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Infrastructure of audiovisual services – Communication procedures

Gateway control protocol: Resource management packages

Recommendation ITU-T H.248.63

ITU-T H-SERIES RECOMMENDATIONS

AUDIOVISUAL AND MULTIMEDIA SYSTEMS

For further details, please refer to the list of ITU-T Recommendations.

Recommendation ITU-T H.248.63

Gateway control protocol: Resource management packages

Summary

Recommendation ITU-T H.248.63 contains packages that allow a media gateway controller (MGC) and media gateway (MG) to work together to allow a MG to manage its resources in the most efficient manner possible. It allows the MGC to indicate which resources may be used in the Context and whether the use of certain resources will change or not for the life of the Termination/Stream. The MG can then use this information to optimize the allocation and use of resources.

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Gateway control protocol: Resource management packages

1 Scope

This Recommendation contains packages that allow a media gateway controller (MGC) and a media gateway (MG) to work together to allow the MG to manage its resources in the most efficient manner possible. Three approaches are defined: rules-based, configuration, and abstract.

In the rules-based approach, the MG expects the MGC to behave in a particular manner in order to manage resources. For example, the MG may expect that, for optimal resource allocation, once a stream is assigned to a particular media (e.g., audio), it will not change it to another media (e.g., video).

In the configuration approach, the MGC indicates the expected characteristics of the Context in terms of the actual resources required. This could be a number of a particular type of Termination. For example, the MGC could indicate that for a particular Context, it may have up to five receive-only Terminations.

An "abstract" approach is also provided, whereby the MGC indicates a specific resource management requirement via a single codepoint which then relates directly to a particular H.248 configuration. For example, the MGC could indicate "conference listener" and this would then map directly to a send-only Termination configuration and to a particular type of audio codec.

The description of MG internal resource structures is out of scope of this Recommendation.

This Recommendation assumes that the MGC is responsible for determining for how long the resources are reserved, and thus is responsible for requesting and clearing the resources. This is in keeping with the H.248 LocalControl descriptor ReserveGroup/ReserveValue functionality.

2 References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published. The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation.

[ITU-T H.248.1]   Recommendation ITU-T H.248.1 (2005), *Gateway Control Protocol: Version 3*.

[ITU-T H.248.19]   Recommendation ITU-T H.248.19 (2004), *Gateway control protocol: Decomposed multipoint control unit, audio, video and data conferencing packages.*

[ITU-T H.248.32]   Recommendation ITU-T H.248.32 (2005), *Gateway control protocol: Detailed congestion reporting package*.

[ITU-T H.248.39]   Recommendation ITU-T H.248.39 (2006), *Gateway control protocol: H.248 SDP parameter identification and wildcarding*.

[ITU-T H.248.46]   Recommendation ITU-T H.248.46 (2007), *Gateway control protocol: Connection capability control package*.

3 Definitions

3.1 Terms defined elsewhere

None.

3.2 Terms defined in this Recommendation

This Recommendation defines the following terms:

3.2.1 MG resource: This is a generic term that describes physical or logical entities in a MG used by the MG to perform a certain function. These resources could be but are not limited to processor resources, memory resources, system resources, and digital signal processor resources.

3.2.2 resource management rule: This is a generic term to describe a set of procedures/H.248 actions that a MG expects a MGC to adopt in order to optimize resources. The terms "rule" or "rules" are used in this Recommendation to mean "Resource Management Rule".

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

ABNF   Augmented Backus-Naur Form

AMR   Adaptive Multi-Rate

ASN.1   Abstract Syntax Notation One

BHCoA   Busy Hour Context Attempts

Cxt   Context

MG   Media Gateway

MGC   Media Gateway Controller

Tid   Termination Identifier

5 Conventions

None.

6 Resource management interactions

A MG only has a finite set of resources that may be committed in order to satisfy requests from its MGC. In some instances, the use of resource management mechanisms provides a means for the MG to optimize how it assigns and uses resources. How the MG actually assigns physical resources at the time of the request may result in poor performance as resources are being held without being used. This may limit the number of MGC requests that can be satisfied. In some usage scenarios, the resource availability may be reduced if implementations reserve resources in advance of their use in order to ensure they are available for a given call. This would particularly occur where such resources are dimensioned based on a pooling or timeshare concept. Therefore, the balance between reservation and availability should also be considered. As such, the use of the packages in this Recommendation does not negate the need for correct network dimensioning. When dimensioning a network, the type of calls and their percentage of the overall traffic need to be taken into account. However, the proper usage of the packages in this Recommendation leads to better resource availability allowing certain services to be more reliable.

In packages using a rules-based approach (i.e., Resource Management Rules package, *rmr*) in conjunction with network dimensioning, the MG can optimize its resource allocation/usage according to the specified rule.

In packages using a configuration approach (i.e., Resource Management Configuration package, *rmc*), the MG receives an indication of what resources are likely to be used for a particular Context. When combined with dimensioning, it allows the MG to optimize the resource availability pools. The configuration approach can be applied at any time during call establishment. Thus, the configuration applied may be based on a particular service. Indicating resources at call establishment is unlikely to have a detrimental effect on available resources because, if there are any unused resources, they may be cleared when the call/session reaches a steady state. In cases where the steady state may be determined and the resources may be freed, if used correctly, the packages will have little detrimental effect on pooling or dimensioning, and will enhance resource availability for a particular connection. In other cases, the use of the packages needs to be considered against potential pooling or dimensioning issues as it may lead to an increase in the utilization of the resources.

In packages using an abstraction approach (i.e., Abstract Resource Management package, *arm*), an indication is used to describe a general set of behaviour. This is used to allow the MG to optimize resources based on a certain service need. Given that [ITU-T H.248.1] already permits a level of detachment from the MGC call level service description and of the implementation of resources in the MG, the abstraction codepoints are accompanied by a "Resource mapping Description" and "Procedures" to ensure that the usage is clear.

The packages in this Recommendation assume the MG uses the information in the packages to optimize its resource allocation and processing. It is assumed that the MG will only commit physical resources when descriptors of the H.248 commands indicate so. As a result, Context priority handling procedures should not be modified as a result of the packages in this Recommendation.

6.1 Interaction with related H.248 Recommendations

6.1.1 Core gateway control protocol (H.248.1)

The [ITU-T H.248.1] protocol has resource reservation capabilities defined in its core behaviour. The "Reserve Value" and "Reserve Group" properties of the LocalControl Descriptor allow a MGC to request a MG to reserve resources for all alternatives specified in the Local and/or Remote Descriptors for which it currently has resources available. This allows an MGC during call establishment to reserve resources in order to negotiate the media properties and then later remove the unnecessary resources once the call reaches steady state. Likewise, the Resource Management Configuration (*rmc*) package allows the MGC to reserve resources (in addition to Local and Remote resources) which may then be later released if they are unnecessary when the call reaches steady state.

6.1.2 Decomposed multipoint control unit, audio, video and data conferencing (H.248.19)

[ITU-T H.248.19] currently describes the interface between the MGC and the MG in a decomposed multipoint control unit which largely provides conferencing services. There is currently no discussion in [ITU-T H.248.19] regarding resource management. However, there exists scope for optimizing resource usage for conferencing scenarios.

Conference resources can be reserved at conference booking in order to enhance the availability of resources for the participants. For example, the ASCI Group Call package [b-3GPP TS 29.232] allows the reservation of a number of conference Terminations. Further description of the resources may be achieved through the Resource Management Configuration (*rmc*) package.

MG resource allocations may also be optimized through the prior knowledge of the characteristics of a Termination. For example, if the MG is aware that a Termination will only represent a "Listenonly" (see clause 9.6.1) participant through the Abstract Resource Management (*arm*) package, at conference establishment it can assign resources to a "send" direction, thus leaving the resources that would be associated with the "receive" direction free to be used elsewhere in the MG.

If the indication of resource optimization prior to resource allocation is not possible (i.e., upon allocation through an H.248 Add, Modify or Move command), then the Resource Management Rules (*rmr*) package may be used at the allocation to allow the MG perform any potential optimizations. For example, if the MGC adds a Termination with an Audio Stream with the "Constant Media" codepoint set, then the MG knows it will not need to assign resources that are capable of video for the life of the Context/Termination.

6.1.3 Detailed congestion reporting (H.248.32)

[ITU-T H.248.32] allows for the reporting of resource usage through an abstraction approach. In using the abstraction approach, the MG must determine the relationship between the states of the physical resources and the percentage value of the abstraction codepoint. Through Congestion reports (see clause 5.2.1 of [ITU-T H.248.32]), the MGC learns of the resource usage. As such, the MGC must convert the abstract codepoint into an action at the call/service level to manage the congestion condition; it may utilize the *arm* and *rmr* packages of this Recommendation in order to optimize the MG resource allocation, thus allowing more calls/services for the available MG capacity. The MGC may also utilize the *rmc* package in order to reserve resources for important conferences/calls to maximize their success when the MG is congested.

6.1.4 Connection capability control (H.248.46)

H.248 allows an MG to save transcoding resources by autonomously connecting the Terminations in the same MG but different Contexts directly to each other. [ITU-T H.248.46] enables a MGC to determine if the MG has this capability and to control whether this capability is used. If the MG supports this autonomous connection capability, it also supports resource optimization. Where both autonomous connection capability and this Recommendation are used on a MG, then it should consider the setting of the packages of this Recommendation as part of the determination to use autonomous connection capability.

Consider the following example. A MGC creates on a MG two Contexts with two Terminations in each (i.e., Cxt1 has Tid1 and Tid2, Cxt2 has Tid3 and Tid4). Terminations Tid2 and Tid3 have addresses which indicate that internal connection is possible. Tid1 has a G.711 codec, Tid2 and Tid3 have an AMR codec and Tid4 has a G.711 codec. The MG may use its autonomous connection capability to effectively remove Tid2 and Tid3 and remove a transcoding stage. However, due to the nature of H.248, it must be prepared to re-insert a transcoding stage if the encoding of Tid1 or Tid4 change, irrespective of whether the change actually takes place. With the Resource Management Rules (*rmr*) package, the MG would not have to be prepared to change the transcoding resources.

6.1.5 Control load quantum for decomposed gateways (H-series Supplement 6)

Load is placed on a MG when a Context is created. [b-ITU-T H-Sup.6] describes load control metrics for H.248 systems and introduces the concept of busy hour context attempts (BHCoA). It discusses how resource holding times affect load that may be placed on a MG. By using the packages in this Recommendation, the MG may describe the usage of resources at Context allocation time.

7 Resource management rules package

Package Name: Resource management rules

Package ID: rmr (0x00cd)

Description: This package enables the MGC to discover the rules that, when followed, allow the MG to manage the usage of its resources in a particular way, e.g., optimize its resources. If the MGC can comply with these rules, it can then indicate

which rules it will use. The MG can then be certain of particular MGC behaviour and can manage its resources accordingly.

Specific rules are defined as separate properties as this allows the property value to provide more information to describe the rule to the MG. The properties indicate rules that will lead to resources being managed on a MG in a particular way, e.g., an optimization of resources on the MG. These rules may be applied to the MG on a whole or on a particular Termination.

Version: 1

Extends: None

7.1   Properties

7.1.1   Constant media

Property Name: Constant media

Property ID: cm (0x0001)

Description: This rule indicates that once a media type (audio, video, image, data) has been set for a particular H.248 Stream, it will not change to another media type whilst the Termination remains in the Context.

Type: Enumeration

Possible values: MC (0x0000)   Media stream type may change

MNC (0x0001) Media stream type shall not change

Default: MC (0x0000)

Defined in: LocalControl

Characteristics: Read/Write

7.1.2   Constant property value

Property Name: Constant property value

Property ID: cpv (0x0002)

Description: This rule indicates that a particular Property value is constant after it has been assigned. The value will not change again for the life of the Termination/Stream.

Type: Sub-List of String

Possible values: Each String having the format `constprop` according to the following ABNF:

```
constprop = resource      ; See 8.1.1 for a definition of
                          ; resource
```

Default: Empty String (All resources are variable)

Defined in: Termination State or LocalControl

Characteristics: Read/Write

7.2   Events

None.

7.3 Signals

None.

7.4 Statistics

None.

7.5 Error codes

7.5.1 Behaviour contradicts resource rule

Error Code #: 478

Name: Behaviour contradicts resource rule

Definition: This error indicates that the MGC has performed an H.248 action that contravenes the agreed resource management rule behaviour defined in H.248.63. The action is disregarded.

Error Text in the Error Descriptor: The PropertyID of the rule that is contravened. E.g., "0x0001" or "cm".

Comment: None

7.6 Procedures

The MGC should perform an AuditCapabilities command on the properties defining the rules to determine the resource management rules that are supported on the MG. If the MGC can support any of these rules, it shall set the corresponding property to the values that it supports. From that point onward, the MG shall expect the MGC to operate in this manner. If the actions received by the MG from the MGC contravene these rules, then the MG shall return an error code 478 "Behaviour contradicts resource rule".

The behaviour associated with each rule is described in the subclauses below.

7.6.1 Constant media (cm, 0x0001)

This rule indicates that, once a media type (audio, video, image, or data) has been set for a particular H.248 Stream, it will not change to another media type whilst the Termination remains in the Context. The format or other characteristics of the media stream may however change. This property does not affect the coding of media (for example, if the stream is an audio stream, it shall not change to a video stream; however, the codec used may change). As the MGC is aware of the service capabilities, this property is applicable to all Termination types (for example, for an IP Termination, this property may relate to the "SDP media type parameter in an m= line"; for a TDM Termination, it may relate to the Transmission Medium Requirement information element, etc.). As such, this property is technology/description independent. Once the constant media property has been set to indicate that the media type for the Termination/Stream will not change, if the MGC then requests to modify the value to indicate that it "may change", then the MG shall respond with error code "542 – Command is not allowed on this Termination".

7.6.2 Constant property value (cpv, 0x0002)

The default behaviour of H.248 is that any of the properties associated with a Termination/Stream may be modified by a MGC at any time. This rule allows the indication that the value of certain properties once set will remain constant whilst the Termination remains in the Context or whilst the Stream exists. When the property is set in the TerminationState descriptor, it only applies to properties set in that descriptor. When set in the LocalControl descriptor, it applies to properties for that particular Stream. The Constant Property Value (*rmr/cpv*) property should be set before or at the time that the associated property is set. This allows the MG to optimize its resources around the

fact that the property will not change. Once a property has been added to the *rmr/cpv* sub-list and is set on the Termination/Stream, it shall not be removed from the *rmr/cpv* sub-list on the Termination/Stream until Termination Subtraction or the removal of the Stream. If the MGC attempts to remove the property from the *rmr/cpv* sub-list, the MG shall respond with error code "542 – Command is not allowed on this Termination".

8 Resource management configuration package

Package Name: Resource management configuration

Package ID: rmc (0x00ce)

Description: This package allows a MGC to describe to the MG which resources are expected to be used in a Context. The resources are described in a manner consistent with the H.248 connection model. That is, the overall resource picture of a particular Context is described through the use of setting characteristics on Terminations and Streams.

Version: 1

Extends: None

8.1 Properties

8.1.1 Resource description

Property Name: Resource description

Property ID: rd (0x0001)

Description: This property allows the MGC to describe the resources that will be used in the Context. This is achieved by describing the resources on a Termination basis.

Type: ABNF: Sub-list of String, ASN.1: Sub-list of Octet String

Possible values: The value of each instance of the string is given by the following:

For both Text and Binary encoding ABNF:

```
rd = [number COLON resource *(COMMA resource)]
number = UINT16
resource = termstate / localcont / localremote
termstate = TerminationStateToken COLON packageitems
localcont =  LocalControlToken COLON ( packageitems /
streamMode )
localremote = (MediaToken / StreamToken / LocalToken /
RemoteToken) COLON (packageitems / sdp)
packageitems = propertyParm *(COMMA propertyParm)
sdp = "SDP(" OCTETSTRING ")"
; sdp & packageitems are deemed equivalent as sdp
; may contain multiple parameters,
```

The "quotedstring" form of value should be used.

An empty string indicates that there is no initial or further resource description.

Binary equivalents for the package name, property name and values may be used. The package name and property name shall drop the leading zero (0) from the hexadecimal notation in order to match the NAME syntax, i.e., x0000/x1001=2.

Default: Empty String

Defined in: ContextAttribute

Characteristics: Read/Write

8.2   Events

None.

8.3   Signals

None.

8.4   Statistics

None.

8.5   Error codes

None.

8.6   Procedures

8.6.1   Resource description

This property may be used to describe the resources that will be used by the H.248 Context. This is not the same as adding the Terminations through H.248 commands. The resources are only utilized when the appropriate descriptors are set on the Terminations.

The resources are described in a manner consistent with the H.248 connection model. That is, each Termination describes the characteristics at the input and output of the Context. The MG then builds its own resource picture based on the description.

The MGC may indicate one or more resources and may couple these resources to build dependencies between them. Dependent resources shall share the same value instance. The MGC may use a higher level construct as a form of wildcarding. The reference to a Stream means that the resource applies to both the local and remote sides. The use of Media means that the resources apply to both the local and remote sides of all streams. CHOOSE may be used in the place of a value when the MGC does not care about the value. Wildcarding of package names and property names shall not be used. Wildcarding of SDP shall follow the guidelines outlined in [ITU-T H.248.39].

8.6.2   Resource allocation and clearing

As discussed in clause 6, the resource management configuration package is typically used when a Context is first created (i.e., at call/session establishment). The MGC determines from the required service what resources are likely to be used in the MG and sets these in the resource description (*rmc/rd*) property. The MG can then use this information to allocate resources in an efficient manner.

For example, the MGC may determine that the Context creation is as a result of a dial in audio conference with eight ports. The MG can then pre-assign a conferencing device to the Context rather than assigning a connection for a normal two-party call. As each extra participant dials in, the MGC then requests a Termination/Stream using the normal H.248 mechanisms. The *rmc/rd* property does not need to be changed as resources are allocated by the MGC/MG.

The MGC may change the value of the *rmc/rd* property after the initial Context allocation; however, it is up to the MG whether any action is taken based on this setting. A MG is likely to take action if it determines that the information is useful for any other resource optimization.

Once the MGC has determined that the Call/Service is in steady state, it should remove the *rmc/rd* property in order to indicate to the MG that the expected resources have been used. The MG may

then use this fact and the actual resources allocated to determine if it can clear any unallocated pre-assigned resources.

NOTE 1 – The use of rmc/rd for resource allocation/clearing is as a guide to the MG for initial resource allocation. The MGC, based on further services/interactions, may need to alter the resources at a later stage.

NOTE 2 – The resources for an eight port audio conference may also be reserved by allocating eight terminations to a Context in a single transaction. However, this means that the MG must allocate resources for each of these terminations, even though they may not be used. In order to determine optimal resource allocation, the MG must parse the transaction as a whole, rather than deal with each command individually.

8.6.3   Usage examples

Example 1: The MG can expect three audio Terminations using text encoding. The value would be set:

```
rmc/rd="3:stream:SDP(v=0
                   c=$ $ $
                   m=audio $ $ $)"
```

Example 2: The MG can expect three audio Terminations, two with video and one audio-only using text encoding. The value would be set:

```
rmc/rd="1:stream:SDP(v=0
                   c=$ $ $
                   m=audio $ $ $)",
      "2:stream:SDP(v=0
                   c=$ $ $
                   m=audio $ $ $),
        stream:SDP(v=0
                   c=$ $ $
                   m=video $ $ $)"
```

Example 3: The MG can expect ten listening-only Terminations and two speaking and listening in the Context, with the binary package ID and values used. The value would be set:

```
rmc/rd="10:stream:x0000/x1001=0,
        Localcontrol:SendOnly",
      "2:stream:x0000/x1001=0,
        Localcontrol:SendRecv"
```

9   Abstract resource management package

Package Name: Abstract resource management

Package ID: arm (0x00cf)

Description: This package allows a MGC to manage a set of resources via the use of a single codepoint which references a set of MG resources and particular management behaviour.

Version: 1

Extends: None

9.1   Properties

9.1.1   Resource description

Property Name: Resource description

Property ID: rd (0x0001)

Description: This property allows the MGC to associate an abstract resource description with a certain resource and management action on a Termination. It also allows the MGC to provide extra information that may be necessary to map the abstract resource name to actual MG resources.

Type: Sub-list of String

Possible values: The value of each instance of the string is given by the following ABNF:

```
rd = NAME [COLON *(SafeChar/EOL /%x80-FF/ RestChar/WSP)]
```

How the "NAME" and OCTETSTRING data maps to specific resources shall be described in the procedures section of this package or any extension package and should be documented as follows:

x.x.x Abstract Resource Heading

Name: *<The name of the abstract resource>*

Extra data: *<The extra information that may be necessary to map the abstract resource name to actual MG resources. If there is extra data describe the format using ABNF.>*

Resource mapping description: *<This section describes how the abstract name maps to a set of actual MG resources which may be present as H.248 protocol element.>*

Procedures: *<This section describes why the MGC sets the property and how the MG behaves in H.248 terms when the property is set and/or removed.>*

Default: None

Defined in: TerminationState or LocalControl

Characteristics: Read/Write

9.2 Events

None.

9.3 Signals

None.

9.4 Statistics

None.

9.5 Error Codes

None.

9.6 Procedures

If the MGC wants to utilize the abstract resource concept to indicate the MG to allocate/reserve resource, it shall set the *arm/rd* property with the abstract resource names and possible extra information/data described in the subclause below. The MG shall then map the abstract resource name to a set of associated actual MG resources which will be allocated/reserved. Where multiple abstract resources are requested, the MG should consider the resources to be cumulative unless specified otherwise.

The abstract resource shall be defined before being used. This definition includes its name, the possible extra information/data that may be necessary to do mapping, the identifiers of the

associated actual MG resources, and the procedures of the management behaviour on these resources. The extra information/data may be used to adjust (i.e., increase, reduce or modify) the resource, based on the set of the associated actual MG resource. When an abstract resource is defined, any potential interaction problems with previously defined resources should be documented.

The MGC may cancel the previous abstract behaviour setting by removing the string instance that defined the behaviour from the *arm/rd* property.

9.6.1 ListenOnly Termination participant

Name: Listenonly

Extra Data: None

Resource mapping description: Maps to the fact that the Stream associated with the Termination will only have a local control stream mode of "SendOnly" or "Inactive"

Procedures: When the MGC adds a Termination to a Context with this value, it shall optimize its resources recognizing the fact that the stream mode of the Termination will never be set to "SendRecv" or "RecvOnly", whilst the Termination remains in the Context. If the MGC tries to set the Termination to "SendRecv" or "RecvOnly", the MG should reply with error code 449 "Unsupported or unknown parameter or property value".

Bibliography

[b-ITU-T H-Sup.6]   ITU-T H-series Recommendations – Supplement 6 (2006), *Control load quantum for decomposed gateways*.

[b-3GPP TS 29.232]   3GPP Technical Specification 29.232 v7.5.0 (2007-03), *Media Gateway Controller (MGC) – Media Gateway (MGW) interface; Stage 3 (Release 7)*.

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