



ISO/IEC 29341-17-10

Edition 1.0 2011-09

INTERNATIONAL STANDARD



**Information technology – UPnP device architecture –
Part 17-10: Quality of Service Device Control Protocol – Level 3 – Quality of
Service Device Service**



THIS PUBLICATION IS COPYRIGHT PROTECTED
Copyright © 2011 ISO/IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester.

If you have any questions about ISO/IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

IEC Central Office
3, rue de Varembe
CH-1211 Geneva 20
Switzerland
Email: inmail@iec.ch
Web: www.iec.ch

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigenda or an amendment might have been published.

- Catalogue of IEC publications: www.iec.ch/searchpub

The IEC on-line Catalogue enables you to search by a variety of criteria (reference number, text, technical committee,...). It also gives information on projects, withdrawn and replaced publications.

- IEC Just Published: www.iec.ch/online_news/justpub

Stay up to date on all new IEC publications. Just Published details twice a month all new publications released. Available on-line and also by email.

- Electropedia: www.electropedia.org

The world's leading online dictionary of electronic and electrical terms containing more than 20 000 terms and definitions in English and French, with equivalent terms in additional languages. Also known as the International Electrotechnical Vocabulary online.

- Customer Service Centre: www.iec.ch/webstore/custserv

If you wish to give us your feedback on this publication or need further assistance, please visit the Customer Service Centre FAQ or contact us:

Email: csc@iec.ch
Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00



ISO/IEC 29341-17-10

Edition 1.0 2011-09

INTERNATIONAL STANDARD



**Information technology – UPnP device architecture –
Part 17-10: Quality of Service Device Control Protocol – Level 3 – Quality of
Service Device Service**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

PRICE CODE



ICS 35.200

ISBN 978-2-88912-657-6

CONTENTS

1	Overview and Scope.....	5
1.1	Referenced Specifications	5
1.1.1	Normative References	5
1.1.2	Informative References	6
2	Service Modeling Definitions.....	6
2.1	ServiceType	6
2.2	State Variables.....	7
2.2.1	XML Fragments as UPnP Arguments.....	7
2.2.2	A_ARG_TYPE_TrafficDescriptor	8
2.2.3	A_ARG_TYPE_TrafficDescriptorsPerInterface.....	8
2.2.4	A_ARG_TYPE_TrafficHandle	10
2.2.5	A_ARG_TYPE_NumTrafficDescriptors	10
2.2.6	A_ARG_TYPE_QosDeviceCapabilities	10
2.2.7	A_ARG_TYPE_QosDeviceState	11
2.2.8	PathInformation	12
2.2.9	A_ARG_TYPE_QosDeviceInfo	14
2.2.10	A_ARG_TYPE_QosStateId.....	14
2.2.11	A_ARG_TYPE_NumRotameterObservations	14
2.2.12	A_ARG_TYPE_RotameterInformation	15
2.2.13	A_ARG_TYPE_ConfRotameterObservations	20
2.2.14	MostRecentStreamAction	21
2.2.15	A_ARG_TYPE_MaxPossibleRotameterObservations	22
2.2.16	A_ARG_TYPE_Resource	22
2.2.17	A_ARG_TYPE_AdmitTrafficQosExtendedResult	23
2.2.18	A_ARG_TYPE_ListOfAdmittedTraffic	26
2.2.19	A_ARG_TYPE_PREFERREDQph	28
2.2.20	UnexpectedStreamChange.....	29
2.2.21	A_ARG_TYPE_PreemptingTrafficInfo.....	29
2.2.22	A_ARG_TYPE_ListOfMostRecentUnexpectedStreamChanges.....	30
2.2.23	A_ARG_TYPE_QosDeviceExtendedState.....	33
2.2.24	A_ARG_TYPE_Layer2Mapping	38
2.2.25	A_ARG_TYPE_AdmitTrafficQosSucceeded	38
2.2.26	A_ARG_TYPE_TrafficDescriptorsWanted	38
2.2.27	A_ARG_TYPE_SetPreferredQphResults	38
2.2.28	A_ARG_TYPE_NumberOfUnexpectedStreamChangesRequested	39
2.2.29	A_ARG_TYPE_NumberOfUnexpectedStreamChangesReported	39
2.2.30	A_ARG_TYPE_NewTrafficLeaseTime	39
2.2.31	A_ARG_TYPE_TrafficDescriptorContainer	39
2.2.32	A_ARG_TYPE_Layer2MappingContainer	41
2.2.33	A_ARG_TYPE_QosDeviceInfoContainer	41
2.3	Eventing and Moderation	43
2.3.1	Event Model.....	43
2.4	Actions.....	44
2.4.1	GetQosDeviceCapabilities()	45
2.4.2	GetQosState()	46

2.4.3	SetupTrafficQos()	47
2.4.4	ReleaseTrafficQos()	49
2.4.5	GetPathInformation	50
2.4.6	GetQosDeviceInfo()	51
2.4.7	ConfigureRotameterObservation()	52
2.4.8	GetRotameterInformation()	53
2.4.9	AdmitTrafficQos()	54
2.4.10	UpdateAdmittedQos()	62
2.4.11	ReleaseAdmittedQos()	65
2.4.12	GetExtendedQosState()	67
2.4.13	SetPreferredQph()	68
2.4.14	GetUnexpectedStreamChanges()	70
2.4.15	VerifyTrafficHandle()	71
2.4.16	UpdateTrafficLeaseTime()	71
2.4.17	SetL2Map()	72
2.4.18	Non-Standard Actions Implemented by a UPnP Vendor	73
2.4.19	Error Code Summary	73
2.4.20	Reason Code Summary	74
2.5	Theory of Operation (Informative)	75
2.5.1	Parameterized QoS	77
2.5.2	Prioritized QoS	80
2.5.3	Hybrid QoS	81
3	XML Service Descriptions	82
4	Test	88
Annex A	(informative) Additional Examples for State Variables	89
A.1	Additional <i>PathInformation</i> Examples	89
A.1.1	Sample argument XML string – PC with two network interfaces that are both end point device and bridged	89
A.1.2	Sample argument XML string –Four port Ethernet Switch	89
A.1.3	Sample argument XML string – Wireless AP with one Ethernet Interface	90
A.1.4	Sample argument XML string – Bridge device between Wireless station and Ethernet	90
A.2	Additional A_ARG_TYPE_RotameterInformation Examples	91
A.2.1	Sample argument XML string – PC with two network interfaces that are both end point devices	91
A.2.2	Sample argument XML string – PC with two network interfaces that are both end point device with TrafficImportanceNumber reporting	94
A.2.3	Sample argument XML string –Four port Ethernet Switch	95
A.2.4	Sample argument XML string – Wireless AP with one Ethernet Interface	95
A.2.5	Sample argument XML string – Bridge device between Wireless station and Ethernet	96
Annex B	(normative) Template for Requirements on the QosDevice Service implementation that are specific for the underlying Network Technologies	98
B.1	<Technology Name>	98
B.1.1	References	98
B.1.2	Priority Mapping	98
B.1.3	<u>QosSegmentId</u> formation	98
B.1.4	<u>Layer2StreamId</u> representation	99

B.1.5	Mapping of UPnP-QoS Parameters to <i><technology></i> Parameters	99
B.1.6	Blocking traffic stream identification	100
B.1.7	Responsibility for QoS Setup	100
B.1.8	Mapping of <i><technology></i> Returned Parameters to <i>ProtoTspec</i> Parameters	101
B.1.9	Mapping of <i><technology></i> Returned Parameters to <i>AdmitTrafficQosExtendedResult and AllocatedResources</i> Parameters	102
Figure 2-1	— Relationship between ROPeriod and MonitorResolutionPeriod	16
Figure 2-2	— PC with Two Network Interfaces	18
Figure 2-3	— Example of a PC connected to an active network	19
Figure 2-4	— Relationship between End-to-End Delay and QoS Segment Delay	57
Figure 2-5	— Relationship between QoS Segment Delay And MaxCommittedDelay.	58
Figure 2-6	— Components of <i>MaxCommittedDelay</i>	59
Figure 2-7	— Containers and How They Nest	78
Figure A.1	— Example of a PC connected to an active network	91
Table 2-1	— State Variables	7
Table 2-2	— Reason Codes For AdmissionStatusNet	24
Table 2-3	— Reason Codes For AdmissionStatusDev	25
Table 2-4	— Containers In Which A Parameter Can Appear	34
Table 2-5	— Reason Codes For <i>A_ARG_TYPE_SetPreferredQphResults</i>	39
Table 2-6	— Event Moderation	43
Table 2-7	— Actions	45
Table 2-8	— Arguments for <i>GetQosDeviceCapabilities()</i>	45
Table 2-9	— Error Codes for <i>GetQosDeviceCapabilities()</i>	46
Table 2-10	— Arguments for <i>GetQosState()</i>	46
Table 2-11	— Error Codes for <i>GetQosState()</i>	47
Table 2-12	— Arguments for <i>SetupTrafficQos()</i>	47
Table 2-13	— Error Codes for <i>SetupTrafficQos()</i>	49
Table 2-14	— Arguments for <i>ReleaseTrafficQos()</i>	49
Table 2-15	— Error Codes for <i>ReleaseTrafficQos()</i>	50
Table 2-16	— Arguments for <i>GetPathInformation()</i>	50
Table 2-17	— Error Codes for <i>GetPathInformation</i>	50
Table 2-18	— Arguments for <i>GetQosDeviceInfo()</i>	51
Table 2-19	— Error Codes for <i>GetQosDeviceInfo()</i>	51
Table 2-20	— Arguments for <i>ConfigureRotameterObservation()</i>	52
Table 2-21	— Error Codes for <i>ConfigureRotameterObservation()</i>	53
Table 2-22	— Arguments for <i>GetRotameterInformation()</i>	53
Table 2-23	— Error Codes for <i>GetRotameterInformation()</i>	54
Table 2-24	— Arguments for <i>AdmitTrafficQos()</i>	54
Table 2-25	— Error Codes for <i>AdmitTrafficQos()</i>	61
Table 2-26	— Reason Codes for <i>AdmitTrafficQos()</i>	61
Table 2-27	— Arguments for <i>UpdateAdmittedQos()</i>	62

Table 2-28 — Error Codes for <u>UpdateAdmittedQos()</u>	65
Table 2-29 — Reason Codes for <u>UpdateAdmittedQos()</u>	65
Table 2-30 — Arguments for <u>ReleaseAdmittedQos()</u>	65
Table 2-31 — Error Codes for <u>ReleaseAdmittedQos()</u>	67
Table 2-32 — Arguments for <u>GetExtendedQosState()</u>	67
Table 2-33 — Error Codes for <u>GetExtendedQosState()</u>	68
Table 2-34 — Arguments for <u>SetPreferredQph()</u>	68
Table 2-35 — <u>SetPreferredQphResults</u> for <u>SetPreferredQph()</u>	69
Table 2-36 — Arguments for <u>GetUnexpectedStreamChanges()</u>	70
Table 2-37 — Error Codes for <u>GetUnexpectedStreamChanges()</u>	70
Table 2-38 — Arguments for <u>VerifyTrafficHandle()</u>	71
Table 2-39 — Error Codes for <u>VerifyTrafficHandle()</u>	71
Table 2-40 — Arguments for <u>UpdateTrafficLeaseTime()</u>	72
Table 2-41 — Error Codes for <u>UpdateTrafficLeaseTime()</u>	72
Table 2-42 — Arguments for <u>SetL2Map()</u>	73
Table 2-43 — Error Codes for <u>SetL2Map()</u>	73
Table 2-44 — Error Code Summary	73
Table 2-45 — Common Reason Codes	75
Table 2-46 — Actions in Version 3 and Version 2	76
Table 2-47 — State Variables in Version 3 and Version 2	77
Table B.1 — Priority Mapping	98
Table B.2 — Traffic Specification Parameters	100
Table B.3 — ProtoTspec Parameters	102
Table B.4 — AllocatedResources Parameters	103

INFORMATION TECHNOLOGY – UPNP DEVICE ARCHITECTURE –

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

FOREWORD

- 1) ISO (International Organization for Standardization) and IEC (International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards. Their preparation is entrusted to technical committees; any ISO and IEC member body interested in the subject dealt with may participate in this preparatory work. International governmental and non-governmental organizations liaising with ISO and IEC also participate in this preparation.
- 2) In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.
- 3) The formal decisions or agreements of IEC and ISO on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC and ISO member bodies.
- 4) IEC, ISO and ISO/IEC publications have the form of recommendations for international use and are accepted by IEC and ISO member bodies in that sense. While all reasonable efforts are made to ensure that the technical content of IEC, ISO and ISO/IEC publications is accurate, IEC or ISO cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 5) In order to promote international uniformity, IEC and ISO member bodies undertake to apply IEC, ISO and ISO/IEC publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any ISO/IEC publication and the corresponding national or regional publication should be clearly indicated in the latter.
- 6) ISO and IEC provide no marking procedure to indicate their approval and cannot be rendered responsible for any equipment declared to be in conformity with an ISO/IEC publication.
- 7) All users should ensure that they have the latest edition of this publication.
- 8) No liability shall attach to IEC or ISO or its directors, employees, servants or agents including individual experts and members of their technical committees and IEC or ISO member bodies for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication of, use of, or reliance upon, this ISO/IEC publication or any other IEC, ISO or ISO/IEC publications.
- 9) Attention is drawn to the normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 10) Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights.

International Standard ISO/IEC 29341-17-10 was prepared by UPnP Forum Steering committee¹, was adopted, under the fast track procedure, by subcommittee 25: Interconnection of information technology equipment, of ISO/IEC joint technical committee 1: Information technology.

The list of all currently available parts of the ISO/IEC 29341 series, under the general title *Information technology – UPnP device 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.

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

IMPORTANT – The “colour inside” logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this publication using a colour printer.

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.

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](http://www.HomePlug.org), 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_PreferedQph</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/qos:tdpi2/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).

MaxPhyRate: Indicates the maximum PHY rate of the interface and expressed as a value of type unsignedInt. This parameter is required and indicates (Units) phy rate measured in bits/sec.

ChannelInformation: This is an optional unsignedInt field . It indicates the channel number of the [IanaTechnologyType](#) (IANAifType), if the technology supports channels. For example, 802.11 (value=71) supports multiple channels. Expressed as a value of type UnsignedInt.

2.2.6.3 Sample argument XML string

```
<?xml version="1.0" encoding="UTF-8"?>
<QosDeviceCapabilities
xmlns="http://www.upnp.org/schemas/QosDeviceCapabilities.xsd"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://www.upnp.org/schemas/QosDeviceCapabilities.xsd
http://www.upnp.org/schemas/qos/QosDeviceCapabilities-v2.xsd">
  <Interface>
    <InterfaceId>eth0</InterfaceId>
    <MacAddress>0212abcdef11</MacAddress>
    <IanaTechnologyType>6</IanaTechnologyType>
    <AdmissionControlSupported>No</AdmissionControlSupported>
    <PacketTaggingSupported>Yes</PacketTaggingSupported>
    <NativeQos>Prioritized</NativeQos>
    <MaxPhyRate>100000000</MaxPhyRate>
  </Interface>
  <Interface>
    <InterfaceId>eth1</InterfaceId>
    <MacAddress>0212abcdef12</MacAddress>
    <IanaTechnologyType>71</IanaTechnologyType>
    <AdmissionControlSupported>No</AdmissionControlSupported>
    <PacketTaggingSupported>Yes</PacketTaggingSupported>
    <NativeQos>Prioritized</NativeQos>
    <MaxPhyRate>30000000</MaxPhyRate>
    <v2>
      <ChannelInformation>6</ChannelInformation>
    </v2>
  </Interface>
  <Interface>
    <InterfaceId>eth2</InterfaceId>
    <MacAddress>0212abcdef13</MacAddress>
    <IanaTechnologyType>6</IanaTechnologyType>
    <AdmissionControlSupported>No</AdmissionControlSupported>
    <PacketTaggingSupported>Yes</PacketTaggingSupported>
    <NativeQos>BestEffort</NativeQos>
    <MaxPhyRate>50000000</MaxPhyRate>
  </Interface>
  <Interface>
    <InterfaceId>example1</InterfaceId>
    <MacAddress>0212abcdefff</MacAddress>
    <IanaTechnologyType>12</IanaTechnologyType>
    <AdmissionControlSupported>No</AdmissionControlSupported>
    <PacketTaggingSupported>Yes</PacketTaggingSupported>
    <NativeQos>BestEffort</NativeQos>
    <MaxPhyRate>50000000</MaxPhyRate>
    <v2>
      <ChannelInformation>6</ChannelInformation>
    </v2>
  </Interface>
</QosDeviceCapabilities>
```

2.2.7 A_ARG_TYPE_QosDeviceState

[A_ARG_TYPE_QosDeviceState](#) is a structure that provides information about a device's current QoS state. Use of this state variable is discouraged for UPnP-QoS v3.

2.2.7.1 XML Schema Definition

This is a [string](#) containing an XML fragment. It contains information describing the current state of the [QosDevice](#) Service. The XML fragment in this argument MUST validate against

the XML schema for QosDeviceState in the XML namespace "http://www.upnp.org/schemas/QosDeviceState.xsd" which is located at "http://www.upnp.org/schemas/qos/QosDeviceState-v2.xsd".

2.2.7.2 Description of fields in the A_ARG_TYPE_QosDeviceState structure

QosStateId: This is a required string field. It MUST identify the QoS-related state of the QosDevice Service. In particular it MUST change after successful invocations of SetupTrafficQos() or ReleaseTrafficQos(). There may be other reasons a QosDevice Service changes QosStateId, but when the QosStateId is the same at two instances in time, all relevant QosDevice Service-state MUST be the same. Read the theory of operation for more details as to how this parameter is used.

Interface: This is a required structure and defines an interface. An Interface definition is required for each interface supported by the device.

2.2.7.3 Description of fields in the *Interface* structure

InterfaceId: This is a required field. Its format is defined in clause 2.2.6.2.

IpAddress: This is an optional field. This specifies the IP Address of the interface. This is optional for interfaces not configured with an IP Address. However the IP Address of configured interfaces MUST advertise this value.

InterfaceAvailability: This is a required enumeration field. The value of "0" indicates that the interface is not available. A value of "1" indicates the interface is available which may include being in power-save mode.

2.2.7.4 Sample argument XML string

```
<?xml version="1.0" encoding="UTF-8"?>
<QosDeviceState
  xmlns="http://www.upnp.org/schemas/QosDeviceState.xsd"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xsi:schemaLocation="http://www.upnp.org/schemas/QosDeviceState.xsd
http://www.upnp.org/schemas/qos/QosDeviceState-v2.xsd">
  <QosStateId>MyStateId001</QosStateId>
  <Interface>
    <InterfaceId>eth0</InterfaceId>
    <IpAddress>
      <Ipv4>10.10.145.24</Ipv4>
    </IpAddress>
    <InterfaceAvailability>1</InterfaceAvailability>
  </Interface>
  <Interface>
    <InterfaceId>eth1</InterfaceId>
    <InterfaceAvailability>0</InterfaceAvailability>
  </Interface>
  <Interface>
    <InterfaceId>eth2</InterfaceId>
    <IpAddress>
      <Ipv4>10.10.144.23</Ipv4>
    </IpAddress>
    <InterfaceAvailability>1</InterfaceAvailability>
  </Interface>
</QosDeviceState>
```

2.2.8 PathInformation

PathInformation is a structure that provides MAC address information about devices reachable through each active interface.

2.2.8.1 XML Schema Definition

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

2.2.8.2 Description of fields in **PathInformation** structure

DeviceReachableMacs: This is a required structure. **DeviceReachableMac** serves as a container for the interface specific lists of reachable MACs.

2.2.8.3 Description of fields in **DeviceReachableMacs** structure

LinkReachableMacs: This is a required structure. A **LinkReachableMacs** element is required for each available link supported by the device. For a device with physical media dedicated to an interface (such as Ethernet) there will be a **LinkReachableMacs** definition for each physical interface. For a device with a shared media (such as 802.11) there will be a **LinkReachableMacs** definition for each device pair where communication is supported by the device.

2.2.8.4 Description of fields in **LinkReachableMacs** structure

LinkId: This is a required field. Its value is of type **string** and contains the **InterfaceId** as defined in clause 2.2.6.2. Note: this field was named **LinkId** in v2 although this field actually contains the **InterfaceId**; this name MUST be retained for backward compatibility,

Bridged: This is an optional field. It is of type **string**. Interfaces (links) that are interconnected (bridged) within the device at L2 are identified with the same value for **Bridged**.

MacAddress: This is an optional field. It MUST be provided when supported by the technology. It provides the MAC address of the interface for an end point device.

ReachableMac: This is an optional structure. It MUST be provided when MAC addresses are supported by the technology. It provides the MAC address(es) of end point devices that are reachable through the link, if any. The device MUST list all MAC address that it currently knows for the link.

QosSegmentId: This is a required field. Its format is defined in clause 2.2.23.2.

ActualLinkId: This is an optional field. It is of type **string**. It contains the **LinkId** as defined in clause 2.2.23.2.

2.2.8.5 Sample argument XML string – PC with two network interfaces

This is an example of an end point network device with two network interfaces.

```
<?xml version="1.0" encoding="UTF-8"?>
<DeviceReachableMacs
  xsi:schemaLocation="http://www.upnp.org/schemas/PathInformation.xsd
  PathInformation-v3.xsd" xmlns="http://www.upnp.org/schemas/PathInformation.xsd"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
  <LinkReachableMacs>
    <LinkId>eth0</LinkId>
    <MacAddress>112233aabb03</MacAddress>
    <ReachableMac>112233aabb06</ReachableMac>
    <ReachableMac>112233aac206</ReachableMac>
    <ReachableMac>232233aa7126</ReachableMac>
    <ReachableMac>112333aab123</ReachableMac>
  </v2>
</v3>
```

```

        <QosSegmentId>174A98172392717512321</QosSegmentId>
        <ActualLinkId>c8d7aa92c12897</ActualLinkId>
    </v3>
</v2>
</LinkReachableMacs>
</DeviceReachableMacs>

```

2.2.9 A_ARG_TYPE_QosDeviceInfo

[A_ARG_TYPE_QosDeviceInfo](#) is a structure that is returned to provide information concerning the specified traffic stream.

2.2.9.1 XML Schema Definition

This is a **string** containing an XML fragment. It contains transport-related information specific to the stream identified by a TrafficDescriptor. The XML fragment in this argument MUST validate against the XML schema for QosDeviceInfo in the XML namespace "http://www.upnp.org/schemas/QosDeviceInfo.xsd" which is located at "http://www.upnp.org/schemas/qos/QosDeviceInfo-v3.xsd".

2.2.9.2 Description of fields in [A_ARG_TYPE_QosDeviceInfo](#) structure

TrafficHandle: This is a required field that identifies the Traffic Descriptor for which [QosDevice](#) Service information is being returned.

SourcePort: This is an optional integer field. It contains the source port of the specified traffic stream.

DestinationPort: This is an optional integer field. It contains the destination port of the specified traffic stream.

IpProtocol: This is an optional integer field. It contains the IANA assigned protocol number of the specified traffic stream.

SourceAddress: This is an optional field. It contains the source address of the specified traffic stream.

DestinationAddress: This is an optional field. It contains the destination address of the specified traffic stream.

2.2.9.3 Sample argument XML string

```

<?xml version="1.0" encoding="UTF-8"?>
<QosDeviceInfo xsi:schemaLocation="http://www.upnp.org/schemas/QosDeviceInfo.xsd
QosDeviceInfo-v3.xsd" xmlns="http://www.upnp.org/schemas/QosDeviceInfo.xsd"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
    <TrafficHandle>TH1b4-a222-08002b34c0037f921234-723c-11b4</TrafficHandle>
    <SourcePort>554</SourcePort>
    <DestinationPort>8572</DestinationPort>
    <IpProtocol>17</IpProtocol>
</QosDeviceInfo>

```

2.2.10 A_ARG_TYPE_QosStateId

This is a **string** argument state variable. This state variable identifies the QoS-related state of the [QosDevice](#) Service.

2.2.11 A_ARG_TYPE_NumRotameterObservations

This is an unsigned integer state variable. This state variable indicates the number of Rotameter Observations per MAC address that a requesting Control Point is interested in receiving. If the [QosDevice](#) Service has this number of observations available, it MUST return

the most recent (in time) observations indicated by the number [A_ARG_TYPE_NumRotameterObservations](#).

2.2.12 A_ARG_TYPE_RotameterInformation

[A_ARG_TYPE_RotameterInformation](#) is a structure that provides MAC address and Rotameter information about devices reachable through each active interface.

2.2.12.1 XML Schema Definition

This is a [string](#) containing an XML fragment. The XML fragment in this argument MUST validate against the XML schema for RotameterInformation in the XML namespace “http://www.upnp.org/schemas/RotameterInformation.xsd” which is located at “http://www.upnp.org/schemas/qos/RotameterInformation-v2.xsd”.

2.2.12.2 Description of fields in A_ARG_TYPE_RotameterInformation structure

LinkReachableMacs: This is a required structure. A [LinkReachableMacs](#) definition is required for each available link supported by the device. See clause 2.2.8.4.

LinkId: This is a required field. Its value is of type [string](#) and contains the [InterfaceId](#) as defined in clause 2.2.6.2. Note: this field was named [LinkId](#) in v2 although this field actually contains the [InterfaceId](#); this name MUST be retained for backward compatibility. It MUST be unique within the [QosDevice](#) Service.

QosSegmentId: This is an optional field. Its value is of type [string](#). It MUST be unique within the [QosDevice](#) Service. It uniquely identifies a network segment of a shared media technology. Refer to description of [QosSegmentId](#) field in the clause 2.2.23.2 below for more details.

MacAddress: This is an optional field. It MUST be provided when supported by the technology. It provides the MAC address of the interface for an end point [QosDevice](#) Service. This is optional because not all interfaces are configured with a MAC Address. [MacAddress](#) may not be applicable to devices such as individual ports on switches.

Bridged: This is an optional field. It is of type [string](#). Interfaces (links) that are interconnected (bridged) within the device at L2 are identified with the same value for [Bridged](#).

RotameterObservation: This is a repeating field. Each instance contains information describing a single rotameter observation. This field is defined in clause 2.2.12.3

2.2.12.3 Description of fields in the [RotameterObservation](#) structure

[RotameterObservation](#) structure contains the following elements that describe a Rotameter Observation

RotameterIndex: This is an integer index that is incremented and is unique per observation on the reporting [QosDevice](#) Service. This can serve to correlate overlapping history snapshots to determine where they overlap.

MonitorResolutionPeriod: This integer field specifies, in seconds, how often a Rotameter observation is initiated (See Figure 2-1).

ROPeriod: This integer field specifies the duration in seconds over which the [RotameterObservation](#) is performed. ROPeriod MUST be less than or equal to the [MonitoringResolutionPeriod](#). (See Figure 2-1)

ReportingDateTime: This is a Time of Completion of Observation Period. This is wall clock time formatted per [RFC3339]; which can potentially be non-synchronized with other devices on the network.

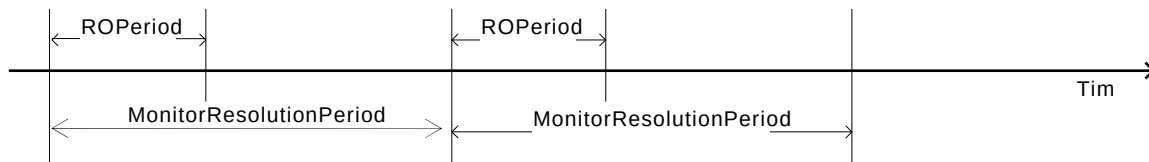


Figure 2-1 — Relationship between ROPeriod and MonitorResolutionPeriod

ROAddr: This is the MAC address of an interface on a [QosDevice](#) Service at which the Rotameter information is provided in the report. This parameter can be configured by the Control Point.

If it is the same address as the [MacAddress](#) field on the reporting [QosDevice](#) Service, then the Rotameter Observation is for all traffic to/from that interface on a reporting [QosDevice](#) Service identified by the ROAddr field.

If the address is different than the [MacAddress](#) field on the reporting [QosDevice](#) Service, then the Rotameter Observation is for all traffic between the interface identified by the [ROAddr](#) field on another device (which may not be a [QosDevice](#) Service) and the interface on a reporting [QosDevice](#) Service identified by the MacAddress field.

If the address is all zeros, then the report is for the entire QoS Segment of the shared media technology identified by the [QosSegmentId](#). For example, this will be set to all zeros by a [QosDevice](#) Service on a Layer2 scheduler of a QoS Segment when reporting diagnostic information for the entire QoS Segment.

ROBits: integer field is a total number of bits of all streams (best effort, prioritized and parameterized) measured in the Observation period (ROPeriod).

ROBits0: (Optional): This integer field represents number of bits interpreted as [TrafficImportanceNumber](#) 0 of strictly prioritized flows in the Observation period.

ROBits1: (Optional): This integer field represents number of bits interpreted as [TrafficImportanceNumber](#) 1 of strictly prioritized flows in the Observation period.

ROBits2: (Optional): This integer field represents number of bits interpreted as [TrafficImportanceNumber](#) 2 of strictly prioritized flows in the Observation period.

ROBits3: (Optional): This integer field represents number of bits interpreted as [TrafficImportanceNumber](#) 3 of strictly prioritized flows in the Observation period.

ROBits4: (Optional): This integer field represents number of bits interpreted as [TrafficImportanceNumber](#) 4 of strictly prioritized flows in the Observation period.

ROBits5: (Optional): This integer field represents number of bits interpreted as [TrafficImportanceNumber](#) 5 of strictly prioritized flows in the Observation period.

ROBits6: (Optional): This integer field represents number of bits interpreted as [TrafficImportanceNumber](#) 6 of strictly prioritized flows in the Observation period.

ROBits7: (Optional): This integer field represents number of bits interpreted as TrafficImportanceNumber 7 of strictly prioritized flows in the Observation period

It is recommended that the QosDevice Service employs separate priority queues for different traffic types and manages separate traffic counters (total number of bits in and out of the queue) for each of these priority queues (per attached device). For example, if a WLAN AP has four priority queues (background, best-effort, video, and voice) and is capable of managing separate counters for each of these queues, each of ROBits1, ROBits0, ROBits5, and ROBits7 respectively should be implemented for each attached device. If the QosDevice Service is unable to manage separate counters for each priority queue (per attached device), implementing a single counter (ROBits) per attached device is a reasonable compromise.

To further this example, ROPeriod and MonitorResolutionPeriod are both set to 1 second and there is only a single WLAN STA attached to the WLAN AP. If the AP supports per-priority counters and the attached STA sends two bursts of traffic as follows: One at 1 Mbps for 1 second with no priority (i.e., best-effort), followed by another at 6 Mbps for 1 second with video priority (equal to 5). Then the counters for two requested observations would contain:

Observation #1: ROBits (1000000), and ROBits0 (1000000). If only a single counter per-device is possible for this AP, the single counter would contain: ROBits (1000000).

Observation #2: ROBits (6000000), and ROBits5 (6000000). If only a single counter per-device is possible for this AP, the single counter would contain: ROBits (6000000).

If only a single observation was requested, the most recent would be returned, i.e., Observation #2 above. If an observation was requested after 1.5 seconds, i.e., between observation periods, the most recent complete observation would be returned (#1 above).

ROBitsParameterized: This is a mandatory parameter. This is the total number of bits of all parameterized streams measured in the Observation period (ROPeriod).

ROPacketsParameterized: This is a mandatory parameter. This is the total number of packets of all parameterized streams measured in the Observation period (ROPeriod).

ROParameterizedPacketsDropped: This is a mandatory parameter. This is the total number of packets dropped for all the parameterized streams in the Observation period (ROPeriod).

ROPerStreamObservation: This is an optional field. Each instance of this repeating field contains information about a specific stream. This field is defined in more details in Clause 2.2.12.4

2.2.12.4 Description of fields in the ROPerStreamObservation structure

ROPerStreamObservation structure contains the following elements that describe a Rotameter Observations per stream.

TrafficHandle: This is an optional field of type string. This identifies a unique UPnP traffic stream flowing through the QosDevice Service. A Control Point can optionally provide a list of TrafficHandles for which it would like to obtain diagnostic information. See [QM] for the detailed definition of TrafficHandle. At least one of TrafficHandle and Layer2StreamId MUST be present in ROPerStreamObservation.

Layer2StreamId: This is an optional field. Its value is of type string and it is 64 characters in length. This identifies a unique traffic stream flowing through a QoS Segment identified by a QosSegmentId. If an L2 Technology supported by a QosDevice Service cannot track per stream information, then this field may be absent. A Control Point can optionally provide a specific list of Layer2StreamIds about which it would like to obtain diagnostic information. Layer2StreamId is defined in clause 2.2.17.7.

StreamBitsTransmitted: (Optional) This is the total number of bits transmitted of a parameterized traffic stream identified by a [Layer2StreamId](#) in the ObservationPeriod.

StreamPacketsTransmitted: (Optional) This is the total number of packets transmitted of a parameterized traffic stream identified by a [Layer2StreamId](#) in the ObservationPeriod.

StreamBitsReceived: (Optional) This is the total number of bits received of a parameterized traffic stream identified by a [Layer2StreamId](#) in the ObservationPeriod.

StreamPacketsReceived: (Optional) This is the total number of packets received of a parameterized traffic stream identified by a [Layer2StreamId](#) in the ObservationPeriod.

StreamPacketsDropped: (Optional) This is the total number of dropped packets of a parameterized traffic stream identified by a [Layer2StreamId](#) in the ObservationPeriod.

2.2.12.5 Sample argument XML string – PC with two network interfaces

This is an example of an end point network device with two network interfaces that are not currently making Rotameter Observations.

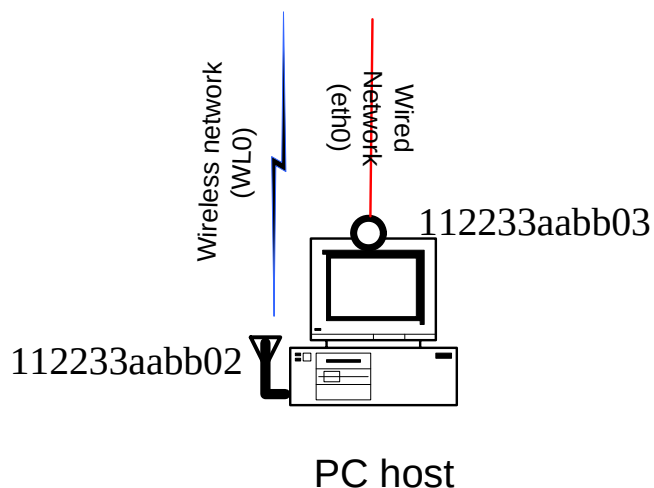


Figure 2-2 — PC with Two Network Interfaces

Example Network Rotameter Observation on a PC with two interfaces

```
<?xml version="1.0" encoding="UTF-8"?>
<RotameterInformation
  xsi:schemaLocation="http://www.upnp.org/schemas/RotameterInformation.xsd
  RotameterInformation-v3-20071209.xsd"
  xmlns="http://www.upnp.org/schemas/RotameterInformation.xsd"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
  <LinkReachableMacs>
    <LinkId>eth0</LinkId>
    <v3>
      <QosSegmentId>1579172877A91C2DE</QosSegmentId>
      <MacAddress>112233aabb02</MacAddress>
    </v3>
  </LinkReachableMacs>
  <LinkReachableMacs>
    <LinkId>WLO</LinkId>
    <v3>
      <QosSegmentId>0069172877A91C23A</QosSegmentId>
      <MacAddress>112233aabb03</MacAddress>
    </v3>
  </LinkReachableMacs>
</RotameterInformation>
```

2.2.12.6 Sample argument XML string – PC with two network interfaces that are both end point device

Similar to the previous example this is an example of an end point network device with two network interfaces. In this example the interfaces are actively connected and actively making Rotameter Observations.

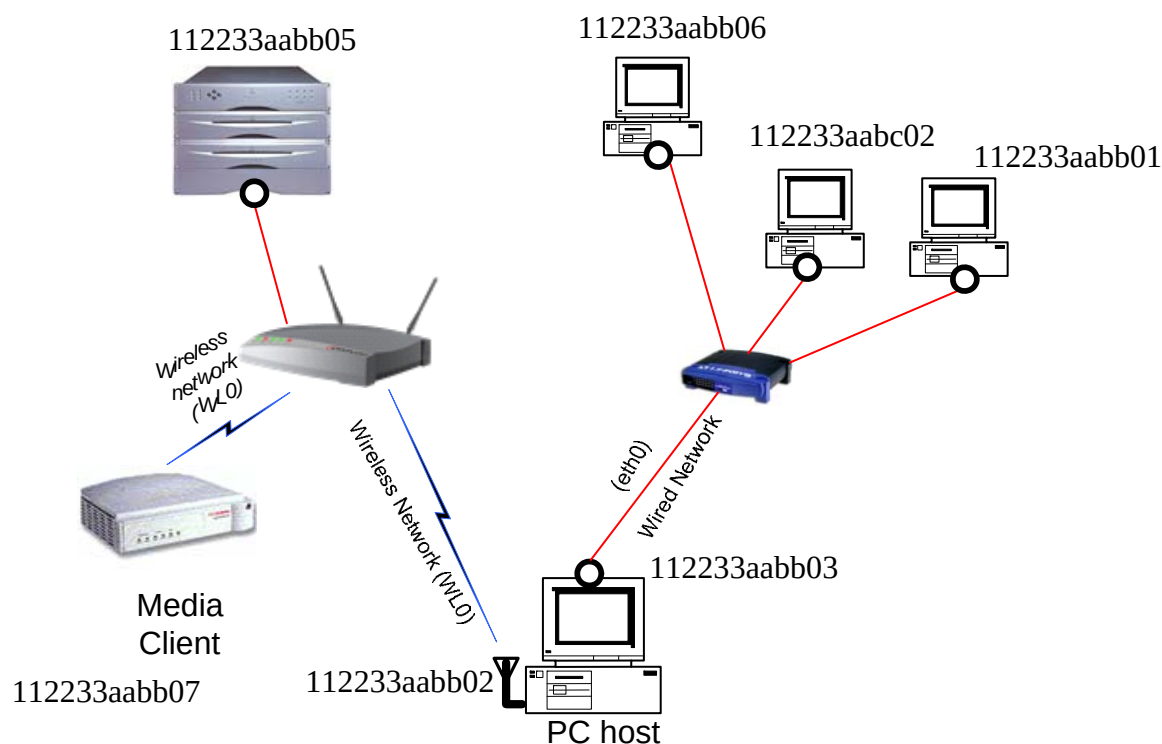


Figure 2-3 — Example of a PC connected to an active network

```
<?xml version="1.0" encoding="UTF-8"?>
<RotameterInformation
  xsi:schemaLocation="http://www.upnp.org/schemas/RotameterInformation.xsd
  RotameterInformation-v3-20071209.xsd"
  xmlns="http://www.upnp.org/schemas/RotameterInformation.xsd"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
  <LinkReachableMacs>
    <LinkId>eth0</LinkId>
    <v3>
      <QosSegmentId>157A9172877A91C2DE</QosSegmentId>
      <MacAddress>112233aabb03</MacAddress>
    </v3>
  <RotameterObservation>
    <RotameterIndex>0</RotameterIndex>
    <ROAddr>0077c71ad71a</ROAddr>
    <ROBits>0</ROBits>
    <ROBits0>0</ROBits0>
    <ROBits1>0</ROBits1>
    <ROBits2>0</ROBits2>
    <ROBits3>0</ROBits3>
    <ROBits4>0</ROBits4>
    <ROBits5>0</ROBits5>
    <ROBits6>0</ROBits6>
    <ROBits7>0</ROBits7>
    <ROPeriod>10</ROPeriod>
    <ReportingDateTime>2006-12-19T16:39:57-08:00</ReportingDateTime>
    <MonitorResolutionPeriod>100</MonitorResolutionPeriod>
    <v3>
      <ROBitsParameterized>0</ROBitsParameterized>
      <ROPacketsParameterized>0</ROPacketsParameterized>
      <ROParameterizedPacketsDropped>
```

[illegible]

2.2.13 A ARG TYPE ConfRotameterObservations

This structure is used to configure how Rotameter observations are made. Some of the configuration parameters include time period over which the rotameter observation is made, the MAC address of the device where the observation is made, specific traffic stream for which the observation is requested, etc.

2.2.13.1 XML Schema Definition

This is a **string** containing an XML fragment. It contains information specifying Rotamer configuration. The XML fragment in this argument MUST validate against the XML schema for ConfRotamerObservations in the XML namespace “<http://www.upnp.org/schemas/ConfRotamerObservations.xsd>” which is located at “<http://www.upnp.org/schemas/qos/ConfRotamerObservations-v2.xsd>”.

2.2.13.2 Description of fields in A ARG TYPE ConfRotameterObservations structure

ROPeriod: This is a mandatory field. Refer to the description of *ROPeriod* field in clause 2.2.12.3 above.

MonitorResolutionPeriod: This is a mandatory field. Refer to the description of *MonitorResolutionPeriod* field in clause 2.2.12.3 above.

PerStreamConfiguration: This optional structure contains information regarding rotameter observation configuration for each stream.

2.2.13.3 Description of fields in PerStreamConfiguration structure

ROAddr: This is an optional field. Refer to description of *ROAddr* field in clause 2.2.12.3 above.

If value of all zeros is provided, the device reports information about the traffic for the entire QoS Segment identified by *QosSegmentId*. If non-zero value is provided, the device reports information about traffic only between the device identified by the *ROAddr* field and its interface identified by the *MacAddress* field. If no value is specified, the device either reports traffic to/from itself or between itself and other devices on the network. See clause 2.3.11.2 for more details.

TrafficHandle: This is an optional field. This identifies a unique UPnP traffic stream flowing through a *QosDevice* Service. A Control Point optionally specifies this field if it is interested in obtaining information for a specific UPnP traffic stream.

2.2.14.3 Sample Argument XML String

```
<?xml version="1.0" encoding="UTF-8"?>
<MostRecentStreamAction xsi:schemaLocation="urn:schemas-upnp-
org:qos:MostRecentStreamAction MostRecentStreamAction-v2.xsd" xmlns="urn:schemas-
upnp-org:qos:MostRecentStreamAction" xmlns:xsi="http://www.w3.org/2001/XMLSchema-
instance">
  <SetupTrafficQos>2</SetupTrafficQos>
  <ReleaseTrafficQos>1</ReleaseTrafficQos>
</MostRecentStreamAction>
```

2.2.15 A_ARG_TYPE_MaxPossibleRotameterObservations

A_ARG_TYPE_MaxPossibleRotameterObservations is an unsigned integer field representing the maximum number of observations that the device is capable of providing.

2.2.16 A_ARG_TYPE_Resource

A_ARG_TYPE_Resource is a required state variable. It identifies and describes the target resource in the QosDevice Service of a ReleaseAdmittedQos(), AdmitTrafficQos() or UpdateAdmittedQos() action.

2.2.16.1 XML Schema Definition

This is a **string** containing an XML fragment. The XML fragment in this argument MUST validate against the XML schema for Resource in the XML namespace "urn:schemas-upnp-org:qos:Resource" which is located at "http://www.upnp.org/schemas/qos/Resource-v3.xsd".

2.2.16.2 Description of fields in A_ARG_TYPE_Resource structure

The A_ARG_TYPE_Resource structure MUST contain one of the following structures:

DeviceResource: This structure identifies a resource on the device.

NetworkResource: This structure identifies and describes a specific network resource on the device.

2.2.16.3 Description of fields in DeviceResource structure

DeviceResourceId: This required field is of type **string** and MUST be one of the DeviceResourceId field values provided in the A_ARG_TYPE_QosDeviceExtendedState state variable.

2.2.16.4 Description of fields in NetworkResource structure

The following fields identify the specific network resource which may be an interface or a link:

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

QosSegmentId: This is a required field of type **string**. It is used to identify the QoS Segment on which the Interface resides. Its format is defined in clause 2.2.23.2.

LinkId: This is an optional field of type **string**. It is a unique value for a given link within the interface of the QosDevice Service. Its value MUST be one of the LinkId field values provided in the A_ARG_TYPE_QosDeviceExtendedState state variable.

The following fields give the QosDevice Service information to aid its determination of what action it should take regarding this resource (see clause 2.5.1). Please note that the indications of QosDevice:3 Services being upstream or downstream are from the perspective

of the current [QosDevice](#) Service and within the context of the stream that is the subject of the action in which the [A_ARG_TYPE_Resource](#) state variable is received.

QDDownstream: This is a required field. It contains a [boolean](#) value which = “1” if there is a [QosDevice](#):3 Service downstream (towards the destination of the stream) within the same QoS Segment for which the [AdmitTrafficQos\(\)](#) (or [UpdateAdmittedQos\(\)](#)) action has been invoked.

QDUpstream: This is a required field. It contains a [boolean](#) value = “1” if there is a [QosDevice](#):3 Service upstream (towards the source of the stream) within the same QoS Segment for which the [AdmitTrafficQos\(\)](#) (or [UpdateAdmittedQos\(\)](#)) action has been invoked.

2.2.16.5 Sample Argument XML String

```
<?xml version="1.0" encoding="UTF-8"?>
<Resource xsi:schemaLocation="urn:schemas-upnp-org:qos:Resource Resource-v3.xsd"
xmlns="urn:schemas-upnp-org:qos:Resource"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
  <NetworkResource>
    <InterfaceId>plc0</InterfaceId>
    <QosSegmentId>174A76932C87A219EF0C</QosSegmentId>
    <QDDownstream>1</QDDownstream>
    <QDUpstream>0</QDUpstream>
  </NetworkResource>
</Resource>
```

2.2.17 A_ARG_TYPE_AdmitTrafficQosExtendedResult

[A_ARG_TYPE_AdmitTrafficQosExtendedResult](#) is a required state variable. This state variable contains information about the status of a requested traffic stream. If admission of the traffic stream fails, this state variable provides information regarding the cause.

2.2.17.1 XML Schema Definition

This is a [string](#) containing an XML fragment. The XML fragment in this argument MUST validate against the XML schema for [AdmitTrafficQosExtendedResult](#) in the XML namespace "urn:schemas-upnp-org:qos:AdmitTrafficQosExtendedResult" which is located at "http://www.upnp.org/schemas/qos/AdmitTrafficQosExtendedResult-v3.xsd".

2.2.17.2 Description of fields in [A_ARG_TYPE_AdmitTrafficQosExtendedResult](#) structure

The [A_ARG_TYPE_AdmitTrafficQosExtendedResult](#) structure returns the admission state information for the network or device resources. In the case of admission success, an indication of whether the [QosDevice](#) Service invoked the underlying Admission Mechanism is provided. In the case of admission failure, this structure returns the reason(s) for the failure. The [A_ARG_TYPE_AdmitTrafficQosExtendedResult](#) structure consists of the following fields:

TrafficHandle: This is a required field. It identifies the [TrafficDescriptor](#) with which the admission status is associated.

Exactly one of the following structures MUST be provided:

AdmissionStatusNet: Required when an admission request is made for network resources. Defined in clause 2.2.17.3.

AdmissionStatusDev: Required when an admission request is made for device resources. Defined in clause 2.2.17.5.

2.2.17.3 Description of fields in the AdmissionStatusNet structure

The AdmissionStatusNet is a structure that consists of a list of entries which provides the admission status of an instance of a traffic descriptor within the QoS segment. Here are the details of the parameters:

Reason: This field is a **string** that contains either a reason code (see Table 2-1) or a text string identifying the reason why the requested action was not accomplished. The **Reason** field is a required field; it MAY appear more than once. There are two types of reasons: “standard” and “non-standard”:

- Standard reasons are abbreviated as a three digit number, as shown in Table 2-2.
- Non-standard reasons are identified by a text string to describe the reason. Non-standard reasons can be used for testing, plugfests, vendor specific reasons, etc.

ListOfLayer2StreamIds: This optional structure contains one or more tuples identifying the streams that may be blocking the stream whose admission has failed on this QoS Segment. It may or may not be possible for the **QosDevice** Service to include all Layer2StreamIds on this QoS Segment. It is defined in clause 2.2.17.7.

AllocatedResources: This is an optional field that indicates the resources that have been reserved for a successful admit or update request. The format of this field is defined in clause 2.2.17.4.

2.2.17.4 Description of fields in the AllocatedResources structure

The **AllocatedResources** is a structure that contains information that indicates the resources that have been allocated for a successful admit or update request.

MaxCommittedDelay: This optional field is of type ui4. This is the maximum of the QoS Segment Delay that this QosDevice has committed to provide on this QoS Segment. See [QD_Add] for technology-specific details.

MaxCommittedJitter: This optional field is of type ui4. This is the maximum of the QoS Segment Jitter that this QosDevice has committed to provide on this QoS Segment. See [QD_Add] for technology-specific details.

Table 2-2 — Reason Codes For AdmissionStatusNet

ReasonCode	Reason Description	Description
000	Success	Traffic stream was admitted as requested.
001	Registered	This QosDevice Service has determined that another QosDevice Service on the QoS Segment is responsible for the request. It is remaining passive but has registered the Traffic stream and is aware of it.
762	Insufficient resources	Action failed due to insufficient resources.
764	Admission Control Not Supported	Admission Control is not supported on this QoS Segment.

2.2.17.5 Description of fields in the AdmissionStatusDev structure

Deviceld: This is a required field. This field is a **string** that uniquely identifies a particular Device Resource within the **QosDevice** Service. The **Deviceld** provided in this field MUST exist in the device as reported in the **QosDeviceExtendedState** state variable.

Reason: This field is a **string** that contains either a reason code or a text string identifying the reason why the requested action was not accomplished. The **Reason** field is a required field; it MAY appear more than once. There are two types of reasons: “standard” and “non-standard”:

Standard reasons are abbreviated as a three digit number, as shown in Table 2-3.

Non-standard reasons are identified by a text string to describe the reason. Non-standard reasons can be used for testing, plugfests, vendor specific reasons, etc.

Table 2-3 — Reason Codes For AdmissionStatusDev

ReasonCode	ReasonDescription	Description
000	Success	Traffic stream was admitted as requested.
762	Insufficient resources	Action failed due to insufficient resources.
764	Admission Control Not Supported	Admission Control is not supported on this Device Resource.

ListOfLayer2StreamIds: This optional structure contains one or more tuples identifying the admitted streams that may be blocking the stream whose admission has failed on this Device Resource (no prioritized streams will be included since they cannot possibly be blocking). It is defined in clause 2.2.17.6.

2.2.17.6 Description of fields in the ListOfLayer2StreamIds structure

NumberOfLayer2StreamIds: This is a required unsigned integer field. Its value is the number of entries in **ListOfLayer2StreamIds**.

Layer2Stream: This is an optional repeating structure (clause 2.2.17.7), each instance identifying a particular stream on the device. The number of **Layer2Stream** structures present MUST equal **NumberOfLayer2StreamIds**.

2.2.17.7 Description of fields in the Layer2Stream structure

Layer2StreamId: This is a required field of type **string**. It consists of 64 characters which provide an L2 Stream ID that uniquely identifies a particular stream to all **QosDevice** Services on the QoS Segment. The interpretation of this field is dependent upon the L2 Technology, several of which are described in the UPnP QosDevice:3 Underlying Technology Interface Addendum [QD_Add]. The QosManager treats this as a string, using it for matching purposes when looking for the **TrafficDescriptor** associated with the blocking stream. A given stream may have a different **Layer2StreamId** on each QoS Segment it traverses. Details on the formation of a Layer2StreamId based on the underlying technology can be found in the reference document [QD_Add]

TrafficDescriptorAvailable: This is a required field of type **boolean**: “1” indicates that the **QosDevice** Service can provide the **TrafficDescriptor** for the Blocking Stream if requested; “0” indicates that it can not.

2.2.17.8 Sample argument XML string

```
<?xml version="1.0" encoding="UTF-8"?>
<AdmitTrafficQosExtendedResult xsi:schemaLocation="urn:schemas-upnp-
org:qos:AdmitTrafficQosExtendedResult AdmitTrafficQosExtendedResult-v3.xsd"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns="urn:schemas-upnp-
org:qos:AdmitTrafficQosExtendedResult">
  <TrafficHandle>TH01234567</TrafficHandle>
  <AdmissionStatusNet>
    <Reason>000</Reason>
    <AllocatedResources>
      <MaxCommittedDelay>2000</MaxCommittedDelay>
      <MaxCommittedJitter>500</MaxCommittedJitter>
    </AllocatedResources>
  </AdmissionStatusNet>
</AdmitTrafficQosExtendedResult>
```

2.2.18 A_ARG_TYPE_ListOfAdmittedTraffic

This is a required state variable. It contains the list of admitted traffic streams and associated resources known to this [QosDevice](#) Service.

2.2.18.1 XML Schema Definition

This is a [string](#) containing an XML fragment. It contains information describing the traffic admitted on this [QosDevice](#) Service. The XML fragment in this argument MUST validate against the XML schema for ListOfAdmittedTraffic in the XML namespace "urn:schemas-upnp-org:qos:ListOfAdmittedTraffic" which is located at "http://www.upnp.org/schemas/qos/ListOfAdmittedTraffic-v3.xsd".

2.2.18.2 Description of fields in the ListOfAdmittedTraffic structure

The [ListOfAdmittedTraffic](#) is a required structure containing zero or more entries of [AdmittedTrafficItem](#) and a count of the number of [AdmittedTrafficItem](#) structures provided.

NumberOfAdmittedTrafficItems: This is a required unsigned integer field. It contains the number of [AdmittedTrafficItem](#) instances in the list.

AdmittedTrafficItem: This is an optional structure. There MUST be one instance of this structure for each stream on the device. The number of [AdmittedTrafficItem](#) structures present MUST equal [NumberOfAdmittedTrafficItems](#).

2.2.18.3 Description of fields in the AdmittedTrafficItem structure

Each [AdmittedTrafficItem](#) lists one [TrafficDescriptor](#), followed by several elements providing information about the stream: The scope of the TrafficDescriptors can range from a specific set of Traffic Descriptors to every Traffic Descriptor registered on the device.

TrafficDescriptor: This required field contains a TrafficDescriptor currently active on the [QosDevice](#) Service.

NetworkResource: Either this structure or [DeviceResource](#), but not both, MUST be present. It contains information about the network resources for which QoS was setup for this [AdmittedTrafficItem](#).

DeviceResource: Either this structure or [NetworkResource](#), but not both, MUST be present. It contains information about the device resources for which QoS was setup for this [AdmittedTrafficItem](#).

2.2.18.3.1 Description of the fields in the NetworkResource structure

Interfaceld: This is a required field of type **string**; its format is defined in clause 2.2.6.2. This field contains the **Interfaceld** associated with this **AdmittedTrafficItem**.

QosSegmentId: This is a required field that uniquely identifies a network segment. This is a **string** that is used by the QosManager to determine the **QosDevice** Services that are attached to a specific segment. Its format is defined in clause 2.2.23.2.

LinkId: This is an optional field of type **string**; its format is defined in clause 2.2.23.2. If present, this field contains the **LinkId** associated with this **AdmittedTrafficItem**.

Layer2StreamId: This is an optional field; it is defined in clause 2.2.17.7. If present, this field contains the **Layer2StreamId** associated with this **AdmittedTrafficItem**.

AdmissionStatusNet: This optional structure contains information about the admission status associated with this **AdmittedTrafficItem**. See clause 2.2.17.3.

2.2.18.3.2 Description of the fields in DeviceResource structure

DeviceResourceId: This is an optional field of type **string**; its format is defined in clause 2.2.16.3. If present, this field contains the **DeviceResourceId** associated with this **AdmittedTrafficItem**.

AdmissionStatusDev: This optional structure contains information about the admission status associated with this **AdmittedTrafficItem**. See clause 2.2.17.5.

2.2.18.4 Sample argument XML string

```
<?xml version="1.0" encoding="UTF-8"?>
<ListOfAdmittedTraffic xsi:schemaLocation="urn:schemas-upnp-
org:qos:ListOfAdmittedTraffic ListOfAdmittedTraffic-v3.xsd" xmlns="urn:schemas-
upnp-org:qos:ListOfAdmittedTraffic"
xmlns:td="http://www.upnp.org/schemas/TrafficDescriptorv1.xsd"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns:at="urn:schemas-upnp-
org:qos:AdmitTrafficQosExtendedResult">
  <NumberOfAdmittedTrafficItems>1</NumberOfAdmittedTrafficItems>
  <AdmittedTrafficItem>
    <TrafficDescriptor>
      <td:TrafficHandle>TH1b4-a222-08002b34c0037f921234-723c-
11b4</td:TrafficHandle>
      <td:TrafficId>
        <SourceAddress>
          <Ipv4>192.168.1.1</Ipv4>
        </SourceAddress>
        <SourcePort>554</SourcePort>
        <DestinationAddress>
          <Ipv4>192.168.1.3</Ipv4>
        </DestinationAddress>
        <DestinationPort>7572</DestinationPort>
        <IpProtocol>17</IpProtocol>
        <v2TrafficId>
          <v3TrafficId>
            <SourceUuid>2fac1234-31f8-11b4-a222-08002b34c003</SourceUuid>
            <DestinationUuid>7f921234-723c-11b4-a222-
2fac2b34c003</DestinationUuid>
          </v3TrafficId>
        </v2TrafficId>
      </td:TrafficId>
      <td:AvailableOrderedTspecList>
        <td:Tspec>
          <td:TspecIndex>1</td:TspecIndex>
        </td:Tspec>
      </td:AvailableOrderedTspecList>
      <AvTransportUri>rtsp://192.168.1.1/Movies/Sample1.mpeg</AvTransportUri>
    </TrafficDescriptor>
  </AdmittedTrafficItem>
</ListOfAdmittedTraffic>
```

[illegible]

2.2.19 A ARG TYPE PreferredQph

This is an optional state variable. It contains information pertaining to a [*QosPolicyHolder*](#) Service that is either preferred or a candidate for preference. For information on [*QosPolicyHolder*](#) Services and their preference see [OPH].

2.2.19.1 XML Schema Definition

This is a **string** containing an XML fragment. The XML fragment in this argument **MUST** validate against the XML schema for PreferredQph in the XML namespace "urn:schemas-upnp-org:qos:PreferredQph" which is located at "http://www.upnp.org/schemas/qos/PreferredQph-v3.xsd".

2.2.19.2 Description of fields in the PreferredQph structure

PreferredQphId: This **string** is the Serviceld of the Preferred *QosPolicyHolder* Service [refer to QPH].