ISO/IEC 29341-17-1

Edition 1.0 2011-08

INTERNATIONAL STANDARD

colour inside

Information technology – UPnP device architecture – Part 17-1: Quality of Service Device Control Protocol – Level 3 – Quality of Service Architecture

INTERNATIONAL ELECTROTECHNICAL COMMISSION

PRICE CODE R

ICS 35.200

ISBN 978-2-88912-649-1

CONTENTS

1 Introduction 4
1.1 Versions of the UPnP-QoS Specifications 4
1.2 Informative References 4
2 Architecture Overview 6
2.1 Scope 6
2.2 Assumptions 6
2.3 Architecture Summary 6
3 Architecture 8
3.1 Policy-based QoS 8
3.2 Types of QoS 8
3.2.1 Prioritized QoS 8
3.2.2 Parameterized QoS 9
3.2.3 Hybrid QoS 11
4 Key Concepts and Examples 11
4.1 Interfaces and Links 11
4.2 Path Information 12
4.2.1 Example – Bridge on the path 12
4.2.2 Example – Device not on the path 13
4.2.3 Example – Path Determination 13
4.3 QoS Segments 14
4.3.1 Example – Simple QoS Segment 14
4.3.2 Example – Multiple QoS Segments 15
4.3.3 Example – Homogeneous QoS Segment with L2 QoS Bridges 15
4.3.4 Example – Heterogeneous QoS Segment with L2 QoS Bridges 16
4.3.5 *QosSegmentId* generation examples 17
4.4 Adjacency of *QosDevice* Services 17
5 UPnP-QoS Services 19
5.1 The *QosPolicyHolder* Service 19
5.1.1 Overview 19
5.1.2 Traffic Stream QoS Policy Description 19
5.1.3 Multiple instances of the *QosPolicyHolder* Services 20
5.1.4 Preferred *QosPolicyHolder* Service 20
5.1.5 Maintaining the Preference of a *QosPolicyHolder* Service 20
5.1.6 Configuring the *QosPolicyHolder* Service 21
5.2 The *QosManager* Service 21
5.2.1 Overview 21
5.2.2 Behavior 22
5.2.3 Update the QoS reservation 22
5.3 The *QosDevice* Service 22
5.3.1 Overview 22
5.3.2 Behavior 23
5.3.3 Configuring QoS 24
5.3.4 Path Information 24
5.3.5 Ancillary actions 24

5.3.6 Events 25
6 System Operation 25
6.1 Selection of a *QosManager* Service 25
6.2 Invoking the *QosManager* Service 26
6.2.1 Initiation of QoS Setup (I) 26
6.2.2 Initiation QoS Setup (II) 26
6.2.3 Release of QoS Resources 27
6.2.4 Changing the QoS Setup 27
6.2.5 Integrated Control Point 27
6.2.6 Independent AV Control Point 28
6.2.7 Determination of QosBoundary Source and Destination 28
6.2.8 Creation of the TSPEC (Traffic Specification) 29
6.3 Determination of Policy for the Traffic Stream 29
6.3.1 Preferred *QosPolicyHolder* Service 29
6.3.2 CP-Indicated *QosPolicyHolder* Service 29
6.3.3 Single *QosPolicyHolder* Service 29
6.3.4 Priority Order of *QosPolicyHolder* Services for Prioritized QoS 30
6.3.5 Priority Order of *QosPolicyHolder* Services for Parameterized QoS and Hybrid QoS 30
6.3.6 The *QosPolicyHolder* Service 30
6.3.7 Default Policy 30
6.4 Determination of *QosDevice* Services that have to be managed 31
6.4.1 Configuration of QoS Devices 31
6.4.2 Path Determination 31
6.4.3 QoS Segment Identification 31
6.5 Admission Control 32
6.5.1 Decomposition of End-to-End Requirements into Per-QoS Segment Requirements 32
6.5.2 Determination of adjacent *QosDevice* services within a QoS Segment 33
6.5.3 Configuring *QosDevice* Services within a QoS Segment – release 34
6.5.4 Configuring *QosDevice* Services within a QoS Segment 34
6.5.5 Device resources managed by the *QosDevice* Service 35
6.5.6 Collecting the results of all QoS Segments 35
6.5.7 The *QosDevice* Service and the *QD:AdmitTrafficQos()* action 36
6.5.8 The *QosDevice* Service and the *QD:ReleaseAdmittedQos()* action 37
6.5.9 The *QosDevice* Service and the *QD:UpdateAdmittedQos()* action 37
6.6 Preemption 38
6.6.1 Identifying the Blocking Traffic Streams 38
6.6.2 Determining Candidates for Preemption 38
6.6.3 The Preemption and notification 40
6.6.4 Re-Attempt To Admit the Traffic Stream 40
6.7 Run time Operation 40
6.7.1 Traffic Lease Management and Link failures 40
6.7.2 Violation and Policing of the TSPEC 41
6.7.3 Being Preempted 41
7 QoS Boundary Addresses 41

Figure 1 — UPnP-QoS Architecture Overview 7

Figure 2 — An Example Interaction Diagram for *RequestTrafficQos()* action for prioritized QoS setup. 9

Figure 3 — An Example Interaction Diagram for RequestTrafficQos() (without preemption). 10

Figure 4: An Example Interaction Diagram for RequestExtendedTrafficQos() with preemption capability. 10

Figure 5 — Example of Interfaces and Links. Device A has 1 interface that contains 3 links. Device B, C, and D each contain an interface with only a single link. 12

Figure 6 — A bridge is on the path if and only if it reports the MAC address of the source on a different link than the MAC address of the sink and these two links are bridged. 13

Figure 7 — Laptop is not bridging its interfaces and therefore not on the path 13

Figure 8 — Example network for path determination 13

Figure 9 — A simple network with one QoS Segment 15

Figure 10 — A network with two different technologies and two QoS Segments 15

Figure 11 — A network with Ethernet Layer-2-QoS bridges, L2Q-end point devices and legacy Ethernet bridges and legacy Ethernet devices 16

Figure 12 — A network with all L2Q-end point devices but with different underlying technologies: MoCA (left hand side) and Ethernet (Right hand side), respectively 16

Figure 13 — QoS Segment with two *QosDevice* services 18

Figure 14 — QoS Segment with only one *QosDevice* Service 18

Figure 15 — Example of Adjacent *QosDevice* services 33

Figure 16 — Example of Adjacent *QosDevice* Services. Note that only A and C are *QosDevice* Services. 34

Figure 17 — Examples of approaches to determine candidates for preemption 39

Table 4-1 — Overview of the Admission Mechanism invocation 18

Table 2 — Devices A, B, C, D all implement *QosDevice* Service 33

Table 3 — Only Devices A and C implement *QosDevice* Service 33

INFORMATION TECHNOLOGY – UPNP DEVICE ARCHITECTURE –

Part 17-1: Quality of Service Device Control Protocol – Level 3 – Quality of Service Architecture

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 29341-17-1 was prepared by UPnP Forum Steering committee[1], 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 Introduction

This architecture document describes the motivation, use and interaction of the three services that comprise version 3 of the UPnP-QoS Framework:

- The *QosDevice:3* Service [QD:3],
- The *QosPolicyHolder:3* Service [QPH:3], and
- The *QosManager:3* Service [QM:3].

While UPnP-QoS defines three services (listed above), it does not define a new device type. Since Quality of Service issues need to be solved for multiple usage scenarios, it is expected that vendors could use any UPnP device as a container for the services defined by UPnP-QoS.

The UPnP-QoS Framework is compliant with the UPnP Device Architecture version 1.0.

This document is INFORMATIVE. This document is derived from the specifications and it does not describe what is required or optional. For required and optional functionalities, refer to the service definition documents. When there is a conflict between this document and (one of) the service definition documents, the latters prevail. This document avoids the words must, should, and may. Implementers are therefore referred to the appropriate service definition documents for requirements.

Definitions for terms used in this document can be found in [QM:3].

1.1 Versions of the UPnP-QoS Specifications

There are currently three versions of UPnP-QoS.

UPnP-QoS version 1 defines a framework for policy-based prioritized QoS.

UPnP-QoS version 2 extends the version 1 framework with

- A rotameter service to measure network performance and assist in the diagnosis of network problems, and
- A mechanism to indicate a *QosPolicyHolder* Service that will be used by the *QosManager* Service

UPnP-QoS version 3 extends the version 2 framework with

- Support for Admission Control,
- A mechanism to support a Preferred *QosPolicyHolder* Service,
- A way to configure the policy in the *QosPolicyHolder* Service.

This document describes UPnP-QoS version 3, please refer to the version 2 [QA:2] or version 1 [QA:1] architecture documents for more information on those versions.

1.2 Informative References

[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. Available at:

http://www.w3.org/TR/2000/REC-xml-20001006 Latest version available at: http://www.w3.org/TR/REC-xml/

[QM:1] – *UPnP QosManager:1* Service Document, Available at: http://www.upnp.org/standardizeddcps/documents/UPnP_Qos_Manager1_000.pdf

[QM:2] – *UPnP QosManager:2* Service Document, Available at: http://www.upnp.org/specs/qos/UPnP-qos-QosManager-v2-Service-20061016.pdf Latest version available at: http://www.upnp.org/specs/qos/UPnP-qos-QosManager-v2-Service.pdf

[QM:3] – *UPnP QosManager:3* Service Document, 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

[QD:1] – *UPnP QosDevice:1* Service Document Available at: http://www.upnp.org/standardizeddcps/documents/UPnP_Qos_Device1_000.pdf

[QD:2] – *UPnP QosDevice:2* Service Document Available at: http://www.upnp.org/specs/qos/UPnP-qos-QosDevice-v2-Service-20061016.pdf Latest version available at: http://www.upnp.org/specs/qos/UPnP-qos-QosDevice-v2-Service.pdf

[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

[QDA:3] – *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

[QPH:1] – *UPnP QosPolicyHolder:1* Service Document Available at: http://www.upnp.org/standardizeddcps/documents/UPnP_Qos_Policy_Holder1.pdf

[QPH:2] – *UPnP QosPolicyHolder:2* Service Document Available at: http://www.upnp.org/specs/qos/UPnP-qos-QosPolicyHolder-v2-Service-20061016.pdf Latest version available at: http://www.upnp.org/specs/qos/UPnP-qos-QosPolicyHolder-v2-Service.pdf

[QPH:3] – *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

[AV]– UPnP AV Architecture:1 Document version 1.0 Available at: http://www.upnp.org/specs/av/UPnP-av-AVArchitecture-v1-20020625.pdf.

[DEVICE] – UPnP Device Architecture, version 1.0. Available at: http://www.upnp.org/specs/arch/UPnP-arch-DeviceArchitecture-v1.0-20060720.pdf Latest version available at: http://www.upnp.org/specs/arch/UPnP-arch-DeviceArchitecture-v1.0.pdf

[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

[RFC3339] – *Date and Time on the Internet: Timestamps*, G. Klyne et al., July 2002. Available at: http://www.ietf.org/rfc/rfc3339.txt

[RFC3927] – *Dynamic Configuration of IPv4 Link-Local Addresses*. S. Cheshire et al., May 2005. Available at: http://www.ietf.org/rfc/rfc3927.txt

[MoCA 1.0] – MoCA Mac/Phy Specification v1.0 2006.

[MoCA 1.1] – MoCA Mac/Phy Specification v1.1 Extensions 2007.

[HPAV] – HPAV HomePlug AV Specification Version 1.1.00.

[CDS:1] – UPnP AV ContentDirectory Service Definition document version 1.0. Available at: http://www.upnp.org/standardizeddcps/documents/ContentDirectory1.0.pdf Latest version available at:

[CDS:2] – UPnP AV ContentDirectory Service Definition document version 2.0. Available at: http://www.upnp.org/specs/av/UPnP-av-ContentDirectory-v2-Service.pdf Latest version available at: http://www.upnp.org/specs/av/UPnP-av-ContentDirectory-v2-Service-20060531.pdf

[QA:1] – UPnP-QoS Architecture version 1.0 Available at: http://www.upnp.org/standardizeddcps/documents/UPnP_QoS_Architecture1.pdf

[QA:2] – UPnP-QoS Architecture version 2.0 Available at: http://www.upnp.org/specs/qos/UPnP-qos-Architecture-v2-20061016.pdf Latest version available at: http://www.upnp.org/specs/qos/UPnP-qos-Architecture-v2.pdf