



# **Advanced Emulation Techniques For MPEG & Other Video Applications**

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## **Overview**

As video applications become more prevalent in the network, there are new testing requirements that mandate that applications be tested and analyzed in real network conditions. The PacketStorm1800E, PacketStorm2600E, Hurricane, and Hurricane II emulators have the following features to address video application testing: Media Delivery Index (MDI) measurements, Packet Accumulate & Burst impairment, Delete Data impairment, MPEG2 TS filter, and MPEG2 PDR modifier.

## **MPEG Background**

MPEG (Moving Picture Experts Group) is a standard for coding of moving pictures and associated audio. MPEG's basic scheme is to predict motion on a frame to frame basis. When MPEG is transported over IP, every IP packet contains seven MPEG frames. Most likely the seven MPEG frames are of different MPEG streams. There are three types of MPEG frames: I (intra), P (predicted), and B (bidirectional). An "I frame" is used as the starting frame and contains a frame coded as a still image. A "P frame" is predicted from the most recently reconstructed I or P frame. A "B frame" is predicted from the closest two I or P frames, one in the past and one in the future. In the US and Japan, consecutive I frames are separated by 12 frames.

## **MDI Measurements**

Per the IETF RFC4445, MDI (Media Delivery Index) measurement can be used as a diagnostic tool or a quality indicator for monitoring a network intended to deliver applications such as streaming media, MPEG video, Voice over IP, or other information sensitive to arrival time and packet loss. MDI is used for subjective and objective evaluations of perceived media quality.

PacketStorm emulators have two MDI measurements: Delayed Factor (DF) and Media Loss Rate (MLR). DF is a measurement for the required buffer size to accommodate the inter arrival variances of packets. MLR provides the percentage of transport packets being dropped or out of order. The combination of DF and MLR values provides the MDI measurement.

MDI measurements are contained in the Packet Tap function. The user defines the video stream's media rate and the Packet Tap will measure, log, and plot DF and MLR measurements in real time.

## Packet Accumulate & Burst Impairment

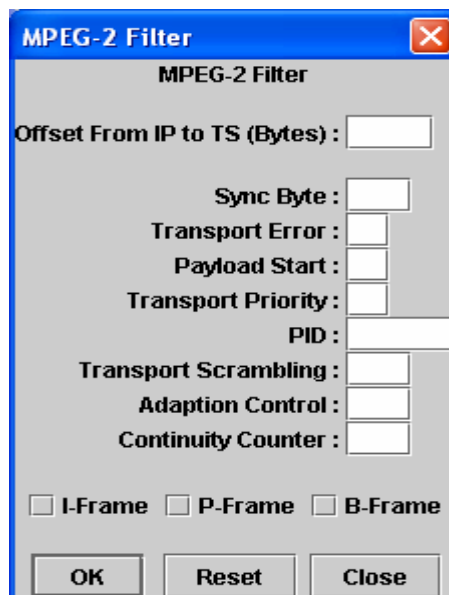
When a router becomes heavily loaded with incoming packets, the router gets congested and the result is that the packets get backed up in queues. Depending on service levels and router priorities, the typical outcome is that packets are sent out a congested router in bursts. Packet Accumulate & Burst (PAB) impairment emulates the burst conditions caused by congested routers. PAB collects a user specified number of incoming packets and releases them all at once as a burst. In addition, PAB can be specified with a minimum time value between bursts. Video streams are greatly affected by bursts because the bursts stress the optimization of the video receiver jitter buffers.

## Data Delete Impairment

The Data Delete impairment allows the user to delete a number of bytes in the payload. The user can decide to recalculate valid checksums or not. Data Delete is an important feature for video testing because the user can drop a single or more MPEG frames in an IP packet instead of dropping the entire packet. Dropping an IP packet would drop seven MPEG frames.

## MPEG-2 TS Filter

The MPEG-2 TS (Transport Stream) Filter is an option that allows the user to filter traffic for impairments by characteristics in the video stream. Specifically it allows the user to isolate traffic based on any of the fields contained in the MPEG-2 transport stream header, and/or I,P or B designation in the elementary stream packet. The filter has a user specified offset to match MPEG frames that utilize and don't utilize RTP. In addition, there is a feature to delete the I-Frame or replace it with a null value.



MPEG-2 Filter

Offset From IP to TS (Bytes) :

Sync Byte :

Transport Error :

Payload Start :

Transport Priority :

PID :

Transport Scrambling :

Adaption Control :

Continuity Counter :

I-Frame  P-Frame  B-Frame

OK Reset Close

## **MPEG-2 PCR Modifier**

The MPEG video source generates a 27 MHz program clock reference and must be reconstructed exactly at the receiver to assure proper regeneration of video. Too much variation between when the PCR (Program Clock Reference) was intended to arrive and when it did arrive will affect the video output quality.

The MPEG-2 PCR Modifier alters the PCR by adding a drift component based on one of three functions to stress the phase locked loop recovery capability of the MPEG receiver. The three functions are: linear, quadratic polynomial, and sinusoidal.

## **Summary**

This white paper illustrates the specific features that are targeted at video applications. These advanced functions stress and measure video applications to accurately emulate real world performance. Besides the fore mentioned video features, the core set of impairments, modifiers, advanced filtering, dynamic emulation, and multiple routing modes are some of the other attributes required to fully stress video applications.

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## **About PacketStorm Communications**

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PacketStorm Communications, Inc. develops IP Network Emulators that allow users to emulate various IP Network conditions. By developing proprietary hardware and software, PacketStorm has created emulators that can be used to extensively test networking applications that are available today as well as future technologies that have yet to be deployed

PacketStorm is a privately held company founded in 1998 by a team of engineers and managers from the prestigious Bell Laboratories. With extensive backgrounds and experience in both network development and testing, PacketStorm continues to focus on the needs of IP developers and network managers. PacketStorm's world headquarters in New Jersey handles product engineering, marketing, and customer support.

### **Headquarters**

PacketStorm Communications, Inc.  
20 Meridian Road  
Eatontown, New Jersey 07724  
Phone: (732) 544-2434  
Fax: (732) 544-2437

### **Website**

[www.PacketStorm.com](http://www.PacketStorm.com)