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SERIES H: AUDIOVISUAL AND MULTIMEDIA SYSTEMS
Infrastructure of audiovisual services – Communication
procedures

**Gateway control protocol: Connection capability
control package**

ITU-T Recommendation H.248.46



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Gateway control protocol: Connection capability control package

Summary

MGCs and MGs employ different methods to control the MG internal connections. An MG may save transcoding resources by autonomously connecting the terminations in the same MG but different contexts directly to each other. However, in some special applications (e.g., test) this autonomous behaviour may not be desired. Not all MGs support this autonomous behaviour, nor do they all support terminations being connected internally. Such a mix of behaviour leads to interoperability issues.

This Recommendation contains a H.248 package to determine the MG internal connection capability and to set the appropriate MG internal connection behaviour where necessary.

Source

ITU-T Recommendation H.248.46 was approved on 13 January 2007 by ITU-T Study Group 16 (2005-2008) under the ITU-T Recommendation A.8 procedure.

FOREWORD

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ITU-T Recommendation H.248.46

Gateway control protocol: Connection capability control package

1 Scope

This Recommendation defines a package that allows a MGC to determine and control whether the MG allows the application of optimization mechanisms with regard to efficiency maximization of MG data-path resources, and/or optimization of QoS/performance metrics (e.g., MG transfer delay, speech quality, etc.), to the MG internal connection.

Dedicated MGC implementations may not resolve cascaded contexts, therefore would benefit from using this package to determine if MGs are capable of this behaviour. MG may then simplify the internal connection of intentionally created and connected contexts in series under strict control of the MGC.

The data path is the path that data flows from the ingress side to the egress side of the user plane which connects the two participants of a call. It is the MG's physical implementation of the abstract H.248 connection model. When the ingress and the egress are on the same MG, it is known as the "Internal connection".

This is illustrated in a 2-termination single context configuration, where termination A is a TDM termination with G.711 encoded and termination B is an IP/RTP termination G.723.1 encoded; the data path may include the following steps:

- 1) E1/T1 decoding (media stream taken from correct timeslot);
- 2) Transport conversion (e.g., TDM to packet);
- 3) G.711 decoding;
- 4) G.723.1 encoding;
- 5) RTP encoding;
- 6) IP packetization;
- 7) IP packet routing.

Such a configuration results when a TDM call is received on a MGC/MG and the destination of the call is on another MGC/MG, and the connection between these is IP based.

However, the data path in a MG is not constrained to a single context/termination configuration. If for example the TDM call is received and the destination (also TDM) of the call is on the same MG (a separate MGC may control this), then the data path will be extended as such:

- 1) E1/T1 decoding (media stream taken from correct timeslot);
- 2) Transport conversion (e.g., TDM to packet);
- 3) G.711 decoding;
- 4) G.723.1 encoding;
- 5) RTP encoding;
- 6) IP packetization;
- 7) IP packet routing;
- 8) IP packet reception;
- 9) IP un-packetization;
- 10) RTP decoding;
- 11) G.723.1 decoding;

- 12) G.711 encoding;
- 13) Transport conversion (e.g., packet to TDM);
- 14) E1/T1 encoding (media stream sent to correct timeslot).

The additional steps (8-14) are largely the inverse of the previous steps (1-7) and as such cancel each other out. In order to optimize the data path, the MG could perform step (1) and (14) and successfully have media flow between the originator and the destination of the call.

For each of these steps, the MG may have an internal means of addressing the function that performs the appropriate step. This is NOT the same address as any of those used by the H.248 connection model, but will be derived from the model. The MG can use these internal addresses to perform optimizations. The MG-internal connection optimization may be based on connection information given by termination/context data and/or other internal resource usage data, but do not require call related information like call control information from analog line signalling (Annex E.9 of [ITU-T H.248.1]) or channel associated signalling ([ITU-T H.248.25], [ITU-T H.248.28], [ITU-T H.248.29]) or DCME signalling ([ITU-T H.248.42]) or detected Digit strings (in case of enabled DigitMaps). That means for instance, MG-internal connection optimization is not using address information from call/session control signalling. However, it is not in the scope of this Recommendation to describe how the MG-internal data path is addressed or how this is derived from the H.248 connection model as these are MG implementation/hardware specific.

As the H.248 connection model does not directly operate on the data path but by abstraction, the MG is responsible for determining the optimization mechanisms that may be applied to the data path. As such this package is also applicable for terminations with associated bearer control protocols (BCP) like Q.2630.x signalling for AAL2 terminations or [ITU-T Q.1970]/[ITU-T Q.1990] for IP terminations. (Termination-associated) BCPs could for instance delay internal connection optimizations, but this package may be in general also applied for such kind of terminations.

In order to facilitate data-path optimization, this Recommendation defines a H.248 package in order to determine the MG internal connection capability and to set the appropriate MG internal connection behaviour (Notes 1 and 2). Whilst the properties of the package may apply to all termination types, the optimizations that can be performed are data-path dependent.

NOTE 1 – Only MG-internal connections are considered. That means that the only MG external connections loops that can be realized internally to the MG are optimized. Example of MG external connections loop: Context Cid1 with Tid1(type '\$') and Tid2(type 'IP') and 2nd context Cid2 with Tid3(type 'IP') and Tid4(type '\$'), and IP source/destinations addresses of Tid2 and Tid3 are so, that there would be an IP bearer connection between Tid2 and Tid3.

NOTE 2 – There are specific connection models with explicit internal terminations, e.g., cascaded context model according to clause 13.7.5 of [b-ETSI TS 123 205]. There are consequently MG internal connections established (there are three in the Multi-Party supplementary service example of [b-ETSI TS 123 205]). Such specific context models could benefit from this package, i.e., are also in the scope of this Recommendation.

This package may be used by physical MGs (PMG) which utilize the VMG concept. According to H.248.1 procedures, there is one control association between a MGC and VMG; thus the use of the package is for a single VMG instance. However there may be multiple MGCs controlling VMGs in a single PMG. In case of multiple VMGs, there may be a superior instance on the PMG level having knowledge about resource information and usage of all VMGs (instantiated on PMG). Such a function would be then associated with this package, but the function itself is out of scope of this Recommendation. In this case, data-path optimizations may occur across VMGs according to the internal connection capability and internal connection behaviour properties associated with each of the VMGs. For example, if a PMG discovers that a data path occurs across two of its VMGs and their associated contexts and these contexts are allowed to be optimized, then the PMG may optimize the path across both VMGs. However, if the contexts on one of the VMGs were marked that optimizations were not allowed then, only the path on the other VMG may be optimized.

Parallel operation of multiple profiles per PMG or VMG, with different support of this package in each profile, is principally possible, but MAY affect the degree of application of this package.

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] ITU-T Recommendation H.248.1 (2005), *Gateway control protocol: Version 3*.
- [ITU-T H.248.25] ITU-T Recommendation H.248.25 (2007), *Gateway control protocol: Basic CAS packages*.
- [ITU-T H.248.28] ITU-T Recommendation H.248.28 (2007), *Gateway control protocol: International CAS packages*.
- [ITU-T H.248.29] ITU-T Recommendation H.248.29 (2005), *Gateway control protocol: International CAS compelled register signalling packages*.
- [ITU-T H.248.42] ITU-T Recommendation H.248.42 (2006), *Gateway control protocol: DCME interworking package*.
- [ITU-T Q.1970] ITU-T Recommendation Q.1970 (2006), *BICC IP bearer control protocol*.
- [ITU-T Q.1990] ITU-T Recommendation Q.1990 (2001), *BICC bearer control tunnelling protocol*.

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

- 3.1.1 ADD.req** [ITU-T H.248.1]: H.248.1 Add command request
- 3.1.2 MOD.req** [ITU-T H.248.1]: H.248.1 Modify command request
- 3.1.3 MOV.req** [ITU-T H.248.1]: H.248.1 Move command request
- 3.1.4 AuditCapability.req** [ITU-T H.248.1]: H.248.1 AuditCapability command request
- 3.1.5 AuditCapability.rep** [ITU-T H.248.1]: H.248.1 AuditCapability command reply

3.2 Terms defined in this Recommendation

This Recommendation defines the following terms:

3.2.1 internal connection: The direct collection/linkage of resources in a MG between the ingress and the egress of a user plane data which connects the two participants of a call. An "internal connection" is there the intra-MG connection segment from an end-to-end (user plane) connection perspective.

3.2.2 autonomous behaviour: The ability of a MG to perform media/data path optimization for H.248 connections without the MGC performing optimizations of the media/data path through manipulation of the MG-internal H.248 connection configuration.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

AAL2	Asynchronous Transfer Mode (ATM) Adaptation Layer type 2
BCP	Bearer Control Protocol
Cid	Context Identifier
DCME	Digital Circuit Multiplication Equipment
DTMF	Dual-Tone Multi-Frequency
E1	Electrical interface signal, Level 1, (2.048 Mbit/s)
IP	Internet Protocol
MG	Media Gateway
MGC	Media Gateway Controller
PMG	Physical Media Gateway
QoS	Quality of Service
RTP	Real-time Transport Protocol
T1	Digital Signal Level 1 at 1544 kbit/s
TDM	Time Division Multiplexing
Tid	Termination Identifier
VMG	Virtual Media Gateway

5 Convention

None.

6 Termination connection model package

Package name:	Connection capability control package
Package ID:	ccc, 0x00ad
Description:	This package defines properties for determining the internal connection capability on a particular MG. Once the connection capability is determined, the MGC may utilize the appropriate control method.
Version:	1
Extends:	None

6.1 Properties

6.1.1 Connection capability

Property name:	Connection capability
Property ID:	cc, 0x0001
Description:	This property indicates the MG's internal connection capability.
Type:	Enumeration

Possible values: "*Controlled*" which indicates the internal connection is determined and controlled by the MGC.
"*Autonomous*" which indicates the internal connection is determined and controlled by the MG.
"*Invalid*" which indicates the internal connection is non-supported by the MG.

Default: Provisioned

Defined in: TerminationState and only for Root Termination

Characteristics: ReadOnly

6.1.2 Enable autonomy

Property name: Enable autonomy

Property ID: ea, 0x0002

Description: Where autonomous internal connection is supported by the MG, this property enables or disables this autonomous capability.

Type: Boolean

Possible values: "*On*" which to enable the autonomous internal connection capability.
"*Off*" which to disable the autonomous internal connection capability.

Default: "*On*"

Defined in: ContextAttribute

NOTE – The property is defined on context level in order to respect different call types.

Characteristics: Read/Write

6.2 Events

None.

6.3 Signals

None.

6.4 Statistics

None.

6.5 Error codes

None.

6.6 Procedures

6.6.1 General

When a 2-party-call is routed through a network at each MGC, the call is routed through a context with two terminations created in the corresponding MG. This can result in chains of MGs (contexts) being connected. However, situations exist where one PMG may contain two or more contexts involved in the call. This may lead to various MG internal connection architectures. For example:

- 1) **Controlled model:** The MGC determines that the caller side and the callee side are in the same MG and directly requests the MG to add the two terminations into one context, as follows:

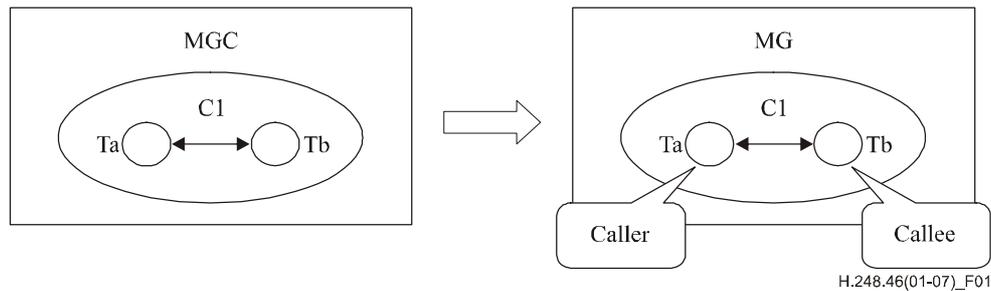


Figure 1 – Controlled model

- 2) **Autonomous model:** The MGC does not determine whether the caller side and the callee side are in the same MG. The MGC requests the MG to create a context for caller and the callee respectively, i.e., two contexts (one per call leg) and each context contains two terminations. The MG then determines that these two contexts are in the same MG and directly connects the two subscriber terminations (caller side and callee side), as follows:

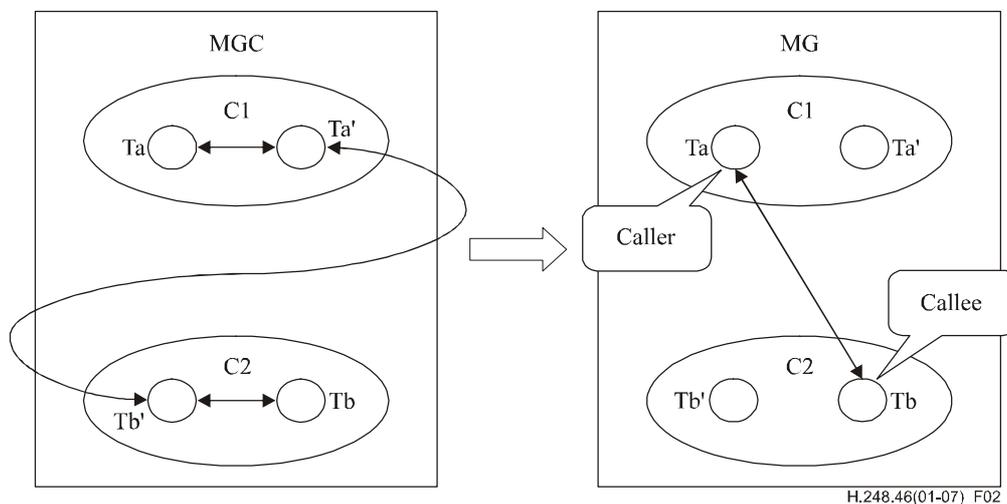


Figure 2 – Autonomous model

- 3) **Invalid model:** The MG cannot support the direct connection in a MG between the ingress and the egress of a user plane data which connects the two participants of a call (i.e., internal connection). In Figure 2, the data flowing between Ta' and Tb' would be routed externally to the MG. The MG would send the data and then later receive the data.

To determine the connection model that a MG supports, the MGC should perform a H.248 AuditCapability.req command on the MG's root termination, with property *connection capability* (*cc*) to determine the internal connection capabilities. It is expected that the MG will be provisioned with the internal connection capabilities it supports. The reply is given in an AuditCapability.rep. The MG may return both "Controlled" and/or "Autonomous" if the internal connection is supported, or "Invalid" if the internal connection is non-supported. The value "Invalid" shall not be returned in combination with "Controlled" or "Autonomous" (or both).

Based on the results of this audit, the MGC should consider this information and the application requirements and then decide which connection model it shall use. For example, for a test call where measurements are being taken, it may be decided not to optimize the internal connection, in times of high MG resource utilization the MGC may decide to optimize internal connections and for legal intercept calls, optimization may be turned off. If the MGC takes advantage of the Autonomous model, it may subsequently decide on a per call basis to disable the MG's autonomous internal connection capability. If the MGC wishes to disable the autonomous connection capability, it shall send the *enable autonomy* (*ea*) property to the MG indicating "Off" in an ADD.req, MOD.req or MOV.req. This will have the effect of turning off the autonomous internal connection capability when providing for such special applications as loop-back test.

6.6.2 Statistic descriptor interaction

The use of statistics should be an input into the MG decision to optimize the data path. For example:

In the case of connecting Context 1 {Termination A(TDM[b-ITU-T G.711]), Termination B (IP[b-ITU-T G.723.1])} to Context 2 { Termination C(IP[b-ITU-T G.723.1]), Termination D(TDM[b-ITU-T G.711])}.

If the Network package statistics were placed on the TDM terminations, the MG could still optimize the data path by effectively removing the IP segments. However, in the case that the RTP statistics were requested for the IP terminations, then the data path MAY not be fully optimized. MAY is used as for instance when the MG could be intelligent enough not to perform transcoding between G.723.1 and G.711 but use RTP to transfer packets. Another solution MAY be that the MGC could accept the RTP statistics unchanged or ineffectual if the MG removes the IP segments.

The general rule is if the MG cannot provide the statistic values, then the data path resource should not be optimized. If the MGC does require no optimization, then the *enable autonomy* (*ea*) property shall be set to "Off".

6.6.3 Event descriptor interaction

The setting of events should be an input into the MG decision to optimize the data path. The general rule is that the resource used to detect a set event should not be optimized out of the data path. There are exceptions where due to a data-path optimization a set event becomes superfluous, in these cases the event may be optimized out of the data path.

For example: Given a TDM1-RTP1-RTP2-TDM2 connection scenario. If the Quality Alert Event (clause E.11.2.2 of [ITU-T H.248.1]) is set on RTP1, then the data path for RTP1 and RTP2 may be optimized because if the RTP segment is removed the Quality Alert Event would never be reported because there would never be a low quality connection. However, if DTMF tone detection (clause E.6 of [ITU-T H.248.1]) is set on RTP1, then the data path could not be optimized because the MGC would be expecting the MG to detect DTMF digits and if this was optimized out then digits sent from the RTP2/TDM2 would be missed.

If the MGC does require no optimization, then the *enable autonomy* (*ea*) property shall be set to "Off".

6.6.4 Topology descriptor interaction

The package may be in principle also applied for contexts using the topology descriptor. When the MGC performs a topology request, it shall also set *enable autonomy (ea)* property to "Off". This is to minimize data-path optimization interactions.

6.6.5 Command interaction

If the data path has been optimized, a subsequent Modify or Move command may introduce a new resource that may need to be included into the data path. In this case, the MG should determine whether the optimized data path can be retained with this new resource or an "un-optimized" path needs to be created in order to be inserted. A Modify or Move command may also remove a resource from the data path. Again the MG should determine whether the removal of the resource affects the data path. For instance: if the resource has already been optimized out then there may be no impact; however, in some cases such as the removal of a termination may remove resources already optimized but it also removes a connection. In the case of a Move command optimization should be applied to the new context according to the *enable autonomy (ea)* property.

Bibliography

- [b-ITU-T G.711] ITU-T Recommendation G.711 (1988), *Pulse code modulation (PCM) of voice frequencies.*
- [b-ITU-T G.723.1] ITU-T Recommendation G.723.1 (2006), *Dual rate speech coder for multimedia communications transmitting at 5.3 and 6.3 kbit/s.*
- [b-ETSI TS 123 205] ETSI TS 123 205 v6.7.0 Release 6 (2006), *Technical Specification Group Core Network; Bearer Independent CS Core Network; Stage 2.*

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