Project	**IEEE 802.16 Broadband Wireless Access Working Group** <http://ieee802.org/16>
Title	**Peer-to-peer File Sharing Traffic Model for IEEE 802.16m EVM**
Date Submitted	**2008-01-16**
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Re:	Call for Comments on Draft 802.16m Evaluation Methodology Document
Abstract	This contribution proposed a traffic model for peer-to-peer file sharing applications.
Purpose	Adopt this contribution to insert a new subsection in section 10.
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Peer-to-peer File Sharing Traffic Model for IEEE 802.16m EVM

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Introduction

Peer-to-peer (P2P) file sharing is emerging as an important application and has occupied a high percentage of internet traffic over the last years. As the wireless broadband access systems rapidly evolve, the P2P file sharing networks will soon overlap with the broadband wireless networks. Therefore, it is essential to consider the P2P file sharing model in the IEEE 802.16m EVM. This document proposes a traffic model which covers the major characteristics of P2P file sharing networks.

Text Proposal

Part 1

[In IEEE 802.16m-07/037r2, add the following item in the Abbreviations and Acronyms section]

P2P Peer to Peer

Part 2

----------Start of the Text----------

[*In IEEE 802.16m-07/037r2, add the following items in the References section*]

[81] B. Cohen. “Incentives build robustness in BitTorrent,” in Proceedings of the First Workshop on the Economics of Peer-to-Peer Systems, Berkeley, CA, June 2003.
[82] “BitTorrent Protocol Specification v1.0,” available at http://wiki.theory.org/BitTorrentSpecification.
[83] Qiu, D., and Srikant, R. “Modeling and performance analysis of bittorrent-like peer-to-peer networks,” In Proceedings of ACM Sigcomm, 2004.
[84] D. Erman, “Bittorrent traffic measurements and models,” October 2005, licentiate thesis, Blekinge Institute of Technology.
[85] D. Erman, D. Ilie and A. Popescu, “BitTorrent Traffic Characteristics,” International Multi-Conference on Computing in the Global Information Technology, 2006 (ICCGI '06).

----------End of the Text----------

Part 3

----------Start of the Text----------

[*In IEEE 802.16m-07/037r2, insert the following section after section 10.7*]

10.8. Peer-to-peer File Sharing Traffic Model

Peer-to-peer (P2P) file sharing is an emerging application that occupies a high percentage of the internet traffic nowadays. A typical P2P file sharing consists of two phases: content query phase and content distribution phase. In content query phase, a requesting peer tries to locate the content through the search facilities provided by the P2P network it is participating in. Once the requesting peer locates enough content holders (peers who own entire or parts of the requesting content), it proceeds to the content distribution phase and starts to request and download pieces of the content

from content holders. Different pieces of content can be acquired from different content holders simultaneously by establishing multiple connections.

The BitTorrent [1], [2] model is used to represent the P2P file sharing traffic model for two reasons. Firstly, BitTorrent has become extremely popular over the last years and constitutes a substantial part of the total internet P2P traffic. Secondly, BitTorrent provides no content query, routing or overlay forming functionality but solely efficient content distribution, and the content distribution traffic is the dominant traffic in all P2P file sharing networks. Therefore, the proposed model considers only traffic in content distribution phase and ignores traffic in content query phase.

A BitTorrent session is equivalent to a TCP session, and the connections between BitTorrent peers are single TCP sessions, carrying both data and signaling traffic. A BitTorrent peer maintains two states for each associated peer: interested and choked states. A peer is said to be choked by a remote serving peer if the remote serving peer decides not to send any data to it, and a peer is said to be interested in a remote peer if the remote peer has pieces of its requesting content. Data transfer between BitTorrent peers is performed in parts of a piece, called block, at a time by issuing a request message. The typical block size is 2^{14} bytes.

For simplicity, all leech peers (peers that do not have the entire content) are assumed to be interested in a piece of infinite size, and will not be choked by any remote seed peers (peers that have the entire content). Therefore, leech peers continuously send requests for blocks and receive piece messages containing the requested blocks. Both the request inter-departure time and piece inter-arrival time can be modeled by the exponential distribution [3], [4], [5]. The simplified BitTorrent traffic pattern is illustrated in Figure 1.

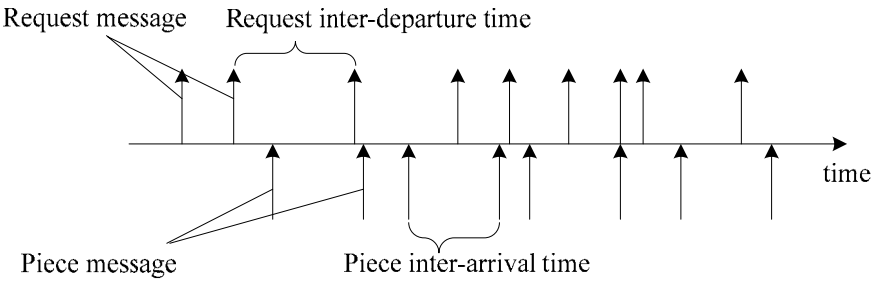

Figure 1: BitTorrent traffic pattern

The parameters for the BitTorrent traffic model is listed in Table 1 [3], [4], [5]. Additional network protocol overhead, such as IP and TCP headers, should be added to each message generated by the BitTorrent traffic model described in Table 1.

Component	Distribution	Parameters	PDF
Request message size	Deterministic	17 bytes	-
Piece message size (with 16 KB block)	Deterministic	16397 bytes	-
Request inter-departure time (Leech peer)	Exponential	Mean = 0.03 sec	$f_x = \lambda e^{-\lambda x}, x \geq 0$ $\lambda = 32.8$
Piece inter-arrival time (Leech peer)	Exponential	Mean = 0.02 sec	$f_x = \lambda e^{-\lambda x}, x \geq 0$ $\lambda = 48.4$

Table 1: BitTorrent traffic model parameters

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Part 4

----------Start of the Text----------

[*In IEEE 802.16m-07/037r2, Section 10.8, modify Table 43 as follows*]

	VoIP	FTP	HTTP	NRTV	Gaming	VT	Full Buffer	Email	P2P	Mandatory/ Optional
VoIP only	100% (#users=N_v)	0%	0%	0%	0%	0%	0%	0%	0%	Mandatory
Full Buffer Data only	0%	0%	0%	0%	0%	0%	100%, 10 users per sector	0%	0%	Mandatory
NGMN Traffic Mix	0%	0%	0%	0%	0%	0%	0%	0%	0%	Optional
FTP only	0%	100%	0%	0%	0%	0%	0%	0%	0%	Optional
HTTP only	0%	0%	100%	0%	0%	0%	0%	0%	0%	Optional
NRTV only	0%	0%	0%	100%	0%	0%	0%	0%	0%	Optional
Gaming only	0%	0%	0%	0%	100%	0%	0%	0%	0%	Optional
VT only	0%	0%	0%	0%	0%	100%	0%	0%	0%	Optional
Email only	0%	0%	0%	0%	0%	0%	0%	100%	0%	Optional
VoIP & Full Buffer Mix 1	0.5 of N_v	0%	0%	0%	0%	0%	10 users per sector	0%	0%	Optional
VoIP & Full Buffer Mix 2	0.75 of N_v	0%	0%	0%	0%	0%	10 users per sector	0%	0%	Optional
P2P only	0%	0%	0%	0%	0%	0%	0%	0%	100%	Optional

----------End of the Text----------

Part 5

----------Start of the Text----------

[*In IEEE 802.16m-07/037r2, Page 115, Modify the section number as follows*]

~~10.8.~~ 10.9 Traffic Mixes

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