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Quality of Service Parameters for Usage with Diameter
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Status of this Memo

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Abstract

This document defines a number of Quality of Service (QoS) parameters that can be reused for conveying QoS information within Diameter.

The defined QoS information includes data traffic parameters for describing a token bucket filter, bandwidth, defending and preemption

priority, admission priority, application-level resource priority, per-hop behavior class, and DiffServ-aware Multiprotocol Label Switching (MPLS) traffic engineering.

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1. Introduction

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This document defines a number of Quality of Service (QoS) parameters that can be reused for conveying QoS information within the Diameter protocol.
This document defines an initial QoS profile containing a set of QoS AVPs.

The traffic model (TMOD) AVPs are containers consisting of four AVPs and is a way to describe the traffic source.

- *rate (r)
- *bucket size (b)
- *peak rate (p)
- *minimum policed unit (m)

The encoding of <TMOD-1> and <TMOD-2> can be found in Section 3.1 (TMOD-1 AVP) and Section 3.2 (TMOD-2 AVP) and the semantic is described in [RFC2210] (Wroclawski, J., "The Use of RSVP with IETF Integrated Services," September 1997.) and in [RFC2215] (Shenker, S. and J. Wroclawski, "General Characterization Parameters for Integrated Service Network Elements," September 1997.). <TMOD-2> is, for example, needed by some DiffServ applications. It is typically assumed that DiffServ EF traffic is shaped at the ingress by a single rate token bucket. Therefore, a single TMOD parameter is sufficient to signal DiffServ EF traffic. However, for DiffServ AF traffic two sets of token bucket parameters are needed, one token bucket for the average traffic and one token bucket for the burst traffic. [RFC2697] (Heinanen, J. and R. Guerin, "A Single Rate Three Color Marker," September 1999.) defines a Single Rate Three Color Marker (srTCM), which meters a traffic stream and marks its packets according to three traffic parameters, Committed Information Rate (CIR), Committed Burst Size (CBS), and Excess Burst Size (EBS), to be either green, yellow, or red. A packet is marked green if it does not exceed the CBS, yellow if it does exceed the CBS, but not the EBS, and red otherwise. [RFC2697] (Heinanen, J. and R. Guerin, "A Single Rate Three Color Marker," September 1999.) defines specific procedures using two token buckets that run at the same rate. Therefore, two TMOD AVPs are sufficient to distinguish among three levels of drop precedence. An example is also described in the appendix of [RFC2597] (Heinanen, J., Baker, F., Weiss, W., and J. Wroclawski, "Assured Forwarding PHB Group," June 1999.).

The <Preemption-Priority> AVP refers to the priority of a new flow compared with the <Defending-Priority> AVP of previously admitted flows. Once a flow is admitted, the preemption priority becomes irrelevant. The <Defending-Priority> AVP is used to compare with the preemption priority of new flows. For any specific flow, its preemption priority is always less than or equal to the defending priority.

The <Admission-Priority> AVP and <ALRP> AVP provide an essential way to differentiate flows for emergency services, ETS, E911, etc., and assign them a higher admission priority than normal priority flows and best-effort priority flows.

Resource reservations might refer to a packet processing with a particular DiffServ per-hop behavior (PHB) [RFC2475] (Blake, S., Black, D., Carlson, M., Davies, E., Wang, Z., and W. Weiss, "An Architecture for Differentiated Services," December 1998.) (using the <PHB-Class> AVP) or to a particular QoS class, e.g., a DiffServ-aware MPLS traffic engineering (DSTE) class type, as described in [RFC3564] (Le Faucheur, F. and W. Lai, "Requirements for Support of Differentiated Services-aware MPLS Traffic Engineering," July 2003.) and in [RFC4124] (Le Faucheur, F., "Protocol Extensions for Support of Diffserv-aware MPLS Traffic Engineering," June 2005.), using the <DSTE-Class-Type> AVP.

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2. Terminology and Abbreviations

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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 RFC2119 [RFC2119] (Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels," March 1997.).

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3. QoS Parameter Encoding

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3.1. TMOD-1 AVP

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The TMOD-1 AVP is obtained from [RFC2210] (Wroclawski, J., "The Use of RSVP with IETF Integrated Services," September 1997.) and [RFC2215] (Shenker, S. and J. Wroclawski, "General Characterization Parameters for Integrated Service Network Elements," September 1997.). The structure of the AVP is as follows:

```
TMOD-1  ::= < AVP Header: TBD >
            { TMOD-Rate }
            { TMOD-Size }
            { Peak-Data-Rate }
            { Minimum-Policed-Unit }
```

3.1.1. TMOD-Rate AVP

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The TMOD-Rate AVP (AVP Code TBD) is of type Float32 and contains the rate (r).

3.1.2. TMOD-Size AVP

TOC

The TMOD-Size AVP (AVP Code TBD) is of type Float32 and contains the bucket size (b).

3.1.3. Peak-Data-Rate AVP

TOC

The Peak-Data-Rate AVP (AVP Code TBD) is of type Float32 and contains the peak rate (p).

3.1.4. Minimum-Policed-Unit AVP

TOC

The Minimum-Policed-Unit AVP (AVP Code TBD) is of type Unsigned32 and contains the minimum policed unit (m).

3.2. TMOD-2 AVP

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A description of the semantic of the parameter values can be found in [RFC2215] (Shenker, S. and J. Wroclawski, “General Characterization Parameters for Integrated Service Network Elements,” September 1997.). The TMOD-2 AVP is useful in a DiffServ environment. The coding for the TMOD-2 AVP is as follows:

```
TMOD-2  ::= < AVP Header: TBD >
            { TMOD-Rate }
            { TMOD-Size }
            { Peak-Data-Rate }
            { Minimum-Policed-Unit }
```

3.3. Bandwidth AVP

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The Bandwidth AVP (AVP Code TBD) is of type Float32 and is measured in bytes of IP datagrams per second.

3.4. Priority AVP

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The Priority AVP is a grouped AVP consisting of two AVPs, the Preemption-Priority and the Defending-Priority AVP. A description of the semantic can be found in [RFC3181] (Herzog, S., "Signaled Preemption Priority Policy Element," October 2001.).

```
Priority  ::= < AVP Header: TBD >
              { Preemption-Priority }
              { Defending-Priority }
```

3.4.1. Preemption-Priority AVP

TOC

The Preemption-Priority AVP (AVP Code TBD) is of type Unsigned32 and it indicates the priority of the new flow compared with the defending priority of previously admitted flows. Higher values represent higher priority.

3.4.2. Defending-Priority AVP

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The Defending-Priority AVP (AVP Code TBD) is of type Unsigned32. Once a flow is admitted, the preemption priority becomes irrelevant. Instead, its defending priority is used to compare with the preemption priority of new flows.

3.5. Admission-Priority AVP

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The Admission-Priority AVP (AVP Code TBD) is of type Unsigned32. The admission control priority of the flow, in terms of access to network bandwidth in order to provide higher probability of call completion to selected flows. Higher values represent higher priority. A given admission priority is encoded in this information element using the same value as when encoded in the Admission-Priority AVP defined in Section 3.1 of [I-D.ietf-tsvwg-emergency-rsvp] (Faucheur, F., Polk, J., and K. Carlberg, "Resource ReSerVation Protocol (RSVP) Extensions for Admission Priority," March 2010.) (Admission Priority parameter).

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3.6. ALRP AVP

The Application-Level Resource Priority (ALRP) AVP is a grouped AVP consisting of two AVPs, the ALRP-Namespace and the ALRP-Priority AVP. A description of the semantic of the parameter values can be found in [RFC4412] (Schulzrinne, H. and J. Polk, “Communications Resource Priority for the Session Initiation Protocol (SIP),” February 2006.) and in [I-D.ietf-tsvwg-emergency-rsvp] (Faucheur, F., Polk, J., and K. Carlberg, “Resource ReSerVation Protocol (RSVP) Extensions for Admission Priority,” March 2010.). The coding for parameter is as follows:

```
ALRP  ::= < AVP Header: TBD >
          { ALRP-Namespace }
          { ALRP-Priority }
```

3.6.1. ALRP-Namespace AVP

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The ALRP-Namespace AVP (AVP Code TBD) is of type Unsigned32.

3.6.2. ALRP-Priority AVP

TOC

The ALRP-Priority AVP (AVP Code TBD) is of type Unsigned32. [RFC4412] (Schulzrinne, H. and J. Polk, “Communications Resource Priority for the Session Initiation Protocol (SIP),” February 2006.) defines a resource priority header and established the initial registry. That registry was later extended by [I-D.ietf-tsvwg-emergency-rsvp] (Faucheur, F., Polk, J., and K. Carlberg, “Resource ReSerVation Protocol (RSVP) Extensions for Admission Priority,” March 2010.).

3.7. PHB-Class AVP

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The PHB-Class AVP (AVP Code TBD) is of type Unsigned32. A description of the semantic of the parameter values can be found in [RFC3140] (Black, D., Brim, S., Carpenter, B., and F. Le Faucheur, “Per Hop Behavior Identification Codes,” June 2001.). The registries needed for usage with [RFC3140] (Black, D., Brim, S., Carpenter, B., and F. Le Faucheur, “Per Hop Behavior Identification Codes,” June 2001.) already exist and hence no new registry needs to be created by this document.

The encoding requires three cases need to be differentiated. All bits indicated as "reserved" MUST be set to zero (0).

3.7.1. Case 1: Single PHB

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As prescribed in [RFC3140] (Black, D., Brim, S., Carpenter, B., and F. Le Faucheur, “Per Hop Behavior Identification Codes,” June 2001.), the encoding for a single PHB is the recommended DSCP value for that PHB, left-justified in the 16 bit field, with bits 6 through 15 set to zero.

```
 0                   1                   2                   3
 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
| DSCP      |0 0 0 0 0 0 0 0 0 0|            (Reserved)         |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

3.7.2. Case 2: Set of PHBs

TOC

The encoding for a set of PHBs is the numerically smallest of the set of encodings for the various PHBs in the set, with bit 14 set to 1. (Thus for the AF1x PHBs, the encoding is that of the AF11 PHB, with bit 14 set to 1.)

```
 0                   1                   2                   3
 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
| DSCP      |0 0 0 0 0 0 0 0 1 0|            (Reserved)         |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

3.7.3. Case 3: Experimental or Local Use PHBs

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PHBs not defined by standards action, i.e., experimental or local use PHBs as allowed by [RFC2474] (Nichols, K., Blake, S., Baker, F., and D. Black, “Definition of the Differentiated Services Field (DS Field) in the IPv4 and IPv6 Headers,” December 1998.). In this case an arbitrary 12 bit PHB identification code, assigned by the IANA, is placed left-justified in the 16 bit field. Bit 15 is set to 1, and bit 14 is zero for a single PHB or 1 for a set of PHBs. Bits 12 and 13 are zero. Bits 12 and 13 are reserved either for expansion of the PHB identification code, or for other use, at some point in the future.

In both cases, when a single PHBID is used to identify a set of PHBs (i.e., bit 14 is set to 1), that set of PHBs MUST constitute a PHB Scheduling Class (i.e., use of PHBs from the set MUST NOT cause intra-microflow traffic reordering when different PHBs from the set are applied to traffic in the same microflow). The set of AF1x PHBs [RFC2597] (Heinanen, J., Baker, F., Weiss, W., and J. Wroclawski, “Assured Forwarding PHB Group,” June 1999.) is an example of a PHB Scheduling Class. Sets of PHBs that do not constitute a PHB Scheduling Class can be identified by using more than one PHBID.

```
 0                   1                   2                   3
 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|      PHD ID CODE      |0 0 1 0|            (Reserved)         |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

3.8. DSTE-Class-Type AVP

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The DSTE-Class-Type AVP (AVP Code TBD) is of type Unsigned32. A description of the semantic of the parameter values can be found in [RFC4124] (Le Faucheur, F., “Protocol Extensions for Support of Diffserv-aware MPLS Traffic Engineering,” June 2005.). Currently, the values of alues currently allowed are 1, 2, 3, 4, 5, 6, 7. The value of zero (0) is marked as reserved in [RFC4124] (Le Faucheur, F., “Protocol Extensions for Support of Diffserv-aware MPLS Traffic Engineering,” June 2005.). Furthermore, the CLASSTYPE attribute in [RFC4124] (Le Faucheur, F., “Protocol Extensions for Support of Diffserv-aware MPLS Traffic Engineering,” June 2005.) is 32 bits in length with 29 bits reserved.

4. Extensibility

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This document is designed with extensibility in mind given that different organizations and groups are used to define their own Quality of Service parameters. This document provides an initial QoS profile with common set of parameters. Ideally, these parameters should be used whenever possible but there are cases where additional parameters might be needed, or where the parameters specified in this document are used with a different semantic. In that case it is advisable to define a new QoS profile that may consist of new parameters in addition to parameters defined in this document or an entirely different set of parameters. Finally, it is also possible to register a specific QoS profile that defines a specific set of QoS values rather than parameters that need to be filled with values in order to be used. To enable the definition of new QoS profiles a 8 octet registry is defined field that is represented by a 4-octet vendor and 4-octet specifier field. The vendor field indicates the type as either standards-specified or vendor-specific. If the four octets of the vendor field are 0x00000000, then the value is standards-specified and the registry is maintained by IANA as Enterprise Numbers defined in [RFC2578] (McCloghrie, K., Ed., Perkins, D., Ed., and J. Schoenwaelder, Ed., “Structure of Management Information Version 2 (SMIv2),” April 1999.), and any other value represents a vendor-specific Object Identifier (OID). IANA created registry is split into two value ranges; one range uses the "Standards Action" and the second range uses "Specification Required" allocation policy. The latter range is meant to be used by organizations outside the IETF.

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5. IANA Considerations

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5.1. AVP Codes

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IANA is requested to allocate AVP codes for the following AVPs that are defined in this document.

AVP Name	AVP Code	Section Defined	Data Type
TMOD-1	TBD	3.1	Grouped
TMOD-Rate	TBD	3.1.1	Float32
TMOD-Size	TBD	3.1.2	Float32
Peak-Data-Rate	TBD	3.1.3	Float32
Minimum-Policed-Unit	TBD	3.1.4	Unsigned32
TMOD-2	TBD	3.2	Grouped
Bandwidth	TBD	3.3	Float32
Priority	TBD	3.4	Grouped
Preemption-Priority	TBD	3.4.1	Unsigned32
Defending-Priority	TBD	3.4.2	Unsigned32
Admission-Priority	TBD	3.5	Unsigned32
ALRP	TBD	3.6	Grouped
ALRP-Namespace	TBD	3.6.1	Unsigned32
ALRP-Priority	TBD	3.6.2	Unsigned32
PHB-Class	TBD	3.7	Unsigned32
DSTE-Class-Type	TBD	3.8	Unsigned32

5.2. QoS Profile

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IANA is requested to create the following registry.
The QoS Profile refers to a 64 bit long field that is represented by a 4-octet vendor and 4-octet specifier field. The vendor field indicates the type as either standards-specified or vendor-specific. If the four octets of the vendor field are 0x00000000, then the value is standards-specified and the registry is maintained by IANA, and any other value represents a vendor-specific Object Identifier (OID).
The specifier field indicates the actual QoS profile. The vendor field 0x00000000 is reserved to indicate that the values in the specifier field are maintained by IANA. This document requests IANA to create such a registry and to allocate the value zero (0) for the QoS profile defined in this document.
For any other vendor field, the specifier field is maintained by the vendor.
For the IANA maintained QoS profiles the following allocation policy is defined:

> 0 to 511: Standards Action
>
> 512 to 4095: Specification Required

Standards action is required to depreciate, delete, or modify existing QoS profile values in the range of 0-511 and a specification is required to depreciate, delete, or modify existing QoS profile values in the range of 512-4095.

6. Security Considerations

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This document does not raise any security concerns as it only defines QoS parameters and does not yet describe how they are exchanged in a AAA protocol. Security considerations are described in documents using this specification.

7. Acknowledgements

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The authors would like to thank the NSIS QSPEC [I-D.ietf-nsis-qspec] (Bader, A., Kappler, C., and D. Oran, “QoS NSLP QSPEC Template,” January 2010.) authors (Cornelia Kappler, Jerry Ash, Attila Bader, Dave Oran), the NSIS working group chairs (John Loughney and Martin Stiemerling) and the former Transport Area Directors (Allison Mankin, Jon Peterson) for their help. The authors of this document are thankful for the suggestions and input received from the NSIS QSPEC [I-D.ietf-nsis-qspec] (Bader, A., Kappler, C., and D. Oran, “QoS NSLP QSPEC Template,” January 2010.) authors.
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8. References

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8.1. Normative References

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[RFC2210]	Wroclawski, J., "The Use of RSVP with IETF Integrated Services," RFC 2210, September 1997 (TXT, HTML, XML).
[RFC2215]	Shenker, S. and J. Wroclawski, "General Characterization Parameters for Integrated Service Network Elements," RFC 2215, September 1997 (TXT, HTML, XML).
[RFC2474]	Nichols, K., Blake, S., Baker, F., and D. Black, "Definition of the Differentiated Services Field (DS Field) in the IPv4 and IPv6 Headers," RFC 2474, December 1998 (TXT, HTML, XML).
[RFC2578]	McCloghrie, K., Ed., Perkins, D., Ed., and J. Schoenwaelder, Ed., "Structure of Management Information Version 2 (SMIv2)," STD 58, RFC 2578, April 1999 (TXT).
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[RFC4124]	Le Faucheur, F., "Protocol Extensions for Support of Diffserv-aware MPLS Traffic Engineering," RFC 4124, June 2005 (TXT).
[RFC4412]	Schulzrinne, H. and J. Polk, "Communications Resource Priority for the Session Initiation Protocol (SIP)," RFC 4412, February 2006 (TXT).

8.2. Informative References

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[RFC2475]	

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