IEEE P802.16p AWD

~~DRAFT Amendment to IEEE Standard for Local and metropolitan area networks~~

~~Part 16: Air Interface for Broadband Wireless Access Systems~~

Enhancements to Support Machine-to-Machine Applications

~~Sponsor~~

~~LAN/MAN Standards Committee~~
~~of the~~
~~IEEE Computer Society~~

~~and the~~

~~IEEE Microwave Theory and Techniques Society~~

Introduction

This introduction is not part of IEEE Std 802.16p, IEEE Standard for Local and metropolitan area networks—Part 16: Air Interface for Broadband Wireless Access Systems - Amendment: Air Interface for Broadband Wireless Access Systems – Enhancements to Support Machine-to-Machine Applications.

This amendment specifies support for Machine-to-Machine Applications. As of the publication date, the current applicable version of IEEE Std 802.16 is IEEE Std 802.16-2009, as amended by IEEE 802.16j-2009, IEEE 802.16h-2010, and IEEE 802.16m-2011.

Notice to users

Laws and regulations

~~Users of these documents should consult all applicable laws and regulations. Compliance with the provisions of this standard does not imply compliance to any applicable regulatory requirements. Implementers of the standard are responsible for observing or referring to the applicable regulatory requirements. IEEE does not, by the publication of its standards, intend to urge action that is not in compliance with applicable laws, and these documents may not be construed as doing so.~~

Copyrights

~~This document is copyrighted by the IEEE. It is made available for a wide variety of both public and private uses. These include both use, by reference, in laws and regulations, and use in private self-regulation, standardization, and the promotion of engineering practices and methods. By making this document available for use and adoption by public authorities and private users, the IEEE does not waive any rights in copyright to this document.~~

Updating of IEEE documents

~~Users of IEEE standards should be aware that these documents may be superseded at any time by the issuance of new editions or may be amended from time to time through the issuance of amendments, corrigenda, or errata. An official IEEE document at any point in time consists of the current edition of the document together with any amendments, corrigenda, or errata then in effect. In order to determine whether a given document is the current edition and whether it has been amended through the issuance of amendments, corrigenda, or errata, visit the IEEE Standards Association website at http://ieeexplore.ieee.org/xpl/standards.jsp, or contact the IEEE at the address listed previously.~~

~~For more information about the IEEE Standards Association or the IEEE standards development process, visit the IEEE-SA website at http://standards.ieee.org.~~

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

~~***[The following notice shall appear when the IEEE receives assurance from a known patent holder or patent applicant prior to the time of publication that a license will be made available to all applicants either without compensation or under reasonable rates, terms, and conditions that are demonstrably free of any unfair discrimination.]***~~

~~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. A patent holder or patent applicant has filed a statement of assurance that it will grant licenses under these rights without compensation or under reasonable rates, with reasonable terms and conditions that are demonstrably free of any unfair discrimination to applicants desiring to obtain such licenses. Other Essential Patent Claims may exist for which a statement of assurance has not been received. The IEEE is not responsible for identifying Essential Patent Claims for which a license may be required, for conducting inquiries into the legal validity or scope of Patents Claims, or determining whether any licensing terms or conditions are reasonable or non-discriminatory. Further information may be obtained from the IEEE Standards Association.~~

~~***[If the IEEE has not received letters of assurance prior to the time of publication, the following notice shall appear:]***~~

~~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 document was developend by the IEEE 802.16 Working Group on Broadband Wireless Access, which develops the WirelessMAN® Standard for Wireless Metropolitan Area Networks.

Roger B. Marks, *Chair*
Jose Puthenkulam, *Vice-Chair*
Herbert M. Ruck, *Secretary*
Scott Migaldi, *Treasurer*

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:

Yan-Xiu Zheng	Lei Zhou	Jing Zhu
Hua Zhou	Chenxi Zhu	Peiying Zhu

Primary development was carried out by the Working Group's Task Group p.

TGp Leadership Team:

Ron Murias, Chair
TBD, Vice Chair
TBD, Secretary
TBD, Chief Editor, 802.16m
Jin Lee, Editor, System Requirements Document
HanGyu Cho, Editor, M2M Technical Report

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

When the IEEE-SA Standards Board approved this standard on XX Month 2008, it had the following membership:

Robert M. Grow, *Chair*
Thomas Prevost, *Vice Chair*
Steve M. Mills, *Past Chair*
Judith Gorman, *Secretary*

Victor Berman	Jim Hughes	Chuck Powers
Richard DeBlasio	Richard H. Hulett	Narayanan Ramachandran
Andy Drozd	Young Kyun Kim	Jon Walter Rosdahl
Mark Epstein	Joseph L. Koepfinger*	Robby Robson
Alexander Gelman	John Kulick	Anne-Marie Sahazizia
William R. Goldbach	David J. Law	Malcolm V. Thaden
Arnold M. Greenspan	Glenn Parsons	Howard L. Wolfman
Kenneth S. Hanus	Ronald C. Petersen	Don Wright

*Member Emeritus

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

Satish K. Aggarwal, *NRC Representative*
Michael H. Kelly, *NIST Representative*

Your name here
IEEE Standards Program Manager, Document Development

Your name here
IEEE Standards Program Manager, Technical Program Development

3. Definitions

Add the following definitions:

3.148 Machine-to-Machine (M2M) communication: Information exchange between user devices through a Base Station, or between a device and a server in the core network through a Base Station that may be carried out without any human interaction.

3.149 M2M ASN: An Access Service Network that supports M2M service.

3.150 M2M device: An MS with M2M functionality.

3.151 M2M subscriber: A consumer of M2M service.

3.152 M2M Server: An entity to communicate with M2M devices. The M2M server provides an interface which can be accessed by an M2M subscriber.

3.153 M2M feature: A unique characteristic of an M2M application that is supported by the M2M ASN. One or more features may be needed to support an application.

3.154 M2M group: A group of devices that share one or more features in common and/or belong to same M2M subscriber.

6. MAC common part sublayer

Insert the following text

6.3.23.10.1 Network reentry from idle mode for M2M devices

BS may assign ranging resources, including ranging code and ranging opportunity, dedicated for M2M devices. In this case, M2M devices perform ranging for network (re-)entry using dedicated ranging resources. If BS does not assign dedicated ranging resources, M2M devices perform ranging for network (re-)entry using the ranging resources defined in 6.3.10.3

16. WirelessMAN-Advanced Air Interface

16.1 Introduction

16.2 Medium access control

16.2.1 Addressing

16.2.1.2 Logical Identifiers

Add the following new text

16.2.1.2.1 Station Identifier (STID)

The STID is used to identify the M2M devices in the domain of the ABS.

16.2.1.3 Address for machine to machine application

16.2.1.3.1 M2M Group Identifier (MGID)

A 15-bit value that uniquely identifies an M2M group which one or more M2M devices belong to. This ID shall be used to send control messages to a group of devices (e.g., group paging) or to transmit the multicast data to the M2M devices.

An MGID is assigned by a network entity during initial network entry and released during an explicit network exit (e.g., power down location update) or when the device enters DCR mode. The assigned MGID shall be retained by an M2M device even in idle state unless the M2M device exits from the network. The MGID can be re-assigned; the re-assignment procedure is TBD.

16.2.2 MAC PDU formats

Add new section and table

16.2.2.2.10 Multicast transmission end extended header (MTEEH)

Table 676a—MTEEH format

Syntax	Size (bits)	Notes
METEEH () {		
Type	4	Extended header type = 0b1001 (MTEEH Type)
}		

16.2.3 MAC Control messages

16.2.3.23 AAI-PAG-ADV (paging advertisement) Message

Modify Table 700 as indicated

Table 700—AAI-PAG-ADV message field description

Field	Size (bits)	Value/Description	Condition
...	...	...	...
For (i=0; i<Num_MGID; i++) {		Num_MGID indicates the number of MGIDs included in this paging message	Shall be included if the ABS sends DL multicast data for M2M after transmission of the AAI-PAG-ADV message.
MGID	15	M2M Group ID	
Action Code	1	0: Performing netwok re entry 1: Receiving multicast traffic	
If (Action Code == 1) {			
Multicast transmission start time (MTST)	TBD	Least significant TBD bits of the frame nuimber in which the ABS starts sending DL multicast data.	Shall be present when the MTST needs to be included in this message.
}			
...	...	...	...
}			

16.2.4 Construction and Transmission of MAC PDUs

16.2.5 AAI Security

Add new section and text

16.2.5.5 Security Support for Multi-cast Traffic

Security for Multi-cast traffic provides encryption and integrity protection of such data information for secure group informing and management. A common security key is used by devices within a group.

16.2.5.5.1 Key Derivation

The key hierarchy defines what keys are present in the system for Multi-cast traffic and how keys are generated. The BS may derive the Group Master Key (GMK) from the M2M authentication server or generate it locally. The group traffic encryption key (GTEK) is derived directly from the GMK.

16.2.5.5.1.1 GTEK Derivation

The GTEK is the transport encryption key used to encrypt Multi-cast data. The GTEK (Group Traffic Encryption Key) is derived based on the GMK (Group Master Key). The GMK is provided by the ABS during the network entry through the AAI-REG-RSP message, which also includes GTEK_COUNT and

MGID.
The GTEK derivation is done:

$$GTEKi = Dot16KDF (GMK, MGID, GTEK\_COUNT \mid \text{“GTEK”}, 128), \quad (1)$$

Where:

- GMK is the Group Master Key.
- GTEK_COUNT is a counter used to derive different GTEKs for the same GMK, the value of the counter is changed every time a new GTEK need to be derived within the time the same GMK is valid.
- MGID is the identifier of the group, which the AMS and GMK is associated with

16.2.5.5.2 Key Hierarchy

Figure 411a outlines the process to calculate the GTEK based on a GMK provided by the ABS.

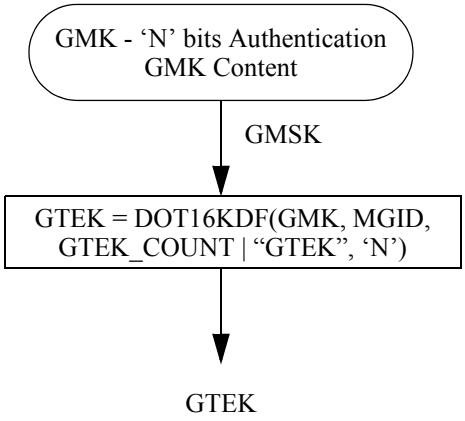

Figure 411a—GTEK derivation from GMK

16.2.5.5.3 GTEK Key Usage

The GTEK is used for encrypting DL multi-cast data by the ABS, which is also used for decrypting such DL multi-cast data by the AMS.

Each GTEK has its own PN counter size of 22bits.

16.2.5.5.3.1 GTEK Update

The GTEK update is triggered whenever GTEK is running out the relevant PN space.

16.2.5.5.3.2 Key Update during Location Update

The AMS shall include its current GTEK_COUNT in the AAI-RNG-REQ message during location update to the ABS. If ABS detects that the AMS has an old GTEK_COUNT, the ABS shall include the current GTEK_COUNT of the GMK in the AAI-RNG-RSP message and send it to the AMS. Otherwise, no GTEK update will be performed.

16.2.5.5.3.3 Key Update during Handover

During handover, the serving ABS shall include the new GTEK information via AAI-HO-MCD message, if the MGID of the AMS changes. If the MGID does not change for AMS, the serving ABS shall indicate that no change of GTEK is required.

16.2.6 MAC HO procedures

16.2.7 Persistent Scheduling in the Advanced Air Interface

16.2.8 Multicarrier operation

16.2.9 Group Resource Allocation

16.2.10 Connection Management

16.2.11 Bandwidth Request and Allocation Mechanism

16.2.12 Quality of Service (QoS)

16.2.13 ARQ mechanism

16.2.14 HARQ functions

16.2.15 Network entry and initialization

16.2.16 Periodic ranging

16.2.17 Sleep mode

16.2.18 Idle mode

Add new section and text

16.2.18.7 Idle mode for M2M application

When an M2M device enters idle mode, the M2M device shall follow the procedures defined in 16.2.18 except the procedures described in this section.

If an M2M device requires the longer inactive interval, longer paging cycle can be provided for the M2M device during the idle mode initiation through AAI-DREG-REQ/AAI-DREG-RSP messages.

Idle mode timer for the M2M device may be assigned during idle mode initiation. In this case, the AAI-DREG-RSP message includes M2M device-specific Idle Mode Timer. When the M2M device receives the AAI-DREG-RSP message with M2M device-specific Idle Mode Timer, the M2M device shall perform location update prior to the expiration of the M2M device-specific Idle Mode Timer. At every location update including the paging group location update, the M2M device-specific Idle Mode Timer is reset to 0 and restarted.

16.2.18.7.1 Paging operation

Group paging may be used for M2M devices. For this, M2M Group Identifier (MGID) defined in 16.2.1.3.1 may be included in a paging message instead of an individual identifier to identify the group of M2M devices.

16.2.18.7.2 Network re-entry from idle mode for M2M devices

For network reentry from Idle Mode, ranging parameters may be different for M2M devices or M2M groups.

BS may assign ranging resources, including ranging code and ranging opportunity, dedicated for M2M devices. In this case, M2M devices perform ranging for network (re-)entry using dedicated ranging resources. If BS does not assign dedicated ranging resources, M2M devices perform ranging for network (re-)entry using the ranging resources defined in Table 833 in 16.3.5.5.1.2.

For the network reentry indicated by a paging message that contains ranging configuration, the M2M device shall select a ranging opportunity according to the ranging configuration. Ranging configuration may include differentiated waiting offset time and backoff window size.

16.2.19 Deregistration with context retention (DCR) mode

16.2.20 Co-located coexistence (CLC)

16.2.21 Interference mitigation mechanism

16.2.22 MAC control reliability

16.2.23 Power management for active mode

16.2.24 Update of S-SFH IEs

16.2.25 Short Message Service

16.2.26 Coverage Loss Detection and Recovery from Coverage Loss

16.2.27 AMS deregistration

16.2.28 Support for Multicast Service

Add new section and text

16.2.28.4 Multicast Operation for machine to machine (M2M) applications

When an M2M BS receives DL multicast data for M2M application from the network, it shall send DL multicast data to M2M devices belonging to a M2M Group.

16.2.28.4.1 M2M Multicast operation in idle mode

An M2M BS shall provide the multicast service for M2M devices in idle mode. Before an M2M BS sends DL multicast data, the M2M BS shall transmit the paging message including the multicast traffic indication to M2M devices during the paging listening intervals of the M2M devices. When an M2M device receives the multicast traffic indication through the paging message during its paging listening interval, the M2M device shall start receiving the DL multicast data without the idle mode termination.

The multicast transmission start time may be included in the paging message in order to indicate when the DL multicast data is sent by the BS. The value of multicast transmission start time shall be less than the start time of next paging listening interval of the devices receiving the AAI-PAG-ADV message. The M2M device may power down until the frame indicated by multicast transmission start time in the AAI-PAG-ADV message.

When the multicast data transmission ends, the BS shall notify the end of multicast data transmission to M2M devices by using Multicast Transmission End extended header (MTEEH). Upon receiving the MTEEH, the device may enter the paging unavailable interval as specified in 16.2.18.2.

16.2.28.4.2 Reliable multicast transmission for M2M applications

An M2M BS shall provide the reliable transmission of the multicast traffic for M2M applications.