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 |
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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: Redlines from r1 accepted, some “description” text provided as redlined text, additional “description” text is requested.

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 Plenary 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.

The IEEE 802.11 WG agrees that these potential challenges and gaps do 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, the specification does not provide a standardized implementation that address these challenges and gaps, as IEEE Std. 802.11 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.

*{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 IEEE Std. 802.11ax:
	+ OFDMA (UL and DL) - RUs
	+ 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, not supported by 802.11ax)
	+ EDCA

Features that support increased available resources:

* 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)
* From IEEE Std. 802.11-2020:
	+ Multi Band Operation
	+ Fast Session Transfer
	+ Fast BSS Transition

*{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?}*

Feature Descriptions – additional descriptions TBS

TCLAS: traffic classification

The specification of one of several types of matching filter to classify protocol data units (PDUs) or medium access control (MAC) service data units (MSDUs) as belonging to a particular traffic stream (TS). Depending on the type of classification, the filter is applied within the MAC sublayer management entity (MLME), above the MAC, or within the MAC itself. {*from [3] – definition of TCLAS*}

[3] defines several capabilities that make use of TCLAS elements for packet classification, notably the Stream Classification Service (SCS) (refer to subclause 11.25.2) and TS operations (refer to subclause 11.4). In both cases, the STA can request the AP to apply rules that, on transmission, assign a specified User Priority (UP) to frames containing IP packets that match the TCLAS element(s) classifier. {*from 11-21/953r0*}

TSPEC: traffic specification

The quality-of-service (QoS) characteristics of a data flow to and from a QoS station (STA). {*[3] definitions page 171*}

QoS traffic scheduling provides intra-BSS QoS frame transfers under the HCF, using either contention

based or controlled channel access. At each TXOP, a traffic scheduling entity at the STA selects a frame

for transmission, from the set of frames at the heads of a plurality of traffic queues, based on requested UP

and/or parameter values in the traffic specification (TSPEC) for the requested MSDU. Additional

information is available in 10.23. {*[3] clause 4.5.2.3 page 263*}

HCCA: hybrid coordination function (HCF) controlled channel access

 Allows for the reservation of transmission opportunities (TXOPs) with the hybrid coordinator (HC). A STA requests the HC for TXOPs, both for its own transmissions as well as for transmissions from the AP to it.18 The request is initiated by the station management entity (SME) of the STA. The HC, which is collocated at the AP, either accepts or rejects the request based on an admission control policy. If the request is accepted, the HC schedules TXOPs for both STAs (both the AP and the non-AP STA). For transmissions from the non-AP STA, the HC polls the STA based on the parameters supplied by the STA at the time of its request. For transmissions to the STA, the AP directly obtains TXOPs from the collocated HC and delivers the queued frames to the STA, again based on the parameters supplied by the STA. Details of the mechanism are provided in clauses 10.23.3 and 11.4 of [3]. This mechanism might be used for applications such as voice and video, which need periodic service from the HC. If the application constraints dictate the use of this mechanism, the application initiates this mechanism by using the management service primitives. {*ref page 227, last paragraph*}.

EDCA: enhanced distributed channel access

The prioritized carrier sense multiple access with collision avoidance (CSMA/CA) access mechanism used by quality-of-service (QoS) stations (STAs) in a QoS basic service set (BSS) and STAs operating outside the context of a BSS. This access mechanism is also used by the QoS access point (AP) and operates concurrently with hybrid coordination function (HCF) controlled channel access (HCCA). {*definition form [3] page 189*}.

*{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.}*

*{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.}*

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.

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”