Video enhanced DSL

End to end solution for delivery of multiple video channels over DSL

WHAT IS VIDEO ENHANCED DSL?

Video enhanced DSL is a research project (under the US NIST ATP framework) that attacks two major technical barriers; advanced video compression and multi-channel video stream multiplexing in the access network environment. This project is a collaborative research initiative jointly performed by Alcatel, SBC, Thomson, and Sarnoff Labs. Figure 1 shows the role each partner plays within this project. The objective is to provide a solution for multiple simultaneous Standard Definition (SD) and High Definition (HD) TV channels over limited bandwidth DSL links. This will provide commercial quality video services for subscribers of IPTV by supporting multiple TV channels.

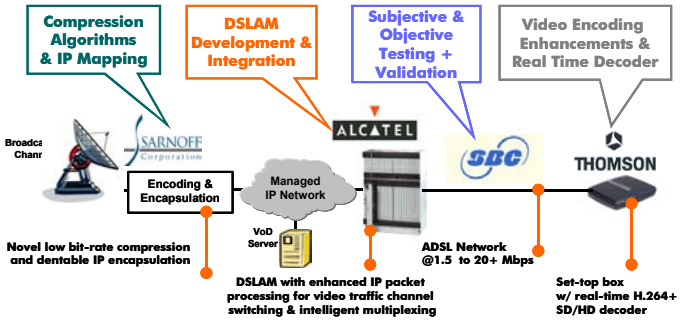


Figure 1: Multi channel streaming video services over existing ADSL infrastructure

The Video Enhanced DSL (VeDSL) project illustrates the following benefits:

- Triple-play at lower bandwidths
- Expanded service coverage
- Lower delivery cost

VIDEO COMPRESSION CHALLENGES

The current state-of-the-art video compression standard is H.264/MPEG-4 AVC. Video encoders and set-top boxes (decoders) are coming on the market now and are expected to improve the compression by a factor of 2 compared to MPEG-2. Additional enhancements to H.264 AVC are being explored in this project that targets the compression performance of .07 bits per pixel that represents about 3X improvement to MPEG-2.

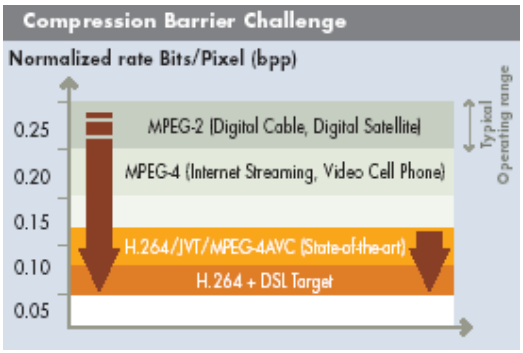
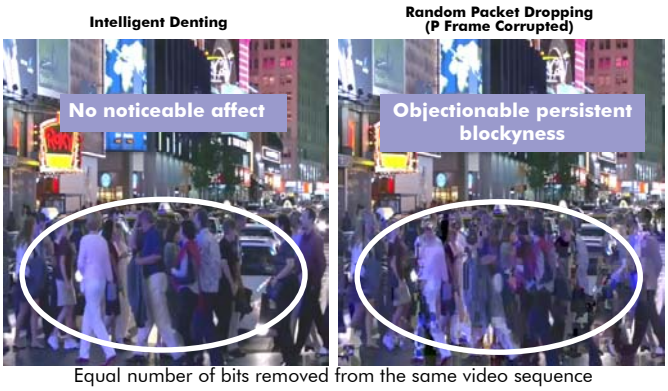


Figure 2: Compression Barrier Challenge

ADVANTAGES OF INTELLIGENT (VIDEO AWARE) TRAFFIC MANAGEMENT

Video aware traffic management allows two or more video channels to be intelligently multiplexed onto DSL facilities at lower bandwidths and without degrading video quality. Intelligent traffic management protects the most important video information within a video stream at the point of stream multiplexing. During congestion periods, the traffic manager selectively discards information that will least affect picture quality. Discarded information concealment in the video decoder can effectively maintain good picture quality. The consequences of random video packet discarding during congestion periods can produce lingering artifacts that produce objectionable picture quality. Figure 3 contains an example illustrating the benefits obtained by the application of intelligent traffic management.



Equal number of bits removed from the same video sequence

Figure 3: Intelligent vs. random packet dropping

CHANNEL CHANGE CONSIDERATIONS

DSL will benefit from ever increasing video compression, but highly compressed video can have an unintended side effect of lengthening the channel change time due to less frequent I-frames within the video stream that are needed to start the video decoding process. The DSLAM, where channel switching is performed, will respond quickly to end user channel change requests, but depending on the I-Frame arrival time the channel change experience may not be acceptable to the viewer. One approach to address this issue is to have a low bit rate (lower resolution) channel change stream with frequent I-frames encoded for each channel as shown in Figure 4.

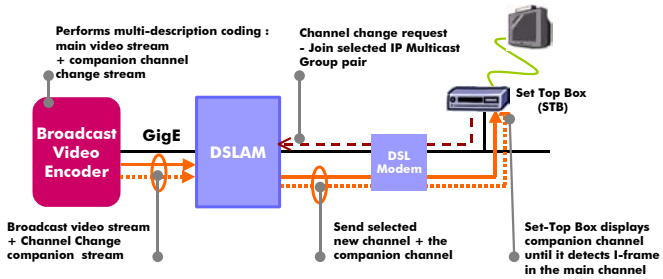


Figure 4: channel change

The decoder would temporarily decode the channel change stream and then would decode the normal channel upon the arrival of an I-Frame. This approach can ensure an acceptable channel change experience.

INCREASED REACH AND COVERAGE ADVANTAGE OFFERED BY ENHANCED COMPRESSION

It is assumed that by using H.264 for video compression a bit rate of about 22 Mbps is required to support multiple High Definition and Standard Definition channels along with VoIP and high speed internet traffic. In order to support this data rate, it can be seen from Figure 5 that a loop length of about 800 meters or less would be required. Figure 5 also shows that 800 meters may only reach about 70% of the subscribers.

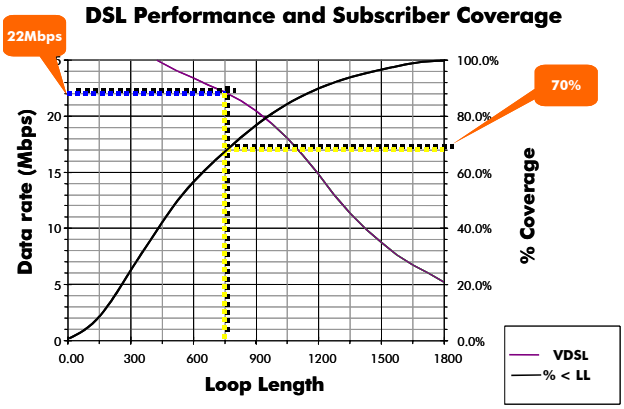


Figure 5: Bit rate and reach offered by H.264

However, if advanced compression with intelligent traffic management were utilized, the required data rate to support the same set of services at the same video quality level could be reduced to about 16 Mbps. 16Mbps can be supported on loops up to 1150 meters as shown in figure 6. Also shown in figure 6, 87% of the loops could be served with a reach of 1150 meters. In this example the use of the investigated technology can be utilized to increase the coverage for Video services from 70% of the loops to about 87% of the loops or an increase of 17% subscriber coverage.

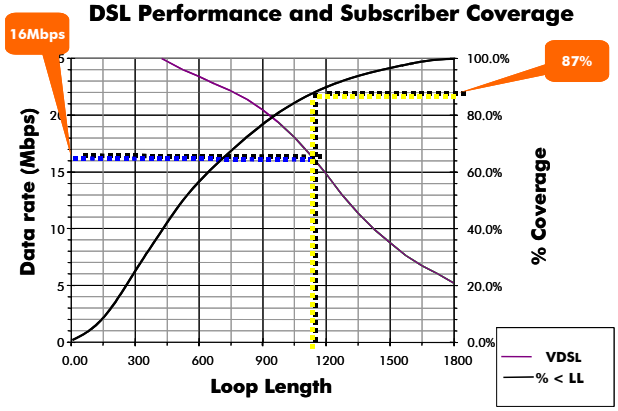


Figure 6: Increase in coverage with use of H.264+ and Intelligent Traffic Management

This increased coverage can reduce the cost of service build out and can generate additional revenue for Telcos from the additional potential subscribers to Telco provided IPTV services.

VIDEO ENHANCED DSL MARKET ADVANTAGE

Carriers within the United States that offer video services require the capability to offer multi-channel services to their subscribers. They are competing with MSOs and satellite service providers that offer this type of service today. In the US, most families have in their homes multiple TV sets and recording devices, each actively viewing or recording different TV channels. Most existing DSL service drops within the US today deliver 1.5Mbps. With the demonstrated technology, two SD channels could be delivered to those subscribers. As carriers build out their high performance broadband access networks, utilizing the demonstrated technology would allow carriers in the US and worldwide to offer additional channels with both SD and HD content of high quality at a lower aggregate bandwidth. This would allow carriers to realize lower initial CAPEX, increased market coverage and thus an improved return on their investments.

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