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ABSTRACT

This contribution proposes new Appendices for Y.QoSmap. Two separate issues are addressed: Appendix IV and V propose informative mappings of the 3GPP TS23.203 Quality Class Indicators to QoS classes and Diffserv Codepoints respectively and Appendix VI proposes a fixed network consumer access upstream QoS class mapping for untrusted Home Gateways as an additional aspect of wholesale interconnection.

1 Introduction

The contents of this contribution have not been finally agreed in Question 17/12. They are published to enable broader discussion. While appendices IV and V with informative mappings for 3GPP TS23.203 QCI's are within the scope of Y.QoSmap (as agreed between authors), Appendix VI is a new suggestion governing a specific environment upstream QoS within a deregulated fixed network consumer access as part of interconnection agreements.

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2 Proposed new informative Appendix IV of Y.QoSmap: Example class mapping for 3GPP TS 23.203 to IR.34 and Y.QoSmap

(This appendix does not form an integral part of this Recommendation)

This section proposes a mapping for the 3GPP TS 23.203 QoS Class Identifiers (QCI) to Y.QoSmap classes. 3GPP TS 23.401 defines a mapping of the QCIs to IR.34 classes, which can be extended to Y.QoSmap as shown in table IV.1

Table IV.1 - QCI Class mapping of 3GPP TS 23.401 and proposed relation to Y.QoSmap

3GPP TS 23.203 QCI	3GPP TS 23.203 Application (examples)	3GPP TS 23.203 class properties (Note 1)	Y.QoSmap (IR.34 classes in brackets)
1	Conversational Voice	Loss tolerable, low delay, admission control	Priority (Conversational)
2	Conversational Video (Live Streaming) (Note 2)	Moderate loss, moderate delay, admission control	
3	Real Time Gaming	Loss tolerable, very low delay, admission control	
4	Non-Conversational Video (Buffered Streaming)	Low loss, delay insensitive, admission control	Bulk inelastic (Streaming) (Note 3)
5	IMS Signaling	Low loss, low delay	Assured (Interactive)
6	Video (Buffered Streaming) TCP-data	Low loss, delay insensitive	
7	Voice, Video (Live Streaming), Interactive Gaming	Low loss, low delay	
8	Video (Buffered Streaming) TCP-data	Low loss, delay insensitive	
9	Video (Buffered Streaming) TCP-data	Unspecified	Default (Background)

Note 1 - The class properties are derived from 3GPP TS 23.203 wireless network section performance budgets (delay ranges from 50 - 300 ms and Packet Error Loss Rate from 10^{-2} to 10^{-6}) whether admission control is required. Note 2 - Live Streaming is interpreted as Video Conferencing by the authors of Y.QoSmap, not as digital television transmission. The interpretation applied by 3GPP TS 23.203 is not known or explained there. Note 3 - The presence of admission control was picked as the cause to map this QCI to the Multimedia (Streaming) class. Particularly in the case of digital television transmission distributed by IP multicast, the packet loss rate depends on predictable resource assignment for a constant multicast stream in the core IP network.

3 Proposed new informative Appendix V of Y.QoSmap

Example codepoint mapping for 3GPP TS 23.203 to IR.34 and Y.QoSmap

(This appendix does not form an integral part of this Recommendation)

Table V.1 picks up the class mapping of table IV.1 and proposes DiffServ codepoints for the 3GPP TS 23.203 QoS Class Identifiers (QCI). The codepoint scheme picked in table V.1 is not an exact match of IR.34. It proposes an adaptation of the IR.34 to better match RFC 2597 requirements. This would result in better mapping of IR.34 to the interconnection class and codepoint scheme of section 7 and appendix I. The notes of table V.1 discuss the benefits and add information on mapping of the unchanged IR.34 codepoint scheme.

Table V.1 - Suggested Class mapping for 3GPP TS 23.20

3GPP TS 23.203 QCI	3GPP TS 23.203 Application (examples)	Y.QoSmap class	Proposed IP Precedence (and IP DSCP)
1	Conversational Voice	Priority (Conversational)	5 (EF) (Note 1)
2	Conversational Video (Live Streaming) 2)		
3	Real Time Gaming		
4	Non-Conversational Video (Buffered Streaming)	Bulk inelastic (Streaming)	4 (AF41)
5	IMS Signaling	Assured (Interactive)	3 (THP 1, PHB AF31) (Note 4)
6	Video (Buffered Streaming) TCP-data		3 (THP 2, PHB AF32) (Note 2 and 5)

7	Voice, Video (Live Streaming), Interactive Gaming		3 (THP 2, PHB AF32) (Note 3 and 5)
8	Video (Buffered Streaming) TCP-data		3 (THP 3, PHB AF33) (Note 3 and 5)
9	Video (Buffered Streaming) TCP-data	Default (Background)	0
Note 1 - Several QCIs are mapped to a single DSCP. If there is a requirement to assign individual DSCPs per QCI (e.g. to enable QCI reconstruction if a communication involves two or more Mobile Terminals), the mapping of conversational traffic as proposed here must be reviewed. Note 2 - IR.34 proposes AF21 as a second priority Interactive class codepoint (see Annex 1 of this document). At an interconnection point, this codepoint may be mapped to a single "Assured Service"/Interactive class of an IP packet exchange (IPX) service provider. If this is an IP interconnection without tunneling, the IP header IP Precedence may be rewritten. In that case, the DSCP can't be reconstructed at the next interconnection point, as the 3 lower digits of AF31 are identical with those of AF21. A reconstruction of the original DSCP and subclass is possible also after an IP precedence rewrite, if AF32 is applied instead of AF21. Applying a different DSCP neither breaks priority nor class distinction assumptions IR.34 and follows RFC 2597 (the IR.34 interpretation of AF21 is as lower priority than AF31 is not in line with RFC 2597). Please note that application of DSCP AF32 for second priority traffic is in line with MEF23 (while application of AF21 isn't). Note 3 - IR.34 proposes AF11 as a third priority Interactive class codepoint. At an interconnection point, this codepoint may be mapped to a single "Assured Service"/ Interactive class of an IP packet exchange (IPX) service provider. If this is an IP interconnection without tunneling, the IP header IP Precedence may be rewritten. In that case, the DSCP can't be reconstructed at the next interconnection point, as the 3 lower digits of AF31 are identical with those of AF11. A reconstruction of the original DSCP and subclass is possible also after an IP precedence rewrite, if AF33 is applied instead of AF11. Applying a different DSCP neither breaks priority nor class distinction assumptions of IR.34 and follows RFC 2597 (the IR.34 interpretation of AF11 is as lower priority than AF31 and AF21 is not in line with RFC 2597). Please note that application of DSCP AF33 for a third priority traffic is in line with MEF23 (while application of AF11 breaks MEF23). Note 4 - This proposal emphasises signaling as a subclass with an own IP DSCP. This is in contradiction with 3GPP TS23.401, which suggests QCI 5 and QCI 6 to have the same priority. Note 5 - If a mobile provider only wants to use one DSCP for Interactive class applications, this should be AF31.			

3GPP TS 23.401 assigns 4 QCIs to the Interactive class. It is not possible to assign 4 separate AF codepoints to these QCIs while respecting RFC 2597 (as is by the time of writing). Hence any proposal on the assignment of DSCPs must compromise, either on codepoints or on class assignment or on both.

Table V.1 proposes to share one DSCP between QCI 6 and QCI 7. They are understood as not competing in fixed network sections, where low loss and low delay transport is expected as long as the fixed network incurs no more than predictable disturbances. This doesn't break 3GPP TS 23.203, which only specifies UTRAN QCI properties between UE and PCEF, but not in the IP backbone.

The benefits of the revised IR.34 DSCP scheme are: QCI 5 or signaling in general is receiving a dedicated IP DSCP. This matches the MEF and ITU Y.QoSmap recommendations (also see below). Further, QCI 6 may be prioritised against QCI 8 by having a separate DSCP. Further, all 4 QCIs are mapped to the Interactive class in a RFC 2597 conformant way:

RFC 2597 specifies that packets in one AF class MUST be forwarded independently from packets in another AF class, i.e., a DS node MUST NOT aggregate two or more AF classes together. IR.34 currently is not in line with this, as AF3, AF2 and AF1 are ordered by a Traffic Handling Priority (THP). RFC 2597 specifies a Traffic Handling Priority like mechanism to apply within a single AF class only. See Appendix VIII for the IR.34 70 Interactive class PHB specification.

MEF 23.1 QoS class “Medium” is designed for identical purposes as the GSMA IR.34 Interactive class (see Appendix VIII for an extract of MEF 23.1 QoS specification). MEF specifies AF31 as the Medium subclass having lowest packet drop probability and classifies AF32 and AF33 as having the higher one (MEF only differentiates between two drop precedence subclasses). This would interoperate with the revised codepoint scheme suggested for the Interactive class. It may be applicable e.g. if QoS traffic of a mobile carrier terminates in a third party data center.

MEF 23.1 defines three traffic classes on the Ethernet and IP layer (the number of classes alone indicates differences as compared with GSMA). Striving for end to end QoS standardised QoS class definitions and codepoints (by that order of priorities) are required, so agreeing the smallest common denominator is a reasonable standardisation target.

A significant difference is that MEF classifies AF1 traffic for the MEF Low priority queue, shared by Best Effort traffic. This contradicts IR.34 70 and is not desirable, if interoperable end to end QoS should result. The problem is solved with the revised IR.34 codepoint scheme (which replaces AF11 in the Interactive class by AF33, which maps to the MEF QoS class Medium).

Note that MEF recommends classifying “Layer 2 Control Protocol” traffic (Ethernet signaling) for the class M (DSCP AF3, Ethernet Priority 3). This is generalised by the revised IR.34 Interactive class specification recommending AF31 as DSCP for signaling traffic.

MEF 23.1 offers proper mappings also for the GSMA classes Background (class Low) and Conversational (class High).

4 Proposed new informative Appendix VI: Informative IR.34 migration proposal to a revised Interactive class codepoint scheme

The Interactive class PHBs doesn’t change with the proposed revision. In the opposite, it is compliant with RFC 2597. That doesn’t hold for the Interactive class PHB proposed by IR.34 70 (see Appendix VIII).

The following text only relates to the Interactive traffic class, as all other classes remain unchanged.

A provider who already transmits traffic using all three PHBs / DSCPs of IR.34 70 may continue to use these PHBs/DSCPs. The provider should migrate his marking scheme to the revised marking scheme. A way to do this may be to support both marking schemes in parallel and switch off the IR.34 70 one after all network elements have migrated to the revised marking scheme.

It is recommended that a provider receiving the IR.34 70 Interactive DSCPs remarks them to the corresponding revised ones as shown in V.1 for Traffic Handling Priority (THP) 2 and 3 . The provider may continue to use IR.34 70 marking, if the IR.34 70 Interactive PHB is deployed already with all three THPs. It is recommended that the latter type of provider supports both coding schemes, IR.34 70 and the revised one in parallel and then turns off IR.34 70.

It is recommended that a provider receiving IR.34 Interactive class traffic with the revised codepoint scheme transmits them without changing the DSCP.

5 Proposed informative Appendix VII: Upstream QoS for fixed line consumer access in multi carrier environments

Wholesale leasing of retail accesses is pushed in some markets to bolster competition. The individual retail accesses may be bundled and result in a multipoint to point packet stream, which is transmitted by a carrier to the leasing service provider at a wholesale interconnection interface. The interconnection agreement for traffic out of the service provider network to the retail accesses may be based on the interconnection QoS mapping recommended by section 7 of Y.QoSmap. The QoS treatment of the traffic transmitted by the service provider's consumers via their home gateway to the carrier's network is a second and independent QoS interconnection negotiation aspect. Due to the low degree of QoS class and codepoint standardisation it is reasonable to assume that each service provider configures an individual class and codepoint scheme for his home gateways. If the carrier offers service to more than one service provider, choices for the service provider home gateway QoS to carrier QoS mapping are limited. Low cost home gateways may not be customised for the carrier QoS scheme. Customised per service provider QoS mappings cause serious cost and operational effort for the carrier. They are no choice too. Finally, the carrier may classify home gateways of a service providers customers as untrusted equipment.

A Policy Enforcement Point like a Broadband Access Router supporting customised QoS configurations is reasonably expected in the service provider domain only. This reduces options for upstream QoS on consumer access interfaces in multi provider access leasing environments:

- All QoS traffic is mapped to a single upstream QoS class (while a Best Effort class is used for Best Effort traffic).
- Only standard QoS classes and codepoints are allowed in upstream direction.
- All traffic may be transported with single QoS class (backhaul).

Even the Voice (Conversational) class is marked by different codepoints than three bit "5" by some ISPs, hence the idea of standard classes can easily result in a customised mapping limiting future options. Such a scheme can't be expanded to cover less standardised QoS classes.

Mapping all traffic in a single upstream consumer backhaul QoS class is simple. It may not be desirable if volume based QoS accounting is present.

This leaves the option of mapping all upstream consumer QoS traffic into a single upstream QoS class in addition to an upstream Best Effort transporting Best Effort traffic. This allows limiting the QoS bandwidth and it doesn't require any customised mappings. Agreement must be reached on the code points identifying upstream QoS traffic in contrast to Best Effort traffic. As suggested in this document, the (three bit) codepoints "0" and "1" may be looked at as identifying Best Effort traffic. The single upstream QoS class may be picked to suit the dominating use. If a third party home gateway is classified as a network device to which a carrier has no trust relation, QoS classes which are specifically engineered for few applications, like the Voice (Conversational) class, may not be applicable.

Applying the Multimedia (Streaming) class seems to be a fair compromise ensuring timely and reliable transport for upstream consumer real time and data communication with QoS requirements.

Mapping all upstream consumer traffic of third party Home Gateways to the Multimedia (Streaming) class is a simple QoS mapping method which can be expanded to an arbitrary number of QoS classes without requiring customised QoS mappings.

Figure VI.I shows an example.

Note that the downstream traffic could consist of more QoS classes, as here a trust relation between ISP and access provider may be assumed and the standardised interconnection QoS scheme (see section 7 of Y.QoSmap) may be applied.

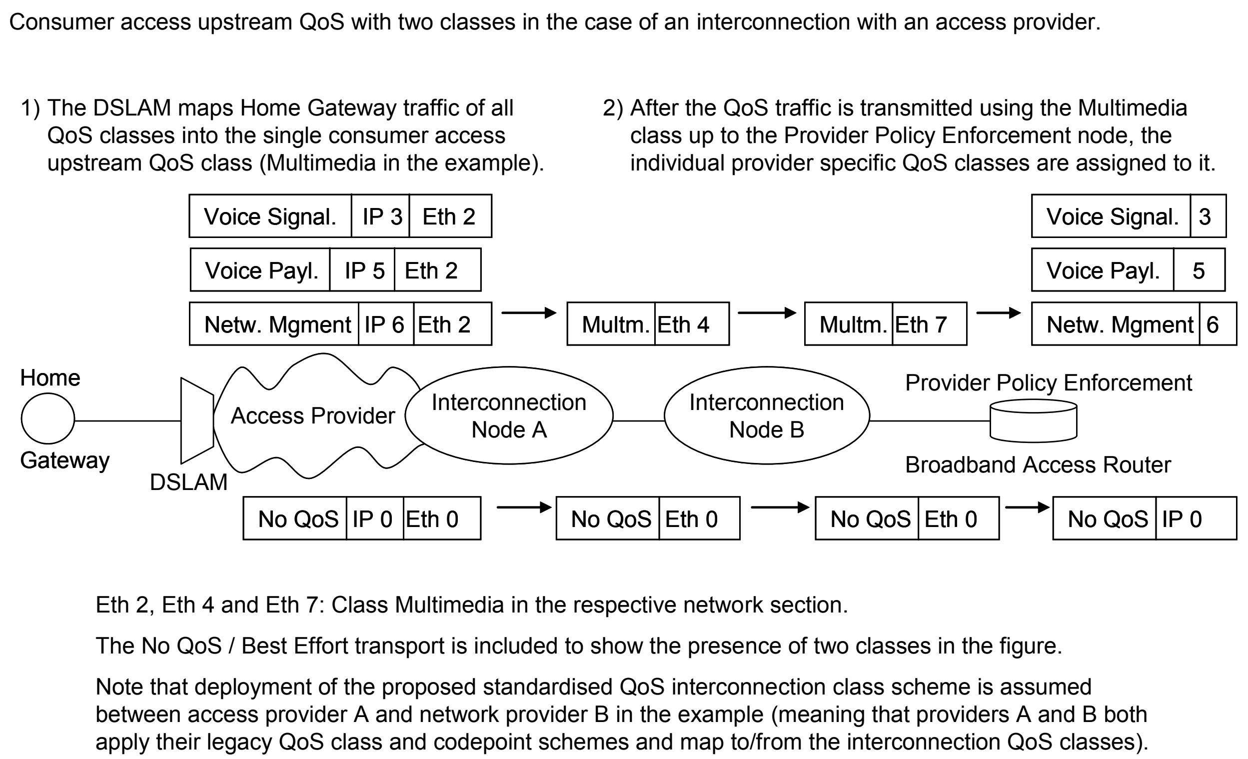

Figure VI.1 - Example for consumer access upstream QoS with two classes in the case of an interconnection of a provider with an access provider.

Appendix VIII QoS mappings of related standards

MEF23 excerpt (2011) - informative

CoS Name	Ethernet Priority Codepoint	CoS and Color Identifier	
	IP PHB and DSCP	Color Green	Color Yellow
High (H)	S-Tag Priority Codepoint (w/o DEI)	5	N/A
	PHB (DSCP)	EF	N/A

Medium (M)	S-Tag Priority Codepoint (w/o DEI)	3	2
	PHB (DSCP)	AF31	AF32, AF33
Low (L)	S-Tag Priority Codepoint (w/o DEI)	1	0
	PHB (DSCP)	AF11	AF12, AF13, 0

Note: Green would mean "Committed Information Rate" in MEF philosophy, while Yellow is "Excess Information Rate", meaning yellow has a higher drop probability if a class is congested.

PCP is the 3 bit Ethernet Priority Code Point.

IR.34 class to codepoint mapping - informative

QoS Information		Diffserv PHB	DSCP
Traffic Class	**Priority**		
Conversational	N/A	EF	101110
Streaming	N/A	AF41	100010
Interactive	1	AF31	011010
	2	AF21	010010
	3	AF11	001010
Background	N/A	BE	000000

3GPP TS23.401 QCI to class mapping - normative

QCI	Traffic Class	Traffic Handling Priority	Signalling Indication
1	Conversational	N/A	N/A
2	Conversational	N/A	N/A
3	Conversational	N/A	N/A
4	Streaming	N/A	N/A
5	Interactive	1	Yes
6	Interactive	1	No
7	Interactive	2	No
8	Interactive	3	No
9	Background	N/A	N/A

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