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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

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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".

The 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".

This 11/2015 revision adds Annex A that describes Extensible Messaging and Presence Protocol (XMPP) to MSRP interworking utilising mechanisms defined in this Recommendation.

History

Edition	Recommendation	Approval	Study Group	Unique ID*
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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.

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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

In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

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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/.

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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 (ALGs) 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 Recommendation also supports the ability to use an alternative method to identify the bearer-level application protocol on an ITU-T H.248 Stream. The "MG located Bearer Level ALG" package allows an MG to autonomously act as an application level gateway and modify address information.

This Recommendation also contains an annex that describes Extensible Messaging and Presence Protocol (XMPP) to MSRP interworking utilising mechanisms defined in this Recommendation.

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 6121] IETF RFC 6121 (2011), *Extensible Messaging and Presence Protocol (XMPP): Instant Messaging and Presence*.

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

[IETF RFC 7247] IETF RFC 7247 (2014), *Interworking between the Session Initiation Protocol (SIP) and the Extensible Messaging and Presence Protocol (XMPP): Architecture, Addresses, and Error Handling*.

[IETF RFC 7248] IETF RFC 7248 (2014), *Interworking between the Session Initiation Protocol (SIP) and the Extensible Messaging and Presence Protocol (XMPP): Presence*.

[IETF RFC 7572] IETF RFC 7572 (2015), *Interworking between the Session Initiation Protocol (SIP) and the Extensible Messaging and Presence Protocol (XMPP): Instant Messaging*.

[IETF RFC 7573] IETF RFC 7573 (2015), *Interworking between the Session Initiation Protocol (SIP) and the Extensible Messaging and Presence Protocol (XMPP): One-to-One Text Chat Sessions*.

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

GW Gateway

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
S2X	SIP to XMPP
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
X2S	XMPP to SIP
XMPP	Extensible Messaging and Presence Protocol

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 application level gateways (ALGs)* are consequently out of scope of ITU-T H.248-series 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-{transmission control protocol (TCP)|user datagram protocol (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-{stream control transport protocol (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).

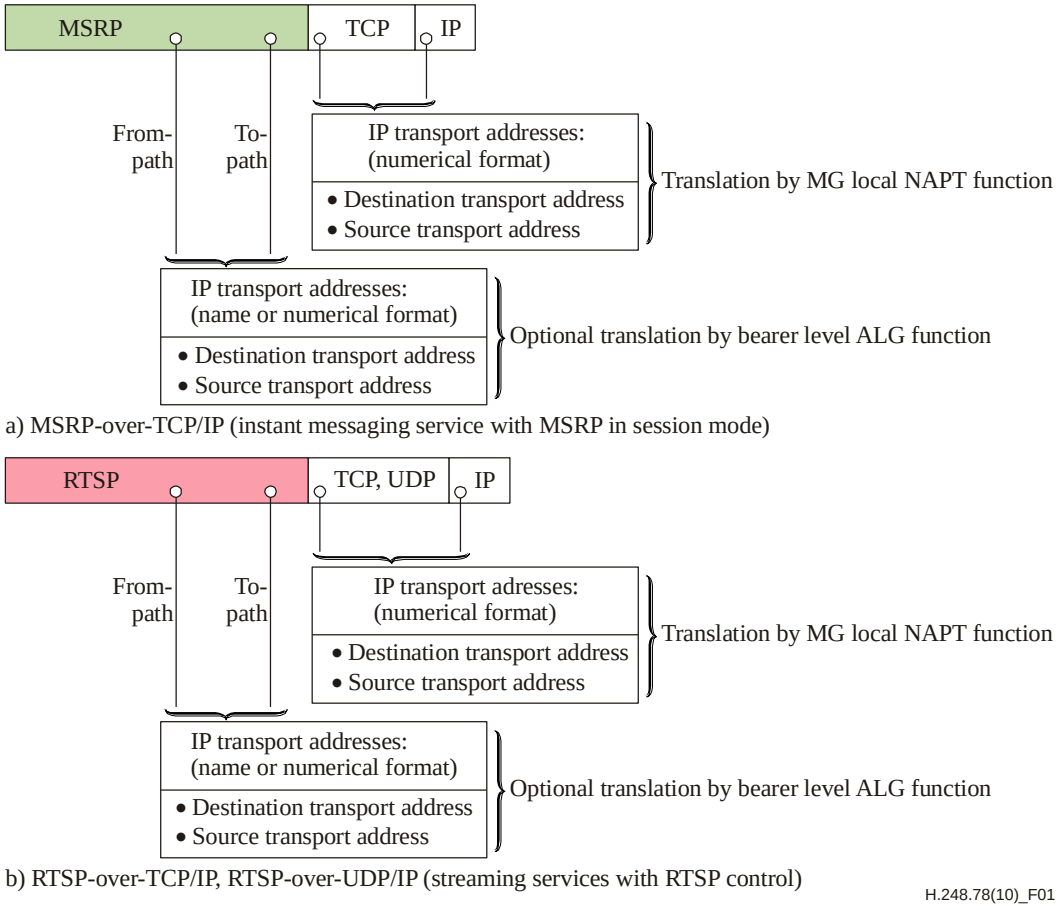


Figure 1 – Examples for potential ALG

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., domain name system (DNS)) information.

6.1 MGC strictly controlled MG embedded bearer-level ALG

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

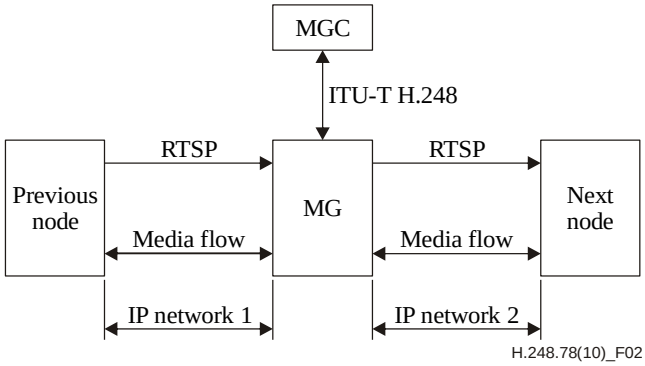


Figure 2 – RTSP and media traversing an MG

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.

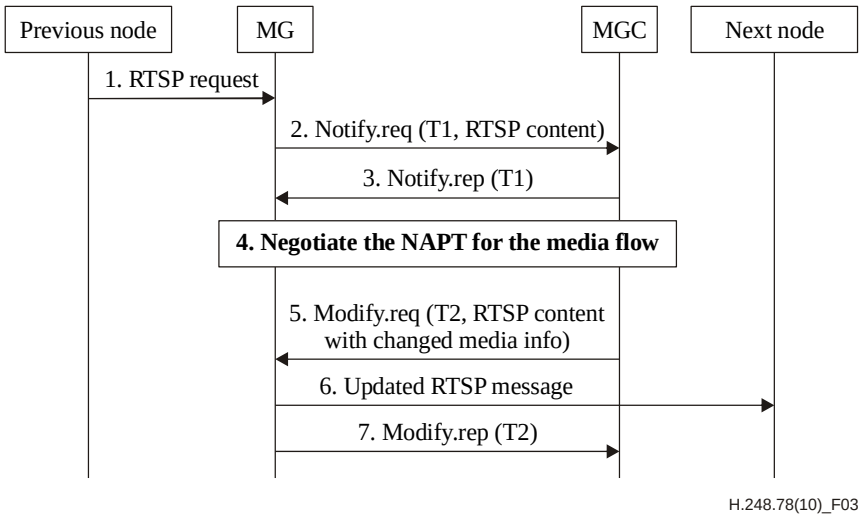


Figure 3 – RTSP and media traversal signalling flow

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 an 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 an 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 web real-time communication (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)

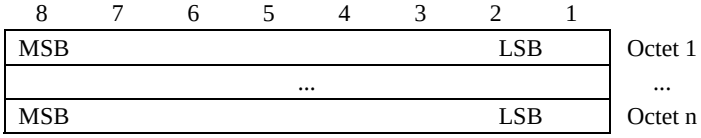
Description: This parameter contains the content of the detected application control protocol message. It contains only the L4+ information.

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 an 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 back to back (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 ITU-T 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 (LD) (if *mgbalg/sosaip=SD*), or in the Remote Descriptor (RD) (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 bearer level application-level gateway (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 ITU-T 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 ITU-T H.248 signalling) in Appendices I.2.1 and I.2.2.

Annex A

XMPP to MSRP interworking utilising ITU-T H.248.78

(This annex forms an integral part of this Recommendation.)

A.1 Scope

This annex describes the interworking between the Extensible Messaging and Presence Protocol (XMPP) [IETF RFC 6121] and the Message Session Relay Protocol (MSRP) [b-IETF RFC 4975].

NOTE – MSRP supports *page-mode messaging* (e.g., MSRP-over-SIP) and *session-mode messaging* (e.g., MSRP-over-TCP). Only MSRP session-mode is in scope of this annex (because XMPP to MSRP page-mode interworking would be out of scope of ITU-T H.248).

[IETF RFC 7247] provides an architecture for mapping between XMPP and SIP [IETF RFC 3261] with its associated messaging extensions. It defines two types of logical gateway functions: a "XMPP to SIP gateway" and a "SIP to XMPP gateway" that cover protocol translation in terms of flow from an XMPP-based system to a SIP-based system and vice versa. The RFC indicates that these logical functions could occur in one physical entity. The RFC considers the gateway functions as monolithic entities and does not describe situations where the gateway functions could be decomposed into an MGC and an MG. This annex provides additional information on the interwork when the gateway functions are decomposed.

In addition to [IETF RFC 7247] several RFCs and drafts describe in further detail the interworking of different functionalities offered by SIP and XMPP. These include:

– Presence [IETF RFC 7248];

– Instant Messaging [IETF RFC 7572];

– One-to-One Text Chat Sessions [IETF RFC 7573];

– Groupchat [b-IETF RFC 7702];

– Media Sessions [b-IETF STOX MEDIA].

When considering the allocation of functionality in a decomposed gateway typically control (e.g., call control) functionality is allocated to an MGC and bearer/media related functionality is allocated to an MG.

As [IETF RFC 7248] and [IETF RFC 7572] are only related to SIP and XMPP messages the interworking described in these RFCs is contained in the MGC. No involvement of the MG is necessary and thus no interaction with ITU-T H.248 is needed. These RFCs are not considered further by this annex.

[b-IETF STOX MEDIA] discusses the interworking between SIP and XMPP when they are used to establish media flows. This interworking is relevant to decomposed gateways as the XMPP and SIP signalling is processed at the MGC and the media is processed on the MG. The draft describes the mapping of XMPP to SIP and SDP (which is used to describe the characteristics of the media). As ITU-T H.248 uses SDP to describe the characteristics of the media, the SDP defined in the draft can be used to derive the ITU-T H.248 messages. While the XMPP and SIP messages will result in the need for ITU-T H.248 signalling to establish and release media this annex does not describe these message flows.

[IETF RFC 7573] and [b-IETF RFC 7702] describes the interworking between XMPP and SIP where MSRP is used for messaging in the SIP network. MSRP is considered an application bearer-level protocol and thus may be terminated at an MG. Therefore, there is interworking between XMPP and SIP/MSRP involving both the MGC and MG. Thus, there is an interaction with ITU-T H.248. This annex further describes this interaction.

A.2 Architectural assumptions

Figure 1 of [IETF RFC 7247] provides a possible gateway deployment architecture showing the SIP to XMPP gateway (S2X GW) and the XMPP to SIP gateway (X2S GW) being implemented in a monolithic way.

Figure A.1 below shows an alternate architecture where the gateway functions for XMPP to SIP/MSRP (and vice versa) interworking are implemented in a decomposed ITU-T H.248 controlled gateway.

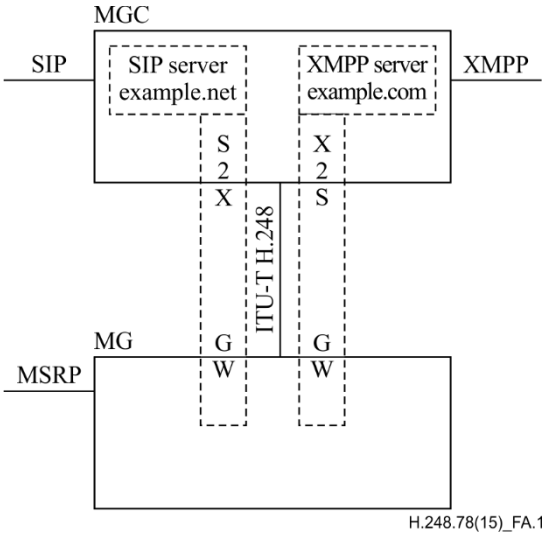


Figure A.1 – XMPP to SIP/MSRP interworking architecture

The S2X GW and X2S GW encompass the procedures as described by [IETF RFC 7573]. The MGC provides interworking between SIP and XMPP messages. As a result of this interworking, the MGC establishes an MSRP bearer on the MG. MSRP messages are carried across the ITU-T H.248 interface. The "MGC Controlled Bearer Level ALG" (*mcbalg*) package in clause 7 is used to transport the MSRP messages between the MGC and MG and vice versa.

A.3 Procedures

[IETF RFC 7573] provides procedures for mapping XMPP chat sessions using message stanzas of type "chat" as specified in [IETF RFC 6121] and MSRP chat sessions using the SIP INVITE and SEND request types as specified in [b-IETF RFC 4975]. In order to interwork XMPP and SIP/MSRP the MGC shall follow the procedures defined in [IETF RFC 7573] with the following additions:

1) When the MGC receives either:

   a) a SIP INVITE with SDP indicating a media type "message" and protocol "TCP/MSRP", or

   b) an XMPP message with type "chat" that results in the sending of a SIP INVITE with SDP indicating a media type "message" and a protocol indicating the use of MSRP (e.g., TCP/MSRP).

   It shall add a Termination/Stream to a Context with sufficient information in the Local/Remote Descriptors to initiate an MSRP bearer connection.

2) To allow MSRP messages to be received from the MG, the MGC shall set the "Detect bearer level message" (*mcbalg/det*) Event with a protocol filter parameter indicating that MSRP shall be detected and reported. The message filter parameter should be set to "*" so that all MSRP messages are reported.

3) If the MGC receives an XMPP message with type "chat" and once the MSRP bearer has been established, the MGC shall use the "Send bearer level message" (*mcbalg/sblm*) Signal to send MSRP messages (resulting from the MGC applying the [IETF RFC 7573] interworking procedures) to the MG. The MG then forwards the MSRP messages across the MSRP bearer connection.

4) The MG for MSRP messages received on the MSRP bearer, shall forward the message via the Detect Bearer level message" (*mcbalg/det*) ObservedEvent to the MGC. The MGC shall then apply the interworking procedures from [IETF RFC 7573] to produce an appropriate XMPP message.

5) The MGC on reception of a SIP BYE or an XMPP message indicating a gone chat state which results in the sending of a SIP BYE, shall remove the MSRP Termination/Stream.

A.4 Example

The following example is based on the order of Events as described by Figure 1 of [IETF RFC 7573]. It describes additional Events (H1 to H12) when the interworking function is decomposed across an ITU-T H.248 media gateway. In this example MSRP is transported over a TCP bearer connection. The method for carrying MSRP messages via ITU-T H.248 is independent of the transport protocol that MSRP utilises. A flow for clause 5 of [IETF RFC 7573] is not detailed as the same basic ITU-T H.248 messages and method of transporting MSRP messages across ITU-T H.248 is used.

A.4.1 XMPP to MSRP

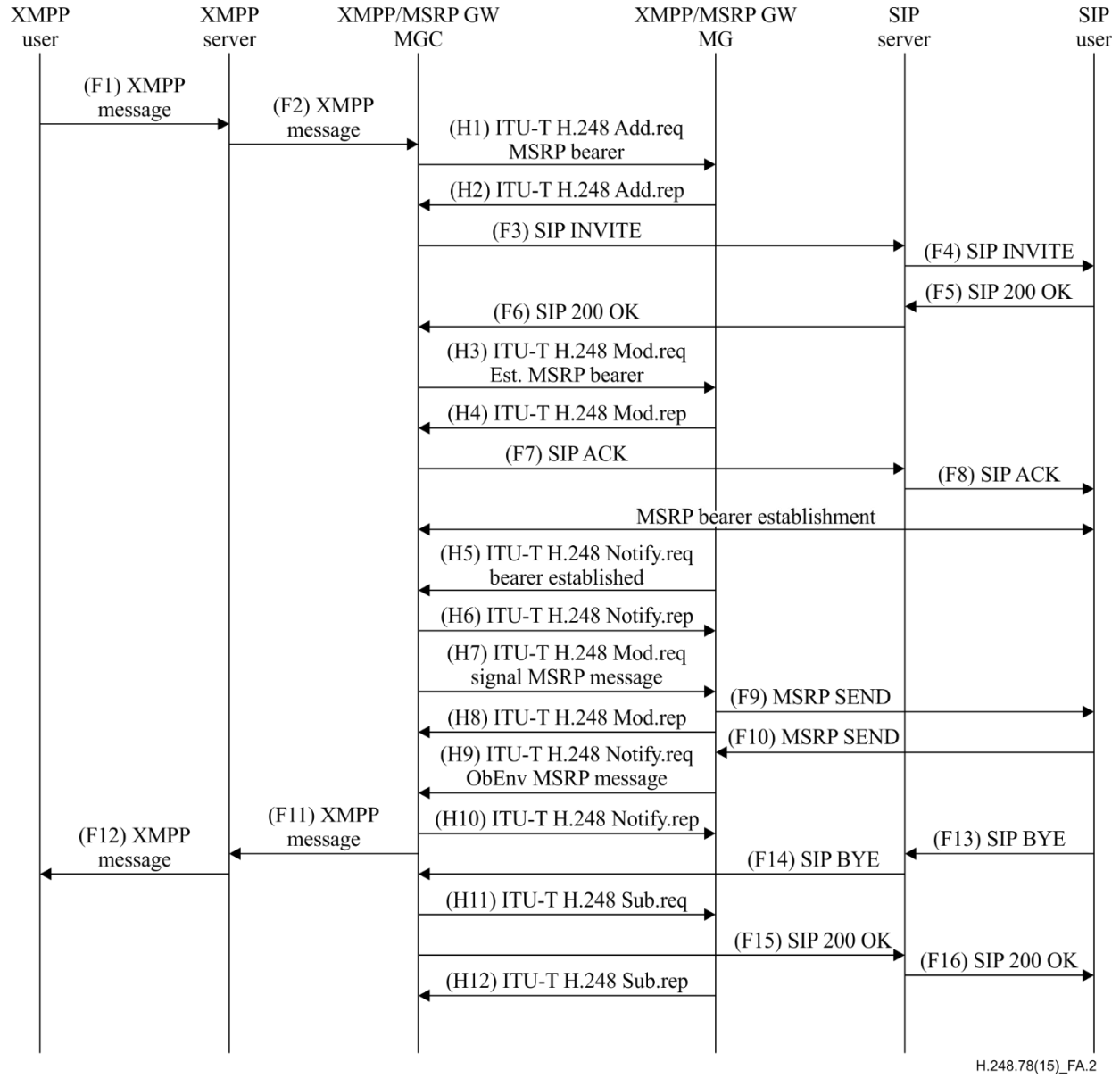


Figure A.2 – XMPP to MSRP order of events in an ITU-T H.248 controlled gateway

The messages related to F1 to F16 are as per clause 4 of [IETF RFC 7573].

On reception of the XMPP message (F2) the MGC determines that an ITU-T H.248 Termination/Stream needs to be instantiated on the MG. The MGC sends an ITU-T H.248 Add.req (H1) requesting that a bearer be added for an MSRP media stream. The MGC requests local address information (e.g., IP address and port):

```
     MGC to MG:
     MEGACO/3 [123.123.123.4]:55555
     Transaction = 10000 {
         Context = $ {
             Add = T$ {
                 Media {
                    Stream = 1 {
                         Local {
v=0
c=IN IP4 $
```

```
m=message $ TCP/MSRP *
a=accept-types:text/plain
a=path:msrp://s2x.example.net:12763/kjhd37s2s20w2a;tcp
                                }

                }
            }
        }
    }
```

The address information is returned via an Add.rep (H2).

```
    MEGACO/3 [125.125.125.111]:55555
    Reply = 10000 {
       Context = 1234 {
      Add=A4445{
        Media {
            Stream = 1 {
                Local {
v=0
c=IN IP4 x2s.example.com
m=message 7654 TCP/MSRP *
a=accept-types:text/plain
a=path:msrp://s2x.example.net:12763/kjhd37s2s20w2a;tcp
                }
        }
    }
```

The address information is used by the MGC to construct the SIP INVITE (F3).

On reception of the SIP 200 OK (F6) the MGC uses the provided address information and sends an ITU-T H.248 Modify.req to the MG to update the Remote Descriptor with the far end transport address. In the Modify the MGC also includes a request to establish the underlying MSRP transport as well as setting Events related to the underlying transport (e.g., to detect when the bearer is established). It also includes the "Detect bearer level message" (*mcbalg/det*) Event with a protocol filter parameter indicating that MSRP is to be detected and reported:

```
    MGC to MG:
    MEGACO/3 [123.123.123.4]:55555
    Transaction = 10001 {
        Context = 1234 {
            Modify = T1 {
                Media {
                   Stream = 1 {
                        Remote {
v=0
c=IN IP4 s2x.example.net
m=message 12763 TCP/MSRP *
a=accept-types:text/plain
a=path:msrp://s2x.example.net:12763/kjhd37s2s20w2a;tcp
                               }
                              }
                },
                Events = 2223 {
                    mcbalg/det{pf=2855},
                    tcpbcc/BNCChange{type=[Est,Rel]}
                },
                Signals {
                    tcpbcc/EstBNC
                }
            }
        }
    }
```

The MG then responds with an ITU-T H.248 Modify.rep (H4) and the MSRP bearer begins establishment.

On completion of the MSRP bearer establishment the MG notifies the MGC that bearer establishment has completed via an ITU-T H.248 Notify.req (H5). The MGC acknowledges the receipt of the message via an ITU-T H.248 Notify.rep (H6).

As the MSRP bearer has been established the MGC forwards the MSRP SEND message derived from the XMPP message (F2) to the MG via an ITU-T H.248 Modify.req with the "Send bearer level message" (*mcbalg/sblm*) Signal with the MSRP SEND message as the Message Content parameter value:

```
MGC to MG:
MEGACO/3 [123.123.123.4]:55555
Transaction = 10002 {
  Context = 1234 {
    Modify = T1 {
      Signals {
          mcbalg/sblm{stream=1,mc=
   "MSRP a786hjs2 SEND
            From-Path: msrp://x2s.example.com:7654/jshA7weztas;tcp
            To-Path: msrp://s2x.example.net:12763/kjhd37s2s20w2a;tcp
            Message-ID: 54C6F4F1-A39C-47D6-8718-FA65B3D0414A
            Byte-Range: 1-25/25
            Content-Type: text/plain
            Art thou not Romeo, and a Montague?
            -------a786hjs2$
          "}
    }
  }
}
```

The MG then sends the MSRP SEND message to the user (F9). The MG acknowledges the receipt of the Modify command via an ITU-T H.248 Modify.rep.

On receipt of the MSRP SEND (F10) from the user, the MG forwards the MSRP SEND message to the MGC via an ITU-T H.248 Notify.req (H9) with a Detect bearer level message" (*mcbalg/det*) ObservedEvent. The Message Content parameter contains the detected MSRP message:

```
MEGACO/3 [125.125.125.111]:55555
Transaction = 10003 {
   Context = 1234 {
       Notify = T1 {ObservedEvents =2223 {
              mcbalg/det{ stream=1, mc=
       "MSRP di2fs53v SEND
               To-Path: msrp://x2s.example.com:7654/jshA7weztas;tcp
               From-Path: msrp://s2x.example.net:12763/kjhd37s2s20w2a;tcp
               Message-ID: 6480C096-937A-46E7-BF9D-1353706B60AA
               Byte-Range: 1-25/25
               Failure-Report: no
               Content-Type: text/plain

               Neither, fair saint, if either thee dislike.
               -------di2fs53v$"}}
       }
   }
}
```

The MGC acknowledges the receipt of the message via an ITU-T H.248 Notify.rep (H10). The MGC then uses the received MSRP message and maps it to an appropriate XMPP message (F11).

The MGC on the receipt of a SIP BYE (F14) will remove the MSRP Termination/Stream via an ITU-T H.248 Subtract.req (H11). This will have the effect of removing the MSRP bearer. The MG will acknowledge the removal via an ITU-T H.248 Subtract.rep.

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 an 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).

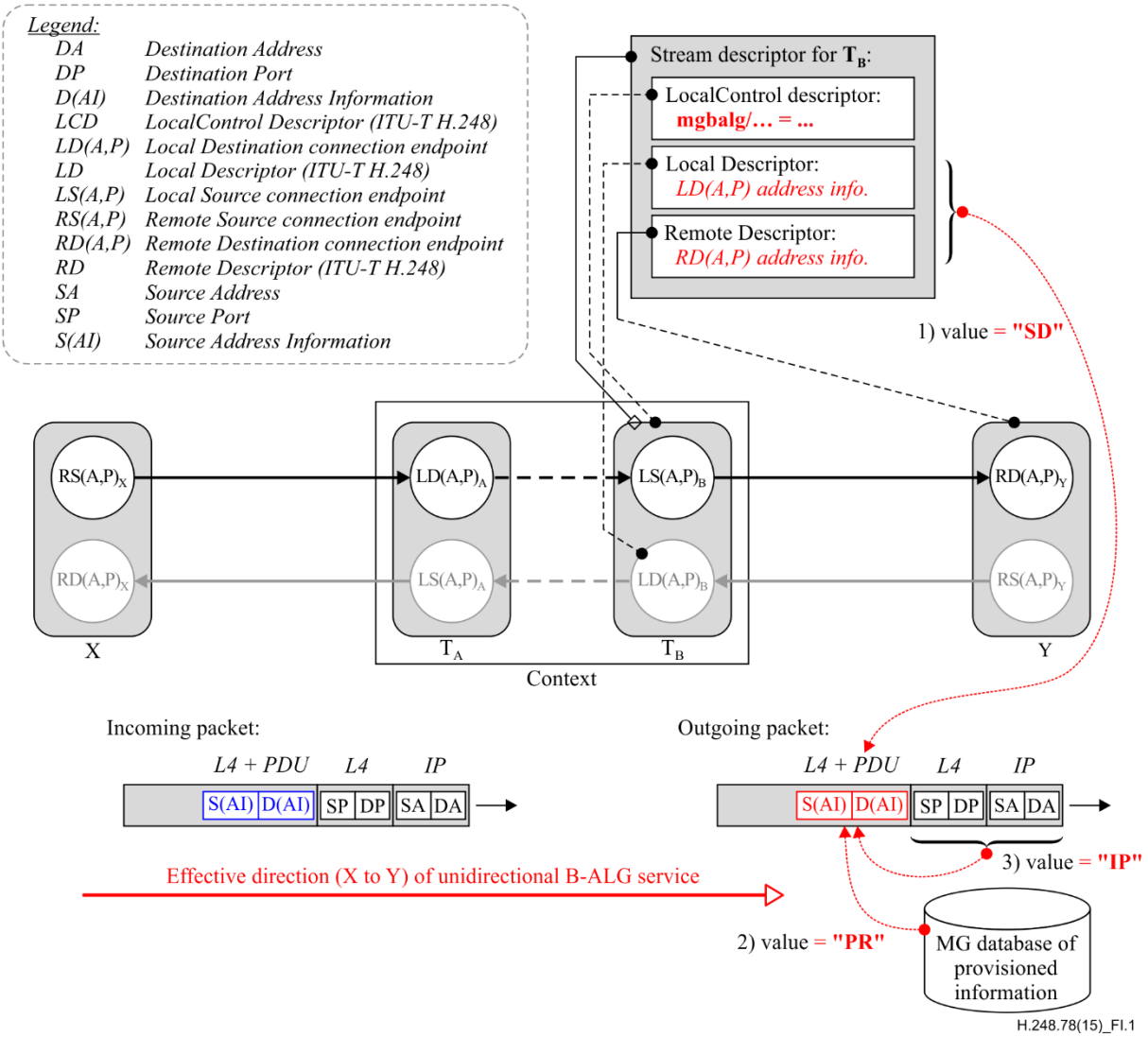


Figure I.1 – Concept of MG located bearer level ALG service

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).

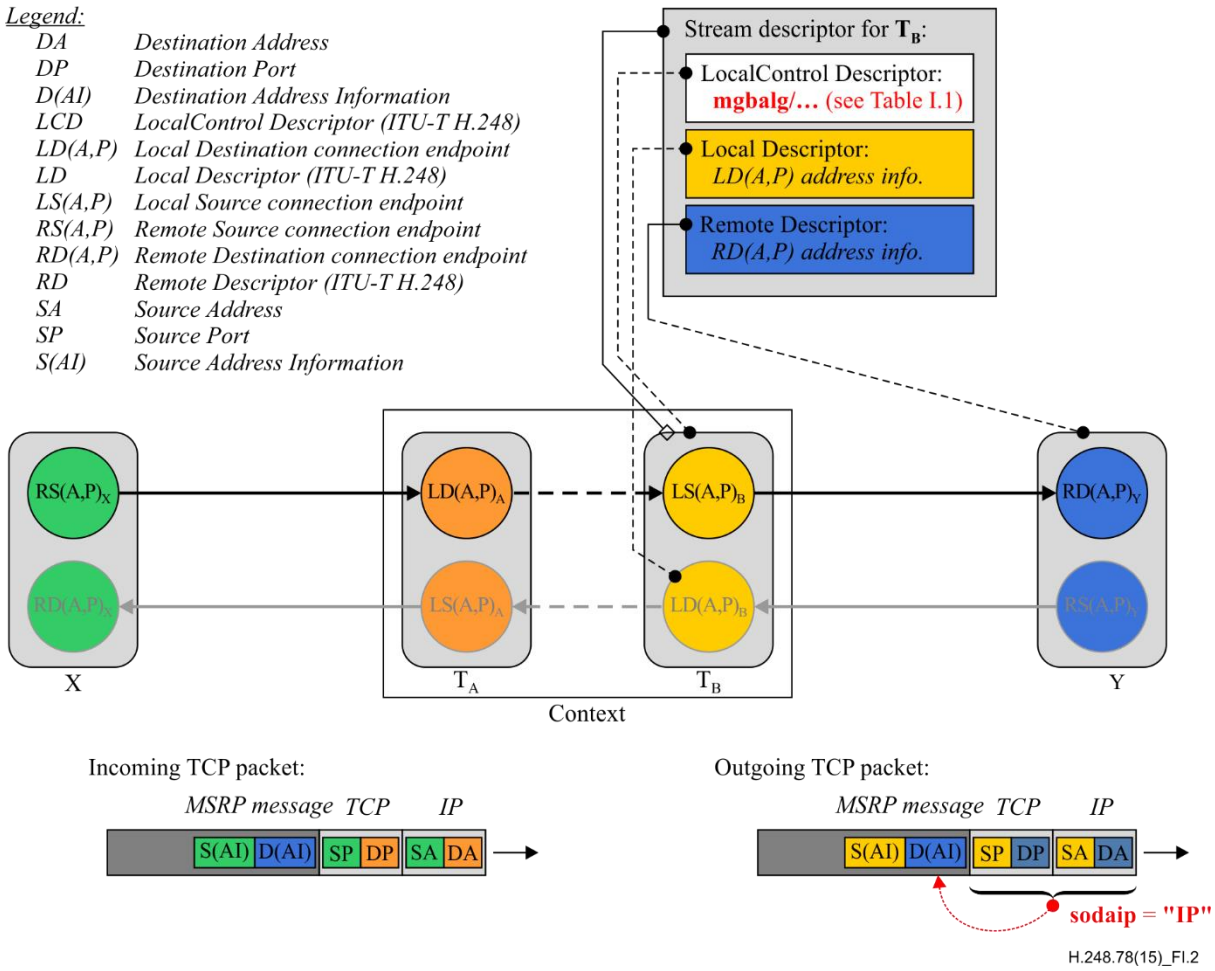


Figure I.2 – Use case "Unidirectional B-ALG with destination address information translation" – MSRP bearer traffic

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.

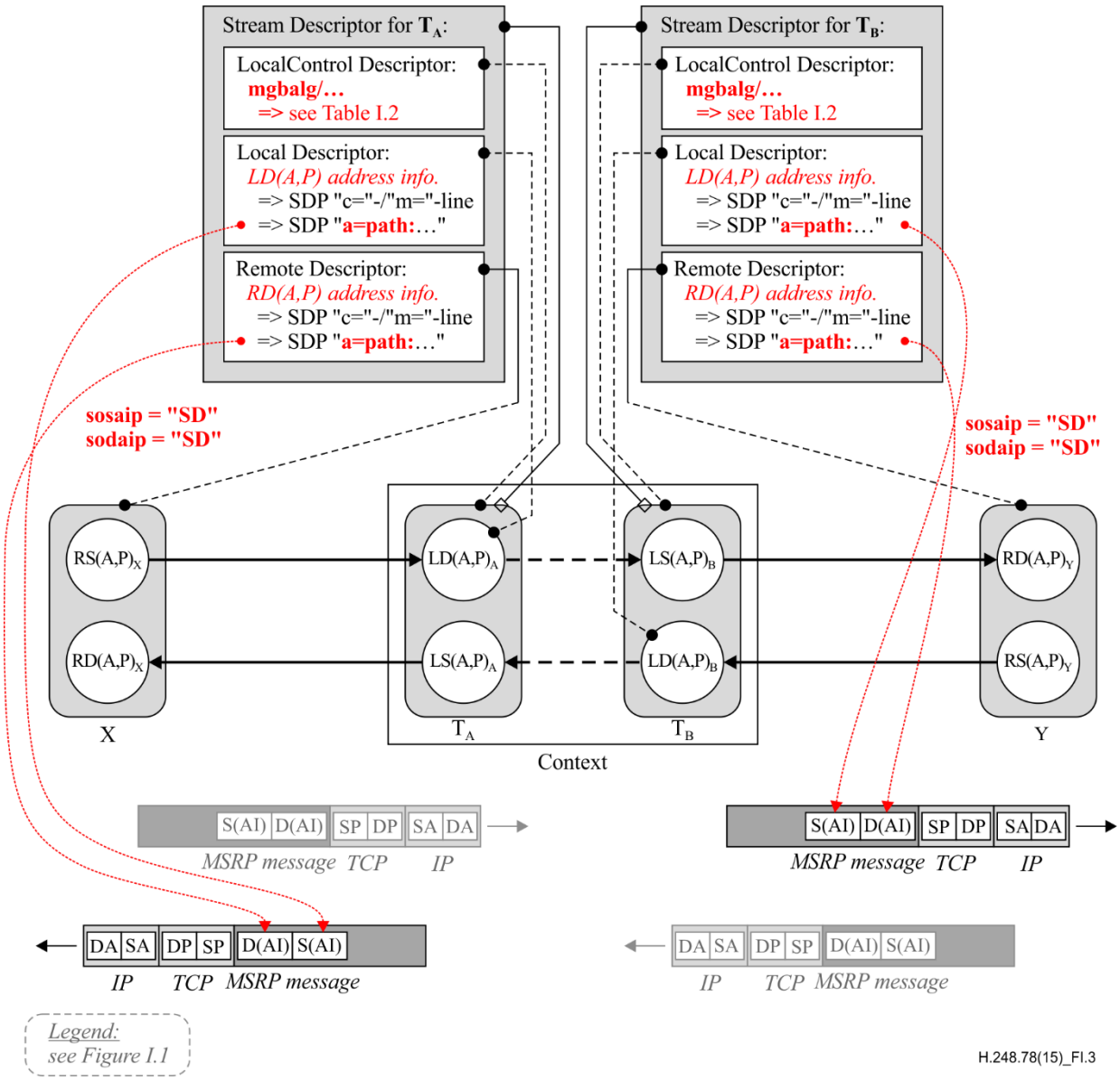


Figure I.3 – Use case "Bidirectional B-ALG with source and destination address information translation" – MSRP bearer traffic

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.

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