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## A Single Rate Three Color Marker

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### Abstract

This document defines a Single Rate Three Color Marker (srTCM), which can be used as component in a Diffserv traffic conditioner [RFC2475, RFC2474]. The srTCM 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 doesn't exceed the CBS, yellow if it does exceed the CBS, but not the EBS, and red otherwise.

### 1. Introduction

The Single Rate Three Color Marker (srTCM) meters an IP packet stream and marks its packets either green, yellow, or red. Marking is based on a Committed Information Rate (CIR) and two associated burst sizes, a Committed Burst Size (CBS) and an Excess Burst Size (EBS). A packet is marked green if it doesn't exceed the CBS, yellow if it does exceed the CBS, but not the EBS, and red otherwise. The srTCM is useful, for example, for ingress policing of a service, where only the length, not the peakrate, of the burst determines service eligibility.



### 3. Metering

The behavior of the Meter is specified in terms of its mode and two token buckets, C and E, which both share the common rate CIR. The maximum size of the token bucket C is CBS and the maximum size of the token bucket E is EBS.

The token buckets C and E are initially (at time 0) full, i.e., the token count  $Tc(0) = CBS$  and the token count  $Te(0) = EBS$ . Thereafter, the token counts Tc and Te are updated CIR times per second as follows:

- o If Tc is less than CBS, Tc is incremented by one, else
- o if Te is less than EBS, Te is incremented by one, else
- o neither Tc nor Te is incremented.

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

- o If  $Tc(t) - B \geq 0$ , the packet is green and Tc is decremented by B down to the minimum value of 0, else
- o if  $Te(t) - B \geq 0$ , the packet is yellow and Te is decremented by B down to the minimum value of 0, else
- o the packet is red and neither Tc nor Te is decremented.

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

- o If the packet has been precolored as green and  $Tc(t) - B \geq 0$ , the packet is green and Tc is decremented by B down to the minimum value of 0, else
- o If the packet has been precolored as green or yellow and if  $Te(t) - B \geq 0$ , the packet is yellow and Te is decremented by B down to the minimum value of 0, else
- o the packet is red and neither Tc nor Te is decremented.

Note that according to the above rules, marking of a packet with a given color requires that there be enough tokens of that color to accommodate the entire packet. Other marking policies are clearly possible. The above policy was chosen in order to guarantee a

deterministic behavior where the volume of green packets is never smaller than what has been determined by the CIR and CBS, i.e., tokens of a given color are always spent on packets of that color.

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 srTCM can be used to mark a 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 both the committed and excess burst sizes, forward yellow packets as best effort, and forward green packets with a low drop probability.

#### 6. Security Considerations

The srTCM has no known security concerns.

#### 7. References

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- [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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