MediaWindow™ - MPEG Traffic Flow in a Single View

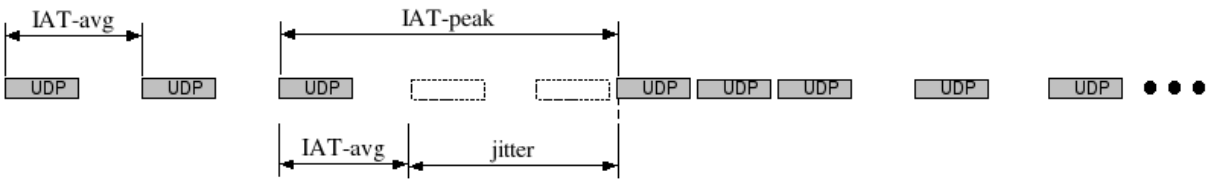
When transporting MPEG data in an IP network, two parameters in particular should be monitored closely: packet loss and packet jitter. If there is no packet loss and packets are transmitted in a reasonably even pace through the network, the signal may be received without transmission errors. This means that the transmission is completely transparent with respect to signal quality. If however packet loss or excessive packet jitter occurs, the result will most likely be signal impairments noticeable to the end user, e.g. in the form of picture blocking.

This paper describes how current and historical packet loss and packet jitter measurements may be represented in a single dynamic view, for maximum network monitoring confidence. The principle of operation of the Bridgetech patented MediaWindow is described, as well as Bridgetech's practical implementation.

Introduction

Packet loss can be estimated by checking the continuity counters of MPEG transport stream packet headers. Packet loss may be specified as the number of packets lost during a fixed period of one second - the MPEG Loss Rate (MLR).

Packet jitter can be detected by checking the spacing between packets. To avoid the need for specifying stream bit-rate, the maximum Inter-packet Arrival Time (IAT) may be used as a measure of packet jitter (and the buffer size needed for signal reception), even if it is strictly the sum of the average IAT and the jitter. The maximum IAT as a measure of jitter is also applicable for variable bitrate streams.



To provide the best possible overview of network performance over time, packet loss and packet jitter measurements should be displayed simultaneously in a single, intuitive graphical view, indicating both current and historical status.

MediaWindow - Principle of Operation

A graphical user interface should convey important data immediately. Based on user-defined thresholds that divide measurements into different cathegories, the MediaWindow gives a real-time view to current packet loss and packet jitter status. A dual number representation is also displayed but different colours are used to give exact representation of status, for example:

a) OK - GREEN b) CRITICAL - ORANGE c) ERROR - RED

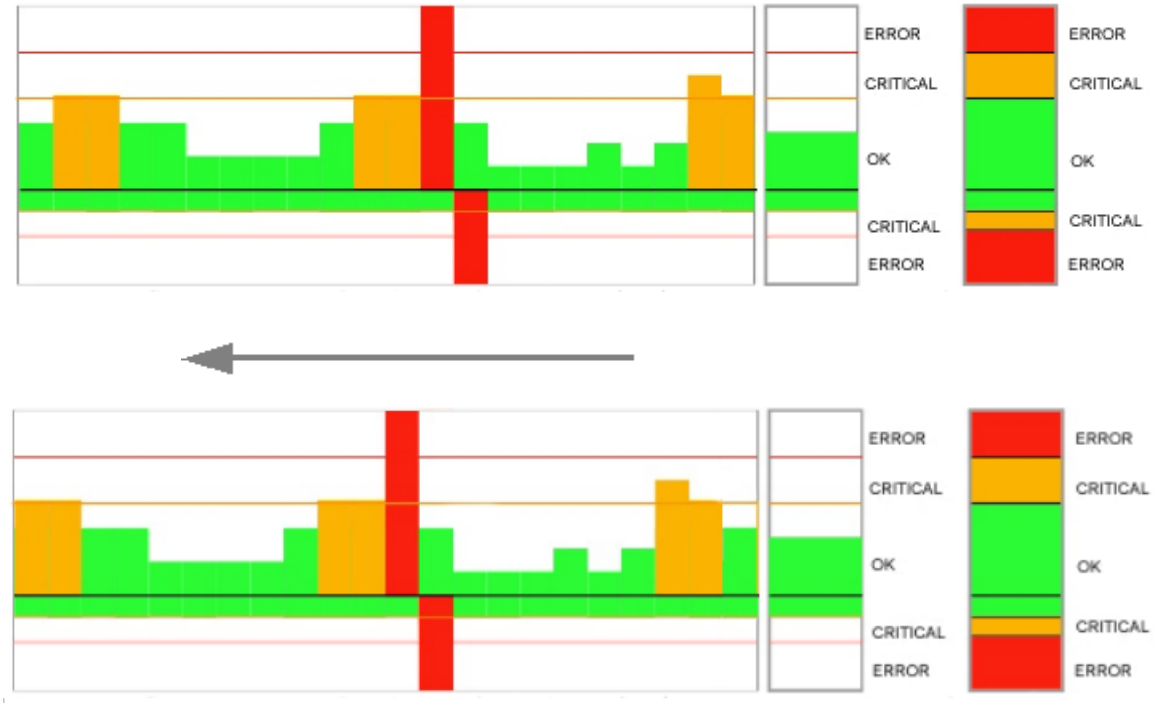
Typical MediaWindow scale of an IAT/MLR measurement

As can be seen in illustration above, the MediaWindow is divided into two parts, representing packet jitter and packet loss.

The MediaWindow should give complete status-at-a-glance and accurate representation with easy indication of how close the system is to the threshold for critical errors.

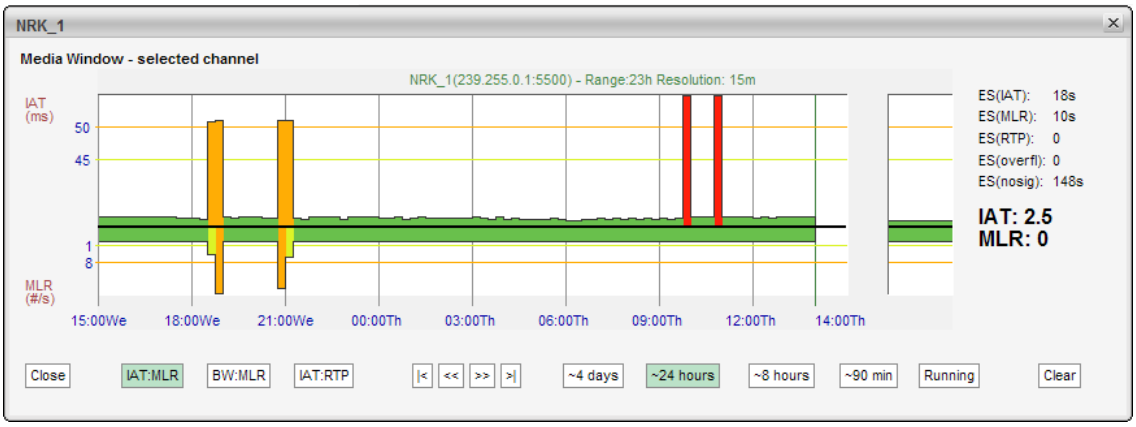
MediaWindow - The Timeline Waterflow View

The introduction of an innovative waterflow display further enhances the visual representation of dynamic network behaviour. A waterflow function may be implemented to provide a graphical representation in both a real-time measurement environment and an historical environment. The two are represented simultaneously. The illustration below gives an idea as to how this works. One should remember that the timeline keeps constantly moving and that all data flows from right to left, i.e. from present time to past.



Waterflow monitoring of MediaWindow with graphical representation of IAT and MLR

MediaWindow - The Bridgetech Implementation

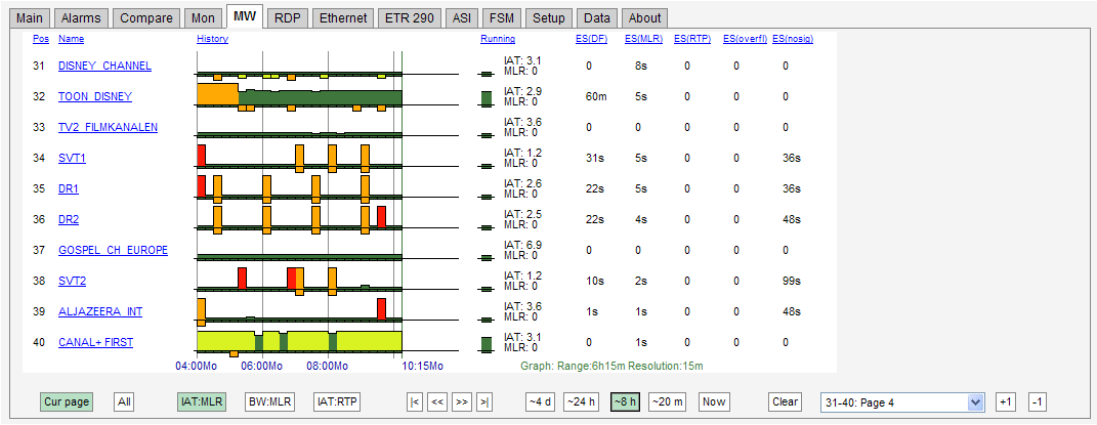


MediaWindow - selected stream

MediaWindow views are used in the Bridgetech VideoBridge probes used for digital television monitoring. In the Bridgetech implementation of the MediaWindow the user selects thresholds that define different status levels. Threshold values are configured by the user, and are selected so that the graph colour indications give representative readings for the system and stream monitored. There are four different status colours. Measurement values lower than the warning threshold will result in a green representation in the graph, a value between warning and error threshold yields yellow, and if the error threshold is exceeded the graph will be orange. 'No signal' is represented by red colour. The IAT and MLR warning thresholds are shown as yellowish green lines with associated magnitude, and the error thresholds are likewise displayed as orange lines.

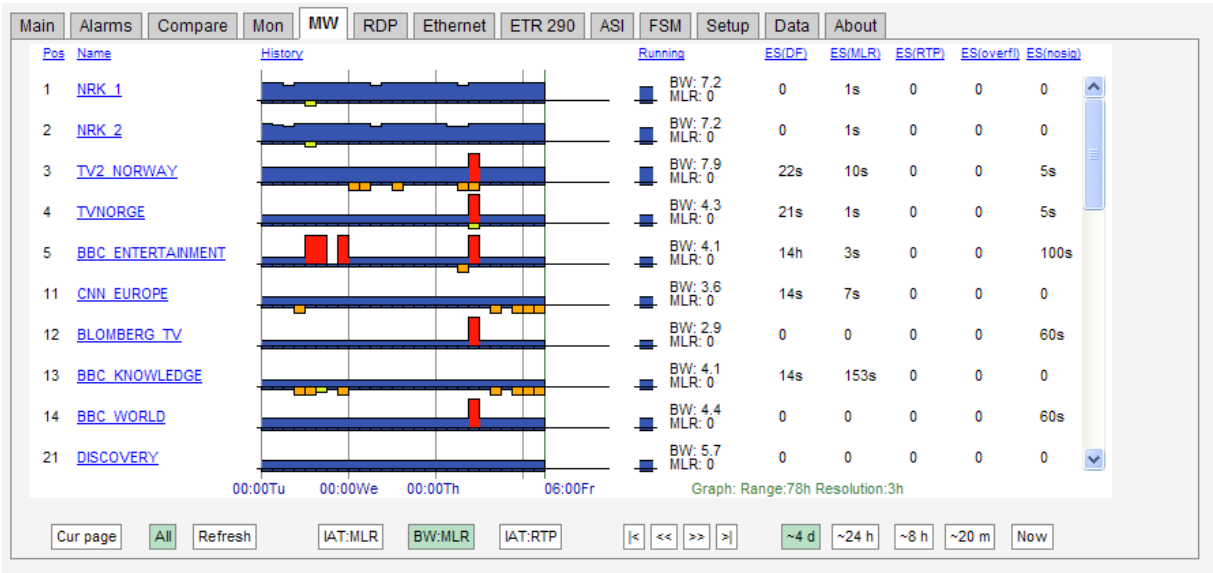
Data from the last four days are stored with a time resolution of one minute; the one-second measurement with the highest value within each one-minut period is stored. The displayed time window is selectable from approximately 4 minutes to 4 days, and scroll arrows allow high resolution display of any time period within the last 4 days. Tool-tip functionality makes it easy to read the time and measurement values of a specific incident.

There are two different MediaWindow views for IAT/MLR displaying: an overall view presenting several streams and a selected stream view that allows more accurate examination of the stream.

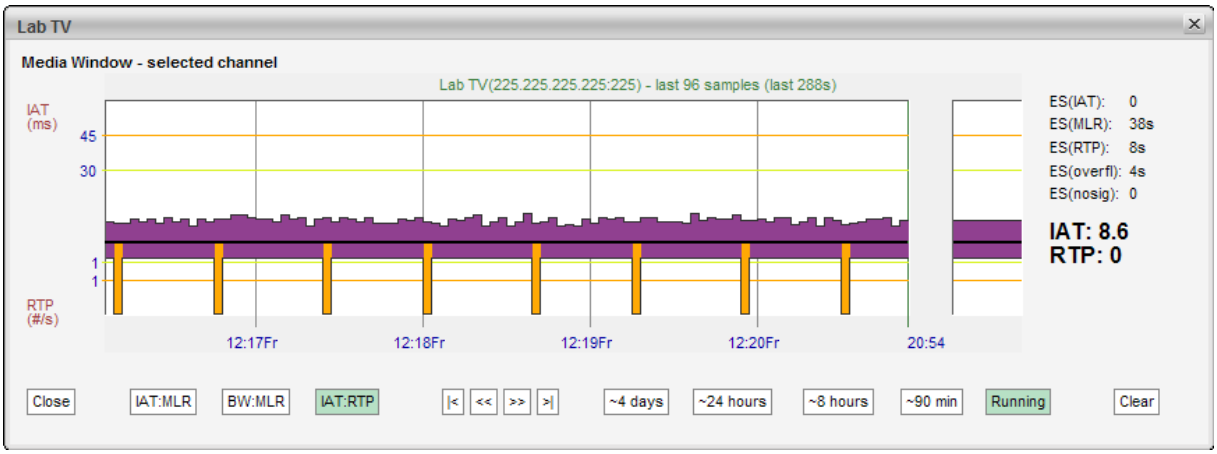


MediaWindow - multiple streams overview

In addition to the IAT/MLR MediaWindow views, similar Bridgetech probe views visualise stream bandwidth versus MLR and IAT versus RTP packet loss. The MediaWindow views are used together with other Bridgetech probe monitoring techniques to enable exceptionally easy error detection and fault-finding, facilitating the everyday life for digital television system operators.



Bandwidth versus MLR - bandwidth shown in blue colour



IAT versus RTP packet loss - IAT shown in violet colour

Conclusion

As seen here, measurement representation of all-important packet loss and packet jitter is clearly enhanced when the MediaWindow is used. Digital television system operators now have a powerful tool to utilise the underlaying mathematics for status-at-a-glance as well as an historical view to undertake easy diagnostics and fault-finding.