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INTERNATIONAL STANDARD

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Information technology – UPnP device architecture – Part 17-13: Quality of Service Device Control Protocol – Level 3 – Quality of Service Device Service – Underlying Technology Interfaces

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INFORMATION TECHNOLOGY – UPNP DEVICE ARCHITECTURE –

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FOREWORD

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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.

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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 addendum contains recommendations for implementing interfaces between the UPnP QosDevice Service and various lower transport layers. Its purpose is to ensure that implementers of these interfaces use consistant mapping of methods and parameters from UPnP to the lower layers.

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:

[QD 3] *UPnP QosDevice:3* Service Document. Available at: http://www.upnp.org/specs/qos/UPnP-qos-QosDevice-v3-Service-20081130.pdf Latest version available at: http://www.upnp.org/specs/qos/UPnP-qos-QosDevice-v3-Service.pdf

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

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

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:3 Document 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

[Annex_G] – IEEE 802.1Q-2005, Annex G, IEEE Standard for Information technology - Telecommunications and information exchange between systems – IEEE Standard forLocal and metropolitan area networks - Virtual Bridged Local Area Networks, 2005.

2 (Normative) Requirements on the QosDevice Service and interactions that are specific for the Underlying Network Technologies

This addendum provides requirements for the *QosDevice* Service that are specific to particular Underlying Network Technologies. It is expected that these UPnP *QosDevice* Services will run directly on top of Layer 2 MAC/PHYs. QosDevice Services MAY also run on top of higher layer mechanisms . Both of these Layer 2 and higher layer mechanisms will be referred to as L2 technologies and *QosDevice* Service interactions with the L2 technologies. The described technologies were among those considered during development of UPnP-QoS v3.

Given the map in the Mapping Table defined in the appropriate L2 technology subclause below, if a an optional parameter is omitted in the active TSPEC and there is a UPnP-QoS default value, the *QosDevice* Service MUST use the UPnP-QoS default value (in preference to the L2 default value).

If UPnP-QoS v3 is implemented on an L2 technology that is not defined in this addendum, a clause based on the template provide in Annex B of *QosDevice* Service [QD 3] MUST be completed. The purpose of this requirement is to ensure interoperability between products from different manufacturers.

The clauses below assume that the referenced specifications are available to the reader for terminology and functional definition.

2.1 DSCP

2.1.1 References

[RFC2475] – An Architecture for Differentiated Services, Klyne, et. al., July 2002. http://www.ietf.org/rfc/rfc2475.txt

2.1.2 Priority Mapping

A QosDevice that supports DSCP [RFC2475] tagging must use the following mapping table.

Table 2.1-1 — Priority Mapping

UPnP-QoS Traffic Importance Number	DSCP tag (values are in hexadecimal)
0	0
1	8
2	10
3	18
4	20
5	28
6	30
7	38

2.2 *HomePlug AV*

2.2.1 References

[HPAV] HomePlug AV Specification Version 1.1.00. This specification is available from the HomePlug Powerline Alliance (http://www.homeplug.org).

2.2.2 Priority Mapping

HomePlug defines four priority levels at layer 2. These levels, from highest to lowest priority, are: CA3, CA2, CA1 and CA0. The mapping of the QoS Traffic Importance number to a HomePlug priority MUST follow the mappings in Table 2.1-1.

Table 2.2-1 — Priority Mapping

UPnP-QoS Traffic Importance Number	HomePlug Priority
0	CA1
1	CA0
2	CA0
3	CA1
4	CA2
5	CA2
6	CA3
7	CA3

2.2.3 QosSegmentId formation

The *QosSegmentId* MUST be formed by concatenating the IANAInterfaceType “174”, the hex digit “A” and “00000000” with the 54 bit Network ID (NID) of the AVLN as defined in [HPAV]. The NID is defined as being 6 octets (bits 0-7) and a 7th octet (bits 0-5). It is represented in the Beacon payload of 7 octets and must be represented as 14 hex digits in the

QosSegmentId. Each hex digit MUST correspond to a specific nibble of the NID with the following restrictions: The most significant nibble of the NID—as defined in [HPAV]—shall be the leftmost nibble in the *QosSegmentId* following the IANAifType. Within the nibble, the least significant bit—as defined in [HPAV]—shall correspond to the least significant bit as defined in XML/UPnP. Non-numeric Hex characters “A”-“F” MUST be upper case.

Example: Given a NID with the hex value 1234567, the *QosSegmentId* would be “174A00000001234567”.

2.2.4 Layer2StreamId representation

The *Layer2StreamId* MUST equal a hex-encoded string of exactly 64 uppercase hex digits consisting of the Connection ID (CID) of the Connection (stream) as specified in [HPAV] postpended with trailing zeros. An HPAV CID is 4 hex digitis. Each of the remaining (rightmost) 60 hex digits MUST be set to “0”. Bit ordering of the CID must be identical to the ordering of the CID in the Mac Management Messages (MMEs). The most significant nibble of the CID—as defined in [HPAV]—shall be the leftmost nibble in the *Layer2StreamId*. Within the nibble, the least significant bit—as defined in [HPAV]—shall correspond to the least significant bit as defined in XML/UPnP. Non-numeric Hex characters “A”-“F” MUST be upper case.

Example: Given a CID with the hex value 1A2B, the *Layer2StreamId* would be “1A2B000000000000000000000000000000000000000000000000000000000000”.

2.2.5 Mapping of UPnP QoS Parameters to HomePlug CSPEC Parameters

Table 2.2-2 shows how HomePlug AV CSPEC parameters are determined from UPnP-QoS TSPEC parameters.

Table 2.2-2 — Traffic Specification Parameters

HomePlug AV Parameter	R / O	UPnP-QoS parameter	Comment
Average Data Rate	*R*	*DataRate*	
Minimum Data Rate	*O*	*MinServiceRate*	
Maximum Burst Size	*O*	*MaxBurstSize*	
Maximum Data Rate	*O*	*PeakDataRate*	
Maximum MSDU Size	*O*	*MaxPacketSize*	
Delay Bound	*R*	*QosSegmentMaxDelayHigh*	(Either Maximum Inter-TXOP time or Delay Bound are required) If neither *QosSegmentMaxDelayHigh* nor MaxServiceInterval is provided, a default value of 10 seconds is used for Delay Bound
Jitter Bound	*O*	*QosSegmentMaxJitter*	
Maximum Inter-TXOP time	*R*	*MaxServiceInterval*	(Either Maximum Inter-TXOP time or Delay Bound are required)
Minimum Inter-TXOP time	*O*	*MinServiceInterval*	
MSDU Error Rate	*O*	*LossSensitivity*	
Inactivity Interval	*O*	*TrafficLeaseTime*	

Note: Unit conversion may be necessary.

2.2.6 Blocking traffic stream identification

If an *AdmitTrafficQos ()* or *UpdateAdmittedQos ()* action fails to admit a stream because of inadequate resources on a HomePlug AV QoS Segment, the *QosDevice* Service MUST return a list containing the *Layer2StreamId* values of all currently active L2 streams on the HPAV QoS Segment.

2.2.7 Responsibility for Stream Setup.

In HomePlug AV the source or the destination within the QoS Segment is responsible for the setup of QoS and for UPnP-QoS setup the arbitrary choice was made to set up QoS from the destination side. Thus, if a *QosDevice* Service receives an *AdmitTrafficQos ()* action or an *UpdateAdmittedQos ()* action in which the *Resource* argument indicates that there is a *QosDevice* Service downstream from this *QosDevice* Service, this *QosDevice* Service MUST NOT take any action to reserve resources on the HPAV network, and MUST acknowledge the request by returning a *ReasonCode* = “001” to the QoS Manager.

2.2.8 Mapping of *HomePlug AV* Returned Parameters to *ProtoTspec* Parameters

Table 2.2-3 shows how UPnP-QoS ProtoTspec parameters are determined from returned *HomePlug AV* parameters. (See QosManager Service for definition of *ProtoTspec*) .

Table 2.2-3 — *ProtoTspec* Parameters

UPnP-QoS Parameter	*HPAV* Parameter	Comment
DataRate	Average Data Rate	
MinServiceRate	Minimum Data Rate	
MaxBurstSize	Maximum Burst Size	
PeakDataRate	Maximum Data Rate	
MaxPacketSize	Maximum MSDU Size	
QosSegmentMaxDelayHigh	Delay Bound	
QosSegmentMaxJitter	Jitter Bound	
MaxServiceInterval	Maximum Inter-TXOP time	
MinServiceInterval	Minimum Inter-TXOP time	
LossSensitivity	MSDU Error Rate	
TrafficLeaseTime	Inactivity Interval	

Note: Unit conversion may be necessary.

2.2.9 Mapping of *HomePlug AV* Returned Parameters to *AdmitTrafficQosExtendedResult* and *AllocatedResources* Parameters

HomePlug AV does not provide additional information regarding QoS resource commitments.

2.3 HPNA

2.3.1 References

[HPNA] HomePNA Specification 3.1, December 2006; http://www.homepna.org/en/spec_download/download_request.asp

2.3.2 Priority Mapping

HPNA defines eight priority levels. These are from highest to lowest, 7-0. The mapping of the QoS Traffic Importance number to a HPNA priority MUST follow the mappings in Table 2.3-1.

Table 2.3-1 — Priority Mapping

UPnP-QoS Traffic Importance Number	HPNA Priority
0	2
1	1
2	0
3	3
4	4
5	5
6	6
7	7

2.4 IEEE 802.1Q, Annex G

2.4.1 References

[Annex_G] – IEEE 802.1Q-2005, Annex G, IEEE Standard for Information technology - Telecommunications and information exchange between systems – IEEE Standard forLocal and metropolitan area networks - Virtual Bridged Local Area Networks, 2005.

2.4.2 Priority Mapping

Devices that support IEEE 802.1Q, Annex G priority scheme must convert the UPnP Traffic Importance Number to the appropriate VLAN tag. The following mapping table must be used. Note that this table is used for tagging; for the queuing and buffer management when dealing with less than 8 queues, the behavior is specified by IEEE 802.1Q.

Table 2.4-1 — Priority Mapping

UPnP-QoS Traffic Importance Number	VLAN / IEEE 802.1Q priority
0	0
1	1
2	2
3	3
4	4
5	5
6	6
7	7

Processing of received frames should be done in accordance with the IEEE 802.1q specification.

2.5 *MoCA*

2.5.1 References

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

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

2.5.2 Priority Mapping

MoCA 1.x defines three priority levels. These are low, medium, and high. The mapping of the QoS Traffic Importance number to a MoCA 1.x priority MUST follow the mappings in Table 2.5-1.

Table 2.5-1 — Priority Mapping

UPnP-QoS Traffic Importance Number	MoCA 1.x Priority
0	Low
1	Low
2	Low
3	Low
4	Medium
5	Medium
6	High
7	High

2.5.3 *QosSegmentId* formation

The *QosSegmentId* MUST be formed by concatenating the string "236" (the MoCA IANAInterfaceType value) with the MoCA NetworkId right justified in a string of 32 characters.

For example for a MoCA network the *QosSegmentId* is "23600000000000000000000000000004" where 4 is the MoCA NetworkID.

2.5.4 *Layer2StreamId* representation

There are three MoCA values that are mapped into the *Layer2StreamId* field. The 2 left most characters represent the version of MoCA ("10" for version 1.0, "11" for version 1.1). The third character is a hex digit representing the class of the traffic. The FLOW_ID is right justified in the field with zeros to pad between the traffic class and the FLOW_ID. The FLOW_ID is mapped to the string as hex characters each representing 4 bits of the FLOW_ID. The least significant 4 bits are represented by the rightmost character in the string. Non-numeric Hex characters "A"-"F" MUST be upper case.

Example: For a version 1.1 stream with the FLOW_ID of 0x123456789ABC and traffic class of 4 the *Layer2StreamId* would be: "1140000000000000000000000000000000000000000000000000000123456789ABC"

2.5.5 Mapping of UPnP QoS Parameters to *MoCA* Parameters

Table 2.5-2 shows how *MoCA* Traffic specification parameters are determined from UPnP-QoS TSPEC parameters.

Table 2.5-2 — Traffic Specification Parameters

MoCA Parameter	R / O	UPnP-QoS parameter	Comment
T_PEAK_DATA_RATE	R	PeakDataRate if provided otherwise DataRate	The maximum number of kilobits of payload that a MoCA PQoS Flow transfers over a one second period in the MoCA Network
T_PACKET_SIZE	O	MaxPacketSize	The packet length in octets of a flow. The bandwidth cost of the flow is calculated using this value.

Note: Unit conversion may be necessary.

For each flow admitted by the MoCA layer 2, every involved node is required by the MoCA 1.1 specification to be able to sustain the PQoS Flow as long as the following requirements are satisfied:

a) The Injection Bit Rate is always less than or equal to the PQoS Flow's T_PEAK_DATA_RATE.

b) The Injection PDU Rate is always less than or equal to the PQoS Flow's T_PEAK_DATA_RATE/T_PACKET_SIZE.

c) The length of all injected PDUs is less than or equal to T_PACKET_SIZE.

2.5.6 Blocking traffic stream identification

If an *AdmitTrafficQos()* or *UpdateAdmittedQos()* action fails to admit a traffic stream because of inadequate resources on a QoS Segment, the *QosDevice* Service on a MoCA interface MUST return a list containing the MoCA *Layer2StreamId* values of all currently active L2 streams on the MoCA QoS Segment.

2.5.7 Responsibility for QoS Setup

In MoCA the source or the destination within the QoS Segment is responsible for the setup of QoS and for UPnP-QoS setup the arbitrary choice was made to set up QoS from the source side. Thus, if a *QosDevice* Service receives an *AdmitTrafficQos ()* action or an *UpdateAdmittedQos ()* action in which the *Resource* argument indicates that there is a *QosDevice* Service upstream from this *QosDevice* Service, it need not take any action but MUST acknowledge the request by returning a *ReasonCode* = "001" to the QoS Manager.

2.5.8 Mapping of *MoCA* Returned Parameters to *ProtoTspec* Parameters

Table 2.5-3 shows how UPnP-QoS ProtoTspec parameters are determined from returned *MoCA parameters.* (See QosManager Service for definition of *ProtoTspec*)

Table 2.5-3 — *ProtoTspec* Parameters

UPnP-QoS parameter	*MoCA* Parameter	Comment
DataRate	T_PEAK_DATA_RATE	For a ProtoTspec the DataRate should reflect the throughput currently available for reservation on the requested path.

Note: Unit conversion may be necessary.

2.5.9 Mapping of *MoCA* Returned Parameters to *AdmitTrafficQosExtendedResult* and *AllocatedResources* Parameters

Table 2.5-4 shows how UPnP-QoS *AdmitTrafficQosExtendedResult* and *AllocatedResources* parameters are determined from returned *MoCA* parameters.

A *QosDevice* Service with a *MoCA* interface that is the source of the traffic stream in the *MoCA* QoS segment MUST return the sum of *MaxCommittedDelay* values for all the QosDevices on the QoS Segment. If a MoCA device cannot return all of the *MaxCommittedDelay* for the Qos Segment it MUST return 0. All other QosDevices on the QoS Segment MUST return zero.

A *QosDevice* Service with a *MoCA* interface that is the source of the traffic stream in the *MoCA* QoS segment MUST return the sum of *MaxCommittedJitter* values for all the QosDevices on the segment. If a MoCA device cannot return all of the *MaxCommittedJitter* for the QoS Segment it MUST return zero. All other QosDevices on the QoS Segment MUST return zero.

Table 2.5-4 — *AllocatedResource* Parameters

UPnP-QoS parameter	As calculated from MoCA Parameter(s)	Comment
MaxCommittedDelay	*Latency*	MUST be the maximum latency defined for the MoCA version at 80% of bandwidth capacity.
MaxCommittedJitter		This is implementation dependent. Default should be the same value as Latency.

Note: Unit conversion may be necessary.

2.6 Wi-Fi WMM-AC

The requirements provided in this clause are applicable to all 802.11 wireless stations (STA) that are operating in infrasture mode. It includes requirements for STAs that implement QoS enhancements

2.6.1 References

[WMM] WMM Specification, Wi-Fi WMM (Wireless Multimedia) Specification v1.1, Wi-Fi Alliance, December 2005. http://www.wi-fi.org.

2.6.2 Priority Mapping

Wi-Fi Alliance's Wi-Fi Multi Media (WMM) defines four priority levels at layer 2. These levels, from
highest to lowest priority, are: AC_VO, AC_VI, AC_BE and AC_BK. The mapping of the QoS Traffic Importance number to a WMM priority MUST follow the mappings in Table 2.6-1.

Table 2.6-1 — Priority Mapping

UPnP-QoS Traffic Importance Number	WMM Priority
0	AC_BE
1	AC_BK
2	AC_BK
3	AC_BE
4	AC_VI
5	AC_VI
6	AC_VO
7	AC_VO

2.6.3 *QosSegmentId* formation

The *QosSegmentId* MUST be formed by a QoS Device concatenating the Wi-Fi IANAInterfaceType string "071" and the BSSID of the associated access point (AP). The BSSID field is a 48-bit field of the same format as an IEEE 802 MAC address.

Example: (BSSID = "012345678901") 071012345678901.

2.6.4 *Layer2StreamId* representation

There are five WMM fields that are mapped into the *Layer2StreamId* field: Version, Direction, TID, RA and TA of the frame containing the WMM TSPEC element, postpended with trailing zeros.. The two left most characters represent the version of WMM ("10" for version 1.0, "11" for version 1.1). The third character is an upper-case hex digit representing the 2 bit Direction. The fourth character is an upper-case hex digit representing the 4 bit TID. The next 12 characters are hex digit representation of the 48 bit RA. The next 12 characters are the upper-case hex digit representation of the 48 bit TA. This part is 28 characters which is postpended with 36 trailing zeros for a total string length of 64 characters. Non-numeric Hex characters "A"-"F" MUST be upper case.

Example: (version =1.1, Direction=1, TID=6 RA=222222222222 TA=333333333333) "11162222222222223333333333330000000000000000000000000000000000000000000000"

2.6.5 Mapping of UPnP QoS Parameters to *WMM* Parameters

Table 2.6-2 shows how *WMM* Traffic specification parameters are determined from UPnP-QoS TSPEC parameters.

Table 2.6-2 — Traffic Specification Parameters

WMM Parameter	R/O	UPnP-QoS parameter	Comment
Mean Data Rate	*R*	*DataRate*	
Minimum PHY Rate	*O*	*MinServiceRate*	
Nominal MSDU Size	*O*	*MaxPacketSize*	

Note: Unit conversion may be necessary.

2.6.6 Blocking traffic stream identification

If an *AdmitTrafficQos()* or *UpdateAdmittedQos()* action fails to admit a traffic stream because of inadequate resources on a QoS Segment, the *QosDevice* Service on a WMM interface MAY return a list containing the WMM *Layer2StreamId* values of all currently active admitted L2 streams on the WMM QoS Segment.

2.6.7 Responsibility for QoS Setup

In WMM, the STA within the QoS Segment is responsible for the setup of QoS. For UPnP-QoS this implies that the ingress and egress of the QoS Segment are jointly responsible for the setup of QoS.

If a *QosDevice* Service with a WMM interface receives an *AdmitTrafficQos ()* action or an *UpdateAdmittedQos ()* and it is a STA, then this *QosDevice* Service uses an WMM ADDTS request frame to setup a Traffic Stream (TS) between it and an AP..

If a *QosDevice* Service with a WMM interface receives an *AdmitTrafficQos ()* action or an *UpdateAdmittedQos ()* action, and it is an AP, then this *QosDevice* Service behavior depends on the value of the Network *Resource* argument in the action.

- If *QDUpstream*=1 and *QDDownstream*=1 in the *NetworkResource* structure for this *QosDevice* Service, then the flow is STA(QD) → AP(QD) → STA(QD); this AP is in the middle and the *QosDevice* Service on the AP MUST NOT take any action to reserve resources but MUST acknowledge the request by returning a *ReasonCode* = “001” to the QoS Manager.
- If *QDUpstream*=0 in the *NetworkResource* structure for this *QosDevice* Service and the MAC address corresponding to the SourceAddress in the TrafficDescriptor is not in the list of ReachableMacs for the wireless interface in the PathInformation structure then the AP is at the ingress of the QoS Segment AP(QD)→STA(QD); and the *QosDevice* Service on the AP MUST NOT take any action to reserve resources but MUST acknowledge the request by returning a *ReasonCode* = “001” to the QoS Manager.
- If *QDUpstream*=0 in the *NetworkResource* structure for this *QosDevice* Service and the MAC address corresponding to the SourceAddress in the TrafficDescriptor is in the list of ReachableMacs for the wireless interface in the PathInformation structure then the AP is not at the ingress of the QoS Segment STA(non-QD) → AP(QD) → STA(QD). The AP accounts for layer 2 network resources of the STA → AP connection (since there is no *QosDevice* Service on the STA that will be able to perform a UPnP request for QoS). The returned *ReasonCode* depends on the success or failure of the layer 2 accounting.
- If *QDDownstream*=0 in the *NetworkResource* structure for this *QosDevice* Service and the MAC address corresponding to the DestinationAddress in the TrafficDescriptor is not in the list of ReachableMacs for the wireless interface in the PathInformation structure then the AP is at the egress of the QoS Segment STA(QD) → AP(QD); and the *QosDevice* Service on the AP MUST NOT take any action to reserve resources but MUST acknowledge the request by returning a *ReasonCode* = “001” to the QoS Manager.
- If *QDDownstream*=0 in the *NetworkResource* structure for this *QosDevice* Service and the MAC address corresponding to the DestinationAddress in the TrafficDescriptor is in the list of ReachableMacs for the wireless interface in the PathInformation structure then the AP is not at the egress of the QoS Segment STA(QD) → AP(QD) → STA(non-QD). The AP accounts for layer 2 network resources of the AP → STA connection (since there is no *QosDevice* Service on the STA that will be able to perform a UPnP request for QoS). The returned *ReasonCode* depends on the success or failure of the layer 2 accounting.

2.6.8 Mapping of *WMM* Returned Parameters to *ProtoTspec* Parameters

Table 2.6-3 shows how UPnP-QoS ProtoTspec parameters are determined from returned *WMM* parameters. (See *QosManager* Service for definition of *ProtoTspec*)

The values for all returned parameters for the ProtoTspec are implementation specific in WMM.

Table 2.6-3 — *ProtoTspec* Parameters

UPnP-QoS parameter	*WMM* Parameter	Comment
DataRate	Mean Data Rate	For a *ProtoTspec* the DataRate should reflect the throughput currently available for admission on the requested path.

Note: Unit conversion may be necessary.

2.6.9 Mapping of *WMM* Returned Parameters to *AdmitTrafficQosExtendedResult* and *AllocatedResources* Parameters

Table 2.6-4 shows how UPnP-QoS *AdmitTrafficQosExtendedResult* and *AllocatedResources* parameters are determined from returned *WMM* parameters.

A *QosDevice* Service with a *WMM* interface that is the source of the traffic stream in the *WMM* QoS segment MUST return the sum of *MaxCommittedDelay* values for all the QosDevices on the QoS Segment. If a WMM device cannot return all of the *MaxCommittedDelay* for the Qos Segment it MUST return 0. All other QosDevices on the QoS Segment MUST return zero.

A *QosDevice* Service with a *WMM* interface that is the source of the traffic stream in the *WMM* QoS segment MUST return the sum of *MaxCommittedJitter* values for all the QosDevices on the segment. If a WMM device cannot return all of the *MaxCommittedJitter* for the QoS Segment it MUST return 0. All other QosDevices on the QoS Segment MUST return zero.

Table 2.6-4 — *AllocatedResource* Parameters

UPnP-QoS parameter	As calculated from WMM Parameter(s)	Comment
MaxCommittedDelay		See above text
MaxCommittedJitter		See above text
ListOfLayer2StreamIds		

Note: Unit conversion may be necessary.

2.7 UPA

2.7.1 References

[UPA] Digital Home Specifications. Universal Powerline Association UPA (http://www.upaplc.org)

2.7.2 Priority Mapping

UPA defines eight priority levels. These are from highest to lowest, 7-0. The mapping of the QoS Traffic Importance number to a UPA priority MUST follow the mappings in Table 2.7-1..

Table 2.7-1 — Priority Mapping

UPnP-QoS Traffic Importance Number	UPA Priority
0	0
1	1
2	2
3	3
4	4
5	5
6	6
7	7

2.7.3 *QosSegmentId* formation

The *QosSegmentId* MUST be formed by concatenating the IANAInterfaceType “174” the hex digit “B” and 4 hex digits which identifies the Network ID (NID) of the Layer-2 logical network.Where each hex digit MUST correspond to a specific nibble with the following restrictions: The least significant nibble MUST be the leftmost nibble in the *QosSegmentId* following the IANAifType. Within the nibble, the least significant bit MUST correspond to the least significant bit as defined in XML/UPnP. Non-numeric Hex characters “A”-“F” MUST be upper case.

Example: Given a NID with the hex value 0x1234, the *QosSegmentId* would be “174B1234”.

2.7.4 *Layer2StreamId* representation

The *Layer2StreamId* MUST be a string of 64 characters. An UPA session identifier (SID) is 2 hex digits. These 2 hex digits MUST be mapped as the first two characters into the *Layer2StreamId* string. Each of the remaining (rightmost) characters MUST be set to “0”. (*Layer2StreamId* MUST be unique on this QoS Segment) Non-numeric Hex characters “A”-“F” MUST be upper case..

Example: Given a SID with the hex value 0x25, the *Layer2StreamId* would be “2500000000000000000000000000000000000000000000000000000000000000”

2.7.5 Mapping of UPnP QoS Parameters to UPA Parameters

Table 2.7-2 shows how UPA Traffic specification parameters are determined from UPnP-QoS TSPEC parameters.

Table 2.7-2 — Traffic Specification Parameters

UPA Parameter	R/O	As calculated from UPnP-QoS parameter(s)	Comment
Service Class	R	*TrafficClass*	
Average Bandwidth	R	*DataRate*	
Minimum Bandwidth	O	*MinServiceRate*	
Maximum Bandwidth	O	*MaxBurstSize*	
Maximum Burst Size	O	*PeakDataRate*	
Reserved Bandwidth	O	*ReservedServiceRate*	
Time Interval	O	*TimeUnit*	
Maximum MSDU Size	O	*MaxPacketSize*	
Latency Bound	R	*QosSegmentMaxDelayHigh*	If *QosSegmentMaxDelayHigh* is not provided the default is 10 seconds.
Jitter Bound	O	*QosSegmentMaxJitter*	
MaxChannelAccessTime	O	*MaxServiceInterval*	
MinChannelAccessTime	O	*MinServiceInterval*	
MSDU Loss Rate	R	*LossSensitivity*	
Quality Session Type	O	*ServiceType*	
Inactivity Time Period	O	*TrafficLeaseTime*	

Note: Unit conversion may be necessary.

2.7.6 Blocking traffic stream identification

If an *AdmitTrafficQos()* or *UpdateAdmittedQos()* action fails to admit a traffic stream because of inadequate resources on a QoS Segment, the *QosDevice* Service MUST return a list containing the *Layer2StreamId* values of all currently active L2 streams on the UPA QoS Segment.

2.7.7 Responsibility for QoS Setup

In UPA Technology the source or the destination within the QoS Segment is responsible for the setup of QoS and for UPnP-QoS setup the arbitrary choice was made to set up QoS from the source side. Thus, if a *QosDevice* Service receives an *AdmitTrafficQos ()* action or an *UpdateAdmittedQos ()* action in which the *Resource* argument indicates that there is a *QosDevice* Service upstream from this *QosDevice* Service, it MUST NOT take any action but MUST acknowledge the request by returning a *ReasonCode* = “001” to the QoS Manager.

2.7.8 Mapping of *UPA* Returned Parameters to *ProtoTspec* Parameters

Table 2.7-3 shows how UPnP-QoS ProtoTspec parameters are determined from returned *UPA* parameters. (See *QosManager* Service for definition of *ProtoTspec*)

Table 2.7-3 — *ProtoTspec* Parameters

UPnP-QoS parameter	As calculated from UPA Parameter(s)	Comment
TrafficClass	Service Class	
DataRate	Average Bandwidth	
MinServiceRate	Minimum Bandwidth	
MaxBurstSize	Maximum Bandwidth	
PeakDataRate	Maximum Burst Size	
ReservedServiceRate	Reserved Bandwidth	
TimeUnit	Time Interval	
MaxPacketSize	Maximum MSDU Size	
QosSegmentMaxDelayHigh	Latency Bound	
QosSegmentMaxJitter	Jitter Bound	
MaxServiceInterval	MaxChannelAccessTime	
MinServiceInterval	MinChannelAccessTime	
LossSensitivity	MSDU Loss Rate	
ServiceType	Quality Session Type	

Note: Unit conversion may be necessary.

2.7.9 Mapping of *UPA* Returned Parameters to *AdmitTrafficQosExtendedResult* and *AllocatedResources* Parameters

Table 2.7-4 shows how UPnP-QoS *AdmitTrafficQosExtendedResult* and AllocatedResources parameters are determined from returned *UPA* parameters.

A *QosDevice* Service with a *UPA* interface MUST return only its contribution to the *MaxCommittedDelay* value for its QoS Segment. All other QosDevices on the QoS Segment MUST also return their own contribution.

Table 2.7-4 — *AllocatedResource* Parameters

UPnP-QoS parameter	As calculated from UPA Parameter(s)	Comment
MaxCommittedDelay	MaximumLatency Bound	
ListOfLayer2StreamIds	ReservedSessionList	List of admitted streams in the segment

Note: Unit conversion may be necessary.

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