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Part 10-12: Quality of Service Device Control Protocol – Quality of Service Policy Holder Service

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Part 10-12: Quality of Service Device Control Protocol Quality of Service Policy Holder Service

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The list of all currently available parts of the ISO/IEC 29341 series, under the general title *Universal plug and play (UPnP) architecture*, can be found on the IEC web site.

This International Standard has been approved by vote of the member bodies, and the voting results may be obtained from the address given on the second title page.

ORIGINAL UPNP DOCUMENTS
(informative)

Reference may be made in this document to original UPnP documents. These references are retained in order to maintain consistency between the specifications as published by ISO/IEC and by UPnP Implementers Corporation. The following table indicates the original UPnP document titles and the corresponding part of ISO/IEC 29341:

UPnP Document Title	ISO/IEC 29341 Part
UPnP Device Architecture 1.0	ISO/IEC 29341-1
UPnP Basic:1 Device	ISO/IEC 29341-2
UPnP AV Architecture:1	ISO/IEC 29341-3-1
UPnP MediaRenderer:1 Device	ISO/IEC 29341-3-2
UPnP MediaServer:1 Device	ISO/IEC 29341-3-3
UPnP AVTransport:1 Service	ISO/IEC 29341-3-10
UPnP ConnectionManager:1 Service	ISO/IEC 29341-3-11
UPnP ContentDirectory:1 Service	ISO/IEC 29341-3-12
UPnP RenderingControl:1 Service	ISO/IEC 29341-3-13
UPnP MediaRenderer:2 Device	ISO/IEC 29341-4-2
UPnP MediaServer:2 Device	ISO/IEC 29341-4-3
UPnP AV Datastructure Template:1	ISO/IEC 29341-4-4
UPnP AVTransport:2 Service	ISO/IEC 29341-4-10
UPnP ConnectionManager:2 Service	ISO/IEC 29341-4-11
UPnP ContentDirectory:2 Service	ISO/IEC 29341-4-12
UPnP RenderingControl:2 Service	ISO/IEC 29341-4-13
UPnP ScheduledRecording:1	ISO/IEC 29341-4-14
UPnP DigitalSecurityCamera:1 Device	ISO/IEC 29341-5-1
UPnP DigitalSecurityCameraMotionImage:1 Service	ISO/IEC 29341-5-10
UPnP DigitalSecurityCameraSettings:1 Service	ISO/IEC 29341-5-11
UPnP DigitalSecurityCameraStillImage:1 Service	ISO/IEC 29341-5-12
UPnP HVAC_System:1 Device	ISO/IEC 29341-6-1
UPnP HVAC_ZoneThermostat:1 Device	ISO/IEC 29341-6-2
UPnP ControlValve:1 Service	ISO/IEC 29341-6-10
UPnP HVAC_FanOperatingMode:1 Service	ISO/IEC 29341-6-11
UPnP FanSpeed:1 Service	ISO/IEC 29341-6-12
UPnP HouseStatus:1 Service	ISO/IEC 29341-6-13
UPnP HVAC_SetpointSchedule:1 Service	ISO/IEC 29341-6-14
UPnP TemperatureSensor:1 Service	ISO/IEC 29341-6-15
UPnP TemperatureSetpoint:1 Service	ISO/IEC 29341-6-16
UPnP HVAC_UserOperatingMode:1 Service	ISO/IEC 29341-6-17
UPnP BinaryLight:1 Device	ISO/IEC 29341-7-1
UPnP DimmableLight:1 Device	ISO/IEC 29341-7-2
UPnP Dimming:1 Service	ISO/IEC 29341-7-10
UPnP SwitchPower:1 Service	ISO/IEC 29341-7-11
UPnP InternetGatewayDevice:1 Device	ISO/IEC 29341-8-1
UPnP LANDevice:1 Device	ISO/IEC 29341-8-2
UPnP WANDevice:1 Device	ISO/IEC 29341-8-3
UPnP WANConnectionDevice:1 Device	ISO/IEC 29341-8-4
UPnP WLANAccessPointDevice:1 Device	ISO/IEC 29341-8-5
UPnP LANHostConfigManagement:1 Service	ISO/IEC 29341-8-10
UPnP Layer3Forwarding:1 Service	ISO/IEC 29341-8-11
UPnP LinkAuthentication:1 Service	ISO/IEC 29341-8-12
UPnP RadiusClient:1 Service	ISO/IEC 29341-8-13
UPnP WANCableLinkConfig:1 Service	ISO/IEC 29341-8-14
UPnP WANCommonInterfaceConfig:1 Service	ISO/IEC 29341-8-15
UPnP WANDSLLinkConfig:1 Service	ISO/IEC 29341-8-16
UPnP WANEthernetLinkConfig:1 Service	ISO/IEC 29341-8-17
UPnP WANIPConnection:1 Service	ISO/IEC 29341-8-18
UPnP WANPOTSLinkConfig:1 Service	ISO/IEC 29341-8-19
UPnP WANPPPConnection:1 Service	ISO/IEC 29341-8-20
UPnP WLANConfiguration:1 Service	ISO/IEC 29341-8-21
UPnP Printer:1 Device	ISO/IEC 29341-9-1
UPnP Scanner:1.0 Device	ISO/IEC 29341-9-2
UPnP ExternalActivity:1 Service	ISO/IEC 29341-9-10
UPnP Feeder:1.0 Service	ISO/IEC 29341-9-11
UPnP PrintBasic:1 Service	ISO/IEC 29341-9-12
UPnP Scan:1 Service	ISO/IEC 29341-9-13
UPnP QoS Architecture:1.0	ISO/IEC 29341-10-1
UPnP QosDevice:1 Service	ISO/IEC 29341-10-10
UPnP QosManager:1 Service	ISO/IEC 29341-10-11
UPnP QosPolicyHolder:1 Service	ISO/IEC 29341-10-12
UPnP QoS Architecture:2	ISO/IEC 29341-11-1
UPnP QOS v2 Schema Files	ISO/IEC 29341-11-2

UPnP Document Title	ISO/IEC 29341 Part
UPnP QosDevice:2 Service	ISO/IEC 29341-11-10
UPnP QosManager:2 Service	ISO/IEC 29341-11-11
UPnP QosPolicyHolder:2 Service	ISO/IEC 29341-11-12
UPnP RemoteUIClientDevice:1 Device	ISO/IEC 29341-12-1
UPnP RemoteUIServerDevice:1 Device	ISO/IEC 29341-12-2
UPnP RemoteUIClient:1 Service	ISO/IEC 29341-12-10
UPnP RemoteUIServer:1 Service	ISO/IEC 29341-12-11
UPnP DeviceSecurity:1 Service	ISO/IEC 29341-13-10
UPnP SecurityConsole:1 Service	ISO/IEC 29341-13-11

1. Overview and Scope

This service definition is compliant with the UPnP Device Architecture version 1.0.

This service-type enables modeling of the 'QosPolicyHolder' function capabilities. The functionality for the QosPolicyHolder service can be implemented by any device on the home network. The QosPolicyHolder service is responsible for providing the traffic policy values for any given traffic stream as requested by an entity that manages home network traffic. The traffic policy values are determined by applying the policy rules configured for the home network to the requested traffic information. The configuration and management of home network policy are out of scope within the UPnP QoS architecture [QoS Architecture]. If there is a QosPolicyHolder, then there must be only *one* QosPolicyHolder service that gets advertised (SSDP discovered) within the home network. If more than one service instance gets advertised (discovered) by an entity that manages home network traffic, then that entity must operate as if *no* QosPolicyHolder service is present within the home network and operate with the default policy rules for UPnP QoS [QoS Architecture].

This document does not address the procedure for end to end set up of new traffic or revoking of existing traffic.

2. Service Modeling Definitions

2.1. ServiceType

The following service type identifies a service that is compliant with this template:

urn:schemas-upnp-org:service:QosPolicyHolder:1

The shorthand 'QosPolicyHolder service' is used herein to refer to this service type.

2.2. Namespaces

The XML [XML] in this document should be read as if the following namespace definitions were in effect.

`xmlns:uqos="http://www.upnp.org/schemas/TrafficDescriptorv1.xsd"` [QoS MGR]

`xmlns:uph="http://www.upnp.org/schemas/TrafficPolicy.xsd"` [3.2.1]

2.3. Referenced Specifications

Unless explicitly stated otherwise herein, implementation of the mandatory provisions of any standard referenced by this specification shall be mandatory for compliance with this specification.

2.3.1. Normative References

This section lists the normative references used in this document and includes the tag inside square brackets that is used for each sub reference:

[IEEE] - IEEE 802.1D-2004, Annex G, *IEEE Standard for Information technology - Telecommunications and information exchange between systems - IEEE standard for local and metropolitan area networks - Common specifications - Media access control (MAC) Bridges*, 2004.

[XML] – *Extensible Markup Language (XML) 1.0 (Second Edition)*, T. Bray, J.Paoli, C. M. Sperberg-McQueen, E Maler, eds. W3C Recommendations, 6 October 2000.

[DEVICE] - *UPnP Device Architecture, version 1.0.1*.

[QoS MGR] – UPnP QosManager Service Document.
Note that only the schema definition used for the A_ARG_TYPE_TrafficDescription is normative for this specification and the schema is defined in this reference.

2.3.2. Informative References

This section lists the informative references used in this document and includes the tag inside square brackets that is used for each sub reference:

[QoS Architecture] – UPnP QoS Architecture Document.

[QoS DEV] – UPnP QosDevice Service Document.

2.4. State Variables

Unlike most other service templates, the QosPolicyHolder service is 'action' based. This service's state variables exist primarily to support argument passing of the service's actions. Information is not exposed directly through explicit state variables. Rather, a client retrieves QosPolicyHolder service information via the return parameters of the actions defined in section 2.6. All of the state variables defined exist simply to enable the various actions of this service. This service is not intended to maintain any persistent state information.

Reader Note: For first-time reader, it may be more insightful to read the action definitions before reading the state variable definitions.

2.4.1. Derived data types

This section defines some derived data types that are represented as UPnP string data types with special syntax.

2.4.1.1. XML Fragments as UPnP Arguments

When an XML fragment is used for a UPnP argument, it places restrictions on the XML string data type. It needs to be represented as well formed XML. An XML fragment used within SOAP actions, in adherence to the UPnP Device Architecture version1.0 [DEVICE], needs to be escaped by using the normal XML rules, [XML] Section 2.4 Character Data and Markup, before embedding it in a SOAP request or response message. Every QosPolicyHolder service action described in this document requires that the arguments themselves to be XML fragments. The XML escaping rules are summarized from the [XML] reference mentioned above:

- The (<) character is encoded as (<)
- The (>) character is encoded as (>)
- The (&) character is encoded as (&)
- The (") character is encoded as (")
- The (') character is encoded as (')

Table 2-1: State Variables

Variable Name	Req. or Opt.[1]	Data Type	Allowed Value	Default Value	Eng. Units
A_ARG_TYPE_TrafficDescriptor	R	string (XML fragment)	see section 2.4.2	n/a	n/a
A_ARG_TYPE_TrafficPolicy	R	string (XML fragment)	see section 2.4.3	n/a	n/a

[1] R = Required, O = Optional, X = Non-standard.

2.4.2. A_ARG_TYPE_TrafficDescriptor

This is an escaped XML fragment, as specified in section 2.4.1.1, which contains information about some QoS traffic stream. Refer to the UPnP QosManager Service [QoS MGR] for syntax details of this XML fragment using the namespace,
`xmlns:uqos="http://www.upnp.org/schemas/TrafficDescriptorv1.xsd"`.

2.4.3. A_ARG_TYPE_TrafficPolicy

This is an escaped XML fragment, as specified in section 2.4.1.1, which contains the prescribed level of QoS for some traffic stream. It is composed of three elements that are summarized briefly below:

- Whether ***AdmissionPolicy*** is enabled or disabled for the network.
- A ***TrafficImportanceNumber*** is an integer with values in the range of 0 through 7. This value follows the numbering scheme for traffic classes as described in IEEE 802.1D Annex G [IEEE] and with additional traffic classes described in [QoS MGR]. This value is used by device(s) in the traffic's path to indicate what priority level to utilize when tagging the traffic's network packets.
- A ***UserImportanceNumber*** is an integer with values in the range of 0 through 255. This will be used by a QoS managing entity for basing traffic admission policy decisions. This value is applicable only when the ***AdmissionPolicy*** is enabled. Note that a value of 255 is the highest user importance and 0 is the lowest.

The formal XML schema definition for "TrafficPolicy" is a defined in section 3.2.1 of this specification.

2.4.4. Relationships Between State Variables

There are no relationships between any of the state variables for this service.

2.5. Eventing and Moderation

Table 2-2: Event Moderation

Variable Name	Evented	Moderated Event	Max Event Rate[1]	Logical Combination	Min Delta per Event[2]

[1] Determined by N, where Rate = (Event)/(N secs).
[2] (N) * (allowedValueRange Step).

2.5.1. Event Model

None of the state variables are evented for this service.

2.6. Actions

The QosPolicyHolder service is added to a UPnP device that will manage the QoS policy for the entire home network. As such, it should be resident within devices that will always be available on the network at any time and should provide an out of band mechanism from UPnP that allows for the disabling of service announcements.

Immediately following Table 2-3 is detailed information about the actions listed in this table, including short descriptions of the actions, the effects of the actions on state variables, and error codes defined by the actions.

Table 2-3: Actions

Name	Req. or Opt.[1]
GetTrafficPolicy	R

[1] R = Required, O = Optional, X = Non-standard.

2.6.1. GetTrafficPolicy

This action will determine what the prescribed level of QoS that will get applied to the requested traffic stream.

If QosManager does not supply ActiveTspecIndex in TrafficDescriptor to the QosPolicyHolder, this action must return error code 723.

If a QosManager does not supply a TrafficHandle in a TrafficDescriptor to QosPolicyHolder, this action must return error code 700.

The QosPolicyHolder only returns the policy for the Tspec indicated by the ActiveTspecIndex.

In the TrafficDescriptor to the QosPolicyHolder, the Tspec for which TrafficPolicy is needed is indicated by the ActiveTspecIndex. ActiveTspecIndex must be one of the TspecIndex values in the AvailableOrderedTspecList. If not, QosPolicyHolder must return an error code 723.

2.6.1.1. Arguments

Table 2-4: Arguments for GetTrafficPolicy

Argument	Direction	relatedStateVariable
RequestedTrafficDescriptor	IN	A_ARG_TYPE_TrafficDescriptor
OutputTrafficPolicy	OUT	A_ARG_TYPE_TrafficPolicy

The RequestedTrafficDescriptor input argument is an escaped XML fragment, as specified in section 2.4.2, which contains information for the traffic stream requiring some level of Qos. This action will then determine what the prescribed level of QoS that will get applied to this requested traffic stream. Refer to the UPnP QosManager Service [QoS MGR] for details on this XML fragment using the namespace, `xmlns:uqos="http://www.upnp.org/schemas/TrafficDescriptorv1.xsd"`.

The OutputTrafficPolicy output argument is an escaped XML string, as specified in section 2.4.3, which contains the prescribed level of QoS for the requested traffic stream.

Illustrated below are two separate examples for possible results returned (OutputTrafficPolicy), when executing the GetTrafficPolicy action. XML escaping is not shown to provide better readability.

Example 1:

```
<uph:TrafficPolicy
    xmlns:uph="http://www.upnp.org/schemas/TrafficPolicy.xsd">
    <uph:AdmissionPolicy>Enabled</uph:AdmissionPolicy>
    <uph:TrafficImportanceNumber>3</uph:TrafficImportanceNumber>
    <uph:UserImportanceNumber>128</uph:UserImportanceNumber>
</uph:TrafficPolicy>
```

Example 2:

```
<uph:TrafficPolicy
    xmlns:uph="http://www.upnp.org/schemas/TrafficPolicy.xsd">
    <uph:AdmissionPolicy>Disabled</uph:AdmissionPolicy>
    <uph:TrafficImportanceNumber>5</uph:TrafficImportanceNumber>
</uph:TrafficPolicy>
```

The formal XML schema definition for “TrafficPolicy” is a defined in section 3.2.1 of this specification.

2.6.1.2. Dependency on State (if any)

There is no dependency on the current state of this service when this action gets executed.

2.6.1.3. Effect on State (if any)

There is no effect on the state of this service when this action gets executed.

2.6.1.4. Errors

The only error codes returned by this action are those that are related to the UPnP Device Architecture [DEVICE]. There are not any additional error codes that are unique only to this service.

Table 2-5: Error Codes for GetTrafficPolicy

errorCode	errorDescription	Description

2.6.2. Non-Standard Actions Implemented by a UPnP Vendor

To facilitate certification, non-standard actions implemented by UPnP vendors should be included in this service template. The UPnP Device Architecture [DEVICE] specifies naming requirements for non-standard actions (see the section on Description).

2.6.3. Relationships Between Actions

There is no relationship between the actions for this service.

2.6.4. Common Error Codes

The following table lists error codes common to actions for this service type. If an action results in multiple errors, the most specific error must be returned. These common error codes are defined in the UPnP Device Architecture [DEVICE] and other Technical Committee documents.

Table 2-6: Common Error Codes

errorCode	errorDescription	Description
400-499	TBD	See UPnP Device Architecture section on Control.
500-599	TBD	See UPnP Device Architecture section on Control
600-699	TBD	See UPnP Device Architecture section on Control
700-799	*Not Applicable*	Common action errors defined by the UPnP Forum working committees.
800-899	*TBD*	*(Specified by UPnP vendor.)*

3. Supporting Information

3.1. Glossary

Refer to the UPnP QoS Architecture [QoS Architecture] document for glossary of terms.

3.2. Namespaces

In XML [XML], an element name is not just the local part but that part combined with a namespace ID (explicit or default) to form a qualified name. XML processing requires that one deals with qualified names rather than merely local parts. See the UPnP Device Architecture [DEVICE] document for more details.

3.2.1. Schema Definition

This following is the formal XML schema definition for the UPnP QosPolicyHolder service namespace "http://www.upnp.org/schemas/TrafficPolicy".

```
<?xml version="1.0" encoding="UTF-8"?>
<xs:schema
  targetNamespace="http://www.upnp.org/schemas/TrafficPolicy.xsd"
  xmlns:xs="http://www.w3.org/2001/XMLSchema"
  xmlns="http://www.upnp.org/schemas/TrafficPolicy.xsd"
  elementFormDefault="qualified"
  id="TrafficPolicy.xsd"
  attributeFormDefault="unqualified">

  <xs:annotation>
    <xs:documentation>
    See Section 2.4.3 in the QosPolicyHolder  service specification
    Copyright 2004, 2005 UPnP(tm). All rights reserved.
    </xs:documentation>
  </xs:annotation>

  <xs:element name="TrafficPolicy" type="TrafficPolicyType" />

  <xs:complexType name="TrafficPolicyType">
    <xs:sequence>
      <xs:element name="AdmissionPolicy" minOccurs="1" maxOccurs="1">
        <xs:simpleType>
          <xs:restriction base='xs:string' >
            <xs:enumeration value='Disabled'/>
            <xs:enumeration value='Enabled'/>
          </xs:restriction>
        </xs:simpleType>
      </xs:element>
      <xs:element name="TrafficImportanceNumber" minOccurs="1"
maxOccurs="1">
        <xs:simpleType>
          <xs:restriction base='xs:nonNegativeInteger'>
            <xs:maxInclusive value="7"/>
          </xs:restriction>
        </xs:simpleType>
      </xs:element>
      <xs:element name="UserImportanceNumber" minOccurs="0" maxOccurs="1">
        <xs:simpleType>
          <xs:restriction base='xs:nonNegativeInteger' >
            <xs:maxInclusive value="255"/>
          </xs:restriction>
        </xs:simpleType>
      </xs:element>
      <xs:element name="v2" type="v2ExtensionType" minOccurs="0" />
      <!-- allow any element except those from (v1) target namespace -->
```

```
      <xs:choice minOccurs="0" maxOccurs="unbounded" >
        <xs:any namespace="##other" processContents="lax"/>
        <xs:any namespace="##local" processContents="lax"/>
      </xs:choice>
    </xs:sequence>
  </xs:complexType>

  <xs:complexType name="v2ExtensionType">
    <xs:sequence>
      <xs:any namespace="##targetNamespace" processContents="lax"
maxOccurs="unbounded"/>
    </xs:sequence>
    <xs:anyAttribute />
  </xs:complexType>
</xs:schema>
```

3.2.2. <Any> XML Tag Usage

The <any> tag within a schema allows for vendors to add their own additions to this schema definition without impacting implementations that verifies XML text using the schema defined above. To prevent name collisions, vendors should define and use their own namespace to prevent name collision of their tags with those of other vendors. It's recommended that implementations do not require the retrieval of their corresponding schemas from the Internet.

The any tag is required for future extensibility of schema definitions without versioning the schema. The following examples demonstrate the usage of any tag in TrafficPolicy.

```
<TrafficPolicy
  xmlns="http://www.upnp.org/schemas/TrafficPolicy.xsd"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xmlns:prv="http://myPrivate.com"
  xmlns:prv2="http://myPrivate2.com"
  xsi:schemaLocation="http://www.upnp.org/schemas/TrafficPolicy.xsd
TrafficPolicy.xsd">
    <AdmissionPolicy>Enabled</AdmissionPolicy>
    <TrafficImportanceNumber>3</TrafficImportanceNumber>
    <UserImportanceNumber>128</UserImportanceNumber>
    <v2>
        <PolicyHolderId>urn:10.0.0.50:port:1024</PolicyHolderId>
         <prv2:MyPrivate2>whatever</prv2:MyPrivate2>
    </v2>
    <prv:MyPrivate1>whatever</prv:MyPrivate1>
</TrafficPolicy>
```

The xml tags in xml fragments must be in the same order as they are described in the XSD schema definitions.

The XSD files and the XML arguments have xsi:schemaLocation specified. This is strictly for unique identification purposes only. The location will not contain the XSD files.

4. Theory of Operation (Informative)

The sole purpose of this service is to provide a simple interface to some network entity that will host policy decisions for the home network, such as the LAN side of an Internet Gateway Device. While the policy enforcement, decision making, and configuration is out of scope for UPnP Qos, it is necessary for such an entity, within the LAN, to provide some traffic policy values for any network traffic stream that wants to have QoS that is better than "BestEffort". This is accomplished by this service, which has a single action named *GetTrafficPolicy*. The QoS network entities that will manage QoS for the LAN, such as a UPnP device with the QosManager [QoS MGR] service, will discover a UPnP device that contains the QosPolicyHolder service. Only a single UPnP device containing the QosPolicyHolder service can be active within the LAN. If none or more than one UPnP device containing the QosPolicyHolder service exists, then the network entities managing QoS for the LAN will use the default traffic policy rules and values for the network traffic stream requesting Qos. Any UPnP device containing the QosPolicyHolder service should provide a method, that's out of band to UPnP, to disable service announcements (e.g. disable the service). This will allow for a mechanism to resolve to only a single QosPolicyHolder service being visible on the network. When only a single QosPolicyHolder service exists, the *GetTrafficPolicy* action will accept as input a traffic descriptor, defined as an XML string [QoS MGR], which contains all the information needed to generate QoS traffic policy values for this traffic stream. Again to reiterate, the rules that this network policy entity uses to generate these traffic policy values are out of scope for UPnP Qos. The QoS traffic policy values, as an XML string, that are returned by the *GetTrafficPolicy* action for a requested traffic descriptor are as summarized below:

- Whether ***AdmissionPolicy*** logic, such as parameterized Qos, is to be used for all requested traffic by the QoS network entities that manage QoS for the LAN. Possible values are enumerated as either ***Enabled*** or ***Disabled***.

- A ***TrafficImportanceNumber*** with a value from ***0*** through ***7*** inclusive. This value is an IEEE 802.1D Annex G [IEEE] number that is provided to device(s) in the traffic's path. Device(s) must interpret this number according the IEEE 802.1D Annex G specification and apply to network packets for this traffic stream. Basically it's tagging a priority value to the traffic's network packets.

- A ***UserImportanceNumber*** with a value from ***0*** through ***255*** inclusive. This value will be used by the QoS network entities that manage QoS for the LAN for admission policy decisions. Note that this value is not used when the ***AdmissionPolicy*** value for the requested traffic stream is ***Disabled***.

In summary, network admission decisions, when ***AdmissionPolicy*** is ***Enabled***, are made by using the ***UserImportanceNumber***. Once that traffic stream is admitted it will then use the ***TrafficImportanceNumber*** for priority based QoS implementations. The schemas definitions used by the *GetTrafficPolicy* action for its input and output arguments are defined in reference [QoS MGR] and section 3.2.1 respectively.