Implementation Agreement for explicit SIP signaling pinhole control via H.248 as a supplement document of H.248 IA

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Abstract: This contribution proposes an Implementation Agreement (IA) for explicit SIP signaling pinhole control via H.248 to be determined as a supplement document of H.248 IA “S-SBG-NE to D-SBG-NE Interface IA” (msf2005.159). Controlling signaling pinholes explicitly via H.248, SIP proxy can determine to admit or refuse to receive signaling messages from a specific subscriber. This contribution also proposes draft packages to add capability of advanced operation on signaling pinholes.

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Table of Context

A.1 Scope

This supplement provides an explicit mechanism for load regulation of SIP traffic. The mechanism is located in a D-SBG-NE and controlled via H.248. Such a load regulation may be for instance applied for "MGC overload control" (note: the H.248 MGC entity relates here to the S-SBG-NE) with regards to incoming SIP traffic like new session attempts. Further use cases are detailed in clause A.6.

The **S-SBG-NE** has the "H.248 **MGC**" **role** in the scope of this Supplement. The **D-SBG-NE** has the "H.248 **MG**" **role** in the scope of this Supplement.

A.1.1 Overview

This supplement provides an extension to H.248 Profiles for IP-to-IP interworking/peering. There are two modes for SIP signaling pinhole control defined. The extension covers in detail for:

1. Basic mode for SIP signaling pinhole control
   - Profile extensions:
     - TerminationID syntax extension
     - Usage of TerminationState Descriptor
     - Usage of Local and Remote Descriptors
2. Advanced mode for SIP signaling pinhole control (see clause A.7)
   - New/additional H.248 packages:
     - Termination State Control Package
     - Session Failure Reaction Package

A.1.2 Applicability Statements

This supplement is applicable in network environments with:

- signaling: SIP as session control protocol,
- media-path coupled signaling, i.e. signaling and media traffic are going both through the D-SBG-NE.

This supplement is not applicable in network environments with:

- already segregated signaling and media traffic before reaching D-SBG-NE.

A.2 Terms and Definitions

A.2.1 Definitions

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

Pinhole (see ITU-T Rec. H.248.37 [2]): A configuration of two associated H.248 IP Terminations within the same H.248 Context, which allows/prohibits unidirectional forwarding of IP packets under specified conditions (e.g., address tuple).

A.2.2 Abbreviation

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

D-SBG-NE	Data Path SBG
IA	Implementation Agreement
MSF	MultiService Forum
S-SBG-NE	Signalling SBG
SBG	Session Border Gateway
VLAN	Virtual Local Area Network

A.3 References

[1] ITU-T Recommendation H.248.1 (09/2005), Gateway control protocol: Version 3.
[2] ITU-T Recommendation H.248.37 (09/2005), Gateway control protocol: IP NAPT Traversal Package.
[3] S-SBG-NE to D-SBG-NE Interface Implementation Agreement: MSF-AF-PROTS-SBG-NE-toD-SBG-NE-Interface-IA-001-STRAW
[4] ETSI ES 283 018 (06/2006), TISPAN NGN Release 1; RACS; H.248 Profile for the Ia Interface.

A.4 H.248 Control Model

A.4.1 Connection model

The call connection model is shown in Figure A.4.1.1.

In addition to conventional media pinhole control via H.248 (e.g., by MSF IA "H.248 SBG Profile" [3], or ETSI ES 283 018 "H.248 Ia Profile" [4]), pinholes for call control signaling, i.e. SIP, flows are also created and controlled via H.248 in this IA.

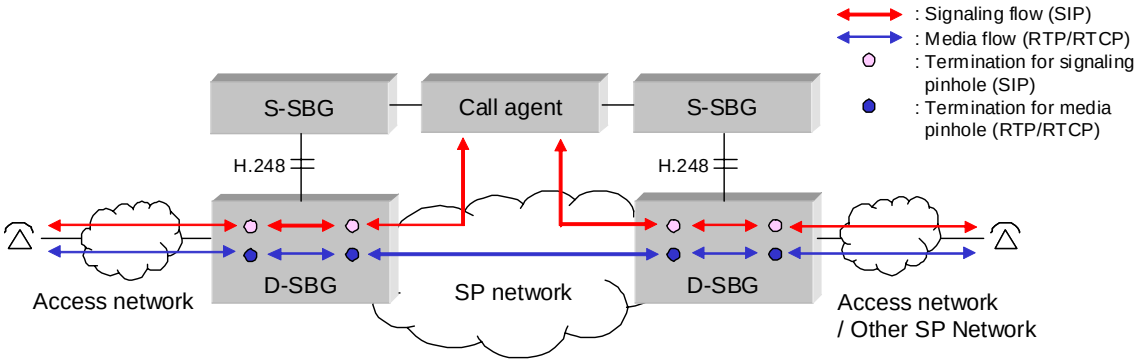
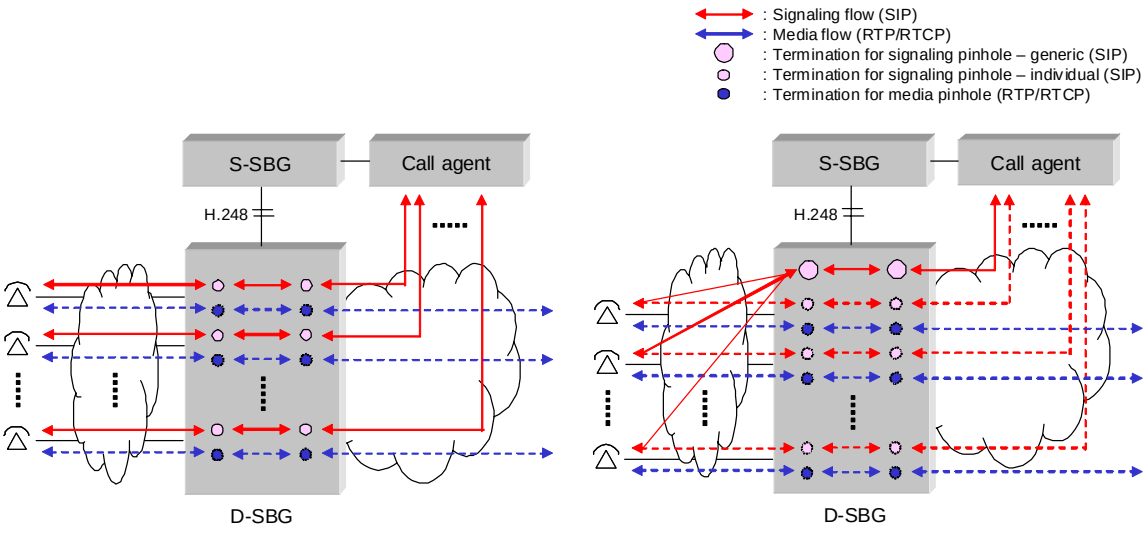


Figure A.4.1.1 Connection Model

NOTE: Figures A.4.1.1 and A.4.2.1 do intentionally not indicate the H.248 context boundaries. The specific termination-to-context association has to be controlled via property "Attribute for associating Terminations" from "Termination state control" package.

A.4.2 SIP signaling pinhole

Two types of pinhole operation, as shown in Figure A.4.2.1, are assumed for signaling pinhole in this IA.



(a) Individual Pinhole **(b) Generic Pinhole**

Figure A.4.2.1 SIP Signaling Pinhole Types

A.4.2.1 Individual pinhole

An individual SIP signaling pinhole is created per signaling flow (e.g. individual SIP device registration) basis. This type of operation is assumed for the case, in which IP addresses allocated to each subscriber can be attained before the first SIP message, i.e. Register message, is received at the call agent.

As a default condition, before an S-SBG-NE opens a signaling pinhole for a subscriber at a D-SBG-NE associating with the S-SBG-NE, the call agent should not be reachable from the subscriber. Typically, a signaling pinhole may be created at a subscriber's subscription to a certain connection service based on SIP signaling, such as VoIP, video phone, etc. When an S-SBG identify that a subscriber subscribes to a connection service, S-SBG creates a pinhole to allow SIP signaling flow from the subscriber to traverse D-SBG-NE, and a call agent finally receives SIP Register message from the subscriber.

A.4.2.2 Generic pinhole

A generic SIP signaling pinhole is created for any subscribers to reach for a call agent in a service provider network via a certain D-SBG-NE. This type of operation is assume for the case, in which IP addresses allocated to each subscriber can not be attained before a call agent receives Register message from a subscriber, i.e. the address is allocated by the different network to be reached from.

As a default condition, an S-SBG-NE creates and maintains a generic pinhole to allow all the subscribers to be reachable with a call agent via a D-SBG-NE associating with the S-SBG-NE. Typically to explicitly control SIP signaling pinhole, after a call agent receives a Register message from a certain subscriber, an S-SBG-NE creates an individual pinhole for SIP signaling from the subscriber with specific source address and port number information attained from the Register message received. In case of overload, general access via a generic pinhole can be turned off while preserving access for established registrations by individual pinholes.

A.5 Required extensions to H.248 profiles

A.5.1 Extended TerminationID structure

For the hierarchical structure of TerminationID, the new field <service> should be added extending <group> field to the structure determined in H.248 IA of "S-SBG-NE to D-SBG-NE Interface IA". The extended TerminationID is described in the structure of "ip/<service>/<group>/<interface>/<id>".

A.5.1.1 Additional Field <service>

Name: service
Description:
This field indicates the service which is provided by the Terminations. This field allows operator to handle the Terminations explicitly with the policy different for the service which the Termination provide.
Values: 0 = "sip"; (e.g. SIP signaling traffic)
1 = "voice"; (e.g. Voice-over-RTP traffic)
2 = "video"; (e.g. Video-over-RTP traffic)
CHOOSE wildcard: No
ALL wildcard: Yes

A.5.2 Number of Terminations in a Context

For advanced SIP pinhole operation determined in section A.7, a Context may hold the Terminations of a SIP pinhole and a media pinhole(s) created in the context of the SIP pinhole. Therefore number of Terminations in a Context may need to be expanded from two to more than four, i.e. two for a SIP pinhole and another two for a media pinhole.
In case that the Terminations of a SIP pinhole and a media pinhole(s) are created in the same Context, different StreamID should be assigned for each flow to identify between a SIP flow and a media flow(s).

A.5.3 TerminationState Descriptor

ServiceState property should be implemented with this profile to explicitly control the Terminations for signaling pinholes.

ServiceState property	Yes

The Terminations for a SIP signaling pinhole are assumed to exist as far as a subscriber joins the service. The Terminations are not assumed to be subtracted, but of which ServiceState is assumed to be changed to “Out-of-Service”, in case that the corresponding pinhole is required to be closed temporarily for some reason.

A.5.4 Local and Remote Descriptors

Local Descriptor of a Termination at subscriber side (see Figures A.4.1.1/A.4.2.1) should be specified with proxy IP address and port number for a call agent, which should be provisioned with the subscribers as a contact address to the call agent. At service provider network side, the intented translated IP address and port number of the subscribers should be allocated in Remote Descriptor for receiving Add commands with wildcard CHOOSE TerminationID.

Remote Descriptor of a Termination at subscriber side should be specified with the IP address and/or port number allocated to the subscriber, if such information is attainable beforehand via provisioning or interaction with Network Attachment Subsystem (NASS). If not, for address resolution of IP address and/or port number, latching or re-latching should be specified in Local Descriptor instead of Remote Descriptor. At service provider network side, real IP address and port number of the call agent should be specified in Remote Descriptor.

A.6 Use cases

A.6.1 Service suspension for a specific subscriber

In case that a call agent finds a specific subscriber behaves in a nonconforming way such as sending nonconforming SIP messages to the call agent, etc., the call agent can request an S-SBG to close the pinhole for the SIP signaling of the specific subscriber in a D-SBG-NE.

A.6.2 Call agent protection from intensive signaling message rates/loads

In case that a call agent finds itself extremely overloaded, then the call agent can request associating S-SBG-NEs to close (all) the signaling pinholes in specific D-SBG-NEs, so that the call agent does not have to receive any more signaling messages from the subscribers.

The other case may be that a call agent is in the process to recover its service from failures, i.e. software reboot. In the process, the call agent cannot process any SIP messages, and does not want to take any resource for discarding received SIP messages, the call agent can request associating S-SBG-NEs to close (all) the signaling pinholes in specific D-SBG-NEs.

The feature above may be equipped with S-SBG-NE and D-SBG-NE as a last resort against attacks and/or call congestion to/in S-SBG-NE. S-SBG-NE may have the other feature against attacks and/or call congestion, typically by its software implementation.

A.7 Advanced SIP pinhole operation

Additional new packages for advanced SIP signaling pinhole operation are proposed as an appendix of this IA.

A.7.1 Termination state control package

Termination state control package allows a D-SBG-NE to control H.248 ServiceState of a SIP signaling pinhole, i.e. active or not, by the D-SBG-NE itself, with reference to the appearance of media pinholes in the D-SBG-NE, i.e. exist or not, created in the context of the SIP signaling pinhole.

Typical use case of the package is to close all the SIP signaling pinholes in a graceful manner. With the package, an S-SBG-NE can indicate wildcard ALL TerminationID with a modify command to change ServiceState of the Terminations from active (In-Service) to inactive (Out-of-Service), even in the case that any active media pinholes still exist in the D-SBG-NE.

Receiving a modify command, the D-SBG-NE changes ServiceState of only the SIP signaling pinholes with no media pinhole created in the context of the SIP signaling pinhole. Afterwards, the D-SBG-NE changes ServiceState of the SIP signaling pinholes, when detecting all the media pinholes created in the context of the SIP signaling pinhole are deleted, as far as the package is configured with the Terminations for a SIP signaling pinhole.

With this package, to allow a D-SBG-NE to identify each signaling-media association among Terminations, Terminations for a specific SIP signaling pinhole, and Terminations for media pinholes which are created in the context of SIP signaling through the SIP signaling pinhole, may be managed within the same Context, as shown in Figure A.7.1.1.

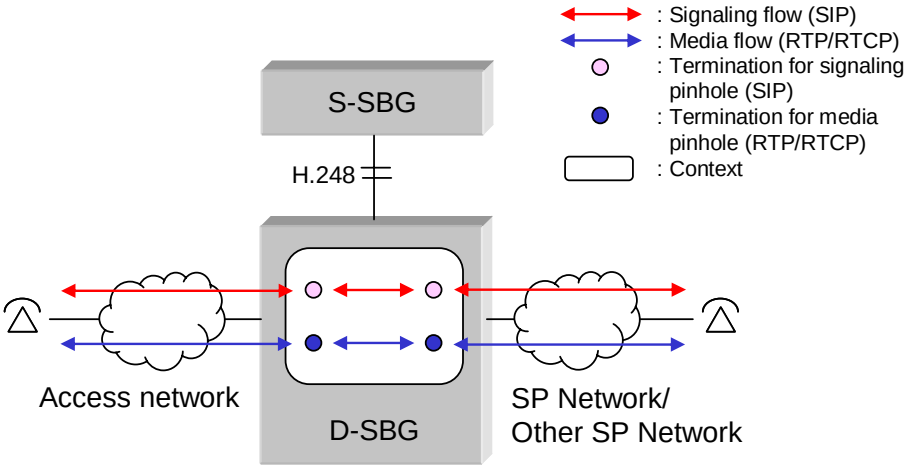


Figure A.7.1.1 Context Model Example

A.7.2 Session failure reaction package

Session failure reaction package allows a D-SBG-NE to close all the SIP signaling pinholes in a graceful manner when D-SBG-NE detects that H.248 control association fails with the associating S-SBG-NE.

With this package, to allow a D-SBG-NE to identify each signaling-media association among Terminations, the Context model shown in Figure A.7.1.1 may be taken as well as termination state control package.

Appendix

Gateway control protocol: Extended SIP pinhole control packages

1. Scope

This Appendix defines the packages that extend the applicability of the H.248.1 Gateway Control Protocol Recommendation [1] for pinhole control. Specifically, this Appendix describes packages for the H.248.1 gateway protocol related to controlling the SIP signaling pinholes. With the SIP signaling terminations implementing these packages, when a SIP signaling pinhole is intended to be closed by a media gateway (MG) or a media gateway controller (MGC), the media gateway is expected to change H.248 ServiceState of the terminations related to the SIP signaling pinhole in a graceful manner.

The **S-SBG-NE** has the "H.248 **MGC**" **role** in the scope of this Appendix. The **D-SBG-NE** has the "H.248 **MG**" **role** in the scope of this Appendix.

1.1 ServiceState control mechanism

With the packages, the service state of the SIP signaling termination should be controlled with ServiceState property in TerminationState Descriptor by Modify command, while in the conventional operation in H.248.1 gateway control protocol the service state of a termination is changed by Add and Subtract commands, and is notified to a gateway controller by ServiceChange message. The SIP signaling terminations are to be created at user's service contract to a service requiring the SIP signaling pinhole, and should be kept during the user remaining subscribed to the service.

1.2 Applicability statement

The packages are applicable for non-Root Terminations, which are of type "ephemeral", and which are terminations used for SIP signaling traffic ("SIP pinholes").

2. References

[1] ITU-T Recommendation H.248.1 (09/2005), Gateway control protocol: Version 3.
[2] ITU-T Recommendation H.248.37 (09/2005), Gateway control protocol: IP NAPT Traversal Package.
[3] S-SBG-NE to D-SBG-NE Interface Implementation Agreement: MSF-AF-PROTS-SBG-NE-toD-SBG-NE-Interface-IA-001-STRAW
[4] ETSI ES 283 018 (09/2006), TISPAN NGN Release 1; RACS; H.248 Profile for the Ia Interface.

3. Definitions

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

Pinhole (see ITU-T Rec. H.248.37[2]): A configuration of two associated H.248 IP Terminations within the same H.248 Context, which allows/prohibits unidirectional forwarding of IP packets under specified conditions (e.g., address tuple).

4. Abbreviations

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

D-SBG-NE	Data Path SBG
IA	Implementation Agreement
MSF	MultiService Forum
S-SBG-NE	Signalling SBG
SBG	Session Border Gateway

5. Termination state control package

5.1 Overall description

Package Name:	Termination state control package
PackageID:	tsc (0x####)
Description:	This package allows D-SBG-NE to change ServiceState of a specific Termination from or to Out-of-Service state when the conditions provisioned with the properties described within this package have been achieved.
Version:	1
Extends:	none

5.2 Properties

5.2.1 Termination recovery by timer

Property Name:	Termination recovery by timer
PropertyID:	trt (0x0001)
Description:	This property allows D-SBG-NE to automatically recover ServiceState of a specific Termination from Out-of-Service to the former state when specific time which is provisioned as recovery timer has elapsed. Provisioning this property, ServiceState must be changed to Out-of-Service state at the same time.
Type:	Boolean
Possible values:	ON (Enforce the Termination recovery procedure on a specific Termination.) OFF

Default:	OFF
Defined in:	Local Control
Characteristics:	Read/Write

5.2.2 Recovery timer

Property Name:	Recovery timer
PropertyID:	rt (0x0002)
Description:	This property indicates specific time after which ServiceState of the provisioned Termination is recovered from Out-of-Service state to the former state automatically. The value “0” does not invoke the procedure itself, i.e. synonymous with trt equals to OFF.
Type:	Integer
Possible values:	0-65,535 （ms）
Default:	0
Defined in:	Local Control
Characteristics:	Read/Write

5.2.3 Graceful Termination deactivation

Property Name:	Graceful Termination deactivation
PropertyID:	gtd (0x0003)
Description:	This property allows D-SBG-NE to automatically change ServiceState of a specific Termination to Out-of-Service state, when all the other Terminations, which are associating with the provisioned Termination and are not provisioned with this property, are subtracted.
Type:	Boolean
Possible values:	ON (Enforce the graceful deactivation procedure on a specific Termination.) OFF
Default:	OFF
Defined in:	Local Control
Characteristics:	Read/Write

5.2.4 Attribute for associating Terminations

Property Name:	Attribute for associating Terminations
PropertyID:	ata (0x0004)
Description:	This property indicates the attribute of the associating Terminations with the provisioned Termination. When the “Context”/”VLAN” is provisioned with this property, ServiceState of the provisioned Termination is changed to Out-of-Service state automatically after all the other Terminations in the same Context/VLAN have been subtracted.
Type:	Enumeration
Possible values:	“CTXT” Context

"VLAN" Vlan tags (see vlan package in ETSI TS 102 333, Annex G)

Default : CTXT
Defined in: Local Control
Characteristics: Read/Write

5.3 Events

5.3.1 Recovery completed

Event name: Recovery completed
EventID: rc (0x0005)
Description: Enforce the event reporting to S-SBG-NE when ServiceState of the Termination provisioned with property of Termination recovery by timer is recovered to the former state.

5.3.1.1 EventsDescriptor parameters

None.

5.3.1.2 ObservedEventsDescriptor parameters

None.

5.3.2 Deactivation completed

Event name: Deactivation completed
EventID: dc (0x0006)
Description: Enforce the event reporting to S-SBG-NE when ServiceState of the Termination provisioned with the property of graceful Termination deactivation is changed to Out-of-Service state.

5.3.2.1 EventsDescriptor parameters

None.

5.3.2.2 ObservedEventsDescriptor parameters

None.

5.4 Signals

None

5.5 Statistics

5.5.1 Time to recovery

Statistics name: Time to recovery
StatisticsID: ttr (0x0007)
Description: This statistics indicates the remaining time in milliseconds after which ServiceState of the Termination provisioned with the

property of Termination recovery by timer is recovered to the former state.

Type: Integer
Possible Values: *Any*
Level: Termination

5.6 Procedures

This package allows D-SBG-NE to change ServiceState of specific Terminations from or to Out-of-Service state when the conditions provisioned with the properties described within this package have been achieved.

The procedures of this package shall not interact with ServiceChange procedures. Notification of the state changes of the Terminations are still notified by ServiceChange. This package enables MGC to explicitly indicate MG to change the state of a specific Termination if specific conditions are met in MG.

5.6.1 Usage of Property "Associating Termination attributes"

As shown in 6.2.3, individual SIP signaling flows could be associated with their media flow(s) in a single H.248 context, leading typically to a single SIP pinhole and one or multiple media pinholes per Context. Or SIP signaling flows could be segregated from media flows by using separate Contexts for each flow. In the case VLAN may be used as an H.248 context to associate individual SIP signaling flows and their media flows.

5.6.2 Self-recovery of SIP terminations

When an S-SBG-NE intends to stop the service of a specific Termination temporarily and expects the Termination to recover its state automatically after provisioned time, S-SBG-NE modified ServiceState of the Termination to Out-of-Service with the required properties specified. The S-SBG-NE can receive the notification of the recovery of ServiceState after provisioned time by setting an event at changing the state to Out-of-Service. An example call flow is shown in Figure 5.1.

5.6.3 Temporary suspensions of traffic through SIP terminations

When an S-SBG-NE intends to stop the service of a specific Termination and if the Termination has the other Terminations which may be disturbed if the Termination is forcedly stop its service, the S-SBG-NE modifies ServiceState of the Termination to be stopped with the required properties specified. For example in the case of SIP pinhole control by H.248, this package can be utilized to close a SIP pinhole gracefully without disturbing any media flows associating with the SIP flow. An S-SBG-NE can receive the notification of ServiceState changed to Out-of-Service state, after all the other associating Terminations are subtracted, by setting an event at changing the state to Out-of-Service. To make a signaling-media association among the Terminations, the Terminations may be explicitly created and managed in the same Context, or a signaling-media association may be implicitly made among the Terminations in the same VLAN. This is configurable by "attribute for associating Terminations" in this package. An example call flow is shown in Figure 5.2.

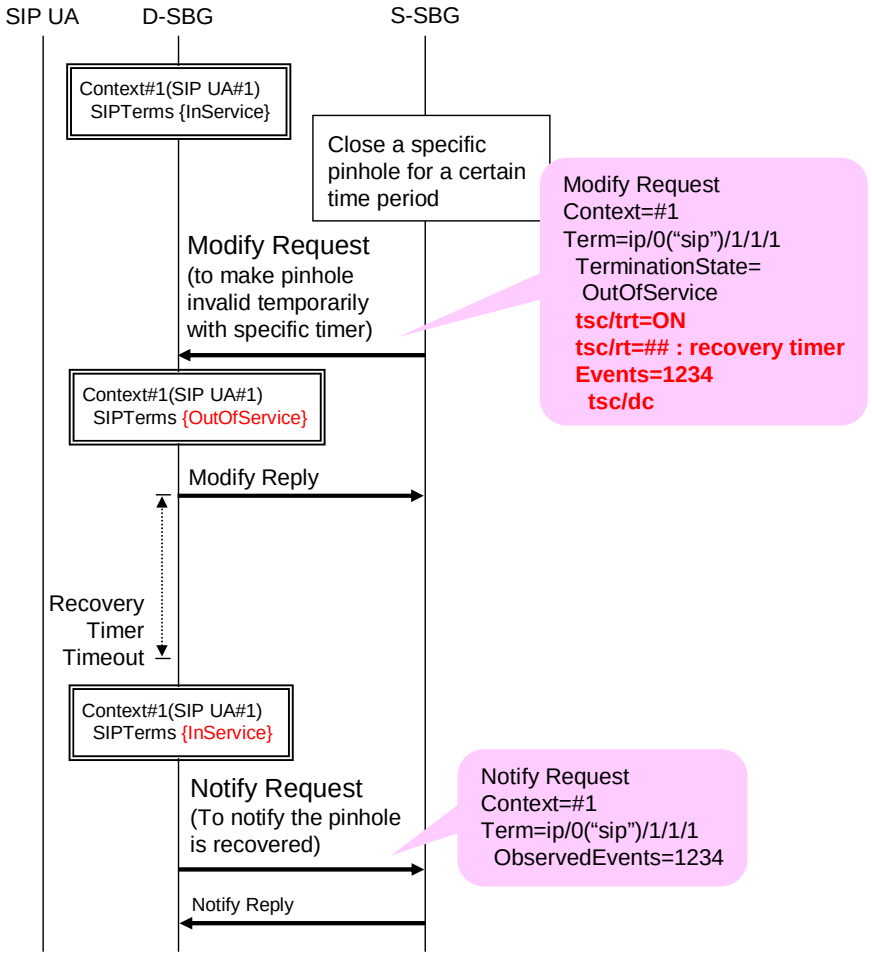


Figure 5.1: Example Call Flow for tsc Package (simple notification)

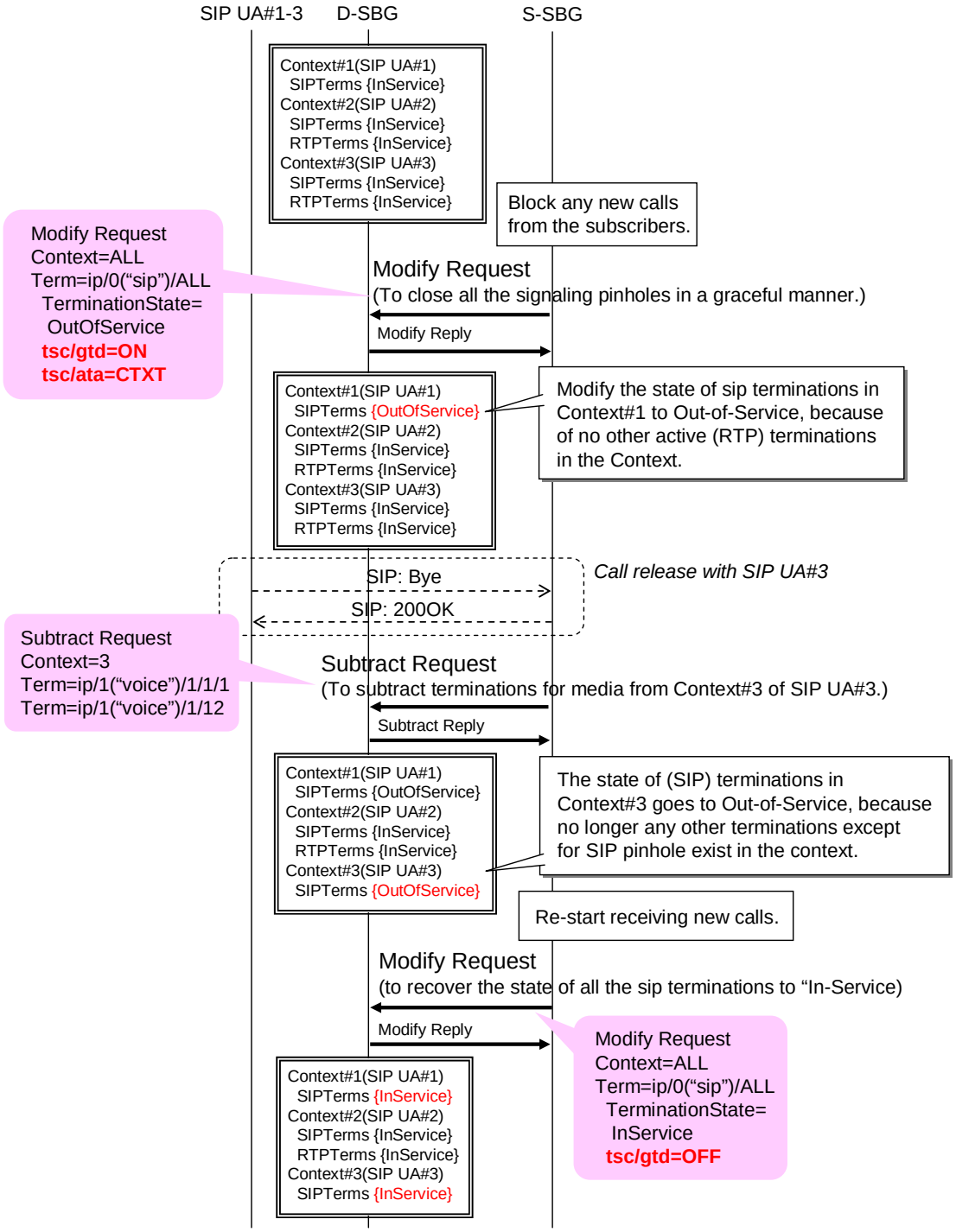


Figure 5.2: Example Call Flow for tsc Package (subtraction of media terminations and modification SIP terminations)

6. Session failure reaction package

6.1 Overall description

Package Name: Session failure reaction package
PackageID: sfr (0x####)

Description:	This package allows D-SBG-NE to change ServiceState of a specific Termination to Out-of-Service state in graceful or forced manner when the D-SBG-NE finds that H.248 control association fails between the D-SBG-NE and associating S-SBG-NE.
Version:	1
Extends:	none

6.2 Properties

6.2.1 Termination deactivation at session failure

Property Name:	Termination deactivation at control association failure
PropertyID:	td (0x0001)
Description:	This property allows D-SBG-NE to change ServiceState of the provisioned Termination to Out-of-Service state provisioned time after the D-SBG-NE finds that the H.248 control association with the associating S-SBG-NE has failed.
Type:	Boolean
Possible values:	ON (Change ServiceState to Out-of-Service state after the H.248 control association has failed.) OFF (no operation)
Default:	OFF
Defined in:	Local Control
Characteristics:	Read/Write

6.2.2 Deactivation behavior

Property Name:	Deactivation behavior
PropertyID:	db (0x0002)
Description:	This property indicates the behavior of changing ServiceState to Out-of-Service state, when the H.248 control association has failed.
Type:	Enumeration
Possible values:	“graceful” graceful deactivation of termination “forced” forced deactivation of termination
Default:	graceful
Defined in:	Local Control
Characteristics:	Read/Write

6.2.3 Associating Termination attributes

Property Name:	Associating Termination attributes
PropertyID:	aa (0x0003)
Description:	This property indicates, in case of the property of “graceful” as deactivation behavior, the attribute of the associating Terminations with the provisioned Termination. When the Context/VLAN is provisioned with this property, ServiceState of the provisioned Termination is changed to Out-of-Service state automatically after all the other Terminations in the same Context/VLAN have been

	subtracted. This property should be ignored, if the property of deactivation behavior is set to “forced”.
Type:	Enumeration
Possible values:	“CTXT” Context “VLAN” Vlan tags (ETSI TS 102 333 Annex G) (optional)
Default:	CTXT
Defined in:	Local Control
Characteristics:	Read/Write

6.2.4 Deactivation timer

Property Name:	Deactivation timer
PropertyID:	dt (0x004)
Description:	This property indicates specific time after which ServiceState of the provisioned Termination is changed to Out-of-Service state in graceful or forced manner automatically, if the H.248 control association fails.
Type:	Integer
Possible values:	0-4,095 seconds
Default:	0
Defined in:	Local Control
Characteristics:	Read/Write

6.3 Events

None

6.4 Signals

None

6.5 Statistics

None

6.6 Procedures

This package allows D-SBG-NE to change ServiceState of a specific Termination to Out-of-Service state in a graceful or forced manner in the case that the D-SBG-NE finds that the H.248 control association failed between the D-SBG-NE and associating S-SBG-NE.

The procedures of this package shall not interact with ServiceChange procedures. Notification of the state changes of the Terminations are still notified by ServiceChange. This package enables MGC to explicitly indicate MG to change the state of a specific Termination if specific conditions are met in MG.

6.6.1 Usage of Property "Associating Termination attributes"

As shown in 6.2.3, individual SIP signaling flows could be associated with their media flow(s) in a single H.248 context, leading typically to a single SIP pinhole and one or multiple media pinholes per Context. Or SIP signaling flows could be segregated from media flows by using separate Contexts for each flow. In the case VLAN may be used as an H.248 context to associate individual SIP signaling flows and their media flows.

6.6.2 Temporary suspensions of traffic through SIP terminations at H.248 control association failure

When an S-SBG-NE intends to stop the service of a specific Termination if the H.248 control association with the associating D-SBG-NE fails, the S-SBG-NE in advance provisions the property of Termination deactivation at control association failure and control options with it. As control options, the provisioned timer for Termination deactivation and deactivation behavior with forced or graceful options are determined. For the provisioned timer, specified time after the D-SBG-NE finds that the H.248 control association failed, ServiceState of the provisioned Termination is changed to Out-of-Service in a forced or graceful manner. For the deactivation behavior, if forced option is specified in the property, the ServiceState is changed to Out-of-Service in a forced manner, without any consideration of the other active Terminations created in association with the Termination to be sopped. If graceful option is specified, ServiceState is not changed to Out-of-Service unless all the other associating Terminations are subtracted. For example in the case of SIP pinhole control by H.248, this package can be utilized to close a SIP pinhole gracefully without disturbing any media flows associating with the SIP flow. The Termination which has been changed its state to Out-of-Service via this package is not recovered to the former state by itself, and only the S-SBG-NE can recover the state. Deactivation timer should start from the beginning when the H.248 control association fails, and should not remain the time at which the timer stopped last time the H.248 control association failed and recovered. To make a signaling-media association among the Terminations, the Terminations may be explicitly created and managed in the same Context, or a signaling-media association may be implicitly made among the Terminations in the same VLAN. This is configurable by "attribute for associating Terminations" in this package. An example call flow is shown in Figure 6.1.

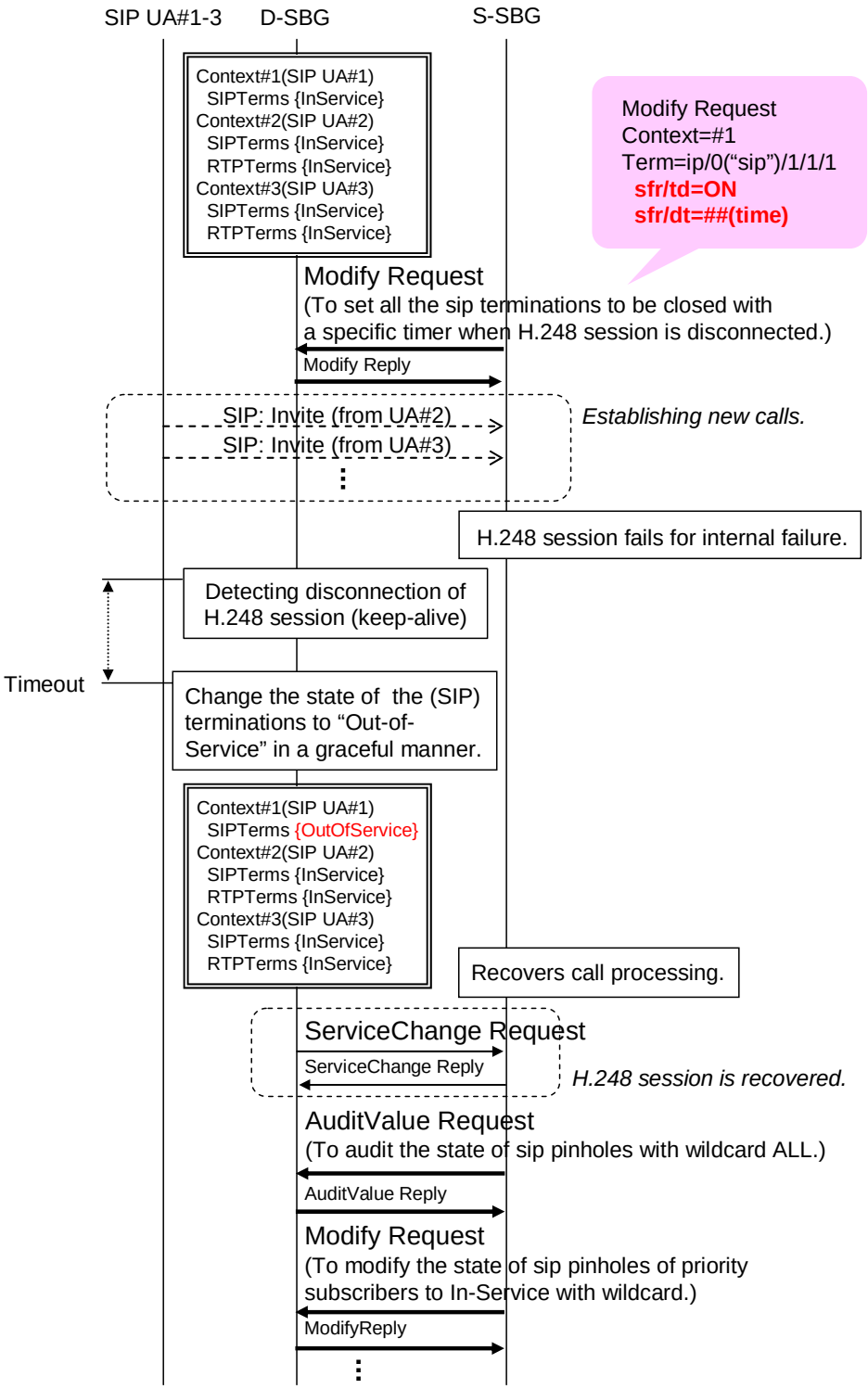


Figure 6.1: Example Call Flow for sfr Package