IEEE STANDARDS ASSOCIATION IEEE

IEEE Standard for Information technology—
Telecommunications and information exchange between systems
Local and metropolitan area networks—
Specific requirements

Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications

Amendment 4: Enhancements for Transit Links Within Bridged Networks

IEEE Computer Society

Sponsored by the
LAN/MAN Standards Committee

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

IEEE Std 802.11ak™-2018
(Amendment to IEEE Std 802.11™-2016
as amended by IEEE Std 802.11ai™-2016,
IEEE Std 802.11ah™-2016,
and IEEE Std 802.11aj™-2018)

IEEE Std 802.11ak™-2018
(Amendment to IEEE Std 802.11™-2016
as amended by IEEE Std 802.11ai™-2016,
IEEE Std 802.11ah™-2016,
and IEEE Std 802.11aj™-2018)

**IEEE Standard for Information technology—
Telecommunications and information exchange between systems
Local and metropolitan area networks—
Specific requirements**

Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications

Amendment 4: Enhancements for Transit Links Within Bridged Networks

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

Approved 8 March 2018

IEEE-SA Standards Board

Abstract: Protocols, procedures, and managed objects to enhance the ability of IEEE 802.11™ media to provide transit links internal to IEEE 802.1Q™ bridged networks are specified in this amendment to IEEE Std 802.11™-2016.

Keywords: bridged, bridging, EPD, GCR, GLK, GLK-GCR, IEEE 802.11™, IEEE 802.11ak™, IEEE 802.1Q™, LPD, priority code point, SYNRA, transit link

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

PDF: ISBN 978-1-5044-4811-6 STD23075
Print: ISBN 978-1-5044-4812-3 STDPD23075

Important Notices and Disclaimers Concerning IEEE Standards Documents

IEEE documents are made available for use subject to important notices and legal disclaimers. These notices and disclaimers, or a reference to this page, appear in all standards and may be found under the heading "Important Notices and Disclaimers Concerning IEEE Standards Documents." They can also be obtained on request from IEEE or viewed at http://standards.ieee.org/IPR/disclaimers.html.

Notice and Disclaimer of Liability Concerning the Use of IEEE Standards Documents

IEEE Standards documents (standards, recommended practices, and guides), both full-use and trial-use, are developed within IEEE Societies and the Standards Coordinating Committees of the IEEE Standards Association ("IEEE-SA") Standards Board. IEEE ("the Institute") develops its standards through a consensus development process, approved by the American National Standards Institute ("ANSI"), which brings together volunteers representing varied viewpoints and interests to achieve the final product. IEEE Standards are documents developed through scientific, academic, and industry-based technical working groups. Volunteers in IEEE working groups are not necessarily members of the Institute and participate without compensation from IEEE. While IEEE administers the process and establishes rules to promote fairness in the consensus development process, IEEE does not independently evaluate, test, or verify the accuracy of any of the information or the soundness of any judgments contained in its standards.

IEEE Standards do not guarantee or ensure safety, security, health, or environmental protection, or ensure against interference with or from other devices or networks. Implementers and users of IEEE Standards documents are responsible for determining and complying with all appropriate safety, security, environmental, health, and interference protection practices and all applicable laws and regulations.

IEEE does not warrant or represent the accuracy or content of the material contained in its standards, and expressly disclaims all warranties (express, implied and statutory) not included in this or any other document relating to the standard, including, but not limited to, the warranties of: merchantability; fitness for a particular purpose; non-infringement; and quality, accuracy, effectiveness, currency, or completeness of material. In addition, IEEE disclaims any and all conditions relating to: results; and workmanlike effort. IEEE standards documents are supplied "AS IS" and "WITH ALL FAULTS."

Use of an IEEE standard is wholly voluntary. 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.

In publishing and making its standards available, IEEE is not suggesting or rendering professional or other services for, or on behalf of, any person or entity nor is IEEE undertaking to perform any duty owed by any other person or entity to another. Any person utilizing any IEEE Standards document, should rely upon his or her own independent judgment in the exercise of reasonable care in any given circumstances or, as appropriate, seek the advice of a competent professional in determining the appropriateness of a given IEEE standard.

IN NO EVENT SHALL IEEE BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO: PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE PUBLICATION, USE OF, OR RELIANCE UPON ANY STANDARD, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE AND REGARDLESS OF WHETHER SUCH DAMAGE WAS FORESEEABLE.

Translations

The IEEE consensus development process involves the review of documents in English only. In the event that an IEEE standard is translated, only the English version published by IEEE should be considered the approved IEEE standard.

Official statements

A statement, written or oral, that is not processed in accordance with the IEEE-SA Standards Board Operations Manual shall not be considered or inferred to be the official position of IEEE or any of its committees and shall not be considered to be, or be relied upon as, a formal position of IEEE. 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 of IEEE.

Comments on standards

Comments for revision of IEEE Standards documents are welcome from any interested party, regardless of membership affiliation with IEEE. However, IEEE does not provide consulting information or advice pertaining to IEEE Standards documents. Suggestions for changes in documents should be in the form of a proposed change of text, together with appropriate supporting comments. Since IEEE standards represent a consensus of concerned interests, it is important that any responses to comments and questions also receive 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 comments or questions except in those cases where the matter has previously been addressed. For the same reason, IEEE does not respond to interpretation requests. Any person who would like to participate in revisions to an IEEE standard is welcome to join the relevant IEEE working group.

Comments on standards should be submitted to the following address:

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

Laws and regulations

Users of IEEE Standards documents should consult all applicable laws and regulations. Compliance with the provisions of any IEEE Standards document 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

Photocopies

Updating of IEEE Standards documents

Users of IEEE Standards documents 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. A current 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.

Every IEEE standard is subjected to review at least every ten years. When a document is more than ten years old and has not undergone a revision process, 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 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-SA Website at http://ieeexplore.ieee.org or contact IEEE at the address listed previously. For more information about the IEEE SA or IEEE's standards development process, visit the IEEE-SA Website at http://standards.ieee.org.

Errata

Errata, if any, for all IEEE standards can be accessed on the IEEE-SA Website at the following URL: http://standards.ieee.org/findstds/errata/index.html. Users are encouraged to check this URL for errata periodically.

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 by the IEEE with respect to the existence or validity of any patent rights in connection therewith. If a patent holder or patent applicant has filed a statement of assurance via an Accepted Letter of Assurance, then the statement is listed on the IEEE-SA Website at http://standards.ieee.org/about/sasb/patcom/patents.html. Letters of Assurance may indicate whether the Submitter is willing or unwilling to grant licenses under patent 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.

Essential Patent Claims may exist for which a Letter 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 provided in connection with submission of a Letter of Assurance, if any, or in any licensing agreements are reasonable or non-discriminatory. Users of this standard are expressly advised that determination of the validity of any patent rights, and the risk of infringement of such rights, is entirely their own responsibility. Further information may be obtained from the IEEE Standards Association.

Participants

At the time this amendment was submitted to the IEEE-SA Standards Board for approval, the IEEE 802.11 Working Group had the following officers:

Adrian P. Stephens, *Chair*
Jon W. Rosdahl and **Dorothy V. Stanley**, *Vice-chairs*
Stephen McCann, *Secretary*
Robert Stacey and **Peter Ecclesine**, *Technical Editors*

At the time this amendment was submitted for balloting, the Enhancements for Transit Links in Bridged Networks Task Group had the following membership:

Donald E. Eastlake, III, *Chair and Editor*
Mark A. Hamilton, *Vice Chair*
Norman Finn, *Vice Editor*
(**Filip Mestanov, Yan Zhuang**, *Former Secretaries*)

Osama S. Aboulmagd
Santosh P. Abraham
Tomoko Adachi
Kare Agardh
Jaehyun Ahn
Jinsoo Ahn
Woojin Ahn
Roberto Aiello
Carlos H. Aldana
Yaron Alpert
Carol Ansley
Tsuguhide Aoki
Lee R. Armstrong
Yusuke Asai
Alfred Asterjadhi
Kwok Shum S. Au
Vijay Auluck
Stefan Aust
Shahrnaz Azizi
Alireza Babaei
Eugene Baik
Gabor Bajko
Phillip Barber
Stephane Baron
Gwendolyn Barriac
Nehru Bhandaru
Andre Bourdoux
John Buffington
Ann Bynum
Lin Cai
Yu Cai
George Calcev
Chris Calvert
Radhakrishna Canchi
Fengming Cao
Rui Cao
Cagatay Capar
Laurent Cariou
William Carney
Soo-Young Chang
Clint F. Chaplin
Jiamin Chen
Xiaogang Chen
Minho Cheong
George Cherian
Dmitry Cherniavsky
Zhipei Chi
Hangyu Cho
Joongwon Cho
In-Kyeong Choi
Jinsoo Choi
Sangsung Choi
Sayantan Choudhury
Liwen Chu
Jinyoung Chun
John Coffey
Kenneth Coop
Carlos Cordeiro
Subir Das
Rolf J. de Vegt
Der-Jiunn Deng
Thomas Derham
Klaus Doppler
Malcolm Dowse
JiaDong Du
Richard Edgar
Marc Emmelmann
Iksoo Eo
Vinko Erceg
Zhong Fan
Ping Fang
Yonggang Fang
Matthew J. Fischer
Dan Gal
Chittabrata Ghosh
Monisha Ghosh
James P. Gilb
Tim Godfrey
Michael Grigat
Russell Haines
David Halls
Christopher J. Hansen
Peng Hao
Nathaniel Hardison
Daniel N. Harkins
Brian D. Hart
Chris Hartman
Victor Hayes
Shiwen He
Allen Heberling
Ahmadreza Hedayat
Carolyn Heide
Robert F. Heile
Jerome Henry
Guido R. Hiertz
Koji Horisaki
Jing-Rong Hsieh
Lei Huang
Po-Kai Huang
Rongsheng Huang
John Humbert
David Hunter
Jeorge Hurtarte
Yasuhiko Inoue
Koichi Ishihara
Mitsuru Iwaoka
Amin Jafarian
Alan Jauh
Chanyong Jeong
Jinjing Jiang
Robert Jiang
Liang Jin
Nihar Jindal
Allan Jones
Vincent Knowles Jones
Kaushik Josiam
Carl W. Kain
Naveen K. Kakani
Hyunduk Kang
Hyunjeong Kang
Masami Katagiri
Richard H. Kennedy
John Kenney
Stuart J. Kerry
Evgeny Khorov
Sangwon Ki

Jaehwan Kim
Jeehoon Kim
Jeongki Kim
Joonsuk Kim
Kyeongpyo Kim
Sang Gook Kim
Suhwook Kim
Yongho Kim
Youhan Kim
Youngsoo Kim
Akira Kishida
Shoichi Kitazawa
Jarkko Kneckt
Gwangzeen Ko
Fumihide Kojima
Tom Kolze
Igal Kotzer
Bruce P. Kraemer
Maciej Krasicki
Byung-Jae Kwak
Jin-Sam Kwak
Joseph Kwak
Hyoungjin Kwon
Yong-Jin Kwon
Young Hoon H. Kwon
Massinissa Lalam
Paul Lambert
Zhou Lan
James Lansford
Daewon Lee
Hongsup Lee
Jae Seung S. Lee
Jehun Lee
Joonsoo Lee
Wookbong Lee
Young Ha Lee
Yuro Lee
Zhongding Lei
James Lepp
Joseph Levy
Bo Li
Dejian Li
Feng Li
Guoqing Li
Huan-Bang Li
Jing Li
Qinghua Li
Yunbo Li
Zhiqiang Li
Dong Guk Lim
Yingpei Lin
Der-Zheng Liu
Jianhan Liu
Le Liu
Pei Liu
Yong Liu
Peter Loc
Hui-Ling Lou
Su Lu
Chuck Lukaszewski
Jun Luo
Yi Luo
Kaiying Lv
Michael Lynch
Jouni K. Malinen
Alexander Maltsev
Hiroshi Mano
James Marin
Roger Marks
Simone Merlin
James Miller
Apurva Mody
Pooya Monajemi
Michael Montemurro
Hiroki Mori
Kenichi Mori
Masahito Mori
Hitoshi Morioka
Yuichi Morioka
Ronald Murias
Andrew Myles
Toshihisa Nabetani
Yukimasa Nagai
Hiroki Nakano
Sai Shankar S. Nandagopalan
Chiu Ngo
Paul Nikolich
Eric Nordstrom
John Notor
Jinhyung Oh
Jong-Ee Oh
Minseok Oh
Min-Seok Oh
Robert Olesen
Oghenekome Oteri
Kazuyuki Ozaki
Santosh Ghanshyam G. Pandey
Jiyong Pang
Babis Papadopoulos
Thomas Pare
Eunsung Park
Giwon Park
Hyungu Park
Jaewoo Park
Glenn Parsons
Xiaoming Peng
Eldad Perahia
Stephanie Pereira
Hakan Persson
James E. Petranovich
Albert Petrick
Walter Pienciak
Steve Pope
Ron Porat
Rethnakaran Pulikkoonattu
Emily H. Qi
Verotiana Rabarijaona
Demir Rakanovic
Stephen G. Rayment
Edward Reuss
Maximilian Riegel
Mark Rison
Zhigang Rong
Richard Roy
Cheol Ryu
Kiseon Ryu
Bahareh Sadeghi
Takenori Sakamoto
Kazuyuki Sakoda
Hemanth Sampath
Behcet Sarikaya
Ioannis Sarris
Sigurd Schelstraete
Daniel Schneider
Andy Scott
Jonathan Segev
Yongho Seok
Kunal Shah
Stephen J. Shellhammer
Ian Sherlock
Jung-Chul Shin
Robert Slater
Graham K. Smith
Ju-Hyung Son
JungBo B. Son
Hayeong Song
Sudhir Srinivasa
Jung Hoon H. Suh
Bo Sun
Li-Hsiang Sun
Sheng Sun
Yakun Sun
Kazuaki Takahashi
Mineo Takai
Yasushi Takatori
Sagar Tamhane
Tomoya Tandai
Rakesh Taori
Alireza Tarighat
Bin Tian
Jens Tingleff
Fei Tong
Payam Torab
Filippo Tosato
Toshimitsu Tsubaki
Kazuyoshi Tsukada
Esa Tuomaala
Richard D. Van Nee
Allert Van Zelst
Lorenzo Vangelista
Prabodh Varshney
Ganesh Venkatesan
Sriram Venkateswaran
Sameer Vermani
Gabriel Villardi
George A. Vlantis
Chao Chun Wang
Haiguang Wang
Haiming Wang
James June J. Wang
Lei Wang
Qi Wang
Xiaofei Wang
Xuehuan Wang
Lisa Ward
Fujio Watanabe

Zou Wei-Xia
Menzo M. Wentink
Leif Wilhelmsson
Eric Wong
Harry R. Worstell
Tianyu Wu
Pengfei Xia
Yan Xin
Mingguang Xu
Akira Yamada
Rongzhen Yang
Xun Yang
Xun Yang
Yunsong Yang
Ke Yao
James Yee
Peter Yee
Su Khiong K. Yong
Larry Yonge
Christopher Young
Chinghwa Yu
Heejung Yu
Mao Yu
Tevfik Yucek
Ji-Hoon Yun
Katsuo D. Yunoki
Hongyuan Zhang
Jiayin Zhang
Yan Zhang
Mu Zhao
Jingyi Zhou
Chunhui Zhu
Hufei Zhu
Lan Zhuo
Juan Carlos Zuniga

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

Osama Aboulmagd
Tomoko Adachi
Thomas Alexander
Nobumitsu Amachi
Carol Ansley
Butch Anton
Alfred Asterjadhi
Kwok Shum S. Au
Stefan Aust
Michael Bahr
Harry Bims
Demetrio Bucaneg
William Byrd
William Carney
Juan Carreon
Jiamin Chen
Keith Chow
Charles Cook
Sourav Dutta
Donald E. Eastlake, III
Richard Edgar
Michael Fischer
Avraham Freedman
Tim Godfrey
David Goodall
Eric W Gray
Randall Groves
Michael Gundlach
Stephen Haddock
Mark A. Hamilton
Shiwen He
Marco Hernandez
Werner Hoelzl
Noriyuki Ikeuchi
Yasuhiko Inoue
Sergiu Iordanescu
Akio Iso
Atsushi Ito
Raj Jain
SangKwon Jeong
Piotr Karocki
Stuart J. Kerry
Evgeny Khorov
Yongbum Kim
Yasushi Kudoh
Thomas Kurihara
James Lepp
Dejian Li
Elvis Maculuba
Jouni K. Malinen
Roger Marks
Jeffery Masters
Stephen McCann
Michael McInnis
Michael Montemurro
Ronald Murias
Andrew Myles
Michael Newman
Nicks A. Nikjoo
Paul Nikolich
Robert O'Hara
Satoshi Oyama
Clinton Powell
Venkatesha Prasad
Maximilian Riegel
Robert Robinson
Benjamin Rolfe
Richard Roy
Shigenobu Sasaki
Naotaka Sato
Andy Scott
Ian Sherlock
Graham K. Smith
Robert Stacey
Dorothy V. Stanley
Thomas Starai
Walter Struppler
Mark Sturza
Pedro Tonhozi de Oliveira
Mark-Rene Uchida
Lorenzo Vangelista
Dmitri Varsanofiev
Ganesh Venkatesan
George A. Vlantis
Khurram Waheed
Haiming Wang
Lei Wang
Xiaofei Wang
Karl Weber
Yunsong Yang
Oren Yuen

When the IEEE-SA Standards Board approved this amendment on 8 March 2018, it had the following membership:

Jean-Philippe Faure, *Chair*
Gary Hoffman, *Vice Chair*
John D. Kulick, *Past Chair*
Konstantinos Karachalios, *Secretary*

Ted Burse	Xiaohui Liu	Robby Robson
Guido R. Hiertz	Kevin Lu	Dorothy Stanley
Christel Hunter	Daleep Mohla	Mehmet Ulema
Joseph L. Koepfinger*	Andrew Myles	Phil Wennblom
Thomas Koshy	Paul Nikolich	Philip Winston
Hung Ling	Ronald C. Petersen	Howard Wolfman
Dong Liu	Annette D. Reilly	Jingyi Zhou

*Member Emeritus

Introduction

This introduction is not part of IEEE Std 802.11ak-2018, IEEE Standard for Information technology—Local and metropolitan area networks—Specific requirements—Part 11: Wireless LAN MAC and PHY Specifications—Amendment 3: Enhancements for Transit Links Within Bridged Networks.

IEEE Std 802.11™ was originally designed with the assumption that non-access point (non-AP) non-mesh stations (STAs) would be leaf nodes of the network. This amendment extends IEEE Std 802.11 so that communication links can be established between general link (GLK) STAs that are usable as transit links inside an IEEE 802.1Q™ network.

Areas of extension and related improvements include the following:

a) Optional support of IEEE 802® length/type (EPD) frame encoding, as opposed to ISO/IEC 8802-2: 1998 logical link control (LLC) encoding (LPD).

b) Facilities for GLK APs to send group addressed Data GLK frames to a subset of receiving GLK STAs.

c) Priority code points in IEEE Std 802.1Q™ have a different default meaning than they do in IEEE Std 802.1D™. For example, in IEEE Std 802.1Q, priority 2 is, by default, higher priority than priority 1, while in IEEE Std 802.1D, it is lower. Thus it is suggested in Annex V that GLK associations use a Priority code point to user priority mapping in their corresponding IEEE 802.1Q bridge port.

d) Accessibility to the wireless medium via one or more Internal Sublayer Service service access points (SAPs) that map to attached bridge ports.

e) Improvement of groupcast with retries (GCR) setup to extend GCR to GLK STAs.

Contents

Tables

Figures

IEEE Standard for Information technology—
Telecommunications and information exchange between systems
Local and metropolitan area networks—
Specific requirements

Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications

Amendment 4: Enhancements for Transit Links Within Bridged Networks

(This amendment is based on IEEE Std 802.11™-2016 as amended by IEEE Std 802.11ai™-2016, IEEE Std 802.11ah™-2016, and IEEE Std 802.11aj™-2018.)

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

Editing instructions are shown ***bold italic***. Four editing instructions are used: change, delete, insert, and replace. ***Change*** is used to make corrections in existing text or tables. The editing instruction specifies the location of the change and describes what is being changed by using either ~~strikethrough~~ (to remove old material) or underscore (to add new material). ***Delete*** removes existing material. ***Insert*** adds new material without disturbing the existing material. Insertions may require renumbering. If so, renumbering instructions are given in the editing instruction. ***Replace*** is used to make large changes in existing text, subclauses, tables, or figures by removing existing material and replacing it with new material. Editorial notes will not be carried over into future editions because the changes will be incorporated into the base standard.[1]

1. Overview

1.3 Supplementary information on purpose

Insert the following item at the end of the dashed list in 1.3:

— Defines the mechanisms for communications over the wireless medium used as a link in an IEEE 802.1Q™ bridged network.

[1] Notes in text, tables, and figures are given for information only and do not contain requirements needed to implement the standard.

2. Normative references

Insert the following normative reference into Clause 2 in alphanumeric order:

IEEE Std 802.1AC™-2016, IEEE Standard for Local and metropolitan area networks—Media Access Control (MAC) Service Definition.

3. Definitions, acronyms, and abbreviations

3.1 Definitions

Change the following definition in 3.1 as shown:

distribution system access function (DSAF): A function within an access point (AP) or mesh gate that uses the medium access control (MAC) service and distribution system service (DSS) to provide access between the distribution system (DS) and the wireless medium (WM). Within a general link (GLK) AP or GLK mesh station (STA), the DSAF also switches GLK traffic to the GLK convergence function and from there to the IEEE 802.1Q bridge port.

3.2 Definitions specific to IEEE Std 802.11

Insert the following definitions into 3.2 in alphabetic order:

attached bridge: An IEEE 802.1Q bridge that has one or more bridge port Enhanced Internal Sublayer Service (EISS) interfaces supported by general links (GLKs) provided by a GLK access point (AP), GLK non-AP station (STA), GLK mesh STA, or GLK independent basic service set (IBSS) STA.

general link (GLK): A point-to-point connection between two instances of the IEEE 802.1D Internal Sublayer Service that uses an IEEE 802.11 wireless link between stations (STAs). A general link is suitable for use in an IEEE 802.1Q bridged network.

general link (GLK) convergence function: The convergence function defined in IEEE Std 802.1AC between an IEEE 802.11 medium access control (MAC) and an IEEE 802.1Q bridge.

general link groupcast with retries (GLK-GCR): A variant of GCR that specifies the use of GCR for general link.

general link (GLK) station (STA): A STA that implements GLK functionality.

Change the following definition in 3.2 as shown:

medium access control (MAC) service tuple: The collection of a MAC service data unit (MSDU) along with the associated source address, destination addresses, priority, ~~and~~ service class, optional set of service_access_point_identifiers, and optional indication of whether the supplied ~~associated with the~~ MSDU is in EtherType Protocol Discrimination (EPD) or Logical link control (LLC) Protocol Discrimination (LPD) format, which are all passed as parameters across the MAC service access point (SAP) and are all except the service_access_point_identifiers delivered across the distribution system between access points (APs), mesh gates, and the portal of an extended service set (ESS).

Insert the following definitions into 3.2 in alphabetic order:

method-specific service access point (SAP) (MS-SAP): The point at which an instance of the IEEE 802.11 method-specific medium access control (MAC) service is offered.

synthetic receiver address (SYNRA): A constructed group address used by a general link (GLK) access point (AP) as a receiver address to forward frames to a subset of GLK non-AP stations (STAs), as required by IEEE 802.1Q bridges.

3.4 Abbreviations and acronyms

Insert the following abbreviations into 3.4 in alphabetic order:

GLK	general link
GLK-GCR	general link groupcast with retries
MS-SAP	method specific service access point
SYNRA	synthetic receiver address

4. General description

4.2 How wireless local area networks (WLANs) are different

4.2.5 Interaction with other IEEE 802® layers

Change the first sentence of the first paragraph of 4.2.5 as follows:

IEEE Std 802.11 is required to appear to higher layers [logical link control (LLC) sublayer] as a general-purpose IEEE 802 LAN.

4.3 Components of the IEEE 802.11 architecture

4.3.5 Distribution system (DS) concepts

4.3.5.1 Overview

Change the second paragraph of 4.3.5.1 as follows:

Instead of existing independently, an infrastructure BSS might also form a component of an extended form of network that is built with multiple BSSs. The architectural component used to interconnect infrastructure BSSs is the DS for non-general link (non-GLK) operation. The DS and extended service set (ESS) are mechanisms for expanding connectivity for non-GLK operation. For GLK operation, an IEEE 802.1Q bridge might be used to form an extended network (see 4.3.27).

4.3.7 Integration with non-IEEE 802.11 LANs

Change the first paragraph of 4.3.7 as follows:

To integrate the IEEE 802.11 non-GLK architecture with a non-IEEE 802.11 LAN, including a traditional wired LAN, a final logical architectural component is introduced—a *portal*. The IEEE 802.11 GLK architecture (see 4.3.27) does not include the concept of a portal.

4.3.20 Mesh BSS

4.3.20.4 IEEE 802.11 components and mesh BSS

Change the second and third paragraphs of 4.3.20.4 as follows:

However, instead of existing independently, an MBSS might also interconnect with other BSSs through ~~access~~ the distribution system (DS) or a bridged LAN. ~~The MBSS interconnects with other BSSs through the DS.~~ Then, mesh STAs can communicate with nonmesh STAs. ~~Therefore, a~~ A logical architectural component is introduced in order to integrate the non-GLK mesh STA ~~MBSS~~ with the DS—the mesh gate. Data move between a non-GLK ~~an~~ MBSS and the DS via one or more mesh gates. Thus the mesh gate is the logical point at which MSDUs from ~~an~~ a non-GLK MBSS enter the ~~IEEE 802.11~~ DS~~, via the DSAF~~. In a GLK MBSS, mesh STAs can communicate with nonmesh STAs via a GLK mesh STA with an attached bridge port and from there to the bridged LAN. Once an MBSS contains a mesh gate that connects it to the ~~IEEE 802.11~~ DS or a GLK mesh STA that connects it to a bridge port, the MBSS can be integrated with other infrastructure BSSs ~~too~~, given that their APs connect to the same DS or bridged network. Several mesh gates are shown in Figure 4-9 connecting different MBSSs to the DS.

When an MBSS accesses the ~~IEEE 802.11~~ DS or a bridged network ~~through its mesh gate~~, the MBSS can be integrated with a non-IEEE-802.11 LAN. To integrate ~~the IEEE 802.11~~ a DS to which this MBSS connects, the DS needs to contain a portal. See 4.3.7. Consequently, mesh gate and portal are different entities. The portal integrates the IEEE 802.11 architecture with a non-IEEE-802.11 LAN (e.g., a traditional wired LAN)~~, whereas the~~ The mesh gate integrates the MBSS with the ~~IEEE 802.11~~ DS. A GLK mesh STA integrates the MBSS with a bridged network.

Insert the following subclauses (4.3.27 and 4.3.28, including Figure 4-13a, Figure 4-13b, and Figure 4-13c) after 4.3.26:

4.3.27 General link (GLK)

4.3.27.1 General

GLK STAs establish general links with other GLK STAs. These general links are suitable to be used as links inside an IEEE 802.1Q network. For an infrastructure general link example, see Figure 4-13b (in 4.3.27.3.3).

A GLK STA coordinates with a GLK convergence function to provide the Internal Sublayer Service, as defined in IEEE Std 802.1AC, to an IEEE 802.1Q bridge for each peer GLK STA with which it is communicating. GLK STAs also provides link metrics for the use of external path selection protocols such as spanning tree protocol.

A GLK STA that starts a BSS uses membership selector values to set the BSS policy of requiring or not requiring general link or Ethertype protocol discrimination (EPD) support for any STA that joins the BSS.

A non-AP STA acts as either a GLK STA or a non-GLK STA. A GLK AP might permit associations from non-GLK STAs and acts as a non-GLK AP for those associated non-GLK STAs. GLK DMG STAs can establish a general link through a DMG relay. GLK S1G STAs cannot use or be a S1G relay.

The four-address MAC header can be used in GLK transmissions of Data frames. The use of the four-address MAC header or basic A-MSDU format is necessary for such MPDUs if the frame's SA, TA, RA, and DA fields (source address, transmitter address, receiver address, and destination address, respectively) are all different from each other. The three-address frame format can be used, as defined by Table 9-3, provided the addresses are consistent with Table 9-26.

A SYNRA is a group address RA used by a GLK AP to forward frames to a subset of GLK non-AP STAs, as required by IEEE 802.1Q bridges. The use of a SYNRA can improve bandwidth usage in some cases. SYNRAs are used in GLK AP transmissions.

As described in 4.3.27.2, when a GLK AP transmits a Data frame with a four-address MAC header whose RA contains a group address, the contents of the RA is a synthetic receiver address (SYNRA), and therefore its RA and DA values will not be equal. A GLK non-AP STA supports selective reception of group addressed frames by supporting SYNRA reception.

4.3.27.2 Selective reception of group addressed frames

For the reasons given below, when transmitting a data MPDU that has a group address RA to a set of receiving STAs, the GLK transmitter needs to transmit those MSDUs so that they are accepted by a specified subset of the associated GLK STAs indicated by the IEEE 802.1Q bridge.

The reason for such selective reception is to support requirements of IEEE 802.1Q bridges and can include the MAC service requirements that, when an MSDU is sent, it is not subsequently received and processed by the transmitting station or to break loops in the network topology. When a GLK STA associated with a GLK AP sends an MSDU to that AP with a group address destination, the AP retransmits it and uses the selective reception facility to stop the originating GLK STA from accepting it. Also, since the AP Internal Sublayer Service SAPs are mapped to IEEE 802.1Q bridge ports, loop prevention might need the traffic to be blocked to one or more of the associated GLK STAs. Such blocking can be implemented by the selective reception facility.

Implementation of this selective reception facility in a BSS case includes use of a synthetic group address RA (SYNRA addressing, see 9.3.2.1.2). As an alternative to the use of a SYNRA, selective reception includes sending a copy of the Data frame to each intended receiver using individually addressed MPDUs. In either case, an appropriate address format is needed because the DA is different from the RA (since the RA is either the SYNRA or a serial individual RA). SYNRA addressed MPDUs are transmitted by APs only.

All GLK non-AP STAs in an infrastructure BSS support receipt of SYNRAs (see 9.3.2.1.2 and 10.66). A GLK AP that is requested to deliver an MPDU to multiple GLK STAs can choose to construct and transmit a SYNRA addressed MPDU, use a sequence of unicast MPDUs, or both.

Parameters exchanged during the association (or reassociation) of a GLK STA with a GLK AP determine the mechanism used by the GLK AP to enable selective reception at the GLK STA of group addressed frames transmitted by the GLK AP. One such mechanism is GLK-GCR, which is a subset of GCR customized for general links (see 11.24.16). In GLK-GCR the group address is a SYNRA. Features of GCR that do not apply to GLK-GCR are as follows:

a) DMS Request and DMS Response frame exchange to set up GLK-GCR service
b) ADDBA Request/Response frame exchange to setup block ack agreement
c) GCR-SP delivery method
d) Unsolicited DMS Response frame for “GCR Advertise”
e) Concealment address

4.3.27.3 GLK Service Sets

4.3.27.3.1 Provision of the MAC service

MAC service data unit (MSDU) delivery services in an IEEE 802.1Q network can be supported by the IEEE 802.1AC MAC service. GLK STAs coordinate with an IEEE 802.1AC-compliant GLK convergence function, to provide access to the WM via one or more Internal Sublayer Service SAPs. The routing of all MSDUs that are provided by an IEEE 802.1Q relay entity via GLK STAs is controlled by the routing protocols of the IEEE 802.1Q network to which the GLK STA is attached. This enables the routing protocols to use all the general links available to the GLK STA.

4.3.27.3.2 GLK IBSS and PBSS

A GLK IBSS or GLK PBSS can provide access to the WM via general links that are suitable for use in an IEEE 802.1Q network. Figure 4-13a shows an example of a GLK IBSS (or equivalently a PBSS) involving three GLK non-AP STAs. Each participating STA provides MAC services at the MS-SAP, with the inclusion of a station vector that is then mapped to one or more Internal Sublayer Service SAPs by the IEEE 802.1AC GLK Convergence Function. Three general links are shown that connect three pairs of Internal Sublayer Service SAPs in a point-to-point manner. Each of the Internal Sublayer Service SAPs is then mapped to either an Enhanced Internal Sublayer Service (EISS) SAP or MAC-SAP, by the IEEE 802.1Q Media Independent Function or the Internal Sublayer Service to MAC-SAP function, respectively. The EISS SAP provides EISS services to the MAC relay entity of a VLAN bridge component (IEEE 802.1Q MAC Relay Entity). The MAC-SAP provides services to the LLC Sublayer.

NOTE—IEEE Std 802.11 does not specify the details of the IEEE 802.1AC GLK Convergence Function, the IEEE 802.1Q Media Independent Function, the Internal Sublayer Service to MAC-SAP function, the IEEE 802.1Q MAC Relay Entity, and the LLC Sublayer. These entities are specified in other documents such as IEEE Std 802.1AC™-2016 and IEEE Std 802.1Qbz™-2016 [B24a]. These entities are shown with dashed outlines in the figure. Entities that IEEE Std 802.11 does specify are shown with solid outlines and are within the box labeled “802.11 GLK IBSS/PBSS.”

A difference from a non-GLK STA’s IEEE 802.11 IBSS/PBSS is that either or both MAC-SAPs could directly connect to an IEEE 802.1Q bridge.

For example, each of the STAs and attached bridges (including the IEEE 802.1Q MAC Relay Entities) shown could be at the top of a rack in a data center to provide inter-rack connectivity. The two MAC-SAPs shown could even be safely connected to the same IEEE 802.1Q network, since such a network provides protection from loops.

Also, shown in the figure is the possibility to provide a point-to-point link between two LLC Sublayer entities that are each attached to a GLK non-AP STA. For example, this link could allow a computer attached to a GLK STA to directly connect to a network attached storage device attached to a GLK STA.

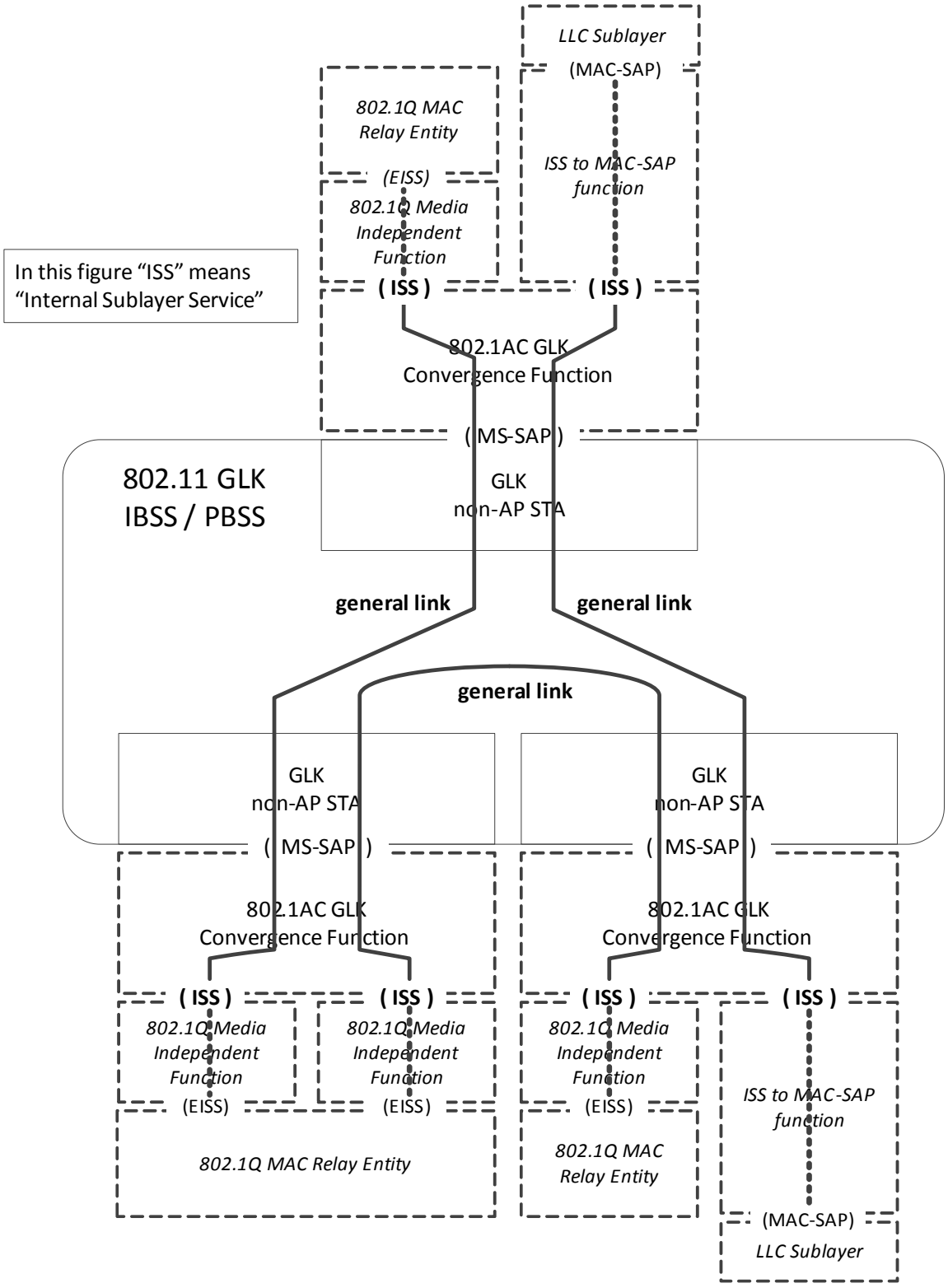

Figure 4-13a—Example of GLK IBSS or PBSS

4.3.27.3.3 Infrastructure BSS with general links

A GLK infrastructure BSS can provide access to the WM via general links that are suitable for use in an IEEE 802.1Q network. Figure 4-13b shows an example of a GLK infrastructure BSS with three GLK non-AP STAs and one GLK AP. Each participating STA provides MAC services at the MS-SAP, with the inclusion of a station vector that is then mapped to one or more Internal Sublayer Service SAPs by the IEEE 802.1AC GLK Convergence Function. Four general links are shown that connect four pairs of Internal Sublayer Service SAPs in a point-to-point manner. Each of the Internal Sublayer Service SAPs is then mapped, by the IEEE 802.1Q Media Independent Function or the Internal Sublayer Service to MAC-SAP function, to either an EISS SAP or a MAC-SAP, respectively. The EISS SAP provides EISS services to the MAC relay entity of a VLAN bridge component (IEEE 802.1Q MAC Relay Entity). The MAC-SAP provides services to the LLC Sublayer.

NOTE—IEEE Std 802.11 does not specify the details of the IEEE 802.1AC GLK Convergence Function, the IEEE 802.1Q Media Independent Function, the Internal Sublayer Service to MAC-SAP function, the IEEE 802.1Q MAC Relay Entity, and the LLC Sublayer. These entities are specified in other documents such as IEEE Std 802.1AC-2016 and IEEE Std 802.1Qbz-2016 [B24a]. These entities are shown with dashed outlines in the figure. Entities that IEEE Std 802.11 does specify are shown with solid outlines and are with in the box labeled “802.11 BSS.”

Although transmissions by an AP are typically received by all STAs associated with that AP, the service provided by a GLK infrastructure BSS might be considered as separate point-to-point links between the corresponding Internal Sublayer Service SAPs. Provisioning of such apparent point-to-point links is natural for MPDUs with an individually addressed RA. In order to provide such apparent point-to-point links for group addressed frames, the GLK AP can transmit them so that they are accepted by a subset of the associated GLK STAs. Such selective transmission can be provided through the GLK SYNRA addressing facility (see 4.3.27.2) or by serial transmissions to the desired receivers.

Three types of example general links are shown in Figure 4-13b:

— The first type is an infrastructure general link that connects a non-AP GLK STA attached bridge port of an IEEE 802.1Q MAC Relay Entity with an GLK AP attached bridge (two of these general links are shown in the figure). These links could be used to enhance the reliability and routing options of an IEEE 802.1Q-compliant LAN by providing redundant wireless links between the bridges in the LAN.

— The second type is a non-AP GLK STA to non-AP GLK STA link that connects the STAs’ attached bridges (IEEE 802.1Q MAC Relay Entities). This type of general link is similar to the IBSS or PBSS STA to STA link.

— The third type of general link is a “leaf-node” type of general link that connects entities in the LLC layer attached to a non-AP GLK STA via a general link and an IEEE 802.1Q bridge attached to the GLK AP to another entity available via the IEEE 802.1Q network attached to the GLK AP. Such a general link could provide a connection between a network printer attached to the LAN and a computer attached to the non-AP GLK STA.

A difference between a GLK AP’s IEEE 802.11 links and a non-GLK AP’s IEEE 802.11 links, which can only be connected to an Internal Sublayer Service SAP via a DS and portal, is that an Internal Sublayer Service SAP could directly connect to an IEEE 802.1Q bridge.

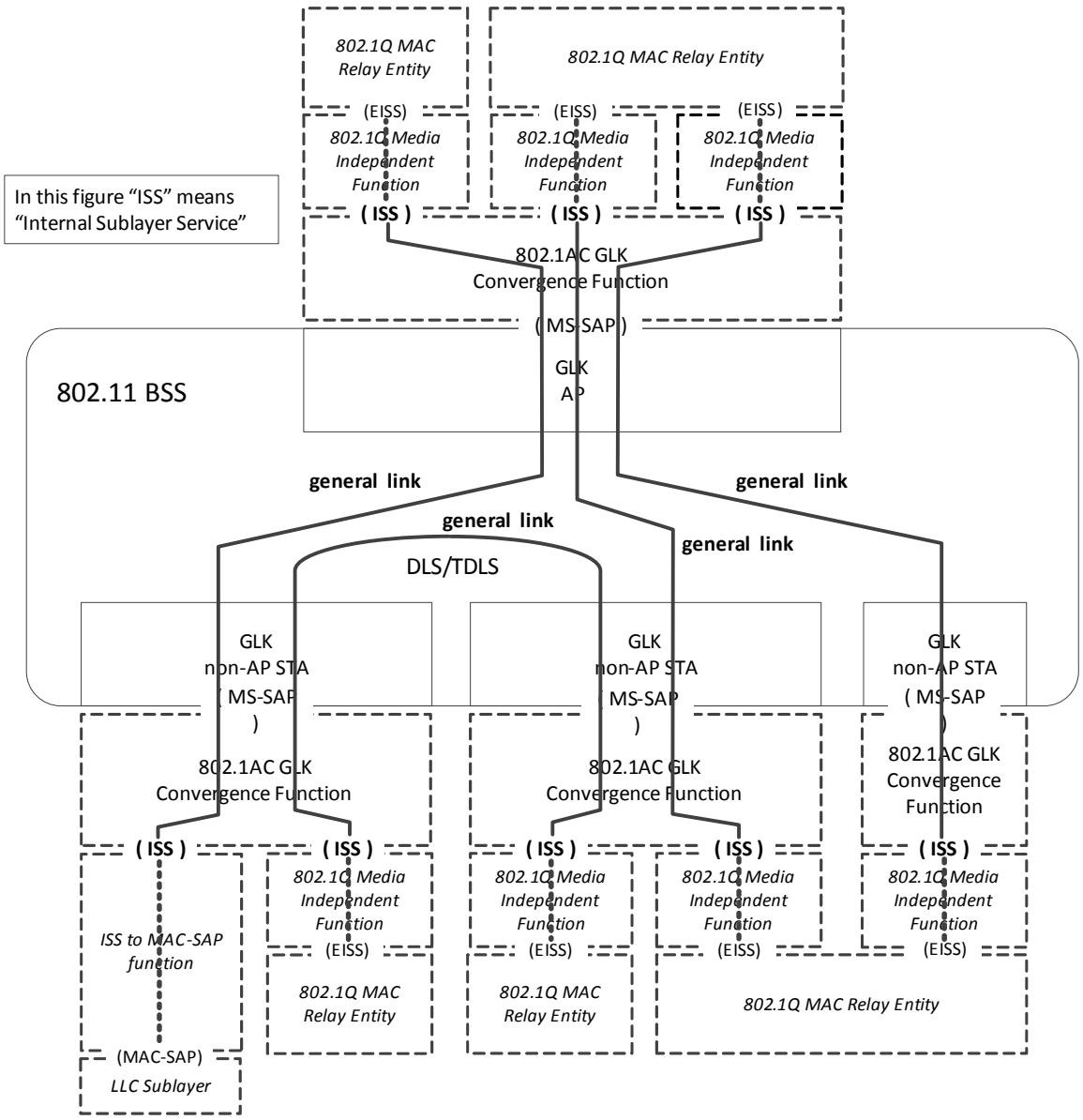

Figure 4-13b—Example of infrastructure BSS with general links

4.3.27.3.4 Infrastructure BSSs with general links in the presence of an ESS

BSSs that support general links can be components of an extended form of network by using the general links within an IEEE 802.1Q bridged network. In such a bridged network, the concept of the DS in a non-GLK ESS is replaced by the other components of the IEEE 802.1Q network. However, such a GLK topology is more general than the non-GLK infrastructure mode. For example, Figure 4-13c shows a network consisting of three types of BSSs: a GLK infrastructure BSS (with only GLK STAs), an infrastructure BSS (with both GLK and non-GLK STAs), and an infrastructure BSS (containing only non-GLK STAs). The example ESS shown in the figure consists of all the non-GLK non-AP STAs, the non-GLK AP, and the portion of the GLK AP that has associated non-GLK non-AP STAs. In the ESS the portal

that is connected to the DS does not show any additional connection because the portal could be connected to any type of bridge, switch, or LAN. Hence no specific interconnection is shown. The general links shown in Figure 4-13c are similar to those shown in Figure 4-13b and provide point-to-point links as described in 4.3.27.3.3. Also, shown in the figure is an example of the possible configuration of more than one IEEE 802.1Q MAC relay entity being attached to a GLK AP or GLK non-AP STA and the possible configuration of more than one GLK AP or GLK non-AP STA being attached to the same IEEE 802.1Q MAC relay entity. These configurations show the flexibility available with general links.

NOTE—IEEE Std 802.11 explicitly does not specify the details of the IEEE 802.1AC GLK Convergence Function, the IEEE 802.1Q Media Independent Function, the Internal Sublayer Service to MAC-SAP function, the IEEE 802.1Q MAC Relay Entity, and the LLC Sublayer. These entities are specified in other documents such as IEEE Std 802.1AC-2016 and IEEE Std 802.1Qbz-2016 [B24a]. These entities are shown with dashed outlines in the figure. Entities that IEEE Std 802.11 does specify are shown with solid outlines.

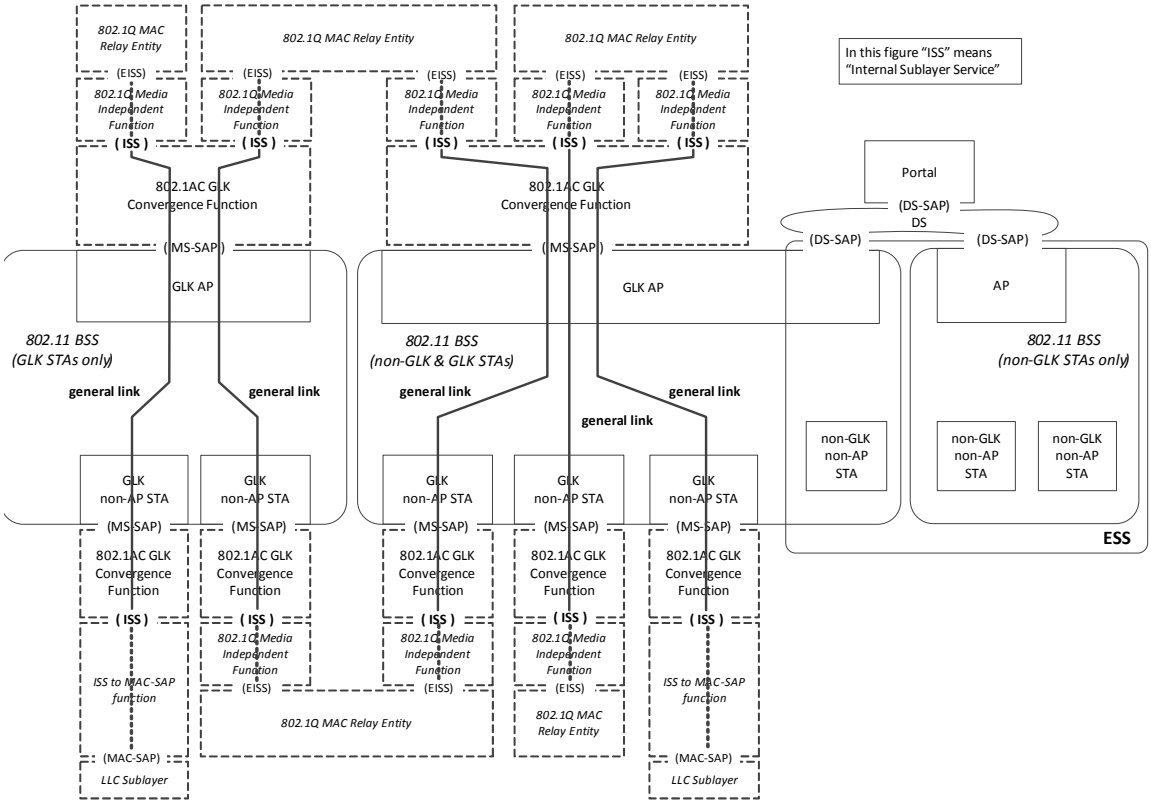

Figure 4-13c—Example of an ESS and extended network with general links

4.3.28 Ethertype protocol discrimination (EPD)

IEEE Std 802-2014 describes the two LLC sublayer protocols: Ethertype protocol discrimination (EPD) and LLC protocol discrimination (LPD). LPD is the default for IEEE 802.11 MSDUs with the exception of the 5.9 GHz bands where EPD is used for the transmission of all MSDUs (see E.2.3 and E.2.4). While not the default, EPD might be used in other bands when it is known that the addressed STAs and the transmitting STA support EPD.

An EPD STA is a STA that supports EPD format MSDUs. EPD STAs, other than those operating in the 5.9 GHz bands, indicate their support through a bit in the Capability Information field, DMG STA Capability Information field, and Relay Capabilities element. An EPD STA, when transmitting an

individually addressed RA, uses EPD if the recipient supports EPD; otherwise, such individually addressed transmissions use LPD.

In an MPDU transmitted with a groupcast RA, the choice between of EPD or LPD format of MSDUs in the MPDU is controlled by the policy of the BSS (see 5.1.4).

4.5 Overview of the services

4.5.2 Distribution of MSDUs within a DS

4.5.2.1 Distribution

Change the first paragraph of 4.5.2.1 as follows:

This is the primary service used by IEEE 802.11 non-GLK STAs. It is conceptually invoked by every data message to or from an IEEE 802.11 non-GLK STA operating in an ESS (when the frame is sent via the DS). Distribution is via the DSS.

Change the subclause title of 4.5.3 as follows:

4.5.3 Connectivity-related sServices ~~that support the distribution service and the PCP service~~

4.5.3.3 Association

Change the first and second paragraphs of 4.5.3.3 as follows (including splitting the second paragraph into two paragraphs):

To deliver an MSDU within an ESS via the DS, the ~~distribution service~~ DS needs to know to which AP within the ESS to deliver the MSDU, ~~access~~ so that the MSDU might ultimately be delivered to the addressed ~~for the given~~ IEEE 802.11 STA. This information is provided to the DS by the concept of association. Association is necessary, but not sufficient, to support BSS-transition mobility. Association is sufficient to support no-transition mobility. Association is one of the services in the DSS.

Before a STA is allowed to send an MSDU via an AP, it first becomes associated with the AP.

~~The~~ For a non-GLK STA, the act of becoming associated invokes the association service, which provides the STA to AP mapping to the DS. How the information provided by the association service is stored and managed within the DS is not specified by this standard.

Insert the following paragraph after the now third paragraph of 4.5.3.3:

For a GLK STA, the act of becoming associated invokes the association service, which establishes a general link between two instances of the IEEE 802.1D Internal Sublayer Service. This link provides a point-to-point link between the two Internal Sublayer Service SAPs. The GLK AP STA and the GLK non-AP STA each coordinate with higher layer services and each other to create the point-to-point link. The higher layer services create or enable the Internal Sublayer Service SAPs, inform the GLK convergence function of the mapping of the Internal Sublayer Service SAPs, and inform the network routing protocol of the existence of the general link. The GLK AP and the GLK non-AP STA each establish a service_access_point_identifier for each general link, for their respective MS-SAPs. This process allows for the establishment of a point-to-point link suitable for use in an IEEE 802.1Q network.

4.5.3.4 Reassociation

Change the second paragraph of 4.5.3.4 as follows:

The reassociation service is invoked to "move" a current association of a non-AP STA from one AP to another. In an ESS with a DS, the reassociation service informs ~~this keeps~~ the DS ~~informed~~ of the current mapping between AP and STA as the STA moves from BSS to BSS within ~~an~~ the ESS. For a general link in an IEEE 802.1Q network, the reassociation service informs higher layer services how the link is reconfigured, commonly, with which BSS the GLK non-AP STA is associated. The higher layer services will then destroy, disable, or maintain the existing Internal Sublayer Service SAPs, create or enable new Internal Sublayer Service SAPs, inform the GLK convergence function of the reconfigured general link mapping of the Internal Sublayer Service SAPs, and inform the network routing protocol of the updated general link. The GLK AP and GLK non-AP STA each then establish or maintain a service_access_point_identifier for the reconfigured general link, for their respective MS-SAPs. Reassociation also enables changing association attributes of an established association while the STA remains associated with the same AP. Reassociation is always initiated by the non-AP STA.

4.5.3.5 Disassociation

Change the second paragraph of 4.5.3.5 as follows:

For a non-GLK STA, the act of becoming disassociated invokes the disassociation service, which voids any existing STA to AP mapping known to the DS, for the disassociating STA. How the information provided by the disassociation service is managed within the DS is not specified by this standard. For a general link, disassociation removes or disables the corresponding Internal Sublayer Service SAPs that were configured for the general link. The IEEE 802.1Q bridge uses this information to update bridging for the GLK non-AP STA. ~~In an ESS, this tells the DS to void existing association information. Attempts to send MSDUs via the DS to a disassociated STA will be unsuccessful.~~

Insert the following paragraph after the second paragraph of 4.5.3.5:

For an IEEE 802.11 link that is the basis of a general link, the disassociation service informs higher layer services of the IEEE 802.1Q network that the general link has been destroyed. The GLK AP and the GLK non-AP STA each coordinate with higher layer services and each other to destroy the point-to-point link. The higher layer services destroy or disable the Internal Sublayer Service SAPs, inform the GLK convergence function of the deletion of the mapping of the Internal Sublayer Service SAPs, and inform the network routing protocol of the destruction of the general link, for their respective MS-SAPs. This process destroys the previously existing point-to-point link that was suitable for use in an IEEE 802.1Q network.

4.6 Multiple logical address spaces

Change the fourth paragraph of 4.6 as follows:

The IEEE 802.11 choice of address space implies that for many instantiations of the IEEE 802.11 architecture, the non-IEEE-802.11 LAN MAC address space and the IEEE 802.11 MAC address space might be the same. In situations where a DS that uses MAC-level IEEE 802 addressing is appropriate, all three of the logical address spaces used within a system could be identical. While this is a common case, it is not the only combination allowed by the architecture. The IEEE 802.11 architecture allows for all three logical address spaces to be distinct. In the GLK case, IEEE 802.1Q bridges are included in the network topology; therefore, the wired LAN MAC address space and IEEE 802.11 MAC address space are the same.

5. MAC service definition

5.1 Overview of MAC services

5.1.1 Data service

5.1.1.1 General

Change the first two sentences of the first paragraph of 5.1.1.1 as follows:

This service provides peer LLC sublayer entities or IEEE 802.1Q bridge ports with the ability to exchange MSDUs. To support this service, the local MAC uses the underlying PHY-level services to transport an MSDU to a peer MAC entity, where it is delivered to the peer LLC sublayer or bridge port.

5.1.1.2 Determination of UP

Change 5.1.1.2 as follows:

The QoS facility supports eight priority values, referred to as *UPs*. The values a UP may take are the integer values from 0 to 7 and are identical to the IEEE 802.1D priority tags. An MSDU with a particular UP is said to belong to a traffic category (TC) with that UP. The UP is provided with each MSDU at the medium access control service access point (MAC SAP) either directly, in the UP parameter, or indirectly, in a TSPEC or SCS Descriptor element designated by the UP parameter. For the transmission of an MSDU that was provided to the Internal Sublayer Service SAP associated with a general link, the UP is determined by the GLK convergence function based on the priority parameter of the M_UNITDATA.request. (See Annex R for recommended mapping guidelines.)

5.1.1.3 Interpretation of priority parameter in MAC service primitives

Change the last paragraph of 5.1.1.3 as follows:

QoS APs deliver the UP with the received MSDUs to the DS or bridge port.

5.1.4 MSDU format

Change the first paragraph of 5.1.4 as follows:

Logical Link Control (LLC) sublayer entities use the MAC sublayer service to exchange PDUs with peer LLC sublayer entities. These PDUs are termed MAC sublayer SDUs (MSDUs) when sent to the MAC sublayer. There are two LLC sublayer protocols used (see IEEE Std 802-2014): LLC Protocol Discrimination (LPD) (see ISO/IEC 8802-2:1998) and Ethertype Protocol Discrimination (EPD) (see IEEE Std 802.3-2012). ~~LPD is used for transmission of all IEEE 802.11 MSDUs with the exception of the 5.9 GHz bands where EPD is used (see E.2.3 and E.2.4).~~ MSDUs are formatted in accordance with LPD or with EPD, as determined by the first condition below that is true. After a true condition has been found, subsequent conditions are ignored.

a) In the 5.9 GHz bands (see E.2.3 and E.2.4), use EPD.
b) For OCB communications outside of the 5.9 GHz bands, use LPD.
c) Within Data frames with individually addressed RAs, if both the transmitter and receiver are EPD STAs, use EPD.

d) Within Data frames with individually addressed RAs, if either the transmitter or the receiver are not EPD STAs, use LPD.

e) If the transmitting AP will accept association only from an EPD STA, use EPD.

f) If the transmitting mesh STA will peer only with an EPD mesh STA, use EPD.

g) For all other cases, use LPD.

5.1.5 MAC data service architecture

5.1.5.1 General

Change the third and fourth paragraphs of 5.1.5.1 as follows:

During transmission, an MSDU goes through some or all of the following processes: MSDU rate limiting, aggregate MSDU (A-MSDU) aggregation, frame delivery deferral during power save mode, sequence number assignment, integrity protection, fragmentation, encryption, frame formatting (including optional SYNRA construction), and aggregate MAC protocol data unit (A-MPDU) aggregation. When transparent FST is used, an MSDU first goes through an additional transparent FST entity that contains a demultiplexing process that forwards the MSDU down to the selected TX MSDU Rate Limiting process and from there to MAC data plane processing as described in the previous sentence. IEEE Std 802.1X-2010 may block the MSDU at the Controlled Port before the preceding processing occurs. Otherwise, at some point, the Data frames that contain all or part of the MSDU are queued per AC/TS.

During reception, a received Data frame goes through processes of possible A-MPDU deaggregation, MPDU header and cyclic redundancy code (CRC) validation, Address 1 filtering, scoreboarding if the block ack mechanism is used, duplicate removal, decryption, possible reordering if the block ack mechanism is used, replay detection, defragmentation, integrity checking, SYNRA receive filtering when the corresponding link is a general link, possible A-MSDU deaggregation, and possible MSDU rate limiting. Then one or more MSDUs are delivered to the MAC SAP or ~~to the DS via the DSAF~~, via the DSAF, to either the DS or an IEEE 802.1Q bridge port. When transparent FST is used, MSDUs originating from different PHY SAPs go through a final step of a transparent FST entity that contains a multiplexing process before delivering the MSDU. The IEEE 802.1X Controlled/Uncontrolled Port~~s~~ discards any received MSDU if the Controlled Port is not enabled and if the MSDU does not represent an IEEE 802.1X frame.

Change Figure 5-1 and Figure 5-2 as shown:

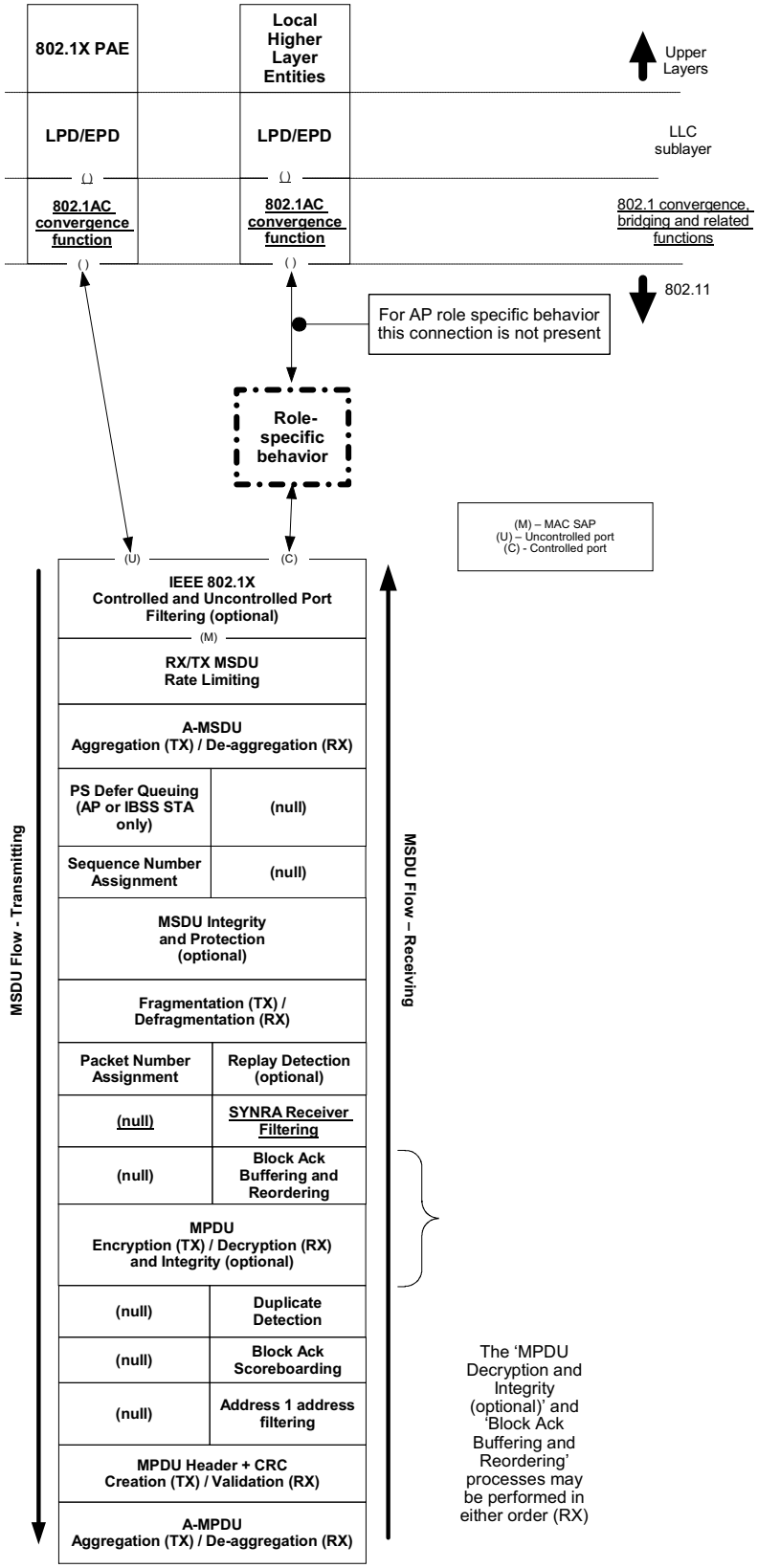

Figure 5-1—MAC data plane architecture

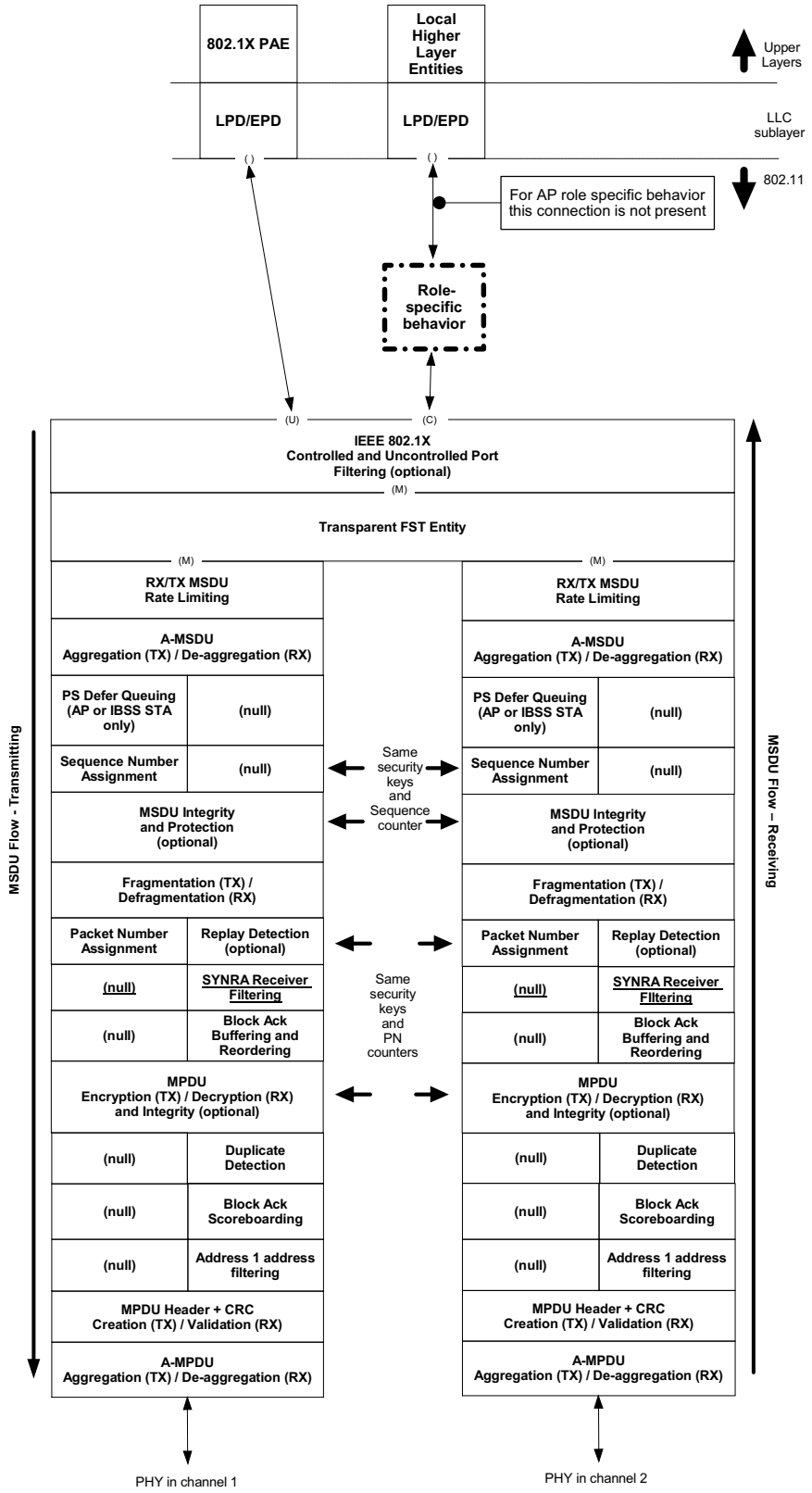

Figure 5-2—MAC data plane architecture (transparent FST)

Change the subclause title and the first sentence of the first paragraph of 5.1.5.2 as follows:

5.1.5.2 Non-GLK n~~N~~on-AP STA role

The MAC data plane architecture of a non-GLK non-AP STA is completed by replacing the role-specific behavior block with that shown in Figure 5-3.

Change the title of Figure 5-3 as follows:

Figure 5-3—Role-specific behavior for a non-GLK non-AP STA

Change the subclause title and the first sentence of the first paragraph of 5.1.5.3 as follows:

5.1.5.3 Non-GLK AP role

In a non-GLK AP, the MAC data plane architecture includes distribution system access in its role-specific behavior block, as shown in Figure 5-4.

Change the title of Figure 5-4 as follows:

Figure 5-4—Role-specific behavior for a non-GLK AP

Change the subclause title of 5.1.5.4 as follows:

5.1.5.4 Non-GLK m~~M~~esh STA role

5.1.5.6 S1G Relay

Change Figure 5-7 to add Block Ack Scoreboarding as shown in Figure 5-1 and Figure 5-2.

Figure 5-7—S1G relay data plane architecture

Insert the following subclauses (5.1.5.7, 5.1.5.8, and 5.1.5.9, including Figure 5-8, Figure 5-9, and Figure 5-10) after 5.1.5.6:

5.1.5.7 GLK STA role

In a GLK STA's MAC data plane architecture, the role-specific behavior block is as shown in Figure 5-8. The MAC service interface to this block includes a station vector, to provide the selective delivery service to a GLK convergence function. This block performs destination address filtering, as described in 10.2.8, and provides access to the GLK convergence function and ultimately to the bridge ports.

5.1.5.8 GLK AP role

A GLK AP that supports only general links (dot11GLKRequired is true) has the same general architectural structure as described in 5.1.5.7 for a general GLK STA.

A GLK AP that supports both general links and non-GLK links provides access between the bridge ports and general links, and between the DS and non-GLK links. The DSAF behavior of such an AP is extended by adding a switching function to direct received MSDUs to either the DS or toward a bridge port, as appropriate, as shown in Figure 5-9.

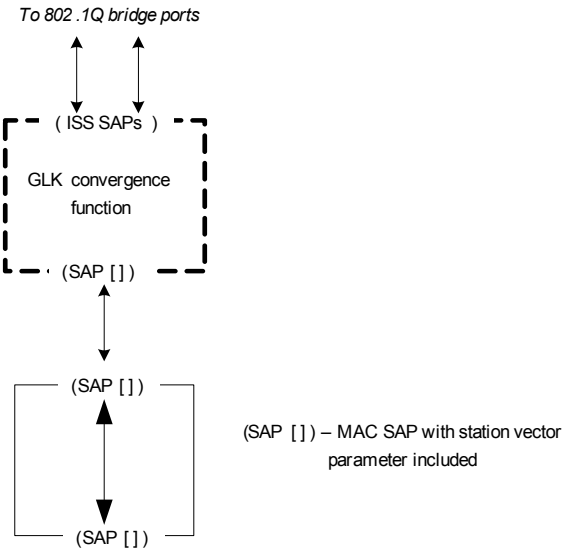

Figure 5-8—Role-specific behavior block for a GLK STA

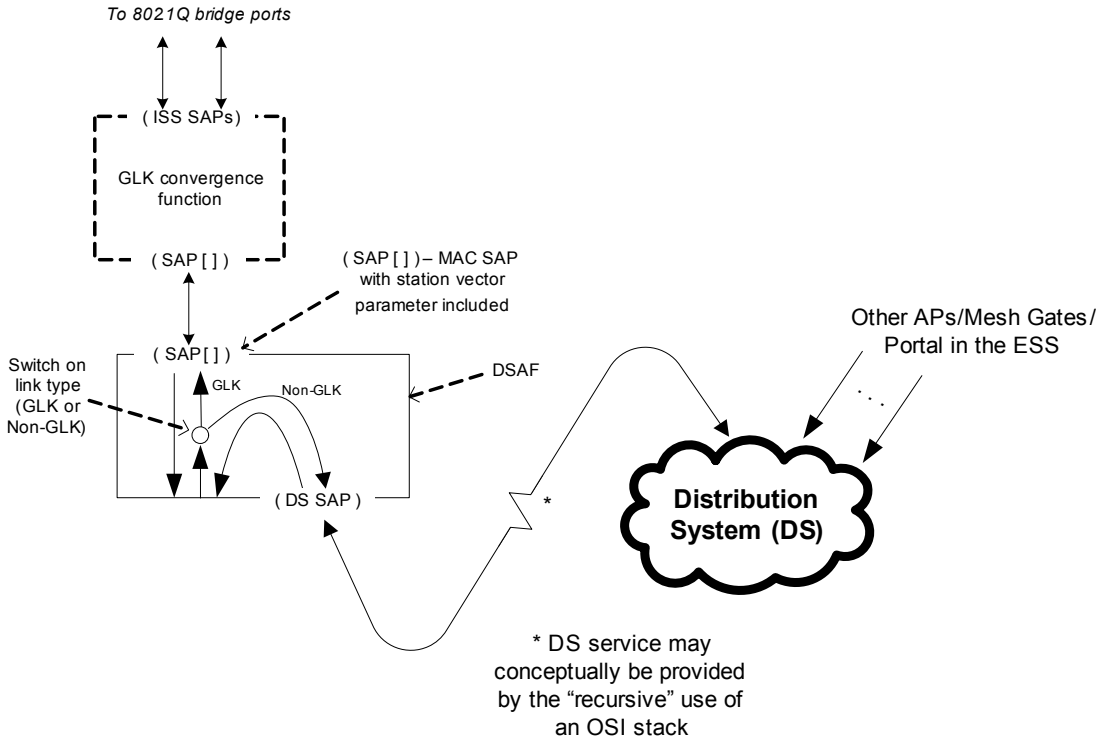

Figure 5-9—Role-specific behavior block for a mixed-mode GLK AP

5.1.5.9 GLK mesh STA role

The only type of mesh STA that has explicit support for GLK is the GLK mesh STA, which is the equivalent of a mesh gate, except it is attached to a bridge rather than a DS. Other mesh STA types implicitly may support general links with the role specific structure shown in 5.1.5.4.

The MAC data plane architecture of a GLK mesh STA, like that for a non-GLK mesh STA, is completed by replacing the role-specific behavior block with that shown in Figure 5-10. In a GLK mesh STA, the function of this block is described in 10.35, to provide access to bridge ports, through provision of the station vector parameter, rather than access to only the local DA address like a non-GLK mesh STA.

This role is not applicable when transparent FST is used and does not apply to Figure 5-2.

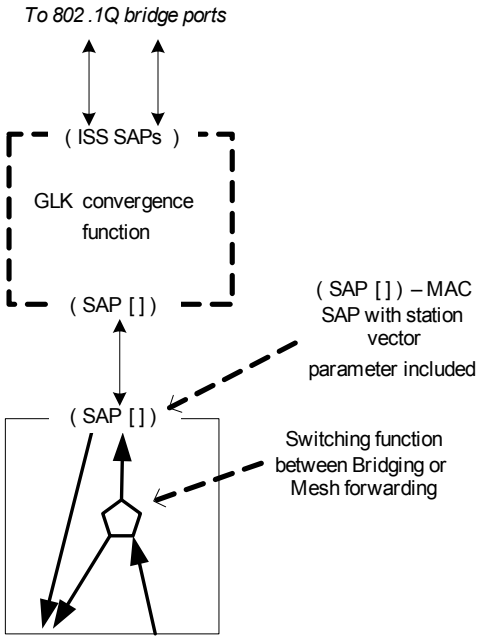

Figure 5-10—Role-specific behavior block for a GLK mesh STA

5.2 MAC data service specification

5.2.1 General

Insert the following subclause (5.2.1a) after 5.2.1:

5.2.1a GLK MAC data service specification

A GLK STA coordinates with the GLK convergence function to create a virtual point-to-point LAN for each general link to an associated or peered GLK STA. This point-to-point LAN is presented by the convergence function as a unique Internal Sublayer Service SAP, which is ultimately mapped to an IEEE 802.1Q bridge port. Each such SAP is identified by a locally unique service_access_point_identifier (as defined in IEEE Std 802.1Q), generated by the STA and the convergence function.

In a GLK STA the MAC data plane architecture's MAC service uses the two parameters, a set of service_access_point_identifiers and an MSDU format indicator.

When GLK is in use, the MAC service primitives presented require the presence of the parameter station vector on request and supply a non-null value for this parameter on indication. In an MA-UNITDATA.request, this parameter is a set of service_access_point_identifiers specifying the one or more general links that are to be used for this request. In an MA-UNITDATA.indication, it is a vector of exactly one service_access_point_identifier specifying the general link that carried this MSDU.

When GLK is in use, the MAC service primitives make use of the MSDU format parameter. In an MA-UNITDATA.request, this parameter indicates whether the supplied MSDU is in EPD or LPD format. If the format is inappropriate for the transmission that carries this MSDU as described in 5.1.4, the STA converts the format before transmission. In an MA-UNITDATA.indication, this parameter indicates the format of the received MSDU, which is determined as described in 5.1.4. The MAC service user uses this information to parse the MSDU correctly.

5.2.2 MA-UNITDATA.request

5.2.2.1 Function

Change 5.2.2.1 as follows:

This primitive requests a transfer of an MSDU from a local LLC sublayer entity or bridge port to a single peer LLC sublayer entity or bridge port, or multiple peer LLC sublayer entities or bridge ports in the case of group addresses.

5.2.2.2 Semantics of the service primitive

Change the primitive parameter list in 5.2.2.2 as follows:

The parameters of the primitive are as follows:

MA-UNITDATA.request(
source address,
destination address,
routing information,
data,
priority,
service class,
station vector,
MSDU format
)

Insert the following note after the sixth paragraph ("The priority parameter ....") of 5.2.2.2:

NOTE—For a GLK STA, the bridge port provides the priority. That priority might have been derived from a priority tag in the frame arriving on another port of the bridge or from the configuration of that port if the frame arrived there untagged.

Insert the following paragraphs at the end of 5.2.2.2:

The station vector parameter is a set of service_access_point_identifiers (see 5.2.1a) and is not null when dot11GLKImplemented is true and is null or not present otherwise. It indicates the set of virtual point-to-point LANs for these data transfers, which are mapped to the set of general links over which the MSDU is transferred.

The MSDU format parameter indicates whether the supplied MSDU is in EPD or LPD format.

5.2.2.3 When generated

Change 5.2.2.3 as follows:

This primitive is generated by the LLC sublayer entity or bridge when an MSDU is to be transferred to a peer LLC sublayer entity or entities or to a peer bridge or bridges.

5.2.2.4 Effect of receipt

Change the first paragraph of 5.2.2.4 as follows:

On receipt of this primitive, the MAC sublayer entity determines whether it is able to fulfill the request according to the requested parameters. A request that cannot be fulfilled according to the requested parameters is discarded, and this action is indicated to the LLC sublayer entity using an MA-UNITDATA-STATUS.indication primitive that describes why the MAC was unable to fulfill the request. If the request can be fulfilled according to the requested parameters, the MAC sublayer entity properly formats a frame, passes it to the lower layers for transfer to a peer MAC sublayer entity or entities (see 5.1.4), and indicates this action to the LLC sublayer entity or bridge port using an MA-UNITDATA-STATUS.indication primitive with transmission status set to Successful.

5.2.3 MA-UNITDATA.indication

5.2.3.1 Function

Change 5.2.3.1 as follows:

This primitive defines the transfer of an MSDU from the MAC sublayer entity to the LLC sublayer entity or bridge port or entities or bridge ports in the case of group addresses. In the absence of error, the contents of the data parameter are logically complete and unchanged relative to the data parameter in the associated MA-UNITDATA.request primitive.

5.2.3.2 Semantics of the service primitive

Change the primitive parameter list in 5.2.3.2 as follows:

The parameters of the primitive are as follows:

```
MA-UNITDATA.indication(
                        source address,
                        destination address,
                        routing information,
                        data,
                        reception status,
                        priority,
                        service class,
                        station vector,
                        MSDU format
                        )
```

Insert the following paragraphs at the end of 5.2.3.2:

The station vector parameter is a set of service_access_point_identifiers (see 5.2.1a) and is not null when dot11GLKImplemented is true. It indicates only the single virtual point-to-point LAN for this data transfer, which is mapped from the general link over which the MSDU was received.

The MSDU format parameter indicates if the received MSDU is in EPD or LPD format.

5.2.3.3 When generated

Change 5.2.3.3 as follows:

The MA-UNITDATA.indication primitive is passed from the MAC sublayer entity to the LLC sublayer entity or entities, or bridge port or ports, to indicate the arrival of a frame at the local MAC sublayer entity. Frames are reported only if they are validly formatted at the MAC sublayer, received without error, received with valid (or null) security and integrity information, and their destination address designates the local MAC sublayer entity. The MA-UNITDATA.indication primitive might also be passed from the MAC sublayer entity, in coordination with the MAC sublayer management entity, to the LCC sublayer entity to indicate the arrival of a FILS higher layer protocol (HLP) Container element.

5.2.3.4 Effect of receipt

Change the first paragraph of 5.2.3.4 as follows:

The effect of receipt of this primitive by the LLC sublayer or bridge port is dependent on the content of the MSDU.

5.2.4 MA-UNITDATA-STATUS.indication

5.2.4.1 Function

Change 5.2.4.1 as follows:

This primitive has local significance and provides the LLC sublayer or bridge port with status information for the corresponding preceding MA-UNITDATA.request primitive.

5.2.4.2 Semantics of the service primitive

Change the first sentence of the fourth paragraph of 5.2.4.2 as follows:

The transmission status parameter is used to pass status information back to the local requesting LLC sublayer entity or bridge port.

5.2.4.3 When generated

Change 5.2.4.3 as follows:

The MA-UNITDATA-STATUS.indication primitive is passed from the MAC sublayer entity to the LLC sublayer entity or bridge port to indicate the status of the service provided for the corresponding MA-UNITDATA.request primitive.

5.2.4.4 Effect of receipt

Change 5.2.4.4 as follows:

The effect of receipt of this primitive by the LLC sublayer or bridge port is dependent upon the type of operation employed by the LLC sublayer entity or bridge port.

6. Layer management

6.3 MLME SAP interface

6.3.3 Scan

6.3.3.2 MLME-SCAN.request

6.3.3.2.2 Semantics of the service primitive

Change the primitive parameter list in 6.3.3.2.2 as follows:

The primitive parameters are as follows:

MLME-SCAN.request(
BSSType,
BSSID,
SSID,
ScanType,
ActiveScanType,
ProbeDelay,
ChannelList,
MinChannelTime,
MaxChannelTime,
RequestInformation,
SSID List,
ChannelUsage,
AccessNetworkType,
HESSID,
MeshID,
DiscoveryMode,
FILSRequestParameters,
ReportingOption,
APConfigurationSequenceNumber,
SIGRelayDiscovery,
PV1ProbeResponseOption,
S1GCapabilities,
ChangeSequence,
ELOperation,
MaxAwayDuration,
GeneralLinkType,
VendorSpecificInfo
)

Insert the following row into the untitled parameter table in 6.3.3.2.2 before the "VendorSpecificInfo" row:

Name	Type	Valid range	Description
GeneralLinkType	Enumeration	GLK_SUPPORTED, GLK_UNSPECIFIED	This parameter is present if dot11GLKImplemented is true. If GLK_SUPPORTED, a BSS in which the AP supports GLK is requested. If GLK_UNSPECIFIED, the GLK nature of the BSS is ignored.

6.3.7 Associate

6.3.7.2 MLME-ASSOCIATE.request

6.3.7.2.2 Semantics of the service primitive

Change the primitive parameter list in 6.3.7.2.2 as follows:

The primitive parameters are as follows:

MLME-ASSOCIATE.request(
PeerSTAAddress,
BSSMaxIdlePeriod,
ListenInterval,
Supported Channels,
RSN,
QoSCapability,
Content of FT Authentication elements,
SupportedOperatingClasses,
SM Power Save,
QoSTrafficCapability,
TIMBroadcastRequest,
EmergencyServices,
DMG Capabilities,
Multi-band local,
Multi-band peer,
MMS,
FILSHLPContainer,
FILSIPAddressAssignment,
AID Request,
S1G Capabilities,
TWT,
MaxAwayDuration,
S1GRelayActivation,
ReachableAddress,
CDMG Capabilities,
CMMG Capabilities,
GLK-GCR Parameter Set,
VendorSpecificInfo
)

Insert the following row into the untitled parameter table in 6.3.7.2.2 before the "VendorSpecificInfo" row:

Name	Type	Valid range	Description
GLK-GCR Parameter Set	GLK-GCR Parameter Set element	As defined in 9.4.2.232	This parameter is present if dot11GLKGCRImplemented is true and not present otherwise. Specifies the GLK-GCR capabilities supported by the STA.

6.3.7.3 MLME-ASSOCIATE.confirm

6.3.7.3.2 Semantics of the service primitive

Change the primitive parameter list in 6.3.7.3.2 as follows:

The primitive parameters are as follows:

MLME-ASSOCIATE.confirm(
ResultCode,
CapabilityInformation,
AssociationID,
EDCAParameterSet,
RCPI of Request,
RSNI of Request,
RCPI of Response,
RSNI of Response,
RMEnabledCapabilities,
Content of FT Authentication elements,
SupportedOperatingClasses,
Extended Capabilities,
20/40 BSS Coexistence,
TimeoutInterval,
BSSMaxIdlePeriod,
TIMBroadcastResponse,
QosMapSet,
QMFPolicy,
DMG Capabilities,
Multi-band local,
Multi-band peer,
MMS,
FILSHLPContainer,
FILSIPAddressAssignment,
KeyDelivery,
S1G Sector Operation,
S1G Capabilities,
AID Response,
TSF Timer Accuracy,
TWT,
Sectorized Group ID List,
MaxAwayDuration,
S1GRelayActivation,
S1GOperation,
SSTOperation,
S1GRelay,
HeaderCompression,
CDMG Capabilities,
CMMG Capabilities,
<u>GLK-GCR Parameter Set,</u>
VendorSpecificInfo
)

Insert the following row into the untitled parameter table in 6.3.7.3.2 before the "VendorSpecificInfo" row:

Name	Type	Valid range	Description
GLK-GCR Parameter Set	GLK-GCR Parameter Set element	As defined in 9.4.2.232	Specifies the values from the GLK-GCR Parameter Set element if such an element was present in the Association Response frame, otherwise null.

6.3.7.4 MLME-ASSOCIATE.indication

6.3.7.4.2 Semantics of the service primitive

Change the primitive parameter list in 6.3.7.4.2 as follows:

The primitive parameters are as follows:

MLME-ASSOCIATE.indication(
PeerSTAAddress,
CapabilityInformation,
BSSMaxIdlePeriod,
ListenInterval,
SSID,
OperationalRateSet,
BSSMembershipSelectorSet,
RSN,
QoSCapability,
RCPI,
RSNI,
RMEnabledCapabilities,
Content of FT Authentication elements,
SupportedOperatingClasses,
DSERegisteredLocation,
HT Capabilities,
Extended Capabilities,
20/40 BSS Coexistence,
QoSTrafficCapability,
TIMBroadcastRequest,
EmergencyServices,
DMG Capabilities,
Multi-band local,
Multi-band peer,
MMS,
VHT Capabilities,
FILSHLPContainer,
FILSIPAddressAssignment,
AID Request,
S1G Capabilities,
TWT,
MaxAwayDuration,
S1GRelayActivation,
ReachableAddress,
CDMG Capabilities,

CMMG Capabilities,
GLK-GCR Parameter Set,
VendorSpecificInfo
)

Insert the following row into the untitled parameter table in 6.3.7.4.2 before the "VendorSpecificInfo" row:

Name	Type	Valid range	Description
GLK-GCR Parameter Set	GLK-GCR Parameter Set element	As defined in 9.4.2.232	Specifies the values from the GLK-GCR Parameter Set element if such an element was present in the Association Request frame, otherwise null.

6.3.7.5 MLME-ASSOCIATE.response

6.3.7.5.2 Semantics of the service primitive

Change the primitive parameter list in 6.3.7.5.2 as follows:

The primitive parameters are as follows:
MLME-ASSOCIATE.response(
PeerSTAAddress,
ResultCode,
AssociationID,
RCPI,
RSNI,
RMEnabledCapabilities,
Content of FT Authentication elements,
SupportedOperatingClasses,
TimeoutInterval,
BSSMaxIdlePeriod,
TIMBroadcastResponse,
QoSMapSet,
Multi-band peer,
FILSHLPContainer,
FILSIPAddressAssignment,
KeyDelivery,
S1G Sector Operation,
S1G Capabilities,
AID Response,
TSF Timer Accuracy,
TWT,
Secotorized Group ID List,
MaxAwayDuration,
S1GRelay,
S1GRelayActivation,
S1GOperation,
HeaderCompression,
SSTOperation,
CDMG Capabilities,
CMMG Capabilities,

GLK-GCR Parameter Set,
VendorSpecificInfo
)

Change the following row in the untitled parameter table in 6.3.7.5.2 as shown:

Name	Type	Valid range	Description
ResultColor	Enumeration	SUCCESS, REFUSED_REASON_UNSPECIFIED, REFUSED_CAPABILITIES_MISMATCH, REFUSED_EXTERNAL_REASON, REFUSED_AP_OUT_OF_MEMORY, REFUSED_BASIC_RATES_MISMATCH, REJECTED_EMERGENCY_SERVICES_NOT_SUPPORTED, REFUSED_TEMPORARILY, GLK_NOT_AUTHORIZED	Indicates the result response to the association request from the peer MAC entity.

Insert the following row into the untitled parameter table in 6.3.7.5.2 before the "VendorSpecificInfo" row:

Name	Type	Valid range	Description
GLK-GCR Parameter Set	GLK-GCR Parameter Set element	As defined in 9.4.2.232	This parameter is present only if the AP selects GLK-GCR for groupcast (either unsolicited retry or block ack) over the general link. Describes the parameters that define how GLK-GCR operates.

6.3.8 Reassociate

6.3.8.2 MLME-REASSOCIATE.request

6.3.8.2.2 Semantics of the service primitive

Change the primitive parameter list in 6.3.8.2.2 as follows:

The primitive parameters are as follows:
MLME-REASSOCIATE.request(
NewPCPorAPAddress,
BSSMaxIdlePeriod,
ListenInterval,
Supported Channels
RSN,
QoSCapability,
Content of FT Authentication elements,
SupportedOperatingClasses,
SM Power Save,

QoSTrafficCapability,
TIMBroadcastRequest,
FMSRequest,
DMSRequest,
EmergencyServices,
DMG Capabilities,
Multi-band local,
Multi-band peer,
MMS,
FILSHLPContainer,
FILSIPAddressAssignment,
AID Request,
S1G Capabilities,
TWT,
Sectorized Group ID List,
MaxAwayDuration
S1GRelayActivation,
ELOperation,
S1GRelay,
HeaderCompression,
ReachableAddress,
S1GOperation,
SSTOperation,
CDMG Capabilities,
CMMG Capabilities,
GLK-GCR Parameter Set,
VendorSpecificInfo
)

Insert the following row into the untitled parameter table in 6.3.8.2.2 before the "VendorSpecificInfo" row:

Name	Type	Valid range	Description
GLK-GCR Parameter Set	GLK-GCR Parameter Set element	As defined in 9.4.2.232	This parameter is present if dot11GLKGCRImplemented is true and not present otherwise. Specifies the GLK-GCR capabilities supported by the STA.

6.3.8.3 MLME-REASSOCIATE.confirm

6.3.8.3.2 Semantics of the service primitive

Change the primitive parameter list in 6.3.8.3.2 as follows:

The primitive parameters are as follows:
MLME-REASSOCIATE.confirm(
ResultCode,
CapabilityInformation,
AssociationID,
EDCAParameterSet,
RCPI of Request,

RSNI of Request,
RCPI of Response,
RSNI of Response,
RMEnabledCapabilities,
Content of FT Authentication elements,
SupportedOperatingClasses,
Extended Capabilities,
20/40 BSS Coexistence,
TimeoutInterval,
BSSMaxIdlePeriod,
TIMBroadcastResponse,
FMSResponse,
DMSResponse,
QoSMapSet,
QMFPolicy,
DMG Capabilities,
Multi-band local,
Multi-band peer,
MMS,
FILSHLPContainer,
FILSIPAddressAssignment,
KeyDelivery,
S1G Sector Operation,
S1G Capabilities,
AID Response.
TSF Timer Accuracy,
TWT,
MaxAwayDuration,
S1GRelayActivation,
ELOperation,
S1GRelay,
HeaderCompression,
S1GOperation,
SectorizedGroupIDList,
SSTOperation,
CDMG Capabilities,
CMMG Capabilities,
GLK-GCR Parameter Set,
VendorSpecificInfo
)

Insert the following row into the untitled parameter table in 6.3.8.3.2 before the "VendorSpecificInfo" row:

Name	Type	Valid range	Description
GLK-GCR Parameter Set	GLK-GCR Parameter Set element	As defined in 9.4.2.232	Specifies the values from the GLK-GCR Parameter Set element if such an element was present in the Reassociation Response frame, otherwise null.

6.3.8.4 MLME-REASSOCIATE.indication

6.3.8.4.2 Semantics of the service primitive

Change the primitive parameter list in 6.3.8.4.2 as follows:

The primitive parameters are as follows:

MLME-REASSOCIATE.indication(
PeerSTAAddress,
CurrentAPAddress,
CapabilityInformation,
BSSMaxIdlePeriod,
ListenInterval,
SSID,
OperationalRateSet,
BSSMembershipSelectorSet,
RSN,
QoSCapability,
RCPI,
RSNI,
RMEnabledCapabilities,
Content of FT Authentication elements,
SupportedOperatingClasses,
DSERegisteredLocation,
HT Capabilities,
Extended Capabilities,
20/40 BSS Coexistence,
QoSTrafficCapability,
TIMBroadcastRequest,
FMSRequest,
DMSRequest,
EmergencyServices,
DMG Capabilities,
Multi-band local,
Multi-band peer,
MMS,
VHT Capabilities,
FILSHLPContainer,
FILSIPAddressAssignment,
AID Request,
S1G Capabilities,
TWT,
Sectorized Group ID List,
MaxAwayDuration,
S1GRelayActivation,
ELOperation,
S1GRelay,
HeaderComrpession,
ReachableAddress,
S1GOperation,
SST Operation,
CDMG Capabilities,
CMMG Capabilities,
GLK-GCR Parameter Set,

VendorSpecificInfo
)

Insert the following row into the untitled parameter table in 6.3.8.4.2 before the "VendorSpecificInfo" row:

Name	Type	Valid range	Description
GLK-GCR Parameter Set	GLK-GCR Parameter Set element	As defined in 9.4.2.232	The GLK-GCR Parameter Set element from the received Reassociation Request frame.

6.3.8.5 MLME-REASSOCIATE.response

6.3.8.5.2 Semantics of the service primitive

Change the primitive parameter list in 6.3.8.5.2 as follows:

The primitive parameters are as follows:
MLME-REASSOCIATE.response(
PeerSTAAddress,
ResultCode,
AssociationID,
RCPI,
RSNI,
RMEnabledCapabilities,
Content of FT Authentication elements,
SupportedOperatingClasses,
TimeoutInterval,
BSSMaxIdlePeriod,
TIMBroadcastResponse,
FMSResponse,
DMSResponse,
QoSMapSet,
Multi-band peer,
FILSHLPContainer,
FILSIPAddressAssignment,
KeyDelivery,
S1G Sector Operation,
S1G Capabilities,
AID Response,
TSF Timer Accuracy,
TWT,
Sectorized Group ID List,
MaxAwayDuration,
S1GRelay,
S1GRelayActivation,
S1GOperation,
HeaderCompression
SSTOperation,
CDMG Capabilities,
CMMG Capabilities,
GLK-GCR Parameter Set,

VendorSpecificInfo
)

Insert the following row into the untitled parameter table in 6.3.8.5.2 before the "VendorSpecificInfo" row:

Name	Type	Valid range	Description
GLK-GCR Parameter Set	GLK-GCR Parameter Set element	As defined in 9.4.2.232	This parameter is present only if the AP selects GLK-GCR for groupcast (either unsolicited retry or block ack) over the general link. Describes the parameters that define how GLK-GCR operates.

9. Frame formats

9.2 MAC frame formats

9.2.4 Frame fields

9.2.4.1 Frame Control field

9.2.4.1.4 To DS and From DS subfields

Change the following rows in Table 9-3 as shown:

Table 9-3—To/From DS combinations in Data frames

To DS and From DS values	Meaning
To DS = 0 From DS = 1	A Data frame exiting the DS or being sent by the Port Access Entity in an AP, or a group addressed mesh Data frame with the Mesh Control field present using the three-address MAC header format. This is the only valid combination for Data frames transmitted by ~~an~~ a non-GLK AP and group addressed Data frames transmitted by a mesh STA.
To DS = 1 From DS = 1	A Data frame using the four-address MAC header format. This standard defines procedures for using this combination of field values in mesh BSSs, ~~and~~ by S1G relays, as specified in 10.50, or by a GLK STA. This is the only valid combination for individually addressed Data frames transmitted by a mesh STA.

9.3 Format of individual frame types

9.3.1 Control frames

9.3.1.8 BlockAckReq frame format

9.3.1.8.1 Overview

Change Figure 9-27 as shown:

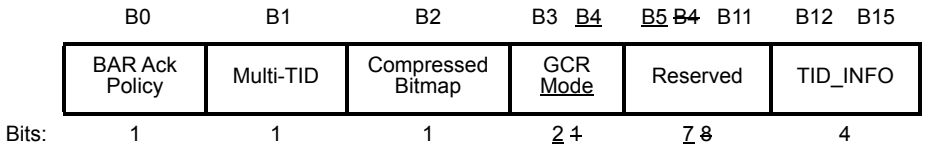

Figure 9-27—BAR Control field

Change the seventh paragraph of 9.3.1.8.1 as follows:

The values of the Multi-TID, Compressed Bitmap, and GCR Mode subfields indicate ~~determine~~ which of the ~~four~~ possible BlockAckReq frame variants is used ~~represented~~, as indicated in Table 9-22.

Replace Table 9-22 with the following:

Table 9-22—BlockAckReq frame variant encoding

Multi-TID subfield value	Compressed Bitmap subfield value	GCR Mode subfield value (B3 B4)	BlockAckReq frame variant
0	0	00	Basic BlockAck
		01	Reserved
		10	Reserved
		11	Reserved
0	1	00	Compressed BlockAck
		01	GLK-GCR BlockAck
		10	GCR BlockAck
		11	Reserved
1	0	00	Extended Compressed BlockAck
		01	Reserved
		10	Reserved
		11	Reserved
1	1	00	Multi-TID BlockAck
		01	Reserved
		10	Reserved
		11	Reserved

Insert the following subclause (9.3.1.8.7) after 9.3.1.8.6:

9.3.1.8.7 GLK-GCR BlockAckReq variant

For the BlockAcqReq variant, the TID_INFO subfield in the BAR Control field in the GLK-GCR BlockAckReq frame is 0.

The BAR Information field in the GLK-GCR BlockAckReq frame contains the Block Ack Starting Sequence Control subfield as shown in Figure 9-28. The Starting Sequence Number subfield in the Block Ack Starting Sequence Control subfield contains the sequence number of the first MSDU or A-MSDU for which this GLK-GCR BlockAckReq frame is sent. The Fragment Number subfield in the Block Ack Starting Sequence Control subfield is 0.

9.3.1.9 BlockAck frame format

9.3.1.9.1 Overview

Change Figure 9-33 as shown:

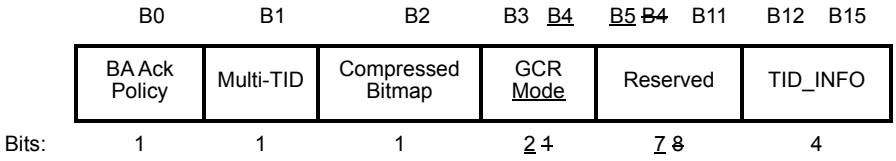

Figure 9-33—BA Control field

Change the seventh paragraph of 9.3.1.9.1 as follows:

The values of the Multi-TID, Compressed Bitmap, and GCR Mode subfields of the BA Control field determine which of the possible BlockAck frame variants is represented, as indicated in the Table 9-24.

Replace Table 9-24 with the following:

Table 9-24—BlockAck frame variant encoding

Multi-TID subfield value	Compressed Bitmap subfield value	GCR Mode subfield value (B3 B4)	BlockAck frame variant
0	0	00	Basic BlockAck
		01	Reserved
		10	Reserved
		11	Reserved
0	1	00	Compressed BlockAck
		01	GLK-GCR BlockAck
		10	GCR BlockAck
		11	Reserved

Table 9-24—BlockAck frame variant encoding *(continued)*

Multi-TID subfield value	Compressed Bitmap subfield value	GCR Mode subfield value (B3 B4)	BlockAck frame variant
1	0	00	Extended Compressed BlockAck
		01	Reserved
		10	Reserved
		11	Reserved
1	1	00	Multi-TID BlockAck
		01	Reserved
		10	Reserved
		11	Reserved

Change the eighth paragraph of 9.3.1.9.1 as follows:

The GCR Mode subfield indicates whether the BlockAck frame was sent in response to a GCR BlockAckReq or a GLK-GCR BlockAckReq frame. The GCR Mode subfield is ~~set to~~ 10 when the BlockAck frame is sent in response to a GCR BlockAckReq frame, 01 when the BlockAck frame is sent in response to a GLK-GCR BlockAckReq, and ~~set to~~ 00 otherwise.

Insert the following subclause (9.3.1.9.7, including Figure 9-38a) after 9.3.1.9.6:

9.3.1.9.7 GLK-GCR BlockAck variant

The TID_INFO subfield in the BA Control field in the GLK-GCR BlockAck frame contains the TID for which this BlockAck frame is sent.

The BA Information field in the GLK-GCR BlockAck frame comprises the Block Ack Starting Sequence Control and the Block Ack Bitmap subfields, as shown in Figure 9-38a. The Block Ack Starting Sequence Control subfield is shown in Figure 9-38a. The Starting Sequence Number subfield in the Block Ack Starting Sequence Control subfield contains the sequence number of the first A-MSDU for which this BlockAck frame is sent. The value of this subfield is defined in 9.24.10. The Fragment Number subfield in the Block Ack Starting Sequence Control subfield is 0.

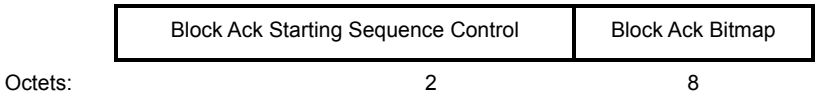

Figure 9-38a—BA Information field format (GLK-GCR BlockAck)

The Block Ack Bitmap subfield is 8 octets in length and is used to indicate the received status of up to 64 MSDUs and A-MSDUs. Each bit that is equal to 1 in the Block Ack Bitmap subfield acknowledges the successful reception of a single MSDU or A-MSDU in the order of sequence number, with the first bit of the Block Ack Bitmap subfield corresponding to the MSDU or A-MSDU with the sequence number that matches the value of the Starting Sequence Number subfield in the Block Ack Starting Sequence Control subfield.

9.3.2 Data frames

9.3.2.1 Format of Data frames

Insert level 5 subclause headings, and change the text (originating from the former 9.3.2.1 and including new Figure 9-53a, Figure 9-53b, and Table 9-26a) for the now 9.3.2.1.1 through 9.3.2.1.5 as shown:

9.3.2.1.1 General

The format of a Data frame is defined in Figure 9-53. The Frame Control, Duration, Address 1, Address 2, Address 3, and Sequence Control fields are present in all data frame subtypes. The presence of the Address 4 field is determined by the setting of the To DS and From DS subfields of the Frame Control field (see below). The QoS Control field is present when the QoS subfield of the Subtype subfield is set to 1.

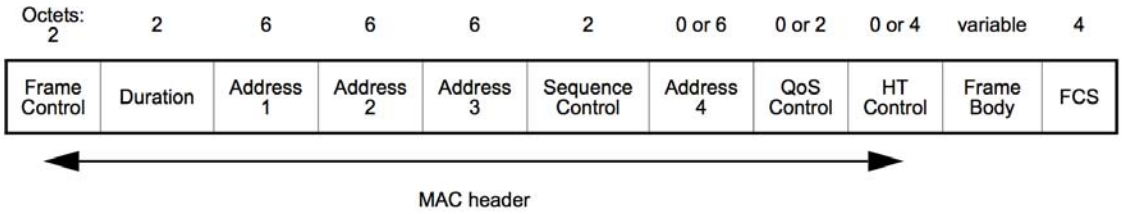

Figure 9-53—Data frame

NOTE—The maximum frame body size shown in Figure 9-53 is for GCMP encryption of a maximum-size A-MSDU (note that TKIP encryption is not allowed in this case and any Mesh Control fields are part of the A-MSDU subframes). The corresponding maximum for CCMP encryption is 7951 octets. The maximum frame body size if A-MSDUs are not used is 2346 octets for GCMP encryption of a maximum-size MSDU, 2338 octets for CCMP encryption of a maximum-size MSDU, and 2342 octets for TKIP encryption of a maximum-size MSDU, including in both cases an 18-octet Mesh Control field. The frame body size might in all cases be greater if a vendor-specific cipher suite is used.

Data frames with a value of 1 in the QoS subfield of the Subtype subfield are collectively referred to as *QoS Data frames*. Each of these data subtypes contains QoS in their names, and this frame format is distinguished by the presence of a QoS Control field in the MAC header.

A QoS STA always uses QoS Data frames for data transmissions to other QoS STAs. A QoS STA uses frames with the QoS subfield of the Subtype subfield set to 0 for data transmissions to non-QoS STAs. A non-QoS STA always uses frames with the QoS subfield of the Subtype subfield set to 0 for data transmissions to other STAs. All STAs use frames with the QoS subfield of the Subtype subfield set to 0 for nonconcealed GCR broadcast Data frames unless a transmitting STA knows that all STAs in a BSS have QoS capability, in which case the transmitting STAs use QoS Data frames. All STAs use frames with the QoS subfield of the Subtype subfield set to 0 for nonconcealed GCR group addressed Data frames unless it is known to the transmitter that all STAs in the BSS that are members of the multicast group have QoS capability, in which case STAs use QoS Data frames. APs where dot11RobustAVStreamingImplemented is true or mesh STAs where dot11MeshGCRImplemented is true use frames with the QoS subfield of the Subtype subfield set to 1 for concealed GCR frames, as described in 11.24.16.3.5.

9.3.2.1.2 Address and BSSID fields

The content of the address fields of Data frames is dependent upon the values of the To DS and From DS subfields in the Frame Control field and whether the Frame Body field contains either an MSDU (or fragment thereof) or an entire A-MSDU, as determined by the A-MSDU Present subfield of the QoS Control field (see 9.2.4.5.9). The content of the address fields transmitted by nonmesh STAs is defined in Table 9-26. The content of the address fields transmitted by mesh STAs is defined in 9.3.5, and the content of the fields transmitted by GLK STAs is defined in 10.65. Where the content of a field is shown as not

applicable (N/A), the field is omitted. Note that Address 1 always holds the receiver address of the intended receiver (or, in the case of group addressed frames, receivers) and that Address 2 always holds the address of the STA that is transmitting the frame.

Table 9-26—Address field contents

To DS	From DS	Address 1	Address 2	Address 3		Address 4	
				MSDU and Short A- MSDU case	Basic A- MSDU and Dynamic A-MSDU case	MSDU and Short A-MSDU case	Basic A- MSDU and Dynamic A-MSDU case
0	0	RA = DA	TA = SA	BSSID	BSSID	N/A	N/A
0	1	RA (see NOTE 1)	TA = BSSID	SA	BSSID	N/A	N/A
1	0	RA = BSSID	TA (see NOTE 2)	DA	BSSID	N/A	N/A
1	1	RA	TA	DA	BSSID	SA	BSSID

NOTE 1—Address 1 field of a frame with To DS equal to 0 and From DS equal to 1 is equal to the DA, except when an individually addressed A-MSDU frame is used in DMS and S1G relay, in which case, the destination address of the frame is included in the DA field of the A-MSDU subframe (see 11.24.16 and 10.50).

NOTE 2—Address 2 field of a frame with To DS equal to 1 and From DS equal to 0 is equal to the SA, except when an individually addressed A-MSDU frame is used in S1G relay, in which case, the source address of the frame is included in the SA field of the A-MSDU subframe (see 10.50).

A STA uses the contents of the Address 2 field to direct the acknowledgment if an acknowledgment is necessary.

The DA field contains the destination of the MSDU (or fragment thereof) or A-MSDU in the Frame Body field.

NOTE—A SYNRA is never the DA. When a GLK AP uses a SYNRA as the RA, the actual DA is carried in another field. See 10.65.

The SA field contains the address of the MAC entity that initiated the MSDU (or fragment thereof) or A-MSDU in the Frame Body field.

When a Data frame carries an MSDU (or fragment thereof), the DA and SA values related to that MSDU are carried in the Address 1, Address 2, Address 3, and Address 4 fields (according to the setting of the To DS and From DS subfields) as defined in Table 9-26.

When a Data frame carries a basic ~~an~~ A-MSDU, the DA and SA values related to each MSDU carried by the A-MSDU are carried within the A-MSDU subframe header. Zero, one, or both of these fields are present in the Address 1 and Address 2 fields as indicated in Table 9-26.

The RA field is the individual address of the STA that is the immediate intended receiver of the frame or the group address of the STAs that are the immediate intended receivers of the frame.

When a GLK AP Data frame is sent with a four-address MAC header with a groupcast RA, the RA is a SYNRA (see 10.65). A SYNRA is also used when the DA is not known by the corresponding IEEE 802.1Q bridge. The format of the RA field when it carries a SYNRA is shown in Figure 9-53a.

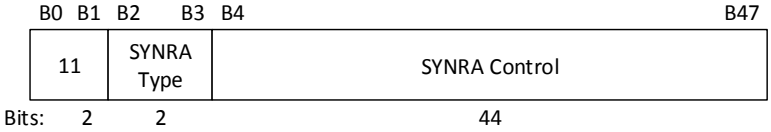

Figure 9-53a—Format of an RA field carrying a SYNRA

NOTE—IEEE Std 802 and IEEE Std 802.1CQ define groupcast MAC addresses with a similar format to a SYNRA, which are DAs in the context of IEEE Std 802.11. Since SYNRAs only occur in the RA field, the similar formats are disambiguated by virtue of being used within an RA or DA.

The SYNRA Type subfield is used to select between multiple possible SYNRA formats. The SYNRA types and the format of the SYNRA Control subfield for each type are listed in Table 9-26a.

The SYNRA Control subfield format is specified separately for each SYNRA type, as defined in Table 9-26a.

Table 9-26a—SYNRA Type field encoding

Value	Description	SYNRA Control subfield format
0	Basic SYNRA	See Figure 9-53b.
1–3	Reserved	—

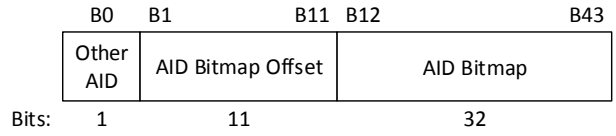

Figure 9-53b—Basic SYNRA Control subfield

The AID Bitmap Offset subfield in a Basic SYNRA Control subfield is used to indicate the starting AID value, which is associated with bit 0 of the AID Bitmap subfield. Its value is multiplied by 4 to find the starting AID value, and it has a value from 0 to 494 for a non-S1G STA, or 0 to 2040 for a S1G STA. Other values are reserved.

NOTE—These match the maximum AID values of 2007 (for non-S1G STAs) and 8191 (for S1G STAs).

The AID Bitmap subfield in a Basic SYNRA Control subfield provides the accept/discard indication for a range of 32 consecutive AIDs. Bits B12 to B43 represent AID values in the range AID Bitmap Offset × 4 + 1 to AID Bitmap Offset × 4 + 32, respectively. For each bit in the AID Bitmap subfield, a value of 1 indicates acceptance, and a value of 0 indicates discarding.

The Other AID subfield in a Basic SYNRA Control subfield provides the accept/discard indication for AIDs outside the range of values covered by the AID Bitmap subfield. A value of 1 indicates acceptance, and a value of 0 indicates discarding.

The TA field is the address of the STA that is transmitting the frame.

The BSSID of the Data frame is determined as follows:

a) If the STA is contained within an AP or is associated with an AP, the BSSID is the address currently in use by the STA contained in the AP.
b) If the STA is a member of an IBSS, the BSSID is the BSSID of the IBSS.
c) If the STA is transmitting a Data frame when dot11OCBActivated is true, the BSSID is the wildcard BSSID.
d) If the STA is a member of an MBSS, the BSSID is the address of the transmitter and is equal to the Data frame's TA.
e) If the STA participates in a PBSS, the BSSID is the address of the STA contained in the PCP of the PBSS.

9.3.2.1.3 Other MAC Header fields

The Sequence Control field is defined in 9.2.4.4.

The QoS Control field is defined in 9.2.4.5. The presence of the QoS Control field is determined by the Subtype subfield of the Frame Control field, as specified in 9.2.4.1.3.

The HT Control field is defined in 9.2.4.6. The presence of the HT Control field is determined by the +HTC/ Order subfield of the Frame Control field, as specified in 9.2.4.1.10.

9.3.2.1.4 The frame body

The frame body consists of either of the following:

— The MSDU (or a fragment thereof), the Mesh Control field (present if the frame is transmitted by a mesh STA and the Mesh Control Present subfield of the QoS Control field is 1, otherwise absent), and a security header and trailer (present if the Protected Frame subfield in the Frame Control field is 1, otherwise absent)
— The A-MSDU and a security header and trailer (present if the Protected Frame subfield in the Frame Control field is 1, otherwise absent)

The presence of an A-MSDU in the frame body is indicated by setting the A-MSDU Present subfield of the QoS Control field to 1, as shown in Table 9-6.

For Data frames of subtype Null (no data), CF-Ack (no data), CF-Poll (no data), and CF-Ack+CF-Poll (no data) and for the corresponding QoS data frame subtypes, the Frame Body field is null (i.e., has a length of 0 octets); these subtypes are used for MAC control purposes. For Data frames of subtypes Data, Data+CF-Ack, Data+CF-Poll, and Data+CF-Ack+CF-Poll, the Frame Body field contains all of, or a fragment of, an MSDU after any encapsulation for security. For Data frames of subtypes QoS Data, QoS Data+CF-Ack, QoS Data+CF-Poll, and QoS Data+CF-Ack+CF-Poll, the Frame Body field contains an MSDU (or fragment thereof) or A-MSDU after any encapsulation for security. For Data frames of subtype QoS Data that are transmitted by a mesh STA, the Frame Body field also contains a Mesh Control field, as described in 9.2.4.7.3.

The maximum length of the Frame Body field can be determined from the maximum MSDU length, plus the length of the Mesh Control field (if present), plus any overhead from encapsulation for encryption (i.e., it is

always possible to send a maximum length MSDU, with any encapsulations provided by the MAC layer within a single Data frame). When the frame body carries an A-MSDU, the size of the Frame Body field is limited by the following:

— The PHY's maximum PHY service data unit (PSDU) length

— If A-MPDU aggregation is used by a non-VHT and non-DMG STA, a maximum MPDU length of 4095 octets (see 9.7)

9.3.2.1.5 Duration field

Within all Data frames sent by STAs during the CFP under PCF, the Duration field is set to 32 768. Within all Data frames sent by the QoS STA, the Duration field contains a duration value as defined in 9.2.5. Within all Data frames sent during the CP by non-QoS STAs, the Duration field is set according to the following rules:

— If the Address 1 field contains a group address, the duration value is set to 0.

— If the More Fragments bit is 0 in the Frame Control field of a frame and the Address 1 field contains an individual address, the duration value is set to the time, in microseconds, required to transmit one Ack frame, plus one SIFS.

— If the More Fragments bit is 1 in the Frame Control field of a frame and the Address 1 field contains an individual address, the duration value is set to the time, in microseconds, required to transmit the next fragment of this Data frame, plus two Ack frames, plus three SIFSs.

The duration value calculation for the Data frame is based on the rules in 10.7 that determine the data rate at which the Control frames in the frame exchange sequence are transmitted. If the calculated duration includes a fractional microsecond, that value is rounded up to the next higher integer. All STAs process Duration field values less than or equal to 32 767 from valid Data frames (without regard for the RA, DA, and/or BSSID address values that might be present in these frames) to update their NAV settings as appropriate under the coordination function rules.

NOTE 1—The QoS Data and QoS Null subtypes are the only Data subtypes transmitted by a DMG STA.

NOTE 2—The HT Control field is not present in frames transmitted by a DMG STA.

9.3.3 Management frames

9.3.3.6 Association Request frame format

Insert the following row into Table 9-29 in numeric order:

Table 9-29—Association Request frame body

Order	Information	Notes
41	GLK-GCR Parameter Set	The GLK-GCR Parameter Set element is present if dot11GLKImplemented is true to indicate the number of reorder buffers the STA has to support GLK-GCR with GCR block ack and respond to corresponding GLK-GCR BlockAckReq frames. Otherwise this element is not present.

9.3.3.7 Association Response frame format

Insert the following row into Table 9-30 in numeric order:

Table 9-30—Association Response frame body

Order	Information	Notes
53	GLK-GCR Parameter Set	The GLK-GCR Parameter Set element is present if dot11GLKimplemented is true and the AP has set up a GLK-GCR for groupcast transmissions over the underlying general link. Otherwise this element is not present.

9.3.3.8 Reassociation Request frame format

Insert the following row into Table 9-31 in numeric order:

Table 9-31—Reassociation Request frame body

Order	Information	Notes
46	GLK-GCR Parameter Set	The GLK-GCR Parameter Set element is present if dot11GLKImplemented is true to indicate the number of reorder buffers the STA has to support GLK-GCR with GCR block ack and respond to corresponding GLK-GCR BlockAckReq frames. Otherwise this element is not present.

9.3.3.9 Reassociation Response frame format

Insert the following row into Table 9-32 in numeric order:

Table 9-32—Reassociation Response frame body

Order	Information	Notes
56	GLK-GCR Parameter Set	The GLK-GCR Parameter Set element is present if dot11GLKimplemented is true and the AP has set up a GLK-GCR for groupcast transmissions over the underlying general link. Otherwise this element is not present.

9.4 Management and Extension frame body components

9.4.1 Fields that are not elements

9.4.1.4 Capability Information field

Change Figure 9-68 and Figure 9-69 as follows:

B0	B1	B2	B3	B4	B5	B6	B7
ESS	IBSS	CF Pollable	CF-Poll Request	Privacy	Short Preamble	Reserved	Reserved

B8	B9	B10	B11	B12	B13	B14	B15
Spectrum Management	QoS	Short Slot Time	APSD	Radio Measurement	EPD ~~Reserved~~	Delayed Block Ack	Immediate Block Ack

Figure 9-68—Capability Information field (non-DMG STA)

	B0	B7	B8	B9	B10	B11	B12	B13	B14 ~~B13~~	B15
	DMG Parameters		Spectrum Management	Triggered Unscheduled PS	Reserved		Radio Measurement	EPD	Reserved	
Bits:	8		1	1	2		1	1	2 ~~3~~	

Figure 9-69—Capability Information field (DMG STA)

Insert the following paragraph after the 27th paragraph ("A STA sets the Radio Measurement subfield ....") of 9.4.1.4:

A STA sets the EPD subfield in the Capability Information field to 1 when dot11EPDImplemented is true and sets it to 0 otherwise.

9.4.1.9 Status Code field

Insert the following row into Table 9-46 in numeric order, and change the Reserved row accordingly:

Table 9-46—Status codes

Status Code	Name	Meaning
122	GLK_NOT_AUTHORIZED	The STA is not authorized to use GLK per local policy.

9.4.1.11 Action field

Insert the following row into Table 9-47 in numeric order, and change the Reserved row accordingly:

Table 9-47—Category values

Code	Meaning	See subclause	Robust	Group addressed privacy
29	GLK	9.6.31	Yes	Yes

9.4.2 Elements

9.4.2.1 General

Insert the following row into Table 9-77 in numeric order:

Table 9-77—Element IDs

Element	Element ID	Element ID Extension	Extensible
GLK-GCR Parameter Set (see 9.4.2.232)	255	34	Yes

9.4.2.3 Supported Rates and BSS Membership Selectors element

Insert the following rows at the end of Table 9-78 in numeric order:

Table 9-78—BSS membership selector value encoding

Value	Feature	Interpretation
125	GLK	Indicates that support for the mandatory features of 11.51 is required in order to join the BSS that was the source of the Supported Rates and BSS Membership Selectors element or Extended Supported Rates and BSS Membership Selectors element containing this value.
124	EPD	Indicates that support for EPD is required in order to join the BSS that was the source of the Supported Rates and BSS Membership Selectors element or Extended Supported Rates and BSS Membership Selectors element containing this value.

9.4.2.27 Extended Capabilities element

Change the following rows in Table 9-135 as shown:

Table 9-135—Extended Capabilities field

Bit	Information	Notes
1	GLK ~~Reserved~~	The STA sets the GLK field to 1 when dot11GLKImplemented is true and sets it to 0 otherwise.
3	GLK-GCR ~~Reserved~~	The STA sets the GLK-GCR field to 1 when dot11GLKGCRImplemented is true and sets it to 0 otherwise.

9.4.2.128 DMG Capabilities element

9.4.2.128.2 DMG STA Capability Information field

Change Figure 9-504 as follows:

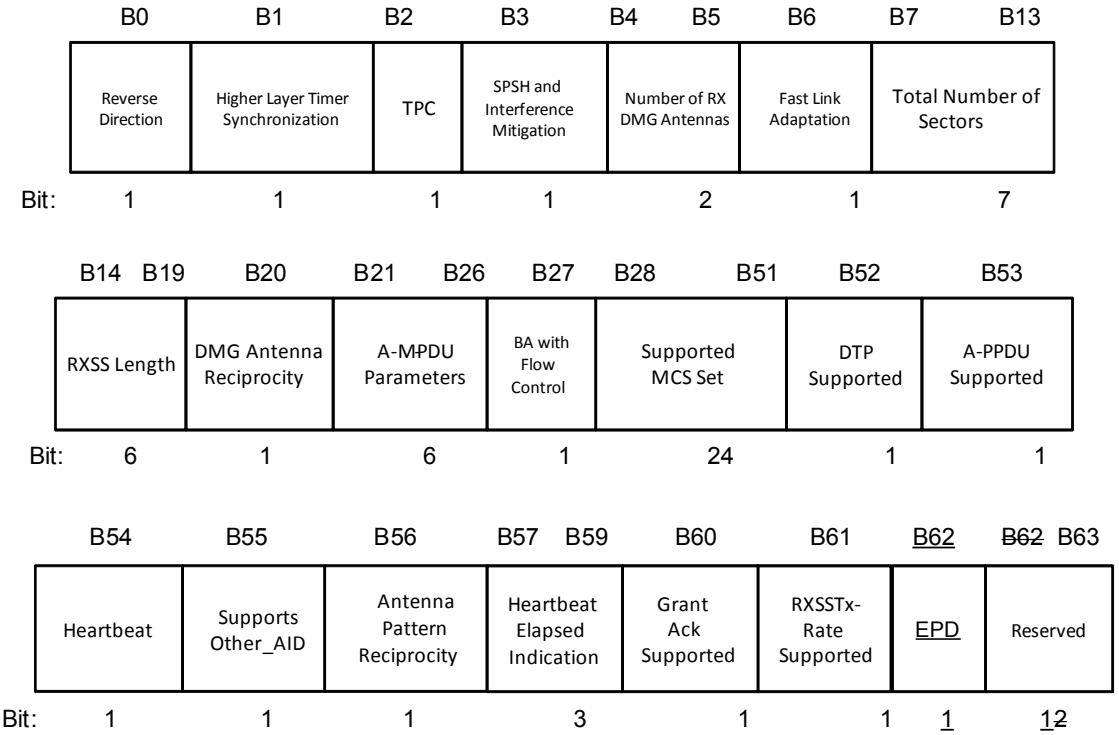

Figure 9-504—DMG STA Capability Information field format

Insert the following paragraph at the end of 9.4.2.128.2:

A DMG STA sets the EPD subfield in the DMG STA Capability Information field to 1 when dot11EPDImplemented is true and sets it to 0 otherwise.

Insert the following subclause (9.4.2.232, including Figure 9-589ds, Figure 9-589dt, and Table 9-262ag) after 9.4.2.231:

9.4.2.232 GLK-GCR Parameter Set element

The GLK-GCR Parameter Set element is included in an Association Request or a Reassociation Request transmitted by a non-AP STA to indicate its buffering capability to support GLK-GCR. The GLK-GCR Parameter Set element is included in the corresponding Association Response or Reassociation Response transmitted by an AP to define the parameters that are used when the GLK AP transmits groupcast frames using GLK-GCR to the associated GLK non-AP STAs. Figure 9-589ds shows the fields that make up the GLK-GCR Parameter Set element.

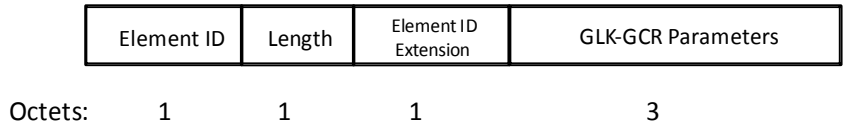

Figure 9-589ds—GLK-GCR Parameter Set element format

The GLK-GCR Parameters field is shown in Figure 9-589dt.

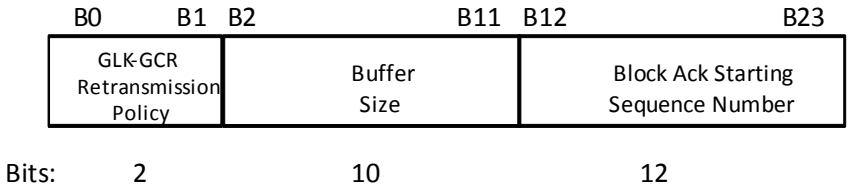

Figure 9-589dt—GLK-GCR Parameters field format

The GLK-GCR Retransmission Policy subfield is described in Table 9-262ag. This subfield is reserved when the corresponding GLK-GCR Parameters Set element is part of an Association Request or a Reassociation Request.

Table 9-262ag—GLK-GCR Retransmission Policy subfield

B0	B1	Description of the corresponding GLK-GCR mode
0	0	Reserved
0	1	GLK-GCR not operational
1	0	Operating in GLK-GCR unsolicited retry mode
1	1	Operating in GLK-GCR block ack mode

The Buffer Size subfield indicates the maximum number of buffers in the GLK-GCR block ack block. Each buffer is capable of holding a number of octets equal to the maximum size of an A-MSDU that is supported by the STA.

In an Association Request or a Reassociation Request, the Buffer Size subfield in a GLK-GCR Parameter Set element is intended to provide guidance for the recipient to decide its reordering buffer size. If the transmitter has no guidance for the receivers reordering buffer size it sets the Buffer Size subfield to 0.

In an Association Response or Reassociation Response, the Buffer Size subfield in a GLK-GCR Parameters field in the GLK-GCR Parameter Set element is set to a value greater than equal to 1, if the GLK-GCR retransmission policy indicates GLK-GCR block ack mode. Otherwise this subfield is reserved.

The Block Ack Starting Sequence Control subfield indicates the sequence number of the first MSDU or A-MSDU for this GLK-GCR block ack agreement, and is defined in 9.3.1.8. This subfield is reserved when the corresponding GLK-GCR Parameters Set element is part of an Association Request or Reassociation Request.

9.6 Action frame format details

Insert the following subclause (9.6.31, including Table 9-421ag and Table 9-421ah) after 9.6.30.3:

9.6.31 GLK Action frame details

9.6.31.1 GLK Action field

A GLK Action field, in the octet immediately after the Category field, differentiates the GLK Action frame formats. The GLK Action field values associated with each frame format within the GLK category are defined in Table 9-421ag.

Table 9-421ag—GLK Action field values

Value	Meaning	Time priority
0	GLK Groupcast Mode Change Notification	No
1–255	Reserved	—

9.6.31.2 GLK Groupcast Mode Change Notification

The GLK Groupcast Mode Change Notification frame is an Action frame used to indicate a change to the GLK groupcast transmission policy. See Table 9-421ah.

Table 9-421ah—GLK Groupcast Mode Change Notification frame format

Order	Information
1	Category
2	GLK Action
3	GLK-GCR Parameter Set

The Category field is defined in 9.4.1.11. The GLK Action field is defined in 9.6.31.1. The GLK-GCR Parameter Set element is defined in 9.4.2.232.

10. MAC sublayer functional description

10.2 MAC architecture

10.2.8 MAC data service

Insert the following paragraph after the fifth paragraph ("Unless the MPDU ....") of 10.2.8:

A STA transmitting on a general link also uses the addressing rules described in 10.65.

Change the now seventh paragraph of 10.2.8 as follows:

The MAC performs address filtering on the Address 1 field ~~of~~ in each MPDU contained in a PPDU and, for non-GLK non-AP STAs, on the DA of each MSDU within an A-MSDU. In the case of a non-GLK STA receiver, w~~W~~hen the Address 1 field or DA field contains a group address, address filtering is performed by comparing the value in the Address 1 field or DA field to all values in the dot11GroupAddressesTable, and the STA also validates the BSSID to verify either that the group addressed frame originated from a STA in the BSS of which the receiving STA is a member, or that it contains the wildcard BSSID value, indicating a Data frame sent outside the context of a BSS (dot11OCBActivated is true in the transmitting STA). Address 1 filtering is as specified in 10.66 when Address 1 is a SYNRA. A GLK AP does not perform any DA filtering for MPDUs received over a non-general link; all MSDUs so received are passed to the DS for further processing. A GLK STA does not perform DA filtering for MPDUs received over a general link; all MSDUs so received are passed to the GLK convergence function and from there to the bridge for further processing.

10.3 DCF

10.3.6 Group addressed MPDU transfer procedure

Change the last paragraph of 10.3.6 as follows:

A STA that is not an S1G relay STA shall discard an MPDU with a group address in the Address 1 field unless one of the following cases applies: (1) ~~if~~ the value in the Address 1 field matches ~~does not match~~ any value in the dot11GroupAddressesTable or matches ~~and does not match~~ the Broadcast address value, or (2) the STA is a GLK STA and the address in the Address 1 field is a SYNRA. A GLK STA shall process an MPDU with a SYNRA in the Address 1 field as described in 10.66. If an MPDU originates from an S1G relay STA's associated AP and if the MPDU has any group address in its Address 1 field, then the STA shall forward that MPDU to the S1G relay AP.

10.12 A-MSDU operation

Change the fourth paragraph of 10.12 as follows:

In non-GLK transmissions, the ~~The~~ Address 1 field ~~of~~ in an MPDU carrying an A-MSDU shall be set to an individual address or to the GCR concealment address. In GLK transmissions by an AP, the Address 1 field may be set to a SYNRA. In GLK transmissions by a non-AP STA, the Address 1 field shall be set to an individual address.

10.24 Block acknowledgment (block ack)

10.24.1 Introduction

Change the second paragraph of 10.24.1 as follows:

The block ack mechanism is initialized by an exchange of ADDBA Request/Response frames except for GLK-GCR block ack. After initialization, blocks of QoS Data frames may be transmitted from the originator to the recipient. A block may be started within a polled TXOP, within an SP, or by winning EDCA contention. The number of frames in the block is limited, and the amount of state that is to be kept by the recipient is bounded. The MPDUs within the block of frames are acknowledged by a BlockAck frame, which is requested by a BlockAckReq frame.

Insert the following paragraph after the second paragraph of 10.24.1:

For GLK-GCR block ack, the block ack mechanism is initialized when the GLK STA associates with the GLK AP. The MPDUs within a block of SYNRA addressed Data frames are acknowledged by a BlockAck frame, which is requested by a BlockAckReq frame.

10.24.2 Set up and modification of the block ack parameters

Insert the following note after the first note (now "NOTE 1—A block ack ....") of 10.24.2:

NOTE 2—A GLK-GCR block ack is set up at the time the general link is established and might be used by the general link originator whenever the GCR block ack retransmission policy is active. Therefore, an explicit block ack setup or modification procedure is not defined for GLK-GCR block ack. The GLK-GCR block ack is deleted when the corresponding general link gets reassociated or disassociated.

10.24.3 Data and acknowledgment transfer using immediate block ack policy and delayed block ack policy

Change the first paragraph of 10.24.3 as follows:

After setting up either an immediate block ack agreement or a delayed block ack agreement following the procedure in 10.24.2, and having gained access to the medium and established protection, if necessary, the originator may transmit a block of QoS Data frames separated by SIFS, with the total number of frames not exceeding the Buffer Size subfield value in the associated ADDBA Response frame or the GLK-GCR Parameter Set element in the (Re)Association Response frame and subject to any additional duration limitations based on the channel access mechanism. Each of the frames shall have the Ack Policy subfield in the QoS Control field set to No Ack. The RA field in the frames that are not delivered using the GCR block ack retransmission policy shall be the recipient's individual address. The RA field ~~of~~ in GCR frames delivered using the GCR block ack retransmission policy shall be set to the GCR concealment address. The RA field in data frames delivered using the GLK-GCR block ack retransmission policy shall be set to a SYNRA. The originator requests acknowledgment of outstanding QoS Data frames by sending a Basic BlockAckReq frame. The recipient shall maintain a block ack record for the block.

10.24.5 Teardown of the block ack mechanism

Change the last paragraph of 10.24.5 as follows:

The DELBA frame transmitted to release the block ack setup of a GCR service shall include the GCR Group Address element to indicate the group address of the GCR service. For general links using a GLK-GCR block ack retransmission policy, there is no explicit teardown of the block ack mechanism. The GLK-GCR block ack agreement terminates when the general link is reassociated/disassociated.

10.24.6 Selection of BlockAck and BlockAckReq variants

Change the sixth paragraph of 10.24.6 as follows (including splitting it into two paragraphs, each with a dashed list):

The GCR Mode subfield of the BAR Control field (see Table 9-22) shall be set to ~~1~~

- GCR BlockAck: in all BlockAckReq frames ~~where the~~ within a GCR block ack agreement or
- GLK-GCR BlockAck: in all BlockAckReq frames within a GLK-GCR block ack agreement.
  ~~is for a group address delivered using the GCR block ack retransmission policy and shall be set to 0 otherwise.~~

The GCR Mode subfield ~~of~~ in the corresponding BA Control field (see Table 9-24) shall be set to ~~1~~

- GCR BlockAck: in all BlockAck frames ~~where the~~ within a GCR block ack agreement or
- GLK-GCR BlockAck: in all Block Ack frames within a GLK-GCR block ack agreement.
  ~~is for a group address delivered using the GCR block ack retransmission policy and shall be set to 0 otherwise.~~

Change the subclause title of 10.24.10 as follows:

10.24.10 GCR and GLK-GCR block ack

10.24.10.1 Introduction

Change 10.24.10.1 as follows:

Subclause 10.24.10 extends the block ack mechanism to group addressed frames that are transmitted using the GCR block ack and GLK-GCR retransmission policies ~~policy~~. Other than the exceptions noted in 10.24.10.2 through 10.24.10.3, the operation of GCR block ack is the same as is described in 10.24.7.

Insert the following subclause (10.24.10.2a) after 10.24.10.2:

10.24.10.2a Scoreboard context control during GLK-GCR block ack

GLK-GCR scoreboarding accounts for all GLK-GCR frames received under the GLK-GCR block ack agreement. The received frame may be discarded after SYNRA filtering (see 10.66) but still accounted for in the scoreboarding.

A GLK AP may set up a GLK-GCR block ack agreement with each GLK STA that has indicated support for GLK-GCR in the Association/Reassociation Request frame when the GLK STA associated/reassociated with the GLK AP. Each of those GLK STAs with GLK-GCR block ack agreement shall maintain a block acknowledgment record for full state operation as defined in 10.24.3. This record includes the following information:

- A bitmap, indexed by sequence number
- A 12-bit unsigned integer starting sequence number
- $WinStart_R$, representing the lowest sequence number position in the bitmap
- A variable $WinEnd_R$
- The maximum transmission window size, $WinSize_R$

$WinSize_R$ is set to the smaller of 64 and the value of the Buffer Size subfield in the GLK-GCR Parameter Set element in the most recently received Association Response or the Reassociation Response frame that established the GLK-GCR block ack agreement, or the GLK Groupcast Mode Change Notification action

frame. $WinEnd_R$ is defined as the highest sequence number in the current transmission window. A STA implementing a GLK-GCR block ack agreement shall maintain the block acknowledgment record for that agreement according to the following rules:

a) At GCR block ack agreement establishment (either during general link establishment or when GLK-GCR groupcast mode changes):
   1) $WinStart_R$ = the Starting Sequence Number subfield value (SSN) from the GLK-GCR Parameter Set element included in the Association Response frame, Reassociation Response frame or in the GLK-GCR Groupcast Mode Change Notification frame.
   2) $WinEnd_R = WinStart_R + WinSize_R - 1$.

b) For each Data frame that is received under the GLK-GCR block ack agreement, the block acknowledgment record for that agreement is modified as follows, where SN is the value of the Sequence Number subfield in the received Data frame:
   1) If $WinStart_R \leq SN \leq WinEnd_R$, set to 1 the bit in position SN within the bitmap.
   2) If $WinEnd_R < SN < WinStart_R + 2^{11}$,
      i) Set to 0 the bits corresponding to MPDUs with Sequence Number subfield values from $WinEnd_R + 1$ to SN – 1.
      ii) Set $WinStart_R = SN - WinSize_R + 1$.
      iii) Set $WinEnd_R = SN$.
      iv) Set to 1 the bit at position SN in the bitmap.
   3) If $WinStart_R + 2^{11} \leq SN \leq WinStart_R$, make no changes to the record.

c) For each BlockAckReq frame received under the GLK-GCR block ack agreement, the block acknowledgment record for that agreement is modified as follows, where SSN is the value from the Starting Sequence Number subfield in the received BlockAckReq frame:
   1) If $WinStart_R < SSN \leq WinEnd_R$,
      i) Set $WinStart_R = SSN$.
      ii) Set to 0 the bits corresponding to MPDUs with Sequence Number subfield values from $WinEnd_R + 1$ to $WinStart_R + WinSize_R - 1$.
      iii) Set $WinEnd_R = WinStart_R + WinSize_R - 1$.
   2) If $WinEnd_R < SSN < WinStart_R + 2^{11}$,
      i) Set $WinStart_R = SSN$.
      ii) Set $WinEnd_R = WinStart_R + WinSize_R - 1$.
      iii) Set to 0 bits the corresponding to MPDU with Sequence Number subfield values from $WinStart_R$ to $WinEnd_R$.
   3) If $WinStart_R + 2^{11} \leq SSN \leq WinStart_R$, make no changes to the record.

10.24.10.3 GCR block ack BlockAckReq and BlockAck frame exchanges

Insert the following paragraph after the seventh paragraph ("For GCR streams .... NOTE—This is ... counter.") of 10.24.10.3:

For GLK-GCR transmissions with retransmission policy equal to GLK-GCR block ack, an originator may send a BlockAckReq frame with the Block Ack Starting Sequence Control subfield set to the Sequence Number field in the MPDU containing the earliest MSDU that has not been acknowledged and has not expired due to lifetime limits, in order to minimize buffering latency at the receivers of the GLK-GCR transmission.

Insert the following subclauses (10.61 and 10.62) after 10.60.5:

10.61 Addressing of GLK data frame transmission

If a corresponding IEEE 802.1Q Bridge provides a station vector parameter that indicates a single general link, then the GLK STA shall transmit the MSDU using individually addressed MPDU(s) to the peer STA with one of the following methods:

- A frame with a three-address MAC header if the RA and the DA are equal and the transmitter is an AP.
- A frame with a four-address MAC header.
- A frame containing a Basic A-MSDU.

If a corresponding IEEE 802.1Q Bridge provides a station vector parameter that indicates multiple general links, then GLK transmission of the MSDU shall use one of the following methods:

- Transmit multiple individually addressed MPDUs to peer STAs.
- Transmit group addressed MPDU(s) using a SYNRA in a frame with a four-address MAC header with the following restrictions:
  - Shall not be sent by a non-GLK STA or non-AP STA.
  - Shall not address a STA that is in PS mode.
  - Shall not address a STA whose general link might pass through a relay.

A GLK AP may use any combination of these methods, such that each peer STA is addressed once. This also applies for each retry triggered by GLK-GCR, which shall use the same method for all transmission attempts.

The addressing of the frame with a four-address MAC header shall be as follows:

- Address 1 is the MAC address of the immediate destination STA (the receiver of the MPDU) or a SYNRA.
- Address 2 is the MAC address of the transmitter STA (the transmitter of the MPDU).
- Address 3 is the DA of the MSDU (the destination address of the MSDU), or BSSID for a Basic A-MSDU.
- Address 4 is the SA of the MSDU (the source address of the MSDU), or BSSID for a Basic A-MSDU.

The addressing of the frame with the three-address MAC header format containing a basic A-MSDU shall be as follows:

- Address 1 is the MAC address of the immediate destination STA (the receiver of the MPDU).
- Address 2 is the MAC address of the transmitter STA (the transmitter of the MPDU).
- Address 3 is the BSSID.
- DA in A-MSDU subframe header is the DA of the MSDU (the destination address of the MSDU).
- SA in A-MSDU subframe header is the SA of the MSDU (the source address of the MSDU).

10.62 SYNRA filtering operation

A GLK infrastructure non-AP STA shall support reception of frames with a SYNRA as RA.

When a GLK non-AP STA receives a group address RA in an MPDU from its associated GLK AP, if the SYNRA Type subfield does not represent a supported SYNRA type, or the From DS and To DS subfields in the Frame Control field are not both 1, then the non-AP STA shall discard the frame, and not use the frame

for updating any scoreboard used for GLK-GCR block ack. All other group addressed Data frames received from the associated GLK AP shall be counted as received for the purposes of the scoreboard used for GLK-GCR block ack, even if discarded based on the subsequent SYNRA filtering, as described below.

For Basic SYNRA Control subfield, the frame shall be discarded if any of the following filter rules are satisfied:

— The AID of the STA falls within the range of AID values covered by the AID Bitmap subfield, and the bit representing its AID value is 0.

— The AID of the STA falls outside the range of AID values covered by the AID Bitmap subfield, and the Other AID subfield is 0.

11. MLME

11.2 Power management

11.2.3 Power management in a non-DMG infrastructure network

11.2.3.1 General

Change the third paragraph of 11.2.3.1 as follows:

If any non-GLK STA in its BSS is in PS mode, the AP shall buffer all non-GCR-SP group addressed BUs that arrive via the DS and deliver them to all non-GLK STAs immediately following the next Beacon frame containing a DTIM transmission. If the AP is an S1G AP, the AP may additionally deliver these BUs using group AID as defined in 10.51. If any GLK STA in its BSS is in PS mode, the AP shall not include any such STAs as a SYNRA destination and shall buffer all group addressed BUs that arrive from the attached bridge and are destined to such STAs, delivering them with individually addressed MPDUs using power save delivery methods.

Insert the following note after the third paragraph of 11.2.3.1:

NOTE—The group addressed buffered BUs containing one or more MSDUs for GLK type STAs and for non-GLK type STAs are not repeated by the AP to the other type of STA. Network entities external to the AP, such as the bridged network, may repeat these MSDUs to both types of STAs by other means, outside the scope of this standard.

11.2.3.3 AP TIM transmissions

Change the first paragraph of 11.2.3.3 as follows (footnote 42 remains unchanged):

The TIM shall identify the STAs for which traffic is pending and buffered in the AP. This information is coded in a *partial virtual bitmap*, as described in 9.4.2.6. In addition, the TIM contains an indication whether non-SYNRA group addressed traffic is pending. Every STA is assigned an AID by the AP as part of the association process. AID 0 (zero) is reserved to indicate the presence of buffered non-GCR-SP group addressed BUs that will be delivered using MPDUs with an RA other than a SYNRA but that are not delivered using group AID. The AP shall identify those STAs for which it is prepared to deliver[42] buffered BUs by setting bits in the TIM's partial virtual bitmap that correspond to the appropriate AIDs.

11.2.3.4 TIM types

Change the first paragraph of 11.2.3.4 as follows:

Two different TIM types are distinguished: TIM and DTIM. After a DTIM, the AP shall transmit buffered non-GCR-SP group addressed BUs that will be delivered using MPDUs with an RA other than a SYNRA, before transmitting any individually addressed frames. The AP may additionally delivery these BUs using group AID as defined in 10.51.

11.2.3.6 AP operation during the CP

Change the following list items in the lettered list of 11.2.3.6 as shown:

d) If a STA has …. The bit for AID 0 (zero) in the Bitmap Control field of the TIM element shall be set to 1 when non-GCR-SP non-SYNRA group addressed traffic that is not delivered using group AID is buffered, according to 9.4.2.6.

e) If any associated non-GLK STAs are in PS mode, the AP shall buffer all non-GCR-SP group addressed BUs that arrive via the DS, except those that have the StrictlyOrdered service class. If any GLK STA in its BSS is in PS mode, the AP shall not include any such STAs as a SYNRA destination and shall buffer all group addressed BUs destined to such STAs, except those that have the StrictlyOrdered service class, delivering them with individually addressed MPDUs using power save delivery methods.

f) When dot11FMSActivated is false, the AP shall transmit all buffered non-GCR-SP non-SYNRA group addressed BUs immediately after every DTIM.

When dot11FMSActivated is true and the AP has established an FMS delivery interval for a multicast stream, the AP shall transmit all non-GCR-SP non-SYNRA group addressed BUs belonging to particular FMS stream immediately after the DTIM that has the Current Count field value of the FMS Counter field set to 0 for that particular FMS stream.

The More Data subfield of each group addressed frame shall be set to indicate the presence of further buffered non-GCR-SP group addressed BUs that will be delivered using MPDUs with an RA other than a SYNRA. If the AP is unable, before the primary or secondary TBTT following the DTIM, to transmit all of the buffered non-GCR-SP group addressed BUs that will be delivered using MPDUs with an RA other than a SYNRA, ~~before the primary or secondary TBTT following the DTIM,~~ then the AP shall set the bit for AID 0 (zero) in the TIM element to 1 for a single BSSID or set the corresponding group address bit to 1 for multiple BSSIDs, as defined in 9.4.2.6, and when dot11FMSActivated is true, shall set the appropriate bits in the FMS Descriptor element as described in 9.4.2.75 to indicate for which non-GCR-SP non-SYNRA group addresses there are still buffered BUs, until all buffered non-GCR-SP group addressed BUs that will be delivered using MPDUs with an RA other than a SYNRA have been transmitted.

When the AP transmits an STBC DTIM or TIM Beacon frame, the AP shall retransmit all non-GCR-SP group addressed BUs that will be delivered using MPDUs with an RA other than a SYNRA and that were transmitted following the non-STBC DTIM or TIM Beacon frame except that they are transmitted using the basic STBC MCS. It may be the case that a complete set of buffered non-GCR-SP non-SYNRA group addressed BUs is sent over a period of time during which non-STBC and STBC transmissions are interleaved, but the transition from non-STBC group addressed transmissions to STBC group addressed transmissions shall be preceded by the transmission of an STBC Beacon frame and the transition from STBC group addressed transmissions to non-STBC group addressed transmissions shall be preceded by the transmission of a non-STBC Beacon frame.

11.2.3.7 AP operation during the CFP

Change the following list items in the lettered list of 11.2.3.7 as shown:

c) Prior to every CFP, and at each beacon interval within the CFP, the AP shall assemble the partial virtual bitmap containing the buffer status per destination for STAs in the PS mode, set to 1 the bits in the partial virtual bitmap for STAs the PC is intending to poll during this CFP, and shall send this out in the TIM field of the DTIM. The bit for AID 0 (zero) in the Bitmap Control field of the TIM element shall be set to 1 when non-SYNRA group addressed traffic is buffered, according to 9.4.2.6.

d) All non-GCR-SP group addressed MSDUs that will be delivered using non-SYNRA MPDUs except those with a service class of StrictlyOrdered shall be buffered if any associated STAs are in the PS mode, regardless of whether those STAs are CF-Pollable.

e) When dot11FMSActivated is false, the AP shall transmit all buffered non-GCR-SP non-SYNRA group addressed BUs immediately after every DTIM (Beacon frame with DTIM Count field of the TIM element equal to 0).

When dot11FMSActivated is true and the AP has set up an FMS delivery interval for a multicast stream, the AP shall send all non-GCR-SP group addressed BUs that will be delivered using MPDUs with an RA other than a SYNRA and belonging to a particular FMS stream immediately after the DTIM with the Current Count field value of the FMS Counter field set to 0 for that particular FMS stream.

The More Data subfield shall be set to 1 in the headers of all but the final frame containing one of these buffered non-GCR-SP group addressed BUs that will be delivered using MPDUs with an RA other than a SYNRA to indicate the presence of further buffered group addressed BUs. If the AP is unable to transmit all of the buffered non-GCR-SP group addressed BUs before the non-STBC or STBC TBTT following the DTIM, the AP shall set the bit for AID 0 (zero) in the TIM element to 1 for a single BSSID or set the corresponding group addressed bit to 1 for multiple BSSIDs, as defined in 9.4.2.6, and when dot11FMSActivated is true, shall set the appropriate bits in the FMS Descriptor element as described in 9.4.2.75 to indicate for which group addresses there are still buffered BUs, until all buffered non-GCR-SP group addressed BUs that will be delivered using MPDUs with an RA other than a SYNRA have been transmitted.

When the AP transmits an STBC DTIM or TIM Beacon frame, the AP shall retransmit all non-GCR-SP group addressed BUs that will be delivered using MPDUs with an RA other than a SYNRA and that were transmitted following the non-STBC DTIM or TIM Beacon frame except that they are transmitted using the basic STBC MCS. It may be the case that a complete set of buffered non-GCR-SP non-SYNRA group addressed BUs is sent over a period of time during which non-STBC and STBC transmissions are interleaved, but the transition from non-STBC group addressed transmissions to STBC group addressed transmissions shall be preceded by the transmission of a STBC Beacon frame and the transition from STBC group addressed transmissions to non-STBC group addressed transmissions shall be preceded by the transmission of a non-STBC Beacon frame.

f) Buffered BUs for STAs in the PS mode shall be forwarded to the CF-Pollable STAs under control of the PC. Transmission of these buffered BUs as well as CF-Polls to STAs in the PS mode that were indicated in the DTIM in accordance with paragraph c) of this subclause shall begin immediately after transmission of buffered non-GCR-SP non-SYNRA group addressed frames (if any), and shall occur in order by increasing AID of CF-Pollable STAs. A CF-Pollable STA for which the TIM element of the most recent Beacon frame indicated buffered BUs shall be in the awake state at least until the receipt of an individually addressed frame from the AP in which the Frame Control field does not indicate the existence of more buffered BUs. After acknowledging the last of the buffered BUs, the CF-Pollable STA operating in the PS mode may enter the doze state until the next DTIM is expected.

Insert the following subclause (11.2.9) after 11.2.8:

11.2.9 Power management with general links

GLK STAs that have established general links (associations) have additional power management behaviors to support data frames with a SYNRA and GLK GCR. These behaviors are in addition to the GLK STA behaviors listed in the previous subclauses.

NOTE—It is suggested that a STA using a general link that carries unknown traffic loads on behalf of other endpoints not use PS mode, due to the increased delay and jitter it would cause. However, GLK STAs that find PS mode useful may utilize PS mode while performing behaviors in this subclause.

Data frames with a SYNRA are queued for normal (nonbuffered) transmission to associated GLK STAs that are not in PS mode. A SYNRA shall not be used to address GLK STAs in PS mode.

NOTE—The net effect of the above is that any GLK non-AP STA in PS mode will, for all traffic for which the PS STA is a recipient, result in MPDUs that are buffered and, if there are multiple receivers, potentially duplicated. The IEEE 802.1Q bridge at the AP should use higher-layer facilities to filter traffic being sent to the STA so as to limit the amount of buffered traffic.

A GLK STA that has enabled GLK-GCR on its general link shall not enter PS mode. GLK STAs shall not use the FMS, TFS nor WNM-Sleep procedures applied to group addressed frames.

11.3 STA authentication and association

11.3.5 Association, reassociation, and disassociation

11.3.5.3 AP or PCP association receipt procedures

Change the following list item in the lettered list of 11.3.5.3 as shown:

f) The SME shall refuse an association request from a STA that does not support all of the rates in the BSSBasicRateSet parameter <u>and all of the membership selectors in the BSSMembershipSelectorSet parameter</u> in the MLME-START.request primitive.

Insert the following list item and note after item h) in 11.3.5.3, and reletter the remaining list items appropriately:

i) An AP or PCP may refuse GLK association based on local policy and, if so, shall return the GLK_NOT_AUTHORIZED ResultCode.

NOTE—For example, there might be a list of authorized GLK peers or clients or a limit on the number of GLK peers or clients and the peer or client is not on that list or its acceptance would exceed the limit.

11.3.5.4 Non-AP and non-PCP STA reassociation initiation procedures

Change the first numbered list of item c) in the lettered list of 11.3.5.4 as follows:

c) If a Reassociation Response frame ... SUCCESS, the state variable ... to initial values:
   1) All EDCAF state
      ...
   <u>11) GLK-GCR agreement</u>

11.3.5.5 AP or PCP reassociation receipt procedures

Change the following list item in the lettered list of 11.3.5.5 as shown:

f) The SME shall refuse a reassociation request from a STA that does not support all of the rates in the BSSBasicRateSet parameter and all of the membership selectors in the BSSMembershipSelectorSet parameter in the MLME-START.request primitive.

11.24 Wireless network management procedures

11.24.16 Group addressed transmission service

11.24.16.3 GCR procedures

11.24.16.3.1 Overview

Insert the following paragraphs at the end of 11.24.16.3.1:

GLK-GCR is a variant of GCR where the setup is implicit and is accomplished using a (Re)Association frame exchange between the peers and termination is implicit and is accomplished when the corresponding general link is torn down. Modification is explicit and is accomplished using a GLK Groupcast Mode Change Notification frame.

GLK-GCR defines two retransmission policies for group addressed frames:

— GLK-GCR unsolicited retry
— GLK-GCR block ack

When a GLK STA implements the GLK-GCR procedures defined in 11.24.16.4.2 or 11.24.16.4.3, it shall set dot11GLKGCRImplemented to true; otherwise dot11GLKGCRImplemented shall be set to false. When dot11GLKGCRImplemented is true the GLK-GCR bit field shall be set to 1 in the Extended Capabilities element, to indicate support for GLK-GCR, otherwise the field shall be set to 0.

11.24.16.3.2 GCR group membership procedures

Insert the following paragraph at the beginning of 11.24.16.3.2:

The GCR group membership procedures do not apply to GLK-GCR. GLK-GCR uses SYNRAs.

11.24.16.3.3 GCR setup procedures

Insert the following paragraph at the beginning of 11.24.16.3.3:

The following setup procedures apply only if the underlying link is a non-general link.

11.24.16.3.4 GCR frame exchange procedures

Insert the following paragraph at the beginning of 11.24.16.3.4:

The GCR frame exchange procedures do not apply to GLK-GCR. See 11.24.16.4.2 for GLK-GCR frame exchange procedures.

11.24.16.3.5 Concealment of GCR transmissions

Insert the following paragraph at the beginning of 11.24.16.3.5:

The concealment of GCR transmissions does not apply to GLK-GCR.

11.24.16.3.6 GCR unsolicited retry

Insert the following paragraph at the beginning of 11.24.16.3.6:

The GCR unsolicited retry procedures do not apply to GLK-GCR. See 11.24.16.4.3 for GLK-GCR unsolicited retry.

11.24.16.3.7 GCR block ack

Insert the following paragraph at the beginning of 11.24.16.3.7:

The GCR block ack procedures do not apply to GLK-GCR. See 11.24.16.4.4 for GLK-GCR block ack.

11.24.16.3.8 GCR-SP

Insert the following paragraph at the beginning of 11.24.16.3.8:

The GCR-SP delivery method does not apply to GLK-GCR.

Insert the following subclause (11.24.16.4) after 11.24.16.3.8:

11.24.16.4 GLK-GCR

11.24.16.4.1 Overview

GLK-GCR functions as GCR does except as described in the subclauses below. The RA field in the MAC header corresponding to the Data frames transmitted under the GLK-GCR agreement shall contain a SYNRA.

11.24.16.4.2 GLK-GCR frame exchange procedures

A GLK AP that supports GLK-GCR and has set up GLK-GCR for groupcast transmissions shall transmit group addressed frames only via the GLK-GCR mechanism. The GLK AP shall not transmit groupcast frames via the No-Ack/No-Retry (non-GCR; see 10.3.6) service as long as GLK-GCR is active. Data frames using the GLK-GCR mechanism use the non-GCR-SP delivery mode. A GLK AP providing GLK-GCR service may switch between GCR block ack, or GCR unsolicited retry retransmission policies only after indicating such a switch using the GLK Groupcast Mode Change Notification frame.

When the GLK AP updates the GLK-GCR retransmission policy, the GLK AP shall set the Last Sequence Control field in the GLK-GCR Parameter Set element to the sequence number of the MPDU corresponding to the GCR traffic flow that is being updated that was delivered prior to the change in retransmission policy.

To avoid undetected retries being passed up at a receiver's MAC SAP, GLK non-AP STAs that support GLK-GCR should detect duplicates of received group addressed frames and discard them (see 10.3.2.12).

A GLK AP may update the retransmission policy for any reason, such as a change in the size of the group or the capabilities of the members of the group The GLK AP advertises the current settings using a GLK Groupcast Mode Change Notification frame.

11.24.16.4.3 GLK-GCR unsolicited retry

A STA supports the GLK-GCR unsolicited retry retransmission policy if dot11GLKGCRImplemented is true; otherwise, the STA does not support the GLK-GCR unsolicited retry retransmission policy.

A GLK AP adopting the GLK-GCR unsolicited retry retransmission policy uses the backoff procedure described in 10.22.2.10.2.

If a block ack agreement has successfully been established for a group addressed stream that is delivered using the GLK-GCR unsolicited retry retransmission policy, the GLK STA shall follow the duplicate detection procedures defined in 10.3.2.12 and 10.24.4.

11.24.16.4.4 GLK-GCR block ack

A STA supports the GLK-GCR block ack retransmission policy if dot11GLKGCRImplemented is true; otherwise, the STA does not support the GLK-GCR block ack retransmission policy.

The Buffer Size subfield in the GLK-GCR Parameters field in the GLK-GCR Parameter Set element sent in the (Re)Association Response frame by the GLK AP is the GCR buffer size (see 10.24.10).

Insert the following subclauses (11.51 and 11.52) after 11.50.7:

11.51 GLK operation

11.51.1 General

GLK STAs are capable of creating general links with other GLK STAs, that can be used as links within an IEEE 802.1Q bridged network. Such links (1) include facilities to send group addressed Data frames to a subset of receiving GLK STAs including use of improved GCR mechanisms, (2) can be mapped to the IEEE 802.1Q Internal Sublayer Service, and (3) provide link metrics appropriate for use by IEEE 802.1Q bridges in making routing decisions.

When dot11GLKImplemented is true, the STA is a GLK STA and dot11QosOptionImplemented shall be true. A STA advertises its GLK capability using the GLK field of the Extended Capabilities element (see 9.4.2.27). dot11GLKImplemented is true if and only if a STA implements the GLK facility.

The Supported Rates and BSS Membership Selectors or Extended Supported Rates and BSS Membership Selectors elements shall include the GLK selector if dot11GLKRequired is true.

If dot11GLKRequired is true, every association or mesh peering created by the STA shall establish a general link.

In an IBSS, if dot11GLKRequired is not true, general links shall not be established.

A GLK STA shall support SYNRA operations as described in 10.65 and 10.66.

11.51.2 Reported general link metrics

The bridge management protocols in IEEE Std 802.1Q require link metrics for each general link. GLK STAs shall provide metrics for their general links as follows:

— The dot11GLKLinkRawRate variable, which is the maximum rate at which the GLK STA is capable of transmitting, given its available features and those of the STA with which it is communicating.
— For a windowed set of link rate samples:
  — The minimum
  — The arithmetic mean
  — The geometric mean
  — The standard deviation
  — A composite link rate

NOTE—The passing of link metrics from a GLK STA to the attached IEEE 802.1Q bridge is implementation dependent.

A GLK STA shall maintain an array of sample window data rates for each of its general links. Each such array consists of rate sample windows R[0] to R[N+1] in units of 100 kb/s, where N is the value of dot11GLKLinkRateSamples. Each sample window covers a time period of dot11GLKLinkRateWindowSize×16 TUs. When the association or peering is created, R[0] to R[N+1] are initialized to the lowest data bit rate the STA is configured to use.

Every dot11GLKLinkRateWindowSize×16 TUs, the following steps occur in the order given:

Step 1: The data rate sample array is shifted with the value of R[N+1] being discarded, each R[K] is set to the value of R[K-1] for K from N+1 to 1, and R[0] is set as follows:

— Zero if all attempts to transmit data during the window failed.
— The arithmetic mean data rate in units of 100 kb/s of successful transmissions in the window if there were any successful transmissions.
— The data rate that would have been attempted if there were no attempts to transmit data during the window.

Step 2: The minimum, arithmetic mean, geometric mean, and standard deviation of the data rates in the sample array entries are calculated as follows:

— The minimum rate is R_{min}, the array entry with the smallest magnitude.
— The arithmetic mean is $R_{\text{avg}} = \lfloor \sum_{i=0}^{N+1} R[i]/(N+2) \rfloor$
— The geometric mean is $R_{\text{geo}} = \left\lfloor \sqrt[N+2]{\prod_{i=0}^{N+1}(R[i]+1)} \right\rfloor$
— The standard deviation is $R_{\text{std}} = \left\lfloor \sqrt{\sum_{i=0}^{N+1}\left(R[i] - \mathrm{R}_{avg}\right)^2 / N+1} \right\rfloor$

These are available as dot11GLKLinkMinRate, dot11GLKLinkAvgRate, dot11GLKLinkGeoRate, and dot11GLKLinkSTDRate.

Step 3: A composite data rate is then computed using non-negative weights W as follows:

$$R_{\text{composite}} = \left\lfloor \frac{W_{min} \times R_{min} + W_{avg} \times R_{avg} + W_{geo} \times R_{geo}}{1 + W_{min} + W_{avg} + W_{geo}} \right\rfloor$$

where
W_{min} is dot11GLKLinkRateWmin
W_{avg} is dot11GLKLinkRateWavg
W_{geo} is dot11GLKLinkRateWgeo

Step 4: A rate is then computed from $R_{composite}$.

$$R_{current} = \lfloor (R_{composite} \times 16) / \text{dot11GLKLinkRateScaling} \rfloor$$

Step 5: The first $R_{reported}$ for a general link is $R_{current}$ as determined in step 4. Subsequent values of $R_{reported}$ are subject to hysteresis based on dot11GLKLinkRateHysteresis. If the previous $R_{reported}$ is greater than the new $R_{current}$ × dot11GLKLinkRateHysteresis/256 and less than the new $R_{current}$ × 256/dot11GLKLinkRateHysteresis, then the new $R_{reported}$ is unchanged from the previous $R_{reported}$. In all other cases, the new $R_{reported}$ is the new $R_{current}$. $R_{reported}$ is available in the per association, direct link, or peering GLK Link dot11GLKLinkRateReported.

In the case of transparent FST, the general link metric is measured relative to the single presented MAC SAP regardless of which PHY is used to exchange MSDUs.

11.52 EPD operation

A STA operating in the 5.9 GHz bands is an EPD STA and dot11EPDimplemented shall be set to true or not present. For an EPD STA not operating in the 5.9 GHz bands, dot11EPDImplemented shall be set to true. For a STA that is not EPD, dot11EPDImplemented shall be set to false or not present. When an EPD STA is not operating in the 5.9 GHz bands the EPD subfield is set to 1 in the Capability Information and DMG STA Capability Information fields.

The Supported Rates and BSS Membership Selectors or Extended Supported Rates and BSS Membership Selectors elements shall include the EPD selector if dot11EPDRequired is true.

See also 5.1.4.

14. MLME mesh procedures

14.1 Mesh STA dependencies

Insert the following paragraph at the end of 14.1:

A mesh STA with dot11EPDImplemented true shall set dot11EPDRequired to true.

14.2 Mesh discovery

14.2.3 Mesh profile

Change the lettered list of the first paragraph of 14.2.3 as follows:

A mesh profile is a set of parameters that specifies the attributes of a mesh BSS. A mesh profile consists of the following:

a) A Mesh ID—specified by dot11MeshID
...
g) EPD support—specified by dot11EPDImplemented

Change the subclause titles of 14.11 and 14.11.1 and the first two paragraphs and first note of 14.11.1 as follows:

14.11 Interworking with the DS or an attached bridge

14.11.1 Overview of interworking between a mesh BSS and a DS or attached bridge

A mesh STA that has direct access to a DS is called a *mesh gate*. Other m~~M~~esh STAs in an MBSS access the DS via the mesh gate. A GLK mesh STA accesses external networks through its attached bridge. An MBSS functions like an IEEE 802 LAN segment that is compatible with IEEE Std 802.1D. The MBSS appears as a single access domain.

An MBSS may contain two or more mesh gates and/or GLK mesh STAs. When multiple mesh gates and/or GLK mesh STAs in an MBSS have access to the same bridged network or DS, the MBSS has more than one "port" (in the sense of IEEE Std 802.1D-2004, for example) through which it accesses the DS or bridged network. ~~Accordingly,~~ This situation might lead to broadcast loops ~~may occur~~. Therefore, mesh gates should cooperate with the DS if present to implement a loop preventing protocol ~~in the DS~~.

NOTE—Bridged networks already have a loop preventing protocol, such as ~~In the DS a typical implementation uses the~~ Rapid Spanning Tree Protocol (RSTP) as specified in IEEE Std 802.1D-2004. With RSTP the resulting active DS or bridged network topology forms a tree. With such cooperation, ~~Then,~~ even if multiple mesh gates and/or GLK mesh STAs connect with the same bridged network or DS, there will not be a loop ~~the MBSS only accesses the DS through a single mesh gate~~.

Insert the following paragraph after the second paragraph (and its note) of 14.11.1:

A GLK mesh STA creates a virtual point-to-point LAN to each other GLK mesh STA in the MBSS. Each of these point-to-point LANs is presented by the GLK convergence function as a unique Internal Sublayer Service SAP that is mapped to an IEEE 802.1Q bridge port. Each such SAP is identified by a locally unique service_access_point_identifier, generated by the STA and the GLK convergence function (see 5.2.1a).

Annex A

(informative)

Bibliography

Insert the following reference into Annex A in numeric order:

[B24a] IEEE Std 802.1Qbz™-2016, Bridges and Bridged Networks—Amendment 27: Enhancements to Bridging of IEEE 802.11 Media.

Annex B

(normative)

Protocol Implementation Conformance Statement (PICS) proforma

B.4 PICS proforma—IEEE Std 802.11-2016

B.4.3 IUT configuration

Insert the following rows at the end of the table in B.4.3:

Item	IUT configuration	References	Status	Support
*CFGLK	GLK enabled STA	11.51	(NOT CFOCB):O	Yes ☐ No ☐ N/A ☐
CFGLK.1	GLK-GCR	11.24.16.4	CFGLK:O	Yes ☐ No ☐ N/A ☐

B.4.4 MAC protocol

B.4.4.2 MAC frames

Insert the following rows into the table in B.4.4.2 in numeric order:

Item	MAC frame	References	Status	Support
FT51	LPD MSDU	5.1.4	M	Yes ☐ No ☐ N/A ☐
FT52	EPD MSDU	5.1.4, 11.52	O	Yes ☐ No ☐ N/A ☐
FR52	LPD MSDU	5.1.4	M	Yes ☐ No ☐ N/A ☐
FR53	EPD MSDU	5.1.4, 11.52	FT52:M	Yes ☐ No ☐ N/A ☐

B.4.4.4 MAC addressing functions

Insert the following rows into the table in B.4.4.4 in numeric order:

Item	MAC Address function	References	Status	Support
AD16	Receive SYNRA	10.66	(CFGLK AND CFIndepSTA):M	Yes ☐ No ☐ N/A ☐
AD17	Transmit SYNRA	10.66	(CFGLK AND CFAP):O	Yes ☐ No ☐ N/A ☐

Annex C

(normative)

ASN.1 encoding of the MAC and PHY MIB

C.3 MIB detail

Insert the following entries at the end of the "dot11StationConfigEntry SEQUENCE" list in C.3:

```
dot11GLKImplemented                                    TruthValue,
dot11GLKRequired                                       TruthValue,
dot11EPDImplemented                                    TruthValue,
dot11EPDRequired                                       TruthValue,
dot11GLKLinkRateSamples                                Unsigned32,
dot11GLKLinkRateWindowSize                             Unsigned32,
dot11GLKLinkRateWmin                                   Unsigned32,
dot11GLKLinkRateWavg                                   Unsigned32,
dot11GLKLinkRateWgeo                                   Unsigned32,
dot11GLKLinkRateScaling                                Unsigned32,
dot11GLKLinkRateHysteresis                             Unsigned32,
dot11GLKGCRImplemented                                 TruthValue
```

Insert the following text after dot11FutureChannelGuidanceActivated (dot11StationConfigEntry 166) in C.3:

```
dot11GLKImplemented OBJECT-TYPE
   SYNTAX TruthValue
   MAX-ACCESS read-only
   STATUS current
   DESCRIPTION
      "When true, this attribute indicates a GLK capable
      STA. When false, it indicates a non-GLK
      capable STA. This is a capability variable."
   ::= { dot11StationConfigEntry 169 }

dot11GLKRequired OBJECT-TYPE
   SYNTAX TruthValue
   MAX-ACCESS read-write
   STATUS current
   DESCRIPTION
      "When true, this attribute indicates a STA that
      will not accept associations from or peer with a non-GLK
      capable STA. When false, it indicates a STA that
      will peer with or accept associations from a non-GLK
      capable STA. This is a control variable. It is
      written by an external management entity. Changes
      take effect as soon as practical in the implementation."
   ::= { dot11StationConfigEntry 170 }

dot11EPDImplemented OBJECT-TYPE
   SYNTAX TruthValue
   MAX-ACCESS read-only
   STATUS current
   DESCRIPTION
      "When true, this attribute indicates a STA that
      supports the receipt and transmission of EPD MSDUs.
      When false, it indicates a STA that does
      not support EPD. This is a capability variable."
```

```
    ::= { dot11StationConfigEntry 171 }

dot11EPDRequired OBJECT-TYPE
    SYNTAX TruthValue
    MAX-ACCESS read-write
    STATUS current
    DESCRIPTION
        "When true, this attribute indicates a STA that
        will only associate, direct link, or peer with
        a STA supporting EPD. When false, it indicates a STA
        that will associate, direct link, or peer with a STA
        that does not support EPD. This is a control variable.
        It is written by an external management entity.
        Changes take effect as soon as practical in the implementation."
    ::= { dot11StationConfigEntry 172 }

dot11GLKLinkRateSamples OBJECT-TYPE
    SYNTAX Unsigned32 (2..257)
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "This is the number of data bit rate sample windows
        in the array of such values used in the determination
        of the data rate metrics for general links. This is a
        control variable. It is written by an external
        management entity. Changes take effect as soon as
        practical in the implementation."
    DEFVAL { 8 }
    ::= { dot11StationConfigEntry 173 }

dot11GLKLinkRateWindowSize OBJECT-TYPE
    SYNTAX Unsigned32 (1..256)
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "The size of the data bit rate sample window duration
        in units of 16 TUs. This is a control variable. It is
        written by an external management entity. Changes take
        effect as soon as practical in the implementation."
    DEFVAL { 8 }
    ::= { dot11StationConfigEntry 174 }

dot11GLKLinkRateWmin OBJECT-TYPE
    SYNTAX Unsigned32 (0..255)
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "This value is the relative weight given to the
        minimum bit rate observed in the data rate sample
        windows on a general link or peering. A larger value
        means more weight or influence for the minimum
        observed bit rate. This is a control variable.
        It is written by an external management entity.
        Changes take effect as soon as practical in the
        implementation.

        It is used in the determination of the data rate
        metrics for general links."
    DEFVAL { 50 }
    ::= { dot11StationConfigEntry 175 }

dot11GLKLinkRateWavg OBJECT-TYPE
    SYNTAX Unsigned32 (0..255)
    MAX-ACCESS read-only
```

```
    STATUS current
    DESCRIPTION
        "This value is the relative weight given to the
        arithmetic mean bit rate observed in the data rate sample
        windows on a general link or peering. A larger value means
        more weight or influence for the arithmetic mean
        observed bit rate. This is a control variable. It
        is written by an external management entity. Changes
        take effect as soon as practical in the implementation.

        It is used in the determination of the data rate
        metrics for general links."
    DEFVAL { 50 }
    ::= { dot11StationConfigEntry 176 }

dot11GLKLinkRateWgeo OBJECT-TYPE
    SYNTAX Unsigned32 (0..255)
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "This value is the relative weight given to the
        geometric mean of the bit rates observed in the data
        rate sample windows on a general link or peering. A larger
        value means more weight or influence for the geometric
        mean of the observed bit rates. This is a control
        variable. It is written by an external management
        entity. Changes take effect as soon as practical in
        the implementation.

        It is used in the determination of the data rate
        metrics for general links."
    DEFVAL { 50 }
    ::= { dot11StationConfigEntry 177 }

dot11GLKLinkRateScaling OBJECT-TYPE
    SYNTAX Unsigned32 (1..256)
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "This value is used to scale the data rate reported
        appropriately depending on the use of that rate and
        how pessimistically data rates are being determined.
        A scaling of 16 would produce a data rate suitable
        for use in IEEE 802.1Q protocols with no pessimism.
        This is a control variable. It is written by an
        external management entity. Changes take effect as
        soon as practical in the implementation."
    DEFVAL { 10 }
    ::= { dot11StationConfigEntry 178 }

dot11GLKLinkRateHysteresis OBJECT-TYPE
    SYNTAX Unsigned32 (1..256)
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "This value is used to apply hysteresis to the data
        rate reported for a general link. If it contains 256,
        then any change in rate is immediately reported. The
        smaller its value, the larger the change that occurs
        before that change is reported.
        This is a control variable. It is written by an
        external management entity. Changes take effect as
        soon as practical in the implementation."
    DEFVAL { 200 }
```

```
    ::= { dot11StationConfigEntry 179 }

dot11GLKGCRImplemented OBJECT-TYPE
    SYNTAX TruthValue
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "When true, this attribute indicates a GLK-GCR
        capable STA. When false, this attribute indicates a
        GLK capable STA that does not support GLK-GCR or a
        STA that is not GLK capable. This is a capability variable."
    ::= { dot11StationConfigEntry 180 }
```

Insert the following text at the end of the "dot11smt OBJECT IDENTIFIER" list in "Major sections" in C.3:

```
  --  dot11GLKLinkMetricsTable      ::= ( dot11smt 41 )
```

Insert the following table after the dot11CMMGSTAConfigTable in C.3:

```
-- ************************************************************
-- * dot11GLKLinkMetrics TABLE
-- ************************************************************

dot11GLKLinkMetricsTable OBJECT-TYPE
    SYNTAX SEQUENCE OF dot11GLKLinkMetricsEntry
    MAX-ACCESS not-accessible
    STATUS current
    DESCRIPTION
        "Table of GLK Link metrics information. One entry
         per association or peering."
    ::= { dot11smt 41 }

dot11GLKLinkMetricsEntry OBJECT-TYPE
    SYNTAX Dot11GLKLinkMetricsEntry
    MAX-ACESS not-accessible
    STATUS current
    DESCRIPTION
        "An entry in the dot11GLKLinkMetricsTable"
    INDEX { ifIndex }
    ::= { dot11GLKLinkMetricsTable 1 }

Dot11GLKLinkMetricsEntry ::=
    SEQUENCE {
        dot11GLKLinkRawRate                                 Unsigned32,
        dot11GLKLinkMinRate                                 Unsigned32,
        dot11GLKLinkAvgRate                                 Unsigned32,
        dot11GLKLinkGeoRate                                 Unsigned32,
        dot11GLKLinkSTDRate                                 Unsigned32,
        dot11GLKLinkRateReported                            Unsigned32 }

dot11GLKLinkRawRate OBJECT-TYPE
    SYNTAX Unsigned32
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "The maximum achievable data rate given the
         enabled STA features in units of 100 kbit/s.
         This is a status variable."
    ::= { dot11GLKLinkMetricsEntry 1 }

dot11GLKLinkMinRate OBJECT-TYPE
    SYNTAX Unsigned32
```

```
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "The minimum data rate seen in the
         window of samples in units of 100 kbit/s.
         This is a status variable."
    ::= { dot11GLKLinkMetricsEntry 2 }

dot11GLKLinkAvgRate OBJECT-TYPE
    SYNTAX Unsigned32
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "The arithmetic mean data rate seen across the window
         of samples in units of 100 kbit/s. This is a status
         variable."
    ::= { dot11GLKLinkMetricsEntry 3 }

dot11GLKLinkGeoRate OBJECT-TYPE
    SYNTAX Unsigned32
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "The geometric mean of the data rates seen
         across the window of samples in units of 100 kbit/s.
         This is a status variable."
    ::= { dot11GLKLinkMetricsEntry 4 }

dot11GLKLinkSTDRate OBJECT-TYPE
    SYNTAX Unsigned32
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "The standard deviation of the data rates seen
         across the window of samples in units of 100 kbit/s.
         This is a status variable."
    ::= { dot11GLKLinkMetricsEntry 5 }

dot11GLKLinkRateReported OBJECT-TYPE
    SYNTAX Unsigned32
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "The reported link data rate in units of 100 kbit/s.
        This is a status variable."
    ::= { dot11GLKLinkMetricsEntry 6 }

-- ************************************************************
-- * End of dot11GLKLinkMetrics TABLE
-- ************************************************************
```

Insert the following compliance statement after the "Compliance Statements - CMMG" section in C.3:

```
-- ************************************************************
-- * Compliance Statements - GLK
-- ************************************************************

dot11GLKComplianceGroup OBJECT-GROUP
    OBJECTS {
    dot11GLKImplemented,
    dot11GLKRequired,
    dot11EPDImplemented,
    dot11EPDRequired,
    dot11GLKLinkRateSamples,
```

```
    dot11GLKLinkRateWindowSize,
    dot11GLKLinkRateWmin,
    dot11GLKLinkRateWavg,
    dot11GLKLinkRateWgeo,
    dot11GLKLinkRateScaling,
    dot11GLKLinkRateHysteresis,
    dot11GLKGCRImplemented }
    STATUS current
    DESCRIPTION
        "This object group provides the objects from the IEEE 802.11
        MIB required to manage General Link functionality."
    ::= { dot11Groups 99 }

dot11GLKCompliance MODULE-COMPLIANCE
    STATUS current
    DESCRIPTION
        "This object class provides the objects from the IEEE 802.11
        MIB required to manage General Link functionality."
    MODULE -- this module
    MANDATORY-GROUPS {
    dot11GLKComplianceGroup }
    ::= { dot11Compliances 21 }
```

Annex M

(informative)

Change the title of Annex M as shown:

EPD and LPD headers and the i~~I~~ntegration function

M.1 Introduction

Change M.1 as follows:

The purposes of this informative annex are to (1) guide the implementer of a non-GLK WLAN system that includes a portal that integrates the WLAN systems with a wired LAN, (2) clarify EPD and LPD headers including the case of A-MSDU subframes, and (3) clarify where and how EPD to LPD and LPD to EPD conversions are required. ~~The purpose of this annex is to guide the implementer of an ESS's infrastructure that includes a portal that integrates the ESS's infrastructure with a wired LAN.~~

As specified in IEEE Std 802-2014, EPD encoding always starts with a Length/Type field that is either a 2-octet length or a 2-octet Ethertype while LPD encoding always starts with an LSAP octet. There is no indication in a Data frame as to whether EPD or LPD MSDU encoding is in use. A receiving STA uses the rules in 5.1.4 to determine the encoding of MSDUs it receives.

Change the subclause title of M.2 as shown:

M.2 ~~Ethernet V2.0/IEEE 802.3 LAN i~~Integration function header conversions

Delete the following text of M.2, including Table M-1:

~~It is recommended ... IEEE Std 802.1H-1997 [B24].~~

~~Table M-1—IEEE 802.11 integration service STT~~

Insert the following paragraphs, including a new Table M-1, into M.2:

Table M-1 illustrates EPD and LPD protocol header encodings. The encoding used within the DS is unspecified. If the DS has a portal, that portal provides the integration function. The integration function converts between the encoding used within the DS and that used in the non-IEEE-802.11 network with which the portal is connecting the DS. If the DS uses LPD and the portal connects to a network that uses EPD, for example IEEE Std 802.3, the integration function converts MSDUs exiting the DS from LPD to EPD format and those entering the DS from EPD to LPD.

Conversion between LPD and EPD might also be required at any GLK STA unless the GLK STA will only join BSSs limited to EPD STAs. If the GLK STA might receive or transmit Data frames containing LPD MSDUs, it converts them to or from the EPD MSDUs required by the Internal Sublayer Service SAPs provided by GLK STAs.

Conversion between LPD and EPD is discussed in 5.1.4 and IEEE Std 802.1AC.

Table M-1—EPD and LPD MSDU headers

Protocol	EPD MSDU Header	LPD MSDU Header
BPDU	length[a]-42-42-03	42-42-03
IPv4	08-00	AA-AA-03-00-00-00-08-00
IPv6	86-DD	AA-AA-03-00-00-00-86-DD
IP ARP	08-06	AA-AA-03-00-00-00-08-06
IS-IS	length[a]-FE-FE-03	FE-FE-03
C-VLAN[b] tagged IPv4	81-00-xy-zw-08-00	AA-AA-03-00-00-00-81-00-xy-zw-08-00
S-VLAN[c] and C-VLAN[b] tagged IPv6	88-A8-st-uv-81-00-xy-zw-86-DD	AA-AA-03-00-00-00-88-A8-st-uv-81-00-xy-zw-86-DD

[a] A 2-octet, big-endian, unsigned integer length in octets.
[b] Assuming C-VLAN ID xy-zw.
[c] Assuming S-VLAN ID st-uv.

Change the subclause title of M.3 as shown:

M.3 ~~Example~~A-MSDU subframes

Delete the following text of M.3, including Table M-2 and Table M-3:

~~The table below ... VLAN ID=1893).~~

~~Table M-2—Ethernet/IEEE 802.3 to IEEE 802.11 translation~~

~~Table M-3—IEEE 802.11 to Ethernet/IEEE 802.3 translation~~

Insert the following paragraphs, including Figure M-1, Figure M-2, and Figure M-3, into M.3:

The formats of A-MSDU subframes are shown in 9.3.2.2, specifically in Figure 9-54, Figure 9-55, and Figure 9-56. These formats apply as shown regardless of whether the MSDU is EPD or LPD encoded.

When the MSDU is EPD encoded, it always starts with a 2-octet Length/Type field as shown in Table M-1. Thus, in the case where that 2-octet field is a length (indicated by its value considered as an unsigned field being less than 0x05DC) and the MSDU appears in an A-MSDU subframe, there will be two sequential length fields or, in the mesh data case, two length fields separated only by the Mesh Control field. Figure M-1, Figure M-2, and Figure M-3 show basic A-MSDU subframes containing an EPD encoded BPDU, an EPD encoded VLAN tagged IPv4 packet, and an EPD encoded VLAN tagged IS-IS PDU respectively. In those figures, the arrowed line from each Length field goes to a curly bracket covering the data whose Length is in that length field.

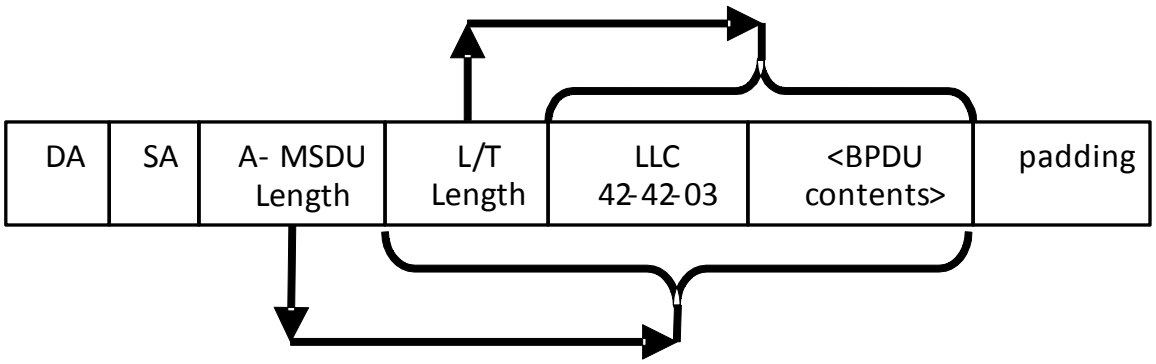

Figure M-1—EPD BPDU subframe

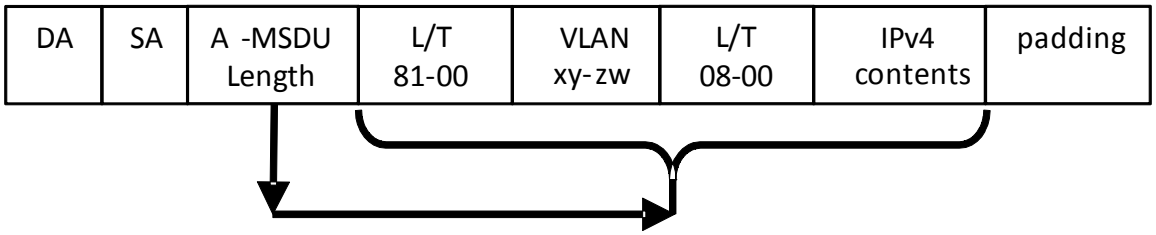

Figure M-2—EPD VLAN tagged IPv4 subframe

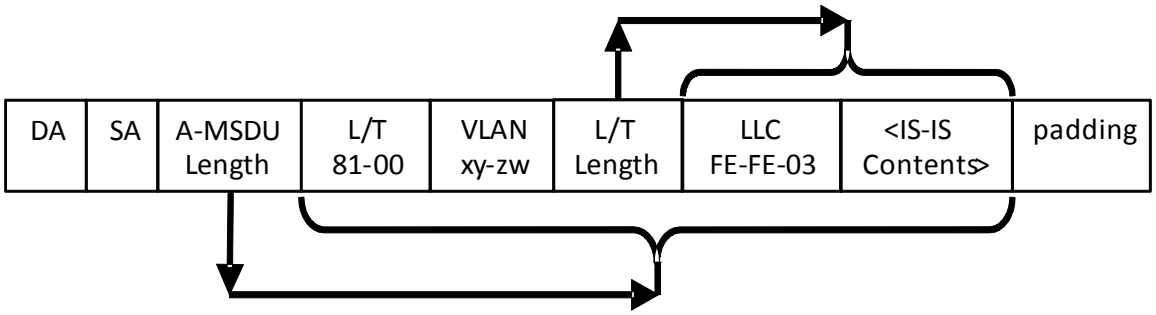

Figure M-3—EPD VLAN tagged IS-IS subframe

When parsing an MSDU, if the default LPD encoding is being used, the MSDU starts with an LSAP; if EPD encoding is being used, the MSDU starts with a Length/Type field. Subclause 5.1.4 specifies which encoding is used.

M.4 Integration service versus bridging

Change M.4 as follows:

There are a number of differences between the IEEE 802.11 integration service and the service provided by an IEEE 802.1~~D~~ bridge ~~[B23]~~. In the IEEE 802.11 non-GLK architecture, a portal provides the minimum connectivity between an IEEE 802.11 WLAN system and a non-IEEE-802.11 LAN. Requiring an IEEE 802.1D or IEEE 802.1Q bridge in order to be compliant with IEEE Std 802.11 would unnecessarily render some implementations noncompliant.

The most important distinction is that a portal has only one "port" (in the sense of IEEE Std 802.1D, for example) through which it accesses the DS. This renders it unnecessary to update bridging tables inside a portal each time a STA changes its association status. In other words, the details of distributing MSDUs inside the non-GLK IEEE 802.11 WLAN need not be exposed to the portal.

Another difference is that the DS is not an IEEE 802 LAN (although it carries IEEE 802 LLC SDUs). Requiring that the DS implement all behaviors of an IEEE 802 LAN places an undue burden on the architecture.

Finally, it is an explicit intent of this standard to permit transparent integration of an IEEE 802.11 WLAN into another non-IEEE-802.11 LAN, including passing bridge PDUs through a portal. While an implementer might wish to attach an IEEE 802.1D or IEEE 802.1Q bridge to the portal (note that the non-IEEE-802.11 LAN interface on the bridge need not be any particular type of LAN), it is not an architectural requirement of this standard to do so.

Annex N

(informative)

AP functional description

N.1 Introduction

Change the first paragraph of N.1 as follows:

This informative annex seeks to clarify the AP functional description; however, it does not provide information or clarification for GLK APs. At times there is some confusion surrounding the term *AP* and the relation of that term to the AP functions and common implementations of AP devices. The core IEEE 802.11 conceptual definitions that surround the AP (refer to Clause 4) are abstract (and can sometimes cause confusion), but Clause 4 definitions are crafted to be flexible and hence serve to allow the adaptation and extension of this standard in a wide variety of ways.

Annex R

(informative)

Interworking with external networks

R.3 QoS mapping guidelines for interworking with external networks

Insert the following subclause (R.3.4, including Table R.3a and Table R.3b) after R.3.3:

R.3.4 QoS mapping and GLK

General links connect through a STA to an IEEE 802.1D Internal Sublayer Service instance. Note that IEEE 802.11 UPs are IEEE 802.1D priorities that differ from IEEE 802.1Q priorities. For example, in IEEE Std 802.1D, priority 2 is lower than priority 0 while in IEEE Std 802.1Q it is higher.

The priority provided to the MS-SAP by the GLK Convergence Function is the UP for the IEEE 802.11 MSDU being transmitted. As provided in IEEE Std 802.1AC, the GLK Convergence Function derives this UP from the priority code point associated with the frame inside the IEEE 802.1Q bridge. A suggested mapping is given in Table R-3a. The GLK Convergence Function might be configured to provide other mappings.

Table R-3a—Suggested default priority code point to UP mapping

Priority code point	UP
7	7
6	6
5	5
4	4
3	3
2	3
0	0
1	1

When an MSDU received over the WM is passed up to the corresponding GLK Convergence Function, the UP passed up is mapped to an IEEE 802.1Q Priority Code Point. A suggested mapping is shown in Table R-3b.

Table R-4—Suggested default UP to priority code point mapping

UP	Priority code point
7	7
6	6
5	5
4	4
3	3
0	0
2	1
1	1

Insert the following text, Annex X, after Annex W:

Annex X

(informative)

Link rate considerations

Default values for the link cost determination variables whose names start with "dot11GLKLinkRate" are provided in Annex C. In adjusting the values of these variables, the following considerations are recommended:

— For applications such as bulk data transfer, in which the long-term bandwidth is of primary concern, it is recommended that dot11GLKLinkRateWavg be set near the top of its range while dot11GLKLinkRateWgeo and dot11GLKLinkRateWmin are set low, perhaps to 0. It might also be reasonable to increase some combination of dot11GLKLinkRateSamples and dot11GLKLinkRateWindowSize and decrease dot11GLKLinkRateHysteresis from their default values.

— For time critical applications requiring good performance on short bursts of transmissions, it is recommended that dot11GLKLinkRateWmin be set near the top of its range while dot11GLKLinkRateWavg and dot11GLKLinkRateWgeo be set low, perhaps to 0. It might also be reasonable to decrease dot11GLKLinkRateWindowSize and/or increase dot11GLKLinkRateHysteresis from their default values to make the cost more responsive. dot11GLKLinkRateSamples × dot11GLKLinkRateWindowSize will determine how quickly $R_{composite}$ can spring back from one or more samples of low or 0 effective data bandwidth.

— For general applications that are not time critical but require reasonable performance, for example, messages related to human interaction or the like, it is recommended that dot11GLKLinkRateWgeo weight dominate and dot11GLKLinkRateWmin and dot11GLKLinkRateWavg are set low, perhaps to 0. In this case, it is also recommended that dot11GLKLinkRateSamples × dot11GLKLinkRateWindowSize not exceed typical human response expectations, perhaps 1 s or 2 s.

Consensus

WE BUILD IT.

Connect with us on:

Facebook: https://www.facebook.com/ieeesa

Twitter: @ieeesa

LinkedIn: http://www.linkedin.com/groups/IEEESA-Official-IEEE-Standards-Association-1791118

IEEE-SA Standards Insight blog: http://standardsinsight.com

YouTube: IEEE-SA Channel

IEEE
standards.ieee.org
Phone: +1 732 981 0060 Fax: +1 732 562 1571