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Part 17-10: Quality of Service Device Control Protocol – Level 3 – Quality of
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INFORMATION TECHNOLOGY – UPNP DEVICE ARCHITECTURE –

Part 17-10: Quality of Service Device Control Protocol – Level 3 – Quality of Service Device Service

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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.

¹ UPnP Forum Steering committee, UPnP Forum, 3855 SW 153rd Drive, Beaverton, Oregon 97006 USA. See also "Introduction".

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1 Overview and Scope

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

This service-type enables modeling of the 'QosDevice' function capabilities. The QosDevice:3 Service is a function typically implemented in source, sink and intermediate network. The QosDevice Service is responsible for providing the appropriate network resources to traffic streams and information about the state of the device as requested by the QosManager as defined in the QosManager:3 Service. [QM]

Several L2 Technologies were considered during the design of UPnP-QoS v3. These technologies are described in UPnP QosDevice:3 Underlying Technology Interface Addendum [QD_Add] . Every attempt was made to ensure that the design of version 3 would accommodate other L2 Technologies as well. Each L2 Technology on which UPnP-QoS version 3 is implemented is recommended to have a document that is compliant to the template in Annex B which specifies how the L2 Technology defines certain state variables, maps parameters, etc.

This document does not address the procedures for end-to-end set up of a new traffic stream or end-to-end revocation of an existing traffic stream. This procedure is defined in the UPnP QosManager:3 Service Document [QM] .

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.

ISO/IEC 29341-17-10:2011

1.1.1 Normative References

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

[Annex_G] – 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.

[QM] – UPnP QosManager:3 Service Document: This reference is informative except for the definitions of the following state variables, which are normative:
A_ARG_TYPE_TrafficDescriptor, A_ARG_TYPE_NumTrafficDescriptors and A_ARG_TYPE_TrafficHandle.

Available at: <http://www.upnp.org/specs/qos/UPnP-qos-QosManager-v3-Service-20081130.pdf>

Latest version available at: <http://www.upnp.org/specs/qos/UPnP-qos-QosManager-v3-Service.pdf>

[QPH] - *UPnP QosPolicyHolder:3 Service Document*
Available at: <http://www.upnp.org/specs/qos/UPnP-qos-QosPolicyHolder-v3-Service-20081130.pdf>

Latest version available at: <http://www.upnp.org/specs/qos/UPnP-qos-QosPolicyHolder-v3-Service.pdf>

[DEVICE] - *UPnP Device Architecture, version 1.0.*

[RFC3339] – Date and Time on the Internet: Timestamps, G. Klyne, July 2002.
<http://www.ietf.org/rfc/rfc3339.txt>

[IANA] - IANA Interface Type (IANAifType)-MIB <http://www.iana.org/assignments/ianaiftype-mib>

[QD_Add] –UPnP QoSDevice:3 Underlying Technology Interface Addendum
 Available at: <http://www.upnp.org/specs/qos/UPnP-qos-QoSDevice-v3-Addendum-20081130.pdf>

Latest version available at: <http://www.upnp.org/specs/qos/UPnP-qos-QoSDevice-v3-Addendum.pdf>

1.1.2 Informative References

This clause 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 V3.0
 Available at: <http://www.upnp.org/specs/qos/UPnP-qos-Architecture-v3-20081130.pdf>
 Latest version available at: <http://www.upnp.org/specs/qos/UPnP-qos-Architecture-v3.pdf>

[HomePlug AV] – HomePlug AV Specification, version 1.1.00, Homeplug Powerline Alliance, www.HomePlug.org.

[MoCA1.0] MoCA MAC/PHY SPECIFICATION v1.0, 2006.

[MoCA1.1] MoCA MAC/PHY SPECIFICATION v1.1 EXTENSIONS. 2007.

[IEEE802.3] – IEEE Standard for Information technology— Telecommunications and information exchange between systems—Local and metropolitan area networks—Specific requirements Part 3: Carrier sense multiple access with collision detection (CSMA/CD) access method and physical layer specifications IEEE Std 802.3™-2005.
<http://standards.ieee.org/getieee802/802.3.html>

[IEEE11] - 802.11-2007 IEEE Standard for Information Technology—Telecommunications and information exchange between systems—Local and metropolitan area networks— Specific requirements Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications http://shop.ieee.org/ieeestore/Product.aspx?product_no=SS95708

[DSCP] - IETF RFC 2474, Definition of the Differentiated Services Field (DS Field) in the IPv4 and IPv6 Headers, K. Nichols et al., December 1998.
 Available at: <http://www.ietf.org/rfc/rfc2474.txt>

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:QoSDevice:3

The term QoSDevice Service is used herein to refer to this type of service.

2.2 State Variables

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

2.2.1 XML Fragments as UPnP Arguments

UPnP-QoS 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).

An XML fragment, in adherence to the UPnP V1.0 architecture [DEVICE], MUST be escaped by using the normal XML rules, [XML] Clause 2.4 Character Data and Markup, before embedding it in a SOAP request / response message or an event notification message. The XML escaping rules are summarized:

- 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 (');

In their XML fragments, implementations MAY use an explicit reference to appropriate namespaces.

Table 2-1 — State Variables

Variable Name	R/O a	Data Type	Allowed Value b	Default Value b	Eng. Units
<u>A_ARG_TYPE_TrafficDescriptor</u>	R	String (XML fragment)	See 2.2.2	n/a	n/a
<u>A_ARG_TYPE_TrafficDescriptorContainer</u>	R	String (XML fragment)	See 2.2.31	n/a	n/a
<u>A_ARG_TYPE_TrafficDescriptorsPerInterface</u>	R	String (XML fragment)	See 2.2.3	n/a	n/a
<u>A_ARG_TYPE_TrafficHandle</u>	R	string	See 2.2.4	n/a	n/a
<u>A_ARG_TYPE_NumTrafficDescriptors</u>	R	ui4	See 2.2.5	n/a	n/a
<u>A_ARG_TYPE_QosDeviceCapabilities</u>	R	String (XML fragment)	See 2.2.6	n/a	n/a
<u>A_ARG_TYPE_QosDeviceState</u>	R	String (XML fragment)	See 2.2.7	n/a	n/a
<u>PathInformation</u>	R	String (XML fragment)	See 2.2.8	n/a	n/a
<u>A_ARG_TYPE_QosDeviceInfo</u>	R	String (XML fragment)	See 2.2.9	n/a	n/a
<u>A_ARG_TYPE_QosDeviceInfoContainer</u>	R	String (XML fragment)	See 2.2.33	n/a	n/a
<u>A_ARG_TYPE_QosStateId</u>	R	string	See 2.2.10	n/a	n/a
<u>A_ARG_TYPE_NumRotameterObservations</u>	O	ui4	See 2.2.11	1	n/a
<u>A_ARG_TYPE_RotameterInformation</u>	O	String (XML fragment)	See 2.2.12	n/a	n/a
<u>A_ARG_TYPE_ConfRotameterObservations</u>	O	String (XML fragment)	See 2.2.13	n/a	n/a

Variable Name	R/O ^a	Data Type	Allowed Value ^b	Default Value ^b	Eng. Units
<u>MostRecentStreamAction</u>	O	String (XML fragment)	See 2.2.14	n/a	n/a
<u>A_ARG_TYPE_MaxPossibleRotameterObservations</u>	O	ui4	See 2.2.15	1	n/a
<u>A_ARG_TYPE_Resource</u>	R	String (XML fragment)	See 2.2.16	n/a	n/a
<u>A_ARG_TYPE_AdmitTrafficQosExtendedResult</u>	R	String (XML fragment)	See 2.2.17	n/a	n/a
<u>A_ARG_TYPE_ListOfAdmittedTraffic</u>	R	String (XML fragment)	See 2.2.18	n/a	n/a
<u>A_ARG_TYPE_PREFERREDQPH</u>	O	String (XML fragment)	See 2.2.19	n/a	n/a
<u>UnexpectedStreamChange</u>	R	ui4	See 2.2.20	n/a	n/a
<u>A_ARG_TYPE_PreemptingTrafficInfo</u>	O	String (XML fragment)	See 2.2.21	n/a	n/a
<u>A_ARG_TYPE_ListOfMostRecentUnexpectedStreamChanges</u>	O	String (XML fragment)	See 2.2.22	n/a	n/a
<u>A_ARG_TYPE_QosDeviceExtendedState</u>	R	String (XML fragment)	See 2.2.23	n/a	n/a
<u>A_ARG_TYPE_Layer2Mapping</u>	R	String (XML fragment)	See 2.2.24	n/a	n/a
<u>A_ARG_TYPE_Layer2MappingContainer</u>	R	String (XML fragment)	See 2.2.32	n/a	n/a
<u>A_ARG_TYPE_AdmitTrafficQosSucceeded</u>	R	boolean	See 2.2.25	n/a	n/a
<u>A_ARG_TYPE_TrafficDescriptorsWanted</u>	R	boolean	See 2.2.26	n/a	n/a
<u>A_ARG_TYPE_SetPreferredQphResults</u>	O	ui4	See 2.2.27	n/a	n/a
<u>A_ARG_TYPE_NumberOfUnexpectedStreamChangesRequested</u>	O	ui4	See 2.2.28	n/a	n/a
<u>A_ARG_TYPE_NumberOfUnexpectedStreamChangesReported</u>	O	ui4	See 2.2.29	n/a	n/a
<u>A_ARG_TYPE_NewTrafficLeaseTime</u>	R	ui4	See 2.2.30	n/a	n/a
^a R = Required, O = Optional, X = Non-standard ^b 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.					

2.2.2 A_ARG_TYPE_TrafficDescriptor

This required state variable is defined in the [QosManager](#) Service specification; it contains QoS related information for a traffic stream. Refer to [QM] for details of this state variable.

2.2.2.1 XML Schema Definition

This is a **string** containing an XML fragment. It contains information describing the traffic descriptor. The XML fragment in this argument MUST validate against the XML schema for TrafficDescriptor in the XML namespace "http://www.upnp.org/schemas/TrafficDescriptorv1.xsd" which is located at "http://www.upnp.org/schemas/qos/TrafficDescriptor-v3.xsd".

2.2.3 A_ARG_TYPE_TrafficDescriptorsPerInterface

This required state variable contains the list of traffic descriptors that are associated with a network interface on a given [QosDevice](#) Service.

2.2.3.1 XML Schema Definition

This is a **string** containing an XML fragment. The XML fragment in this argument MUST validate against the XML schema for TrafficDescriptorsPerInterface in the XML namespace

"http://www.upnp.org/schemas/TrafficDescriptorsPerInterface.xsd" which is located at "http://www.upnp.org/schemas/qos/TrafficDescriptorsPerInterface-v2.xsd".

2.2.3.2 Description of fields in the TrafficDescriptorsPerInterface structure

The *TrafficDescriptorsPerInterface* is a structure that consists of one or more entries of *TdInterfacePair*. *TdInterfacePair* lists one *TrafficDescriptor*, followed by the *InterfaceId* of the associated interface. Here are the details about these two parameters:

TrafficDescriptor: This required field describes a Traffic Descriptor associated with an Interface. An Interface can have multiple associated Traffic Descriptor objects.

InterfaceId: This is a required field of type **string**; its format is defined in clause 2.2.6.2.

2.2.3.3 Sample argument XML string

```
<?xml version="1.0" encoding="UTF-8"?>
<TrafficDescriptorsPerInterface
xmlns="http://www.upnp.org/schemas/TrafficDescriptorsPerInterface.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/TrafficDescriptorsPerInterface.xsd
http://www.upnp.org/schemas/qos/TrafficDescriptorsPerInterface-v2.xsd">
  <TdInterfacePair>
    <TrafficDescriptor>
      <td:TrafficHandle>wxyz</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>
        <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>
      <td:ActiveTspecIndex>300</td:ActiveTspecIndex>
      <td:TrafficImportanceNumber>5</td:TrafficImportanceNumber>
      <td:OptionalPolicyParams>
        <td:CpName>Amy's CP</td:CpName>
      </td:OptionalPolicyParams>
    </TrafficDescriptor>
    <InterfaceId>eth0</InterfaceId>
  </TdInterfacePair>
</TrafficDescriptorsPerInterface>
```

2.2.4 A_ARG_TYPE_TrafficHandle

A_ARG_TYPE_TrafficHandle is a **string** to identify a traffic stream. Refer to the [QM] document for more details.

2.2.5 A_ARG_TYPE_NumTrafficDescriptors

This is an integer argument specifying the number of Traffic Descriptors contained in the accompanying ListOfTrafficDescriptors. Refer to the [QM] document for more details.

2.2.6 A_ARG_TYPE_QosDeviceCapabilities

This required structure contains information describing a device's QoS capabilities. Use of this state variable is discouraged for UPnP-QoS v3. For v3 QosDevice Services, the information contained in this state variable can also be found in the A_ARG_TYPE_QosDeviceExtendedState state variable.

2.2.6.1 XML Schema Definition

This is a **string** containing an XML fragment. It contains information describing the capabilities of the QosDevice Service. The XML fragment in this argument MUST validate against the XML schema for QosDeviceCapabilities in the XML namespace "http://www.upnp.org/schemas/QosDeviceCapabilities.xsd" which is located at "http://www.upnp.org/schemas/qos/QosDeviceCapabilities-v2.xsd".

2.2.6.2 Description of fields in the QosDeviceCapabilities structure

Interface: This is a required structure and defined as an XML element. This field describes a network interface on the QosDevice Service. An Interface definition is required for each interface supported by the device. This information is provided even if the physical interface is down at a given time.

MacAddress: This is an optional field. If a given interface has an associated MAC address, the QosDevice MUST provide this information here. It provides the MAC address of the Interface and is of type MacAddressType (defined in the schema).

InterfaceId: This is a required field. The value is of type **string** and MUST uniquely identify an interface within the QosDevice Service. Furthermore, the InterfaceId MUST remain the same for a given interface (L2 Technology) until the QosDevice Service reboots.

IanaTechnologyType: This is an optional integer field. The IanaTechnologyType (IANA uses the designation IANAifType) is an integer assigned by IANA for any media type, such as a value of 6 for 802.3 media type or a value of 71 for 802.11 media type. The allowed integer values for this parameter are specified in [IANA].

AdmissionControlSupported: This is a required enumeration field. This field is maintained for backward compatibility. This field can report only one of two values "Yes" or "No".. QosManager:3 ignores the value of this field.

PacketTaggingSupported: This is a required enumeration field. PacketTaggingSupported field indicates whether the device is capable of tagging L2 priorities on the outgoing interface. This field can report only one of two values "Yes" or "No".

NativeQos: This is an optional enumeration field. To ensure backward compatibility, this field MUST contain one of the values (Prioritized, BestEffort).