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Gateway control protocol: Establishment procedures for the H.248 MGC-MG control association

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Supplement 7 to ITU-T H-series Recommendations

Gateway control protocol: Establishment procedures for the H.248 MGC-MG control association

Summary

This supplement to ITU-T H-series Recommendations provides clarifications on the operation of H.248 control associations with a focus on IP-based transport connections for H.248 signalling traffic and establishment procedures, e.g., due to start-up phases or changeover scenarios of H.248 entities.

Source

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1 Scope

This supplement provides clarifications on the operation of H.248 control associations (CA) and its scope includes:

- IP-based transport connections for H.248 signalling traffic, and
- Establishment procedures, e.g., due to start-up phases or changeover scenarios of H.248 entities (see Figure 1 for a possible network configuration).

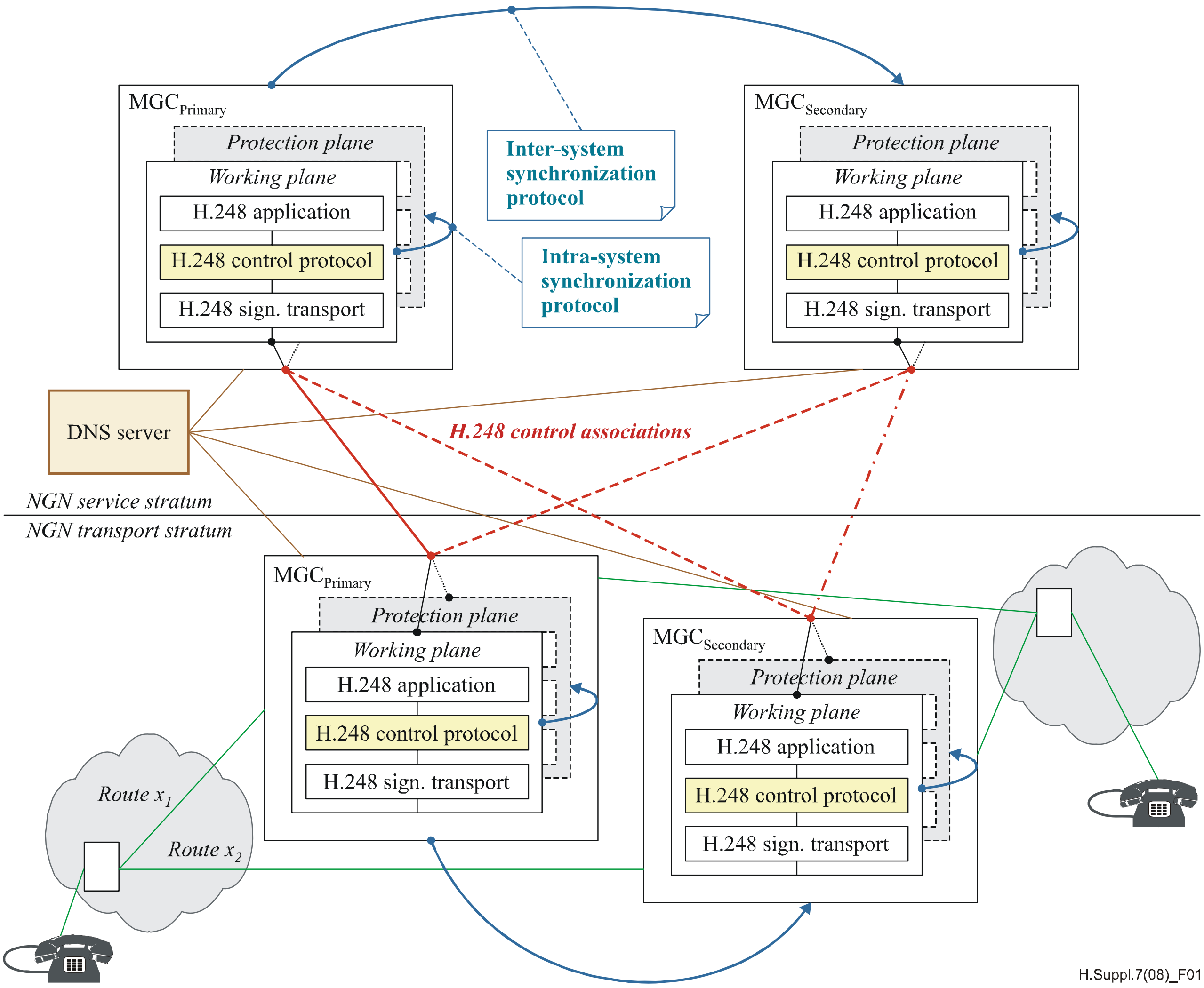

Figure 1 – Example for H.248 control associations
(in a one-for-one redundancy model and an optional DNS Server)

NOTE – The concept of "primary" and "secondary" H.248 network elements is defined in clause 7.2.8 of [ITU-T H.248.1]. The number of secondary entities may vary from zero to more than one (see e.g., Table 2). Figure 1 depicts an example redundancy model with exactly one secondary entity at the media gateway controller (MGC) and at the media gateway (MG) levels.

There is one H.248 control association between the primary network elements (indicated by the solid line). The dashed lines indicate potential future control associations in case of successful changeover procedures from primary to secondary H.248 network elements.

Any H.248 network element itself may be designed for high availability. This is architecturally achieved on the basis of service or redundancy groups ("members of such a group are active and standby entities"). The corresponding entities may be abstracted by the working and protection planes internal to a network element, as indicated in Figure 1. Such network element-level architectural details are implementation-specific and beyond the scope of this supplement. A crucial point here is that, in Figure 1, such details of the internal operation of a network element are hidden from the network by a single H.248 control association endpoint of a H.248 network element.

This abstract approach leads to a network design where the intra-network element changeover procedures are fully decoupled from the network-level or inter-network element changeover procedures. For instance, a MG internal failover event does not have any impact on the externally visible H.248 control association.

Any meaningful primary/secondary concept requires some kind of synchronization between the primary and secondary. Such kind of synchronization is outlined in Figure 1, but out of the scope of ITU-T H.248.x-series of Recommendations. These mechanisms are mentioned for completeness because they are essential parts of network engineering.

Changeover between primary and secondary network elements is discussed in clause 5.6.6. The potential involvement of DNS servers (as indicated in the figure) is in scope of clause 5.6.6.2.1.

This supplement discusses typical use cases of H.248 control associations regarding:

- basic principles,
- address assignment mechanisms,
- traversal of multiple address realms,
- security,
- authentication of H.248 entities,
- changeovers between primary and secondary H.248 entities.

If there are any discrepancies between this supplement and [ITU-T H.248.1], the procedures and specifications of [ITU-T H.248.1] take precedence over those described in this supplement.

2 References

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3 Definitions

This supplement defines the following terms:

3.1 5-tuple: The commonly used tuple <source address, source port, destination address, destination port, transport protocol> of IP protocol control information fields. A 5-tuple is a subset of an address tuple.

3.2 address tuple: As defined in clause 2.3.5 of [IETF RFC 3989].

3.3 destination-2-tuple: The commonly used tuple <destination address, destination port> of IP protocol control information fields. A destination 2-tuple is a subset of 5-tuple.

3.4 IP connection: A *bidirectional* (user plane) association between two IP (signalling) endpoints (aligned with clause 3.1 of [ITU-T Q-Sup.43]). An IP connection is designated by a *pair of IP address/port number combinations* (according to clause 3.1 of [ITU-T Q.2631.1]). An IP connection is therefore related to the 4-tuple <source address, source port, destination address, destination port>.

3.5 (IP) interface redirection: Relates to a change of the destination-2-tuple fields IP DA or IP DA and IP DP (during the control association establishment phase).

3.6 (IP) port redirection: Relates to a change of the destination-2-tuple field IP DP (during the control association establishment phase).

3.7 receiver-2-tuple: The commonly used tuple <address, port> of IP protocol control information fields at an IP interface for received IP packets. In a H.248 control association, a receiver-2-tuple relates therefore to the destination-2-tuple for the peer H.248 entity.

3.8 source-2-tuple: The commonly used tuple <source address, source port> of IP protocol control information fields. A source 2-tuple is a subset of 5-tuple.

3.9 transmitter-2-tuple: The commonly used tuple <address, port> of IP protocol control information fields at an IP interface for transmitted IP packets. In a H.248 control association, a transmitter-2-tuple relates therefore to the source-2-tuple of the sending H.248 entity.

4 Abbreviations and acronyms

This supplement uses the following abbreviations and acronyms:

@, A	Address
A_{MG}	Address for MG (actual address as opposed to translated address)
A'_{MG}	Virtual Address for MG (translated address as opposed to actual address)
A_{MGC}	Address for MGC (actual address as opposed to translated address)
A'_{MGC}	Virtual Address for MGC (translated address as opposed to actual address)
B2BIH	Back-to-Back IP Host
CA	Control association (H.248)
CSN	Circuit-Switched Network
DA	Destination Address (IP)

DHCP	Dynamic Host Configuration Protocol
DN	Domain Name
DNS	Domain Name System
DoS	Denial of Service
DP	Destination Port (IP)
FIB	Forwarding Information Base
FQDN	Fully Qualified Domain Name (DNS: a FQDN or *absolute domain name* is a domain name that ends with a period, or "dot")
FW	Firewall
H	Host (IP)
IS	In-Service (H.248)
MID	Message Identifier (H.248)
MID_{MG}	Message Identifier for H.248 MG entity
MID_{MGC}	Message Identifier for H.248 MGC entity
MG	Media Gateway
MGC	Media Gateway Controller
NAPT	Network Address and Port Translation
NA(P)T	Network Address (and Port) Translation
NAT	Network Address Translator/Translation
NAT/FW	Network Address Translator and/or Firewall
NGN	Next Generation Network
OoS	Out-of-Service (H.248)
P	Port
PSN	Packet-Switched Network
R	Router (IP)
RIB	Routing Information Base
SA	Source Address (IP)
SC	ServiceChange (H.248)
SCTP	Stream Control Transmission Protocol
SP	Source Port (IP)
STUN	Simple Traversal of User Datagram Protocol

5 Network conditions

5.1 Introduction

A pair of two H.248 entities (e.g., a primary MGC and a primary MG) constitutes a H.248 control association (see clause F.2 of [ITU-T H.248.1]). This logical concept is accompanied by a correspondent transport connection for H.248 signalling traffic (e.g., clauses D.1 and D.2 of

[ITU-T H.248.1], [ITU-T H.248.4], clauses 4, 5 and 6 of [ITU-T H.248.5] or Annex A of [ETSI TS 129 202]).

The transport connection between a MGC/MG pair may be IP-based or non-IP-based. IP-based H.248 transport connections have many more aspects to be considered, for instance due to the connectionless network technology and/or the diversity of IP network architectures and operation.

IP-based H.248 transport connections are therefore the prime scope of this supplement. Figure 2 illustrates a possible scenario for IP-based H.248 transport connections. The general assumption is that there are a number of interim IP entities, for instance network address translators, firewalls, proxies, etc., between an MGC and MG.

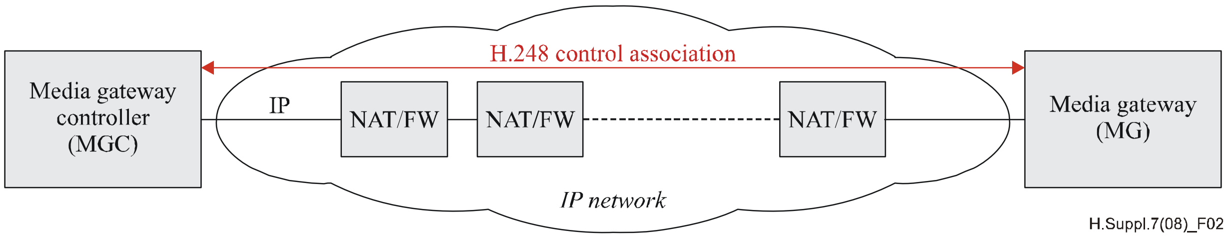

Figure 2 – IP-based transport of H.248 signalling

5.2 Constitution of a control association

An H.248 control association is unambiguously defined by the pair of H.248 Message Identifiers (MID) used by the two H.248 entities. This definition is based on clause 8.3 of [ITU-T H.248.1]:

> *"An H.248.1 entity (MG/MGC) must consistently use the same MID in all messages it originates for the duration of control association with the peer (MGC/MG)."*

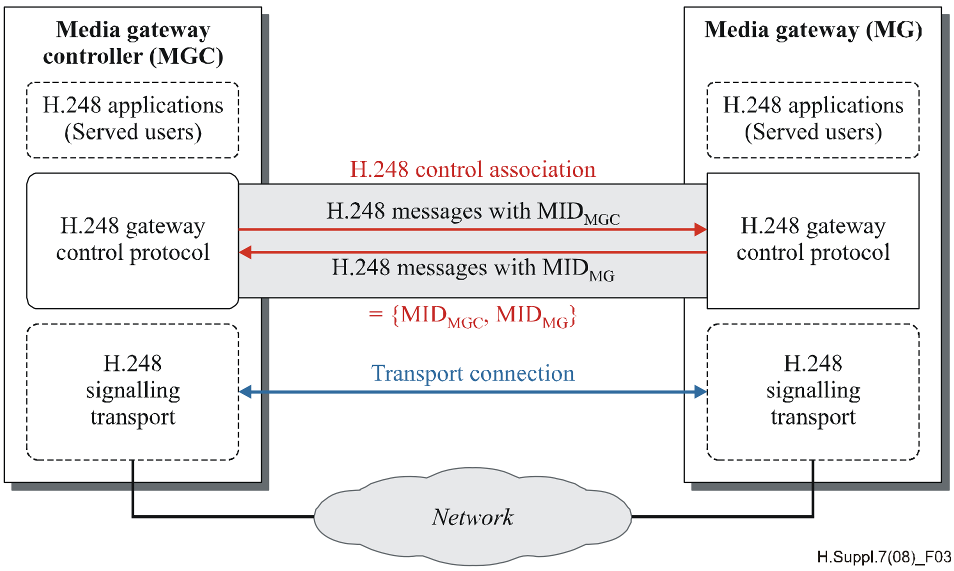

Figure 3 – Constitution of a control association

The constitution of an H.248 control association is *independent* of the underlying transport connection identifiers, e.g., like 5-tuple in case of IP-based transport (see also clause 5.3.1). The rationale behind this is a de-coupling of ServiceChange procedures from possible changeover procedures at the transport connection level.

NOTE – For example, H.248-over-SCTP (see also clause 6.1.1) and SCTP in multi-homing mode. Any changeover (i.e., failovers within a multi-homed SCTP endpoint) leads to a change of the 5-tuple, but does not affect the SCTP association as such. Such transport connection level changeovers should not impact the H.248 control association.

Any change of the MID value inherently leads to the termination of the present control association and the establishment of a new control association. See also clause 8.

5.3 IP-based H.248 transport

5.3.1 IP connection and IP transport connection

There is basically an IP connection between an MGC and an MG. Such an IP connection is represented by a 4-tuple. This connection model is extended to an IP transport connection by a dedicated transport protocol[1] (5-tuple). The specific transport protocol, and possible default port, is specific to a selected H.248 transport mode. See Table 1.

Table 1 – IP transport connections for different H.248 transport modes

H.248 transport mode (Examples)	Reference	5-Tuple$_{MGC}$					5-Tuple$_{MG}$				
		SA	DA	SP	DP	Protocol	SA	DA	SP	DP	Protocol
H.248-over-UDP (text encoded)	Annex D.1/ H.248.1	SA_{MGC}	SA_{MG}	2944	2944	17	SA_{MG}	SA_{MGC}	2944	2944	17
H.248-over-UDP (binary encoded)	Annex D.1/ H.248.1	SA_{MGC}	SA_{MG}	2945	2945	17	SA_{MG}	SA_{MGC}	2945	2945	17
H.248-over-TCP (text encoded)	Annex D.2/ H.248.1	SA_{MGC}	SA_{MG}	2944	2944	6	SA_{MG}	SA_{MGC}	2944	2944	6
H.248-over-TCP (binary encoded)	Annex D.2/ H.248.1	SA_{MGC}	SA_{MG}	2945	2945	6	SA_{MG}	SA_{MGC}	2945	2945	6
H.248-over-SCTP (text encoded)	H.248.4	SA_{MGC}	SA_{MG}	2944	2944	132	SA_{MG}	SA_{MGC}	2944	2944	132
H.248-over-SCTP (binary encoded)	H.248.4	SA_{MGC}	SA_{MG}	2945	2945	132	SA_{MG}	SA_{MGC}	2945	2945	132
…	…	…	…	…	…	…	…	…	…	…	…
NOTE – There are transport technologies with support of multi-homed transport connection endpoints (like e.g., SCTP). Then, in the case of multi-homing, multiple network addresses are provisioned.											

Port values other than the default port assignments may be used (via provisioning actions).

It may be stated that an IP transport connection (according to Table 1) unambiguously identifies an H.248 control association as long as the transport connection endpoint addresses do not change (which could be the case for multi-homed endpoints in failover situations at the transport connection level). Both 5-tuples identify both IP transport connection and H.248 control association endpoints.

5.3.2 IP addresses for H.248 entities

5.3.2.1 IP interface for H.248 traffic

There is a dedicated IP interface and an associated IP address for H.248 signalling traffic at each H.248 entity (MGC, MG types, like circuit-to-packet MGs, packet-to-packet MGs, or media servers). The interface is designated by A_{MGC} or A_{MG} addresses respectively.

[1] See: http://www.iana.org/assignments/protocol-numbers

Address A_{MGC} (or A_{MG}) relates to a specific IP address tuple in case of IP transport connections for H.248 traffic:

- A H.248 message from the MGC towards the MG uses an IP packet with source address/port information according to A_{MGC} and destination address/port information according to A_{MG}.
- A H.248 message from the MG towards the MGC uses an IP packet with source address/port information according to A_{MG} and destination address/port information according to A_{MGC}.

It has to be noted that address A_{MG} may not have a relation with user plane traffic address(es) (e.g., RTP traffic in case of a VoIP MG). See clause 5.3.2.2.2.1 for the discussion of this aspect.

5.3.2.2 IP interfaces for H.248 entities

This clause provides further background of IP network design principles.

5.3.2.2.1 MGC

The MGC is an IP host (H) system. The MGC may be a single-homed host from the MG perspective. In case of a multi-homed IP host MGC, the MGC could carry out IP interface redirections (via the ServiceChangeAddress parameter) during the CA establishment phase (see clause 5.6.1.2).

5.3.2.2.2 MG

The MG is located in the NGN transport stratum (see [ITU-T Y.2011] and [ITU-T Y.2012]), thus there are more aspects in regard to IP interfaces and addressing.

5.3.2.2.2.1 Single versus multiple IP interfaces

The number of physical and logical IP interfaces per MG depends mainly on:

- the MG capacity for RTP traffic, i.e., engineered capacity for H.248 RTP terminations ("limited UDP resources for RTP sessions"),
- the network position of the MG (e.g., residential MGs versus trunking MGs), and/or
- the specific IP network design (e.g., driven by aspects of security, QoS, resilience, VPN, etc.).

5.3.2.2.2.2 Host versus embedded router function

The MG is fundamentally an IP host (H) system. The MG is a single-homed host from the MGC perspective. The VoIP MG is also basically a host system for RTP traffic, either a single- or multi-homed host (see previous clause 5.3.2.2.2.1).

Another example is the category of IP-to-IP MGs, which fundamentally may serve multiple IP interfaces, distributed over different IP address realms (see e.g., [ITU-T H.248.41]). For instance, the MG type according to the profile in [ETSI ES 283 018] defines an (IP, IP) connection model, which represents a "back-to-back IP host" (B2BIH) configuration.

5.3.3 IP routing

Databases for IP routing, like routing information base (RIB) or forwarding information base (FIB), are beyond the scope of this supplement because these tables do not affect addresses A_{MGC} or A_{MG}. They are only used for the "next hop" determination from the MGC or MG perspective.

NOTE – A MGC or MG embedded RIB/FIB may be either configured ("static routing") or dynamically adapted using IP routing protocols (like for instance RIP as distance vector protocol or link state based OSPF).

5.4 Relation between the address of an H.248 entity and an H.248 message identifier

5.4.1 General

Clause 8.3 of [ITU-T H.248.1] defines the H.248 message identifier (MID; H.248.1 offers presently a choice of five different identifier formats):

> *"The Message Identifier (MID) of a message is set to a provisioned name (e.g., domain address/domain name/device name) of the entity transmitting the message. Domain name is a suggested default. An H.248.1 entity (MG/MGC) must consistently use the same MID in all messages it originates for the duration of control association with the peer (MGC/MG)."*

Therefore, there is a single MID assigned to an H.248 entity. The MID unambiguously identifies an MGC or MG, thus, also a logical endpoint identifier of the present active control association.

However, there is no relation defined in H.248 between the MID of an H.248 entity and its correspondent (transport) address. Both parameters are firstly decoupled and disjoint from an H.248 perspective.

NOTE – Both parameters may be coupled by additional functions, but other, non-ServiceChange based mechanisms for the correlation of MID with H.248 entity address(es), are beyond the scope of (existing) H.248 Recommendations.

5.4.2 Correlation via ServiceChange parameter "MgcID"

There is one possibility for the MGC, but not for MGs, to correlate MID and address by using parameter ServiceChangeMgcID in ServiceChange commands (from MGC towards MG). Parameter ServiceChangeMgcID is of type "MID". The allowed procedures are defined in clause F.5.7 of [ITU-T H.248.1] (see also clause 5.6.5.2).

The new MID_{MGC} is extracted from the received parameter ServiceChangeMgcID by the MG. The derivation of the actual IP address of the MGC (address A_{MGC}) may require an additional translation step (e.g., DNS query) dependent on the chosen MID_{MGC} encoding scheme.

5.5 MG database for MGC entries

Connection data for control associations is maintained in a database. This clause illustrates a possible MG database for IP-based H.248 transport.

5.5.1 Database structure

H.248 control associations are established via ServiceChange procedures. The contact attempt, initiated always by the MG, is based on a database (see clause 11.5 of [ITU-T H.248.1]). Below is a possible table for such a database in the MG. The pre-provisioned list contains here K entries for MGCs. The table contains more than the minimum required information. (The minimum table information is column "MGC role" with an associated "IP address entry").

Table 2 – Possible MG database for IP-based control association

MGC list item	MGC role	Service state (e.g., IS, OoS or unknown)	IP address A_{MGC} (Note 1)		MID_{MGC} (configured in MG)	MID_{MGC} (sent by MGC)
			Numeric	Symbolic (FQDN)		
1	Primary	...	...	...	...	...
2	1st secondary	...	...	...	...	...
3	2nd secondary	...	...	...	...	...
4	3rd secondary	...	...	...	...	...
5	4th secondary	...	...	...	...	...
6	...	...	...	...	...	...
...	...	...	...	...	...	...
K	...	...	...	...	...	...
NOTE – Default IP port assumed (see Table 1).						

Column "IP address" (relates to A_{MGC}):

- Either numeric (actual IP address) and/or symbolic addresses (text-based Internet addresses) are configured before the "MG registration" procedure. The MGC may provide an *alternate address* (see clause 7.2.8.1.3 of [ITU-T H.248.1]), which would lead to an update of the correspondent table entries (and thus to a loss of the originally provisioned address information). Alternatively, an extended database could be used, see e.g., Table 3.
- The MG requires a numeric IP address for control association establishment. Thus, there is a symbolic address, typically in the form of a FQDN, configured in case of a missing numeric IP address. DNS queries are first required before a ServiceChange procedure for control association establishment may be started.

Column "MID_{MGC} (configured in MG)":

- The MID_{MGC} used by the present MGC.
- The MID_{MGC} value is configured in the MG.

Column "MID_{MGC} (sent by MGC)":

- The MID_{MGC} may be encoded in multiple ways (see clause 5.4.1). The used encoding scheme is mutually agreed, e.g., by a H.248 profile specification.
- The MG checks the received MID_{MGC} with the configured one.

Table 3 – Example for a MG database with additional address fields

MGC list item	MGC role	Service state (e.g., IS, OoS or unknown)	Provisioned IP address A_{MGC}		Alternative IP address A_{MGC}		MID_{MGC} (configured in MG)	MID_{MGC} (sent by MGC)
			Numeric	Symbolic FQDN	Numeric	Symbolic FQDN		
1	Primary	...	...	...	...			...
2	1st secondary	...	...	...	...			...
3	2nd secondary	...	...	...	...			...
4	3rd secondary	...	...	...	...			...
5	4th secondary	...	...	...	...			...
6	...	...	...	...	...			...
...	...	...	...	...	...			...
K	...	...	...	...	...			...

5.5.2 Database operations

The "MID" is of static nature according to clause 8.3 of [ITU-T H.248.1] ("*MID ... is set to a provisioned name* ..."). The MID element could be conveniently applied in overlay functions (like simple sender checks, basic DoS prevention, etc.) in addition to its main function of H.248 message identification.

5.5.2.1 MGC verification

Verification may be based on a comparison of the $MID_{MGC,Sent}$ with the $MID_{MGC,Configured}$ information. There are multiple MID formats, which may lead to different policy rules. See clause 12 for more detailed information and example policy rules.

5.5.2.2 MG verification

Verification may be based on a comparison of the $MID_{MG,Sent}$ with the $MID_{MG,Configured}$ information. Also see clause 12.

5.6 Dedicated network applications

5.6.1 Basic establishment scenario

5.6.1.1 General

See clause 6.

5.6.1.2 Address changes (during establishment scenario)

Address fields of the receiver-2-tuple (see also Figure 4) might be subject to changes during the establishment phase, e.g., due to

- an "(IP) interface redirection", or
- an "(IP) port redirection".

This is only applicable to IP-based H.248 transports, where an H.248 entity acts as:

- a multi-homed host, or
- a single-homed host with multiple IP ports for "H.248 processing", or
- a combination of both.

Such kind of address changes must be realized via the ServiceChangeAddress parameter.

Figure 4 illustrates such address changes. The receiver-2-tuple is equal to:

- $IP_{Rx,MGC} = \{A_{Rx,MGC}, P_{Rx,MGC}\}$ for the MGC, and relates to the destination-2-tuple used by the MG for MG-to-MGC traffic, and
- $IP_{Rx,MG} = \{A_{Rx,MG}, P_{Rx,MG}\}$ for the MG, and relates to the destination-2-tuple used by the MGC for MGC-to-MG traffic.

The address 2-tuples of an H.248 entity do not have to be symmetric, because there could be different IP interfaces for receiving and transmitting H.248-over-IP traffic.

The sender (see Note) of the ServiceChange.request command indicates, with parameter ServiceChangeAddress, changes in its receiver-2-tuple. The receiver could indicate in every ServiceChange.reply command the parameter ServiceChangeAddress by changing its receiver-2-tuple. See clause 7.2.8.1.11 of [ITU-T H.248.1].

NOTE – The sender in general could be either the MG or the MGC. The sender in case of the control association establishment phase is the MG (see clause F.3.1 of [ITU-T H.248.1]).

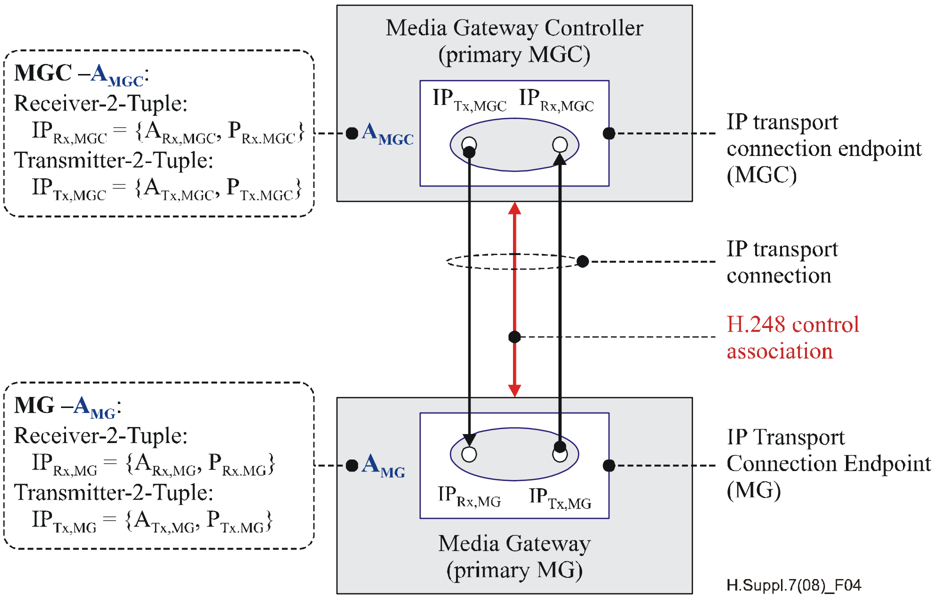

Figure 4 – IP transport connection endpoint address tuples

5.6.1.2.1 Comments on IP interface redirections

IP interface redirections are only possible for H.248 entities with multiple IP interfaces (see also clause 5.3.2.2), and in case that all IP interfaces could be principally used for the H.248 control association. Of course, only one IP interface is used at a particular point in time.

NOTE – The other IP interfaces of the H.248 entity could be, for instance, part of the node internal protection plane (see also Figure 1), and/or used for "load scheduling" mechanisms (e.g., MGC could "forward" or "bind" dynamically the control association to a "processor element" during the establishment procedure).

The ServiceChangeAddress base mechanism of IP interface redirection is only applicable to primary H.248 entities. This mechanism is not aimed for changeover procedures between primary and secondary entities.

5.6.1.2.2 Relation to address floating

Address floating is related to redundancy concepts, when the protection element will use the same address as the working element. For instance, the IP interface of the H.248 control association could be the same for the working and protection planes in H.248 entities (Figure 1).

A nodal internal failover from the working to the protection plane may be based on "address floating" (also known as "IP interface takeover", or "IP address takeover"). Such a scenario is not related to IP interface redirections due, to the unchanged address, from the control association perspective.

However a nodal internal failover could also result in ServiceChangeAddress usage, in case of different IP interfaces being assigned for the working and protection planes. Such behaviour, with different interfaces, may be questionable due to the transition period, where both their addresses (i.e., IP interfaces) must be available (see clauses 7.2.8.1.3 and F.5.4 of [ITU-T H.248.1]).

NOTE – Clause F.5.4 of [ITU-T H.248.1] states that "... any new transactions shall be sent to the new address and/or port number specified. Replies shall be sent back to the address from which the corresponding request came."

5.6.2 Configuration management: IP address assignment and modifications

5.6.2.1 Provisioned (static)

The assignment of addresses A_{MGC} and A_{MG} to H.248 entities is typically a provisioning activity. The reason behind that fact is that MGCs and MGs are network elements, as opposed to user equipment.

NOTE– An example of an exception might be an H.248 terminal, e.g., compliant to the H.248 profile given in [IETF RFC 3054].

5.6.2.2 Dynamic

Dynamic address assignment is rather a topic for MGs, but not for MGCs.

5.6.2.2.1 Via DHCP

A potential use case for DHCP provisioning is when MGs are located at customer premises. Address A_{MG} may be dynamically configured via DHCP, but address A_{MGC} (or the list of MGCs according to clause 11.5 of [ITU-T H.248.1]) is pre-provisioned in the MG.

5.6.2.2.2 Via MGC

It is not possible for a MGC to assign address A_{MG} to a MG via H.248.

5.6.3 Network address translators and/or firewalls

All potential scenarios may be abstracted on two use cases (Figure 5):

- without any interim NAT/FW device,
- with one or many NAT/FW devices. A series of NAT/FW devices may be modelled by a single NAT/FW function.

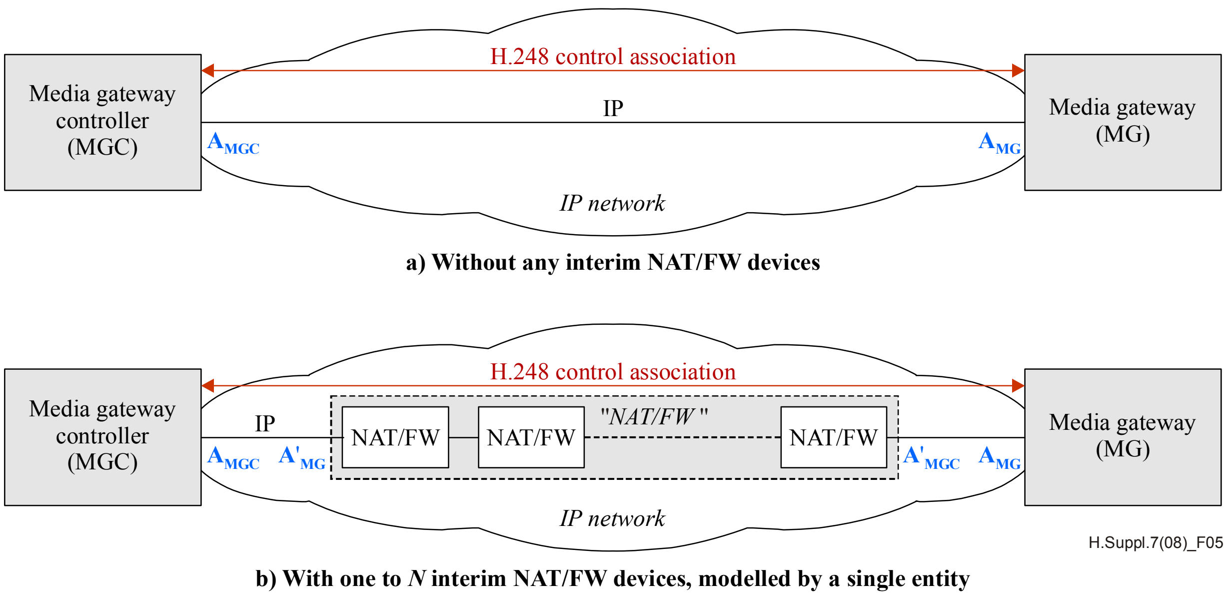

Figure 5 – H.248 IP transport connections – without or with NAT/FWs

NAT traversal support for H.248 traffic is out of the scope of [ITU-T H.248.1]. Interim NAT devices may need to be considered in case of database operations (clause 5.5.1), or when the ServiceChangeMgcID parameter is based on an *address* format (because the address (= A) carried in the MID may then differ from the IP address (= A') of the H.248 message).

5.6.4 Security: authentication

5.6.4.1 Authentication in the network layer

Any H.248 CA uses an *IP transport connection* within is in the scope of this supplement. The IP connection may be secured by IPsec[2] ([IETF RFC 4301]). Security support generally follows the recommendations given in clause 10.1 of [ITU-T H.248.1]; further details concerning authentication are outlined below.

5.6.4.1.1 IPsec security associations per H.248 control association

There is a single H.248 control association between the MGC and the MG, and basically two IPsec security associations (SA) for the H.248 CA.

NOTE – The IPsec SA is basically "simplex" (see [IETF RFC 4301] or [ETSI 133 210]).

5.6.4.1.2 Authentication with IPsec

Authentication may be based either on the IP authentication header (AH; [IETF RFC 4302]), or on the IP encapsulating security payload (ESP) header ([IETF RFC 4303]). In the case of ESP it is used for authentication only, i.e., encryption is set to "Null Cipher".

---

2 RFC 4301: "*The spelling "IPsec" is preferred and used throughout this and all related IPsec standards. All other capitalizations of IPsec (e.g., IPSEC, IPSec, ipsec) are deprecated. However, any capitalization of the sequence of letters "IPsec" should be understood to refer to the IPsec protocols.*"

While Recommendation ITU-T H.248.1 references IETF RFCs 2401 through 2411 in relation to IPsec, the discussion below includes IETF RFCs 4301 through 4310, which have replaced and made obsolete the former documents.

5.6.4.2 Authentication in the application layer, based on the H.248 message identifier

The MID may be used for authentication. Such an authentication approach requires a provisioning activity for configured MID values (see Table 2).

5.6.4.2.1 Authentication of the MG by the MGC, based on the MID

See clause 5.5.2.2.

5.6.4.2.2 Authentication of the MGC by the MG, based on the MID

See clause 5.5.2.1. Such an authentication may also be performed in case of MGC changeover procedures. For instance, the MGC must send a "new" MID value (via ServiceChangeMgcID parameter) in case of an MGC-initiated "handoff" (see also clause 8.2). The new MID points out the new MGC for the MG. The new MGC must already be listed as a secondary MGC in the MG database for MGC entries (see clause 5.5). The new MGC may then be verified (and thus authenticated) by the configured MID value according to clause 5.5.2.1.

5.6.5 ServiceChange command: usage of parameters "Address" and "MgcId"

There are two ServiceChange parameters related to addresses of H.248 entities. The scope of both protocol elements is basically different, see clause 7.2.8.1.3 of [ITU-T H.248.1]:

> *"The ServiceChangeAddress provides an address to be used within the context of the association currently being negotiated, while the ServiceChangeMgcID provides an alternate address where the MG should seek to establish another association."*

5.6.5.1 ServiceChangeAddress

ServiceChangeAddress allows address changes, a choice of six possibilities is supported by H.248.1 (see syntax in Annexes A and B of [ITU-T H.248.1]). The application is described in clauses 7.2.8.1.3 and F.5.4 of [ITU-T H.248.1]. Note that the use of ServiceChangeAddress was not encouraged over the past few years, but is again explicitly supported by version 3 of [ITU-T H.248.1] (see clause 7.2.8.1.3 of [ITU-T H.248.1]).

NOTE – This is the prime reason why implementations are deployed which only support the ServiceChangeMgcID parameter, trying to achieve the same behaviour as typically done with ServiceChangeAddress.

5.6.5.2 ServiceChangeMgcID

The application of this parameter is described in clause F.5.7 of [ITU-T H.248.1].

5.6.6 Network availability: Changeover between primary and secondary systems

5.6.6.1 Address hierarchies

Using domain names for the MID of an H.248 entity allows the introduction of a further address hierarchy due to the basic possibility in mapping multiple IP addresses on a single FQDN. The basic idea is to support H.248 entities with multiple (physical and/or logical) IP interfaces (see clause 5.3.2.2). Changeover procedures between IP interfaces may affect correspondent address changes, but the domain name may be unchanged.

This concept is for instance anchored in some H.248 Profiles (e.g., [ETSI ES 283 002]).

Address-to-name or name-to-address resolution is not entirely described in [ITU-T H.248.1], but partially indicated in clause 7.2.8.1.3 of [ITU-T H.248.1]. Overloading of a name with multiple addresses, or vice versa, may not be excluded, but it is out of scope of the core protocol itself (H.248.1). Such kind of overlay functionality requires a mutual agreement between MGC and MG, e.g., could be defined in a profile specification.

5.6.6.2 Address changes (associated with changeover procedures)

The support of domain names, as a specific MID type, allows the support of two principal possibilities for address changes of H.248 entities.

5.6.6.2.1 With DNS involvement

This approach is based on the applied concept of clause 5.6.6.1. The H.248 entity must provide a DNS client instance and the DNS protocol for DNS server access. The local DNS database is coupled with databases of H.248 entities as described in clause 5.5.1.

For instance, in case of an MG the idea is the following:

The MG provides a database for MGC entries according to Table 2. The $FQDN_{MGC}$ (see column "symbolic IP address") remains unchanged for the designated MGC entity, but changes of address A_{MGC} may be detected by the MG through DNS queries.

It has to be noted that this requires careful design considerations, primarily because of the following aspects:

- Correspondent database updates at the MGC and MG levels are inherently not tightly synchronized (due to the third instance of a DNS server).
- DNS is based on caching, associated with the DNS time-to-live (TTL) concept. The expiration of timer DNS-TTL triggers cache refreshes. It may thus take a rather long time until the MG gets the new MGC address via DNS.

  NOTE – Typical TTL configurations are for instance 60 seconds. H.248 entity embedded DNS clients require definitely much smaller TTL values.
- There might be interactions with other ServiceChange-based procedures (e.g., according to clause 11.6 of [ITU-T H.248.1]), due to a natural transition period with address inconsistencies.

5.6.6.2.2 Directly controlled by peer H.248 entity

Address changes may be directly triggered via ServiceChange parameters: ServiceChangeAddress (see clause 5.6.5.1) or ServiceChangeMgcID (see clause 5.6.5.2), when the chosen address format relates to an actual IP address (IPv4 or IPv6, respectively). In case of a domain name based address format, there is a subsequent access operation on the local DNS cache, and a potential DNS query to a DNS server in case of a missing entry.

NOTE – There might be an enhancement of the "with DNS involvement" mechanism. The H.248 entity should always trigger a DNS server query – in case the above ServiceChange parameters are received – independent of whether an entry already exists in the local cache.

5.6.6.3 Role changes between primary and secondary entities

Any successful changeover between a primary and a secondary H.248 entity is always accompanied by the release of the old control association (with the primary) and the establishment of a new control association (with the secondary).

6 Procedures for IP-based H.248 control associations

6.1 Starting point

The procedure responsible for the establishment of a control association assumes an already existent IP transport connection (Figure 6).

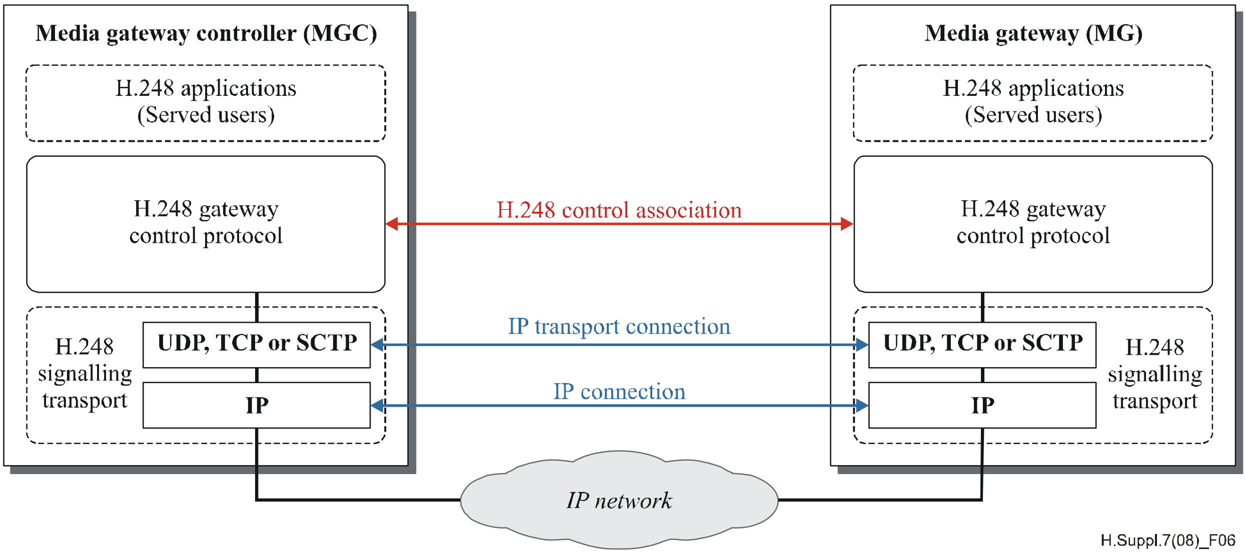

Figure 6 – IP-based H.248 control associations

The starting point is the pre-provisioned IP address information in accordance with Table 1, in the MGC and MG. This management plane action defines the IP connection. The second phase is related to the establishment of the IP transport connection. There are two types, which depend on the chosen transport protocol:

1) Stateless: UDP-based IP transport connection.

   The UDP connection is already implicitly set up with the IP connection establishment.

2) Stateful: TCP- or SCTP-based IP transport connections.

   TCP and SCTP are connection-oriented, requiring therefore an explicit procedure for the establishment of a TCP connection or an SCTP association (see [IETF RFC 793] and [IETF RFC 4960], respectively).

There is then a third phase in case of SCTP ([ITU-T H.248.4]) due to the multi-streaming capability of this transport technology. One or multiple SCTP streams and their identifiers must be selected (H.248 transport in SCTP single-stream or multi-stream mode).

6.1.1 SCTP association establishment

The establishment procedures for the H.248 control association and the underlying SCTP association (in case of H.248.4 transport) are completely decoupled.

There are explicit role assignments in case of H.248 control association establishment: initiation is done at the MG side, but not at the MGC side.

This is different with regard to the SCTP association. SCTP is a fully symmetrical protocol as there is no client/server, active/passive, master/slave, etc. concept (see [IETF RFC 4960]). Consequently, the SCTP state machines at both endpoints (here MG and MGC) are identical.

As a result, either the MGC or the MG may initiate the SCTP association establishment. The SCTP association initialization is defined in clause 5 of [IETF RFC 4960].

6.2 Control association establishment

The establishment procedure is realized via ServiceChange procedure(s), and is initiated by the MG. The procedures are described e.g., in clauses 11.2, F.3.1 and F.3.2 of [ITU-T H.248.1].

6.2.1 Establishment phase: start event

The event triggering the start of an establishment procedure is a ServiceChange.request sent by the MG towards the MGC in the context of "MG registration". There are three ways, realized by three different ServiceChange methods (see clause F.3.1 of [ITU-T H.248.1]).

6.2.2 Establishment phase: end event

The event correlated with the end of the establishment phase is the sent ServiceChange.reply on the MGC side and the received ServiceChange.reply on the MG side, respectively.

6.2.3 Valid/existent control association

6.2.3.1 One-step registration ("one request/reply cycle")

There is no control association before the "end event". See clause F.3.2 of [ITU-T H.248.1]: "The control association is established upon completion of registration.". Figure 7 illustrates the phases with valid control associations.

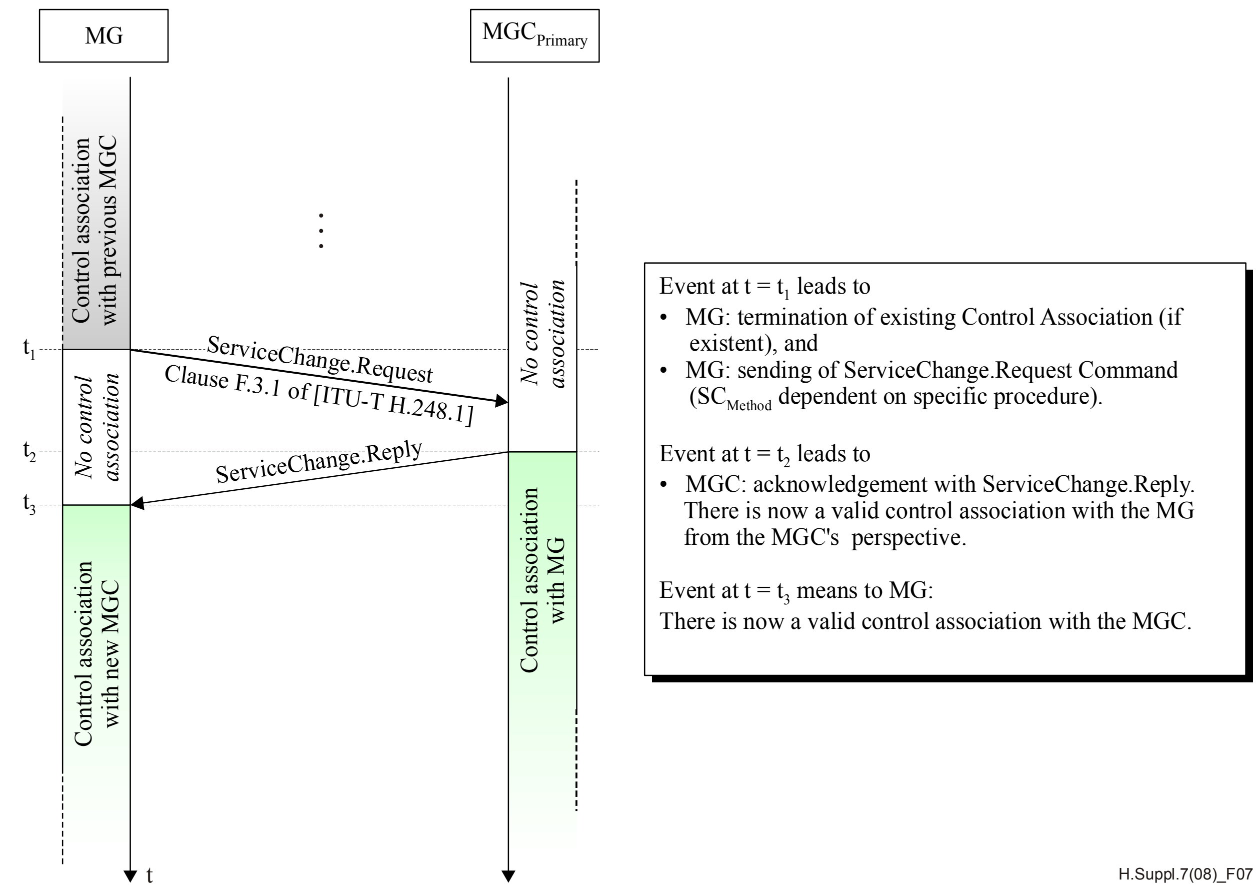

Figure 7 – Phases with valid control associations (MG perspective) for single-step registration

6.2.3.1.1 One-step registration with ServiceChangeAddress

The MGC may include the ServiceChangeAddress parameter in the ServiceChange.reply, if it wants to redirect the interface and/or port of the control association (see also clause 5.5.1.2). This is still a one cycle registration procedure (Figure 8) due to the single primary MGC instance. The control association is already established at t_2 (from MGC point of view) because the MGC is already prepared to receive H.248 traffic under the new "address".

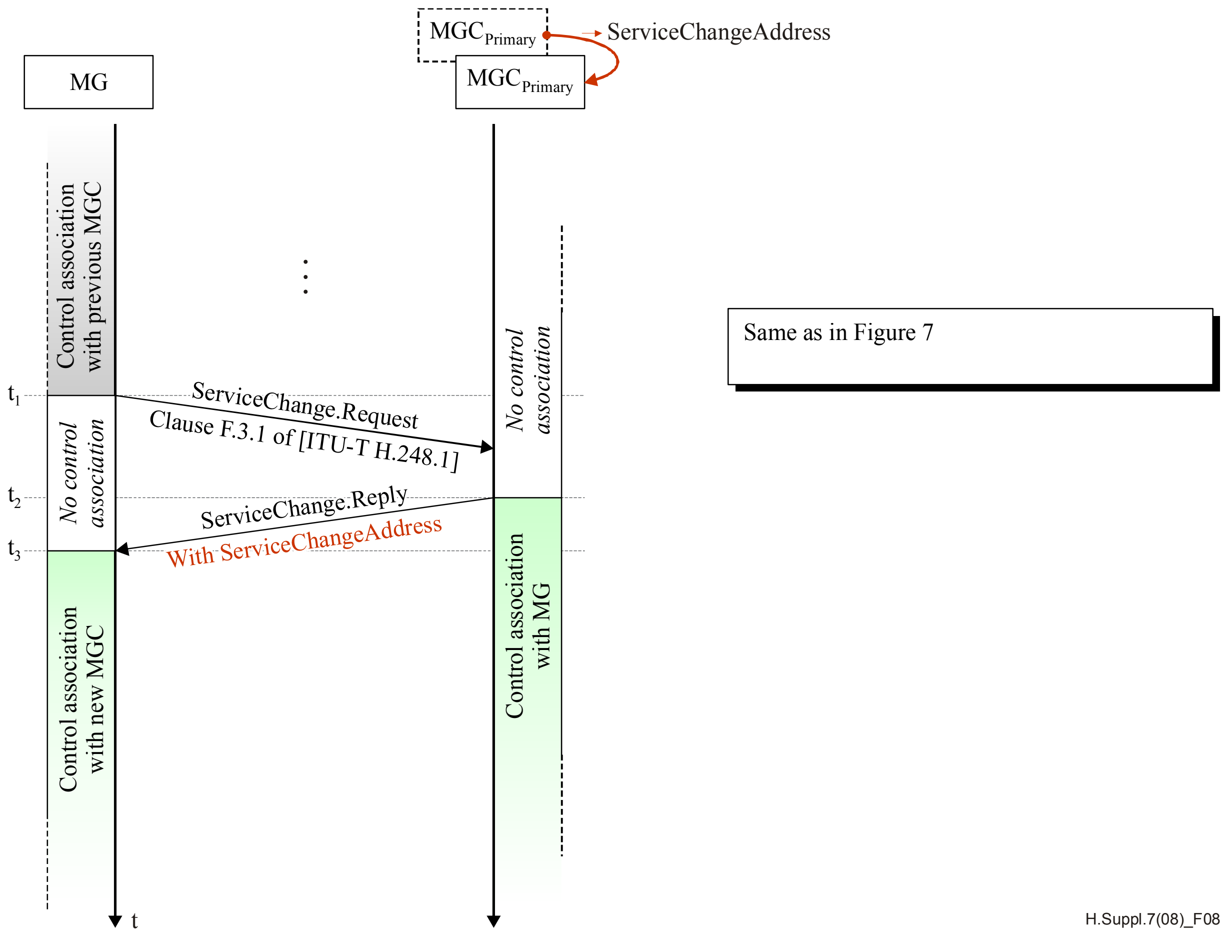

Figure 8 – Phases with valid control associations (MG perspective) for one-step registration with ServiceChangeAddress

6.2.3.1.2 Loss of H.248 message with ServiceChange.reply command

The ServiceChange.reply could be lost in the above one-step registration scenarios. The H.248 CA is then considered to be established from the MGC perspective, but not yet existing from the MG point of view (see also clause 6.2.2).

The MGC may consequently start (just after t_2) call-independent or call-dependent procedures by issuing H.248 Command.requests.

The MG will reply to such requests with error code 505 ("TransactionRequest Received before a ServiceChange Reply has been received"). The MG will reply using a H.248 Version 1 Message.

The MGC does not react on the ServiceChange.reply with error code 505, because the MG will re-submit the failed initial ServiceChange.request for registration purposes.

6.2.3.2 Multiple-step registration

6.2.3.2.1 Two-step registration due to ServiceChangeMgcID

The MGC may include the ServiceChangeMgcID parameter in the ServiceChange.reply, if the MGC "*does not wish to sustain an association with the MG*" (see clause 7.2.8.1.11 of [ITU-T H.248.1]). Figure 9 indicates the 2nd request/reply cycle, in addition to Figure 7. If the first registration attempt is unsuccessful, there is thus no valid control association at both sides. It has to be noted that the MGC entity behind the specified address by ServiceChangeMgcID is considered to be a "secondary MGC" instance. The 2nd cycle is therefore part of a re-registration procedure (see clause F.3.2 or F.3.8 of [ITU-T H.248.1]). The 2nd cycle could be a handoff-based changeover procedure (see e.g., clause 8.2).

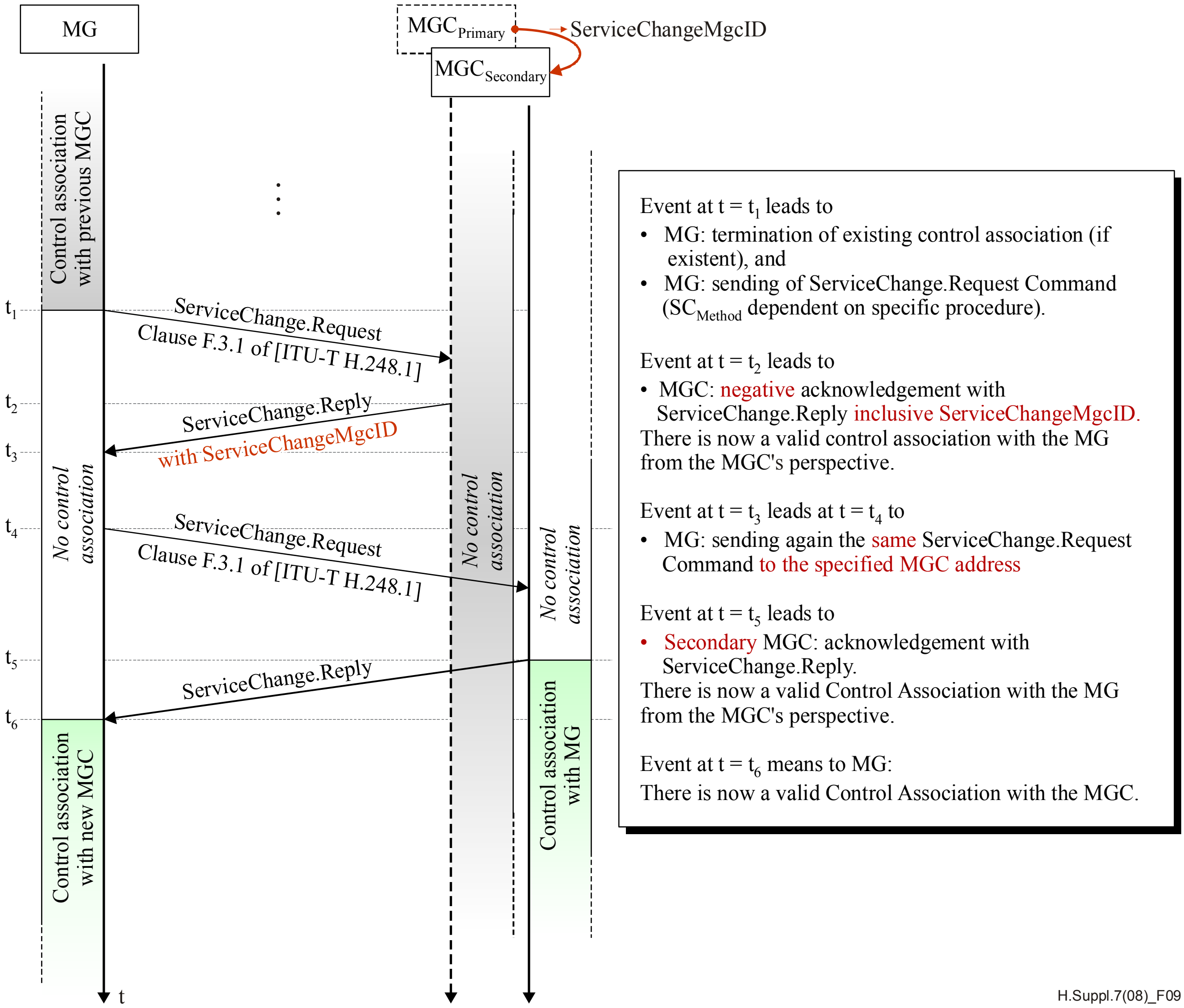

Figure 9 – Phases with valid control associations (MG perspective) for two-step registration due to ServiceChangeMgcID

The following side aspects are for further study:

1) The ServiceChangeMgcID points out a MGC entity that is not in the MG's pre-configured list (see e.g., Table 2).

2) The repeated registration fails towards this new MGC entity (and the MG will fail over to the provisioned entity where the last ServiceChangeMgcID was received from).

3) The repeated registration is successful, but after a while the control association fails (same action as in the previous point).

4) The provisioned entity is in-service, so the failover procedure is successful.

5) The provisioned entity is not in-service, so the failover procedure is unsuccessful. In this case, the MG shall take the next provisioned MGC in its list.

6.3 Control association refreshment

6.3.1 Understanding

The term "refreshment" (also known as "renewal") of an H.248 CA is related to the application of ServiceChange method and reason combination of {*Disconnected, #900*}. CA refreshment is characterized by situations of a previous existing CA, a subsequent short-term interruption, and then a continuation of the previous CA without any MG (re-)registration step(s).

The normative service change procedures are defined in clause F.3.6 of [ITU-T H.248.1]. Possible situations with CA refreshment are detailed in the below subclauses.

6.3.2 Normal CA refreshment after short-term interruption of an H.248 transport connection

Figure 10 indicates a short-term interruption of the H.248 transport connection (see also Figure 4) between MG and MGC. The MG comes to the conclusion "MG lost communication", e.g., based on application level framing procedures, in case of H.248overUDP; dedicated indications by the transport layer, in case of H.248overSCTP; H.248.14, etc. The MGC may come to a similar conclusion, denoted here as "MG not available".

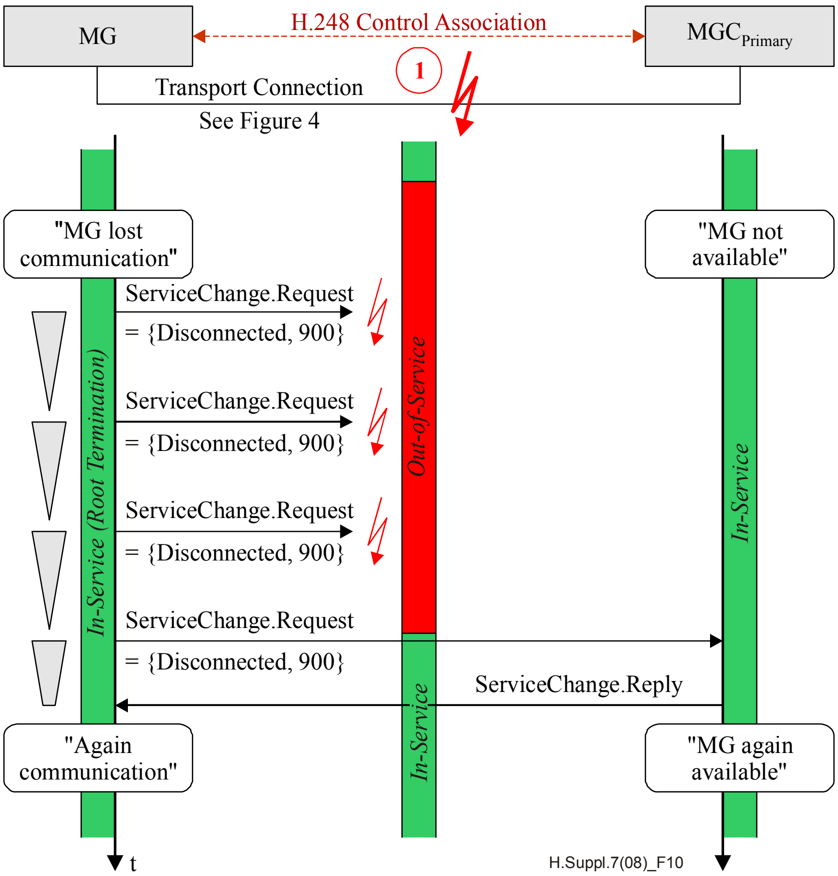

Figure 10 – MG Lost Communication –
Short-term interruption of H.248 transport connection

The MG follows clause F.3.6 of [ITU-T H.248.1] by sending one or multiple, timer-controlled re-connection attempts as ServiceChange {Disconnected, #900} command requests to its primary MGC. The underlying motivation is to connect again with the "primary MGC" and not to initiate an (unnecessary) failover procedure to a secondary MGC.

The primary MGC in Figure 10 is always "In-Service", but it does not initiate any ServiceChange procedure (note that one exception could be clause 11.4 of [ITU-T H.248.1] in case of "secondary MG" deployments). The primary MGC is therefore passive, awaiting "re-connection" attempts by the (primary) MG.

6.3.3 Normal CA refreshment after short-term interruption of primary MGC

Figure 11 depicts a second scenario. The MG again concludes "MG lost communication".

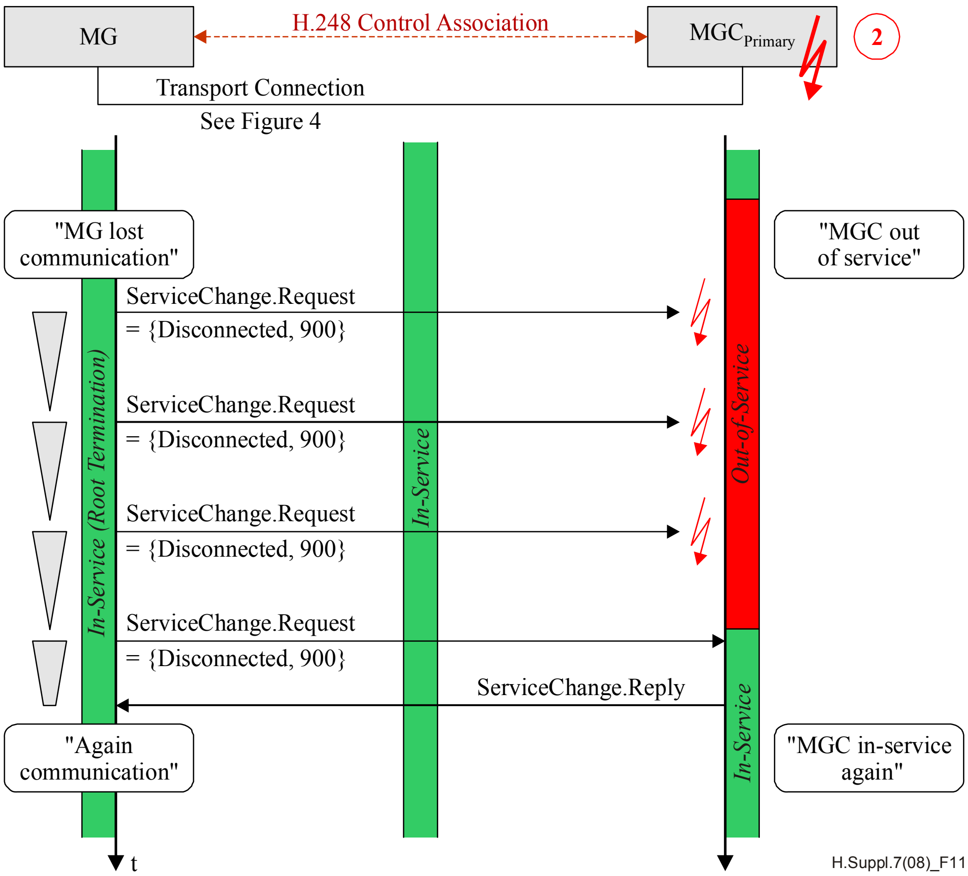

Figure 11 – MG lost communication –
Short-term transition of MGC from IS→OoS→IS

The transition of the primary MGC from IS→OoS→IS may or not lead to the *loss* of relevant call/bearer information and/or MG configuration information:

a) "Lossless" IS→OoS→IS transition, or

b) "Lossy" IS→OoS→IS transition.

The specific behaviour is then up to the MGC. For instance, the (still) primary MGC may accept the ServiceChange request (as in Figure 11), which would imply a CA refreshment.

7 Procedures for non-IP-based H.248 control associations

Procedures for ATM-based control associations are given in [ITU-T H.248.5] and in the signalling specifications referenced by that Recommendation.

8 H.248 control association: summary of scenarios with usage of ServiceChangeMgcID parameter

The following scenarios illustrate all possible cases with the ServiceChangeMgcID parameter. Note that the given Version and Profile parameter values are only examples. Present time stamps and further ServiceChange descriptor parameters are not shown here. Furthermore, the ServiceChangeReason codes are also examples. The permitted SC method/reason combinations can be found in Annex F of [ITU-T H.248.1].

8.1 Case a): Restart request (Initial registration)

MGC_1 is configured as the primary MGC of the MG. Figure 12 illustrates the two request-reply cycles.

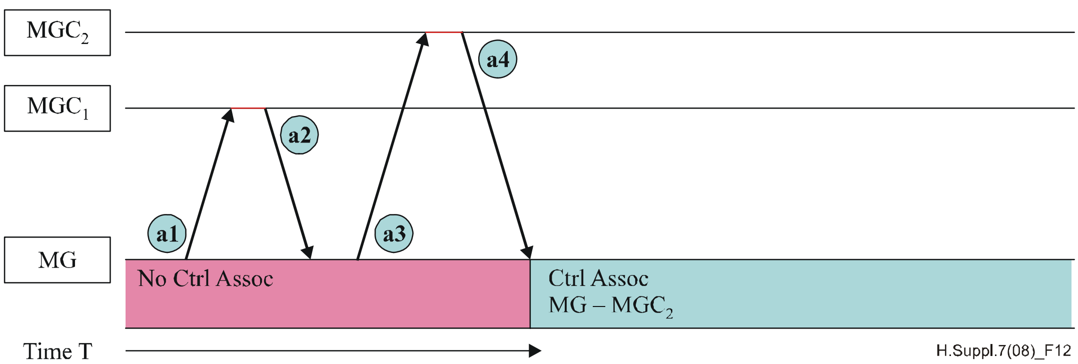

Figure 12 – Case a) – Restart request (Initial registration)

a1. – MG to MGC_1, first initial registration request

H.248 message information elements	Value
Message/protocol version	1
Message Identifier	mg_mid
Termination Identifier	ROOT
ServiceChange parameters (used in this example):	
ServiceChangeMethod	Restart
ServiceChangeReason	901 – Cold Boot
ServiceChangeVersion	2
ServiceChangeProfile	abc/1

a2. – MGC_1 to MG, ServiceChange reply of MGC_1 containing ServiceChangeMgcID

H.248 message information elements	Value
Message/protocol version	1
Message Identifier	mgc1_mid
Termination Identifier	ROOT
ServiceChange parameters (used in this example):	
ServiceChangeMgcID	mgc2_mid

a3. – MG to MGC_2, second initial registration request, identical to message a1, except for the transaction identifier

See a1., with an increased transaction identifier value.

a4. – MGC_2 to MG, ServiceChange reply of MGC_2 accepting MG's registration

H.248 message information elements	Value
Message/protocol version	1
Message Identifier	mgc2_mid
Termination Identifier	ROOT
ServiceChange parameters (used in this example):	
–	

This scenario relates to the two-step registration described in clause 6.2.3.2.1.

8.2 Case b): Handoff request

Figure 13 illustrates the three request-reply cycles.

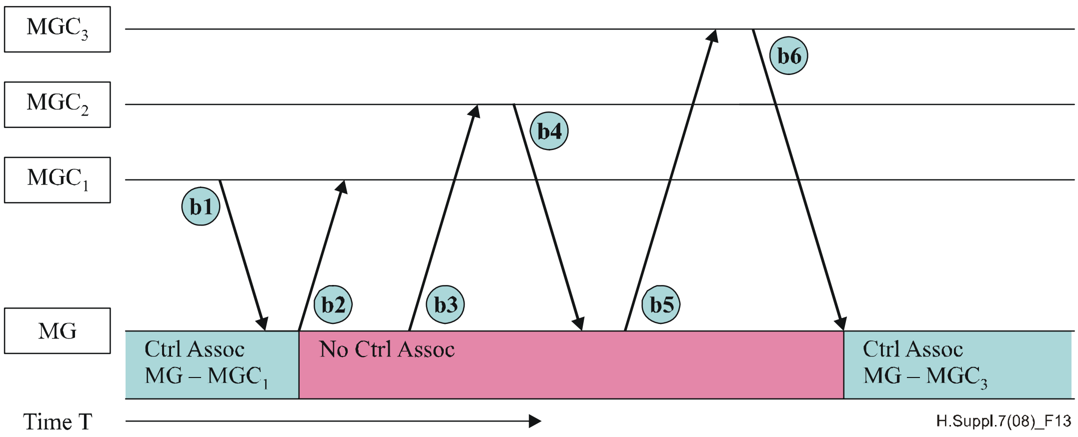

Figure 13 – Case b) – Handoff request

b1. – MGC_1 to MG, MGC_1-initiated handoff request

H.248 message information elements	Value
Message/protocol version	2
Message Identifier	mgc1_mid
Termination Identifier	ROOT
ServiceChange parameters (used in this example):	
ServiceChangeMethod	Handoff
ServiceChangeReason	903 – MGC Directed Change
ServiceChangeMgcID	mgc2_mid

b2. – MG to MGC_1, ServiceChange reply of MG

H.248 message information elements	Value
Message/protocol version	2
Message Identifier	mg_mid
Termination Identifier	ROOT
ServiceChange parameters (used in this example):	
–	

This ServiceChange.reply command terminates the control association {MG, MGC_1} from the MG's perspective. See Figure 13.

b3. – MG to MGC_2, re-registration request

H.248 message information elements	Value
Message/protocol version	1
Message Identifier	mg_mid
Termination Identifier	ROOT
ServiceChange parameters (used in this example):	
ServiceChangeMethod	Handoff
ServiceChangeReason	903 – MGC Directed Change
ServiceChangeVersion	2
ServiceChangeProfile	abc/1

b4. – MGC_2 to MG, ServiceChange reply of MGC_2 containing ServiceChangeMgcID

H.248 message information elements	Value
Message/protocol version	1
Message Identifier	mgc2_mid
Termination Identifier	ROOT
ServiceChange parameters (used in this example):	
ServiceChangeMgcID	mgc3_mid

b5. – MG to MGC_3, re-registration request, identical to message b3, except for the transaction identifier

See b3., with an increased transaction identifier value.

b6. – MGC_3 to MG, ServiceChange reply of MGC_3 accepting re-registration request

H.248 message information elements	Value
Message/protocol version	1
Message Identifier	mgc3_mid
Termination Identifier	ROOT
ServiceChange parameters (used in this example):	
–	

This ServiceChange.reply contains the MID_{MGC} from MGC_3. It has to be noted that any other MID value than "`mgc3_mid`" would be incorrect (due to the contradiction with step b4), and should therefore lead to a subsequent, appropriate ServiceChange procedure.

8.3 Case c): Failover request

The MG has a control association with MGC_1, and then detects a failure of MGC_1. MGC_2 is configured to be the secondary MGC of MG. Figure 14 illustrates the two request-reply cycles.

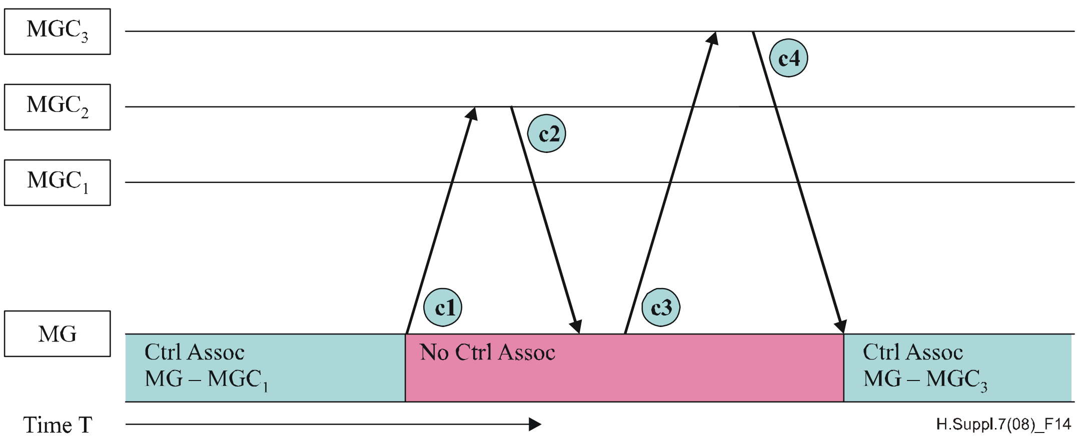

Figure 14 – Case c) – Failover request

c1. – MG to MGC_2, re-registration request

H.248 message information elements	Value
Message/protocol version	1
Message Identifier	mg_mid
Termination Identifier	ROOT
ServiceChange parameters (used in this example):	
ServiceChangeMethod	Failover
ServiceChangeReason	909 – MGC Impending Failure
ServiceChangeVersion	2
ServiceChangeProfile	abc/1

This control association is terminated upon the sending of the ServiceChange command (here: transaction request c1.), see clause F.4.1.1 of [ITU-T H.248.1], list item 4).

NOTE – However, if the contacted secondary MGC (here MGC_2) does not answer either, then typically the MG would try to refresh (via the "Disconnected" method, see clause 6.3) the previous control association. The conclusion by the MG for a refreshment attempt of the CA is in line with clause 6.3 and clause 7.2.8 of [ITU-T H.248.1].

c2. – MGC_2 to MG, ServiceChange reply of MGC_2 containing ServiceChangeMgcID

H.248 message information elements	Value
Message/protocol version	1
Message Identifier	mgc2_mid
Termination Identifier	ROOT
ServiceChange parameters (used in this example):	
ServiceChangeMgcID	mgc3_mid

c3. – MG to MGC_3, re-registration request, identical to message c1 except for transaction identifier

See c1., increased transaction identifier value.

c4. – MGC_3 to MG, ServiceChange reply of MGC_3 accepting re-registration request

H.248 message information elements	Value
Message/protocol version	1
Message Identifier	mgc3_mid
Termination Identifier	ROOT
ServiceChange parameters (used in this example):	
–	

There is now an established CA between MGC_3 and the MG.

8.4 Case d): Disconnected H.248 control association renewal request

Figure 15 illustrates the two request-reply cycles.

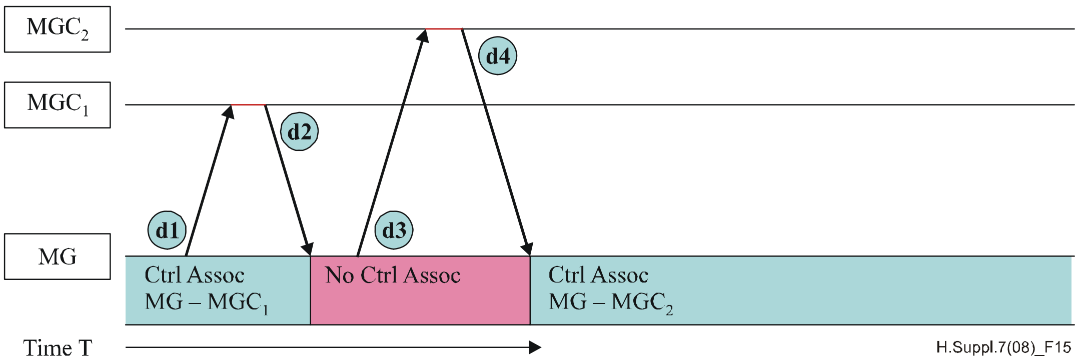

Figure 15 – Case d) – Disconnected H.248 control association renewal request

Figure 15 illustrates the case when the renewed CA is continued later with MGC_2.

d1. – MG to MGC_1, disconnected request

H.248 message information elements	Value
Message/protocol version	2
Message Identifier	mg_mid
Termination Identifier	ROOT
ServiceChange parameters (used in this example):	
ServiceChangeMethod	Disconnected
ServiceChangeReason	900 – Service Restored

d2. – MGC_1 to MG, ServiceChange reply of MGC_1 containing ServiceChangeMgcID

H.248 message information elements	Value
Message/protocol version	2
Message Identifier	mgc1_mid
Termination Identifier	ROOT
ServiceChange parameters (used in this example):	
ServiceChangeMgcID	mgc2_mid
NOTE – When MGC_1 wants to point to himself, then the value of ServiceChangeMgcID must be "`mgc1_mid`". The "handoff" in next step d3 will be then sent to MGC_1.	

d3. – MG to MGC_2, re-registration request

H.248 message information elements	Value
Message/protocol version	1
Message Identifier	mg_mid
Termination Identifier	ROOT
ServiceChange parameters (used in this example):	
ServiceChangeMethod	Handoff (Note)
ServiceChangeReason	903 – MGC Directed Change
ServiceChangeVersion	2
ServiceChangeProfile	abc/1
NOTE – Clause F.4.1.1 of [ITU-T H.248.1], list item 5), states that the "The MG shall not use Handoff without being commanded to do so by an MGC". The "commanding trigger" for step d3 here is the MGC reaction in step d2.	

d4. – MGC_2 to MG, ServiceChange reply of MGC_2 accepting re-registration request

H.248 message information elements	Value
Message/protocol version	1
Message Identifier	mgc2_mid
Termination Identifier	ROOT
ServiceChange parameters (used in this example):	
–	

8.5 Case e): Forced H.248 control association closure request

Figure 16 illustrates the request-reply cycles.

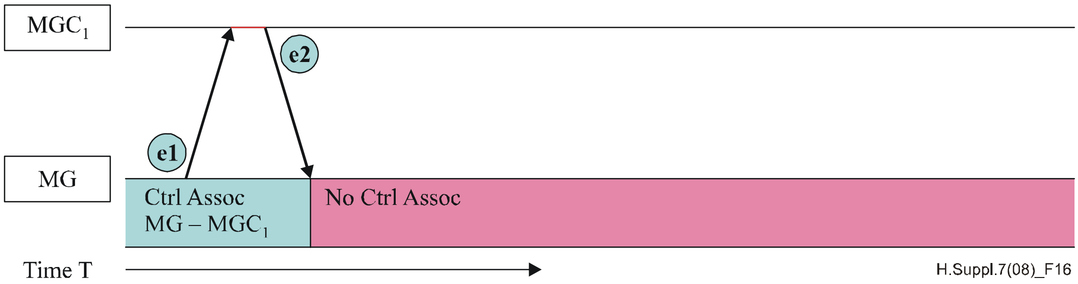

Figure 16 – Case e) – Forced H.248 control association closure request

e1. – MG to MGC_1, forced request

H.248 message information elements	Value
Message/protocol version	2
Message Identifier	mg_mid
Termination Identifier	ROOT
ServiceChange parameters (used in this example):	
ServiceChangeMethod	Forced
ServiceChangeReason	908 – MG Impending Failure

e2. – MGC_1 to MG, ServiceChange reply of MGC_1 containing ServiceChangeMgcID

H.248 message information elements	Value
Message/protocol version	2
Message Identifier	mgc1_mid
Termination Identifier	ROOT
ServiceChange parameters (used in this example):	
ServiceChangeMgcID	mgc2_mid

This ServiceChange.reply of MGC_1 is in line with the current H.248.1 syntax and semantics, but it does not really make sense. In such a case, the MG would ignore the incoming ServiceChange.reply; alternatively, the MGC could omit the ServiceChangeMgcID parameter.

e3. – MG does not issue any new ServiceChange request

8.6 Case f): Graceful H.248 control association release request

The MG has a control association with MGC_1, and initiates (with step f1) a graceful release of the CA (see Figure 17).

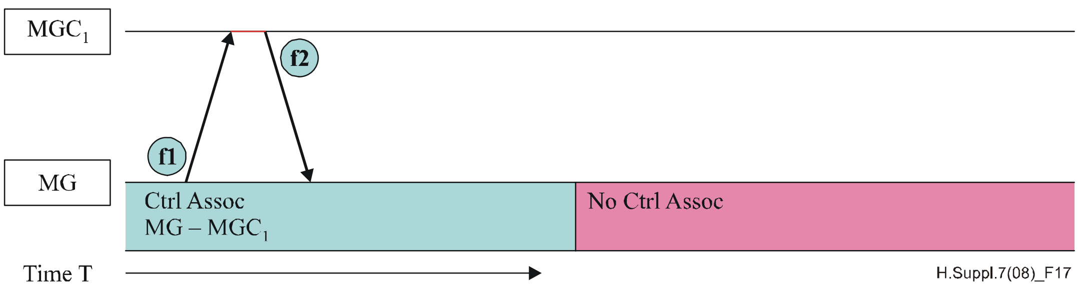

Figure 17 – Case f) – Graceful H.248 control association release request

f1. – MG to MGC_1, graceful request

H.248 message information elements	Value
Message/protocol version	2
Message Identifier	mg_mid
Termination Identifier	ROOT
ServiceChange parameters (used in this example):	
ServiceChangeMethod	Graceful
ServiceChangeReason	908 – MG Impending Failure
Timestamp	<*value*>

f2. – MGC_1 to MG, ServiceChange reply of MGC_1 containing ServiceChangeMgcID

H.248 message information elements	Value
Message/protocol version	2
Message Identifier	mgc1_mid
Termination Identifier	ROOT
ServiceChange parameters (used in this example):	
ServiceChangeMgcID	mgc2_mid

This ServiceChange.reply from the MGC_1 is in line with the current H.248.1 syntax and semantics, but it might be questionable. In such a case, the MG would be requested to attempt a registration during the "graceful" period.

f3. – MG does not issue any new ServiceChange request

NOTE – [ITU-T H.248.1]: The MGC should not use the ServiceChangeMgcID parameter in a ServiceChange reply when responding to a ServiceChange forced or graceful command with reason 908. In case that the MGC would still reply with a ServiceChangeMgcID parameter, then the MG ignores such a changeover request.

9 H.248 control association: impact of protocol version changes and/or profile changes on established control associations

The change of 1) protocol version and/or 2) profile is related to an upgrade process on both sides of the control association. Correspondent ServiceChange procedures could be therefore initiated either by the MG or the MGC. Figure 18 illustrates the two principal scenarios. The main difference concerning the control association is:

1) The control association is terminated and later re-established between the same MGC-MG pair in case that the Restart-based ServiceChange procedure is triggered by the MGC (see left side of Figure 18);

2) The control association is renewed between the same MGC-MG pair during the Restart-based ServiceChange procedure for capability change announcement (see right side of Figure 18). The MGC then triggers the re-registration process, see 1).

NOTE – The scenario selected depends on the management plane.

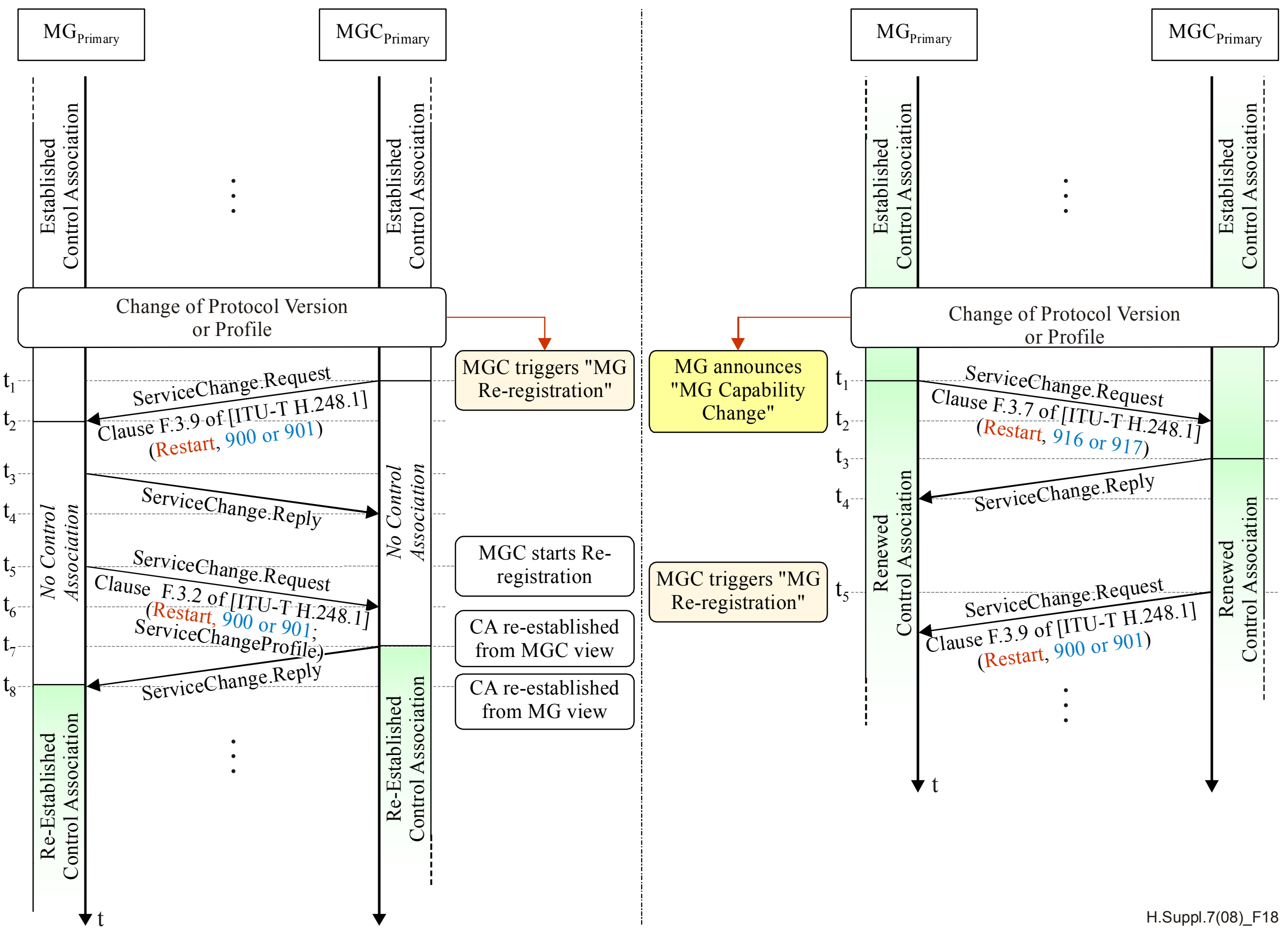

Figure 18 – Impact of protocol version and/or profile changes on established control associations – There are two principal scenarios

Since profile changes may lead to MID changes, the re-established or renewed control association may have either a new identifier {MID'_{MGC}, MID'_{MG}} or the same identifier {MID_{MGC}, MID_{MG}} (see also clause 5.2) as before the Restart-based MG re-registration procedure.

10 H.248 control association: Impact of transport mode changes

Any H.248 CA using an IP transport connection is in the scope of this supplement. The H.248 transport mode relates to a specific transport protocol (see clause 5.3.1).

10.1 Situation of transport mode changes

There might be transport mode changes based on the variety of possible transport modes defined for H.248. For instance, a UDP-based transport connection may be replaced by SCTP or vice versa. There would be then a UDP-to-SCTP or a SCTP-to-UDP transport mode change respectively.

10.2 Impact on established control associations

A transport mode change implies the existence of an already established CA. At a very minimum, a transport mode change means a change of the well-known port numbers, onside from the transport protocol itself (apart from an SCTP establishment or SCTP release procedure respectively).

A transport mode change would lead to at least a temporary interruption of transport, thus every transport mode change leads to a ‘release' and subsequent re-establishment of the CA.

10.3 Relation between profile and transport modes

A profile may specify multiple transports. Thus, a change in transport will result in a re-negotiation of a profile but it may mean the same transport is chosen. A change of a transport mode leads to a change in profile, and vice versa.

10.4 Indication of transport mode

10.4.1 Indication based on provisioning

After the release of the CA, the new transport mode must be provisioned on the MG and MGC sides. After that management action, the re-establishment of the CA may be initiated.

10.4.2 Indication based on ServiceChange procedures

There is no explicit ServiceChange parameter for the indication of a specific transport mode, but there is an implicit method available based on the ServiceChangeProfile parameter.

A "dynamic transport mode" change is actually related to a profile change, e.g., from "profile *x* with UDP" to "profile *y* with SCTP". Thus, the ServiceChange procedure is primarily due to a profile upgrade (see clause 9), which indirectly points to a transport mode change.

11 H.248 control association: registration of multi-mode transport capable media gateways

A multi-mode transport capable media gateway supports multiple transport protocols in parallel. When registering, the MG must select a transport mode for the first ServiceChange.request command.

NOTE – The theoretical possibility of sending the first H.248 message towards the MGC on all available transport modes is not considered here.

Based on a negotiated profile, the MG may re-establish a control association with an alternative transport mode. This may be applicable to the case when an MGC returns an alternate profile to the one the MG supplied.

There are a couple of different possibilities for registering multi-mode transport capable MGs.

11.1 Variant A: single-mode transport capable MGC

The MGC is not multi-mode transport capable, thus the applied transport technology must be initially provisioned in the MG.

11.2 Variant B: multi-mode transport capable MGC, prepared to serve all transport modes

The MGC is multi-mode transport capable and prepared to receive the very first H.248 message at every transport connection endpoint (i.e., UDP or SCTP port). The MGC then uses the same transport technology for its reply.

NOTE – SCTP implies an already established SCTP association between the MG and the MGC (see also clause 6.1.1).

11.3 Variant C: multi-mode transport capable MGC, not prepared to serve all transport modes

The MGC is multi-mode transport capable and not prepared to receive the very first H.248 message at every transport connection endpoint. The applied transport technology (for the first message) must be provisioned in the MG. The MGC then uses the same transport technology for its reply.

12 H.248 control association: policing of incoming H.248 messages

Policing of incoming H.248 messages from the control association may be driven by enhanced security requirements. This could be based on particular protocol elements, and can be done by one or both peering H.248 entities (see also clause 5.5.2).

NOTE – The figures in this clause are from the MG respective.

12.1 Overview

Figure 19 depicts an incoming H.248 message at an H.248 entity using the example of a UDP or SCTP based H.248 transport connection. The picture provides an overview of example filter stages, which may be involved in policing of incoming H.248 traffic.

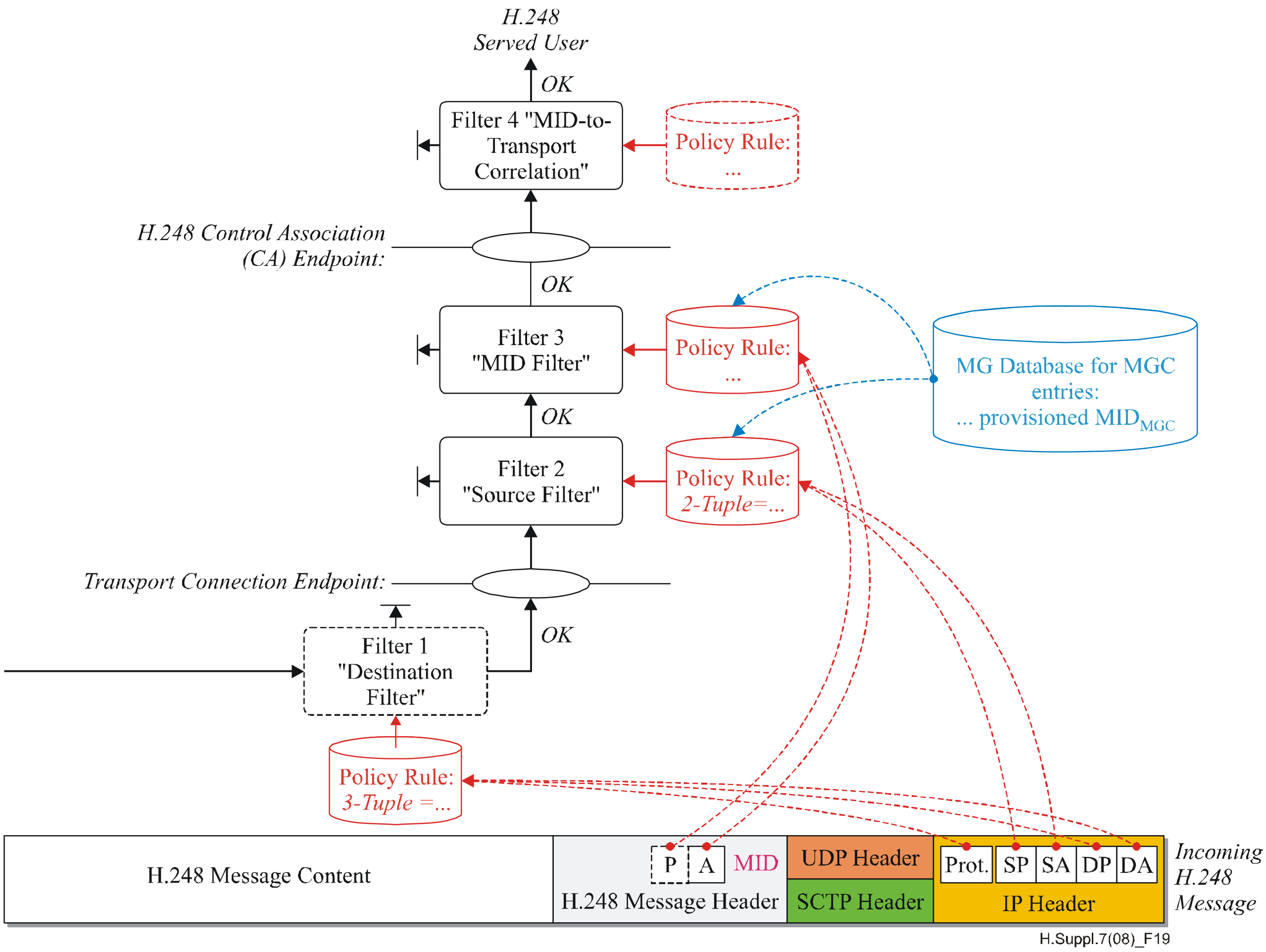

Figure 19 – Policing of incoming H.248 messages – Overview of possible filter stages

The different filter stages may be categorized into H.248-independent, IP-specific filters (see subclauses 12.2.1 and 12.2.2), and filter stages which are primarily dependent on H.248 information (see other subclauses).

Figure 19 also points out that the input information for a filter condition may be based on information carried by the incoming IP packet (which carries either a complete or a segment of an H.248 message), and/or on the MG database for MGC entries (see also clause 5.5.2).

12.2 Principal filter stages

12.2.1 Address policing on destination information

Figure 20 illustrates a basic IP filter, which checks the destination address/port information plus protocol type. Such a filter could be meaningful for H.248 traffic in the case of multi-transport mode capable H.248 entities (see also clauses 10 and 11).

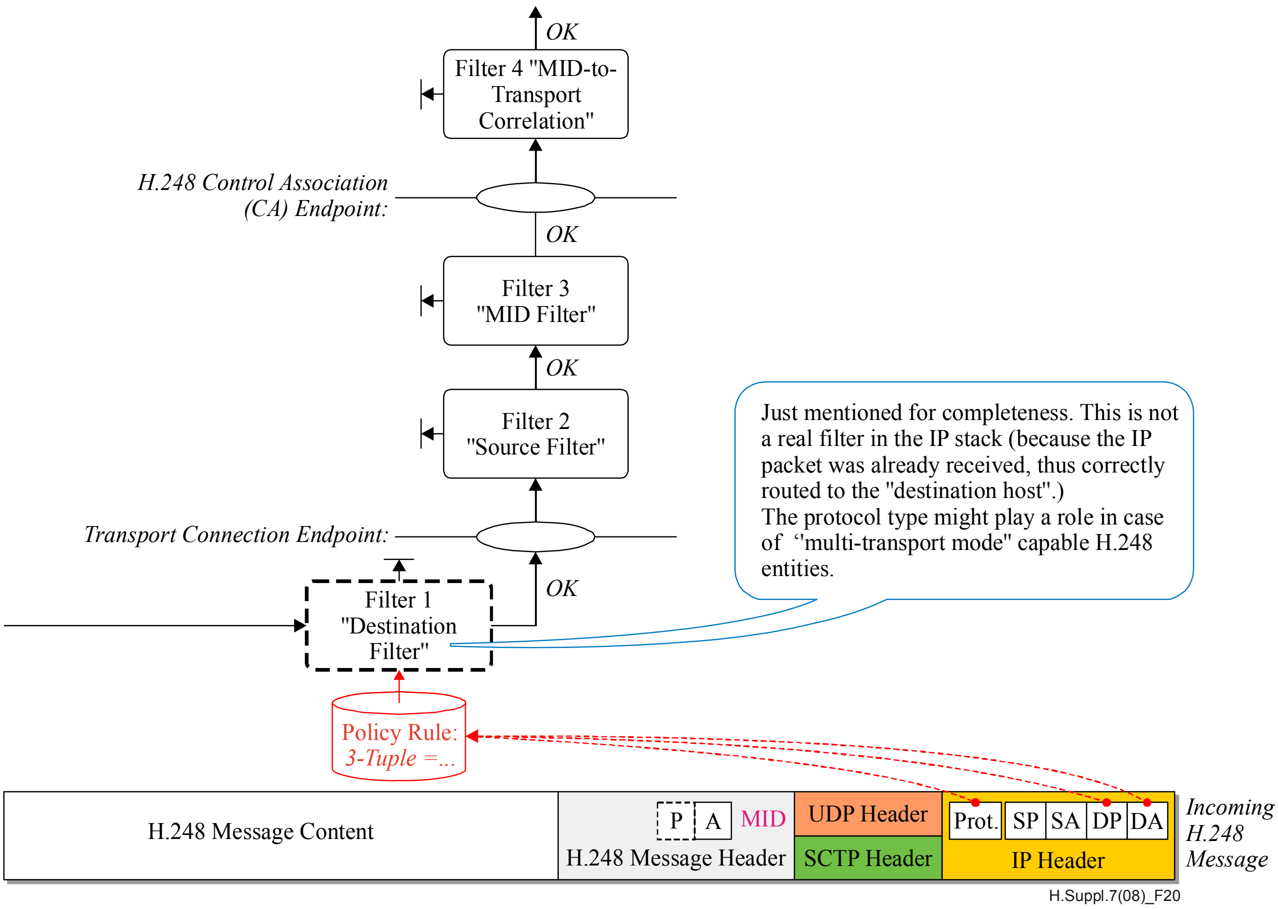

Figure 20 – Address policing on destination information

12.2.2 Address policing on source information

Figure 21 shows the example of a source address filter for H.248 traffic. The applicability of such a filter depends on interim NAT devices (see also clause 5.6.3).

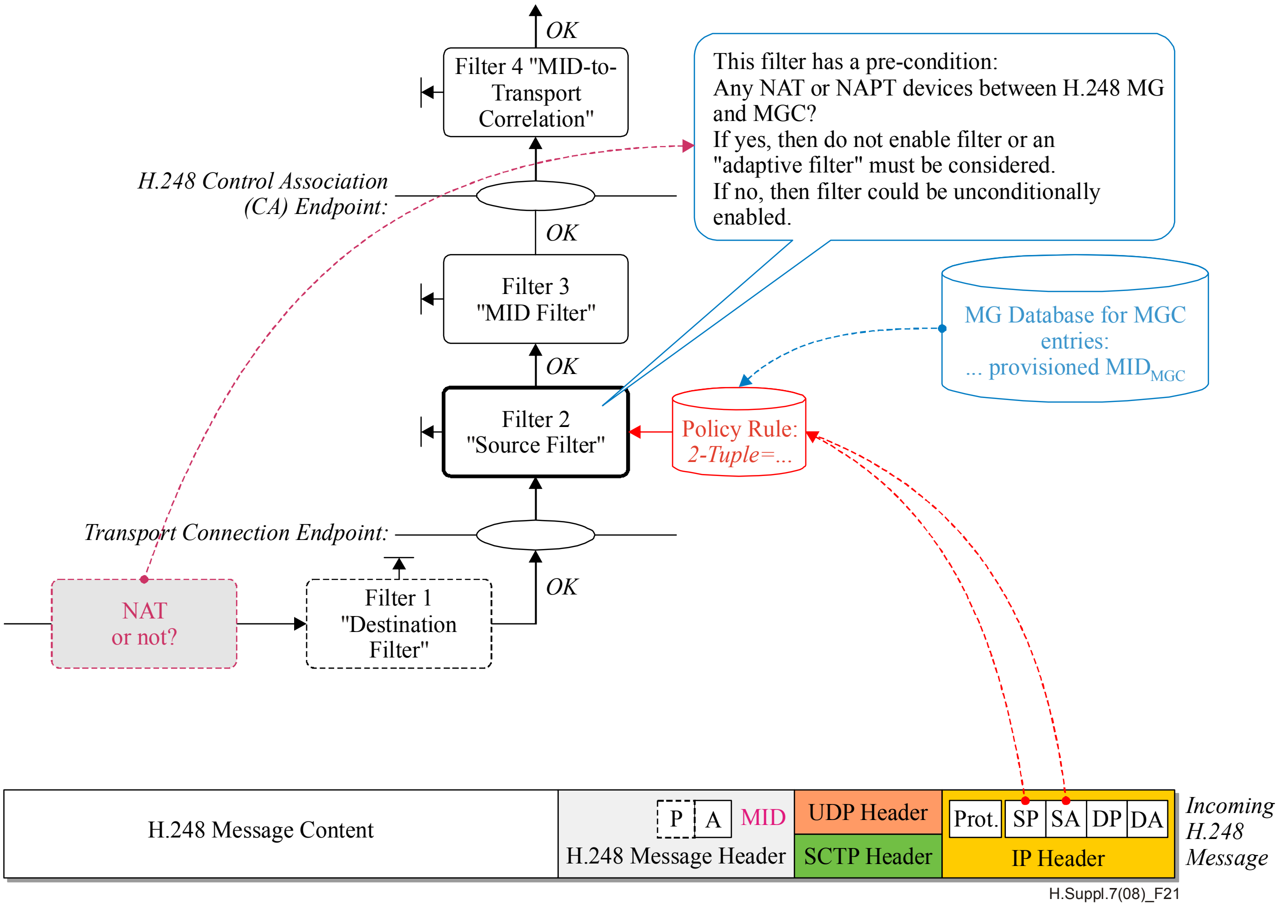

Figure 21 – Address policing on source information

12.2.3 Policing on correlated MID-source information

The MessageID may be encoded in different formats (see also clause 5.4.1): address- or name-based, with or without port information. The MID allows an unambiguous identification of a MGC entity. The MID relates to a table index for the database of MGC entries in the MG (see clause 5.5.1). The MG database may be queried for MGC address/port information via the received MID value. This local information could be the correlated with the received IP layer information.

Figure 22 depicts an example of such a filter, which correlates the MID information with transport connection information.

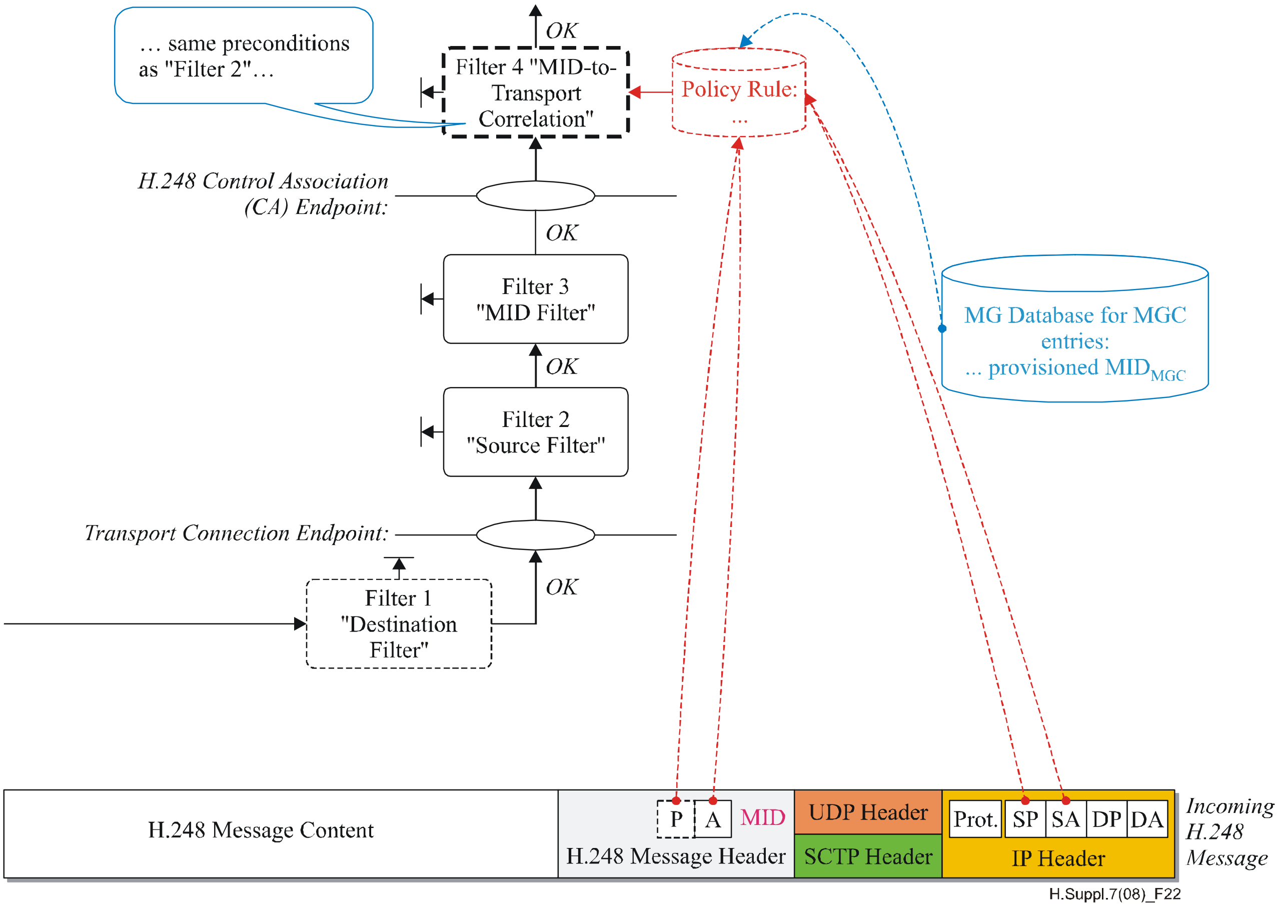

Figure 22 – Policing on correlated MID-source information

12.2.4 Policing on MID information

Previous filter stages all use IP layer information. Figure 23 shows a filter stage, which is solely based on MID information. There are many meaningful policy rules, dependent on the MID format itself, and dependent on received and provisioned MID information. Figure 23 illustrates the principle as such, and an example location within the overall "filter pipeline". Clause 12.3 indicates some possible policy rules in more detail.

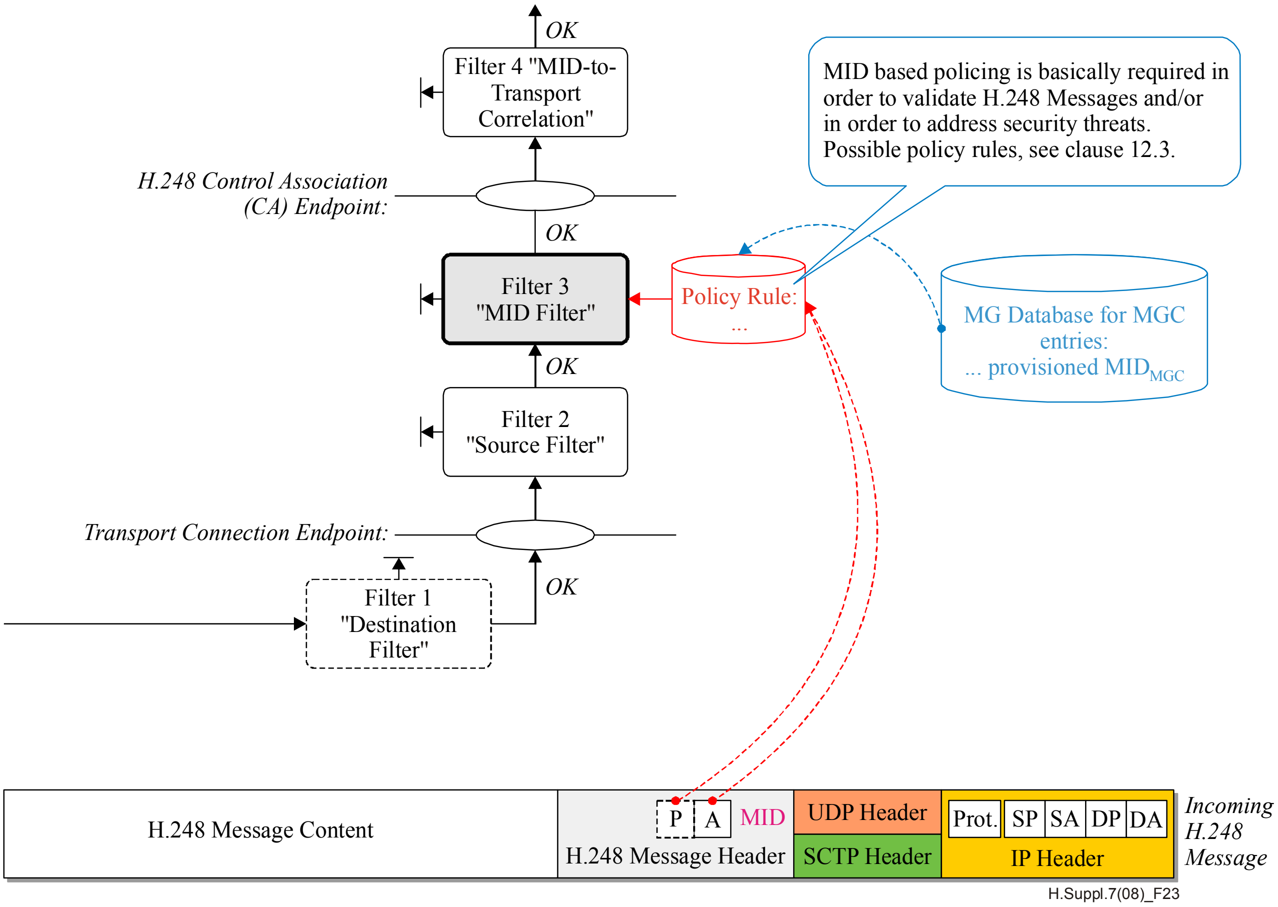

Figure 23 – Policing on MID information

12.3 MID Policing: filter rules, dependent on MID format and provisioned information

12.3.1 +Port/+Provisioned

Figure 24 shows the example of a port-based MID. The database contains also port information for the MGC entity. The filter condition may be then based on address/name information and port information.

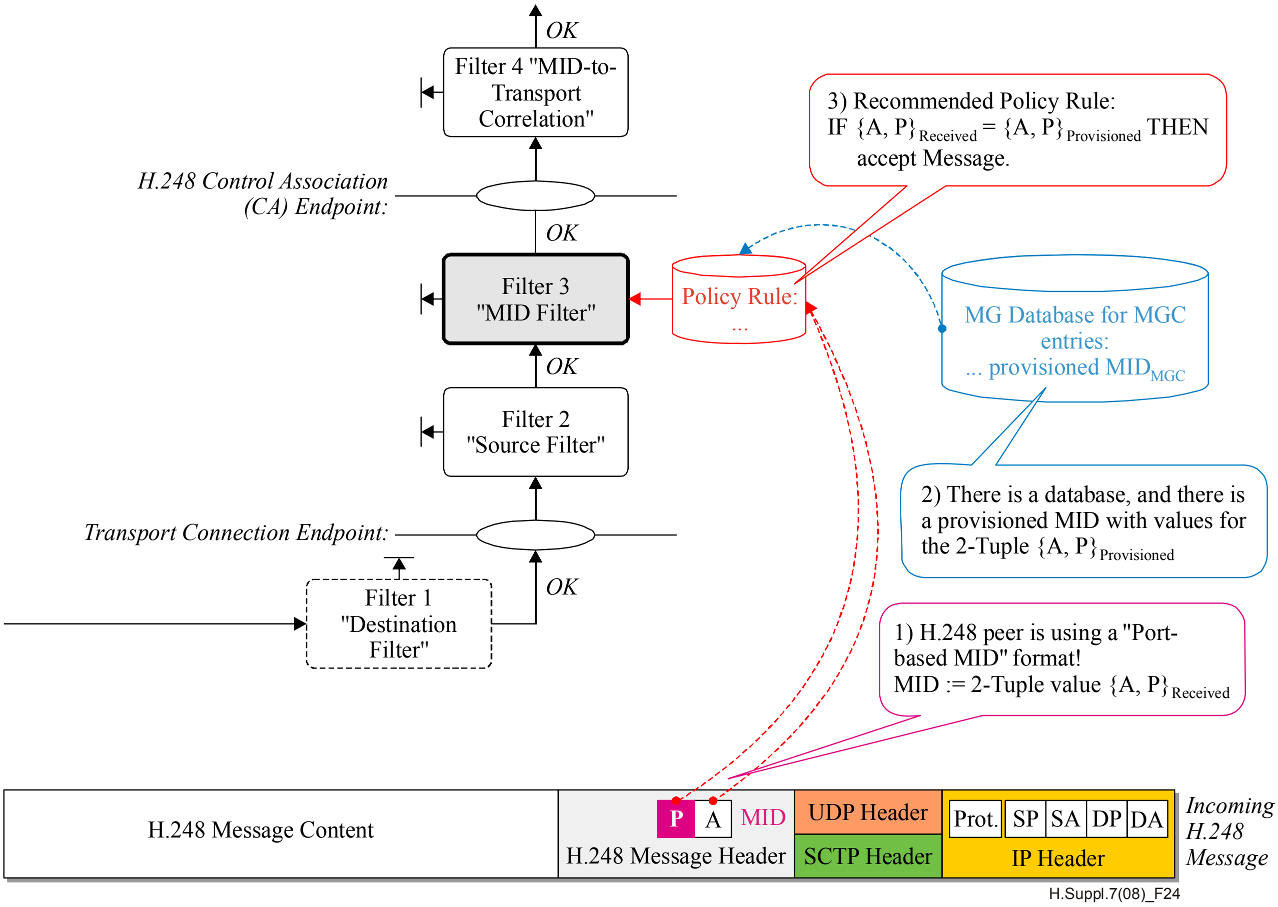

Figure 24 – Correlating received and stored MID information – Filter condition with port information

12.3.2 -Port/+Provisioned

Figure 25 illustrates the case when the port information is stored, but the received MID does not contain port information.

NOTE – It has to be clarified whether this case is compliant with H.248.1. The received MID is syntactically correct, the provisioned MID is syntactically correct, but both formats are different concerning "port information". Stringent implementation could reject the received H.248 message because the provisioned information should take precedence over the signalled information, in case of security concerns.

The MG could still apply a policy rule based on address/name information elements.

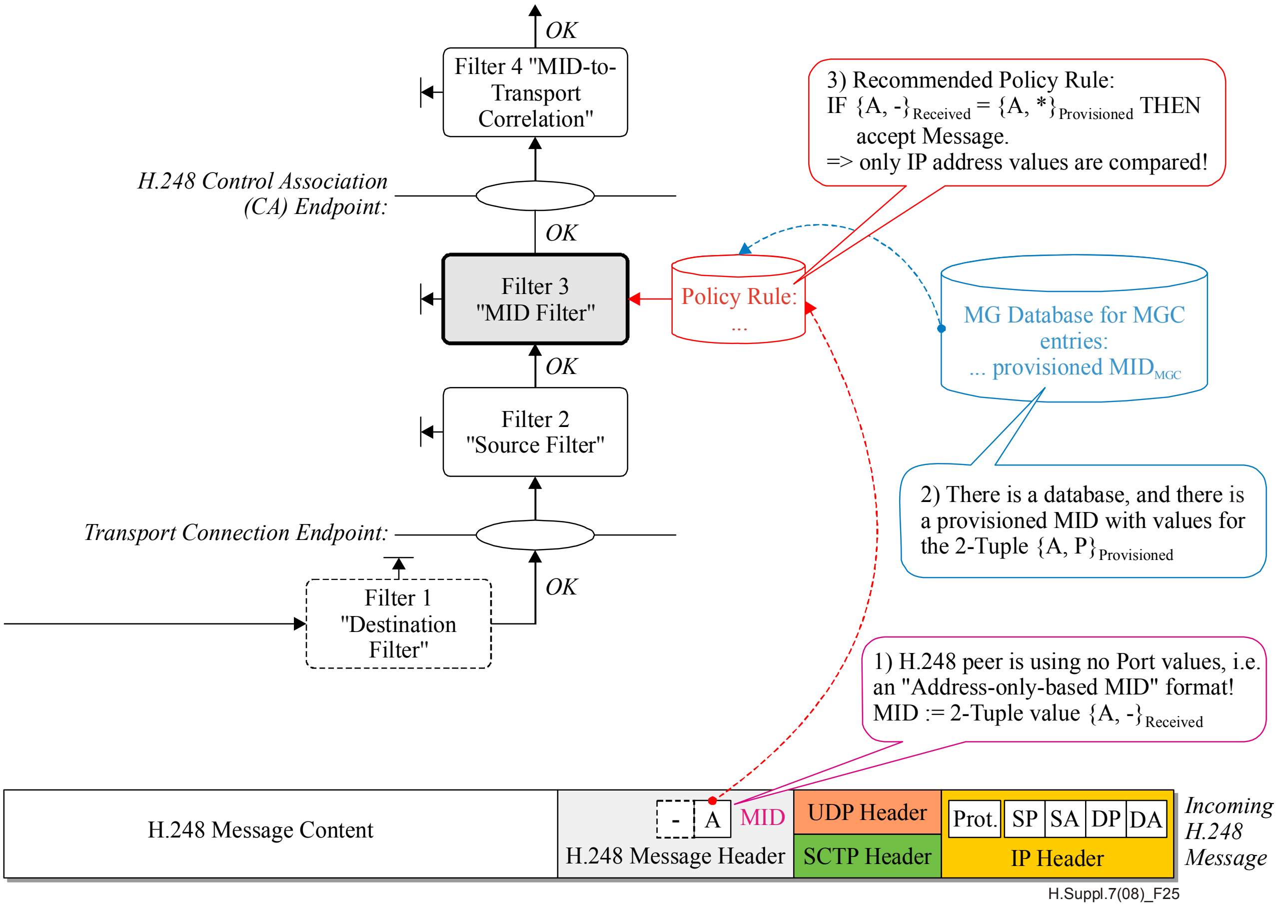

Figure 25 – Correlating received and stored MID information – No received port information

12.3.3 -Port/-Provisioned

Figure 26 illustrates the port-less MID case. Again, just a policy rule based on address/name information elements could be enforced.

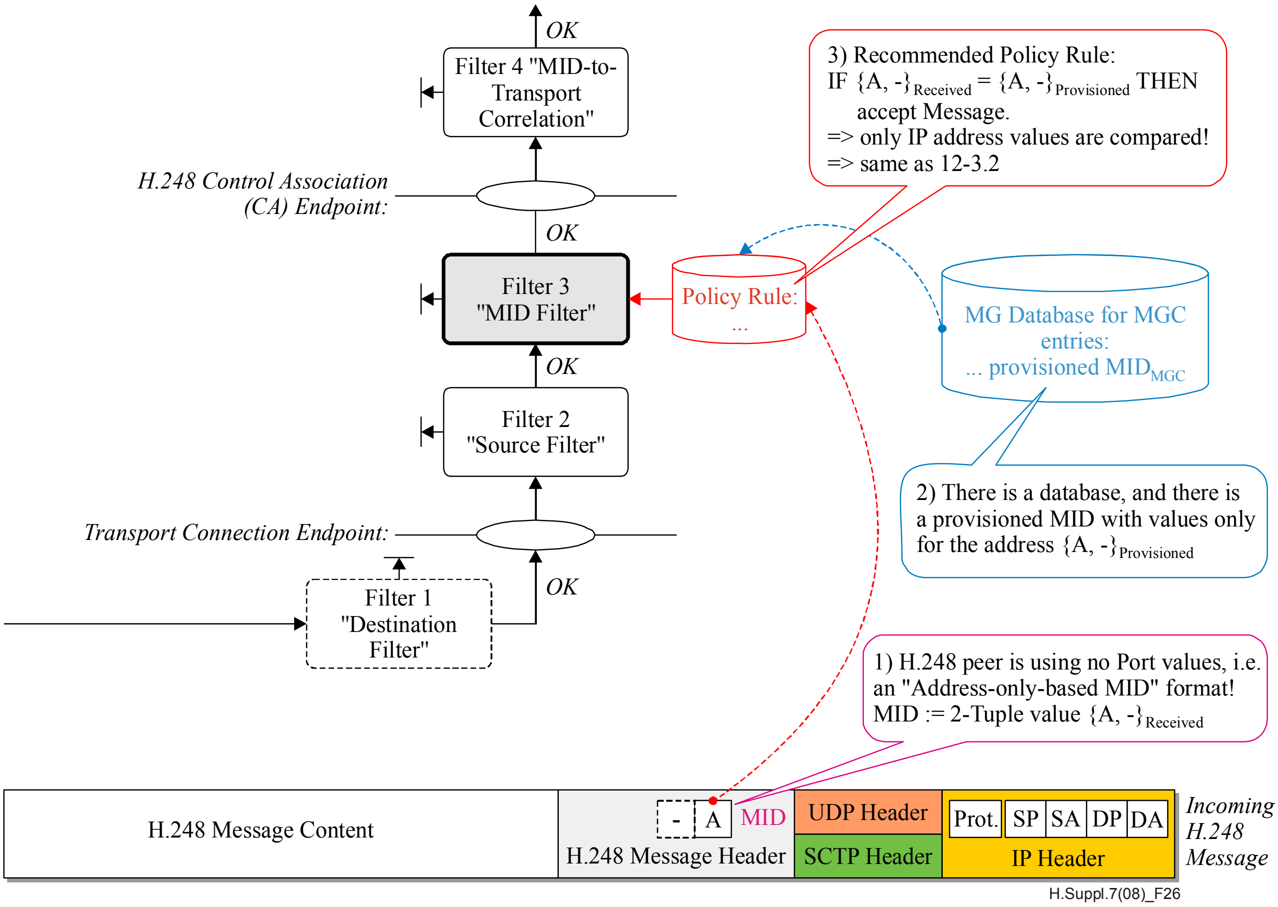

Figure 26 – Correlating received and stored MID information – Possible filter condition for port-less MID case

12.3.4 +Port/-Provisioned

Figure 27 depicts the case where the received MID contains port information, but the provisioned database is missing an explicit port value entry. However, there are still meaningful policy rules possible, due to the well-known port definitions for H.248.

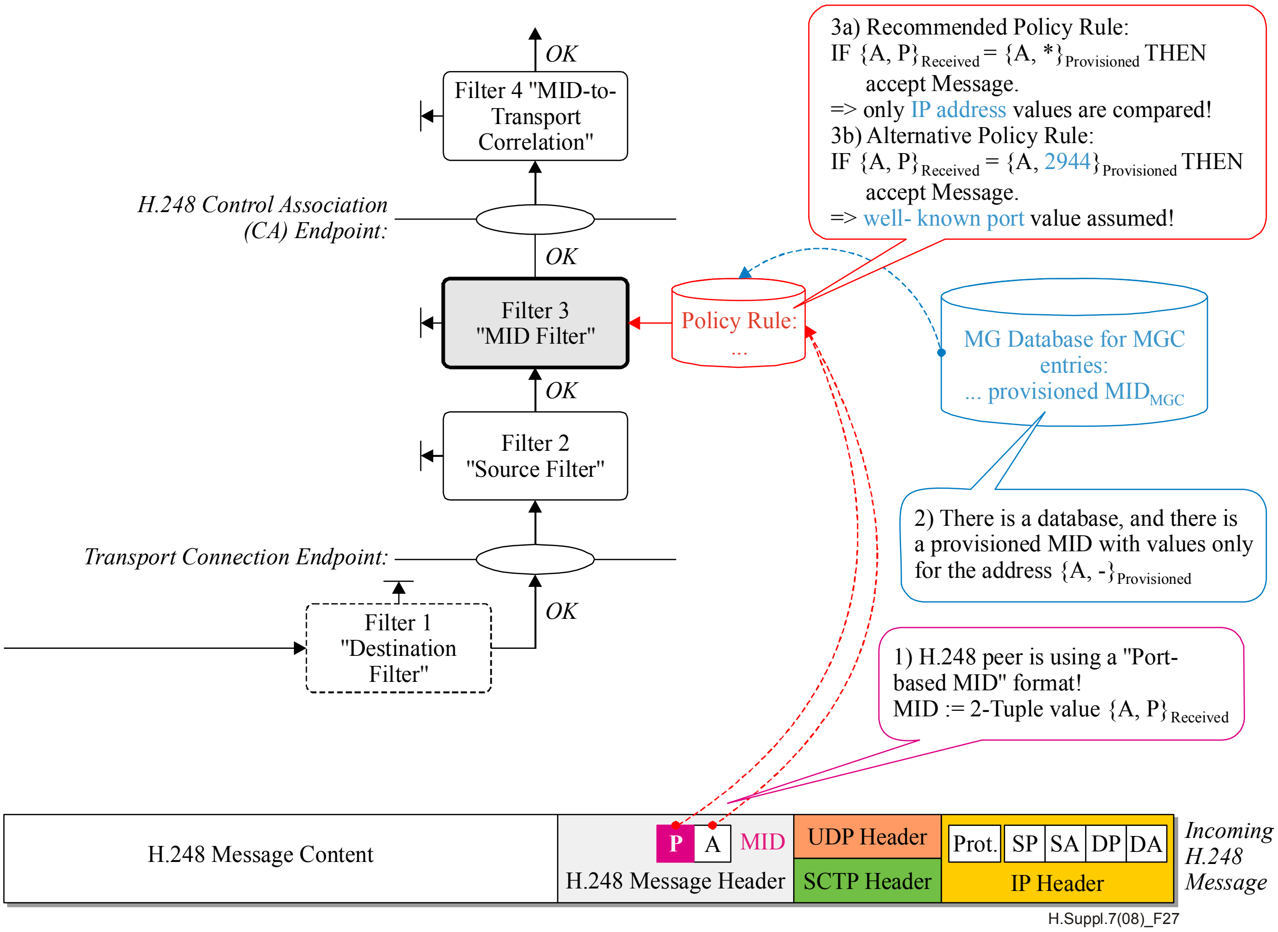

Figure 27 – Correlating received and stored MID information – Possible filter condition with well-known port information

12.3.5 No MG database

Figure 28 shows the case without MID policing due to the lack of a provisioned MG database of MGC entries. This might be a valid use case for fully secure H.248 domains without any secondary MGC entities.

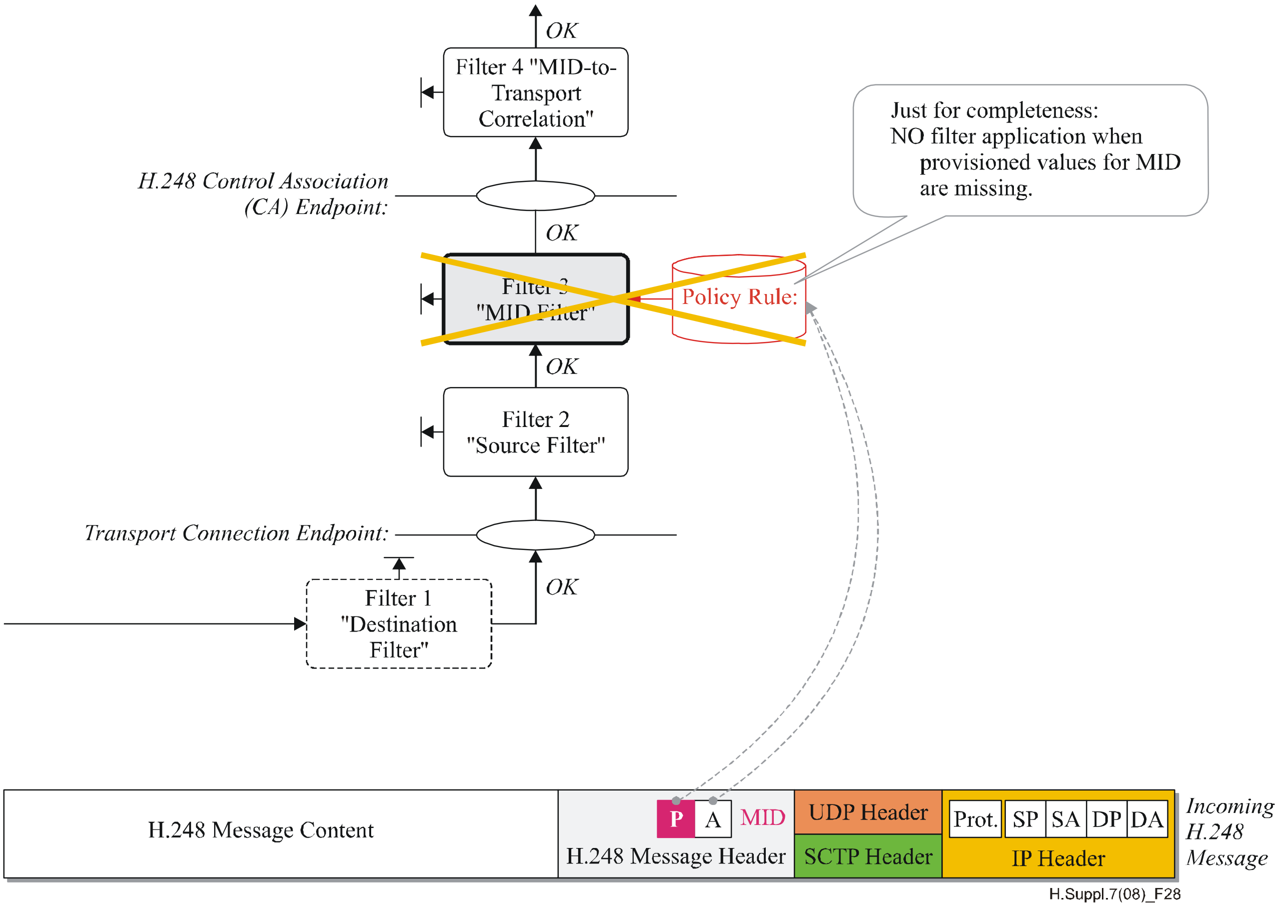

Figure 28 – Lack of provisioned database of MGC entries

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