IEEE P802.11
Wireless LANs

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| Draft Reply LS from 802.11 to WBA regarding the WBA 5G & Wi-Fi RAN Convergence Paper |
| Date: 2021-07-19 |
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Abstract

This document contains draft text for a reply liaison statement (LS) from IEEE 802.11 to the WBA 5G Work Group in response to their LS and the information they have provided in [11-21/0170r0](https://mentor.ieee.org/802.11/dcn/21/11-21-0170-00-0000-2021-jan-liaison-from-wba-re-convergence.docx).

r1: Redlined updated draft, based on inputs received via e-mail and during AANI SC teleconferences. This draft includes suggested additions, provided in *{italicized bracket text}*, this text is not intended to be included in the final reply LS.

r2: Redlined text from r1 is accepted, changes from r1 are redlined in this updated draft. As in r1 this draft includes suggested additions, provided in *{italicized bracket text}*, this text is not intended to be included in the final reply LS.

r3: Redlined text from r2 is accepted, changes from r2 are redlined in this updated draft. As in r1 and r2 this draft includes suggested additions, provided in *{italicized bracket text}*, this text is not intended to be included in the final reply LS.

r4: As modified in the 13 July AANI SC Teleconference (note redlines from r3 have not been removed).

r5: As modified in the 14 July AANI SC Teleconference (note redlines from r4 have not been removed)

r6: As modified in the 15 July AANI SC Teleconference. Also, this draft reworks some of the previous text to address comments made during the 13, 14, and 15 July AANI SC Teleconferences. Lastly, input from *Alfred Asterjadhi (Qualcomm) Chair of 802.11 TGbe* has been added, these inputs are highlighted. (note redlines from r3, r4, and r5 have not been removed)

To: Wireless Broadband Alliance (WBA): 5G Work Group
Nigel Bird, Chair, 5G Working Group ()

CC:

Subject: IEEE 802.11 Working Group Reply Liaison Statement to the WBA Liaison Statement on 5G & Wi-Fi RAN Convergence to IEEE 802.11

Date: 2021-07-xx

**Discussion:**

The IEEE 802.11 Working Group (WG) thanks the Wireless Broadband Alliance (WBA) for sharing their work on 5G and Wi-Fi RAN convergence and providing the resulting white paper “5G and Wi-Fi RAN Convergence – Aligning the Industry on Opportunities and Challenges” [1]. The IEEE 802.11 WG also thanks the WBA for providing and presenting an overview of the white paper at the January 2021 IEEE 802.11 Virtual meeting [2].

In addition, IEEE 802.11 WG thanks the WBA 5G working group for highlighting potential challenges and gaps in the following key areas:

1. 5G and Wi-Fi convergence architecture (for Trusted and Untrusted WLAN access);
2. ATSSS multi-access functionality;
3. End-to-end QoS;
4. Policy Interworking and enhancements across 5G and Wi-Fi;
5. Support for Wi-Fi only devices.

*{It was suggested that the text focus more on what 802.11 does provide vs. being limited to a MAC/PHY, text below was edited to address this concern, additional edits are likely}*

*{The following is still viewed as being too negative – we should focus on what we have.}*

*{Proposed “new” text 7/19}*

IEEE Std. 802.11[3, 4] is the basis for WLAN implementations that support Voice, Video, and Data traffic application. In general, these applications have QoS requirements that are being met by WLAN implementations. For example, all current applications supporting Voice over Internet Protocol (VoIP) support WLAN connectivity, most Video over IP application also support WLAN connectivity, and WLAN implementations support “Wi-Fi Off-load” for 3GPP cellular (3G, 4G, and 5G). In addition, many cellular telephones and cellular network operators reliably support “Wi-Fi Calling” a service that provides 3GPP data, voice, and NAS services via a WLAN.

Even though WLAN implementation do currently provide adequate QoS for many applications, the IEEE 802.11 WG agrees that the identified potential challenges and gaps may impact 5G and Wi-Fi RAN convergence, as QoS management of many WLAN implementation do not “match well” with 3GPP QoS management. The IEEE 802.11 WG notes that IEEE Std. 802.11 provides features and capabilities that can be used in WLAN implementations to address these challenges and gaps, providing a better “match” to 3GPP management. Hence, the IEEE 802.11 WG in this reply will provide information on existing (IEEE Std 802.11-2020 [3] and IEEE Std 802.11ax [4]) and planned (IEEE P802.11be [7]) features and capabilities that may be used by implementations to address the challenges and gaps noted in the WBA white paper.

{Old text to be deleted? 7/19}

The IEEE 802.11 WG agrees that these potential challenges and gaps may impact 5G and Wi-Fi RAN convergence. The IEEE 802.11 WG notes that IEEE Std. 802.11 defines one Medium Access Control (MAC) and several physical layer (PHY) specifications for wireless connectivity for fixed, portable, and moving stations (STAs) within a local area [3, 4]. IEEE Std. 802.11 provides features and capabilities that are used in various WLAN implementations to address these challenges and gaps. However, IEEE Std. 802.11 does not provide a standardized implementation that address these challenges and gaps, as the standard does not prescribe a particular configuration for implementation. Hence, the IEEE 802.11 WG in this reply will provide information on existing features and capabilities that IEEE Std. 802.11 does standardize that may be used by implementations to address the challenges and gaps noted in the WBA white paper.

It should also be noted that WLAN implementations based on IEEE Std. 802.11 currently provide support for Voice, Video, and Data traffic application. For example, all current applications supporting Voice over Internet Protocol (VoIP) support WLAN connectivity, most Video over IP application also support WLAN connectivity, and WLAN implementations also currently support “Wi-Fi Off-load” for 3GPP cellular (3G, 4G, and 5G). In addition, many cellular telephones and cellular network operators support “Wi-Fi Calling” a service that provides 3GPP data, voice, and NAS services via a WLAN radio link.

*{Adding the features from* [***11-21/0616r0***](https://mentor.ieee.org/802.11/dcn/21/11-21-0616-00-AANI-802-11ax-features-and-applicability-to-5g-and-wi-fi-convergence.pptx) *and discussed during previous AANI SC teleconferences.}*

IEEE Std. 802.11 provides the following features that can be used to improve QoS performance of implementations based on the IEEE Std. 802.11:

Features that support efficient allocation of resources to achieve traffic prioritization:

*{“From TGbe” provided by Alfred Asterjadhi (Qualcomm) Chair of 802.11 TGbe}*

* From IEEE802.11be TG:
	+ Multiple link operation
	+ Restricted target wake times (TWT)
	+ NSEP prioritized access
	+ Multiple Resource unit (MRU) aggregation
	+ Enhancements to traffic/stream classification services
* From IEEE Std. 802.11ax:
	+ OFDMA (UL and DL) – Rus
	+ UL MU MIMO *{provided by Alfred Asterjadhi (Qualcomm) Chair of 802.11 TGbe}*
	+ Trigger Frame
		- basic trigger frame
		- BSRP, BQRP, and NFPR are supporting features that can be used as an input to the scheduler
	+ TWT (Both types – individual and broadcast)
	+ MU-EDCA
* From IEEE Std. 802.11-2020:
	+ TCLAS
	+ TSPEC
	+ HCCA (not widely implemented) {*it was suggested that the statement that HCCA is not supported by 802.11ax was too strong and is incorrect, so the statement was deleted*}
	+ EDCA
	+ QoS Map
	+ MSCS
	+ SCS
	+ DL MU MIMO *{provided by Alfred Asterjadhi (Qualcomm) Chair of 802.11 TGbe}*

Features that support increased available resources:

*{“From TGbe provided by Alfred Asterjadhi (Qualcomm) Chair of 802.11 TGbe”}*

* From IEEE802.11be TG:
	+ Bandwidth of 320 MHz
	+ MCS 12 and MCS 13 (4096 QAM)
	+ Preamble puncturing
	+ Multiple Resource unit (MRU) aggregation
	+ HT duplication mode in 6 GHz band (MCS 14)
* From IEEE Std. 802.11ax:
	+ Spatial Reuse (distributing power in space for user connectivity)
	+ MCS 10 and MCS 11 (1024 QAM)
	+ MU MIMO (distributing power in space for user connectivity)
	+ Operation in 6 GHz *{Do we want to include 6 GHz operation, and should we consider also adding it above do the improved QoS provided by 802.11ax only?}*
* From IEEE Std. 802.11-2020:
	+ Multi Band Operation
	+ Fast Session Transfer
	+ Fast BSS Transition
	+ DL MU MIMO *{provided by Alfred Asterjadhi (Qualcomm) Chair of 802.11 TGbe}*

*{It was suggested that a high level summary of each of these features should be provided – volunteers are requested. Note: it may be possible to include some text from IEEE Std. 802.11 clause 4 to provide the suggested high level text}*

*{Should we reference the technical report in 11-20/0013? Does additional information need to be added to 11-20/0013? Should a new document be created to describe these features instead of describing them here in the reply LS?}*

*{It was suggested we need more detailed technical information on how QoS can be met using 802.11 tools}*

*{We have GBR for a long time, to support voice – if we are going to talk about “real” guarantees do we need to address licensed vs. unlicensed spectrum issues?}*

*{Concern was expressed about providing too detailed an 802.11 technical response. An example is acceptable.}*

Feature Descriptions *{TGbe, 802.11ax 802.11-2020}*– TBS

*{It was suggested that referencing the clause 4 sections to the above list may be adequate}*

*{It was suggested that the following item is not needed}*

*{It was suggested that high level detail about 3GPP QoS may help focus this discussion – see* [*TS 23.501*](https://www.3gpp.org/ftp/Specs/archive/23_series/23.501/23501-h00.zip) *section 5.7:*

* *3GPP QoS is divided into two phases for data connection: 1) call connection/admission phase 2) the packet forwarding phase*
	1. *The call connection/admission phase – “allocation Retention Priority (ARP)” – the 3GPP system evaluates the priority of the data connection request (UE/service) that is requesting resources relative to other existing and requested connections. The 3GPP system then manages resources and assigns them – this may result in a lower priority connection already running on the system losing its resources if the system is congested.*
	2. *Once “connected”, the QoS enters the packet forwarding phase, TG QoS class identity is used by the system to schedule resources to support the QoS data connection. (see* [*TS 23.501*](https://www.3gpp.org/ftp/Specs/archive/23_series/23.501/23501-h00.zip) *Table 5.7.4-1 in section 5.7.4).}*

*{It was suggested that we discuss the different architecture philosophy used by IEEE Std. 802.11 and 3GPP 5G? Should this discussion include use cases that rely on QoS that have been implemented? e.g., voice and video are currently well supported on many WLAN implementation, based on IEEE Std. 802.11. IEEE Std. 802.11 has consistently been enhancing its data link performance and features to support QoS application and meet user performance expectations.}*

*{It was suggested that it may be possible for QoS requirements to be met using “natively” and properly in the lower OSI layers (MAC/PHY) in WLAN, based on IEEE Std. 802.11, if the upper layers properly manage the macro-level QoS matrix. In other words, QoS mapping between the WLAN layer and 3GPP upper layer QoS matrix may or may not be needed. Therefore, the study information provided by WBA may not be sufficient for the 802.11 WG to draw a definitive conclusion. This may require this reply LS to request WBA provide more specific requirements and/or specific use cases to illustrate specific gaps beyond the differences in WLAN and 5G access architecture and management styles. As it is unlikely that IEEE Std. 802.11 based WLANs with change from autonomous resource management to a centralized resource management model similar to the one defined by 3GPP. Not adopting the 3GPP resource management model does not mean the WLANs based on IEEE Std. 802.11 cannot provide users with QoS capabilities that meet user requirements and meet QoS performance requirements for the identified use cases.}*

*{If any of the above 3 items are added – the statement that we are only providing discussion on features needs to be revisited}*

*{It was suggested – that we need more information from WBA regarding the specific use cases that need to be addressed by the 802.11 WG}*

*{It was suggested that discussion should be provide that states IEEE Std. 802.11 provides connectivity to multiple “core networks”, e.g., ISP, Internet, Enterprise networks, and cellular core networks. Therefore, support of interworking with the 3GPP 5G core will only use a subset of IEEE Std. 802.11 features as some features are provided to address other application. Therefore, it would be helpful if WBA could provide more detailed requirements on the IEEE Std. 802.11 features it expects to use and what limitations it sees in these features.}*

*{TGbe additional input – if any}*

*{IMT-2020 performance should be noted, see below}*

It should be noted that: IEEE Std 802.11ax meets or exceeds requirements specified by the International Telecommunications Union for the 5G Indoor Hotspot and Dense Urban test environments of the enhanced Mobile Broadband (eMBB) usage scenario of IMT-2020. IEEE Std 802.11ax establishes a foundation for an advanced Wi-Fi technology capable of supporting 5G network performance. [5, 6]

Enabling IEEE Std 802.11™ to meet wireless capacity demands being driven by remote video streaming, cloud access, and an increasingly connected mobile world.

*{A polite conclusion should be added – affirming our willingness to work to make WLAN work for 5G}*

Sincerely,

Dorothy Stanley

IEEE 802.11 Working Group Chair

**Dates of future IEEE 802.11 WG Meetings:**

TBS

**References:**

1. [11-21/0170r0](https://mentor.ieee.org/802.11/dcn/21/11-21-0170-00-0000-2021-jan-liaison-from-wba-re-convergence.docx) “2021 Jan Liaison from WBA re: Convergence”

1. [11-21/0408r0](https://mentor.ieee.org/802.11/dcn/21/11-21-0408-00-0wng-wba-5g-and-wi-fi-ran-convergence-ieee-802-11-wng-session.pdf) “WBA\_5G and Wi-Fi RAN Convergence IEEE 802-11 WNG Session”
2. IEEE Std 802.11-2020 “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”
3. IEEE Std 802.11ax “Draft 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 1: Enhancements for High Efficiency WLAN”

1. <https://standards.ieee.org/news/2019/5g-indoor-hotspot-and-dense-urban-deployments.html> “IEEE P802.11ax™ Meets Requirements for 5G Indoor Hotspot and Dense Urban Deployments Enabling Enhanced Wireless Network Performance”, 17 December 2019

1. [11-19/1284r2](https://mentor.ieee.org/802.11/dcn/19/11-19-1284-02-AANI-summary-of-802-11ax-self-evaluation-for-imt-2020-embb-indoor-hotspot-and-dense-urban-test-environments.docx) “Summary of 802.11ax Self Evaluation for IMT-2020 EMBB Indoor Hotspot and Dense Urban Test Environments”
2. Status of Project IEEE P802.11be: https://grouper.ieee.org/groups/802/11/Reports/tgbe\_update.htm