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SERIES H: AUDIOVISUAL AND MULTIMEDIA SYSTEMS

Infrastructure of audiovisual services – Communication procedures

Gateway control protocol: Adaptive jitter buffer package

ITU-T Recommendation H.248.31

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ITU-T Recommendation H.248.31

Gateway control protocol: Adaptive jitter buffer package

Summary

This Recommendation defines a package that allows the media gateway controller (MGC) to specify the nominal value and the minimum value of the adaptive jitter buffer on the media gateway (MG). This package allows the MGC to specify adaptive jitter buffer value settings on a particular stream at any time throughout a call, and it allows the MGC to enable or disable the use of a jitter buffer. In addition, the package contains a set of jitter buffer metrics that are consistent with those described in IETF RFC 3611, RTP Control Protocol Extended Reports (RTCP XR). These jitter buffer metrics may be used, for example, with voice over IP, video, and audio. The package should be used in combination with the base network package that defines the maximum value for the jitter buffer. An adaptive jitter buffer (AJB) is characterized by these minimum, maximum, and nominal values.

The AJB functions in a MG to smooth the play out of packets arriving at the MG. As the packet arrival delay varies during the course of the transmission, the jitter buffer adapts using the minimum, maximum, and nominal values to control the adaptation. Real time media requirements are stringent and, for that reason, it is important to set the jitter buffer values to their optimal setting as early on the call as possible since a jitter buffer that is too large will introduce unnecessary bearer delay, which has a negative impact on real time media quality, and a jitter buffer that is too small will prevent a smooth play out (packet loss, another negative impact). The proper jitter buffer size is the balance between delay and packet loss. The distortion that the media receiver would otherwise observe is eliminated with the AJB.

Source

ITU-T Recommendation H.248.31 was approved on 22 April 2004 by ITU-T Study Group 16 (2001-2004) under the ITU-T Recommendation A.8 procedure.

FOREWORD

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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, implementors are cautioned that this may not represent the latest information and are therefore strongly urged to consult the TSB patent database.

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ITU-T Recommendation H.248.31

Gateway control protocol: Adaptive jitter buffer package

1 Scope

This Recommendation defines a package that allows the media gateway controller (MGC) to specify the nominal value and the minimum value of the adaptive jitter buffer on the media gateway (MG). This package allows the MGC to specify adaptive jitter buffer value settings on a particular stream at any time throughout a call, and it allows the MGC to enable or disable the use of a jitter buffer. In addition, the package contains a set of jitter buffer metrics that are consistent with those described in IETF RFC 3611, RTP Control Protocol Extended Reports (RTCP XR). These jitter buffer metrics may be used, for example, with voice over IP, video, and audio. The package should be used in combination with the base network package that defines the maximum value for the jitter buffer. An adaptive jitter buffer (AJB) is characterized by these minimum, maximum, and nominal values.

The MGC will be able to determine more meaningful values for the adaptive jitter buffer as in a majority of cases the MGC will have the knowledge of: the network architecture, the number of contexts involved in a single call, the packet networks between contexts in a call, the characteristics of the packet delay variations, etc. This, in turn, will optimize the real time media quality and end-to-end delay of a call. Each packet can encounter a different amount of delay when traversing from end-to-end. Although the variation is somewhat random, its variance depends on the network topology. For example, the greater the number of hops and the longer the distance required to make the packet transmission, the more delay is expected to get through the network and the more variance in the delay. If the MGC has knowledge of the network topology, it can adjust the jitter buffer parameters accordingly. In the case of multiple MGCs being involved in an end-to-end call, each individual MGC will be responsible for determining the appropriate jitter buffer value(s) based on its own knowledge.

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 Recommendation H.248.1 (2002), *Gateway control protocol: Version 2*.

– IETF RFC 3611 (2003), *RTP Control Protocol Extended Reports (RTCP XR)*.

3 Definitions

N/A

4 Abbreviations

This Recommendation uses the following abbreviations:

AJB Adaptive Jitter Buffer

EPH Ephemeral

IP	Internet Protocol
MG	Media Gateway
MGC	Media Gateway Controller
RTCP	RTP Control Protocol
RTCP XR	RTCP Extended Reports
RTP	Real-time Transfer Protocol
TDM	Time Division Multiplex (Network)
VoIP	Voice over IP

5 Conventions

5.1 Convention for Termination Identifiers in this Recommendation

E_x: This refers to an Ephemeral Termination Identifier.

T_x: This refers to a TDM (Physical) Termination Identifier.

Where "x" is an alphanumeric value (e.g., O (originating), T (terminating), s (send), r (receive), s2, r2, 1, 2, 3).

These are set to distinguish the different terminations within the diagram.

5.2 Convention for Context Identifiers in this Recommendation

Cy: This refers to an H.248 Context Identifier.

Where "y" is an alphanumeric value.

6 Adaptive Jitter Buffer Package

PackageID: ajb (0x007a)

Version: 1

Extends: nt (0x000b) version 1

This package extends the base Network Package and allows the media gateway controller (MGC) to specify the nominal value and the minimum value of the adaptive jitter buffer on a stream in the media gateway (MG). The package also provides the ability to enable/disable a jitter buffer, and it defines properties to report extended jitter buffer metrics.

6.1 Properties

6.1.1 Minimum Jitter Buffer

PropertyID: jitmin (0x0008)

Description:

This property sets the minimum size of the adaptive jitter buffer.

Type: Integer

Possible Values: Any integral number of milliseconds greater than or equal to zero

Defined In: LocalControlDescriptor

Characteristics: Read/Write

6.1.2 Nominal Jitter Buffer

PropertyID: jitnom (0x0009)

Description:

This property sets the nominal size of the adaptive jitter buffer.

Type: Integer

Possible Values: Any integral number of milliseconds greater than or equal to zero.

Defined In: LocalControlDescriptor

Characteristics: Read/Write

6.1.3 Enable Jitter Buffer

PropertyID: enabjb (0x000a)

Description:

It enables/disables a jitter buffer. The type of jitter buffer enabled is indicated with *Jitter Buffer Type (0x000b)*. If disabled, no jitter buffer is inserted.

Type: Boolean

Possible values: on/off

Defined In: LocalControlDescriptor

Characteristics: Read/Write

6.1.4 Jitter Buffer Type

PropertyID: type (0x000b)

Description:

Indicates the jitter buffer type. When the jitter buffer is adaptive, then its size is being dynamically adjusted to deal with varying levels of jitter. When non-adaptive, the jitter buffer size is maintained at a fixed level.

Type: Enumeration

Possible values: "NO" (0x0000) No Jitter Buffer (Default)

"N" (0x0001) Non-adaptive

"A" (0x0002) Adaptive

Defined In: LocalControlDescriptor

Characteristics: Read/Write

6.1.5 Current Jitter Buffer

PropertyID: jitcur (0x000c)

Description:

This property is used to obtain the current jitter buffer size at the media gateway.

Type: Integer

Possible Values: Any integral number of milliseconds greater than or equal to zero

Defined In: LocalControlDescriptor

Characteristics: Read Only

6.1.6 Adaptation Rate

PropertyID: ar (0x000d)

Description:

The adaptation rate for the adaptive jitter buffer. This is defined as the time taken in milliseconds adjusting to a step from 30 ms to 100 ms in peak-to-peak jitter divided by twice the frame size in milliseconds. This property does not apply to non-adaptive jitter buffers and shall be 0 if the jitter buffer type is set to non-adaptive.

Type: Integer

Possible values: Any integral number greater than or equal to zero

Defined In: LocalControlDescriptor

Characteristics: Read Only

6.2 Events

None.

6.3 Signals

None.

6.4 Statistics

None.

6.5 Procedures

A jitter buffer is inserted to smooth out the delay variance that real time media packets may experience through packet transport network(s). Large jitter buffers enable a GW to tolerate longer delay variance and minimize packet loss introduced by delay. However, larger jitter buffers also introduce bearer delay, which has a negative impact on real time media quality. Therefore, it is important to optimize the insertion of jitter buffers. The nominal value is a default system value that is used at the beginning of a call. In the case of adaptive jitter buffers, the media gateway will adjust the size of the jitter buffer dynamically during the call based on the packet delay variation. To optimize the delay and packet loss, it is necessary to specify the minimum, maximum, and/or nominal values of the adaptive jitter buffer based on the known network topology of each individual call.

The absolute maximum jitter buffer size and the absolute minimum jitter buffer size capabilities of the media gateway may be obtained through use of AuditCapabilities of the maximum jitter buffer property *jit (0x0007)* and the minimum jitter buffer property *jitmin (0x0008)*. The current jitter buffer size in use may be obtained through use of AuditValue of the current jitter buffer property *jitcur (0x000c)*. AuditValue of the maximum jitter buffer property *jit (0x0007)* and the minimum jitter buffer property *jitmin (0x0008)* will provide the current maximum and minimum jitter buffer size values.

When this package is implemented, the MGC is able to, on a per stream basis:

- enable or disable the use of a jitter buffer;
- specify the type of jitter buffer to be enabled;
- for an adaptive jitter buffer, set the minimum and nominal jitter buffer values along with the maximum jitter buffer value (as described in the Network Package);
- for a static jitter buffer, the existing maximum jitter buffer property *jit* (as described in the Network Package) is used to set the jitter buffer value; and

- audit the MGW for VoIP jitter buffer metrics.

The initial jitter buffer values may be set on a stream. In the case of adaptive jitter buffers, the MG would then *adapt* the jitter buffer based on buffer occupancy, packet arrival time, etc. Additionally the MGC has the flexibility to change these values during the course of the call if it deemed this as a beneficial to the whole system.

The MGC has knowledge of the different contexts involved in a single call. Given this knowledge, along with other information such as the network architecture, etc., the MGC is able to set more meaningful values for the involved jitter buffers.

For example, when a call involves two contexts on the same MG (as shown in Figure 1), the jitter buffers will be set with lower minimum, maximum and nominal values than a call that involves two contexts, each in a separate MG (as shown in Figure 2).

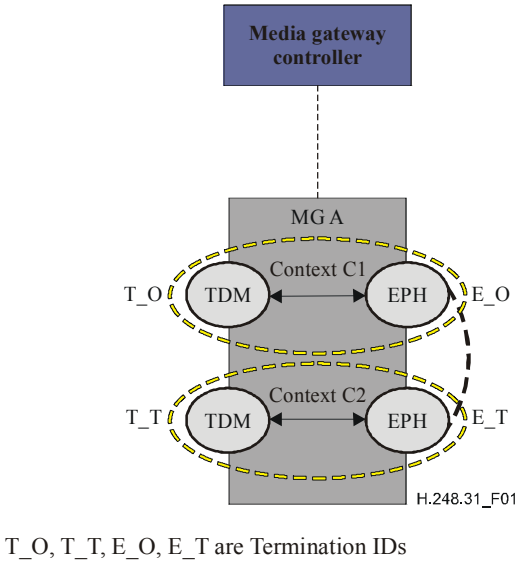


Figure 1/H.248.31 – Two contexts in a single MG

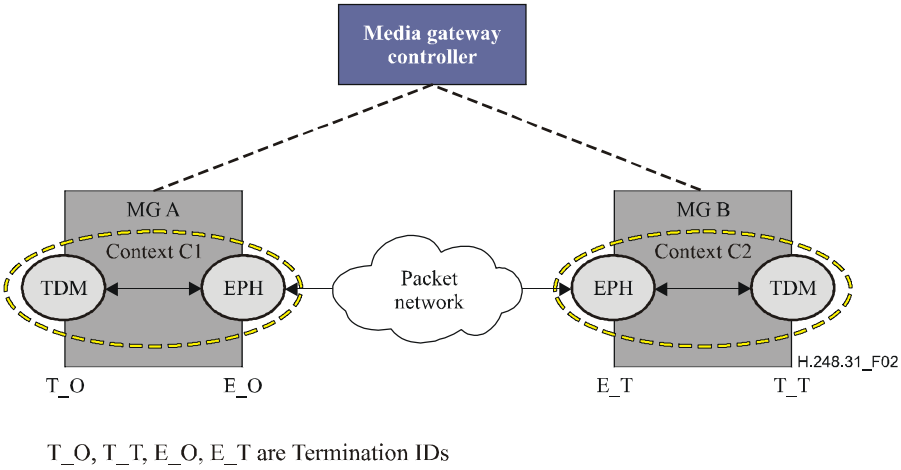
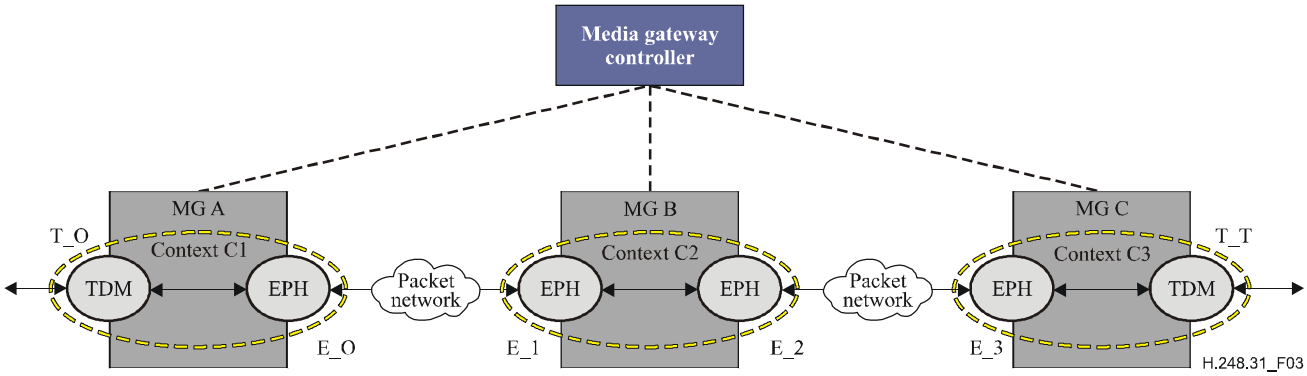


Figure 2/H.248.31 – Two contexts in separate MGs

If a call traverses more than two MGs (refer to Figure 3), it might be desired to have different jitter buffer values (min/nominal/max) at each of the MGs depending on, for example, whether most of the jitter buffer is decided to be inserted at the end MGs (MG A and MG C), or if alternatively additional jitter buffer insertion is desired in the 'middle' MG (MG B). In this particular case, the

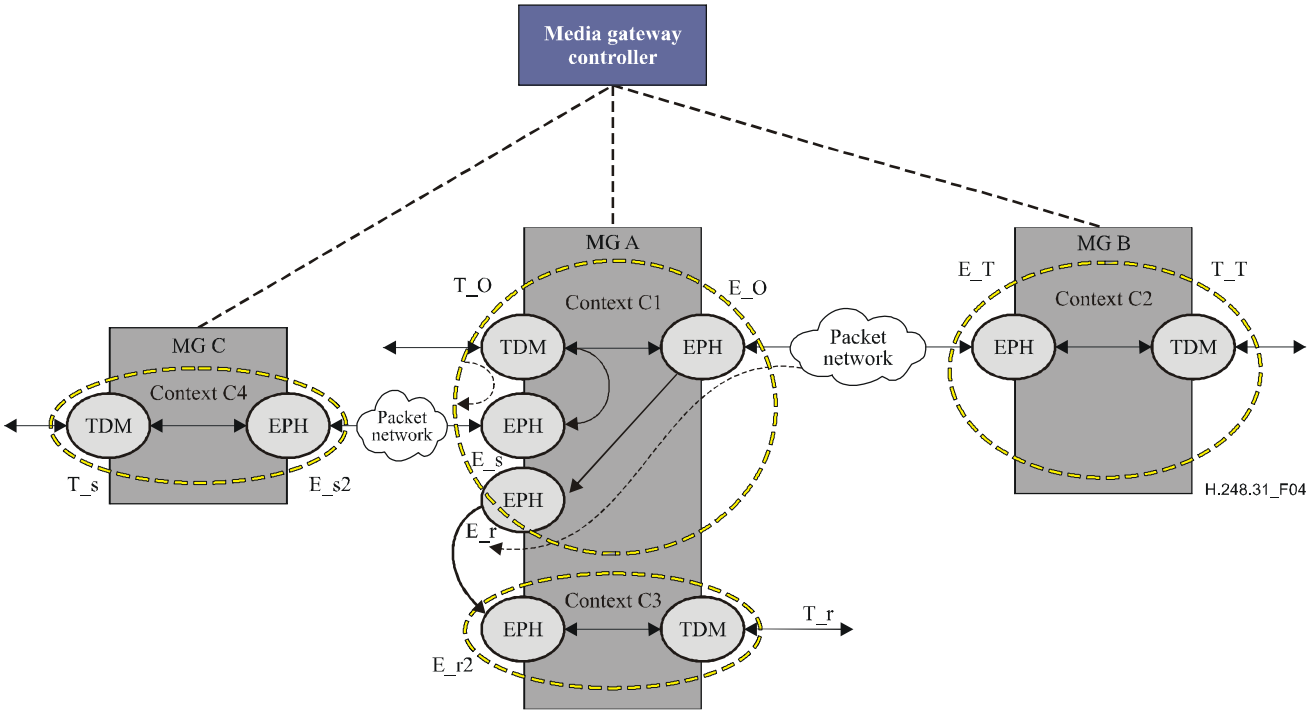
MGC is the only network element capable of knowing that more than two MGs are involved in a call and, therefore, it is the only intelligent element in the network that will be able to set different jitter buffer sizes in the appropriate contexts. Additionally, the jitter buffer values will also depend on the delay variance introduced by the packet network that is being traversed.



T_O, E_O, E_1, E_2, E_3, T_T are Termination IDs

Figure 3/H.248.31 – Call traversing three MGs

The insertion of jitter buffer would be on a per stream basis. A termination may have more than one stream, so a context may be a multi-stream context. Multiple terminations in a context (refer to Figure 4), and the streams associated with each termination, might require different jitter buffer settings depending on the end-to-end path in which that termination is involved in as well as the jitter buffers already present in that path.



T_O, T_T, T_r, T_s, E_s, E_s2, E_r, E_r2, E_0, E_T are Termination IDs

Figure 4/H.248.31 – Call traversing multiple MGs, with an MG having multiple terminations in a context

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