                     A Two Rate Three Color Marker

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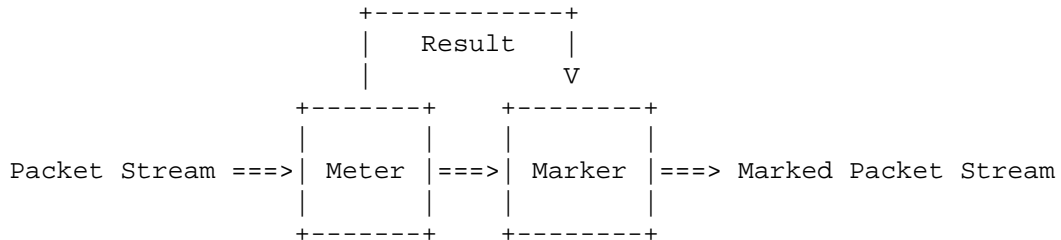Abstract

   This document defines a Two Rate Three Color Marker (trTCM), which
   can be used as a component in a Diffserv traffic conditioner
   [RFC2475, RFC2474]. The trTCM meters an IP packet stream and marks
   its packets based on two rates, Peak Information Rate (PIR) and
   Committed Information Rate (CIR), and their associated burst sizes to
   be either green, yellow, or red. A packet is marked red if it
   exceeds the PIR. Otherwise it is marked either yellow or green
   depending on whether it exceeds or doesn't exceed the CIR.

1. Introduction

   The Two Rate Three Color Marker (trTCM) meters an IP packet stream
   and marks its packets either green, yellow, or red. A packet is
   marked red if it exceeds the Peak Information Rate (PIR). Otherwise
   it is marked either yellow or green depending on whether it exceeds
   or doesn't exceed the Committed Information Rate (CIR). The trTCM is
   useful, for example, for ingress policing of a service, where a peak
   rate needs to be enforced separately from a committed rate.

The Meter meters each packet and passes the packet and the metering
result to the Marker:

```
                     +------------+
                     |   Result   |
                     |            V
           +-------+     +--------+
           |       |     |        |
  Packet Stream ===>| Meter |===>| Marker |===> Marked Packet Stream
           |       |     |        |
           +-------+     +--------+
```

The Meter operates in one of two modes. In the Color-Blind mode, the
Meter assumes that the packet stream is uncolored. In the Color-
Aware mode the Meter assumes that some preceding entity has pre-
colored the incoming packet stream so that each packet is either
green, yellow, or red. The details of the pre-coloring process,
including handling of error scenarios, and how the Meter determines
the color of a pre-colored packet are DS domain specific and outside
the scope of this document.

The Marker (re)colors an IP packet according to the results of the
Meter. The color is coded in the DS field [RFC2474] of the packet in
a PHB specific manner (see section 4 for an example).

A companion document [RFC2697] describes another three color marker,
called a Single Rate Three Color Maker (srTCM), where packets are
marked based on a single rate and two burst sizes.

2. Configuration

   The trTCM is configured by setting its mode and by assigning values
   to four traffic parameters: a Peak Information Rate (PIR) and its
   associated Peak Burst Size (PBS) and a Committed Information Rate
   (CIR) and its associated Committed Burst Size (CBS).

   The PIR and CIR are measured in bytes of IP packets per second, i.e.,
   it includes the IP header, but not link specific headers. The PIR
   must be equal to or greater than the CIR.

   The PBS and the CBS and are measured in bytes and both of them must
   be configured to be greater than 0. It is recommended that they be
   configured to be equal to or greater than the size of the largest
   possible IP packet in the stream.

3. Metering

   The behavior of the Meter is specified in terms of its mode and two
   token buckets, P and C, with rates PIR and CIR, respectively. The
   maximum size of the token bucket P is PBS and the maximum size of the
   token bucket C is CBS.

   The token buckets P and C are initially (at time 0) full, i.e., the
   token count Tp(0) = PBS and the token count Tc(0) = CBS. Thereafter,
   the token count Tp is incremented by one PIR times per second up to
   PBS and the token count Tc is incremented by one CIR times per second
   up to CBS.

   When a packet of size B bytes arrives at time t, the following
   happens if the trTCM is configured to operate in the Color-Blind
   mode:

      o If Tp(t)-B < 0, the packet is red, else

      o if Tc(t)-B < 0, the packet is yellow and Tp is decremented by B,
        else

      o the packet is green and both Tp and Tc are decremented by B.

   When a packet of size B bytes arrives at time t, the following
   happens if the trTCM is configured to operate in the Color-Aware
   mode:

      o If the packet has been precolored as red or if Tp(t)-B < 0, the
        packet is red, else

      o if the packet has been precolored as yellow or if Tc(t)-B < 0,
        the packet is yellow and Tp is decremented by B, else

      o the packet is green and both Tp and Tc are decremented by B.

   The actual implementation of a Meter doesn't need to be modeled
   according to the above formal specification.

4. Marking

   The Marker reflects the metering result by setting the DS field of
   the packet to a particular codepoint. In case of the AF PHB
   [RFC2597], the color can be coded as the drop precedence of the
   packet.

5. Service Example

   The trTCM can be used to mark a IP packet stream in a service, where
   different, decreasing levels of assurances (either absolute or
   relative) are given to packets which are green, yellow, or red. For
   example, a service may discard all red packets, because they exceeded
   the peak rate, forward yellow packets as best effort, and forward
   green packets with a low drop probability.

6. Security Considerations

   The trTCM has no known security concerns.

7. References

   [RFC2697] Heinanen, J. and R. Guerin, "A Single Rate Three Color
             Marker", RFC 2697, September 1999.

   [RFC2597] Heinanen, J., Baker, F., Weiss, W. and J. Wroclawski,
             "Assured Forwarding PHB Group", RFC 2597, June 1999.

   [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.

   [RFC2475]   Blake, S., Black, D., Carlson, M., Davies, E., Wang, Z
             and W. Weiss, "An Architecture for Differentiated
             Services", RFC 2475, December 1998.

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Acknowledgement