Application Loss Pattern Metrics

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Abstract

Using the one-way loss pattern metrics defined in RFC 3357, this document defines two new metrics Type-P-One-Way-Complete-Frame-Loss and Type-P-One-Way-Partial-Frame-Received to provide a better
understanding of the affects of packet loss at the application level. The statistic Type-P-One-Way-Errored-Seconds is derived from the above metrics to compute the affect of packet loss at the application level.

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1. Introduction

RFC 2680 defines a one-way packet loss metric across Internet paths. RFC 3357 uses the base loss metric defined in RFC 2680 and defines two derived metrics "loss distance" and "loss period", and the associated statistics that together capture the loss patterns experienced by packet streams on the Internet. These metrics have proved to be very useful in understanding the performance of various real-time applications such as packet voice and video when delivered over the Internet.

However, for many real-time applications the loss patterns that are more salient to the user experience are losses that an application sees rather than the more basic packet level loss. For example, in a video conferencing application, the loss of a given IP packet...
carrying video affects one or more video frames at the application level. Understanding the effects of the loss at the application level provides the framework to talk about user experience both for end-users and operators. As such, this draft extends the loss pattern metrics defined in RFC 3357 to the application level.

2. 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 [RFC2119].

3. Motivation

In typical IPTV applications, the payload format specified in [RFC2250] for MPEG1/MPEG2 Video is used. The MPEG Transport stream is encapsulated within the RTP payload. The RTP payload contains an integral number of MPEG2 transport packets. Each transport packet is 188 bytes in size. Multiple transport packets from various elementary streams such as audio, video, and data are combined in the transport stream and carried within a single RTP packet. The packet loss metrics defined in [RFC3357] provide the mechanism to understand the loss at the RTP level. However, from the user perspective it is more meaningful to understand for example how the loss affects a video frame.

In video conferencing applications that use RTP as the transport protocol, a video frame may have to be broken into smaller units to fit into the RTP payload. The last unit of the frame is identified using a frame marker bit. The metrics in [RFC3357] again provide loss pattern information for the RTP packets, but from the application perspective it is more useful to know how the loss of a single packet affects a video frame.

The new metrics defined in this draft extend the [RFC3357] metrics to the application space so that there is a better understanding at the application level on the impacts of packet loss at lower levels.

4. Frame Metrics

4.1 Metric Names
4.1.1 Type-P-One-Way-Complete-Frame-Loss
4.1.2 Type-P-One-Way-Partial-Frame-Received

4.2 Metric Parameters

+ Src, the IP address of a host
+ Dst, the IP address of a host
+ Ts, a start time
+ Te, an end time

4.3 Metric Units

The value of a Type-P-One-Way-Complete-Frame-Loss is either a zero (signifying the some or all of the frame was received) or one (signifying loss). The value of a Type-P-One-Way-Partial-Frame-Received is one (signifying that a partial frame was received) or zero (signifying a complete frame was received).

4.4 Definitions

The *Type-P-One-Way-Complete-Frame-Loss* from Src to Dst between times Ts and Te is 0 means the Src sent the first bits of all the Type-P packets that belong to the frame to Dst between times Ts and Te, and that the Dst received all the packets.

The *Type-P-One-Way-Partial-Frame-Received* from Src to Dst between times Ts and Te is 1 means that the Src sent the first bits of all the Type-P packets that belong to the frame to Dst between times Ts and Te, and the Dst received at least one but not all of the packets.

5. Stream Metrics

The following metrics and the derived statistics are an extension of the packet level metrics defined in [RFC3357] to media frames at the application level.

5.1 Metric Names

5.1.1 Type-P-One-Way-Media-Loss-Distance-Stream

5.1.2 Type-P-One-Way-Media-Loss-Period-Stream

5.2 Metric Parameters

+ Src, the IP address of a host
+ Dst, the IP address of a host
+ Ts, a start time
5.3 Metric Units

5.3.1 Type-P-One-Way-Media-Loss-Distance-Stream

A sequence of pairs of the form <media loss distance, media loss>, where media loss is derived from Type-P-One-Way-Complete-Frame-Loss and Type-P-One-Way-Partial-Frame-Received and loss distance is either zero or a positive integer.

5.3.2 Type-P-One-Way-Media-Loss-Period-Stream

A sequence of pairs of the form <media loss period, media loss> where media loss is derived from Type-P-One-Way-Complete-Frame-Loss and Type-P-One-Way-Partial-Frame-Received and loss period is an integer.

6. Statistics

6.1 Type-P-One-Way-Media-Loss-Noticeable-Rate

A media frame loss is defined as ‘noticeable’ if the distance between the lost frame and the previously lost frame is no greater than delta, a positive integer, where delta is the "loss constraint".

6.2 Type-P-One-Way-Media-Loss-Period-Total

This represents the total number of media loss periods, and can be derived from the Type-P-One-Way-Media-Loss-Period-Stream. This is given by the maximum value of the first entry of the set of pairs, <media loss period, media loss>, representing the media loss metric Type-P-One-Way-Media-Loss-Period-Stream.

6.3 Type-P-One-Way-Media-Loss-Period-Lengths

This statistic is a sequence of pairs <media loss periods, length>, with the media loss period entry ranging from 1 to Type-P-One-Way-Media-Loss-Period-Total.

6.4 Type-P-One-Way-Errored-Media-Seconds

This metric is directly devied from Type-P-One-Way-Complete-Frame-Loss and Type-P-One-Way-Partial-Frame-Received as the number of errored seconds over a given period of time. It is computed by
determining for each frame in the time period, if the frame was completely lost, or partially lost, or not lost at all. For each of the frames that are either completely or partially lost, the amount of time that the loss is spread out is computed and added to determine Type-P-One-Way-Errored-Seconds.

7. Security Considerations

The security considerations of [RFC2680] and [RFC3357] apply.

8. IANA Considerations

Since this document does not define a specific protocol, nor does it define any well-known values, there are no IANA considerations for this document.

9. Normative References


10. Informative References


Authors’ Addresses

Nagarjuna Venna
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