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Mapping 802.11 QoS in a PMIPv6 Mobility Domain
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Abstract

This document provides a model for enabling end to end QoS in systems where there is a 802.11 based wireless system coupled with a PMIPv6 mobility domain consisting a local mobility anchor and mobility access gateway. This enables QoS policing and labeling of packets in a consistent manner on the 802.11 link between the MN and the AP as well as the link between the MAG and the LMA. To enable this, the document specifies mapping between QoS parameters on the 802.11 link and the QoS Mobility options in the PMIPv6 domain.

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1. Introduction

802.11 networks can currently apply QoS policy by using ALG (Application Level Gateway) to detect an application (e.g. SIP signaling) and then install QoS for the corresponding IP flow on the Wireless LAN Controller (WLC)/ Access Point (AP). However, this is not a general mechanism and would require ALG or detection of application level semantics in the access to install the right QoS.

[PMIP-QoS] describes a application neutral procedure to obtain QoS for PMIPv6 flows and sessions. However, there are differences in parameters and procedures that need to be mapped between PMIPv6 QoS and 802.11. PMIPv6 has the notion of QoS for mobility sessions and flows while in 802.11 these should correspond to QoS for 802.11 data frames. Parameters in 802.11 QoS do not always have a one-to-one correspondence in PMIPv6 QoS. Further, 802.11 and PMIP QoS procedures need to be aligned based on whether QoS setup is triggered by the MN or pushed by the the network, as well as working with WMM or 802.11aa mechanisms.

This document provides information on using PMIPv6 QoS parameters for an MN connection over a 802.11 access network. The recommendations here allow for dynamic QoS policy information per Mobile Node (MN) and session to be configured by the 802.11 access network. PMIPv6 QoS signaling between MAG and LMA provisions the per MN QoS policies in the MAG. In the 802.11 access network modeled here, the MAG is located at the Access Point (AP)/ Wireless LAN Controller (WLC) . Figure 1 below provides an overview of the entities and protocols.

```
                                +---------+          +--------+
                                |  AAA    |          |  PCF   |
                                +---+-----+          +---+----+
                                    |                    |
                                    |                    |
        +-----+                 +---+-----+          +---+----+
        |     | 802.11 (WMM, 802.11aa) |         |  PMIPv6  |        |
        | MN <------------------------> AP/WLC <===========>  LMA  |
        |     |     (ADDTS, DELTS)     | (MAG)  |   QoS    |        |
        +-----+                 +---------+          +--------+
```

Figure 1: QoS Policy in 802.11 Access

MN and AP/WLC use 802.11 QoS mechanisms to setup admission controlled flows.

The AP/WLC (MAG) requests QoS policy from the LMA using PMIPv6 QoS extensions. This document does not exclude various deployments including those where AP and WLC are separate nodes, or the MAG control and data planes are separate.

The LMA provisions QoS policy when the MN initiates QoS requests and when QoS policy is pushed to the MN. In WMM [WMM 1.2.0], the AP advertises if admission control is mandatory for an access class. Admission control for best effort or background access classes is not recommended. When the MN initiates QoS setup, it uses ADDTS (Add Traffic Stream) to request QoS for a traffic stream between itself and the AP, and DELTS (Delete Traffic Stream) to delete that stream. When the network initiates QoS policy provisioning, 802.11aa capability is required. The LMA sends QoS policy to the AP/WLC, which in turn triggers an ADDTS reservation request to the MN.

The parameter mapping recommendations described here support the procedures by which the 3GPP network provisions QoS per application dynamically or during authorization of the Mobile Node (MN). However, the 802.11 procedures described here are not limited to work for just the 3GPP policy provisioning. If PMIPv6 QoS parameters can be provisioned on the MAG via mechanisms defined in [PMIP-QoS], the 802.11 procedures can be applied in general for provisioning OoS in a 802.11 network.

PMIPv6 QoS parameters need to be mapped to 802.11 QoS parameters. In some cases, there is no one-to-one mapping. And in other cases such as bandwidth, the values received in PMIP should be mapped to the right 802.11 parameters. This document provides recommendations to perform QoS mapping between PMIPv6 and 802.11 QoS.

[PMIP-QoS] does not explicitly describe how the QoS signaling and QoS sub-options map into corresponding signaling and parameters in the 802.11 access network. This mapping and the procedures in the 802.11 network to setup procedures are the focus of this document. The end-to-end flow spanning 802.11 access and PMIPv6 domain and the QoS parameters in both segments are described here. Thus, it provides a systematic way to map the various QoS parameters available in initial authorization, as well as setup of new sessions (such as a voice/video call). The mapping recommendations allow for proper provisioning and consistent interpretation between the various QoS parameters provided by PMIP QoS, and 802.11.

The rest of the document is organized as follows. Chapter 2 provides an overview of establishing mobility sessions with no admission control. These mechanisms are specified in [PMIP QoS] and outlined here since the mobility session established is the basis for subsequent admission controlled requests for flows. Chapter 3 describes how end to end QoS with 802.11 admission control is achieved. The mapping of parameters between 802.11 and PMIP QoS is described in Chapter 5.

1.1. Terminology

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in RFC 2119 [RFC2119].

1.2. Definitions

Peak Data Rate
: In WMM, Peak Data Rate specifies the maximum data rate in bits per second. The Maximum Data Rate does not include the MAC and PHY overheads [WMM 1.2.0].

Mean Data Rate
: This is the average data rate in bits per second. The Mean Data Rate does not include the MAC and PHY overheads [WMM1.2.0]

Minimum Data Rate
: In WMM, Minimum Data Rate specifies the minimum data rate in bits per second. The Minimum Data Rate does not include the MAC and PHY overheads [WMM 1.2.0].

TSPEC
: The TSPEC element in 802.11 contains the set of parameters that define the characteristics and QoS expectations of a traffic flow.

TCLAS
: The TCLAS element specifies an element that contains a set of parameters necessary to identify incoming MSDU (MAC Service Data Unit) that belong to a particular TS (Traffic Stream) [802.11].

1.3. Abbreviations

AAA	Authentication Authorization Accounting
AMBR	Aggregate Maximum Bit Rate
ARP	Allocation and Retention Priority
AP	Access Point
DSCP	Differentiated Services Code Point
EPC	Enhanced Packet Core
GBR	Guaranteed Bit Rate
MAG	Mobility Access Gateway
MBR	Maximum Bit Rate
MN	Mobile Node
QCI	QoS Class Indicator
QoS	Quality of Service
TCLAS	Type Classification
TSPEC	Traffic Conditioning Spec

WLC   Wireless Controller

2. Mapping 802.11 and PMIP QoS

This section provides an outline of the semantics and mapping of QoS parameters between 802.11 and PMIP QoS. While PMIP QoS provisions QoS for IP sessions and flows, 802.11 QoS reservations are made for an MN's data frames. Similarly, parameters in PMIP QoS and 802.11 do not have a one-to-one correspondence. The sections below provide recommendations on mapping of parameters as well as signaling triggers for the QoS service request.

2.1. Service Structure and Semantics of 802.11 QoS

IEEE 802.11-2012 [802.11-2012] provides an enhancement of the MAC layer in 802.11 networks to support QoS--EDCA (Enhanced Distributed Channel Access). EDCA uses a contention based channel access method to provide differentiated, distributed access using eight different UPs (User Priorities). EDCA defines four access categories (AC) that provide support for the delivery of traffic. In EDCA, the random back-off timer and arbitration inter-frame space is adjusted according to the QoS priority. Frames with higher priority AC have shorter random back-off timers and arbitration inter-frame spaces. Thus, there is a better chance for higher priority frames to be transmitted. The Wi-Fi Alliance has created a specification referred to as WMM (Wi-Fi Multimedia) based on above.

The MN uses ADDTS (Add Traffic Specs) to setup QoS for a traffic stream between itself and the AP, and DELTS to delete that stream. In WMM [WMM 1.2.0], the AP advertises if admission control is mandatory for an access class. Admission control for best effort or background access classes is not recommended. The Wi-Fi Alliance has created a specification referred to as WMM-AC (Wi-Fi Multimedia Admission Control) based on the above.

It should be noted that there are no guaranteed or committed resources in an 802.11 network - only prioritization that gives better opportunity for frames to compete for a shared medium.

2.2. Mapping of 802.11 QoS to PMIP QoS Parameters

2.2.1. Connection Parameters

TSPEC in 802.11 is used to reserve QoS for a traffic stream (MN MAC, TS(Traffic Stream) id). The 802.11 QoS reservation is for 802.11 frames associated with an MN's MAC address. TCLAS element with Classifier 1 (TCP/UDP Parameters) are used to identify a PMIP QoS flow. There is a one-to-one mapping between the TCLAS defined flow

and that in Traffic Selector.

MN <--> AP/WLC(802.11)	AP/WLC(MAG) <--> LMA PMIPv6
(TCLAS) TCP/UDP IP	Traffic Selector (IP flow)
(TCLAS) User Priority	DSCP

Table 1: 802.11 - PMIPv6 QoS Connection mapping

If the MN or AP/WLC is not able to convey flow parameters in TCLAS, the AP/WLC should use out of band methods to determine the IP flow for which QoS is requested. This may include higher level connection setup signaling (e.g., WCS in 3GPP 23.402).

2.2.2. QoS Class

Table 2 contains a mapping between Access Class (WMM AC) and 802.1D in 802.11 frames, and DSCP in IP data packets. The table also provides the mapping between Access Class (WMM AC) and DSCP for use in 802.11 TSPEC and PMIP QoS reservations.

QCI	DSCP	802.1D UP	WMM AC	Example Services
1	EF	6(VO)	3 AC_VO	conversational voice
2	EF	6(VO)	3 AC_VO	conversational video
3	EF	6(VO)	3 AC_VO	real-time gaming
4	AF41	5(VI)	2 AC_VI	buffered streaming
5	AF31	4(CL)	2 AC_VI	signaling
6	AF32	4(CL)	2 AC_VI	buffered streaming
7	AF21	3(EE)	0 AC_BE	interactive gaming
8	AF11	1(BE)	0 AC_BE	web access
9	BE	0(BK)	1 AC_BK	e-mail

Table 2: QoS Mapping between QCI/DSCP, 802.1D UP, WMM AC

The MN tags all data packets with DSCP and 802.1D UP corresponding to the application and the subscribed policy or authorization. The AP/WLC polices sessions and flows based on the configured QoS policy values for the MN.

For QoS reservations, TSPEC uses WMM AC values and PMIP QoS uses corresponding DSCP values in Traffic Selector. 802.11 QoS Access Class AC_VO, AC_VI are used for QoS reservations. AC_BE, AC_BK should not be used in reservations.

2.2.3. Bandwidth

Bandwidth parameters that need to be mapped between 802.11 and PMIP QoS are shown in Table 3.

Table 3 shows the mapping of bandwidth parameters.

MN <--> AP/WLC(802.11)	AP/WLC(MAG) <--> LMA PMIPv6
Mean Data Rate, DL	Guaranteed-DL-Bit-Rate
Mean Data Rate, UL	Guaranteed-UL-Bit-Rate
Peak Data Rate, DL	Aggregate-Max-DL-Bit-Rate
Peak Data Rate, UL	Aggregate-Max-UL-Bit-Rate

Table 3: Bandwidth Parameters for Admission Controlled Flows

In PMIP QoS, services using a sending rate smaller than or equal to Guaranteed Bit Rate (GBR) can in general assume that congestion related packet drops will not occur [TS 23.203]. If the rate offered by the service exceeds this threshold, there are no guarantees provided. 802.11 radio networks do not offer such a guarantee, but [WMM 1.2.0] notes that the application (service) requirements are captured in TSPEC by the MSDU (MAC Service Data Unit) and Mean Data Rate. The TSPEC should contain Mean Data Rate and it is recommended that it be mapped to the GBR parameters, Guaranteed-DL-Bit-Rate and Guaranteed-UL-Bit-Rate in PMIP QoS.

802.11 TSPEC requests do not require all fields to be completed. [WMM 1.2.0] specifies a list of TSPEC parameters that are required in the specification. Peak Data Rate is not required in WMM, however for MNs and APs that are capable of specifying the Peak Data Rate, it should be mapped to MBR (Maximum Bit Rate) in PMIP QoS. The AP/WLC should use the MBR parameters, Aggregate-Max-DL-Bit-Rate and Aggregate-Max-UL-Bit-Rate to police these flows on the backhaul segment between MAG and LMA.

During the QoS reservation procedure, if the MN requests Mean Data Rate, or Peak Data Rate in excess of values authorized in PMIP QoS, the AP/WLC should deny the request in ADDTS Response. The AP/WLC may set the reject cause code to REJECTED_WITH_SUGGESTED_CHANGES and send a revised TSPEC with Mean Data Rate and Peak Data Rate set to acceptable GBR and MBR respectively in PMIP QoS.

2.3. 802.11 and MAG Admission Control Considerations

Flows and sessions that do not need QoS reservation have no signaling or equivalent mapping in 802.11. These sessions and flows are

policed
by the AP/WLC to ensure that QoS policy obtained initially (during
MN

authorization) or dynamically over PMIP QoS is not exceeded by the MN.

All connection sessions of the MN with no explicit reservation should not in total exceed Per-MN-Agg-Max-DL-Bit-Rate and Per-MN-Agg-Max-UL-Bit-Rate in the downlink and uplink directions respectively. The non-admission controlled flows of a single connectivity session of an MN should not exceed Per-Session-Agg-Max-DL-Bit-Rate and Per-Session-Agg-Max-UL-Bit-Rate in the downlink and uplink directions respectively.

When there are insufficient resources in the radio network, the AP/WLC may preempt existing calls based on the Preemption-Capability of a new call and Preemption-Vulnerability of established calls. Parameter Allocation-Retention-Priority and sub fields of Priority, Preemption-Capability and Preemption-Vulnerability are used as defined in [RFC 7222]. If the AP/WLC determines that an established flow with reserved resources should be released, the AP/WLC should inform the MN using ADDTS (802.11aa) and signal the LMA with a revised QoS reservation in PBU/PBA.

3. Call Flows

There are two main types of interaction possible to provision QoS for flows that require admission control - one where the MN initiates the QoS request and the network provisions the resources. The second is where the network provisions resources as a result of PMIP QoS request. In the second scenario, if the MN supports 802.11aa, the network can push the QoS configuration to the MN. If the MN only supports WMM QoS, then MN requests for QoS for the 802.11 segment and the MAG provisions based on QoS already provisioned for the MN.

3.1. MN Initiated QoS Provisioning

3.1.1. MN Initiated QoS Request

This procedure outlines the case where the MN is configured to start the QoS signaling. In this case, the MN sends an ADDTS request indicating the QoS required for the flow. The AP/WLC (MAG) obtains the corresponding level of QoS to be granted to the flow by PMIPv6 PBU/PBA sequence with QoS options with the LMA. Details of the QoS provisioning for the flow are described below.

```
                                  +--------+
      +----+                      | AP/WLC |            +-------+
      | MN |                      | (MAG)  |            |  LMA  |
      +-+--+                      +---+----+            +---+---+
        |                             |                     |
      +---------------------------------------------------------------+
      |   [0] establish connection session to mobile network         |
      +---------------------------------------------------------------+
        |                             |                     |
      +-------------+                 |                     |
      |upper layer  |                 |                     |
      |notification |                 |                     |
      +-+-+-+-+-+-+-+                 |                     |
        |                             |                     |
        | ADDTS Request (TCLAS,TSPEC) |                     |
        |---------------------------->| PBU(QoS options)[2] |
        |             [1]             |-------------------->| QoS
Policy
        |                             |PBA (QoS option) [3] |<---------
>
        | ADDTS Response(TCLAS,TSPEC) |<--------------------|
        |<----------------------------|                     |
        |             [4]             |                     |
```

      Figure 3: MN initiated QoS setup

    [0] The MN establishes a connectivity session as described in [RFC
        7222], section 3.1, MAG-initiated QoS service request, steps 1-
        4. At this point, a connection with PMIPv6 tunnel is
established
        to the LMA. This allows the MN to start application level
        signaling.

    [1] The trigger for MN to request QoS is an upper layer
        notification. This may be the result of end-to-end application
        signaling and setup procedures (e.g. SIP)

        Since the MN is configured to start QoS signaling, it sends an
        ADDTS request with TSPEC and TCLAS identifying the flow for
        which QoS is requested. The TSPECs for both uplink and downlink
        in this request should contain the Mean Data Rate and and may
        contain Peak Data Rate.

    [2] If there are sufficient resources at the AP/WLC to satisfy the
        request, the MAG (AP/WLC sends a PBU with QoS options,
        operational code ALLOCATE and Traffic Selector identifying the
        flow. The Traffic selector is derived from the TCLAS to
identify
        the flow requesting QoS. 802.11 QoS parameters in TSPEC are
        mapped to PMIPv6 parameters. The mapping of TCLAS to PMIPv6 is
        shown in Table 1. TSPEC parameter mapping is shown in Table 3.

[3] The LMA obtains the authorized QoS for the flow and responds to the MAG with operational code set to RESPONSE. Mapping of PMIPv6 to 802.11 TCLAS is shown in Table 1, TSPEC parameters in Table 3.

Reserved bandwidth for flows are accounted separately from the non-reserved session bandwidth. The Traffic Selector identifies the flow for which the QoS reservations are made.

[4] The AP/WLC (MAG) provisions the corresponding QoS and replies with ADDTS Response containing authorized QoS in TSPEC and flow identification in TSPEC.

The AP/WLC polices these flows according to the QoS provisioning.

3.1.2. MN Initiated QoS Release

QoS resources reserved for a session are released on completion of the session. When the application session completes, the policy server, or the MN may signal for the release of resources. In this use case, the network initiates the release of QoS resources.

```
                      +--------+
  +----+              | AP/WLC |          +-------+
  | MN |              | (MAG)  |          |  LMA  |
  +-+--+              +---+----+          +---+---+
    |                     |                   |
  +--------------------------------------------------------------+
  |         [0] Establishment of application session             |
  |              and reservation of QoS resources                |
  |                                                              |
  |                  ( Session in progress)                      |
  |                                                              |
  |               Release of application session                 |
  +--------------------------------------------------------------+
    |                         |                    |
    | DELTS Request           |                    |
    |       (TS INFO)[1]      |                    |
    |------------------------>|                    |
    | DELTS Response          |                    |
    |       (TS INFO)[2]      |                    |
    |<------------------------|                    |
    |                         |PBU(QoSx,DE-ALLOC)[3]
    |                         |------------------->| Policy Update
    |                         |PBA(QoSx,RESPONSE)[4]<------------->
    |                         |<-------------------|
    |                         |                    |
```

Figure 6: Network initiated QoS resource release

[0] The MN establishes and reserves QoS resources as in use cases A, B or C.
When the application session terminates, the MN prepares to release QoS resources.

[1] MN releases its own internal resources and sends a DELTS Request to the AP/WLC with TS (Traffic Stream) INFO.

[2] AP/WLC receives the DELTS request, releases local resources and responds to MN with a DELTS response.

[3] AP/WLC (MAG) initiates a PBU with Traffic Selector constructed from TCLAS and PMIPv6 QoS parameters from TSPEC (QoSx).
[4] LMA receives the PBU, releases local resources and informs policy server. The LMA then responds with a PBA.

3.2. Network Initiated QoS Provisioning

3.2.1. Network Initiated QoS Request

When the MN is provisioned to wait for QoS configuration from the network, QoS policy configuration is triggered by PMIP QoS requests from LMA to MAG. This use case illustrates how an MN and 802.11 network that support 802.11aa can provision QoS to flows of the MN that when the policy server pushes the reservation request.

```
                                  +--------+
      +----+                      | AP/WLC |         +-------+
      | MN |                      | (MAG)  |         |  LMA  |
      +-+--+                      +---+----+         +---+---+
        |                             |                  |
      +-----------------------------------------------------------------
+
      |   [0] establish connection session to mobile network
|
      +-----------------------------------------------------------------
+
        |                             |                  |
        |                             |                  | Policy
update
        |                             |UPN(QoS option)[2]|
<-------------
        | ADDTS Reserve Request       |<-----------------|       [1]
        |        (TCLAS, TSPEC)[3]    |                  |
        |<----------------------------|                  |
        | ADDTS Reserve Response      |                  |
        |        (TCLAS, TSPEC)[4]    |                  |
        |---------------------------->|                  |
        |                             |UPA(QoS option)[5]|
        |                             |----------------->|
        |                             |                  |
```

Figure 4: Network initiated QoS setup with 802.11aa

[0] The MN sets up best effort connectivity session as described in Case A. This allows the MN to perform application level signaling and setup.

[1] The policy server sends a QoS reservation request to the LMA. This is usually sent in response to an application that requests the policy server for higher QoS for some of its flows.

The LMA reserves resources for the flow requested.

[2] LMA sends PMIP UPN (Update Notification) to the MAG with QoS parameters for the flow for which the LMA reserved resources in step [1]. In UPN, the operational code in QoS option is set to ALLOCATE and the Traffic Selector identifies the flow for QoS.

The LMA QoS parameters include Guaranteed-DL-Bit-Rate/Guaranteed-UL-Bit-Rate and Aggregate-Max-DL-Bit-Rate/Aggregate-Max-UL-Bit-Rate for the flow. In networks like

3GPP, the reserved bandwidth for flows are accounted separately from the non-reserved session bandwidth.

[3] If there are sufficient resources to satisfy the request, the AP/WLC (MAG) sends an ADDTS Reserve Request (802.11aa) specifying the QoS reserved for the traffic stream including TSPEC and TCLAS element mapped from PMIP QoS Traffic Selector to identify the flow.

PMIPv6 parameters are mapped to TCLAS (Table 1) and TSPEC (Table 3).

If there are insufficient resources at the AP/WLC, the MAG will not send and ADDTS message and will continue processing of step [5].

[4] MN accepts the QoS reserved in the network and replies with ADDTS Reserve Response.

[5] The MAG (AP/WLC) replies with UPA confirming the acceptance of QoS options and operational code set to RESPONSE. The AP/WLC police flows based on the new QoS.

If there are insufficient resources at the AP/WLC, the MAG sends a response with UPA status code set to CANNOT_MEET_QOS_SERVICE_REQUEST.

3.2.2. Network Initiated QoS Release

QoS resources reserved for a session are released on completion of the session. When the application session completes, the policy server, or the MN may signal for the release of resources. In this use case, the network initiates the release of QoS resources.

```
                             +---------+
      +----+                 | AP/WLC |          +--------+
      | MN |                 | (MAG)  |          |  LMA   |
      +-+--+                 +---+----+          +---+---+
        |                        |                   |
      +--------------------------------------------------------------+
      |         [0] Establishment of application session             |
      |              and reservation of QoS resources                |
      |                                                              |
      |                  ( Session in progress)                      |
      |                                                              |
      |               Release of application session                 |
      +--------------------------------------------------------------+
        |                        |                   | Policy update
        |                        |UPN(QoSx,DE-ALLOC)[2]<---------------
        |                        |<------------------|       [1]
        |                        |UPA(QoSx,RESPONSE)[3]
        |                        |------------------>|
        | DELTS Request          |                   |
        |       (TS INFO)[4]     |                   |
        |<-----------------------|                   |
        | DELTS Response         |                   |
        |       (TS INFO)[5]     |                   |
        |----------------------->|                   |
        |                        |                   |
```

Figure 6: Network initiated QoS resource release

[0] The MN establishes and reserves QoS resources as in use cases
A,
B or C.
When the application session terminates, the policy server
receives notification that the session has terminated.

[1] LMA receives a policy update indicating that QoS for flow
(QoSx)
should be released. The LMA releases local resources associated
with the flow.

[2] LMA sends a UPN with QoS options - Traffic Selector field
identifying the flow for which QoS resources are to be
released,
and operation code set to DE-ALLOCATE. No additional LMA QoS
parameters are sent.

[3] MAG replies with UPA confirming the acceptance and operation
code set to RESPONSE.

[4] AP/WLC (MAG) releases local QoS resources associated with the
flow. AP/WLC derives the corresponding 802.11 Traffic Stream
from the PMIPv6 Traffic Selector. The AP sends a DELTS Request

with TS INFO identifying the reservation.

[5] MN sends DELTS Response confirming release.

Since the MN has completed the session, it may send a DELTS to explicitly request release QoS resources at AP. If the AP and MN are 802.11aa capable, the release of resources may also be signaled to the MN.

4. Security Considerations

This document describes mapping of PMIP QoS parameters to IEEE 802.11 QoS parameters. No security concerns need to be addressed as a result of this mapping.

5. IANA Considerations

No IANA assignment of parameters are required.

6. Acknowledgements

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7. References

7.1. Normative References

[RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", BCP 14, RFC 2119, March 1997.

[RFC7222] Liebsch, et al., "Quality of Service Option for Proxy Mobile IPv6", draft-ietf-netext-pmip6-qos-11, Feb 2014.

[RFC 5226] Narten, T. and H. Alvestrand, "Guidelines for Writing an IANA Considerations Section in RFCs", BCP 26, RFC 5226, May 2008.

7.2. Informative References

[802.11-2012] 802.11-2012 - 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

[WMM 1.2.0]   Wi-Fi Multimedia Technical Specification (with WMM-Power Save and WMM-Admission Control) Version 1.2.0

[802.11aa]   Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specification, Amendment 2: MAC Enhancements for Robust Audio Video Streaming, IEEE 802.11aa-2012.

[GSMA-IR34]   Inter-Service Provider Backbone Guidelines 5.0, 22 December 2010

[TS23.402]   Architecture Enhancements for non-3GPP accesses(Release 12), 3GPP TS 23.402, V12.2.0 (2013-09).

[TS23.203]   Policy and Charging Control Architecture, Release 11, 3GPP TS 23.203, V11.2.0 (2011-06).

[RFC 2211]   Wroclawski, J., "Specification of the Controlled Load Quality of Service", RFC 2211, September 1997.

[RFC 2212]   Shenker, S., Partridge, C., and R. Guerin, "Specification of Guaranteed Quality of Service", RFC 2212, September 1997.

[RFC 2216]   Shenker, S., and J. Wroclawski, "Network Element QoS Control Service Specification Template", RFC 2216, September 1997.

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