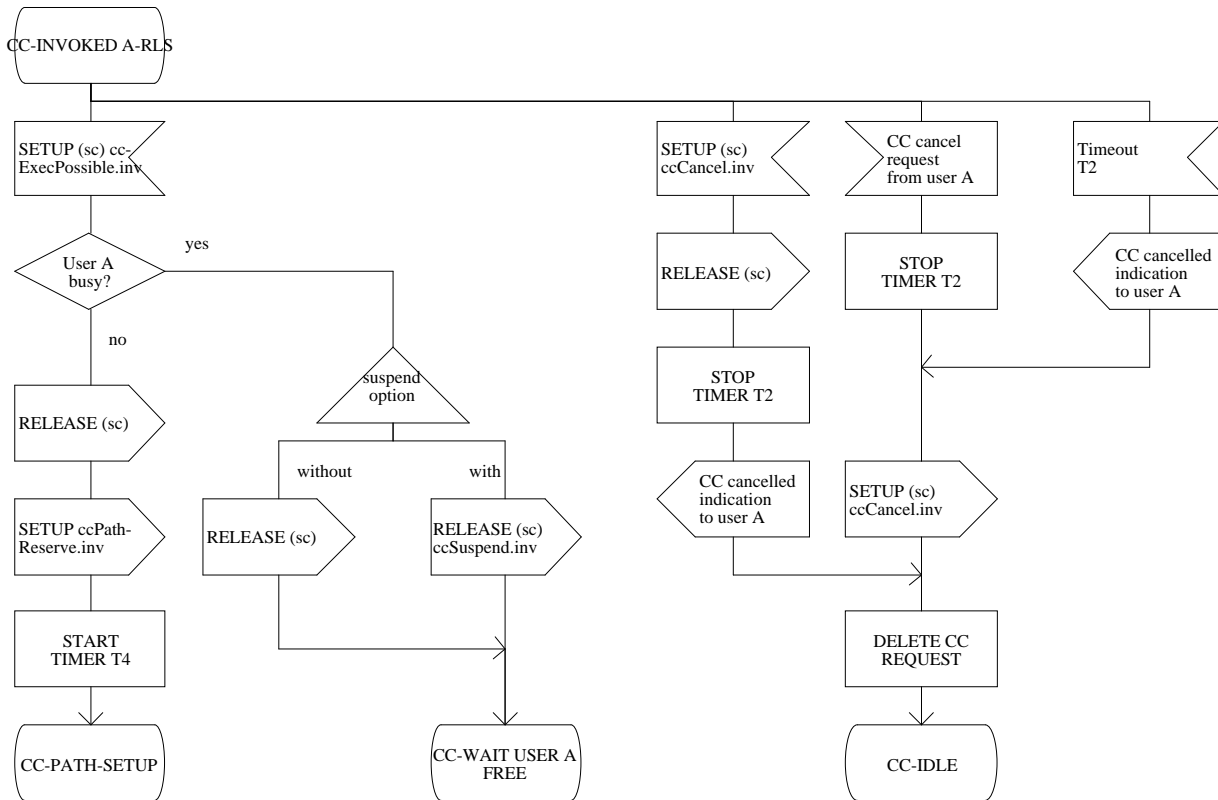
Figure C.2 (sheet 1 of 6) - Terminating PTNX Behaviour

Process Terminating_PTNX_Behaviour   Page 2(6)
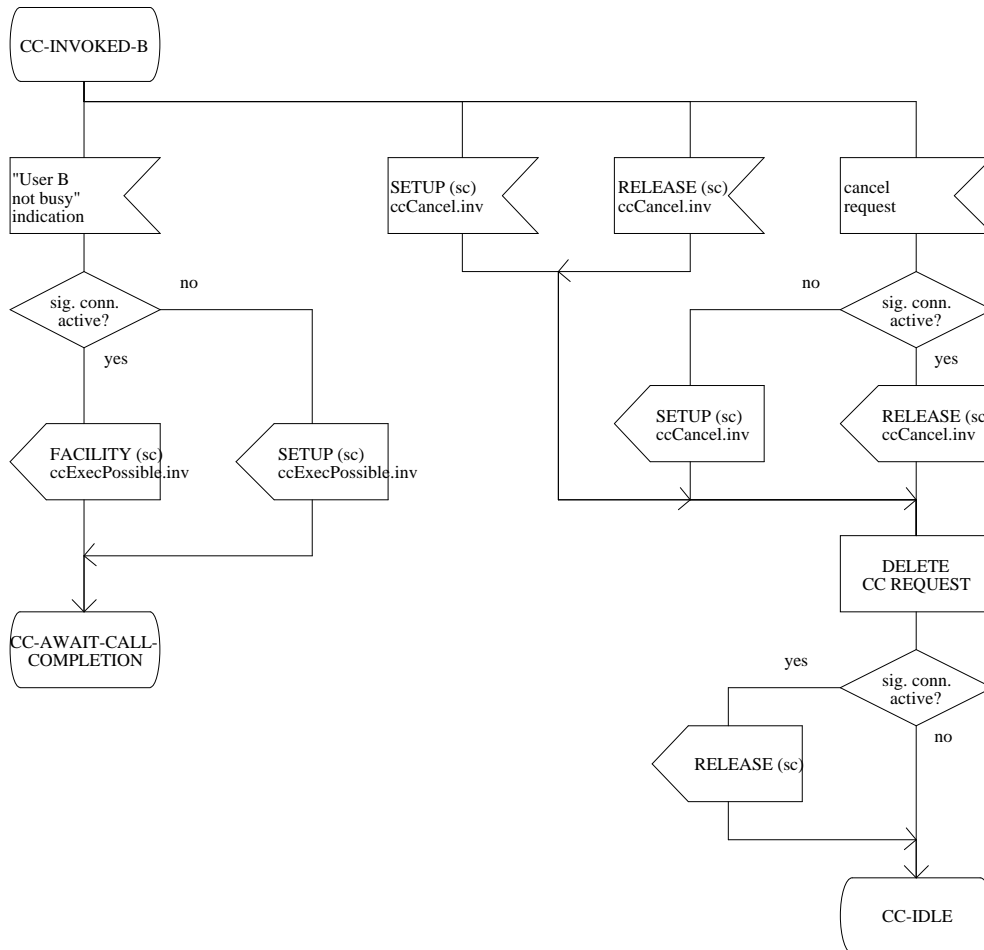
Figure C.2 (sheet 2 of 6) - Terminating PTNX Behaviour

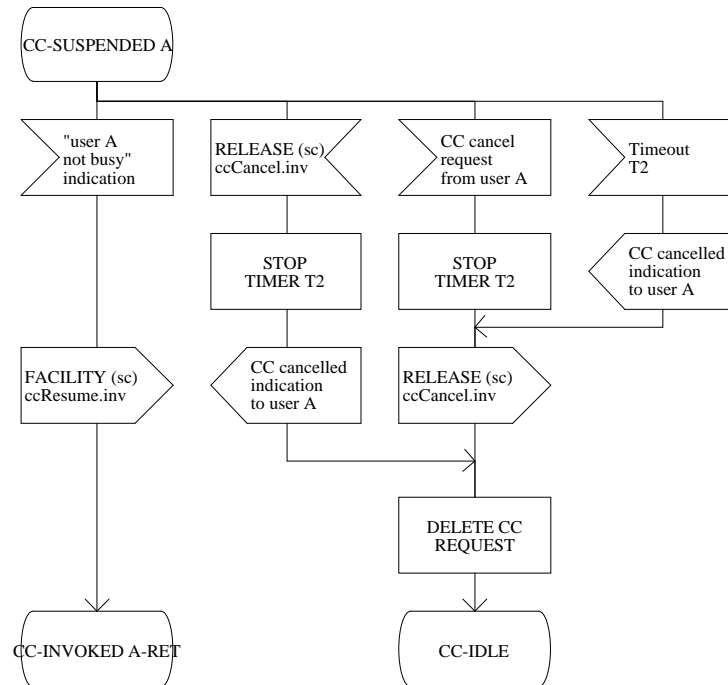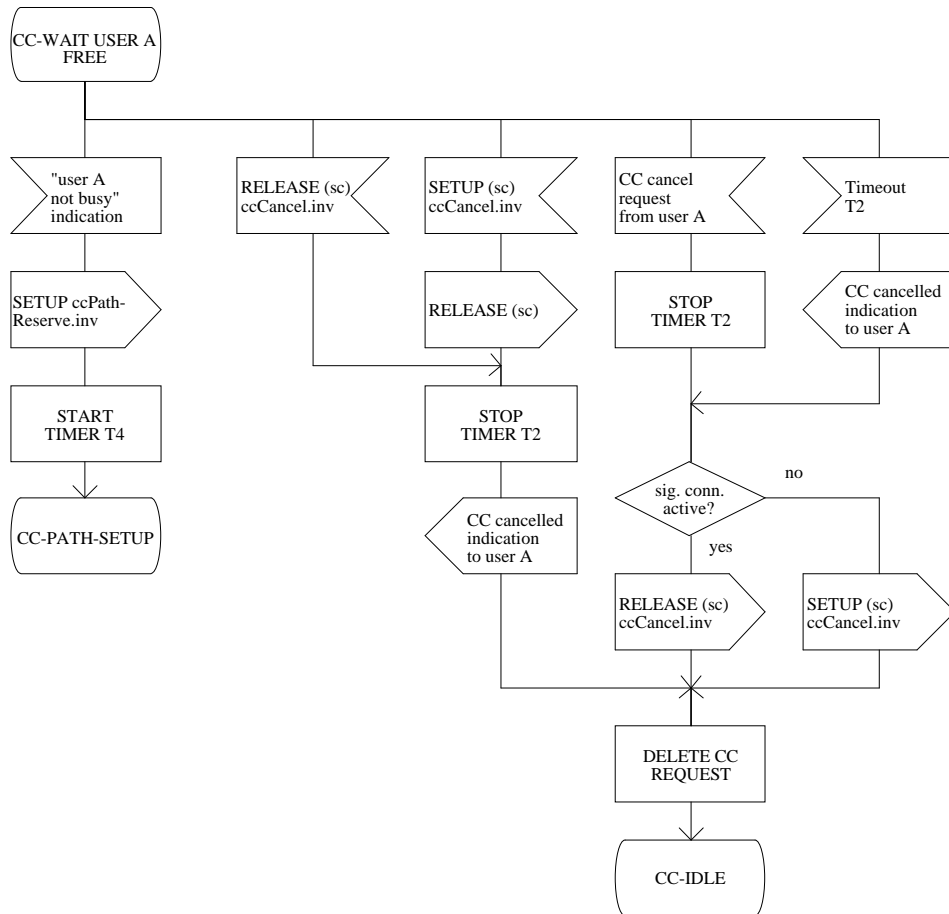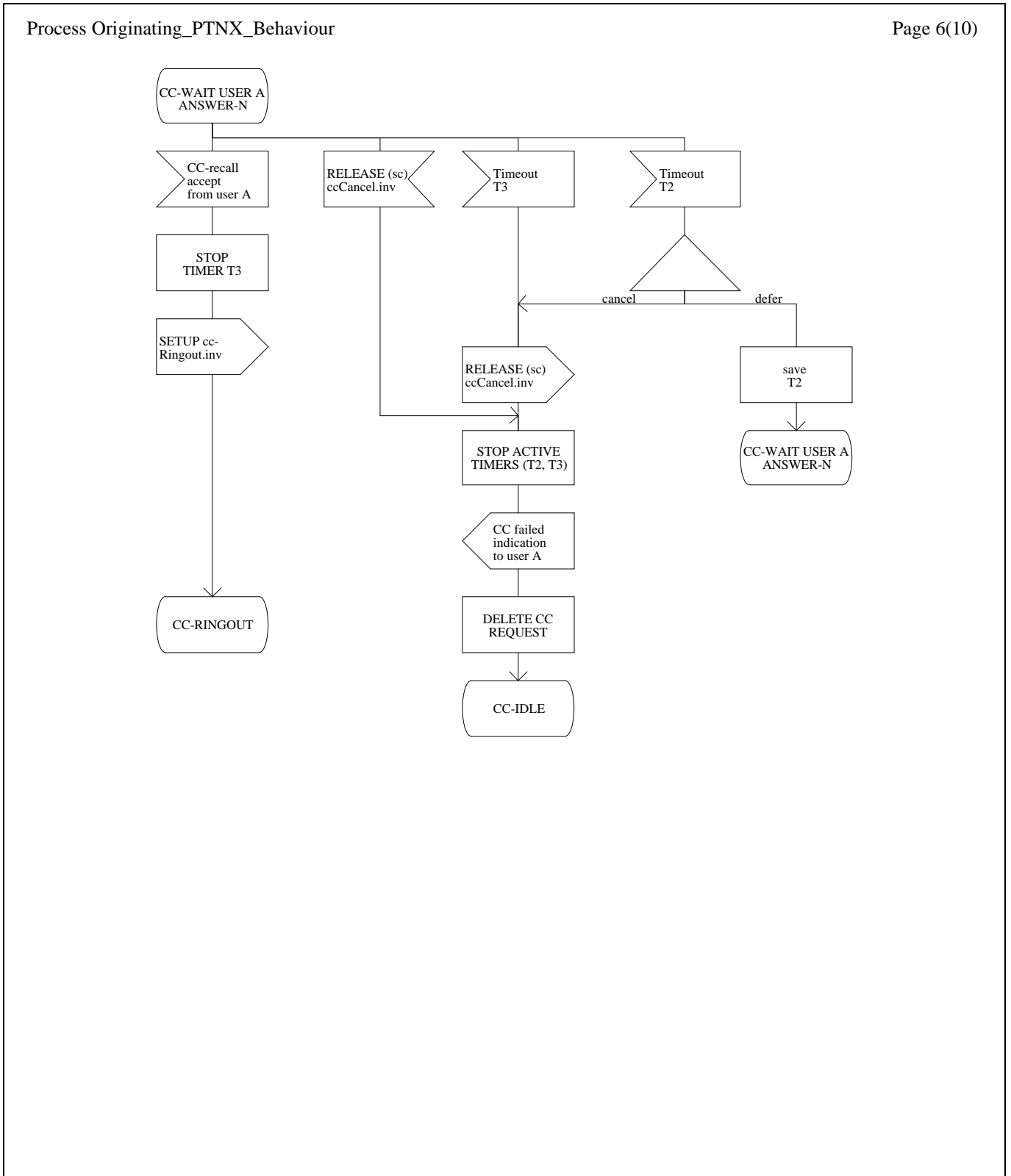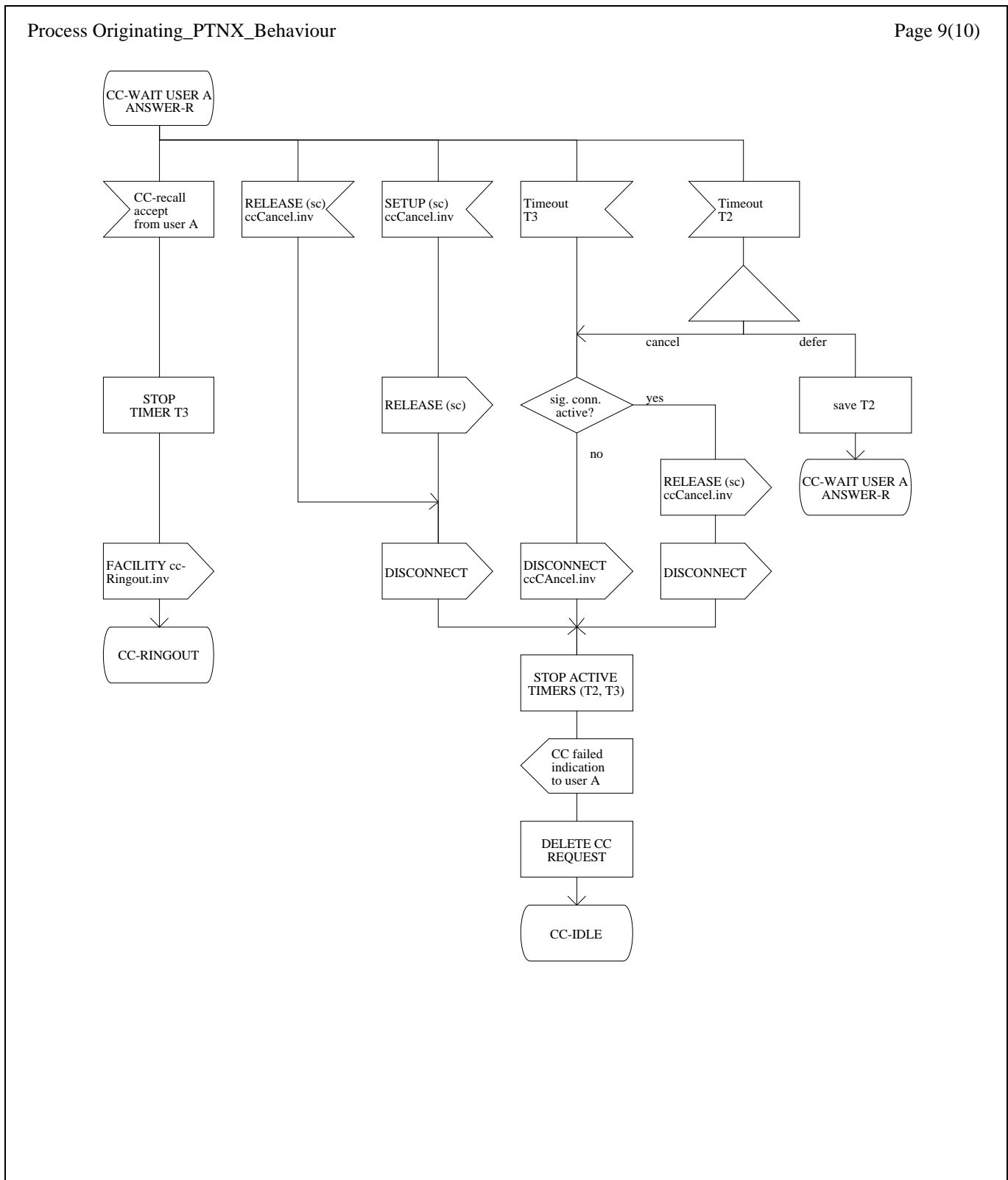Process Terminating_PTNX_Behaviour   Page 3(6)

CC-AWAIT-CALL-
COMPLETION

SETUP cc-
PathReserve.inv

RELEASE (sc)

SETUP
ccRingout.inv

FACILITY /
RELEASE (sc)
ccSuspend.inv

cancel
request

RELEASE (sc)
ccCancel.inv

CC-AWAIT-CALL-
COMPLETION

CC-SUSPEND-B

sig. conn.
active?

no

SETUP (sc)
ccCancel.inv

yes

SETUP (sc)
ccCancel.inv

RELEASE (sc)

user B
busy
again?

no

BC_Setup
indication
to user B

user B
busy
again?

yes

DISCONNECT
ccRingout.err

CC-WAIT-USER-B-
ALERT

RELEASE (sc)
ccCancel.inv

no

PROGRESS cc-
PathReserve.res

DISCONNECT cc-
PathReserve.err

service
retained?

no

CC-PATH-
COMPLETE

CC-INVOKED-B

yes

RELEASE (sc)

DELETE
CC REQUEST

DELETE
CC REQUEST

CC-IDLE

CC-INVOKED-B

CC-IDLE

Figure C.2 (sheet 3 of 6) - Terminating PTNX Behaviour

Process Terminating_PTNX_Behaviour   Page 4(6)
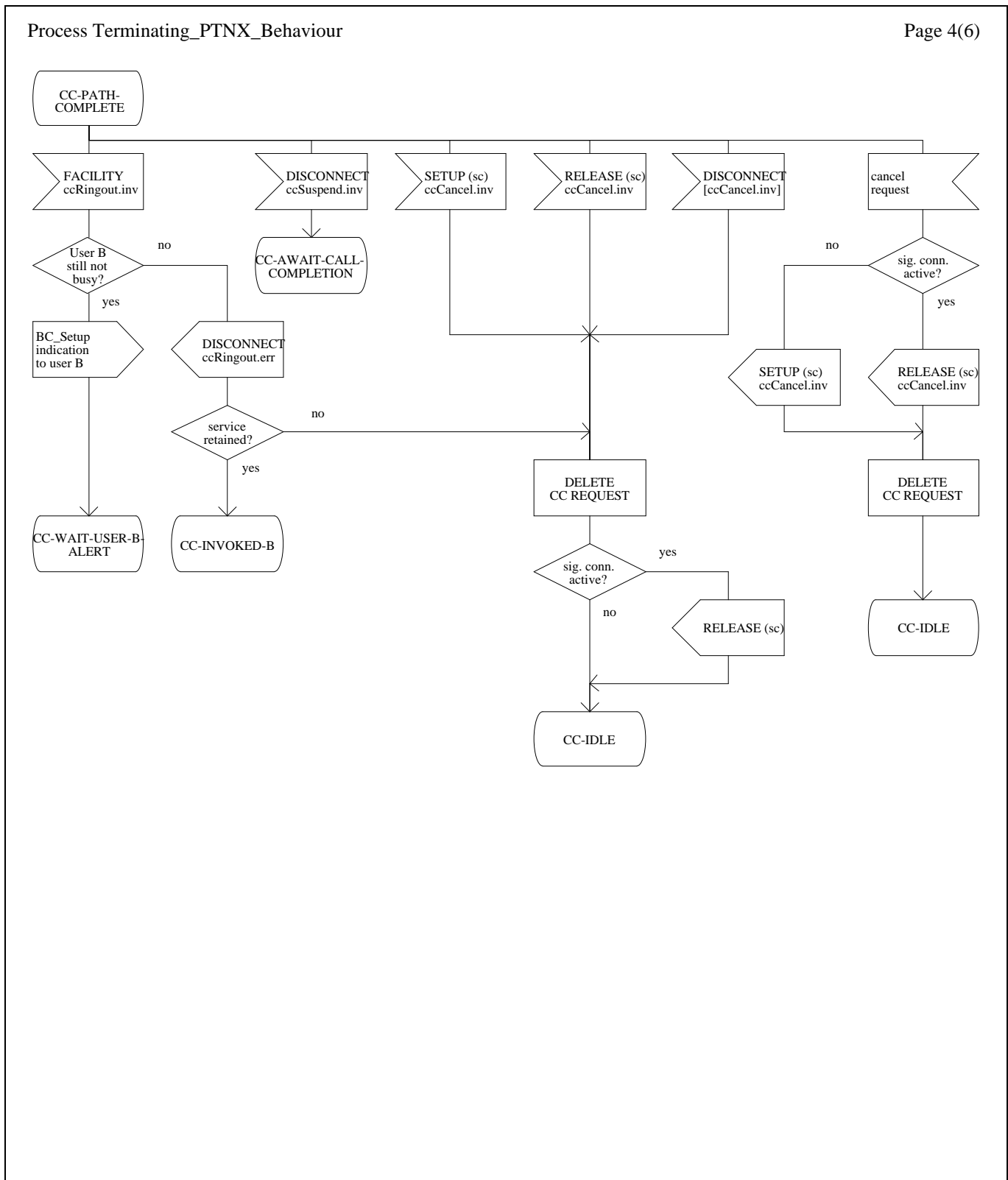
Figure C.2 (sheet 4 of 6) - Terminating PTNX Behaviour

Process Terminating_PTNX_Behaviour   Page 5(6)

CC-WAIT-USER-B-
ALERT

| BC_Alerting user B | BC_Setup conf. user B | BC_Cleared (CC Call) | SETUP (sc) ccCancel.inv | RELEASE (sc) ccCancel.inv |

ALERTING   CONNECT

DELETE
CC REQUEST

yes   sig. conn.
active?

                no

RELEASE (sc)

CC-IDLE
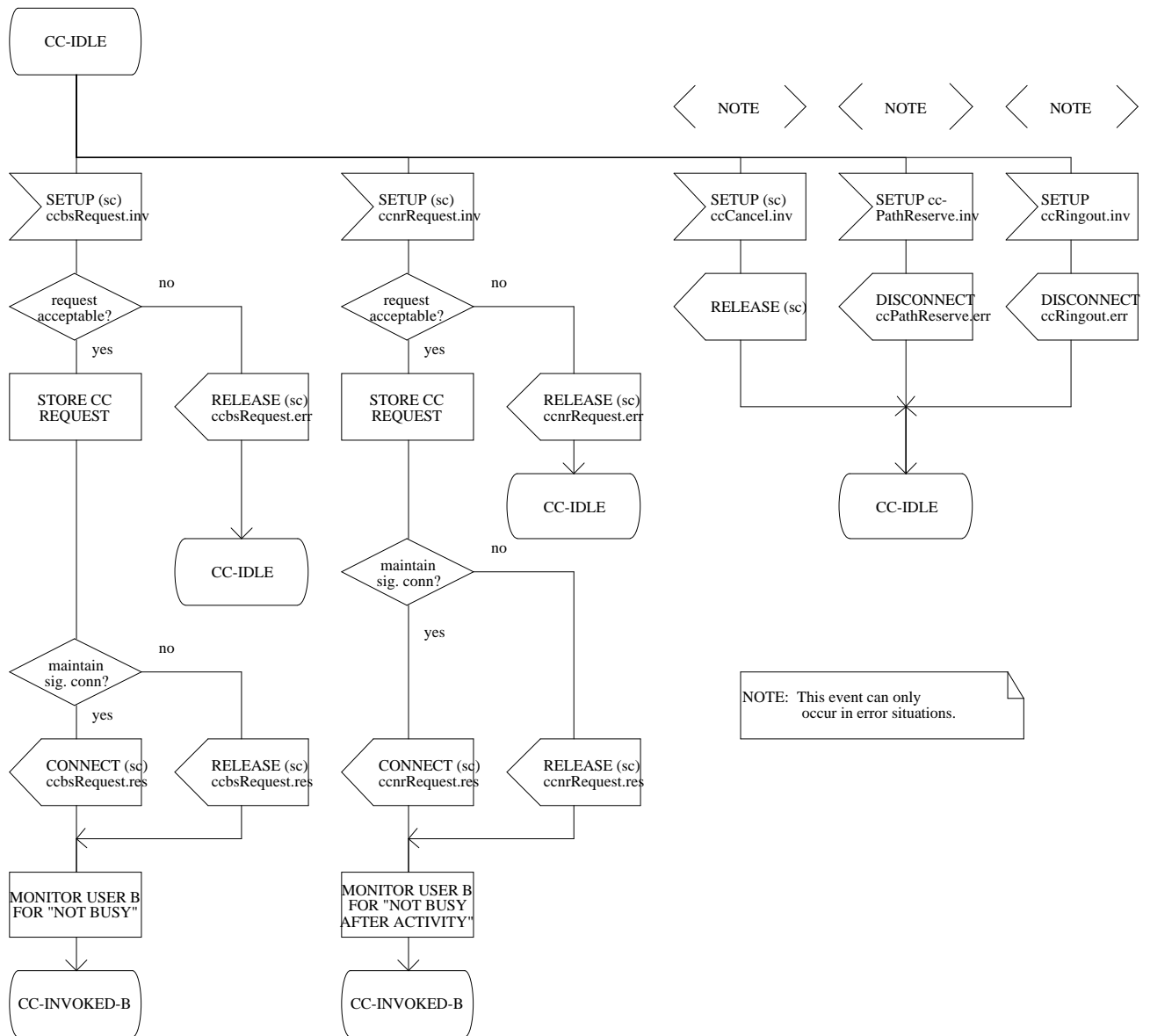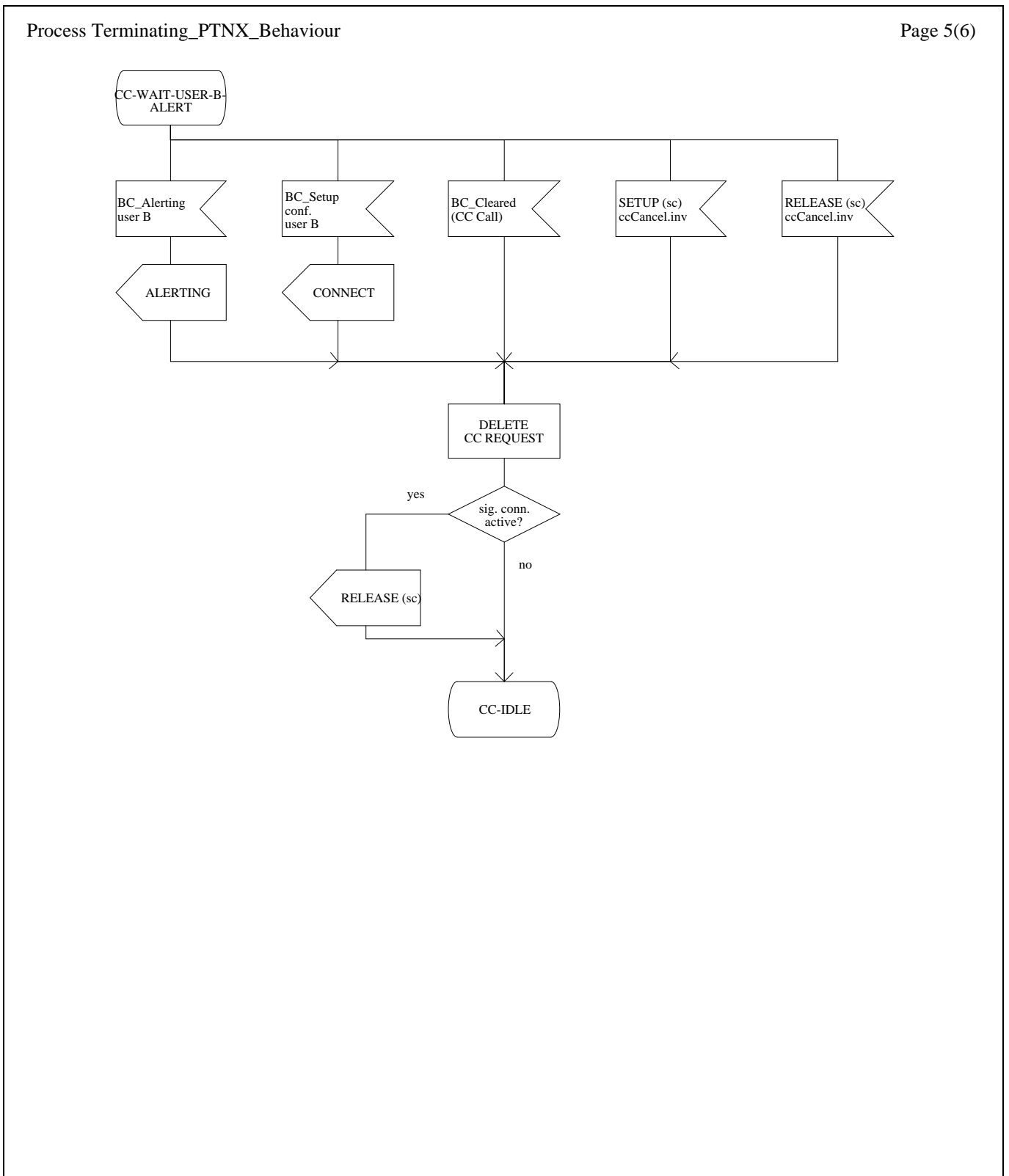
Figure C.2 (sheet 5 of 6) - Terminating PTNX Behaviour

Process Terminating_PTNX_Behaviour   Page 6(6)
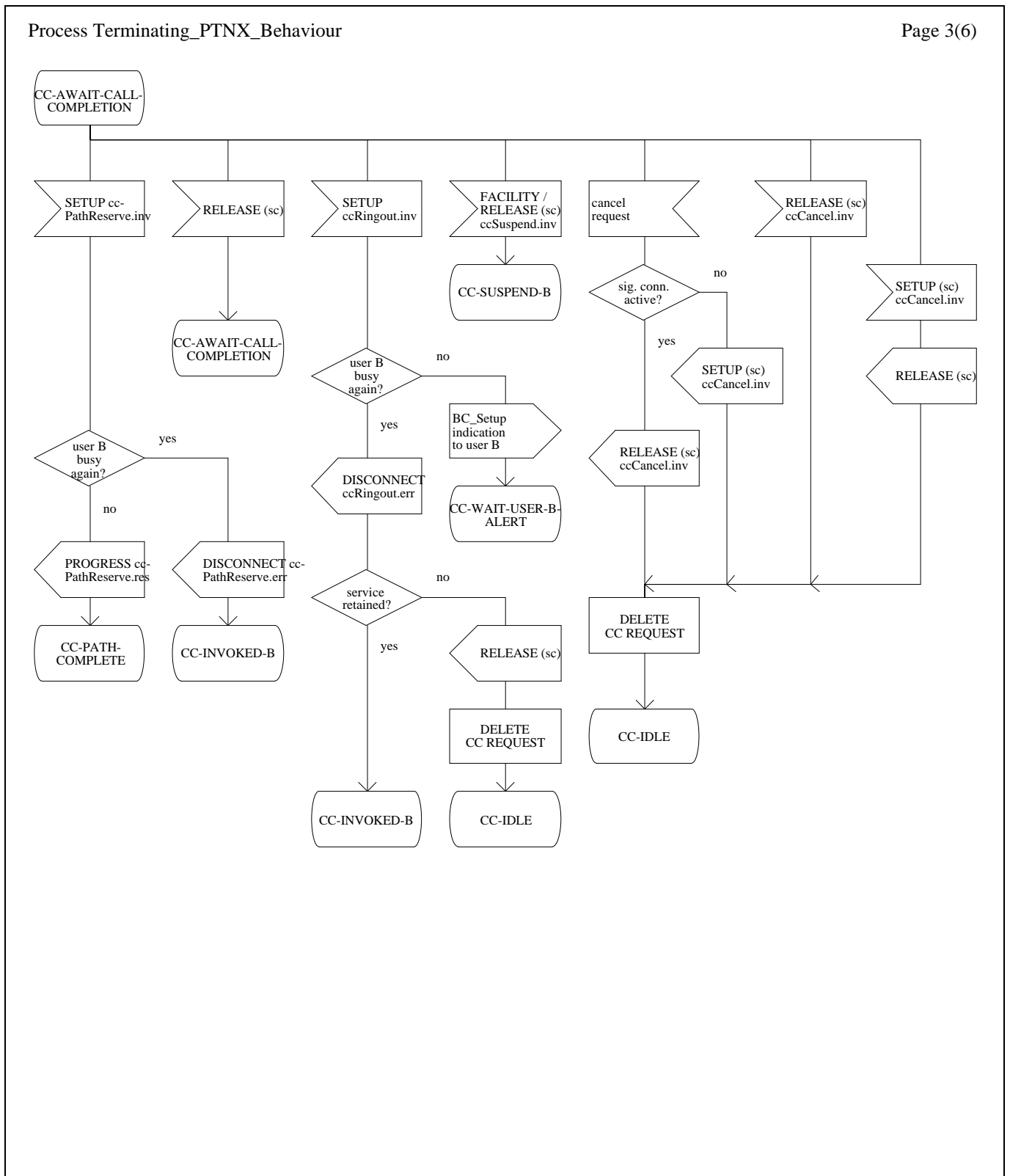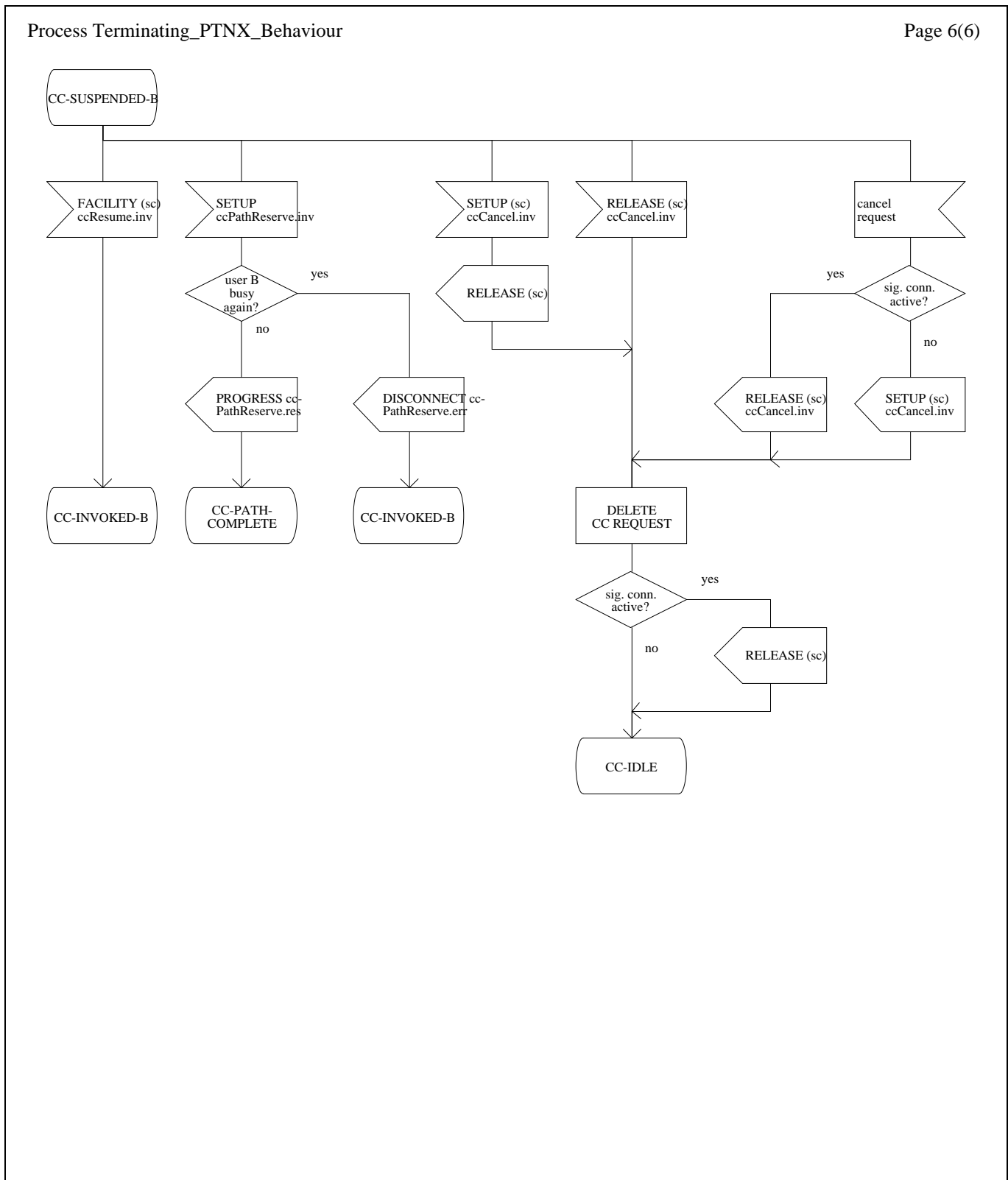
Figure C.2 (sheet 6 of 6) - Terminating PTNX Behaviour

Annex D (informative): Imported Data types

The following is an extract from module 'Addressing-data-elements' defined in ETS 300 196-1.

```
- Definition of Types PartyNumber, PresentedNumberUnscreened, Party Subaddress -

PartyNumber              ::=              CHOICE      {
                         unknownPartyNumber         [0]  IMPLICIT  NumberDigits,
                         publicPartyNumber          [1]  IMPLICIT  PublicPartyNumber,
                         dataPartyNumber            [3]  IMPLICIT  NumberDigits,
                         telexPartyNumber           [4]  IMPLICIT  NumberDigits,
                         privateNumber              [5]  IMPLICIT  PrivatePartyNumber,
                         nationalStandardPartyNumber [8] IMPLICIT  NumberDigits   }

NumberDigits             ::=      NumericString ( SIZE (1..20) )

PrivatePartyNumber   ::=      SEQUENCE    {    privateTypeOfNumber  PrivateTypeOfNumber,
                                               privateNumberDigits  NumberDigits   }

PrivateTypeOfNumber  ::=      ENUMERATED  {    unknown               (0),
                                               level2RegionalNumber  (1),
                                               level1RegionalNumber  (2),
                                               pTNSpecificNumber     (3),
                                               localNumber           (4),
                                               abbreviatedNumber     (6)      }

PublicPartyNumber    ::=      SEQUENCE    {    publicTypeOfNumber  PublicTypeOfNumber,
                                               publicNumberDigits  NumberDigits   }

PublicTypeOfNumber   ::=      ENUMERATED  {    unknown              (0),
                                               internationalNumber  (1),
                                               nationalNumber            (2),
                                               networkSpecificNumber     (3),
                                               subscriberNumber     (4),
                                               abbreviatedNumber    (6)      }

PresentedNumberUnscreened ::=    CHOICE      {
                         presentationAllowedNumber       [0]  IMPLICIT  PartyNumber,
                         presentationRestricted          [1]  IMPLICIT  NULL,
                         numberNotAvailableDueToInterworking  [2]  IMPLICIT  NULL,
                         presentationRestrictedNumber         [3]  IMPLICIT  PartyNumber   }

PartySubaddress          ::=      CHOICE     {    UserSpecifiedSubaddress,
                                                  NSAPSubaddress              }

NSAPSubaddress       ::=      OCTET STRING ( SIZE (1..20) )

SubaddressInformation        ::=      OCTET STRING ( SIZE (1..20) )

UserSpecifiedSubaddress ::= SEQUENCE   {    SubaddressInformation,
                                            oddCountIndicator  BOOLEAN  OPTIONAL }
```

History

Document history	
July 1994	First Edition
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