IEEE P802.11
Wireless LANs

|  |
| --- |
| Some 11ak Text |
| Date: 2014-03-20 |
| Author(s): |
| Name | Affiliation | Address | Phone | Email |
| Donald Eastlake | Huawei Technologies | 155 Beaver Street, Milford, MA 01757, USA | +1-508-333-2270 | d3e3e3@gmail.com |
|  |  |  |  |  |

Abstract

This document provides some tentative text for a P802.11ak draft. It uses Draft P802.11REVmc\_D2.4 as its base document.

**Editor’s notes**

The editor’s notes do not form a part of this standard. They will be removed before publication. Please do not comment on editor’s notes in any ballot on the draft, as these comments would have no effect on the published standard.

***Editor’s Note: Editor’s Notes in the body of the standard appear like this. They will be removed before*** ***publication. They indicate some item of work or comment that will be addressed prior to publication.***

***This text is based on 802.11REV-mc D2.4 and will need to be revised in light of 802.11 amendments not incorporated in that draft and adopted after that draft but before P802.11ak.***

***Some minor changes herein maybe proposed in 802.11REVmc and deleted herefrom.***

**Table of Contents**

Introduction 8

1 Overview 8

1.1 Scope 8

1.2 Purpose 8

1.3 Supplementary Information on Purpose 8

1.4 Word Usage 9

1.5 Mathematical Usage 9

2 Normative references 9

3 Definitions, acronyms, and abbreviations 9

3.1 Definitions 9

3.2 Definitions specific to IEEE 802.11 9

3.3 Abbreviations and acronyms 9

4 General Description 10

4.1 General description of the architecture 10

4.2 How wireless local area networks (WLANs) are different 10

4.2.1 Introduction 10

4.2.2 Wireless station (STA) 10

4.2.3 Media impact on design and performance 10

4.2.4 The impact of handling mobile STAs 10

4.2.5 Interaction with other IEEE 802® layers 10

4.2.6 Interaction with non-IEEE-802 protocols 10

4.3 Components of the IEEE Std 802.11 architecture 10

4.3.1 General 10

4.3.2 The independent BSS 10

4.3.3 The personal BSS 10

4.3.4 STA membership in a BSS is dynamic 10

4.3.5 Distribution system (DS) concepts 10

4.3.5.1 Overview 10

4.3.5.2 Extended service set (ESS): The large coverage network 11

4.3.5.3 Robust security network association (RSNA) 11

4.3.5.4 Centralized coordination service set (CCSS) and extended centralized AP or PCP cluster (ECAPC) within the DMG 11

4.3.6 Area concepts 11

4.3.7 Integration with wired LANs 11

4.3.8 QoS BSS 11

4.3.9 Wireless LAN Radio Measurements 11

4.3.10 Operation in licensed frequency bands 11

4.3.11 High throughput (HT) STA 11

4.3.12 Very high throughput (VHT) STA 11

4.3.13 STA transmission of Data frames outside the context of a BSS 11

4.3.14 Tunnelled direct-link setup 12

4.3.15 Wireless network management 12

4.3.16 Subscription service provider network (SSPN) interface 12

4.3.17 Mesh BSS: IEEE Std 802.11 wireless mesh network 12

4.3.18 DMG STA 12

4.3.19 DMG Relay 12

4.3.20 Robust audio video (AV) streaming 12

4.3.21 General Link (GLK) concepts 12

4.3.21.1 General 12

4.3.21.2 GLK MSDU Encoding 12

4.3.21.3 CBA-MSDU Support 13

4.3.21.4 GLK SSes 13

4.4 Logical service interfaces 16

4.4.1 General 16

4.4.2 SS 17

4.4.3 PBSS control point service (PCPS) 17

4.4.4 DSS 17

4.5 Overview of the services 17

4.5.1 General 17

4.5.2 Distribution of messages with a DS 17

4.5.2.1 Distribution 17

4.5.3 Services that support the ~~distribution service~~ DS, GLK ESSes, and PCP service 17

4.5.3.1 General 17

4.5.3.2 Mobility Types 17

4.5.3.3 Association 17

4.5.3.4 Reassociation 17

4.5.3.5 Disassociation 18

4.5.4 Access control and data confidentiality services 18

4.5.5 Spectrum Management services 18

4.5.6 Traffice differentiation and QoS support 18

4.5.7 Support for higher layer timer synchronization 18

4.5.8 Radio measurement service 18

4.5.9 Interworking with external networks 18

4.6 Multiple logical address spaces 18

4.7 Differences among ESS, PBSS, and IBSS LANs 19

4.8 Differences between ESS and MBSS LANs 19

4.9 Reference model 19

4.10 IEEE Std 802.11 and IEEE Std 802.1X-2010 19

4.11 Generic advertisement service (GAS) 19

5 MAC service definition 19

5.1 Overview of MAC services 19

5.1.1 Data service 19

5.1.1.2 Determination of UP 19

5.1.2 Security services 19

5.1.3 MSDU ordering 19

5.1.4 MSDU format 19

5.1.5 MAC data service architecture 20

5.2 MAC data service specification 20

6 Layer management 20

6.1 Overview of management model 20

6.2 Generic management primitives 20

6.3 MLME SAP interface 20

6.3.3 Scan 20

6.3.3.2.2 Semantics of the service primitive 20

6.4 MAC state generic convergence function (MSGCF) 22

6.5 PLME SAP interface 22

7 PHY service specification 22

8 Frame formats 23

8.1 General requirements 23

8.2 MAC frame formats 23

8.2.1 Basic components 23

8.2.2 Conventions 23

8.2.3 General frame format 23

8.2.4 Frame fields 23

8.2.4.1.4 To DS and From DS fields 23

8.2.5 Duration/ID field (QoS STA) 23

8.3 Format of individual frame types 23

8.3.1 Control frames 23

8.3.2 Data frames 23

8.3.2.1 Data frame format 23

8.3.2.2 Aggregate MSDU (A-MSDU) format 24

8.3.2.2.1 General 24

8.3.2.3 Control Block (CB) A-MSDU (CBA-MSDU) format 24

8.3.2.3.1 Subsetting Exclusion CB (SE-CB) 25

8.3.2.3.2 Subsetting Inclusion CB (SI-CB) 26

8.3.2.3.3 Subsetting Inclusion with Prefix Data CB (SIPD-CB) 26

8.3.2.3.4 Vendor Specific CB 27

8.3.3 Management frames 28

8.3.4 Extension frames 28

8.4 Management and Extension frame body components 28

8.4.1 Fields that are not elements 28

8.4.1.4 Capability Information field 28

8.4.2 Elements 29

8.4.2.3 Supported Rates element 29

8.4.2.30 TCLAS Element 29

8.4.2.127.2 DMG STA Capability Information field 29

8.4.2.147 Relay Capabilities element 30

8.4.3 Information Subelements 31

8.4.4 Access network query protocol (ANQP) elements 31

8.5 Fields used in Management and Extension frame bodies and Control frames 31

8.6 Action frame format details 31

8.7 Aggregate MPDU (A-MPDU) 31

9 MAC sublayer functional description 31

9.1 Introduction 31

9.2 MAC architecture 31

9.2.1 General 31

9.2.2 DCF 31

9.2.3 PCF 31

9.2.4 Hybrid coordination function (HCF) 31

9.2.4.2 HCF contention based channel access (EDCA) 31

9.2.5 Mesh coordination function (MCF) 32

9.2.6 Combined use of DCF, PCF, and HCF 32

9.2.7 Fragmentation/defragmentation overview 32

9.2.8 MAC data service 32

9.3 DCF 33

9.4 PCF 33

9.5 Fragmentation 33

9.6 Defragmentation 33

9.7 Multirate support 33

9.8 MSDU transmission restrictions 33

9.9 HT Control field operation 33

9.10 Control Wrapper operation 33

9.11 A-MSDU operation 33

9.12 A-MPDU operation 33

9.12.1 A-MPDU contents 33

9.12.2 A-MPDU length limit rules 33

9.12.3 Minimum MPDU Start Spacing field 33

9.12.4 A-MPDU aggregation of group addressed Data 33

9.12.5 Transport of A-MPDU by the PHY data service 33

9.13 PPDU duration constraint 34

9.14 DMG A-PPDU operation 34

9.15 LDPC operation 34

9.16 STBC operation 34

9.17 Short GI operation 34

9.18 Greenfield operation 34

9.19 Group ID and partial AID in VHT PPDUs 34

9.20 Operation across regulatory domains 34

9.21 HCF 34

9.22 Mesh coordination function (MCF) 34

9.23 Block acknowledgement (block ack) 34

9.24 No Acknowledgement (No Ack) 34

9.25 Protection mechanisms 34

9.26 MAC frame processing 34

9.27 Reverse direction protocol 34

9.28 PSMP Operation 34

9.29 Sounding PPDUs 34

9.30 Link adaptation 34

9.31 Transmit beamforming 34

9.32 Antenna selection (ASEL) 34

9.33 Null data packet (NDP) sounding 34

9.34 Mesh forwarding framework 35

9.35 DMG channel access 35

9.36 DMG AP or PCP clustering 35

9.37 DMG beamforming 35

9.38 DMG block ack with flow control 35

9.39 DMG link adaptation 35

9.40 DMG dynamic tone pairing (DTP) 35

9.41 DMG relay operation 35

9.42 GLK operation 35

10 MLME 35

11 Security 35

12 Fast BSS transition 35

13 MLME Mesh procedures 36

13.1 Mesh STA dependencies 36

13.2 Mesh discovery 36

13.3 Mesh peering management (MPM) 36

13.4 Mesh peering management finite state machine (MPM FSM) 36

13.5 Authenticated mesh peering exchange (AMPE) 36

13.6 Mesh group key handshake 36

13.7 Mesh security 36

13.8 Mesh path selection and metric framework 36

13.9 Airtime link metric 36

13.10 Hybrid wireless mesh protocol (HWMP) 36

13.11 Interworking with the DS 36

13.11.1 Overview of interworking between a mesh BSS and a DS 36

13.11.2 Gate announcement (GANN) 36

13.11.3 Data forwarding at proxy mesh gates 36

13.11.4 Proxy information and proxy update 36

13.11.5 Mesh STA collocation 36

13.12 Intra-mesh congestion control 37

13.13 Synchronization and beaconing in MBSSs 37

13.14 Power save in mesh BSS 37

14 Frequency-Hopping spread spectrum (FHSS) PHY specification for the 2.4 GHz industrial, scientific, and medical (ISM) band 37

15 Infrared (IR) PHY specification 37

16 DSSS PHY specification for the 2.4 GHz band designated for ISM applications 37

17 High rate direct sequence spread spectrum (HR/DSSS) PHY specification 37

18 Orthogonal frequency division multiplexing (OFDM) PHY specification 37

19 Extended Rat PHY (ERP) specification 37

20 High Throughput (HT) PHY specification 37

21 Directional multi-gigabit (DMG) PHY specification 37

22 Very High Throughput (VHT) PHY 37

Annex A, Bibliography 38

Annex B, Protocol Implementation Conformance Statement (PICS) 38

Annex C, ASN.1 encoding of the MAC and PHY MIB 38

… 38

Annex P, Integration Function 38

P.1 Introduction 38

P.2 Ethernet V2.0/IEEE Std 802.3 LAN integration function 38

P.3 Example 38

P.4 Integration service versus bridging 38

… 38

Annex V, Interworking with external networks 39

V.1 General 39

V.2 Network discovery and selection 39

V.3 QoS mapping guidelines for interworking with external networks 39

V.3.3 Example of QoS mapping from different networks 39

V.4 Interworking and SSPN interface support 39

V.5 Interworking with external networks and emergency call support 39

V.6 Peer information 39

… 39

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

The editing instructions are shown in ***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 instructions specify the location of the change and describe what is being changed by using ~~strike through~~ (to remove old material) and 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 changes in figures or equations by removing the existing figure or equation and replacing it with a new one. Editorial notes will not be carried over into future editions because the changes will be incorporated into the base standard.

# Introduction

This section will not be included when P802.11ak is rolled into the base standard.

IEEE Std 802.11 was originally designed with the assumption that non-AP non-mesh STAs would be leaf nodes of the network. This amendment optionally extends the 802.11 standard so that communication between STAs are usable as a transit link inside a general network conformant to IEEE Std 802.1Q.

Areas of extension are as follows:

1. Use of EPD, as opposed to LPD, in all MSDUs between GLK STAs
2. Facilities for a GLK AP to send an augmented A-MSDU, called a Control Block A-MSDU (CBA-MSDU).
	1. Multi-destination CBA-MSDUs include facilities to send to an arbitrary subset of an AP’s associated GLK STAs
	2. Facilities for different associated GLK STAs to see different prefix information for the MSDUs in a CBA-MSDU from a GLK AP

# Overview

## Scope

## Purpose

## Supplementary Information on Purpose

***Add the following at the end of Clause 1.3:***

* Define the mechanisms for using IEEE 802.11 media as transit links in a bridged LAN.

## Word Usage

## Mathematical Usage

# Normative references

***Insert the following references (maintaining alphabetic order):***

IEEE Std 802.1AC-20XX, “Media Access Control (MAC) Service Definition”

IEEE Std 802.1Qbz™-20XX, “Virtual Bridged Local Area Networks — Amendment: Enhancements to Bridging of 802.11 Media”

# Definitions, acronyms, and abbreviations

## Definitions

***Insert the following definitions (maintaining alphabetical order):***

EtherType Protocol Discrimination (EPD): A frame format that uses an EtherType to identify the protocol of the following information.

**LLC Protocol Discrimination (LPD):** A frame format that uses a destination LSAP, a source LSAP, and a Control octet (LLC) to identify the protocol of the following information.

## Definitions specific to IEEE 802.11

***Insert the following definition (maintaining alphabetical order):***

**General link (GLK):** Communication between two stations (STAs) over the wireless medium suitable for use as a link in the middle of an IEEE Std. 802.1Q conformant network.

## Abbreviations and acronyms

***Insert the following acronyms (maintaining alphabetical order):***

CB Control Block

CBA-MDSU Control Block Aggregated MSDU

EPD EtherType Protocol Discrimination

GLK General Link

LPD LLC Protocol Discrimination

MSAP MAC Service Access Point

SE-CB Subsetting Exclusion CB

SI-CB Subsetting Inclusion CB

SIPD-CB Subsetting Inclusion with Prefix Data CB

# General Description

## General description of the architecture

## How wireless local area networks (WLANs) are different

### Introduction

### Wireless station (STA)

***Change the first paragraph as follows:***

~~In the design of wired LANs it is implicitly assumed that an address is equivalent to a physical location. In wireless networks, this is not always the case.~~ In IEEE Std 802.11, the addressable unit is a station (STA). The term implies no more than the origin or/and destination of a message. Physical and operational characteristics are defined by modifiers that are placed in front of the term STA. For example, in the case of location and mobility, the addressable units are the fixed STA, the portable STA, and the mobile STA. The STA is a message destination, but not (in general) a fixed location.

### Media impact on design and performance

### The impact of handling mobile STAs

### Interaction with other IEEE 802® layers

### Interaction with non-IEEE-802 protocols

## Components of the IEEE Std 802.11 architecture

### General

### The independent BSS

### The personal BSS

### STA membership in a BSS is dynamic

### Distribution system (DS) concepts

#### Overview

***Change text as follows:***

PHY limitations determine the direction station-to-station distance that may be supported. For some networks this distance is sufficient; for other networks, increased coverage is required. 4.3.5 discusses the DS and ESS as one means of expanded range and the ESS Portal as one means of connectivity to non-802.11 networks in the context of non-GLK operation. 4.3.21 discusses the GLK STA alternative means to accomplish these goals.

#### Extended service set (ESS): The large coverage network

#### Robust security network association (RSNA)

#### Centralized coordination service set (CCSS) and extended centralized AP or PCP cluster (ECAPC) within the DMG

### Area concepts

### Integration with wired LANs

To integrate the IEEE Std 802.11 non-GLK architecture with a non-IEEE Std 802.11 LAN, including a traditional wired LAN, a final *logical* architectural component is introduced—a *portal*. A portal is not used in the GLK 802.11 architecture (see 4.3.21).

### QoS BSS

### Wireless LAN Radio Measurements

### Operation in licensed frequency bands

### High throughput (HT) STA

### Very high throughput (VHT) STA

### STA transmission of Data frames outside the context of a BSS

Note: I am told that users of this service are anxious to save every bit they can. Thus it is possible they will want to use 802.11ak (EtherType) formatted data frames.

### Tunnelled direct-link setup

### Wireless network management

### Subscription service provider network (SSPN) interface

### Mesh BSS: IEEE Std 802.11 wireless mesh network

### DMG STA

### DMG Relay

### Robust audio video (AV) streaming

Insert a new sub-Clause at the end of Clause 4.3 as follows:

### General Link (GLK) concepts

#### General

GLK STAs are extended non-GLK STAs such that a link between GLK STAs is suitable, insofar as the capabilities of 802.11 wireless permit, to be used as a transit link inside an IEEE Std 802.1Q conformant network.

Every STA is either a GLK STA or a non-GLK STA. A GLK STA is also an HT STA and a QoS STA. GLK STAs advertise themselves as such through the use of the GLK bit in the Capability Information field (see 8.4.1.4) or the GLK bit in the DMG Capabilities Information field (see 8.4.2.127.2). For a GLK STA, dot11GeneralLink is true. For a non-GLK station, dot11GeneralLink is false or absent.

A GLK STA does not attempt to form an infrastructure, IBSS, or PBSS association or mesh peering with any non-GLK STA. If a non-GLK STA attempts to associate with a GLK AP, the GLK AP will refuse the association. If a non-GLK mesh STA attempts to peer with a GLK mesh STA, the GLK mesh STA will refuse the peering.

GLK STAs support the 4-address format.

#### GLK MSDU Encoding

IEEE Std 802.1Q requires EPD MSDU encoding. Thus a transit IEEE Std 802.11 link using the LPD required in previous 802.11 standards would have to convert from EPD to LPD on entry to the 802.11 link and from LPD to EPD on exit. Especially as such links may be in the interior of complex networks, it is anticipated that the MSDUs will sometimes include multiple tags, includes new tags to be defined in the future. However, conversion between EPD and LPD formats in either direction requires knowledge of at least the lengths of all tags that might be encountered within the MSDUs being converted, which would be impossible in general.

Thus, while all non-GLK STAs use LPD and interpret Priority Code Points according to IEEE Std 802.1D, all GLK STAs use EPD and interpret Priority Code Points according to IEEE Std 802.1Q.

#### CBA-MSDU Support

GLK STAs use the Control Block (CB) Aggregated MSDUs (CBA-MSDUs, 8.3.2.3) format for all A-MSDUs they send and GLK STAs include support of SE-CB, SI-CB, and SIPD-CB. This provides for the inclusion of additional information with a CBA-MSDU that determines which receivers of a group addressed CBA-MSDU should accept that frame. In addition, prefix information can be provided for the MSDUs in a CBA-MSDU that differs per receiving STA.

Full support for SE-CB and SI-CB CBA-MSDUs is required of all GLK STAs while only the ability to receive and process SIPB-CB CBA-MSDs is required. The ability create and transmit SIPD-CB CBA-MSDUs is optional.

#### GLK SSes

##### Provision of the MAC service

To provide transit service suitable for use within an 802.1Q conformant network, it is essential that the 802.1AC MAC service be provided at the interface to such transit service. The exact service provided at the ends of an 802.11 association, for example from a non-AP STA to an AP, has not been precisely specified in pervious revisions of 802.11; the point of convergence between non-GLK 802.11 and other network types is the integration service and it was not assumed that any other points within 802.11 networks would interconnect with non-802.11 networks.

GLK STAs provide access to the WM via one or more MSAPs.

In all figures in 4.3.21.3, items labelled “802.1Q Bridge” can actually by anything offering the services of an 802.1Q conformant network, such as an 802.1Q bridged LAN.

##### GLK IBSS and PBSS

Figure 4-12a shows a GLK IBSS involving two GLK STAs. Each participating STA provides the MAC service via an MSAP. For example, each of the STAs shown could be part of a laptop computer with the STA providing, via the MSAP, access to the link to the other STA and thence to the other laptop. A difference from non-GLK 802.11 is that either or both of the MSAPs could be connected to an 802.1Q bridge or network providing 802.1Q conformant service that, in turn could be connected to one or more end stations. The two MSAPs shown could even be safely connected to the same 802.1Q conformant network since one service provided by such a network is protection from loops.

 **Figure 4-12a—GLK IBSS**

GLK

STA

GLK

STA

(MSAP)

(MSAP)

A GLK PBSS similarly provides two linked instances of the MAC service.

##### GLK infrastructure BSS

An example GLK infrastructure BSS is show in Figure 4-12b. The MAC service is provided via the MSAPs shown. These multiple GLK AP MSAPs may be logical entities implemented as a single interface that accepts a vector of destinations as a parameter.

Although transmissions by an AP are typically received by all STAs associated with that AP, the service provided by a GLK infrastructure BSS is intended to be equivalent, insofar as practical, to separate point-to-point links between the corresponding MSAP provided by the GLK AP and each associated GLK STA. Provision of such apparent point-to-point links is natural for MSDUs that are unicast. To provide such apparent point-to-point links for multi-destination MSDUs requires that the GLK AP be able to transmit them so that they are accepted by an arbitrary subset of the associated GLK STAs. Such selective transmission is provided through the CBA-MSDU facility (see 4.3.21.3).

Reasons for such selective transmission include the MAC service requirement that, when an MSDU is transmitted, it is not returned to the transmitting end station. When a non-AP STA associated with a GLK AP sends a group addressed MSDU to that AP, the AP retransmits it but can use the selective transmission facility to stop the originating GLK non-AP STA from accepting it. Also, since the AP MSAPs may connect to an 802.1Q Bridge, loop prevention can require blocking traffic to one or more of the associated GLK non-AP STAs. Such blocking can be implemented by the selective transmission facility.

 **Figure 4-12b—GLK infrastructure BSS**

A GLK ESS can be constructed from GLK BSSes, for example as shown in the middle of Figure 4-12c. There is no portal in a GLK ESS. The concept of the DS is roughly replaced, for a GLK ESS, by an 802.1Q conformant network; however, the GLK ESS topology is more general. For example, as shown in Figure 4-12c, a GLK ESS can be formed of GLK BSSes connected by 802.1Q Bridged LANs connected in some cases to an MSAP provided by a GLK AP and in other cases provided by a GLK non-AP STA.

 **Figure 4-12c—GLK ESS**

## Logical service interfaces

### General

***Change text as follows:***

A DS may be created from many different technologies or combinations of technologies including ~~current~~ IEEE 802.1Q bridging ~~wired LANs~~ or IETF IP routing. IEEE Std 802.11 does not constrain the DS to be either data link or network layer based. Nor does IEEE Std 802.11 constrain a DS to be either centralized or distributed in nature.

### SS

### PBSS control point service (PCPS)

### DSS

## Overview of the services

### General

### Distribution of messages with a DS

#### Distribution

***Change text as follows:***

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

***Change to name of 4.5.3 as follows:***

### Services that support the ~~distribution service~~ DS, GLK ESSes, and PCP service

#### General

#### Mobility Types

#### Association

***Change text as follows:***

In the non-GLK case, to deliver a message within a DS, the distribution service needs to know which AP to access for the given IEEE Std 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 a data message via an AP, it first becomes associated with the AP. The act of becoming associated invokes the association service, which provides the STA to AP mapping to the DS in the non-GLK case or creates or enables a corresponding MSAP on the GLK AP in the GLK case. The DS uses this information to accomplish its message distribution service. How the information provided by the association service is stored and managed within the DS is not specified by this standard.

#### Reassociation

***Change text as follows:***

Association is sufficient for no-transition message delivery between IEEE Std 802.11 STAs. Additional functionality is needed to support BSS-transition mobility. The additional required functionality is provided by the reassociation service. In the non-GLK case, reassociation is one of the services in the DSS.

The reassociation service is invoked to “move” a current association from one AP to another. In the non-GLK case, this keeps the DS informed of the current mapping between AP and STA as the STA moves from BSS to BSS within an ESS. In the GLK case, such a BSS-transition results in the removal or disablement of the corresponding MSAP provided by the from GLK AP and the creation or enablement of a corresponding MSAP provided by the to GLK AP. 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.

#### Disassociation

***Change text as follows:***

The disassociation service is invoked when an existing association is to be terminated. In the non-GLK case, disassociation is one of the services in the DSS.

In an non-GLK ESS, this tells the DS to void existing association information. Attempts to send messages via the DS to a disassociated STA will be unsuccessful. For a GLK AP, disassociation removes or disables the corresponding MSAP being provided by that GLK AP.

### Access control and data confidentiality services

### Spectrum Management services

### Traffice differentiation and QoS support

### Support for higher layer timer synchronization

### Radio measurement service

### Interworking with external networks

## Multiple logical address spaces

***Change text as follows:***

The IEEE Std 802.11 choice of address space implies that for many instantiations of the IEEE

Std 802.11 architecture, the wired LAN MAC address space and the IEEE Std 802.11 MAC

address space might be the same. In those 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 Std 802.11 architecture allows for all three logical address spaces to be distinct. However, in the GLK case, all three address spaces are the IEEE 802 48-bit address space.

## Differences among ESS, PBSS, and IBSS LANs

## Differences between ESS and MBSS LANs

## Reference model

## IEEE Std 802.11 and IEEE Std 802.1X-2010

## Generic advertisement service (GAS)

# MAC service definition

## Overview of MAC services

### Data service

#### 5.1.1.2 Determination of UP

Change text 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 Std 802.1D priority ~~tags~~ values for non-GLK STAs and to the IEEE Std 802.1Q priority values for GLK STAs. 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.

### Security services

### MSDU ordering

### MSDU format

***Change Clause 5.1.4 as follows:***

~~This standard is part of the IEEE 802 family of LAN standards, and as such~~ All ~~all~~ MSDUs sent by non-GLK STAs use LPD ~~are LLC PDUs~~ as defined in IEEE Std 802.1Qbz~~ISO/IEC 8802-2: 1998~~. In order to achieve interoperability between non-GLK STAs and networks using EPD, implementers are recommended to apply the procedures described in ISO/IEC Technical Report 11802-5:1997(E) (previously known as IEEE Std 802.1H-1997 [B21]), along with a selective translation table (STT) that handles a few specific network protocols, with specific attention to the operations required when passing MSDUs to or from LANs or operating system components that use EPD ~~the Ethernet frame format~~. Note that such translations might be required in a STA.

All GLK STA MSDUs use EPD as specified in IEEE Std 802.1Qbz.

### MAC data service architecture

***Change text as follows:***

The MAC data plane architecture (i.e., processes that involve transport of all or part of an MSDU) is shown in Figure 5-2 (MAC data plane architecture (transparent FST)) for when transparent FST is used and shown in Figure 5-1 (MAC data plane architecture) otherwise. During transmission, an MSDU goes through some or all of the following processes: MSDU rate limiting, aggregate MSDU (A-MSDU) aggregation including CBA-MSDU contruction, frame delivery deferral during power save mode, sequence number assignment, fragmentation, encryption, integrity protection, frame formatting, and aggregate MAC protocol data unit (A-MPDU) aggregation. When transparent FST is used, an MSDU 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 thence further MAC data plane processing. IEEE Std 802.1X-2010 may block the MSDU at the Controlled Port. 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, duplicate removal, possible reordering if the block ack mechanism is used, decryption, defragmentation, integrity checking, and replay detection. After replay detection (or defragmentation if security is not used), possible A-MSDU deaggregation including CBA-MSDU processing, and possible MSDU rate limiting, ~~one~~ zero or more MSDUs are, delivered to the MAC\_SAP or to the DS. When transparent FST is used, MSDUs originating from different PHY-SAPs go through an additional transparent FST entity that contains a multiplexing process before forwarding the MSDU to the MSDU rate limiting process. The IEEE 802.1X Controlled~~/Uncontrolled~~ Port~~s~~ discards any received MSDU if the Controlled Port is not enabled. The Uncontrolled Port admits the frame for use if it is ~~and if the MSDU does not represent~~ an IEEE Std 802.1X frame and optionally for other protocols that use the Uncontrolled Port. Frame order enforcement provided by the enhanced data cryptographic encapsulation mechanisms occurs after decryption, but prior to MSDU defragmentation; therefore, defragmentation fails if MPDUs arrive out of order.

## MAC data service specification

# Layer management

## Overview of management model

## Generic management primitives

## MLME SAP interface

### 6.3.3 Scan

#### 6.3.3.2.2 Semantics of the service primitive

***Change text as follows:***

 MLME-SCAN.request(

 BSSType,

 BSSID,

 SSID,

 ScanType,

 ProbeDelay,

 ChannelList,

 MinChannelTime,

 MaxChannelTime,

 RequestInformation,

 SSID List,

 ChannelUsage,

 AccessNetworkType,

 HESSID,

 MeshID,

 DiscoveryMode,

 GeneralLinkType,

 VendorSpecifInfo

 )

***Change the MLME-SCAN.request parameter table by adding the following as the next to last entry:***

|  |  |  |  |
| --- | --- | --- | --- |
| GeneralLinkType | Integer | 0-2 | If 0, only a non-GLK BSS is desired. If 1, only a GLK BSS is desired. If 2, the GLK nature of the BSS is ignored. |

Note:

* No change is needed in the BSSDescription for MLME-SCAN.confirm because it already includes BSSMembershipSelectorSet that indicates a GLK BSS as described in 8.4.2.3.
* No change is needed in the parameters to MLME-JOIN.request because it already includes the Capability Information field, which includes a GLK bit as described in 8.4.1.4.
* No change is needed in the parameters to MLME-ASSOCIATE.request because it already includes the Capability Information field, which includes a GLK bit as described in 8.4.1.4.
* No change is needed in the parameters to MLME-ASSOCIATE.confirm because it already includes the Capability Information field, which includes a GLK bit as described in 8.4.1.4, and ResultCode includes the possible value REFUSED\_CAPABILITIES\_MISMATCH.
* No change is needed in the parameters to MLME-ASSOCIATE.indication because it already includes the Capability Information field, which includes a GLK bit as described in 8.4.1.4.
* No change is needed in the parameters to MLME-ASSOCIATE.response because it already includes the Capability Information field, which includes a GLK bit as described in 8.4.1.4, and ResultCode includes the possible value REFUSED\_CAPABILITIES\_MISMATCH.
* No change is needed in the parameters to MLME-REASSOCIATE.request because it already includes the Capability Information field, which includes a GLK bit as described in 8.4.1.4.
* No change is needed in the parameters to MLME-REASSOCIATE.confirm because it already includes the Capability Information field, which includes a GLK bit as described in 8.4.1.4, and ResultCode includes the possible value REFUSED\_CAPABILITIES\_MISMATCH.
* No change is needed in the parameters to MLME-REASSOCIATE.indication because it already includes the Capability Information field, which includes a GLK bit as described in 8.4.1.4.
* No change is needed in the parameters to MLME-REASSOCIATE.response because it already includes the Capability Information field, which includes a GLK bit as described in 8.4.1.4, and ResultCode includes the possible value REFUSED\_CAPABILITIES\_MISMATCH.
* No change is needed in the parameters to MLME-START.request because it already includes the Capability Information field, which includes a GLK bit as described in 8.4.1.4.
* No change is needed in the parameters to MLME-MESHPEERINGMANAGEMENT.request or MLME-MESHPEERINGMANAGEMENT.indication because the relevant MeshPeeringMgmtFrameContent values (Mesh Peering Open (8.6.16.2) and Mesh Peering Confirm (8.6.16.3)) already includes the Capability Information field, which includes a GLK bit as described in 8.4.1.4.
* No change is needed to the set of MLME-RELAYSearch.\* or set of MLME-RLS.\* because the Relay Capabilities Information field includes a GLK bit as described in 8.4.2.147.

## MAC state generic convergence function (MSGCF)

## PLME SAP interface

# PHY service specification

# Frame formats

## General requirements

## MAC frame formats

### Basic components

### Conventions

### General frame format

### Frame fields

#### 8.2.4.1.4 To DS and From DS fields

***Change the last row in Table 8-4 – To/From DS combination in Data frames***

|  |  |
| --- | --- |
| To DS = 1From DS = 1 | A Data frame using the four-address MAC header format. This standard defines procedures for using this combination of field values only in a mesh BSS or by a GLK STA.This is the only valid combination for individually addressed Data frames transmitted by a mesh STA. |

### Duration/ID field (QoS STA)

## Format of individual frame types

### Control frames

### Data frames

#### Data frame format

***Change text as follows:***

NOTE 2—If a DA or SA value also appears in any of these address fields in a Data frame sent by a non-GLK STA, the value is necessarily the same for all MSDUs within the A-MSDU because this is guaranteed by the To DS and From DS field settings.

***Change text as follows:***

An A-MSDU contains only MSDUs whose DA and SA parameter values map to the same receiver address (RA) and transmitter address (TA) values, i.e., all the MSDUs are intended to be received by a single receiver if individually addressed and the same set of receivers if group addressed, and necessarily they are all transmitted by the same transmitter. The rules for determining RA and TA are independent of whether the frame body carries an A-MSDU.

#### Aggregate MSDU (A-MSDU) format

#### 8.3.2.2.1 General

***Add the following text to the beginning of Clause 8.3.2.2.1***

There are four variations of the A-MSDU format. If the transmitter is a GLK STA, the CBA-MSDU format or Short CBA-MSDU format is used as specified in 8.3.2.3. The the transmitter is a non-GLK STA, the A-MSDU or Short A-MSDU format is used as described in the remainder of 8.3.2.2.

***Insert the following new clause 8.3.2.3:***

#### Control Block (CB) A-MSDU (CBA-MSDU) format

Note: The capability to send multi-destination MSDUs to an arbitrary sub-set of the non-AP STAs in an infrastructure BSS is important in 11ak so that the communication to each non-AP STA can emulate a point-to-point link. See new Clause 4.3.21.

Note: There was some controversy in the 11ak Task Group concerning the details of the CB mechanism. In particular, questions were raised on the following two points on which members of the WG may wish to comment:

 1. Does the CB mechanism need to be as extensible as currently provided?

 2. Is the SIPD-CB type needed?

A CBA-MSDU is a sequence of Control Blocks (CBs) followed by a sequence of A-MSDU subframes as shown in Figure 8-48a (CBA-MSDU structure). A DMG GLK STA may send Short CBA-MSDUs that use Short A-MSDU subframes as specified in 8.3.2.2.3.

NOTE: Using CB types specified herein, excluding the Vendor Specific CB, there will be exactly one CB in a CBA-MSDU and the More CBs bit specified below will be zero.

CB 1

 **Figure 8-48a – CBA-MSDU structure**

CB n

•••

A-MSDU sub-frames

Octets: 2 – 1028 2 – 1028 2 – 1028

CB 2

The CBs influence handling of the CBA-MSDU at a receiving STA. Each CB consists of a CB Header, a variable size CB Data field, and from 0 to 3 octets of padding such that the length of every CB is a multiple of 4 octets as shown in Figure 8-48b (CB structure).

CB Header

 **Figure 8-48b – CB structure**

Padding

Octets: 2 0 – 1023 0 – 3

CB Data

The structure of the CB Header is as shown in Figure 8-48c (CB Header structure).

CB Type

More CBs

CB Data Length

 B0 B3 B5 B6 B15

Bits: 1 5 10

 **Figure 8-48c – CB Header structure**

The CB Data Length is an unsigned 10-bit value giving the number of octets of CB Data in the CB after the CB Header. The CB Type is a 5-bit field that, in conjunction with the CB Data, specifies the effect of the CB at a receiver of the CBA-MSDU as listed in Table 8-23a.

**Table 8-23a, CB Types**

|  |  |  |
| --- | --- | --- |
| **Type** | **Name** | **Clause** |
| 0 | Reserved | N/A |
| 1 | Subsetting Exclusion (SE-CB) | 8.3.2.3.1 |
| 2 | Subsetting Inclusion (SI-CB) | 8.3.2.3.2 |
| 3 | Subsetting Inclusion with Prefix Data (SIPD-CB) | 8.3.2.3.3 |
| 4-29 | Reserved | N/A |
| 30 | Vendor Specific | 8.3.2.3.4 |
| 31 | Reserved | N/A |

If there is a CB Type in a CBA-MSDU that is not implemented by the receiving STA, that STA discards that CBA-MSDU.

If the More CBs bit is zero, the CB is the last CB in that CBA-MSDU and is followed by the A-MSDU. If the More CBs bit is one, another CB follows the CB.

#### 8.3.2.3.1 Subsetting Exclusion CB (SE-CB)

The Subsetting Exclusion CB (SE-CB) is CB type 1. It provides facilities to cause a group addressed CBA-MSDU to be accepted by a subset of the receiving STAs specified by exclusion.

The CB Data of an SE-CB is a sequence of AIDs, as shown in Figure 8-48d (SE-CB and SI-CB data structure).

Octets: 2 2 2

AID 1

 **Figure 8-48d – SE-CB and SI-CB data structure**

AID 2

•••

AID n

The CB Data length of the SE-CB specifies the length of the list of AIDs. If the CB Data Length is not an even number, a receiving STA shall discard the CBA-MSDU. If more than one SE-CB or both an SE-CB and an SI-CB or an SIPD-CB occur in a CBA-MSDU, a receiving STA shall discard the CBA-MSDU.

A STA receiving a CBA-MSDU on an association whose AID appears in the SE-CB in that CBA-MSDU shall discard the CBA-MSDU. A STA receiving a CBA-MSDU on an association whose AID does not so appear in the SE-CB accepts the CBA-MSDU. An empty AID list, which is indicated by a CB Data Length of zero, indicates no receiver exclusions so all receiving STAs associated with the transmitter will accept the CBA-MSDU.

#### 8.3.2.3.2 Subsetting Inclusion CB (SI-CB)

The Subsetting Inclusion CB (SI-CB) is CB type 2. It provides facilities to cause a group addressed CBA-MSDU to be accepted by a subset of the receiving STAs specified by inclusion.

The CB Data of an SI-CB is a sequence of AIDs, as shown in Figure 8-48d (SE-CB and SI-CB data structure).

The CB Data length of the SI-CB specifies the length of the list of AIDs. If the CB Data Length is not an even number, a receiving STA shall discard the CBA-MSDU. If more than one SI-CB or both an SI-CB and an SE-CB or an SIPD-CB occur in a CBA-MSDU, a receiving STA shall discard the CBA-MSDU.

A STA receiving a CBA-MSDU on an association whose AID does not appear in the SI-CB in that CBA-MSDU discards the CBA-MSDU. A STA receiving a CBA-MSDU on an association whose AID appears in the SI-CB in that CBA-MSDU accepts the CBA-MSDU. An empty AID list, which is indicated by a CB data length of zero, indicates no receiver inclusions so all receiving STAs will discard the CBA-SMDU.

#### 8.3.2.3.3 Subsetting Inclusion with Prefix Data CB (SIPD-CB)

The Subsetting Inclusion with Prefix Data CB (SIPD-CB) is CB type 3. Prefix Data means a sequence of octets that are treated as if they were the first octets of the MSDU, after the A-MSDU subframe header. The SIPD-CB is similar to the SI-CB but in addition provides for different Prefix information for each receiver as identified by AID.

The CB Data of a SIPD-CB is a sequence of AID Items, as show in Figure 8-48e (SIPD-CB Data structure).

AID Item 1

AID Item 2

Octets: 3 – 18 3 – 18 3 – 18

 **Figure 8-48e – SIPD-CB Data structure**

AID Item n

•••

The format of an AID Item is as shown in Figure 8-48f (AID Item structure).

Octets: 2 1 0-15

AID

AID Item Control

Prefix Data

 **Figure 8-48f – AID Item structure**

The format of the AID Item Control field is as shown in Figure 89-48g (AID Item Control structure).

Reserved

Prefix Data Length

 B0 B1 B3 B4 B7

Bits: 4 4

 **Figure 8-48g – AID Item Control structure**

Copy Prefix

The CB Data length of the SIPD-CB specifies the length of the AID Item List field. If more than one SIPD-CB or both a SIPD-CB and an SE-CB or an SI-CB occur in a CBA-MSDU, a receiving STA shall discard the CBA-MSDU.

As with the SI-CB, a receiving STA accepts a CBA-MSDU if the AID of its association with the transmitter appears in the AID Item list; however, with a SIPD-CB, the Prefix Data is prefixed to each MSDU in an A-MSDU sub-frame in the CBA-MSDU for the processing of the A-MSDU subframe by the receiving STA. The Prefix Data may be null (zero length).

The AID Items are processed from left to right. The Copy Prefix bit set to one in the AID Item Control for an AID Item means that the most recently specified Prefix Data in an earlier AID Item is to be used. If the Copy Prefix bit is one in the first AID Item, the CBA-MSDU is discarded. If the Copy Prefix bit in any AID Item is one and the Prefix Data Length in that same AID Item is non-zero, the CBA-MSDU is discarded.

#### 8.3.2.3.4 Vendor Specific CB

The Vendor Specific CB is CB Type 30.

The CB Data field of the Vendor Specific CB starts with a 3 octet OUI. The meaning of any additional CB Data and the effect of the Vendor Specific CB are specified by the organization to which the OUI is assigned. STAs discard a received CBA-MSDU if the CB Data length is less than 3.

NOTE: It is suggested that the OUI be followed by a 1-octet sub-type field and a 1-octet version field to accommodate multiple and evolving uses under an OUI.

### Management frames

### Extension frames

## Management and Extension frame body components

### Fields that are not elements

#### 8.4.1.4 Capability Information field

Note: Add B13 as General link bit. This is pending ANA assignment of that bit to GLK.

***Change Figure 8-65—Capability Information field (non-DMG STA) and Figure 8-66—Capability Information field (DMG STA) as follows:***

ESS

 B0 B1 B2 B3 B4 B5 B6 B7

 **Figure 8-65—Capability Information field (non-DMG STA)**

CF Pollable

CF-Poll Request

Short Preamble

Reserved

IBSS

Privacy

Reserved

Spectrum Management

 B8 B9 B10 B11 B12 B13 B14 B15

QoS

Radio Measurement

GLK

APSD

Delayed Block Ack

Short Slot Time

Immediate Block Ack

DMG Parameters

 B0 B7 B8 B9 B11 B12 B13 B14 B15

Reserved

GLK

Reserved

Spectrum Management

Radio Measurement

 **Figure 8-66—Capability Information field (DMG STA)**

***Add the following as the 2nd to last paragraph of Clause 8.4.1.4:***

A STA sets the GLK sub-field in the Capabilities Information field to 1 when do11GeneralLink is true and sets it to 0 otherwise.

### Elements

#### 8.4.2.3 Supported Rates element

***Add a row at the end of Table 8-75—BSS membership selector value encoding:***

|  |  |  |
| --- | --- | --- |
| 125 | GLK | Support for the features of Clause 9.42 (GLK operation) is required in order to join the BSS that was the source of the Supported Rates element or Extended Supported Rates element containing this value.  |

#### 8.4.2.30 TCLAS Element

Note: PCP used below and in 802.1 means Priority Code Point but in 802.11 it means PBSS Control Point. I have expanded or dropped PCP to avoid this conflict.

***Change text in Clause 8.4.2.30 as follows:***

For Classifier Type 5, the classifier parameters are the following parameters in an IEEE Std 802.1D/Q~~-2003~~ [B22] tag header: Priority Code Point (~~PCP;~~ equivalent to IEEE Std 802.1D/Q~~-2004~~ [B20] User Priority), ~~Canonical Format Indicator (CFI)~~ Drop Eligibility Indicator (DEI), and VLAN ID (VID).

***Change Figure 8-238 as follows:***

Classifier Type (5)

Octets: 1 1 1 1 1

 **Figure 8-238—Frame Classifier field of Classifier Type 5**

Classifier Mask

802.1Q ~~PCP~~ Priority
Code Point

802.1Q

~~CFI~~ DEI

802.1Q VID

***Change text in Clause 8.4.2.30 as follows:***

The ~~PCP~~ Priority Code Point subfield contains the value in the 4 LSBs; the 4 MSBs are reserved.

The ~~CFI~~ DEI subfield contains the value in the LSB; the 7 MSBs are reserved.

#### 8.4.2.127.2 DMG STA Capability Information field

***Change Figures 8-481 as follows:***

Reverse Direction

 B0 B1 B2 B3 B4 B5 B6 B7 B13

 **Figure 8-481—DMG STA Capability Information field format**

TPC

SPSH and Interference Mitigation

Fast Link Adaptation

Total Number of Sectors

Higher Layer Timer Synchronization

Number of RX DMG Antennas

RXSS Length

B14 B19 B20 B21 B26 B27 B28 B51 B52 B53

DMG Antenna Reciprocity

Supported MCS Set

BA with Flow Control

DTP Supported

A-MPDU Parameters

A-PPDU Supported

 B54 B55 B56 B57 B59 B60 B61 B62 B63

Heartbeat

Antenna Pattern Reciprocity

GLK

Supports Other\_AID

Heartbeat Elapsed Indication

RXSSTx- Rate Supported

Bit: 1 1 1 1 2 1 7

Bit: 6 1 6 1 24 1 1

Grant Ack Supported

Reserved

Bit: 1 1 1 3 1 1 1 1

***Add to the end of Clause 8.4.2.127.2:***

A DMG STA sets the GLK sub-field in the DMG Capabilities Information field to 1 when do11GeneralLink is true and sets it to 0 otherwise.

#### 8.4.2.147 Relay Capabilities element

***Change Figure 8-519 as follows:***

Relay Supportability

Bits: 1 1 1 1 1 1 1 1 1

 **Figure 8-519—Relay Capability Information field format**

Relay Usability

A/C Power

Cooperation

Reserved

 B0 B1 B2 B3 B4 B5 B6 B7 B8 B9 B15

Relay Permission

Relay Preference

Duplex

GLK

***Add the following text at the end of Clause 8.4.2.147:***

A DMG STA sets the GLK sub-field in the Relay Capabilities Information field to 1 when do11GeneralLink is true and sets it to 0 otherwise.

### Information Subelements

### Access network query protocol (ANQP) elements

## Fields used in Management and Extension frame bodies and Control frames

## Action frame format details

## Aggregate MPDU (A-MPDU)

# MAC sublayer functional description

## Introduction

## MAC architecture

### General

### DCF

### PCF

### Hybrid coordination function (HCF)

#### 9.2.4.2 HCF contention based channel access (EDCA)

***Change the first paragraph in 9.2.4.2 as follows:***

The EDCA mechanism provides differentiated, distributed access to the WM for STAs using eight different UPs. The EDCA mechanism defines four access categories (ACs) that provide support for the delivery of traffic with UPs at the STAs. Six transmit queues are defined when dot11AlternateEDCAActivated is true, and four transmit queues otherwise. The transmit queue and AC are derived from the UPs as shown in Table 9-1 (UP-to-AC mappings) for non-GLK STAs. For GLK STAs, Table 9-1 gives the default mapping of Ups to AC but other mappings are configurable.

Table 9-1 is changed as shown below by adding a column on the left and adding a second section to the table for the GLK case.

***Replace Table 9-1 with the following:***

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Type | Priority | UP | 802.1 | AC | Transmit queue | Transmit queue | Designation (informative) |
| Non-GLK (802.1D UP) | LowestHighest | 1 | BK | AC\_BK | BK | BK | Background |
| 2 | — | AC\_BK | BK | BK | Background |
| 0 | BE | AC\_BE | BE | BE | Best Effort |
| 3 | EE | AC\_BE | BE | BE | Best Effort |
| 4 | CL | AC\_VI | VI | A\_VI | Video (alternate) |
| 5 | VI | AC\_VI | VI | VI | Video |
| 6 | VO | AC\_VO | VO | VO | Voice |
| 7 | NC | AC\_VO | VO | A\_VO | Voice (alternate) |
| GLK (802.1Q UP) | LowestHighest | 1 | BK | AC\_BK | BK | BK | Background |
| 0 | BE | AC\_BE | BE | BE | Best Effort |
| 2 | EE | AC\_BE | BE | BE | Best Effort |
| 3 | CA | AC\_VI | VI | A\_VI | Video (alternate) |
| 4 | VI | AC\_VI | VI | VI | Video |
| 5 | VO | AC\_VO | VO | VO | Voice |
| 6 | IC | AC\_VO | VO | VO | Voice |
| 7 | NC | AC\_VO | VO | A\_VO | Voice (alternate) |

### Mesh coordination function (MCF)

### Combined use of DCF, PCF, and HCF

### Fragmentation/defragmentation overview

### MAC data service

## DCF

## PCF

## Fragmentation

## Defragmentation

## Multirate support

## MSDU transmission restrictions

## HT Control field operation

## Control Wrapper operation

## A-MSDU operation

***Change text as follows:***

The Address 1 field of an MPDU carrying an A-MSDU transmitted by a non-GLK STA shall be set to an individual address or to the GCR concealment address. If such an MPDU is transmitted by a GLK STA, the Address 1 field may be group addressed.

## A-MPDU operation

### A-MPDU contents

### A-MPDU length limit rules

### Minimum MPDU Start Spacing field

### A-MPDU aggregation of group addressed Data

***Change text as follows:***

A STA that is a DMG STA or a GLK STA may transmit an A-MPDU containing MPDUs with a group addressed RA.

### Transport of A-MPDU by the PHY data service

## PPDU duration constraint

## DMG A-PPDU operation

## LDPC operation

## STBC operation

## Short GI operation

## Greenfield operation

## Group ID and partial AID in VHT PPDUs

## Operation across regulatory domains

## HCF

## Mesh coordination function (MCF)

## Block acknowledgement (block ack)

## No Acknowledgement (No Ack)

## Protection mechanisms

## MAC frame processing

## Reverse direction protocol

## PSMP Operation

## Sounding PPDUs

## Link adaptation

## Transmit beamforming

## Antenna selection (ASEL)

## Null data packet (NDP) sounding

## Mesh forwarding framework

## DMG channel access

## DMG AP or PCP clustering

## DMG beamforming

## DMG block ack with flow control

## DMG link adaptation

## DMG dynamic tone pairing (DTP)

## DMG relay operation

***Add new Clause 9.42:***

## GLK operation

All MSDUs transmitted by a GLK STA shall use EPD.

A GLK STA shall set dot11GeneralLink to true.

# MLME

# Security

# Fast BSS transition

# MLME Mesh procedures

## Mesh STA dependencies

## Mesh discovery

## Mesh peering management (MPM)

## Mesh peering management finite state machine (MPM FSM)

## Authenticated mesh peering exchange (AMPE)

## Mesh group key handshake

## Mesh security

## Mesh path selection and metric framework

## Airtime link metric

## Hybrid wireless mesh protocol (HWMP)

## Interworking with the DS

### Overview of interworking between a mesh BSS and a DS

***Change first paragraph as follows:***

A mesh STA that has access to a DS is called a mesh gate. Mesh STAs in an MBSS access the DS via the mesh gate. An MBSS functions like an IEEE 802 LAN segment that is compatible with IEEE Std 802.1D if the MBSS is composed of non-GLK mesh STAs and compatible with IEEE Std 802.1Q if the MBSS is composed of GLK mesh STAs. The MBSS appears as a single access domain.

### Gate announcement (GANN)

### Data forwarding at proxy mesh gates

### Proxy information and proxy update

### Mesh STA collocation

## Intra-mesh congestion control

## Synchronization and beaconing in MBSSs

## Power save in mesh BSS

# Frequency-Hopping spread spectrum (FHSS) PHY specification for the 2.4 GHz industrial, scientific, and medical (ISM) band

# Infrared (IR) PHY specification

# DSSS PHY specification for the 2.4 GHz band designated for ISM applications

# High rate direct sequence spread spectrum (HR/DSSS) PHY specification

# Orthogonal frequency division multiplexing (OFDM) PHY specification

# Extended Rat PHY (ERP) specification

# High Throughput (HT) PHY specification

# Directional multi-gigabit (DMG) PHY specification

# Very High Throughput (VHT) PHY

# Annex A, Bibliography

# Annex B, Protocol Implementation Conformance Statement (PICS)

Need to do something about the PICS.

# Annex C, ASN.1 encoding of the MAC and PHY MIB

Need to add more for configuration of UP to AC mapping for GLK STAs.

***Add the following entry at the end of the* dot11StationConfigEntry SEQUENCE*:***

dot11GeneralLink TruthValue

# …

# Annex P, Integration Function

Note: More extensive changes in Annex P may be required.

## P.1 Introduction

***Replace the contents of P.1 with the following:***

The purpose of this annex is to guide the implementer of a non-GLK WLAN system that includes a portal that integrates the WLAN systems with a wired LAN. This annex does not apply to GLK WLAN systems.

## P.2 Ethernet V2.0/IEEE Std 802.3 LAN integration function

## P.3 Example

***Change the second paragraph as follows:***

In the tables below the rows that have a 81-00 Type/Length field value represent bridging between an Ethernet/IEEE Std 802.3 LAN and an IEEE Std 802.11 LAN. Both LANs are carrying VLAN-tagged MSDUs (User Priority=4, ~~CFI-~~DEI=0, VLAN ID=1893).

## P.4 Integration service versus bridging

# …

# Annex V, Interworking with external networks

## V.1 General

## V.2 Network discovery and selection

## V.3 QoS mapping guidelines for interworking with external networks

### V.3.3 Example of QoS mapping from different networks

***Change the first sentence of Clause V.3.3 as follows:***

IEEE Std 802.1D/Q UPs map to EDCA ACs, as described in Table 9-1 (UP-to-AC mappings).

Table V-1 is changed below by adding a new column on the right and changing the headings of the two rightmost columns.

***Change Table V-1 to the following:***

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 3GPP QoS Information | DiffServ PHB | DSCP | QoS Requirement on GPRS Roaming Exchange | EDCA Access Category | UP (non-GLK 802.1D) | UP (GLK 802.1Q) |
| Traffic Class | THP |   |   | Max Delay | Max Jitter | MSDU Loss |  MSDU Error Rate |   |   |   |
| Conversational | N/A | EF | 101110 | 20 ms | 5 ms | 0.5% | 1.0E-05 | AC\_VO | 7, 6 | 7, 6, 5 |
| Streaming | N/A | AF41 | 100010 | 40 ms | 5 ms | 0.5% | 1.0E-05 | AC\_VI | 5, 4 | 4, 3 |
| Interactive | 1 | AF31 | 011010 | 250 ms | N/A | 0.1% | 1.0E-07 | AC\_BE | 3 | 2 |
|   | 2 | AF21 | 010010 | 300 ms | N/A | 0.1% | 1.0E-07 | AC\_BE | 3 | 2 |
|   | 3 | AF11 | 001010 | 350 ms | N/A | 0.1% | 1.0E-07 | AC\_BE | 0 | 0 |
| Background | N/A | BE | 000000 | 400 ms | N/A | 0.1% | 1.0E-07 | AC\_BK | 2, 1 | 1 |

## V.4 Interworking and SSPN interface support

## V.5 Interworking with external networks and emergency call support

## V.6 Peer information

# …