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STANDARDIZATION SECTOR  
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SERIES Q: SWITCHING AND SIGNALLING

Signalling requirements and protocols for the NGN –  
Resource control protocols

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**Resource control protocol No. 8 – Protocol at  
the interface between a policy decision physical  
entity and a customer premises network  
gateway policy enforcement physical entity  
(Rh interface): COPS alternative**

Recommendation ITU-T Q.3308.1

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## **Recommendation ITU-T Q.3308.1**

### **Resource control protocol No. 8 – Protocol at the interface between a policy decision physical entity and a customer premises network gateway policy enforcement physical entity (Rh interface): COPS alternative**

#### **Summary**

Recommendation ITU-T Q.3308.1 specifies the rcp8 protocol used between a policy decision physical entity (PD-PE) and a customer premises network gateway policy enforcement physical entity (CGPE-PE). This interface was defined in Recommendation ITU-T Y.2111. The interface can be supported in direct mode and the interaction for resource and admission control between PD-PE and CGPE-PE.

#### **History**

Edition	Recommendation	Approval	Study Group
1.0	ITU-T Q.3308.1	2012-03-29	11

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# Recommendation ITU-T Q.3308.1

## **Resource control protocol No. 8 – Protocol at the interface between a policy decision physical entity and a customer premises network gateway policy enforcement physical entity (Rh interface): COPS alternative**

### **1 Scope**

This Recommendation specifies the protocol used between a policy decision physical entity (PD-PE) and a customer premises network (CPN) gateway policy enforcement physical entity (CGPE-PE). The functional requirements of the Rh interface are contained in [ITU-T Y.2111]. The Rh interface between a PD-PE in the access network and a CGPE-PE can be handled by quality of service (QoS) resource control modes, such as push mode and pull mode. That is, the Rh interface allows the final admission decisions to be installed (either pushed or pulled) to the CGPE-PE from the PD-PE.

The normative part of this Recommendation uses or refers to messages which are defined, and whose behaviours are described, in one or more IETF RFCs. To help the users of this Recommendation, a list of all these messages and their origins are provided in Annex B.

### **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 Q.3300 v2] Recommendation ITU-T Q.3300 v2 (2010), *Architectural framework for the Q.33xx series of Recommendations*.
- [ITU-T Y.2012] Recommendation ITU-T Y.2012 (2010), *Functional requirements and architecture of next generation networks*.
- [ITU-T Y.2111] Recommendation ITU-T Y.2111 (2011), *Resource and admission control functions in next generation networks*.
- [IETF RFC 2748] IETF RFC 2748 (2000), *The COPS (Common Open Policy Service) Protocol*.
- [IETF RFC 3084] IETF RFC 3084 (2001), *COPS Usage for Policy Provisioning (COPS-PR)*.

### **3 Definitions**

#### **3.1 Terms defined elsewhere**

This Recommendation uses the following terms defined elsewhere:

**3.1.1 COPS connection** [b-ITU-T Q.3303.1]: A COPS signalling relationship established between the PD-PE acting in the role of a COPS Policy Decision Point (PDP) and the CGPE-PE acting in the role of a COPS Policy Enforcement Point (PEP).

**3.1.2 policy decision physical entity (PD-PE)** [b-ITU-T Q.3303.1]: The PD-PE is an implemented instance of the policy decision functional entity (PD-FE) as defined in [ITU-T Y.2111].

**3.1.3 flow ID** [b-ITU-T Q.3303.1]: It is an identifier for the individual media flow within a session. Usually the Flow ID is created by the PD-PE.

**3.1.4 flow information** [b-ITU-T Q.3303.1]: It describes the features of the media flow (e.g., filter and filter status).

## **3.2 Terms defined in this Recommendation**

This Recommendation defines the following term:

**3.2.1 CPN gateway policy enforcement physical entity (CGPE-PE)**: The CGPE-PE is an implemented instance of the customer premises network (CPN) gateway policy enforcement functional entity (CGPE-FE) as defined in [ITU-T Y.2111].

## **4 Abbreviations and acronyms**

This Recommendation uses the following abbreviations and acronyms:

CAT	Client Accept
CC	Client Close
CGPE-PE	CPN Gateway Policy Enforcement Physical Entity
COPS	Common Open Policy Service
COPS-PR	COPS Usage for Policy Provisioning
CPE	Customer Premises Equipment
CPN	Customer Premises Network
DEC	Decision
DiffServ	Differentiated Services
DRQ	Delete Request state
DSCP	Differentiated Services Code Point
IP	Internet Protocol
KA	Keep Alive
NACE	Network Attachment Control Entity
OPN	client Open
PD-PE	Policy Decision Physical Entity
PIB	Policy Information Base
PRC	Provisioning Class
PRI	Provisioning Instance
QinQ	802.1Q in 802.1Q
QoS	Quality of Service
RACF	Resource and Admission Control Functions
REQ	Request
RIP	Resource Initiation Response
RIR	Resource Initiation Request
RMR	Resource Modification Request



RPT	Report state
SCE	Service Control Entity
SLA	Service Level Agreement
SSC	Synchronize Complete
SSQ	Synchronize State Request
TOS	Type of Service
T-PE	Transport Physical Entity
TRC-PE	Transport Resource Control Physical Entity
TRE-PE	Transport Resource Enforcement Physical Entity
VLAN	Virtual Local Area Network

## 5 Conventions

None.

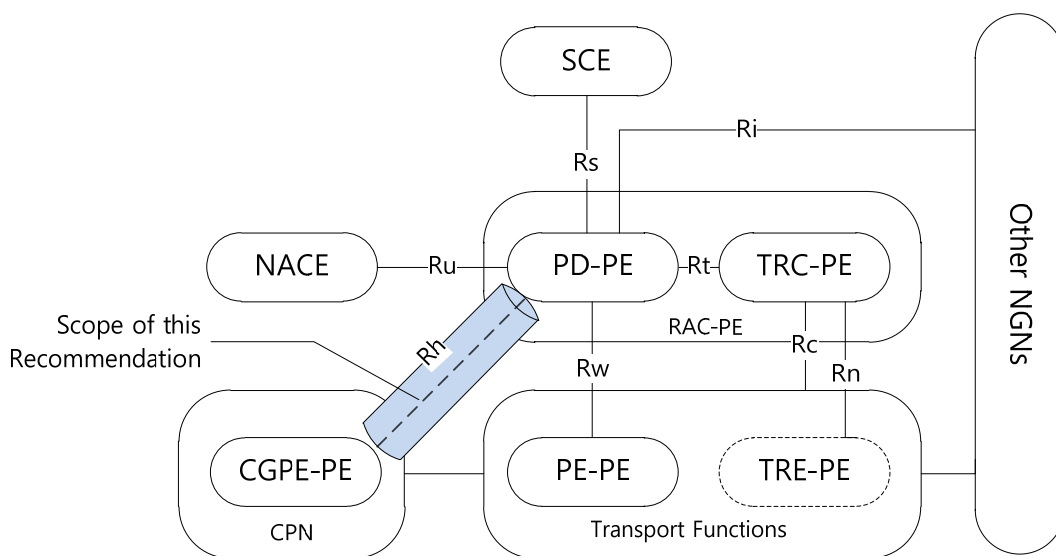
## 6 Rh interface

### 6.1 Overview

The Rh reference point is used for interaction between a policy decision physical entity (PD-PE) and a CPN gateway policy enforcement physical entity (CGPE-PE). The interface is defined in [ITU-T Y.2111]. The Rh reference point allows the final admission decisions to be installed or uninstalled to the CGPE-PE from the PD-PE.

### 6.2 Rh reference model

Figure 6-1 shows the Rh reference model.



**Figure 6-1 – Overall architecture of the Rh interface**

## **6.3 Functional elements and capabilities**

### **6.3.1 Policy decision physical entity (PD-PE)**

The PD-PE is a physical element that coordinates a resource reservation request received from the service control entity (SCE). The PD-PE makes policy decisions using network resource and admission control based on network policy rules and service level agreements (SLAs).

### **6.3.2 CPN gateway policy enforcement physical entity (CGPE-PE)**

The CGPE-PE is a physical element that enforces the network policy rules instructed by the PD-PE in the access network via the Rh interface. The CGPE-PE should be able to support the opening and closing gate; rate limiting and bandwidth allocation; traffic classification and marking; traffic policing and shaping; mapping of the Internet Protocol (IP) layer QoS information onto link layer QoS information based on pre-defined static policy rules; collecting and reporting resource usage information; etc.

## **7 Resource control procedures**

### **7.1 Procedures at the PD-PE**

#### **7.1.1 Resource initiation**

##### **7.1.1.1 Transport subscription profile verification**

The Rh interface allows the PD-PE to push policy decisions to the CGPE-PE. The PD-PE verifies the transport profile received from the network attachment control entity (NACE). Thus, the PD-PE acquires the QoS class, priority of reservation, and maximum and/or minimum uplink and downlink bandwidth.

##### **7.1.1.2 Transport resource detection and admission**

The PD-PE is required to confirm transport resources availability to the transport resource control (TRC)-PE. The PD-PE is required to make policy decisions based on the confirmation result from the TRC-PE.

##### **7.1.1.3 Initial policy decisions**

The PD-PE makes initial policy decisions for IP flows by the resource initiation request from the SCE based on all information, including:

- Service information received from the SCE.
- Transport subscription information from the PD-PE.
- Transport subscription profiles.
- Service based network policies.
- Transport resource availability and admission decision information received from the TRC-PE.

In order to support the policy decision, the following information shall be contained in the policy decisions.

– *IP media flow description*

The uplink and downlink packet classifiers from the IP addresses and port numbers provided by the SCE shall be derived from the PD-PE.

– *Transport subscription information*

The transport subscription information includes QoS parameter for L2 (layer 2) packet marking and handling in CGPE-PE (e.g., 802.1p). It can be derived from the network QoS parameters and transport subscription information by the PD-PE.

– *QoS information*

The QoS information includes QoS class based on the requested service type and bandwidth requirements. The QoS information for IP media flows is extracted from the media profile (e.g., type of service (TOS), traffic class, media priority and bandwidth) received from the SCE. Also, it can be derived from the network QoS parameters and transport subscription information by the PD-PE. A QoS parameter for L2 packet marking and handling can be used in CGPE-PE (e.g., 802.1p).

The PD-PE may select the QoS class for the media, and the PD-PE shall use the same QoS class for both links (uplink and downlink) when both directions are required for the service.

According to the network and pre-defined customer premises network (CPN) policy (e.g., service priority), resource availability and the transport subscription profile, the PD-PE shall authorize the requested bandwidth value in the resource initiation request (RIR) message from the SCE.

– *Resource control actions*

The PD-PE shall decide on resource control actions based on the RIR from the SCE. The CGPE-PE may receive the reservation request to enforce the initial policy decision from the PD-PE. The reservation action requests the CGPE-PE to enforce the initial policy decisions without passing the packets. When the RhFlowInfoFilterStatus attribute of RhFlowInfoEntity is "closed", the Reservation action can be used.

The RhFlowInfoEntity instance in the decision (DEC) message represents the resource control action for each IP media flow or group of IP media flow. Also, Rh802Filter instance in the DEC message represents the resource control action for L2 packet marking and handling.

An initial request can be admitted by the PD-PE for all IP media flows in the session, if all conditions are satisfied. If the request is sent, the PD-PE shall send a resource initiation response back to the SCE and include a successful resource request result code, that is, the rhStateReportStatus attribute of RhStateReportEntry (see Annex A). Otherwise, the PD-PE may include available resource information in the resource initiation response if the reason of failed authorization is because of insufficient resources.

The PD-PE will process simultaneous requests from SCE based on the priority level specified in the Resource Request Priority, which is also sent to the CGPE-PE. If the Resource Request Priority is not specified, the priority default is value.

### **7.1.2 Resource modification**

Upon receipt of the Resource Modification Request (RMR) message from the SCE, with modified information (or local triggers) due to such events as network policies and configurations, the PD-PE is required to perform transport subscription verification and transport resource detection and admission. From here, the policy decision is updated as described in clauses 7.1.1.1 to 7.1.1.3 for new or modified media components, based on locally stored state information.

### **7.1.3 Resource release**

Resource termination can optionally be initiated by the PD-PE, upon receipt of a resource release request from SCE or triggered by pre-defined static policies inside the PD-PE. Upon receipt of the resource release request from the SCE, the PD-PE is required to release all relevant resources. The PD-PE sends resource release request to the CGPE-PE via the Rh interface.

## **8 Procedures at the CGPE-PE**

### **8.1 Session initiation**

Based on a DEC message from the PD-PE, the CGPE-PE shall map it into its CPN QoS control mechanisms (e.g., bandwidth control for each service types), install the initial policy decision and inform the PD-PE of the result. When the policy decision is installed, the result includes the value (Report-Type='Success') or (Report-Type='Failure').

When the RhFlowInfoFilterStatus attribute is set to the value "open" in the initial DEC Install message, the CGPE-PE shall commit the requested resources and open the gates for the related IP media flow using the packet filters defined in the RhFlowInfoFilter attribute. Also, CGPE-PE shall commit requested resources for L2 packet marking and handling using 802.1q filters defined in the Rh802Filter attribute.

The CGPE-PE shall monitor and drop packets based on the policy rules from the PD-PE.

### **8.2 Session modification**

When the decision flags are set to "install", and upon receipt of a DEC message with an existing Client Handle from the PD-PE, the CGPE-PE will reinstall the policy decision.

The CGPE-PE may perform the following operations:

- Install a policy decision for a new IP media flow without committing the requested resources if the RhFlowInfoFilterStatus attribute is set to close.
- Install a policy decision for the requested resources for a new IP media flow if the RhFlowInfoFilterStatus attribute is set to open.
- Modify a policy decision for an existing IP media flow without committing the requested resources if the RhFlowInfoFilterStatus attribute is set to close.
- Modify a policy decision and commit the requested resources for an existing IP media flow if the RhFlowInfoFilterStatus attribute set to open.
- Revoke the installed decisions for reserved resource for all related media flows.

### **8.3 Session termination**

Upon receipt of the Resource Release Request message from SCE, the PD-PE forwards it to the CGPE-PE. The CGPE-PE shall release the network resource.

## **9 Protocol specifications**

### **9.1 Protocol support**

The Rh interface is required to conform to the IETF Common Open Policy Service (COPS) framework, guidance and COPS-policy provisioning (PR) procedures [IETF RFC 2748]. Data models of COPS-PR are defined in [IETF RFC 3084].

This Recommendation makes use of a simplified and modified version of the COPS protocol as specified in [IETF RFC 2748] and [IETF RFC 3084]. The COPS protocol supports the Rh interface between the PD-PE and the CGPE-PE. The CGPE-PE serves as a policy enforcement point (PEP) (Client) and the PD-PE serves as a PDP (Server).

## **9.2 COPS basic message**

In order to apply the COPS protocol for the Rh interface, all messages and formats specified in [IETF RFC 3084] are required to be used. Client Open (OPN), Client Accept (CAT), Client Close (CC), Keep Alive (KA), Synchronize State Request (SSQ) and Synchronize Complete (SSC) messages are used for setting up and maintaining the connection and synchronization of the request state between the PD-PE and the CGPE-PE. For policy control, Request (REQ), Delete Request State (DRQ), Decision (DEC) messages are used over the Rh interface.

### **9.2.1 Role of the policy information base**

As its global name space of policy, COPS uses a named data structure, known as a policy information base (PIB), to identify the type and purpose of unsolicited policy information for a provisioning policy or a notification between different production vendors. As a conceptual tree namespace where the branches of the tree represent structures of data or provisioning classes (PRCs), while the leaves represent various instantiations of Provisioning Instances (PRIs), the PIB can be described.

#### **9.2.1.1 Definition of the PIB**

The detailed PIB information, based on an IP network for QoS guarantee, is defined in Annex A.

## **9.3 Resource management information**

### **9.3.1 Flow ID**

In order to identify the media flow within a session, a unique flow ID may be used for it. The PD-PE creates a unique flow ID for media flows.

### **9.3.2 Flow information**

In the policy install messages, flow information includes several values as the following;

- Flow direction
- Flow filter
  - Address type
  - IP addresses
  - Ports
  - Protocol number
  - Differentiated Services Code Point (DSCP)
  - 802.1q
- Flow filter status
- Service type

### **9.3.3 Traffic information**

In the policy install messages, traffic information includes several values as the following;

- Peak bandwidth
- Average bandwidth
- Bandwidth unit

## **10 Message specifications**

### **10.1 Request (CGPE-PE→PD-PE)**

The Request (REQ) message is sent by the CGPE-PE to the PD-PE to request a configuration decision. The CGPE-PE can optionally send the connection information (Physical and/or Logical connection) of the home network to which the CPE is attached. The CPE can optionally classify flow or flow aggregation by using identifiers such as IP and Mac address, User ID, Service ID, and other physical information to assist the PD-PE in deciding what types of policy should be installed to the CGPE-FE.

### **10.2 Decision (PD-PE→CGPE-PE)**

The Decision (DEC) message is sent by the PD-PE to the CGPE-PE to push the final admission decision.

- **Flow-based policy**

The rhFlowbasedDecInfoGroup, rhEventIndicatorGroup and rhFlowDecGroup are used for this purpose.

- Resource Request Priority: described by rhFlowBasedDecInfoRequestPriority attribute;
- Event notification indication: described by rhFlowBasedDecInfoEventIndicator attribute;
- Description of groups of the media flow within a session: described by rhFlowBasedDecInfoFlowDesc attribute.

In push mode, the rhDecCapGroup is used for providing the following PD-PE capabilities and limitations in the configuration of the DEC message:

- Indication of the maximum number of Flow identifiers:

The PD-PE may notify the CGPE-PE of how many flow identifiers the PD-PE is able to send with an install DEC message.

### **10.3 Report (CGPE-PE→PD-PE)**

The Report (RPT) message is sent by the CGPE-PE to the PD-PE to report processing result or resource status between the CGPE-PE and the PD-PE. The processing result will be reported to the PD-PE after the CGPE-PE installs or uninstalls service messages. The RPT message is a response message to any kind of DEC message and to an unsolicited report.

- Event notification

The rhStateReportGroup is used to provide event notification to the PD-PE.

### **10.4 Delete request State (CGPE-PE→PD-PE)**

The Delete Request State (DRQ) message is sent by the CGPE-PE to inform the PD-PE whether the state identified by the client is available. If the corresponding state for the client is not available, the request state is removed at the PD-PE.

## **11 Security considerations**

In this Recommendation, the security mechanisms described in COPS [IETF RFC 2748] and COPS-PR [IETF RFC 3084] are applicable. COPS provides its own security mechanisms to protect the per-hop integrity of the developed policy.

## Annex A

### Rh policy information base

(This annex forms an integral part of this Recommendation.)

```
ITUT-RhPib PIB-DEFINITIONS ::= BEGIN

IMPORTS
    Unsigned32,
    Integer32,
    MODULE-IDENTITY,
    MODULE-COMPLIANCE,
    OBJECT-TYPE,
    OBJECT-GROUP
FROM COPS-PR-SPPI -- Defined in RFC 3159

    InstanceId,
    Prid
FROM COPS-PR-SPPI-TC -- Defined in RFC 3159

    DscpOrAny
FROM DIFFSERV-DSCP-TC -- Defined in RFC 3289

    zeroDotZero
FROM SNMPv2-SMI

    InetAddress,
    InetAddressType,
    InetAddressPrefixLength,
    InetPortNumber
FROM INET-ADDRESS-MIB; -- Defined in RFC 3291

iTUT-RhPib MODULE-IDENTITY
    SUBJECT-CATEGORIES { Rh(0x800e) } -- ITU-T Rh COPS Client Type
    LAST-UPDATED "201109090000Z"
    ORGANIZATION "ITU-T Study Group 11"
    CONTACT-INFO "zeroplus@hufs.ac.kr"
    DESCRIPTION
        "A PIB module containing the set of provisioning
         classes that are required for support of policies for
         Rh Cops interface"
    REVISION "201109090000Z"
    DESCRIPTION
        "The ITU-T Rh PIB for Rec. Q.3308.1 version 1"
::= { 0.0.17.3308.127.1.2.0 }
-- itu-t(0) recommendation(0) q(17) q3308(3308) hyphen(127) (1)
-- pib(2) version1(0)

rhCapabilityClasses      OBJECT IDENTIFIER ::= { iTUT-RhPib 1}
rhEventInfoClasses      OBJECT IDENTIFIER ::= { iTUT-RhPib 2}
rhServiceInfoClasses    OBJECT IDENTIFIER ::= { iTUT-RhPib 3}
rhReqInfoClasses        OBJECT IDENTIFIER ::= { iTUT-RhPib 4}
rhDecInfoClasses        OBJECT IDENTIFIER ::= { iTUT-RhPib 5}
rhReportClasses         OBJECT IDENTIFIER ::= { iTUT-RhPib 6}
rhConformance           OBJECT IDENTIFIER ::= { iTUT-RhPib 7}

-----
-- Capability and Limitation Policy Rule Classes

-- Rh Decision Capability Table
--
```

```

rhDecCapTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF RhDecCapEntry
    PIB-ACCESS   notify
    STATUS       current
    DESCRIPTION
        "PRC from PD-PE to CGPE-PE carried by DEC during initial capability
negotiation, indicating the PD-PE's capability."
    ::= { rhCapabilityClasses 1 }

rhDecCapEntry OBJECT-TYPE
    SYNTAX      RhDecCapEntry
    STATUS       current
    DESCRIPTION
        "An instance of the RhDecCap class identifies a specific PRC and
associated attributes as supported by the device."
    PIB-INDEX { RhDecCapPrid }
    UNIQUENESS { }
    ::= { rhDecCapTable 1 }

RhDecCapEntry ::= SEQUENCE {
    rhDecCapPrid      InstanceId,
    rhDecCapFlowIds   Unsigned32
}

rhDecCapPrid OBJECT-TYPE
    SYNTAX      InstanceId
    STATUS       current
    DESCRIPTION
        "An arbitrary integer index that uniquely identifies an
instance of the RhDecCap class."
    ::= { rhDecCapEntry 1 }

rhDecCapFlowIds OBJECT-TYPE
    SYNTAX      Unsigned32
    STATUS       current
    DESCRIPTION
        "Indication of the maximum number of Flow Id possible in a single Dec
message. The value of zero indicates limit is not specified."
    DEFVAL { 0 }
    ::= { rhDecCapEntry 2 }

-----

-- Rh Decision Capability Acknowledge Table
--
rhDecCapACKTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF RhDecCapACKEntry
    PIB-ACCESS   install
    STATUS       current
    DESCRIPTION
        "PRC from PD-PE to CGPE-PE carried by COPS-PR RPT messages indicating
the result of the capability negotiation."
    ::= { rhCapabilityClasses 2 }

rhDecCapACKEntry OBJECT-TYPE
    SYNTAX      RhDecCapACKEntry
    STATUS       current
    DESCRIPTION
        "An instance of the RhDecCapACK class sent by the CGPE-PE to the PD-
PE."
    PIB-INDEX { RhDecCapACKPrid }
    UNIQUENESS { }
    ::= { rhDecCapACKTable 1 }

```



```

RhDecCapACKEntry ::= SEQUENCE {
    rhDecCapACKPrid      InstanceId,
    rhDecCapACKEnable    INTEGER,
    rhDecCapACKFlowIds   Unsigned32
}

rhDecCapACKPrid OBJECT-TYPE
    SYNTAX      InstanceId
    STATUS      current
    DESCRIPTION
        "An arbitrary integer index that uniquely identifies an instance of
this class."
 ::= { rhDecCapACKEntry 1 }

rhDecCapACKEnable OBJECT-TYPE
    SYNTAX      INTEGER {
        enable(1),
        disable(2)
    }
    STATUS      current
    DESCRIPTION
        "Controls the usage of PD-PE capability negotiation."
    DEFVAL { enable }
 ::= { rhDecCapACKEntry 2 }

rhDecCapACKFlowIds OBJECT-TYPE
    SYNTAX      Unsigned32
    STATUS      current
    DESCRIPTION
        "Indication of the maximum number of Flow Id in a DEC message which is
acceptable to CGPE-PE.
        The value of zero indicates limit is not specified."
    DEFVAL { 0 }
 ::= { rhDecCapACKEntry 3 }

-----
--
-- Rh Event Info Classes
--
-- Rh Event Notification Indication Table

rhEventIndicatorTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF RhEventIndicatorEntry
    PIB-ACCESS   install-notify
    STATUS      current
    DESCRIPTION
        "PRC representing event notification indicator. In COPS-PR install
decision object and sent by PD-PE to CGPE-PE indicate the PD-PE requests the
CGPE-PE to provide a notification at the transport event. In PRT message and
sent by CGPE-PE to PD-PE indicate the CGPE-PE report the transport event to PD-
PE. "
 ::= { rhEventInfoClasses 1 }

rhEventIndicatorEntry OBJECT-TYPE
    SYNTAX      RhEventIndicatorEntry
    STATUS      current
    DESCRIPTION
        "An entry in the Event Indicator Table describing a transport event.
        Each entry is referenced by RhDecInfoEventIndicator."
    PIB-INDEX { RhEventIndicatorPrid }
    UNIQUENESS { }
 ::= { rhEventIndicatorTable 1 }

```

```

rhEventIndicatorEntry ::= SEQUENCE {
    rhEventIndicatorPrid      InstanceId,
    rhEventIndicator          Integer32,
    rhEventIndicatorNext      Prid
}

rhEventIndicatorPrid OBJECT-TYPE
    SYNTAX      InstanceId
    STATUS      current
    DESCRIPTION
        "An arbitrary integer index that uniquely identifies an
        instance of the RhEventIndicator class."
    ::= { rhEventIndicatorEntry 1 }

rhEventIndicator OBJECT-TYPE
    SYNTAX      Integer32{
        indicationOfLoss(1),
        indicationOfRecovery(2),
        indicationOfRelease(3),
        deviceoverload(4),
        devicerecoverfromoverload(5)
    }
    STATUS      current
    DESCRIPTION
        "An integer indicating the query and notification of a transport
        event."
    ::= { rhEventIndicatorEntry 2 }

rhEventIndicatorNext OBJECT-TYPE
    SYNTAX      Prid
    STATUS      current
    DESCRIPTION
        "References the next of a list of RhEventIndicator instances. A value
        of zeroDotZero indicates this is the last of a list of RhEventIndicator
        instances."
    DEFVAL { zeroDotZero }
    ::= { rhEventIndicatorEntry 3 }
-----

-- Rh Service Info Classes

--
-- Rh Flow Desc Table
--
rhFlowDescTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF RhFlowDescEntry
    PIB-ACCESS   install-notify
    STATUS      current
    DESCRIPTION
        "PRC representing the information of flows involved in a session.
        Referenced by the RhFlowBasedDecInfoFlowDesc and RhFlowDescNext.."
    ::= { rhServiceInfoClasses 1 }

rhFlowDescEntry OBJECT-TYPE
    SYNTAX      RhFlowDescEntry
    STATUS      current
    DESCRIPTION
        "An entry in the Flow Desc Table describing the information of a list
        flows.
        It is referenced by RhFlowBasedDecInfoFlowDesc and RhFlowDescNext. It
        may be carried by COPS-PR Install decision from PD-PE to CGPE-PE."
    PIB-INDEX { RhFlowDescPrid }
    UNIQUENESS { }
    ::= { rhFlowDescTable 1 }

```

```

rhFlowDescEntry ::= SEQUENCE {
    rhFlowDescPrid          InstanceId,
    rhFlowDescSingleFlowInfo Prid,
    rhFlowDescConnectInfo   Prid,
    rhFlowDescNext          Prid
}

rhFlowDescPrid OBJECT-TYPE
    SYNTAX      InstanceId
    STATUS      current
    DESCRIPTION
        "An arbitrary integer index that uniquely identifies an instance of
the RhFlowDesc class."
    ::= { rhFlowDescEntry 1 }

rhFlowDescSingleFlowInfo OBJECT-TYPE
    SYNTAX      Prid
    STATUS      current
    DESCRIPTION
        "An arbitrary integer index that references the first of a list of
RhSingleFlowInfo Instances."
    ::= { rhFlowDescEntry 2 }

rhFlowDescConnectInfo OBJECT-TYPE
    SYNTAX      Prid
    STATUS      current
    DESCRIPTION
        "An arbitrary integer index that uniquely identifies
an instance of the RhCPNGWConnectInfo. A value of zeroDotZero indicates there is
no Flow Connection Information included."
    DEFVAL { zeroDotZero }
    ::= { rhFlowDescEntry 3 }

rhFlowDescNext OBJECT-TYPE
    SYNTAX      Prid
    STATUS      current
    DESCRIPTION
        "References the next of a list of RhFlowDesc instances. A value of
zeroDotZero indicates this is the last of a list of RhFlowDesc instances."
    DEFVAL { zeroDotZero }
    ::= { rhFlowDescEntry 4 }

-----

--
-- Rh Single Flow Info Table
--

rhSingleFlowInfoTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF RhSingleFlowInfoEntry
    PIB-ACCESS   install-notify
    STATUS      current
    DESCRIPTION
        "PRC representing the information of flow, which is identified with a
Flow ID."
    ::= { rhServiceInfoClasses 2 }

rhSingleFlowInfoEntry OBJECT-TYPE
    SYNTAX      RhSingleFlowInfoEntry
    STATUS      current
    DESCRIPTION

```

```

        "An entry in the Single Flow Info Table describing the information of
a flow."
        PIB-INDEX { RhSingleFlowInfoPrid }
        UNIQUENESS { }
::= { rhSingleFlowInfoTable 1 }

rhSingleFlowInfoEntry ::= SEQUENCE {
        rhSingleFlowInfoPrid                               InstanceId,
        rhSingleFlowInfoFlowId                             Integer32,
        rhSingleFlowInfoFlowTermination                    Prid,
        rhSingleFlowInfoAddressRealm                       Prid,
        rhSingleFlowInfoFlowDirDesc                        Prid
    }

rhSingleFlowInfoPrid OBJECT-TYPE
    SYNTAX      InstanceId
    STATUS      current
    DESCRIPTION
        "An arbitrary integer index that uniquely identifies an
instance of the RhSingleFlowInfo entry."
::= { rhSingleFlowInfoEntry 1 }

rhSingleFlowInfoFlowId OBJECT-TYPE
    SYNTAX      Integer32
    STATUS      current
    DESCRIPTION
        "The FlowId itself."
::= { rhSingleFlowInfoEntry 2 }
rhSingleFlowInfoFlowTermination OBJECT-TYPE
    SYNTAX      Prid
    STATUS      current
    DESCRIPTION
        "An arbitrary integer index that uniquely identifies an instance of
RhFlowTermination. A value of zeroDotZero indicates there are no NAT
implementation in the CGPE-PE."
    DEFVAL { zeroDotZero }
::= { rhSingleFlowInfoEntry 3 }

rhSingleFlowInfoAddressRealm OBJECT-TYPE
    SYNTAX      Prid
    STATUS      current
    DESCRIPTION
        "An arbitrary integer index that uniquely identifies an instance of
RhFlowAddressRealm. A value of zeroDotZero indicates there are no Address Realm
information associated with this Single Flow Info."
    DEFVAL { zeroDotZero }
::= { rhSingleFlowInfoEntry 4 }

rhSingleFlowInfoFlowDirDesc OBJECT-TYPE
    SYNTAX      Prid
    STATUS      current
    DESCRIPTION
        "References the first of a list of RhFlowDirDesc associated with this
instance of Single Flow Info. There is one RhFlowDirDesc instance per
direction(uplink or downlink)."
::= { rhSingleFlowInfoEntry 5 }

-----
--
-- Rh Flow Termination Table
--

rhFlowTerminationTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF RhFlowTerminationEntry

```

```

    PIB-ACCESS    install-notify
    STATUS        current
    DESCRIPTION
        "PRC representing the side(access or core network) of the flow, which
is identified with a Flow ID."
    ::= { rhServiceInfoClasses 3 }

rhFlowTerminationEntry OBJECT-TYPE
    SYNTAX        RhFlowTerminationEntry
    STATUS        current
    DESCRIPTION
        "An entry in the Flow Termination Table describing the side
information of a flow.
        It is referenced by RhSingleFlowInfoFlowTermination."
    PIB-INDEX { RhFlowTerminationPrid }
    UNIQUENESS { }
    ::= { rhFlowTerminationTable 1 }

RhFlowTerminationEntry ::= SEQUENCE {
    rhFlowTerminationPrid      InstanceId,
    rhFlowTermination          Integer32,
}

rhFlowTerminationPrid OBJECT-TYPE
    SYNTAX        InstanceId
    STATUS        current
    DESCRIPTION
        "An arbitrary integer index that uniquely identifies an instance of
the RhFlowTermination entry."
    ::= { rhFlowTerminationEntry 1 }

rhFlowTermination OBJECT-TYPE
    SYNTAX        Integer32
    STATUS        current
    DESCRIPTION
        "An integer indicating the side of the flow is terminated."
    ::= { rhFlowTerminationEntry 2 }

-----
--
-- Rh Flow Address Realm Table
--

rhFlowAddressRealmTable OBJECT-TYPE
    SYNTAX        SEQUENCE OF RhFlowAddressRealmEntry
    PIB-ACCESS    install
    STATUS        current
    DESCRIPTION
        "PRC representing the address realm of the flow's IP address."
    ::= { rhServiceInfoClasses 4 }

rhFlowAddressRealmEntry OBJECT-TYPE
    SYNTAX        RhFlowAddressRealmEntry
    STATUS        current
    DESCRIPTION
        "An entry in the Flow Address Realm Table describing the realm
information of a flow's source and destination address.
        It is referenced by RhSingleFlowInfoAddressRealm."
    PIB-INDEX { RhFlowAddressRealmPrid }
    UNIQUENESS { }
    ::= { rhFlowAddressRealmTable 1 }

rhFlowAddressRealmEntry ::= SEQUENCE {
    rhFlowAddressRealmPrid      InstanceId,

```

```

        rhwFlowAddressRealm          OCTET STRING,
    }
rhFlowAddressRealmPrid OBJECT-TYPE
    SYNTAX      InstanceId
    STATUS      current
    DESCRIPTION
        "An arbitrary integer index that uniquely identifies an
instance of the RhFlowAddressRealm entry."
 ::= { rhFlowAddressRealmEntry 1 }

rhFlowAddressRealm OBJECT-TYPE
    SYNTAX      OCTET STRING
    STATUS      current
    DESCRIPTION
        "Indicates the address realm of the flow's source and destination
address."
 ::= { rhwFlowAddressRealmEntry 2 }

-----
--
-- Rh Flow Direction Description Table
--

rhFlowDirDescTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF RhFlowDirDescEntry
    PIB-ACCESS   install
    STATUS      current
    DESCRIPTION
        "PRC representing the information of flow in the direction of uplink
and/or downlink."
 ::= { rhServiceInfoClasses 7}

rhFlowDirDescEntry OBJECT-TYPE
    SYNTAX      RhFlowDirDescEntry
    STATUS      current
    DESCRIPTION
        "An entry in the Flow Dec Table describing the information of a flow.
It is referenced by RhSingleFlowInfoFlowDirDesc and RhFlowDirDescNext."
    PIB-INDEX { RhFlowDirDescPrid }
    UNIQUENESS { }
 ::= { rhFlowDirDescTable 1 }

RhFlowDirDescEntry ::= SEQUENCE {
    rhFlowDirDescPrid      InstanceId,
    rhFlowDirDescInfo      Prid,
    rhFlowDirDescFluxInfo  Prid,
    rhFlowDirDescNext      Prid
}

rhFlowDirDescPrid OBJECT-TYPE
    SYNTAX      InstanceId
    STATUS      current
    DESCRIPTION
        "An arbitrary integer index that uniquely identifies an
instance of the RhFlowDirDesc entry."
 ::= { rhFlowDirDescEntry 1 }

rhFlowDirDescInfo OBJECT-TYPE
    SYNTAX      Prid
    STATUS      current
    DESCRIPTION
        "An arbitrary integer index that references the RhFlowInfo Instances."

```

```

::= { rhFlowDirDescEntry 2 }

rhFlowDirDescFluxInfo OBJECT-TYPE
    SYNTAX      Prid
    STATUS      current
    DESCRIPTION
        "An arbitrary integer index that references the RhFluxInfo Instances."
::= { rhFlowDirDescEntry 3 }

rhFlowDirDescNext OBJECT-TYPE
    SYNTAX      Prid
    STATUS      current
    DESCRIPTION
        "References the next of a list of RhFlowDirDesc instances. A value of
        zeroDotZero indicates this is the last of a list of RhFlowDirDesc instances."
    DEFVAL { zeroDotZero }
::= { rhFlowDirDescEntry 4 }

-----
--
-- Rh FlowInfo Table
--

rhFlowInfoTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF RhFlowInfoEntry
    PIB-ACCESS   install
    STATUS      current
    DESCRIPTION
        "PRC representing the information of flow in the direction of uplink
        or downlink."
::= { rhServiceInfoClasses 8 }

rhFlowInfoEntry OBJECT-TYPE
    SYNTAX      RhFlowInfoEntry
    STATUS      current
    DESCRIPTION
        "An entry in the Flow Info Table describing the information of a flow
        in the direction of uplink or downlink.
        It is referenced by RhFlowDirDec."
    PIB-INDEX { RhFlowInfoPrid }
    UNIQUENESS { }
::= { rhFlowInfoTable 1 }

RhFlowInfoEntry ::= SEQUENCE {
    rFlowInfoPrid          InstanceId,
    rhFlowInfoDirection    INTEGER,
    rhFlowInfoFilter        Prid,
    rhFlowInfoFilterStatus  INTEGER,
    rhFlowInfoServiceType   INTEGER
}

rhFlowInfoPrid OBJECT-TYPE
    SYNTAX      InstanceId
    STATUS      current
    DESCRIPTION
        "An arbitrary integer index that uniquely identifies an
        instance of the RhFlowInfo."
::= { rhFlowInfoEntry 1 }

rhFlowInfoDirection OBJECT-TYPE
    SYNTAX      INTEGER {
        uplink      (1),
        downlink    (2)
    }

```

```

        }
        STATUS      current
        DESCRIPTION
            "Indicates the direction the flow."
::= { rhFlowInfoEntry 2 }

rhFlowInfoFilter OBJECT-TYPE      -- filter
    SYNTAX      Prid
    STATUS      current
    DESCRIPTION
        "References an entry of RhFilterTable
that describes the applicable classification filter.
        A value of zeroDotZero indicates no filter is
used with this RhFlowInfoTable."
::= { rhFlowInfoEntry 3 }

rhFlowInfoFilterStatus OBJECT-TYPE      -- filter status
    SYNTAX      INTEGER {
                        close(0),
                        open(1)
                    }
    STATUS      current
    DESCRIPTION
        "Indicates if this gate will allow traffic to flow."
    DEFVAL { open }
::= { rhFlowInfoEntry 4 }

rhFlowInfoServiceType OBJECT-TYPE      -- service type
    SYNTAX      INTEGER {
                        audio(1),
                        video(2)
                    }
    STATUS      current
    DESCRIPTION
        "service type"
::= { rhFlowInfoEntry 5 }

-----

-- Rh Filter Table
--

rhFilterTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF RhFilterEntry
    PIB-ACCESS   install
    STATUS      current
    DESCRIPTION
        "The Filter class. A packet has to match all fields in an Filter.
Wildcards may be specified for those fields that are not relevant."
::= { rhServiceInfoClasses 9 }

rhFilterEntry OBJECT-TYPE
    SYNTAX      RhFilterEntry
    STATUS      current
    DESCRIPTION
        "An entry in the Filter Table describing the information of a filter."
    PIB-INDEX { RhFilterPrid }
    UNIQUENESS { }
::= { rhFilterTable 1 }

RhFilterEntry ::= SEQUENCE {
    rhFilterPrid          InstanceId,
    rhFilterDstAddrType   InetAddressType,
    rhFilterDstAddr       InetAddress,

```



rhFilterDstPrefixLength	InetAddressPrefixLength,
rhFilterSrcAddrType	InetAddressType,
rhFilterSrcAddr	InetAddress,
rhFilterSrcPrefixLength	InetAddressPrefixLength,
rhFilterDscp	DscpOrAny,
rhFilterProtocol	Unsigned32,
rhFilterDstL4PortMin	InetPortNumber,
rhFilterDstL4PortMax	InetPortNumber,
rhFilterSrcL4PortMin	InetPortNumber,
rhFilterSrcL4PortMax	InetPortNumber

}

rhFilterPrid OBJECT-TYPE  
 SYNTAX InstanceId  
 STATUS current  
 DESCRIPTION  
 "An arbitrary integer index that uniquely identifies an instance of the Rh Filter class."  
 ::= { rhFilterEntry 1 }

rhFilterDstAddrType OBJECT-TYPE  
 SYNTAX InetAddressType  
 STATUS current  
 DESCRIPTION  
 "The address type enumeration value to specify the type of the packet's destination IP address."  
 REFERENCE  
 "Textual Conventions for Internet Network Addresses.  
 RFC 3291."  
 ::= { rhFilterEntry 2 }

rhFilterDstAddr OBJECT-TYPE  
 SYNTAX InetAddress  
 STATUS current  
 DESCRIPTION  
 "The IP address to match against the packet's destination IP address. If the address type is 'ipv4', 'ipv6', 'ipv4z' or 'ipv6z' then, the attribute RhFilterDstPrefixLength indicates the number of bits that are relevant."  
 REFERENCE  
 "Textual Conventions for Internet Network Addresses.  
 RFC 3291."  
 ::= { rhFilterEntry 3 }

rhFilterDstPrefixLength OBJECT-TYPE  
 SYNTAX InetAddressPrefixLength  
 STATUS current  
 DESCRIPTION  
 "The length of a mask for the matching of the destination IP address. This attribute is interpreted only if the InetAddressType is 'ipv4', 'ipv4z', 'ipv6' or 'ipv6z'. Masks are constructed by setting bits in sequence from the most-significant bit downwards for RhFilterDstPrefixLength bits length. All other bits in the mask, up to the number needed to fill the length of the address RhFilterDstAddr are cleared to zero. A zero bit in the mask then means that the corresponding bit in the address always matches.  
 In IPv4 addresses, a length of 0 indicates a match of any address; a length of 32 indicates a match of a single host address, and a length between 0 and 32 indicates the use of a CIDR Prefix. IPv6 is similar, except that prefix lengths range between 0 and 128"  
 REFERENCE  
 "Textual Conventions for Internet Network Addresses."

```

        RFC 3291."
    DEFVAL { 0 }
::= { rhFilterEntry 4 }

rhFilterSrcAddrType OBJECT-TYPE
    SYNTAX      InetAddressType
    STATUS      current
    DESCRIPTION
        "The address type enumeration value to specify the type of
        the packet's source IP address."
    REFERENCE
        "Textual Conventions for Internet Network Addresses.
        RFC 3291."
::= { rhFilterEntry 5 }

rhFilterSrcAddr OBJECT-TYPE
    SYNTAX      InetAddress
    STATUS      current
    DESCRIPTION
        "The IP address to match against the packet's source IP address. If
        the address type is 'ipv4', 'ipv6', 'ipv4z' or 'ipv6z' then, the attribute
        RhFilterSrcPrefixLength indicates the number of bits that are relevant."
    REFERENCE
        "Textual Conventions for Internet Network Addresses.
        RFC 3291."
::= { rhFilterEntry 6 }

rhFilterSrcPrefixLength OBJECT-TYPE
    SYNTAX      InetAddressPrefixLength
    STATUS      current
    DESCRIPTION
        "The length of a mask for the matching of the source
        IP address. This attribute is interpreted only if the
        InetAddressType is 'ipv4', 'ipv4z', 'ipv6' or 'ipv6z'.
        Masks are constructed by setting bits in sequence from the
        most-significant bit downwards for RhFilterSrcPrefixLength bits
        length. All other bits in the mask, up to the number needed to
        fill the length of the address RhFilterDstAddr are cleared to zero.
        A zero bit in the mask then means that the corresponding bit in
        the address always matches.

        In IPv4 addresses, a length of 0 indicates a match of any
        address; a length of 32 indicates a match of a single host
        address, and a length between 0 and 32 indicates the use of
        a CIDR Prefix. IPv6 is similar, except that prefix lengths
        range between 1 and 128"
    REFERENCE
        "Textual Conventions for Internet Network Addresses.
        RFC 3291."
    DEFVAL { 0 }
::= { rhFilterEntry 7 }

rhFilterDscp OBJECT-TYPE
    SYNTAX      DscpOrAny
    STATUS      current
    DESCRIPTION
        "The value that the DSCP in the packet can have and
        match this filter. A value of -1 indicates that a specific
        DSCP value has not been defined and thus all DSCP values
        are considered a match."
    REFERENCE
        "Management Information Base for the Differentiated Services
        Architecture. RFC 3289."
    DEFVAL { -1 }

```

```

::= { rhFilterEntry 8 }

rhFilterProtocol OBJECT-TYPE
    SYNTAX      Unsigned32 (0..255)
    STATUS      current
    DESCRIPTION
        "The layer-4 protocol Id to match against the IPv4 protocol
        number or the IPv6 Next-Header number in the packet. A value
        of 255 means match all. Note the protocol number of 255 is
        reserved by IANA, and Next-Header number of 0 is used in
        IPv6."
    DEFVAL { 255 }

::= { rhFilterEntry 9 }

rhFilterDstL4PortMin OBJECT-TYPE
    SYNTAX      InetPortNumber
    STATUS      current
    DESCRIPTION
        "The minimum value that the packet's layer 4 destination
        port number can have and match this filter. This value must
        be equal to or lesser than the value specified for this
        filter in RhFilterDstL4PortMax.

        COPS-PR error code 'attrValueInvalid' must be returned if
        the RhFilterDstL4PortMin is greater than
        RhFilterDstL4PortMax"
    REFERENCE
        "COPS Usage for Policy Provisioning. RFC 3084, error
        codes section 4.5."
    DEFVAL { 0 }

::= { rhFilterEntry 10 }

rhFilterDstL4PortMax OBJECT-TYPE
    SYNTAX      InetPortNumber
    STATUS      current
    DESCRIPTION
        "The maximum value that the packet's layer 4 destination
        port number can have and match this filter. This value must
        be equal to or greater than the value specified for this
        filter in RhFilterDstL4PortMin.

        COPS-PR error code 'attrValueInvalid' must be returned if
        the RhFilterDstL4PortMax is less than
        RhFilterDstL4PortMin"
    REFERENCE
        "COPS Usage for Policy Provisioning. RFC 3084, error
        codes section 4.5."
    DEFVAL { 65535 }
::= { rhFilterEntry 11 }

rhFilterSrcL4PortMin OBJECT-TYPE
    SYNTAX      InetPortNumber
    STATUS      current
    DESCRIPTION
        "The minimum value that the packet's layer 4 source port
        number can have and match this filter. This value must
        be equal to or lesser than the value specified for this
        filter in RhFilterSrcL4PortMax.

        COPS-PR error code 'attrValueInvalid' must be returned if
        the RhFilterSrcL4PortMin is greated than
        RhFilterSrcL4PortMax"

```

```

REFERENCE
    "COPS Usage for Policy Provisioning. RFC 3084, error
    codes section 4.5."
    DEFVAL { 0 }
::= { rhFilterEntry 12 }

rhFilterSrcL4PortMax OBJECT-TYPE
    SYNTAX      InetPortNumber
    STATUS      current
    DESCRIPTION
        "The maximum value that the packet's layer 4 source port
        number can have and match this filter. This value must be
        equal to or greater than the value specified for this filter
        in RhFilterSrcL4PortMin.

        COPS-PR error code 'attrValueInvalid' must be returned if
        the RhFilterSrcL4PortMax is less than
        RhFilterSrcL4PortMin"
    REFERENCE
        "COPS Usage for Policy Provisioning. RFC 3084, error codes
        section 4.5."
    DEFVAL { 65535 }
::= { rhFilterEntry 13 }

-----
--
-- The IEEE 802 Filter Table
--

rh802FilterTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF Rh802FilterEntry

    PIB-ACCESS   install
    STATUS      current
    DESCRIPTION
        "IEEE 802-based filter definitions. A class that contains
        attributes of IEEE 802 (e.g., 802.3) traffic that form
        filters that are used to perform traffic classification."
    REFERENCE
        "IEEE Standards for Local and Metropolitan Area Networks.
        Overview and Architecture, ANSI/IEEE Std 802, 1990."
    ::= { rh802FilterTable 1 }

rh802FilterEntry OBJECT-TYPE
    SYNTAX      Rh802FilterEntry
    STATUS      current
    DESCRIPTION
        "IEEE 802-based filter definitions. An entry specifies
        (potentially) several distinct matching components. Each
        component is tested against the data in a frame
        individually. An overall match occurs when all of the
        individual components match the data they are compared
        against in the frame being processed. A failure of any
        one test causes the overall match to fail.

        Wildcards may be specified for those fields that are not
        relevant."

    EXTENDS { rhFilterEntry }
    UNIQUENESS { rhFilterNegation,
                 rh802FilterDstAddr,
                 rh802FilterDstAddrMask,
                 rh802FilterSrcAddr,
                 rh802FilterSrcAddrMask,

```

```

        rh802FilterVlanId,
        rh802FilterVlanTagRequired,
        rh802FilterEtherType,
        rh802FilterUserPriority }

 ::= { rh802FilterTable 2 }

Rh802FilterEntry ::= SEQUENCE {
    rh802FilterDstAddr      PhysAddress,
    rh802FilterDstAddrMask  PhysAddress,
    rh802FilterSrcAddr      PhysAddress,
    rh802FilterSrcAddrMask  PhysAddress,
    rh802FilterVlanId       Integer32,
    rh802FilterVlanTagRequired INTEGER,
    rh802FilterEtherType    Integer32,
    rh802FilterUserPriority  BITS
}

rh802FilterDstAddr OBJECT-TYPE
    SYNTAX      PhysAddress
    STATUS      current
    DESCRIPTION
        "The 802 address against which the 802 DA of incoming
        traffic streams will be compared. Frames whose 802 DA
        matches the physical address specified by this object,
        taking into account address wildcarding as specified by the
        rh802FilterDstAddrMask object, are potentially subject to
        the processing guidelines that are associated with this
        entry through the related action class."
    REFERENCE
        "Textual Conventions for SMIV2, RFC 2579std58."

 ::= { rh802FilterEntry 1 }

rh802FilterDstAddrMask OBJECT-TYPE
    SYNTAX      PhysAddress
    STATUS      current
    DESCRIPTION
        "This object specifies the bits in a 802 destination address
        that should be considered when performing a 802 DA
        comparison against the address specified in the
        rh802FilterDstAddr object.

        The value of this object represents a mask that is logically
        and'ed with the 802 DA in received frames to derive the
        value to be compared against the rh802FilterDstAddr
        address. A zero bit in the mask thus means that the
        corresponding bit in the address always matches. The
        rh802FilterDstAddr value must also be masked using this
        value prior to any comparisons.

        The length of this object in octets must equal the length in
        octets of the rh802FilterDstAddr. Note that a mask with no
        bits set (i.e., all zeroes) effectively wildcards the
        rh802FilterDstAddr object."

 ::= { rh802FilterEntry 2 }

rh802FilterSrcAddr OBJECT-TYPE
    SYNTAX      PhysAddress
    STATUS      current
    DESCRIPTION
        "The 802 MAC address against which the 802 MAC SA of

```

incoming traffic streams will be compared. Frames whose 802

MAC SA matches the physical address specified by this object, taking into account address wildcarding as specified by the rh802FilterSrcAddrMask object, are potentially subject to the processing guidelines that are associated with this entry through the related action class."

::= { rh802FilterEntry 3 }

rh802FilterSrcAddrMask OBJECT-TYPE

SYNTAX PhysAddress

STATUS current

DESCRIPTION

"This object specifies the bits in a 802 MAC source address that should be considered when performing a 802 MAC SA comparison against the address specified in the rh802FilterSrcAddr object.

The value of this object represents a mask that is logically and'ed with the 802 MAC SA in received frames to derive the value to be compared against the rh802FilterSrcAddr address. A zero bit in the mask thus means that the corresponding bit in the address always matches. The rh802FilterSrcAddr value must also be masked using this value prior to any comparisons.

The length of this object in octets must equal the length in octets of the rh802FilterSrcAddr. Note that a mask with no bits set (i.e., all zeroes) effectively wildcards the rh802FilterSrcAddr object."

::= { rh802FilterEntry 4 }

rh802FilterVlanId OBJECT-TYPE

SYNTAX Integer32 (-1 | 1..4094)

STATUS current

DESCRIPTION

"The VLAN ID (VID) that uniquely identifies a VLAN within the device. This VLAN may be known or unknown (i.e., traffic associated with this VID has not yet been seen by the device) at the time this entry is instantiated.

Setting the rh802FilterVlanId object to -1 indicates that VLAN data should not be considered during traffic classification."

::= { rh802FilterEntry 5 }

rh802FilterVlanTagRequired OBJECT-TYPE

SYNTAX INTEGER {  
taggedOnly(1),  
priorityTaggedPlus(2),  
untaggedOnly(3),  
ignoreTag(4)  
}

STATUS current

DESCRIPTION

"This object indicates whether the presence of an IEEE 802.1Q VLAN tag in data link layer frames must be considered when determining if a given frame matches this 802 filter entry.

A value of 'taggedOnly(1)' means that only frames containing a VLAN tag with a non-Null VID (i.e., a VID in the range 1..4094) will be considered a match.

A value of 'priorityTaggedPlus(2)' means that only frames containing a VLAN tag, regardless of the value of the VID, will be considered a match.

A value of 'untaggedOnly(3)' indicates that only untagged frames will match this filter component.

The presence of a VLAN tag is not taken into consideration in terms of a match if the value is 'ignoreTag(4)'."

```
::= { rh802FilterEntry 6 }
```

rh802FilterEtherType OBJECT-TYPE

SYNTAX Integer32 (-1 | 0..'ffff'h)

STATUS current

DESCRIPTION

"This object specifies the value that will be compared against the value contained in the EtherType field of an IEEE 802 frame. Example settings would include 'IP' (0x0800), 'ARP' (0x0806) and 'IPX' (0x8137).

Setting the rh802FilterEtherTypeMin object to -1 indicates that EtherType data should not be considered during traffic classification.

Note that the position of the EtherType field depends on the underlying frame format. For Ethernet-II encapsulation, the EtherType field follows the 802 MAC source address. For 802.2 LLC/SNAP encapsulation, the EtherType value follows

the Organization Code field in the 802.2 SNAP header. The value that is tested with regard to this filter component therefore depends on the data link layer frame format being used. If this 802 filter component is active when there is no EtherType field in a frame (e.g., 802.2 LLC), a match is implied."

```
::= { rh802FilterEntry 7 }
```

rh802FilterUserPriority OBJECT-TYPE

SYNTAX BITS {  
    matchPriority0(0),  
    matchPriority1(1),  
    matchPriority2(2),  
    matchPriority3(3),  
    matchPriority4(4),  
    matchPriority5(5),  
    matchPriority6(6),  
    matchPriority7(7)  
}

STATUS current

DESCRIPTION

"The set of values, representing the potential range of user priority values, against which the value contained in the user priority field of a tagged 802.1 frame is compared. A test for equality is performed when determining if a match exists between the data in a data link layer frame and the value of this 802 filter component. Multiple values may be set at one time such that potentially several

different user priority values may match this 802 filter component.

Setting all of the bits that are associated with this object causes all user priority values to match this attribute. This essentially makes any comparisons with regard to user priority values unnecessary. Untagged frames are treated as an implicit match."

```
::= { rh802FilterEntry 8 }
```

```
-----
--
-- Rh Flux Info Table
--

rhFluxInfoTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF RhFluxInfoEntry
    PIB-ACCESS   install
    STATUS       current
    DESCRIPTION
        "PRC representing the bandwidth information."
::= { rhServiceInfoClasses 10 }

rhFluxInfoEntry OBJECT-TYPE
    SYNTAX      RhFluxInfoEntry
    STATUS       current
    DESCRIPTION
        "An entry in the Flux Info Table describing the bandwidth
        information of a flow in the direction of uplink or downlink.
        It is referenced by RhFlowDirDec, RhCPNGWFluxInfoBaseFluxInfo and
        RhUserbasedDecInfo."
    PIB-INDEX { RhFluxInfoPrid }
    UNIQUENESS { }
::= { rhFluxInfoTable 1 }

RhFluxInfoEntry ::= SEQUENCE {
    rhFluxInfoPrid                InstanceId,
    rhFluxInfoBandwidthUnit       INTEGER,
    rhFluxInfoPeakBandwidth       Unsigned32,
    rhFluxInfoAverageBandwidth    Unsigned32,
    rhFluxInfoMaxPktLength        Unsigned32

}

rhFluxInfoPrid OBJECT-TYPE
    SYNTAX      InstanceId
    STATUS       current
    DESCRIPTION
        "An arbitrary integer index that uniquely identifies an
        instance of the Rh Flux class."
::= { rhFluxInfoEntry 1 }

rhFluxInfoBandwidthUnit OBJECT-TYPE -- bandwidth unit
    SYNTAX      INTEGER {
        bps (1),
        kbps (2),
        mbps (3)
    }
    STATUS       current
    DESCRIPTION
        "Indication of the unit of measure for RhFluxPeakBandwidth and
        RhFluxAverageBandwidth, in bits per second, kilo bits per second,
        or mega bits per second."
```



```

::= { rhFluxInfoEntry 2 }

rhFluxInfoPeakBandwidth OBJECT-TYPE -- peak bandwidth
    SYNTAX      Unsigned32
    STATUS      current
    DESCRIPTION
        "The Flux peak bandwidth."
::= { rhFluxInfoEntry 3 }

rhFluxInfoAverageBandwidth OBJECT-TYPE -- average bandwidth
    SYNTAX      Unsigned32
    STATUS      current
    DESCRIPTION
        "The Flux average bandwidth."
::= { rhFluxInfoEntry 4 }

rhFluxInfoMaxPktLength OBJECT-TYPE -- Max package length
    SYNTAX      Unsigned32
    STATUS      current
    DESCRIPTION
        "The Flux max packet length."
::= { rhFluxInfoEntry 5 }

-----
--
-- Rh CPNGW Flux Table
--

rhCPNGWFluxInfoTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF RhCPNGWFluxInfoEntry
    PIB-ACCESS   install
    STATUS      current
    DESCRIPTION " PRC representing the flux information."
::= { rhServiceInfoClasses 11 }

rhCPNGWFluxInfoEntry OBJECT-TYPE
    SYNTAX      RhCPNGWFluxInfoEntry
    STATUS      current
    DESCRIPTION
        "An entry in the CPNGW Flux Info Table describing the flux information
of a flow in the direction of uplink or downlink.
        It is referenced by RhFlowDirDec."
    PIB-INDEX { RhCPNGWFluxInfoPrid }
    UNIQUENESS { }
::= { rhCPNGWFluxInfoTable 1 }

RhCPNGWFluxInfoEntry ::= SEQUENCE {
    rhCPNGWFluxInfoPrid          InstanceId,
    rhCPNGWFluxInfoBaseFluxInfo Prid,
    rhCPNGWFluxInfoFlowPriority  INTEGER,
}

rhCPNGWFluxInfoPrid OBJECT-TYPE
    SYNTAX      InstanceId
    STATUS      current
    DESCRIPTION
        "An arbitrary integer index that uniquely identifies an
instance of the Rh CPNGW Flux class."
::= { rhCPNGWFluxInfoEntry 1 }

rhCPNGWFluxInfoBaseFluxInfo OBJECT-TYPE -- base traffic information
    SYNTAX      Prid
    STATUS      current

```

```

DESCRIPTION
    "References the instances of the RhFluxInfoTable,
    contains the basic bandwidth information "
::= { rhCPNGWFluxInfoEntry 2 }

rhCPNGWFluxInfoFlowPriority OBJECT-TYPE
    SYNTAX      INTEGER
    STATUS      current
    DESCRIPTION
        "Indication of the flow's priority.
        Can be divided by 8. level 0 - 7"
::= { rhCPNGWFluxInfoEntry 3 }

-----
-- CPNGW Connection Table
--

rhCPNGWConnectInfoTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF RhCPNGWConnectInfoEntry
    PIB-ACCESS   install
    STATUS      current
    DESCRIPTION
        "PRC representing the information of the CPNGW connection."
::= { rhServiceInfoClasses 14 }

rhCPNGWConnectInfoEntry OBJECT-TYPE
    SYNTAX      RhCPNGWConnectInfoEntry
    STATUS      current
    DESCRIPTION
        "An entry in the Connection Table describing the information of the
        CPNGW connection.
        It is referenced by RhFlowDescConnectInfo."
    PIB-INDEX { RhCPNGWConnectInfoPrId }
    UNIQUENESS { }
::= { rhCPNGWConnectInfoTable 1 }

RhCPNGWConnectInfoEntry ::= SEQUENCE {
    rhCPNGWConnectInfoPrId          InstanceId,
    rhCPNGWConnectInfoSrcIFName     OCTET STRING,
    rhCPNGWConnectInfoSrcVlanID     Unsigned32,
    rhCPNGWConnectInfoSrcVlanIDQinQ Unsigned32,
    rhCPNGWConnectInfoDstIFName     OCTET STRING,
    rhCPNGWConnectInfoDstVlanID     Unsigned32,
    rhCPNGWConnectInfoDstVlanIDQinQ Unsigned32
}

rhCPNGWConnectInfoPrId OBJECT-TYPE
    SYNTAX      InstanceId
    STATUS      current
    DESCRIPTION
        "An arbitrary integer index that uniquely identifies an
        instance of the Rh CPNGW Connection Info class."
::= { rhCPNGWConnectInfoEntry 1 }

rhCPNGWConnectInfoSrcIFName OBJECT-TYPE
-- source interface address information
    SYNTAX      OCTET STRING
    STATUS      current
    DESCRIPTION
        "Source Interface Name."
::= { rhCPNGWConnectInfoEntry 2 }

```

```

rhCPNGWConnectInfoSrcVlanID OBJECT-TYPE          -- source VlanID
    SYNTAX      Unsigned32(0..64535)
    STATUS      current
    DESCRIPTION
        "Source VlanID."
 ::= { rhCPNGWConnectInfoEntry 3 }

rhCPNGWConnectInfoSrcVlanIDQinQ OBJECT-TYPE      -- source VlanID QinQ
    SYNTAX      Unsigned32(0..64535)
    STATUS      current
    DESCRIPTION
        "It is the normal 802.1Q when the value is illegal or invalid.
        If the value is valid, it is the QinQ, the value is inner
        VlanID and RhCPNGWConnectInfoSrcVlanID is the outer VlanID."
 ::= { rhCPNGWConnectInfoEntry 4 }

rhCPNGWConnectInfoDstIFName OBJECT-TYPE
    -- destination interface address information
    SYNTAX      OCTET STRING
    STATUS      current
    DESCRIPTION
        "Dest Interface Name."
 ::= { rhCPNGWConnectInfoEntry 5 }

rhCPNGWConnectInfoDstVlanID OBJECT-TYPE          -- destination VlanID
    SYNTAX      Unsigned32(0..64535)
    STATUS      current
    DESCRIPTION
        "Dest VlanID."
 ::= { rhCPNGWConnectInfoEntry 6 }

rhCPNGWConnectInfoDstVlanIDQinQ OBJECT-TYPE      -- destination VlanID QinQ
    SYNTAX      Unsigned32(0..64535)
    STATUS      current
    DESCRIPTION
        "It is the normal 802.1Q VlanID if the value is illegal or invalid.
        Otherwise, it is the QinQ VlanID and identifies the inner VlanID."
 ::= { rhCPNGWConnectInfoEntry 7 }

-----
--
-- Rh Request Info Classes
--
-- Rh Request Info Table
--

rhReqInfoTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF RhReqInfoEntry
    PIB-ACCESS   notify
    STATUS      current
    DESCRIPTION
        "PRC from CGPE-PE to PD-PE, indicating the physical and/or logical
        connection of the access transport network that the CPE is attached to,
        requesting user-based policy."
 ::= { rhReqInfoClasses 1 }

rhReqInfoEntry OBJECT-TYPE
    SYNTAX      RhReqInfoEntry
    STATUS      current
    DESCRIPTION
        "An instance of the RhReqInfo class sent by CGPE-PE to PD-PE."
    PIB-INDEX { RhReqInfoPrid }

```

```

        UNIQUENESS { }
 ::= { rhReqInfoTable 1 }

RhReqInfoEntry ::= SEQUENCE {
    rhReqInfoPrid          InstanceId,
    rhReqInfoIPAddrType   InetAddressType,
    rhReqInfoIPAddress     InetAddress,
    rhReqInfoUserId       OCTET STRING,
    rhReqInfoMacAddr      OCTET STRING,
    rhReqInfoPhyInfo      OCTET STRING,
}

rhReqInfoPrid OBJECT-TYPE
    SYNTAX      InstanceId
    STATUS      current
    DESCRIPTION
        "An arbitrary integer index that uniquely identifies an
        instance of the RhReqInfo entry."
 ::= { rhReqInfoEntry 1 }

rhReqInfoIPAddrType OBJECT-TYPE
    SYNTAX      InetAddressType
    STATUS      current
    DESCRIPTION
        "The address type enumeration value to specify the type of the CPE's
        IP address(Ipv4, Ipv6 or DNS etc)."
 ::= { rhReqInfoEntry 2 }

rhReqInfoIPAddress OBJECT-TYPE
    SYNTAX      InetAddress
    STATUS      current
    DESCRIPTION
        "CPE's Ip Address."
 ::= { rhReqInfoEntry 3 }

rhReqInfoUserId OBJECT-TYPE
    SYNTAX      OCTET STRING(SIZE (0..67))
    STATUS      current
    DESCRIPTION
        "User ID uniquely identifies the CPE, in a format consistent with the
        NAI specification."
 ::= { rhReqInfoEntry 4 }

rhReqInfoMacAddr OBJECT-TYPE
    SYNTAX      OCTET STRING(SIZE (0..16))
    STATUS      current
    DESCRIPTION
        "CPE's Mac Address. "
 ::= { rhReqInfoEntry 5 }

rhReqInfoPhyInfo OBJECT-TYPE
    SYNTAX      OCTET STRING(SIZE (0..63))
    STATUS      current
    DESCRIPTION
        "CPE's physics infomation."
 ::= { rhReqInfoEntry 6 }

```

```

-----
-- Rh Decision Info classes

-- Rh Flow-based Decision Information Table
--

```

```

rhFlowBasedDecInfoTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF RhFlowBasedDecInfoEntry
    PIB-ACCESS   install
    STATUS       current
    DESCRIPTION
        "PRC from PD-PE to CGPE-PE carried by COPS-PR Install decision,
        providing flow-based policy and/or NAT request."
    ::= { rhDecInfoClasses 1 }

rhFlowBasedDecInfoEntry OBJECT-TYPE
    SYNTAX      RhFlowBasedDecInfoEntry
    STATUS       current
    DESCRIPTION
        "An instance of the RhFlowBasedDecInfo class sent by PD-PE to
        CGPE-PE, carrying the QoS policy."
    PIB-INDEX { RhFlowBasedDecInfoPrid }
    UNIQUENESS                                     {
::= { rhFlowBasedDecInfoTable 1 }
RhFlowBasedDecInfoEntry ::= SEQUENCE {
    rhFlowBasedDecInfoPrid      InstanceId,
    rhFlowBasedDecInfoRequestPriority Integer32,
    rhFlowBasedDecInfoFlowDesc  Prid,
    rhFlowBasedDecInfoEventIndicator Prid,
}

rhFlowBasedDecInfoPrid OBJECT-TYPE
    SYNTAX      InstanceId
    STATUS       current
    DESCRIPTION
        "An arbitrary integer index that uniquely identifies an
        instance of the RhFlowBasedDecInfo Entry."
    ::= { rhFlowBasedDecInfoEntry 1 }

rhFlowBasedDecInfoRequestPriority OBJECT-TYPE
    SYNTAX      Integer32(0-7)
    STATUS       current
    DESCRIPTION
        "The indication of the importance of a resource control request. It
        can be used for processing simultaneous requests by CGPE-PE based on the
        priority level. 0 is the lowest level of priority by default."
    DEFVAL { 0 }
    ::= { rhFlowBasedDecInfoEntry 2 }

rhFlowBasedDecInfoFlowDesc OBJECT-TYPE
    SYNTAX      Prid
    STATUS       current
    DESCRIPTION
        "References the first of a list of RhFlowDesc associated
        with this instance of RhFlowBasedDecInfo.
        A value of zeroDotZero indicates an empty list which is an error condition."
    ::= { rhFlowBasedDecInfoEntry 3 }

rhFlowBasedDecInfoEventIndicator OBJECT-TYPE
    SYNTAX      Prid
    STATUS       current
    DESCRIPTION
        "An arbitrary integer that uniquely identifies an instance of the
        RhEventIndicator Entry."
    ::= { rhFlowBasedDecInfoEntry 4 }

```

-----  
--

```

-- Rh User-based Decision Information Table
--

rhUserBasedDecInfoTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF RhUserBasedDecInfoEntry
    PIB-ACCESS  install
    STATUS      current
    DESCRIPTION
        "PRC from PD-PE to CGPE-PE carried by COPS-PR install decision,
provision user-based policy."
 ::= { rhDecInfoClasses 4 }

rhUserBasedDecInfoEntry OBJECT-TYPE
    SYNTAX      RhUserBasedDecInfoEntry
    STATUS      current
    DESCRIPTION
        "An entry in the User based Dec Info Table describing the policy
information."
    PIB-INDEX { RhUserBasedDecInfoPrid }
    UNIQUENESS { }
 ::= { rhUserBasedDecInfoTable 1 }

RhUserBasedDecInfoEntry ::= SEQUENCE {
    rhUserBasedDecInfoPrid      InstanceId,
    rhUserBasedDecInfoUserId    Unsigned32,
    rhUserBasedDecInfoPolicyId  Unsigned32,
    rhUserBasedDecInfoNetworkClass Prid,
    rhUserBasedDecInfoDirFlux   Prid
}

rhUserBasedDecInfoPrid OBJECT-TYPE
    SYNTAX      InstanceId
    STATUS      current
    DESCRIPTION
        "An arbitrary integer index that uniquely identifies an
instance of the RhUserBasedDecInfo class."
 ::= { rhUserBasedDecInfoEntry 1 }

rhUserBasedDecInfoUserId OBJECT-TYPE
    SYNTAX      Unsigned32
    STATUS      current
    DESCRIPTION
        "User ID uniquely identifies the user for which
the policy is applied."
 ::= { rhUserBasedDecInfoEntry 2 }

rhUserBasedDecInfoPolicyId OBJECT-TYPE
    SYNTAX      Unsigned32
    STATUS      current
    DESCRIPTION
        "PolicyID is the handle of one policy. The PolicyID is
assigned by PDP. Since there can be a many-to-many relationship
between PDP and PEP, the PolicyID allocated by different PDPs
cannot be guaranteed to be unique across network. So PEP can use IP
address of the PDP along with PolicyID to uniquely identify a
dedicated policy."
 ::= { rhUserBasedDecInfoEntry 3 }

rhUserBasedDecInfoNetworkClass OBJECT-TYPE
    SYNTAX      Prid
    STATUS      current
    DESCRIPTION

```

"An arbitrary integer index that uniquely identifies an instance of the NetworkClass. A value of zeroDotZero indicates the default network service class."

```
DEFVAL { zeroDotZero }
::= { rhUserBasedDecInfoEntry 4 }
```

rhUserBasedDecInfoDirFlux OBJECT-TYPE

```
SYNTAX      Prid
STATUS      current
DESCRIPTION
```

"An arbitrary integer index that uniquely identifies an instance of the RhDirFlux. A value of zeroDotZero indicates the default bandwidth."

```
DEFVAL { zeroDotZero }
::= { rhUserBasedDecInfoEntry 5 }
```

```
-----
-- Rh Network Class Table
--
```

rhNetworkClassTable OBJECT-TYPE

```
SYNTAX      SEQUENCE OF RhNetworkClassEntry
PIB-ACCESS  install
STATUS      current
DESCRIPTION
```

"PRC representing network service class subscribed by a CPE sent by PD-PE to CGPE-PE. In a COPS-PR install decision object."

```
::= { rhDecInfoClasses 5 }
```

rhNetworkClassEntry OBJECT-TYPE

```
SYNTAX      RhNetworkClassEntry
STATUS      current
DESCRIPTION
```

"An entry in the Network Class Table describing network service class subscribed by a CPE.

Referenced by RhUserBasedDecInfoNetworkClass."

```
PIB-INDEX { RhNetworkClassPrid }
UNIQUENESS { }
::= { rhNetworkClassTable 1 }
```

```
RhNetworkClassEntry ::= SEQUENCE {
    rhNetworkClassPrid InstanceId,
    rhNetworkClass      OCTET STRING
}
```

rhNetworkClassPrid OBJECT-TYPE

```
SYNTAX      InstanceId
STATUS      current
DESCRIPTION
```

"An arbitrary integer index that uniquely identifies an instance of the RhNetworkClass."

```
::= { rhNetworkClassEntry 1 }
```

rhNetworkClass OBJECT-TYPE

```
SYNTAX      OCTET STRING
STATUS      current
DESCRIPTION
```

"The network service class subscribed by a CPE (e.g., Premium, Gold, Silver, and Regular)."

```
::= { rhNetworkClassEntry 2 }
```

```
-----
--
-- Rh Dir Flux Table
--
```

```

rhDirFluxTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF RhDirFluxEntry
    PIB-ACCESS   install
    STATUS       current
    DESCRIPTION
        "PRC representing uplink and/or downlink bandwidth information, sent
        by PD-PE to CGPE-PE. In a COPS-PR install decision object."
    ::= { rhDecInfoClasses 6 }

rhwDirFluxEntry OBJECT-TYPE
    SYNTAX      RhDirFluxEntry
    STATUS       current
    DESCRIPTION
        "An entry in the Direction Flux Table describing uplink and/or
        downlink bandwidth information subscribed by a CPE.
        Referenced by RhUserBasedDecInfoDirFlux."
    PIB-INDEX { RhDirFluxPrid }
    UNIQUENESS { }
    ::= { rhDirFluxTable 1 }

RhDirFluxEntry ::= SEQUENCE {
    rhDirFluxPrid      InstanceId,
    rhDirFluxDirection Integer32,
    rhDirFluxInfo      Prid,
    rhDirFluxNext      Prid
}

rhDirFluxPrid OBJECT-TYPE
    SYNTAX      InstanceId
    STATUS       current
    DESCRIPTION
        "An arbitrary integer index that uniquely identifies an instance of
        the RhDirFlux."
    ::= { rhDirFluxEntry 1 }

rhDirFluxDirection OBJECT-TYPE
    SYNTAX      Integer32 {
        uplink(1),
        downlink(2)
    }
    STATUS       current
    DESCRIPTION
        "Indicates the direction of the flow."
    ::= { rhDirFluxEntry 2 }

rhDirFluxInfo OBJECT-TYPE
    SYNTAX      Prid
    STATUS       current
    DESCRIPTION
        "An arbitrary integer index that references the RhFluxInfo
        Instances."
    ::= { rhDirFluxEntry 3 }

rhDirFluxNext OBJECT-TYPE
    SYNTAX      Prid
    STATUS       current
    DESCRIPTION
        "References the next RhDirFluxEntry. There should be at most two
        Directional Flux per COPS-PR install decision. A value of zeroDotZero indicates
        the end of the list of DirFlux."
    ::= { rhDirFluxEntry 4 }

```

-----  
-- Rh Report Classes



```

-- Rh State Report Table
--

rhStateReportTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF RhStateReportEntry
    PIB-ACCESS   notify
    STATUS       current
    DESCRIPTION
        "PRCs from CGPE-PE to PD-PE carried by the COPS-PR RPT message, carrying the
        Decision enforcement result or the notification of transport event."
    ::= { rhReportClasses 1 }

rhStateReportEntry OBJECT-TYPE
    SYNTAX      RhStateReportEntry
    STATUS       current
    DESCRIPTION
        "An entry in the State Report Table describing the Decision
        enforcement result or the notification of transport event."
    PIB-INDEX { RhStateReportPrid }
    UNIQUENESS { }
    ::= { rhStateReportTable 1 }

RhStateReportEntry ::= SEQUENCE {
    rhStateReportPrid          InstanceId,
    rhStateReportStatus        INTEGER,
    rhStateReportDetails       Prid,
}

rhStateReportPrid OBJECT-TYPE
    SYNTAX      InstanceId
    STATUS       current
    DESCRIPTION
        "An arbitrary integer index that uniquely identifies an
        instance of the RhDecResultRpt class."
    ::= { rhStateReportEntry 1 }

rhStateReportStatus OBJECT-TYPE
    SYNTAX      INTEGER {
        success      (1),
        failure      (2),
        event         (3) }
    STATUS       current
    DESCRIPTION
        "When Status is:success: Indicates the successful implementation of
        the decision. Failure: Indicates the failure of implementing the
        decision.
        RhStateReportDetails may reference an Error object, or may have
        the
        value zeroDotZero when no error object is needed, in which case COPS
        and COPS-PR error codes and error objects are sufficient.
        Event: RhStateReportDetails references an instance of
        RhEventIndicator."
    ::= { rhStateReportEntry 2 }

rhStateReportDetails OBJECT-TYPE
    SYNTAX      Prid
    STATUS       current
    DESCRIPTION
        "May reference an instance of RhEventIndicator, or may have the value
        of zeroDotZero depending on the value of RhStateReportStatus."
    ::= { rhStateReportEntry 3 }

```

```

-----
--
-- Conformance Section
--
rhCompliances OBJECT IDENTIFIER ::= { rhConformance 1 }
rhGroups       OBJECT IDENTIFIER ::= { rhConformance 2 }

rhCompliance MODULE-COMPLIANCE
    STATUS current
    DESCRIPTION
        "Describes the requirements for conformance to the ITUTRhPIB."
    MODULE FRAMEWORK-PIB -- Defined in RFC 3318
        MANDATORY-GROUPS {
            frwkPrcSupportGroup,

        }
    MODULE RH-PIB -- this module
        MANDATORY-GROUPS {
            rhDecCapGroup,
            rhDecCapACKGroup,
            rhEventIndicatorGroup,
            rhFlowDescGroup,
            rhSingleFlowInfoGroup,
            rhFlowTerminationGroup,
            rhFlowAddressRealmGroup,
            rhFlowDirDescGroup,
            rhFlowInfoGroup,
            rh802InfoGroup,
            rhFilterGroup,
            rhFluxInfoGroup,
            rhCPNGWFluxInfoGroup,
            rhCPNGWConnectInfoGroup,
            rhReqInfoGroup,
            rhFlowbasedDecInfoGroup,
            rhUserBasedDecInfoGroup,
            rhNetworClassGroup,
            rhDirFluxGroup,
            rhStateReportGroup,
        }
    ::= { rhCompliances 1 }

rhDecCapGroup OBJECT-GROUP
    OBJECTS {
        RhDecCapAppChrgIds,
        RhDecCapFlowIds
    }
    STATUS current
    DESCRIPTION
        "This Group defines the PIB Objects that describe the Decision
capabilities."
    ::= { rhGroups 1 }

rhDecCapACKGroup OBJECT-GROUP
    OBJECTS {
        RhDecCapACKEnable,
        RhDecCapACKChrgIds,
        RhDecCapACKFlowIds
    }
    STATUS current
    DESCRIPTION
        "This Group defines the PIB Objects that describe capabilities which
CGPE-PE is acceptable."
    ::= { rhGroups 2 }

```

```

rhEventIndicatorGroup OBJECT-GROUP
    OBJECTS {
        rhEventIndicator,
        rhEventIndicatorNext
    }
    STATUS current
    DESCRIPTION
        "This Group defines the PIB Objects that describe the query and
notification of a transport event."
 ::= { rhGroups 3 }

rhFlowDescGroup OBJECT-GROUP
    OBJECTS {
        rhFlowDescSingleFlowInfo,
        rhFlowDescConnectInfo,
        rhFlowDescNext
    }
    STATUS current
    DESCRIPTION
        "This Group defines the PIB Objects that describe the information of a
list of flows in a session."
 ::= { rhGroups 4 }

rhSingleFlowInfoGroup OBJECT-GROUP
    OBJECTS {
        rhSingleFlowInfoFlowId,
        rhSingleFlowInfoFlowTermination,
        rhSingleFlowInfoAddressRealm,
        rhSingleFlowInfoFlowDirDesc
    }
    STATUS current
    DESCRIPTION
        "This Group defines the PIB Objects that describe the information of a
flow, including QoS information and path selection information, etc."
 ::= { rhGroups 5 }

rhFlowTerminationGroup OBJECT-GROUP
    OBJECTS {
        rhFlowTermination
    }
    STATUS current
    DESCRIPTION
        "This Group defines the PIB Objects that describe the side information
of a flow (access or core)."
 ::= { rhGroups 6 }

rhFlowAddressRealmGroup OBJECT-GROUP
    OBJECTS {
        rhFlowAddressRealmAddressRealm
    }
    STATUS current
    DESCRIPTION
        "This Group defines the PIB Objects that describe the realm
information of a flow's source and destination address."
 ::= { rhGroups 7 }

rhFlowDirDescGroup OBJECT-GROUP
    OBJECTS {
        rhFlowDirDescInfo,
        rhFlowDirDescFluxInfo,
        rhFlowDirDescNext
    }
    STATUS current
    DESCRIPTION

```

```

        "This Group defines the PIB Objects that describe the Qos information
of flow."
 ::= { rhGroups 8 }

rhFlowInfoGroup OBJECT-GROUP
    OBJECTS {
        rhFlowInfoDirection,
        rhFlowInfoFilter,
        rhFlowInfoFilterStatus,
        rhFlowInfoServiceType
    }
    STATUS current
    DESCRIPTION
        "This Group defines the PIB Objects that describe the filter
information of a flow."
 ::= { rhGroups 9 }

rhFilterGroup OBJECT-GROUP
    OBJECTS {
        rhFilterDstAddrType,
        rhFilterDstAddr,
        rhFilterDstPrefixLength,
        rhFilterSrcAddrType,
        rhFilterSrcAddr,
        rhFilterSrcPrefixLength,
        rhFilterDscp,
        rhFilterProtocol,
        rhFilterDstL4PortMin,
        rhFilterDstL4PortMax,
        rhFilterSrcL4PortMin,
        rhFilterSrcL4PortMax
    }
    STATUS current
    DESCRIPTION
        "This Group defines the PIB Objects that describe the information of a
filter."
 ::= { rhGroups 10 }

Rh802InfoGroup OBJECT-GROUP
    OBJECTS {
        rhFilterNegation,
        rh802FilterDstAddr,
        rh802FilterDstAddrMask,
        rh802FilterSrcAddr,
        rh802FilterSrcAddrMask,
        rh802FilterVlanId,
        rh802FilterVlanTagRequired,
        rh802FilterEtherType,
        rh802FilterUserPriority }
    STATUS current
    DESCRIPTION
        "This Group defines the PIB Objects that describe the information of
802.1q filter."
 ::= { rhGroups 11 }

rhFluxInfoGroup OBJECT-GROUP
    OBJECTS {
        rhFluxInfoBandwidthUnit,
        rhFluxInfoPeakBandwidth,
        rhFluxInfoAverageBandwidth,
        rhFluxInfoMaxPktLength
    }
    STATUS current
    DESCRIPTION

```

```

        "This Group defines the PIB Objects that describe the bandwidth
information."
 ::= { rhGroups 12 }

rhCPNGWFluxInfoGroup OBJECT-GROUP
    OBJECTS {
        rhCPNGWFluxInfoBaseFluxInfo,
        rhCPNGWFluxInfoFlowPriority,
        rhCPNGWFluxInfoCarFlag,
        rhCPNGWFluxInfoBroadcastBateFlag,
        rhCPNGWFluxInfoPathBackupFlag
    }
    STATUS current
    DESCRIPTION
        "This Group defines the PIB Objects that describe the flux information
of a flow."
 ::= { rhGroups 13 }

rhCPNGWConnectInfoGroup OBJECT-GROUP
    OBJECTS {
        rhCPNGWConnectInfoSrcIFName,
        rhCPNGWConnectInfoSrcVlanID,
        rhCPNGWConnectInfoSrcVlanIDQinQ,
        rhCPNGWConnectInfoDstIFName,
        rhCPNGWConnectInfoDstVlanID,
        rhCPNGWConnectInfoDstVlanIDQinQ
    }
    STATUS current
    DESCRIPTION
        "This Group defines the PIB Objects that describe the information of
the CPNGW connection."
 ::= { rhGroups 14 }

rhReqInfoGroup OBJECT-GROUP
    OBJECTS {
        rhReqInfoIPAddrType,
        rhReqInfoIPAddress,
        rhReqInfoUserId,
        rhReqInfoMacAddr,
        rhReqInfoPhyInfo
    }
    STATUS current
    DESCRIPTION
        "This Group defines the PIB Objects that describe the physical and/or
logical connection of the access transport network that the CPE is attached to."
 ::= { rhGroups 15 }

rhFlowbasedDecInfoGroup OBJECT-GROUP
    OBJECTS {
        rhFlowBasedDecInfoRequestPriority,
        rhFlowBasedDecInfoFlowDesc,
        rhFlowBasedDecInfoEventIndicator,
    }
    STATUS current
    DESCRIPTION
        "This Group defines the PIB Objects that describe the information QoS
policy."
 ::= { rhGroups 16 }

rhUserBasedDecInfoGroup OBJECT-GROUP

```

```

OBJECTS {
    rhUserBasedDecInfoUserId,
    rhUserBasedDecInfoPolicyId,
    rhUserBasedDecInfoNetworkClass,
    rhUserBasedDecInfoDirFlux
}
STATUS current
DESCRIPTION
    "This Group defines the PIB Objects that describe the user-based
policy."
::= { rhGroups 17 }

rhNetworkClassGroup OBJECT-GROUP
    OBJECTS {
        rhNetworkClass
    }
    STATUS current
    DESCRIPTION
        "This Group defines the PIB Objects that describe network service
class subscribed by a CPE."
::= { rhGroups 18 }

rhDirFluxGroup OBJECT-GROUP
    OBJECTS {
        rhDirFluxDirection,
        rhDirFluxInfo,
        rhDirFluxNext
    }
    STATUS current
    DESCRIPTION
        "This Group defines the PIB Objects that describe uplink and/or
downlink bandwidth information subscribed by a CPE."
::= { rhGroups 19 }

rhStateReportGroup OBJECT-GROUP
    OBJECTS {
        rhStateReportStatus,
        rhStateReportDetails
    }
    STATUS current
    DESCRIPTION
        "This Group defines the PIB Objects that describe the Decision
enforcement result or the notification of transport event."
::= { rhGroups 20 }

END

```

## **Annex B**

### **List of messages imported from IETF RFCs**

(This annex forms an integral part of this Recommendation.)

This annex provides a list of IETF messages which have been used or referred to throughout this Recommendation.

#### **B.1 IETF RFC 2748**

The following messages used or referred to in this Recommendation have been defined in [IETF RFC 2748]:

- Client Accept (CAT)
- Client Close (CC)
- Client Open (OPN)
- Delete Request State (DRQ)
- Keep Alive (KA)
- Report State (RPT)
- Request (REQ)
- Synchronize Complete (SSC)
- Synchronize State Request (SSQ)

#### **B.2 IETF RFC 3084**

The following messages used or referred to in this Recommendation have been defined in [IETF RFC 3084]:

- Policy control:
  - Decision (DEC)
  - Delete Request State (DRQ)
  - Request (REQ)
- General state messages:
  - Client Accept (CAT)
  - Client Close (CC)
  - Client Open (OPN)
  - Keep Alive (KA)
  - Synchronize Complete (SSC)
  - Synchronize State Request (SSQ)

## Appendix I

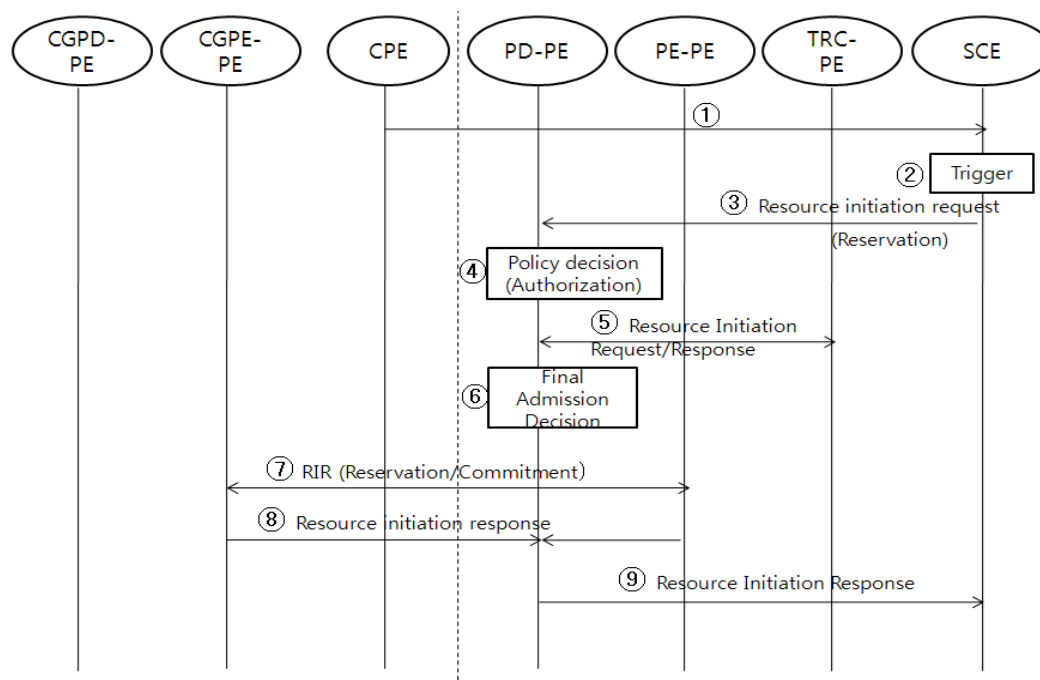
### Examples of procedures of the Rh interface for resource reservation and modification

(This appendix does not form an integral part of this Recommendation.)

#### I.1 Use case for the Rh interface

##### I.1.1 Resource reservation procedure (Rh interface)

Figure I.1 shows the resource reservation procedure (Rh interface).



**Figure I.1 – Resource reservation procedure (Rh interface)**

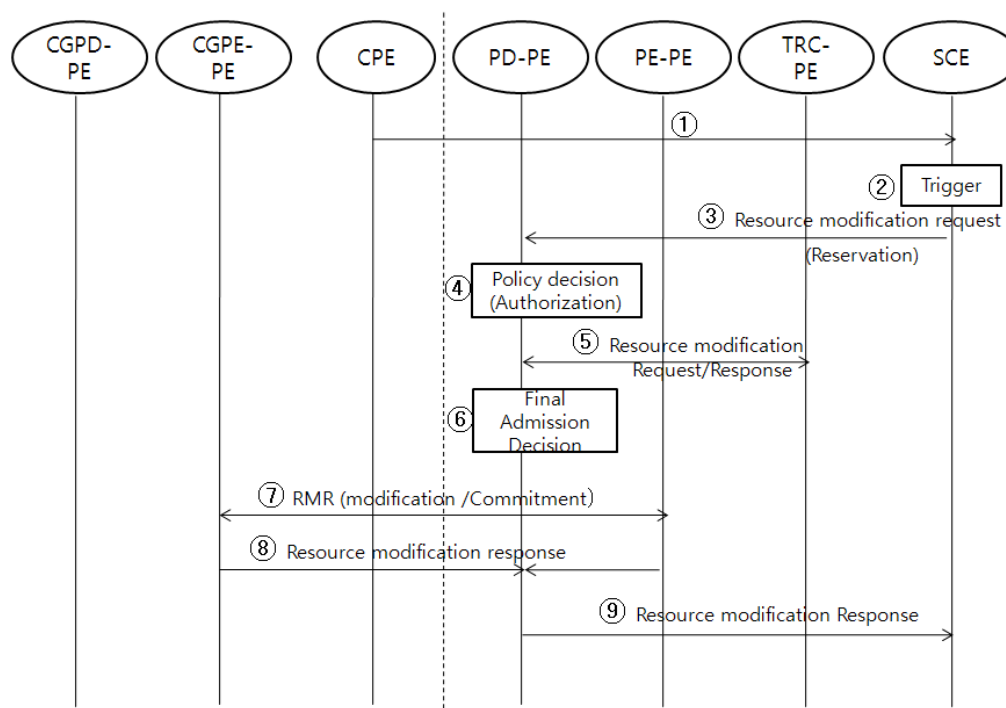
- 1) The application in the home network requests an application-specific service by sending a service request to the SCE. The service request may or may not contain any explicit (application) service QoS requirements.
- 2) A resource initiation request (reservation) (i.e., RIR (reservation)) is triggered in the SCE.
- 3) The SCE determines or derives the QoS requirement parameters (such as bandwidth, class, of service) for the media flows of a given service. It then sends an RIR (reservation) with the media flow description and its QoS parameters to the PD-PE at the network side across the Rs reference point for QoS resource authorization and reservation.
- 4) On receipt of the RIR (reservation), the PD-PE at the network side is required to authorize the required QoS resources for the media flow. The PD-PE checks if the media flow description and the required QoS resources are consistent with network policy rules held in the PD-PE and the transport subscription information held in the NACE.



- 5) The PD-PE positions and determines which access networks and core networks are involved for the media flow. If there are TRC-PE instances in an involved network, the PD-PE sends an RIR (availability check) to one of the TRC-PE instances registered in the PD-PE to check resource availability in the involved network. If there are multiple TRC-PE instances in the involved network, they communicate with each other to determine if the required QoS resource is available from edge to edge in the involved network. The TRC-PE instance which received the RIR (availability check) is required to send a resource initiation response (i.e., RIP) back to the PD-PE.
- 6) The PD-PE makes the final admission decisions based on the results of Step 4 and 5. If the media flow is not admitted, the PD-PE sends a RIP with the rejection reason back to the SCE.
- 7) The PD-PE may send a RIR to install the final admission decisions in the CGPE-FE and the PE-PE.
- 8) The CGPE-FE and PE-PE install (and enforces) the final admission decisions sent from the PD-PE and send a RIP back to the PD-PE.
- 9) The PD-PE sends a RIP back to the SCE.

### I.1.2 Resource modification procedure (Rh interface)

Figure I.2 shows the resource modification procedure (Rh interface).



**Figure I.2 – Resource modification procedure (Rh interface)**

- 1) The application in the home network requests an application-specific service by sending a service request to the SCE. The service request may or may not contain any explicit (application) service QoS requirements.
- 2) A resource modification request (reservation) (i.e., RMR (modification)) is triggered in the SCE.
- 3) The SCE determines or derives the QoS requirement parameters (such as bandwidth, class of service) for the media flows of a given service. It then sends a RMR (modification) with the media flow description and its QoS parameters to the PD-PE at the network side across the Rs reference point for QoS resource authorization and reservation.

- 4) On receipt of the RMR (modification), the PD-PE at the network side is required to authorize the required QoS resources for the media flow. The PD-PE checks if the media flow description and the required QoS resources are consistent with network policy rules held in the PD-PE and the transport subscription information held in the NACE.
- 5) The PD-PE positions determine which access networks and core networks are involved for the media flow. If there are TRC-PE instances in an involved network, the PD-PE sends a RMR (availability check) to one of the TRC-PE instances registered in the PD-PE to check resource availability in the involved network. The TRC-PE instance which received the RMR (availability check) is required to send a resource initiation response back to the PD-PE.
- 6) The PD-PE makes the final admission decisions based on the results of Step 4 and 5. If the media flow is not admitted, the PD-PE sends a RIP with the rejection reason back to the SCE.
- 7) The PD-PE may send a RMR to install the final admission decisions in the CGPE-FE and the PE-PE.
- 8) The CGPE-FE and PE-PE install the final admission decisions sent from the PD-PE and send a RMP back to the PD-PE.
- 9) The PD-PE sends a RMP back to the SCE.

## Appendix II

### Rh Stage 1 message to COPS message mapping

(This appendix does not form an integral part of this Recommendation.)

Table II.1 shows the Rh stage 1 message to COPS message mapping.

**Table II.1 – Rh stage 1 message to COPS message mapping**

<b>Rh stage 1 message</b>	<b>Source</b>	<b>Destination</b>	<b>COPS message name</b>	<b>Abbreviation</b>
Resource Initiation Request	PD-PE	CGPE-FE	Decision	DEC
Resource Initiation Response	CGPE-FE	PD-PE	Report State	RPT
Resource Modification Request	PD-PE	CGPE-FE	Decision	DEC
Resource Modification Response	CGPE-FE	PD-PE	Report State	RPT
Resource Action Request	CGPE-FE	PD-PE	Request	REQ
Resource Action Response	PD-PE	CGPE-FE	Decision	DEC
Resource Notification	CGPE-FE	PD-PE	Report State	RPT
Resource Release Request	PD-PE	CGPE-FE	Decision	DEC
Resource Release Response	CGPE-FE	PD-PE	Report State	RPT
Abort Resource Request	CGPE-FE	PD-PE	Delete Request State	DRQ
Abort Resource Response	PD-PE	CGPE-FE	—	—

## Bibliography

- [b-ITU-T Q.3303.1] Recommendation ITU-T Q.3303.1 (2007), *Resource control protocol No. 3 – Protocol at the interface between a Policy Decision Physical Entity (PD-PE) and a Policy Enforcement Physical Entity (PE-PE): COPS alternative*.



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