IEEE P802.11
Wireless LANs

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| Assorted 11ak Improvements |
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|  |  |  |  |  |

Abstract

This document proposes text for improvements to P802.11ak D0.07.

# Introduction

This document proposes text and rational for a number of improvements to P802.11ak D0.07. There are written as changes to D0.07 using the usual ***change, delete, insert, replace*** notation. The *Editorial Notes* are just for explanation in this document and would not be added to the draft.

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# AP only, No IBSS/Mesh, Selective Reception

Editorial Note: These changes clarify that selective reception (SYNRA) is NOT available in an IBSS or Mesh.

***Change text in Clause 4.3.23.1 as follows:***

As described in clause 4.3.23.3, in a data MPDU transmitted ~~between~~ by a GLK AP ~~STAs~~ that has a group address RA, the RA will be a SYNRA and therefore not equal the DA; a non-AP GLK STA supports selective reception of group addressed MPDUs using SYNRA.

It only applies when there is ~~a “central control point” of some sort (~~ an AP, ~~PCP, etc.),~~ thus we will not try to apply it to IBSS, or Mesh.

***Change the last two paragraphs of Clause 4.3.23.4.3 as follows:***

Implementation of this selective reception facility in the AP case includes use of a synthetic group address RA (SYNRA, see clause 8.3.2.1.2). As an alternative to the use of a SYNRA, a copy of the data MPDU can be sent to each intended receiver using MPDUs with individual address RAs, a process known as serial unicast. In either case, an appropriate address format must be used given that the DA will differ from the RA, because the RA is the SYNRA or a serial unicast individual RA. In the case of IBSS or mesh, the choice for MPDUs intended for a group of receivers is either a non-SYNRA group addressed RA or serial unicast, because SYNRA is only used by APs.

All non-mesh GLK STAs support receipt of SYNRAs (see 8.3.2.1.2 and 9.42) but are not required to be able to construct a SYNRA MPDU, since it is always possible to use serial unicast.

Change text in Clause 9.43 as follows:

If a corresponding IEEE 802.1Q Bridge specifies multiple immediate STA destinations, GLK transmission of a MSDU shall use one of the following methods:

* Transmit multiple individually addressed MPDUs to each immediate destination.
* If the transmitter is an AP, transmit group addressed MPDU(s) using a SYNRA as specified in 9.42 (SYNRA address filtering operation).

***The above Section “a” changes to P802.11ak\_D0.07 were adopted by a vote of TGak in PM2, 11 March 2015.***

# GLK STA versus Transmission

Editorial Note: Although we still have the concept of a GLK STA, that is a STA that is GLK capable and enabled, transmissions from such STAs can be to another GLK STA or, in the case of a mixed infrastructure BSS, can be to a non-GLK STA. So text about GLK traffic should not be conditional on being sent by a GLK STA but rather conditional on being a GLK transmission or sent over a GLK link or the like.

***Change text in Clause 9.12* A-MSDU Operation *as follows:***

In non-GLK transmissions, ~~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~~ In GLK transmissions by an AP, the Address 1 field may be group addressed.

***The above change to P802.11ak\_D0.07 was adopted by unanimous consent by TGak in PM2 Tuesday 11 March.***

# SYNRA address filtering

***Change text in Clause 9.42 as follows:***

Editorial Note: The text in Clause 9.2.8 as amended by D0.07 includes validation of the BSSID but only for non-SYNRA Address 1. So that needs to be added to 9.42.

A GLK STA receiving an MPDU with a SYNRA performs the address filtering described in this clause 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).

***The above change to P802.11ak\_D0.07 was adopted by unanimous consent by TGak in PM2 Tuesday 11 March.***

# Annex P Clarifications

***Change the title of Annex P as follows:***

## Annex P, EPD and LPD headers and the Integration Function

(Informative)

### P.1 Introduction

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

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 sub-frames, and (3) clarify where and how EPD to LPD and LPD to EPD conversions are required.

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 (MSDU format) to determine the encoding of MSDUs it receives.

***Replace Clauses P.2 and P.3 with the following new P.2 and P.3:***

### P.2 EPD/LPD header conversions and the Integration function

Table P-1 below 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 must convert between the encoding used within the DS and that used in the non-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 must covert 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 MPDUs containing LPD MSDUs, it must convert them to or from the EPD MSDUs required by the ISS SAPs provided by GLK STAs.

Conversion between LPD and EPD is discussed in 5.1.4 (MSDU format) and IEEE Std 802.1AC.

**Table P-1 – EPD and LPD MSDU headers**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  |  |  |  |
|  | **Protocol** | **EPD MSDU Header** | **LPD MSDU Header** |  |
|  | BPDU | lengtha-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 | lengtha-FE-FE-03 | FE-FE-03 |  |
|  | C-VLANb tagged IPv4 | 81-00-xy-zw-08-00 | AA-AA-03-00-00-00-81-00-xy-zw-08-00 |  |
|  | S-VLANc and C-VLANb 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 two-octet unsigned integer length in octets.
b Assuming C-VLAN ID xy-zw.
c Assuming S-VLAN ID st-uv.

### P.3 A-MSDU sub-frames

The formats of A-MSDU sub-frames are shown in 8.3.2.2 (Aggregate MSDU (A-MSDU) format), specifically in Figures 8-54 (Basic A-MSDU subframe structure), 8-55 (A-MSDU subframe structure for Mesh Data), and 8-56 (Short A-MSDU subframe structure). These formats apply as shown whether or not 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 P-1 (EPD and LPD headers). 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 sub-frame, there will be two sequential length fields or, in the mesh data case, two length fields separated only by the Mesh Control field. Figure P-1 through P-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.

DA

SA

A-MSDU Length

L/T Length

LLC

42-42-03

padding

<BPDU contents>

**Figure P-1 – EPD BPDU subframe**

DA

SA

A-MSDU Length

L/T 81-00

VLAN

xy-zw

padding

L/T 08-00

IPv4

contents

**Figure P-2 – EPD VLAN tagged IPv4 subframe**

DA

SA

A-MSDU Length

L/T

81-00

VLAN

xy-zw

padding

L/T Length

LLC

FE-FE-03

<IS-IS

Contents>

**Figure P-3 – EPD VLAN tagged IS-IS subframe**

There is never confusion between the first octet of an EtherType and an initial LSAP because if the MSDU is LPD encoded, it always starts with an LSAP while if it is EPD encoded, it always starts with a two-octet field that holds a length (if it is less than 0x05DC) or an EtherType (if it is 0x0600 or greater).

### P.4 Integration service versus bridging

***Change text in Clause P.4 as follows:***

There are a number of differences between the IEEE Std 802.11 integration service and the service provided by an IEEE Std 802.1 bridge. In the IEEE Std 802.11 non-GLK architecture a portal provides the minimum connectivity between an IEEE Std 802.11 WLAN system and a non-IEEE-802.11 LAN. Requiring an IEEE Std 802.1D or IEEE Std 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 Std 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~~s~~ 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 Std 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 802.1D or 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.

***Adopted by unanimous consent at 11ak AM2, 12 March 2015.***

# Link cost/rate changes

***Change clause 10.47.2 as follows:***

### 10.47.2 Reported GLK link metrics ~~cost determination~~

GLK STAs provide six metrics for their GLK links to other STAs. One such metric is the maximum rate of transmission the GLK STA is capable of given its available features and those of the STA with which it is communicating and is available in the dot11GLKLinkRawRate variable. The other metrics as specified below, are the minimum, average, geometric mean, and composite link rate, and the standard deviation of the link rate.

For each GLK association, direct link, or peering at a STA there is an array of sample window data rates. Each such array consists of rate sample windows R[0] to R[N+1] in units of 500 kbit/s, where N is the value of dot11GLKLink~~Cost~~RateSamples. Each sample window covers a time period of dot11GLKLink~~Cost~~RateWindowSize \* 16 TUs. When the association or peering is created, R[0] through R[N] are initialized to the lowest data bit rate the STA is configured to use.

Every dot11GLKLink~~Cost~~RateWindowSize TUs the following steps occur in the order given:

(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 to 1, and R[0] is set as follows:

* Zero if all attempts to transmit data that ended during the window failed;
* The average data rate in units of 500 kbit/s of successful transmissions ending in the window if there were any successful transmissions; and,
* The data rate that would have been attempted if there were no attempts to transmit data during the window.

(2) The minimum, average, ~~and~~ geometric mean, and standard deviation of the data rates in the sample array entries are calculated as follows:

* The minimum rate $R\_{min}$ is the array entry with the smallest magnitude.
* The average is Ravg = Floor ($ {\sum\_{i=0}^{i=N}R[i]}/{(N+1})$ )
* The geometric mean is Rgeo = Floor ( $\sqrt[N+1]{\prod\_{i=0}^{i=N}(R\left[i\right]+1)}$ )
* The standard deviation $R\_{std}= \sqrt{^{\sum\_{i=0}^{N+1}\left(R\left[i\right]-R\_{avg}\right)^{2}}/\_{N+2}}$

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

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

 Rcomposite = Floor ($\frac{W\_{min}×R\_{min} + W\_{avg}×R\_{avg} + W\_{geo}×R\_{geo} }{1 + W\_{min} + W\_{avg} + W\_{geo}}$)

where

 Wmin = dot11GLKLink~~Cost~~RateWmin

 Wavg = dot11GLKLink~~Cost~~RateWavg

and Wgeo = dot11GLKLink~~Cost~~RateWgeo

(4) A ~~cost~~ rate is then computed ~~by dividing a large integer by~~ from Rcomposite.

 ~~Cost~~~~raw~~ ~~= Floor(dot11GLKLinkCostScaling×40,000,000 / (R~~~~composite~~~~×16) )~~

 Ratecurrent = Floor( (Rcomposite×16) /dot11GLKLinkRateScaling )

(5) The first ~~Cost~~~~reported~~ Ratereported for a GLK link is ~~Cost~~~~raw~~ Ratecurrent as determined in step 4. Subsequent values of ~~Cost~~~~reported~~ Ratereported are subject to hysteresis based on dot11GLKLink~~Cost~~RateHysteresis. In particular, if the previous ~~Cost~~~~reported~~ Ratereported is greater than the new ~~Cost~~~~raw~~ Ratecurrent× dot11GLKLink~~Cost~~RateHysteresis /256 and less than the new ~~Cost~~~~raw~~ Ratecurrent×256/ dot11GLKLink~~Cost~~RateHysteresis then the new ~~Cost~~~~reported~~ Ratereported is unchanged from the previous ~~Cost~~~~reported~~ Ratereported. In all other cases, the new ~~Cost~~~~reported~~ Ratereported is the new ~~Cost~~~~raw~~ Ratecurrent. ~~Cost~~~~reported~~ Ratereported is available in a per ~~association, direct link, or peering~~ GLK Link dot11GLKLink~~Cost~~RateReported ~~MIB~~ variable.

***Change text in Annex C as follows:***

# GLK Mesh

***Change the title of 13.11 and 13.11.1 and the text in 13.11.1 as follows:***

### 13.11 Interworking with the DS or an attached bridge

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

A non-GLK mesh STA that has access to a DS or is a GLK mesh STA is called a mesh gate. Mesh STAs in an MBSS access the DS or an attach bridge via the mesh gate. 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. When multiple mesh gates in an MBSS have access to the same DS or to bridges in the same bridged LAN, 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 LAN~~. Accordingly,~~ which can lead to broadcast loops ~~may occur~~. Therefore, mesh gates should cooperate with the DS and any bridged LAN to implement a loop preventing protocol ~~in the DS~~. Bridged LANs already have a loop preventing protocol, such as Rapid Spanning Tree Protocol (RSTP) as specified in IEEE Std 802.1D-2004. With RSTP, the resulting active DS or bridged LAN topology forms a tree. With such cooperation, even if multiple mesh gates connect with the same DS or bridged LAN, the MBSS will only access the DS or bridged LAN through a single mesh gate.

~~NOTE 1—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 topology forms a tree. Then, even if multiple mesh gates connect with the same DS, the MBSS only accesses the DS through a single mesh gate.~~

A GLK mesh STA coordinates with the 802.1AC IEEE 802.11 General Link convergence function to create a virtual point-to-point LAN to each mesh gate in the MBSS other than itself. Each of these point-to-point LANs is presented by the convergence function as a unique ISS SAP that is ultimately mapped to an 802.1Q bridge port. Each such SAP is identified by a locally unique service\_access\_point\_identifier, generated by the STA and the convergence function.

***Adopted by 11ak at AM2 12 March 2015 resolving CID #89.***

# Minor Miscellaneous

Editorial Note: Clarify as follows.

Replace the following sentence in 4.3.23.2 with the second sentence below.

Pairwise communication between two EPD STAs in a BSS uses EPD otherwise LPD is used.

Communication in a BSS between two EPD STAs with an individually addressed RA uses EPD; if either STA does not support EPD, such communication uses LPD.

Editorial Note: Fix typos:

Change the first sentence of 4.3.23.4.2 as follows:

Figure 4-14a shows a GLK IBSS involving three ~~two~~ GLK STAs. Each participating STA provides the MAC service via ~~an~~ ISS SAPs.

Editorial Note: MMRP is used in Clause 8.4.2.171 but not expanded nor any reference given.

***Insert in alphabetic order in Clause 3.4 Abbreviations and acronyms:***

MMRP Multiple Mac Registration Protocol (IEEE Std 802.1Q-2014)

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

**serial unicast:** The sequential transmission of an MPDU by a STA to a set of individually addressed RAs in lieu of a single transmission to a group addressed RA.

***The above Section “g” changes to P802.11ak\_D0.07 were deemed to be editorial during TGak PM2 11 March 2015.***

# Update Figure 4-14a