



Technical Specification

**Digital cellular telecommunications system (Phase 2+);
Universal Mobile Telecommunications System (UMTS);
LTE;
Completion of Communications to Busy Subscriber (CCBS)
and Completion of Communications by No Reply (CCNR)
using IP Multimedia (IM) Core Network (CN) subsystem;
Protocol specification
(3GPP TS 24.642 version 9.10.0 Release 9)**



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650 Route des Lucioles
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - NAF 742 C
Association à but non lucratif enregistrée à la
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1 Scope

The present document specifies the stage three Protocol Description of the Completion of Communications to Busy Subscriber (CCBS) service and the Completion of Communication on no Reply (CCNR) service, based on stage one and two of the ISDN supplementary services. It provides the protocol details in the IP Multimedia (IM) Core Network (CN) subsystem based on the Session Initiation Protocol (SIP) and the Session Description Protocol (SDP).

The **Completion of Communications to Busy Subscriber CCBS** service enables user A, encountering a busy destination B, to have the communication completed without having to make a new communication attempt when the destination B becomes not busy.

The **Completion of Communications on No Reply CCNR** supplementary service enables user A, encountering a destination B which does not answer the communication (No Reply), to have the communication completed without having to make a new communication attempt when the destination becomes not busy after having initiated an activity.

The present document is applicable to User Equipment (UE) and Application Servers (AS) which are intended to support the CCBS and CCNR supplementary services.

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

- [1] 3GPP TS 22.173: "IP Multimedia Core Network Subsystem (IMS) Multimedia Telephony Service and supplementary services; Stage 1".
- [2] 3GPP TS 24.229: "Internet Protocol (IP) multimedia call control protocol based on Session Initiation Protocol (SIP) and Session Description Protocol (SDP); Stage 3".
- [3] 3GPP TS 24.628: "Common Basic Communication procedures using IP Multimedia (IM) Core Network (CN) subsystem; Protocol specification".
- [4] 3GPP TS 24.623: "Extensible Markup Language (XML) Configuration Access Protocol (XCAP) over the Ut interface for Manipulating Supplementary Services".
- [5] RFC 6910 (April 2013): "Completion of Calls for the Session Initiation Protocol (SIP)".
- [6] RFC 3265 (June 2002): "Session Initiation Protocol (SIP)-Specific Event Notification".
- [7] 3GPP TS 24.238: "Session Initiation Protocol (SIP) based user configuration".
- [8] ITU-T Recommendation I.221 (1993): "Common specific characteristics of services".
- [9] RFC 5875 (May 2010): "An Extensible Markup Language (XML) Configuration Access Protocol (XCAP) Diff Event Package".
- [10] IETF RFC 4825: "The Extensible Markup Language (XML) Configuration Access Protocol (XCAP)".
- [11] IETF RFC 3023: "XML Media Types".
- [12] IETF RFC 4483: "A Mechanism for Content Indirection in Session Initiation Protocol (SIP) Messages".
- [13] IETF RFC 3261: "SIP: Session Initiation Protocol".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in 3GPP TS 22.173 [1] and the following terms and definitions apply.

busy: See ITU-T Recommendation I.221 [8], subclause 2.1.5.

call information retention: A procedure of network A to store the call information of a specific call so that it can be used for that call.

caller: The user who originated the call and to whom the CCBS service is provided.

callee: The user which is identified as destination B.

CC: Completion of Communication

CC busy: Any one of the following conditions will cause a CCBS busy condition:

- maximum number of calls reached at user A (see ITU-T Recommendation I.221 [8], subclause 2.1.3, item 2));
- no resources (bandwidth) available at user A;
- CC recall pending on user A.

CCBS/CCNR call: A call generated by the network connecting the caller to the callee, resulting from the callers' acceptance of a CCBS/CCNR recall.

CCBS/CCNR recall: An indication informing the caller that the network is ready to initiate a CCBS/CCNR call to the callee and that the network is awaiting a response to this indication.

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

Suspended CCBS/CCNR request: A CCBS/CCNR request which cannot be served even if the callee is in the appropriate state because the caller is busy.

CCBS/CCNR request retention: If an attempt to establish a CCBS/CCNR call fails because the destination is busy again, then the network provider option "CC request retention" defines whether the CCBS supplementary service is continued or not, i.e. if the "CC request retention" is supported, the original CCBS/CCNR request retains its position in the queue B, and monitoring of user B shall continue. Otherwise the CCBS/CCNR request is revoked.

CC service duration timer: A maximum time the CC service will remain activated for the caller within the network.

destination B: The entity addressed in the original call.

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

queue A: A buffer at the originating side for the control of CCBS/CCNR requests associated with the caller.

queue B: A buffer at the terminating side for the control of CCBS/CCNR requests associated with destination B.

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

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

UE-A: The caller's UE.

UE-B: The callee's UE.

3.2 Abbreviations

For the purposes of the present document, the following abbreviations apply:

AOC	Advice Of Charge
AS	Application Server
CB	Communication Barring
CC	Completion of Communications
CCBS	Completion of Communication to Busy Subscriber
CCNR	Completion of Communications on No Reply
CD	Communication Deflection
CDIV	Call DIVersion
CFB	Communication Forwarding Busy
CFNL	Communication Forwarding on No Logged-in
CFU	Communication Forwarding Unconditional

CN	Core Network
CNR	Completion of communication on No Reply
CONF	CONFerence calling
CS	Circuit Switched
CW	Communication Waiting
ECT	Explicit Communication Transfer
HOLD	Communication HOLD
IFC	Initial Filter Criteria
IM	IP Multimedia
IMS	IP Multimedia Subsystem
IP	Internet Protocol
ISDN	Integrated Service Data Network
MCID	Malicious Communication IDentification
MIME	Multipurpose Internet Mail Extensions
OIP	Originating Identification Presentation
OIR	Originating Identification Restriction
PLMN	Public Land Mobile Network
PSTN	Public Switch Telephone Network
SIP	Session Initiation Protocol
TIP	Terminating Identification Presentation
TIR	Terminating Identification Restriction
UE	User Equipment

4 Completion of Communications to Busy Subscriber (CCBS) / Completion of Communication on No Reply (CCNR)

4.1 Introduction

The CCBS and CCNR services enables a user, encountering a destination that is busy or does not answer, to have the communication completed at a later point in time without the user having to manually initiate a new communication attempt.

4.2 Description

4.2.1 General description

The CCBS service enables user A, encountering a busy destination B, to have the communication completed without the user having to manually initiate a new communication attempt when the destination B becomes not busy.

When user A requests the CCBS supplementary service, the network will monitor for destination B becoming free again.

When destination B becomes free again, the network will wait a short time in order to allow the resources to be re-used for originating a communication. If the resources are not re-used by destination B within this time, the network will automatically recall user A.

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

The CCNR supplementary service enables user A, encountering a destination B which does not answer the communication (No Reply), to have the communication completed without the user having to manually initiate a new communication attempt when the destination becomes not busy after having initiated and completed a new communication.

When user A encounters a destination B which does not answer the communication (No Reply), user A can request the CCNR supplementary service.

When user A requests the CCNR supplementary service, the network will monitor for destination B becoming not busy after having initiated and completed a new communication.

When destination B becomes not busy after having initiated and completed a new communication, the network will wait a short time (as defined by the destination B idle guard timer) in order to allow the resources to be reused for originating a communication. If the resources are not reused by destination B within this time, the network will automatically recall user A.

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

The CCBS / CCNR service control is done by the application servers. It is possible to modify the queue by the users (add entry, delete entries, delete whole queue) by usage of appropriate procedures.

On the originating side the originating AS A manages the queue of user A and on terminating side the terminating AS B manages the queue of outstanding communications towards UE B.

The originating AS keeps track of the CCBS/CCNR requests started by each user for a given period of time, and rejects a new request in case the provisioned limit has been overcome.

The terminating AS keeps track of the CCBS /CCNR requests directed to each user for a given period of time, and rejects a new request in case the provisioned limit has been overcome.

After successful CCBS/CCNR Call setup the respective entry is deleted in both queues. Also a proper management of the queue in the suspend/resume scenario upon reception of the corresponding message takes place.

4.3 Operational requirements

4.3.1 Provision/withdrawal

The CCBS/CCNR service is provided to the served user after prior arrangement with the service provider, or as a service provider option. Withdrawal of these services is made on the served user's request or for service provider reasons.

4.4 Coding requirements

No specific requirements needed.

4.5 Signalling requirements

4.5.1 Activation/deactivation

The call completion services are individually activated at provisioning or at the subscriber's request.

The call completion services are individually deactivated at withdrawal or at the subscriber's request.

4.5.2 Registration/erasure

The CCBS/CCNR service requires no registration. Erasure is not applicable.

4.5.3 Interrogation

For the interrogation of the call-completion services the Ut interface using XCAP as enabling protocol as described in 3GPP TS 24.623 [4] or SIP based user configuration as described in 3GPP TS 24.238 [7] in combination with announcement procedures according to 3GPP TS 24.628 [3] could be used.

4.5.4 Invocation and operation

4.5.4.1 Actions at the originating UE

Basic call procedures and in case of a call-completion recall initiated by a REFER request, normal REFER method handling procedures according to 3GPP TS 24.229 [2] shall apply.

When the UE receives a SIP final response to the SIP INVITE request and the SIP response contains

- a) a Date header field; and
- b) a MIME body of the message/external-body MIME type as specified in IETF RFC 4483 [12] with:
 1. "access-type" MIME type parameter containing "URL";
 2. "URL" MIME type parameter containing an HTTP URI identifying an element <cc-entry> stored in the XML document of the "users" tree of the communication completion request records XCAP application usage and the element <cc-entry> is identified by attribute selector using the "id" attribute; and
 3. "expiration" MIME type parameter;

then the UE should use this information to inform the user that:

- a) if the date and time in the "expiration" MIME type parameter is later than the date and time of the Date header field, then the communication attempt has led to a communication completion invocation; and
- b) if the date and time in the "expiration" MIME type parameter is equal to or earlier than the date and time of the Date header field, then the communication attempt has led to a communication completion revocation.

For invoking and revoking of the call completion services, announcement procedures according to 3GPP TS 24.628 [3] and inband-interaction procedures should be used.

Editor's note: The usage of inband interaction procedures needs further studies and specification. For invoking and revoking of the call-completion services also out-of-band stimulus procedures according to ETSI TR 183 057 [4] could be used.

4.5.4.2 Actions at the originating AS

4.5.4.2.0 General

The originating AS shall operate as a SIP proxy as specified in subclause 5.7.4 of 3GPP TS 24.229 [2] or operate as a routing B2BUA as specified in subclause 5.7.5 of 3GPP TS 24.229 [2] for the incoming INVITE request and all future requests and responses in the same dialog.

4.5.4.2.1 CC Invocation

4.5.4.2.1.1 Normal procedures

4.5.4.2.1.1.1 Detecting if CC is possible

When in case of CCBS a 486 (Busy Here) response has been received from the terminating network, and the following set of conditions apply:

- the 486 (Busy Here) response contains a Call-Info header field with a "purpose" header field parameter set to "call-completion"; and
- the user A CCBS queue limit has not been exceeded; and
- CCBS has not been activated for an identical communication (network option), determined by the stored basic communication information defined in subclause 4.5.4.2.1.1.2; and
- there are no service interactions that preclude CCBS;

then the service retention procedure as specified in subclause 4.5.4.2.1.1.2 is executed.

When in case of CCNR a 180 (Ringing) response has been received from the terminating network, and the following set of conditions apply:

- the 180 (Ringing) response contains a Call-Info header with a purpose parameter set to 'call-completion'; and
- the user A CCNR queue limit has not been exceeded; and
- CCNR has not been invoked for an identical communication (network option), determined by the stored basic communication information defined in subclause 4.5.4.2.1.1.2; and
- there are no service interactions that preclude CCNR,

then the originating AS shall remove the Call-Info header from the 180 (Ringing) response, forward it to UE-A and start the CC no-reply timer CCNR-T5. When this timer expires then the service retention procedure as specified in subclause 4.5.4.2.1.1.2 is executed.

4.5.4.2.1.1.2 Starting of the service retention procedure

The originating AS shall start the retention timer CC-T1. The originating AS shall retain the following information from the original communication, if available:

- 1) SDP offer, and
- 2) Request-URI, and
- 3) To header field, and
- 4) From header field, and
- 5) Privacy header field, and
- 6) P-Asserted-ID header field.

4.5.4.2.1.1.3 CC service invocation by user A

For the invocation of the CC service, in case of CCBS immediately after receipt of a 486 (Busy Here) response with a CCBS possible indication or in case of CCNR after receipt of a 180 (Ringing) response with a CCNR possible indication upon expiry of the No-Reply timer CCNR-T5, the originating AS shall provide an announcement that CC is possible to user A, according to 3GPP TS 24.628 [3], followed by inband-interaction procedures for the activation confirmation.

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

If user A does not confirm the activation of CC, the AS shall restore the communication condition from before the announcement and proceed with basic communication procedures by forwarding the 486 (Busy here) response in case of CCBS or sending a 199 (Early Dialog Terminated) on the announcement dialog in case of CCNR.

4.5.4.2.1.1.4 Stopping of the service retention procedure

On receiving a CC invocation confirmation from user A before the expiry of the retention timer CC-T1, the originating AS shall:

- a) stop the retention timer CC-T1; and
- b) store the retained call information from the original basic communication.

As a network option, in case of receipt of a CCNR invocation confirmation, the originating AS may terminate the original communication by sending a CANCEL request to UE-B, in accordance with the procedures described in 3GPP TS 24.229 [2].

NOTE: The above procedure avoids a race condition between answering the call at the terminating side and subscribing to CCNR at the originating side.

4.5.4.2.1.1.5 Sending of the CC invocation request to the terminating AS

The originating AS shall send a SUBSCRIBE request to the terminating AS according to RFC 3265 [6] and RFC 6910 [5]. The originating AS shall populate the SUBSCRIBE request as follows:

- a Request-URI set to the URI returned by the terminating AS in the Call-Info header field of the response including the CC possible indication
- in case of CCBS as received in the Call-Info header field in the 486 (Busy Here) response, including an "m" SIP URI parameter with a value set to "BS";
- in case of CCNR as received in the Call-Info header in the 180 (Ringing) response, including an "m" SIP URI parameter with a value set to "NR";
- a From header field set to the URI of UE-A from the original communication;
- a To header field set to the URI of UE-B from the original communication;
- a Contact header field set to the URI of the originating AS;
- a Call-Info header field with the URI of UE-A from the P-Asserted-Identity, a "purpose" header field parameter set to "call-completion", and an m-parameter set to "BS" in case of CCBS or "NR" in case of CCNR;
- a P-Asserted-Identity header field as received from the original INVITE request; and

NOTE 1: If available and to avoid interworking problems (e.g. if the called user is in the PSTN) a P-Asserted-Identity header field that contains an E.164 number is preferable.

- an Expires header field set to at least the initial value of the service duration timer CC-T3.

The originating AS shall start the CC request timer CC-T2.

NOTE 2: The To header field is used to identify a particular CC target.

4.5.4.2.1.1.6 Procedures after CC invocation confirmation from the terminating AS

If the originating AS receives a NOTIFY request as an answer to an outstanding CC request which was described in subclause 4.5.4.2.1.1.5 with the cc-state parameter set to 'queued', the originating AS shall:

- a) stop the CC request timer CC-T2;
- b) start the CC service duration timer CC-T3;
- c) store the information whether the cc-service-retention parameter has been received or not; and
- d) confirm to the caller that the invocation was successful, using announcement procedures according to 3GPP TS 24.628 [3].

In case of CCBS the originating AS shall forward the 486 (Busy Here) response to UE-A.

In case of CCNR, if the original communication with the UE-B has already been cancelled by the originating AS, the originating AS shall send a 480 (Temporarily unavailable) response to UE-A.

The originating AS shall include in the SIP 486 (Busy Here) response or the SIP 480 (Temporarily unavailable) response:

- a) a Date header field containing the current date and time; and

NOTE: To function correctly the Date header field cannot be removed from SIP response to SIP INVITE request by an IBCF between originating P-CSCF and originating S-CSCF

- b) an message/external-body MIME type as specified in IETF RFC 4483 [12] with:
 1. "access-type" MIME type parameter containing "URL"; and
 2. "URL" MIME type parameter containing an HTTP URI identifying an element <cc-entry>

- i) representing the new communication completion request;
 - ii) stored in the XML document of the "users" tree of the communication completion request records XCAP application usage; and
 - iii) identified by attribute selector using the "id" attribute;
3. "expiration" MIME type parameter containing the date and time of the communication completion request expiration.

4.5.4.2.1.2 Exceptional procedures

If the originating AS receives a 480 (Temporarily Unavailable) response (short term denial) or a 403 (Forbidden) response (long term denial), in accordance with the procedures of subclause 4.5.4.3.2.2, to an outstanding CC request which was described in subclause 4.5.2.2.1.1.5, then the originating AS shall:

- a) stop the CC request timer CC-T2; and
- b) confirm to the caller that the invocation was not successful, using announcement procedures according to 3GPP TS 24.628 [3].

In case of CCBS the originating AS shall forward the 486 (Busy Here) response to UE-A.

4.5.4.2.2 CC Revocation

4.5.4.2.2.1 Normal procedures

4.5.4.2.2.1.1 Generating a revocation request

For revoking the CC service, the originating AS shall send a SUBSCRIBE request to the terminating AS according to RFC 3265 [6] and RFC 6910 [5] in the SUBSCRIBE dialog. The originating AS shall populate the SUBSCRIBE request following normal procedures as specified in 3GPP TS 24.229 [2] with the following additions:

- a Call-Info header field with the URI of UE-A from the P-Asserted-Identity, a "purpose" header field parameter set to "call-completion", and an m-parameter set to "BS" in case of CCBS or "NR" in case of CCNR;
- a P-Asserted-Identity header field as received from the original INVITE request;

NOTE: If available and to avoid interworking problems (e.g. if the called user is in the PSTN) a P-Asserted-Identity header field that contains an E.164 number is preferable.

and

- an Expires header field set to zero.

4.5.4.2.2.1.2 Revocation requested by the user

If the originating AS receives a revocation request by the user, the originating AS shall

- construct a SUBSCRIBE request according to subclause 4.5.4.2.2.1.1; and
- send the SUBSCRIBE request to the terminating AS; and
- inform user A of the result of the revocation by using announcement procedures and inband-interaction procedures according to 3GPP TS 24.628 [3].

The originating AS shall include in the SIP final response to the revocation request:

- a) a Date header field containing the current date and time; and

NOTE: To function correctly the Date header field cannot be removed from SIP response to SIP INVITE request by an IBCF between originating P-CSCF and originating S-CSCF

- b) an message/external-body MIME type as specified in IETF RFC 4483 [12] with:

1. "access-type" MIME type parameter containing "URL"; and
2. "URL" MIME type parameter containing an HTTP URI identifying an element <cc-entry>
 - i) representing the communication completion request being revoked;
 - ii) stored in the XML document of the "users" tree of the communication completion request records XCAP application usage; and
 - iii) identified by attribute selector using the "id" attribute;
3. "expiration" MIME type parameter containing the date and time of the communication completion request revocation.

4.5.4.2.2.1.3 Revocation caused by timer expiry

If the service-duration timer CC-T3 expires, the originating AS shall:

- construct a SUBSCRIBE request according to subclause 4.5.4.2.2.1.1; and
- send the SUBSCRIBE request to the terminating AS.

4.5.4.2.2.2 Exceptional procedures

The originating AS shall be prepared to receive a NOTIFY request caused by a service-duration timer expiry at the terminating AS, according to the procedures of subclause 4.5.4.3.3.2, with:

- the Subscription-State header field set to "terminated"; and
- the "reason" Subscription-State header field parameter set to "noresource".

In this case the originating AS shall stop the CC service-duration timer CC-T3, if this timer is still running.

4.5.4.2.3 CC Operation

4.5.4.2.3.1 Normal procedures

On receipt of a CC recall notification as described in subclause 4.5.4.3.4.1.2, and if user A is neither busy nor CC busy, the originating AS shall initiate the CC recall to user A by sending a REFER request to UE-A according to 3GPP TS 24.229 [2], and shall start the recall timer CC-T4. The originating AS shall populate the REFER request as follows:

- a Request-URI set to the URI of UE-A from the original communication, including an "m" SIP URI parameter with a value set to "BS" in case of CCBS or "NR" in case of CCNR; and
- a Refer-to header set to the URI of UE-B.

If there are multiple outstanding CC requests at the originating AS, then the correct target for the CC recall is identified using standard SIP dialog identification procedures.

In the case UE-A does not support the REFER method extension, the special REFER request handling procedures according to 3GPP TS 24.628 [3] should be used. As a network option, e.g. in the case the originating AS has knowledge that UE-A does not support the REFER method extension, the originating AS may start the 3rd party call control procedures according to 3GPP TS 24.628 [3] without waiting for a 3xx – 6xx response. In this case, the originating AS shall send an INVITE request with a Request-URI set to the URI of UE-A from the original communication, including a "m" SIP URI parameter with a value set to "BS" in case of CCBS or "NR" in case of CCNR. The INVITE request shall include identity information about user B in the From header field as received in the To header field of the original request. Other identity information may be included if allowed by the Privacy settings in the response of the original communication.

If user A accepts the recall before the CC recall timer expires (a NOTIFY request with a body containing SIP/2.0 100 Trying or a 200 OK to the 3pcc INVITE request according to the special REFER request handling procedures according to 3GPP TS 24.628 [3] is received), the originating AS shall stop timer CC-T4 and initiate the CC call to destination B

by sending an INVITE request, in accordance with RFC 6910 [5]. The originating AS shall populate the INVITE request as follows.

- a Request-URI set to the URI of UE-B from the original communication, including an "m" SIP URI parameter
 - set to "BS" in case of CCBS; or
 - set to "NR" in case of CCNR;
- a From header field set to the URI of UE-A from the original communication;
- a To header field set to the URI of UE-B from the original communication.
- a Call-Info header field with the URI of UE-A from the P-Asserted-Identity in the original communication, a "purpose" header field parameter set to "call-completion", and an m-parameter set to "BS" in case of CCBS and "NR" in case of CCNR;

4.5.4.2.3.2 Exceptional procedures

4.5.4.2.3.2.1 Non-acceptance of CC recall

See subclause 4.5.4.2.2.1.3.

4.5.4.2.3.2.2 User A is found busy or CC busy

If the caller is found to be busy or CC busy, when a CC recall notification as described in subclause 4.5.4.3.4.1.2 has been received, then the originating AS shall suspend the CC request until the caller becomes not busy or not CC busy again. The originating AS shall send a PUBLISH request to the terminating AS according to RFC 6910 [5] in the existing SUBSCRIBE dialog. The originating AS shall populate the PUBLISH request following normal procedures as specified in 3GPP TS 24.229 [2] with the following additions:

- a Request-URI set to the contact address of the terminating AS returned by the terminating AS when the SUBSCRIBE dialog was created;
- a Call-Info header field with the URI of UE-A from the P-Asserted-Identity in the original communication, a "purpose" header field parameter set to "call-completion", and an m-parameter set to "BS" in case of CCBS and "NR" in case of CCNR;
- a P-Asserted-Identity header field as received from the original INVITE request;

NOTE 1: If available and to avoid interworking problems (e.g. if the called user is in the PSTN) a P-Asserted-Identity header field that contains an E.164 number is preferable.

- an Expires header field set to the current value of the remaining duration of the subscription; and
- a body set to a PIDF informing about the basic state 'closed' for the caller's identity as presentity.

When the caller is no longer busy or CC busy, then the originating AS shall resume the CC request. The originating AS shall send a PUBLISH request to the terminating AS according to RFC 6910 [5] in the existing SUBSCRIBE dialog. The originating AS shall populate the PUBLISH request following normal procedures as specified in 3GPP TS 24.229 [2] with the following additions:

- a Request-URI set to the contact address of the terminating AS returned by the terminating AS when the SUBSCRIBE dialog was created;
- a Call-Info header field with the URI of UE-A from the P-Asserted-Identity in the original communication, a "purpose" header field parameter set to "call-completion", and an m-parameter set to "BS" in case of CCBS and "NR" in case of CCNR;
- a P-Asserted-Identity header field as received from the original INVITE request;

NOTE 2: If available and to avoid interworking problems (e.g. if the called user is in the PSTN) a P-Asserted-Identity header field that contains an E.164 number is preferable.

- an Expires header field set to the current value of the remaining duration of the subscription; and

- a body set to a PIDF informing about the basic state 'open' for the caller's identity as presentity.

In case of the originating AS has sent several suspension requests to different terminating ASs and the caller becomes neither busy nor CC busy, the originating AS shall resume each suspended request.

4.5.4.2.3.2.3 The caller makes another call to the same destination B

If the caller initiates another communication to the same destination B and activates the same CC service (CCBS or CCNR) again, then:

- if the two communications are identical, then the following network provider options exist:
 - 1) the originating AS shall retain the original request with the current request being discarded and inform the caller that the request has not been accepted because a CC request had already been stored against the requested destination B; or
 - 2) the originating AS shall treat this as a new CC request; and
- if the two calls are not identical, then the originating AS shall treat this as a new CC request. In order to decide that the two calls are identical, the originating AS shall only compare the basic communication information, i.e. the SDP offer, the destination selection information, and calling user identity (if any).

NOTE: It is a network provider option which information is used to identify identical communications.

4.5.4.2.3.2.4 CC call failure

If the CC call fails, the originating AS shall inform the caller as for the basic communication procedures.

If CC is possible (a received 180 (Ringing) or 486 (Busy Here) response contains a Call-Info header field with a purpose parameter set to "call-completion"), two possibilities exist:

- if the retain option is supported across the networks (the originating AS has received a cc-service-retention parameter in the NOTIFY request described in subclause 4.5.4.3.2.1), the originating AS shall keep the transaction resources and shall not restart the service duration timer CC-T3. If the caller attempts to activate CC again, the originating AS shall treat this as described in subclause 4.5.4.2.3.2.3.
- if the retain option is not supported across the networks, the originating AS shall release the transaction resources. The originating AS shall deactivate the CC request and shall inform the caller accordingly.

If CC is not possible (a received 180 (Ringing) or 486 (Busy Here) response does not contain a Call-Info header field with a purpose parameter set to 'call-completion'), the originating AS shall deactivate the CC request according to the procedures described in subclause 4.5.4.2.2 and shall inform the caller accordingly.

4.5.4.3 Actions at the terminating AS

4.5.4.3.0 General

The terminating AS shall operate as a SIP proxy as specified in subclause 5.7.4 of 3GPP TS 24.229 [2] or operate as a routing B2BUA as specified in subclause 5.7.5 of 3GPP TS 24.229 [2] for the incoming INVITE request and all future requests and responses in the same dialog.

4.5.4.3.1 CC possible indication

4.5.4.3.1.1 Normal operation

When on an incoming communication the terminating AS supports the CCNR service, then the terminating AS shall insert a Call-Info header field with either the URI of the terminating AS or the URI received in the original INVITE request, a purpose-parameter set to 'call-completion', and an m-parameter set to 'NR' in the 180 (Ringing) response forwarded by the AS to indicate whether CCNR is possible or not, in accordance with RFC 6910 [5].

When on an incoming communication the callee is found to be busy and the terminating AS supports the CCBS service, then the terminating AS shall insert a Call-Info header field with either the URI of the terminating AS or the URI

received in the original INVITE request, a "purpose" header field parameter set to "call-completion", and an m-parameter set to "BS" in the 486 (Busy Here) response generated by the terminating AS (in case of 'network determined user busy') or forwarded by the terminating AS (in case of 'user determined user busy') to indicate whether CCBS is possible or not, in accordance with RFC 6910 [5].

If the terminating AS knows that the CC is not possible on destination B, the terminating AS shall not include a Call-Info header field with a "purpose" header field parameter set to "call-completion" in any response sent to the originating side.

4.5.4.3.1.2 Exceptional procedures

Not applicable

4.5.4.3.2 CC Invocation

4.5.4.3.2.1 Normal operation

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

As a network option the destination network operator can reduce the sizes of the CC queues associated with individual users. The reduced size can be zero. The size of the CCBS queue can also be related to the size of the CCNR queue if existing.

On receipt of a CC invocation request as described in subclause 4.5.4.2.1.1.5, the terminating AS shall:

- a) acknowledge the receipt of the SUBSCRIBE request with a 202 Accepted response. The terminating AS shall set the Expires header field in the 202 Accepted response to a value less or equal than the value of the Expires header field in the received SUBSCRIBE request, in accordance with RFC 3265 [6].
- b) check if the Request-URI of the SUBSCRIBE request is available for the requested CC service; if there is no match, the terminating AS shall check if the URI in the To header field of the SUBSCRIBE request is available for the requested CC service; if it is available, the terminating AS shall store the information received in the CC invocation request in the destination B queue and send a NOTIFY request to the originating AS according to RFC 6910 [5]. The terminating AS shall populate the NOTIFY request as follows:
 - a Request-URI set to the URI of the originating AS as received in the Contact header field of the SUBSCRIBE request;
 - a To header field set to the URI of UE-A as received in the From header field of the SUBSCRIBE request;
 - a From header field set to the URI of UE-B as received in the To header field of the SUBSCRIBE request;
 - a Subscription-State header field set to "active";
 - the "expires" Subscription-State header field parameter set to the current value of the subscription duration,
 - a body set to a cc-state parameter set to 'queued'; and
 - if the retain option is supported at the terminating AS, a cc-service-retention parameter in the same body;
- c) start the service duration timer CC-T7; and
- d) monitor destination B
 - in case of CCBS for becoming not busy; or
 - in case of CCNR for becoming not busy after having initiated an activity.

NOTE: Methods for monitoring the callee for becoming not busy are a network provider implementation option.

4.5.4.3.2.2 Exceptional procedures

When the invocation of the requested CC service is rejected by the terminating AS, in accordance with RFC 6910 [5] the terminating AS shall send a 480 (Temporarily Unavailable) response (short term denial) or a 403 (Forbidden) response (long 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 other services which prevents the invocation of the requested CC service;
- if the URI in the To header field of the SUBSCRIBE request is not available for the requested CC service at destination B.

If the callee is no longer busy when the CCBS invocation request arrives, the terminating AS shall apply the normal CC invocation procedures as described in subclause 4.5.4.3.2.1.

If the callee has answered the communication when the CCNR invocation request arrives, the terminating AS shall apply the normal CC revocation procedures as described in subclause 4.5.4.3.3.1.

NOTE: A general error, e. g. a syntax error, or a non-compliance to the call-completion event-package, is answered according to the procedures described in RFC 3265 [6].

4.5.4.3.3 CC Revocation

4.5.4.3.3.1 Normal operation

On receipt of a CC revocation request as described in subclause 4.5.4.2.2.1.1, the terminating AS shall delete the CC request from the destination B queue and send a NOTIFY request to the originating AS according to RFC 3265 [6] and RFC 6910 [5]. The terminating AS shall populate the NOTIFY request as follows:

- a Request-URI set to the URI of the originating AS as received in the Contact header field of the SUBSCRIBE request;
- a To header field set to the URI of UE-A as received in the From header field of the SUBSCRIBE request;
- a From header field set to the URI of UE-B as received in the To header field of the SUBSCRIBE request;
- a Subscription-State header field set to "terminated"; and
- the "reason" Subscription-State header field parameter set to 'timeout'.

4.5.4.3.3.2 Exceptional procedures

The terminating AS shall automatically revoke a particular request for the CC service if the CC service duration timer CC-T7 expires. If timer CC-T7 expires, the terminating AS shall send a NOTIFY request to the originating AS as described in subclause 4.5.4.3.3.1 with the "reason" Subscription-State header field parameter set to 'noresource'.

4.5.4.3.4 CC Operation

4.5.4.3.4.1 Normal operation

4.5.4.3.4.1.1 The callee becomes available

When the callee becomes not busy, then the terminating AS shall check queue B:

- a) if there is an entry in the queue currently being processed, the terminating AS shall take no further action;
- b) otherwise, the terminating AS shall examine:
 - the CCBS entries in the queue; and
 - the CCNR entries in the queue, if the callee became not busy after having initiated an activity;

- c) if an entry is suspended, the terminating AS shall take another entry; and
- d) if an entry is not suspended, the terminating AS shall select it for the CC recall.

NOTE: The algorithm for the order addressing entries in the queue is outside the scope of this document. It needs not to be the order of creation of the queue entries.

The terminating AS shall start the destination B idle guard timer CC-T8. When the destination B idle guard timer CC-T8 expires, the terminating AS shall process the selected CC request.

4.5.4.3.4.1.2 The CC recall is started

When processing a CC request, provided that the callee is still available, the terminating AS shall start the CC recall procedure.

The CC recall procedure is defined as follows:

- the terminating AS shall send a NOTIFY request to the originating AS according to RFC 6910 [5]. The terminating AS shall populate the NOTIFY request as follows:
 - a Request-URI set to the URI of the originating AS as received in the Contact header field of the SUBSCRIBE request
 - a To header field set to the URI of UE-A as received in the From header field of the SUBSCRIBE request;
 - a From header field set to the URI of UE-B as received in the To header field of the SUBSCRIBE request;
 - a Subscription-State header field set to "active";
 - the "expires" Subscription-State header field parameter set to the remaining duration of the subscription;
 - a body set to a cc-state parameter set to 'ready'; and
- the terminating AS shall start the CC recall timer CC-T9.

4.5.4.3.4.1.3 Incoming communication during the CC recall processing

If the terminating AS receives an INVITE request while a CC recall is processed, the terminating AS shall check whether this new incoming communication includes a CC call indicator (an "m" SIP URI parameter is added to the Request-URI, or a Call-Info header field exists and includes an "m" header parameter).

If the INVITE request includes a CC Call indicator, the terminating AS shall offer the incoming communication to the callee.

If the INVITE request does not include a CC call indicator, the terminating AS shall reject the incoming communication by generating a 486 (Busy Here) response which includes a CC possible indication, according to the normal CC possible indication procedures described in subclause 4.5.4.3.1.1.

4.5.4.3.4.1.4 Procedures after the CC call was offered to the callee

When the terminating AS has sent a 183 (Session Progress) response, a 180 (Ringing) response or a 200 (OK) response, it shall:

- stop the timers CC-T7 and CC-T9;
- delete the CC request from the destination B queue
- send a CC revocation notification as described in subclause 4.5.4.3.3.2 to the originating AS; and
- if there are further CC requests to be processed, then check whether the callee is busy:
 - if the callee is busy, the terminating AS shall take no further action; or
 - if the callee is not busy, the terminating AS shall service the queue for destination B as described above.

4.5.4.3.4.1.5 Further procedures

If the originating AS resumes a CC request according to the procedures describe in subclause 4.5.4.2.3.2.2 because user A has become free (i.e. not busy and not CC busy), then, if the callee is available and there is no entry in the CC queue which is currently being processed, the terminating AS shall service the destination B queue as described above.

If the originating AS suspends a CC request according to the procedures describe in subclause 4.5.4.2.3.2.2, the terminating AS shall:

- stop timer CC-T9; and
- send a NOTIFY request to the originating AS, including a body with a cc-state parameter set to 'queued'; and
- attempt to process another CC request in the same queue.

If the originating AS revokes a CC request according to the procedures described in subclause 4.5.4.2.1.1, the terminating AS shall stop timers CC-T7 and CC-T9 and attempt to process another CC request in the same queue.

4.5.4.3.4.2 Exceptional procedures

- a) The callee is busy when destination B idle guard timer expires:

If, upon expiry of the destination B idle guard timer CC-T8, the callee is busy (e.g. the callee has initiated an outgoing communication), then the terminating AS shall defer servicing of the destination B CC queue until the callee becomes not busy again.

- b) The terminating AS receives a "ready" notification while processing the destination B CC queue:

See subclause 4.6.10.

- c) The callee is busy upon arrival of the CC call:

If the callee is busy when a CC call arrives, then the procedures depend on whether the retain option is supported across the networks:

- if the retain option is not supported at the terminating AS, the terminating AS shall cancel the corresponding CC request; the terminating AS shall send a 486 (Busy Here) response with a Call-Info header field with a "purpose" header field parameter set to "call-completion" to the originating AS; if a new CCBS invocation request is received from the originating AS, normal procedures apply, according to subclause 4.5.4.3.2;
- if the retain option is supported at the terminating AS, the terminating AS shall retain the original CC request in the queue; in this case the terminating AS shall continue to monitor destination B, shall not restart the timer CC-T7, shall stop timer CC-T9 and shall send a 486 (Busy Here) response with a Call-Info header field with a "purpose" header field parameter set to "call-completion" to the originating AS.

- d) No CC call as result:

If no CC call results from the CC recall mechanism, the recall timer CC-T9 expires. In this case the terminating AS shall send a NOTIFY request to the originating AS according to RFC 3265 [6] and RFC 6910 [5]. The terminating AS shall populate the NOTIFY request as follows:

- a Request-URI set to the URI of the originating AS as received in the Contact header field of the SUBSCRIBE request;
- a To header field set to the URI of UE-A as received in the From header field of the SUBSCRIBE request;
- a From header field set to the URI of UE-B as received in the To header field of the SUBSCRIBE request;
- a Subscription-State header field set to 'terminated'; and
- the "reason" Subscription-State header field parameter set to 'rejected'.

4.5.4.4 Actions at the terminating UE

Basic call procedures according to 3GPP TS 24.229 [2] shall apply.

4.5.5 SIP specific Event Notifications

SIP specific Event Notifications shall be used in accordance with RFC 3265 [6] including as referenced in IETF RFC 6910 [5].

4.6 Interaction of Call-Completion with other services

4.6.1 Communication waiting (CW)

The CW AS shall not invoke the CW service on a CC recall.

NOTE 1: For a waiting communication, destination B is not considered as busy.

If the communication waiting indication cannot be given at the destination B, user A will receive busy indication and can invoke the CCBS service to destination B.

NOTE 2: Procedures for the case the CC call encounters busy again are described in subclause 4.5.4.3.4.2.

4.6.2 Communication Hold (HOLD)

No impact, i.e. neither service shall affect the operation of the other service.

NOTE: When receiving a CC recall indication, user A can invoke the communication hold service in order to make interface resources available for the establishment of the CC call.

4.6.3 Terminating Identification Presentation (TIP)

No impact, i.e. neither service shall affect the operation of the other service.

4.6.4 Terminating Identification Restriction (TIR)

The TIR AS shall enforce the privacy settings of the CC recall answer on the CC call and if necessary on the subsequent communication, if the CC recall was invoked via 3pcc procedures.

4.6.5 Originating identification presentation (OIP)

No impact, i.e. neither service shall affect the operation of the other service.

4.6.6 Originating identification restriction (OIR)

The OIR AS shall enforce the privacy settings of the originating call on the CC call.

The OIR AS shall enforce the privacy settings of the originating call for SUBSCRIBE and NOTIFY requests when CC is invoked.

4.6.7 Conference calling (CONF)

No impact, i.e. neither service shall affect the operation of the other service.

4.6.8 Communication diversion services (CDIV)

4.6.8.1 General

The CDIV AS shall not divert a CC recall. The CDIV AS shall give a CC recall to user A at user A's original location.

4.6.8.2 Communication Forwarding Unconditional

For CFU activated by B before A requests CC on B:

- If user B has activated CFU, and the forwarded communication results in a call-completion condition at user C, the CC AS shall inform user A that CC is possible at user C. If user A activates CC and subsequently activates CFU, the CDIV AS shall give the CC recall to user A at his original location.
As a network option, in case of a diversion at user B, the CC AS shall not inform user A that CC is possible.

For CFU activated by B after A requests CC on B:

- If user B activates CFU after user A has activated CC on user B, then the CC AS shall revoke the CC request by sending a NOTIFY request to the originating AS as described in subclause 4.5.4.3.3.1 with the "reason" Subscription-State header field parameter set to 'noresource'. The CC AS serving user A shall send a notification "CC cancelled" to the user A.
As a network option, the CC AS shall suspend the CC request until user B deactivates CFU. If the service duration timer CC-T7 expires before user B deactivates CFU, the CC AS shall revoke the CC request as described in subclause 4.5.4.3.3.2.

NOTE: How the "CC cancelled" notification is sent to user A is FFS.

4.6.8.3 Communication forwarding busy

For CFB activated by B before A requests CC:

- If user B has activated CFB and is busy, and the forwarded communication results in a call-completion condition at user C, the CC AS shall inform user A that CC is possible at user C.
As a network option, the CC AS shall inform user A that CCBS at user B is possible.

For CFB activated by B after A requests CC on B:

- If user B activates CFB after user A has activated CC on user B, a CC call from user A which encounters a busy condition at user B shall be treated as follows:
 - user B shall be considered as being busy and the CC AS shall apply the procedures of CCBS; or
 - the CDIV AS shall forward the communication as a normal communication.

4.6.8.4 Communication forwarding no reply

For CFNR activated by B before A requests CC:

- If user B has activated CFNR and does not answer the communication, and the forwarded communication results in a call-completion condition at user C, the CC AS shall inform user A that CC is possible at user C.
As a network option, the CC AS shall inform user A that CCNR at user B is possible.

For CFNR activated by B after A requests CC on B:

- If user B activates CFNR after user A has activated CC on user B, a CC call from user A which encounters a no reply condition at user B shall be treated as follows:
 - the CC AS shall apply the procedures of CCNR; or
 - the CDIV AS shall forward the communication as a normal communication.

4.6.8.5 Communication forwarding not registered

For CFNL activated by B before A requests CC on B:

- If user B has activated CFNL and is not logged in, and the forwarded communication results in a call-completion condition at user C, the CC AS shall inform user A that CC is possible at user C.
As a network option, the CC AS shall inform user A that CCNR at user B is possible.

For CFNL activated by B after A requests CC on B:

- If user B activates CFNL after user A has activated CC on user B, then the CC AS shall cancel the CC request and shall send a notification "CCBS cancelled" to the user A.
As a network option, the CC AS shall suspend the CC request until user B deactivates CFNL. If the service duration timer CC-T3 expires before user B deactivates CFNL, the CC AS shall cancel the CC request.

NOTE: How the "CC cancelled" notification is send to user A is FFS.

4.6.8.6 Communication deflection (CD)

For the originating user A:

- If a communication to the called user B is deflected to user C by the CD service and results in a call-completion condition at user C, the CC AS shall inform user A that CC is possible at user C. The CDIV AS shall not deflect a CC recall.

For the called user B:

- The CDIV AS shall not deflect a CC call.

4.6.9 Advice of charge (AOC)

Charging information can be given for the original communication, and for the resulting CCBS communication.

4.6.10 Completion of communications (CCBS/CCNR)

A user can be both a "user A" and a "user B" simultaneously, i.e. that user can have activated the CC service and have CC requests outstanding whilst at the same time that user can be the destination of CC requests from other users.

The CC AS shall handle CC requests activated by this user (the user's queue A) with priority over CC requests activated by other users on this user (the user's queue B), see subclause 4.5.4.3.4.1.1.

4.6.11 Malicious communication identification (MCID)

No impact, i.e. neither service shall affect the operation of the other service.

4.6.12 Anonymous Communication Rejection and Communication Barring (ACR/CB)

No impact, i.e. neither service shall affect the operation of the other service.

4.6.13 Message Waiting Indication (MWI)

No impact, i.e. neither service shall affect the operation of the other service.

4.6.14 Explicit Communication Transfer (ECT)

Editor's note: For further studies. For ECT with REFER the transferee does not know to who he sends the INVITE, and if the SUBSCRIBE is sent on another dialog, the SUBSCRIBE may not reach the target AS.

4.6.15 Flexible Alerting (FA)

No impact, i.e. neither service shall affect the operation of the other service.

4.6.16 Customized Alerting Tones (CAT)

No impact, i.e. neither service shall affect the operation of the other service.

4.7 Void

4.8 Parameter values (timers)

4.8.1 Timers referring to the originating AS

CC-T1 Retention timer. This timer specifies the amount of time that the network retains the communication information of the original communication which was not established successfully. After being informed that CC is possible the caller sends a CC invocation request before expiry of this timer. The minimum value of this timer is 15 seconds.

CC-T2 CC request operation timer. Supervision of response to a CC activation request sent from the originating AS to the terminating AS. CC-T2 will expire if signalling is not possible, at signalling failures, or if the terminating AS cannot respond. The minimum value of this timer is 10 seconds.

CC-T3 CC service duration timer. This timer specifies the maximum time the service will remain activated for user A. The maximum value of this timer is 180 minutes.

NOTE: The value of the CC service duration timer can differ in the network dependent on its usage for CCBS or CCNR.

CC-T4 CC recall timer. This timer specifies the maximum time the originating AS will wait for a response from user A to a CC recall. The maximum value of this timer is 20 seconds.

CCNR-T5 No-reply timer. This timer specifies the maximum time after which the originating AS will provide the announcement that CCNR is possible, and inband activation is possible. The maximum value of this timer is 20 seconds.

4.8.2 Timers referring to the terminating AS

CC-T7 CC service duration timer CC-T7 expiry will only be meaningful if the expiry of CC-T3 has not been notified to the terminating AS. CC-T7 takes a longer duration than CC-T3, i.e. CC-T7 expires at abnormal situations only. The maximum value of this timer is 190 minutes. When CC-T7 expires, the CC request will be cancelled at the terminating AS as well as at the originating AS.

NOTE: The value of the CC service duration timer can differ in the network dependent on its usage for CCBS or CCNR.

CC-T8 Destination B idle guard timer. This timer specifies the amount of time the terminating AS will delay after destination B has become free, before initiating a CC recall towards the originating AS. The maximum value of this timer is 10 seconds.

CC-T9 Recall timer. CC-T9 should expire at emergency only, i.e. the recall should be cancelled by CC-T4 at the originating AS if recall is not responded to. Duration of CC-T9 = 20 seconds + some seconds for CC call set-up. The maximum value is 30 seconds.

4.9 Communication completion configuration XCAP application usage

4.9.1 General

Communication completion configuration documents are sub-trees of the sirmservs XML document specified in 3GPP TS 24.623 [4]. As such, communication completion configuration documents use the XCAP application usage in 3GPP TS 24.623 [4].

Data semantics: The semantics of the communication completion XML configuration document is specified in subclause 4.9.2.

XML schema: Implementations in compliance with this specification shall implement the XML schema that minimally includes the XML Schema defined in subclause 4.9.3 and the *simservs* XML schema specified in subclause 6.3 of 3GPP TS 24.623 [4].

4.9.2 Data semantics

The active attribute of <communication-completion> element indicates whether the communication completion service is activated or not.

The <communication-completion> element contains an optional <CCBS-CC-T3-timer> and optional <CCNR-CC-T3-timer> elements.

The <CCBS-CC-T3-timer> is a read-only element and indicates the value, in minutes, of the CC-T3 of the CCBS.

The <CCNR-CC-T3-timer> is a read-only element and indicates the value, in minutes, of the CC-T3 of the CCNR.

4.9.3 XML schema

```
<?xml version="1.0" encoding="UTF-8"?>
<xs:schema xmlns:ss="http://uri.etsi.org/ngn/params/xml/simservs/xcap"
  xmlns:xs="http://www.w3.org/2001/XMLSchema"
  targetNamespace="http://uri.etsi.org/ngn/params/xml/simservs/xcap"
  elementFormDefault="qualified" attributeFormDefault="unqualified"
  >

<xs:include schemaLocation="XCAP.xml"/>

<xs:element name="communication-completion" substitutionGroup="ss:absService">
  <xs:annotation>
    <xs:documentation>communication completion</xs:documentation>
  </xs:annotation>

  <xs:complexType>
    <xs:complexContent>
      <xs:extension base="ss:simservType">
        <xs:sequence>
          <xs:element name="CCBS-CC-T3-timer" type="xs:positiveInteger" minOccurs="0"/>
          <xs:element name="CCNR-CC-T3-timer" type="xs:positiveInteger" minOccurs="0"/>
          <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
        </xs:sequence>
        <xs:anyAttribute namespace="##any" processContents="lax"/>
      </xs:extension>
    </xs:complexContent>
  </xs:complexType>
</xs:element>

</xs:schema>
```

4.10 Communication completion request records

4.10.1 General

The communication completion request records XCAP application usage allows a UE to interrogate the communication completion AS to find out a list of the currently pending communication completion requests originated by a public user identity registered at the UE.

The communication completion AS shall support acting as XCAP server as specified in IETF RFC 4825 [10] providing the communication completion request records XCAP application usage as specified in subclause 4.10.2 and shall support acting as notifier of the changes in the communication completion request records XML document using RFC 5875 [9].

The UE may support acting as XCAP client as specified in IETF RFC 4825 [10] accessing the communication completion request records XCAP application usage as specified in subclause 4.10.2 and may support acting as subscriber for the changes in the communication completion request records XML document using RFC 5875 [9].

4.10.2 Communication completion request records XCAP application usage

4.10.2.1 Application Unique ID (AUID)

The AUID of the communication completion request records XCAP application usage is "org.3gpp.ccrri"

4.10.2.2 XML schema

The communication completion request records XML documents are composed according to the XML schema defined in this subclause.

```
<?xml version="1.0" encoding="UTF-8"?>
<xs:schema
  xmlns:xs="http://www.w3.org/2001/XMLSchema"
  xmlns:ccrr="urn:3gpp:ns:ccrr:1.0"
  targetNamespace="urn:3gpp:ns:ccrr:1.0"
  elementFormDefault="qualified"
  attributeFormDefault="unqualified">

  <xs:element name="cc-records" type="ccrr:Tcomm-completion-req-records"/>

  <xs:complexType name="Tcomm-completion-req-records">
    <xs:sequence>
      <xs:element ref="ccrr:cc-entry" minOccurs="0" maxOccurs="unbounded"/>
      <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xs:sequence>
    <xs:anyAttribute namespace="##any" processContents="lax"/>
  </xs:complexType>

  <xs:element name="cc-entry" type="ccrr:Tcomm-completion-entry"/>

  <xs:complexType name="Tcomm-completion-entry">
    <xs:sequence>
      <xs:element name="orig-URI" type="xs:anyURI"/>
      <xs:element name="called-URI" type="xs:anyURI"/>
      <xs:element name="term-URI" type="xs:anyURI" minOccurs="0"/>
      <xs:element name="expiration" type="xs:dateTime"/>
      <xs:any namespace="##other" processContents="lax" minOccurs="0" maxOccurs="unbounded"/>
    </xs:sequence>
    <xs:attribute name="id" type="xs:string" use="required"/>
    <xs:anyAttribute namespace="##any" processContents="lax"/>
  </xs:complexType>
</xs:schema>
```

4.10.2.3 Default document namespace

The default namespace of the communication completion request records XCAP application usage is "urn:3gpp:ns:ccrr:1.0"

4.10.2.4 MIME type

The MIME type of the communication completion request records XML document is specified in annex C.

4.10.2.5 Validation constraints

No additional constraints beyond those defined by IETF RFC 4825 [10] are defined.

4.10.2.6 Data semantics

The communication completion request records XML document contains a root element <cc-records> containing a list of <cc-entry> child elements.

The <cc-entry> element contains information related to a particular pending communication completion request. The <cc-entry> element contains a <orig-URI> element, a <called-URI> element, an optional <term-URI> child element and a <expiration> child element.

The <orig-URI> element contains the identity of the caller.

The <called-URI> element contains the identity called by the caller.

The <term-URI> element contains the identity where the call was routed to. The <term-URI> element is included in the <cc-entry> element, if the identity where the call was routed to was provided by the terminating side and unless the privacy was requested.

The <expiration> element indicates the expiration of the communication completion request.

4.10.2.7 Naming conventions

When stored in a directory of a user within the "users" subdirectory of the communication completion request records XCAP application usage, the filename of the communication completion request records XML document is "index".

4.10.2.8 Resource interdependencies

When the communication completion request records XML document is stored in a directory of a user identified by a URI within the "users" subdirectory of the communication completion request records XCAP application usage, then the <orig-URI> elements contain the URI of the user owning the document.

4.10.2.9 Authorization policies

The owner of the communication completion request records XML document is allowed to read the XML document.

Annex A (informative): Signalling flows

A.1 CCBS activation and CCBS call

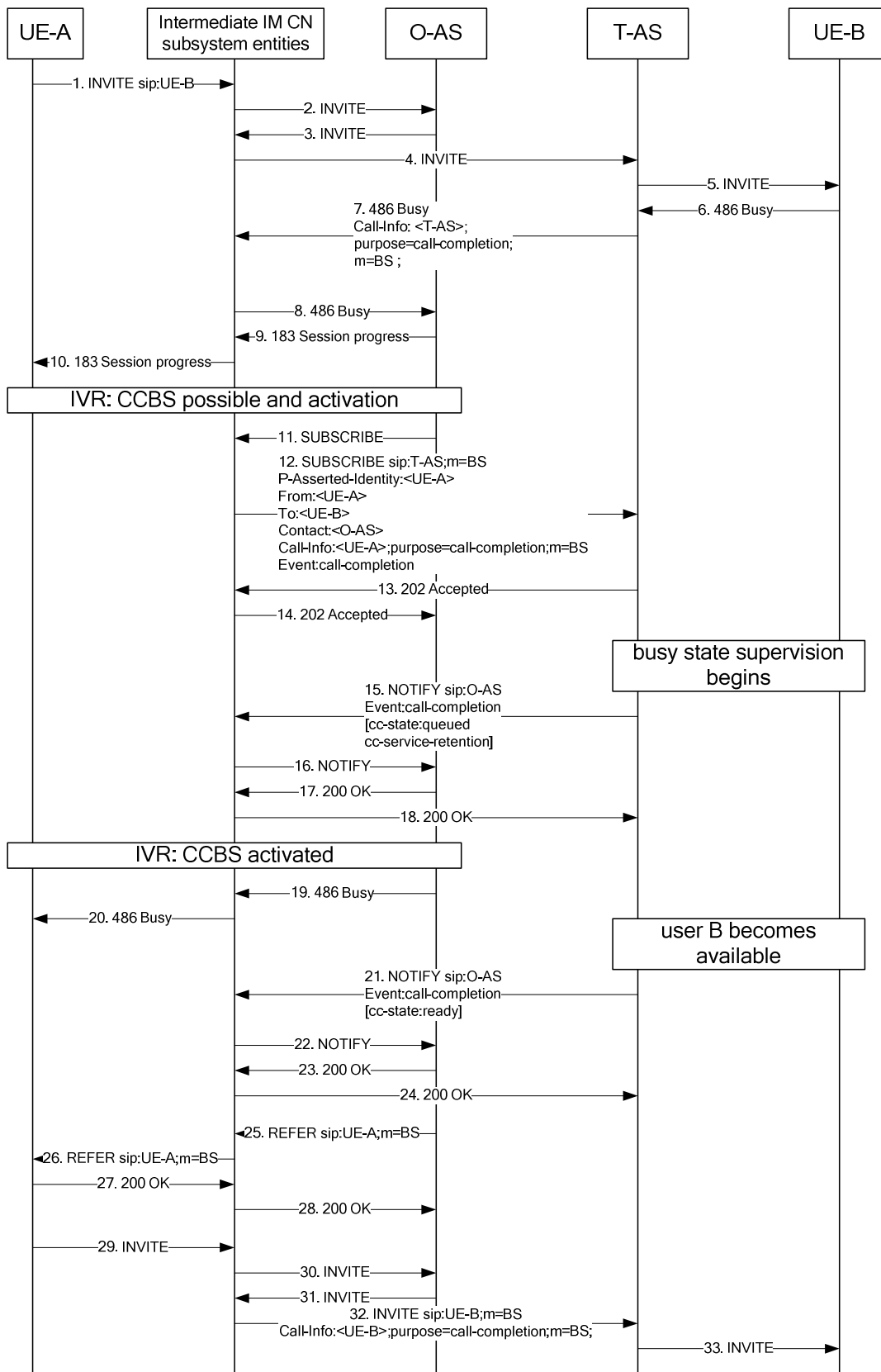


Figure A.1.1: CCBS activation and CCBS call

Figure A.1.1 shows a basic signalling flow for a CCBS activation and a CCBS call.

Call flows

1 to 5: The communication is initiated by UE-A by sending an INVITE request. The Request-URI will include the URI of UE-B. After IFC evaluation in the S-CSCF the INVITE request is routed to the originating AS and after that to the terminating AS and further on to UE-B.

Table A.1-1: SIP INVITE request (UE to P-CSCF)

```

INVITE sip:user2_public2@home2.net SIP/2.0
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd]:1357;comp=sigcomp;branch=z9hG4bKnashds7
Max-Forwards: 70
Route: sip:pcscf1.home1.net:7531;lr;comp=sigcomp>, <sip:orig@scscf1.home1.net;lr>
Accept-Contact: *;+g.3gpp.icsi-ref="urn%3Aurn-7%3gpp-service.ims.icsi.mmtel"
Privacy: none
From: <sip:user1_public1@home1.net>; tag=171828
To: <sip:user2_public2@home2.net>
Call-ID: cb03a0s09a2sdfglkj490333
Cseq: 127 INVITE
Supported: 100rel; precondition, gruu, 199
Require: sec-agree
Contact: <sip:user1_public1@home1.net;gr=urn:uuid:f81d4fae-7dec-11d0-a765-
00a0c91e6bf6>;+g.3gpp.icsi-ref="urn%3Aurn-7%3gpp-service.ims.icsi.mmtel"
Allow: INVITE, ACK, CANCEL, BYE, PRACK, UPDATE, INFO, REFER
Accept: application/sdp,application/3gpp-ims+xml
Content-Type: application/sdp
Content-Length: (...)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::aaa:bbb:ccc:ddd
t=0 0
m=video 3400 RTP/AVP 98 99
b=AS:75
a=crr:qos local none
a=crr:qos remote none
a=des:qos mandatory local sendrcv
a=des:qos none remote sendrcv
a=inactive
a=rtpmap:98 H263
a=fmtp:98 profile-level-id=0
a=rtpmap:99:MPVMP4V-ES
m=audio 3456 RTP/AVP 97 96
b=AS:25.4
a=crr:qos local none
a=crr:qos remote none
a=des:qos mandatory local sendrcv
a=des:qos none remote sendrcv
a=inactive
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
a=rtpmap:96 telephone-event

```

- 6: UE-B answers with a 486 (Busy Here) response. The 486 (Busy Here) response is routed back to the terminating AS.
- 7 to 8: The terminating AS inserts a Call-Info header field in the 486 (Busy Here) response according to the procedures described in RFC 6910 [5]. The Call-Info header field will contain the URI of the terminating AS with an "m" header field parameter set to "BS" (busy subscriber). It further includes a "purpose" header field parameters set to "call-completion". The 486 (Busy Here) response is routed back to the originating AS.

Table A.1-2: 486 (Busy Here) response (Terminating AS to S-CSCF)

```

SIP/2.0 486 Busy Here
Via: SIP/2.0/UDP tas.home2.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
    scscf2.home2.net;branch=z9hG4bK344a65.1, SIP/2.0/UDP
    icscf2_s.home2.net;branch=z9hG4bKj5hgrt2o, SIP/2.0/UDP
    scscf1.home1.net;branch=z9hG4bKehuehjgt, SIP/2.0/UDP oas.home1.net;branch=z9hG4bKnashds7,
    SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1,
    [5555::aaa:bbb:ccc:ddd]:1357;comp=sigcomp;branch=z9hG4bKnashds7
From: <sip:user1_public1@home1.net>;tag=171828
To: <sip:user2_public2@home2.net>;tag=314159
Call-ID: cb03a0s09a2sdfglkj490333
CSeq: 127 INVITE
Retry-After: 3600
Contact: <sip:user2_public2@visited2.net;gr=urn:uuid:f81d4fae-7dec-11d0-a765-
    00a0c91ewxyz>;+g.3gpp.icsi-ref="urn%3Aurn-7%3gpp-service.ims.icsi.mmtel"
Content-Length: 0
Call-Info:<sip:tas.home2.net>;purpose=call-completion;m=BS

```

9 to 10: The originating AS sends back a 183 (Session Progress) response to UE-A and initiates IVR procedures. User A is informed that CCBS is possible. User A activates CCBS.

11 to 12: The originating AS subscribes for the call-completion event package according to the procedures described in RFC 6910 [5] at the terminating AS. The originating AS generates a SUBSCRIBE request which Request-URI will include the URI of the terminating AS. In order to mark the SUBSCRIBE request as a request for CCBS, the originating AS adds the "m" SIP URI parameter with the value "BS" to the Request-URI. The From header field will include the caller URI. The To header field will include the callee URI.

Table A.1-3: SUBSCRIBE request (Originating AS to S-CSCF)

```

SUBSCRIBE sip:tas.home2.net;m=BS SIP/2.0
Via: SIP/2.0/UDP oas.home1.net;branch=z9hG4bKnashds7
Max-Forwards: 70
Route: <sip:scscf1.home1.net>
P-Asserted-Identity: <sip:user1_public1@home1.net>
From: <sip:user1_public1@home1.net>;tag=31415
To: <sip:user2_public2@home2.net>
Call-ID: b89rjhnedlrfjflslj40a222
Call-Info:<sip:user1_public1@home1.net>;purpose=call-completion;m=BS
CSeq: 61 SUBSCRIBE
Event: call-completion
Expires: 2700
Contact: <sip:oas.home1.net>
Content-Length: 0

```

13 to 14 The terminating AS accepts the subscription and starts busy state supervision procedures on the callee.

Table A.1-4: 202 (Accepted) response (Terminating AS to S-CSCF)

```

SIP/2.0 202 Accepted
Via: SIP/2.0/UDP scscf2.home2.net;branch=z9hG4bK344a65.1, SIP/2.0/UDP
    icscf2_s.home2.net;branch=z9hG4bKj5hgrt2o, SIP/2.0/UDP
    scscf1.home1.net;branch=z9hG4bKehuehjgt, SIP/2.0/UDP oas.home1.net;branch=z9hG4bKnashds7
Record-Route:
From:
To: <sip:user2_public2@home2.net>;tag=151170
Call-ID:
CSeq:
Event:
Expires: 2700
Contact: <sip:tas.home2.net>
Content-Length:

```

15 to 18: The terminating AS sends a notification to the originating AS, according to the procedures described in RFC 6910 [5]. The Request-URI of the NOTIFY request will include the URI of the originating AS. The body contains parameters informing of the caller's call-completion state 'queued' and the availability of the call-

completion service retention at the terminating AS. After confirmation of the notification the originating AS starts announcements procedures informing about the activation of CCBS.

Table A.1-5: NOTIFY request (Terminating AS to S-CSCF)

```
NOTIFY sip:oas.home1.net SIP/2.0
Via: SIP/2.0/UDP tas.home2.net;branch=z9hG4bK348923.1
Max-Forwards: 70
Route: <sip:scscf2.home2.net>
P-Asserted-Identity: <sip:tas.home2.net>
From: <sip:user2_public2@home2.net>;tag=151170
To: <sip:user1_public1@home1.net>;tag=31415
Call-ID: b89rjhnedlrfjflslj40a222
CSeq: 42 NOTIFY
Subscription-State: active ;expires=2699
Event: call-completion
Contact: <sip:tas.home2.net>
Content-Type: application/call-completion
Content-Length: (...)

cc-state: queued
cc-service retention
```

19 to 20: The originating AS forwards the 486 (Busy Here) response to UE-A.

21 to 24: The terminating AS sends a NOTIFY request to the originating AS, according to the procedures described in RFC 6910 [5]. The body contains a parameter informing of the caller's call-completion state 'ready' (for recall). The originating AS confirms the notification.

Table A.1-6: NOTIFY request (Terminating AS to S-CSCF)

```
NOTIFY sip:oas.home1.net SIP/2.0
Via: SIP/2.0/UDP tas.home2.net;branch=z9hG4bK348923.1
Max-Forwards: 70
Route: <sip:scscf2.home2.net>
P-Asserted-Identity: <sip:tas.home2.net>
From: <sip:user2_public2@home2.net>;tag=151170
To: <sip:user1_public1@home1.net>;tag=31415
Call-ID: b89rjhnedlrfjflslj40a222
CSeq: 47 NOTIFY
Subscription-State: active ;expires=1800
Event: call-completion
Contact: <sip:tas.home2.net>
Content-Type: application/call-completion
Content-Length: (...)

cc-state: ready
cc-service retention
```

25 to 28: The originating AS initiates the CCBS recall to UE A (by sending a REFER request, the "m" SIP URI parameter set to "BS" will be included in the Request-URI of the REFER request. UE-A confirms the REFER request.

Table A.1-7: REFER request (Originating AS to S-CSCF)

```

REFER sip:user1_public1@home1.net;m=BS SIP/2.0
Via: SIP/2.0/UDP oas.home1.net;branch=z9hG4bK23273846
Max-Forwards: 70
Route: <sip:scscf1.home1.net;lr>
P-Asserted-Identity: <sip:oas.home1.net>
From: <sip:oas.home1.net>; tag=161828
To: <sip:user1_public1@home1.net>
Call-ID: cb03a0s09a2sdfg1kj490333
Cseq: 127 REFER
Refer-To: <sip:user2_public2@home2.net;method=INVITE>
Referred-By: <sip:oas.home1.net>
Contact: <sip:oas.home1.net>
Content-Length: 0

```

29 to 30: UE-A starts the CCBS call by sending an INVITE request to UE-B.

31 to 33: In order to mark the INVITE request as a prioritized request for call-completion, the originating AS adds the "m" SIP URI parameter with the value 'BS' to the Request-URI.

Table A.1-8: SIP INVITE request (Originating AS to S-CSCF)

```

INVITE sip:user2_public2@home2.net;m=BS SIP/2.0
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd]:1357;comp=sigcomp;branch=z9hG4bKnashds7
Max-Forwards: 70
Route: sip:pcscf1.home1.net:7531;lr;comp=sigcomp>, <sip:orig@scscf1.home1.net;lr>
Accept-Contact: *;+g.3gpp.icsi-ref="urn%3Aurn-7%3gpp-service.ims.icsi.mmtel"
Privacy: none
From: <sip:user1_public1@home1.net>; tag=171829
To: <sip:user2_public2@home2.net>
Call-ID: cb03a0s09a2sdfg1kj490444
Call-Info:<sip:user1_public1@home1.net>;purpose=call-completion;m=BS
Cseq: 154 INVITE
Supported: 100rel, precondition, gruu, 199
Require: sec-agree
Contact: <sip:user1_public1@home1.net;gr=urn:uuid:f81d4fae-7dec-11d0-a765-
00a0c91e6bg6>;+g.3gpp.icsi-ref="urn%3Aurn-7%3gpp-service.ims.icsi.mmtel"
Allow: INVITE, ACK, CANCEL, BYE, PRACK, UPDATE
Accept: application/sdp,application/3gpp-ims+xml
Content-Type: application/sdp
Content-Length: (...)

```

A.2 CCBS suspend and resume procedures

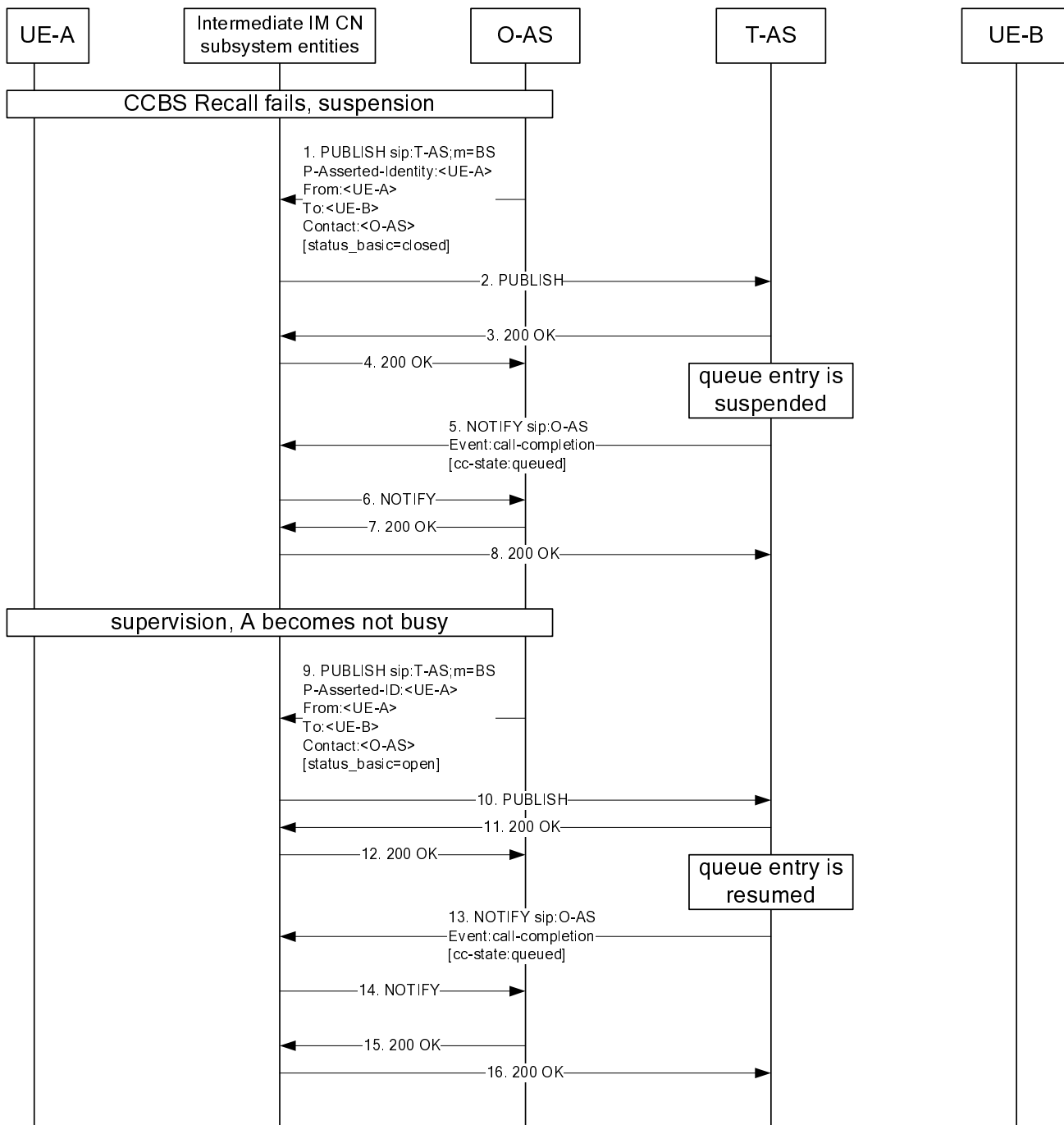


Figure A.2.1: CCBS suspend and resume procedures

Figure A.2.1 shows a basic signalling flow for CCBS suspend and resume procedures.

Call flows

1 to 4: UE-A is busy and the CCBS recall fails. The originating AS initiates the suspension procedure. It generates a PUBLISH request according to the procedures described in RFC 6910 [5]. The Request-URI of the PUBLISH request includes the URI of the terminating AS. The From header field includes the URI of UE-A and the To header field includes the URI of UE-B. The body of the PUBLISH request indicates the PIDF state 'closed'.

Table A.2-1: PUBLISH request (Originating AS to S-CSCF)

```

PUBLISH sip: sip:tas.home2.net@home1.net;m=BS SIP/2.0
Via: SIP/2.0/UDP oas.home1.net;branch=z9hG4bKnashds7
Max-Forwards: 70
Route: <sip:scscf1.home1.net>
P-Asserted-Identity: <sip:user1_public1@home1.net>
From: <sip:user1_public1@home1.net>;tag=31415
To: <sip:user2_public2@home2.net>; tag=151170
Call-ID: b89rjhnedlrfjflslj40a222
CSeq: 71 PUBLISH
Event: presence
Expires: 1800
Content-Type: application/pidf+xml
Content-Length: (...)

<?xml version="1.0" encoding="UTF-8"?>
  <presence xmlns="urn:ietf:params:xml:ns:pidf"
            xmlns:rpid="urn:ietf:params:xml:ns:pidf:rpid"
            xmlns:dm="urn:ietf:params:xml:ns:pidf:data-model"
            xmlns:pcp="urn:ietf:params:xml:ns:pidf:caps"
            xmlns:c="urn:ietf:params:xml:ns:pidf:cipid"
            entity="pres:user2_public1@home2.net">

    <tuple id="a8098a.672364762364">
      <status>
        <basic>closed</basic>
      </status>
    </tuple>

  </presence>

```

5 to 8: The terminating AS suspends the queue entry and sends a NOTIFY request to the originating AS, according to the procedures described in RFC 6910 [5]. The body contains a parameter informing of the caller's call-completion state 'queued'. The originating AS starts busy state supervision procedures on UE-A.

Table A.2-2: NOTIFY request (Terminating AS to S-CSCF)

```

NOTIFY sip:oas.home1.net SIP/2.0
Via: SIP/2.0/UDP tas.home2.net;branch=z9hG4bK348923.1
Max-Forwards: 70
Route: <sip:scscf2.home2.net>
P-Asserted-Identity: <sip:tas.home2.net>
From: <sip:user2_public2@home2.net>;tag=151170
To: <sip:user1_public1@home1.net>;tag=31415
Call-ID: b89rjhnedlrfjflslj40a222
CSeq: 72 NOTIFY
Subscription-State: active ;expires=1795
Event: call-completion
Contact: <sip:tas.home2.net>
Content-Type: application/call-completion
Content-Length: (...)

cc-state: queued
cc-service retention

```

9 to 12: UE-A becomes not busy. The originating AS initiates the resumption procedure. It generates a PUBLISH request according to the procedures described in RFC 6910 [5]. The Request-URI of the PUBLISH request includes the URI of the terminating AS. The From header field includes the URI of UE-A and the To header field includes the URI of UE-B. The body of the PUBLISH request indicates the PIDF state 'open'.

Table A.2-3: PUBLISH request (Originating AS to S-CSCF)

```

PUBLISH sip: sip:tas.home2.net@home1.net;m=BS SIP/2.0
Via: SIP/2.0/UDP oas.home1.net;branch=z9hG4bKnashds7
Max-Forwards: 70
Route: <sip:scscf1.home1.net>
P-Asserted-Identity: <sip: user1_public1@home1.net>
From: <sip:user1_public1@home1.net>;tag=31416
To: <sip:user2_public2@home2.net>; tag=151170
Call-ID: b89rjhnedlrfjflslj40a222
CSeq: 85 PUBLISH
Event: presence
Expires: 1100
Content-Type: application/pidf+xml
Content-Length: (...)

<?xml version="1.0" encoding="UTF-8"?>
  <presence xmlns="urn:ietf:params:xml:ns:pidf"
            xmlns:rpid="urn:ietf:params:xml:ns:pidf:rpid"
            xmlns:dm="urn:ietf:params:xml:ns:pidf:data-model"
            xmlns:pcp="urn:ietf:params:xml:ns:pidf:caps"
            xmlns:c="urn:ietf:params:xml:ns:pidf:cipid"
            entity="pres:user2_public1@home2.net">

    <tuple id="a8098a.672364762364">
      <status>
        <basic>open</basic>
      </status>
    </tuple>

  </presence>

```

13 to 16: The terminating AS resumes the queue entry and sends a NOTIFY request to the originating AS, according to the procedures described in RFC 6910 [5]. The body contains a parameter informing of the caller's call-completion state 'queued'.

Table A.2-4: NOTIFY request (Terminating AS to S-CSCF)

```

NOTIFY sip:oas.home1.net SIP/2.0
Via: SIP/2.0/UDP tas.home2.net;branch=z9hG4bK348923.1
Max-Forwards: 70
Route: <sip:scscf2.home2.net>
P-Asserted-Identity: <sip:tas.home2.net>
From: <sip:user2_public2@home2.net>;tag=151170
To: <sip:user1_public1@home1.net>;tag=31415
Call-ID: b89rjhnedlrfjflslj40a222
CSeq: 86 NOTIFY
Subscription-State: active ;expires=1095
Event: call-completion
Contact: <sip:tas.home2.net>
Content-Type: application/call-completion
Content-Length: (...)

cc-state: queued
cc-service retention

```

A.3 CCNR activation

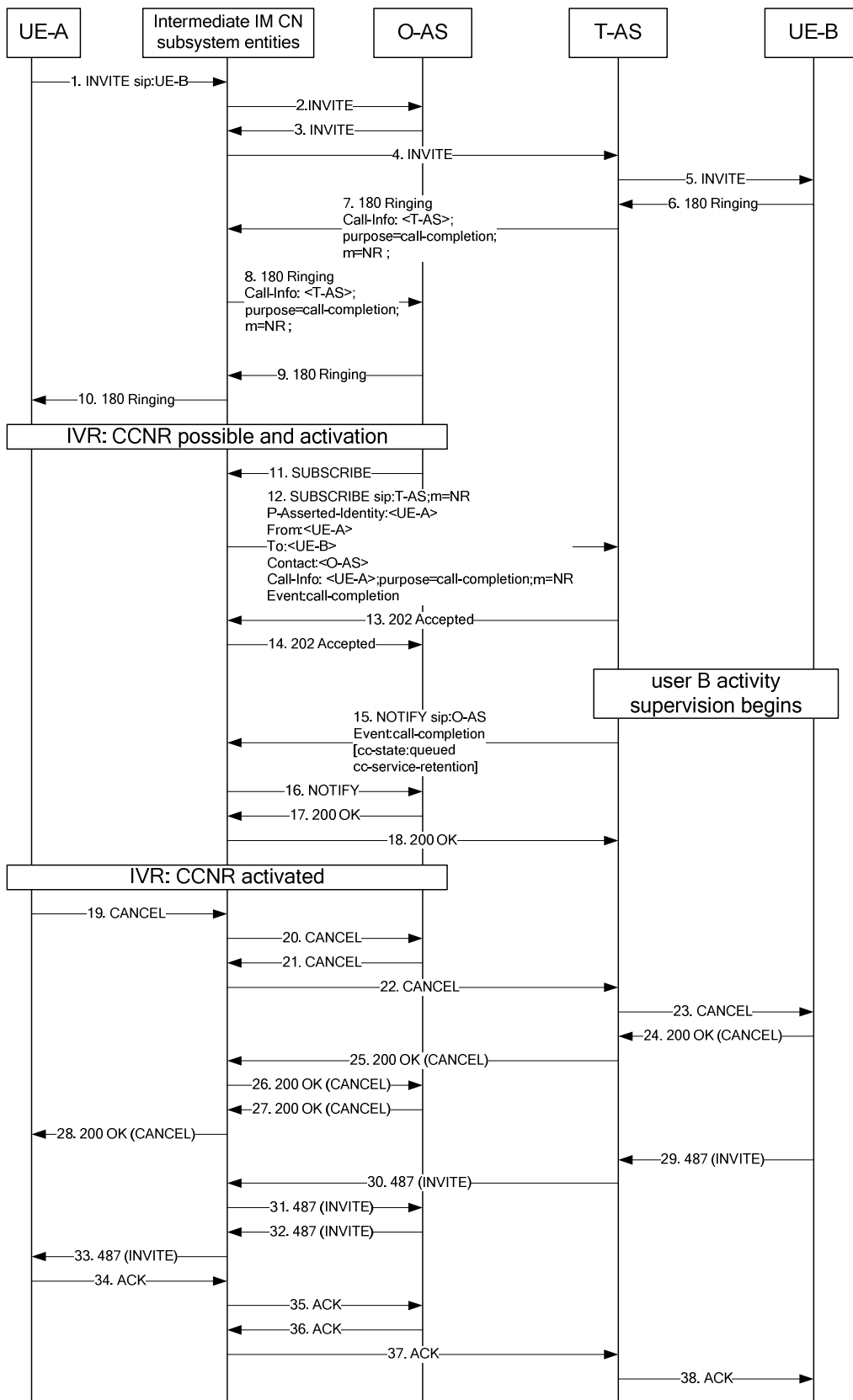


Figure A.3.1: CCNR activation

Figure A.3.1 shows a basic signalling flow for a CCNR activation.

Call flows

- 1 to 5: The communication is initiated by UE-A by sending an INVITE request. The Request-URI will include the URI of UE-B. After IFC evaluation in the S-CSCF the INVITE request is routed to the originating AS and after that to the terminating AS and further on to UE-B.

Table A.3-1: SIP INVITE request (UE to P-CSCF)

```

INVITE sip:user2_public2@home2.net SIP/2.0
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd]:1357;comp=sigcomp;branch=z9hG4bKnashds7
Max-Forwards: 70
Route: sip:pcscf1.home1.net:7531;lr;comp=sigcomp>, <sip:orig@scscf1.home1.net;lr>
Accept-Contact: *;+g.3gpp.icsi-ref="urn%3Aurn-7%3gpp-service.ims.icsi.mmtel"
Privacy: none
From: <sip:user1_public1@home1.net>; tag=171828
To: <sip:user2_public2@home2.net>
Call-ID: cb03a0s09a2sdfglkj490333
Cseq: 127 INVITE
Supported: 100rel; precondition, gruu, 199
Require: sec-agree; replaces
Contact: <sip:user1_public1@home1.net;gr=urn:uuid:f81d4fae-7dec-11d0-a765-00a0c91e6bf6>;+g.3gpp.icsi-ref="urn%3Aurn-7%3gpp-service.ims.icsi.mmtel"
Allow: INVITE, ACK, CANCEL, BYE, PRACK, UPDATE
Accept: application/sdp,application/3gpp-ims+xml
Content-Type: application/sdp
Content-Length: (...)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::aaa:bbb:ccc:ddd
t=0 0
m=video 3400 RTP/AVP 98 99
b=AS:75
a=crr:qos local none
a=crr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=inactive
a=rtpmap:98 H263
a=fmtp:98 profile-level-id=0
a=rtpmap:99:MPVMP4V-ES
m=audio 3456 RTP/AVP 97 96
b=AS:25.4
a=crr:qos local none
a=crr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=inactive
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
a=rtpmap:96 telephone-event

```

- 6: UE-B answers with a 180 (Ringing) response. The 180 (Ringing) response is routed back to the terminating AS.
- 7 to 8: The terminating AS inserts a Call-Info header field in the 180 (Ringing) response according to the procedures described in RFC 6910 [5]. The Call-Info header field will contain the URI of the terminating AS with a "m" header field parameter set to "NR" (no reply). It further includes a "purpose" header field parameter set to "call-completion". The 180 (Ringing) response is routed back to the originating AS.

Table A.3-2: 180 Ringing (Terminating AS to S-CSCF)

```

SIP/2.0 180 Ringing
Via: SIP/2.0/UDP tas.home2.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
    scscf2.home2.net;branch=z9hG4bK344a65.1, SIP/2.0/UDP
    icscf2_s.home2.net;branch=z9hG4bKj5hgrt2o, SIP/2.0/UDP
    scscf1.home1.net;branch=z9hG4bKehuehjgt, SIP/2.0/UDP oas.home1.net;branch=z9hG4bKnashds7,
    SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1,
    [5555::aaa:bbb:ccc:ddd]:1357;comp=sigcomp;branch=z9hG4bKnashds7
From: <sip:user1_public1@home1.net>;tag=171828
To: <sip:user2_public2@home2.net>;tag=314159
Call-ID: cb03a0s09a2sdfg1kj490333
CSeq: 127 INVITE
Retry-After: 3600
Contact: <sip:user2_public2@visited2.net;gr=urn:uuid:f81d4fae-7dec-11d0-a765-
    00a0c91ewxyz>;+g.3gpp.icsi-ref="urn:3Aurn-7%3gpp-service.ims.icsi.mm1tel"
Content-Length: 0
Call-Info:<sip:tas.home2.net>;purpose=call-completion;m=NR

```

9 to 10: The originating AS removes the Call-Info header field, forwards the 180 (Ringing) response to UE-A and initiates IVR procedures. User A is informed that CCNR is possible. User A activates CCNR.

11 to 12: The originating AS subscribes for the call-completion event package according to the procedures described in RFC 6910 [5] at the terminating AS. The originating AS generates a SUBSCRIBE request which Request-URI will include the URI of the terminating AS. In order to mark the SUBSCRIBE request as a request for CCNR, the originating AS adds the "m" SIP URI parameter with the value "NR" to the Request-URI. The From header field will include the caller URI. The To header field will include the URI of UE-B.

Table A.3-3: SUBSCRIBE request (Originating AS to S-CSCF)

```

SUBSCRIBE sip:tas.home2.net;m=NR SIP/2.0
Via: SIP/2.0/UDP oas.home1.net;branch=z9hG4bKnashds7
Max-Forwards: 70
Route: <sip:scscf1.home1.net>
P-Asserted-Identity: <sip:user1_public1@home1.net>
From: <sip:user1_public1@home1.net>;tag=31415
To: <sip:user2_public2@home2.net>
Call-ID: b89rjhned1rfjfls1j40a222
CSeq: 61 SUBSCRIBE
Call-Info:<sip:user1_public1@home1.net>;purpose=call-completion;m=NR
Event: call-completion
Expires: 5400
Contact: <sip:oas.home1.net>
Content-Length: 0

```

13 to 14 The terminating AS accepts the subscription and starts supervision procedures on activity of the callee.

Table A.3-4: 202 (Accepted) response (Terminating AS to S-CSCF)

```

SIP/2.0 202 Accepted
Via: SIP/2.0/UDP scscf2.home2.net;branch=z9hG4bK344a65.1, SIP/2.0/UDP
    icscf2_s.home2.net;branch=z9hG4bKj5hgrt2o, SIP/2.0/UDP
    scscf1.home1.net;branch=z9hG4bKehuehjgt, SIP/2.0/UDP oas.home1.net;branch=z9hG4bKnashds7
Record-Route:
From:
To: <sip:user2_public2@home2.net>;tag=151170
Call-ID:
CSeq:
Event:
Expires: 5400
Contact: <sip:tas.home2.net>
Content-Length:

```

15 to 18: The terminating AS sends a notification to the originating AS, according to the procedures described in RFC 6910 [5]. The Request-URI of the NOTIFY request will include the URI of the originating AS. The body contains parameters informing of the caller's call-completion state 'queued' and the availability of the call-completion service retention at the terminating AS. After confirmation of the notification the originating AS starts announcements procedures informing about the activation of CCNR.

Table A.3-5: NOTIFY request (Terminating AS to S-CSCF)

```

NOTIFY sip:oas.home1.net SIP/2.0
Via: SIP/2.0/UDP tas.home2.net;branch=z9hG4bK348923.1
Max-Forwards: 70
Route: <sip:scscf2.home2.net>
P-Asserted-Identity: <sip:tas.home2.net>
From: <sip:user2_public2@home2.net>;tag=151170
To: <sip:user1_public1@home1.net>;tag=31415
Call-ID: b89rjhnedlrfjflslj40a222
CSeq: 42 NOTIFY
Subscription-State: active ;expires=5399
Event: call-completion
Contact: <sip:tas.home2.net>
Content-Type: application/call-completion
Content-Length: (...)

cc-state: queued
cc-service retention
    
```

19 to 28: UE-A initiates the termination of the session setup by sending a CANCEL request to UE-B.

29 to 38: UE-B terminates the session setup by sending a 487 Request terminated to UE-A.

A.4 CCNR call

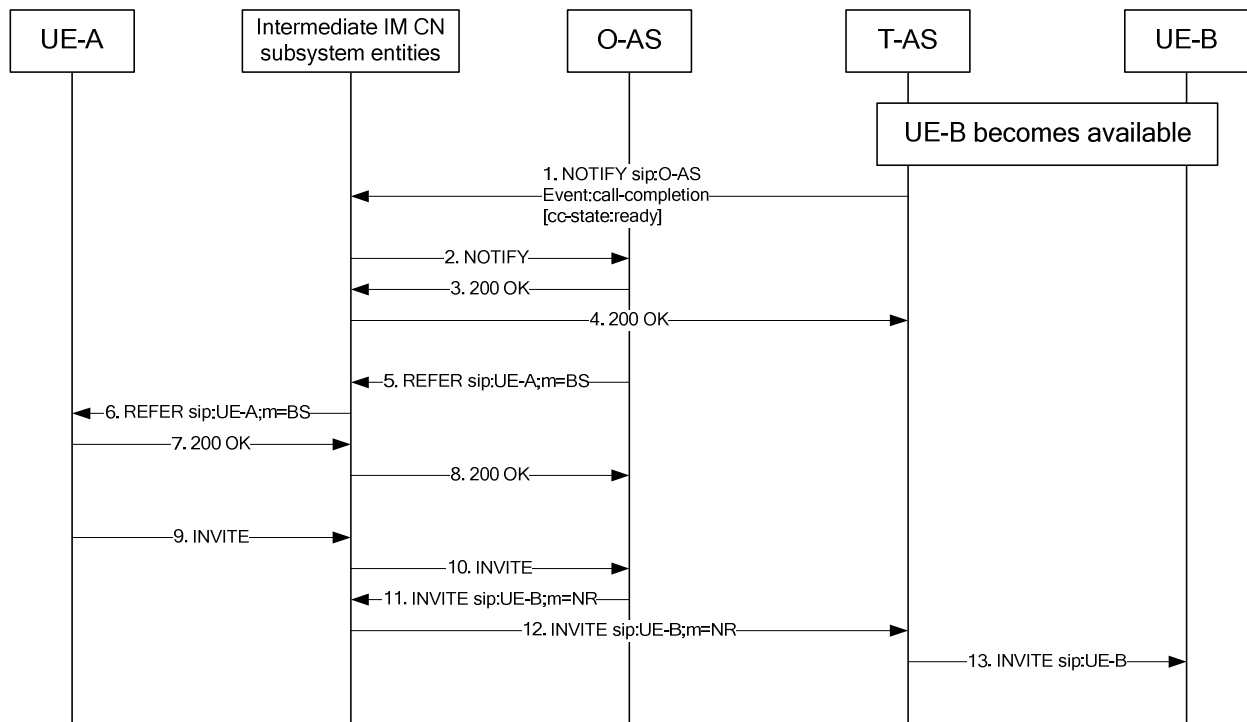


Figure A.4.1: CCNR call

Figure A.4.1 shows a basic signalling flow for a CCNR operation and a CCNR call.

Call flows

1 to 4: The terminating AS sends a NOTIFY request to the originating AS, according to the procedures described in RFC 6910 [5]. The body contains a parameter informing of the caller's call-completion state "ready" (for recall). The originating AS confirms the notification.

Table A.4-1: NOTIFY request (Terminating AS to S-CSCF)

```

NOTIFY sip:oas.home1.net SIP/2.0
Via: SIP/2.0/UDP tas.home2.net;branch=z9hG4bK348923.1
Max-Forwards: 70
Route: <sip:scscf2.home2.net>
P-Asserted-Identity: <sip:tas.home2.net>
From: <sip:user2_public2@home2.net>;tag=151170
To: <sip:user1_public1@home1.net>;tag=31415
Call-ID: b89rjhnedlrfjflslj40a222
CSeq: 47 NOTIFY
Subscription-State: active ;expires=1800
Event: call-completion
Contact: <sip:tas.home2.net>
Content-Type: application/call-completion
Content-Length: (...)

cc-state: ready
cc-service retention

```

5 to 8: The originating AS initiates the CCNR recall to UE A by sending a REFER request, the "m" SIP URI parameter set to "NR" will be included in the Request-URI of the REFER request. UE-A confirms the REFER request.

Table A.4-2: REFER request (Originating AS to S-CSCF)

```

REFER sip:user1_public1@home1.net;m=NR SIP/2.0
Via: SIP/2.0/UDP oas.home1.net;branch=z9hG4bK23273846
Max-Forwards: 70
Route: <sip:scscf1.home1.net;lr>
P-Asserted-Identity: <sip:oas.home1.net>
From: <sip:oas.home1.net>;tag=161828
To: <sip:user1_public1@home1.net>
Call-ID: cb03a0s09a2sdfglkj490333
Cseq: 127 REFER
Refer-To: <sip:user2_public2@home2.net;method=INVITE>
Referred-By: <sip:oas.home1.net>
Contact: <sip:oas.home1.net>
Content-Length: 0

```

9 to 10: UE-A starts the CCNR call by sending an INVITE request to UE-B.

11 to 13: In order to mark the INVITE request as a prioritized request for call-completion, the originating AS adds the "m" SIP URI parameter with the value "NR" to the Request-URI, and forwards the INVITE request to UE-B.

Table A.4-3: SIP INVITE request (Originating AS to S-CSCF)

```

INVITE sip:user2_public2@home2.net;m=NR SIP/2.0
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd]:1357;comp=sigcomp;branch=z9hG4bKnashds7
Max-Forwards: 70
Route: sip:pcscf1.home1.net:7531;lr;comp=sigcomp>, <sip:orig@scscf1.home1.net;lr>
Accept-Contact: *;+g.3gpp.icsi-ref="urn:3Aurn-7%3gpp-service.ims.icsi.mmtel"
Privacy: none
From: <sip:user1_public1@home1.net>;tag=171829
To: <sip:user2_public2@home2.net>
Call-ID: cb03a0s09a2sdfglkj490444
Cseq: 154 INVITE
Supported: 100rel; precondition, gruu, 199
Require: sec-agree
Contact: <sip:user1_public1@home1.net;gr=urn:uuid:f81d4fae-7dec-11d0-a765-00a0c91e6bg6>;+g.3gpp.icsi-ref="urn:3Aurn-7%3gpp-service.ims.icsi.mmtel"
Allow: INVITE, ACK, CANCEL, BYE, PRACK, UPDATE
Accept: application/sdp,application/3gpp-ims+xml
Call-Info:<sip:user1_public1@home1.net>;purpose=call-completion;m=BS
Content-Type: application/sdp
Content-Length: (...)

```

Annex B (informative): Example of filter criteria

B.0 General

This annex provides an example of a filter criterion that triggers SIP requests that are subject to initial filter criteria evaluation.

B.1 Originating

An example of an IFC when the CCBS or CCNR services are active at the originating S-CSCF is:

- Method: INVITE.

B.2 Terminating side

Examples of the IFC at the terminating S-CSCF when the user is registered and CCBS or CCNR or both are supported are:

- Method: INVITE.
- Method: SUBSCRIBE.

Annex C (informative): IANA Registration templates

C.1 IANA registry for application media types

C.1.1 IANA registration template for application/vnd.3gpp.ccr+xml

Editor's note: The MIME type "application/vnd.3gpp.ccr+xml" as defined in this subclause is to be registered in the IANA registry for Application Media Types based upon the following template.

MIME media type name:

application

MIME subtype name:

vnd.3gpp.ccr+xml

Required parameters:

None

Optional parameters:

"charset" the parameter has identical semantics to the charset parameter of the "application/xml" media type as specified in IETF RFC 3023 [11].

Encoding considerations:

Same as encoding considerations of application/xml as specified in IETF RFC 3023 [11]

Security considerations:

Same as general security considerations for application/xml as specified in section 10 of IETF RFC 3023 [11]. In addition, this content type provides a format for exchanging information in SIP, so the security considerations from IETF RFC 3261 [13] apply. Furthermore, 3GPP has defined mechanisms for ensuring the privacy and integrity protection of the bodies of XCAP messages used in the 3GPP IM CN Subsystem.

Interoperability considerations:

Same as interoperability considerations as specified in section 3.1 of IETF RFC 3023 [11].

Published specification:

3GPP TS 24.642 "Completion of Communications to Busy Subscriber (CCBS), Completion of Communications by No Reply (CCNR) using IP Multimedia (IM) Core Network (CN) subsystem", version 9.1.0, available via <http://www.3gpp.org/specs/numbering.htm>.

Applications which use this media:

Applications that use the 3GPP IM CN Subsystem as defined by 3GPP.

Intended usage:

COMMON

Additional information:

1. Magic number(s): none

2. File extension(s): none
3. Macintosh file type code: none
4. Object Identifiers: none

Annex D (informative): Change history

Change history							
Date	TSG #	TSG Doc.	CR	Rev	Subject/Comment	Old	New
19.02.2008			C1-080478			-	0.0.0
19.02.2008			C1-080259			0.0.0	0.1.0
19.02.2008			C1-080260			0.0.0	0.1.0
19.02.2008			C1-080480			0.0.0	0.1.0
19.02.2008			C1-080481			0.0.0	0.1.0
19.02.2008			C1-080482			0.0.0	0.1.0
19.02.2008			C1-080483			0.0.0	0.1.0
19.02.2008			C1-080265			0.0.0	0.1.0
19.02.2008			C1-080479			0.0.0	0.1.0
19.02.2008			C1-080484			0.0.0	0.1.0
					TS number added	0.1.0	0.1.1
17.04.2008			C1-081166			0.1.1	0.2.0
15.5.2008			C1-081561			0.2.0	0.3.0
15.5.2008			C1-082014			0.2.0	0.3.0
03.07.2008			C1-082632			0.3.0	0.4.0
03.07.2008			C1-082660			0.3.0	0.4.0
22.08.2008			C1-082955			0.4.0	0.5.0
22.08.2008			C1-083172			0.4.0	0.5.0
22.08.2008			C1-083173			0.4.0	0.5.0
22.08.2008			C1-083368			0.4.0	0.5.0
22.08.2008			C1-083413			0.4.0	0.5.0
03.09.2008					Creation of v1.0.0 for presentation to CT-41 for information.	0.5.0	1.0.0
15.10.2008			C1-084089			1.0.0	1.1.0
15.10.2008			C1-084239			1.0.0	1.1.0
15.10.2008			C1-084240			1.0.0	1.1.0
15.10.2008			C1-084241			1.0.0	1.1.0
15.10.2008			C1-084440			1.0.0	1.1.0
19.11.2008			C1-085264		Editorial corrections	1.1.0	1.2.0
19.11.2008			C1-085266		Combining CCBS and CCNR in procedures	1.1.0	1.2.0
19.11.2008			C1-085267		Specification of service interactions	1.1.0	1.2.0
19.11.2008			C1-085017		Usage of m-parameter in CC recall scenarios	1.1.0	1.2.0
19.11.2008			C1-085019		Queue handling	1.1.0	1.2.0
26.11.2008					Creation of v2.0.0 for presentation to CT-42 for approval	1.2.0	2.0.0

12-2008	CT#42				Creation of v8.0.0 after approval in CT-42	2.0.0	8.0.0
01-2009					Inclusion of " Foreword" clause	8.0.0	8.0.1
03-2009	CT#43	CP-090138	0001	1	Editorial modifications and corrections	8.0.1	8.1.0
03-2009	CT#43	CP-090138	0002	1	Adding of missing reference I.221	8.0.1	8.1.0
03-2009	CT#43	CP-090138	0003	1	Revision of signalling flows.	8.0.1	8.1.0
06-2009	CT#44	CP-090408	0005	1	Correction of CC invocation exceptional procedures	8.1.0	8.2.0
06-2009	CT#44	CP-090408	0006	1	Correction of CC possible indication procedures	8.1.0	8.2.0
06-2009	CT#44	CP-090408	0007	1	Correction of CC recall processing	8.1.0	8.2.0
06-2009	CT#44	CP-090408	0008	1	Correction of CCNR activation procedures	8.1.0	8.2.0
06-2009	CT#44	CP-090408	0009	1	Correction of missing Expires values	8.1.0	8.2.0
06-2009	CT#44	CP-090408	0010	1	Correction of flow numbering	8.1.0	8.2.0
06-2009	CT#44	CP-090408	0011	1	Correction of procedures after recall	8.1.0	8.2.0
06-2009	CT#44	CP-090408	0012	1	Correction of wrong subclause reference	8.1.0	8.2.0
06-2009	CT#44	CP-090408	0013	1	Correction of subscription-state header reason parameter	8.1.0	8.2.0
06-2009	CT#44	CP-090408	0014		Removal of unnecessary editor's notes	8.1.0	8.2.0
09-2009	CT#45	CP-090663	0015	1	Correction of activation rejection	8.2.0	8.3.0
09-2009	CT#45	CP-090663	0016	1	Corrections of CC call busy procedures	8.2.0	8.3.0
09-2009	CT#45	CP-090663	0017	1	Correction of CC recall procedures.	8.2.0	8.3.0
09-2009	CT#45	CP-090663	0018	1	Correction of OIR/TIR interaction procedures	8.2.0	8.3.0
09-2009	CT#45	CP-090663	0019	1	Correction of suspension procedures	8.2.0	8.3.0
09-2009	CT#45	CP-090691	0021	2	XML schema for ut interface	8.3.0	9.0.0
12-2009	CT#46	CP-090933	0022	4	Moving CC request records out of suppl. service settings	9.0.0	9.1.0
03-2010	CT#47	CP-100115	0025	2	Queue check correction	9.1.0	9.2.0
03-2010	CT#47	CP-100135	0026	1	Editorial corrections	9.1.0	9.2.0
03-2010	CT#47	CP-100135	0028	1	Identify the CC Call request	9.1.0	9.2.0
03-2010	CT#47	CP-100115	0030		CCNR timer handling before starting service retention	9.1.0	9.2.0
03-2010	CT#47	CP-100115	0032	1	Service duration timers	9.1.0	9.2.0
03-2010	CT#47	CP-100115	0034	1	CC correction to support phone numbers on terminating side	9.1.0	9.2.0
06-2010	CT#48	CP-100342	0039	1	Correction of and-or mix up	9.2.0	9.3.0
09-2010	CT#49	CP-100489	0043		Removal of editor's note and completion of annex B	9.3.0	9.4.0
09-2010	CT#49	CP-100489	0045	1	Use of From header for CC invocation	9.3.0	9.4.0
09-2010	CT#49	CP-100489	0049	1	Privacy in CC recall procedures for 3pcc	9.3.0	9.4.0
12-2010	CT#50	CP-100731	0053		Where to send CC revocation request	9.4.0	9.5.0
06-2011	CT#52	CP-110444	0055	1	Reference update draft-ietf-bliss-call-completion	9.5.0	9.6.0
09-2011	CT#53	CP-110652	0059	1	CC invocation target correction	9.6.0	9.7.0
09-2011	CT#53	CP-110664	0062		IETF reference updates	9.6.0	9.7.0
12-2011	CT#54	CP-110865	0067	2	CC call identification correction	9.7.0	9.8.0
06-2012	CT#56	CP-120283	0075	1	CC CDIV interaction correction	9.8.0	9.9.0
06-2013	CT#60	CP-130221	0082	2	Reference Update: RFC 6910	9.9.0	9.10.0

History

Document history		
V9.1.0	January 2010	Publication
V9.2.0	April 2010	Publication
V9.3.0	June 2010	Publication
V9.4.0	October 2010	Publication
V9.5.0	January 2011	Publication
V9.6.0	June 2011	Publication
V9.7.0	October 2011	Publication
V9.8.0	January 2012	Publication
V9.9.0	July 2012	Publication
V9.10.0	July 2013	Publication