3GPP TSG-CN Meeting #24 **NP-040242**
2nd – 4th June 2004. Seoul, Korea.

Source: **TSG CN WG3**

Title: **CRs to Rel-6 on Work Item "IMS-CCR-IWCS"**

Agenda item: **9.12**

Document for: **APPROVAL**

Introduction:

This document contains 6 CRs to Rel-6 on Work Item "IMS-CCR-IWCS" that have been agreed by TSG CN WG3, and are forwarded to TSG CN Plenary for approval.

WG_tdoc	Spec	CR	R	Cat	Title	Rel	C_Ver
N3-040234	29.163	039	2	B	Interworking with Nb user plane procedures	Rel-6	6.2.0
N3-040349	29.163	040	1	B	Codec Negotiation between BICC CS networks and the IM CN subsystem	Rel-6	6.2.0
N3-040350	29.163	041	1	B	Codec negotiation incoming call interworking	Rel-6	6.2.0
N3-040396	29.163	042	2	B	Codec negotiation Mid call interworking	Rel-6	6.2.0
N3-040352	29.163	043	1	B	Codec parameter translation – IM CN subsystem to BICN	Rel-6	6.2.0
N3-040397	29.163	044	2	B	MGCF IM-MGW interactions	Rel-6	6.2.0

CR-Form-v7

CHANGE REQUEST

⌘ 29.163 CR 039 ⌘ rev 2 ⌘ Current version: 6.2.0 ⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects: UICC apps⌘ ☐ ME ☐ Radio Access Network ☐ Core Network ☒

Title:	⌘	Interworking with Nb user plane procedures
Source:	⌘	TSG_CN WG3
Work item code:	⌘	IIMS-CCR-IWCS
Date:	⌘	29/03/2004
Category:	⌘	**B**
Release:	⌘	Rel-6

Use one of the following categories:
F *(correction)*
A *(corresponds to a correction in an earlier release)*
B *(addition of feature),*
C *(functional modification of feature)*
D *(editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use one of the following releases:

2	*(GSM Phase 2)*
R96	*(Release 1996)*
R97	*(Release 1997)*
R98	*(Release 1998)*
R99	*(Release 1999)*
Rel-4	*(Release 4)*
Rel-5	*(Release 5)*
Rel-6	*(Release 6)*

Reason for change:	⌘	IM-MGW interworking procedures between the Mb and Nb interfaces are not complete in this TS. This CR provides those procedures.
Summary of change:	⌘	This CR provides procedures for IuFP interworking which are required as part of a TrFO solution
Consequences if not approved:	⌘	User plane interworking will not be complete within this specification

Clauses affected:	⌘	8, 2

		Y	N		
Other specs affected:	⌘		X	Other core specifications	⌘
			X	Test specifications	
			X	O&M Specifications	

Other comments:	⌘	Discussion document N3-040064 introduced this CR

**********FIRST CHANGE**********

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] ITU-T Recommendation G.711: "Pulse Code Modulation (PCM) of voice frequencies".

[2] ITU-T Recommendation H.248.1 (2002): "Gateway control protocol: Version 2".

[3] ITU-T Recommendation Q.701 to Q.709: "Functional description of the message transfer part (MTP) of Signalling System No. 7".

[4] ITU-T Recommendations Q.761 to Q.764 (2000): "Specifications of Signalling System No.7 ISDN User Part (ISUP)".

[5] Void.

[6] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[7] Void.

[8] 3GPP TS 24.228: "Signalling flows for the IP multimedia call control based on SIP and SDP".

[9] 3GPP TS 24.229: "IP Multimedia Call Control Protocol based on SIP and SDP".

[10] 3GPP TS 23.002: "Network Architecture".

[11] 3GPP TS 22.228: "Service requirements for the IP Multimedia Core Network Subsystem".

[12] 3GPP TS 23.228: "IP Multimedia subsystem (IMS)".

[13] Void.

[14] 3GPP TS 29.205: "Application of Q.1900 series to Bearer Independent CS Network architecture; Stage 3".

[15] 3GPP TS 29.332: "Media Gateway Control Function (MGCF) – IM-Media Gateway (IM-MGW) interface, Stage 3".

[16] IETF RFC 791: "Internet Protocol".

[17] IETF RFC 768: "User Datagram Protocol".

[18] IETF RFC 2960: "Stream Control Transmission Protocol".

[19] IETF RFC 3261: "SIP: Session Initiation Protocol".

[20] 3GPP TS 29.202: "Signalling System No. 7 (SS7) signalling transport in core network; Stage 3".

[21] IETF RFC 2474: "Definition of the Differentiated Services Field (DS Field) in the IPv4 and IPv6 Headers".

[22] IETF RFC 2475: "An Architecture for Differentiated Services".

[23] IETF RFC 3267: "-Real-Time Transport Protocol (RTP) payload format and file storage format for the Adaptive Multi-Rate (AMR) Adaptive Multi-Rate Wideband (AMR-WB) audio codecs".

[24] IETF RFC 793: "Transmission Control Protocol".

[25] 3GPP TS 29.414: "Core network Nb data transport and transport signalling".

[26] 3GPP TS 29.415: "Core network Nb interface user plane protocols".

[27] 3GPP TS 23.205: "Bearer-independent circuit-switched core network; Stage 2".

[28] Void.

[29] ITU-T Recommendation Q.2150.1: "Signalling transport converter on MTP3 and MTP3b".

[30] ITU-T Recommendations Q.1902.1 to Q.1902.6 (07/2001): "Bearer Independent Call Control".

[31] ITU-T Recommendation Q.1950 (2002): "Bearer independent call bearer control protocol".

[32] 3GPP TS 26.236: "Packet switched conversational multimedia applications; Transport protocols".

[33] 3GPP TS 29.232: "Media Gateway Controller (MGC) – Media Gateway (MGW) interface; Stage 3".

[34] IETF RFC 2833: "RTP Payload for DTMF Digits, Telephony Tones and Telephony Signals".

[35] ITU-T Recommendation Q.765.5: "Signalling system No. 7 – Application transport mechanism: Bearer Independent Call Control (BICC)".

[36] IETF RFC 3264: "An Offer/Answer Model with the Session Description Protocol (SDP)".

[37] IETF RFC 3312: "Integration of Resource Management and Session Initiation Protocol (SIP)".

[38] ITU-T Recommendation Q.850 (1998): "Usage of cause and location in the Digital Subscriber Signalling System No. 1 and the Signalling System No. 7 ISDN User Part".

[39] IETF RFC 2460: "Internet Protocol, Version 6 (IPv6) Specification"

[40] IETF RFC 3323: "A Privacy Mechanism for the Session Initiation Protocol (SIP)".

[41] IETF RFC 3325: "Private Extensions to the Session Initiation Protocol (SIP) for Asserted Identity within Trusted Networks".

[42] ITU-T Recommendation Q.730 to Q.737 (12/1999): "ISDN user part supplementary services".

[43] ITU-T Recommendation I.363.5 (1996): "B-ISDN ATM Adaptation Layer specification: Type 5 AAL".

[44] ITU-T Recommendation Q.2110 (1994): "B-ISDN ATM adaptation layer - Service Specific Connection Oriented Protocol (SSCOP)".

[45] ITU-T Recommendation Q.2140 (1995): "B-ISDN ATM adaptation layer - Service specific coordination function for signalling at the network node interface (SSCF AT NNI)".

[46] ITU-T Recommendation Q.2210 (1996): "Message transfer part level 3 functions and messages using the services of ITU-T Recommendation Q.2140".

[47] 3GPP TS 23.221: "Architectural requirements".

[48] ITU-T Recommendation E.164 (05/1997): "-The international public telecommunication numbering plan".

[49] 3GPP TS 26.102: "Adaptive Multi-Rate (AMR) speech codec; Interface to Iu and Uu".

[50] IETF RFC 3550: "RTP: A Transport Protocol for Real-Time Applications".

[51] IETF RFC 3551: "RTP Profile for Audio and Video Conferences with Minimal Control".

[52] IETF RFC 3555: "MIME Type Registration of RTP Payload Formats".

**********NEXT CHANGE**********

8 User plane interworking

8.1 Interworking between IM CN subsystem and bearer independent CS network

When the IM CN subsystem interworks with the bearer independent CS networks (e.g. CS domain of a PLMN, 3GPP TS 29.414 [25], 3GPP TS 29.415 [26], 3GPP TS 23.205 [27]), the Transport Network Layer (TNL) of the bearer independent CS network can be based e.g. on IP/UDP/RTP, or IP/UDP/RTP/IuFP, or ATM/AAL2/ framing protocol (e.g. Iu framing) transport techniques. Figure 31 shows the user plane protocol stacks for the IM CS subsystem and bearer independent CS network interworking. If the same AMR ~~mode~~ configuration is used ~~as codec~~ on the CS network side as on the IMS side, transcoding is not required. However, there is still a need to interwork between RTP/UDP/IP/L2/LI to TNL/LI.

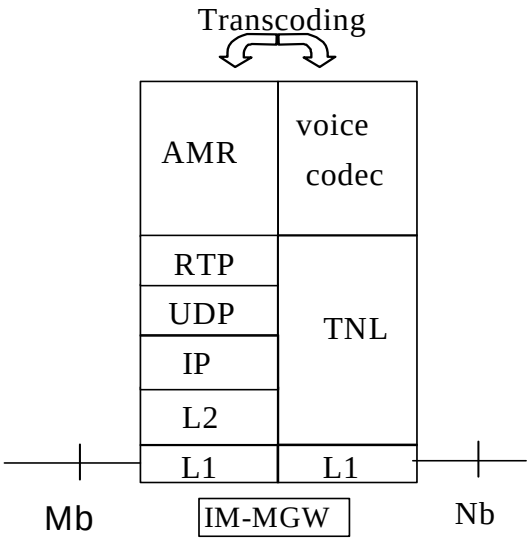

Figure 31/1: IM CN subsystem to bearer independent CS network user plane protocol stack

8.1.1 Transcoder-less Mb to Nb Interworking

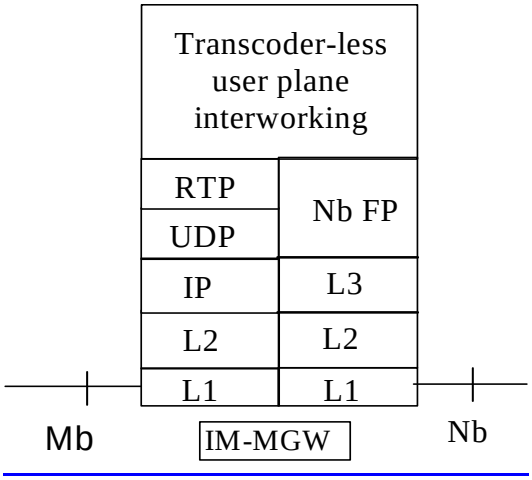

Figure 31/2: IM CN subsystem to bearer independent CS network user plane protocol stack (optional in the event the codecs on both sides are the same)

If no transcoder is inserted, the IM-MGW shall interwork the following procedures between the Nb and Mb interfaces.

8.1.1.1 Initialisation

. There is no need to interwork initialisation procedures between Nb and Mb interfaces see 3GPP TS 29.415 [26].

8.1.1.2 Time alignment

The purpose of the time alignment procedure on the Nb interface is to minimise the buffer delay in the RNC for downlink transmissions by adjusting the vocoder time reference within the network. No such procedure exists on the Mb interface, so the IM-MGW shall return NACK indication time alignment not supported according to 3GPP TS 25.415 [26].

8.1.1.3 Rate control

The rate control procedure signals to the peer entity the maximum rate among the currently allowed rates at which it can receive codec frames. Rate control only applies to AMR family codec configurations with multiple active modes. On the Nb interface, IuFP provides for rate control via the exchange of RATE CONTROL and RATE CONTROL ACK PDUs. On the Mb interface, RFC 3267 [23] provides for in-band rate control via the Codec Mode Request (CMR) field of every codec frame.

Interworking of rate control procedures at an IM-MGW between an Mb interface and a corresponding Nb interface only applies when the IM-MGW bridges compatible codec configurations between the interfaces without applying a transcoding function. An IM-MGW receiving a CMR from an Mb interface shall initiate the IuFP rate control procedure on the corresponding Nb interface. An IM-MGW receiving a rate control request on an Nb interface shall adjust the CMR field of outgoing speech frames on the corresponding Mb interface.

8.1.1.4 Frame quality indication

The Nb interface signals frame quality with the Frame Quality Classification (FQC) field of each speech frame PDU. See 3GPP TS 26.102 [49] and 3GPP TS 25.415 [26] for details. The FQC may have possible values: 0=frame_good; 1=frame_bad; 2=frame_bad_due_to_radio; and 3=spare. The Mb interface signals frame quality with the Q bit (frame quality indicator) field of each speech frame, as defined in RFC 3267 [23]. The Q bit may have values: 1=speech_good; and 0=speech_bad or sid_bad.

Tables x and y provide the mapping between Mb and Nb interfaces.

Table x: Mapping of Mb (Q bit) onto Nb (FQC)

Mb - Qbit	Mb - FT	Nb - FQC
1	x	0
0	x	1

Table y: Mapping Nb onto Mb

Nb - FQC	Mb - Qbit	Mb - FT
0	1	NC
1	0	NO_DATA
2	0	NC

8.1.1.5 Framing

Even when the IM-MGW bridges compatible codec configurations between the Nb and Mb interfaces, the IM-MGW shall perform translation between the frame formats defined for the two interfaces, since all codec configurations have different framing procedures for the two interfaces. The framing details for Nb are defined in 3GPP TS 26.102 [49] and 3GPP TS 25.415 [26], although they do not describe the framing for ITU-T codecs other than G.711. The framing details for Mb are defined in RFC 3267 [23], RFC 3550 [50], RFC 3551 [51] and RFC 3555 [52].

8.1.1.6 Transcoding

Transcoding at the IM-MGW is avoided when the IM-MGW bridges compatible codec configurations between the Nb and Mb interfaces. Otherwise transcoding is necessary, which eliminates the need to interwork other user plane procedures between the interfaces.

8.1.1.7 Discontinuous transmission

When the IM-MGW bridges compatible codec configurations between the Nb and Mb interfaces, the DTX procedures are normally interworked transparently by translating between the framing formats on the interfaces. All the ITU-T and AMR family codecs have configurations that are compatible between the Mb and Nb interfaces.

8.2 Interworking between IM CN subsystem and TDM-based CS network

It shall be possible for the IM CN subsystem to interwork with the TDM based CS networks (e.g. PSTN, ISDN or CS domain of a PLMN). Figure 32 describes the user plane protocol stack to provide the particular interworking.

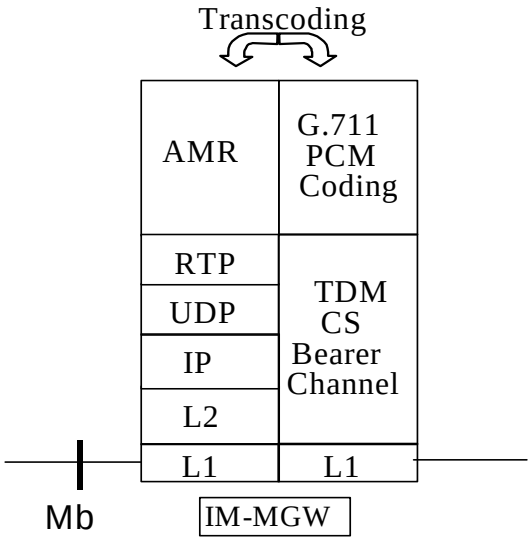

Figure 32: IM CN subsystem to TDM-based CS network user plane protocol stack

8.3 Transcoding requirements

The IM CN subsystem supports the AMR codec as the native codec for basic voice services. For IM CN subsystem terminations, the IM MGW shall support the transport of AMR over RTP according to RFC 3267 [23]. The MGCF shall support the options of RFC 3267 listed within clause 5.1.1 of 3GPP TS 26.236 [32].

It shall be possible for the IM CN subsystem to interwork with the CS networks (e.g. PSTN, ISDN or a CS domain of a PLMN) by supporting AMR to G.711 transcoding (see ITU-T Recommendation G.711 [1]) in the IM-MGW. The IM-MGW may also perform transcoding between AMR and other codec types supported by CS networks.

8.4 Diffserv code point requirements

The IM-MGW shall perform DiffServ Code Point (DSCP) markings (see RFC 2474 [21]) on the IP packets sent towards the IM CN subsystem entity like UE or MRFP across the Mb interface to allow DiffServ compliant routers and GGSNs to schedule the traffic accordingly.

The IETF Differentiated Services architecture (see RFC 2475 [22]) shall be used to provide QoS for the external bearer service.

The DSCP shall be operator configurable.

**********END OF CHANGES**********

CR-Form-v7

CHANGE REQUEST

⌘ 29.163 CR 040 ⌘rev 1 ⌘ Current version: 6.2.0 ⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects: UICC apps⌘ ☐ ME ☐ Radio Access Network ☐ Core Network ☒

Title:	⌘	Codec Negotiation between BICC CS networks and the IM CN subsystem
Source:	⌘	TSG_CN WG3
Work item code:	⌘	IMS-CCR-IWCS ***Date:*** ⌘ 10/05/2004
Category:	⌘	**B** ***Release:*** ⌘ Rel-6

Use one of the following categories:
F *(correction)*
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R99	*(Release 1999)*
Rel-4	*(Release 4)*
Rel-5	*(Release 5)*
Rel-6	*(Release 6)*

Reason for change:	⌘	This document introduces topic (see title) and the subsequent outline for Annex B
Summary of change:	⌘	Introductory and explanatory text for codec negotiation. This text is only required whilst codec negotiation control plane forms part of Annex B for Rel-6. Upon move of this topic into clause 7.3 of this TS the introductory text will be deleted.
Consequences if not approved:	⌘	Codec negotiation as an annex will be incomplete.

Clauses affected:	⌘	2, Annex B, Annex C

	Y	N		
Other specs affected: ⌘		X	Other core specifications	⌘
		X	Test specifications	
		X	O&M Specifications	

Other comments:	⌘	This approach discussed and agreed in CN3#31bis. The references updated include the additions since last plenary, March 2004

********** FIRST CHANGE **********

2 References

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

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[1] ITU-T Recommendation G.711: "Pulse Code Modulation (PCM) of voice frequencies".

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[5] Void.

[6] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[7] Void.

[8] 3GPP TS 24.228: "Signalling flows for the IP multimedia call control based on SIP and SDP".

[9] 3GPP TS 24.229: " IP Multimedia Call Control Protocol based on SIP and SDP".

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[31] ITU-T Recommendation Q.1950 (2002): "Bearer independent call bearer control protocol".

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[44] ITU-T Recommendation Q.2110 (1994): "B-ISDN ATM adaptation layer - Service Specific Connection Oriented Protocol (SSCOP)".

[45] ITU-T Recommendation Q.2140 (1995): "B-ISDN ATM adaptation layer - Service specific coordination function for signalling at the network node interface (SSCF AT NNI)".

[46] ITU-T Recommendation Q.2210 (1996): "Message transfer part level 3 functions and messages using the services of ITU-T Recommendation Q.2140".

[47] 3GPP TS 23.221: "Architectural requirements".

[48] ITU-T Recommendation E.164 (05/1997): "The international public telecommunication numbering plan".

[49] ITU-T Recommendation Q.1912.5: "Interworking between Session Initiation Protocol (SIP) and Bearer Independent Call Control Protocol or ISDN User Part".

[50] IETF RFC 3550: "RTP: A Transport Protocol for Real-Time Applications".

[51] IETF RFC 3551: "RTP Profile for Audio and Video Conferences with Minimal Control".

[52] IETF RFC 3555: "MIME Type Registration of RTP Payload Formats".

[53] 3GPP TS 26.102: "Adaptive Multi-Rate (AMR) speech codec; Interface to Iu and Uu".

[54] IETF RFC 3262: "Reliability of provisional responses".

[55] IETF RFC 3311: "SIP UPDATE method".

[56] IETF RFC 2327: "SDP: Session Description Protocol".

[57] 3GPP TS 26.103: " Speech Codec List for GSM and UMTS".

[58] 3GPP TS 28.062: " Inband Tandem Free Operation (TFO) of speech codecs".

**********SECOND CHANGE **********

Annex B (normative): Codec Negotiation between a BICC CS network and the IM CN subsystem

B.1 Introduction

This annex describes optional procedures for interworking of codec negotiation between a BICC CS network and the IM CN subsystem.

B.2 Control plane interworking

B.2.1 Incoming call interworking from SIP to BICC at I-MGCF

B.2.2 Incoming call interworking from BICC to SIP at O-MGCF

B.2.3 Mid-call interworking from SIP to BICC at I-MGCF or O-MGCF

B.2.4 Mid-call interworking from BICC to SIP at I-MGCF or O-MGCF

B.2.5 Codec parameter translation between a BICC CS network and the IM CN subsystem

B.3 MGCF – IM-MGW interaction during interworking of codec negotiation

Annex ~~B~~ C(informative): Change history

Change history							
Date	**TSG #**	**TSG Doc.**	**CR**	**Rev**	**Subject/Comment**	**Old**	**New**
2003-09	NP#21	NP-030326			Approved at NP#21 and placed under change control	2.0.0	6.0.0
2003-12	NP#22	NP-030569	001	1	Use of response code 500 instead of 503	6.0.0	6.1.0
2003-12	NP#22	NP-030569	002	1	Autonomous Release at I MGCF on T7 expiry	6.0.0	6.1.0
2003-12	NP#22	NP-030569	003	1	Clarification of 487 mapping to 127	6.0.0	6.1.0
2003-12	NP#22	NP-030569	004	2	Table 12 modifications	6.0.0	6.1.0
2003-12	NP#22	NP-030569	008		Correction of clause titles	6.0.0	6.1.0
2003-12	NP#22	NP-030570	009	1	Failure handling in MGCF	6.0.0	6.1.0
2003-12	NP#22	NP-030569	010	1	Interworking of user plane	6.0.0	6.1.0
2003-12	NP#22	NP-030569	011	2	Alignment between subclause 7.2.3 and 7.3.3 in TS 29.163	6.0.0	6.1.0
2003-12	NP#22	NP-030570	012	5	Corrections to clause 9 of TS 29.163	6.0.0	6.1.0
2003-12	NP#22	NP-030569	013	1	Interworking (overlap to en-bloc conversion) timer corrections	6.0.0	6.1.0
2003-12	NP#22	NP-030570	014	2	IM-MGW initiated release	6.0.0	6.1.0
2003-12	NP#22	NP-030569	015	1	Alignment of TS 29.163 with the ITU-T Q.1912.5 recommendation	6.0.0	6.1.0
2003-12	NP#22	NP-030570	016	1	Corrections to table 29 and 30 of TS 29.163	6.0.0	6.1.0
2003-12	NP#22	NP-030569	018	1	Mapping of unknown cause code values	6.0.0	6.1.0
2003-12	NP#22	NP-030569	021	2	Addition of References	6.0.0	6.1.0
2003-12	NP#22	NP-030569	022	3	Handling of closed used group supplementary service	6.0.0	6.1.0
2003-12	NP#22	NP-030570	023	2	Corrections on Clause 9.2.8 Handling of RTP telephony events	6.0.0	6.1.0
2003-12	NP#22	NP-030570	024		Wrong Mn Procedure in Figure 36	6.0.0	6.1.0
2003-12	NP#22	NP-030569	025	1	Interworking of Hold/Resume from the CS Network	6.0.0	6.1.0
2004-03	NP#23	NP-040083	030	2	Reason Headers	6.1.0	6.2.0
2004-03	NP#23	NP-040083	031	2	Informative annex for missalignments with Q.1912.5	6.1.0	6.2.0
2004-03	NP#23	NP-040083	032	2	Criteria for sending UPDATE in BICC	6.1.0	6.2.0
2004-03	NP#23	NP-040084	033	2	Impact of Forking on Mn procedures	6.1.0	6.2.0
2004-03	NP#23	NP-040083	034	1	Impact of Forking on Incoming call interworking	6.1.0	6.2.0
2004-03	NP#23	NP-040083	035	2	Impact of Forking on Outgoing call interworking	6.1.0	6.2.0
2004-03	NP#23	NP-040083	036	1	Impact of Forking on COLP supplementary service	6.1.0	6.2.0

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CHANGE REQUEST

⌘ 29.163 CR 041 ⌘rev 1 ⌘ Current version: 6.2.0 ⌘

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Proposed change affects: UICC apps⌘ ☐ ME ☐ Radio Access Network ☐ Core Network ☒

Title:	⌘	Codec negotiation incoming call interworking
Source:	⌘	TSG_CN WG3
Work item code:	⌘	IMS-CCR-IWCS
Date:	⌘	10/05/2004
Category:	⌘	**B**
Release:	⌘	Rel-6

Use one of the following categories:
F *(correction)*
A *(corresponds to a correction in an earlier release)*
B *(addition of feature),*
C *(functional modification of feature)*
D *(editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use one of the following releases:

2	*(GSM Phase 2)*
R96	*(Release 1996)*
R97	*(Release 1997)*
R98	*(Release 1998)*
R99	*(Release 1999)*
Rel-4	*(Release 4)*
Rel-5	*(Release 5)*
Rel-6	*(Release 6)*

Reason for change:	⌘	Provision of interworking techniques for incoming calls
Summary of change:	⌘	Interworking procedure for incoming SIP to BICC calls at I-MGCF and BICC to SIP at O-MGCF
Consequences if not approved:	⌘	Incomplete codec negotiation interworking procedures

Clauses affected:	⌘	B.2

Other specs affected: ⌘	Y	N	
		X	Other core specifications
		X	Test specifications
		X	O&M Specifications

⌘

Other comments:	⌘	This approach discussed and agreed in CN3#31bis

How to create CRs using this form:
Comprehensive information and tips about how to create CRs can be found at http://www.3gpp.org/specs/CR.htm.
Below is a brief summary:

1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.
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3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

B.2 Control plane interworking

The following optional procedures apply in addition to the procedures of clause 7.3 when both the BICC CS network and the IM CN subsystem support codec negotiation. All five variations of the bearer set-up procedures defined in clauses 7.4 and 7.5 of ITU-T Q.1902.4 [30] are supported. The codec negotiation procedures are also independent of the procedures for interworking between continuity procedures and SDP preconditions.

B.2.1 Incoming call interworking from SIP to BICC at I-MGCF

B.2.1.1 Sending of IAM

When the I-MGCF receives an INVITE with SDP offer, the I-MGCF shall follow the procedures of clause B.2.5 to convert the list of codecs in the SDP offer into a Supported Codec List for transmission in the outgoing IAM, according to clause 8.3.1 of ITU-T Q.1902.4 [30], and deleting those codecs not supported at the IM-MGW. When generating the Supported Codec List, the I-MGCF should add to the SDP offer all codec configurations for which it can provide transcoding. The I-MGCF shall allocate any IM-MGW resources as necessary to support the chosen bearer set-up procedures towards the BICC CS network.

When the I-MGCF receives an INVITE without SDP offer, the I-MGCF shall continue call establishment without interworking of codec negotiation procedures. The mid-call interworking procedures of clause B.2.3 and clause B.2.4 may still apply.

B.2.1.2 Sending of SDP answer

The I-MGCF shall suspend the SDP answer procedure until it receives backward codec information from the BICC serving node terminating codec negotiation. When the I-MGCF receives the backward codec information, it shall select a codec configuration for use on the bearer interface to the IM CN subsystem from the codecs in the SDP offer, format an SDP answer based on this selected codec, send the SDP answer to the offerer in the appropriate SIP message (e.g., a reliable 18x response), and complete bearer establishment procedures. To avoid allocating a transcoder at the IM-MGW, the I-MGCF should preferably select a codec for the IM CN subsystem by converting the Selected Codec from the BICC CS network into an SDP answer according to the procedures of clause B.2.5, if allowed by the SDP offer/answer rules. Otherwise the I-MGCF should select the highest priority codec from the codecs in the received SDP offer supported by the IM-MGW for insertion in the SDP answer. Note that the I-MGCF stores the Available Codec List and does not send it to the offerer in the SDP answer. Codec negotiation is complete so it is not necessary for the offerer to begin a second phase offer/answer exchange using the PRACK request.

B.2.2 Outgoing call interworking from BICC to SIP at O-MGCF

B.2.2.1 Sending of INVITE

When the O-MGCF receives an IAM, the O-MGCF shall follow the procedures of clause B.2.5 to convert the Supported Codec List from the IAM into an SDP offer for transmission in the outgoing INVITE request, according to RFC 3264, deleting those codecs not supported at the IM-MGW. When generating the SDP offer, the O-MGCF should include all codec configurations for which it can provide transcoding in addition to those converted from the Supported Codec List. The O-MGCF shall include at least one AMR codec configuration in the SDP offer. The O-MGCF shall allocate any IM-MGW resources as necessary to support the inclusion of session address information in the SDP offer towards the IM CN subsystem.

B.2.2.2 Responding to serving node initiating codec negotiation

The O-MGCF shall suspend the incoming bearer set-up procedure while waiting for receipt of the SDP answer from the IM CN subsystem. When the O-MGCF receives the SDP answer while suspending the incoming bearer set-up procedure, it shall select a codec configuration for use on the bearer interface to the IM CN subsystem from the codecs in the SDP answer, construct the Available Codec List for the BICC CS network from the list of codecs received in the Supported Codec List by removing codecs not supported at the IM-MGW, choose the Selected Codec for the BICC CS network from the codecs in the Available Codec List, initiate the second SDP offer/answer exchange with the IM CN subsystem using the codec selected for the IM CN subsystem, if necessary, and resume the incoming bearer set-up procedure in the BICC CS network. The O-MGCF should select codecs for the bearer interfaces to the BICC CS

network and IM CN subsystem in such a way as to avoid transcoding at the IM-MGW and minimize speech degradation, if possible, according to clause B.2.5. Otherwise the O-MGCF should choose the highest priority codec from the Available Codec List as the Selected Codec for the BICC CS network, and the highest priority codec from the codecs in the SDP answer as the codec for the IM CN subsystem. If the SDP answer only included a single voice codec, then there is no need for a second SDP offer/answer exchange, and the codec selected for the IM CN subsystem is the codec in the SDP answer.

Certain BICC timers or events can force completion of the incoming bearer set-up procedure before the O-MGCF receives the SDP answer from the IM CN subsystem. In this case, the O-MGCF shall perform the terminating codec negotiation procedure according to clause 8.3.3 of ITU-T Q.1902.4 [30], including all supported codecs in the Available Codec List, and shall resume the incoming bearer set-up procedure without waiting any longer for the SDP answer.

When an SDP answer arrives from the IM CN subsystem in response to the SDP offer in an INVITE request after the BICC incoming bearer set-up procedure has started, the O-MGCF shall select a codec configuration for use on the bearer interface to the IM CN subsystem from the codecs in the SDP answer, choose a new Selected Codec for the BICC CS network from the codecs in the Available Codec List constructed during incoming bearer set-up, and initiate the second SDP offer/answer exchange with the IM CN subsystem using the codec selected for the IM CN subsystem, if necessary. The O-MGCF should select codecs for the bearer interfaces to the BICC CS network and IM CN subsystem in such a way as to avoid transcoding at the IM-MGW and minimize speech degradation, if possible, according to clause B.2.5. Otherwise the O-MGCF should select the highest priority codecs from the available options for the two bearer interfaces. If the SDP answer only included a single voice codec, then there is no need for a second SDP offer/answer exchange, and the codec selected for the IM CN subsystem is the codec in the SDP answer. When the call in the BICC CS network enters a state capable of supporting codec modification, if the new Selected Codec is different from the Selected Codec chosen during the incoming bearer set-up procedure for the BICC CS network, the O-MGCF should initiate the codec modification procedure towards the BICC CS network using the new Selected Codec, according to clause 10.4.1 of ITU-T Q.1902.4 [30].

3GPP TSG-CN WG3 #32 **N3-040352**
Zagreb, Croatia. 10th May – 14th May 2004.

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CHANGE REQUEST

⌘ **29.163** **CR** **043** ⌘**rev** **1** ⌘ Current version: **6.2.0** ⌘

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Proposed change affects: UICC apps⌘ ☐ ME ☐ Radio Access Network ☐ Core Network ☒

Title:	⌘	Codec parameter translation – IM CN subsystem to BICN
Source:	⌘	TSG_CN WG3
Work item code:	⌘	IMS-CCR-IWCS
Date:	⌘	10/05/2004
Category:	⌘	**B**
Release:	⌘	Rel-6

Use one of the following categories:
F *(correction)*
A *(corresponds to a correction in an earlier release)*
B *(addition of feature),*
C *(functional modification of feature)*
D *(editorial modification)*
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Use one of the following releases:

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R96	*(Release 1996)*
R97	*(Release 1997)*
R98	*(Release 1998)*
R99	*(Release 1999)*
Rel-4	*(Release 4)*
Rel-5	*(Release 5)*
Rel-6	*(Release 6)*

Reason for change:	⌘	To define procedures for codec parameter translation between IMS and BICC CS network during codec negotiation
Summary of change:	⌘	Addition of codec parameter translation procedures for codec negotiation
Consequences if not approved:	⌘	Codec negotiation as an annex will be incomplete.

Clauses affected:	⌘	B.2.5

Other specs affected: ⌘	Y	N	
		X	Other core specifications
		X	Test specifications
		X	O&M Specifications

⌘

Other comments:	⌘	This approach discussed and agreed in CN3#31bis

B.2.5 Codec parameter translation between BICC CS network and the IM CN subsystem

The IM CN subsystem uses the Session Description Protocol (SDP, defined in RFC 2327 [56]) to select and potentially re-negotiate the codec and associated bearer format attributes to be used in the user plane. RFC 3550 [50] defines the Real Time Protocol (RTP) for framing of all codecs in the user plane, RFC 3551 [52] and RFC 3555 [55] define the framing details for many of the ITU-T codecs, and RFC 3267 [23] defines framing details for the AMR family of codecs. This clause will focus only on codec-specific SDP parameters not already constrained by clause 5.1.1 of TS 26.236 [32]. The signalling plane of the IM CN subsystem uses SDP offer/answer procedures defined in RFC 3264 [36] to select the desired codec configuration for the user plane from a prioritized list of codec configurations and to re-negotiate the user plane configuration as necessary.

The bearer independent CS network uses the Single Codec and Codec List information elements of the Application Transport Mechanism (APM) defined in ITU-T Q.765.5 [35] to select and potentially re-negotiate the codec and associated bearer format attributes to be used in the user plane. TS 29.414 [25] and TS 25.415 [26] define the IuFP framing protocol for all codecs in the user plane for both ATM and IP transport, and TS 26.102 [53] provides the framing details for AMR and PCM family codecs. The Codec List information element of the APM comprises multiple instances of the Single Codec information element in priority order, as shown in Figure 13 of ITU-T Q.765.5 [35]. Figure 14 of ITU-T Q.765.5 [35] defines the Single Codec information element. Clause 11.1.7.2 of ITU-T Q.765.5 [35] defines the encoding of the Single Codec information element for the ITU-T codecs. TS 26.103 [57] defines the encoding of the Single Codec information element for the 3GPP codecs, and Table 7.11.3.1.3-2 of TS 28.062 [58] defines the preferred configurations of the narrowband AMR codecs (Config-NB-Code) for interoperation with TFO. The signalling plane of the bearer independent CS network uses the APM to select the desired codec configuration for the user plane from the prioritized list of codec configurations and to re-negotiate the user plane configuration as necessary.

The following subclauses define the translations between the SDP payload format parameters of the IM CN subsystem and the corresponding subfields of the Single Codec information element of the bearer independent CS network for certain 3GPP and ITU-T codecs. Following these translation rules will in many cases allow the IM-MGW to perform interworking between the framing protocols on the bearer interfaces to the BICC CS network and the IM CN subsystem without transcoding. Implementations may signal other codecs not listed herein or other configurations of codecs listed herein. Implementations may also choose to perform transcoding between codec configurations signalled separately for the bearer interfaces to the networks, if necessary, but voice quality may suffer.

B.2.5.1 Codec parameters for 3GPP AMR-NB codecs

Table B.1 shows the correspondence between the codec format parameters in the Single Codec information element (TS 26.103 [57]) and the SDP for the 3GPP narrowband AMR codecs (RFC 3267 [23]). The table only shows preferred configurations that TS 28.062 [58] defines in Table 7.11.3.1.3-2 for TFO operation of AMR-NB, using the Config-NB-Code parameter. TS 28.062 [58] defines how Config-NB-Code values map to the ACS, SCS, OM and MACS parameters of the Single Codec information for AMR-NB codecs. Implementations may choose sets of values for the ACS, SCS, OM and MACS parameters that do not correspond to the preferred configurations defined by Config-NB-Code values. Translation between non-preferred AMR-NB configurations and SDP payload format configurations are not explicitly defined herein, but the principles of translation can be abstracted from the examples shown here.

Table B.1: Mapping between Single Codec subfields and SDP parameters for 3GPP AMR-NB codecs

Single Codec information element		SDP payload format parameters		
Codec IDentification	**Config-NB-Code**	**Payload Type number**	**Encoding name**	**Other Parameters**
HR_AMR, FR_AMR, OHR_AMR, UMTS_AMR or UMTS_AMR_2	0	dynamic	AMR	mode-set=0
HR_AMR, FR_AMR, OHR_AMR, UMTS_AMR or UMTS_AMR_2	2	dynamic	AMR	mode-set=2
HR_AMR, FR_AMR, OHR_AMR, UMTS_AMR or UMTS_AMR_2	3	dynamic	AMR	mode-set=3
HR_AMR, FR_AMR, OHR_AMR, UMTS_AMR or UMTS_AMR_2	4	dynamic	AMR	mode-set=4
HR_AMR, FR_AMR, OHR_AMR, UMTS_AMR or UMTS_AMR_2	5	dynamic	AMR	mode-set=5
FR_AMR, OHR_AMR, UMTS_AMR or UMTS_AMR_2	6	dynamic	AMR	mode-set=6
FR_AMR, OHR_AMR, UMTS_AMR or UMTS_AMR_2	7	dynamic	AMR	mode-set=7
HR_AMR, FR_AMR, OHR_AMR, UMTS_AMR or UMTS_AMR_2 (NOTE 1)	8	dynamic	AMR	mode-set=0,2
HR_AMR, FR_AMR, OHR_AMR, UMTS_AMR or UMTS_AMR_2 (NOTE 1)	9	dynamic	AMR	mode-set=0,2,3
HR_AMR, FR_AMR, OHR_AMR, UMTS_AMR or UMTS_AMR_2 (NOTE 1)	10	dynamic	AMR	mode-set=0,2,3,4
FR_AMR, OHR_AMR, UMTS_AMR or UMTS_AMR_2 (NOTE 1)	11	dynamic dynamic dynamic	AMR AMR AMR	mode-set=0,2,3,4 mode-set=0,2,5,7 mode-set=0,2,3,6
FR_AMR, OHR_AMR, UMTS_AMR or UMTS_AMR_2 (NOTE 1)	12	dynamic	AMR	mode-set=0,2,3,6
FR_AMR, OHR_AMR, UMTS_AMR or UMTS_AMR_2 (NOTE 1)	13	dynamic dynamic dynamic	AMR AMR AMR	mode-set=0,2,3,6 mode-set=0,2,5,7 mode-set=0,2,3,4
FR_AMR, OHR_AMR, UMTS_AMR or UMTS_AMR_2 (NOTE 1)	14	dynamic	AMR	mode-set=0,2,5,7
FR_AMR, OHR_AMR, UMTS_AMR or UMTS_AMR_2 (NOTE 1)	15	dynamic dynamic dynamic	AMR AMR AMR	mode-set=0,2,5,7 mode-set=0,2,3,6 mode-set=0,2,3,4

NOTE 1: SDP payload format configurations corresponding to HR_AMR, FR_AMR, and OHR_AMR shall also include the "mode-change-period=2" parameter. SDP payload format configurations corresponding to UMTS_AMR shall also include the "mode-change-period=1" parameter. SDP payload format configurations corresponding to UMTS_AMR_2 shall not include the "mode-change-period" parameter when generating SDP from the Single Codec information element. When generating Single Codec information elements from SDP, the MGCF may include UMTS_AMR_2 with either a "mode-change-period=1" parameter, a "mode-change-period=2" parameter, or no "mode-change-period" parameter.

NOTE 2: SDP payload format configurations in this table with only one value in the "mode-set" parameter (corresponding to Config-NB-Code values of 0 through 7) do not use the "mode-change-period" parameter.

NOTE 3: Every SDP payload format configuration in this table with more than one value in the "mode-set" parameter (corresponding to Config-NB-Code values of 8-15) shall also include the "mode-change-neighbor=1" parameter when generating SDP from the Single Codec information element.

When translating from a Single Codec information element to the equivalent SDP payload format parameters, the SDP shall include a distinct payload type and any associated parameters for each row in the table that matches the Config-NB-Code parameter. For example, OHR_AMR with Config-NB-Code=11 shall generate three SDP payload types for AMR, each including the "mode-change-period=2" parameter, the "mode-change-neighbor=1" parameter, and the "mode-set" parameter with value sets "0,2,3,4", "0,2,5,7", and "0,2,3,6", respectively. When translating a list of Single Codec information elements, only a single version of each distinct payload type shall be included in the SDP, and redundant entries shall be removed.

When translating from SDP payload format specifications to Single Codec information elements, all Codec IDentification values that match shall be represented, and matching configurations for each Codec IDentification value

shall be represented with the fewest values of Config-NB-Code, while retaining the priority represented by the order of the SDP payload format specifications. For example, three SDP payload types for AMR, each including the "mode-change-neighbor=1" parameter, and the "mode-set" parameter with value sets "0,2,3", "0,2,5,7", "0,2,3,4", and "0,2,3,6", respectively, shall generate the Single Codec information elements corresponding to the following: HR_AMR, FR_AMR, OHR_AMR, UMTS_AMR and UMTS_AMR_2 with Config-NB-Code=9; and FR_AMR, OHR_AMR, UMTS_AMR and UMTS_AMR_2 with Config-NB-Code=15. Note that other values of Config-NB-Code for these codecs are excluded even though they are all consistent with the available mode-set values.

B.2.5.2 Codec parameters for 3GPP AMR-WB codecs

Table B.2 shows the correspondence between the codec format parameters in the Single Codec information element (TS 26.103 [57]) and the SDP for the 3GPP wideband AMR codecs (RFC 3267 [23]).

Table B.2: Mapping between Single Codec subfields and SDP parameters for 3GPP AMR-WB codecs

Single Codec information element		SDP payload format parameters		
Codec IDentification	**Config-WB-Code**	**Payload Type number**	**Encoding name**	**Other Parameters**
FR_AMR-WB	0	dynamic	AMR-WB	mode-set=0,1,2; mode-change-period=2
OHR_AMR-WB	0	dynamic	AMR-WB	mode-set=0,1,2; mode-change-period=2
OFR_AMR-WB or UMTS_AMR-WB (NOTE 1)	0	dynamic	AMR-WB	mode-set=0,1,2
OFR_AMR-WB or UMTS_AMR-WB (NOTE 1)	1	dynamic dynamic dynamic	AMR-WB AMR-WB AMR-WB	mode-set=0,1,2 mode-set=0,1,2,8 mode-set=0,1,2,4
OFR_AMR-WB or UMTS_AMR-WB (NOTE 1)	2	dynamic	AMR-WB	mode-set=0,1,2,4
OFR_AMR-WB or UMTS_AMR-WB (NOTE 1)	3	dynamic dynamic dynamic	AMR-WB AMR-WB AMR-WB	mode-set=0,1,2,4 mode-set=0,1,2,8 mode-set=0,1,2
OFR_AMR-WB or UMTS_AMR-WB (NOTE 1)	4	dynamic	AMR-WB	mode-set=0,1,2,8
OFR_AMR-WB or UMTS_AMR-WB (NOTE 1)	5	dynamic dynamic dynamic	AMR-WB AMR-WB AMR-WB	mode-set=0,1,2,8 mode-set=0,1,2,4 mode-set=0,1,2

NOTE 1: SDP payload format configurations corresponding to OFR_AMR-WB shall also include the "mode-change-period=2" parameter. SDP payload format configurations corresponding to UMTS_AMR-WB shall not include the "mode-change-period" parameter when generating SDP from the Single Codec information element. When generating Single Codec information elements from SDP, the MGCF may include UMTS_AMR-WB with either a "mode-change-period=1" parameter, a "mode-change-period=2" parameter, or no "mode-change-period" parameter.

NOTE 2: Every SDP payload format configuration in this table shall also include the "mode-change-neighbor=1" parameter when generating SDP from the Single Codec information element.

When translating from a Single Codec information element to the equivalent SDP payload format parameters, the SDP shall include a distinct payload type and any associated parameters for each row in the table that matches the Config-WB-Code parameter. For example, OFR_AMR-WB with Config-WB-Code=3 shall generate three SDP payload types for AMR-WB, each including the "mode-change-period=2" parameter, the "mode-change-neighbor=1" parameter, and the "mode-set" parameter with value sets "0,1,2,4", "0,1,2,8", and "0,1,2", respectively. When translating a list of Single Codec information elements, only a single version of each distinct payload type shall be included in the SDP, and redundant entries shall be removed.

When translating from SDP payload format specifications to Single Codec information elements, all Codec IDentification values that match shall be represented, and matching configurations for each Codec IDentification value shall be represented with the fewest values of Config-WB-Code, while retaining the priority represented by the order of the SDP payload format specifications. For example, three SDP payload types for AMR-WB, each including the "mode-change-period=2" parameter, the "mode-change-neighbor=1" parameter, and the "mode-set" parameter with value sets "0,1,2,4", "0,1,2,8", and "0,1,2", respectively, shall generate the following Single Codec information elements: UMTS_AMR-WB with Config-WB-Code=3; OFR_AMR-WB with Config-WB-Code=3; OHR_AMR-WB with Config-WB-Code=0; and FR_AMR-WB with Config-WB-Code=0. Note that other values of Config-WB-Code

for UMTS_AMR-WB and OFR_AMR-WB are excluded even though they are all consistent with the available mode-set values.

B.2.5.3 Codec parameters for 3GPP non-AMR codecs

Table B.3 shows the correspondence between the codec format parameters in the Single Codec information element (TS 26.103 [57]) and the SDP for the 3GPP non-AMR codecs (RFC 3267 [23], RFC 3551 [51], and RFC 3555 [52]).

Table B.3: Mapping between Single Codec subfields and SDP parameters for 3GPP non-AMR codecs

Single Codec information element	SDP payload format parameters		
Codec IDentification	Payload Type number	Encoding name	Other Parameters
GSM FR	3	GSM	
GSM HR	N/A	N/A	
GSM EFR (NOTE 1)	dynamic	GSM-FR	
GSM EFR (NOTE 2)	dynamic	AMR	mode-set=7
TDMA EFR (NOTE 2)	dynamic	AMR	mode-set=4
PDC EFR (NOTE 2)	dynamic	AMR	mode-set=3

NOTE 1: GSM-FR framing according to RFC 3551 [51] does not support DTX. The IM-MGW may support this configuration by providing interworking between DTX procedures in the BICC CS network and non-DTX operation in the IM CN subsystem.

NOTE 2: AMR DTX is not compatible with the DTX schemes for any of the codecs in this list. The IM-MGW may support these configurations without transcoding by providing interworking between the DTX procedures and frame encodings on the bearer interfaces to the BICC CS network and the IM CN subsystem.

B.2.5.4 Codec parameters for ITU-T codecs

Table B.4 shows the correspondence between the codec format parameters in the Single Codec information element (Clause 11.1.7 of ITU-T Q.765.5 [35]) and the SDP for the ITU-T codecs (Table 4 of RFC 3551 [51], and RFC 3555 [52]).

Table B.4: Mapping between Single Codec subfields and SDP parameters for ITU-T codecs

Single Codec information element			SDP payload format parameters		
Codec Type subfield	Codec Name	Codec Configuration subfield (dcba)	Payload Type number	Encoding name	Other Parameters
00000001	G.711 64 kbit/s A-law	N/A	8	PCMA	
00000010	G.711 64 kbit/s μ-law	N/A	0	PCMU	
00000011	G.711 56 kbit/s A-law	N/A	N/A	N/A	
00000100	G.711 56 kbit/s μ-law	N/A	N/A	N/A	
00000101	G.722 (SB-ADPCM)	N/A	9	G722	
00000110	G.723.1	N/A	4	G723	annexa=no
00000111	G.723.1 Annex A (silence suppression)	N/A	4	G723	
00001000	G.726 (ADPCM)	xxx1 xx1x x1xx 1xxx	dynamic dynamic dynamic dynamic	G726-16 G726-24 G726-32 G726-40	
00001001	G.727 (Embedded ADPCM)	xxxx	N/A	N/A	
00001010	G.728	111 (subsets of defined rates not supported)	15	G728	
00001011	G.729 (CS-ACELP)	xx1 x1x 1xx	dynamic 18 dynamic	G729D G729 G729E	annexb=no annexb=no annexb=no
00001100	G.729 Annex B (silence suppression)	xx1 x1x 1xx	dynamic 18 dynamic	G729D G729 G729E	

NOTE: An "x" in a bit position of the Codec Configuration subfield indicates a "don't care" value. The SDP payload description for each listed codec includes a clock rate of 8000 Hz. TS 26.102 [53] only describes the BICC CS network framing for the PCM codecs.

When translating from a Single Codec information element to the equivalent SDP payload format parameters, the SDP shall include a distinct payload type and any associated parameters for each matching instance of the Codec Configuration subfield. For example, G.726 (ADPCM) with Codec Configuration subfield "0101" shall generate SDP payload types for G726-32 and G726-16.

When translating from an SDP payload format specification to the Single Codec information element, each SDP payload type should be represented by one matching Single Codec information element. For example, SDP payload types for G729 and G729E may generate one Single Codec information element for "G.729 Annex B" with Codec Configuration subfield "110". The G729 and G729E codecs may alternately be represented by two Single Codec information elements for "G.729 Annex B" with Codec Configuration subfields "100" and "010", respectively, if it is necessary to indicate preference between them.

3GPP TSG-CN WG3 #32 **N3-040396**
Zagreb, Croatia. 10th May – 14th May 2004.

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CHANGE REQUEST

⌘ **29.163** **CR** **042** ⌘ **rev** **2** ⌘ Current version: **6.2.0** ⌘

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Proposed change affects: UICC apps⌘ ☐ ME ☐ Radio Access Network ☐ Core Network ☒

Title:	⌘	Codec negotiation – Mid call interworking
Source:	⌘	TSG_CN WG3
Work item code:	⌘	IMS-CCR-IWCS
Date:	⌘	10/05/2004
Category:	⌘	**B**
Release:	⌘	Rel-6

Use one of the following categories:
F *(correction)*
A *(corresponds to a correction in an earlier release)*
B *(addition of feature),*
C *(functional modification of feature)*
D *(editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use one of the following releases:

2	*(GSM Phase 2)*
R96	*(Release 1996)*
R97	*(Release 1997)*
R98	*(Release 1998)*
R99	*(Release 1999)*
Rel-4	*(Release 4)*
Rel-5	*(Release 5)*
Rel-6	*(Release 6)*

Reason for change:	⌘	Provision of interworking techniques for mid-call codec negotiation are required
Summary of change:	⌘	This CR provides text detailing the mid-call SIP to BICC and BICC to SIP interworking at I-MGCF and O-MGCF by negotiation.
Consequences if not approved:	⌘	Incomplete codec negotiation interworking procedures

Clauses affected:	⌘	B.2.3

Other specs affected:	⌘	Y	N		⌘
			X	Other core specifications	
			X	Test specifications	
			X	O&M Specifications	

Other comments: ⌘

B.2.3 Mid-call interworking from SIP to BICC at I-MGCF or O-MGCF

B.2.3.1 Receipt of SDP offer

When the MGCF receives a SIP message (e.g. UPDATE request or re-INVITE request) with an SDP offer that is not associated with incoming call bearer establishment or preconditions, if the call is in a state capable of supporting BICC codec negotiation, the MGCF shall follow the procedures of clause B.2.5 to convert the list of codecs in the SDP offer into a Supported Codec List, delete those codecs in the Supported Codec List not supported at the IM-MGW, and initiate the mid-call codec negotiation procedure according to clause 10.4.4 of ITU-T Q.1902.4 [30], by sending an APM with the Supported Codec List and an Action indicator set to "mid-call codec negotiation". When generating the Supported Codec List, the MGCF should add to the SDP offer all codec configurations for which it can provide transcoding.

When the MGCF receives a SIP message with an SDP offer that is not associated with incoming call bearer establishment or preconditions, if the call is not in a state capable of supporting BICC codec negotiation, the MGCF shall respond to the SDP offer with existing procedures for the IM CN subsystem. When the call is in a state capable of supporting BICC codec negotiation, the MGCF may send a re-INVITE request without SDP towards the IM CN subsystem, soliciting a response with an SDP offer, thereby restarting the codec negotiation interworking procedure.

B.2.3.2 Generating SDP answer

After initiating a BICC codec negotiation procedure towards the BICC CS network in response to receipt of a SIP message with an SDP offer from the IM CN subsystem, the MGCF shall suspend the SDP answer procedure until it receives codec information from the succeeding BICC serving node. If the succeeding serving node returns a successful response, the MGCF shall select a codec configuration for use on the bearer interface to the IM CN subsystem from the codecs in the SDP offer, format an SDP answer based on this selected codec, send the SDP answer to the offerer in the appropriate SIP message (e.g. 200 OK (UPDATE) or 200 OK (INVITE)), send an APM to the succeeding serving node with an Action indicator set to "successful codec modification", and complete bearer establishment procedures. To avoid allocating a transcoder at the IM-MGW, the MGCF should preferably select a codec for the IM CN subsystem by converting the Selected Codec from the BICC CS network into an SDP answer according to the procedures of clause B.2.5, if allowed by the SDP offer/answer rules. Otherwise the MGCF should select the highest priority codec from the codecs in the received SDP offer supported by the IM-MGW for insertion in the SDP answer. Note that the MGCF stores the Available Codec List and does not send it to the offerer in the SDP answer.

If the succeeding serving node returns an Action indicator set to "mid-call codec negotiation failure", the MGCF either should send a 488 response to the SDP offerer indicating rejection of the initial SDP offer, or should select the highest priority codec from the codecs in the received SDP offer supported by the IM-MGW, format an SDP answer based on this selected codec, and send the SDP answer to the offerer in the appropriate SIP message. If the MGCF sends a 488 response to the SDP offerer, it should continue the call with the bearer configuration in place before initiating this codec negotiation procedure.

B.2.4 Mid-call interworking from BICC to SIP at I-MGCF or O-MGCF

B.2.4.1 Receipt of mid-call codec negotiation request

When the MGCF receives an APM with an Action indicator set to "mid-call codec negotiation", the MGCF shall follow the procedures of clause B.2.5 to convert the Supported Codec List from the APM into an SDP offer for transmission in an appropriate SIP message (e.g. re-INVITE request) towards the IM CN subsystem, according to RFC 3264 [36], deleting those codecs not supported at the IM-MGW. When generating the SDP offer, the MGCF should include all codec configurations for which it can provide transcoding in addition to those converted from the Supported Codec List. The MGCF shall include at least one AMR codec configuration in the SDP offer.

B.2.4.2 Responding to serving node initiating mid-call codec negotiation

The MGCF shall delay responding to the mid-call codec negotiation from the BICC CS network until it receives a response to the SDP offer from the IM CN subsystem. If the MGCF receives an SDP answer, it shall construct the Available Codec List for the BICC CS network from the list of codecs received in the Supported Codec List by removing codecs not supported at the IM-MGW, choose the Selected Codec for the BICC CS network from the codecs in the Available Codec List, and complete the mid-call codec negotiation procedure towards the preceding serving node

according to clause 10.4.5 of ITU-T Q.1902.4 [30]. The MGCF should choose the Selected Codec for the BICC CS network in such a way as to avoid transcoding at the IM-MGW and minimize speech degradation, if possible, according to clause B.2.5. Otherwise the MGCF should choose the highest priority codec from the Available Codec List for the Selected Codec for the BICC CS network. If the MGCF receives an APM from the preceding serving node with an Action indicator set to "codec modification failure", then the MGCF may initiate a new SDP offer/answer exchange towards the IM CN subsystem in an attempt to recreate the bearer configuration in place before this codec negotiation procedure began.

If the MGCF receives a 488 response or other failure response (e.g. 3xx-6xx) to the SDP offer, either it should reject the mid-call codec negotiation from the BICC CS network by sending an APM with an Action indicator set to "mid-call codec negotiation failure" towards the preceding serving node, or it should continue as if it received an SDP answer with no change in codec selected for the IM CN subsystem. If the MGCF sends an APM with an Action indicator set to "mid-call codec negotiation failure", it should continue the call with the bearer configuration in place before initiating this codec negotiation procedure.

B.2.4.3 Receipt of codec modification request

If the MGCF receives an APM from a BICC CS network that includes an Action indicator set to "modify codec" with no change in the selected codec, it shall act as a serving node terminating codec modification, according to clause 10.4.2 of ITU-T Q.1902.4 [30], without interworking the procedure with the IM CN subsystem.

If the MGCF receives an APM from a BICC CS network that includes an Action indicator set to "modify codec" and the new selected codec in the message is different from the Selected Codec at the IM-MGW bearer interface to the BICC CS network, the MGCF either may act as a serving node terminating codec modification, according to clause 10.4.2 of ITU-T Q.1902.4 [30], without interworking the procedure with the IM CN subsystem, or may follow the procedures of clause B.2.5 to convert the new Available Codec List (with new priority order) from the APM into an SDP offer for transmission in an appropriate SIP message (e.g. re-INVITE request) towards the IM CN subsystem, according to RFC 3264 [36], deleting those codecs not supported at the IM-MGW. When generating the SDP offer, the MGCF should include all codec configurations for which it can provide transcoding in addition to those converted from the new Available Codec List. The MGCF shall include at least one AMR codec configuration in the SDP offer.

If the MGCF sends a SIP message with an SDP offer towards the IM CN subsystem in response to receipt of a BICC codec modification request, then it shall delay responding to the BICC codec modification request until it receives a response to the SDP offer from the IM CN subsystem. When the MGCF receives either an SDP answer or a rejection of the SDP offer within the appropriate SIP message (e.g. 200 OK (INVITE)) from the IM CN subsystem, it shall decide whether to accept or reject the BICC codec modification procedure and complete the procedure for a BICC serving node terminating codec modification, according to clause 10.4.2 of ITU-T Q.1902.4 [30].

If the MGCF sends an APM with an Action indicator set to "codec modification failure" in response to receipt of a codec modification request, the preceding BICC serving node may retry the request with a mid-call codec negotiation using an APM including an Action indicator set to "mid-call negotiation" and a Supported Codec List with a new priority order encouraging selection of a new codec.

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CHANGE REQUEST

⌘ **29.163** **CR** **044** ⌘**rev** **2** ⌘ Current version: **6.2.0** ⌘

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Proposed change affects: UICC apps⌘ ☐ ME ☐ Radio Access Network ☐ Core Network ☒

Title:	⌘	MGCF IM-MGW interactions
Source:	⌘	TSG_CN WG3
Work item code:	⌘	IMS-CCR-IWCS
Date:	⌘	10/05/2004
Category:	⌘	**B**
Release:	⌘	Rel-6

Use one of the following categories:
F *(correction)*
A *(corresponds to a correction in an earlier release)*
B *(addition of feature),*
C *(functional modification of feature)*
D *(editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use one of the following releases:

2	*(GSM Phase 2)*
R96	*(Release 1996)*
R97	*(Release 1997)*
R98	*(Release 1998)*
R99	*(Release 1999)*
Rel-4	*(Release 4)*
Rel-5	*(Release 5)*
Rel-6	*(Release 6)*

Reason for change:	⌘	To add MGCF to IM-MGW interactions to the annex on interworking of codec negotiation procedures.
Summary of change:	⌘	Addition of clause B.3 to annex B with four new message sequence charts.
Consequences if not approved:	⌘	Codec negotiation as an annex will be incomplete.

Clauses affected:	⌘	B.3

		Y	N		
Other specs affected:	⌘		X	Other core specifications	⌘
			X	Test specifications	
			X	O&M Specifications	

Other comments:	⌘	This approach discussed and agreed in CN3#31bis.

B.3 MGCF – IM-MGW interaction during interworking of codec negotiation

B.3.1 Basic IM CN subsystem originated session

This clause shows an example of the interworking of codec negotiation between an IM CN subsystem and a BICC CS network during session establishment for an IM CN subsystem originated session. The example applies to BICC forward bearer establishment. Similar procecures apply to the other four versions of bearer establishment procedure applicable to the BICC CS network. The exchange of codec information is identical in all five cases, but there are differences in the sequence of operations associated with bearer establishment within the BICC CS network.

B.3.1.1 BICC forward bearer establishment

B.3.1.1.1 IM-MGW selection

The MGCF shall select an IM-MGW for the bearer connection before it performs the CS network side bearer establishment. This may happen either before sending the IAM or after receiving the APM message (signal 3 or signal 4 in figure B.1). In the latter case, the IM-MGW selection may be based on a possibly received MGW-id from the succeeding node.

B.3.1.1.2 CS network side bearer establishment

The MGCF shall either select bearer characteristics or request the IM-MGW to select and provide the bearer characteristics for the CS network side bearer connection before sending the IAM. In the latter case the MGCF shall use the Prepare Bearer procedure, not shown in figure B.1, to request the IM-MGW to select the bearer characteristics. After the succeeding node has provided a bearer address and a binding reference in the APM, the MGCF shall use the Establish Bearer procedure to request the IM-MGW to establish a bearer towards the destination CS-MGW. The MGCF shall provide the IM-MGW with the bearer address, the binding reference and the bearer characteristics (signal 5 in figure B.1).

B.3.1.1.3 IM CN subsystem side session establishment

When the MGCF receives the Selected Codec from the succeeding serving node in the CS network (signal 4 in figure B.1) and selects a codec for use in the IM CN subsystem, the MGCF shall initiate the Reserve IMS Connection Point and Configure Remote Resources procedure (signal 7 and 8 in figure B.1). From the received SDP and selected configuration data the MGCF:

- Shall send the appropriate remote codec(s), the remote UDP port and the remote IP address to the IM-MGW. The remote UDP port and IP address refer to the destination of user plane data sent towards the IM CN subsystem. The remote codec(s) are the codec(s) the IM-MGW may select for user plane data sent towards the IM CN subsystem.

- Shall indicate to the IM-MGW the appropriate local codec(s) and request a local IP address and UDP port. The local IP address and UDP port are used by the IM-MGW to receive user plane data from the IM CN subsystem. The local codec(s) are the codec(s) the IM-MGW may select to receive user plane data from the IM CN subsystem.

- If DTMF support together with speech support is required, the reserve value indicator shall be set to "true".

The IM-MGW

- Shall reply to the MGCF with the selected local codec(s) and the selected remote codec(s) and the selected local UDP port and IP address.

- Shall reserve resources for those codec(s).

The MCGF shall send the local codec(s), UDP port and IP address to the IMS in the Session Progress (signal 9 in figure B.1).

B.3.1.1.4 Through-connection

During the Prepare Bearer and Establish Bearer procedures, the MGCF shall either use the Change Through-Connection procedure to request the IM-MGW to backward through-connect the BICC terminations, or the MGCF shall use this procedure to both-way through-connect the BICC termination already on this stage (signal 5 in figure B.1). During the Reserve IMS Connection Point procedure, the MGCF shall use the Change IMS Through-Connection procedure to request the IM-MGW to backward through-connect the IMS termination (signal 7 in figure B.1).

When the MGCF receives the BICC:ANM answer indication, it shall request the IM-MGW to both-way through-connect the termination using the Change Through-Connection or Change IMS Through-Connection procedures (signal 20 in figure B.1), unless those terminations are already both-way through-connected.

B.3.1.1.5 Codec handling

The IM-MGW may include a speech transcoder based upon the speech coding information provided to each termination.

B.3.1.1.6 Failure handling in MGCF

If any procedure between the MGCF and the IM-MGW is not completed successfully the default action by the MGCF is to release the session, as described in clause 9.2.6. If the MGCF receives a Bearer Released procedure from the IM-MGW the default action by the MGCF is to release the session as described in clause 9.2.7.

Note: As an implementation option the MGCF may also decide for example to only release the resources in the IM-MGW that caused the failure, possibly select a new IM-MGW for the connection and continue the call establishment using new resources in the selected IM-MGW but such handling is outside of the scope of the present document.

B.3.1.1.7 Message sequence chart

Figure B.1 shows the message sequence chart for the IM CN subsystem originating session with BICC forward bearer establishment where the selection of IM-MGW is done after receipt of the APM. The MGCF then requests the seizure of a CS network side bearer termination and the establishment of the bearer. When the MGCF receives an answer indication, it requests the IM-MGW to both-way through-connect the terminations.

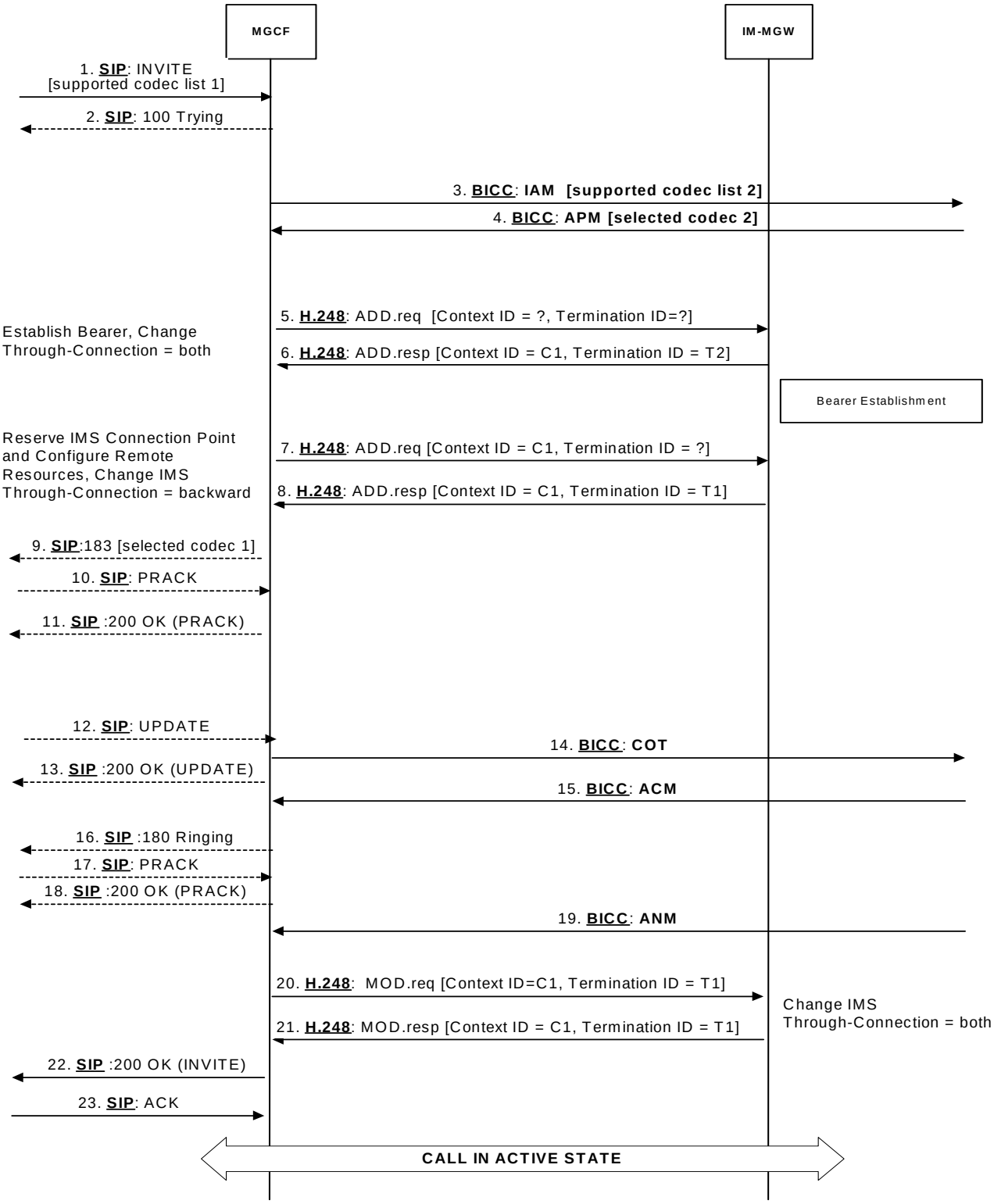

Figure B.1: Basic IM CN Subsystem originating session, BICC forward bearer establishment (message sequence chart)

B.3.2 Basic CS network originated session

This clause shows an example of the interworking of codec negotiation between a BICC CS network and an IM CN subsystem during session establishment for a BICC CS network originated session. The example applies to BICC forward bearer establishment. Similar procecures apply to the other four versions of bearer establishment procedure applicable to the BICC CS network. The exchange of codec information is identical in all five cases, but there are differences in the sequence of operations associated with bearer establishment within the BICC CS network.

B.3.2.1 BICC forward bearer establishment

B.3.2.1.1 IM-MGW selection

The MGCF shall select an IM-MGW for the bearer connection before it performs the IM CN subsystem session establishment or the CS network side bearer establishment.

B.3.2.1.2 IM CN subsystem side termination reservation

The MGCF shall derive from the codec negotiation procedure one or several appropriate local codec(s) the IM-MGW may use to receive user plane data from the IM CN subsystem. The MGCF shall use the Reserve IMS Connection Point procedure (signals 2 and 3 in figure B.2/1). Within this procedure, the MGCF shall indicate the local codec(s) and request a local IP address and UDP port from the IM-MGW. The local IP address and UDP port are used by the IM-MGW to receive user plane data from the IM CN subsystem. If DTMF support together with speech support is required, or if the resources for multiple speech codecs shall be reserved at this stage, the reserve value indicator shall be set to "true".

The IM-MGW shall reply to the MGCF with the selected local codec(s) and the selected local IP address and UDP port.

The MGCF shall send this information in the INVITE (signal 4 in figure B.2/1) to the IM CN subsystem.

B.3.2.1.3 IM CN subsystem side session establishment

The MGCF shall use the Configure IMS Resources procedure (signals 7 and 8 in figure B.2/1) to provide configuration data (derived from SDP received in signal 6 in figure B.2/1 and the codec negotiation procedure) to the IM-MGW as detailed below:

- The MGCF shall indicate the remote IP address and UDP port, i.e. the destination IP address and UDP port for data sent in the user plane towards the IM CN subsystem,
- The MGCF shall indicate the remote codec(s), i.e. the speech codec(s) for data sent in the user plane towards the IM CN subsystem.
- The MGCF may indicate the local codec(s) and the local IP address and UDP port. The MGCF shall indicate the local codec(s) if a change is required.
- IF DTMF support together with speech support is required, the reserve value indicator shall be set to "true".

The IM-MGW shall reply with the selected remote codec(s) and reserve resources for these codec(s). If local codec(s) were received, the IM-MGW shall also reply with the selected local codec(s) and reserve the corresponding resources.

If the selected local codec(s) differ from the codec(s) received in the SDP of signal 6 in figure B.2/1, the MGCF shall send the local reserved codec(s), and the local IP address and UDP port in the PRACK (signal 9 in figure B.2/1) to the IMS.

B.3.2.1.4 CS network side bearer establishment

The MGCF shall request the IM-MGW to prepare for the CS network side bearer establishment using the Prepare Bearer procedure (signals 11 and 12 in figure B.2/1). Within this procedure, the MGCF shall request the IM-MGW to

provide a bearer address, a binding reference and optionally notify when the bearer is established. The MGCF shall also provide the IM-MGW with the bearer characteristics determined by the codec negotiation procedure. After the IM-MGW has replied with the bearer address and the binding reference, the MGCF provides the APM message (signal 13 in figure B.2/1) to the preceding node. The MGCF may also provide the IM-MGW-id in the APM message.

B.3.2.1.5 Called party alerting

The MGCF shall request the IM-MGW to provide an awaiting answer indication (ringing tone) to the calling party using the Send Tone procedure (signals 21 and 22 in figure B.2/1) , when the first of the following conditions is satisfied:

- the MGCF receives the first 180 Ringing message
- Timer T i/w_1 expires
- Timer T i/w_2 expires

B.3.2.1.6 Called party answer

When the MGCF receives a 200 OK message (signal 23 in figure B.2/2), it shall request the IM-MGW to stop providing the ringing tone to the calling party using the Stop Tone procedure (signals 26 and 27 in figure B.2/2).

B.3.2.1.7 Through-Connection

During the Prepare Bearer procedure, the MGCF shall either use the Change Through-Connection procedure to request the IM-MGW to backward through-connect the BICC termination, or the MGCF shall use this procedure to both-way through-connect the BICC termination already on this stage (signals 11 and 12 in figure B.2/1). During the Reserve IMS Connection Point procedure, the MGCF shall use the Change IMS Through-Connection procedure to request the IM-MGW to backward through-connect the IMS termination (signals 2 and 3 in figure B.2/1).

When the MGCF receives the SIP 200 OK(INVITE) (signal 23 in figure B.2/2), it requests the IM-MGW to both-way through-connect the terminations using the Change IMS Through-Connection or Change Through-Connection procedures (signals 28 and 29 in figure B.2/2), unless those terminations are already both-way through-connected.

B.3.2.1.8 Codec handling

The IM-MGW may include a speech transcoder based upon the speech coding information provided to each termination.

B.3.2.1.9 Failure handling in MGCF

If any procedure between the MGCF and the IM-MGW is not completed successfully, the default action by the MGCF is to release the session as described in clause 9.2.6. If the MGCF receives a Bearer Released procedure from the IM-MGW the default action by the MGCF is to release the session, as described in clause 9.2.7.

Note: As an implementation option the MGCF may also decide for example to only release the resources in the IM-MGW that caused the failure, possibly select a new IM-MGW for the connection and continue the call establishment using new resources in the selected IM-MGW but such handling is outside of the scope of the present document.

B.3.2.1.10 Message sequence chart

Figures B.2/1 and B.2/2 show the message sequence chart for the CS network originating session with BICC forward bearer establishment.

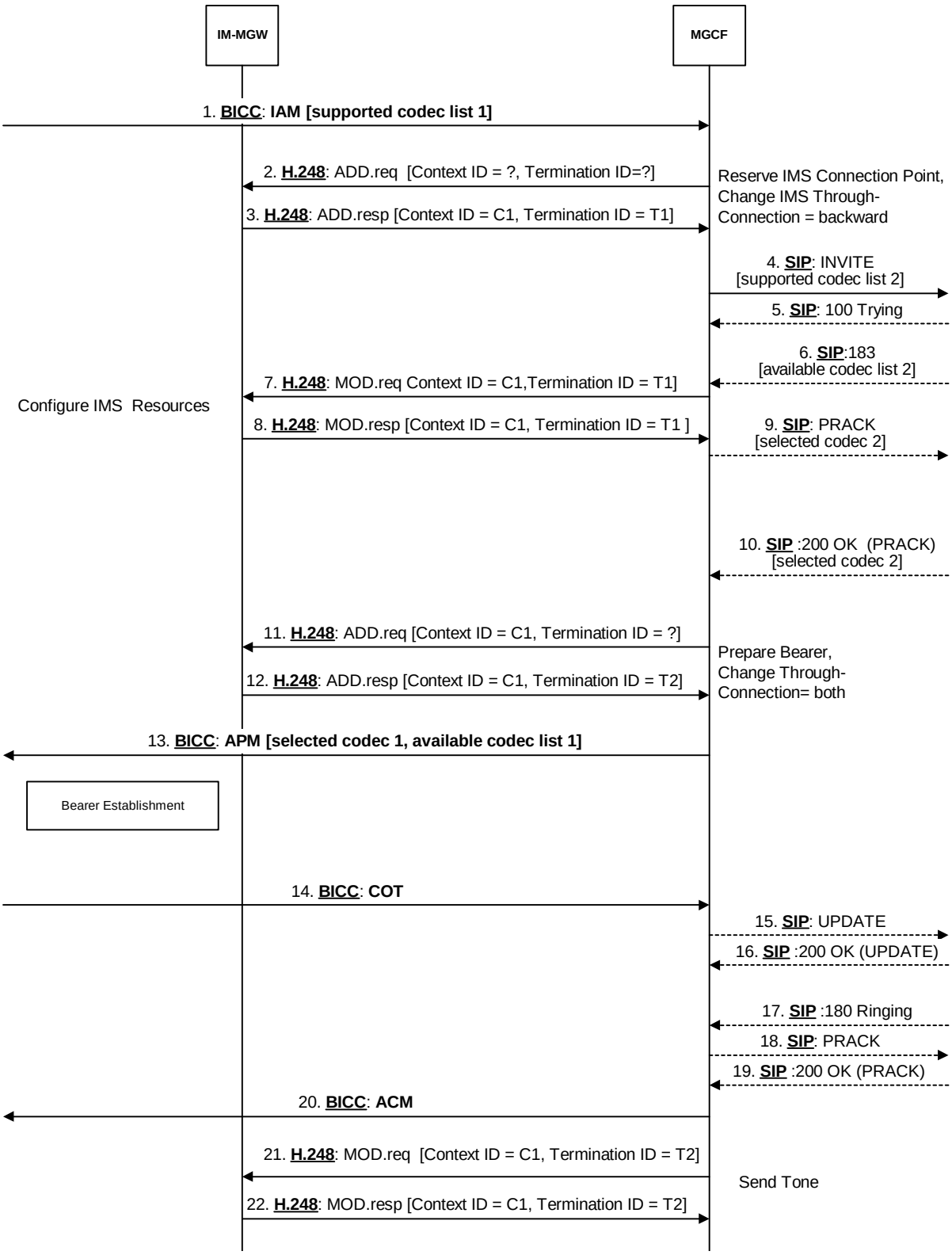

Figure B.2/1: Basic CS Network Originating Session, BICC forward bearer establishment (message sequence chart)

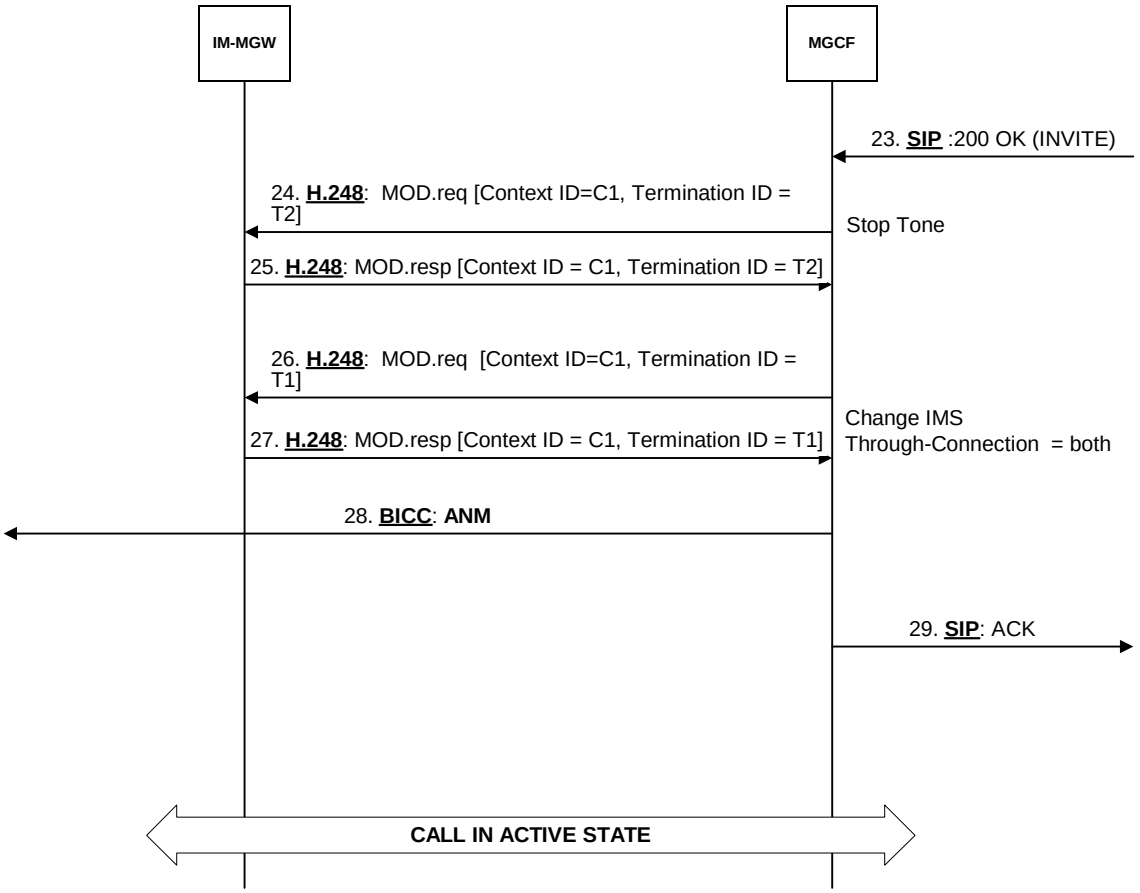

Figure B.2/2: Basic CS Network Originating Session, BICC forward bearer establishment (message sequence chart continued)

B.3.3 CS network initiated mid-call codec negotiation

Figure B.3 shows the CS network initiated mid-call codec negotiation procedure interworking with the IM CN subsystem. When the MGCF selects the codecs for the CS network and the IM CN subsystem (after signal 3 in figure B.3), the MGCF shall modify the CS network termination and the IM CN subsystem termination on the IM-MGW to conform to the newly selected configuration data on the two interfaces. The MGCF may perform bearer operations (not shown) at the IM-MGW before interworking the initial codec modification request (signal 2 in figure B.3) to determine new connection information, if necessary, or to verify resource availability.

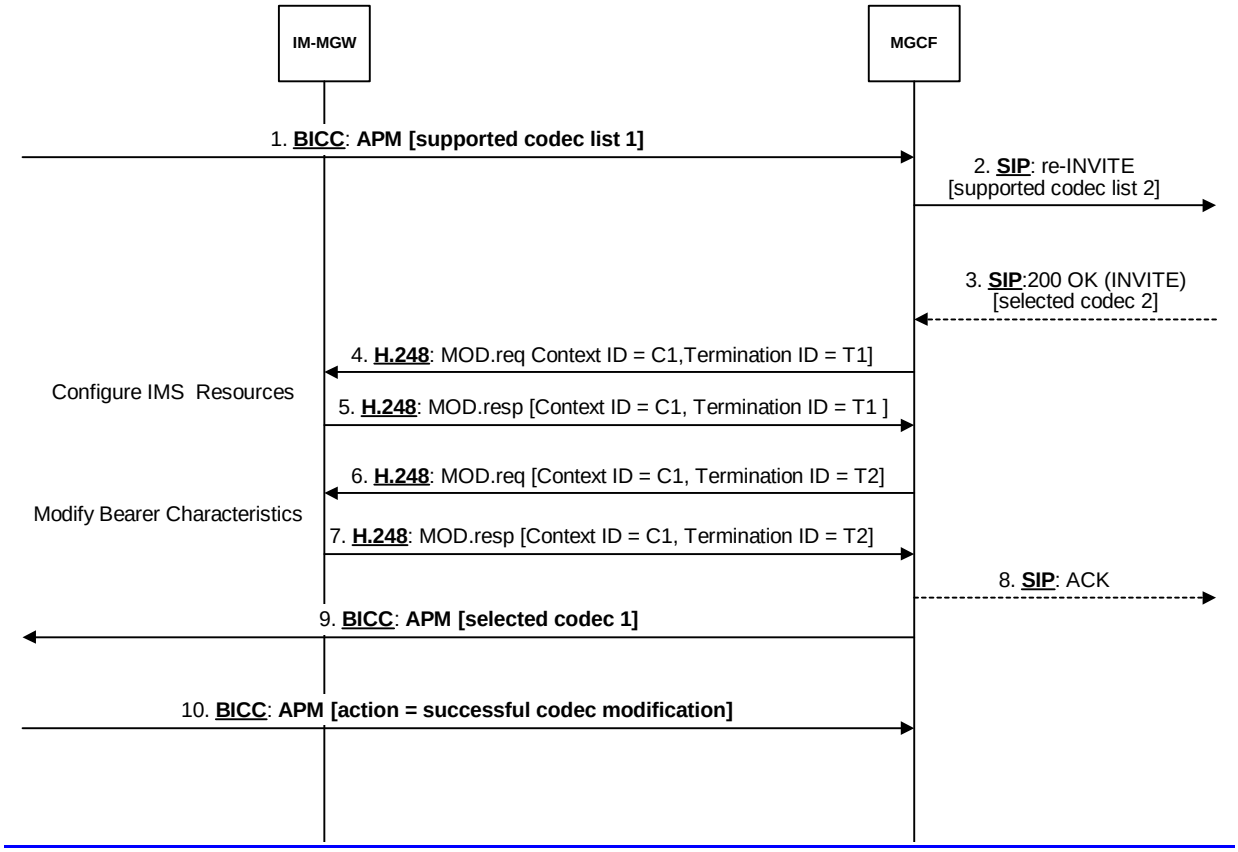

Figure B.3: CS network initiated mid-call codec negotiation (message sequence chart)

B.3.4 IM CN subsystem initiated mid-call codec negotiation

Figure B.4 shows the IM CN subsystem initiated mid-call codec negotiation procedure interworking with a BICC CS network. When the MGCF selects the codecs for the CS network and the IM CN subsystem (after signal 3 in figure B.4), the MGCF shall modify the CS network termination and the IM CN subsystem termination on the IM-MGW to conform to the newly selected configuration data on the two interfaces. The MGCF may perform bearer operations (not shown) at the IM-MGW before interworking the initial codec modification request (signal 2 in figure B.3) to determine new connection information, if necessary, or to verify resource availability. The MGCF may also perform bearer operations (not shown) at the IM-MGW after sending the final APM (signal 8 in figure B.4) to modify transport bandwidth, if necessary.

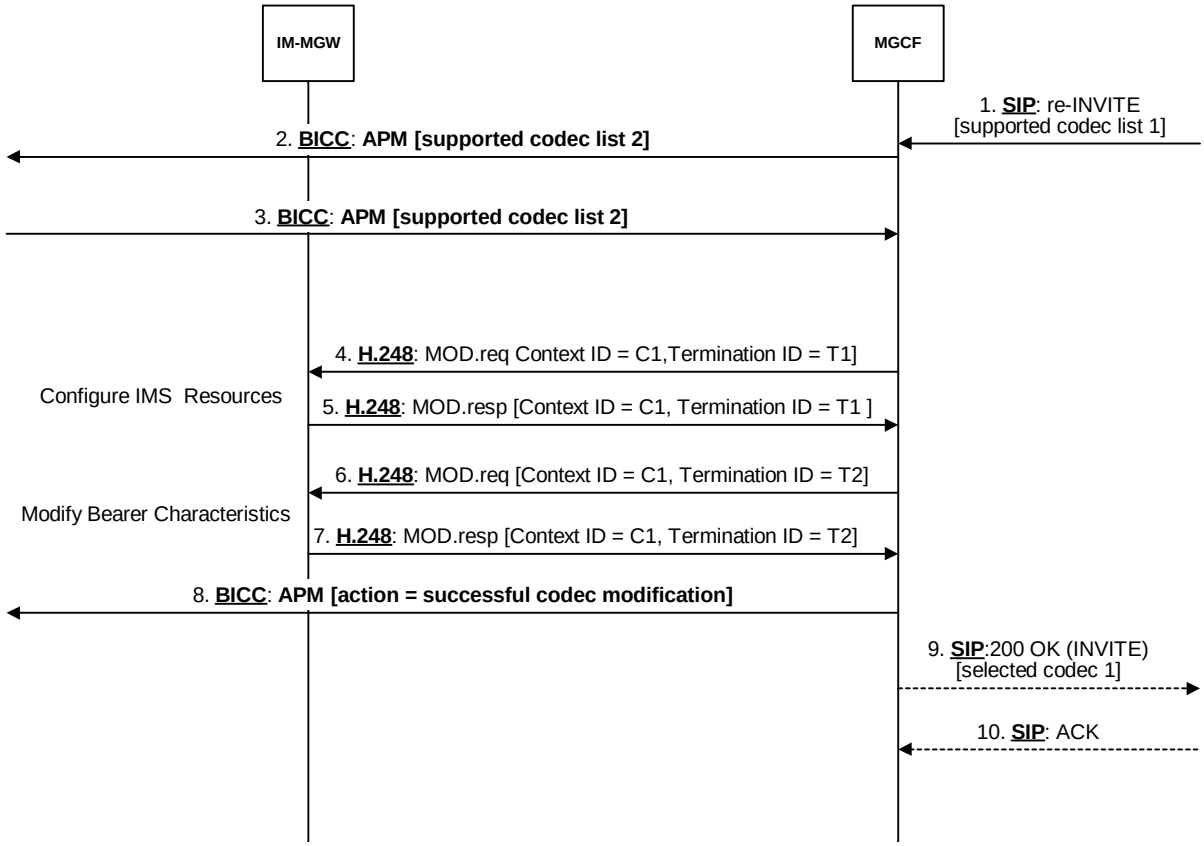

Figure B.4: IM CN subsystem initiated mid-call codec negotiation (message sequence chart)