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**3rd Generation Partnership Project;
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Customised Applications for Mobile network Enhanced Logic
(CAMEL) Phase 3 - Stage 2
(Release 1999)**

Keywords

UMTS, GSM, CAMEL, stage 2, network

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Contents

Foreword

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

The present document specifies the stage 2 description for the third phase (see 3GPP TS 22.078 [2]) of the Customized Applications for Mobile network Enhanced Logic (CAMEL) feature within the 3GPP system.

The contents of 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 then 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;

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

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1 Scope

The present document specifies the stage 2 description for the third phase (see 3GPP TS 22.078 [2]) of the Customized Applications for Mobile network Enhanced Logic (CAMEL) feature which provides the mechanisms to support services of operators which are not covered by standardized GSM services even when roaming outside the HPLMN.

The CAMEL feature is a network feature and not a supplementary service. It is a tool to help the network operator to provide the subscribers with the operator specific services even when roaming outside the HPLMN.

In the present document, the GSM Service Control Function (gsmSCF) is treated as being part of the HPLMN. The regulatory environment in some countries may require the possibility that the gsmSCF and the HPLMN are controlled by different operators, and the gsmSCF and the HPLMN are therefore distinct entities.

In the third phase the CAMEL feature supports:

- mobile originated and forwarded calls;

- mobile terminating calls;

- any time interrogation;

- active location information retrieval;

- suppression of announcements;

- announcements, in band user interaction;

- charging features;

- supplementary service invocation notifications;

- USSD interaction with the gsmSCF;

- North American carrier selection;

- Mobility Management event notifications;

- change of Calling Line Identification Presentation Indicator for an MO call to restricted;

- SoLSA;

- Subscribed dialled services;

- Serving network dialled services;

- MO SMS;

- GPRS data transmission;

- Mobility management;

- Notification to CSE of change of subscriber data;

- Any Time Modification;

- Any Time Interrogation of subscription Information;

- T-BCSM in the VMSC and terminating AoC;

- Interworking with Location Services;

- Multiple Subscriber Profile;

- Active Location Retrieval;

- Call Gapping.

Note that CAMEL is not applicable to Emergency Setup (TS 12), i.e., in case an Emergency call has been requested the gsmSSF shall not be invoked.

The mechanism described in the present document addresses especially the need for information exchange between the VPLMN or IPLMN and the HPLMN for support of operator specific services. Any user procedures for the control of operator specific services are outside the scope of the present document. Subscribers who have subscribed to operator specific services and therefore need the functional support of the CAMEL feature shall be marked in the HPLMN and VPLMN. In case a subscriber is marked to need CAMEL support, the appropriate procedures which provide the necessary information to the VPLMN or the HPLMN are invoked. It is possible for the HPLMN to instruct the VPLMN or IPLMN to interact with a gsmSCF which is controlled by the HPLMN.

The specification of operator specific services is outside the scope of the present document.

2 References

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

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.

- For a specific reference, subsequent revisions do not apply.

- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document.*

[1]   3GPP TR 21.905: "3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; Vocabulary for 3GPP Specifications".

[2]   3GPP TS 22.078: "3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; Customised Applications for Mobile network Enhanced Logic (CAMEL); Service description, Stage 1".

[3]   3GPP TS 23.018: "3rd Generation Partnership Project; Technical Specification Group Core Network; Basic call handling; Technical realization".

[4]   3GPP TS 29.002: "3rd Generation Partnership Project; Technical Specification Group Core Network; Mobile Application Part (MAP) specification".

[5]   3GPP TS 29.078: "3rd Generation Partnership Project; Technical Specification Group Core Network; Customised Applications for Mobile network Enhanced Logic (CAMEL) Phase 3 CAMEL; Application Part (CAP) specification".

[6]   ITU-T Recommendation Q.1214 (1995): "Distributed Functional Plane for Intelligent Network CS-1".

[7]   ETSI EN 301 070-1 (V1.2.2): "Integrated Services Digital Network (ISDN) ; Signalling System No.7 ; ISDN User Part (ISUP) version 3 interactions with the Intelligent Network Application Part (INAP); Part 1: Protocol specification [ITU-T Recommendation Q.1600 (1997), modified]".

[8]   3GPP TS 23.090: "3rd Generation Partnership Project; Technical Specification Group Core Network; Unstructured Supplementary Service Data (USSD) - Stage 2".

[9]   3GPP TS 23.085: "3rd Generation Partnership Project; Technical Specification Group Core Network; Closed User Group (CUG) supplementary service - Stage 2".

[10]   ANSI T1.113-1995: "Signalling System No. 7, ISDN User Part".

[11]   3GPP TS 23.060: "3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; General Packet Radio Service (GPRS); Service description; Stage 2".

[12]   ITU-T Recommendation Q.1290 (1998): "Glossary of terms used in the definition of intelligent networks".

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

[14]   ETSI EN 300 403-1: "Integrated Services Digital Network (ISDN); Digital Subscriber Signalling System No. one (DSS1) protocol; Signalling network layer for circuit-mode basic call control; Part 1: Protocol specification [ITU-T Recommendation Q.931 (1993), modified]".

[15]   ITU-T Recommendation Q.762 (1999): "Signalling System No. 7 – ISDN user part general functions of messages and signals".

[16]   ITU-T Recommendation Q.763 (1999): "Signalling System No. 7 – ISDN user part formats and codes".

[17]   3GPP TS 22.071: "3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; Location Services (LCS); Service description, Stage 1".

[18]   3GPP TS 25.305: "3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Stage 2 Functional Specification of UE Positioning in UTRAN".

[19]   3GPP TS 27.001: "3rd Generation Partnership Project; Technical Specification Group Core Network; General on Terminal Adaptation Functions (TAF) for Mobile Stations (MS)".

[20]   ETSI EN 300 356-1 (V3.2.2): "Integrated Services Digital Network (ISDN); Signalling System No.7; ISDN User Part (ISUP) version 3 for the international interface; Part 1: Basic services[ITU-T Recommendations Q.761 to Q.764 (1997), modified]".

[21]   3GPP TS 23.040 (V7.1.0): "3rd Generation Partnership Project; Technical Specification Group Terminals; Technical realization of the Short Message Service (SMS) (Release 1998)".

[22]   3GPP TS 22.030: "3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; Man-Machine Interface (MMI) of the User Equipment (UE)".

[23]   3GPP TS 23.073: "3rd Generation Partnership Project; Technical Specification Group Core Network; Support of Localised Service Area (SoLSA); Stage 2".

[24]   3GPP TS 22.002 (V3.0.0): "3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; Circuit Bearer Services (BS) supported by a Public Land Mobile Network (PLMN) (Release 1999)".

[25]   3GPP TS 22.004 (V3.0.0): "3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; General on supplementary services (Release 1999)".

[26]   3GPP TS 23.011 (V3.0.0): "3rd Generation Partnership Project; Technical Specification Group Core Network; Technical realization of Supplementary Services (Release 1999)".

[27]   3GPP TS 23.082 (V3.0.0): "3rd Generation Partnership Project; Technical Specification Group Core Network; Call Forwarding (CF) supplementary services - Stage 2 (Release 1999)".

[28]   3GPP TS 23.084: "3rd Generation Partnership Project; Technical Specification Group Core Network; Multi Party (MPTY) supplementary service; Stage 2".

[29]   3GPP TS 23.091: "3rd Generation Partnership Project; Technical Specification Group Core Network; Explicit Call Transfer (ECT) supplementary service; Stage 2".

[30]   ITU-T Recommendation Q.1224 (1997): "Distributed Functional Plane for Intelligent Network Capability Set 2".

[31]   3GPP TS 22.024: "3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; Description of Charge Advice Information (CAI)".

[32]   3GPP TS 23.012: "3rd Generation Partnership Project; Technical Specification Group Core Network; Location management procedures".

[33] 3GPP TS 24.008: "3rd Generation Partnership Project; Technical Specification Group Core Network; Mobile radio interface layer 3 specification; Core Network Protocols; Stage 3".

[34] 3GPP TS 23.032: "3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; Universal Geographical Area Description (GAD)".

[35] 3GPP TS 23.072: "3rd Generation Partnership Project; Technical Specification Group Core Network; Call Deflection (CD) Supplementary Service; Stage 2".

[36] 3GPP TS 23.079: "3rd Generation Partnership Project; Technical Specification Group Core Network; Support of Optimal Routeing (SOR); Technical realization; Stage 2".

[37] 3GPP TS 23.003: "3rd Generation Partnership Project; Technical Specification Group Core Network; Numbering, addressing and identification".

[38] 3GPP TS 23.093: "3rd Generation Partnership Project; Technical Specification Group Core Network; Technical realization of Completion of Calls to Busy Subscriber (CCBS) - Stage 2".

[39] 3GPP TS 23.088: "3rd Generation Partnership Project; Technical Specification Group Core Network; Call Barring (CB) Supplementary Services; Stage 2".

[40] GSM TR 03.47: "Example protocol stacks for interconnecting; Service Centre(s) (SC) and Mobile-services Switching Centre(s) (MSC)".

3 Definitions and abbreviations

3.1 Definitions

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

Basic Call State Model (BCSM): BCSM provides a high-level model of GMSC- or MSC/VLR-activities required to establish and maintain communication paths for users. As such, it identifies a set of basic call activities in a GMSC or MSC/VLR and shows how these activities are joined together to process a basic call

Call Control Function (CCF): CCF is the Call Control Function in the network that provides call/service processing and control (see ITU-T Recommendation Q.1224)

Detection Points (DP): points in processing at which notifications (to the service logic) can occur and transfer of control (to the gsmSCF) is possible are called Detection Points (DPs)

Dialled Service CAMEL Subscription Information (D-CSI): D-CSI identifies the subscriber as having originating CAMEL dialled services

Forwarding MSC: MSC which is either an MSC invoking a GSM standardized call forwarding or call deflection service; or an MSC invoking a Camel based call forwarding service

Gateway MLC (GMLC): functional entity that allows external LCS Clients to request real-time information about a Mobile Station. The information that can be requested from the GMLC is:

- location of Mobile Station.

See 3GPP TS 22.071 [17] and 3GPP TS 23.071 [18] for information on the GMLC.

Geodetic Information: information defining the location of a mobile station, coded according to ITU-T Recommendation Q.763. The derivation of this information from other information defining the location of a mobile station is a network operator option. If an entity derives the geodetic information it shall also provide the equivalent geographical information

Geographical Information: information defining the location of a mobile station, coded according to 3GPP TS 23.032

GPRS CAMEL Subscription Information (GPRS-CSI): GPRS-CSI identifies the subscriber as having GPRS CAMEL services.

GPRS Dialogue: dialogue between the gprsSSF and the gsmSCF. A single gprsDialogue may consist of one or more TCAP dialogues. Only one TCAP dialogue shall exists at one point in time for one gprsDialogue

GPRS Service Switching Function (gprsSSF): functional entity that interfaces the SGSN to the gsmSCF. The concept of the gprsSSF is derived from the IN SSF, but uses different triggering mechanisms because of the nature of the mobile network

GPRS Session: GPRS session starts when the GPRS subscriber attaches to the GPRS data network. It ends when the GPRS subscriber detaches from the GPRS data network

GSM Service Control Function (gsmSCF): functional entity that contains the CAMEL service logic to implement OSS. It interfaces with the gsmSSF, the gsmSRF, the GMLC and the HLR

GSM Service Switching Function (gsmSSF): functional entity that interfaces the MSC/GMSC to the gsmSCF. The concept of the gsmSSF is derived from the IN SSF, but uses different triggering mechanisms because of the nature of the mobile network

GSM Specialised Resource Function (gsmSRF): functional entity which provides various specialized resources. It interfaces with the gsmSCF and with the MSC. This entity is defined in ITU-T Recommendation Q.1224 [30] with variations defined in the specification

Location Information: indicates the location of the Mobile Station. The provision of location information is independent of the MS status. As part of the location information, an indication of the age of this information may be delivered

Mobile Station State: similar to **Subscriber State**, but associated only with a Mobile Station, not with a subscriber

Mobility Management event CAMEL Subscription Information (M-CSI): M-CSI identifies the subscriber as having Mobility Management event notification CAMEL services

NA (North American): prefix attached to certain information items used by North American PLMNs in connection with routing a call to a preferred or dialled long distance carrier

Network CAMEL Service Information (N-CSI): N-CSI identifies services offered on a per-network basis by the serving PLMN operator for all subscribers

Originating Basic Call State Model (O-BCSM): originating half of the BCSM. The O-BCSM corresponds to that portion of the BCSM associated with the originating party

Originating CAMEL Subscription Information (O-CSI): O-CSI identifies the subscriber as having originating CAMEL services

Point In Association (PIA): PIAs identify MSC/VLR/ SGSN activities associated with one or more basic association/connection states of interest to OSS service logic instances

Point In Call (PIC): PICs identify MSC/VLR (GMSC) activities associated with one or more basic call/connection states of interest to OSS service logic instances

Service Key: Service Key identifies to the gsmSCF the service logic. The Service Key is administered by the HPLMN, and is passed transparently by the VPLMN/IPLMN to the gsmSCF. The Service Key is a part of the T/O/VT/D/GPRS/SMS/M-CSI

Serving MLC: functional entity that performs location information retrieval

Short Message Service CAMEL Subscription Information (SMS-CSI): SMS-CSI identifies the subscriber as having MO SMS CAMEL services

Short Message Service Centre (SMSC): also abbreviation SC is used for SMSC

Subscriber State: see 3GPP TS 22.078 [2].

Supplementary Service Notification CAMEL Subscription Information (SS-CSI): SS-CSI identifies the subscriber as having supplementary service invocation notification CAMEL services

Terminating Basic Call State Model (T-BCSM): terminating half of the BCSM. The T-BCSM corresponds to that portion of the BCSM associated with the terminating party

Terminating CAMEL Subscription Information (in the GMSC) (T-CSI): T-CSI identifies the subscriber as having terminating CAMEL services in the GMSC

VMSC Terminating CAMEL Subscription Information (VT-CSI): VT-CSI identifies the subscriber as having terminating CAMEL services in the VMSC

Translation Information Flag (TIF-CSI): TIF-CSI is a flag in the CAMEL subscriber data which indicates that when the subscriber registers a forwarded-to number, that the HLR shall not attempt to perform any translation, number format checks, prohibited FTN checks, call barring checks

USSD CAMEL Subscription Information (U-CSI): U-CSI identifies a set of subscriber specific mappings from a USSD service code to a gsmSCF address

USSD General CAMEL Service Information (UG-CSI): UG-CSI globally identifies a set of mappings from a USSD service code to a gsmSCF address. The global mapping applies to all HPLMN subscribers. If, for a particular service code, both U-CSI and UG-CSI are applicable then the U-CSI shall take precedence

3.2 Abbreviations

Abbreviations used in the present document are listed in 3GPP TR 21.905 [1].

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

BCSM	Basic Call State Model
CAMEL	Customized Applications for Mobile network Enhanced Logic
DP	Detection Point
DTN	Deflected To Number
D-CSI	Dialled Services CAMEL Subscription Information
EDP	Event Detection Point
FTN	Forwarded To Number
GMLC	Gateway MLC
GMSC	Gateway MSC
GPRS	General Packet Radio Service
gprsSSF	GPRS Service Switching Function
GPRS-CSI	GPRS CAMEL Subscription Information
gsmSCF	GSM Service Control Function
gsmSRF	GSM Specialised Resource Function
gsmSSF	GSM Service Switching Function
HLR	Home Location Register
HPLMN	Home PLMN
IE	Information Element
IF	Information Flow
IP	Intelligent Peripheral
IPLMN	Interrogating PLMN
LCS	Location Services
LSA	Localised Service Area
M-CSI	Mobility Management event Notification CAMEL Subscription Information
MF	Mobile Forwarding
MLC	Mobile Location Centre
MO	Mobile Originating
MSC	Mobile service Switching Centre
MT	Mobile Terminating in GMSC
N-CSI	Network CAMEL Service Information
NA	North American
NNI	Network Node Interface
O-BCSM	Originating Basic Call State Model
O-CSI	Originating CAMEL Subscription Information
ODB	Operator Determined Barring
OSS	Operator Specific Service
PDP	Packet Data Protocol
PIC	Point In Call
PLMN	Public Land Mobile Network

SGSN   Serving GPRS Support Node
SLPI   Service Logic Program Instance
SMF   Service Management Function
SMLC   Serving MLC
SMS-CSI   Short Message Service CAMEL Subscription Information
SS-CSI   Supplementary Service Notification CAMEL Subscription Information
T-BCSM   Terminating Basic Call State Model
T-CSI   Terminating CAMEL Subscription Information (in the GMSC)
TDP   Trigger Detection Point
TPDU   Transfer Protocol Data Unit
TIF-CSI   Translation Information Flag
U-CSI   USSD CAMEL Subscription Information
UG-CSI   USSD General CAMEL Service Information
UNI   User Network Interface
VLR   Visitor Location Register
VPLMN   Visited PLMN
VT   Mobile Terminating in VMSC
VT-CSI   VMSC Terminating CAMEL Subscription Information

4 Circuit switched Call Control

4.1 Architecture

4.1.1 Functional Entities used for CAMEL

This clause describes the functional architecture needed to support CAMEL. Also the additions needed to the basic GSM functionality are described. Figure 4.1 shows the functional entities involved in calls requiring CAMEL support. The architecture is applicable to the third phase of CAMEL.
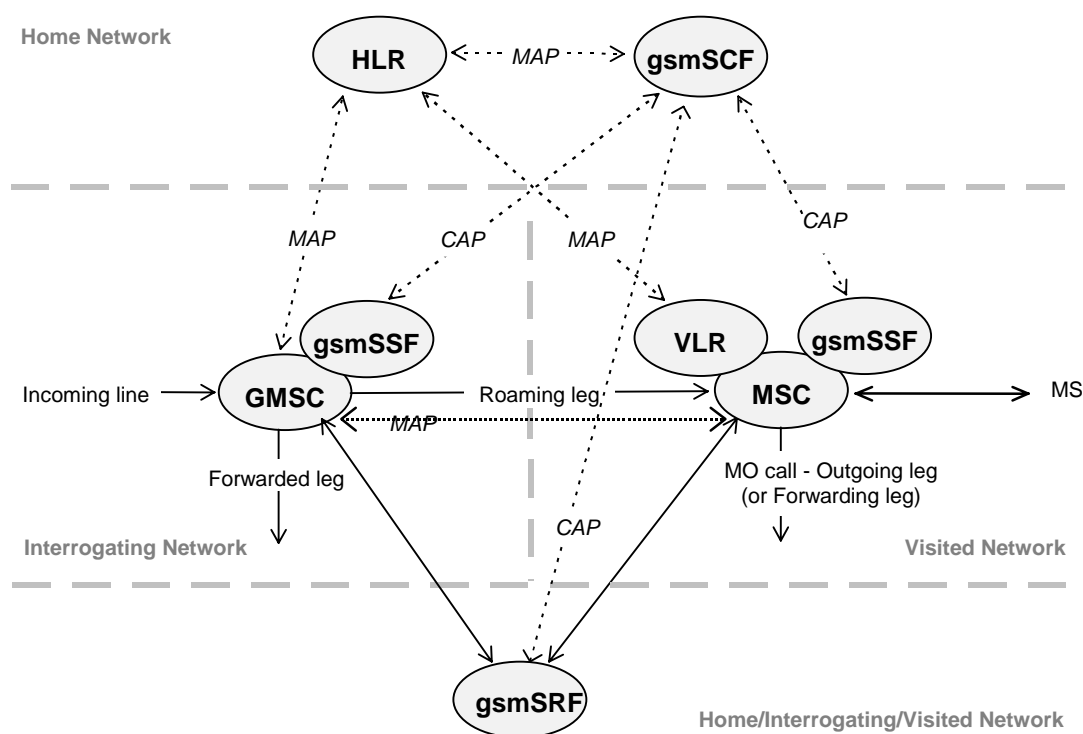
Figure 4.1: Functional architecture for support of CAMEL

HLR: For subscribers requiring CAMEL support, the HLR stores the information relevant to the current subscription regarding O-CSI, D-CSI, T-CSI, VT-CSI and TIF-CSI. The O-CSI is sent to the VLR at Location Update, on data restoration or if the O-CSI is updated by administrative action. The D-CSI is sent to the VLR at Location Update, on data restoration or if the D-CSI is updated by administrative action. The VT-CSI is sent to the VLR at Location Update, on data restoration or if the VT-CSI is updated by administrative action. The O/T-CSI is sent to the GMSC when the HLR responds to a request for routeing information.

GMSC: When processing the calls for subscribers requiring CAMEL support, the GMSC receives an O/T-CSI from the HLR, indicating the GMSC to request instructions from the gsmSSF. The GMSC monitors on request the call states (events) and informs the gsmSSF of these states during processing, enabling the gsmSSF to control the execution of the call in the GMSC.

MSC: When processing the calls for subscribers requiring CAMEL support, the MSC receives an O-CSI and / or VT-CSI from the VLR indicating the MSC to request instructions from the gsmSSF. The MSC monitors on request the call states (events) and informs the gsmSSF of these states during processing, enabling the gsmSSF to control the execution of the call in the MSC.

VLR: The VLR stores the O-CSI, VT-CSI and TIF-CSI as a part of the subscriber data for subscribers roaming in the VLR area.

gsmSSF: see clause 3.1.

gsmSCF: see clause 3.1.

gsmSRF: see clause 3.1.

4.1.2 Interfaces defined for CAMEL

This clause describes the different interfaces applicable to CAMEL. It specifies on a high level the functions specific to CAMEL.

4.1.2.1 HLR - VLR interface

This interface is used to send the CAMEL related subscriber data to the visited PLMN and for provision of MSRN. The interface is also used to retrieve subscriber status and location information of the mobile subscriber or to indicate suppression of announcement for a CAMEL service.

4.1.2.2 GMSC - HLR interface

This interface is used at terminating calls to exchange routeing information, subscriber status, location information, subscription information and suppression of announcements. The O/T-CSI that is passed to the IPLMN is sent over this interface.

4.1.2.3 GMSC - gsmSSF interface

This is an internal interface. The interface is described in the specification to make it easier to understand the handling of DPs (arming/disarming of DPs, DP processing etc.).

4.1.2.4 gsmSSF - gsmSCF interface

This interface is used by the gsmSCF to control a call in a certain gsmSSF and to request the gsmSSF to establish a connection with a gsmSRF. Relationships on this interface are opened as a result of the gsmSSF sending a request for instructions to the gsmSCF.

4.1.2.5 MSC - gsmSSF interface

This is an internal interface. The interface is described in the specification to make it easier to understand the handling of DPs (arming/disarming of DPs, DP processing etc.).

4.1.2.6 gsmSCF - HLR interface

This interface is used by the gsmSCF to request information from the HLR. As a network operator option the HLR may refuse to provide the information requested by the gsmSCF.

4.1.2.7 gsmSCF - gsmSRF interface

This interface is used by the gsmSCF to instruct the gsmSRF to play tones/announcements to the users.

4.1.2.8 GMSC - MSC interface

This interface is used to transfer control of a call from a VMSC back to a GMSC for optimal routeing.

4.2 Detection Points (DPs)

4.2.1 Definition and description

Certain basic call events may be visible to the GSM Service Control Function (gsmSCF). The DPs are the points in call at which these events are detected. The DPs for Mobile Originated Calls and Mobile Terminated Calls are described in clauses 4.4.2 and 4.4.3.

A DP can be armed in order to notify the gsmSCF that the DP was encountered, and potentially to allow the gsmSCF to influence subsequent handling of the call. If the DP is not armed, the processing entity continues the processing without gsmSCF involvement.

Three different types of DPs are identified:

- Trigger Detection Point - Request (TDP-R).

    This detection point is statically armed and initiates a CAMEL control relationship when encountered and there is no existing relationship due to the same CSI. Processing is suspended when the DP is encountered.

- Event Detection Point - Request (EDP-R).

    This detection point is dynamically armed within the context of a CAMEL control relationship. Processing is suspended when encountering the DP and the gsmSSF waits for instructions from the gsmSCF.

- Event Detection Point - Notification (EDP-N).

    This detection point is dynamically armed within the context of a CAMEL control relationship. Processing is not suspended when encountering the DP.

The DPs are characterized in the following clauses.

4.2.1.1 Arming/disarming mechanism

The mechanism by which the DP is armed. A DP may be statically armed or dynamically armed.

The following arming rules apply:

- DP for mobile terminating call handling is statically armed in GMSC as result of T-CSI delivery from HLR. DP for mobile terminating call handling is statically armed in VMSC as result of VT-CSI delivery from VLR. DP for forwarding leg handling is statically armed in GMSC as result of O-CSI delivery from HLR. DP for mobile originating call or forwarded leg handling is statically armed in VMSC as result of O-CSI delivery from VLR.

- A DP is dynamically armed by the gsmSCF within the context of a CAMEL control relationship (between the gsmSSF and the gsmSCF).

The following disarming rules apply:

- A statically armed DP is disarmed when a O-CSI, T-CSI or VT-CSI is withdrawn in the HLR. Only TDP-Rs can be disarmed using this mechanism.

- If an armed EDP is met, then it is disarmed.

- If an EDP is met that causes the release of the related leg, then all EDPs related to that leg are disarmed.

- If a call is released, then all EDPs related to that call are disarmed.

- If an EDP is met, then other EDPS are disarmed, in accordance with the implicit disarming rule table (see clause 4.4.4).

- If an EDP is armed, it can be explicitly disarmed by the gsmSCF by means of the RequestReportBCSMEvent information flow.

4.2.1.2   Criteria

Criteria are the conditions that must be met in order for the gsmSSF to request instructions from the gsmSCF.

4.2.1.2.1   Criteria at DP Collected_Info

The criteria for an mobile originating call are checked in the originating MSC.

The criteria for an mobile forwarded call are checked in the forwarding MSC.

For early forwarded calls in the GMSC, the HLR may decide not to include the DP Collected_Info trigger criteria in the subscriber data sent to the GMSC if the trigger criteria for the call are not met.

For optimally routed late forwarded calls, the MSC may decide not to include the DP Collected Info trigger criteria in the RCH message sent to the GMSC, if the trigger criteria for the call are not met.

The following criteria are applicable for DP Collected_Info:

- Destination number triggering criterion: The HLR may store a list of up to 10 destination numbers and/or up to 3 number lengths. There is no restriction on the nature of address. There is no restriction on the numbering plan indicator. This criterion may be defined to be either "enabling" or "inhibiting".

- Basic service triggering criterion: The HLR may store a list of up to 5 basic service codes, each of which may represent an individual basic service or a basic service group. Compound basic service group codes, as defined in 3GPP TS 29.002 [4], are not allowed for conditional triggering. This list is a triggering list.

- Forwarding triggering criterion: The HLR may store an indicator that triggering shall occur only for a call which has been subject to GSM or CAMEL call forwarding. This criterion may be defined to be either "enabling" or "inhibiting".

For MO calls, triggering at DP Collected_Info shall be strictly based on the number received over the access network. No service selection information, such as ∗ and # digits, or carrier selection information, dialled by the subscriber, shall be removed from the number before conditional triggering check takes place.

For MF calls at the VMSC, triggering at DP Collected_Info shall be strictly based on the number received over the access network (the Deflected-to-Number in case of Call Deflection), the Forwarded-to-Number retained in the VLR or the Destination Routing Address received in the Connect operation from SCF during a Terminating CAMEL Service at the VMSC.
No service selection information or carrier selection information shall be removed from the number before conditional triggering check takes place.

For MF calls at the GMSC, triggering at DP Collected_Info shall be strictly based on the Forwarded-to-Number received from HLR, on the Destination Routing Address received in the Connect operation from SCF during a Terminating CAMEL Service or on the Forwarded-to-Number received in the RCH message.
No service selection information or carrier selection information shall be removed from the number before conditional triggering check takes place.

One or more DP criteria may be applicable. All applicable triggering criteria must be satisfied before the dialogue is established with the gsmSCF.

If the destination number triggering criterion is enabling, then the gsmSSF may establish a dialogue with the gsmSCF if:

- the destination number matches one of the destination number strings defined in the list; or

- the length of the destination number matches one of the destination number lengths defined in the list.

In this test the destination number matches one of the destination number strings in the list if:

- the nature of address of destination number is the same as the nature of address of the destination number string;

- the destination number is at least as long as the destination number string in the list; and

- all the digits in the destination number string in the list match the leading digits of the destination number.

If the destination number triggering criterion is inhibiting, then the gsmSSF may establish a dialogue with the gsmSCF if:

- the destination number does not match any of the destination number strings defined in the list; and

- the length of the destination number does not match any of the destination number lengths defined in the list.

In this test the destination number matches one of the destination number strings in the list if:

- the nature of address of destination number is the same as the nature of address of the destination number string;

- the destination number is at least as long as the destination number string in the list; and

- all the digits in the destination number string in the list match the leading digits of the destination number.

The basic service triggering criterion is met if the basic service for the call matches a stored individual basic service code or is a member of the group defined by a stored basic service group code. For the purpose of this paragraph a general bearer service is a member of the corresponding bearer service group.

If the forwarding triggering criterion is enabling, then the gsmSSF may establish a dialogue with the gsmSCF only if the call has been subject to CAMEL or GSM call forwarding. If the forwarding triggering criterion is inhibiting, then the gsmSSF may establish a dialogue with the gsmSCF only if the call has not been subject to CAMEL or GSM call forwarding.

4.2.1.2.2 Criteria at DP Analysed_Information

4.2.1.2.2.1 General

The criteria for a mobile originating call are checked in the originating MSC. The criteria for a mobile forwarded call are checked in the forwarding MSC.

For early forwarded calls in the GMSC, the HLR shall always include the trigger criteria in the subscriber data sent to the GMSC. Reason is that the HLR can not check the criteria applicable at DP Analysed Info, since the number that the criteria check shall be based on, may be modified by a Mobile Terminating or Mobile Forwarding Service Logic for this call.

For optimally routed late forwarded calls, the MSC shall always include the trigger criteria in the RCH message sent to the GMSC. Reason is that the MSC can not check the criteria applicable at DP Analysed Info, since the number that the criteria check shall be based on, may be modified by a Mobile Terminating or Mobile Forwarding Service Logic for this call.

The following criteria are applicable for DP Analysed_Information:

- Destination number triggering criterion: The HLR may store a list of up to 10 destination numbers. There is no restriction on the nature of address. There is no restriction on the numbering plan indicator.

For MO calls, triggering at DP Analysed_Info shall be based on the called party number received over the access network.

For MF calls at the VMSC, triggering at DP Analysed_Info shall be based on the number received over the access network (the Deflected-to-Number in case of Call Deflection), the Forwarded-to-Number retained in the VLR, or the Destination Routing Address in the Connect operation from the SCF during a Mobile Terminated or Mobile Forwarded CAMEL Service.

For MF calls at the GMSC, triggering at DP Analysed_Info shall be based on the Forwarded-to-Number received from HLR, on the Destination Routing Address received in the Connect operation from SCF during a Mobile Terminated or Mobile Forwarded CAMEL Service, or on the Forwarded-to-Number received in the RCH message.

4.2.1.2.2.2 Removal of information significant to the serving entity

In order to decide whether triggering shall take place, the trigger criteria need to be compared with the address information. Before the comparison takes place the following information shall be removed from the destination address information:

- Operator specific service selection information that is recognised and treated locally in the serving entity. This shall not lead to a change of the type of number indicator of the address information.

- Carrier selection information. If the removal of carrier selection information also removes international or national (trunk) prefixes (depending on regulatory requirements), then the type of number indicator of the address information shall be changed to "international number" or "national (significant) number" respectively. Otherwise the type of number indicator shall remain unchanged.

The address information in a subsequent Initial DP message at DP Analysed_Info shall not contain the removed information, however in the further call handling the serving entity shall invoke the requested services (e.g. carrier selection).

4.2.1.2.2.3 Number comparison

The following procedure shall be performed for the comparison of the destination number triggering criterion and the address information in the given order.

1. The numbering plan indicators of both numbers are ignored.

2. The type of number/nature of address indicators of both numbers are compared. If there is a match of the type of number indicator, then the check shall be performed by comparing the digits as defined in step 6. If there is no match of the type of number the comparison procedure shall continue as follows.

3. If there are other type of number/nature of address indicators present than "unknown", "national (significant) number" or "international number" then the destination number does not match the destination number triggering criterion. Otherwise the comparison procedure shall continue as follows.

4. If there is a number with type of number/nature of address "unknown" this number shall be translated based on the numbering plan of the serving entity in either of the following ways:

   - if the leading digits refer to an international prefix, those digits shall be removed and the type of number/nature of address shall be set to "international number".

   - if the leading digits refer to a national (trunk) prefix, those digits shall be removed and the type of number/nature of address shall be set to "national (significant) number".

   If the leading digits refer neither to an international prefix nor to a national (trunk) prefix, then the destination number does not match the destination number triggering criterion.

   If there is a match of the type of number/nature of address indicator after this number modification, then the check shall be performed by comparing the digits as defined in step 6, otherwise the comparison procedure shall continue as follows.

5. If there is a number with type of number/nature of address "national (significant) number" this number shall be translated based on the numbering plan of the serving entity to international format by adding the country code of the serving entity to the number string. After this modification both numbers shall be in international format and shall be checked by comparing the digits as defined in step 6.

6   If the number digits of the address information are compared with the number digits of the destination number triggering criterion, then there is a match if:

-    the destination number is at least as long as the destination number string of the destination number triggering criterion, and

-    all the digits in the destination number string of the destination number triggering criterion match the leading digits of the destination number.

The check described in this clause shall be repeated for every number contained in the destination number triggering criterion of the D-CSI until a match is recognised and DP Analysed_Info is triggered, or until all the destination numbers have been checked without a match being recognised. In the latter case DP Analysed_Info is not triggered.

The procedures for the destination number triggering criterion check for the N-CSI are network specific.

The modifications of the address information described in this clause shall be only be done for comparison purposes, i.e. they shall not affect the format of the destination address information sent in the Initial DP message.

4.2.1.2.3   Criteria at DP Route_Select_Failure

The HLR may store a list of up to 5 cause values.

The criteria for a mobile originating call are checked in the originating MSC. The criteria for a mobile forwarded call are checked in the forwarding MSC.

For early forwarded calls in the GMSC, the HLR shall always include the trigger criteria in the subscriber data sent to the GMSC. Reason is that the cause code received from ISUP is used in the trigger criteria check. The cause code is not known at the time of sending the O-CSI to the GMSC.

For optimally routed late forwarded calls, the MSC shall always include the trigger criteria in the RCH message sent to the GMSC. Reason is that the cause code received from ISUP is used in the trigger criteria check. The cause code is not known at the time of sending the O-CSI to the GMSC.

The following criteria are applicable for DP Route_Select_Failure:

-    Release cause code.

The trigger criteria are met if the cause code received from ISUP is equal to at least one of the cause codes in the trigger criteria list.

If a O-BCSM was already invoked and there is a relationship with the gsmSCF at that moment, then no additional relationship shall be initiated.

4.2.1.2.4   Criteria at DP Terminating_Attempt_Authorised

The HLR may store a list of up to 5 basic service codes, each of which may represent an individual basic service or a basic service group. Compound basic service group codes, as defined in 3GPP TS 29.002 [4], are not allowed for conditional triggering. This list is a triggering list.

The criteria for DP Terminating_Attempt_Authorised are checked in the HLR for the GMSC or in the VLR for the MSC. The HLR shall include the information for this TDP in the CAMEL subscription information sent to the GMSC only if the criteria are met. The VLR shall include the information for this TDP in the CAMEL subscription information sent to the MSC only if the criteria are met.

The basic service criterion is met if the basic service for the call matches a stored individual basic service code or is a member of the group defined by a stored basic service group code. For the purpose of this paragraph a general bearer service is a member of the corresponding bearer service group.

4.2.1.2.5   Criteria at DP T_Busy and T_No_Answer

The HLR may store a list of up to 5 cause values.

The criteria for a mobile terminating call are checked in the GMSC or in MSC.

For mobile terminating calls in the GMSC, the HLR shall include the trigger criteria in the subscriber data sent to the GMSC. Reason is that the cause code received from ISUP is used in the trigger criteria check. The cause code is not known at the time of sending the T-CSI to the GMSC.
If SRI-Ack includes the Not Reachable FTN, then HLR may decide not to include the trigger criteria, if the HLR has identified that T-CSI includes DP T_Busy with cause code Not Reachable.

If SRI-Ack includes the Not Reachable FTN and also T-CSI, including DP T_Busy with cause code, then the not reachable condition shall be mapped to an ISUP release code, which shall be used for triggering check.

For Mobile terminating calls in the VMSC, the trigger criteria are received in the VT-CSI from the HLR in Insert Subscriber Data IF. The triggering is based on the ISUP release cause code (call set up result).

The following criteria are applicable for DP T_Busy and T_No_Answer:

- Release cause code.

The trigger criteria are met if the cause code received from ISUP or MAP is equal to at least one of the cause codes in the trigger criteria list.

If trigger criteria are satisfied, either in GMSC or VMSC, then the corresponding Service Logic shall be invoked.
If a T-BCSM was already invoked and there is a relationship with the gsmSCF at that moment, then no additional relationship shall be initiated.

When a RCH message is received in the GMSC and the subscriber has T-CSI then the forwarding reason in the RCH message shall be used to perform trigger criteria check for DP T_Busy or DP T_No_Answer. If a match is found, then the corresponding Service Logic shall be invoked.
If a T-BCSM was already invoked and there is a relationship with the gsmSCF at that moment, then no additional relationship shall be initiated.

Table 4.1: Mapping of Send Info For Incoming Call (SIFIC) response, Send Routeing Info Ack (SRI-Ack) or Resume Call Handling (RCH) to ISUP release causes for triggering criteria check

SIFIC response / SRI-Ack / RCH "forwarding reason"	ISUP release cause number	ISUP release cause name
MS not reachable	20	Subscriber absent
MS Busy	17	User busy
Call deflection (note)	21	Call rejected
No reply	19	No answer from user (user alerted)
NOTE: Call Deflection is used only in the RCH operation, and in the Visited MSC. The same code point in the SIFIC response indicates CFU. However, the CFU invocation in the GMSC triggers in the Terminating_Attempt_Authorised DP; thus the reason code mapping is not needed in the CFU case.		

4.2.1.3 Relationship

Given that an armed DP was encountered, the gsmSSF provides an information flow via the already established relationship with the gsmSCF.

A relationship between the gsmSSF and the gsmSCF for the purpose of operator specific service processing is considered to be a CAMEL relationship. There are two types of CAMEL relationships:

- A CAMEL control relationship if the gsmSCF is able to influence the call processing via the relationship.

- A CAMEL monitor relationship if the gsmSCF is not able to influence the call processing via the relationship.

4.2.2 DP processing rules

The gsmSSF shall apply the following set of rules during DP processing to ensure a single point of control:

- EDPs are disarmed by the gsmSSF as they are encountered and reported to the gsmSCF, when the occurrence of another EDP causes the implicit disarming of the EDP or when the leg clears.

- A control relationship persists as long as there is 1 or more EDP-R armed for this portion of the call or if the gsmSSF is in any state except Monitoring or Idle.

- A control relationship changes to a monitor relationship if the control relationship does not persist and:

  - 1 or more EDP-N armed; or

  - 1 or more Call information Report outstanding; or

  - an Apply Charging Report outstanding.

- A control relationship terminates if it does not persist and does not change to a monitor relationship. A monitor relationship terminates if there are neither EDP-Ns armed nor reports outstanding or if the call clears.

4.3 Description of CAMEL Subscriber Data

4.3.1 Originating CAMEL Subscription Information (O-CSI)

This clause defines the contents of the Originating CAMEL Subscription Information.

4.3.1.1 TDP List

The TDP List indicates on which detection point triggering shall take place.

The following trigger detection points are possible: DP Collected_Info and DP Route_Select_Failure.

4.3.1.2 gsmSCF address

Address to be used to access the gsmSCF for a particular subscriber. The address shall be an E.164 number to be used for routeing. Different gsmSCF addresses may be associated to different TDPs.

4.3.1.3 Service Key

The Service Key identifies to the gsmSCF the service logic. Different Service Keys may be associated to different TDPs.

4.3.1.4 Default Call Handling

The Default Call Handling indicates whether the call shall be released or continued as requested in case of error in the gsmSSF to gsmSCF dialogue or in case the call is submitted to call gapping in the gsmSSF. A default call handling shall be associated to each Service Key.

4.3.1.5 DP criteria

The DP criteria indicate whether the gsmSSF shall request the gsmSCF for instructions.

4.3.1.6 CAMEL Capability Handling

CAMEL Capability Handling indicates the phase of CAMEL which is asked by the gsmSCF for the service.

The HLR shall not include in a CSI which it sends to a VLR or GMSC any data for a CAMEL phase later than that which the CAMEL capability handling indicates. E.g. if the CAMEL Capability Handling indicates CAMEL phase 1 then the HLR shall not send triggering criteria to the VLR. Different CSIs may contain different values of CAMEL Capability Handling.

NOTE: If CAMEL is not supported or if a lower phase of CAMEL is supported in the VLR, the HLR can decide on a subscriber basis to apply ODB, perform normal call handling or perform operator specific handling (eventually support of a lower version of CSI).

4.3.1.7 CSI state

The CSI state indicates whether the O-CSI is active or not.

4.3.1.8 Notification flag

The notification flag indicates whether the change of the O-CSI shall trigger Notification on Change of Subscriber Data.

4.3.2 Dialled Service CAMEL Subscription Information (D-CSI)

This clause defines the contents of the Dialled Service CAMEL Subscription Information.

4.3.2.1 DP criteria

The DP criteria indicate whether the gsmSSF shall request the gsmSCF for instructions.

4.3.2.2 gsmSCF address

Address to be used to access the gsmSCF for a particular subscriber. The address shall be an E.164 number to be used for routeing.

For the D-CSI a gsmSCF address shall be associated to each DP criterion.

4.3.2.3 Service Key

The Service Key identifies to the gsmSCF the service logic.

For the D-CSI a Service Key shall be associated to each DP criteria.

4.3.2.4 Default Call Handling

The Default Call Handling indicates whether the call shall be released or continued as requested in case of error in the gsmSSF to gsmSCF dialogue or in case the call is submitted to call gapping in the gsmSSF. A default call handling shall be associated to each DP criteria.

4.3.2.5 CAMEL Capability Handling

CAMEL Capability Handling indicates the phase of CAMEL which is asked by the gsmSCF for the service. It shall indicate CAMEL phase 3.

NOTE: If CAMEL is not supported or if a lower phase of CAMEL is supported in the VLR, the HLR can decide on a subscriber basis to apply ODB, perform normal call handling or perform operator specific handling (eventually support of a lower version of CSI).

4.3.2.6 CSI state

The CSI state indicates whether the D-CSI is active or not.

4.3.2.7 Notification flag

The notification flag indicates whether changes of the D-CSI shall trigger the Notification on Change of Subscriber Data.

4.3.3 Network Service CAMEL Subscription Information (N-CSI)

The N-CSI identifies services offered on a per-network basis by the serving PLMN operator for all subscribers. This CSI shall be stored in MSC.

4.3.4 Terminating CAMEL Subscription Information (in the GMSC) (T-CSI)

This clause defines the contents of the Terminating CAMEL Subscription Information.

4.3.4.1 TDP List

The TDP List indicates on which detection point triggering shall take place.

The following trigger detection points are possible: DP Terminating_Attempt_Authorised, DP T_Busy, and DP T_No_Answer.

4.3.4.2 gsmSCF address

Address to be used to access the gsmSCF for a particular subscriber. The address shall be an E.164 number to be used for routeing. Different gsmSCF addresses may be associated to different TDPs.

4.3.4.3 Service Key

The Service Key identifies to the gsmSCF the service logic. Different Service Keys may be associated to different TDPs.

4.3.4.4 Default Call Handling

The Default Call Handling indicates whether the call shall be released or continued as requested in case of error in the gsmSSF to gsmSCF dialogue or in case the call is submitted to call gapping in the gsmSSF. A default call handling shall be associated to each Service Key.

4.3.4.5 DP criteria

The DP criteria indicate whether the gsmSSF shall request the gsmSCF for instructions.

4.3.4.6 CAMEL Capability Handling

CAMEL Capability Handling indicates the phase of CAMEL which is asked by the gsmSCF for the service.

The HLR shall not include in a CSI which it sends to a GMSC any data for a CAMEL phase later than that which the CAMEL capability handling indicates. Different CSIs may contain different values of CAMEL Capability Handling.

> NOTE: If CAMEL is not supported or if a lower phase of CAMEL is supported in the GMSC, the HLR can decide on a subscriber basis to apply ODB, perform normal call handling or perform operator specific handling (e.g. support of a lower version of CSI).

4.3.4.7 CSI state

The CSI state indicates whether the T-CSI is active or not.

4.3.4.8 Notification flag

The notification flag indicates whether the change of the T-CSI shall trigger Notification on Change of Subscriber Data or not.

4.3.5 VMSC Terminating CAMEL Subscription Information (VT-CSI)

This clause defines the contents of the Terminating CAMEL Subscription Information for the VMSC.

4.3.5.1 TDP List

The TDP List indicates on which detection point triggering shall take place.

The following trigger detection points are possible: DP Terminating_Attempt_Authorised, DP T_Busy, and DP T_No_Answer.

4.3.5.2 gsmSCF address

Address to be used to access the gsmSCF for a particular subscriber. The address shall be an E.164 number to be used for routeing. Different gsmSCF addresses may be associated to different TDPs.

4.3.5.3 Service Key

The Service Key identifies to the gsmSCF the service logic. Different Service Keys may be associated to different TDPs.

4.3.5.4 Default Call Handling

The Default Call Handling indicates whether the call shall be released or continued as requested in case of error in the gsmSSF to gsmSCF dialogue or in case the call is submitted to call gapping in the gsmSSF. A default call handling shall be associated to each Service Key.

4.3.5.5 DP criteria

The DP criteria indicate whether the gsmSSF shall request the gsmSCF for instructions.

4.3.5.6 CAMEL Capability Handling

CAMEL Capability Handling indicates the phase of CAMEL which is asked by the gsmSCF for the service.

The HLR shall not include in a CSI which it sends to a VLR any data for a CAMEL phase later than that which the CAMEL capability handling indicates.

> NOTE: If CAMEL is not supported or if a lower phase of CAMEL is supported in the VLR, the HLR can decide on a subscriber basis to apply ODB, perform normal call handling or perform operator specific handling (eventually support of a lower version of CSI).

4.3.5.7 CSI state

The CSI state indicates whether the VT-CSI is active or not.

4.3.5.8 Notification flag

The notification flag indicates whether the change of the VT-CSI shall trigger Notification on Change of Subscriber Data or not.

4.3.6 Other CAMEL data

4.3.6.1 Location information/Subscriber state Interrogation

This data indicates whether additional subscriber information shall be sent to the GMSC as part of the terminating call handling.

- An indication that the HLR shall send the location information of the called subscriber.

- An indication that the HLR shall send the subscriber state of the called subscriber.

4.3.6.2 Translation Information Flag CAMEL Subscription Information (TIF-CSI)

4.3.6.2.1 Translation Information Flag

The TIF-CSI in the CAMEL Subscriber data indicates:

- when the subscriber registers a forwarded-to number, that the HLR shall not attempt to perform any translation, number format checks, prohibited FTN checks or call barring checks. (see 3GPP TS 23.082 [27]).

- when the subscriber invokes the Call Deflection supplementary service, that the VLR shall not attempt to perform any translation, number format checks, prohibited DTN checks, call barring checks. (see 3GPP TS 23.072 [35]).

4.3.6.2.2 Notification flag

The notification flag indicates whether the change of the TIF-CSI is notified to the gsmSCF or not.

4.3.6.3 gsmSCF address list for CSI

The gsmSCF address list for CSI indicates a list of gsmSCF addresses to which Notification on Change of Subscriber Data is to be sent. This list is common to all CSI.

4.4 Description of CAMEL BCSMs

4.4.1 General Handling

The BCSM is used to describe the actions in an MSC/GMSC/VMSC during originating, forwarded or terminating calls.

The BCSM identifies the points in basic call processing when Operator Specific Service (OSS) logic instances (accessed through the gsmSCF) are permitted to interact with basic call control capabilities.

Figure 4.2 shows the components that have been identified to describe a BCSM.

Transition

DP

Point In Call (PIC)
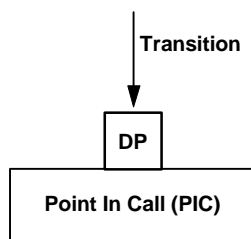
Figure 4.2: BCSM Components

4.4.2 Originating Basic Call State Model (O-BCSM)

4.4.2.1 Description of O-BCSM

The O-BCSM is used to describe the actions in an MSC during originating (MSC) or forwarded (MSC or GMSC) calls.

When encountering a DP the O-BCSM processing is suspended at the DP and the MSC/GMSC indicates this to the gsmSSF which determines what action, if any, shall be taken in case the DP is armed.

Figure 4.3: Originating BCSM for CAMEL
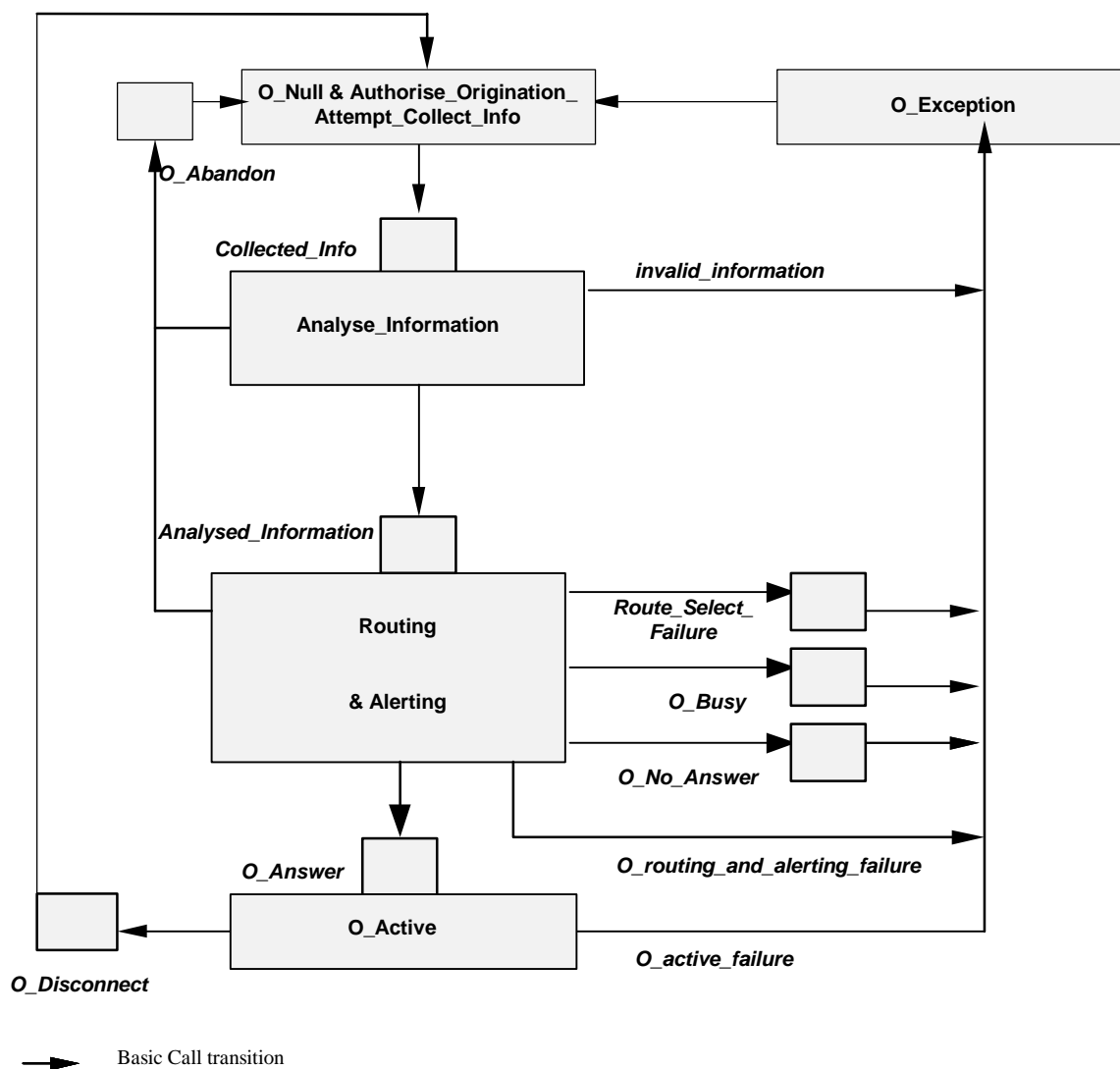
NOTE: The *O_Busy* DP includes also the 'not reachable' case.

The following table defines the different DPs which apply to mobile originating and forwarded calls.

Table 4.2: Description of O-BCSM DPs in the MSC

CAMEL Detection Point:	DP Type	Description:
DP Collected_Info	TDP-R	Indication that the O-CSI is analysed.
DP Analysed_Information	TDP-R (note 2)	Availability of routeing address and nature of address.
DP Route_Select_Failure	TDP-R (note 3), EDP-N, EDP-R	Indication that the call establishment failed.
DP O_Busy	EDP-N, EDP-R	Indication that: - a busy indication is received from the terminating party, - a not reachable event is determined upon a cause IE in the ISUP release message.
DP O_No_Answer	EDP-N, EDP-R	Indication that: - an application timer associated with the O_No_Answer DP expires, - a no answer event is determined upon a cause IE in the ISUP release message.
DP O_Answer	EDP-N, EDP-R	Indication that the call is accepted and answered by the terminating party.
DP O_Disconnect	EDP-N, EDP-R	A disconnect indication is received from the originating party or from the terminating party.
DP O_Abandon	EDP-N, EDP-R	Indication that a disconnect indication is received from the originating party during the call establishment procedure.
NOTE 1: The DPs are defined in ITU-T Recommendation Q.1224 [30]. NOTE 2: For TDP-R Analysed_Information new relationship to gsmSCF is opened. NOTE 3: DP Route_Select_Failure shall be reported as TDP-R when there is no relationship to gsmSCF. If a relationship to gsmSCF is already open, it shall be reported as EDP-R or EDP-N if armed so.		

4.4.2.1.1 Description of the call model (PICs)

This clause describes the call model for originating and forwarded calls. For each PIC a description can be found of the entry events, functions and exit events.

It should be noted that although the names used for PICs match those used in ITU-T Recommendation Q.1224 [30] the specific descriptions differ.

4.4.2.1.1.1 O_Null & Authorise_Origination_Attempt_Collect_Info

Entry events:

- Disconnection and clearing of a previous call (DP O_Disconnect) or default handling of exceptions by gsmSSF/(G)MSC completed.

- Abandon event is reported from Analyse_Information or Routing and Alerting PIC.

- Exception event is reported.

Actions:

- Interface is idled.

- Originating call: SETUP message containing the dialled number is received from MS.

- Originating call: The supplementary service "barring of all outgoing calls" is checked and invoked if necessary.

- Originating call: The ODB category "barring of all outgoing calls" is checked and ODB is invoked if necessary.

  NOTE: the ODB category "barring of all outgoing calls when roaming" causes the HLR to send the category "barring of all outgoing call" if the VLR is not in the HPLMN.

- Originating call: CUG checks done in the originating MSC/VLR are performed.

- Information being analysed e.g., O-CSI is analysed.

Exit events:

- Originating CSI is analysed.

- An exception condition is encountered. For this PIC, if the call encounters one of these exceptions during the PIC processing, the exception event is not visible because there is no corresponding DP. Example exception condition: Calling party abandons call.

4.4.2.1.1.2 Analyse_Information

Entry events:

- Originating CSI is analysed. (DP Collected Info).

- New routeing information is received when Busy event (DP O_Busy), Route Select Failure event (DP Route_Select_Failure), Not Reachable event (DP O_Busy) or No Answer event (DP O_No_Answer) is reported from Routing and Alerting PIC.

- New routeing information is received when Disconnect event is reported from O_Active PIC.

Actions:

- Compare the called party number with the dialled services information.

Exit events:

- Availability of routeing address and nature of address. (DP Analysed_Information).

- An exception condition is encountered (e.g. wrong number)- this leads to the O_Exception PIC.

- Calling party abandons the call- this leads to the O_Abandon DP.

4.4.2.1.1.3 Routing & Alerting

Entry events:

- Availability of routeing address and nature of address. (DP Analysed_Information).

Actions:

- Information is being analysed and/or translated according to dialling plan to determine routeing address.

- Routeing address being interpreted.

- Originating call: Outgoing barring services and ODB categories not already applied are checked and invoked if necessary.

- Call is being processed by the terminating half BCSM. Continued processing of call setup (e.g., ringing) is taking place. Waiting for indication from terminating half BCSM that the call has been answered by terminating party.

Exit events:

- Indication from the terminating half BCSM that the call is accepted and answered by terminating party. (DP O_Answer)

- An exception condition is encountered - this leads to the O_Exception PIC.

- Calling party abandons the call- this leads to the O_Abandon DP.

- A busy indication is received from the terminating party - this leads to the O_Busy DP.

- A not reachable indication is received from the terminating party - this leads to the O_Busy DP.

- Attempt to select the route for the call fails - this leads to the Route_Select_Failure DP.

- If the no reply timer expires and DP O_No_Answer is armed - this leads to the O_No_Answer DP.

4.4.2.1.1.4 O_Active

Entry events:

- Indication from the terminating half BCSM that the call is accepted and answered by the terminating party. (DP O_Answer)

Actions:

- Connection established between originating party and terminating party. Call supervision is provided.

- Call release is awaited.

Exit events:

- A disconnection indication is received from the originating party, or received from the terminating party via the terminating half BCSM. (DP - O_Disconnect).

- An exception condition is encountered.

4.4.2.1.1.5 O_Exception

Entry events:

- An exception condition is encountered. In addition to specific examples listed above, exception events include any type of failure, which means that the normal exit events for a PIC can not be met.

Actions:

- Default handling of the exception condition is being provided. This includes general actions necessary to ensure that no resources remain inappropriately allocated such as:

    - If any relationship exists between the gsmSSF and the gsmSCF, the gsmSSF shall send an error information flow closing the relationships and indicating that any outstanding call handling instructions will not run to completion.

    - The (G)MSC/gsmSSF should make use of vendor-specific procedures to ensure release of resources within the (G)MSC/gsmSSF, so that line, trunk and other resources are made available for new calls.

Exit events:

- Default handling of the exception condition by gsmSSF/(G)MSC completed.

4.4.3 Terminating Basic Call State Model (T-BCSM)

4.4.3.1 Description of T-BCSM

The T-BCSM is used to describe the actions in a GMSC and in a VMSC during terminating calls.

When encountering a DP the T-BCSM processing is suspended at the DP and the GMSC / VMSC indicates this to the gsmSSF which determines what action, if any, shall be taken in case the DP is armed.
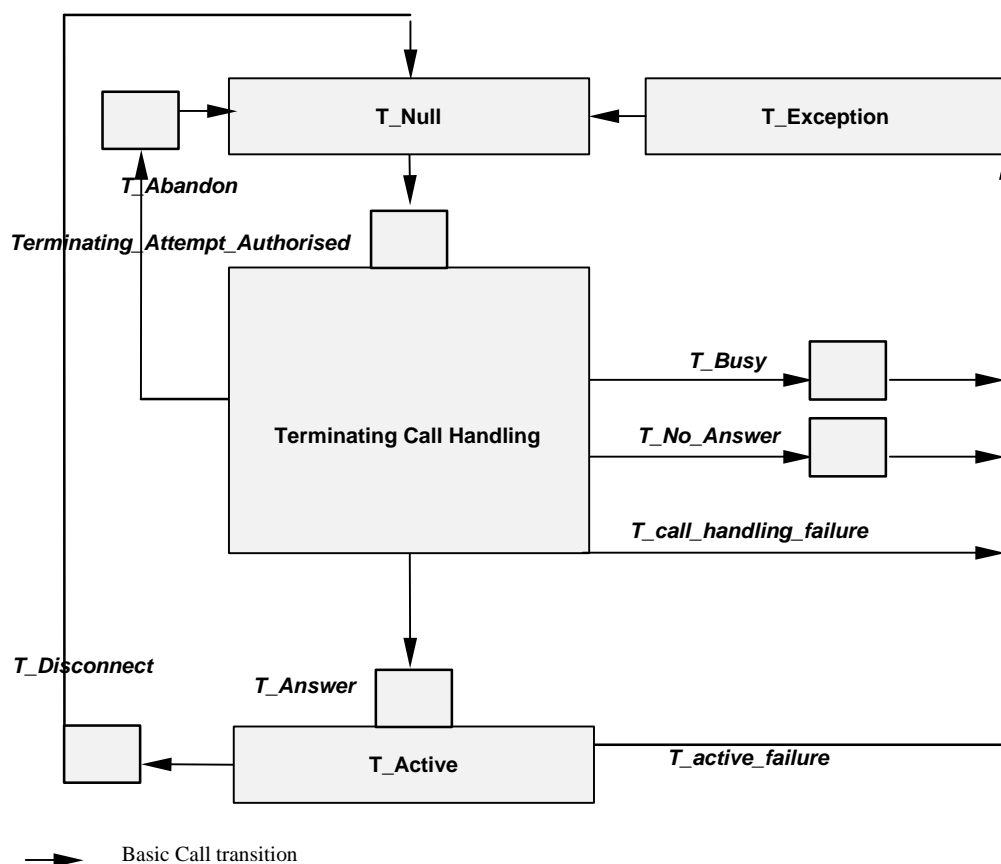
Figure 4.4: T-BCSM in the GMSC / VMSC

In the following table the different DPs (in the T-BCSM) are described.

Table 4.3: Description of T-BCSM DPs in the GMSC / VMSC

CAMEL Detection Point:	DP Type	Description:
DP Terminating_Attempt_ Authorised	TDP-R	Indication that the T-CSI / VT_CSI is analysed.
DP T_Busy	TDP-R (note 2), EDP-N, EDP-R	Indication that: - a busy indication is received from the destination exchange, - Busy event is determined in the visited MSC, - Not reachable or call establishment failure event is determined from the HLR response or upon a cause IE in the ISUP release message.
DP T_No_Answer	TDP-R (note 2), EDP-N, EDP-R	Indication that an application timer associated with the T_No_Answer DP expires.
DP T_Answer	EDP-N, EDP-R	Call is accepted and answered by terminating party.
DP T_Disconnect	EDP-N, EDP-R	A disconnect indication is received from the terminating party or from the originating party.
DP T_Abandon	EDP-N, EDP-R	A disconnect indication is received from the originating party during the call establishment procedure.
NOTE 1: The DPs are defined in ITU-T Recommendation Q.1224 [30]. NOTE 2: DP T_No_Answer and DP T_Busy shall be reported as TDP-R when there is no relationship to gsmSCF. If a relationship to gsmSCF is already open, it shall be reported as EDP-R or EDP-N if armed so.		

4.4.3.1.1 Description of the call model (PICs)

This clause describes the call model for terminating calls in the GMSC and in the VMSC. For each PIC a description can be found of the entry events, functions, information available and exit events.

It should be noted that although the names used for PICs match those used in ITU-T Recommendation Q.1224 [30] the specific descriptions differ.

4.4.3.1.1.1 T_Null

Entry events:

- Disconnection and clearing of a previous call (DP T_Disconnect) or default handling of exceptions by gsmSSF / GMSC / VMSC completed.

- Abandon event is reported from Terminating Call Handling PIC.

- Exception event is reported.

Actions:

- Interface is idled.

- ISUP_IAM is received, the appropriate information is analysed.

- Send_Routeing_Info information flow is sent to HLR in case of GMSC.

- Send_Info_For_Incoming_Call information flow is sent to VLR in case of VMSC.

- In case of GMSC:

    - The supplementary services "barring of all incoming calls" and "barring of incoming calls when roaming" are checked and invoked if necessary.

    - The ODB categories "barring of all incoming calls" and "barring of incoming calls when roaming" are checked and ODB is invoked if necessary.

    - The supplementary service "CUG" is checked and invoked if necessary.

- T-CSI/VT-CSI is received and analysed.

Exit events:

- Response is received from HLR / VLR and terminating CSI (if available) is analysed.

- An exception condition is encountered. For this PIC, if the call encounters one of these exceptions during the PIC processing, the exception event is not visible because there is no corresponding DP.

    Example exception condition is:

    - Calling party abandons call.

4.4.3.1.1.2 Terminating Call Handling

Entry events:

- Response is received from HLR / VLR and terminating CSI (if available) is analysed.
  (DP Terminating_Attempt_Authorised).

- New routeing information is received when Busy event (DP T_Busy) or No Answer event (DP T_No_Answer) is reported from Terminating Call Handling PIC.

- New routeing information is received when Disconnect event is reported from T_Active PIC.

- New routeing information is received when the terminating party not reachable is reported from Terminating Call Handling PIC.

- NOTE: The HLR may use MAP signalling to indicate to the GMSC before the call is extended to the destination VMSC that the terminating party is not reachable, or the destination VMSC may use telephony signalling to indicate to the GMSC after the call has been extended to the destination VMSC that the terminating party is not reachable.

Actions:

- The response from HLR / VLR is analysed.

- Routeing address and call type being interpreted. The next route or terminating access is being selected.

- The terminating party is being alerted. Waiting for the call to be answered by terminating party.

- The GSM supplementary service call forwarding is invoked if necessary.

Exit events:

- Call is accepted and answered by terminating party.

- An exception condition is encountered - this leads to the T_Exception PIC. Example exception conditions: the call setup to the MSC/GMSC was not successful.

- Calling party abandons the call - this leads to the T_Abandon DP.

- The terminating access is busy in the VMSC or a busy indication is received from the destination exchange in the GMSC - this leads to the T_Busy DP.

- Not reachable event detected or failure of attempt to select the route for the terminating leg in GMSC or the MS cannot be reached in the VMSC - this leads to the T_Busy DP.

- If no reply timer expires and DP T_No_Answer is armed - this leads to the T_No_Answer DP.

4.4.3.1.1.3 T_Active

Entry events:

- Indication that the call is accepted and answered by the terminating party. (DP T_Answer).

Actions:

- Connection established between originating party and terminating party. Call supervision is being provided.

- Call release is awaited.

Exit events:

- A disconnection indication is received from the terminating party, or received from the originating party via the originating half BCSM. (DP T_Disconnect).

- An exception condition is encountered. In addition to specific examples listed above, exception events include any type of failure that means that the normal exit events for a PIC can not be met.

4.4.3.1.1.4 T_Exception

Entry events:

- An exception condition is encountered. In addition to specific examples listed above, exception events include any type of failure, which means that the normal exit events for PIC cannot be met.

Actions:

- Default handling of the exception condition is being provided. This includes general actions necessary to ensure that no resources remain inappropriately allocated such as:

  - If any relationship exists between the gsmSSF and the gsmSCF, the gsmSSF shall send an error information flow closing the relationships and indicating that any outstanding call handling instructions will not run to completion.

  - The GMSC / VMSC / gsmSSF should make use of vendor-specific procedures to ensure release of resources within the GMSC / VMSC / gsmSSF, so that line, trunk and other resources are made available for new calls.

Exit events:

- Default handling of the exception condition by gsmSSF/GMSC completed.

4.4.4 Rules for Implicit Disarming of Event Detection Points'

The following tables give the rules for implicit disarming of event detection points.

Implicit EDP disarming rules are specified in the tables below for Originating BCSM and respectively Terminating BCSM. Each table specifies which EDPs shall be disarmed (i.e. MonitorMode set to Transparent) if/when each EDP is encountered, irrespective of the EDP's MonitorMode (Transparent, NotifyAndContinue, or Request).

When EDP's armed with MonitorMode 'Request' (EDP-R's) are encountered, any implicit EDP disarming shall take place before reporting the EDP and transiting the gsmSSF to the WFI state (if not already suspended in the WFI state).

If the BCSM has encountered DP O/T_Answer then an originator release must be detected as a DP O/T_Disconnect.

NOTE: The rules are designed for use in a Single Point of Control configuration and may require further enhancements if they were to be used in a Multiple Points of Control configuration. Enhancements to these rules in order to cover all aspects of MPC will have to be catered for in the next CAMEL Phase.

The table entry 'X' means that if one DP occurs (independently of arming and reporting to the gsmSCF) the marked one is implicitly disarmed.

It shall be possible to rearm explicitly an implicitly disarmed DP, e.g. for follow on call.

Table 4.4: Implicit disarmed DPs in the O-BCSM

Encountered DP	Implicit disarmed DPs						
	DP4	DP 5	DP 6	DP 7	DP 9 Leg1	DP 9 Leg2	DP 10
DP4 Route_Select_Failure	X	X	X	X		X	
DP5 O_Busy	X	X	X	X		X	
DP6 O_No_Answer	X	X	X	X		X	
DP7 O_Answer	X	X	X	X			X
DP9 O_Disconnect Leg1					X		X
DP9 O_Disconnect Leg2	X	X	X	X		X	
DP10 O_Abandon					X		X

Table 4.5: Implicit disarmed DPs in the T-BCSM

Encountered DP	Implicit disarmed DPs					
	DP 13	DP 14	DP 15	DP 17 Leg1	DP 17 Leg2	DP 18
DP13 T_Busy	X	X	X		X	
DP14 T_No_Answer	X	X	X		X	
DP15 T_Answer	X	X	X			X
DP17 T_Disconnect Leg1				X		X
DP17 T_Disconnect Leg2	X	X	X		X	
DP18 T_Abandon				X		X

4.4.5 BCSM Modelling of Call Scenarios

This clause describes how the BCSMs defined above are used to model GSM call scenarios. For each scenario the used and unused BCSMs involved in the call are shown.

In some cases these models may have an allocation to physical nodes different from that shown. However, the physical separation of the logic functions shown shall not impact the modelling. This clause describes the call scenarios without optimal routeing. If optimal routeing is invoked the physical configurations may be different from those shown, but the modelling is not changed.

CAMEL may be applied simultaneously and independently for each GSM subscriber involved in a call. This is not shown in these scenarios.

Subscribers other than those being served by CAMEL may be either PSTN subscribers, other GSM subscribers or any other addressable subscriber.

4.4.5.1 Mobile Originated Call

For the call from A to B, an instance of the O-BCSM will be created in the MSC (labelled "O(A-B)"). If the A-party has an active O-CSI or D-CSI, or the MSC has an active N-CSI, and the trigger criteria, if present, are fulfilled, then a CAMEL control relationship with gsmSCF(1) shall be established.
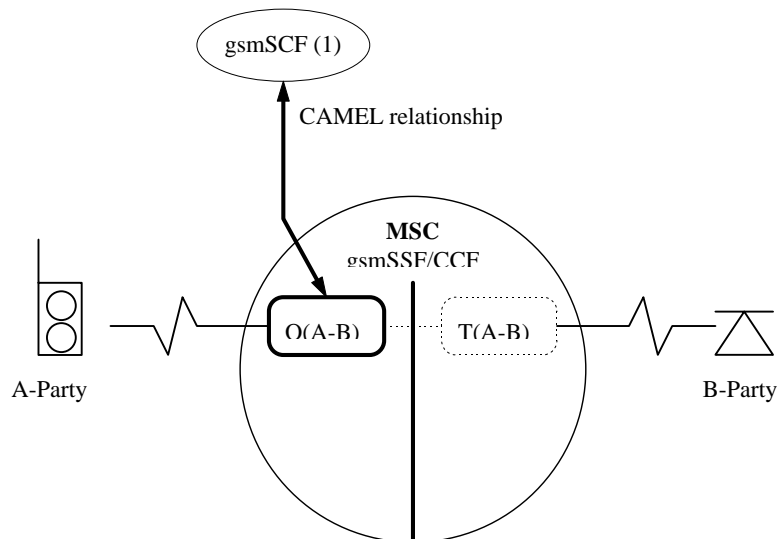
Figure 4.5: BCSM Scenario for Mobile Originated Call

4.4.5.2 Mobile Terminated Call at the GMSC / VMSC

For the call from A to B, an instance of the T-BCSM will be created in the GMSC (labelled "T(A-B)") and an instance of the T-BCSM will be created in the VMSC (labelled "T(A-B)").
If the B-party has an active T-CSI in the GMSC and the trigger criteria, if present, are fulfilled, then a CAMEL control relationship between the GMSC and the gsmSCF(1) shall be established. If the B-party has an active VT-CSI in the VMSC and the trigger criteria, if present, are fulfilled, then a CAMEL control relationship between the VMSC and the gsmSCF(2) shall be established.

The relationships with gsmSCF (1) and gsmSCF(2) may exist simultaneously. The two gsmSCF endpoints of the relationships are treated independently.

The nodes gsmSCF (1) and gsmSCF (2) may be the same or different entities.
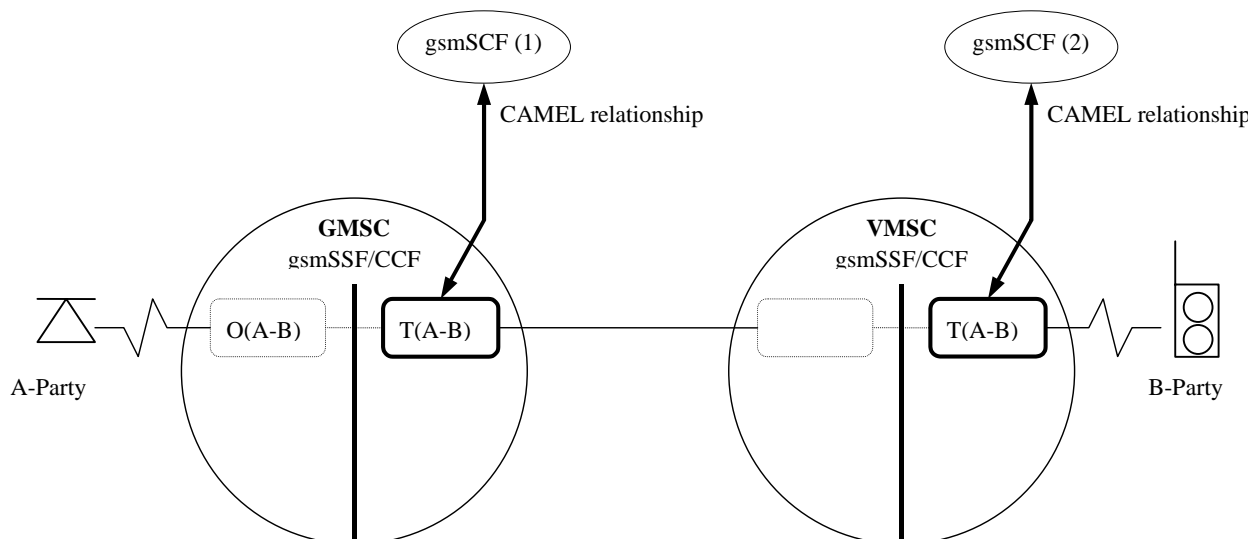
Figure 4.6: BCSM Scenario for Mobile Terminated Calls at the GMSC / VMSC

4.4.5.3 Call Forwarding at the GMSC / VMSC

If the B-party has an active T-CSI in the GMSC or VT-CSI in the VMSC and the trigger criteria, if present, are fulfilled, then a CAMEL control relationship between the GMSC or VMSC and the gsmSCF(1) shall be established.

Following processing at the GMSC / VMSC the call will be extended to the VMSC serving the B-party. This VMSC may be physically integrated with the GMSC.

A new call leg to a "C" party shall be created if:

- a GSM call forwarding or call deflection supplementary service forwards the call to C. An instance of the O-BCSM O(B-C) will be created for the forwarding leg. If the B-party has an active O-CSI or D-CSI in the GMSC or VMSC, or the GMSC or VMSC has an active N-CSI, and the trigger criteria, if present, are fulfilled, then a CAMEL control relationship between the GMSC or VMSC and the gsmSCF(2) shall be established; or

- a CAMEL service in a control relationship with T(A-B) performs a CAMEL-based call forwarding by using a Connect information flow. An instance of the O-BCSM O(B-C) will be created for the forwarding leg. If the B-party has an active O-CSI or D-CSI in the GMSC or VMSC, or the GMSC or VMSC has an active N-CSI, and the trigger criteria, if present, are fulfilled, then a CAMEL control relationship between the GMSC or VMSC and the gsmSCF(2) shall be established. The O-CSI shall be used for the forwarding leg only if the last Connect operation includes the "O-CSI applicable" flag.

The relationship with gsmSCF (1) and the relationship with gsmSCF(2) may exist simultaneously. The two relationships are treated independently at the GMSC. The instance of the BCSM T(A-B) and the instance of the BCSM O(B-C) are linked by an internal interface which is assumed to behave in a similar way to an ISUP interface.

The nodes gsmSCF (1) and gsmSCF (2) may be the same or different physical entities.
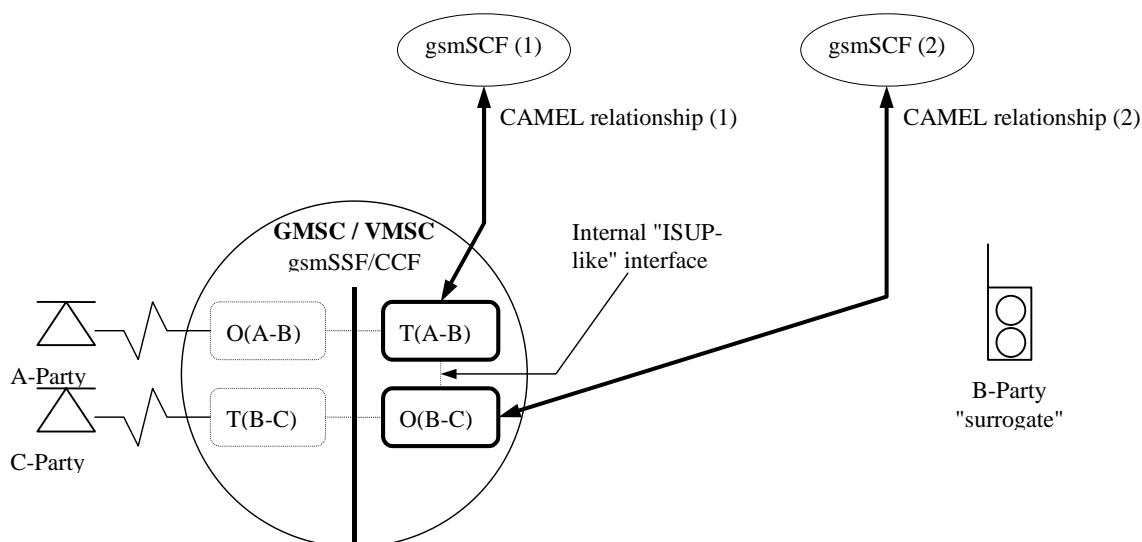
Figure 4.7: BCSM Scenario for Call Forwarding at the GMSC / VMSC

4.5 Procedures for CAMEL

The SDLs in the present document illustrate how CAMEL modifies the normal call handling. They do not attempt to show all the details of call handling in nodes that support CAMEL. Relevant parts of 3GPP TS 23.018 [3] apply in addition to these SDLs. For example, some inputs leading to unsuccessful call attempts are not shown on these diagrams - corresponding clauses in 3GPP TS 23.018 [3] apply.

Note that in some SDL processes and procedures the Release message may be sent on both an access interface and an inter-switch interface. If the message is sent on a UNI, its effect is the same as a Release transaction message.

The text in this clause is a supplement to the definition in the SDL diagrams; it does not duplicate the information in the SDL diagrams.

4.5.1 Overall SDL architecture

The following diagram shows the overall architecture for the SDL diagrams.
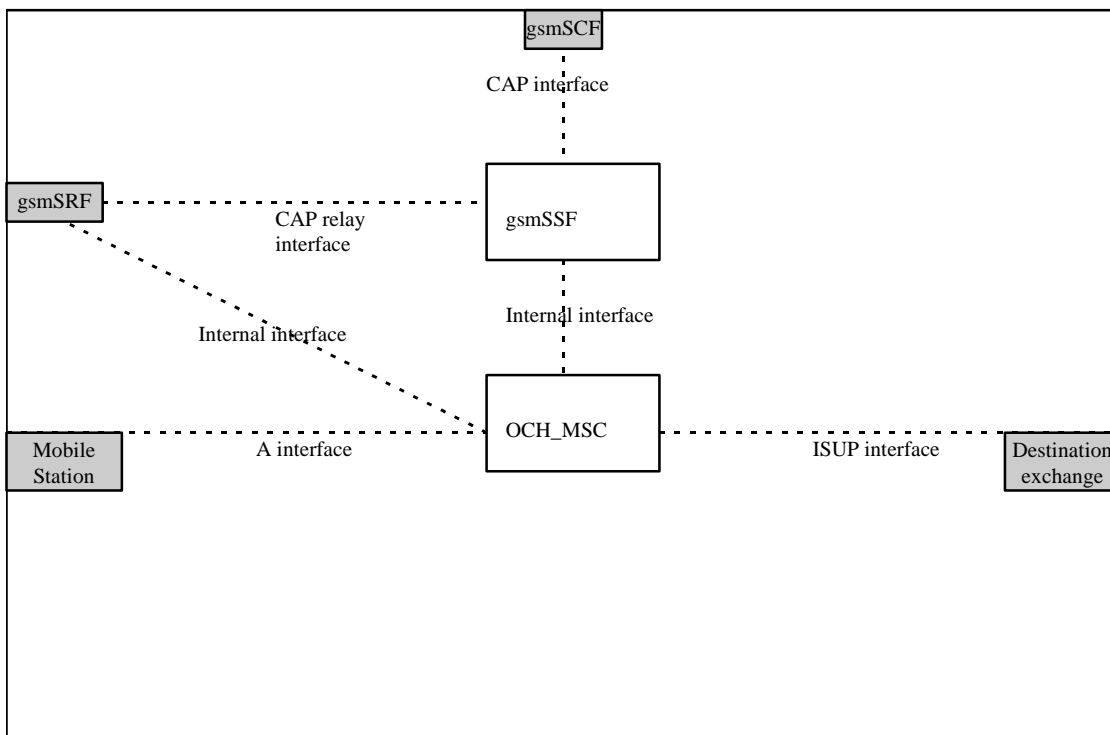
Figure 4.8a: Outgoing case (gsmSSF relay)
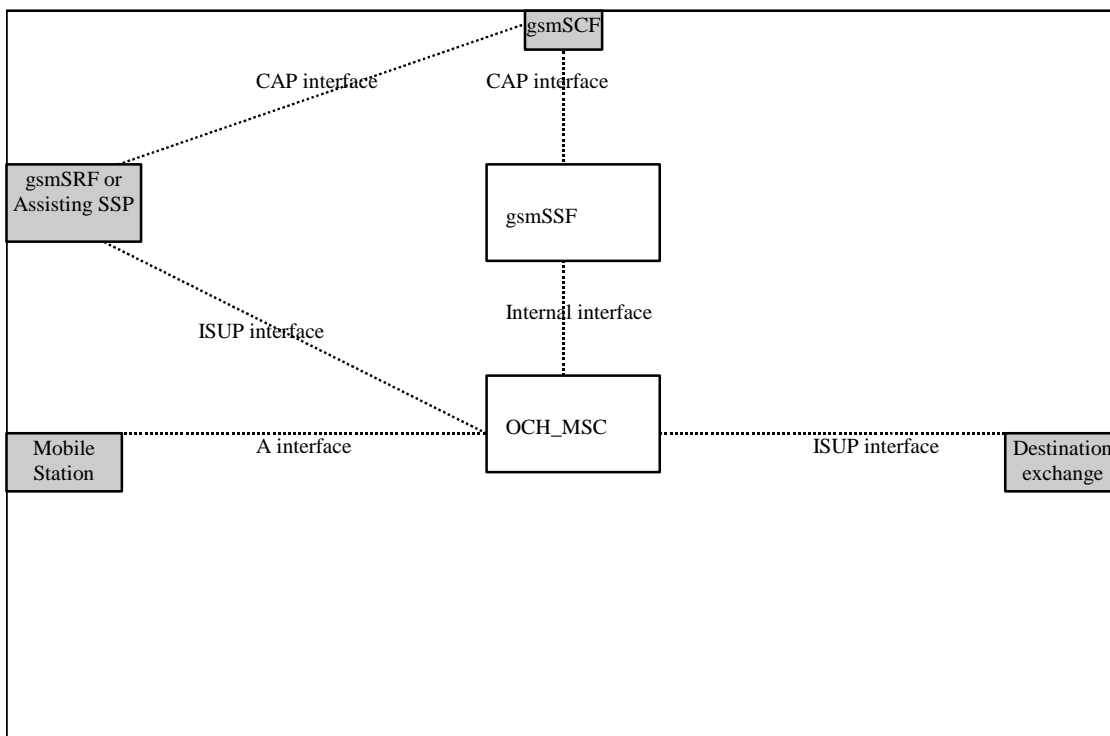
Figure 4.8b: Outgoing case (direct path gsmSCF to gsmSRF or assist with relay)
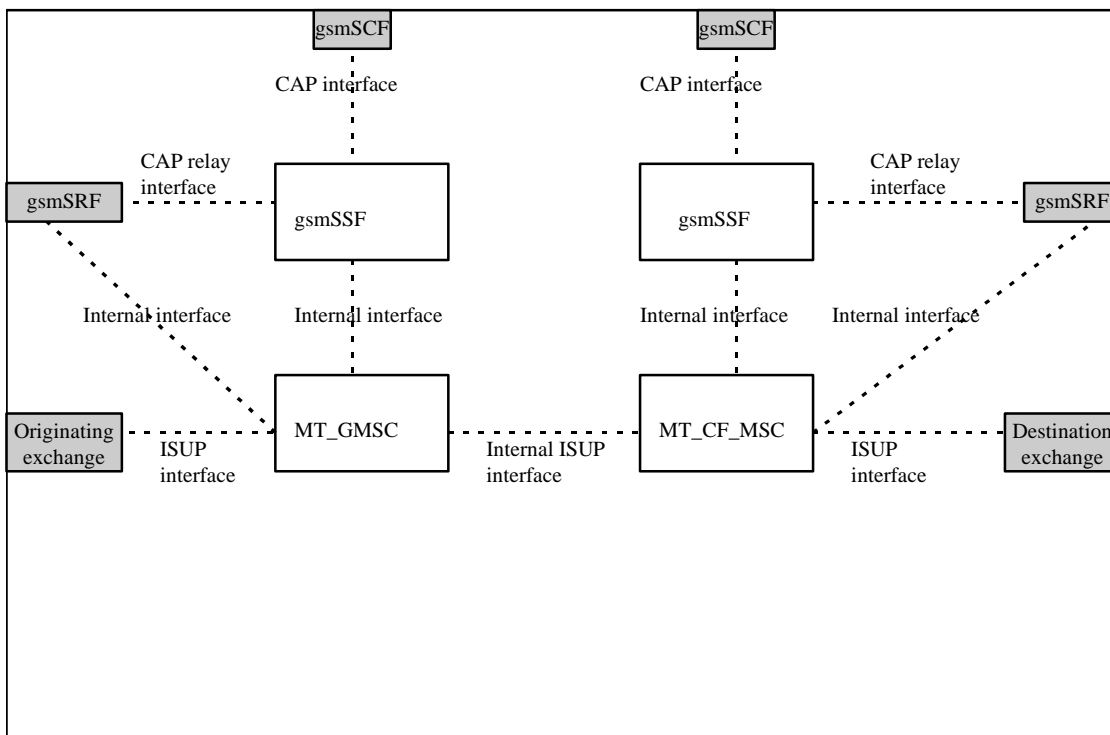
Figure 4.8c: Terminating GMSC case (gsmSSF relay)
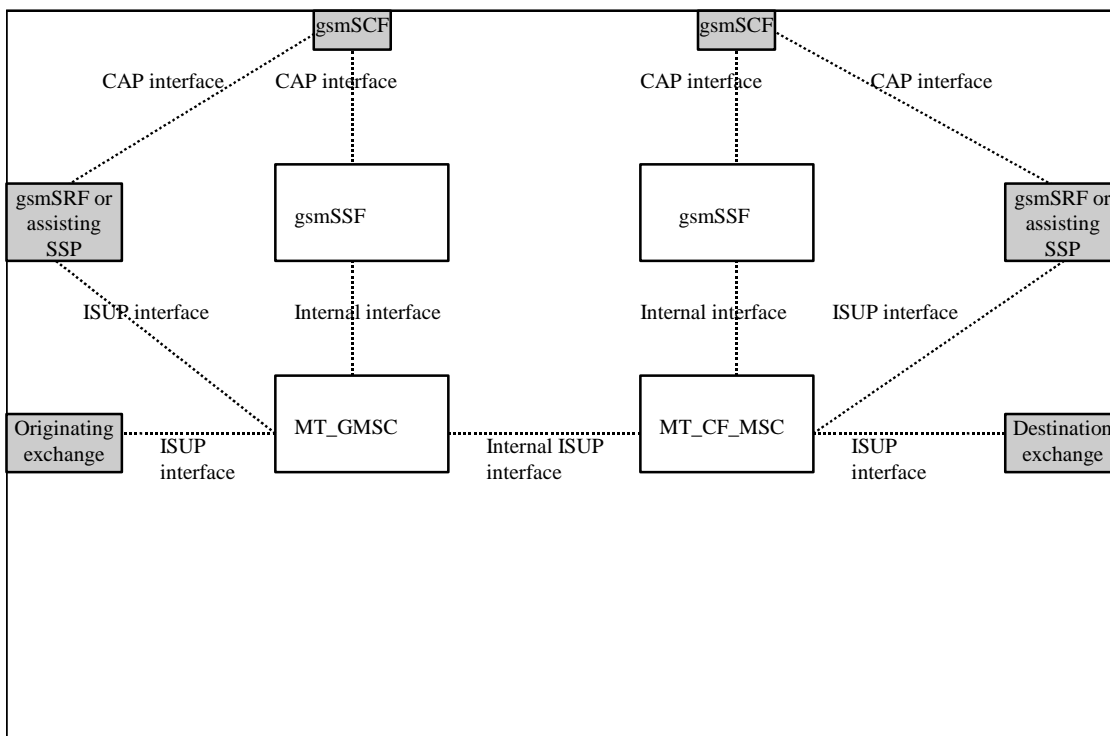
Figure 4.8d: Terminating GMSC case (direct path gsmSCF to gsmSRF or assist with relay)
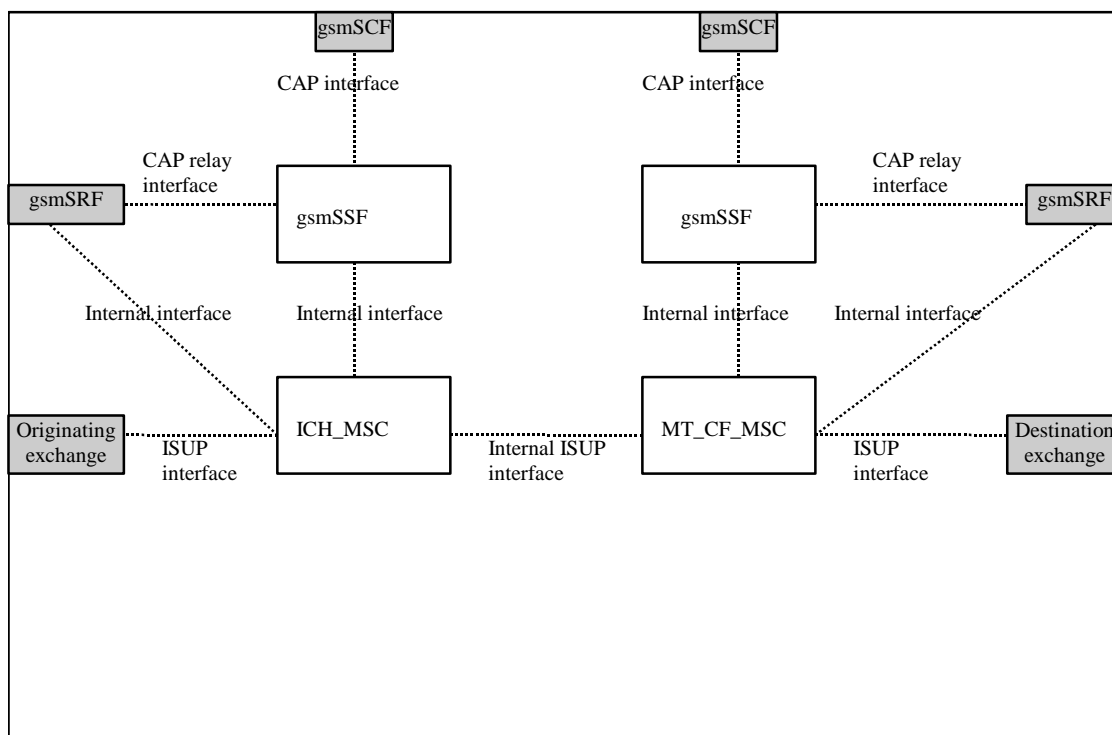
NOTE: The ICH_MSC may also be connected via an A interface to the terminating Mobile Station.

Figure 4.8e: Terminating VMSC case (gsmSSF relay)
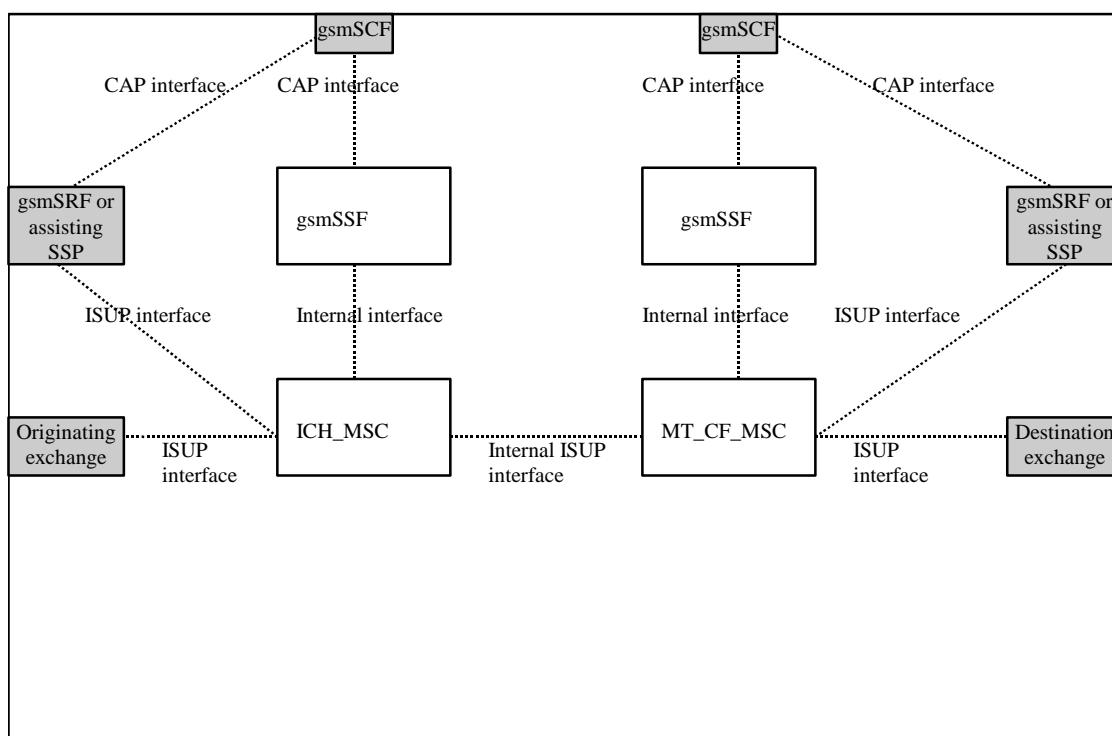
NOTE: The ICH_MSC may also be connected via an A interface to the terminating Mobile Station

Figure 4.8f: Terminating VMSC case (direct path gsmSCF to gsmSRF or assist with relay)
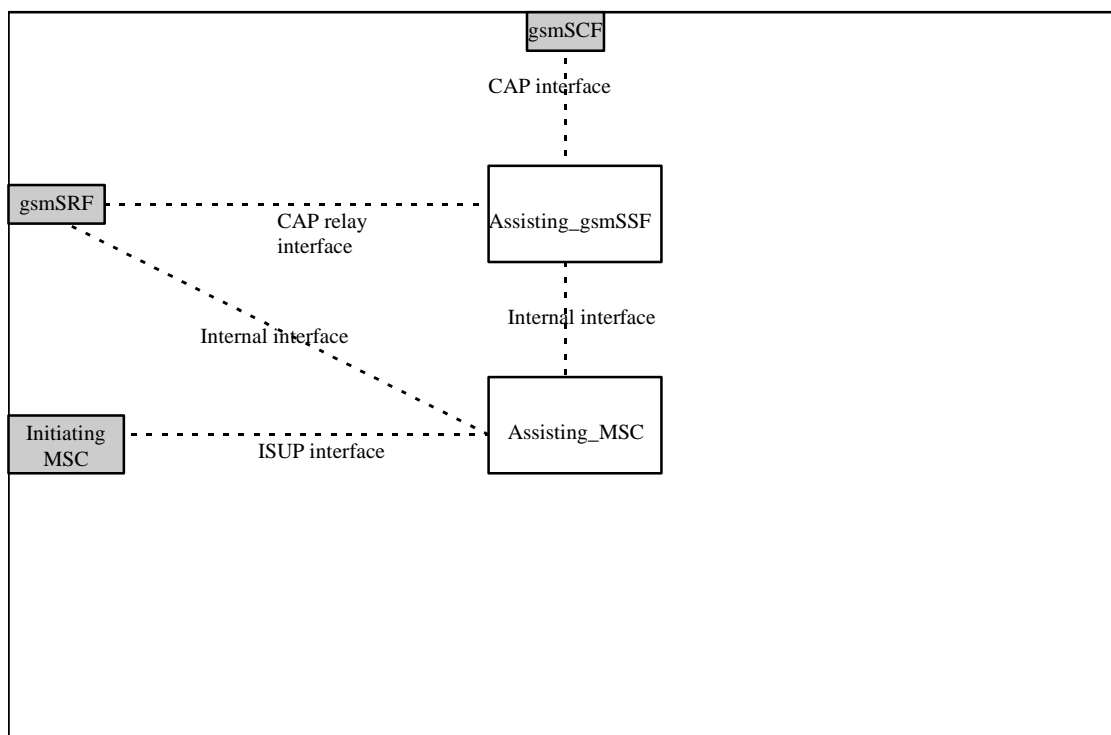
Figure 4.8g: Assisting case

4.5.2 Handling of mobile originated calls

4.5.2.1 Handling of mobile originated calls in the originating MSC

The functional behaviour of the originating VMSC is specified in 3GPP TS 23.018 [3]. The procedures specific to CAMEL are specified in this clause:

- Procedure CAMEL_OCH_MSC_INIT;

- Procedure CAMEL_OCH_MSC_ANSWER;

- Procedure CAMEL_OCH_MSC1;

- Procedure CAMEL_OCH_MSC2;

- Procedure CAMEL_OCH_MSC_DISC1;

- Procedure CAMEL_OCH_MSC_DISC2;

- Procedure CAMEL_OCH_MSC_DISC3;

- Procedure CAMEL_OCH_MSC_DISC4;

- Procedure CAMEL_OCH_ETC;

- Procedure CAMEL_OCH_CTR;

- Procedure CAMEL_Start_TNRy;

- Procedure CAMEL_Stop_TNRy;

- Procedure CAMEL_Store_Destination_Address;

- Procedure CAMEL_Modify_CUG_Info;

- Procedure CAMEL_N_CSI_CHECK_MSC.

NOTE: Procedure CAMEL_OCH_MSC_DISC3 applies to CAMEL Phase 1 only.

The procedure Send_Access_Connect_If_Required is specified in 3GPP TS 23.018 [3].

The following paragraphs give details on the behaviour of the MSC in the procedure CAMEL_OCH_MSC_INIT, CAMEL_OCH_ETC, CAMEL_OCH_ANSWER and CAMEL_Store_Destination_Address.

4.5.2.1.1 Actions of the MSC on receipt of Int_Error

The MSC checks the default Call Handling parameter in the relevant CSI.

If the default call handling is release call, a Release is sent to the MS and an Abort to the VLR. The MSC then releases all call resources and the procedure CAMEL_OCH_MSC_INIT ends.

If the default call handling is continue call, the MSC continues processing without CAMEL support. It sends Send_Info_For_Ougoing_Call to the VLR and waits in state Wait_For_MO_Call_Result.

4.5.2.1.2 Actions of the MSC on receipt of Int_Continue

The MSC continues processing without any modification of call parameters. At DP_Analysed_Information it sends Send_Info_For_Ougoing_Call to the VLR and waits in state Wait_For_MO_Call_Result.

4.5.2.1.3 Actions of the MSC on receipt of Int_Continue_With_Argument

The MSC continues processing with modified call parameters. The MSC shall replace the call parameters by the information received in the Int_Continue_With_Argument message. Call parameters which are not included in the Int_Continue_With_Argument message are unchanged.

Signalling limitations or regulatory requirements may require the Calling Party Category, Generic Number, Original Called Party Number and Redirecting Party ID to be ignored or modified.

4.5.2.1.4 Actions of the MSC on receipt of Int_Connect

The MSC continues processing with modified call parameters. The MSC shall transparently modify the call parameters with the received information. The MSC then sends a PROGRESS message to the MS. Call parameters which are not included in the Int_Connect message are unchanged.

Signalling limitations or regulatory requirements may require the Calling Party Category, Generic Number, Original Called Party Number and Redirecting Party ID to be ignored or modified.

The network signalling system shall indicate that this is an internal network number.

At DP_Collected_Information the MSC sets the O-CSI suppression parameter. If D-CSI and N-CSI are not present, the MSC sends a Send Info For Outgoing Call to the VLR and waits in state Wait_For_MO_Call_Result.

At DP_Analysed_Information it sets the D-CSI suppression parameter, sends a Send Info For Outgoing Call to the VLR and waits in state Wait_For_MO_Call_Result.

4.5.2.1.5 Actions of the MSC on receipt of Int_Release_Call

A Release is sent to the MS, an abort to the VLR and a Release is sent to the destination exchange. The release cause received in the Int_Release_Call is used. The MSC then releases all call resources and the procedure CAMEL_OCH_MSC_INIT ends.

4.5.2.1.6 Action of the MSC in procedure CAMEL_OCH_MSC_ANSWER

If the MSC received a destination address from the GMSC in the ISUP Answer or Connect message, the MSC relays the destination address to the gsmSSF in the Int_DP_O_Answer message.

NOTE 1: The sending of e-parameters by the gsmSCF after receiving the DP_O_Answer indication may be to late.

NOTE 2: If the MO call is not subject to Basic OR, then the destination address is generated by the MSC. If the MO call is subject to Basic OR, the MSC will receive a destination address from the GMSC in the ISUP answer or connect message.

4.5.2.1.7 Action of the MSC in procedure CAMEL_OCH_ETC

In procedure CAMEL_OCH_ETC (sheet 2) the MSC will remain in the Wait_For_Assisting_Answer state until it receives an ISUP Answer Message (ANM) or timeout occurs. This is to ensure that a call record is always generated for every successful establishment of a temporary connection to a gsmSRF, especially in the case where the connection is between PLMNs.

NOTE: This means that it may not be possible to access an SRF which does not generate an ISUP Answer Message (ANM).

If a Progress message is sent towards the MS the progress indicator shall indicate "In Band Information".

4.5.2.1.8 Action of the MSC in procedure CAMEL_Store_Destination_Address

The Int_Store_DA message carries the value of the global variable Destination address and the parameters OR and Forwarding received in the procedure call.

Procedure CAMEL_MO_Dialled_Services 1(2)

/* Procedure in the MSC to process CAMEL dialled services for mobile originated calls */

/* Signals to/from the left are to/from the BSS; signals to/from the right are to/from the VLR. */

1

CAMEL_SDS_MO_INIT

Fail   Result?   Abort

Pass

'Set D-CSI suppression'

CAMEL_NDS_MO_INIT

Fail   Result?   Abort

Pass

CAMEL_OCH_MSC1

Result= Reconnect?   Yes

No

Release transaction

Reconnect:= True

Result:= Pass

1

CAMEL_Invocation?   False

True

3   2

'Set O-CSI suppression'

Send Info For Outgoing Call

Wait_For MO_Call_Result
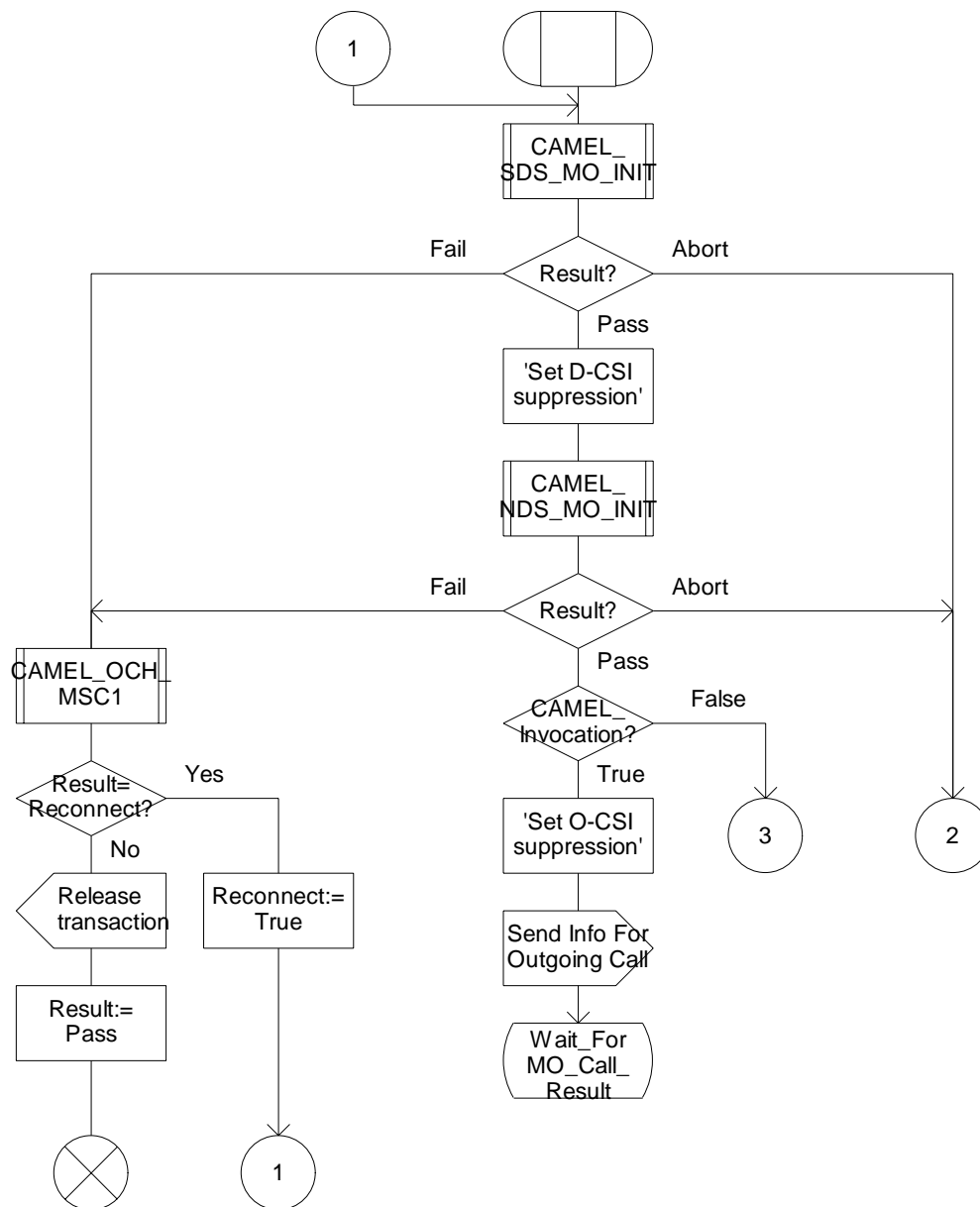
Figure 4.9a: Procedure CAMEL_MO_Dialled_Services (sheet 1)

Procedure CAMEL_MO_Dialled_Services   2(2)

/* Procedure in the MSC to process CAMEL dialled services for mobile originated calls */

/* Signals to/from the left are to/from the BSS; signals to/from the right are to/from the VLR. */

Wait_For MO_Call_ Result

3   Complete Call

Send Info For Outgoing Call_Negative Response

Release transaction   2

Int_O_Exception

Abort

'Destination address := Called Party Number'

Release transaction

CAMEL_OCH_ MSC_DISC4

Result:= Pass

Result:= Fail

Result:= Fail
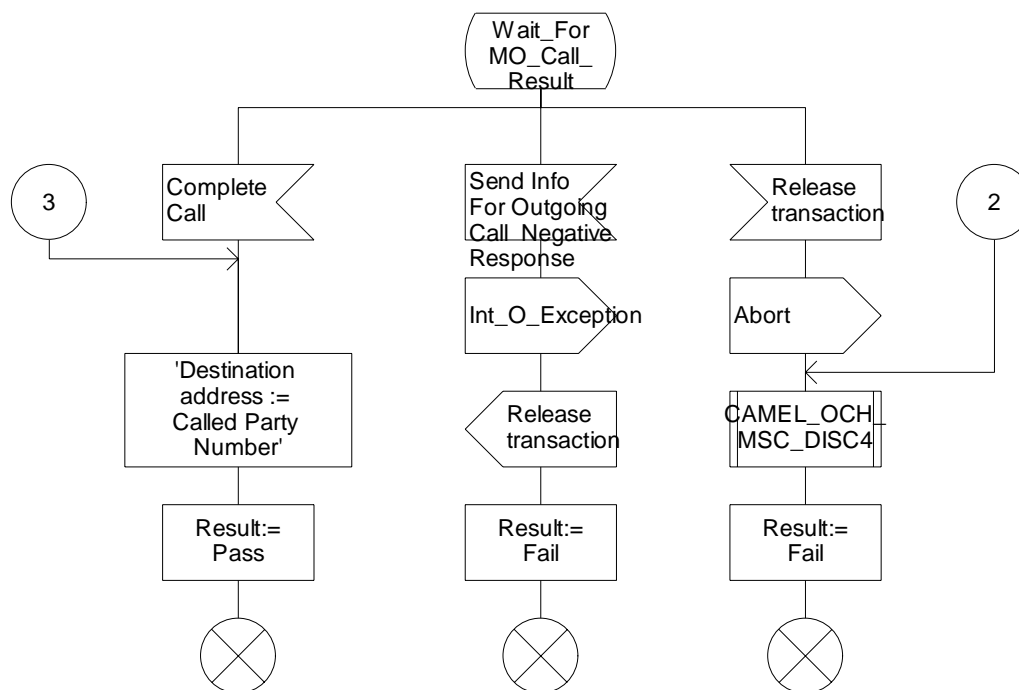
Figure 4.9b: Procedure CAMEL_MO_Dialled_Services (sheet 2)

Procedure CAMEL_OCH_MSC_INIT 1(4)

/* Procedure in the MSC to perform CAMEL handling for an outgoing call request */

/* Signals to/from the right are to/from the gsmSSF. */

O-CSI invocation?

No

Yes

Result:= pass

CAMEL_ Invocation := True

Allocate call reference number

Answer_Received := False

Store original call parameters

Int_Invoke_gsmSSF (O-CSI)

Wait_for_ gsmSSF_ Invoked

Int_error

Int_gsmSSF_ Invoked

Release

Result:= fail

Int_DP_ Collected_ Info

Int_O_Exception

DP_ Collected_ Info

Result:= fail
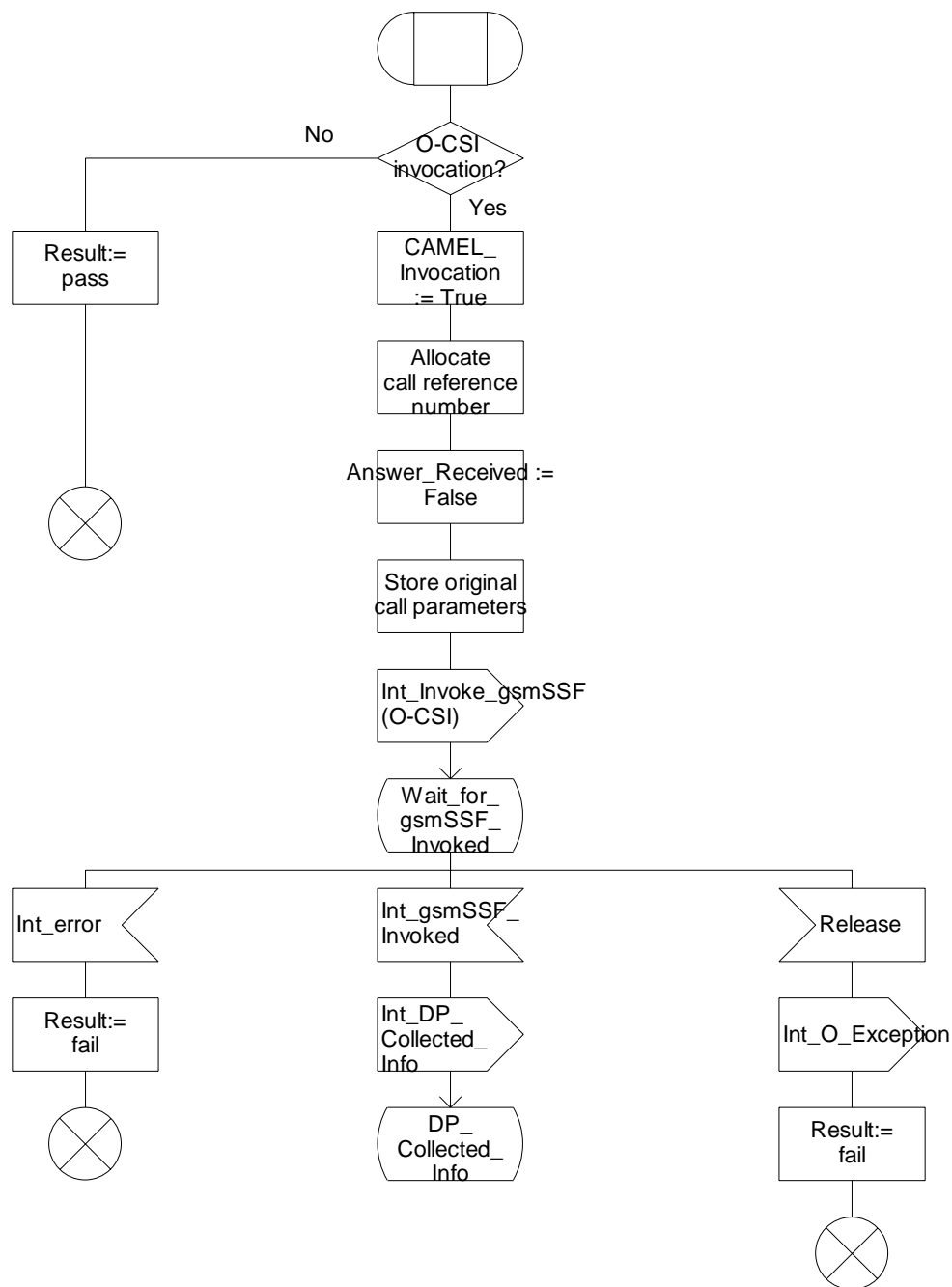
Figure 4.10a: Procedure CAMEL_OCH_MSC_INIT (sheet 1)

Procedure CAMEL_OCH_MSC_INIT

2(4)

/* Procedure in the MSC to perform CAMEL handling for an outgoing call request */

/* Signals to/from the left are to/from the BSS; signals to/from the right are to/from the gsmSSF if not otherwise stated. */

DP_ _Collected_ _Info

Int_Release_Call

Int_Error

Int_Continue_ With_Argument

Int_Continue

Int_Connect

CAMEL_ _Modify_ _CUG_Info

Progress

'Modify call parameters with received information'

CAMEL_ _Modify_ _CUG_Info

'Default call handling = continue call ?'

No   Yes

'Modify call parameters with received information'

Abort

To VLR

Release transaction

Result:= fail

Result:= Pass
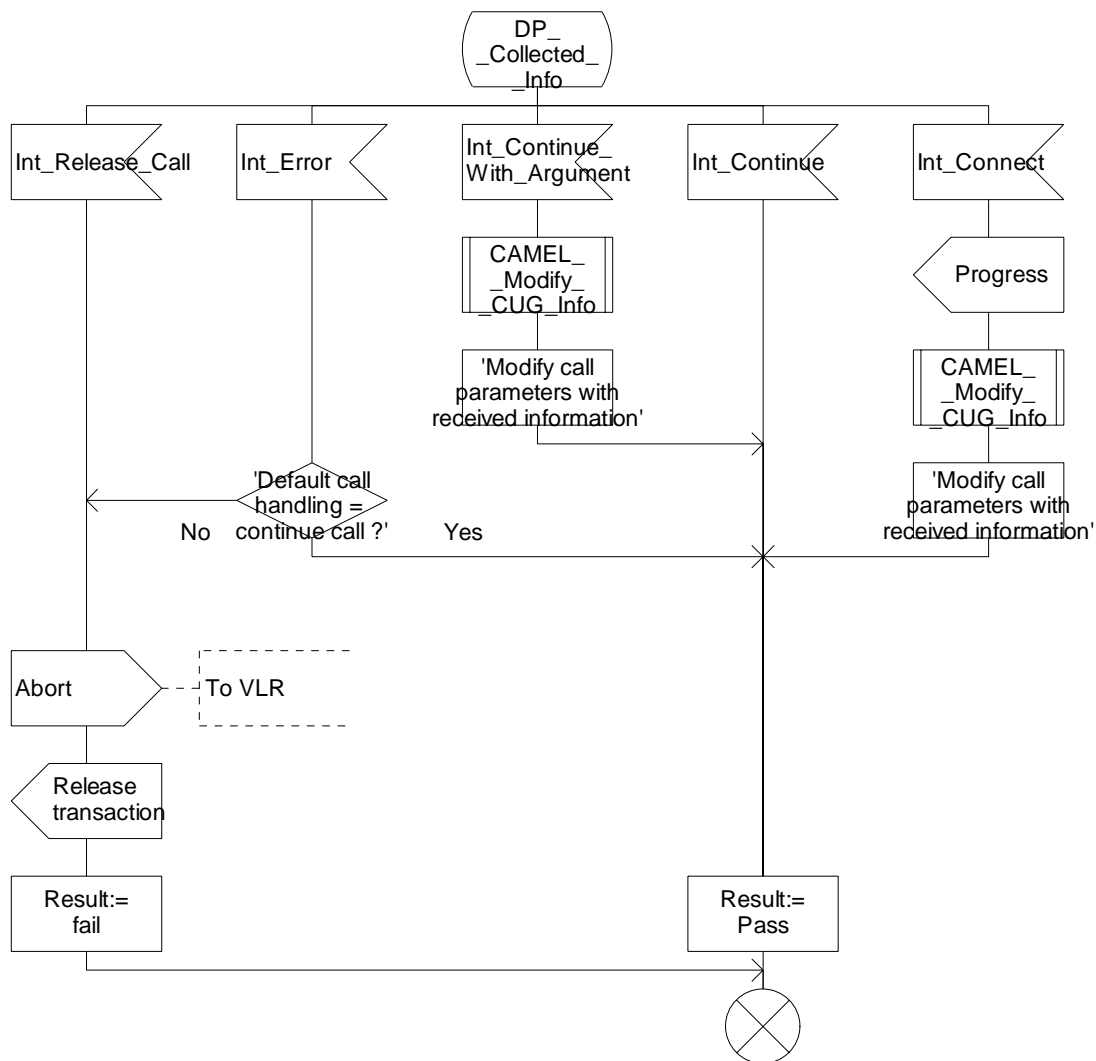
Figure 4.10b: Procedure CAMEL_OCH_MSC_INIT (sheet 2)

Procedure CAMEL_OCH_MSC_INIT 3(4)

/* Procedure in the MSC to perform
CAMEL handling for an outgoing
call request */

/* Signals to/from the right are to/from
the gsmSSF if not otherwise stated. */

DP_Collected_Info

Int_Establish_
Temporary
Connection

Int_Connect_To_
Resource

CAMEL_OCH_ETC

CAMEL_OCH_CTR

Result=
fail?

No

Yes

Result=
fail

DP_Collected_
Info
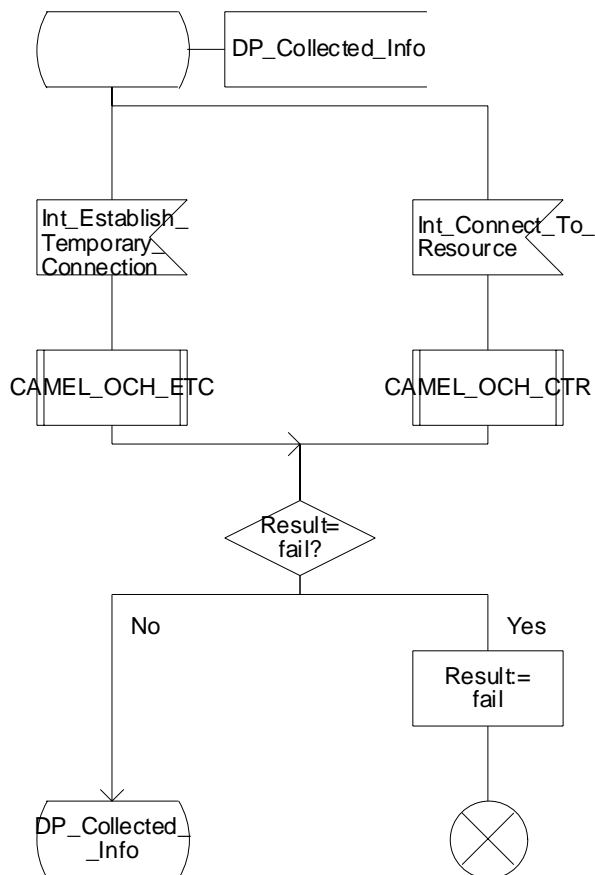
Figure 4.10c: Procedure CAMEL_OCH_MSC_INIT (sheet 3)

Procedure CAMEL_OCH_MSC_INIT 4(4)

/* Procedure in the MSC to perform
CAMEL handling for an outgoing
call request */

/* Signals to/from the left are
to/from the BSS; signals to/from
the right are to/from the gsmSSF. */

DP_Collected_info
Wait_For_MO_Call_Result

Release

Int_DP_O_Abandon

DP_O_Abandon

Int_continue

Result:=
fail
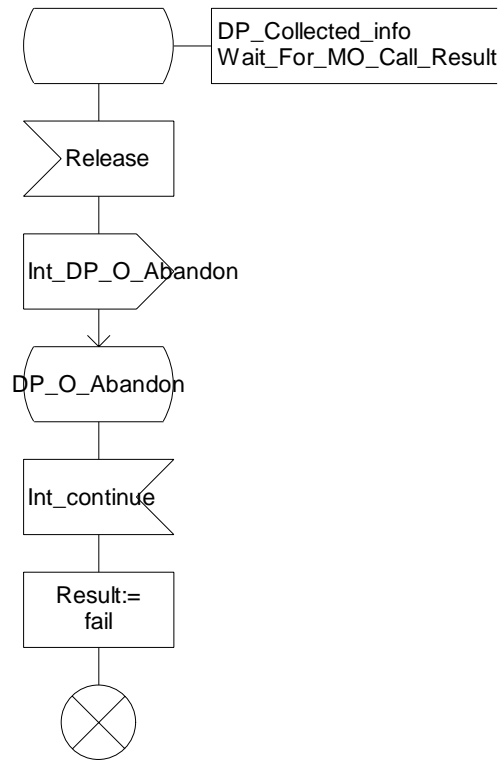
Figure 4.10d: Procedure CAMEL_OCH_MSC_INIT (sheet 4)

Procedure CAMEL_SDS_MO_INIT 1(3)

/* Procedure in the MSC to perform CAMEL handling for a subscribed Dialled Service */

/* Signals to/from the left are to/from the BSS; signals to/from the right are to/from the gsmSSF. */

D-CSI invocation?

No → Result= Pass

Yes → CAMEL_ Invocation := True

Call Reference Number stored?

Yes

No → Allocate Call Reference Number

Store Original Call Parameters

Int_Invoke_ gsmSSF (D-CSI)

Wait_for_ gsmSSF_Invoked

Int_gsmSSF_ Invoked

Int_DP_ Analysed_ Info

DP_ Analysed_ Info

Release transaction

Int_O_Exception

Result:= Abort
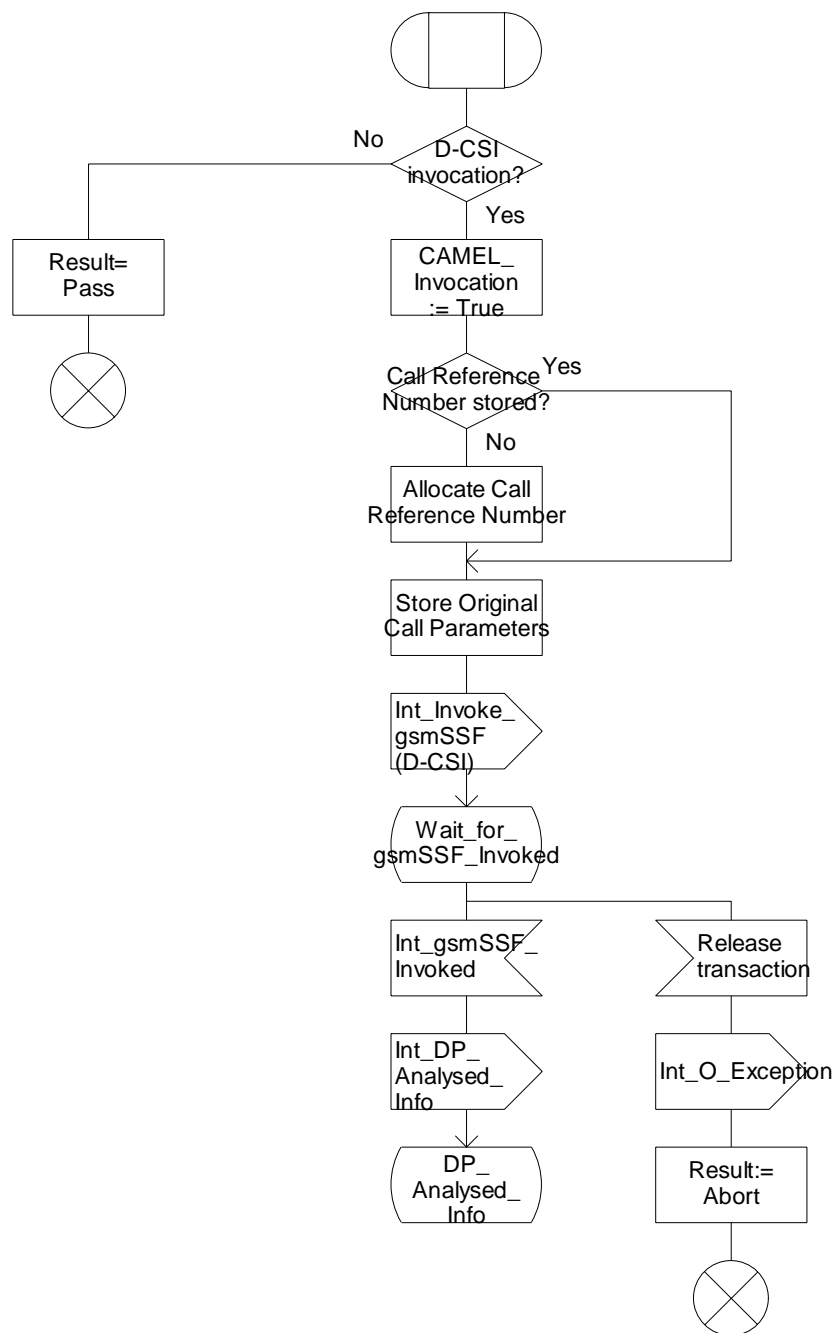
Figure 4.11a: Procedure CAMEL_SDS_MO_Init (sheet 1)

Procedure CAMEL_SDS_MO_INIT 2(3)

/* Procedure in the MSC to perform CAMEL handling for a subscribed Dialled Service */

/* Signals to/from the left are to/from the BSS; signals to/from the right are to/from the gsmSSF. */

DP_
Analysed_
Info

Int_Release_
Call

Int_Error

Int_Continue

Int_Connect

Int_Continue_
With
_Argument

Release
transaction

'Default call
handling = continue
call ?'

Yes

No

CAMEL_
Modify
_CUG_Info

'Modify call
parameters with
received information'

Int_DP_O_
Abandon

Result:=
Fail

Result:=
Pass

Result:=
Pass

Result:=
Abort
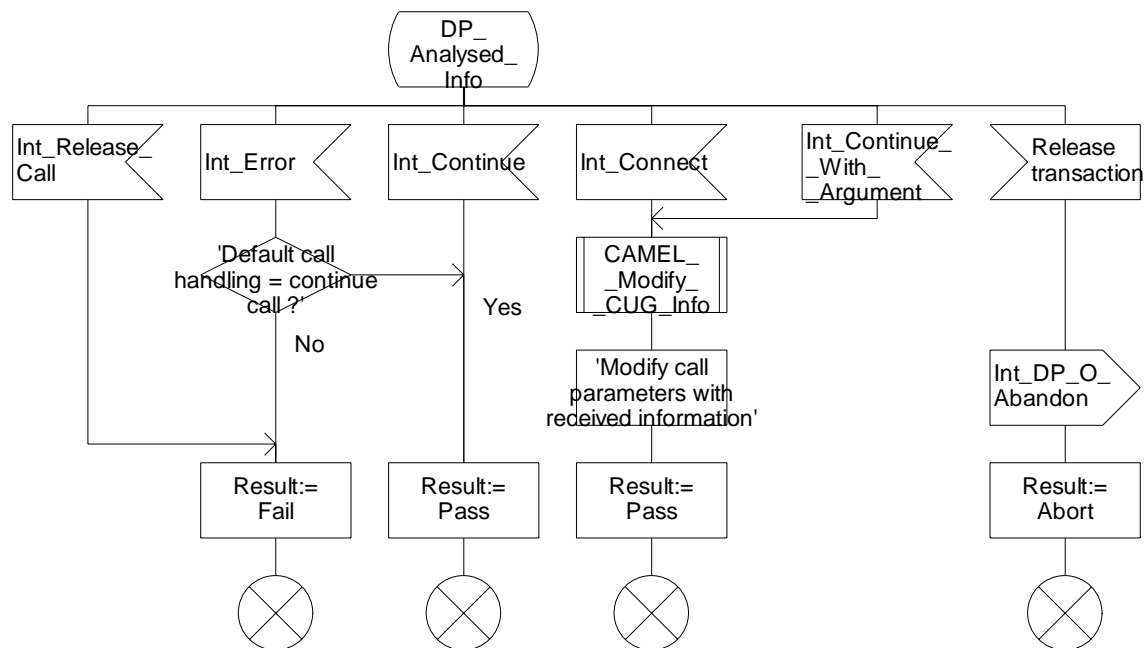
Figure 4.11b: Procedure CAMEL_SDS_MO_INIT (sheet 2)

Procedure CAMEL_SDS_MO_INIT 3(3)

/* Procedure in the MSC to perform
CAMEL handling for a subscribed
Dialled Service */

/* Signals to/from the right are to/from
the gsmSSF if not otherwise stated. */

DP_Analysed_Info

Int_Establish_
Temporary
Connection

Int_Connect_To_
Resource

CAMEL_OCH_ETC

CAMEL_OCH_CTR

Result=
fail?

No

Yes

Result:=
fail

DP_Analysed_
Info

⊗
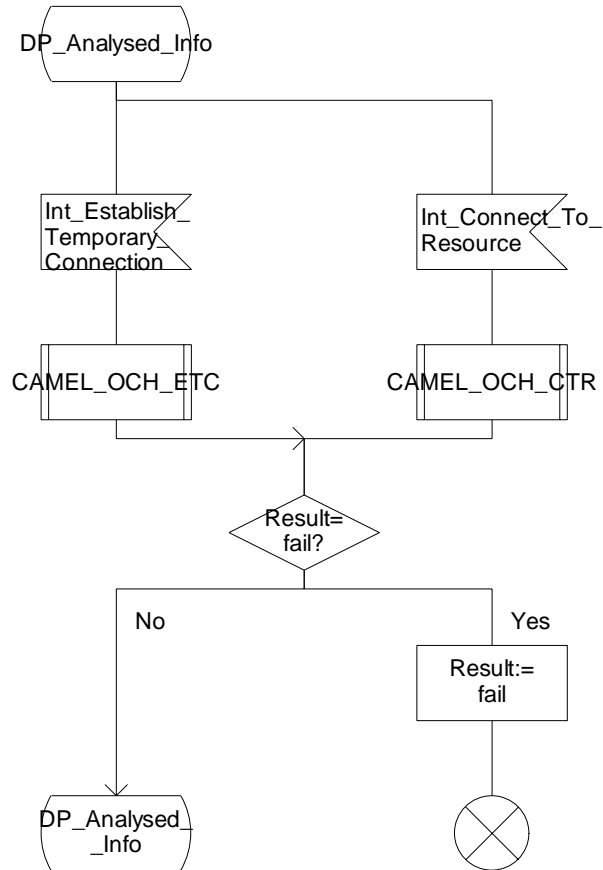
Figure 4.11c: Procedure CAMEL_SDS_MO_INIT (sheet 3)

Procedure CAMEL_NDS_MO_INIT   1(3)

/* Procedure in the MSC to perform
CAMEL handling for a network
Dialled Service for mobile originated calls*/

/* Signals to/from the right are
to/from the gsmSSF. */

N-CSI invocation?

No → Result= Pass

Yes

CAMEL_ Invocation := True

Call Reference Number stored?

Yes

No

Allocate Call Reference Number

Store Original Call Parameters

Int_Invoke_ gsmSSF (N-CSI)

Wait_for_ gsmSSF_Invoked

Int_gsmSSF_ Invoked

Release transaction

Int_DP_ Analysed_ Info

Int_O_Exception

DP_ Analysed_ Info

Result:= Abort
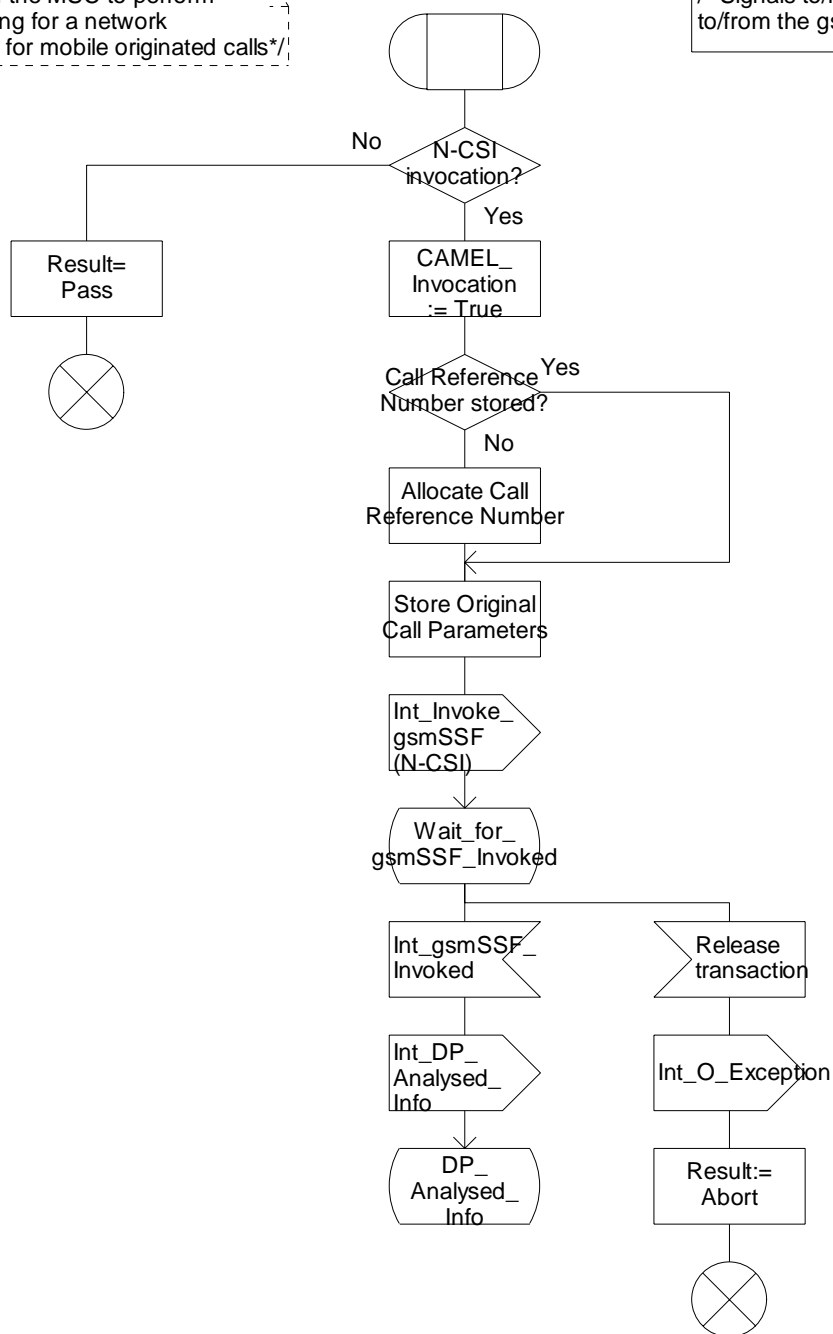
Figure 4.12a: Procedure CAMEL_NDS_MO_INIT (sheet 1)

Procedure CAMEL_NDS_MO_INIT 2(3)

/* Procedure in the MSC to perform
CAMEL handling for a network
Dialled Service for mobile originated calls*/

/* Signals to/from
the right are to/from the gsmSSF if
not otherwise stated. */

DP_
Analysed_
Info

Int_Release_
Call

Int_Error

Int_Continue

Int_Connect

Int_Continue_
With
_Argument

Release
transaction

'Default call
handling = continue
call ?'

Yes

No

CAMEL_
Modify
_CUG_Info

'Modify call
parameters with
received information'

Int_DP_O_
Abandon

Result:=
Fail

Result:=
Pass

Result:=
Pass

Result:=
Abort
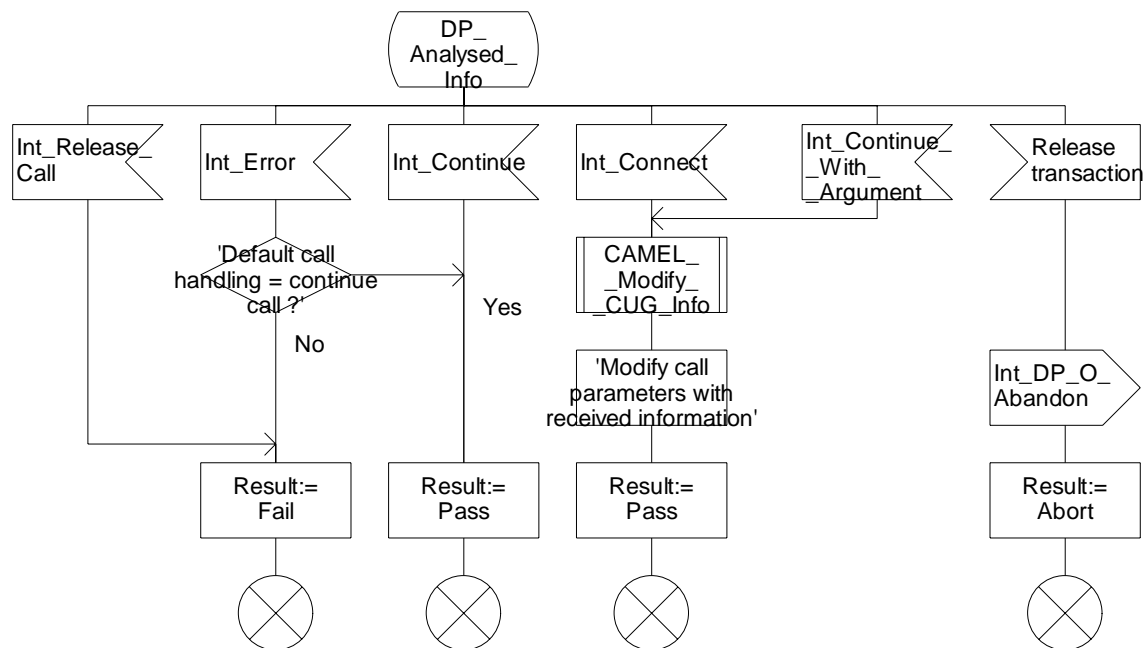
Figure 4.12b: Procedure CAMEL_NDS_MO_INIT (sheet 2)

Procedure CAMEL_NDS_MO_INIT 3(3)

/* Procedure in the MSC to perform
CAMEL handling for a network
Dialled Service for mobile originated calls*/

/* Signals to/from the right are to/from
the gsmSSF if not otherwise stated. */

DP_Analysed_Info

Int_Establish_
Temporary
Connection

Int_Connect_To_
Resource

CAMEL_OCH_ETC

CAMEL_OCH_CTR

Result=
fail?

No

Yes

Result:=
fail

DP_Analysed_
_Info
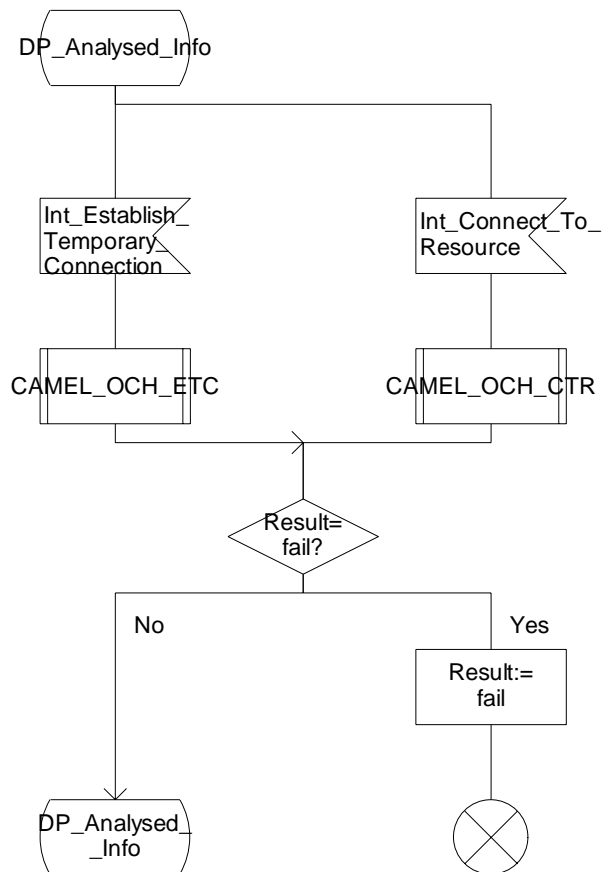
Figure 4.12c: Procedure CAMEL_NDS_MO_INIT (sheet 3)

Procedure CAMEL_OCH_MSC_ANSWER 1(2)

/* Procedure in the MSC to handle an outgoing call */

/* Signals to/from the left are to/from the BSS; signals to/from the right are to/from the gsmSSF if not otherwise stated. */
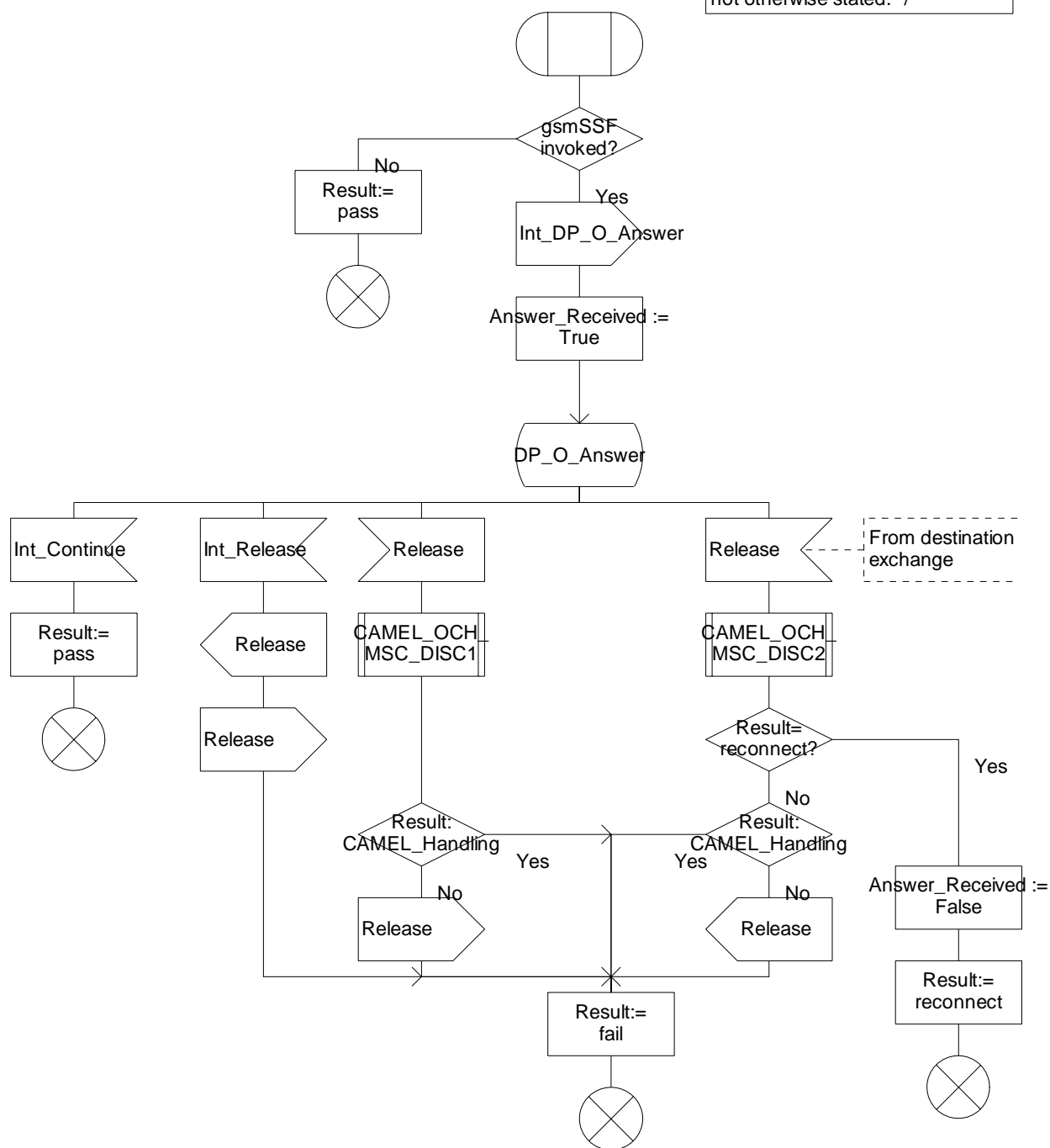
Figure 4.13a: Procedure CAMEL_OCH_MSC_ANSWER (sheet 1)

Procedure CAMEL_OCH_MSC_ANSWER 2(2)

/* Procedure in the MSC to handle an outgoing call */

/* Signals to/from the left are to/from the BSS; signals to/from the right are to/from the gsmSSF if not otherwise stated. */

DP_O_Answer

Int_Error

No ◇ Default Call Handling = Continue Call?

Yes

Release

Release

Result:= fail

⊗

Result := pass

⊗
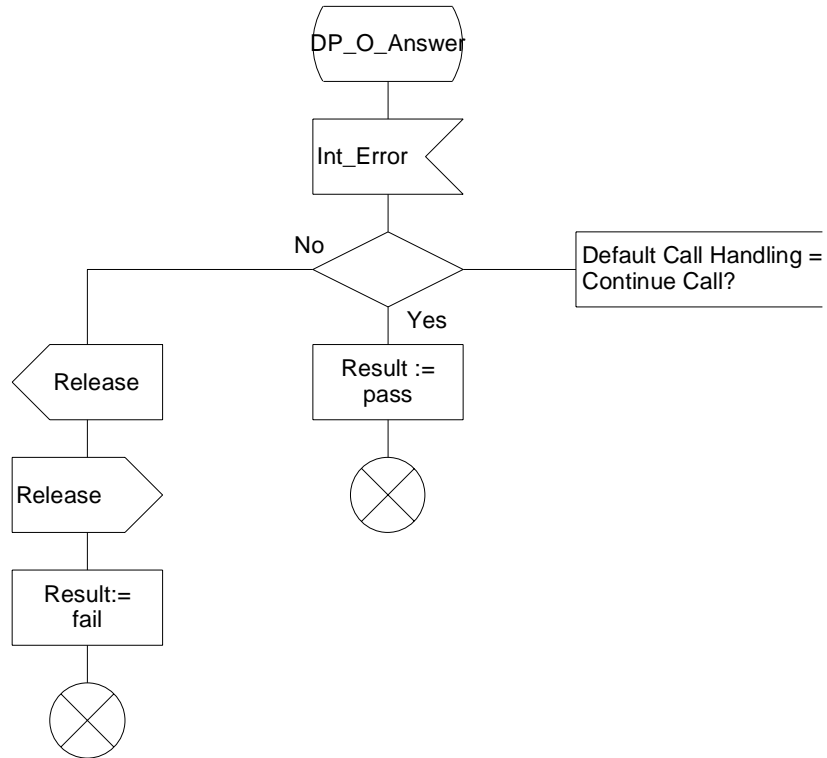
Figure 4.13b: Procedure CAMEL_OCH_ANSWER (sheet 2)

Procedure CAMEL_OCH_MSC1 1(3)

/* Procedure in the MSC in the case of CAMEL handling to connect a call at DP Busy, Route select failure. */

Signals to/from the right are to/from the gsmSSF if not otherwise stated.

gsmSSF invoked? — No

Yes

Release cause

Busy Subscriber Absent — Other cause

Int_DP_O_Busy — Int_DP_Route_ _Select_ _Failure

DP_O_Busy — DP_Route_ _Select_ _Failure

Int_Connect Int_Continue Int_Error Int_Release_Call

CAMEL_ _Modify_ _CUG_Info

Modify call parameters with received information

Result:= reconnect

Result:= continue
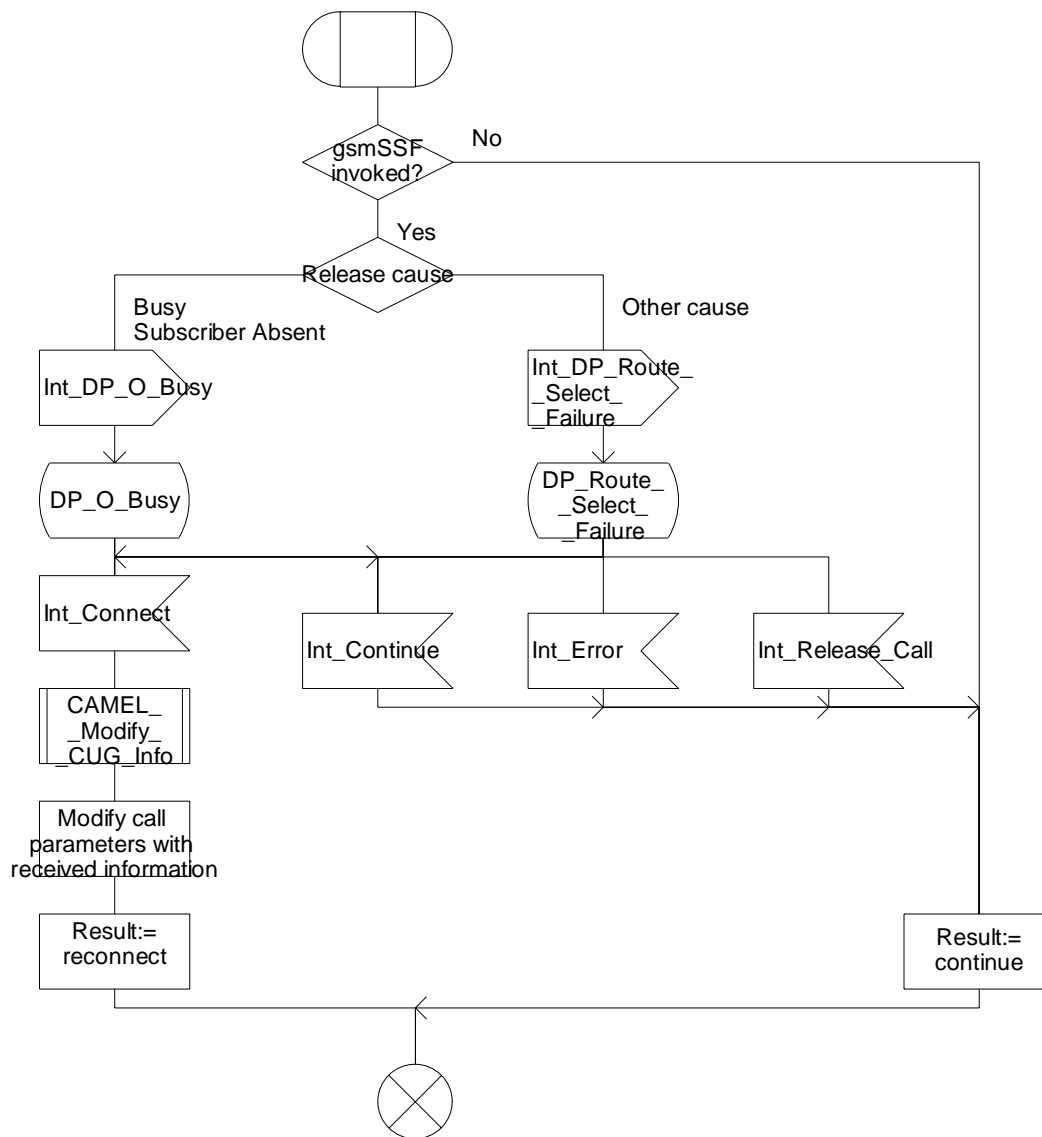
Figure 4.14a: Procedure CAMEL_OCH_MSC1 (sheet 1)

Procedure CAMEL_OCH_MSC1 2(3)

/* Procedure in the MSC in the
case of CAMEL handling to
connect a call at DP Busy,
Route select failure. */

DP_O_Busy
DP_Route_Select_Failure

Signals to/from the left are
to/from the BSS; signals to/from
the right are to/from the gsmSSF if
not otherwise stated.

Release

Int_DP_O_Abandon

DP_O_Abandon

Int_continue

Result:=
continue

⊗
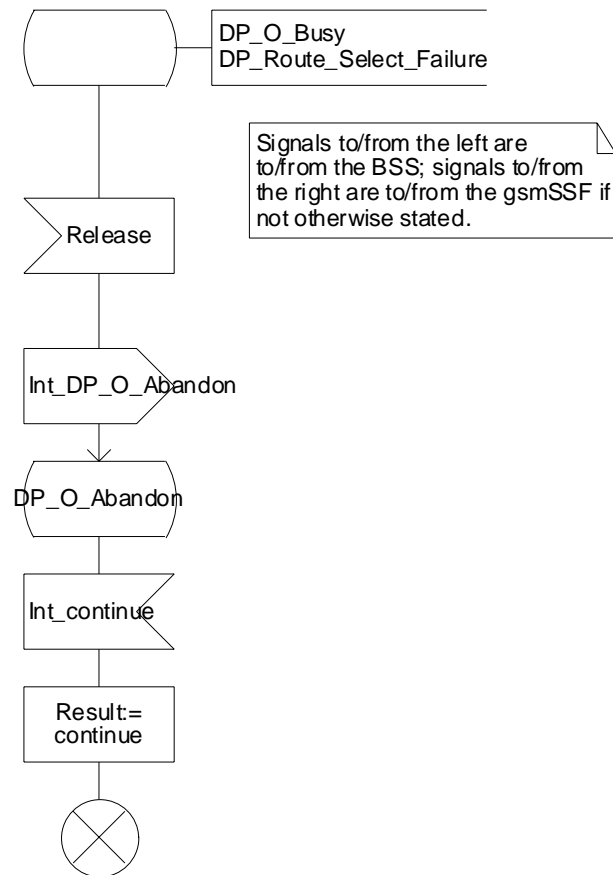
Figure 4.14b: Procedure CAMEL_OCH_MSC1 (sheet 2)

Procedure CAMEL_OCH_MSC1 3(3)

/* Procedure in the MSC in the case of CAMEL handling to connect a call at DP Busy, Route select failure. */

Signals to/from the right are to/from the gsmSSF if not otherwise stated.

DP_Route_Select__Failure
DP_O_Busy

Int_Establish_
Temporary
Connection

Int_Connect_To_
Resource

CAMEL_OCH_ETC

CAMEL_OCH_CTR

Result=
fail?

No

Yes

Result:=
continue

-
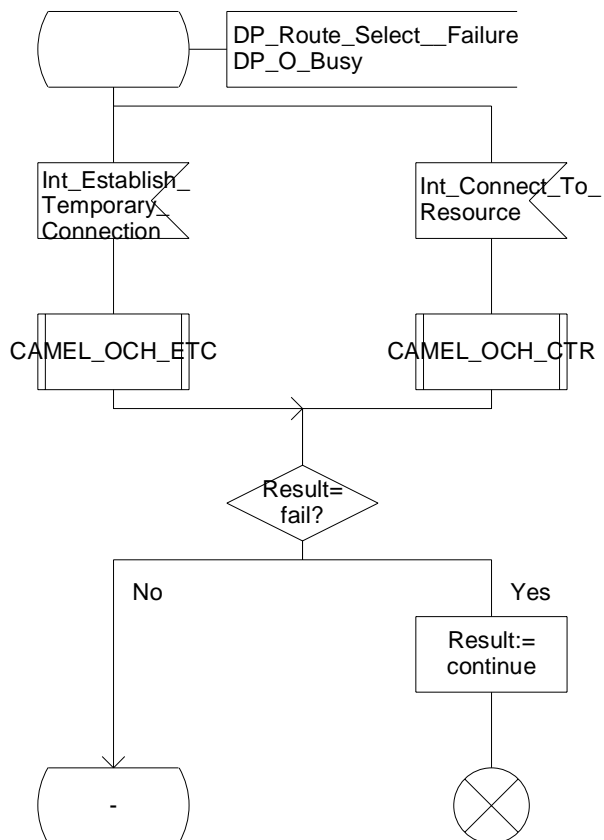
Figure 4.14c: Procedure CAMEL_OCH_MSC1 (sheet 3)

Procedure CAMEL_OCH_MSC2   1(3)

/* Prodecu/re in the MSC to connect a call at DP No_Answer */

Signals to/from
the right are to/from the gsmSSF if
not otherwise stated.

No — gsmSSF invoked?

Yes

Int_DP_O_No_Answer

DP_O_No_Answer

Int_Connect   Int_Continue   Int_Error   Int_Release_Call

CAMEL_
Modify
_CUG_Info

Int_O_Exception

Modify call
parameters with
received information

Result:=
coninue

Result:=
reconnect

Result:=
release
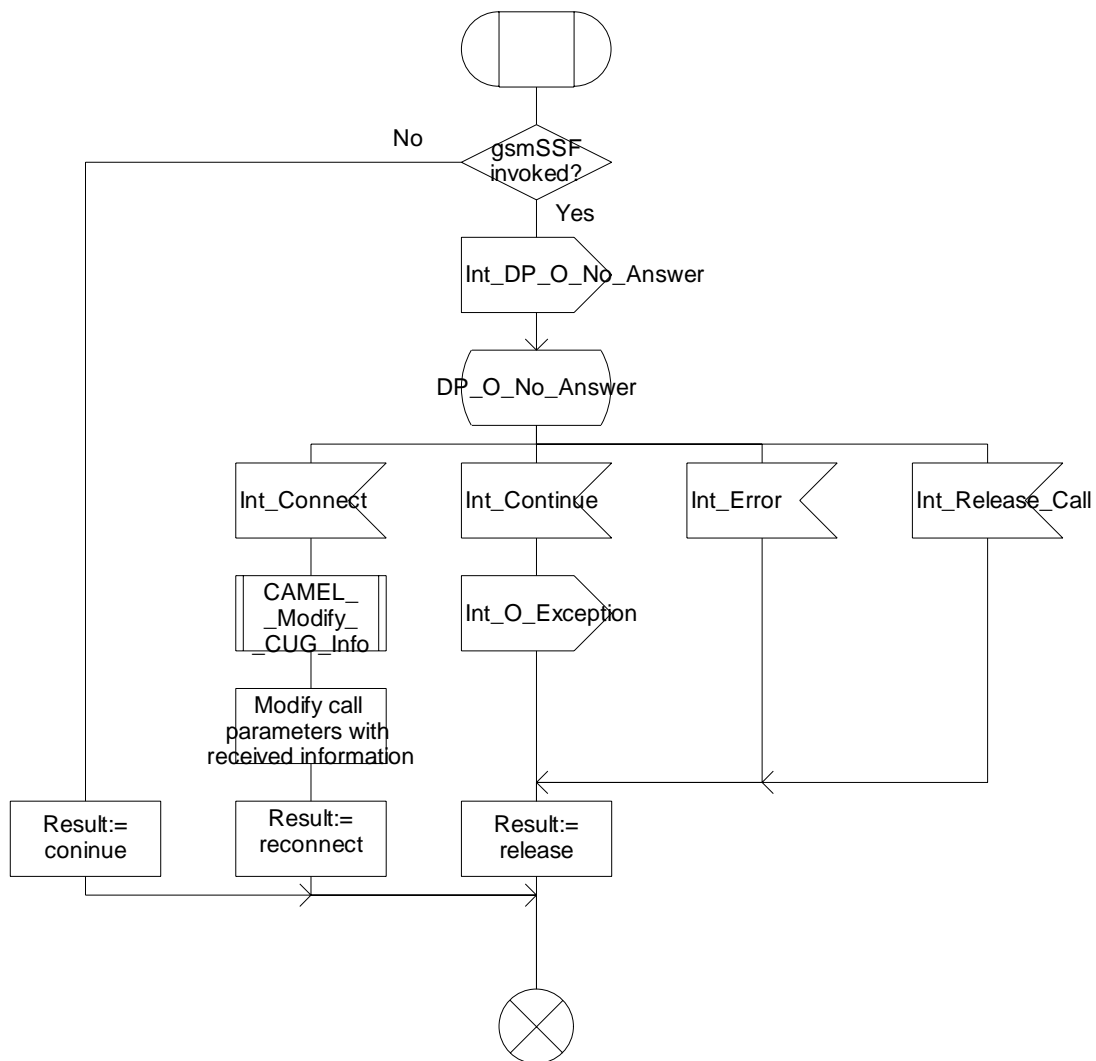
Figure 4.15a: Procedure CAMEL_OCH_MSC2 (sheet 1)

Procedure CAMEL_OCH_MSC2 2(3)

/* Prodecu/re in the MSC to
connect a call at DP
No_Answer */

Signals to/from the left are
to/from the BSS; signals to/from
the right are to/from the gsmSSF if
not otherwise stated.

DP_O_No_Answer

Release

Int_DP_O_Abandon

DP_O_Abandon

Int_continue

Result:=
fail
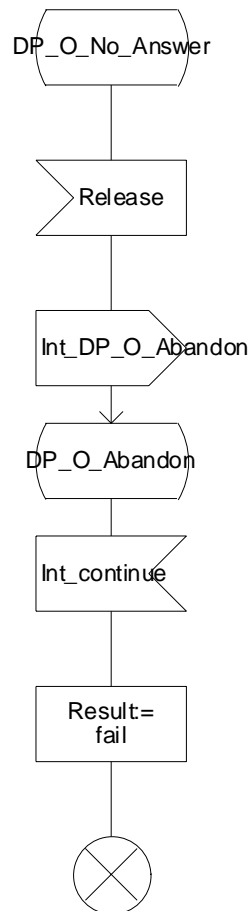
Figure 4.15b: Procedure CAMEL_OCH_MSC2 (sheet 2)

Procedure CAMEL_OCH_MSC2   3(3)

/* Prodecu/re in the MSC to connect a call at DP No_Answer */

Signals to/from the right are to/from the gsmSSF if not otherwise stated.

DP_O_No_Answer

Int_Establish_ Temporary Connection

Int_Connect_To_ Resource

CAMEL_OCH_ETC

CAMEL_OCH_CTR

Result= fail?

No   Yes

Result:= release

DP_O_No_Answer
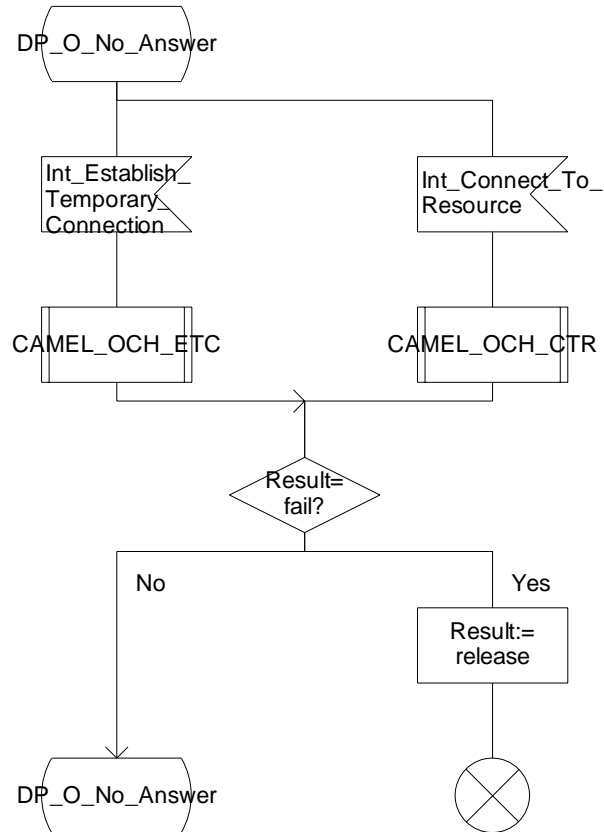
Figure 4.15c: Procedure CAMEL_OCH_MSC2 (sheet 3)

Procedure CAMEL_OCH_MSC_DISC1 1(1)

/* Procedure in the MSC perform handling for a call release */

/* Signals to/from the right are to/from the gsmSSF if not otherwise stated. */

gsmSSF invoked?

No

Yes

Int_DP_
O_Disconnect
/* legId = 1 */

DP_
O_Disconnect_1

Int_Error   Int_Release_Call   Int_Continue   Release

From destination exchange

Int_DP_
O_Disconnect
/* legId = 2 */

Release

To destination exchange

DP_O_Disconnect

Int_Continue   Int_Error   Int_ReleaseCall

result:=
normal_
handling

result:=
CAMEL_
handling
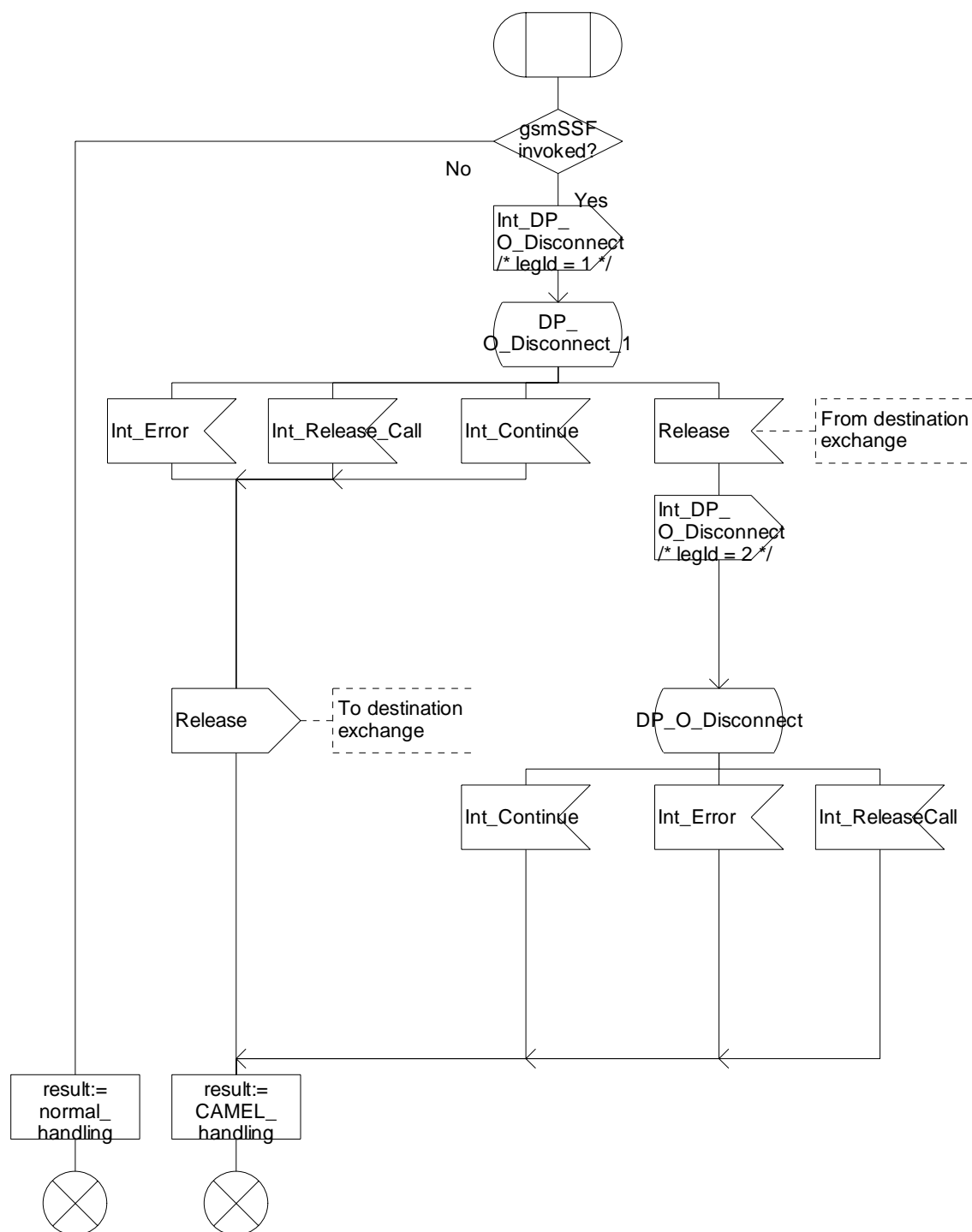
Figure 4.16a: Procedure CAMEL_OCH_MSC_DISC1 (sheet 1)

Procedure CAMEL_OCH_MSC_DISC2 1(2)

/* Procedure in the MSC perform handling for a call release */

/* Signals to/from the left are to/from the BSS or the process MT_GMSC; signals to/from the right are to/from the gsmSSF if not otherwise stated. */

gsmSSF invoked?

No

Yes

Int_DP_ _O_Disconnect /* legId = 2 */

result:= normal_ handling

DP_ O_Disconnect_2

Release

Int_Continue

Int_Release_ _Call

Int_error

Int_Connect

Int_DP_ O_Disconnect /* legId = 1 */

Release

CAMEL_ _Modify_ _CUG_Info

DP_ O_Disconnect

Modify call parameters with received information

Int_Error

Int_Continue

Int_Release_Call

Answer Received := False

Result:= reconnect

result:= CAMEL_ handling
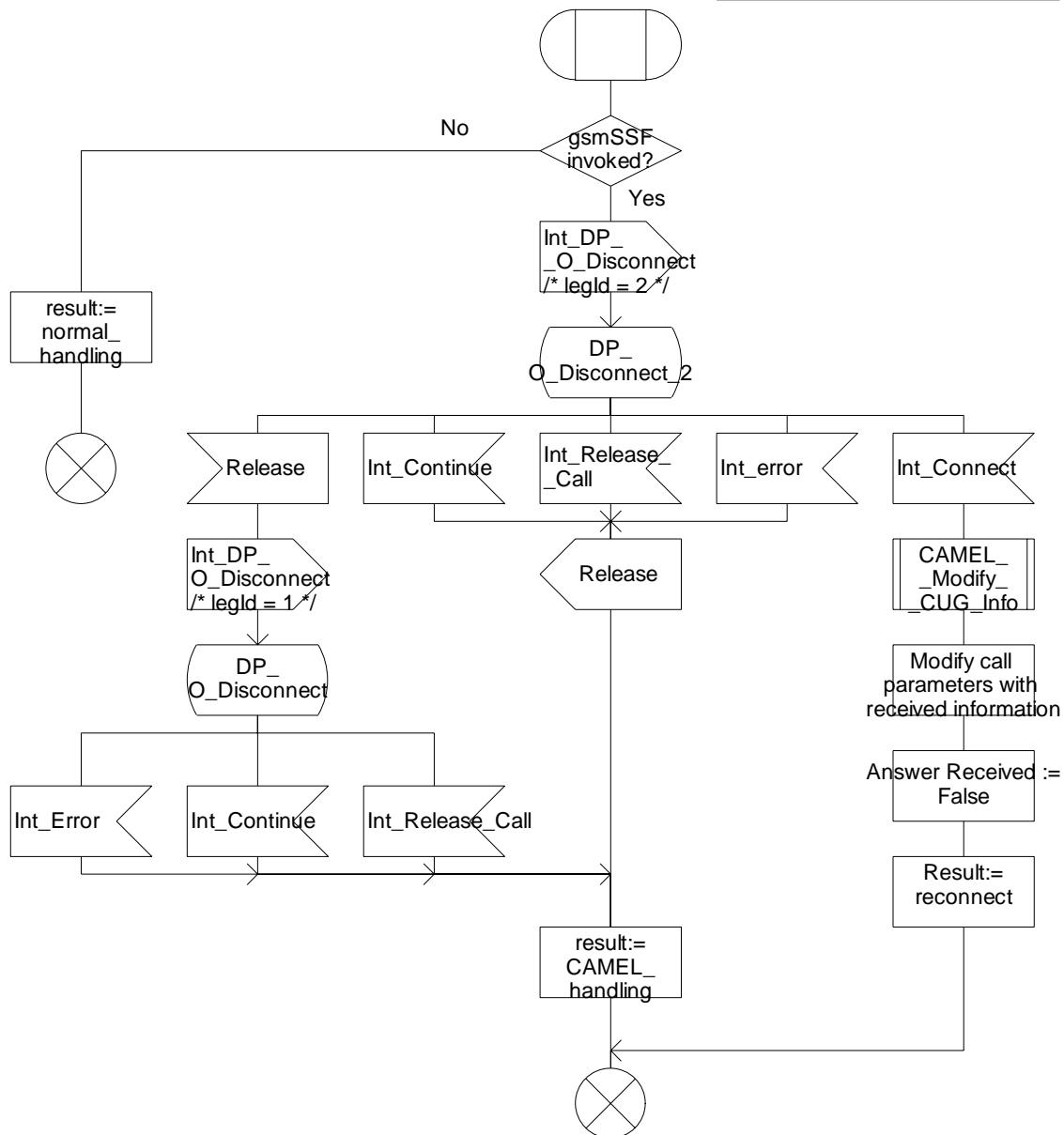
Figure 4.17a: Procedure CAMEL_OCH_MSC_DISC2 (sheet 1)

Procedure CAMEL_OCH_MSC_DISC2 2(2)

/* Procedure in the MSC perform
handling for a call release */

Signals to/from the right are to/from
the gsmSSF if not otherwise stated.

DP_O_Disconnect_2

Int_Establish_
Temporary
Connection

Int_Connect_To_
Resource

CAMEL_OCH_ETC

CAMEL_OCH_CTR

Result=
fail?

No

Yes

Result:=
release

DP_O_Disconnect_2

⊗
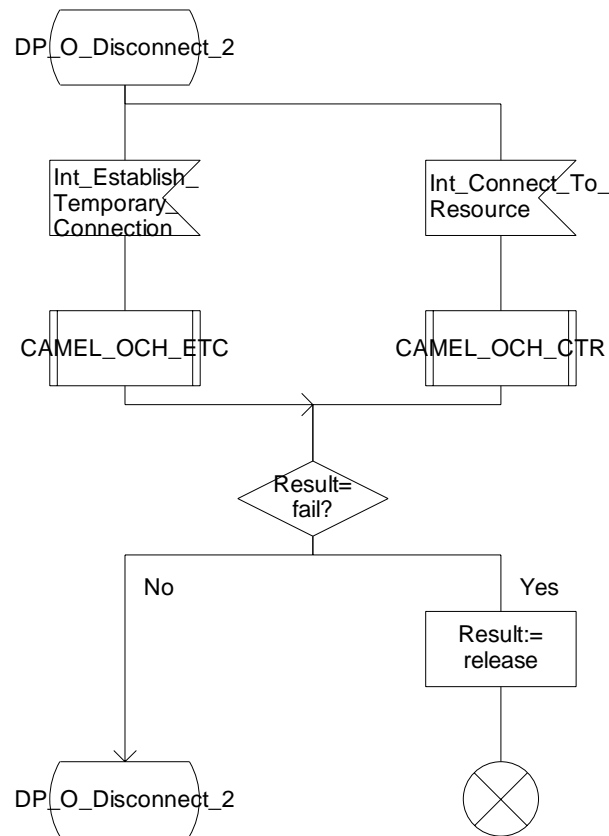
Figure 4.17b: Procedure CAMEL_OCH_MSC_DISC2 (sheet 2)

Procedure CAMEL_OCH_MSC_DISC3 CAMOD3_1(1)

/* Procedure in the originating VMSC
to handle premature release of a CAMEL call*/
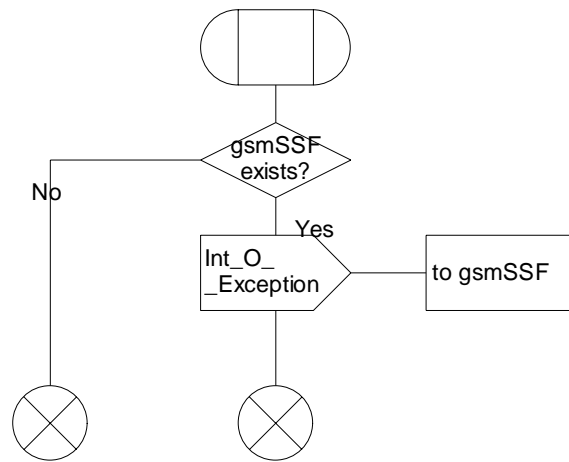
Figure 4.18a: Procedure CAMEL_OCH_MSC_DISC3 (sheet 1)

Procedure CAMEL_OCH_MSC_DISC4 1(1)

/* Procedure in the MSC perform
CAMEL handling for a call release */

/* Signals to the right are to
the gsmSSF */

gsmSSF
invoked?

No

Yes

Int_DP_O_Abandon

DP_O_Abandon

Int_continue
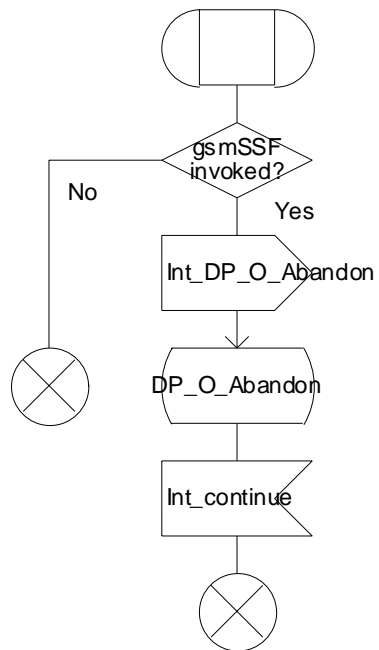
Figure 4.19a: Procedure CAMEL_OCH_MSC_DISC4 (sheet 1)

Procedure CAMEL_OCH_ETC 1(3)

Procedure in the MSC to handle a temporary connection

Signals to/from the left are to/from the BSS;
signals to/from the right are to/from the gsmSSF;
if not otherwise stated.

Initial Address → To CAMEL_Assisting_MSC or SRF

Send_Alerting_If_Required — Procedure defined in 3GPP TS 23.018

Wait_For_Assisting_ACM

Release

Release ← From CAMEL_Assisting_MSC or SRF

Int_ETC_Failed

Answer Received

True

Int_DP_O_Disconnect /*legID*/

Wait_For_Disconnect_Forward_Connection

Int_Disconnect_Forward_Connection

Release → To CAMEL_Assisting_MSC or SRF

Result:= pass

False

Int_DP_O_Abandon

DP_O_Abandon

Int_continue

Release → To CAMEL_Assisting_MSC or SRF

Result:= fail

Result:= pass
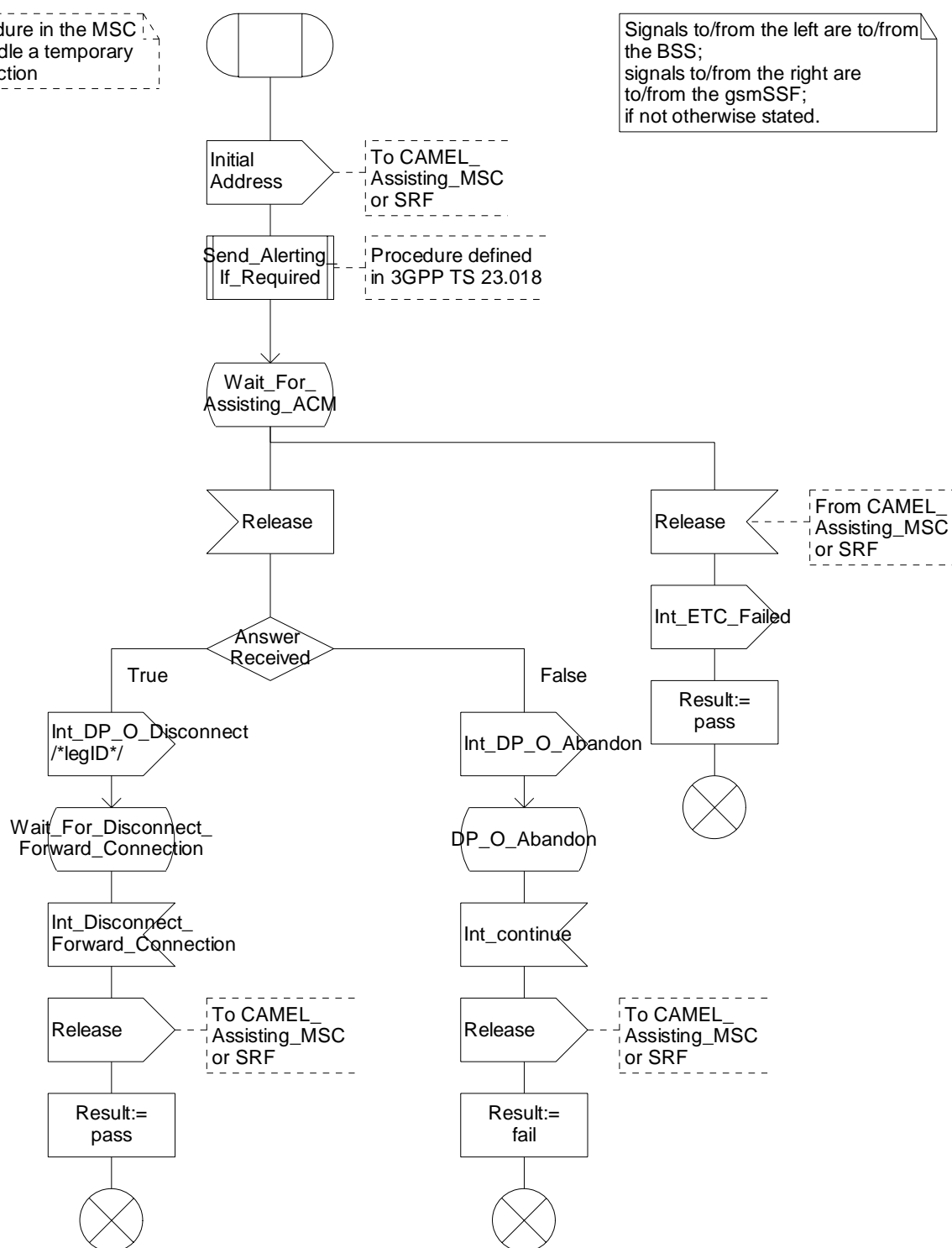
Figure 4.20a: Procedure CAMEL_OCH_ETC (sheet 1)

Procedure CAMEL_OCH_ETC 2(3)

Procedure in the MSC
to handle a temporary
connection

Signals to/from the left are to/from
the BSS;
signals to/from the right are
to/from the CAMEL_Assisting_MSC or SRF.

Wait_For_
Assisting_ACM

Address
Complete

Connect

Wait_For_
Assisting_
Answer

Answer

Bothway
through connection
required?

No

No

Bothway
through connection
required?

Procedure defined
in 3GPP TS 23.018

Send_Access
Connect_
If_Required

Yes

Progress

Progress

Yes

Send_Access
Connect_
If_Required

Procedure defined
in 3GPP TS 23.018

Int_Temporary
Connection
Established

Temporary_
Connection_
Established
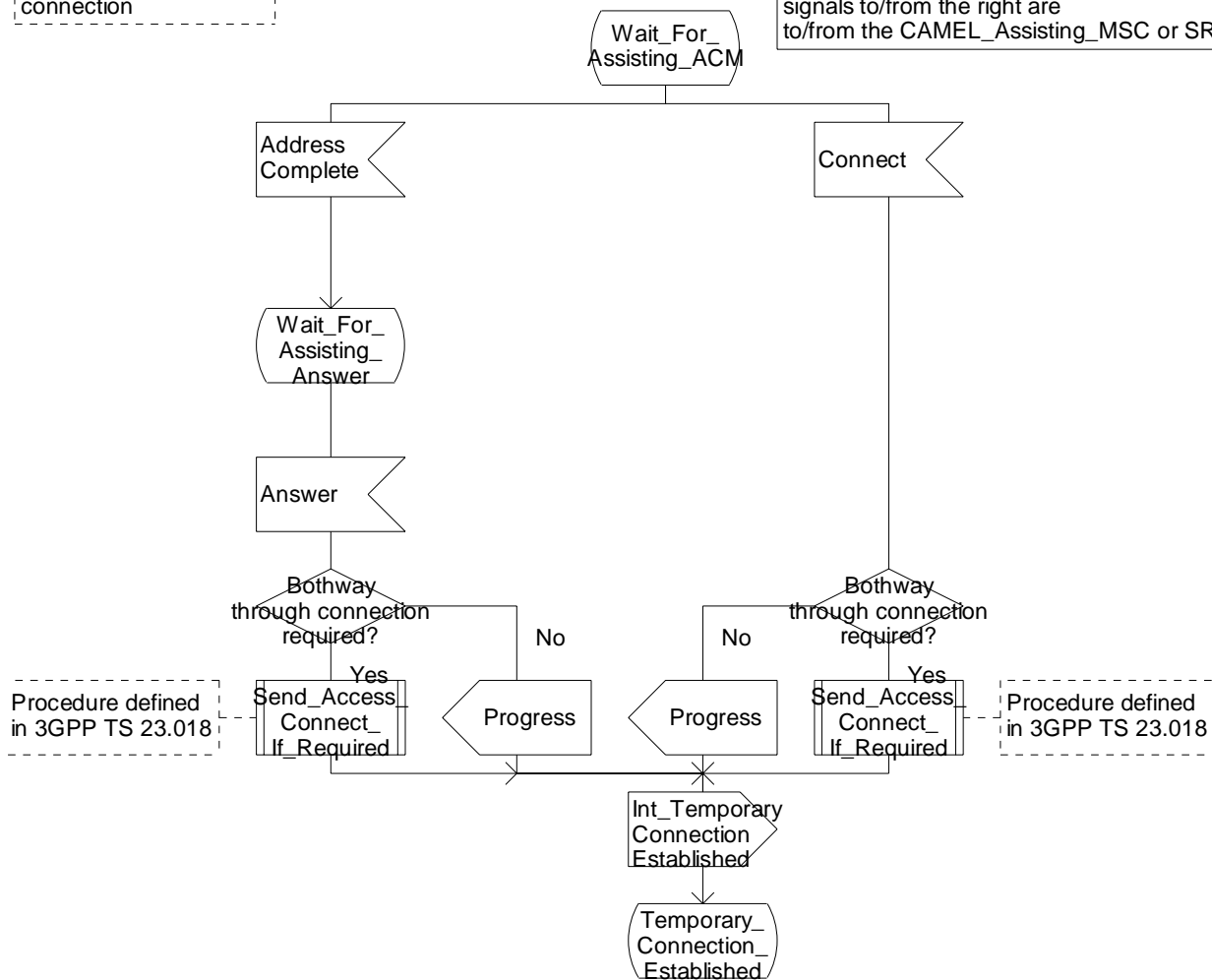
Figure 4.20b: Procedure CAMEL_OCH_ETC (sheet 2)

Procedure CAMEL_OCH_ETC 3(3)

Procedure in the MSC to handle a temporary connection

Signals to/from the left are to/from the BSS; signals to/from the right are to/from the gsmSSF; if not otherwise stated.

Temporary_Connection_Established
Wait_For_Assisting_Answer

Release

Answer Received — false

True

Int_DP_O_ Disconnect /*legID*/

Wait_For_Disconnect_ Forward_Connection

Int_DP_O_ Abandon

DP_O_Abandon

Int_continue

Release — To CAMEL_ Assisting_MSC or SRF

Result:= fail

Release — From CAMEL_ Assisting_MSC or SRF

Int_TC_ Released

Result:= pass

Int_Disconnect_ Forward_ Connection

Int_TC_ Released

Release — To CAMEL_ Assisting_MSC or SRF

Result:= pass
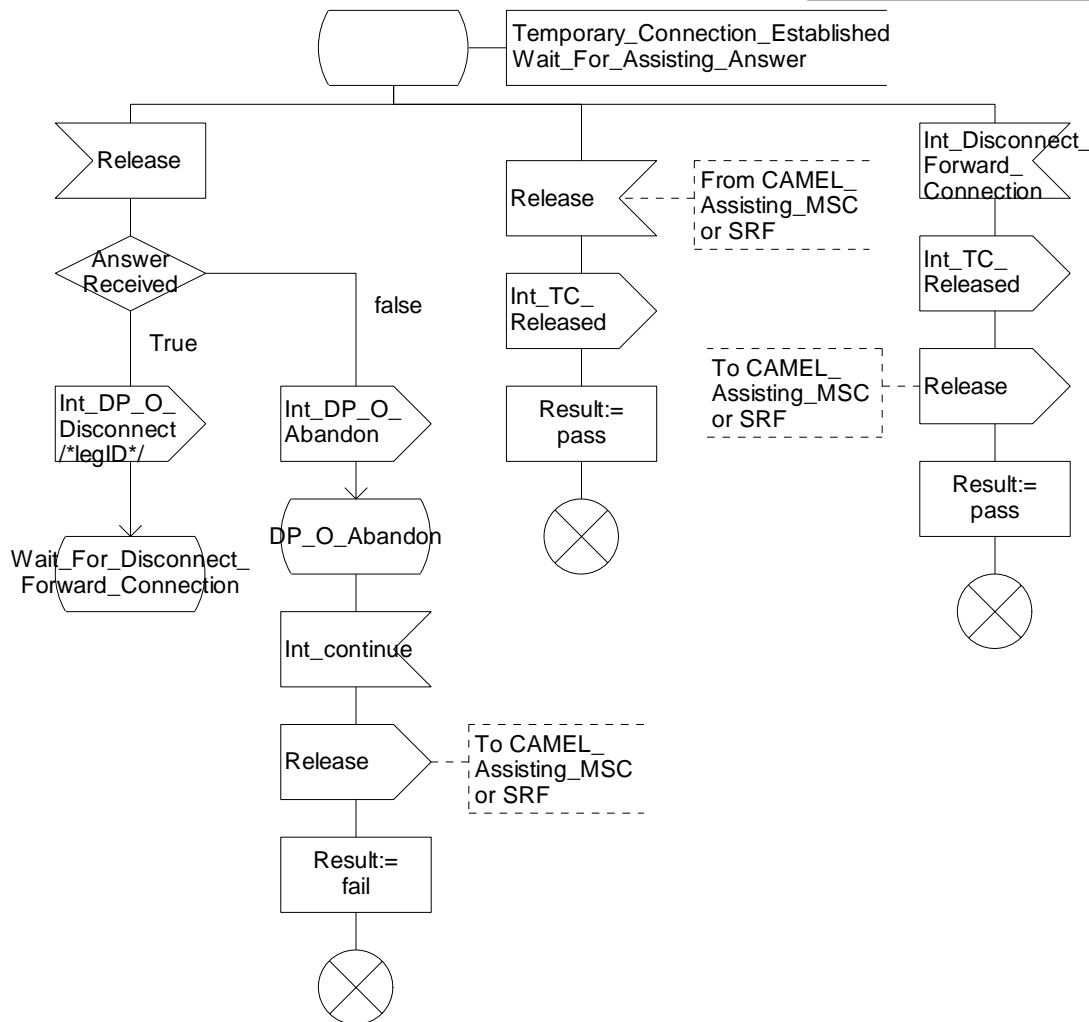
Figure 4.20c: Procedure CAMEL_OCH_ETC (sheet 3)

Procedure CAMEL_OCH_CTR 1(4)

Procedure in the originating MSC to handle a Connect To Resource operation

Signals to/from the left are to/from the BSS; signals to/from the right are to/from the gsmSSF if not otherwise stated.

Int_Invoke_SRF → To SRF

Await_SRF_Initialisation

Int_SRF_Connection Failure ← from SRF

Int_SRF_Connected ← from SRF

Connect SRF to the call

Send_Alerting_If_Required — Procedure defined in 3GPP TS 23.018

Through-connection required?

Yes

No

Send_Access Connect_If_required — Procedure defined in 3GPP TS 23.018

Int_CTR_Failed

Result:= pass

Int_SRF_Connected

⊗

relay
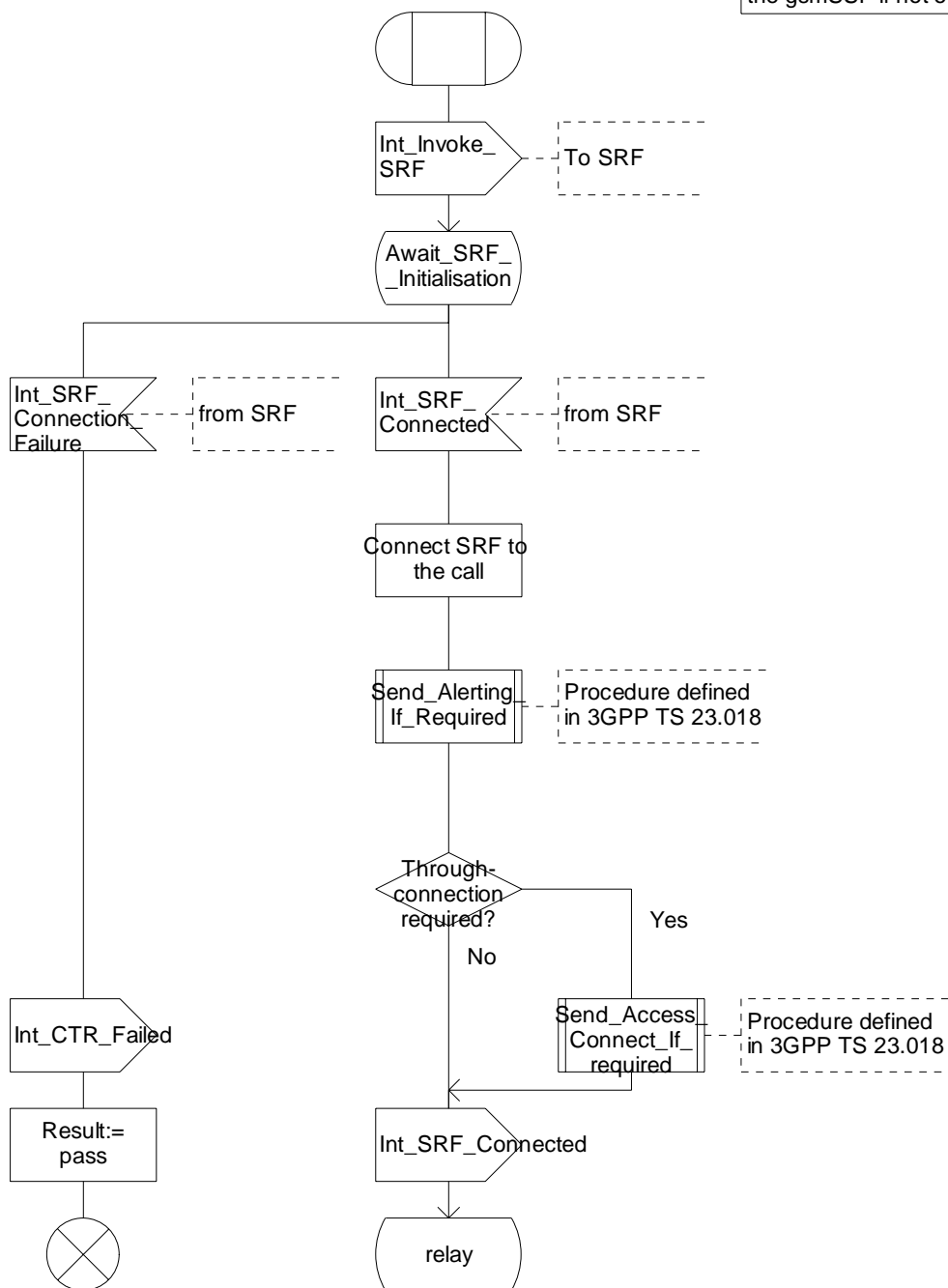
Figure 4.21a: Procedure CAMEL_OCH_CTR (sheet 1)

Procedure CAMEL_OCH_CTR 2(4)

Procedure in the originating MSC to handle a Connect To Resource operation

Signals to/from the left are to/from the BSS;
signals to/from the right are to/from the gsmSSF if not otherwise stated.

Relay

Release ⟵--- From SRF

Int_SRF_Released

Result:= pass

⊗

Int_Disconnect_ Forward_ Connection

Int_Disconnect_ SRF --- To SRF

Await_SRF_ Disconnection_ Continue

Release

Int_SRF_ Released ⟵--- From SRF

Int_SRF_Released

Result:= pass

⊗

Answer Received

True

Int_DP_O_ Disconnect /* legID */

Result:= pass

⊗

False

Int_DP_O_ Abandon /* legID */

DP_O_Abandon

Int_continue

Result:= fail

⊗

Release

Answer Received

True

Int_DP_O_ Disconnect /* legID */

Result:= pass

⊗

False

Int_DP_O_ Abandon /* legID */

DP_O_Abandon

Int_continue

Wait_For_Disconnect_ Forward_Connection

Int_Disconnect_ Forward_Connection

Int_Disconnect_ SRF

To SRF ---

Await_SRF_ Disconnection_ Active

Int_SRF_ Released

Result := Pass

⊗

Wait_For_Disconnect_ Forward_Connection

Int_Disconnect_ Forward_Connection

Int_Disconnect_ SRF

Await_SRF_ Disconnection_ Fail

To SRF ---

Figure 4.21b: Procedure CAMEL_OCH_CTR (sheet 2)

Procedure CAMEL_OCH_CTR 3(4)

Procedure in the originating MSC
to handle a Connect To Resource
operation

Signals to/from the right are to/from
the gsmSSF.
Signals to/from the left are to/from
the external SRF.

Relay

| CAP_Play_ Announcement | CAP_Prompt_ And_Collect_ User_Information | CAP_Specialized_ Ressource_Report | CAP_Prompt_ And_Collect_ User_Information ack |

| CAP_Play_ Announcement | CAP_Prompt_ And_Collect_ User_Information | CAP_Specialized_ Ressource_Report | CAP_Prompt_ And_Collect_ User_Information ack |

Relay

Figure 4.21c: Procedure CAMEL_OCH_CTR (sheet 3)

Procedure CAMEL_OCH_CTR 4(4)

Procedure in the originating MSC to handle a Connect To Resource operation

Signals to/from the left are to/from the BSS; signals to/from the right are to/from the gsmSSF if not otherwise stated.

Await_SRF_Initialisation

Release

Answer Received

True False

Int_DP_O_Disconnect /*legID*/

Int_Disconnect_SRF - - - To SRF

Await_SRF_ Disconnection_ Active

Int_SRF_ Released ← - - From SRF

Result:= pass

⊗

Int_DP_O_Abandon

DP_O_Abandon

Int_continue

Int_Disconnect_SRF - - - To SRF

Await_SRF_ Disconnection_ Fail

Int_SRF_ Released ← - - From SRF

Result:= fail

⊗
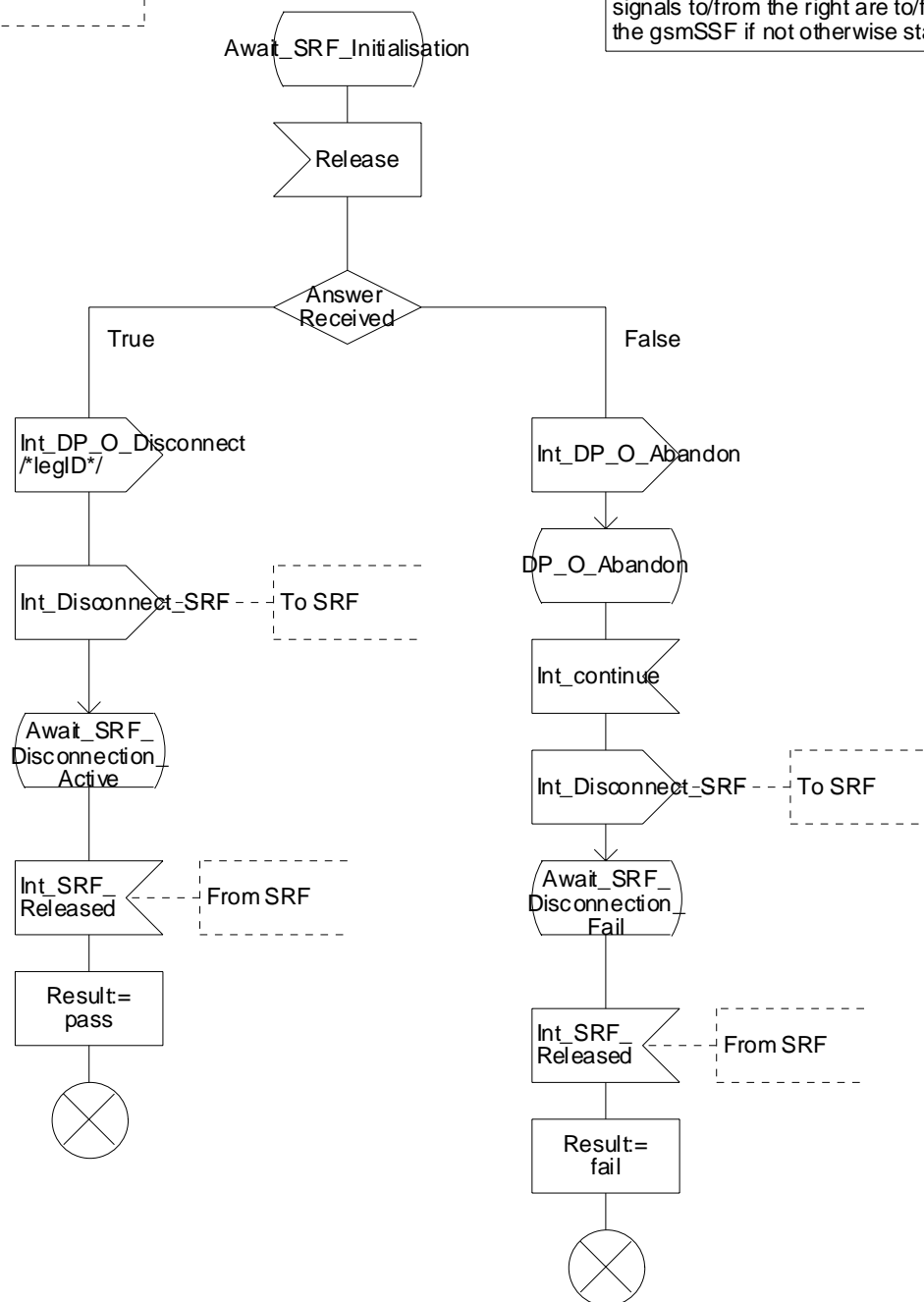
Figure 4.21d: Procedure CAMEL_OCH_CTR (sheet 4)

Procedure CAMEL_Start_TNRy 1(1)

Prodedure in MSC to start
the timer TNRy

gsmSSF
invoked?

No

Yes

DP6 or
No DP14 armed?

Yes

TNRy received? No

Yes

Start TNRy
with received
time value

TNRy default
value available?

No

Yes

Start TNRy with
default value
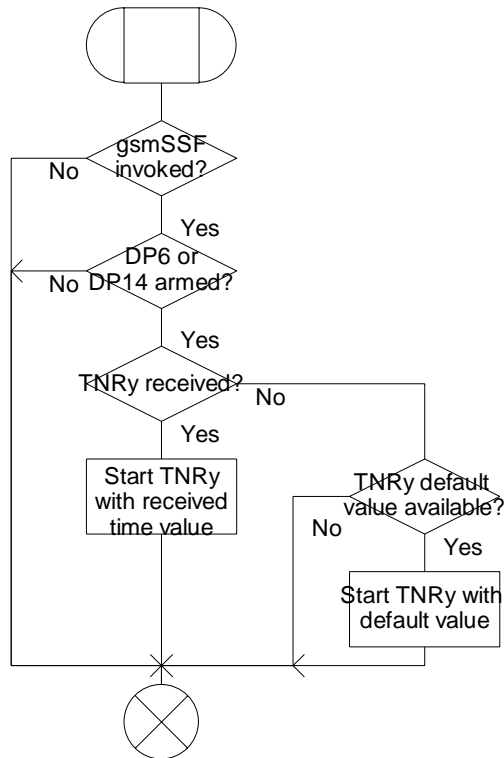
Figure 4.22: Procedure CAMEL_Start_TNRy (sheet 1)

Procedure CAMEL_Stop_TNRy 1(1)

Procedure in the MSC
to stop the timer TNRy
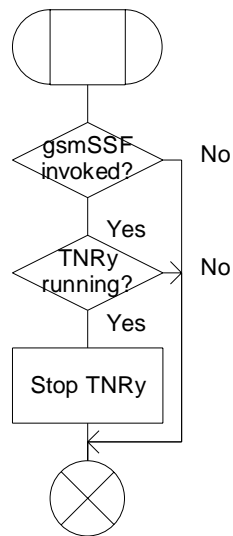
Figure 4.23: Procedure CAMEL_Stop_TNRy (sheet 1)

Procedure CAMEL_Store_Destination_Address 1(1)

Procedure in the MSC to
store the destination address
for an originating call leg,
roaming leg or forwarding leg
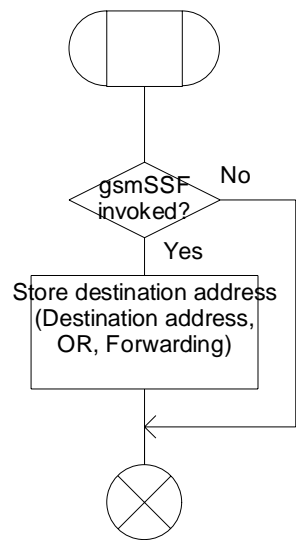
Procedure CAMEL_Store_Destination_Address
FPAR IN OR, Forwarding

gsmSSF
invoked? — No

Yes

Store destination address
(Destination address,
OR, Forwarding)

Figure 4.24: Procedure CAMEL_Store_Destination_Address (sheet 1)

Procedure CAMEL_Modify_CUG_Info 1(1)

/* Procedure in the MSC to modify CUG
information for the call as instructed
by the gsmSCF via the gsmSSF. */

Yes — CUG Interlock present?

No

Yes — CUG Outgoing Access present?

No

Modify CUG parameters with received info.

Yes — Non-CUG call present in SII2?

No

Remove CUG parameters from call info.
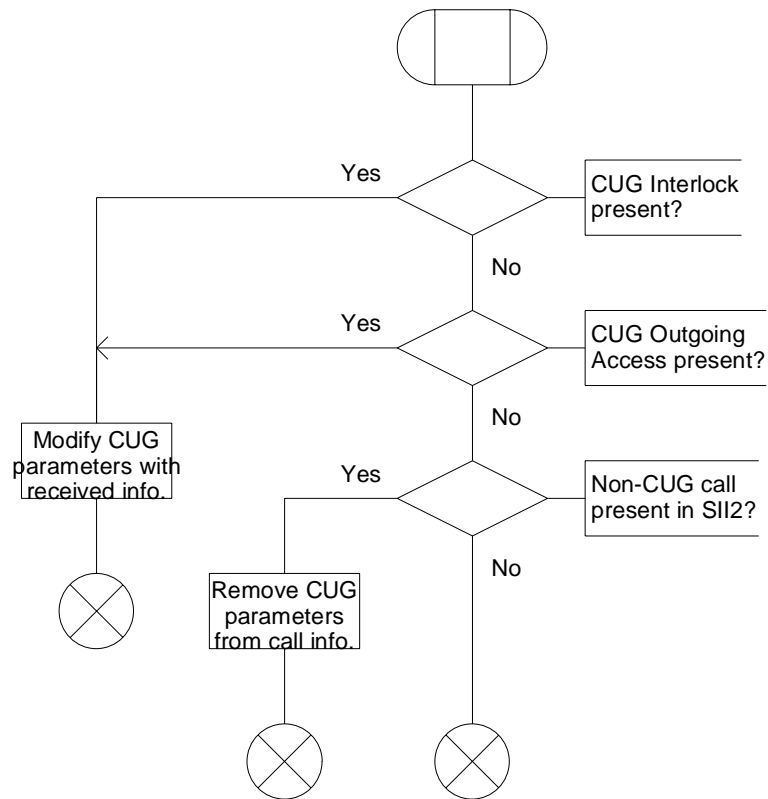
Figure 4.25: Procedure CAMEL_Modify_CUG_Info (sheet 1)

Procedure CAMEL_N_CSI_CHECK_MSC 1(1)

/* Procedure in the MSC to check
the N-CSI and set the N-CSI available
parameter for SIFOC accordingly.*/
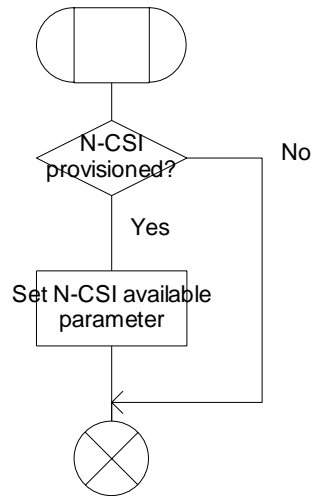
Figure 4.26: Procedure CAMEL_N_CSI_CHECK_MSC (sheet 1)

4.5.2.2 Handling of mobile originating calls in the originating VLR

The functional behaviour of the originating VLR is specified in 3GPP TS 23.018 [3]. The procedure specific to CAMEL are specified in this clause:

- Procedure CAMEL_OCH_VLR.

- Process CAMEL_Reconnected_Call_VLR.

Procedure CAMEL_OCH_VLR 1(1)

Procedure in the VLR
to handle an outgoing call stup

/* Signals to/from the left are
to/from the MSC */

O-CSI or D-CSI present
or N-CSI available received?

No

Yes

Result:=
pass

Complete Call

Wait_for_
SIFOC_2

Abort

Send Info
For Outgoing
Call

Result:=
fail

Result:=
pass
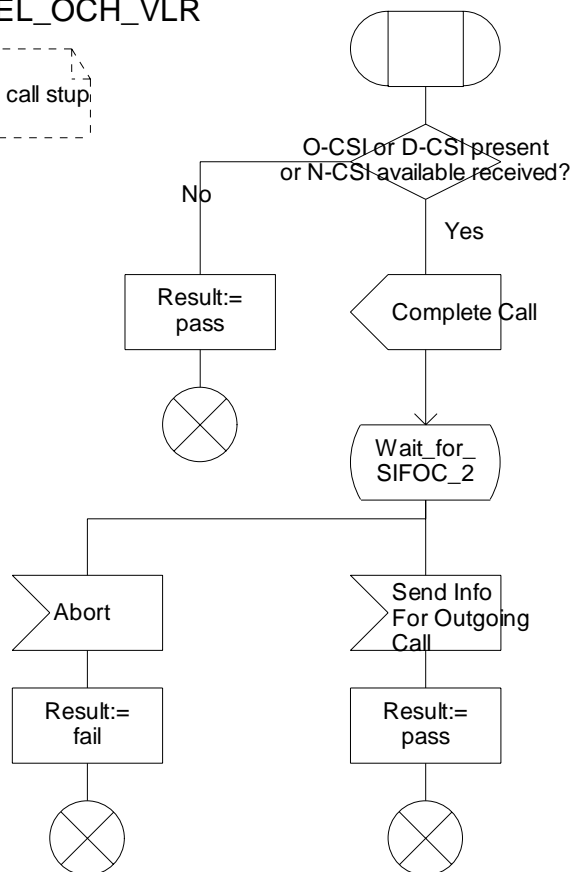
Figure 4.27a: Procedure CAMEL_OCH_VLR (sheet 1)

Process CAMEL_Reconnected_Call_VLR 1(1)

Process in the VLR to handle Send_Info_ For_Reconnected_Call

Signals to/from the left are to/from the MSC.

Idle

Send Info For Reconnected Call

Check_OG_ Barring

Check ODB and SS barring. Specified in 3GPP TS 23.018

Result= Call barred?

No

Yes

Send Info For Reconnected Call Ack

Idle

Set error:= Call barred

Send Info For Reconnected Call Negative Response

Idle
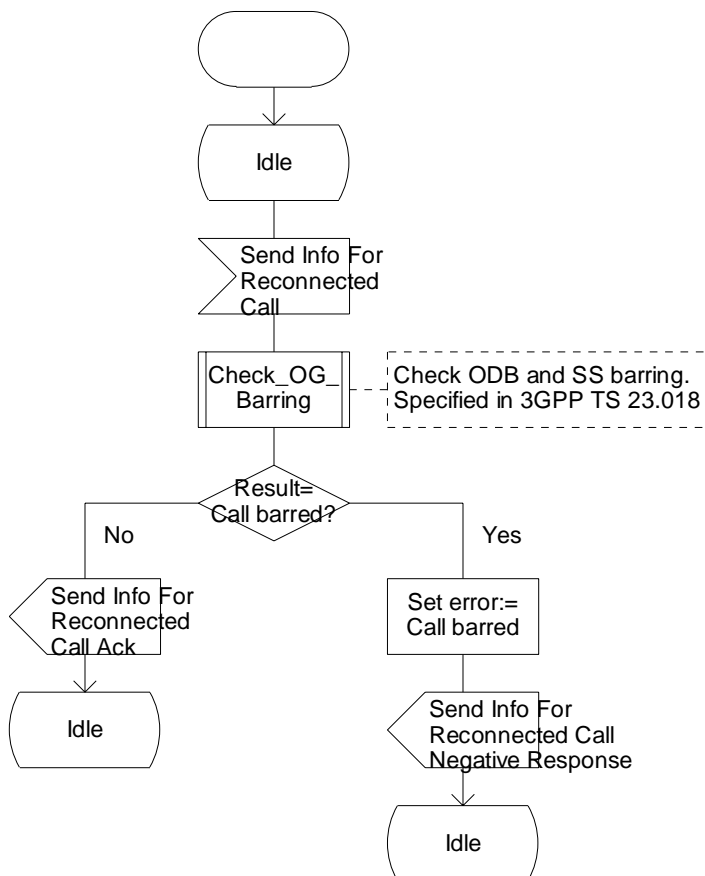
Figure 4.28a: Process CAMEL_Reconnected_Call_VLR (sheet 1)

4.5.3 Retrieval of routeing information

4.5.3.1 Retrieval of routeing information in the GMSC

The functional behaviour of the GMSC is specified in 3GPP TS 23.018 [3]. The procedures specific to CAMEL are specified in this clause:

- Procedure CAMEL_Set_ORA_Parameters;

- Procedure CAMEL_MT_GMSC_INIT;

- Procedure CAMEL_MT_GMSC_ANSWER;

- Procedure CAMEL_MT_GMSC_DISC1;

- Procedure CAMEL_MT_GMSC_DISC2;

- Procedure CAMEL_MT_GMSC_DISC3;

- Procedure CAMEL_MT_GMSC_DISC4;

- Procedure CAMEL_MT_GMSC_DISC5;

- Procedure CAMEL_MT_GMSC_DISC6;

- Procedure CAMEL_MT_CTR;

- Procedure CAMEL_MT_ETC;

- Procedure CAMEL_Start_TNRy;

- Procedure CAMEL_Stop_TNRy;

- Procedure CAMEL_MT_GMSC_Notify_CF.

  NOTE: Procedure CAMEL_MT_GMSC_DISC3 applies to CAMEL Phase 1 only.

The procedure Send_ACM_If_Required is specified in 3GPP TS 23.018 [3].

The following paragraphs give details on the behaviour of the GMSC in the procedure CAMEL_MT_GMSC_INIT.

4.5.3.1.1 Action of the GMSC on receipt of Int_Release_Call

An ISUP_Release is sent to the originating exchange and resources are released.

4.5.3.1.2 Action of the GMSC on receipt of Int_Error

The GMSC checks in T-CSI the default Call Handling parameter.

If the default call handling is release call, an ISUP_Release is sent to the originating exchange. The MSC then releases all call resources and the procedure CAMEL_MT_GMSC_INIT returns result=fail.

If the default call handling is continue call, the MSC continue call handling without CAMEL support.

4.5.3.1.3 Action of the GMSC on receipt of Int_Continue

If a FTN has been stored the information received from HLR is used to overwrite corresponding call parameters. Note that the MSISDN is replaced by the FTN as the Called party number. The redirection counter is incremented.

If no FTN has been stored, a Send Routeing Info message including a T-CSI suppression parameter is sent to the HLR. The Send Routing Info includes an indication which CAMEL Phases are supported by the GMSC/gsmSSF.

4.5.3.1.4 Action of the GMSC on receipt of Int_Continue_With_Argument

If an FTN has been stored, the information received from HLR is used to overwrite corresponding call parameters. The MSISDN is replaced by the FTN as the Called party number. The redirection counter is incremented.

If no FTN has been stored, a Send Routeing Info message including a T-CSI suppression parameter is sent to the HLR. The Send Routing Info includes an indication which CAMEL phases are supported by the GMSC/gsmSSF.

The MSC shall replace the call parameters by the information received in the Int_Continue_With_Argument message. Call parameters which are not included in the Int_Continue_With_Argument message are unchanged.

Signalling limitations or regulatory requirements may require the Calling Party Category, Generic Number, Original Called Party Number and Redirecting Party ID to be ignored or modified.

4.5.3.1.5 Action of the GMSC on receipt of Int_Connect

If the Destination Number received from the gsmSCF (via the gsmSSF) is the same as the ISUP Called party number, i.e. the MSISDN, the following parameters, if received, are used to overwrite the corresponding ISUP parameters (for mapping see 3GPP TS 29.078 [5]): Calling Party Category and Generic Number. If received, the Announcement Suppression Indicator is stored. The further processing is described in clause 4.5.3.1.3 with the addition that the Announcement Suppression indicator, if stored, is sent to the HLR in the Send_Routeing_Info message.

If:

- the Destination Number received from the gsmSCF (via the gsmSSF) is not the same as the stored ISUP Called party number, i.e. the MSISDN; and

- a CUG active indication was received from the HLR; and

- CUG information was received in the ISUP_IAM for the incoming call;

then an exception event is reported to the process gsmSSF, an ISUP_Release is sent to the originating exchange and all resources are released.

Otherwise the following parameters, if received, are used to overwrite the corresponding ISUP parameters (for mapping see 3GPP TS 29.078 [5]): Destination Number, Calling Party Category, Generic Number, Original Called Party ID, Redirecting Party ID and Redirection Information. Call parameters that are not included in the Int_Connect message are unchanged.

As a network operator option loop prevention mechanisms may cause the redirection information to be ignored or modified (e.g., if the Redirection counter has been decreased).

Signalling limitations or regulatory requirements may require the Calling Party Category, Generic Number, Original Called Party Number and Redirecting Party ID to be ignored or modified.

The network signalling system shall indicate that this is an internal network number.

4.5.3.1.6 Action of the GMSC on receipt of Send_Routeing_Info Negative Response (at state Wait_For_Routeing_Info_2)

An exception event is reported to the process gsmSSF. If the Announcement Suppression indicator has been received from the gsmSCF (via the gsmSSF) any announcements or tones shall be suppressed.

4.5.3.1.7 Action of the GMSC on receipt of Send_Routeing_Info ack with MSRN (at state Wait_For_Routeing_Info_2)

An ISUP_IAM with the MSRN as Called party number is constructed.

4.5.3.1.8 Action of the GMSC on receipt of Send_Routeing_Info ack with FTN (at state Wait_For_Routeing_Info_2)

The information received from HLR is used to overwrite corresponding call parameters (for details see 3GPP TS 23.018 [3]). The redirection counter is incremented.

4.5.3.1.9 Action of the GMSC on receipt of Send_Routeing_Info ack with O-CSI and/or D-CSI and FTN (at state Wait_For_Routeing_Info_2)

The information received from the HLR is used to overwrite corresponding call parameters. The redirection counter is incremented. The Called Party Number is set to FTN. The O-CSI and/or D-CSI is stored.

4.5.3.1.10 Action of the GMSC in procedure CAMEL_MT_ETC

In procedure CAMEL_MT_ETC (sheet 2) the GMSC will remain in the Wait_For_Assiting_Answer state until it receives an ISUP Answer Message (ANM) or timeout occurs. This is to ensure that a call record is always generated for every successful establishment of a temporary connection to a gsmSRF, especially in the case where the connection is between PLMNs.

   NOTE: This means that it may not be possible to access an SRF which does not generate an ISUP Answer Message (ANM).

If a Progress message is sent towards the MS the progress indicator shall indicate "In Band Information".

4.5.3.1.11 Action of the GMSC in procedure CAMEL_MT_GMSC_Notify_CF

The Forwarding reason is taken from the Send Routeing Info ack (for early call forwarding) or the Resume Call Handling (for Optimal Routeing of Late Call Forwarding).

The Int_DP_T_No_Answer and Int_DP_T_Busy messages include a parameter to indicate that the call has encountered conditional call forwarding. The gsmSSF will transfer this parameter to the CAP_Event_Report_BCSM message which it sends to the gsmSCF.

Procedure CAMEL_Set_ORA_Parameters 1(1)

/* Procedure in the GMSC
to set CAMEL parameters for
the procedure Obtain_Routeing_Address. */

Call reference
Number
allocated ?

No

Allocate Call
reference number

Yes
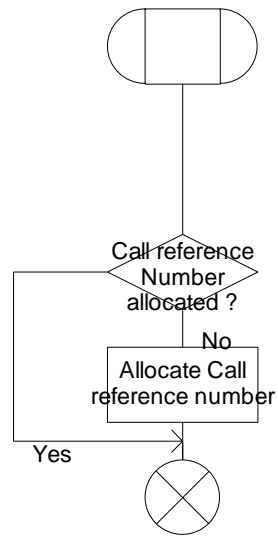
Figure 4.29a: Procedure CAMEL_Set_ORA_Parameters (sheet 1)

Procedure CAMEL_MT_GMSC_INIT 1(8)

/* Process in the GMSC
to perform CAMEL handling
for a terminating call request */

/* Signals to/from the right are to/from
the gsmSSF. */

Reconnect=
true?

No

Yes

2

CAMEL information
Received in SRIack?

Yes

no

MSRN
received?

No

yes

FTN
Received?

No

yes

Result:=
MSRN

Result:=
GSM_FTN

Result:=
Fail

⊗ ⊗ ⊗

Content of
SRI ack

| T-CSI | T-CSI O-CSI and/or D-CSI | T-CSI FTN | FTN T-CSI O-CSI and/or D-CSI | FTN O-CSI and/or D-CSI |

set
CSI=T-CSI

Set
CSI=T-CSI

Set
CSI=T-CSI

Set
CSI=T-CSI

Set
CSI=O-CSI
and/or D-CSI

Store O-CSI
and/or D-CSI

Store FTN

Store O-CSI
and/or D-CSI
& FTN

set redirection
information

Result:=
GSM_FTN

⊗

Int_Invoke
gsmSSF
(T-CSI)

wait_for_
gsmSSF_Invoked
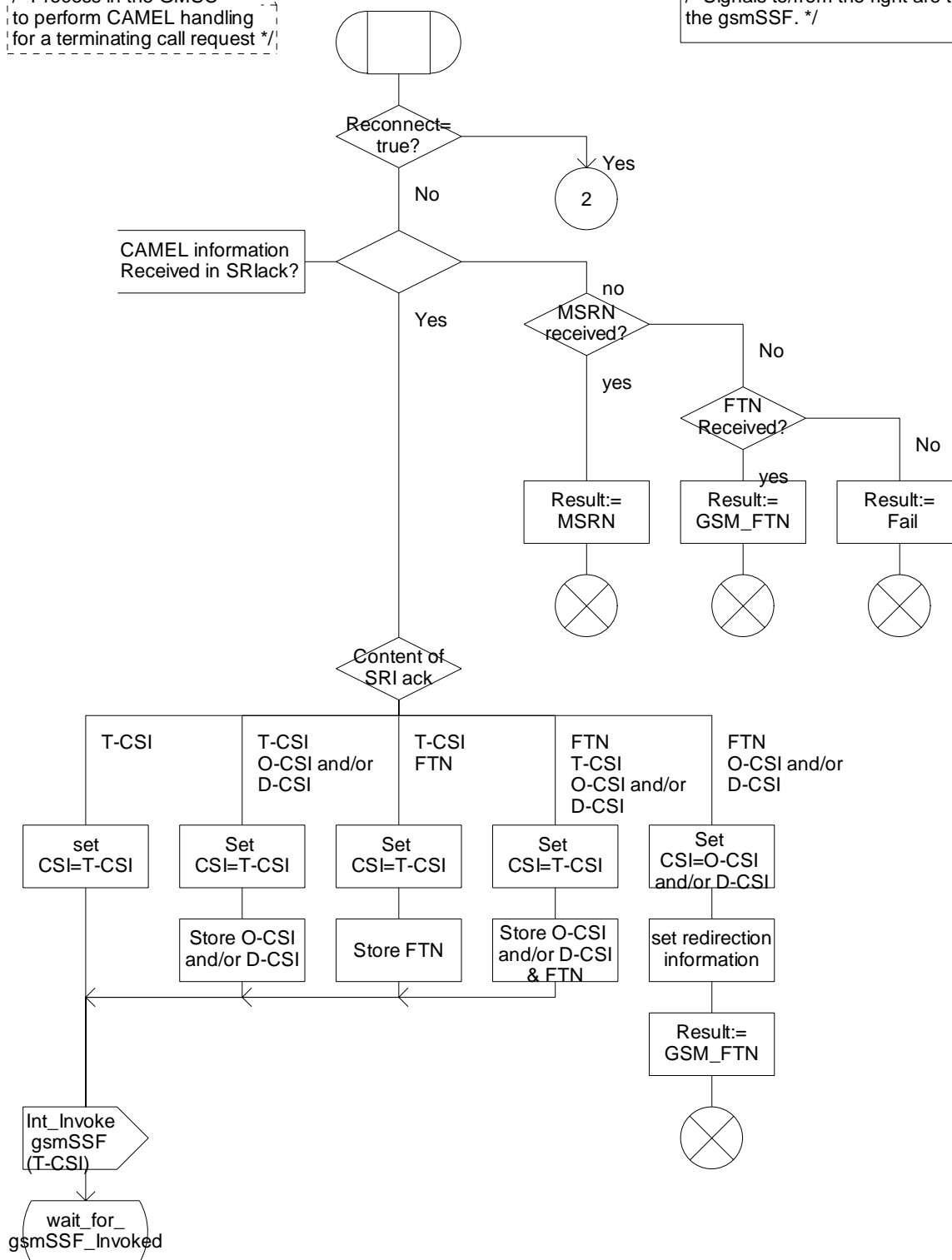
Figure 4.30a: Procedure CAMEL_MT_GMSC_INIT (sheet 1)

Procedure CAMEL_MT_GMSC_INIT 2(8)

/* Process in the GMSC
to perform CAMEL handling
for a terminating call request */

Signals to/from the left are to/from
the orginating exchange;
signals to/from the right are to/from
the gsmSSF

wait_for_
gsmSSF_Invoked

Int_gsmSSF_
Invoked

Release

Answer_Received :=
False

Int_T_Exception

Int_DP_Termination_
attempt_Autorized

Result:=
aborted

DP_Termination_
attempt_
Autorized
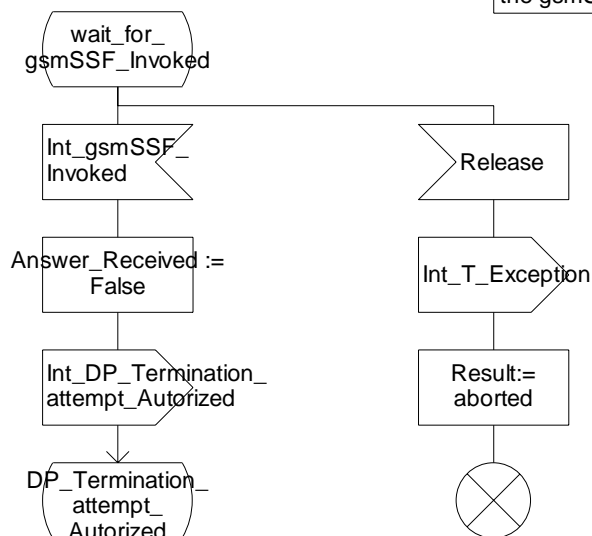
Figure 4.30b: Procedure CAMEL_MT_GMSC_INIT (sheet 2)

Procedure CAMEL_MT_GMSC_INIT 3(8)

/* Process in the GMSC
to perform CAMEL handling
for a terminating call request */

Signals to/from the left are to/from
the orginating exchange;
signals to/from the right are to/from
the gsmSSF;
if not otherwise stated.

DP_Termination_
Attempt
_Authorised

Int_Continue_
With
_Argument

Int_Continue

Int_Connect

2

'Modify call
parameters with
received information'

Send_ACM_
If_Required

Procedure defined
in 3GPP TS 23.018

Yes — Destination
Number=
called MSISDN

No

Original
Called Party Subscribed
To CUG?

Yes

No

CAMEL_
Modify
_CUG_Info

1

Modify call
parameters
with received
information.

FTN
stored ?

Yes

No — CUG info
received in
incoming call?

No

CAMEL_CHECK
_SII2_CDTI

Modify call
parameters
with received
information

Yes

Result=
Pass

No

Yes

CFU — Type of
Call forwarding?

Set redirection
information

FTN:=
Destination Routing
Address

Int_Exception

Set T-CSI
suppression

Others

Int_DP_T_Busy

Result:=
GSM_FTN

Result:=
CAMEL_FTN

Result:=
fail

CLI_MT_
GMSC

DP_T_Busy

⊗

⊗

⊗

Send
Routeing
Info

See 3GPP TS 23.081

Wair_For_
Routeing
_Info_2

To HLR

Figure 4.30c: Procedure CAMEL_MT_GMSC_INIT (sheet 3)

Procedure CAMEL_MT_GMSC_INIT 4(8)

Process in the GMSC to perform CAMEL handling for a terminating call request

Signals to/from the left are to/from the originating exchange; signals to/from the right are to/from the gsmSSF; if not otherwise stated.

DP_Termination_ Attempt_ Authorised

Release

Int_DP_ _T_Abandon

DP_T_Abandon

Int_continue

Result= aborted

Int_ReleaseCall

Int_Error

Default Call Handling = Continue Call?

No

Yes

1

Result= fail
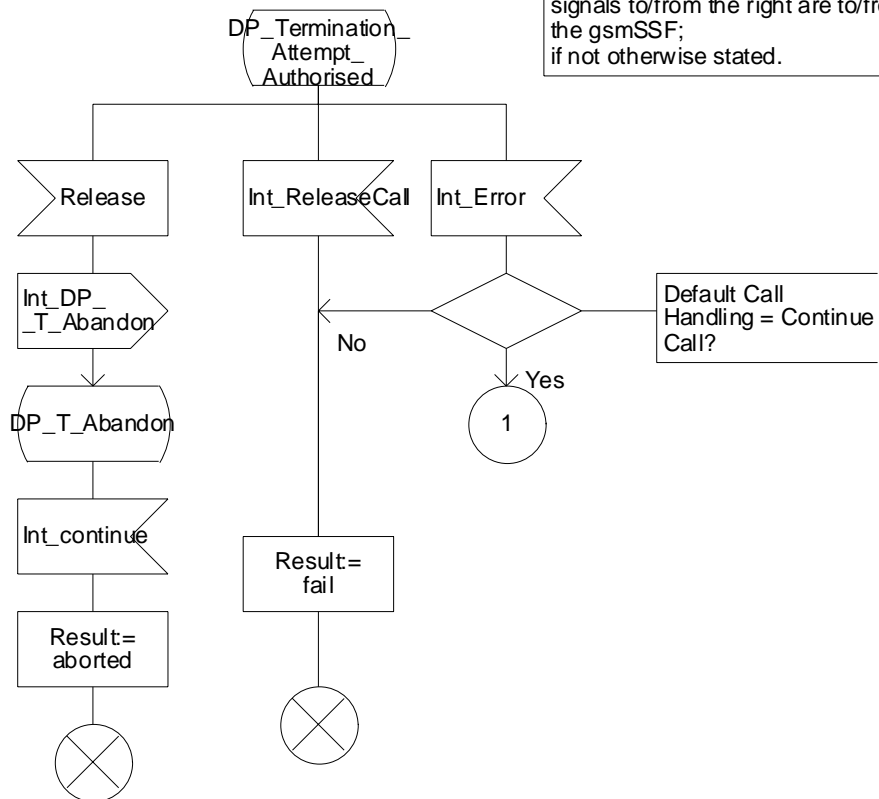
Figure 4.30d: Procedure CAMEL_MT_GMSC_INIT (sheet 4)

Procedure CAMEL_MT_GMSC_INIT 5(8)

/* Process in the GMSC
to perform CAMEL handling
for a terminating call request */

Signals to/from the right are to/from
the gsmSSF.

DP_Termination_Attempt_Authorised
DP_T_Busy

Int_Establish_
Temporary
Connection

Int_Connect_To_
Resource

CAMEL_MT_ETC

CAMEL_MT_CTR

Result=
fail?

No

Yes

Result:=
fail

-

⊗
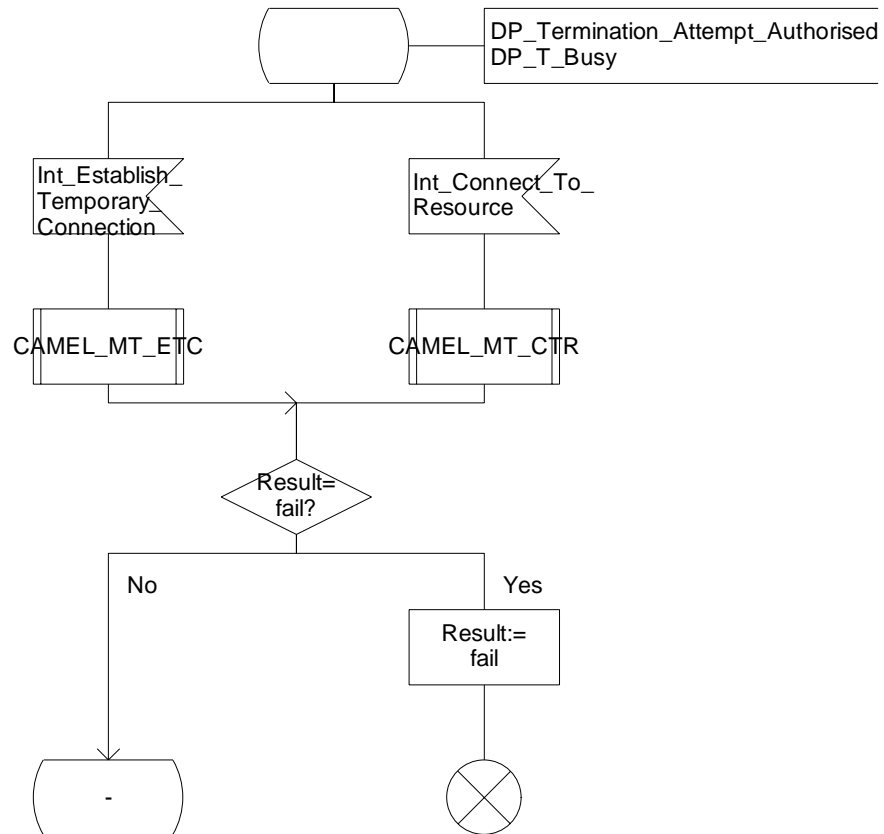
Figure 4.30e: Procedure CAMEL_MT_GMSC_INIT (sheet 5)

Procedure CAMEL_MT_GMSC_INIT 6(8)

Process in the GMSC
to perform CAMEL handling
for a terminating call request

Signals to/from the right are to/from
the gsmSSF;
if not otherwise stated.

Wait_For_
Routeing_
Info_2

Send Routeing
Info
Negative Response <--- From HLR

Int_Release_Call

Int_DP_T_Busy

DP_T_Busy

Result:=
Fail

⊗
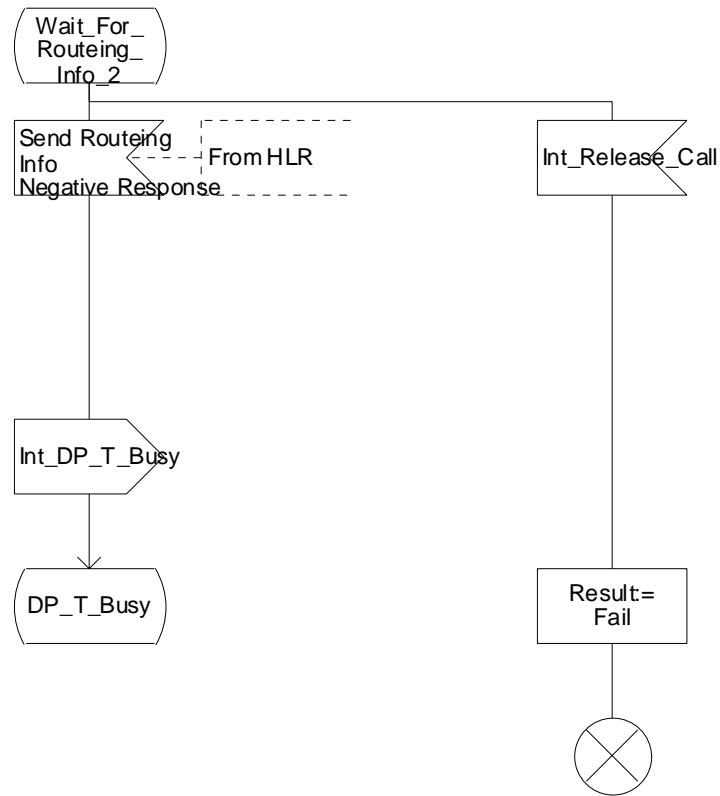
Figure 4.30f: Procedure CAMEL_MT_GMSC_INIT (sheet 6)

Procedure CAMEL_MT_GMSC_INIT 7(8)

/* Process in the GMSC
to perform CAMEL handling
for a terminating call request */

/* Signals to/from the left are to/from
the orginating exchange;
signals to/from the right are to/from
the gsmSSF;
if not otherwise stated. */

Wait_For_
Routeing
_Info_2

Send Routeing
Info Ack
/* FTN */ — From HLR

Send Routeing
Info Ack
/* FTN, O-CSI
and/or D-CSI */ — From HLR

Send Routeing
Info Ack
/* MSRN */ — From HLR

Store O-CSI
and/or D-CSI

Set redirection
information

Result:=
MSRN

Result:=
GSM_FTN

⊗

⊗
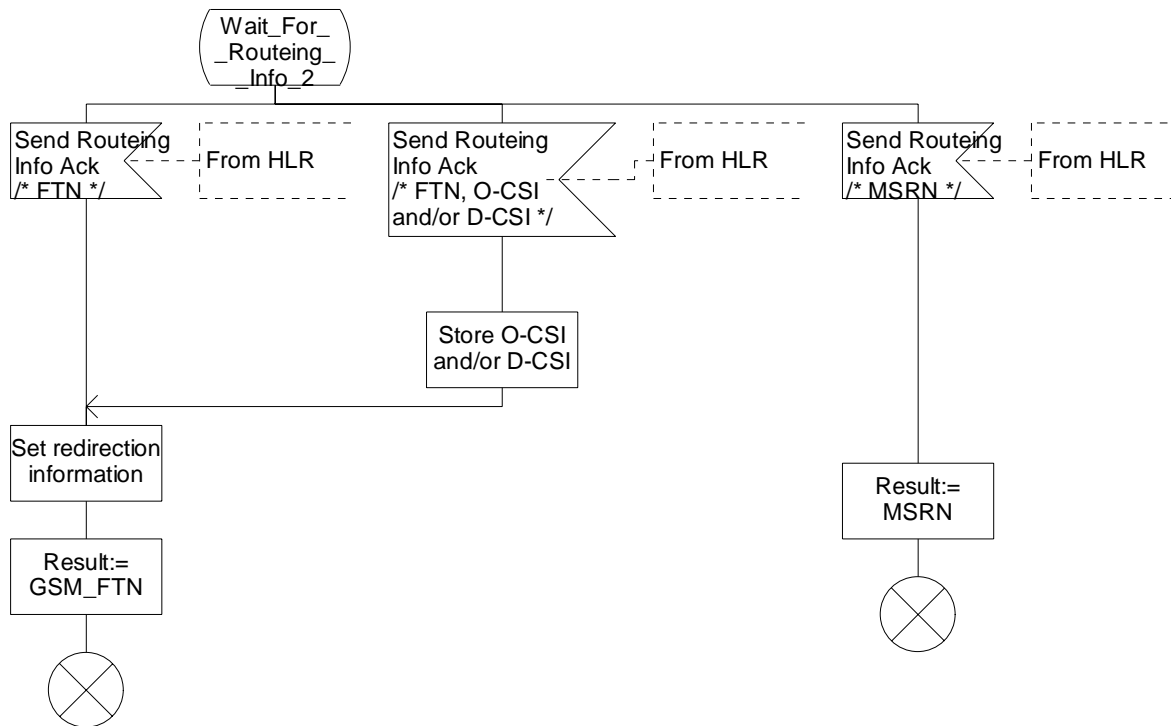
Figure 4.30g: Procedure CAMEL_MT_GMSC_INIT (sheet 7)

Procedure CAMEL_MT_GMSC_INIT 8(8)

Process in the GMSC
to perform CAMEL handling
for a terminating call request

DP_T_busy

Signals to/from the left are to/from
the orginating exchange;
signals to/from the right are to/from
the gsmSSF;
if not otherwise stated.

Release

Int_Release

Int_Error

Int_Continue

Int_Connect

Int_T_Abandon

Result=
fail

Int_T_Exception

⊗

DP_T_Abandon

Result=
fail

2

Int_continue

⊗

Result=
aborted

⊗

Figure 4.30h: Procedure CAMEL_MT_GMSC_INIT (sheet 8)

Procedure CAMEL_MT_GMSC_ANSWER 1(2)

/* Process in the GMSC to handle a terminating call request */

/* Signals to/from the left are to/from the originating exchange; signals to/from the right are to/from the terminating exchange if not otherwise stated. */

gsmSSF invoked?

no

yes

Result:= pass

Int_DP_T_Answer — to gsmSSF

Answer Received := True

DP_T_Answer

Int_Release --- from gsmSSF

Release

Release

Release

from gsmSSF --- Int_continue

CAMEL_MT_GMSC_DISC1

CAMEL_MT_GMSC_DISC2

Release

Result= reconnect?

Yes

Result= CAMEL_handling?

Yes

Result= CAMEL_handling?

No

No

No

Release

Release

Answer Received := False

Result:= fail

Result:= pass

Result:= fail

Result:= reconnect
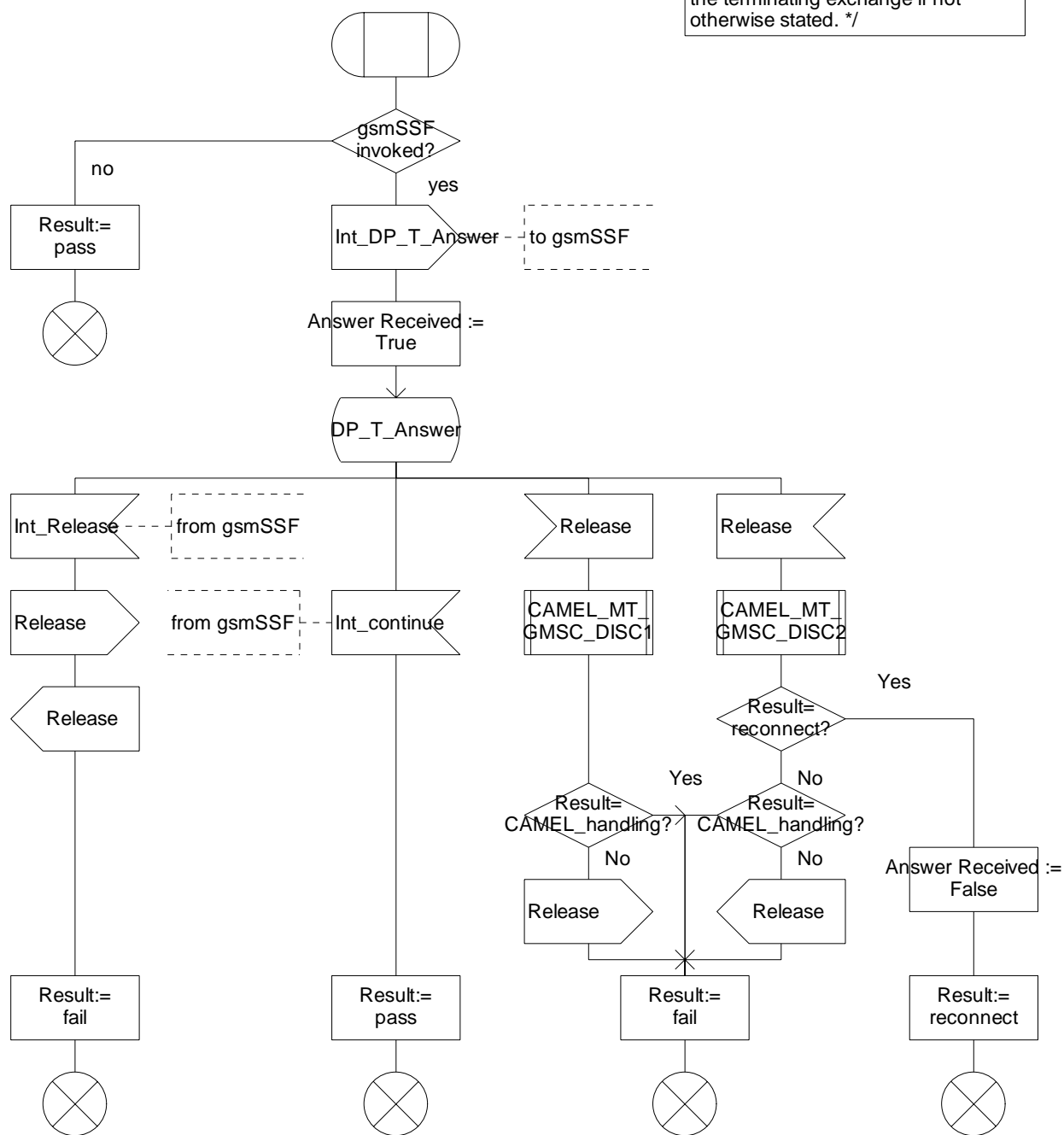
Figure 4.31a: Procedure CAMEL_MT_GMSC_ANSWER (sheet 1)

Procedure CAMEL_MT_GMSC_ANSWER 2(2)

/* Process in the GMSC
to handle a
terminating call request */

/* Signals to/from the left are to/from
the originating exchange;
signals to/from the right are to/from
the terminating exchange if not
otherwise stated. */

DP_T_Answer

Int_Error

No ◇ Default Call Handling =
Continue Call?

Yes

Release

Result :=
pass

⊗

Release

Result:=
fail

⊗
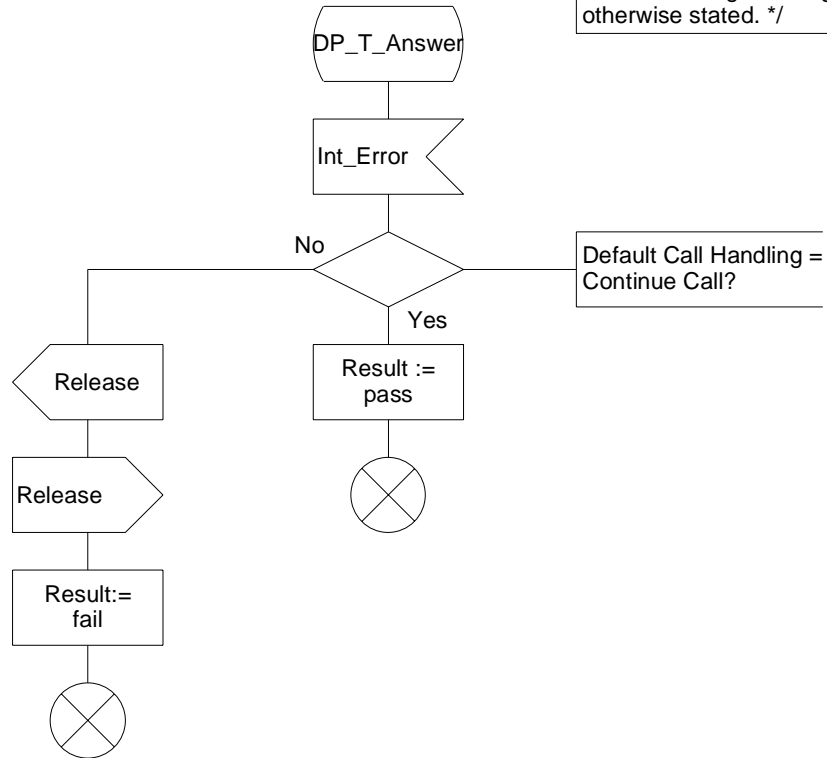
Figure 4.31b: Process CAMEL_MT_GMSC_ANSWER (sheet 2)

Procedure CAMEL_MT_GMSC_DISC1 1(1)

/* Process in the GMSC
to handle a
terminating call request */

/* Signals to/from
the right are to/from the gsmSSF if
not otherwise stated. */

gsmSSF
invoked?

No

Yes

Int_DP_
T_Disconnect
/* legId = 1 */

DP_
T_Disconnect_1

Int_Error   Int_Release_Call   Int_Continue   Release

From destination
exchange or process
MT_CF_MSC

Int_DP_
T_Disconnect
/* legId = 2 */

DP_
T_Disconnect

To destination
exchange
or MT_CF_MSC

Int_Continue   Int_Error   Int_ReleaseCall

Release

Result:=
normal_handling

Result:=
CAMEL_Handling
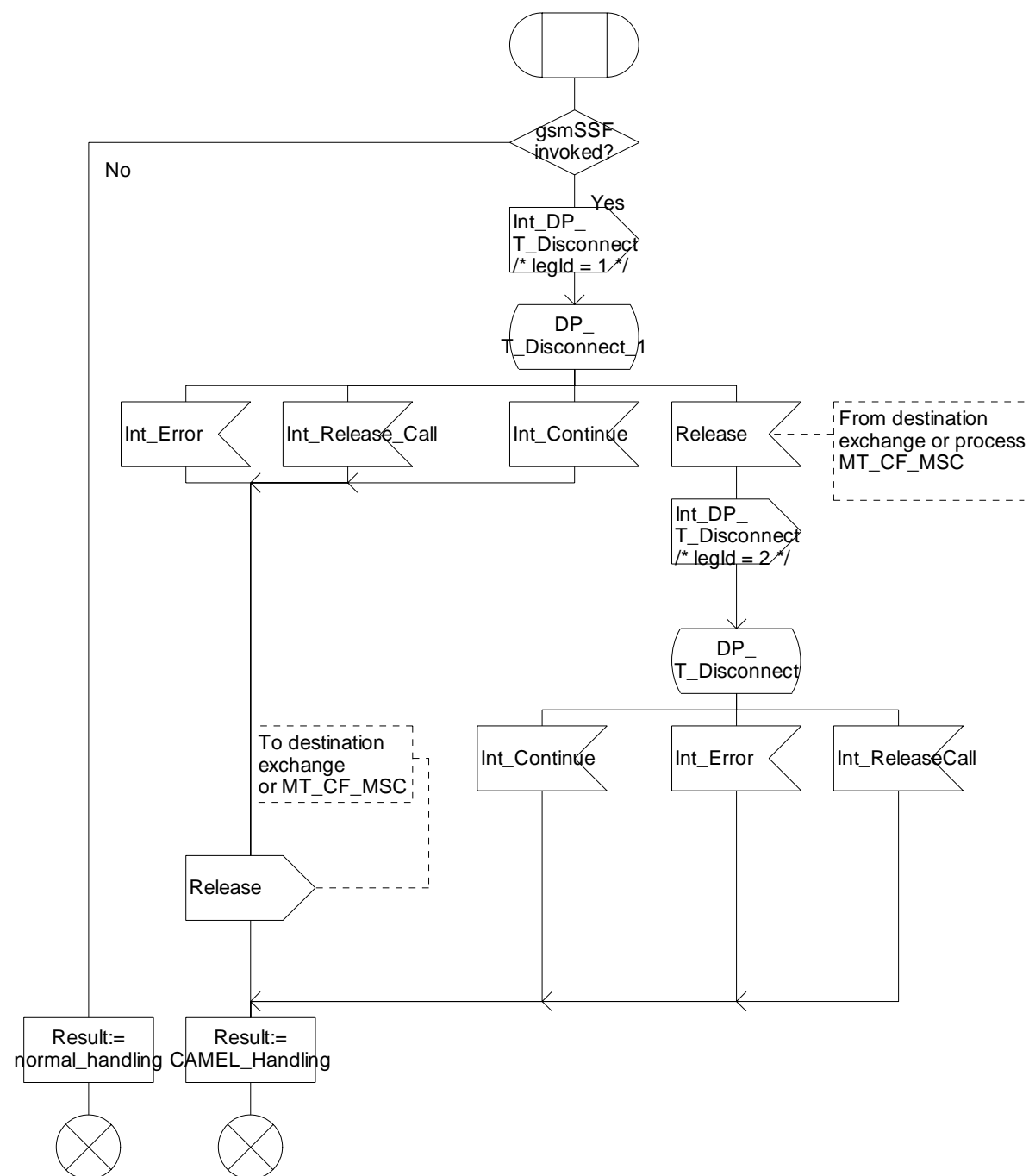
Figure 4.32a: Procedure CAMEL_MT_GMSC_DISC1 (sheet 1)

Procedure CAMEL_MT_GMSC_DISC2 1(2)

/* Process in the GMSC to handle a terminating call request */

/* Signals to/from the left are to/from the originating exchange; signals to/from the right are to/from the gsmSSF if not otherwise stated. */

gsmSSF invoked?

No
Result:= normal_handling

Yes
Int_DP_ T_Disconnect /* legId = 2 */

DP_ T_Disconnect_2

Int_Connect

Int_Error

Int_Release_Call

Int_Continue

Release

Answer Received := False

CAMEL_ _Modify_ _CUG_Info

Modify call parameters with received information

Result:= reconnect

Release

Int_DP_ T_Disconnect /* legId = 1 */

DP_ T_Disconnect

Int_Continue

Int_Error

Int_ReleaseCall

Result:= CAMEL_handling

Figure 4.33a: Procedure CAMEL_MT_GMSC_DISC2 (sheet 1)

Procedure CAMEL_MT_GMSC_DISC2 2(2)

/* Process in the GMSC
to handle a
terminating call request */

Signals to/from
the right are to/from the
gsmSSF.

DP_T_Disconnect_2

Int_Establish_
Temporary_Connection

Int_Connect_
To_Ressource

CAMEL_MT_ETC

CAMEL_MT_CTR

Result=
fail?

No

Yes

DP_T_Disconnect_2

Result:=
fail
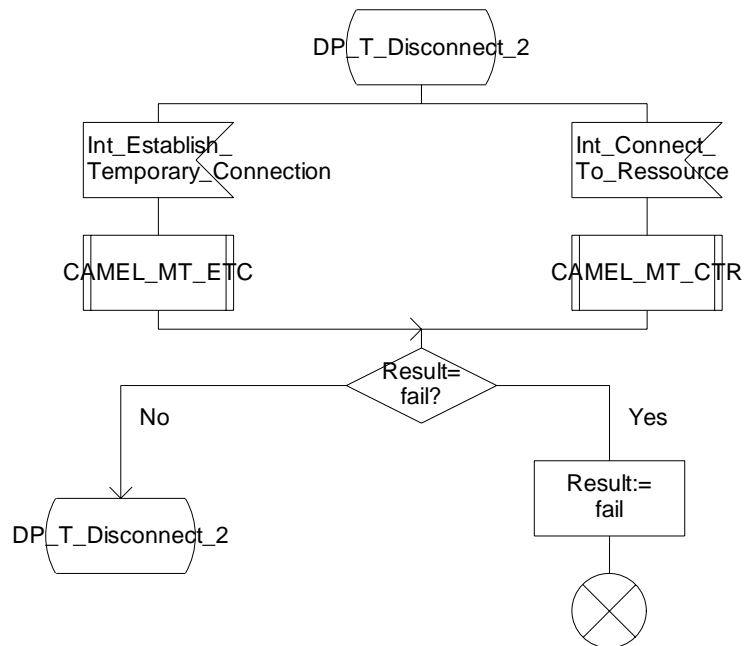
Figure 4.33b: Procedure CAMEL_MT_GMSC_DISC2 (sheet 2)

Procedure CAMEL_MT_GMSC_DISC3 CAMTD3_1(1)

Procedure in the GMSC to handle
premature release of a CAMEL call

No — gsmSSF exists?

Yes

Int_T_ Exception — To gsmSSF
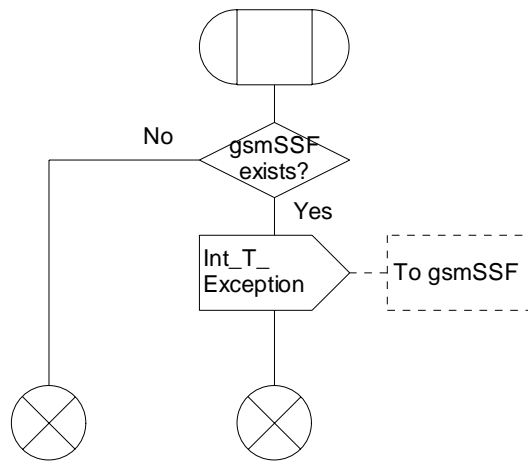
Figure 4.34a: Procedure CAMEL_MT_GMSC_DISC3 (sheet 1)

Procedure CAMEL_MT_GMSC_DISC4 1(3)

/* Procedure in the GMSC to handle a terminating call request */

/* Signals to/from the left are to/from the orginating exchange; signals to/from the right are to/from the gsmSSF. */

gsmSSF invoked?

No

Result:= fail

Yes

Int_DP_T_Busy

DP_T_Busy

Int_Connect

CAMEL_ _Modify_ _CUG_Info

Modify call parameters with received information

Result:= reconnect

Int_Continue

Int_Error

Int_Release_Call

Result:= fail
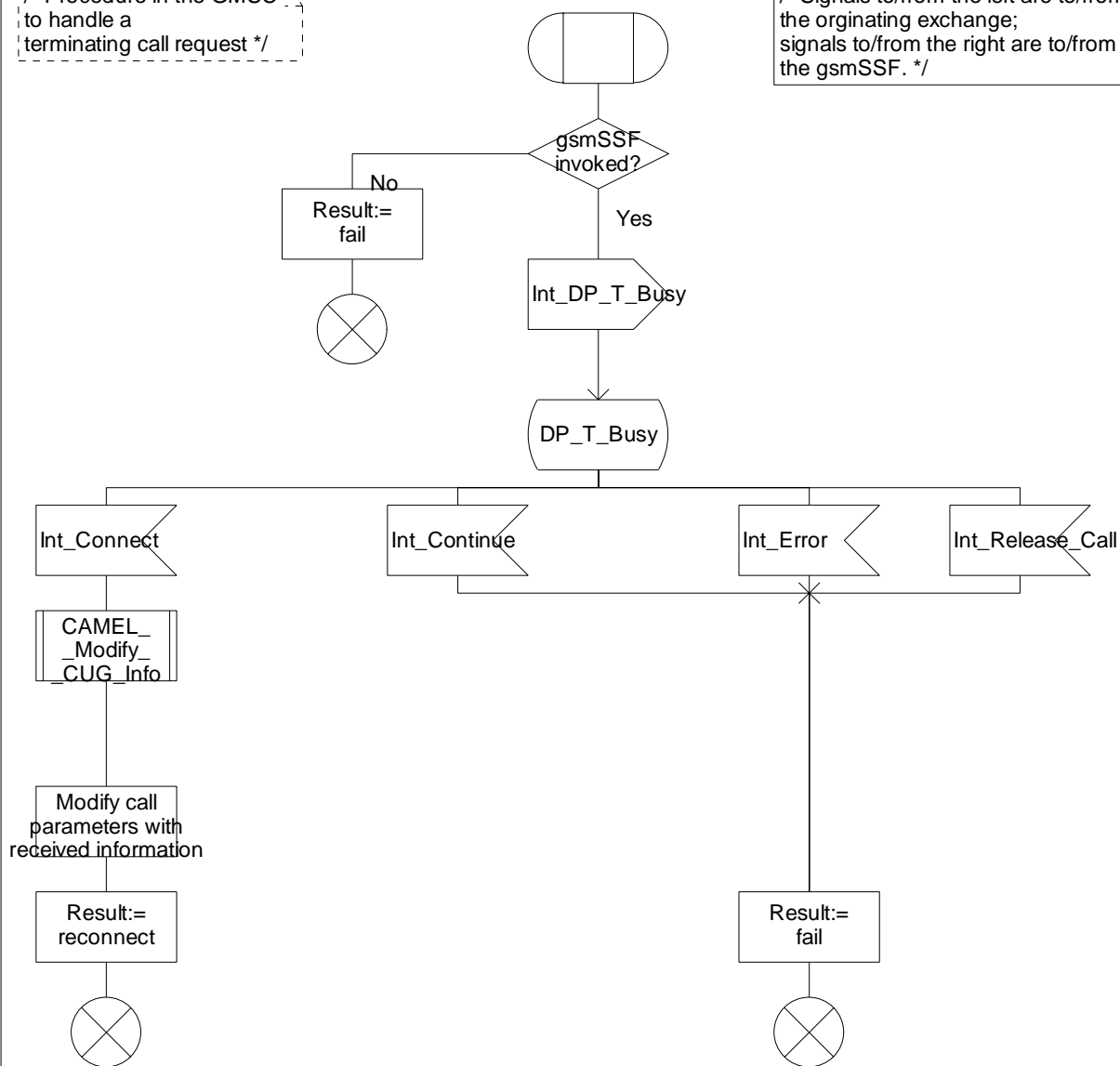
Figure 4.35a: Procedure CAMEL_MT_GMSC_DISC4 (sheet 1)

Procedure CAMEL_MT_GMSC_DISC4 2(3)

/* Procedure in the GMSC
to handle a
terminating call request */

Signals to/from the right are to/from
the gsmSSF if not otherwise stated.

DP_T_Busy

Int_Establish_
Temporary
Connection

Int_Connect_To_
Resource

CAMEL_MT_ETC

CAMEL_MT_CTR

Result=
fail?

No

Yes

Result:=
fail

-

⊗
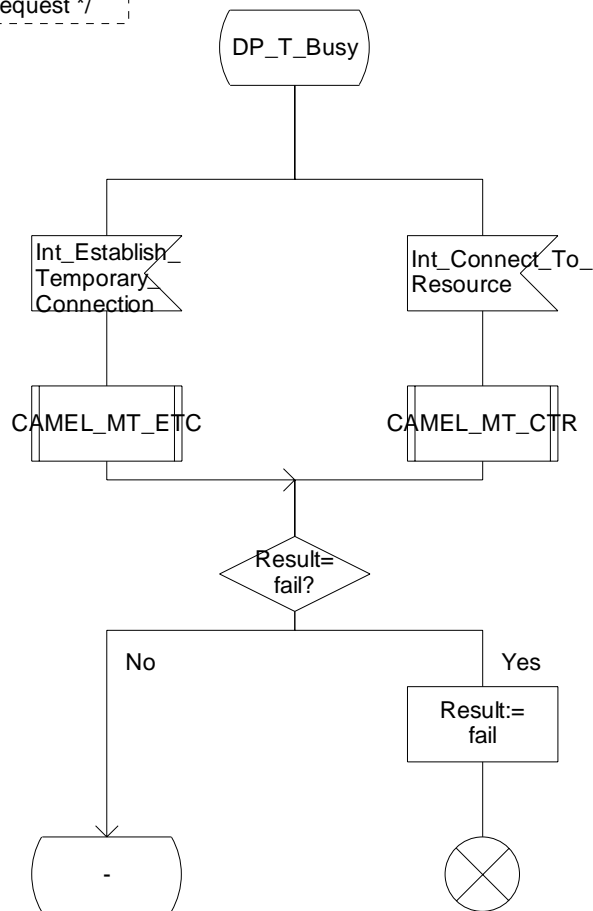
Figure 4.35b: Procedure CAMEL_MT_GMSC_DISC4 (sheet 2)

Procedure CAMEL_MT_GMSC_DISC4 3(3)

/* Procedure in the GMSC
to handle a
terminating call request */

Signals to/from the left are to/from
the orginating exchange;
signals to/from the right are to/from
the gsmSSF.

DP_T_Busy

Release

Int_DP_T_Abandon

DP_T_Abandon

Int_continue

Result:=
fail
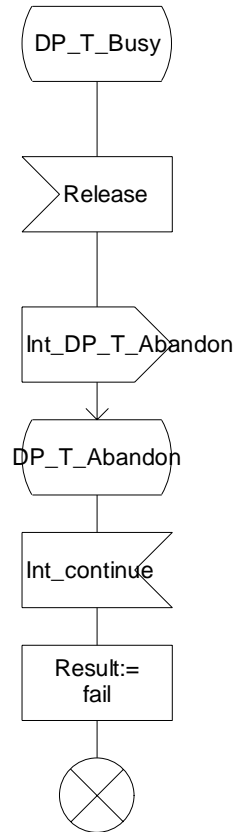
Figure 4.35c: Procedure CAMEL_MT_GMSC_DISC4 (sheet 3)

Procedure CAMEL_MT_GMSC_DISC5 1(3)

Process in the GMSC to handle a terminating call request

Signals to/from the right are to/from the gsmSSF; if not otherwise stated.

gsmSSF invoked?

No

Result:= continue

Release → To process MT_CF_MSC

Yes

Int_DP_T_ _No_Answer

ORA result= Forward

Yes

No

Release → To process MT_CF_MSC

DP_T_No_Answer

Int_Connect

Int_Continue

Int_Error

Int_Release_Call

CAMEL_ _Modify_ _CUG_Info

Int_T_Exception

Modify call parameters with received information

Result:= reconnect

Result:= release

Result:= release

Figure 4.36a: Procedure CAMEL_MT_GMSC_DISC5 (sheet 1)

Procedure CAMEL_MT_GMSC_DISC5   2(3)

Process in the GMSC
to handle a
terminating call request

Signals to/from the right are to/from
the gsmSSF if not otherwise stated.

DP_T_No_Answer

Int_Establish_
Temporary
Connection

Int_Connect_To_
Resource

CAMEL_MT_ETC

CAMEL_MT_CTR

Result=
fail?

No   Yes

Result:=
release

DP_T_No_Answer
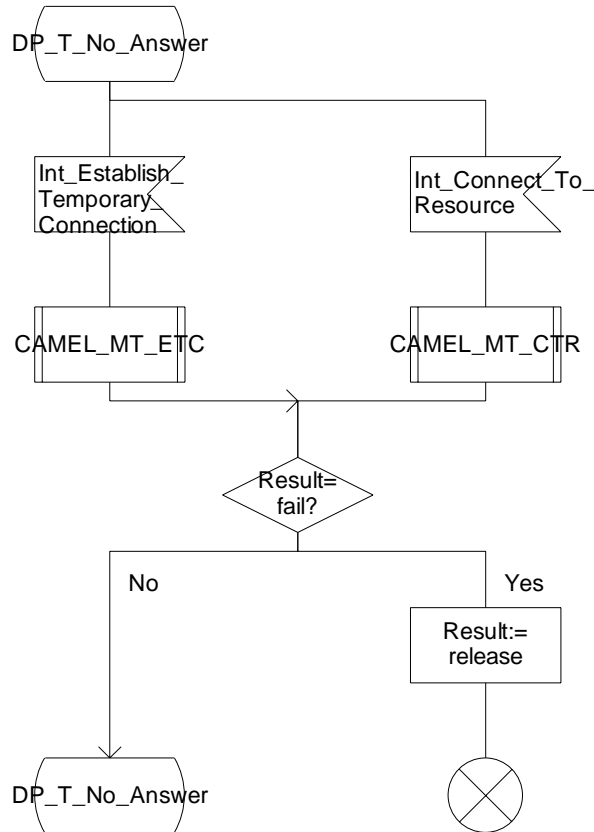
Figure 4.36b: Procedure CAMEL_MT_GMSC_DISC5 (sheet 2)

Procedure CAMEL_MT_GMSC_DISC5   3(3)

Process in the GMSC
to handle a
terminating call request
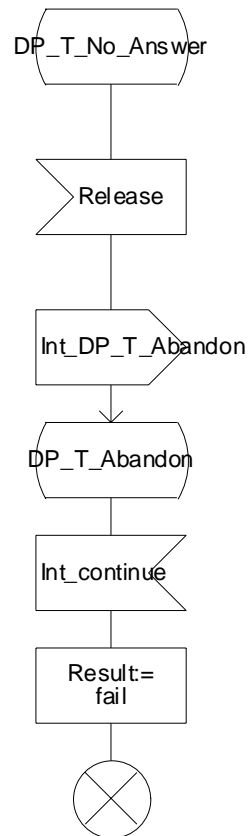
DP_T_No_Answer

Signals to/from the left are to/from
the orginating exchange;
signals to/from the right are to/from
the gsmSSF;
if not otherwise stated.

Release

Int_DP_T_Abandon

DP_T_Abandon

Int_continue

Result:=
fail

⊗

Figure 4.36c: Procedure CAMEL_MT_GMSC_DISC5 (sheet 3)

Procedure CAMEL_MT_GMSC_DISC6   1(1)

/* Process in the GMSC
to handle a
terminating call request */

/* Signals to/from the right are to/from
the gsmSSF;
if not otherwise stated. */

gsmSSF
invoked?

No

Yes

Result:=
continue

Int_DP_T_Abandon

DP_T_Abandon

Int_continue

Result:=
fail
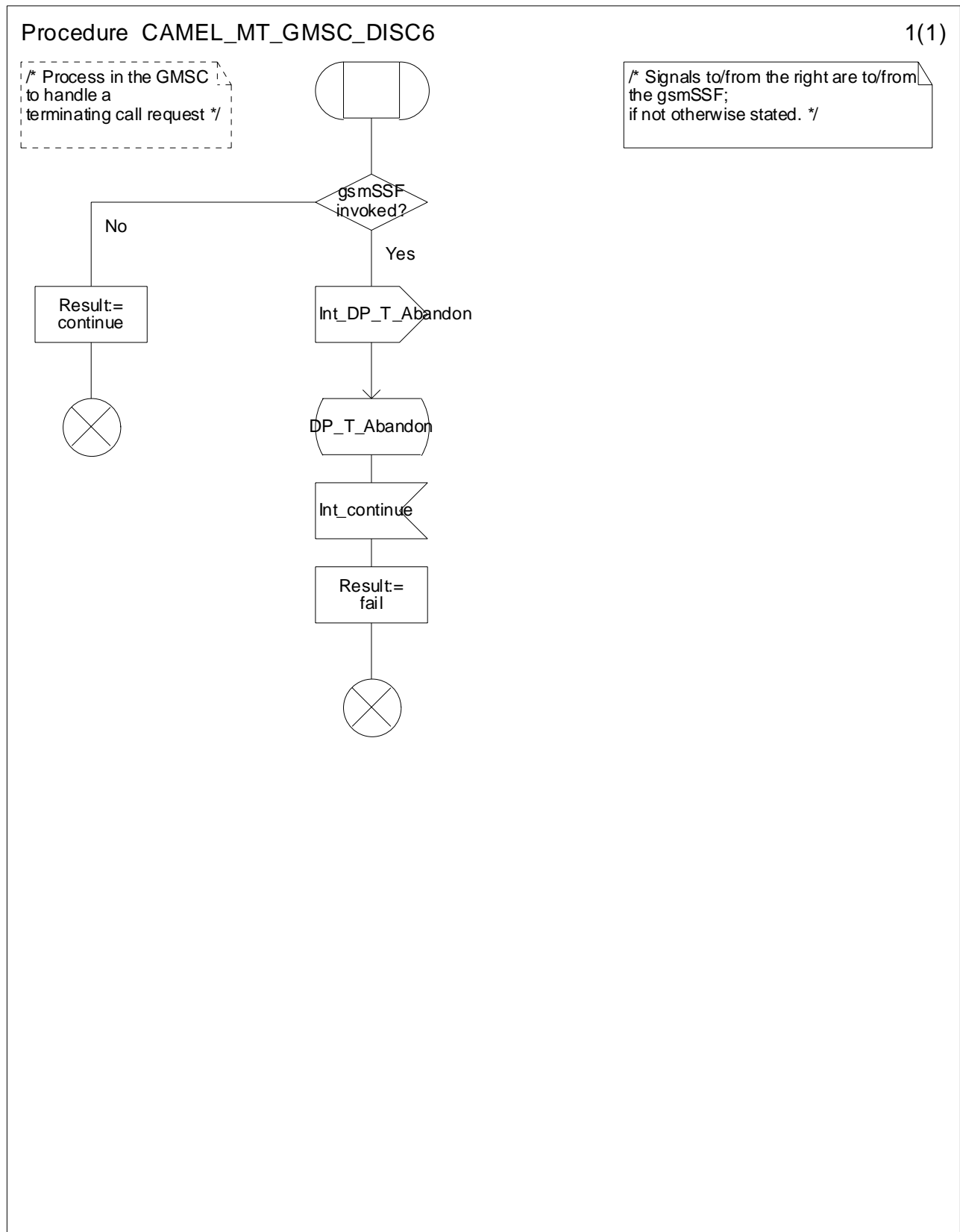
Figure 4.37a: Procedure CAMEL_MT_GMSC_DISC6 (sheet 1)

Procedure CAMEL_MT_ETC 1(3)

Procedure in the GMSC to handle a temporary connection

Signals to/from the left are to/from the originating exchange; signals to/from the right are to/from the gsmSSF; if not otherwise stated.

Initial Address → To CAMEL_Assisting_MSC or SRF.

Send_ACM_If_Required — Procedure defined in 3GPP TS 23.018

Wait_For_Assisting_ACM

Release

Release ← From CAMEL_Assisting_MSC or SRF

Int_ETC_Failed

Result:= pass

⊗

Answer Received

True / False

Int_DP_T_Disconnect /*legID*/

Int_DP_T_Abandon

Wait_For_Disconnect_Forward_Connection

DP_T_Abandon

Int_Disconnect_Forward_Connection

Int_continue

Release → To CAMEL_Assisting_MSC or SRF

Release → To CAMEL_Assisting_MSC or SRF

Result:= pass

Result:= fail

⊗

⊗
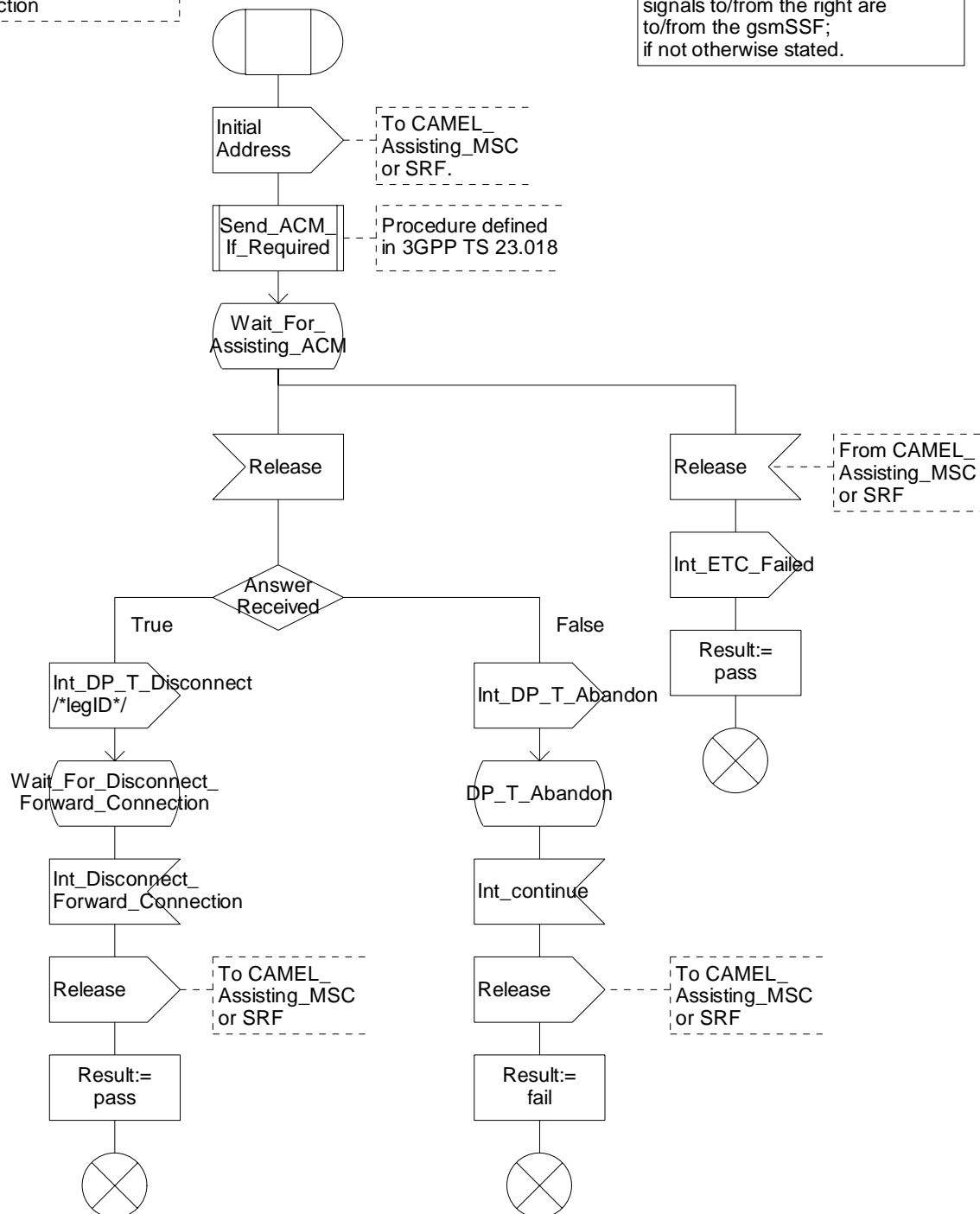
Figure 4.38a: Procedure CAMEL_MT_ETC (sheet 1)

Procedure CAMEL_MT_ETC 2(3)

Procedure in the GMSC
to handle a temporary
connection

Signals to/from the left are to/from
the originationg exchange;
signals to/from the right are
to/from the CAMEL_Assisting_MSC or SRF.

Wait_For_
Assisting_ACM

Address
Complete

Connect

Wait_For_
Assisting_
Answer

Answer

Bothway
through connection
required?

No

Yes

Bothway
through connection
required?

No

Yes

Send_Answer_
If_Required

Send_ACM_
If_Required

Progress

Send_Network_
Connect_If_
Required

Procedure defined
in 3GPP TS 23.018

Procedure defined
in 3GPP TS 23.018

Int_Temporary
Connection
Established

Procedure defined
in 3GPP TS 23.018

Temporary_
Connection_
Established
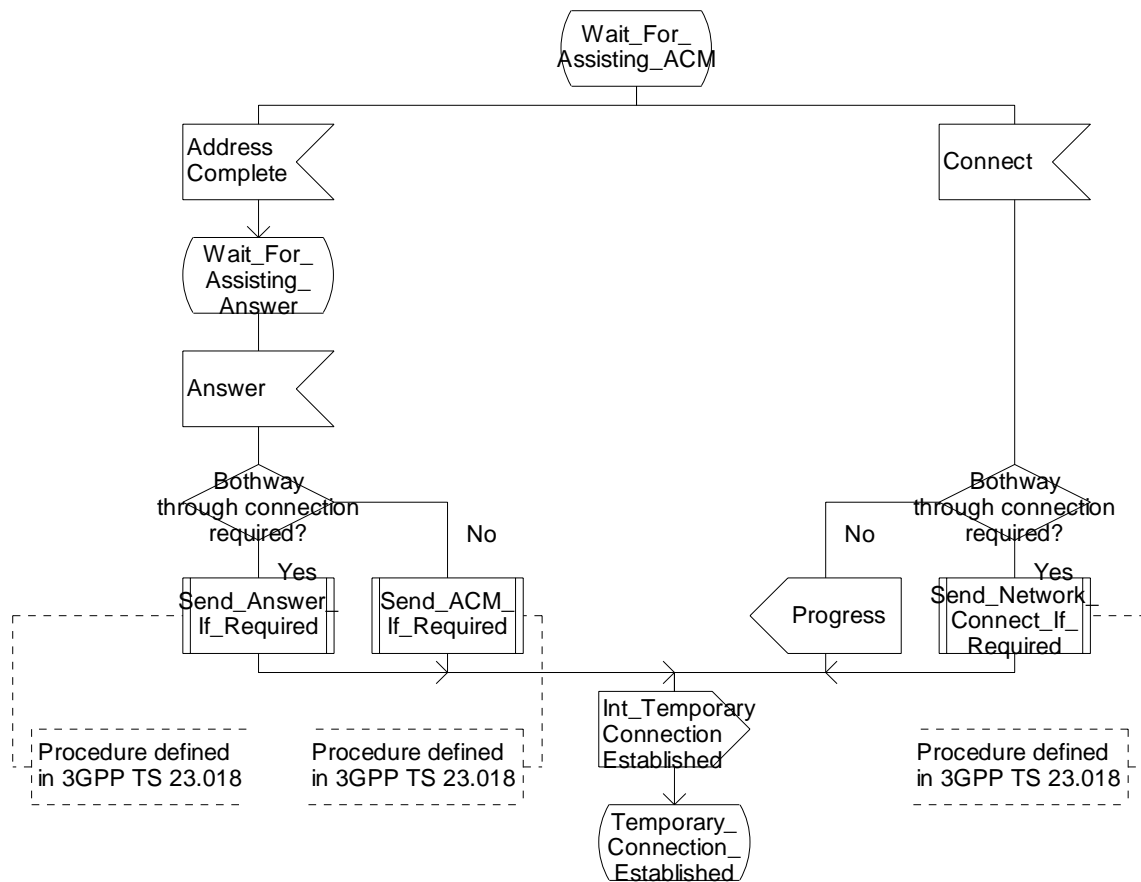
Figure 4.38b: Procedure CAMEL_MT_ETC (sheet 2)

Procedure CAMEL_MT_ETC 3(3)

Procedure in the GMSC to handle a temporary connection

Signals to/from the left are to/from the orinating exchange; signals to/from the right are to/from the gsmSSF; if not otherwise stated.

Temporary_Connection_Established
Wait_For_Assisting_Answer

Release

Answer Received

True / false

Int_DP_T_Disconnect /*legID*/

Wait_For_Disconnect_Forward_Connection

Int_DP_T_Abandon

DP_T_Abandon

Int_continue

Release — To CAMEL_Assisting_MSC or SRF

Result:= fail

Release — From CAMEL_Assisting_MSC or SRF

Int_TC_Released

Result:= pass

Int_Disconnect_Forward_Connection

Int_TC_Released

Release — To CAMEL_Assisting_MSC or SRF

Result:= pass
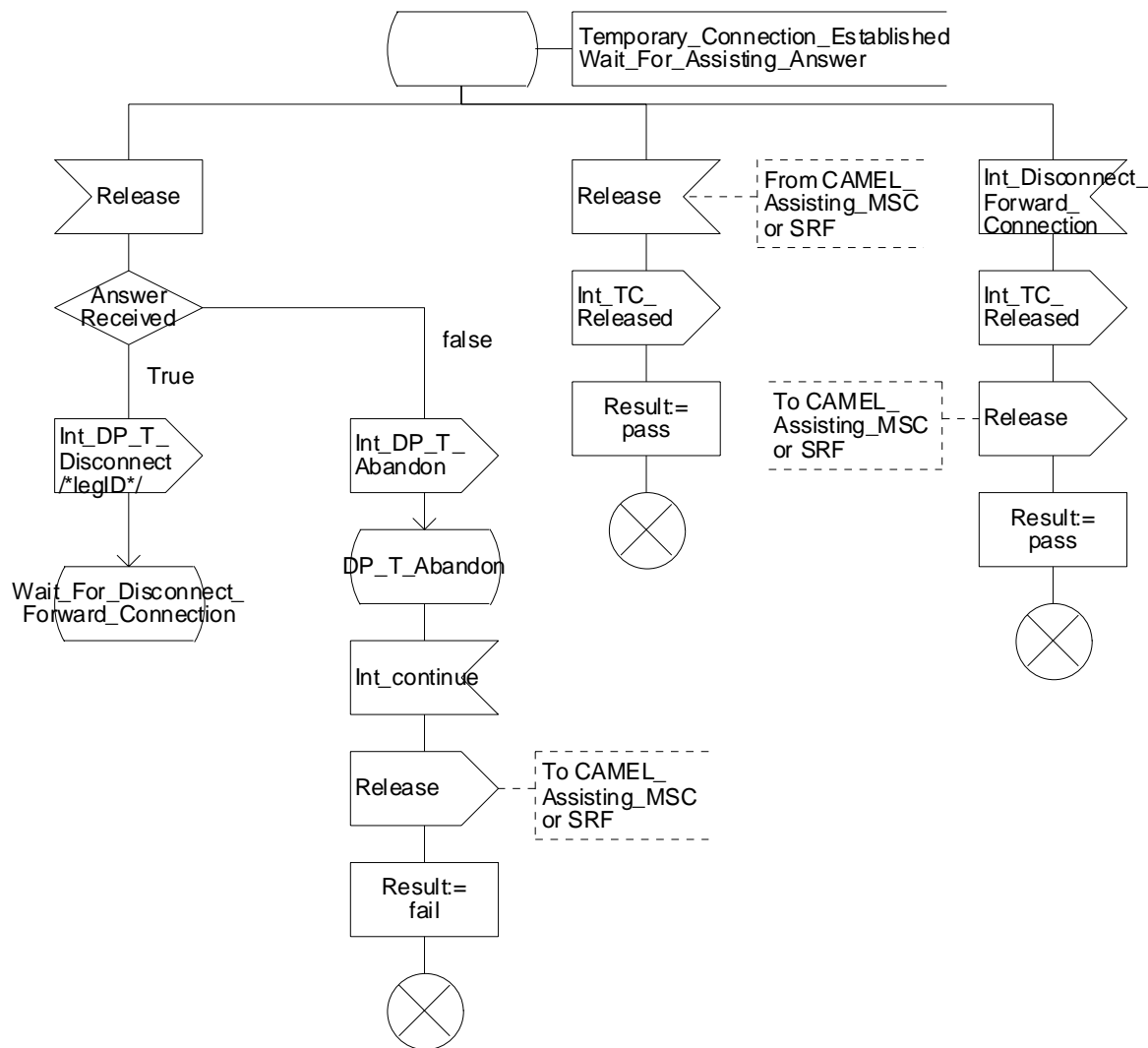
Figure 4.38c: Procedure CAMEL_MT_ETC (sheet 3)

Procedure CAMEL_MT_CTR 1(4)

Procedure in the GMSC to handle a Connect To Resource operation

Signals to/from the left are to/from the originating exchange; signals to/from the right are to/from the gsmSSF if not otherwise stated.
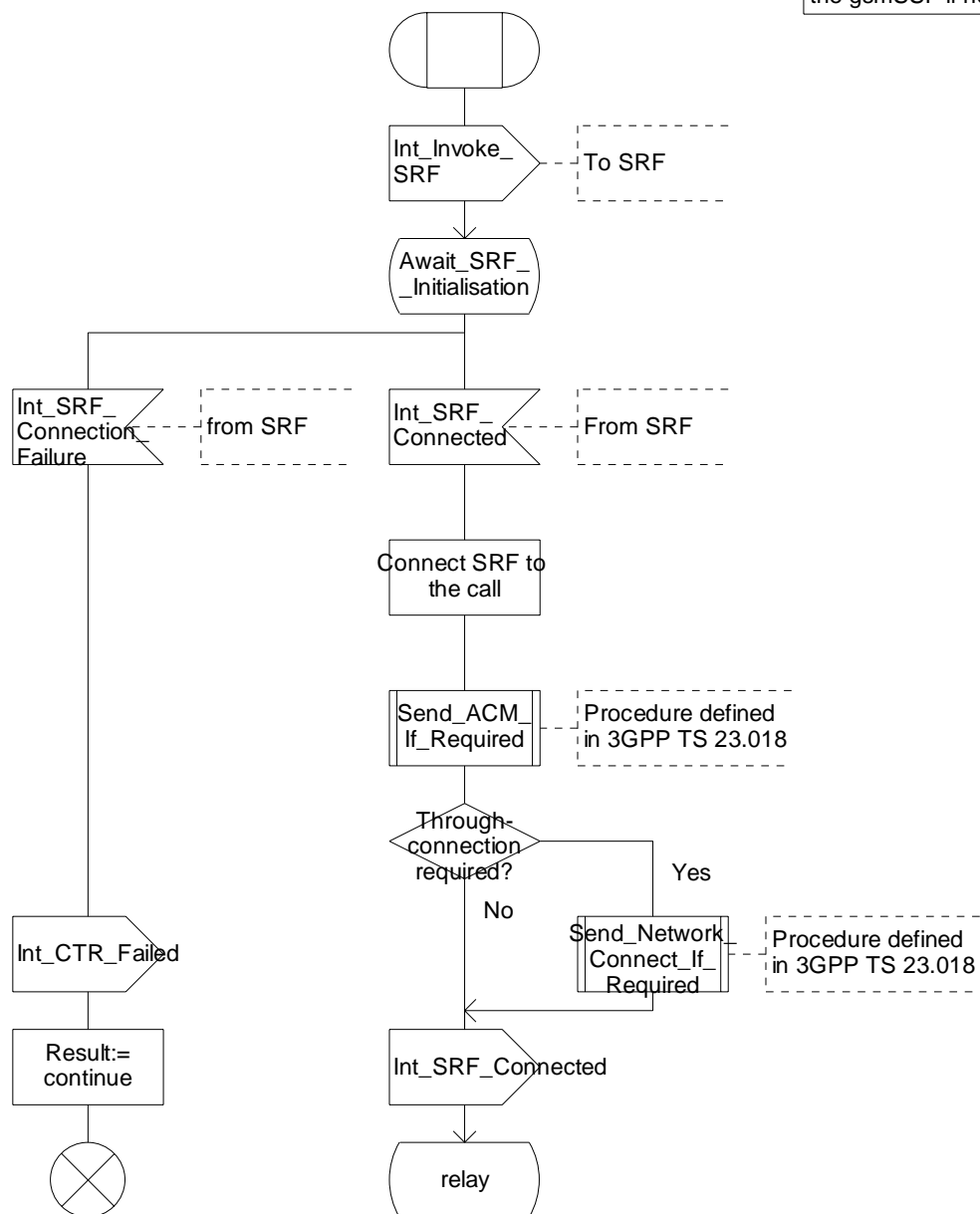
Figure 4.39a: Procedure CAMEL_MT_CTR (sheet 1)

Procedure CAMEL_MT_CTR 2(4)

Procedure in the GMSC to handle a Connect To Resource operation

Signals to/from the left are to/from the originating exchange; signals to/from the right are to/from the gsmSSF if not otherwise stated.

Relay

Release ◁---- From SRF

Int_Disconnect_Forward_Connection

Release

Int_SRF_Released

Int_Disconnect_SRF ---- To SRF

Answer Received

Result:= pass

Await_SRF_Disconnection_Continue

True

Int_DP_T_Disconnect /* legID */

False

Int_DP_T_Abandon /* legID */

⊗

Release

Int_SRF_Released ◁---- From SRF

Wait_For_Disconnect_Forward_Connection

DP_T_Abandon

Answer Received

True

Int_SRF_Released

Int_Disconnect_Forward_Connection

Int_continue

Int_DP_T_Disconnect /* legID */

False

Int_DP_T_Abandon /* legID */

Result:= pass

Int_Disconnect_SRF ---- To SRF

Wait_For_Disconnect_Forward_Connection

Result:= pass

DP_T_Abandon

⊗

Await_SRF_Disconnection_Active

Int_Disconnect_Forward_Connection

⊗

Int_continue

Int_SRF_Released

Int_Disconnect_SRF ----

Result:= fail

Result := Pass

Await_SRF_Disconnection_Fail

⊗

⊗

To SRF

Figure 4.39b: Procedure CAMEL_MT_CTR (sheet 2)

Procedure CAMEL_MT_CTR 3(4)

Procedure in the GMSC to handle
a Connect To Resource operation

Signals to/from the right are to/from
the gsmSSF.
Signals to/from the left are to/from
the external SRF.

```
                                  Relay

   CAP_Play_        CAP_Prompt_        CAP_Specialized_     CAP_Prompt_
   Announcement     And_Collect_       Ressource_Report     And_Collect_
                    User_Information                        User_Information
                                                            ack

   CAP_Play_        CAP_Prompt_        CAP_Specialized_     CAP_Prompt_
   Announcement     And_Collect_       Ressource_Report     And_Collect_
                    User_Information                        User_Information
                                                            ack

                                  Relay
```
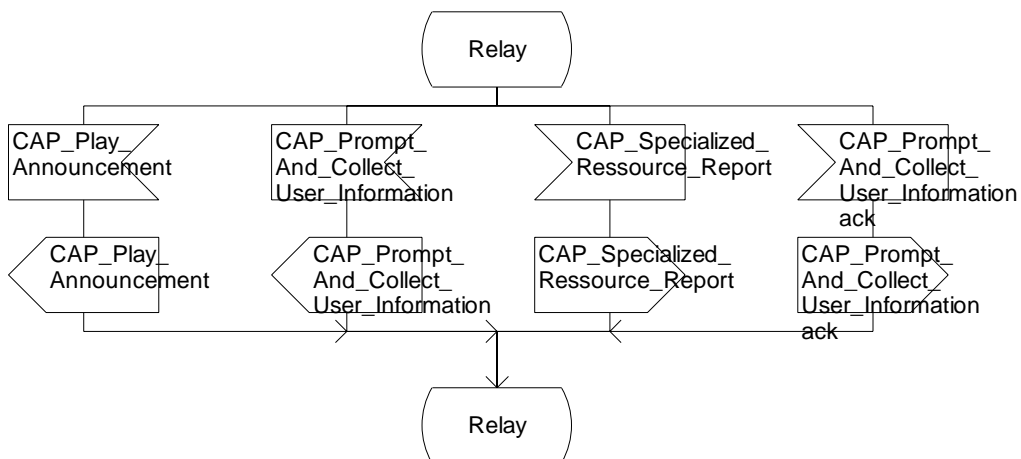
Figure 4.39c: Procedure CAMEL_MT_CTR (sheet 3)

Procedure CAMEL_MT_CTR 4(4)

Procedure in the GMSC to handle
a Connect To Resource operation

Await_SRF_Initialisation

Signals to/from the left are
to/from the originating exchange;
signals to/from the right are to/from
the gsmSSF if not otherwise stated.

Release

Answer
Received

True False

Int_DP_T_Disconnect
/*legID*/

Int_DP_T_Abandon

Wait_For_Disconnect_
Forward_Connection

DP_T_Abandon

Int_Disconnect_
Forward_Connection

Int_continue

Int_Disconnect_SRF — To SRF

Wait_For_Disconnect_
Forward_Connection

Await_SRF_
Disconnection_
Active

Int_Disconnect_
Forward_Connection

Int_SRF_
Released

From SRF

Int_Disconnect_SRF To SRF

Result:=
pass

Await_SRF_
Disconnection_
Fail

Int_SRF_
Released

From SRF

Result:=
fail
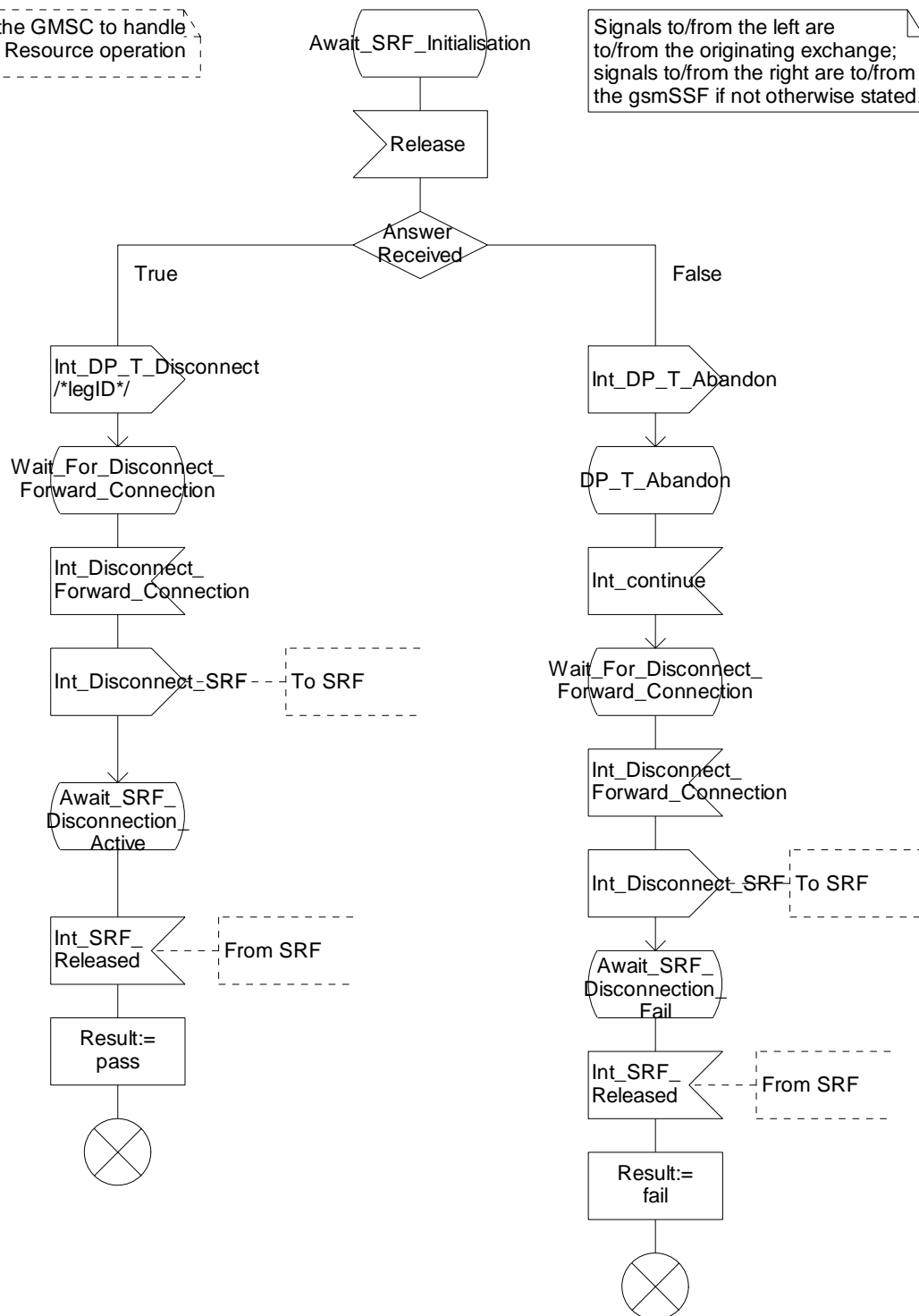
Figure 4.39d: Procedure CAMEL_MT_CTR (sheet 4)

Procedure CAMEL_MT_GMSC_Notify_CF 1(1)

/* Procedure in the GMSC
to notify the gsmSSF that
a call has encountered
conditional call forwarding */

/* Signals to/from the left are
to/from the originating MSC;
signals to/from the right are
to/from the gsmSSF
unless marked otherwise */

gsmSSF invoked?
Yes No

Forwarding Reason?

ELSE

CFNRy CD CFB, CFNRc

FTN as a result of
the first SRI and TDP 12
has been triggered?

No
Yes

Int_DP_T_No_Answer(CF)

Int_DP_T_Busy(CF)

Result:= Continue

DP_T_CCF

Release

Int_Continue

Int_Continue_With_Argument

Int_Connect

Int_Release_Call

Int_DP_T_Abandon

CAMEL_Modify_CUG_Info

DP_T_Abandon

'Modify call parameters with received information'

'Modify call parameters with received information'

Release

Int_continue

To proces MT_CF_MSC

CF cancelled

CF cancelled

To proces MT_CF_MSC

Release call resources

Destination number = called MSISDN?

Yes No

'Modify call parameters with received information'

Release call resources

Result:= Fail

Result:= Continue

Result:= Reconnect

Result:= Fail

Figure 4.40a: Procedure CAMEL_MT_GMSC_Notify_CF (sheet 1)

4.5.3.2 Retrieval of routeing information in the HLR

The functional behaviour of the HLR is specified in 3GPP TS 23.018 [3]. The procedures specific to CAMEL are specified in this clause:

- CAMEL_HLR_INIT;

- CAMEL_CSI_Check_HLR;

- CAMEL_O_CSI_CHECK_HLR;

- CAMEL_D_CSI_CHECK_HLR;

- CAMEL_T_CSI_CHECK_HLR;

- CAMEL_CHECK_SII2_CDTI.

The procedure CAMEL_Provide_Subscriber_Info is specified in clause 4.5.8.

Procedure CAMEL_HLR_INIT 1(1)

Procedure in the HLR to handle a request for routeing information for an MT call.

Figure 4.41: Procedure CAMEL_HLR_INIT (sheet 1)

Procedure CAMEL_CSI_Check_HLR 1(1)

/* This procedure in the HLR
to perform the handling for a
forwarded CAMEL call. */

CAMEL_T_CSI_
CHECK_HLR

Result=
T-CSI
active?

Yes No

CAMEL_O_CSI_
CHECK_HLR

CAMEL_D_CSI_
CHECK_HLR

Result:=
CSI active

Result:=
CSI not active
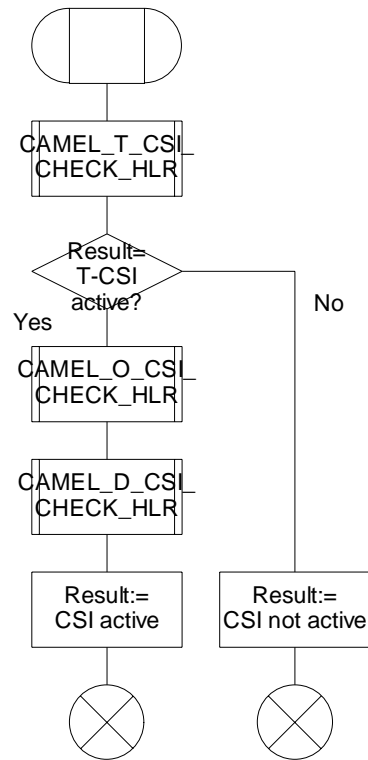
Figure 4.42: Procedure CAMEL_CSI_Check_HLR (sheet 1)

Procedure CAMEL_O_CSI_CHECK_HLR 1(1)

/* Procedure in the HLR to check
the O-CSI and set the O-CSI
parameter for SRI ack accordingly. */

O-CSI present and active?

No

Yes

Set O-CSI
parameter
(note 1, note 2)
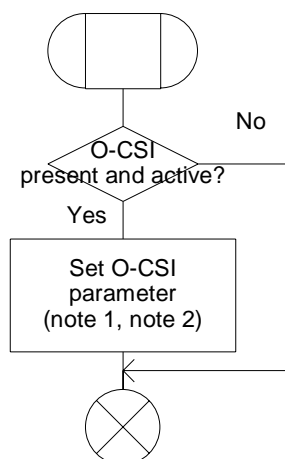
Note 1:
In case of GSM call forwarding, as an implementation option, the HLR may perform conditional triggering check
for DP Collected Info services in O-CSI.
If the check passes, O-CSI shall be sent to the GMSC without conditional triggering criteria for DP Collected info.
If the check fails, DP Collected Info triggers shall not be sent to the GMSC.

Note 2:
The HLR shall not send O-CSI data to the GMSC if the GMSC does not support the indicated CAMEL Capability
Handling in O-CSI.

Figure 4.43: Procedure CAMEL_O_CSI_CHECK_HLR (sheet 1)

Procedure CAMEL_D_CSI_CHECK_HLR 1(1)

/* Procedure in the HLR to check
the D-CSI and set the D-CSI
parameter for SRI ack accordingly. */

D-CSI
present and active? No

Yes

CAMEL Phase 3
supported in GMSC?

Yes No

Set D-CSI
parameter
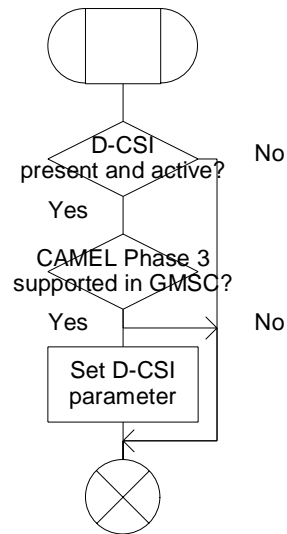
Figure 4.44: Procedure CAMEL_D_CSI_CHECK_HLR (sheet 1)

Procedure CAMEL_T_CSI_CHECK_HLR 1(1)

/* Procedure in the HLR to
check the T-CSI and set the SRI ack
parameter accordingly */

T-CSI
present and active? — No

Yes

Suppress
T-CSI? → Yes

No

Criteria
applicable?

Criteria
fulfilled? → No

No Yes

Subscriber
info
required?

Yes

CAMEL_Provide_
Subscriber_
Info_HLR

No

Set T-CSI
parameter

Result:=
T-CSI active

Result:=
continue
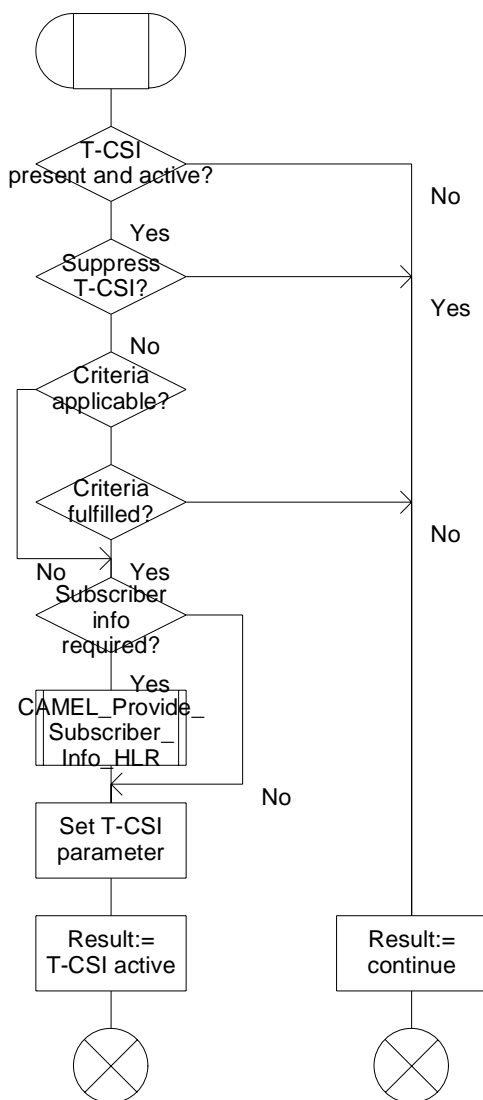
Figure 4.45: Procedure CAMEL_T_CSI_CHECK_HLR (sheet 1)

Procedure CAMEL_CHECK_SII2_CDTI 1(1)

/* Procedure in the HLR or MSC to
determine if the SII2 allows or disallows
invocation of Call Forwarding or Call
Deflection. */

Call Diversion Treatment
Indicator present in SII2?

Yes

No

Call Diversion Treatment
Indicator set to Call
Diversion allowed?

Yes

No

Result :=
Fail

Result :=
Pass
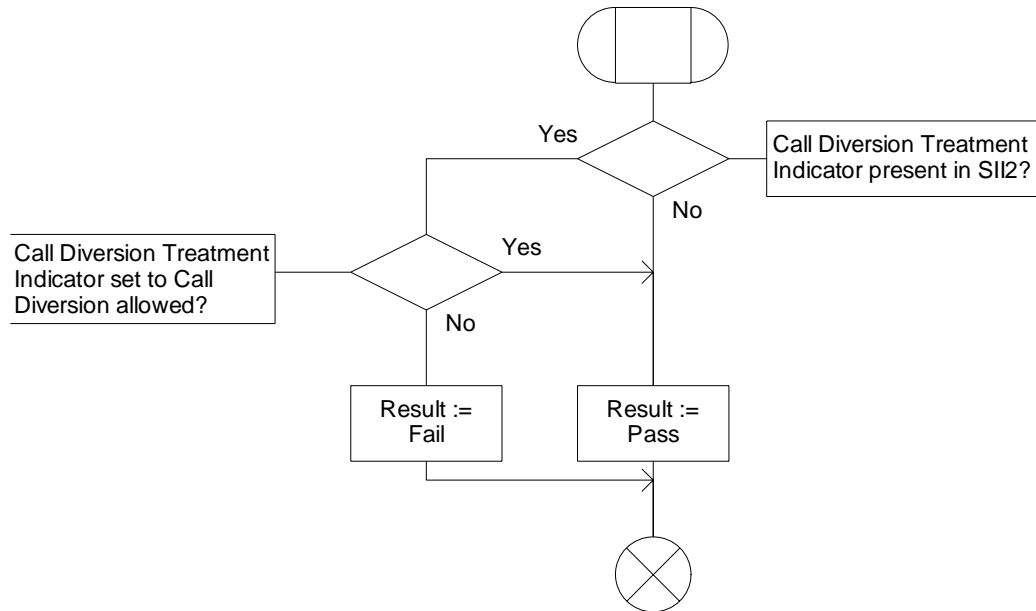
Figure 4.46: Procedure CAMEL_CHECK_SII2_CDTI (sheet 1)

4.5.3.3 Handling of provide roaming number request in the VLR

The functional behaviour of the VLR is specified in 3GPP TS 23.018 [3]. The procedure specific to CAMEL is specified in this clause:

- CAMEL_SET_SOA.
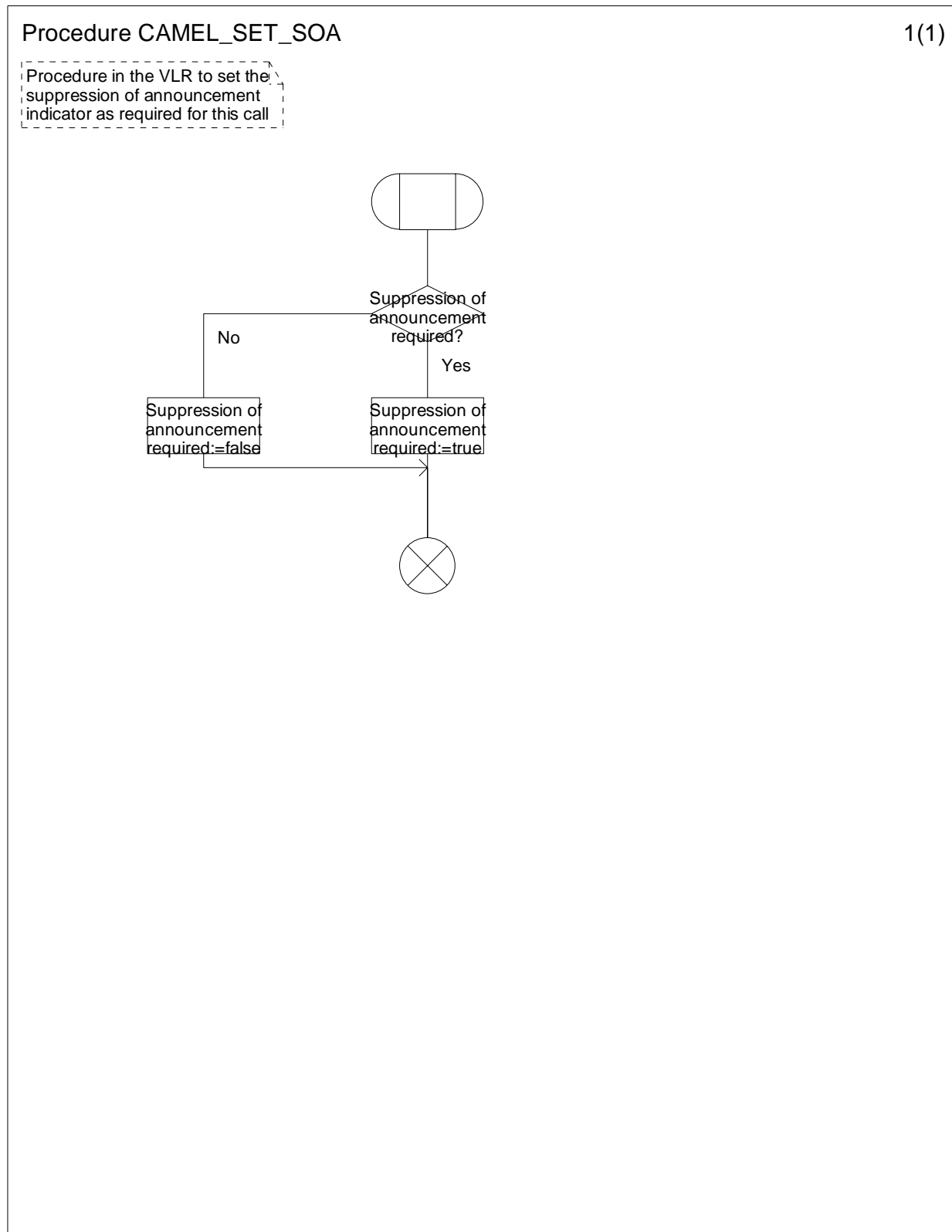
Figure 4.47: Procedure CAMEL_SET_SOA (sheet 1)

4.5.4 Handling of mobile terminating calls

4.5.4.1 Handling of mobile terminating calls in the terminating VMSC

The functional behaviour of the terminating VMSC is specified in 3GPP TS 23.018 [3].

The behaviour specific to CAMEL is:

- the inclusion of the O-CSI and/or D-CSI parameter in the Perform Call Forwarding message sent to the process MT_CF_MSC if it was received in the Send Info For Incoming Call ack;

- the requirement to suppress the connection of announcements or tones if the VLR includes the suppression of announcements parameter in the Send Info For Incoming Call negative response.

The procedures specific to CAMEL are specified in this clause:

- Procedure CAMEL_ICH_VLR.

- Procedure CAMEL_O_CSI_Check_VLR.

- Procedure CAMEL_D_CSI_Check_VLR

- Procedure CAMEL_VT_CSI_Check_VLR.

- Procedure CAMEL_ICH_MSC_INIT.

- Procedure CAMEL_MT_VMSC_Notify_CF.

4.5.4.1.1 Action of the VMSC in procedure CAMEL_MT_VMSC_Notify_CF

The Forwarding reason is taken from the Complete Call message from the VLR.

The Int_DP_T_No_Answer and Int_DP_T_Busy messages include a parameter to indicate that the call has encountered conditional call forwarding. The gsmSSF will transfer this parameter to the CAP_Event_Report_BCSM message which it sends to the gsmSCF.

Procedure CAMEL_ICH_VLR 1(1)

/* This procedure is called in
ICH_VLR (in GSM 23.018) */

/* Signals to/from the left
are to/from the MSC. */

VMSC/VLR supports Camel phase 3 — No

Yes

CAMEL_VT_CSI_
_CHECK_VLR

Result =
CCH? — No

Yes

Continue
CAMEL
Handling

Wait_for_
_SIFIC_2

Abort

Send Info For
Incoming Call

Result:=
FAIL

Result:=
Pass

Result:=
Pass
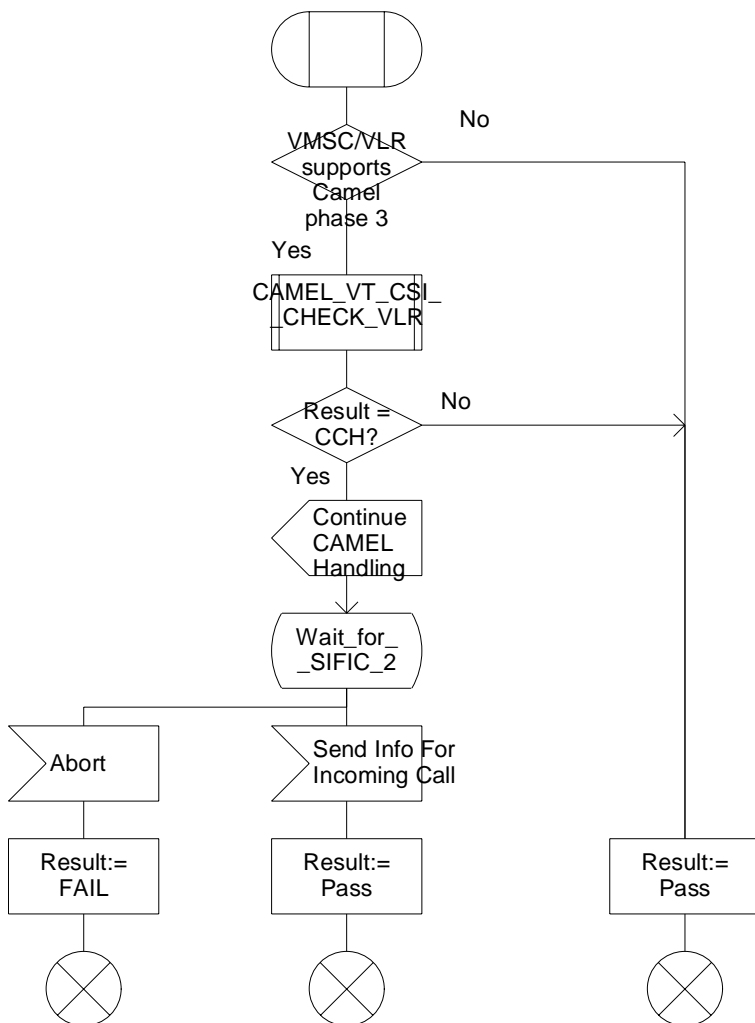
Figure 4.48: Procedure CAMEL_ICH_VLR (sheet 1)

Procedure CAMEL_O_CSI_CHECK_VLR 1(1)

Procedure in the VLR to check
the O-CSI and set the O-CSI
parameter for SIFIC ack accordingly.

O-CSI
provisioned?

Yes

Set O-CSI
parameter

No
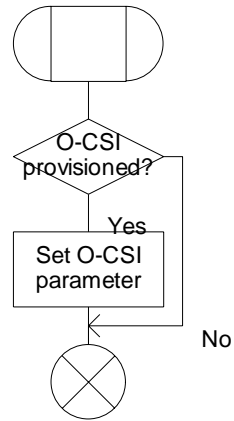
Figure 4.49: Procedure CAMEL_O_CSI_Check_VLR (sheet 1)

Procedure CAMEL_D_CSI_CHECK_VLR 1(1)

/* Procedure in the VLR to check
the D-CSI and set the D-CSI
parameter for SIFIC ack accordingly. */

D-CSI provisioned?

No

Yes

Set D-CSI parameter
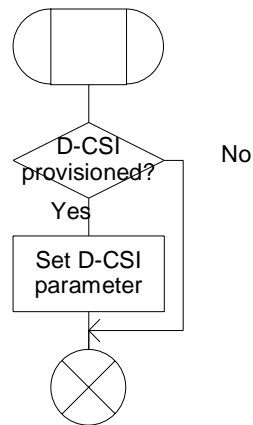
Figure 4.50: Procedure CAMEL_D_CSI_Check_VLR (sheet 1)

Procedure CAMEL_VT_CSI_CHECK_VLR   1(1)

/* Procedure in the VLR to
check the VT-CSI and set the SIFIC ack
parameter accordingly */

VT-CSI
provisioned? — No

Yes

Suppress
VT-CSI? — Yes

No

Criteria
applicable?

Yes

- Check basic service code criteria
- Check VT-CSI in VMSC-B

Criteria
fulfilled? — No

No

Yes

Set VT-CSI
parameter

Result:=
CCH

Result:=
continue
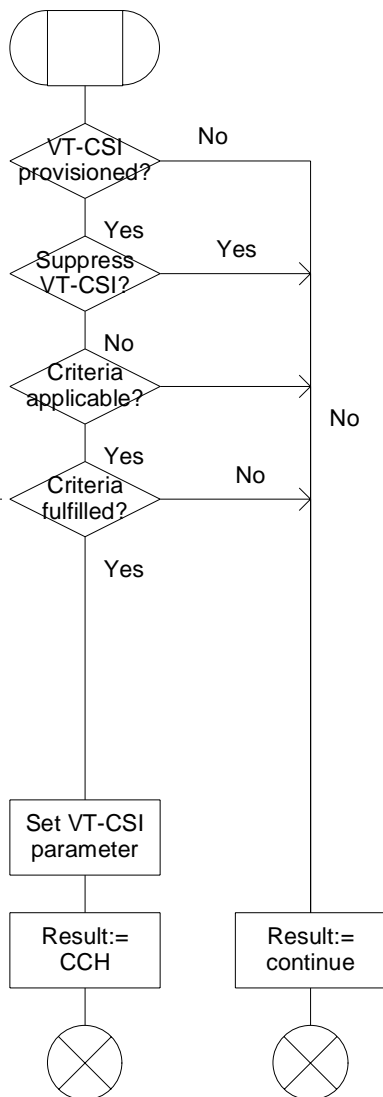
Figure 4.51: Procedure CAMEL_VT_CSI_Check_VLR (sheet 1)

Procedure CAMEL_ICH_MSC_INIT   1(5)

/* Process in the VMSC-B
to handle a
terminating call request */

/* Signals to/from the right are to/from
the gsmSSF */

set
CSI=VT-CSI

Int_Invoke
gsmSSF
(VT-CSI)

wait_for_
gsmSSF_Invoked
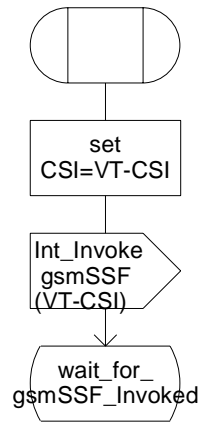
Figure 4.52a: Procedure CAMEL_ICH_MSC_INIT (sheet 1)

Procedure CAMEL_ICH_MSC_INIT 2(5)

/* Process in the VMSC-B
to handle a
terminating call request */

/* Signals to/from the left are to/from
the orginating exchange;
signals to/from the right are to/from
the gsmSSF */

wait_for_
gsmSSF_Invoked

Int_gsmSSF_
Invoked

Release

Call_Active :=
False

Int_T_Exception

Int_DP_Termination_
attempt_Autorized

Result:=
aborted

DP_Termination_
attempt_
Autorized

⊗
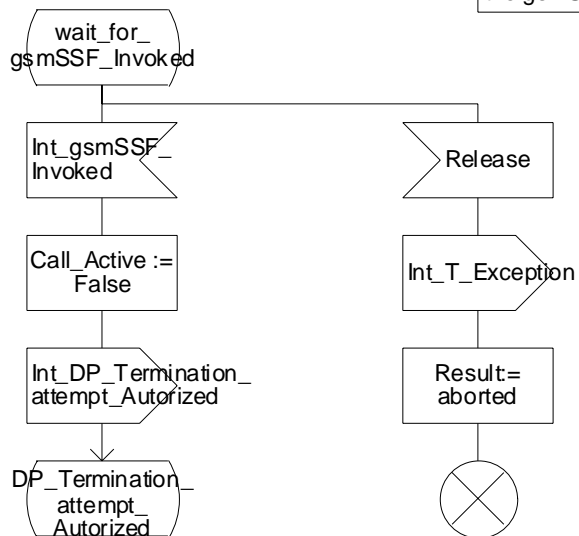
Figure 4.52b: Procedure CAMEL_ICH_MSC_INIT (sheet 2)

Procedure CAMEL_ICH_MSC_INIT 3(5)

/* Process in the VMSC-B to handle a terminating call request */

/* Signals to/from the left are to/from the orginating exchange; signals to/from the right are to/from the gsmSSF; if not otherwise stated. */

DP_Termination_ _Attempt_ _Authorised

Int_Continue_ _With_ _Argument

Int_Continue

Int_Connect

Send_ACM_ If_Required

Procedure defined in 3GPP TS 23.018

'Modify call parameters with received information'

Yes

Destination Number = called MSISDN?

No

1

Modify call parameters with received information.

Original Called Party Subscribed To CUG?

Yes

No

CAMEL_ _Modify_ _CUG_Info

Set VT-CSI suppression

No

CUG info received in incoming call?

Yes

Result:= MSRN

Modify call parameters with received information

⊗

FTN:= Destination Routing Address

Int_Exception

Result:= Reconnect

Result:= fail

⊗

⊗

Figure 4.52c: Procedure CAMEL_ICH_MSC_INIT (sheet 3)

Procedure CAMEL_ICH_MSC_INIT 4(5)

/* Process in the VMSC-B to handle a terminating call request */

DP_Termination_
Attempt_
Authorised

/* Signals to/from the left are to/from the orginating exchange; signals to/from the right are to/from the gsmSSF; if not otherwise stated. */

Release | Int_ReleaseCall | Int_Error

Default Call Handling = Continue Call?

No

Int_DP_
_T_Abandon

Release

Yes

1

DP_T_Abandon

Int_continue

Result=
aborted

Result=
Aborted
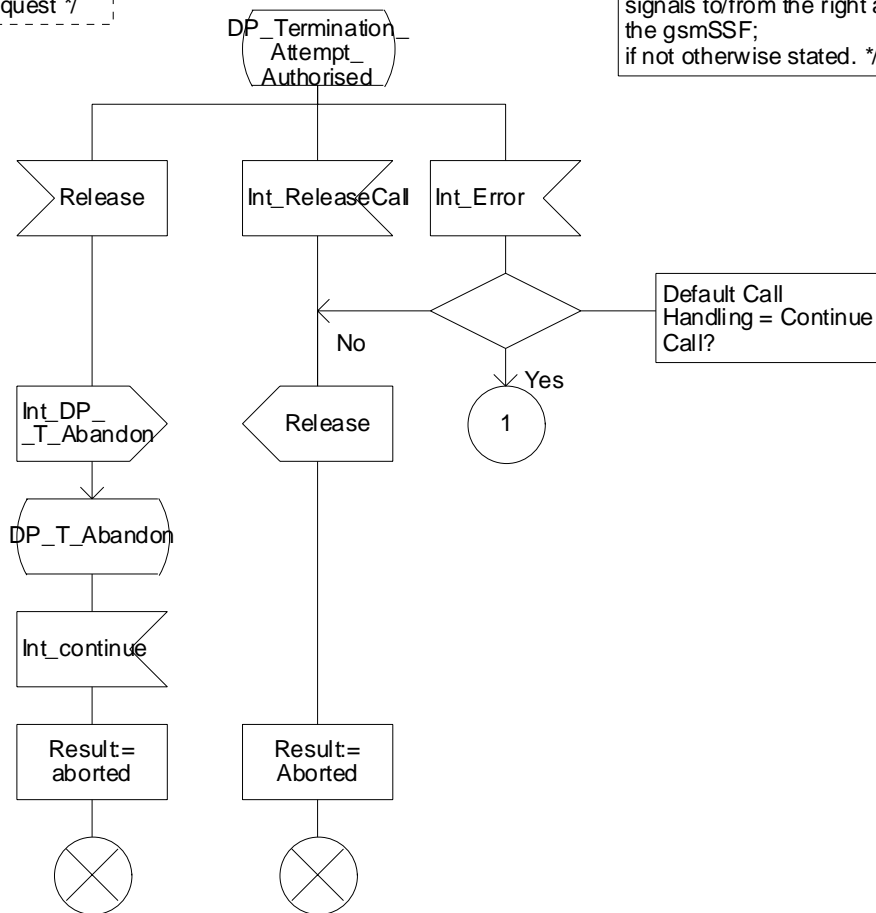
Figure 4.52d: Procedure CAMEL_ICH_MSC_INIT (sheet 4)

Procedure CAMEL_ICH_MSC_INIT 5(5)

/* Process in the VMSC-B
to handle a
terminating call request */

/* Signals to/from the right are to/from
the gsmSSF. */

DP_Termination_Attempt_Authorised
DP_T_Not_Reachable

Int_Establish_
Temporary
Connection

Int_Connect_To_
Resource

CAMEL_MT_ETC

CAMEL_MT_CTR

Result=
fail?

No

Yes

Result:=
fail

-
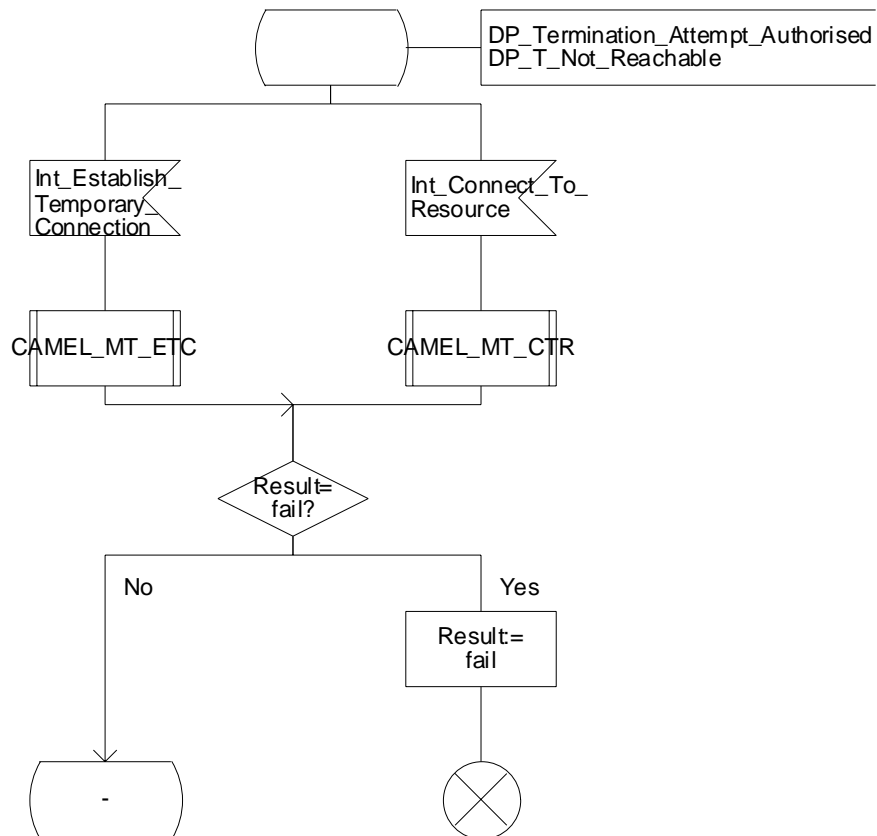
Figure 4.52e: Procedure CAMEL_ICH_MSC_INIT (sheet 5)

Procedure CAMEL_MT_VMSC_Notify_CF 1(1)

/* Procedure in the VMSC to notify the gsmSSF that a call has encountered conditional call forwarding */

/* Signals to/from the left are to/from the VMSC; signals to/from the right are to/from the gsmSSF unless marked otherwise */

gsmSSF invoked?

No → Result := Continue

Yes

Forwarding Reason?

CFNRy → Int_DP_T_No_Answer (CF)

CFB, CFNRc, CD → Int_DP_T_Busy(CF)

DP_T_CCF

Release → Int_DP_T_Abandon → DP_T_Abandon → Int_continue → CF cancelled (To process MT_CF_MSC) → Release call resources → Result:= Fail

Int_Continue__With__Argument → 'Modify call parameters with received information' → Result:= Continue

Int_Continue → Result:= Reconnect

Int_Connect → CAMEL__Modify__CUG_Info → 'Modify call parameters with received information'

Int_Release_Call → Release → CF cancelled (To process MT_CF_MSC) → Release call resources → Result:= Fail

Figure 4.53a: Procedure CAMEL_MT_VMSC_Notify_CF (sheet 1)

4.5.4.2 Handling of mobile terminating calls in the VLR

The functional behaviour of the terminating VLR is specified in 3GPP TS 23.018 [3]. The process specific to CAMEL is specified in this clause:

- Process Reconnected_MT_Call_VLR.

The behaviour specific to CAMEL is:

- the inclusion of the O-CSI and/or D-CSI parameter in the Send Info For Incoming Call ack if the call is to be forwarded and O-CSI and/or D-CSI is included in the subscriber data for that subscriber in the VLR;

- the inclusion of the suppression of announcements parameter in the Send Info For Incoming Call negative response if it was received in the Provide Roaming Number.

Process Reconnected_MT_CALL_VLR RMTC_VLR1(1)

/* Process in the VLR to
handle a request for information
for a reconnected incoming (MT) call */

/* Signals to/from the left
are to/from the MSC. */

```
                               ┌──────────┐
                               │   Idle   │
                               └──────────┘
                                    │
                          ╱ Send Info For
                          ╲ MT Reconnected
                            Call
                                    │
                                   ╱ ╲              No
        CUG info provided         ╱   ╲──────────────────────────┐
        for incoming call?        ╲   ╱                          │
                                   ╲ ╱                           │
                                    │ Yes                        │
                                    │                            │
                                   ╱ ╲              No            │
        CUG provisioned           ╱   ╲───────────────────┐      │
        for called subscriber?    ╲   ╱                   │      │
                                   ╲ ╱                     │      │
                                    │ Yes                  │      │
                                    │                      │      │
                             ┌────────────┐         ┌────────────┐│
                             │Set negative│         │Set result: ││
                             │response:   │         │Forward     ││
                             │CUG reject  │         └────────────┘│
                             └────────────┘               │      │
                                    │             ┌────────────┐  │
                                    │             │Set         │  │
                                    │             │forwarding  │  │
                                    │             │information │  │
                                    │             └────────────┘  │
                                    │             ┌────────────┐  │
                                    │             │CAMEL_O_CSI_│  │
                                    │             │CHECK_VLR   │  │
                                    │             └────────────┘  │
                                    │             ┌────────────┐  │
                                    │             │CAMEL_D_CSI_│  │
                                    │             │CHECK_VLR   │  │
                                    │             └────────────┘  │
                                    │                   │         │
                        ╲ Send Info For MT    ╲ Send Info For MT ◄┘
                        ╱ Reconnected         ╱ Reconnected
                          Call negative         Call ack
                          response
                                    │                   │
                                    └─────────┬─────────┘
                               ┌──────────┐
                               │   Idle   │
                               └──────────┘
```

Figure 4.54: Process Reconnected_MT_Call_VLR (sheet 1)

4.5.5 Handling of forwarded calls

The handling of forwarded calls in the GMSC or the terminating VMSC is specified in 3GPP TS 23.018 [3]. The procedures specific to CAMEL are specified in this clause.

- Procedure CAMEL_Check_ORLCF_VMSC.

- Procedure CAMEL_CF_MSC_INIT.

- Procedure CAMEL_CF_MSC_ANSWER.

- Procedure CAMEL_CF_ETC.

- Procedure CAMEL_CF_CTR.

A mobile terminated call can be forwarded either in the GMSC (indicated by provision of Forwarded-To-Number from HLR or gsmSCF) or in the MSC (indicated by provisioning of Forwarded-To-Number from VLR).

4.5.5.1 Procedure CAMEL_CF_MSC_INIT: handling of Int_Continue_With_Argument

The received parameters are used to overwrite the corresponding ISUP parameters (for mapping see 3GPP TS 29.078 [5]). Call parameters which are not included in the Int_Continue_With_Argument message are unchanged.

Signalling limitations or regulatory requirements may require the Calling Party Category, Generic Number, Original Called Party Number and Redirecting Party ID to be ignored or modified.

4.5.5.2 Procedure CAMEL_CF_MSC_INIT: handling of Int_Connect

The received parameters are used to overwrite the corresponding ISUP parameters (for mapping see 3GPP TS 29.078 [5]. Call parameters which are not included in the Int_Connect message are unchanged.

An a network operator option, loop prevention mechanisms may cause the redirection information to be ignored or modified (e.g., if the Redirection counter has been decreased).

Signalling limitations or regulatory requirements may require the Calling Party Category, Generic Number, Original Called Party Number and Redirecting Party ID to be ignored or modified.

The network signalling system shall indicate that this is an internal network number.

4.5.5.3 Action of the MSC in procedure CAMEL_CF_MSC_ANSWER

If the MSC received a destination address from the GMSC in the ISUP Answer or Connect message, the MSC relays the destination address to the gsmSSF in the Int_DP_O_Answer message.

4.5.5.4 Action of the MSC in procedure CAMEL_CF_ETC

In procedure CAMEL_CF_ETC (sheet 2) the GMSC or terminating VMSC will remain in the Wait_For_Assisting_Answer state until it receives an ISUP Answer Message (ANM) or timeout occurs. This is to ensure that a call record is always generated for every successful establishment of a temporary connection to a gsmSRF, especially in the case where the connection is between PLMNs.

NOTE: This means that it may not be possible to access an SRF which does not generate an ISUP Answer Message (ANM).

Procedure CAMEL_Check_ORLCF_VMSC

1(2)

/* Procedure in the VMSC TO check which CSIs
have to be included in RCH for Optimal
Roueting of Late Forwarded calls*/

Notes
1. When CAMEL Capability
handling is not present in O-CSI,
it is assumed to be CAMEL Phase 1.
2. When GMSC Supported
CAMEL Phases was not received
from HLR (in PRN), it is assumed
to be CAMEL Phase 1.

If No O-CSI or D-CSI is
present in VLR, then non-
CAMEL ORLCF shall be
invoked.

O-CSI or D-CSI
present in VMSC?
No

Yes

If the required CAMEL
Phases are not supported
by GMSC, then Forwarding
shall be done in the VMSC.
(note 1, 2)

Requested CAMEL
phases supported by
GMSC?

Yes

No

No

O-CSI
present?

No

Yes

DP Collected
_Info in O-CSI?

No

If DP Collected Info
criteria are fulfilled, then
the DP Collected Info
shall be included in RCH.
Otherwise, DP Collected
Info shall not be included
in RCH.

Yes

criteria
fullfilled?

No

Yes

'Mark DP Collected_Info for
inclusion in RCH
(no criteria shall be included
in RCH)'

DP Route Select Failure,
if available, shall be
included in RCH.

DP Route_Select_
_Failure in O-CSI?

No

Yes

'Mark DP Route_Select_
_Failure for inclusion in RCH'

Result := VMSCCF

Result := ORLCF

1

⊗
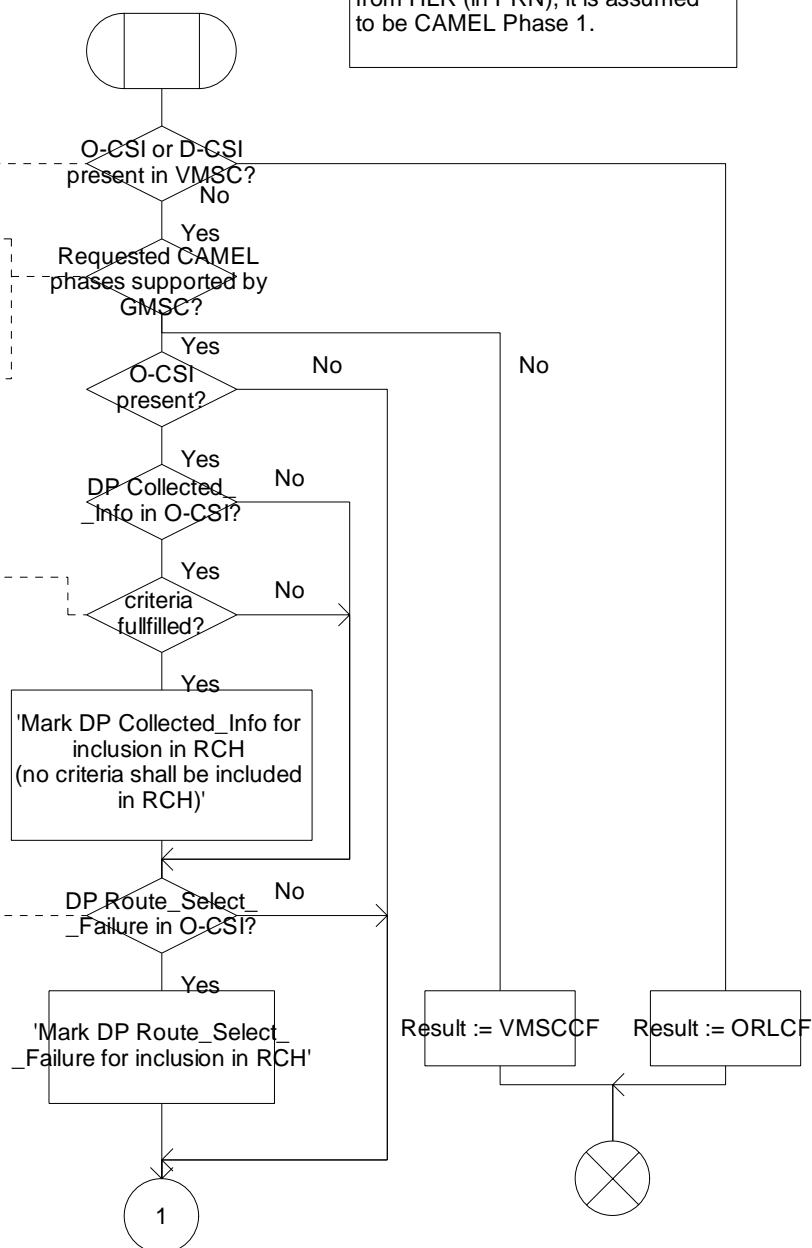
Figure 4.55a: Procedure CAMEL_Check_ORLCF_VMSC (sheet 1)

Procedure CAMEL_Check_ORLCF_VMSC 2(2)

/* Procedure in the VMSC TO check which CSIs
have to be included in RCH for Optimal
Roueting of Late Forwarded calls*/

```
              ( 1 )
                │
                                  No
         ┌──────────────┐
  D-CSI, if available, shall │◇ D-CSI ◇├──────┐
  be included in RCH        ◇ present ◇      │
         └──────────────┘   │              │
                           Yes             │
                ┌──────────────────┐       │
                │ 'Mark D-CSI for  │       │
                │ inclusion in RCH'│       │
                └──────────────────┘       │
                           │◄──────────────┘
                ┌──────────────────┐
                │  Reult := ORLCF  │
                └──────────────────┘
                           │
                          ⊗
```
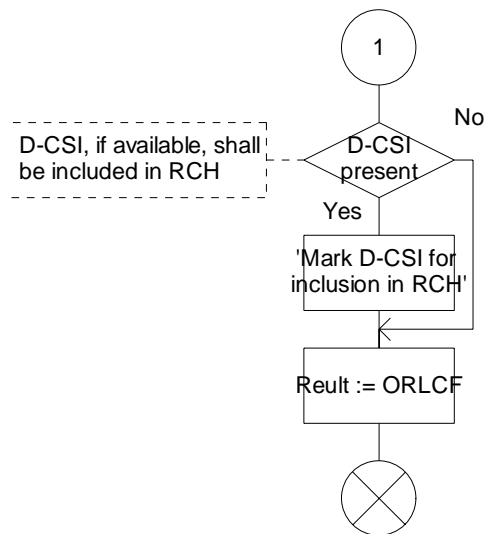
Figure 4.55b: Procedure CAMEL_Check_ORLCF_VMSC (sheet 2)

Procedure CAMEL_CF_Dialled_Services 1(1)

Procedure in the MSC to
process CAMEL dialled services
for forwarded calls

/* Signals to/from the left are
to/from the origination Exchange. */

CAMEL_
SDS_CF_INIT

Result?
Fail   Abort
Pass

CAMEL_
NDS_CF_INIT

Result?
Fail   Abort
Pass

CAMEL_OCH_
MSC_DISC4

Result:=
Fail

Result:=
Pass

Result:=
Abort
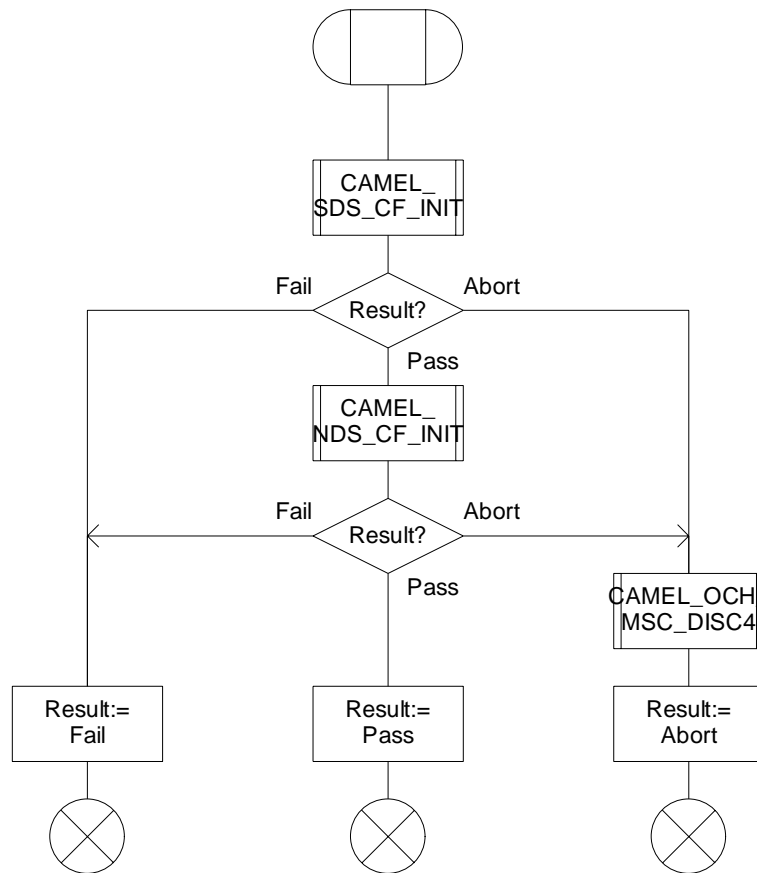
Figure 4.56a: Procedure CAMEL_CF_Dialled_Services (sheet 1)

Procedure CAMEL_CF_MSC_INIT 1(4)

/* Procedure in the MSC to handle a forwarded call */

/* Signals to/from the left are to/from the process MT_GMSC / ICH_MSC; signals to/from the right are to/from the process gsmSSF if not otherwise stated. */

O-CSI stored,

No

Yes

Call forwarding or Call Deflection

Result:= pass

Yes

Type of forwarding

Connect

Connect without O-CSI Applicable Indicator

No

Int_Invoke gsmSSF (O-CSI)

Wait_For_ _gsmSSF_ _Invoked

Int_Error

Int_gsmSSF Invoked

CF Cancelled

Release

Answer Received := False

Int_O_Exception

Result:= fail

Int_DP_ _Collected_ _Info

Result:= cancelled

DP_ _Collected_ _Info
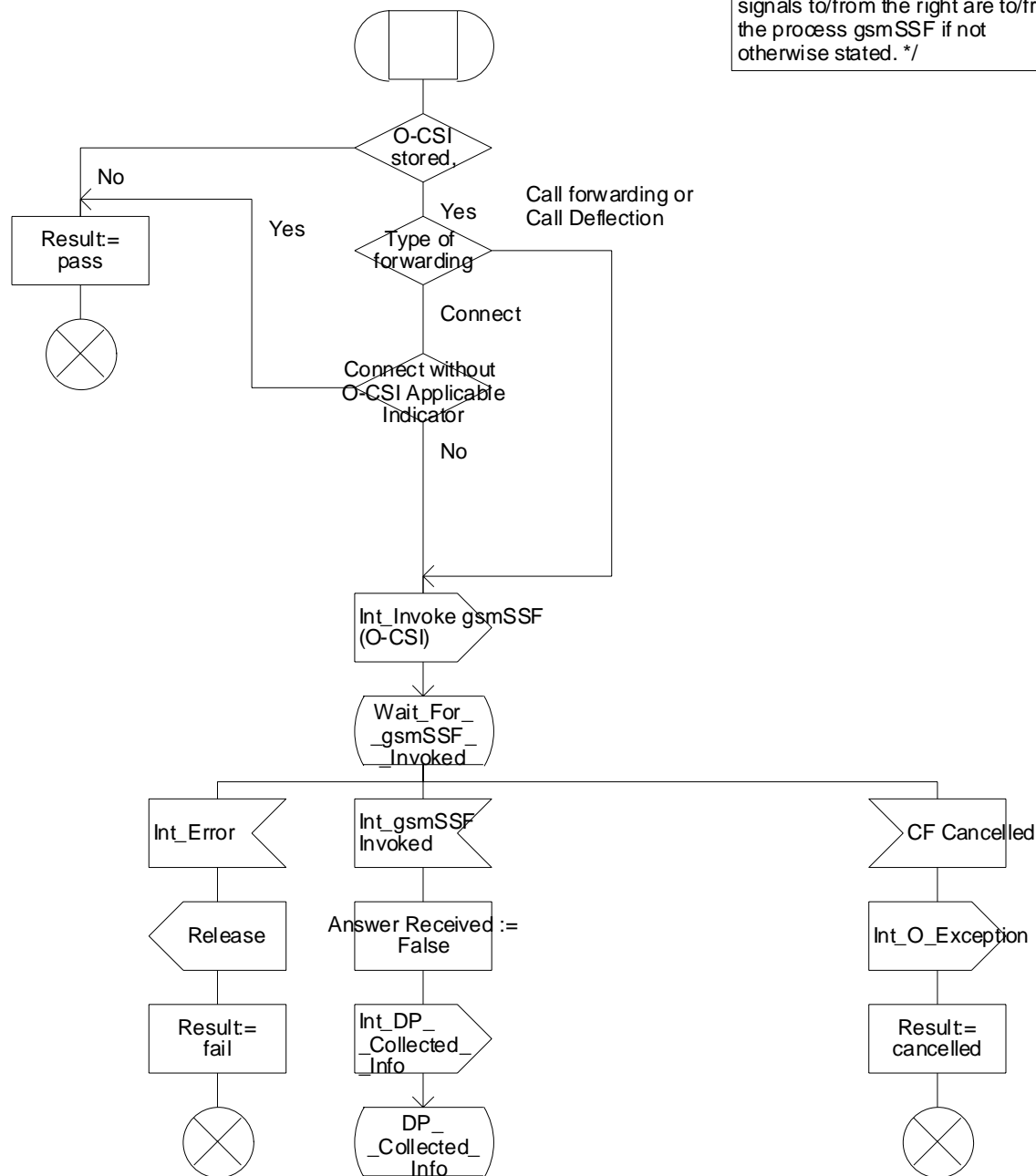
Figure 4.57a: Procedure CAMEL_CF_MSC_INIT (sheet 1)

Procedure CAMEL_CF_MSC_INIT 2(4)

/* Procedure in the MSC to handle a forwarded call */

/* Signals to/from the left are to/from the process MT_GMSC / ICH_MSC; signals to/from the right are to/from the process gsmSSF if not otherwise stated. */

DP_Collected_Info

Int_Release_Call

Int_Error

Int_Continue

Int_Continue_With_Argument

Int_Connect

Default Call Handling = Continue Call?

No

Yes

CAMEL_Modify_CUG_Info

CAMEL_Modify_CUG_Info

Release

'Modify call parameters with received information'

'Modify call parameters with received information'

Result:= fail

'Destination address := Called Party Number'

Result:= pass

Figure 4.57b: Procedure CAMEL_CF_MSC_INIT (sheet 2)

Procedure CAMEL_CF_MSC_INIT   3(4)

/* Procedure in the MSC to
handle a forwarded call */

/* Signals to/from the right are to/from
the gsmSSF if not otherwise stated. */

DP_Collected
Info

Int_Establish_
Temporary
Connection

Int_Connect_To_
Resource

CAMEL_CF_ETC

CAMEL_CF_CTR

Result=
fail?

No   Yes

                            Result=
                            fail

DP_Collected
Info
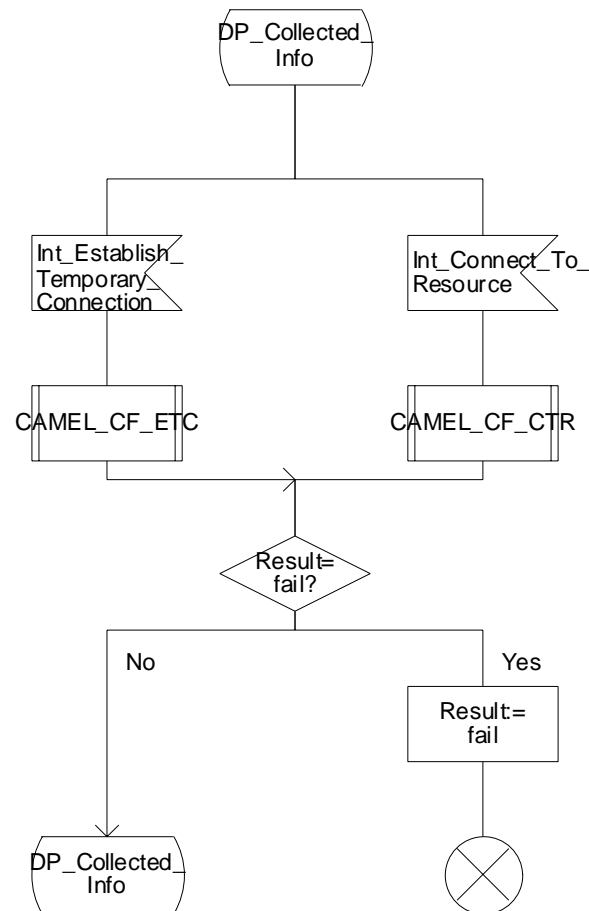
Figure 4.57c: Procedure CAMEL_CF_MSC_INIT (sheet 3)

Procedure CAMEL_CF_MSC_INIT 4(4)

/* Procedure in the MSC to handle a forwarded call */

/* Signals to/from the left are to/from the process MT_GMSC / ICH_MSC; signals to/from the right are to/from the gsmSSF; if not otherwise stated. */

DP_Collected_ Info

Release

Int_DP_O_Abandon

DP_O_Abandon

Int_continue

Result:= fail
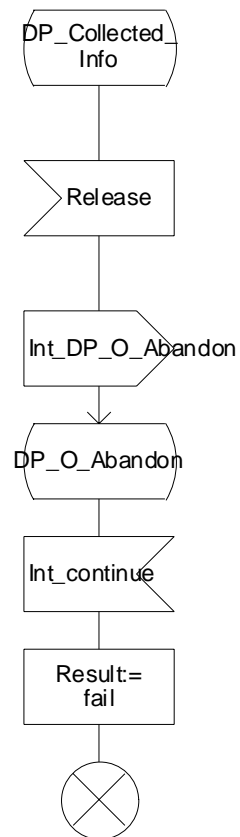
Figure 4.57d: Procedure CAMEL_CF_MSC_INIT (sheet 4)

Procedure CAMEL_SDS_CF_INIT 1(3)

/* Procedure in the MSC to perform CAMEL handling for a subscribed Dialled Service */

/* Signals to/from the left are to/from parent process; signals to/from the right are to/from the gsmSSF. */

D-CSI invocation?

No → Result= Pass → ⊗

Yes

Call Reference Number stored?

Yes →

No → Allocate Call Reference Number

Store Original Call Parameters

Int_Invoke_gsmSSF (D-CSI)

Wait_for_gsmSSF_Invoked

Int_gsmSSF_Invoked

Int_DP_Analysed_Info

DP_Analysed_Info

CF cancelled

Int_O_Exception

Result:= Abort

⊗
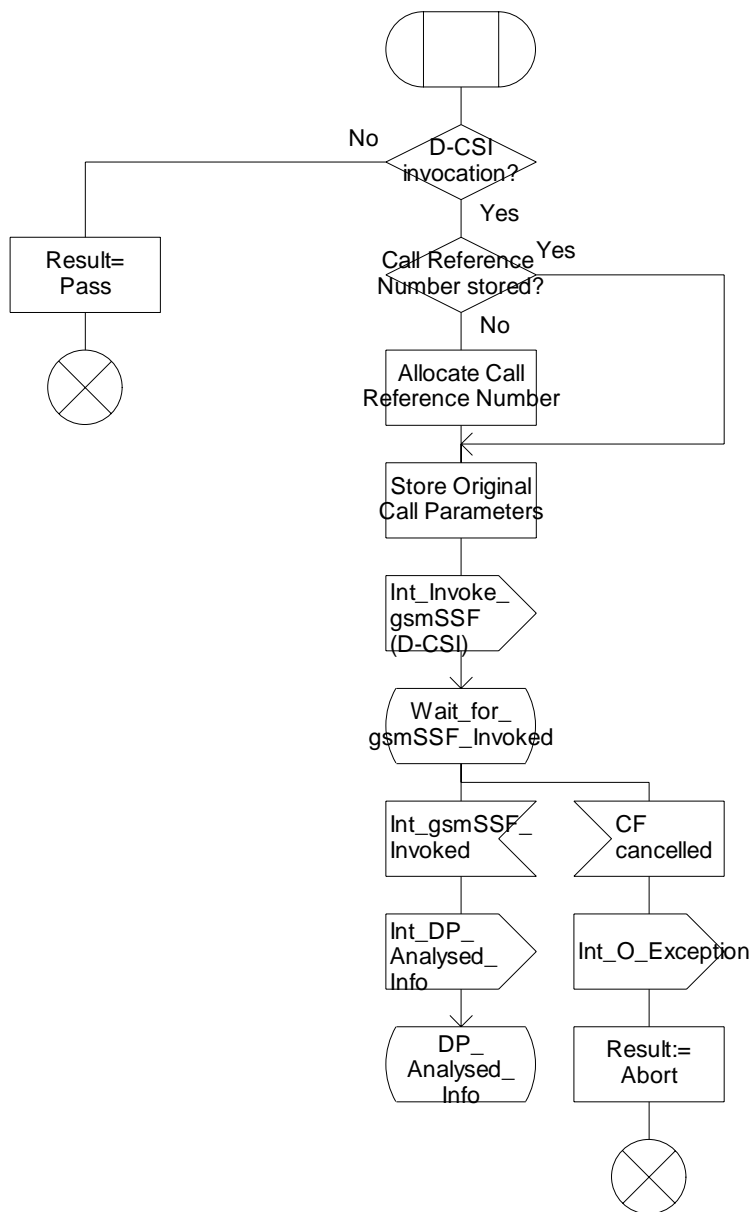
Figure 4.58a: Procedure CAMEL_SDS_CF_INIT (sheet 1)

Procedure CAMEL_SDS_CF_INIT 2(3)

/* Procedure in the MSC to perform
CAMEL handling for a subscribed
Dialled Service */

/* Signals to/from the left are
to/from the parent process; signals to/from the right are
to/from the gsmSSF. */

DP_
Analysed_
Info

Int_Release_
Call

Int_Error

Int_Continue

Int_Continue_
With
_Argument

Int_Connect

CF
cancelled

'Default call
handling = continue
call ?'

Yes

CAMEL_
Modify
_CUG_Info

No

'Modify call
parameters with
received information'

Int_DP_O_
Abandon

Result:=
Fail

Result:=
Pass

Result:=
Pass

Result:=
Abort
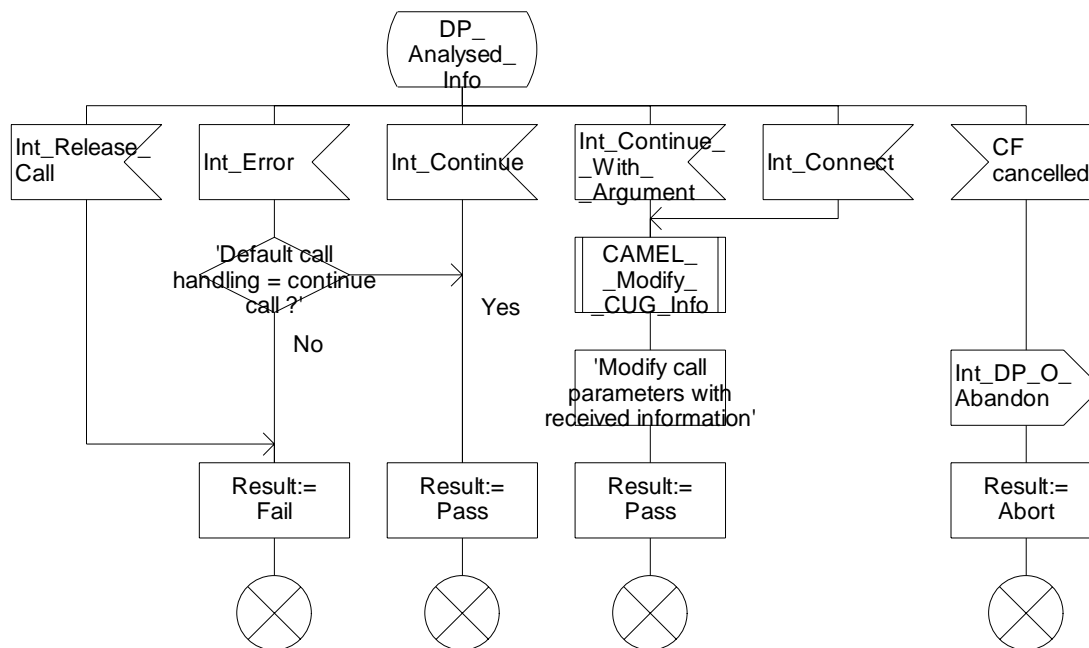
Figure 4.58b: Procedure CAMEL_SDS_CF_INIT (sheet 2)

Procedure CAMEL_SDS_CF_INIT 3(3)

/* Procedure in the MSC to perform CAMEL handling for a subscribed Dialled Service */

/* Signals to/from the right are to/from the gsmSSF if not otherwise stated. */

DP_Analysed_Info

Int_Establish_ Temporary Connection

Int_Connect_To_ Resource

CAMEL_CF_ETC

CAMEL_CF_CTR

Result= fail?

No

Yes

Result:= fail

DP_Analysed_ _Info

⊗
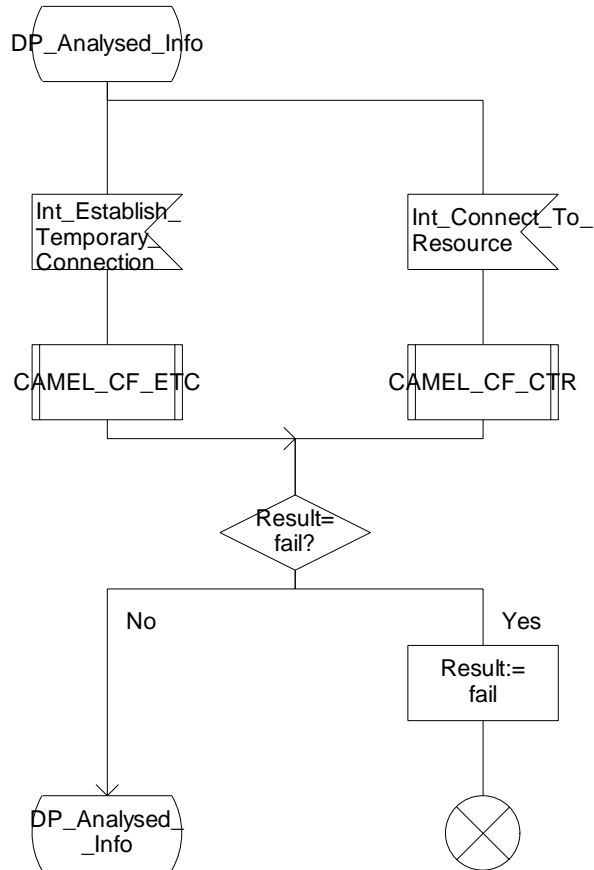
Figure 4.58c: Procedure CAMEL_SDS_CF_INIT (sheet 3)

Procedure CAMEL_NDS_CF_INIT   1(3)

/* Procedure in the MSC to perform
CAMEL handling for a network
Dialled Service for mobile originated calls */

/* Signals to/from the left
are to/from parent process; signals
to/from the right are to/from the gsmSSF. */

No — N-CSI invocation?

Result=
Pass

Yes

Call Reference
Number stored?   Yes

No

Allocate Call
Reference Number

Store Original
Call Parameters

Int_Invoke_
gsmSSF
(N-CSI)

Wait_for_
gsmSSF_Invoked

Int_gsmSSF_
Invoked

CF
cancelled

Int_DP_
Analysed_
Info

Int_O_Exception

DP_
Analysed_
Info

Result:=
Abort
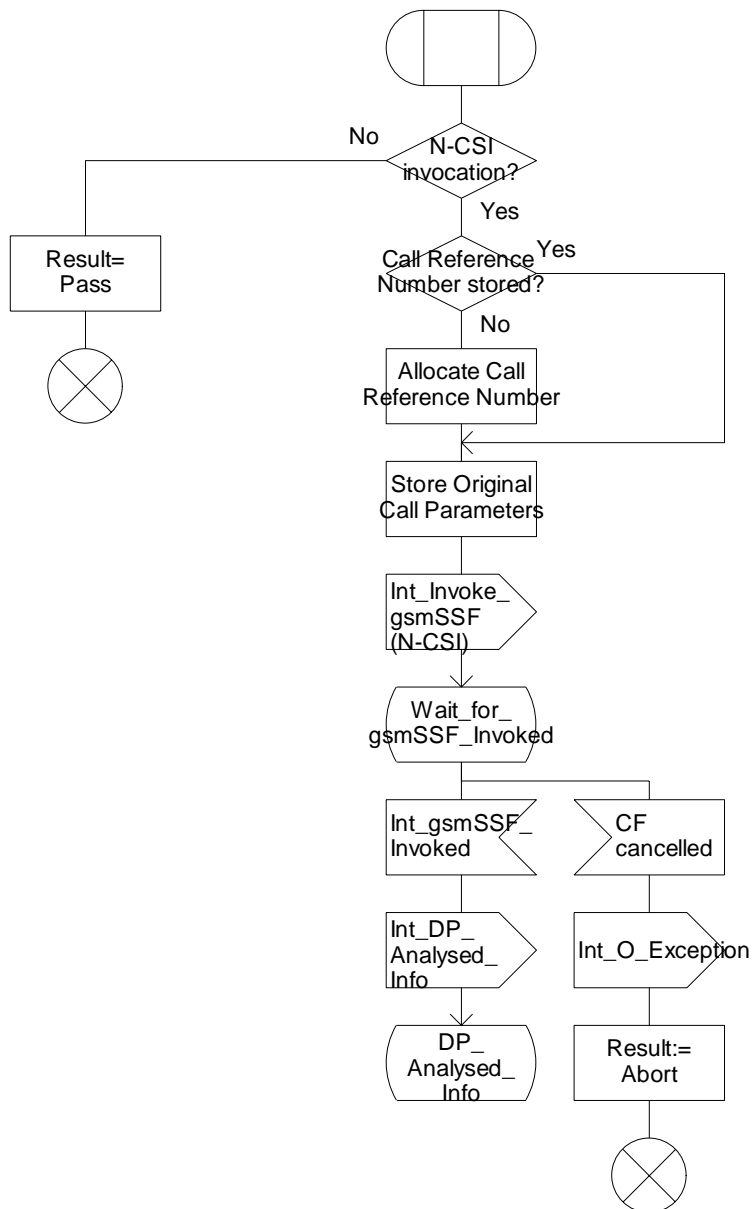
Figure 4.59a: Procedure CAMEL_NDS_CF_INIT (sheet 1)

Procedure CAMEL_NDS_CF_INIT 2(3)

/* Procedure in the MSC to perform
CAMEL handling for a network
Dialled Service for mobile originated calls */

/* Signals to/from the left
are to/from parent process; signals
to/from the right are to/from the gsmSSF. */

DP_
Analysed_
Info

Int_Release_
Call

Int_Error

Int_Continue

Int_Continue_
With
_Argument

Int_Connect

CF
cancelled

'Default call
handling = continue
call ?'

Yes

No

CAMEL_
Modify
_CUG_Info

'Modify call
parameters with
received information'

Int_DP_O_
Abandon

Result:=
Fail

Result:=
Pass

Result:=
Pass

Result:=
Abort
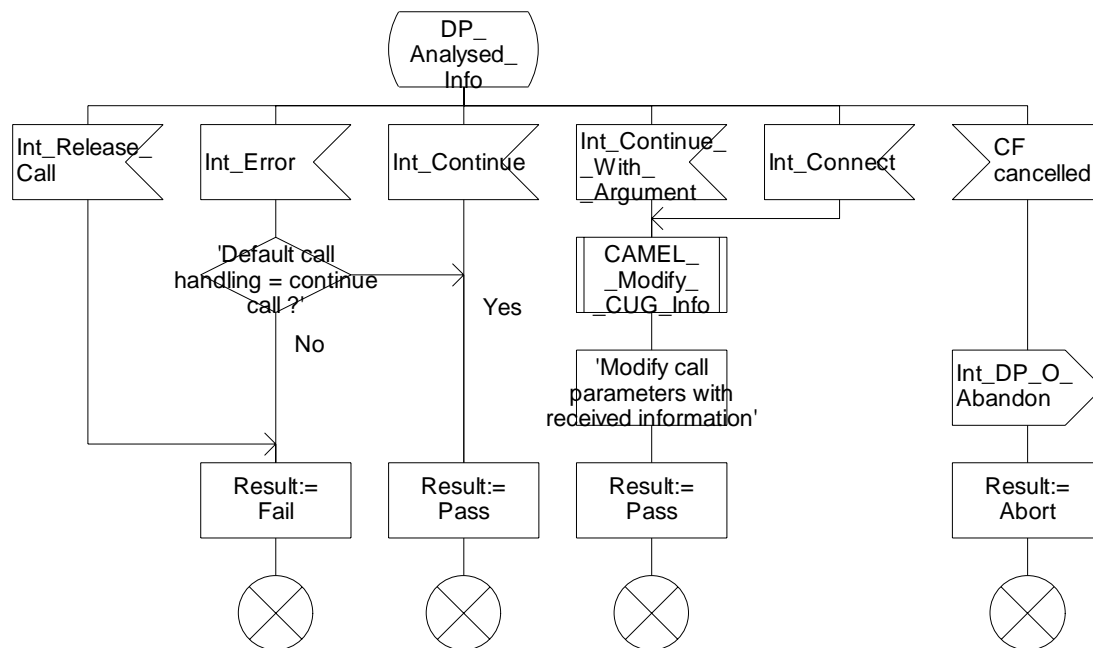
Figure 4.59b: Procedure CAMEL_NDS_CF_INIT (sheet 2)

Procedure CAMEL_NDS_CF_INIT 3(3)

/* Procedure in the MSC to perform
CAMEL handling for a network
Dialled Service for mobile originated calls */

/* Signals to/from the right are to/from
the gsmSSF if not otherwise stated. */

DP_Analysed_Info

Int_Establish_
Temporary
Connection

Int_Connect_To_
Resource

CAMEL_CF_ETC

CAMEL_CF_CTR

Result=
fail?

No

Yes

Result:=
fail

DP_Analysed
_Info

⊗
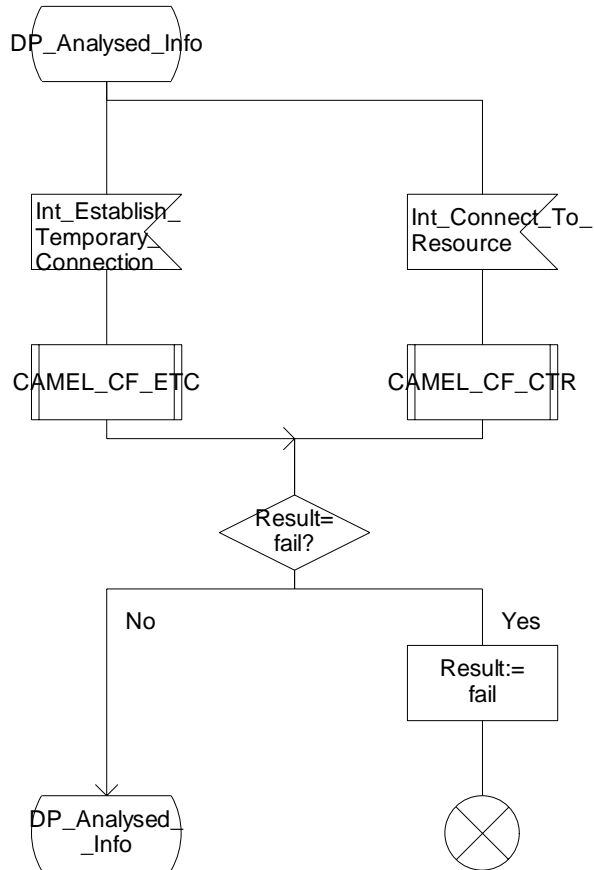
Figure 4.59c: Procedure CAMEL_NDS_CF_INIT (sheet 3)

3GPP

Procedure CAMEL_CF_MSC_ANSWER 1(2)

/* Procedure in the MSC to handle a fowarded call */

/* Signals to/from the left are to/from the process MT_GMSC / ICH_MSC; signals to/from the right are to/from the terminating exchange. */

gsmSSF exists?

No

Result=pass

Yes

Int_O_Answer — to the gsmSSF

Answer Received := True

DP_O_Answer

from the gsmSSF

from the gsmSSF

Int_Release

Int_continue

Release

Release

Release

CAMEL_OCH_MSC DISC_1

CAMEL_OCH_MSC DISC_2

Release

Result=:fail

Result:=pass

Result= reconnect?

Yes

Result= CAMEL_handling?

Yes

No

Result= CAMEL_handling?

No

Release

No

Release

Answer Received := False

Result:=fail

Result:= reconnect
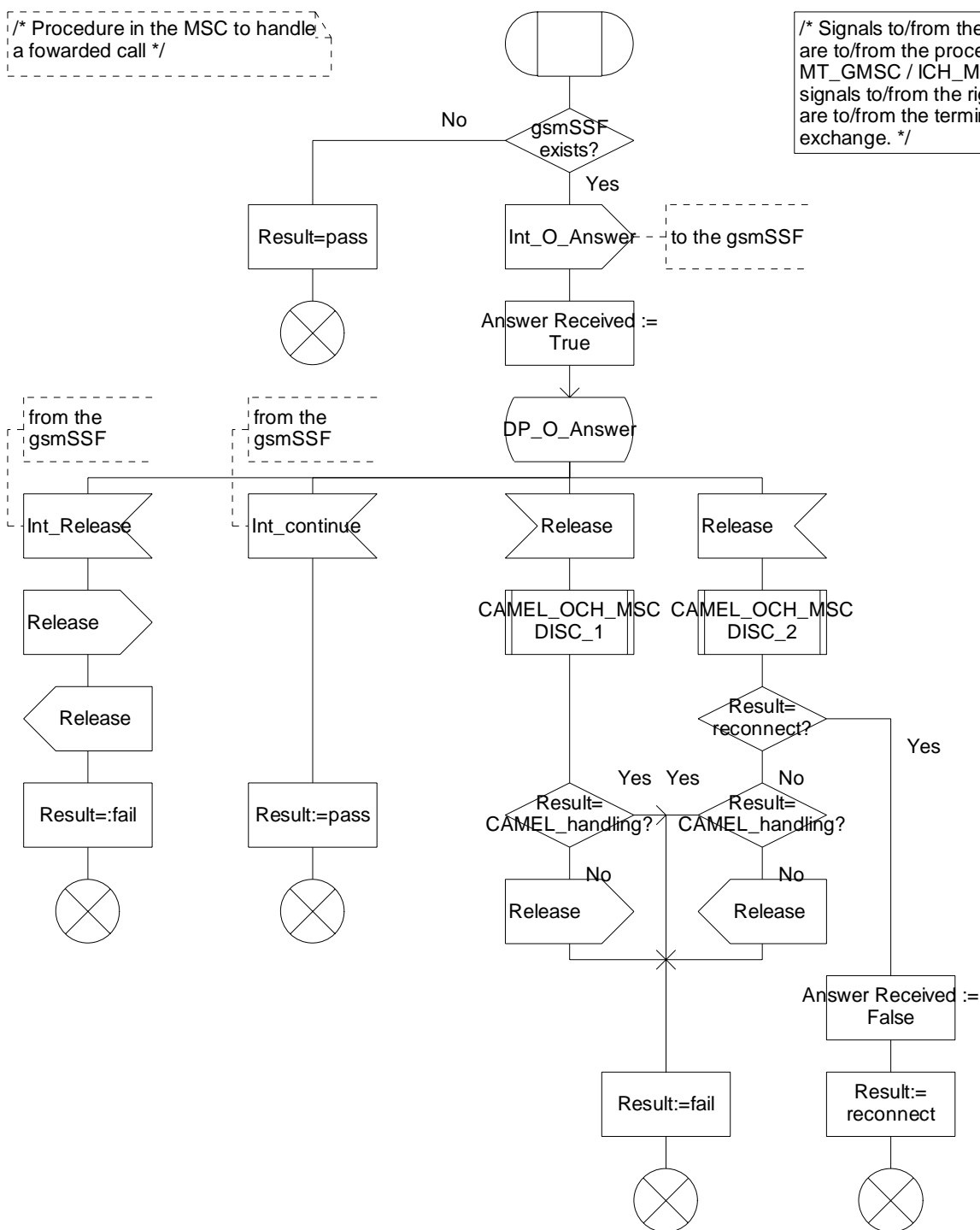
Figure 4.60a: Procedure CAMEL_CF_MSC_ANSWER (sheet 1)

Procedure CAMEL_CF_MSC_ANSWER 2(2)

/* Procedure in the MSC to handle a fowarded call */

/* Signals to/from the left are to/from the process MT_GMSC / ICH_MSC; signals to/from the right are to/from the terminating exchange. */

DP_O_Answer

Int_Error

No — Default call handling = continue call ?

Yes

Release

Release

Result:= fail

⊗

Result:= Pass

⊗
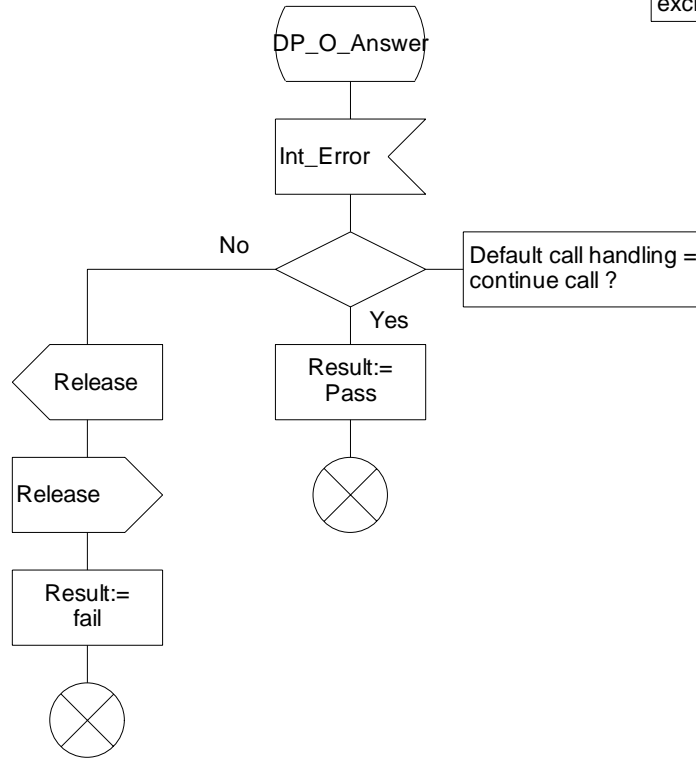
Figure 4.60b: Process CAMEL_CF_MSC_ANSWER (sheet 2)

Procedure CAMEL_CF_ETC 1(3)

/* Procedure in the MSC to handle a temporary connection */

/* Signals to/from the left are to/from the process MT_GMSC / ICH_MSC; signals to/from the right are to/from the gsmSSF; if not otherwise stated. */

Initial Address — To CAMEL_ Assisting_MSC or SRF

Send_ACM_ If_Required — Procedure defined in 3GPP TS 23.018

Wait_For_ Assisting_ACM

Release

Release — From CAMEL_ Assisting_MSC or SRF

Answer Received

Int_ETC_Failed

True

False

Result:= pass

Int_DP_O_Disconnect /*legID*/

Int_DP_O_Abandon

Wait_For_Disconnect_ Forward_Connection

DP_O_Abandon

Int_Disconnect_ Forward_Connection

Int_continue

Release — To CAMEL_ Assisting_MSC or SRF

Release — To CAMEL_ Assisting_MSC or SRF

Result:= pass

Result:= fail
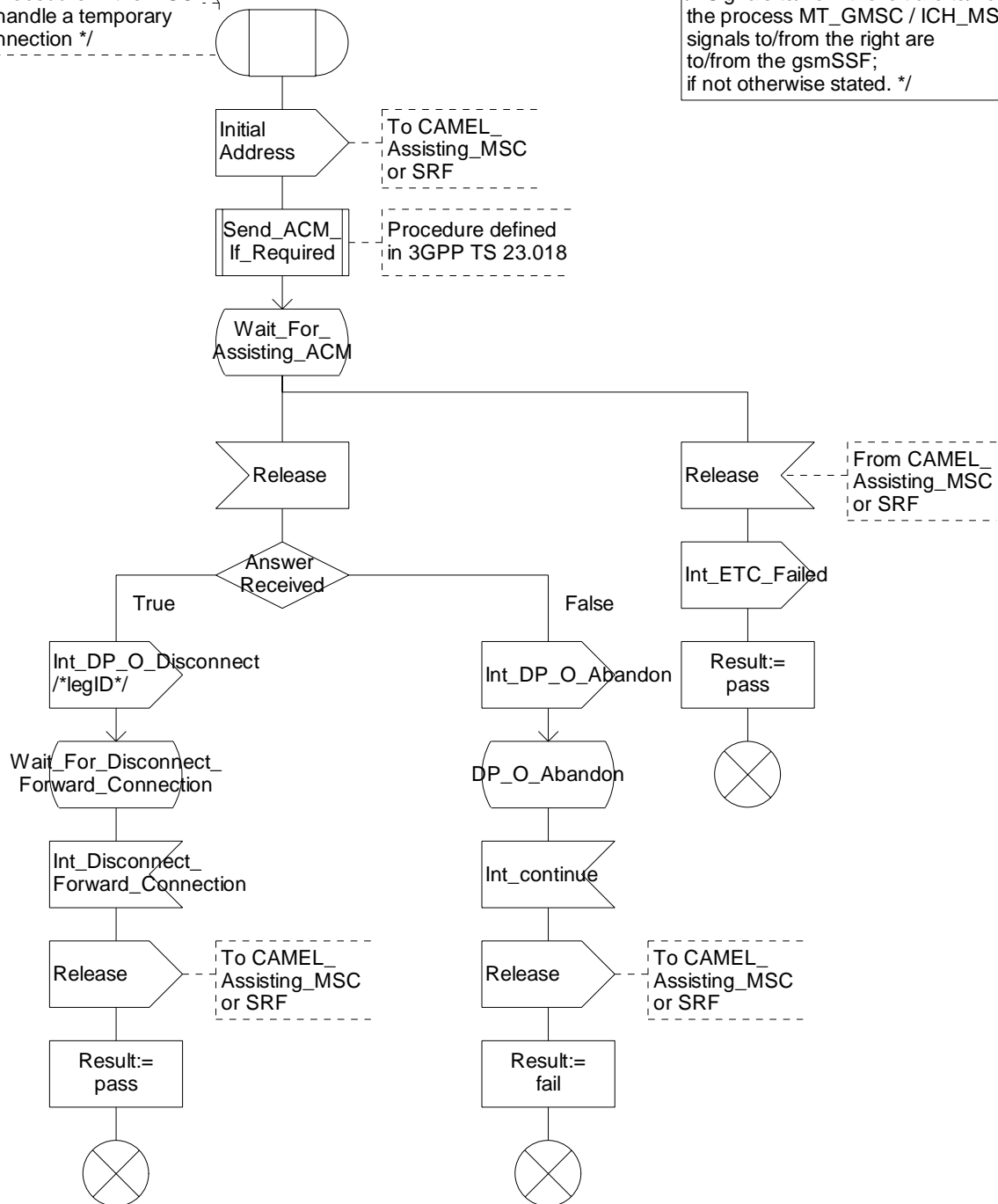
Figure 4.61a: Process CAMEL_CF_ETC (sheet 1)

Procedure CAMEL_CF_ETC   2(3)

/* Procedure in the MSC
to handle a temporary
connection */

/* Signals to/from the left are to/from
the process MT_GMSC / ICH_MSC;
signals to/from the right are
to/from the CAMEL_Assisting_MSC or SRF. */

Wait_For_
Assisting_ACM

Address
Complete

Connect

Wait_For_
Assisting_
Answer

Answer

Bothway
through connection
required?

No

Bothway
through connection
required?

No

Yes

Send_Answer_
If_Required

Send_ACM_
If_Required

Procedure defined
in 3GPP TS 23.018

Progress

Send_Network_
Connect_If_
Required

Yes

Int_Temporary
Connection
Established

Procedure defined
in 3GPP TS 23.018

Temporary_
Connection_
Established

Procedure defined
in 3GPP TS 23.018
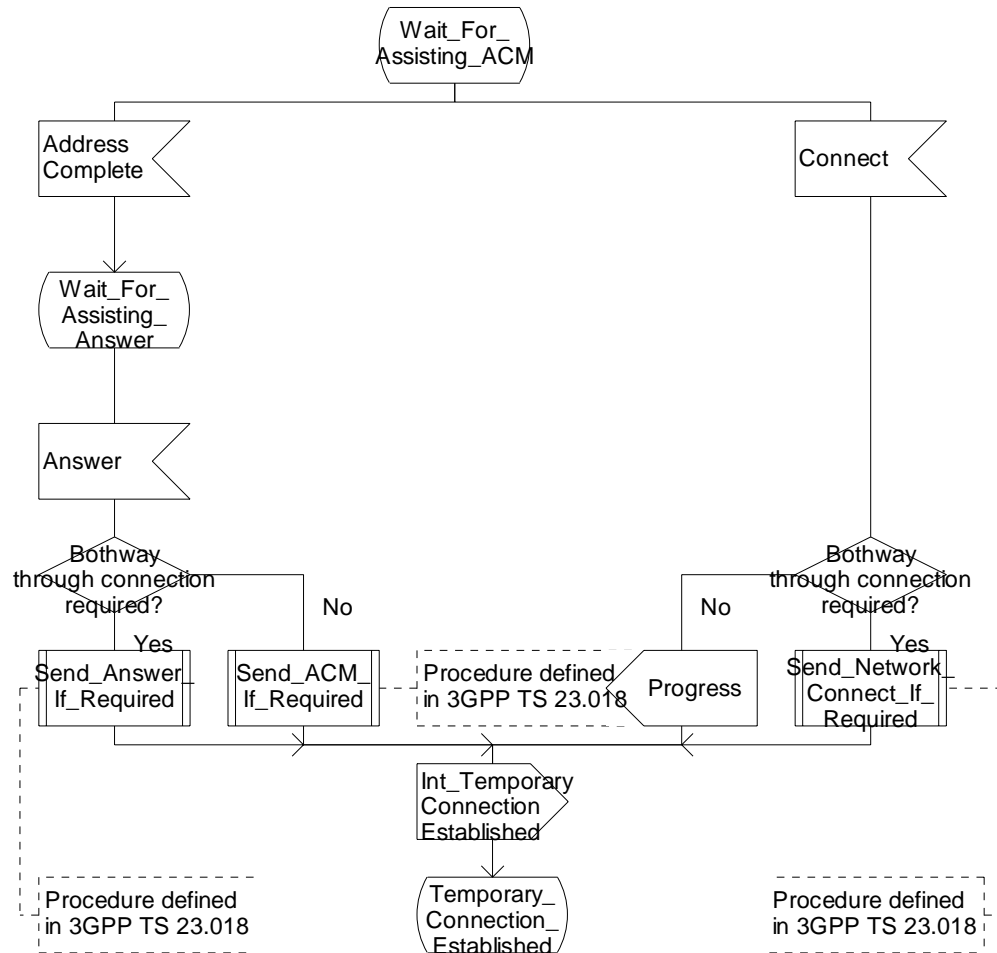
Figure 4.61b: Procedure CAMEL_CF_ETC (sheet 2)

Procedure CAMEL_CF_ETC 3(3)

/* Procedure in the MSC to handle a temporary connection */

/* Signals to/from the left are to/from the process MT_GMSC / ICH_MSC; signals to/from the right are to/from the gsmSSF; if not otherwise stated. */
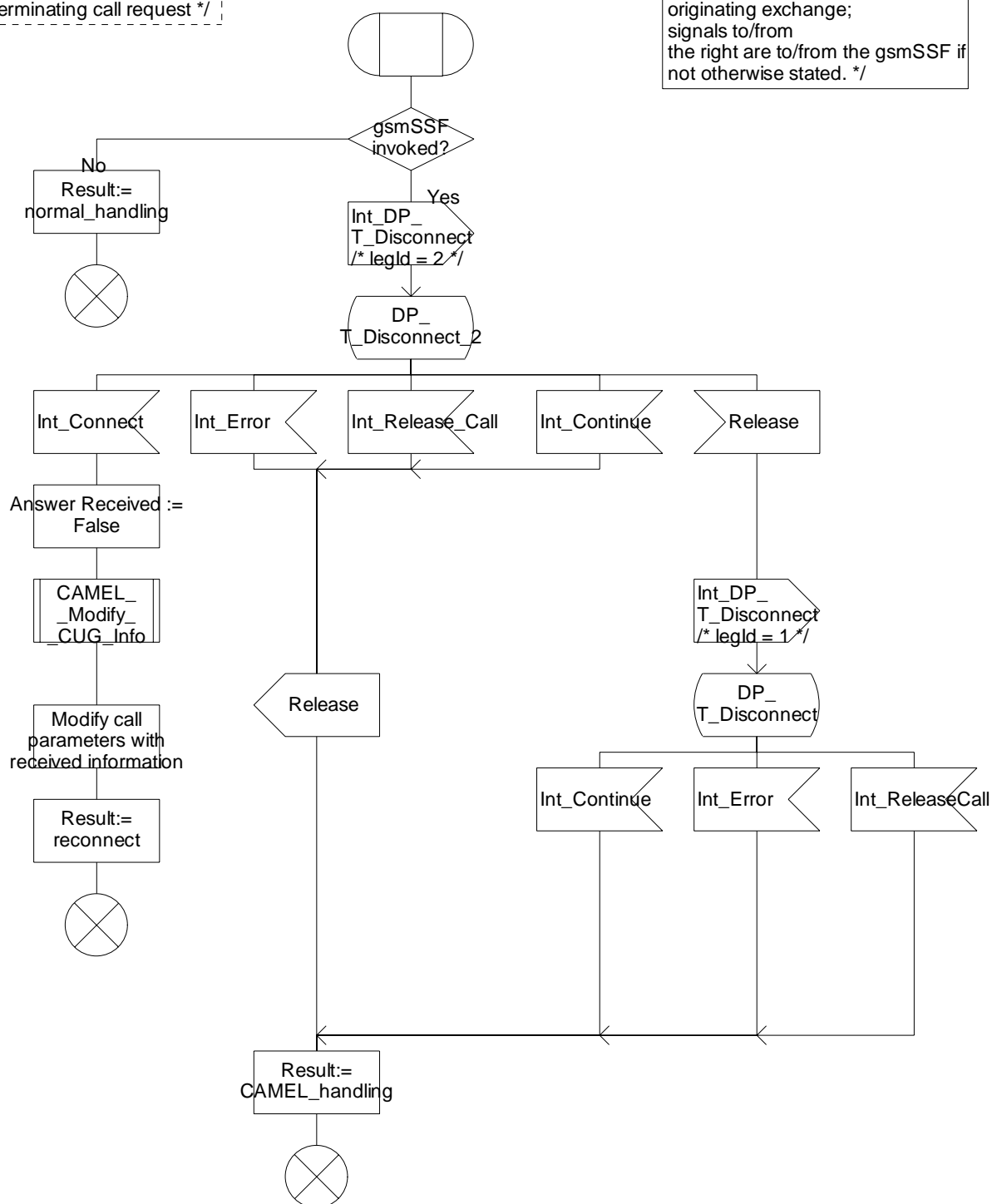
Temporary_Connection_Established
Wait_For_Assisting_Answer

Release

Answer Received

True false

Int_DP_O_Disconnect /*legID*/

Int_DP_O_Abandon

Wait_For_Disconnect_Forward_Connection

DP_O_Abandon

Int_continue

Release

To CAMEL_Assisting_MSC or SRF

Result:= fail

Release

From CAMEL_Assisting_MSC or SRF

Int_TC_Released

Result:= pass

To CAMEL_Assisting_MSC or SRF

Int_Disconnect_Forward_Connection

Int_TC_Released

Release

Result:= pass
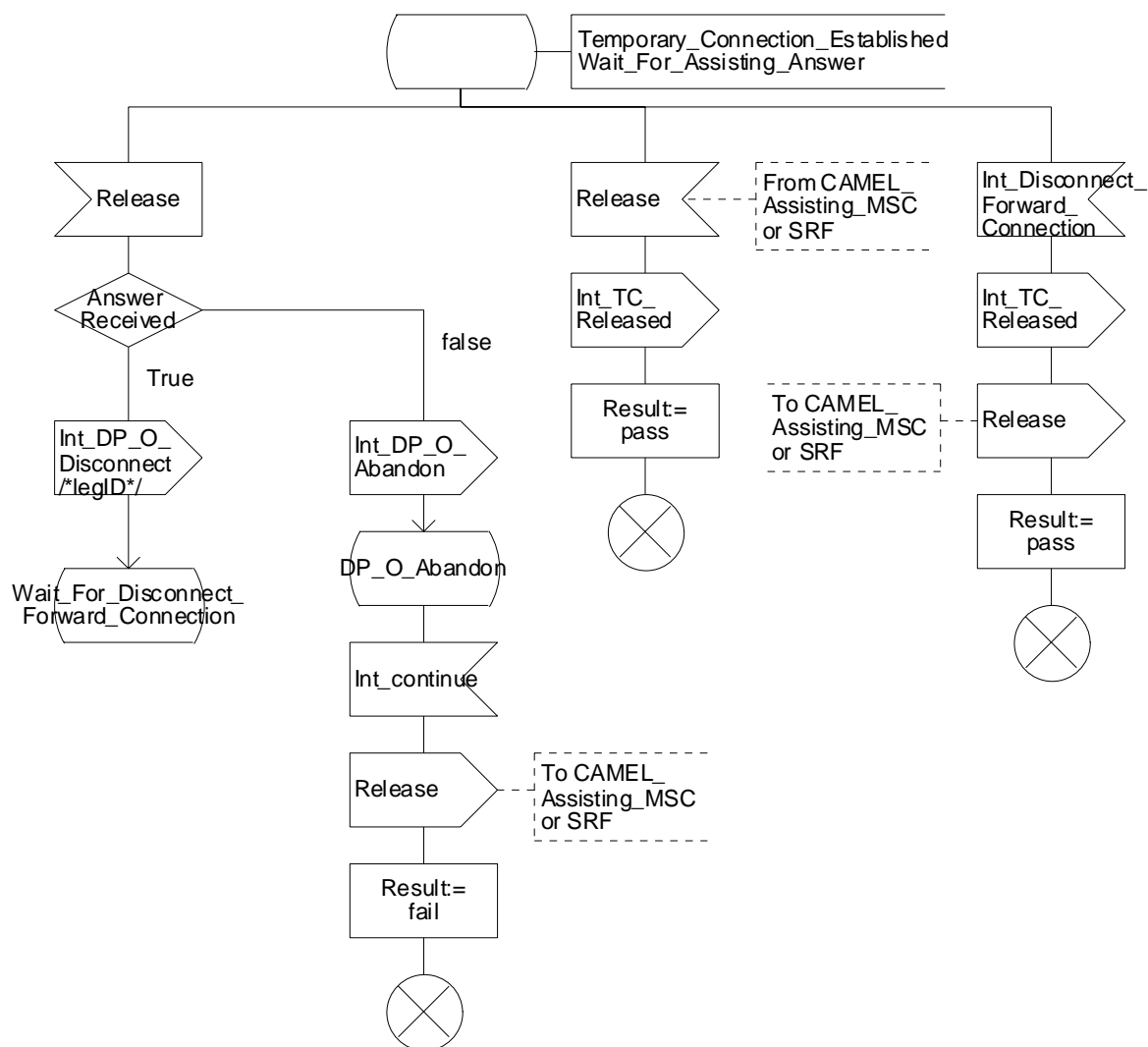
Figure 4.61c: Procedure CAMEL_CF_ETC (sheet 3)

Procedure CAMEL_CF_CTR 1(4)

/* Procedure in the MSC to handle a Connect To Resource operation */

/* Signals to/from the left are to/from the process MT_GMSC / ICH_MSC signals to/from the right are to/from the gsmSSF if not otherwise stated. */

Int_Invoke_SRF → To SRF

Await_SRF_Initialisation

Int_SRF_Connection_Failure ← from SRF

Int_SRF_Connected ← from SRF

Connect SRF to the call

Send_ACM_If_Required — Procedure defined in 3GPP TS 23.018

Through-connection required?

No / Yes

Int_CTR_Failed

Send_Network_Connect_If_required — Procedure defined in 3GPP TS 23.018

Result:= pass

Int_SRF_Connected

⊗

relay
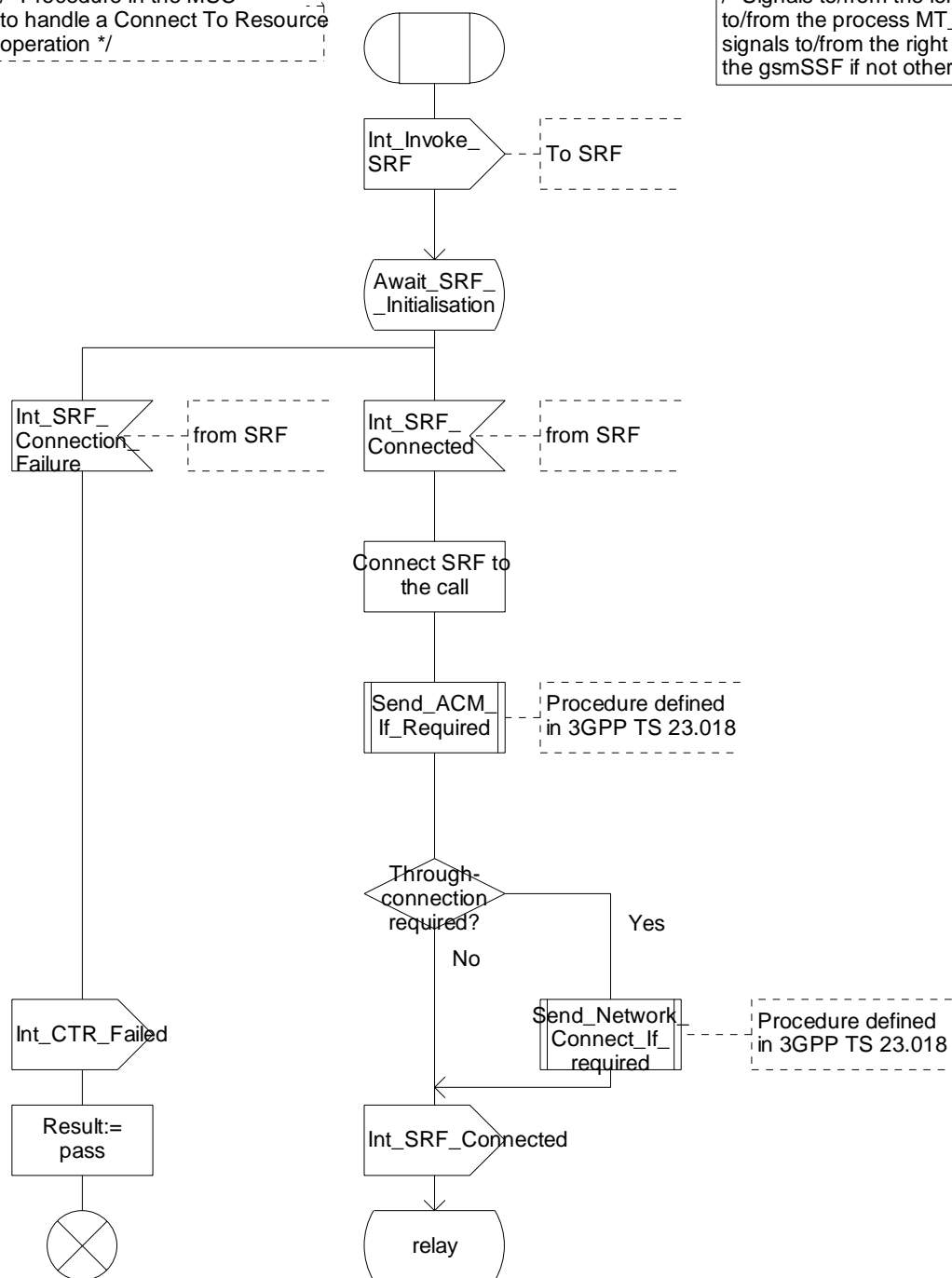
Figure 4.62a: Process CAMEL_CF_CTR (sheet 1)

Procedure CAMEL_CF_CTR 2(4)

/* Procedure in the MSC
to handle a Connect To Resource
operation */

/* Signals to/from the left are
to/from the process MT_GMSC / ICH_MSC
signals to/from the right are to/from
the gsmSSF if not otherwise stated. */

Relay

Release ← From SRF

Int_Disconnect_Forward_Connection

Release

Int_SRF_Released

Int_Disconnect_SRF → To SRF

Answer Received

Result:=
pass

Await_SRF_Disconnection_Continue

True

Int_DP_O_Disconnect /* legID */

False

Int_DP_O_Abandon /* legID */

Release

Int_SRF_Released ← From SRF

Wait_For_Disconnect_Forward_Connection

DP_O_Abandon

Answer Received

Int_SRF_Released

Int_Disconnect_Forward_Connection

Int_continue

True

False

Result:=
pass

Int_DP_O_Disconnect /* legID */

Int_DP_O_Abandon /* legID */

Result:=
pass

To SRF

Int_Disconnect_SRF

Wait_For_Disconnect_Forward_Connection

Result:=
pass

DP_O_Abandon

Await_SRF_Disconnection_Active

Int_Disconnect_Forward_Connection

Int_continue

Int_SRF_Released

Int_Disconnect_SRF

Result:=
fail

Result :=
Pass

Await_SRF_Disconnection_Fail

To SRF

Figure 4.62b: Procedure CAMEL_CF_CTR (sheet 2)

Procedure CAMEL_CF_CTR 3(4)

/* Procedure in the MSC
to handle a Connect To Resource
operation */

/* Signals to/from the right are to/from
the gsmSSF.
Signals to/from the left are to/from
the external SRF. */

Relay

CAP_Play_
Announcement

CAP_Prompt_
And_Collect_
User_Information

CAP_Specialized_
Ressource_Report

CAP_Prompt_
And_Collect_
User_Information
ack

CAP_Play_
Announcement

CAP_Prompt_
And_Collect_
User_Information

CAP_Specialized_
Ressource_Report

CAP_Prompt_
And_Collect_
User_Information
ack

Relay

Figure 4.62c: Procedure CAMEL_CF_CTR (sheet 3)

Procedure CAMEL_CF_CTR 4(4)

/* Procedure in the MSC
to handle a Connect To Resource
operation */

Await_SRF_Initialisation

/* Signals to/from the left are
to/from the process MT_GMSC / ICH_MSC;
signals to/from the right are to/from
the gsmSSF if not otherwise stated. */

Release

Answer
Received

True

Int_DP_O_Disconnect
/*legID*/

Int_Disconnect_SRF --- To SRF

Await_SRF_
Disconnection_
Active

Int_SRF_
Released <--- From SRF

Result=
pass

⊗

False

Int_DP_O_Abandon

DP_O_Abandon

Int_continue

Int_Disconnect_SRF --- To SRF

Await_SRF_
Disconnection_
Fail

Int_SRF_
Released <--- From SRF

Result=
fail

⊗
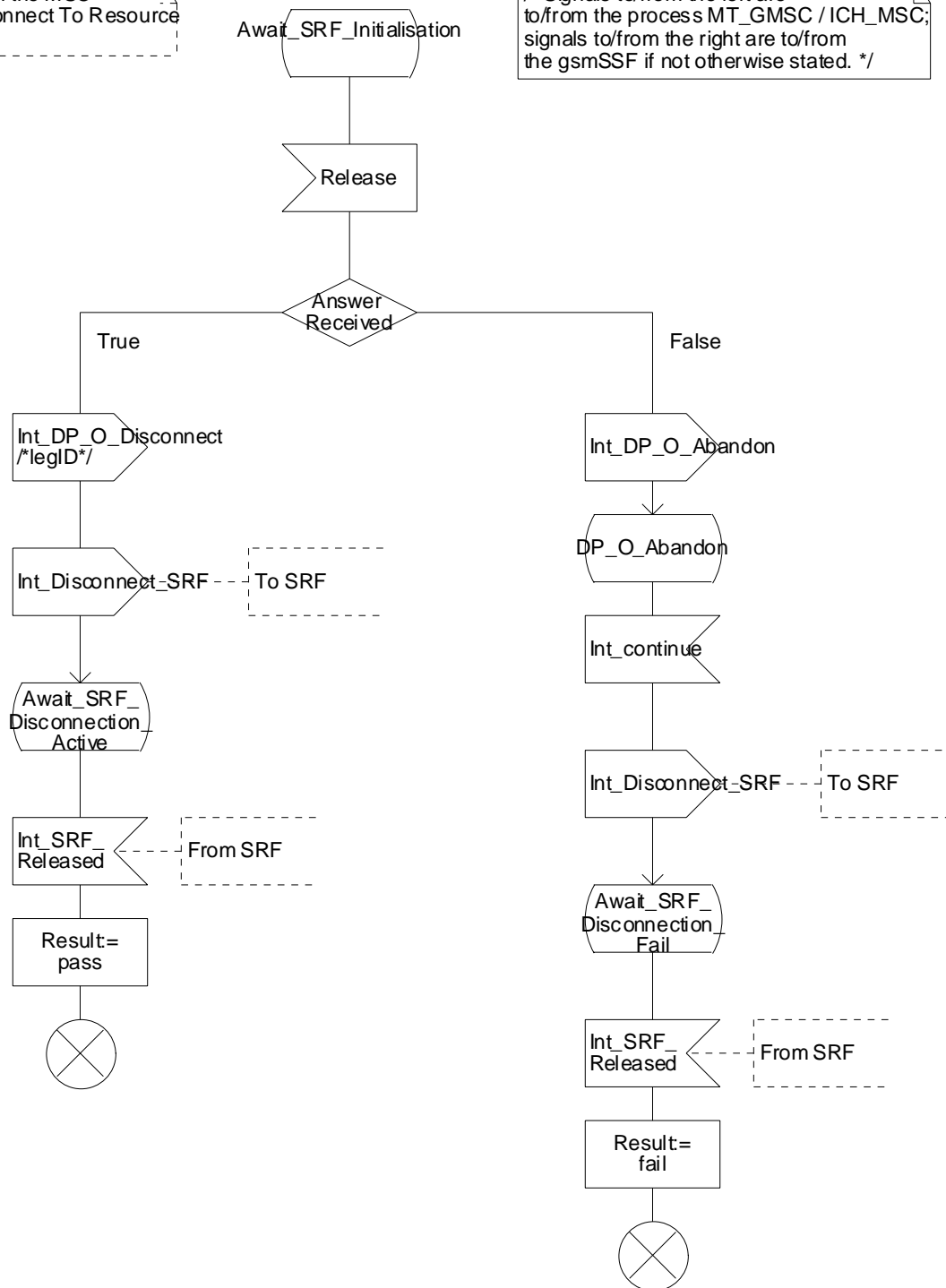
Figure 4.62d: Procedure CAMEL_CF_CTR (sheet 4)

4.5.6 Handling of mobile calls in the gsmSSF

Handling of mobile calls in the gsmSSF may involve the following process and procedures:

- gsmSSF;

- Check_Criteria;

- Connect_To_Resource;

- Handle_AC;

- Handle_ACR;

- Handle_CIR;

- Handle_CIR_leg;

- Complete_FCI_record;

- Complete_all_FCI_records;

- Handle_SCI;

- Handle_O_Answer;

- Handle_T_Answer.

The detailed error handling for the process gsmSSF and the associated procedures is specified in 3GPP TS 29.078 ([5]).

4.5.6.1 Information flow for call duration control

The following diagram shows the handling of the different timers that are used in the process gsmSSF and in the procedures Handle_AC, Handle_ACR, Handle_CIR. Timers Tssf, Tcp, Tsw, Tw and DELTA are defined in the process gsmSSF.
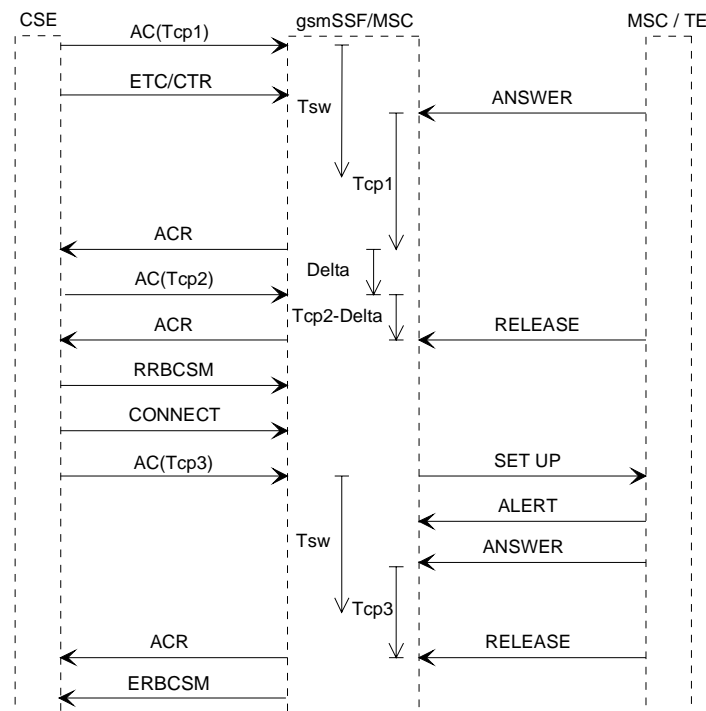
Figure 4.63: Information flow for call control duration

4.5.6.2 Behaviour of the gsmSSF in the process gsmSSF

The following paragraphs give details on the behaviour of the gsmSSF in the process gsmSSF.

4.5.6.2.1 Actions of the gsmSSF on receipt of CAP_Request_Report_BCSM_Event (at the state Waiting_For_Instructions)

The gsmSSF arms the requested EDP, if the arming rules are fulfilled and returns to state Waiting_For_Instructions.

The gsmSCF may request the monitoring for any one or more Answer, Busy, No Answer, Abandon, Route Select Failure and Disconnect Event of a party in the call.

4.5.6.2.2 Actions of the gsmSSF on receipt of CAP_Continue (at the state Waiting_For_Instructions)

An Int_Continue is sent to request the GMSC/MSC to continue call set-up as originally requested.

4.5.6.2.3 Actions of the gsmSSF on receipt of CAP_Release_Call (at the state Monitoring)

When a control relationship exists between the gsmSCF and gsmSSF (at least one EDP-R is armed), the gsmSCF may spontaneously instruct the gsmSSF to release the call at any time using the Release Call IF. The Release Call IF shall not be sent from the gsmSCF if only monitor relationship exists between the gsmSSF and the gsmSCF.

4.5.6.2.4 Actions of the gsmSSF on receipt of Int_DP_T_Busy or Int_DP_T_No_Answer including the parameter CF (at the state Monitoring)

If the handling of Int_DP_T_Busy or Int_DP_T_No_Answer including the parameter CF leads to the gsmSSF sending a CAP_Event_Report_BCSM to the gsmSCF, the gsmSSF shall include the parameter Call Forwarded as the Event Specific Information BCSM.

4.5.6.3 Procedure Handle_SCI

The following terminology has been used for e-parameters:

- Applicable and in use.   The set of e-parameters is currently applicable and the set has been sent to the MS.

- Applicable but waiting. The set of e-parameters is currently applicable but the set has not yet been sent to the MS.

- Applicable but not in use. The set of e-parameters is currently applicable but it is not sent to the MS, e.g. because the Advice of Charge supplementary service is not subscribed.

- Stored. The set of e-parameters is not yet applicable. The stored set of e-parameters becomes applicable when a tariff switch occurs.

1) Precondition: before an answer event is detected and no Tsw running at DP Collected_Info:

   if 1 set of e-parameters received --> send to the MSC;

   if 2 sets e-parameters received --> error;

   if 1 set of e-parameters and Tariff Switch received --> error;

   if 2 sets of e-parameters and Tariff Switch received --> send 1st to the MSC/start Tsw/store 2nd.

2) Precondition: before an answer event is detected and Tsw running and no e-parameters at DP Collected_Info:

   if 1 set of e-parameters received --> error, no e-parameters stored;

   if 2 sets e-parameters received --> send 1st to the MSC/store 2nd;

   if 1 set of e-parameters and Tariff Switch received --> error;

   if 2 sets of e-parameters and Tariff Switch received --> error.

3) Precondition: before an answer event is detected and Tsw running and e-parameters stored at DP Collected_Info:

   if 1 set of e-parameters received --> error;

   if 2 sets e-parameters received --> error;

   if 1 set of e-parameters and Tariff Switch received --> error;

   if 2 sets of e-parameters and Tariff Switch received --> error.

4) Precondition: after an answer event is detected and no Tsw running:

   if 1 set of e-parameters received --> send to the MSC;

   if 2 sets e-parameters received --> error;

   if 1 set of e-parameters and Tariff Switch received --> start Tsw/store set;

   if 2 sets of e-parameters and Tariff Switch received --> error.

5) Precondition: after an answer event is detected and Tsw running and no e-parameters:

   if 1 set of e-parameters received --> store e-parameters;

   if 2 sets e-parameters received --> error;

   if 1 set of e-parameters and Tariff Switch received --> error;

   if 2 sets of e-parameters and Tariff Switch received --> error.

6) Precondition: after an answer event is detected and Tsw running and e-parameters stored:

   if 1 set of e-parameters received --> error;

   if 2 sets e-parameters received --> error;

   if 1 set of e-parameters and Tariff Switch received --> error;

   if 2 sets of e-parameters and Tariff Switch received --> error.

7) Precondition: call processing is suspended at DP Analysed_Information:

   if 1 set of e-parameters received --> send to the MSC;

   if 2 sets e-parameters received --> error;

   if 1 set of e-parameters and Tariff Switch received --> error;

   if 2 sets of e-parameters and Tariff Switch received --> send 1st to the MSC/start Tsw/store 2nd.

NOTE 1: The MSC shall store the received e-parameters to be sent subsequently to the MS. The MSC shall send these e parameters to the MS in a Connect message or in a Facility message.

NOTE 2: Dialled service gsmSCF can only give e-parameter(s)/Tsw when it is not given previously by Subscriber Service gsmSCF. After Dialled service gsmSCF gives e-parameter(s)/Tsw, Subscriber Service gsmSCF shall not give further on-line charging instructions (i.e. Send Charging Information and Apply Charging).

   For D-CSI, this is ensured by service subscription restriction by a home network operator. For N-CSI, this is ensured by a roaming agreement between home network operator and visited network operator or is only applicable within a home network.

NOTE 3: When a CSE relationship is closed then the *stored* e-parameters given by that dialogue are discarded. Any Tariff Switch timer (Tsw) is also stopped when the CSE relationship is closed. If the CSE has given any e-parameters which are not *stored* but which are applicable (regardless of whether they are *applicable and in use*, *applicable but waiting,* or *applicable but not in use*) when the CSE relationship is closed, those e-parameters are also valid after the CSE relationship is closed. If any subsequent CAP dialogues give e-parameters those new e-parameters shall overwrite the applicable e-parameters given by the preceding CAP dialogues.

4.5.6.4 Process gsmSSF and procedures

The call gap operation can only be received for an opened transaction between the gsmSSF and the gsmSCF.

Process gsmSSF 1(33)

/* Invocation of gsmSSF in MO,
MT, VT or CF call case. */

/* Timers used in the gsmSSF process:

Tssf: Application timer in the ssf.
Tcp: Timer for call period.
    This timer measures the duration of a call period.
Tsw: Timer for tariff switch.
    At the expiration of this timer, a new tariff switch shall be started.
Tw: Warning timer.
    At the expiration of this timer, a warning tone shall be played to the calling party.
DELTA: time, measured in the gsmSSF, elapsed between the time an
    ApplyChargingReport operation is send to the gsmSCF and an
    ApplyCharging operation is received from the gsmSCF.
Tccd: Control of call duration timer.
    This timer supervises if after sending of ACR a new AC is received.
    Tccd has a value range of 1 to 20 seconds.

Ranges for the default values for Tssf.
- non user interaction Tssf timer value: 1 second to 20 seconds
- user interaction Tssf timer value: 1 minute to 30 minutes
*/

/* TASK definition:
The sending of an Application_Begin signal opens a new relationship to the gsmSCF.
The sending of an Application_End or Abort signal terminates the relationship to the gsmSCF.
*/

/* Decision box definitions (1)

'armed TDPs for this CSI?'
It is questioned whether or not the ongoing call can encounter further TDPs which are
indicated in the current CSI.

'Call to be released?'
It is questioned whether or not the ongoing call will be released imediately after gsmSSF
has responded; that is the ongoing call will not send any signals furtheron to the gsmSSF.
NOTE: In this case the gsmSSF shall also go to idle.

*/

/* Decision box definitions (2)
Thefollowing decisions are used by procedures in CCF.

'gsmSSF invoked?'
Is the gsmSSF process in any state other than Idle?

*/

Figure 4.64a: Process gsmSSF (sheet 1)

Process gsmSSF 2(33)

/* Invocation of gsmSSF in MO, MT, VT or CF call case. */

/* Signals to/from the left are to/from the MSC; signals to/from the right are to/from the gsmSCF. */

The received CSI states whether DP Collected_Info or DP Analysed_Information or DP Route_Select_Failure or DP T_Busy or DP T_No_Answer or DP Terminating_Attempt_ Authorised shall be armed as TDP.

Start_State

Idle

Idle

Int_Invoke gsmSSF (O-CSI)

Int_Invoke gsmSSF (T-CSI)

Int_Invoke gsmSSF (VT-CSI)

Int_Invoke gsmSSF (D-CSI)

Int_Invoke gsmSSF (N-CSI)

Arm DP

Int_O_Exception, Int_T_Exception

Int_DP_O_Answer, Int_DP_T_Answer, Int_DP_O_Abandon, Int_DP_T_Abandon, Int_DP_Route_Select_Failure, Int_DP_O_No_Answer, Int_DP_T_No_Answer, Int_DP_O_Busy, Int_DP_T_Busy, Int_DP_O_Disconnect, Int_DP_T_Disconnect, Int_DP_Analysed_Info

Int_gsmSSF Invoked

Int_Continue

Wait_For_ _Request

Idle

Figure 4.64b: Process gsmSSF (sheet 2)

Process gsmSSF   3(33)

/* Invocation of gsmSSF in MO, MT, VT or CF call case. */

/* Signals to/from the left are to/from the MSC; signals to/from the right are to/from the gsmSCF. */

Int_DP_O_Abandon,
Int_DP_T_Abandon,
Int_DP_O_Disconnect,
Int_DP_T_Disconnect,
Int_DP_O_Answer,
Int_DP_T_Answer,
Int_DP_O_Busy,
Int_DP_O_No_Answer

Int_DP_Route_Select_Failure,
Int_DP_T_Busy,
Int_DP_T_No_Answer

Wait_For_ _Request

Int_T_Exception,
Int_O_Exception

Int_DP_ _Terminating_ _Attempt_ _Authorized

Int_DP_ _Collected_ _Information

Int_DP_ _Analysed_ Information

'DP_ _Terminating_ _Attempt_ _Authorized_ armed?'

No

Check_Criteria_ Unsuccessful

Check_Criteria_ Collected_Info

Idle

Check_Criteria_ _Analysed_Info

Yes

Result= pass?

Yes

Result= pass?

No

Result= pass?

No

Yes

Int_Continue

Int_Continue

Int_Continue

Idle

Check_Gap_ _Criteria

Idle

Idle

'armed TDPs for this CSI?'

Result = pass?

Check_Gap_ _Criteria

Yes

No

Yes

No

Wait_For_ _Request

Idle

Result = pass?

Yes

2

Result = pass?

No

Default Call Handling = Continue Call?

Yes

1

No

Yes

Int_Continue

Apply Gap treatment if present

Gap treatment depends on the info received in the Call Gap message (i.e. tone/announce, cause, etc.)

'armed TDPs for this CSI?'

Int_ReleaseCall

Yes

No

Wait_For_ _Request

Idle

Figure 4.64c: Process gsmSSF (sheet 3)

Process gsmSSF   4(33)

/* Invocation of gsmSSF in MO, MT, VT or CF call case. */

/* Signals to/from the left are to/from the MSC; signals to/from the right are to/from the gsmSCF. */

(1)

'Set Tssf to default non user interaction Tssf timer interval and restart Tssf'

Application_ Begin

'Set Control Relationship'

CAP_InitialDP

ACR sent:=false
AC pending:=false
Outstanding requests = 1
Oustanding Call Information Report = 0

Waiting_for_ _Instructions

(2)

'Set Tssf to default non user interaction Tssf timer interval and restart Tssf'

Application_ Begin

'Set Control Relationship'

CAP_InitialDP

Waiting_for_ _Instructions_ for DS

Figure 4.64d: Process gsmSSF (sheet 4)

Process gsmSSF 5(33)

/* Invocation of gsmSSF in MO, MT, VT or CF call case. */

/* Signals to/from the left are to/from the MSC; signals to/from the right are to/from the gsmSCF. */

Waiting_for_ _Instructions

CAP_Apply_ Charging

Handle_AC

Set Tssf to CAP_Reset_Timer time interval and restart Tssf

CAP_Reset_Timer

Yes | No

Set Tssf to CAP_Reset_Timer time interval and restart Tssf

Waiting_For_ _Instructions

'Not Waiting for first response after IDP or first reset Timer'

Internal

Timer expiry Tssf

Abort

Int_Error

Complete_all_ FCI_records

'Default call handling = continue call?' — No

Yes

'armed TDPs for this CSI?' — No

Yes

Wait_For_ _Request

Idle

Figure 4.64e: Process gsmSSF (sheet 5)

Figure 4.64f: Process gsmSSF (sheet 6)

Process gsmSSF 7(33)

/* Invocation of gsmSSF in MO, MT, VT or CF call case. */

/* Signals to/from the left are to/from the MSC; signals to/from the right are to/from the gsmSCF. */

Waiting_for_ _Instructions

CAP_Request_ _ReportBCSM_ _Event

Set Tssf to last used time interval and restart Tssf

Arming rules fulfilled?

No

Error Unexpected Data Value

Yes

Arm EDP and/or disarm EDP

Waiting_For_ _Instructions

Depending on the Monitoring parameter received for the indicated detection point. For DP O/T Disconnect a DP is only disarmed for the leg for which the event was received.

CAP_ _ReleaseCall

AC pending?

False

True

CallActive := FALSE

CAP_Apply_ Charging_Report

Handle_CIR

Complete_all_ FCI_records

Application_ End

Int_Release Call

Int_T_Exception, Int_O_Exception

AC pending?

False

True

CAP_Apply_ Charging_Report

Handle_CIR

Complete_all_ FCI_records

Abort

Stop Tssf

Idle

Figure 4.64g: Process gsmSSF (sheet 7)

Process gsmSSF 8(33)

/* Invocation of gsmSSF in MO, MT, VT or CF call case. */

Waiting_For_ _Instructions

/* Signals to/from the left are to/from the MSC; signals to/from the right are to/from the gsmSCF. */

CAP_Establish Temporary Connection

Stop Tssf

Int_Establish Temporary Connection

Await_Temporary_ Connection_ Establishment

Int_Temporary_ Connection_ Established

AC pending?

No

Yes

Start Tcp

Tw>0

No

Yes

Start Tw

Set Tssf to user interaction timer value and restart Tssf

Waiting_For_ _End_Of_ Temporary_ Connection

CAP_Cancel_(All)

Disarm all EDPs

Cancel all reports

Int_ETC_Failed

Error ETC failed

Set Tssf to last used time interval and restart Tssf

Waiting_For_ Instructions
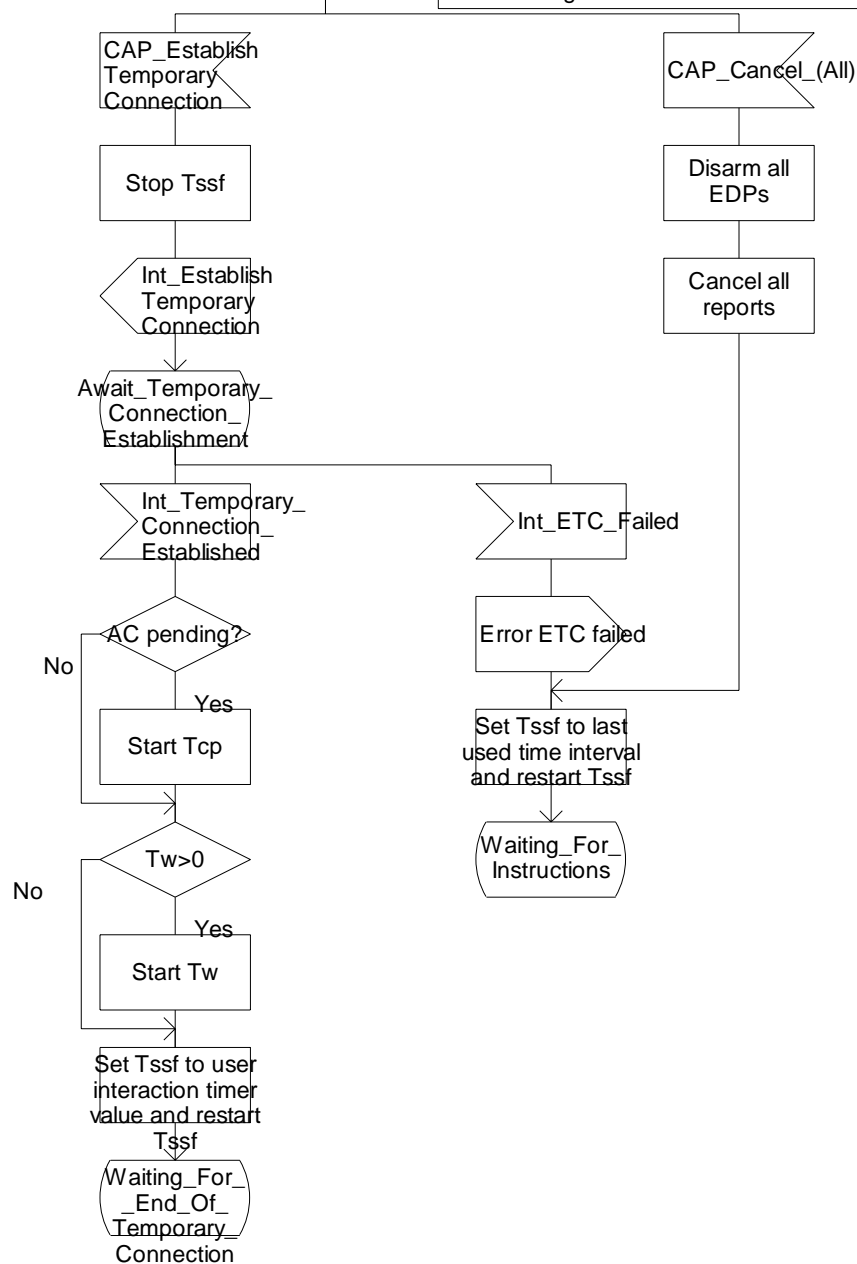
Figure 4.64h: Process gsmSSF (sheet 8)

Process gsmSSF 9(33)

/* Invocation of gsmSSF in MO, MT, VT or CF call case. */

Waiting_for_ _Instructions

/* Signals to/from the left are to/from the MSC; signals to/from the right are to/from the gsmSCF. */

CAP_ConnectTo Resource

Stop Tssf

Connect_To_ Resource

result

pass

AC pending?

No   Yes

Start Tcp

Tw>0

No   Yes

Start Tw

Set Tssf to user interaction timer value and restart Tssf

Waiting_For _End_Of_ User_Interaction

fail

Set Tssf to last used time interval and restart Tssf

Return appropriate error to the gsmSCF

Waiting_For_ Instructions
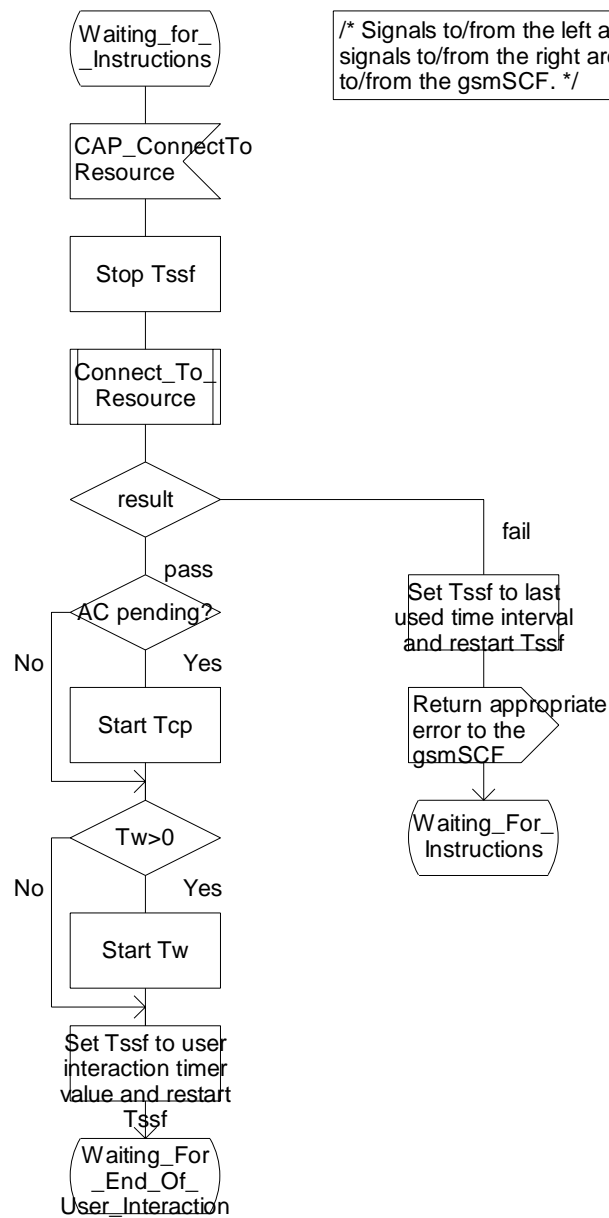
Figure 4.64i: Process gsmSSF (sheet 9)

Process gsmSSF   10(33)

/* Invocation of gsmSSF in MO, MT, VT or CF call case. */

/* Signals to/from the right are to/from the gsmSCF. */

Monitoring

CAP_Request_ Report_BCSM_ Event

No ← Arming rules fulfilled?

In state 'Monitoring', only requests to disarm DPs or to sent notifications are allowed

Error: Unexpected Data Value

Arm DP and/or disarm DP

Yes ← Any armed EDP or report pending

Monitoring

No

Complete_all_ FCI_records

Application_End

'armed TDPs for this CSI?' → No

Yes

Wait_For_ _Request

Idle
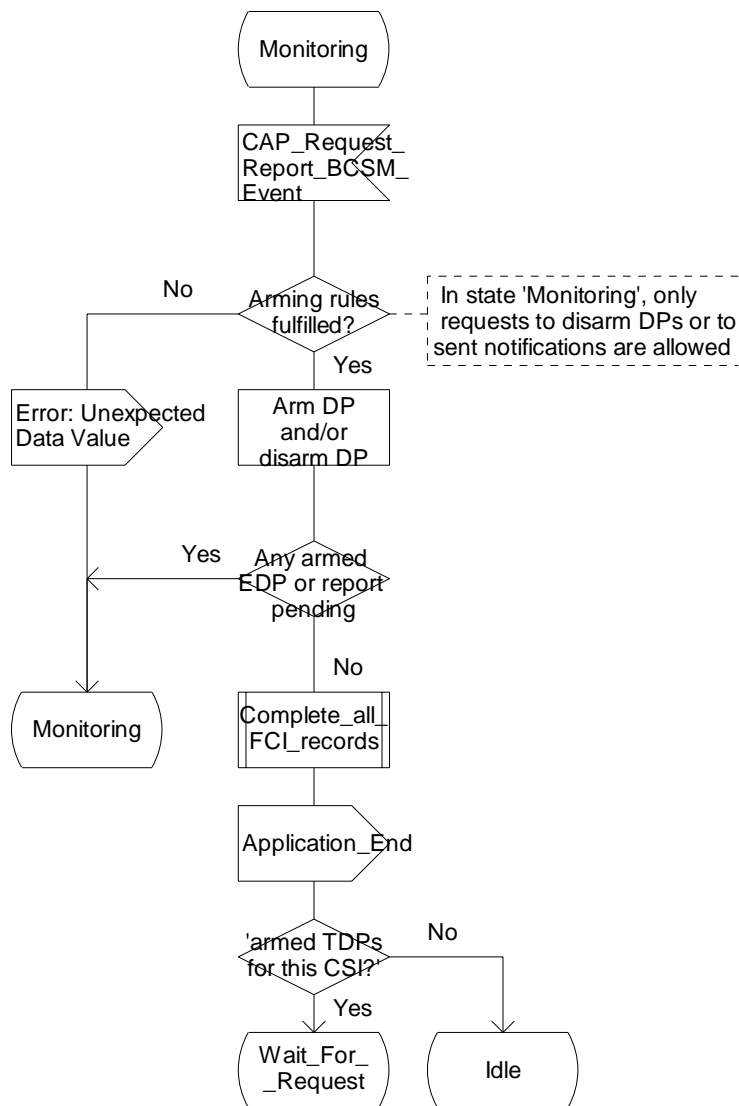
Figure 4.64j: Process gsmSSF (sheet 10)

Process gsmSSF 11(33)

/* Invocation of gsmSSF in MO, MT, VT or CF call case. */

Waiting_for_Instructions,
Monitoring ,
Waiting_for_End_Of_Temporary_Connection,
Waiting_for_End_Of_User_Interaction,
Await_Temporary_Connection_Establishment

Int_DP_O_ _Disconnect /* legID */

Int_DP_T_ _Disconnect /* legID */

Int_DP_O_ _Abandon

Int_DP_T_ _Abandon

/* Signals to/from the left are to/from the MSC; signals to/from the right are to/from the gsmSCF. */

DP armed for legID?

CAP_Event_ _Report_BCSM (Notify & Continue)

Yes

No

DP armed as EDP-R?

Yes

Perform implicit disarming of DPs

Perform implicit disarming of DPs

Handle_ACR

No

Perform implicit disarming of DPs

Handle_ACR

Stop Tssf

Handle_CIR

CallActive := FALSE

Handle_CIR_ leg (legID)

Int_Continue

Stop Tssf

CAP_Event_ _Report_BCSM (Interrupted)

Handle_ACR

Int_Continue

CallActive := FALSE

Handle_CIR

Complete_all_ FCI_records

Set Tssf to default non user interaction timer value and restart Tssf

Complete_all_ FCI_records

Application_ End

Outstanding_ _Requests := Outstanding_ _Requests + 1

Application_ End

Idle

Waiting_for_ Instructions

Idle

Figure 4.64k: Process gsmSSF (sheet 11)

Process gsmSSF 12(33)

/* Invocation of gsmSSF in MO, MT, VT or CF call case. */

/* Signals to/from the left are to/from the MSC; signals to/from the right are to/from the gsmSCF. */

Waiting_for_End_ _Of_Temporary_ Connection

CAP_Disconnect_ ForwardConnection

Int_TC_Released

CAP_Apply_ Charging

CAP_Reset_ _Timer

Tssf expired --- Internal

Handle_AC

Set Tssf to CAP_Reset_Timer time interval and restart Tssf

Abort

Handle_ACR

Handle_ACR

Int_Disconnect_ Forward_ Connection

Int_Disconnect_ Forward_Connection

Set Tssf to last used time interval and restart Tssf

CallActive := FALSE

Waiting_for_End_ _Of_Temporary_ Connection

TC_Release_ Pending

Int_TC_Released

Waiting_For_ _Instructions

Int_Error

Complete_all_ FCI_record

'Default call handling = continue call?'

No

Yes

'armed TDPs for this CSI?'

No

Yes

Wait_For_ _Request

Idle

Figure 4.64I: Process gsmSSF (sheet 12)

Process gsmSSF 13(33)

/* Invocation of gsmSSF in MO, MT, VT or CF call case. */

/* Signals to/from the left are to/from the MSC; signals to/from the right are to/from the gsmSCF. */

Waiting_for_End_Of_Temporary_Connection,
Waiting_for_End_Of_User_Interaction

Internal Internal

Tw expired Internal Tsw expired Tcp expired Tccd expired

Int_Apply_
Warning_Tone

Internal

This provokes the MSC
to play a tone to the party
for whom the BCSM is operating

Release?

Yes

CAP_
Apply_Charging_
Report

No

Handle_ACR

Int_Disconnect_
Forward_Connections

Set Tssf to last
used time interval
and restart Tssf

Handle_CIR

Stored
e parameters?

Start Tccd

Complete_all_
FCI_record

Yes

Set stored
e parameters
as applicable

No

Int_Release

Send_e_
Parameters

Stop Tssf

Store curent
value of Tcp

Application_
End

This provokes the MSC
to send e parameters to
the calling party

-

CallActive :=
TRUE

Idle

No stored
e-parameters exist
after this setting

CallActive := FALSE;
'CallReleasedAtTcpExpiry' present;

Figure 4.64m: Process gsmSSF (sheet 13)

Process gsmSSF 14(33)

/* Invocation of gsmSSF in MO, MT, VT or CF call case. */

/* Signals to/from the left are to/from the MSC; signals to/from the right are to/from the gsmSCF. */

Monitoring

Internal

Tw expired

Tsw expired

Tcp expired

Tccd expired

Int_Apply_ Warning_Tone

Stored e parameters?

No

Release?

Yes

CAP_ Apply_Charging_ Report

Set stored e parameters as applicable

Yes

'Any EDP or reports outstanding?'

No

Answer sent to MS?

No

Yes

No stored e-parameters exist after this setting

CAP_ Apply_Charging_ Report

Handle_CIR

Complete_all_ FCI_record

Complete_all_ FCI_record

Handle_ACR

Application_ End

Int_Release

Send_e_ Parameters

Set Tssf to last used time interval and restart Tssf

Idle

Store curent value of Tcp

Start Tccd

Application_ End

-

Idle

This provokes the MSC to send e parameters to the calling party

CallActive := TRUE

This provokes the MSC to play a tone to the party for whom the BCSM is operating

CallActive := FALSE; 'CallReleasedAtTcpExpiry' present

Figure 4.64n: Process gsmSSF (sheet 14)

Process gsmSSF 15(33)

/* Invocation of gsmSSF in MO, MT, VT or CF call case. */

/* Signals to/from the left are to/from the MSC; signals to/from the right are to/from the gsmSCF. */

Waiting_for_End_ _Of_User_ _Interaction

CAP_Apply_ Charging

CAP_Disconnect_ ForwardConnection

Int_SRF_ _Released

CAP_Reset_ _Timer

CAP_Play_ _Announcement

CAP_Prompt_&_ _Collect_User_ _Information

CAP_Cancel_ _(Invoke_ID)

Handle_AC

Handle_ACR

Handle_ACR

CallActive := FALSE

Relay the operation to the SRF

To SRF

Int_Disconnect_ Forward_Connection

Set Tssf to CAP_Reset_Timer time interval and restart Tssf

Set Tssf to last used time interval and restart Tssf

Set Tssf to last used time interval and restart Tssf

Set Tssf to default non user interaction time interval and restart Tssf

Set Tssf to default non user interaction time interval and restart Tssf

Waiting_For_End_ Of_User_ _Interaction

Waiting_For_ _Instructions

Waiting_for_End_ _Of_User_ _Interaction

Figure 4.64o: Process gsmSSF (sheet 15)

Process gsmSSF 16(33)

/* Invocation of gsmSSF in MO, MT, VT or CF call case. */

/* Signals to/from the left are to/from the process Generic_SRF; signals to/from the right are to/from the gsmSCF unless otherwise stated. */

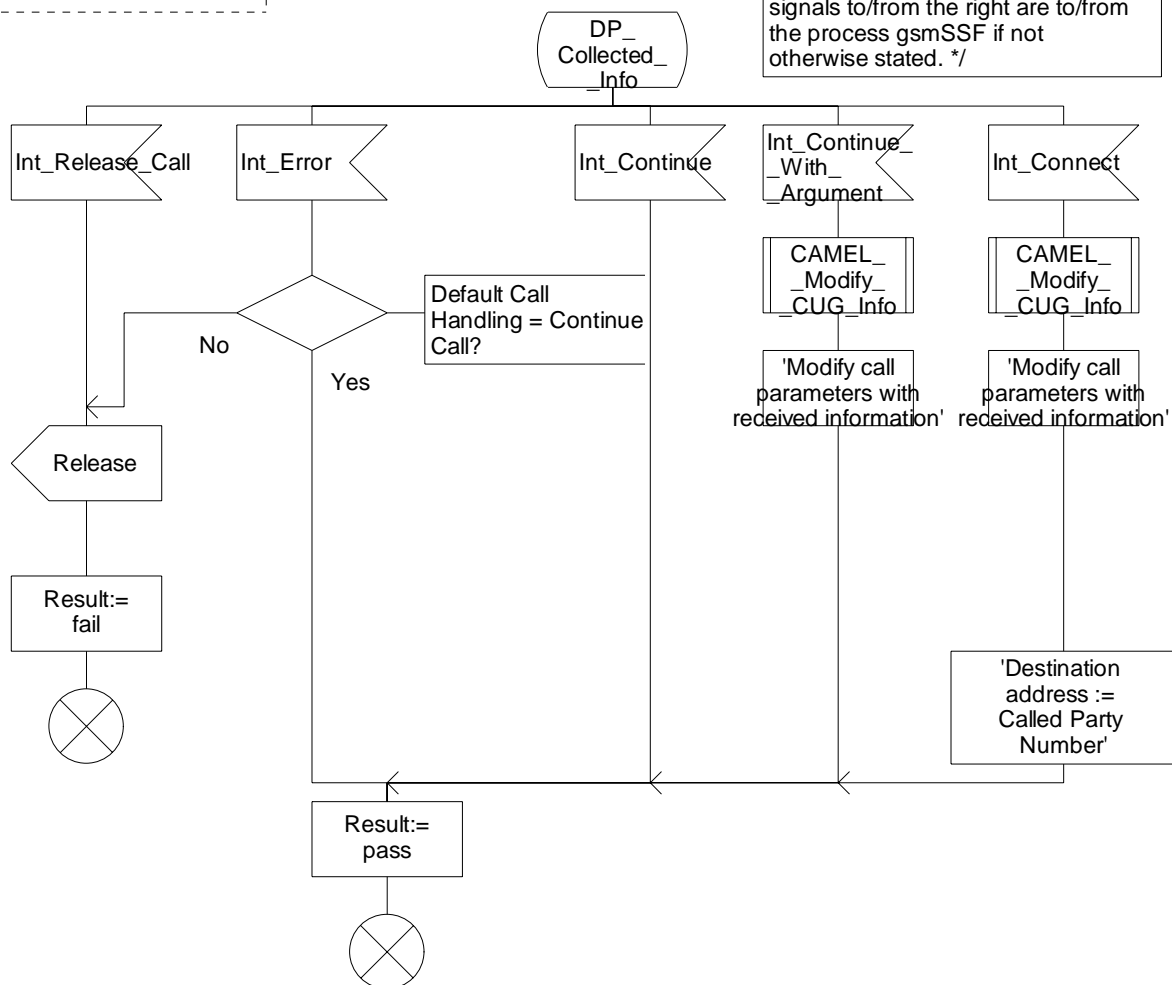Waiting_for_End_ _Of_User_ _Interaction

CAP_Cancelled _error

CAP_Cancel_ _Failed_error

From SRF

CAP_Prompt_& _Collect_User_ _Information_ _Result

From SRF

CAP_ Specialised_ Resource_ Report

Relay the operation/ result/error to the gsmSCF

Internal

Timer expiry Tssf

Abort

Waiting_for_End_ _Of_User_ _Interaction

Int_Disconnect_ Forward_Connection

SRF_Release_ Pending

Int_SRF_Released

Int_Error

Complete_all_ FCI_record

'Default call handling = continue call?'

No

Yes

'armed TDPs for this CSI?'

No

Yes

Wait_For_ _Request

Idle

Figure 4.64p: Process gsmSSF (sheet 16)

Process gsmSSF 17(33)

/* Invocation of gsmSSF in MO, MT, VT or CF call case. */

Monitoring

/* Signals to/from the left are to/from the MSC; signals to/from the right are to/from the gsmSCF. */

CAP_Cancel_(All)

Disarm all EDPs

Cancel all reports

Int_DP_O_Answer

Handle_O_ Answer

Int_DP_T_Answer

Handle_T_ Answer

DP armed for legID

No

Yes

Perform implicit disarming of DPs.

DP armed as EDP-R?

No

CAP_Event_ _Report_BCSM (Notify & Continue)

Yes

CAP_Event_ _Report_BCSM (Interrupted)

For DP O/T Disconnect the DP is only disarmed for the leg for which the event was received.

Disarm this DP. Perform implicit disarming of DPs.

Disarm this DP. Perform implicit disarming of DPs.

No

Any remaining armed EDPs or outstanding report?

Yes

Outstanding_ _Requests := 1

Application_ End

Int_Continue

Set Tssf to default non user interaction Tssf timer value and restart Tssf

Complete_all_ FCI_record

Monitoring

Waiting_For_ _Instructions

Int_Continue

armed TDPs for this CSI?

No

Yes

Wait_For_ _Request

Idle

Figure 4.64q: Process gsmSSF (sheet 17)

Process gsmSSF 18(33)

/* Invocation of gsmSSF in MO, MT, VT or CF call case. */

Monitoring

/* Signals to/from the left are to/from the MSC; signals to/from the right are to/from the gsmSCF. */

Int_DP_O_No_Answer,
Int_DP_T_No_Answer,
Int_DP_O_Busy,
Int_DP_T_Busy,
Int_DP_Route_Select_Failure

EDP type?

EDP_N   EDP_R

Not armed for LegID

CAP_Event
_Report_BCSM
(Notify & Continue)

Handle_ACR   Handle_ACR

CallActive :=
FALSE

Stop Delta   Stop Delta

Perform implicit
disarming of DPs.

Call Forwarding
pending?

No   Yes

Handle_CIR   Handle_CIR_   Handle_CIR_
                    leg (leg2)   leg (leg2)

CAP_Event
_Report_BCSM
(Interrupted)

Any remaining armed
EDPs or
outstanding report?

No

Complete_all_   Yes
_FCI_records

Complete_   Disarm this DP.
_FCI_record   Perform implicit
(leg2)   disarming of DPs.

Application_
End   Outstanding_
                                             _Requests := 1

Int_Continue   Int_Continue

                                             Set Tssf to default
                                             non user interaction
                           Monitoring   Tssf timer value and
Idle   restart Tssf

                    For DP O/T Disconnect the DP   Waiting_For_
                    is only disarmed for the leg   _Instructions
                    for which the event was
                    received.

Figure 4.64r: Process gsmSSF (sheet 18)

Process gsmSSF 19(33)

/* Invocation of gsmSSF in MO, MT, VT or CF call case. */

/* Signals to/from the left are to/from the MSC; signals to/from the right are to/from the gsmSCF. */

Monitoring

CAP_ _ReleaseCall

Handling of CAP_Release_Call is only specified in a control relationship.
The gsmSCF shall not send a CAP_Release_Call in a monitor relationship

CAP_ Apply_Charging

Handle_AC

Monitoring

AC pending

Int_O_Exception, Int_T_Exception

True

CAP_ Apply_Charging_ Report

False

AC pending

Handle_CIR

CallActive := FALSE

True

CAP_ Apply_Charging_ Report

Complete_all_ FCI_records

False

Application_ End

Handle_CIR

Int_Release_Call

Complete_all_ FCI_records

Idle

Abort

Idle

Figure 4.64s: Process gsmSSF (sheet 19)

Process gsmSSF 20(33)

/* Invocation of gsmSSF in MO, MT, VT or CF call case. */

/* Signals to/from the right are to/from the gsmSCF. */

Waiting_For_Instructions,
Waiting_For_End_Of_Temporary_Connection,
Waiting_For_End_Of_User_Interaction

CAP_
Furnish_Charging_
Information

Set Tssf to last used time interval and restart Tssf

Non-completed CAMEL logical call record exists for this legID?

Yes

No

AppendFree FormatData in FCI?

Create CAMEL logical call record

"Append"

Not present, "Overwrite"

Append free format data to existing logical call record

Overwrite all CAMEL logical call record data with this FCI data

Write FCI data in CAMEL logical call record

-

Figure 4.64t: Process gsmSSF (sheet 20)

Process gsmSSF 21(33)

/* Invocation of gsmSSF in MO, MT, VT or CF call case. */

/* Signals to/from the right are to/from the gsmSCF. */

Monitoring

CAP_
Furnish_Charging_
Information

Non-completed CAMEL logical call record exists for this legID?

No

Yes

Create CAMEL logical call record

AppendFree FormatData in FCI?

"Append"

Not present, "Overwrite"

Append free format data to existing logical call record

Overwrite all CAMEL logical call record data with this FCI data

Write FCI data in CAMEL logical call record

Monitoring
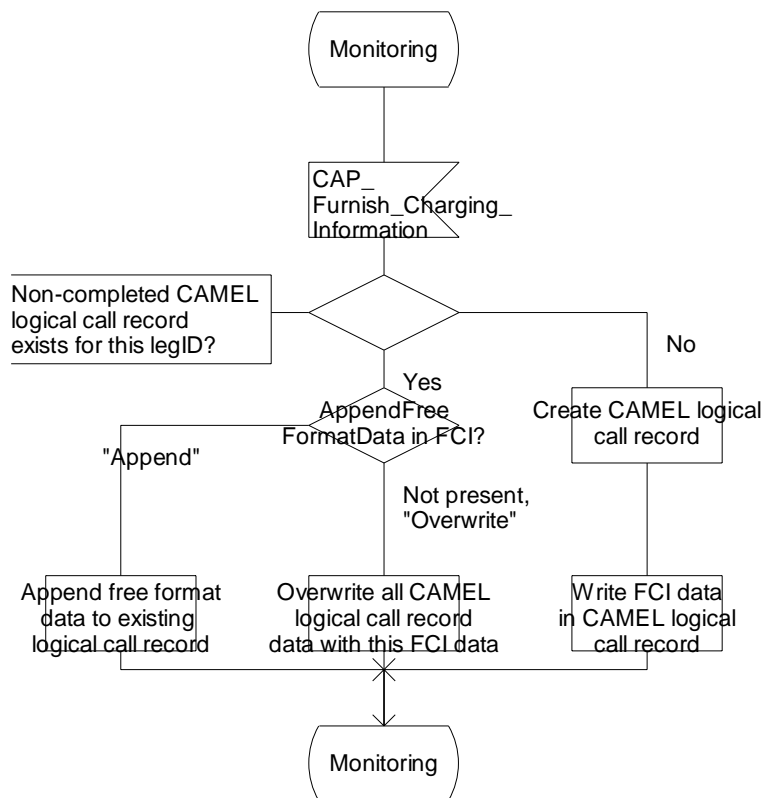
Figure 4.64u: Process gsmSSF (sheet 21)

Process gsmSSF 22(33)

/* Invocation of gsmSSF in MO, MT, VT or CF call case. */

/* Signals to/from the right are to/from the gsmSCF. */

Waiting_For_Instructions,
Waiting_For_Instructions_for_DS,
Waiting_For_End_Of_User_Interaction,
Waiting_For_End_Of_Temporary_Connection

CAP_Send_Charging_Information

Set Tssf to last used time interval and restart Tssf

Handle_SCI — — See section 4.5.6.3

-

Monitoring

CAP_Send_Charging_Information

Handle_SCI — — See section 4.5.6.3

-
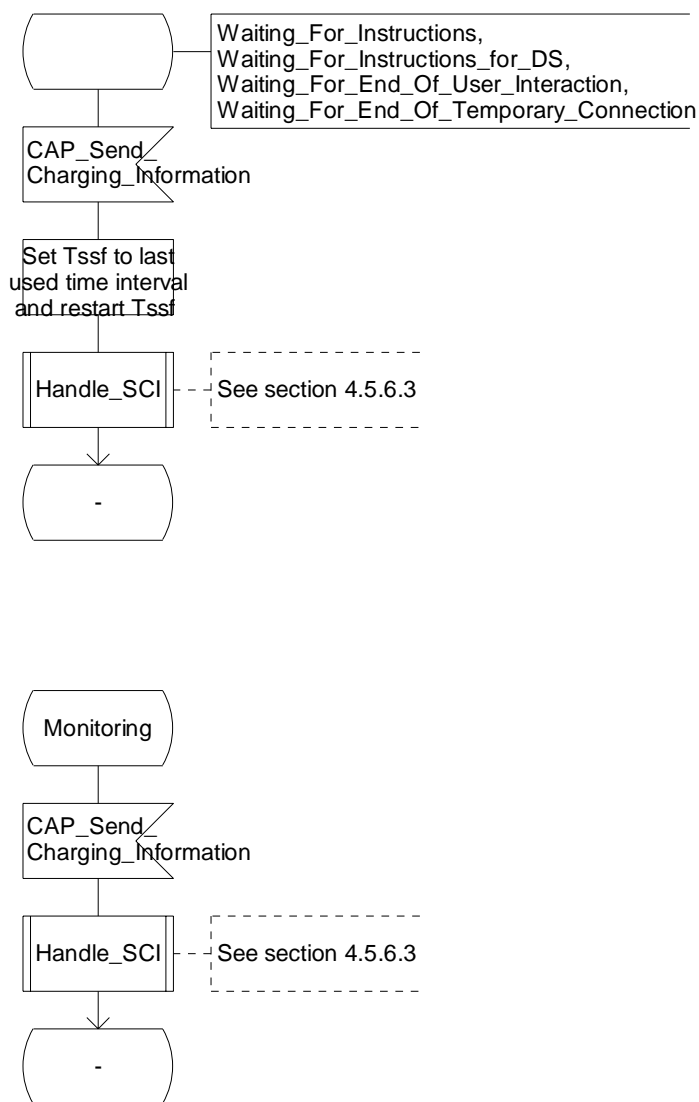
Figure 4.64v: Process gsmSSF (sheet 22)

Process gsmSSF 23(33)

/* Invocation of gsmSSF in MO, MT, VT or CF call case. */

/* Signals to/from the right are to/from the gsmSCF. */

Waiting_For_Instructions

CAP_ Call_Information_Request

Set Tssf to last used time interval and restart Tssf

store request

Oustanding Call Information Report:= Oustanding Call Information Report +1

Waiting_For_Instructions
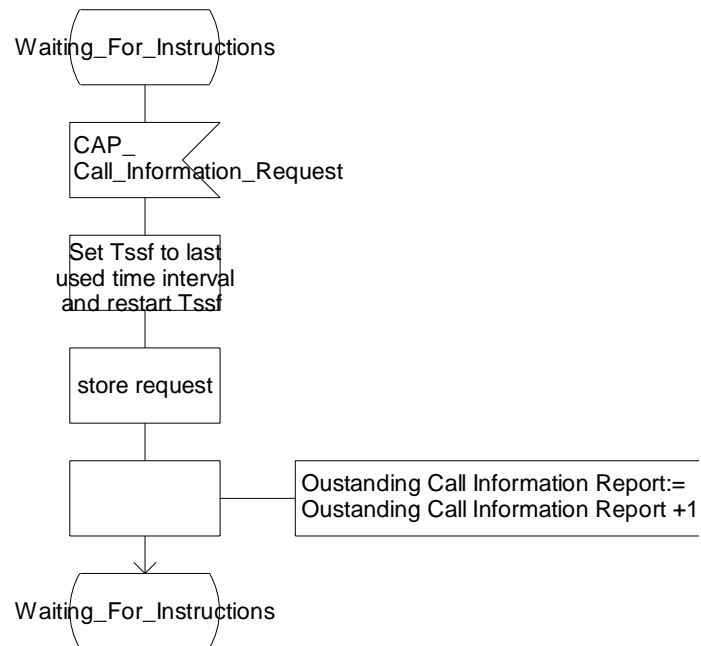
Figure 4.64w: Process gsmSSF (sheet 23)

Process gsmSSF 24(33)

/* Invocation of gsmSSF in MO, MT, VT or CF call case. */

/* Signals to/from the left are to/from the MSC. */

Monitoring

Int_DP_Analysed_ _Information

Int_Continue

Monitoring

Figure 4.64x: Process gsmSSF (sheet 24)

Process gsmSSF   25(33)

/* Invocation of gsmSSF in MO, MT, VT or CF call case. */

/* Signals to/from the left are to/from the MSC; signals to/from the right are to/from the gsmSCF. */

Waiting_for_ Instructions_ for DS

CAP_ Furnish_Charging_ Information

Set Tssf to last used time interval and restart Tssf

Non-completed CAMEL logical call record exists for this legID?

Yes

No

Create CAMEL logical call record

Write FCI data in CAMEL logical call record

Overwrite CAMEL logical call record with FCI data

Waiting_for_ Instructions_ for DS

CAP_Continue_ _With_ _Argument

Stop Tssf

Int_Continue_ _With_ _Argument

CAP_Continue

Stop Tssf

Int_Continue

CAP_Connect

Stop Tssf

Int_Connect

CAP_ _ReleaseCall

Stop Tssf

Int_Release Call

Application_ End

Complete_all_ FCI_Records

Idle

Figure 4.64y: Process gsmSSF (sheet 25)

3GPP

Process gsmSSF 26(33)

/* Invocation of gsmSSF in MO, MT, VT or CF call case. */

/* Signals to/from the left are to/from the MSC; signals to/from the right are to/from the gsmSCF. */

Waiting_for_ _Instructions_ For DS

Internal

Timer expiry Tssf

Int_DP_O_ Abandon

Abort

Stop Tssf

Int_Error

Complete_all_ FCI_records

Complete_all_ FCI_records

Application_ End

Idle

Idle
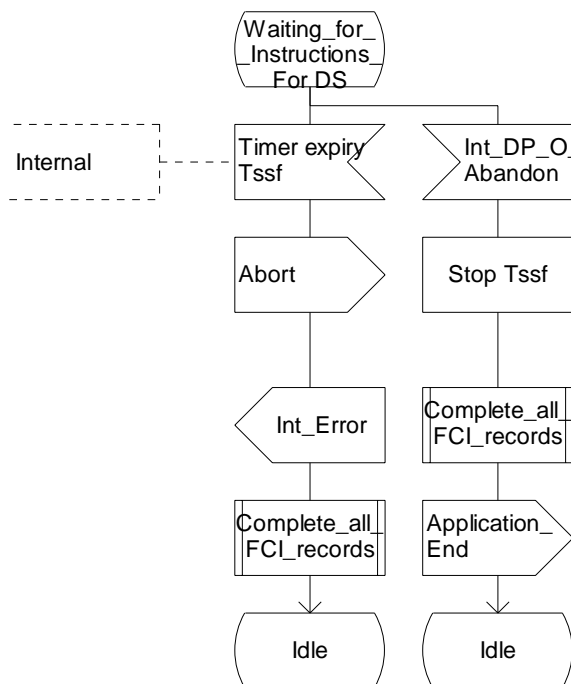
Figure 4.64z: Process gsmSSF (sheet 26)

Process gsmSSF   27(33)

/* Invocation of gsmSSF in MO, MT, VT or CF call case. */

/* Signals to/from the left are to/from the MSC; signals to/from the right are to/from the gsmSCF. */

Waiting_For_ _Instructions_ _For_DS

CAP_Establish Temporary Connection

Stop Tssf

Int_Establish Temporary Connection

Await_Temporary_ Connection_ Establishment_DS

Int_Temporary_ Connection_ Established

Int_ETC_Failed

Set Tssf to user interaction timer value and restart Tssf

Error ETC failed

Waiting_For_ _End_Of_ Temporary_ Connection_For_DS

Set Tssf to last used time interval and restart Tssf

Waiting_For_ Instructions_For_DS
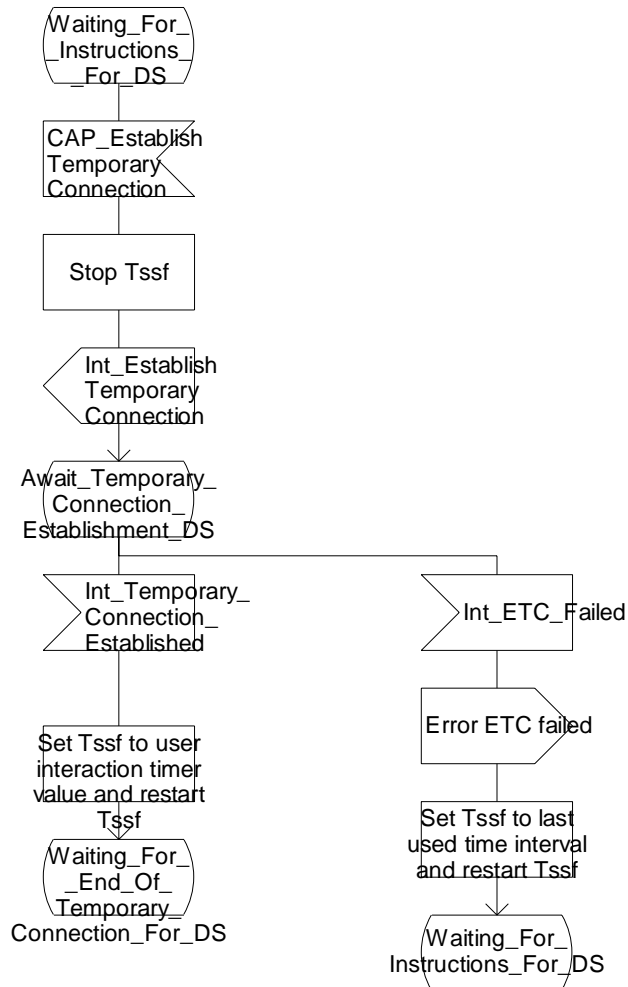
Figure 4.64aa: Process gsmSSF (sheet 27)

Process gsmSSF 28(33)

/* Invocation of gsmSSF in MO, MT, VT or CF call case. */

/* Signals to/from the left are to/from the MSC; signals to/from the right are to/from the gsmSCF. */

Waiting_for_End_
_Of_Temporary_
Connection_For_DS

CAP_Disconnect_
ForwardConnection

Int_TC_Released

CAP_Reset_
_Timer

Tssf expired ---- Internal

Int_Disconnect_
Forward_
Connection

Set Tssf to
CAP_Reset_Timer
time interval and
restart Tssf

Abort

Set Tssf to last
used time interval
and restart Tssf

-

Int_Disconnect_
Forward_Connection

Waiting_For_
_Instructions_For_DS

TC_Release_
Pending_DS

Int_TC_Released

Int_Error

Complete_all_
FCI_record

Idle
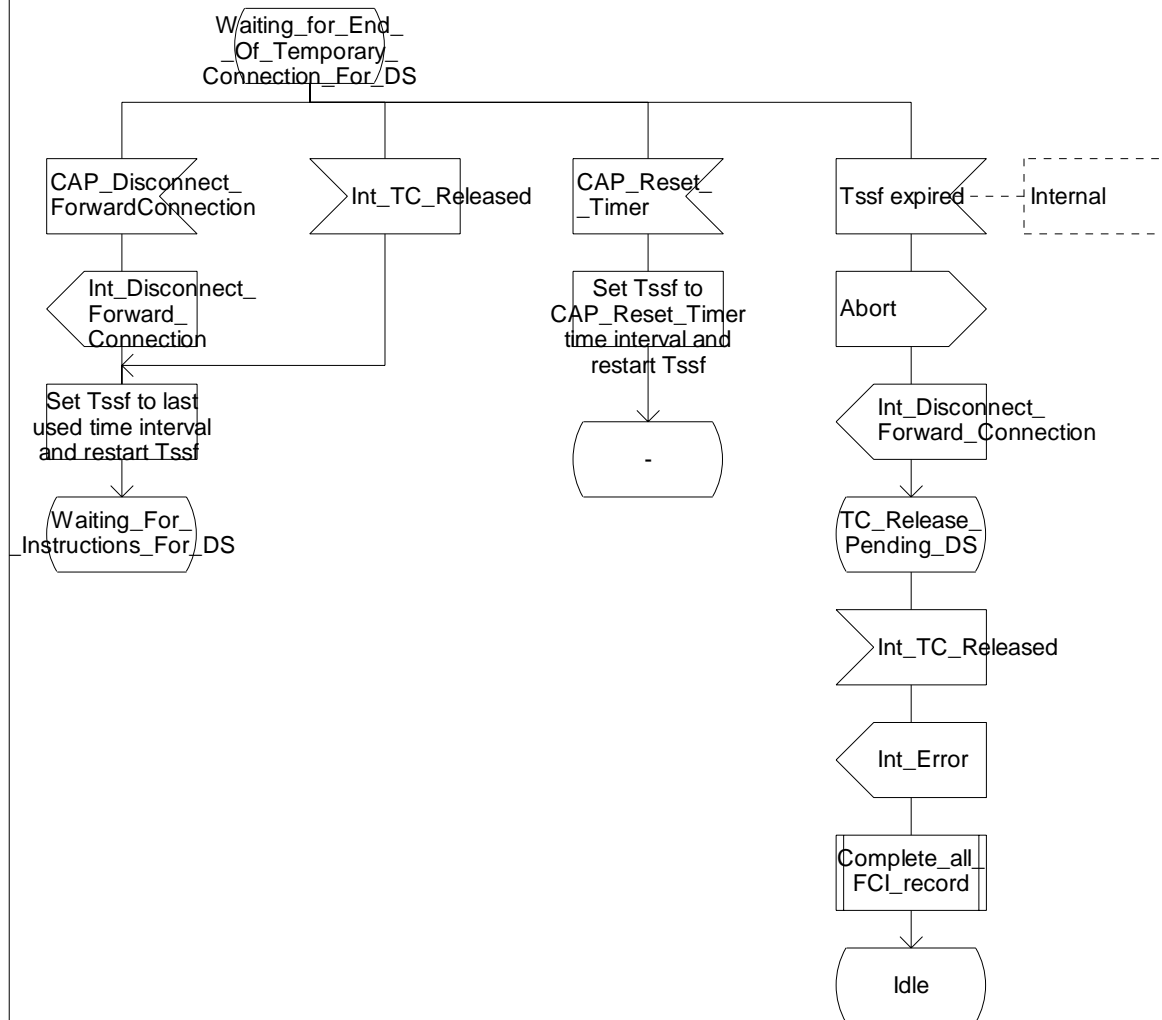
Figure 4.64bb: Process gsmSSF (sheet 28)

Process gsmSSF 29(33)

/* Invocation of gsmSSF in MO, MT, VT or CF call case. */

/* Signals to/from the left are to/from the MSC; signals to/from the right are to/from the gsmSCF. */

Waiting_for_ _Instructions_For_DS

CAP_ConnectTo Resource

Stop Tssf

Connect_To_ Resource

result

pass

fail

Set Tssf to user interaction timer value and restart Tssf

Set Tssf to last used time interval and restart Tssf

Waiting_For _End_Of_ User_Interaction_For_DS

Return appropriate error to the gsmSCF

Waiting_For_ Instructions_For_DS
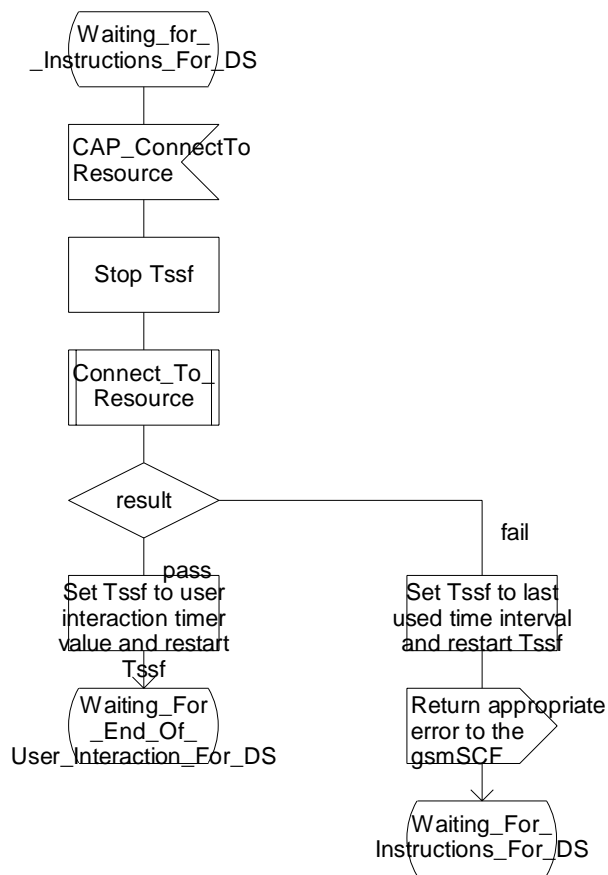
Figure 4.64cc: Process gsmSSF (sheet 29)

Process gsmSSF   30(33)

/* Invocation of gsmSSF in MO, MT, VT or CF call case. */

/* Signals to/from the left are to/from the MSC; signals to/from the right are to/from the gsmSCF. */

Waiting_for_End_Of_Temporary_Connection_For_DS,
Waiting_for_End_Of_User_Interaction_For_DS

Int_DP_O_
_Abandon

Stop Tssf

Complete_all_
FCI_records

Application_
End

Idle
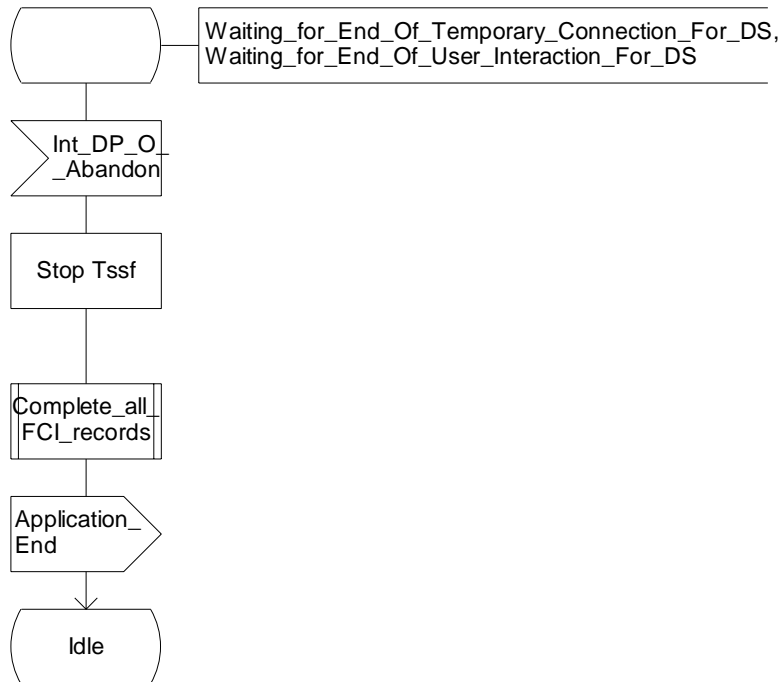
Figure 4.64dd: Process gsmSSF (sheet 30)

Process gsmSSF 31(33)

/* Invocation of gsmSSF in MO, MT, VT or CF call case. */

/* Signals to/from the left are to/from the MSC; signals to/from the right are to/from the gsmSCF. */

Waiting_for_End_ _Of_User_ _Interaction_For_DS

CAP_Disconnect_ ForwardConnection

Int_SRF_ _Released

CAP_Reset_ _Timer

CAP_Play_ _Announcement

CAP_Prompt_& _Collect_User_ _Information

CAP_Cancel_ _(Invoke_ID)

Relay the operation to the SRF

to SRF

Int_Disconnect_ Forward_Connection

Set Tssf to CAP_Reset_Timer time interval and restart Tssf

Set Tssf to last used time interval and restart Tssf

Set Tssf to default non user interaction time interval and restart Tssf

Set Tssf to default non user interaction time interval and restart Tssf

Waiting_For_ _Instructions_For_DS

Waiting_for_End_ _Of_User_ _Interaction_For_DS

Figure 4.64ee: Process gsmSSF (sheet 31)

Process gsmSSF 32(33)

/* Invocation of gsmSSF in MO, MT, VT or CF call case. */

/* Signals to/from the left are to/from the process Generic_SRF; signals to/from the right are to/from the gsmSCF unless otherwise stated. */

from SRF

Waiting_for_End_ _Of_User_ _Interaction_For_DS

from SRF

Internal

CAP_Cancelled _error

CAP_Cancel_ _Failed_error

CAP_Prompt_& _Collect_User_ _Information_ _Result

CAP_ Specialised_ Resource_ Report

Timer expiry Tssf

Relay the operation/ result/error to the gsmSCF

Abort

Waiting_for_End_ _Of_User_ _Interaction_For_DS

Int_Disconnect_ Forward_Connection

SRF_Release_ Pending_DS

Int_SRF_Released

Int_Error

Complete_all_ FCI_record

Idle

Figure 4.64ff: Process gsmSSF (sheet 32)

Process gsmSSF   33(33)

/* Invocation of gsmSSF in MO,
MT, VT or CF call case. */

/* Signals to/from the left are to/from the MSC;
signals to/from the right are
to/from the gsmSCF. */

* (Idle,
Wait_For_Request)

CAP_
_CallGap

Int_CallGap   to a new
gsm_SSME_SSF
process

-
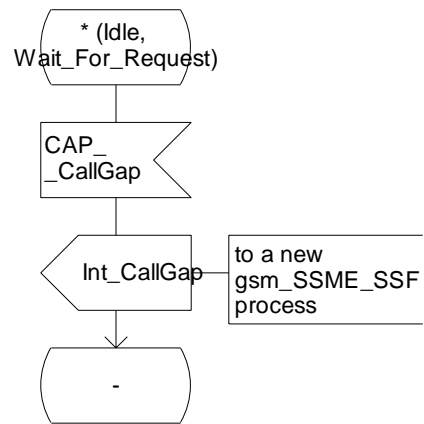
Figure 4.64gg: Process gsmSSF (sheet 33)

Procedure Check_Criteria_Collected_Info 1(1)

/* Procedure to check
the criteria in the gsmSSF */

Destination number
triggering criterion
exists?

Yes

No

enabling criterion
met?

Yes

No

inhibiting criterion
met?

No

Yes

Basic service
criterion exists?

Yes

No

basic service
criterion met?

Yes

No

Forwarding triggering
criterion exists?

Yes

No

enabling criterion
met?

Yes

No

inhibiting criterion
met?

No

Yes

Result:=
pass

Result:=
fail
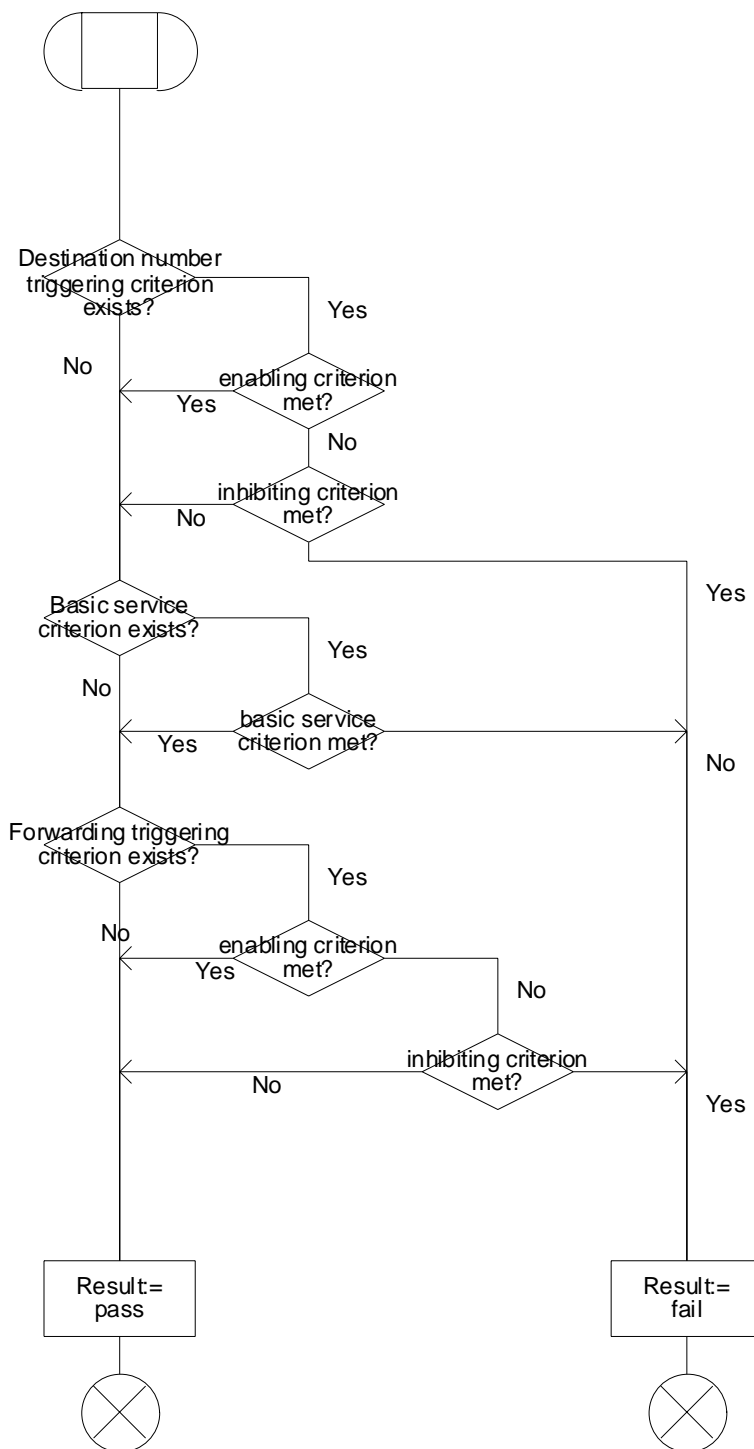
Figure 4.65a: Procedure Check_Criteria_Collected_Info(sheet 1)

Procedure Check_Criteria_Analysed_Info 1(1)

/* Procedure to check
the criteria in the gsmSSF */

Called number
matches string
defined in
criterion?

Yes

No

All criteria met DP
In the list checked?

Yes N0

Result:=
pass

Result:=
fail
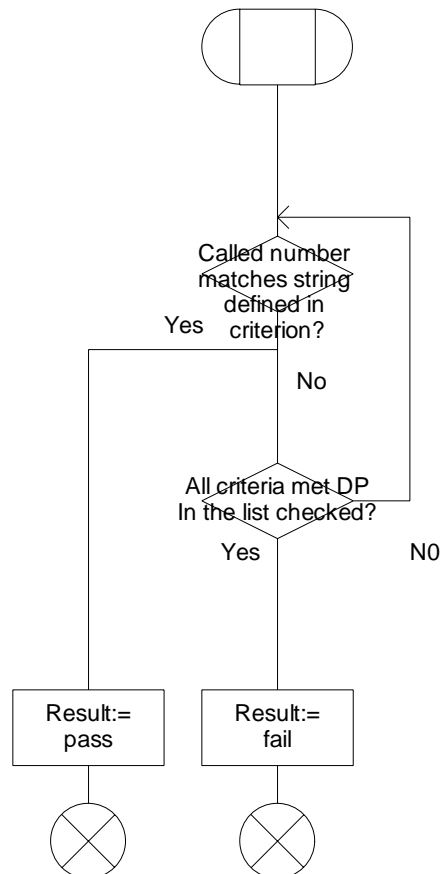
Figure 4.66a: Procedure Check_Criteria_Analysed_Info(sheet 1)

Procedure Check_Criteria_Unsuccessful 1(1)

/* Procedure to check
the criteria in the gsmSSF */

Release Cause criterion exists?

Yes

No

Release Cause matches value defined in criterion?

Yes

No

Result:= pass

Result:= pass

Result:= fail
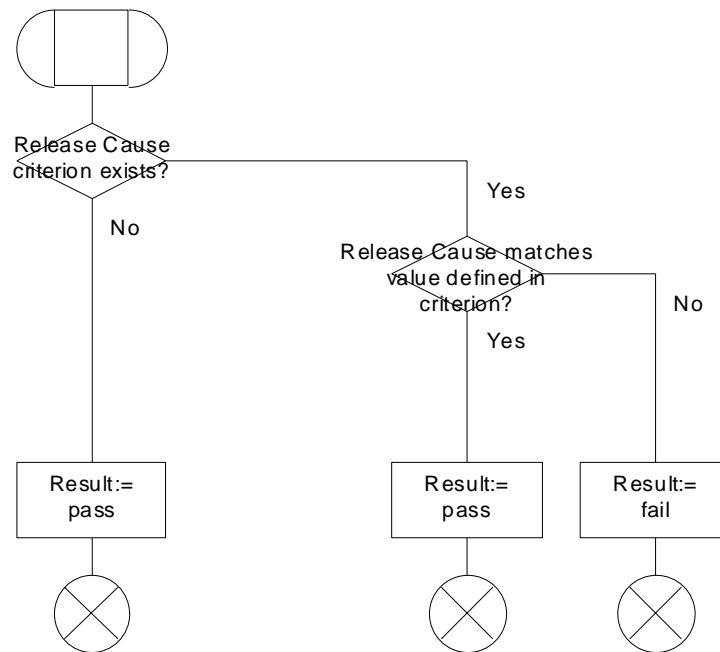
Figure 4.67a: Procedure Check_Criteria_Unsuccessful(sheet 1)

Procedure Connect_To_Resource 1(1)

This procedure is called, when the
ConnectToResource request is received
in WfI or Mon state.

/* Signals to/from the left are to from the
Call Control Function in the MSC. */

Int_Connect_
To_Resource

Await_Resource_
Connection

Int_SRF
Connected

Int_CTR_Failed

result:=
pass

result:=
fail
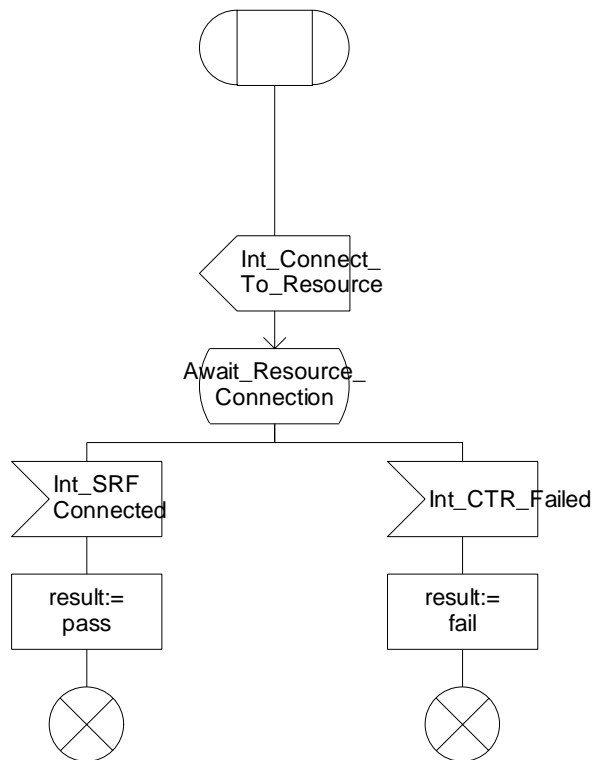
Figure 4.68a: Procedure Connect_To_Resource (sheet 1)

Procedure Handle_AC 1(1)

/* This procedure shows the handling in the gsmSSF for the operation CAP Apply Charging. */

Set Tssf to last used time interval and restart Tssf

Tccd running

Yes → Stop Tccd

No

AC pending?

True → ⊗

False

Tariff switch provided?

No

Yes → Start Tsw

Answer received?

Yes

Stop delta measurement

Tcp:=Tcp-delta

Tone to be played?

No → Tw:=0

Yes → Tw:= Tcp-Warning time

1

1

Answer received?

No

Yes → Start Tcp

Tw>0

No

Yes → Start Tw

AC pending:= true

⊗
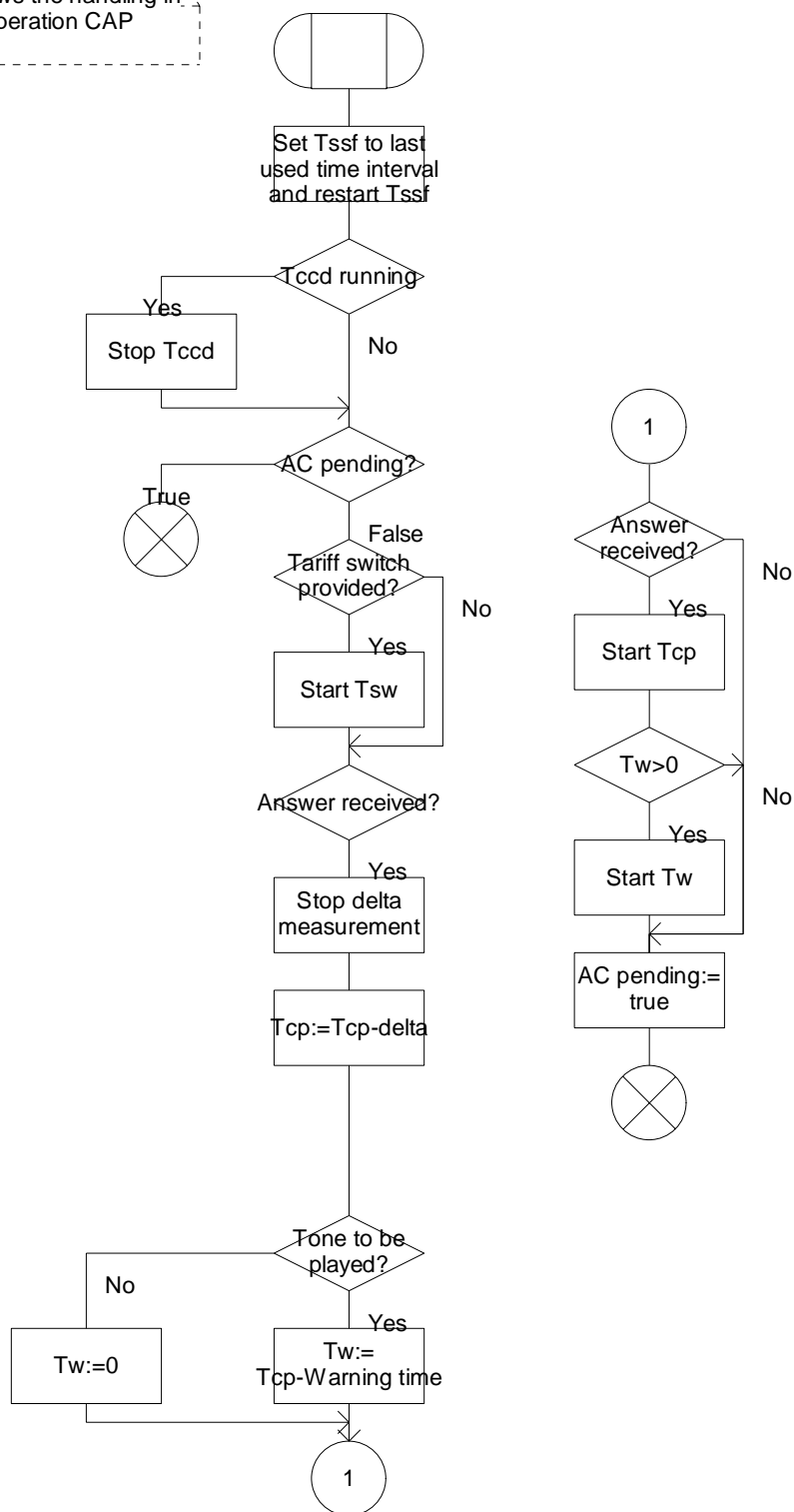
Figure 4.69a: Procedure Handle_AC (sheet 1)

Procedure Handle_ACR   1(1)

This procedure is only called at the
end of connection to an outgoing leg,
a temporary connection or a connection
to a SRF when the call can be continued

/* Signals to/from the right
are to/from the gsmSCF. */

Tsw running? —— No

Yes

Stop Tsw

e-values
stored? —— No

Yes

discard
e-values

AC pending=
true? —————————————— No

Yes   ⊗

If running ----- Stop Tcp

If running ----- Stop Tw

Start Delta

CAP_
Apply_Charging_
Report

Value of Call Active in ACR is
defined in the calling process
(process 'gsmSSF').

AC pending:=
false

⊗
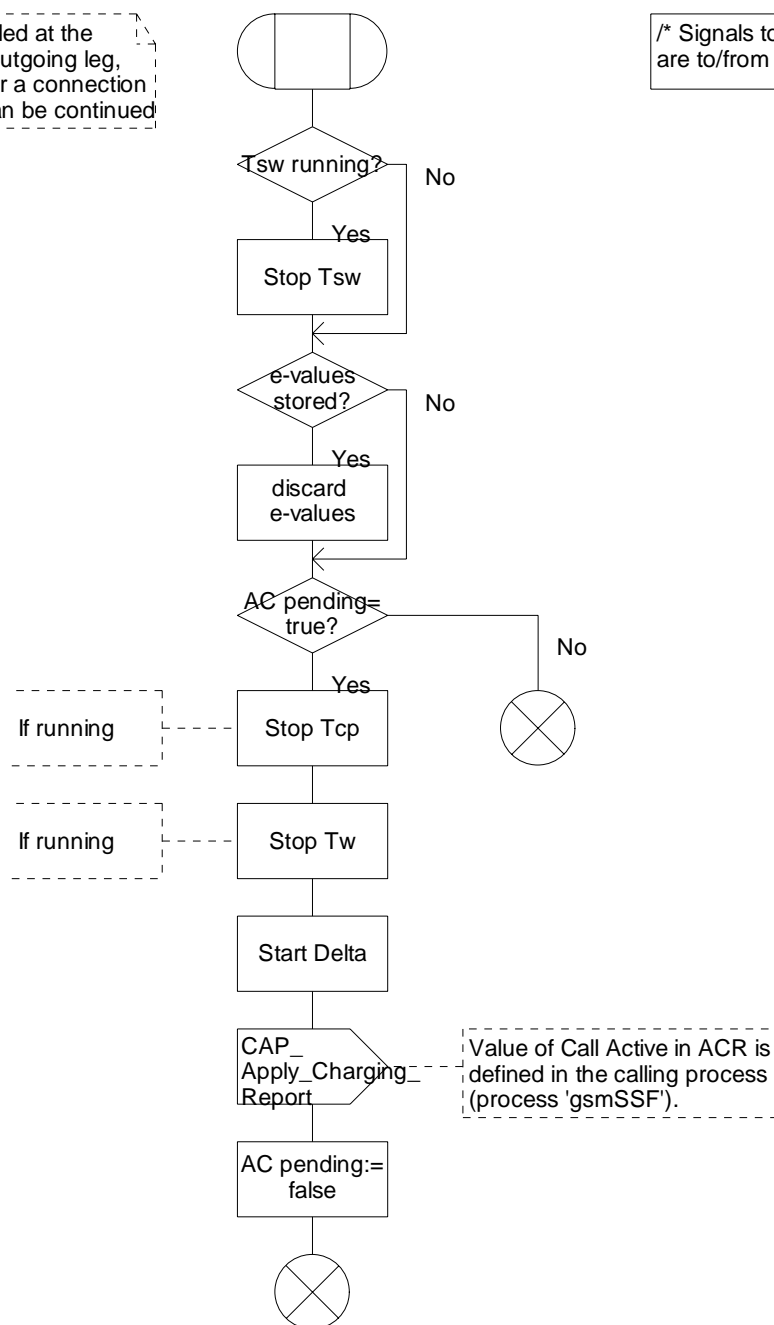
Figure 4.70a: Procedure Handle_ACR (sheet 1)

Procedure Handle_CIR   1(1)

/* Procedure in the gsmSSF to
handle Call Information Report. */

/* Signals to/from the right are
to/from the gsmSCF. */

Handle_CIR_
leg (leg2)
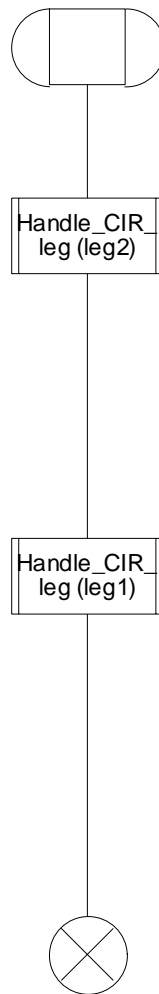
Handle_CIR_
leg (leg1)

Figure 4.71a: Procedure Handle_CIR (sheet 1)

Procedure Handle_CIR_leg 1(1)

/* Procedure in the gsmSSF to handle Call Information Report for the specified leg. */
;FPAR IN LegID LegType;

/* Signals to/from the right are to/from the gsmSCF. */

Outsanding Call Information Report>0?   No

Yes

Call Information Report pending for this leg ID?   No

Yes

Outsanding Call Information Report:= Outsanding Call Information Report -1

CAP_Call_ Information_ Report
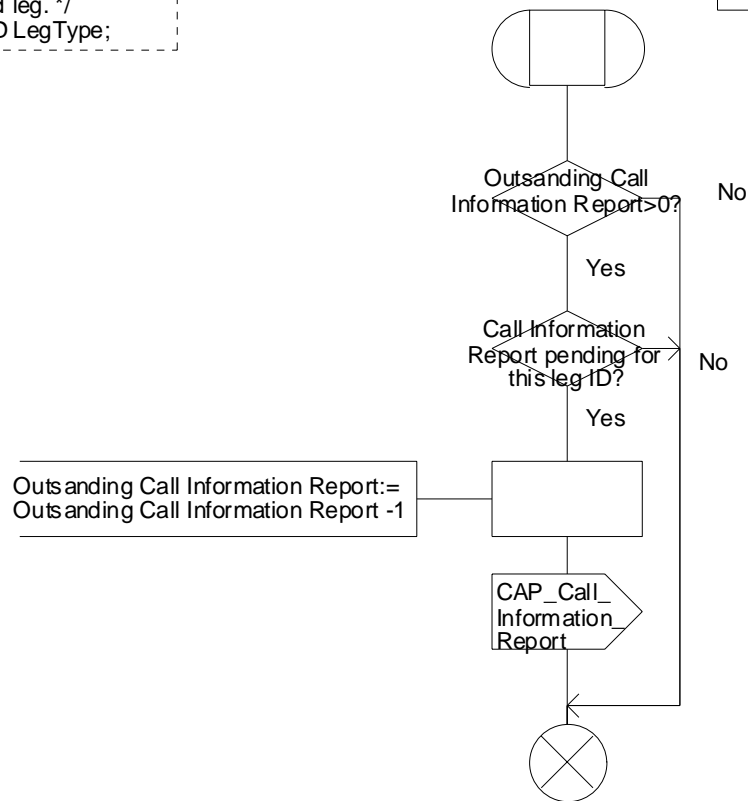
Figure 4.72a: Procedure Handle_CIR_leg (sheet 1)

Procedure Complete_FCI_record   1(1)

/* Procedure in the gsmSSF to
write Furnish Charging Information
data to CDR for the specified LegID. */
;FPAR IN LegID LegType;

/* Signals to/from the right are
to/from the gsmSCF. */

Non-completed Logical
CAMEL call record
exsists for this
LegID?

No

Yes

complete CAMEL
logical call record
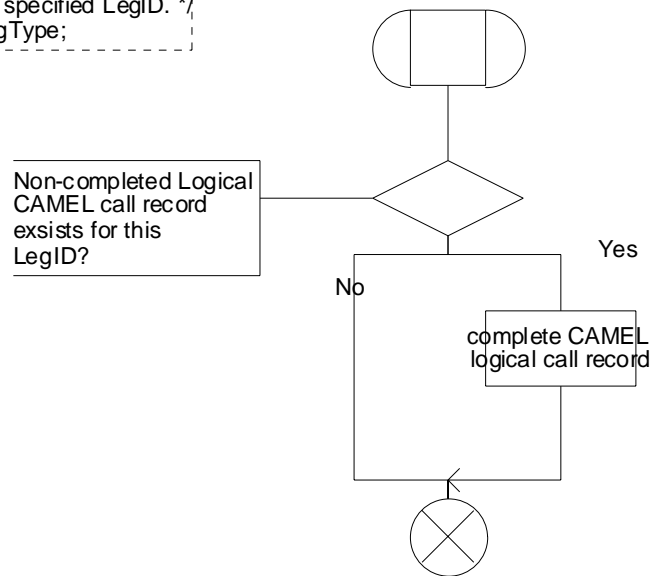
Figure 4.73a: Procedure Complete_FCI_record (sheet 1)

Procedure Complete_all_FCI_records 1(1)

/* Procedure in the gsmSSF to write Furnish Charging Information data to CDR for the both LegIDs. */

/* Signals to/from the right are to/from the gsmSCF. */

Complete_
FCI_record
(leg1)

Complete_
FCI_record
(leg2)
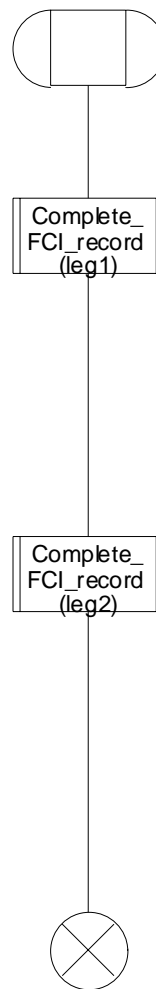
Figure 4.74a: Procedure Complete_all_FCI_records (sheet 1)

Procedure Handle_O_Answer   1(1)

/* Procedure in the gsmSSF
to handle notification of
originating answer from the MSC */

/* Signals to/from the left are
to/from the MSC. */

False — AC pending — True

Start Tcp

No — Tw>0? — Yes

Start Tw

No — Destination address received in Int_O_Answer? — Yes

'Set Destination address=stored Destination address'

'Set Destination address=received Destination address'

Set indicators= stored indicators

⊗
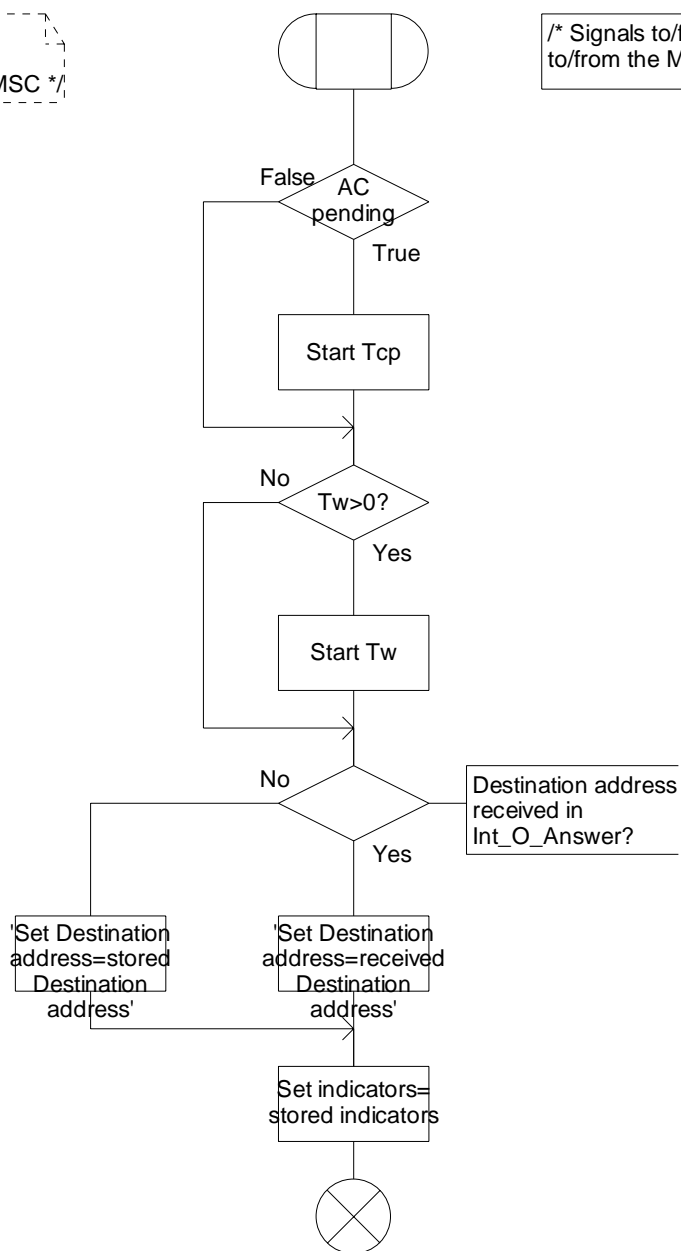
Figure 4.75a: Procedure Handle_O_Answer (sheet 1)

Procedure Handle_T_Answer   1(1)

/* Procedure in the gsmSSF
to handle notification of
terminating answer from the MSC */

/* Signals to/from the left are
to/from the MSC. */

False ── AC pending

True

Start Tcp

No ── Tw>0

Yes

Start Tw

Set Destination
address=stored
Destination
address

Set indicators=
stored indicators

⊗
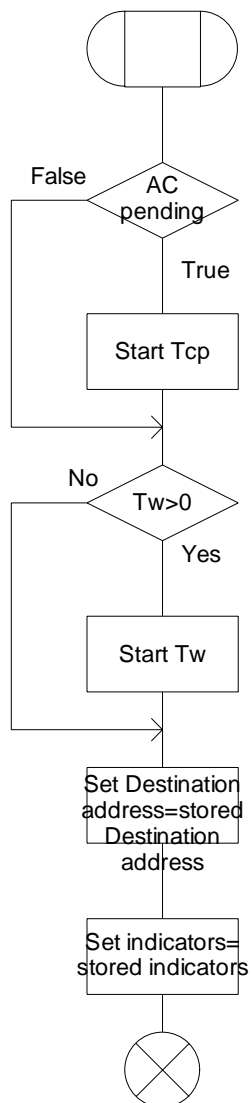
Figure 4.76a: Procedure Handle_T_Answer (sheet 1)

4.5.6.5 Process gsmSSF_SSME_FSM and procedures

One process is instantiated for each Call Gap message received from a gsmSCF.

Figure 4.77a: Process gsm_SSME_SSF (sheet 1)

Process gsm_SSME_SSF   2(2)

/* Signals to/from the left
are to/from the gsmSSF ;
signals to/from the right are
to/from internal processes */

Active

| Tcgi expiry | Trigger Tcgi | Tcgd expiry | Remove CallGap |

CG Reject := False

Start Tcgi

Clear Call Gapping Context (i.e. remove timers and criteria)

CG Reject := True

NOTE: The timer Tcgi is started for the first time after the first call encountering the call gapping criteria is met.

Active

Idle

Figure 4.77b: Process gsm_SSME_SSF (sheet 2)

Procedure Store_Call_Gap_Criteria 1(1)

/* Store parameters received in the CallGap operation */

/* Signals to/from the left are to/from the MSC; signals to/from the right are to/from the gsmSCF */

CG Duration value

/* Note : see §4.6.2. for the exact use of this parameter */

0 -2 else

Set Tcgd with network specific value

Set Tcgd with received value

Start Tcgd

CG Interval value

/* Note : see §4.6.2. for the exact use of this parameter */

0 1 else

CG Int := false
CG Reject := false

CG Int := false
CG Reject := true

CG Int := true
CG Reject := false

Set Tcgi with received value

store Gap Criteria, gsmSCF address (if present) and Gap Treatment

Result := Fail

Result := Pass
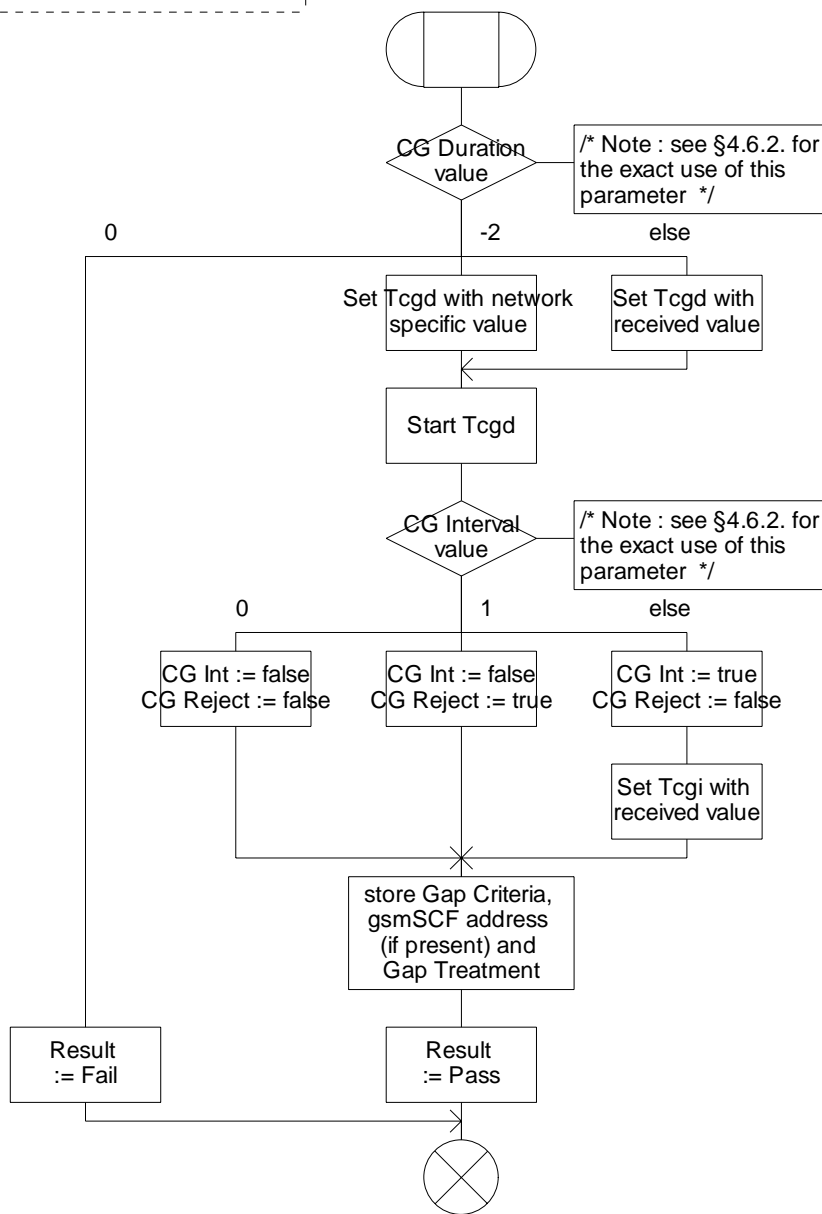
NOTE: CG Int and CG Reject internal variables are initiated with False value.

Figure 4.78a: Procedure Store_Gap_Criteria (sheet 1)

Procedure Check_Gap_Criteria   1(1)

/* Check if the Call Gap is applicable. */

/* Signals to the right are to the gsm_SSME_SSF. */

One Call Gapping context active? — No

Yes

V/IPLMN is the subscriber's HPLMN? — No

Yes

gsmSCF address of the CSI is the same as the gsmSCF address stored along the Gap Criteria? (note) — No

Yes

Call parameters match with Call Gap criteria? — No

Yes

CG Reject = True ? — No

Yes

CG Int = true? — No

Yes

Trigger Tcgi
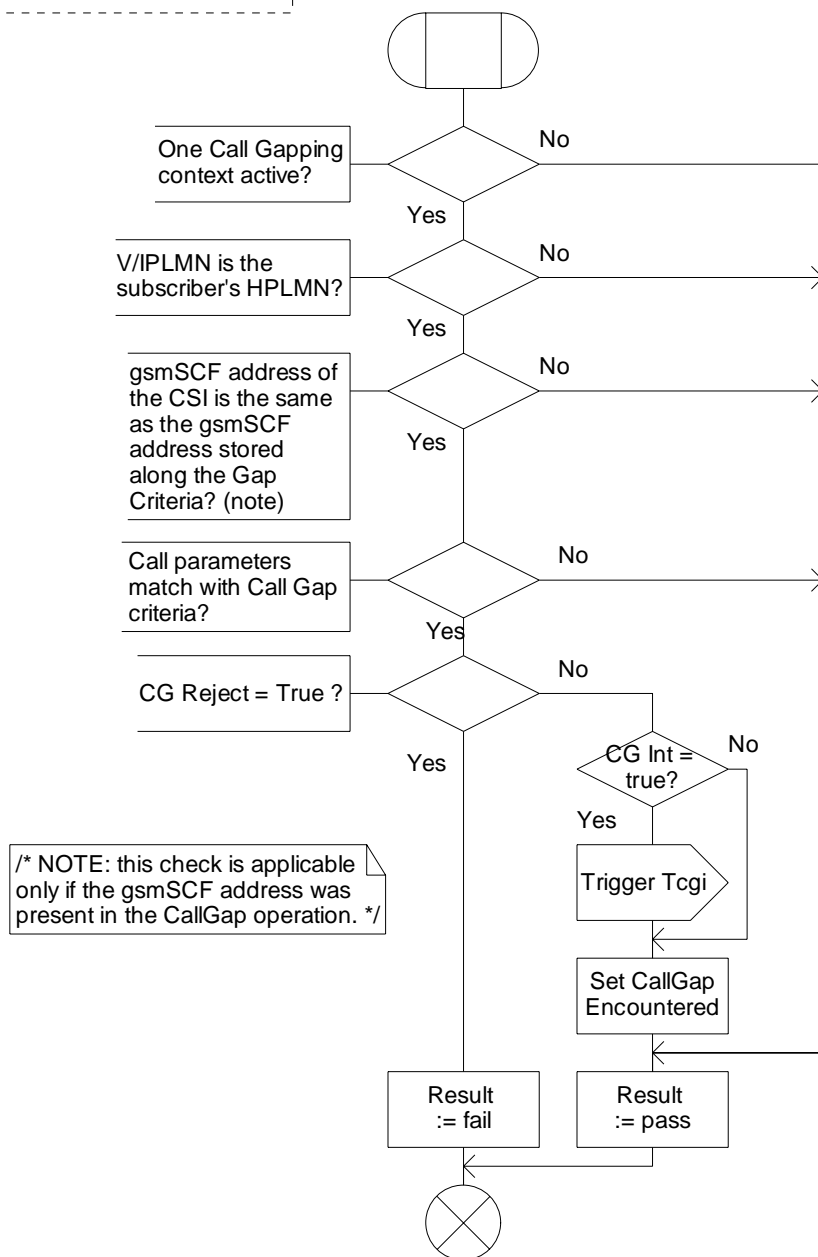
/* NOTE: this check is applicable only if the gsmSCF address was present in the CallGap operation. */

Set CallGap Encountered

Result := fail

Result := pass

Figure 4.79a: Procedure Check_Gap_Criteria (sheet 1)

4.5.7   Assisting case

Assisting case involves the following processes:

- CAMEL_Assisting_MSC,

- Assisting_gsmSSF.

The detailed error handling for these 2 processes is specified in 3GPP TS 29.078 [5].

Process CAMEL_Assisting_MSC 1(3)

Process in the MSC
to handle an assist
request

Signals to/from the left are to/from the
process CAMEL_OCH_ETC, CAMEL_
TC_ETC or CAMEL_CF_ECT;
signals to/from the right are to/from
the assisting_gsmSSF;

Idle

Initial Address

Int_Assist_
_Required

Wait_for_assisting_
_gsm_SSF_invoked

Int_assisting_
_gsmSSF_invoked

Release

Wait_For_
Assisting
__Event

Int_Release_
Assisting_gsmSSF

Idle
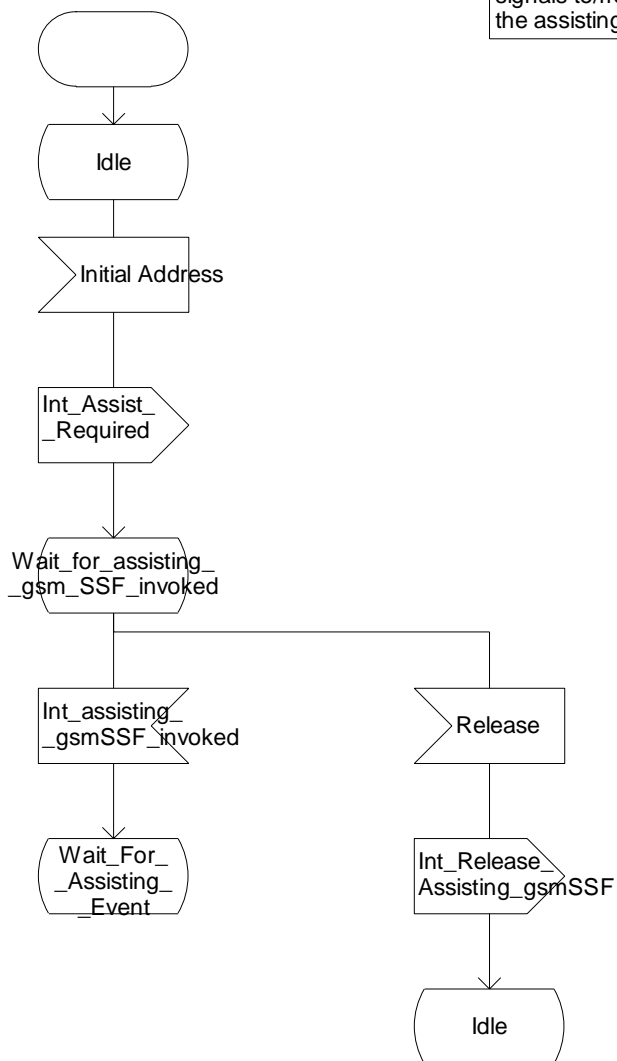
Figure 4.80a: Process CAMEL_Assisting_MSC (sheet 1)

Process CAMEL_Assisting_MSC 2(3)

Process in the MSC
to handle an assist
request

Signals to/from the left are to/from the
process CAMEL_OCH_ETC, CAMEL_
TC_ETC or CAMEL_CF_ECT;
signals to/from the right are to/from
the assisting_gsmSSF;
if not otherwise stated.

Wait_For_
Assisting_
Event

Int_Connect_To_
Resource

Int_assisting_
gsmSSF
_released

Release

Int_Invoke_
_SRF — to SRF

Release

Int_release_
_assisting_gsmSSF

Await_SRF_
_Initialisation

Releasing_assisting_
_gsmSSF

Int_assisting_
gsmSSF_released

Idle
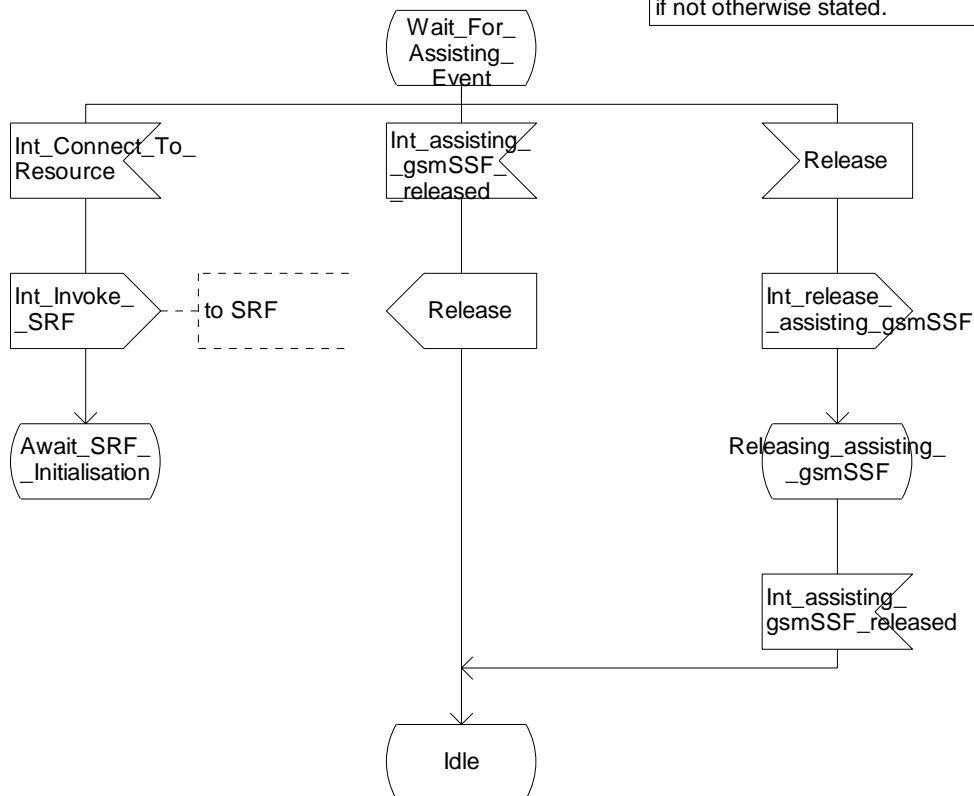
Figure 4.80b: Process CAMEL_Assisting_MSC (sheet 2)

Process CAMEL_Assisting_MSC 3(3)

Process in the MSC to handle an assist request

Signals to/from the left are to/from the process CAMEL_OCH_ETC, CAMEL_TC_ETC or CAMEL_CF_ECT; signals to/from the right are to/from the assisting_gsmSSF; if not otherwise stated.

Await_SRF_ _Initialisation

Int_SRF_ _Connected — from SRF

Int_SRF_ _Connection_ _Failure — from SRF

Release

Int_assisting_ _gsmSSF_ _released

Connect SRF to the Call

To SRF --- Int_Disconnect_SRF Release

Send_ACM_ If_Required — Procedure specified in 3GPP TS 23.018

Await_gsmSRF_ _disconnection

Send_Answer_ If_Required — Procedure specified in 3GPP TS 23.018

From SRF --- Int_SRF_ Released

Int_SRF_Connected

Int_CTR_Failed

Int_release_ _assisting_gsmSSF

Wait_For_ Assisting_ Event

Releasing_assisting_ _gsmSSF

Int_assisting_ gsmSSF_released

Idle
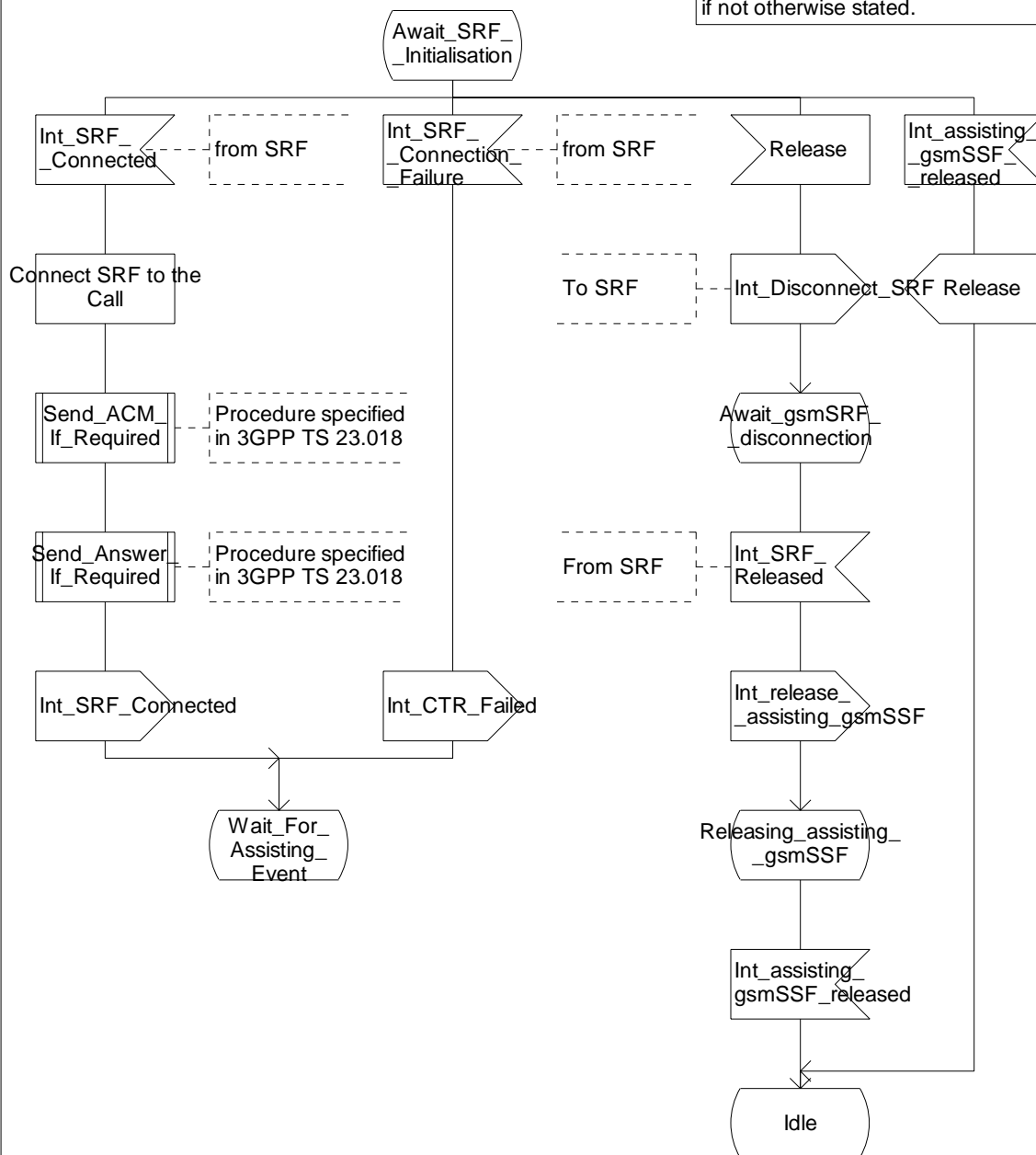
Figure 4.80c: Process CAMEL_Assisting_MSC (sheet 3)

Process assisting_gsmSSF 1(6)

/* Invocation of gsmSSF in MO, MT or CF call case. */

Signals to/from the left are to/from the process CAMEL_Assisting_MSC; signals to/from the right are to/from the gsmSCF, unless otherwise indicated.

/* Timers used in the assisting gsmSSF process:
Tssf: Application timer in the ssf.
Ranges for the default values for Tssf.
- non user interaction Tssf timer value: 1 second to 20 seconds
- user interaction Tssf timer value: 1 minute to 30 minutes
*/

Idle

Int_Assist_ _Required

Int_assisting_ _gsmSSF_ _Invoked

Set Tssf to default non user interaction Tssf timer interva and restart Tssfl

Open Control Relationship

CAP_Assist _Request_ _Instructions

Waiting_for_ _Instructions
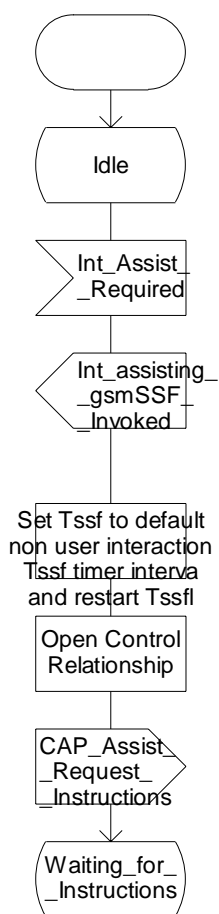
Figure 4.81a: Process Assisting_gsmSSF (sheet 1)

Process assisting_gsmSSF   2(6)

/* Invocation of gsmSSF in MO, MT or CF call case. */

Signals to/from the left are to/from the process CAMEL_Assisting_MSC; signals to/from the right are to/from the gsmSCF, unless otherwise indicated.

Waiting_for_ _Instructions

Tssf expires — — — Internal

Abort

Int_assisting_ _gsmSSF_ _released

Idle

CAP_Reset_Timer

Set Tssf to CAP_Reset_Timer time interval and resart Tssf

CAP_ConnectTo Resource

Int_Connect_ To_Resource

Await_Resource_ Connection

From process CAMEL_Assisting_MSC

Int_CTR_Failed — — —

Int_SRF Connected

Return appropriate error to SCF

Set Tssf to default user interaction timer value and restart Tssf

Set Tssf to default non user interaction timer value and resart Tssf

Waiting_For_ Instructions

Waiting_For _End_Of_ User_Interaction

Figure 4.81b: Process Assisting_gsmSSF (sheet 2)

Process assisting_gsmSSF 3(6)

/* Invocation of gsmSSF in MO, MT or CF call case. */

Signals to/from the left are to/from the process CAMEL_Assisting_MSC; signals to/from the right are to/from the gsmSCF, unless otherwise indicated.

From SRF

Waiting_for_End_ _Of_User_ _Interaction

CAP_Disconnect_ Forward_ _Connection /* legID */

Int_SRF_Release

CAP_Reset_Timer

CAP_Play_ Announcement

CAP_Prompt_& _Collect_User_ _Information

CAP_Cancel_ _(Invoke_ID)

Set Tssf to default user interaction Tssf timer interva and resrt Tssfl

Relay the operation to the SRF

To SRF

Int_Disconnect_ _SRF

Set Tssf to last used time interval and restart Tssf

to SRF

Set Tssf to CAP_Reset_Timer time interval and restart Tssf

Waiting_For_ _Instructions

Waiting_for_End_ _Of_User_ _Interaction

Waiting_for_End_ _Of_User_ _Interaction

Figure 4.81c: Process Assisting_gsmSSF (sheet 3)

Process assisting_gsmSSF 4(6)

/* Invocation of gsmSSF in MO, MT or CF call case. */

Signals to/from the left are to/from the SRF;
signals to/from the right are to/from the gsmSCF.

Waiting_for_End_
_Of_User_
_Interaction

CAP_Cancelled
_error

CAP_Cancel_
_Failed_error

CAP_Prompt_&
_Collect_User_
_Information_Result

CAP_Specialised_
Resource_Report

Relay the operation/
result/error to the
gsmSCF

Waiting_for_End_
_Of_User_
_Interaction
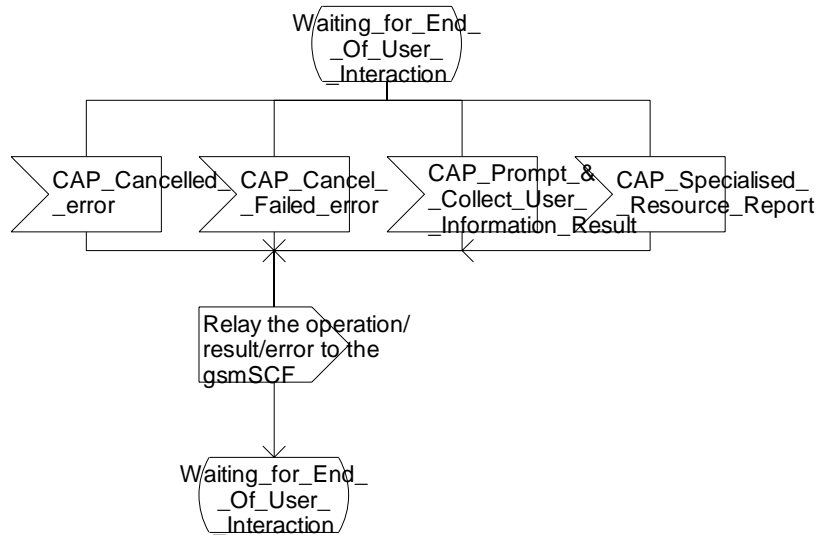
Figure 4.81d: Process Assisting_gsmSSF (sheet 4)

Process assisting_gsmSSF 5(6)

/* Invocation of gsmSSF in MO, MT or CF call case. */
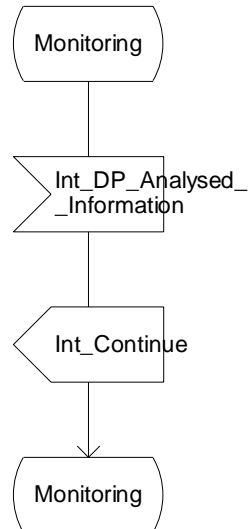
Signals to/from the left are to/from the process CAMEL_Assisting_MSC; signals to/from the right are to/from the SRF, unless otherwise indicated.

Waiting_for_End_ _Of_User_ _Interaction

Tssf expires - - - Internal

Abort - - To gsmSCF

Int_disconnect_ _SRF

Wait_For_ gsm_SRF_Release

Int_SRF_ Released

Int_assisting_ _gsmSSF_ _released

Idle
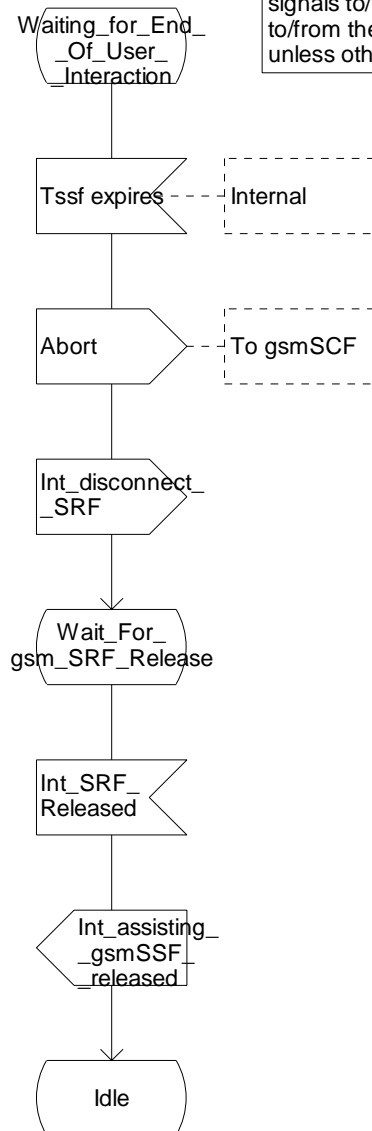
Figure 4.81e: Process Assisting_gsmSSF (sheet 5)

Process assisting_gsmSSF 6(6)

/* Invocation of gsmSSF in MO, MT or CF call case. */

Signals to/from the right are to/from the process CAMEL_Assisting_MSC.

Waiting_For_Instructions
Waiting_For_End_Of_User_Interaction

Int_release_assisting_gsmSSF

Terminate Control Relationship

Int_assisting_gsmSSF_released

Stop Tssf

Idle
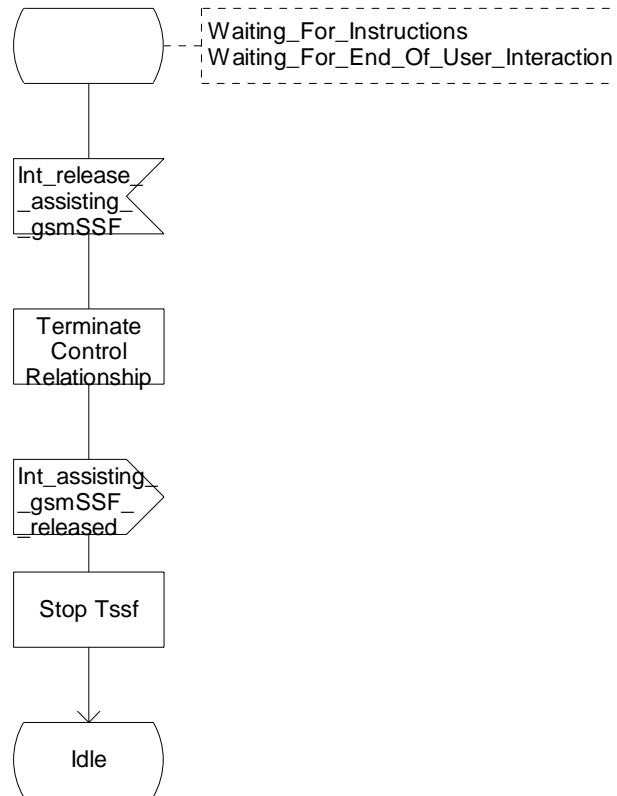
Figure 4.81f: Process Assisting_gsmSSF (sheet 6)

4.5.8 Procedure CAMEL_Provide_Subscriber_Info

4.5.8.1 MS reachable

A Provide_Subscriber_Info Request is sent to VLR and the HLR waits in state Wait_For_Information.

If the VLR returns a Provide_Subscriber_Info ack, the HLR uses the returned information to set the Subscriber Info to be returned to the gsmSCF. As a network option, the HLR may use the returned Cell Id or Location Area to derive the location number and/or Geographical Info. The mapping from cell ID and location area to location number is network-specific and outside the scope of the GSM standard.

> NOTE: The handling in the VLR of Provide_Subscriber_Info Request is defined in 3GPP TS 23.018 [3].

4.5.8.2 MS not reachable

4.5.8.2.1 Location Information requested

If VLR number is available in the HLR, then the Location Information is set to this parameter only.

If location information is not available in the HLR, no location information is set.

4.5.8.2.2 Subscriber State requested

The Subscriber State is set to "Network determined not reachable".

4.5.8.3 Actions at state Wait_For_Information

The following actions are possible in state Wait_For_Information depending on the result of the Provide_Subscriber_Info Request sent to VLR.

4.5.8.3.1 Provide_Subscriber_Info ack

The Location Information or/and the Subscriber State are set to the received information.

4.5.8.3.2 Provide_Subscriber_Info Negative Response

If location information was requested the VLR number is provided as location information. If the subscriber state was requested the subscriber state is set to "not provided from VLR".

Procedure CAMEL_Provide_Subscriber_Info   1(1)

Procedure in the HLR
for Retrieval of Location information
and Subscriber Status

Signals to/from the left are to/from
the VLR.

MS reachable?

Yes

No

Provide_Subscriber_
_Info

Wait_for_
_Information

Provide_Subscriber
_Info ack

Provide_Subscriber_
Information
negative response

Loc. info.
requested?

Yes

No

Loc. Info.
available?

No

Yes

Loc_Info=latest
stored loc. info.
Status="unreliable"

Loc_Info=
"unavailable"

Subscr. status
requested?

Yes

No

Subscriber
status=
"Network determined
not reachable"

Figure 4.82a: Procedure CAMEL_Provide_Subscriber_Info (sheet 1)

4.5.9   CAMEL specific handling of location updating and data restoration

When requesting location updating or data restoration the VLR shall indicate to the HLR which CAMEL phases it
supports.

The CAMEL phase 2 HLR shall then send to the VLR CAMEL subscription data for one of the CAMEL phases supported by the VLR or, if some different handling is required, data for substitute handling.

When location update has been completed, the MSC/VLR in which the subscriber is registered after the location update, shall check the M-CSI. If a Mobility Management notification to the gsmSCF is required for this subscriber, then the MSC/VLR shall now send the notification to the gsmSCF.

Refer to clause 9.2.1 for a description of M-CSI and the conditions under which a notification shall be sent.

4.5.10   Cross phase compatibility

To avoid a case by case fallback between the gsmSSF and the gsmSCF, the gsmSSF shall use the CAP phase corresponding to the CAMEL phase negotiated on the HLR-VLR interface when it opens a dialogue with the gsmSCF. The HLR-VLR negotiation of CAMEL phase is per subscriber.

4.5.11   Handling of North American Carrier Information

The following procedures apply only when the HPLMN of the CAMEL subscriber and either the VPLMN (for a mobile originated or forwarded call) or the IPLMN (for a mobile terminated call or forwarded call) are both North American. A gsmSCF may then provide the gsmSSF with any of the following North American (NA) carrier related information items.

-   NA Carrier Information.

-   NA Originating Line Information.

-   NA Charge Number.

A gsmSSF shall use the received information items both to select any long distance carrier needed for the call and to provide certain information needed by this carrier. Any required information items not received shall be defaulted to those that would normally apply to the call in the absence of an interaction with a gsmSCF.

If any NA information item received from the gsmSCF is found to be invalid, the gsmSSF may either, as an operator option, release the call or behave as if the invalid information item had not been sent.

If the carrier specified in the Carrier parameter is not supported in the VPLMN or IPLMN, the gsmSSF may either, as an operator option, release the call or substitute for the unsupported carrier a preferred carrier of the VPLMN or IPLMN.

Support of the NA Originating Line Information and Charge Number parameters is an operator option in a VPLMN based on roaming agreements with the operators of other PLMNs, A gsmSSF may ignore these items when received from certain or all gsmSCFs located in other PLMNs and replace them with the corresponding default items for an MO, MF, MT or VT call.

4.6   Description of information flows

This clause contains the detailed description of the information flows used by CAMEL.

Each Information Element, IE is marked as Mandatory (M), Conditional (C), Optional (O) or Not applicable (-) for each different traffic case, Mobile Originating call (MO), Mobile Forwarded call (MF), Mobile Terminating call in the GMSC (MT) and Mobile Terminating call in the VMSC (VT). This categorization is a functional classification, i.e., stage 2 information and not a stage 3 classification to be used for the ASN.1 syntax of the protocol. This distinction between MO, MF, and MT and VT calls is not applicable to all Information Flows.

The following principles apply for the handling of the IEs by the receiving entity:

-   The gsmSSF shall functionally support all IEs which can be sent to it.

-   The gsmSCF may silently discard any IE which it does not functionally support.

-   The gsmSRF shall return an error if it does not functionally support a IE which it receives.

-   The HLR may silently discard any IE which it does not functionally support.

Details of errors and exceptions to these rules are specified in are specified in 3GPP TS 29.078 [5].

4.6.1 gsmSSF to gsmSCF information flows

4.6.1.1 Activity Test ack

4.6.1.1.1 Description

This IF is the response to the Activity Test.

4.6.1.1.2 Information Elements

This IF contains no information elements.

4.6.1.2 Apply Charging Report

4.6.1.2.1 Description

This IF is used by the gsmSSF to report to the gsmSCF the information requested in the Apply Charging IF.

4.6.1.2.2 Information Elements

Information element name	MO	MF	MT	VT	Description
Call Result	M	M	M	M	This IE contains the charging information to be provided by the gsmSSF.
M	Mandatory (The IE shall always be sent).				

Call Result contains the following information:

Information element name	MO	MF	MT	VT	Description
Time Duration Charging Result	M	M	M	M	This IE is a list defined in the next table.
M	Mandatory (The IE shall always be sent).				

Time Duration Charging Result contains the following information:

Information element name	MO	MF	MT	VT	Description
Time Information	M	M	M	M	This IE is a choice between Time if No Tariff Switch and Time if Tariff Switch.
Party To Charge	M	M	M	M	This IE is received in the related ApplyCharging operation to correlate the result to the request. This IE shall be a copy of the corresponding IE received in the Apply Charging operation.
Call Active	M	M	M	M	This IE indicates whether the call is active or not.
Call Released at Tcp Expiry	C	C	C	C	This element is an indication that the gsmSSF has released the call and terminated the dialogue, due to Tcp expiry. It shall be present when ACR is sent due to Tcp expiry and the gsmSSF has released the call (because 'ReleaseIfExceeded' was present in ACH operation). In all other circumstances, this element shall be absent.
M	Mandatory (The IE shall always be sent).				
C	Conditional (The IE shall be sent, if available).				

Time Information contains one of the following information:

Information element name	MO	MF	MT	VT	Description
Time If No Tariff Switch	C	C	C	C	This IE will be present if no tariff switch has occurred since the detection of Answer for the connection to the Called Party, the Temporary Connection, or the SRF connection, otherwise it will be absent.
Time If Tariff Switch	C	C	C	C	This IE will be present if a tariff switch has occurred since the detection of Answer for the connection to the Called Party, the Temporary Connection, or the SRF connection, otherwise it will be absent.
C	Conditional (The IE shall be sent, if available).				

4.6.1.3 Call Information Report

4.6.1.3.1 Description

This IF is used to send specific call information for a single call to the gsmSCF as requested from the gsmSCF in a previous Call Information Request.

4.6.1.3.2 Information Elements

Information element name	MO	MF	MT	VT	Description
Requested Information List	M	M	M	M	This IE specifies a list of Requested information Values which are requested.
Leg ID	M	M	M	M	This IE indicates the party in the call for which information shall be collected. When absent, it indicates the 'outgoing' leg created with Connect, Continue or Continue With Argument.
M	Mandatory (The IE shall always be sent).				

4.6.1.4 Event Report BCSM

4.6.1.4.1 Description

This IF is used to notify the gsmSCF of a call-related event (i.e., BCSM events as answer and disconnect) previously requested by the gsmSCF in a Request Report BCSM Event IF.

4.6.1.4.2 Information Elements

The following information elements are required:

Information element name	MO	MF	MT	VT	Description
Event type BCSM	M	M	M	M	This IE specifies the type of event that is reported.
Event Specific Information BCSM	C	C	C	C	This IE indicates the call related information specific to the event.
Leg ID	M	M	M	M	This IE indicates the party in the call for which the event is reported.
Misc Call Info	M	M	M	M	This IE indicates the DP type.
M	Mandatory (The IE shall always be sent).				
C	Conditional (The IE shall be sent, if available).				

If the Event Type BCSM IE contains either O_Answer or T_Answer, then the Event Specific Information BCSM IE contains the following information elements:

Information element name	MO	MF	MT	VT	Description
Destination address	M	M	M	M	This IE specifies the destination address for the call leg.
OR	-	C	C	-	This IE indicates that the call was subject to basic Optimal Routeing as specified in 3GPP TS 23.079 [36].
Forwarded call	-	M	C	C	This IE indicates that the call has been subject to GSM call forwarding.
M	Mandatory (The IE shall always be sent).				
C	Conditional (The IE shall be sent if its value is True, otherwise it shall not be sent).				
-	Not applicable.				

If the Event Type BCSM IE contains one of Route_Select_Failure, O_Called_Party_Busy, O_Disconnect or T_Disconnect, then the Event Specific Information BCSM IE contains the following information element:

Information element name	MO	MF	MT	VT	Description
Cause	C	C	C	C	This IE indicates the cause.
C	Conditional (The IE shall be sent if available).				

If the Event Type BCSM IE contains T_Busy then the Event Specific Information BCSM IE contains the following information elements:

Information element name	MO	MF	MT	VT	Description
Cause	C	C	C	C	This IE indicates the cause.
Call forwarded	-	-	C	C	This IE indicates that the call may be forwarded by the appropriate GSM Call Forwarding supplementary service.
Route not permitted	-	-	C	-	This IE indicates that call forwarding will not take place in this GMSC due to the rules of basic optimal routeing. See 3GPP TS 23.079 [36].
C	Conditional (The IE shall be sent if available).				
-	Not applicable.				

If the Event Type BCSM IE contains T_No_Answer then the Event Specific Information BCSM IE contains the following information element:

Information element name	MO	MF	MT	VT	Description
Call forwarded	-	-	C	C	This IE indicates that the call may be forwarded by the appropriate GSM Call Forwarding supplementary service.
C	Conditional (The IE shall be sent if available).				
-	Not applicable.				

If the Event Type BCSM IE contains O_No_Answer then the Event Specific Information BCSM IE is not included.

4.6.1.5 Initial DP

4.6.1.5.1 Description

This IF is generated by the gsmSSF when a trigger is detected at a DP in the BCSM, to request instructions from the gsmSCF.

4.6.1.5.2 Information Elements

The following information elements are required:

Information element name	MO	MF	MT	VT	Description
Additional Calling Party Number	C	C	C	C	The calling party number provided by the access signalling system of the calling user or received from the gsmSCF due to the previous CAMEL processing.
Bearer Capability	M	C	C	C	This IE indicates the type of the bearer capability connection to the user.
Called Party Number	C	M	M	M	This IE contains the number used to identify the called party in the forward direction. For the MO and MF calls this parameter is used in the case of TDP Route_Select_Failure (this is the destination number used to route the call) and in the case of TDP Busy and TDP No Reply (this is the MSISDN when the destination number used for the call is a MSRN, or in the case of unsuccessful establishment received from the HLR via MAP interface, otherwise it is the number used to route the call). For the VT calls when there is no forwarding pending this is the MSISDN received in the Provide Roaming Number; if the MSISDN is not available, the basic MSISDN is used. For the MT and VT call case when there is call forwarding or call deflection pending, this is the MSISDN, i.e. not the forwarded-to or deflected-to number.
Called Party BCD Number	C	-	-	-	This IE contains the number used to identify the called party in the forward direction. It is used for MO call in all cases except in the case of TDP Route_Select_Failure. For the TDP Collected_Information, the number contained in this IE shall be identical to the number received over the access network. It may e.g. include service selection information, such as ∗ and # digits, or carrier selection information dialled by the subscriber. For the TDP Analysed_Information, the number contained in this IE shall be the dialled number received over the network access or received from a gsmSCF in a CONNECT operation, service selection information, such as * and # digits may be present (see clause 4.2.1.2.2), carrier selection information dialled by the subscriber is not present.
Calling Party Number	M	C	C	C	This IE carries the calling party number to identify the calling party or the origin of the call.
Calling Party Category	M	C	C	C	Indicates the type of calling party (e.g., operator, pay phone, ordinary subscriber).
CallGap Encountered	C	C	C	C	This parameter indicates the type of gapping the related call have been subjected to. This parameter shall be present only if a call gapping context is applicable to the initialDP operation.
Call Reference Number	M	M	M	M	This IE may be used by the gsmSCF for inclusion in a network optional gsmSCF call record. It has to be coupled with the identity of the MSC which allocated it in order to define unambiguously the identity of the call. For MO calls, the call reference number is set by the serving VMSC and included in the MO call record. For MT calls, the call reference number is set by the GMSC and included in the RCF call record in the GMSC and in the MT call record in the terminating MSC. For VT calls, the call reference number is set by the GMSC and included in the RCF call record in the GMSC and in the MT call record in the terminating MSC. For CF calls, the call reference number is set by the GMSC and included in the CF record in the forwarding MSC.
Cause	C	C	C	C	This IE indicates the cause specific to the armed BCSM DP event. This IE is applicable to DP Route_Select_Failure and DP T_Busy. The cause may be used by the SCF to decide about the further handling of the call.

Information element name	MO	MF	MT	VT	Description
Event Type BCSM	M	M	M	M	This IE indicates the armed BCSM DP event, resulting in the Initial DP IF.
Ext-Basic Service Code	C	C	C	C	This IE indicates the type of basic service i.e., teleservice or bearer service.
High Layer Compatibility	C	C	C	C	This IE indicates the type of the high layer compatibility, which will be used to determine the ISDN-teleservice of a connected ISDN terminal.
IMSI	M	M	M	M	This IE identifies the mobile subscriber.
IP SSP Capabilities	C	C	C	C	This IE indicates which SRF resources are supported within the gsmSSF and are available. If this IE is absent, this indicates that no gsmSRF is attached and available.
Location Information	M	-	C	M	This IE is described in the next table.
Location Number	M	C	C	C	For mobile originated calls this IE represents the location of the calling party. For all other call scenarios this IE contains the location number received in incoming ISUP signalling.
MSC Address	M	M	M	M	For MO calls, the MSC Address carries the international E.164 address of the serving VMSC. For MT calls, the MSC Address carries the international E.164 address of the GMSC. For VT calls, the MSC Address carries the international E.164 address of the serving VMSC. For CF calls, the MSC Address carries the international E.164 address of the forwarding MSC.
GMSC Address	-	M	-	M	For CF calls, the GMSC Address carries the international E.164 address of the GMSC. For VT calls, the GMSC Address carries the international E.164 address of the GMSC.
Carrier	C	C	C	C	The content of this IE is described in the next table. The IE may be sent when the VPLMN and the HPLMN of the subscriber are both North American. For MO calls, this IE shall contain any carrier that was dialled by the calling subscriber. If no carrier was dialled, the IE shall contain the calling subscriber's subscribed carrier. For MT and VT calls, the IE shall contain the carrier subscribed to by the called subscriber. For CF calls, the IE shall contain the carrier subscribed to by the forwarding subscriber.
Original Called Party ID	C	C	C	C	This IE carries the dialled digits if the call has met call forwarding on the route to the gsmSSF. This IE shall also be sent if it was received from the gsmSCF due to the previous CAMEL processing.
Redirecting Party ID	C	C	C	C	This IE indicates the directory number the call was redirected from. This IE shall also be sent if it was received from the gsmSCF due to the previous CAMEL processing.
Redirection Information	C	C	C	C	This IE contains forwarding related information, such as redirection counter. This IE shall also be sent if it was received from the gsmSCF due to the previous CAMEL processing.
Service Key	M	M	M	M	This IE indicates to the gsmSCF the requested CAMEL Service. It is used to address the required application/SLP within the gsmSCF.
Subscriber State	-	-	C	C	This IE indicates the status of the MS. The states are: - CAMELBusy: The MS is engaged on a transaction for a mobile originating or terminated circuit-switched call. - NetworkDeterminedNotReachable: The network can determine from its internal data that the MS is not reachable. - AssumedIdle: The state of the MS is neither "CAMELBusy" nor "NetworkDeterminedNotReachable". - Not provided from VLR.
Time And Timezone	M	M	M	M	This IE contains the time that the gsmSSF was triggered, and the time zone the gsmSSF resides in.

Information element name	MO	MF	MT	VT	Description
GSM Forwarding Pending	-	-	C	C	This parameter indicates that a forwarded-to-number was received and the call will be forwarded due to GSM supplementary service call forwarding in the GMSC/VMSC. This parameter is present in the following cases: - When the FTN is received from the HLR prior to triggering in the Terminating_Attempt_Authorised DP. - When a conditional call forwarding or call deflection is invoked in the GMSC/MSC, and T_Busy or T_No_answer is reported as a TDP.
Service Interaction Indicators Two	C	C	C	C	This IE is sent if it is received in the ISUP message or due to previous CAMEL processing. The IE is described in a table below.
CUG Index	C	-	-	-	See 3GPP TS 23.085 [9] for details of this IE.
CUG Interlock Code	C	C	C	C	See 3GPP TS 23.085 [9] for details of this IE. The latest available data shall be used, i.e., if the CUG data which had been obtained in the ISUP IAM or from the VLR has been modified by the previous Connect or Continue With Argument IF, this modified data shall be used.
Outgoing Access Indicator	C	C	C	C	See 3GPP TS 23.085 [9] for details of this IE. In the MO case this IE is received from the VLR.
M Mandatory (The IE shall always be sent). C Conditional (The IE shall be sent, if available). - Not applicable.					

Location Information is defined in 3GPP TS 23.018 [3]. The following differences apply:

Information element name	MO	MF	MT	VT	Description
Location Number	-	-	C	C	See 3GPP TS 23.018 [3].
Service area ID	C2	-	C2	C2	See 3GPP TS 23.018 [3].
Cell ID	C2	-	C2	C2	See 3GPP TS 23.018 [3].
Geographical information	C	-	C	C	See 3GPP TS 23.018 [3].
Geodetic information	C	-	C	C	See 3GPP TS 23.018 [3].
VLR number	M	-	C	M	See 3GPP TS 23.018 [3].
Age Of location information	M	-	C	C	See 3GPP TS 23.018 [3].
Current Location Retrieved	-	-	-	-	Not applicable
Location area ID	C2	-	C2	C2	See 3GPP TS 23.003 [37].
Selected LSA Identity	C1	-	C1	C1	This IE indicates the LSA identity associated with the current position of the MS. Shall be present if the LSA ID in the subscriber data matches the LSA ID of the current cell. In the case of multiple matches the LSA ID with the highest priority shall be sent. See 3GPP TS 23.073 [23].
M Mandatory (The IE shall always be sent). C Conditional (The IE shall be sent, if available. Further conditions are in the description column.). C1 Conditional (The IE shall be sent, if available and SoLSA is supported). C2 Conditional (One and only one of the three conditional IEs shall be sent). - Not applicable.					

Carrier contains the following information:

Information element name	MO	MF	MT	VT	Description
Carrier Identification Code	M	M	M	M	This IE uniquely identifies a North American long distance carrier.
Carrier Selection Information	M	M	M	M	This IE indicates the way the carrier was selected e.g.: – dialled – subscribed
M	Mandatory (The IE shall always be sent).				

Service Interaction Indicators Two contains the following information:

Information element name	MO	MF	MT	VT	Description
Forward Service Interaction Indicator	C	C	C	C	This IE is described in a table below.
HOLD Treatment Indicator	C	-	-	C	This IE indicates whether the CAMEL subscriber can invoke HOLD for the call.
CW Treatment Indicator	C	-	-	C	This IE indicates whether CW can be applied for a call to the CAMEL subscriber whilst this call is ongoing.
ECT Treatment Indicator	C	-	-	C	This IE indicates whether the call leg can become part of an ECT call initiated by the calling subscriber.
C	Conditional (The IE shall be sent, if available).				
-	Not applicable.				

Forward Service Interaction Indicator contains the following information:

Information element name	MO	MF	MT	VT	Description
Conference Treatment Indicator	C	C	C	C	This IE indicates whether the call leg can become part of a MPTY call initiated by the called subscriber.
Call Diversion Treatment Indicator	C	C	C	C	This IE indicates whether the call can be forwarded using the Call Forwarding or Call Deflection Supplementary Services.
C	Conditional (The IE shall be sent, if available).				

4.6.2   gsmSCF to gsmSSF information flows

4.6.2.1   Activity Test

4.6.2.1.1   Description

This IF is used to check for the continued existence of a relationship between the gsmSCF and gsmSSF. If the relationship is still in existence, then the gsmSSF will respond. If no reply is received, then the gsmSCF will assume that the gsmSSF has failed in some way and will take the appropriate action.

4.6.2.1.2   Information Elements

This IF contains no information elements.

4.6.2.2   Apply Charging

4.6.2.2.1   Description

This IF is used for interacting from the gsmSCF with the gsmSSF charging mechanisms to control the call duration.

4.6.2.2.2 Information Elements

Information element name	MO	MF	MT	VT	Description
ACh Billing Charging Characteristics	M	M	M	M	This IE specifies the charging related information to be provided by the gsmSSF and the conditions on which this information has to be provided back to the gsmSCF.
Party To Charge	M	M	M	M	This IE shall be reflected in the corresponding IE of the Apply Charging Report operation. This IE has no effect on the charging procedures in the MSC.
M	Mandatory (The IE shall always be sent).				

ACh Billing Charging Characteristics contains the following information:

Information element name	MO	MF	MT	VT	Description
Time Duration Charging	M	M	M	M	This IE is described in the next table.
M	Mandatory (The IE shall always be sent).				

Time Duration Charging contains the following information:

Information element name	MO	MF	MT	VT	Description
Max Call Period Duration	M	M	M	M	This IE indicates the maximum call period duration timer.
Tariff Switch Interval	O	O	O	O	This IE indicates the tariff switch time until the next tariff switch applies.
Release If Duration Exceeded	O	O	O	O	This IE indicates that the call shall be released when the Max call Period Duration expires, with a warning tone if the Play Tone IE is present. The cause used in the release message shall be "normal unspecified". Default is to continue the call.
Play Tone	O	-	O	O	This IE is set if a tone has to be played to the party for whom the BCSM is operating. If present, this IE indicates that 30 seconds before the Max Call Period Duration timer expires, a triple tone of 900 Hz (200 milliseconds tone, 200 milliseconds pause) shall be played.
M	Mandatory (The IE shall always be sent).				
O	Optional (Service logic dependent).				
-	Not applicable.				

4.6.2.3 Call Gap

4.6.2.3.1 Description

This IF is used to activate/modify/remove a call gap mechanism in the gsmSSF. The call gap mechanism is used to reduce the rate at which specific service requests are sent to a gsmSCF.

A Call Gap operation can only be sent on an opened dialogue between a gsmSCF and a gsmSSF.

It is possible to have several call gapping conditions applicable to the same gsmSSF (i.e. each conditions were activated for a defined Service (identified by the serviceKey) by a defined gsmSCF (identified by the gsmSCFAddress).

4.6.2.3.2 Information Elements

Information element name	Status	Description
Gap Criteria	M	This IE specifies the criteria for a call to be subject to call gapping.
Gap Indicators	M	This parameter indicates the gapping characteristics.
Control Type	O	This parameter indicates the reason for activating call gapping. The value "sCPOverloaded" indicates that an automatic congestion detection and control mechanism in the SCP has detected a congestion situation. The value "manuallyInitiated" indicates that the service and or network/service management centre has detected a congestion situation, or any other situation that requires manually initiated controls. The controlType "manuallyInitiated" will have priority over "sCPOverloaded" call gap. It should be noted that also non-IN controlled traffic control mechanism can apply to an exchange with the SSF functionality. As the non-IN controlled traffic control is within the CCF, this traffic control has implicit priority over the IN controlled traffic control. The non-IN controlled traffic control may also have some influence to the IN call. Therefore it is recommended to take measures to coordinate several traffic control mechanisms. The non-IN controlled traffic control and co-ordination of several traffic control mechanisms are out of the scope of core INAP.
Gap Treatment	O	This parameter indicates how calls that were rejected due to the call gapping condition and for which the Default Call Handling was set to "Release Call" shall be treated.
M	Mandatory (The IE shall always be sent).	
O	Optional (Service logic dependent).	

Gap Criteria contains one of the following (Choice):

Information element name	Status	Description
Basic Gap Criteria	O	This IE is a choice of various basic criteria.
Compound Gap Criteria	O	This IE is a choice of various criteria including a ScfID.
O	Optional (Service logic dependent).	

Compound Gap Criteria contains the following Information:

Information element name	Status	Description
Basic Gap Criteria	M	This IE is a choice of various criteria.
ScfID	O	This IE contains the address of the gsmSCF which initiated the CallGapping.
M	Mandatory (The IE shall always be sent).	
O	Optional (Service logic dependent).	

Basic Gap Criteria contains one of the following (Choice):

Information element name	Status	Description
Called Address	O	This parameter contains a string of digits. At each call attempt, when the leading digits of the dialled number match this specific value, the call gapping treatment shall be applied to this call.
Service	O	This parameter contains a service key value. At each call attempt, when the service key match this specific value, the call gapping treatment shall be applied to this call.
Called Address and Service	O	This parameter contains a specific string of digits and a service key value. At each call attempt, when the leading digits of the dialled number and the service key of a call match these specific values, the call gapping treatment shall be applied to this call.
Calling Address and Service	O	This parameter contains a specific string of digits and a service key value. At each call attempt, when the leading digits of the calling party number and the service key match these specific values, the call gapping treatment shall be applied to this call.
O	Optional (Service logic dependent).	

Gap Indicators contains the following information:

Information element name	Status	Description
Duration	M	Duration specifies the total time interval during which call gapping for the specified gap criteria will be active. A duration of 0 indicates that gapping is to be removed. A duration of -2 indicates a network specific duration. Other values indicate duration in seconds.
Interval	M	This parameter specifies the minimum time between calls being allowed through. An interval of 0 indicates that calls meeting the gap criteria are not to be rejected. An interval of -1 indicates that all calls meeting the gap criteria are to be rejected. Other values indicate interval in milliseconds.
M	Mandatory (The IE shall always be sent).	

Gap Treatment contains one of the following (choice):

Information element name	Status	Description
Information To Send	O	This parameter indicates an announcement or a tone to be sent to the calling party. At the end of information sending, the call shall be released.
Release Cause	O	If the call is to be released, this IE indicates a specific cause value to be sent in the release message. See ETSI EN 300 356-1 [20] for the coding.
O	Optional (Service logic dependent).	

Information To Send contains one of the following (choice):

Information element name	Status	Description
In-band Info	O	This parameter specifies the in-band information to be sent.
Tone	O	This parameter specifies a tone to be sent to the end-user.
O	Optional (Service logic dependent).	

In-band Info contains the following information:

Information element name	Status	Description
Message Id	M	This parameter indicates the message(s) to be sent, it can be one of the following:
Message Duration	O	This parameter indicates the maximum time duration in seconds that the message shall be played/repeated. ZERO indicates endless repetition.
M	Mandatory (The IE shall always be sent).	
O	Optional (Service logic dependent).	

Message Id contains one of the following (choice):

Information element name	Status	Description
Elementary Message Id	O	This parameter indicates a single announcement.
O	Optional (Service logic dependent).	

4.6.2.4 Call Information Request

4.6.2.4.1 Description

This IF is used to request the gsmSSF to record specific information about a single call and report it to the gsmSCF (with a CallInformationReport).

4.6.2.4.2 Information Elements

Information element name	MO	MF	MT	VT	Description
Requested Information Type List	M	M	M	M	This IE specifies a list of specific items of information which are requested.
Leg ID	M	M	M	M	This IE indicates the party in the call for which information shall be collected. When absent, it indicates the 'outgoing' leg created with Connect, Continue or Continue With Argument.
M	Mandatory (The IE shall always be sent).				

Requested Information Type List contains the following information:

Information element name	MO	MF	MT	VT	Description
Call Attempt Elapsed Time	O	O	O	O	This IE indicates that the Call Attempt Elapsed Time is requested in the Call Information Report. Call Attempt Elapsed Time is the duration between the end of the CAMEL processing initiating call setup (Connect, Continue or Continue With Argument IF) and the received answer indication from the called party side. For the Calling Party, the value of Call Attempt Elapsed Time in the Call Information Report shall be set to 0.
Call Stop Time	O	O	O	O	This IE indicates that the Call Stop Time is requested in the Call Information Report. Call Stop Time is the time stamp when the connection is released.
Call Connected Elapsed Time	O	O	O	O	This IE indicates that the Call Connected Elapsed Time is requested in the Call Information Report. Call Connected Elapsed Time is the duration between the received answer indication from the called party side and the release of the connection. For a Calling Party, it indicates the duration between the sending of IDP and the release of that party
Release Cause	O	O	O	O	This IE indicates that the Release Cause is requested in the Call Information Report. Release Cause is the release cause for the call.
O	Optional (Service logic dependent).				

4.6.2.5 Cancel

4.6.2.5.1 Description

This IF is used by the gsmSCF to request the gsmSSF to cancel all EDPs and reports.

4.6.2.5.2 Information Elements

The following information elements are used:

Information element name	MO	MF	MT	VT	Description
All Requests	M	M	M	M	This IE indicates that all active requests for EventReportBCSM, ApplyChargingReport and CallInformationReport shall be cancelled.
M	Mandatory (The IE shall always be sent).				

4.6.2.6 Connect

4.6.2.6.1 Description

This IF is used to request the gsmSSF to perform the call processing actions to route a call to a specific destination. To do so, the gsmSSF may use destination information from the calling party and existing call set-up information depending on the information provided by the gsmSCF.

4.6.2.6.2 Information Elements

The following information elements are required:

Information element name	MO	MF	MT	VT	Description
Alerting Pattern	-	-	O	O	This parameter indicates the kind of Alerting Pattern to be applied.
Calling Party Category	O	O	O	O	This IE indicates the type of calling party (e.g., operator, pay phone, ordinary subscriber).
Destination Routing Address	M	M	M	M	This IE contains the called party number towards which the call is to be routed.
Generic Number	O	O	O	O	This IE contains the generic number. Its used to convey the additional calling party number, which e.g. could be used to modify the calling line ID presented to the called user.
Carrier	O	O	O	O	This IE is described in the next table.
NA Originating Line Information	O	O	O	O	This IE identifies the type of number in the Charge Number (e.g. subscriber versus PLMN operator number).
Charge Number	O	O	O	O	This IE identifies the chargeable number for the usage of a North American carrier.
O-CSI Applicable	-	-	O	O	This IE indicates that the O-CSI, if present shall be applied on the outgoing leg.
Original Called Party ID	O	O	O	O	This IE carries the dialled digits if the call has met call forwarding on route to the gsmSSF or is forwarded by the gsmSCF.
Redirecting Party ID	O	O	O	O	This IE indicates the directory number the call was redirected from.
Redirection Information	O	O	O	O	This IE contains forwarding related information, such as redirecting counter.
Suppression Of Announcements	-	-	O	O	This IE indicates that announcements or tones generated as a result of unsuccessful call setup shall be suppressed.
Service Interaction Indicators Two	O	O	O	O	This IE is described in a table below.
CUG Interlock Code	O	O	O	O	See 3GPP TS 23.085 [9] for details of this IE.
Outgoing Access Indicator	O	O	O	O	See 3GPP TS 23.085 [9] for details of this IE.
O Optional (Service logic dependent).					
- Not applicable.					

Carrier contains the following information:

Information element name	MO	MF	MT	VT	Description
Carrier Identification Code	M	M	M	M	This IE uniquely identifies a North American long distance carrier.
Carrier Selection Information	M	M	M	M	This IE indicates the way the carrier was selected e.g.: – dialled – subscribed
M Mandatory (The IE shall always be sent).					

Service Interaction Indicators Two contains the following information:

Information element name	MO	MF	MT	VT	Description
Forward Service Interaction Indicator	O	O	O	O	This IE is described in a table below.
Backward Service Interaction Indicator	O	O	O	O	This IE is described in a table below.
HOLD Treatment Indicator	O	-	-	O	This IE indicates whether the CAMEL subscriber can invoke HOLD for the call.
CW Treatment Indicator	O	-	-	O	This IE indicates whether CW can be applied for a call to the CAMEL subscriber whilst this call is ongoing.
ECT Treatment Indicator	O	-	-	O	This IE indicates whether the call leg can become part of an ECT call initiated by the CAMEL subscriber.
Connected number treatment indicator	O	O	O	O	This IE indicates the treatment of the connected number at the originating side.
Non-CUG Call	O	O	O	O	This IE indicates that no parameters for CUG should be used for the call (i.e. the call should be a non-CUG call).
O Optional (Service logic dependent). - Not applicable.					

   NOTE: Non-CUG Call shall not be present if at least one of CUG Interlock Code and Outgoing Access Indicator are present in the Information Flow.

Forward Service Interaction Indicator contains the following information:

Information element name	MO	MF	MT	VT	Description
Conference Treatment Indicator	O	O	O	O	This IE indicates whether the call leg can become part of a MPTY call initiated by the called subscriber.
Call Diversion Treatment Indicator	O	O	O	O	This IE indicates whether the call can be forwarded using the Call Forwarding or Call Deflection Supplementary Services.
Calling Party Restriction Indicator	O	-	-	-	This IE indicates whether the CLI shall be marked as Restricted by CAMEL action for the call.
O Optional (Service logic dependent). - Not applicable.					

Backward Service Interaction Indicator contains the following information:

Information element name	MO	MF	MT	VT	Description
Conference Treatment Indicator	O	O	O	O	This IE indicates if the call leg can become part of a MPTY call initiated by the calling subscriber.
Call Completion Treatment Indicator	O	O	O	O	This IE indicates whether a CCBS request can be made for the call. See also 3GPP TS 23.093 [38] for description.
O Optional (Service logic dependent).					

4.6.2.7   Connect To Resource

4.6.2.7.1   Description

This IF is used to connect a call from the gsmSSF to a gsmSRF.

4.6.2.7.2 Information Elements

The following information elements are required:

Information element name	MO	MF	MT	VT	Description
Service Interaction Indicators Two	O	O	O	O	This parameter indicates whether or not a bothway through connection is required between the Calling party and the gsmSRF. The handling when this IE is not present is defined in ETSI EN 301 070-1 ([7]).
Resource Address	O	O	O	O	This IE indicates the physical location of the gsmSRF.
O Optional (Service logic dependent).					

Resource Address contains the following information:

Information element name	MO	MF	MT	VT	Description
IP Routing Address	C	C	C	C	This IE indicates the routeing address to set up a connection towards the gsmSRF.
None	C	C	C	C	This parameter indicates that the call party is to be connected to a predefined gsmSRF.
C Conditional.					

4.6.2.8 Continue

4.6.2.8.1 Description

This IF requests the gsmSSF to proceed with call processing at the DP at which it previously suspended call processing to await gsmSCF instructions. The gsmSSF completes DP processing, and continues basic call processing (i.e., proceeds to the next point in call in the BCSM) without substituting new data from the gsmSCF.

4.6.2.8.2 Information Elements

This IF contains no information elements.

4.6.2.9 Continue With Argument

4.6.2.9.1 Description

This information flow requests the gsmSSF to proceed the call processing with modified information at the DP at which it previously suspended call processing to await gsmSCF instructions. The gsmSSF completes DP processing, and continues basic call processing (i.e., proceeds to the next point in call in the BCSM) with the modified call setup information as received from the gsmSCF.

4.6.2.9.2 Information Elements

The following information elements are required:

Information element name	MO	MF	MT	VT	Description
Alerting Pattern	-	-	O	O	This parameter indicates the kind of Alerting Pattern to be applied.
Calling Party Category	O	O	O	O	This IE indicates the type of calling party (e.g., operator, pay phone, ordinary subscriber).
Generic Number	O	O	O	O	This IE contains the generic number. Its used to convey the additional calling party number, which e.g. could be used to modify the calling line ID presented to the called user.
Carrier	O	O	O	O	This IE is described in the next table.
NA Originating Line Information	O	O	O	O	This IE identifies the type of number in the Charge Number (e.g. subscriber versus PLMN operator number).
Charge Number	O	O	O	O	This IE identifies the chargeable number for the usage of a North American carrier.
Suppression Of Announcements	-	-	O	O	This IE indicates that announcements or tones generated as a result of unsuccessful call setup shall be suppressed.
Service Interaction Indicators Two	O	O	O	O	This IE is described in a table below.
CUG Interlock Code	O	O	-	-	See 3GPP TS 23.085 [9] for details of this IE.
Outgoing Access Indicator	O	O	-	-	See 3GPP TS 23.085 [9] for details of this IE.
O Optional (Service logic dependent).					
- Not applicable.					

Carrier contains the following information:

Information element name	MO	MF	MT	VT	Description
Carrier Identification Code	M	M	M	M	This IE uniquely identifies a North American long distance carrier.
Carrier Selection Information	M	M	M	M	This IE indicates the way the carrier was selected e.g.: - dialled - subscribed
M Mandatory (The IE shall always be sent).					

Service Interaction Indicators Two contains the following information:

Information element name	MO	MF	MT	VT	Description
Forward Service Interaction Indicator	O	O	O	O	See the Information Flow table for the Service Interaction Indicators Two IE in the Connect operation for an explanation of this parameter.
Backward Service Interaction Indicator	O	O	O	O	See the Information Flow table for the Service Interaction Indicators Two IE in the Connect operation for an explanation of this parameter.
HOLD Treatment Indicator	O	-	-	O	This IE indicates whether the CAMEL subscriber can invoke HOLD for the call.
CW Treatment Indicator	O	-	-	O	This IE indicates whether CW can be applied for a call to the CAMEL subscriber whilst this call is ongoing.
ECT Treatment Indicator	O	-	-	O	This IE indicates whether the call leg can become part of an ECT call initiated by the CAMEL subscriber.
Connected number treatment indicator	O	O	O	O	This IE indicates the treatment of the connected number at the originating side.
Non-CUG Call	O	O	-	-	This IE indicates that no parameters for CUG should be used for the call (i.e. the call should be a non-CUG call).
O Optional (Service logic dependent).					
- Not applicable.					

NOTE: Non-CUG Call shall not be present if at least one of CUG Interlock Code and Outgoing Access Indicator are present in the Information Flow.

4.6.2.10 Disconnect Forward Connection

4.6.2.10.1 Description

This IF is used:

- to disconnect a connection with a gsmSRF previously established with a Connect To Resource IF;

- to disconnect an initiating gsmSSF from an assisting gsmSSF and its associated gsmSRF. The IF is send to the initiating gsmSSF.

4.6.2.10.2 Information Elements

This IF contains no information elements.

4.6.2.11 Establish Temporary Connection

4.6.2.11.1 Description

This IF is used to create a connection between an initiating gsmSSF and an assisting gsmSSF as a part of the assist procedure. It can also be used to create a connection between a gsmSSF and a gsmSRF.

4.6.2.11.2 Information Elements

The following information elements are required.

Information element name	MO	MF	MT	VT	Description
Assisting SSP IP Routing Address	M	M	M	M	This parameter indicates the destination address of the gsmSRF or assisting gsmSSF for the assist procedure. As a network operator option, the Assisting SSP IP Routing Address may contain embedded within it, a "Correlation ID" and " Scf ID", but only if "Correlation ID" and "Scf ID" are not specified separately.
Correlation ID	O	O	O	O	This parameter is used for: - the correlation of dialogues from the initiating gsmSSF-> gsmSCF with dialogues from gsmSRF -> gsmSCF - the correlation of dialogues from the initiating gsmSSF-> gsmSCF with dialogues from assisting gsmSSF -> gsmSCF.
Carrier	O	O	O	O	This IE is described in the next table.
NA Originating Line Information	O	O	O	O	This IE identifies the type of number in the Charge Number (e.g. subscriber versus PLMN operator number).
Charge Number	O	O	O	O	This IE identifies the chargeable number for the usage of a North American carrier.
Scf ID	O	O	O	O	This parameter indicates the gsmSCF identifier
Service Interaction Indicators Two	O	O	O	O	This parameter indicates whether or not a bothway through connection is required between the Calling party and the gsmSRF. The handling when this IE is not present is defined in ETSI EN 301 070-1 ([7]).
M Mandatory (The IE shall always be sent). O Optional (Service logic dependent).					

Carrier contains the following information:

Information element name	MO	MF	MT	VT	Description
Carrier Identification Code	M	M	M	M	This IE uniquely identifies a North American long distance carrier.
Carrier Selection Information	M	M	M	M	This IE indicates the way the carrier was selected e.g.: – dialled – subscribed
M Mandatory (The IE shall always be sent).					

4.6.2.12 Furnish Charging Information

4.6.2.12.1 Description

This IF is used to request the gsmSSF to include call related information in the CAMEL specific logical call record. The logical call record is created when FCI is received and a logical call record for that leg does not exist. For modelling purposes the logical call record is buffered in the gsmSSF. The gsmSSF completes logical call records as defined in the SDLs. Once the logical call record is completed, then its free format data is moved to the corresponding CDR and the logical call record is deleted.

The CSE can send multiple concatenated FCIs per leg for completion. The total maximum of free format data is 160 octets per leg. The 160 octets may be sent in one or more FCI operations. If there is non-completed free format data and new FCI operation(s) is/are received to overwrite the non-completed data, then the non-completed data is discarded and the gsmSCF can send another 160 octets per leg. The SDLs of 3GPP TS 23.078 define when Logical CDRs are completed. After the completion the gsmSCF can send another 160 octets of free format data in one or more FCI operations for the called leg.

4.6.2.12.2 Information Elements

The following information elements are required:

Information element name	MO	MF	MT	VT	Description
FCI Billing Charging Characteristics	M	M	M	M	This IE is described in the next table.
M Mandatory (The IE shall always be sent).					

FCI Billing Charging Characteristics contains the following information:

Information element name	MO	MF	MT	VT	Description
FCIBCCCAMEL Sequence 1	M	M	M	M	This IE is described in the next table.
M Mandatory (The IE shall always be sent).					

FCIBCCCCAMEL Sequence 1 contains the following information:

Information element name	MO	MF	MT	VT	Description
Free Format Data	M	M	M	M	This IE is a free format data to be inserted in the CAMEL logical call record.
Party To Charge	M	M	M	M	This IE indicates the party for whom a CAMEL logical call record will be created.
Append Free Format Data	O	O	O	O	This IE indicates that the gsmSSF shall append the free format data to the Logical call record. - If this IE is present and indicates "Append", the gsmSSF shall append the free format data received in this IF to the free format data already present in the Logical call record for that leg of the call. - If this IE is absent or in value "Overwrite", then the gsmSSF shall overwrite all free format data already present in the Logical call record for that leg of the call, by the free format data received in this IF. If no Logical call record exists yet for that leg of the call, then the gsmSSF shall ignore this IE.
M	Mandatory (The IE shall always be sent).				
O	Optional (Service logic dependent).				

4.6.2.13 Release Call

4.6.2.13.1 Description

This IF is used to tear down by the gsmSCF an existing call at any phase of the call for all parties involved in the call.

4.6.2.13.2 Information Elements

The following information elements are required:

Information element name	MO	MF	MT	VT	Description
Release Cause	M	M	M	M	A number giving an indication to the gsmSSF about the reason of releasing this specific call. This may be used by MSC/GMSC for generating specific tones to the different parties in the call or to fill in the "cause" in the release message.
M	Mandatory (The IE shall always be sent).				

4.6.2.14 Request Report BCSM Event

4.6.2.14.1 Description

This IF is used to request the gsmSSF to monitor for a call-related event, then send a notification back to the gsmSCF when the event is detected (see Event Report BCSM).

4.6.2.14.2 Information Elements

The following information elements are used:

Information element name	MO	MF	MT	VT	Description
BCSM Event	M	M	M	M	This IE specifies the event or events of which a report is requested.
M	Mandatory (The IE shall always be sent).				

BCSM Event contains the following information:

Information element name	MO	MF	MT	VT	Description
Event type	M	M	M	M	This IE specifies the type of event of which a report is requested.
Leg ID	C	C	C	C	This IE indicates the party in the call for which the event shall be reported.
Monitor Mode	M	M	M	M	When this IE is "interrupted", the event shall be reported as a request, if it is "notifyAndContinue", the event shall be reported as a notification, if the IE is "transparent", the event shall not be reported.
DP Specific Criteria	O	O	O	O	This IE is described in the next table.
M	Mandatory (The IE shall always be sent).				
C	Conditional.				
O	Optional (Service logic dependent).				

DP Specific Criteria is defined as:

Information element name	MO	MF	MT	VT	Description
Application Timer	O	O	O	O	This IE carries additional timer duration information (timer values for No Answer event) required for arming No_Answer EDPs in the gsmSSF. The TNRy timer (value defined between 10s and 40s) shall be shorter than the network no answer timer.
O	Optional (Service logic dependent).				

4.6.2.15 Reset Timer

4.6.2.15.1 Description

This IF is used to refresh a timer.

4.6.2.15.2 Information Elements

The following information elements are required:

Information element name	MO	MF	MT	VT	Description
Timer Value	M	M	M	M	This IE specifies the value to which the indicated timer shall be set.
Timer ID	O	O	O	O	This IE indicates which timer shall be reset. It shall be set to 'Tssf'.
M	Mandatory (The IE shall always be sent).				
O	Optional (Service logic dependent).				

4.6.2.16 Send Charging Information

4.6.2.16.1 Description

This IF is used to send e-parameters from the gsmSCF to the gsmSSF. If charge advice information is received from the gsmSCF, it shall replace the charge advice information which would be generated by the MSC and inhibit any further generation of CAI by the MSC. Further processing of the charge advice information by the MSC shall be in accordance with the GSM Advice of Charge Supplementary Service.

The IF is only used in the MO case or in the VT case.

NOTE: If charge advice information is received from the gsmSCF after charge information has been generated by the MSC and sent to the MS, the behaviour of the service may be unpredictable or incorrect; the service designer should therefore ensure that the first set of charge advice information is sent to the gsmSSF before charge information is sent to the to the MS.

4.6.2.16.2 Information Elements

The following information elements are only used for the MO case and for the VT case:

Information element name	MO	MF	MT	VT	Description
SCI Billing Charging Characteristics	M	-	-	M	This IE defines the Advice Of Charge related information to be provided to the Mobile Station
Leg ID	M	-	-	M	This IE indicates where the charging information shall be sent.
M	Mandatory (The IE shall always be sent).				

SCI Billing Charging Characteristics is defined as:

Information element name	MO	MF	MT	VT	Description
AOC After Answer	C	-	-	C	This IE is sent after an Answer from event has been detected from the called party, the current connected SRF or the temporary connection.
AOC Before Answer	C	-	-	C	This IE is sent before an Answer event has been detected from the called party, the current connected SRF or the temporary connection.
C	Conditional (only one of these IEs may be sent).				

AOC Before Answer is defined as:

Information element name	MO	MF	MT	VT	Description
AOC Initial	M	-	-	M	This IE contains CAI elements as defined in 3GPP TS 22.024 [31].
AOC Subsequent	O	-	-	O	See definition in the next table.
M	Mandatory (The IE shall always be sent).				
O	Optional (Service logic dependent).				

AOCSubsequent is defined as:

Information element name	MO	MF	MT	VT	Description
CAI Elements	M	-	-	M	This IE contains CAI elements as defined in 3GPP TS 22.024 [31].
Tariff Switch Interval	O	-	-	O	This IE indicates the tariff switch time until the next tariff switch applies.
M	Mandatory (The IE shall always be sent).				
O	Optional (Service logic dependent).				

AOCAfterAnswer is defined as:

Information element name	MO	MF	MT	VT	Description
CAI Elements	M	-	-	M	This IE contains CAI elements as defined in 3GPP TS 22.024 [31].
Tariff Switch Interval	O	-	-	O	This IE indicates the tariff switch time until the next tariff switch applies.
M	Mandatory (The IE shall always be sent).				

4.6.3 Optional (Service logic dependent) gsmSCF to gsmSRF information flows

4.6.3.1 Activity Test

4.6.3.1.1 Description

This IF is used to check for the continued existence of a relationship between the gsmSCF and gsmSRF. If the relationship is still in existence, then the gsmSRF will respond. If no reply is received, then the gsmSCF will assume that the gsmSRF has failed in some way and will take the appropriate action.

4.6.3.1.2 Information Elements

This IF contains no information elements.

4.6.3.2 Cancel

4.6.3.2.1 Description

This IF is used by the gsmSCF to request the gsmSRF to cancel a correlated previous operation.

4.6.3.2.2 Information Elements

The following information elements are used:

Information element name	MO	MF	MT	VT	Description
Invoke ID	M	M	M	M	This IE specifies the operation to be cancelled.
M Mandatory (The IE shall always be sent).					

4.6.3.3 Play Announcement

4.6.3.3.1 Description

This IF is used for inband interaction.

4.6.3.3.2 Information Elements

The following information elements are required:

Information element name	MO	MF	MT	VT	Description
Information To Send	M	M	M	M	This IE indicates an announcement or a tone to be sent to the end user by the gsmSRF.
Disconnect From IP Forbidden	M	M	M	M	This IE indicates whether or not the gsmSRF may be disconnected from the user when all information has been sent.
Request Announcement Complete	M	M	M	M	This IE indicates whether or not a SpecializedResourceReport shall be sent to the gsmSCF when all information has been sent.
M Mandatory (The IE shall always be sent). O Optional (Service logic dependent).					

Information To Send contains the following information:

Information element name	MO	MF	MT	VT	Description
Inband Info	C	C	C	C	This IE indicates the inband information to be sent.
Tone	C	C	C	C	This IE indicates the tone to be sent. The mapping from the code points of this IE to tones is a matter for agreement between the gsmSCF operator and the gsmSRF operator.
C	Conditional (only one element shall be present).				

Inband Info contains the following information:

Information element name	MO	MF	MT	VT	Description
Message ID	M	M	M	M	This IE is described in the next table.
Number Of Repetitions	M	M	M	M	This IE indicates the maximum number of times the message shall be sent to the end-user.
Duration	O	O	O	O	This IE indicates the maximum duration time in seconds that the message shall be played/repeated. Zero indicates endless repetition.
Interval	O	O	O	O	This IE indicates the time interval in seconds between two repetitions.
M	Mandatory (The IE shall always be sent).				
O	Optional (Service logic dependent).				

Message ID contains the following information:

Information element name	MO	MF	MT	VT	Description
Elementary Message ID	C	C	C	C	This IE indicates a single announcement
Text	C	C	C	C	This IE indicates a text to be sent. The text shall be transformed to inband information (speech) by the gsmSRF.
Elementary Message IDs	C	C	C	C	This IE indicates a sequence of announcements
Variable Message	C	C	C	C	This IE indicates an announcement with one or more variable parts.
C	Conditional (only one element shall be present).				

Tone contains the following information:

Information element name	MO	MF	MT	VT	Description
Tone ID	M	M	M	M	This IE indicates the tone to be sent.
Duration	O	O	O	O	This IE indicates the maximum duration time in seconds that the message shall be played/repeated. Zero indicates endless repetition.
M	Mandatory (The IE shall always be sent).				
O	Optional (Service logic dependent).				

4.6.3.4 Prompt And Collect User Information (received information)

4.6.3.4.1 Description

This IF is used to interact with a call party in order to collect information.

4.6.3.4.2 Information Elements

The following information elements are required:

Information element name	MO	MF	MT	VT	Description
Collected Info	M	M	M	M	This IE is described in the next table.
Information To Send	O	O	O	O	This IE indicates an announcement or a tone to be sent to the end user by the gsmSRF.
Disconnect From IP Forbidden	O	O	O	O	This IE indicates whether the gsmSRF shall be disconnected from the user when all information has been sent.
O Optional (Service logic dependent).					

Collected Info contains the following information:

Information element name	MO	MF	MT	VT	Description
Collected Digits	M	M	M	M	This IE is described in the next table.
O Optional (Service logic dependent).					

Collected Digits contains the following information:

Information element name	MO	MF	MT	VT	Description
Minimum Number Of Digits	M	M	M	M	This IE indicates the minimum number of valid digits to be collected.
Maximum Number Of Digits	M	M	M	M	This IE specifies the maximum number of valid digits to be collected
End Of Reply Digit	O	O	O	O	This IE indicates the digit(s) used to signal the end of input.
Cancel Digit	O	O	O	O	If this IE is present, the cancel digit can be entered by the user to request a possible retry
Start Digit	O	O	O	O	If this IE is present, the start digit(s) indicates the start of the valid digits to be collected.
First Digit Time Out	O	O	O	O	If this IE is present, the first digit shall be received before the expiration of the first digit timer expiration
Inter Digit Time Out	O	O	O	O	If this IE is present, any subsequent valid or invalid digit shall be received by the gsmSRF before the inter digit timer expires.
Error Treatment	O	O	O	O	This IE indicates what specific action shall be taken by the gsmSRF in the event of error conditions occurring.
Interruptable Ann Ind	O	O	O	O	If this IE is set to TRUE (default value) the announcement is interrupted after the first valid or invalid digit received by the gsmSRF. If this IE is present and explicitly set to FALSE, the announcement will not be interrupted after the first digit is received by the gsmSRF
Voice Information	O	O	O	O	This IE is optional, where the default value is specified being FALSE. If the VoiceInformation IE is set to FALSE, all valid or invalid digits are entered by DTMF If this IE is present and explicitly set to TRUE, calling user is required to provide all valid or invalid information by speech
Voice Back	O	O	O	O	This IE is optional, where the default value is specified being FALSE. If the VoiceBack IE is set to FALSE, no voice back information is given by the gsmSRF If this IE is present and explicitly set to TRUE, the valid input digits received by the gsmSRF will be announced back to the calling user immediately after the end of input is received
O Optional (Service logic dependent).					

InformationToSend is defined in clause 4.6.3.3.

4.6.4 gsmSRF to gsmSCF information flows

4.6.4.1 Activity Test ack

4.6.4.1.1 Description

This IF is the response to the Activity Test.

4.6.4.1.2 Information Elements

This IF contains no information elements.

4.6.4.2 Assist Request Instructions

4.6.4.2.1 Description

This IF is sent to the gsmSCF by a gsmSSF which is acting as the assisting gsmSSF or by a gsmSRF.

4.6.4.2.2 Information Elements

The following information elements are required:

Information element name	MO	MF	MT	VT	Description
CorrelationID	M	M	M	M	This IE is used to associate the AssistRequestInstructions IF from an assisting gsmSSF or by a gsmSRF with the InitialDP from the initiating gsmSSF.
IP SSP Capabilities	M	M	M	M	This IE indicates which SRF resources are attached, available and supported within the MSC where the gsmSSF resides or the IP in which the gsmSRF resides.
M	Mandatory (The IE shall always be sent).				

4.6.4.3 Prompt And Collect User Information ack (received information)

4.6.4.3.1 Description

This IF is used by the gsmSRF to indicate the result a Prompt And Collect User Information IF.

4.6.4.3.2 Information Elements

The following information elements are required:

Information element name	MO	MF	MT	VT	Description
Digits Response	C	C	C	C	This IE indicates the digit sequence received from the end user
C	Conditional (The IE shall be sent, if available).				

4.6.4.4 Specialized Resource Report

4.6.4.4.1 Description

This IF is used to response to a PlayAnnouncement IF when the announcement complete indication is set.

4.6.4.4.2 Information Elements

This IF contains no information elements.

4.6.5 gsmSCF to Assisting SSF information flows

4.6.5.1 Activity Test

4.6.5.1.1 Description

This IF is used to check for the continued existence of a relationship between the gsmSCF and assistSSF. If the relationship is still in existence, then the assistSSF will respond. If no reply is received, then the gsmSCF will assume that the assistSSF has failed in some way and will take the appropriate action.

4.6.5.1.2 Information Elements

This IF contains no information elements.

4.6.5.2 Cancel

4.6.5.2.1 Description

This IF is described in clause 4.6.3.

4.6.5.3 Connect To Resource

4.6.5.3.1 Description

This IF is described in clause 4.6.2.

4.6.5.4 Play Announcement

4.6.5.4.1 Description

This IF is described in clause 4.6.3.

4.6.5.5 Prompt And Collect User Information

4.6.5.5.1 Description

This IF is described in clause 4.6.3.

4.6.5.6 Reset Timer

4.6.5.6.1 Description

This IF is described in clause 4.6.2.

4.6.6 Assisting SSF to gsmSCF information flows

4.6.6.1 Activity Test ack

4.6.6.1.1 Description

This IF is the response to the Activity Test.

4.6.6.1.2 Information Elements

This IF contains no information elements.

4.6.6.2 Assist Request Instructions

4.6.6.2.1 Description

This IF is defined in clause 4.6.4.

4.6.6.3 Prompt And Collect User Information ack (received information)

4.6.6.3.1 Description

This IF is described in clause 4.6.4.

4.6.6.4 Specialized Resource Report

4.6.6.4.1 Description

This IF is described in clause 4.6.4.

4.6.7 HLR to VLR information flows

4.6.7.1 Delete Subscriber Data

4.6.7.1.1 Description

This IF is used by an HLR to remove certain subscriber data from a VLR if the subscription of one or more supplementary services or basic services is withdrawn. Note that this IF is not used in case of erasure or deactivation of supplementary services. This IF is specified in 3GPP TS 29.002 [4].

4.6.7.1.2 Information Elements

The Delete Subscriber Data contains the following CAMEL specific IE:

Information element name	Required	Description
CAMEL Subscription Info Withdraw	C	This IE identifies that all CSIs shall be deleted from the subscriber data in VLR.
Specific CSI Withdraw	C	This IE indicates that one or more specific elements of CAMEL Subscription Info shall be deleted from the VLR. The specific elements of CAMEL Subscription Info which may be deleted are: - O-CSI with TDP criteria for O-CSI; - TIF-CSI; - D-CSI; - VT-CSI with TDP criteria for VT-CSI; This IE should not be sent when CAMEL Subscription Info Withdraw is present.
C	Conditional (The IE shall be sent when deletion is requested).	

4.6.7.2 Insert Subscriber Data

4.6.7.2.1 Description

This IF is used by an HLR to update a VLR with certain subscriber data. This IF is specified in 3GPP TS 29.002 [4].

4.6.7.2.2 Information Elements

Insert Subscriber Data contains the following CAMEL specific IE:

Information element name	Required	Description
O-CSI	C	This IE identifies the subscriber as having originating CAMEL services.
D-CSI	C	This IE identifies the subscriber as having originating CAMEL dialled services.
VT-CSI	C	This IE identifies the subscriber as having terminating CAMEL services in the VMSC.
C Conditional (The IE shall be sent, if required).		

O-CSI contains the following information:

Information element name	Required	Description
gsmSCF Address	M	This IE is described in clause 4.3.1
Service Key	M	This IE is described in clause 4.3.1.
Default Call Handling	M	This IE is described in clause 4.3.1.
TDP List	M	This IE is described in clause 4.3.1.
DP Criteria	O	This IE is described in clause 4.3.1.
CAMEL Capability Handling	C	This IE is described in clause 4.3.1. If this IE is absent, this indicates that CAMEL phase 1 is asked.
M Mandatory (The IE shall always be sent). C Conditional (The IE shall be sent when required). O Optional (service logic dependant).		

D-CSI contains the following information:

Information element name	Required	Description
gsmSCF Address	M	This IE is described in clause 4.3.2.
Service Key	M	This IE is described in clause 4.3.2.
Default Call Handling	M	This IE is described in clause 4.3.2.
DP Criteria	M	This IE is described in clause 4.3.2.
CAMEL Capability Handling	M	This IE is described in clause 4.3.2. The CAMEL Capability Handling shall indicate CAMEL phase 3 or higher.
M Mandatory.		

VT-CSI contains the following information:

Information element name	Required	Description
gsmSCF Address	M	This IE is described in clause 4.3.4.
Service Key	M	This IE is described in clause 4.3.4.
Default Call Handling	M	This IE is described in clause 4.3.4.
TDP List	M	This IE is described in clause 4.3.4.
DP Criteria	O	This IE is described in clause 4.3.4.
CAMEL Capability Handling	M	This IE is described in clause 4.3.4. The CAMEL Capability Handling shall indicate CAMEL phase 3 or higher.
M Mandatory. O Optional (service logic dependant).		

4.6.7.3 Provide Subscriber Info

4.6.7.3.1 Description

This IF is described in TS 23.018 [3] and is used by the HLR to request information (subscriber state and location) from the VLR at any time.

4.6.7.4 Provide Roaming Number

4.6.7.4.1 Description

This IF is specified in 3GPP TS 23.018 [3] and used by the HLR to request a roaming number from the VLR.

4.6.7.4.2 Information Elements

Provide Roaming Number contains the following CAMEL specific IE:

Information element name	Required	Description
Suppression Of Announcements	C	This IE indicates that announcements or tones generated as a result of unsuccessful call setup shall be suppressed.
Call Reference Number	M	This IE carries the Call Reference Number provided by the GMSC in the Send Routeing Info IF.
GMSC Address	M	This IE is the E.164 address of the GMSC
Alerting Pattern	C	This IE indicates the kind of Alerting Pattern to be applied.
GMSC CAMEL Phases	C	This IE indicates the CAMEL Phases supported in the GMSC.
M Mandatory (The IE shall always be sent).		
C Conditional (The IE shall be sent, if received from the GMSC in the Send Routeing Info).		

4.6.8 VLR to HLR information flows

4.6.8.1 Insert Subscriber Data ack

4.6.8.1.1 Description

This IF is used by the VLR to indicate to the HLR the result of the Insert Subscriber Data IF. This IF is specified in 3GPP TS 29.002 [4].

4.6.8.1.2 Information Elements

Insert Subscriber Data ack contains the following CAMEL specific IE:

Information element name	Required	Description
Supported CAMEL Phases	C	This IE identifies which CAMEL phases are supported by the MSC/VLR.
C Conditional (The IE shall always be sent when a CSI has been included in the ISD).		

4.6.8.2 Provide Subscriber Info ack

4.6.8.2.1 Description

This IF is described in TS 23.018 [3] and is used by the VLR to provide the requested information to the HLR.

4.6.8.3 Update Location

4.6.8.3.1 Description

This IF is used by the VLR to provide the information about supported CAMEL phases to the HLR.

4.6.8.3.2 Information Elements

Update Location contains the following CAMEL specific IE:

Information element name	Required	Description
Supported CAMEL phases	C	This IE indicates which phases of CAMEL are supported. It shall be present if a CAMEL phase different from phase 1 is supported. Otherwise may be absent.

4.6.8.4 Restore Data

4.6.8.4.1 Description

This IF is used by the VLR to provide the information about supported CAMEL phases to the HLR.

4.6.8.4.2 Information Elements

Restore Data contains the following CAMEL specific IE:

Information element name	Required	Description
Supported CAMEL phases	C	This IE indicates which phases of CAMEL are supported. It shall be present if a CAMEL phase different from phase 1 is supported. Otherwise may be absent.

4.6.9 HLR to GMSC information flows

4.6.9.1 Send Routeing Info ack

4.6.9.1.1 Description

This IF is specified in 3GPP TS 23.018 [3] and is used by the HLR to transfer the requested routeing information to the GMSC.

4.6.9.1.2 Information Elements

Send Routeing Info ack contains the following CAMEL specific IE:

Information element name	Required	Description
Location Information	C	This IE indicates the location of the served subscriber.
O-CSI	C	This IE identifies the subscriber as having originating CAMEL services. Shall be sent if O-CSI is active, and CFU or CFNRc has been invoked, or if both O-CSI and T-CSI are active.
D-CSI	C	This IE identifies the subscriber as having originating CAMEL dialled services. Shall be sent if D-CSI is active, and CFU or CFNRc has been invoked, or if both D-CSI and T-CSI are active.
Subscriber State	C	This IE indicates the status of the MS. The possible values of the IE are: - CAMELBusy: The VLR has indicated that the MS is engaged on a transaction for a mobile originating or terminated circuit-switched call. - NetworkDeterminedNotReachable: The VLR has indicated that the network can determine from its internal data that the MS is not reachable. - AssumedIdle: The VLR has indicated that the state of the MS is neither "CAMELBusy" nor "NetworkDeterminedNotReachable". - NotProvidedFromVLR: The VLR did not provide any information on subscriber state even though it was requested.
T-CSI	C	This IE identifies the subscriber as having terminating CAMEL services. Shall be sent if T-CSI is active and no Suppress T-CSI indicator is present in the SRI.
Basic Service Code	C	This IE indicates the type of basic service i.e., teleservice or bearer service.
CUG Subscription Flag	C	This IE indicates if the called party has a CUG subscription. It shall only be sent if the T-CSI is active and included in the Send Routing Information ack.
C	Conditional (The IE shall be sent, if available).	

Location Information contains is defined in 3GPP TS 23.018 [3]. The following differences apply:

Information element name	Required	Description
Service area ID	C1	See 3GPP TS 23.018 [3].
Cell ID	C1	See 3GPP TS 23.018 [3].
Current Location Retrieved	-	Not applicable
Location area ID	C1	See 3GPP TS 23.003 [37].
Selected LSA Identity	C	This IE indicates the LSA identity associated with the current position of the MS. Shall be present if the LSA ID in the subscriber data matches the LSA ID of the current cell. In the case of multiple matches the LSA ID with the highest priority shall be sent. See 3GPP TS 23.073 [23].
C	Conditional (The IE shall be sent, if available and SoLSA is supported).	
C1	Conditional (The IE shall be sent, if available. One and only one of the three conditional IEs shall be sent).	
-	Not applicable	

O-CSI is defined in clause 4.3.1.

D-CSI is defined in clause 4.3.2.

T-CSI contains the following information:

Information element name	Required	Description
gsmSCF Address	M	This IE is described in clause 4.3.3.
Service Key	M	This IE is described in clause 4.3.3.
Default Call Handling	M	This IE is described in clause 4.3.3.
TDP List	M	This IE is described in clause 4.3.3.
CAMEL Capability Handling	C	This IE is described in clause 4.3.3. If this IE is absent, this indicates that CAMEL phase 1 is asked.
M Mandatory.		
C Conditional.		

4.6.10 GMSC to HLR information flows

4.6.10.1 Send Routeing Info

4.6.10.1.1 Description

This IF is described in 3GPP TS 23.018 [3] and is used to request information from the HLR to route an MT call.

4.6.10.1.2 Information Elements

Send Routeing Info contains the following CAMEL specific IE:

Information element name	Required	Description
Alerting Pattern	C	This IE indicates the kind of Alerting Pattern to be applied.
Suppression Of Announcement	C	This IE indicates that announcements or tones generated as a result of unsuccessful call setup shall be suppressed. Shall be sent in the interrogation if available, i.e., when it has been received from the gsmSCF.
Suppress T-CSI	C	This IE indicates that T-CSI shall be suppressed. Shall always be sent in the second interrogation
Supported CAMEL Phases	M	This IE lists the supported CAMEL phases.
Call Reference Number	M	This IE carries the Call Reference Number allocated for the call by the GMSC. Shall be allocated once per call and sent in both first and second interrogations.
GMSC Address	M	This IE is the E.164 address of the GMSC
Call Diversion Treatment Indicator	C	This IE indicates whether or not the call can be forwarded using the Call Forwarding or Call Deflection Supplementary Services. Shall be sent if received within Forward Service Interaction Indicator in Service Interaction Indicators Two from the IAM or previous CAMEL processing.
C Conditional (The IE shall be sent, if received from the gsmSCF or set by the gsmSSF).		
M Mandatory (The IE shall always be sent when the GMSC supports CAMEL).		

4.6.11 VMSC to GMSC information flows

4.6.11.1 Resume Call Handling

4.6.11.1.1 Description

This IF is described in 3GPP TS 23.079 [36] and is used to request the GMSC to take over handling the call so that it can be forwarded from the GMSC.

4.6.11.1.2 Information Elements

Resume Call Handling contains the following CAMEL specific IE:

Information element name	Required	Description
O-CSI	C	This IE indicates that CAMEL handling applies for an optimally routed late forwarded call. This IE shall be present if CAMEL handling applies; otherwise it shall be absent. Trigger criteria for DP Collected Information, if present, shall be omitted in this IF. Trigger criteria for DP Route Select Failure, if present, shall be included in this IF.
D-CSI	C	This IE indicates that CAMEL handling applies for an optimally routed late forwarded call. This IE shall be present if CAMEL handling applies; otherwise it shall be absent.
C	Conditional (The IE shall be sent if applicable).	

4.6.12 MSC to VLR information flows

4.6.12.1 Send Info For Incoming Call

4.6.12.1.1 Description

This IF is described in 3GPP TS 23.018 [3] and is used to request the VLR to provide information to handle an incoming call.

4.6.12.1.2 Information Elements

Send Info For Incoming Call contains the following CAMEL specific IE:

Information element name	Required	Description
Suppress VT-CSI	C	This IE indicates that VT-CSI shall be suppressed. Shall never be sent in the first interrogation; shall always be sent in the second interrogation.
Call Diversion Treatment Indicator	C	This IE indicates whether or not the call can be forwarded using the Call Forwarding or Call Deflection Supplementary Services. Shall be sent if received within the Forward Service Interaction Indicator in the Service Interaction Indicators Two from the IAM or previous CAMEL processing.
C	Conditional (The IE shall be sent if applicable).	

4.6.12.2 Send Info For Outgoing Call

4.6.12.2.1 Description

This IF is described in 3GPP TS 23.018 [3] and is used to request the VLR to provide information to handle an outgoing call.

4.6.12.2.2 Information Elements

Send Info For Outgoing Call contains the following CAMEL specific IE.

Information element name	Required	Description
Suppress O-CSI	C	This IE indicates that O-CSI shall be suppressed. Shall always be sent in the second interrogation.
Suppress D-CSI	C	This IE indicates that D-CSI shall be suppressed. Shall always be sent in the second interrogation.
N-CSI available	C	This IE indicates that N-CSI is available in MSC. Shall be sent in the first interrogation if N-CSI is available in MSC.
C Conditional (The IE shall be sent if applicable).		

4.6.12.3 Send Info For Reconnected Call

4.6.12.3.1 Description

This IF is used to request the VLR to provide information to handle a reconnected call.

4.6.12.3.2 Information Elements

Send Info For Reconnected Call contains the following IE.

Information element name	Required	Description
Called number	M	E.164 number of the call destination.
Bearer service	C	Bearer service required for the MO call, derived from the GSM bearer capability information received in the setup request from the MS. One of bearer service or teleservice shall be present.
Teleservice	C	Teleservice required for the MO call, derived from the GSM bearer capability information received in the setup request from the MS or from the emergency setup request from the MS. One of bearer service or teleservice shall be present.
CUG index	C	For the definition of this IE, see 3GPP TS 23.085 [9]. Shall be present if it was received in the setup request from the MS.
Suppress preferential CUG	C	For the definition of this IE, see 3GPP TS 23.085 [9]. Shall be present if it was received in the setup request from the MS.
Suppress CUG outgoing access	C	For the definition of this IE, see 3GPP TS 23.085 [9]. Shall be present if it was received in the setup request from the MS.
Suppress O-CSI	C	This IE indicates that O-CSI shall be suppressed. Shall always be sent in the second interrogation.
M Mandatory (The IE shall always be sent). C Conditional (The IE shall be sent if applicable).		

4.6.13 VLR to MSC information flows

4.6.13.1 Complete Call

4.6.13.1.1 Description

This IF is described in 3GPP TS 23.018 [3] and is used to instruct the MSC to continue the connection of a call.

4.6.13.1.2 Information Elements

Complete Call contains the following CAMEL specific IE:

Information element name	MO	MF	MT	VT	Description
O-CSI	C	-	-	-	This IE indicates that CAMEL handling applies for an MO call. It shall be present in the response to the first interrogation for an MO call if CAMEL handling applies; otherwise it shall be absent. It shall be absent from the response to the second interrogation for an MO call and in the response to the interrogation for an MT call.
D-CSI	C	-	-	-	This IE identifies the subscriber as having originating CAMEL dialled services.
Call Reference Number	-	-	-	M	This IE carries the Call Reference Number provided by the HLR in the Provide Roaming Number IF.
GMSC Address	-	-	-	M	This IE is the E.164 address of the GMSC.
M Mandatory (The IE shall always be sent).					
C Conditional (The IE shall be sent if applicable).					

4.6.13.2 Continue CAMEL Handling

4.6.13.2.1 Description

This IF is used to instruct the MSC to continue the CAMEL specific handling.

4.6.13.2.2 Information Elements

Continue CAMEL Handling contains the following IE:

Information element name	Required	Description
VT-CSI	M	This IE identifies the subscriber as having terminating CAMEL services in the VMSC.
IMSI	M	IMSI of the B subscriber.
MSISDN	C	E.164 number which identifies the B subscriber. It will be used to create the redirecting number presented to the C subscriber. Shall be present if the call is to be forwarded, otherwise shall be absent.
CUG interlock	C	For the definition of this IE, see 3GPP TS 23.085 [9]. Shall be present if the VLR has determined that the forwarded call is to be treated as a CUG call in accordance with the rules in 3GPP TS 23.085 [9], otherwise shall be absent.
CUG outgoing access	C	For the definition of this IE, see 3GPP TS 23.085 [9]. Shall be present if the VLR has determined that the forwarded call is to be treated as a CUG call with outgoing access in accordance with the rules in 3GPP TS 23.085 [9], otherwise shall be absent.
Location information	C	Information to define the location of the MS: see definition in 3GPP TS 23.018 [3]. Shall be present if location information was requested and is available; otherwise shall be absent.
GMSC-Address	M	The E.164 address of the GMSC which was received in the Provide Roaming Number.
Call Reference Number	M	This IE carries the Call Reference Number provided by the HLR in the Provide Roaming Number IF.
ExtBasic Service Code	C	This IE indicates the type of basic service i.e., teleservice or bearer service.
M Mandatory (The IE shall always be sent).		
C Conditional (The IE shall be sent if applicable).		

4.6.13.3 Process Call Waiting

4.6.13.3.1 Description

This IF is described in 3GPP TS 23.018 [3] and is used to instruct the MSC to continue the connection of a waiting call.

4.6.13.3.2   Information Elements

Process Call Waiting contains the following CAMEL specific IE:

Information element name	Required	Description
Call Reference Number	M	This IE carries the Call Reference Number provided by the HLR in the Provide Roaming Number IF.
GMSC Address	M	This IE is the E.164 address of the GMSC.
M Mandatory (The IE shall always be sent).		

4.6.13.4   Send Info For Incoming Call ack

4.6.13.4.1   Description

This IF is described in 3GPP TS 23.018 [3] and is used to indicate that the incoming call for which the MSC requested subscription information shall be forwarded.

4.6.13.4.1   Information Elements

Send Info For Incoming Call ack contains the following CAMEL specific IE:

Information element name	Required	Description
O-CSI	C	This IE indicates that originating CAMEL service handling applies for a forwarded call. Shall be present if originating CAMEL service handling applies; otherwise shall be absent.
D-CSI	C	This IE indicates that originating CAMEL dialled service handling applies for a forwarded call. Shall be present if originating CAMEL dialled service handling applies; otherwise shall be absent.
Suppression Of Announcement	C	This IE indicates that announcements or tones generated when the call is forwarded shall be suppressed. Shall be sent if it was received in the Provide Roaming Number for this call.
Call Reference Number	M	This IE carries the Call Reference Number provided by the HLR in the Provide Roaming Number IF.
GMSC Address	M	This IE is the E.164 address of the GMSC.
M Mandatory (The IE shall always be sent). C Conditional (The IE shall be sent if applicable).		

4.6.13.5   Send Info For Incoming Call negative response

4.6.13.5.1   Description

This IF is described in 3GPP TS 23.018 [3] and is used to indicate that the incoming call for which the MSC requested subscription information shall not be connected.

4.6.13.5.2 Information Elements

Send Info For Incoming Call negative response contains the following CAMEL specific IE which may be attached as a IE to any of the negative response values defined in 3GPP TS 23.018 [3]:

Information element name	Required	Description
Suppression Of Announcement	C	This IE indicates that announcements or tones generated as a result of unsuccessful call setup shall be suppressed. Shall be sent if it was received in the Provide Roaming Number for this call.
C Conditional (The IE shall be sent if applicable).		

4.7 Interaction with supplementary services

4.7.1 Line identification

For an MO call subject to CAMEL interactions, the gsmSCF shall have the option to include the Calling Party Restriction Indicator parameter in the Connect message to the gsmSSF. This will be sent to the MSC and shall indicate whether the CLI Presentation Indicator present in the Calling Party Number Parameter shall be set by CAMEL action to Restricted.

4.7.2 Call forwarding services

4.7.2.1 Registration of Call Forwarding

The functional behaviour for the registration of the Call Forwarding supplementary service is defined in 3GPP TS 23.082 [27]. The procedure specific to CAMEL is defined in this clause:

- CAMEL_Check_CF_Interaction.

Procedure CAMEL_Check_CF_Interaction 1(1)

Procedure in the HLR to check the provision of TIF-CSI.
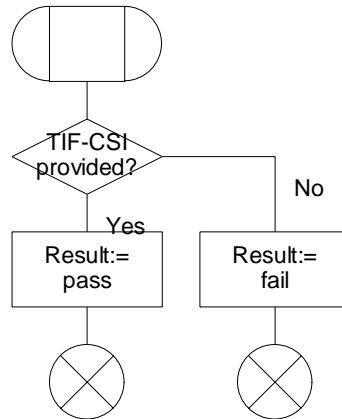
Figure 4.83: Procedure CAMEL_Check_CF_Interaction

4.7.2.2 Invocation of Call Forwarding

The functional behaviour for the invocation of the Call Forwarding supplementary service is defined in 3GPP TS 23.018 [3] and 3GPP TS 23.082 [27]. The following additional requirements apply.

When Call Forwarding is invoked for a CAMEL subscriber with O-CSI, the gsmSSF shall send the FTN to the gsmSCF in the format in which it was received from the HLR. When Call Forwarding is invoked for a CAMEL subscriber with D-CSI or if a N-CSI is present in the forwarding MSC, then the FTN shall be treated as defined in clause 4.2.1.2.2.

If the Service Interaction Indicators Two parameter was included in the Initial Address Message, the Continue With Argument message or the Connect message, the appropriate indicator shall be applied for the forwarded call.

An HLR shall not send an FTN which is not in international format to a GMSC which does not support CAMEL phase 2, i.e. if the HLR is handling a request from a GMSC for routeing information and the forwarded-to number is registered in a format other than international, the service logic in the HLR shall behave as if the call forwarding is provisioned but not registered.

4.7.2.3 Invocation of Call Deflection

The functional behaviour for the invocation of the Call Deflection supplementary service is defined in 3GPP TS 23.018 [3] and 3GPP TS 23.072 [35]. The following additional requirements apply.

When Call Deflection is invoked by a CAMEL subscriber with O-CSI, the gsmSSF shall send the DTN to the gsmSCF in the format in which it was received from the MS. When Call Deflection is invoked by a CAMEL subscriber with D-CSI or if a N-CSI is present in the VMSC, then the DTN shall be treated as defined in clause 4.2.1.2.2.

If the Service Interaction Indicators Two parameter was included in the Initial Address Message, the Continue With Argument message or the Connect message, the appropriate indicator shall be applied for the deflected call.

4.7.3 Call Barring services

When a CAMEL subscriber with O-CSI and TIF-CSI attempts to activate a conditional call barring service (BOIC,BOIC-exHC), the HLR shall not check the interactions with call forwarding.

4.7.4 Closed User Group

For a CUG subscriber with CAMEL services:

- The HLR shall store (and transfer to the VLR) the necessary subscriber data to ensure that the served subscriber is not unnecessarily prevented by CUG constraints from originating calls.

- The HLR shall store the necessary subscriber data to ensure that the served subscriber is not unnecessarily prevented by CUG constraints from receiving calls.

For an MO or MF call, the CUG information for that call shall be sent to the gsmSCF in the Initial DP.

If the gsmSCF returns a Continue message, the call shall continue with the original CUG information unchanged.

If the gsmSCF returns a Connect or Continue With Argument message, the CUG handling in table 4.6 applies.

Table 4.6: CUG handling on receipt of Connect or Continue With Argument for an MO or MF call

CUG parameters in message	Handling
Non-CUG call (note 1)	Remove CUG information for the call and continue as a non-CUG call
CUG information (note 2)	Call shall continue with modified CUG information
No CUG information	Call shall continue with original CUG information
NOTE 1: Received in Service Interaction Indicators Two IE.	
NOTE 2: CUG information consists of at least one of CUG Interlock Code and Outgoing Access Indicator.	

For an MT or VT call which is to be routed to the terminating subscriber, the CUG information shall be extracted from the incoming ISUP IAM and sent to the gsmSCF in the Initial DP, but the gsmSCF shall not have the ability to change the CUG information for the call.

For an MT or VT call which is subject to CAMEL forwarding, the gsmSCF shall return a Connect message and the CUG handling in table 4.6 applies.

5 USSD to/from gsmSCF

5.1 Architecture

5.1.1 Functional Entities used for CAMEL

This clause describes the functional architecture needed to support CAMEL handling of USSD to/from gsmSCF. The functional model of USSD in an HLR that supports CAMEL is shown in figure 5.1. The phase 2 USSD handler is defined in 3GPP TS 23.090 [8]. Phase 1 USSD messages may be relayed from the HLR to the gsmSCF. CAMEL introduces a "CAMEL USSD application" which is invoked by the USSD handler. The CAMEL USSD functional entities and application behaviour is specified in this clause.
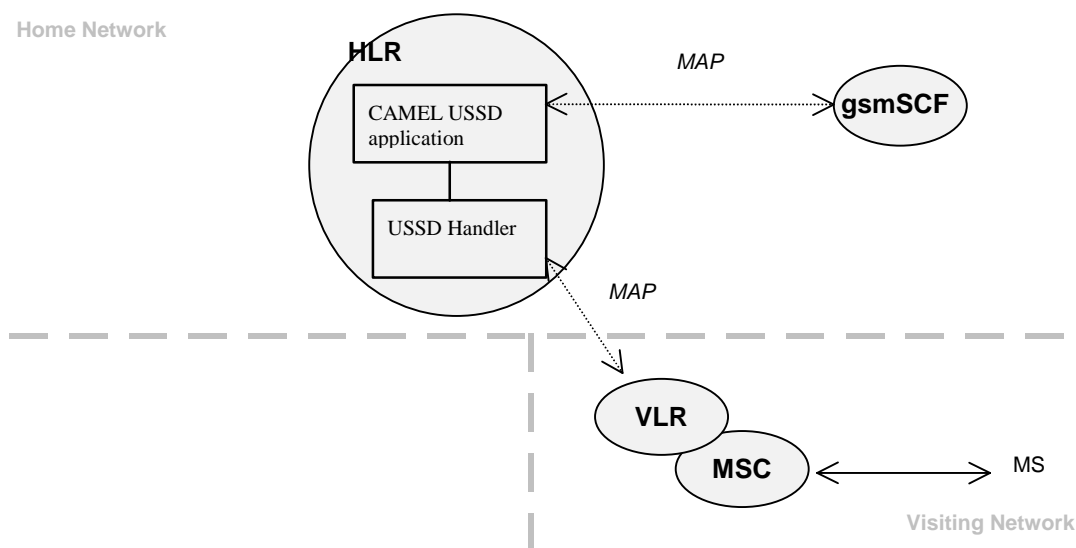
Figure 5.1: Handling of USSD to and from a CAMEL subscriber

HLR: The HLR stores for subscribers requiring CAMEL support the information relevant to the current subscription regarding U-CSI. The UG-CSI is stored as global data applicable to all subscribers. The U-CSI and the UG-CSI are stored in the HLR only.

gsmSCF: see clause 3.1.

5.1.2 Interfaces defined for CAMEL

This clause describes the different interfaces applicable to CAMEL. It specifies on a high level the functions specific to CAMEL.

5.1.2.1 gsmSCF - HLR interface

This interface is used for USSD operations, both for gsmSCF-initiated dialogues and MS-initiated dialogues (relayed via HLR). It is a network operator option whether to support or not USSD operations on this interface.

5.2 Description of CAMEL Subscriber Data

5.2.1 USSD CAMEL Subscription Information (U-CSI)

The subscription information specified in this clause is for information only.

This clause defines the contents of the USSD CAMEL Subscription Information (U-CSI). The U-CSI consists of a list of pairs of the following two parameters.

5.2.1.1 Service Code

Service code for a specific application in a gsmSCF which interacts with the user by USSD.

5.2.1.2 gsmSCF address

Address to be used to access the gsmSCF for a particular subscriber and a particular service code. The address shall be an E.164 number to be used for routeing.

5.3 Content of the USSD General CAMEL Service Information (UG-CSI)

The service information specified in this clause is for information only.

This clause defines the contents of the USSD General CAMEL Service Information (UG-CSI). The allocation of the UG-CSI is independent from a particular subscriber.

The UG-CSI consists of a list of pairs of the following two parameters.

5.3.1 Service Code

Service code for a specific application in a gsmSCF which interacts with the user by USSD.

5.3.2 gsmSCF address

Address to be used to access the gsmSCF for a particular a particular service code. The address shall be an E.164 number to be used for routeing.

5.4 Procedures

5.4.1 MS Initiated USSD

For the behaviour of the USSD handler in HLR when receiving a MS initiated USSD see 3GPP TS 23.090 [8].

When the USSD handler has determined that the service code present in the received USSD does not indicate that an USSD application in the HLR shall be invoked it shall route the USSD to the USSD application specific for CAMEL, i.e. the CAMEL USSD application.

The procedure at the CAMEL USSD application at the HLR is implementation dependent. The following text describes a recommended procedure.

The CAMEL USSD application shall check the U-CSI data assigned to the specific subscriber. If the service code is present in the U-CSI the USSD is routed to the gsmSCF given by the gsmSCF address stored against the service code in the U-CSI.

If the service code is not present in the U-CSI (or the subscriber does not have U-CSI defined) then the CAMEL USSD application shall check the UG-CSI data assigned to the HLR. If the service code is present in the UG-CSI then the USSD is routed to the gsmSCF given by the gsmSCF address stored against the service code in the UG-CSI.

If the service code is not present in U-CSI or UG-CSI an error (unknown application) is returned to the USSD handler.

5.4.2 gsmSCF Initiated USSD

The HLR may at any time receive a USSD operation from the gsmSCF. If the subscriber can be contacted, the HLR shall set up a transaction to the VLR and forward the operation unchanged. Any further information exchange between the gsmSCF and MSC shall be transparent to the VLR and the HLR. When one transaction is released, the HLR shall release the other. If an error is received from the MSC, the VLR shall release the transaction to the HLR and the HLR shall release the transaction to the gsmSCF.

5.5 Description of information flows

This clause contains the detailed description of the information flows used by CAMEL.

Each Information Element (IE) is marked as Mandatory (M), Conditional (C), Optional (O) or Not applicable (-). This categorization is a functional classification, i.e., stage 2 information and not a stage 3 classification to be used for the ASN.1 syntax of the protocol.

The following principles apply for the handling of the IEs by the receiving entity:

- The gsmSCF may silently discard any IE which it does not functionally support.

- The HLR shall return an error if it does not functionally support an IE which it receives.

Details of errors and exceptions to these rules are specified in are specified in 3GPP TS 29.002 [4].

5.5.1 gsmSCF to HLR information flows

5.5.1.1 Unstructured SS Request

5.5.1.1.1 Description

This IF is used for the gsmSCF to request data from the MS via the HLR.

5.5.1.1.2 Information Elements

The following information elements are required:

Information element name	Required	Description
USSD String	M	This IE contains the string that will be sent to the MS.
Data Coding Scheme	M	This IE indicates the characteristics of the USSD string.
IMSI	C	This IE identifies the subscriber for which the information is requested.
MSISDN	C	This IE identifies the subscriber for which the information is requested.
Alerting Pattern	O	This IE indicates an alerting pattern to be sent to the MS.
M	Mandatory (The IE shall always be sent).	
C	Conditional (This IE shall be sent if this IF is the first IF in a USSD dialogue. Either IMSI or MSISDN shall be present).	
O	Optional (Service Logic dependent).	

5.5.1.2 Unstructured SS Notify

5.5.1.2.1 Description

This IF is used for the gsmSCF to send data to the MS via the HLR.

5.5.1.2.2   Information Elements

The following information elements are required:

Information element name	Required	Description
USSD String	M	This IE contains the string that will be sent to the MS.
Data Coding Scheme	M	This IE indicates the characteristics of the USSD string.
IMSI	C	This IE identifies the subscriber for which the information is requested.
MSISDN	C	This IE identifies the subscriber for which the information is requested.
Alerting Pattern	O	This IE indicates an alerting pattern to be sent to the MS.
M	Mandatory (The IE shall always be sent).	
C	Conditional (This IE shall be sent if this IF is the first IF in a USSD dialogue. Either IMSI or MSISDN shall be present).	
O	Optional (Service Logic dependent).	

5.5.1.3   Process Unstructured SS Data ack

5.5.1.3.1   Description

This IF is used for the gsmSCF to send the response to the MS via the HLR for the MS initiated operation.

5.5.1.3.2   Information Elements

The following information element is required:

Information element name	Required	Description
SS User Data	C	This IE contains the string that will be sent to the MS.
C	Conditional (The IE shall be sent, if requested and available).	

5.5.1.4   Process Unstructured SS Request ack

5.5.1.4.1   Description

This IF is used for the gsmSCF to send the response to the MS via the HLR for the MS initiated operation.

5.5.1.4.2   Information Elements

The following information elements are required:

Information element name	Required	Description
USSD String	C	This IE contains the string that will be sent to the MS.
Data Coding Scheme	C	This IE indicates the characteristics of the USSD string.
C	Conditional (the presence of the IE depends on the application. Both IEs shall be sent).	

5.5.2   HLR to gsmSCF information flows

5.5.2.1   Unstructured SS Request ack

5.5.2.1.1   Description

This IF is used for the MS to via the HLR send the response to the gsmSCF for the gsmSCF initiated operation.

5.5.2.1.2 Information Elements

The following information elements are required:

Information element name	Required	Description
USSD String	C	This IE contains the string that will be sent to the gsmSCF.
Data Coding Scheme	C	This IE indicates the characteristics of the USSD string.
C Conditional (The presence of the IE depends on the application. Both IEs shall be sent).		

5.5.2.2 Unstructured SS Notify ack

5.5.2.2.1 Description

This IF is used for the MS to via the HLR acknowledge to the gsmSCF that the notification was received.

5.5.2.2.2 Information Elements

This IE contains no information element.

5.5.2.3 Process Unstructured SS Data

5.5.2.3.1 Description

This IF is used for the MS to request data from the gsmSCF via the HLR.

5.5.2.3.2 Information Elements

The following information element is required:

Information element name	Required	Description
SS User Data	M	This IE contains the string that was received from the MS.
M Mandatory (The IE shall always be sent).		

5.5.2.4 Process Unstructured SS Request

5.5.2.4.1 Description

This IF is used for the gsmSCF to request data from the MS via the HLR.

5.5.2.4.2 Information Elements

The following information elements are required:

Information element name	Required	Description
USSD String	M	This IE contains the string that will be sent to the gsmSCF, including the Service Code.
Data Coding Scheme	M	This IE indicates the characteristics of the USSD string.
IMSI	M	This IE identifies the subscriber.
MSISDN	O	This IE contains the basic MSISDN of the subscriber who has requested the USSD operation. This IE is used as an operator option.
Originating Entity Number	M	This IE identifies the functional entity initiating the information flow. In this case, this shall be the address of the HLR.
M Mandatory (The IE shall always be sent). O Optional (Operator option).		

5.5.2.5 Begin Subscriber Activity

5.5.2.5.1 Description

This IF is used by the HLR to start subscriber activity towards the gsmSCF for USSD purposes.

5.5.2.5.2 Information Elements

The following information elements are required:

Information element name	Required	Description
IMSI	M	This IE identifies the subscriber.
Originating Entity Number	M	This IE identifies the functional entity initiating the subscriber activity. In this case, this shall be the address of the HLR.
M	Mandatory (The IE shall always be sent).	

6 GPRS interworking

6.1 Architecture

6.1.1 Functional Entities used for CAMEL

This clause describes the functional architecture needed to support GPRS interworking for CAMEL. Figure 6.1 shows the functional entities involved in a GPRS session requiring CAMEL support. The architecture is applicable to the third phase of CAMEL.

Home/Interrogating/Visiting Network
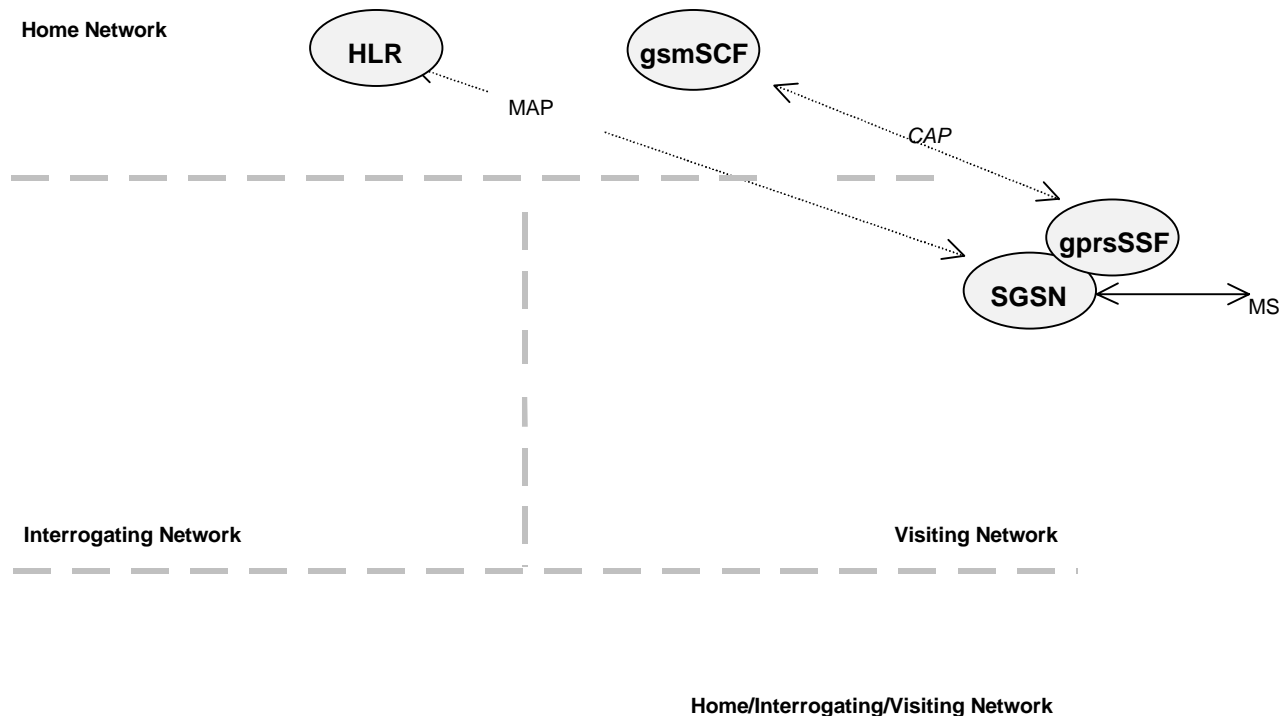
Figure 6.1: Functional architecture for support of CAMEL

HLR: The HLR stores for subscribers requiring CAMEL support the information relevant to the current subscription GPRS-CSI. The GPRS-CSI is stored in the HLR.

SGSN: When processing GPRS Attach requests or Inter-SGSN Routeing Area Updates for subscribers requiring CAMEL support, the SGSN receives a GPRS-CSI from the HLR, indicating the SGSN to request instructions from the gprsSSF. The SGSN monitors on request the GPRS events and informs the gprsSSF of these events during processing, enabling the gprsSSF to control the execution of the GPRS session or individual PDP contexts in the SGSN.

gprsSSF: see clause 3.1.

gsmSCF: see clause 3.1.

6.1.2 Interfaces defined for CAMEL

6.1.2.1 SGSN - gprsSSF interface

This is an internal interface. The interface is described in the specification to make it easier to understand the handling of DPs (arming/disarming of DPs, DP processing etc.).

6.1.2.2 gprsSSF - gsmSCF interface

This interface is used by the gsmSCF to control a GPRS session or individual PDP Context in a certain gprsSSF. GPRS dialogues between the gprsSSF and the gsmSCF on this interface are opened as a result of the gprsSSF sending a request for instructions to the gsmSCF. A GPRS dialogue is composed of a sequence of TC dialogues linked together by the same reference. The GPRS dialogue handler allows the TC dialogue handling.

6.1.2.3 HLR – SGSN interface

This interface is used to send CAMEL related subscriber data to a visited GPRS network, e.g. GPRS-CSI.

6.2 Detection Points (DPs)

6.2.1 Definition and description

GPRS events may be made visible to the gsmSCF. The DPs are the points in association at which these events are detected. The DPs for GPRS Session and PDP Context are described in clause 6.4.2 and clause 6.4.3.

A DP can be armed in order to notify the gsmSCF that the GPRS event was encountered, and to allow the gsmSCF to influence subsequent handling of the GPRS Session, or the PDP Context. If the DP is not armed, the processing entity continues the processing without gsmSCF involvement at this DP.

Three different types of DPs are identified:

- Trigger Detection Point-Request (TDP-R): This detection point is statically armed and may initiate a CAMEL control relationship. This CAMEL control relationship is within a new GPRS dialogue. When the GPRS event is encountered and reported, processing is suspended.

- Event Detection Point- Request (EDP-R): This detection point is dynamically armed within the context of a CAMEL control relationship. When the GPRS event is encountered, and reported, processing is suspended and the gprsSSF waits for instructions from the gsmSCF.

- Event Detection Point-Notification (EDP-N): This detection point is dynamically armed within the context of a CAMEL control relationship. When the GPRS event is encountered and reported, processing is not suspended.

Arming/disarming mechanism:

A DP may be statically armed or dynamically armed. The following arming rules apply:

- DPs for GPRS Session and PDP Context are statically armed as a result of the GPRS-CSI analysis in the SGSN.

- DPs may be dynamically armed by the gsmSCF within the context of a CAMEL control relationship. In scenario 1 which is described in the clause 6.4.4.1, PDP context related DPs may be armed as generic DP or as non-generic DP.

The following disarming rules apply:

- A statically armed DP is disarmed when the GPRS-CSI is withdrawn in the HLR. Only TDP-Rs can be disarmed using this mechanism.

- If the GPRS Session is released, then all EDPs related to the GPRS Session are disarmed.

- If a PDP context is released, then all non-generically armed EDPs related to that PDP context are disarmed.

- If a non-generically armed EDP is met, then EDPs for the GPRS Session or that PDP Context are disarmed, in accordance with the implicit disarming rule (see clause 6.4.6).

- Armed EDPs may be explicitly disarmed by the gsmSCF by means of the Request Report BCSM Event information flow.

6.2.2 Relationship, DP processing rules and GPRS dialogue

A relationship between the State Models (in the gprsSSF) and the gsmSCF for the purpose of operator specific service processing is considered to be a CAMEL relationship. There are two types of CAMEL relationships: monitor relationship and control relationship.

- A CAMEL control relationship: the gsmSCF is able to influence the GPRS Session/PDP Context via the relationship for the given state model.

- A CAMEL monitor relationship: the gsmSCF is not able to influence the GPRS Session/PDP Context via the relationship for the given state model.

A control relationship persists as long as there is one or more EDP-R armed for this instance of the state model, or if the gprsSSF is in the state Waiting For Instruction for this instance of state model.

A control relationship changes to a monitor relationship if the conditions for a control relationship are no longer fulfilled and one or more EDP-N is armed or one or more Apply Charging Report is outstanding for this instance of the state model. If no EDP-Ns are armed and no Apply Charging Reports are outstanding for this instance of the state model, the relationship terminates.

A GPRS dialogue exists between gprsSSF and gsmSCF if at least one of the following conditions is fulfilled:

- There is at least one EDP armed;

- At least one report is pending;

- gprsSSF is in state Waiting_For_Instructions.

6.3 Description of CAMEL Subscriber Data

6.3.1 GPRS CAMEL Subscription Information (GPRS-CSI)

This clause defines the contents of the GPRS CAMEL Subscription Information.

6.3.1.1 gsmSCF Address

Address to be used to access the gsmSCF for a particular subscriber. The address shall be an E.164 number to be used for routeing.

6.3.1.2 Service Key

The Service Key identifies to the gsmSCF the service logic that shall apply.

6.3.1.3 Default GPRS Handling

The Default GPRS Handling indicates whether the GPRS session or PDP context shall be released or continued as requested in case of error in the gprsSSF to gsmSCF dialogue.

6.3.1.4 TDP List

The TDP List indicates on which detection point triggering shall take place.

6.3.1.5 CAMEL Capability Handling

CAMEL Capability Handling indicates the phase of CAMEL which is asked by the gsmSCF for the service.

6.3.1.6 CSI state

The CSI state indicates whether the GPRS-CSI is active or not.

6.3.1.7 Notification flag

The notification flag indicates whether the change of the GPRS-CSI shall trigger Notification on Change of Subscriber Data or not.

6.3.1.8 gsmSCF address list for CSI

The gsmSCF address list contains a list of gsmSCF addresses to which Notification on Change of Subscriber Data is to be sent. This list is common to all CSI.

6.4 Description of CAMEL State Models

GPRS can support multiple PDP contexts simultaneously for an attached subscriber, requiring the behaviour of a GPRS session to be modelled by two state models, one for the attach/detach procedures (GPRS Attach/Detach State Model) and the other for modelling individual PDP Contexts (GPRS PDP Context State Model).

6.4.1 General Handling

The GPRS State Model is used to describe the actions in an SGSN during processing of a GPRS session or PDP Contexts.

The GPRS State Model identifies the points in basic GPRS processing when Operator Specific Service (OSS) logic instances (accessed through the gsmSCF) are permitted to interact with basic GPRS control capabilities.

Figure shows the components that have been identified to describe a GPRS State Model.
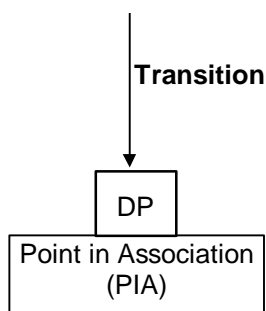
Figure 6.2: GPRS State Model Components

6.4.2 GPRS Attach/Detach State Model

The GPRS Attach/Detach State Model is used to model the behaviour of the GPRS attach/detach procedures.

When encountering a DP the Attach/Detach State Model processing is suspended at the DP and the SGSN indicates this to the gprsSSF which determines what action, if any, shall be taken in case the DP is armed.

Change of Position GPRS Session
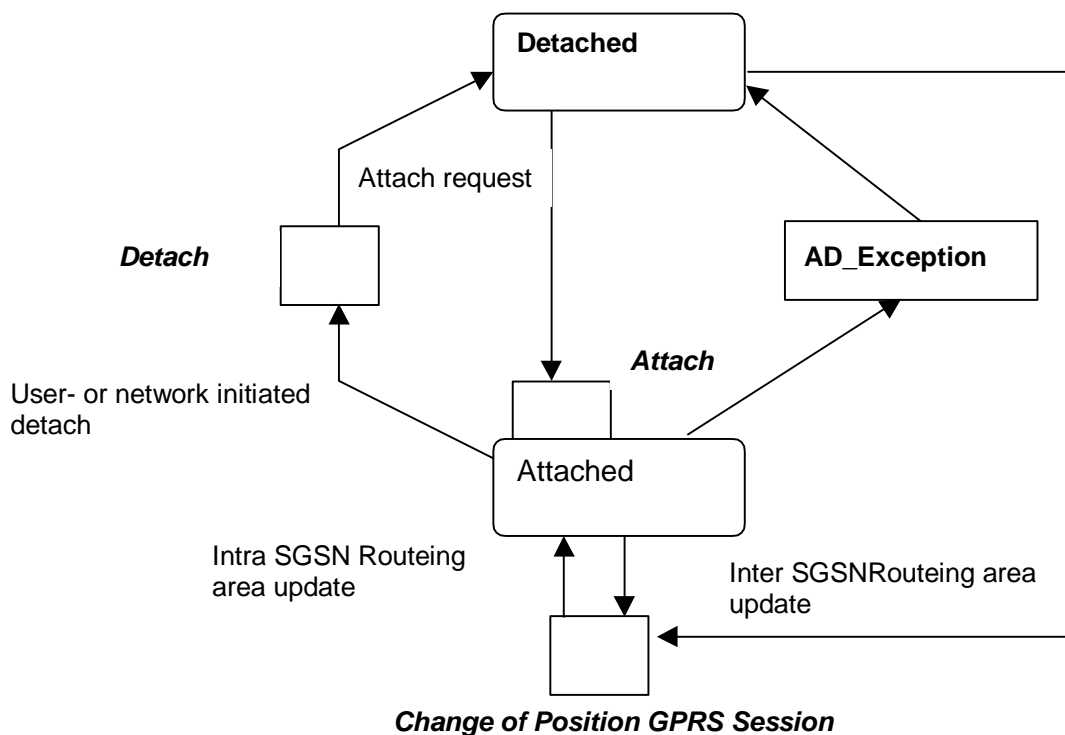
Figure 6.3: GPRS Attach/Detach State Model

Table 6.1: Description of GPRS Attach/Detach DPs in the SGSN

CAMEL Detection Point	DP Type	Description
DP Attach	TDP-R	A request to attach is received.
DP Change of Position GPRS Session	TDP-R[1)], EDP-N	Routeing Area Update is accepted.
DP Detach	EDP-N, EDP-R	A detach request is received either from the MS, the SGSN or a 'Cancel Location' received from HLR or Inter SGSN Routeing update occurred in the old SGSN.
Note 1: Change of Position GPRS Session is reported as TDP-R in the case of Inter-SGSN Routeing Area Update (provided that this DP is statically armed in GPRS-CSI). Change of Position GPRS Session is reported as EDP-N in the case of Intra-SGSN Routeing Area Update (provided that this DP is dynamically armed by the Service Logic).		

6.4.2.1   Description of the Attach/Detach model (PIAs)

This clause describes the model for the attach and detach a GPRS session in the SGSN. For each PIA a description can be found of the entry events, actions and exit events.

6.4.2.1.1   Detached

Entry events:

- Detach (user or network initiated) and clearing of a previous GPRS session.

- Processing of exceptional conditions.

Actions:

- Interface is idled.

- Attach request is received from MS containing the IMSI/P-TMSI and the type of attach requested and, the identity of the MS is established (IMSI) (DP Attach), or Inter-SGSN Routeing Area Update Request is accepted (DP Change of Position GPRS Session).

- Information being analysed, e.g. GPRS-CSI is analysed.

Exit events:

- GPRS-CSI is analysed (DP Attach or DP Change of Position GPRS Session).

6.4.2.1.2 Attached

Entry events:

- GPRS-CSI is analysed (DP Attach).

Actions:

- MM contexts are established at the MS and the SGSN.

Exit events:

- A GPRS Detach request is received from the MS or from the network (DP Detach).

- Intra-SGSN Routeing Area Update is accepted (DP Change of Position GPRS Session).

- An exception is encountered.

The GPRS Attach/Detach State Model shall only have one or more GPRS PDP Context State Models associated with it when in the Attached state. A GPRS PDP Context State Model cannot exist without its associated GPRS Attach/Detach State Model being in the Attached state. Closure of the GPRS Attach/Detach State Model via a detach will result in the idling of all associated GPRS PDP Context State Models and the release of the associated GPRS PDP Contexts.

It shall not be necessary to trigger a relationship from the GPRS Attach/Detach State Model to the gsmSCF in order for triggering to occur in an associated GPRS PDP Context State Model. However, in this latter case a GPRS Attach/Detach State Model shall still exist at the SGSN. This is so that CSE-initiated detach events sent within a given GPRS PDP Context relationship shall result in the GPRS Attach/Detach State Model transiting to the Detached state. As noted above, in this state no PDP Contexts can exist and so all associated GPRS PDP Context State Models will transit to state Idle.

6.4.3 GPRS PDP Context State Model

The GPRS PDP Context State Model is used to model the behaviour for the GPRS PDP Context procedures. There is one PDP Context State Model per GPRS PDP context.

When encountering a DP the PDP Context State Model processing is suspended at the DP and the SGSN indicates this to the gprsSSF which determines what action, if any, shall be taken in case the DP is armed.
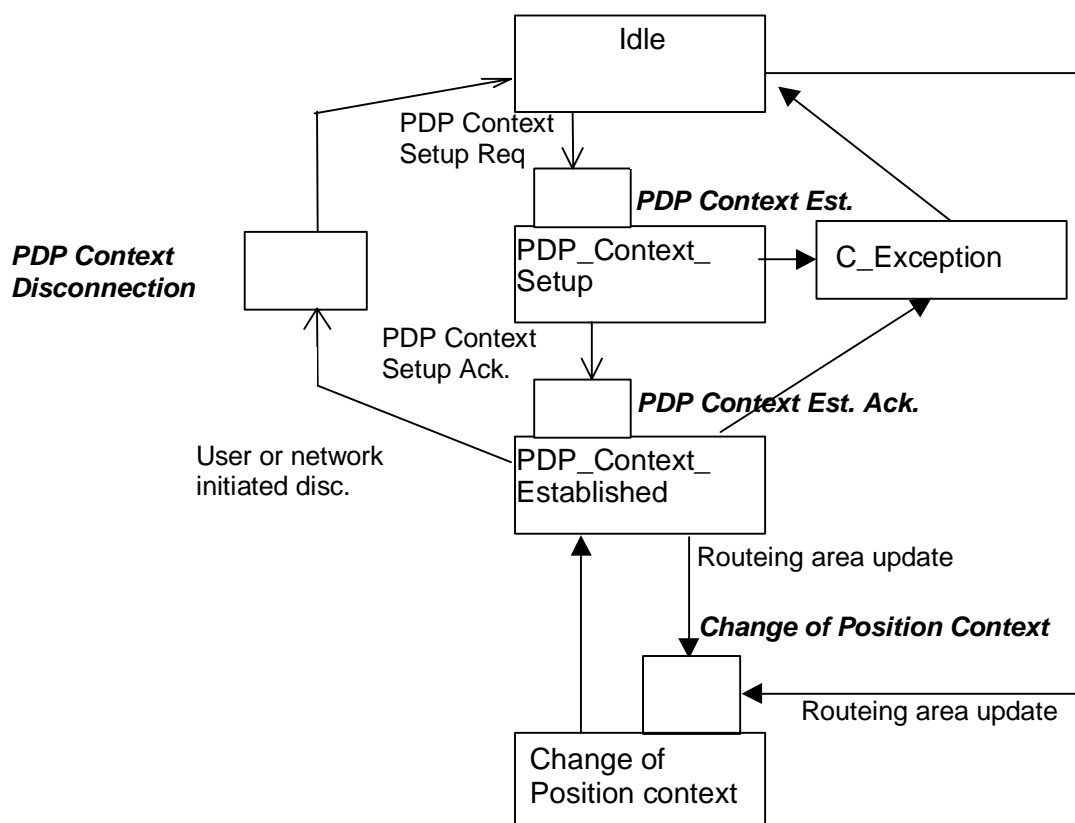
Figure 6.4: GPRS PDP Context State Model

Table 6.2: Description of GPRS PDP Context DPs in the SGSN

CAMEL Detection Point	DP Type	Description
DP PDP Context Establishment	TDP-R[1], EDP-R, EDP-N	Activate PDP Context request is received from the MS.
DP PDP Context Establishment Acknowledgement	TDP-R[2], EDP-R, EDP-N	Create PDP Context response is received from the GGSN.
DP PDP Context Disconnection	EDP-N, EDP-R	Deactivate PDP Context Request is received from the MS, Delete PDP Context request is received from the GGSN. Inter SGSN Routeing update occurred in old SGSN.
DP Change of Position Context	TDP-R[3], EDP-N, EDP-R	Routeing Area Update is accepted.
NOTE 1: The PDP Context Establishment shall be reported as TDP-R (provided that this DP is statically armed in GPRS-CSI) if there is no relationship with the gsmSCF. If there is a relationship with the gsmSCF it shall be reported as EDP-R or EDP-N if armed so.		
NOTE 2: The PDP Context Establishment Acknowledgment shall be reported as TDP-R (provided that this DP is statically armed in GPRS-CSI) if there is no relationship with gsmSCF. If there is a relationship with the gsmSCF, it shall be reported as EDP-R or EDP-N if armed so.		
NOTE 3: Change of Position Context is reported as TDP-R in the case of Inter-SGSN Routeing Area Update (provided that this DP is statically armed in GPRS-CSI) if there is no relationship with the gsmSCF. Change of Position Context is reported as EDP-N or EDP-R in the case of Inter-SGSN Routeing Area Update (provided that this DP is armed as generic EDP) if there is a relationship with the gsmSCF. Change of Position Context is reported as EDP-N in the case of Intra-SGSN Routeing Area Update (provided that this DP is dynamically armed by the Service Logic).		

6.4.3.1 Description of the PDP Context model (PIAs)

This clause describes the model for PDP Context State Model in the SGSN. For each PIA a description can be found of the entry events, actions and exit events.

6.4.3.1.1 Idle

Entry events:

- Deactivation (user or network initiated) and clearing of a previous PDP Context.

- Processing of exceptional conditions.

Actions:

- Interface is idled.

- Activate PDP Context request is received from MS (containing NSAPI, PDP Type, PDP Address, Access Point Name, QoS Requested, PDP Configuration Options), or Inter-SGSN Routeing Area Update is accepted (DP Change of Position Context).

- Information being analysed, e.g. GPRS-CSI is analysed.

Exit events:

- GPRS-CSI is analysed (DP PDP Context Establishment or DP Change of Position Context, new SGSN).

6.4.3.1.2 PDP Context Setup

Entry events:

- GPRS-CSI is analysed (DP PDP Context Establishment).

Actions:

- *APN and GGSN selection* procedure is performed for a primary PDP context as specified in Annex A of 3GPP TS 23.060. *APN and GGSN selection* procedure is not performed for a secondary PDP context.

- Access Point Name is verified against the subscription. If the gsmSCF has provided an Access Point Name then the Access Point Name provided by the gsmSCF is checked against the subscription. For details refer to 3GPP TS 23.060 [11] Annex A.

- The SGSN ensures that an already active PDP context is not reactivated.

- GGSN address is derived from the Access Point Name by interrogation of a DNS. The Access Point Name consists of a Network Identifier and an Operator Identifier.

- Create PDP Context Request is sent to the GGSN.

Exit events:

- Create PDP Context Response is received from the GGSN (DP PDP Context Establishment Acknowledgement).

- An exception is encountered.

6.4.3.1.3 PDP Context Established

Entry events:

- GPRS-CSI is analysed (DP PDP Context Establishment Acknowledgement or DP Change of Position Context).

Actions:

- PDP context is established at the MS and the SGSN.

Exit events:

- Deactivation of the PDP Context is received from the MS or the GGSN, or is due to an inter SGSN routing area update (DP PDP Context Disconnection, old SGSN).

- Intra-SGSN Routeing Area Update Request is received from the MS (DP Change of Position Context).

- Inter-SGSN Routeing Area Update (DP Change of Position Context, new SGSN).

- An exception is encountered.

6.4.3.1.4 Change of Position Context

Entry events:

- Inter SGSN Routing Area update accepted (new SGSN).

- Intra SGSN Routeing Area update request received from the MS.

Actions:

- PDP Context (containing NSAPI, PDP Type, PDP Address, Access Point Name, QoS Requested, PDP Configuration Options) is re-established in case of Inter-SGSN Routeing Area update accepted (new SGSN).

- Intra SGSN Routeing Area updated.

Exit events:

- reestablishment of the PDP context at the new SGSN and return to PDP context established in case of inter SGSN Routeing Area update accepted in new SGSN (PIA PDP context established).

- Routeing Area update completed in case of intra SGSN Routeing Area update (PIA PDP context established).

6.4.4 GPRS CAMEL Scenarios

Two different scenarios are applicable for CAMEL control of GPRS.

Scenario 1:
Scenario 1 allows CAMEL control of the GPRS session and of multiple PDP contexts related to this session within a single GPRS dialogue.

Scenario 2:
Scenario 2 allows CAMEL control of single PDP contexts. Multiple PDP contexts are controlled in this scenario via multiple GPRS dialogues.

Scenario 1 and scenario 2 are mutually exclusive, i.e. it is not possible to use both for one GPRS session at the same time in one SGSN. A GPRS session is involved in GPRS CAMEL at one moment in time either by using scenario 1 or by using possible multiple instances of scenario 2. GPRS sessions in different SGSNs are independent from a CAMEL perspective.

6.4.4.1 GPRS CAMEL Scenario 1

Scenario 1 allows CAMEL control of the GPRS session and of multiple PDP contexts related to this session within a single GPRS dialogue (Session dialogue).
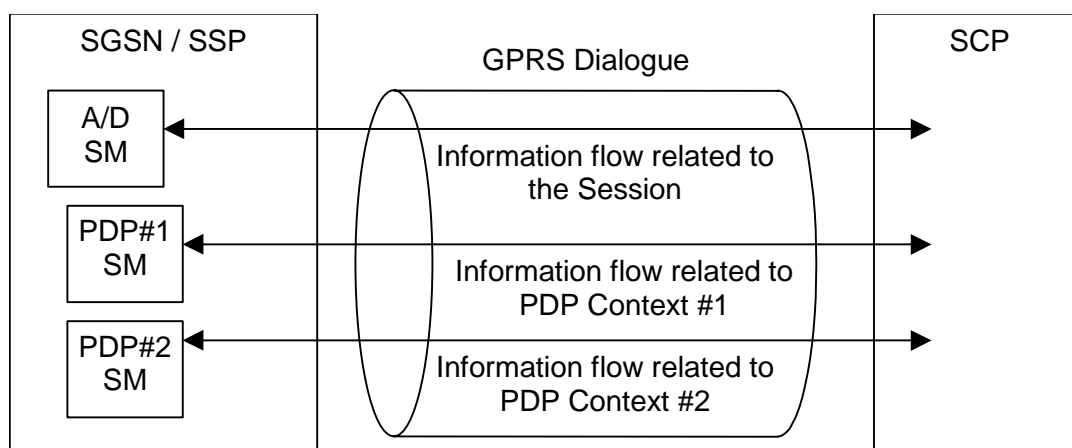
Figure 6.5: GPRS CAMEL Scenario 1

A GPRS dialogue in scenario 1 always consists of one GPRS Attach/Detach State Model and optionally of additional multiple GPRS PDP Context State Models related to the Attach/Detach State Model for the GPRS session. There is at most one GPRS Attach/Detach State Model per non idle GPRS session in one SGSN and at most one PDP Context State Model per active GPRS PDP context in one SGSN. The various PDP Context State Models are treated independently of each other.

The GPRS dialogue and the relationship between the GPRS Attach/Detach State Model and the gsmSCF are always initiated using the TDPs of the GPRS Attach/Detach State Model.

The gsmSCF requests further control or monitoring of individual GPRS PDP contexts using the Request Report GPRS Event information flow. To be informed about new individual PDP contexts the gsmSCF arms the DP 'PDP Context Establishment' or the DP 'PDP Context Establishment Acknowledgement' generically, i.e. without a PDP ID, as an EDP. To be informed about the handed over PDP contexts the gsmSCF arms the DP 'Change of Position Context' generically as an EDP-N or EDP-R.

Each GPRS PDP context is identified by a PDP ID. The PDP ID is assigned by the SGSN during PDP context establishment. The PDP ID is unique within one GPRS dialogue. The Request Report GPRS Event information flows to control new or handed over PDP contexts do not include a PDP ID. There is no 'PDP ID' related to the GPRS Attach/Detach State Model.

The PDP Id is reported to the gsmSCF in the first event notification for that PDP context.

6.4.4.2 GPRS CAMEL Scenario 2

Scenario 2 allows CAMEL control of single PDP contexts. Multiple PDP contexts are controlled in this scenario via multiple GPRS dialogues (PDP Context dialogues).
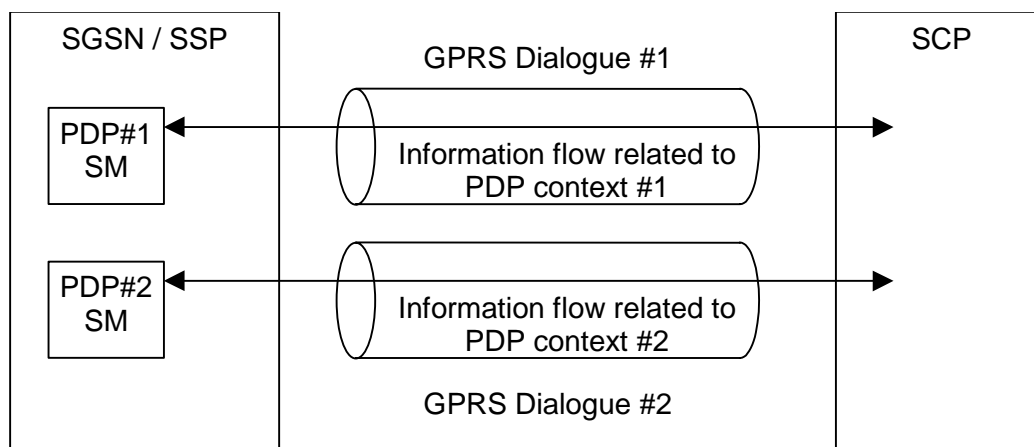
Figure 6.6: GPRS CAMEL Scenario 2

A GPRS dialogue in scenario 2 consists of a single GPRS PDP Context State Model. There is no GPRS Attach/Detach State Model involved in this scenario. There is at most one PDP Context State Model per active GPRS PDP context in one SGSN.

There might be multiple GPRS dialogues in scenarios 2 for one GPRS session, each of the dialogues controlling a single GPRS PDP context. The various GPRS dialogues are independent of each other.

The GPRS dialogue and the relationship between the GPRS PDP Context State Model and the gsmSCF are always initiated using the TDPs for the GPRS PDP Context State Model.

Control of further individual GPRS PDP contexts in the same GPRS dialogue as in scenario 1 is not possible. There are no PDP IDs in this scenario.

6.4.5 SGSN Routeing Area Update

6.4.5.1 Intra-SGSN Routeing Area Update

Intra-SGSN Routeing Area Update will be detected via the DP 'Change of Position GPRS Session' for the session using the GPRS Attach/Detach State Model and via the DPs 'Change of Position Context' for the individual PDP contexts using the GPRS PDP Context State Models.

It will be reported via an EDP-N if the necessary EDP-N is armed.

6.4.5.2 Inter-SGSN Routeing Area Update

Inter-SGSN Routeing Area Update from the old SGSN to the new SGSN will be detected via the DP 'Change of Position GPRS Session' for the session using the GPRS Attach/Detach State Model and via the DPs 'Change of Position Context' using the GPRS PDP Context State Models for the individual PDP contexts which have been handed over.

Scenario 1:

Inter-SGSN Routeing Area Update from the old SGSN to the new SGSN will be detected in the new SGSN via the DP 'Change of Position GPRS Session' for the session using the GPRS Attach/Detach State Model and in the new SGSN via the DPs 'Change of Position Context' using the GPRS PDP Context State Models for the individual PDP contexts which have been handed over.

In this scenario the DP 'Change of Position GPRS Session' is armed as a TDP-R. If the Routeing Area Update is accepted the gprsSSF reports this TDP-R to the gsmSCF using the Initial DP GPRS information flow. To be informed about new PDP contexts the gsmSCF arms the DP 'PDP Context Establishment' or the DP 'PDP Context Establishment Acknowledgement' generically as EDP-R or EDP-N. The DPs 'Change of Position Context' for the PDP contexts which have been handed over will be reported with all necessary information to the gsmSCF when the gprsSSF is continued, i.e. it is not longer waiting for instructions. Contexts which are not continued in the new SGSN are not reported. The EDPs for new PDP contexts are reported as usual.

The Detach in the old SGSN is reported to the gsmSCF, provided this event is armed. All outstanding reports in the old SGSN are sent to the gsmSCF and all open CDRs are closed.

Scenario 2:

Inter-SGSN Routeing Area Update from the old SGSN to the new SGSN will be detected in the new SGSN via the DPs 'Change of Position Context' using the GPRS PDP Context State Models for the individual PDP contexts which have been handed over.

In this scenario the DP 'Change of Position Context' is armed as TDP-R. If the Routeing Area Update is accepted the gprsSSF reports these TDP-Rs PDP contexts which have been handed over to the gsmSCF using the Initial DP GPRS information flows in multiple GPRS dialogues.

The PDP Context Disconnection in the old SGSN is reported to the gsmSCF, provided this event is armed. All outstanding reports in the old SGSN are sent to the gsmSCF and the open CDR is closed.

6.4.6 Rules for Implicit Disarming of Detection Points

The following two tables give the rules for implicit disarming of event detection points.

Implicit EDP disarming rules are specified for the Attach/Detach State Model and PDP Context State Model. The tables specify which EDP's shall be disarmed (i.e. MonitorMode set to Transparent) if/when each EDP is encountered, irrespective of the EDP's MonitorMode (Transparent, NotifyAndContinue, or Request).

EDPs which are armed generically for GPRS PDP Context State Models shall only be implicitly disarmed at the end of the GPRS dialogue. Explicit disarming is possible.

When EDP's are armed with MonitorMode 'Request' (EDP-R's) are encountered, any implicit EDP disarming shall take place before reporting the EDP and transiting the gprsSSF to the WFI state (if not already suspended in the WFI state).

The table entry 'X' means that if one DP occurs (independently of arming and reporting to the gsmSCF) the marked one is implicitly disarmed. It shall be possible to rearm explicitly an implicitly disarmed DP.

Table 6.3: Implicit disarming rules for Scenario 1
(the rules apply for non-generically armed DPs)

Encountered DP	Implicit disarmed DPs					
	DP Change of Position GPRS Session	DP Change of Position Context	DP Detach	DP PDP Context Establishment	DP PDP Context Establishment Acknowledgement	DP PDP Context Disconnection
DP Change of Position GPRS Session						
DP Change of Position Context						
DP Detach	X	X	X	X	X	X
DP PDP Context Establishment						
DP PDP Context Establishment Acknowledgement					X	
DP PDP Context Disconnection		X			X	X

Table 6.4: Implicit disarming rules for Scenario 2
(the rules apply for non-generically armed DPs)

Encountered DP	Implicit disarmed DPs		
	DP Change of Position Context	DP PDP Context Establishment Acknowledgement	DP PDP Context Disconnection
DP PDP Context Establishment Acknowledgement		X	
DP PDP Context Disconnection	X	X	X
DP Change of Position Context			

6.5 Procedures for CAMEL GPRS

6.5.1 Overall SDL Architecture
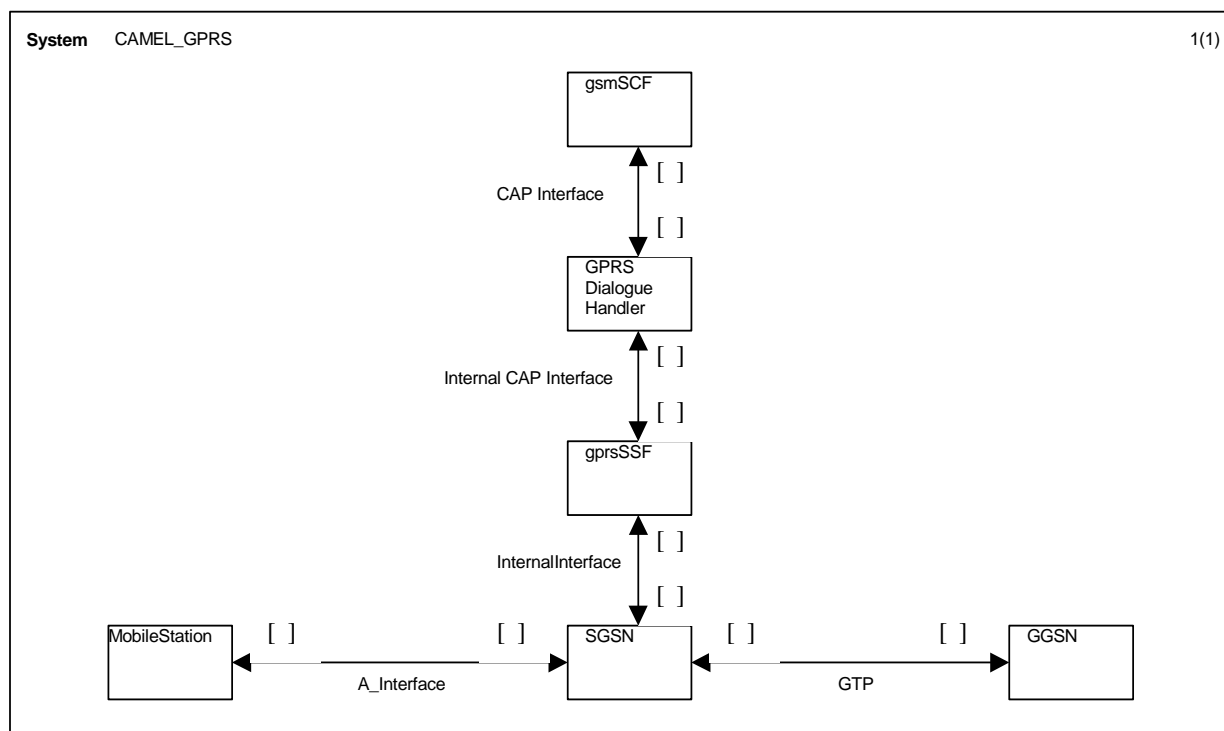
Figure 6.7: Architecture for CAMEL/GPRS interworking

6.5.2 Handling GPRS in the SGSN

The functional behaviour of the SGSN is specified in 3GPP TS 23.060 [11]. The procedures specific to CAMEL are specified in this clause:

- Procedure CAMEL_GPRS_Attach;

- Procedure CAMEL_GPRS_Detach;

- Procedure CAMEL_GPRS_Routeing_Area_Update_Session;

- Procedure CAMEL_GPRS_Routeing_Area_Update_Context;

- Procedure CAMEL_GPRS_PDP_Context_Establishment;

- Procedure CAMEL_GPRS_Create_PDP_Context_Establishment_Acknowledgement;

- Procedure CAMEL_GPRS_Change_Of_QoS;

- Procedure CAMEL_GPRS_PDP_Context_Disconnection.

6.5.2.1 Actions of the SGSN on receipt of Int_Error

The SGSN checks the default GPRS Handling parameter in GPRS-CSI.

If the default GPRS handling is release, a Detach indication is sent to the MS. The SGSN then releases all resources and the invoked CAMEL procedure ends.

If the default GPRS handling is continue, the SGSN continues processing without CAMEL support.

6.5.2.2 Actions of the SGSN on receipt of Int_Continue

The SGSN continues processing without any modification of GPRS parameters.

6.5.2.3 Handling of GPRS Attach/Detach

Procedure CAMEL_GPRS_Attach 1(2)

/* Procedure in the SGSN for CAMEL handling of MS Attach */

/* Signals to/from the right are to/from the gprsSSF; signal from the left is from the access network. */
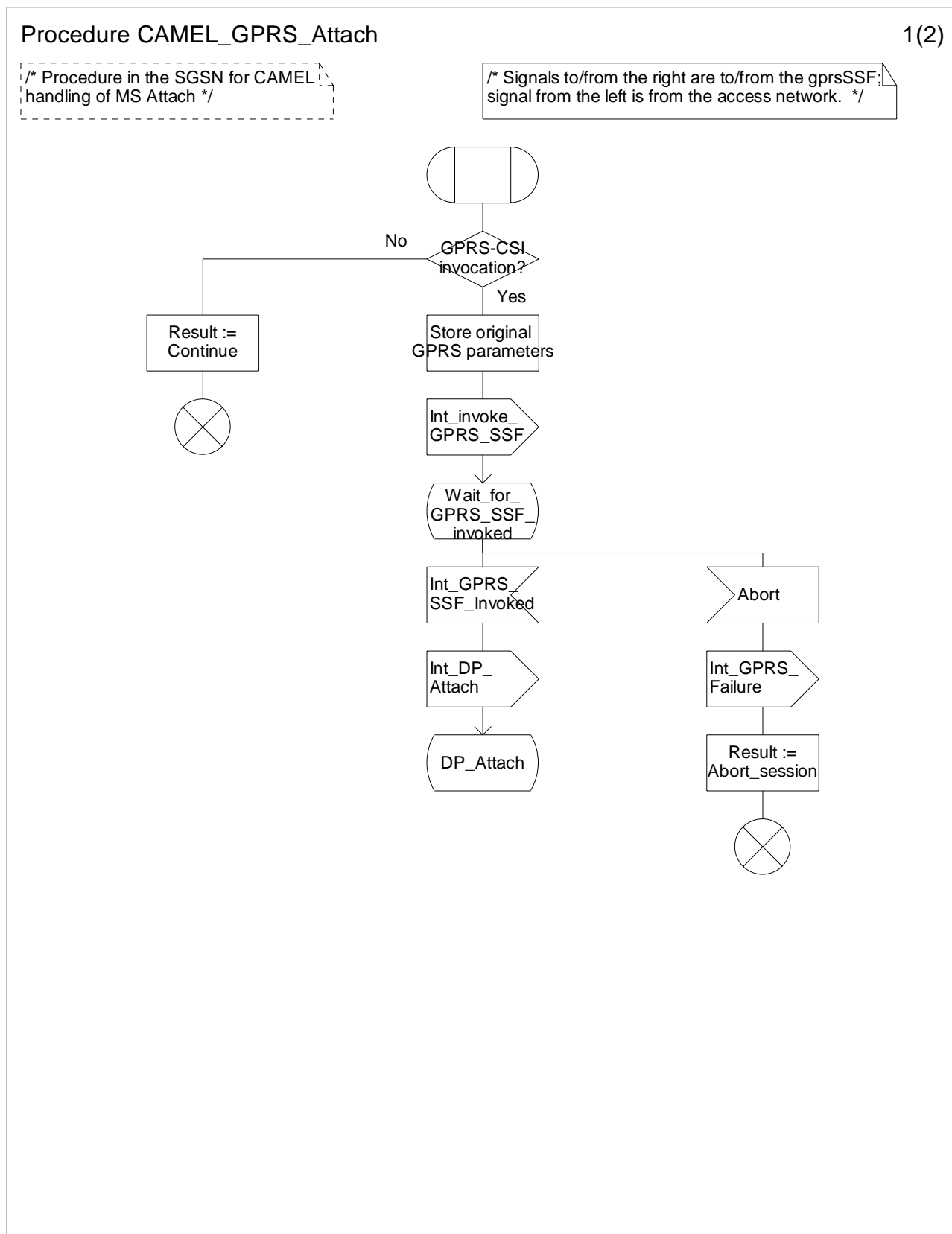
Figure 6.8a: Procedure CAMEL_GPRS_Attach (sheet 1)

Procedure CAMEL_GPRS_Attach 2(2)

/* Procedure in the SGSN for CAMEL
handling of MS Attach */

/* Signals from the right are from the gprsSSF.*/

DP_Attach

Int_Release_
Session

Int_error

Int_Continue_
GPRS

No — Default GPRS handling =
Continue?

Yes

Result :=
Release_session

Result :=
Abort_session

Result :=
Continue
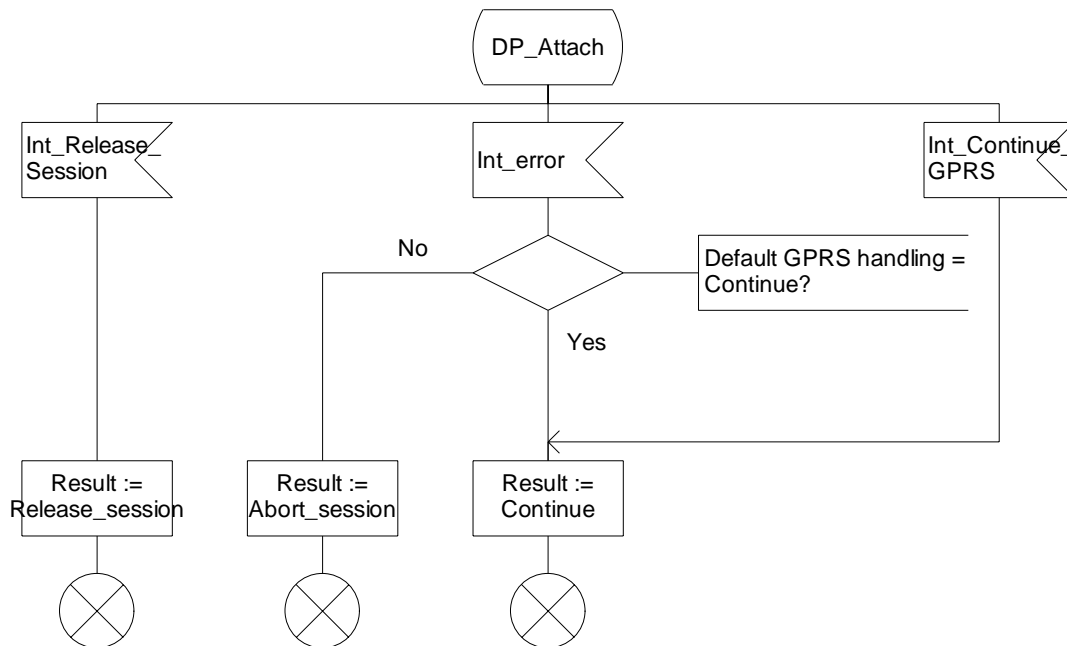
Figure 6.8b: Procedure CAMEL_GPRS_Attach (sheet 2)

Procedure CAMEL_GPRS_Detach 1(1)

/* Procedure in the SGSN for CAMEL handling of MS or network indicated Detach */

/* Signals to/from the right are to/from the gprsSSF */

gprsSSF invoked?

No

Result := Continue

Yes

Int_DP_Detach

DP_Detach

Int_Continue_GPRS

Int_Continue

Int_error

Result := Continue
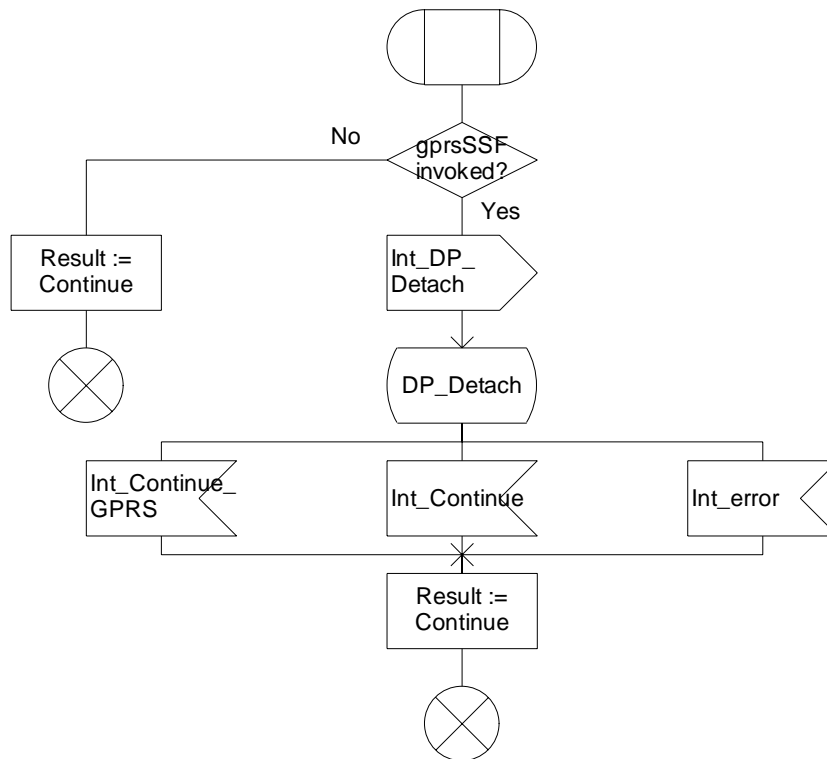
Figure 6.9: Procedure CAMEL_GPRS_Detach (sheet 1)

6.5.2.4 Handling of GPRS Routeing Area Update

Procedure CAMEL_GPRS_Routeing_Area_Update_Session 1(2)

/* Procedure in the SGSN for CAMEL handling of:
- intra-SGSN Routeing Area Update, or
- inter-SGSN Routeing Area Update in the new SGSN */

/* Signals to/from the right are to/from the gprsSSF; signal from the left is from the access network. */

No — gprsSSF invoked? — Yes

Intra-SGSN

Inter-SGSN

No — GPRS-CSI Invocation? — Yes

Result := Continue

Int_invoke_ GPRS_SSF

Intra- or Inter-SGSN Routeing Area Update?

Int_DP_Change_ Of_Position_Session

DP_Change_ Of_Position_Session

Wait_for_ GPRS_SSF_ invoked

Int_GPRS_ SSF_invoked

Abort

Int_DP_Change_ Of_Position_Session

Int_GPRS_ Failure

DP_Change_ Of_Position_Session

Result := Abort_session
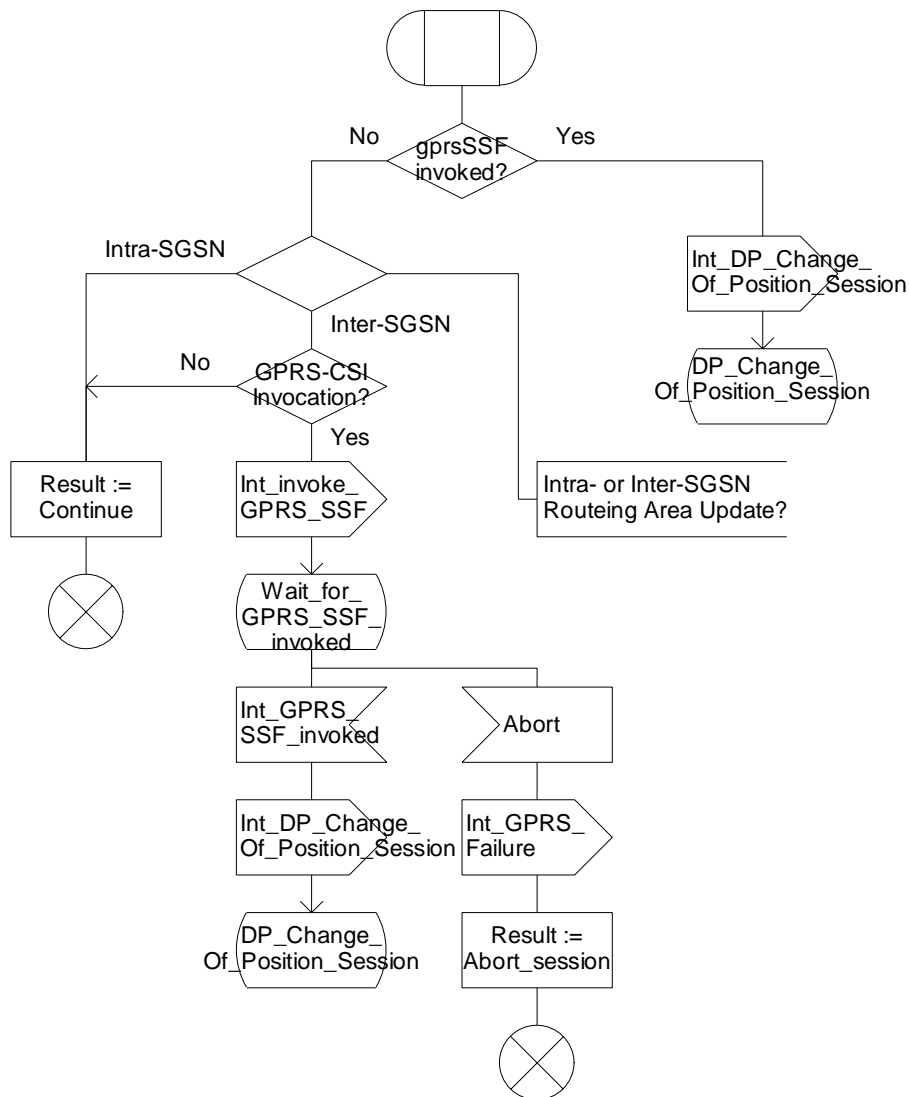
Figure 6.10a: Procedure CAMEL_GPRS_Routeing_Area_Update_Session (sheet 1)

Procedure CAMEL_GPRS_Routeing_Area_Update_Session 2(2)

/* Procedure in the SGSN for CAMEL handling of:
- intra-SGSN Routeing Area Update, or
- inter-SGSN Routeing Area Update in the new SGSN */

/* Signals from the right are from the gprsSSF.*/

DP_Change_
Of_Position_Session

Int_Release_
Session

Int_error

Int_Continue

Int_Continue_
GPRS

No

Default GPRS handling =
Continue?

Yes

Result :=
Release_session

Result :=
Abort_session

Result :=
Continue
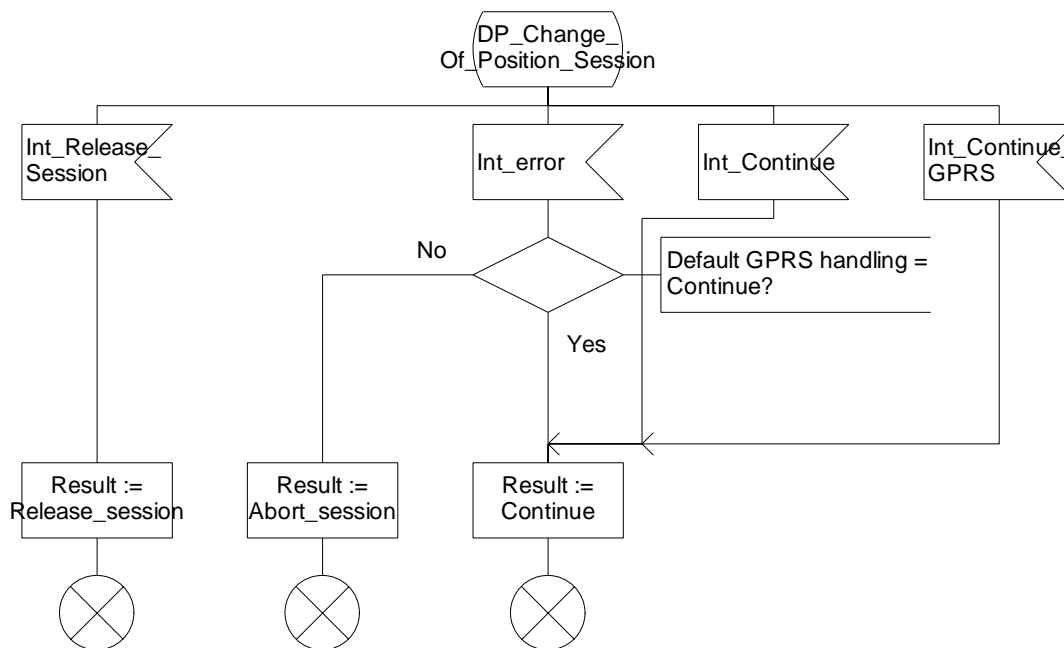
Figure 6.10b: Procedure CAMEL_GPRS_Routeing_Area_Update_Session (sheet 2)

Procedure CAMEL_GPRS_Routeing_Area_Update_Context 1(2)

/* Procedure in the SGSN for CAMEL handling of:
- intra-SGSN Routeing Area Update, or
- inter-SGSN Routeing Area Update in the new SGSN */

/* Signals to/from the right are to/from the gprsSSF; signal from the left is from the access network. */

/* NOTE: See Table 7: 'Description of GPRS PDP Context DPs in the SGSN' Note 3 for further explanation whether reporting occurs within a new gprsSSF or in an existing (invoked) one. */

No ← gprsSSF invoked? → Yes

Intra-SGSN

Inter-SGSN

No ← GPRS-CSI Invocation?

Yes

Result := Continue

Int_invoke_ GPRS_SSF

Intra- or Inter-SGSN Routeing Area Update?

Int_DP_Change_ Of_Position_Context

DP_Change_ Of_Position_Context

Wait_for_ GPRS_SSF_ invoked

Int_GPRS_ SSF_invoked

Abort

Int_DP_Change_ Of_Position_Context

Int_GPRS_ Failure

DP_Change_ Of_Position_Context

Result := Abort_context

Figure 6.11a: Procedure CAMEL_GPRS_Routeing_Area_Update_Context (sheet 1)

Procedure CAMEL_GPRS_Routeing_Area_Update_Context 2(2)

/* Procedure in the SGSN for CAMEL handling of:
- intra-SGSN Routeing Area Update, or
- inter-SGSN Routeing Area Update in the new SGSN */

/* Signals from the right are from the gprsSSF.*/

DP_Change_
Of_Position_Context

Int_Release_
Context

Int_error

Int_Continue

Int_Continue_
GPRS

No

Default GPRS handling =
Continue?

Yes

Result :=
Release_context

Result :=
Abort_context

Result :=
Continue
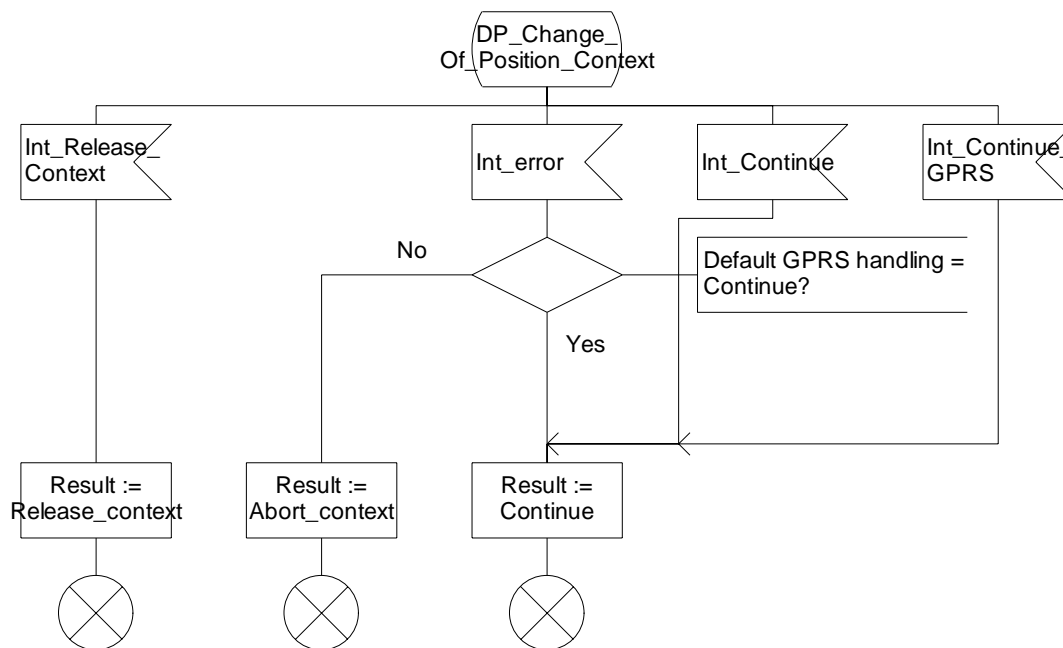
Figure 6.11b: Procedure CAMEL_GPRS_Routeing_Area_Update_Context (sheet 2)

6.5.2.5 Handling of PDP Context establishment and deactivation

Procedure CAMEL_GPRS_PDP_Context_Establishment 1(2)

/* Procedure in the SGSN for CAMEL handling of PDP Context Establishment */

/* Signals to/from the right are to/from the gprsSSF; signal from the left is from the access network. */

gprsSSF invoked?

No → GPRS-CSI Invocation?

Yes → Int_DP_PDP_Context_Establishment (PDP Id) → DP_PDP_Context_Establishment

No → Result := Continue

Yes → Int_invoke_GPRS_SSF → Wait_for_GPRS_SSF_invoked

Int_GPRS_SSF_invoked → Int_DP_PDP_Context_Establishment (PDP Id) → DP_PDP_Context_Establishment

Abort → Int_GPRS_Failure → Result := Abort_context

Figure 6.12a: Procedure CAMEL_GPRS_PDP_Context_Establishment (sheet 1)

Procedure CAMEL_GPRS_PDP_Context_Establishment 2(2)

/* Procedure in the SGSN for CAMEL handling of PDP Context Establishment */

/* Signals from the right are from the gprsSSF. */

DP_PDP_Context_Establishment

Int_Release_Context

Int_error

Int_Continue

Int_Continue_GPRS

Int_Connect_GPRS

Set new APN

No

Yes

Result := Release_Context

Result := Abort_Context

Result := Continue

Default GPRS handling = Continue?
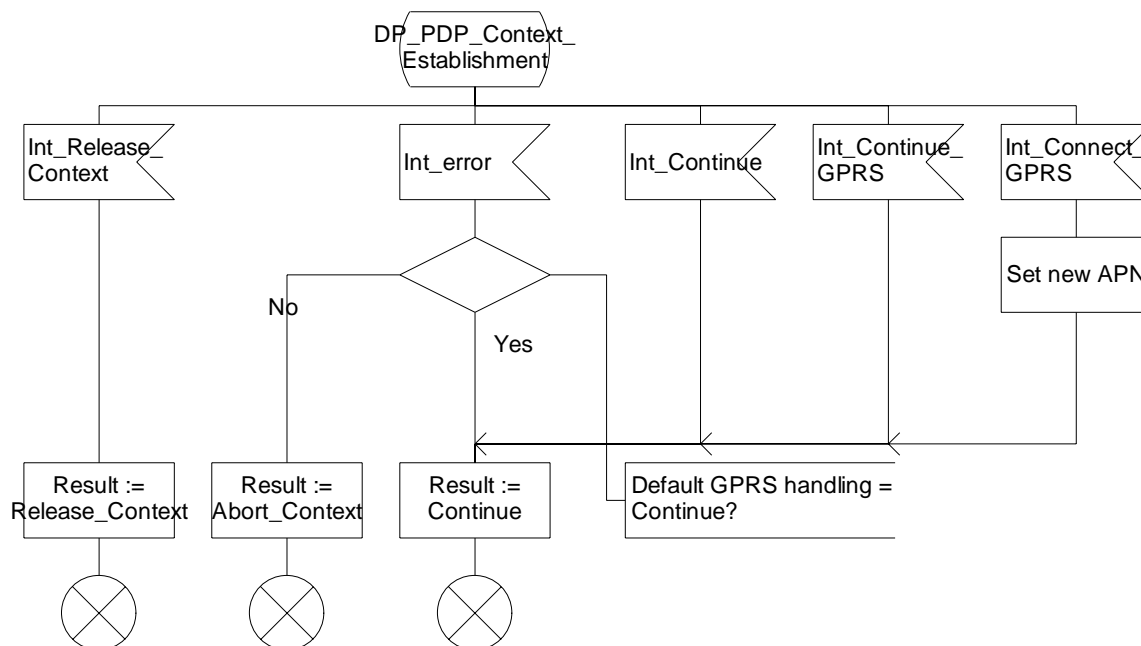
Figure 6.12b: Procedure CAMEL_GPRS_PDP_Context_Establishment (sheet 2)

Procedure CAMEL_GPRS_PDP_Context_Establishment_Acknowledgement 1(2)

/* Procedure in the SGSN for CAMEL handling of PDP Context Establishment Acknowledgement */

/* Signals to/from the right are to/from the gprsSSF; signal from the left is from the access network unless otherwise stated. */

gprsSSF invoked?

No — GPRS-CSI Invocation?

Yes — Int_DP_PDP_Context_Establishment_Acknowledgement (PDP Id)

DP_PDP_Context_Establishment_Acknowledgement

No — Result := Continue

Yes — Int_invoke_GPRS_SSF

Wait_for_GPRS_SSF_invoked

Int_GPRS_SSF_invoked

Int_DP_PDP_Context_Establishment (PDP Id)

DP_PDP_Context_Establishment_Acknowledgement

Abort

Int_GPRS_Failure

Result := Abort_context

Figure 6.13a: Procedure CAMEL_GPRS_PDP_Context_Establishment_Acknowledgement (sheet 1)

Procedure CAMEL_GPRS_PDP_Context_Establishment_Acknowledgement 2(2)

/* Procedure in the SGSN for CAMEL
handling of PDP Context Establishment
Acknowledgement */

/* Signals from the right are from the gprsSSF. */

DP_PDP_Context_
Establishment_
Acknowledgement

Int_Release_
Context

Int_error

Int_Continue

Int_Continue_
GPRS

No

Default GPRS handling =
Continue?

Yes

Result :=
Release_Context

Result :=
Abort_Context

Result :=
Continue
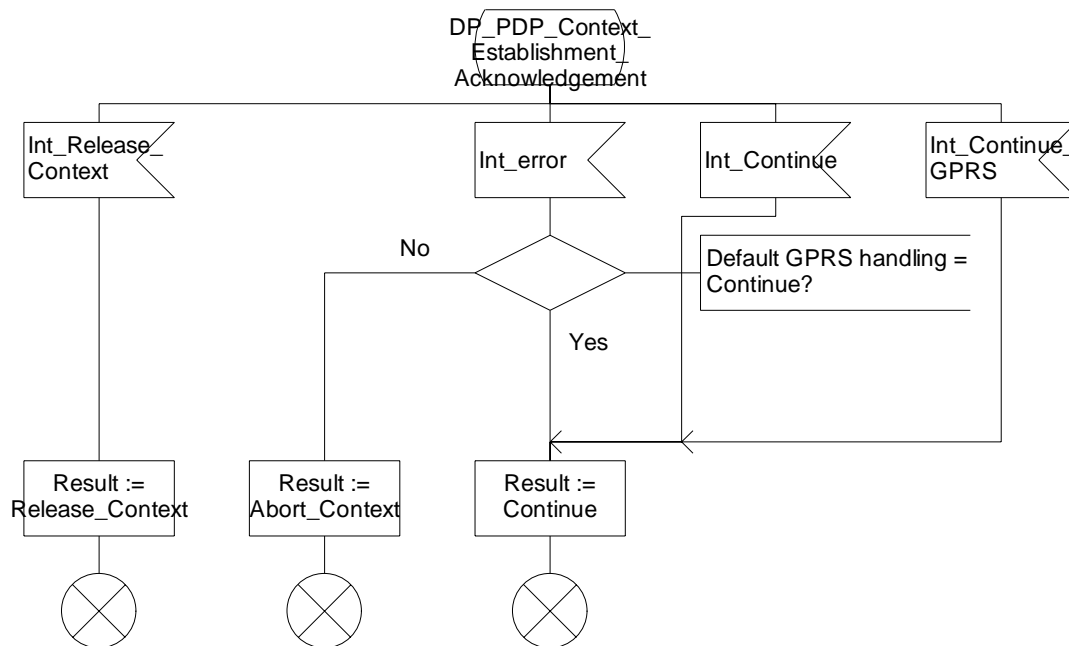
Figure 6.13b: Procedure CAMEL_GPRS_PDP_Context_Establishment_Acknowledgement (sheet 2)

Procedure CAMEL_GPRS_Change_of_QoS 1(1)

/* Procedure in the SGSN for CAMEL
handling a change of QoS for a PDP Context */

/* Signal to the right is to the gprsSSF */

gprsSSF
invoked?

No

Yes

Int_QoS_Change
(PDP Id)

Result :=
Continue
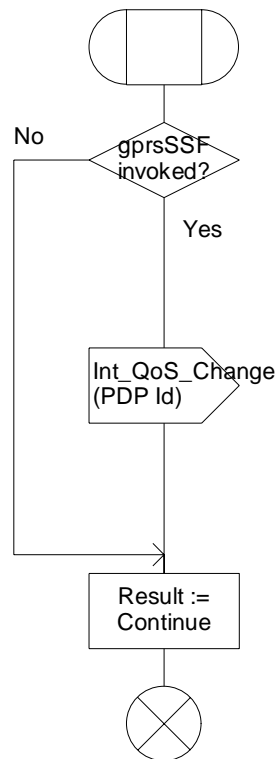
Figure 6.14: Procedure CAMEL_GPRS_Change_Of_QoS (sheet 1)

Procedure CAMEL_GPRS_PDP_Context_Disconnection 1(1)

/* Procedure in the SGSN for CAMEL handling of MS or network indicated PDP Context Disconnection */

/* Signals to/from the right are to/from the gprsSSF */

gprsSSF invoked?

No

Yes

Result := Continue

Int_DP_PDP_Context_Disconnection (PDP Id)

DP_PDP_Context_Disconnection

Int_Continue_GPRS

Int_Continue

Int_error

Result := Continue
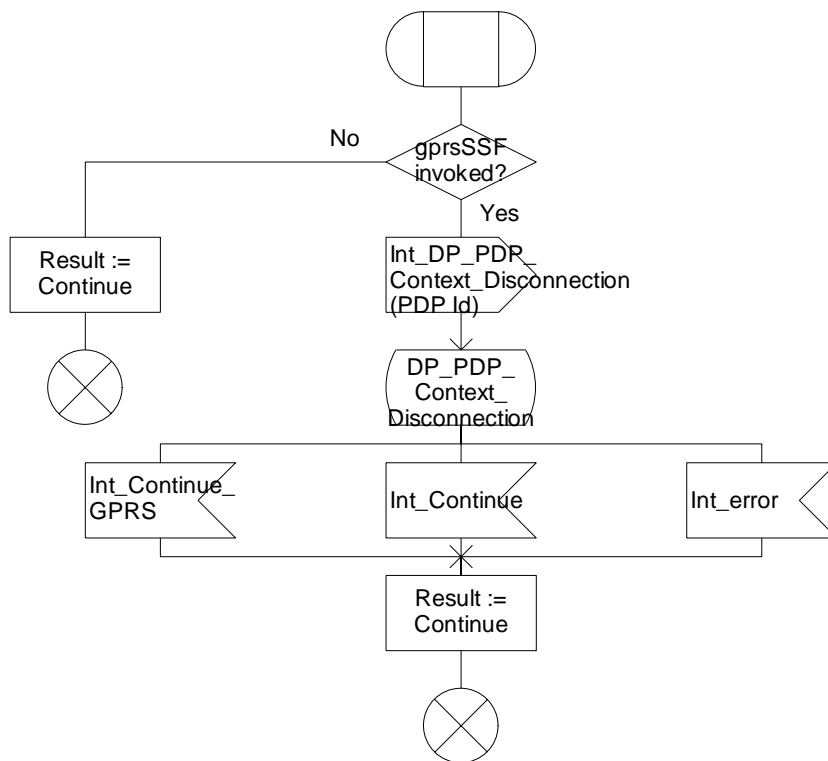
Figure 6.15: Procedure CAMEL_GPRS_PDP_Context_Disconnection (sheet 1)

6.5.3 Handling GPRS in the gprsSSF

6.5.3.1 Process GPRS_SSF

A relationship exists between the gsmSCF and the Attach/Detach State Model and/or between the gsmSCF and every PDP Context State Model. The relationship may be in controlling or monitoring mode. When a ContinueGPRS, ConnectGPRS or RequestReportGPRSEvent operation is received, then the relationship between the gsmSCF and the Attach/Detach State Model, and between the gsmSCF and a PDP Context State Model may be downgraded from controlling to monitoring.

When Tssf expires, the CAMEL procedures that are waiting for an instruction from the gsmSCF shall receive an Int_Error signal. The Default GPRS Handling parameter determines the subsequent action of those CAMEL procedures.

If the Default GPRS Handling parameter is set to 'Release', then:

- if the GPRS Dialogue is controlling a GPRS Session, then the gprsSSF shall release the entire GPRS Session;

- if the GPRS Dialogue is controlling a single PDP Context, then the gprsSSF shall release the PDP Context.

The task box 'Open GPRS Dialogue' comprises all the tasks that are required for starting a GPRS dialogue. This includes, amongst others, the allocation of a GPRS Reference Number and the allocation of resources. The task box 'Terminate GPRS Dialogue' comprises all the tasks that are required for closing a GPRS dialogue.

6.5.3.2 Process GPRS_Dialogue_Handler

When process gprsSSF sends a TC_End request primitive to process GPRS_Dialogue_Handler, then the corresponding TC_End TC Message shall be sent to the gsmSCF only when the following conditions have been fulfilled:

- The gprsSSF has processed all Operations that the gprsSSF has received from the gsmSCF.

- No Operations remain to be sent from the gprsSSF to the gsmSCF.

- The gprsSSF is not waiting for a Result or Error component for any Operations that the gprsSSF has sent to the gsmSCF.

6.5.3.3 Procedure Handle_AC_GPRS

Procedure Handle_AC_GPRS is called from process gprsSSF with the following input parameters:

- 'Session'. The Apply Charging GPRS procedure shall be executed for the Session.

- 'PDP Id'. The Apply Charging GPRS procedure shall be executed for the indicated PDP Context.

6.5.3.4 Procedure Handle_ACR_GPRS

Procedure Handle_ACR_GPRS is called from process gprsSSF with the following input parameters:

- 'Session'. The Apply Charging Report GPRS procedure shall be executed for the Session. This procedure checks if a Session Period report is pending and if so, sends this report to the gsmSCF.

- 'PDP Id'. The Apply Charging Report GPRS procedure shall be executed for the indicated PDP Context. This procedure checks if a Context Volume report is pending and if so, sends this report to the gsmSCF. The procedure then checks if a Context Period is pending and if so, sends this report to the gsmSCF.

- 'Session + PDPs'. The Apply Charging Report GPRS procedure shall be executed for the Session and all PDP Contexts. The sequence of checking the reports shall be as follows:

  1) The procedure checks the pending Volume and Period reports for each PDP Context.

  2) The procedure then checks the pending Period report for the Session.

When a PDP Context Volume counter or PDP context Period timer expires, then the procedure Apply Charging Report GPRS procedure is called with the PDP Id as input parameter. The procedure will then check both reports for that PDP Context.

6.5.3.5 Procedure Complete_FCI_Record_GPRS

Procedure Complete_FCI_Record_GPRS is called from process gprsSSF with the following input parameters:

- 'Session'. The Complete_FCI_Record_GPRS procedure shall be executed for the Session.

- 'PDP Id'. The Complete_FCI_Record_GPRS procedure shall be executed for the indicated PDP Context.

- 'Session + PDPs'. The Complete_FCI_Record_GPRS procedure shall be executed for the Session and all PDP Contexts.

6.5.3.6 Procedure Handle_SCI_GPRS

For terminology see clause 4.5.6.3.

The gsmSCF may send e-parameters to the Session and to individual PDP Contexts.

When e-parameters are sent for the Session, the SGSN will forward these e-parameters directly to the Mobile Station.

When e-parameters are sent for a PDP Context and that PDP Context is not yet acknowledged (= active), then the SGSN shall retain these parameters (pending parameters). These parameters will be sent to the Mobile Station when the PDP Context is acknowledged.

The gsmSCF may send two sets of e-parameters and a Tariff Switch for the Session or a PDP Context. The first set of e-parameters shall be sent to the SGSN and the second set of e-parameters shall be stored. This second set of e-parameters shall be sent to the SGSN when the tariff switch expires.

When the Tariff Switch for the Session expires, then the stored e-parameters for the Session shall be sent to the SGSN.

When the Tariff Switch for a PDP Context expires before that PDP Context is acknowledged, then the pending e-parameters for that PDP Context shall be replaced by the stored e-parameters for that PDP Context.

The stored e-parameters for that PDP Context shall be discarded.

When the Tariff Switch for a PDP Context expires after that PDP Context has been acknowledged, then the stored e-parameters for that PDP Context shall be sent to the SGSN.

6.5.3.6.1 Handling of SCI_GPRS for the Session

1) Precondition: no Tsw running for the Session:

   - if 1 set of e-parameters received --> send e-parameters to the SGSN;

   - if 2 sets of e-parameters received --> error;

   - if 1 set of e-parameters and Tariff Switch received --> error;

   - if 2 sets of e-parameters and Tariff Switch received --> send 1st set of e-parameters to the SGSN/start Tsw (Session)/store 2nd set of e-parameters.

2) Precondition: Tsw running for the Session and no e-parameters stored for the Session:

   - if 1 set of e-parameters received --> error;

   - if 2 sets of e-parameters received --> send 1st set of e-parameters to the SGSN/store 2nd set of e-parameters;

   - if 1 set of e-parameters and Tariff Switch received --> error;

   - if 2 sets of e-parameters and Tariff Switch received --> error.

3) Precondition: Tsw running for the Session and e-parameters stored for the Session:

   - if 1 set of e-parameters received --> error;

   - if 2 sets of e-parameters received --> error;

   - if 1 set of e-parameters and Tariff Switch received --> error;

   - if 2 sets of e-parameters and Tariff Switch received --> error.

6.5.3.6.2 Handling of SCI_GPRS for a PDP Context

1) Precondition: before a PDP Context Establishment Acknowledgement event is detected and no Tsw running for this PDP Context:

   - if 1 set of e-parameters received --> send e-parameters to the SGSN;

   - if 2 sets of e-parameters received --> error;

   - if 1 set of e-parameters and Tariff Switch received --> error;

   - if 2 sets of e-parameters and Tariff Switch received --> send 1st set of e-parameters to the SGSN/start Tsw(PDP Id)/store 2nd set of e-parameters;

2) Precondition: before a PDP Context Establishment Acknowledgement event is detected and Tsw running for this PDP Context and no e-parameters stored for this PDP Context:

   - if 1 set of e-parameters received --> error;

   - if 2 sets of e-parameters received --> send 1st set of e-parameters to the SGSN/store 2nd set of e-parameters;

   - if 1 set of e-parameters and Tariff Switch received --> error;

   - if 2 sets of e-parameters and Tariff Switch received --> error.

3) Precondition: before a PDP Context Establishment Acknowledgement event is detected and Tsw running for this PDP Context and e-parameters stored for this PDP Context:

   - if 1 set of e-parameters received --> error;

   - if 2 sets of e-parameters received --> error;

   - if 1 set of e-parameters and Tariff Switch received --> error;

   - if 2 sets of e-parameters and Tariff Switch received --> error.

4) Precondition: after a PDP Context Establishment Acknowledgement event is detected and no Tsw running for this PDP Context:

   - if 1 set of e-parameters received --> send e-parameters to the SGSN;

   - if 2 sets of e-parameters received --> error;

   - if 1 set of e-parameters and Tariff Switch received --> start Tsw(PDP Id)/store e-parameters;

   - if 2 sets of e-parameters and Tariff Switch received --> send 1st set of e-parameters to the SGSN/start Tsw(PDP Id)/store 2nd set of e-parameters.

5) Precondition: after a PDP Context Establishment Acknowledgement event is detected and Tsw running for this PDP Context and no e-parameters stored for this PDP Context;

   - if 1 set of e-parameters received --> store e-parameters;

   - if 2 sets of e-parameters received --> send 1st set of e-parameters to the SGSN/store 2nd set of e-parameters;

   - if 1 set of e-parameters and Tariff Switch received --> error;

   - if 2 sets of e-parameters and Tariff Switch received --> error.

6) Precondition: after a PDP Context Establishment Acknowledgement event is detected and Tsw running for this PDP Context and e-parameters stored for this PDP Context:

- if 1 set of e-parameters received --> error;

- if 2 sets of e-parameters received --> error;

- if 1 set of e-parameters and Tariff Switch received --> error;

- if 2 sets of e-parameters and Tariff Switch received --> error.

6.5.3.7 Procedure Handle_PDP_Acknowledgement

Procedure Handle_PDP_Acknowledgement is called when an event occurs that may signal the activation (=Acknowledgement) of a PDP Context. The event signal is passed on to the Handle_PDP_Acknowledgement procedure.

6.5.3.8 GPRS duration and volume control

6.5.3.8.1 Examples of information flows for GPRS session and PDP context control
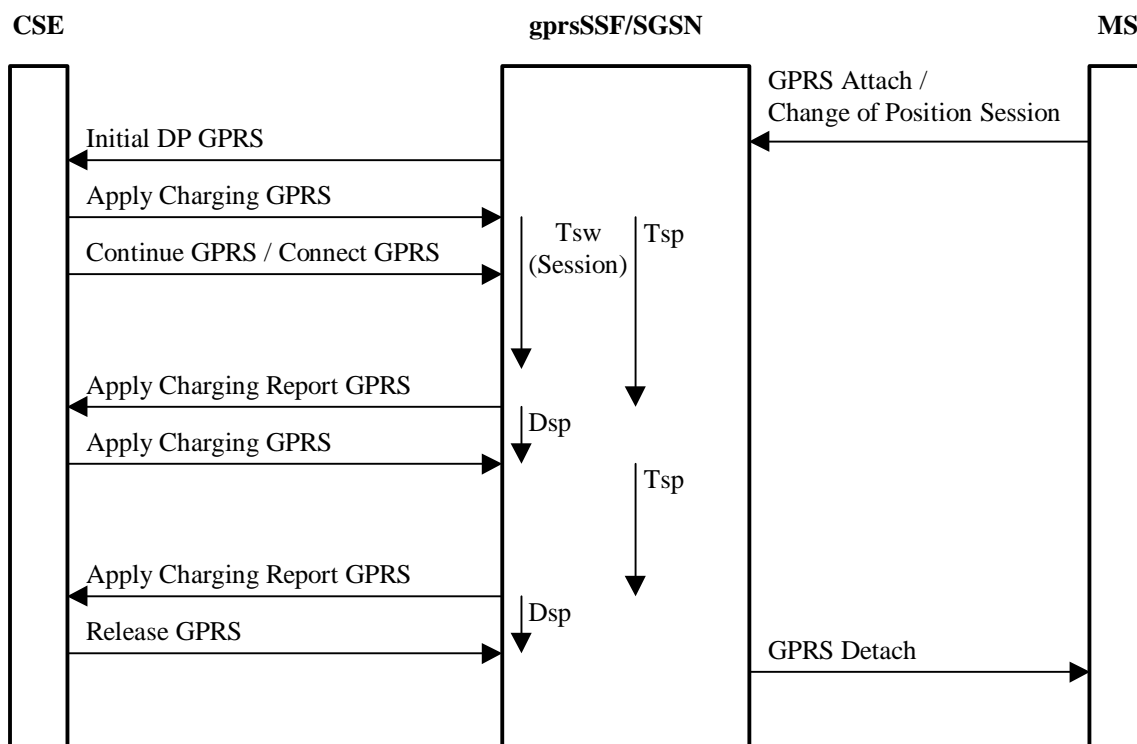
**Figure 6.16a: Example of information flows for GPRS session duration
at GPRS attach and change of position session**
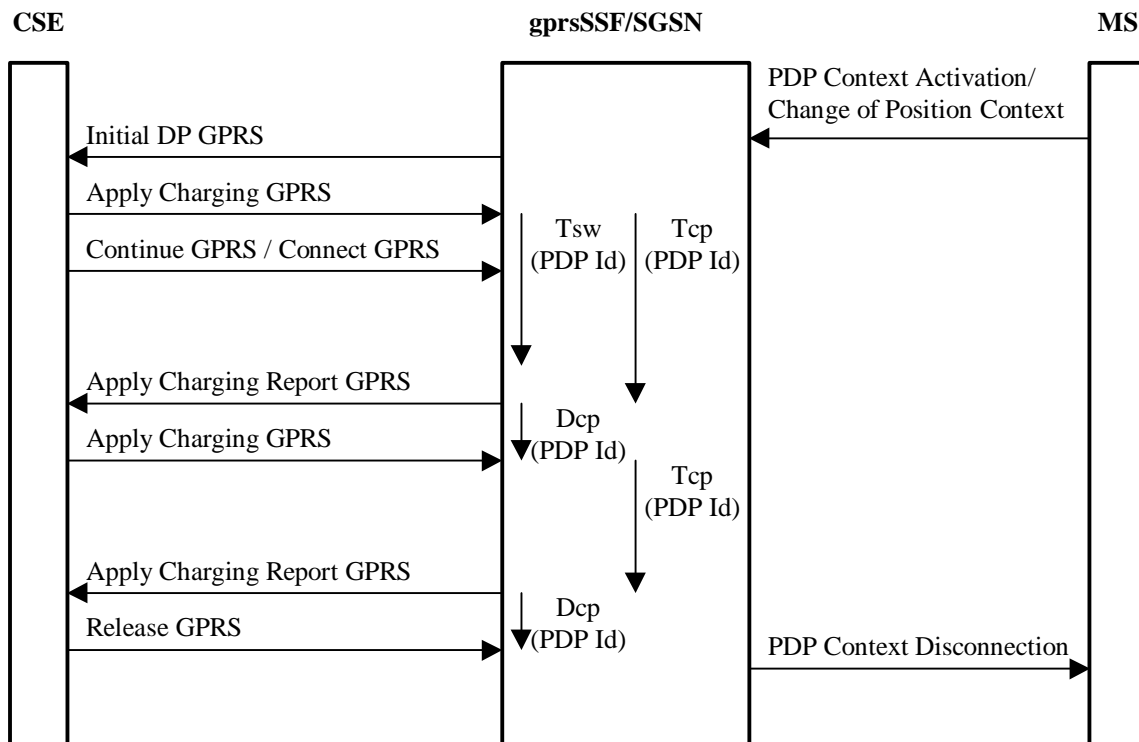
**Figure 6.16b: Example of information flows for PDP context duration control
at context activation and change of position context**
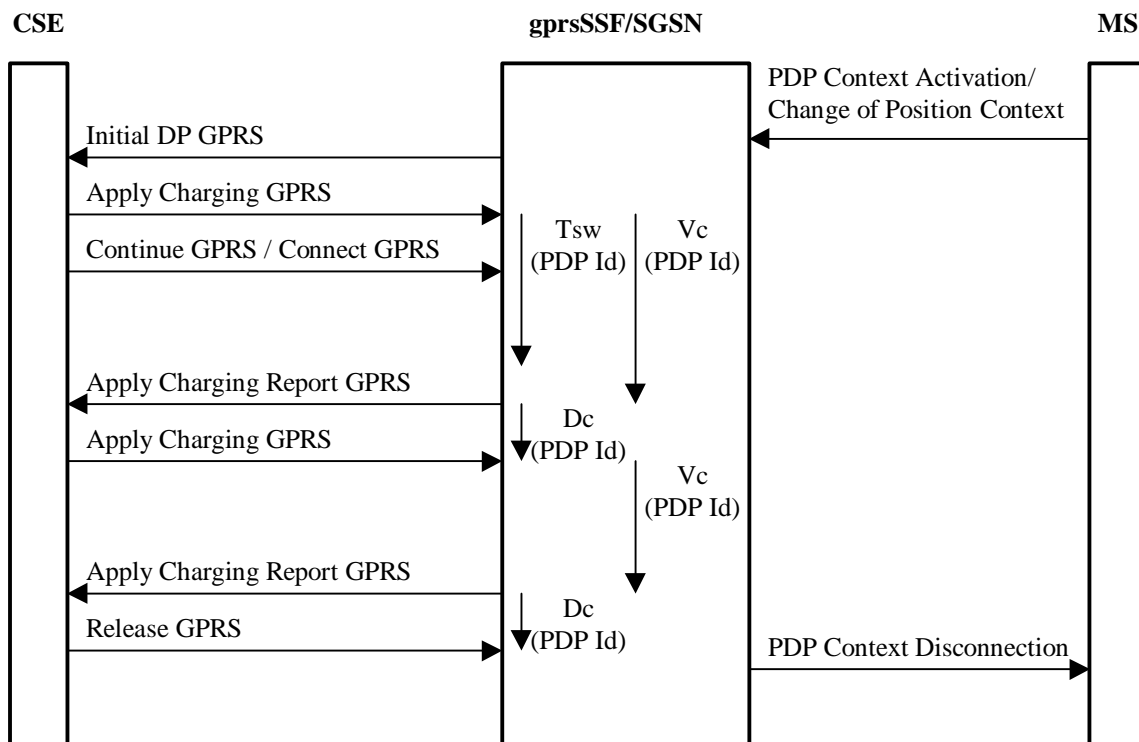
**Figure 6.16c: Example of information flows for PDP context volume control
at context activation and change of position context**
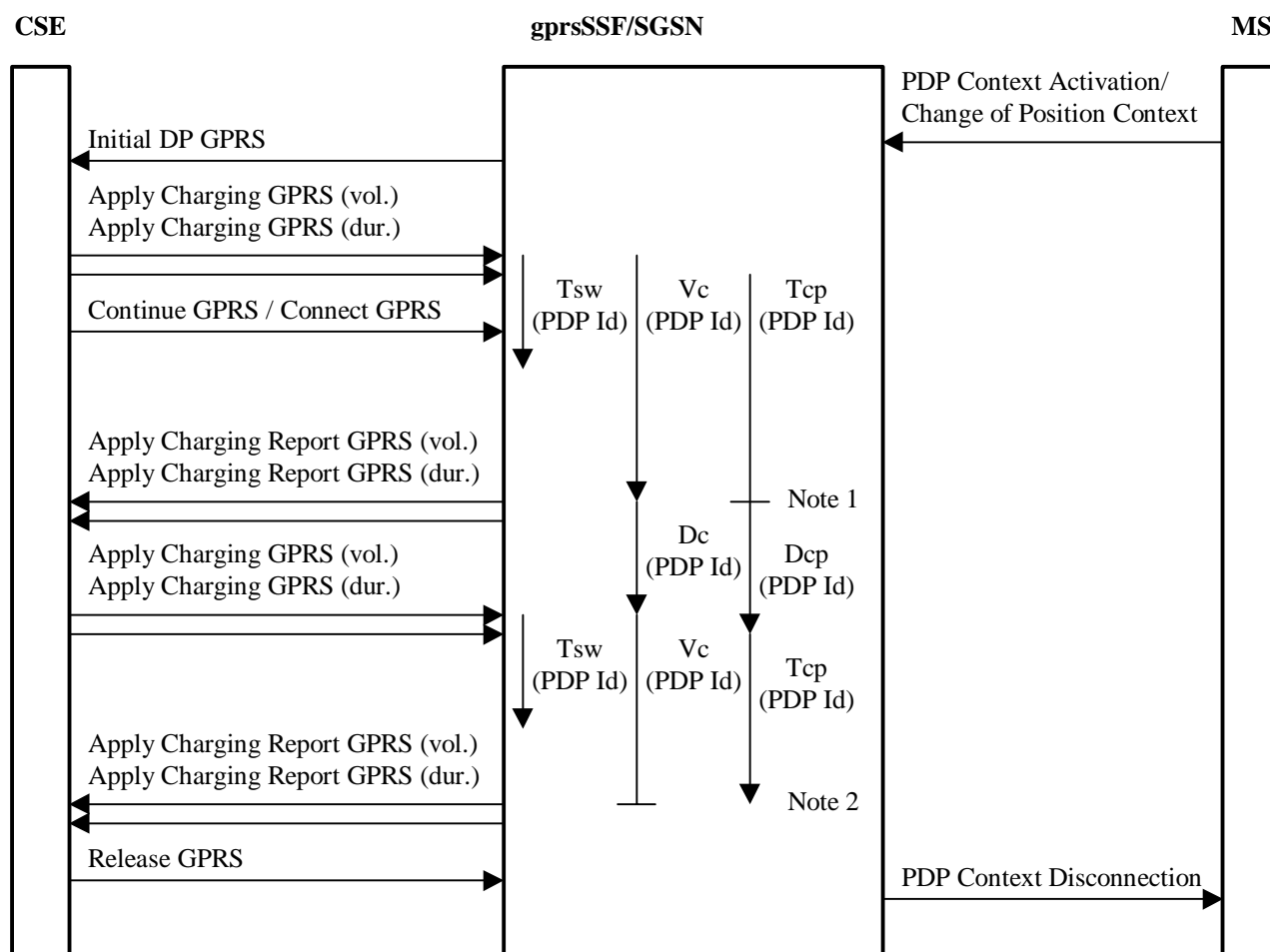
NOTE 1: Vc threshold reached, Tcp is stopped.
NOTE 2: Tcp time out, Vc is stopped.

**Figure 6.16d: Example of information flows for PDP context volume
and duration control at context activation and change of position context**

These figures show examples of handling of the timers that are used in the process gprsSSF and in the procedures Handle_AC_GPRS and Handle_ACR_GPRS.

Duration timers (Tsp for the GPRS session and one Tcp for each PDP context) are used if the charging is on duration of the GPRS session or a PDP context.

Tariff Switch Timers (Tsw(Session) for the GPRS session and one Tsw(PDP Id) for each PDP context) define the start point of a new Tariff. Tsw(Session) is used for charging on duration. Tsw(PDP Id) is used for both methods of charging: duration charging and volume charging. If a PDP context is charged on duration and volume, only one Tsw(PDP Id) timer will be accepted from the gsmSCF for that PDP context.

Delta timers measure the response time of the gsmSCF after an Apply Charging Report GPRS operation:

- Dsp for the GPRS session; this delta timer is used for GPRS session period timing.

- Dcp for each PDP context; these delta timers are used for PDP context period timing.

- Dc for each PDP context; these delta counters are used for PDP context volume counting.

After the sending of Apply Charging Report GPRS, the gsmSCF may reply either with:

- Apply Charging GPRS, if the gsmSCF sends a new duration because of the expiration of the previous period or because of QOS change.

- Release GPRS, if the gsmSCF decides to release the GPRS session or PDP context.

6.5.3.8.2 TC guard timer

6.5.3.8.2.1 General

When the gprsSSF sends an Apply Charging Report GPRS operation to the gsmSCF, with SessionActive or ContextActive variable set to TRUE, then the gprsSSF shall start the TC guard timer. The gprsSSF shall also mark for the Session or PDP Context for which the Apply Charging Report GPRS was sent, that a corresponding Apply Charging GPRS operation from the gsmSCF is expected.

When the gprsSSF receives an Apply Charging GPRS operation or a Release GPRS operation, then the 'Waiting-for-AC' marking(s) for the Session or PDP Context shall be removed. The gprsSSF shall then check if the TC guard timer shall be stopped (task box 'Check TC guard timer'). The TC guard timer shall be stopped if there are no more Apply Charging GPRS operations expected for the Session and all PDP Contexts.

When an event occurs that results in the termination of a PDP Context, then the 'Waiting-for-AC' markings for that PDP Context shall be removed. The gprsSSF shall then check if the TC guard timer shall be stopped (task box 'Check TC guard timer'). The TC guard timer shall be stopped if there are no more ApplyChargingGPRS operations expected for the Session and all PDP Contexts.

When the TC guard timer expires in state Monitoring, then the gprsSSF shall close the TC dialogue, provided that all conditions for closing the TC dialogue are fulfilled, i.e. there are no Operation Results expected from the gsmSCF, no Operations or Errors to be sent to the gsmSCF and no Operations from the gsmSCF received and waiting to be processed.

When the TC guard timer expires in state Waiting_for_Instructions, then no action shall be taken.

Service Designers should note that there may be additional timer(s) in the gprsSSF to supervise the response from the gsmSCF on the Apply Charging Report GPRS procedure. As a result of this, if the gsmSCF does not send an Apply Charging GPRS, Release GPRS or Cancel GPRS in response to an Apply Charging Report GPRS when the gprsSSF is awaiting such response, then service behaviour may be unpredictable.

6.5.3.8.2.2 Check TC guard timer

This clause describes the actions to be taken in the task box 'Check TC guard timer'.

The tasks to be executed in the 'Check TC guard timer' box depend on the event that resulted in execution of the task box.

6.5.3.8.2.2.1 Apply Charging GPRS

If 'Check guard timer' is executed as a result of an Apply Charging GPRS operation from the gsmSCF, then the appropriate 'Waiting-for-AC' marker shall be removed, depending on the information received in the Apply Charging GPRS operation:

- if the Apply Charging GPRS operation carries a Session Time threshold, then the Session-Period 'Waiting-for-AC' marker shall be removed.

- if the Apply Charging GPRS operation carries a PDP Context Volume threshold, then the PDP Context-Volume 'Waiting-for-AC' marker shall be removed.

- if the Apply Charging GPRS operation carries a PDP Context Time threshold, then the PDP Context -Period 'Waiting-for-AC' marker shall be removed.

The gprsSSF then checks if there is any 'Waiting-for-AC' marker for the Session or any PDP Context. If there is no 'Waiting-for-AC' marker remaining, then the TC guard timer shall be stopped.

6.5.3.8.2.2.2 Release GPRS

If 'Check TC guard timer' is executed as a result of a Release GPRS operation from the gsmSCF, then the appropriate 'Waiting-for-AC' markers shall be removed, depending on the information received in the Release GPRS operation:

- if the Release GPRS operation is for the Session, then the Session 'Waiting-for-AC' markers shall be removed.

- if the Release GPRS operation is for the PDP Context, then the PDP Context 'Waiting-for-AC' markers shall be removed.

The gprsSSF then checks if there is any 'Waiting-for-AC' marker for the Session or any PDP Context. If there is no 'Waiting-for-AC' marker remaining, then the TC guard timer shall be stopped.

6.5.3.8.2.2.3 PDP Context Disconnect

If 'Check TC guard timer' is executed as a result of a PDP Context Disconnect signal from the SGSN, then the 'Waiting-for-AC' markers for that PDP Context shall be removed.

The gprsSSF then checks if there is any 'Waiting-for-AC' marker for the Session or any PDP Context. If there is no 'Waiting-for-AC' marker remaining, then the TC guard timer shall be stopped.

6.5.3.9 SDL diagrams for process GPRS_SSF and procedures

Process GPRS_SSF 1(21)

/* Process in the gprsSSF for the handling of CAMEL interaction with a GPRS Session and PDP Context. */

/* Signals to/from the left are to/from the SGSN. */

/*
The following timers are defined:
- Tsp: GPRS session period timer,
- Dsp: GPRS session delta timer,
- Tcp(PDP Id): PDP Context period timer,
- Dcp(PDP Id): PDP Context delta timer,
- Tsw(Session): Tariff switch timer for the GPRS session,
- Tsw(PDP Id): Tariff switch timer for a PDP Context,
- Tssf: gprsSSF state machine timer.
   This timer has a default value range of 1 to 20 seconds.
- TC guard timer: charging guard timer.
   This timer has a value range of 1 to 20 seconds.

The following octet counters are defined:
- Vc(PDP Id): PDP Context volume counter,
- Dc(PDP Id): Volume delta counter for the PDP Context.
*/

/* Messages are sent from the gprsSSF via the GPRS_Dialogue_Handler to the gsmSCF and vice versa. */

Idle

Int_Invoke_ GPRS_SSF

Arm TDPs

The GPRS-CSI may contain the following TDPs:
DP_Attach,
DP_Change_Of_Position_Session,
DP_Change_Of_Position_Context,
DP_PDP_Context_Establishment,
DP_PDP_Context_Establishment_Acknowledgement

Int_GPRS_ SSF_Invoked

Wait_for_ Request

Figure 6.17a: Process GPRS_SSF (sheet 1)

Process GPRS_SSF 2(21)

/* Process in the gprsSSF for the handling of CAMEL interaction with a GPRS Session and PDP Context. */

/* Signals from the left are from the SGSN; signal to the right is to the GPRS_Dialogue_Handler. */

Wait_for_Request

Int_GPRS_Failure

Idle

Int_DP_Attach,
Int_DP_Change_Of_Position_Session,
Int_DP_Change_Of_Position_Context,
Int_DP_PDP_Context_Establishment,
Int_DP_PDP_Context_Establishment_Acknowledgement

Set Tssf to default value and start Tssf

Open GPRS Dialogue

CAP_InitialDP_GPRS

Input signal?

Int_DP_Change_Of_Position_Context,
Int_DP_PDP_Context_Establishment_Acknowledgement

Int_DP_Attach,
Int_DP_Change_Of_Position_Session

ContextActive (PDP Id) :=true

SessionActive :=true

Instruction_Counter := 1

Waiting_for_Instructions

Figure 6.17b: Process GPRS_SSF (sheet 2)

Process GPRS_SSF 3(21)

/* Process in the gprsSSF for the handling of CAMEL interaction with a GPRS Session and PDP Context. */

/* Signals to the left are to the SGSN; signals to/from the right are to/from the GPRS_Dialogue_Handler. */

Waiting_for_ Instructions

CAP_Apply_ Charging_GPRS

Set Tssf to last used interval and restart Tssf

Handle_AC_ GPRS (Session/PDP Id)

Waiting_for_ Instructions

CAP_Cancel_ GPRS

Set Tssf to last used interval and restart Tssf

Disarm all EDPs (Session/PDP Id)

Cancel all reports (Session/PDP Id)

CAP_Connect_ GPRS

Int_Connect_ GPRS (PDP Id)

Decrement Instruction_counter

Any armed EDP-R for the Session or this PDP Context?

Yes → No

Set monitor relationship for the Session or this PDP Context

CAP_Continue_ GPRS

Int_Continue_ GPRS (Session/PDP Id)

Instruction_ counter?

0 → > 0

Stop Tssf

TC_End

Set Tssf to last used interval and restart Tssf

Waiting_for_ Instructions

Any EDPs armed or reports outstanding?

No → Yes

Complete_FCI_ Record_GPRS (Session+PDPs)

Terminate GPRS dialogue

Monitoring

Idle

Figure 6.17c: Process GPRS_SSF (sheet 3)

Process GPRS_SSF 4(21)

/* Process in the gprsSSF for the handling of CAMEL interaction with a GPRS Session and PDP Context. */

/* Signals from the right are from the GPRS_Dialogue_Handler. */

Waiting_for_ Instructions

CAP_ FurnishCharging_ InformationGPRS	CAP_ RequestReport_ GPRSEvent	CAP_ ResetTimer_ GPRS	CAP_ SendCharging_ InformationGPRS
Set Tssf to last used interval and restart Tssf	Set Tssf to last used interval and restart Tssf	Reset Tssf to value received and restart Tssf	Set Tssf to last used interval and restart Tssf
Handle_FCI_ GPRS (Session/PDP Id)	Perform arming/ disarming of events (Session/PDP Id)		Handle_SCI_ GPRS (Session/PDP Id)

Yes

No

Set monitor relationship for the Session or this PDP Context

Waiting_for_ Instructions

Any armed EDP-R for the Session or this PDP Context?

Shall not be performed if the Session or PDP Context for which the operation was sent, is waiting for instructions from the gsmSCF.

Figure 6.17d: Process GPRS_SSF (sheet 4)

Process GPRS_SSF 5(21)

/* Process in the gprsSSF for the handling of CAMEL interaction with a GPRS Session and PDP Context. */

/* Signals to the left are to the SGSN; signals to/from the right are to/from the GPRS_Dialogue_Handler. */

Waiting_for_ Instructions

Released entity?

Session

Context

CAP_ Release_ GPRS

Stop Tssf

Int_Release_ Context (PDP Id)

Check TC guard timer

Int_Release_ Session

ContextActive (PDP Id) := false

SessionActive := false

Handle_ACR_ GPRS (PDP Id)

ContextActive (all PDP's) := false

Complete_FCI_ Record_GPRS (PDP Id)

Handle_ACR_ GPRS (Session+PDP's)

'Context for which DP-R was issued'

No

Complete_FCI_ Record_GPRS (Session+PDP's)

Any EDPs armed or reports outstanding?

Yes

Decrement Instruction_counter

TC_End

TC_End

Terminate GPRS dialogue

No

0

Instruction counter?

>0

Idle

Yes

Set Tssf to last used interval and restart Tssf

Complete_FCI_ Record_GPRS (Session+PDP's)

Terminate GPRS dialogue

Monitoring

Idle

Waiting_for_ Instructions

Figure 6.17e: Process GPRS_SSF (sheet 5)

Process GPRS_SSF 6(21)

/* Process in the gprsSSF for the
handling of CAMEL interaction with
a GPRS Session and PDP Context. */

/* Signals to/from the left are to/from the SGSN;
signals to the right are to the GPRS_Dialogue_Handler. */

Waiting_for_
Instructions

Int_DP_Change_Of_Position_Session,
Int_DP_Change_Of_Position_Context,
Int_DP_PDP_Context_Establishment,
Int_DP_PDP_Context_Establishment_Acknowledgement

Perform Implicit
Disarming

Handle_PDP_
Acknowledgement
(input signal)

Was DP armed?

| No | EDP-N | EDP-R |

Int_Continue
(Session/PDP Id)

CAP_Event_Report_GPRS
(DP, notify & continue)

CAP_Event_Report_GPRS
(DP, interrupted)

Waiting_for_
Instructions

Set Tssf to last
used interval
and restart Tssf

Set Tssf to last
used interval
and restart Tssf

Int_Continue
(Session/PDP Id)

Increment
Instruction_counter

Waiting_for_
Instructions

Waiting_for_
Instructions

Figure 6.17f: Process GPRS_SSF (sheet 6)

Process GPRS_SSF 7(21)

/* Process in the gprsSSF for the handling of CAMEL interaction with a GPRS Session and PDP Context. */

/* Signals to/from the left are to/from the SGSN; signals to the right are to the GPRS_Dialogue_Handler. */

Waiting_for_ Instructions

/* Note: Change Of Position Complete is reported as a Int_DP_PDPContext_Disconnection with the cause 'Change of Position'. */

Int_DP_PDP_Context_Disconnection

Perform implicit disarming of DPs

Check TC guard timer

Was DP armed?

| No | EDP-N | EDP-R |

No:

ContextActive (PDP Id) := false

Handle_ACR_ GPRS (PDP Id)

Complete_FCI_ Record_GPRS (PDP Id)

Int_Continue (PDP Id)

CAP_Entity_ Released_GPRS (PDP Id)

Set Tssf to last used interval and restart Tssf

Waiting_for_ Instructions

EDP-N:

CAP_Event_Report_GPRS (DP, notify & continue)

ContextActive (PDP Id) := false

Handle_ACR_ GPRS (PDP Id)

Set Tssf to last used interval and restart Tssf

Complete_FCI_ Record_GPRS (PDP Id)

Int_Continue (PDP Id)

EDP-R:

ContextActive (PDP Id) := false

Handle_ACR_ GPRS (PDP Id)

CAP_Event_Report_GPRS (DP, interrupted)

Set Tssf to last used interval and restart Tssf

Increment Instruction_counter

Figure 6.17g: Process GPRS_SSF (sheet 7)

Process GPRS_SSF 8(21)

/* Process in the gprsSSF for the handling of CAMEL interaction with a GPRS Session and PDP Context. */

/* Signal from the left is from the SGSN.*/

Waiting_for_ Instructions

Int_QoS_Change (PDP Id)

No ◁── Any outstanding report for this PDP Context?

Yes

Handle_ACR_GPRS (PDP Id)

Set Tssf to last used interval and restart Tssf

Waiting_for_ Instructions
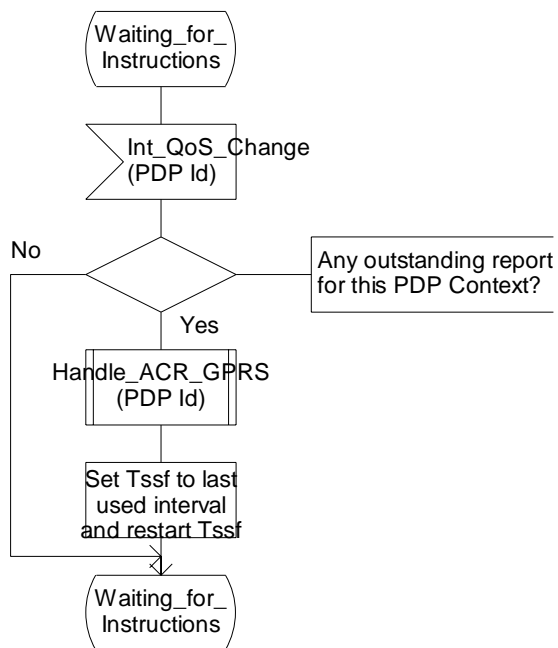
Figure 6.17h: Process GPRS_SSF (sheet 8)

Process GPRS_SSF 9(21)

/* Process in the gprsSSF for the handling of CAMEL interaction with a GPRS Session and PDP Context. */

/* Notes:
- The period timers are received from an entity internal to the gprsSSF when the threshold has been reached.
- The volume counters are received from an entity internal to the gprsSSF when the threshold has been reached.
*/
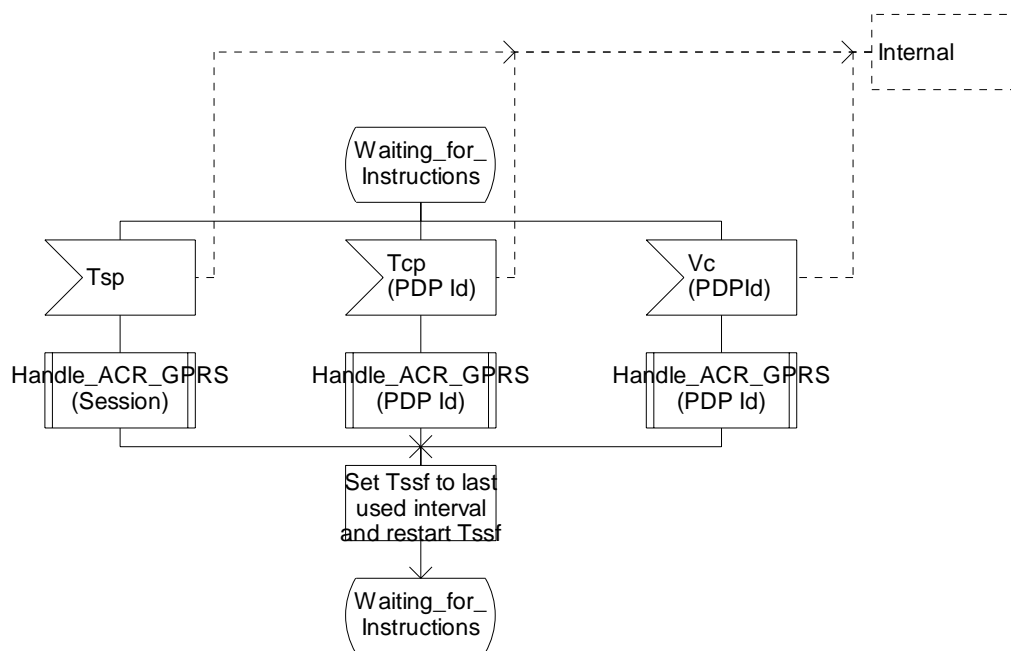
Figure 6.17i: Process GPRS_SSF (sheet 9)

Process GPRS_SSF   10(21)

/* Process in the gprsSSF for the
handling of CAMEL interaction with
a GPRS Session and PDP Context. */

/* Signal to the right is to the GPRS_Dialogue_Handler.
Signals to the left are to the SGSN. */

Waiting_for_
Instructions

Tssf - - - - Internal

TC_Abort

Int_Error

Decrement
Instruction_counter

Instruction_
counter = 0?   No

Yes

Default GPRS   Continue
handling?

Release

Int_Release_
Session

Complete_FCI_
Record_GPRS
(Session+PDP Id)

Terminate
GPRS Dialogue

Idle
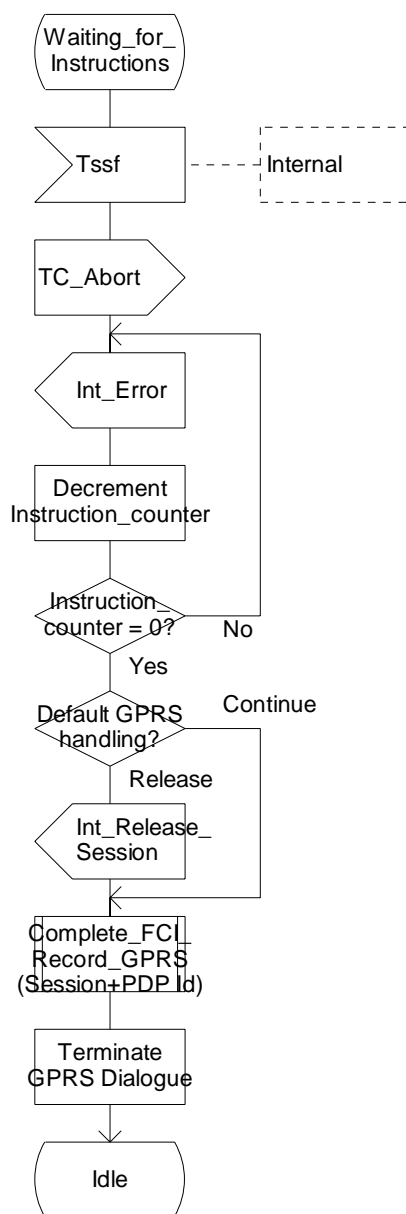
Figure 6.17j: Process GPRS_SSF (sheet 10)

Process GPRS_SSF   11(21)

/* Process in the gprsSSF for the
handling of CAMEL interaction with
a GPRS Session and PDP Context. */

Waiting_for_
Instructions

TC guard
timer   Internal

Waiting_for_
Instructions
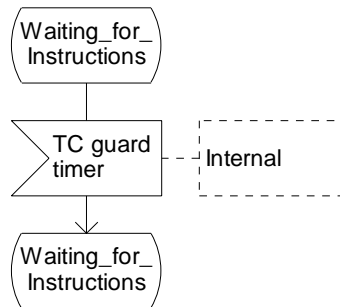
Figure 6.17k: Process GPRS_SSF (sheet 11)

Process GPRS_SSF 12(21)

/* Process in the gprsSSF for the handling of CAMEL interaction with a GPRS Session and PDP Context. */

/* Signals to/from the right are to/from the GPRS_Dialogue_Handler. */

Monitoring

CAP_Apply_Charging_GPRS

Handle_AC_GPRS
(Session/PDP Id)

TC_End

Monitoring

CAP_Cancel_GPRS

Disarm all EDPs
(Session/PDP Id)

Cancel all reports
(Session/PDP Id)

Complete_FCI_Records_GPRS
(Session/PDP Id)

Any EDPs armed or reports outstanding?

No

Yes

TC_End

Monitoring

Complete_FCI_Record_GPRS
(Session+PDP's)

TC_End

Terminate GPRS dialogue

Idle

CAP_FurnishCharging_InformationGPRS

Handle_FCI_GPRS
(Session/PDP Id)

TC_End

Monitoring

CAP_SendCharging_InformationGPRS

Handle_SCI_GPRS
(Session/PDP Id)

TC_End

Monitoring
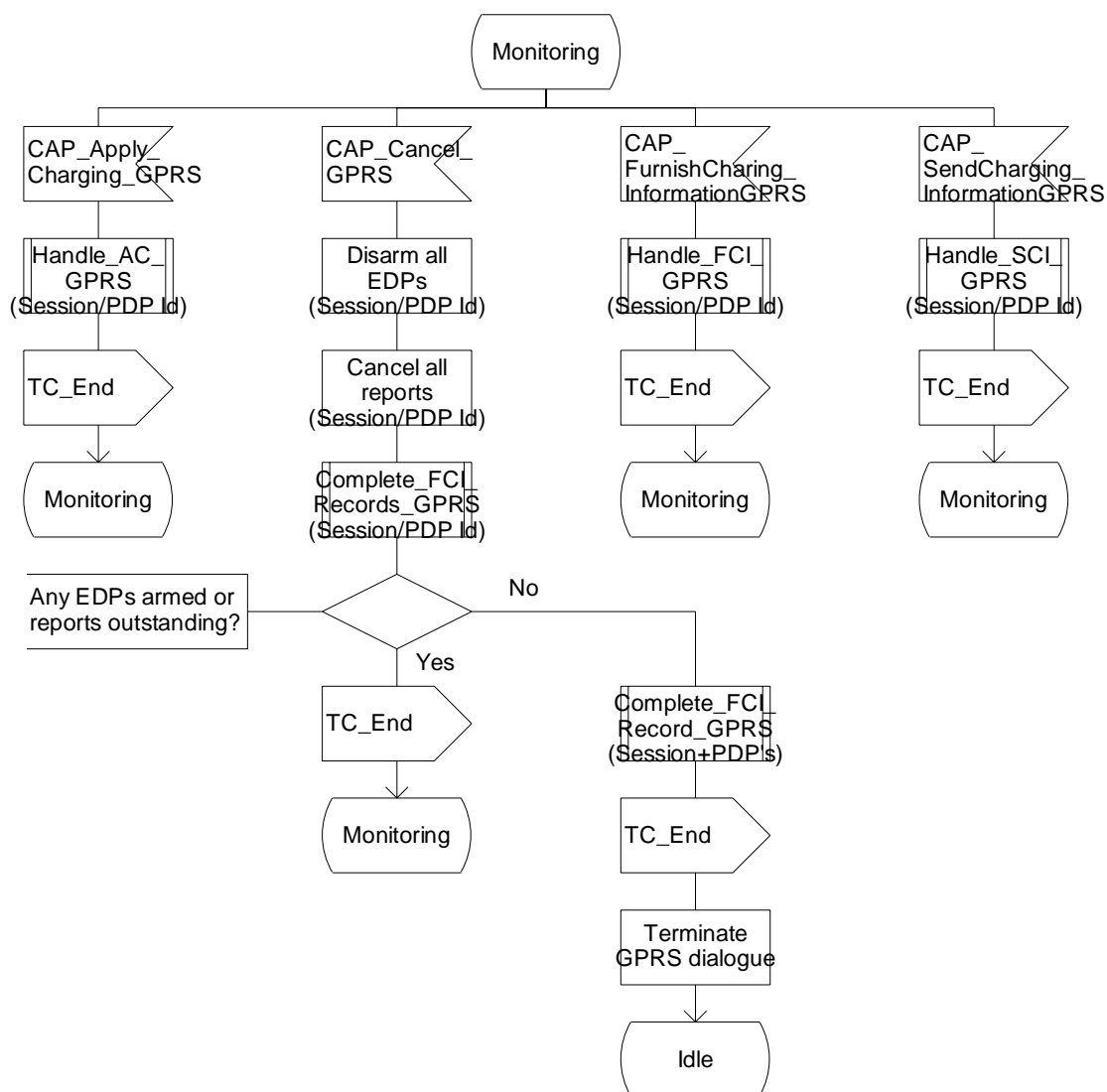
Figure 6.17I: Process GPRS_SSF (sheet 12)

Process GPRS_SSF 13(21)

/* Process in the gprsSSF for the handling of CAMEL interaction with a GPRS Session and PDP Context. */

/* Signals to the left are to the SGSN; signals to/from the right are to/from the GPRS_Dialogue_Handler. */

Monitoring

CAP_Release_GPRS

Released entity?

Session → Int_Release_Session

SessionActive := false

ContextActive (all PDP's) :=false

Handle_ACR_GPRS (Session+PDP's)

Complete_FCI_Record_GPRS (Session+PDP's)

TC_End

Terminate GPRS dialogue

Idle

Any EDPs armed or reports outstanding?

Context → Int_Release_Context (PDP Id)

Check TC guard timer

ContextActive (PDPId) := false

Handle_ACR_GPRS (PDPId)

Complete_FCI_Record_GPRS (PDP Id)

TC_End

No

Yes

Complete_FCI_Records_GPRS (Session+PDP's)

Terminate GPRS dialogue

Monitoring

Idle
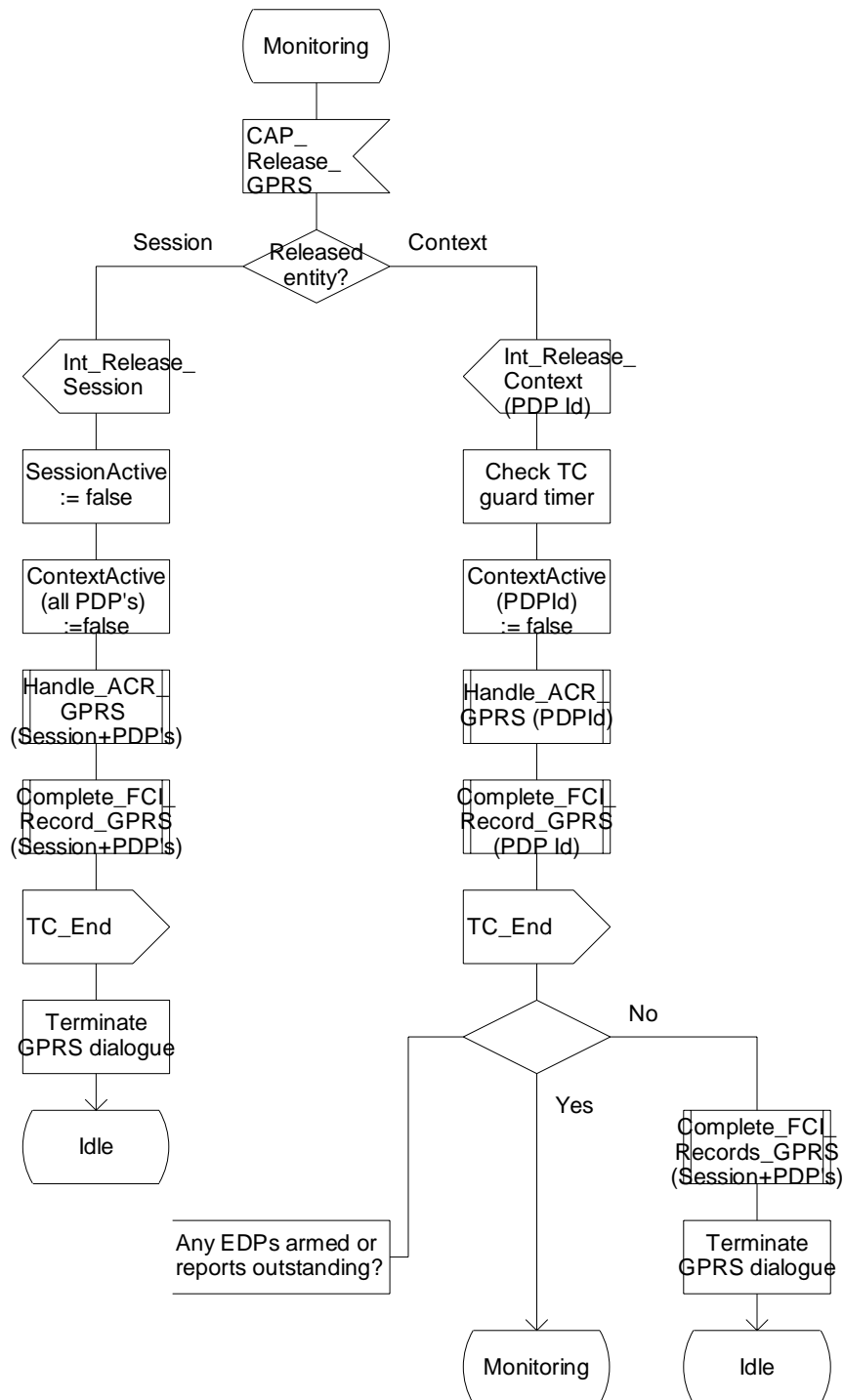
Figure 6.17m: Process GPRS_SSF (sheet 13)

Process GPRS_SSF 14(21)

/* Process in the gprsSSF for the handling of CAMEL interaction with a GPRS Session and PDP Context. */

/* Signals to/from the right are to/from the GPRS_Dialogue_Handler. */

Monitoring

CAP_ RequestReport_ GPRSEvent

Perform disarming of events (Session/PDP Id)

Yes ◇ Any armed EDP or outstanding report for the Session or this PDP Context

No

Complete_FCI_ Record_GPRS (Session/PDP Id)

TC_End

Yes ◇ Any armed EDP-R for the Session or this PDP Context?

No

Set monitor relationship for the session or this PDP context

Any EDPs armed or reports outstanding? ◇ No

Yes

Complete_FCI_ Record_GPRS (Session+PDPs)

Terminate GPRS dialogue

Monitoring   Idle

Figure 6.17n: Process GPRS_SSF (sheet 14)

Process GPRS_SSF 15(21)

/* Process in the gprsSSF for the handling of CAMEL interaction with a GPRS Session and PDP Context. */

/* Signals to/from the left are to/from the SGSN; signals to the right are to the GPRS_Dialogue_Handler. */

Monitoring

Int_DP_Change_Of_Position_Session,
Int_DP_Change_Of_Position_Context,
Int_DP_PDP_Context_Establishment,
Int_DP_PDP_Context_Establishment_Acknowledgement

Perform Implicit Disarming

Handle_PDP_ Acknowledgement (input signal)

Was DP armed?

No

Int_Continue (Session/PDP Id)

Monitoring

EDP-N

CAP_Event_Report_GPRS (DP, notify & continue)

Int_Continue (Session/PDP Id)

TC_End

Any EDPs armed or reports outstanding?

No

Yes

Complete_FCI_ Record_GPRS (Session+PDP's)

Terminate GPRS dialogue

Monitoring

Idle

EDP-R

CAP_Event_Report_GPRS (DP, interrupted)

Set Tssf to last used interval and restart Tssf

Instruction_ counter := 1

Waiting_for_ Instructions

Figure 6.17o: Process GPRS_SSF (sheet 15)

Figure 6.17p: Process GPRS_SSF (sheet 16)

Process GPRS_SSF   17(21)

/* Process in the gprsSSF for the
handling of CAMEL interaction with
a GPRS Session and PDP Context. */

/* Signal from the left is from the SGSN.*/

Monitoring

Int_QoS_Change
(PDP Id)

Handle_ACR_GPRS
(PDP Id)

Monitoring

Figure 6.17q: Process GPRS_SSF (sheet 17)

Process GPRS_SSF   18(21)

/* Process in the gprsSSF for the
handling of CAMEL interaction with
a GPRS Session and PDP Context. */

/* Notes:
- The period timers are received from an entity internal
  to the gprsSSF when the threshold has been reached.
- The volume counters are received from an entity
  internal to the gprsSSF when the threshold has been
  reached.
*/

Internal

Monitoring

Tsp

Tcp
(PDP Id)

Vc
(PDP Id)

Handle_ACR_GPRS
(Session)

Handle_ACR_GPRS
(PDP Id)

Handle_ACR_GPRS
(PDP Id)

Any EDPs armed or
reports outstanding?

No

Yes

Complete_FCI_
Record_GPRS
(Session+PDPs)

Terminate
GPRS dialogue

Monitoring

Idle
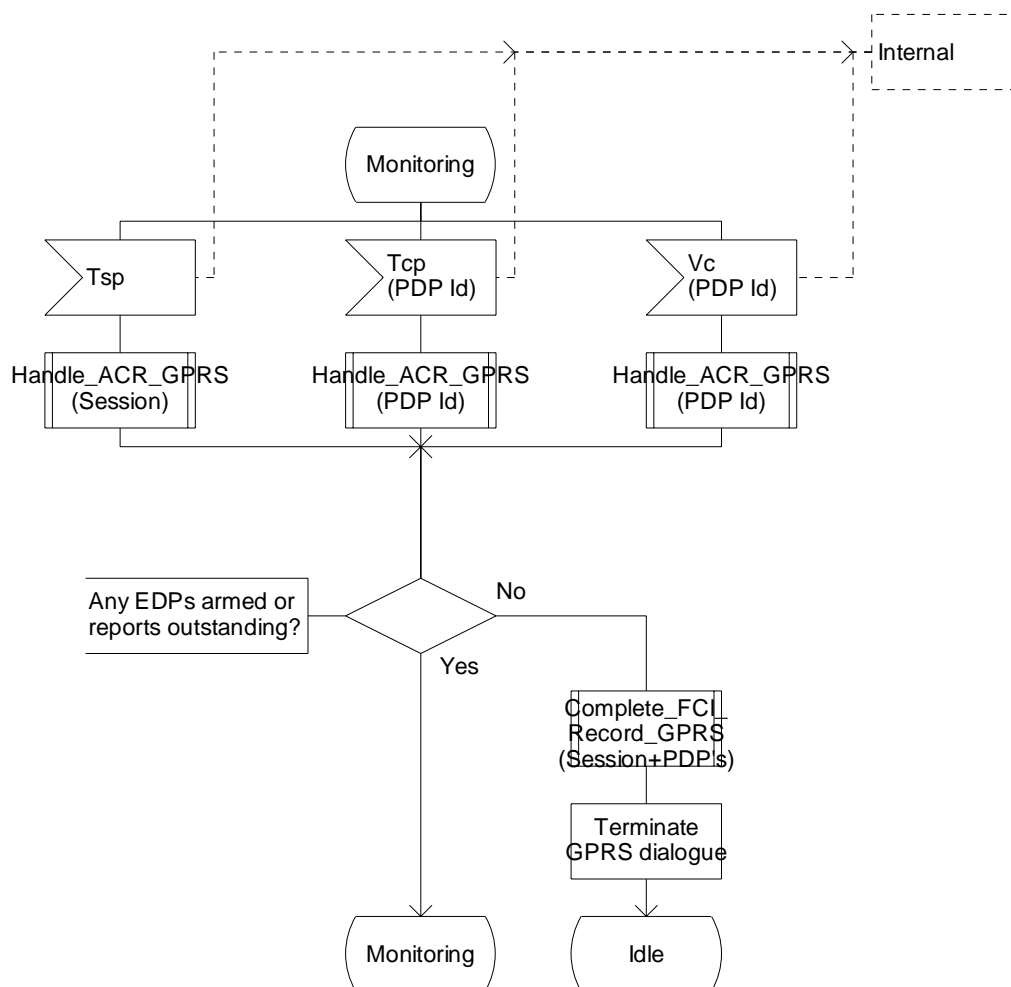
Figure 6.17r: Process GPRS_SSF (sheet 18)

Process GPRS_SSF 19(21)

/* Process in the gprsSSF for the handling of CAMEL interaction with a GPRS Session and PDP Context. */

/* Signals to the right is to the GPRS_Dialogue_Handler */

Monitoring

TC guard timer — Internal

TC_End

Monitoring
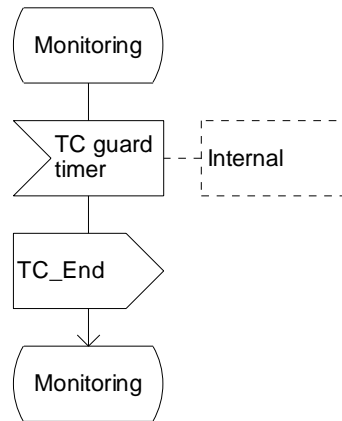
Figure 6.17s: Process GPRS_SSF (sheet 19)

Process GPRS_SSF 20(21)

/* Process in the gprsSSF for the handling of CAMEL interaction with a GPRS Session and PDP Context. */

/* Signals to/from the left are to/from the SGSN; signals to the right are to the GPRS_Dialogue_Handler. */

Waiting_for_Instructions, Monitoring

/* Note: DP Change Of Position SessionComplete is signaled with Int_DP_Detach with the cause 'Change of Position'. */

Int_DP_Detach

Perform implicit disarming of DPs

Was DP armed?

No

Stop Tssf

SessionActive := false

ContextActive (all PDP's) := false

Handle_ACR_ GPRS (Session+PDP's)

Int_Continue (Session)

CAP_Entity_ Released_GPRS (Session)

Complete_FCI_ Record_GPRS (Session+PDP's)

TC_End

Terminate GPRS dialogue

Idle

EDP-N

Stop Tssf

CAP_Event_Report_GPRS (DP, notify & continue)

SessionActive := false

ContextActive (all PDP's) := false

Handle_ACR_ GPRS (Session+PDP's)

Int_Continue (Session)

Complete_FCI_ Record_GPRS (Session+PDP's)

TC_End

Terminate GPRS dialogue

Idle

EDP-R

SessionActive := false

ContextActive (all PDP's) := false

Handle_ACR_ GPRS (Session+PDP's)

CAP_Event_Report_GPRS (DP, interrupted)

Set Tssf to last used interval and restart Tssf

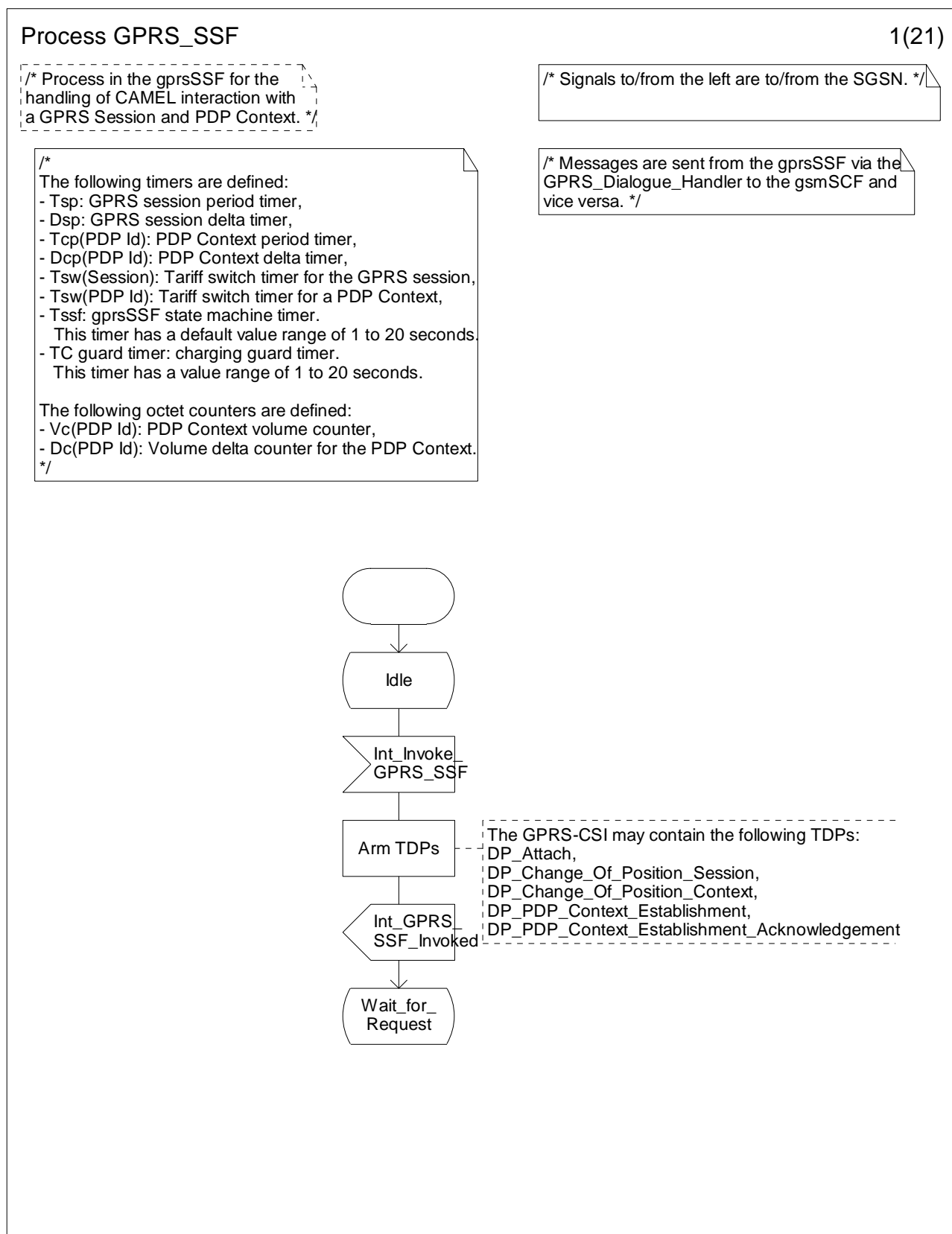Increment Instruction_counter

Waiting_for_ Instructions

Figure 6.17t: Process GPRS_SSF (sheet 20)

Process GPRS_SSF 21(21)

/* Process in the gprsSSF for the handling of CAMEL interaction with a GPRS Session and PDP Context. */

/* Signals to the left are to the SGSN */

Waiting_for_instructions, Monitoring

Tsw (Session)

Tsw (PDPId)

Internal

Any stored e-parameters?

No   Yes

Set stored e-parameters as applicable

No stored e-parameters exist after this setting

Send_ e-parameters

This provokes the SGSN to send e-parameters to the MS if the AoC is supported by the SGSN

Any stored e-parametes?

No   Yes

Context-Active(PDPId) = true?

No

Yes

Set stored e-parameters as applicable

Send_ e-parameters

-

Overwrite pending e-parameters by stored e-parameters. Discard stored e-parameters.

Figure 6.17u: Process GPRS_SSF (sheet 21)

Process GPRS_Dialogue_Handler 1(1)

/* Handling of GPRS dialogues */

/* Signals to/from the left are to/from the gprsSSF; signals to/from the right are to/from the gsmSCF. */

/* Messages are sent from the gprsSSF via the GPRS_Dialogue_Handler to the gsmSCF and vice versa. */

/* A new GPRS Dialogue is created when a CAP_InitialDP_GPRS is to be sent. It is deleted by 'Terminate GPRS dialogue'. The receipt of TC-End signal closes the TCAP dialogue. */

Idle

any signal

any signal — in TC_BEGIN (Dialogue ID=j)

Open TCAP dialogue

Open TCAP dialogue

in TC_BEGIN (Dialogue ID=j) — same signal

same signal

Active

TC_Abort (Dialogue ID=j)

TC_End (Dialogue ID=j)

any signal

any signal

TC_BEGIN (Dialogue ID=k)

TC_ABORT (Dialogue ID=j)

Any messages buffered?

same signal

same signal

CAP-U-ABORT-REASON :=overlapping-dialogue

No | Yes

TC_END (Dialogue ID=j)

Active

TC_ABORT (Dialogue ID=k)

Close TCAP dialogue

Idle

Refer to subclause 6.5.3.2

in TC_CONTINUE (Dialogue ID=j)

Figure 6.18a: Process GPRS_Dialogue_Handler (sheet 1)

Procedure Handle_AC_GPRS 1(2)

/* Procedure in the gprsSSF for handling of
ApplyChargingGPRS. */

AC_GPRS
for session? — No → (1)

Yes

Tsp pending
= true? — Yes → ⊗

No

Tsw(Session)
provided? — No →

Yes

Start
Tsw(Session)

Stop delta
measurement
(Dsp)

Tsp :=
Tsp - Dsp

Start Tsp

Tsp pending
:= true

Check TC
guard timer

⊗
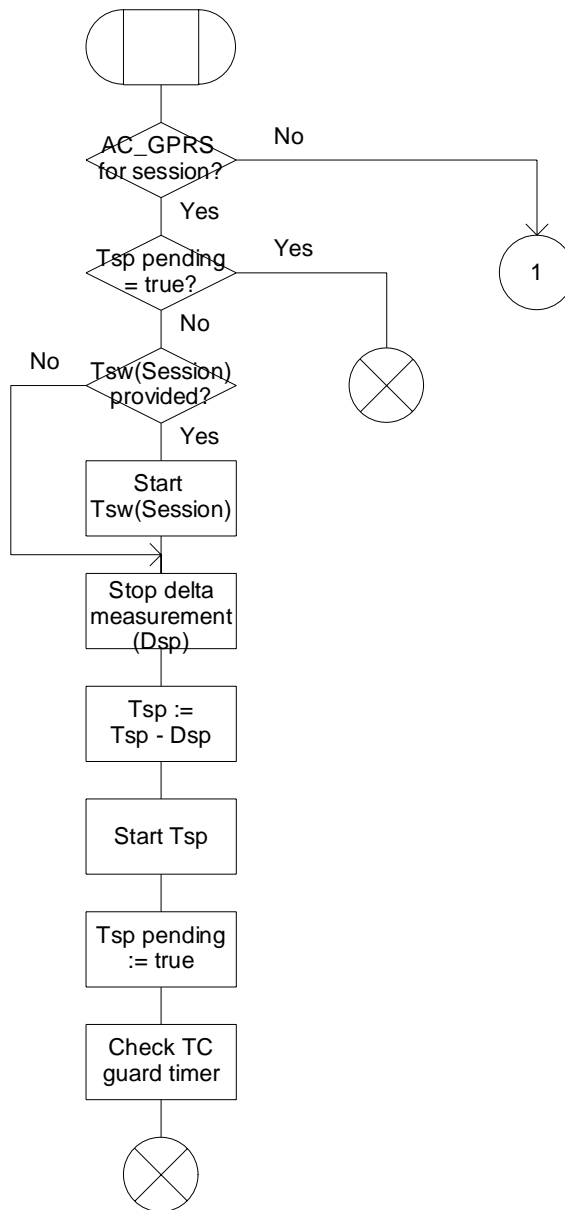
Figure 6.19a: Procedure Handle_AC_GPRS (sheet 1)

Procedure Handle_AC_GPRS 2(2)

/* Procedure in the gprsSSF for handling of
ApplyChargingGPRS. */

```
                                    ( 1 )
                                      │
                    Volume    ╱ Type of ╲    Time
              ┌──────────────<  threshold? >──────────────┐
              │               ╲         ╱                 │
              │                                           │
              │                                           │
        Yes ╱ Vc(PDP Id) ╲                    ╱ Tcp(PDP Id) ╲ Yes
      ┌─────<   pending?   >                  <   pending?    >─────┐
      │      ╲           ╱                     ╲            ╱       │
     ⊗             │ No                              │ No         ⊗
              ╱ Tsw(PDP Id) ╲                  ╱ Tsw(PDP Id) ╲
          No ╱   provided?   ╲              No ╱   provided?   ╲
        ┌──<                  >           ┌──<                  >
        │   ╲               ╱              │  ╲               ╱
        │        │ Yes                     │       │ Yes
        │   ┌──────────┐                   │   ┌──────────┐
        │   │  Start   │                   │   │  Start   │
        │   │ Tsw(PDP Id)│                 │   │ Tsw(PDP Id)│
        │   └──────────┘                   │   └──────────┘
        │        │                         │        │
        │   ContextActive                  │   ContextActive
     No │   ╱(PDP Id)=true?╲            No │   ╱(PDP Id)=true?╲
        ├──<                >             ├──<                >
        │   ╲             ╱               │   ╲             ╱
        │        │ Yes                    │        │ Yes
        │   ┌──────────┐                  │   ┌──────────┐
        │   │Stop delta │                 │   │Stop delta │
        │   │measurement│                 │   │measurement│
        │   │(Dc(PDP Id))│                │   │(Dcp(PDP Id))│
        │   └──────────┘                  │   └──────────┘
        │        │                        │        │
        │   ┌──────────┐                  │   ┌──────────┐
        │   │Vc(PDP Id):=│                │   │Tcp(PDP Id):=│
        │   │Vc(PDP Id) -│                │   │Tcp(PDP Id) -│
        │   │Dc(PDP Id) │                 │   │Dcp(PDP Id) │
        │   └──────────┘                  │   └──────────┘
        │        │                        │        │
        │   ┌──────────┐                  │   ┌──────────┐
        │   │  Start   │                  │   │  Start   │
        │   │Vc(PDP Id)│                  │   │Tcp(PDP Id)│
        │   └──────────┘                  │   └──────────┘
        │        │                        │        │
        │   ┌──────────┐                  │   ┌──────────┐
        │   │Vc(PD PId)│                  │   │Tcp(PDP Id)│
        │   │ pending  │                  │   │ pending  │
        │   │ := true  │                  │   │ := true  │
        │   └──────────┘                  │   └──────────┘
        │        │                        │        │
        │   ┌──────────┐                  │   ┌──────────┐
        │   │ Check TC │                  │   │ Check TC │
        │   │guard timer│                 │   │guard timer│
        │   └──────────┘                  │   └──────────┘
        └────────┴────────────┬───────────┴────────┘
                              ⊗
```

Figure 6.19b: Procedure Handle_AC_GPRS (sheet 2)

Procedure Handle_ACR_GPRS 1(2)

/* Procedure in the gprsSSF for handling of ApplyChargingReport. */

/* Signals to the right are to the GPRS_Dialogue_Handler. */
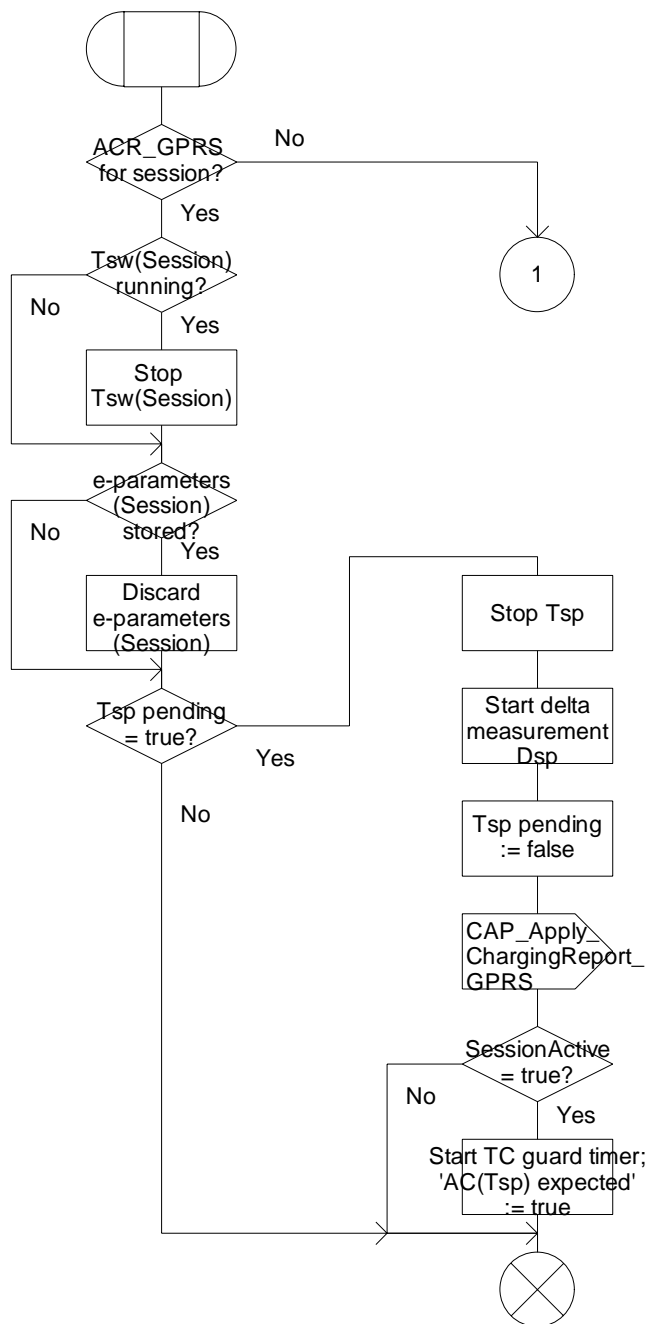
Figure 6.20a: Procedure Handle_ACR_GPRS (sheet 1)

Procedure Handle_ACR_GPRS 2(2)

/* Procedure in the gprsSSF for handling of ApplyChargingReport. */

/* Signals to the right are to the GPRS_Dialogue_Handler. */
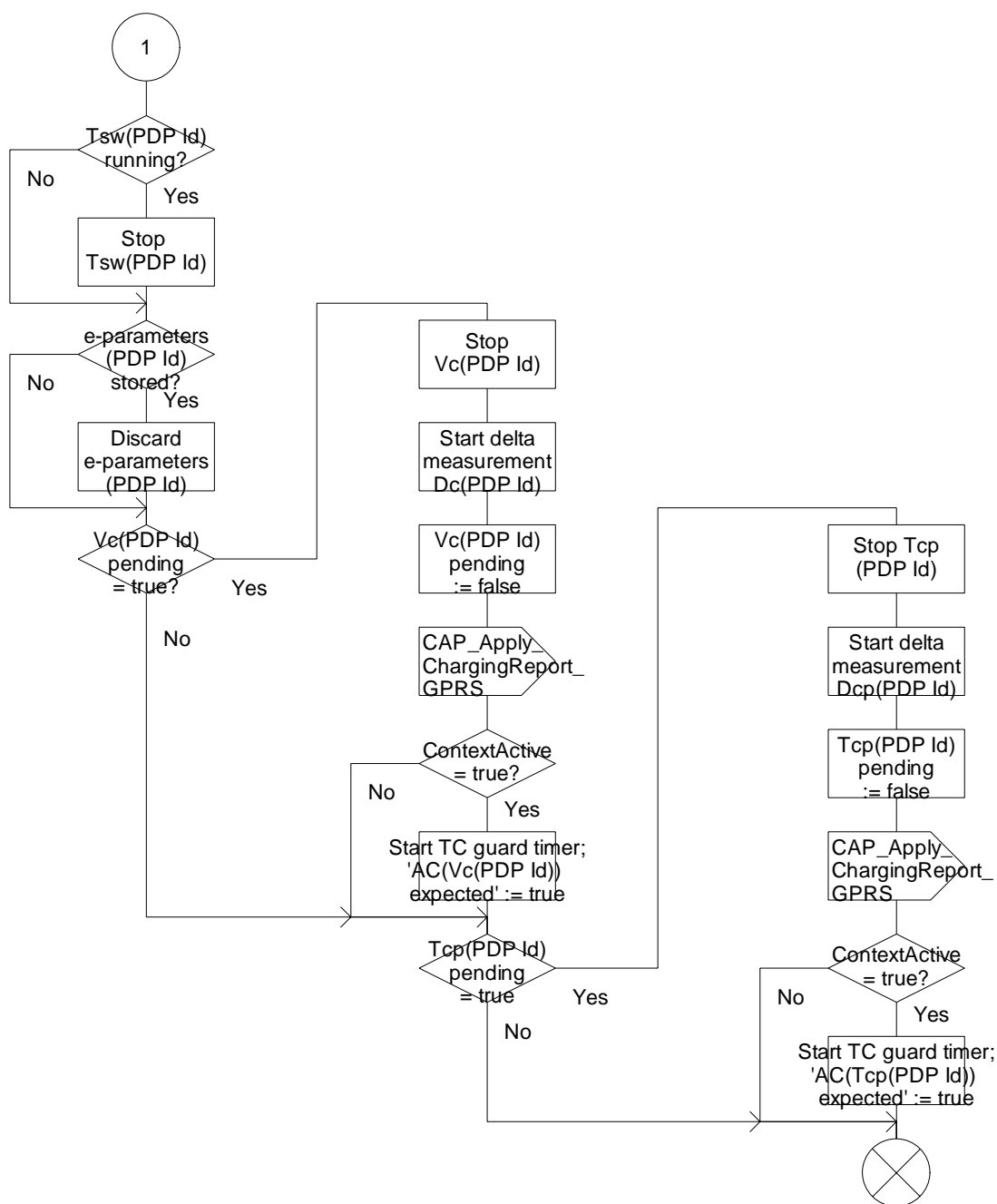
Figure 6.20b: Procedure Handle_ACR_GPRS (sheet 2)

Procedure Handle_FCI_GPRS 1(1)

/*Procedure in the gprsSSF to handle
FurnishChargingInformationGPRS*/

FCI_GPRS
for session?

No   Yes

Non-completed CAMEL
logical GPRS record
exists for this PDP?   No

Yes

Append Free Format
Data in FCI_GPRS?

Append   Not present,
Overwrite   Create CAMEL
logical GPRS
record

Append free format
data to existing
logical GPRS record

Overwrite all CAMEL
logical GPRS record
data with this FCI data

Write FCI data
in CAMEL logical
GPRS record

Non-completed CAMEL
logical GPRS record
exists for this session?   No

Yes

Append Free Format
Data in FCI_GPRS?

Append   Not present,
Overwrite   Create CAMEL
logical GPRS
record

Append free format
data to existing
logical GPRS record

Overwrite all CAMEL
logical GPRS record
data with this FCI data

Write FCI data
in CAMEL logical
GPRS record

Figure 6.21a: Procedure Handle_FCI_GPRS (sheet 1)

Procedure Complete_FCI_Record_GPRS 1(1)

/* Procedure in the gprsSSF to
write Furnish Charging Information
data to a PDP context for the specified
PDP Id, or session. */

Non-completed Logical
CAMEL record exists for
this PDP context or session?

Yes

No

Complete CAMEL
logical GPRS
record
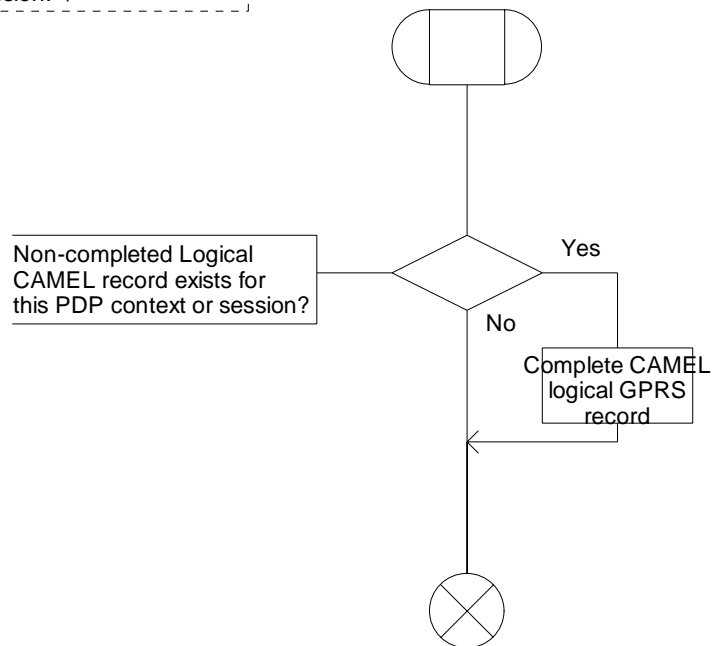
Figure 6.22a: Procedure Complete_FCI_Record_GPRS (sheet 1)

Procedure Handle_SCI_GPRS 1(3)

/* Procedure in the gprsSSF for handling of
SendChargingInformationGPRS>
Refer also to subclause 6.5.3.6. */

SCI_GPRS for session? — No → (1)

Yes

Tsw (Session) running? — Yes → e-parameters stored?

No

Received in SCI?

1 set of e-parameters	Tsw + 2 sets of e-parameters	other
Send e-parameters to SGSN	Send 1st set to SGSN, store 2nd set, start Tsw(Session)	Error

e-parameters stored? — Yes → Error

No

Received in SCI?

2 sets of e-parameters	other
Send 1st set to SGSN, store 2nd set	Error

⊗

Figure 6.23a: Procedure Handle_SCI_GPRS (sheet 1)
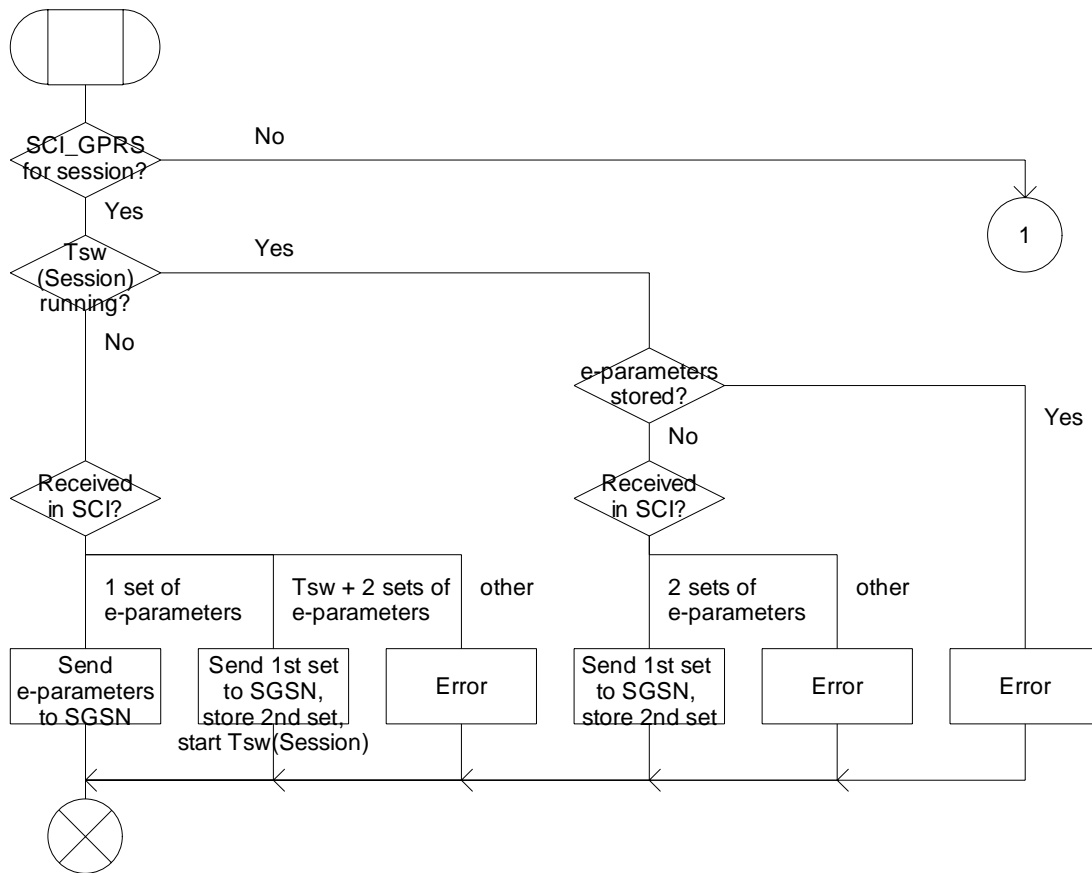
Procedure Handle_SCI_GPRS 2(3)

/* Procedure in the gprsSSF for handling of
SendChargingInformationGPRS>
Refer also to subclause 6.5.3.6. */

1

ContextActive
= true? — Yes → 2

No

Tsw
(PDP Id)
running? — Yes

No

e-parameters
stored? — Yes

No

Received
in SCI?

Received
in SCI?

| 1 set of e-parameters | Tsw + 2 sets of e-parameters | other |
| Tsw + 2 sets of e-parameters | 2 sets of e-parameters | other |

Send e-parameters to SGSN

Send 1st set to SGSN, store 2nd set, start Tsw(PDP Id)

Error

Send 1st set to SGSN, store 2nd set

Error

Error

⊗
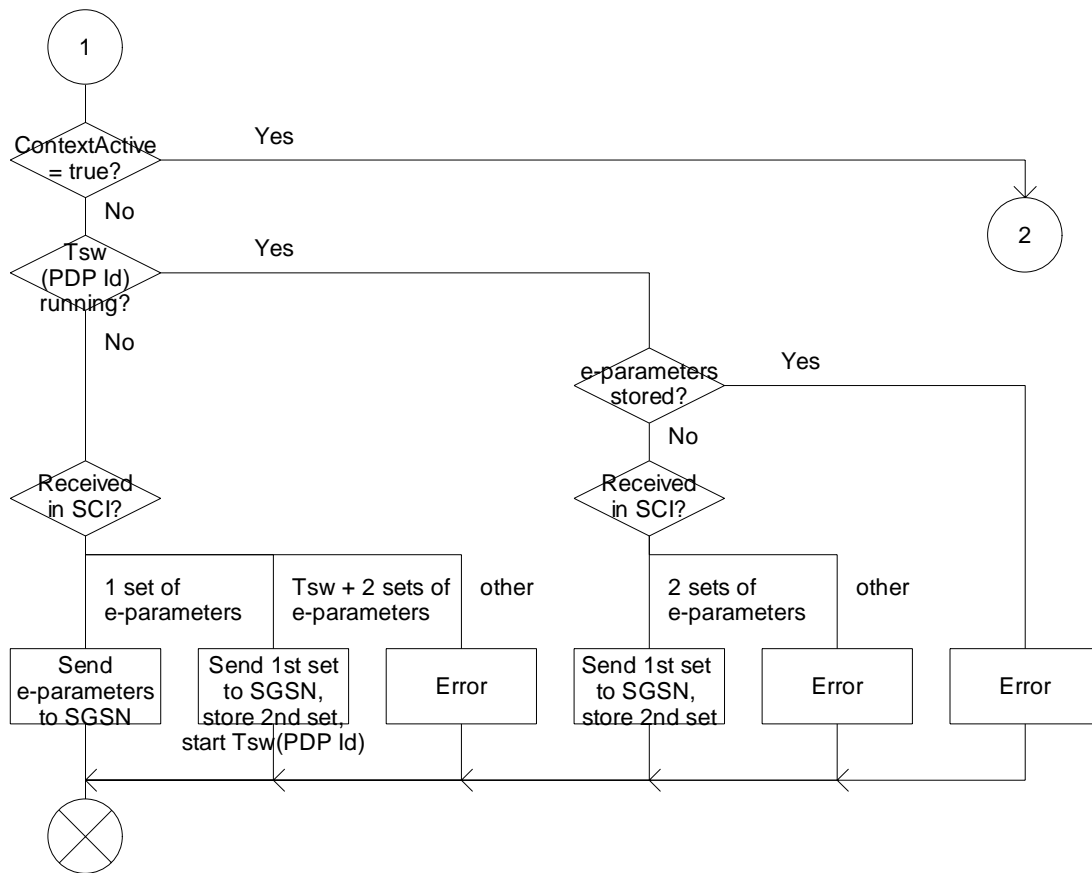
Figure 6.23b: Procedure Handle_SCI_GPRS (sheet 2)

Procedure Handle_SCI_GPRS 3(3)

/* Procedure in the gprsSSF for handling of
SendChargingInformationGPRS>
Refer also to subclause 6.5.3.6. */

```
                    ( 2 )

                  ╱ Tsw  ╲         Yes
                 ╱ (PDP Id)╲───────────────────┐
                 ╲ running? ╱                   │
                  ╲       ╱                      │
                     No                    ╱ e-parameters ╲      Yes
                      │                   ╱   stored?      ╲──────────────────────┐
                      │                   ╲               ╱                       │
                      │                    ╲             ╱                        │
                      │                        No                            ┌─────────┐
                      │                         │                            │  Error  │
                      │                    ╱ Received ╲                      └─────────┘
                      │                   ╱  in SCI?   ╲
                      │                   ╲            ╱
                      │                    ╲          ╱
                      │        ┌────────────┴──────────────┬──────────┐
                      │     1 set of              2 sets of        other
                      │    e-parameters          e-parameters
                      │
                      │      ┌──────────┐       ┌──────────────┐   ┌─────────┐
                      │      │  Store   │       │ Send 1st set │   │  Error  │
                      │      │e-parameters│     │  to SGSN,    │   └─────────┘
                      │      └──────────┘       │ store 2nd set│
                      │            │            └──────────────┘
                 ╱ Received ╲
                ╱  in SCI?   ╲
                ╲            ╱
                 ╲          ╱
       ┌──────────┴──────────┬──────────────────┬──────────┐
    1 set of         Tsw + 1 set of      Tsw + 2 sets of   other
   e-parameters      e-parameters         e-parameters

   ┌──────────┐     ┌──────────────┐    ┌──────────────┐   ┌─────────┐
   │  Send    │     │Store e-parameters,│ │ Send 1st set │   │  Error  │
   │e-parameters│   │ start Tsw(PDP Id)│  │  to SGSN,    │   └─────────┘
   │ to SGSN  │     └──────────────┘    │ store 2nd set,│
   └──────────┘                         │ start Tsw(PDP Id)│
        │                               └──────────────┘

      ( ⊗ )
```
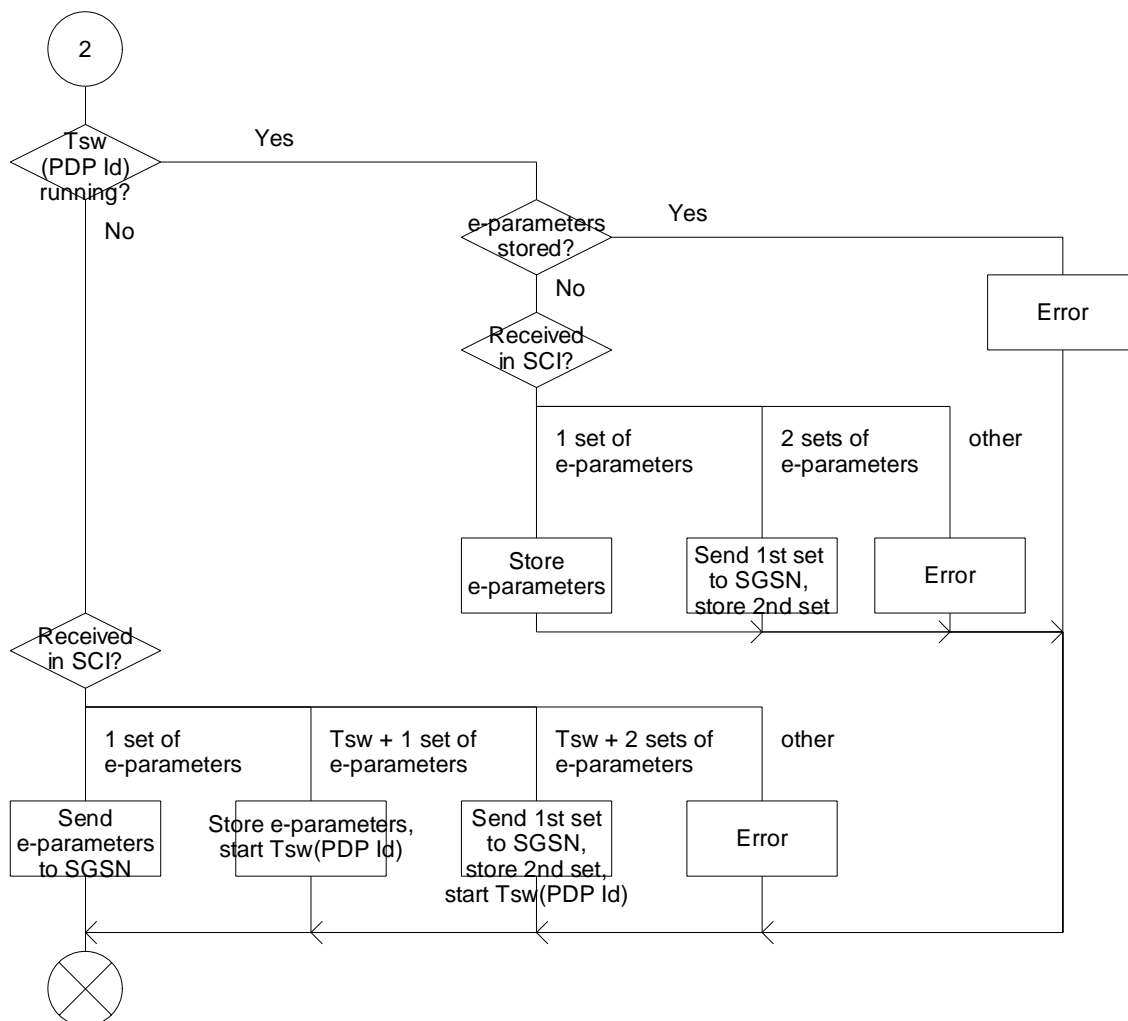
Figure 6.23c: Procedure Handle_SCI_GPRS (sheet 3)

Procedure Handle_PDP_Acknowledgement 1(1)

/* Procedure in the gprsSSF for
the handling of PDP Context
Acknowledgement. */

```
                              ┌───┬───┐
                              │   │   │
                              └───┴───┘
                                 │
                              ╱input ╲
              other  ────────<  signal? >
                              ╲      ╱
                                 │
                   Int_DP_PDP_Context_Establishment_Acknowledgement,
                   Int_DP_Change_of_Position_Context
                                 │
                          ┌──────────────┐
                          │ ContextActive│
                          │ (PDP Id) := true│
                          └──────────────┘
                                 │
                              ╱Input ╲
              other  ────────<  signal? >
                              ╲      ╱
                                 │
                   Int_DP_PDP_Context_Establishment_Acknowledgement
                                 │
                            ╱e-parameters╲
                   No  ─────<   (PDP Id)   >
                            ╲  pending?   ╱
                                 │ Yes
                          ┌──────────────┐
                          │Send e-parameters│
                          │   (PDP Id)   │
                          │   to SGSN    │
                          └──────────────┘
                                 │
                            ╱Tcp(PDP Id)╲
                           <  pending = true? >──── Yes
                            ╲           ╱              │
                                 │ No            ┌──────────┐
                                 │               │  Start   │
                                 │               │ Tcp(PDP Id)│
                                 │               └──────────┘
                                 │<─────────────────┘
                            ╱Vc(PDP Id)╲
                           <  pending = true? >──── Yes
                            ╲          ╱               │
                                 │ No            ┌──────────┐
                                 │               │  Start   │
                                 │               │ Vc(PDP Id)│
                                 │               └──────────┘
                                 │<─────────────────┘
                                ⊗
```

Figure 6.24a: Procedure Handle_PDP_Acknowledgement (sheet 1)

6.6 Description of information flows

This clause contains the detailed description of the information flows used by CAMEL.

Each Information Element (IE) is marked as Mandatory (M), Conditional (C), Optional (O) or Not applicable (-). This categorization is a functional classification, i.e., stage 2 information and not a stage 3 classification to be used for the ASN.1 syntax of the protocol.

Details of errors and exceptions to these rules are specified in 3GPP TS 29.002 [4] and TS 29.078 [5].

6.6.1 gprsSSF to gsmSCF Information Flows

6.6.1.1 Activity Test GPRS Ack

6.6.1.1.1 Description

This IF is the response to the Activity Test GPRS.

6.6.1.1.2 Information Elements

This IF contains no information elements.

6.6.1.2 Apply Charging Report GPRS

6.6.1.2.1 Description

This IF is used by the gprsSSF to report to the gsmSCF the information requested in the Apply Charging GPRS IF. In addition, this IF is used to notify the gsmSCF of user initiated change in QoS. Note that there are several possible QoS profiles defined by the combinations of the different QoS attributes as defined in 3GPP TS 23.060 [11]. A PLMN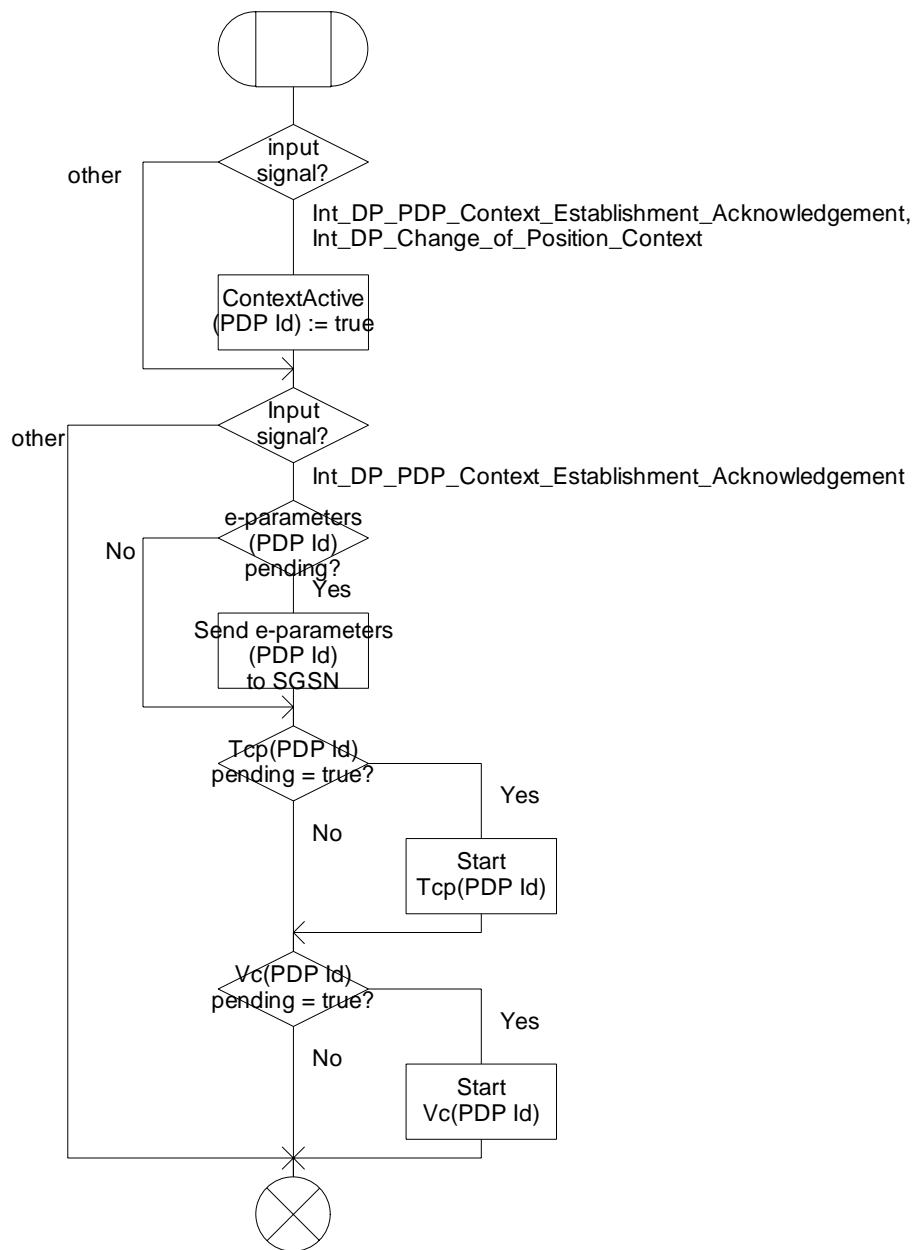 may only support and charge on a limited subset of those QoS. It is recommended that changes in QoS are only reported in Apply Charging Report GPRS for those QoS profiles.

6.6.1.2.2 Information Elements

The following information elements are required:

Information element name	Required	Description
GPRS Reference Number	C	This IE consists of a number assigned by the gprsSSF and a number assigned by the gsmSCF. It is used for TCAP dialogue segmentation. Refer to 3GPP TS 29.078 [5] for the usage of this element.
Charging Result	M	This IE contains the charging information for the PDP provided by the gsmSSF. It is a choice between elapsed time and data volume.
Quality of Service	C	This IE is described in the table below.
Active	M	This IE indicates if the GPRS session or PDP context is still established, or if it has been detached or deactivated.
PDP ID	C	This IE identifies the PDP context which the Apply Charging Report is applicable for. If not present the dialogue corresponds to the GPRS session or to one single PDP context.
Charging Roll Over	C	This IE indicates which parameter(s) of the *Charging Result* have overflowed. Refer to 3GPP TS 29.078 [5] for the usage of this element. NOTE: It is possible that early implementations of the gprsSSF do not support this information element.
M Mandatory (The IE shall always be sent).		
C Conditional (The IE shall be sent, if available).		

Quality of Service contains the following information element:

Information element name	Required	Description
Negotiated QoS	C	This IE identifies the QoS which was negotiated between the user, the SGSN and the GGSN, as a result of a 'Modify PDP Conext' request. This IE shall be included only if sending of the Apply Charging Report was triggered by a change in Quality of Service.
C Conditional (The IE shall be sent, if available).		

6.6.1.3 Entity Released GPRS

6.6.1.3.1 Description

This IF is used by the gprsSSF to inform the gsmSCF at any phase that a GPRS Session has been detached or a PDP Context has been disconnected without reporting any EDP.

6.6.1.3.2 Information Elements

The following information elements are required:

Information element name	Required	Description
GPRS Reference Number	C	This IE consists of a number assigned by the gprsSSF and a number assigned by the gsmSCF. It is used for TCAP dialogue segmentation. Refer to 3GPP TS 29.078 [5] for the usage of this element.
GPRS Cause	M	This IE contains the Cause value indicating the reason for the GPRS Session Detach event or the PDP Context Disconnection event.
PDP ID	C	This IE identifies the PDP context which has been terminated. If not present the relationship corresponds to the Attach/Detach State Model or to one single PDP context within a PDP context relationship.
M Mandatory (The IE shall always be sent). C Conditional.		

6.6.1.4 Event Report GPRS

6.6.1.4.1 Description

This IF is used to notify the gsmSCF of a GPRS event previously requested by the gsmSCF in a Request Report GPRS Event IF.

6.6.1.4.2 Information Elements

The following information elements are required:

Information element name	Required	Description
GPRS Reference Number	C	This IE consists of a number assigned by the gprsSSF and a number assigned by the gsmSCF. It is used for TCAP dialogue segmentation. Refer to 3GPP TS 29.078 [5] for the usage of this element.
GPRS Event type	M	This IE specifies the type of event that is reported.
Misc GPRS Info	M	This IE indicates the DP type (EDP-N or EDP-R).
GPRS Event Specific Information	M	This IE contains information specific to the reported event.
PDP ID	C	This IE identifies the PDP context, which the Report GPRS Event is applicable for. If not present the dialogue corresponds to the Attach/Detach State Model or to one single PDP context.
M Mandatory (The IE shall always be sent). C Conditional (The IE shall be sent, if available).		

If the *GPRS Event type* contains DP Change of Position GPRS Session, then the GPRS Event Specific Information IE contains the following information elements:

Information element name	Required	Description
Location Information in SGSN	M	See clause 7.6.1.2.2.
M	Mandatory (The IE shall always be sent).	

If the *GPRS Event type* contains DP Change of Position Context, then the GPRS Event Specific Information IE contains the following information elements:

Information element name	Required	Description
Access Point Name	C1	This IE identifies the Access Point Name to which the MS is connected.
Charging ID	C1	This IE contains the Charging ID received from the GGSN for the PDP context.
Location Information in SGSN	M	See clause 7.6.1.2.2.
End User Address	C1	See clause 6.6.1.5.2.
Quality Of Service	C1	This IE is described in the table below.
Time and Time Zone	C1	This IE contains the time that the gprsSSF met the detection point, and the time zone the gprsSSF resides in.
GGSN Address	C1	This IE contains the GGSN address for control plane to which the MS is connected, see 3GPP TS 23.003 [37].
M	Mandatory (The IE shall always be sent).	
C1	Conditional (The IE shall be sent, if available at inter-SGSN routing area update. Shall not be sent at intra-SGSN routing area update).	

If the *GPRS Event type* contains DP Detach or DP PDP context disconnection, then the GPRS Event Specific Information IE contains the following information elements:

Information element name	Required	Description
Initiating Entity	M	This IE identifies the entity that has initiated the disconnection or detachment.
Routeing Area Update	C	This IE indicates that the Detach or Disconnection is due to inter-SGSN routeing area update.
M	Mandatory (The IE shall always be sent).	
C	Optional (The IE shall be sent, if applicable).	

If the *GPRS Event type* contains DP PDP context establishment, then the GPRS Event Specific Information IE contains the following information elements:

Information element name	Required	Description
Access Point Name	C	This IE identifies the Access Point Name the MS has requested to connect to.
End User Address	C	See clause 6.6.1.5.2.
Quality Of Service	M	This IE is described in the table below.
Location Information in SGSN	M	See clause 7.6.1.2.2.
Time and Time Zone	M	This IE contains the time that the gprsSSF met the detection point, and the time zone the gprsSSF resides in.
PDP Initiation Type	M	This IE indicates whether a PDP context was established as a result of a network-initiated request or as a result of a subscriber request.
Secondary PDP context	C	This IE indicates that the PDP context activation was requested for a secondary PDP context. See 3GPP TS 23.060 [11].
M	Mandatory (The IE shall always be sent).	
C	Conditional (The IE shall be sent, if available).	

If the *GPRS Event type* contains DP PDP context establishment acknowledgement, then the GPRS Event Specific Information IE contains the following information elements:

Information element name	Required	Description
Access Point Name	M	This IE identifies the Access Point Name to which the MS is connected.
Charging ID	M	This IE contains the Charging ID received from the GGSN for the PDP context.
End User Address	M	See clause 6.6.1.5.2.
Quality Of Service	M	This IE is described in the table below.
Location Information in SGSN	M	See clause 7.6.1.2.2.
Time and Time Zone	M	This IE contains the time that the gprsSSF met the detection point, and the time zone the gprsSSF resides in.
GGSN Address	M	This IE contains the GGSN address for control plane to which the MS is connected, see 3GPP TS 23.003 [37].
M Mandatory (The IE shall always be sent).		

6.6.1.5   Initial DP GPRS

6.6.1.5.1   Description

This IF is generated by the gprsSSF when a trigger is detected at a DP in the GPRS state models, to request instructions from the gsmSCF.

6.6.1.5.2   Information Elements

The following information elements are required:

Information element name	Required	Description
GPRS Reference Number	M	This IE consists of a number assigned by the gprsSSF. It is used for TCAP dialogue segmentation. Refer to 3GPP TS 29.078 [5] for the usage of this element.
ServiceKey	M	This IE indicates to the gsmSCF the requested CAMEL Service. It is used to address the required application/SLP within the gsmSCF.
GPRS Event Type	M	This IE indicates the armed GPRS DP event resulting in the Initial Data Event IF.
MSISDN	M	This IE contains the basic MSISDN of the MS.
IMSI	M	This IE identifies the mobile subscriber.
Time and Time zone	M	This IE contains the time that the gprsSSF was triggered, and the time zone the gprsSSF resides in.
GPRS MS Class	C	This IE contains the MS network and radio access capabilities.
End User Address	C	Described in a table below.
Quality of Service	C	This IE is described in the table below.
Access Point Name	C	This IE identifies the Access Point Name: - At DP Change Of Position Context contains the selected APN. - AT DP PDP Context Establishment contains the APN which the MS has requested. - AT DP PDP Context Establishment Acknowledgement contains the selected APN.
Charging ID	C	This IE contains the Charging ID received from the GGSN for the PDP context.
SGSN Capabilities	C	This IE specifies the capabilities of the SGSN node to support the CAMEL interwork, e.g. support of Advice of Charge.
Location Information in SGSN	M	This IE is described in the clause 7.6.1.2.2.
PDP Initiation Type	C	This IE indicates whether a PDP context was established as a result of a network-initiated request or as a result of a subscriber request.
GGSN Address	C	This IE contains the GGSN address for control plane to which the MS is connected, see 3GPP TS 23.003 [37].
Secondary PDP context	C	This IE indicates that the PDP context activation was requested for a secondary PDP context. See 3GPP TS 23.060 [11].
M Mandatory (The IE shall always be sent). C Conditional (The IE shall be sent, if available).		

Quality of Service contains the following information elements:

Information element name	Required	Description
Requested QoS	C	This IE identifies the QoS requested by the subscriber for a new PDP Context. It shall be included if the InitialDPGPRS is sent at PDP Context Establishment, at PDP Context Establishment Acknowledgement and at Change of Position Context.
Subscribed QoS	C	This IE identifies the subscribed QoS. It shall be included if the InitialDPGPRS is sent at PDP Context Establishment, at PDP Context Establishment Acknowledgement and at Change of Position Context.
Negotiated QoS	C	This IE identifies the QoS which was negotiated between the user, the SGSN and the GGSN. It shall be included if the InitialDPGPRS is sent at PDP Context Establishment Acknowledgement and at Change of Position Context.
C Conditional (The IE shall be sent, if available).		

End User Address shall be populated as follows:

- At DP Change Of Position Context in an Inter-SGSN Routeing Area Update: InitialDPGPRS and EventReportGPRS contain the selected value;

- At DP PDP Context Establishment: InitialDPGPRS and EventReportGPRS contain the value which the MS has requested;

- At DP PDP Context Establishment Acknowledgement: InitialDPGPRS and EventReportGPRS contain the selected value. Note that the PDP Address is not always available at this DP.

For details see 3GPP TS 23.060 [11].

End User Address contains the following information elements:

Information element name	Required	Description
PDP Type Organization	C	This IE identifies the PDP Type Organisation (e.g. IETF).
PDP Type Number	C	This IE identifies the PDP type, e.g. IPv4 or IPv6.
PDP Address	C	This IE identifies the address of the subscriber for a new PDP Context.
C Conditional (The IE shall be sent, if available).		

6.6.2 gsmSCF to gprsSSF Information Flows

6.6.2.1 Activity Test GPRS

6.6.2.1.1 Description

This IF is used to check for the continued existence of a relationship between the gsmSCF and gprsSSF. If the relationship is still in existence, then the gprsSSF will respond. If no reply is received, then the gsmSCF will assume that the gprsSSF has failed in some way and will take the appropriate action.

6.6.2.1.2 Information Elements

The following information elements are required:

Information element name	Required	Description
GPRS Reference Number	C	This IE consists of a number assigned by the gprsSSF and a number assigned by the gsmSCF. It is used for TCAP dialogue segmentation. Refer to 3GPP TS 29.078 [5] for the usage of this element.
C Conditional.		

6.6.2.2 Apply Charging GPRS

6.6.2.2.1 Description

This IF is used for interacting from the gsmSCF with the gprsSSF charging mechanisms to control the charging of a GPRS session or a PDP Context.

6.6.2.2.2 Information Elements

The following information elements are required:

Information element name	Required	Description
GPRS Reference Number	C	This IE consists of a number assigned by the gprsSSF and a number assigned by the gsmSCF. It is used for TCAP dialogue segmentation. Refer to 3GPP TS 29.078 [5] for the usage of this element.
Charging Characteristics	M	This IE specifies the charging related information to be provided by the gprsSSF and the conditions on which this information has to be provided back to the gsmSCF. It is a choice between granted volume and granted time for the data transfer. Time charging may be applied to GPRS Session or PDP Contexts; volume charging may be applied to PDP Contexts only.
Tariff Switch Interval	O	This information element specifies the time duration until the next tariff switch occurrence.
PDP ID	C	This IE identifies the PDP context, which the Apply GPRS Charging is applicable for. If not present the dialogue corresponds to the GPRS session or to one single PDP context.
M Mandatory (The IE shall always be sent). O Optional (Service logic dependent). C Conditional (The IE shall be sent, if available).		

6.6.2.3 Apply Charging Report GPRS Ack

6.6.2.3.1 Description

This IF is the response to the Apply Charging Report GPRS.

6.6.2.3.2 Information Elements

This IF contains no information elements.

6.6.2.4 Cancel GPRS

6.6.2.4.1 Description

This IF is used by the gsmSCF to request the gprsSSF to cancel all EDPs and reports.

6.6.2.4.2 Information Elements

The following information elements are required:

Information element name	Required	Description
GPRS Reference Number	C	This IE consists of a number assigned by the gprsSSF and a number assigned by the gsmSCF. It is used for TCAP dialogue segmentation. Refer to 3GPP TS 29.078 [5] for the usage of this element.
PDP ID	C	This IE identifies the PDP context which is to be cancelled. If not present the dialogue corresponds to the GPRS session or to one single PDP context.
C Conditional.		

6.6.2.5 Connect GPRS

6.6.2.5.1 Description

This IF is used by the gsmSCF to request the gprsSSF to modify the APN used when establishing a PDP Context. This IF shall not be used for a secondary PDP context or for a network initiated PDP context.

6.6.2.5.2 Information Elements

The following information elements are required:

Information element name	Required	Description
Access Point Name	M	This IE contains the Access Point Name (APN) to be used when establishing the PDP Context. The gsmSCF should provide an APN which is allowed by the served subscriber's subscription. The APN provided by the gsmSCF is used for selecting the primary PDP context as specified in 3GPP TS 23.060 [11]. The gsmSCF provided APN may consist of Network Identity (NI) only, or Network Identity and Operator Identity (OI). The APN provided by the gsmSCF replaces entirely the APN requested by the MS. If the gsmSCF does not provide OI in APN then the SGSN selects the OI independent of MS.
PDP Id	C	This IE identifies the PDP Context where the new Access Point Name shall be used. If not present the dialogue corresponds to one single PDP context.
M Mandatory (The IE shall always be sent).		
C Conditional.		

6.6.2.6 Continue GPRS

6.6.2.6.1 Description

This information flow requests the gprsSSF to proceed with processing at the DP at which it previously suspended processing to await gsmSCF instructions. The gprsSSF completes DP processing, and continues processing (i.e., proceeds to the next point in the Attach/Detach State Model or PDP Context State Model) without substituting new data from the gsmSCF.

6.6.2.6.2 Information Elements

The following information element is required:

Information element name	Required	Description
PDP ID	C	This IE identifies the PDP context which processing shall continue for. If not present the dialogue corresponds to the GPRS session or to one single PDP context.
C Conditional (The IE shall be sent, if available).		

6.6.2.7 Entity Released GPRS Ack

6.6.2.7.1 Description

This IF is the response to the Entity Released GPRS.

6.6.2.7.2 Information Elements

This IF contains no information elements.

6.6.2.8 Event Report GPRS Ack

6.6.2.8.1 Description

This IF is the response to the Event Report GPRS.

6.6.2.8.2 Information Elements

This IF contains no information elements.

6.6.2.9 Furnish Charging Information GPRS

6.6.2.9.1 Description

This IF is used to request the gprsSSF to include information in the CAMEL specific logical call record.

The logical call record is created when FCI-GPRS is received and a logical call record for that state model does not exist. For modelling purposes the logical call record is buffered in the gprsSSF. The gprsSSF completes logical call records as defined in the SDLs. Once the logical call record is completed, then its free format data is moved to the corresponding CDR and the logical call record is deleted.

In the SGSN there is a separate Logical call record for the attach/detach state model and for each PDP context.

The CSE can send multiple concatenated FCIs per Logical Call Record for completion. The total maximum of free format data is 160 octets per Logical Call Record. The 160 octets may be sent in one or more FCI operations. If there is non-completed free format data and new FCI operation(s) is/are received to overwrite the non-completed data, then the non-completed data is discarded and the gsmSCF can send another 160 octets per CDR.

6.6.2.9.2 Information Elements

The following information elements are required:

Information element name	Required	Description
GPRS Reference Number	C	This IE consists of a number assigned by the gprsSSF and a number assigned by the gsmSCF. It is used for TCAP dialogue segmentation.
FCI GPRS Billing Charging Characteristics	M	This IE is described in the next table.
M Mandatory (The IE shall always be sent).		
C Conditional.		

FCI GPRS Billing Charging Characteristics contains the following information:

Information element name	Required	Description
FCIBCCCAMEL Sequence 1	M	This IE is described in the next table.
M Mandatory (The IE shall always be sent).		

FCIBCCCAMEL Sequence 1 contains the following information:

Information element name	Required	Description
Free Format Data	M	This IE is a free format data to be inserted in the CAMEL logical call record.
Append Free Format Data	O	This IE indicates that the gprsSSF shall append the free format data to the Logical call record. In the SGSN there is a separate Logical call record for the attach/detach state model and for each PDP context. - If this IE is present indicating "Append", the gprsSSF shall append the free format data received in this IF to the free format data already present in the Logical call record for that GPRS session or PDP Context. - If this IE is absent or in value "Overwrite", then the gprsSSF shall overwrite all free format data already present in the Logical call record for that GPRS session or PDP Context, by the free format data received in this IF. If no Logical call record exists yet for that GPRS session or PDP Context, then the gprsSSF shall ignore this IE.
PDP Id	C	This IE identifies the PDP context's Logical call record to which the free format data shall be appended or overwritten. If not present, the free format data belong to a Logical call record for a GPRS session or a single PDP context for the dialogue.
M	Mandatory (The IE shall always be sent).	
O	Optimal (Service logic dependent).	
C	Conditional (The IE shall be sent, if available).	

6.6.2.10 Release GPRS

6.6.2.10.1 Description

This IF is used by the gsmSCF to tear down an existing GPRS session or PDP Context at any phase.

6.6.2.10.2 Information Elements

The following information elements are required:

Information element name	Required	Description
GPRS Reference Number	C	This IE consists of a number assigned by the gprsSSF and a number assigned by the gsmSCF. It is used for TCAP dialogue segmentation.
GPRS Cause	M	This IE contains the Cause value indicating the reason for releasing the GPRS session or PDP context.
PDP ID	C	This IE identifies the PDP context which shall be released. If not present the dialogue corresponds to the GPRS session or to one single PDP context.
M	Mandatory (The IE shall always be sent).	
C	Conditional (The IE shall be sent, if available).	

6.6.2.11 Request Report GPRS Event

6.6.2.11.1 Description

This IF is used to request the gprsSSF to monitor for an event and send a notification back to the gsmSCF when the event is detected (see Event Report GPRS IF).

6.6.2.11.2 Information Elements

The following information elements are required:

Information element name	Required	Description
GPRS Reference Number	C	This IE consists of a number assigned by the gprsSSF and a number assigned by the gsmSCF. It is used for TCAP dialogue segmentation.
GPRS Event	M	This IE specifies the event or events of which a report is requested.
PDP ID	C	This IE identifies the PDP context, which the Request Report GPRS Event is applicable for. If not present the dialogue corresponds: - to the GPRS session, or - to a generically armed EDP in a Session dialogue, or - to one single PDP context in a PDP Context dialogue.
M	Mandatory (The IE shall always be sent).	
C	Conditional (The IE shall be sent, if available).	

Data Event contains the following information:

Information element name	Required	Description
GPRS Event type	M	This IE specifies the type of event of which a report is requested.
Monitor Mode	M	This IE indicates how the event shall be reported.
M	Mandatory (The IE shall always be sent).	

6.6.2.12 Reset Timer GPRS

6.6.2.12.1 Description

This IF is used to refresh the gprsSSF timer.

6.6.2.12.2 Information Elements

The following information elements are required:

Information element name	Required	Description
GPRS Reference Number	C	This IE consists of a number assigned by the gprsSSF and a number assigned by the gsmSCF. It is used for TCAP dialogue segmentation.
Timer ID	M	This IE specifies the default value for the Tssf timer.
Timer Value	M	This IE specifies the value to which the timer Tssf shall be set.
M	Mandatory (The IE shall always be sent).	
C	Conditional (The IE shall be sent, if available).	

6.6.2.13 Send Charging Information GPRS

6.6.2.13.1 Description

This IF is used to send e-parameters from the gsmSCF to the gprsSSF. If charge advice information is received from the gsmSCF, it shall replace the charge advice information which would be generated by the SGSN and inhibit any further generation of CAI by the SGSN. Further processing of the charge advice information by the SGSN shall be in accordance with the GSM Advice of Charge Supplementary Service.

NOTE: If charge advice information is received from the gsmSCF after charge information has been generated by the SGSN and sent to the MS, the behaviour of the service may be unpredictable or incorrect; the service designer should therefore ensure that the first set of charge advice information is sent to the gprsSSF before charge information is sent to the to the MS.

6.6.2.13.2 Information Elements

The following information elements are required:

Information element name	Required	Description
GPRS Reference Number	C	This IE consists of a number assigned by the gprsSSF and a number assigned by the gsmSCF. It is used for TCAP dialogue segmentation.
SCI GPRS Billing ChargingCharacteristics	M	This IE defines the Advice Of Charge related information to be provided to the Mobile Station, if supported by the SGSN.
M	Mandatory (The IE shall always be sent).	
C	Conditional.	

GPRS SCI Billing Charging Characteristics contains the following information:

Information element name	Required	Description
AOC GPRS	M	This IE is sent after an Activate PDP Context Accept or Attach Accept has been received from the SGSN. This IE defines the Advice Of Charge related information to be provided to the Mobile Station, if supported by the SGSN.
PDP Id	C	This IE is included if the AoC is applicable to a PDP context. If not present the AoC is applicable to the GPRS session or for a single PDP context for the dialogue.
M	Mandatory (The IE shall always be sent).	
C	Conditional (The IE shall be sent, if available).	

AOC GPRS contains the following information:

Information element name	Required	Description
AOC Initial	M	This IE contains CAI elements as defined in 3GPP TS 22.024 [31].
AOC Subsequent	O	See definition in the next table.
M	Mandatory (The IE shall always be sent).	
O	Optional (Service logic dependent).	

AOC Subsequent contains the following information:

Information element name	Required	Description
CAI Elements	M	This IE contains CAI elements as defined in 3GPP TS 22.024 [31].
Tariff Switch Interval	O	This IE indicates the tariff switch time until the next tariff switch applies.
M	Mandatory (The IE shall always be sent).	
O	Optional (Service logic dependent).	

6.6.3 HLR to SGSN Information Flows

6.6.3.1 Delete Subscriber Data

6.6.3.1.1 Description

This IF is specified in 3GPP TS 29.002 [4] and is used by the HLR to delete subscriber data in the SGSN.

6.6.3.1.2 Information Elements

The Delete Subscriber Data contains the following CAMEL specific IE:

Information element name	Required	Description
CAMEL Subscription Info Withdraw	C	This IE identifies that all CSIs shall be deleted from the subscriber data in SGSN.
Specific CSI Withdraw	C	This IE is used to indicate that only GPRS-CSI shall be deleted from the SGSN. This IE should not be sent when CAMEL Subscription Info Withdraw is present.
C Conditional (The IE shall be sent when deletion is requested).		

6.6.3.2 Insert Subscriber Data

6.6.3.2.1 Description

This IF is specified in 3GPP TS 29.002 [4] and used by the HLR to insert subscriber data in the SGSN.

6.6.3.2.2 Information Elements

Insert Subscriber Data contains the following CAMEL specific IE:

Information element name	Required	Description
GPRS-CSI	C	This IE identifies the subscriber as having CAMEL GPRS services.
C Conditional (The IE shall be sent, if required).		

GPRS-CSI contains the following information:

Information element name	Required	Description
GsmSCF Address	M	See clause 6.3.1.1.
Service Key	M	See clause 6.3.1.2.
Default Session Handling	M	See clause 6.3.1.3.
TDP List	M	See clause 6.3.1.4.
CAMEL Capability Handling	M	See clause 6.3.1.5.
M Mandatory (The IE shall always be sent).		

6.6.4 SGSN to HLR Information Flows

6.6.4.1 Insert Subscriber Data ack

See clause 4.6.8.1.

6.6.4.2 Update GPRS Location

6.6.4.2.1 Description

This IF is used by the SGSN to indicate to the HLR a GPRS location update. This IF is specified in 3GPP TS 29.002 [4].

6.6.4.2.2 Information Elements

Update GPRS location contains the following CAMEL specific IE:

Information element name	Required	Description
Supported CAMEL Phases	C	This IE identifies which CAMEL phases are supported by the SGSN. The SGSN may indicate support of CAMEL phase 3 or higher.
C	Conditional (The IE shall always be sent when the SGSN supports CAMEL).	

7 Short Message Service

7.1 Architecture

7.1.1 Functional Entities used for CAMEL

This clause describes the functional architecture needed to support Mobile Originating Short Message Service (MO SMS) interworking for CAMEL. Figures 7.1 and 7.2 show the functional entities involved in MO SM's requiring CAMEL support. The architecture is applicable to the third phase of CAMEL.
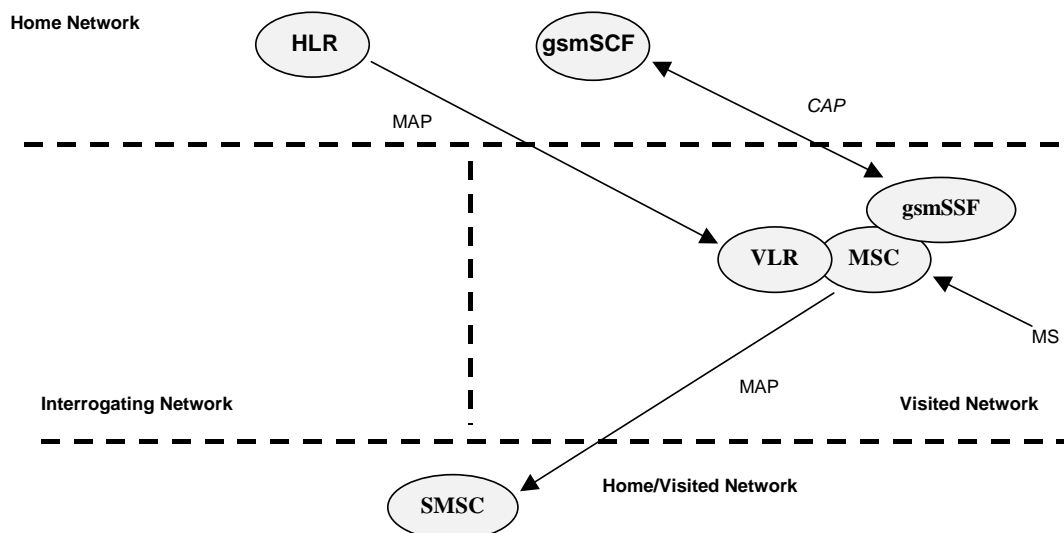
Figure 7.1: Functional architecture for support of CAMEL control of MSC switched MO SMS
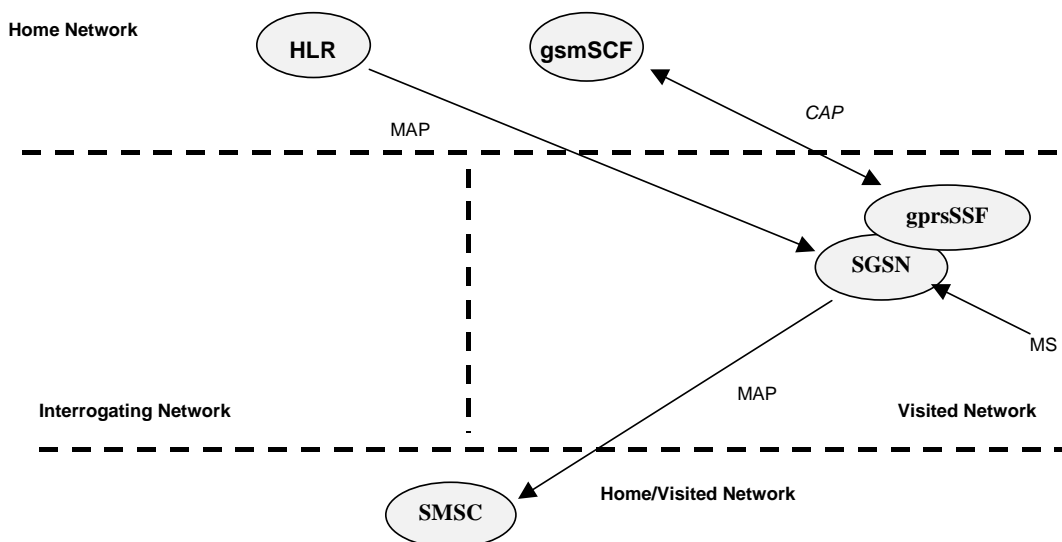
Figure 7.2: Functional architecture for support of CAMEL control of SGSN switched MO SMS

HLR: The HLR stores SMS-CSI. SMS-CSI contains subscription information for subscribers that require CAMEL support of MO SMS. SMS-CSI is transferred to the VLR or to the SGSN on Location Update and Restore Data or when SMS-CSI has changed.

VLR: The VLR receives the SMS-CSI for the subscriber from the HLR. SMS-CSI is used by the MSC to determine if a Service Logic shall be invoked for an MO SMS.

SGSN: The SGSN receives the SMS-CSI for the subscriber from the HLR. The SGSN uses the SMS-CSI to determine if a Service Logic shall be invoked for an MO SMS.

MSC: The MSC receives SMS-CSI from the VLR and uses this to determine if a Service Logic shall be invoked for an MO SMS.

gprsSSF: see clause 3.1.

gsmSSF: see clause 3.1.

gsmSCF: see clause 3.1.

SMSC: Short Message Service Centre.

7.1.2 Interfaces defined for CAMEL

7.1.2.1 HLR – VLR interface

This interface is used to send CAMEL related subscriber data (SMS-CSI) to a visited MSC/VLR or to remove CAMEL related subscriber data from a visited MSC/VLR.

7.1.2.2 HLR – SGSN interface

This interface is used to send CAMEL related subscriber data (SMS-CSI) to a visited SGSN or to remove CAMEL related subscriber data from a visited SGSN.

7.1.2.3 gsmSSF - gsmSCF interface

This interface is used by the gsmSCF to control the handling of MO SMS in the MSC. A relationship on this interface is opened as a result of the gsmSSF sending a request for instructions to the gsmSCF.

7.1.2.4 gprsSSF - gsmSCF interface

This interface is used by the gsmSCF to control the handling of MO SMS in the SGSN. A relationship on this interface is opened as a result of the gprsSSF sending a request for instructions to the gsmSCF.

7.1.2.5 MSC - gsmSSF interface

This is an internal interface. The interface is described in the specification to make it easier to understand the handling of DPs (arming/disarming of DPs, DP processing etc.).

7.1.2.6 SGSN - gprsSSF interface

This is an internal interface. The interface is described in the specification to make it easier to understand the handling of DPs (arming/disarming of DPs, DP processing etc.).

7.1.2.7 MSC - VLR interface

This is an internal interface. The interface is described in the specification to make it easier to understand the internal information flow within the MSC/VLR.

7.1.2.8 MSC - SMSC interface

This interface is used by the MSC to submit a SM to the SMSC.

7.1.2.9 SGSN - SMSC interface

This interface is used by the SGSN to submit a SM to the SMSC.

7.2 Detection Points (DPs)

See clause 4.2.

7.3 Description of CAMEL Subscriber Data

7.3.1 Short Message Service CAMEL Subscription Information (SMS-CSI)

This clause defines the contents of the Short Message Service CAMEL Subscription Information.

7.3.1.1 gsmSCF address

Address to be used to access the gsmSCF for a particular subscriber. The address shall be an E.164 number to be used for routeing.

7.3.1.2 Service Key

The Service Key identifies to the gsmSCF the service logic.

7.3.1.3 Default SMS Handling

The Default SMS Handling indicates whether the Short Message submission shall be released or continued as requested in the case of error in the dialogue between gsmSCF and gsmSSF or gprsSSF.

7.3.1.4 TDP List

The TDP List indicates on which detection point triggering shall take place. For SMS-CSI only DP SMS_Collected_Info is used.

7.3.1.5 CAMEL Capability Handling

CAMEL Capability Handling indicates the phase of CAMEL which is asked by the gsmSCF for the service.

7.3.1.6 CSI state

The CSI state indicates whether the SMS-CSI is active or not.

7.3.1.7 Notification flag

The notification flag indicates whether the change of the SMS-CSI shall trigger Notification on Change of Subscriber Data or not.

7.3.1.8 gsmSCF address list for CSI

The gsmSCF address list indicates a list of gsmSCF addresses to which Notification on Change of Subscriber Data is to be sent. This list is common to all CSI.

7.4 Description of SMS State Model

7.4.1 General Handling

See clause 4.4.1.

The State Model for MO SMS handling contains Points in Association (PIA's) instead of Points in Call (PIC's).

7.4.2 Mobile Originating SMS State Model

7.4.2.1 Description of MO SMS state model

The MO SMS state model is used to describe the actions in an MSC and in a SGSN during mobile originating SMS.
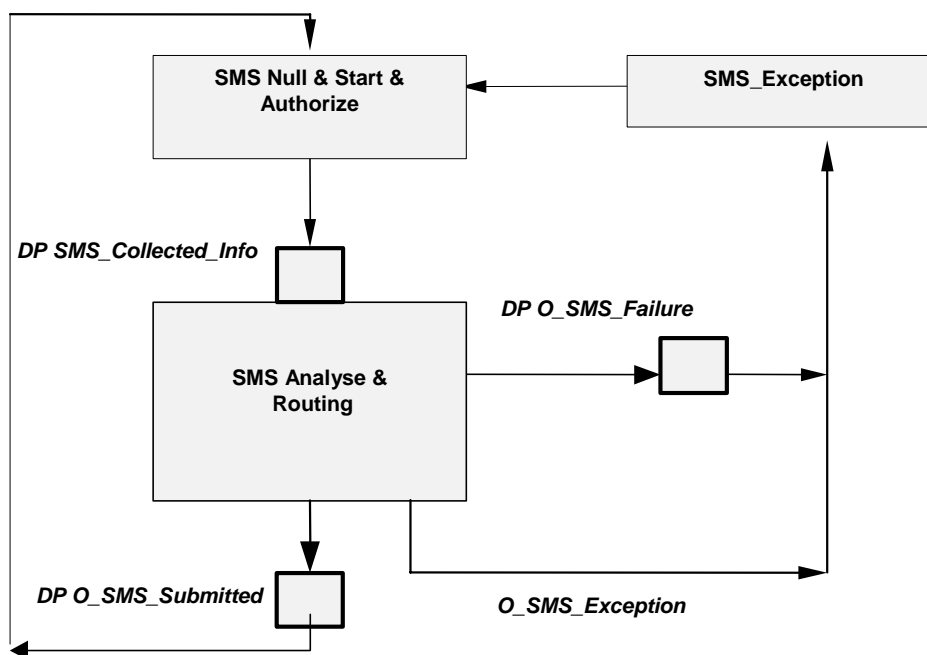
Figure 7.3: MO SMS State Model

Table 7.1: Description of MO SMS DPs in the MSC and SGSN

CAMEL Detection Point	DP Type	Description
DP SMS_Collected_Info	TDP-R	Indication that the SMS-CSI is analysed and a mobile originated short message is received.
DP O_SMS_Failure	EDP-N, EDP-R	Indication that the SM submission to the Short Message Service Centre failed
DP O_SMS_Submitted	EDP-N, EDP-R	Indication that the SM has been successfully submitted to the Short Message Service Centre.

7.4.2.1.1 Description of the MO SMS state model (PIAs)

This clause describes the state model for originating SMS transfer. For each PIA a description can be found of the entry events, actions and exit events.

7.4.2.1.1.1 SMS Null & Start & Authorize

Entry events:

- Previous MO SMS transfer to the SMSC completed (DP O_SMS_Submitted).

- Exception event is reported.

Actions:

- Interface is idled.

- Authentication.

- Ciphering.

- SMS subscription check.

- RP-MO-DATA message containing the User Data and the SMSC address is received from MS.

- The supplementary service "barring of all outgoing calls" is checked and invoked if necessary.

- The ODB category "barring of all outgoing calls" is checked and ODB is invoked if necessary.

Exit events:

- SMS-CSI is analysed.

- An exception condition is encountered.

7.4.2.1.1.2 SMS Analyse & Routing

Entry events:

- SMS - CSI is analysed. (DP SMS_Collected_Info).

Actions:

- Information being analysed and/or translated to determine routeing address of the SMSC.

- Outgoing barring services and ODB categories not already applied are checked and invoked if necessary.

- The short message is sent to the SMSC.

Exit events:

- Acknowledge from the SMSC is received. (DP O_SMS_submitted).

  A positive acknowledgement is sent to the MS.

- An exception condition is encountered - this leads to the SMS_Exception PIA.

A negative acknowledgement is sent to the MS.

- Attempt to select the route for the SMS fails (DP O_SMS_Failure).

A negative acknowledgement is sent to the MS.

- Negative acknowledgement from the SMSC is received (DP O_SMS_Failure).

A negative acknowledgement is sent to the MS.

7.4.2.1.1.3 SMS_Exception

Entry events:

- An exception condition is encountered. In addition to specific examples listed above, exception events include any type of failure, which means that the normal exit events for a PIA can not be met.

Actions:

- Default handling of the exception condition is applied. This includes general actions necessary to ensure that no resources remain inappropriately allocated such as:

    - If a relationship exists between the gsmSCF and gsmSSF or gprsSSF send an error information flow closing the relationship and indicating that any outstanding Short Message handling instructions will not run to completion.

    - The MSC/gsmSSF or SGSN/gprsSSF shall make use of vendor-specific procedures to ensure release of internal resources.

Exit events:

- Default handling of the exception condition by MSC/gsmSSF or SGSN/gprsSSF completed.

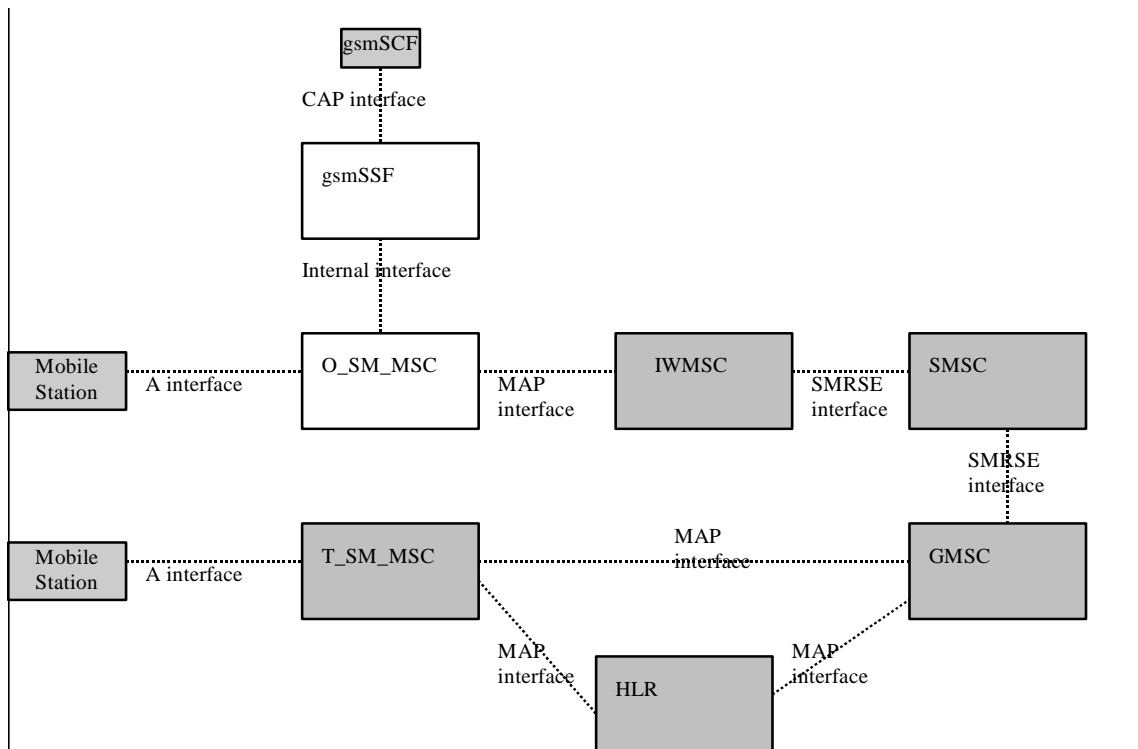# 7.5 Procedures for CAMEL SMS

7.5.1 Overall SDL architecture

Figure 7.4: Case of MO SMS via MSC (separated IWMSC)
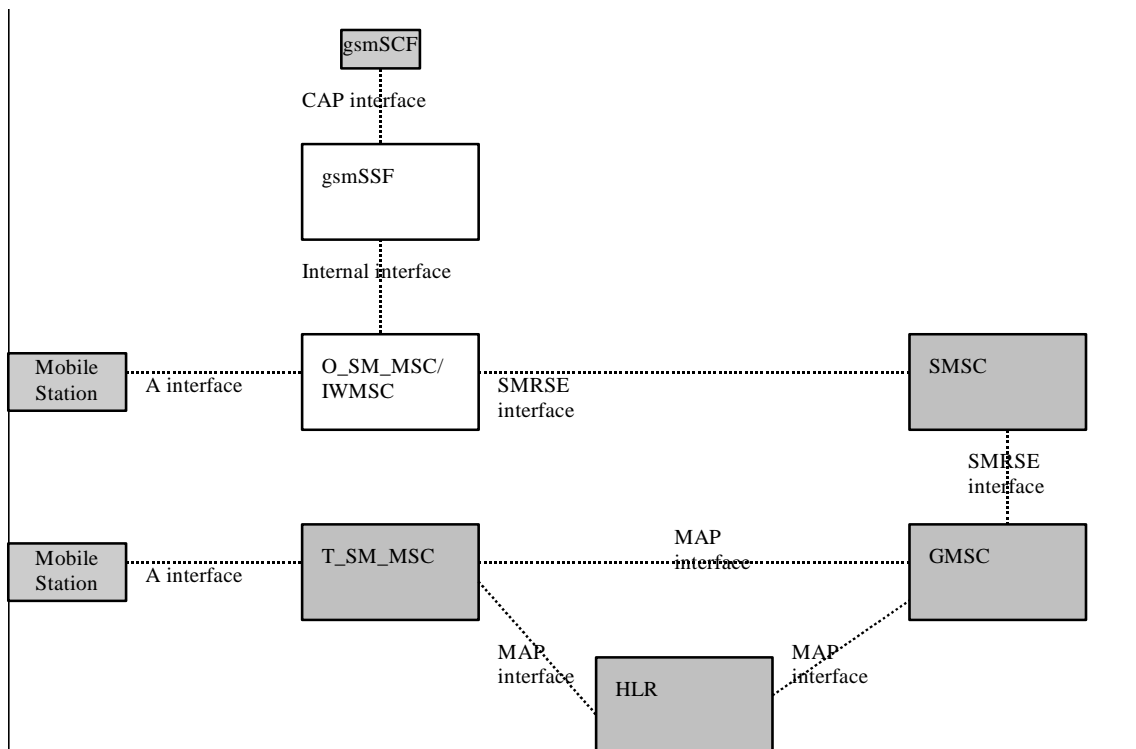
Figure 7.5: Case of MO SMS via MSC (integrated IWMSC)
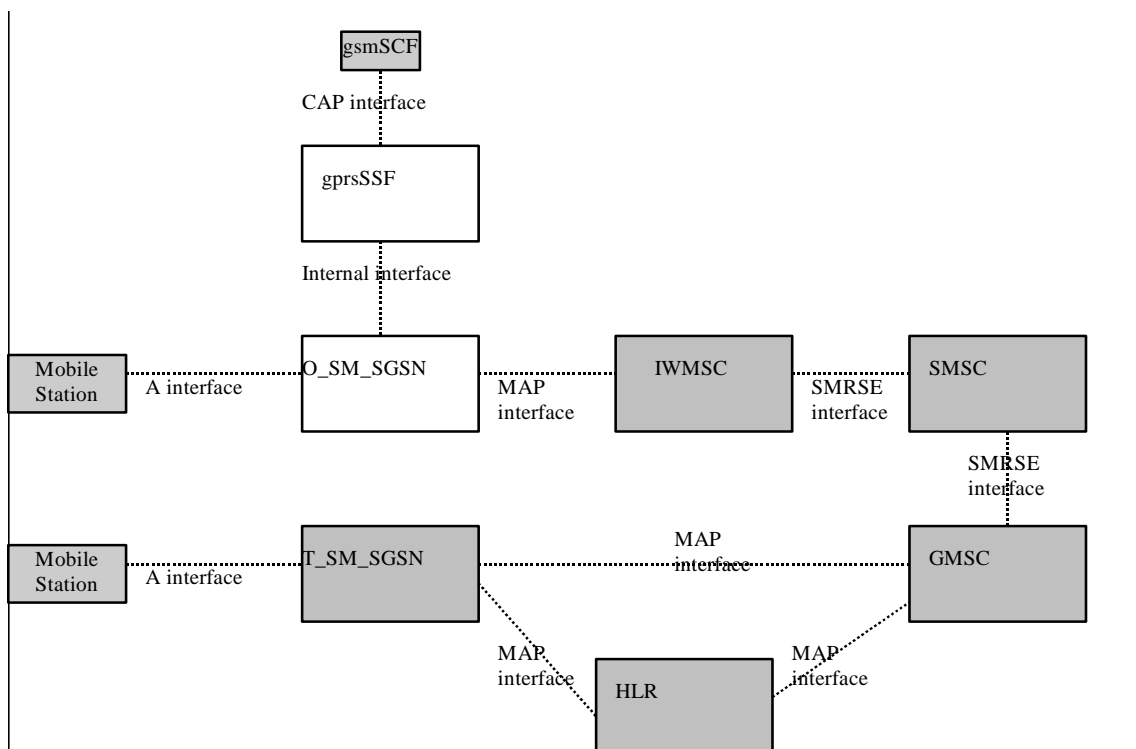
Figure 7.6: Case of MO SMS via GPRS SGSN

7.5.2 Handling of mobile originating SMS

7.5.2.1 Handling of mobile originating SMS in the originating MSC/SGSN

The functional behaviour of the originating VMSC/SGSN is specified in 3GPP TS 29.002 [4] and 3GPP TS 23.060 [11]. The procedures specific to CAMEL are specified in this clause:

- Procedure CAMEL_O_SMS_INIT;

- Procedure CAMEL_O_SMS_SUBMITTED;

- Procedure CAMEL_O_SMS_FAILURE.

A CAMEL Service may be invoked for the following Mobile Originated short message types:

- Short Message Submission (PDU type = SMS-SUBMIT)

- Short Message Command (PDU type = SMS-COMMAND)

Refer to 3GPP TS 23.040 [21] for a description of the various PDU types.

7.5.2.1.1 Actions of the VMSC/SGSN on receipt of Int_Error

The MSC/SGSN checks the default SMS Handling parameter in SMS-CSI.

If the default SMS handling is release SM, a A_RP_ERROR is sent to the MS. The MSC/SGSN then releases all resources and the procedure CAMEL_O_SMS_INIT ends.

If the default SMS handling is continue SMS submission, the MSC/SGSN continues processing without CAMEL support.

7.5.2.1.2 Actions of the MSC/SGSN on receipt of Int_Continue_SMS

The MSC/SGSN continues processing with modified SM parameters. The MSC/SGSN shall transparently modify the SMS parameters with the received information. Parameters which are not included in the Int_Continue_SMS message are unchanged.

7.5.2.1.3 Actions of the MSC/SGSN on receipt of Int_Connect_SMS

The MSC/SGSN continues processing with modified SM parameters. The MSC/SGSN shall transparently modify the SMS parameters with the received information. Barring is checked with the modified parameters. Parameters which are not included in the Int_Connect_SMS message are unchanged.

7.5.2.1.4 Actions of the MSC/SGSN on receipt of Int_Release_SMS

A A_RP_ERROR is sent to the MS and SMS is deleted. The SMS cause received in the Int_Release_SMS is used. The MSC/SGSN then releases all resources and the procedure CAMEL_O_SMS_INIT ends.

7.5.2.2 Handling of A_MM_Release and A_LLC_Release

If the radio link with the subscriber is lost during the handling of a CAMEL procedure in the MSC/SGSN, then the MSC/SGSN sends signal A_MM_Release_ind or A_LLC_Release_ind to that procedure. This results in the termination of that CAMEL procedure. (Refer to 3GPP TS 29.002 [4] for details.)

7.5.2.3 Handling of time-out from SMSC

If the MSC/SGSN does not receive a confirmation from the SMSC after submission of a Short Message, then the MSC/SGSN calls procedure CAMEL_O_SMS_FAILURE. (Refer to 3GPP TS 29.002 [4] for details.)

Procedure CAMEL_O_SMS_INIT 1(3)

/* A procedure in the MSC or SGSN
to perform CAMEL handling of mobile originated
SMS submission request.*/

/* Signals to/from the right are to/from
gsmSSF/gprsSSF (SMS_SSF).
Signals from the left are from MS,
unless otherwise stated. */
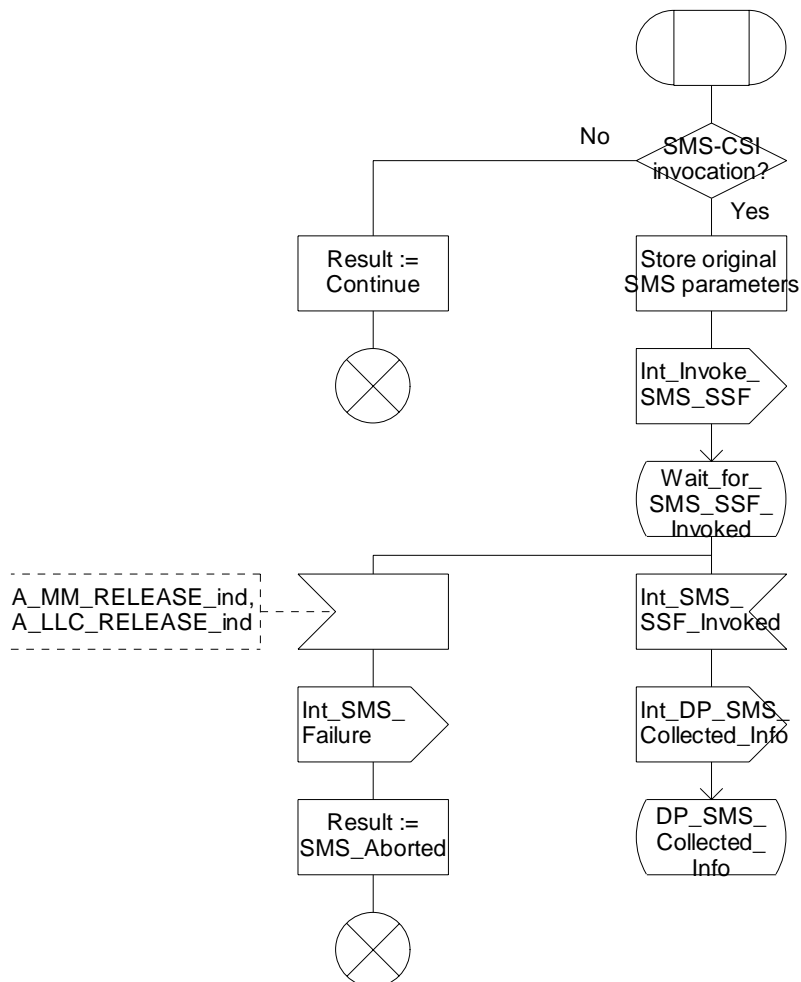
Figure 7.7a: Procedure CAMEL_O_SMS_INIT (sheet 1)

Procedure CAMEL_O_SMS_INIT 2(3)

/* A procedure in the MSC or SGSN
to perform CAMEL handling of mobile originated
SMS submission request.*/

/* Signals from the right are from
gsmSSF/gprsSSF (SMS_SSF).*/

DP_SMS_
Collected_Info

Int_Release_
SMS

Int_Error

Int_Continue_SMS

Int_Connect_SMS

Modify SMS parameters
in accordance with
the received information

Modify SMS parameters
in accordance with
the received information

Default SMS
handling =
continue?

Yes

No

Set RP_ERROR

Result :=
Release_SMS

Result :=
Continue

Result :=
Redirect_SMS
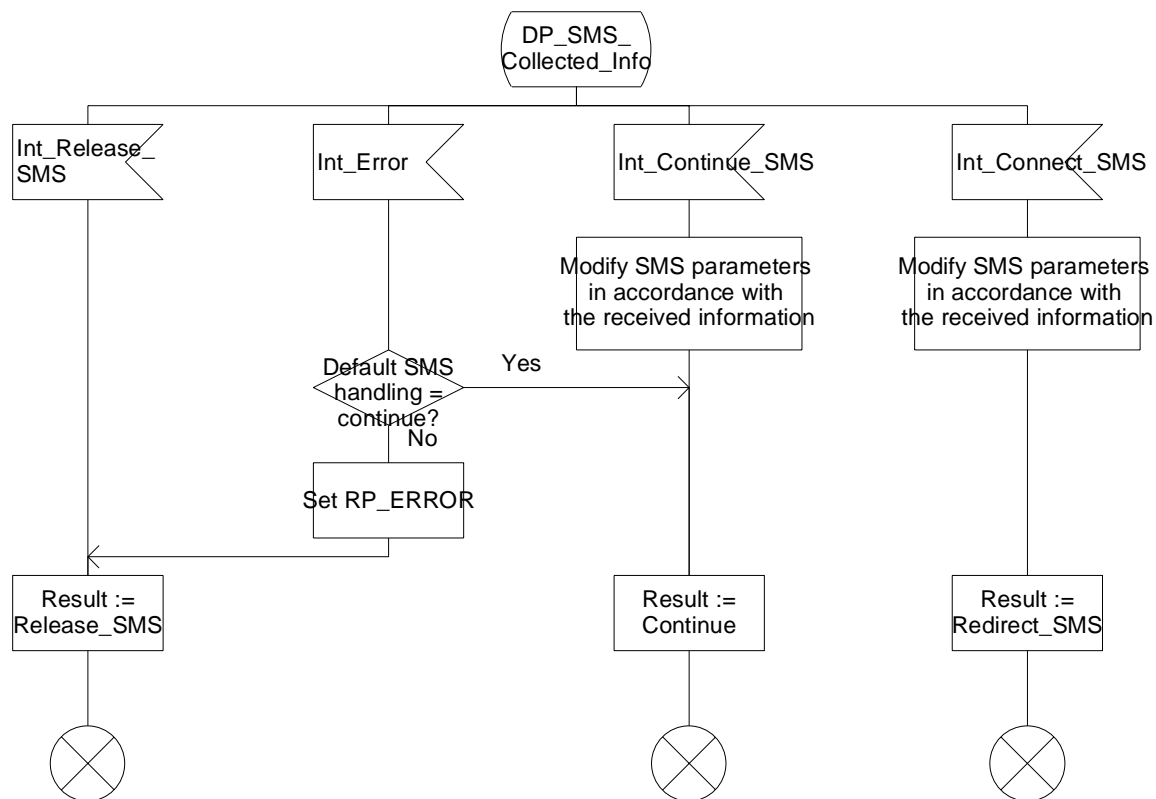
Figure 7.7b: Procedure CAMEL_O_SMS_INIT (sheet 2)

Procedure CAMEL_O_SMS_INIT 3(3)

/* A procedure in the MSC or SGSN
to perform CAMEL handling of mobile originated
SMS submission request.*/

/* Signal to the right is to
gsmSSF/gprsSSF (SMS_SSF).
Signals from the left are from MS.*/

DP_SMS_
Collected_Info

A_MM_RELEASE_ind,
A_LLC_RELEASE_ind

Int_SMS_
Failure

Result :=
SMS_Aborted
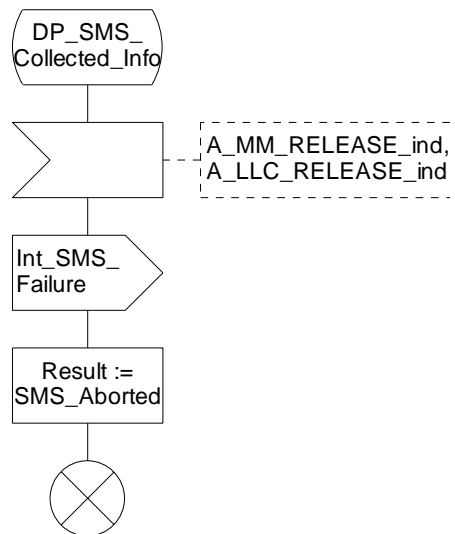
Figure 7.7c: Procedure CAMEL_O_SMS_INIT (sheet 3)

Procedure CAMEL_O_SMS_SUBMITTED 1(1)

/* Procedure in the MSC or SGSN (SMS_SSF) to report successful submission to gsmSCF of CAMEL. */

/* Signals to/from the right are to/from gsmSSF/gprsSSF (SMS_SSF). */

No SMS_SSF Invoked?

Yes

Int_O_SMS_ Submitted

DP_O_SMS_ Submitted

Int_Continue_SMS

Int_error

Int_Continue
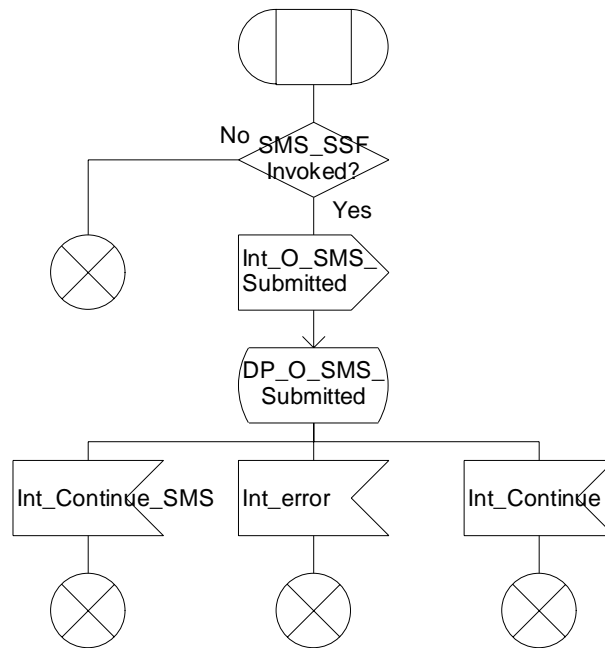
Figure 7.8: Procedure CAMEL_O_SMS_SUBMITTED (sheet 1)

Procedure CAMEL_O_SMS_FAILURE 1(1)

/* Procedure in the MSC or SGSN
to handle CAMEL notification to gsmSCF
about unsuccessfull submission. */

/* Signals to/from the right are to/from
gsmSSF/gprsSSF (SMS_SSF). */

No — SMS_SSF Invoked?

Yes

Int_O_SMS_Failure

DP_O_SMS_Failure

Int_Continue_SMS   Int_error   Int_Continue
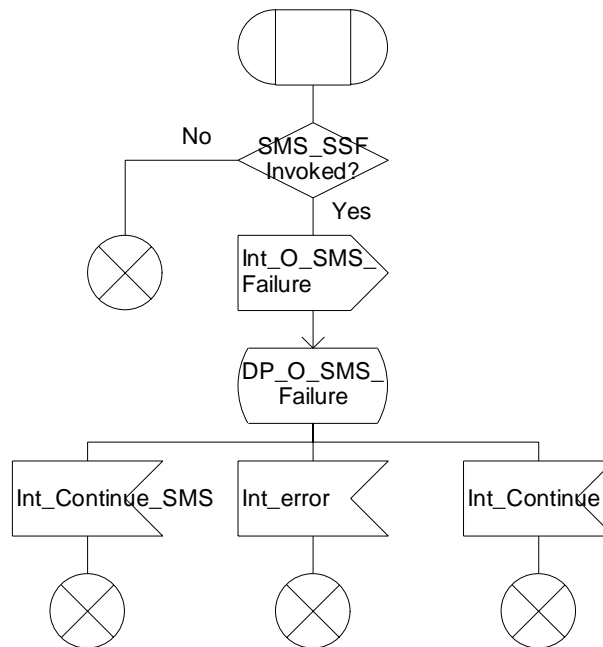
Figure 7.9: Procedure CAMEL_O_SMS_FAILURE (sheet 1)

7.5.3 Handling of mobile originating SMS in the gsmSSF/gprsSSF

Process SMS_SSF 1(7)

/* Process to handle MO SMS.
Locates either in the gsmSSF or gprsSSF.*/

/* Signals to/from the left are to/from MSC or SGSN. */

/*
The following timer is defined:
- Tssf: gsmSSF or gprsSSF state machine timer.
   This timer has a default value range of 1 to 20 seconds.
*/

Idle

Int_Invoke_
SMS_SSF
(SMS-CSI)

Arm DP   The CSI states that
          DP SMS_Collected_Info
          must be armed as an TDP.

Int_SMS_
SSF_Invoked

Wait_For_
Request

Figure 7.10a: Process SMS_SSF (sheet 1)

3GPP

Process SMS_SSF 2(7)

/* Process to handle MO SMS.
Locates either in the gsmSSF or gprsSSF.*/

/* Signal from the left is from MSC or SGSN.
Signal to the right is to gsmSCF.*/

Wait_For_
Request

Int_DP_SMS_
Collected_Info

Int_SMS_
Failure

Set Tssf to
default value
and restart Tssf

Idle

Open Control
Relationship

CAP_Initial_
DP_SMS

Waiting_for_
Instructions
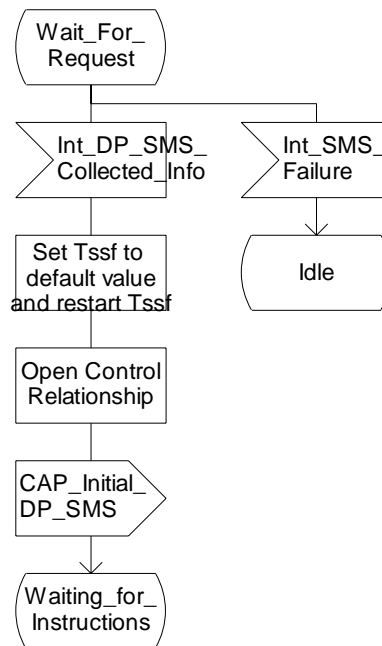
Figure 7.10b: Process SMS_SSF (sheet 2)

Process SMS_SSF 3(7)

/* Process to handle MO SMS.
Locates either in the gsmSSF or gprsSSF.*/

/* Signals to the left are to MSC or SGSN.
Signals to/from the right are to/from gsmSCF.*/

Waiting_for_
Instructions

CAP_Reset_
Timer_SMS

Set Tssf to
received time
interval and
restart Tssf

Waiting_for_
Instructions

CAP_Continue_
SMS

Stop Tssf

CAP_Connect_
SMS

Stop Tssf

Internal

Timer expiry
Tssf

Abort

No ◄ SMSC Address or
Destination Subscriber
Number present in
Connect_SMS?

Yes

Int_Continue_
SMS

Int_Connect_
SMS

Int_Error

Type of
remaining
armed EDP?

EDP-N None

EDP-R

Terminate
Control
relationship

Terminate Control
relationship and open
monitor relationship

Change type
of relationship

Complete_SMS_
FCI_record

Idle

Monitoring

Figure 7.10c: Process SMS_SSF (sheet 3)

Process SMS_SSF   4(7)

/* Process to handle MO SMS.
Locates either in the gsmSSF or gprsSSF.*/

/* Signal to the left is to MSC or SGSN.
Signals to/from the right are to/from gsmSCF.*/

Waiting_for_
Instructions

CAP_Request_
Report_SMS_
Event

Set Tssf to last
used time interval
and restart Tssf

Arm EDP
and/or
disarm EDP

Waiting_for_
Instructions

CAP_Release_
SMS

Stop Tssf

Terminate
Control
relationship

Int_Release_
SMS

Complete_SMS_
FCI_record

Idle
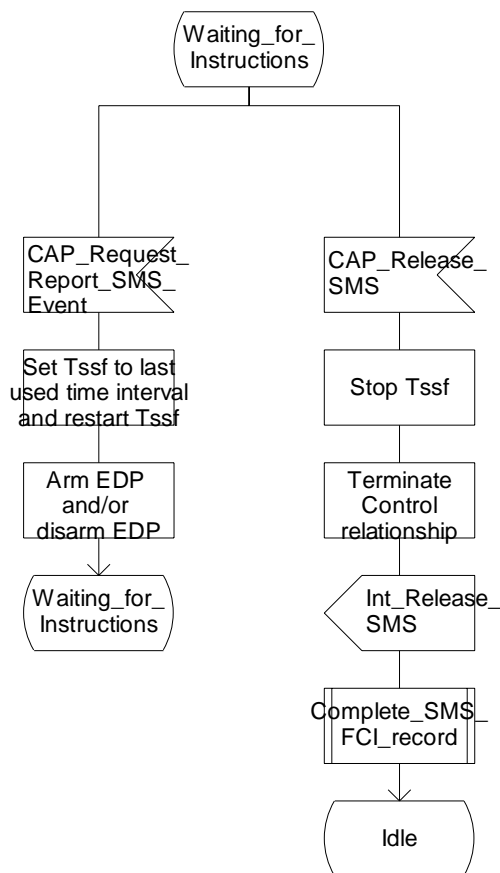
Figure 7.10d: Process SMS_SSF (sheet 4)

Process SMS_SSF 5(7)

/* Process to handle MO SMS.
Locates either in the gsmSSF or gprsSSF.*/

/* Signal from the right is from gsmSCF.*/

Waiting_for_
Instructions

CAP_Furnish_Charging_
Information_SMS

Set Tssf to last
used time interval
and restart Tssf

Non-completed CAMEL logical SMS
record exists?

No

Yes

AppendFree
FormatData in FCI?

"Append"

Not present,
"Overwrite"

Append FCI data
to existing
logical SMS record

Already completed
records are
not affected

Overwrite all CAMEL
logical SMS record
data with this FCI data.

Create CAMEL
logical
SMS record

Write FCI data
in CAMEL logical
SMS record

Waiting_for_
Instructions

Figure 7.10e: Process SMS_SSF (sheet 5)

Process SMS_SSF 6(7)

/* Process to handle MO SMS.
Locates either in the gsmSSF or gprsSSF.*/

/* Signal to the left is to MSC or SGSN.
Signals to/from the right are to/from gsmSCF.*/

Waiting_for_
Instruction

Int_SMS_
Failure

Application_
End

Complete_SMS_
FCI_record

Idle
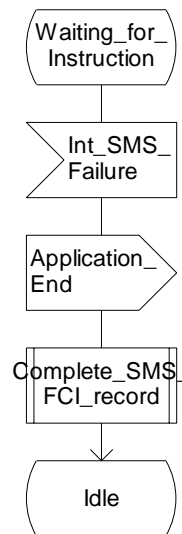
Figure 7.10f: Process SMS_SSF (sheet 6)
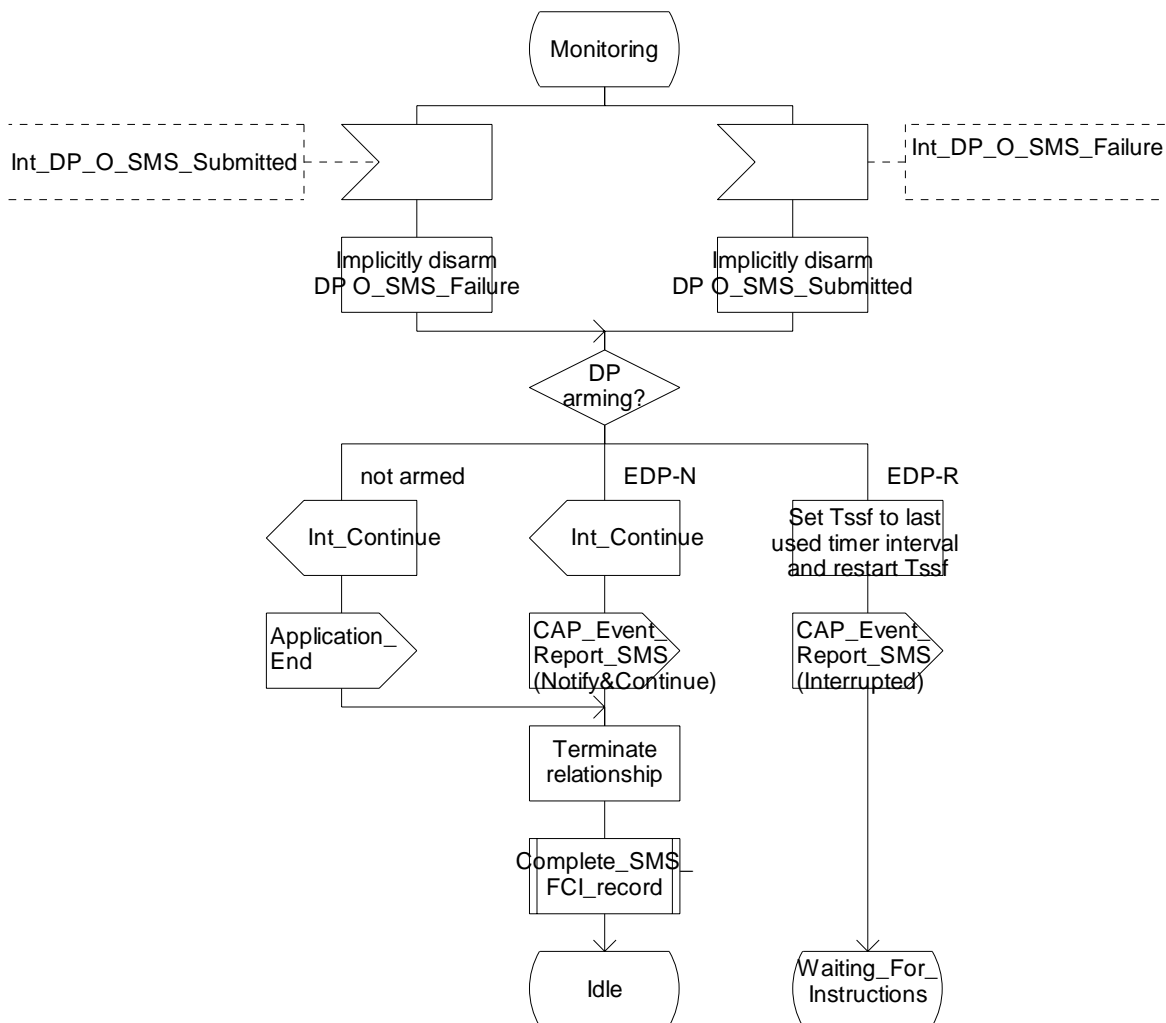
Figure 7.10g: Process SMS_SSF (sheet 7)

Procedure Complete_SMS_FCI_record 1(1)

/* Procedure in the MSC/SGSN (either in gsmSSF or gprsSSF)
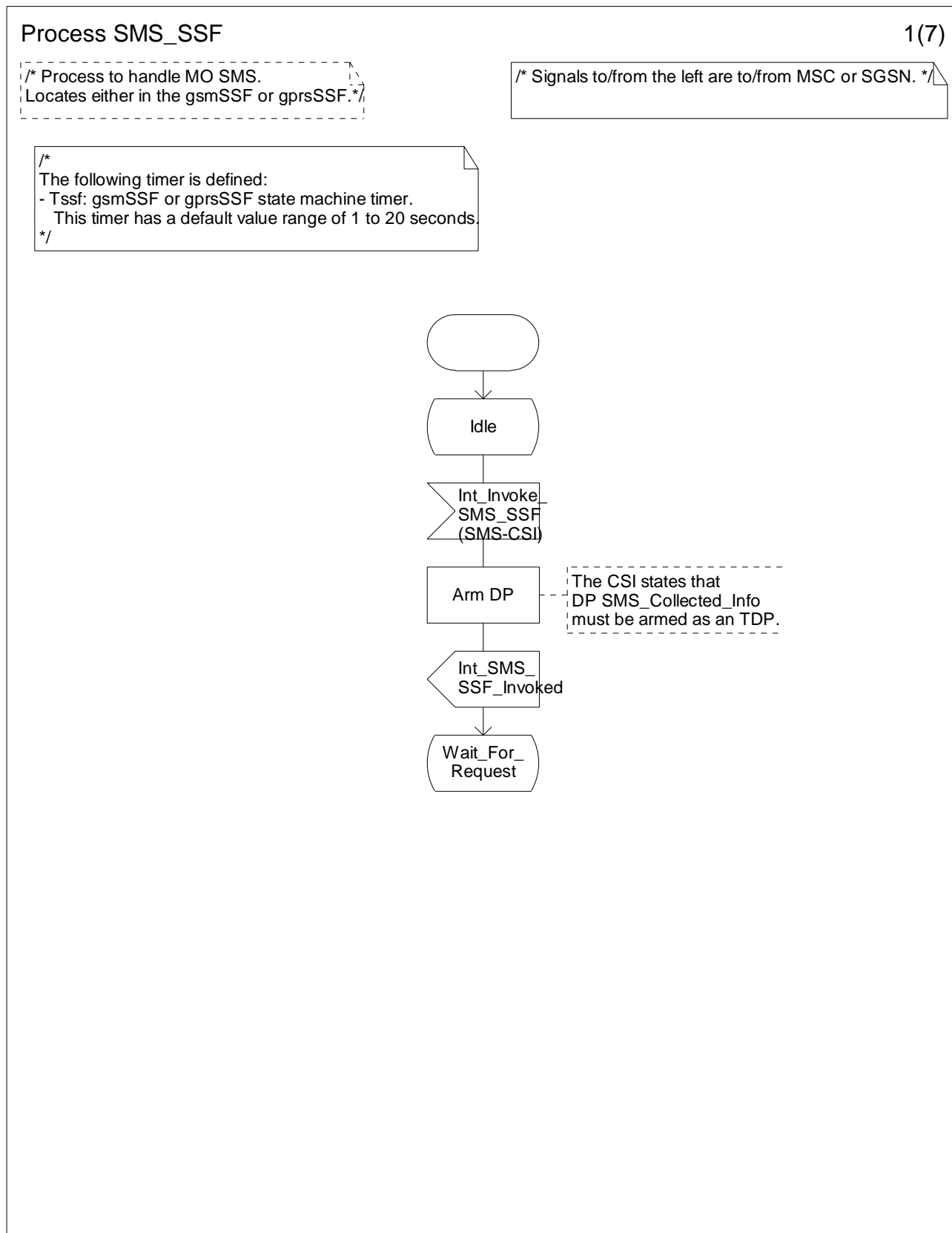to complete logical CDRs created by
Furnish_Charging_information_SMS operations.*/

Non-completed CAMEL
logical SMS record
exists?

No

Yes

Complete CAMEL
logical SMS
record
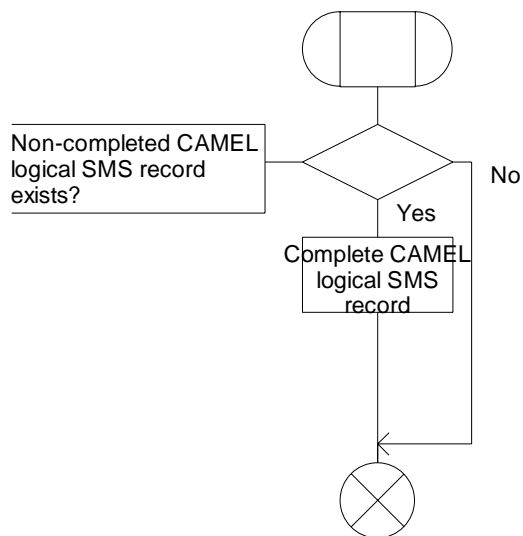
Figure 7.11: Procedure Complete_SMS_FCI_record (sheet 1)

7.6 Description of information flows

This clause contains the detailed description of the information flows used by CAMEL.

Each Information Element (IE) is marked as Mandatory (M), Conditional (C), Optional (O) or Not applicable (-). This categorization is a functional classification, i.e., stage 2 information, and not a stage 3 classification to be used for the ASN.1 syntax of the protocol.

Details of errors and exceptions to these rules are specified in 3GPP TS 29.002 [4], TS 29.078 [5].

7.6.1 gsmSSF/gprsSSF to gsmSCF information flows

7.6.1.1 Event Report SMS

7.6.1.1.1 Description

This IF is used to notify the gsmSCF of an event previously requested by the gsmSCF in a Request Report SMS Event IF.

7.6.1.1.2 Information Elements

The following information elements are required:

Information element name	Required	Description
Event type	M	This IE specifies the type of event that is reported.
Event Specific Information	C	This IE indicates the SMS related information specific to the event.
Misc SMS Info	M	This IE indicates the DP type.
M Mandatory (The IE shall always be sent).		
C Conditional (The IE shall be sent, if available).		

7.6.1.2 Initial DP SMS

7.6.1.2.1 Description

This IF is generated by the gsmSSF/gprsSSF when a trigger is detected at a DP in the state model, to request instructions from the gsmSCF.

7.6.1.2.2 Information Elements

The following information elements are required:

Information element name	Required	Description
Destination Subscriber Number	M	This IE contains a number to identify the Destination short message entity. The Destination Subscriber Number shall be retrieved from the SMS-SUBMIT TPDU or the SMS-COMMAND TPDU, which are specified in 3GPP TS 23.040 [21].
Calling Party Number	M	This IE carries the MSISDN of the subscriber who sent the short message.
Event Type	M	This IE indicates the armed event (i.e., *SMS_Collected_Info*) resulting in the Initial DP SMS IF.
IMSI	M	This IE identifies the mobile subscriber.
Location Information in MSC	C	This IE is described in a table below.
Location Information in SGSN	C	This IE is described in a table below.
Service Key	M	This IE indicates to the gsmSCF the requested CAMEL Service. It is used to address the required application/SLP within the gsmSCF.
Time And Timezone	M	This IE contains the time that the gsmSSF/gprsSSF was triggered, and the time zone the gsmSSF/gprsSSF resides in.
TP Short Message Submission Specific Information	M	This IE contains the 1st octet of the SMS-SUBMIT TPDU or the SMS-COMMAND TPDU, which are specified in 3GPP TS 23.040 [21]. For the SMS-SUBMIT TPDU, the 1st octet contains the following information: - Message Type Indicator - Reject Duplicates - Validity Period Format - Status Report Request - User Data Header Indicator - Reply Path For the SMS-COMMAND TPDU, the 1st octet contains the following information: - Message Type Indicator - User Data Header Indicator - Status Report Request Refer to 3GPP TS 23.040 [21] for an indication of which elements of this 1st octet are Mandatory and which elements are Conditional.
TP Protocol Identifier	M	This IE indicates the protocol used above SM-Transfer Layer. The TP Protocol Identifier shall be retrieved from the SMS-SUBMIT TPDU or the SMS-COMMAND TPDU, which are specified in 3GPP TS 23.040 [21].
TP Data Coding Scheme	C	This IE indicates the data coding scheme of the TP-User Data field, and may indicate a message class. The message class may indicate e.g. the originator of the Short Message. The TP Data Coding Scheme shall be retrieved from the SMS-SUBMIT TPDU, which is specified in 3GPP TS 23.040 [21].
TP Validity Period	C	This IE indicates the length of the validity period or the absolute time of the validity period termination. This IE is only used for the SMS-SUBMIT TPDU. The TP Validity Period shall be retrieved from the SMS-SUBMIT TPDU which is specified in 3GPP TS 23.040 [21].
SMSC Address	M	This IE defines the address of the SMSC to which the MO short message is intended to be submitted.
M Mandatory (The IE shall always be sent). C Conditional (The IE shall be sent, if available).		

Location Information in MSC is based on the Location Information IE defined in 3GPP TS 23.018 [3]. The following differences apply:

Information element name	Required	Description
Location number	C	See 3GPP TS 23.018 [3].
VLR number	M	See 3GPP TS 23.018 [3].
Age of location information	-	Not applicable
Current Location Retrieved	-	Not applicable
Selected LSA Identity	C1	This IE indicates the LSA identity associated with the current position of the MS. Shall be sent if the LSA ID in the subscriber data matches the LSA ID of the current cell. In the case of multiple matches the LSA ID with the highest priority shall be sent. See 3GPP TS 23.073 [23].
M	Mandatory (The IE shall always be sent).	
C	Conditional (The IE shall be sent, if available).	
C1	Conditional (The IE shall be sent, if available and SoLSA is supported).	
-	Not applicable.	

Location Information in SGSN is based on the Location Information IE defined in 3GPP TS 23.018 [3]. The following differences apply:

Information element name	Required	Description
Location number	-	Not applicable
Service area ID	C1	See 3GPP TS 23.018 [3].
Cell ID	C1	See 3GPP TS 23.018 [3].
Location area ID	C1	See 3GPP TS 23.018 [3].
Routeing area ID	C	See 3GPP TS 23.003 [37].
Geographical information	C	See 3GPP TS 23.032 [34].
Geodetic information	-	Not applicable
VLR number	-	Not applicable
Age of location information	-	Not applicable
Current Location Retrieved	-	Not applicable
SGSN number	M	Global Title of the Serving GPRS Service Node. See 3GPP TS 23.060 [11].
Selected LSA Identity	C2	This IE indicates the LSA identity associated with the current position of the MS. Shall be sent if the LSA ID in the subscriber data matches the LSA ID of the current cell. In the case of multiple matches the LSA ID with the highest priority shall be sent. See 3GPP TS 23.073 [23]
M	Mandatory (The IE shall always be sent).	
C	Conditional (The IE shall be sent, if available).	
C1	Conditional (The IE shall be sent, if available. One and only one of the three conditional IEs shall be sent).	
C2	Conditional (The IE shall be sent, if available and SoLSA is supported).	
-	Not applicable.	

7.6.2 gsmSCF to gsmSSF/gprsSSF information flows

7.6.2.1 Connect SMS

7.6.2.1.1 Description

This IF is used to request the gsmSSF/gprsSSF to perform the actions to route the SMS to a specific destination.

7.6.2.1.2 Information Elements

The following information elements are required:

Information element name	Required	Description
Calling Party Number	O	This IE indicates the subscriber who sent the SMS; possibly changed by the gsmSCF.
Destination Subscriber Number	O	This IE identifies the Destination short message entity; possibly changed by the gsmSCF. The Destination Subscriber Number shall be placed in the header information of the TPDU.
SMSCAddress	O	Indicates the SMSC address where the MO short message shall be submitted to; possibly changed by the gsmSCF.
O	Optional (Service logic dependent).	

7.6.2.2 Continue SMS

7.6.2.2.1 Description

This information flow requests the gsmSSF/gprsSSF to proceed normally. The gsmSSF/gprsSSF completes DP processing, and continues SMS.

7.6.2.2.2 Information Elements

This IF contains no information elements.

7.6.2.3 Furnish Charging Information SMS

7.6.2.3.1 Description

This IF is used to request the gsmSSF/gprsSSF to include information in the CAMEL specific logical MO SMS record.

The logical call record is created when FCI-SMS is received and a logical call record for that short message does not exist. For modelling purposes the logical call record is buffered in the gsmSSF/gprsSSF. The gsmSSF/gprsSSF completes logical call records as defined in the SDLs. Once the logical call record is completed, then its free format data is moved to the corresponding CDR and the logical call record is deleted.

The CSE can send multiple concatenated FCIs per Short Message for completion. The total maximum of free format data is 160 octets per SM. The 160 octets may be sent in one or more FCI operations. If there is non-completed free format data and new FCI operation(s) is/are received to overwrite the non-completed data, then the non-completed data is discarded and the gsmSCF can send another 160 octets per SM.

7.6.2.3.2 Information Elements

The following information element is required:

Information element name	Required	Description
FCI Billing Charging Characteristics	M	This IE is described in the next table.
M	Mandatory (The IE shall always be sent).	

FCI Billing Charging Characteristics contains the following information:

Information element name	Required	Description
FCIBCCCAMEL Sequence 1	M	This IE is described in the next table.
M	Mandatory (The IE shall always be sent).	

FCIBCCCCAMEL Sequence 1 contains the following information:

Information element name	Required	Description
Free Format Data	M	This IE is a free format data to be inserted in the CAMEL logical call record.
Append Free Format Data	O	This IE indicates that the gsmSSF/gprsSSF shall append the free format data to the Logical MO SMS record. - If this IE is present indicating "Append", the gsmSSF/gprsSSF shall append the free format data received in this IF to the free format data already present in the Logical MO SMS record. - If this IE is absent or in value "Overwrite", then the gsmSSF shall overwrite all free format data already present in the Logical MO SMS record, by the free format data received in this IF. If no Logical MO SMS record exists yet, then the gsmSSF/gprsSSF shall ignore this IE.
M	Mandatory (The IE shall always be sent).	
O	Optional (Service logic dependent).	

7.6.2.4 Release SMS

7.6.2.4.1 Description

This IF is used to tear down by the gsmSCF an existing SMS transfer.

7.6.2.4.2 Information Elements

The following information element is required:

Information element name	Required	Description
Cause	M	SMS Cause. Indicates the SMS specific cause of the release. The cause is reported to the MS.
M	Mandatory (The IE shall always be sent).	

7.6.2.5 Request Report SMS Event

7.6.2.5.1 Description

This IF is used to request the gsmSSF/gprsSSF to monitor for an event (i.e., O_SMS_Submitted or O_SMS_Failure), then send a notification back to the gsmSCF when the event is detected (see Event Report SMS IF).

7.6.2.5.2 Information Elements

The following information elements are required:

Information element name	Required	Description
SMS Event	M	This IE specifies the event or events of which a report is requested.
M	Mandatory (The IE shall always be sent).	

SMS Event contains the following information:

Information element name	Required	Description
Event type	M	This IE specifies the type of event of which a report is requested.
Monitor Mode	M	This IE indicates how the event shall be reported.
M	Mandatory (The IE shall always be sent).	

7.6.2.6 Reset Timer SMS

7.6.2.6.1 Description

This IF is used to refresh a gsmSSF/gprsSSF timer.

7.6.2.6.2 Information Elements

The following information elements are required:

Information element name	Required	Description
Timer Value	M	This IE specifies the value to which the indicated timer shall be set.
Timer ID	O	This IE indicates which timer shall be reset. It shall be set to 'Tssf'.
M	Mandatory (The IE shall always be sent).	
O	Optional (Service logic dependent).	

7.6.3 HLR to VLR/SGSN information flows

7.6.3.1 Delete Subscriber Data

7.6.3.1.1 Description

This IF is specified in 3GPP TS 29.002 [4] and is used by the HLR to delete subscriber data in the VLR/SGSN.

7.6.3.1.2 Information Elements

The Delete Subscriber Data contains the following CAMEL specific IE:

Information element name	Required	Description
CAMEL Subscription Info Withdraw	C	This IE identifies that all CSIs shall be deleted from the subscriber data in VLR/SGSN.
Specific CSI Withdraw	C	This IE is used to indicate that only SMS-CSI shall be deleted from the VLR/SGSN. This IE should not be sent when CAMEL Subscription Info Withdraw is present.
C	Conditional (The IE shall be sent when deletion is requested).	

7.6.3.2 Insert Subscriber Data

7.6.3.2.1 Description

This IF is specified in 3GPP TS 29.002 [4] and is used by the HLR to insert subscriber data in the VLR/SGSN.

7.6.3.2.2 Information Elements

The Insert Subscriber Data contains the following CAMEL specific IE:

Information element name	Required	Description
SMS-CSI	C	This IE identifies the subscriber having MO SMS CAMEL services.
C	Conditional (The IE shall be sent, if required).	

SMS-CSI contains the following information:

Information element name	Required	Description
gsmSCF Address	M	See clause 7.3.1.1.
Service Key	M	See clause 7.3.1.2.
Default SMS Handling	M	See clause 7.3.1.3.
CAMEL Capability Handling	M	See clause 7.3.1.5.
SMS Triggers	M	See clause 7.3.1.4. It includes the following trigger: *SMS_Collected_Info*
M Mandatory (the IE shall always be sent).		

7.6.4 VLR/SGSN to HLR information flows

7.6.4.1 Insert Subscriber Data ack

See clause 4.6.8.1.

7.6.4.2 Update Location

See clause 4.6.8.3. This information flow is sent by the VLR.

7.6.4.3 Update GPRS Location

See clause 6.6.4.1. This information flow is sent by the SGSN.

7.6.5 VLR to MSC Information Flows

7.6.5.1 Send Info For MO SMS Ack

7.6.5.1.1 Description

This IF is specified in 3GPP TS 29.002 [4]. It is used to transport MO SMS related subscription data from the VLR to the MSC.

The Send Info For MO SMS Ack contains the following information:

Information element name	Required	Description
SMS-CSI	C	This IE contains the CAMEL Subscription Information for MO-SMS.
ODB Data	C	This IE contains ODB data. This information is used to apply ODB for a reconnected Short Message, if needed.
CB SS Data	C	This IE contains CB SS data. This information is used to apply CB for a reconnected Short Message, if needed.
C Conditional (shall be sent if available).		

8 SS Notifications

8.1 Architecture

8.1.1 Functional Entities used for CAMEL

This clause describes the functional architecture needed to support Supplementary Service (SS) Notifications. Figure 8.1 shows the functional entities involved in sending SS Notifications. The architecture is applicable to the third phase of CAMEL.
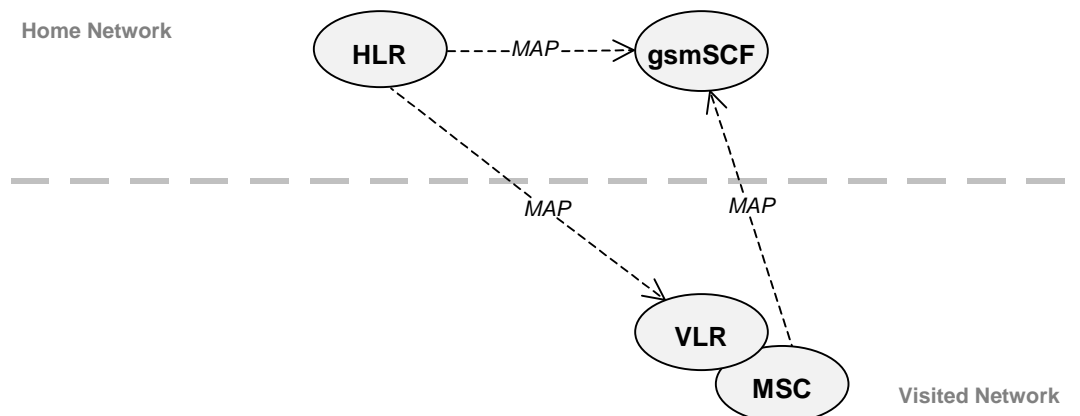
Figure 8.1: Functional architecture for support of SS Notifications

HLR: For subscribers requiring CAMEL support, the HLR stores the information relevant to the current subscription regarding SS-CSI. The SS-CSI is sent to the VLR at Location Update, on Data Restoration or if the SS-CSI is updated by administrative action. When processing an invocation of the CCBS supplementary service, the HLR shall send a notification of the invocation of the supplementary service to the gsmSCF if required by the SS-CSI.

MSC: When processing an invocation of any of the supplementary services ECT, CD and MPTY, the MSC may receive an SS-CSI from the VLR, indicating that a notification of the invocation of the supplementary service shall be sent to the gsmSCF.

VLR: The VLR stores the SS-CSI as a part of the subscriber data for subscribers roaming in the VLR area.

gsmSCF: The gsmSCF receives the SS Invocation Notification from the MSC or HLR.

8.1.2 Interfaces defined for SS Notifications

This clause describes the different interfaces applicable to SS Notifications. It specifies on a high level the functions specific to SS Notifications.

8.1.2.1 MSC - gsmSCF interface

This interface is used by the MSC to send supplementary service invocation notifications to the gsmSCF. The SS invocations that can be notified to the gsmSCF via this interface are Call Deflection (CD), Explicit Call Transfer (ECT) and Multi Party (MPTY).

8.1.2.2 HLR - gsmSCF interface

This interface is used by the HLR to send supplementary service invocation notifications to the gsmSCF. The SS invocation that can be notified to the gsmSCF via this interface is Call Completion to Busy Subscriber (CCBS).

8.1.2.3 VLR - MSC interface

This interface is used by the VLR to transfer SS-CSI to the MSC.

8.1.2.4 HLR-VLR interface

This interface is used by the HLR to send the SS-CSI to the VLR or to remove SS-CSI from the VLR.

8.2 Description of CAMEL Subscriber Data

8.2.1 Supplementary Service Invocation Notification CAMEL Subscription Information (SS-CSI)

This clause defines the contents of the Supplementary Service Invocation Notification CAMEL Subscription Information (SS-CSI).

8.2.1.1 Notification criteria

This data indicates for which supplementary services notifications shall be sent. The supplementary services which may be indicated are ECT, CD, CCBS and MPTY.

8.2.1.2 gsmSCF address

Address to be used to access the gsmSCF for a particular subscriber. The address shall be an E.164 number to be used for routeing.

8.2.1.3 CSI state

The CSI state indicates whether the SS-CSI is active or not.

8.2.1.4 Notification flag

The notification flag indicates whether the change of the SS-CSI shall trigger Notification on Change of Subscriber Data or not.

8.2.1.5 gsmSCF address list for CSI

The gsmSCF address list indicates a list of gsmSCF addresses to which Notification on Change of Subscriber Data is to be sent. This list is common to all CSI.

8.3 Procedures for CAMEL

8.3.1 Handling of Supplementary Service Invocation Notification

At the invocation of any of the services ECT, CD and MPTY the VLR checks whether the criteria for sending a notification are fulfilled, i.e. whether the subscriber is provisioned with the SS-CSI and the particular invoked supplementary service is marked in the SS-CSI. If this is the case a notification is sent to the gsmSCF given by the gsmSCF address contained in the SS-CSI. The processing of the particular SS invocation is not suspended. If the notification criteria are not fulfilled the processing of the particular supplementary service continues unchanged and no notification is sent.

The sending of the notification is independent of call related CAMEL processing, i.e. processing indicated by O/D/T/VT-CSI.

On invocation of ECT, the VLR shall include the SS-CSI in the Invoke ECT response message (see Process MAF027 in 3GPP TS 23.091 [29]) to the MSC if applicable for ECT.

On invocation of MPTY, the VLR shall include the SS-CSI in the Process MPTY message (see Process MPTY_MAF026 in 3GPP TS 23.084 [28]) to the MSC if applicable for MPTY.

On invocation of CD, the VLR shall include the SS-CSI in the Send Info For Incoming Call ack message to the MSC if applicable to CD (see 3GPP TS 23.072 [35]).

When a subscriber activates a CCBS request, the HLR checks whether the criteria for sending a notification are fulfilled, i.e. whether

- The subscriber is provisioned with an active SS-CSI; and

- CCBS is marked in the SS-CSI.

If the criteria are fulfilled, a notification is immediately sent to the gsmSCF given by the gsmSCF address contained in the SS-CSI and the processing of the CCBS request continues. Whenever the state of the CCBS request changes (see 3GPP TS 23.093 [38]), an additional notification is immediately sent to the gsmSCF and the processing of the CCBS request continues.

If the criteria are not fulfilled, the processing of the CCBS request continues unchanged and no notifications are sent.

At the invocation of the CCBS supplementary service, the HLR checks whether the criteria for sending a notification are fulfilled, i.e. whether the subscriber is provisioned with the SS-CSI and the particular invoked supplementary service is marked in the SS-CSI. If this is the case, a notification is sent to the gsmSCF given by the gsmSCF address contained in the SS-CSI. The processing of the SS invocation is not suspended. If the notification criteria are not fulfilled the processing of the particular supplementary service continues unchanged and no notification are sent.

8.4 Description of information flows

This clause contains the detailed description of the information flows used by CAMEL.

Each Information Element (IE) is marked as Mandatory (M), Conditional (C), Optional (O) or Not applicable (-). This categorization is a functional classification, i.e., stage 2 information, and not a stage 3 classification to be used for the ASN.1 syntax of the protocol.

The following principles apply for the handling of the IEs by the receiving entity:

- The gsmSCF may silently discard any IE which it does not functionally support.

Details of errors and exceptions to these rules are specified in are specified in 3GPP TS 29.002 [4].

8.4.1 MSC to gsmSCF information flows

8.4.1.1 SS Invocation Notification

8.4.1.1.1 Description

This IF is generated by the MSC when it shall notify the gsmSCF of a supplementary service invocation.

8.4.1.1.2 Information Elements

The following information elements are required:

Information element name	Required	Description
Notification Event	M	This IE indicates the supplementary service invocation, resulting in the SS Invocation Notification IF. Only the following Supplementary Services are allowed: Explicit Call Transfer, Call Deflection, Multi Party.
Notification Event Specific Information	C	In the case of ECT, the sending entity shall include the called party for each call originated by the subscriber and relevant to the ECT invocation. Note: the subscriber may have originated zero, one or two calls relevant to the ECT service. In the case of CD, the deflected to number shall be included in this information element. In the case of MPTY, this IE shall be omitted.
IMSI	M	This IE identifies the mobile subscriber who has invoked the supplementary service to be notified.
MSISDN	M	This IE identifies the mobile subscriber who has invoked the supplementary service to be notified.
M Mandatory (The IE shall always be sent).		
C Conditional (The IE shall be sent if applicable).		

8.4.2 HLR to VLR information flows

8.4.2.1 Delete Subscriber Data

8.4.2.1.1 Description

This IF is used by the HLR to remove CAMEL subscription data from the VLR. This IF is specified in 3GPP TS 29.002 [4].

8.4.2.1.2 Information Elements

The Delete Subscriber Data contains the following CAMEL specific IE for SS Notifications:

Information element name	Required	Description
CAMEL Subscription Info Withdraw	C	This IE identifies that all CSIs shall be deleted from the subscriber data in the VLR.
Specific CSI Withdraw	C	This IE is used to indicate that only SS-CSI shall be deleted from the VLR. This IE should not be sent when CAMEL Subscription Info Withdraw is present.
C Conditional (The IE shall be sent when deletion is requested).		

8.4.2.2 Insert Subscriber Data

8.4.2.2.1 Description

This IF is used by an HLR to update a VLR with certain subscriber data. This IF is specified in 3GPP TS 29.002 [4].

8.4.2.2.2 Information Elements

The Insert Subscriber Data contains the following CAMEL specific IE for SS Notifications:

Information element name	Required	Description
SS-CSI	C	This IE identifies the subscriber as having supplementary service invocation notification services. It contains the Notification Criteria and gsmSCFAddress. This IE is described in clause 8.2.1. When SS-CSI is sent to the VLR, it shall not contain a marking for CCBS.
C Conditional (The IE shall be sent, if required).		

8.4.3 HLR to gsmSCF information flows

8.4.3.1 SS Invocation Notification

This IF is generated by the HLR when it shall notify the gsmSCF of a supplementary service invocation.

8.4.3.1.2 Information Elements

The following information elements are required:

Information element name	Required	Description
Notification Event	M	This IE indicates the supplementary service invocation, resulting in the SS Invocation Notification IF. Only the following Supplementary Services are allowed: Completion of Calls to Busy Subscriber
IMSI	M	This IE identifies the mobile subscriber who has invoked the supplementary service to be notified.
MSISDN	M	This IE identifies the mobile subscriber who has invoked the supplementary service to be notified.
B- Number	M	This IE indicates the destination address of the CCBS request.
CCBS Request State	M	This IE identifies the current state of the CCBS request. It can be one of: Request Recall Active Completed Suspended Frozen Deleted
M Mandatory (The IE shall always be sent).		

8.4.4 VLR to MSC information flows

8.4.4.1 Invoke SS result

8.4.4.1.1 Description

This IF is used by the VLR to send SS-CSI to the MSC. This IF is specified in 3GPP TS 29.002 [4].

8.4.4.1.2 Information Elements

The Invoke SS result contains the following CAMEL specific IE for SS Notifications:

Information element name	Required	Description
SS-CSI	C	This IE is included when it is available in the VLR and either ECT or MPTY has been successfully invoked and that supplementary service has been marked for notification.
C	Conditional (The IE shall be sent when ECT or MPTY invocation shall be notified).	

8.4.4.2 Send Info For Incoming Call ack

8.4.4.2.1 Description

This IF is used by the VLR to send SS-CSI to the MSC. This IF is specified in 3GPP TS 23.018 [3].

8.4.4.2.2 Information Elements

The Send Info For Incoming Call ack contains the following CAMEL specific IE for SS Notifications:

Information element name	Required	Description
SS-CSI	C	This IE is included when it is available in the VLR and CD has been successfully invoked and that supplementary service has been marked for notification.
C	Conditional (The IE shall be sent when CD invocation shall be notified).	

9 Mobility Management

9.1 Architecture

9.1.1 Functional Entities used for CAMEL

This clause describes the functional architecture required to support Mobility Management in CAMEL. Figure 9.1 shows the functional entities involved in CAMEL support of Mobility Management. The architecture is applicable to the third phase of CAMEL.
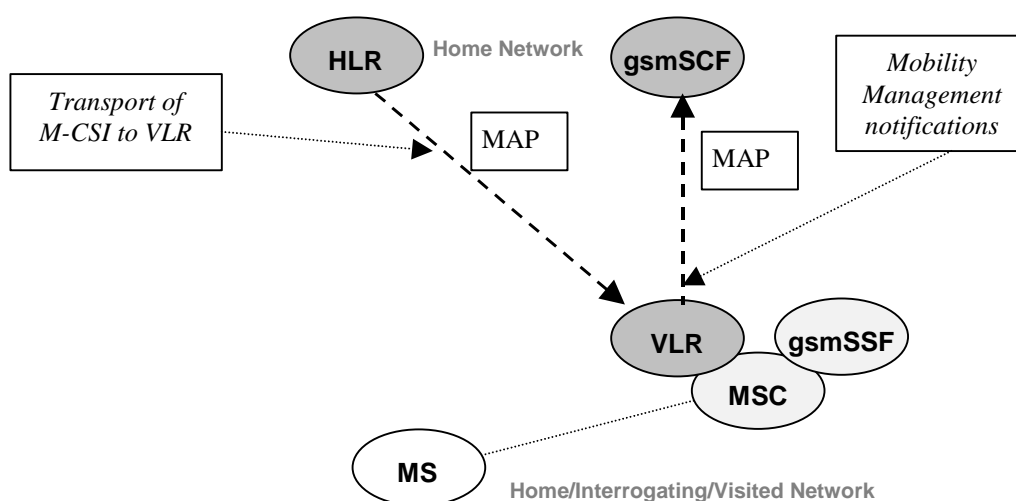
Figure 9.1: Functional architecture for support of CAMEL

gsmSCF: see clause 4.1.

HLR: The HLR contains Mobility management CAMEL Subscription Information (M-CSI) for those subscribers that require CAMEL control of Mobility Management events. M-CSI is sent to the VLR during the Location Update and Restore Data procedures or when M-CSI is modified in the HLR. The M-CSI is deleted in the VLR with the Delete Subscriber Data procedure.

MS: Mobile Station (GSM terminal).

MSC: see clause 4.1.

VLR: After having completed a Mobility Management event from a subscriber, the VLR may find it necessary to send a notification to the gsmSCF. The contents of M-CSI indicates which Mobility Management events shall be reported to the gsmSCF.

9.1.2   Interfaces defined for CAMEL

This clause describes the different interfaces applicable to CAMEL control of Mobility Management events. It specifies on a high level the functions specific to CAMEL.

9.1.2.2   VLR - gsmSCF interface

This interface is used by the VLR to send Mobility Management event notifications to the gsmSCF. When processing a mobility management event, the VLR may find it necessary to send a notification to the gsmSCF, depending on the presence of M-CSI for the subscriber and the contents of M-CSI.

9.2   Description of CAMEL Subscriber Data

9.2.1   Mobility Management CAMEL Subscription Information (M-CSI)

This clause specifies the contents of the Mobility Management CAMEL Subscription Information (M-CSI).

9.2.1.1   Mobility Management Triggers

This data indicates which Mobility Management events shall result in a notification to the gsmSCF. One or more events may be marked per subscriber.. These events are:

-   Location update in the same VLR service area;

-   Location update to another VLR service area;

-   IMSI attach;

-   MS initiated IMSI detach (explicit detach);

-   Network initiated IMSI detach (implicit detach).

9.2.1.2   gsmSCF address

This is the address of the gsmSCF where the Mobility Management event notification shall be sent to. The gsmSCF address is in E.164 format.

9.2.1.3   Service Key

The Service Key is included in the notification message to the gsmSCF. It indicates to the gsmSCF which Service Logic shall be applied.

9.2.1.4   CSI state

The CSI state indicates whether the M-CSI is active or not.

9.2.1.5 Notification flag

The notification flag indicates whether the change of the M-CSI shall trigger Notification on Change of Subscriber Data or not.

9.2.1.6 gsmSCF address list for CSI

The gsmSCF address list indicates a list of gsmSCF addresses to which Notification on Change of Subscriber Data is to be sent. This list is common to all CSI.

9.3 Procedures for Mobility management

The different procedures for Mobility Management are shown in Figures 9.2a to 9.2e.

Figure 9.2a: Location Update within a single VLR Service Area. (The VLR Service area may be in the HPLMN or in the VPLMN.);

Figure 9.2b: Location Update from one VLR Service Area to another VLR Service Area. (Both VLR Service Areas are in the HPLMN or in the same VPLMN.);

Figure 9.2c: Location Update from one PLMN to another PLMN:

- update from HPLMN to VPLMN;

- update from VPLMN to HPLMN;

- update from one VPLMN to another VPLMN.

Figure 9.2d IMSI Detach (in HPLMN or in VPLMN):

- explicit detach (the MS has been switched off by the subscriber);

- implicit detach (the network has not received a periodic paging update from the MS and assumes that the MS is switched off or unreachable).

Figure 9.2e IMSI Attach (in HPLMN or in VPLMN):

- attach (the MS has been switched on by the subscriber – subscription data is still available in the VLR, no location update is needed).
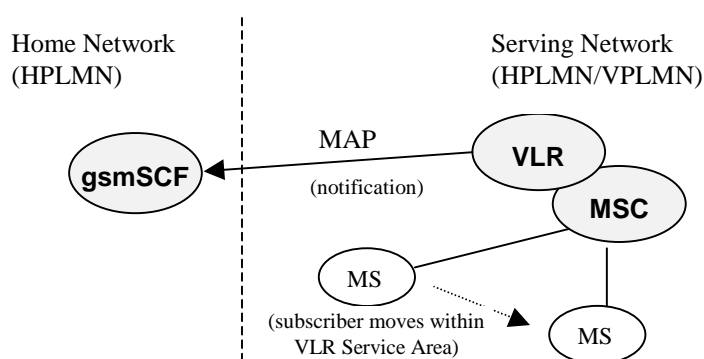
Figure 9.2a: Location Update within a single VLR Service Area
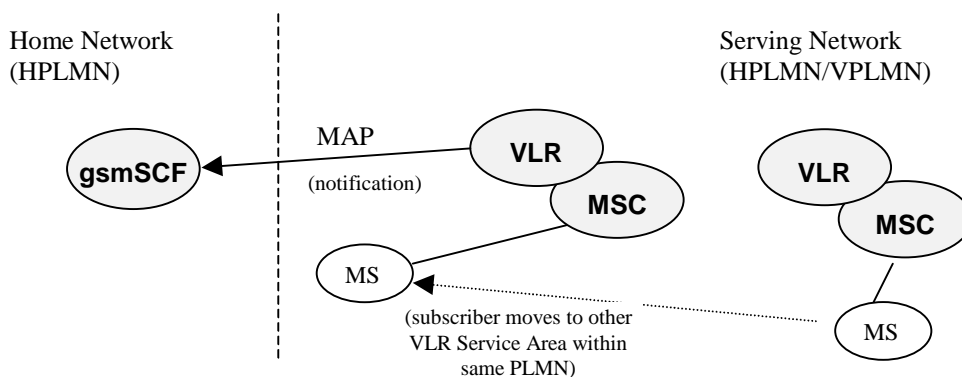
Figure 9.2b: Location Update from one VLR Service Area to another VLR Service Area
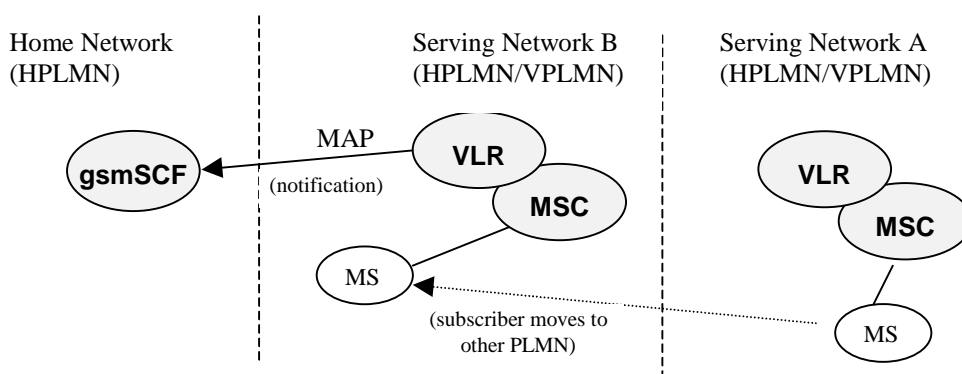
Figure 9.2c: Location Update from one PLMN to another PLMN
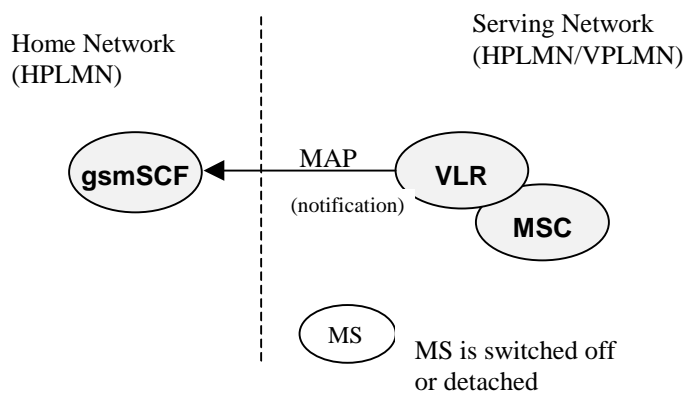
Figure 9.2d: IMSI Detach (implicit/explicit)
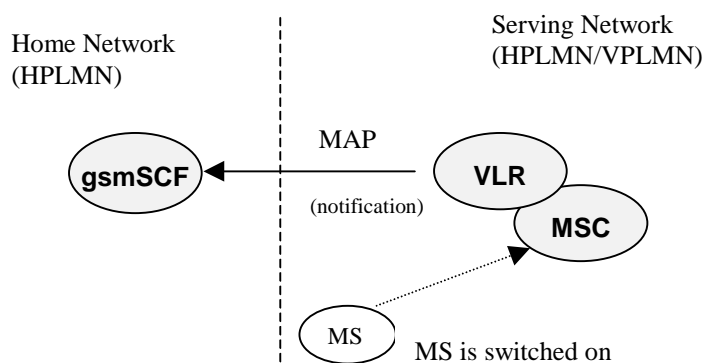
Figure 9.2e: IMSI Attach

When a Mobility Management Event has taken place and the processing has been completed, then the VLR may find it necessary to send a notification to the gsmSCF. The processing of the Mobility Management event in the VLR is not suspended by the sending of the notification nor is it in any way affected by the notification.

The sending of a Mobility Management notification to gsmSCF is independent of other CAMEL subscription data for a subscriber. E.g. a subscriber may have M-CSI without O-CSI or VT-CSI.

The sending of a Mobility Management event notification is subscription based.

Refer to clause 9.2.1 for a description of M-CSI and the different Mobility Management events that may lead to a notification to the gsmSCF.

9.3.1 Procedure descriptions

9.3.1.1 Procedure Set_Notification_Type

This procedure is called from process Update_Location_VLR in 3GPP TS 23.012 [32]. It checks the information element 'Location Update Type', which the VLR receives from the MSC via MAP_UPDATE_LOCATION_AREA service. This element identifies the type of Location Update requested by the mobile station.

The possible values of this parameter are specified in 3GPP TS 24.008 [33].

The type of Location Update that was requested by the mobile station determines which Mobility Management notification message shall be sent to the gsmSCF.

The values 'Periodic Updating' and 'Reserved' shall not lead to a Mobility Management notification to the gsmSCF.

Procedure Set_Notification_Type 1(1)

/* Determining the type of Mobility
Management event notification
to be sent to the gsmSCF. */

Location
Update Type?

'IMSI Attach'

'Nomal
Location
Updating'

'Reserved'
or
'Periodic Updating'

Previous
LAI in
VLR?

No

Yes

Notify :=
Attach

Notify := Location
update in the same
VLR Service Area

Notify := Location
update to the new
VLR Service Area

No notification
required
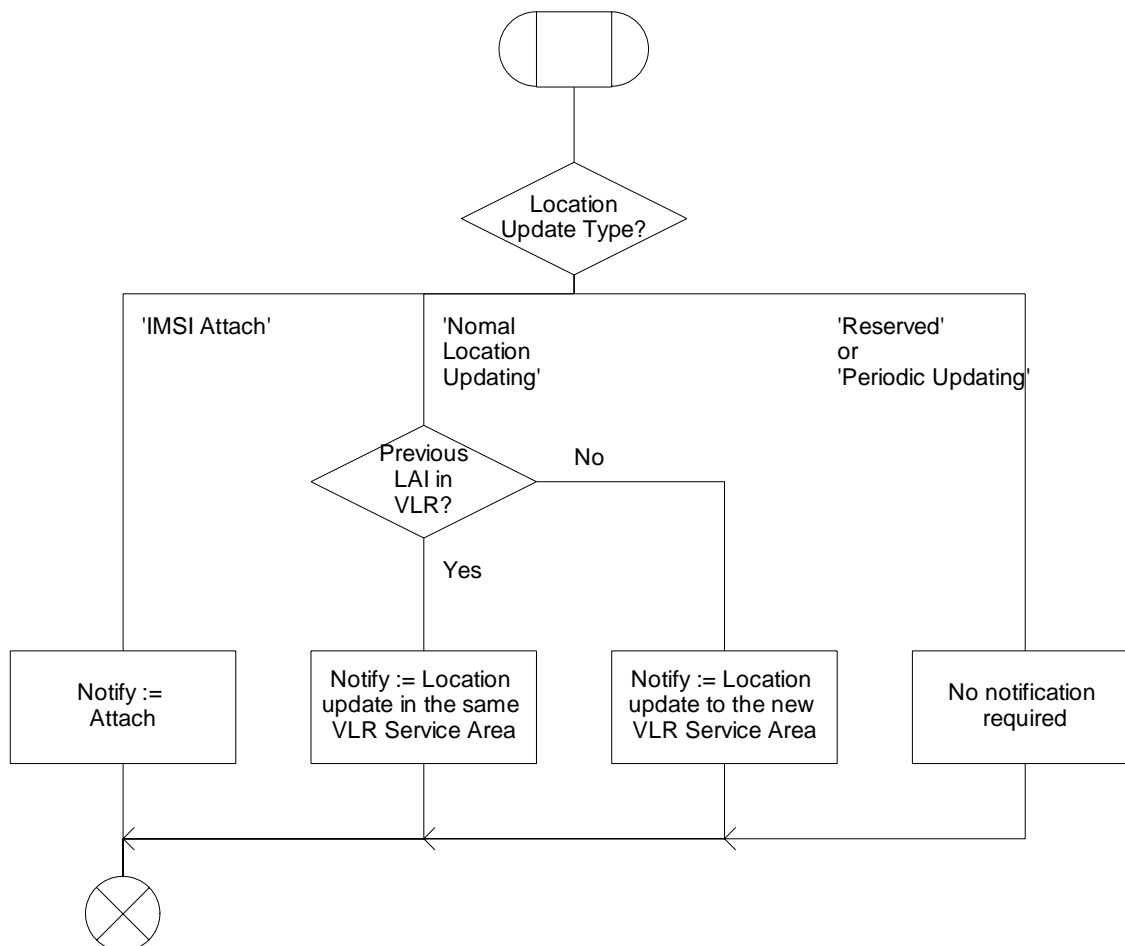
Figure 9.3: Procedure Set_Notification_Type (sheet 1)

9.3.1.2   Procedure Notify_gsmSCF

This procedure is called from the process 'Update_Location_Area_VLR' and process 'Detach_IMSI_VLR' in 3GPP
TS 23.012 [32]. It is also called from the process 'Update_Location_VLR' in 3GPP TS 29.002 [4].

The calling process passes on the variable 'Notify' to the procedure 'Notify_gsmSCF'. This variable indicates which Mobility Management notification may be necessary to be sent to the gsmSCF. If this variable has a value NULL, then no notification shall be sent to the gsmSCF.

If a notification may be necessary to be sent to the gsmSCF, then the procedure checks the presence of M-CSI.

- If M-CSI is present and the Mobility Management event indicated in the variable 'Notify' is marked in M-CSI, then a notification shall be sent to the gsmSCF.

- If M-CSI is not present or the Mobility Management event indicated in the variable 'Notify' is not marked in M-CSI, then no notification shall be sent to the gsmSCF.

Procedure Notify_gsmSCF 1(1)

/* Sending a notification to the gsmSCF, if needed. */

/* Signals to/from the right are to/from the process 'MM_Event_Notification_VLR' in 3GPP TS 29.002. */

Event notification required?

No

Yes

Send MM Event Notification

Waiting_for_ Notification_Reply

Send MM Event Notification Positive Response

Send MM Event Notification Negative Response
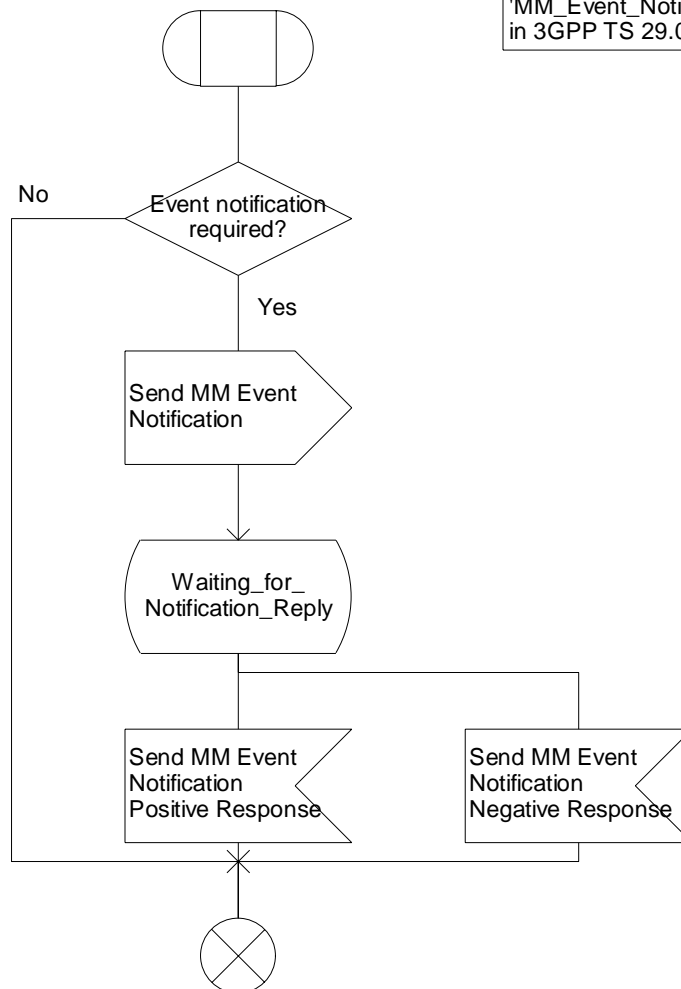
Figure 9.4: Procedure Notify_gsmSCF (sheet 1)

9.4 Description of information flows

This clause contains the detailed description of the information flows used by CAMEL for Mobility Management control.

Each Information Element (IE) is marked as Mandatory (M), Conditional (C), Optional (O) or Not applicable (-). This categorization is a functional classification, i.e., stage 2 information, and not a stage 3 classification to be used for the ASN.1 syntax of the protocol.

The following principles apply for the handling of the IEs by the receiving entity:

- The gsmSCF may silently discard any IE which it does not functionally support.

- The VLR shall functionally support all IE's which can be sent to it.

9.4.1 VLR to gsmSCF information flows

9.4.1.1 Mobility Management event Notification

9.4.1.1.1 Description

This IF is generated by the VLR when it shall notify the gsmSCF of a Mobility Management event.

9.4.1.1.2 Information Elements

The following information elements are required:

Information element name	Required	Description
Event Met	M	This IE indicates the type of Mobility Management that lead to the notification. The value of this IE shall be one of the following. - Location update in the same VLR service area - Location update to another VLR service area - IMSI attach - MS initiated IMSI detach (explicit detach) - Network initiated IMSI detach (implicit detach)
Service Key	M	This IE indicates the Service Logic that the gsmSCF shall apply.
IMSI	M	This IE identifies the mobile subscriber to whom the Mobility Event applies.
Basic MSISDN	M	This IE identifies the mobile subscriber to whom the Mobility Event applies.
Location Information	C	This IE indicates the current location of the MS. This IE is described in the next table.
Supported CAMEL Phases	M	This IE indicates the CAMEL Phases that are supported by the MSC/VLR in which the MS is registered after the mobility management event.
M Mandatory (The IE shall always be sent).		
C Conditional (The IE shall be sent, if available).		

Location Information is defined in 3GPP TS 23.018 [3]. The following differences apply:

Information element name	Required	Description
Service area ID	C1	See 3GPP TS 23.018 [3].
Cell ID	C1	See 3GPP TS 23.018 [3].
Current Location Retrieved	-	Not applicable
Location area ID	C1	See 3GPP TS 23.003 [37].
Selected LSA Identity	C	This IE indicates the LSA identity associated with the current position of the MS. Shall be sent if the LSA ID in the subscriber data matches the LSA ID of the current cell. In the case of multiple matches the LSA ID with the highest priority shall be sent. See 3GPP TS 23.073 [23].
C Conditional (The IE shall be sent, if available and SoLSA is supported).		
C1 Conditional (The IE shall be sent, if available. One and only one of the three conditional IEs shall be sent).		
- Not applicable.		

9.4.2   HLR to VLR information flows

9.4.2.1   Delete Subscriber Data

9.4.2.1.1   Description

This IF is used by an HLR to remove certain subscriber data from a VLR if the subscription of one or more supplementary services or basic services is withdrawn. Note that this IF is not used in the case of erasure or de-activation of supplementary services. This IF is specified in 3GPP TS 29.002 [4].

9.4.2.1.2   Information Elements

The Delete Subscriber Data contains the following CAMEL specific IE for Mobility Management:

Information element name	Required	Description
CAMEL Subscription Info Withdraw	C	This IE identifies that all CSIs shall be deleted from the subscriber data in VLR.
Specific CSI Withdraw	C	This IE is used to indicate that only M-CSI shall be deleted from the VLR. This IE should not be sent when CAMEL Subscription Info Withdraw is present.
C Conditional (The IE shall be sent when deletion is requested).		

9.4.2.2   Insert Subscriber Data

9.4.2.2.1   Description

This IF is used by an HLR to update a VLR with certain subscriber data. This IF is specified in 3GPP TS 29.002 [4].

9.4.2.2.2   Information Elements

Insert Subscriber Data contains the following CAMEL specific IE for Mobility Management:

Information element name	Required	Description
M-CSI	C	This IE identifies the subscriber as having mobility management notification services. It contains the events that shall be reported, the gsmSCF Address and the Service Key.
C Conditional (The IE shall be sent, if required).		

M-CSI contains the following information:

Information element name	Required	Description
GsmSCF Address	M	This IE is described in clause 9.2.1.
Service Key	M	This IE is described in clause 9.2.1.
Mobility Management Triggers	M	This IE indicates which Mobility Management events shall be reported to the gsmSCF. It shall contain one or more of the following elements: - Location update in the same VLR service area - Location update to another VLR service area - IMSI attach - MS initiated IMSI detach (explicit detach) - Network initiated IMSI detach (implicit detach)
M	Mandatory (The IE shall always be sent).	

10 Control and interrogation of subscription data

Support of the procedures described in this clause in CAMEL Phase 3 is a network operator option.

10.1 Architecture

10.1.1 Functional Entities used for CAMEL

This clause describes the functional architecture required to support control and interrogation of subscription data. Figure 10.1 shows the functional entities involved in CAMEL support of control and interrogation of subscription data.
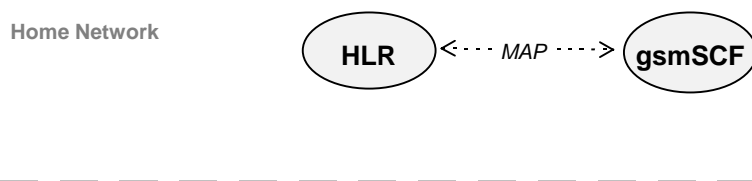
Figure 10.1: Functional architecture for support of control and interrogation of subscription data

gsmSCF: see clause 3.1.

HLR: The HLR may provide an interface to the gsmSCF for the Any Time Subscription Interrogation and Any Time Modification procedures. The gsmSCF may provide an interface to the HLR for the Notify Subscriber Data Change procedure.

10.1.2 Interfaces defined for CAMEL

This clause describes the interface applicable to CAMEL control of subscription data. It specifies on a high level the functions specific to CAMEL.

10.1.2.1 gsmSCF - HLR

This interface is used by the gsmSCF to interrogate or modify information in the HLR. As a network operator option, the HLR may refuse to provide or modify the information requested by the gsmSCF. This interface is also used by the HLR to notify the gsmSCF of a change of subscriber data.

10.2 Procedures for CAMEL

10.2.1 Any Time Subscription Interrogation

Handling of Any Time Interrogation for Subscription Information Retrieval involves the following process:

- CAMEL_ATSI_HLR.

If an OSS needs the Subscription Information, the gsmSCF initiates a transaction to the HLR by sending an Any Time Subscription Interrogation Request.

Process CAMEL_ATSI_HLR 1(2)

/* Process in the HLR receiving
an Any Time Subscription Interrogation
request from gsmSCF. */

/* Signals to/from the left are to/from
the gsmSCF. */

Idle

Any Time Subscription
Interrogation Request

ATSI accepted? — No

Yes

MS known? — No

Yes

Error :=
"Unknown
Subscriber"

Error :=
"ATSI Not
Allowed"

Any Time Subscription
Interrogation negative
response (Error)

1

Idle
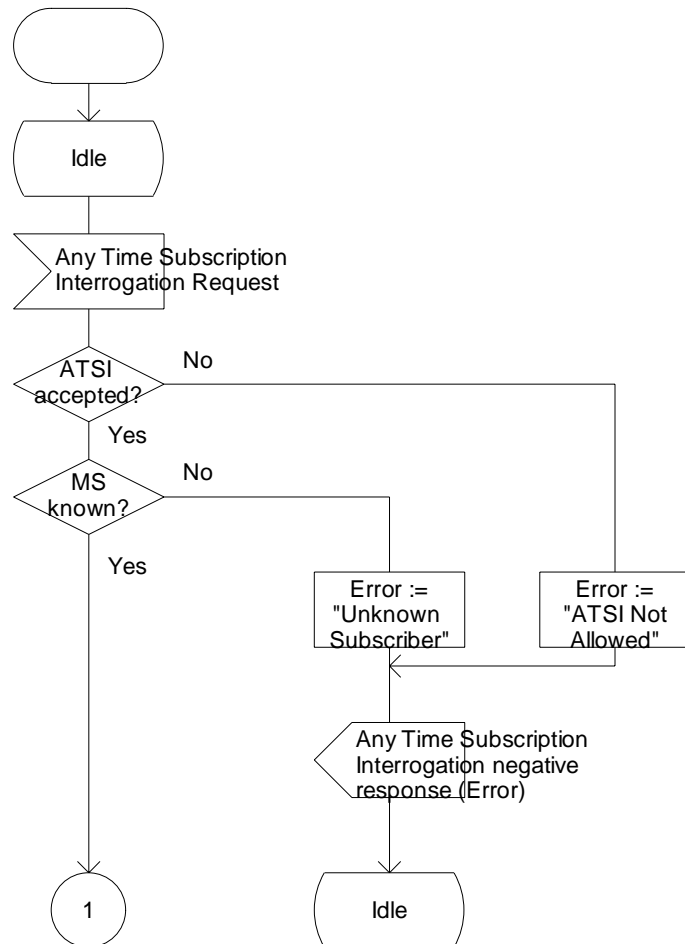
Figure 10.2a: Process CAMEL_ATSI_HLR (sheet 1)

Process CAMEL_ATSI_HLR 2(2)

/* Process in the HLR receiving an Any Time Subscription Interrogation request from gsmSCF. */

/* Signals to/from the left are to/from the gsmSCF. */
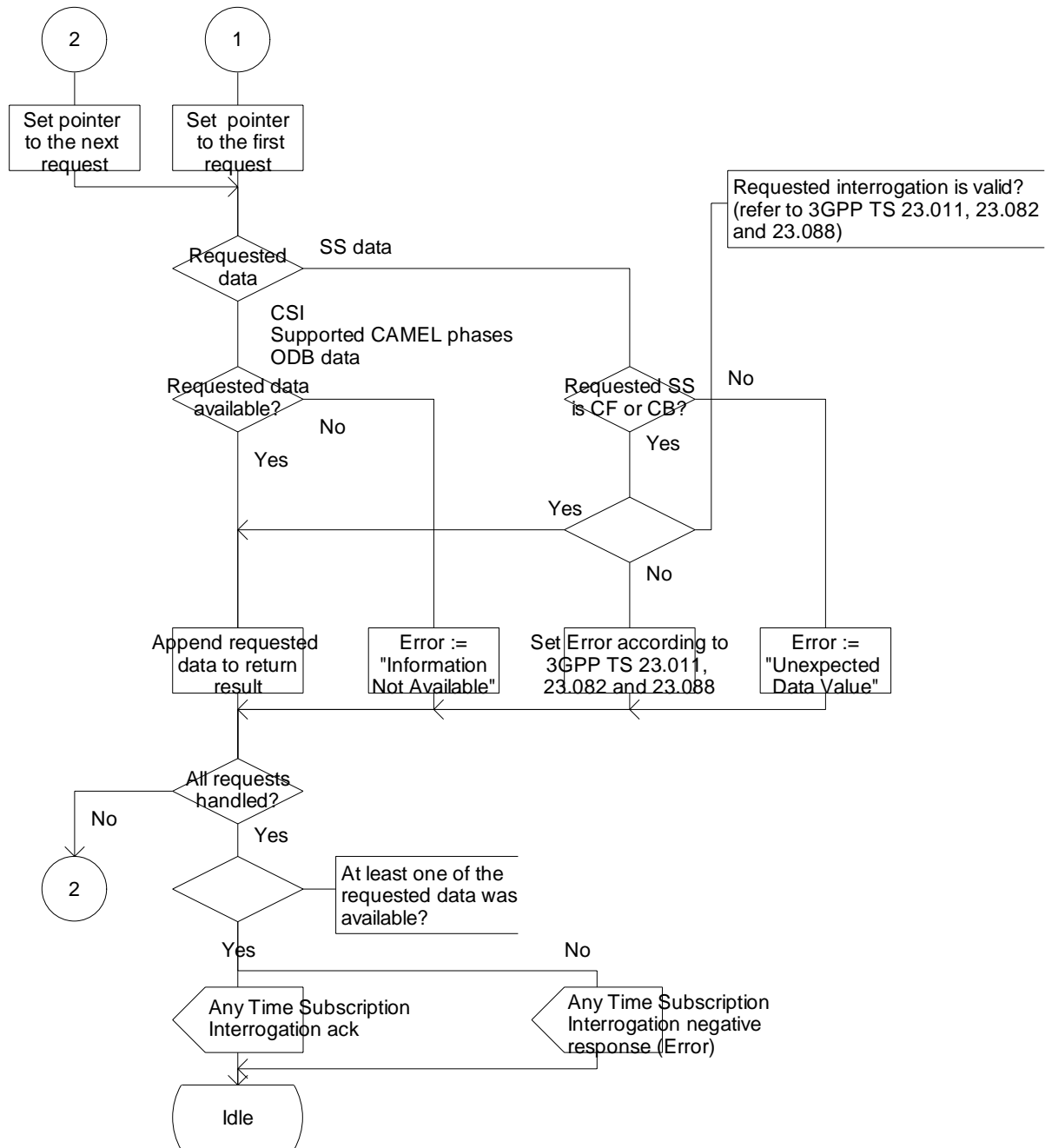
Figure 10.2b: Process CAMEL_ATSI_HLR (sheet 2)

10.2.2   Any Time Modification

Handling of Any Time Modification involves the following process:

- CAMEL_ATM_HLR.

The following procedures are involved:

- ATM_Modify_Data
  This procedure checks which data shall be modified and calls the appropriate data modification procedure.

- ATM_Modify_CSI_Data
  If the CSI indicated in the ATM request is not available in the HLR, then an error is returned.
  Otherwise, the CSI state and/or Notification-to-CSE flag are set as instructed with the ATM request.

- ATM_Modify_CF_Data
  When only the SS-code and (optionally) a Basic Service code are present in the ATM request, then all Call Forwarding data belonging to this SS code and basic service code is erased.
  Otherwise, the behaviour is as follows:

  - If a valid SS state is present in the ATM request, then an SS state transition is performed.

  - If a valid FTN, FTN sub address or No Reply Condition Time is present in the ATM request, then the indicated variable is modified.

  - Before modification of CF data (SS state changed to 'registered', insert or change of FTN), the interaction checks between CF and ODB and between CF and CB shall be performed as described in 3GPP TS 23.015 [40] and TS 23.082 [27] respectively. The CF data shall only be modified if the changed new CF data would not conflict with the existing ODB or CB entries.

  - If an instruction to modify the notification-to-CSE flag is present in the ATM request, then the notification-to-CSE flag is modified.

- ATM_Modify_CB_Data
  When only the SS-code and (optionally) a Basic Service code are present in the ATM request, then all Call Barring data belonging to this SS code and basic service code is erased.
  Otherwise, the behaviour is as follows:

  - If a valid SS state is present in the ATM request, then an SS state transition is performed.

  - Before modification of CB data (SS state), the interaction checks between CF and CB shall be performed as described in 3GPP TS 23.088 [39]. The CB data shall only be modified if the changed new CB data would not conflict with the existing CF entries.

  - If a valid Password or 'Wrong password attempt counter' is present in the ATM request, then the indicated variable is modified.

  - If an instruction to modify the notification-to-CSE flag is present in the ATM request, then the notification-to-CSE flag is modified.

After having executed the Any Time Modification instruction from the gsmSCF, the HLR calls the procedure CAMEL_NSDC_HLR, which sends notifications to gsmSCF(s), if required.

Process CAMEL_ATM_HLR   1(1)

/* Process in the HLR receiving
an Any Time Subscription Modification
request from gsmSCF. */

/* Signals to/from the left are to/from
the gsmSCF, unless otherwise indicated.*/

Idle

Any Time
Modification
request

ATM
accepted? — No

Yes

MS
known? — No

Yes

Requested data
available? — No

Yes

ATM_Modify_
Data

Set UE=
"Not available"

Set UE=
"Unknown
subscriber"

Set UE=
"ATM Not
Allowed"

Result? — Fail

Pass

Set Result to
modified data

Any Time
Modification
ack

Any Time
Modification
Error

CAMEL_NSDC_
HLR

Idle
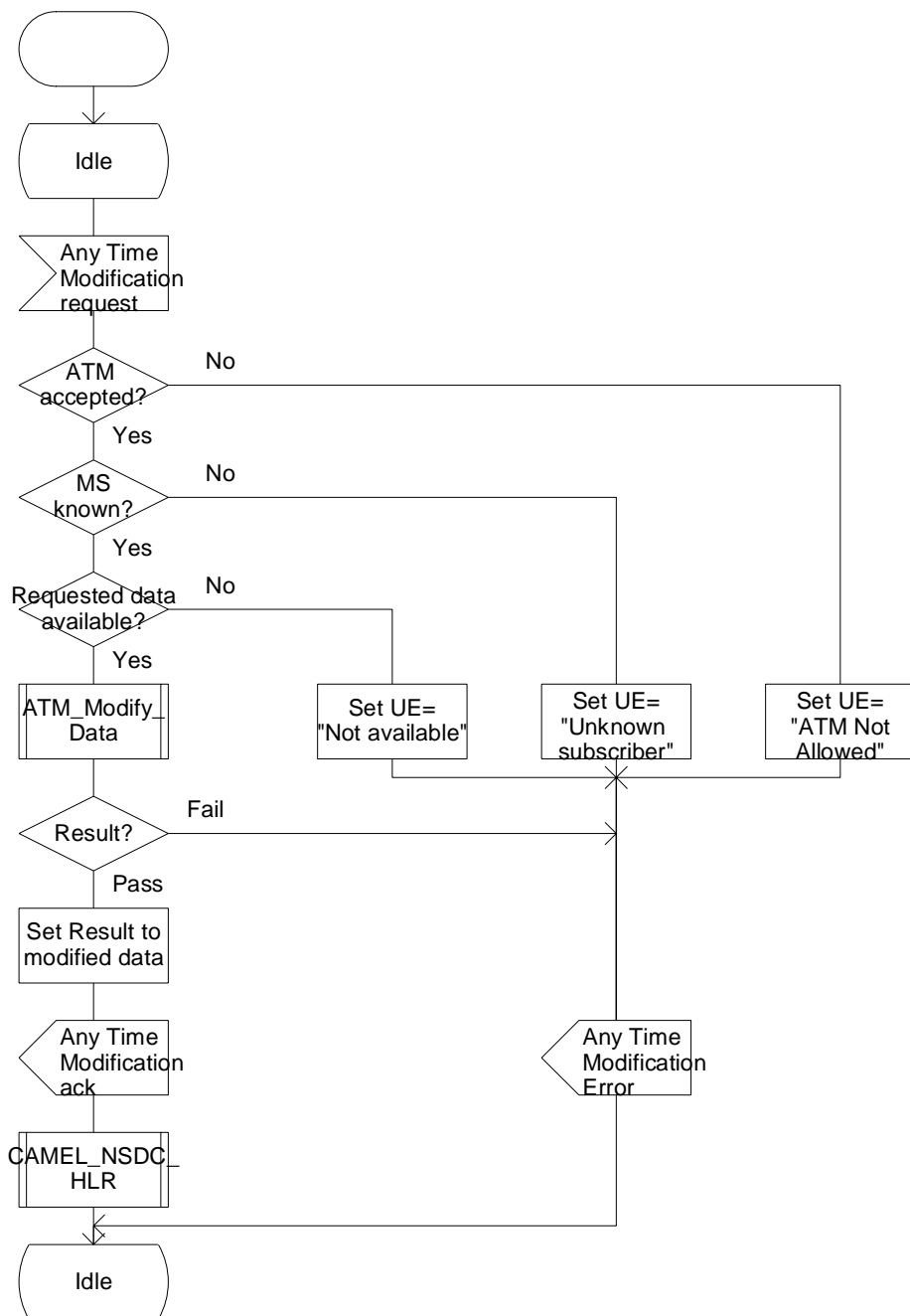
Figure 10.3: Process CAMEL_ATM_HLR (sheet 1)

Procedure ATM_Modify_Data 1(1)

/* Procedure in the HLR to modify subscriber data as a result of an ATM request. */
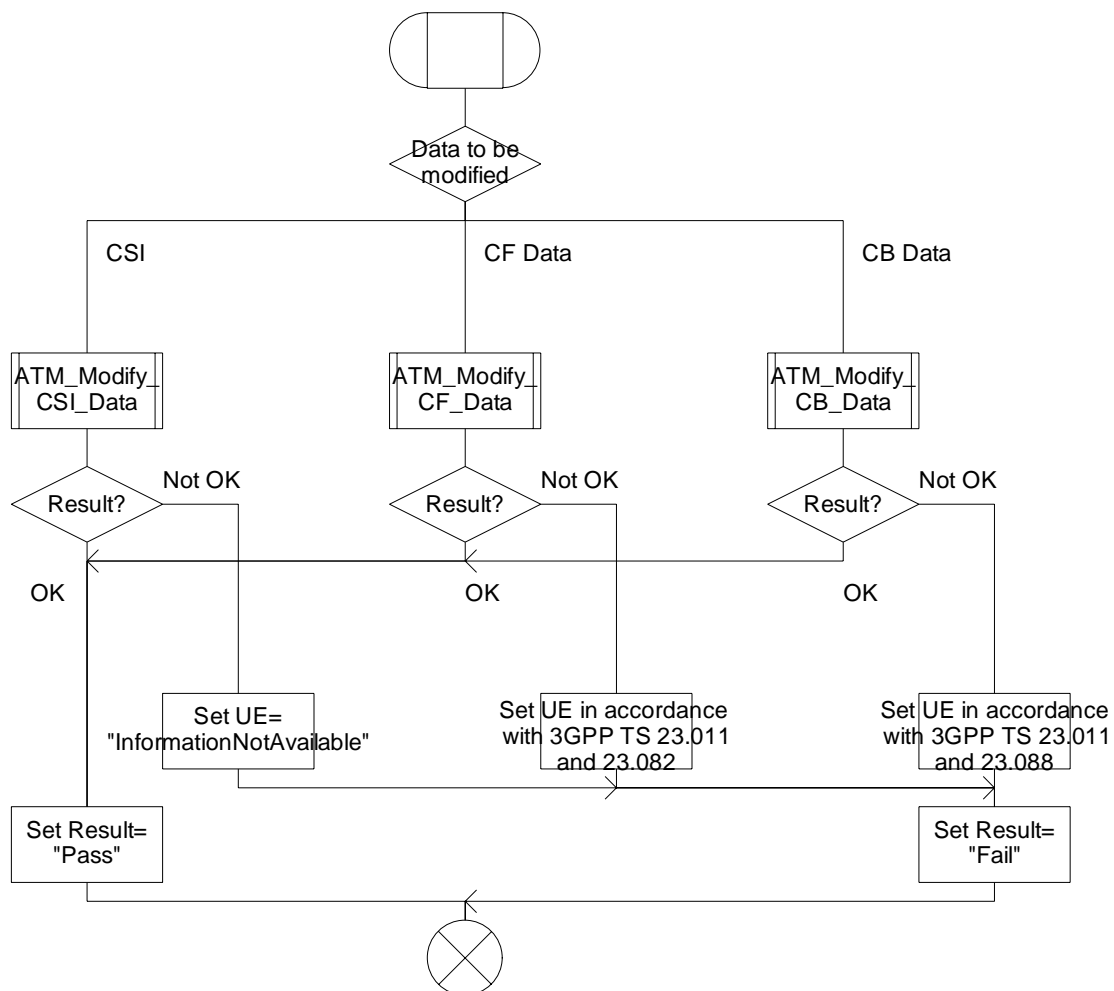
Figure 10.4: Procedure ATM_Modify_Data (sheet 1)

Procedure ATM_Modify_CSI_Data 1(1)

/* Procedure in the HLR to modify CSI data
as a result of an ATM request. */

```
                              ┌─────────┐
                              │  │  │   │
                              └─────────┘
                                   │
  No                        ╱──────────╲           ┌──────────────┐
 ←────────────────────────◇ Requested CSI ◇────────│ Requested CSI │
                           ╲  available ╱           │ available in  │
                            ╲ in HLR? ╱             │ HLR?          │
                                   │                └──────────────┘
                                  Yes
                                   │
  No                        ╱──────────╲           ┌──────────────┐
 ←────────────────────────◇ Modify CSI ◇───────────│ Modify CSI    │
                           ╲   state   ╱            │ state         │
                            ╲requested?╱            │ requested?    │
                                   │                └──────────────┘
                                  Yes
                                   │
                            ┌─────────────┐
                            │  Modify CSI  │
                            │    state     │
                            └─────────────┘
                                   │
  No                        ╱──────────╲           ┌──────────────┐
 ←────────────────────────◇  Modify   ◇────────────│ Modify        │
                           ╲notification╱           │ notification  │
                            ╲ flag req? ╱           │ flag requested?│
                                   │                └──────────────┘
                                  Yes
                                   │
                            ┌─────────────┐
                            │   Modify    │
                            │notification │
                            │    flag     │
                            └─────────────┘
                                   │
    ┌─────────────┐         ┌─────────────┐
    │ Set Result= │         │ Set Result= │
    │  "Not OK"   │         │    "OK"     │
    └─────────────┘         └─────────────┘
           │                       │
           └───────────┬───────────┘
                       │
                      ⊗
```
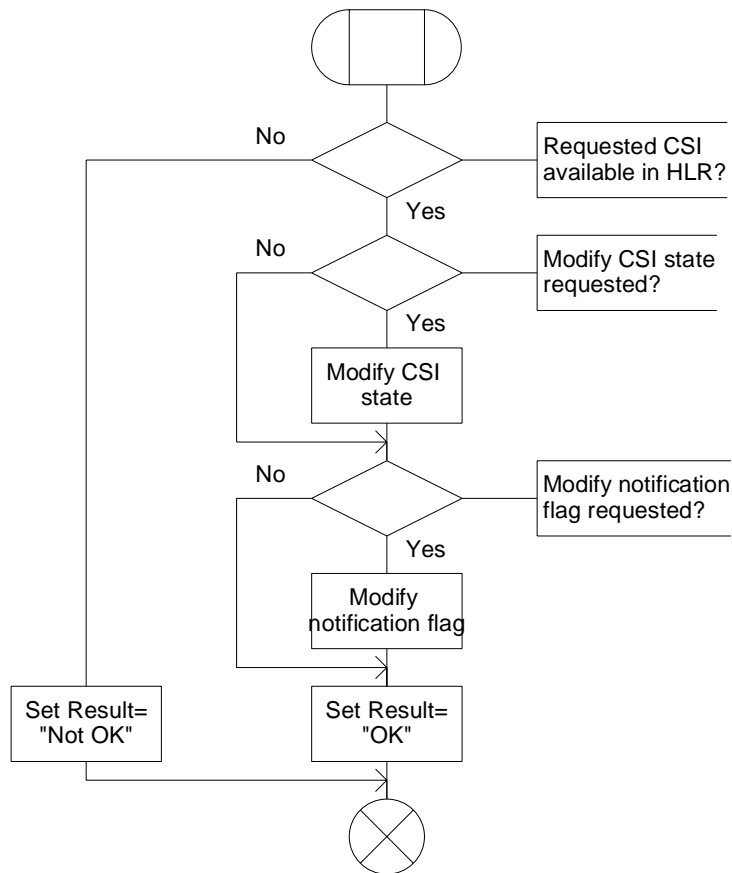
Figure 10.5: Procedure ATM_Modify_CSI_Data (sheet 1)

Procedure ATM_Modify_CF_Data 1(1)

/* Procedure in the HLR to modify Call Forwarding data, as a result of an ATM request. */

Yes — Only SS-code and (optionally) Basic Service present in ATM?

No

No — SS-status present in ATM?

Yes

No — Requested CF state transition valid? (refer 3GPP TS 23.082 and 3GPP TS 23.011)

Yes

No — Check interaction with ODB data pass? (refer 3GPP TS 23.015)

Yes

No — Check interaction with CB data pass? (by equivalent function to CFU1, CFU2, CFU3 or CFU4. See 3GPP TS 23.082)

Erase Call Forwarding Data

Yes

Set Call Forwarding state

No — FTN, FTN sub address or No Reply Condition Time present in ATM?

Yes

No — Requested FTN, FTN sub address or No Reply Condition Time valid? (refer 3GPP TS 23.082 and 3GPP TS 23.011)

Yes

Set FTN, FTN sub address or No Reply Condition Time

No — Notification flag instruction present in ATM?

Yes

Set notification-to-CSE flag

Set Result= "OK"

Set Result= "Not OK"

Set Result= "OK"

Note 1
When ATM contains 'BasicService', then the changes to CF apply to that BasicService only. When ATM does not contains 'BasicService', then the changes to CF apply to all BasicService.

Note 2
Changes to Call Forwarding data shall be done in accordance with 3GPP TS 23.082 and 3GPP TS 23.011.

Figure 10.6: Procedure ATM_Modify_CF_Data (sheet 1)

Figure 10.7: Procedure ATM_Modify_CB_Data (sheet 1)

10.2.3 Notify Subscriber Data Change

Changes of CSI, Call Forwarding data, Call Barring data or ODB data shall be notified only if the CSI, Call Forwarding data, Call Barring data or ODB data is marked with the Notification-to-CSE flag.

The HLR maintains a list of gsmSCF address(es) for Call Forwarding Data, Call Barring Data, ODB and CSI. When any of these items has been modified, a notification shall be sent to each gsmSCF in the corresponding list.

The sending of a notification to the gsmSCF may be triggered by the following processes:

- subscriber data change by administrative procedure;

- subscriber data changed by subscriber;

- subscriber data changed by Any Time Modification request from gsmSCF;

- subscriber data changed due to a change of other subscriber data;

- subscriber data change due to Location Update.

When the change of subscriber data was requested by Any Time Modification the notification of change of subscriber data shall not be sent to the gsmSCF which originated this Any Time Modification request.

Each gsmSCF shall be notified only once. Multiple occurrence of gsmSCF Address in these lists shall not lead to multiple notification.

Handling of Notify Subscriber Data Change involves the following procedure:

- CAMEL_NSDC_HLR.

If a change of subscriber data needs to be notified to the gsmSCF, then the HLR initiates a transaction to the gsmSCF by sending Notify Subscriber Data Change message.

Procedure CAMEL_NSDC_HLR   1(1)

/* Procedure in the HLR to notify
the gsmSCF about a change in
subscriber data. */

/* Signals to/from the left are to/from
the gsmSCF. */

No — Notification flag set for this data item?

Yes

Start at position 1 of gsmSCF address list
associated with this data item.

Yes — End of gsmSCF address list?

No

No — Valid gsmSCF address?

Yes

Yes — Data modification requestd by ATM
from this gsmSCF?

No

Nofity_Subscriber_
Data_Change

Wait for
response

Nofity_Subscriber_
Data_Change
response

Go to next
position in list
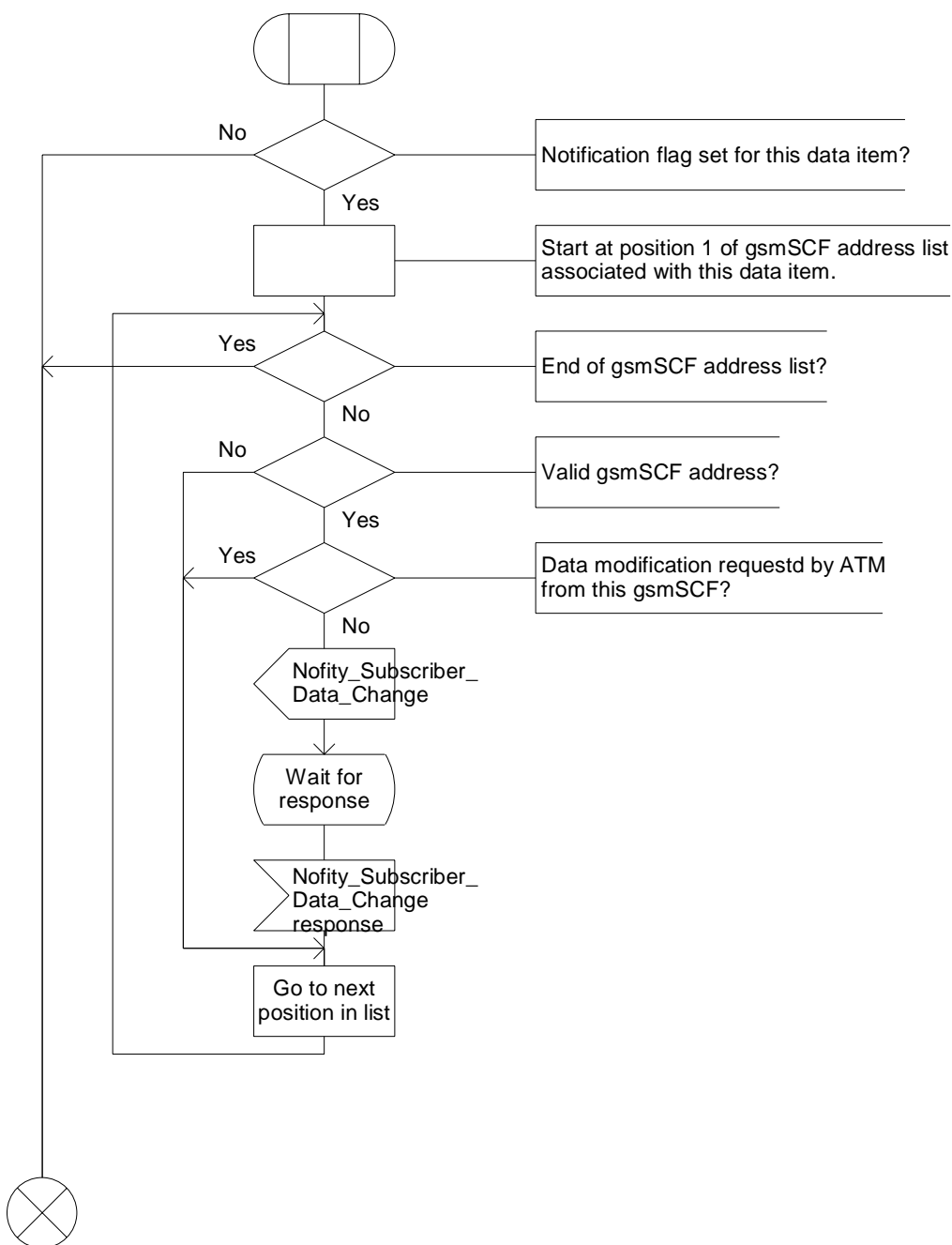
Figure 10.8: Procedure CAMEL_NSDC_HLR (sheet1)

10.3 Description of information flows

This clause contains the detailed description of the information flows used by CAMEL.

Each Information Element (IE) is marked as Mandatory (M), Conditional (C), Optional (O) or Not applicable (-). This categorization is a functional classification, i.e. stage 2 information, and not a stage 3 classification to be used for the ASN.1 syntax of the protocol.

The following principles apply for the handling of the IEs by the receiving entity:

- The gsmSCF may silently discard any IE which it does not functionally support.

- The HLR shall return an error if it does not functionally support an IE which it receives.

Details of errors and exceptions to these rules are specified in 3GPP TS 29.002 [4].

10.3.1 gsmSCF to HLR information flows

10.3.1.1 Any Time Subscription Interrogation Request

10.3.1.1.1 Description

This IF is used to request subscription information from the HLR at any time.

10.3.1.1.2 Information Elements

The following information elements are required:

Information element name	Required	Description
GsmSCF Address	M	This IE indicates the address of the interrogating gsmSCF.
Requested Info	M	This IE indicates the type of subscriber information being requested: This shall consist of one or more of the following list: - supplementary service, described in a table below - Operator Determined Barring - CAMEL Subscription Information, described in a table below - supported CAMEL phases in VLR - supported CAMEL phases in SGSN
Subscriber Identity	M	This IE identifies the subscriber for which the information is requested. The identity shall be either: - IMSI, or - MSISDN
M Mandatory (The IE shall always be sent).		

Supplementary service contains the following information:

Information element name	Required	Description
SS code	M	This IE indicates a supplementary service as defined in 3GPP TS 22.004 [25]. Only the Call Forwarding and Call Barring supplementary services are allowed for this IE.
Basic Service	O	See 3GPP TS 22.002 [24].
M Mandatory (The IE shall always be sent). O Optional (Service Logic Dependent).		

CAMEL subscription information contains the following information:

Information element name	Required	Description
CAMEL subscription information	M	This IE indicates which CAMEL Subscription Information is requested. It shall be one of the following elements: O-CSI/T-CSI/VT-CSI/TIF-CSI/GPRS-CSI/SMS-CSI/SS-CSI/M-CSI/D-CSI
M Mandatory (The IE shall always be sent).		

10.3.1.2 Any Time Modification Request

10.3.1.2.1 Description

This IF is used to modify information in the HLR at any time.

10.3.1.2.2 Information Elements

The following information elements are required:

Information element name	Required	Description
gsmSCF Address	M	This IE indicates the address of the interrogating gsmSCF.
Subscriber Identity	M	This IE identifies the subscriber for which the information is requested. The identity shall be either: - IMSI, or - MSISDN
Modification Request for Call Forwarding SS data	O	This IE indicates the data of Call Forwarding data to be modified. It is described in a table below.
Modification Request for Call Barring SS data	O	This IE indicates the data of call barring data to be modified. It is described in a table below.
Modification Request for CAMEL Subscription Information	O	This IE indicates the Modification Request for CAMEL Subscription Information. It is described in a table below.
M Mandatory (The IE shall always be sent). O Optional (Service Logic dependent).		

Modification Request for Call Forwarding SS data contains the following information:

Information element name	Required	Description
SS Code	M	This IE indicates Call Forwarding supplementary service as defined in 3GPP TS 22.004 [25].
Basic Service	O	See 3GPP TS 22.002 [24].
SS Status	O	See 3GPP TS 23.011 [26]. Provisioning and withdrawal are not allowed for the gsmSCF.
Forwarded-to Number	O	See 3GPP TS 23.082 [27].
Forwarded-to Subaddress	O	See 3GPP TS 23.082 [27].
No Reply Condition Time	O	See 3GPP TS 23.082 [27].
Modify Notification Flag	O	This IE contains an instruction to activate or de-activate the Notification-to-CSE flag.
M Mandatory (The IE shall always be sent). O Optional (Service Logic dependent).		

Modification Request for Call Barring SS data contains the following information:

Information element name	Required	Description
SS Code	M	This IE indicates Call Barring supplementary service as defined in 3GPP TS 22.004 [25].
Basic Service	O	See 3GPP TS 22.002 [24].
SS Status	O	See 3GPP TS 23.011 [26]. Provisioning and withdrawal are not allowed for the gsmSCF.
Password	O	See 3GPP TS 23.011 [26].
Wrong password attempts counter	O	See 3GPP TS 23.011 [26].
Modify Notification flag	O	This IE contains an instruction to activate or de-activate the Notification-to-CSE flag.
M Mandatory (The IE shall always be sent). O Optional (Service Logic dependent).		

Modification Request for CAMEL Subscription Information contains the following information:

Information element name	Required	Description
Requested CSI	M	This IE indicates which CSI shall be modified. Only one CSI may be changed in one ATM Request.
Modify Notification flag	O	This IE contains an instruction to activate or de-activate the Notification-to-CSE flag.
Modify CSI state	O	This IE contains an instruction to activate or de-activate the CSI.
M	Mandatory (The IE shall always be sent).	
O	Optional (Service Logic dependent).	

10.3.1.3 Notify Subscriber Data Change response

10.3.1.3.1 Description

This IF is used by the gsmSCF to respond to the HLR of the change of subscriber data notify.

10.3.1.3.2 Information Elements

This IF contains no information elements.

10.3.2 HLR to gsmSCF information flows

10.3.2.1 Any Time Subscription Interrogation ack

10.3.2.1.1 Description

This IF is used by the HLR to provide the requested subscription information to the gsmSCF.

10.3.2.1.2 Information Elements

The following information elements are required:

Information element name	Required	Description
Call Forwarding SS data	C	This IE is described in a table below.
Call Barring SS data	C	This IE is described in a table below.
Operator Determined Barring data	C	This IE is described in a table below.
CAMEL Subscription Information	C	This IE is described in a table below.
Supported CAMEL phases in VLR	C	This IE indicates the CAMEL phase supported in the VLR.
Supported CAMEL phases in SGSN	C	This IE indicates the CAMEL phase supported in the SGSN.
C	Conditional (The IE shall be sent, if requested and available).	

Call Forwarding SS data contains the following information:

Information element name	Required	Description
Forwarding Feature List	C	See the table below
Notification-to-CSE Flag	C	This IE indicates whether the gsmSCF is notified of a change of Call Forwarding SS data.
C	Conditional (The IE shall be sent, if available and applicable).	

Forwarding Feature List contains 1 to 32 items of the following information:

Information element name	Required	Description
Basic Service	C	See 3GPP TS 22.002 [24].
SS Status	C	See 3GPP TS 23.011 [26].
Forwarded-to Number	C	See 3GPP TS 23.082 [27].
Forwarded-to Subaddress	C	See 3GPP TS 23.082 [27].
Subscription Options	C	See 3GPP TS 23.082 [27].
No Reply Condition Time	C	See 3GPP TS 23.082 [27].
C	Conditional (The IE shall be sent, if available and applicable).	

Call Barring SS data contains the following information:

Information element name	Required	Description
Call Barring Feature List	C	See the table below.
Password	C	See 3GPP TS 23.011 [26].
Wrong password attempts counter	C	See 3GPP TS 23.011 [26].
Notification-to-CSE flag	C	This IE indicates whether the gsmSCF is notified of a change of Call Barring SS data.
C	Conditional (The IE shall be sent, if available and applicable).	

Call Barring Feature List contains 1 to 32 items of the following information:

Information element name	Required	Description
Basic Service	C	See 3GPP TS 22.002 [24].
SS Status	C	See 3GPP TS 23.011 [26].
C	Conditional (The IE shall be sent, if available and applicable).	

Operator determined barring data contains the following information:

Information element name	Required	Description
ODB General Data	C	This IE indicates the set of subscribers features that the network operator or the service provider can regulate.
ODB HPLMN Specific Data	C	This IE indicates the set of subscribers features that the network operator or the service provider can regulate only when the subscriber is registered in the HPLMN.
Notification-to-CSE flag	C	This IE indicates whether the gsmSCF is notified of a change of ODB data.
C	Conditional (The IE shall be sent, if available and applicable).	

CAMEL Subscription Information contains the following information:

Information element name	Required	Description
O-CSI	C	See clause 4.3.1.
D-CSI	C	See clause 4.3.2.
T-CSI	C	See clause 4.3.4.
VT-CSI	C	See clause 4.3.5.
TIF-CSI	C	See clause 4.3.6.2.
GPRS-CSI	C	See clause 6.3.1.
SMS-CSI	C	See clause 7.3.1.
SS-CSI	C	See clause 8.2.1.
M-CSI	C	See clause 9.2.1.
C	Conditional (The IE shall be sent, if requested and available).	

10.3.2.2   Any Time Modification ack

10.3.2.2.1 Description

This IF is used by the HLR to provide the modified information to the gsmSCF.

10.3.2.2.2 Information Elements

The following information elements are required:

Information element name	Required	Description
Call Forwarding SS data	C	This IE is described in a table below.
Call Barring SS data	C	This IE is described in a table below.
CAMEL Subscription Information	C	This IE is described in a table below.
C Conditional (The IE shall be sent if it was modified).		

Call Forwarding SS data contains the following information:

Information element name	Required	Description
SS Code	C	This IE indicates Call Forwarding supplementary service as defined in 3GPP TS 22.004 [25].
Forwarding Feature List	C	See the table below.
Notification-to-CSE Flag	C	This IE indicates whether the gsmSCF is notified of a change of Call Forwarding SS data.
C Conditional (The IE shall be sent, if available).		

Forwarding Feature List contains 1 to 32 items of the following information:

Information element name	Required	Description
Basic Service	C	See 3GPP TS 22.002 [24].
SS Status	C	See 3GPP TS 23.011 [26].
Forwarded-to Number	C	See 3GPP TS 23.082 [27].
Forwarded-to Subaddress	C	See 3GPP TS 23.082 [27].
Subscription Options	C	See 3GPP TS 23.082 [27].
No Reply Condition Time	C	See 3GPP TS 23.082 [27].
C Conditional (The IE shall be sent, if available and applicable).		

Call Barring SS data contains the following information:

Information element name	Required	Description
SS Code	C	This IE indicates Call Barring supplementary service as defined in 3GPP TS 22.004 [25].
Call Barring Feature List	C	See the table below.
Password	C	See 3GPP TS 23.011 [26].
Wrong password attempts counter	C	See 3GPP TS 23.011 [26].
Notification-to-CSE flag	C	This IE indicates whether the gsmSCF is notified of a change of Call Barring SS data.
C Conditional (The IE shall be sent, if available).		

Call Barring Feature List contains 1 to 32 items of the following information:

Information element name	Required	Description
Basic Service	C	See 3GPP TS 22.002 [24].
SS Status	C	See 3GPP TS 23.011 [26].
C Conditional (The IE shall be sent, if available and applicable).		

CAMEL Subscription Information contains the following information:

Information element name	Required	Description
O-CSI	C	See clause 4.3.1.
D-CSI	C	See clause 4.3.2.
T-CSI	C	See clause 4.3.4.
VT-CSI	C	See clause 4.3.5.
TIF-CSI	C	See clause 4.3.6.2.
GPRS-CSI	C	See clause 6.3.1.
SMS-CSI	C	See clause 7.3.1.
SS-CSI	C	See clause 8.2.1.
M-CSI	C	See clause 9.2.1.
C Conditional (The IE shall be sent, if it was modified).		

10.3.2.3   Notify Subscriber Data Change

10.3.2.3.1   Description

This IF is used by the HLR to notify to the gsmSCF of the change of subscriber data.

10.3.2.3.2   Information Elements

The following information elements are required:

Information element name	Required	Description
IMSI	M	The IMSI is used to identify the subscriber.
MSISDN	M	The MSISDN is used to identify the subscriber.
Call Forwarding SS data	C	This IE is described in a table below.
Call Barring SS data	C	This IE is described in a table below.
Operator Determined Barring data	C	This IE is described in a table below.
CAMEL Subscription Information	C	This IE is described in a table below.
M Mandatory (The IE shall always be sent). C Conditional (The IE shall be sent, if available).		

Call Forwarding SS data contains the following information:

Information element name	Required	Description
SS Code	C	This IE indicates Call Forwarding supplementary service as defined in 3GPP TS 22.004 [25].
Forwarding Feature List	C	See the table below.
Notification-to-CSE Flag	C	This IE indicates whether the gsmSCF is notified of a change of Call Forwarding SS data.
C Conditional (The IE shall be sent, if available).		

Forwarding Feature List contains 1 to 32 items of the following information:

Information element name	Required	Description
Basic Service	C	See 3GPP TS 22.002 [24]. Also compound basic service codes can be used in this operation if the subscriber has used a compound code when modifying the SS (e.g. all bearer services compound code).
SS Status	C	See 3GPP TS 23.011 [26].
Forwarded-to Number	C	See 3GPP TS 23.082 [27].
Forwarded-to Subaddress	C	See 3GPP TS 23.082 [27].
Subscription Options	C	See 3GPP TS 23.082 [27].
No Reply Condition Time	C	See 3GPP TS 23.082 [27].
C Conditional (The IE shall be sent, if available and applicable).		

Call Barring SS data contains the following information:

Information element name	Required	Description
SS Code	C	This IE indicates Call Barring supplementary service as defined in 3GPP TS 22.004 [25].
Call Barring Feature List	C	See the table below.
Password	C	See 3GPP TS 23.011 [26].
Wrong password attempts counter	C	See 3GPP TS 23.011 [26].
Notification-to-CSE flag	C	This IE indicates whether the gsmSCF is notified of a change of Call Barring SS data.
C Conditional (The IE shall be sent, if available).		

Call Barring Feature List contains 1 to 32 items of the following information:

Information element name	Required	Description
Basic Service	C	See 3GPP TS 22.002 [24]. Also compound basic service codes can be used in this operation if the subscriber has used a compound code when modifying the SS (e.g. all bearer services compound code).
SS Status	C	See 3GPP TS 23.011 [26].
C Conditional (The IE shall be sent, if available and applicable).		

Operator determined barring data contains the following information:

Information element name	Required	Description
ODB General Data	C	This IE indicates the set of subscribers features that the network operator or the service provider can regulate.
ODB HPLMN Specific Data	C	This IE indicates the set of subscribers features that the network operator or the service provider can regulate only when the subscriber is registered in the HPLMN.
Notification-to-CSE flag	C	This IE indicates whether the gsmSCF is notified of a change of ODB data.
C Conditional (The IE shall be sent, if available and applicable).		

CAMEL Subscription Information contains the following information:

Information element name	Required	Description
O-CSI	C	See clause 4.3.1.
D-CSI	C	See clause 4.3.2.
T-CSI	C	See clause 4.3.4.
VT-CSI	C	See clause 4.3.5.
TIF-CSI	C	See clause 4.3.6.2.
GPRS-CSI	C	See clause 6.3.1.
SMS-CSI	C	See clause 7.3.1.
SS-CSI	C	See clause 8.2.1.
M-CSI	C	See clause 9.2.1
C Conditional (The IE shall be sent, if it was modified).		

11 Subscriber Location and State retrieval

Support of the procedures described in this clause in CAMEL Phase 3 is a network operator option.

11.1 Architecture

11.1.1 Functional Entities used for CAMEL

This clause describes Any Time Interrogation and CAMEL support of Location Services. Location Services is only supported in CAMEL Phase 3.

Figure 11.1 indicates the functional entities involved in Any Time Interrogation and Location Services.

This clause defines two procedures for Location Services:

1) The interfaces between gsmSCF and GMLC for Location Services via the GMLC.

2) The interface between gsmSCF and HLR for Any Time Interrogation and Active Location Retrieval.

The operation of Location Services is described in 3GPP TS 22.071 [17].
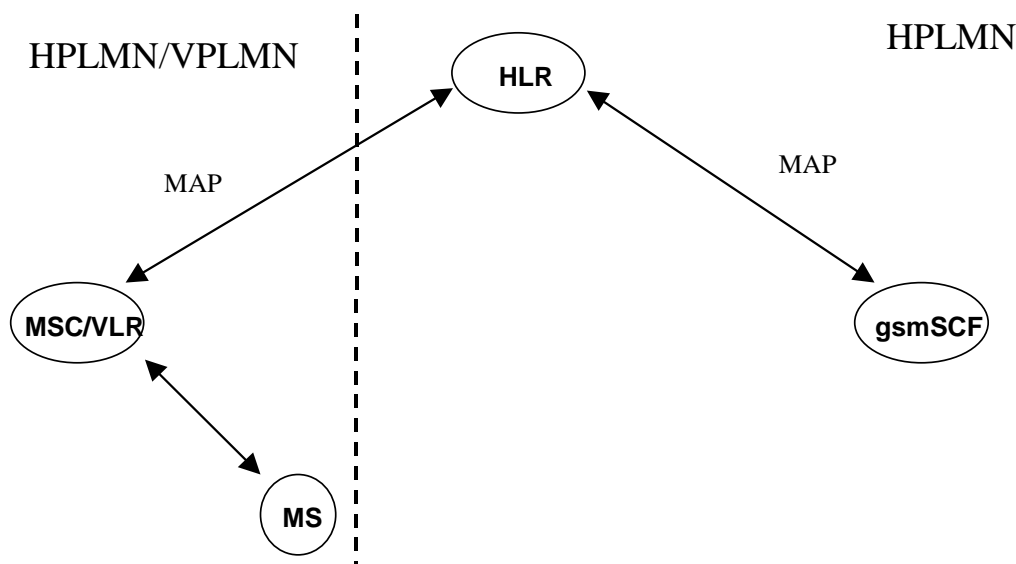
Figure 11.1a: Functional architecture for Any Time Interrogation
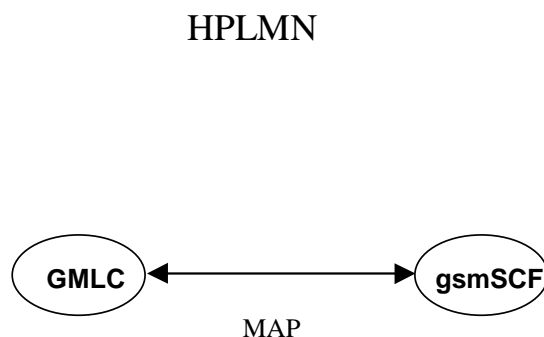
Figure 11.1b: Functional architecture for CAMEL Support of Location Services

gsmSCF: see clause 3.1.

GMLC: A functional entity that allows external LCS Clients to request real-time information about a Mobile Station. The information that can be requested from the GMLC is the location of the mobile station**.**

HLR: see clause 4.1.

MSC/VLR: see clause 4.1.

The information flows between the GMLC and functional entities other than the gsmSCF, have not been indicated in the functional architecture shown in figures 11.1. These information flows are outside the scope of the present document.

11.1.2   Interfaces defined for CAMEL

This clause describes the interfaces applicable to CAMEL. It specifies on a high level the functions specific to CAMEL.

11.1.2.1 gsmSCF - GMLC interface

This interface is used by the gsmSCF to request information (Mobile Station location) from the GMLC at any time.

11.1.2.2 GMLC - gsmSCF interface

This interface is used by the GMLC to return the requested information (Mobile Station location) to the gsmSCF as requested by the gsmSCF via the Any Time Interrogation procedure.

11.1.2.3 gsmSCF - HLR

This interface is used by the gsmSCF to interrogate the HLR. As a network operator option, the HLR may refuse to provide the information requested by the gsmSCF.

11.1.2.4 HLR - gsmSCF

This interface is used by the HLR to return the requested information (Mobile Station location and/or Mobile Station state) to the gsmSCF as requested by the gsmSCF via the Any Time Interrogation procedure.

11.2 Procedures for CAMEL

11.2.1 Location Services

Handling of Any Time Interrogation to obtain Location Information involves the following process:

- CAMEL_ATI_GMLC.

If an OSS needs to retrieve the active location of a Mobile Station, the gsmSCF initiates a transaction to the GMLC by sending a Any Time Interrogation Request.

Process CAMEL_ATI_GMLC 1(1)

/* Process in the GMLC Receiving an Any Time Interrogation request from the gsmSCF. */

/* Signals to/from the left are to/from the gsmSCF. */

Idle

Any Time Interrogation Request

ATI accepted?

No

Yes

Procedure in GMLC See 3GPP TS 22.071

Obtain Location Information

Set UE= "ATI Not Allowed"

Any Time Interrogation ack

Any Time Interrogation Negatifve response

Idle

Idle
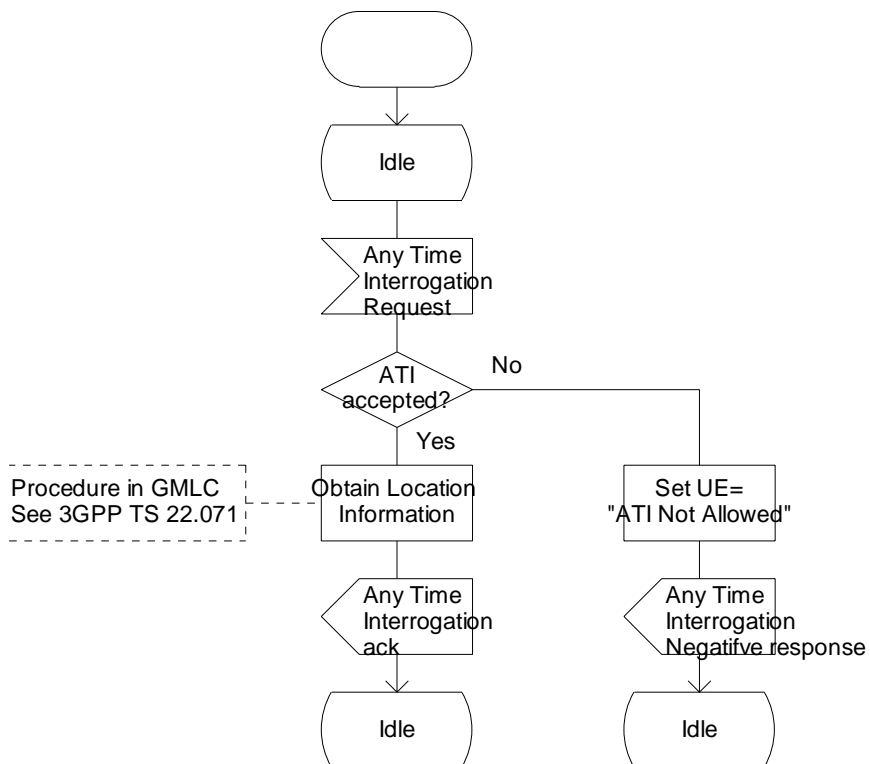
Figure 11.2: Process CAMEL_ATI_GMLC (sheet 1)

11.2.2   Any Time Interrogation

Handling of Any Time Interrogation to obtain Subscriber State and Location Information involves the following process:

- CAMEL_ATI_HLR.

If an OSS needs the Subscriber State and/or the Location Information, the gsmSCF initiates a transaction to the HLR by sending an Any_Time_Interrogation Request.

Process CAMEL_ATI_HLR 1(1)

/* Process in the HLR receiving an ANY Time Interrogation request from gsmSCF.*/

/* Signals to/from the left are to/from the gsmSCF. */

Idle

Any Time Interrogation request

ATI accepted? — No

Yes

MS known? — No

Yes

Provide_ Subscriber_Info /*input data= requested info*/

Set UE= "Unknown subscriber"

Set UE= "ATI Not Allowed"

Any Time Interrogation ack

Any Time Interrogation negative response

Idle
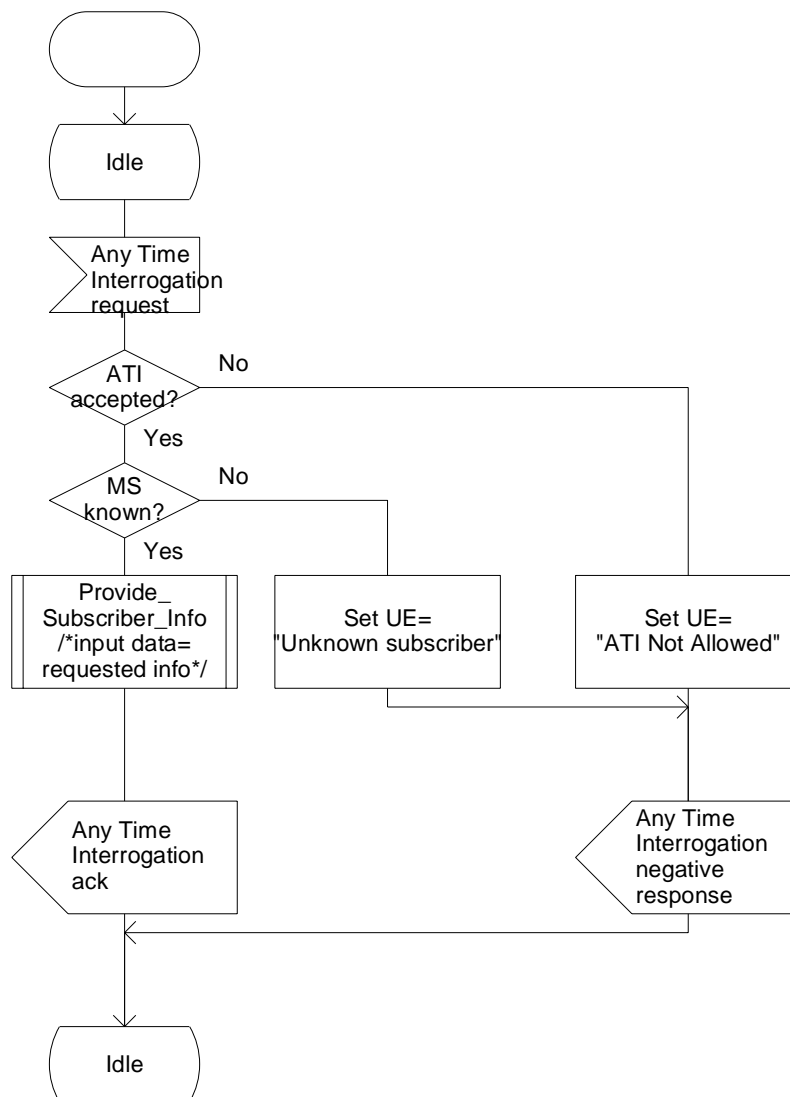
Figure 11.3: Process CAMEL_ATI_HLR (sheet 1)

11.3 Description of information flows

This clause contains the detailed description of the information flows used by CAMEL.

Each Information Element (IE) is marked as Mandatory (M), Conditional (C), Optional (O) or Not applicable (-). This categorization is a functional classification, i.e. stage 2 information, and not a stage 3 classification to be used for the ASN.1 syntax of the protocol.

The following principles apply for the handling of the IEs by the receiving entity:

- The gsmSCF may silently discard any IE which it does not functionally support.

- The GMLC shall return an error if it does not functionally support an IE which it receives.

Details of errors and exceptions to these rules are specified in 3GPP TS 29.002 [4].

11.3.1 gsmSCF to GMLC information flows

11.3.1.1 Any Time Interrogation Request

11.3.1.1.1 Description

This IF is used to request information (Mobile Station location) from the GMLC.

11.3.1.1.2 Information Elements

The following information elements are required:

Information element name	Required	Description
gsmSCF Address	M	This IE indicates the address of the interrogating gsmSCF.
Requested Info	M	This IE indicates the type of information that is requested. It shall have the following value: - Mobile Station location
Mobile Station Identity	M	This IE identifies the Mobile Station of which the information is requested. The identity shall be either: - IMSI, or - MSISDN
M Mandatory (The IE shall always be sent).		

11.3.2 GMLC to gsmSCF information flows

11.3.2.1 Any Time Interrogation ack

11.3.2.1.1 Description

This IF is used by the GMLC to provide the requested information to the gsmSCF.

11.3.2.1.2 Information Elements

The following information element is required:

Information element name	Required	Description
Location Information	C	This IE indicates the location of the Mobile Station.
C Conditional (The IE shall be sent if requested and available).		

Location Information is defined in 3GPP TS 23.018 [3]. The following differences apply:

Information element name	Required	Description
Location number	-	Not applicable
Service area ID	-	Not applicable
Cell ID	-	Not applicable
Geographical information	C	See 3GPP TS 23.032 [34]. The GMLC receives Extended Geographical Information from the MSC. The Extended Geographical Information shall be converted to the Geographical Information by the GMLC.
VLR number	-	Not applicable
Current Location Retrieved	-	Not applicable
MSC number	C	The GMLC receives the MSC number from the HLR in the SendRoutingInfoForLCS MAP message.
C Conditional (The IE shall be sent, if available). - Not applicable.		

11.3.3 gsmSCF to HLR information flows

11.3.3.1 Any Time Interrogation Request

11.3.3.1.1 Description

This IF is used to request information (subscriber state and/or location) from the HLR at any time.

11.3.3.1.2 Information Elements

The following information elements are required:

Information element name	Required	Description
gsmSCF Address	M	This IE indicates the address of the interrogating gsmSCF.
Requested Info	M	This IE indicates the type of subscriber information being requested: - Location Information - Subscriber State - Current Location Current Location shall not be present if Location Information is not present in Requested Info
Subscriber Identity	M	This IE identifies the subscriber for which the information is requested. The identity shall be either: - IMSI, or - MSISDN
M Mandatory (The IE shall always be sent).		

11.3.4 HLR to gsmSCF information flows

11.3.4.1 Any Time Interrogation ack

11.3.4.1.1 Description

This IF is used by the HLR to provide the requested subscriber location and/or subscriber state information to the gsmSCF.

11.3.4.1.2 Information Elements

The following information elements are required:

Information element name	Required	Description
Location Information	C	This IE indicates the location of the served subscriber.
Subscriber State	C	This IE indicates the status of the MS. The possible values of the IE are: - CAMELBusy: The VLR has indicated that the MS is engaged in a transaction for a mobile originating or terminated circuit-switched call. - NetworkDeterminedNotReachable: The VLR has indicated that the network can determine from its internal data that the MS is not reachable. - AssumedIdle: The VLR has indicated that the state of the MS is neither "CAMELBusy" nor "NetworkDeterminedNotReachable". - NotProvidedFromVLR: The VLR did not provide any information on subscriber state even though it was requested.
C	Conditional (The IE shall be sent, if requested and available).	

Location Information is defined in 3GPP TS 23.018 [3]. The following differences apply:

Information element name	Required	Description
Service area ID	C1	See 3GPP TS 23.018 [3].
Cell ID	C1	See 3GPP TS 23.018 [3].
Location area ID	C1	See 3GPP TS 23.003 [37].
Selected LSA Identity	C	This IE indicates the LSA identity associated with the current position of the MS. Shall be sent if the LSA ID in the subscriber data matches the LSA ID of the current cell. In the case of multiple matches the LSA Id with the highest priority shall be sent. See 3GPP TS 23.073 [23].
C	Conditional (The IE shall be sent, if available and SoLSA is supported).	
C1	Conditional (The IE shall be sent, if available. One and only one of the three conditional IEs shall be sent).	

Annex A (informative): Change history

						Change history
TSG CN#	**Spec**	**Version**	**CR**	**<Phase>**	**New Version**	**Subject/Comment**
Apr 1999	GSM 03.78	7.0.0				Transferred to 3GPP CN1
CN#03	23.078	3.0.0			3.0.0	Approved at CN#03
CN#4	23.078	3.1.0	003	R99	3.1.0	Inclusion of Subscriber Activity Information Flow
CN#4	23.078	3.1.0	004	R99	3.1.0	Inclusion of Alerting Pattern in Provide Roaming Number
CN#4	23.078	3.1.0	005	R99	3.1.0	Dialled Number String Format
CN#4	23.078	3.1.0	006	R99	3.1.0	Handling of AC/ACR in DP Busy, DP No Answer and DP
CN#4	23.078	3.1.0	007	R99	3.1.0	Inclusion of Activity Test IF between gsmSCF & gsmSRF and gsmSCF and assistSSF
CN#4	23.078	3.1.0	008	R99	3.1.0	Correction of USSD Information flows
CN#4	23.078	3.1.0	009	R99	3.1.0	Various corrections
CN#4	23.078	3.1.0	010	R99	3.1.0	Correction of CAMEL Phase interworking with Call Forwarding
CN#4	23.078	3.1.0	011	R99	3.1.0	Renaming of Call Active Variable
CN#4	23.078	3.1.0	012	R99	3.1.0	Reporting of O/T_Abandon DP when caller clears during O/T_Busy, O/T_No_Answer or Route_Select_Failure EDP-R.
CN#4	23.078	3.1.0	013	R99	3.1.0	Clarification on the scope of CAMEL Capability Handling parameter
CN#4	23.078	3.1.0	014	R99	3.1.0	Refining trigger criteria at DP2, due to the introduction of North American Equal Access
CN#4	23.078	3.1.0	015	R99	3.1.0	Introduction of MSISDN in USSD operation
CN#4	23.078	3.1.0	016	R99	3.1.0	MSC address in Initial DP
CN#4	23.078	3.1.0	017	R99	3.1.0	Correction of gsmSDL; return to idle after ACR
CN#4	23.078	3.1.0	018	R99	3.1.0	Notification of call forwarding to the gsmSCF
CN#5	23.078	3.1.0	019	R99	3.2.0	Inclusion of the SS invocation notification procedure
CN#5	23.078	3.1.0	021	R99	3.2.0	Removal of TDP criteria from resume call handling
CN#5	23.078	3.1.0	022r1	R99	3.2.0	GMSC CAMEL phases in Provide Roaming Number
CN#5	23.078	3.1.0	023r1	R99	3.2.0	Call Reference Number
CN#5	23.078	3.1.0	025	R99	3.2.0	Clarification on Call Reference Number and GMSC address
CN#5	23.078	3.1.0	027	R99	3.2.0	Value of the Active Call parameter in ACR operation
CN#5	23.078	3.1.0	028	R99	3.2.0	Correction of process gsmSSF SDL
CN#5	23.078	3.1.0	029	R99	3.2.0	Alignment of CAMEL2 FCI & handling of CIR
CN#5	23.078	3.1.0	030	R99	3.2.0	Correction of Inhibiting Triggering Criteria
CN#6	23.078	3.2.0	032r2	R99	3.3.0	23.078 revised for CAMEL Phase 3 Release 1999
CN#6	23.078	3.2.0	033	R99	3.3.0	Correction of the direction of Int_Continue after sending Int_O/T-Abandon
CN#7	23.078	3.3.0	034r1	R99	3.4.0	Correction to some SDLs in clause 4
CN#7	23.078	3.3.0	035r3	R99	3.4.0	Correction of Translation Information Flag in the VLR for DTN
CN#7	23.078	3.3.0	037r3	R99	3.4.0	Clarification on CUG handling
CN#7	23.078	3.3.0	038r1	R99	3.4.0	Clarification of SS Invocation Notification
CN#7	23.078	3.3.0	040r5	R99	3.4.0	Correction of SS Invocation Notification for CCBS
CN#7	23.078	3.3.0	041r5	R99	3.4.0	Introduction of call gapping
CN#7	23.078	3.3.0	042r2	R99	3.4.0	Technical and editorial corrections to ATSI, ATM, NCSD

						Change history
TSG CN#	**Spec**	**Version**	**CR**	**<Phase>**	**New Version**	**Subject/Comment**
CN#7	23.078	3.3.0	043r2	R99	3.4.0	Technical and editorial corrections to Location Services and Any Time Interrogation
CN#7	23.078	3.3.0	044r1	R99	3.4.0	Technical and editorial corrections to circuit switched call handling
CN#7	23.078	3.3.0	045	R99	3.4.0	Technical and editorial corrections to USSD
CN#7	23.078	3.3.0	046r1	R99	3.4.0	Technical and editorial corrections to GPRS
CN#7	23.078	3.3.0	047	R99	3.4.0	Technical and editorial corrections to SMS
CN#7	23.078	3.3.0	048r1	R99	3.4.0	Inclusion of O-CSI trigger criteria in Resume Call Handling
CN#7	23.078	3.3.0	051r4	R99	3.4.0	Correction of SDL related to CAMEL Phase3 for D-CSI
CN#7	23.078	3.3.0	052r4	R99	3.4.0	Addition of description of D-CSI in MO Calls
CN#7	23.078	3.3.0	055	R99	3.4.0	Reporting of T_Busy when absent subscriber
CN#7	23.078	3.3.0	056r3	R99	3.4.0	GPRS TCAP dialogues
CN#7	23.078	3.3.0	059	R99	3.4.0	Addition of gsmSRF disconnect handling in CCF SDL
CN#7	23.078	3.3.0	061r3	R99	3.4.0	Addition of SCI handling in Waiting for Instructions For DS state
CN#7	23.078	3.3.0	063r2	R99	3.4.0	Clarification of N-CSI in Core NW.
CN#7	23.078	3.3.0	066	R99	3.4.0	Addition of Int_Error in DP_O/T_Answer states
CN#7	23.078	3.3.0	068	R99	3.4.0	Correction of the decision box after receiving Int_DP_O_Answer and Int_DP_T_Answer in the procedure gsmSSF
CN#7	23.078	3.3.0	069r1	R99	3.4.0	Correction of the description in the creation of a new leg in CF
CN#7	23.078	3.3.0	070r1	R99	3.4.0	Correction of the description of BCSM relationships
CN#7	23.078	3.3.0	071	R99	3.4.0	Correction of the direction of Int_Continue after sending Int_T-Abandon (additional CR to 23.078-033)
CN#7	23.078	3.3.0	073	R99	3.4.0	Editorial changes for legs
CN#7	23.078	3.3.0	076r2	R99	3.4.0	Extension of the description of the O_No_Answer
CN#7	23.078	3.3.0	079r1	R99	3.4.0	Inclusion of Release transaction in CAMEL_OCH_MSC_INIT
CN#7	23.078	3.3.0	081r1	R99	3.4.0	Improved SDLs in GPRS interworking
CN#7	23.078	3.3.0	082	R99	3.4.0	Correction of the description of the SGSN
CN#7	23.078	3.3.0	084r1	R99	3.4.0	Correction of references occurring in the SDL figures
CN#7	23.078	3.3.0	085	R99	3.4.0	Inclusion of CAMEL Phase 1 procedures as targets for references in 3GPP TS 23.018
CN#7	23.078	3.3.0	086	R99	3.4.0	unsuccessful Dps call model
CN#7	23.078	3.3.0	090	R99	3.4.0	Correction and Editorial changes, Clause 12
CN#7	23.078	3.3.0	091r1	R99	3.4.0	Correction of CF Notification
CN#7	23.078	3.3.0	093r2	R99	3.4.0	Addition of Long Forwarded-to Numbers
CN#7	23.078	3.3.0	094	R99	3.4.0	Removal of Redirection Information from the ContinueWithArgument operation
CN#7	23.078	3.3.0	096r2	R99	3.4.0	Addition to SDL of user interaction in Waiting_for_Instructions_for_DS
CN#7	23.078	3.3.0	098r1	R99	3.4.0	addition of gsmSCF address list to CSI
CN#7	23.078	3.3.0	100r1	R99	3.4.0	Introduction of 'Service Area Identity (SAI)' (revise of N2A000178)
CN#7	23.078	3.3.0	101r1	R99	3.4.0	Correction of SII2 description
CN#7	23.078	3.3.0	102r1	R99	3.4.0	Clarification on CUG handling
CN#7	23.078	3.3.0	103	R99	3.4.0	Replacement of Figure 4.57g: Process gsmSSF (sheet 7) by correct SDL figure.
CN#7	23.078	3.3.0	104	R99	3.4.0	Correction of "Figure 6.2: GPRS Attach/Detach FSM"
CN#7	23.078	3.3.0	105	R99	3.4.0	Correction of first state in "Figure 6.14 l: Process GPRS_SSF"
CN#7	23.078	3.3.0	106r1	R99	3.4.0	Correction of GPRS session description
CN#7	23.078	3.3.0	108r2	R99	3.4.0	Correction of GPRS PDP context FSM

TSG CN#	Spec	Version	CR	\<Phase>	New Version	Subject/Comment
						Change history
CN#7	23.078	3.3.0	109r1	R99	3.4.0	Enhancement of the SDL for ATM
CN#7	23.078	3.3.0	110r1	R99	3.4.0	Enhancement of the SDL for NCSD
CN#7	23.078	3.3.0	111	R99	3.4.0	Removal of PSI description
CN#7	23.078	3.3.0	112r1	R99	3.4.0	Procedure Handle_SCI_GPRS and Complete_FCI_Record_GPRS
CN#7	23.078	3.3.0	114r1	R99	3.4.0	Correction on gsmSSF SDL; return to idle after ACR
CN#7	23.078	3.3.0	116	R99	3.4.0	O-CSI and D-CSI checks for ORLCF
CN#7	23.078	3.3.0	117	R99	3.4.0	Removal of user interaction in the monitoring state
CN#7	23.078	3.3.0	119r1	R99	3.4.0	Enhancement of the ATSI SDL
CN#7	23.078	3.3.0	120	R99	3.4.0	Transfer of destination address to gsmSCF
CN#7	23.078	3.3.0	121r1	R99	3.4.0	Implementation of retriggering in gsmSSF SDL
CN#8	23.078	3.4.0	062r5	R99	3.5.0	Correction of SDL and IF for Dialled Services in Call Forwarding case
CN#8	23.078	3.4.0	077r2	R99	3.5.0	gsmSSF DP handling in CF
CN#8	23.078	3.4.0	123r1	R99	3.5.0	Correction of incoming call handling
CN#8	23.078	3.4.0	125r2	R99	3.5.0	Correction of Call Gapping
CN#8	23.078	3.4.0	130r1	R99	3.5.0	Remove of SII2 frw CCBS treatment ind
CN#8	23.078	3.4.0	132	R99	3.5.0	Correction of the CWA SII2 description
CN#8	23.078	3.4.0	133r2	R99	3.5.0	Improvements on ATM/ATSI/NSDC
CN#8	23.078	3.4.0	138r1	R99	3.5.0	Reception of Int_QoS_Change in the gprsSSF in gsmSSF SDL
CN#8	23.078	3.4.0	140	R99	3.5.0	Disallowing Compound Basic Service group codes for conditional triggering
CN#8	23.078	3.4.0	141	R99	3.5.0	Correction on clause 10.
CN#8	23.078	3.4.0	142r1	R99	3.5.0	Proposed information flow on Notify subscriber Data Change
CN#8	23.078	3.4.0	145r1	R99	3.5.0	Invocation of O-BCSM in case of GSM call forwarding
CN#8	23.078	3.4.0	146r2	R99	3.5.0	Clarification on TDP Analyzedinfo Criteria checks
CN#8	23.078	3.4.0	147r2	R99	3.5.0	CAMEL Subscription Info
CN#8	23.078	3.4.0	148r1	R99	3.5.0	Usage of GPRS Reference Number
CN#8	23.078	3.4.0	150r2	R99	3.5.0	Correction on Quality of Service (GPRS)
CN#8	23.078	3.4.0	153	R99	3.5.0	Alignment of the EventSpecificInformationBCSM Stage 2&3 definitions
CN#8	23.078	3.4.0	154	R99	3.5.0	Clean-up the Monitoring state User Interaction
CN#8	23.078	3.4.0	156r1	R99	3.5.0	Correction of MM paragraph
CN#8	23.078	3.4.0	157	R99	3.5.0	Editorial correction of the GPRS_activate_PDP_context SDL
CN#8	23.078	3.4.0	158r1	R99	3.5.0	Removal of ActivityTestSMS operation
CN#8	23.078	3.4.0	159r1	R99	3.5.0	PDPid in the EntityReleasedGPRS operation
CN#8	23.078	3.4.0	161r1	R99	3.5.0	Renaming "FSM" to "State Model" in GPRS
CN#8	23.078	3.4.0	162r2	R99	3.5.0	Various corrections and updates for 23.078
CN#8	23.078	3.4.0	163r1	R99	3.5.0	Specification of segmented GPRS Dialogues
CN#8	23.078	3.4.0	164	R99	3.5.0	Release of PDP context during Waiting for Instructions
CN#8	23.078	3.4.0	165r1	R99	3.5.0	Reset Timer GPRS
CN#8	23.078	3.4.0	166	R99	3.5.0	Correction: Enhancement of the SDL for ATM
CN#8	23.078	3.4.0	167	R99	3.5.0	gprsSSF definition
CN#8	23.078	3.4.0	168	R99	3.5.0	Reference to 3GPP TS 23.088
CN#8	23.078	3.4.0	169	R99	3.5.0	Editorial corrections in the clause 5
CN#8	23.078	3.4.0	170r1	R99	3.5.0	Editorial corrections in the clause 6
CN#8	23.078	3.4.0	171r1	R99	3.5.0	Editorial corrections in the clause 7
CN#8	23.078	3.4.0	172	R99	3.5.0	Editorial corrections in the clause 8
CN#8	23.078	3.4.0	173r1	R99	3.5.0	Editorial corrections in the clause 9
CN#8	23.078	3.4.0	174r1	R99	3.5.0	Editorial corrections in the clause 10
CN#8	23.078	3.4.0	175r1	R99	3.5.0	Editorial corrections in the clause 11
CN#8	23.078	3.4.0	176r2	R99	3.5.0	Clarifications on GPRS Concepts

						Change history
TSG CN#	**Spec**	**Version**	**CR**	**<Phase>**	**New Version**	**Subject/Comment**
CN#8	23.078	3.4.0	177r2	R99	3.5.0	Usage of Announcement Suppression Indicator
CN#8	23.078	3.4.0	180r1	R99	3.5.0	Addition of Location Information to Initial DP GPRS
CN#9	23.078	3.5.0	134r4	R99	3.6.0	Interworking of Call Forwarding and new CAMEL3 trigger detection points
CN#9	23.078	3.5.0	137r4	R99	3.6.0	E-parameter handling of distinct CAP dialogues/TDPs
CN#9	23.078	3.5.0	181r2	R99	3.6.0	Indication of Network requested PDP Context in Initial DPGPRS message
CN#9	23.078	3.5.0	185r1	R99	3.6.0	Addition of the Handle_FCI_GPRS procedure
CN#9	23.078	3.5.0	186	R99	3.6.0	Correction to Procedure CAMEL_ICH_MSC_INIT
CN#9	23.078	3.5.0	187r1	R99	3.6.0	Transfer of Procedure Check_CD_SII2 from TS 23.072
CN#9	23.078	3.5.0	188r2	R99	3.6.0	Update of References for the Location Information IE
CN#9	23.078	3.5.0	190	R99	3.6.0	Removal of duplicate SGSN address/number from IDP-GPRS
CN#9	23.078	3.5.0	191	R99	3.6.0	Clean-up the Monitoring state User Interaction
CN#9	23.078	3.5.0	192	R99	3.6.0	Editorial corrections and enhancements
CN#9	23.078	3.5.0	193r1	R99	3.6.0	GPRS Change of Position Procedure for Session and Context
CN#9	23.078	3.5.0	194r3	R99	3.6.0	Corrections on GPRS
CN#9	23.078	3.5.0	198r2	R99	3.6.0	Location Number GPRS
CN#9	23.078	3.5.0	201r1	R99	3.6.0	Correction to Procedure CAMEL_Modify_CUG_Info
CN#9	23.078	3.5.0	203r1	R99	3.6.0	Move of processing rules for GPRS context.
CN#9	23.078	3.5.0	204	R99	3.6.0	Interaction with CUG
CN#9	23.078	3.5.0	200r7	R99	3.6.0	ACR/AC supervision for GPRS
CN#9	23.078	3.5.0	205r1	R99	3.6.0	Handling of the Call Diversion Treatment Indicator
CN#9	23.078	3.5.0	206r1	R99	3.6.0	GPRS location information in GPRSEventSpecificInformation
CN#9	23.078	3.5.0	207r1	R99	3.6.0	Removal of NPI check in DP Analyzed_Information
CN#9	23.078	3.5.0	208r2	R99	3.6.0	SDL modelling and overlapping dialogue case
CN#9	23.078	3.5.0	209	R99	3.6.0	Correction CAMEL_MT_GMSC_INIT
CN#9	23.078	3.5.0	213r1	R99	3.6.0	Correction of MO-SMS SDLs
CN#9	23.078	3.5.0	215	R99	3.6.0	Correction to description of DP Collected_Info
CN#9	23.078	3.5.0	216r1	R99	3.6.0	Introduction of Guard Timer for GPRS TCAP dialogue handling
CN#9	23.078	3.5.0	217	R99	3.6.0	PDP establishment
CN#9	23.078	3.5.0	218r1	R99	3.6.0	Clarification of description of number comparison for dialled services
CN#9	23.078	3.5.0	219	R99	3.6.0	Correction to Initial DP SMS Information Flow
CN#9	23.078	3.5.0	220	R99	3.6.0	Correction to the missing connection in SDL gsmSSF
CN#10	23.078	3.6.0	221r3	R99	3.7.0	Correction on CAMEL CF and OR
CN#10	23.078	3.6.0	222r1	R99	3.7.0	Corrections in clauses 3 and 4
CN#10	23.078	3.6.0	223r1	R99	3.7.0	Clarification for the relationship for DPs
CN#10	23.078	3.6.0	224r2	R99	3.7.0	Clarification for the CUG data in Initial DP
CN#10	23.078	3.6.0	225r1	R99	3.7.0	Correction on the SDL CAMEL_Store_Destination_Address
CN#10	23.078	3.6.0	226	R99	3.7.0	Correction on the SDL gsmSSF
CN#10	23.078	3.6.0	228r3	R99	3.7.0	Correction for ambiguous description in clause 10 and 11
CN#10	23.078	3.6.0	229r1	R99	3.7.0	Clarification on GPRS 'guard timer'
CN#10	23.078	3.6.0	230r1	R99	3.7.0	Specifying timer range values

						Change history
TSG CN#	**Spec**	**Version**	**CR**	**<Phase>**	**New Version**	**Subject/Comment**
CN#10	23.078	3.6.0	231	R99	3.7.0	Correction to 'Initial DP SMS' Information Flow
CN#10	23.078	3.6.0	232r4	R99	3.7.0	First set of corrections of paragraph 6 GPRS
CN#10	23.078	3.6.0	233r3	R99	3.7.0	Second set of corrections of paragraph 6 GPRS
CN#10	23.078	3.6.0	235	R99	3.7.0	Correction on error implementing a CR 23.078-159r1
CN#10	23.078	3.6.0	236	R99	3.7.0	Correction on error implementing a CR 23.078-194r3
CN#10	23.078	3.6.0	237	R99	3.7.0	CallGap IF correction
CN#10	23.078	3.6.0	238	R99	3.7.0	CAMEL3 removal of duplicate RAI
CN#10	23.078	3.6.0	239	R99	3.7.0	Check_Gap_Criteria correction
CN#10	23.078	3.6.0	244	R99	3.7.0	GsmSSF state transition in the case of Abandon/Disconnect is armed as an EDP-N, or when they are not armed
CN#10	23.078	3.6.0	248r2	R99	3.7.0	Improved description of the location information in SGSN
CN#10	23.078	3.6.0	249r2	R99	3.7.0	Error handling in ATSI
CN#10	23.078	3.6.0	250r2	R99	3.7.0	Additional clarification for ATM
CN#10	23.078	3.6.0	255	R99	3.7.0	Introduction of GGSN Address
CN#11	23.078	3.7.0	256r2	R99	3.8.0	Clarification on APN usage in the ConnectGPRS operation
CN#11	23.078	3.7.0	257	R99	3.8.0	Update of References
CN#11	23.078	3.7.0	258r1	R99	3.8.0	Routeing Area Update indication to Detach and Disconnect notifications to SCP
CN#11	23.078	3.7.0	259r1	R99	3.8.0	Description of Entity Released GPRS
CN#11	23.078	3.7.0	260r1	R99	3.8.0	Correction to usage of the term 'O-BCSM'
CN#11	23.078	3.7.0	261r1	R99	3.8.0	Restriction on SS-CSI to VLR - no marking for CCBS
CN#11	23.078	3.7.0	263r1	R99	3.8.0	No Volume charging on GPRS Session (clarifying text)
CN#11	23.078	3.7.0	264r2	R99	3.8.0	Correction of "Call Forwarding Notification" feature in CAMEL Phase 3.
CN#11	23.078	3.7.0	267r1	R99	3.8.0	Usage of MSISDN for CAMEL - USSD Information Flows
CN#11	23.078	3.7.0	268r1	R99	3.8.0	Correction of error implementing CR 23.078-118r2
CN#11	23.078	3.7.0	269r4	R99	3.8.0	Correction of reference
CN#11	23.078	3.7.0	271r1	R99	3.8.0	Correction on GPRS related information flows
CN#11	23.078	3.7.0	272	R99	3.8.0	Corrections to Information Flow Definitions
CN#11	23.078	3.7.0	273r1	R99	3.8.0	Correction of the Location Information IE
CN#11	23.078	3.7.0	274	R99	3.8.0	Correction of Interactions with Call Barring in CAMEL Phase 3.
CN#11	23.078	3.7.0	279	R99	3.8.0	Correction of Triggering after Call Gapping in CAMEL Phase 3.
CN#11	23.078	3.7.0	280r1	R99	3.8.0	Correction of SDL Set_Notification_Type
CN#11	23.078	3.7.0	282r1	R99	3.8.0	Correction to vendor/operator specific GPRS charging-response timer handling
CN#11	23.078	3.7.0	283	R99	3.8.0	Marking of Location Number in Initial DP SMS as 'Conditional'
CN#11	23.078	3.7.0	284r1	R99	3.8.0	Correction on checking DP criteria and sending VT/T-CSI
CN#11	23.078	3.7.0	285	R99	3.8.0	Correction of Output Signals in Process Reconnected_MT_Call_VLR
CN#12	23.078	3.8.0	286	R99	3.9.0	GGSN address in SGSN to SCP interface
CN#12	23.078	3.8.0	288r1	R99	3.9.0	Mapping of Call Forwarding parameters from CAP-Connect to ISUP-IAM and CAP-InitialDP
CN#12	23.078	3.8.0	290	R99	3.9.0	Correction of error implementing CR 23.078-181r2
CN#12	23.078	3.8.0	292r1	R99	3.9.0	Handling of second SIFOC
CN#12	23.078	3.8.0	294r1	R99	3.9.0	Correction to GPRS SDL: no state transition for QoS-induced ACR-GPRS

						Change history
TSG CN#	**Spec**	**Version**	**CR**	**<Phase>**	**New Version**	**Subject/Comment**
CN#12	23.078	3.8.0	295r1	R99	3.9.0	Correction on the call-Diversion-Treatment-Indicator at the GMSC
CN#12	23.078	3.8.0	301	R99	3.9.0	CAMEL Capability Handling in GPRS-CSI
CN#12	23.078	3.8.0	308	R99	3.9.0	Correction to PDP Context DP description table (table 6.2)
CN#12	23.078	3.8.0	306r1	R99	3.9.0	Correction for the CAMEL3 ACR-GPRS parameter range problem (roll-over)
CN#13	23.078	3.9.0	310r1	R99	3.10.0	Correction of error implementing CR 23.078-194r3
CN#13	23.078	3.9.0	312r2	R99	3.10.0	Possible information in Initial DP
CN#13	23.078	3.9.0	317r1	R99	3.10.0	Correction of CUG information handling