Project	IEEE P802.16 Broadband Wireless Access Working Group		
Title	A Multi-Service LMDS System		
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Re:	This is a response to a Call for Contributions for System Requirements broadcast on May 19, 1999, addressing in particular the QoS-based categorization of applications.		
Abstract	An LMDS system must support both connectionless and connection-oriented services. Connectionless IP is more efficient for non-real-time services, such as internet browsing, while connection-oriented ATM is much better for delivery of real-time services, such as telephony. It is unlikely that one technology will overcome its shortcomings to the extent of completely replacing the other. This document proposes an LMDS system that integrates both ATM and IP.		
Purpose	The author recommends 802.16 adopt the proposal as part of System Requirements.		
Notice	This document has been prepared to assist the IEEE P802.16. It is offered as a basis for discussion and is not binding on the contributing individual(s) or organization(s). The material in this document is subject to change in form and content after further study. The contributor(s) reserve(s) the right to add, amend or withdraw material contained herein.		
Release	The contributor acknowledges and accepts that this contribution may be made publicly available by 802.16.		

A Multi-Service LMDS System

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Abstract

An LMDS system must offer a set of bearer services and a grade of service similar to the competition. In the residential market, this means comparison with DSL and cable modems. In the business market, this means comparison with optical fiber. All the applications fall into the camps of connectionless, of which IP is the dominant technology, and connection-oriented, of which ATM is the dominant technology. The deficiencies of IP over ATM are well described [1]. Similarly, there is a lack of standardization for TDM services over IP. Integrating the strengths of IP and ATM gives an ideal match for the QoS requirements of service.

Introduction

An LMDS system encompasses all core and access components of a network. This includes seamless integration with other networks, such as ISPs and PSTNs, such that no protocol adaptation is required. It must also integrate a wide range of applications with different QoS requirements. The diversity ranges from intercell linking integrated with a base station, to complimentary technologies, such as xDSL and HFC. Finally, it must provide full management of all aspects of the network, making it possible to charge on the basis of usage with an end-to-end managed QoS.

These technical factors make it convenient to use ATM as the standard interface technology in a homogeneously diverse network. However, current protocol architectures are moving towards more IP oriented networks that may be optimized with IP as the standard interface technology.

ATM-only System

Each application fits into a service category, with its accompanying traffic description and QoS guarantees, as shown in **Table 1**.

Service Categories	Traffic Description	QoS Guarantees		
		CLR min	Delay	Bandwidth
CBR	PCR	✓	✓	✓
VBR-rt	PCR, SCR, MBS	✓	✓	✓
VBR-nrt	PCR, SCR, MBS	✓		✓
ABR	PCR, MCR	✓		Best effort

UBR	PCR

Table 1. ATM Service Category Attributes

Traffic Parameters

- PCR Peak Cell Rate
- SCR Sustainable Cell Rate
- MBS Maximum Burst Size
- MCR Minimum Cell Rate
- QoS Quality of Service

QoS Parameters

- CDVT Cell Delay Variation Tolerance
- Max CTD Maximum Cell Transfer Delay
- CLR Cell Loss Ratio

IP-only System

The current service model for IP does not provide QoS support. This is being addressed by IETF with two models: the Integrated Internet model (IntServ) [2], which has been rejected by carriers as too complex and lacking in scalability in the backbone, and the Differentiated Internet model (DiffServ) [3].

DiffServ currently defines two Levels of Service (LoS), Expedited Forwarding and Assured, but leaves the QoS mappings unclear.

IP-over-ATM System

Table 2 provides a mapping for DiffServ capabilities into ATM service categories.

ATM service categories (ATM Forum)	Differentiated services		Best effort
	Expedited forwarding	Assured forwarding	
CBR	✓		
VBR-rt	✓		
VBR-nrt		✓	
ABR		✓	✓
UBR			✓

Table 2. Service Mapping from ATM into DiffServ model

References

[1] M. Taylor, “LAN emulation over ATM”, Computer Commun., Vol. 20, No. 1, January 1997

[2] R. Braden et al., “Integrated Services in the Internet Architecture: An Overview”, RFC 1633, June 1994

[3] S. Blake et al, “An Architecture for Differentiated Services”, RFC 2475, December, 1998.

[4] S. Blake et al, “A Framework for Differentiated Services”, Internet Draft, October, 1998.

[5] “Broadband Radio Access Networks (BRAN); Requirements and architectures for broadband fixed radio access networks (HIPERACCESS)”, ETSI Technical Report TR 101 177 V1.1.1 (1998-05)

[6] A. Azcorra et al., “IP/ATM Integrated Services over Broadband Access Copper Technologies” IEEE Communications, pp. 90-97, Vol. 37, No. 5, May 1999