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INTERNATIONAL STANDARD

Information technology – UPnP Device Architecture – Part 11-11: Quality of Service Device Control Protocol – Level 2 – Quality of Service Manager Service



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INFORMATION TECHNOLOGY – UPNP DEVICE ARCHITECTURE –

Part 11-11: Quality of Service Device Control Protocol – Level 2 – Quality of Service Manager 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.

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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

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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

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1. Overview and Scope

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

This service-type enables modeling of 'Quality of Service Manager' function capabilities. QosManager functionality is a combination of QosManager service and control point functionality that discovers and controls QosDevice and QosPolicyHolder services running on the network. The QosManager function is responsible for requesting, updating, releasing and in general controlling the Quality of Service assigned by networking devices to various traffic streams. The QosManager service will be invoked from an UPnP Control Point to perform the functions related to setting up QoS[2] for that traffic. Once the network is configured with respect to the QoS for the upcoming traffic stream, the QosManager service will hand back control to the Control Point. This service provides a mechanism for Control Point to:

- Be agnostic of the QoS capabilities and associated details about the various devices on the network.
- Hand-over the tasks of setting up, modifying and revoking the QoS associated with every traffic stream
- Hand-over the task of Control Point functionality with respect to the UPnP QosDevice service – its discovery, control and eventing.
- Hand-over the task of Control Point functionality with respect to the UPnP QosPolicyHolder service – its discovery, control and eventing.

Thus, a QosManager is a dual-role entity in the sense that it exposes a QosManager service to the Control Point while acting as a Control Point for the QosPolicyHolder and QosDevice services running on the network. This document describes the components of the UPnP QosManager service and the QoS Management Entity. The QoS Management Entity provides the Control Point functionality that discovers and controls QosDevice services and the QosPolicyHolder Services running on the network. Additional information concerning the QoS Management Entity may be found in:

- UPnP QoS Architecture document
- UPnP QosDevice Service Definition Document
- UPnP QosPolicyHolder Service Definition Document

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

1.1.1. Normative References

[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.*

[POLICY HOLDER] – UPnP QosPolicyHolder:2 Service Document.

[QOS DEVICE] – UPnP QosDevice:2 Service Document.

[2] Quality of Service

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1.1.2. 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 2.0 Document.

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2. Service Modeling Definitions

2.1. ServiceType

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

xmlns="urn:schemas-upnp-org:service:QosManager:2"

2.2. State Variables

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

2.2.1.1. XML Fragments as UPnP Arguments

The UPnP QoS Framework often uses XML fragments as arguments in UPnP actions. The containing UPnP data type is a string. This places restrictions on a string's content; it has to represent a well-formed XML fragment (this includes a complete XML document).

In their XML fragments, implementations may use an explicit reference to appropriate name spaces.

At several places in the XML schemas there is room for vendor differentiation through the use of the "any"-tag. When extending UPnP-QoS with their own XML tags, vendors should use a name space to prevent collisions of their tags with those of other vendors. It is recommended that implementations are not required to retrieve the corresponding schemas from the Internet.

Finally, an XML fragment, in adherence to the UPnP V 1.0 architecture [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. 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 [2]	Default Value [2]	Eng. Units
A_ARG_TYPE_TrafficDescriptor	R	string	Escaped XML fragment of TrafficDescriptor Schema.	n/a	n/a
A_ARG_TYPE_TrafficHandle	R	string		n/a	n/a
A_ARG_TYPE_NumTrafficDescriptors	R	integer	Non-negative integer.	n/a	n/a
A_ARG_TYPE_NumPolicyHolders	R	integer	Non-negative integer.	n/a	n/a
A_ARG_TYPE_ListOfTrafficDescriptors	R	string	Escaped XML fragment	n/a	n/a

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

[2] Values listed in this column are required. To specify standard optional values or to delegate assignment of values to the vendor, you must reference a specific instance of an appropriate table below.

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2.2.2. A_ARG_TYPE_TrafficDescriptor

This state variable contains information about a particular traffic stream. A TrafficDescriptor consists of an XML structure consisting of:

- TrafficHandle
- TrafficId
- AvailableOrderedTspecList
- QosBoundarySourceAddress
- QosBoundaryDestinationAddress
- TrafficImportanceNumber
- PolicyHolderId
- PolicyLastModified
- PolicyModifyingUserName
- PolicyHolderConfigUrl
- UserName
- CpName
- VendorApplicationName
- PortName
- ServiceProviderServiceName
- TrafficLeaseTime

This argument is described by the schema identified by "`http://www.upnp.org/schemas/TrafficDescriptorv1.xsd`" and located at "`http://www.upnp.org/schemas/qos/TrafficDescriptor-v2.xsd`".

2.2.2.1. Description of fields in the TrafficDescriptor structure

TrafficHandle

TrafficHandle is a unique identifier associated with a particular instance of TrafficDescriptor; i.e. a particular traffic stream. It is a unique string generated by the QosManager and provided to the Control Point in response to the **RequestTrafficQos** action. The QosManager must insure that the generated Traffic Handle string is unique for all Traffic Descriptors on the network. In all subsequent communication between the Control Point and the QosManager service, TrafficHandle is used to uniquely reference a particular traffic stream.

TrafficId

TrafficId contains information about identifying / classifying packets that belong to that particular traffic stream. It consists of an XML structure consisting of: SourceAddress, DestinationAddress, SourcePort, DestinationPort, and IpProtocol. The TrafficId at a minimum must contain SourceAddress and DestinationAddress. Any of the other arguments that are not known are absent.

The value of IpProtocol is an IANA assigned IP protocol number from 0-255 (for more information: http://www.iana.org/assignments/protocol-numbers).

Tspec

Tspec contains a description of content QoS Requirements. Tspec is represented in the form of an XML structure. In UPnP AV scenario, this information is extracted from the Content Directory Service of the Media Server. In the Content Directory Service, Tspec is represented either as a string, containing an escaped XML structure, or as an URI pointing to the escaped XML structure. UPnP AV Control Point uses **CDS[3]:Browse** and/or **CDS:Search** action calls to acquire the Tspec(s) associated with the content and creates an AvailableOrderedTspecList field in the Traffic Descriptor.

Tspec XML structure consists of the following:

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[3] CDS: Content Directory Services

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- TspecIndex: Unique numerical index associated with a particular Tspec. The value of TspecIndex indicates preference (as defined by the application or the end user). A Tspec with smaller index is more preferred compared to a Tspec with larger Index.

- AVTransportURI: This string field contains a unique URI associated with the UPnP AV content item for which QoS is being requested.

- AVTransportInstanceID: This integer field contains a unique Instance ID associated with the UPnP AV Transport service associated with the content item for which QoS is being requested.

- TrafficClass: The traffic class associated with the traffic stream. This is an enumerated variable that can be assigned to one of the following list of values:

    - Network Control
    - Streaming Control
    - Voice
    - AV
    - Data
    - Audio
    - Image
    - Gaming
    - Other
    - Background

TspecIndex must be filled in by the Control Point. Other Tspec parameters may be omitted if they are not known.

AvailableOrderedTspecList

AvailableOrderedTspecList contains one or more Tspec components. The Tspec index reflects the order of preference. Tspec indices must be unique within an AvailableOrderedTspecList. Tspec value with smaller index values are more preferred. TspecIndex values need not be consecutive numbers. The order of Tspec structures in the AvailableOrderedTspecList is not relevant. AvailableOrderedTspecList is a required parameter in the TrafficDescriptor structure. A Tspec may be defined via any combination of its components.

ActiveTspecIndex

ActiveTspecIndex contains an integer which indicates the index of the current active Tspec from the AvailableOrderedTspecList. Tspec and AvailableOrderedTspecList are defined above.

TrafficImportanceNumber:

See definition in A_ARG_TYPE_TrafficPolicy of QosPolicyHolder [POLICY HOLDER] .

QosBoundarySourceAddress

If a traffic stream originates outside the home network (e.g. on the Internet), the Control Point application must provide the QoS boundary point IP address. This address will be treated as the QoS termination point for UPnP QoS. This parameter is optional, because it is applicable only to traffic streams originating outside the home network. It should be noted that this address is not part of traffic identifier, because the IP packets will carry the IP address of the actual source address. QosBoundarySourceAddress is used by QosManager for decisions related to path determination and device selection.

The “Don’t care” situation that may apply for SourceAddress and DestinationAddress IP address does not apply here. If the SourceAddress is not in the subnet and a QosBoundarySourceAddress was not provided, the QosManager must return an error code 752.

QosBoundaryDestinationAddress

If a traffic stream terminates outside the home network (e.g. on the Internet), the Control Point application must provide the QoS boundary point IP address. This address will be treated as the QoS termination point for UPnP QoS. This parameter is optional, because it is applicable only to traffic streams terminating outside the home network. It should be noted that this address is not part of traffic identifier, because the IP packets will carry the IP address of the actual destination address. QosBoundaryDestinationAddress is used by QosManager for decisions related to path determination and device selection.

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The "Don't care" situation that may apply for SourceAddress and DestinationAddress IP address does not apply here. If the DestinationAddress is not in the subnet and a QosBoundaryDestinationAddress was not provided, the QosManager must return an error code 752.

MediaServerConnectionId:

This is an optional field. This field may be useful in case of UPnP AV based streaming with multiple Tspec parameters. MediaServerConnectionId may be used by the QosManager to identify the traffic stream that is being setup by the UPnP AV Control Point which is requesting QoS. Please refer to UPnP QoS Architecture document for more details. The MediaServerConnectionId is obtained from the Media Server via **CM[4]::PrepareForConnection** action.

MediaRendererConnectionId:

This is an optional field. This field may be useful in case of UPnP AV based streaming with multiple Tspecs. MediaRendererConnectionId may be used by the QosManager to identify the traffic stream that is being setup by the UPnP AV Control Point which is requesting QoS. Please refer to UPnP QoS Architecture document for more details. The MediaRendererConnectionId is obtained from the Media Renderer via **CM::PrepareForConnection** action.

TrafficLeaseTime

This field contains the lease-time associated with a particular traffic stream. The lease time is expressed in 'seconds'. When not specified, it indicates an indefinite lease, that is the TrafficDescriptor will remain active until it is explicitly removed or the QosDevice is rebooted. When the QosDevice or QosManager reports the lease time to a Control Point, this is the remaining lease time.

PolicyHolderId:

This is an optional field. This field may be provided by a Control Point to a QosManager to identify the QosPolicyHolder that the QosManager must use to obtain the policy for this TrafficDescriptor. See definition in A_ARG_TYPE_TrafficPolicy of QosPolicyHolder (v2) [POLICY HOLDER]

PolicyLastModified

See definition in A_ARG_TYPE_TrafficPolicy of QosPolicyHolder (v2) [POLICY HOLDER]

PolicyModifyingUserName

See definition in A_ARG_TYPE_TrafficPolicy of QosPolicyHolder (v2)[POLICY HOLDER]

PolicyHolderConfigUrl

See definition in A_ARG_TYPE_TrafficPolicy of QosPolicyHolder (v2)[POLICY HOLDER]

The following are various optional policy parameters that may be provided

UserName

UserName field contains a string associated with the user who requested a particular traffic stream. This field, if present, shall identify the name of the user initiating the UPnP QoS Action. The field must be <= 64 UTF-8 characters. At present this specification does not define the semantics for this field. This field represents the name of the user initiating the QoS action. Examples include, "Dad", "Jimmy", "CN#1234567". The latter is an example of a name provided by a service provider to uniquely identify its individual customers.

CpName

CpName field contains a string associated with the Control Point requesting the traffic stream. This field, if present, shall identify the name of the Control Point initiating the UPnP QoS Action. The field must be <= 64 UTF-8 characters. At present this specification does not define the semantics for this field. The CpName may

[4] CM: Connection Manager

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specify the brand name of the Control Point or it may indicate the location of the Control Point such as “living room”

VendorApplicationName

VendorApplicationName field contains a single URI string associated with an application. This field, if present, shall identify the name of the application initiating the UPnP QoS Action. For applications specified by vendors, the value of this field must begin with “urn:”, followed by an ICANN domain name owned by the vendor, followed by “:application:”, followed by an application name, i.e. the value of this field should be constructed as follows:

urn:*domain-name*:application:*appl-name*

domain-name: Application vendor domain name. This must follow the syntax specified for Namespace Identifier (NID) in the RFC 2141. The *domain-name* field must be <= 64 UTF-8 characters. If the control point is not aware of this field, then it may be left blank as per the following format:

urn::application:*appl-name*

appl-name: Name of the application provided by a vendor. This must follow the syntax specified for Name Specific String (NSS) in the RFC 2141. The *appl-name* field must be <= 64 UTF-8 characters. The *application-name* must not contain a colon character.

When requesting QoS it may be useful to know the manufacturer and name of the application software client or server that will process the traffic stream.

PortName:

PortName field contains a single URI string associated with the fixed port used by an application for its connection set-up. This field, if present, shall identify the port number used by the application. The value of this field must begin with “urn:”, followed by an ICANN domain name owned by the vendor, followed by “:port:”, followed by the port name. i.e. the value of this field should be constructed as follows

urn:*domain-name*:port:*port-number*

domain-name: Application vendor domain name. This must follow the syntax specified for Namespace Identifier (NID) in the RFC 2141. The *domain-name* field must be <= 64 UTF-8 characters.

port-number: A fixed port number used by the application either for connection set-up. This must be an integer value in the range 1 to 65535. If the application uses a range of port numbers then the starting port number of that range shall be specified. This value is either a vendor specific port used for the application or an IANA assigned port number for the application. The list of all the IANA assigned port numbers is maintained by IANA and is available at http://www.iana.org/assignments/port-numbers.

These fields indicate the port that is used by an application for its connection set-up. The use of IANA assigned port numbers is encouraged, but if not available for a particular application, a vendor assigned port number may be used.

ServiceProviderServiceName

ServiceProviderServiceName field contains a single URI string associated with a service offered by a service provider. This field, if present, shall identify the name of the service offered by a service provider. For services provided by service providers, the value of this field must begin with “urn:”, followed by an ICANN domain name owned by a service provider , followed by “service:”, followed by a service name, i.e. the value of this field should be constructed as follows:

urn:*domain-name*:service:*serv-name*

domain-name: Service Provider domain name. This must follow the syntax specified for Namespace Identifier (NID) in the RFC 2141. The *domain-name* field must be <= 64 UTF-8 characters.

serv-name: Name of the service provided by a service vendor. This must follow the syntax specified for Name Specific String (NSS) in the RFC 2141. The serv-*name* field must be <= 64 UTF-8 characters. The serv-*name* must not contain the colon character.

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This represents the name of a particular service being offered by a service provider. Note that while multiple services provided by the same service provider may use the same software application, different Service offerings may be given different priorities (traffic importance).

2.2.2.2. Sample argument XML string

```
<?xml version="1.0" encoding="UTF-8"?>
<TrafficDescriptor
  xmlns="http://www.upnp.org/schemas/TrafficDescriptorv1.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/TrafficDescriptorv1.xsd
    http://www.upnp.org/schemas/qos/TrafficDescriptor-v2.xsd">

    <!-- prv and prv2 are for illustration purpose only to show how vendor specific namespaces
could be added -->
  <TrafficHandle>kiwin1</TrafficHandle>
  <TrafficId>
    <SourceAddress>
      <Ipv4>192.168.1.50</Ipv4>
    </SourceAddress>
    <SourcePort>23</SourcePort>
    <DestinationAddress>
      <Ipv4>192.168.1.53</Ipv4>
    </DestinationAddress>
    <DestinationPort>23</DestinationPort>
    <IpProtocol>1</IpProtocol>
    <v2TrafficId>
      <v3TrafficId>
        <Whatever>whatever</Whatever>
      </v3TrafficId>
      <prv2:MyPrivate2>whatever</prv2:MyPrivate2>
    </v2TrafficId>
    <prv:MyPrivate1>whatever</prv:MyPrivate1>
  </TrafficId>
  <AvailableOrderedTspecList>
    <Tspec>
      <TspecIndex>300</TspecIndex>
      <TrafficClass>AV</TrafficClass>
    </Tspec>
    <Tspec>
      <TspecIndex>2</TspecIndex>
      <TrafficClass>Audio</TrafficClass>
      <v2TrafficSpecification>
        <v3TrafficSpecification>
          <Whatever>whatever</Whatever>
        </v3TrafficSpecification>
        <prv2:MyPrivate2>whatever</prv2:MyPrivate2>
      </v2TrafficSpecification>
      <prv:MyPrivate1>whatever</prv:MyPrivate1>
    </Tspec>
  </AvailableOrderedTspecList>
  <ActiveTspecIndex>300</ActiveTspecIndex>
  <TrafficImportanceNumber>5</TrafficImportanceNumber>
  <v2>
    <v3>
      <Whatever>whatever</Whatever>
    </v3>
    <prv2:MyPrivate2>whatever</prv2:MyPrivate2>
  </v2>
  <prv:MyPrivate1>whatever</prv:MyPrivate1>
  <OptionalPolicyParams>
    <CpName>Amy's CP</CpName>
    <v2OptionalParams>
      <v3OptionalParams>
        <Whatever>whatever</Whatever>
      </v3OptionalParams>
      <prv2:MyPrivate2>whatever</prv2:MyPrivate2>
    </v2OptionalParams>
    <prv:MyPrivate1>whatever</prv:MyPrivate1>
  </OptionalPolicyParams>
</TrafficDescriptor>
```

Different Tspec(s) for the same traffic could be differentiated using traffic class as shown below.

```
<?xml version="1.0" encoding="UTF-8"?>
<TrafficDescriptor
  xmlns="http://www.upnp.org/schemas/TrafficDescriptorv1.xsd"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
```

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```
  xsi:schemaLocation="http://www.upnp.org/schemas/TrafficDescriptorv1.xsd
  http://www.upnp.org/schemas/qos/TrafficDescriptor-v2.xsd">
  <TrafficHandle>kiwin1</TrafficHandle>
  <TrafficId>
    <SourceAddress>
      <Ipv4>192.168.1.50</Ipv4>
    </SourceAddress>
    <SourcePort>23</SourcePort>
    <DestinationAddress>
      <Ipv4>192.168.1.53</Ipv4>
    </DestinationAddress>
    <DestinationPort>23</DestinationPort>
    <IpProtocol>1</IpProtocol>
  </TrafficId>
  <AvailableOrderedTspecList>
    <Tspec>
      <TspecIndex>300</TspecIndex>
      <TrafficClass>AV</TrafficClass>
    </Tspec>
    <Tspec>
      <TspecIndex>2</TspecIndex>
      <TrafficClass>Audio</TrafficClass>
    </Tspec>
  </AvailableOrderedTspecList>
  <ActiveTspecIndex>300</ActiveTspecIndex>
  <TrafficImportanceNumber>5</TrafficImportanceNumber>
  <v2>
    <PolicyHolderId>uuid:XYZ-Com-QosPolicyHolder-T001:serviceId:qphT2</PolicyHolderId>
    <PolicyLastModified>2004-11-26T15:03:23-08:00</PolicyLastModified>
    <PolicyModifyingUserName>Amy</PolicyModifyingUserName>
    <PolicyHolderConfigUrl>http://10.0.0.50/ConfigPolicy.html </PolicyHolderConfigUrl>
  </v2>
  <OptionalPolicyParams>
    <CpName>Amy's CP</CpName>
  </OptionalPolicyParams>
</TrafficDescriptor>
```

2.2.3. A_ARG_TYPE_TrafficHandle

This state variable contains a unique identifier associated with a particular instance of TrafficDescriptor i.e. a particular traffic stream. It is a unique string generated by the QosManager and provided to the Control Point in response to the **RequestTrafficQos** action. In all subsequent communication between the Control Point and the QosManager service, TrafficHandle is used to reference a particular traffic stream. QosManager must insure that TrafficHandle is a unique string that identifies one and only one TrafficDescriptor on the network.

2.2.4. A_ARG_TYPE_NumTrafficDescriptors

This state variable contains the number of Traffic Descriptors registered/admitted by a given instance of the QosDevice as reported by the QosManager service. This information is returned in response to the **BrowseAllTrafficDescriptors** service action call from the Control Point.

2.2.5. A_ARG_TYPE_NumPolicyHolders

This state variable contains the number of instances of QosPolicyHolder service discovered by a given instance of the QosManager service. This variable is returned in response to **RequestTrafficQos** and **UpdateTrafficQos** actions (as an output argument) to convey to a Control Point the number of active QoS Policy Holders on the network. If the value of this variable is not equal to 1, it means that the default policy was used by the QosManager to make admission control decisions. A value of "1" indicates that the policy provided by the Control Point selected QosPolicyHolder Service has been used or that exactly one QosPolicyHolder was found on the network.

2.2.6. A_ARG_TYPE_ ListOfTrafficDescriptors

This state variable contains one or more instances of the state variable A_ARG_TYPE_TrafficDescriptor.

This argument is described by the schema identified by
"`http://www.upnp.org/schemas/ListOfTrafficDescriptors.xsd`" and located at
"`http://www.upnp.org/schemas/qos/ListOfTrafficDescriptors-v2.xsd`".

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2.2.6.1. Sample argument XML string

```
<?xml version="1.0" encoding="UTF-8"?>
<ListOfTrafficDescriptors
  xmlns="http://www.upnp.org/schemas/ListOfTrafficDescriptors.xsd"
  xmlns:td="http://www.upnp.org/schemas/TrafficDescriptorv1.xsd"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xsi:schemaLocation="http://www.upnp.org/schemas/ListOfTrafficDescriptors.xsd
  http://www.upnp.org/schemas/qos/ListOfTrafficDescriptors-v2.xsd">
  <TrafficDescriptor>
    <td:TrafficHandle>kiwin1</td:TrafficHandle>
    <td:TrafficId>
      <td:SourceAddress>
        <td:Ipv4>192.168.1.50</td:Ipv4>
      </td:SourceAddress>
      <td:SourcePort>23</td:SourcePort>
      <td:DestinationAddress>
        <td:Ipv4>192.168.1.50</td:Ipv4>
      </td:DestinationAddress>
      <DestinationPort>23</DestinationPort>
      <IpProtocol>1</IpProtocol>
    </td:TrafficId>
    <td:AvailableOrderedTspecList>
      <td:Tspec>
        <td:TspecIndex>300</td:TspecIndex>
        <td:TrafficClass>AV</td:TrafficClass>
      </td:Tspec>
      <td:Tspec>
        <td:TspecIndex>2</td:TspecIndex>
        <td:TrafficClass>Audio</td:TrafficClass>
      </td:Tspec>
    </td:AvailableOrderedTspecList>
    <ActiveTspecIndex>1</ActiveTspecIndex>
    <TrafficImportanceNumber>5</TrafficImportanceNumber>
    <OptionalPolicyParams>
      <CpName>Amy's CP</CpName>
    </OptionalPolicyParams>
  </TrafficDescriptor>
  <TrafficDescriptor>
    <td:TrafficHandle>kiwin2</td:TrafficHandle>
    <td:TrafficId>
      <td:SourceAddress>
        <td:Ipv4>192.168.1.53</td:Ipv4>
      </td:SourceAddress>
      <td:SourcePort>23</td:SourcePort>
      <td:DestinationAddress>
        <td:Ipv4>192.168.1.55</td:Ipv4>
      </td:DestinationAddress>
      <td:DestinationPort>23</td:DestinationPort>
      <td:IpProtocol>1</td:IpProtocol>
    </td:TrafficId>
    <td:AvailableOrderedTspecList>
      <td:Tspec>
        <td:TspecIndex>300</td:TspecIndex>
        <td:TrafficClass>AV</td:TrafficClass>
      </td:Tspec>
      <td:Tspec>
        <td:TspecIndex>2</td:TspecIndex>
        <td:TrafficClass>Audio</td:TrafficClass>
      </td:Tspec>
    </td:AvailableOrderedTspecList>
    <ActiveTspecIndex>1</ActiveTspecIndex>
    <TrafficImportanceNumber>5</TrafficImportanceNumber>
    <OptionalPolicyParams>
      <CpName>Amy's CP</CpName>
    </OptionalPolicyParams>
  </TrafficDescriptor>
</ListOfTrafficDescriptors>
```

2.2.7. Relationships Between State Variables

None

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2.3. Eventing and Moderation

Table 2-2: Event Moderation

Variable Name	Evented	Moderated Event	Max Event Rate[1]	Logical Combination	Min Delta per Event[2]
A_ARG_TYPE_TrafficDescriptor	*NO*	*n/a*	*n/a*	*n/a*	*n/a*
A_ARG_TYPE_TrafficHandle	*NO*	*n/a*	*n/a*	*n/a*	*n/a*
A_ARG_TYPE_NumTrafficDescriptors	*NO*	*n/a*	*n/a*	*n/a*	*n/a*
A_ARG_TYPE_NumPolicyHolders	*NO*	*n/a*	*n/a*	*n/a*	*n/a*
A_ARG_TYPE_ListOfTrafficDescriptors	*NO*	*n/a*	*n/a*	*n/a*	*n/a*

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

2.3.1. Event Model

This service does not expose any eventing state variables.

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2.4. Actions

Immediately following this table is detailed information about these actions, 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]
RequestTrafficQos	R
UpdateTrafficQos	R
ReleaseTrafficQos	R
BrowseAllTrafficDescriptors	R

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

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2.4.1 RequestTrafficQos

A Control Point can invoke this action for setting up the QoS for a particular traffic stream.

2.4.1.1. Service requirements

If a Control Point supplies TrafficImportanceNumber in TrafficDescriptor to QosManager when calling the **RequestTrafficQos** action, QosManager must return an error (Error Code 721).

If a Control Point supplies ActiveTspecIndex in TrafficDescriptor to QosManager when calling the **RequestTrafficQos** action, the QosManager must return an error (Error Code 722).

The QosManager must include a valid ActiveTspecIndex value in the TrafficDescriptor when it returns a non error value in response to **RequestTrafficQos**.

If a Control Point supplies a non-null TrafficHandle in the **RequestTrafficQos** action of QosManager, the QosManager must return error code 701.

When there are multiple Tspec(s) in the TrafficDescriptor provided by the Control Point to **RequestTrafficQoS** at the QosManager, the QosManager must set up the most preferred Tspec first. If the setup fails, then the QosManager must try the next preferred Tspec and so on.

If a Control Point supplies PolicyLastModified, PolicyModifyingUserName, or PolicyHolderConfigUrl when calling the **RequestTrafficQos** action, the QosManager must return error code 715.

If a Control Point does not supply a unique TspecIndex for every Tspec within an AvailableOrderedTspecList, then the QosManager will return the error 725.

The QosManager must include the TrafficPolicy parameters received from the **QPH:GetTrafficPolicy** in the TrafficDescriptor when successfully returning the UpdatedTrafficDescriptor. The QosManager must always include QosPolicyHolderId.

2.4.1.2. Control Point requirements when calling the action

A Control Point must not supply a non-null TrafficHandle element in the **RequestTrafficQos** action

A Control Point must supply a TrafficId structure which contains at least SourceAddress and DestinationAddress.

A Control Point in the UPnP AV scenario, invoking the QosManager must supply the AVTransportURI, AVTransportInstanceId, MediaServerConnectionId and MediaRendererConnectionId.

A Control Point must not supply TrafficImportanceNumber in TrafficDescriptor when calling the **RequestTrafficQos** action.

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A Control Point must supply a unique TspecIndex for every Tspec within an AvailableOrderedTspecList.

A Control Point must not supply an ActiveTspecIndex when invoking **RequestTrafficQos**.

A Control Point must supply a valid QosBoundarySourceAddress if the SourceAddress is not in the subnet in which the QosManager resides.

If a Control Point supplies a QosBoundarySourceAddress it must be a valid IP Address. The 0.0.0.0 option for the "don't care" address does not apply to QosBoundarySourceAddress.

A Control Point must supply a valid QosBoundaryDestinationAddress if the DestinationAddress is not in the subnet in which the QosManager resides.

If a Control Point supplies a QosBoundaryDestinationAddress it must be a valid IP Address. The 0.0.0.0 option for the "don't care" address does not apply to QosBoundaryDestinationAddress.

Whenever a Control Point specifies a PolicyHolderId it must specify a valid Id for a PolicyHolder as defined in the QosPolicyHolder service definition. [POLICY HOLDER]

A Control Point must not supply PolicyLastModified, PolicyModifyingUserName, PolicyHolderConfigUrl.

2.4.1.3. QoS Management Entity requirements

When a Control Point calls the **RequestTrafficQos** action, the QosManagement Enitity must obtain traffic policy. If the QosPolicyHolder identified in the PolicyHolderId is available, the QoS Management Entity must use the **QPH[5]:GetTrafficPolicy** action to retrieve the TrafficPolicy from that QosPolicyHolder service. The QoS Management Entity must not supply any of the TrafficPolicy elements in the TrafficDescriptor when calling the **QPH:GetTrafficPolicy** action. If the QosPolicyHolder identified in the PolicyHolderId is not available, the QosManager responds to a **RequestTrafficQos** or **UpdateTrafficQos** actions with error 780. If a PolicyHolderId is not provided in a TrafficDescriptor, it is expected that there will be one QosPolicyHolder service instance on the network. If the QoS Management Entity fails to discover any QosPolicyHolder service, or if the QoS Management Entity discovers more than one QosPolicyHolder service, the QosManager assumes the default policy of first-come-first serve admission control with default priorities based on 802.1D Annex G and indicates the number of QosPolicyHolder services discovered with the return value NumPolicyHolders. The QoS Management Entity must search for all QosPolicyHolder service instances regardless of UPnP device type.

When a Control Point calls the **RequestTrafficQos** action with unknown SourcePort, unknown DestinationPort, and/or unknown IpProtocol information and the QosManager service does not otherwise return an error code, the QoS Management Entity must invoke the **QD[6]:GetQosDeviceInfo** action on QosDevice service(s) to complete the information.

When a Control Point calls the **RequestTrafficQos** action and the QosManager service does not otherwise return an error code, the QoS Management Entity must invoke the **QD:SetupTrafficQoS** action on all the QosDevices on the path of that traffic to provide TrafficDescriptor that includes Traffic Importance Number (0-7).

When a Control Point calls the **RequestTrafficQos** action and the QoS Management Entity subsequently invokes actions with a TrafficDescriptor as an argument, the QoS Management Entity must not modify those elements that must equal the original TrafficDescriptor according to Table 2-4.

Table 2-4 Elements that must equal those of the original TrafficDescriptor

Parameter Name	Must equal original TrafficDescriptor?	Comments
TrafficHandle	No	
TrafficId	Not applicable	See containing elements

[5] QPH: QosPolicyHolder

[6] QD: QosDevice

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Parameter Name	Must equal original TrafficDescriptor?	Comments
. SourceAddress	Yes	
. SourcePort	Yes, if supplied	If not supplied by the Control Point, QME may supply one
. DestinationAddress	Yes	
. DestinationPort	Yes, if supplied	If not supplied by the Control Point, QME may supply one
. IpProtocol	Yes, if supplied	If not supplied by the Control Point, QME may supply one
AvailableOrderedTspecList	Not applicable	See containing elements
. Tspec	Yes	
. . TspecIndex	Yes	
..AvTransportUri	Yes	
..AvTransportInstanceId	Yes	
. . TrafficClass	Yes	
ActiveTspecIndex	No	
TrafficImportanceNumber	No	
QosBoundarySourceAddress	Yes	
QosBoundaryDestinationAddress	Yes	
MediaServerConnectionId	Yes	
MediaRendererConnectionId	Yes	
TrafficLeaseTime	Yes	
PolicyHolderId	Yes	
PolicyLastModified	No	
PolicyModifyingUserName	No	
PolicyHolderConfigUrl	No	
UserName	Yes	
VendorApplicationName	Yes	
PortName	Yes	
ServiceProviderServiceName	Yes	
CpName	Yes	

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2.4.1.4. Arguments

Table 2-5: Arguments for RequestTrafficQos

Argument	Direction	relatedStateVariable
InitialTrafficDescriptor	In	A_ARG_TYPE_TrafficDescriptor
TrafficHandle	Out	A_ARG_TYPE_TrafficHandle
NumPolicyHolders	Out	A_ARG_TYPE_NumPolicyHolders
UpdatedTrafficDescriptor	Out	A_ARG_TYPE_TrafficDescriptor

2.4.1.5. Dependency on State (if any)

Since UPnP QosManager is defined as a stateless entity, there is no effect of this action on state. However, it is expected that since UPnP QosManager is a dual-role entity, it would access the interface exposed by UPnP QosDevice service hosted on various UPnP QoS enabled devices and attempt to request QoS for the specified traffic stream.

2.4.1.6. Effect on State (if any)

Since UPnP QosManager is defined as a stateless entity, there is no effect of this action on state. However, it is expected that since UPnP QosManager is a dual-role entity, it would access the interface exposed by UPnP QosDevice service hosted on various UPnP QoS enabled devices and attempt to request QoS for the specified traffic stream.

2.4.1.7. Errors

Table 2-6: Error Codes for RequestTrafficQos

errorCode	errorDescription	Description
701	TrafficHandle must not be specified by the Control Point	
710	Incomplete TrafficId	Source Ip and Destination Ip must be present
711	TrafficId could not be completed	The QosManager could not complete the TrafficId
713	Malformed Name-string	The string VendorApplicationName, ServiceProviderServiceName, … does not follow the format from the specification
715	Policy parameters must not be specified by the Control Point	PolicyLastModified, PolicyModifyingUserName, or PolicyHolderConfigUrl must not be specified by the Control Point
716	An input parameter (e.g. TrafficDescriptor) does not validate against the XML schema	One of the XML-based input arguments does not follow the schema
721	TrafficImportanceNumber must not be specified by the Control Point	
722	The ActiveTspecIndex must not be specified by the Control Point	

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errorCode	errorDescription	Description
725	Duplicate TspecIndex	All Tspec indices must be unique
740	No QosDevice at Source IP address	Source QosDevice does not exist.
741	No QosDevice at Destination IP address	Destination QosDevice does not exist.
742	No QosDevice at QosBoundarySourceAddress	Source Boundary QosDevice does not exist.
743	No QosDevice at QosBoundaryDestinationAddress	Destination Boundary QosDevice does not exist.
744	No QosDevices available	No QosDevice instances found on the network.
746	QosPolicyHolder failure	QosManager gets incorrect information from the QosPolicyHolder (could be malformed XML)
752	QosBoundarySourceAddress or QosBoundaryDestinationAddress not on the QoS Managed subnet	The source and/or destination is not on the subnet which is under the management of this QosManager
762	A QosDevice is not capable of handling this connection	The maximum bit rate exceeds the capacity of the interfaces of the QosDevice.
770	Network is not cooperating	A QosDevice service is not responding
771	Network does not allow temporary	Existing traffic streams have higher or equal UserImportanceNumber. Hence the traffic stream cannot be setup at this time
772	Network not capable (never)	Network is unable to ever setup QoS for this traffic stream. e.g. No path exists from source to sink.
773	Cannot retrieve XML namespace	An XML namespace was included in one of the arguments, but the QosManager service was unable to retrieve the namespace from the location provided.
780	QosPolicyHolder not found	The QosPolicyHolder specified by the PolicyHolderId was not found.

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2.4.2. UpdateTrafficQos

Control Point can invoke this action for updating the Quality of Service for a particular traffic stream.

Table 2-7 shows which elements may be updated by the Control Point when calling the **UpdateTrafficQos** action.

Table 2-7 Allowed Elements that may be updated when calling UpdateTrafficQos

Parameter Name	May be Updated?	Comments
TrafficHandle	No	
TrafficID	No	Not applicable / see containing elements
. SourceAddress	No	Must be the same one as from the returned Traffic Descriptor
. SourcePort	No	Must be the same one as from the returned Traffic Descriptor
. DestinationAddress	No	Must be the same one as from the returned Traffic Descriptor
. DestinationPort	No	Must be the same one as from the returned Traffic Descriptor
. IpProtocol	No	Must be the same one as from the returned Traffic Descriptor
AvailableOrderedTspecList	No	
. Tspec	No	Not applicable / see containing elements
. . TspecIndex	No	
..AvTransportUri	No	
..AvTransportInstanceId	No	
. . TrafficClass	No	
ActiveTspecIndex	No	QosManager may update this in its response
TrafficImportanceNumber	No	QosManager may update this in its response
QosBoundarySourceAddress	No	
QosBoundaryDestinationAddress	No	
MediaServerConnectionId	No	
MediaRendererConnectionId	No	
TrafficLeaseTime	Yes	
PolicyHolderId	Yes	
PolicyLastModified	N/A	Must not be supplied by Control Point
PolicyModifyingUserName	N/A	Must not be supplied by Control Point
PolicyHolderConfigUrl	N/A	Must not be supplied by Control Point
UserName	Yes	
VendorApplicationName	No	
PortName	No	
ServiceProviderServiceName	No	
CpName	Yes	This must be the CpName of the Control Point invoking the update

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2.4.2.1. Service Requirements

If Control Point supplies TrafficImportanceNumber in TrafficDescriptor to QosManager when calling the **UpdateTrafficQos** action, QosManager returns error 721.

If Control Point supplies ActiveTspecIndex in TrafficDescriptor to QosManager when calling the **UpdateTrafficQos** actions, the QosManager must return error code 722.

The QosManager must include a valid ActiveTspecIndex value in the TrafficDescriptor when it returns a non error value in response to **UpdateTrafficQos** actions.

If a Control Point updates elements in the TrafficDescriptor that are not specified by Table 2-7, the QosManager returns error code 714.

In response to the Control Point calling the **UpdateTrafficQos** action, the QosManager may update ActiveTspecIndex, and/or TrafficImportanceNumber in the TrafficDescriptor structure. All other non-any parameters must not be updated by the QosManager.

If a Control Point supplies a non-existent TrafficHandle as first argument of **UpdateTrafficQos**, the QosManager returns an error (Error Code 703).

If a Control Point supplies a non-null TrafficHandle in the RequestedTrafficDescriptor argument of **UpdateTrafficQos** action, the QosManager must return error code 701.

When there are multiple Tspec(s) in the TrafficDescriptor provided by the Control Point to **UpdateTrafficQoS** at the QosManager, the QosManager must set up the most preferred Tspec first. If the setup fails, then the QosManager must try the next preferred Tspec and so on.

If a Control Point supplies PolicyLastModified, PolicyModifyingUserName, or PolicyHolderConfigUrl when calling the **UpdateTrafficQoS** action, the QosManager must return error code 715.

If a Control Point does not supply a unique TspecIndex for every Tspec within an AvailableOrderedTspecList, then the QosManager will return the error 725.

The QosManager must include the TrafficPolicy parameters received from the **QPH:GetTrafficPolicy** in the TrafficDescriptor when successfully returning the UpdatedTrafficDescriptor. The QosManager must always include QosPolicyHolderId.

2.4.2.2. Control Point requirements when calling the action

A Control Point must supply a valid TrafficHandle as the first argument when calling the **UpdateTrafficQos** action, but must supply a null TrafficHandle or no TrafficHandle in the RequestedTrafficDescriptor argument of **UpdateTrafficQos** .

A Control Point must supply a TrafficId structure which contains at least SourceAddress and DestinationAddress. It is recommended that the Control Point also supplies SourcePort, DestinationPort and IpProtocol.

A Control Point must not supply TrafficImportanceNumber in the TrafficDescriptor to QosManager when calling the **UpdateTrafficQos** action.

A Control Point must supply a unique TspecIndex for every Tspec within an AvailableOrderedTspecList.

A Control Point must not supply ActiveTspecIndex in TrafficDescriptor to QosManager when calling the **UpdateTrafficQos** actions.

A Control Point must supply a TrafficId structure which contains at least one of the elements of SourceAddress or DestinationAddress or SourcePort or DestinationPort or IpProtocol.

A Control Point must supply a valid QosBoundarySourceAddress if the SourceAddress is not in the subnet in which the QosManager resides.

A Control Point must not supply a QosBoundarySourceAddress equal to 0.0.0.0.

A Control Point must supply a valid QosBoundaryDestinationAddress if the DestinationAddress is not in the subnet in which the QosManager resides.

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A Control Point must not supply a QosBoundaryDestinationAddress equal to 0.0.0.0.

Whenever a Control Point specifies a PolicyHolderId it must specify a valid Id for a PolicyHolder as defined in the QosPolicyHolder service definition.[POLICY HOLDER]

A Control Point must not supply PolicyLastModified, PolicyModifyingUserName, PolicyHolderConfigUrl.

A Control Point's updated TrafficDescriptor must be conformant to Table 2-7.

2.4.2.3. QoS Management Entity Requirements

When a Control Point calls the **UpdateTrafficQos** action, the QoS Management Entity must obtain Policy. If the QosPolicyHolder identified in the PolicyHolderId is available, the QoS Management Entity must use the **QPH:GetTrafficPolicy** action to retrieve the TrafficPolicy from that QosPolicyHolder service. The QoS Management Entity must not supply any of the TrafficPolicy elements in the TrafficDescriptor when calling the **QPH:GetTrafficPolicy** action. If the QosPolicyHolder identified in the PolicyHolderId is not available, the QosManager responds to a **RequestTrafficQos** or **UpdateTrafficQos** with error 780. If a PolicyHolderId is not provided in a TrafficDescriptor, it is expected that there will be one QosPolicyHolder service instance on the network. If the QoS Management Entity fails to discover any QosPolicyHolder service, or if the QoS Management Entity discovers more than one QosPolicyHolder service, the QosManager assumes the default policy of first-come-first serve admission control with default priorities based on IEEE 802.1D Annex G and indicates the number of QosPolicyHolder services discovered with the return value NumPolicyHolders. The QoS Management Entity must search for all QosPolicyHolder services regardless of UPnP device type.

When a Control Point calls the **UpdateTrafficQos** action and the QoS Management Entity subsequently invokes actions with a TrafficDescriptor as argument, those elements that according to Table 2-4 Elements that must equal those of the original TrafficDescriptor must equal the original TrafficDescriptor must not be modified by the QoS Management Entity. The only exception to this table is that the QosManager must reuse the original TrafficHandle and must not regenerate a new TrafficHandle.

2.4.2.4. Arguments

Table 2-8: Arguments for UpdateTrafficQos

Argument	Direction	relatedStateVariable
TrafficHandle	In	A_ARG_TYPE_TrafficHandle
RequestedTrafficDescriptor	In	A_ARG_TYPE_TrafficDescriptor
ImplementedTrafficDescriptor	Out	A_ARG_TYPE_TrafficDescriptor
NumPolicyHolders	Out	A_ARG_TYPE_NumPolicyHolders

2.4.2.5. Dependency on State (if any)

Since UPnP QosManager is defined as a stateless entity, there is no dependency for this action on the state.

2.4.2.6. Effect on State (if any)

Since QosManager is defined as a stateless entity, there is no effect of this action on state. However, it is expected that since QosManager is a dual-role entity, it would access the interface exposed by QosDevice service [QOS DEVICE] hosted on various UPnP QoS enabled devices and attempt to update the specified traffic stream.

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2.4.2.7. Errors

Table 2-9: Error Codes for UpdateTrafficQos

errorCode	errorDescription	Description
701	TrafficHandle must not be specified by the Control Point	
703	Traffic Handle unknown to this device	
713	Malformed Name-string	The string VendorApplicationName, ServiceProviderServiceName do not follow the format from the specification
714	Tried to update unmodifiable Traffic Descriptor elements	QosManager cannot be requested to update some of the TrafficDescriptor parameters e.g. TrafficId, TrafficHandle
715	Policy parameters must not be specified by the Control Point	PolicyLastModified, PolicyModifyingUserName, or PolicyHolderConfigUrl must not be specified by the Control Point
716	An input parameter (e.g. TrafficDescriptor) does not validate against the XML schema	One of the XML-based input arguments does not follow the schema
721	TrafficImportanceNumber must not be specified by the Control Point	
722	The ActiveTspecIndex must not be specified by the Control Point	
725	Duplicate TspecIndex	All Tspec indices must be unique
740	No QosDevice at Source IP address	Source QosDevice does not exist.
741	No QosDevice at Destination IP address	Destination QosDevice does not exist.
742	No QosDevice at QosBoundarySource Address	Source Boundary QosDevice does not exist.
743	No QosDevice at QosBoundaryDestinationAddress	Destination Boundary QosDevice does not exist.
744	No QosDevices available	No QosDevice instances found on the network.
746	QosPolicyHolder failure	QosManager gets incorrect information from the QosPolicyHolder (could be malformed XML)

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errorCode	errorDescription	Description
752	QosBoundarySource Address or QosBoundaryDestinationAddress not on the QosManager subnet	The source and/or destination is not on the subnet which is under the management of this QosManager
762	A QosDevice is not capable of handling this connection	The maximum bit rate exceeds the capacity of the interfaces of the QosDevice
770	Network is not cooperating	A QosDevice service instance is not responding
771	Network does not allow temporary	Existing traffic streams have higher or equal UserImportanceNumber. Hence the traffic stream cannot be setup at this time
773	Cannot retrieve XML namespace	An XML namespace was included in one of the arguments, but the service was unable to retrieve the namespace from the location provided.
780	QosPolicyHolder not found	The QosPolicyHolder specified by the PolicyHolderId was not found.

2.4.3. ReleaseTrafficQos

Control Point can invoke this action for releasing the Quality of Service for a particular traffic stream.

2.4.3.1. Service requirements

If a Control Point supplies an invalid TrafficHandle, the QosManager returns an error (Error Code 703)

2.4.3.2. Control Point requirements when calling the action

A Control Point must supply a valid Traffic Handle when calling **ReleaseTrafficQos**

2.4.3.3. QoS Management Entity requirements

Upon receiving **ReleaseTrafficQos**, the QoS Management Entity invokes the **QD:ReleseTrafficQos** action on the QosDevices.

2.4.3.4. Arguments

Table 2-10: Arguments for ReleaseTrafficQos

Argument	Direction	relatedStateVariable
RevokeTrafficHandle	In	A_ARG_TYPE_TrafficHandle

2.4.3.5. Dependency on State (if any)

Since QosManager is defined as a stateless entity, there is no dependency for this action on the state.

2.4.3.6. Effect on State (if any)

Since QosManager is defined as a stateless entity, there is no effect of this action on state. However, it is expected that since QosManager is a dual-role entity, it would access the interface exposed by QosDevice service hosted on various UPnP QoS enabled devices and attempt to revoke the specified traffic stream.

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2.4.3.7. Errors

Table 2-11: Error Codes for ReleaseTrafficQos

errorCode	errorDescription	Description
703	Traffic Handle unknown to this device	
744	No QosDevice services available	
770	Network is not cooperating	A QosDevice service instance is not responding
773	Cannot retrieve XML namespace	An XML namespace was included in one of the arguments, but the service was unable to retrieve the namespace from the location provided.

2.4.4. BrowseAllTrafficDescriptors

A Control Point can invoke this action to browse all the 'TrafficDescriptors' configured on the network. Each TrafficDescriptor represents QoS for a particular traffic stream.

2.4.4.1. QoS Management Entity requirements

When a Control Point calls the **BrowseAllTrafficDescriptors** action, the QoS Management Entity must report back the details on various traffic streams admitted on the QosDevice services on the network by querying known QosDevice services (for example by calling the action **QD:GetQosState**).

2.4.4.2. Arguments

Table 2-12: Arguments for BrowseAllTrafficDescriptors

Argument	Direction	relatedStateVariable
NumberOfTrafficDescriptors	Out	A_ARG_TYPE_NumTrafficDescriptors
TrafficDescriptorList	Out	A_ARG_TYPE_ ListOfTrafficDescriptors

2.4.4.3. Dependency on State (if any)

This action lets the Control Point learn about the currently defined UPnP QoS TrafficDescriptors. This action does not have any dependency on state.

2.4.4.4. Effect on State (if any)

This action lets the Control Point learn about the currently defined UPnP QoS TrafficDescriptors. This action does not have any effect on state.

2.4.4.5. Errors

Table 2-13: Error Codes for BrowseAllTrafficDescriptors

errorCode	errorDescription	Description
704	Network contains Different TrafficDescriptors for same TrafficHandle	

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2.4.5. 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 lists naming requirements for non-standard actions (see the section on Description).

2.4.6. Relationships Between Actions

2.4.7. 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 have already been defined in UPnP Device Architecture and other Technical Committee documents.

Table 2-14: Common Error Codes

errorCode	errorDescription	Description
400-499		See UPnP Device Architecture section on Control.
500-599		See UPnP Device Architecture section on Control.
600-699		See UPnP Device Architecture section on Control.
701	TrafficHandle must not be specified by the Control Point	
703	Traffic Handle unknown to this device	
704	Network contains Different TrafficDescriptors for same TrafficHandle	
710	Incomplete TrafficId	Source Ip and Destination Ip must be present
711	TrafficId could not be completed	The QosManager could not complete the TrafficId
713	Malformed Name-string	The string VendorApplicationName, ServiceProviderServiceName, … does not follow the format from the specification
714	Tried to update unmodifiable Traffic Descriptor elements	QosManager cannot be requested to update some of the TD parameters e.g. TrafficId, TrafficHandle
715	Policy parameters must not be specified by the Control Point	PolicyLastModified, PolicyModifyingUserName, or PolicyHolderConfigURL must not be specified by the Control Point
716	An input parameter (e.g. TrafficDescriptor) does not validate against the XML schema	One of the XML-based input arguments does not follow the schema
721	TrafficImportanceNumber must not be specified by the Control Point	

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errorCode	errorDescription	Description
722	The ActiveTspecIndex must not be specified by the Control Point	
725	Duplicate TspecIndex	All Tspec indices must be unique
740	No QosDevice at Source IP address	Source QosDevice does not exist.
741	No QosDevice at Destination IP address	Destination QosDevice does not exist.
742	No QosDevice at QosBoundarySourceAddress	Source Boundary QosDevice does not exist.
743	No QosDevice at QosBoundaryDestinationAddress	Destination Boundary QosDevice does not exist.
744	No QosDevices available	No QosDevice instances found on the network.
746	QosPolicyHolder failure	QosManager gets incorrect information from the QosPolicyHolder (could be malformed XML)
752	QosBoundarySourceAddress or QosBoundaryDestinationAddress not on the QosManaged subnet	The source and/or destination is not on the subnet which is under the management of this QosManager
762	A QosDevice is not capable of handling this connection	The maximum bit rate exceeds the capacity of the interfaces of the QosDevice.
770	Network is not cooperating	A QosDevice service is not responding
771	Network does not allow temporary	Existing traffic streams have higher or equal UserImportanceNumber. Hence the traffic stream cannot be setup at this time
772	Network not capable (never)	Network is unable to ever setup QoS for this traffic stream. e.g. No path exists from source to sink.
773	Cannot retrieve XML namespace	An XML namespace was included in one of the arguments, but the service was unable to retrieve the namespace from the location provided.
780	QosPolicyHolder not found	The QosPolicyHolder specified by the PolicyHolderId was not found.

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2.5. Theory of Operation

This service-type enables modeling of 'Quality of Service Manager' capabilities. A UPnP QosManager is responsible for setting up, updating, revoking and in general controlling the QoS assigned by networking devices to various traffic streams. A QosManager acts as a control point to UPnP QosDevice services. A QosManager discovers the QosDevice services on the local area network, and may use '**QD:GetQosDeviceCapabilities**' and '**QD:GetQosState**' actions exposed by the QosDevice service to get information about the device. '**QD:GetQosDeviceCapabilities**' action returns capabilities of QoS enabled devices (and the details on the various network interfaces present on the device). '**QD:GetQosState**' action returns the current state of the UPnP QoS enabled device with information such as the TrafficDescriptors that are currently active.

The UPnP QosManager exposes the **BrowseAllTrafficDescriptors** action to the Control Point. Upon receiving this action request, the QosManager must report back the details on various traffic streams admitted on the UPnP QoS devices on the network

A QosManager obtains Policy from a QosPolicyHolder service on the local area network. If the QosPolicyHolder identified in the PolicyHolderId is available, the QosManager must use the **QPH:GetTrafficPolicy** action to retrieve the TrafficPolicy from that QosPolicyHolder service. If the QosPolicyHolder identified in the PolicyHolderId is not available, the QosManager responds to a **RequestTrafficQos** or **UpdateTrafficQos** with error 780. If a PolicyHolderId is not provided in a TrafficDescriptor, it is expected that there will be one QosPolicyHolder service instance on the network. If the QosManager fails to discover any QosPolicyHolder service, or if QosManager discovers more than one QosPolicyHolder service, the QosManager assumes the default policy of first-come-first serve admission control with default priorities based on IEEE 802.1D Annex G and indicates the number of QosPolicyHolder services discovered with the return value NumPolicyHolders. The default value for the AdmissionPolicy is "Enabled".

The following table describes how the QosManager derives default priorities to be used in the TrafficImportanceNumber field. The QosManager takes the value of Traffic Class from the Tspec found inside the Traffic Descriptor structure, and looks up the corresponding default priority from the following table:

Traffic Class	**802.1D (Annex G) Traffic Type**	**Default Priority (Traffic Importance Number)**
Network Control	NC	7
Streaming Control	NC	7
Voice	VO	6
Gaming	VO	6
AV	VI	5
Audio	VI	5
Image	EE	3
Data	BE	0
Background	BK	1
Other	BE	0

In the context of UPnP AV, the AV Control Point invokes QosManager (from the UPnP AV Control Point) to perform the functions related to setting up QoS for a particular traffic. In case of non UPnP AV scenario, any application (acting as a Control Point) can invoke the QosManager service for setting up the QoS for a particular traffic. In either case, the Control Point uses the **RequestTrafficQos** action exposed by the QosManager service to invoke the QosManager service. The control point puts the initial TrafficDescriptor as an input argument in the RequestTrafficQos action. For example, parts of TrafficId (e.g. port numbers) may be unknown to the Control Point at the time of setup. These details may get filled in after the traffic QoS is implemented in the UPnP QoS

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Device. The Control Point may also include: UserName, CpName, VendorApplicationName, PortName, and ServiceProviderServiceName. These fields are conveyed by the QoS Management Entity to the QosPolicyHolder using the **QPH:GetTrafficPolicy** action. The QosPolicyHolder may use any information in the TrafficDescriptor to determine the TrafficImportanceNumber and UserImportanceNumber for the traffic stream that QoS is being requested for. It is recommended that the Control Point provides as much of information as available in the TrafficDescriptor XML fragment.

Upon receiving the **RequestTrafficQos** action, the QoS Management Entity obtains the TrafficImportanceNumber and the UserImportanceNumber for that TrafficDescriptor by querying the QosPolicyHolder as described above. Traffic Importance Number (0-7) will be provided to QosDevices by the QoS Management Entity. User Importance Number (0-255) will be used by QosManager for traffic admission. In addition to User Importance Number and Traffic Importance Number, the QosPolicyHolder also returns a flag that indicates whether admission policy is 'enabled' or 'disabled'.

By invoking **QD:GetPathInformation** action on QosDevice service instances on the network, the QosManager may determine which intermediate devices are on the path from the source to the sink. Some UPnP QosDevice service instances may also expose the **QD:GetQosDeviceInfo** action. The QoS Management Entity may invoke this action on the source and/or sink device to find out the port number and protocol information associated with that particular Traffic Descriptor. The QoS Management Entity issues the **QD:GetQosState** action to every QoS Device on the path of the traffic stream and gets the dynamic status about that device. If QoS Management Entity decides that there are insufficient resources, it may try another Tspec listed in the TrafficDescriptor. If QoS Management Entity decides that there are enough resources available on all the devices on the path of the traffic, the QosManager issues **QD:SetupTrafficQos** actions to those devices on the path. If **QD:SetupTrafficQos** action is successfully executed on all the QoS Devices involved, then the updated TrafficDescriptor created by the QosManager is returned to the Control Point as an output argument to the **QM:RequestTrafficQos** action. Otherwise, QosManager returns appropriate error in response to the **QM:RequestTrafficQos** action.

QosStateId is a state variable defined in the QosDevice that enumerates the state of the device when it was queried by a QoS Management Entity with **QD:GetQosState** action. QosDevice returns QosStateId in response to **QD:GetQosState** as part of QosDeviceState argument. Subsequently, the QosManager repeats this string as input argument to **QD:SetupTrafficQos**. Please see QosDevice Service[QOS DEVICE] for more details.

When a Control Point needs to either change or release the QoS associated with a particular traffic, it uses the **UpdateTrafficQos** or **ReleaseTrafficQos** actions respectively. Upon receiving **UpdateTrafficQos** action, the QosManager repeats the admission control process described above for the revised TrafficDescriptor. Upon receiving **ReleaseTrafficQos** the QosManager invokes the **QD:ReleaseTrafficQos** action on all the devices on the path of that traffic.

A_ARG_TYPE_PathInformation state variable of QoS Device service is optional, but it is evented with moderation. Any time there is a change in path information, the QoS device may issue an event and send the updated A_ARG_TYPE_PathInformation variable in the body of the event. QosManager may subscribe to these events. Upon receiving an event, QosManager may take an action that it deems necessary e.g. recomputing the topology.

Finally, it should be noted that UPnP QoS defines services (QosManager, QosDevice, and QosPolicyHolder) but it does not define new device type. Since QoS problem needs to be solved across the board for multiple usage scenarios, it is expected that vendors may use any UPnP device as a container for the services defined in UPnP QoS. The control points and QoS Management Entities should search for UPnP QoS services embedded in all UPnP device types.

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3. XML Service Description

```
<?xml version="1.0" encoding="utf-8"?>
<scpd xmlns="urn:schemas-upnp-org:service-1-0">

   <specVersion>
      <major>1</major>
      <minor>0</minor>
   </specVersion>

   <actionList>
      <action>
         <name>RequestTrafficQos</name>
         <argumentList>
            <argument>
               <name>InitialTrafficDescriptor</name>
               <direction>in</direction>
               <relatedStateVariable>A_ARG_TYPE_TrafficDescriptor
               </relatedStateVariable>
            </argument>
            <argument>
               <name>TrafficHandle</name>
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               </relatedStateVariable>
            </argument>
            <argument>
               <name>NumPolicyHolders</name>
               <direction>out</direction>
               <relatedStateVariable>A_ARG_TYPE_NumPolicyHolders
               </relatedStateVariable>
            </argument>
            <argument>
               <name>UpdatedTrafficDescriptor</name>
               <direction>out</direction>
               <relatedStateVariable>A_ARG_TYPE_TrafficDescriptor
               </relatedStateVariable>
            </argument>
         </argumentList>
      </action>
      <action>
         <name>BrowseAllTrafficDescriptors</name>
         <argumentList>
            <argument>
               <name>NumberOfTrafficDescriptors</name>
               <direction>out</direction>
               <relatedStateVariable>A_ARG_TYPE_NumTrafficDescriptors
               </relatedStateVariable>
            </argument>
            <argument>
               <name>TrafficDescriptorList</name>
               <direction>out</direction>
               <relatedStateVariable>A_ARG_TYPE_ListOfTrafficDescriptors
               </relatedStateVariable>
            </argument>
         </argumentList>
      </action>
      <action>
         <name>ReleaseTrafficQos</name>
         <argumentList>
            <argument>
               <name>RevokeTrafficHandle</name>
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               </relatedStateVariable>
            </argument>
         </argumentList>
      </action>
      <action>
         <name>UpdateTrafficQos</name>
         <argumentList>
            <argument>
```

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               <name>TrafficHandle</name>
               <direction>in</direction>
               <relatedStateVariable>A_ARG_TYPE_TrafficHandle
               </relatedStateVariable>
            </argument>
            <argument>
               <name>RequestedTrafficDescriptor</name>
               <direction>in</direction>
               <relatedStateVariable>A_ARG_TYPE_TrafficDescriptor
               </relatedStateVariable>
            </argument>
            <argument>
               <name>ImplementedTrafficDescriptor</name>
               <direction>out</direction>
               <relatedStateVariable>A_ARG_TYPE_TrafficDescriptor
               </relatedStateVariable>
            </argument>
            <argument>
               <name>NumPolicyHolders</name>
               <direction>out</direction>
               <relatedStateVariable>A_ARG_TYPE_NumPolicyHolders
               </relatedStateVariable>
            </argument>
         </argumentList>
      </action>
   </actionList>

   <serviceStateTable>
      <stateVariable sendEvents="No">
         <name>A_ARG_TYPE_NumPolicyHolders</name>
         <dataType>ui4</dataType>
      </stateVariable>
      <stateVariable sendEvents="No">
         <name>A_ARG_TYPE_NumTrafficDescriptors</name>
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      </stateVariable>
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      </stateVariable>
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         <name>A_ARG_TYPE_ListOfTrafficDescriptors</name>
         <dataType>string</dataType>
      </stateVariable>
   </serviceStateTable>
</scpd>
```

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4. Test

No semantic tests have been specified for this service.

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Annex A
(normative)

Traffic Descriptor Matrix

Parameter Definition		Populated By			Used By[7]			Comments
Parameter Name	**R/O**	**CP**	**QM**	**QD**	**CP**	**QM**	**QD**	
TrafficHandle	R		*		*	*	*	
TrafficID	R							
. SourceAddress	R	*			*	*		A value of 0.0.0.0 represents 'Don't Care' i.e. condition where Control Point wants to set up QoS for all traffic streams irrespective of the SourceAddress.
. SourcePort	O	*	*[8]				*	If SourcePort tag is missing, it represents value not known. This may happen in a '3 box model'.[9] A value of 0 represents 'Don't Care' i.e. condition where Control Point wants to set up QoS for all traffic streams irrespective of the SourcePort.
. DestinationAddress	R	*				*		A value of 0.0.0.0 represents 'Don't Care' i.e. condition where Control Point wants to set up QoS for all traffic streams irrespective of the DestinationAddress.
. DestinationPort	O	*	*[10]				*	If DestinationPort tag is missing, it represents value not known. This may happen in a '3 box model'.[11] A value of 0 represents 'Don't Care' i.e. condition where Control Point wants to set up QoS for all traffic streams irrespective of the DestinationPort.
. IpProtocol	O		*[12]				*	If Protocol tag is missing, it represents value not known. A value of 0 represents 'Don't Care' i.e. condition where Control Point wants to set up QoS for all traffic streams irrespective of the Protocol.
AvailableOrderedTspecList	R							

[7] Policy Holder may use any or all parts of the TD to make policy decisions. SincePolicy Holder is proprietary and policy definition is out of band for UPnP Qos; this table does not define what TD parameters are 'used by'Policy Holder.

[8] QosManager may query QD:GetQosDeviceInfo action call to obtain the port number.

[9] Please refer to the UPnP QoS Architecture document for more information around '3 box model'.

[10] QosManager may query QD:GetQosDeviceInfo action call to obtain the port number.

[11] Please refer to the UPnP QoS Architecture document for more information around '3 box model'.

[12] QosManager may query QD:GetQosDeviceInfo action call to obtain the IP Protocol.

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. Tspec	O							
. . TspecIndex	R	*				*	*	
..AvTransportUri	O	*			*	*		
..AvTransportInstanceId	O	*			*	*		
. . TrafficClass	R	*				*		
ActiveTspecIndex	R		*		*	*	*	
TrafficImportanceNumber	R		*				*	This information may come from Policy Holder, but is populated in TD by QosManager.
QosBoundarySourceAddress	O	*				*	*	For QosDevice to know if it is on path or not
QosBoundaryDestinationAddress	O	*				*	*	For QosDevice to know if it is on path or not
MediaServerConnectionId	O	*				*	*	Read architecture document for more information on how to use this value in setting up QoS in the case of a three-box AV model.[QoS Architecture]
MediaRendererConnectionId	O	*				*	*	Read architecture document for more information. [QoS Architecture]
TrafficLeaseTime	O	*					*	
PolicyHolderId	O	*				*		If the Control Point wants to specify a specific QosPolicyHolder to be used
PolicyLastModified			*		*			Obtained from QPH:TrafficPolicy. Used by other Control Points for diagnostics
PolicyModifyingUserName			*		*			Obtained from QPH:TrafficPolicy. Used by other Control Points for diagnostics
PolicyHolderConfigUrl			*		*			Obtained from QPH:TrafficPolicy. Used by other Control Points for diagnostics
UserName	O	*			*			
VendorApplicationName	O	*			*			
PortName	O	*			*			
ServiceProviderServiceName	O	*			*			
CpName	O	*			*			

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