Project	IEEE 802.16 Broadband Wireless Access Working Group <http://ieee802.org/16>
Title	Text Modification for Draft 802.16m Evaluation Methodology Document: 11.4 Near Real Time Video Streaming
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Re:	IEEE 802.16m-07/014r1, "Call for Comments on Draft 802.16m Evaluation Methodology Document"
Abstract	This contribution proposes a text modification on the "Near Real Time Video Streaming" section (section 11.4) of the Draft 802.16m Evaluation Methodology Document
Purpose	Propose the text changes to add detailed video streaming traffic model.
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Text Modification for Draft 802.16m Evaluation Methodology: 11.4 Near Real Time Video Streaming

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I. Introduction

Original section 11.4 in IEEE C802.16m-07/080r1 does not specify a detailed video streaming traffic model. In this contribution a detailed traffic model is provided to generate a synthetic video streaming traffic.

II. Text Proposal

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[*Add the following references after the line#35 of the page#11 in C802.16m-07/080r1*]

[1] M. Krunz and S. Tripathi, "On the Characterization of VBR MPEG Stream," ACM, pp. 192-202, 1997

[2] A. Matrawy, I. Lambadaris, and C. Huang, "MPEG4 Traffic Modeling Using The Transform Expand Sample Methodology," Proceedings of the IEEE 4th International Workshop on Networked Appliances, pp. 249-256, 2001.

[3] A. A. Lazar, G. Pacifici, and D. E. Pendarakis. Modeling video sources for real-time scheduling. In Proc. of IEEE GLOBECOM '93, volume 2, pages 835-839, 1993.

[4] F. H. P. Fitzek and M. Reisslein, "MPEG-4 and H.263 Video Traces for Network Performance Evaluation," IEEE Network, Vol. 15, Issue 6, pp. 40-54, 2001.

----------End of the text----------

----------Start of the text----------

[*Add the following text after the line#7 of the page68 in C802.16m-07/080r1*]

A typical business-quality video streaming runs can deliver TV-quality video at 25 to 30 frames per second. There are several types of video compression technologies such as H.264, H.263 and H.261. H.264 is the next-generation video compression technology in the MPEG-4 standard, and it surpasses H.261 and H.263 in terms of video quality, effective compression and resilience to transmission losses, giving it the potential to halve the required bandwidth for digital video services over the internet or wireless networks. H.264 is likely to be used in applications such as Video Streaming, Video Conferencing Mobile devices, Tele-Medicine etc and current 3G mobiles use a derivate of MPEG-4.

MPEG compressed videos are composed of pictures (frames) that are separated into three different types: I, B, and P. I frames are intraframes that encode the current picture, while B and P frames interpolate from previous and future frames. MPEG-4 video traffic modeling with separate set of I, B, and P frames form a final model that looks very similar to the original .

An important feature of common MPEG encoders is the manner in which frame types are generated. Although not required by the standards, typical encoders use a fixed Group-of-Pictures (GOP) pattern when compressing a video sequence (the GOP pattern specifies the number and temporal order of P and B frames between two successive I frames). Quite often the fixed GOP pattern is "regular" in the sense that the number of B frames between two reference frames (I or P) is fixed. Such a GOP pattern can be characterized by two parameters: the I-to-I frame distance (N), and the I-to-P frame distance (M) (if no P frames are used, then M = N).

11.4.1 I Frame

It is observed that I frame exhibit different VBR dynamics at different time scales. At a time scale of the order of few seconds, the bit rate fluctuates in small amounts about some mean level, which itself varies drastically at a larger time scale. The fluctuations in the mean levels at the larger time scale are often attributed to "scene" changes. Incorporating a "scenic" component in a traffic model gives the VBR dynamics a physical interpretation and often leads to better performance predictions, and the scene length distribution can be appropriately fitted by an exponential (or geometric) distribution . Summary statistics of the computed scene lengths for the trace of *Silence of the Lambs* are given in Table 11.4-1.

Table 11.4-1 Summary statistics of the computed scene lengths

Trace	Number of Computed Scenes	Scene Length Statistic (in consecutive I frames)			
		Mean	Std. dev	Max	Min
Silence of the Lambs	327	10.2 (5.1 sec)	18.1	209	1

Source:

11.4.2 P and B Frames

The sizes of P and B frames can be appropriately characterized by lognormal distributions with parameters (μ_P, σ_P) and (μ_B, σ_B) respectively. Although the empirical frame sizes for P frames (also B frames) are correlated, these correlations are negligible compared to the correlations between different types of frames .

11.4.3 Video Streaming Traffic Model

For the video streaming traffic model, high quality movie trace, Silence of the Lambs, is used and two different resolutions for the display have been considered; 176x144 for a small device and 320x240 for a large device. The required bandwidth for the uncompressed video stream with 176x144 pixels and 8 bit color depth is about 7.6 Mbps and with 320x240 pixels and 8 bit color depth is about 23 Mbps. To minimize the effects of the non-uniform delay between the packets, a buffer is used at the user device to guarantee a continuous and smooth display of the video streaming data. For video streaming services, this buffer is set to 5 seconds. The algorithm generating synthetic MPEG stream is described in .

Table 11.4-2 Movie Streaming Traffic Model

Service	Movie Streaming	
Video Codec	MPEG-4	
Protocols	TCP	
Scene Length (sec)	Lognormal(μ=5.1 sec , σ =9.05 sec)	
Direction	Uni-direction (DL only)	
Buffering (sec)	5 sec	
Frames/sec	25 frames/sec	
GOP	N=12, M=3	
Display size	176x144	320x240
Color depth (bit)	8	8
Subsampling method	4:1:1	4:1:1
Mean BW for uncompressed stream	7.6 Mbps	23 Mbps
Compression ratio	13.22	13.22
Mean BW for compressed stream	0.58 Mbps	1.74 Mbps
I frame size (byte)	Lognormal(μ=5640 , σ=2632)	Lognormal(μ=17068 ,σ=7965)
P frame size (byte)	Lognormal(μ=3037 , σ=2315)	Lognormal(μ=9190 ,σ=7005)
B frame size (byte)	Lognormal(μ=2260 ,σ=1759)	Lognormal(μ=6839 ,σ=5323)

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