

Customised Applications for Mobile Enhanced Logic (CAMEL)

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1. ABSTRACT

Taking the increasing competition of GSM networks into account, a standard was needed to enable competition between operators based on the services offered. ETSI has started in 1994 with the specification of Intelligent Network functionality in GSM, named Customised Applications for Mobile Enhanced Logic (CAMEL). CAMEL will provide the GSM operator with the ability to offer operator specific services based on IN service logic to a GSM subscriber even when roaming outside the HPLMN.

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

CAMEL is divided into several phases to provide GSM operators with CAMEL functionality as soon as possible. The first phase of the standard has been approved in 1997 and is currently implemented by the major GSM vendors. The standardisation of the second phase has been finalised in 1998 with products to come in 1999. Phase 3 is planned to be finalised in the end of 1999 with products in 2000.

CAMEL makes use of IN SSP-SCP interface. The CAMEL application protocol (CAP) Phase 1 and 2 are based on ETSI Core INAP CS-1R. However, limited fraction of the whole operation set is used in order to assure 100% vendor compatibility in face of more than 200 mobile networks looking for mutual roaming agreements.

2. CAMEL PHASE 1 ARCHITECTURE

CAMEL phase 1 architecture is illustrated in figure 1 [1].

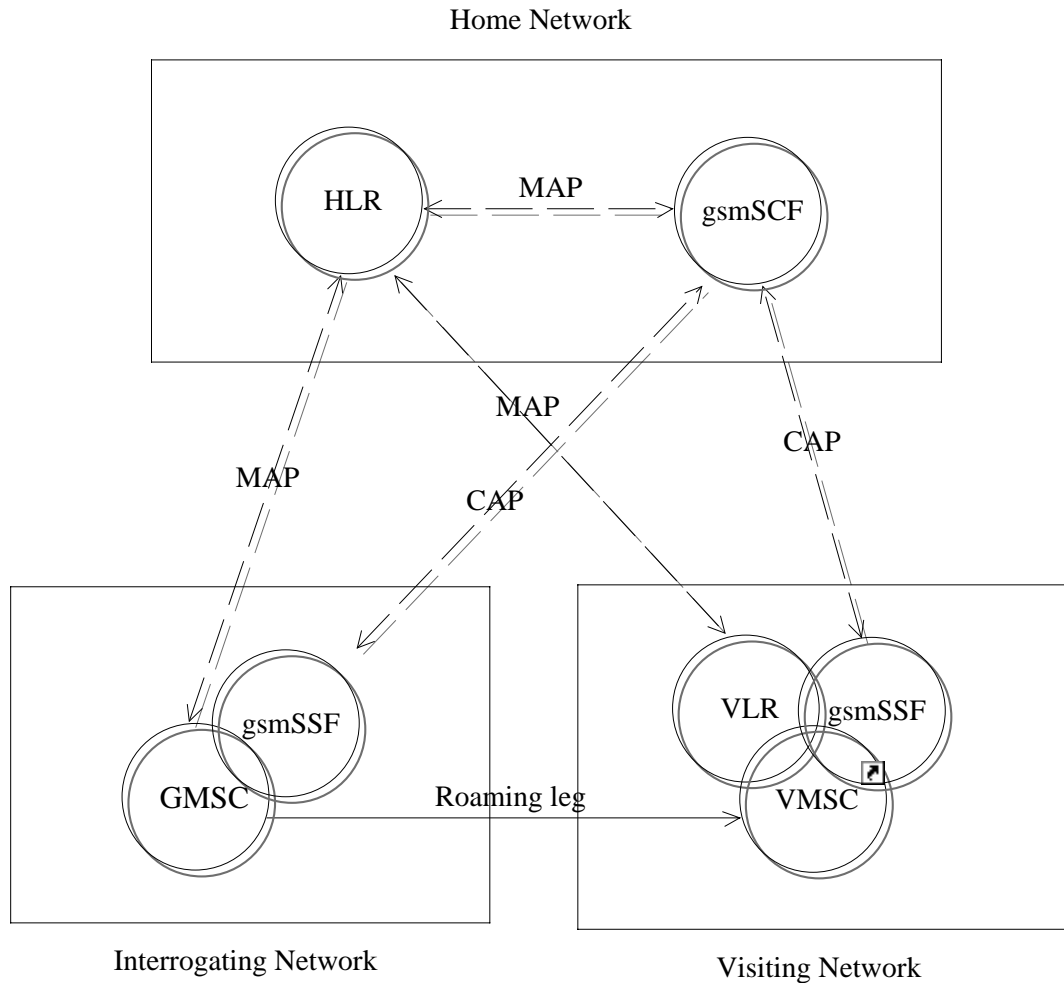


Figure 1. CAMEL phase 1 architecture

Continuous lines present a voice connection in the picture. Dotted lines are used for signalling connections between entities.

2.1 Home Network

Home network presents the home PLMN of the CAMEL subscriber. Home Location Register and GSM Service Control Function are the network elements or functional entities, which are involved in CAMEL.

Home Location Register (HLR) stores subscriber related data, which includes also information whether the subscriber has CAMEL service or not. HLR transfers the CAMEL subscription information to those network elements, which need it to be able to provide CAMEL service. Originating CSI is conveyed to the VLR of visiting network during location update or whenever O-CSI data is modified. HLR passes the originating and

terminating CSI to the GMSC of the interrogating network while handling terminating CAMEL calls.

GSM Service Control Function acts as an entity, where the execution of operator specific services takes place. gsmSCF contains the service logic of OSSs, which is invoked during originating and terminating CAMEL calls. The gsmSSF addresses the gsmSCF based on Global Title.

2.2 Visiting Network

The PLMN where the CAMEL subscriber is roaming is called visiting network. It is involved in the handling of originating and forwarded CAMEL calls. Moreover, visiting network may be requested for a location information and a status of the subscriber. The processing of originating CAMEL calls include sMSC, VLR and gsmSSF.

Visitor Location Register (VLR) stores the subscriber data received from the HLR of home network. The subscriber data includes the O-CSI, which is passed to the MSC during the originating or forwarded call processing. VLR may also be requested for subscriber's location and status information at any time by HLR.

The purpose of MSC is to setup the calls from and towards the visiting subscriber. While handling the originating calls the MSC detects whether the subscriber needs CAMEL service (i.e. the subscriber has O-CSI information active). If the O-CSI exists for the subscriber, an initial contact to the gsmSCF takes place. During the CAMEL call the MSC may be requested to monitor and report certain call events by the gsmSCF.

GSM Service Switching Function acts as an interface from MSC towards the gsmSCF. gsmSSF initiates the dialogue with the gsmSCF in order to get the instructions for CAMEL call handling.

When a subscriber roams to a visiting network, which doesn't support CAMEL, the home network is responsible for handling the roaming. It has to decide on a per subscriber basis whether the mobile originated and/or terminated calls are allowed. Even if MOCs are allowed, the originating OSSs are not provided to the calling subscriber.

2.3 Interrogating Network

Interrogating network performs the interrogation of the home network for information on the treatment of terminating CAMEL calls. Thus the calling party of the terminating CAMEL call resides in the interrogating network and the called party resides in the visiting network. GMSC and gsmSSF are the entities, which are related to the handling of the terminating CAMEL calls.

Gateway MSC sets up the terminating calls towards the visiting CAMEL subscriber. GMSC receives O-CSI and T-CSI of the B-subscriber in the response to the HLR enquiry. If T-CSI exists, the GMSC makes an initial contact to the gsmSSF for further call processing instructions.

In the case of interrogating network doesn't support CAMEL, the terminating OSSs are not invoked for terminating calls towards the CAMEL subscribers.

2.4 Relationships

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.

GMSC - HLR interface

This interface is used at terminating calls to exchange routing 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.

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.).

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.

MSC - gsmSSF interface

This is an internal interface.

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. This interface is also 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.

2.5 BASIC CALL STATE MODEL

Basic Call State Model (BCSM) is used to describe different phases of the call processing in the GMSC or MSC [1].

2.5.1 O-BCSM

The O-BCSM in the CAMEL phase 1 is the simplification of the BCSM of the CS-1. O-BCSM is illustrated in the figure 2.

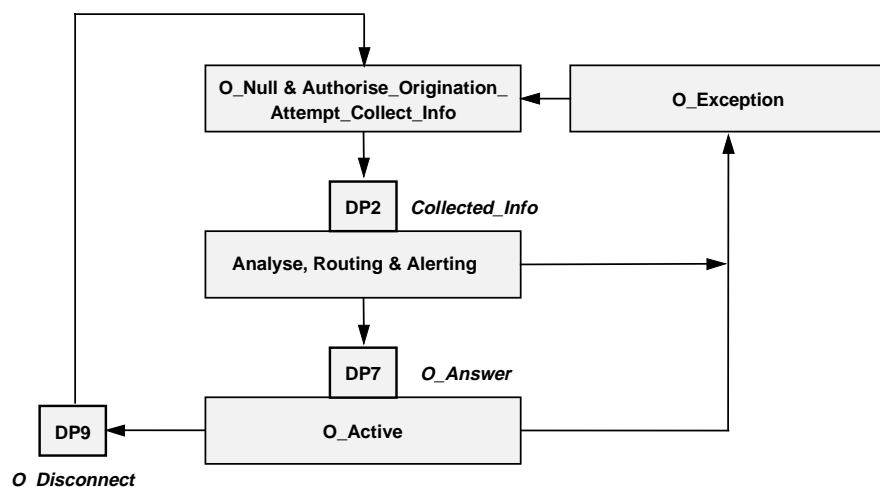


Figure 2: O-BCSM

Description of O-BCSM DPs

CAMEL Detection Point	Description
DP2 Collected_Info	Indication that the O-CSI is active and analysed. The dialled number is received, but not analysed.
DP7 O_Answer	Indication that the call is accepted and answered by the terminating party.
DP9 O_Disconnect	A disconnect indication is received from the originating or the terminating party. Either calling or called party disconnection is informed to the gsmSCF.

2.5.2 T-BCSM

The T-BCSM in the CAMEL phase 1 is the simplification of the BCSM of the CS-1 and is illustrated in figure 3.

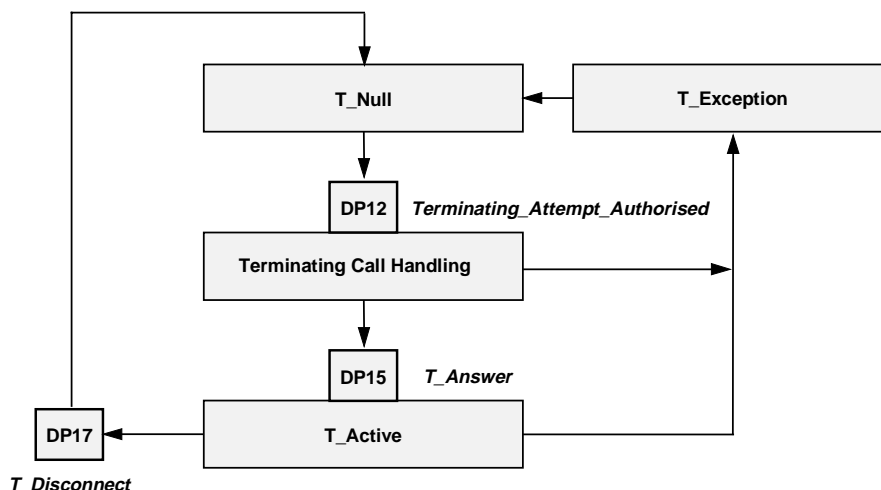
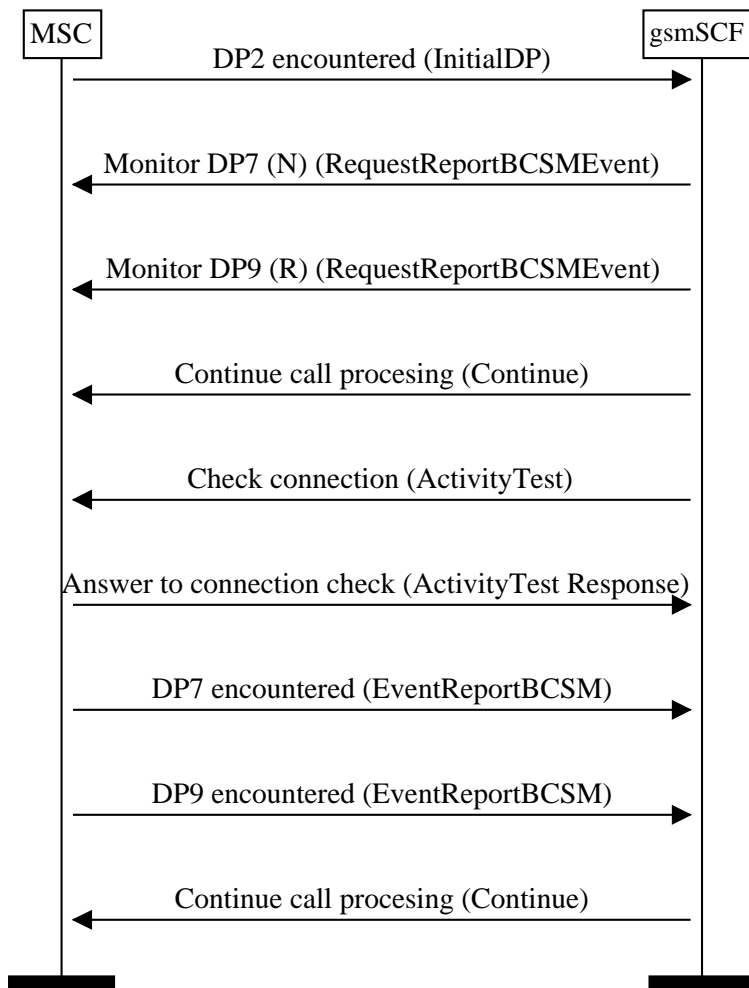


Figure 3: T-BCSM

Description of T-BCSM DPs

CAMEL Detection Point	Description
DP12 Term._Attempt_Authorized	Indication that the T-CSI is active and analysed.
DP15 T_Answer	Call is accepted and answered by terminating party.
DP17 T_Disconnect	A disconnect indication is received from the terminating or the originating party.

2.5.3 Originating Call Example



MSC initiates the dialogue with gsmSCF by informing that statically armed DP2 was encountered in the O-BCSM. The call processing in the MSC is suspended for waiting instructions from the gsmSCF. The gsmSCF requests MSC to monitor the detection points DP7 and DP9. Then gsmSCF instructs MSC to continue call processing with Continue-message. gsmSCF can also enquire the existence of relationship with Activity Test operation. When the call proceeds to the phase, in which called party answers, the MSC sends the notification of the DP7 to the gsmSCF. The call processing in the MSC continues after the notification. When either calling or called party terminates the call, the MSC reports the DP9 as encountered to the gsmSCF and waits for further instructions. Finally gsmSCF asks MSC to continue the call processing [1,3,4].

3. CAMEL PHASE 2 ARCHITECTURE

CAMEL phase 2 architecture is illustrated in figure 4 [2].

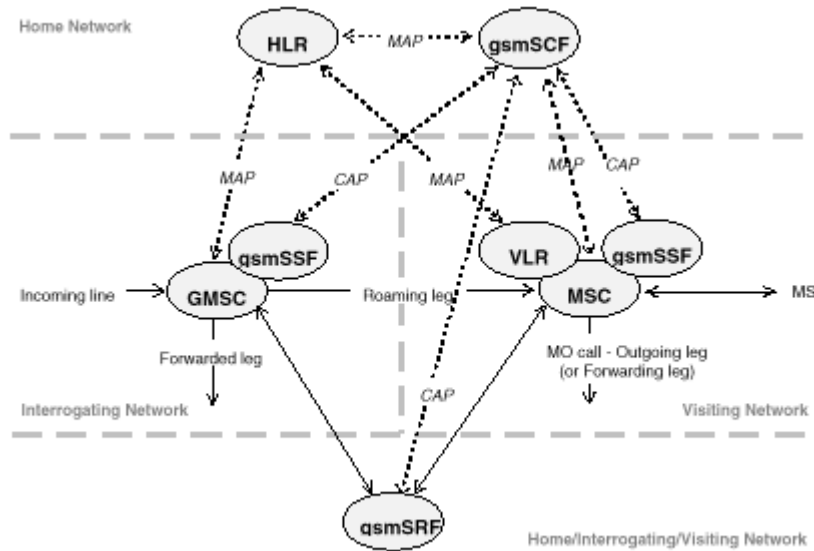


Figure 4: CAMEL phase 2 architecture

The CAMEL phase2 architecture is based on the phase 1 architecture. The basic new component is the gsmSRF. The specialised resource functions provides a pool of resources for access by other network entities.

3.1 Relationships

One new interface compared in addition of CAMEL phase 1 interfaces.

gsmSCF - gsmSRF interface

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

3.2 O-BCSM

O-BCSM of CAMEL phase 2 is illustrated in figure 5.

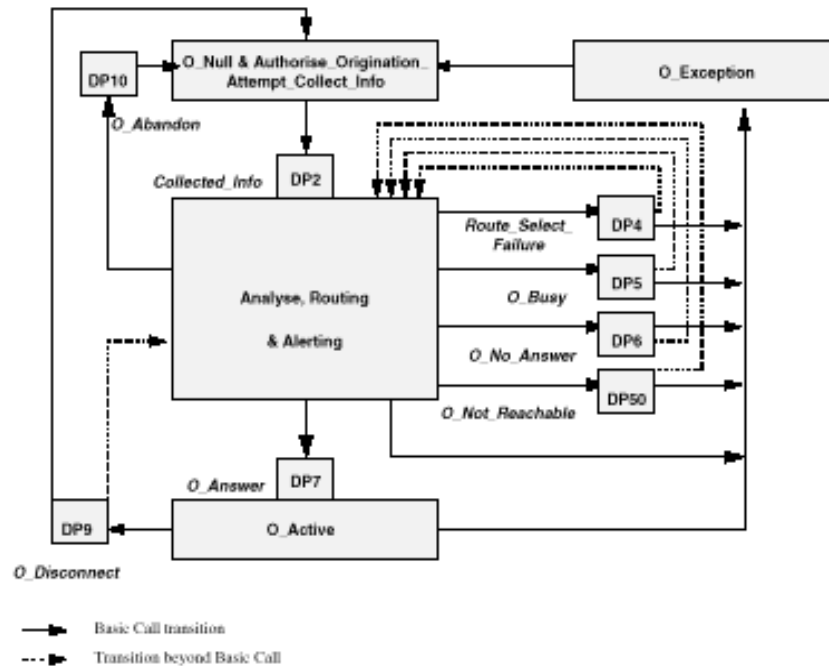


Figure 5: O-BCSM of CAMEL phase 2

Description of O-BCSM DPs

CAMEL Detection Point	Description
DP2 Collected_Info	Indication that the O-CSI is active and analysed. The dialled number is received, but not analysed.
DP 4 Route_Select_Failure	Indication that the call establishment failed
DP 5 O_Busy	Indication that a busy indication is received from the terminating party
DP6 O_No_Answer	Indication that an application timer associated with the O_No_Answer DP expires
DP7 O_Answer	Indication that the call is accepted and answered by the terminating party.
DP9 O_Disconnect	A disconnect indication is received from the originating or the terminating party. Either calling or called party disconnection is informed to the gsmSCF.
DP 10 O_Abandon	Indication that a disconnect indication is received from the originating party during the call establishment procedure
DP 50 O_Not_Reachable	Not reachable event can be determined upon a cause IE in the ISUP release message.

3.3 O-BCSM

T-BCSM of CAMEL phase 2 is illustrated in figure 6.

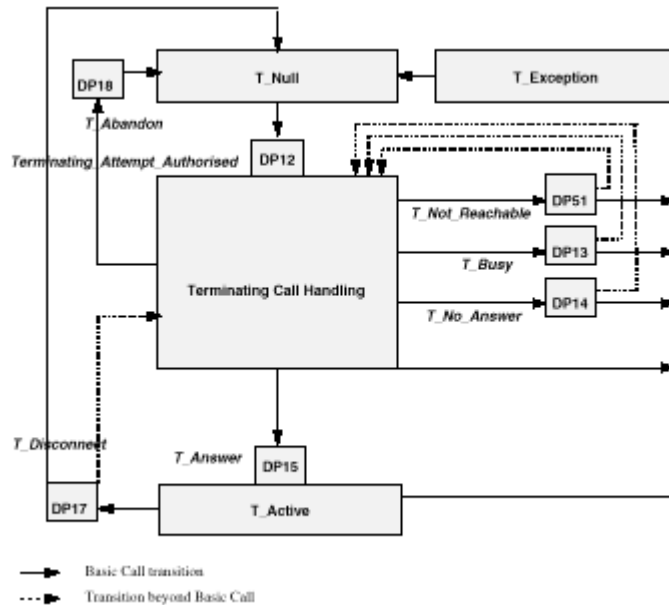
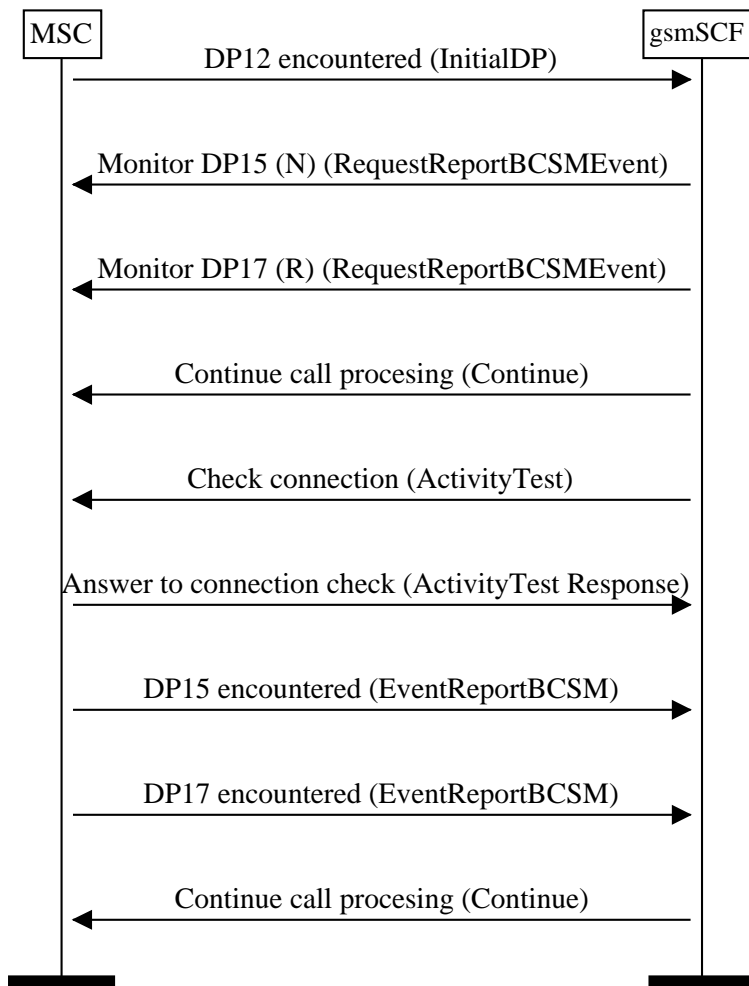


Figure 6: T-BCSM of CAMEL phase 2

Description of T-BCSM DPs

CAMEL Detection Point	Description
DP12 Term._Attempt_Authorized	Indication that the T-CSI is active and analysed.
DP 13 T_Busy	Indication that a busy indication is received from the destination exchange
DP 14 T_No_Answer	Indication that an application timer associated with the T_No_Answer DP expires
DP15 T_Answer	Call is accepted and answered by terminating party.
DP17 T_Disconnect	A disconnect indication is received from the terminating or the originating party.
DP 18 T_Abandon	A disconnect indication is received from the originating party during the call establishment procedure
DP 51 T_Not_Reachable	Not reachable or call establishment failure event can be determined from the HLR or upon a cause IE in the ISUP release message.

3.4 Terminating Call Example



GMSC initiates the dialogue with gsmSCF by informing that statically armed DP12 was encountered in the T-BCSM. The call processing in the GMSC is suspended for waiting instructions from the gsmSCF. The gsmSCF requests GMSC to monitor the detection points DP15 and DP17. Then gsmSCF instructs GMSC to continue with call processing (Continue-message). gsmSCF can also enquire the existence of active dialogue with Activity Test operation. When the call proceeds to the phase, in which called party answers, the GMSC sends the notification of the DP15 to the gsmSCF. The call processing in the GMSC continues after the notification. When either calling or called party terminates the call, the GMSC reports the DP17 as encountered to the gsmSCF and stays waiting for further instructions. Finally gsmSCF asks GMSC to continue the call processing [2,4].

REFERENCES

- [1] ETSI GSM 02.78: Digital cellular telecommunications system (Phase 2+); Customised Applications for Mobile network Enhanced Logic (CAMEL); Service definition (stage 1); v.5.3.0
- [2] ETSI GSM 03.78: Digital cellular telecommunications system (Phase 2+); Customised Applications for Mobile network Enhanced Logic (CAMEL); v.5.3.0
- [3] ETSI GSM 09.78: Digital cellular telecommunications system (Phase 2+); CAMEL Application Part (CAP) specification; v.5.3.0
- [4] ETSI Final Draft EN 301 152-1. Intelligent Network (IN); IN Capability Set 1 (CS1) extensions; Intelligent Network Application Protocol (INAP); Customized Applications for Mobile network Enhanced Logic (CAMEL); Part 1: Protocol Specification, v1.2.1 (1998-07).

ABBREVIATIONS

BCSM	Basic Call State Model
CAMEL	Customized Applications for Mobile network Enhanced Logic
DP	Detection Point
EDP	Event Detection Point
GMSC	Gateway MSC
gsmSCF	GSM Service Control Function
gsmSRF	GSM Specialised Resource Function
gsmSSF	GSM Service Switching Function
HLR	Home Location Register
HPLMN	Home PLMN
IPLMN	Interrogating PLMN
MSC	Mobile service Switching Centre
O-BCSM	Originating Basic Call State Model
O-CSI	Originating CAMEL Subscription Information
OSS	Operator Specific Service
PIC	Point In Call
PLMN	Public Land Mobile Network
SMF	Service Management Function
SS-CSI	Supplementary Service Notification CAMEL Subscription Information
T-BCSM	Terminating Basic Call State Model
T-CSI	Terminating CAMEL Subscription Information
VLR	Visitor Location Register
VPLMN	Visited PLMN