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SERIES H: AUDIOVISUAL AND MULTIMEDIA SYSTEMS

Infrastructure of audiovisual services – Communication procedures

Gateway control protocol: Bearer-level application level gateway

Recommendation ITU-T H.248.78

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Recommendation ITU-T H.248.78

Gateway control protocol: Bearer-level 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 sending 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.

History

Edition	Recommendation	Approval	Study Group
1.0	ITU-T H.248.78	2010-09-13	16

FOREWORD

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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 not 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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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.

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 (2005), *Gateway control protocol: Version 3*, including Amendment 2 (2009).

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

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

[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)*.

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

3.2 Terms defined in this Recommendation

None.

4 Abbreviations

This Recommendation uses the following abbreviations and acronyms:

ALG	Application Level Gateway
B2B	Back to Back
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
MG	Media Gateway
MGC	Media Gateway Controller
MSRP	Message Sending Relay Protocol
NAPT	Network Address and Port Translation
OSI	Open Systems Interconnection
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

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 sending 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).

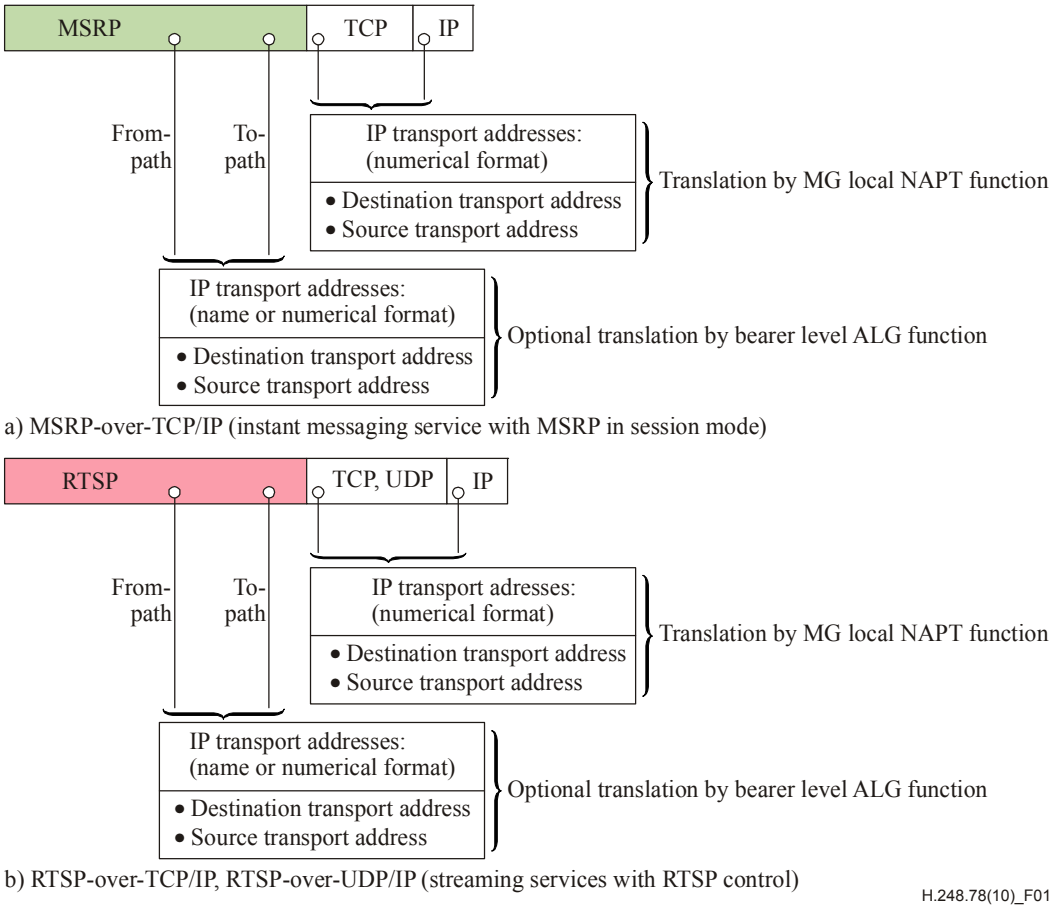


Figure 1 – Examples for potential ALG

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.

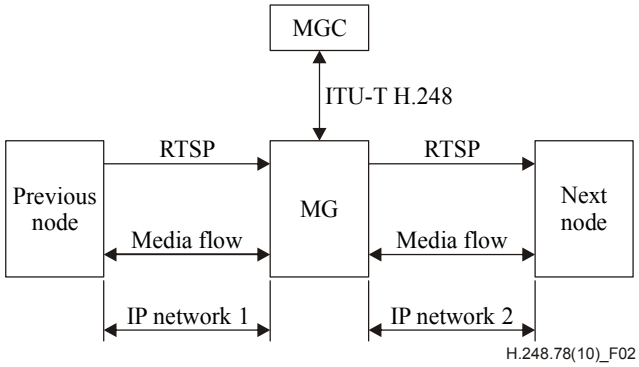


Figure 2 – RTSP and media traversing a MG

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.

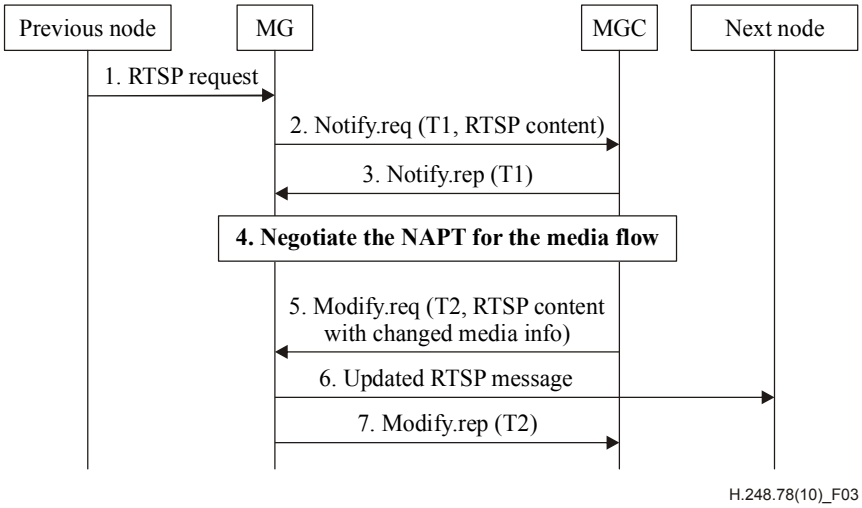


Figure 3 – RTSP and media traversal signalling flow

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

PackageID: mcbalg (0x0108)

Description: This package allows a MGC to receive bearer-level application messages in order to perform ALG functionality (such as NAPT) on them. It 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: 1

Extends: None

7.1 Properties

None.

7.2 Events

7.2.1 Detect bearer level message

Event name: Detect bearer level message

EventID: 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

ParameterID: 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

ParameterID: 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

ParameterID: 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

7.2.1.2 ObservedEventsDescriptor parameters

7.2.1.2.1 Message content

Parameter name: Message Content

ParameterID: mc (0x0001)

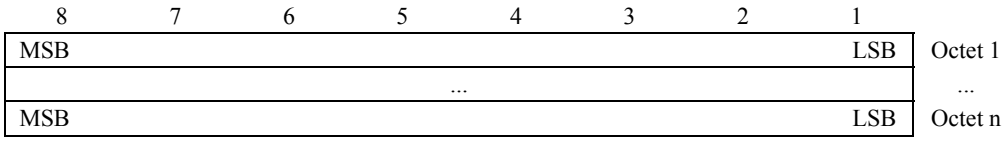
Description: This parameter contains the content of the detected application control protocol message. It contains only the L4+ information.

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

7.3 Signals

7.3.1 Send bearer level message

Signal name: Send bearer level message

SignalID: 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.

7.4 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. If not 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. 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.

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 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.

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"}
     },
  }
}
}
```

Bibliography

[b-ITU-T H.248.64] Recommendation ITU-T H.248.64 (2009), *Gateway control protocol: IP router packages*.

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

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