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SERIES Q: SWITCHING AND SIGNALLING

Specifications of Signalling System No. 7 – ISDN supplementary services

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Stage 3 description for call completion supplementary services using Signalling System No. 7: Completion of calls to busy subscriber (CCBS)

ITU-T Recommendation Q.733.3

(Previously CCITT Recommendation)

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ITU-T RECOMMENDATION Q.733.3

STAGE 3 DESCRIPTION FOR CALL COMPLETION SUPPLEMENTARY SERVICES USING SIGNALLING SYSTEM No. 7: COMPLETION OF CALLS TO BUSY SUBSCRIBER (CCBS)

Summary

Completion of Calls to Busy Subscribers (CCBS) enables a calling user A, upon encountering a busy destination B, to be notified when the busy destination B becomes free and to have the service provider reinitiate the call to the specified destination B if user A desires.

Source

ITU-T Recommendation Q.733.3 was prepared by ITU-T Study Group 11 (1997-2000) and was approved under the WTSC Resolution No. 1 procedure on the 5th of June 1997.

FOREWORD

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NOTE

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

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(Geneva, 1997)

3 Completion of Calls to Busy Subscriber (CCBS)

3.1 Introduction

3.1.1 Scope

Completion of Calls to Busy Subscribers (CCBS) enables a calling user A, upon encountering a busy destination B, to be notified when the busy destination B becomes free and to have the service provider reinitiate the call to the specified destination B if user A desires.

3.1.2 References

The following ITU-T Recommendations, and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; all users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published.

[1] ITU-T Recommendation E.164 (1997), *The international public telecommunication numbering plan.*

[2] ITU-T Recommendation I.112 (1993), *Vocabulary of terms for ISDNs.*

[3] CCITT Recommendation I.130 (1988), *Method for the characterization of telecommunication services supported by an ISDN and network capabilities of an ISDN.*

[4] ITU-T Recommendation I.210 (1993), *Principles of telecommunication services supported by an ISDN and the means to describe them.*

[5] ITU-T Recommendation I.221 (1993), *Common specific characteristics of services.*

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

ITU-T Recommendation X.680 (1994)/Amd.1 (1995), *Information technology – Abstract Syntax Notation One (ASN.1): Specification of basic notation – Amendment 1: Rules of extensibility.*

[7] ITU-T Recommendations Q.711-Q.714 (1996), *Signalling connection control part (SCCP).*

[8] ITU-T Recommendations Q.771-Q.775 (1997), *Transaction capabilities application part.*

[9] CCITT Recommendation Q.767 (1991), *Application of the ISDN user part of CCITT Signalling System No. 7 for international ISDN interconnections.*

[10] ITU-T Recommendations Q.761-Q.764 (1993), *ISDN user part.*

[11] ITU-T Recommendation Q.730 (1993), *ISDN supplementary services.*

[12] ITU-T Recommendation I.253.3 (1996), *Call completion supplementary services: Completion of calls to busy subscribers*.

[13] CCITT Recommendation Q.83.3 (1988), *Stage 2 description for call completion supplementary services: Completion of calls to busy subscriber.*

[14] ITU-T Recommendation Q.953.3 (1997), *Stage 3 description for call completion supplementary services using DSS1: Completion of Calls to Busy Subscribers (CCBS).*

[15] CCITT Recommendation I.230 (1988), *Definition of bearer service categories.*

[16] CCITT Recommendation I.240 (1988), *Definition of teleservices*.

[17] CCITT Recommendation F.721 (1992), *Videotelephony teleservice for ISDN*.

[18] ITU-T Recommendation Q.715 (1996), *Signalling connection control part user guide*.

3.1.3 Terms and definitions

The following terms [i.e. a) through l)] are defined in Recommendation I.253.3. Abbreviated timer names are defined in the brackets.

a) User A.

b) Destination B.

c) CCBS recall.

d) CCBS call.

e) Notification B idle.

f) Busy.

g) Free.

h) CCBS busy.

i) Retention timer (CCBS-T1).

j) CCBS service duration timer (CCBS-T2).

k) CCBS recall timer (CCBS-T3).

l) Destination B idle guard timer (CCBS-T4).

Other terms:

m) retain option: The retain option, if supported in both the originating and destination network, will maintain the CCBS request in the destination B queue, if a CCBS call has failed due to destination busy condition.

n) suspended CCBS request: A request which cannot be served even if destination B is not busy, because user A is busy, or CCBS busy.

o) long-term denial: The network cannot accept user A's request to activate the CCBS supplementary service and a later attempt to activate the CCBS supplementary service for the same destination B will also be rejected.

p) short-term denial: The network temporarily cannot accept user A's request to activate the CCBS supplementary service. A later attempt to activate the CCBS supplementary service for the same destination B may succeed.

q) CCBS call indicator: Information sent in the forward direction, used in a CCBS call set-up to distinguish this call from an ordinary call at the destination local exchange.

r) **CCBS indicator**: Indicator used in the diagnostic field, sent in the cause parameter in the backward release message, at the initial call failure, to indicate the possibility to invoke a possible succeeding CCBS service request.

s) **CCBS request**: An instance of an activation of the CCBS supplementary service which is held in a queue pending the correct conditions for the CCBS supplementary service to be completed.

t) **compatible terminal**: A terminal which can support the bearer service or teleservice requested for the original call to destination B and which can accept calls to the ISDN number and subaddress identifying the called user in the original call to destination B.

3.1.4 Abbreviations

This Recommendation uses the following abbreviations.

ACM	Address Complete Message
ANM	Answer Message
ASE	Application Service Element
ASN.1	Abstract Syntax Notation one
ATP	Access Transport Parameter
CCBS	Completion of Calls to Busy Subscriber (CCBS) supplementary service
CCSS	Call Completion Service Set-up
CFB	Call Forwarding Busy
CFNR	Call Forwarding No Reply
CFU	Call Forwarding Unconditional
CLI	Calling Line Identification
DLE	Destination Local Exchange
DSS 1	Digital Subscriber Signalling System No. 1
GT	Global Title
HLC	High Layer Compatibility
IAM	Initial Address Message
IPI	ISDN user part Preference Indicator
ISDN	Integrated Services Digital Network
ISPBX	Integrated Services Private Branch Exchange
ISUP	Integrated Services Digital Network User Part
LLC	Low Layer Compatibility
OLE	Originating Local Exchange
OU	Originating User
REL	Release Message
RLC	Release Complete Message
SCCP	Signalling Connection Control Part
SDL	Specification and Description Language

SPC Signalling Point Code

SSN SubSystem Number

SUB Sub-address

TC Transaction Capabilities

TE Transit Exchange

TU Terminating User

USI User Service Information

3.2 Description

3.2.1 General description

After receiving a busy indication (e.g. tones or messages), user A may request the CCBS supplementary service. The network will then monitor the wanted destination B for becoming free. When the wanted destination B becomes free, then the network will wait a short time in order to allow the resources to be re-used for originating a call. If the resources are not re-used by destination B within this time, then the network will automatically recall user A.

When user A accepts the CCBS recall, then the network will automatically generate a CCBS call to destination B.

3.2.2 Specific terminology

See 3.1.3, terms and definitions.

3.2.3 Qualification on the applicability to telecommunication services

The CCBS supplementary service shall be applicable to all circuit mode bearer services defined in Recommendation I.230 [15], and all teleservices defined in Recommendation I.240 [16] with the following exceptions:

a) call 2 of the videotelephony service (see Recommendation F.721 [17]);

b) all other circuit-switched telecommunications services requiring the use of more than one B-channel.

3.3 Operational requirements

3.3.1 Provision/withdrawal

The CCBS supplementary service may be provided to user A after prior arrangement with the service provider or may be generally available. The CCBS supplementary service shall be withdrawn by the service provider upon request of the subscriber or for service provider reasons.

As an option of the monitoring network, CCBS activation may be allowed against either network determined user busy or busy. Free is then defined as "neither network determined user busy nor channels busy" or "neither busy nor channels busy", respectively.

As a network option, the presence of compatible terminals at the destination may be verified.

As a network option, CCBS busy is defined as either "network determined user busy or CCBS recall pending for user A" or "busy or CCBS recall pending for user A".

3.3.2 Requirements on the originating network

In order to operate the CCBS supplementary service, the originating local exchange shall have TC capabilities [8]. The originating network shall have SCCP capability [7] for routing the TC operations.

3.3.3 Requirements on the terminating network

In order to operate the CCBS supplementary service, the destination local exchange shall have TC capabilities. The terminating network shall have SCCP capability for routing the TC operations.

3.3.4 Requirements on the transit network

The transit network shall have SCCP capability for routing the TC operations.

3.4 Coding requirements

3.4.1 Introduction

This subclause describes the coding of information needed to support the CCBS supplementary service. The coding is specified for the following two protocols:

a) ISUP [10].

b) ASE for CCBS.

3.4.2 Coding requirements

3.4.2.1 ISUP protocol

3.4.2.1.1 Signalling aspects impacting the routing

For the CCBS call the IPI in the forward call indicators parameter in the IAM message shall be set to "ISDN User Part required all the way".

For some interaction cases, the service is possible without ISUP-X signalling capability. See 3.7.

3.4.2.1.2 CCBS indicator in cause indicators parameter in REL message

An indication about the possibility of invocation of the completion of calls to busy subscriber (CCBS) supplementary service in the destination local exchange is given in the diagnostic field of the cause indicators parameter in the REL message along with cause #17 or #34. As the first call is a basic call and as other signalling systems than "ISUP supporting CCBS" may be used, the diagnostic field is not always conveyed.

NOTE – Cause value #34 applies to interworking with private networks.

The CCBS indicator in the diagnostic field is coded as follows:

Bits 8-1	00000000	Spare
	00000001	CCBS possible
	00000010	CCBS not possible
	00000011	
	to	Spare
	01111111	
	10000000	
	to	Spare for national use
	11111110	
	11111111	Reserved for extention

3.4.2.1.3 CCSS call indicator

The CCSS call indicator is carried in the CCSS parameter.

CCSS parameter

The format of the CCSS parameter is shown in Figure 3-1.

8	7	6	5	4	3	2	1
H	G	F	E	D	C	B	A

Figure 3-1/Q.733.3 – CCSS parameter

The following codes are used in the CCSS parameter field:

bit	A:	CCSS call indicator
	0	no indication
	1	CCSS call
bits	H-B:	Spare

The code of the CCSS parameter is 0100 1011.

3.4.2.2 ASE for CCBS

3.4.2.2.1 General

3.4.2.2.1.1 Subsystem number

The subSystem Number (SSN) value 0000 1011 has been allocated to the ISDN supplementary services ASEs.

3.4.2.2.1.2 List of operations

From originating local exchange to destination local exchange:

a)	CCBS REQUEST (invoke)	class 1
b)	CCBS SUSPEND	class 4
c)	CCBS RESUME	class 4
d)	CCBS CANCEL	class 4

From destination local exchange to originating local exchange:

a) CCBS REQUEST (return result, error) class 1

b) REMOTE USER FREE class 4

c) CCBS CANCEL class 4

3.4.2.2.1.3 List of parameter types

Addressing and identification parameters:

a) Calling party number;

b) Called party number.

NOTE 1 – If presentation of the calling party number is allowed, the country code shall be included in the calling party number in the originating local exchange, in case of an international outgoing call.

Service management parameters:

a) Retain supported.

b) Cancel cause.

Subscriber management parameters:

a) User service information.

b) User service information prime (see Note 2).

c) Access transport.

NOTE 2 – The user service information prime parameter is used in the case of signalling procedures for connection type with fallback capability.

3.4.2.2.1.4 List of application errors

a) Short-term denial.

b) Long-term denial.

3.4.2.3 Abstract syntax, general

Subclause 3.4.3 specifies the abstract syntax for the CCBS-ASE protocol using the Abstract Syntax Notation One (ASN.1) [6].

The set of values each of which is a value of the ASN.1 type TCAPMessages.MessageType are defined in Recommendations Q.771-Q.775 with the ANY DEFINED BY definitions resolved by the operations and errors definitions included in 3.4.3 form the abstract syntax for the CCBS ASE protocol.

The set of encoding rules which are applicable to this abstract syntax are defined in Recommendations Q.771-Q.775. The mapping of the OPERATION and ERROR MACROs to TC components is also described in Recommendations Q.771-Q.775.

The ASN.1 data type which follows the keywords "PARAMETER" or "RESULT" (for OPERATION and ERROR) is always optional from a syntactic point of view. However, except specific mention, it has to be considered as mandatory from a semantic point of view.

When a mandatory element is missing in any component or inner data structure, a reject component is returned (if the dialogue still exists). The problem cause to be used is "Mistyped parameter".

3.4.3 ASN.1 module

Table 3-1 shows the definition of the operations, errors and types required for the CCBS supplementary service using ASN.1 as defined in Recommendations X.208 and X.680 [6] and using the OPERATION and ERROR macros as defined in Recommendations Q.771-Q.775.

The formal definition of the component types to encode these operations, errors and types is provided in Recommendations Q.771-Q.775.

Table 3-1/Q.733.3 – Definition of operations for the CCBS supplementary service

```
CCBS-Protocol {itu-t recommendation q 733 3 modules(2) operations-and-errors(1) version1(1)}
DEFINITIONS EXPLICIT TAGS::=
BEGIN
IMPORTS
OPERATION, ERROR
FROM TCAPMessages {ccitt recommendation q 773 moduleA(0)};
-- operations types
CcbsRequest::=      OPERATION
                        PARAMETER       SEQUENCE{
                            calledPartyNumber           CalledPartyNumber,
                            retainSupported             BOOLEAN DEFAULT FALSE,
                            userServiceInf              [1] IMPLICIT USICode OPTIONAL,
                            callingPartyNumber          [2] IMPLICIT CallingPartyNumber
                                                        OPTIONAL,
                            userServiceInfPrime         [3] IMPLICIT USICode OPTIONAL,
                            accessTransportParameter    [4] IMPLICIT AccessTransport
                                                        OPTIONAL,...}
                        RESULT          SEQUENCE{
                            retainSupported             BOOLEAN DEFAULT FALSE,...}
                        ERRORS {
                            ShortTermDenial,
                            LongTermDenial}
-- Timer T = CCBS-T2
CcbsCancel ::=      OPERATION
                            PARAMETER
                            cancelCause                 CauseCode
                                                        --the cancelCause parameter is optional
                                                        --and may not be sent in certain
                                                        --circumstances
CcbsSuspend ::=     OPERATION
CcbsResume ::=      OPERATION
RemoteUserFree ::=  OPERATION
--error type definitions
ShortTermDenial ::= ERROR
LongTermDenial ::=  ERROR
--constants and data type definitions
CalledPartyNumber ::=   OCTET STRING (SIZE (1..10))
                        --the calling party number is coded as described in itu-t recommendation q763
CallingPartyNumber ::=  OCTET STRING (SIZE (1..10))
                        --the calling party number is coded as described in itu-t recommendation q763
```

```
CauseCode ::=       ENUMERATED{
                            cCBS-T3-Timeout (1),
                            cCBS-T4-Timeout (2),
                            cCBS-T7-Timeout (3),
                            cCBS-T9-Timeout (4)}
USICode ::=         OCTET STRING (SIZE (1..11))
                    ----the USICode is coded as described in itu-t recommendation q763
AccessTransport  ::=OCTET STRING (SIZE (1..maxAccessTransportLength))
                    -- the ATP is used to carry HLC, LLC, Calling Party SUB and
                    -- Called Party SUB as described in ccitt recommendation q931
maxAccessTransportLength                    INTEGER::=255
-- object identifier path
ccbsOID OBJECT IDENTIFIER ::= {itu-t recommendation q 733 3 operations-and-errors(1)}
-- operation values
ccbsRequest CcbsRequest ::=                 globalValue:{ccbsOID ccbsrequest(1)}
ccbsCancel CcbsCancel ::=                   globalValue:{ccbsOID ccbscancel(2)}
ccbsSuspend CcbsSuspend ::=                 globalValue:{ccbsOID ccbssuspend(3)}
ccbsResume CcbsResume ::=                   globalValue:{ccbsOID ccbsresume(4)}
remoteUserFree RemoteUserFree ::=           globalValue:{ccbsOID remoteuserfree(5)}
-- error values
shortTermDenial ShortTermDenial ::=         globalValue:{ccbsOID shorttermdenial(6)}
longTermDenial   LongTermDenial ::=         globalValue:{ccbsOID longtermdenial(7)}
END -- of CCBS Protocol
```

3.5 Signalling requirements

If a call to destination B encounters a busy condition and the destination local exchange supports the CCBS supplementary service, then the destination local exchange shall set the diagnostic field of the Cause indicator parameter in the REL message to indicate whether or not CCBS is possible.

For example if the destination local exchange knows that the CCBS is forbidden on the destination B user, then the diagnostic field shall be set to "CCBS not possible". Otherwise the diagnostic field shall be set to "CCBS possible".

3.5.1 Activation/deactivation/registration

3.5.1.1 Activation

3.5.1.1.1 Actions at the originating local exchange

3.5.1.1.1.1 Normal procedure

NOTE 1 – When user A encounters a busy destination B, the network will retain the call information for a defined period (retention timer), during which user A can activate the CCBS supplementary service.

NOTE 2 – User A can have a limited number of CCBS requests outstanding. This limit is a network-provider option (with a maximum value of 5).

When the originating local exchange has received from the destination local exchange a release message with cause parameter containing value #17 or #34 and a diagnostic field with either a "CCBS possible" or a "CCBS not possible" indication, the originating local exchange shall convey that information to the call control.

NOTE 3 – If the originating local exchange is supporting the CCBS supplementary service and this supplementary service is available to user A and the originating local exchange has received from the destination local exchange a release message with cause parameter containing cause value #17 or #34 and a

diagnostic field with a "CCBS possible" indication, the originating local exchange will start the basic call retention procedure. In case of a diagnostic field, received from the destination local exchange, with a "CCBS not possible" indication, no particular actions are made in the network.

In case an unrecognized value of the CCBS indicator is received, the network acts in the same way as if the CCBS indicator was not received at all. These procedures are described in 3.7.1.

If the originating local exchange receives a CCBS request and accepts this request, the originating local exchange shall send a CcbsRequest invoke component to the destination local exchange including the following information:

– The calledPartyNumber parameter shall contain the number of B.

– The userServiceInf parameter shall contain the bearer capability of the original call, if available.

– The retainSupported parameter shall indicate whether the originating local exchange supports the retain option.

– The callingPartyNumber parameter shall contain the number of A.

NOTE 4 – The inclusion is a network-provider option.

– The parameters userServiceInfPrime and accessTransport contain compatibility information of the original call.

– The TC-INVOKE primitive shall instruct the TC to start the CCBS request timer CCBS-T2.

NOTE 5 – Call information retained by the originating local exchange in support of CCBS will correspond to the following basic call parameters from the original call, if available:

– User service information.

– User service information prime.

– Access transport.

– Calling party number.

– Called party number.

NOTE 6 – Interactions between CCBS and other supplementary services may require other information to be stored; see 3.6.

Upon receipt of the CcbsRequest return result component, the originating local exchange shall:

i) store the information whether the retainSupported parameter has been received or not;

ii) return a CCBS request acceptance to user A to indicate that the service request has been accepted;

iii) start the service duration timer CCBS-T3.

NOTE 7 – The CCBS request timer CCBS-T2 is stopped by TC, when the TC-RESULT-L is received.

Having activated the completion of calls to busy subscriber (CCBS) supplementary service, user A can originate and receive calls as normal.

3.5.1.1.1.2 Exceptional procedure

On receipt of either a TC-P-ABORT, a TC-U-ABORT, a TC-U-REJECT or a TC-L-CANCEL primitive as response to the CcbsRequest invoke component, the service request shall be rejected with short-term denial as a reason.

On receipt of a TC-NOTICE primitive as response to the CcbsRequest invoke component, the service request shall be rejected with long-term denial as a reason.

3.5.1.1.2 Actions at the destination local exchange

3.5.1.1.2.1 Normal procedures

On receipt of a CcbsRequest invoke component, a compatibility check may be performed by the access at the destination local exchange (network option). If a compatible terminal is found or if the compatibility check is not relevant, the destination local exchange shall:

i) store the information received in the CcbsRequest invoke component in the destination B queue;

ii) return a CcbsRequest return result component to the originating local exchange:

- if the retainSupported parameter received in the CcbsRequest invoke component indicates that the retain option is supported at the originating local exchange (coded TRUE), then the retainSupported parameter conveyed in the CcbsRequest return result component shall indicate whether the destination local exchange supports the retain option;
- if the retainSupported parameter received in the CcbsRequest invoke component is coded FALSE, then the retainSupported parameter conveyed in the CcbsRequest return result component is set to the default value (FALSE).

iii) start the service duration timer CCBS-T7;

iv) monitor destination B for becoming free.

3.5.1.1.2.2 Exceptional procedures

a) Destination B no longer busy, when the CcbsRequest invoke component arrives:

If destination B is no longer busy when the CcbsRequest invoke component arrives, the destination local exchange shall apply the normal procedures, as described in 3.5.1.1.2.1.

b) The CcbsRequest invoke component does not contain the UserServiceInformation parameter, needed for the compatibility check:

On reception of a CcbsRequest invoke component not including the UserserviceInformation parameter, then the destination local exchange shall assign the UserServiceInformation parameter with the Bearer capability information corresponding to "3.1 kHz audio" call.

c) The activation of the CCBS supplementary service cannot be accepted:

When the activation of the CCBS supplementary service cannot be accepted by the destination local exchange, it shall send a CcbsRequest return error component to the originating local exchange, indicating short-term denial in the following cases:

- if there are already the maximum number of requests queued against destination B;
- if there is an interaction with a supplementary service, which prohibits the activation of the CCBS supplementary service against that destination;
- if no compatible terminal was found at destination B.

For other cases it shall send a CcbsRequest return error component to the originating local exchange, indicating long-term denial.

3.5.1.2 Deactivation

3.5.1.2.1 Actions at the originating local exchange

3.5.1.2.1.1 Normal procedures

If a deactivation request is received from user A, the originating local exchange shall send a CcbsCancel invoke component to the destination local exchange, without a cancelCause parameter, for each concerned transaction. User A shall be informed that the deactivation is successful. The resources are released.

Deactivation of a CCBS request by any cancelCause received in a CcbsCancel invoke component shall result in this request being removed from the originating CCBS request register.

3.5.1.2.1.2 Exceptional procedures

A particular request for this service shall be automatically deactivated and user A is informed if:

i) The CCBS service duration timer (CCBS-T3) expires:

– If the timer CCBS-T3 expires first, the originating local exchange shall send a CcbsCancel invoke component with cancelCause "CCBS-T3 Timeout", to the destination local exchange.

The resources are released in the originating local exchange.

ii) Non-acceptance of CCBS recall:

– If user A does not accept the CCBS recall before the CCBS recall timer (CCBS-T4) expires, then the CCBS request shall be deactivated. The originating local exchange shall send a CcbsCancel invoke component, with the cancelCause "CCBS-T4 Timeout", to the destination local exchange.

3.5.1.2.2 Actions at the destination local exchange

3.5.1.2.2.1 Normal procedures

Deactivation of a CCBS request by any cancelCause received in a CcbsCancel invoke component shall result in this request being removed from the destination B CCBS request queue.

3.5.1.2.2.2 Exceptional procedures

A particular request for this service shall be automatically deactivated if the CCBS service supervision timer (CCBS-T7) expires.

– If the timer CCBS-T7 expires first, the destination local exchange shall send a CcbsCancel invoke component with cancelCause "CCBS-T7 Timeout", to the originating local exchange.

The resources are released in the destination local exchange.

3.5.1.3 Registration

Not applicable.

3.5.2 Erasure

Not applicable.

3.5.3 Invocation and operation

3.5.3.1 Actions at the originating local exchange

3.5.3.1.1 Normal operation

After the activation process described in 3.5.1.1.1, the originating local exchange may receive a RemoteUserFree invoke component from the destination local exchange. In that case the originating local exchange shall recall user A, (see Recommendation Q.953.3), and the CCBS recall timer CCBS-T4 shall be started.

If user A accepts the recall before the CCBS recall timer expires, then the originating local exchange shall stop timer CCBS-T4 and initiate the CCBS call to destination B by sending an IAM message, including the CCBS call indicator and the retained call information (see 3.5.1.1.1). The IPI in the forward call indicators parameter shall be set to "ISDN User Part required all the way".

3.5.3.1.2 Exceptional procedures

a) User A is found to be busy or CCBS busy:

If user A is found to be busy or CCBS busy, when RemoteUserFree invoke component has been received, then user A shall be notified and the CCBS request shall be suspended until user A becomes not busy or not CCBS busy again. The network shall expect no response from user A to this notification. The originating local exchange shall send a CcbsSuspend invoke component to the destination local exchange.

When user A is no longer busy or CCBS busy, the originating local exchange shall send a CcbsResume invoke component to the destination local exchange. On receipt of a RemoteUserFree invoke component from the destination local exchange, the originating local exchange shall offer a CCBS recall to user A.

In case the originating local exchange had sent several CcbsSuspend invoke components to different destination local exchanges and user A becomes neither busy nor CCBS busy, the originating local exchange shall send a CcbsResume invoke component to each destination local exchange for which there is a suspended CCBS request for which a compatible terminal at user A is neither busy nor CCBS busy.

b) User A reactivates the CCBS supplementary service:

If user A does not wait for the CCBS recall to a particular destination B, but makes another call to the same (busy) destination B and requests the CCBS supplementary service again, as a network option, one of the following shall occur:

i) the network shall check if an identical CCBS request already exists:

- if so, the original request shall be retained with the current request being discarded and user A shall be informed that the request has not been accepted because a CCBS request had already been stored against the requested destination B;
- if not, then the network shall treat this as a new CCBS request.

In order to determine that the two CCBS requests are identical, the network shall only compare the basic call information, i.e. the bearer service and teleservice requirements, the destination selection information and calling user identity (if any); or

ii) the network shall not check if an identical CCBS request already exists and the procedures of 3.5.1.1.1.1 shall apply for this new CCBS request.

c) CCBS call failure:

If the CCBS call fails, user A shall be informed as for the basic call procedures.

If the received Release message contains either cause #17 or #34, two possibilities exist:

– if the retain option is supported across the networks, the originating local exchange shall keep the transaction resources and shall not restart timer CCBS-T3. If user A attempts to activate CCBS again, this shall be treated as described in b) above;

– if the retain option is not supported across the networks, the originating local exchange shall release the transaction resources. The CCBS request shall be deactivated and user A shall be informed accordingly. If user A attempts to activate CCBS again, one of the following procedures shall apply:

  • If the received Release message contained a CCBS indicator, the procedures of 3.5.1.1.1 shall be followed.

  • If the received Release message did not contain a CCBS indicator, interworking is applied and the procedures of 3.7.1 shall be followed.

If the received Release message does contain a cause value other than cause #17 or #34, the originating local exchange shall send a CcbsCancel invoke component to the destination local exchange. The CCBS request shall be deactivated and user A shall be informed accordingly.

NOTE – Some networks may take action to reduce the probability of network congestion on the CCBS call.

d) The originating local exchange receives a TC-NOTICE indication primitive upon sending the CcbsSuspend invoke component:

If the originating local exchange receives a TC-NOTICE indication primitive upon sending the CcbsSuspend invoke component to the destination local exchange, then the timer CCBS-T3 is stopped, the request is deleted and the TC resources are released.

e) The originating local exchange receives a TC-NOTICE indication primitive upon sending the CcbsResume invoke component:

If the originating local exchange receives a TC-NOTICE indication primitive upon sending the CcbsResume invoke component to the destination local exchange, then the timer CCBS-T3 is stopped, the request is deleted and the TC resources are released.

3.5.3.2 Actions at a transit exchange

3.5.3.2.1 Normal operation

The transit exchange shall pass the diagnostic field, in the REL message, including the CCBS indicator transparently to the preceding exchange. It shall also pass the CCSS call indicator, in the IAM message, transparently to the succeeding exchange. Basic call procedures as described in Recommendation Q.764 (1992) are applicable.

3.5.3.2.2 Exceptional procedures

None identified.

3.5.3.3 Actions at the outgoing international gateway exchange

3.5.3.3.1 Normal operation

The outgoing international gateway exchange shall pass the diagnostic field, in the REL message, including the CCBS indicator transparently to the preceding exchange. It shall also pass the CCSS call indicator, in the IAM message, transparently to the succeeding exchange. Basic call procedures as described in Recommendation Q.764 (1992) are applicable.

3.5.3.3.2 Exceptional procedures

None identified.

3.5.3.4 Actions at the incoming international gateway exchange

3.5.3.4.1 Normal operation

The incoming international gateway exchange shall pass the diagnostic field, in the REL message, including the CCBS indicator transparently to the preceding exchange. It shall also pass the CCSS call indicator, in the IAM message, transparently to the succeeding exchange. Basic call procedures as described in Recommendation Q.764 (1992) are applicable.

3.5.3.4.2 Exceptional procedures

None identified.

3.5.3.5 Actions at the destination local exchange

3.5.3.5.1 Normal operation

When destination B becomes not busy then the destination local exchange shall check the status of the queue for destination B.

If there is an entry in the CCBS queue currently being processed, then no further action shall be taken.

Otherwise, the entries in the CCBS queue are examined in order:

– If an entry is suspended, it is skipped over.

– If an entry is not suspended, it shall be selected and, the destination local exchange shall reserve on destination B's interface the resources (e.g. a B-channel) which are necessary to complete the CCBS call. Destination B can use the reserved access resources or other free resources in order to make an outgoing call.

– Check whether a compatible terminal at destination B is not busy. If there is no compatible terminal free, the entry is skipped over.

– If a compatible terminal is free, then the procedures as described below are followed.

– If all the entries in the queue have been checked without finding an entry which is not suspended and for which a compatible terminal is free, then the destination local exchange shall release the reserved resources.

The network shall start the "Destination B Idle Guard Timer" CCBS-T8 in the destination local exchange. When the timer CCBS-T8 expires, the selected CCBS request shall be processed.

When processing a CCBS request, provided that a compatible terminal is free and the reserved resources are still available at destination B, the destination local exchange shall start the CCBS recall procedure.

The CCBS recall procedure is defined as follows:

– send a RemoteUserFree invoke component to the originating local exchange; and

– start the CCBS recall timer CCBS-T9.

If an IAM is received by the destination local exchange, while the network has reserved resources on destination B's interface, the destination local exchange shall:

i) check whether this new incoming call includes a CCSS call indicator. A new incoming call without the CCSS call indicator shall not be offered to destination B if there are one or more

CCBS requests in the destination B queue, which are not suspended and have service requirements and destination selection information identical to the new incoming call;

ii) determine the resources engaged in the CCBS call based on the basic call information;

iii) offer the call to the B user.

If user B is found compatible-free, the call is completed according to the basic call control procedures (ACM, ANM or CON messages).

When the destination local exchange has sent an Address Complete message (with subscriber free), a CPG (Alerting) message or a Connect message, it shall:

– release its TC resources;

– stop the timers CCBS-T7 and CCBS-T9;

– check whether there are free resources on the destination B interface:

  • if there are no free resources on the destination B interface, then no further action shall be taken;

  • if there are free resources on the destination B interface, then the destination local exchange shall service the queue for destination B as described above.

Several CCBS requests can be queued against one destination B in the destination B CCBS queue. The exact size of the destination B CCBS queue (from 1 to 5 entries) is a destination network-provider option.

As a network option the destination network operator can reduce the CCBS queue size associated with individual users. The reduced size can have zero length.

Multiple CCBS requests towards the same destination shall be queued and processed on a First In, First Out (FIFO) basis. The user A, whose CCBS request arrived first, will be informed first each time the destination B idle guard timer has expired after destination B has become not busy.

CCBS requests which have been suspended shall be skipped over and the next CCBS request in the queue shall be selected, and so on.

If the processing of a CCBS request results in suspending that CCBS request, or in deactivating that CCBS request, then the next CCBS request against destination B will be selected, and so on.

When a CCBS request becomes not suspended due to user A becoming not busy or not CCBS busy, and at that time destination B is not busy nor any other CCBS request from the same queue is being processed, then the destination B queue shall be serviced again without starting the destination B idle guard timer CCBS-T8.

If the whole queue has been processed and no CCBS call results, due to all CCBS requests being cancelled or suspended, then processing is complete and will only be restarted when one of the CCBS requests becomes not suspended.

3.5.3.5.2 Exceptional procedure

a) Resources or compatible terminal at destination B are no longer available when destination B idle guard timer expires:

   If, when the destination B idle guard timer (CCBS-T8) expires, no access resources are available at destination B (e.g. no compatible terminal is present or destination B makes an outgoing call), then servicing of the destination B CCBS queue shall be deferred until the destination B becomes not busy again.

If, when the destination B idle guard timer (CCBS-T8) expires, all compatible terminals at destination B are busy, then the next request in the destination B CCBS queue shall be selected for processing.

b) Destination B receives a "RemoteUserFree" indication (this user being a user A for another CCBS request) while processing the destination B CCBS queue:

See 3.6.19 (Interaction with Call Completion to Busy Subscriber).

c) Destination B is busy upon arrival of the CCBS call:

If destination B is again busy when the network attempts to make the CCBS call, then the procedures depend on whether the retain option is supported across the networks [see 3.1.3 m]:

i) If the retain option is not supported across the networks, the corresponding CCBS request shall be cancelled. The destination local exchange shall send a normal REL message (cause #17 or #34 with diagnostic "CCBS possible") to the originating local exchange and shall release its resources.

If user A activates CCBS again, this activation shall be considered as a new CCBS request, which will be put at the end of the destination B queue upon receipt of a new CcbsRequest invoke component from the originating local exchange. In this case the CCBS duration timers CCBS-T3 and CCBS-T7 shall be restarted and user A shall receive a confirmation.

ii) If the retain option is supported across the networks, the original CCBS request shall retain its position in the queue. In this case the destination local exchange shall keep the transaction resources, shall continue to monitor destination B, shall not restart the timer CCBS-T7, shall stop timer CCBS-T9 and shall send a REL message (cause #17 or #34) to the originating local exchange.

The following procedure applies: The option applied by the originating local exchange and the destination local exchange is determined by a negotiation included in the CCBS request procedure.

The procedure without the option applies in each exchange if the retain option is not available in this exchange, or if the received retainOption parameter is coded 0 = no, or if no retainOption parameter is received.

The procedure with the option applies only if each exchange has this option available and has received a positive indication from the other one.

d) No CCBS call as result:

If no CCBS call results from the CCBS recall mechanism, the recall timer CCBS-T9 expires. In this case the destination local exchange shall send a CcbsCancel invoke component to the originating local exchange. The cancelCause shall indicate "CCBS-T9 Timeout". The network shall make any reserved access resources on destination B's interface available for use, if no other CCBS call is placed in the queue.

e) Receipt of a TC-NOTICE upon sending the RemoteUserFree invoke component:

If the destination local exchange receives a TC-NOTICE indication upon sending the RemoteUserFree invoke component to the originating local exchange, then the timers CCBS-T7 and CCBS-T9 are stopped, then the next active request in the queue, if available, will be served. The currently served request is deleted and the TC resources are released in the destination local exchange.

3.5.4 Use of TC and SCCP

The service monitoring and management signals are defined as TC-based application messages (i.e. operations and corresponding results, respectively error messages) as defined in Recommendations Q.771-Q.775 (1993). The coding of these messages is given in 3.4.3.

3.5.4.1 Routing in the SCCP network

For routing on the international interface and for routing based on the GT translation mechanism within national networks, the coding of the called party address and the calling party address in SCCP shall comply with the following restrictions:

–	SSN indicator	1	(SSN for ISDN supplementary services is always included)
–	GT indicator	0100	(includes translation type, numbering plan, encoding scheme and nature of address)
–	Translation type	0001 0001	(translation table)
–	Numbering plan	0001	(ISDN/Telephony Numbering Plan E.164)
–	Routing indicator	0	(Routing on global title)

Alternatively, for routing within a national network, the SCCP addressing method based on SPCs may apply. However, within large national networks, it would be advisable to use a hybrid addressing method based on SPCs for regional traffic and GT translation mechanism for long distance traffic, to keep the SS No. 7 routing data manageable.

3.5.4.2 Number information used for routing

The exchange which initiates a dialogue using the GT translation mechanism, shall give its E.164 service centre address as GT in the SCCP calling address field. This precludes that number information sensible to privacy regulations (e.g. CLI) is used for routing on the international interface.

For routing on the international interface, the number information used for GT translation shall comply to the E.164 numbering schemes for Country code and National destination code.

3.5.4.3 SCCP message return procedure

The SCCP message return procedure is always requested by means of the TC-primitives between the CCBS-ASE and the TC protocols.

3.5.4.4 Primitives used between the CCBS-ASE and TC

With respect to the point of whether or not responses (return result or error) are treated as confirmation or separate indications, Recommendation Q.771 indicates that the situation is as illustrated by Figure 3-2.

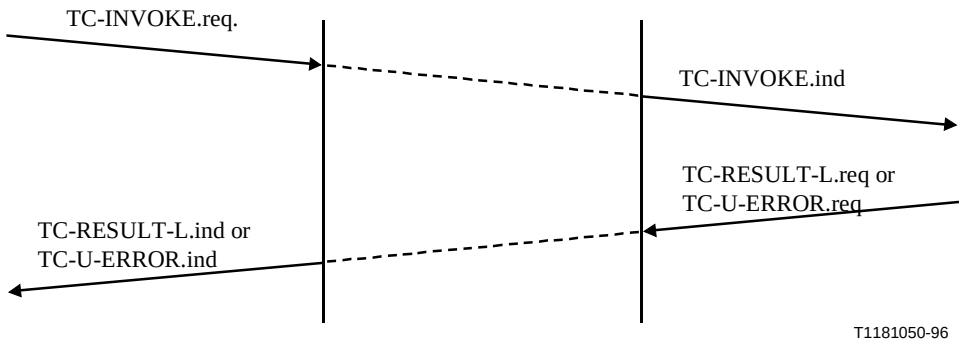


Figure 3-2/Q.733.3

Since these are the primitives available from TC, it is a TC-RESULT-L.indication that the originating local exchange will receive in (positive) response to its TC-INVOKE.request.

3.5.5 Dialogue

3.5.5.1 General

The dialogue defined for the CCBS between the peer-to-peer entities (TC-Users) is a structured dialogue. The dialogue ID parameter is used in both operation handling and transmission (dialogue) handling primitives to determine which component(s) pertain(s) to which dialogue.

Each TC-User has its own reference for a given dialogue. These references are local references and mapping of these local references into protocol references transaction ID, included in the messages, is done by TC.

All the operations belong to the same dialogue.

Only classes 1 and 4 operations are used.

Each TC message conveys only a single CCBS operation.

3.5.5.2 Dialogue beginning

The originating local exchange establishes the dialogue by using a TC-BEGIN request primitive with TC-INVOKE request primitive to transmit a CCBS request operation invoke component to the destination local exchange.

The destination local exchange responds by:

– Using the TC-CONTINUE request primitive with TC-INVOKE request primitive to transmit a CcbsRequest return result component, confirm the dialogue and indicate that the CCBS request operation succeeds.

– Using the TC-END request primitive with TC-U-ERROR request primitive to transmit a CcbsRequest return error component, end the dialogue and indicate that the CCBS request operation fails.

3.5.5.3 Dialogue continuation

The continuation of the dialogue is assumed by class 4 operations using TC-CONTINUE primitives. No result is provided for a class 4 operation. These operations are:

– RemoteUserFree;

– CcbsSuspend;

– CcbsResume.

3.5.5.4 Dialogue end

3.5.5.4.1 Basic end

a) A dialogue end is requested by the CCBS application (originating or destination local exchange), by a TC-END request primitive with TC-INVOKE request primitive to transmit a CcbsCancel invoke component upon the following cases:

i) with cancelCause:

– at time-out of CCBS-T3 and CCBS-T4 (OLE);

– at time-out of CCBS-T7 and CCBS-T9 (DLE);

ii) without cancelCause:

– receipt of a failure indication of the CCBS call from the call control (DLE);

– upon sending of the Release ISUP message with B busy (cause #17 or #34) if the "retain" option is not supported (DLE);

– when user A deactivates the service (OLE);

– in case of an unsuccessful CCBS call set-up in the network (OLE);

– in case of any of the following call forwarding activation exists upon arrival of the CCBS call [DLE, see 3.6.10.2.2 c)]:

• CFU; or

• CFB.

b) A dialogue end is requested by the CCBS application (destination local exchange) by a TC-END request primitive without component primitive upon the following cases:

– Upon sending of the Address Complete message (with subscriber free), Call Progress message (with alerting), Answer message or Connect message from the destination local exchange.

c) A dialogue end is requested by the CCBS application (destination local exchange) by a TC-END request primitive with TC-U-ERROR request primitive to transmit a CcbsRequest return error component upon the following cases:

– if the maximum number of entries in the destination B queue is reached, see 3.5.1.1.2.2;

– if the user has not subscribed to the given basic service;

– if there is no compatible terminal at destination B when using the status request procedure, see 3.5.1.1.2.2.

– in case of one of the following call forwarding activation exists upon arrival of the CcbsRequest invoke component [see 3.6.10.2.2 a)]:

• CFU; or

• CFNR.

d) A dialogue end is requested by the CCBS application by a TC-END request primitive with TC-U-REJECT request primitive in the following cases:

– if the component check fails.

3.5.5.4.2 Abnormal end

a) The TC-user may abandon the service. In this case a peer-to-peer information is delivered at the time the abort is issued, to the remote TC-User. TC-U-ABORT request primitives without abort reason is used in this case.

b) If the CCBS request timer CCBS-T2 expires, at the originating local exchange, the CCBS-ASE receives a TC-L-CANCEL indication primitive as response to the CcbsRequest invoke component. In this case the service request shall also be rejected with short-term denial as a reason.

c) On receipt of a TC-NOTICE or a TC-P-ABORT indication primitive, the TC dialogue shall be terminated and the corresponding CCBS request shall be deleted.

3.6 Interaction with other supplementary services

3.6.1 Call Waiting (CW)

No impact on either ISUP or CCBS-ASE.

3.6.2 Call transfer services

3.6.2.1 Explicit Call Transfer (ECT)

No impact on either ISUP or CCBS-ASE.

3.6.2.2 Single-step call transfer

No impact on either ISUP or CCBS-ASE.

3.6.3 Connected Line Identification Presentation (COLP)

No impact on either ISUP or CCBS-ASE.

3.6.4 Connected Line Identification Restriction (COLR)

No impact on either ISUP or CCBS-ASE.

3.6.5 Calling Line Identification Presentation (CLIP)

No impact on either ISUP or CCBS-ASE.

3.6.6 Calling Line Identification Restriction (CLIR)

The CLIR requirements from the original call shall be retained by the originating local exchange and used when the CCBS call is completed.

The CLIR requirements from the original call shall apply to the calling user's identity in the CcbsRequest operation, i.e. if the CLIR requirements indicate that the presentation of the calling user's identity is restricted, the calling user's identity shall not be included in the CcbsRequest operation.

3.6.7 Closed User Group (CUG)

When the original call was a CUG call, all CUG information is stored in the originating local exchange and is then used for the set-up of the CCBS call.

No impact on either ISUP or CCBS-ASE.

3.6.8 Conference Calling (CONF)

No impact on either ISUP or CCBS-ASE.

NOTE – If a conference controller activates the CCBS supplementary service on a call to a busy user, the resulting CCBS recall indication may not always be successful, i.e. user A may not be able to establish a CCBS call when destination B becomes not busy [see 3.5.3.1.2 a)] "User A is found to be busy or CCBS busy" and "CCBS recall procedure" in Q.953.3 [14]).

3.6.9 Direct-Dialling-In (DDI)

No impact on either ISUP or CCBS-ASE.

3.6.10 Call diversion services

3.6.10.1 Call forwarding activated by user A

CCBS recalls shall not be diverted. They are given to user A at his/her original location.

3.6.10.2 Call forwarding activated by user B

3.6.10.2.1 Originating local exchange

No impact.

3.6.10.2.2 Destination local exchange (B)

a) Call forwarding is (are) already activated on receipt of a CCBS request.

On receipt of a CCBS request:

- if destination B has a CFU activated, the destination B's local exchange rejects the CCBS request with short-term denial as the reason [see 3.5.5.4.1 c)]. If any other call diversion is activated in addition to CFU, the result should be the same;
- if destination B has only a CFB activated, destination B's local exchange accepts the CCBS request;
- if destination B has CFNR activated (with or without a CFB in addition), destination B's local exchange shall reject the CCBS request with short-term denial as the reason [see 3.5.5.4.1 c)].

NOTE – A local exchange is not aware of the activation of any call deflection. Consequently, a CCBS request is always accepted by the local exchange of such a user.

b) Call forwarding is (are) activated after CCBS request(s) has (have) been accepted.

If user B activates a CFB or a CFNR after CCBS requests have been accepted, outstanding CCBS requests will remain in the destination B CCBS queue, no specific action is done.

If user B activates a CFU after CCBS requests have been accepted, the following procedure shall apply:

- on activation of a CFU, outstanding CCBS requests shall remain in the destination B CCBS queue until the CCBS service duration timer expires and destination B's local exchange stops monitoring destination B;
- on deactivation of CFU, if at least one CCBS request is standing in the queue, destination B's local exchange starts monitoring destination B.

c) CCBS call.

Upon the arrival of a CCBS call, if a CFU is activated, the CCBS call shall be forwarded as a normal call and the TC-dialogue is terminated by destination B according to 3.5.5.4.1 a). The forwarded IAM message does not contain the CCSS parameter.

Upon the arrival of a CCBS call, if a CFNR is activated, the TC-dialogue is terminated by destination B according to 3.5.5.4.1 a). After expiry of the No reply timer, the call is forwarded as a normal call.

Upon the arrival of a CCBS call, if a CFB is activated and if destination B is busy, as a network option, the CCBS call can be either:

– treated as a "destination B busy upon arrival of a CCBS request" [see 3.5.3.5.2 b)];

– forwarded as a normal call. The CCSS parameter in the forwarded IAM message is deleted. The TC-dialogue is terminated by destination B according to 3.5.5.4.1 a).

If destination B requests invocation of the call deflection supplementary service upon the arrival of a CCBS call, then the following actions shall result:

– if the request for call deflection was made before alerting, then the request shall be rejected. The CCBS call shall continue according to 3.5.3.5; or

– if the request for call deflection was made during alerting, then the request shall be accepted. The CCBS call shall be deflected as a normal call.

3.6.11 Line Hunting

No applicable interaction at this time.

3.6.12 Three-Party Service (3PTY)

No impact on either ISUP or CCBS-ASE.

3.6.13 User-to-User Signalling (UUS)

Requests for the activation, as sent in the user-to-user indicators (in the original call), of the user-to-user signalling supplementary service (service 2, and/or service 3), contained in the original call request, shall be stored with the CCBS request.

The originating local exchange shall not store any user-to-user information contained in the original call. However, user A can include user-to-user information in response to the CCBS recall.

NOTE – The original call information, excluding any user-to-user information, is retained by the originating local exchange.

3.6.14 Multiple Subscriber Number (MSN)

No impact on either ISUP or CCBS-ASE.

3.6.15 Call Hold (HOLD)

No impact on either ISUP or CCBS-ASE.

3.6.16 Advice of Charge (AOC)

3.6.16.1 AOC: charging information at call set-up time (AOC-S)

No impact on either ISUP or CCBS-ASE.

3.6.16.2 AOC: charging information during the call (AOC-D)

No impact on either ISUP or CCBS-ASE.

3.6.16.3 AOC: charging information at the end of a call (AOC-E)

No impact on either ISUP or CCBS-ASE.

3.6.17 Sub-addressing (SUB)

The called user’s sub-address (if any), which was supplied in the original call, shall be included in the CcbsRequest invoke component and in the CCBS call which may follow it.

3.6.18 Terminal Portability (TP)

No impact on either ISUP or CCBS-ASE.

3.6.19 Completion of Calls to Busy Subscriber (CCBS)

The following actions are applied in case the exchange acts as the destination B's exchange for one instance of the CCBS service, and for another instance of the service acts as the user A's exchange.

If the exchange receives a remote user free indication while processing the destination B CCBS queue, then two cases exist:

a) The destination B idle guard timer (CCBS-T8) is running. If a remote user free indication is received from a remote local exchange, indicating that a recall shall be started towards the user (for this call being a user A for another CCBS request), then the recall to its own user shall take priority over the ongoing B queue processing.

b) The recall timer (CCBS-T9) is running. Depending on the availability of access resources, the following shall occur:

   i) if no other resources than the reserved one is available, then the access is considered as busy and the procedure of 3.5.3.1.2 b) shall apply;

   ii) if there are other resources available, the procedures of 3.5.3.1.1 (if the user accepts the recall) or 3.5.3.1.2 a) (if the user does not accept the recall) shall apply.

When a user who has activated the CCBS supplementary service and CCBS requests have been suspended whilst that user was CCBS busy, subsequently becomes not CCBS busy, then his local exchange shall send CcbsResume for all suspended CCBS requests (activated by him) and start destination B idle guard timer CCBS-T8 (for a CCBS request activated on him).

On expiration of destination B idle guard timer CCBS-T8, if the user is still not busy (no resume has come to a CCBS call), the exchange sends a "RemoteUserFree" indication.

3.6.20 Malicious Call Identification (MCID)

No impact on either ISUP or CCBS-ASE.

3.6.21 Reverse Charging (REV)

No impact on either ISUP or CCBS-ASE.

3.6.22 Multi-level precedence and preemption (MLPP)

No impact on either ISUP or CCBS-ASE.

NOTE – During an MLPP call, the calling user is not able to activate CCBS, in the access signalling, for that MLPP call.

3.6.23 Private Numbering Plan (PNP)

No impact on either ISUP or CCBS-ASE.

3.6.24 International Telecommunication Charge Card (ITCC)

No applicable interaction at this time.

3.6.25 Global Virtual Network Service (GVNS)

For further study.

3.7 Interaction with other networks

When user A and destination B belong to different networks, the Completion of Calls to Busy Subscriber (CCBS) supplementary service can be activated, if all the networks involved, support the Completion of Calls to Busy Subscriber (CCBS) supplementary service, along the communication path between the two users.

3.7.1 Interworking with an ISUP network without an ISUP that fully supports the CCBS capability

NOTE – In the following text ISUP-X is an ISUP version beyond ISUP-92 with the capability of generating the CCSS call indicator (in the CCSS parameter) and the CCBS indicator (in diagnostic for cause values #17 and #34) for the CCBS supplementary service.

As the first call and the CCBS call are normal calls and as other ISUP versions than ISUP-X may be used, the support of the CCBS supplementary service is not always guaranteed, as the CCBS indicator or CCBS call indicator are not always conveyed.

Although in ISUP-X the CCBS indicator in the diagnostic field with the "CCBS is possible" value is received in the Release message, the CCBS call may not succeed in some cases, e.g.:

– in case of interworking with ISUP *Blue Book* in a national network not supporting the transfer of a CCSS call indicator in the Initial Address message;

– if the first call (transferring the diagnostic field in the Release message) was routed via ISUP-X (or ISUP-92 in transit nodes) all along the way, whereas the CCBS call is routed through an intermediate exchange only supporting Recommendation Q.767 [9]. This may be the case both at interworking or at peer-to-peer interworking.

As a network option, the CCBS supplementary service may be supported within networks without ISUP-X capability (in local exchanges) or ISUP-92 (in transit exchanges). Even if no CCBS indicator in the diagnostic field is received in the Release message, the originating local exchange will initiate the sending of a CcbsRequest invoke component if user A activates the CCBS service. The decision in the originating local exchange, whether a CCBS request from user A shall result in the sending of a CcbsRequest invoke component, depends on the received information in the Release message. The outcome of that request depends on the result of the CcbsRequest return component or the TC-NOTICE indication primitive. In Table 3-2 the complete result from the Release message information, the CcbsRequest return result component and the TC-NOTICE indication primitive is shown.

As part of this network option, the signalling system shall support for the CCBS call the transfer of a CCSS call indicator in the Initial Address message. The coding of the CCSS call indicator and the interworking with ISUP-X and ISUP-92 is a national matter, which is outside the scope of this Recommendation.

If the CCBS call fails due to received release message with cause #17 or #34 and if the retention option is supported across the networks, the originating local exchange shall keep the transaction resources and shall not restart the timer CCBS-T3. If user A attempts to activate CCBS again, this shall be treated as described in 3.5.3.1.2 c).

Table 3-2/Q.733.3 – Outcome of the service, related to the diagnostic field in combination with the CcbsRequest return result component and TC-NOTICE indication primitive

	Diagnostic field received (Note 3)		No diagnostic field received
	CCBS possible	**CCBS not possible**	
CcbsRequest return result component received (SCCP/TC end-to-end)	Service supported (Note 1)	Not applicable	Service supported (Note 1)
TC-NOTICE indication received (SCCP/TC not end-to-end)	Service not supported (Note 2)	Not applicable	Service not supported (Note 2)
NOTE 1 – CCBS accepted or short-term denial. NOTE 2 – Long-term denial. NOTE 3 – The diagnostic field is received along with cause #17 or #34.			

3.7.2 Interworking with a network without CCBS-ASE capability

If SCCP/TC capability is available from the originating local exchange towards a network not supporting the CCBS supplementary service, the following shall apply:

– At the destination node, if the indicated subsystem is not provisioned or is unavailable, SCCP will invoke the message return procedure. Alternatively, if the subsystem is available, but the CCBS-ASE does not exist, the dialogue begin request will be rejected. (It is an implementation issue whether the rejection is by TC or the TC-user.)

3.7.3 Interworking with a network without SCCP/TC capability

If the originating local exchange is informed through the SCCP message return procedure with a TC-NOTICE indication primitive about the inability of SCCP/TC capability end-to-end, the dialogue ends. This implies that the CCBS supplementary service is not supported, as described in Table 3-2.

3.7.4 Interworking with an intermediate network without 1993 version of SCCP capability

If an intermediate network supports SCCP, but not the 1993 version, a received segmented CCBS request, carried in a XUDT message is not treated. No result is received by the originating TC, the CCBS request operation timer (CCBS-T2) expires and the service request is rejected according to 3.5.1.1.1.2. For further information see the SCCP user's guide (Recommendation Q.715 [18]).

A received CCBS request, that is not segmented, is supported through interworking with the 1988 version of SCCP.

3.7.5 Interworking with PSTN with analogue subscribers using the CCBS service

If a specific Completion of Calls to Busy Subscriber (CCBS) supplementary service is supported by a PSTN for analogue subscribers (without TC/SCCP/ISUP), interworking with the ITU-T CCBS is a national matter. An international SCCP relay is probably needed.

This item is out of the scope of this Recommendation.

3.7.6 Interworking with PSTN user

It should be possible to activate CCBS on a call meeting busy between an ISDN and a PSTN user and vice versa, if CCBS is supported for the PSTN user. When one of the two networks is not able to determine busy/no busy status, the CCBS request will be rejected.

If the originating local exchange is supporting the CCBS supplementary service and this supplementary service is available to an analogue user A and the originating local exchange has received from the destination local exchange a release message with cause parameter containing cause value #17 or #34 and a diagnostic field with a "CCBS possible" indication, the originating local exchange shall start the retention timer CCBS-T1. In case of a diagnostic field, received from the destination local exchange, with a "CCBS not possible" indication, no particular actions are made in the network.

3.7.7 Procedures for interworking with private ISDNs

The completion of calls to busy subscriber supplementary services shall not apply in the case of congestion at the interface between a public ISDN and a private ISDN. Therefore the completion of calls to busy subscriber supplementary services cannot be activated in this situation.

NOTE – Some private ISDNs may use a path reservation method, i.e. a communication path through the private network is reserved before user A is recalled.

If the private network indicates to the destination local exchange that CCBS is possible and the destination local exchange can set the CCBS indicator (in the diagnostic field of the Cause indicators parameter in the REL message), then the CCBS indicator should be set to "CCBS possible".

If the private network does not indicate to the destination local exchange that CCBS is possible, then the diagnostic field shall not be set.

As user A and/or B monitoring function is assumed by the private network, specific procedures apply in originating local exchange and/or destination local exchange in the case of interworking with one or two private networks.

The specific procedures are only described hereafter.

3.7.7.1 Provision/withdrawal

As indicated above, a specific category is dedicated to the private network’s ISDN number.

3.7.7.2 Normal procedure

3.7.7.2.1 Activation/deactivation/registration

3.7.7.2.1.1 Activation

The "retainSupported" is coded TRUE, in the CCBS request, by the originating local exchange only if received from user A.

This information shall be sent to the ISPBX by the destination local exchange, and the "retainSupported" in the CCBS request return result is coded TRUE only if received from user B (if B ISPBX).

If received by the destination local exchange in the CCBS request, the CLI optional parameter is forwarded towards the private network B in order to allow interworking with existing private networks using CLI in a linkage mechanism.

The destination local exchange shall start the supervision timer Tsup on sending the CCBS request to the private network.

The originating local exchange shall start the supervision timer Tsup on receipt of a successful service activation indication.

3.7.7.2.1.2 Deactivation

If a deactivation request is received from user A, the originating local exchange shall send a CcbsCancel invoke component in a TC-END primitive to the destination local exchange for each concerned transaction. User A shall be informed that the deactivation is successful. The resources are released.

3.7.7.2.1.3 Registration

Not applicable.

3.7.7.2.2 Erasure

Not applicable.

3.7.7.2.3 Invocation and operation

The RemoteUserFree invoke component shall be sent by the destination local exchange to the originating local exchange only when a "Remote User Free" indication is received from the private network.

On successful completion of the CCBS call, the destination local exchange shall be informed by the private network of the successful outcome. The destination local exchange shall end the TC dialogue by means of a TC-END request primitive (basic end), without component primitive.

3.7.7.3 Exceptional procedures

3.7.7.3.1 Activation/deactivation/registration

3.7.7.3.1.1 Activation

None identified.

3.7.7.3.1.2 Deactivation

None identified.

3.7.7.3.1.3 Registration

Not applicable.

3.7.7.3.2 Erasure

Not applicable.

3.7.7.3.3 Invocation and operation

3.7.7.3.3.1 Exceptional situation at destination B's side

In case of Tsup expiry, the destination local exchange releases the TC relation. It has to send a CcbsCancel information to the private network and a TC-END request primitive with TC-INVOKE request primitive to transmit the CcbsCancel invoke component without cancelCause to the originating local exchange.

If a CCBS failure condition is encountered within the private network, the destination local exchange shall be informed. The destination local exchange shall end the TC dialogue by means of a TC-END request primitive (basic end), without component primitive.

3.7.7.3.3.2 Exceptional situation at user A's side

In case of Tsup expiry the originating local exchange releases the TC relation. It has to send a CcbsCancel information to the private network and a TC-END request primitive with TC-INVOKE component primitive to transmit the CcbsCancel invoke component without cancelCause to the destination local exchange.

If a CCBS failure condition is encountered within the private network, the originating local exchange shall be informed. The originating local exchange shall end the TC dialogue by means of a TC-END request primitive (basic end), with TC-INVOKE component primitive for CcbsCancel without cancelCause.

3.7.7.3.3.3 Network congestion

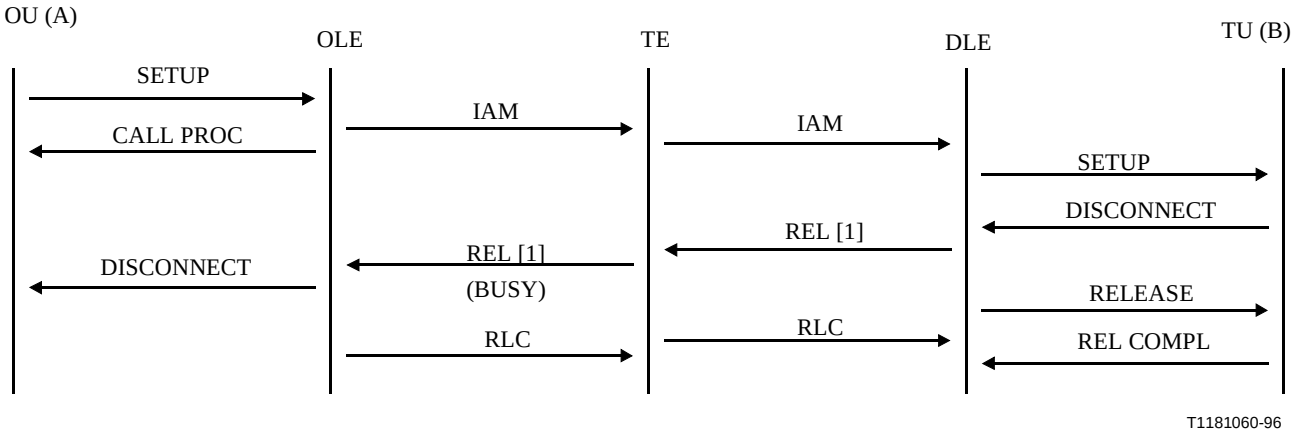
None identified.

3.8 Signalling flows

The access side is only shown for completeness. Only the case with coincident S and T reference point is shown.

3.8.1 Normal call – B busy indication sent to the calling user

See Figure 3-3.



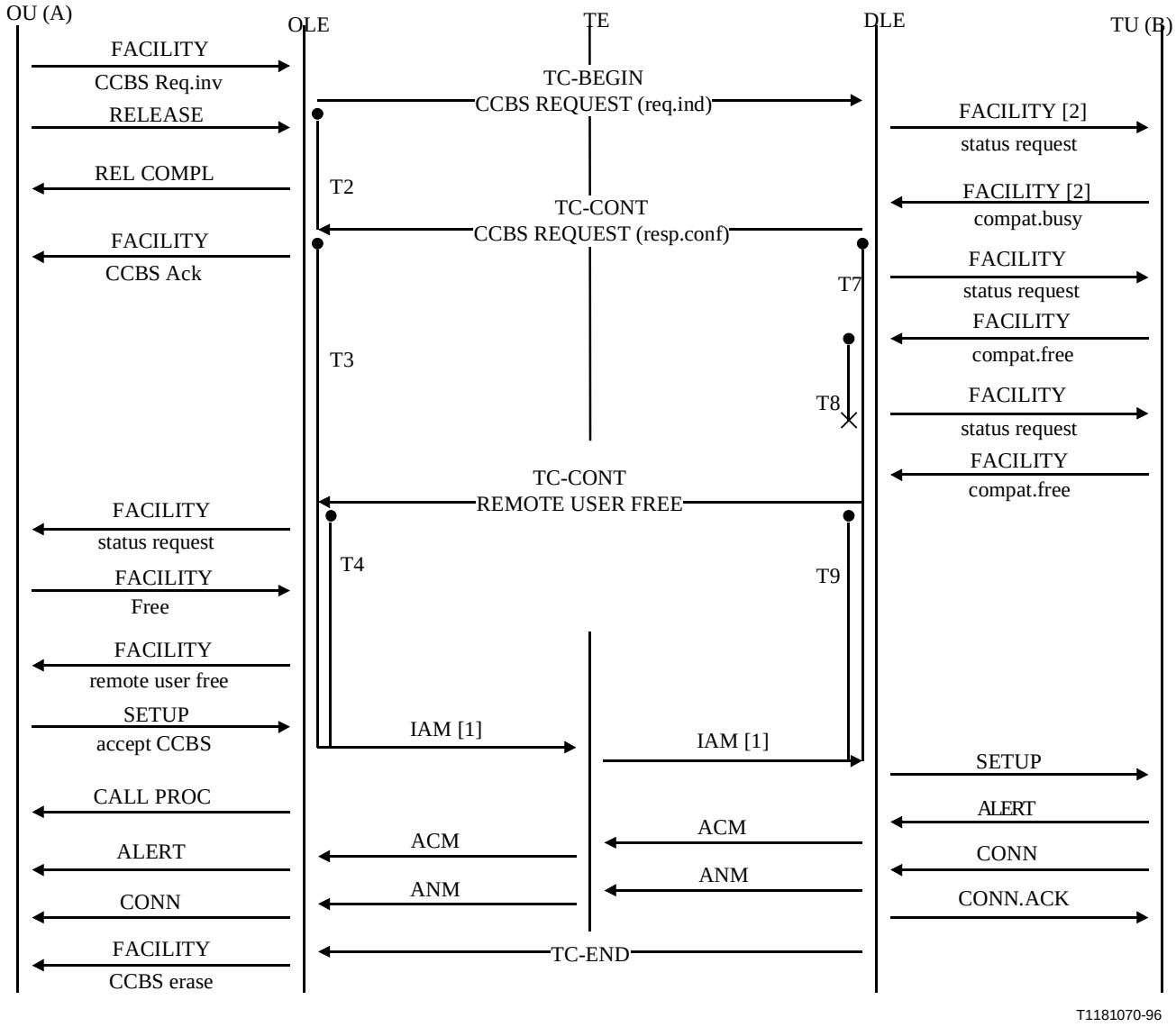
[1] REL (BUSY) cause #17 or #34.

Information about CCBS availability in the DLE is provided in the diagnostic field.

Figure 3-3/Q.733.3

3.8.2 Normal call – Successful CCBS request followed by a successful CCBS call set-up

See Figure 3-4.

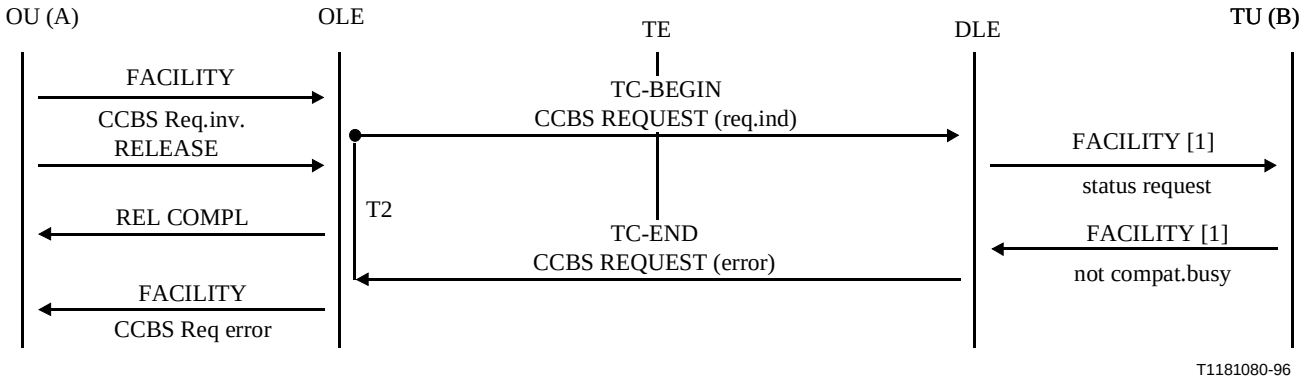


[1] IAM with:
– ISUP required.
– CCSS call indicator.
[2] The network option with compatibility check is shown in the Figure.

Figure 3-4/Q.733.3

3.8.3 Unsuccessful CCBS request, terminal activated

See Figure 3-5.



[1] The network option with compatibility check is shown in the Figure.

Figure 3-5/Q.733.3

3.8.4 Unsuccessful CCBS request, network destination

See Figure 3-6.

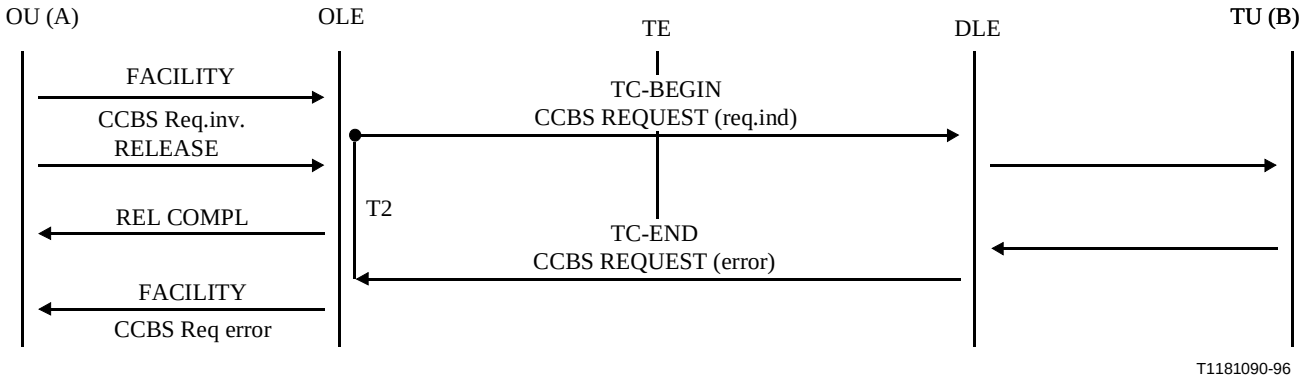
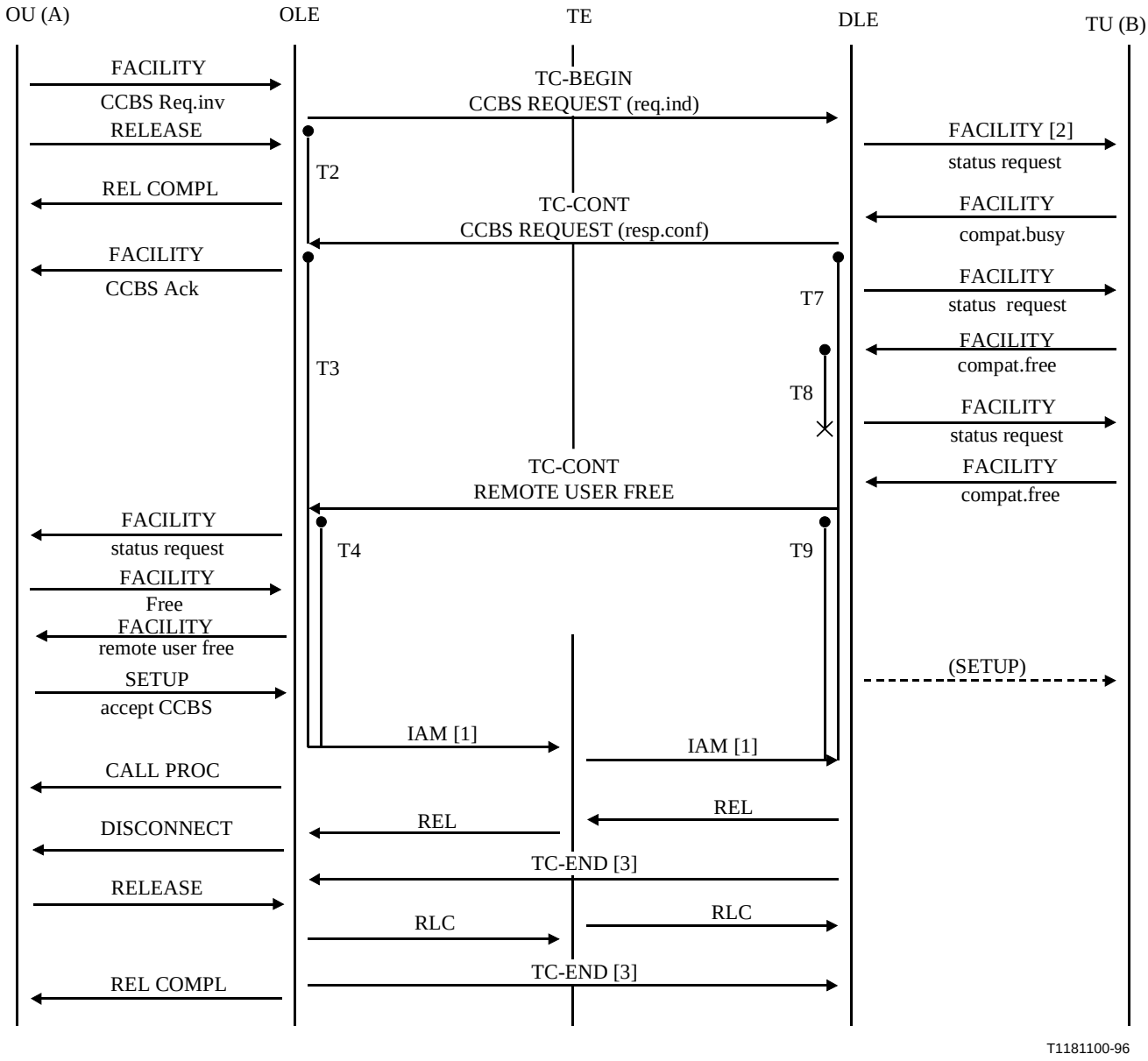


Figure 3-6/Q.733.3

3.8.5 Successful CCBS request followed by an unsuccessful CCBS call set-up

See Figure 3-7.



[1] IAM with:
– ISUP required.
– CCSS call indicator.
[2] The network option with compatibility check is shown in the Figure.
[3] The TC-END is sent from either DLE or OLE.

Figure 3-7/Q.733.3

3.8.6 B idle at CCBS request from A

See Figure 3-8.

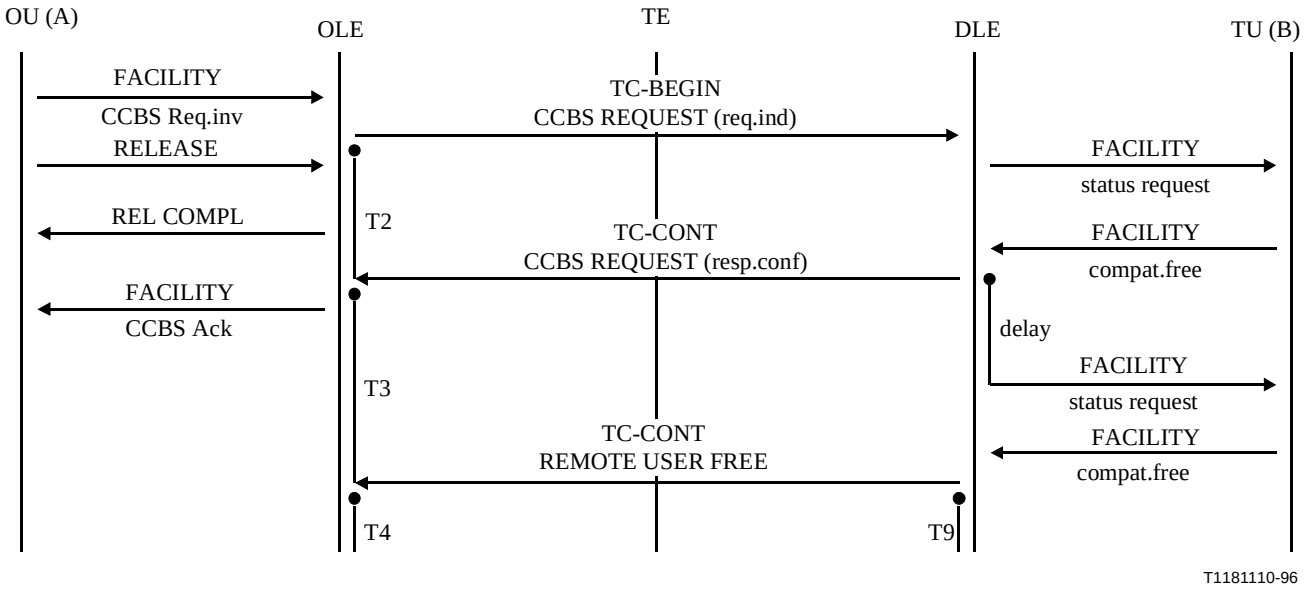


Figure 3-8/Q.733.3

3.8.7 A busy when B becomes free

See Figure 3-9.

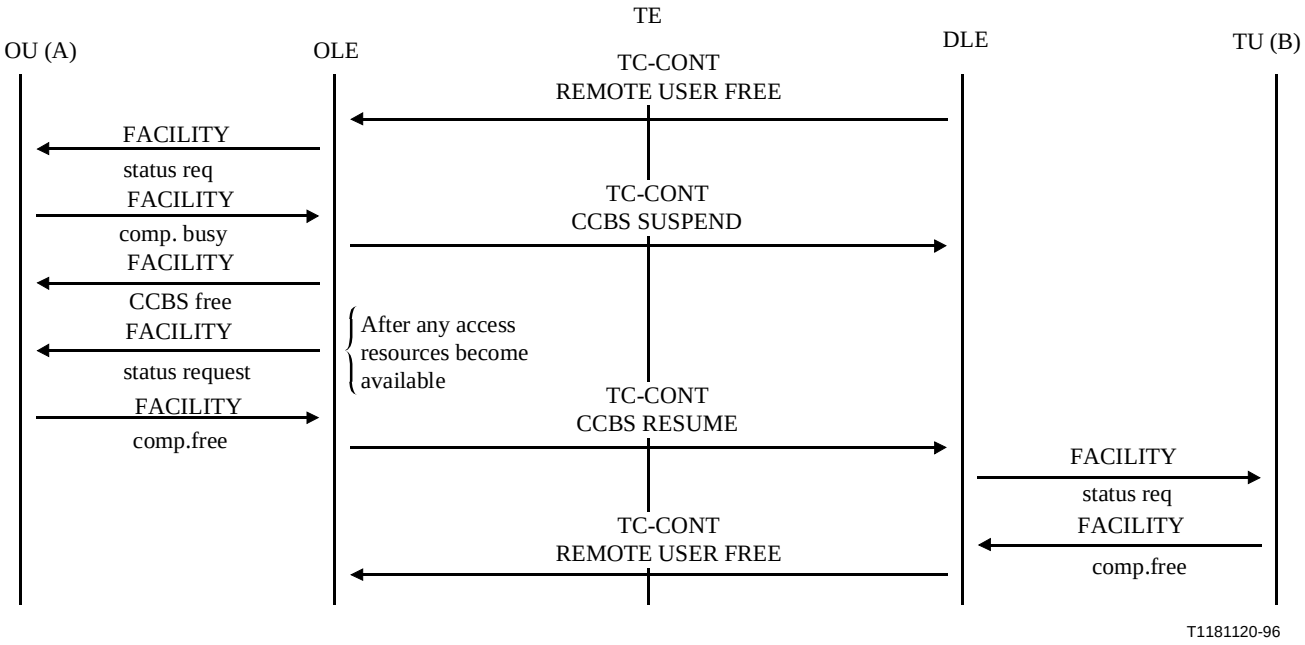


Figure 3-9/Q.733.3

3.9 Parameter values

3.9.1 Timers in the originating local exchange

CCBS-T1 Retention timer. This timer specifies the amount of time that the network retains the call information of the original call encountering busy. The minimum length of the timer is 10 seconds. (See 3.7.6, interworking with PSTN user.)

CCBS-T2 CCBS request operation timer. Supervision of response to "request CCBS" sent from the originating local exchange to the destination local exchange. CCBS-T2 will expire if signalling is not possible, at signalling failures, or if the destination local exchange cannot respond. Duration = a few seconds.

CCBS-T3 CCBS service duration timer (OLE). This timer specifies the maximum time the service will remain activated for user A within the network. The value of this timer is a network option typically 15-45 minutes.

CCBS-T4 CCBS recall timer. This timer specifies the maximum time the network will wait for a response from user A to a CCBS recall. The value of this timer is between 10 and 30 seconds.

3.9.2 Timers in the destination local exchange

CCBS-T7 CCBS service supervision timer CCBS-T7 expiry will only be meaningful if expiry of CCBS-T3 has not been notified to the destination exchange. CCBS-T7 shall have longer duration than CCBS-T3, i.e. CCBS-T7 shall expire at abnormal situations only. The value of this timer shall be 60 minutes. When CCBS-T7 expires, the CCBS request will be cancelled in the destination local exchange as well as in the originating local exchange.

CCBS-T8 Destination B idle guard timer. This timer specifies the amount of time the network will delay after destination B has become free, before initiating a RemoteUserFree invoke component towards the originating destination. The value of this timer is between 0 to 15 seconds.

CCBS-T9 Recall timer. CCBS-T9 should expire at emergency only, i.e. the recall should be cancelled by CCBS-T4 in the originating local exchange if recall is not responded to. Duration of CCBS-T9 = 20 seconds + some seconds for CCBS call set-up.

3.9.3 Interworking timers

CCBS-Tsup Supervision timer. This timer is used in the OLE or DLE whenever a private network is attached to these exchanges and the A user and destination B are in the private network. The duration of this timer shall be 60 minutes.

3.10 Dynamic description

The SDLs for the CCBS service are not required.

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