



# **IEEE Standard for Local and Metropolitan Area Networks: Media Access Control (MAC) Bridges**

## **Amendment 2: Bridging of IEEE 802.16™**

---

**IEEE Computer Society**  
and the  
**IEEE Microwave Theory and Techniques Society**

Sponsored by the  
LAN/MAN Standards Committee

---

IEEE  
3 Park Avenue  
New York, NY 10016-5997, USA  
14 August 2007

**IEEE Std 802.16k™-2007**  
(Amendment to  
IEEE Std 802.1D™-2004)

802.16k™



*Recognized as an  
American National Standard (ANSI)*

**IEEE Std 802.16k™-2007**  
(Amendment to  
IEEE Std 802.1D™-2004)

# **IEEE Standard for Local and Metropolitan Area Networks: Media Access Control (MAC) Bridges**

## **Amendment 5: Bridging of IEEE 802.16™**

Sponsor

**LAN/MAN Standards Committee  
of the  
IEEE Computer Society  
and the**

**IEEE Microwave Theory and Techniques Society**

Approved 9 August 2007

**American National Standards Institute**

Approved 22 March 2007

**IEEE SA-Standards Board**

**Abstract:** This document amends IEEE Std 802.1D, as previously amended by IEEE Std 802.17a™-2004, to support the bridging of the IEEE 802.16 medium access control.

**Keywords:** local area networks, LANs, MAC Bridges, transparent bridging, VLANs, wireless metropolitan area networks, WMAN

---

The Institute of Electrical and Electronics Engineers, Inc.  
3 Park Avenue, New York, NY 10016-5997, USA

Copyright © 2007 by the Institute of Electrical and Electronics Engineers, Inc.  
All rights reserved. Published 14 August 2007. Printed in the United States of America.

IEEE, 802, and WMAN are registered trademarks in the U.S. Patent & Trademark Office, owned by the Institute of Electrical and Electronics Engineers, Incorporated.

Print: ISBN 0-7381-5585-3 SH95678  
PDF: ISBN 0-7381-5586-1 SS95678

*No part of this publication may be reproduced in any form, in an electronic retrieval system or otherwise, without the prior written permission of the publisher.*

**IEEE Standards** documents are developed within the IEEE Societies and the Standards Coordinating Committees of the IEEE Standards Association (IEEE-SA) Standards Board. The IEEE develops its standards through a consensus development process, approved by the American National Standards Institute, which brings together volunteers representing varied viewpoints and interests to achieve the final product. Volunteers are not necessarily members of the Institute and serve without compensation. While the IEEE administers the process and establishes rules to promote fairness in the consensus development process, the IEEE does not independently evaluate, test, or verify the accuracy of any of the information contained in its standards.

Use of an IEEE Standard is wholly voluntary. The IEEE disclaims liability for any personal injury, property or other damage, of any nature whatsoever, whether special, indirect, consequential, or compensatory, directly or indirectly resulting from the publication, use of, or reliance upon this, or any other IEEE Standard document.

The IEEE does not warrant or represent the accuracy or content of the material contained herein, and expressly disclaims any express or implied warranty, including any implied warranty of merchantability or fitness for a specific purpose, or that the use of the material contained herein is free from patent infringement. IEEE Standards documents are supplied “**AS IS**.”

The existence of an IEEE Standard does not imply that there are no other ways to produce, test, measure, purchase, market, or provide other goods and services related to the scope of the IEEE Standard. Furthermore, the viewpoint expressed at the time a standard is approved and issued is subject to change brought about through developments in the state of the art and comments received from users of the standard. Every IEEE Standard is subjected to review at least every five years for revision or reaffirmation. When a document is more than five years old and has not been reaffirmed, it is reasonable to conclude that its contents, although still of some value, do not wholly reflect the present state of the art. Users are cautioned to check to determine that they have the latest edition of any IEEE Standard.

In publishing and making this document available, the IEEE is not suggesting or rendering professional or other services for, or on behalf of, any person or entity. Nor is the IEEE undertaking to perform any duty owed by any other person or entity to another. Any person utilizing this, and any other IEEE Standards document, should rely upon the advice of a competent professional in determining the exercise of reasonable care in any given circumstances.

**Interpretations:** Occasionally questions may arise regarding the meaning of portions of standards as they relate to specific applications. When the need for interpretations is brought to the attention of IEEE, the Institute will initiate action to prepare appropriate responses. Since IEEE Standards represent a consensus of concerned interests, it is important to ensure that any interpretation has also received the concurrence of a balance of interests. For this reason, IEEE and the members of its societies and Standards Coordinating Committees are not able to provide an instant response to interpretation requests except in those cases where the matter has previously received formal consideration. At lectures, symposia, seminars, or educational courses, an individual presenting information on IEEE standards shall make it clear that his or her views should be considered the personal views of that individual rather than the formal position, explanation, or interpretation of the IEEE.

Comments for revision of IEEE Standards are welcome from any interested party, regardless of membership affiliation with IEEE. Suggestions for changes in documents should be in the form of a proposed change of text, together with appropriate supporting comments. Comments on standards and requests for interpretations should be addressed to:

Secretary, IEEE-SA Standards Board  
445 Hoes Lane  
Piscataway, NJ 08854  
USA

Authorization to photocopy portions of any individual standard for internal or personal use is granted by the Institute of Electrical and Electronics Engineers, Inc., provided that the appropriate fee is paid to Copyright Clearance Center. To arrange for payment of licensing fee, please contact Copyright Clearance Center, Customer Service, 222 Rosewood Drive, Danvers, MA 01923 USA; +1 978 750 8400. Permission to photocopy portions of any individual standard for educational classroom use can also be obtained through the Copyright Clearance Center.

# Introduction

This introduction is not part of IEEE Std 802.16k-2007, IEEE Standard for Local and Metropolitan Area Networks: Media Access Control (MAC) Bridges—Amendment 5: Bridging of IEEE Std 802.16.

This document amends IEEE Std 802.1D to support bridging of the IEEE 802.16 medium access control. As of the approval date, the current applicable version of IEEE Std 802.1D is IEEE Std 802.1D-2004, as amended by IEEE 802.17a-2004 and IEEE 802.16k-2007.

## Notice to users

### Errata

Errata, if any, for this and all other standards can be accessed at the following URL: <http://standards.ieee.org/reading/ieee/updates/errata/index.html>. Users are encouraged to check this URL for errata periodically.

### Interpretations

Current interpretations can be accessed at the following URL: <http://standards.ieee.org/reading/ieee/interp/index.html>.

### Patents

Attention is called to the possibility that implementation of this standard may require use of subject matter covered by patent rights. By publication of this standard, no position is taken with respect to the existence or validity of any patent rights in connection therewith. The IEEE shall not be responsible for identifying patents or patent applications for which a license may be required to implement an IEEE standard or for conducting inquiries into the legal validity or scope of those patents that are brought to its attention.

## Participants

This amendment was developed by the IEEE 802.16 Working Group on Broadband Wireless Access, which develops the WirelessMAN Standard for Wireless Metropolitan Area Networks:

IEEE 802.16 Working Group Officers

**Roger B. Marks**, *Chair*

**Jose Puthenkulam**, *Vice Chair*

**Peiyong Zhu**, *Secretary*

Primary development was carried out by the Working Group's Network Management Task Group:

**Phillip Barber**, *Chair*

**David Johnston**, *Chief Technical Editor, IEEE Std 802.16k*

The following members of the IEEE 802.16 Working Group on Broadband Wireless Access participated in the Working Group Letter Ballot in which the draft of this standard was prepared and finalized for IEEE Ballot:

Ray Abrishami	Panyuh Joo	Maximilian Riegel
Dov Andelman	Hyunjeong Kang	Wonil Roh
Phillip Barber	Ivy Kelly	Andrew Sago
Eckard Bogenfeld	Ofer Kelman	Yousuf Saifullah
James Carlo	Brian Kiernan	Atul Salvekar
Giulio Cavalli	Byoung-Jo Kim	Ariel Sharon
Jaesun Cha	Jaeyoel Kim	Kathiravetpillai Sivanesan
Dean Chang	Ronny (Yong-Ho) Kim	Sten Sjöberg
Jae Hwan Chang	Sang Youb Kim	Jung Je Son
Yong Chang	Youngho Kim	Yeong Moon Son
Naftali Chayat	Itzik Kitroser	Kenneth Stanwood
Yuehua (Lucy) Chen	Changhoi Koo	Kyungjoo Suh
Aik Chindapol	Havish Koorapaty	Xiangguo Tang
Jaehee Cho	Jonathan Labs	Wen Tong
Jaewoon Cho	Pierre Lamoureux	Shiau-He Tsai
Seiji Cho	Chi-Chen Lee	David Urban
Yang-Seok Choi	Mihyun Lee	Lucia Valbonesi
Joey Chou	Youn-Tai Lee	Richard Van Leeuwen
José Costa	Jia-Ru Li	Eyal Verbin
Mark Cudak	Aeri Lim	Dorin Viorel
Shujun Dang	Geunhwi Lim	Frederick Vook
Carl Eklund	Sun Ju Lim	Eero Wallenius
Per Elmdahl	Zhibin Lin	Arthur Wang
Mo-Han Fong	Heinz Lycklama	Guo Qiang Wang
Avraham Freedman	Michael Lynch	Jing Wang
Yan Fu	Steve Ma	Lei Wang
Mariana Goldhamer	David Maez	Stanley Wang
Reza Golshan	Jeffrey Mandin	Mattias Wennstrom
Qiang Guo	Roger B. Marks	Geng Wu
Zion Hadad	Willem Mulder	Xuyong Wu
Jung Ho Han	Kenichi Nakamura	David Xiang
Gregory Henderson	Paul Odlyzko	Hassan Yaghoobi
David Holmes	Shlomo Ovadia	Yunsong Yang
Chang-Lung Hsiao	David Paranchych	Vladimir Yanover
Haiming Huang	Paul Piggin	Choong-Il Yeh
John Humbert	Jose Puthenkulam	Nader Zein
Inseok Hwang	Frank Rayal	Peiyong Zhu
David Johnston	Francis Retnasothie	Yongjin Zhu
		Lan Zou

The following members of the individual balloting committee voted on this standard. Balloters may have voted for approval, disapproval, or abstention.

Sassan Ahmadi	Siamack Haghighi	Paul W. Piggini
Jon Paul Anderson	C. J. Hansen	Riku Pirhonen
Butch Anton	John F. Hawkins	Subburajan Ponnuswamy
Mikio Aoki	Sergiu A. Iordanescu	Chuck Powers
Reza Arefi	Atsushi Ito	Michael S. Probasco
Lee R. Armstrong	Raj Jain	Vikram Punj
Phillip Barber	Anthony A. Jeffree	Jose Puthenkulam
John R. Barr	Brian Johnson	Maximilian Riegel
Hugh Barrass	David Johnston	Robert A. Robinson
Tomo Bogataj	Bobby Jose	Fernando L. Rodriguez
Gennaro Boggia	Shinkyoo Kaku	Randall M. Safier,
Monique J. Bourgeois	Hyunjeong Kang	Andy J. Sago
Matthew K. Burnburg	Piotr Karocki	Atul A. Salvekar
Sean S. Cai	Stuart J. Kerry	Bartien Sayogo
Edward J. Carley, Jr	Brian G. Kiernan	Michael J. Seaman
James T. Carlo	Eunkyung Kim	Suman Sharma
Juan C. Carreon	Kyung Ho Kim	Takashi Shono
David A. Castelow	Sang Youb Kim	Mario Siller
Jay Catelli	Yongbum Kim	Rajnesh D. Singh
Giulio Cavalli	Yongho Kim	Sten I. Sjoberg
Dean Chang	Cees Klik	Jung Je Son
Yi-ming Chen	Havish Koorapaty	Amjad A. Soomro
Yung-mu Chen	Thomas M. Kurihara	Manikantan Srinivasan
Elizabeth Chesnutt	Jules Pierre Lamoureux	Kenneth L. Stanwood
Aik Chindapol	Jeremy A. Landt	Thomas E. Starai
Keith Chow	Yigal Leiba	Walter Struppler
Ryon K. Coleman	Jun Li	Mark A. Sturza
Bryan P. Cook	Li Li	Michael L. Takefman
Todor V. Cooklev	Jan-ray Liao	William T. Taylor
Tommy P. Cooper	Chiwoo Lim	Wen Tong
Jose M. Costa	G. L. Luri	Stephen J. Turner
Russell S. Dietz	Heinz Lycklama	Mark-rene Uchida
Thomas J. Dineen	Syam Madanapalli	Lee B. Valerius
Carlo Donati	Dave Maez	Richard M. Van Leeuwen
Sourav K. Dutta	Roger B. Marks	John Visser
Paul S. Eastman	Jon S. Martens	Guo Quiang Wang
Lester F. Eastwood	Francisco J. Melendez	Lei Wang
Carl Eklund	Scott F. Migaldi	Michael Wang
C. J. Fitzgerald	Apurva N. Mody	Stanley S. Wang
Avraham Freedman	Ronald G. Murias	Stephen C. Webb
Devon L. Gayle	Michael S. Newman	Mattias Wennstrom
Michael D. Geipel	Paul Nikolich	Geng Wu
Theodore Georgantas	Richard H. Noens	Oren Yuen
Pieter-paul Giesberts	Mitsuo Nohara	Jungnam Yun
Evan Gilman	Satoshi Obara	Peiying Zhu
Randall C. Groves	David W. Paranchych	
C. G. Guy	Roger L. Peterson	



When the IEEE-SA Standards Board approved this standard on 22 March 2007, it had the following membership:

**Steve M. Mills**, *Chair*  
**Robert M. Grow**, *Vice Chair*  
**Don Wright**, *Past Chair*  
**Judith Gorman**, *Secretary*

Richard DeBlasio  
Alex Gelman  
William R. Goldbach  
Arnold M. Greenspan  
Joanna N. Guenin  
Julian Forster\*  
Kenneth S. Hanus  
William B. Hopf

Richard H. Hullett  
Hermann Koch  
Joseph L. Koepfinger\*  
John Kulick  
David J. Law  
Glenn Parsons  
Ronald C. Petersen  
Tom A. Prevost

Narayanan Ramachandran  
Greg Ratta  
Robby Robson  
Anne-Marie Sahazizian  
Virginia C. Sulzberger  
Malcolm V. Thaden  
Richard L. Townsend  
Howard L. Wolfman

\*Member Emeritus

Also included are the following nonvoting IEEE-SA Standards Board liaisons:

Satish K. Aggarwal, *NRC Representative*  
Alan H. Cookson, *NIST Representative*

Michelle D. Turner  
*IEEE Standards Program Manager, Document Development*

Michael D. Kipness  
*IEEE Standards Program Manager, Technical Program Development*

## Contents

2. Normative references .....	2
4. Abbreviations .....	2
6. Support of the MAC Service .....	2
6.5    Support of the Internal Sublayer Service by specific MAC procedures .....	2
Annex A (normative) PICS Proforma .....	4

# IEEE Standard for Local and Metropolitan Area Network: Media Access Control (MAC) Bridges

## Amendment 5: Bridging of IEEE 802.16™

[This document amends IEEE Std 802.1D™-2004.]

NOTE—The editing instructions contained in this amendment define how to merge the material contained therein into the existing base standard and its amendments to form the comprehensive standard.

Text shown in bold italics in this amendment defines the editing instructions necessary to changes to this base text. Three editing instructions are used: *change*, *delete*, and *insert*. *Change* is used to make a change to existing material. The editing instruction specifies the location of the change and describes what is being changed. Changes to existing text may be clarified using ~~strikeout~~ markings to indicate removal of old material, and underscore markings to indicate addition of new material). *Delete* removes existing material. *Insert* adds new material without changing the existing material. Insertions may require renumbering. If so, renumbering instructions are given in the editing instruction. Editorial notes will not be carried over into future editions of IEEE Std 802.1D.

## 2. Normative references

*Insert reference to 802.16 into Clause 2.*

IEEE Std 802.16™, IEEE Std for Local and Metropolitan Area Networks Part 16: Air Interface for Fixed and Mobile Broadband Wireless Systems

## 4. Abbreviations

*Insert the following abbreviations into Clause 4 in their appropriate collating sequence.*

CPS	Common Part Sublayer
CS	Convergence Sublayer
WMAN	Wireless Metropolitan Area Network

## 6. Support of the MAC Service

### 6.5 Support of the Internal Sublayer Service by specific MAC procedures

*Insert the following as new Subclause 6.5.5, renumbering the existing Subclause 6.5.5 as 6.5.6.*

#### 6.5.5 Support by IEEE Std 802.16 (WMAN)

The Wireless Metropolitan Area Network (WMAN) MAC access method is specified in IEEE Std 802.16. Clause 5 of that standard specifies the Service Specific Convergence Sublayers (CS) that implement the 802.16 MAC service. Subclause 5.2.4 (802.3 Packet CS) describes the mode of the Packet CS that supports the Internal Sublayer Service.

Subclauses 5.1 (ATM CS), 5.2.5 (IEEE Std 802.1Q™-2003 virtual local area network (VLAN) specific part) and 5.2.6 (Packet CS IP specific part) shall not support the Internal Sublayer Service.

Multiple encapsulation methods are provided in the MAC CS in Clause 5. However the bridging function depends on the correct modeling of the Ethernet transport by the Ethernet CS only, and is indifferent to any additional encapsulation.

Clause 6 specifies the MAC Common Part Sublayer (MAC CPS) transmission and reception procedures and Annex C describes the MAC CPS service definition.

IEEE Std 802.16 includes no explicit definition of the MAC service definition for the 802.3 Packet CS. The 802.3 Packet CS MAC service is defined in IEEE Std 802.3 Clause 2.

The 802.16 MAC CPS presents a connection-oriented MAC service. The 802.3 packet CS utilizes this service to present the 802.3 service. A pair of communicating peer CS entities between an 802.16 BS and an 802.16 SS create a point-to-point LAN as defined in 6.4.3.

Since the 802.3 specific part of the packet CS does not forward the frame\_check\_sequence parameter of the M\_UNITDATA.indication, then

- 1) Any service flow using this MAC CS shall enable the 802.16 MAC CRC.

- 2) PHS validation shall not be turned off for this service flow (since 802.16 MAC CRC cannot protect suppressed MAC header fields).

#### **6.5.5.1 Support for Internal Sublayer Service under IEEE Std 802.16 and IEEE Std 802.3 Packet CS**

The **frame\_type**, **destination\_address**, **source\_address**, **mac\_service\_data\_unit** and **user\_priority** parameters of the M\_UNITDATA primitive are encoded as described in 6.5.1.

The value of operPointToPointMAC (6.4.3) shall be TRUE.

The value of MAC\_Enabled shall be determined by the procedure described in 6.5.1.

After the 802.16 SS has registered with the BS, authenticated, and performed capabilities negotiation, and after the 802.3 Packet CS has established the active MAC CPS service flows necessary to carry 802 frames, then the value of the MAC\_Operational parameter shall be determined by the procedure described in 6.5.1. Beforehand, the value of MAC\_Operational shall be FALSE.

Frame size limits are determined by IEEE Std 802.3™.

Annex A

(normative)

PICS Proforma

Change the first row of Table A.6 (Media Access Control Methods), by adding a line for 802.16 and 802.17, as follows:

A.6 Media Access Control Methods

Item	Feature	Status	Reference	Support
	Which Media Access Control methods are implemented in accordance with the relevant MAC standards?		6.4, 6.5	
MAC-802.3	CSMA/CD, IEEE Std 802.3	O.1		Yes <input type="checkbox"/> No <input type="checkbox"/>
MAC-802.5	Token Ring, IEEE Std 802.5™	O.1		Yes <input type="checkbox"/> No <input type="checkbox"/>
MAC-9314-2	FDDI, ISO 9314-2	O.1		Yes <input type="checkbox"/> No <input type="checkbox"/>
MAC-802.11	Wireless LAN, IEEE Std 802.11™	O.1		Yes <input type="checkbox"/> No <input type="checkbox"/>
<u>MAC-802.16</u>	<u>Wireless MAN, IEEE Std 802.16</u>	<u>O.1</u>		<u>Yes <input type="checkbox"/> No <input type="checkbox"/></u>
<u>MAC-802.17</u>	<u>Resilient Packet Ring, IEEE Std 802.17™</u>	<u>O.1</u>		<u>Yes <input type="checkbox"/> No <input type="checkbox"/></u>