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Introduction:

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3GPP TS 23.205 V1.0.1 (2000-11)

Technical Specification

**3rd Generation Partnership Project;
Technical Specification Group Core Network;
Bearer Independent CS Core Network;
Stage 2
(Release 4)**

3GPP

Contents

Foreword

This Technical Specification has been produced by the 3rd Generation Partnership Project (3GPP).

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of the present document, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

Version x.y.z

where:

   x   the first digit:

      1   presented to TSG for information;

      2   presented to TSG for approval;

      3   or greater indicates TSG approved document under change control.

   y   the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.

   z   the third digit is incremented when editorial only changes have been incorporated in the document.

1 Scope

The present document defines the stage 2 description for the bearer independent CS core network. The stage 2 shall cover the information flow between the GMSC server, MSC server and media gateways. It shall show the CS core network termination of the Iu interface in order to cover the information flow stimulus to the core network and describe the interaction with the supplementary and value added services and capabilities.

For the purposes of this specification, the protocol used over the Nc interface is an enhanced call control protocol supporting call bearer separation such as BICC (which is specified in [5]-[12]) or SIP-T (which is specified in [16]-[18]). The protocol used over the Mc interface is H.248 (which is specified in [13]). Existing specifications and recommendations shall not be repeated, as such the relevant specification shall be referred to.

This TS is applicable only for ATM or IP transport in the CS core network.
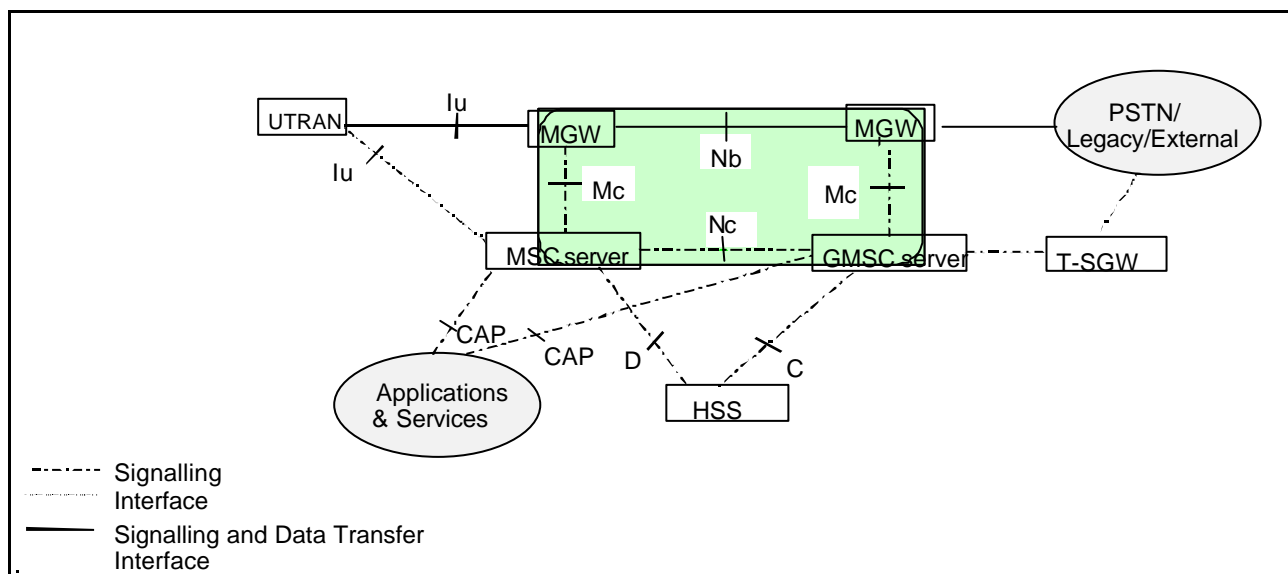
Figure 1: CS core network logical architecture

The CAP interfaces and the interfaces towards the HSS are outside the scope of this TS.

Details of Transcoder-Free Operation are outside the scope of this TS. Please see 3GPPTS 23.153 [3] for more information.

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.

[1]   3GPP TR 21.905: "3G Vocabulary"

[2]   3GPP TS 23.002: "Network Architecture"

[3]   3GPP TS 23.153: "Out of Band Transcoder Control; Stage 2"

[4]   3GPP TS 24.008: "Mobile Radio Interface Layer 3 specification; Core Network Protocols; Stage 3"

[5]   ITU-T Q.1902.1: "Bearer Independent Call Control CS2 Functional Description"

[6]   ITU-T Q.1902.2: "Bearer Independent Call Control CS2 General Functions of Messages and Signals"

[7]   ITU-T Q.1902.3: "Bearer Independent Call Control CS2 Formats and Codes"

[8]   ITU-T Q.1902.4: "Bearer Independent Call Control CS2 Basic Call Procedures"

[9]   ITU-T Q.1902.5: "Exceptions to the Application Transport Mechanism in the Context of Bearer Independent Call Control"

[10]   Reference to BICC CS-2 vertical information flows

[11]   Reference to BICC CS-2 general information flows

[12]   Reference to BICC CS-2 APM user

[13]   ITU-T H.248: "Media Gateway Control Protocol"

[14]   3GPP TS 29.232: "Media Gateway Controller; Media Gateway interface; Stage 3"

[15]   3GPP TS 29.415: " Core Network Nb User Plane Protocols; Stage 3"

[16]   RFC 2543: "SIP Session Initiation Protocol"

Editors note: To be added: [17]   Reference to SIP-T Context and Architectures and

                               [18]   Reference to SIP-T MIME Types for ISUP and OSIG objects

[19]   3GPP TS 23.009: "Handover procedures".

[20]   3GPP TS 23.072: "Call Deflection (CD) supplementary service; Stage2".

[21]   3GPP TS 23.078: "Customized Applications for Mobile network Enhanced Logic (CAMEL) - Phase 3; Stage 2".

[22]   3GPP TS 23.079: "Support of Optimal Routeing (SOR); Technical Realisation".

[23]   3GPP TS 23.081: "Line identification Supplementary Services; Stage 2 ".

[24]   3GPP TS 23.082: "Call Forwarding (CF) Supplementary Services; Stage 2".

[25]   3GPP TS 23.083: "Call Waiting (CW) and Call Hold (HOLD) Supplementary Services; Stage 2".

[26]   3GPP TS 23.084: "Digital cellular telecommunications system (Phase 2+); Multi Party (MPTY) Supplementary Service; Stage 2".

[27]   3GPP TS 23.085: "Closed User Group (CUG) Supplementary Service; Stage 2".

[28]   3GPP TS 23.086: "Advice of Charge (AoC) Supplementary Service; Stage 2".

[29]   3GPP TS 23.087: "User –to-User Signalling (UUS); Stage 2".

[30]   3GPP TS 23.088: "Call Barring (CB) Supplementary Service; Stage 2".

[31]   3GPP TS 23.091: "Explicit Call Transfer (ECT) Supplementary Service; Stage 2".

[32]   3GPP TS 23.093: "Technical realisation of Completion of Calls to Busy Subscriber (CCBS); Stage 2".

[33]   3GPP TS 23.135: "Multicall supplementary service; Technical Realisation; Stage 2".

[34]   3GPP TS 23.108: "Mobile radio interface layer 3 specification; Core Network Protocols; Stage 2".

[35]   GSM TS 02.32: "Immediate Service Termination; Service Description; Stage 1".

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the following terms and definitions apply.

3.2 Symbols

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

Iu	Interface between the RNS and the core network. It is also considered as a reference point.
Mc	Interface between the server and the media gateway.
Nb	Interface between media gateways.
Nc	The NNI call control interface between (G)MSC servers.

3.3 Abbreviations

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

BCF	Bearer Control Function
BICC	Bearer Independent Call Control
CCF	Call Control Function
CS	Circuit Switched
IAM	Initial Address Message
IETF	Internet Engineering Task Force
IP	Internet Protocol
IPv4	Internet Protocol version 4
IPv6	Internet Protocol version 6
MGW	Media Gateway
MGC	Media Gateway Controller
MTP2	Message Transfer Part layer 2
MTP3	Message Transfer Part layer 3
NNI	Network-Network interface
RAB	Radio Access Bearer
RANAP	Radio Access Network Application Protocol
SIP-T	Session Initiation Protocol for Telephony
TCAP	Transaction Capabilities Application Part
TFO	Tandem free operation
TRAU	Transcoder and Rate Adapter Unit
TrFO	Transcoder free operation
UDP	User Datagram Protocol
UTRAN	UMTS Terrestrial Radio Access Network

4 Main Concepts

4.1 General

The circuit switched core network enables the support of different transports (e.g. ATM or IP) in a bearer-independent fashion. For the ATM and IP transport, there is a strict separation between the call control level and the bearer control

level. In the case of ATM or IP transport, the passage of compressed speech at variable bit rates is possible through the CS core network.

The CS core network shall employ the MSC server, GMSC server and media gateways. The GMSC server and MSC server shall provide the call control and mobility management functions, and the media gateway shall provide the bearer control and transmission resource functions. The media gateway shall contain the stream manipulating functions.

The GMSC server and MSC servers are connected to the media gateway via the Mc reference point. The MSC servers and GMSC servers are connected with the Nc reference point. There may be a number of call control transit nodes between the MSC server and GMSC server in the Nc reference point. The MGWs are connected with the Nb reference point.

The users connected to the CS core network shall not be aware whether a MSC server – media gateway combination is used, or a monolithic MSC is used.

4.2 Bearer-Independent Call Control

The protocol used on the Nc interface shall be a call control protocol supporting IP and ATM transports in a bearer-independent manner for the ISDN service set, allowing the physical separation of the call control entities from the bearer control entities.

4.3 H.248/MEGACO

H.248/MEGACO has been jointly developed within the ITU-T and the IETF, and supports a separation of call control entities from bearer control entities, and a separation of bearer control entities from transport entities. H.248 is used on the Mc interface between the (G)MSC servers and the media gateway.

5 General Circuit Switched Core Network Domain Architecture

5.1 Logical Architecture

The overall CS core network logical architecture is shown in Figure 1.

5.1.1 CS Core Network Nodes

5.1.1.1 MSC Server

The MSC server mainly comprises the call control and mobility control parts of a GSM/UMTS MSC as described in 3GPP TS 23.002 [2].

It terminates the user-network signalling (see 3GPP TS 24.008 [4]) and translates it into the Nc signalling. The MSC Server also contains a VLR to hold the mobile subscriber's service data and CAMEL related data.

The MSC server terminates the Mc interface towards the media gateway.

The MSC server controls the parts of the call state model that pertain to connection control for media channels in a MGW.

The MSC server contains the 'Call Control Function' in the BICC model (MGC in the SIP-T model).

5.1.1.2 GMSC Server

The GMSC server mainly comprises the call control and mobility control parts of a GSM/UMTS GMSC as described in 3GPP TS 23.002. It terminates the Nc interface, and call control interfaces to the external networks.

The GMSC server terminates the Mc interface towards the media gateway.

The GMSC server controls the parts of the call state model that pertain to connection control for media channels in a MGW.

The GMSC server contains the 'Call Control Function' in the BICC model (MGC in the SIP-T model).

5.1.1.3 Media Gateway

The media gateway terminates the Mc interface from the (G)MSC servers. The media gateway terminates the bearer control protocols and contains bearer terminations. It also contains media manipulation equipment (e.g. transcoders, echo cancellers, or tone senders). The media gateway may perform media conversion and framing protocol conversion.

The media gateway terminates the bearer part of the Iu interface and the Nb interface.

5.1.2 CS Core Network Interfaces and Reference Points

5.1.2.1 Mc Interface

The Mc reference point in this TS considers the aspects of the interface between the (G)MSC server and MGW. The H.248 protocol [13] together with 3GPP specific extensions/packages shall be used across the Mc interface.

5.1.2.2 Nc Interface

Over the Nc reference point the Network-Network based call control is performed. Any suitable call control protocol may be used across the Nc interface (e.g. BICC, SIP-T).

5.1.2.3 Nb Interface

Over the Nb reference point the bearer control and transport are performed.

5.2 Network Interworking

5.2.1 Interworking on the Nc Reference Point

Interworking between Nc reference point, call control protocols and ISUP shall be defined within the 3GPP stage 3 documentation for each given protocol (or by references specified in stage 3 documentation [14]).

5.2.2 Interworking on the Nb Reference Point

The interworking is specified in 3GPP TS 29.415 [15].

6 Call Establishment

NOTE1: All message sequence charts in this clause are examples. All valid call establishment message sequences can be derived from the example message sequences and associated message pre-conditions.

NOTE2: The continuity indication in the IAM is not used to indicate that a continuity check will be performed on the current leg of the call, but it is used to indicate that a Continuity message can be expected as a result of a continuity check on a preceding ISUP circuit, or establishment of a preceding bearer connection.

6.1 Basic Mobile Originating Call

6.1.1 Forward bearer establishment

The mobile originating call shall be established in accordance with 3GPP TS 23.108 [33]. The following paragraphs describe the additional requirements for the bearer independent CS core network. If an out-of-band transcoder control is applied for a speech call that shall be performed in accordance with 3GPP TS 23.153 [3].

MGW selection

The MSC shall select a MGW for the bearer connection before it performs the RAB assignment or the network side bearer establishment. This may happen either before sending the Initial Address message or after receiving the Bearer Information message. In the latter case, the MGW selection may be based on a possibly received MGW-id from the succeeding node. (Bullet 1 or bullet 2 in figure 6.2)

Initial addressing

The MSC indicates in the Initial Address message that forward bearer establishment is to be used. . If RAB assignment has not been completed, t he MSC indicates that the Continuity message will follow. If the MGW is selected at an earlier stage the MGW-id and/or bearer characteristics may be provided to the succeeding node in the Initial Address message. (Bullet 1 in figure 6.2)

Network side bearer establishment

After the succeeding node has provided the bearer address and binding reference in the Bearer Information message the MSC uses the Establish Bearer procedure to request the MGW to establish a bearer towards the destination MGW. To accomplish this, the MSC provides the MGW with the bearer address and the binding reference. (Bullet 2 in figure 6.2)

RAB assignment

Before the MSC starts the RAB assignment, the MSC uses the Prepare Bearer procedure to request the MGW to provide a bearer address and a binding reference. For a non-speech call the MSC also provides the MGW with a PLMN BC [4]. After the MGW has replied with the bearer address and the binding reference the MSC requests RAB assignment using the provided bearer address and binding reference. (Bullet 3 in figure 6.2)

Confirmation of bearer establishment

If the Initial Address message, which was sent to the succeeding node, indicated that the Continuity message will follow, the MSC sends the Continuity message when the RAB assignment is completed. (Bullet 4 in figure 6.2)

Through-connection

During the Prepare Bearer and Establish Bearer procedures, the MSC requests the MGW to through-connect the bearer terminations in such a manner that the bearer will be backward through-connected. (Bullets 2 and 3 in figure 6.2)

On reception of the answer indication, the MSC requests the MGW to both-way through-connect the bearer using the Change Through-Connect procedure. (Bullet 5 in figure 6.2)

Interworking function

An interworking function may be used by the MGW based on the PLMN BC [4] of the bearer termination. The activation of the possible interworking function in both bearer terminations will be requested by the MSC at reception of answer indication using the Activate Interworking Function procedure. (Bullet 5 in figure 6.2)

Example

The figure 6.1 below shows the network model for the mobile originating call. The 'squared' line represents the call control signalling. The 'dotted' line represents the bearer control signalling and the bearer. The MSC seizes one context with two bearer terminations in the MGW. The bearer termination T1 is used for the bearer towards the RNC and the bearer termination T2 is used for the bearer towards the succeeding MGW.

Figure 6.1 Basic Mobile Originating Call (network model)

The figure 6.2 below shows the message sequence chart example for the mobile originating call. In the example the MSC requests seizure of the network side bearer termination and establishment of the bearer when the Bearer Information message is received from the succeeding node. After the network side bearer termination is seized the MSC requests seizure of the access side bearer termination. At answer the MSC requests to both-way through-connect the bearer terminations. The possible activation of the interworking function in both terminations is requested by the MSC at answer.

Figure 6.2 Basic Mobile Originating Call, Forward Bearer Establishment (message sequence chart)

6.1.2   Backward bearer establishment

The basic mobile originating call shall be established in accordance with 3GPP TS 23.108 [33]. The following paragraphs describe the additional requirements for the bearer independent CS core network. If an out-of-band transcoder control is applied for a speech call that shall be performed in accordance with 3GPP TS 23.153 [3].

MGW selection

The MSC shall select a MGW for the bearer connection before it performs the RAB assignment or the network side bearer establishment. This may happen before sending the Initial Address message (Bullet 1 in figure 6.4).

Network side bearer establishment

The MSC uses the Prepare Bearer procedure to request the MGW to provide a bearer address and a binding reference. (Bullet 2 in figure 6.4)

Initial addressing

The MSC indicates in the Initial Address message that forward bearer establishment is to be used. If RAB assignment has not been completed, the MSC indicates that the Continuity message will follow. The MSC also provides the MGW - id and/or bearer characteristics, bearer address and binding reference to the succeeding node in the Initial Address message. (Bullet 3 in figure 6.4)

RAB assignment

Before the MSC starts the RAB assignment, the MSC uses the Prepare Bearer procedure to request the MGW to provide a bearer address and a binding reference. For a non-speech call the MSC also provides the MGW with a PLMN BC [4]. After the MGW has replied with the bearer address and the binding reference the MSC requests RAB assignment using the provided bearer address and binding reference. (Bullet 1 in figure 6.4)

Confirmation of bearer establishment

If the Initial Address message was sent to the succeeding node indicating that the Continuity message will follow, the MSC sends the Continuity message when the RAB assignment is completed.

Through-connection

During the Prepare Bearer procedures, the MSC requests the MGW to through-connect the bearer terminations in such a manner that the bearer will be backward through-connected. (Bullets 1 and 2 in figure 6.4)

On reception of the answer indication, the MSC requests the MGW to both-way through-connect the bearer using the Change Through-Connect procedure. (Bullet 4 in figure 6.4)

Interworking function

An interworking function may be used by the MGW based on the PLMN BC [4] of the bearer termination. The activation of the possible interworking function in both bearer terminations will be requested by the MSC at reception of answer indication using the Activate Interworking Function procedure. (Bullet 4 in figure 6.4)

Example

The figure 6.3 below shows the network model for the mobile originating call. The 'squared' line represents the call control signalling. The 'dotted' line represents the bearer control signalling and the bearer. The MSC seizes one context with two bearer terminations in the MGW. The bearer termination T1 is used for the bearer towards the RNC and the bearer termination T2 is used for the bearer towards the succeeding MGW.
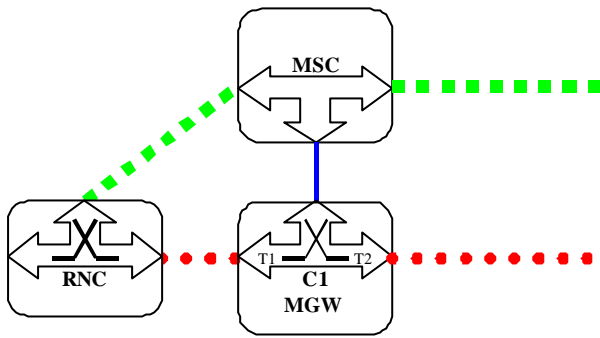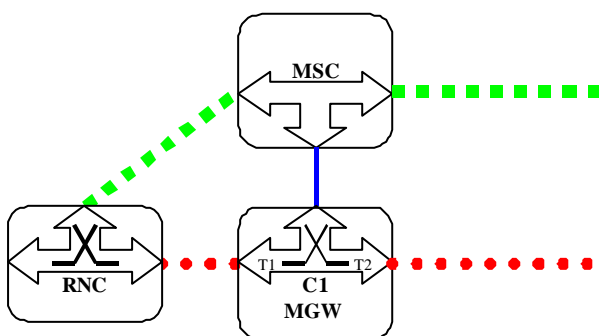

Figure 6.3 Basic Mobile Originating Call, Backward Bearer Establishment (network model)

The figure 6.4 below shows the message sequence chart example for the mobile originating call. In the example the MSC requests seizure of the access side bearer termination and network side bearer termination. As the RAB assignment has been completed before the Initial Address message, no Continuity message will be sent. At answer the MSC requests the MGW to both-way through-connect the bearer terminations. The possible activation of the interworking function in both bearer terminations will be requested by the MSC at answer.
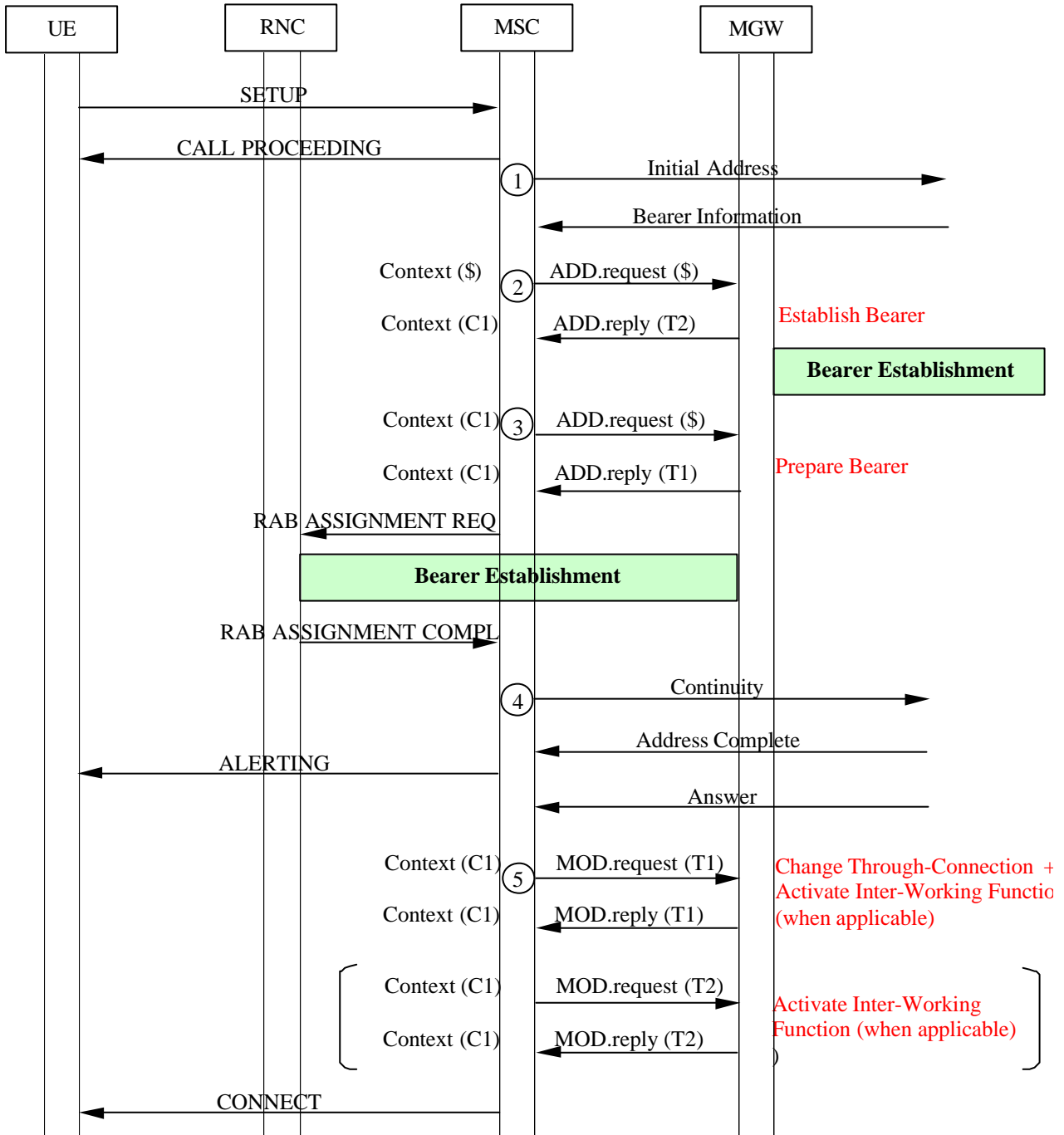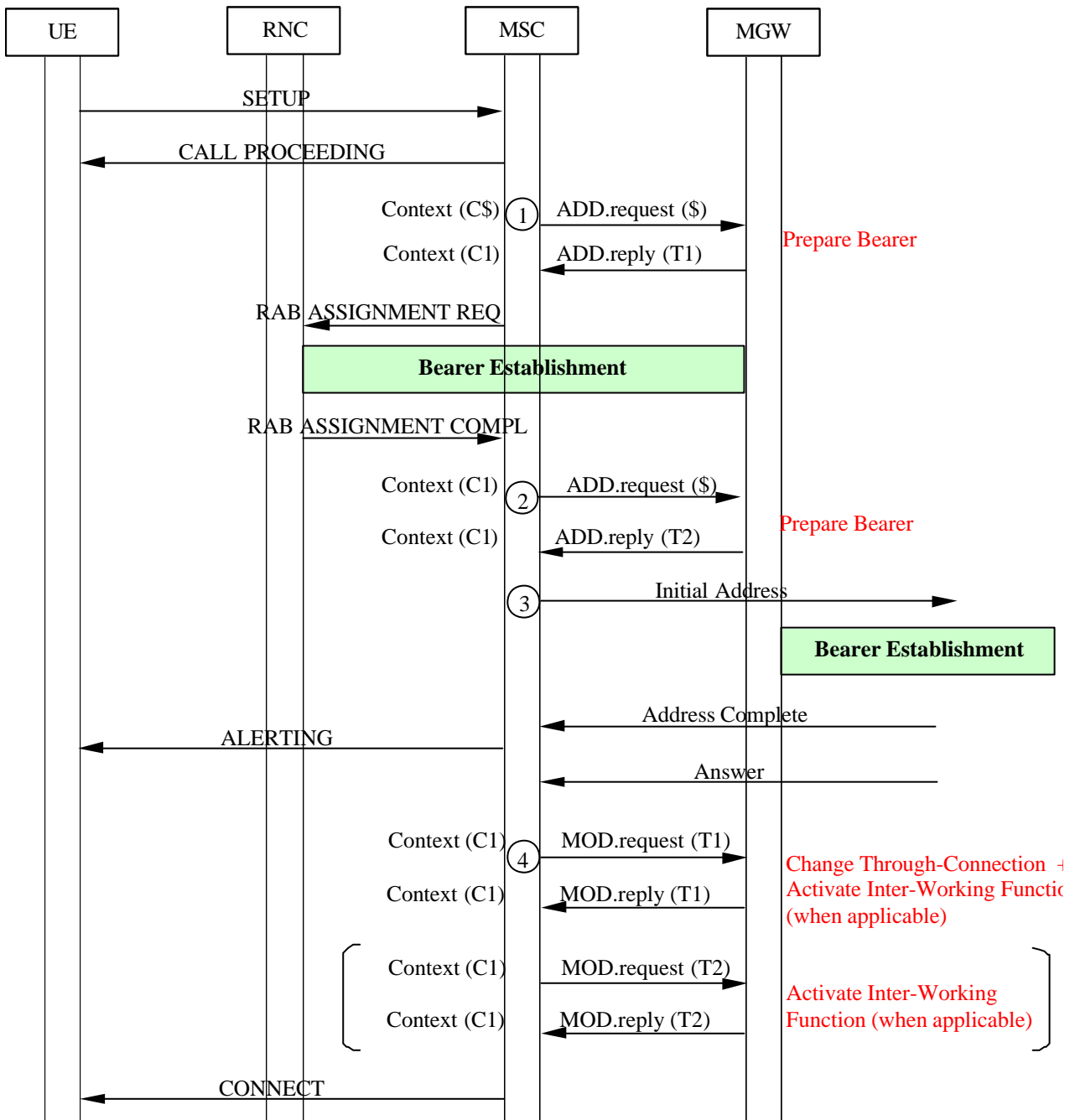
Figure 6.4 Basic Mobile Originating Call, Backward Bearer Establishment (message sequence chart)

6.2 Basic Mobile Terminating Call

6.2.1 Forward bearer establishment

The basic mobile terminating call shall be established in accordance with 3GPP TS 23.108. The following paragraphs describe the additional requirements for the bearer independent CS core network. If an out-of-band transcoder control is applied for a speech call that shall be performed in accordance with 3GPP TS 23.153.

6.2.1.1 GMSC

MGW selection

The GMSC shall select a MGW for the bearer connection before it performs the incoming side bearer establishment or the outgoing side bearer establishment. This may happen either before sending the Initial Address message or after receiving the Bearer Information message. If the GMSC received a MGW -id and/or a bearer characteristics from the preceding node and/or from the succeeding node, those may be used for the MGW selection. (Bullet 1 or bullet 4 in figure 6.6)

> NOTE: As an implementation option, if there is no need for the GMSC to manipulate the bearer, the GMSC may perform call control signalling without any associated MGW. In that case the bearer related information shall be provided transparently through the GMSC.

Initial addressing

The GMSC indicates in the Initial Address message that forward bearer establishment is to be used. The GMSC also indicates in the Initial Address message that the Continuity message will follow, if and only if, either of the following conditions is satisfied before sending the Initial Address message:

1. If the incoming Initial Address message indicated that the Continuity message will follow, no Continuity message has been received.

2. The incoming side bearer has not been established.

If the MGW is selected at early stage the MGW -id and the bearer characteristics may be provided to the succeeding node in the Initial Address message. (Bullet 1 in figure 6.6)

Outgoing side bearer establishment

After the GMSC has received the bearer address and the binding reference in the Bearer Information message from the succeeding node, the GMSC requests the MGW to establish a bearer to the given destination MGW using the Establish Bearer procedure. The GMSC provides the MGW with the bearer address, the binding reference. (Bullet 4 in figure 6.6)

Incoming side bearer establishment

The GMSC requests the MGW to prepare for the bearer establishment using the Prepare Bearer procedure. The GMSC requests the MGW to provide a bearer address, a binding reference and to notify when the bearer is established. (bullet 5 in figure 6.6) After the MGW has replied with the bearer address and the binding reference, the GMSC sends the Bearer Information message to the preceding node. The GMSC may also include the selected MGW -id and the bearer characteristics to the Bearer Information message. (Bullet 6 in figure 6.6)

> NOTE: The incoming side bearer establishment may take place either before or after HLR interrogation.

Through Connection

In the Prepare Bearer and Establish Bearer procedures, the GMSC requests the MGW to both-way through-connect the bearer termination. (Bullet 4 and bullet 5 in figure 6.6).

Confirmation of bearer establishment

If the Initial address message, which was sent to the succeeding node, indicated that the Continuity message will follow, the Continuity message shall be sent when the following conditions are satisfied:

1. If the incoming Initial Address message indicated that the Continuity message will follow, a Continuity message has been received from the preceding node. (Bullet 8 in figure 6.6).

2. If the GMSC selected a MGW, a notification of successful bearer establishment in the incoming side has been received from the MGW. (Bullet 7 in figure 6.6).

6.2.1.2 MSC

<u>Call setup</u>

The MSC indicates to the UE in SETUP message that early RAB assignment is used in order to establish the bearer end-to-end before the UE starts alerting, if either of the following condition is satisfied before sending the SETUP message (bullet 2 in figure 6.6):

1. If the Initial Address message indicated that the Continuity message will follow, no Continuity message has been received.

2. The network side bearer has not been established.

<u>MGW selection</u>

The MSC shall select a MGW for the bearer connection before it performs the network side bearer establishment. This happens latest after the UE has sent the Call Confirmed message. If the MSC received a MGW-id and/or a bearer characteristics from the preceding node those may be used for MGW selection. (Bullet 3 in figure 6.6)

<u>Network side bearer establishment</u>

The MSC requests the MGW to prepare for the bearer establishment using the Prepare Bearer procedure. The MSC requests the MGW to provide a bearer address, a binding reference and to notify when the bearer is established (bullet 3 in figure 6.6). After the MGW has replied with the bearer address and the binding reference, the MSC provides the Bearer Information message to the preceding node. The MSC may also provide the selected MGW-id and the bearer characteristics to the preceding node.

<u>RAB assignment</u>

The RAB assignment may be started when the following conditions are satisfied:

1. If the incoming Initial Address message indicated that the Continuity message will follow, a Continuity message has been received from the preceding node. (Bullet 9 in figure 6.6).

2. A notification of successful bearer establishment in the network side has been received from the MGW. (Bullet 6 in figure 6.6)

For the RAB assignment the MSC requests the MGW to prepare for the RAB assignment using the Prepare Bearer procedure. The MSC requests the MGW to provide a bearer address and a binding reference. For a non-speech call the MSC also provides the MGW with a PLMN BC [4]. After the MGW has replied with the bearer address and the binding reference the MSC requests the RAB assignment using the provided bearer address and the binding reference.

<u>Called party alerting</u>

For a speech call at reception of the Alerting message, the MSC requests the MGW to provide a ringing tone to the calling party using the Send Tone procedure. (Bullet 10 in figure 6.6)

<u>Called party answer</u>

For a speech call, at reception of the Connect message, the MSC requests the MGW to stop providing the ringing tone to the calling party using the Send Tone procedure. (Bullet 11 in figure 6.6)

<u>Through Connection</u>

In the Prepare Bearer procedure, the MSC requests the MGW to through-connect the bearer terminations in such a manner that the bearer will be not through-connected. (Bullet 3 and bullet 9 in figure 6.6).

At reception of the Connect message the MSC requests the MGW to both-way through-connect the bearer using the Change Through-Connection procedure. (Bullet 11 in figure 6.6)

<u>Interworking function</u>

An interworking function may be used by the MGW based on the PLMN BC [4] of the bearer termination. The activation of the possible interworking function in both bearer terminations will be requested by the MSC at reception of the Connect message using the Activate Interworking Function procedure. (Bullet 11 in figure 6.6)

Example

The figure 6.5 below shows the network model for the basic mobile terminating call. The 'squared' line represents the call control signalling. The 'dotted' line represents the bearer control signalling and the bearer. The MSC seizes one context with two bearer terminations in the MGWb. The bearer termination T1 is used for the bearer towards the RNC and the bearer termination T2 is used for the bearer towards the GMSC selected MGWa. The GMSC seizes one context with two bearer terminations in the MGWa. The bearer termination T3 is used for the bearer towards the MSC selected MGWb and the bearer termination T4 is used for the bearer towards the preceding MGW.
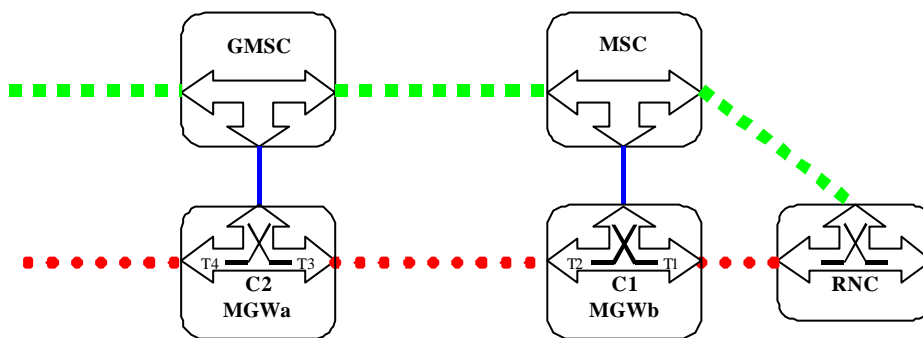
Figure 6.5 Basic Mobile Terminating Call Forward Bearer Establishment (network model)

The figure 6.6 below shows the message sequence example for the mobile terminating call. In the example the GMSC requests seizure of the outgoing side bearer termination and establishment of the bearer when the Bearer Information message is received from the MSC.. After the outgoing side bearer termination is seized the GMSC requests seizure of the incoming side bearer termination. The MGW sends a notification of an established incoming side bearer. The MSC requests seizure of the network side bearer termination when Call Confirmed message is received from the UE. The MGW sends a notification of an established network side bearer. When the Continuity message is received from the GMSC, the MSC requests seizure of the access side bearer termination. For a speech call the MSC requests MGW to provide a ringing tone to the calling party at alerting. At answer the MSC requests MGW to both-way through-connect the bearer. For speech call the MSC request MGW to stop the ringing tone at answer. The possible activation of the interworking function in both bearer terminations is requested by the MSC at answer.
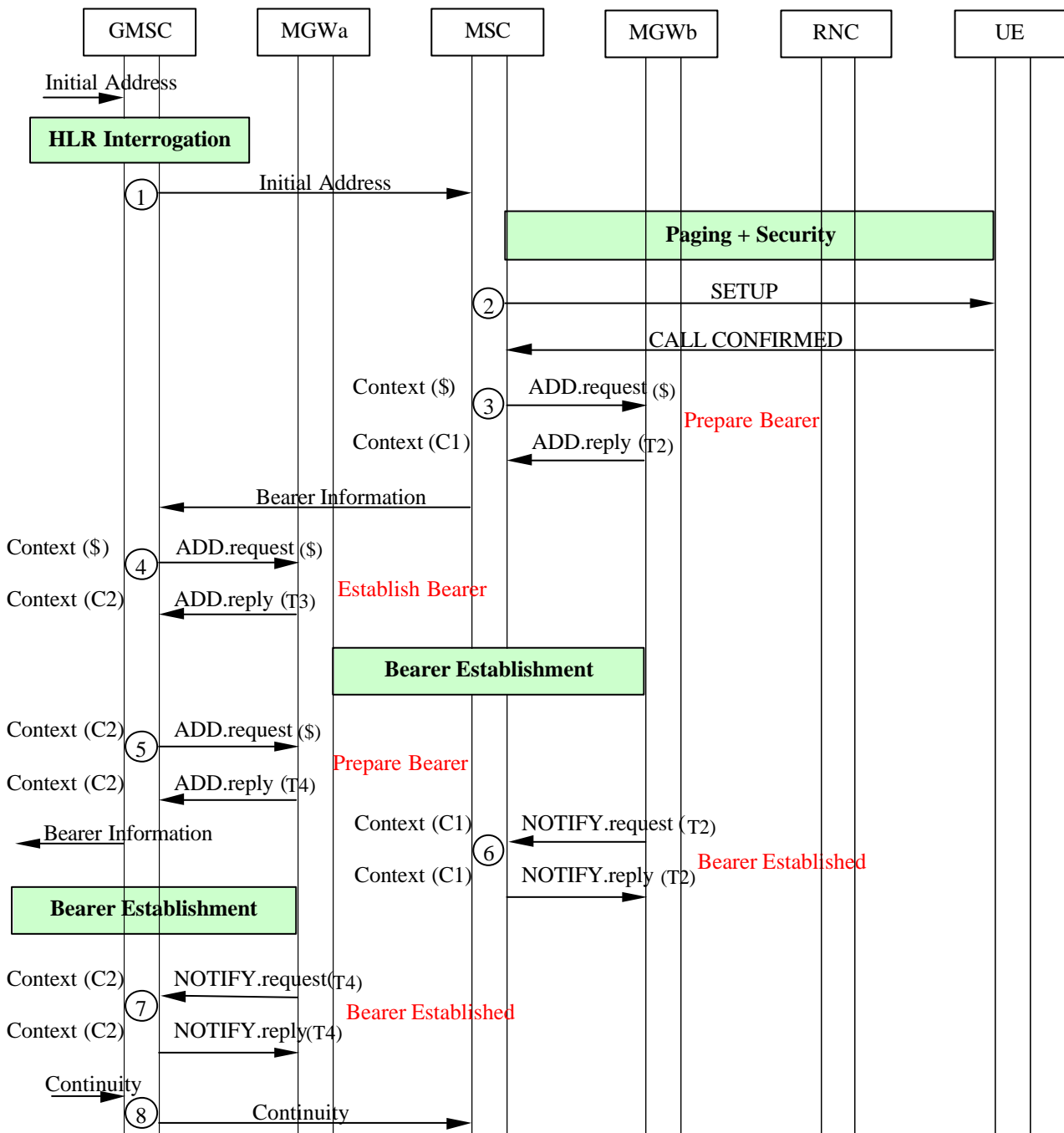
Figure 6.6/1 Basic Mobile Terminating Call, Forward Bearer Establishment (message sequence chart)
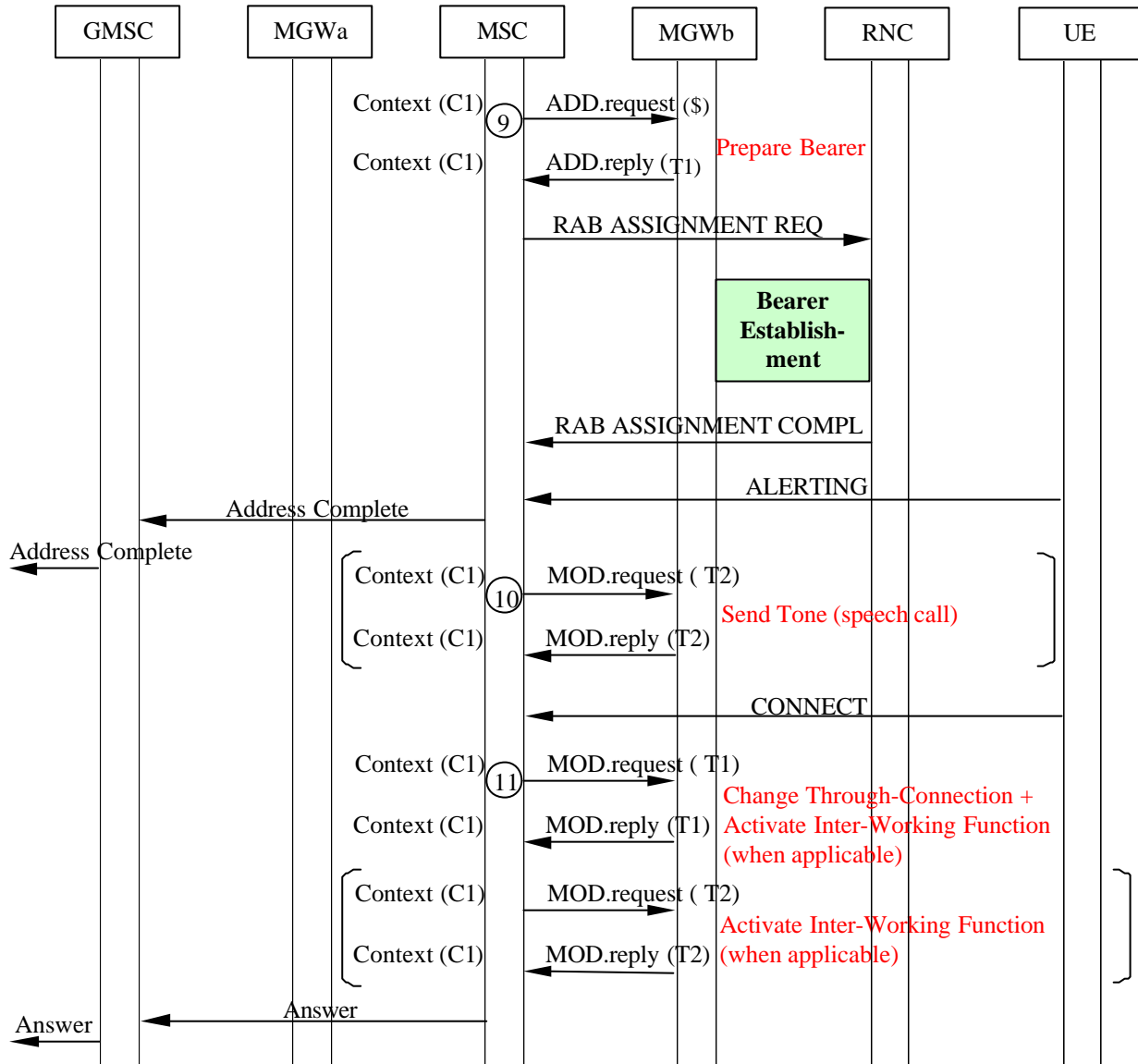
Figure 6.6/2 Basic Mobile Terminating Call, Forward Bearer Establishment (message sequence chart continue)

6.2.2   Backward bearer establishment

The basic mobile terminating call shall be established in accordance with 3GPP TS 23.108. The following paragraphs describe the additional requirements for the bearer independent CS core network. If an out-of-band transcoder control is applied for a speech call that shall be performed in accordance with 3GPP TS 23.153.

6.2.2.1 GMSC

<u>MGW selection</u>

The GMSC shall select a MGW for the bearer connection before it performs the incoming side bearer establishment. This happens before sending the Initial Address message. If the GMSC received a MGW -id and/or a bearer characteristics from the preceding node, those may be used for the MGW selection. (Bullet 1 in figure 6.8)

> NOTE: As an implementation option, if there is no need for the GMSC to manipulate the bearer, the GMSC may perform call control signalling without any associated MGW. In that case the bearer related information shall be provided transparently through the GMSC.

<u>Outgoing side bearer establishment</u>

The GMSC requests the MGW to prepare for the bearer establishment using the Prepare Bearer procedure. The GMSC requests the MGW to provide a bearer address and a binding reference (bullet 1 in figure 6.8). After the MGW has replied with the bearer address and the binding reference, the GMSC sends the Initial Address message to the preceding node.

Initial addressing

The GMSC indicates in the Initial Address message that backward bearer establishment is to be used. The GMSC also indicates in the Initial Address message that the Continuity message will follow, if either of the following condition is satisfied before sending the Initial Address message:

1. If the incoming Initial Address message indicated that the Continuity message will follow, no Continuity message has been received.

2. The incoming side bearer has not been established.

The MGW -id and the bearer characteristics may be provided to the succeeding node in the Initial Address message. (Bullet 2 in figure 6.8)

Incoming side bearer establishment

The GMSC requests the MGW to establish a bearer to the given destination MGW and to notify when the bearer is established using the Establish Bearer procedure. The GMSC provides the MGW with the bearer address and the binding reference that were received from the preceding node in the Initial Address message. (Bullet 3 in figure 6.8)

NOTE: The incoming side bearer establishment may take place either before or after HLR interrogation.

Through Connection

In the Prepare Bearer and Establish Bearer procedures, the GMSC requests the MGW to both-way through-connect the bearer termination. (Bullet 1 and bullet 3 in figure 6.8)

Confirmation of bearer establis hment

If the Initial address message was sent to the succeeding node indicating that the Continuity message will follow, the Continuity message shall be sent when the following conditions are satisfied:

1. If the incoming Initial Address message indicated that the Continuity message will follow, a Continuity message has been received from the preceding node. (Bullet 8 in figure 6.8)

2. If the GMSC selected a MGW, a notification of successful bearer establishment in the incoming side has been received from the MGW .

6.2.2.2 MSC

Call setup

The MSC indicates to the UE in SETUP message that early RAB assignment is used in order to establish the bearer end-to-end before the UE starts alerting, if either of the following condition is satisfied before sending the SETUP message (bullet 5 in figure 6.8):

1. If the Initial Address message indicated that the Continuity message will follow, no Continuity message has been received.

2. The network side bearer has not been established.

MGW selection

The MSC shall select a MGW for the bearer connection before it performs the network side bearer establishment. This happens latest after the UE has sent the Call Confirmed message. If the MSC received a MGW -id and/or a bearer characteristics from the preceding node those may be used for MGW selection. (Bullet 6 in figure 6.8)

Network side bearer establishment

The MSC requests the MGW to establish a bearer to the given destination MGW and to notify when the bearer is established using the Establish Bearer procedure. The MSC provides the MGW with the bearer address and the binding reference that were received from the preceding node in the Initial Address message. (Bullet 6 in figure 6.8)

RAB assignment

The RAB assignment may be started when the following conditions are satisfied:

1. If the incoming Initial Address message indicated that the Continuity message will follow, a Continuity message has been received from the preceding node.

2. A notification of successful bearer establishment in the network side has been received from the MGW. (Bullet 7 in figure 6.8).

For the RAB assignment the MSC requests the MGW to prepare for the RAB assignment using the Prepare Bearer procedure. The MSC requests the MGW to provide a bearer address and a binding reference. For a non-speech call the MSC also provides the MGW with a PLMN BC [4]. After the MGW has replied with the bearer address and the binding reference the MSC requests the RAB assignment using the provided bearer address and the binding reference.

Called party alerting

For a speech call, at reception of the Alerting message, the MSC requests the MGW to provide a ringing tone to the calling party using the Send Tone procedure. (Bullet 9 in figure 6.8)

Called party answer

For a speech call, at reception of the Connect message, the MSC requests the MGW to stop providing the ringing tone to the calling party using the Send Tone procedure. (Bullet 10 in figure 6.8)

Through Connection

In the Prepare Bearer and Establish Bearer procedures the MSC requests the MGW to through-connect the bearer terminations in such a manner that the bearer will be not through-connected. (Bullet 6 and bullet 9 in figure 6.8)

At reception of the Connect message the MSC requests the MGW to both-way through-connect the bearer using the Change Through-Connection procedure. (Bullet 10 in figure 6.8)

Interworking function for a data call

An interworking function may be used by the MGW based on the PLMN BC [4] of the bearer termination. The activation of the possible interworking function in both bearer terminations will be requested by the MSC at reception of the Connect message using the Activate Interworking Function procedure. (Bullet 10 in figure 6.8)

Example

The figure 6.7 below shows the network model for the basic mobile terminating call. The 'squared' line represents the call control signalling. The 'dotted' line represents the bearer control signalling and the bearer. The MSC seizes one context with two bearer terminations in the MGWb. The bearer termination T1 is used for the bearer towards the RNC and the bearer termination T2 is used for the bearer towards the GMSC selected MGWa. The GMSC seizes one context with two bearer terminations in the MGWa. The bearer termination T3 is used for the bearer towards the MSC selected MGWb and the bearer termination T4 is used for the bearer towards the preceding MGW.
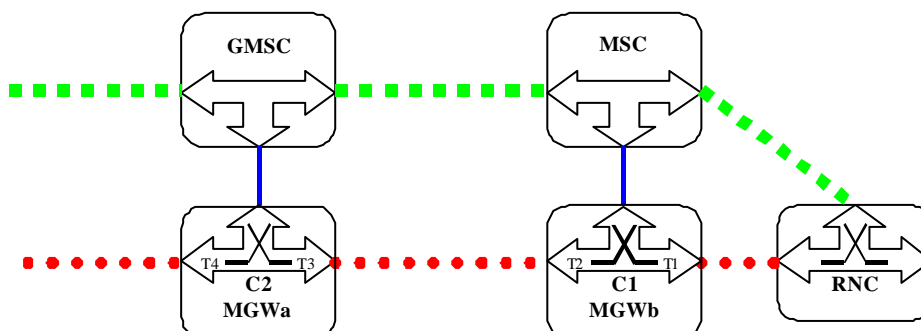
Figure 6.7 Basic Mobile Terminating Call, Backward Bearer Establishment (network model)

The figure 6.8 below shows the message sequence example for the basic mobile terminating call. In the example the GMSC requests seizure of the outgoing side bearer termination before sending the Initial Address message. After the Initial Address message has been sent, the GMSC requests seizure of the incoming side bearer termination and establishment of the bearer. The MGW sends a notification of an established incoming side bearer. The MSC requests seizure of the network side bearer termination and establishment of the bearer when the Call Confirmed message is received from the UE. The MGW sends a notification of an established network side bearer. When the Continuity message is received from the GMSC, the MSC requests seizure of the access side bearer termination. For a speech call the MSC requests MGW to provide a ringing tone to the calling party at alerting. At answer the MSC requests MGW to both-way through-connect the bearer. For a speech call the MSC requests MGW to stop the ringing tone at answer. The possible activation of the interworking function in both bearer terminations is requested by the MSC at answer.
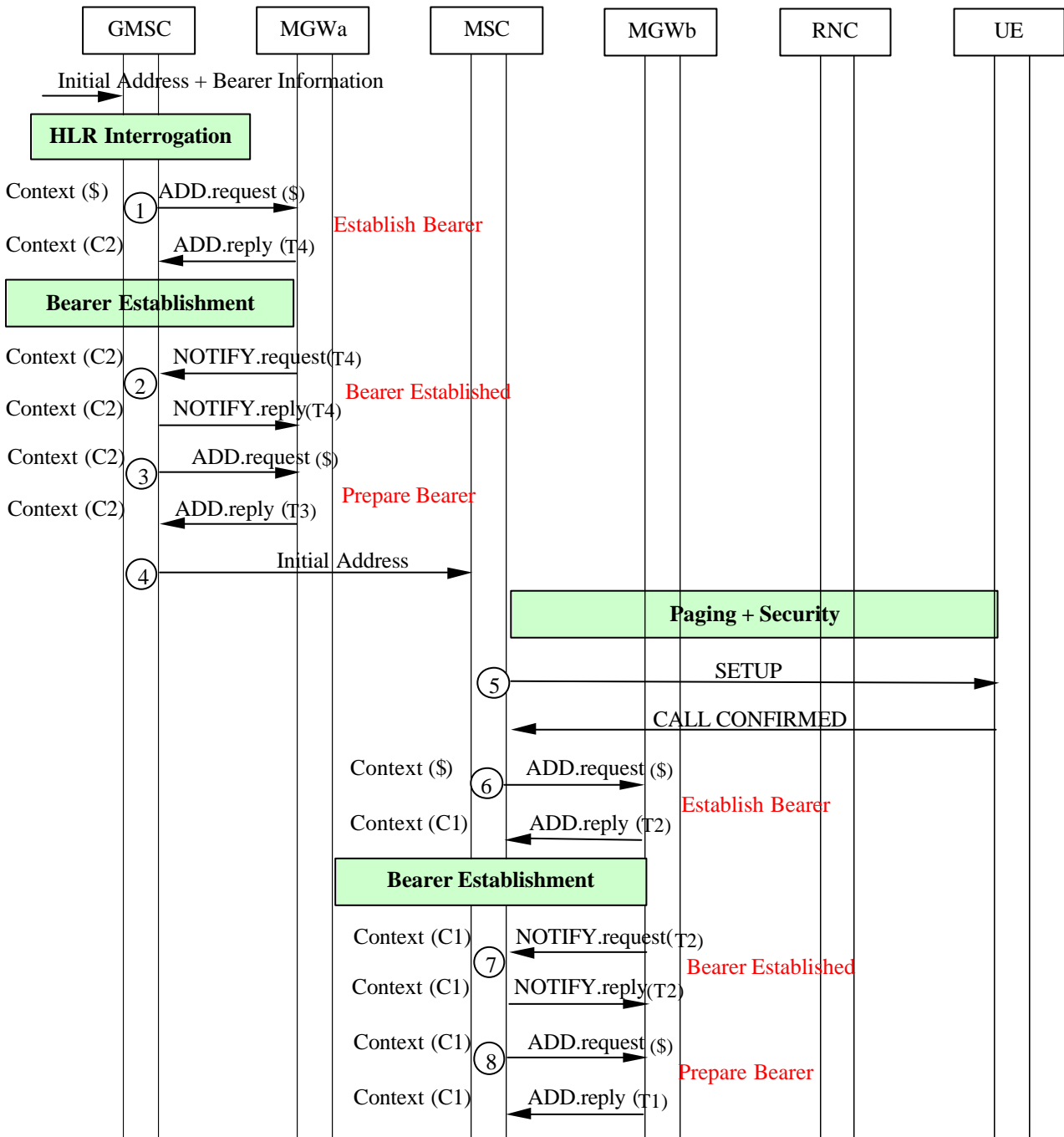
Figure 6.8/1 Basic Mobile Terminating Call, Backward Bearer Establishment (message sequence chart)
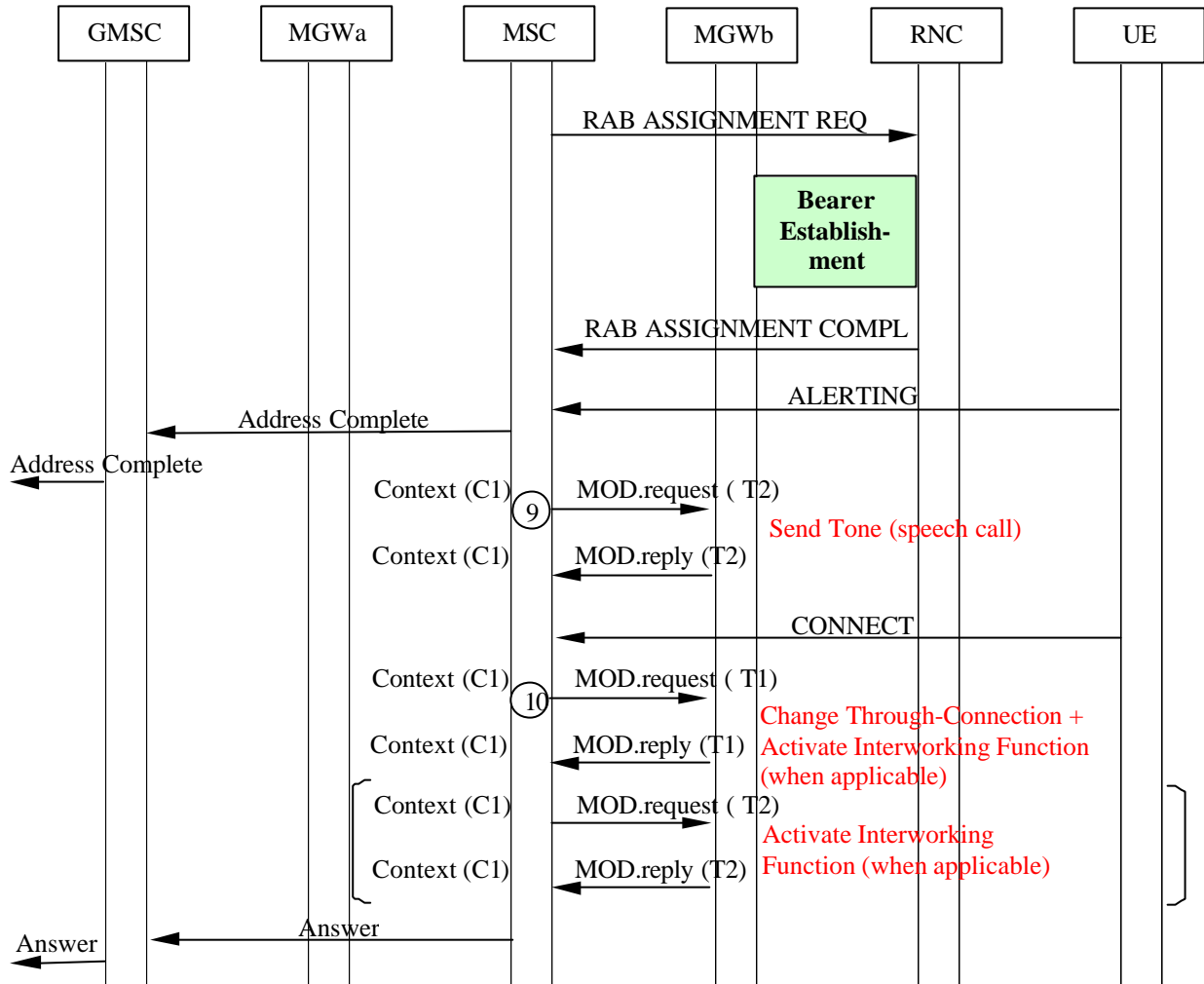
Figure 6.8/2 Basic Mobile Terminating Call, Backward Bearer Establishment (message sequence chart continue)

7 Call Clearing

NOTE: All message sequence charts in this clause are examples. All valid call establishment message sequences can be derived from the example message sequences and associated message pre-conditions.

7.1 Network Initiated

The network initiated call clearing shall be performed in accordance with 3GPP TS 23.108. The following paragraphs describe the additional requirements for the bearer independent CS core network.

7.1.1 GMSC

Incoming side bearer release

Once call clearing indication has been received from the preceding node, the GMSC releases the MGW resources for the incoming side. If the GMSC had previously ordered the MGW to establish the bearer, the GMSC uses the Release Bearer procedure to request the MGW to release the bearer towards the preceding MGW. The GMSC uses the Release Termination procedure to request the MGW to remove the incoming side bearer termination.

Outgoing side bearer release

Once call clearing has been completed by the succeeding node, the GMSC releases the MGW resources for the outgoing side. If the GMSC had previously ordered the MGW to establish the bearer, the GMSC uses the Release Bearer procedure to request the MGW to release the bearer towards the succeeding MGW. The GMSC uses the Release Termination procedure to request the MGW to remove the outgoing side bearer termination.

7.1.2 MSC

<u>Network side bearer release</u>

Once the call clearing indication has been received from the preceding/succeeding node, the MSC releases the MGW resources for the network side. If the MSC had previously ordered the MGW to establish the bearer, the MSC uses the Release Bearer procedure to request the MGW to release the bearer towards the preceding/succeeding MGW. The MSC uses the Release Termination procedure to request the MGW to remove the network side bearer termination. (Bullet 1 in figure 7.2)

<u>IU Release</u>

Once that call has been cleared towards the UE, the MSC requests the RNC to release the IU. This request causes the RNC to release the bearer that was previously established between the RNC and the MGW. In addition to this action, the MSC uses the Release Termination procedure to requests the MGW to remove the access side bearer termination. (Bullet 2 in figure 7.2)

Example

The figure 7.1 below shows the network model for a network initiated clearing of the mobile call. The 'squared' line represents the call control signalling. The 'dotted' line represents the bearer control signalling and the bearer. The MSC seizes one context with two bearer terminations in MGW. Bearer termination T1 is used for the bearer towards RNC and bearer termination T2 is used for the bearer towards succeeding MGW.

Figure 7.1 Network Initiated (Network model)

The figure 7.2 below shows the message sequence example for the network initiated clearing of a mobile call. In the example the MSC requests first the release of the network side bearer termination. After the release of the network side bearer termination then the MSC indicates to the preceding/succeeding node that call clearing has been completed. After the response of the IU release is received then the MSC requests release of the access side bearer termination.
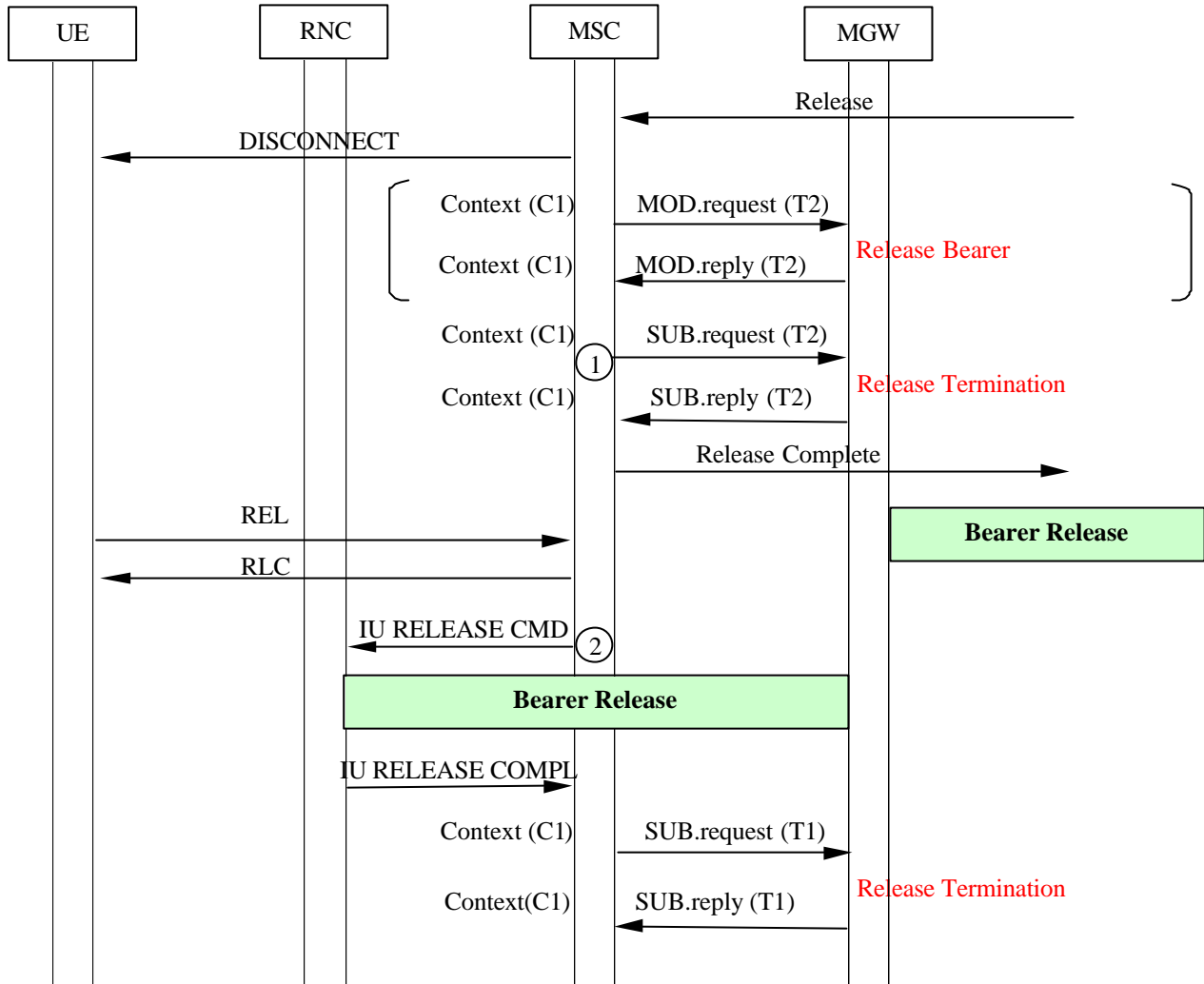
Figure 7.2 Network Initiated (message sequence chart)

7.2 User Initiated

The user initiated call clearing shall be performed in accordance with 3GPP TS 23.108. The following paragraphs describe the additional requirements for the bearer independent CS core network.

7.2.1 GMSC

Outgoing side bearer release

Once call clearing indication has been received from the succeeding node, the GMSC releases the MGW resources for the outgoing side. If the GMSC had previously ordered the MGW to establish the bearer, the GMSC uses the Release Bearer procedure to request the MGW to release the bearer towards the succeeding MGW. The GMSC uses the Release Termination procedure to request the MGW to remove the outgoing side bearer termination.

Incoming side bearer release

Once call clearing has been completed by the preceding node, the GMSC releases the MGW resources for the incoming side. If the GMSC had previously ordered the MGW to establish the bearer, the GMSC uses the Release Bearer procedure to request the MGW to release the bearer towards the preceding MGW. The GMSC uses the Release Termination procedure to request the MGW to remove the incoming side bearer termination.

7.2.2 MSC

<u>IU Release</u>

Once the call has been cleared towards the UE, the MSC requests the RNC to release the IU. This request causes the RNC to release the bearer that was previously established between the RNC and the MGW. In addition to this action, the MSC uses the Release Termination procedure to requests the MGW to remove the access side bearer termination. (Bullet 1 in figure 7.4)

<u>Network side bearer release</u>

Once call clearing has been completed by the preceding/succeeding node, the MSC releases the MGW resources for the network side. If the MSC had previously ordered the MGW to establish the bearer the MSC uses the Release Bearer procedure to request the MGW to release the bearer towards the preceding/s ucceeding MGW. The MSC uses the Release Bearer procedure to request the MGW to remove the network side bearer termination. (Bullet 2 in figure 7.4)

Example

The figure 7.3 below shows the network model for a user initiated clearing of mobile call. The 'squared' line represents the call control signalling. The 'dotted' line represents the bearer control signalling and the bearer. The MSC seizes one context with two bearer terminations in MGW. Bearer termination T1 is used for the bearer towards RNC and bearer termination T2 is used for the bearer towards succeeding MGW.
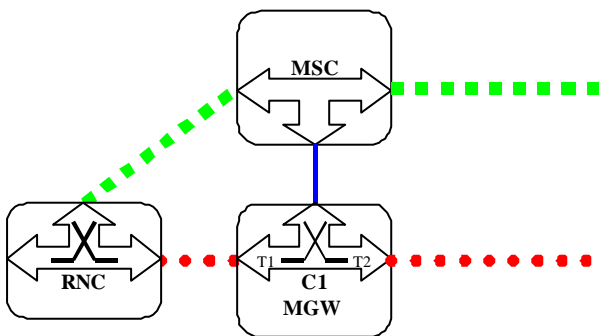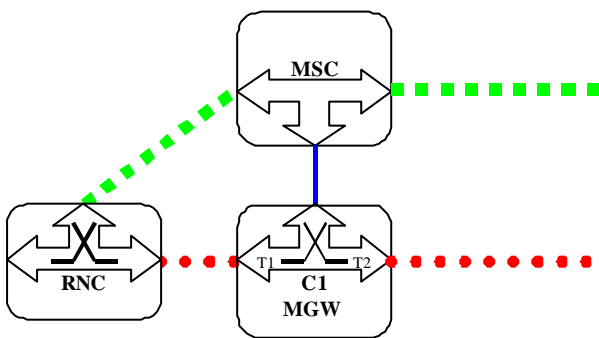

Figure 7.3 User Initiated (Network model)

The figure 7.4 below shows the message sequence example for the user initiated clearing of a mobile call. After the response of the IU release is received then the MSC requests the release of the access side bearer termination. Once the preceding/succeeding node has indicated that call clearing has been completed, the MSC requests the release of the network side bearer termination.
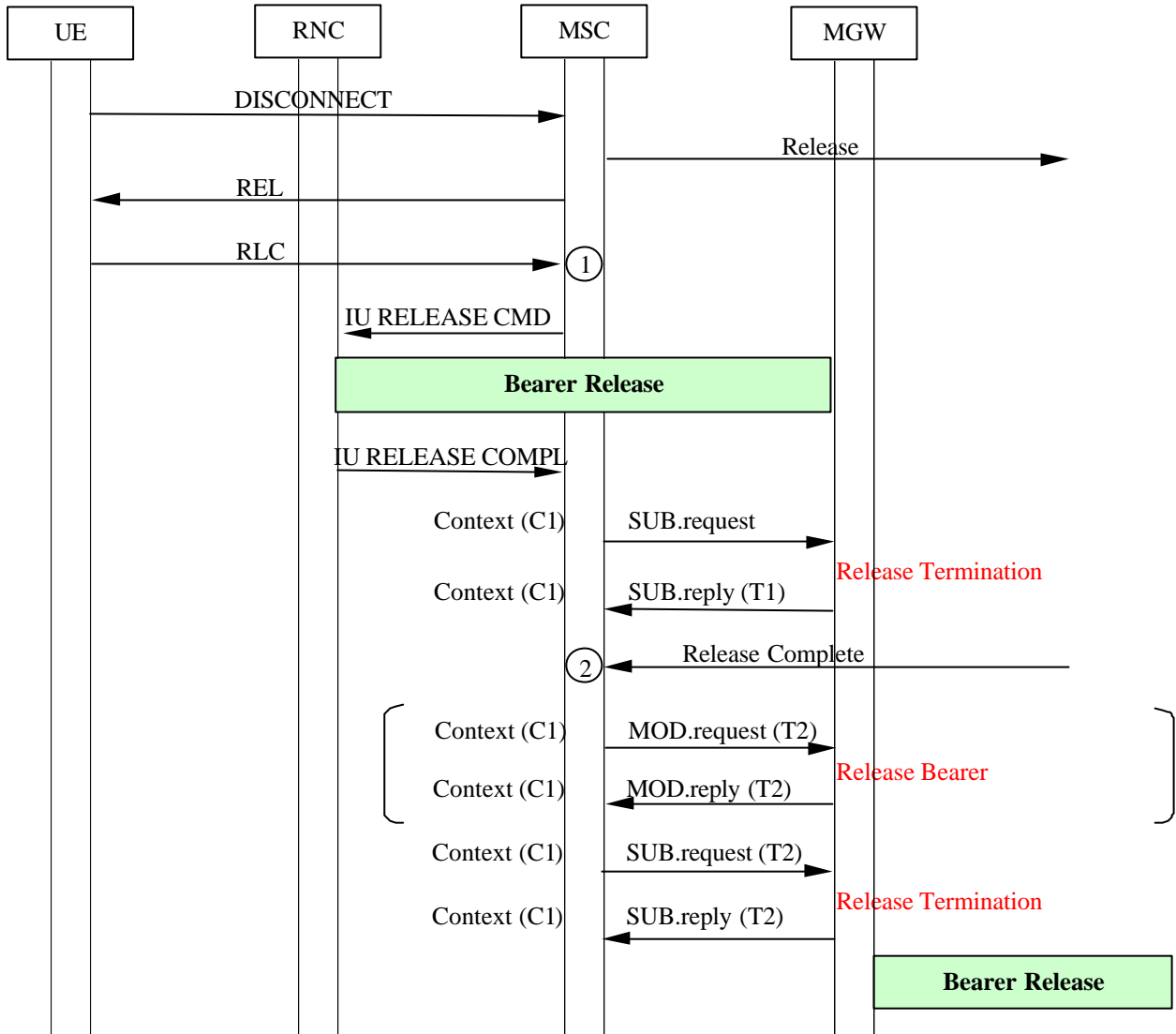
Figure 7.4 User Initiated (message sequence chart)

8 Handover

NOTE: All message sequence charts in this clause are examples. All valid call establishment message sequences can be derived from the example message sequences and associated message pre-conditions. Intra-MSC SRNS Relocation

8.1 Intra-MSC SRNS Relocation

The procedures specified in 3GPP TS 23.009 for 'Intra-3G_MSC SRNS Relocation' shall be followed. The following paragraphs describe the additional requirements for the bearer independent CS core network.

Relocation Required:

When the Relocation Required message is received, the MSC requests the MGW to provide a binding reference and a bearer address, using the Prepare Bearer procedure. For non-speech calls the MSC also provides the MGW with the same PLMN BC [4] as was provided at the last RAB assignment. The MSC sends the Relocation Request message to the RNC-B containing the bearer address and binding reference. (Bullet 1 in figure 8.2.)

Relocation Command/Relocation Detect:

At sending of Relocation Command message or alternatively at receiving of Relocation Detect message the MSC uses the Change Flow Direction procedure to requests the MGW to set the Handover Device to intermediate state. (Bullet 2 in figure 8.2.)

Relocation Complete:

At receiving of Relocation Complete message the MSC requests the RNC-A to release the IU and requests the MGW to set the Handover Device to its final state by removing the bearer termination towards the RNC-A, using the Release Termination procedure. (Bullet 1 in figure 8.2.)

Interworking function:

The interworking functions used by the MGW before relocation will be used also after relocation.

Handling of multiple bearers :

If multiple bearers are established to the UE (e.g. multicall configuration) or all procedures related to the handling of bearers and terminations described for the relocation of a single bearer shall be repeated for each bearer.

Example

The figure 8.1 below shows the network model for the Intra-MSC SRNS Relocation. The 'squared' line represents the call control signalling. The 'dotted' line represents the bearer control signalling and the bearer. The bearer termination T1 is used for the bearer towards RNC-A, bearer termination T3 is used for the bearer towards RNC-B and the bearer termination T2 is used for the bearer towards the succeeding/preceding MGW.

Before Relocation:
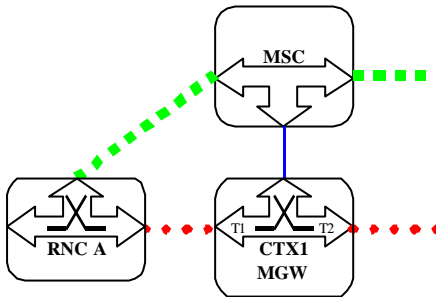
During Relocation:
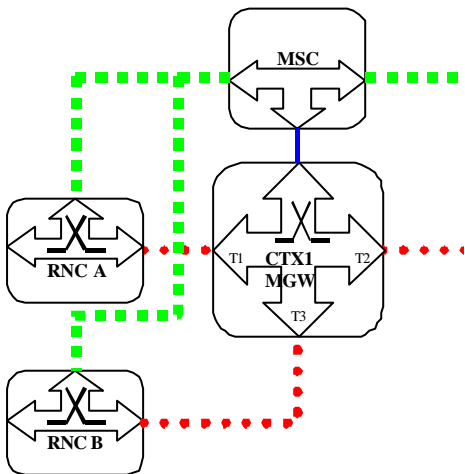
After Relocation:
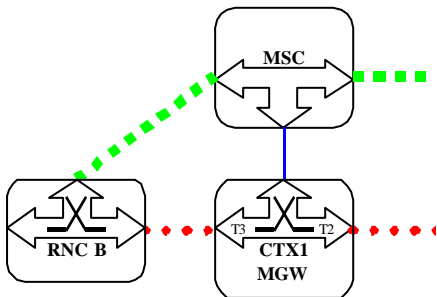
Figure 8.1 Intra-MSC SRNS Relocation (network model)

The figure 8.2 below shows the message sequence example for the Intra-MSC SRNS Relocation.
It is assumed that the Handover Device is located in the MGW selected for the call establishment by the MSC, which controls the call, the mobility management and the radio resources. Also assumed that only one bearer has been

established towards RNC-A.

In the example the MSC requests seizure of RNC-B side bearer termination with specific flow directions. The MSC orders the establishment of the bearer by sending Relocation Request towards RNC-B. When the relocation is detected in RNC-B the MSC requests to change the flow directions between the terminations within the context. When MSC receives Relocation Complete indication from RNC-B it orders RNC-A to release the IU. This action causes release of the bearer between the RNC and the MGW. Finally the MSC requests the MGW to release RNC-A side bearer termination.
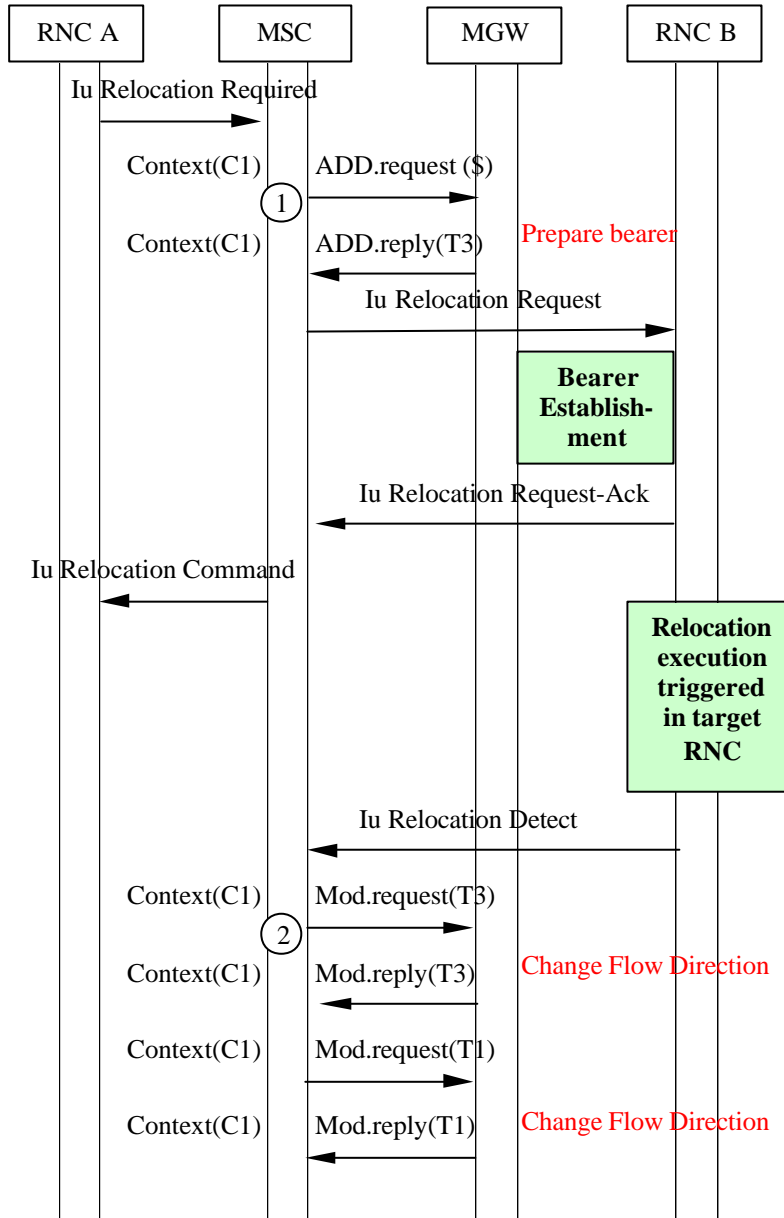
Figure 8.2/1 Intra-MSC SRNS Relocation (message sequence chart)
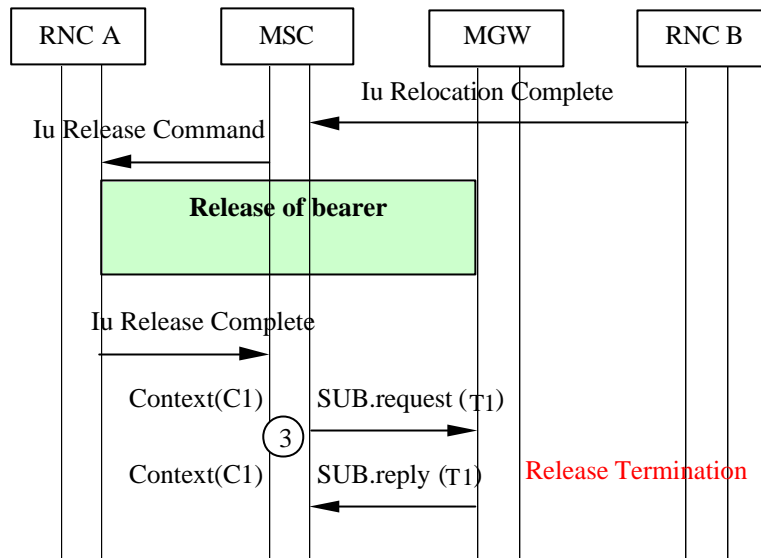
Figure 8.2/2 Intra-MSC SRNS Relocation (message sequence chart)

8.2 Basic Inter-MSC SRNS Relocation

The procedures specified in 3GPP TS 23.009 for 'Basic Relocation Procedure Requiring a Circuit Connection between 3G_MSC-A and 3G_MSC-B' shall be followed. The following paragraphs describe the additional requirements for the bearer independent CS core network.

8.2.1 MSC-A/MGW-A

Bearer establishment between MGW-A and MGW-B:

The bearer establishment is handled as described at Basic Mobile Originating Call, using either forward or backward bearer establishment. The only difference is that for non-speech calls MSC-A also provides MGW-A with the same PLMN BCs [4] as were provided at the last RAB assignment.

Relocation Command/Relocation Detect:

At sending of Relocation Command message or alternatively at receiving of Relocation Detect message the MSC-A uses the Change Flow Direction procedure to requests the MGW-A to set the Handover Device to intermediate state. (Bullet 3 in figure 8.4.)

Relocation Complete:

At receiving of Relocation Complete message, the MSC-A requests the RNC-A to release the IU and requests the MGW-A to set the Handover Device to its final state by removing the bearer termination towards the RNC-A, using the Release Termination procedure. (Bullet 4 in figure 8.4.)

Interworking function:

The interworking functions used by MGW-A before relocation will be used also after relocation.

Handling of multiple bearers (multicall):

If the UE is engaged with multiple bearers all procedures related to the handling of bearers and terminations described for the relocation of a single bearer shall be repeated for each bearer.

8.2.2 MSC-B/MGW-B

MGW selection:

The MSC-B selects a MGW when it receives Prepare Handover Request message. (Bullet 1 in figure 8.4.)

<u>Bearer establishment towards RNC-B:</u>

When the MSC-B has selected the MGW-B it requests the MGW-B to provide a binding reference and a bearer address, using the Prepare Bearer procedure. The MSC-B sends the Relocation Request message to the RNC-B containing the bearer addresses and binding references. (Bullet 2 in figure 8.4.)

<u>Bearer establishment between MGW-A and MGW-B:</u>

The bearer establishment is handled as described at Basic Mobile Terminating Call, using either forward or backward bearer establishment.

<u>Handling of multiple bearers (multicall):</u>

If the UE is engaged with multiple bearers all procedures related to the handling of bearers and terminations described for the relocation of a single bearer shall be repeated for each bearer.

Example

The figure 8.3 below shows the network model for the Basic Inter-MSC SRNS Relocation. The 'squared' line represents the call control signalling. The 'dotted' line represents the bearer control signalling and the bearer. In MGW-A the bearer termination T1 is used for the bearer towards RNC-A, bearer termination T3 is used for the bearer towards MGW-B, and the bearer termination T2 is used for the bearer towards the succeeding/preceding MGW. In MGW-B the bearer termination T4 is used for the bearer towards RNC-B, bearer termination T5 is used for the bearer towards MGW-A.
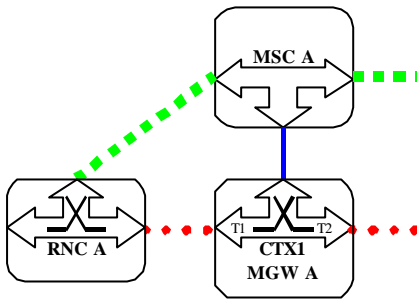
Before Relocation:

During Relocation:
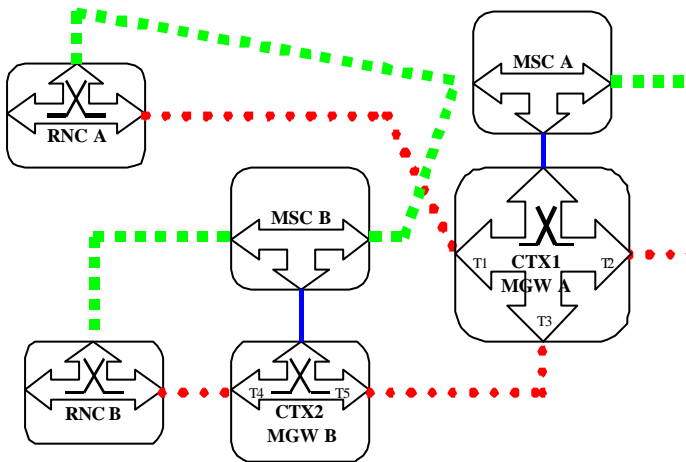
After Relocation:
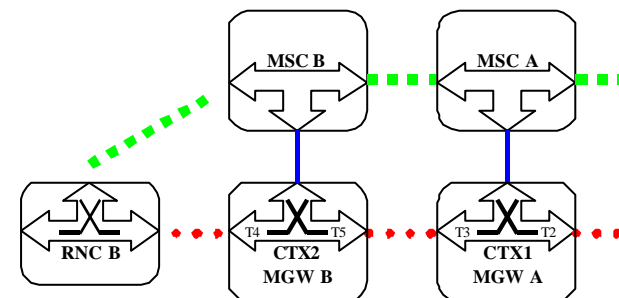
Figure 8.3 Basic Inter-MSC SRNS Relocation (network model)

The figure 8.4 below shows the message sequence example for the Basic Inter-MSC SRNS Relocation.
It is assumed that the Handover Device is located in the MGW (MGW -A) selected for the call establishment by the MSC (MSC-A) which controls the call, the mobility management and the radio resources. Also assumed that only one bearer has been established towards RNC-A.
In the example the MSC-B requests MGW-B to seize RNC-B side bearer. MSC-B orders the establishment of the bearer towards RNC-B by sending Relocation Request. The call is established between MSC-A and MSC-B, and the bearer is established between MGW -A and MGW -B. When the relocation is detected in RNC-B the MSC-A requests to change the flow directions between the terminations within the context in MGW -A. When MSC-A receives Relocation Complete indication from MSC-B it orders RNC-A to release the IU. This action causes release of the bearer between RNC-A and the MGW -A. Finally MSC-A requests MGW -A to remove RNC-A side bearer termination.
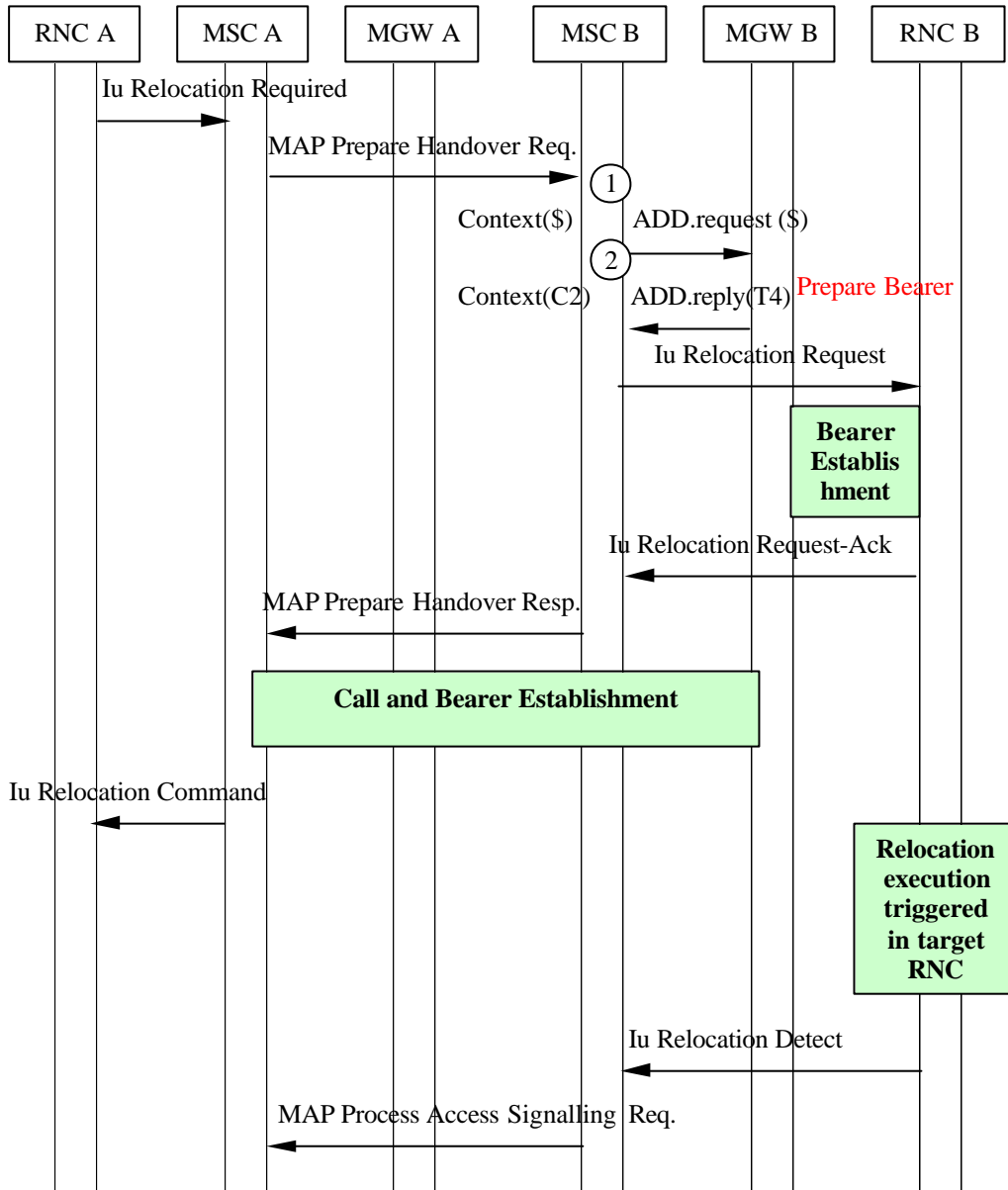
Figure 8.4/1 Basic Inter-MSC SRNS Relocation (message sequence chart)
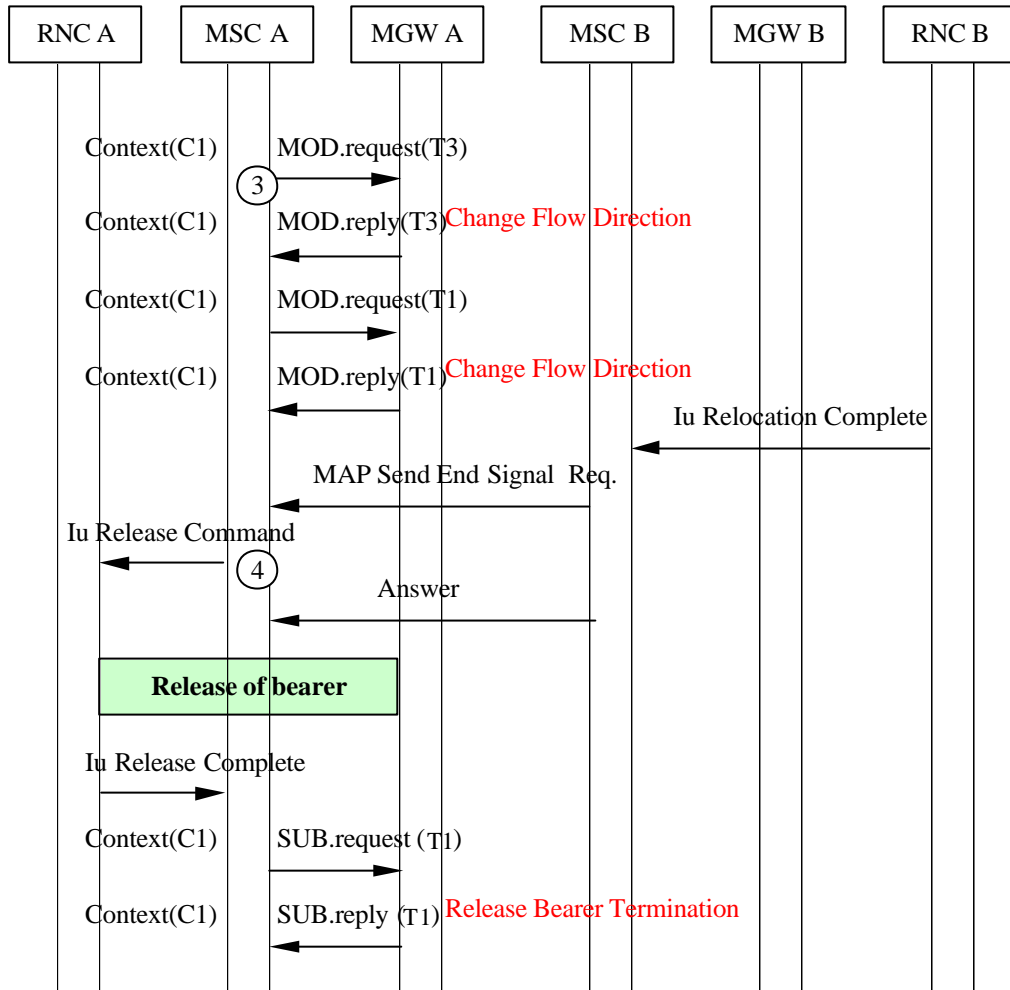
Figure 8.4/2 Basic Inter-MSC SRNS Relocation (message sequence chart)

8.3 Subsequent Inter-MSC SRNS Relocation back to the Anchor MSC

The procedures specified in 3GPP TS 23.009 for 'Subsequent Relocation from 3G_MSC-B to 3G_MSC-A requiring a Circuit Connection between 3G_MSC-A and 3G_MSC-B' shall be followed. The following paragraphs describe the additional requirements for the bearer independent CS core network.

8.3.1 MSC-A/MGW-A

Relocation Required:

When the Relocation Required message is received, the MSC-A requests the MGW-A to provide a binding reference and a bearer address for each established bearer, using the Prepare Bearer procedure. For a non-speech calls the MSC-A also provides the MGW-A with the same PLMN BCs [4] as was provided at the last RAB assignment. The MSC-A sends the Relocation Request message to the RNC-B containing the bearer addresses and binding references. (Bullet 1 in figure 8.6.)

Relocation Command/Relocation Detect:

At sending of Relocation Command message or alternatively at receiving of Relocation Detect message the MSC-A uses the Change Flow Direction procedure to requests the MGW-A to set the Handover Device to intermediate state. (Bullet 2 in figure 8.6.)

Relocation Complete:

At receiving Relocation Complete message the MSC-A informs the MSC-B about reception of this message, then MSC-A initiates call clearing towards the MSC-B as described at Call Clearing.

Interworking function:

The interworking functions used by the MGW-A before relocation will be used also after relocation.

Handling of multiple bearers (multicall):

If the UE is engaged with multiple bearers all procedures related to the handling of bearers and terminations described for the relocation of a single bearer shall be repeated for each bearer.

8.3.2   MSC-B/MGW-B

Relocation Complete:

At receiving of Relocation Complete message, the MSC-B requests the RNC-A to release the IU and requests MGW-B to remove the bearer termination towards RNC-A using the Release Bearer Termination procedure. (Bullet 3 in figure 8.6.)

Release of bearer towards MGW-A:

When the MSC-B receives call clearing indication from the MSC-A, the MSC-B handles it as described at Call Clearing.

Handling of multiple bearers (multicall):

If the UE is engaged with multiple bearers all procedures related to the handling of bearers and terminations described for the relocation of a single bearer shall be repeated for each bearer.

Example

The figure 8.5 below shows the network model for the Subsequent Inter-MSC SRNS Relocation back to the Anchor MSC. The 'squared' line represents the call control signalling. The 'dotted' line represents the bearer control signalling and the bearer. In MGW -A the bearer termination T6 is used for the bearer towards RNC-B, bearer termination T3 is used for the bearer towards MGW -B, and the bearer termination T2 is used for the bearer towards the succeeding/preceding MGW. In MGW -B the bearer termination T4 is used for the bearer towards RNC-A, bearer termination T5 is used for the bearer towards MGW -A.
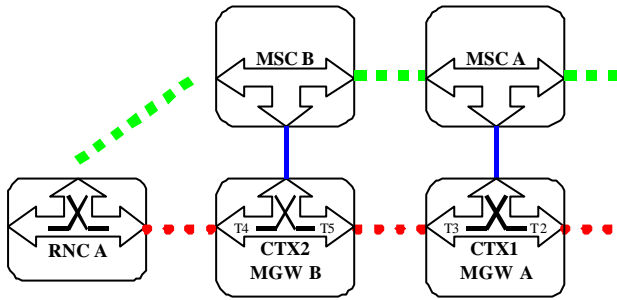
Before Relocation:

During Relocation:
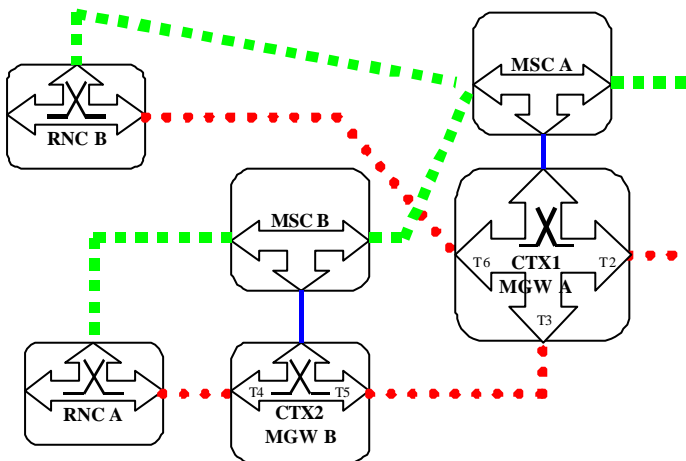
After Relocation:
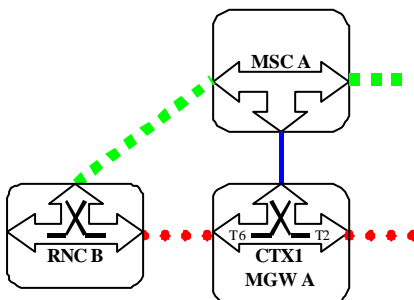
Figure 8.5 Subsequent Inter-MSC SRNS Relocation back to the Anchor MSC (network model)

The figure 8.6 below shows the message sequence example for the Subsequent Inter-MSC SRNS Relocation back to the Anchor MSC.

It is assumed that the Handover Device is located in the MGW (MGW -A) selected for the call establishment by the MSC (MSC-A) which controls the call, the mobility management and the radio resources. Also assumed that only one bearer has been established towards RNC-A.

In the example the MSC-A requests MGW -A to seize RNC-B side bearer termination with specific flow directions. The MSC orders the establishment of the bearer towards RNC-B by sending Relocation Request. When the relocation is detected in RNC-B the MSC-A requests to change the flow directions between the terminations within the context in MGW -A. When MSC-A receives Relocation Complete indication from RNC-B it transfers this indication to MSC-B. MSC-B orders RNC-A to release the IU. This action causes release of the bearer between RNC-A and the MGW -B. MSC-A initiates call clearing towards MSC-B.
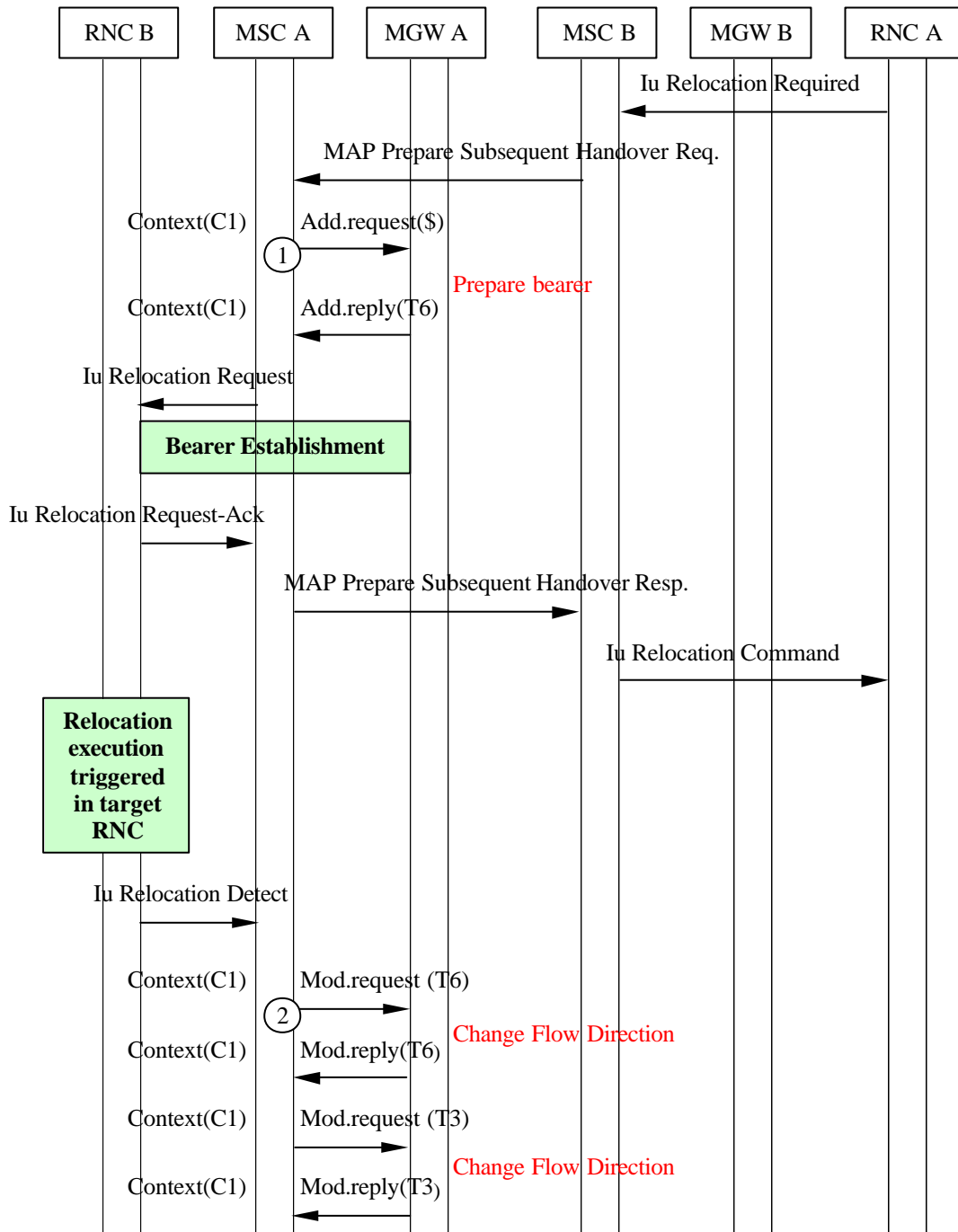
Figure 8.6/1 Subsequent Inter-MSC SRNS Relocation back to the Anchor MSC (message sequence chart)
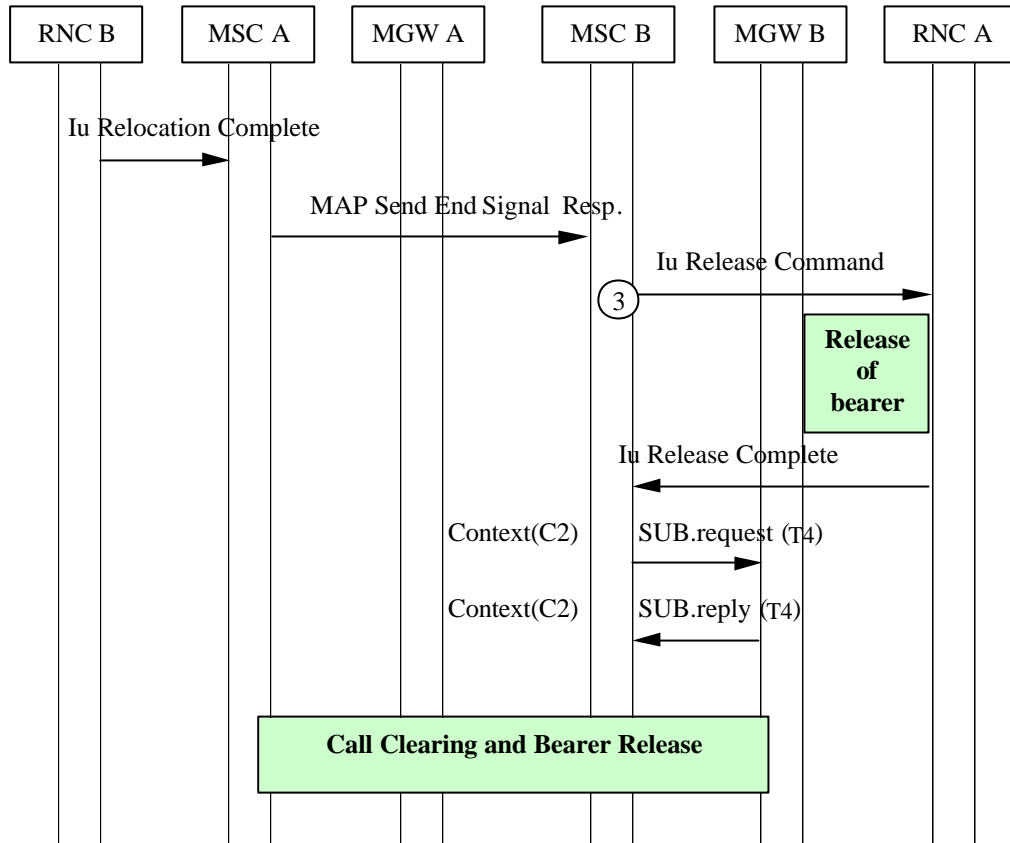
Figure 8.6/2 Subsequent Inter-MSC SRNS Relocation back to the Anchor MSC (message sequence chart)

8.4 Subsequent Inter-MSC SRNS Relocation to a third MSC

The relocation to a third MSC (from MSC-B to MSC-B') consists of two parts:

- a subsequent relocation from MSC-B back to MSC-A as described in chapter 8.3; and

- a basic relocation from MSC-A to MSC-B' as described in chapters 8.2.

8.5 Intra-MSC UMTS to GSM Handover

The following handling shall be applied for a call that started as UMTS call. The procedures specified in 3GPP TS 23.009 for 'Intra-3G_MSC Handover from UMTS to GSM' shall be followed. The following paragraphs describe the additional requirements for the bearer independent CS core network.

Relocation Required:

When Relocation Required message is received, the bearer is established between the MSC and the MGW. (Bullet 1 in figure 8.8.)

Relocation Command/Handover Detect:

At sending of Relocation Command message or alternatively at receiving of Handover Detect message the MSC uses the Change Flow Direction procedure to requests the MGW to set the Handover Device to intermediate state. (Bullet 2 in figure 8.8.)

Handover Complete:

At receiving of Handover Complete message the MSC requests the RNC-A to release the IU and requests the MGW to set the Handover Device to its final state by removing the bearer termination towards the RNC-A, using the Release Termination procedure. (Bullet 3 in figure 8.8.)

Example

Figure 8.7/a below shows the network model for the Basic Intra-MSC UMTS to GSM handover. The 'thick, squared' line represents the call control signalling. The 'thick, dotted' line represents the bearer control signalling and the bearer. The 'thin, continuous' line represents the circuit connection between the 3G_MSC and the BSC, the 'thin, dotted' line represents the BSSMAP control signalling. Within the MGW the bearer termination T1 is used for the bearer towards RNC-A, bearer termination T3 is used for the bearer towards BSS-B, and the bearer termination T2 is used for the bearer towards the succeeding/preceding MGW.

Note: For further details, results from TS GERAN are needed.

The figure 8.7/b below shows the network model for the Intra-MSC UMTS to GSM Handover. The 'squared' line represents the call control signalling. The 'dotted' line represents the bearer control signalling and the bearer. The bearer termination T1 is used for the bearer towards the RNC-A, bearer termination T3 is used for the bearer towards the BSC-B (connected through the MSC) and the bearer termination T2 is used for the bearer towards the succeeding/preceding MGW.

Before UMTS to GSM Handover:

During UMTS to GSM Handover:
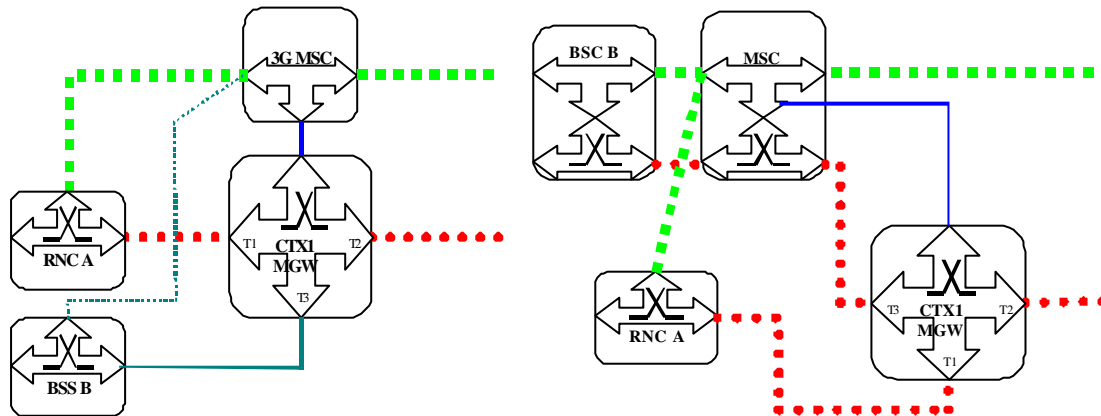
After UMTS to GSM Handover
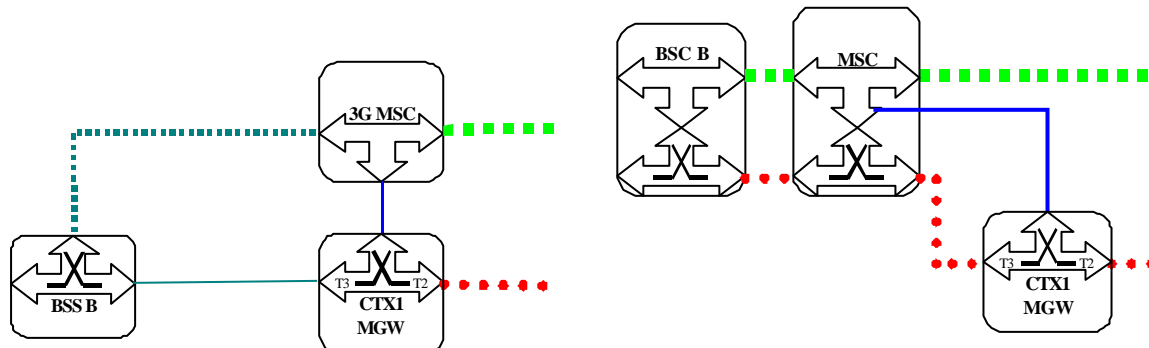
Figure 8.7/a   **Figure 8.7/b**

Intra-MSC UMTS to GSM Handover (network model)

The figure 8.8 below shows the message sequence example for the Intra-MSC UMTS to GSM Handover.
It is assumed that the Handover Device is located in the MGW selected for the call establishment by the MSC, which

controls the call and the mobility management. Also assumed that only one bearer has been established towards the RNC-A.

In the example when Relocation Required is received, the bearer is established between the MGW and the MSC. When the handover is detected in the BSC-B the MSC requests to change the flow directions between the terminations within the context. When MSC receives Handover Complete indication from the BSC-B it orders the RNC-A to release the IU. This action causes release of the bearer between the RNC and the MGW . Finally the MSC requests the MGW to release the RNC-A side bearer termination.
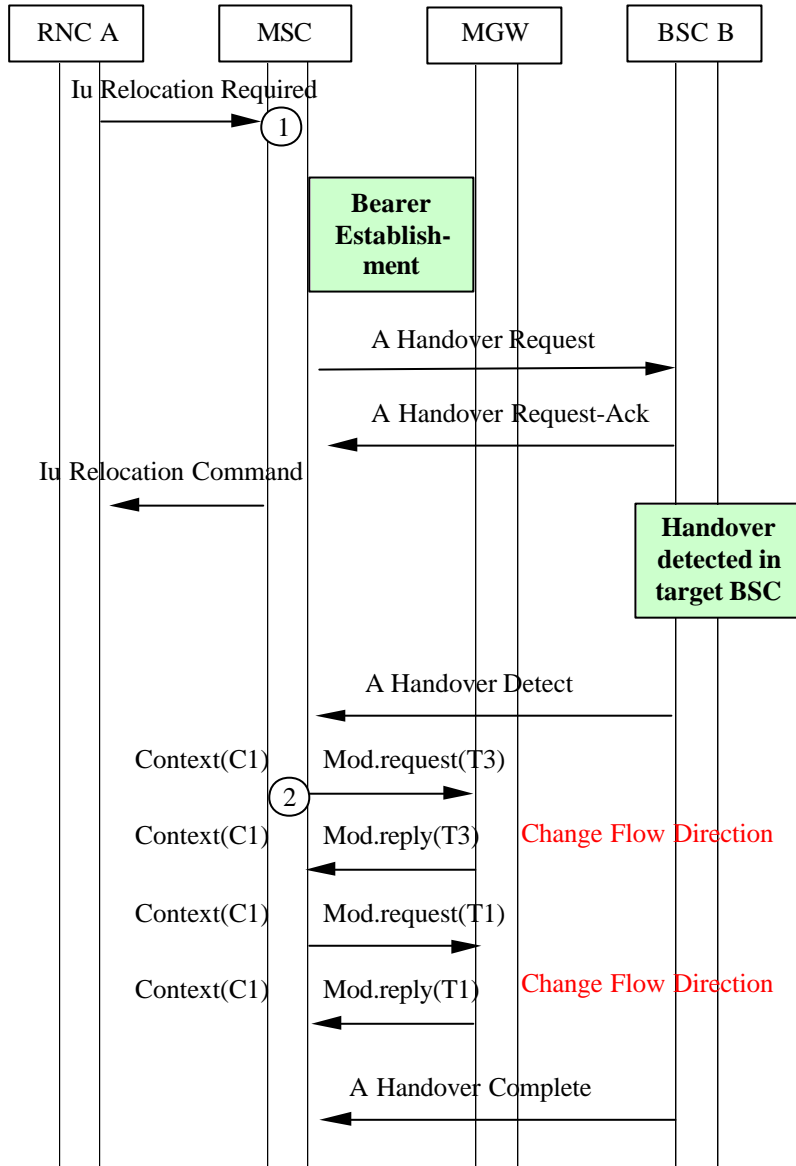
Figure 8.8/1 Intra-MSC UMTS to GSM Handover (message sequence chart)
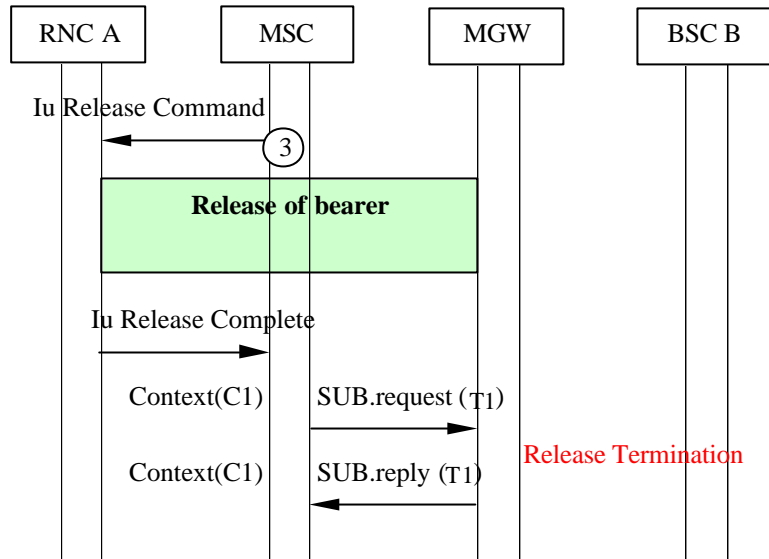
Figure 8.8/2 Intra-MSC UMTS to GSM Handover (message sequence chart)

8.6 Intra-MSC GSM to UMTS Handover

The following handling shall be applied for a call that started as UMTS call. The procedures specified in 3GPP TS 23.009 for 'Intra-3G_MSC GSM to UMTS Handover' shall be followed. The following paragraphs describe the additional requirements for the bearer independent CS core network.

Handover Required:

When Handover Required message is received, the MSC requests the MGW to provide a binding reference and a bearer address using the Prepare Bearer procedure. The MSC sends the Relocation Request message to the RNC-B containing the bearer address and binding reference. (Bullet 1 in figure 8.10.)

Handover Command/Relocation Detect:

At sending of Handover Command message or alternatively at receiving of Relocation Detect message the MSC uses the Change Flow Direction procedure to requests the MGW to set the Handover Device to intermediate state. (Bullet 2 in figure 8.10.)

Relocation Complete:

At receiving of Relocation Complete message the MSC releases the A-interface line towards the BSC-A and requests the MGW to set the Handover Device to its final state by releasing the bearer between the MSC and the MGW. (Bullet 3 in figure 8.10.)

Example

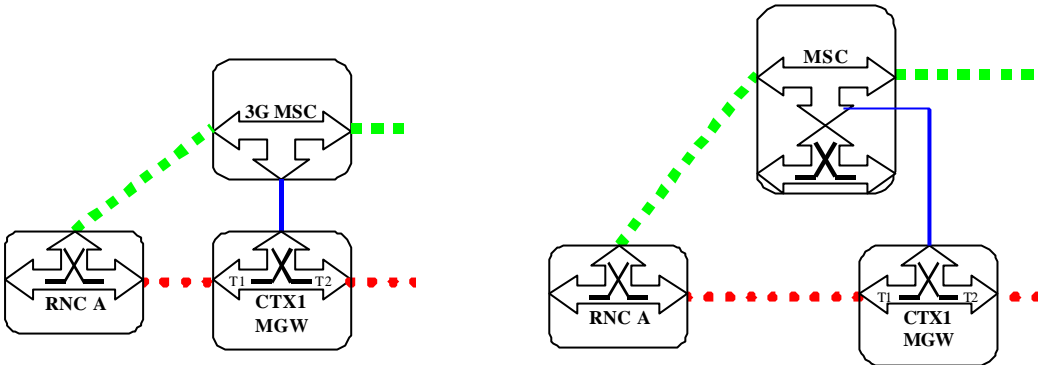The figure 8.9/a below shows the network model for the Basic Intra-MSC GSM to UMTS handover. The 'thick, squared' line represents the call control signalling. The 'thick, dotted' line represents the bearer control signalling and the bearer. The 'thin, continuous' line represents the circuit connection between 3G_MSC and the BSC, the 'thin, dotted' line represents the BSSMAP control signalling. [Note: results from TS GERAN required]. Within the MGW the bearer termination T1 is used for the bearer towards BSS-A, bearer termination T3 is used for the bearer towards RNC-B and the bearer termination T2 is used for the bearer towards the succeeding/preceding MGW.

Note: Towards BSS-A no separation of bearer and control plane applies.

The figure 8.9/b below shows the network model for the Intra-3G_MSC GSM to UMTS Handover. The 'squared' line represents the call control signalling. The 'dotted' line represents the bearer control signalling and the bearer. The bearer termination T1 is used for the bearer towards the BSC-A (connected through the MSC), the bearer termination T3 is

used for the bearer towards the RNC-B and the bearer termination T2 is used for the bearer towards the succeeding/preceding MGW.

Before GSM to UMTS Handover:

During GSM to UMTS Handover:
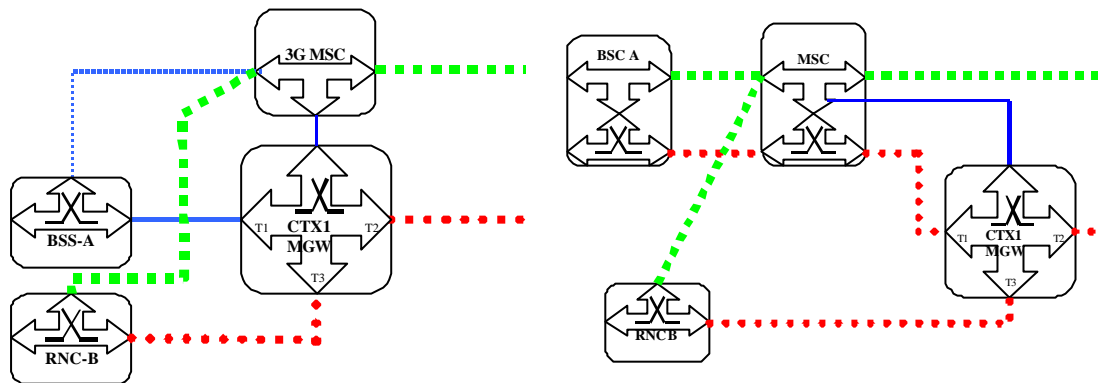
After GSM to UMTS Handover:
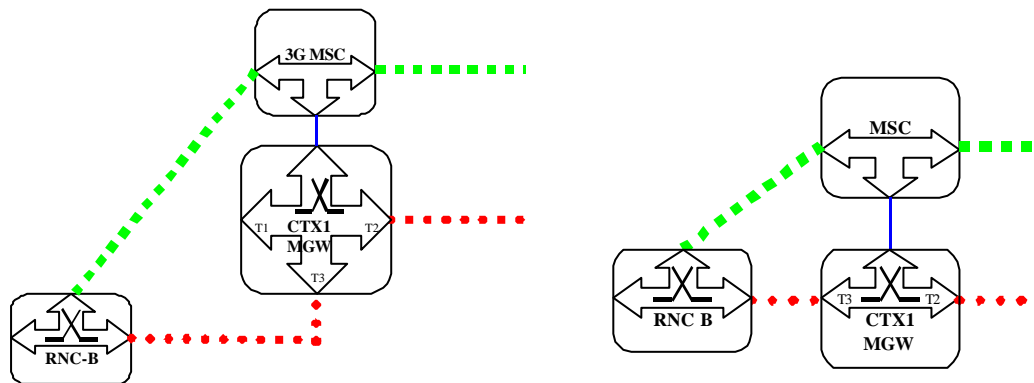
Figure 8.9/a **Figure 8.9/b**

Intra-3G_MSC GSM to UMTS Handover (network model)

The figure 8.10 below shows the message sequence example for the Intra-3G_MSC GSM to UMTS Handover. It is assumed that the Handover Device is located in the MGW selected for the call establishment by the MSC, which controls the call and the mobility management.
In the example the MSC requests seizure of the RNC-B side bearer termination with specific flow directions. The MSC orders the establishment of the bearer towards the RNC-B by sending Relocation Request. When the relocation is detected in the RNC-B the MSC requests to change the flow directions between the terminations within the context.

When the MSC receives Relocation Complete indication from the RNC-B it releases the A-interface line towards the BSC-A. Finally the bearer between the MSC and the MGW is released.
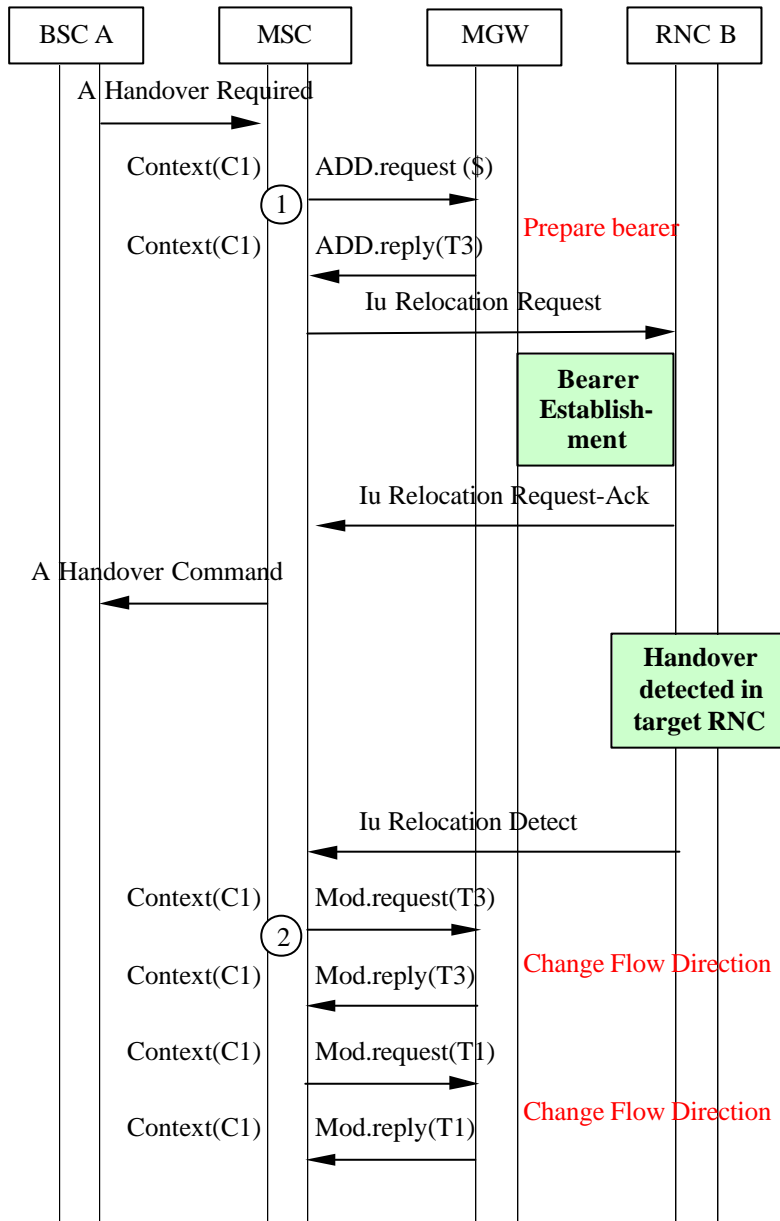
Figure 8.10/1 Intra-3G_MSC GSM to UMTS Handover (message sequence chart)
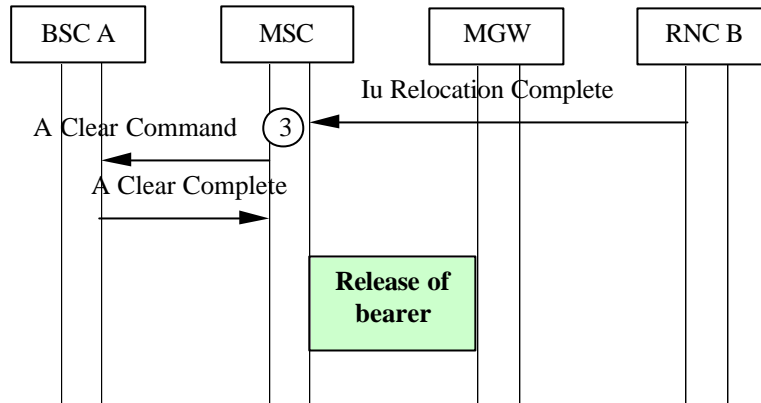
Figure 8.10/2 Intra-3G_MSC GSM to UMTS Handover (message sequence chart)

8.7 Basic Inter-MSC UMTS to GSM Handover

The following handling shall be applied for a call that started as UMTS call. The procedures specified in
3GPP TS 23.009 for 'Basic Handover Procedure Requiring a Circuit Connection between 3G_MSC-A and MSC-B'
shall be followed. The following paragraphs describe the additional requirements for the bearer independent CS core
network.

8.7.1 MSC-A

Relocation Required:

When Relocation Required message is received, the bearer is established between the MSC-A and the MGW. (Bullet 1
in figure 8.12.)

Relocation Command/Handover Detect:

At sending of Relocation Command message or alternatively at receiving of Handover Detect message the MSC-A uses
the Change Flow Direction procedure to requests the MGW to set the Handover Device to intermediate state. (Bullet 2
in figure 8.12.)

Handover Complete:

At receiving of Relocation Complete message, the MSC-A requests the RNC-A to release the IU and requests the
MGW to set the Handover Device to its final state by removing the bearer termination towards the RNC-A, using the
Release Termination procedure. (Bullet 3 in figure 8.12.)
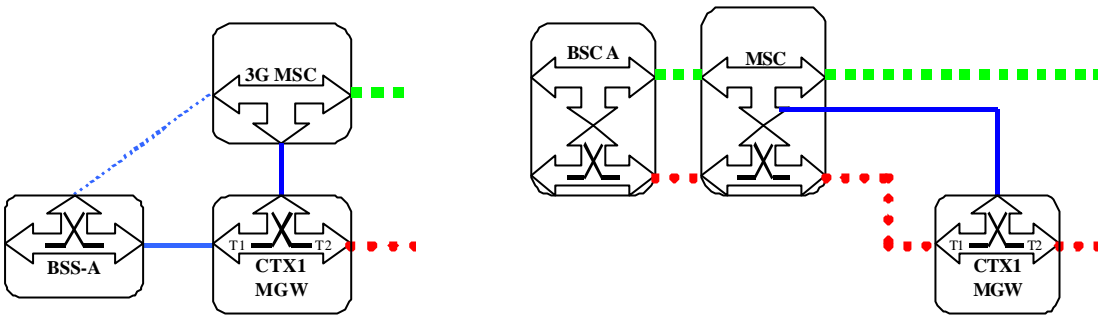
Example

The figure 8.11/a below shows the network model for the Basic Inter-MSC UMTS to GSM handover. The 'thick,
squared' line represents the call control signalling. The 'thick, dotted' line represents the bearer control signalling and
the bearer. The 'thin, continuous' line represents the circuit connection to MSC-B, the 'thin, dotted' line represents the
handover control signalling. In MGW -A the bearer termination T1 is used for the bearer towards RNC-A, bearer
termination T3 is used for the bearer towards MSC-B, and the bearer termination T2 is used for the bearer towards the
succeeding/preceding MGW.

> Note: Towards MSC-B no separation of bearer and control plane applies.

The figure 8.11/b below shows the network model for the Basic Inter-MSC UMTS to GSM Handover. The 'squared'
line represents the call control signalling. The 'dotted' line represents the bearer control signalling and the bearer. In
MGW the bearer termination T1 is used for the bearer towards RNC-A, bearer termination T3 is used for the bearer
towards MSC-B (connected through MSC-A), and the bearer termination T2 is used for the bearer towards the
succeeding/preceding MGW.

Before UMTS to GSM Handover:
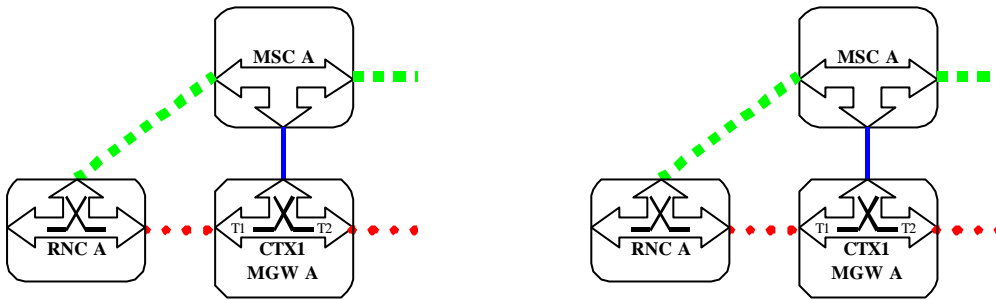
During UMTS to GSM Handover:
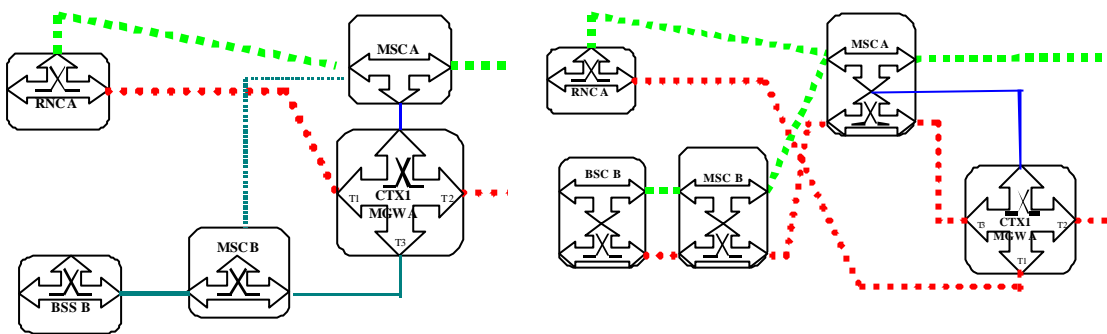

After UMTS to GSM Handover:

Figure 8.11/a **Figure 8.11/b**

Basic Inter-MSC UMTS to GSM Handover (network model)

The figure 8.12 below shows the message sequence example for the Basic Inter-MSC UMTS to GSM Handover.
It is assumed that the Handover Device is located in the MGW selected for the call establishment by the MSC-A, which
controls the call and the mobility management. Also assumed that only one bearer has been established towards the
RNC-A.
In the example when the Iu Relocation Required is received, the bearer is established between the MSC-A and the
MGW. When the handover is detected in the BSC-B the MSC-A requests to change the flow directions between the
terminations within the context in MGW. When the MSC-A receives Handover Complete indication from the MSC-B it
orders the RNC-A to release the IU. This action causes release of the bearer between the RNC-A and the MGW. Finally
MSC-A requests the MGW to remove the RNC-A side bearer termination.

RNC A	MSC A	MGW	MSCB	BSC B

Iu Relocation Required

①

Bearer Establish-ment

MAP Prepare Handover Req.

A Handover Request

A Handover Request-Ack

MAP Prepare Handover Resp.

Initial Address

Address Complete

Iu Relocation Command

Handover detected in target BSC

A Handover Detect

MAP Process Access Signalling Req.

Figure 8.12/1 Basic Inter-MSC UMTS to GSM Handover (message sequence chart)
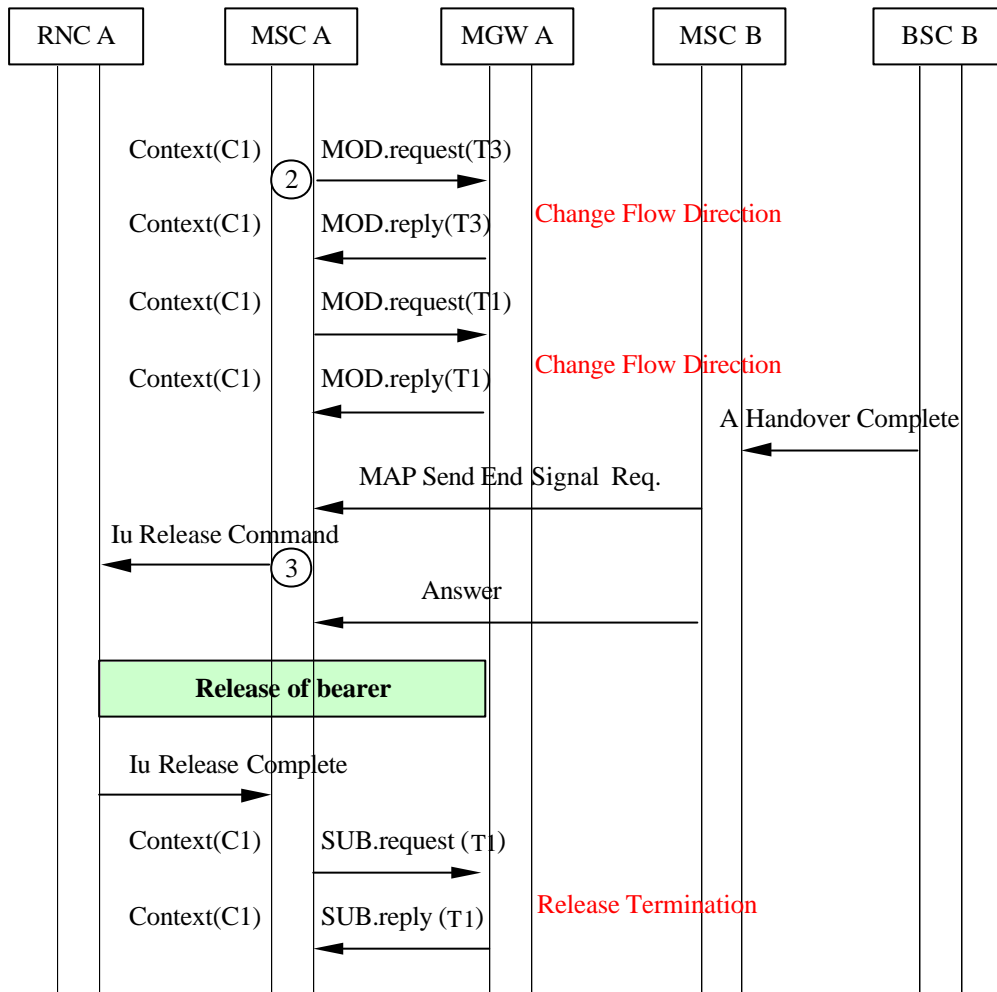
Figure 8.12/2 Basic Inter-MSC UMTS to GSM Handover (message sequence chart)

8.8 Basic Inter-MSC GSM to UMTS Handover

The following handling shall be applied for a call that started as UMTS call. The procedures specified in
3GPP TS 23.009 for 'Basic Handover Procedure Requiring a Circuit Connection between MSC-A and 3G_MSC-B'
shall be followed. The following paragraphs describe the additional requirements for the bearer independent CS core
network.

8.8.1 MSC-A

Bearer establishment between MGW-A and MGW-B:

The bearer establishment is handled as described at Basic Mobile Originating Call, using either forward or backward
bearer establishment.

Handover Command/Handover Detect:

At sending of Handover Command message or alternatively at receiving of Handover Detect message the MSC-A uses
the Change Flow Direction procedure to requests the MGW-A to set the Handover Device to intermediate state. (Bullet
3 in figure 8.14.)

Handover Complete:

At receiving of Handover Complete message, the MSC-A releases the A-interface line towards BSC-A and requests the
MGW-A to set the Handover Device to its final state by releasing the bearer between the MSC-A and the MGW-A.
(Bullet 3 in figure 8.14.)

8.8.2 MSC-B

MGW selection:

The MSC-B selects a MGW when it receives Prepare Handover Request message. (Bullet 1 in figure 8.14.)

Bearer establishment towards RNC-B:

When the MSC-B has selected the MGW-B it requests the MGW-B to provide a binding reference and a bearer address using the Prepare Bearer procedure. . The MSC-B sends the Relocation Request message to the RNC-B containing the bearer address and binding reference. (Bullet 1 in figure 8.14.)

Bearer establishment between MGW-A and MGW-B:

The bearer establishment is handled as described at Basic Mobile Terminating Call, using either forward or backward bearer establishment.

Example

The figure 8.13/a below shows the network model for the Basic Inter-MSC GSM to UMTS handover. The 'thick, squared' line represents the call control signalling. The 'thick, dotted' line represents the bearer control signalling and the bearer. The 'thin, continuous' line represents the circuit connection between MSC-A and MSC-B, the 'violet dotted' line represents the handover control signalling between MSC-A and MSC-B. In MGW-B the bearer termination T1 is used for the bearer towards RNC-B, bearer termination T2 is used for the bearer towards MSC-A.

The figure 8.13/b below shows the network model for the Basic Inter-MSC GSM to UMTS Handover. The 'squared' line represents the call control signalling. The 'dotted' line represents the bearer control signalling and the bearer. In MGW-A the bearer termination T1 is used for the bearer towards BSC-A (connected through MSC-A), bearer termination T3 is used for the bearer towards MGW-B, and the bearer termination T2 is used for the bearer towards the succeeding/preceding MGW. In MGW-B the bearer termination T4 is used for the bearer towards RNC-B, bearer termination T5 is used for the bearer towards MGW-A.

Before GSM to UMTS Handover:
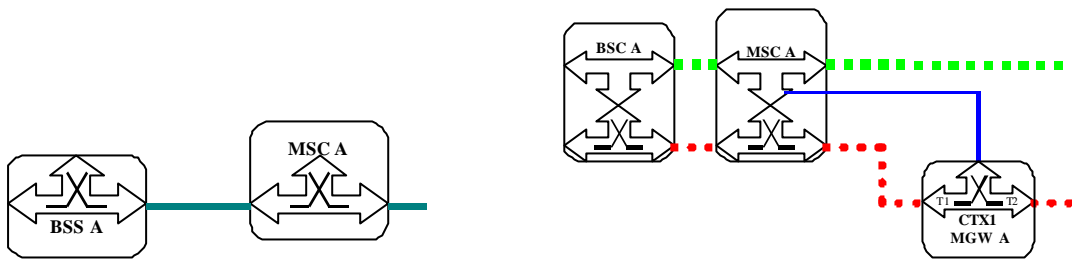
During GSM to UMTS Handover:
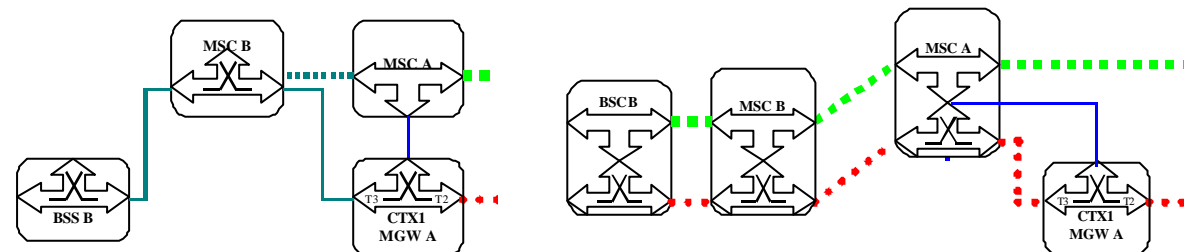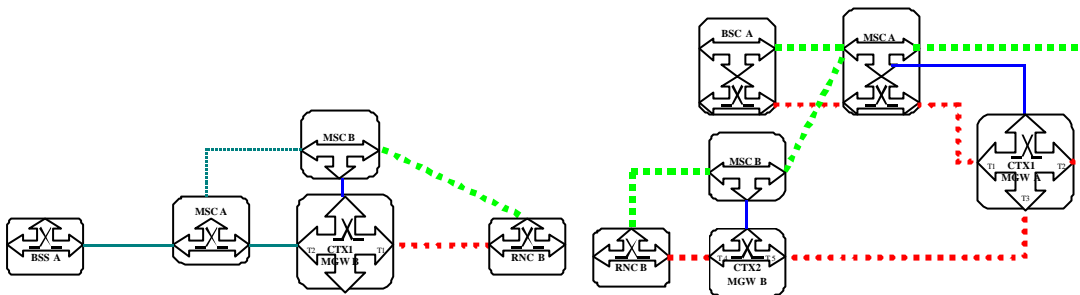

After GSM to UMTS Handover:
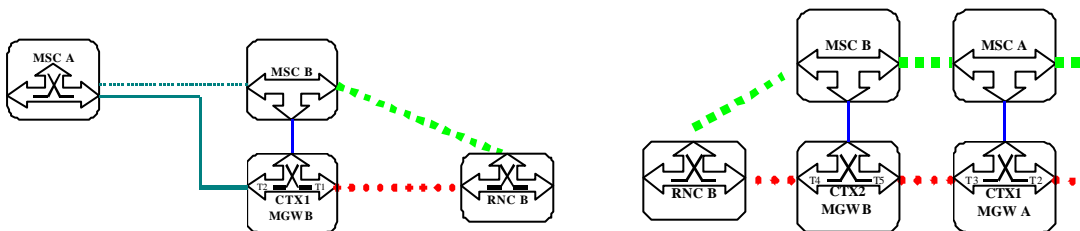
| **Figure 8.13/a** | **Figure 8.13/b** |

Basic Inter-MSC GSM to UMTS Handover (network model)

The figure 8.14 below shows the message sequence example for the Basic Inter-MSC GSM to UMTS Handover.
It is assumed that the Handover Device is located in the MGW-A selected for the call establishment by the MSC-A, which controls the call and the mobility management.
In the example the MSC-B requests MGW-B to seize the RNC-B side bearer termination. The MSC orders the establishment of the bearer towards the RNC-B by sending Relocation Request. After receiving of Relocation Request Acknowledge from the RNC-B the call is established between the MSC-A and the MSC-B, the bearer is established between the MGW-A and the MGW-B. When the relocation is detected in the RNC-B the MSC-A requests to change the flow directions between the terminations within the context in the MGW-A. When the MSC-A receives Handover Complete indication from the MSC-B it releases the A-interface line towards the BSC-A. Finally the bearer between the MSC-A and the MGW-A is released.
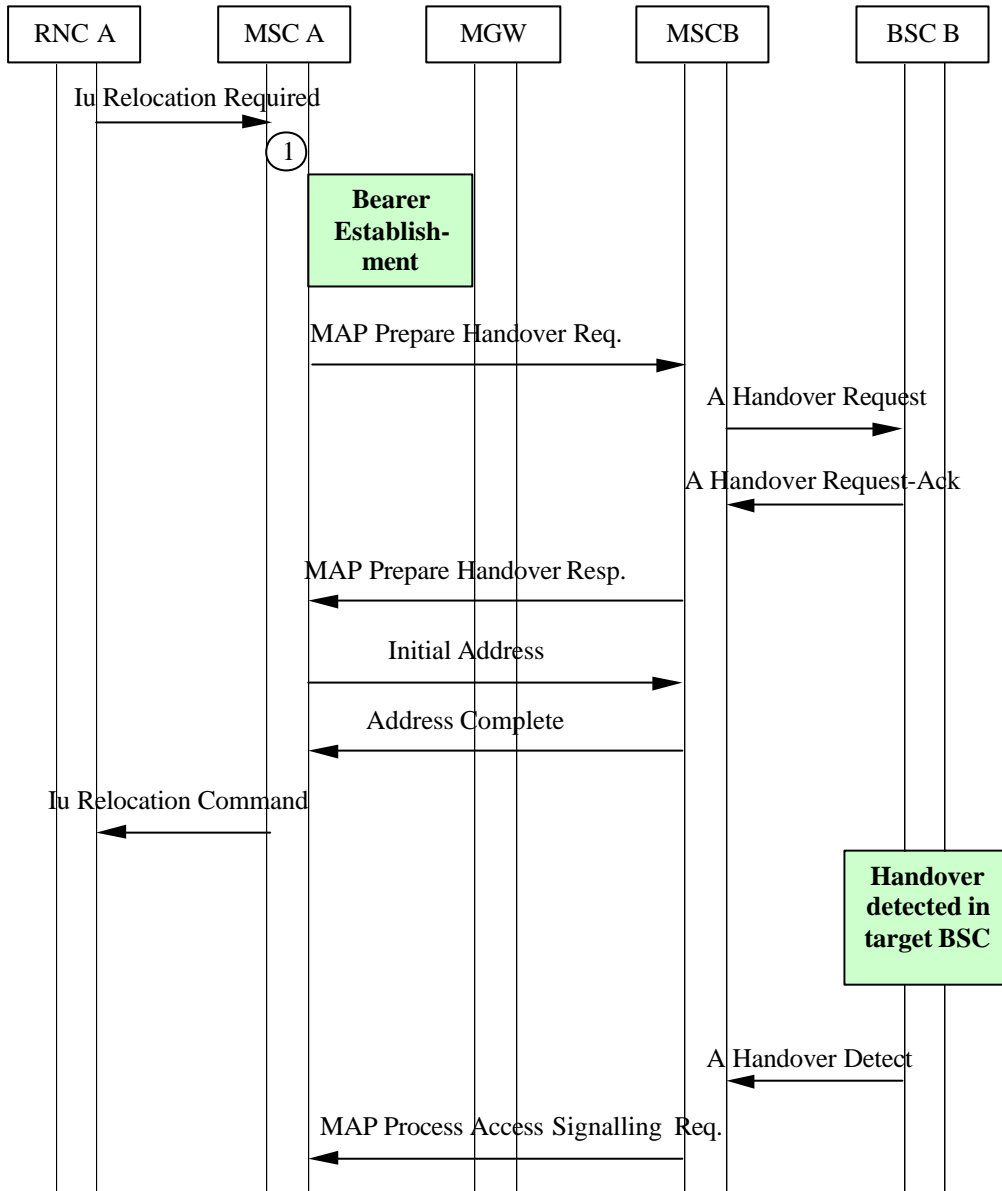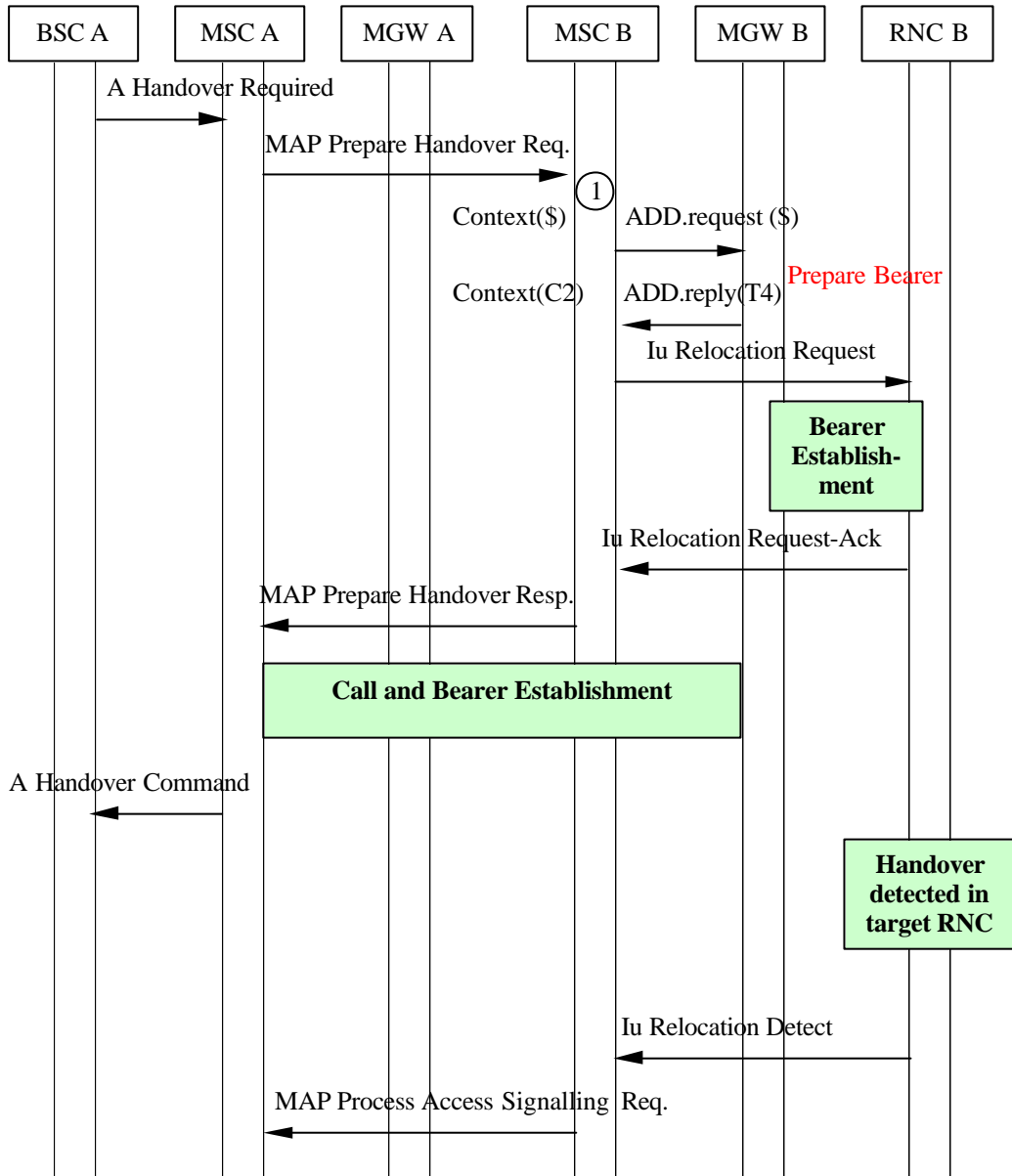
Figure 8.14/1 Basic Inter-MSC GSM to UMTS Handover (message sequence chart)
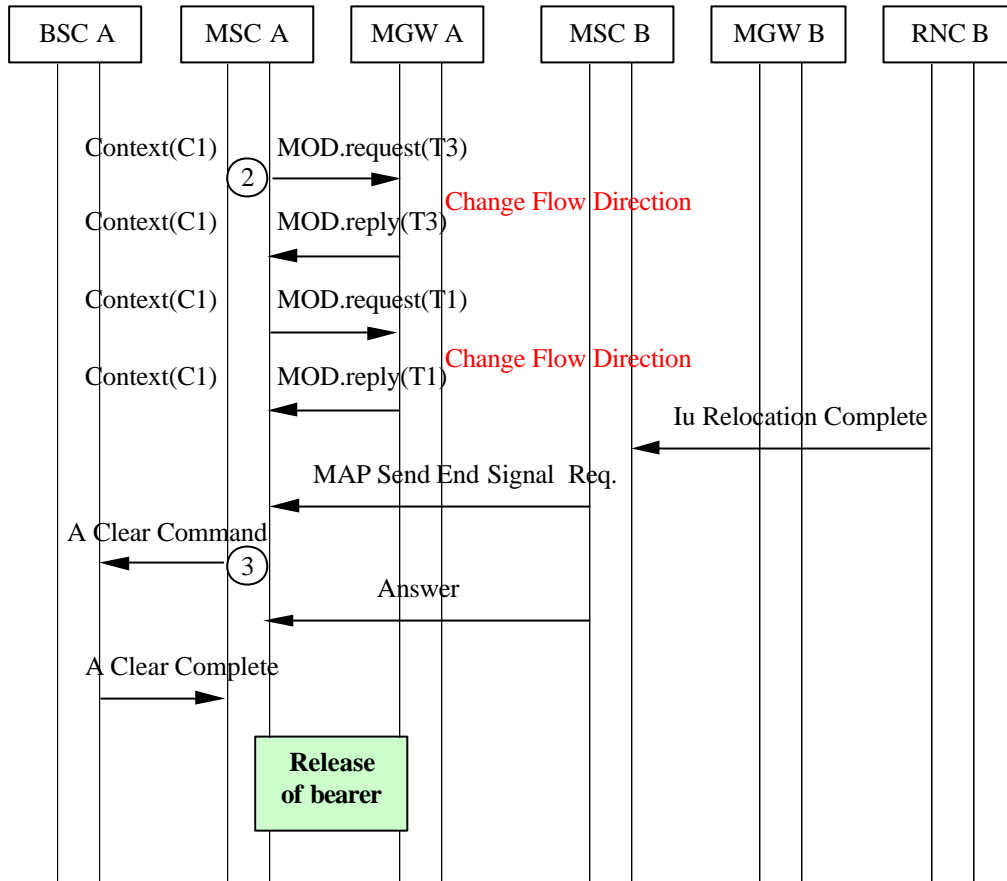
Figure 8.14/2 Basic Inter-MSC GSM to UMTS Handover (message sequence chart)

8.9 Subsequent Inter-MSC UMTS to GSM Handover back to the Anchor MSC

The following handling shall be applied for a call that started as UMTS call. The procedures specified in 3GPP TS 23.009 for 'Subsequent UMTS to GSM handover requiring a Circuit Connection between 3G_MSC-A and 3G_MSC-B, 3G_MSC-B to MSC-A' shall be followed. The following paragraphs describe the additional requirements for the bearer independent CS core network.

8.9.1 MSC-A

Relocation Required:

When Relocation Required message is received from the RNC-A (via MSC-B), a bearer is established between MSC-A and MGW-A. (Bullet 1 in figure 8.16.)

Handover Command/Handover Detect:

At sending of Relocation Command message or alternatively at receiving of Handover Detect message the MSC-A uses the Change Flow Direction procedure to requests the MGW-A to set the Handover Device to intermediate state. (Bullet 2 in figure 8.16.)

Handover Complete:

At receiving of Handover Complete message the MSC-A informs the MSC-B about reception of this message (bullet 3 in figure 8.16), then the MSC-A initiates call clearing towards the MSC-B as described at Call Clearing.

8.9.2 MSC-B

Handover Complete:

At receiving of Handover Complete message, the MSC-B requests the RNC-A to release the IU and requests the MGW-B to remove the bearer termination towards the RNC-A using the Release Termination procedure. (Bullet 4 in figure 8.16.)

Release of bearer towards MGW-A:

When the MSC-B receives call clearing indication from the MSC-A, the MSC-B handles it as described at Call Clearing.

Example

The figure 8.15 below shows the network model for the Subsequent Inter-MSC UMTS to GSM Handover back to the Anchor MSC. The 'squared' line represents the call control signalling. The 'dotted' line represents the bearer control signalling and the bearer. In MGW-A the bearer termination T6 is used for the bearer towards BSC-B (connected through MSC-A), the bearer termination T3 is used for the bearer towards the MGW-B, and the bearer termination T2 is used for the bearer towards the succeeding/preceding MGW. In MGW-B the bearer termination T4 is used for the bearer towards the RNC-A, the bearer termination T5 is used for the bearer towards the MGW-A.

Before UMTS to GSM Handover:
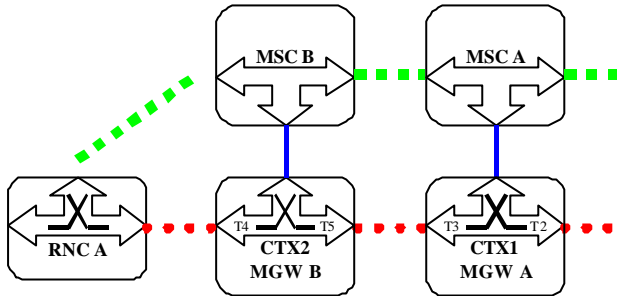
During UMTS to GSM Handover:
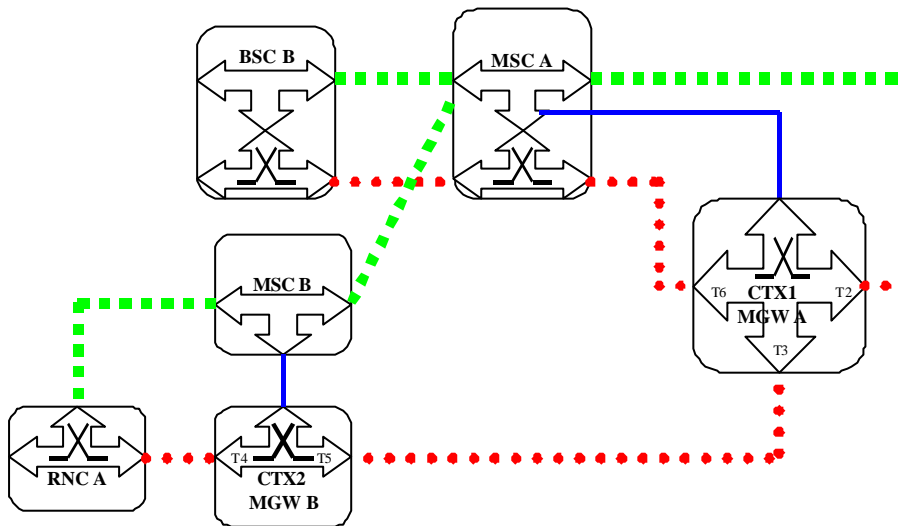

After UMTS to GSM Handover:

Figure 8.15 Subsequent Inter-MSC UMTS to GSM Handover back to the Anchor MSC (network model)

The figure 8.16 below shows the message sequence example for the Subsequent Inter-MSC UMTS to GSM Handover back to the Anchor MSC.
It is assumed that the Handover Device is located in the MGW -A selected for the call establishment by the MSC-A which controls the call and the mobility management. Also assumed that only one bearer has been established towards the RNC-A.

In the example at reception of Relocation Required from the RNC-A the bearer is established between MSC-A and MGW-A. When the handover is detected in the BSC-B, the MSC-A requests to change the flow directions between the terminations within the context in the MGW-A. When the MSC-A receives Handover Complete indication from the BSC-B it transfers this indication to the MSC-B. The MSC-B orders the RNC-A to release the IU. This action causes release of the bearer between the RNC-A and the MGW-B. The MSC-A initiates call clearing towards the MSC-B.
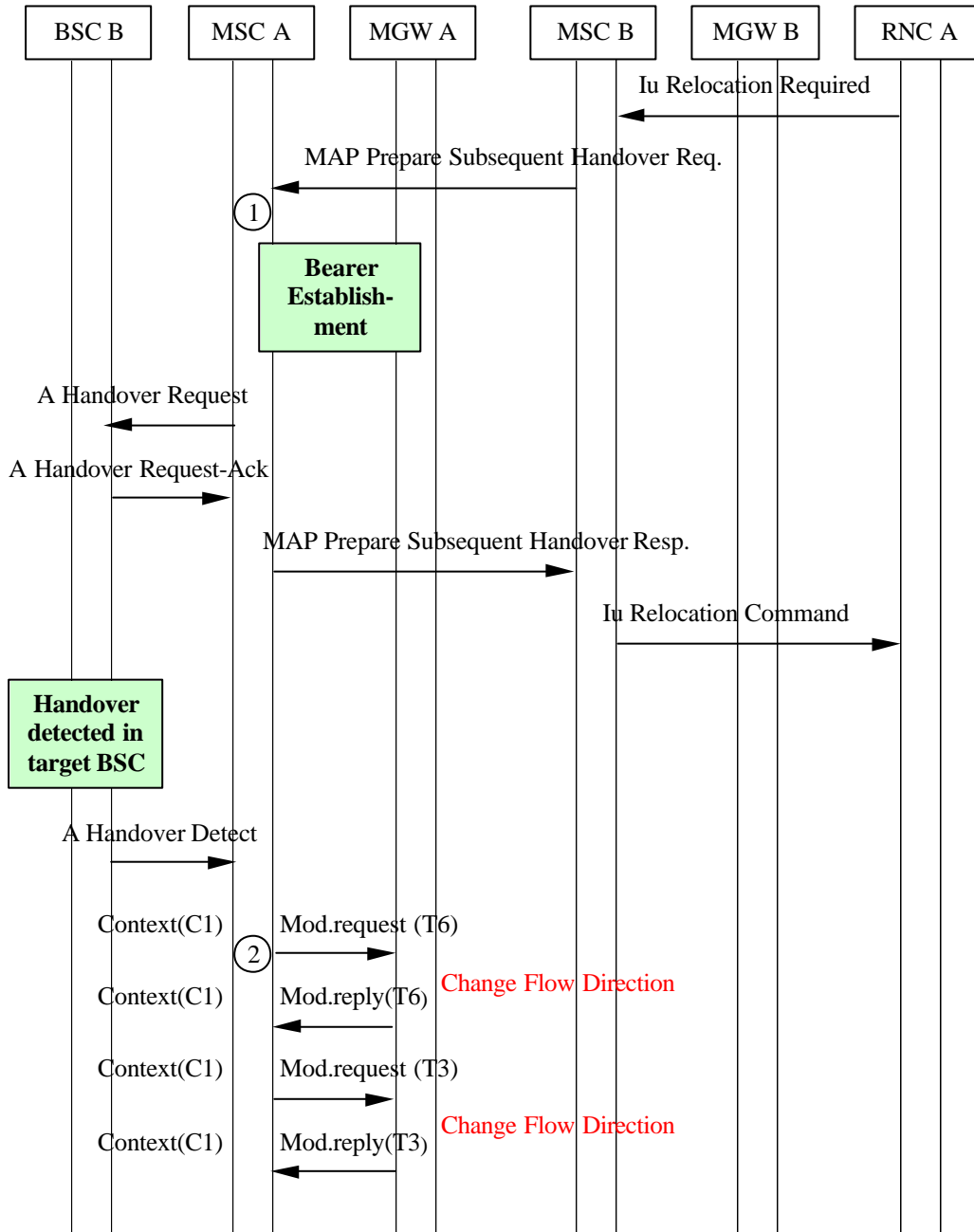
Figure 8.16/1 Subsequent Inter-MSC UMTS to GSM Handover back to the Anchor MSC (message sequence chart)
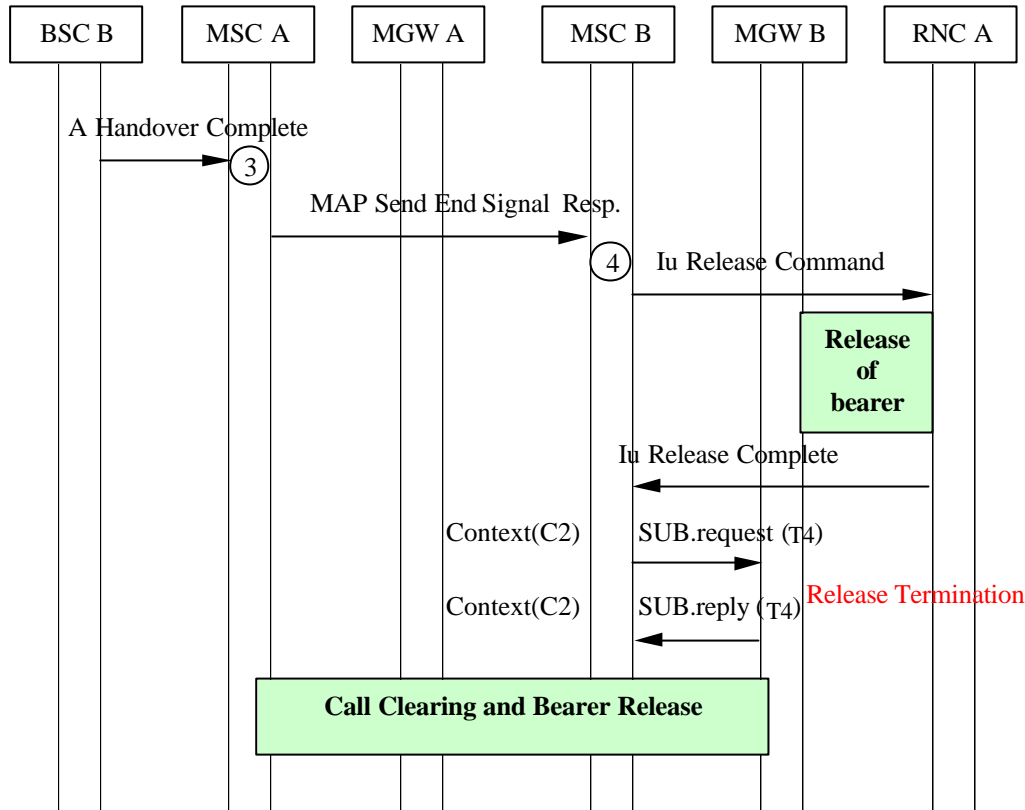
Figure 8.16/2 Subsequent Inter-MSC UMTS to GSM Handover back to the Anchor MSC (message sequence chart)

8.10 Subsequent Inter-MSC GSM to UMTS Handover back to the Anchor MSC

The following handling shall be applied for a call that started as UMTS call. The procedures specified in 3GPP TS 23.009 for 'Subsequent Inter-MSC GSM to UMTS Handover back to the Anchor MSC' shall be followed. The following paragraphs describe the additional requirements for the bearer independent CS core network.

8.10.1 MSC-A

Handover Required:

When Handover Required message is received from BSC-A (via MSC-B), the MSC-A requests the MGW to provide a binding reference and a bearer address using the Prepare Bearer procedure. The MSC sends the Relocation Request message to the RNC-B containing the bearer address and binding reference. (Bullet 1 in figure 8.18.)

Handover Command/Relocation Detect:

At sending of Handover Command message or alternatively at receiving of Relocation Detect message the MSC-A uses the Change Flow Direction procedure to requests the MGW to set the Handover Device to intermediate state. (Bullet 2 in figure 8.18.)

Relocation Complete:

At receiving of Relocation Complete message the MSC-A requests the MGW to set the Handover Device to its final state by releasing the bearer between the MSC-A and the MGW (bullet 3 in figure 8.18).

Example

The figure 8.17 below shows the network model for Subsequent Inter-MSC GSM to UMTS Handover back to the Anchor MSC. The 'squared' line represents the call control signalling. The 'dotted' line represents the bearer control signalling and the bearer. In MGW the bearer termination T1 is used for the bearer towards RNC-B, the bearer termination T3 is used for the bearer towards MSC-A, and the bearer termination T2 is used for the bearer towards the succeeding/preceding MGW.

Before GSM to UMTS Handover:
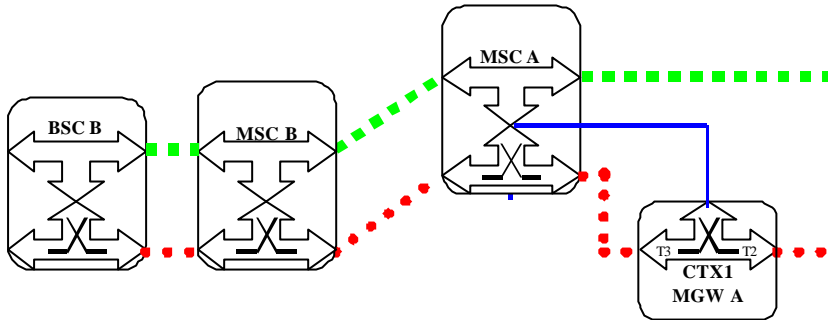
During GSM to UMTS Handover:
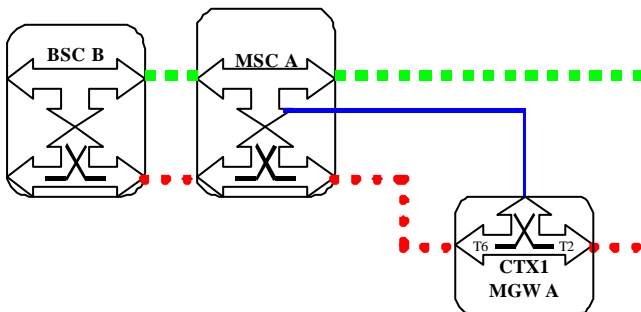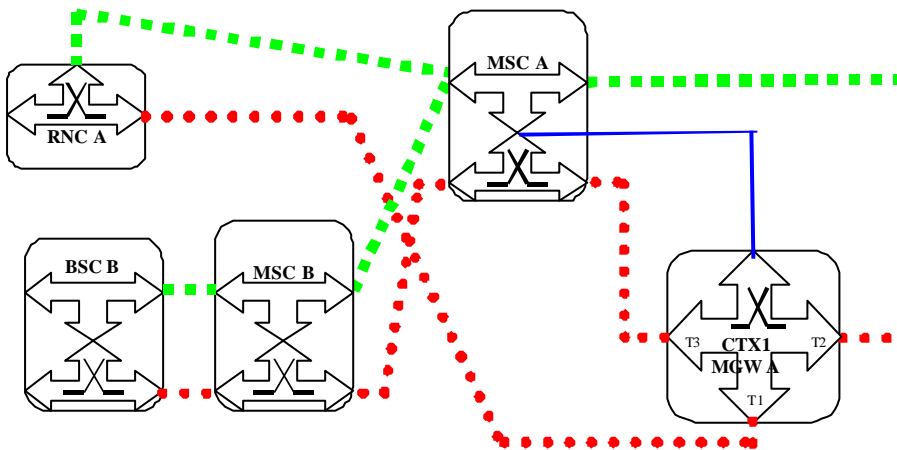
After GSM to UMTS Handover:
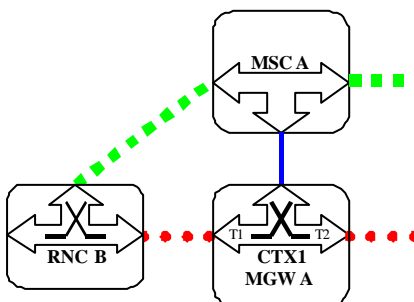
Figure 8.17 Subsequent Inter-MSC GSM to UMTS Handover back to the Anchor MSC (network model)

The figure 8.18 below shows the message sequence example for Subsequent Inter-MSC GSM to UMTS Handover back to the Anchor MSC.

It is assumed that the Handover Device is located in the MGW selected for the call establishment by the MSC-A which controls the call and the mobility management.

In the example the MSC-A requests MGW to seize the RNC-B side bearer termination with specific flow directions. The MSC orders the establishment of the bearer towards the RNC-B by sending Relocation Request. When the relocation is detected in the RNC-B the MSC-A requests to change the flow directions between the terminations within the context in the MGW. When the MSC-A receives Relocation Complete indication from the RNC-B the bearer between MGW and MSC-A is released.
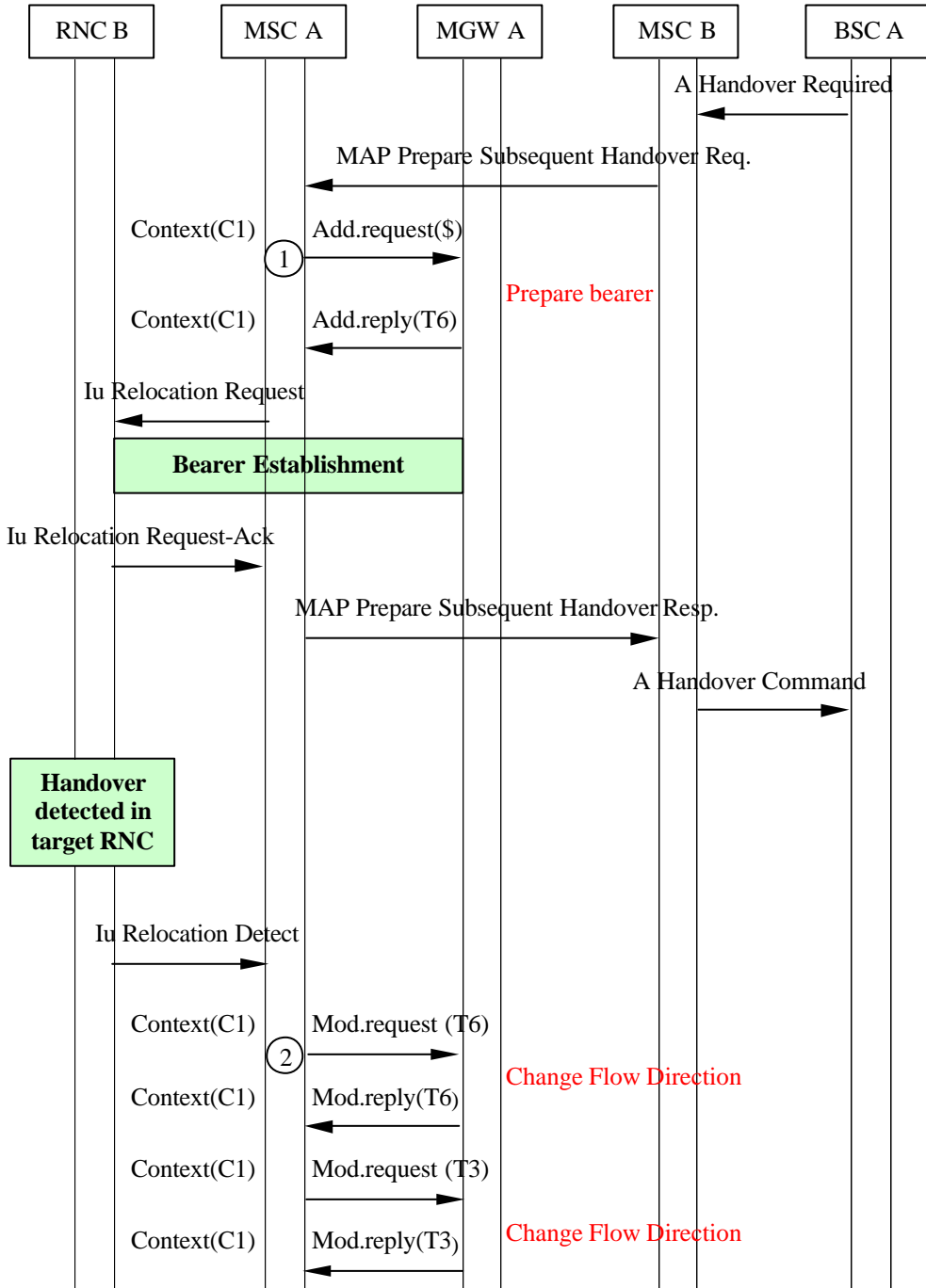
Figure 8.18/1 Subsequent Inter-MSC GSM to UMTS Handover back to the Anchor MSC (message sequence chart)
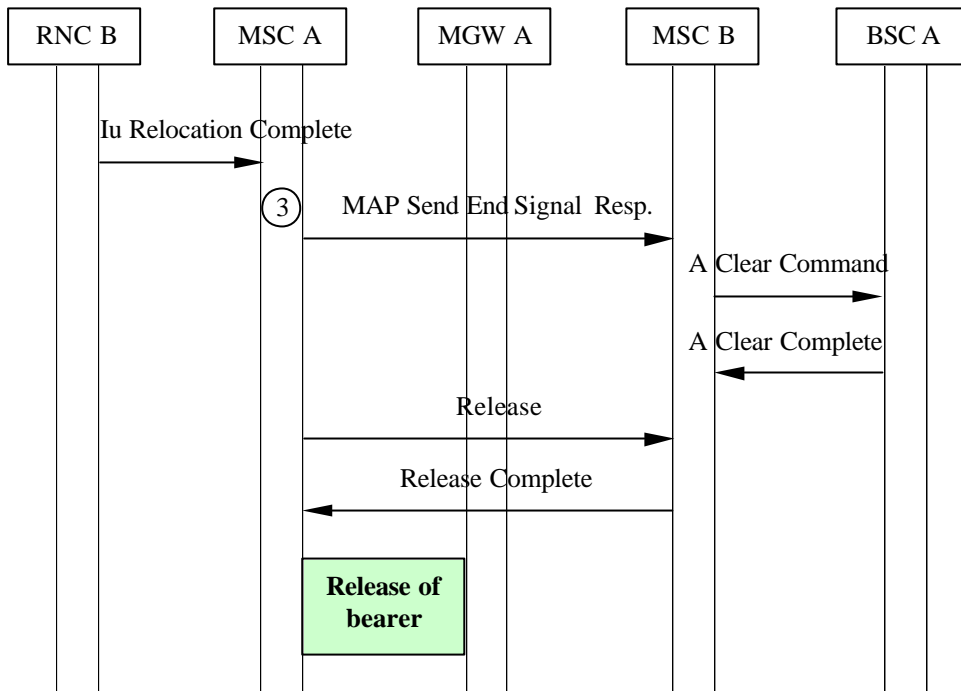
Figure 8.18/2 Subsequent Inter-MSC GSM to UMTS Handover back to the Anchor MSC (message sequence chart)

8.11 Handling of GSM Services after UMTS to GSM Handover

The handling of GSM services after handover in the Bearer Independent CS Core Network architecture is as for the corresponding UMTS services, if not stated differently.

9 Compatibility Issues

{Editors Note:
This section will describe any compatibility issues that need to be considered}

10 General (G)MSC-MGW Procedures

10.1 MGW Unavailable

The (G)MSC recognises that the MGW is unavailable in the following 3 cases:

1. The signalling connection is unavailable as shown below
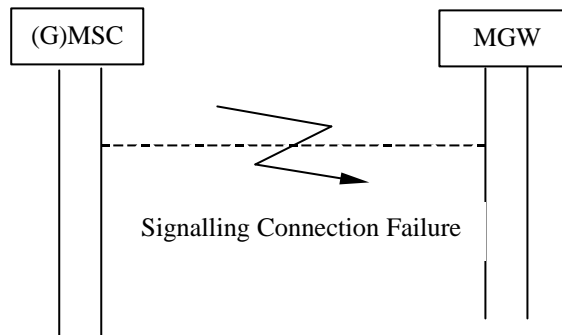
Figure 10.1 Signalling connection failure

2. The MGW indicates the failure condition to all connected (G)MSCs
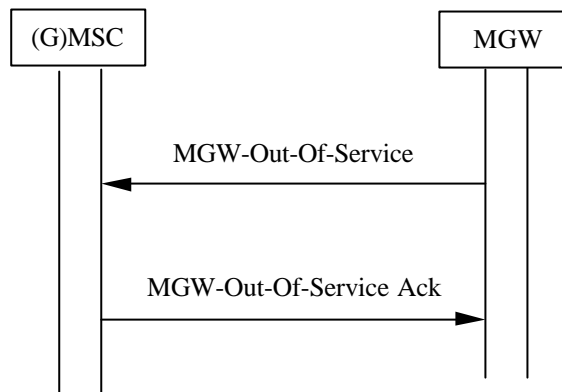
Figure 10.2 MGW indicates the Failure

The failure indication indicates that the MGW will go out of service soon and that no new connections should be established using this MGW. The MGW can choose between the 'graceful' and the 'forced' method. In the graceful method the connections are cleared when the corresponding calls are disconnected. In the forced method all connection are cleared immediately.

3. The (G)MSC recognises that the MGW is not functioning correctly, e.g. because there is no reply on periodic sending of Audits.

In all of the above case the (G)MSC shall prevent the usage of the MGW until the MGW has recovered or the communication with the MG is restored. The (G)MSC shall prohibit the surrounding network from seizing circuits connected to the unavailable TDM access by sending blocking messages.

10.2 MGW Available

The (G)MSC discovers that the MG is available when it receives an MG Communication Up message or an MG Restoration message.

1. Signalling recovery

The MGW indicates to all connected (G)MSCs that the signalling connection is restored.
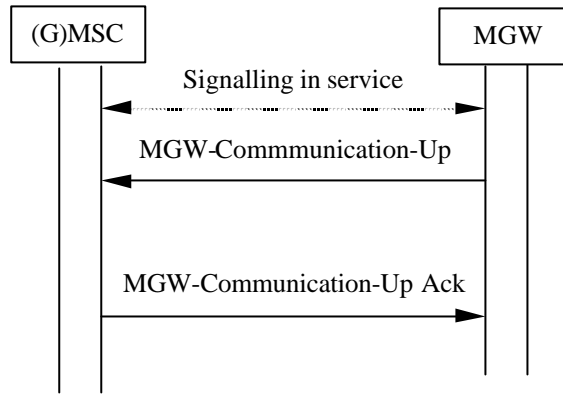
Figure 10.3 Communication goes up

2. MGW restoration indication.

   The MGW indicates to all connected (G)MSCs that normal operation has resumed.
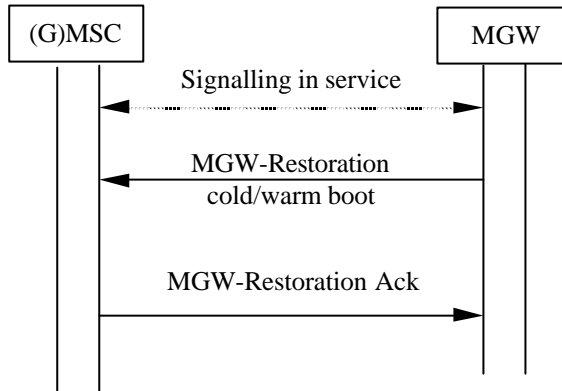
NOTE: This procedure may be used after recovery from a signalling failure.

Figure 10.4 MGW indicates recovery from a failure

3. The (G)MSC recognises that the MGW is now functioning correctly, e.g. because there is a reply on periodic sending of Audits.

   After this the (G)MSC can use the MGW. If the corresponding devices of the surrounding network are blocked, unblocked messages are sent to the nodes concerned.

If none of 1,2, and 3 happens the (G)MSC can initiate the (G)MSC re-registration procedure.

10.3 MGW Recovery

If the MGW recovers from a failure or is restarted it registers to its known (G)MSCs using the MGW Restoration procedure. The MGW can indicate whether it has restarted with a cold or warm boot. The response sent to the MGW indicates a signalling address to be used by the MGW.
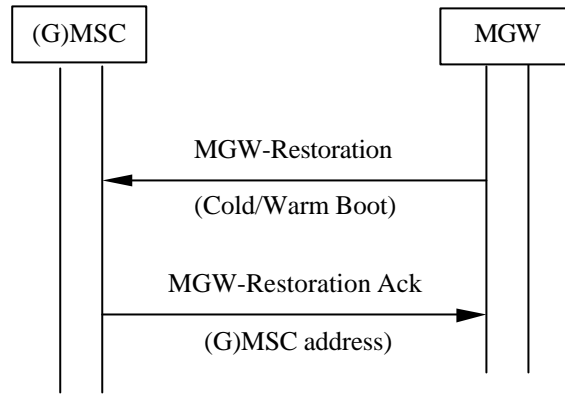
Figure 10.5 MGW Registration

After the recovery the (G)MSC can use the MGW. If the corresponding devices of the surrounding network are blocked, unblocked messages are sent to the nodes concerned.

10.4   (G)MSC Recovery

10.4.1 General

The (G)MSC recovery will from information flow point of view look like MGW unavailable and MGW availability if the failu re/ recovery action provokes a MGW -unavailability condition and MGW availability if the no MGW unavailability condition occur. After the information flow releases of the termination affected by the recovery action is carried out.

10.4.2 (G)MSC service restoration
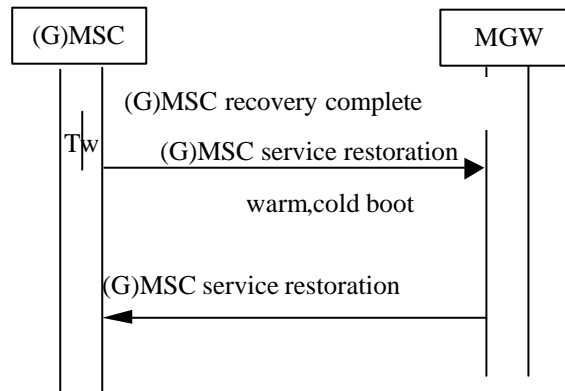
Figure 10.6 (G)MSC service restoration

After the recovery action is complete the (G)MSC starts a timer Tw. If no recovery indications are received (MGW (MGW communication-up or MGW restoration) from the MGW during Tw the (G)MSC restoration is send. If a recovery indication is received, this is acknowledge by the (G)MSC before the (G)MSC restoration is sent.

10.5   MGW Re-registration Ordered by (G)MSC

If the (G)MSC knows that communication is possible, but the MGW has not re gistered, the (G)MSC can order re- registration of the MGW.
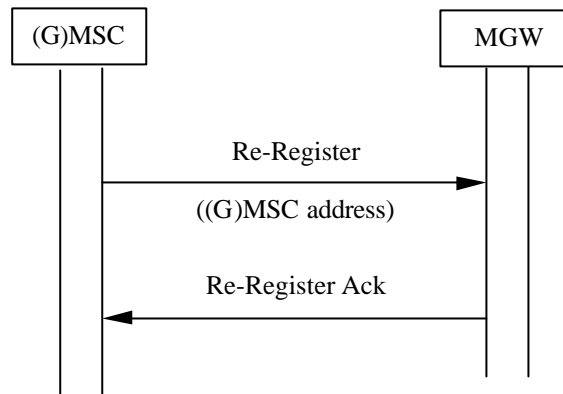
Figure 10.7 Re-registration ordered by the (G)MSC

If the re-registration request is accepted the MGW uses the MGW registration procedure to register to the (G)MSC.

10.6 Removal from Service of a Physical Termination

The MGW indicates the removal from service of a physical termination using the Termination Out of Service procedure. In this procedure the MGW indicates the termination which is removed from service and whether the 'graceful' or 'forced' method will be used. In the graceful method a possible connection is cleared when the corresponding call is disconnected. In the forced method the possible connection is cleared immediately.
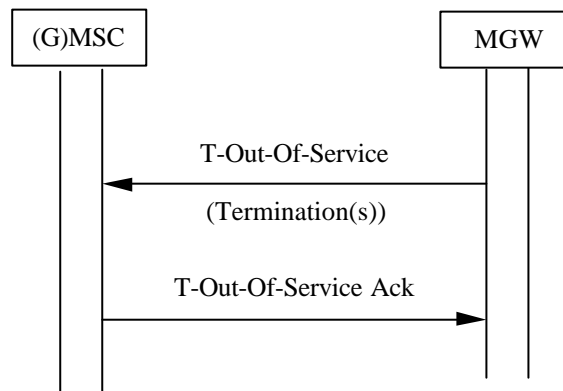
Figure 10.8 Removal from service of a Physical Termination

The (G)MSC shall prevent the use of the Termination(s) concerned until the physical termination is restored to service.

10.7 Restoration to Service of a Physical Termination

If the physical termination is restored to service, the MGW reports it to the (G)MSC(s) using the Termination Restoration procedure.
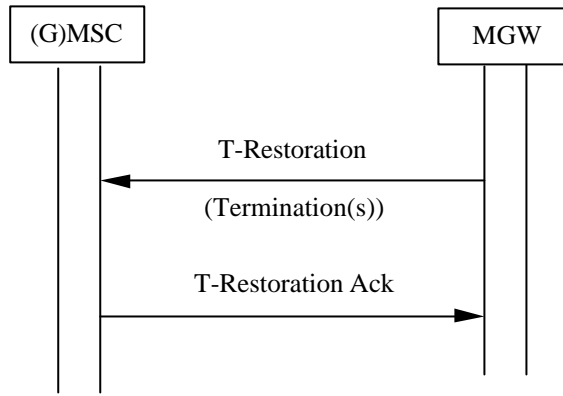
Figure 10.9 Restoration to service of a Physical Termination

After the restoration to service the (G)MSC can use the physical termination. If the corresponding devices of the surrounding network are blocked, the (G)MSC sends an unblocked message to each node concerned.

10.8   Audit of MGW

10.8.1 Audit of Value

The (G)MSC may request the MGW to report the current values assigned to distinct objects in the MGW. Objects, which can be addressed, are listed in 3GPP TS 29.232 [14].
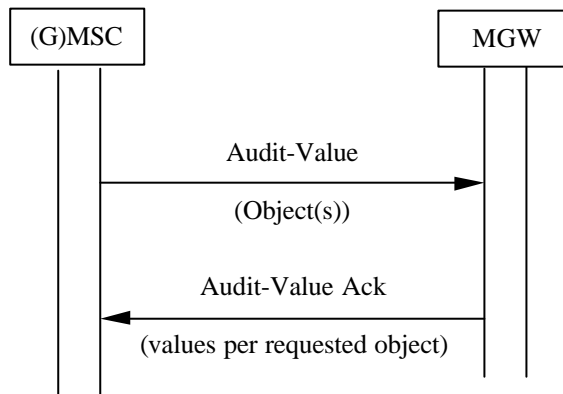
Figure 10.10 Audit Value

10.8.2 Audit of Capability

The (G)MSC may request the MGW to report the capabilities of distinct objects in the MGW. Objects, which can be addressed, are listed in 3GPP TS 29.232 [14].
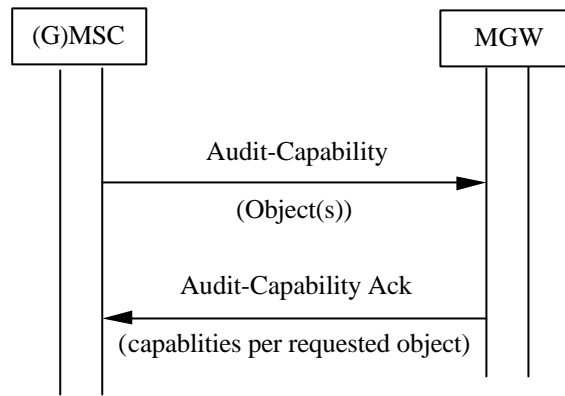
Figure 10.11 Audit Capability

10.9 MGW Capability Change

The MGW reports a change of capability of distinct objects in the MGW. Objects, which can be addressed, are listed in 3GPP TS 29.232 [14].
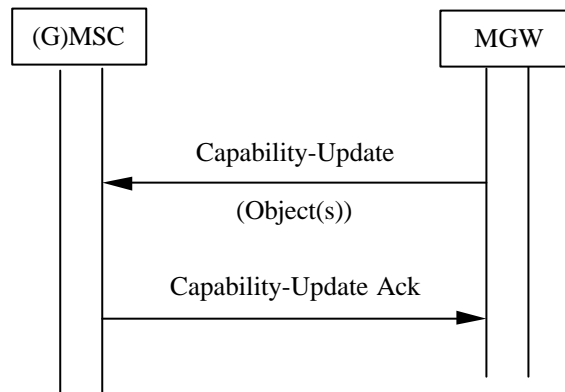
Figure 10.12 Capability Update

The (G)MSC can use the Audit Value and/or Audit Capability procedures to obtain further information, about the objects whose capabilities have changed.

10.10 (G)MSC ordered MGW Re-registration

If the (G)MSC knows that communication is possible, but the MGW has not registered, the (G)MSC can order the re-registration of the MGW.
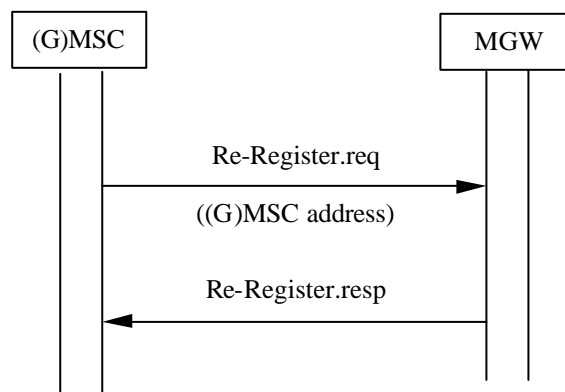
Figure 10.13 (G)MSC ordered MGW Re-registration

10.11 (G)MSC Out of service
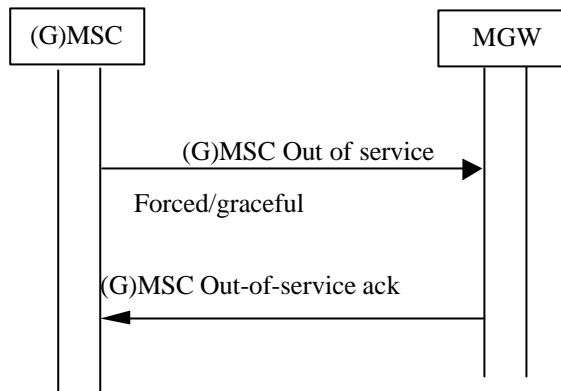
Figure 10.14 (G)MSC out of service

If a (G)MSC discovers that it want to go out of service it sends it starts a (G)MSC out of service procedure. It can indicate that it want the context to be cleared immediately (forced) or cleared as the bearer control protocol clears the bearer (Graceful). Physical termination are always cleared when the (G)MSC out-of-service indication reaches the MGW.

11 Identities

{Editors Note:
This section shall describe the relevant identities used in the CS CN core network.}

12 Operational Aspects

12.1 Charging

FFS

13 Interactions with Other Services

NOTE1: All message sequence charts in this clause are informative examples.

NOTE2: The continuity indication in the IAM is not used to indicate that a continuity check will be performed on the current leg of the call, but it is used to indicate that a Continuity message can be expected as a result of a continuity check on a preceding ISUP circuit, or establishment of a preceding bearer connection.

13.1 enhanced Multi-Level Precedence and Pre-emption service (eMLPP)

No impact.

13.2 Call Deflection Service

The procedures specified in 3GPP TS 23.072 for the Call Deflection supplementary service shall be followed. The following paragraphs describe the additional requirements for the bearer independent CS core network.

MGW selection and incoming side bearer establishment

The MGW selected for the mobile terminating call is used. The incoming side bearer has already been established by the mobile terminating call procedures.

IU release

If the call deflection request from a served subscriber is accepted the call towards the served mobile subscriber will be released as described in the subclause for call clearing.

Notification to the Calling Subscriber

If the served mobile subscriber has requested that the calling subscriber shall receive a notification about the call forwarding, a notification is sent to the calling party. If the notification is implemented using intermediate tones or announcements the MSC requests the MGW to play an announcement/tone to the calling party before establishing the call to the forwarded-to subscriber. The MSC provides the MGW with the announcement/tone identification and requests the MGW to notify the announcement completion using the Play Announcement or Play Tone procedure (bullet 1 in figure 13.2).

Initial addressing

The call towards the deflected-to subscriber is established as for basic call. If out-of-band transcoder control is applied for a speech call, that shall be performed in accordance with 3GPP TS 23.153. After the possible generation of in-band information has been completed (bullet 2 in figure 13.2) the MSC indicates in the Initial Address message that forward or backward bearer establishment is to be used. The MSC will indicate in the Initial Address message that no Continuity message will follow since the incoming bearer has already been established.

The MGW-id can be provided to the succeeding node in the Initial Address message.

Establishment of bearer towards the forwarded-to subscriber

The bearer establishment towards the forwarded-to subscriber is performed as described for the mobile originating call, network side bearer establishment, using either forward or backward bearer establishment. The MSC also requests the MGW to both-way through connect the bearer.

Example

The figure 13.1 below shows the network model for call deflection. The 'squared' line represents the call control signalling. The 'dotted' line represents the bearer control signalling and the bearer. The MSC replaces the bearer termination for the served mobile subscriber (T_B) with the bearer termination for the deflected-to subscriber (T_C) in an existing context in the MGW. The bearer termination T_A is used for the bearer towards the preceding MGW (calling subscriber).

Before CD:

After CD:
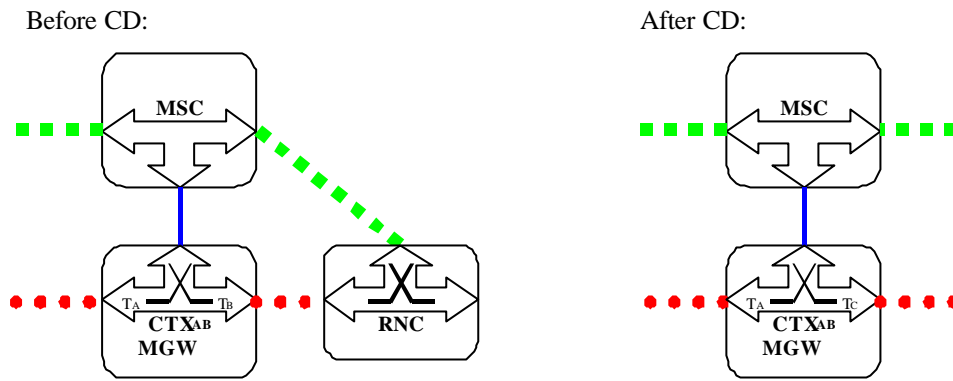
Figure 13.1: Call deflection (Network model)

The figure 13.2 below shows the message sequence example for the call deflection with a notification to the calling party with an announcement. In the example, after the call and the bearer towards the access have been released the MSC requests the MGW to remove the bearer termination for the served mobile subscriber, and requests the MGW to play an announcement and to notify the announcement completion. After the announcement has been completed the MSC requests the establishment of the call towards the deflected-to subscriber.
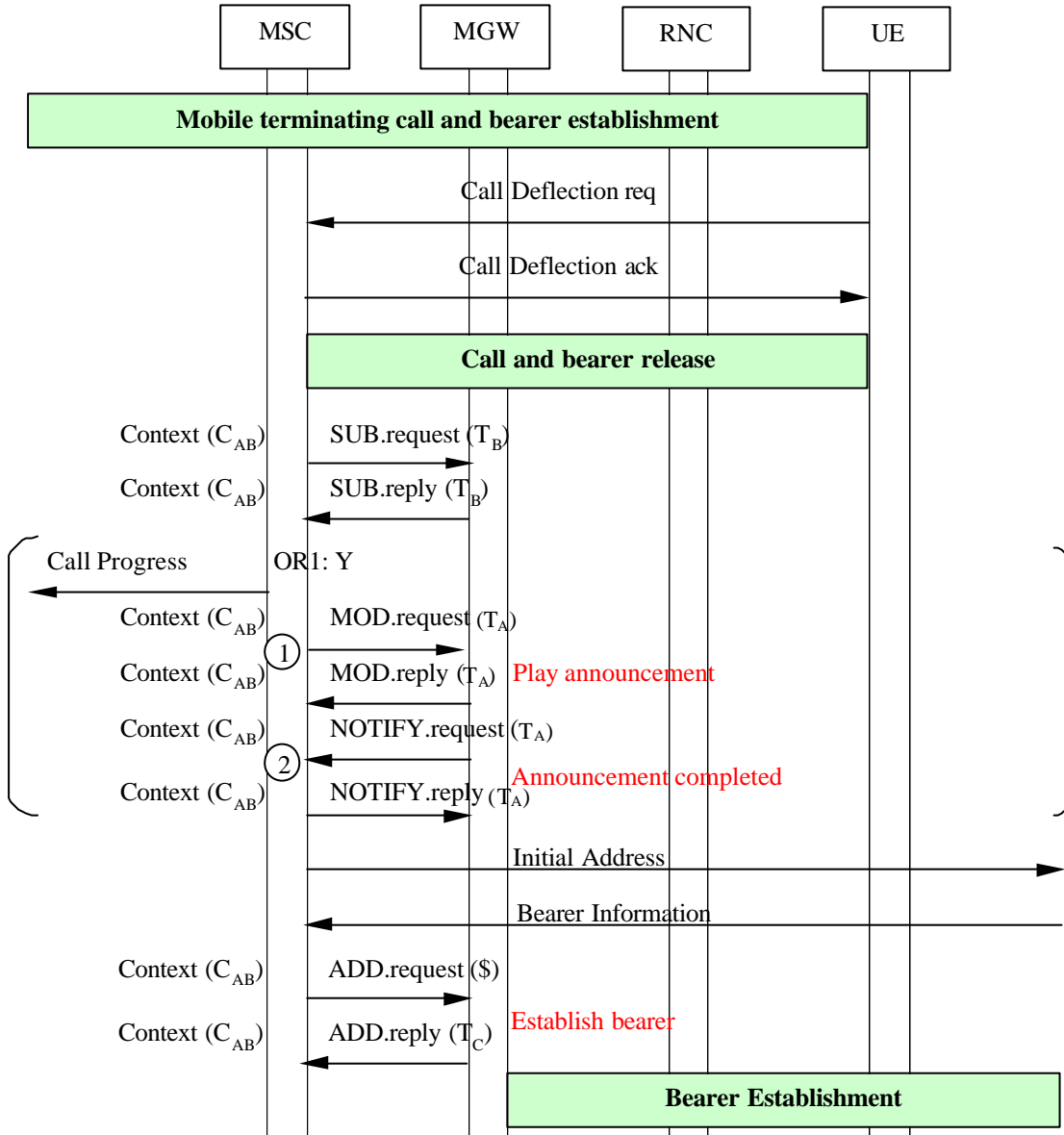
NOTE: OR1: Notification to calling subscriber required (Y:yes N:no)

Figure 13.2: Information flow for call deflection (message sequence chart)

13.3 Line identification Services

13.3.1 Calling Line Identification Presentation (CLIP)

No impact.

13.3.2 Calling Line Identification Restriction (CLIR)

No impact.

13.3.3 Connected Line Identification Presentation (COLP)

No impact.

13.3.4 Connected Line Identification Restriction (COLR)

No impact.

13.4 Call Forwarding Services

13.4.1 Call Forwarding Unconditional (CFU)

The procedures specified in 3GPP TS 23.082 for the Call Forwarding Unconditional supplementary service shall be followed. The following paragraphs describe the additional requirements for the bearer independent CS core network.

MGW selection

If in-band information shall be provided to the calling subscriber the GMSC selects the MGW before providing the in-band information. The MGW selection can be based on a possibly received MGW-Id from the preceding node.

If no in-band information shall be provided to the calling subscriber the GMSC selects the MGW for the bearer as described for the basic mobile terminating call.

Incoming side bearer establishment

The incoming side bearer establishment is handled in the GMSC as described for the mobile terminating call using either forward or backward bearer establishment.

Notification to the Calling Subscriber

If the served mobile subscriber has requested that the calling subscriber shall receive a notification about the call forwarding, a notification is sent to the calling party. If the notification is implemented using intermediate tones or announcements the GMSC requests the MGW to play an announcement/tone to the calling before establishing the call to the forwarded-to subscriber. The following two conditions need to be satisfied before providing the in-band information:

1. If the incoming Initial Address message indicated that the Continuity message will follow, a Continuity message shall be received.

2. Notification indicating successful completion of the incoming side bearer set-up shall be received from the MGW using the Bearer Established procedure.

The GMSC provides the MGW with the announcement/tone identification and requests the MGW to notify the announcement completion party using the Play Announcement or Send Tone procedure (bullet 1 in figure 13.4).

<u>Initial addressing</u>

If the incoming call shall be forwarded without being offered to the served mobile subscriber the call towards the forwarded-to subscriber is established as for basic call. If out-of-band transcoder control is applied for a speech call, that shall be performed in accordance with 3GPP TS 23.153. After the possible generation of in-band information has been completed (bullet 2 in figure 13.4) the initial addressing towards the forwarded-to subscriber is performed as described for the basic mobile terminating call indicating either forward or backward bearer establishment.

<u>Establishment of bearer towards the forwarded-to subscriber</u>

The bearer establishment towards the forwarded-to subscriber is performed as described for the mobile originating call, network side bearer establishment, using either forward or backward bearer establishment. The GMSC also requests the MGW to both-way through-connect the bearer.

<u>Confirmation of bearer establishment</u>

The confirmation of the bearer establishment is handled as described for the basic mobile terminating call.

Example

The figure 13.3 below shows the network model for call forwarding unconditional. The 'squared' line represents the call control signalling. The 'dotted' line represents the bearer control signalling and the bearer. The GMSC seizes one context with two bearer terminations in the MGW. The bearer termination T_A is used for the bearer towards the preceding MGW (calling subscriber) and the bearer termination T_C is used for the bearer towards the succeeding MGW (forwarded-to subscriber).
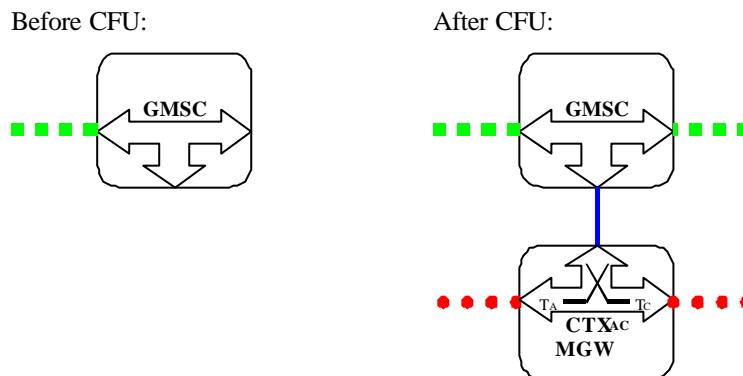
Figure 13.3: CFU (Network model)

The figure 13.4 below shows the message sequence example for the call forwarding unconditional with a notification to the calling party with an announcement. In the example the GMSC requests the MGW to play an announcement and to notify the announcement completion, after the bearer to the incoming side has been established. When the announcement has been completed the GMSC requests the establishment of the call and the bearer towards the forward-to subscriber.
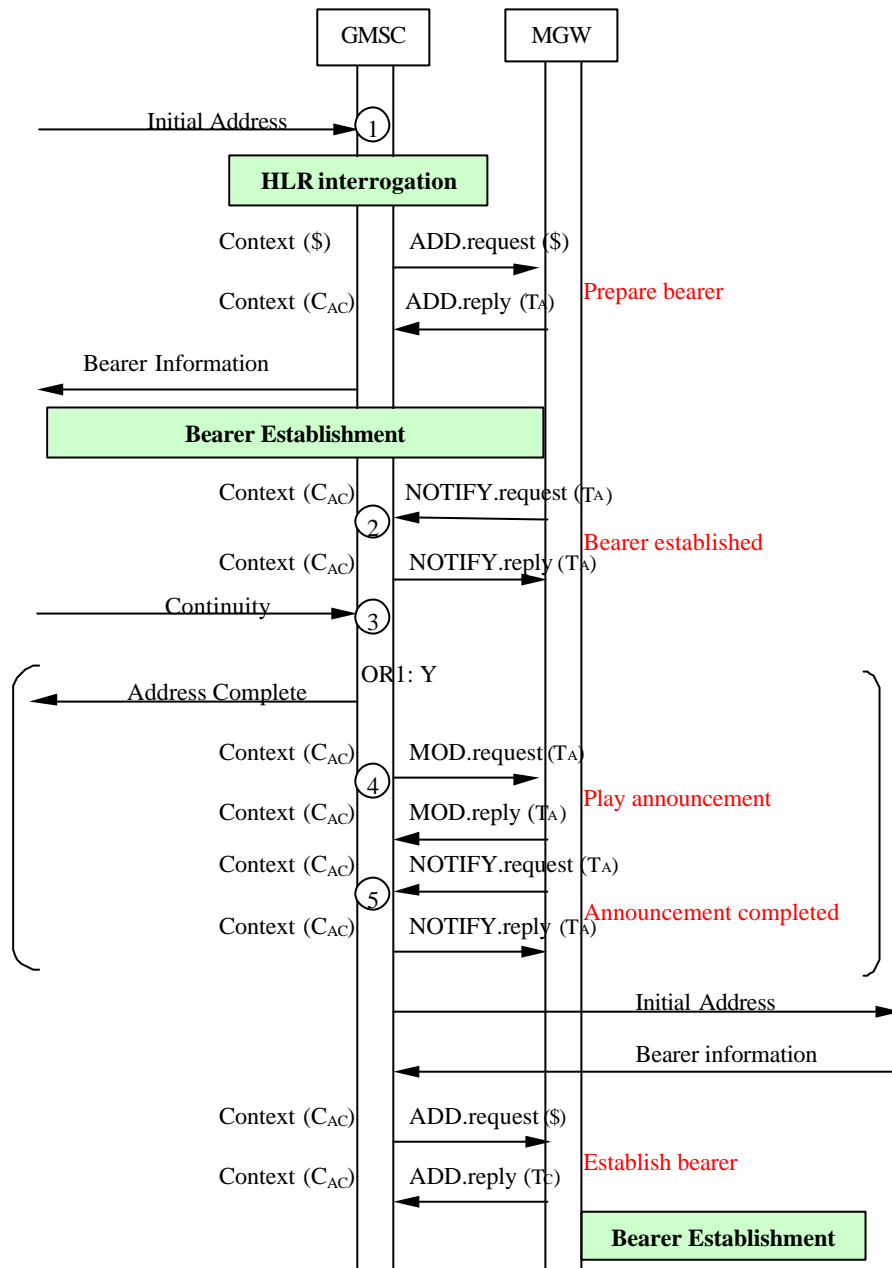
Figure 13.4: Information flow for CFU with announcement (message sequence chart)

13.4.2 Call Forwarding on mobile subscriber Busy (CFB)

The procedures specified in 3GPP TS 23.082 for the Call Forwarding on Busy supplementary service shall be followed. The following paragraphs describe the additional requirements for the bearer independent CS core network.

13.4.2.1 Network Determined User Busy (NDUB)

If the mobile is Network Determined User Busy the incoming call for the specified basic service(s) will be forwarded without being offered to the served mobile subscriber.

MGW selection

The MSC shall select a MGW for the bearer connection either before sending the Initial Address message of after receiving the Bearer Information message. If the MSC received a MGW-id from the preceding node and/or from the succeeding node, those can be used for the MGW selection.

If in-band information shall be provided to the calling subscriber the MSC selects the MGW before providing the in-band information. The MGW selection can be based on a possibly received MGW-Id from the preceding node.

> NOTE: As an implementation option, if there is no need for the MSC to manipulate the bearer, the MSC may only perform call control signalling without any associated MGW. In that case the bearer related information shall be provided transparently through the MSC.

Incoming side bearer establishment

The incoming side bearer establishment is handled in the MSC as described for the mobile terminating call using either forward or backward bearer establishment. The incoming side bearer establishment can take place either before or after the detection of NDUB condition.

Notification to the calling subscriber

If the served mobile subscriber has requested that the calling subscriber shall receive a notification about the call forwarding, a notification is sent to the calling party. If the notification is implemented using intermediate tones or announcements the MSC requests the MGW to play an announcement/tone to the calling party before establishing the call to the forwarded-to subscriber. The following two conditions shall be satisfied before providing the in-band information:

1. If the incoming Initial Address message indicated that the Continuity message will follow, a Continuity message shall be received.

2. Notification indicating successful completion of bearer set-up towards the preceding MGW shall be received from the MGW using the Bearer Established procedure.

The MSC provides the MGW with the announcement/tone identification and requests the MGW to notify the announcement completion using the Play Announcement or Send Tone procedure (bullet 1 in figure 13.6).

Initial addressing

The call towards the forwarded-to subscriber is established as for basic call. If out-of-band transcoder control is applied for a speech call, that shall be performed in accordance with 3GPP TS 23.153. After the possible generation of in-band information has been completed (bullet 2 in figure 13.6), the MSC also indicates in the Initial Address message that the Continuity message will follow from the preceding node to withhold the call completion until the establishment of the bearer is complete, if either of the following conditions is satisfied before sending the Initial Address message:

1. If the incoming Initial Address message indicated that the Continuity message will follow, no Continuity message has been received.

2. The incoming side bearer has not been established.

If the MGW is selected at an early stage the MGW-id can be provided to the succeeding node in the Initial Address message.

Establishment of bearer towards the forwarded-to subscriber

The bearer establishment towards the forwarded-to subscriber is performed as described for mobile originating call, network side bearer establishment, using either forward or backward bearer establishment. The MSC also requests the MGW to both-way through-connect the bearer.

Confirmation of bearer establishment

If the outgoing Initial Address message indicated that the Continuity message will follow, the Continuity message is sent when the two following conditions are satisfied:

1. If the outgoing Initial Address message indicated that the Continuity message will follow, a Continuity message shall be received.

2. If the MSC selected a MGW, notification indicating successful completion of the incoming side bearer set-up shall be received from the MGW using the Bearer Established procedure.

Example

The figure 13.5 below shows the network model for call forwarding busy (network determined user busy). The 'squared' line represents the call control signalling. The 'dotted' line represents the bearer control signalling and the bearer. The MSC seizes one context with two bearer terminations in the MGW. The bearer termination T_A is used for the bearer towards the preceding MGW (calling subscriber) and the bearer termination T_C is used for the bearer towards the succeeding MGW (forwarded-to subscriber).

Before CFB (NDUB):   After CFB (NDUB):
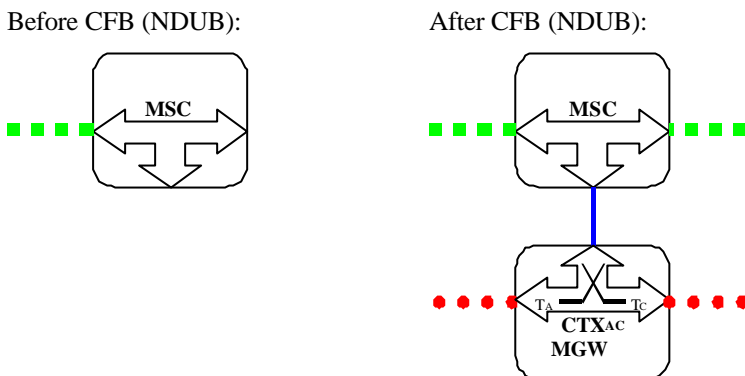
Figure 13.5: CFB; NDUB (Network model)

The figure 13.6 below shows the message sequence example for the call forwarding busy (network determined user busy) with an announcement. In the example the MSC requests the MGW to play an announcement and to notify the announcement completion, after the bearer to the incoming side has been established. When the announcement has been completed the MSC requests the establishment of the call towards the forward-to subscriber.
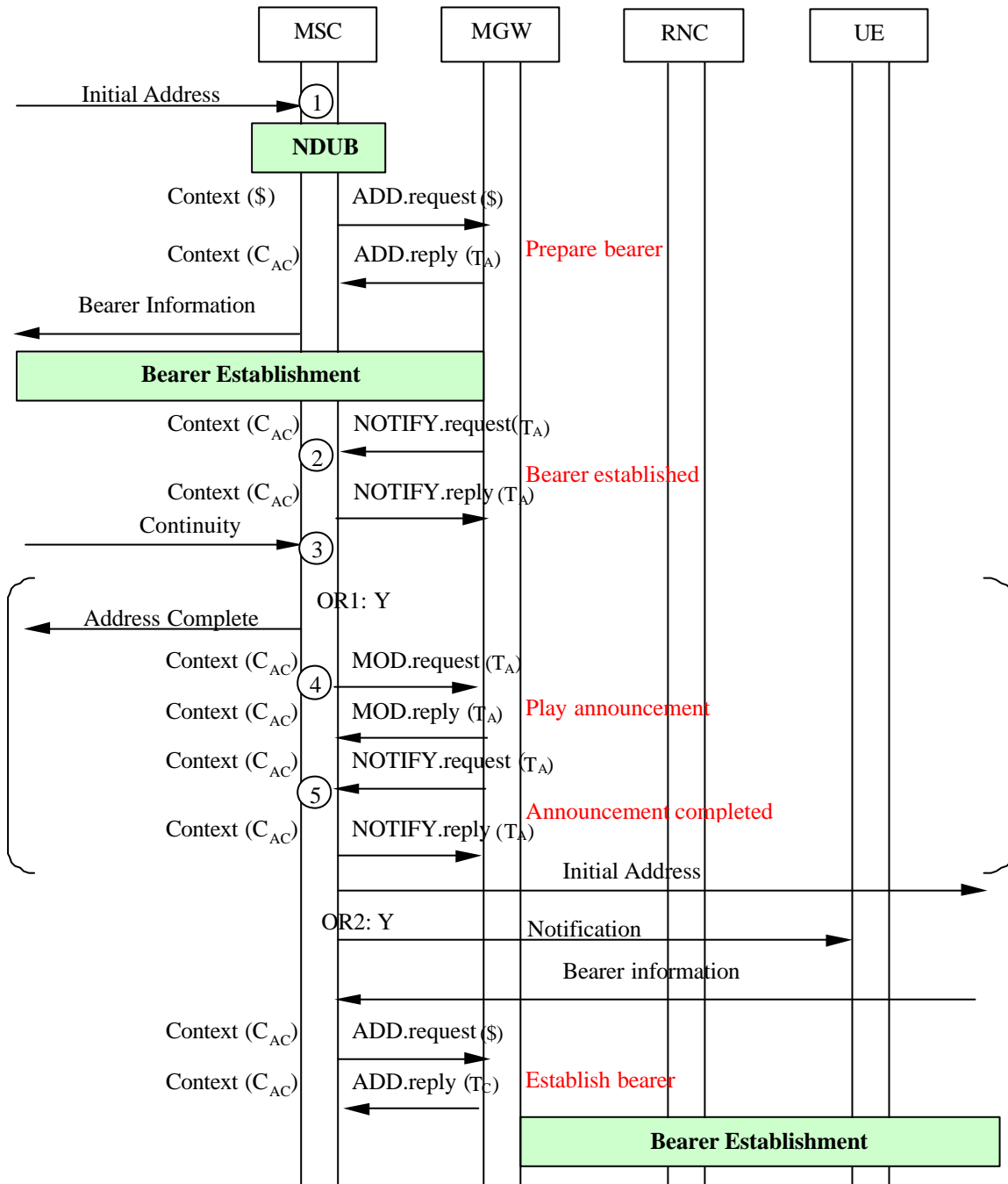
Figure 13.6: Information flow for CFB (NDUB) with announcement

13.4.2.2 User Determined User Busy (UDUB)

<u>MGW selection</u>

The MGW selected for the mobile terminating call is used, if already selected by the mobile terminating call procedures.

The MSC selects a MGW for the bearer either before sending the Initial Address message of after receiving the Bearer Information message. If the MSC received a MGW -id from the preceding node and/or from the succeeding node, those can be used for the MGW selection.

If in-band information shall be provided to the calling subscriber the MSC selects the MGW before providing the in-band information. The MGW selection can be based on a possibly received MGW-Id from the preceding node.

NOTE: As an implementation option, if there is no need for the MSC to manipulate the bearer, the MSC may only perform call control signalling without any associated MGW. In that case the bearer related information shall be provided transparently through the MSC.

Incoming side bearer establishment

For bearer establishment, the sending of bearer information is handled in the MSC as described for the basic mobile terminating call indicating either forward or backward bearer establishment.. The incoming side bearer establishment can take place either before or after the detection of UDUB condition.

IU release

If the mobile is not Network Determined User Busy (NDUB as defined in GSM 02.01) the incoming call is offered (as a normal or waiting call) to the served mobile subscriber. If the mobile indicating 'User Busy' subsequently releases the call, the call towards the served mobile subscriber is released as described in the subclause for call clearing (the MSC orders the MGW to remove the bearer termination towards the served mobile subscriber only in the case that the bearer had already been established towards the RNC). (bullet 1 in figure 13.8)

Notification to the Calling Subscriber

If the served mobile subscriber has requested that the calling subscriber shall receive a notification about the call forwarding, a notification is sent to the calling party. If the notification is implemented using intermediate tones or announcements the MSC requests the MGW to play an announcement/tone to the calling party before establishing the call to the forwarded-to subscriber. The following two conditions needs to be satisfied before providing the in-band information:

1. If the incoming Initial Address message indicated that the Continuity message will follow, a Continuity message shall be received.

2. Notification indicating successful completion of bearer set-up towards the preceding MGW shall be received from the MGW using the Bearer Established procedure.

The MSC provides the MGW with the announcement/tone identification and requests the MGW to notify the announcement completion using the Play Announcement or Send Tone procedure (bullet 2 in figure 13.8).

Initial addressing

The call towards the forwarded-to subscriber is established as basic call. If out-of-band transcoder control is applied for a speech call, that shall be performed in accordance with 3GPP TS 23.153. After the possible generation of in-band information has been completed (bullet 3 in figure 13.8), the MSC also indicates in the Initial Address message that the Continuity message will follow from the preceding node to withhold the call completion until the establishment of the bearer is complete, if either of the following conditions is satisfied before sending the Initial Address message:

1. If the incoming Initial Address message indicated that the Continuity message will follow, no Continuity message has been received.

2. The incoming side bearer has not been established.

If the MGW is selected at an early stage the MGW-id can be provided to the succeeding node in the Initial Address message.

Establishment of bearer towards the forwarded-to subscriber

The bearer establishment towards the forwarded-to subscriber is performed as described for the mobile originating call, network side bearer establishment, using either forward or backward bearer establishment. The MSC also request the MGW to both-way through-connect the bearer.

Confirmation of bearer establishment

If the outgoing Initial Address message indicated that the Continuity message will follow, the Continuity message is sent when the two following conditions are satisfied:

1. If the outgoing Initial Address message indicated that the Continuity message will follow, a Continuity message shall be received.

2. If the MSC selected a MGW, notification indicating successful completion of the incoming side bearer set-up shall be received from the MGW using the Bearer Established procedure.

Example

The figure 13.7 below shows the network model for call forwarding busy (user determined user busy). The 'squared' line represents the call control signalling. The 'dotted' line represents the bearer control signalling and the bearer. The MSC replaces the bearer termination for the served mobile subscriber (T_B) with the bearer termination for the forwarded-to subscriber (T_C) in an existing context in the MGW. The bearer termination T_A is used for the bearer towards the preceding MGW (calling subscriber).

Before CFB (UDUB):
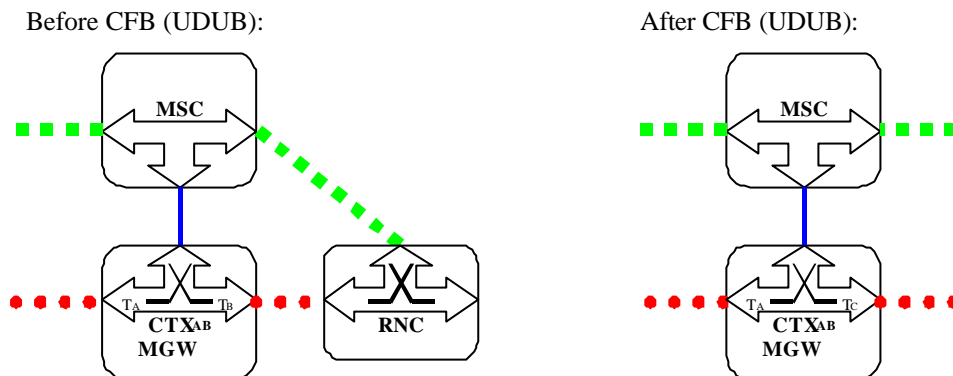
After CFB (UDUB):

Figure 13.7: CFB; UDUB (Network model)

The figure 13.8 below shows the message sequence example for the call forwarding busy (user determined user busy) with a notification to the calling party with an announcement. In the example, after the call and the bearer towards the access have been released the MSC requests the MGW to remove the bearer termination for the served mobile subscriber, and requests the MGW to play an announcement and to notify the announcement completion. After the announcement has been completed the MSC requests the establishment of the call towards the forward-to subscriber.
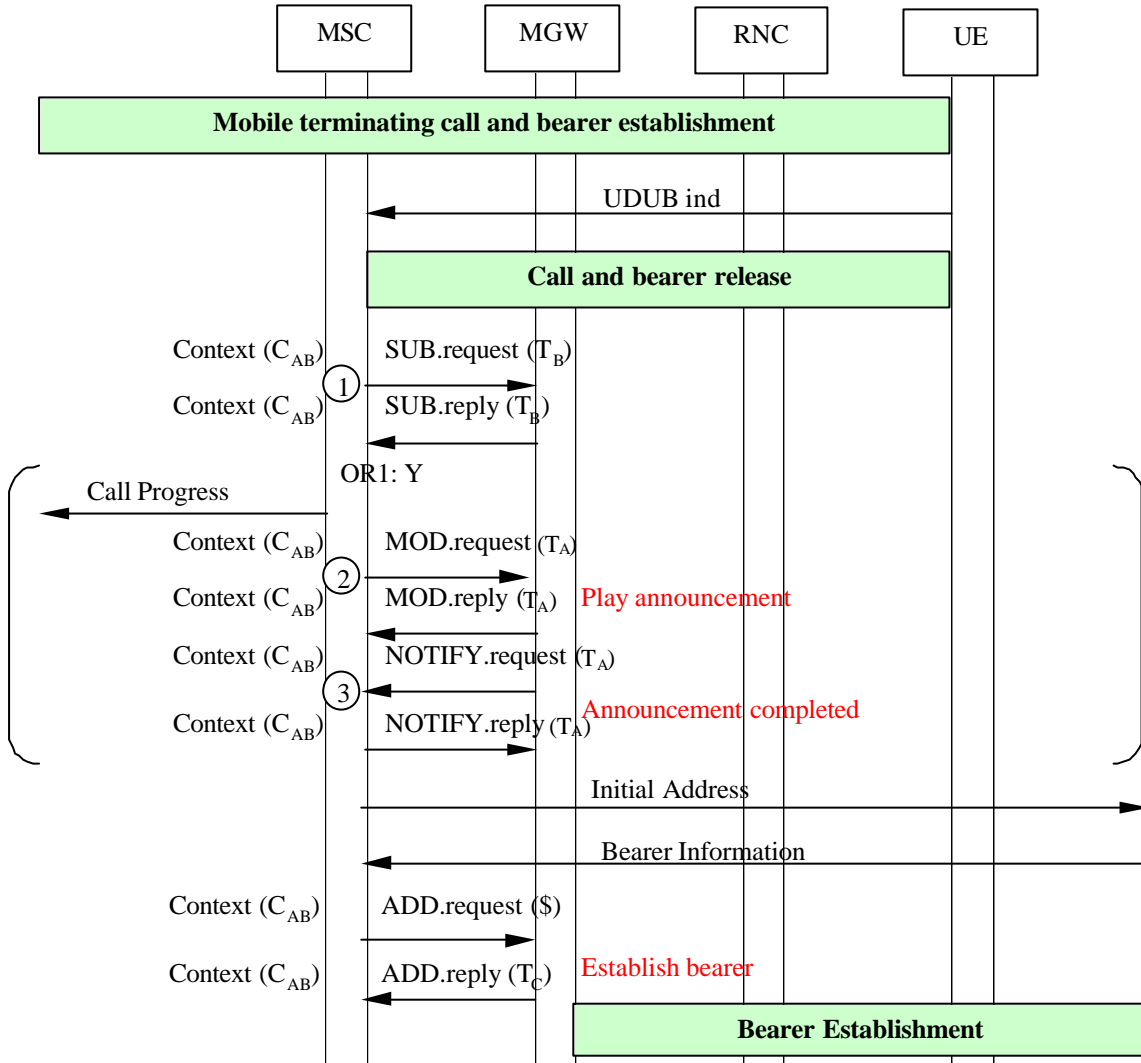
NOTE: OR1: Notification to calling subscriber required (Y:yes N:no)
UDUB: User Determined User Busy

Figure 13.8: Information flow for CFB (UDUB)

13.4.3 Call Forwarding on No Reply (CFNRy)

The procedures specified in 3GPP TS 23.082 for the Call Forwarding on No Reply supplementary service shall be followed. The following paragraphs describe the additional requirements for the bearer independent CS core network.

MGW selection and incoming side bearer establishment

The MGW selected for the mobile terminating call is used. The incoming side bearer has already been established by the mobile terminating call procedures.

IU release

If the call is not answered within the period defined by the no reply condition timer the call towards the served mobile subscriber will be released as described in the subclause for call clearing.

Notification to the Calling Subscriber

If the served mobile subscriber has requested that the calling subscriber shall receive a notification about the call forwarding, a notification is sent to the calling party. If the notification is implemented using intermediate tones or announcements the MSC requests the MGW to play an announcement/tone to the calling party before establishing the call to the forwarded-to subscriber. The MSC provides the MGW with the announcement/tone identification and requests the MGW to notify the announcement completion using the Play Announcement or Send Tone procedure (bullet 1 in figure 13.10).

Initial addressing

The call towards the forwarded-to subscriber is established as basic call. If out-of-band transcoder control is applied for a speech call, that shall be performed in accordance with 3GPP TS 23.153. After the possible generation of in-band information has been completed (bullet 2 in figure 13.10) the MSC indicates in the Initial Address message that no Continuity message will follow from the preceding node because the incoming side bearer has already been established.

The MGW-id can be provided to the succeeding node in the Initial Address message.

Establishment of bearer towards the forwarded-to subscriber

The bearer establishment towards the forwarded-to subscriber is performed as described for the mobile originating call, network side bearer establishment, using either forward or backward bearer establishment. The MSC also requests the MGW to both-way through-connect the bearer.

Example

The figure 13.9 below shows the network model for call forwarding no reply. The 'squared' line represents the call control signalling. The 'dotted' line represents the bearer control signalling and the bearer. The MSC replaces the bearer termination for the served mobile subscriber (T_B) with the bearer termination for the forwarded-to subscriber (T_C) in an existing context in the MGW. The bearer termination T_A is used for the bearer towards the preceding MGW (calling subscriber).

Figure 13.9: CFNRy (Network model)

The figure 13.10 below shows the message sequence example for the call forwarding on no reply with a possible announcement. In the example, after the call and the bearer towards the access have been released the MSC requests the MGW to remove the bearer termination for the served mobile subscriber, and optionally requests the MGW to play an announcement and to notify the announcement completion. When the possible announcement has been completed the MSC requests the establishment of the call towards the forward-to subscriber.
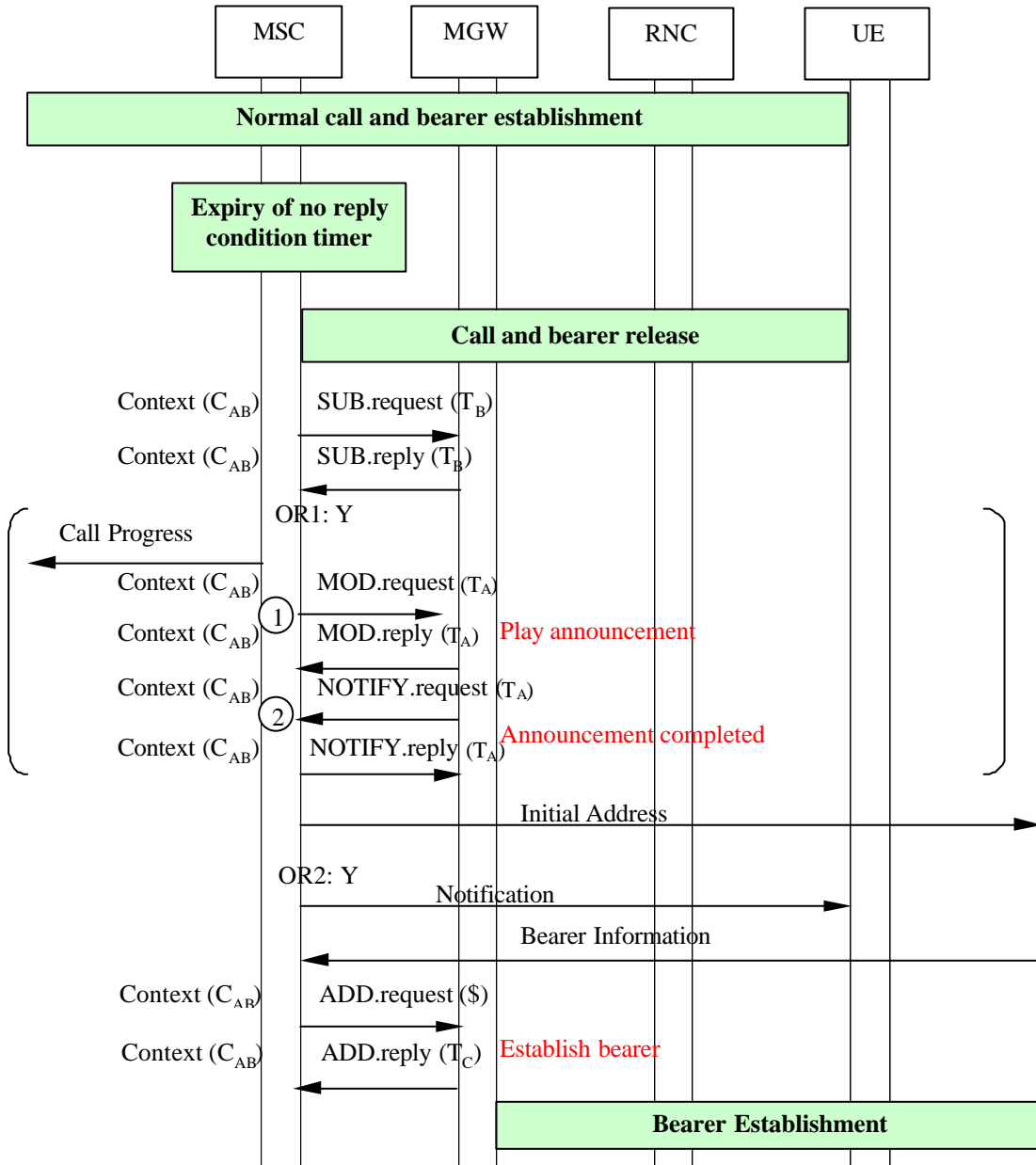
NOTE: OR1: Notification to calling subscriber required (Y:yes N:no)

Figure 13.10: Information flow for CFNRy (message sequence chart)

13.4.4 Call Forwarding on mobile subscriber Not Reachable (CFNRc)

The procedures specified in 3GPP TS 23.082 for the Call Forwarding on Not Reachable supplementary service shall be followed. The following paragraphs describe the additional requirements for the bearer independent CS core network.

13.4.4.1 Rerouting by HLR

The same handling as for Call Forwarding Unconditional applies.

13.4.4.2 Rerouting by VLR

If the mobile is not reachable the incoming call for the specified basic service(s) will be forwarded without being offered to the served mobile subscriber.

<u>MGW selection</u>

If in-band information shall be provided to the calling subscriber the MSC selects the MGW before providing the in-band information. The MGW selection can be based on a possibly received MGW-Id from the preceding node.

> NOTE: As an implementation option, if no in-band information shall be provided to the calling subscriber the MSC may either perform call control without any associated MGW, or reserve resources from a MGW and request bearer establishment through that MGW. In the latter case the MSC selects a MGW for the bearer either before sending the Initial Address message or after receiving the Bearer Information message. If the MSC received a MGW-Id from the preceding node and/or from the succeeding node, those can be used for the MGW selection.

<u>Incoming side bearer establishment</u>

The incoming side bearer establishment is handled in the MSC as described for the mobile terminating call, using either forward or backward bearer establishment. The incoming side bearer establishment can take place either before or after the detection of not reachable condition.

<u>Notification to the calling subscriber</u>

If the served mobile subscriber has requested that the calling subscriber shall receive a notification about the call forwarding, a notification is sent to the calling party. If the notification is implemented using intermediate tones or announcements the MSC requests the MGW to play an announcement/tone to the calling party before establishing the call towards the forwarded-to party. The following two conditions shall be satisfied before providing the in-band information:

1. If the incoming Initial Address message indicated that the Continuity message will follow, a Continuity message shall be received.

2. Notification indicating successful completion of the incoming side bearer set-up shall be received from the MGW using the Bearer Established procedure.

The MSC provides the MGW with the announcement/tone identification and requests the MGW to notify the announcement completion using the Play Announcement or Send Tone procedure (bullet 1 in figure 13.12).

<u>Initial addressing</u>

The call towards the forwarded-to subscriber is established as basic call. If out-of-band transcoder control is applied for a speech call, that shall be performed in accordance with 3GPP TS 23.153. After the possible generation of in-band information has been completed (bullet 2 in figure 13.12), the MSC also indicates in the Initial Address message that the Continuity message will follow from the preceding node to withhold the call completion until the establishment of the bearer is complete, if either of the following conditions is satisfied before sending the Initial Address message:

1. If the incoming Initial Address message indicated that the Continuity message will follow, no Continuity message has been received.

2. The incoming side bearer has not been established.

If the MGW is selected at an early stage the MGW -id can be provided to the succeeding node in the Initial Address message.

<u>Establishment of bearer towards the forwarded-to subscriber</u>

The bearer establishment towards the forwarded-to subscriber is performed as described for mobile originating call, network side bearer establishment, using either forward or backward bearer establishment. The MSC also requests the MGW to both-way through-connect the bearer.

<u>Confirmation of bearer establishment</u>

If the outgoing Initial Address message indicated that a Continuity message will follow, the Continuity message is sent when the two following conditions are satisfied:

1. If the incoming Initial Address message indicated that the Continuity message will follow, a Continuity message shall be received.

2. If the MSC selected a MGW, notification indicating successful completion of the incoming side bearer set-up shall be received from the MGW using the Bearer Established procedure.

Example

The figure 13.11 below shows the network model for call forwarding on not reachable. The 'squared' line represents the call control signalling. The 'dotted' line represents the bearer control signalling and the bearer. The MSC seizes one context with two bearer terminations in the MGW. The bearer termination T_A is used for the bearer towards the preceding MGW (calling subscriber) and the bearer termination T_C is used for the bearer towards the succeeding MGW (forwarded-to subscriber).
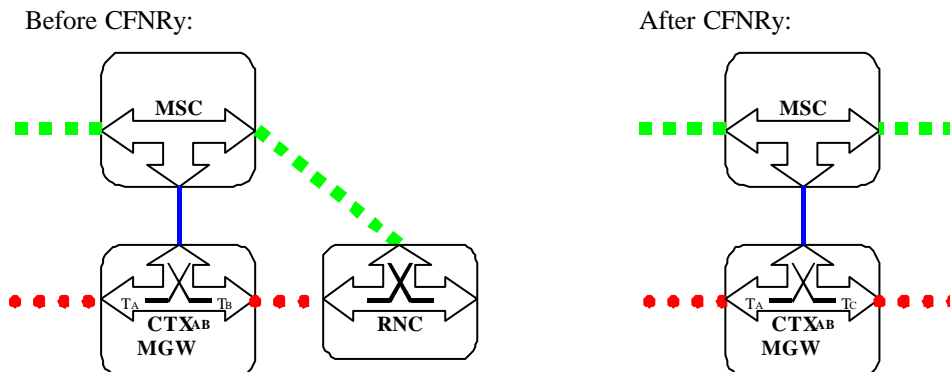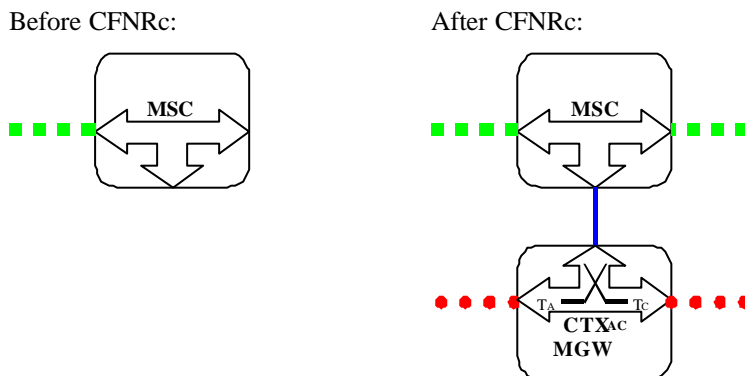

Figure 13.11: CFNRc; Rerouting by VLR (Network model)

The figure 13.12 below shows the message sequence example for the call forwarding on not reachable with an announcement. In the example the MSC requests the MGW to play an announcement and to notify the announcement completion, after the bearer to the incoming side has been established. When the announcement has been completed the MSC requests the establishment of the call towards the forward-to subscriber.
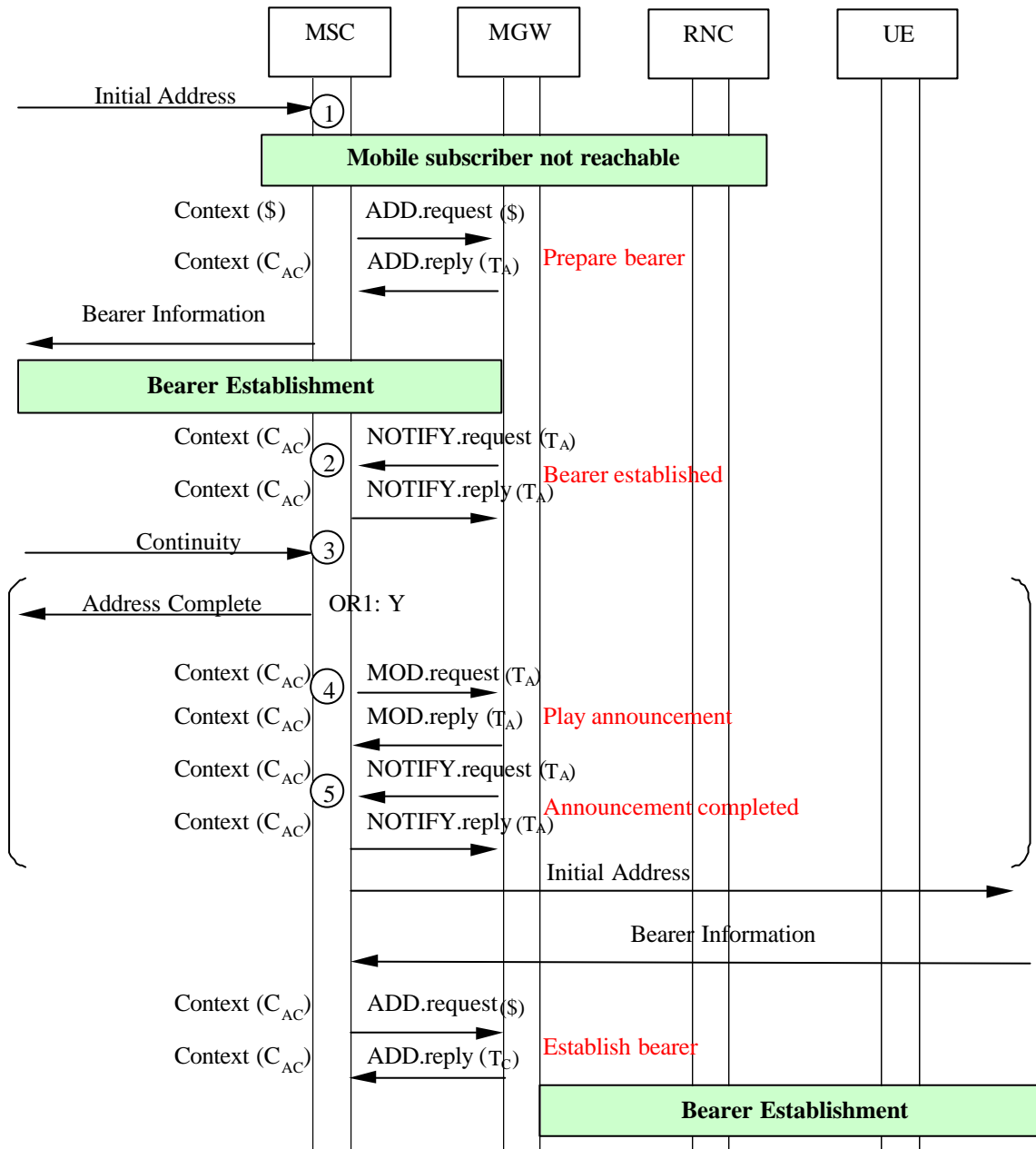
Figure 13.12: Information flow for CFNRc (Rerouting by VLR) with announcement (message (message sequence chart)

13.5 Call Wait (CW)

The procedures specified in 3GPP TS 23.083 for the Call Wait supplementary service shall be followed. The following paragraphs describe the additional requirements for the bearer independent CS core network.

Call confirmation to the waiting call

The MSC shall, on reception of the call confirmation, select the MGW that will be used for the waiting call. If out-of-band transcoder control is applied for the waiting speech call, that shall be performed in accordance with 3GPP TS 23.153.

Existing call on hold

The paragraph 'Hold request' in chapter 13.6 applies.

Existing call released

If the active call is disconnected while another call is waiting, the bearer termination towards the waiting party (C) as well as to the called party (A) is not removed.

Acceptance of waiting call

If the mobile subscriber decides to accept the waiting call, it handles (according to 3GPP TS 23.082) the existing call as described above (either put it on hold or release it). The MSC, on receiving the connect indication from subscriber A, shall move the AN side termination towards the previously created context of the waiting call and modify the waiting call's termination to bothway through-connected.

If out-of-band transcoder control is applied for the waiting speech call, that shall be performed in accordance with 3GPP TS 23.153.

Waiting call released by calling subscriber (subscriber C)

The respective resources already allocated at the selected MGW for the waiting call shall be released.

Example

The figure 13.13 below shows the network model for a waiting call at the serving MSC/MGW. The 'thick, squared' line represents the call control signalling for the existing call and, on the Iu interface, the already existing control plane toward the serving RNC. The 'thin, squared' line represents the call control signalling for the waiting call. The 'thick, dotted' line represents the bearer control signalling and the bearer for the existing call, whereas the 'thin, dotted' line represents the ones for the waiting call.

If the CW condition applies, the MSC seizes a new context with one bearer termination, T_C, in the MGW. T_A and T_B are the terminations of the already existing call.
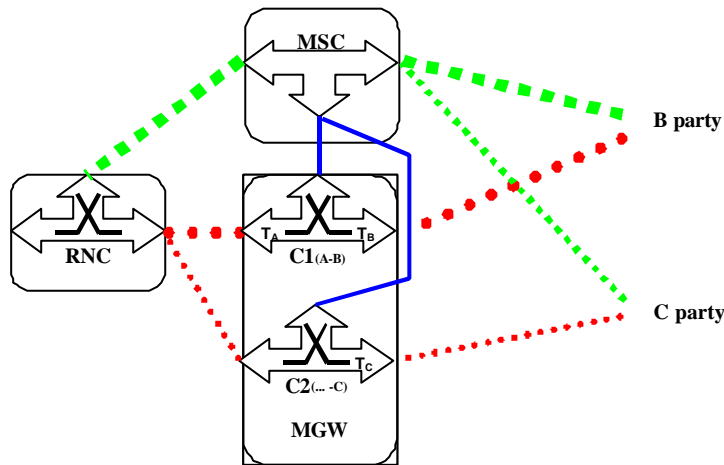
Figure 13.13. Call Wait (network model)

13.5.1 Call Confirmation of the waiting call

The figure 13.14 below shows the sequence chart for the actions necessary within the bearer independent CS CN during call confirmation of the waiting call. Call and bearer establishment shall be as described for the mobile terminating call. After having received the Alerting indication from the called (A) the MSC applies the ringing tone to the waiting termination (T_C).
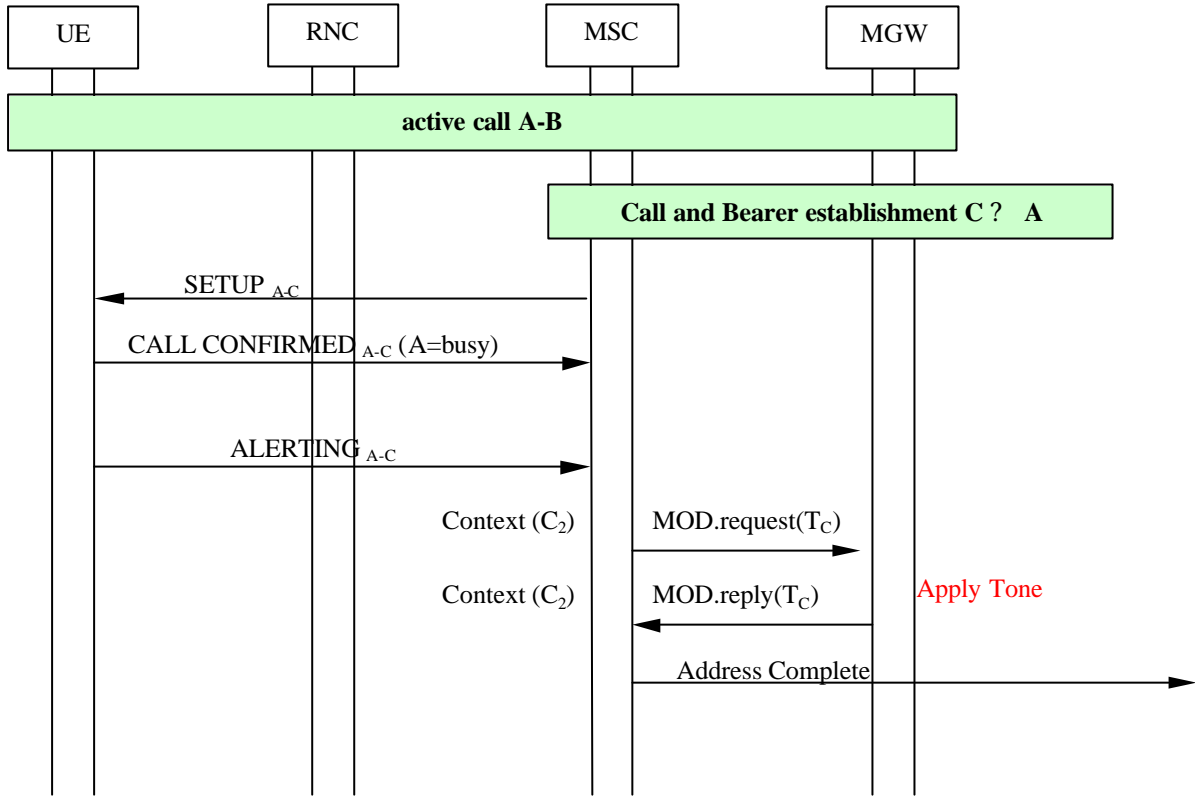
Figure 13.14. Call Confirmation of the Waiting Call.

13.5.2 Acceptance of the Waiting Call

The figure 13.15 below shows the sequence chart for the actions necessary within the bearer independent CS CN for the acceptance of a waiting call. After receiving the Connect indication from UE (subscriber A) (bullet 1), the MSC shall request the MGW to disconnect subscriber C from the tone (bullet 2) and move T_A to the context of the waiting call (bullet 3). Afterwards the flow direction of T_C will be changed to bothway through-connected (bullet 4).
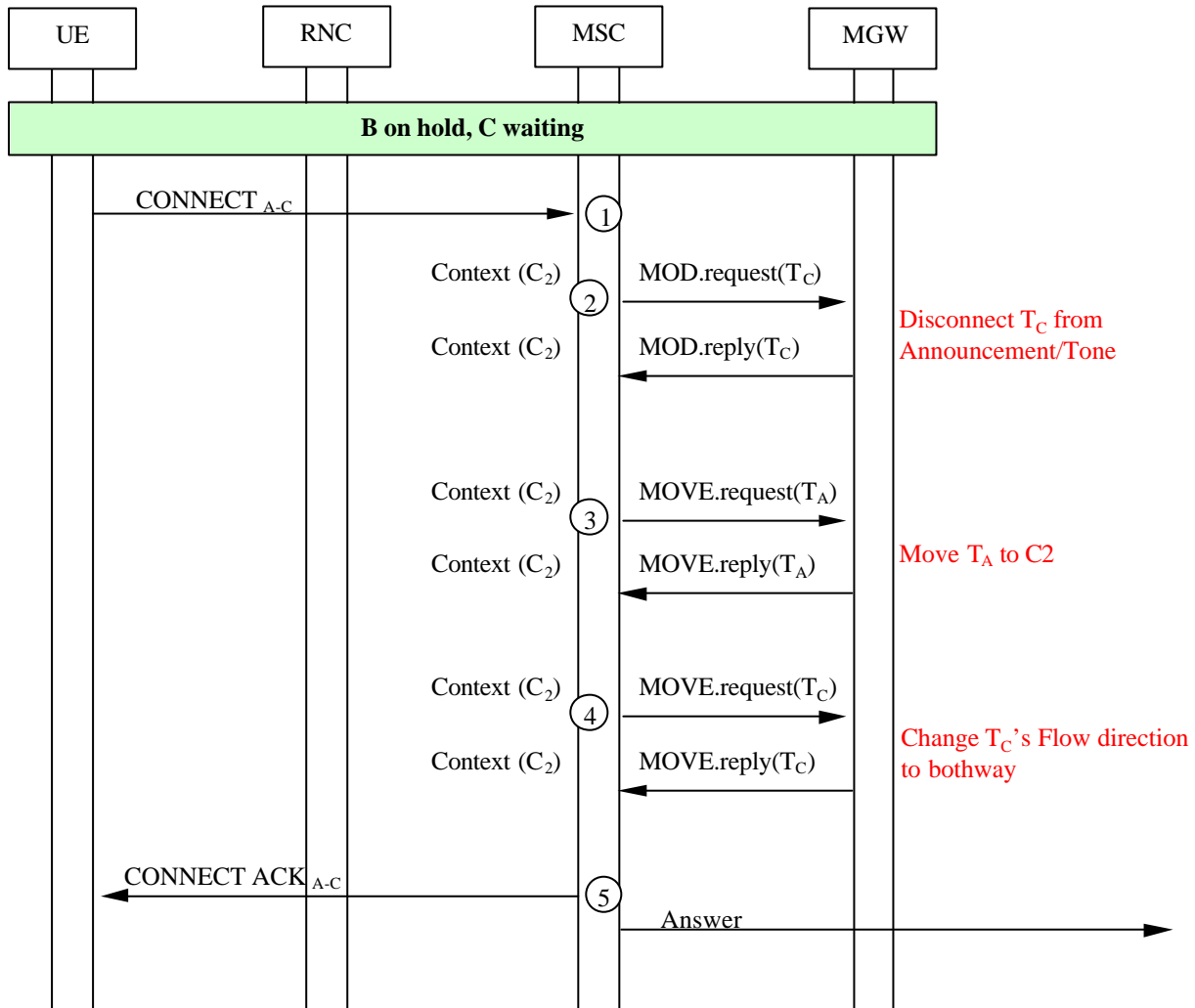
Figure 13.15. Acceptance of the Waiting Call.

13.6 Call Hold (CH)

The procedures specified in 3GPP TS 23.083 for the Call Hold supplementary service shall be followed. The following paragraphs describe the additional requirements for the bearer independent CS core network.

Hold request

When the UE makes a request for the hold function the MSC requests the MGW to interrupt the communication on the bearer by changing the through-connection of the bearer termination towards the served mobile subscriber to 'not through-connected'. Announcements may be applied to the held party.

Retrieval request

When the UE makes a request to retrieve a held call the MSC requests the MGW to re-establish communication to the held party by changing the through-connection of the bearer termination towards the served mobile subscriber to be both-way through-connected.

Setting up another call

The call towards the C party is established as described for the mobile originating call. A new MGW may be selected in the course of setting up the new call. If out-of-band transcoder control is applied for a speech call, that shall be performed in accordance with 3GPP TS 23.153. If a Radio Access Bearer modification is needed due to a change in a telecommunications service, the MSC will request the MGW to create a new access side bearer termination before initiating the Radio Access Bearer modification.

Alternate from one call to the other

When the hold request for the active call is immediately followed by a retrieve request for the held call the MSC requests the MGW to connect the bearer termination of the served mobile subscriber to the bearer termination of the held party. The MSC also requests the MGW to both-way through-connect the bearer for the previously held call.

Disconnect

If the active call is disconnected while another call is on hold, the bearer termination towards the served mobile subscriber is not removed but the call towards the active party is disconnected as described in the subclause for call clearing.

If the held call is disconnected while the served mobile subscriber is connected to an active call the bearer termination towards the served mobile subscriber is not removed but the call towards the held party is disconnected as described in the subclause for call clearing.

Example

The figure 13.16 below shows the network model for the call hold with an establishment of a new call. The 'squared' line represents the call control signalling. The 'dotted' line represents the bearer control signalling and the bearer. The MSC seizes a new context with two bearer terminations in the MGW that is used for the held call. The bearer termination T_{A2} is used for the bearer towards the RNC (served mobile subscriber) and the bearer termination T_C is used for the bearer towards the succeeding MGW (C-party).

B-party on hold:

New call to C subscriber:
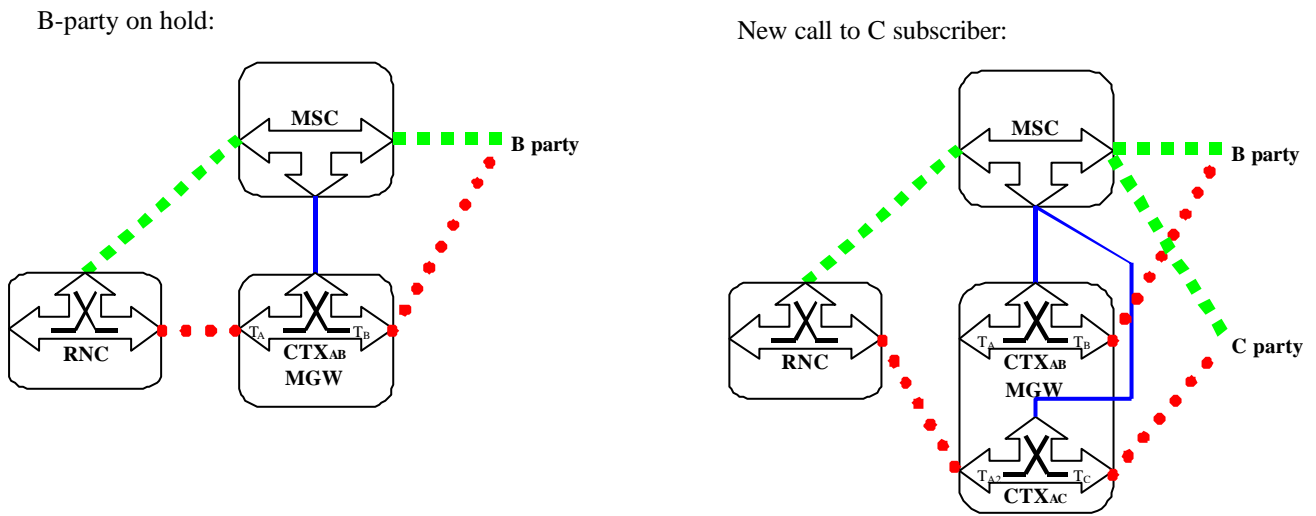
Figure 13.16: Call hold and establishment of a new call (Network model)

The figure 13.17 below shows the message sequence example for the call hold procedure. In the example the MSC changes the through-connection of the bearer to 'not through connected' when hold request is received from the served mobile subscriber (bullet 2). Subsequently an announcement may be applied to termination T_A.
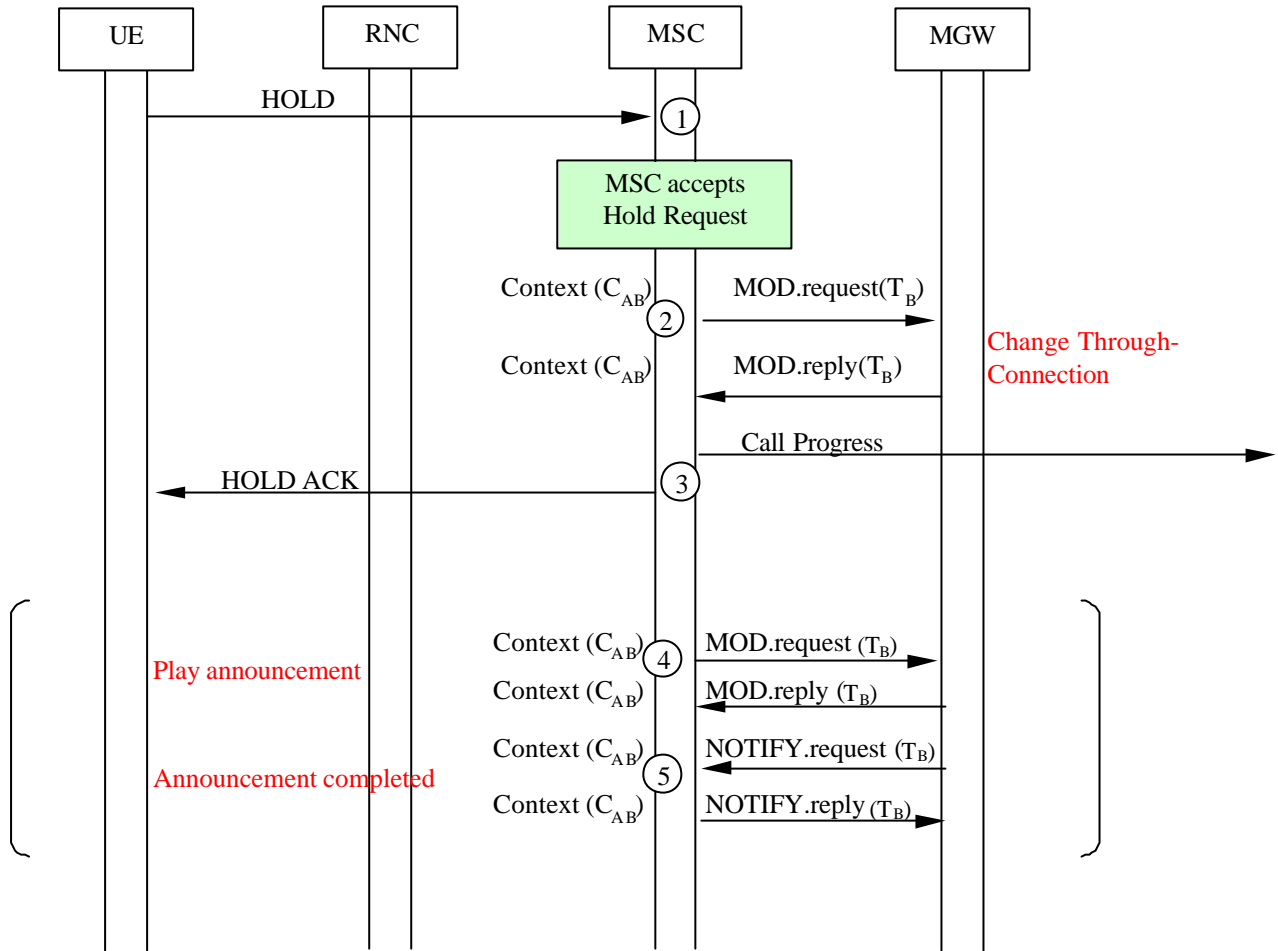
Figure 13.17: Hold request (message sequence chart)

The figure 13.18 below shows the message sequence example for the retrieval procedure. In the example the MSC changes the through-connection of the bearer to 'bothway through connected' (bullet 3) after the held party has been disconnected from an optionally applied announcement (bullet 2)
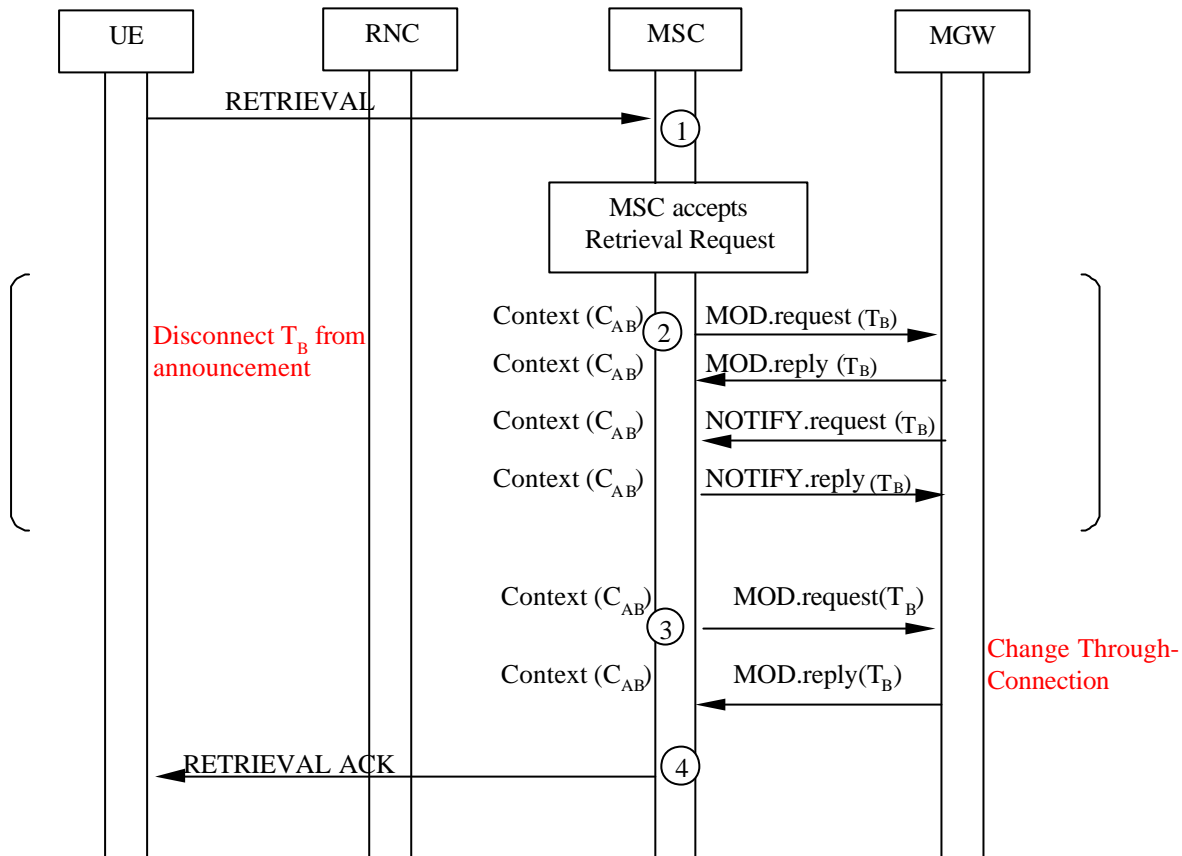
Figure 13.18. Retrieval request (message sequence chart)

13.7 Multiparty (MPTY)

The procedures specified in 3GPP TS 23.084 for the Multi Party supplementary service shall be followed. The following paragraphs describe the additional requirements for the bearer independent CS core network. If out-of-band transcoder control is applied for the call, that shall be performed in accordance with 3GPP TS 23.153.

Beginning the Multi Party call

When the served mobile subscriber invokes a Multi Party service the MSC selects a Media Gateway that provides the Multi Party bridge capabilities. The selected MGW may be different from the MGW that is used for the active call. The MSC requests the MGW(s) to connect the bearer terminations of the participants to the MGW having the Multi Party bridge, if necessary. The bearer terminations are connected together using the Join Bearer Terminations procedure.

Managing of active Multi Party call

When the served mobile subscriber puts the Multi Party call on hold the MSC requests the MGW to interrupt the connection between the served mobile subscriber and the Multi Party bridge.

When the served mobile subscriber retrieves a held Multi Party call the MSC requests the MGW to re-establish the connection between the served mobile subscriber and the Multi Party bridge.

When the served mobile subscriber requests private communication with one of the remote parties (e.g. B-party), then the MSC will request the MGW to interrupt the connection between the served mobile subscriber and the Multi Party bridge, as well as the connection between the remote B party and the Multi Party bridge. The MSC requests the MGW to connect the bearer termination of the served mobile subscriber to the bearer termination of the remote party (or vice versa).

Disconnect

If a remote party is disconnected while other parties still remain the call towards the remote party is disconnected as described in the subclause for call clearing.

Example

The figure 13.19 below shows the network model for multi party call. The 'squared' line represents the call control signalling. The 'dotted' line represents the bearer control signalling and the bearer. In the following example it is assumed that each party participating in the Multi Party conference is handled in an own context representing the call leg between the Multi Party bridge and the Multi Party participant. The Multi Party bridge itself is handled in a context of its own. This separation to several contexts is done in order to simplify interactions with other functionality, such as handover, even though other implementation options are not excluded.
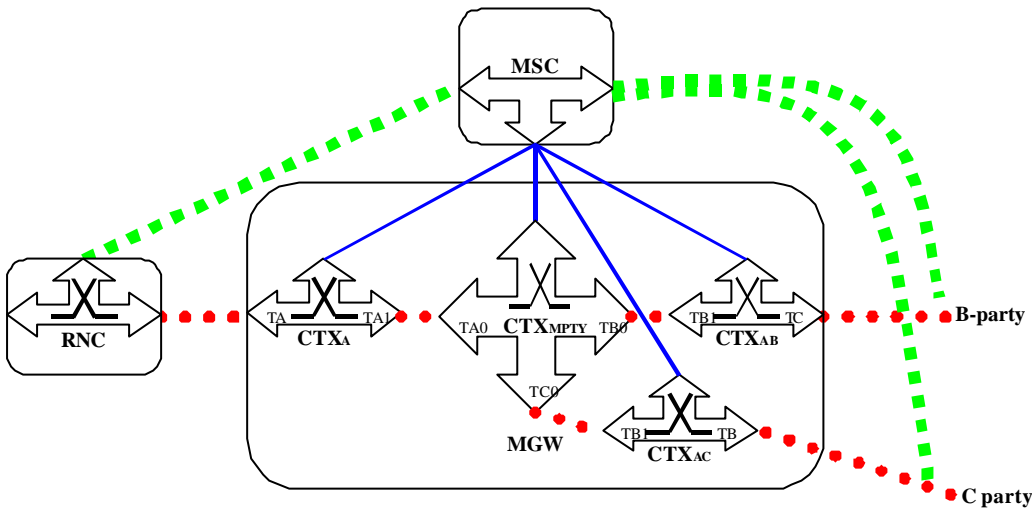
Figure 13.19: Multi Party call (Network model)

For the purposes of the information flow diagrams it is assumed that there are only two remote parties. Party A is the subscriber controlling the Multi Party service (served mobile subscriber). Party B is the held party and party C is the active party.

It is assumed that the Multi Party bridge is located in the MGW that has been selected for the served mobile subscriber.

The figure 13.20 below shows the message sequence example for the beginning of multi party call. When the served mobile subscriber invokes a Multi Party service the MSC requests the MGW to create an own context for the Multi Party bridge. The MSC seizes a bearer termination for each party in that context. In addition, each call leg is represented by an own context. Therefore the parties in the active call will be split in separate contexts. The MSC requests the MGW to create a new context and to move the bearer termination for the served mobile subscriber from the active call context to the new context. To connect the parties to the Multi Party bridge the MSC requests the MGW to establish internal connections between the bearer terminations in the Multi Party bridge context and the call leg contexts. The held party is informed about the retrieval of the held call, and the both remote parties are informed about the multi party call establishment.
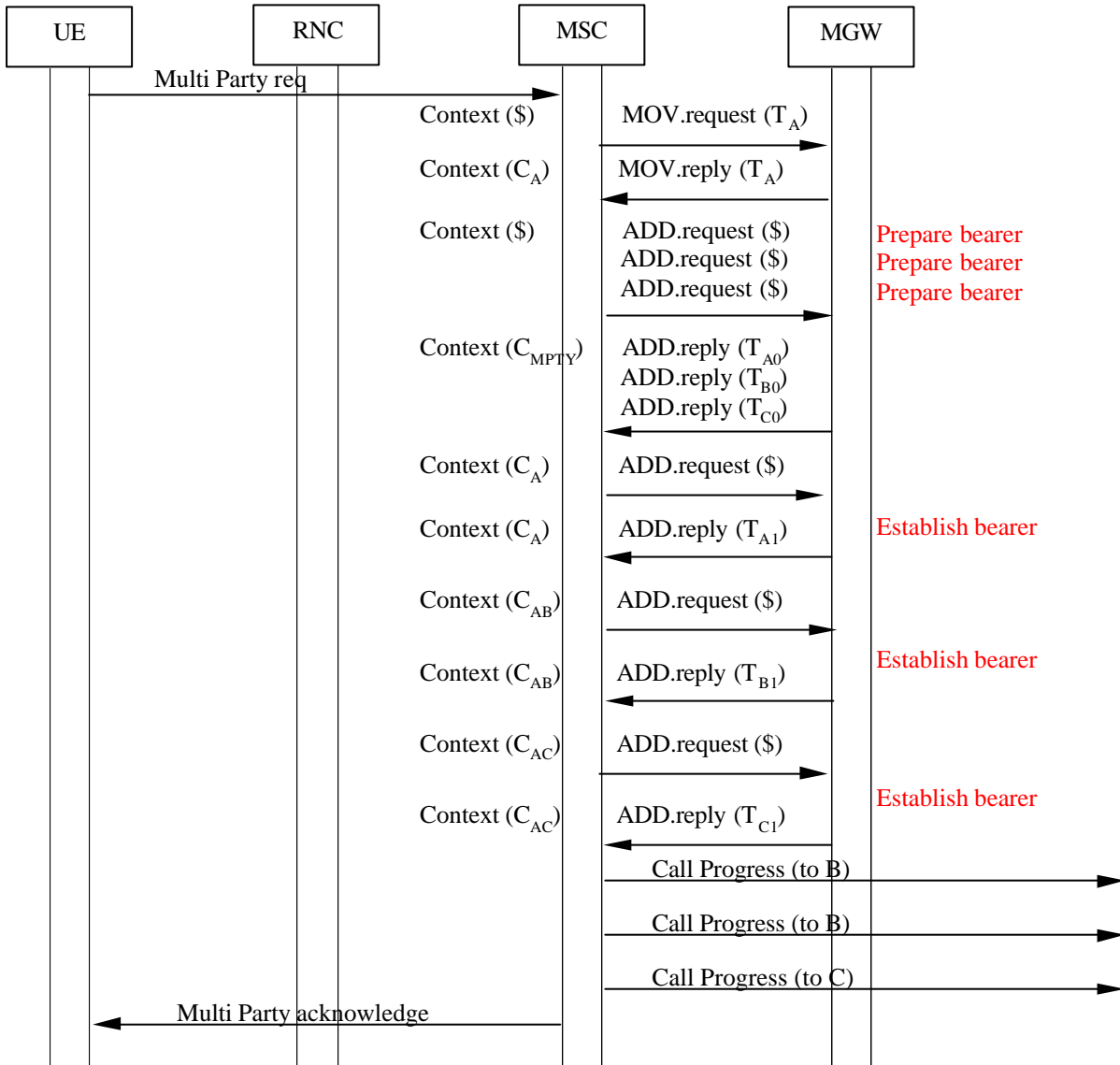
Figure 13.20: Information flow for multi party call (message sequence chart)

13.8 Closed User Group (CUG)

No impact.

13.9 Advice of Charge (AoC)

No impact.

13.10 User-to-User Signalling (UUS)

No impact.

13.11 Call Barring Services

13.11.1 Barring of outgoing calls

No impact.

13.11.2 Barring of incoming calls

No impact.

13.12 Explicit Call Transfer (ECT)

The procedures specified in 3GPP TS 23.091 for the Explicit Call Transfer supplementary service shall be followed. The following paragraphs describe the additional requirements for the bearer independent CS core network.

Party A is the subscriber controlling the Explicit Call Transfer Call (served mobile subscriber). Party B is the first remote party called (held party). Party C is the second remote party called.

Connection of remote parties

If the result of the ECT checks is successful the MSC will order the MGW to connect the bearer termination of the C-party to the bearer termination of the B-party (bullet 1 in figure 13.22 or in figure 13.23). As a result of this action the held party will be retrieved.

If the call towards the C-party has not been answered, the MSC requests the MGW to both-way through-connect the bearer termination towards the C-party.

IU release

The served party is disconnected after a successful transfer request. The call towards the served mobile subscriber shall be released as described in the subclause for call clearing.

Example

The figure 13.21 below shows the network model for call explicit call transfer. The 'squared' line represents the call control signalling. The 'dotted' line represents the bearer control signalling and the bearer. The MSC moves the bearer terminations of the remote parties in the same context and removes the bearer termination for the served mobile subscriber. The bearer termination T_A is used for the bearer towards the served mobile subscriber, the bearer termination T_B is used for the bearer towards the B-party and the bearer termination T_C is used for the bearer towards the C-party.

Before ECT request: After ECT:
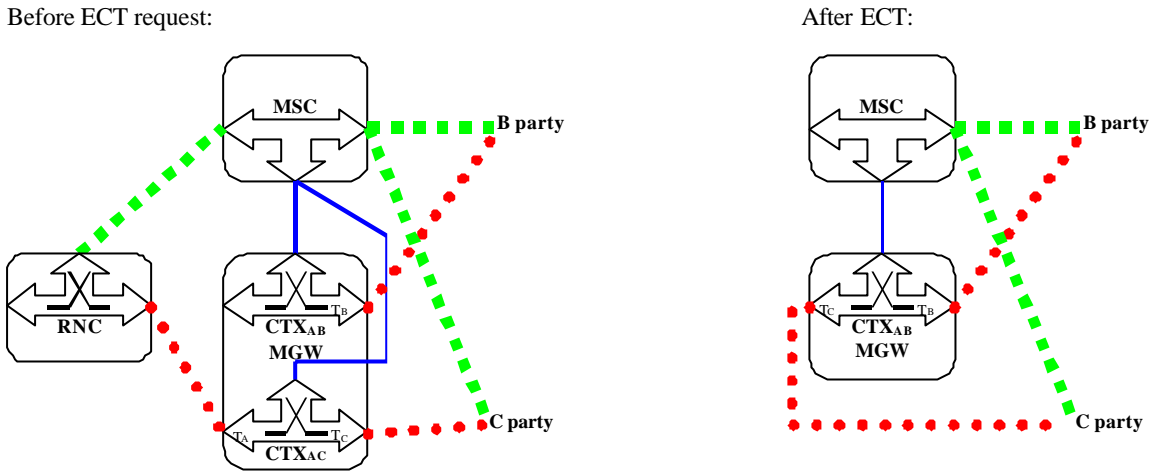
Figure 13.21: ECT (Network model)

The figure 13.22 below shows the message sequence example for the explicit call transfer when both calls have been answered. In the example the MSC requests the MGW to move the bearer termination for the C-party in the active call to the same context with the bearer termination for the B-party. The held party is informed about the retrieval of the held call. Both the remote parties are informed about the call transfer. After the move the MSC releases the call and the bearer connection towards the served mobile subscriber and requests the MGW to remove the bearer termination for the served mobile subscriber.
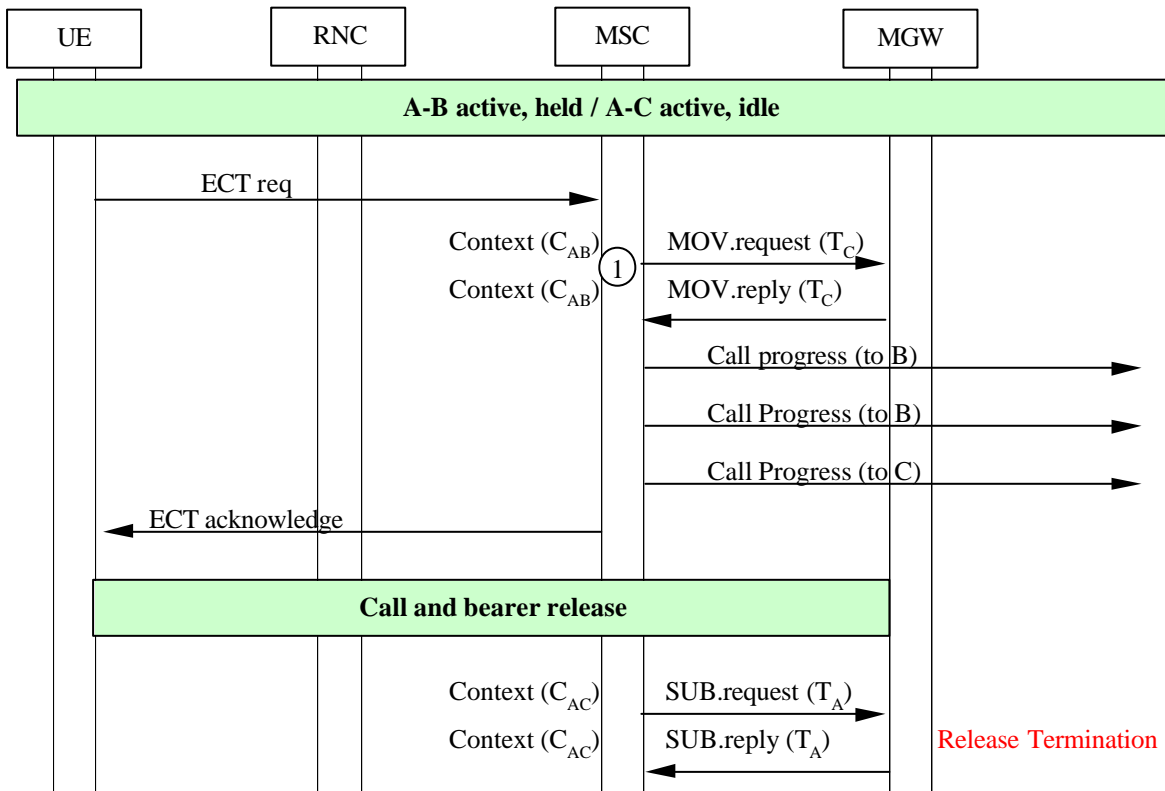
Figure 13.22: Explicit call transfer; both calls answered (message sequence chart)

The figure 13.23 below shows the message sequence example for the explicit call transfer when one call is answered and the other call has been delivered. In the example the MSC requests the MGW to move the bearer termination for the C-party in the active call to the same context with the bearer termination for the B-party. The held party is informed about the retrieval of the held call. Both the remote parties are informed about the call transfer. After the move the MSC

releases the call and the bearer connection towards the served mobile subscriber and requests the MGW to remove the bearer termination for the served mobile subscriber. After the Answer indication from the C-party the B-party is informed about the active call.
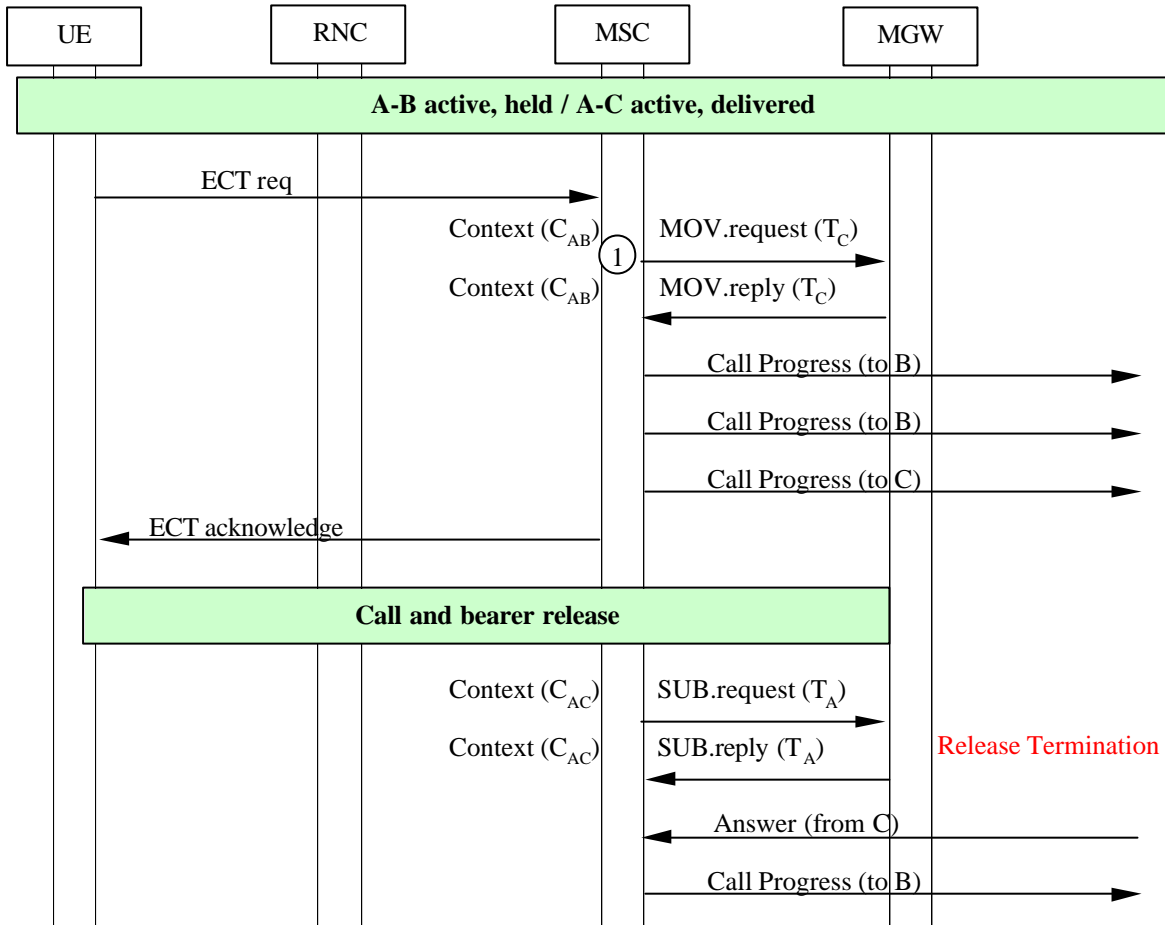
Figure 13.23: Explicit call transfer; other call delivered (message sequence chart)

13.13 Completion of Calls to Busy Subscriber (CCBS)

{Editor's Note:
This section shall describe the interaction with CCBS.}

13.14 Multiple Subscriber Profile (MSP)

No impact.

13.15 Multicall (MC)

No impact.

13.16 Calling Name Presentation (CNAP)

No impact.

14 Interactions with Other Network Features and Services

NOTE: All message sequence charts in this clause are informative examples.

14.1 Customised Applications for Mobile network Enhanced Logic (CAMEL)

14.1.1 Play Announcement

The playing of an announcement shall be performed in accordance with 3GPP TS 23.078. It shall be assumed that the MGW selected for the call has the capabilities to provide announcements.

Request to play an announcement

When the gsmSCF requests the gsmSRF/SSF to play a specified announcement, the gsmSRF/SSF orders the MGW to play the announcement and to notify the announcement completion using Play Announcement procedure. (Bullet 1 in figure 14.1)

Announcement completed

The MGW notifies to the gsmSRF/SSF when the announcement has been completed using Announcement Completed procedure. After reception announcement completed notification the gsmSRF/SSF reports the announcement completion to the gsmSCF. (Bullet 2 in figure 14.1)
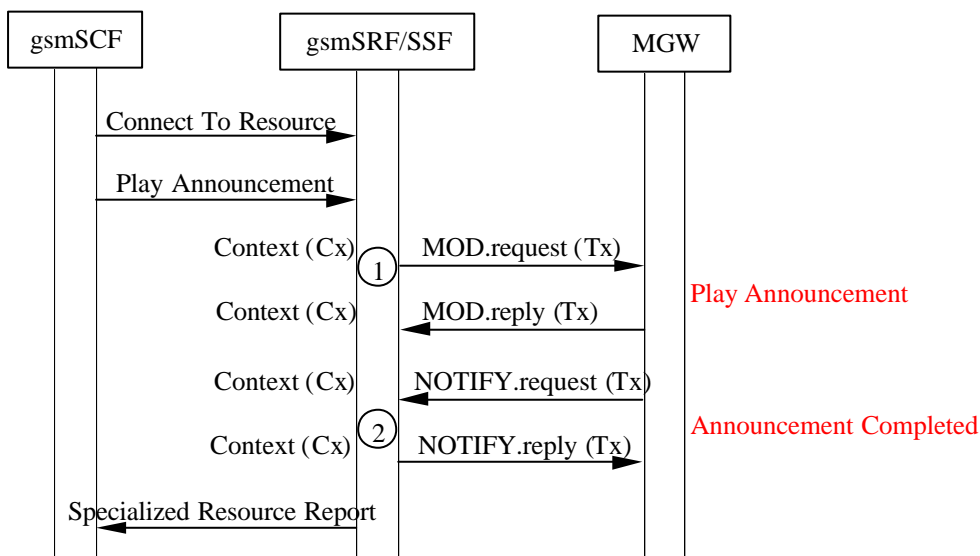
Figure 14.1 CAMEL Announcement Playing (message sequence chart)

14.1.2 User Interaction

The user interaction shall be performed in accordance with TS 23.078. It shall be assumed that the MGW selected for the call has the capabilities to provide announcements. In bearer independent CS core network the DTMF digits can be propagated inband or out-of-band.

14.1.2.1 Inband DTMF

Play announcement

When the gsmSCF requests the gsmSRF/SSF to play a specified announcement and to collect digits that are sent by the user the gsmSRF/SSF requests the MGW to play the announcement and to notify the announcement completion using Play Announcement procedure. (Bullet 1 in figure 14.2)

Detect DTMF tones

The MGW notifies to the gsmSRF/SSF when the announcement has been completed using Announcement Completed procedure. After reception announcement completed notification the gsmSRF/SSF requests the MGW to detect DTMF tones using Detect DTMF procedure. (Bullet 2 in figure 14.2)

Report DTMF tones

At detection of the DTMF tone the MGW reports the digit to the gsmSRF/SSF using Report DTMF procedure. At reception of DTMF tone report the gsmSRF/SSF either requests the MGW to detect another DTMF tone (Bullet 2 in figure 14.2) or requests the MGW to stop detection of DTMF tone (Bullet 3 in figure 14.2) using Detect DTMF procedure. After all requested digits are received the gsmSRF/SSF reports the digits to the gsmSCF.
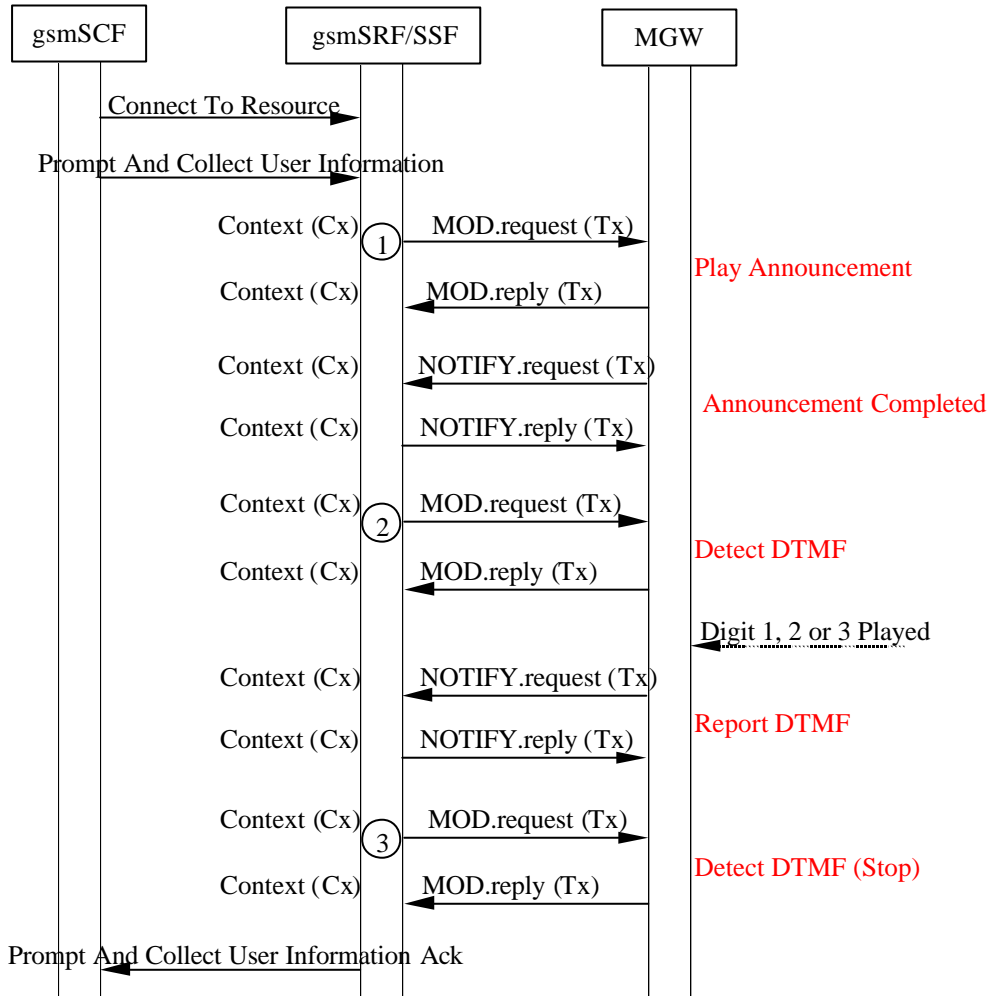
Figure 14.2 CAMEL User Interaction (Inband DTMF)(message sequence chart)

14.1.2.2 Out-of-band DTMF

Play announcement

When the gsmSCF requests the gsmSRF/SSF to play a specified announcement and to collect digits that are sent by the user the gsmSRF/SSF requests the MGW to play the announcement and to notify the announcement completion using Play Announcement procedure. (Bullet 1 in figure 14.2)

Detect DTMF tones

The MGW notifies to the gsmSRF/SSF when the announcement has been completed using Announcement Completed procedure. After reception announcement completed notification the gsmSRF/SSF starts collecting out-of-band DTMF tones. One DTMF tone consists of Start DTMF and Stop DTMF messages. (Bullet 2 in figure 14.3)

Report DTMF tones

When all requested digits are received the gsmSRF/SSF reports the digits to the gsmSCF. (Bullet 3 in figure 14.3)

> NOTE: Since gsmSRF/SSF don't know whether DTMF digits are provided inband or out-of-band the gsmSRF/SSF has to be able to collect DTMF tones both inband and out-of-band.
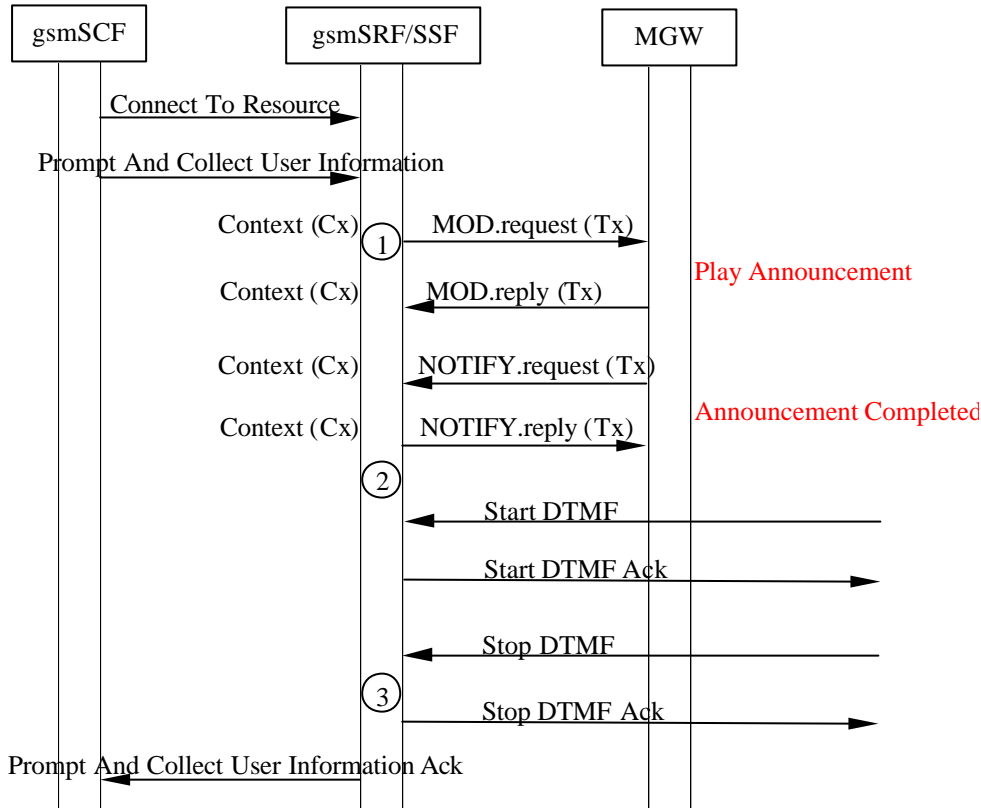
Figure 14.3 CAMEL User Interaction (Out-of-Band DTMF)(message sequence chart)

14.2 IST

The handling of IST is in accordance with GSM TS 02.32 [35]. This section describes the additional requirements for the Bearer Independent CS Core Network.

For clearing of calls due to IST refer to chapter 7 'Call Clearing'.

14.3 Operator Determined Barring (ODB)

> {Editor's Note:
> This section shall describe the interaction with ODB.}

14.4 DTMF

DTMF information can be transported either inband or out of band. In order to minimise the interwork between out of band and in band DTMF signalling, the general principle is to use the DTMF signalling method of the preceding node whenever possible.

If out-of-band transcoder control is applied for a speech call, that shall be performed in accordance with 3GPP TS 23.153.

14.4.1 Inband DTMF

This option uses inband signalling to transport DTMF digits in the core network.

14.4.1.1 DTMF Tone Generation

The DTMF tone generation shall be performed in accordance with 3GPP TS 23.108. The following paragraphs describe the additional requirements for the bearer independent CS core network.

<u>Start DTMF</u>

Once Start DTMF is received from the UE, the MSC uses the Send Tone procedure to request the MGW to modify the bearer termination to play a tone for the pressed digit. The result of the tone sending by the bearer termination will be received by the MSC and sent to the UE. (Bullet 1 in figure 14.4)

<u>Stop DTMF</u>

Once Stop DTMF is received from the UE, the MSC uses the Send Tone procedure to request the MGW to modify the bearer termination to stop digit playing. When the response is received from the MGW, the MSC will acknowledge the Stop DTMF. (Bullet 2 in figure 14.4)

Example

The figure 14.4 below shows an example where out of band signalling of DTMF information is not supported by the call control protocol. For Start DTMF and Stop DTMF operations received from the UE, then the MSC uses resources in MGW to generate tones by modifying the bearer termination.
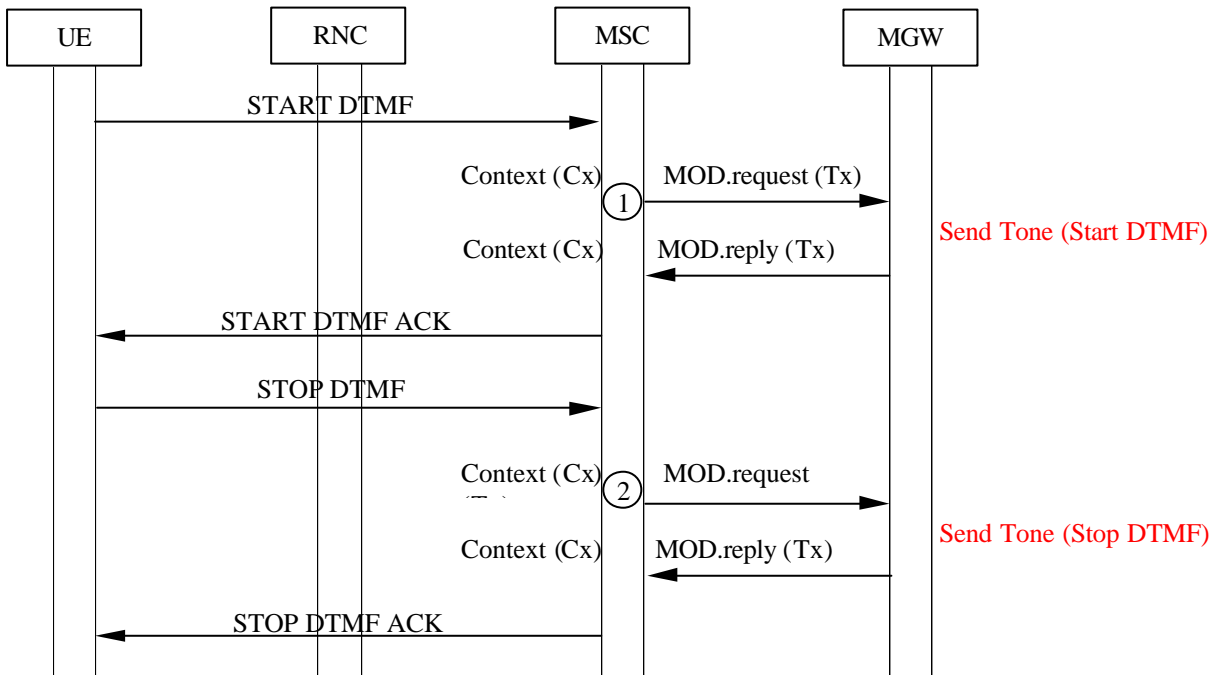
Figure 14.4 Inband DTMF (message sequence chart)

14.4.2 Out-of-band DTMF

This option uses out-of-band network signalling to transport DTMF digits in the core network, where the information is sent on call control layer.

14.4.2.1 DTMF Tone Generation

The DTMF Tone Generation shall be performed in accordance with 3GPP TS 23.108. The following paragraphs describe the additional requirements for the bearer independent CS core network.

<u>Start DTMF</u>

Once Start DTMF is received from the UE, the MSC indicates digit playing using out-of-band signalling. The corresponding result received from the preceding/succeeding node will be sent to the UE. (Bullet 1 in figure 14.5)

<u>Stop DTMF</u>

Once Stop DTMF is received from the UE, the MSC indicates stop digit playing using out-of-band signalling. The succeeding node will indicate that digit playing is stopped. The MSC will send the result back to the UE. (Bullet 2 in figure 14.5)

Example

The figure 14.5 below shows the message sequence example for the out-of-band DTMF during a call. For Start DTMF and Stop DTMF operations received from the UE, then the MSC will send the information using signalling on call control layer. The MSC will not use any dedicated resources of any MGW.
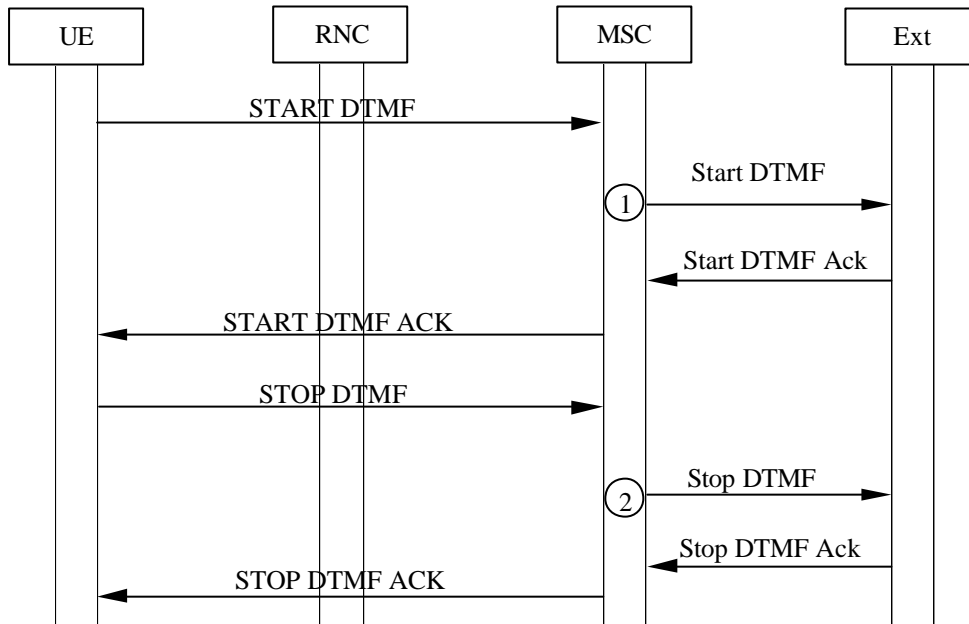
Figure 14.5 Out-of-Band DTMF (message sequence chart)

14.5 OR

The procedures specified in 3GPP TS 23.079 for the Optimal Routeing network service shall be followed. The following paragraphs describe the additional requirements for the bearer independent CS core network.

14.5.1 Optimal routeing for basic mobile-to-mobile calls

The optimally routed call from one mobile subscriber to another mobile subscriber is established as a normal basic call.

14.5.2 Optimal routeing for conditional call forwarding; Early call forwarding

For early call forwarding the same procedures as described for CFU and CFNRc (rerouting by HLR) apply.

14.5.3 Optimal routeing for conditional call forwarding; Late call forwarding

14.5.3.1 MSC

<u>Resume Call Handling and clearing of connection to GMSC</u>

When the MSC determines that the call should be forwarded because the called mobile subscriber is busy (NDUB, UDUB), or is not reachable, or has not replied to the call before the no-reply timer has expired the MSC sends a request to resume call handling to the GMSC.

If the GMSC determines that the call can be forwarded to the forwarded-to destination it sends a Release message to the MSC. If no bearer has been established yet the MSC handles the release only on call control level. If the bearer had been established, the MSC handles the network side bearer release as described in the subclause for the call clearing.

 IU release

When the MSC determines that the call should be forwarded because the called mobile subscriber is busy (UDUB), or has not replied to the call before the no-reply call timer has expired, the MSC releases the call and bearer connection to the served mobile subsriber as described in the subclause for call clearing.

14.5.3.2   GMSC

Resume Call Handling and Clearing of Connection to visited MSC

If the GMSC determines that the call can be forwarded to the forwarded-to destination it sends a Release message to the MSC and handles the outgoing side bearer release as described in the subclause for call clearing, if the bearer had already been established.

MGW selection

The GMSC shall select a MGW for the bearer connection as described for the CFU and CFNRc (in HLR) supplementary services, if not already selected by the mobile terminating call procedures.

Incoming side bearer establishment

The bearer establishment towards the preceding MGW is handled in the GMSC as described for the mobile terminating call, if not already established by the mobile terminating call procedures.

Notification to the Calling Subscriber

The GMSC sends the possible notification towards the calling subscriber according to the procedures described for the CFU and CFNRc (in HLR) supplementary services.

Establishment of call and bearer towards the forwarded-to subscriber

The GMSC establishes the call and bearer towards the forwarded-to subscriber according to the procedures described for the CFU and CFNRc (in HLR) supplementary services.

Example

The figure below shows the network model for optimal routeing when no bearer has been established before the invocation of late call forwarding. The 'squared' line represents the call control signalling. The 'dotted' line represents the bearer control signalling and the bearer. The GMSC seizes one context with two bearer terminations in the MGW. The bearer termination T_A is used for the bearer towards the preceding MGW (calling subscriber) and the bearer termination T_C is used for the bearer towards the succeeding MGW (forwarded-to subscriber).
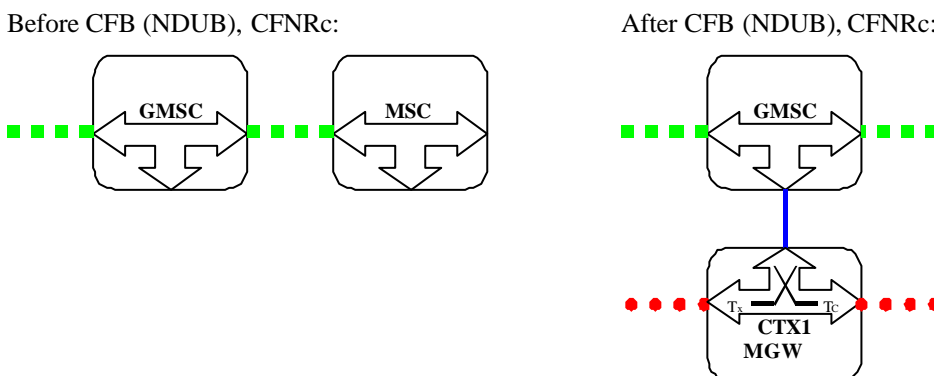
Figure 14.6: Optimal routeing; late call forwarding (CFB (NDUB), CFNRc) (Network model)

The figure 14.7 below shows the message sequence example for the optimal routeing with late call forwarding without any notification to the calling party. In the example below no bearer has been established for the connection when the MSC sends the Resume Call Handling request to the GMSC. After the call towards the visited MSC has been released the GMSC establishes the call and the bearer as described for Call Forwarding Unconditional.
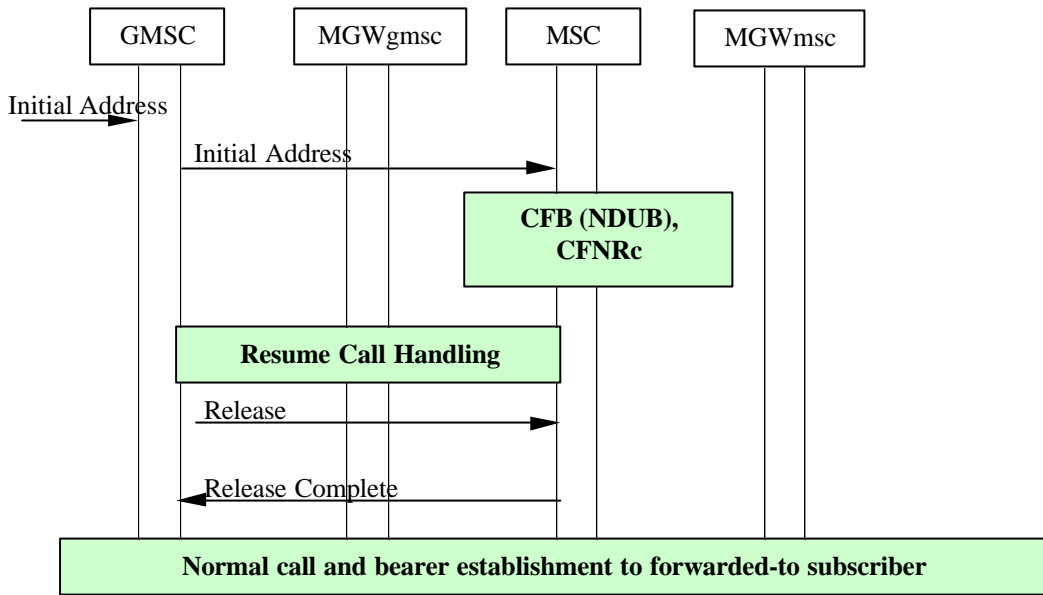
NOTE: CFB Call Forwarding on Busy
NDUB Network Determined User Busy
CFNRc Call Forwarding on Not Reachable

Figure 14.7 Information flow for optimal routeing; late call forwarding (CFB (NDUB), CFNRc) (message sequence chart)

The figure below shows the network model for optimal routeing when a bearer has been established before the invocation of late call forwarding. The 'squared' line represents the call control signalling. The 'dotted' line represents the bearer control signalling and the bearer. The GMSC replaces the bearer termination towards the visited MSC (T_{MSC}) with the bearer termination for the forwarded-to subscriber (T_C) in an existing context in the MGW. The bearer termination T_A is used for the bearer towards the preceding MGW (calling subscriber).
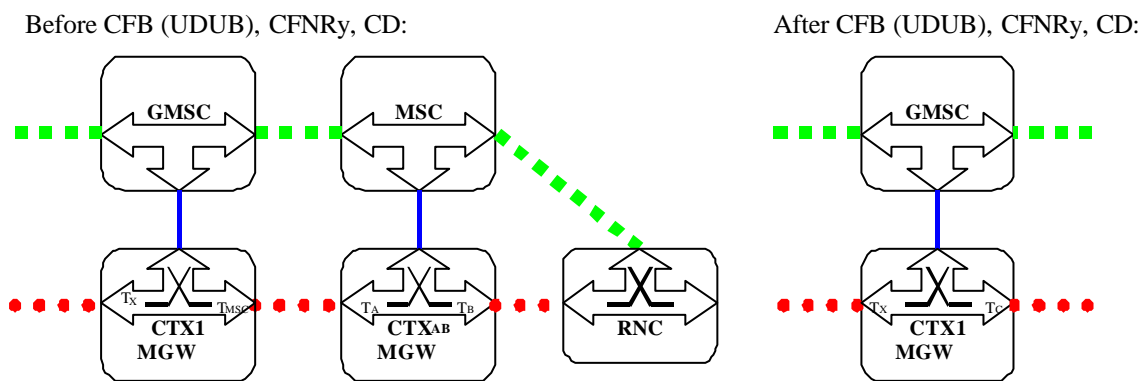
Figure 14.8: Optimal routeing; late call forwarding (CFB (UDUB), CFNRy, CD) (Network model)

The figure 14.9 below shows the message sequence example for the optimal routeing for late call forwarding with a forward bearer release. In the example the MSC requests the MGW to remove the termination towards the served mobile subscriber after the bearer towards the RNC has been released. At reception of the release message from the GMSC the MSC requests the MGW to be prepared for the bearer release. When the GMSC receives the Release Complete it requests the MGW to release the bearer.

Figure 14.9: Information flow for optimal call routeing; late call forwarding (CFB (UDUB), CFNRy, CD), forward bearer release (message sequence chart).

The figure 14.10 below shows the message sequence example for the optimal routeing for late call forwarding with a backward bearer release. In the example the MSC requests the MGW to remove the termination towards the served mobile subscriber after the bearer towards the RNC has been released. At reception of the release message from the GMSC the MSC requests the MGW to be release the bearer. When the GMSC receives the Release Complete it requests the MGW to remove the bearer termination.
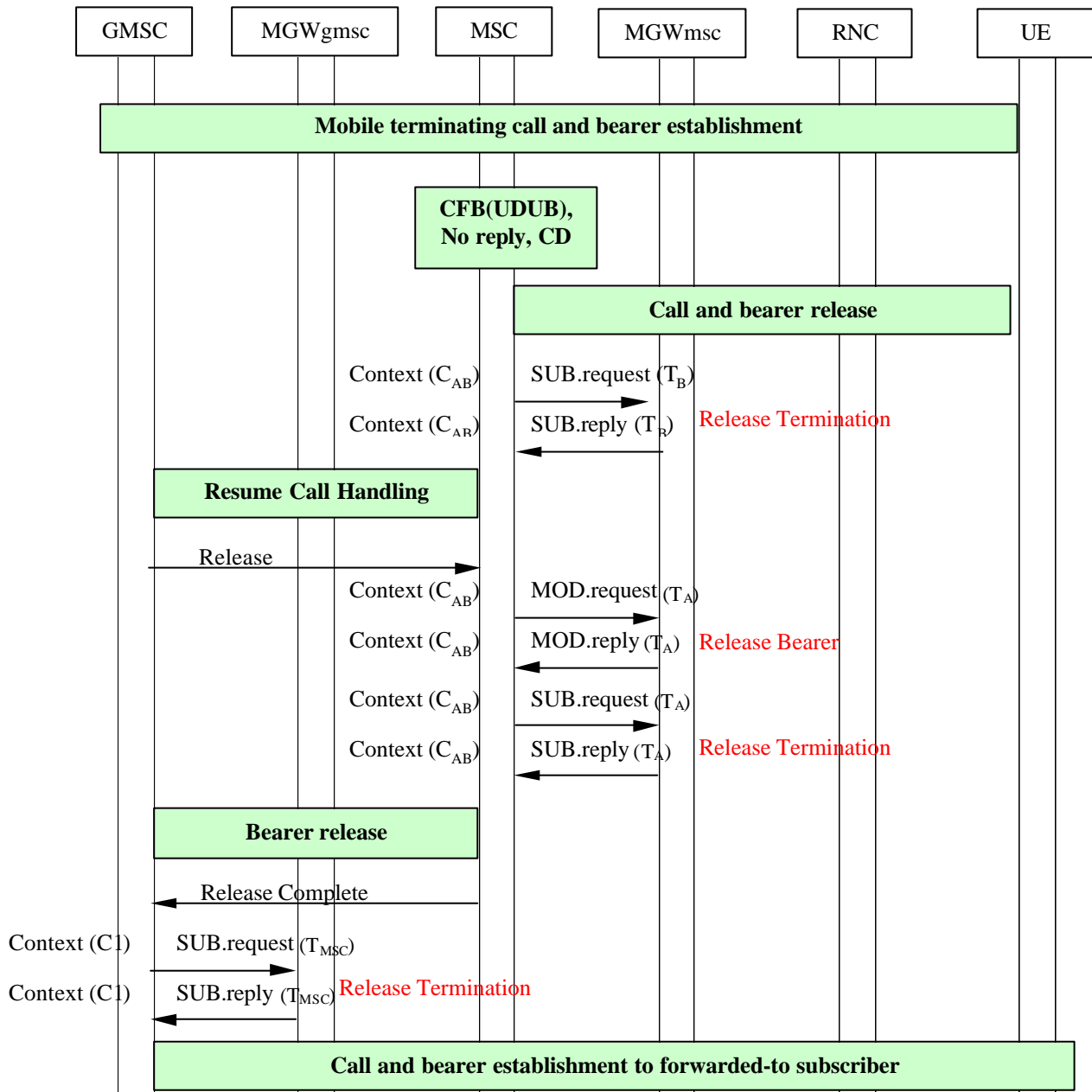
Figure 14.10: Optimal call routeing; late call forwarding (CFB (UDUB), CFNRy, CD), backward bearer release (message sequence chart)

15   Messages/Procedures and Their Contents

This clause contains the detailed description of the information flows used in bearer independent CS core network.

Each Information Element, IE, is marked as (M) Mandatory, (C) Conditional or (O) Optional. A mandatory information element shall always be present. A conditional information shall be present if certain conditions are fulfilled; if those conditions are not fulfilled it shall be absent. An optional information element may be present or absent, at the discretion of the application at the sending entity. This categorisation is a functional classification, i.e., stage 2 information and not a stage 3 classification to be used for the protocol.

The stage 2 and stage 3 message and information element names are not necessarily identical.

15.1 Messages between (G)MSC servers

Table 15.1 indicates messages between (G)MSC servers in Nc interface. Only the new messages and information elements required by the bearer independent CS core network are shown.

Table 15.1: Messages between (G)MSC servers

Message	Message direction	Information element name	Information element required	Information element description
Initial Address	Forward	Bearer Establishment Direction	M	This information element indicates that the direction of bearer establishment.
		Bearer Address	O	This information element indicates the bearer address of the MGW used by the preceding node.
		Binding Reference	O	This information element indicates the bearer identifier in the MGW used by the preceding node.
		MGW -id	O	This information element indicates the MGW selected by the preceding node.
		Bearer Characteristics	O	This information element indicates the characteristics of the bearer.
Bearer Information	Backward	Bearer Address	O	This information element indicates the bearer address of the MGW used by the succeeding node.
		Binding Reference	O	This information element indicates the bearer identifier in the MGW used by the succeeding node.
		MGW -id	O	This information element indicates the MGW selected by the succeeding node.
		Bearer Characteristics	O	This information element indicates the characteristics of the bearer.
Start DTMF	Both	Digit	M	This information element indicates the digit for DTMF tone generation.
Start DTMF Ack	Both			
Stop DTMF	Both			
Stop DTMF Ack	Both			

15.2 Procedures between (G)MSC server and MGW

The chapters below indicates the procedures used between (G)MSC server and MGW in Mc interface. The procedures are logical, i.e. message identifiers are not part of the protocol. Several logical procedures can be combined to perform required transactions.

15.2.1 Change Flow Direction

This procedure is used to change the flow direction between bearer terminations within context.

Table 15.2: Procedures between (G)MSC server and MGW: Change Flow Direction

Procedure	Initiated	Information element name	Information element required	Information element description
Change Flow Direction	(G)MSC	Flow Direction	M	This information element specifies the flow direction between two bearer terminations within the context.
Change Flow Direction Ack	MGW			

15.2.2 Join Bearer Terminations

This procedure is used to join all bearer terminations within the context.

Table 15.3: Procedures between (G)MSC server and MGW: Join Bearer Terminations

Procedure	Initiated	Information element name	Information element required	Information element description
Join Bearer Terminations	(G)MSC	Join Bearer Terminations	M	This information element requests to join the bearer terminations within the context.
Join Bearer Terminations Ack	MGW			

15.2.3 Isolate Bearer Terminations

This procedure is used to isolate one bearer termination from the other bearer terminations within the context.

Table 15.4: Procedures between (G)MSC server and MGW: Isolate Bearer Terminations

Procedure	Initiated	Information element name	Information element required	Information element description
Isolate Bearer Termination	(G)MSC	Isolate Bearer Termination	M	This information element requests to isolate the bearer termination within the context.
Isolate Bearer Termination Ack	MGW			

15.2.4 Establish Bearer

This procedure is used to request a bearer establishment.

Table 15.5: Procedures between (G)MSC server and MGW: Establish Bearer

Procedure	Initiated	Information element name	Information element required	Information element description
Establish Bearer	(G)MSC	Bearer Establishment Request	M	This information element requests establishment of a bearer.
		Binding Reference	M	This information element indicates the bearer identifier in the destination MGW.

		Bearer Address	M	This information element indicates the bearer address of the destination MGW.
		Notify Established Bearer	O	This information element requests a notification of an established bearer.
		Through-Connection	O	This information element indicates the through-connection of the bearer termination.
		PLMN BC	O	This information element indicates the PLMN bearer capabilities [4].
		ISDN BC	O	This information element indicates the ISDN bearer capabilities [4].
		Framing Protocol	O	This information element indicates the framing protocol to be used for the bearer.
		Flow Direction	O	This information element specifies the flow direction between two bearer terminations within the context.
Establish Bearer Ack	MGW	Bearer Characteristics	M	This information element indicates the characteristics of the bearer.

15.2.5 Prepare Bearer

This procedure is used to prepare for a bearer establishment.

Table 15.6: Procedures between (G)MSC server and MGW: Prepare Bearer

Procedure	Initiated	Information element name	Information element required	Information element description
Prepare Bearer	(G)MSC	Binding Reference Request	M	This information element requests the bearer identifier in the MGW.
		Bearer Address Request	M	This information element requests the bearer address of the MGW.
		Notify Established Bearer	O	This information element requests a notification of an established bearer.
		Through-Connection	O	This information element indicates the through-connection of the bearer termination.
		PLMN BC	O	This information element indicates the PLMN bearer capabilities [4].
		ISDN BC	O	This information element indicates the ISDN bearer capabilities [4].
		Framing Protocol	O	This information element indicates the framing protocol to be used for the bearer.
		Flow Direction	O	This information element specifies the flow direction between two bearer terminations within the context.
Prepare Bearer Ack	MGW	Binding Reference	M	This information element indicates the bearer identifier in the MGW.
		Bearer Address	M	This information element indicates the bearer address of the MGW.
		Bearer Characteristics	M	This information element indicates the characteristics of the bearer.

15.2.6 Change Through-Connection

This procedure is used to change the through-connection in the bearer termination.

Table 15.7: Procedures between (G)MSC server and MGW: Change Through-Connection

Procedure	Initiated	Information element name	Information element required	Information element description
Change Through-Connection	(G)MSC	Through-Connection	M	This information element indicates the through-connection of the bearer termination.
Change Through-Connection Ack	MGW			

15.2.7 Activate Interworking Function

This procedure is used to activate the interworking function.

Table 15.8: Procedures between (G)MSC server and MGW: Activate Interworking Function

Procedure	Initiated	Information element name	Information element required	Information element description
Activate Interworking Function	MSC	Activate Interworking Function	M	This information element requests to activate the interworking function.
Activate Interworking Function Ack	MGW			

15.2.8 Release Bearer

This procedure is used to release the bearer.

Table 15.9: Procedures between (G)MSC server and MGW: Release Bearer

Procedure	Initiated	Information element name	Information element required	Information element description
Release Bearer	(G)MSC	Bearer Release Request	M	This information element requests release of a bearer.
Release Bearer Ack	MGW			

15.2.9 Bearer Established

This procedure is used to notify the established bearer.

Table 15.10: Procedures between (G)MSC server and MGW: Bearer Established

Procedure	Initiated	Information element name	Information element required	Information element description

| Bearer Established | MGW | Bearer Established | M | This information element notifies a bearer establishment. |
| Bearer Established Ack | (G)MSC | | | |

15.2.10 Bearer Released

This procedure is used to notify the released bearer.

Table 15.11: Procedures between (G)MSC server and MGW: Bearer Released

Procedure	Initiated	Information element name	Information element required	Information element description
Bearer Released	MGW	Bearer Released	M	This information element notifies a bearer release.
Bearer Released Ack	(G)MSC			

15.2.11 Send Tone

This procedure is used to send a tone.

Table 15.12: Procedures between (G)MSC server and MGW: Send Tone

Procedure	Initiated	Information element name	Information element required	Information element description
Send Tone	(G)MSC	Tone	M	This information element indicates the tone to be generated. Empty information element is a request to stop tone generation.
Send Tone Ack	MGW			

15.2.13 Play Announcement

This procedure is used to play an announcement.

Table 15.13: Procedures between (G)MSC server and MGW: Play Announcement

Procedure	Initiated	Information element name	Information element required	Information element description
Play Announcement	(G)MSC	Announcement	M	This information element indicates the announcement to be played.
		Notify Announcement Completion	O	This information element requests a notification of a completed announcement.
Play Announcement Ack	MGW			

15.2.14 Announcement Completed

This procedure is used to notify the completed announcement.

Table 15.14: Procedures between (G)MSC server and MGW: Announcement Completed

Procedure	Initiated	Information element name	Information element required	Information element description
Announcement Completed	MGW	Announcement Completed	M	This information element indicates completion of the announcement.
Announcement Completed Ack	(G)MSC			

15.2.15 Detect DTMF

This procedure is used to request detection of a DTMF tone.

Table 15.15: Procedures between (G)MSC server and MGW: Detect DTMF

Procedure	Initiated	Information element name	Information element required	Information element description
Detect DTMF	(G)MSC	Digit	M	This information element requests MGW to detect a DTMF tone. Empty information element is a request to stop detection of the DTMF tone.
Detect DTMF Ack	MGW			

15.2.16 Report DTMF

This procedure is used to report a detected DTMF tone.

Table 15.16: Procedures between (G)MSC server and MGW: Report DTMF

Procedure	Initiated	Information element name	Information element required	Information element description
Report DTMF	MGW	Digit	M	This information element reports the detected DTMF tone.
Report DTMF Ack	(G)MSC			

15.2.17 Send DTMF

This procedure is used to request sending of a DTMF tone.

Table 15.17: Procedures between (G)MSC server and MGW: Send DTMF

Procedure	Initiated	Information element name	Information element required	Information element description

Send DTMF	(G)MSC	Digit	M	This information element requests MGW to generate a DTMF tone. Empty information element is a request to stop generation of the DTMF tone.
Send DTMF Ack	MGW			

15.2.18 MGW Out-of-Service

This procedure is used to indicate that the MGW will go out of service.

Table 15.18: Procedures between (G)MSC server and MGW: MGW Out-of-Service

Procedure	Initiated	Information element name	Information element required	Information element description
MGW Out-of-Service	MGW			
MGW Out-of-Service Ack	(G)MSC			

15.2.19 MGW Communication Up

This procedure is used to indicate that the MGW is back in service.

Table 15.19: Procedures between (G)MSC server and MGW: MGW Communication Up

Procedure	Initiated	Information element name	Information element required	Information element description
MGW Communication Up	MGW			
MGW Communication Up Ack	(G)MSC			

15.2.20 MGW Restoration

This procedure is used by to indicate the MGW failure or recovery.

Table 15.20: Procedures between (G)MSC server and MGW: MGW Restoration

Procedure	Initiated	Information element name	Information element required	Information element description
MGW Restoration	MGW	Boot	M	This information element indicates the type of boot in MGW.
MGW Restoration Ack	(G)MSC	(G)MSC Address	O	This information element indicates the (G)MSC signalling address.

15.2.21 Re-Register

This procedure is used by the (G)MSC to request the MGW to register itself.

Table 15.21: Procedures between (G)MSC server and MGW: Re-Register

Procedure	Initiated	Information element name	Information element required	Information element description
Re-Register	(G)MSC	(G)MSC Address	M	This information element indicates the (G)MSC signalling address.
Re-Register Ack	MGW			

15.2.22 Termination Out-of-Service

This procedure is used to indicate that physical termination(s) will go out of service.

Table 15.22: Procedures between (G)MSC server and MGW: Termination Out-of-Service

Procedure	Initiated	Information element name	Information element required	Information element description
Termination Out-of-Service	MGW	Bearer termination(s)	M	This information element indicates the bearer termination(s) that is(are) out of service.
		Method	M	This information element indicates the method for bearer termination clearing.
Termination Out-of-Service Ack	(G)MSC			

15.2.23 Termination Restoration

This procedure is used to indicate that physical termination(s) are back in service.

Table 15.23: Procedures between (G)MSC server and MGW: Termination Restoration

Procedure	Initiated	Information element name	Information element required	Information element description
Termination Restoration	MGW	Bearer termination(s)	M	This information element indicates the bearer termination(s) that is(are) back in service.
Termination Restoration Ack	(G)MSC			

15.2.24 Audit Value

This procedure is used to audit values of different object(s).

Table 15.24: Procedures between (G)MSC server and MGW: Audit Value

Procedure	Initiated	Information element name	Information element	Information element description

			required	
Audit Value	(G)MSC	Object(s)	M	This information element indicates the object(s) to be audited.
Audit Value Ack	MGW	Value(s)	M	This information element indicates the value(s) of the object(s).

15.2.25 Audit Capability

This procedure is used to audit capabilities of different object(s).

Table 15.25: Procedures between (G)MSC server and MGW: Audit Capability

Procedure	Initiated	Information element name	Information element required	Information element description
Audit Capability	(G)MSC	Object(s)	M	This information element indicates the object(s) which capability is requested.
Audit Capability Ack	MGW	Capabilities(s)	M	This information element indicates the capabilities of the object(s).

15.2.26 Capability Update

This procedure is used to indicate update of an object capability.

Table 15.26: Procedures between (G)MSC server and MGW: Capability Update

Procedure	Initiated	Information element name	Information element required	Information element description
Capability Update	MGW	Object(s)	M	This information element indicates the object(s) which capability has changed.
Capability Update Ack	(G)MSC			

15.2.27 Release Termination

This procedure is used to release the bearer termination that doesn't have bearer connected.

Table 15.27: Procedures between (G)MSC server and MGW: Release Termination

Procedure	Initiated	Information element name	Information element required	Information element description
Release Termination	(G)MSC			
Release Termination Ack	MGW			

Annex A: History

Document history			
V0.0.1	July 2000	Initial draft	
V0.0.2	August 2000	Comments from N4#3 incorporated and draft further elaborated	
V0.1.0	September 2000	Contributions and comments from N4#4 incorporated and draft further elaborated	
V 0.2.0	October 2000	Contributions and comments from N4 Ad Hoc incorporated and draft further elaborated	
V 1.0.1	November 2000	For information to TSG-CN #10	