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SERIES H: AUDIOVISUAL AND MULTIMEDIA SYSTEMS

Infrastructure of audiovisual services – Communication procedures

Gateway control protocol: Bearer-level message backhauling and application level gateway

Recommendation ITU-T H.248.78

ITU-T H-SERIES RECOMMENDATIONS

AUDIOVISUAL AND MULTIMEDIA SYSTEMS

CHARACTERISTICS OF VISUAL TELEPHONE SYSTEMS	H.100–H.199
INFRASTRUCTURE OF AUDIOVISUAL SERVICES	
General	H.200–H.219
Transmission multiplexing and synchronization	H.220–H.229
Systems aspects	H.230–H.239
Communication procedures	H.240–H.259
Coding of moving video	H.260–H.279
Related systems aspects	H.280–H.299
Systems and terminal equipment for audiovisual services	H.300–H.349
Directory services architecture for audiovisual and multimedia services	H.350–H.359
Quality of service architecture for audiovisual and multimedia services	H.360–H.369
Telepresence	H.420–H.429
Supplementary services for multimedia	H.450–H.499
MOBILITY AND COLLABORATION PROCEDURES	
Overview of Mobility and Collaboration, definitions, protocols and procedures	H.500–H.509
Mobility for H-Series multimedia systems and services	H.510–H.519
Mobile multimedia collaboration applications and services	H.520–H.529
Security for mobile multimedia systems and services	H.530–H.539
Security for mobile multimedia collaboration applications and services	H.540–H.549
Mobility interworking procedures	H.550–H.559
Mobile multimedia collaboration inter-working procedures	H.560–H.569
BROADBAND, TRIPLE-PLAY AND ADVANCED MULTIMEDIA SERVICES	
Broadband multimedia services over VDSL	H.610–H.619
Advanced multimedia services and applications	H.620–H.629
Ubiquitous sensor network applications and Internet of Things	H.640–H.649
IPTV MULTIMEDIA SERVICES AND APPLICATIONS FOR IPTV	
General aspects	H.700–H.719
IPTV terminal devices	H.720–H.729
IPTV middleware	H.730–H.739
IPTV application event handling	H.740–H.749
IPTV metadata	H.750–H.759
IPTV multimedia application frameworks	H.760–H.769
IPTV service discovery up to consumption	H.770–H.779
Digital Signage	H.780–H.789
E-HEALTH MULTIMEDIA SERVICES AND APPLICATIONS	
Interoperability compliance testing of personal health systems (HRN, PAN, LAN, TAN and WAN)	H.820–H.859
Multimedia e-health data exchange services	H.860–H.869

For further details, please refer to the list of ITU-T Recommendations.

Recommendation ITU-T H.248.78

Gateway control protocol: Bearer-level message backhauling and application level gateway

Summary

Recommendation ITU-T H.248.78 defines a package that allows bearer-level application protocol (such as real time streaming protocol (RTSP) or message session relay protocol (MSRP)) messages received by a media gateway (MG) to be communicated to a media gateway controller (MGC). This allows the MGC to perform application-level gateway functionality such as network address translation on the messages and then forward the messages to the MG for sending to the destination.

The 03/2013 revision incorporates an update to correctly refer to the "Message Session Relay Protocol".

This 04/2015 revision adds a further ITU-T H.248 package for support of:

a) MG located application-level gateway functionality and

b) MG message backhauling functionality

It also updates the title from "bearer-level application level gateway" to "bearer-level message backhauling and application level gateway".

History

Edition	Recommendation	Approval	Study Group	Unique ID*
1.0	ITU-T H.248.78	2010-09-13	16	11.1002/1000/10988
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* To access the Recommendation, type the URL http://handle.itu.int/ in the address field of your web browser, followed by the Recommendation's unique ID. For example, http://handle.itu.int/11.1002/1000/11830-en.

FOREWORD

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The World Telecommunication Standardization Assembly (WTSA), which meets every four years, establishes the topics for study by the ITU-T study groups which, in turn, produce Recommendations on these topics.

The approval of ITU-T Recommendations is covered by the procedure laid down in WTSA Resolution 1.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

NOTE

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As of the date of approval of this Recommendation, ITU had received notice of intellectual property, protected by patents, which may be required to implement this Recommendation. However, implementers are cautioned that this may not represent the latest information and are therefore strongly urged to consult the TSB patent database at http://www.itu.int/ITU-T/ipr/.

Table of Contents

Recommendation ITU-T H.248.78

Gateway control protocol: Bearer-level message backhauling and application level gateway

1 Scope

In a split media gateway controller (MGC) and media gateway (MG) environment, call-level application level gateways (ALG) are common in order to translate address information (i.e., network address and port translation (NAPT)) between two signalling domains. Typically, the application signalling traverses the MGC. ITU-T H.248 is therefore not involved in these translations other than to set the necessary media transport parameters on applicable terminations.

Increasingly bearer-level application control signalling is being used which instead traverses the MG. This bearer-level application signalling typically is used within a session that has been established by the MGC; thus, some coordination between the two levels is needed.

This Recommendation provides functionality that allows the MGC and MG to coordinate bearer-level application level gateway functionality. By transporting bearer-level application protocols between the MGC and MG using ITU-T H.248 signalling (a method known as "backhauling"), it allows the MGC access to the bearer level application protocol.

This revision introduces the ability to use an alternative method to identify the bearer level application protocol on an ITU-T H.248 stream. It also introduces a new package that allows an MG to autonomously act as an application level gateway and modify address information.

2 References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published. The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation.

[ITU-T H.248.1] Recommendation ITU-T H.248.1 (2013), *Gateway control protocol: Version 3*.

[ITU-T H.248.69] Recommendation ITU-T H.248.69 (2009), *Gateway control protocol: Packages for interworking between MSRP and H.248*.

[ETSI TS 123 228] ETSI TS 123 228 (2010), *Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); LTE; IP Multimedia Subsystem (IMS); Stage 2 (3GPP TS 23.228 version 9.4.0 Release 9).*

[IETF RFC 2326] IETF RFC 2326 (1998), *Real Time Streaming Protocol (RTSP).*

[IETF RFC 6455] IETF RFC 6455 (2011), *The WebSocket Protocol*.

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following term defined elsewhere:

3.1.1 application level gateway (ALG) [ETSI TS 123 228]: Is an application specific functional entity that allows communication between disparate address realm or IP versions, e.g., an IPv6 node to communicate with an IPv4 node and vice versa, when certain applications carry network addresses in the payloads like SIP/SDP. NA(P)T-PT or NA(P)T is application unaware whereas ALGs are application specific translation entities that allow a host running an application to communicate transparently with another host running the same application but in a different IP version or IP address realm.

NOTE – This definition originates from the first ALG description in clause 2.9 of [b-IETF RFC 2663].

3.2 Terms defined in this Recommendation

This Recommendation defines the following term:

3.2.1 backhauling: Refers to the transport of signalling information from the point of interface for the concerned protocol in the MG back to the point of call processing (i.e., the MGC) and vice versa. Hence, backhauling implies the transport of a non-ITU-T H.248 related signalling protocol over the ITU-T H.248 gateway control protocol.

NOTE 1 – The definition is derived from [b-IETF RFC 2719].

NOTE 2 – The primary scope of backhauling are signalling protocols, but the mechanism as such can be applied to bearer level application protocols.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

ALG	Application-Level Gateway
B2B	Back to Back
B-ALG	Bearer level Application-Level Gateway
DNS	Domain Name System
HTML	Hypertext Mark-up Language
HTTP	Hypertext Transfer Protocol
IP	Internet Protocol
IPv4	Internet Protocol Version 4
IPv6	Internet Protocol Version 6
L3	Layer three
L4	Layer four
L4+	Above layer four
LD	Local Descriptor
MG	Media Gateway
MGC	Media Gateway Controller
MSRP	Message Session Relay Protocol
NAPT	Network Address and Port Translation
OSI	Open Systems Interconnection
PDU	Protocol Data Unit
RD	Remote Descriptor

RTSP Real-Time Streaming Protocol

SCTP Stream Control Transport Protocol

SDP Session Description Protocol

SIP Session Initiation Protocol

TCP Transmission Control Protocol

UDP User Datagram Protocol

WebRTC Web Real-Time Communication

5 Conventions

Elements of the ITU-T H.248 protocol model, e.g., Context, Termination, Stream, Event are represented using the first letter capitalized. Property, Event, Signal and Parameter identities are given in *italics*.

The suffix ".req" added to an ITU-T H.248 command name stands for a command request, while the suffix ".rep" stands for a command reply. For example "Notify.req" represents a Notify Request.

6 Application-level gateway functionality

Address information carried at layer four (L4) or above (L4+) according to the ISO 7-layer model is primarily related to call/session control signalling (like the session initiation protocol (SIP)). Such *call-level ALGs* are consequently out of scope of ITU-T H.248 Recommendations. However, there are IP applications with bearer-level transport of "L4+ address information". These services may need a *bearer-level ALG* located in the ITU-T H.248 MG.

Examples use cases (see also Figure 1) which may require a *bearer-level ALG* are:

– Message session relay protocol (MSRP)-over-TCP/IP (instant messaging in session mode; ITU-T H.248 MG as in-path node between MSRP client and MSRP server, or between MSRP relay; not necessarily using the procedures of [ITU-T H.248.69]);

– Real time streaming protocol (RTSP)-over-{TCP|UDP}/IP (streaming service; ITU-T H.248 MG as in-path node, not necessarily where the MGC is involved in RTSP signalling);

– Hypertext transfer protocol (HTTP)-over-TCP/IP (web service; ITU-T H.248 MG as in-path node between HTTP client/server);

– SIP-over-{SCTP|TCP|UDP}/IP (e.g., in case of bearer-path coupled SIP signalling and SIP traffic forwarded by ITU-T H.248 Context in *ipr* mode).

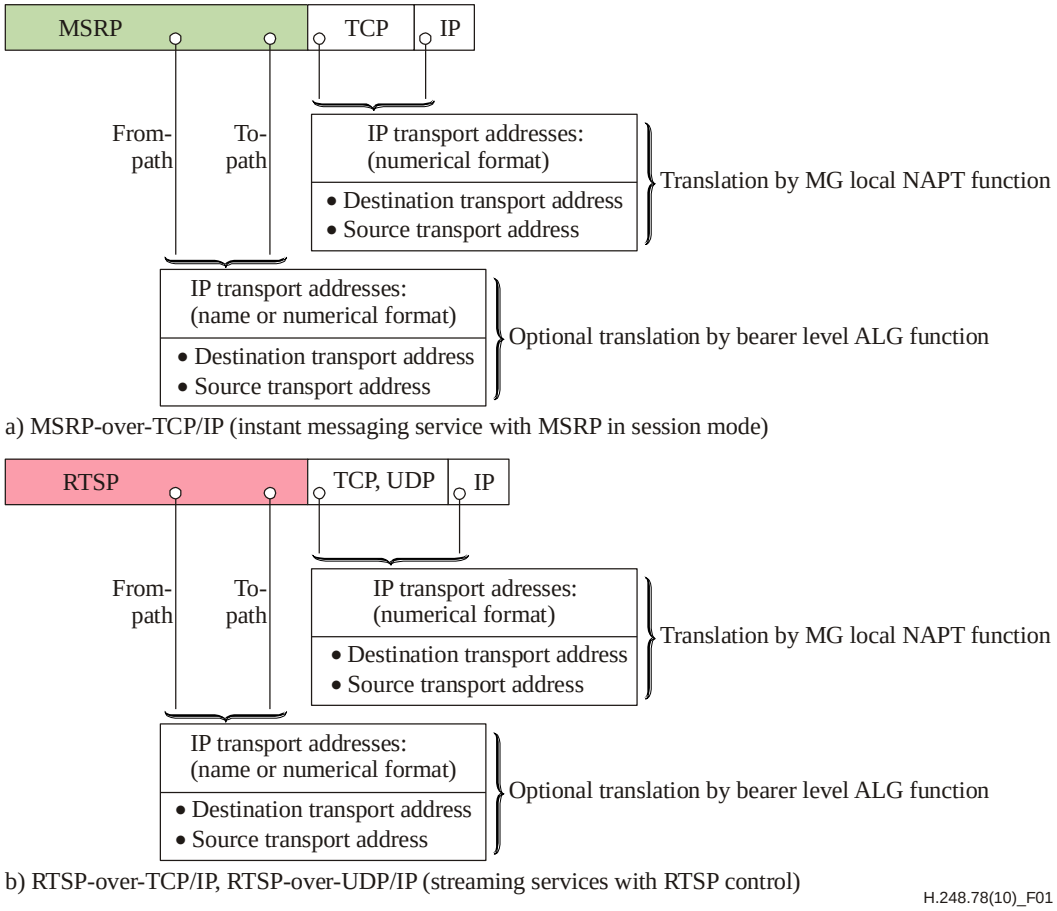


Figure 1 – Examples for potential ALG

There are fundamentally two options for controlling ITU-T H.248 MG embedded *bearer-level ALG* functions:

1) MGC controlled mode:

   The MGC explicitly provides the mapping information for the "L4+ NAPT" function. Any potential "L3/L4 NAPT" function would not be tightly coupled with the "L4+ NAPT" function from MG perspective; or

2) MG autonomous mode:

   The MG would monitor the IP bearer packet flow and try to detect messages which need "L4+ NAPT" handling, and the mapping information would be derived from local "L3/L4 NAPT" information or other (e.g., DNS) information.

6.1 MGC strictly controlled MG embedded bearer-level ALG

This clause describes a network scenario where a MGC controls a MG that handles both a bearer-level application protocol (e.g., RTSP) and its associated media streams. See Figure 2 for an illustration.

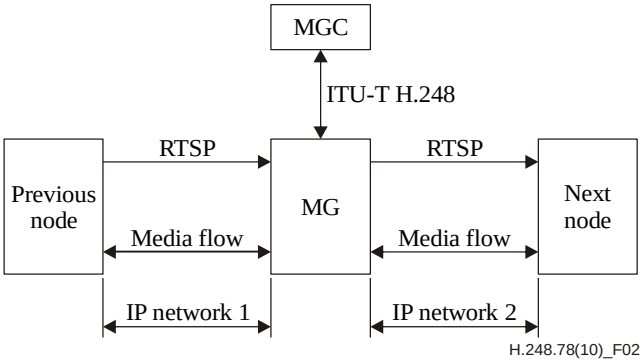


Figure 2 – RTSP and media traversing a MG

When analysing the signalling flow for the network scenario, it is assumed that an appropriate call/session control protocol (e.g., SIP) is used to establish a termination/stream for the bearer-level application protocol (e.g., RTSP). The use of the application-level protocol may result in additional media bearer(s) needing to be established. The basic assumption is that the MGC is still responsible for establishing these media flows. Therefore, some coordination is needed between the bearer/MG level and the MGC. This is illustrated by the signalling flow in Figure 3.

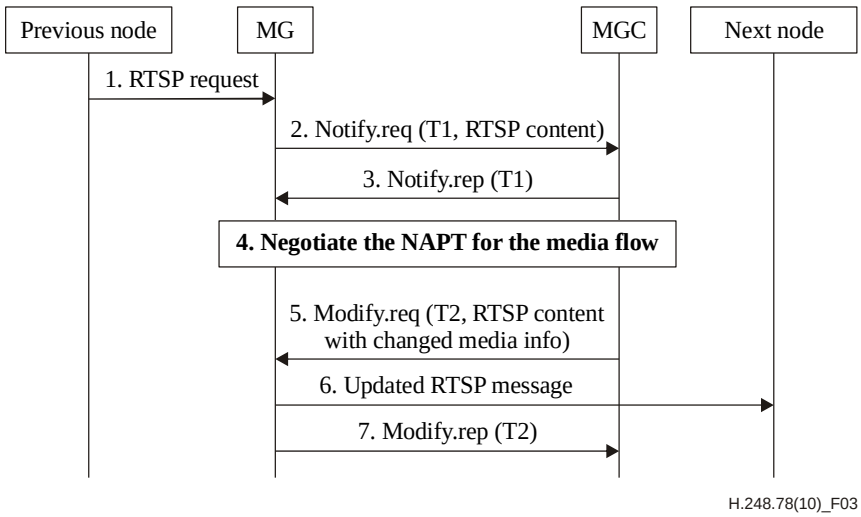


Figure 3 – RTSP and media traversal signalling flow

For the purposes of the steps below, it is assumed that terminations T1 and T2 have already been established and are set to enable reception and sending bearer-level application protocol signalling.

In step 1: The MG receives a RTSP request message including media information via Termination T1.

For example:

```
SETUP RTSP://example.com/foo/bar/baz.rm RTSP/2.0
CSeq: 302
Transport: RTP/AVP;unicast;dest_addr=":4588"/":4589",
RTP/AVP/TCP;unicast;interleaved=0-1
```

In step 2: In order to inform the MGC of this new media request, the MG sends a Notify.req message to MGC with the information from the received RTSP message.

In step 3: The MGC issues a Notify.rep message.

In step 4: Based on the information from the RTSP SETUP message, the MGC would request two additional new Terminations (i.e., T3 and T4, not shown in the signalling flow) for the media flow (back to back mode. See [b-ITU-T H.248.64] for more information regarding this mode). The MG will provide a NAPT function for media flow.

In step 5: The MGC sends a Modify.req message to the MG. Updated media information is included in this modify message.

In step 6: MG sends the updated RTSP request to the next node via Termination T2.

```
SETUP RTSP://example.com/foo/bar/baz.rm RTSP/2.0
CSeq: 302
Transport: RTP/AVP;unicast;dest_addr=":8000"/":8001",
RTP/AVP/TCP;unicast;interleaved=0-1
```

Step 7: The MG sends a Modify.rep message.

Clause 7 defines the "MGC Controlled Bearer Level ALG" package, which provides the necessary elements to support such signalling flows.

6.2 MG autonomous embedded bearer-level ALG

Where a bearer-level application protocol traverses a MG, one theoretical mode of operation is to use an MG embedded bearer-level ALG. In this configuration the ALG would inspect bearer-level application protocol packets and then perform the necessary network address translations. As the embedded function would be independent of the MGC, the mappings would need to be determined via a non-ITU-T H.248 method, such as DNS, provisioning, etc.

However, as shown in the network scenario as presented by Figure 2, bearer-level application protocols such as RTSP may also establish, manipulate or remove media streams. If the bearer-level ALG is embedded in the MG and is independent of the MGC, the MG would be required to autonomously manipulate the characteristics of the media stream. The ITU-T H.248 connection model does not allow such behaviour.

The implementation of such an embedded MG would mean that whilst the network address information may be correctly mapped as the bearer-level application protocol traverses the MG, any subsequent attempts to establish a bearer by the application protocol would fail (as the necessary streams would not be open on the MG).

Therefore, this Recommendation does not provide generic procedures for the support of an autonomous embedded bearer-level ALG.

7 MGC Controlled Bearer Level ALG package

Package name: MGC Controlled Bearer Level ALG

Package ID: mcbalg (0x0108)

Description: This package allows a MGC to receive bearer-level application messages. These bearer-level application messages are transported over ITU-T H.248 (backhauled). This allows the MGC to access the bearer-level messages to perform ALG functionality (such as NAPT) on them or to perform other functions such as interworking to other protocols. The package defines an event allowing the MG to detect bearer-level messages and send them to the MGC and a signal containing an updated bearer-level message which allows the MGC to request the MG to send bearer level messages. The package assumes that the MGC has a decode/encode logic for the application protocol

in question that allows it to receive the native messages, perform ALG functionality and recode them with the updated information.

Version 2 of this package introduces an "Enhanced Protocol Filter" that allows application protocols to be identified through the use of a Websocket Subprotocol Name. It also introduces a "label" parameter that allows multiple application protocols to be identified. This is necessary when for example an ITU-T H.248 stream contains several application protocols of the same type.

Version: 2

Extends: None

7.1 Properties

None.

7.2 Events

7.2.1 Detect bearer level message

Event name: Detect bearer level message

Event ID: det (0x0001)

Description: This event is used by the MGC to indicate to the MG which bearer-level messages should be detected. Once detected by the MG, these messages are sent to the MGC.

7.2.1.1 EventsDescriptor parameters

7.2.1.1.1 Protocol Filter

Parameter name: Protocol Filter

Parameter ID: pf (0x0001)

Description: This parameter indicates the application protocol that shall be detected by the MG and reported to the MGC.

Type: Unsigned Integer

Optional: Yes

Possible values: A value representing an application protocol, using the *well-known* or *registered* port number assigned to that protocol by IANA (http://www.iana.org/assignments/port-numbers). For example:

```
80      World Wide Web HTTP
554     Real Time Streaming Protocol (RTSP)
2855    MSRP
```

Default: 0, indicating that the protocol is determined via the local and remote descriptors.

7.2.1.1.2 Message Filter

Parameter name: Message Filter

Parameter ID: mf (0x0002)

Description: This parameter indicates the messages that shall be detected by the MG and reported to the MGC.

Type: Sub-list of String

Optional: Yes

Possible values: The possible values are determined according to the "message name" field (or an analogous field such as "method") associated with the application control protocol being detected.

For example, in the case of RTSP this would be the "Method" as described in clause 6.1 of [IETF RFC 2326].

Where the application control protocol is a binary protocol, the value will be encoded as hexadecimal octet according to clause B.3 of [ITU-T H.248.1].

Where the application control protocol is a text protocol, case sensitivity with regard to the "message name" is as per the application protocol.

An additional value "*" (wildcard ALL) is defined to allow the MGC to indicate that all messages with valid message names for the particular application protocol are detected and reported.

Default: "*"

7.2.1.1.3 Forwarding Flag

Parameter name: Forwarding Flag

Parameter ID: ff (0x0003)

Description: This parameter indicates whether the MG forwards the detected message to other Terminations in the Context. This allows the MGC to be either fully in control of the application control protocol messages or to only be aware of the information contained in the application protocol messages.

Type: Boolean

Optional: Yes

Possible values: True – On detection, the message is forwarded to the other applicable Terminations in the Context as well as being notified in an ObservedEvent.

False – On detection, the message is NOT sent inwards to the Context, it is only notified in an ObservedEvent.

Default: False

7.2.1.1.4 Enhanced protocol filter

Parameter name: Enhanced Protocol Filter

Parameter ID: ehpf (0x0004)

Description: This parameter provides an alternative means to the protocol filter (*pf*) parameter to identify the application protocol that shall be detected by the MG and reported to the MGC. It is used when there is no defined well-known port number for the application protocol.

Type: String

Optional: Yes

Possible values: A string representing an application protocol using the "Subprotocol Identifier" from the IANA WebSocket Subprotocol Name Registry defined by [IETF RFC 6455].

Default: Empty string indicating that the protocol is determined via the Local and Remote Descriptors or if set the *pf* parameter.

7.2.1.1.5 Label

Parameter name: Label

Parameter ID: lbl (0x0005)

Description: This parameter allows the MGC to provide a label associated with a particular application protocol to be detected. Some bearer control protocols (for example the WebRTC data channel establishment protocol) assign a label to a particular channel. The label parameter may contain a reference to such a label.

The MGC may learn the assigned label either by notification from the MG or an out of band means such as through the use of the SDP. The same label may be used for multiple channels. In such a case the MGC should disambiguate the labels when used in ITU-T H.248 signalling to be able to uniquely identify the channels. The definition of such mechanism is out of scope of this Recommendation.

Type: String

Optional: Yes

Possible values: Any string

Default: Empty string

7.2.1.2 ObservedEventsDescriptor parameters

7.2.1.2.1 Message Content

Parameter name: Message Content

Parameter ID: mc (0x0001)

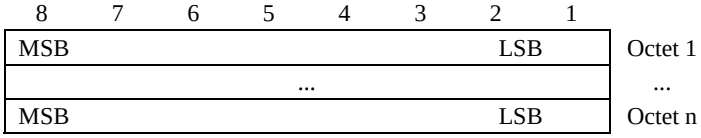
Description: This parameter contains the content of the detected application control protocol message. It contains only the L4+ information.

Type: Binary encoding "Octet String", Text encoding "String"

Optional: No

Possible values: **Binary encoding:**

Structure of Message Content



NOTE – Octet 1 contains the most significant octet of data.

Text encoding:

If the application protocol is a text format protocol (i.e., the protocol messages always consist of octets which have a standard textual representation under UTF-8), the message shall be used "as is" as the parameter value. Message characters that are not valid for inclusion in an ITU-T H.248 quotedString (see clause B.2 of [ITU-T H.248.1]) shall be encoded using the triplet "%xx" where "xx" are the hexadecimal digits representing the character's octet. The "%" character shall also be encoded using such a triplet (i.e., as "%25").

If the application protocol is a binary format protocol, the binary data shall be encoded according to the procedures of clause B.4 of [ITU-T H.248.1].

Default: None

7.2.1.2.2 Detected protocol

Parameter name: Detected protocol

Parameter ID: dtp (0x0002)

Description: This parameter indicates the type of application protocol detected. It is reported if the *ehpf* parameter has been used to set the ObservedEvent. This allows an MGC to distinguish between Events set for multiple application protocols set on the same ITU-T H.248 Stream.

Type: String

Optional: Yes

Possible values: A string representing an application protocol using the "Subprotocol Identifier" from the IANA WebSocket Subprotocol Name Registry defined by [IETF RFC 6455].

Default: None.

7.2.1.2.3 Label

Parameter name: Label

Parameter ID: lbl (0x0003)

Description: This parameter contains a label associated with a particular application protocol to be detected. It is reported if the *lbl* parameter has been used to set the ObservedEvent.

Type: String

Optional: Yes

Possible values: Any string

Default: None.

7.3 Signals

7.3.1 Send bearer level message

Signal name: Send bearer level message

Signal ID: sblm (0x0001)

Description: This signal allows the MGC to send an application protocol message to a MG, to be sent from one of the MG's Terminations/Streams.

Signal type: Brief

Duration: Not Applicable

7.3.1.1 Additional parameters

7.3.1.1.1 Message content

As per clause 7.2.1.2.1.

7.3.1.1.2 Sent Application Protocol

Parameter name: Sent Application Protocol

Parameter ID: sap (0x0002)

Description: This parameter provides a means to identify the channel that the bearer level message is sent on through the use of the protocol type. By knowing the protocol the MG can identify the correct channel to send the message without having to parse the application protocol message. This is useful where there are multiple application protocols in an ITU-T H.248 Stream.

Type: String

Optional: Yes

Possible values: A string representing an application protocol using the "Subprotocol Identifier" from the IANA WebSocket Subprotocol Name Registry defined by [IETF RFC 6455].

Default: Empty string indicating that the protocol is determined via the Local and Remote Descriptors or if set the *pf (or ehpf)* parameter.

7.3.1.1.3 Label

Parameter name: Label

Parameter ID: lbl (0x0003)

Description: This parameter provides an additional means to identify the channel that the bearer level message is sent on through the use of a label. By knowing the label the MG can identify the correct channel to send the message without having to parse the application protocol message. This is useful where there are multiple application protocols in an ITU-T H.248 Stream.

Type: String

Optional: Yes

Possible values: Any string

Default: Empty string

7.4 Statistics

None.

7.5 Error codes

None.

7.6 Procedures

7.6.1 Application control protocol messages detection initiation

In order to request the MG to provide the MGC with certain application control protocol messages, the MGC shall set the "Detect bearer level message" (*mcbalg/det*) event on the termination receiving bearer-level application protocol messages. If multiple application control protocols are to be detected there shall be one instance of the *mcbalg/det* event for each.

The MGC may indicate the applicable application protocol to be detected via the use of the "Protocol Filter" (*pf*) parameter or the "Enhanced Protocol Filter" (*ehpf*) parameter and/or the "label" (*lbl*) parameter. The *pf* and *ehpf* parameters shall not be used together in the same Signal or Event. The MGC may use either or both the *ehpf* and *lbl* parameters to identify the applicable application protocol. If both are used the values must relate to a single application protocol instance. If neither *pf*, *ehpf* nor *lbl* are provided, the MG shall determine the protocol via information in the Local and Remote Descriptors on the applicable Stream. If the Event is set on a Termination with multiple streams without an indication of the StreamID or "Protocol Filter", of if the MG is unable to determine the protocol, it shall return error code "472 Required Information Missing".

The MGC shall indicate which messages shall be detected through the use of the "Message Filter" (*mf*) parameter. This parameter allows a list of messages to be provided. Instead of a list of values, the MGC may also use the value "ALL", which represents all the messages that can be represented within a "message name" field.

The MGC may also indicate through the use of the "Forwarding Flag" (*ff*) parameter what action the MG should take upon detection of an applicable message. In addition to notifying the MGC, the MG may either forward the message into the Context or not, depending on the setting of the parameter.

7.6.2 Detection of application control protocol messages

Once the *mcbalg/det* event is set, the MG shall detect messages according to the parameters of that event. If an applicable message is detected, the MG shall send an ObservedEvent containing the "Message Content" (*mc*) parameter. The ObservedEvent may also contain the "Detected Protocol" (*dtp*) and/or the "Label" (*lbl*) parameters. The *dtp* and *lbl* parameters may be used by the MGC to determine which Event instance the ObservedEvent relates to. By default, the message is not sent to other Terminations in the Context, unless the forwarding flag parameter was set to "True".

7.6.3 Modification and sending of application control protocol messages

On reception of the ObservedEvent containing the L4+ message content the MGC may analyse and update the contents of the message as appropriate. For example, it may modify address information to perform a NAPT function.

NOTE – It is assumed that the MG has already performed all necessary layer 1-3 functions and firewall functions on received messages in order to detect the L4+ message.

The MGC may then send the updated message content through the Termination(s) that would have normally sent the outgoing application protocol message (i.e., in the case of a two Termination B2B Context, the Termination that did not generate the *mcbalg/det* event) using the "Send Bearer Level

Message" (*mcbalg/sblm*) signal. To do so, the MG shall place the updated protocol message in the signal's "Message Content" (*mc*) parameter. If the Termination has multiple streams, the MGC should also provide the applicable StreamID to unambiguously indicate on which Stream it should send the application protocol message. The MGC may also provide the "Sent Application Protocol" (*sap*) and "Label" (*lbl*) parameters to unambiguously indicate the data transport channel used on a Stream.

On reception of the *mcbalg/sblm* signal the MG shall then send the application protocol message to the indicated destination. If the MGC requires further processing by the Context associated with the Termination that received the message, the MGC shall send the *mcbalg/sblm* signal from the Termination that received the original message with a signal direction equal to "internal". If the MG is unable to decode and/or encode the message for sending from the received message content parameter it shall respond with error code 449 "Unsupported or Unknown Parameter or Property Value".

7.6.4 Examples

The examples in this clause illustrate the usage of the MGC Controlled Bearer Level ALG package.

The examples in clauses 7.6.4.1, 7.6.4.2 and 7.6.4.3 assume that the MGC has already added two Terminations (T1 and T2) as a result of session/call control signalling. The applicable bearer level application protocol is RTSP and the SETUP and DESCRIBE methods are to be detected. Stream 2 is associated with this application protocol stream.

The example in clause 7.6.4.4 shows an example using an enhanced protocol filter and label for protocol message detection initiation.

7.6.4.1 Application control protocol message detection initiation

The MGC requests the MG to detect RTSP SETUP and DESCRIBE messages and to be notified when such messages are detected. The messages are not to be forwarded to other Terminations in the Context. Parameter "*ff*" is not shown as this is the default behaviour.

Option 1 – Protocol filter used

```
MGC to MG1:
MEGACO/3 [123.123.123.4]:55555
Transaction = 10001 {
    Context = 1234 {
        Modify = T1 {
            Events = 2223 {
                mcbalg/det{pf=554,mf=[SETUP,DESCRIBE]}
            },
        }
    }
}
```

Option 2 – StreamId used to indicate protocol

```
MGC to MG1:
MEGACO/3 [123.123.123.4]:55555
Transaction = 10001 {
    Context = 1234 {
        Modify = T1 {
            Events = 2223 {
                mcbalg/det{stream=2,pf=554,mf=[SETUP,DESCRIBE]}}
            }
        }
    }
```

7.6.4.2 Message detection and notification

The MG receives the following RTSP message:

```
SETUP RTSP://example.com/foo/bar/baz.rm RTSP/2.0
     CSeq:302
     Transport:RTP/AVP;unicast;dest_addr=":4588"/":4589",
     RTP/AVP/TCP;unicast;interleaved=0-1
```

As the method is "SETUP", this is notified to the MGC using an ObservedEvent:

```
MEGACO/3 [125.125.125.111]:55555
Transaction = 10002 {
   Context = 1234 {
       Notify = T1 {ObservedEvents =2223 {
              mcbalg/det{ stream=2, mc=
              "SETUP RTSP://example.com/foo/bar/baz.rm RTSP/2.0
              CSeq:302
              Transport:RTP/AVP;unicast;dest_addr=%22:4588%22;
              /%22:4589%22,
              RTP/AVP/TCP;unicast;interleaved=0-1"}}
       }
   }
}
```

7.6.4.3 Message modification and sending

On reception of the ObservedEvent, the MGC determines that port translation is necessary and changes the ports in the SETUP message:

```
SETUP RTSP://example.com/foo/bar/baz.rm RTSP/2.0
     CSeq:302
     Transport:RTP/AVP;unicast;dest_addr=":8000"/":8001",
     RTP/AVP/TCP;unicast;interleaved=0-1
```

It then sends the modified message through the MG using the *mcbalg/sblm* signal:

```
MEGACO/3 [123.123.123.4]:55555
Transaction = 10003 {
  Context = 1234 {
    Modify = T2 {
      Signals {
          mcbalg/sblm{stream=2,mc=
               "SETUP RTSP://example.com/foo/bar/baz.rm RTSP/2.0
               CSeq:302
               Transport:RTP/AVP;unicast;dest_addr=%22;:8000%22;
               /%22;:8001%22,
     RTP/AVP/TCP;unicast;interleaved=0-1"}
     },
    }
  }
}
```

7.6.4.4 Enhanced application control protocol message detection initiation

The following shows an example using the enhanced protocol filter and label to detect a bearer level protocol.

```
MGC to MG1:
MEGACO/3 [123.123.123.4]:55555
Transaction = 10001 {
    Context = 1234 {
        Modify = T1 {
            Events = 2223 {
                mcbalg/det{stream=2,ehpf="wamp",label="123456"}}
            }
        }
    }
```

8 MG located Bearer Level ALG package

Package name: MG located Bearer Level ALG

Package ID: mgbalg (0x011d)

Description: The actual ALG function with respect to the replacement of address information at application layer is executed by the MGC when using the *mcbalg* package (clause 7). This package moves that function down to the MG. The MGC is only involved in enabling that function and (if required) providing the address information to be inserted.

Version: 1

Extends: None

8.1 Properties

8.1.1 Protocol type bearer level ALG

Property name: Protocol type bearer level ALG

Property ID: ptbalg (0x0001)

Description: This property enables/disables the MG located Bearer Level ALG based on the protocol type.

Type: Boolean

Possible values: ON to enable MG located bearer level ALG

OFF to disable MG located bearer level ALG

Default: OFF

Defined in: LocalControl on an individual Stream or TerminationState on the Root Termination.

The variants of non-Root and Root Termination level shall be mutually exclusive. An ITU-T H.248 profile should indicate the supported variant.

Characteristics: Read/write

8.1.2 Upper layer protocol filter

Property name: Upper layer protocol filter

Property ID: ulpf (0x0002)

Description: This property specifies the Stream's upper layer protocol/s type that the filtering is applied to. The term "upper layer" denotes the protocol layer above the layer 4 transport protocol, i.e., an "upper layer" protocol is a "L4+" protocol, e.g., HTTP, MSRP, or RTSP.

Type: Sub-list of Integer

Possible values: A *single value* or a *sub-list*. A value representing an application protocol, using the *well known* or *registered* port number assigned to that protocol by IANA (http://www.iana.org/assignments/port-numbers). For example:

```
80   World Wide Web HTTP
554  Real Time Streaming Protocol (RTSP)
2855 MSRP
```

Default: 0, indicating that the protocol is determined via:

a) the Local and Remote Descriptors if the *ulehpf* property is set to a non-empty string, or

b) the *ulehpf* property if set to a non-empty string.

Defined in: LocalControl on an individual Stream or TerminationState on the Root Termination.

The variants of non-Root and Root Termination level shall be mutually exclusive. An H.248 profile should indicate the supported variant.

Characteristics: Read/write

8.1.3 Upper layer enhanced protocol filter

Parameter name: Upper layer enhanced protocol filter

Parameter ID: ulehpf (0x0005)

Description: This parameter provides an alternative means to the upper layer protocol filter (*ulpf*) property to identify the application protocol that filtering will be applied to. It is used when there is no defined well known port number for the application protocol.

Type: String

Optional: Yes

Possible values: A string representing an application protocol using the "Subprotocol Identifier" from the IANA WebSocket Subprotocol Name Registry defined by [IETF RFC 6455].

Default: Empty string indicating that the protocol is determined via the Local and Remote Descriptors or if set the *ulpf* property.

8.1.4 Indication of "source of replaced source address information"

Property name: Source of replaced source address information part

Property ID: sosaip (0x0003)

Description: Communication addresses in Lx-PDUs (protocol data unit at layer Lx; here primarily layers concerned above L3) contain address information of the traffic source and/or traffic sink. The ALG function may be required for the replacement of source information. For

example as a result of a particular remote NAT device's translation behaviour in the IP bearer path.

The translation of source address information only is a very common ALG scenario.

This property allows the MGC to indicate the source(s) used for replaced source address information.

Type: Sub-list of Enumeration

Possible values: A single value or a sub-list, according to the value of *ulpf*:

NR [0x00] No replacement

SD [0x01] Contained in ITU-T H.248 Stream Descriptor

PR [0x02] Provisioned in MG

IP [0x03] IP (transport) address information

(NOTE – This codepoint is for further study and should be used with caution.)

If the value is a sub-list, the order of elements in the list shall correspond to the list of affected protocols as indicated by property *ulpf*.

Default: SD

Defined in: LocalControl on an individual Stream or TerminationState on the Root Termination.

The variants of non-Root and Root Termination level shall be mutually exclusive. An ITU-T H.248 profile should indicate the supported variant.

Characteristics: Read/write

8.1.5 Indication of "source of replaced destination address information"

Property name: Source of replaced destination address information part

Property ID: sodaip (0x0004)

Description: Communication addresses in Lx-PDUs (protocol data unit at layer Lx; here primarily layers concerned above L3) contain address information of the traffic source and/or traffic sink. The ALG function may be required for the replacement of destination information. For example as a result of particular translation behaviour of remote NAT devices in the IP bearer path.

This property allows the MGC to indicate the source used for re-placed destination address information.

Type: Sub-list of Enumeration

Possible values: A single value or a sublist, according to the value of *ulpf*

NR [0x00] No replacement

SD [0x01] Contained in ITU-T H.248 Stream Descriptor

PR [0x02] Provisioned in MG

IP [0x03] Source IP (transport) address information

If the value is a sub-list, the order of elements in the list shall correspond to the list of affected protocols as indicated by property *ulpf*.

Default: SD

Defined in: LocalControl on an individual Stream or TerminationState on the Root Termination.

The variants of non-Root and Root Termination level shall be mutually exclusive. An ITU-T H.248 profile should indicate the supported variant.

Characteristics: Read/write

8.2 Events

None.

8.3 Signals

None.

8.4 Statistics

None.

8.5 Error codes

None.

8.6 Procedures

8.6.1 General characteristics of the MG located bearer level ALG service

8.6.1.1 Directionality

The MG located bearer level ALG service affects only one traffic direction, thus belongs to the category of unidirectional address translation functions (as opposed to bidirectional ones). Appendix I.1 illustrates the concept.

8.6.1.2 Context aspects

The MG located bearer level ALG is enabled at the Termination in the outgoing direction (see also Appendix I.1).

8.6.2 Enabling the MG located bearer level ALG service

When a MG located bearer level ALG service is required for incoming packet traffic, the MGC shall set the property *protocol type bearer level ALG* (*mgbalg/ptbalg*) to "ON".

8.6.3 Indication of affected application protocol(s)

The bearer level ALG function is normally application specific, i.e., enabled for selected application(s). The MGC should use property *upper layer protocol filter* (*mgbalg/ulpf*) or *upper layer protocol filter (mgbalg/ulehpf)* to indicate the application(s). The *mgbalg/ulpf* and the *mgbalg/ulehpf* property shall not both be set to a "non-zero"/"non-empty string" value. If set the MG shall return error code 473 "Conflicting Property Values".

8.6.4 Indication of relevant address information and source of replaced address information

The MG located bearer level ALG service needs to know whether source or/and destination address information should be replaced. And if yes, the MG needs to know which address information has to be used for the ALG service. The MGC should provide a correspondent indication via properties *mgbalg/sosaip* and *mgbalg/sodaip*, else, default property values shall be used.

There are basically three options with respect to the source of replaced address information:

Table 1 – Principle options for the indication of replaced address information

Variant	Source of translated address information	Indicated by MGC via:
1	Contained in ITU-T H.248 Stream Descriptor (Note 1). E.g., as part of the SDP media description, other than "c=" and/or "m=" line address information. Such as related to (general or application specific) SDP attributes.	Explicitly by MGC. Example: The SDP "`a=path:`" attribute (clause 8.2 of [b-IETF RFC 4975]), used by application protocol "MSRP".
2	Provisioned in MG.	Not indicated by the MGC. The MG is configured for that variant via management plane actions.
3	IP L3 (and L4) source (transport) address information of incoming IP packet (Note 2).	Default option, i.e., when neither variant 1 nor 2 is used.

NOTE 1 – This address information is located in the Local Descriptor (if *mgbalg/sosaip=SD*), or in the Remote Descriptor (if *mgbalg/sodaip=SD*) or in both.

NOTE 2 – I.e., numerical IP address information.

8.6.5 L4+ protocol individual B-ALG service configuration

The B-ALG service could be enabled on multiple upper layer protocol types in parallel: the *mgbalg/ulpf* (or *mgbag/ulehbf* as appropriate) property value would be a list format. Then, properties *mgbalg/sosaip* and *mgbalg/sodaip* shall provide the same list format, which allows the L4+ protocol individual configuration of the B-ALG service.

8.6.6 B-ALG: L4+ protocol specific translation details

The translation of address information at L4+ level may not be defined in a generic manner because it is dependent on the particular L4+ protocol. The protocol dependent application details are therefore out of scope of this Recommendation (as in case of the *mcbalg* package, see e.g., clause 7.6.4). Such information could be e.g., part of an H.248 profile specification.

8.6.7 Examples

8.6.7.1 Examples for MSRP-based instant messaging service

Use case:

> MSRP is used in session-mode, leading to the transport of MSRP messages via TCP/IP packets in the bearer plane (as opposed to the page-mode, which uses the SIP MESSAGE method in the signalling plane).

Two example B-ALG configurations for MSRP are described (inclusive example H.248 signalling) in Appendices I.2.1 and I.2.2.

Appendix I

MG located bearer level ALG service – Illustration and signalling examples

(This appendix does not form an integral part of this Recommendation.)

Clause 8 defines the B-ALG variant of a MG located bearer level ALG service. This appendix illustrates the concept and provides example ITU-T H.248 signalling.

I.1 Illustration of concept

The configuration of a particular MG located bearer level ALG service is subject of four properties (as defined by the *mgbalg* package). Figure I.1 illustrates the resulting action when the package properties would be associated to a specific Context (i.e., part of LocalControl Descriptor).

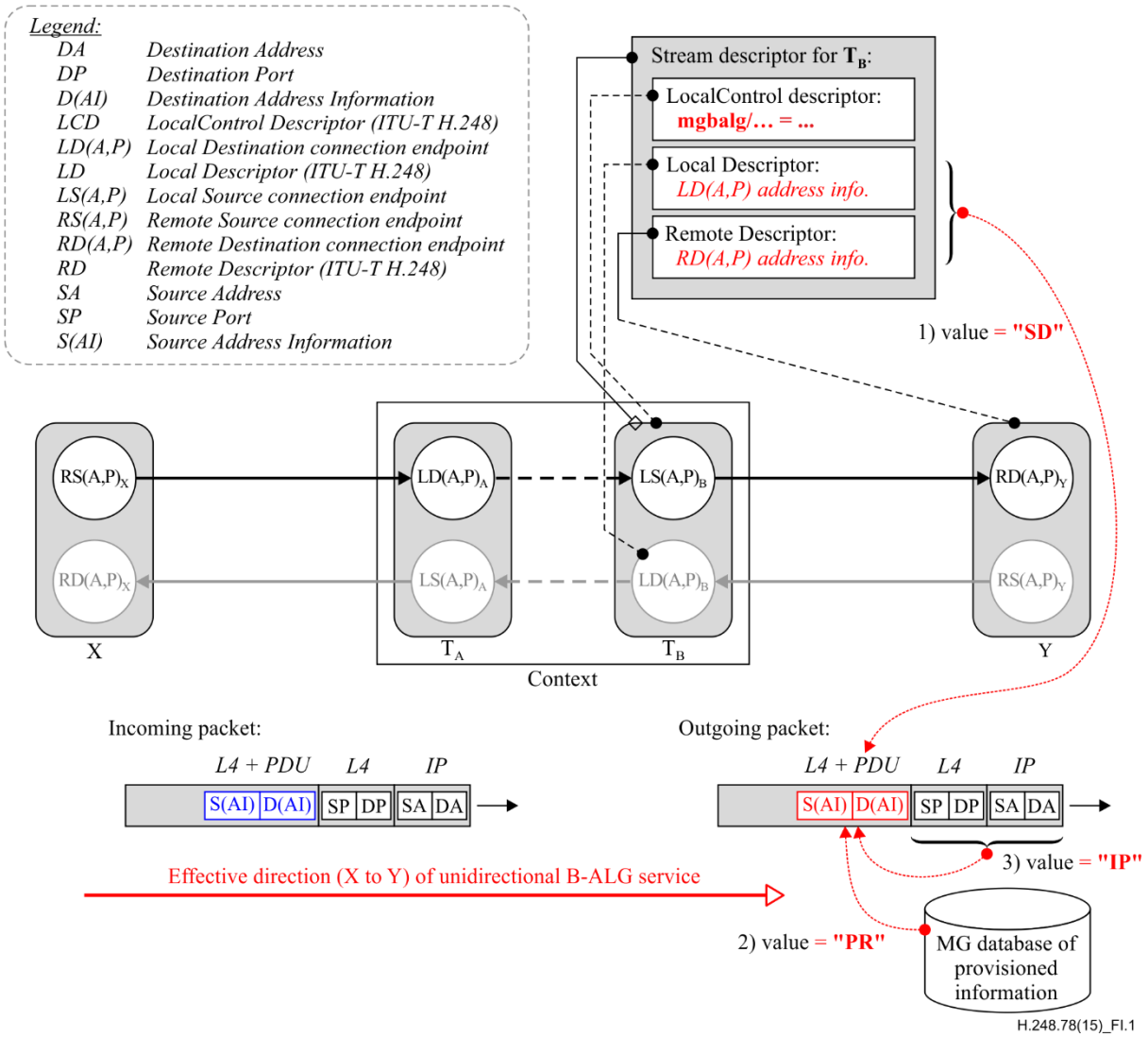


Figure I.1 – Concept of MG located bearer level ALG service

The B-ALG configuration is part of the Stream Descriptor of Termination T_B in Figure I.1. The resulting B-ALG service is thus effective in traffic direction from X to Y.

Background information:

The B-ALG represents a NAT function at protocol layer L4+ ("L4+ NAT"). The behaviour of a L4+ NAT function should be consistent with the usual L3/L4 NAT functions, from an ITU-T H.248 perspective. Such ITU-T H.248 Context models for L3/L4 NAT are e.g., illustrated in Annex H in [b-ETSI TR 183 068].

Essentially, the effect of a L3/L4 NAT function becomes visible at the MG external bearer interface in an outgoing direction. Thus, any local, unidirectional NAT in X-to-Y direction is controlled at Termination T_B (and not at T_A), because the replaced address information is subject of the Stream Descriptor of T_B in case of L3/L4 NAT.

The same principle applies for local L4+ NAT, i.e., the B-ALG in this Recommendation.

If translation is required, the relevant address information part is controlled by the two properties *mgbalg/sosaip* and *mgbalg/sodaip* (for source and destination address information). Figure I.1 depicts the three options concerning the source of replaced address information by their associated property codepoints.

I.2 Illustration of example use cases

Some B-ALG services are illustrated using the example of MSRP traffic (see introduction in clause 6 and Figure 1 concerning L4+ address information elements).

NOTE – The examples command encodings contain abbreviated SDP syntax. They use the *mgbalg/ulpf* property. The *mgbag/ulehbf* could also be used depending on the required application protocol.

I.2.1 Use case "Unidirectional B-ALG with destination address information translation"

This example considers a unidirectional B-ALG for MSRP, taking the assumption that the originating MSRP client (here X) could already insert the correct L4+ source address information (i.e., the MSRP header "From-Path" parameter value is already valid from an end-to-end perspective). However, the L4+ destination address information of incoming MSRP messages is not correct, thus a correspondent B-ALG service needs to be enforced in the MG (see Figure I.2).

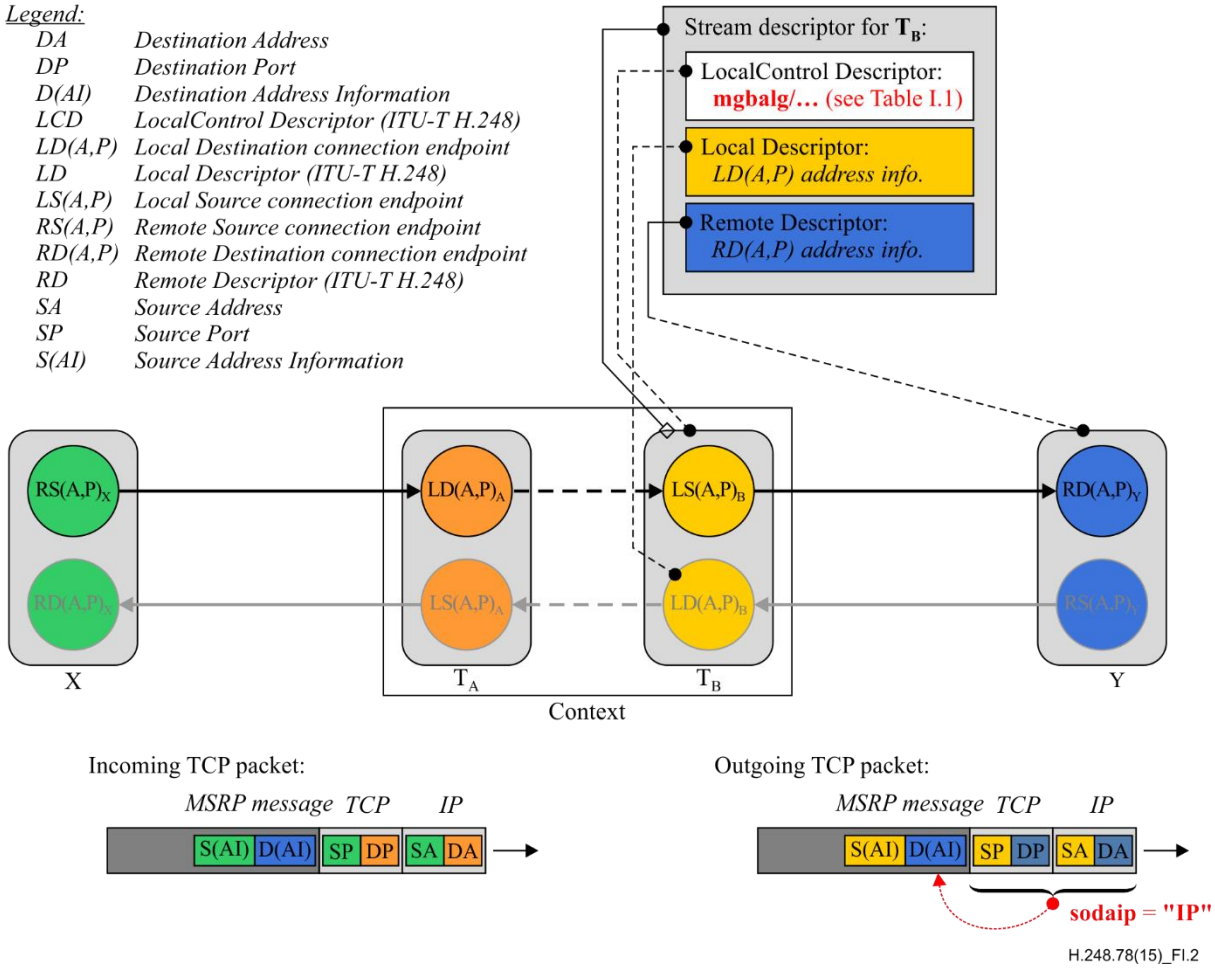


Figure I.2 – Use case "Unidirectional B-ALG with destination address information translation" – MSRP bearer traffic

The TCP/IP header is used as the source of replaced address information (see example H.248 syntax in Table I.1). The translated MSRP "To-Path" element contains a numerical IP address value.

NOTE – A named IP address format would imply a reverse DNS lookup.

Table I.1 – Example command encoding– B-ALG "unidirectional" configuration by MGC

ITU-T H.248 encoding (shortened command)	Comments

MGC to MG:
MEGACO/3 [11.9.19.65]:54321
Transaction = … {
Context = … {
Add = ip/$ { ; **Termination T_B**, SEP S1
Media {
Stream = 1 {
LocalControl {
mgbalg/ptbalg = ON ; B-ALG enabled
mgbalg/ulpf = 2855 ; for MSRP traffic
mgbalg/sosaip = NR ; no source address
; replacement.
mgbalg/sodaip = IP ; from TCP/IP header info.
} ...
Local {
v=0
c=IN IP6 <IP_addr>
m=**message** <port> **TCP/MSRP** – ; NOTE 1
},
	NOTE – The "m=" line <proto> provides an application-aware indication due to the enforced B-ALG function (for application "MSRP").

Table I.1 – Example command encoding– B-ALG "unidirectional" configuration by MGC

ITU-T H.248 encoding (shortened command)	Comments
Remote { v=0 c=IN IP6 <IP_addr> m=**message** <port> **TCP/MSRP** – }…}	

I.2.2 Use case "Bidirectional B-ALG with source and destination address information translation"

This example considers a bidirectional B-ALG for MSRP with the need to adapt L4+ source *and* destination address information. Hence, both MSRP header elements "To-Path" and "From-Path" need to be modified by the MG. The replaced address information is provided by the MGC to the MG via the (MSRP-related) SDP attribute "*a=path:…*", which is in scope of the LD and RD.

Figure I.3 depicts the bidirectional B-ALG service, as composed by two unidirectional B-ALG functions associated to the two Terminations T_A and T_B.

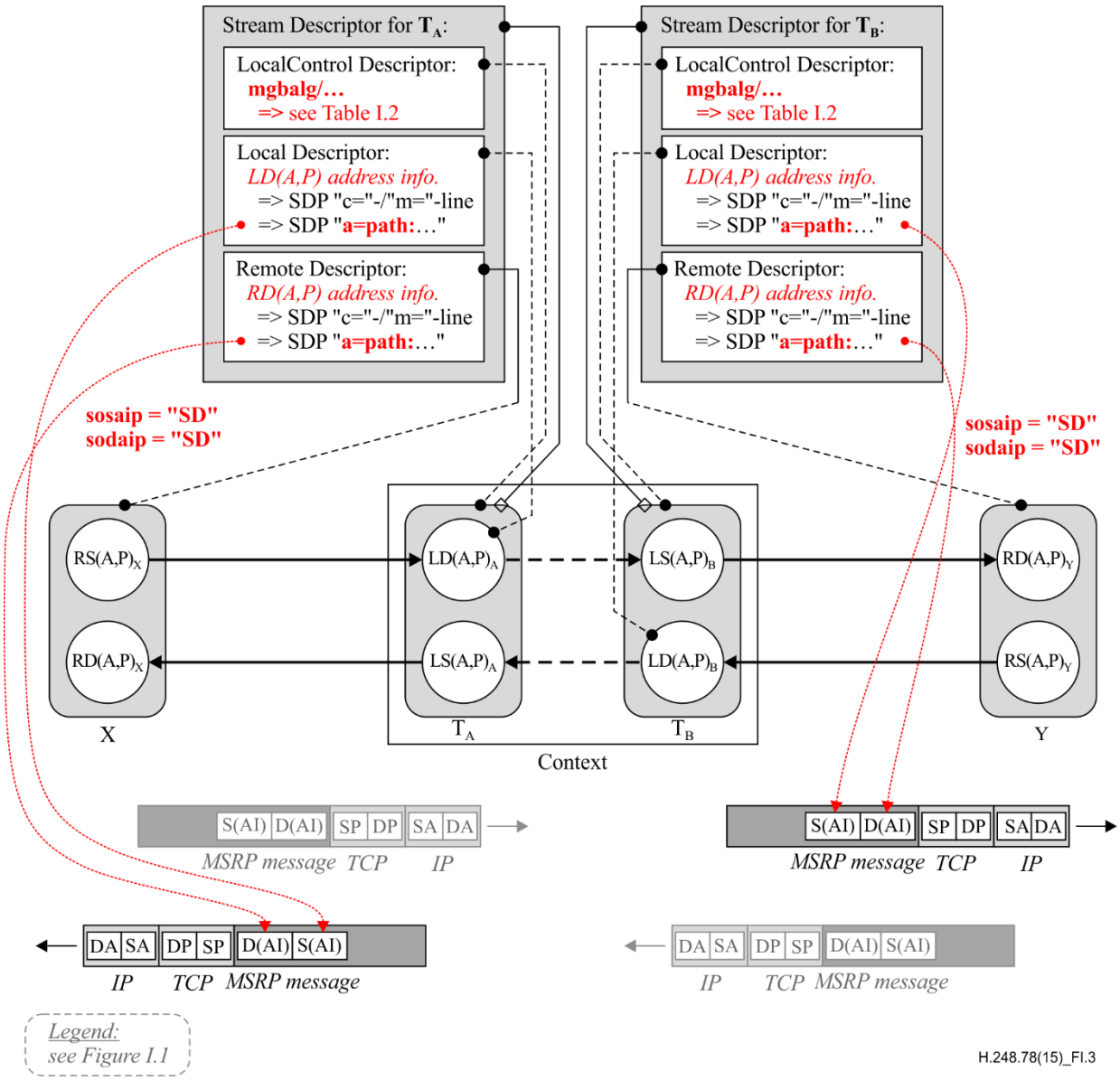


Figure I.3 – Use case "Bidirectional B-ALG with source and destination address information translation" – MSRP bearer traffic

Example ITU-T H.248 syntax is abstracted in Table I.2.

Table I.2 – Example command encoding– B-ALG "bidirectional" configuration by MGC

ITU-T H.248 encoding (shortened command)	Comments

MGC to MG:
MEGACO/3 [11.9.19.65]:54321
Transaction = … {
Context = … {
Add = ip/$ { ; **Termination T_B,** SEP S1
Media {
Stream = 1 {
LocalControl {
mgbalg/ptbalg = ON ; B-ALG enabled
mgbalg/ulpf = 2855 ; for MSRP traffic
mgbalg/sosaip = SD ; for both address info.
mgbalg/sodaip = SD ; from Stream Descriptor
} ...
Local {
v=0
c=IN IP6 <IP_addr> ; NOTE 1
m=message <port> TCP/MSRP – ; NOTE 1
a=path:… ; NOTE 2
},
Remote {
v=0
c=IN IP6 <IP_addr> ; NOTE 3
m=message <port> TCP/MSRP – ; NOTE 3
a=path:… ; NOTE 4
}…}
Add = ip/$ { ; **Termination T_A,** SEP S1
Media {
Stream = 1 {
LocalControl {
mgbalg/ptbalg = ON ; B-ALG enabled
mgbalg/ulpf = 2855 ; for MSRP traffic
mgbalg/sosaip = SD ; for both address info.
mgbalg/sodaip = SD ; from Stream Descriptor
} ...
Local {
v=0
c=IN IP6 <IP_addr> ; NOTE 1
m=message <port> TCP/MSRP – ; NOTE 1
a=path:… ; NOTE 2
},
Remote {
v=0
c=IN IP6 <IP_addr> ; NOTE 3
m=message <port> TCP/MSRP – ; NOTE 3
a=path:… ; NOTE 4
}…}
	Configuration of unidirectional B-ALG in X-to-Y direction (i.e., Termination T_B:
	NOTE 1 – The *local L3/L4 source address information* is subject of the correspondent LD SDP "c="-/"m="-line contents
	NOTE 2 – The *local L4+ source address information* is subject of LD SDP attribute "a=path:…".
	NOTE 3 – The *local L3/L4 destination address information* is subject of the correspondent RD SDP "c="-/"m="-line contents.
	NOTE 4 – The *local L4+ destination address information* is subject of RD SDP attribute "a=path:…".
	Configuration of unidirectional B-ALG in Y-to-X direction (i.e., Termination T_A:
	See Notes 1 to 4.

Bibliography

[b-ITU-T H.248.64] Recommendation ITU-T H.248.64 (2013), *Gateway control protocol: IP router packages*.

[b-ETSI TR 183 068] ETSI TR 183 068 V3.1.1 (2009), *Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); Guidelines on using Ia H.248 profile for control of Border Gateway Functions (BGF); Border Gateway Guidelines*.

[b-IETF RFC 2663] IETF RFC 2663 (1999), *IP Network Address Translator (NAT) Terminology and Considerations*.

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[b-IETF RFC 4975] IETF RFC 4975 (2007), *The Message Session Relay Protocol (MSRP)*.

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