

International Telecommunication Union

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

H.248.55

(06/2008)

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

**Gateway control protocol: Generic pull mode
package**

Recommendation ITU-T H.248.55



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Recommendation ITU-T H.248.55

Gateway control protocol: Generic pull mode package

Summary

H.248 represents a resource control protocol concerning the control of media gateway-level resources. There are two major categories concerning resource control strategies: push mode and pull mode. Push mode is an inherent architectural characteristic of the H.248 master-slave model, where the master entity MGC is pushing the slave entity MG into a particular mode. Pull mode is also supported by the H.248 protocol architecture, but requires additional protocol elements to control a particular pull mode scenario. Recommendation ITU-T H.248.55 defines a generic set of such capabilities.

Source

Recommendation ITU-T H.248.55 was approved on 13 June 2008 by ITU-T Study Group 16 (2005-2008) under Recommendation ITU-T A.8 procedure.

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Recommendation ITU-T H.248.55

Gateway control protocol: Generic pull mode package

1 Scope

There are various resource control mechanisms used in next generation networks (NGNs) such as those described in [ITU-T Y.2111]. A policy control mechanism (such as QoS resource control) is described by this Recommendation. The mechanism itself may result in different control scenarios that are primarily dependent on dedicated user and customer premises equipment (UE, CPE) types. This Recommendation describes how H.248 entities behave in such a network environment, and defines an H.248 package, which may be used in a specific resource control scenario.

Clause 6 provides a background on resource and admission control functions (RACFs) and discusses the resource control modes. The clause then focuses on the "pull mode" of resource control and provides a mapping of the RACF functions and flows of this mode to the H.248 architecture.

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.248.13] Recommendation ITU-T H.248.13 (2002), *Gateway control protocol: Quality Alert Ceasing package*.
- [ITU-T H.248.14] Recommendation ITU-T H.248.14 (2002), *Gateway control protocol: Inactivity timer package*.
- [ITU-T H.248.36] Recommendation ITU-T H.248.36 (2005), *Gateway control protocol: Hanging Termination Detection package*.
- [ITU-T H.248.40] Recommendation ITU-T H.248.40 (2007), *Gateway control protocol: Application data inactivity detection package*.
- [ITU-T Y.2111] Recommendation ITU-T Y.2111 (2006), *Resource and admission control functions in next generation networks*.

3 Terms and definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

3.1.1 path-coupled QoS signalling: [ITU-T Y.2111]: A mode of signalling where the signalling messages follow a path that is tied to the data packets. Signalling messages are routed only through nodes that are in the data path.

3.1.2 pull mode [ITU-T Y.2111]: Defined in clause 6.1.2 of [ITU-T Y.2111], "Scenario 2: Pull mode QoS resource control scenario".

3.1.3 push mode [ITU-T Y.2111]: Defined in clause 6.1.2 of [ITU-T Y.2111], "Scenario 1: Push mode QoS resource control scenario".

3.2 Terms defined in this Recommendation

This Recommendation defines the following term:

3.2.1 authorization token: A piece of information, either clear or encrypted, which can be used to validate a request for specific resources. This information is used as a unique identifier in policy pull mode. The token is generated by the MGC and may be sent back by the MG to the MGC for the re-authorization of the resource request in the pull mode.

NOTE – The authorization token may or may not use H.248 information elements.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

ATM	Asynchronous Transfer Mode
CPE	Customer Premises Equipment
IP	Internet Protocol
MG	Media Gateway
MGC	Media Gateway Controller
MID	Message Identifier
NACF	Network Attachment Control Function
NGN	Next Generation Network
PD-E	Policy Decision Entity
PE-E	Policy Enforcement Entity
PSTN	Public Switched Telecommunications Network
QoS	Quality of Service
RACF	Resource and Admission Control Function
SCF	Service Control Functions
UE	User Equipment
VMG	Virtual Media Gateway

5 Conventions

None.

6 Resource control framework

6.1 Background

Figure 1 provides a simplified model of RACFs in next generation networks. The RACF is aimed at providing real-time application-driven and policy-based transport resource management for a wide range of services and for a variety of transport technologies. See [ITU-T Y.2111] for a detailed description of the RACF subsystem within an NGN.

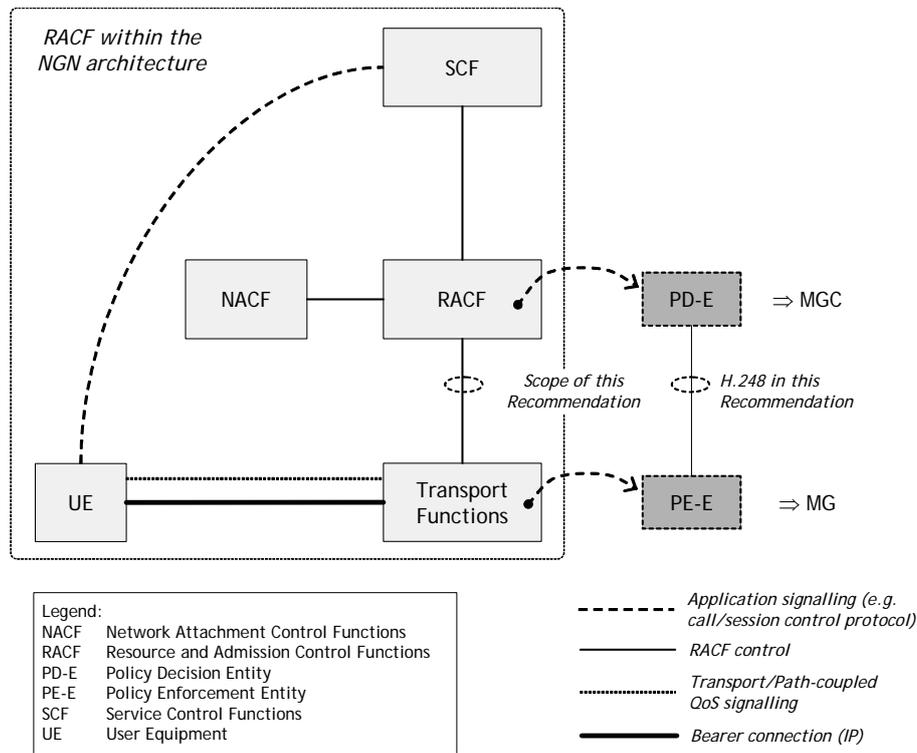


Figure 1 – Simplified model of a NGN architecture – Relationship to this Recommendation

The policy decision entity (PD-E) and policy enforcement entity (PE-E) are elements of this network architecture and in scope of this Recommendation because both could be mapped to H.248 entities (see [b-ITU-T Q.3300] and [b-ITU-T Q.3303.0]).

6.2 Resource control mechanisms

The RACF should support different *resource control modes* in order to handle different types of user equipment (UE), customer premises equipment (CPE) and/or transport QoS capabilities (see clause 6 of [ITU-T Y.2111]). This clause describes those control modes and their relationship to this Recommendation.

6.2.1 Push versus pull mode

There are two basic *resource control modes* (see clause 6.1.1 of [ITU-T Y.2111]):

- 1) Push mode: The RACF makes the authorization and resource control decision based on policy rules and autonomously instructs the transport functions to enforce the policy decision.
- 2) Pull mode: The RACF makes the authorization decision based on policy rules and, *upon the request* of the transport functions, re-authorizes the resource request and responds with the final policy decision for enforcement.

The correspondent high-level resource control scenarios are summarized by Figure 2. The detailed signalling and control phases are not relevant for this Recommendation (they are outlined in [ITU-T Y.2111]). For information regarding messages associated with each of the numbered flows below see [b-ITU-T Q-Sup.59].

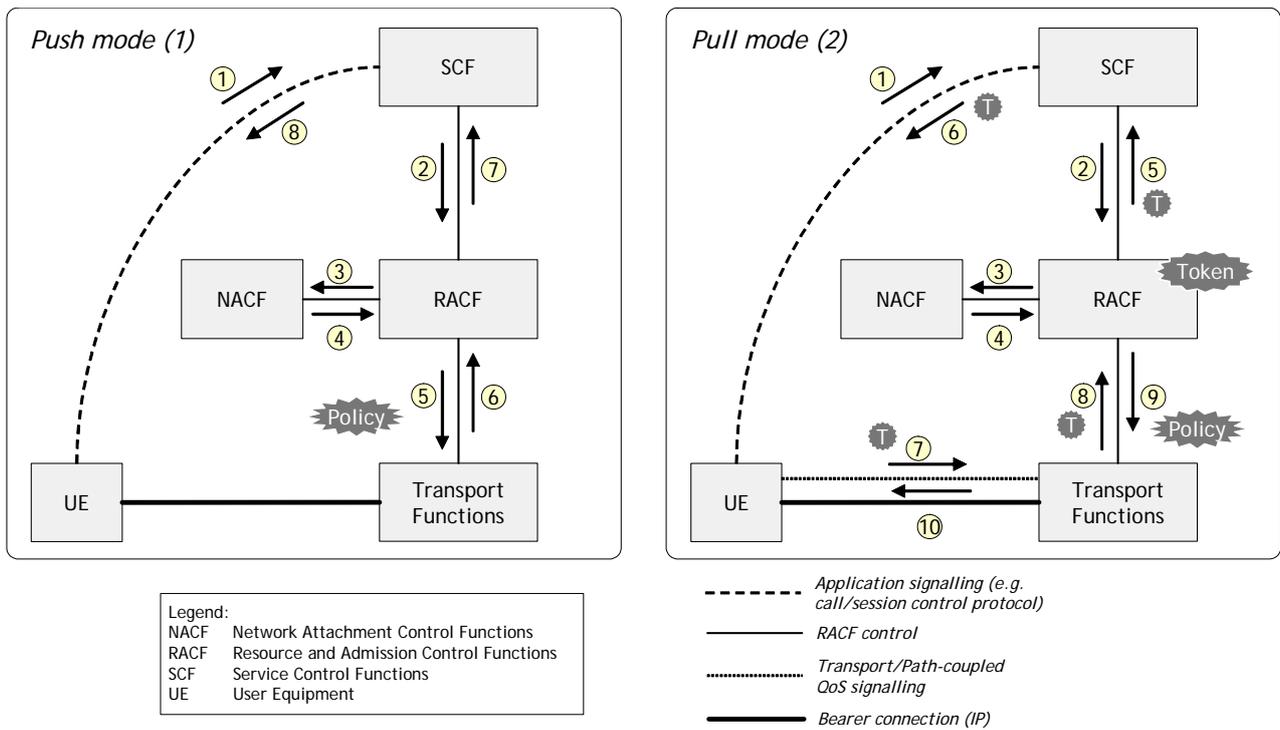


Figure 2 – High-level resource control and policy enforcement – Principles of push and pull mode

From the perspective of this Recommendation, the main difference between these resource control modes is related to the binding mechanism, between a call/session and associated bearer connection(s) and media flows, i.e., H.248 streams/terminations. This relates to a *correlation identifier* (between service and transport stratum in general NGN terms), which is called *authorization token* (briefly token) in case of RACF.

Pull mode requires the signalling of such a token between the network and the UE/CPE, but not in push mode. This Recommendation describes the pull mode operation. Push mode is already supported by H.248 as such, thus it is out of scope of this Recommendation.

6.2.2 Pull mode variants – Different token generation mechanisms

The MGC (PD-E) is involved in the generation of the token. There are multiple possibilities concerning the management of tokens by the MGC. Two possible variants providing representative examples concerning used H.248 capabilities from this Recommendation are depicted by Figure 3. Further variants are not excluded.

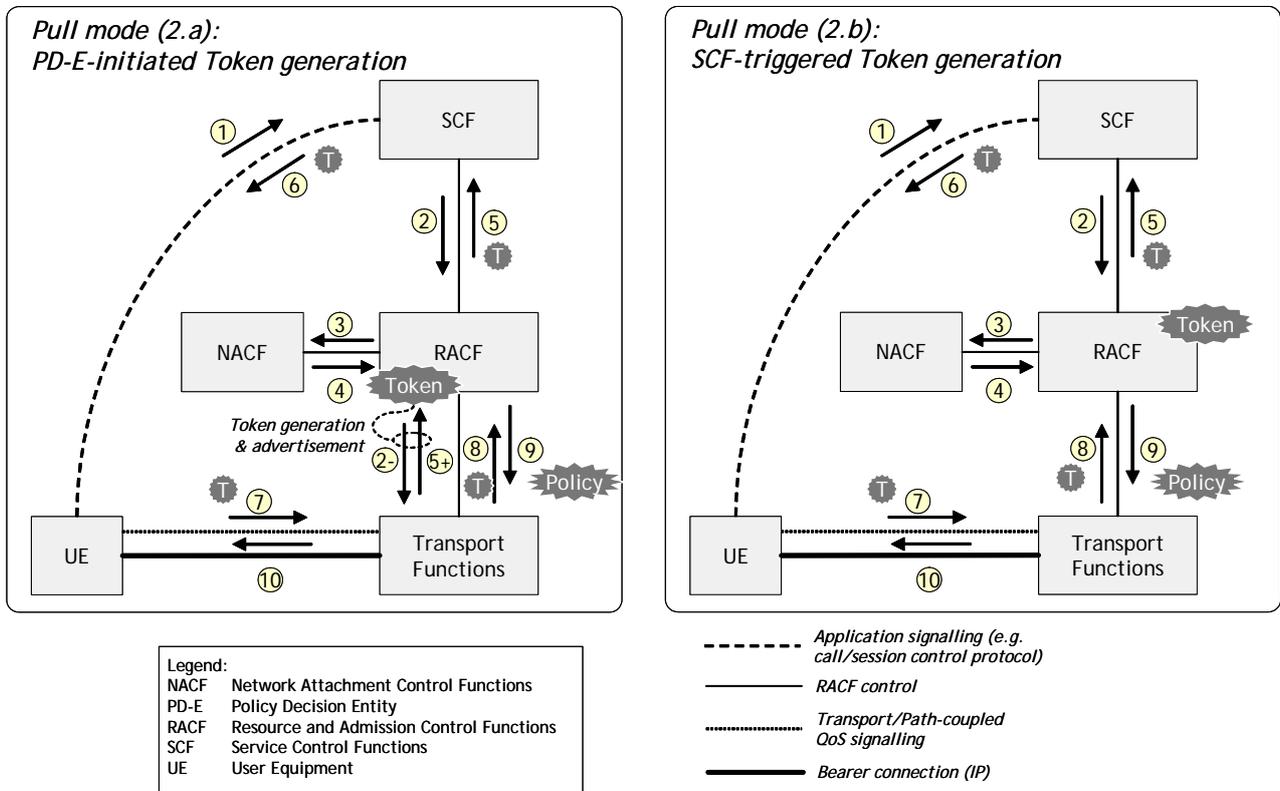


Figure 3 – Pull mode variants – Different token generation mechanisms

Common to the pull mode variants is the generation of a token by "RACF" and the sending of that token to the UE via the SCF in steps 5 and 6 in Figure 3. See following sub-clauses for more signalling details.

6.2.2.1 Abstracted model with H.248 entities

This Recommendation defines a H.248-based interface between policy decision and policy enforcement entities. The two different token principles for pull mode are mapped on the H.248 connection model. Figure 4 illustrates such a model with the focus on pull mode only, i.e., path-coupled (QoS) signalling protocol is depicted in the drawing.

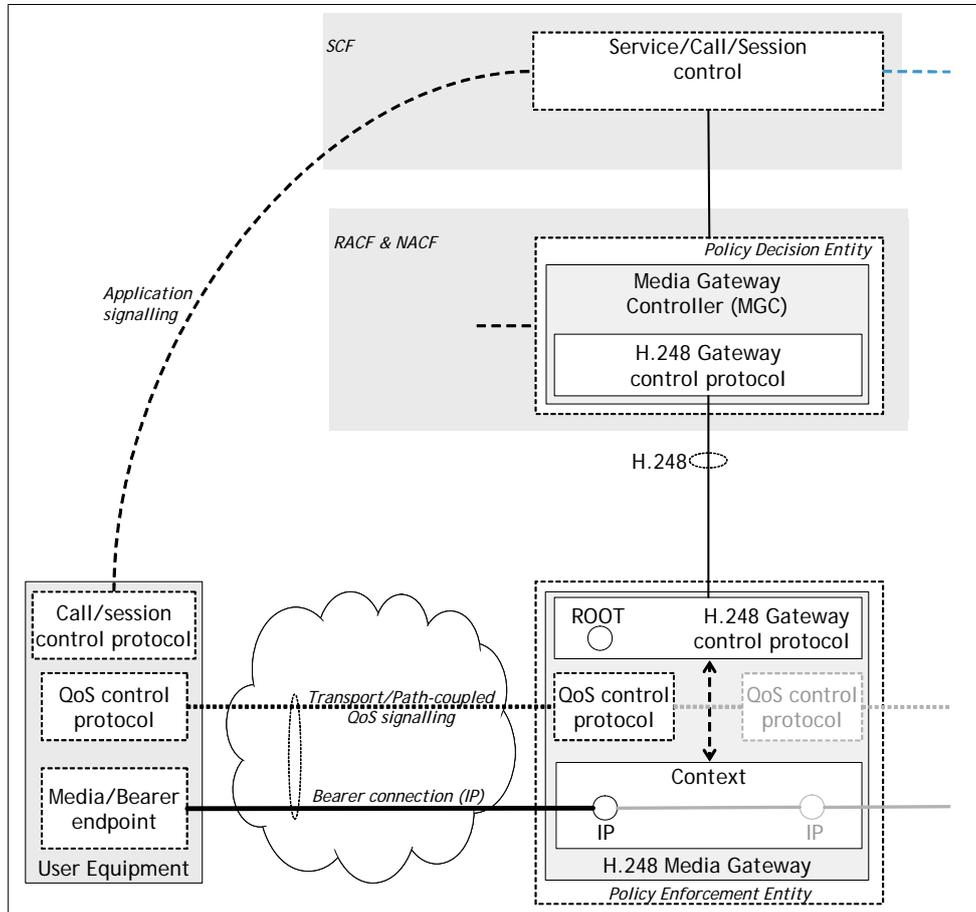


Figure 4 – Pull mode variants – Simplified model with H.248 entities as policy decision and policy enforcement entities

Figure 4 shows only a "half call" model. The two different token principles (in pull mode) use the same H.248 package, the event is associated with different H.248 termination types (root versus non-root), see the next subclauses.

6.2.2.3 Context-less MG pull mode (SCF-triggered token generation)

In this mode, no context has been created. In order to detect an incoming resource reservation request, an event is set on the root termination. The MGC (PD-E) does not advertise the token towards MG (PE-E) before a path-coupled (QoS) signalling message (step 7) is received by the MG (see Figure 3).

Figure 6 illustrates the resource reservation request notification process, starting with an incoming (QoS) resource reservation request leading to the event notification toward the MGC.

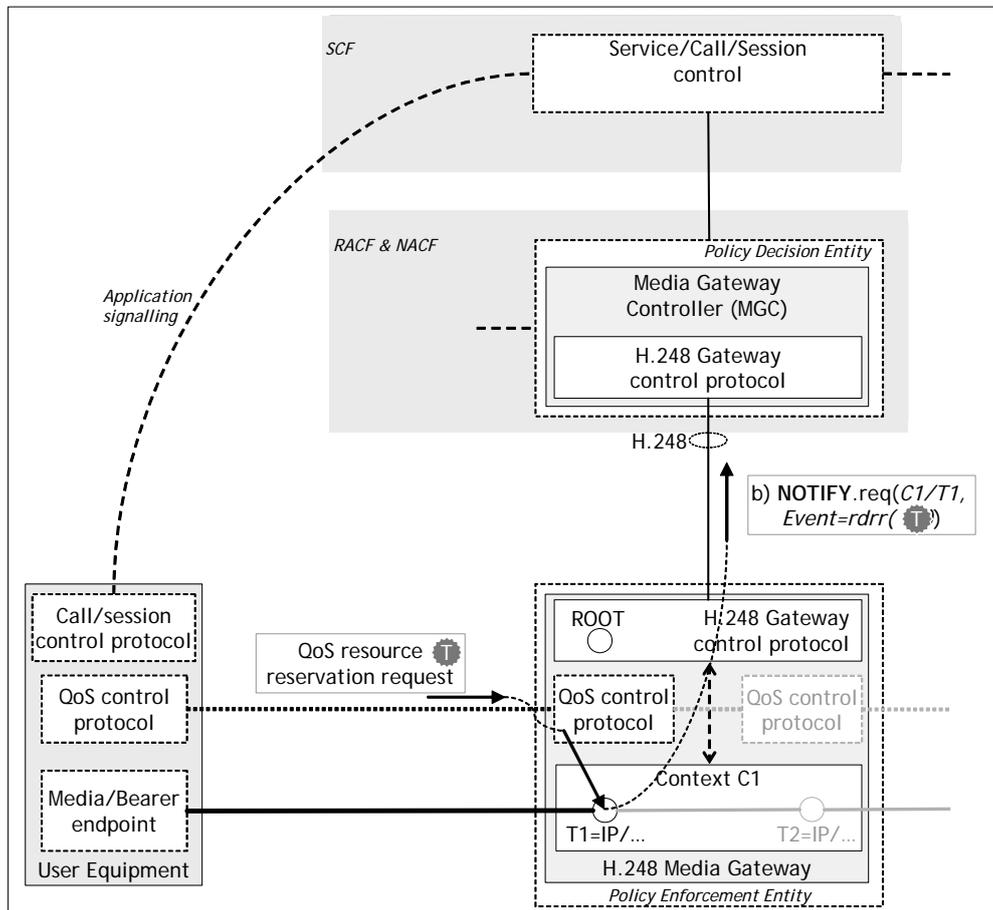


Figure 6 – Pull mode variants – Resource reservation request notification process in case of the context-less MG pull mode

This pull mode variant is called "context-less MG pull mode" because there is not yet any bearer context created (in the MG) when the MG detects the event (via the root termination). See also clause 8.4 for more details.

6.3 Summary

The various resource control variants are summarized by Table 1. The correspondent, high-level resource control scenarios at the H.248 interface are outlined in clause 8.

Table 1 – Summary of push/pull modes and correspondent H.248 support mechanisms

Mode for policy enforcement		Token generation	Possible token format/type (Note)	Specific H.248 support mechanisms
1	Push mode	–	None required.	None required.
2.a	Pull mode (Context-created MG pull mode)	PD-E-initiated token generation	H.248 TerminationID, or H.248 ContextID, or H.248 RequestID, or others	The <i>plm</i> package (see clause 7) according to this Recommendation. Event <i>plm/rdr</i> is associated with a non-root termination.
2.b	Pull mode (Context-less MG pull mode)	SCF-triggered token generation	e.g., String	The <i>plm</i> package (see clause 7) according to this Recommendation. Event <i>plm/rdr</i> is associated with the root termination.
NOTE – There are multiple possibilities with regard to the syntax and encoding of the authorization token (see also clause 3.2.1)				

In scope of this Recommendation are policy decision/enforcement mechanisms at the H.248 interface. The pushed/pulled policy rules could be related in particular to QoS and network border control, but are applicable for other policy rules in general due to H.248 principles and the generic design *plm* package by this Recommendation.

7 Generic pull mode package

Package name: Generic Pull Mode Package

Package ID: plm (0x00ca)

Description: This package defines a number of events to support pull mode QoS resource control.

This package is generic in the sense that the package is agnostic concerning "path-coupled QoS signalling protocols". The support of such specific horizontal QoS signalling protocols may be addressed by extension package(s).

Version: 1

Extends: None

7.1 Properties

7.1.1 Path-coupled request domains under MGC ownership

Property name: Path coupled request domains under MGC ownership

Property ID: rdmo (0x0001)

Description: This root-only property enables an MGC to indicate from which domains path-coupled QoS requests shall be notified to it through the *rdr* event. For this property "domain" is the source network whose messages a VMG/MGC serves.

It only applies when the *rdr* event is set on the root termination.

Type: Sub-list of String

Possible values: May be in a domain name or address format, i.e., domainAddress / domainName (Annex B of [ITU-T H.248.1]), e.g., "mynet.net", or any other string format. Where wildcarding is needed in the value "*" shall be used.

Default: Provisioned
Defined in: TerminationState only on the root termination.
Characteristics: Read/write

7.2 Events

7.2.1 Decision request for QoS resource reservation

Event name: Decision Request for QoS Resource Reservation
Event ID: rdrv (0x0001)
Description: This event is used to detect a resource reservation request for creating a media stream. This request is from an UE/CPE and/or transport network elements to the MG, via dedicated path-coupled QoS signalling. Once detected by the MG, it will notify the MGC of this event to request a resource decision, which the MGC will then provide based on the service requirement and resource condition.
This event shall be applied to the **root termination** or to **ephemeral terminations** only.

7.2.1.1 EventDescriptor parameters

7.2.1.1.1 Bearer request address value

Parameter name: Bearer Request Address Value
Parameter ID: brav (0x0001)
Description: This root termination-only parameter provides the address value with regard to the IP address of the MG which is used to receive resource reservation requests in the context-less MG pull mode.
NOTE – This parameter should be included when the *rdrv* event is applied to the root termination of the MG.
Type: Sub-List of String
Optional: Yes
Possible values: IP version 4 address or IP version 6 address.
Encoded as per IP4Address or IP6Address (both excluding the optional port) in Annex A of [ITU-T H.248.1] or IPv6address or IPv4address in Annex B of [ITU-T H.248.1].
Default: Provisioned.

7.2.1.1.2 Bearer request port value

Parameter name: Bearer Request Port Value
Parameter ID: brpv (0x0002)
Description: This root termination-only parameter provides the port value with regard to the IP address of the MG which is used to receive resource reservation requests in the context-less MG pull mode.
NOTE – This parameter should be included when the *rdrv* event is applied to the root termination of the MG.
Type: Sub-List of String
Optional: Yes

Possible values: 0 to 65535

Default: Provisioned

7.2.1.2 ObservedEventsDescriptor parameters

7.2.1.2.1 Authorization token

Parameter name: Authorization token

Parameter ID: authtok (0x0001)

Description: This is the session authorization token contained in the QoS request received by the MG via dedicated path-coupled QoS signalling (see clause 9.1.2.1.1 of [ITU-T Y.2111]). Whenever this parameter is reported by the MG, the MGC may use it to re-authorize the resource request and respond with the final policy decision to the MG for enforcement.

Type: Octet String

Optional: No

NOTE 1 – The *authtok* parameter is considered to be mandatory. At the time the resource decision request (Figure 13 of [ITU-T Y.2111], message 2) is received by the MG, the bearer path is not yet established. A H.248 call context with a single (ephemeral) termination may or may not yet be created.

Possible values: Any octet string

NOTE 2 – The string length is not limited since the octet string is only forwarded to the MGC and does not have to be stored by the MG.

Default: None

7.2.2 Decision request for QoS resource modification

Event name: Decision Request for QoS Resource Modification

Event ID: rdrm (0x0002)

Description: This event is used to detect a resource modification request for adjusting a media stream. This request is from a UE/CPE and/or transport network elements to the MG via dedicated path-coupled QoS signalling. Once detected by the MG, it will notify the MGC of this event to request resource decision, where the MGC will then provide resource decision based on the service requirement and resource condition. This event shall be applied to **ephemeral terminations** only.

7.2.2.1 EventDescriptor parameters

None.

7.2.2.2 ObservedEventsDescriptor parameters

7.2.2.2.1 Authorization token

As per clause 7.2.1.2.1.

7.2.3 Decision request for QoS resource release

Event name: Decision Request for QoS Resource Release

Event ID: rdrl (0x0003)

Description: This event is used to detect a resource request for ceasing a media stream. This request is from a UE/CPE and/or transport network elements to the MG via dedicated path-coupled QoS signalling. Once detected by the MG, it will notify the MGC of this event to request resource decision. This event shall be applied to **ephemeral terminations** only.

7.2.3.1 EventDescriptor parameters

None.

7.2.3.2 ObservedEventsDescriptor parameters

As per clause 7.2.1.2.1.

7.3 Signals

None.

7.4 Statistics

None.

7.5 Error codes

None.

7.6 Procedures

7.6.1 Enable/disable pull mode

Pull mode is implicitly enabled for the context-less mode as soon as an *rdrr* event is set on a root termination. Pull mode is implicitly enabled for the context-created mode as soon as an *rdrr* event is set on an ephemeral termination.

The setting of the *rdrr* event on root and ephemeral terminations is independent as it will be the remote end-point or the MGC that will determine on which address signalling will be received/sent.

When the *rdrr* event is set to the root termination of the MG, the *brav* and *brpv* parameters should be also included in order to specify or determine the signalling address on which the resource reservation signalling will be received/sent. If the values of those parameters are set to '\$' by the MGC, the MG will then provide the IP address and port in the response. The IP address and port shall be released when the corresponding *rdrr* event is disabled.

7.6.2 Pull mode together with push mode

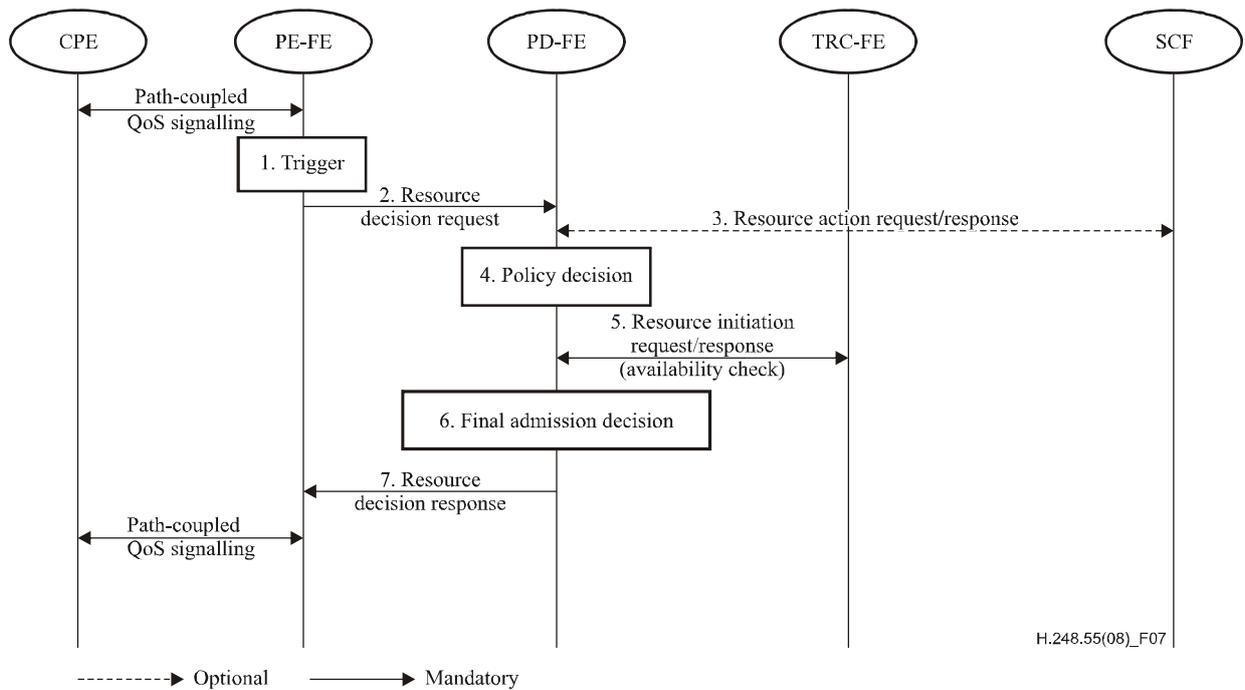
Pull mode and push mode may be applied together on the same MG. There are no interactions between the two modes of operation.

7.6.3 QoS control procedures in pull mode

To invoke the QoS resource reservation for a given flow (see clause 9.1.2 of [ITU-T Y.2111]), the MG receives a 'QoS request' over dedicated path-coupled QoS signalling. See also clause 8.

7.6.3.1 QoS resource reservation procedure

The basic procedure of CPE-requested QoS resource reservation procedure is illustrated in Figure 7. The procedure is invoked by a dedicated path-coupled QoS signalling message from the CPE for a given flow.



**Figure 7 – CPE-requested QoS resource reservation procedure
(Copy of Figure 13 of [ITU-T Y.2111])**

NOTE (Figures 7, 8 and 9) – the transport resource control functional entity (TRC-FE) is out of scope of this Recommendation. The functional entities "PE-FE" and "PD-FE" of [ITU-T Y.2111] are relating to the H.248 entities "PE-E" and "PD-E" in this Recommendation.

The individual signalling steps are described in clause 9.1.2.1.1 of [ITU-T Y.2111].

7.6.3.2 QoS resource modification procedure

The CPE-requested QoS resource modification procedure illustrated in Figure 8 is invoked by a resource decision request.

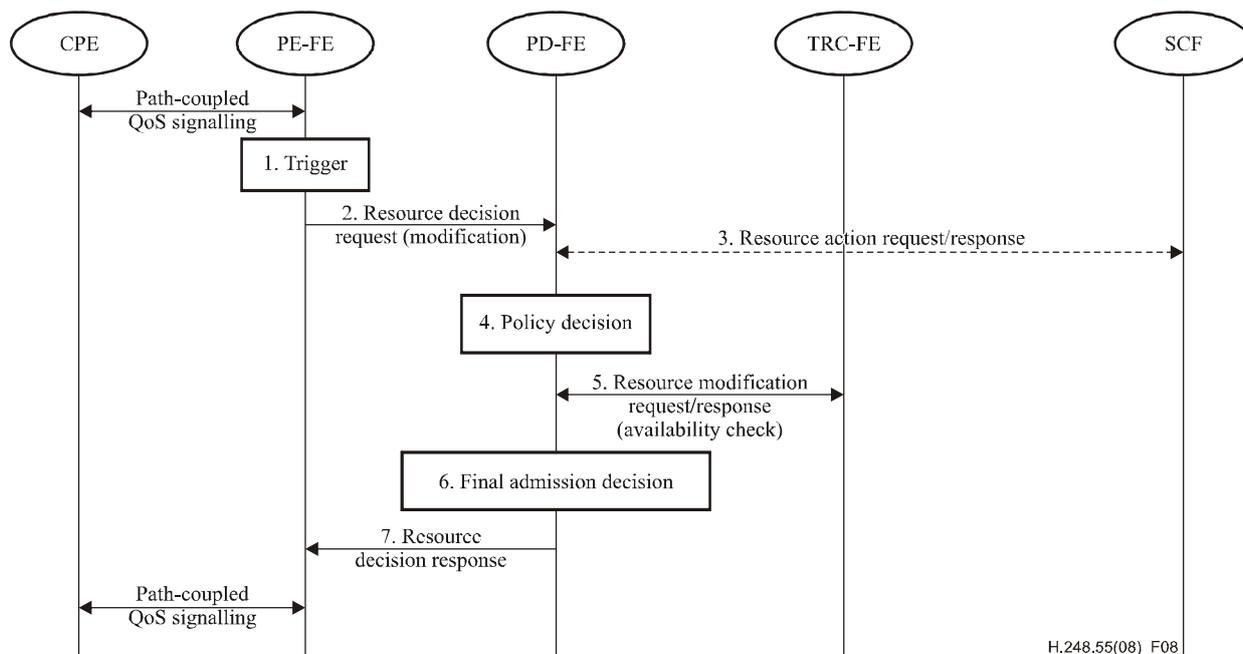


Figure 8 – CPE-requested QoS resource modification procedure (copy of Figure 16 of [ITU-T Y.2111])

The individual signalling steps are described in clause 9.1.2.1.2 of [ITU-T Y.2111].

7.6.3.3 QoS resource release procedure

The CPE-requested QoS resource release procedure illustrated in Figure 9 is invoked by a resource notification from the PE-FE for a given flow.

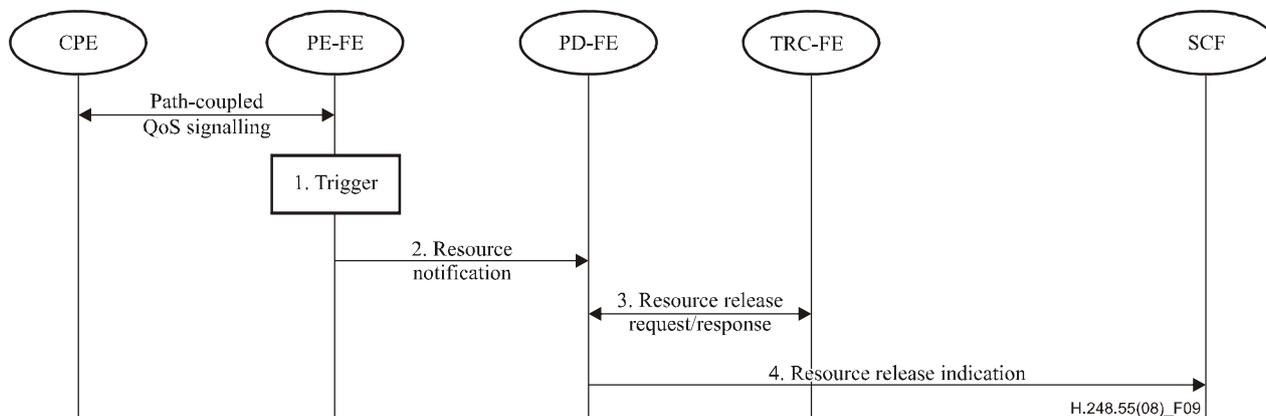


Figure 9 – CPE-requested QoS resource release procedure (copy of Figure 19 of [ITU-T Y.2111])

The individual signalling steps are described in clause 9.1.2.1.5 of [ITU-T Y.2111].

7.6.4 Interaction with path-coupled QoS signalling

There is no direct interaction between (horizontal) path-coupled QoS signalling and (vertical) H.248 signalling (for the application of this package) other than that path-coupled QoS signalling may trigger H.248 event reporting. The two directions of path-coupled QoS signalling are described in more detail:

- Incoming request from path-coupled QoS signalling to MG:
 - Specific request triggers the correspondent H.248 event, i.e., either *plm/rdr*, *plm/rdr*m or *plm/rdr*l.
 - Relevant information elements of the request will be mapped to the correspondent H.248 ObservedEventsDescriptor parameter.
- Outgoing path-coupled QoS signalling from MG:
 - There is generally no interaction due to processing of events as defined by this package. That means that the NOTIFY.reply command from the MGC back to the MG will not necessarily trigger path-coupled QoS signalling.
 - Other usual H.248 commands for ephemeral terminations (such as ADD.request, MODIFY.request, SUBTRACT.request) could lead to triggers for path-coupled QoS signalling, but such types of interaction is out of scope of this Recommendation.

The procedures between (horizontal) path-coupled QoS signalling and (vertical) H.248 signalling are therefore considered to be loosely coupled.

7.6.5 Identifying a VMG and/or MGC from a path-coupled QoS request

Whilst a physical MG may terminate path-coupled QoS requests at a single address/port, when VMGs are used there is a problem for the MG to identify the correct instance of VMG to use to send a notify command to when the *rdr* event is detected. As there is a one-to-one relationship between a VMG and MGC (from an MG perspective), the MG also has a problem to determine which MGC to send the event to. The following behaviour is possible with regard to the authentication token when a path-coupled QoS request is received:

- 1) The MG receives the authentication token and it is able to read the token and it contains the address of the MGC.
- 2) The MG receives the authentication token and it is able to read the token but it does not reveal any information on which VMG/MGC to use.
- 3) The MG receives the authentication token but it is unable to read the token (i.e., it is token-agnostic).
- 4) The authentication token is absent from the path-coupled QoS request.

In situations 2, 3, 4, where the authentication token cannot reveal VMG/MGC selection information, a VMG may examine the source of the path-coupled QoS signalling and compare it to the *rdmo* property to determine the correct VMG/MGC. These situations are applicable to both context-created and context-less pull scenarios where VMGs are used.

In situation 1, where the authentication token may reveal the correct MGC to use (e.g., mapping to the H.248 MID), the physical MG may still be unable to determine the correct VMG instance, as the MGC may control several VMGs. A VMG may then use to *rdmo* property to determine if it is the correct VMG for this instance.

If the MGC has set the *rdmo* property, the MG/VMG shall compare the source of the path-coupled QoS signalling and the domain information from the property. If the source of the path-coupled QoS signalling is part of the domain indicated in the *rdmo* property and the *rdr* event is set on the Root Termination of the MG, a Notify.req shall be generated to that MGC. If the source of the path-coupled QoS signalling is not part of the domain no event shall be generated.

If the MGC has not set the *rdmo* property, then the MG/VMG shall use other means to determine to which MGC an *rdrr* event notification is sent.

For optimal usage, all MGCs connected to an MG should set the *rdmo* property in order to correctly identify the MGC that should receive the *rdrr* event notifications. In the case where a physical MG has VMGs with the *rdmo* property both set and unset, the set properties shall take precedence. The setting of the *rdmo* property and *rdrr* event should occur at the establishment of the control association between the MGC and VMG (MGs), or via provisioning.

7.6.6 Failure handling in pull mode

There is no special failure handling in pull mode. Failure handling is generally based on ServiceChange procedures (see Annex F of [ITU-T H.248.1]) or usual H.248 error handling. Specific failure types may be addressed by dedicated H.248 protocol elements, such as, e.g., clause E.11.2 of [ITU-T H.248.1], [ITU-T H.248.13], [ITU-T H.248.14], [ITU-T H.248.36] or [ITU-T H.248.40]. This is out of scope of this package definition.

8 Resource control scenarios

8.1 Introduction

Resource control in networks (as in NGN RACF) is related to different operations, such as:

- 1) resource authorization;
- 2) resource reservation;
- 3) resource commitment;
- 4) resource modification(s);
- 5) resource de-activation;
- 6) resource release;

There are many descriptions of how one or multiple resource control operations may be mapped on signalling flows (e.g., see [ITU-T Y.2111]).

Thus, the described resource control scenarios in this clause are examples. The figures use pseudo code for the H.248 signalling elements.

8.2 Push mode

Figure 10 shows a typical flow with pseudo code for push mode. This clause and example is only for completeness; no capabilities from this Recommendation are required.

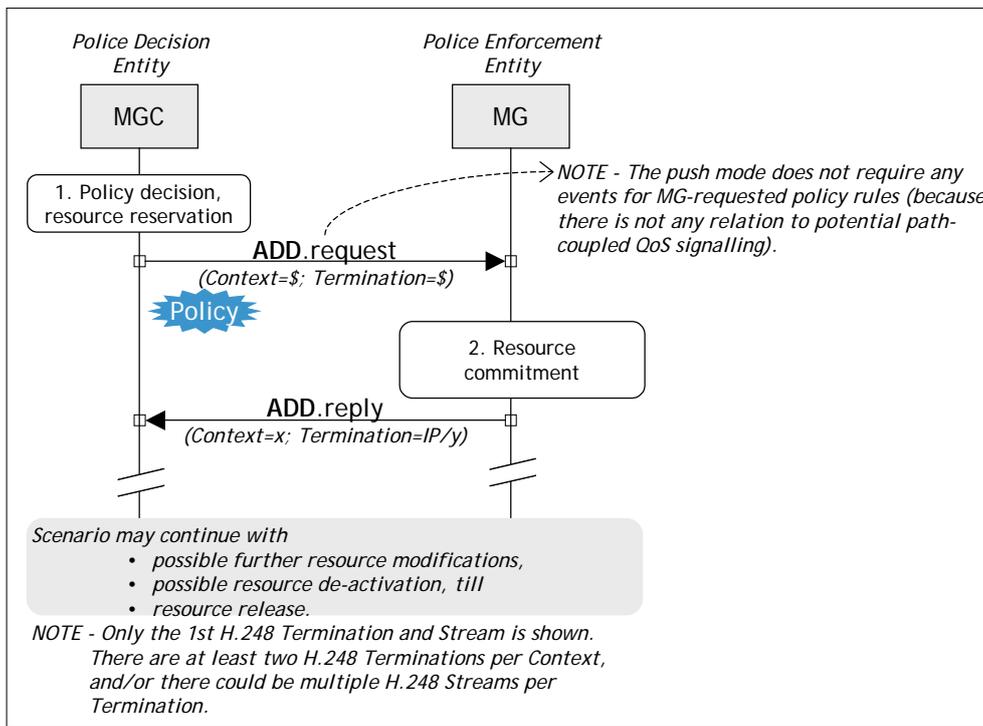


Figure 10 – Push mode – Phase of resource reservation and commitment

8.3 Context-created MG pull mode

Figure 11 illustrates a typical flow with pseudo code for the context-created pull mode variant. The purpose of the first ADD request/reply scenario is the creation of a context including an H.248 IP termination and enabled *plm* package events. The ADD.request command may include only the absolute minimum of H.248 information elements, e.g., may not contain the LocalControl, local and/or remote descriptor. Thus, the created H.248 IP stream/termination may be completely underspecified.

The crucial difference in comparison to the context-less pull mode is the fact that the used token is based on H.248 information elements related to the created context.

The incoming (QoS) signalling message (step 6) carries the token. The token is then relayed by the MG toward the MGC via the correlated H.248 Context via the event *plm/rdr* associated with the Stream/Termination.

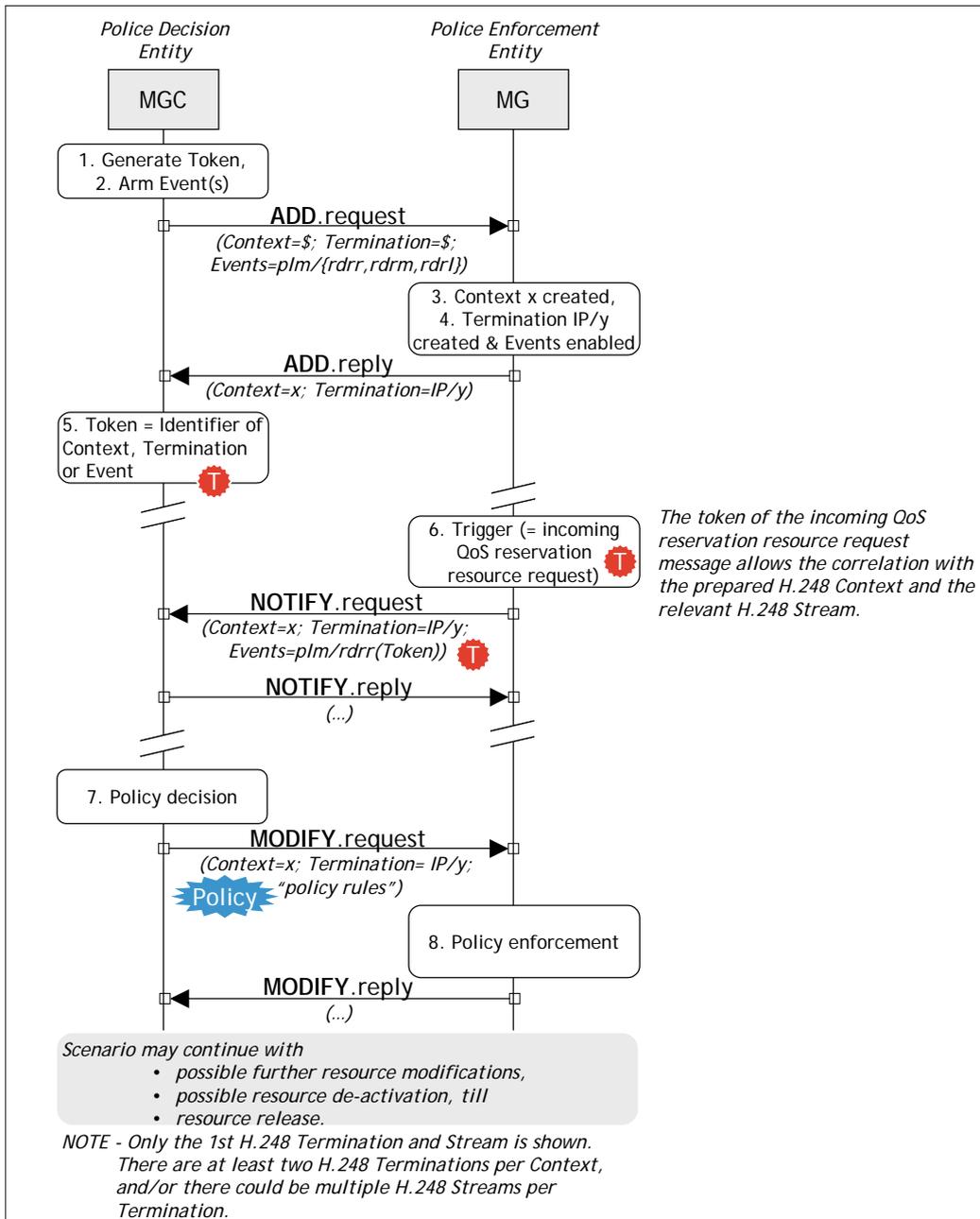


Figure 11 – Context-created pull mode – Phases of resource reservation and commitment

Steps 7 and 8 are the usual policy decision and enforcement phases.

8.4 Context-less MG pull mode

There are two basic procedures related to this pull mode variant.

8.4.1 Session/call-independent procedure: Enabling for MG-level resource reservation request events

The event for (QoS) resource reservation requests is enabled at the MG-level. Figure 12 shows an example flow with pseudo code, highlighting the H.248.55-specific protocol elements.

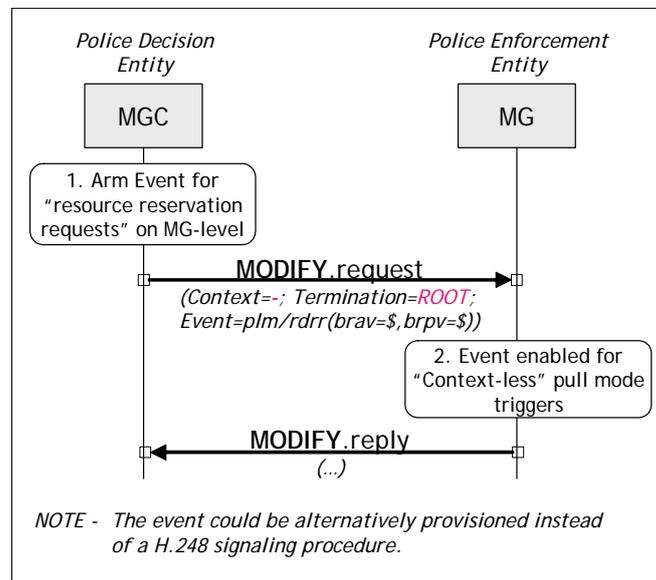


Figure 12 – Context-less pull mode – Enabling for MG-level resource reservation request events

Only the event *plm/rdr* is associated with the root termination.

NOTE – There are many commonalities (from an H.248 perspective), concerning the handling of incoming bearer-level signalling events, between path-coupled QoS signalling protocols and PSTN analogue line signalling, channel-associated signalling or bearer control protocols (such as AAL2 Q.2630 signalling or ATM signalling). The similarities are in the areas of events, correlation elements between bearer and signalled information elements or procedures.

8.4.2 Session/call-dependent procedures: Notification of context-related resource reservation request events

Figure 13 shows the session scenario, starting with an incoming (QoS) resource reservation request. The (QoS) signalling message carries the token, which is then relayed by the MG towards the MGC via the root termination event *plm/rdr*.

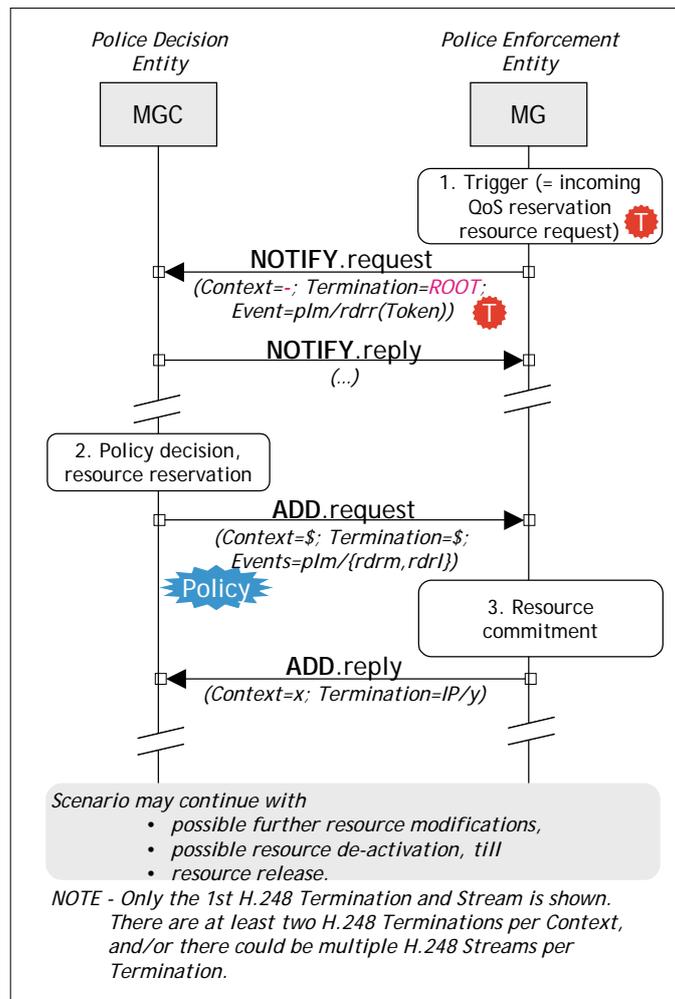


Figure 13 – Context-less pull mode – Notification of context-related resource reservation request events

The subsequent ADD.request then leads to the creation of a context and IP termination, as well as the setting of the two other *plm* events *rdrm* and *rdrl*.

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