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White Paper

RECLAIMING BANDWIDTH WITH CONSTRAINED FIDELITY (CBR)

Overview

This white paper introduces the principles, benefits and performance expectations that are made possible by the Constrained Fidelity CBR feature of Modulus Video AVC encoders. Constrained Fidelity CBR (CF-CBR) offers to reclaim CBR bandwidth and introduce some of the benefits of statistical multiplexing into an IPTV switched broadcast application.

VBR and CBR Principles

Video encoders are designed to operate in one of two distinct ways: variable bit rate (VBR) or constant bit rate (CBR) mode. In basic terms, a CBR stream is created by adapting the quantization parameters to produce a constant bit rate. With VBR mode, the quantization parameters are nearly static to produce a variable rate stream. DVDs, for instance, are encoded using VBR mode and produce very consistent quality. The fundamental principle is that simple scenes require less bandwidth than scenes with a lot of motion and detail. In an ideal world VBR would universally be used. Unfortunately, most applications have bandwidth constraints and, therefore, they do not have the luxury of being able to support VBR. These applications require rate control mechanisms that constrain the bit rate within a predefined setting. Innovative methods such as statistical multiplexing have been developed that allow multiple VBR services to be delivered over a fixed channel by ensuring that the combined bit rate from the encoders doesn't over subscribe the fixed channel size.

Constrained fidelity CBR is a CBR/VBR hybrid implementation. This feature can be described in two ways: as VBR with a cap (or capped VBR); or as CBR that will not encode video with more bits than it needs (or constrained fidelity CBR).

Constrained Fidelity CBR

In a switched broadcast application such as IPTV, services are delivered to a home on an individual basis and statistical multiplexing (statmux) is not an option. Modulus has developed the CF-CBR feature to deliver some of the benefits of statmux to the IPTV environment. CF-CBR allows the video rate to relax during easy sections of video, thereby freeing up bandwidth for data services. While networks are designed to ensure that the combined bit rates of the UDP/IP video services never exceed a fixed amount, CF-CBR looks for easy to encode low complexity content. When such content is found, the bit rate will drop below its maximum rate, freeing additional capacity that can be used to augment TCP/IP data services.

The VBR/CBR Hybrid Implementation

The CF-CBR system is effectively a hybrid implementation. The system behaves as a fixed quantitative implementation until it hits the CBR max rate. The CF-CBR control parameters are:

- CBR max rate
- Bandwidth reclamation strength
- Enable nulls packets

The CBR max rate establishes the maximum bit rate that is not to be exceeded. Bandwidth reclamation provides a pull down menu that offers five strength settings that determine how aggressively the system will aim to reclaim bandwidth. When the CBR reaches a certain threshold the system will produce a variable bit rate transport stream output.

The user interface also includes the facility to enable null packets to produces a constant bit rate stream. This is for applications that want to fix the bit rate at one point in the network so that bandwidth reclamation can be performed in devices downstream.

Constrained Fidelity CBR Benefits

The CF-CBR feature will offer the opportunity to reclaim bandwidth not needed to encode less complex content. The feature will typically be used in IPTV (video over DSL) network applications, where the bit rate reclamation from UDP/IP video services will provide additional capacity for TCP/IP data services. The biggest benefit is that more bandwidth can be provisioned for video services with the knowledge that bandwidth reclamation will ensure that nominal data throughput is maintained for the TCP/IP services.

The amount of bandwidth that can be saved is dependent on the content and strength of the bandwidth reclamation feature. Informal tests have shown that, with typical content, bit rate savings of 20% are readily achievable with no perceived drop in quality of the video service.

Summary

Constrained fidelity CBR feature is a hybrid implementation that offers to maximize video quality by delivering VBR benefits into some CBR applications.

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