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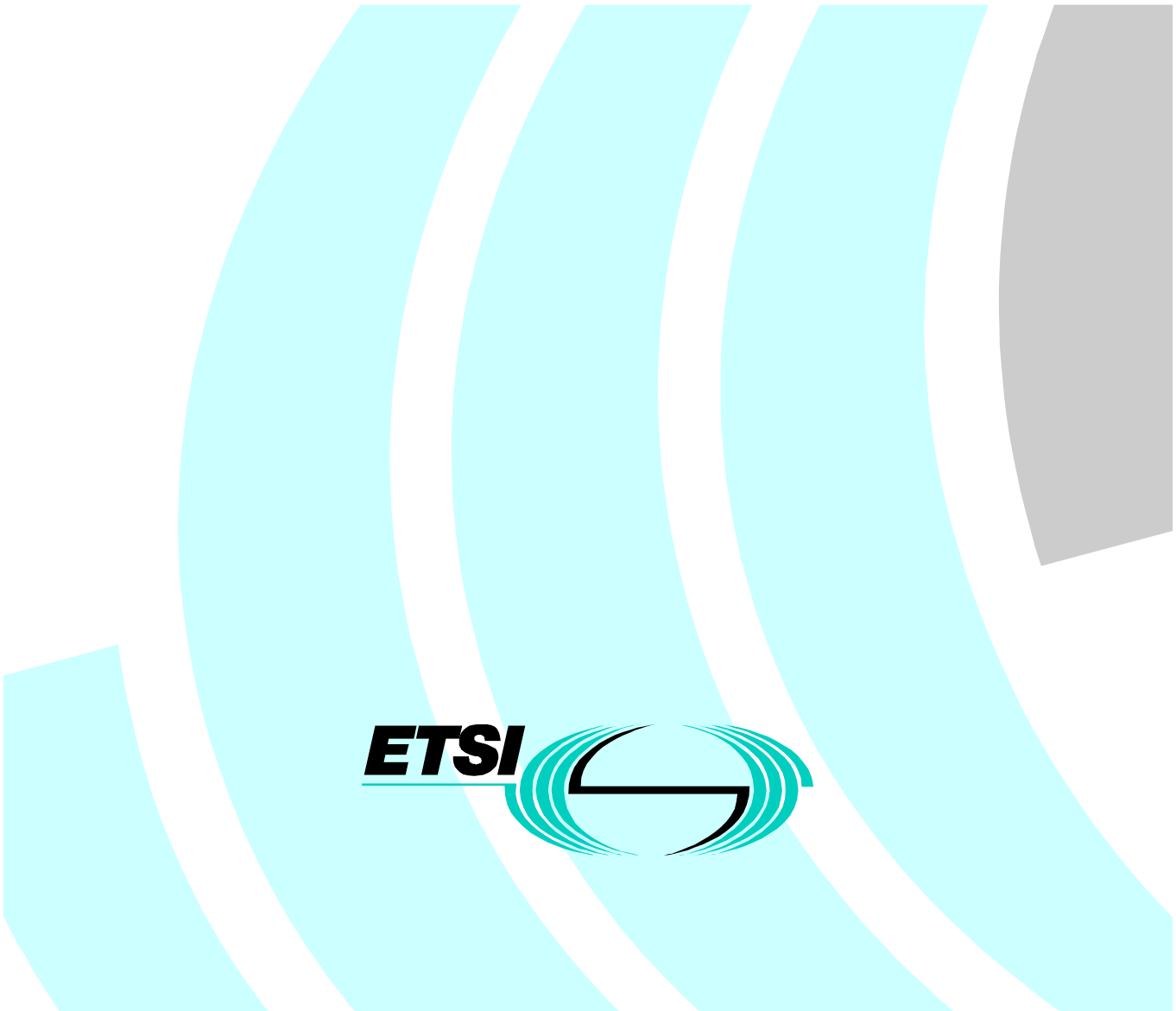
Technical Specification

Telecommunications and Internet Protocol Harmonization Over Networks (TIPHON); Network architecture and reference configurations; TIPHON Release 2



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Contents

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Foreword

This Technical Specification (TS) has been produced by ETSI Project Telecommunications and Internet Protocol Harmonization Over Networks (TIPHON).

1 Scope

The present document defines the network architecture and the reference configurations that are necessary for:

- the delivery of telephone calls which originate in an Internet Protocol (IP) network and are delivered to Switched Circuit Networks (SCN);
- the delivery of telephone calls which originate in SCNs and are delivered in an IP network;
- the delivery of telephone calls which originate in SCNs, routed through a IP network and finally delivered to an SCN; and
- the delivery of telephone calls which originate and terminate in IP networks. Such calls may be routed using an SCN.

These four scenarios are part of TIPHON Release 2.

The architecture includes provision of information and facilities which are incidental to the delivery of telephone calls described above.

The present document builds upon the concepts embodied in the TIPHON Phase II Network Architecture and Reference Configurations [5] by considering the additional scenarios and the expansion of the IP network into a more appropriate network model. Annex B shows the relationship with the previous architecture.

The present document is applicable to equipment performing the roles of terminal, and Gateway, and also to entities within the IP network that are necessary to support the four scenarios of TIPHON Release 2. Where the text indicates the status of a requirement (i.e. as strict command or prohibition, as authorizations leaving freedom or as a capability or possibility), this may modify the nature of a requirement within a referenced standard used to provide the capability.

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.
- A non-specific reference to an ETS shall also be taken to refer to later versions published as an EN with the same number.

[1] ITU-T Recommendation E.164 (1997): "The international public telecommunications numbering plan".

[2] ETSI EN 300 189: "Private Integrated Services Network (PISN); Addressing [ISO/IEC 11571 (1998), modified]".

[3] ISO/IEC 11571: "Information technology -- Telecommunications and information exchange between systems -- Private Integrated Services Networks - Addressing".

[4] ETSI TR 101 300: "Telecommunications and Internet Protocol Harmonization Over Networks (TIPHON); Description of Technical Issues".

[5] ETSI TS 101 313 (V0.4.2): "Telecommunications and Internet Protocol Harmonization Over Networks (TIPHON); Network architecture and reference configurations; Phase II: Scenario 1 + Scenario 2".

[6] ETSI TR 101 307: "Telecommunications and Internet Protocol Harmonization Over Networks (TIPHON); Requirements for service interoperability; Phase 2"

[7] ETSI TS 101 329-2: "Telecommunications and Internet Protocol Harmonisation over Networks (TIPHON); End to End Quality of Service in TIPHON Systems; Part 2: Definition of Quality of Service (QoS) Classes".

3 Definitions and abbreviations

3.1 Definitions

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

administrative domain: network controlled by a single operator

gateway: endpoint on a network which provides for real time, two way communication between an IP based network and an Switched Circuit Network (SCN)

information flow: defines a complete set of logical information exchanged between two functional entities

interconnection function: functional entity connecting two networks having differing administrative policy such as Quality of Service (QoS) or addressing policy but employing the same signalling protocol, and transport technology, at the point of interconnect

interface: common boundary between two communicating entities. One or more protocols may be implemented across an interface

interworking function: function connecting two networks of different signalling and or transport technology

IP network: managed transport network supporting IP

IP telephony: this phrase is used as a shorthand to describe any telephony related service that is supported on IP

NOTE: Such services may also be supported by other technologies.

protocol: set of rules and formats which govern exchange of information across an interface between two functional entities for purposes of information transfer

reference point: conceptual point at the conjunction of two non overlapping functions

service provider network: network controlled by a Service Provider which offers service to other persons

Switched Circuit Network (SCN): telecommunications network, e.g. Public Switched Telephone Network (PSTN), Integrated Services Digital Network (ISDN), and General System for Mobile communications (GSM), that uses circuit-switched technologies for the support of voice calls. The SCN may be a public network or a private network

telephone call: two-way speech communication between two users by means of terminals connected via network infrastructure

terminal: endpoint other than a gateway or a multipoint control unit

TIPHON compliant system: system that complies with the mandatory requirements identified in the TIPHON requirements documents together with compliance to the parts of the TIPHON specifications in which these requirements are embodied

ticket: a ticket is obtained through the registration session, when used in a call it provides the terminal/user with a means to show a valid registration exists

3.2 Abbreviations

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

BC	Bearer Control
BICC	Bearer Independent Call Control
CC	Call Control
DTMF	Dual Tone Multi Frequency
FG	Functional Grouping
IN	Intelligent Network
IP	Internet Protocol
IPTN	IP Telephony Network
IWF	InterWorking Function
MC	Media Control
MSC	Message Sequence Charts
NFG	Network Functional Grouping
OGFG	Originating Gateway Functional Grouping
OTFG	Originating Terminal Functional Grouping
PCM	Pulse Code Modulation
PSTN	Public Switched Telephony Network
QoS	Quality of Service
SC	Service Control
SCN	Switched Circuit Networks
SCNIWF	Switched circuit network inter-working function
SDL	Specification and Description Language
SIP	Session Initiation Protocol
SSP	Service Switching Point
TGFG	Terminating Gateway Functional Grouping
TTFG	Terminating Terminal Functional Grouping

4 Introduction

The network architecture and reference configurations contained in the present document are derived from examination of the capabilities required by [6] for the support of TIPHON Scenarios 0, 1, 2, 3 and 4 as identified in [4].

The present document demonstrates how the scenarios given in [4], may be expressed as a set of interconnected networks with associated Interconnecting Functions. From this model, the concepts of functional planes, Functional Groupings, and functional layers are developed.

Where there is a requirement that an information flow needs to be exchanged between physical equipment, a reference point is defined. Where an information flow will only be internal to pieces of physical equipment, no reference point is defined.

Finally Message Sequence Charts (MSC) and Specification and Description Language (SDL) diagrams are presented in the form of a generalized model.

5 Networks

TIPHON Scenarios 1, 2, 3 and 4 require interconnection of IP Telephony Networks (IPTN) and Switched Circuit Networks (SCN). For the purpose of the model, functionality can be distributed across a number of networks.

Each network is part of only one administrative domain. When different administrative domains provide all functions needed to e.g. originate a call, these functions pertain to different networks. Each administrative domain may have its own policies on addressing, Quality of Service (QoS), etc.

Each network may further be decomposed into functional groups, as shown in Clause 7.

5.1 Networks involved in registration

Figure 1 shows the network types that may inter-operate during the registration of a user.

Figure 1: TIPHON generic network registration model

The Home IPTN is the principle place where the user information is stored. The Home IPTN provides the functions required for registration and for subscriber related operations.

The Serving IPTN provides the function required to register the user and to forward the registration towards the Home IPTN.

The Intermediate IPTN provides the functions required to connect the Serving IPTN and the Home IPTN during the registration. The intermediate IPTN is only present when the Serving IPTN and the Home IPTN are not directly connected.

An IPTN may act as both the Serving IPTN and the Home IPTN.

5.2 Networks involved in calls

Figure 2 shows the different types of networks that may inter-operate for calls in TIPHON compliant systems. A specific call may not involve all network types. Each network will include any required interconnecting and interworking functions.

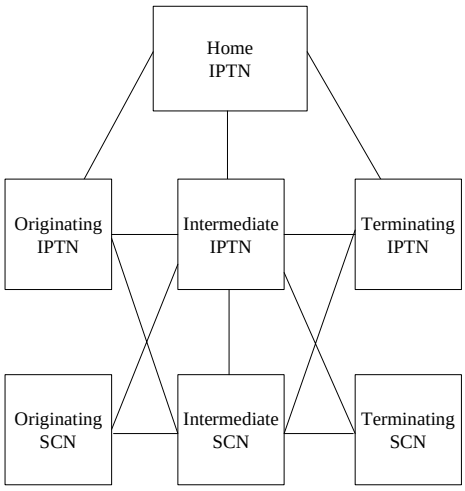


Figure 2: TIPHON generic network call model

The Originating IPTN contains a set of functions required for originating calls from an IP terminal device.

The Originating SCN contains a set of functions required for originating calls from a SCN terminal device.

The Intermediate IPTN contains a set of functions required for connecting calls between originating and terminating networks. This network may not be present for some calls but may be present several times in a call.

The Intermediate SCN contains a set of functions required for connecting calls between originating and terminating networks. This network may not be present for some calls but may be present several times in a call.

The Terminating IPTN contains a set of functions required for terminating calls to an IP terminal device.

The Terminating SCN contains a set of functions required for terminating calls to a SCN terminal device.

The Home IPTN contains a set of functions required for subscription-related operations.

An IPTN may act as any combination of an Originating IPTN, and/or a Home IPTN and/or a Terminating IPTN.

6 Functional planes

Each of the networks in the TIPHON generic network model may be considered as comprising distinct groupings of functionality. Within a network, these functions interact to enable the policies and business objectives for that network to be achieved through exercising appropriate control of the resources within that network.

In order to provide a structured analysis of the requirements, the concept of "functional planes" is used. Each functional plane contains a high level grouping of functionality.

IPTNs can be considered to contain sets of similar functions and it is possible to consider these functions to be grouped as planes of common functionality. The IPTN can be separated into an IP Transport plane and an IP Telephony Application plane.

Figure 3 identifies the following functional planes:

- IP telephony application;
- IP transport;
- SCN;
- Management.

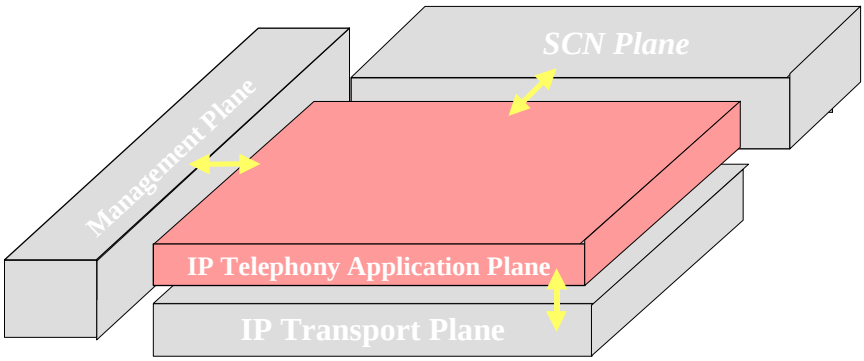


Figure 3: TIPHON Functional Planes

The IP Telephony Application plane makes use of capabilities provided by the other functional planes and it contains functions to support IP telephony.

The IP Transport plane contains the functionality relating to the underlying packet transport and the functionality of servers in general use. The details of this functional plane are not considered further in the present document.

The SCN plane contains the functionality relating to the SCN. The details of this functional plane are not considered further in the present document.

The Management plane contains the functionality relating to network management. The details of this functional plane are not considered further in the present document.

7 Functional groupings

Functionality in the IP Telephony Application plane can be gathered into functional groups.

7.1 Functional groupings involved in registration

Figure 4 shows functional groupings for registration.

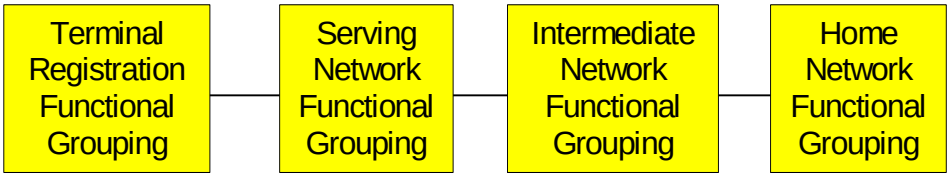


Figure 4: Overview of functional groupings involved in registration

The Terminal Registration Functional Grouping represents the functionality of the registering terminal.

The Serving Network Functional Grouping represents the functions required to enable the user to register and to use services.

The Intermediate Functional Grouping connects the Serving Network Functional Group to the Home Network Functional Grouping.

The Home Network Functional Grouping represents functionality relating to the user's profile and subscription.

The Home Network Functional Grouping and the Serving Network Functional Grouping may reside in the same network or in different networks.

7.2 Functional groupings involved in a call

Figure 5 shows functional groupings for a call.

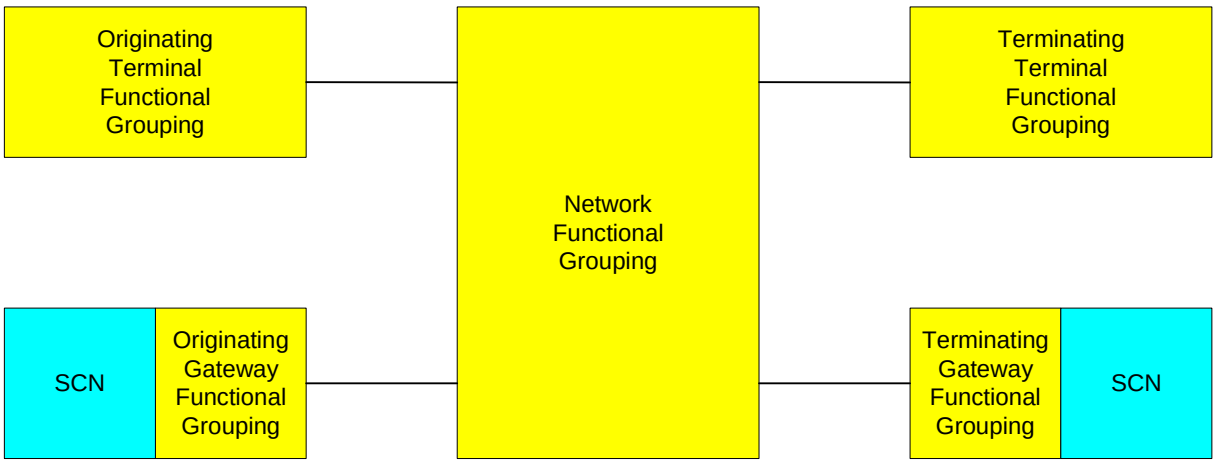


Figure 5: Overview of functional groupings involved in a call

The Originating Terminal Functional Grouping represents the functionality of the calling terminal.

The Originating Gateway Functional Grouping represents the functionality of the ingress gateway from an SCN.

The Terminating Terminal Functional Grouping represents the functionality of the called terminal.

The Terminating Gateway Functional Grouping represents the functionality of the egress gateway to an SCN.

The Network Functional Grouping represents all of the functionality of the IP network(s) in support of the call. Figure 5 shows the case where the originating and terminating functional groupings are associated with a single "network". Where the originating and terminating functional groupings are associated with different networks, the Network Functional Grouping can be separated into an Originating Network Functional Grouping and a Terminating Network Functional Grouping (see figure 6).

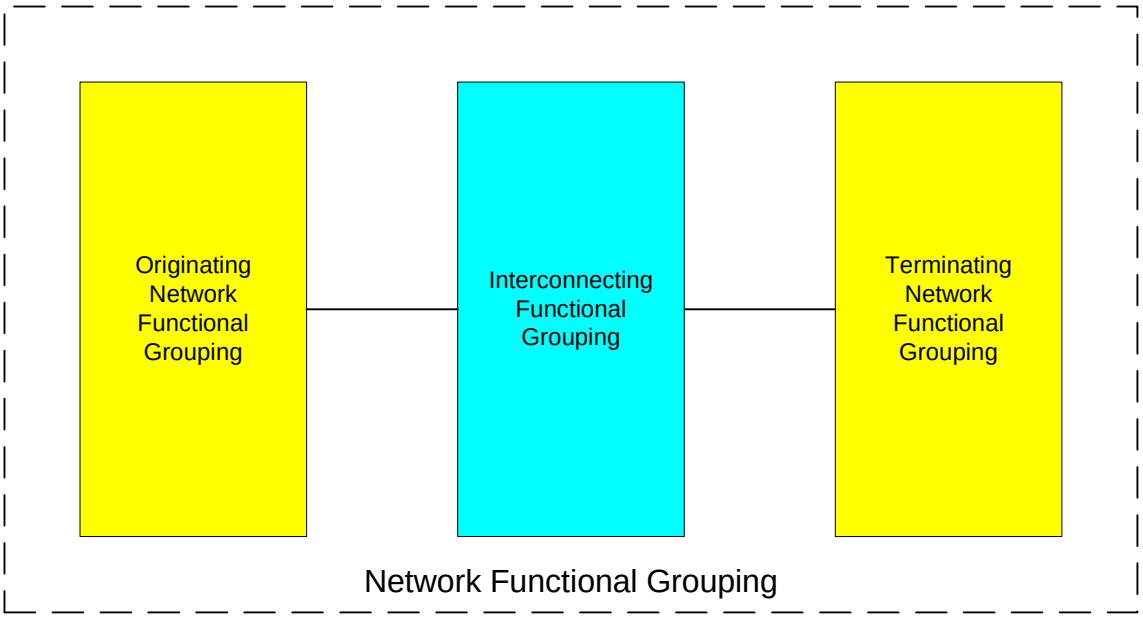


Figure 6: Separation of Network Functional Groupings into originating and terminating Network Functional Groupings

Figure 6 also includes Interconnecting Functional Groupings that provide functions, e.g. protocol conversions, policy enforcement, that enables the networks to communicate.

NOTE 1: In some implementations, there may be no need for an interconnection function between some networks, but it is necessary to include this functionality to develop a consistent model.

Where there is an intermediate network between the Originating Network Functional Grouping and the Terminating Network Functional Grouping, the Network Functional Grouping can be further subdivided to include one or more Intermediate Network Functional Groupings (see figure 7).

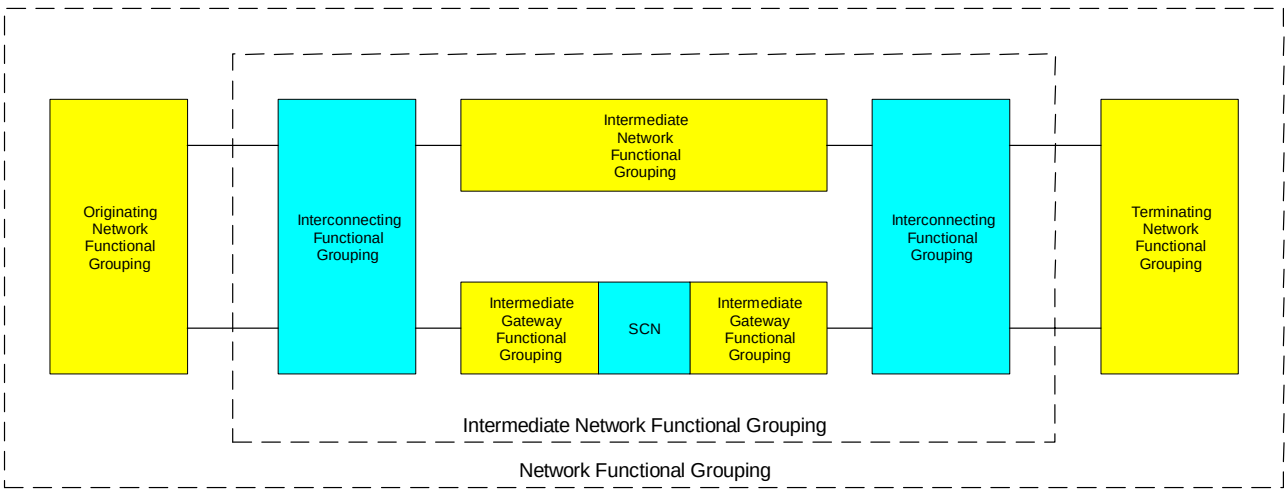


Figure 7: Intermediate Network Functional Grouping

As in figure 6, Interconnecting Functional Groupings are included to enable the networks to communicate.

Also, figure 7 includes an Intermediate Gateway Functional Grouping that provides communication with SCNs.

NOTE 2: The figures do not consider mobility aspects.

These functional groupings may be used to construct the four scenarios as follows:

- for Scenario 1, the call is from an Originating Terminal Functional Grouping to a Terminating Gateway Functional Grouping;
- for Scenario 2, the call is from an Originating Gateway Functional Grouping to a Terminating Terminal Functional Grouping;
- for Scenario 3, the call is from an Originating Gateway Functional Grouping to a Terminating Gateway Functional Grouping; and
- for Scenario 4, the call is from an Originating Terminal Functional Grouping to a Terminating Terminal Functional Grouping using a pair of Intermediate Gateway Functional Groupings enabling communication via an SCN.

8 Functional decomposition of the IP telephony application plane

The architecture for the IP telephony application plane consists of functional entities organized into functional layers. One functional layer builds upon functionality provided by another functional layer. Together they provide the telephony application. This grouping is useful for the *understanding* of the functionality involved but does not imply any physical implementation. There are information flows between the functional entities. Information flows may be:

- between functional entities in the same functional layer;
- between a functional entity in one functional layer and a functional entity in the next functional layer upwards; and
- between a functional entity in one functional layer and a functional entity in the next functional layer downwards.

A functional entity may have one or more of these types of information flow.

There are information flows between functional entities in the IP Telephony Application plane and the other functional planes.

Where it can be determined that there is a requirement for a physical interface between entities residing in separate pieces of physical equipment, a reference point will be defined. One reference point may encompass multiple distinctive information flows.

A standardized protocol will be required to support information flows in cases where a reference point is defined.

8.1 Introduction to the functional layers

The TIPHON functional architecture has 5 functional layers: the service functional layer, the service control functional layer, the call control functional layer, the bearer control functional layer and the media functional layer.

These functional layers are shown in figure 8. For simplicity only two functions are shown in each functional layer with all of the possible communication paths within the functional layer and to the adjacent functional layers.

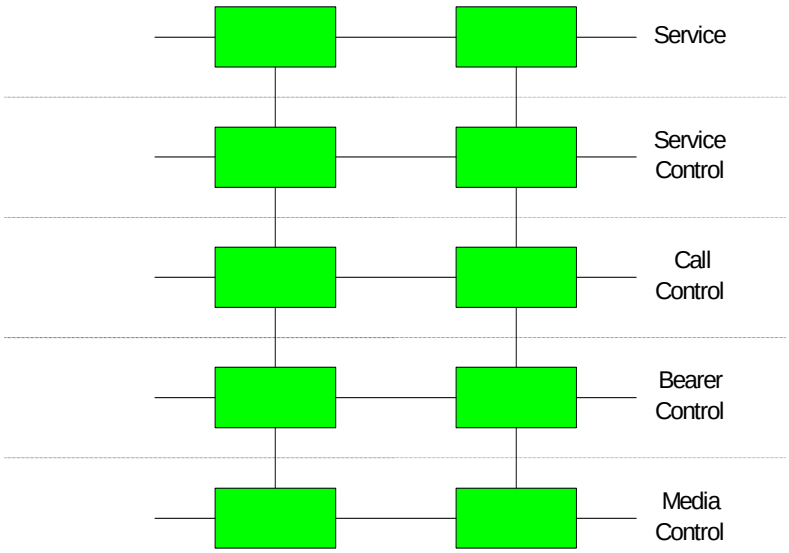


Figure 8: Functional layers in the IP Telephony Application plane

In the subsequent sub-clauses each of the functional layers is introduced.

8.1.1 The services functional layer

The **services functional layer** shall support a range of services (e.g. authentication) provided internally to a service network or functional grouping, or provided by third parties either locally or remotely via other networks or functional groupings.

This functional layer has the following functions.

Service profile function	Provides information required for registration and stores information received during registration. Provides on request information needed for call establishment.

User profile function	Holds information about the user

Route function	Provides address/number translation, number length determination and telephony routing capabilities.

8.1.2 The service control functional layer

The s**ervice control functional layer** shall contain functionality that is needed for the calls but may have a life span longer or shorter than the duration of the call (examples are terminal registration, call routing). The service control functional layer shall provide an interface to functions in the Services functional layer that may be provided internally to a service network, or provided by third parties either locally or remotely via other networks.

This functional layer has the following functions.

Service Control (SC) function	Provides support for calls
• Number portability	Provides a routable user name or address to the called user.
• Called User location	Determines where the called user currently is within the service provider network.
• Name to Name translation	Converts a user name to a routable user name.
• Name to address translation	Provides a routable address associated with the user name.
• Call access authorization	Authorizes a call to proceed.

Registration (terminal part) Function	Registers a user at a terminal with a service provider.

Registration (network part) Function	Accepts registration of a user at a terminal.

8.1.3 The call control functional layer

The **call control functional layer** shall maintain a call context. The call context allows the services offered by the Bearer Control functional layer to provide the connections and capabilities requested by the customer as permitted by the service provider. In order to achieve this control, the Call Control functional layer may request information from the Service Control functional layer. The Call Control functional layer sends and receives signalling to users and networks.

This functional layer has the following functions.

Call Control (CC) Function	Maintains the call state and, if present, provides services that change the call state e.g. call hold, suspend, three way and conferencing. Communication with peer Call Control functions for the establishment and release of calls. Requests services from functions in the Service Control functional layer. Request determination of, allocation of, and release of, resources from Bearer Control functions.

8.1.4 The Bearer Control functional layer

The **Bearer Control functional layer** manages the logical association between pairs of endpoints. Bearer control shall be responsible for mapping call topology to individual media flows (e.g. connect parties a, b and c together). These flows may be between any pair of media processing functions in the media functional layer.

This layer has the following functional functions:

Bearer Control (BC) Function	Allows or disallows media streaming based on information from call control
• Bearer negotiation • Media resource acquisition	Negotiates with other Bearer Control functions. Communicates with the Media Control function to obtain media resources for the bearer.

8.1.5 The Media Control functional layer

The **Media Control functional layer** shall be responsible for the properties of the individual media flows. In this functional layer media encoding is determined, Quality of Service (QoS) paths are reserved and firewalls are controlled in conjunction with the IP Transport plane.

This functional layer has the following functions.

Media Control (MC) functions	Provides IP transport addresses for media reception and transmission.
• Circuit Network Media Termination	Termination of for example: all lower-functional layer circuit network hardware and protocols, including the method by which speech is placed on the wire, e.g. PCM a-law, PCM μ-law, etc.
• Media Processing	Performs signal processing functions such as voice compression, network echo-cancellation, silence suppression, comfort noise generation, encryption, codec translation, fax conversion, media insertion (DTMF, messages) filtering and analogue modem conversion (for passing analogue modem signals "transparently" through the packet network).
• Media Resource Management	Allocates internal resources in the media plane
• Packet Media Termination	Termination of all methods involved in putting media over the packet network. This includes transport protocols and framing.
• IP transport signalling	Reserves QoS paths and controls firewalls in the IP Transport plane.

8.2 Examples

This clause contains some examples describing the entities defined above and their inter-relationship.

8.2.1 Bearer

A bearer is instantiated for the purpose of media communication through co-operation of the Media Control functional layer and the IP Transport plane.

Figure 9 shows how the media control in conjunction with the transport plane provides the call with a bearer (media and transport) and that BC control the properties of the bearer.

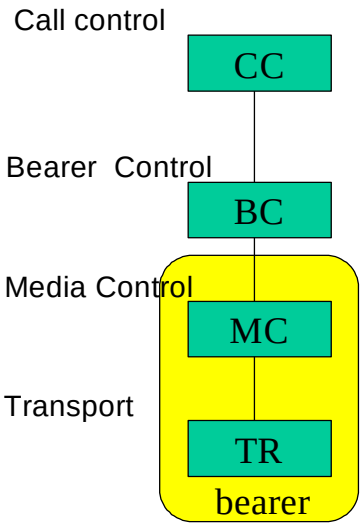
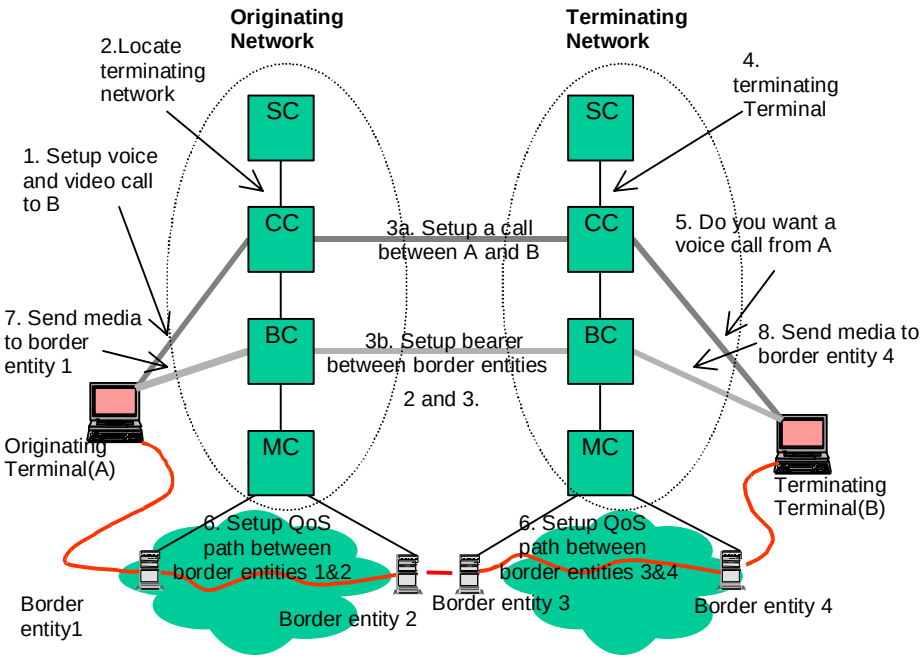


Figure 9: Bearer Control

8.2.2 End to end example

In figure 10 an example is given of the functions of the functional layers. Note that for simplicity the Services functional layer is not shown in figure 10.



NOTE: Steps 3a and 3b may be initiated in parallel, but the completion of bearer establishment may occur prior to establishment of the call.

Figure 10: Example of the functional layers and their communication with the IP Transport plane

The figure 10 shows two terminals and two networks. Each network has its own transport network (the clouds at the bottom). In this example, the user at Originating terminal (A) requests a call to party B. (Note that the functional layers are also present in the terminals but this is not shown in the picture.)

The originating network is asked to set up the call. As a result of the request for routing, the Call Control functional layer in the originating network is instructed to setup the call to the network in which the party B resides. The Call Control functional layers in both networks co-operate to establish this call, each communicating with its Service Control functional layer for authentication and call routing.

The media communication is done through bearers. Within each network the Bearer Control functional layer co-operates with the appropriate terminal to establish the bearer properties. Between the networks the bearer entities communicate the inter-network bearer properties.

The Media Control functional layers in each network allocate the appropriate firewalls/edge routers in the IP Transport plane and establish a QoS channel between them. If media transcoding or other media transformation e.g. echo cancellation is necessary the Media Control functional layer performs it.

8.2.3 Relationship between BC, MC and TR entities

Figure 11 shows how one bearer may be constructed out of multiple concatenated media flows each with its own transport. One Bearer Control entity communicates with multiple entities in the Media Control functional layer. Media flows through each entity in the Media Control functional layer. For each flow the entities in the Media Control functional layer will allocate transport by communicating with the appropriate transport entities.

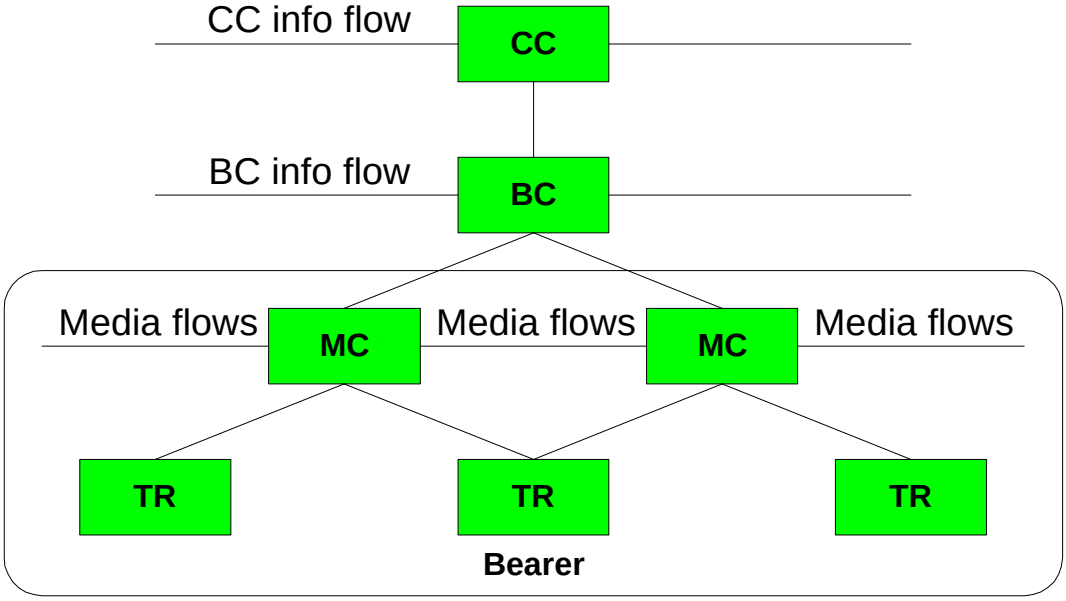


Figure 11: Relationship between BC, MC and TR entities

8.3 Definition of reference points

Reference points are identified for those (groups of) information flows that are to be subject of standardization. The rest of this clause describes the reference points, defines in the IP Telephony Application plane and shows how they can be combined to provide the Telephony Application over IP Networks.

This clause is structured as follows. Clauses 8.3.1 to 8.3.5 provide the registration and call scenarios. The subsequent clauses describe the reference points in more detail.

8.3.1 Registration

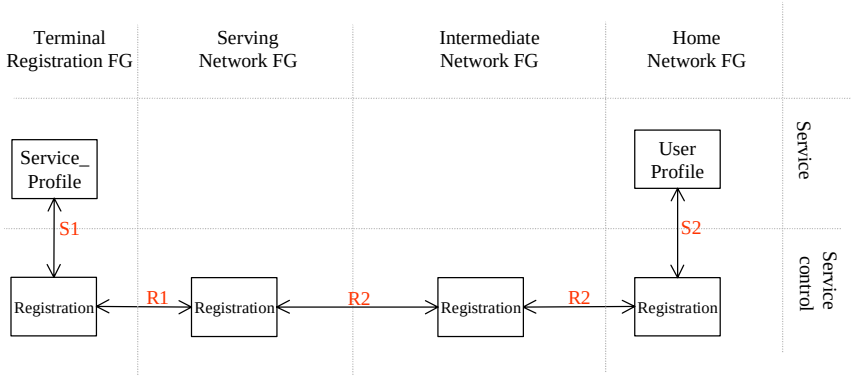
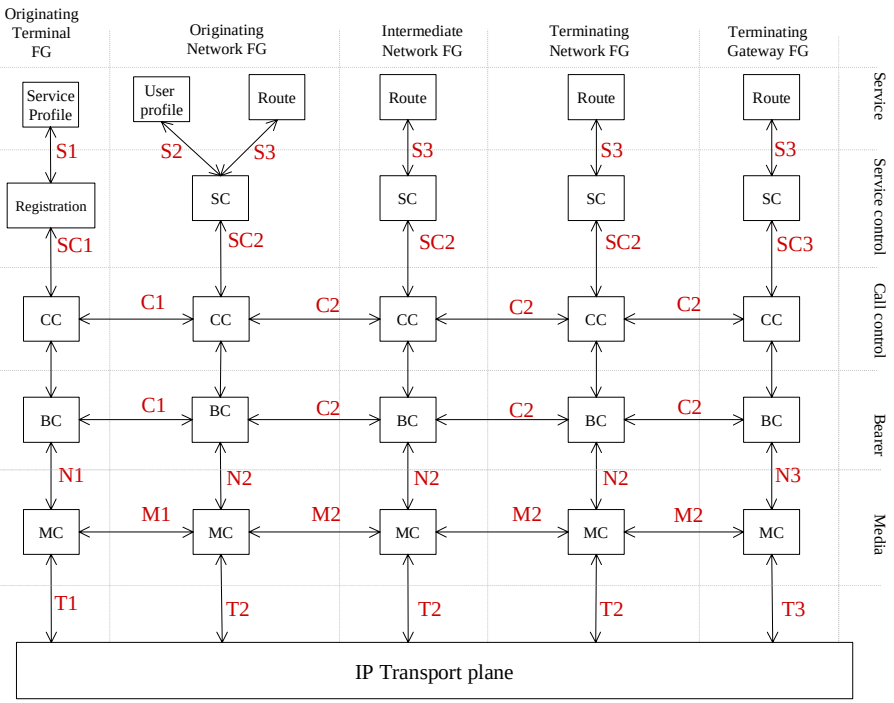


Figure 12: Functions involved during the registration of a user

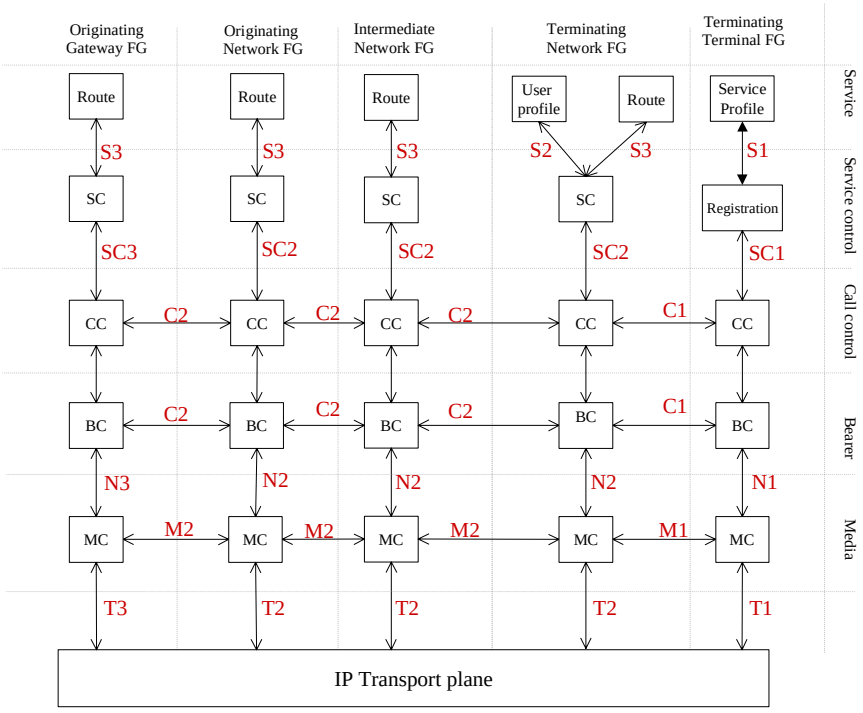
8.3.2 Scenario 1



NOTE: For the simplicity only one Call Control function is showed within each network. However, one network may include more than one call control function with a reference point similar to the C2 reference point.

Figure 13: Reference points for the Scenario 1

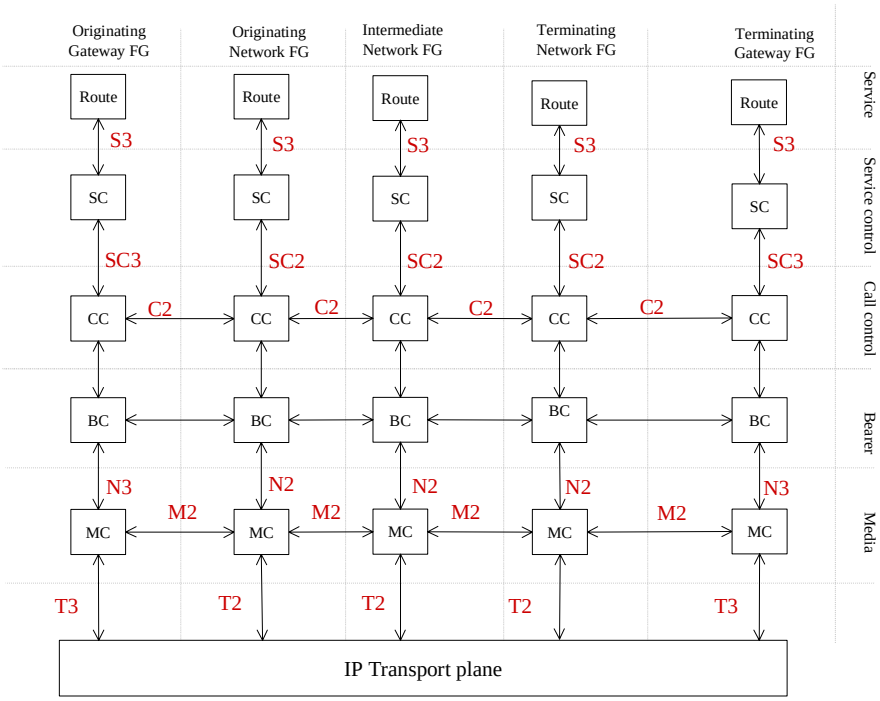
8.3.3 Scenario 2



NOTE: For the simplicity only one Call Control function is showed within each network. However, one network may include more than one call control function with a reference point similar to the C2 reference point.

Figure 14: Reference points for the Scenario 2

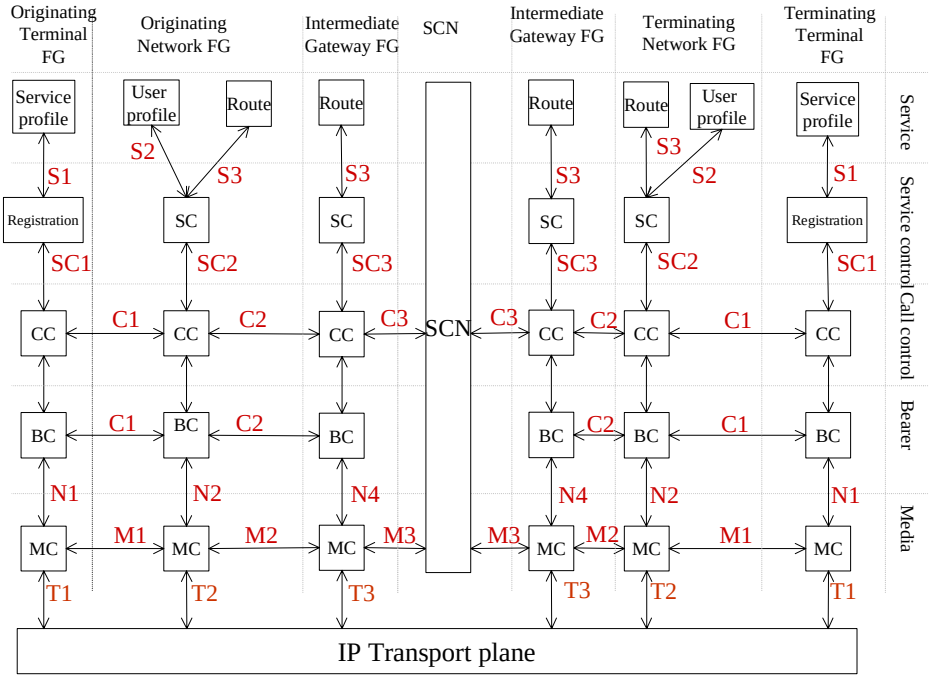
8.3.4 Scenario 3



NOTE: For the simplicity only one Call Control function is showed within each network. However, one network may include more than one call control function with a reference point similar to the C2 reference point.

Figure 15: Reference points for the Scenario 3

8.3.5 Scenario 4



NOTE: For the simplicity only one Call Control function is showed within each network. However, one network may include more than one call control function with a reference point similar to the C2 reference point.

Figure 16: Reference points for the Scenario 4

8.3.6 SC-Service reference points

S1: Information flows at S1 provide the capability to store, retrieve and delete the registration ticket.

S2: Information flows at S2 provide the capability to get and set properties in the User Profile. For the purposes of: User authentication, User authorization, Call routing, User preferences, Allowed services and service options.

S3: Information flows at S3 provide the capability to get call routing information and address translation.

8.3.7 SC-SC reference points

R1: Information flows at R1 provide the capability required for a user to register with the Serving IPTN. They provide the capability to convey user ID, terminal ID, terminal capabilities etc.

R2: Information flows at R2 provide the capability so that networks can exchange user registration and information related to user profile and subscription.

8.3.8 CC-SC reference points

SC1: Information flows at SC1 provide the capability to get a ticket on an existing registration session.

SC2: Information flows at SC2 provide the capability to answer queries to the user profile.

SC3: Information flows at SC3 provide the capability to answer access and routing requests for calls in the context of Network Functional Groupings. Input information may include called address/name, caller, calling domain. Output information may include next-hop address, preferences and constraints for the call parameters.

8.3.9 CC/BC-CC/BC reference points

C1: Information flows at C1 provide the capability to establish, modify and terminate both calls and bearers to and from the terminal.

C2: Information flows at C2 provide the capability to establish, modify and terminate both calls and bearers between non-terminal functional groupings.

C3: Information flows at C3 provide the capability to establish, modify and terminate calls and connections between non-terminal functional groupings using an SCN.

8.3.10 MC-BC reference points

N1: Information flows at N1 provide the capability to request, modify and delete media paths for the creation of a bearer in the context of Terminal Functional Grouping.

N2: Information flows at N2 provide the capability to request, modify and delete media paths for the creation of a bearer and provides the capability to control an insertion of information (e.g. tones and announcements) into media flows in the context of Network Functional Grouping.

N3: Information flows at N3 provide the capability to request, modify and delete media paths for the creation of a bearer in the context of Gateway Functional Grouping.

N4: Information flows at N4 provide the capability to request, modify and delete media paths for the creation of a bearer and provides the capability to control an insertion of information (e.g. tones and announcements) into media flows in the context of Intermediate Gateway Functional Grouping.

8.3.11 MC-MC reference points

M1: Information flows at M1 provide the capability to carry media flows between the terminal and the IPN.

M2: Information flows at M2 provide the capability to carry media flows over the IPN.

M3: Information flows at M3 provide the capability to carry media flows over the SCN.

8.3.12 TR-MC reference points

T1: Information flows at T1 provide the capability to permit, modify and inhibit transport capabilities for the terminal, including Quality of Service, for the creation of a media flow.

T2: Information flows at T2 provide the capability to permit, modify and inhibit transport capabilities for the IPTN, including Quality of Service, for the creation of a media flow.

T3: Information flows at T3 provide the capability to permit, modify and inhibit transport capabilities for the SCN, including Quality of Service, for the creation of a media flow.

9 Basic functional entities information sub-flows

This clause contains the Message Sequence Charts (MSC) and definitions for primitives and their parameters for each reference point.

Annex A contains an overview of functional entities, information flows, the Specification and Description Language (SDL) and functional entity actions from which the MSC diagrams in this clause are derived.

9.1 Introduction

There are request, confirmation, reject, report, and indication primitives defined. The Request primitive shall be used to request a function. The Confirm primitive shall be used to confirm that the Request has been completed. The Reject

primitive shall be used to reject the requested function. The Report primitives may be used to report events while a function is acting on a Request. The Indication primitives are used to report unsolicited events.

9.2 Descriptors

Some of the parameters used in the primitives are grouped. This sub-clause describes these groups.

9.2.1 ServiceClass

The **ServiceClass** represents the TIPHON QoS service class as defined in TS 101 329-2 [7]. It may take the following values: best, high, medium, low.

9.2.2 FlowDescriptor

The **FlowDescriptor** describes a media flow and contains information about the codec, terminal delay and a transport descriptor.

9.2.3 BearerDescriptor

The **BearerDescriptor** combines a **ServiceClass** and a list of **FlowDescriptors** offering multiple ways to achieve that **ServiceClass**.

9.2.4 TransportDescriptor

The **TransportDescriptor** provides all relevant information for the transport of a flow. It contains the following information:

- **maximum gross bit rate;** the maximum bit rate of the CODEC including packetization and framing overhead,
- **delay budget;** the allowed (remaining) delay for the flow,
- **packet rate;** This parameter gives a hint to the transport to arrange the appropriate number of buffers,
- **packet delay variation;** depending on network option either the allowed or achieved variation in the delay (jitter),
- **packet loss;** depending on network option either the allowed or achieved loss of packets in transport,
- **originator transport address,** the sending IP address and port, and
- **destination transport address;** the receiving IP address and port.

9.3 Reference point C1

Information flows at C1 provide the capability to establish, modify and terminate both calls and bearers to or from the terminal. Reference point C1 is placed between a terminal and network functional groupings.

9.3.1 Primitives for Reference point C1

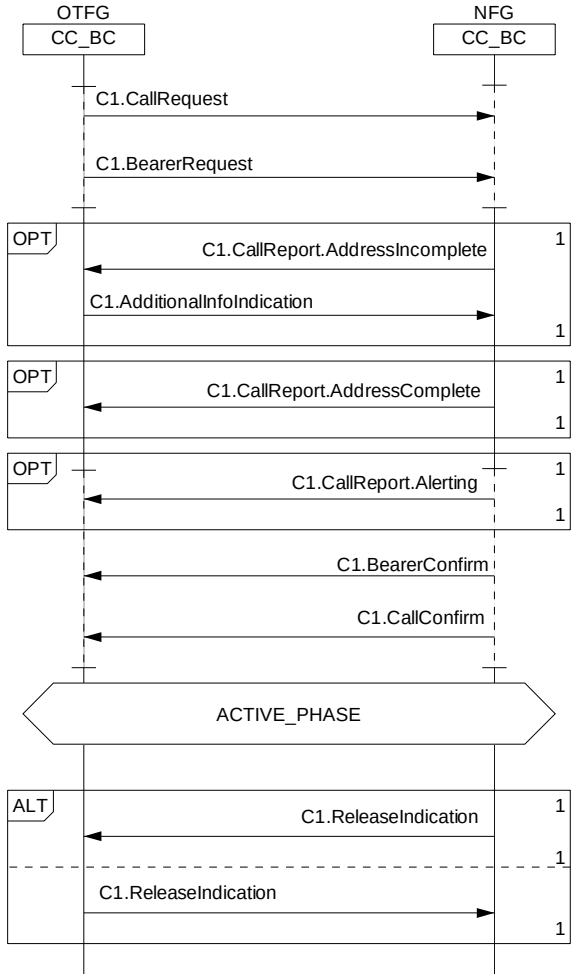
The primitives and their parameters at reference point C1 are defined in the table below.

Table 1: Table of C1 primitives and their parameters

Primitive name	Parameters	Status
C1.AdditionalInfoIndication	CallID Additional called party address information Sending complete indication	M O O
C1.BearerConfirm	CallID bearerID BearerDescriptor for received media BearerDescriptor for send media	M M M M
C1.BearerReject	Call ID Reason	M M
C1.BearerRequest	CallID bearerID BearerDescriptor for received media BearerDescriptor for send media	M M M M
C1.CallConfirm	call ID Ticket	M O
C1.CallReject	call ID reason {Congestion in the network, Called address non-existing or not complete, Requested service not supported, Bearer request missing, Ticket not valid, Caller unauthorized, other}	M M
C1.CallReport. AddressIncomplete	call ID number of digits required	M O (Note 1)
C1.CallReport. AddressComplete	call ID	M
C1.CallReport. Alerting	call ID Ticket	M O
C1.CallRequest	call ID called address Requested Service {audio, video, data, …} ServiceClass caller ID calling number presentation restriction indications Caller location ID Priority bearerID Ticket	M M M O O M O O M O (Note 2)
C1.ReleaseIndication	call ID	M
NOTE 1: The number of digits required parameter is required when the information is available in the SC layer. NOTE 2: The ticket parameter is mandatory in the terminal to network direction.		

9.3.2 Information flows at Reference point C1

The message sequence chart in the figure 17 describes the call setup between an originating terminal and another functional grouping. The primitive C1.BearerConfirm can be sent either along the C1.CallReport.Alerting or C1.CallConfirm.



NOTE: The C1.CallReportAddressIncomplete and the C1.AdditionalInfoIndication may be repeated.

Figure 17: Terminal-originated call flow at C1

The message sequence chart in the figure 18 describes the call setup between a Terminating Network Functional Grouping and a Terminating Terminal Functional Grouping. Please note that the primitive C1.BearerConfirm can be sent either along the C1.CallReport.Alerting or C1.CallConfirm.

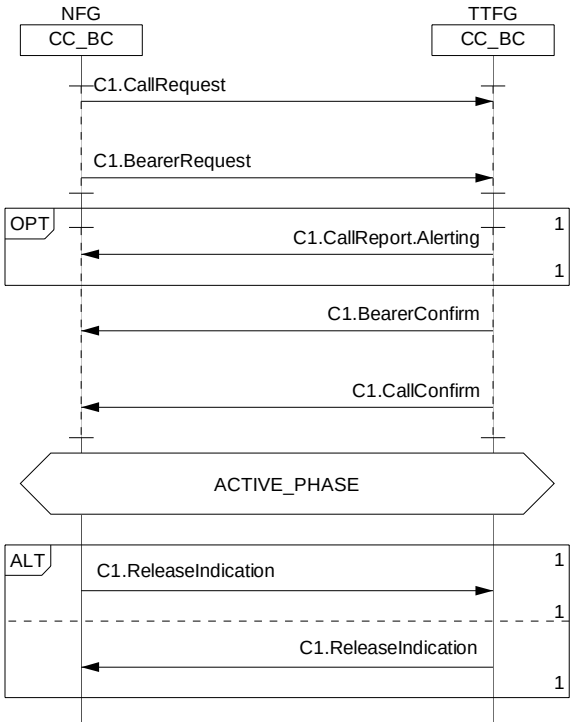


Figure 18: Terminal-terminated call flow at C1

9.4 Reference point C2

Information flows at C2 provide the capability to establish, modify and terminate both calls and bearers between network functional groupings or gateway functional groupings. Reference point C2 is placed between two network functional groupings, between a network functional grouping and a gateway functional grouping, or between two gateway functional groupings.

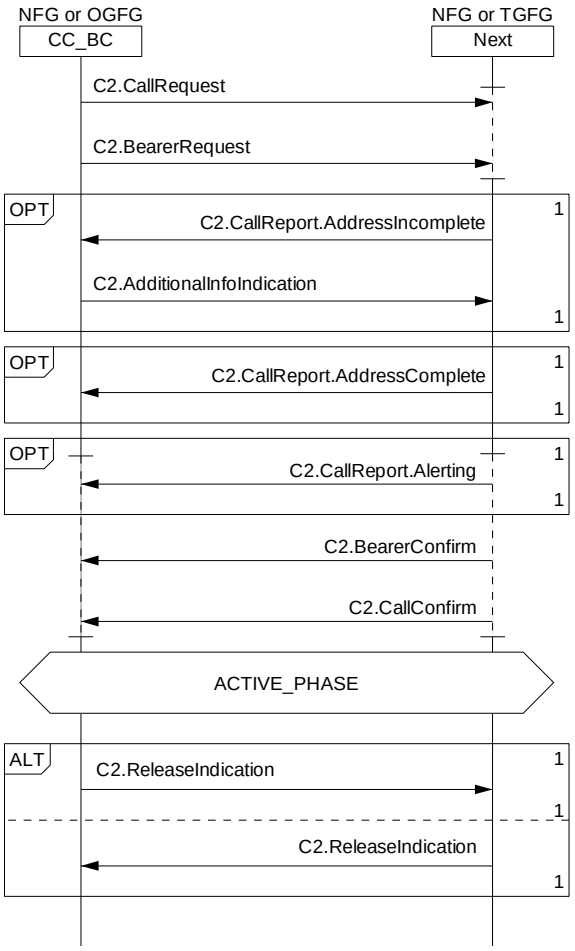
9.4.1 Primitives for Reference point C2

The primitives and their parameters at reference point C2 are defined in the table below.

Table 2: Table of C2 primitives and their parameters

Primitive name	Parameters	Status
C2.AdditionalInformation Indication	CallID Additional called party address information Sending complete indication	M O (Note 1) O (Note 1)
C2.BearerConfirm	CallID bearerID BearerDescriptor for received media BearerDescriptor for send media	M M M M
C2.BearerReject	Call ID Reason terminating domainID, SMPdomainID	M M O
C2.BearerRequest	CallID bearerID BearerDescriptor for received media list of (Address|DomainID)} BearerDecriptor for send media List of (Address|DomainID)}	M M M O M O
C2.CallConfirm	Call ID	M
C2.CallReject	call ID reason{Congestion in the network, Called address non-existing or not complete, Requested service not supported, Bearer request missing, other}	M M
C2.CallReport. AddressIncomplete	Call ID number of digits required	M O (Note 2)
C2.CallReport. AddressComplete	Call ID	M
C2.CallReport. Alerting	Call ID	M
C2.CallRequest	Called address Requested Service {audio, video, data, …} Service Class set of (caller ID, calling number presentation restriction indications type of address) Caller location ID call ID Priority bearerID	M M O M M O O M M O M
C2.ReleaseIndication	call ID	M
NOTE 1: The Additional information indication parameter is mandatory when the Sending complete indication is absent. NOTE 2: The number of digits required parameter is required when the information is available in the SC layer.		

9.4.2 Information flows at Reference point C2



NOTE: The C2.CallReportAddressIncomplete and the C2.AdditionalInfoIndication may be repeated.

Figure 19: Network-network call setup information flow

9.5 Reference point C3

Information flows at C3 provide the capability to establish, modify and terminate both calls and bearers over SCN. Reference point C3 is placed between a Gateway Functional Grouping and a SCN.

9.5.1 Primitives for Reference point C3

The primitives and their parameters at reference point C3 are defined in the table below.

Table 3: Table of C3 primitives and their parameters

Primitive name	Parameters	Status
C3.AdditionalInformation Indication	CallID Additional called party address information Sending complete indication	M O (Note 1) O (Note 1)
C3.CallAndBearerRequest	Called address Requested service {audio, video, data, ..} set of (caller ID, calling number presentation restriction indications type of address) call ID Circuit ID Priority	M M M O O M O (Note 2) O (Note 3)
C3.CallAndBearerConfirm	Call ID Circuit ID	M O (Note 2)
C3.CallReject	Call ID reason {Congestion in the network, Called address non-existing or not complete, Requested service not supported, other}	M M
C3.CallReport. AddressIncomplete	Call ID number of digits required	M O (Note 4)
C3.CallReport. AddressComplete	Call ID	M
C3.CallReport. Alerting	Call ID	M
C3.ReleaseIndication	call ID	M

NOTE 1: The Additional information indication parameter is mandatory when the Sending complete indication is absent from the message.
NOTE 2: The circuit may be assigned either by source or destination.
NOTE 3: Indicates that the call establishment shall be given a special priority, e.g. an emergency call.
NOTE 4: The number of digits required parameter is required when the information is available in the SC layer.

9.5.2 Information flows at Reference point C3

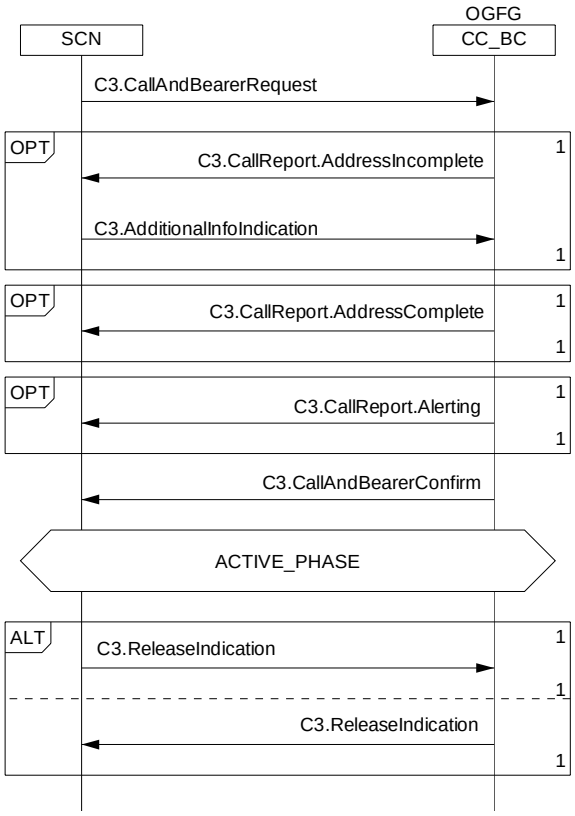


Figure 20: SCN–IPTN call setup information flow

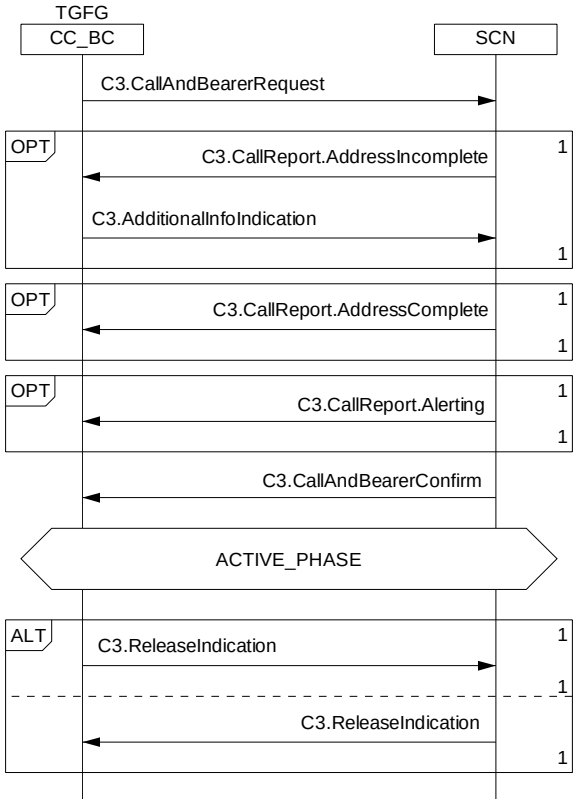


Figure 21: IPTN–SCN call setup information flow

NOTE: The C3.CallReportAddressIncomplete and the C3.AdditionalInfoIndication may be repeated.

9.6 Reference point N1

Information flows at N1 provide the capability to establish, modify and terminate media flows between bearer control and media control within terminal functional grouping. Reference point N1 is placed between two network functional groupings, between a network functional grouping and a gateway functional grouping, or between two gateway functional groupings.

9.6.1 Primitives for Reference point N1

The information flow primitives and their parameters at reference point N1 are defined in the table below.

Table 4: Table of N1 primitives and their parameters

Primitive name	Parameters	Status
N1.MediaEstConfirm	Bearer ID	M
	terminating side	
	FlowDescriptors for received media	O
	FlowDescriptors for send media	O
	Media ID	M
	originating side	
	FlowDescriptors for received media	O
	FlowDescriptors for send media	O
	Media ID	M
N1.MediaEstRequest	terminating side	
	FlowDescriptors for received media	M
	FlowDescriptors for send media	M
	Media ID	M
	originating side	
	FlowDescriptors for received media	M
	FlowDescriptors for send media	M
	Media ID	M
N1.MediaEstReject	Bearer ID	M
	Reason	M
	originating side	
	Media ID	M
	terminating side	
	Media ID	M
N1.MediaActIndication	originating side	
	Media ID	M
	FlowDescriptors for received media	O
	FlowDescriptors for send media	O
	terminating side	
	MediaID	M
	FlowDescriptors for received media	O
	FlowDescriptors for send media	O
N1.MediaReleaseRequest	originating side	
	Media ID	M
	terminating side	
	Media ID	M
N1.MediaReleaseConfirm	Bearer ID	M
	originating side	
	Media ID	M
	terminating side	
	Media ID	M
N1.MediaRsvConfirm	Bearer ID	M
	originating side	
	FlowDescriptors for received media	M
	FlowDescriptors for send media	M
	Media ID	M

Primitive name	Parameters	Status
	terminating side	
	FlowDescriptors for received media	M
	FlowDescriptors for send media	M
	Media ID	M
N1.MediaRsvRequest	Bearer ID	M
	originating side	
	FlowDescriptors for received media	M
	FlowDescriptors for send media	M
	Media ID	M
	terminating side	
	FlowDescriptors for received media	M
	FlowDescriptors for send media	M
	Media ID	M
N1.MediaRsvReject	Bearer ID	M
	Reason {Not enough resource available}	M
	originating side	
	Media ID	M
	terminating side	
	Media ID	M

9.6.2 Information flows at Reference point N1

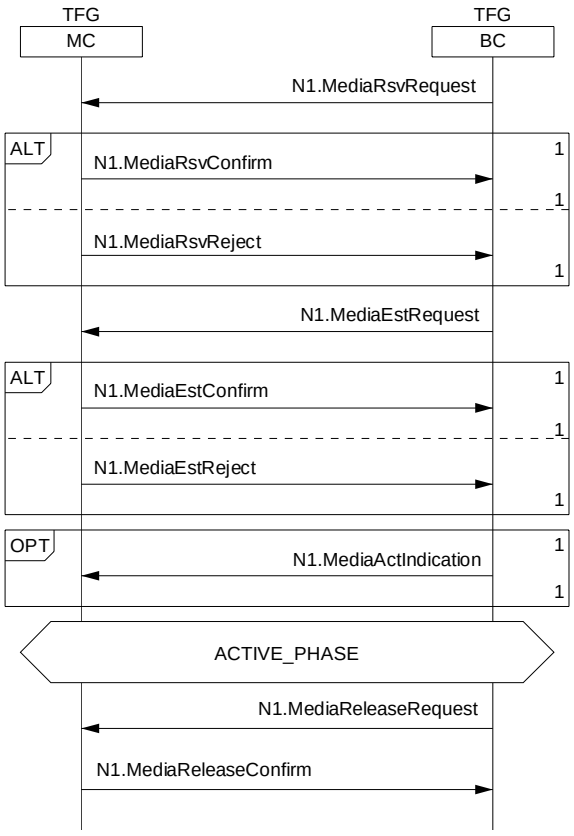


Figure 22: Call setup and call release information flows at N1

9.7 Reference point N2

9.7.1 Primitives for Reference point N2

The information flow primitives and their parameters at reference point N2 are defined in the table below.

Table 5: Table of N2 primitives and their parameters

Primitive name	Parameters	Status
N2.MediaEstConfirm	Bearer ID	M
	terminating side	
	FlowDescriptors for received media	O
	FlowDescriptors for send media	O
	Media ID	M
	originating side	
	FlowDescriptors for received media	O
	FlowDescriptors for send media	O
	Media ID	M
N2.MediaEstRequest	terminating side	
	FlowDescriptors for received media	M
	FlowDescriptors for send media	M
	Media ID	M
	originating side	
	FlowDescriptors for received media	M
	FlowDescriptors for send media	M
	Media ID	M
N2.MediaEstReject	Bearer ID	M
	Reason	M
	originating side	
	Media ID	M
	terminating side	
	Media ID	M
N2.MediaActIndication	originating side	
	Media ID	M
	FlowDescriptors for received media	O
	FlowDescriptors for send media	O
	terminating side	
	Media ID	M
	FlowDescriptors for received media	O
	FlowDescriptors for send media	O
N2.MediaReleaseRequest	originating side	
	Media ID	M
	terminating side	
	Media ID	M
N2.MediaReleaseConfirm	Bearer ID	M
	originating side	
	Media ID	M
	terminating side	
	Media ID	M
N2.MediaRsvConfirm	Bearer ID	M
	terminating side	
	FlowDescriptors for received media	M
	FlowDescriptors for send media	M
	Media ID	M
	originating side	
	FlowDescriptors for received media	M
	FlowDescriptors for send media	M

Primitive name	Parameters	Status
	Media ID	M
N2.MediaRsvRequest	Bearer ID	M
	terminating side	
	FlowDescriptors for received media	M
	FlowDescriptors for send media	M
	Media ID	M
	originating side	
	FlowDescriptors for received media	M
	FlowDescriptors for send media	M
	Media ID	M
N2.MediaRsvReject	Reason {Not enough resource available}	M
	Bearer ID	M
	originating side	
	Media ID	M
	terminating side	
	Media ID	M

9.7.2 Information flows at Reference point N2

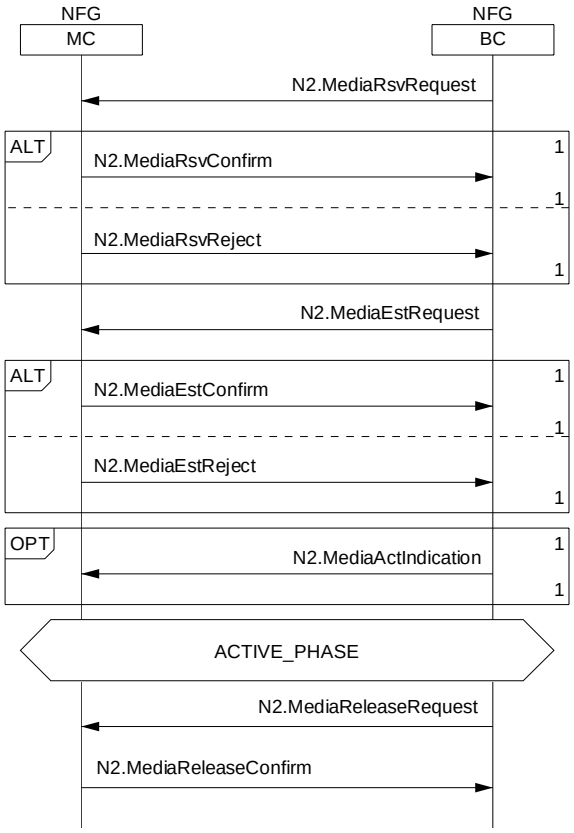


Figure 23: Call setup and call release information flows at N2

9.8 Reference point N3

9.8.1 Primitives for Reference point N3

The information flow primitives and their parameters at reference point N3 are defined in the table below.

Table 6: Table of N3 primitives and their parameters

Primitive name	Parameters	Status
N3.MediaEstConfirm	Bearer ID	M
	terminating side	
	FlowDescriptors for received media	O
	FlowDescriptors for send media	O
	Media ID	M
	originating side	
	FlowDescriptors for received media	O
	FlowDescriptors for send media	O
	Media ID	M
N3.MediaEstRequest	terminating side	
	FlowDescriptors for received media	M
	FlowDescriptors for send media	M
	Media ID	M
	originating side	
	FlowDescriptors for received media	M
	FlowDescriptors for send media	M
	Media ID	M
N3.MediaEstReject	Bearer ID	M
	Reason	M
	originating side	
	Media ID	M
	terminating side	
	Media ID	M
N3.MediaRsvConfirm	Bearer ID	M
	Circuit ID	O
	originating side	M
	FlowDescriptors for received media	M
	FlowDescriptors for send mediacircuitID	M
	Media ID	
	terminating side	
	FlowDescriptors for received media	M
	FlowDescriptors for send mediacircuitID	M
	Media ID	M
N3.MediaRsvRequest	Bearer ID	M
	Circuit ID	O
	originating side	M
	FlowDescriptors for received media	M
	FlowDescriptors for send mediacircuitID	M
	Media ID	
	terminating side	
	FlowDescriptors for received media	M
	FlowDescriptors for send mediacircuitID	M
	Media ID	M
N3.MediaActIndication	originating side	M
	FlowDescriptors for received media	O
	FlowDescriptors for send mediacircuitID	O
	Media ID	M
	terminating side	
	FlowDescriptors for received media	O
	FlowDescriptors for send mediacircuitID	O

Primitive name	Parameters	Status
	Media ID	M
N3.MediaReleaseRequest	originating side Media ID terminating side Media ID	 M M
N3.MediaReleaseConfirm	Bearer ID originating side Media ID terminating side Media ID	M M M
N3.MediaRsvReject	Bearer ID originating side Media ID terminating side Media ID	M M M

9.8.2 Information flows at Reference point N3

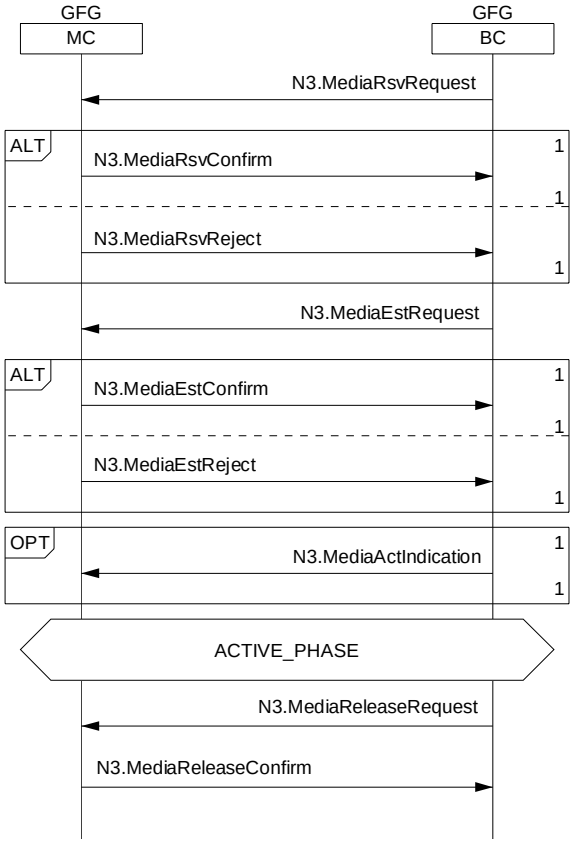


Figure 24: Call setup and call release information flows at N3

9.9 Reference point N4

9.9.1 Primitives for Reference point N4

The information flow primitives and their parameters at reference point N4 are defined in the table below.

Table 7: Table of N4 primitives and their parameters

Primitive name	Parameters	Status
N4.MediaEstConfirm	Bearer ID	M
	terminating side	
	FlowDescriptors for received media	O
	FlowDescriptors for send media	O
	Media ID	M
	originating side	
	FlowDescriptors for received media	O
	FlowDescriptors for send media	O
	Media ID	M
N4.MediaEstRequest	terminating side	
	FlowDescriptors for received media	M
	FlowDescriptors for send media	M
	Media ID	M
	originating side	
	FlowDescriptors for received media	M
	FlowDescriptors for send media	M
	Media ID	M
N4.MediaEstReject	Bearer ID	M
	Reason	M
	originating side	
	Media ID	M
	terminating side	
	Media ID	M
N4.MediaActIndication	originating side	
	Media ID	M
	FlowDescriptors for received media	O
	FlowDescriptors for send media	O
	terminating side	
	Media ID	M
	FlowDescriptors for received media	O
	FlowDescriptors for send media	O
N4.MediaReleaseRequest	originating side	
	Media ID	M
	terminating side	
	Media ID	M
N4.MediaReleaseConfirm	Bearer ID	M
	originating side	
	Media ID	M
	terminating side	
	Media ID	M
N4.MediaRsvConfirm	Bearer ID	M
	terminating side	
	FlowDescriptors for received media	M
	FlowDescriptors for send media	M
	Media ID	M
	originating side	
	FlowDescriptors for received media	M
	FlowDescriptors for send media	M
	Media ID	M
N4.MediaRsvRequest	Bearer ID	M
	terminating side	
	FlowDescriptors for received media	M
	FlowDescriptors for send media	M
	Media ID	M

Primitive name	Parameters	Status
	originating side FlowDescriptors for received media FlowDescriptors for send media Media ID	 M M M
N4.MediaRsvReject	Reason {Not enough resource available} Bearer ID originating side Media ID terminating side Media ID	M M M M

9.9.2 Information flows at Reference point N4

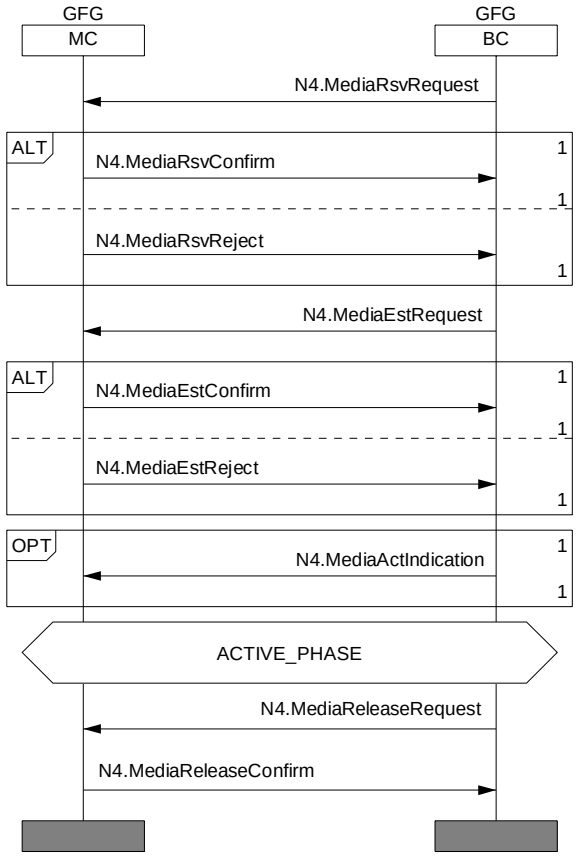


Figure 25: Call setup and call release information flows at N4

9.10 Reference point M1

The information flow at this reference point comprises one-way or two-way media flows and their associated statistics.

9.11 Reference point M2

The information flow at this reference point comprises one-way or two-way media flows and their associated statistics.

9.12 Reference point M3

The information flow at this reference point comprises one-way or two-way media flows and their associated statistics.

9.13 Reference point T1

9.13.1 Primitives for Reference point T1

The information flow primitives and their parameters at reference point T1 are defined in the table below.

Table 8: Table of T1 primitives and their parameters

Primitive name	Parameters	Status
T1.TransportEstConfirm	Receiving TransportDescriptor transportID Sending TransportDescriptor transport ID	M M M M
T1.TransportEstReject	transportID Reason	M M
T1.TransportEstRequest	Receiving TransportDescriptor transportID Sending TransportDescriptor transportID	M M M M
T1.TransporActIndication	Receiving transportID Sending transportID	M M
T1.TransportReleaseRequest	receiving transportID sending transportID	M M
T1.TransportReleaseConfirm	receiving transportID, statistics sending transportID statistics	 M O M O
T1.TransportRsvConfirm	MediaID Sending TransportDescriptors transportID Receiving TransportDescriptors transportID	M M M M M
T1.TransportRsvReject	MediaID TransportDescriptor Reason {Not enough resources available, other}	M M M
T1.TransportRsvRequest	MediaID Sending TransportDescriptor Receiving TransportDescriptor	M M M

9.13.2 Information flows at Reference point T1

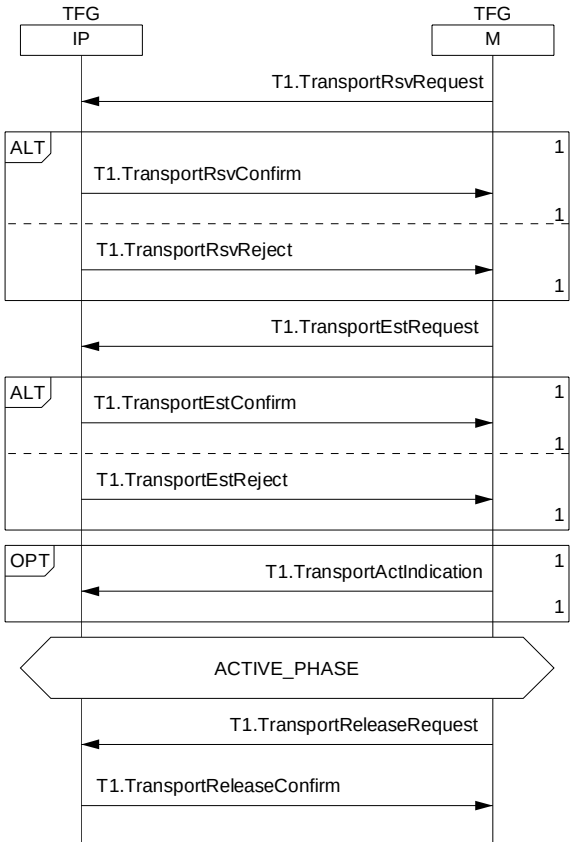


Figure 26: Call setup and call termination at T1

9.14 Reference point T2

9.14.1 Primitives for Reference point T2

The information flow primitives and their parameters at reference point T2 are defined in the table below.

Table 9: Table of T2 primitives and their parameters

Primitive name	Parameters	Status
T2.TransportEstConfirm	originating side	
	ReceivingTransportDescriptor	M
	transportID	M
	Sending TransportDescriptor	M
	transport ID	M
	terminating side	
	ReceivingTransportDescriptor	M
	transportID	M
	Sending TransportDescriptor	M
	transport ID	M
T2.TransportEstReject	transport ID	M
T2.TransportEstRequest	originating side	
	ReceivingTransportDescriptor	M
	transportID	M
	Sending TransportDescriptor	M
	transport ID	M
	terminating side	
	ReceivingTransportDescriptor	M

Primitive name	Parameters	Status
	transportID	M
	Sending TransportDescriptor	M
	transport ID	M
T2.TransportActindication	Originating side	
	Receiving transport ID	M
	Sending transport ID	M
	Terminating side	
	Receiving transport ID	M
	Sending transport ID	M
T2.TransportReleaseRequest	originating side	
	receiving transportID	M
	sending transportID	M
	terminating side	
	receiving transportID	M
	sending transportID	M
T2.TransportReleaseConfirm	originating side	
	receiving	
	transportID,	M
	statistics	O
	sending	
	transportID	M
	statistics	O
	terminating side	
	receiving	
	transportID,	M
	statistics	O
	sending	
	transportID	M
	statistics	O
T2.TransportRsvConfirm	Originating side	
	MediaID	M
	Sending TransportDescriptors	M
	transportID	M
	Receiving TransportDescriptors	M
	transportID	M
	Terminating side	
	MediaID	M
	Sending TransportDescriptors	M
	transportID	M
	Receiving TransportDescriptors	M
	transportID	M
T2.TransportRsvReject		
	originating side	
	Media ID	M
	ReceivingTransportDescriptor	M
	transportID	M
	Sending TransportDescriptor	M
	transport ID	M
	terminating side	
	Media ID	M
	ReceivingTransportDescriptor	M
	transportID	M
	Sending TransportDescriptor	M
	transport ID	M
T2.TransportRsvRequest		
	originating side	
	Media ID	M
	ReceivingTransportDescriptor	M
	transportID	M
	Sending TransportDescriptor	M
	transport ID	M

Primitive name	Parameters	Status
	terminating side Media ID ReceivingTransportDescriptor transportID Sending TransportDescriptor transport ID	 M M M M M

9.14.2 Information flows at Reference point T2

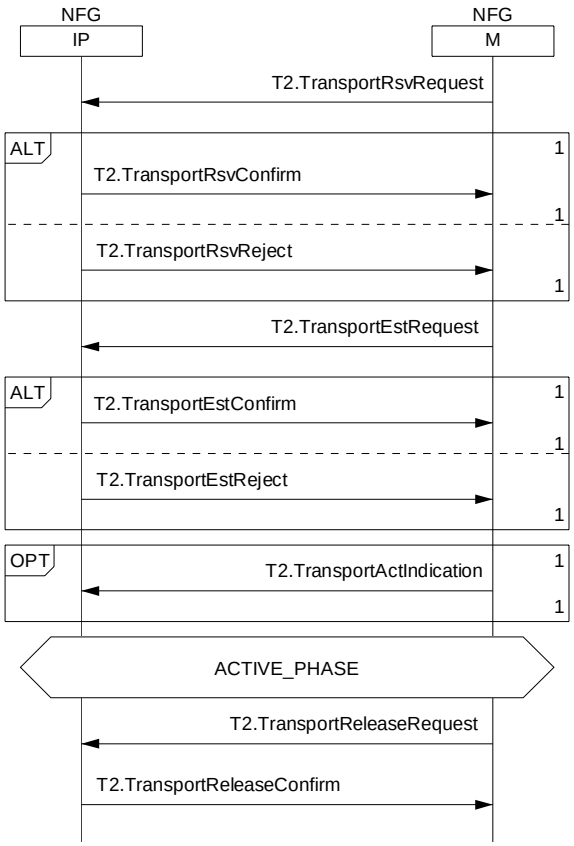


Figure 27: Call setup and call termination at T2

9.15 Reference point T3

9.15.1 Primitives for Reference point T3

The information flow primitives and their parameters at reference point T3 are defined in the table below.

Table 10: Table of T3 primitives and their parameters

Primitive name	Parameters	Status
T3.TransportEstConfirm	ReceivingTransportDescriptor transportID Sending TransportDescriptor transport ID	M M M M
T3.TransportEstReject	transportID	M
T3.TransportEstRequest	Receiving TransportDescriptor transportID Sending TransportDescriptor transportID	M M M M
T3.TransporActtIndication	Receiving transportID Sending transportID	M M
T3.TransportReleaseRequest	receiving transportID sending transportID	M M
T3.TransportReleaseConfirm	receiving transportID, statistics sending transportID statistics	 M O M O
T3.TransportRsvConfirm	MediaID Sending TransportDescriptors Transport ID Receiving TransportDescriptors Transport ID	M M M M M
T3.TransportRsvReject	MediaID TransportDescriptor	M O
T3.TransportRsvRequest	MediaID Sending TransportDescriptor Receiving TransportDescriptor	M M M

9.15.2 Information flows at Reference point T3

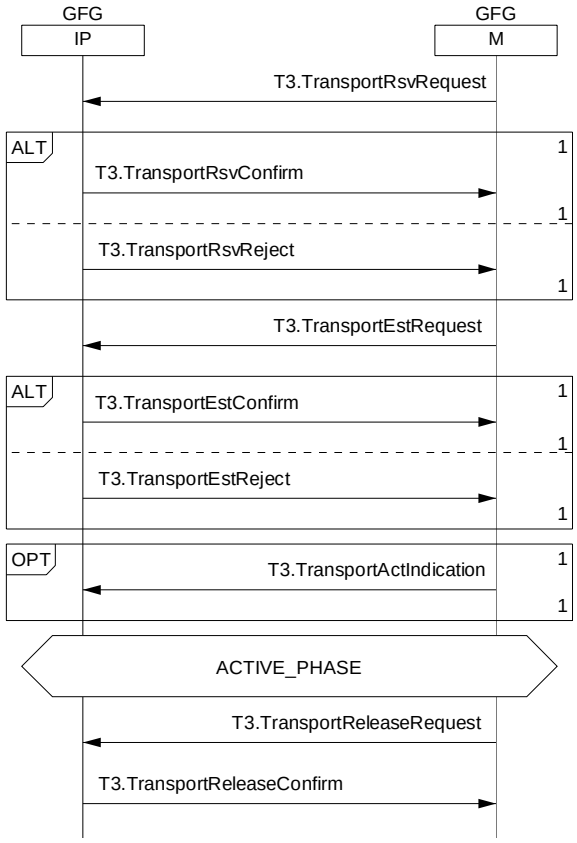


Figure 28: Call setup and call termination at T3

9.16 Reference point SC1

9.16.1 Primitives for Reference point SC1

Table 11: Table of SC1 primitives and their parameters

Primitive name	Parameters	Status
SC1.O_ServiceRequest	Requested Service{audio, video, fax, data, other}	M
SC1.O_ServiceConfirm	UserID Ticket ServiceProvider Address Service Details {QoS class, etc}	M M M M
SC1.O_ServiceReject	Reason { No valid ticket for the service(s), other}	M
SC1.T-ServiceReject	Reason {No valid ticket for the service(s), other}	M
SC1.T-ServiceRequest	Requested Service{audio, video, fax, data, other} Calling party address (Address, Screening, etc) Called party address (Address, Screening, etc)	M M (Note) M
SC1.T-ServiceConfirm	UserID Ticket ServiceProvider Address Service Details {QoS class, etc}	M M M M
SC1.T-ServiceReject	Reason {No valid ticket for this service, other}	M
NOTE: The parameter is mandatory, however, it may contain null information, e.g., when presentation is not allowed.		

9.16.2 Information flows at Reference point SC1

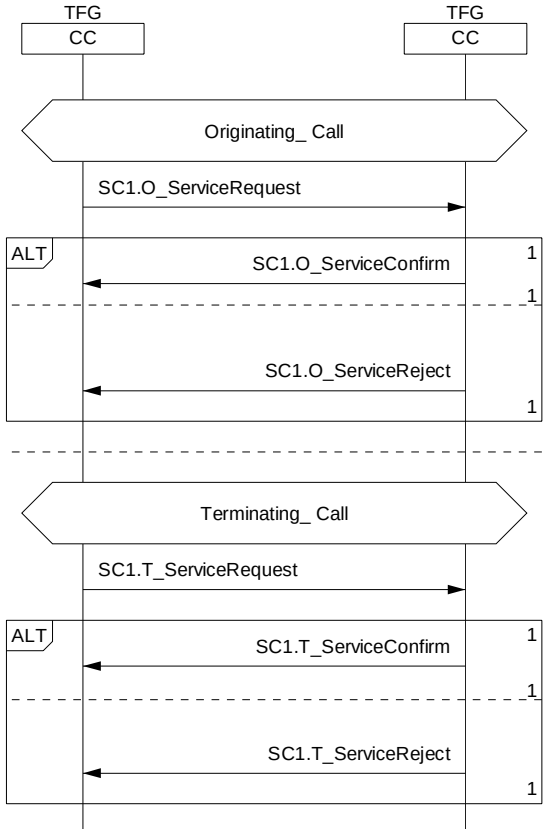


Figure 29: Information flows at Reference point SC1

9.17 Reference point SC2

9.17.1 Primitives for Reference point SC2

The information flow primitives and their parameters at reference point SC2 are defined in the table below.

Table 12:Table of SC2 primitives and their parameters

Primitive name	Parameters	Status
SC2.AccessAndRoutingConfirm	service class, Resource capability limit Allowed service {audio, video, data, other} calling number presentation restriction indications route info, destinations call ID	M O M M M M M
SC2.AccessAndRoutingReject	call ID reason {Number incomplete, other} Number of digits needed	M M O (Note) 1
SC2.AccessAndRoutingRequest	called address caller ID (normally includes an E.164 [1] /Private Numbering Plan [2] and [3] style number) calling number presentation restriction indications call ID service Class Requested service {audio, video, data, other} Resource capability limit Priority Ticket	M M M M M M O O (Note 2) O
NOTE 1: Only sent when the information is available. NOTE 2: Indicates that the call establishment shall be given a special priority, e.g. an emergency call.		

9.17.2 Information flows at Reference point SC2

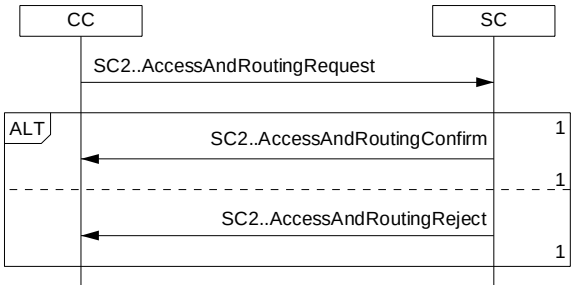


Figure 30: Information flows at Reference point SC2

9.18 Reference point SC3

9.18.1 Primitives for Reference point SC3

The information flow primitives and their parameters at reference point SC3 are defined in the table below.

Table 13: Table of SC3 primitives and their parameters

Primitive name	Parameters	Status
SC3.AccessAndRouting Confirm	call ID Allowed service {audio, video, data, other} calling number presentation restriction indications route info, destinations called address	M M O M M O (Note 1)
SC3.AccessAndRouting Reject	call ID reason {Number incomplete, other}	M M
SC3.AccessAndRouting Request	called address Requested service {audio, video, data, other} caller ID (normally includes an E.164 [1] /Private Numbering Plan [2] and [3] style number) calling number presentation restriction indications call ID service Class Resource capability limit Priority	M M M M M O O O (Note 2)
NOTE 1: Only sent when the called Address is modified. NOTE 2: Indicates that the call establishment shall be given a special priority, e.g. an emergency call.		

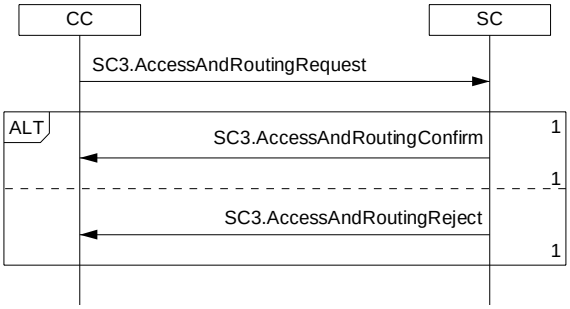


Figure 31: Information flows at Reference point SC3

9.19 Reference point S1

Information flows S1 provide the capabilities to authorize and authenticate incoming or outgoing service or call requests by terminal functional groupings.

9.19.1 Primitives for Reference point S1

Table 13A: Table of S1 primitives and their parameters

Primitive name	Parameters	Status
S1.UserInfoRequest	List of Requested services{audio, video, fax, data, other}	M
S1.UserInfoConfirm	List of (Allowed services{audio, video, fax, data, other} UserID ServiceProviderID)	M M M
S1.RegistrationIndication	List of (Allowed services{audio, video, data, other} Ticket ServiceProviderAddress UserID Registration ID)	M O M M M
S1.DeregistrationIndication	List of (Allowed services {audio, video, data, other} Registration ID)	M M
S1.O-ServiceRequest	Requested Service{audio, video, fax, data, other}	M
S1.O-ServiceConfirm	UserID Ticket ServiceProvider Address Service Details {QoS class, etc}	M O M M
S1O-ServiceReject	Reason {No valid ticket for this service, other}	M
S1.T-ServiceRequest	Requested Service{audio, video, fax, data, other} Calling party address (Address, Screening, etc) Called party address (Address, Screening, etc)	M M (Note) M
S1.T-ServiceConfirm	UserID Ticket ServiceProvider Address Service Details {QoS class, etc}	M O M M
S1T-ServiceReject	Reason {No valid ticket for this service, other}	M
NOTE: The parameter is mandatory however it may contain null information e.g. when presentation is not allowed.		

9.19.2 Information flows at Reference point S1

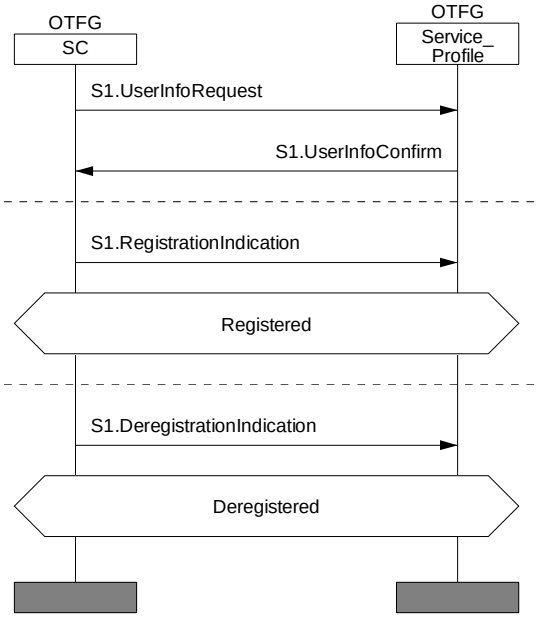


Figure 32: Registration information flows at Reference point S1

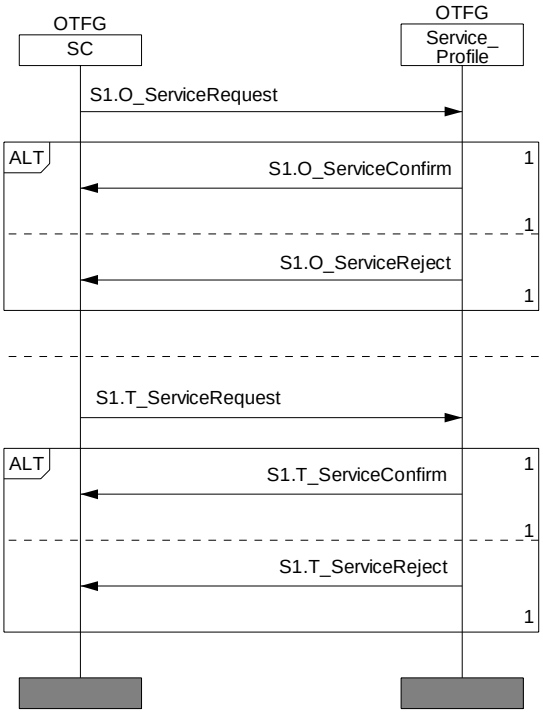


Figure 33: Call-related information flows at Reference point S1

9.20 Reference point S2

Information flows S2 provide the capabilities apply user-specific services, routing or access limits on the network functional grouping.

9.20.1 Primitives for Reference point S2

The information flow primitives and their parameters at reference point S2 are defined in the table below.

Table 14: Table of S2 primitives and their parameters

Primitive name	Parameters	Status
S2.UserRoutingConfirm	callID	M
	routing info	O
	destinations	O
	service	O
	service class	O
	resource capability limit	O
	Priority	M
	Presentation number & restrictions	O
S2.UserRoutingReject	callID	M
	reason	M
S2.UserRoutingRequest	callID	M
	caller ID (normally includes an E.164 [1] /Private Numbering Plan [2] and [3] style number)	O
	calling number presentation restriction indications	O (Note)
	called address	M
	service	O
	service class	O
	resource capability limit	O
	Priority	M
	Ticket	O
NOTE: The calling number presentation restriction indications parameter is mandatory when the caller ID parameter is present.		

9.20.2 Information flows at Reference point S2

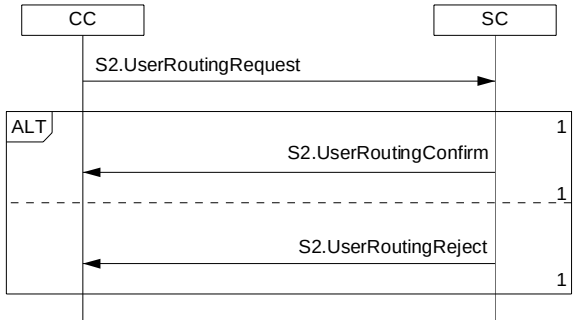


Figure 34: Information flows at Reference point S2

9.21 Reference point S3

Information flows S3 provides the capabilities for non-user-specific call access control and routing.

9.21.1 Primitives for Reference point S3

The information flow primitives and their parameters at reference point S3 are defined in the table below.

Table 15: Table of S3 primitives and their parameters

Primitive name	Parameters	Status
S3.ValidateRoutingConfirm	call ID Routing information (address where to route the call)	M M
S3.ValidateRoutingReject	call ID reason {Address incomplete, other}}	M M
S3.ValidateRoutingRequest	called address service (e.g. voice 3,1 kHz audio) caller ID (normally includes an E.164 [1] /Private Numbering Plan [2] and [3] style number) calling number presentation restriction indications call ID Priority	M M M M M M O (Note 1)
S3.AccessRoutingConfirm	call ID Routing information (address where to route the call)	M M
S3.AccessRoutingRequest	called address service (e.g. voice 3,1 kHz audio) caller ID (normally includes an E.164 [1] /Private Numbering Plan [2] and [3] style number) calling number presentation restriction indications call ID Priority	M M O O (Note 2)
S3.AccessRoutingReject	call ID reason {Address incomplete, other}}	M M
NOTE 1: The calling number presentation restriction indications is mandatory when the caller ID is present. NOTE 2: Indicates that the call establishment shall be given a special priority, e.g. an emergency call.		

9.21.2 Information flows at Reference point S3

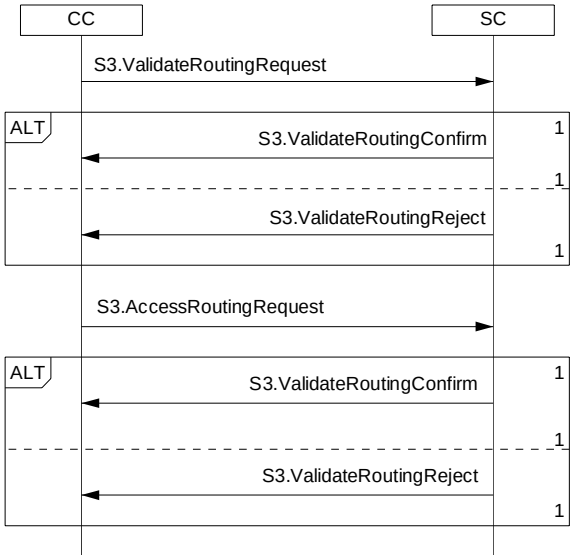


Figure 35: Information flows at Reference point S3

9.22 Reference point R1

9.22.1 Primitives for Reference point R1

Table 16: Table of R1 primitives and their parameters

Primitive	Parameter	Status
R1.RegistrationConfirm	UserID List of Service address [Allowed Service{audio, video, fax, data, other}] Ticket	M O (Note 1,2) M
R1.RegistrationReject	UserID reason{Unknown user, Already registered elsewhere, other}	M M
R1.RegistrationRequest	User ID Requested service(s) {audio, video, fax, data, other} Terminal ID Terminal details{ID, type of terminal, other details}	M O (Note 1,2) O O
R1.DeregistrationConfirm	UserID	M
R1.DeregistrationReject	UserID Reason {Not registered, other}	M M
R1.DeregistrationReport	UserID	M
R1.DeregistrationRequest	UserID	M
NOTE 1: Optional when the User profile function and the SC function (where the Terminal network registers) reside in the same service provider network. NOTE 2: Details about supplementary services and their status is out of scope of the present document.		

9.22.2 Information flows at Reference point R1

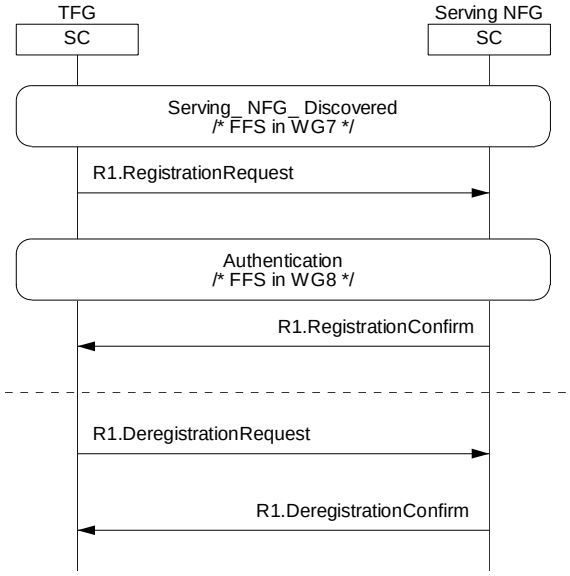


Figure 36: Information flows at Reference point R1

9.23 Reference point R2

9.23.1 Primitives for Reference point R2

Table 17: Table of R2 primitives and their parameters

Primitive	Parameter	Status
R2.UserRegistrationConfirmation	UserID List of Service address [Allowed Service{audio, video, fax, data, other}] Allowed Service(s) {audio, video, fax, data, other} Service Class number presentation restrictions Ticket	M O (Note 1,2) O (Note 2) O O O
R2.UserRegistrationReject	UserID Reason {Unknown user, Already registered elsewhere, other} terminalID {ID, type of terminal, other details}	M M O O
R2.UserRegistrationRequest	UserID Terminal ID Terminal details{ID, type of terminal, other details} User location details Requested service(s) {audio, video, fax, data, other} Address of Home Service ID User location details	M O (Note 3) O (Note 3) O O (Note 1) O (Note 4) O (Note 5)
R2.UserDeregistrationConfirm	UserID User location details	M O (Note 5)
R2.UserDeregistrationReject	UserID Reason {Not registered, other} User location details	M M O (Note 5)
R2.UserDeregistrationReport	UserID User location details Statistics	M O (Note 5) O
R2.UserDeregistrationRequest	UserID User location details	M O (Note 5)

NOTE 1: Requested Service(s)/Allowed Service(s) is mandatory when a subset of subscribed services is requested. The User profile function shall screen the Requested Service(s) parameter and only return the allowed service(s).
NOTE 2: Details about supplementary services and their status is out of scope of the present document.
NOTE 3: Mandatory when the user may register from more than one terminal at the same time.
NOTE 4: Optional when the User profile function and the SC function (where the Terminal network registers) resides in the same service provider network.
NOTE 5: The sending service provider network may provide (local) details only understandable by the sender. Those details shall always be provided in all communication between the network where the User profile resides and the sending Services provider network.

9.23.2 Information flows at Reference point R2

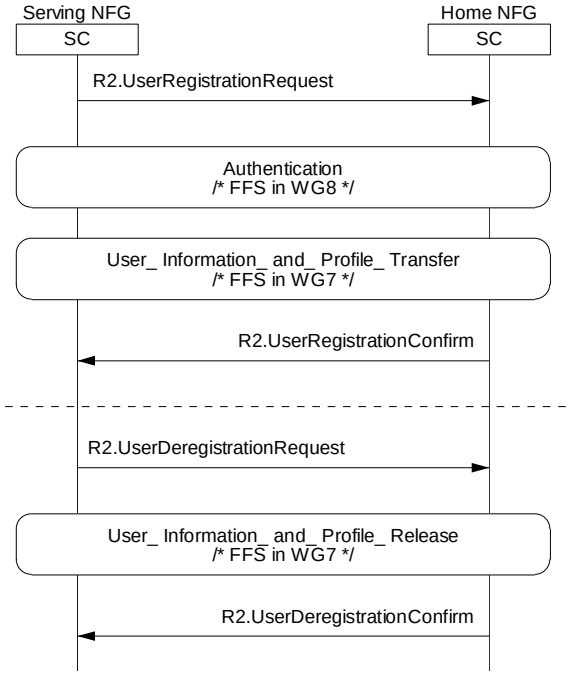


Figure 37: Information flows at Reference point R2

Annex A (normative): Overview of functional entities and information flows

The Message Sequence Charts (MSCs) show information flows between functions required for registration and normal call within and between functional layers in the IP Telephony Application plane. The information flows also show communication with the IP Transport plane and the SCN plane.

In the event of incompatibility between the SDL diagrams and the message sequence charts the SDL shall take precedence.

A.1 Registration

Figure A.1 shows the information flow when a user registers to a Serving Network functional grouping. The location information is forwarded to the Home Network functional grouping using the SC2.UserRegistrationRequest primitive.

Actions in the figure A.1 are described below.

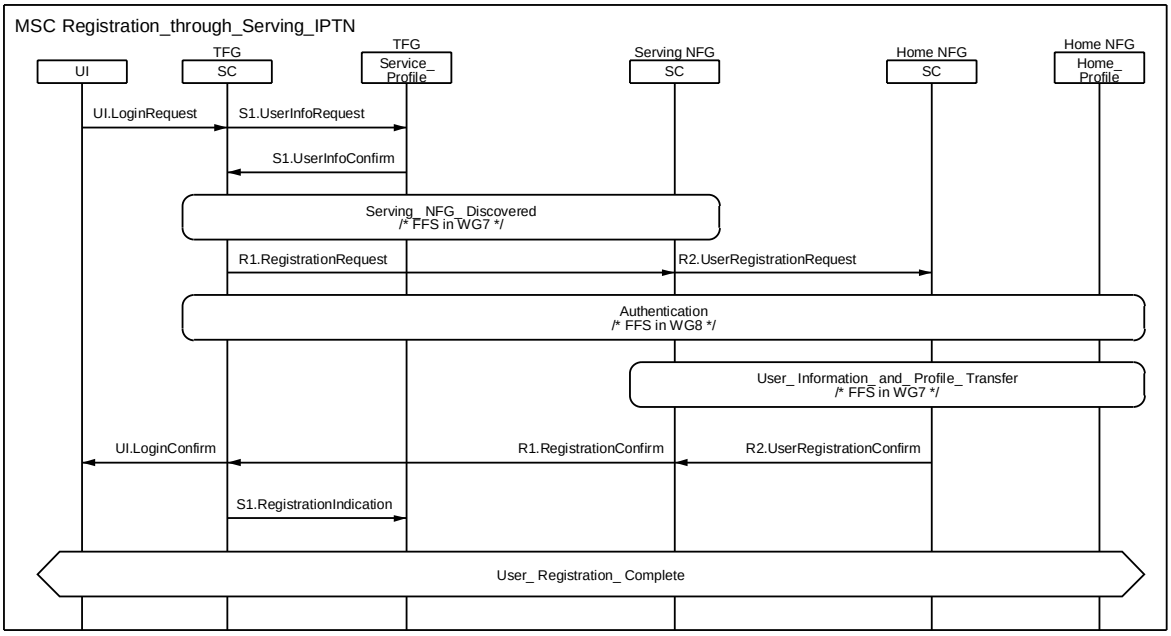


Figure A.1: Information flows during the registration.

Figure A.2: Information flows during the deregistration

A.1.1 Service functional layer

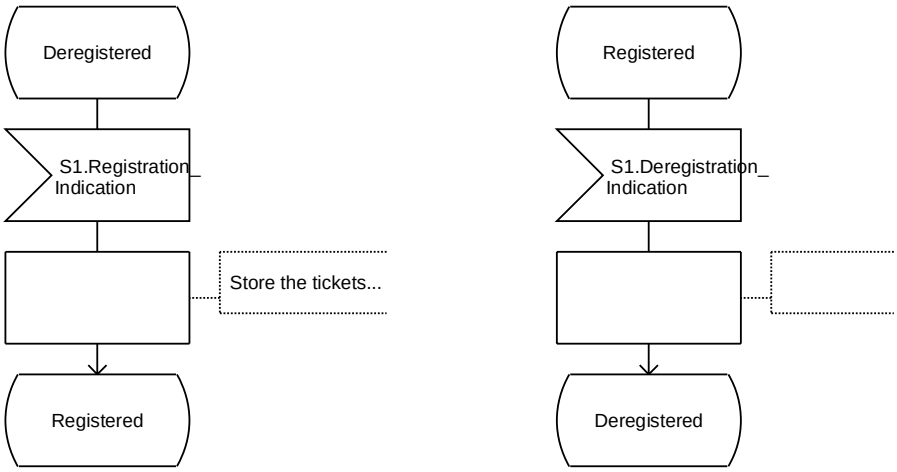


Figure A.3: Storing tickets in the Service Profile in a terminal FG

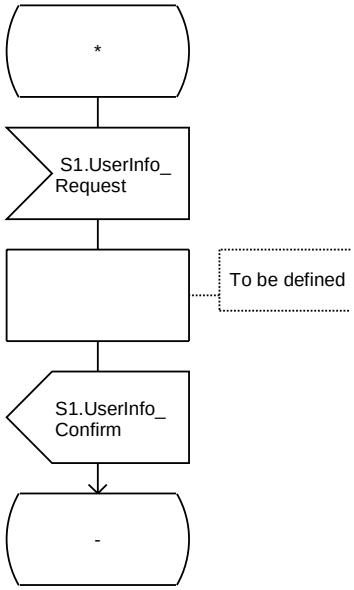


Figure A.4: User info request in a terminal FG

A.1.2 Service Control functional layer

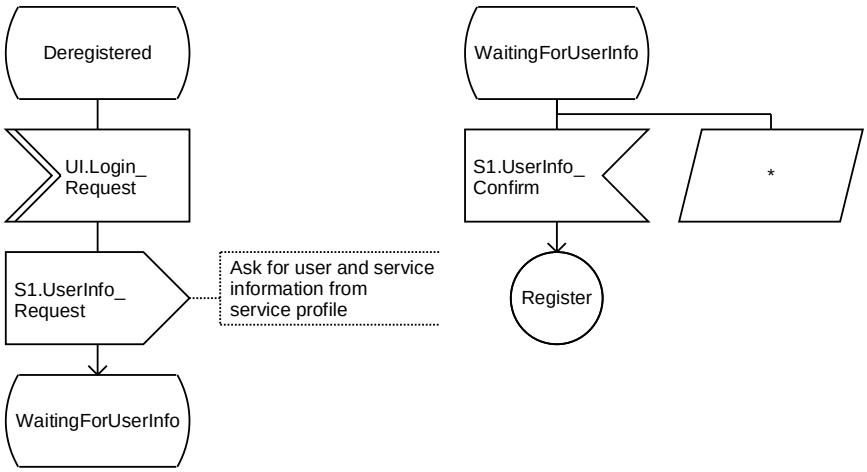


Figure A.5: Terminal FG registration, part 1

NOTE: Actions in the terminal functional grouping is beyond the scope of the present document. However, it can be assumed that the Registration function within the Service Control functional layer informs the user regarding the progress of the registration/deregistration process by means of applicable indications. For example, the SC layer can ask user profile for user information, as shown in figure A.5 above.

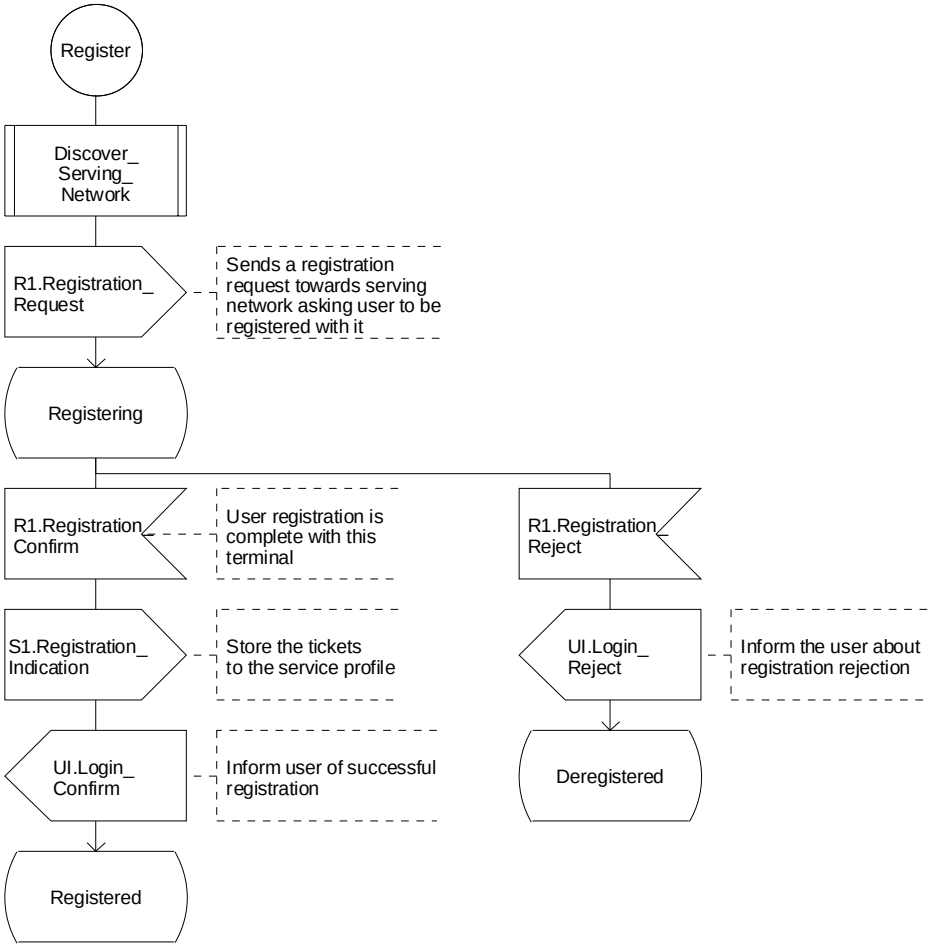


Figure A.6: Terminal FG registration

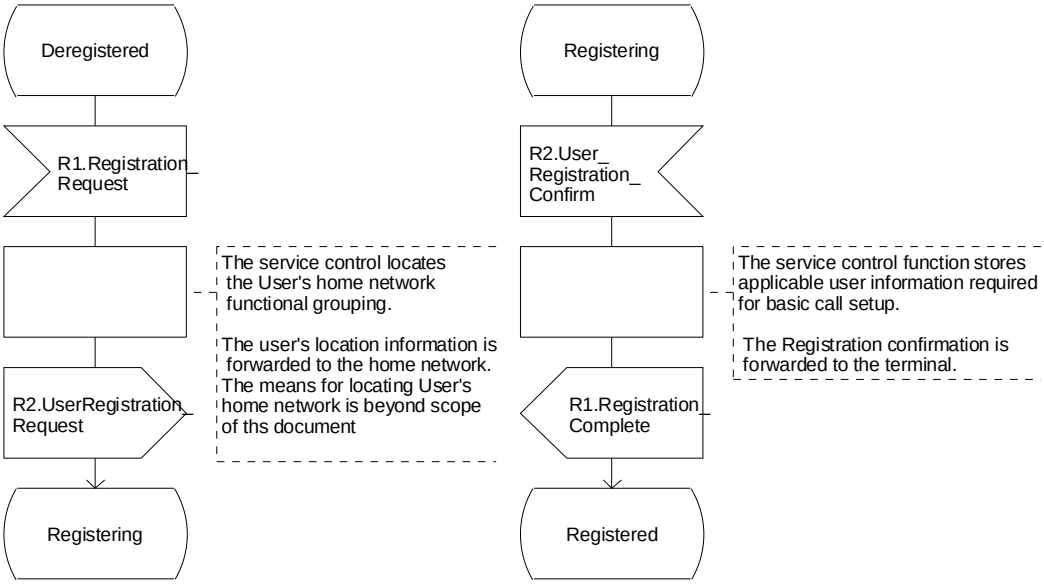


Figure A.7: Serving or Intermediate Network FG registration

NOTE: The means for locating the home network functional grouping is out of scope of the present document.

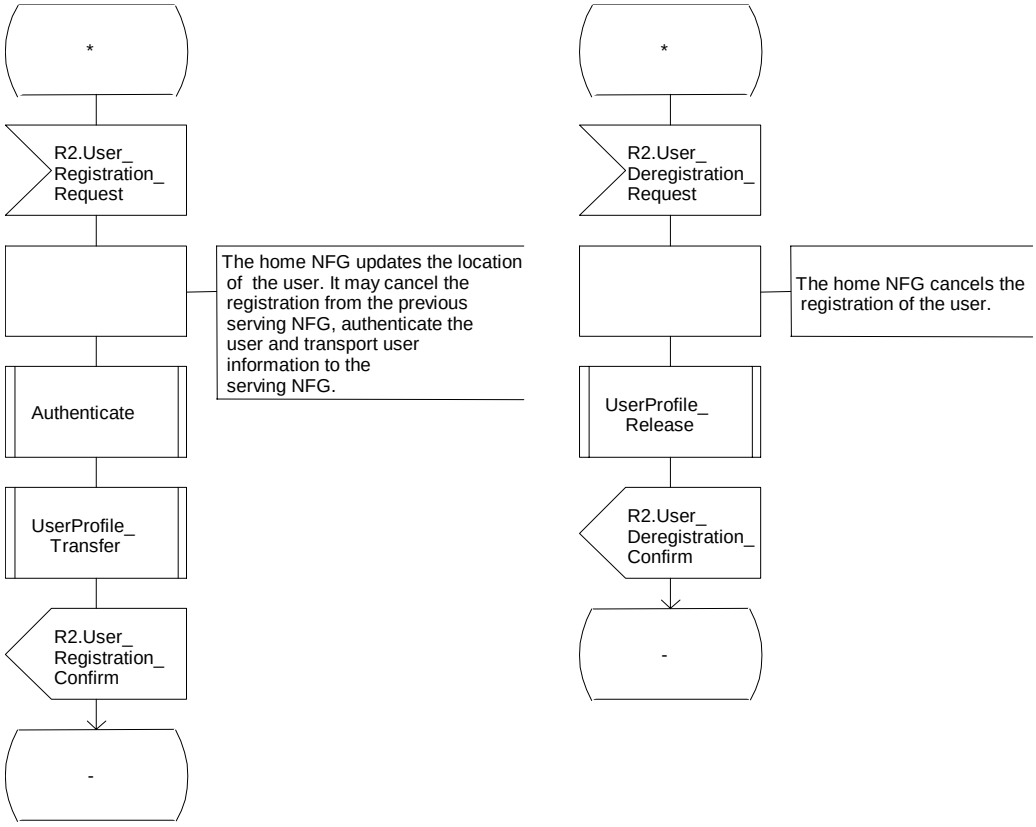


Figure A.8: Home network FG registration and deregistration

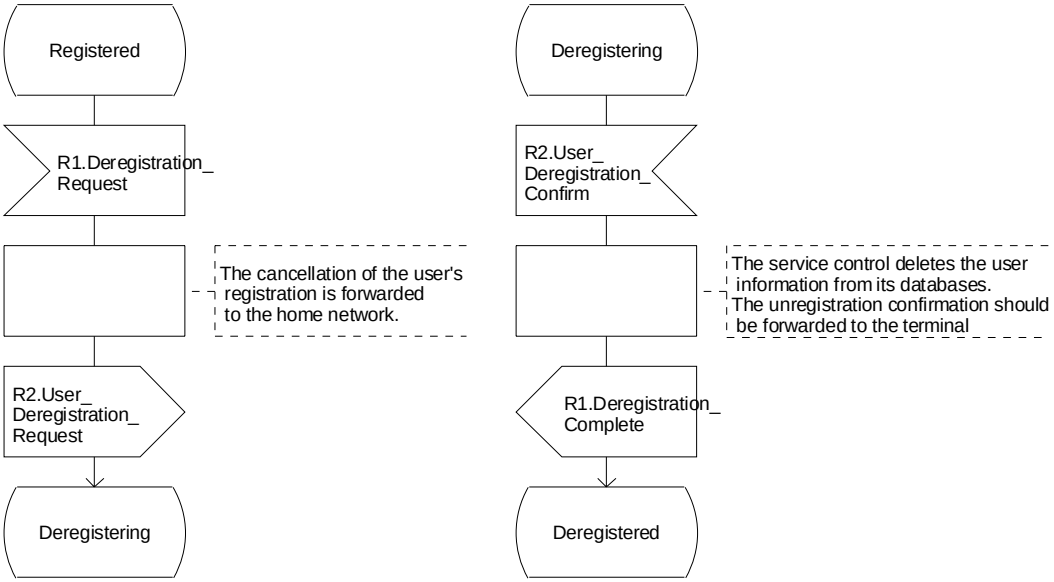


Figure A.9: Serving Network FG deregistration

NOTE: The reasons for deregistration of the User is beyond the scope of the present document.

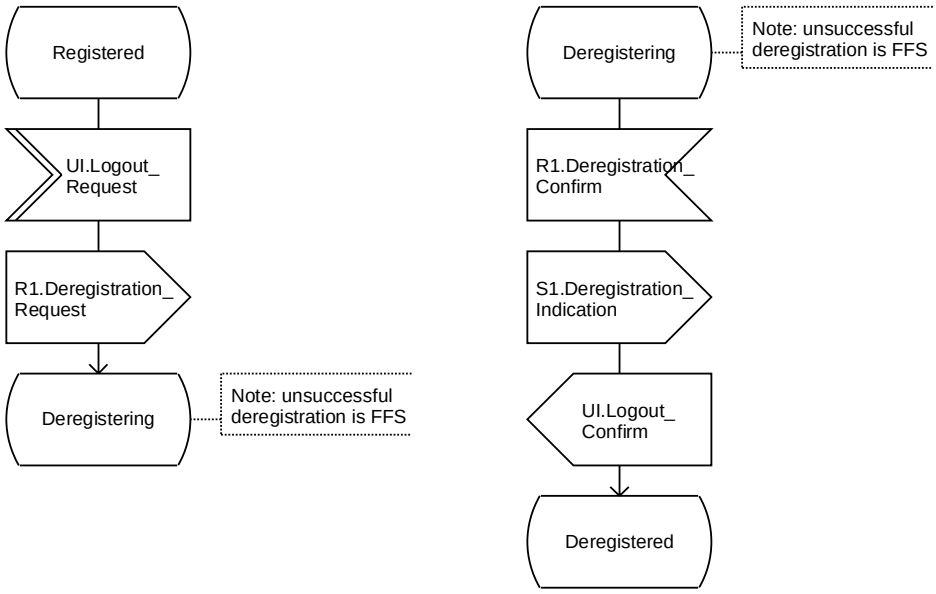


Figure A.10: Terminal FG deregistration

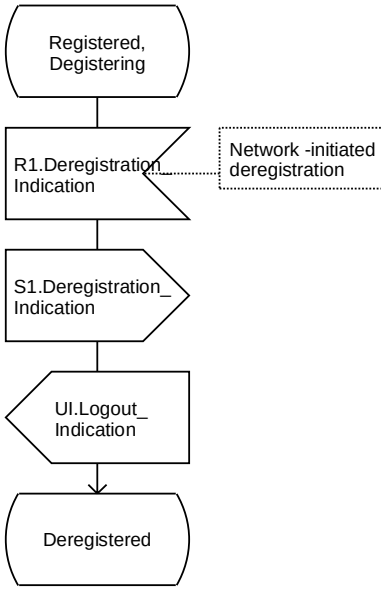
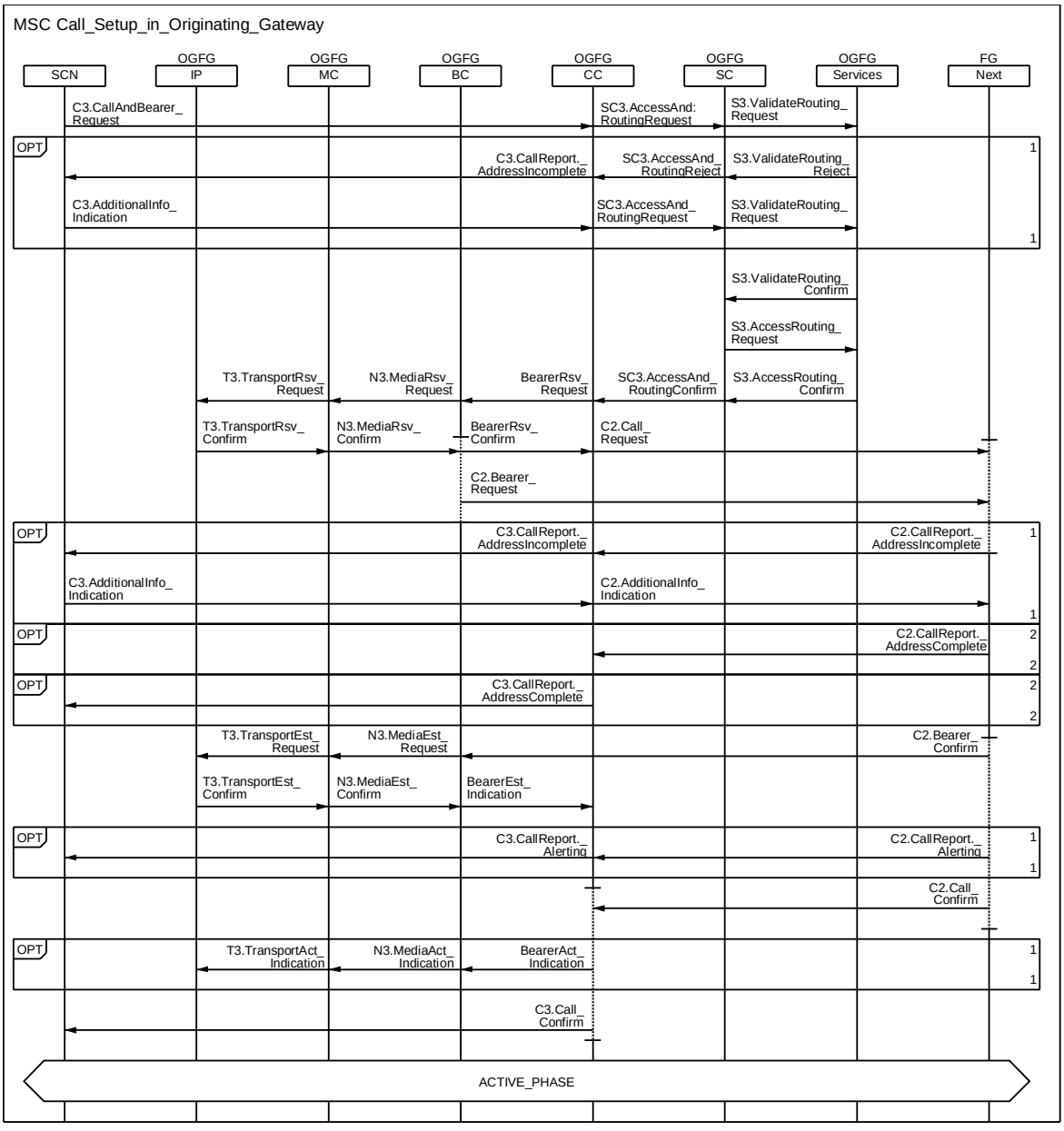


Figure A.11: Network initiated Terminal FG deregistration

A.2 Call control

A.2.1 Originating Gateway FG

The Originating gateway functional grouping implements the SCN Interworking Function (SCNIWF) e.g. a gateway. The figure A.12 shows the information flow within the SCN Interworking function required for a basic call setup on the incoming side of the call.



NOTE 1: The sender of the Bearer request shall be prepared to receive media as soon as the Bearer request is transmitted.

NOTE 2: The Cn.CallReportAddressIncomplete and the Cn.AdditionalInfoIndication may be repeated.

Figure A.12: Information flows at the Originating Gateway Functional Grouping at call establishment phase

The Originating gateway functional grouping receives a clearing indication from the SCN when the calling party clears. The release indication is transferred to the next functional grouping and the bearer is released within the SCN.

The Originating gateway functional grouping receives a clearing indication from the next functional grouping when the Called party clears. The release indication is transferred to the next functional grouping and the bearer is released within the SCN.

The figure A.13 shows the detailed information flow required for clearing the call.

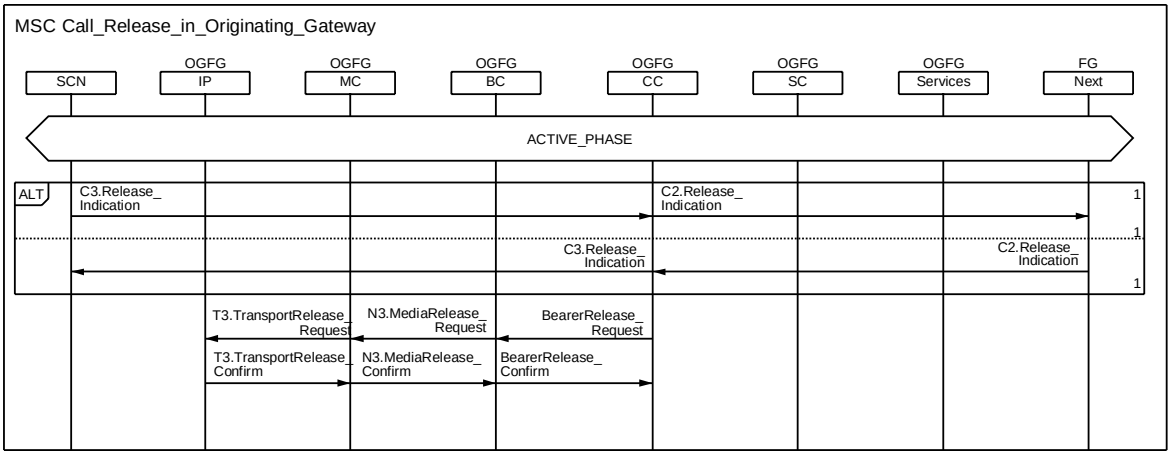


Figure A.13: Information flows at the Originating Gateway Functional Grouping at call teardown phase

A.2.1.1 The Services functional layer

The behaviour of the Services functional layer is implementation dependent. The Services functional layer is expected to respond to requests made from the Service Control functional layer with appropriate parameters.

A.2.1.2 The Service Control functional layer

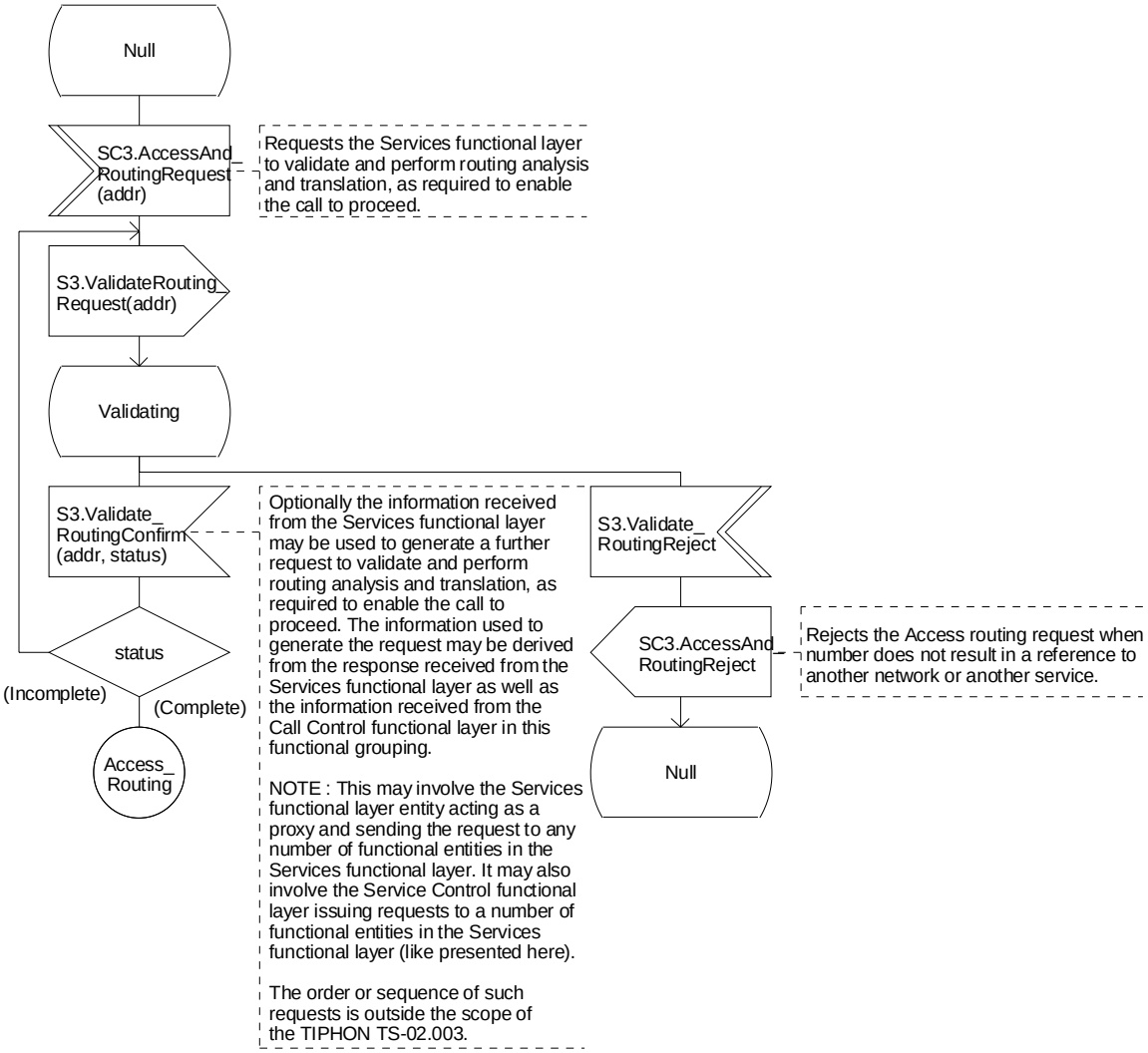


Figure A.14: Originating Gateway: Generic call routing

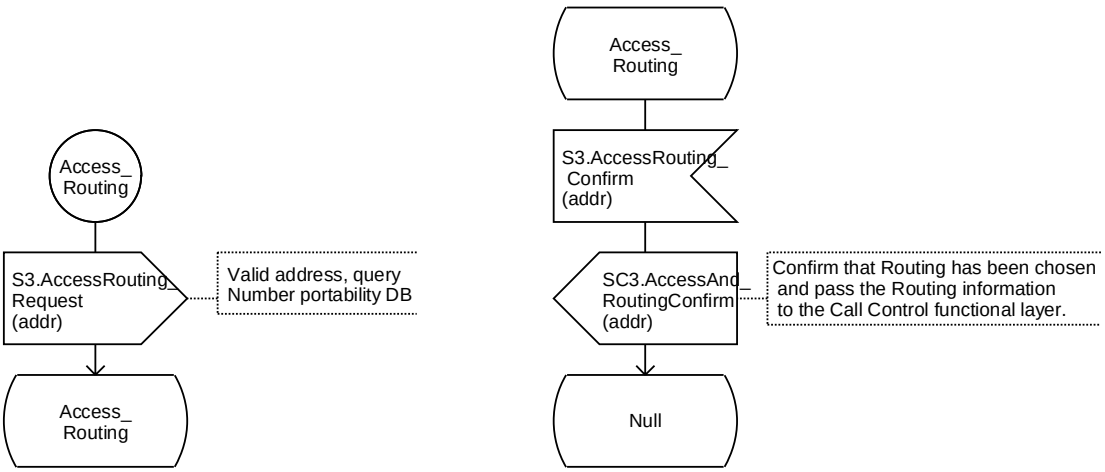


Figure A.15: Originating Gateway: Call routing for number portability

A.2.1.3 The Call Control functional layer

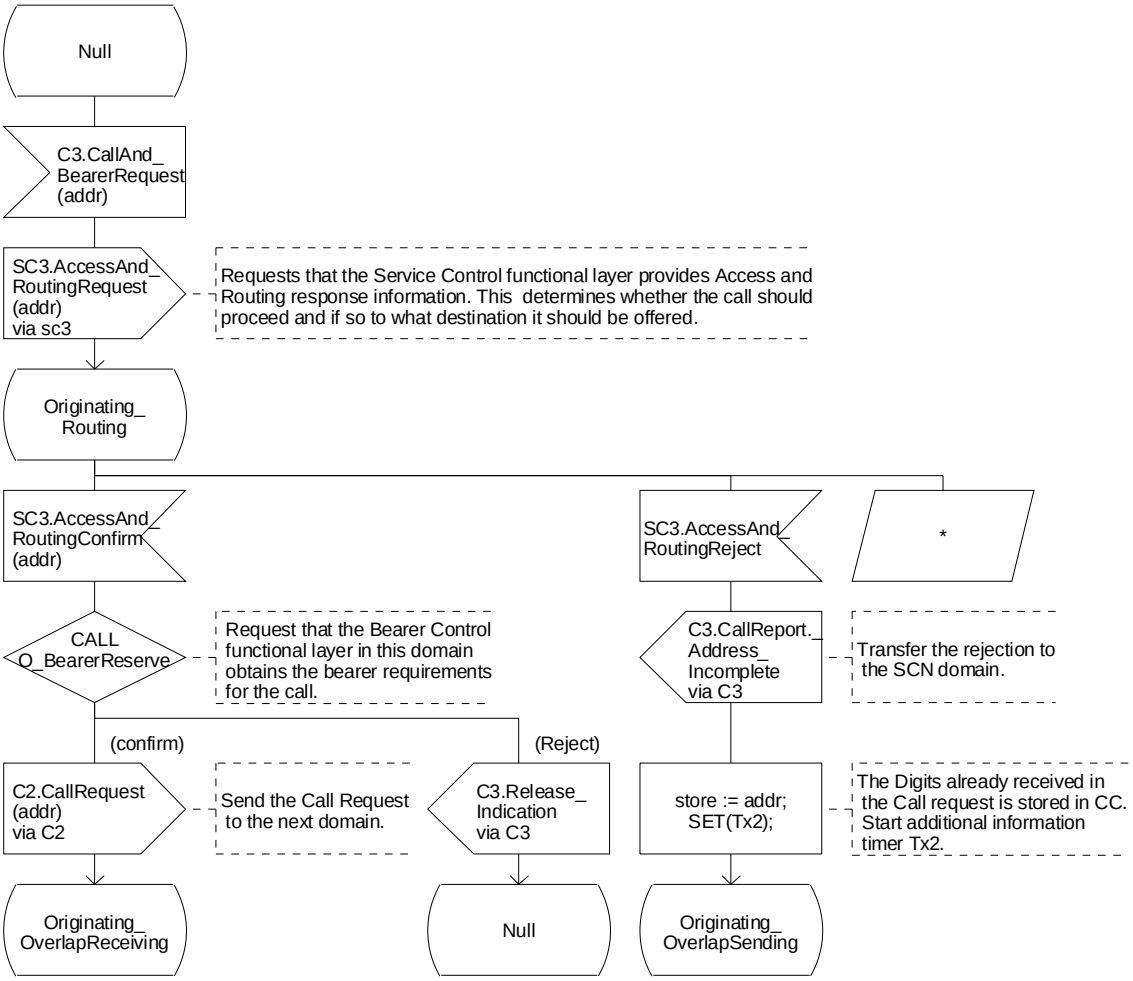


Figure A.16: Originating Gateway: Initiating a call

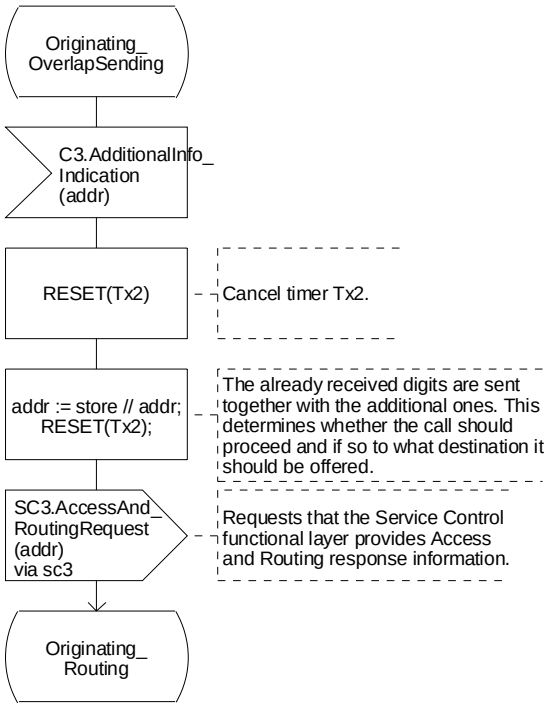


Figure A.17: Originating Gateway: Overlap sending

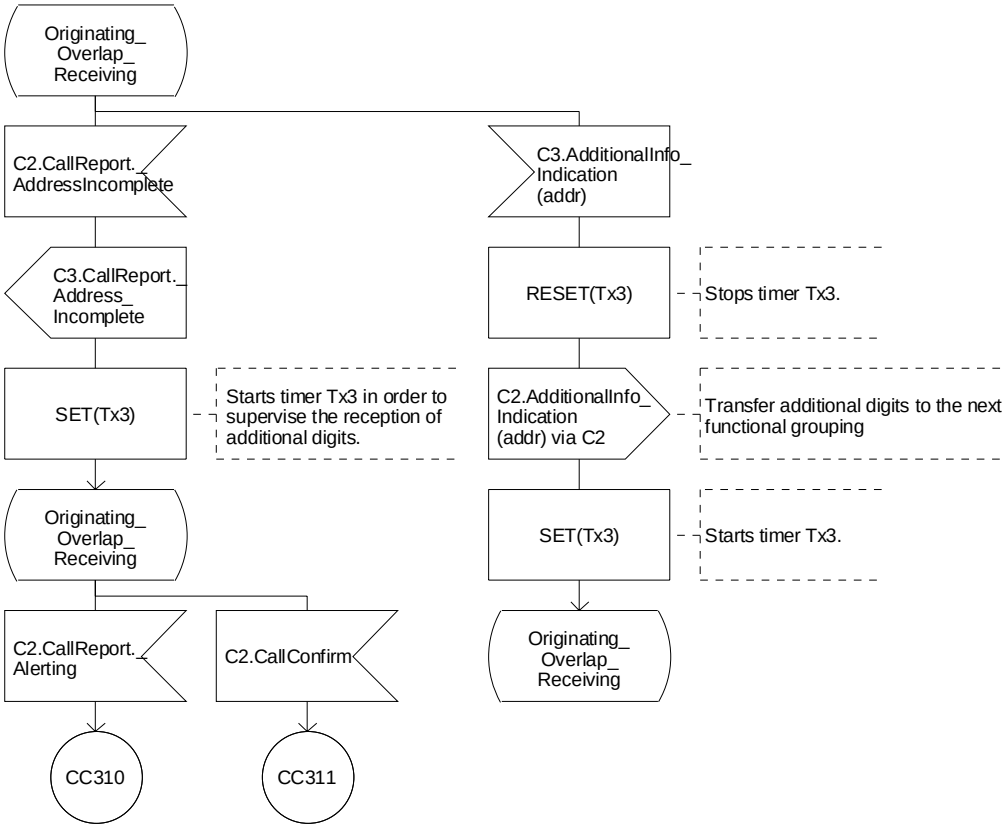


Figure A.18: Originating Gateway: Overlap receiving towards next functional grouping

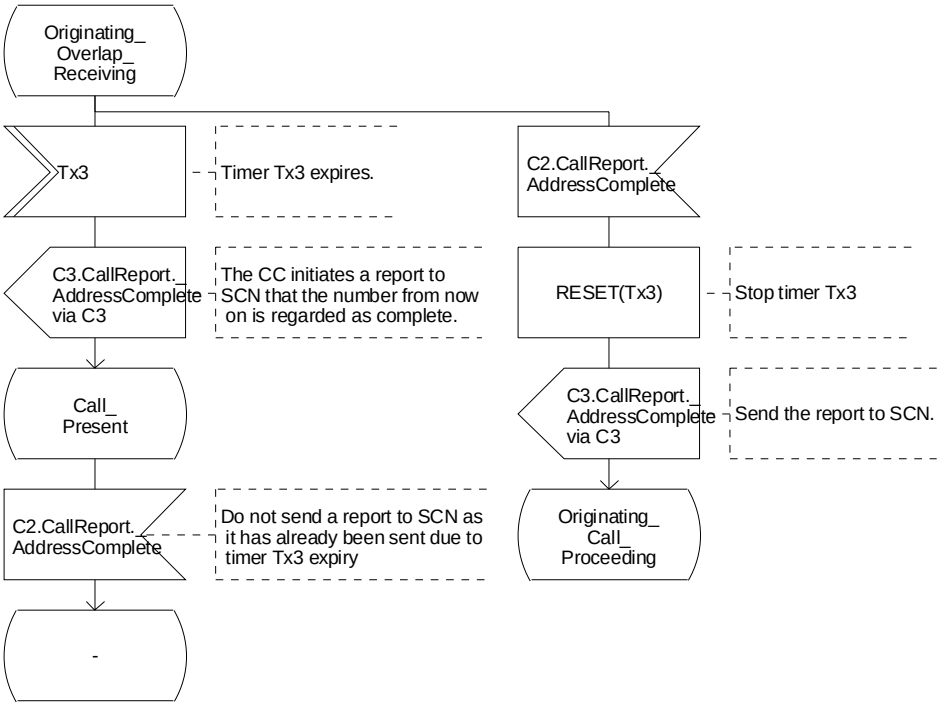


Figure A.19: Originating Gateway: Completing the address

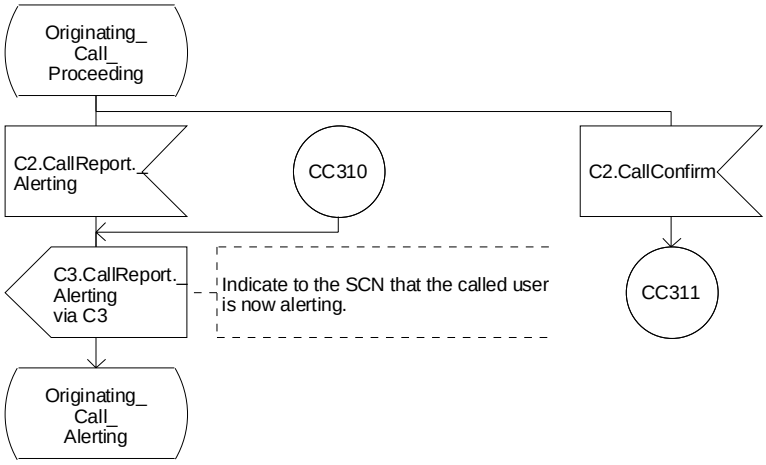


Figure A.20: Originating Gateway: Remote user has been alerted

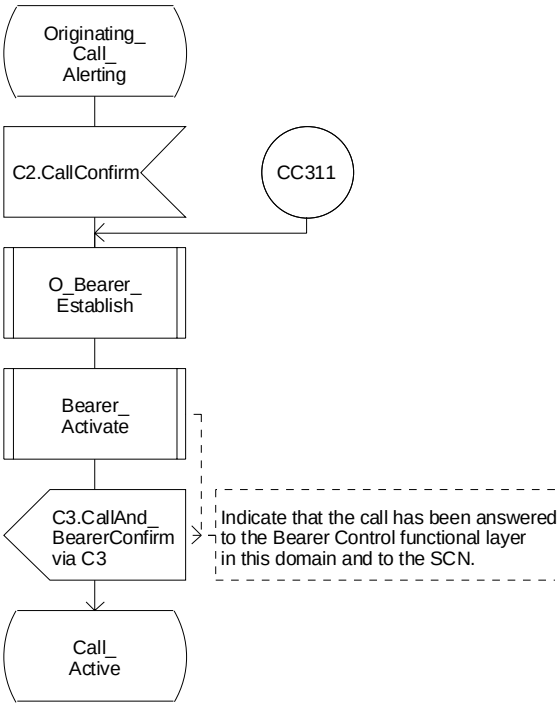


Figure A.21: Originating Gateway: Activating the call

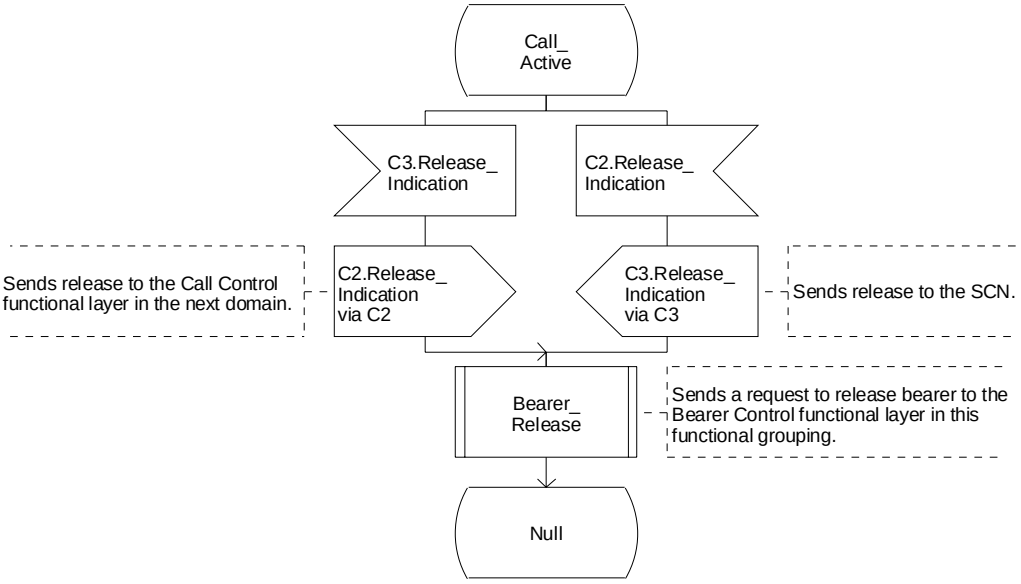


Figure A.22: Originating Gateway: Releasing the call

A.2.1.4 The Bearer control functional layer

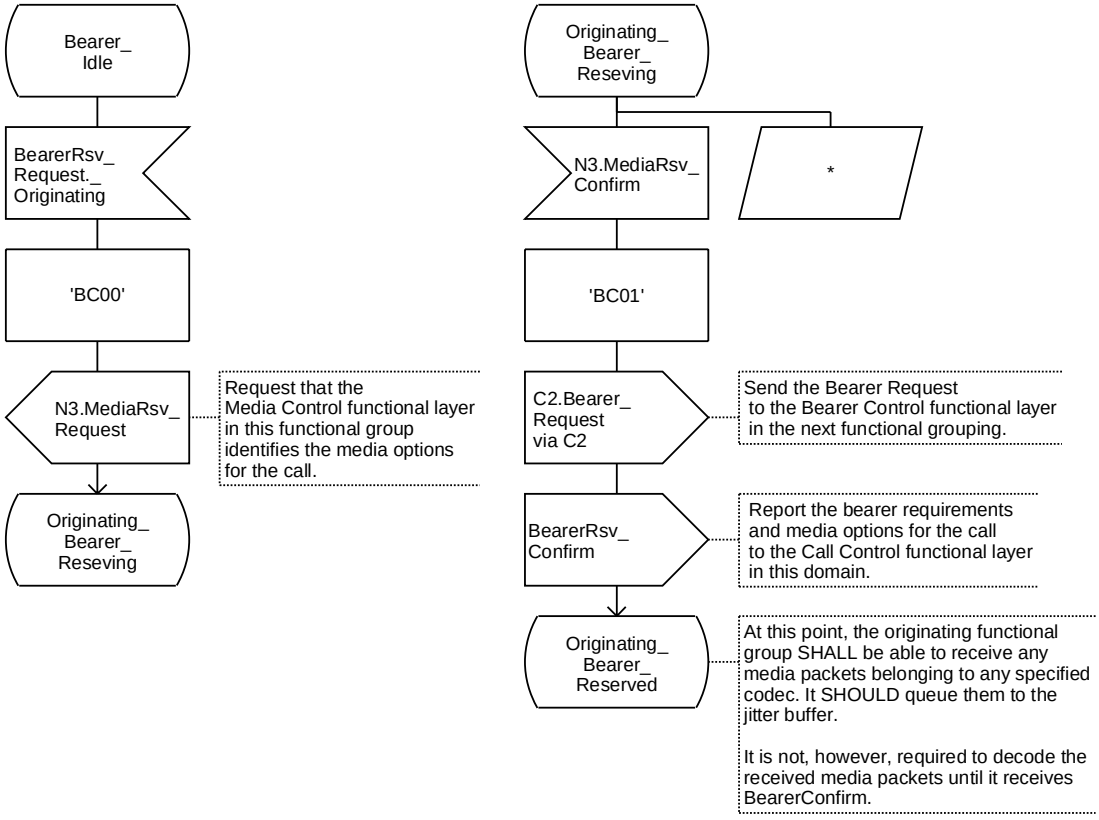


Figure A.23: Originating Gateway: Reserving a bearer

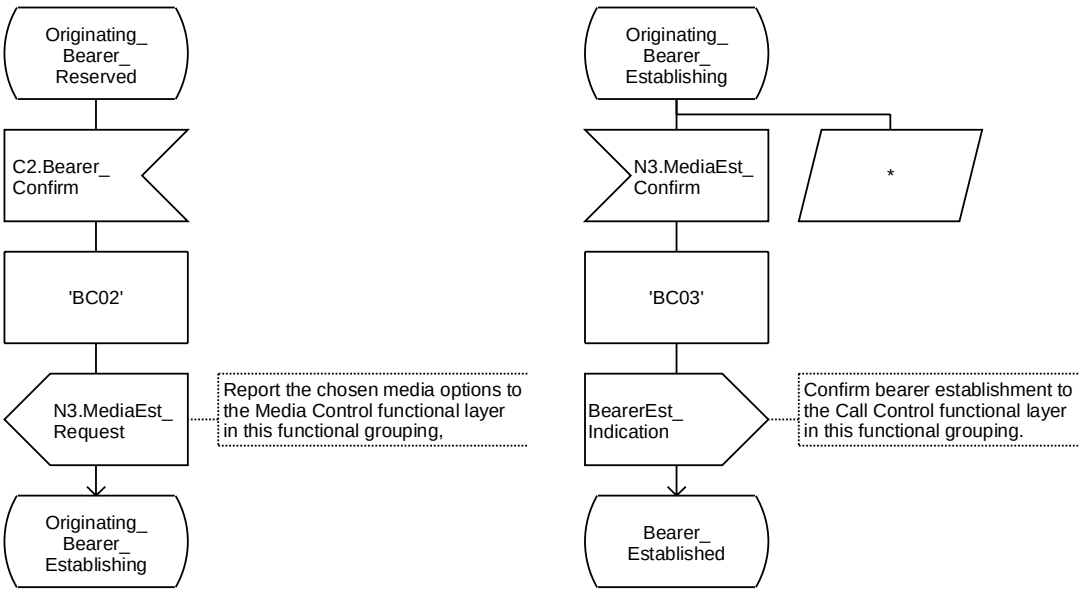


Figure A.24: Originating Gateway: Establishing a bearer

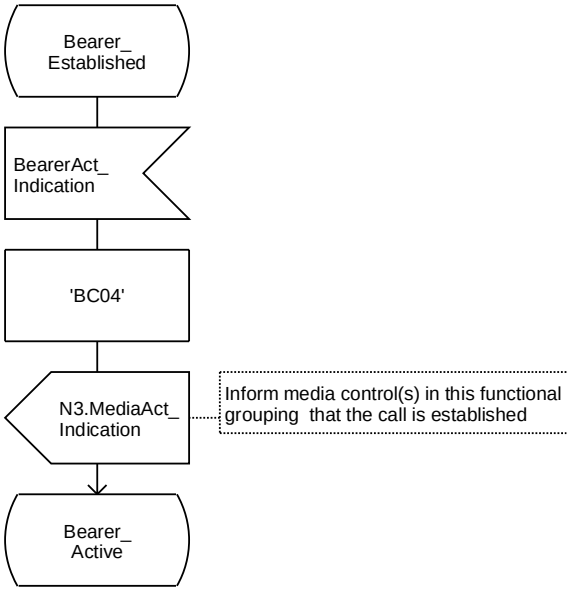


Figure A.25: Originating Gateway: Activating a bearer

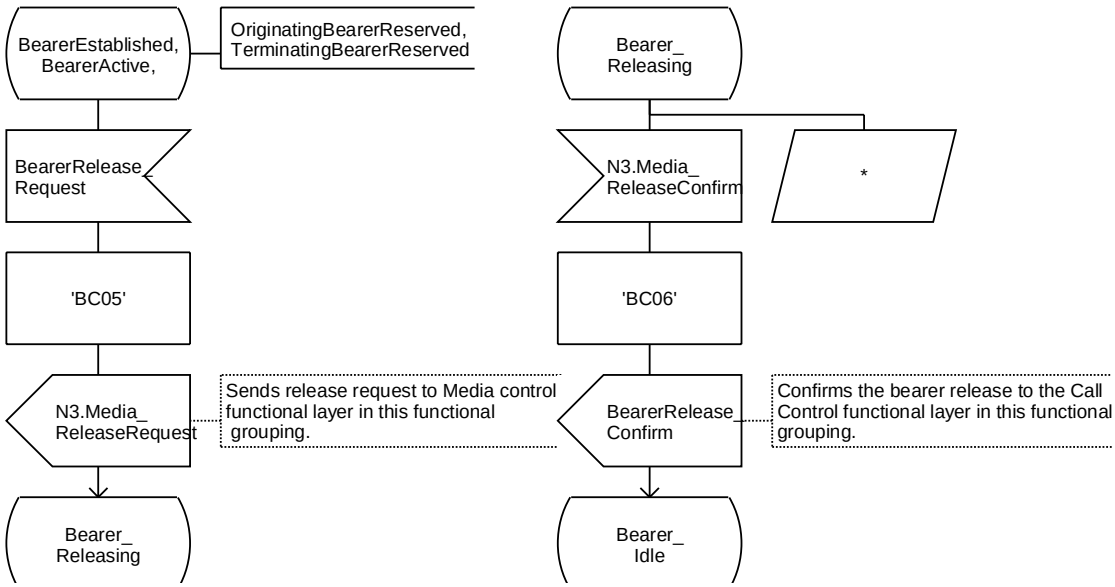


Figure A.26: Originating Gateway: Releasing a bearer

A.2.1.5 The Media Control functional layer

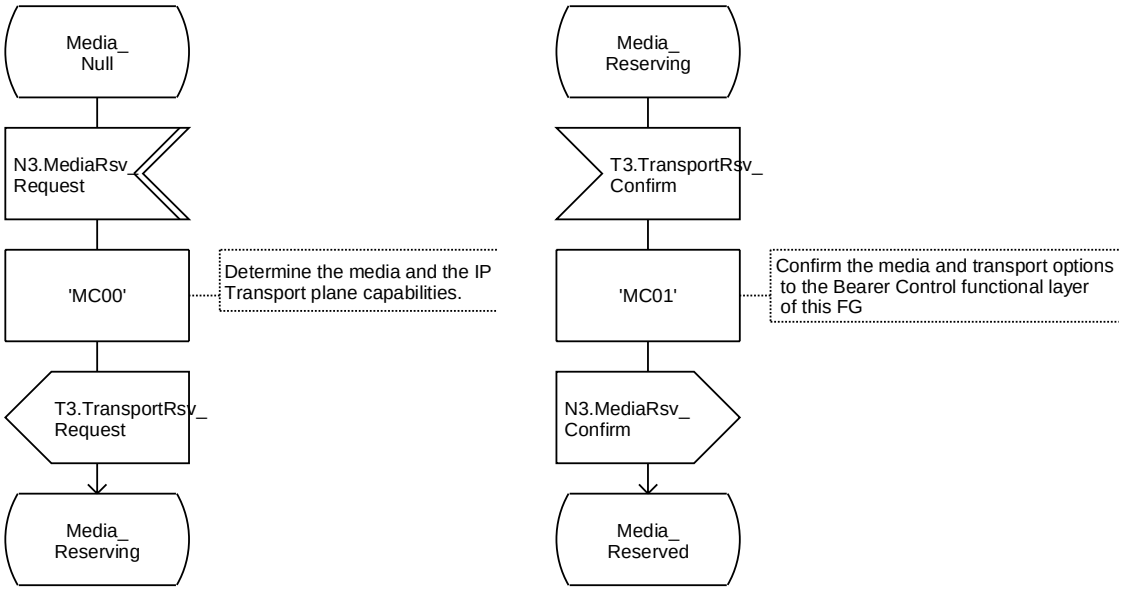


Figure A.27: Originating Gateway: Reserving media

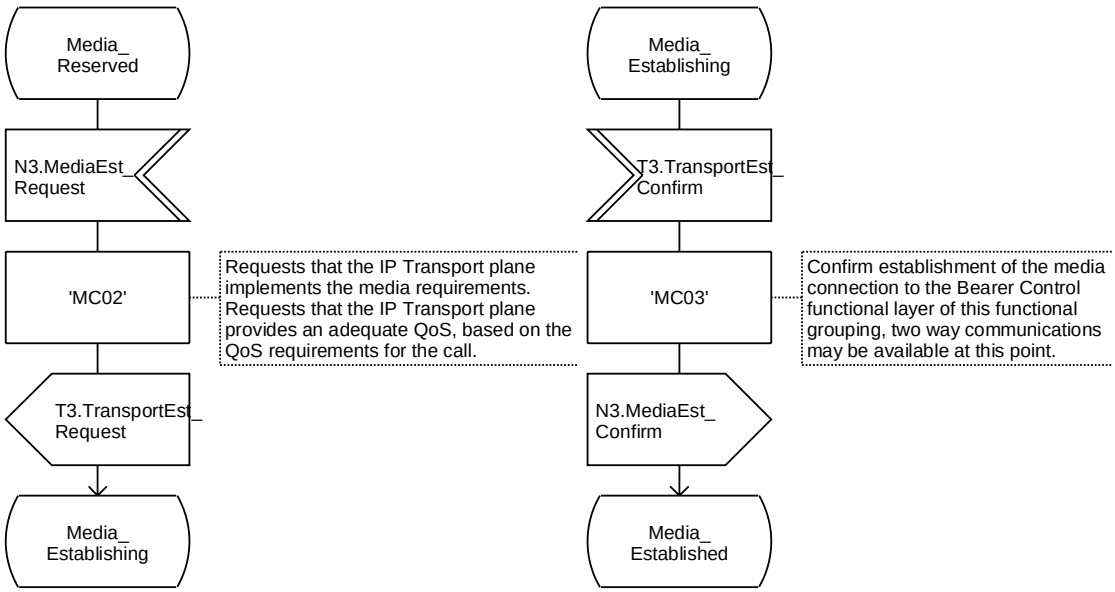


Figure A.28: Originating Gateway: Establishing media

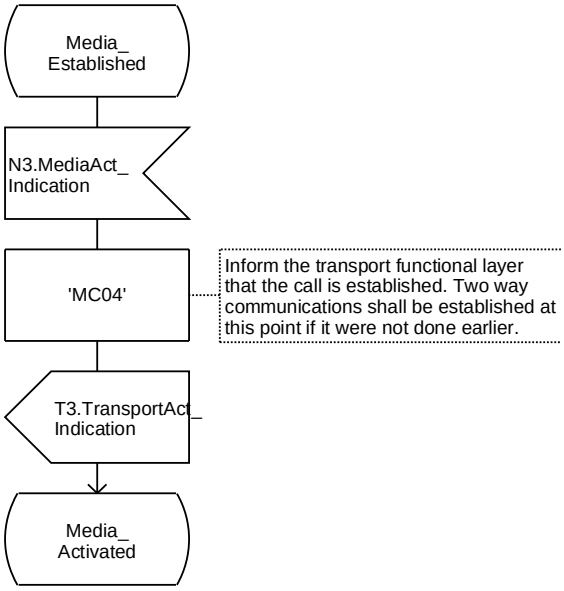


Figure A.29: Originating Gateway: Activating media

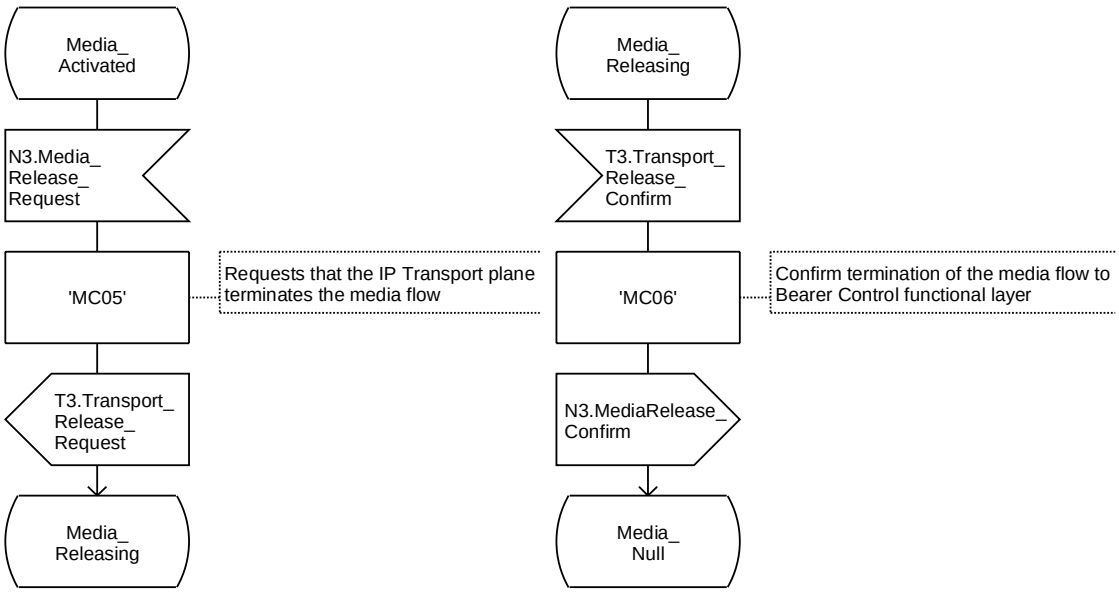


Figure A.30: Originating Gateway: Releasing media

A.2.1.6 The IP Transport plane

The functional model and the functional entity actions of the IP Transport plane are outside the scope of the present document.

A.2.2 Originating Terminal FG

The Originating terminal functional grouping implements the Terminal. The figure A.31 shows the information flow within the Terminal and the information flow to the next functional grouping (e.g. a network functional grouping) on the originating side of the call.

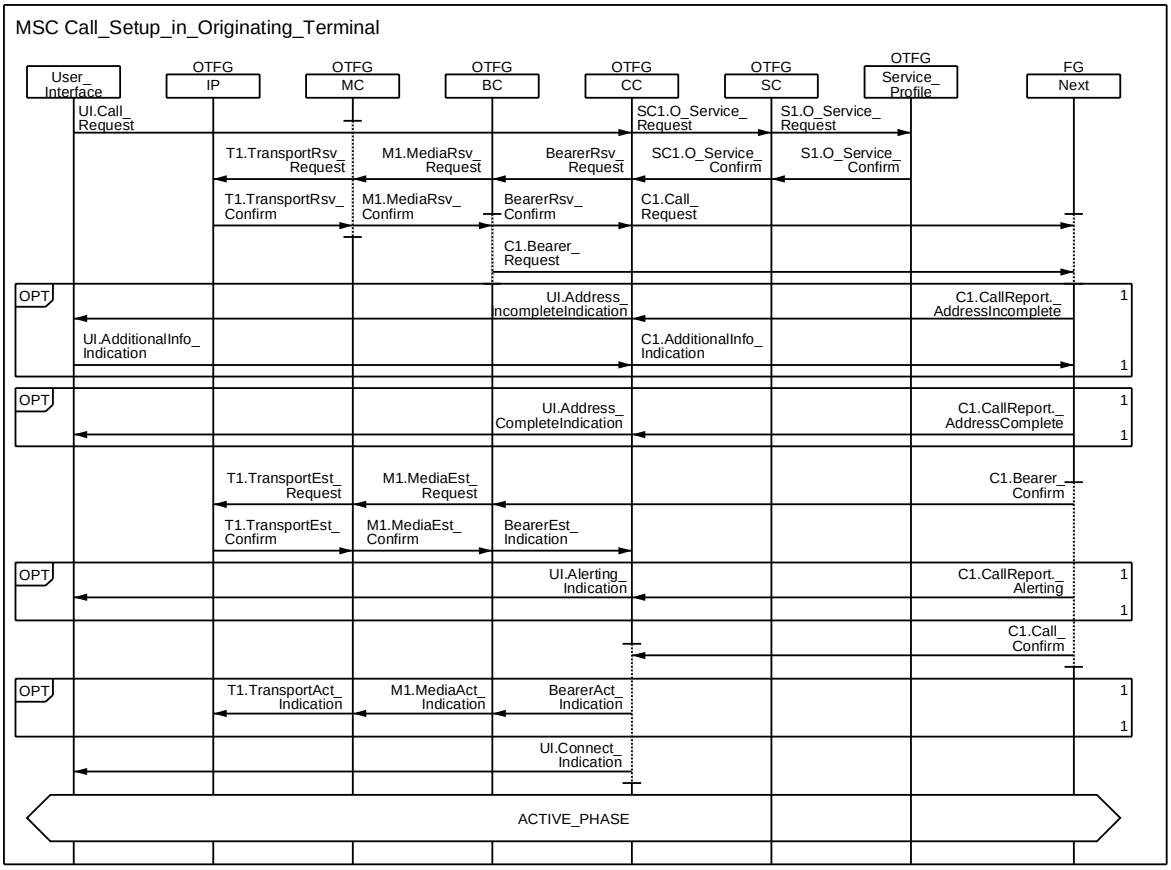


Figure A.31: Information flows at the Originating Terminal Functional Grouping

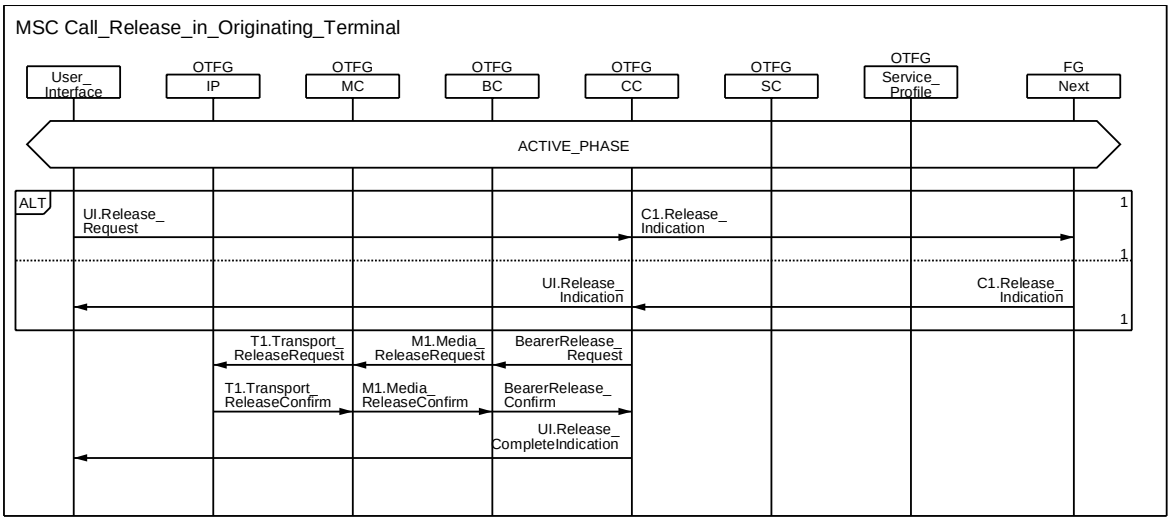


Figure A.32: Information flows at the Originating Terminal Functional Grouping during the call-setup phase

NOTE 1: The sender of the Bearer request shall be prepared to receive media as soon as the Bearer request is transmitted.

NOTE 2: The C1.CallReportAddressIncomplete and the C1.AdditionalInfoIndication may be repeated.

The user indicates, by means of an implementation dependent interface, that the call shall be cleared. The User/Service control interface requests the call to be cleared. The Originating terminal functional grouping indicates clearing of the call to the Next functional grouping. The bearer is internally cleared.

The Originating terminal functional grouping receives from the Next functional grouping an indication that the called party has cleared. The Originating terminal functional grouping clears the bearer internally before the user is informed about the clearing of the call.

A.2.2.1 Service functional layer

The services available to the terminal user are outside the scope of the present document.

A.2.2.2 The Service Control functional layer

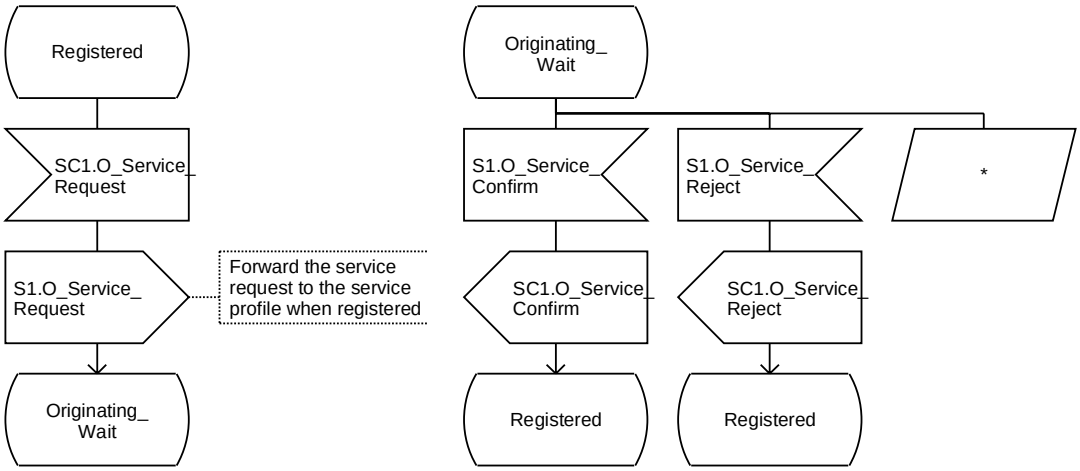


Figure A.33: Originating Terminal: Decide if terminal status and the service profile allows placing the call

A.2.2.3 The Call Control functional layer

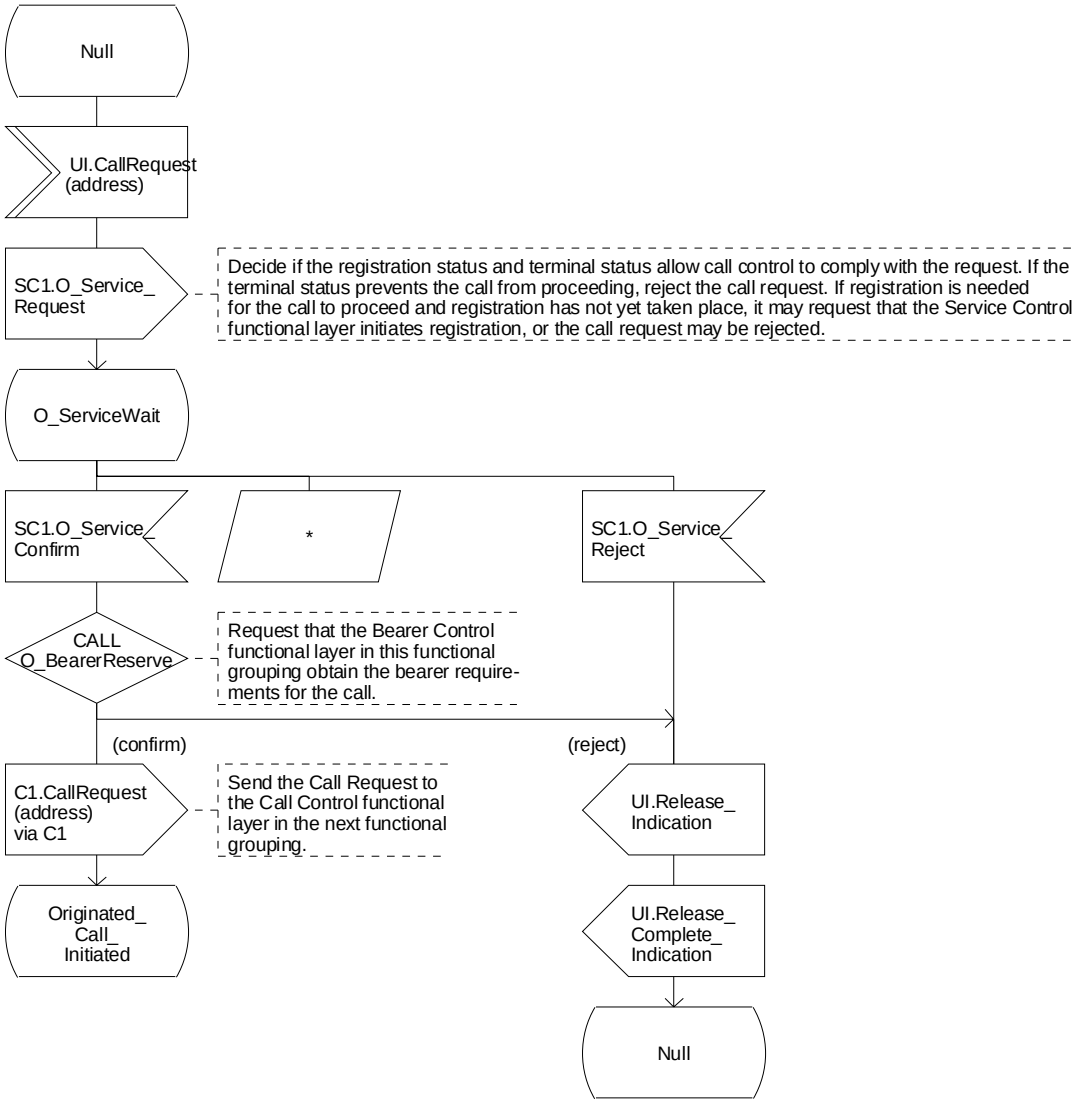


Figure A.34: Originating Terminal: Initiating a call

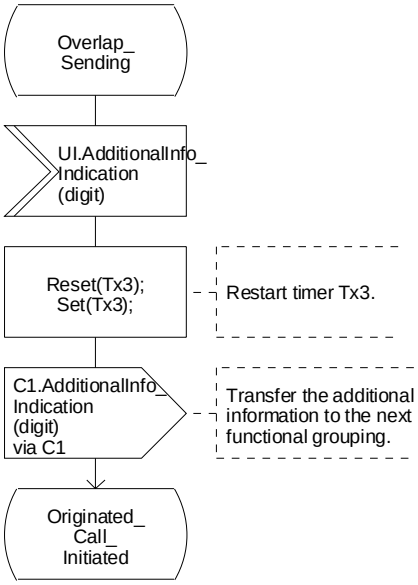


Figure A.35: Originating Terminal: overlap sending to the next functional grouping

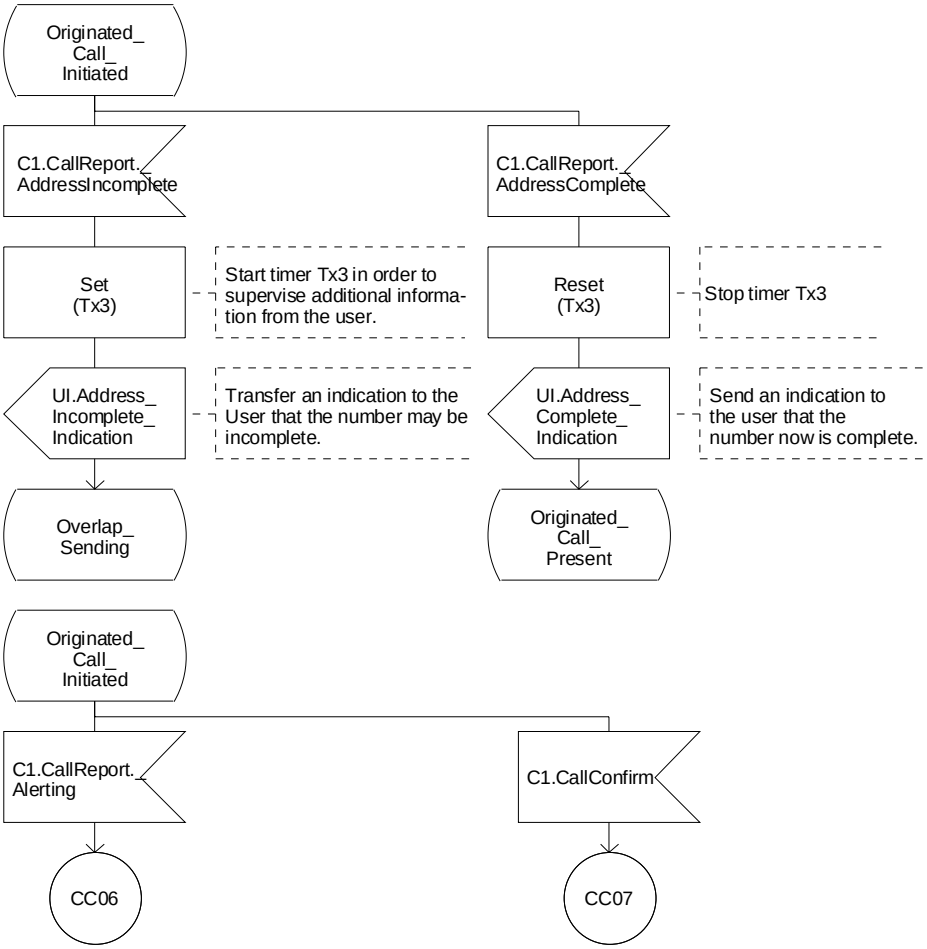


Figure A.36: Originating Terminal: completing the address

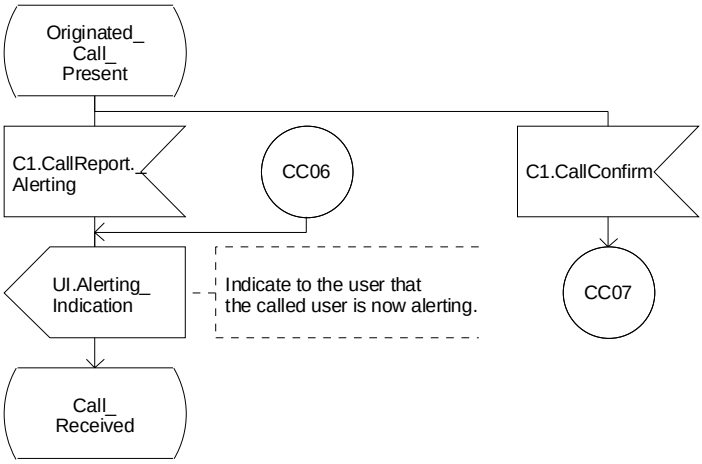


Figure A.37: Originating Terminal: Call received (remote user alerting)

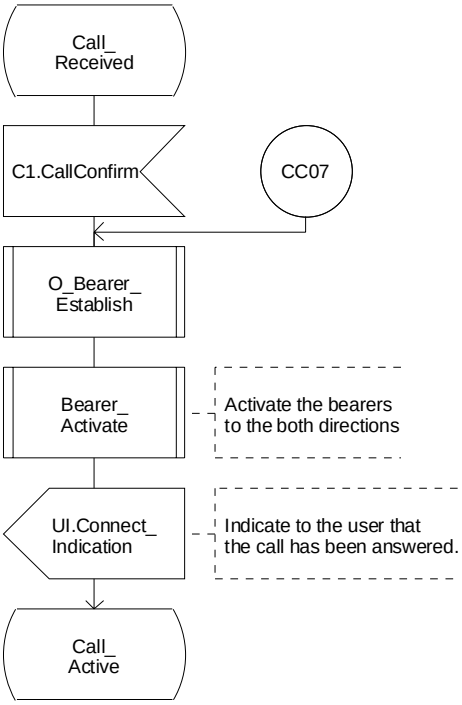


Figure A.38: Originating Terminal: activating a call

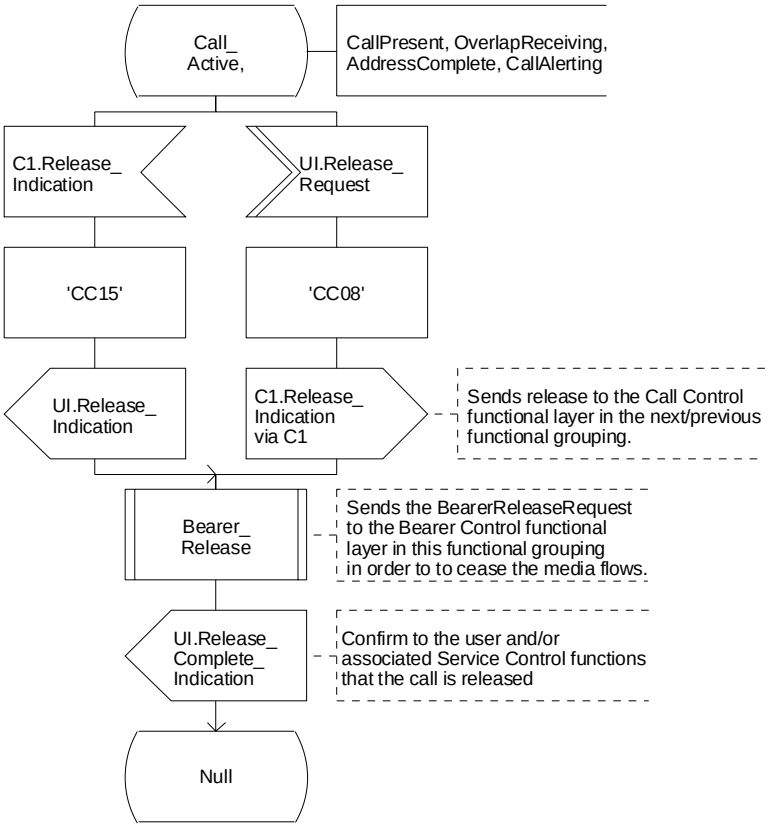


Figure A.39: Originating Terminal: releasing a call

A.2.2.4 The Bearer control functional layer

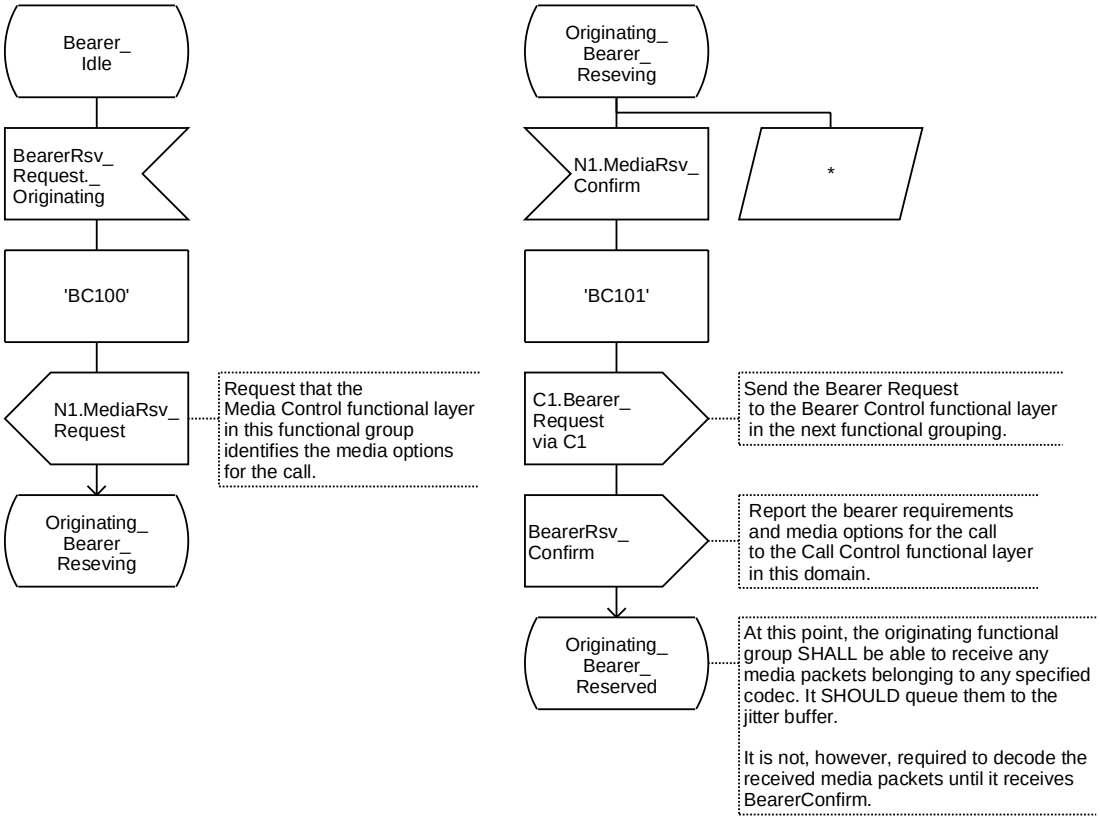


Figure A.40: Originating Terminal: reserving a bearer

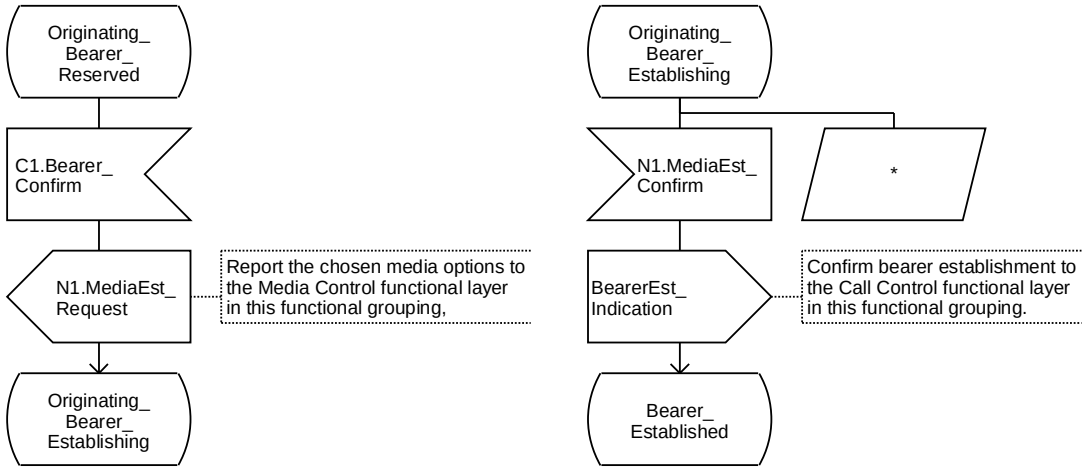


Figure A.41: Originating Terminal: establishing a bearer

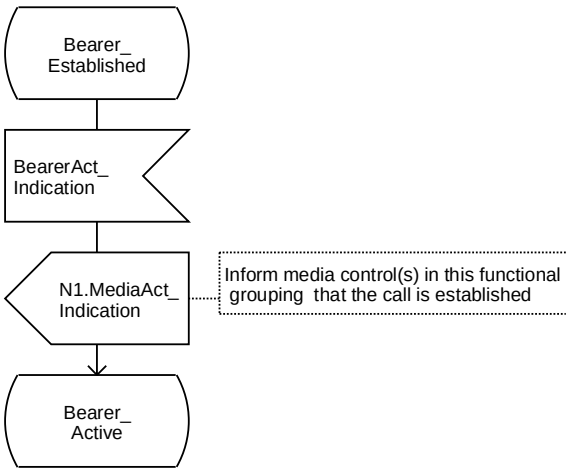


Figure A.42: Originating Terminal: activating a bearer

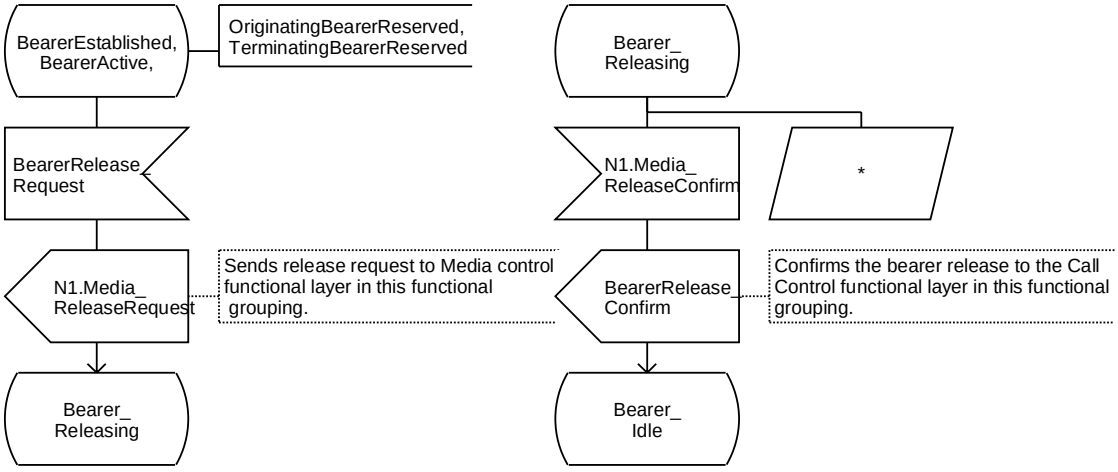


Figure A.43: Originating Terminal: releasing a bearer

A.2.2.5 The Media Control functional layer

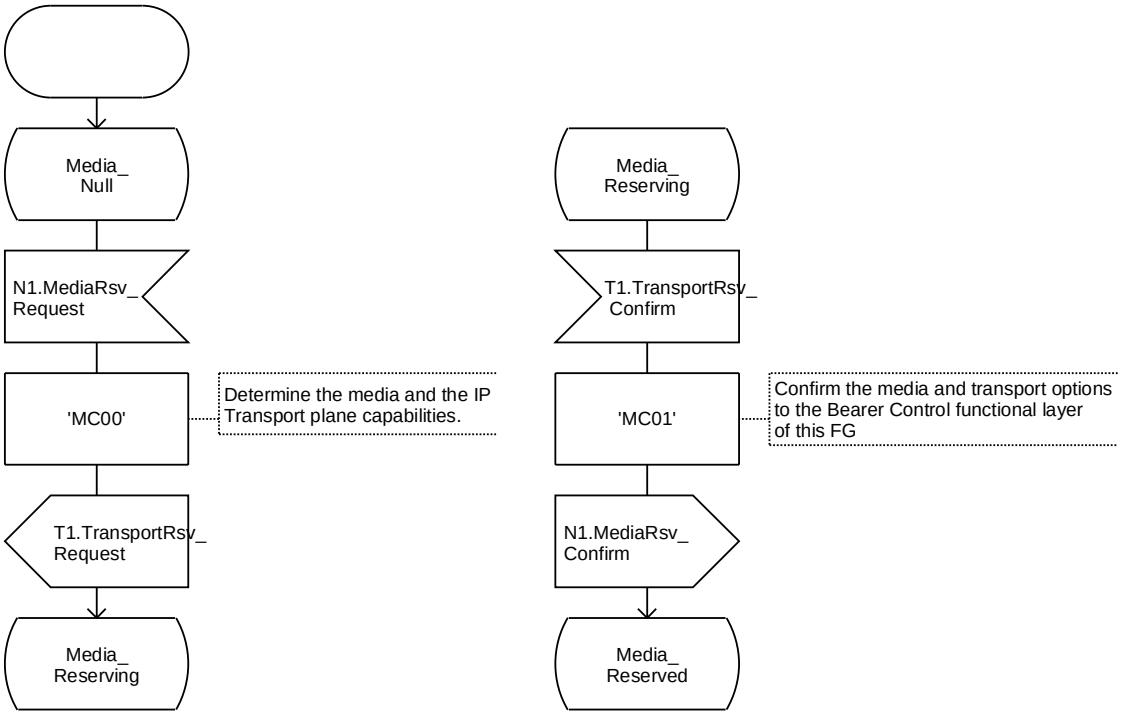


Figure A.44: Originating Terminal: reserving media

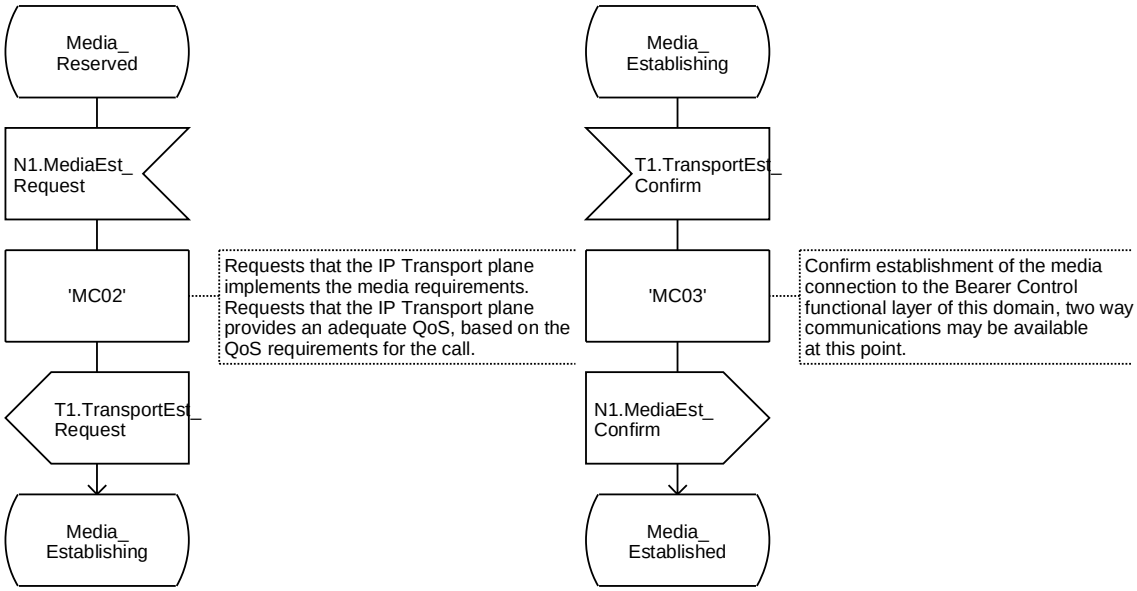


Figure A.45: Originating Terminal: establishing media

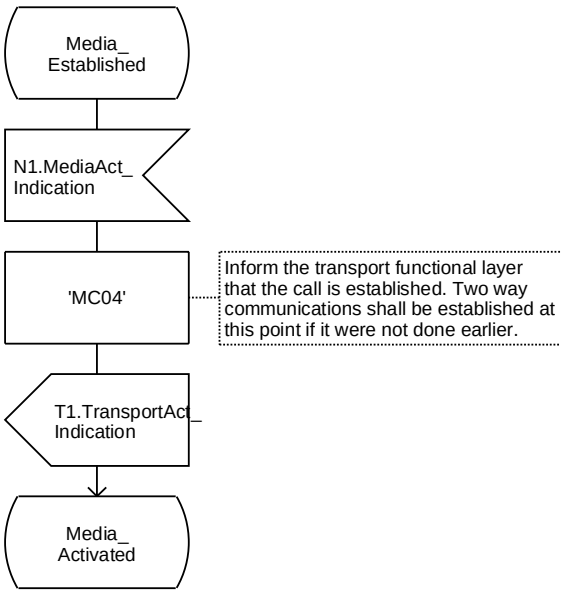


Figure A.46: Originating Terminal: activating media

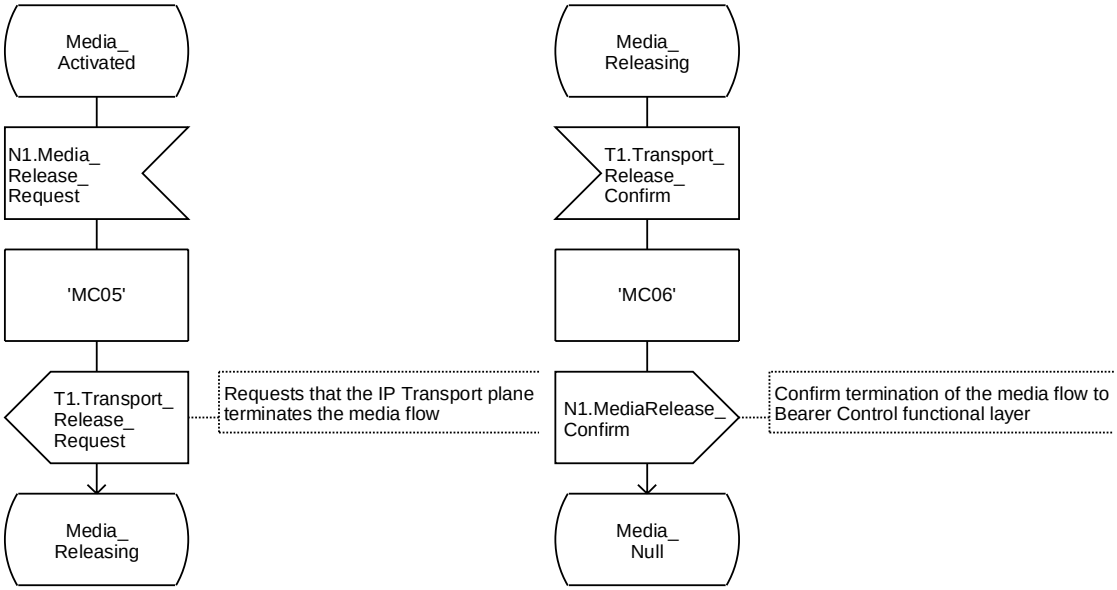


Figure A.47: Originating Terminal: releasing media

A.2.2.6 IP Transport plane

The functional model and the functional entity actions of the IP Transport plane are outside the scope of the present document.

A.2.3 Network Functional Groupings

The network functional grouping receives a call request and a bearer request from the previous functional grouping. The network functional grouping shall co-ordinate the reception of the call request with the reception of the bearer request.

The received called party number does not (when analysed in the Service functional layer) result in a destination, thus the network functional grouping returns a report to the previous functional grouping and waits for additional digits before any routing can take place (Overlap sending phase). Once additional information is received (one or more digits) the network functional grouping can route the call to the next functional grouping (Overlap receiving phase). The

network functional grouping shall supervise the Overlap sending and the Overlap receiving phase. The next functional grouping reports when the Called party number is complete and establishment of the bearer can take place.

User dependent events (Alerting) are reported by the next functional grouping and transferred to the previous functional grouping. Once the user answers the call (Active phase) the Call request is confirmed by the next functional grouping and transferred to the previous functional grouping.

The figure below show the detailed information flow required for a basic call setup.

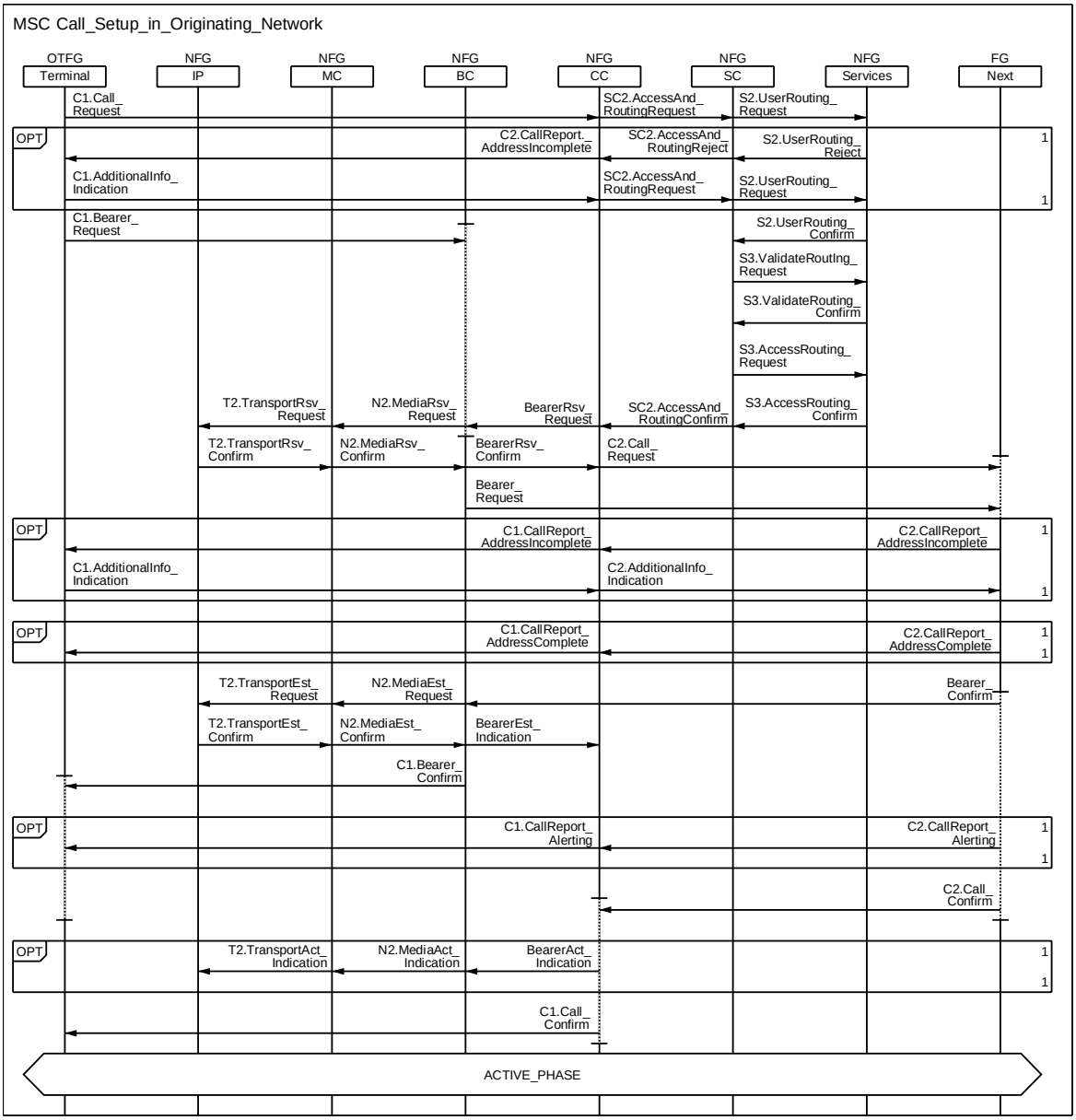


Figure A.48: Information Flows at the Originating Network Functional Grouping during call setup flow

NOTE: The Cn.CallReportAddressIncomplete and the Cn.AdditionalInfoIndication may be repeated. The previous functional grouping sends an indication when the Calling party clears. The indication is transferred to the next functional grouping and the bearer is cleared internally. The network functional grouping receives an indication from the next functional grouping when the Called party clears. The indication is transferred to the previous functional grouping and the bearer is internally cleared.

The figure below shows the detailed information flows required for call termination.

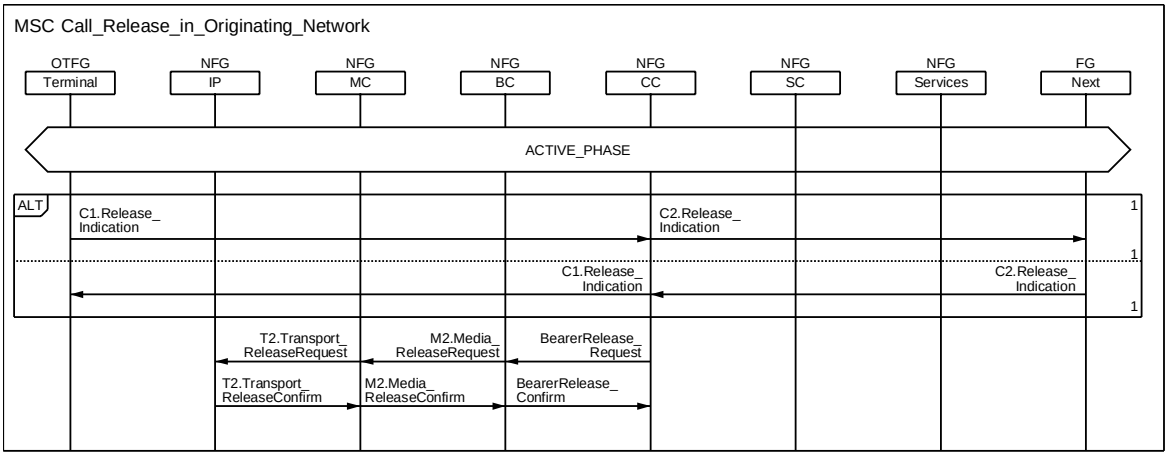


Figure A.49: Information Flows at an Originating Network Functional Grouping during call teardown phase

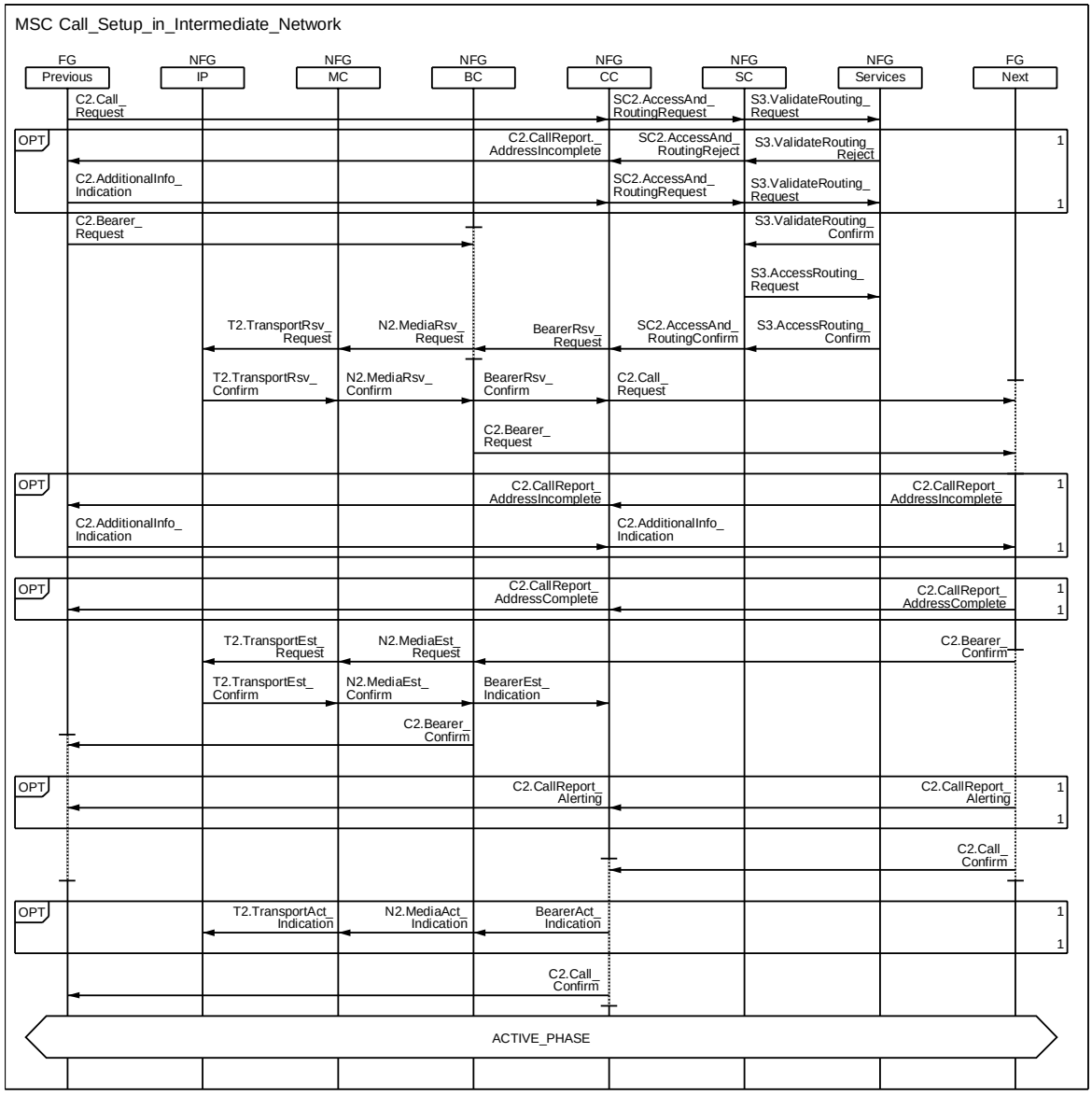


Figure A.50: Information Flows at the Intermediate Network Functional Grouping during call setup time

NOTE 1: The C2.CallReportAddressIncomplete and the C2.AdditionalInfoIndication may be repeated.

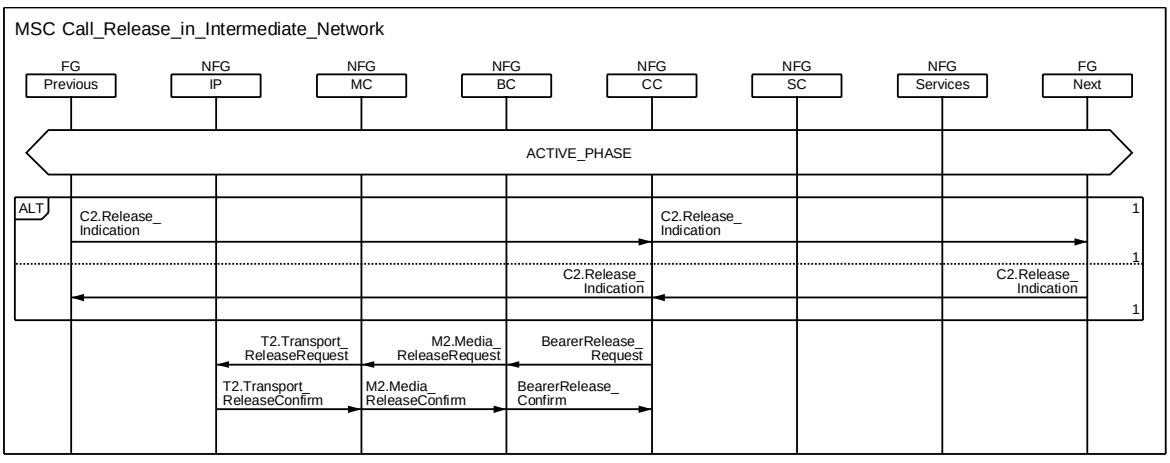


Figure A.51: Information Flows at an Intermediate Network Functional Grouping during call teardown phase

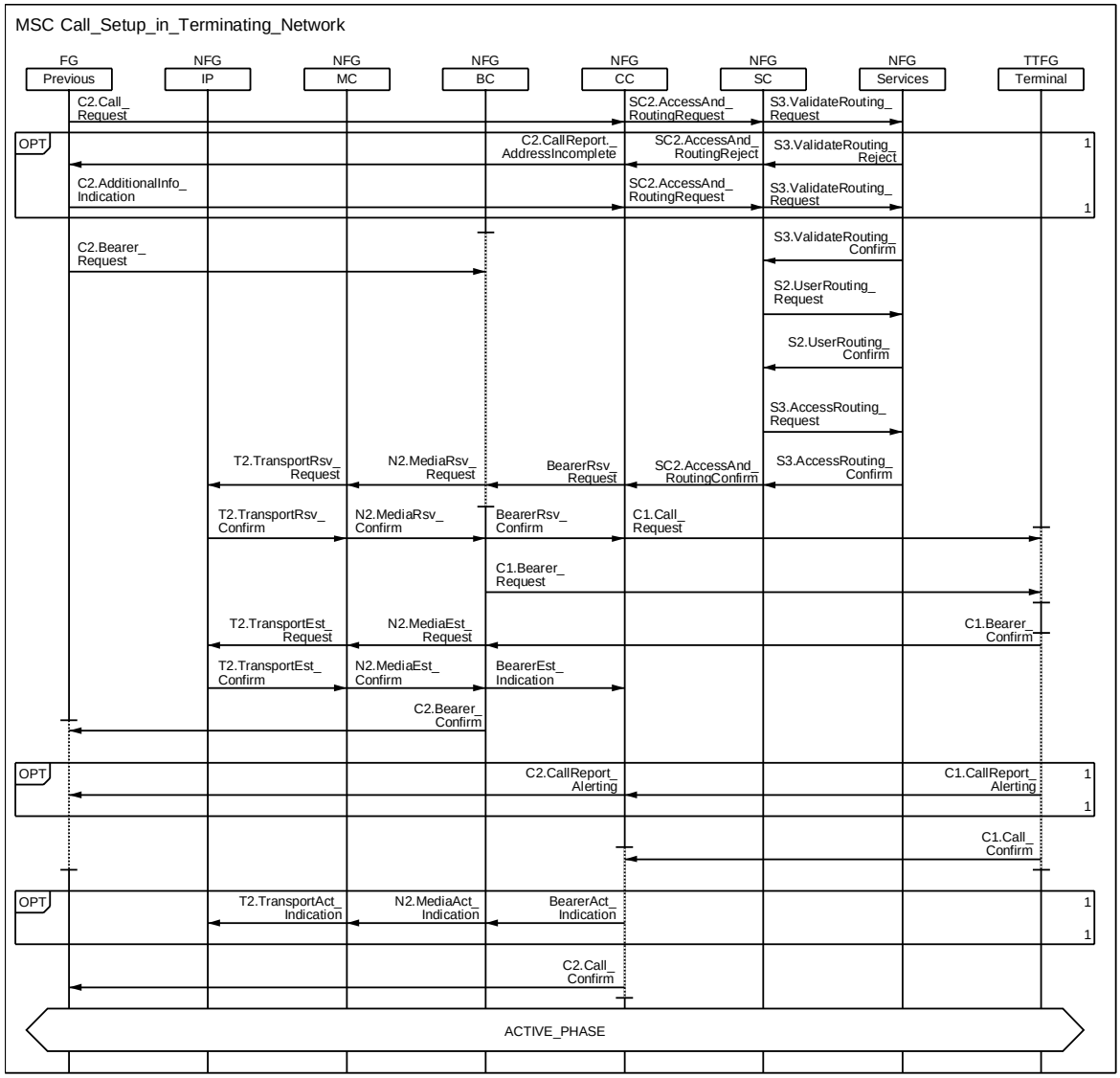


Figure A.52: Information flows at the Terminating Network Functional Grouping during call setup

NOTE 2: The Cn.CallReportAddressIncomplete and the Cn.AdditionalInfoIndication may be repeated.

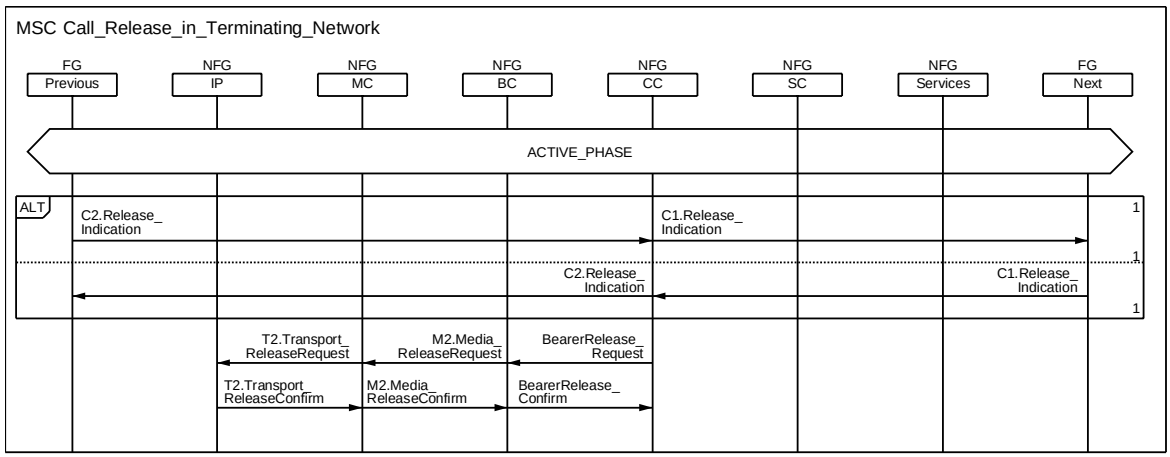


Figure A.53: Information Flows at a Terminating Network Functional Grouping during call tear down phase

NOTE: This clause includes SDL diagrams describing only the Originating Network Functional Grouping. The terminating and intermediate network functional groupings act identically at this abstraction level, so they are left out.

A.2.3.1 The Services functional layer

The behaviour of the Services functional layer is implementation dependent. The Services functional layer is expected to respond to requests made from the Service Control functional layer with appropriate parameters.

A.2.3.2 The Service Control functional layer

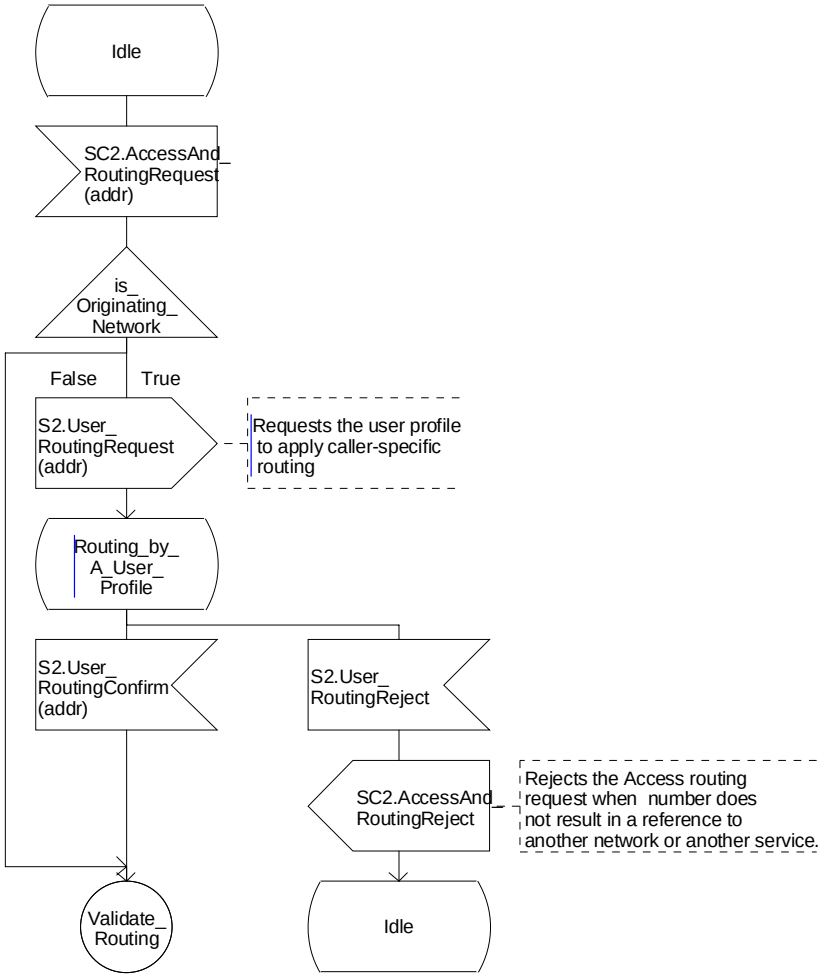


Figure A.54: Network: Call routing according to the caller's user profile is done by Originating Network only

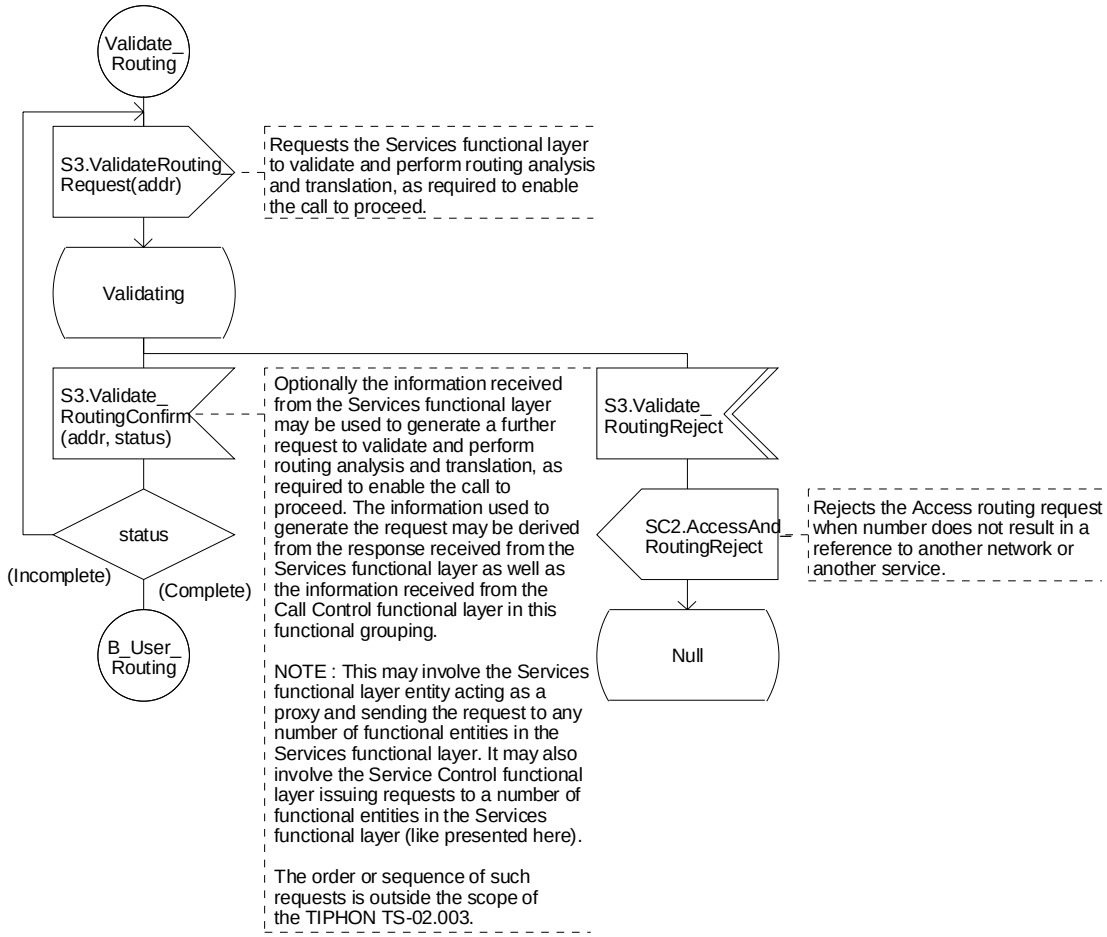


Figure A.55: Network: Generic call routing

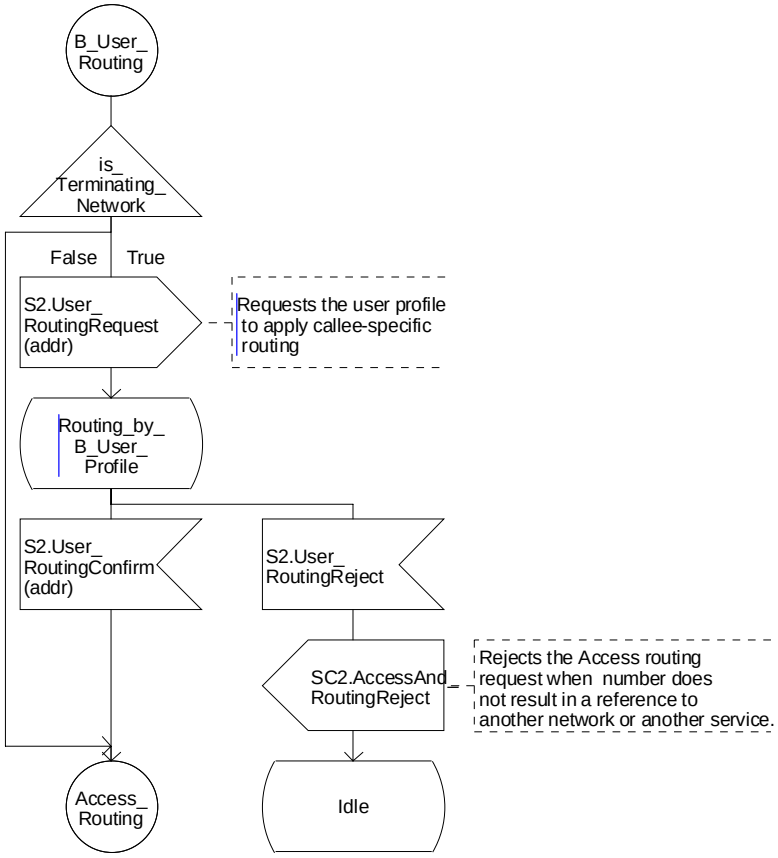


Figure A.56: Network: Call routing according to the callee's user profile by Terminating Network only

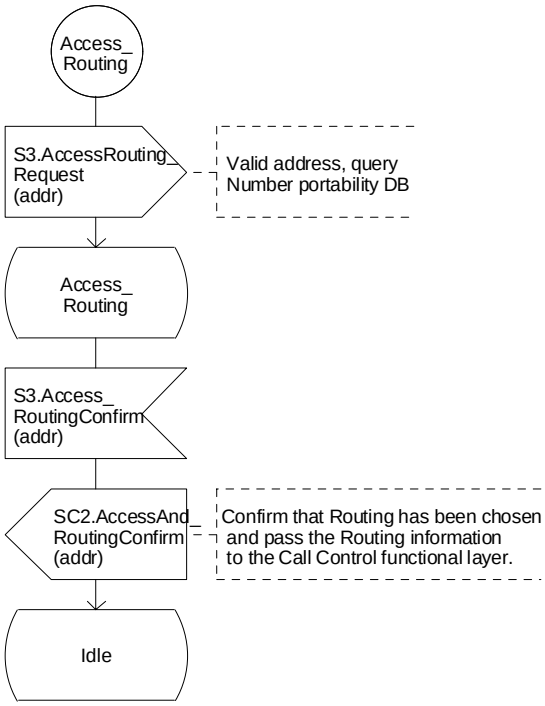


Figure A.57: Network: Call routing by number portability database

A.2.3.3 The Call Control functional layer

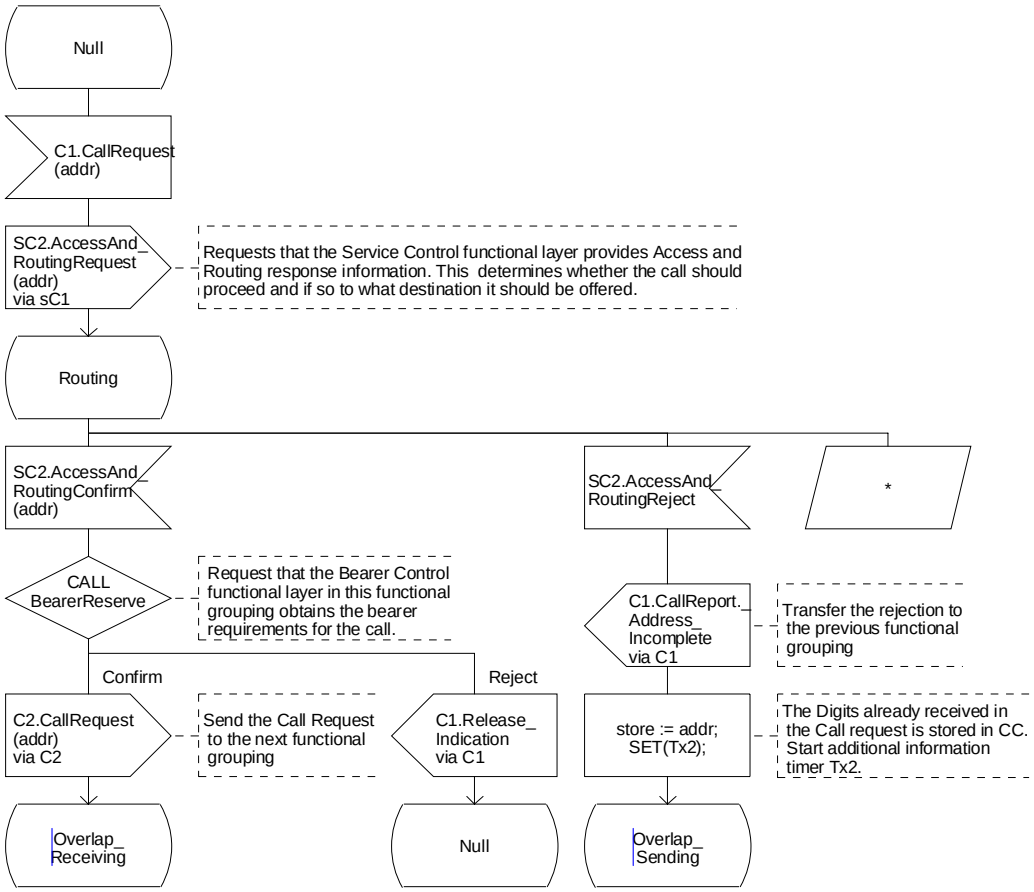


Figure A.58: Network: Initiating a call

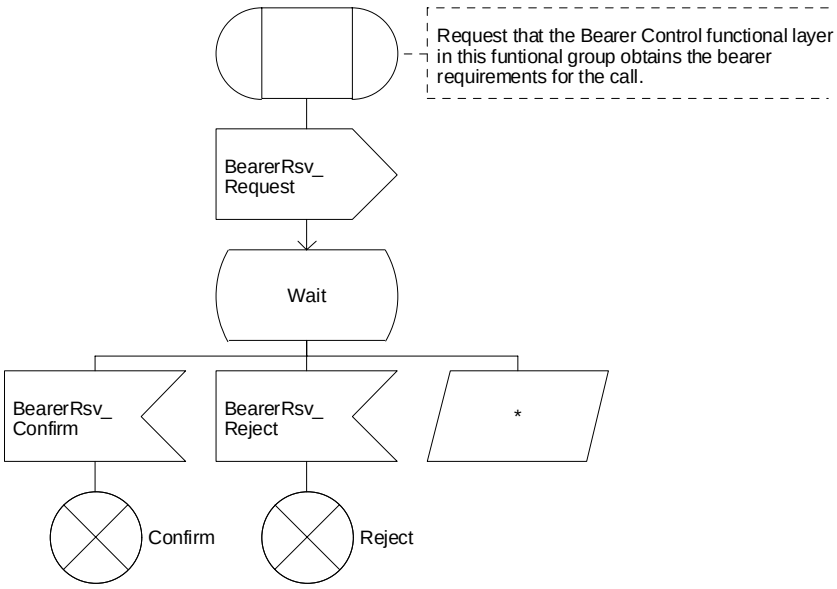


Figure A.59: Network: Procedure BearerReserve

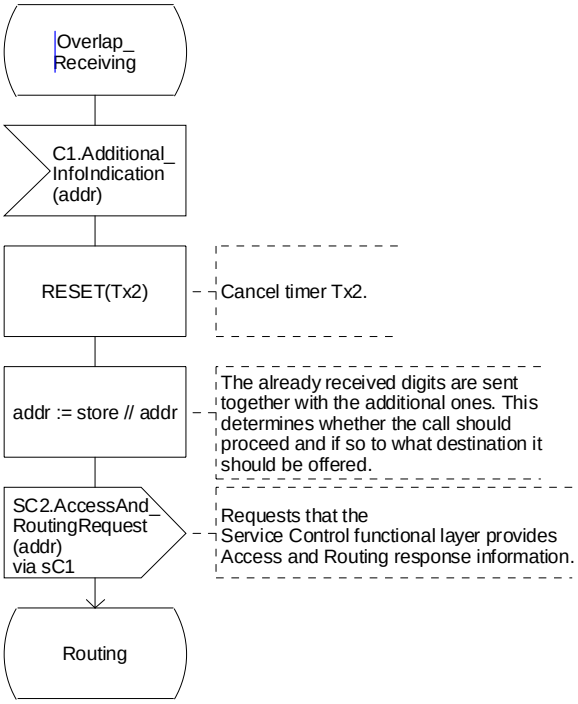


Figure A.60: Network: Overlap sending

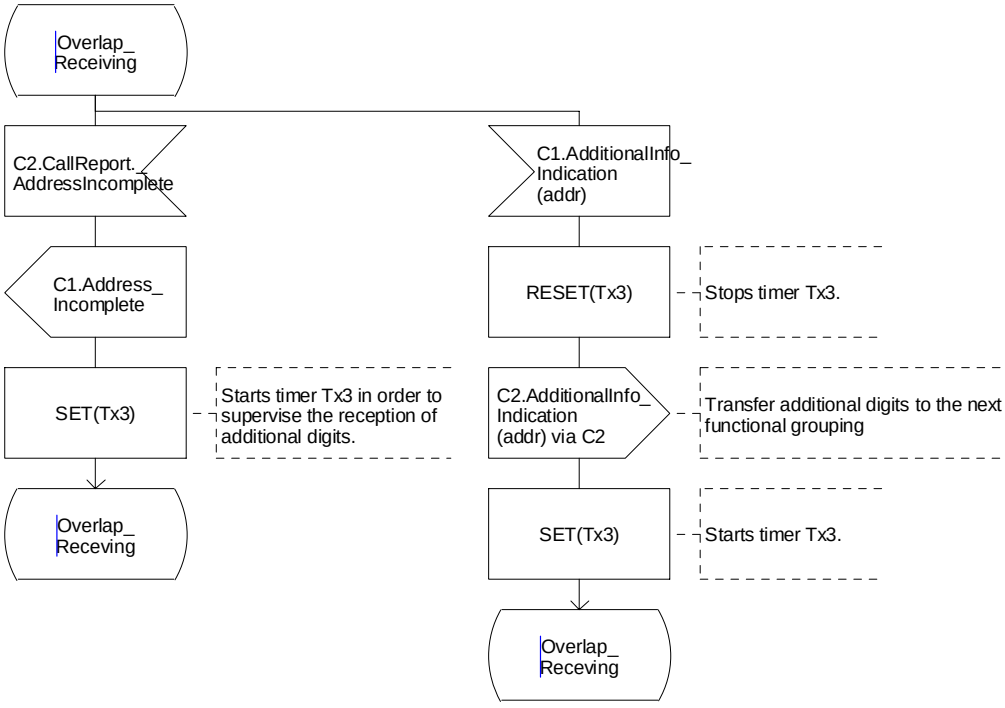


Figure A.61: Network: Overlap receiving between previous and next functional grouping

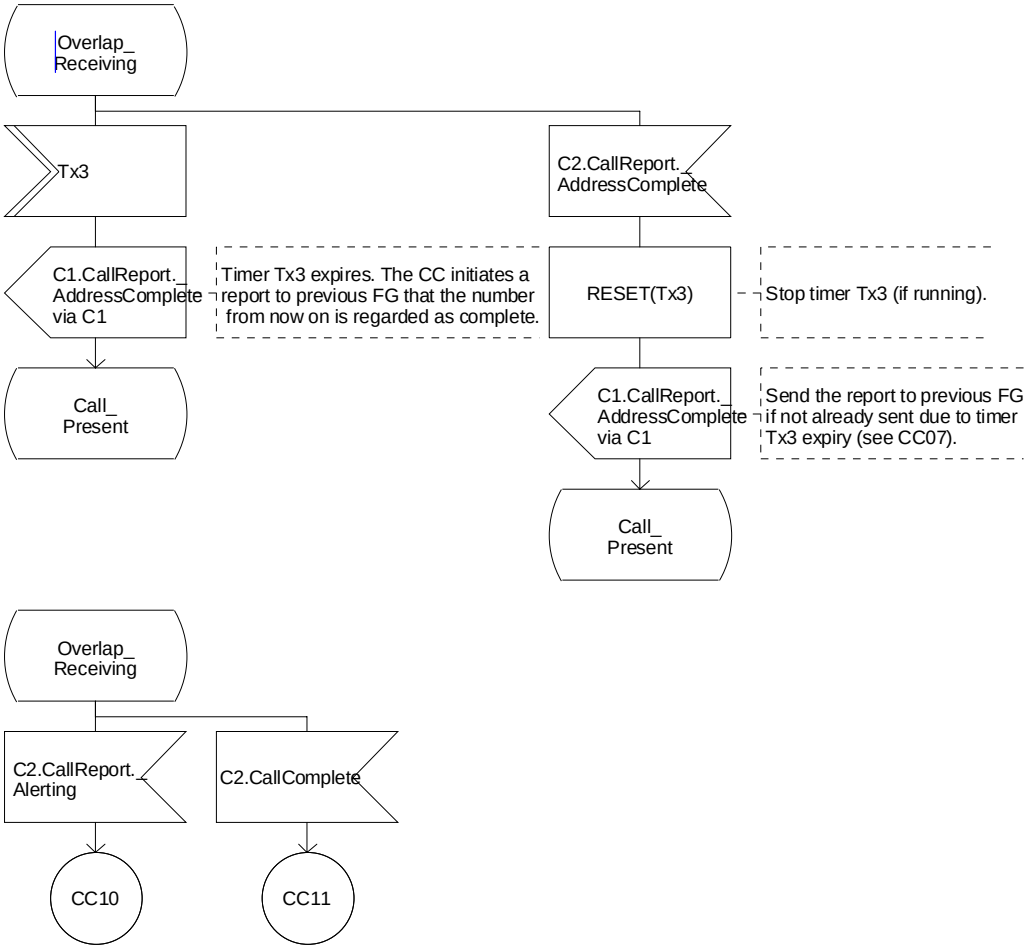


Figure A.62: Network: Completing the address

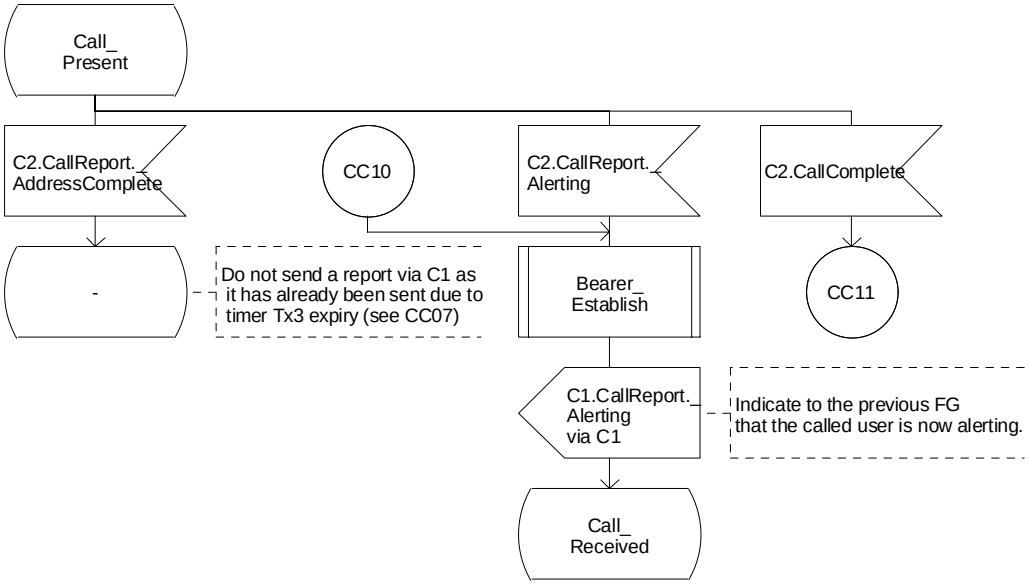


Figure A.63: Network: Call received (remote user alerting)

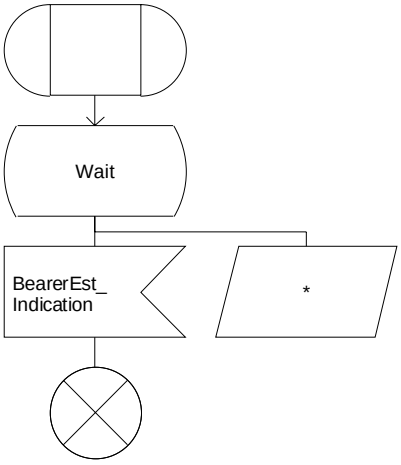


Figure A.64: Network: Procedure BearerEstablish

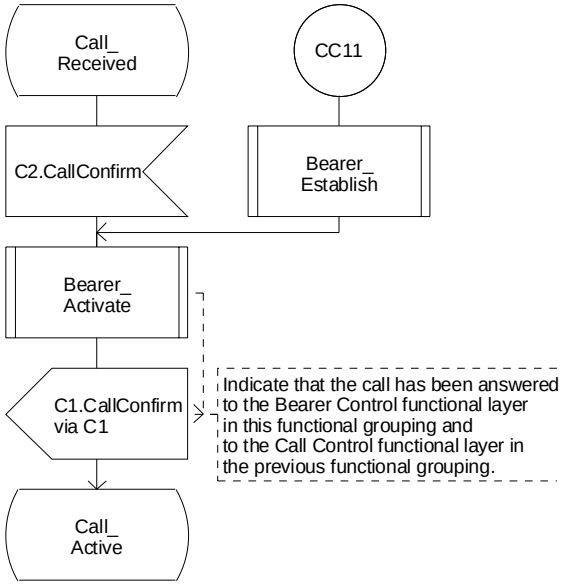


Figure A.65: Network: Call activated

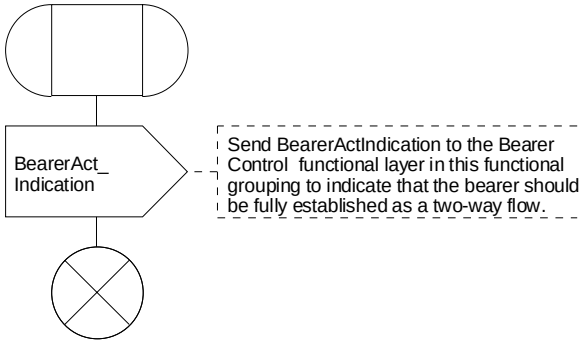


Figure A.66: Network: Procedure BearerActivate

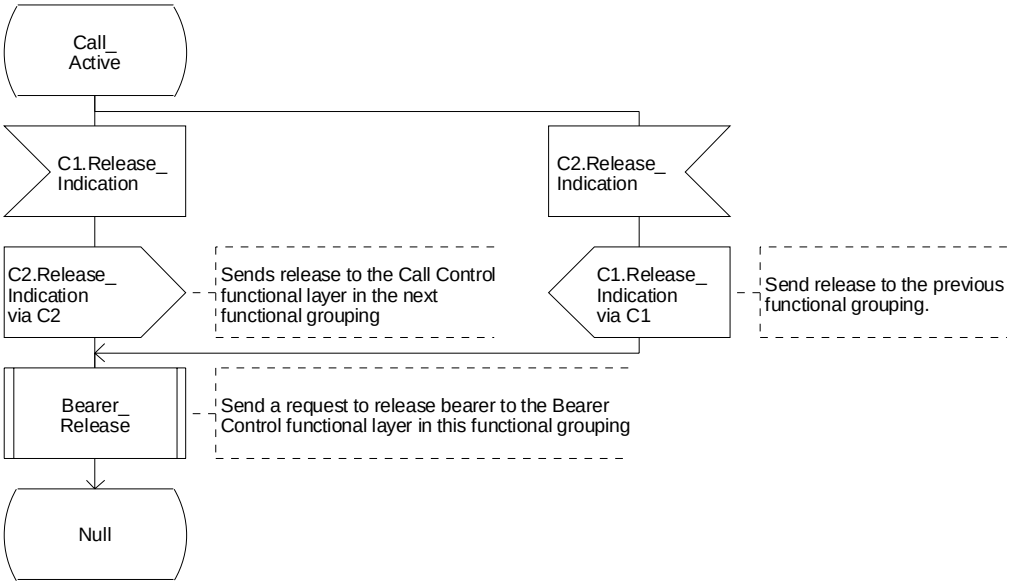


Figure A.67: Network: Releasing a call

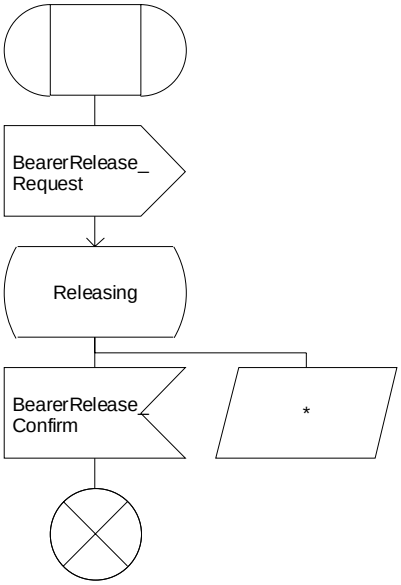


Figure A.68: Network: Procedure BearerActivate

A.2.3.4 The Bearer Control functional layer

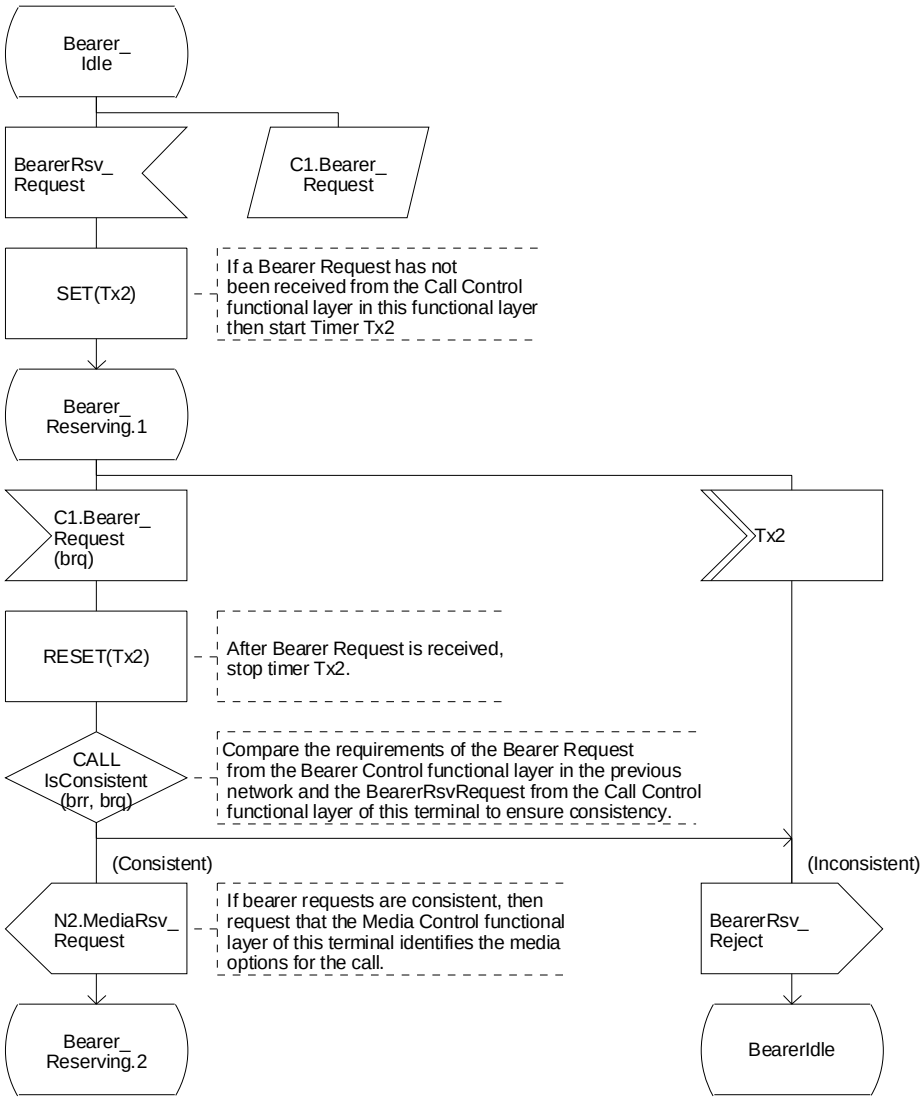


Figure A.69: Network: Reserving a bearer: waiting for BearerRequest from previous Functional Grouping

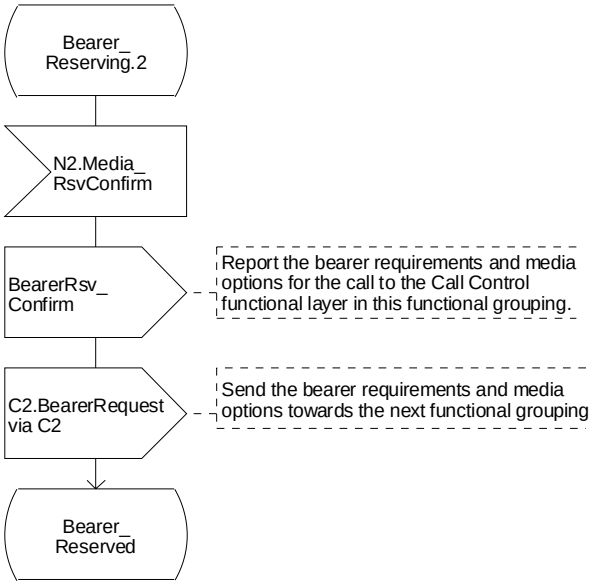


Figure A.70: Network: Reserving a bearer: waiting for MediaRsvConfirms from Media Control functional entity

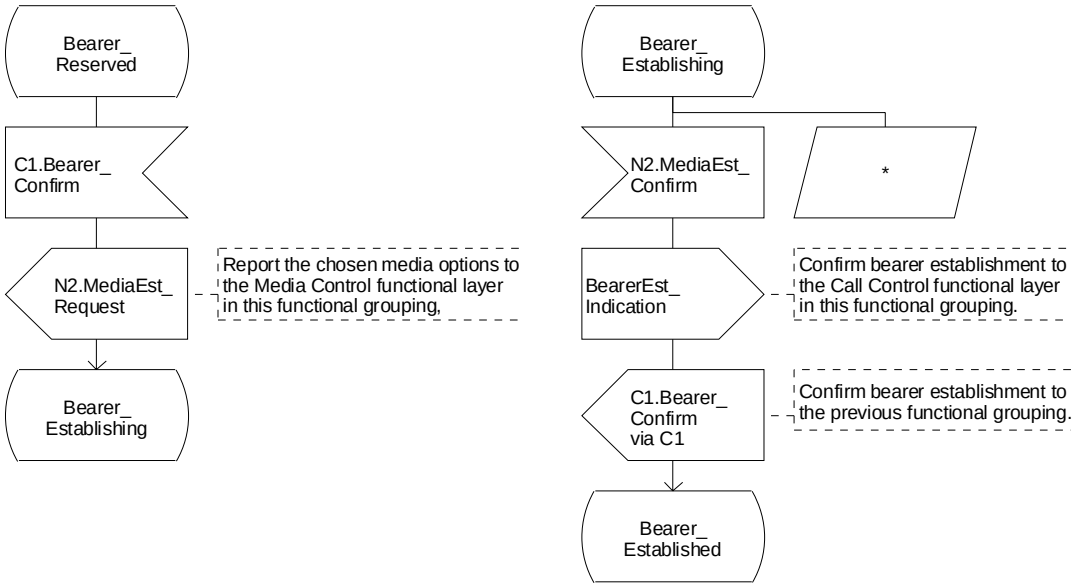


Figure A.71: Network: Establishing a bearer

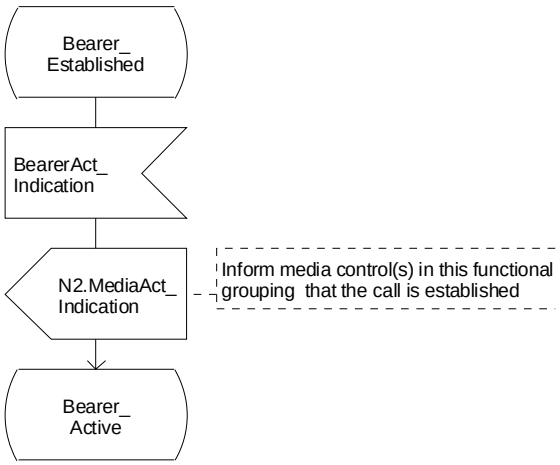


Figure A.72: Network: Activating a bearer

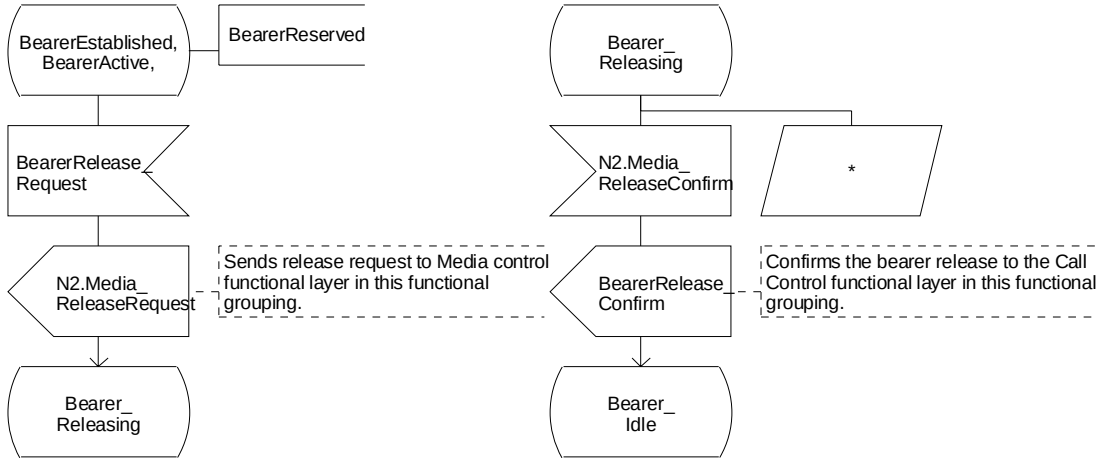


Figure A.73: Network: Releasing a bearer

A.2.3.5 The Media Control functional layer

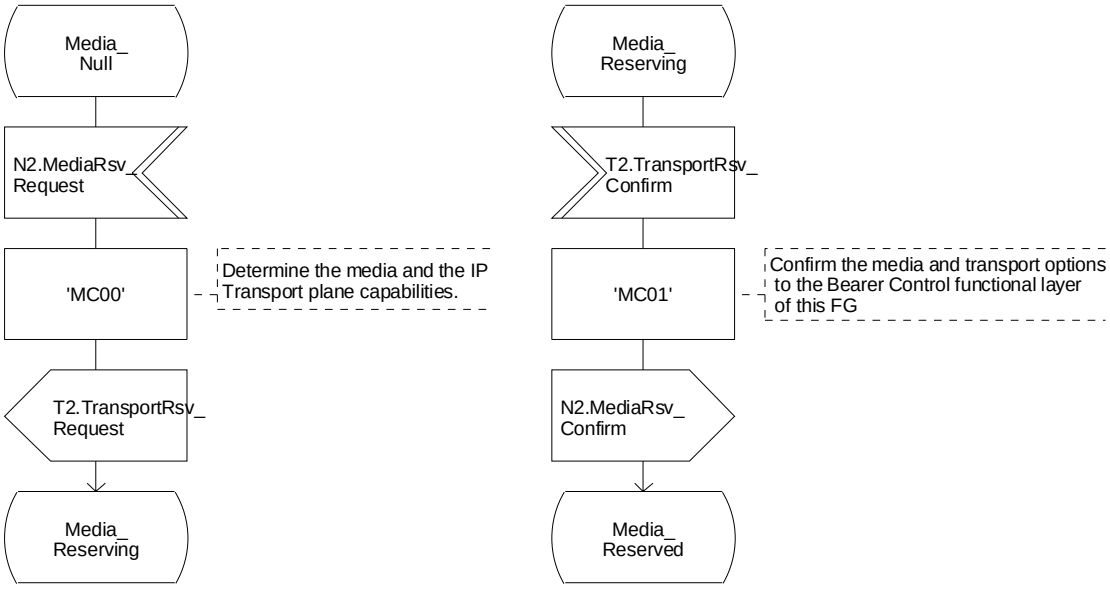


Figure A.74: Network: Reserving media

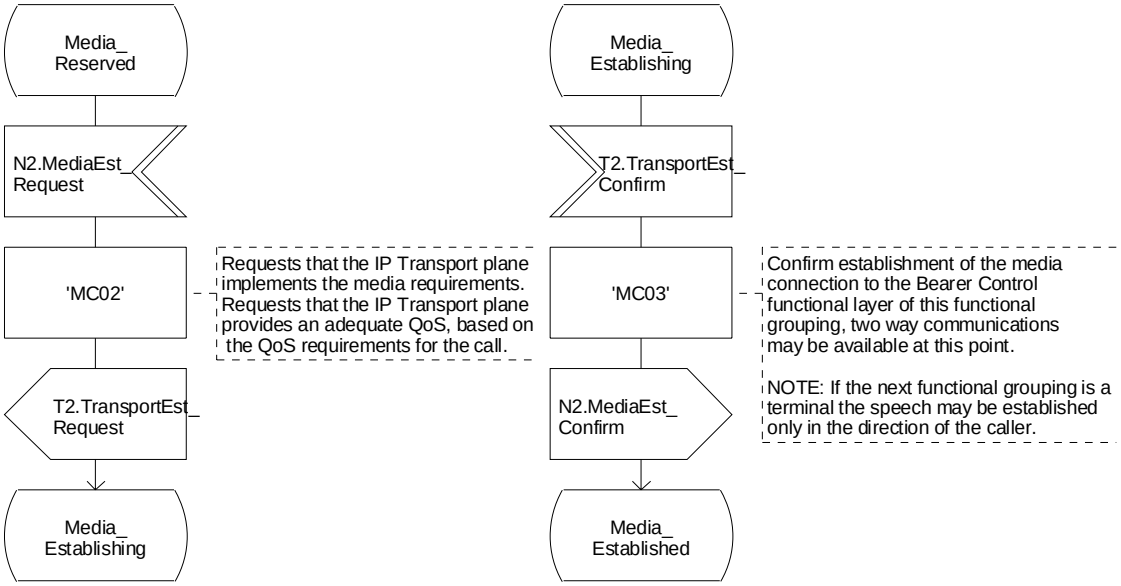


Figure A.75: Network: Establishing media

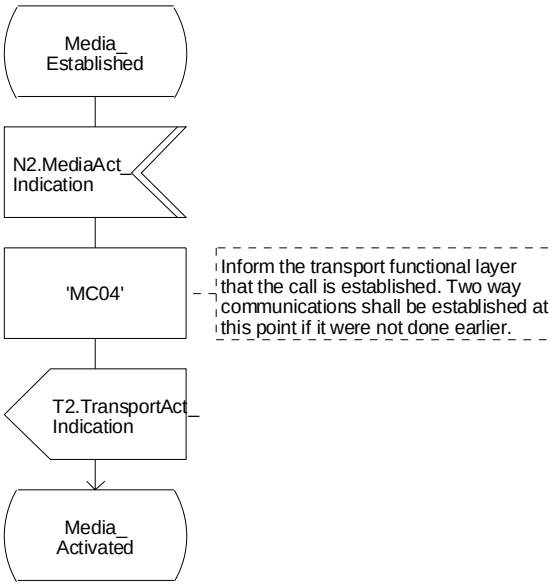


Figure A.76: Network: Activating media

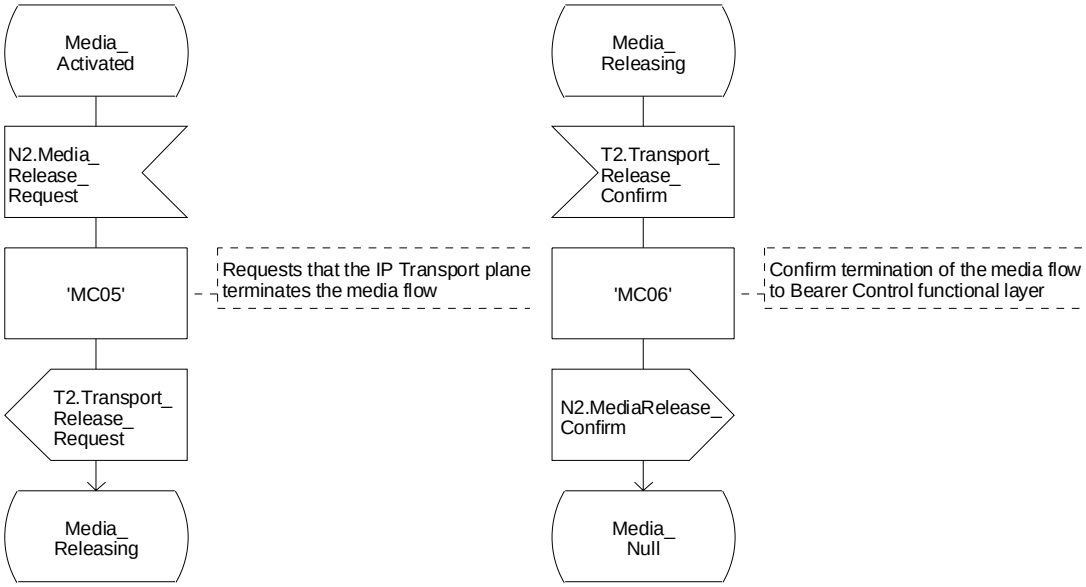


Figure A.77: Network: Releasing media

A.2.3.6 The IP Transport plane

The functional model and the functional entity actions of the IP Transport plane are outside the scope of the present document.

A.2.4 Terminating Gateway Functional Grouping

The Terminating Gateway Functional Grouping receives a call request and a bearer request from the previous functional grouping. The previous network functional grouping shall co-ordinate the reception of the call request with the reception of the bearer request.

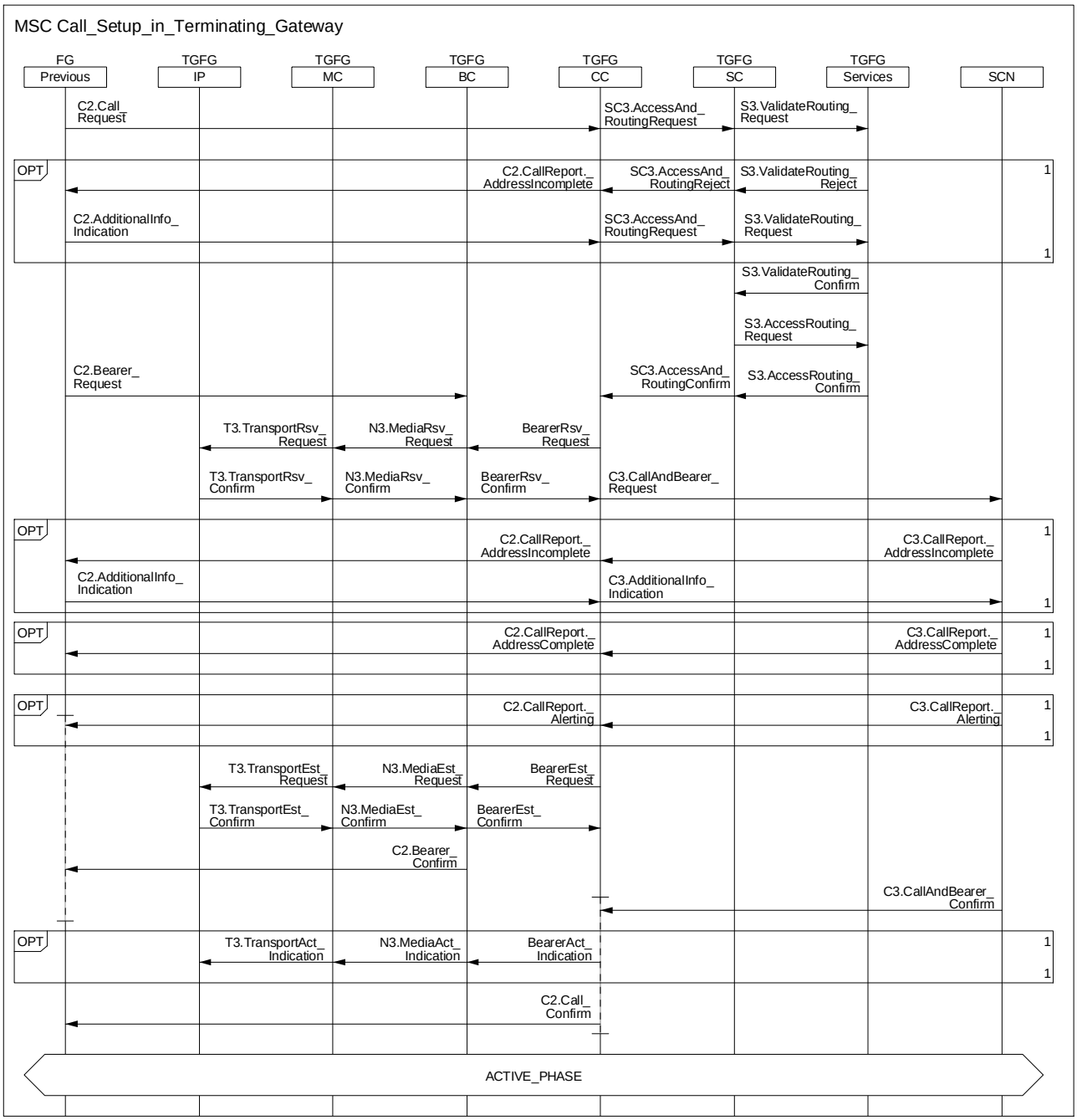


Figure A.78: Information flows at the Terminating Gateway Functional Grouping during call setup phase

NOTE 1: The Cn.CallReportAddressIncomplete and the Cn.AdditionalInfoIndication may be repeated.

The received called party number does not (when analysed in the Service functional layer) result in a destination, thus the Terminating Gateway Functional Grouping returns a report to the previous functional grouping and waits for additional digits before any routing can take place (Overlap sending phase). Once additional information is received (one or more digits) the Terminating Gateway Functional Grouping shall route the call to the SCN (Overlap receiving phase). The Terminating Gateway Functional Grouping shall supervise the Overlap sending and the Overlap receiving

phase. The Terminating Gateway Functional Grouping reports when the Called party number is complete and establishment of the bearer can take place.

User dependent events (Alerting) are reported by the SCN and Terminating Gateway Functional Grouping transfers them to the previous functional grouping. Once the user answers the call (Active phase) the Call request is confirmed by the SCN and Terminating Gateway Functional Grouping transfers confirmation to the previous functional grouping.

The figure A.78 shows the detailed information flow required for a basic call setup.

The Terminating Gateway Functional Grouping receives an indication from the previous functional grouping when the Calling party clears. The indication is transferred to the next functional grouping and the bearer is internally cleared.

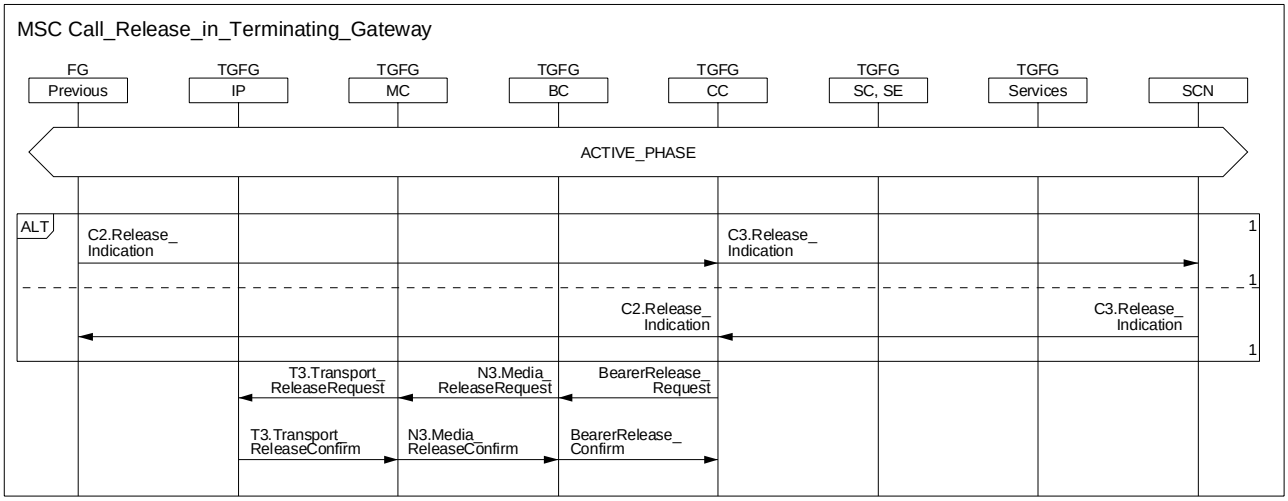


Figure A.79: Information flows at the Terminating Gateway Functional Grouping during call teardown

The Terminating Gateway Functional Grouping receives an indication from the next functional grouping when the Called party clears. The indication is transferred to the previous functional grouping and the bearer is internally cleared.

A.2.4.1 Service functional layer

The behaviour of the Services functional layer is implementation dependent. The Service functional layer is expected to respond to requests made from the Service Control functional layer with appropriate parameters.

A.2.4.2 Service Control functional layer

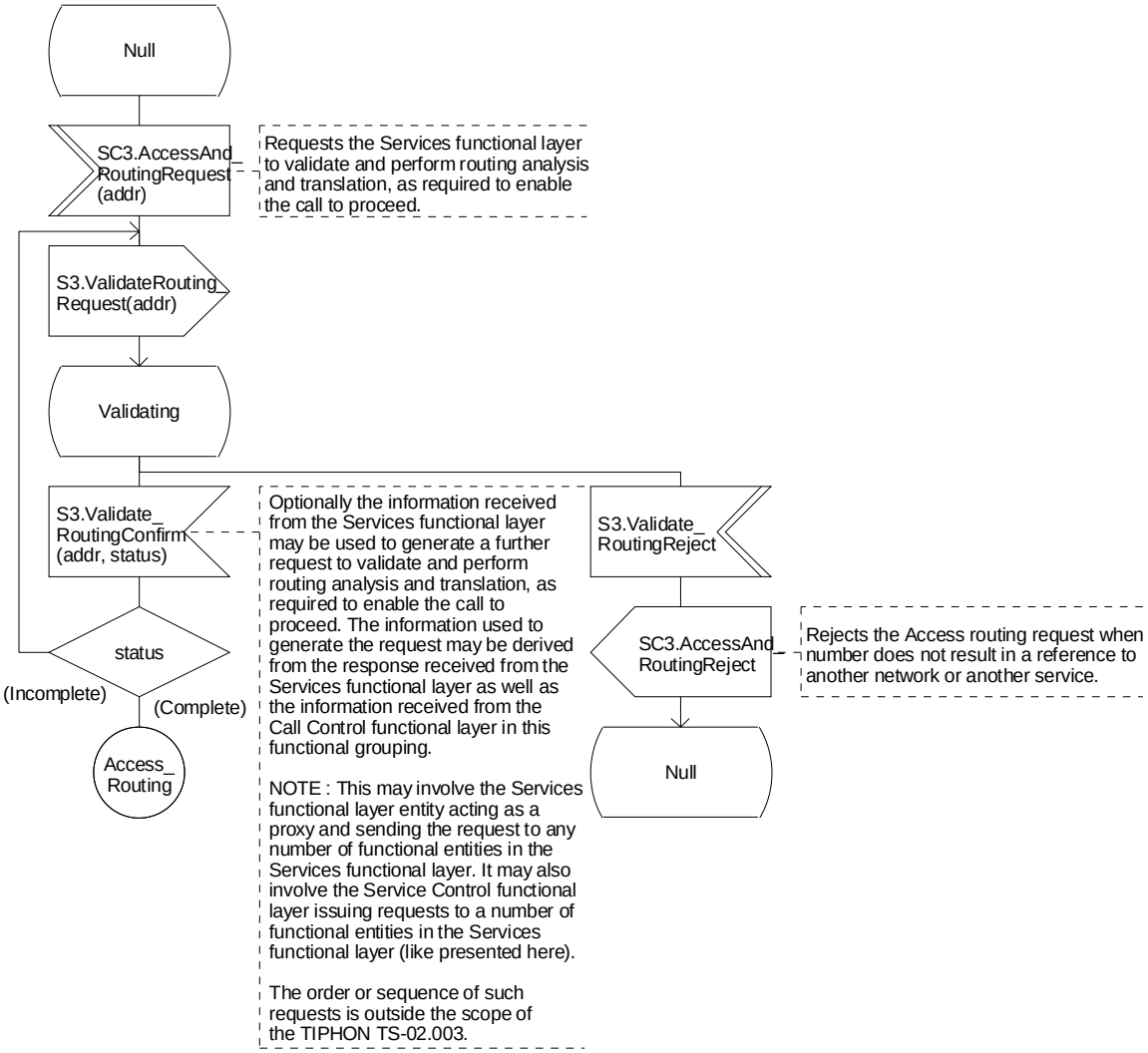


Figure A.80: Terminating Gateway: Generic call routing

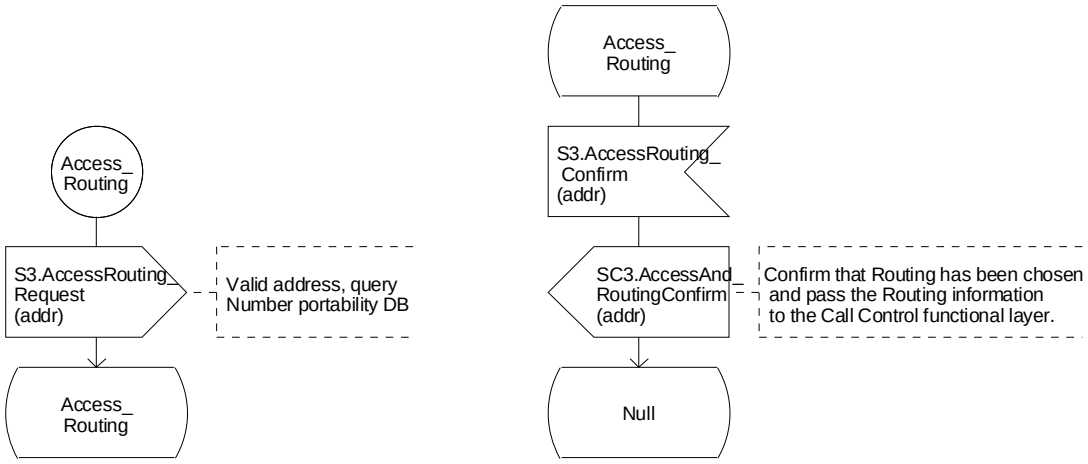


Figure A.81: Terminating Gateway: Call routing with number portability database

A.2.4.3 Call Control functional layer

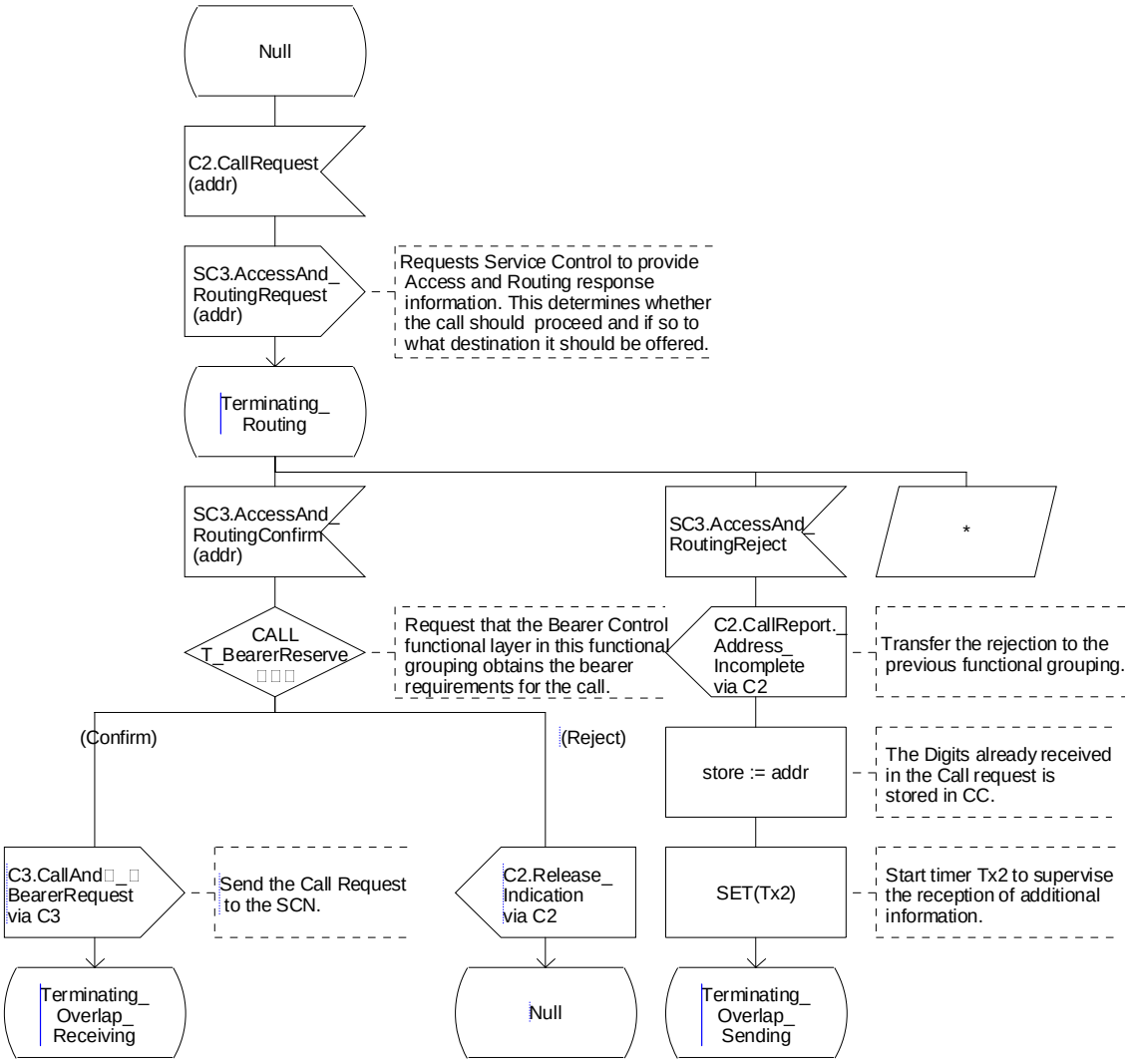


Figure A.82: Terminating Gateway: Initiating a call

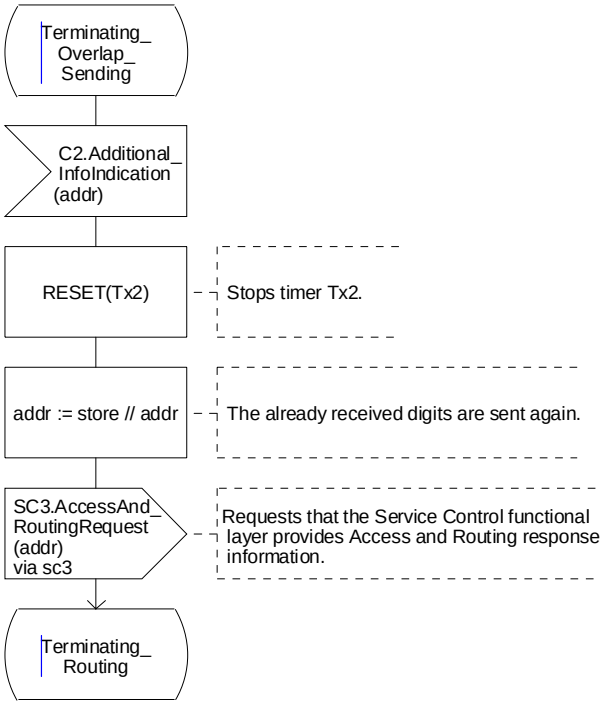


Figure A.83: Terminating Gateway: Overlap sending

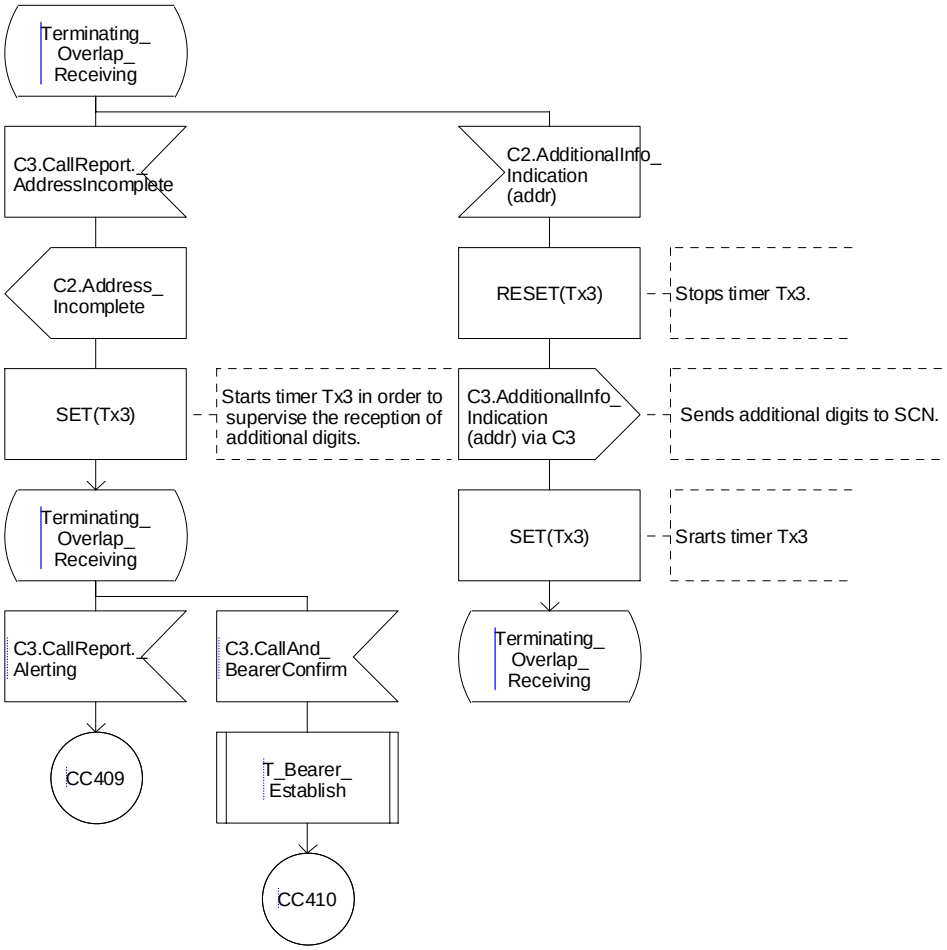


Figure A.84: Terminating Gateway: Overlap receiving – relaying additional address information towards SCN

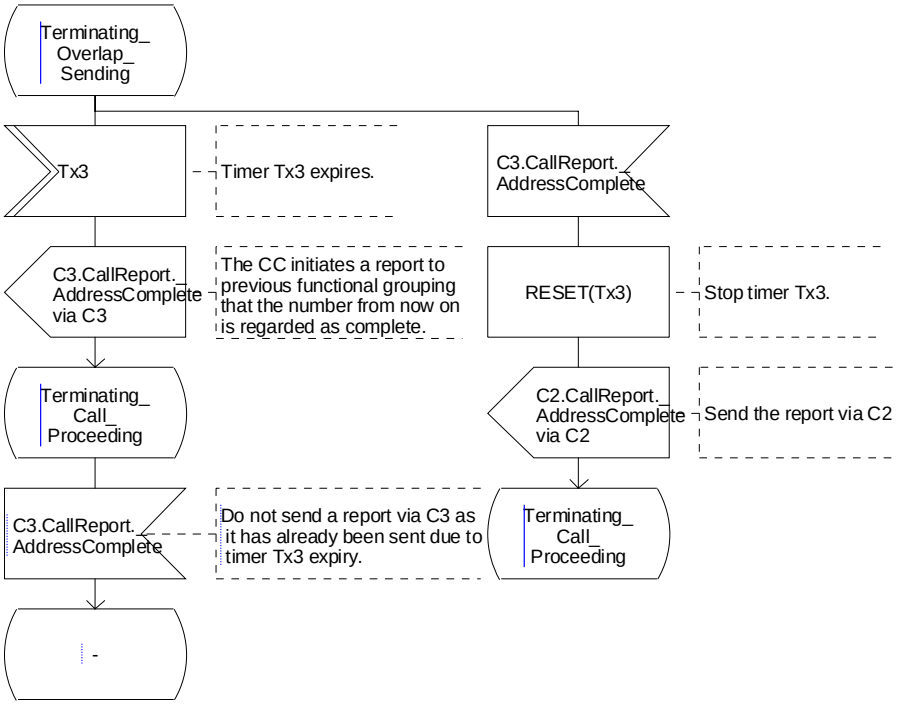


Figure A.85: Terminating Gateway: Address is complete, call will proceed

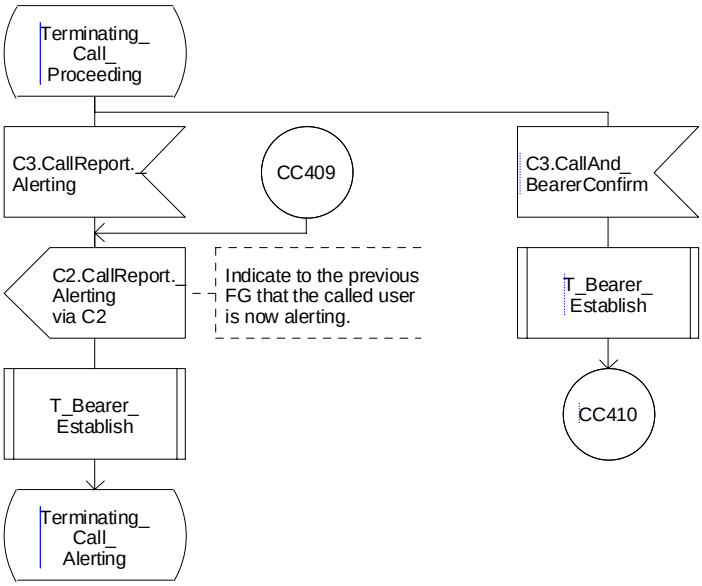


Figure A.86: Terminating Gateway: Call is received, remote user is alerting

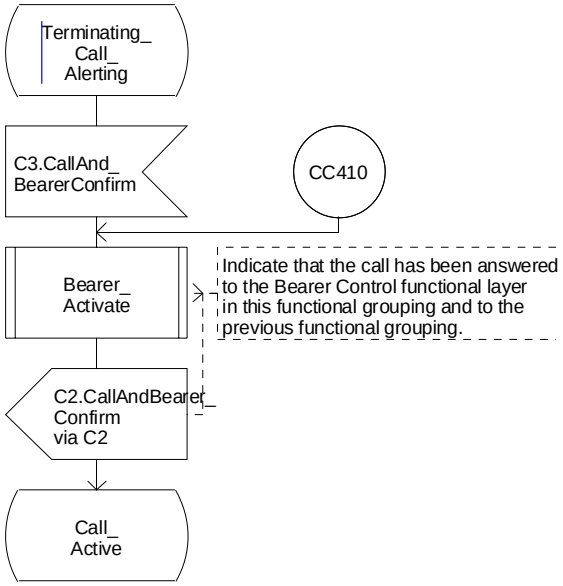


Figure A.87: Terminating Gateway: Completing the call

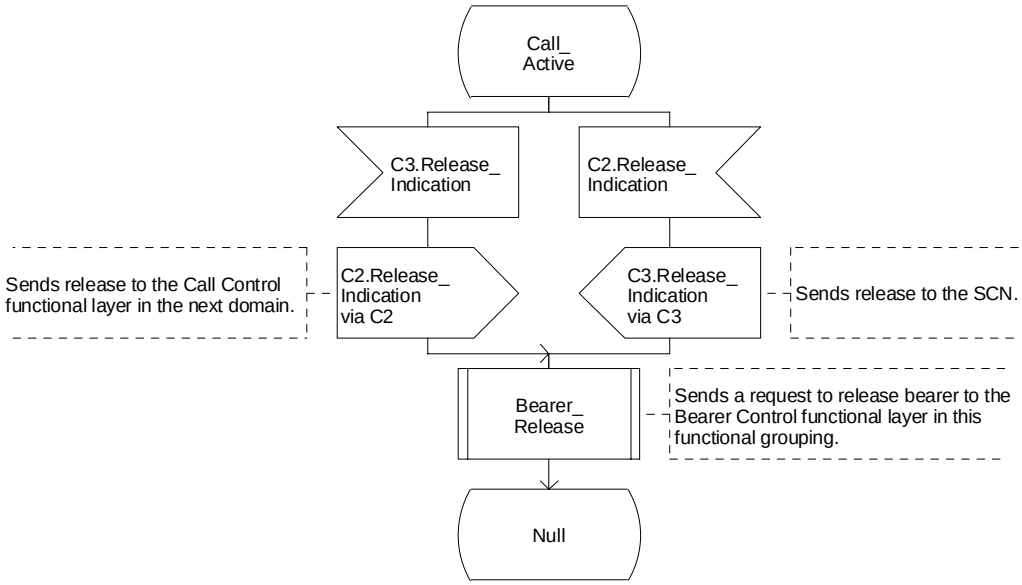


Figure A.88: Terminating Gateway: Releasing the call

A.2.4.4 Bearer Control functional layer

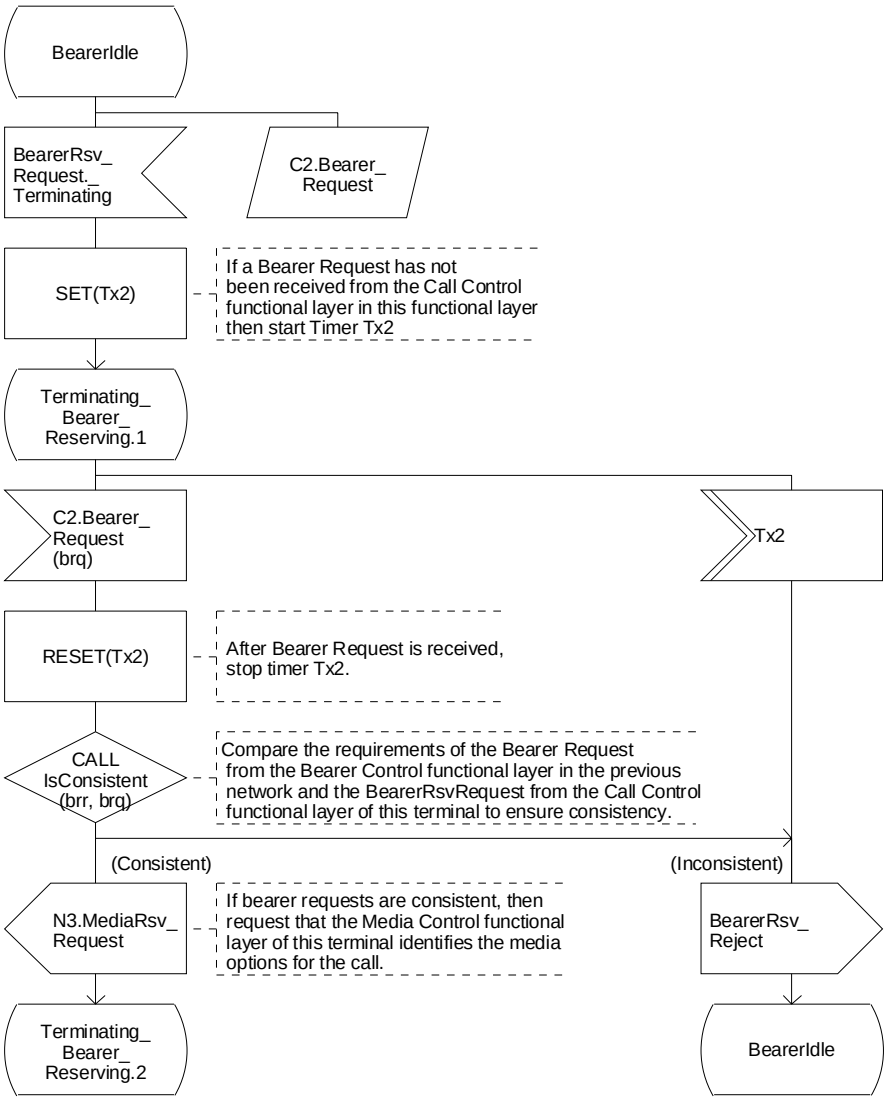


Figure A.89: Terminating Gateway: Reserving a bearer: waiting for BearerRequest from previous functional grouping

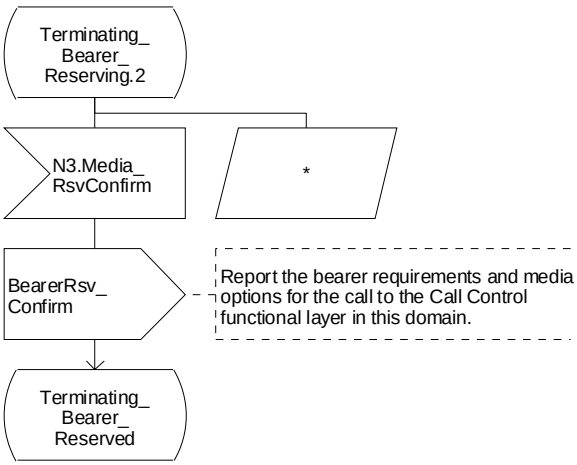


Figure A.90: Terminating Gateway: Confirming bearer reservation

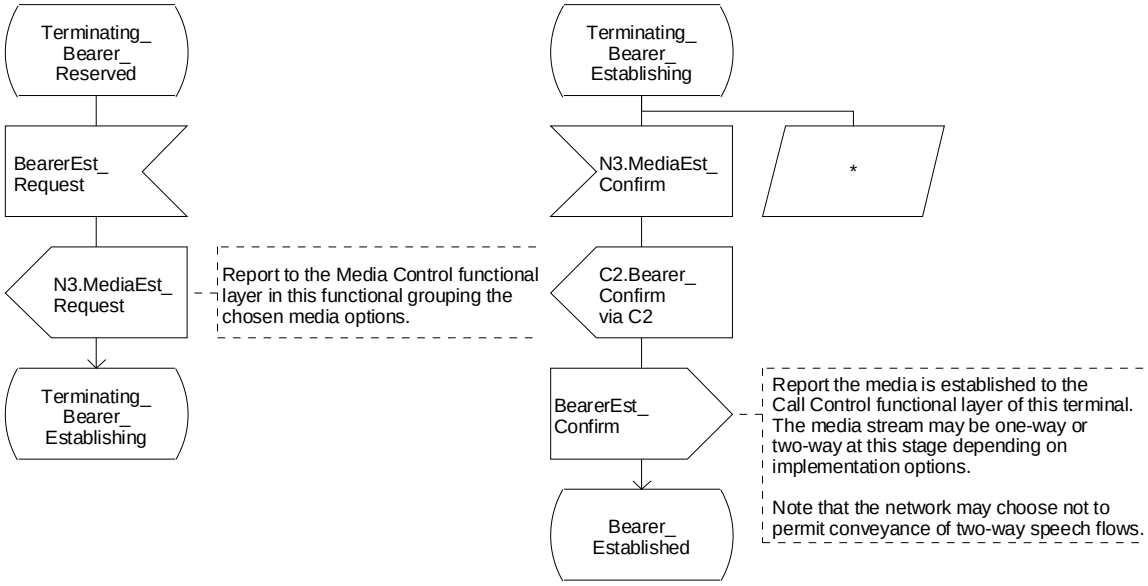


Figure A.91: Terminating Gateway: Establishing a bearer

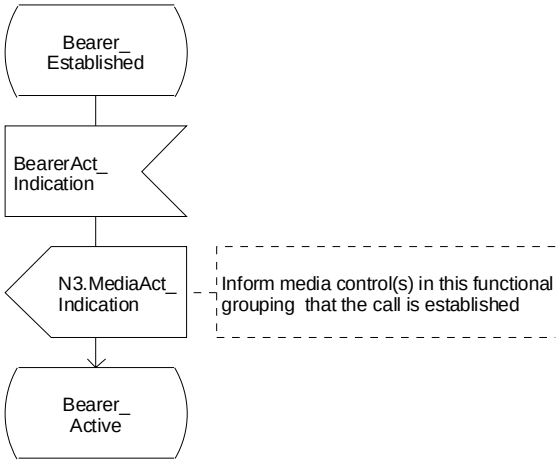


Figure A.92: Terminating Gateway: Activating a bearer

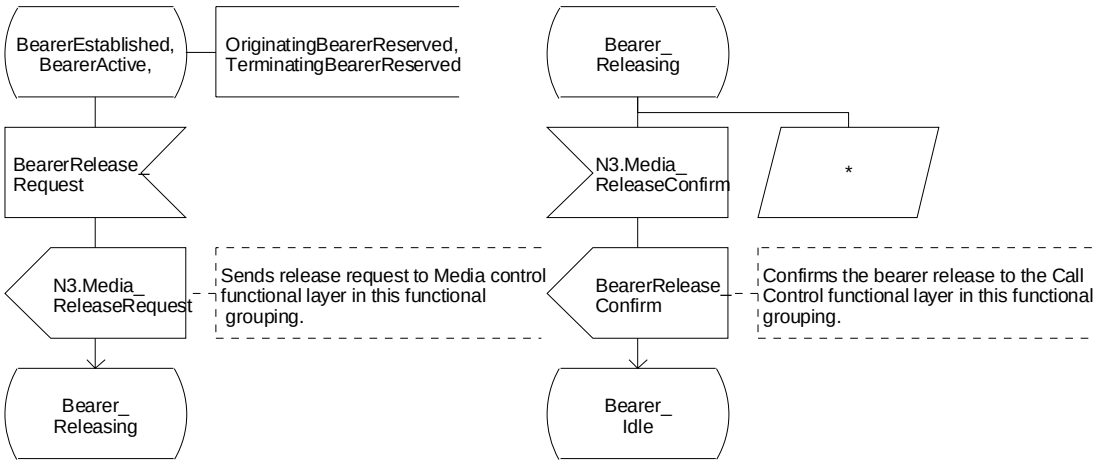


Figure A.93: Terminating Gateway: Releasing a bearer

A.2.4.5 Media control functional layer

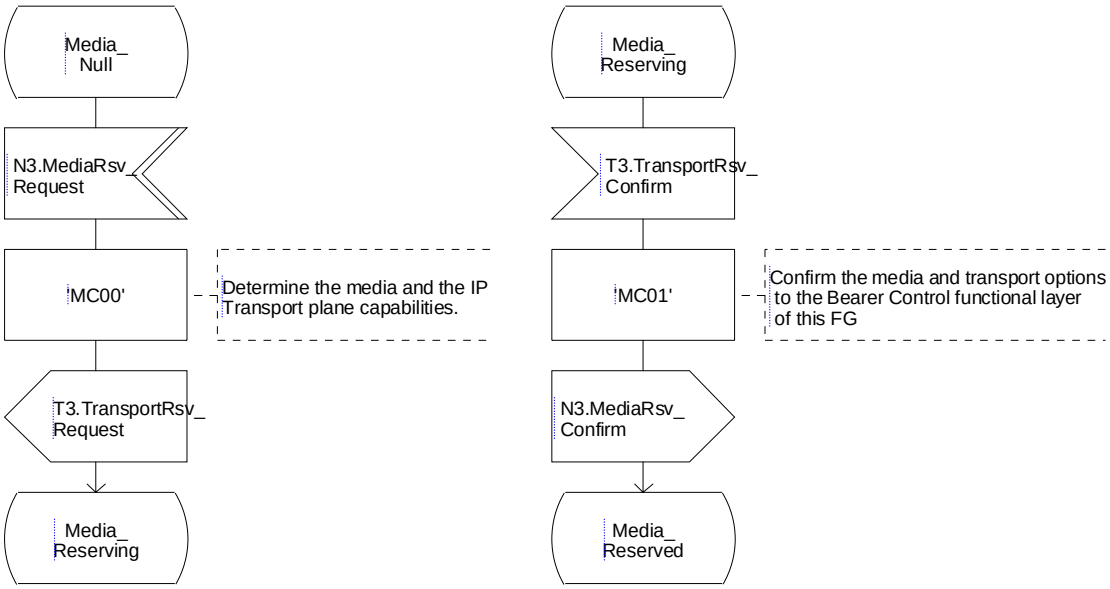


Figure A.94: Terminating Gateway: Reserving media

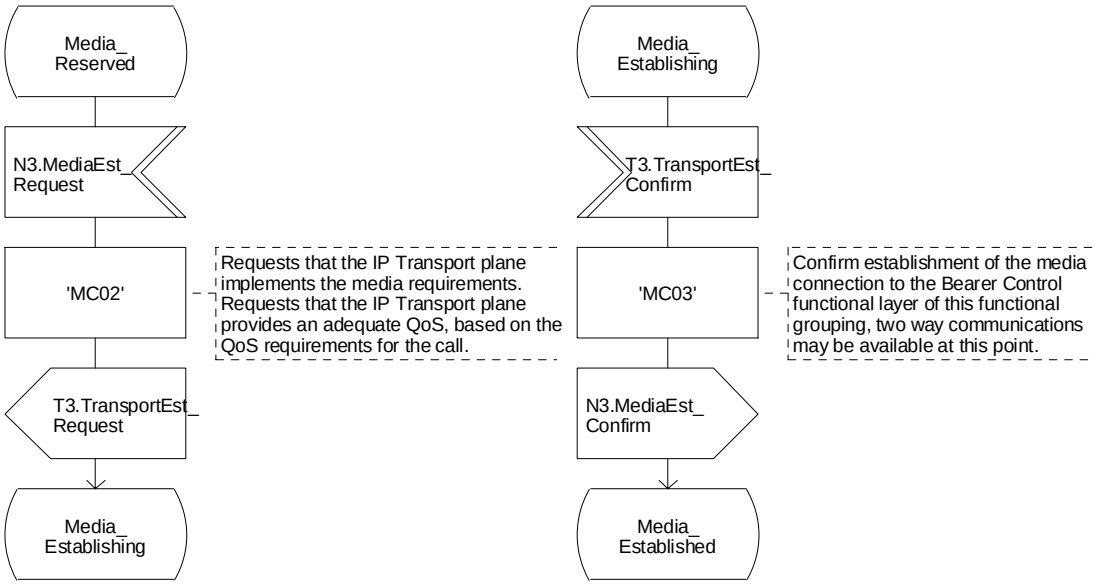


Figure A.95: Terminating Gateway: Establishing media

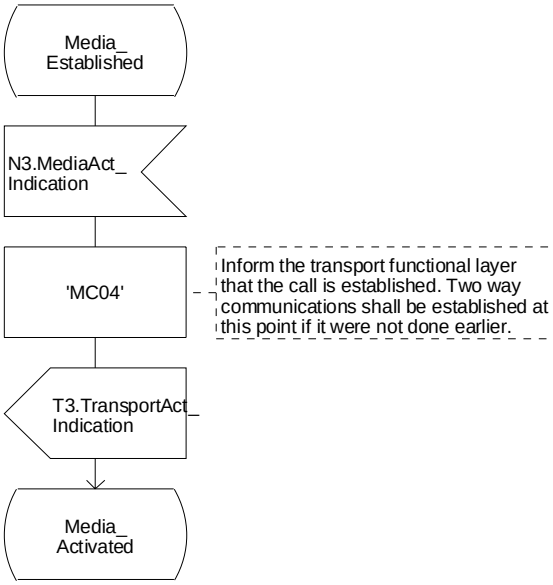


Figure A.96: Terminating Gateway: Activating media

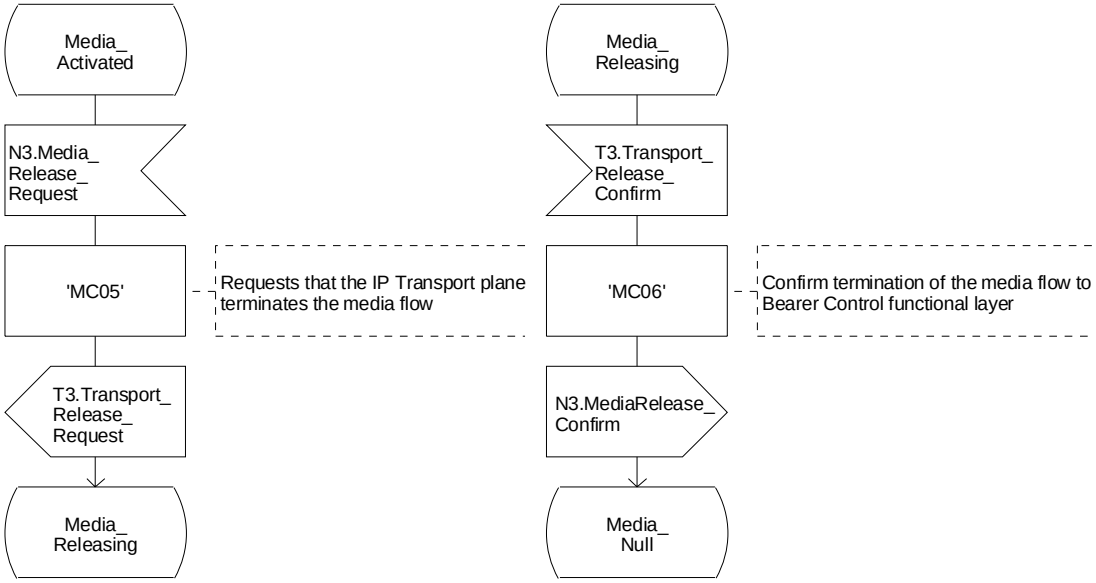


Figure A.97: Terminating Gateway: Releasing media

A.2.4.6 IP Transport plane

The functional model and the functional entity actions of the IP Transport plane are outside the scope of the present document.

A.2.5 Terminating Terminal FG

The Terminating terminal functional grouping receives a call request and a bearer request from the previous functional grouping. The Terminating terminal functional grouping shall co-ordinate the reception of the call request with the reception of the bearer request.

The Service Control functional layer shall co-ordinate the requested service (audio, video, etc.) with the availability of the hardware devices with the called user requirements required to perform the service.

NOTE: The interface for how the User impacts the selection of the hardware device is implementation dependent.

The arrival of the call is indicated to the Services functional layer (and thus the user) and reported to the previous functional grouping as an Alerting event. The Services functional layer shall indicate when the user answers and the call request may be confirmed to the previous functional grouping.

The figure A.98 shows the detailed information flow required for a basic call setup.

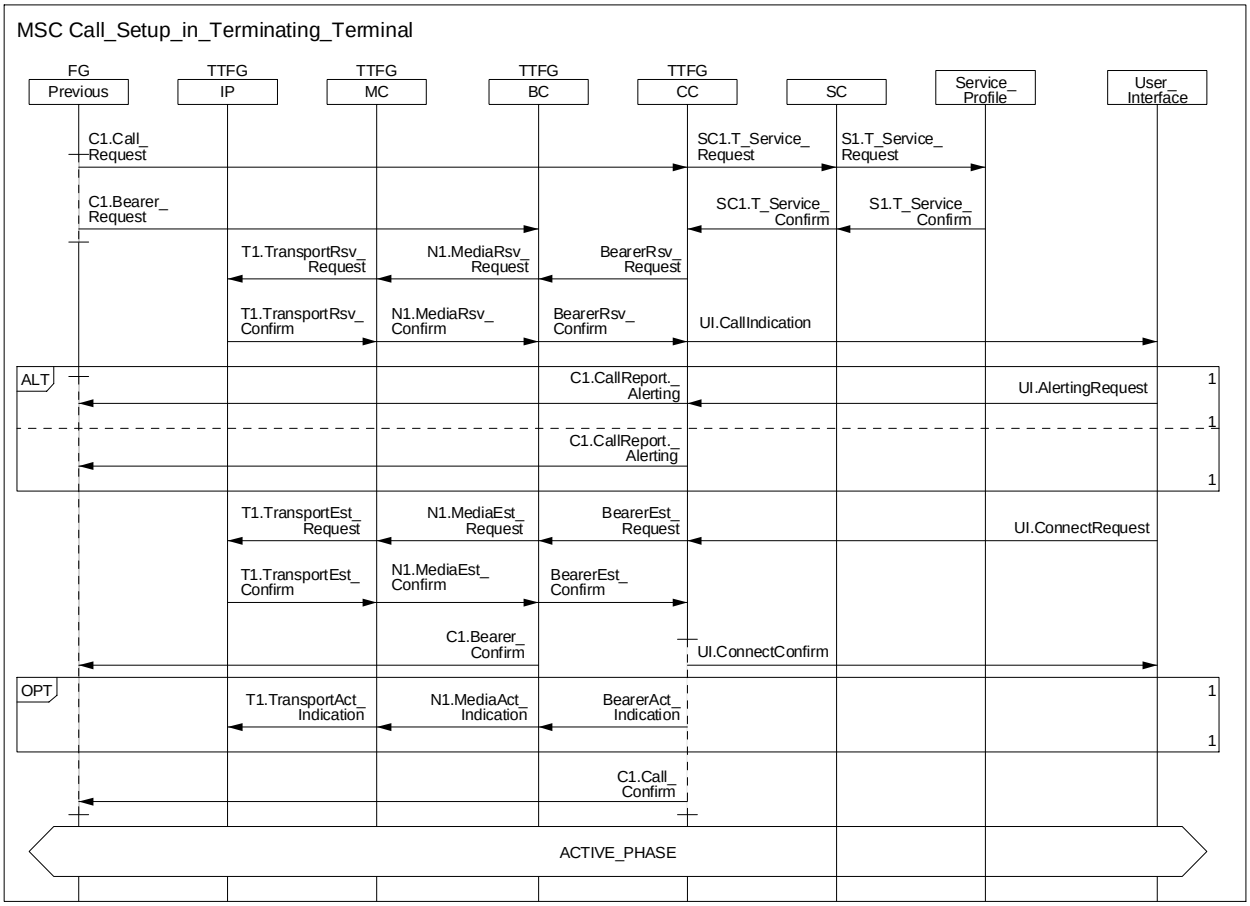


Figure A.98: Information flows at the Terminating Terminal Functional Grouping during the call setup phase

The previous functional grouping shall indicate when the Calling party clears. The bearer shall be released internally before an indication is sent to the Services functional layer. The Services functional layer shall indicate to the user that the call is cleared. The indication to the user is implementation dependent.

The figure shows the detailed information flow required when the Calling party clears.

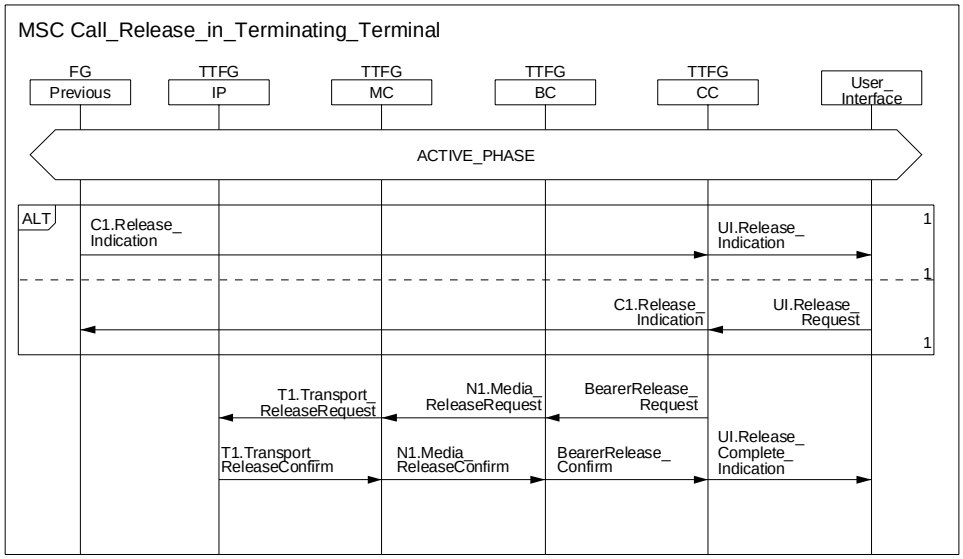


Figure A.99: Information flows at the Terminating Terminal Functional Grouping during the call teardown phase

The Terminating terminal functional grouping shall indicate to the previous functional grouping when the Called party clears and internally release the bearer.

A.2.5.1 The Services functional layers

The services available to the terminal user are outside the scope of the present document.

A.2.5.2 The Service Control functional layer

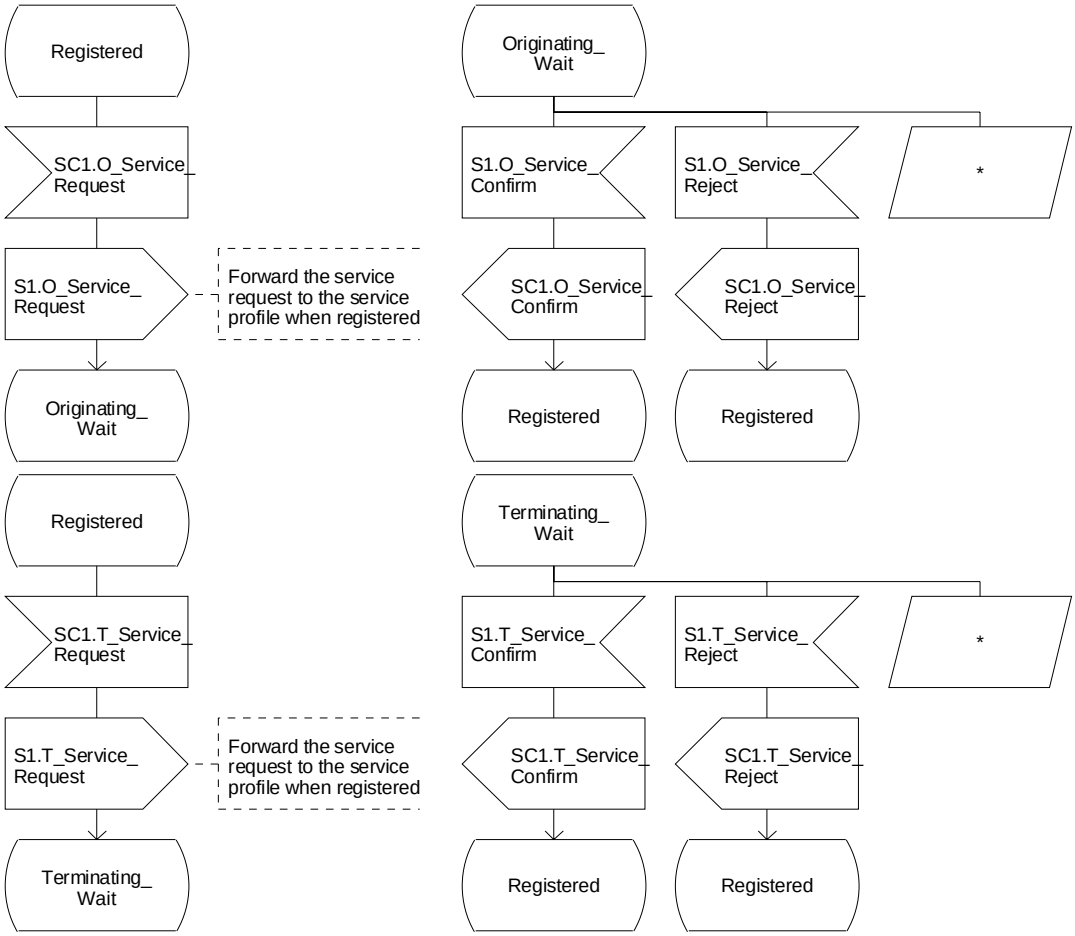


Figure A.100: Terminating Terminal: Decide if terminal status and the service profile allows presenting the call to the user

A.2.5.3 The Call Control functional layer

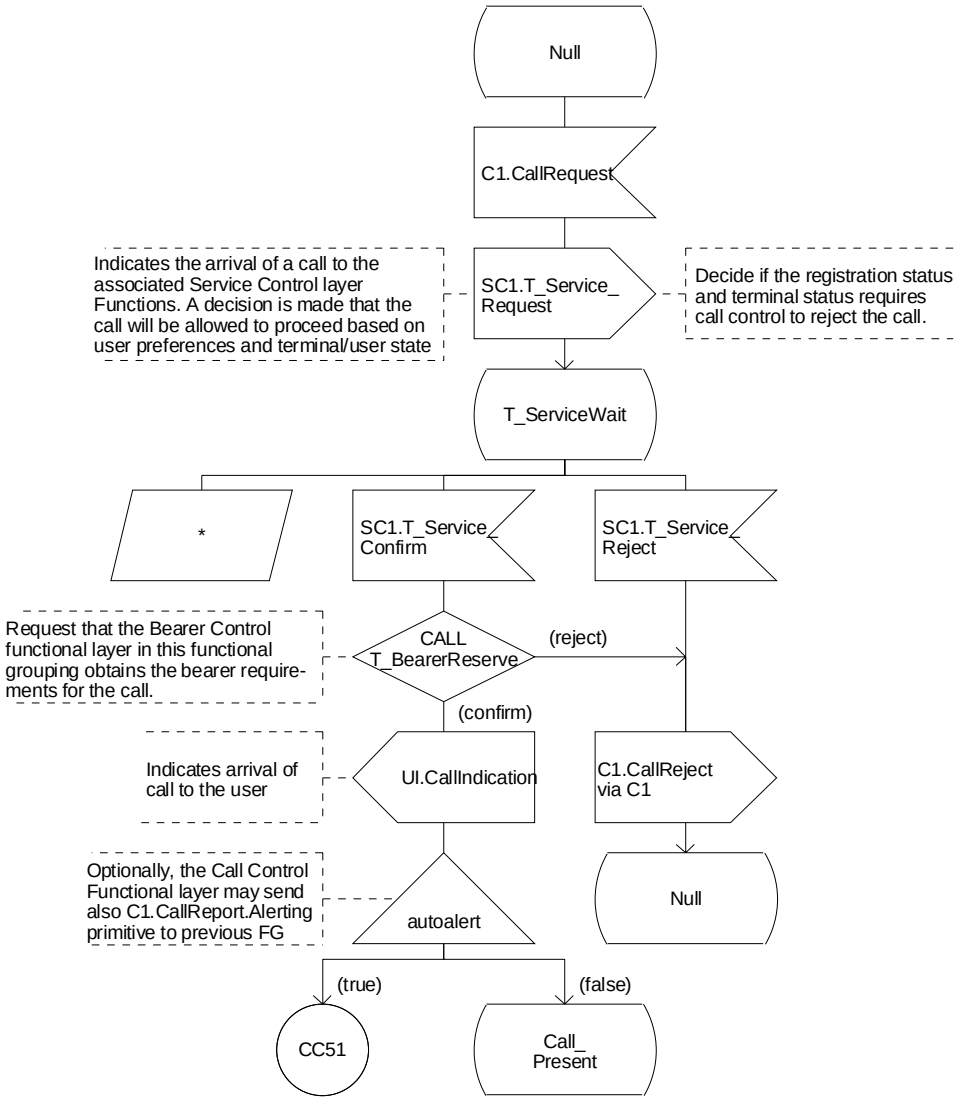


Figure A.101: Terminating Terminal: initiating a call

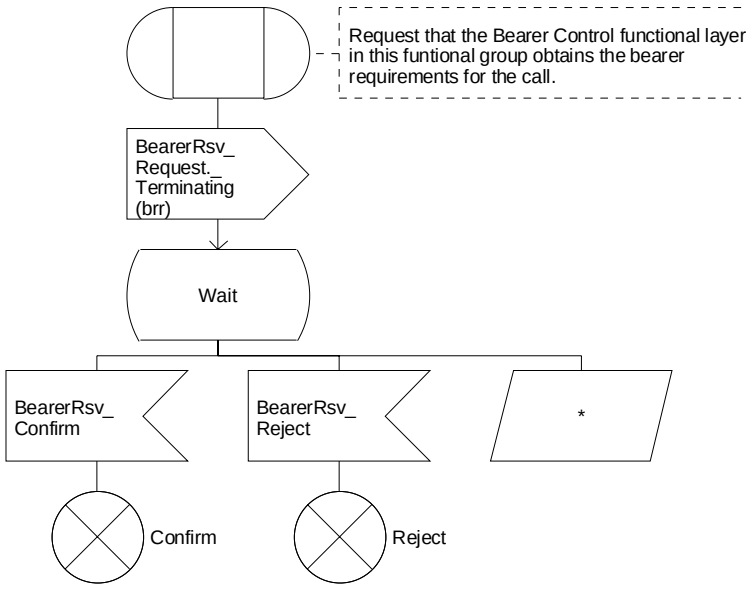


Figure A.102: Terminating Terminal: Procedure T_BearerReserve

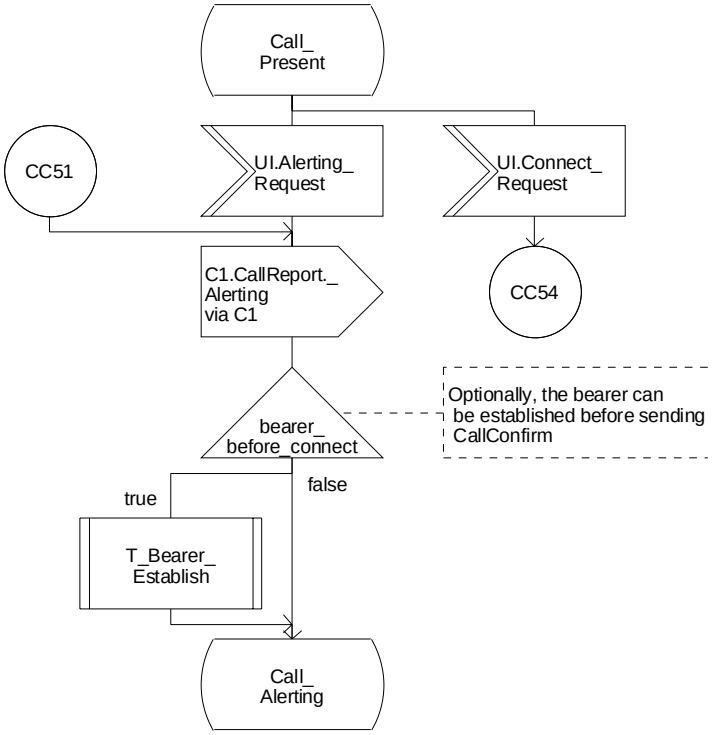


Figure A.103: Terminating Terminal: User alerting

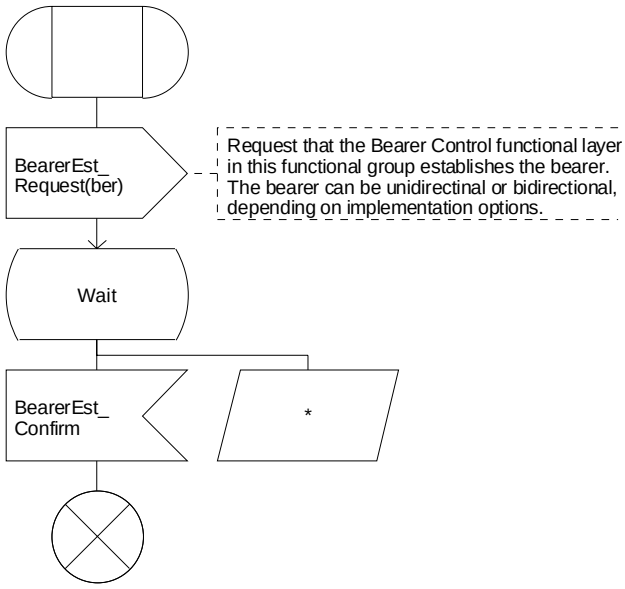


Figure A.104: Terminating Terminal: Procedure T_BearerEstablish

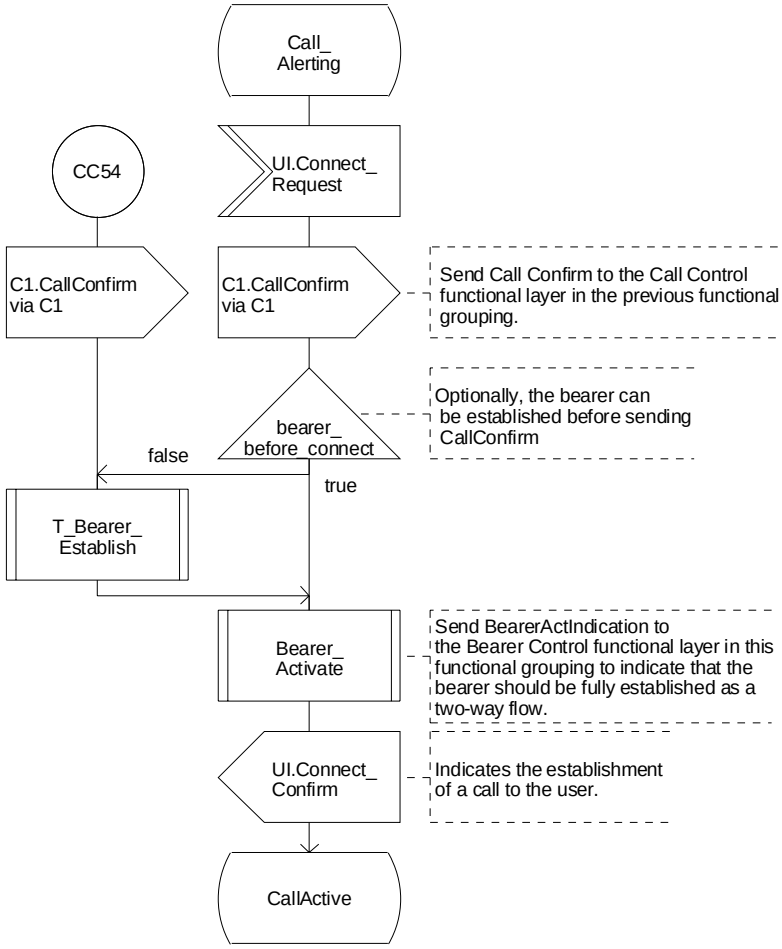


Figure A.105: Terminating Terminal: Accepting a call

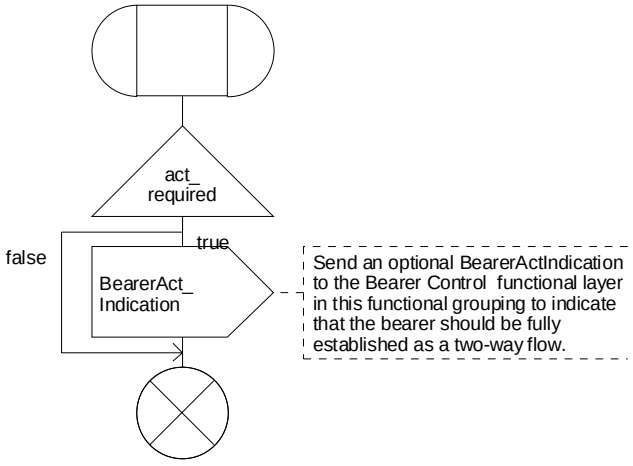


Figure A.106: Terminating Terminal: Procedure BearerActivate

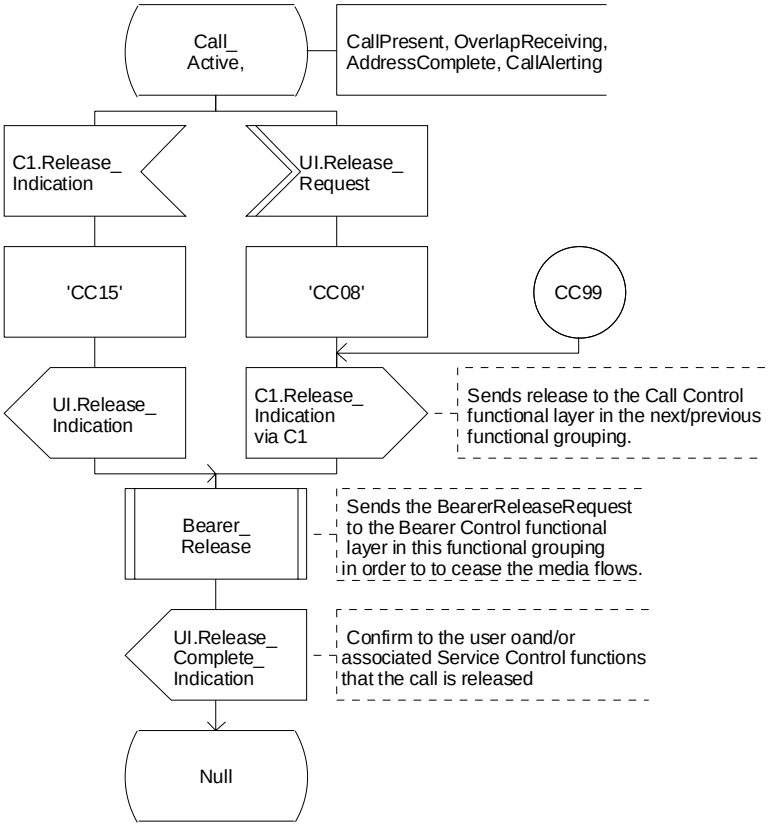


Figure A.107: Terminating Terminal: Releasing a call

A.2.5.4 The Bearer Control functional layer

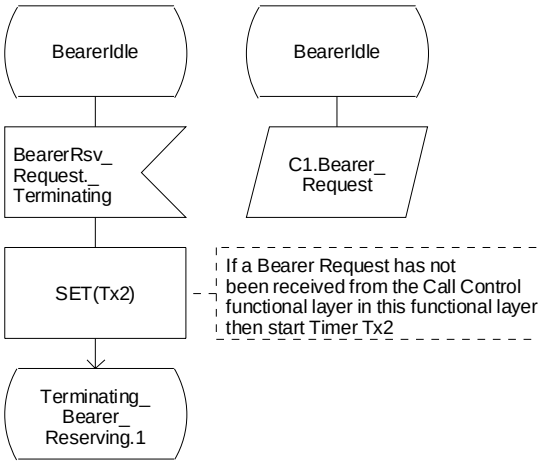


Figure A.108: Terminating Terminal: Reserving a bearer: waiting for BearerRequest from previous Functional Grouping

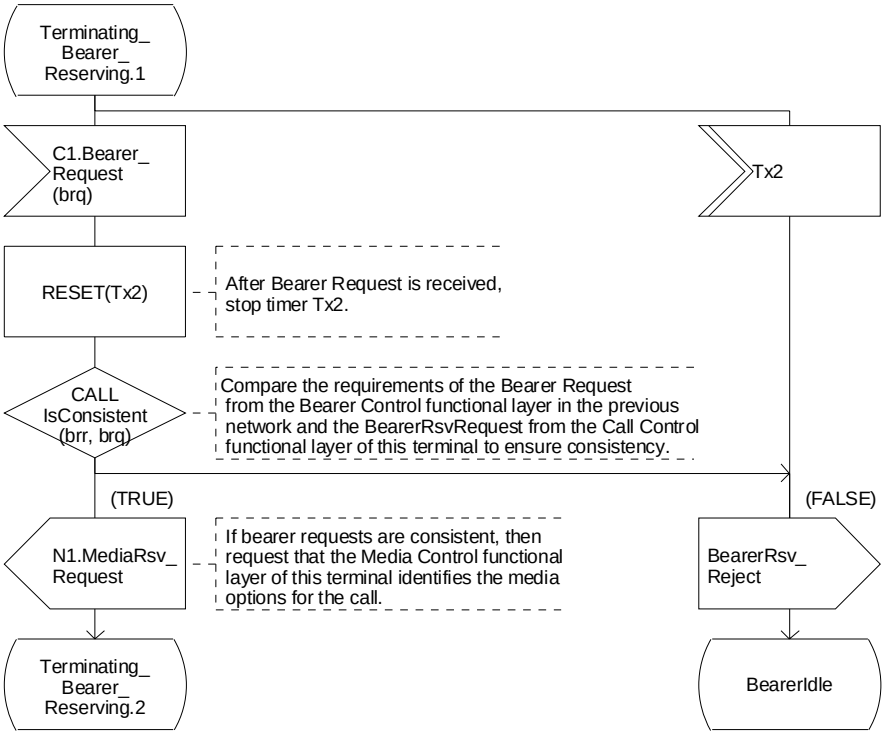


Figure A.109: Terminating Terminal: Reserving a bearer: compare the requirements and reserve media

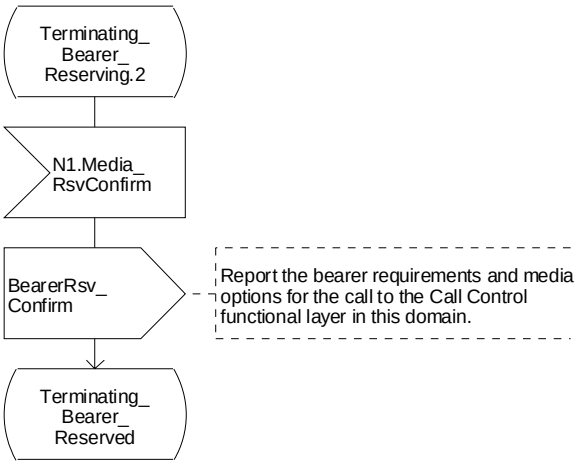


Figure A.110: Terminating Terminal: Reserving a bearer: confirm media reservation to call control layer

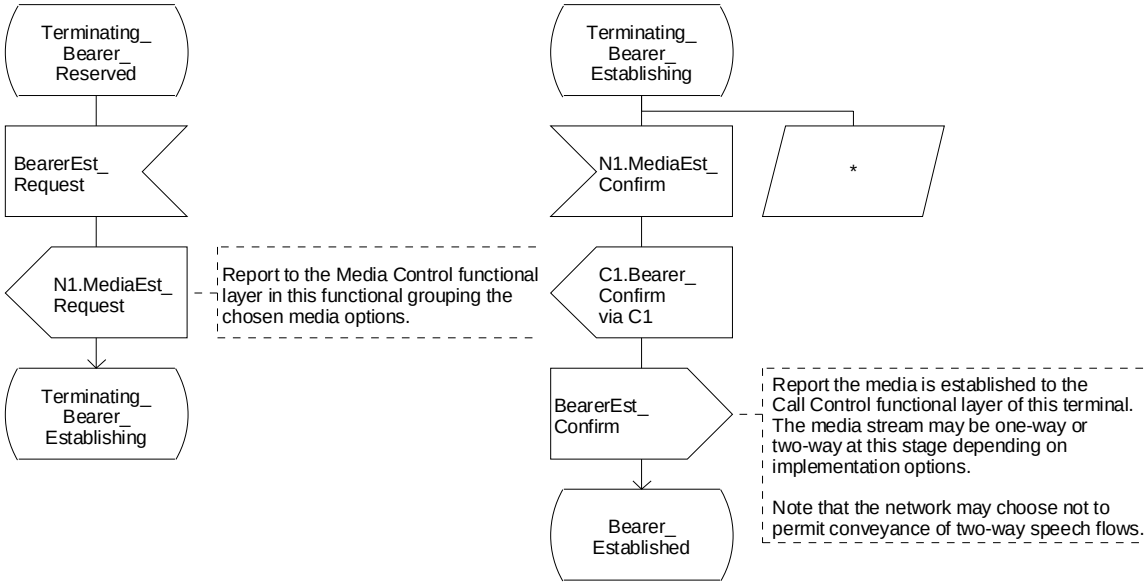


Figure A.111: Terminating Terminal: Establishing a bearer

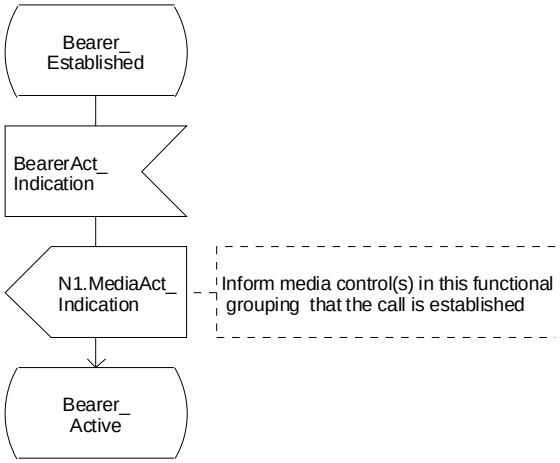


Figure A.112: Terminating Terminal: Activating a bearer

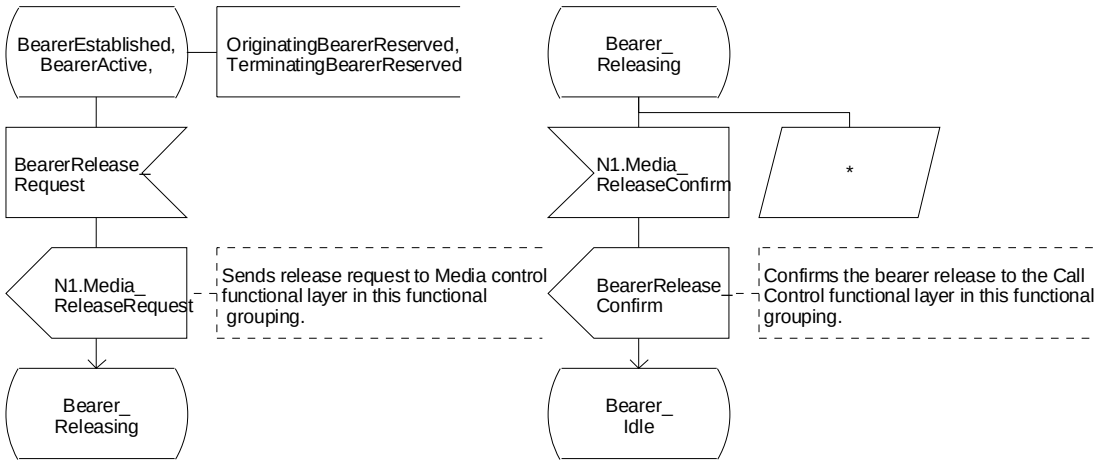


Figure A.113: Terminating Terminal: Releasing a bearer

A.2.5.5 The Media Control functional layer

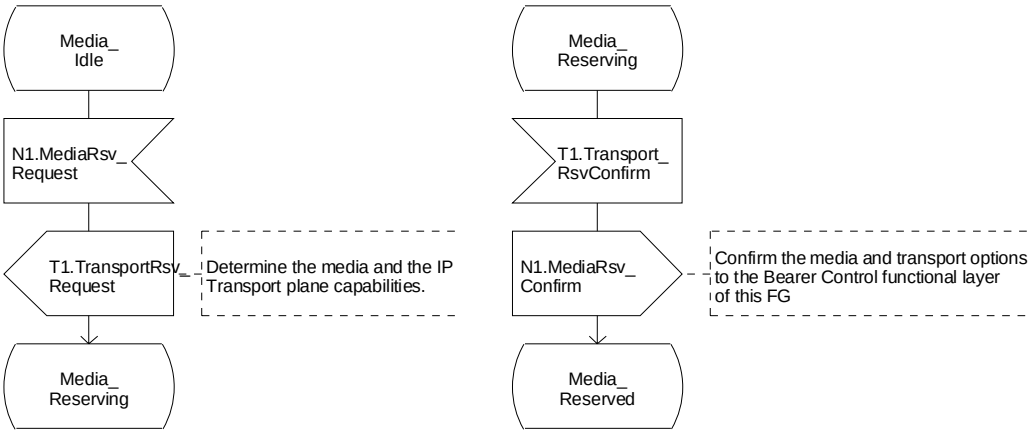


Figure A.114: Terminating Terminal: Reserving media

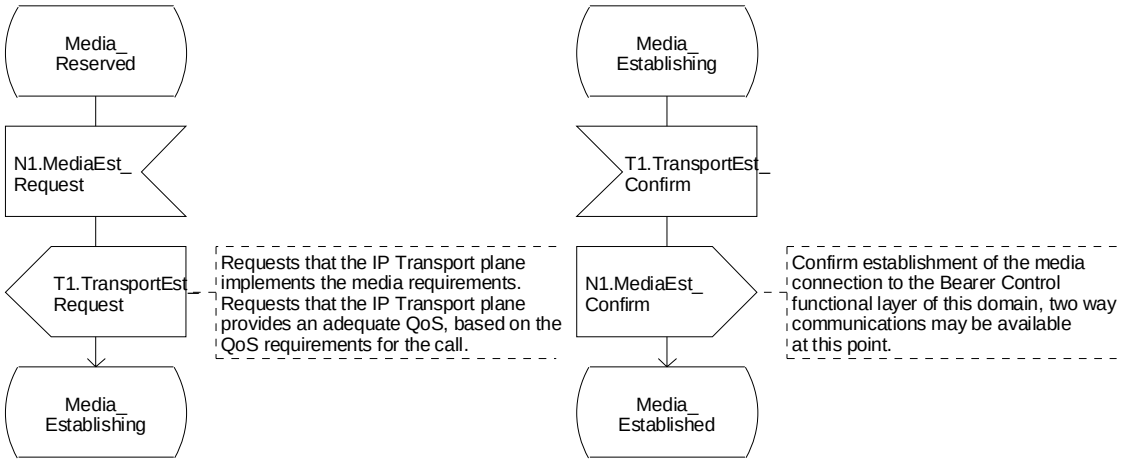


Figure A.115: Terminating Terminal: Establishing media

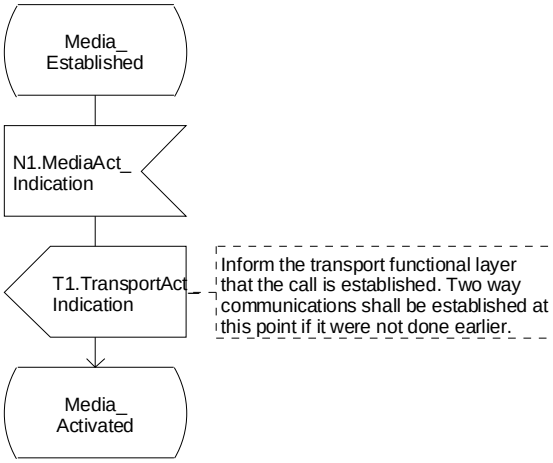


Figure A.116: Terminating Terminal: Activating media

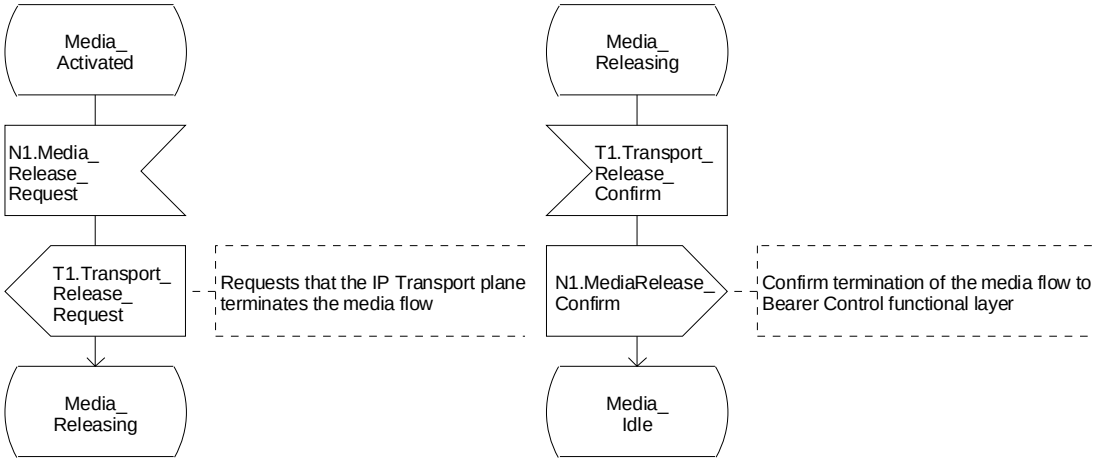


Figure A.117: Terminating Terminal: Releasing media

A.2.5.6 The IP Transport plane

The functional model and the functional entity actions of the IP Transport plane are outside the scope of the present document.

Annex B (informative): Backward compatibility with TS 101 313

This annex shows the relationship between the architecture in the present document and the previous architecture given in the TS 101 313 [5].

Figure B.1 shows the functions and reference points defined in TS 101 313 [5]. These functions are as follows:

- GK is the gatekeeper and provides address translation and controls access to the network for terminals, gateways, etc..
- The Gateway is composed of three separate Functional Blocks:
  - Media Gateway: Provides the media mapping and/or transcoding functions.
  - Media Gateway Controller: Controls the Media Gateways.
  - Signalling Gateway: Provides the signalling mediation function between the IP domain and the SCN domain.
- The H.323 terminal is an endpoint other than a gateway or a multipoint control unit.
- Back end represents services provided by third parties.

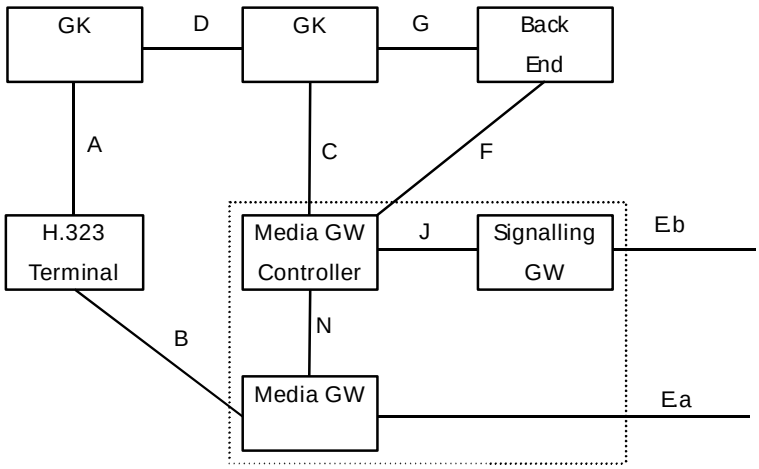


Figure B.1: Functional groupings and reference points in TS 101 313 [5]

Figure B.2 takes the functions defined in TS 101 313 [5] and maps the reference points in the present document to those functions. The functions defined in TS 101 313 [5] can therefore be seen to contain entities in one or more of the functional layers defined in the present document.

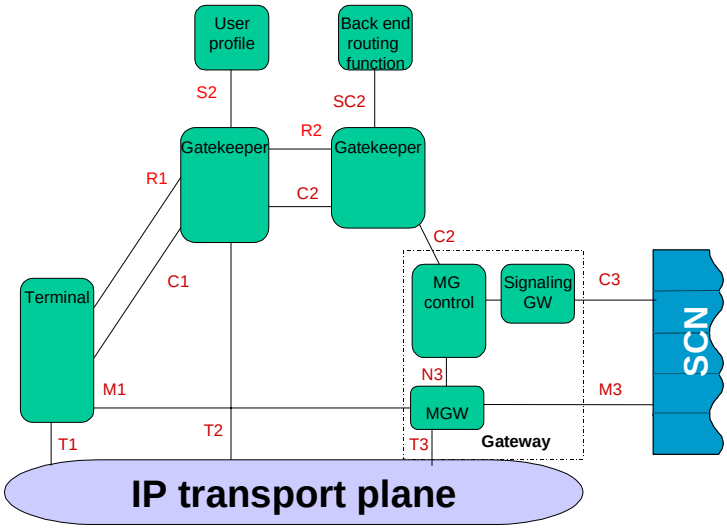


Figure B.2: The old functions and the new reference points

Annex C (informative): Example of an H.323 implementation

This annex contains material that enabled the architecture in the main body of the present document to be compared with an example implementation. The information contained in this annex will be superseded by publications containing a more complete analysis. When that material is available, this annex will be removed.

Figure C.1 and figure C.2 show the elements as defined in ITU-T Recommendation H.323 (see Bibliography) and how the functional entities as described in the present document map to these entities. Please note that these figures show the relationships, *not* a topology.

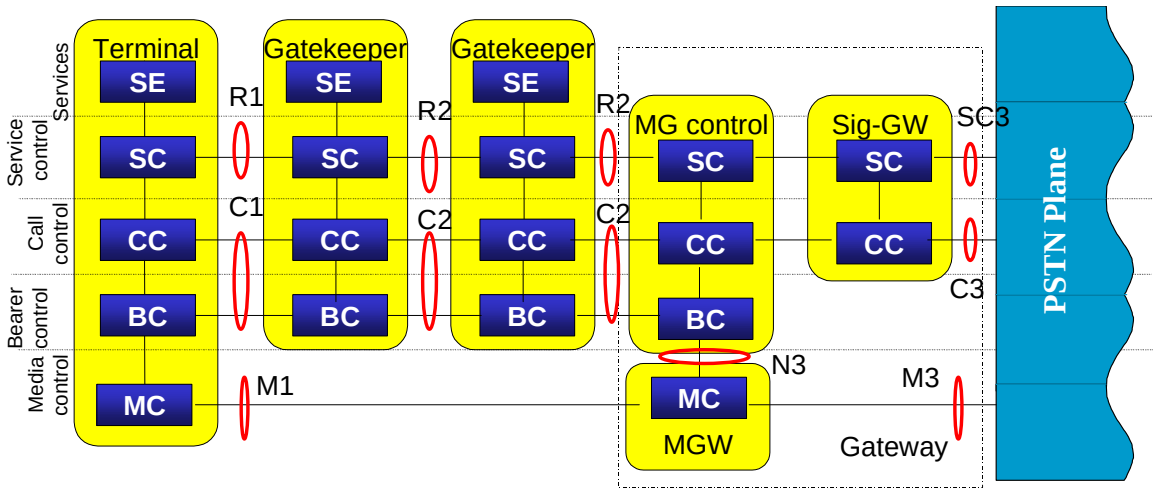


Figure C.1: H.323 entities (1)

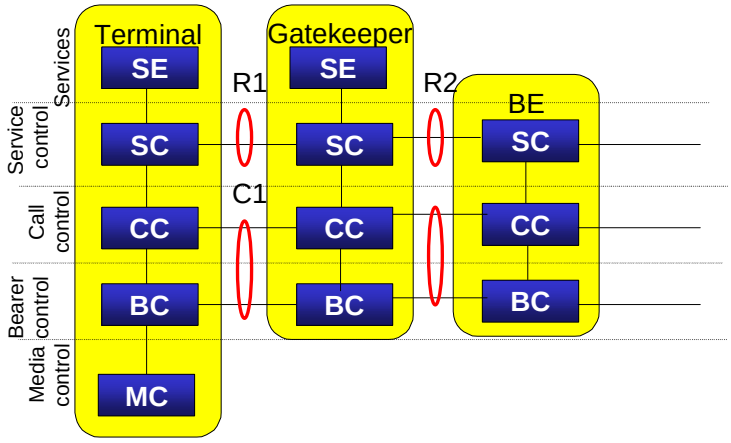


Figure C.2: H.323 entities (2)

C.1 Terminal

The terminal contain the following functional entities as defined in Clause 6:

Services

Ticket

Service Control

Registration (user part)

Call Control

Call control function.

Bearer Control

Bearer control

Media Control

Media control

C.2 Gateway (GW)

The gateway ensures the interworking between an IP network and an SCN network. It is composed of three separate Functional Blocks:

- the Signalling Gateway;
- the Media Gateway;
- the Media Gateway Controller.

C.2.1 Media Gateway

Media Control

C.2.2 Media Gateway Controller

Service Control

Routing (optional)

Call Control

Call Control

Bearer Control:

Bearer Control

C.2.3 Signalling Gateway

Service Control

Routing: (optional)

Call Control

Call Control

Bearer Control: (optional)

Bearer Control

Management

Network entity registration (Entity part)

C.3 GateKeeper (GK)

The gatekeeper Function shall be responsible for control and management of the various elements of the TIPHON Phase 2 reference configuration. The gatekeeper Function shall determine the route that call signalling and media transport takes for each call. It may contain the following functional blocks.

Service Control

Routing:

User profile (optional)

User profile access (optional)

Registration (server part)

Call Control (optional)

Call Control

Bearer Control: (optional)

Bearer Control

Many of these functions are optional. H.323 has made the definition of the Gatekeeper sufficiently broad that all of the implementations shown in figure C.3 may be considered as a legal implementation. The most minimal gatekeeper (number 5) only accepts registration and call routing requests.

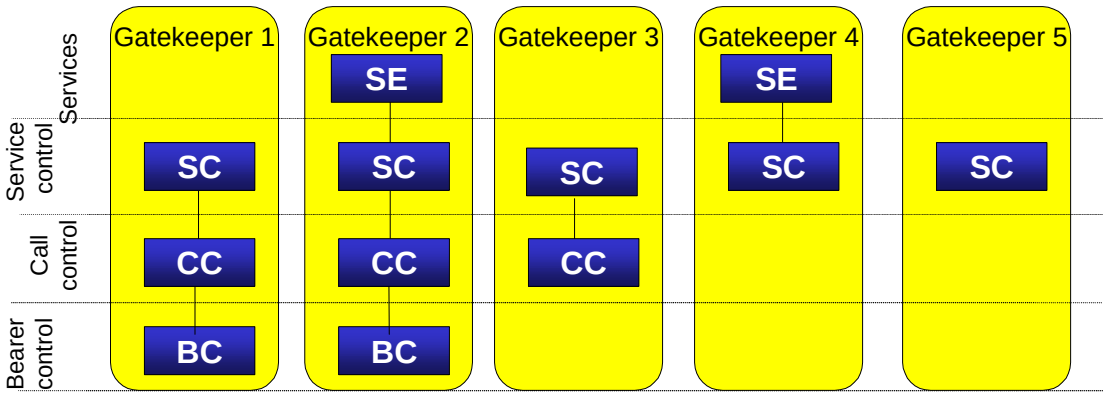


Figure C.3: Legal H.323 gatekeeper implementation alternatives

C.4 Border Element (BE)

The border element shall be responsible for the communication between (IP-based) networks. It may contain the following functional blocks.

Service Control

Call Control (optional)

Bearer Control: (optional)

Annex D (informative): Example of a SIP implementation

This annex contains material that enabled the architecture in the main body of the present document to be compared with an example implementation. The information contained in this annex will be superseded by publications containing a more complete analysis. When that material is available, this annex will be removed.

The SIP technology includes two protocols of interest to TIPHON.

- SIP – As defined in RFC 2543 (see Bibliography), this is often used as a client based call control protocol.
- SIP BCP-T (also known as SIP+) – This is an application of SIP to ISDN/PSTN transparency. The ISUP being encapsulated with a MIME type.

In order to define the example implementation, functional elements of each protocol are identified, and the functions within each element are described.

D.1 The SIP architecture

The SIP protocol has 5 functional elements defined in RFC 2543 (see Bibliography).

- **User agent client** The user agent client is the functional entity that may initiate a SIP request.
- **User agent server** The user agent server is the functional entity that may initiate a SIP response.
- **Proxy server** This functional element is functionally similar to the user agent server, except it is not expected to retain significant call control state. In essence the proxy server is comprised of both a SIP client and a SIP server.
- **Redirect server** The redirect server is not responsible for call control but will simply respond to SIP requests with a new address.
- **Registrar server** The registrar server simply responds to registrar requests. Typically this is co-located with either the proxy or the redirect server, and may be adapted to perform location-based services.

The functional elements can be seen in the call flows in the diagrams below.

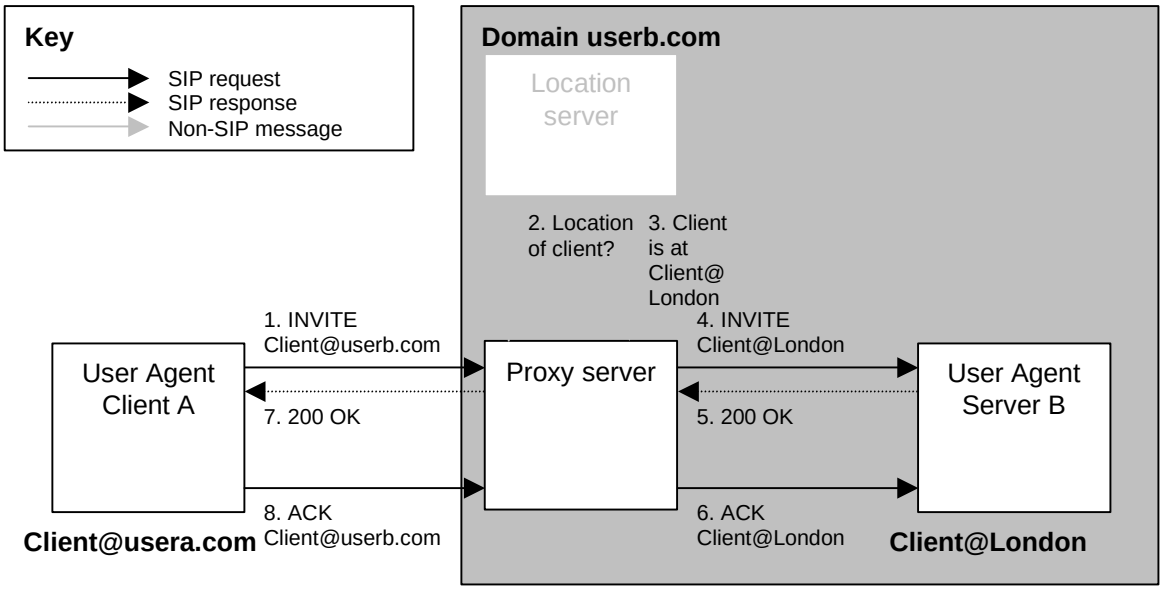


Figure D.1: Example of proxy server and user agent functional entity

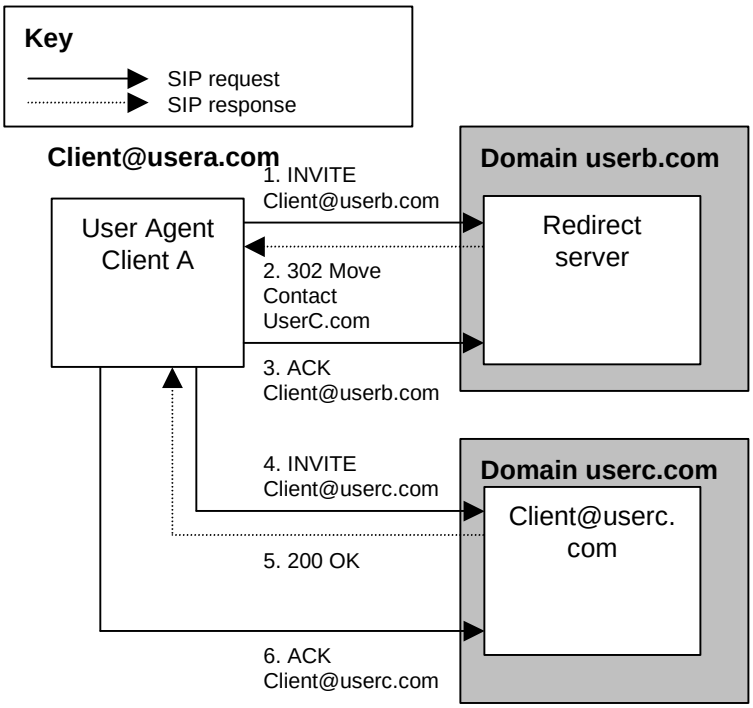


Figure D.2: Example of redirect server functional entity

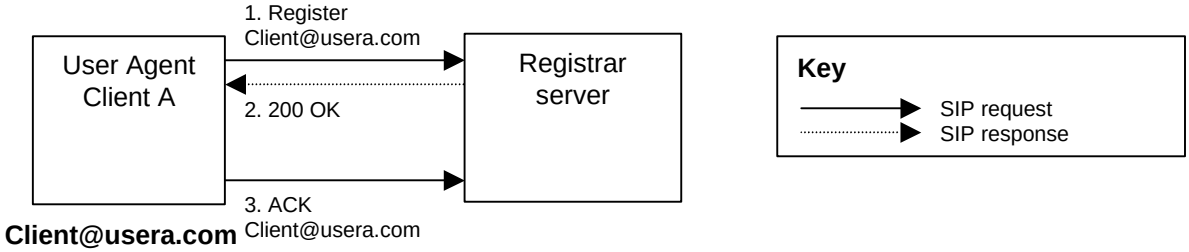


Figure D.3: Example of registrar server functionality

Examining in more detail the nature of each of these functional elements:

D.1.1 User agent (User agent client and User agent server)

User agents are the applications that generate and receive SIP messages, and these applications can either exist as the calling party (user agent client) or the called party (user agent server). The functionality of the user agents can be considered to be roughly equivalent to the composed H.323 gateway and the H.323 terminal.

The user agent is responsible for service control, call control, bearer control and the media control layer. Taking the functional components in the existing document 02003 it is possible to derive the subset of functional elements that are included in each component. The functional elements that the user agent performs may include:

- Service Control
  - Registration (User part)
  - Ticket
- Call Control
  - Call control

- Bearer Control:
  - Bearer control
- Media Control
  - Bearer control

D.1.2 Proxy server

The proxy server is equivalent to the functional combination of a SIP server and SIP client. It may additionally perform some form of translation between these two functions for the purposes of security policy management. Its functional list is therefore a superset of the user agent functional element. The proxy server may include the following functions. In particular the proxy server is unlikely to exist at the bearer control layers and media control layers in the stateless proxy scenario.

- Service Control
  - Routing:
  - User profile
  - Name to Name translation
  - Name to address translation
  - Authentication
- Call Control
  - Call control
- Bearer Control (Optional in the stateless proxy case)
  - Bearer Control
- Media Control (Optional in the stateless proxy case)
  - Media Control

D.1.3 Redirect server

The redirect server is only responsible for redirecting a call to a different server, and is therefore not responsible for performing any of the bearer control and media control functions. The functional elements are included below.

- Service Control
  - Call routing:
  - Name to Name translation
  - Name to address translation
  - User profile
- Call Control
  - Call Control

D.1.4 Registrar server

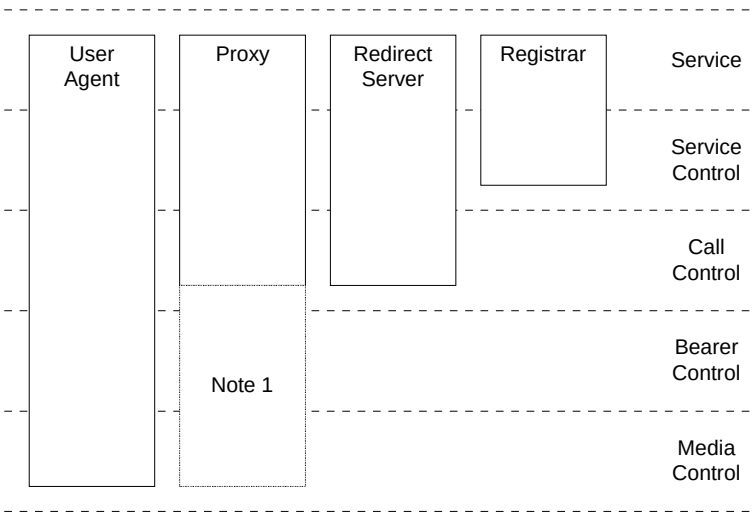
The registrar function is responsible for users to register to a SIP server. It therefore will often be combined with a proxy or redirect server which is then responsible for providing the services required by the user, for example mobility.

The registrar server therefore contains only the registration functions of the TIPHON architecture.

- Service Control
  - Registration (server part)
  - Authentication
  - User profile

D.1.5 The SIP functional elements mapped onto the TIPHON architecture

Figure D.4 shows how the SIP functional elements map onto the Functional layers in the IP Telephony Application plane.



NOTE: The stateless proxy server must not exist in the Bearer Control functional layer or in the Media Control functional layer.

Figure D.4: The SIP example mapped onto the IP Telephony Application plane

D.2 The SIP-BCP-T architecture

The SIP BCP-T protocol enhances SIP by the encapsulation of ISUP in the SIP protocol, with the ISUP identified by a MIME type, see RFC 2049 in Bibliography. The main call control function in SIP-BCP-T is referred to as an MGC. However it is clear that the SIP-BCP-T functional element is different from the MGC defined in ITU-T Recommendation H.323 since the SIP MGC must support all the call control. In ITU-T Recommendation H.323 the MGC may contain the Call control in the direct routed case but in the gatekeeper routed case the call control is shared by both the gatekeeper and the MGC. In order to distinguish between these two cases it is proposed to define the new functional component for the SIP MGC, known as the ***UA-MGC (User Agent Media Gateway Controller).***

D.2.1 The functional elements of the UA-MGC

The UA-MGC is very similar to the user agent in the previous example, the addition of the ISUP only providing an additional method of call control rather than additional functions. The only distinction from the user agent in the SIP example is that it is not responsible for media control since that is the function of the media gateway. The functional elements included within the UA-MGC as taken from 02003 can be seen below.

- Service Control

- Call routing:
- Name to Name translation
- Name to address translation
- Authentication
- User profile

- Call Control
  - Call control
- Bearer Control:
  - Bearer Control

Figure D.5 shows how the SIP BCP-T functional element may be mapped onto the functional layers in the IP Telephony Application plane:

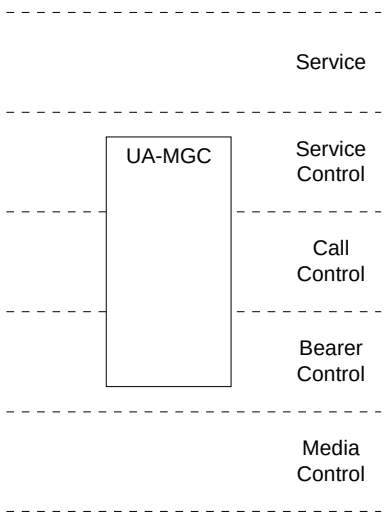


Figure D.5: The SIP-BCP-T functional elements mapped onto the IP Telephony Application plane

Annex E (informative): Example of an BICC implementation

This annex contains material that enabled the architecture in the main body of the present document to be compared with an example implementation. The information contained in this annex will be superseded by publications containing a more complete analysis. When that material is available, this annex will be removed.

The BICC (see Bibliography) protocol is an evolution of ISUP (see ITU-T Recommendations Q.763 and Q.764 in Bibliography) towards packet networks and is of relevance to TIPHON scenario 3. This annex describes the mapping of the BICC architecture to the TIPHON architecture.

E.1 BICC architecture

Figure E.1 (lifted from BICC, see Bibliography) presents the architecture for the Bearer Independent Call Control protocol Capability Set 1 (BICC CS1). This architecture defines a number of functions that are explained below.

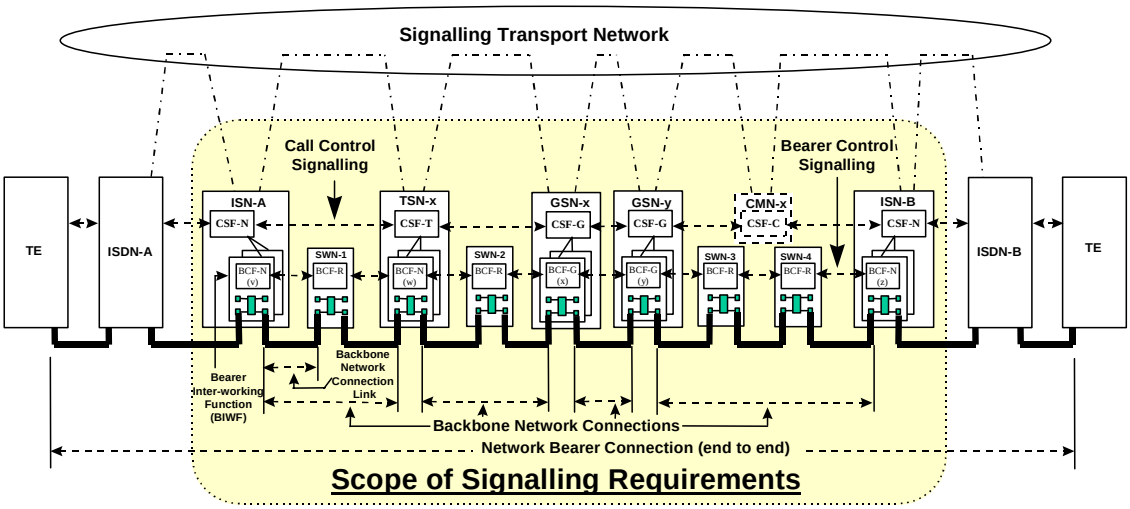


Figure E.1: BICC architecture

Definitions of the relevant items contained in the BICC CS1 composite functional model are as follows (lifted from [2]).

Bearer Control Function (BCF): Four types of BCF are defined; BCF-N, BCF-T, BCF-G and BCF-R. The BCF-N, BCF-T and BCF-G provide the control of the bearer switching function, the communication capability with its associated CSF, and the signalling capability necessary for the establishment and release of the bearer to its peer. The BCF-R provides the control of the bearer switching function and relays the bearer control signalling requests to next BCF in order to complete the end to end bearer control signalling action.

Bearer InterWorking Function (BIWF): A functional entity which provides bearer control functions (BCF) and media mapping/switching functions within the scope of a Serving Node (SN). A BIWF contains one BCF.

Call Mediation Node (CMN): A functional entity which provides CSF functionality without an associated BCF entity.

Call Service Function (CSF): Four types of CSF are defined:

- The Call Service Nodal Function (CSF-N) provides the service control nodal actions associated with the narrowband service by interworking with narrowband and bearer independent signalling, signalling to its peer CSF the characteristics of the call, and invoking the Bearer Control Nodal Functions (BCF-N) necessary to transport the narrow band bearer service across the backbone network.

- The Call Service Transit Function (CSF-T) provides the service transit actions necessary to establish and maintain a backbone network call (see Figure E.2), and its associated bearer by relaying signalling between CSF peers and invoking the Bearer Control Transit Functions (BCF-T) necessary to transport the narrowband bearer service across the backbone network.

- The Call Service Gateway Function (CSF-G) provides the service gateway actions necessary to establish and maintain a backbone network call and its associated bearer by relaying signalling between CSF peers and invoking the Bearer Control Gateway Functions (BCF-G) necessary to transport the narrowband bearer service between backbone networks.

- The Call Service Co-ordination Function (CSF-C) provides the call co-ordination and mediation actions necessary to establish and maintain a backbone network call by relaying signalling between CSF peers. The CSF-C has no association with any BCF. It is only a call control function.

Gateway Serving Node (GSN): A functional entity which provides gateway functionality between two network domains. This functional entity contains the call service function (CSF-G), and one or more bearer interworking functions (BIWF). GSNs interact with other GSNs, in other backbone network domains and other ISNs and TSNs within its own backbone network domain.

Interface Serving Node (ISN): A functional entity which provides the interface with SCNs. This functional entity contains the call service nodal function (CSF-N), and one or more bearer interworking functions (BIWF) which interact with the SCN and its peers within the backbone network.

Switching Node (SWN): A functional entity which provides the switching functions within the backbone core network. This functional entity contains a BCF-R. SWNs interact with other SWNs and BIWFs, within their own backbone network domain.

Switched Circuit Network (SCN): generic term for any network that uses circuit switching technology, i.e. ISDN, PSTN, PLMN…

Transit Serving Node (TSN): A functional entity which provides transit functionality between two SNs. This functional entity contains the call service function (CSF-T), and supports one or more bearer interworking functions (BIWF). TSNs interact with other TSNs, GSNs and ISNs within their own backbone network domain.

E.2 Mapping between BICC and TIPHON

From the above it is clear that BICC has slightly different terminology from TIPHON.

BICC CS1 is a signalling protocol that supports narrow band PSTN/ISDN services transparently over packet networks. BICC as call control protocol is designed to be independent of the medium (i.e. bi-directional voice stream or data stream) and its encoding (g.711, or unrestricted).

The carrier *is* separated out (ATM AAL1, ATM AAL2 and IP in BICC CS2). This implies that while in TIPHON the bearer is the abstract representation of the media flow, in BICC the term is used for the physical representation.

The BICC call control signalling conveys both call set-up and media parameters and would therefore map to the TIPHON call and bearer information flows. BICC conveys (transports) parameters related to the characteristics of the bearer.

The BICC SWN nodes are ATM switches or IP routers (for BICC CS2). So they would fall in the TIPHON transport plane and hence be outside the scope of the present document. Communication to these SWN entities is in BICC regarded as *bearer* communication. A BICC *bearer* information flow is generally implemented using a subset of UNI 4.0 and hence corresponds to a TIPHON application to transport flow.

The BICC BIWF has 2 major groups of functionality:

- signal the establishment of the transport channel (BCF)

- send media over that channel (for that there is RTP over UDP/IP rather than ATM AAL1 or ATM AAL2))

So because of its different focus the corresponding TIPHON function is called MC for media control. That function also harbours media transcoding and media servers.

From this knowledge a TIPHON view of the mapping of the layers between the two architectures follows:

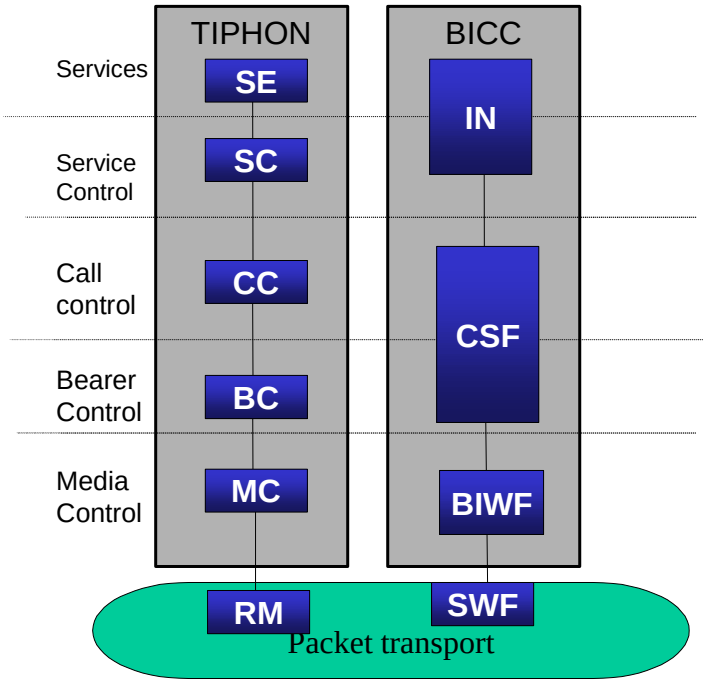


Figure E.2: TIPHON – BICC mapping

Annex F (informative): Intelligent Network (IN)

This annex contains material that enabled the architecture in the main body of the present document to be compared with an example implementation. The information contained in this annex will be superseded by publications containing a more complete analysis. When that material is available, this annex will be removed.

F.0 Scope

This annex describes the mapping of the TIPHON IP Telephony Application planes to IN functions. This annex illustrates how the existing Intelligent Network components can be leveraged by components within the TIPHON architecture. This mapping can be used in deployments, which could then utilize it as an efficient and effective service control layer implementation.

F.1 Introduction to the Intelligent Network

The Intelligent Network is a beneficial switch dis-aggregation model that is designed to conform to a layered architecture. It serves to effectively distinguish between call control- and service control- related functions in the telecommunications network.

The IN conceptual model consists of four planes:

- the services plane,
- the global functional plane,
- the distributed functional plane,
- the physical plane.

For a description of the details of this architectural framework, the interested reader is referred to [1] and [2].

A summary of functions of elements from the Distributed Functional Plane (DFP) is as listed below ([2] and [3]):

CCAF	The CCAF is the call control agent (CCA) function that provides access for users. It is the interface between user and network call control functions
CCF	The CCF is the call control (CC) function in the network that provides call/connection processing and control.
SSF	The SSF is the service switching (SS) function, which, associated with the CCF, provides the set of functions required for interaction between the CCF and a service control function (SCF).
SCF	The SCF is a function that commands call control functions in the processing of IN provided and/or custom service requests. The SCF may interact with other functional entities to access additional logic or to obtain information (service or user data) required to process a call/service logic instance.
SDF	The SDF contains customer and network data for real time access by the SCF in the execution of IN provided service.
SRF	The SRF provides the specialized resources required for the execution of IN provided services (e.g. digit receivers, announcements, conference bridges, etc.)
SCEF	Service Creation Environment Function. This function allows services provided in an intelligent network to be defined, developed, tested and input to SMF. Output of this function would include service logic, service management logic, service data template and service trigger information.
SMAF	Service Management Access Function. This function provides an interface between service managers and the SMF
SMF	Service Management Function. This function allows the deployment and provisioning of IN provided services and allows the support of ongoing operation.
CUSF	The CUSF is the call unrelated service (CUS) function, which, associated with the CCF and SSF, provides a set of call-unrelated service functions required for out-channel interaction with a SCUAF. It also provides the set of functions required for interaction between the SCUAF and a SCF.
SCUAF	The SCUAF is the Service Control User Agent (SCUA) function that proves access for users. It is the interface between a user and the Call Unrelated Service Function (CUSF).

In the physical plane, one maps DFP entities to their corresponding physical components. For example, in traditional PSTN networks, the SSP (Service Switching Point) embodies the SSF and CCF functions, while the SCP (Service Control Point) is a physical manifestation of the SCF and optionally, the SDF functions.

F.2 Mapping Functional Elements onto the TIPHON Reference Architecture

Figure F.1 depicts a mapping of these IN functional elements to the TIPHON architecture.

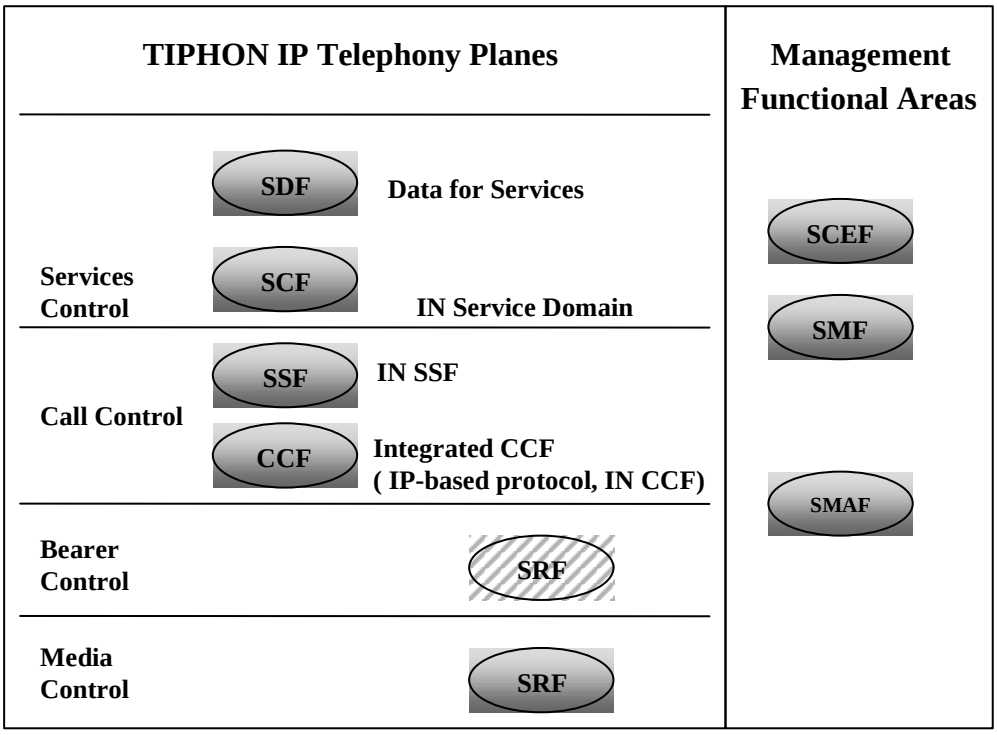


Figure F.1: Mapping of IN functions onto TIPHON functional Architecture

The mapping of most of the functions is straightforward and described in Table F.1.

Table F.1: Mapping of IN functions to TIPHON architecture

IN function	TIPHON layer	TIPHON Function
SDF	Services Layer	Stores registration, user-related, service-related, and routing information in a format that supports real-time retrieval.
SCF	Services layer	Hosts IN services (e.g., LNP, OCS, CNIP, Pre-paid etc.,) accessible to both PSTN and IP end-points.
CCF	Call Control Layer	Supports the IN call model that tracks "service network" view of call state from the base (packet network) network.
SSF	Call Control Layer	Provides the call control element the ability to access IN services.
SCEF, SMF and SMAF	Management Plane	SCEF supports the creation/authoring of new services in the services network. The SMF that is mainly concerned with managing and provisioning services in the IN network, and the SMAF that provides access for such management tasks should be more closely tied in with the rest of the management framework.
SRF	Media Control Layer	Play announcement/ collect digits capabilities as directed by entities in the SC layer
SRF	Bearer Control Layer (optional) (note)	Temporary connections may be set up to the SRF entity.
NOTE: The announcement and digit collection capabilities of the SRF clearly locate this function into the Media control layer of the IP Telephony Application Plane. However, the potential ability of the SRF to manage bearers connections, leads to an extension into the Bearer Control functional layer.		

The mapping of following IN functions is for further study: CCAF (Call Control Agent Function), and additional functions defined in ITU-T Recommendation Q.1224 [3] (CUSF – the Call Unrelated User Function, and CUASF – the Service Control User Agent Function).

F.3 Interaction Scenarios:

The following interaction Scenarios can be distinguished. This clause gives two examples for IN interworking Scenarios:

- basic calls; and
- additional services from the IN services network.

These interaction Scenarios may be of two types:

- IN controls SCN calls but also assists the TIPHON network

  This, by definition requires a call flow that traverses multiple networks. If one end-point involved in the call is an SCN end-point and the other is an IP end-point, then IN components could serve the SCF and SDF functions for the SCN end-point and may simultaneously, if so enabled, support access to IN services from the IP end-point. If, on the other hand, both were SCN end-points but the connection traverses an IP network, and IN services were accessed from that intermediate network, the same technique may be used again. In the latter case, IN services may be accessed at either end, or from the IP network component capable of IN service access.

- IN also controls the TIPHON network

  The SSF for the IN network may be co-located with the CCF for the base (IP) network, thus permitting the base network element to access services from the IN service network.

F.4 Example Scenarios

The following Scenarios serve to illustrate how IN-supported services are made accessible to end-points located within the confines of a packet network. In most cases, the call flows as depicted in the main body of the TIPHON architecture document are general enough to depict such service access.

F.4.1 Local Number Portability (LNP)

Consider the case where the user at an IP terminal originates a call by dialling in an E.164 [1] number for a destination. This number may need to undergo an LNP translation before it is routed to an other network (gateway) and from there, out into the other network to reach correct end-point. For purposes of this scenario, consider that the LNP service is accessed while still in the packet network context, so that the routing function could use this information to determine the optimal gateway to route out to.

The information flows are identical to those depicted in Clause 8 for the various scenarios, only, now the IN network hosts the service control function. (i.e., the flows for "Access & Routing Request" and "Service Request" now transparently serve the purpose of accessing IN services as required).

F.4.2 Originating Call Screening (OCS)

A user at an IP terminal originates a call and the call server within the IP network generates a query to an SCP that verifies that the dialled number is on a list of allowed destinations, and responds accordingly (alternatively, the SCP could verify that the dialled number is not on a list of dis-allowed destinations). The call server parses the response and either route the call, or drops it, based on the SCP generated response.

This is an example of "Routing/Access Request" made by call control to service control on the originating side of the call. This is already reflected in the information flows shown.

F.5 Call Model Integration:

In this clause, **a means is described** by which IP-based call control elements may be enabled to access services from the IN network. It must be emphasized here that this technique serves merely as an illustration of a means to achieve said inter-working between the IP and IN networks, and is by no means the only way to achieve the desired results.

Services hosted off of the Intelligent Network (IN) are advantageously accessed during call processing by IN-aware PSTN switches or SSPs to significantly enhance the user experience in that network.

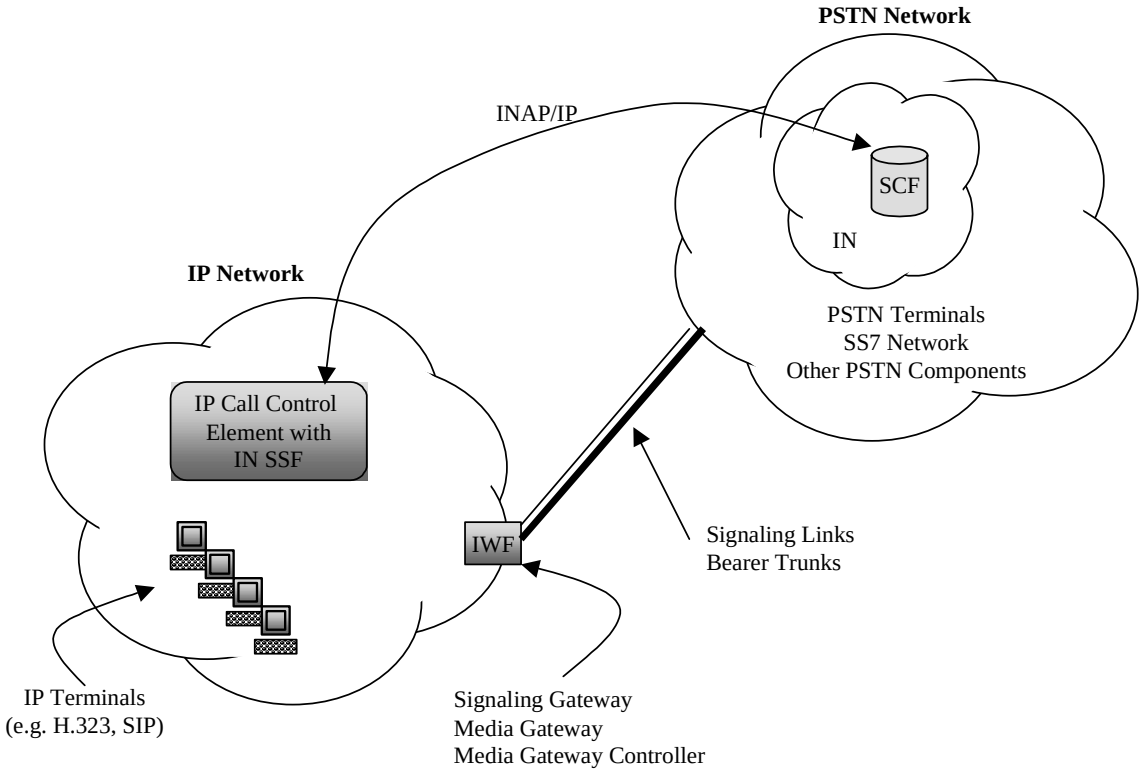


Figure F.2: Overall Architecture

Along similar lines, IP users could also benefit from services in the IN network if a means existed to permit IN service access from IP endpoints. In this clause, a means is described for doing this by integrating the IN call model with the Call Processing Finite State Machine (FSM) on the IP-based platform. This process is called "Call Model Integration" (CMI) [4].

CMI essentially serves as an inter-working function between the existing call control function for the network end-points governed by a packet multimedia conferencing protocol and the call control/service switching function for the IN network that is viewed as the services functional layer. This enables seamless access to IN-supported services from IP end-points.

Call Model Integration achieves this by overlaying an IN call model implementation atop the base call model FSM (the call control state machine in the IP network), with the two state machines operating in lock step. Now, state changes in one FSM are accompanied by the corresponding state changes in the other (so there is a unified view of call-states across networks – the IP-base network and the IN services network).

This is accomplished through the generation of a semantic map between the FSM supported for call control within the gatekeeper or other base network call control element, and the IN-based BCSM that is analogous to the one that is supported within a traditional SSP (Service Switching Point). One thus has a unified view of call control that takes into account the call state information pertaining to the call in each network.

The protocol for communication between the SSF function hosted within the context of the base packet network and the SCF function within the IN may be either INAP/IP (if this is a direct connection), or INAP/SS7 if the communication traverses an IWF (signalling gateway).

F.6 Future extensions

Scenarios that address advanced IN service capabilities such as those pertaining to the firing of mid-call triggers, or access to Intelligent Peripheral functions (the Specialized Resource Function or SRF in the IP network) are for further study.

Please also note that the IN services covered in the examples tend mostly to impact call control messages in the IP network (i.e. the IN response is used to modify call control messages as required, so that call setup is affected appropriately).

Some other services may require modifications to connection control messages in the IP network, and these are for further study. Examples of the latter case include scenarios where call setup requires that a temporary leg be set up to a media server (for instance), and then that this leg be disconnected and a new call leg set up to another called party. This is the case with credit card calls. A caller dials a toll-free number, is presented with an IVR – mainly to authenticate the caller, and asked to dial a destination address. Once the dialled digits for this destination address are collected, the Specialized Resource Function may no longer be involved in the call, and another call leg to the actual called party is established.

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History

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