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Quality of Service Parameters for Usage with Diameter

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, a bandwidth parameter, and a per-hop behavior class object.

Status of This Memo

This document specifies an Internet standards track protocol for the Internet community, and requests discussion and suggestions for improvements. Please refer to the current edition of the "Internet Official Protocol Standards" (STD 1) for the standardization state and status of this protocol. Distribution of this memo is unlimited.

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1. Introduction

This document defines a number of Quality of Service (QoS) parameters that can be reused for conveying QoS information within the Diameter protocol [RFC3588]. The current set of QoS parameters defined in this document are a core subset determined to be useful for a wide range of applications. Additional parameters may be defined in future documents as the need arises and are for future study. The parameters are defined as Diameter-encoded Attribute Value Pairs (AVPs), which are described using a modified version of the Augmented Backus-Naur Form (ABNF), see [RFC3588]. The data types are also taken from [RFC3588].

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

- o token rate (r)
- o bucket depth (b)
- o peak traffic rate (p)

- o minimum policed unit (m)
- o maximum packet size (M)

The encoding of the <TMOD-1> and the <TMOD-2> AVPs can be found in Sections 3.1 and 3.2. The semantics of these two AVPs are described in Section 3.1 of [RFC2210] and in Section 3.6 of [RFC2215].

The <TMOD-2> AVP is, for example, needed by some DiffServ applications.

It is typically assumed that DiffServ expedited forwarding (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 assured forwarding (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] 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] 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].

Resource reservations might refer to a packet processor with a particular DiffServ per-hop behavior (PHB) (using the <PHB-Class> AVP). A generic description of the DiffServ architecture can be found in [RFC2475], and the Differentiated Services Field is described in Section 3 of [RFC2474]. Updated terminology can be found in [RFC3260]. Standardized per-hop behavior is, for example, described in [RFC2597] ("Assured Forwarding PHB Group") and in [RFC3246] ("An Expedited Forwarding PHB").

The above-mentioned parameters are intended to support basic integrated and differentiated services functionality in the network. Additional parameters can be defined and standardized if required to support specific services in the future.

2. Terminology and Abbreviations

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].

3. QoS Parameter Encoding

3.1. TMOD-1 AVP

The TMOD-1 AVP is obtained from [RFC2210] and [RFC2215]. The structure of the AVP is as follows:

```
TMOD-1 ::= < AVP Header: 495 >
          { Token-Rate }
          { Bucket-Depth }
          { Peak-Traffic-Rate }
          { Minimum-Policed-Unit }
          { Maximum-Packet-Size }
```

3.1.1. Token-Rate AVP

The Token-Rate AVP (AVP Code 496) is of type Float32.

3.1.2. Bucket-Depth AVP

The Bucket-Depth AVP (AVP Code 497) is of type Float32.

3.1.3. Peak-Traffic-Rate AVP

The Peak-Traffic-Rate AVP (AVP Code 498) is of type Float32.

3.1.4. Minimum-Policed-Unit AVP

The Minimum-Policed-Unit AVP (AVP Code 499) is of type Unsigned32.

3.1.5. Maximum-Packet-Size AVP

The Maximum-Packet-Size AVP (AVP Code 500) is of type Unsigned32.

3.2. TMOD-2 AVP

A description of the semantics of the parameter values can be found in [RFC2215]. The coding for the TMOD-2 AVP is as follows:

```
TMOD-2 ::= < AVP Header: 501 >
          { Token-Rate }
          { Bucket-Depth }
          { Peak-Traffic-Rate }
          { Minimum-Policed-Unit }
          { Maximum-Packet-Size }
```

3.3. Bandwidth AVP

The Bandwidth AVP (AVP Code 502) is of type Float32 and is measured in octets of IP datagrams per second. The Bandwidth AVP represents a simplified description of the following TMOD setting whereby the token rate (r) = peak traffic rate (p), the bucket depth (b) = large, and the minimum policed unit (m) = large when only bandwidth has to be expressed.

3.4. PHB-Class AVP

The PHB-Class AVP (AVP Code 503) is of type Unsigned32.

A description of the semantics of the parameter values can be found in [RFC3140]. The registries needed for usage with [RFC3140] already exist and hence a new registry is not required for this purpose. The encoding requires that three cases be differentiated. All bits indicated as "reserved" MUST be set to zero (0).

3.4.1. Case 1: Single PHB

As prescribed in [RFC3140], the encoding for a single PHB is the recommended Differentiated Services Code Point (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)          |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+

```

3.4.2. Case 2: Set of PHBs

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)          |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+

```

3.4.3. Case 3: Experimental or Local Use PHBs

PHBs may not be defined by standards actions i.e., experimental or local use PHBs as allowed by [RFC2474]. In this case, an arbitrary 12-bit PHB identification code, assigned by the IANA, is 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, future use.

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] 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)           |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+

```

4. Extensibility

This document is designed with extensibility in mind, given that different organizations and groups are used to defining their own Quality of Service parameters. This document provides an initial QoS profile with a 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 different semantics. 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, an 8-octet registry is defined as a field that is represented by 4-octet vendor and 4-octet specifier fields. The vendor field contains an Enterprise Number as defined in [RFC2578], taken from the values maintained in the IANA Enterprise Numbers registry. If the four octets of the vendor field

are 0x00000000 (reserved value for IANA), then the value in the specifier field MUST be registered with IANA (see Section 5.2). If the vendor field is other than 0x00000000, the value of the specifier field represents a vendor-specific value, where allocation is the responsibility of the enterprise indicated in the vendor field.

5. IANA Considerations

5.1. AVP Codes

IANA allocated AVP codes in the IANA-controlled namespace registry specified in Section 11.1.1 of [RFC3588] for the following AVPs that are defined in this document.

AVP Name	AVP Code	Section Defined	Data Type
TMOD-1	495	3.1	Grouped
Token-Rate	496	3.1.1	Float32
Bucket-Depth	497	3.1.2	Float32
Peak-Traffic-Rate	498	3.1.3	Float32
Minimum-Policed-Unit	499	3.1.4	Unsigned32
Maximum-Packet-Size	500	3.1.5	Unsigned32
TMOD-2	501	3.2	Grouped
Bandwidth	502	3.3	Float32
PHB-Class	503	3.4	Unsigned32

5.2. QoS Profile

The QoS profile refers to a 64-bit field that is represented by 4-octet vendor and 4-octet specifier fields. 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 a registry will be created to maintain the QoS profile specifier values. The specifier field indicates the actual QoS profile. Depending on the value requested, the action needed to request a new value is:

0 to 511: Standards Action

512 to 32767: Specification Required

32768 to 4294967295: Reserved

Standards action is required to add, depreciate, delete, or modify QoS profile values in the range of 0-511, and a specification is required to add, depreciate, delete, or modify existing QoS profile values in the range of 512-32767.

IANA created such a registry and allocated the value zero (0) for the QoS profile defined in this document.

Alternative vendor-specific QoS profiles can be created and identified with an Enterprise Number taken from the IANA registry created by [RFC2578] in the vendor field, combined with a vendor-specific value in the specifier field. Allocation of the specifier values is the responsibility of the vendor.

6. Security Considerations

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

7. Acknowledgements

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Appendix A. ABNF Code Fragment

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```
TMOD-1 ::= < AVP Header: 495 >
        { Token-Rate }
        { Bucket-Depth }
        { Peak-Traffic-Rate }
        { Minimum-Policed-Unit }
        { Maximum-Packet-Size }
```

```
TMOD-2 ::= < AVP Header: 501 >
        { Token-Rate }
        { Bucket-Depth }
        { Peak-Traffic-Rate }
        { Minimum-Policed-Unit }
        { Maximum-Packet-Size }
```

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