IEEE P802.11
Wireless LANs

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| IEEE 802.11 EHT draft Proposed CSD |
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Abstract

CSD document for EHT

R1: Version agreed as the baseline CSD for EHT.

R2: Comments received and proposed edits.

R3: New text in “installation cost” section based on Brian’s contribution, small change in 1.2.3

R4: Final version

R5: With changes based on comments received from other 802 groups.

R6: Incorporating all changes based on comments received from other 802 groups.

R7: Response to 802.3 comment was missed, changed initial phrase in 1.2.4 from “IEEE Std. 802.11 is a mature technology which has a wide variety of legacy devices and a proven track record” to “IEEE Std. 802.11 technology is very mature and has a wide variety of legacy devices and a proven track record”

# 1. IEEE 802 criteria for standards development (CSD)

The CSD documents an agreement between the WG and the Sponsor that provides a description of the project and the Sponsor's requirements more detailed than required in the PAR. The CSD consists of the project process requirements, 1.1, and the 5C requirements, 1.2.

## 1.1 Project process requirements

### 1.1.1 Managed objects

Describe the plan for developing a definition of managed objects. The plan shall specify one of the following:

1. The definitions will be part of this project. YES
2. The definitions will be part of a different project and provide the plan for that project or anticipated future project.
3. The definitions will not be developed and explain why such definitions are not needed.

### 1.1.2 Coexistence

A WG proposing a wireless project shall demonstrate coexistence through the preparation of a Coexistence Assurance (CA) document unless it is not applicable.

1. Will the WG create a CA document as part of the WG balloting process as described in Clause 13? YES
2. If not, explain why the CA document is not applicable.

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## 1.2 5C requirements

## 1.2.1 Broad Market Potential

Each proposed IEEE 802 LMSC standard shall have broad market potential. At a minimum, address the following areas:

a) Broad sets of applicability.

Cisco Visual Networking Index (VNI) [1] predicts that Internet traffic will reach 3.3 zettabytes by the end of 2021. Wireless LAN (WLAN) continues its growth and is more and more important for providing wireless data services in many environments such as home, enterprise and hotspots and more and more individuals increasingly rely on Wi-Fi connections to support their connectivity needs. According to Wi-Fi Alliance [2], three billion Wi-Fi enabled devices are expected to ship in 2018, joining more than eight billion devices already in use. These mobile devices are becoming more and more diverse, spanning from PCs, smartphones, TVs, tablets, sensors and many others. Cisco VNI predicts that TVs, tablets, smartphones, and Machine-to- Machine (M2M) modules will have traffic growth rates of 21 percent, 29 percent, 49 percent, and 49 percent, respectively.

By 2020, WLAN traffic will be about 3 times greater than mobile data traffic. And starting in 2018, WLAN traffic will even surpass Fixed/Wired traffic. Traffic growth continues to be driven by significant growth in the video traffic, IP video traffic will be 82 percent of all consumer Internet traffic by 2021. The throughput requirements of these applications is in constant evolution with the emergence of 4k and 8k video, and new high-throughput applications will proliferate such as Virtual Reality or Augmented Reality, gaming, remote office, cloud computing.

With the throughput and real-time requirements of these applications, WLAN users demand improved throughput and performance in delivering their applications in many environments.

Cellular operators are heavily using WLAN technology for data offloading. 63% of global mobile data traffic will be offloaded by 2021. WLANs are being deployed in more and more public venues. Globally, there will be nearly 541.6 million public Wi-Fi hotspots by 2021, up from 94 million hotspots in 2016, a sixfold increase. Community hotspots or homespots have emerged as a potentially significant element of the public Wi-Fi landscape. Public Wi-Fi hotspots (minus homespots) will nearly double from 8.8 million in 2016 to 15.4 million by 2021. Hotels, cafes and restaurants will have the highest number of hotspots by 2021 globally, and the fastest growth is in healthcare facilities (hospitals) where hotspots will triple over the forecast period. The primary objective of Wi-Fi in hospitals is to improve the delivery of healthcare services and staff productivity, with a secondary benefit being Internet access for patients, their families and guests.

Enterprises, such as small and medium businesses, are increasingly dependent on Wi-Fi technology as their main access network infrastructure. According to MarketandMarkets.com in their latest report [3], the global enterprise Wireless Local Area Network (WLAN) market is expected to reach USD 21.1 Billion by 2021 from USD 5.5 Billion in 2016, driven by factors such as growing demand for Bring Your Own Device (BYOD) and cloud applications, along with the emergence of Internet of Things (IoT).

Integral to these verticals and looking into the future are the game-changing IoT devices and connections. According to Maravedis/Rethink research and the WBA Alliance [4], more than two-thirds (67 percent) of mobile operators and 78 percent of cable companies expect to use Wi-Fi to support IoT services by 2020.

b) Multiple vendors and numerous users.

A wide variety of vendors currently build numerous products for the Wireless Local Area Network (WLAN) marketplace. According to Dell’Oro Group [5], WLAN market revenue will grow to $18.2 Billion by 2022. It is anticipated that the majority of those vendors, and others, will participate in the standards development process and subsequent commercialization activities.

Strategy Analytics estimates in Global Broadband and WLAN (Wi-Fi) Networked Households Forecast 2012-2021 [6] that by the end of 2016, 793 million households worldwide were connected to the internet via fixed-line broadband, and that of these 793 million households, 587 million households (74%) were using a wireless router to create wireless local area network (WLAN), or Wi-Fi home network.

## 1.2.2 Compatibility

Each proposed IEEE 802 LMSC standard should be in conformance with IEEE Std 802, IEEE 802.1AC, and IEEE 802.1Q. If any variances in conformance emerge, they shall be thoroughly disclosed and reviewed with IEEE 802.1 WG prior to submitting a PAR to the Sponsor.

1. Will the proposed standard comply with IEEE Std 802, IEEE Std 802.1AC and IEEE Std 802.1Q? YES
2. If the answer to a) is no, supply the response from the IEEE 802.1 WG.

The review and response is not required if the proposed standard is an amendment or revision to an existing standard for which it has been previously determined that compliance with the above IEEE 802 standards is not possible. In this case, the CSD statement shall state that this is the case.

## 1.2.3 Distinct Identity

Each proposed IEEE 802 LMSC standard shall provide evidence of a distinct identity. Identify standards and standards projects with similar scopes and for each one describe why the proposed project is substantially different.

This project will focus on increasing capacity and link throughput of WLAN.

This project will improve the latency and jitter of WLAN.

There is no other WLAN standard below 8 GHz focusing on significantly improving WLAN throughput, nor improving latency and jitter other than this amendment.

## 1.2.4 Technical Feasibility

Each proposed IEEE 802 LMSC standard shall provide evidence that the project is technically feasible within the time frame of the project. At a minimum, address the following items to demonstrate technical feasibility:

a) Demonstrated system feasibility.

Main technical candidate features that have been discussed are referenced in the PAR document. Some features like increasing the bandwidth and the number of spatial streams are solutions that have been proven to be effective in previous projects focused on increasing link throughput and on which feasibility demonstration is achievable.

The IEEE 802.11 WNG and EHT SG has reviewed many presentations indicating that the proposed solutions are technically feasible.

b) Proven similar technology via testing, modeling, simulation, etc.

IEEE Std. 802.11 technology is very mature and has a wide variety of legacy devices and a proven track record, with several billions of devices shipping each year. The increased capabilities envisioned for the baseband and RF parts necessary to implement the proposed amendment are in line with the current progress in technology and not expected to impinge testability.

**1.2.5 Economic Feasibility**

Each proposed IEEE 802 LMSC standard shall provide evidence of economic feasibility. Demonstrate, as far as can reasonably be estimated, the economic feasibility of the proposed project for its intended applications. Among the areas that may be addressed in the cost for performance analysis are the following:

a) Balanced costs (infrastructure versus attached stations).

1. WLAN equipment is accepted as having balanced costs. The development of Wireless capabilities to enhance the link throughput of WLAN network deployments will not disrupt the established balance.
2. b) Known cost factors.

Support of the proposed standard will likely require a manufacturer to develop a modified radio, modem and firmware. This is similar in principle to the transition between IEEE 802.11ac and IEEE 802.11ax as well as in previous iterations of IEEE Std. 802.11 enhancements. The cost factors for these transitions are well known and the data for this is well understood.

c) Consideration of installation costs.

Industry has recommended dual Cat6a cabling for APs for many years. The focus of this amendment is mostly on WLAN operation that requires no more than dual 10 Gbps full duplex for wired backhaul (i.e. 20 Gbps down and 20 Gbps up). Thus, for venues following this advice, the proposed amendment has no known impact on installation costs even for high end EHT APs.

In cases with lesser backhaul capacity, for lower end APs compliant with EHT or networks designed such that the bulk of the traffic originates or terminates at end-points cohosted with AP and non-AP STAs, the proposed amendment is not expected to impact installation costs either.

In some cases, new cabling infrastructure such as dual Cat6a is required for optimum EHT AP performance. The cabling cost is balanced and comparable to the cost of an initial IEEE Std. 802.11 AP installation.

d) Consideration of operational costs (e.g., energy consumption).

There are billions of WLAN systems in operation around the world. WLAN systems are recognized to provide a total cost of ownership (TCO) that provides a significant operation cost benefits. This amendment is not expected to change today’s operation costs.

e) Other areas, as appropriate.

None.

**References:**

[1] Cisco Visual Networking Index Predicts Global Annual IP Traffic to Exceed Three Zettabytes by 2021, <https://newsroom.cisco.com/zpress-release-content?type=webcontent&articleId=1853168>

[2] Wi-Fi Alliance 2018 Wi-Fi predictions, <https://www.wi-fi.org/news-events/newsroom/wi-fi-alliance-publishes-2018-wi-fi-predictions>

[3] Enterprise WLAN Market worth 21.10 Billion USD by 2021, MarketsandMarkets.com, <https://www.marketsandmarkets.com/PressReleases/enterprise-wlan.asp>

[4] <https://www.maravedis-bwa.com/>

[5] Wireless LAN (WLAN) Market Revenue Will Grow to $18.2 Billion by 2022, According to Dell’Oro Group, Dell’Oro, <http://www.delloro.com/news/wireless-lan-wlan-market-revenue-will-grow-18-2-billion-2022-according-delloro-group>

[6] Global Broadband and WLAN (Wi-Fi) Networked Households Forecast 2012-2021, Strategy Analytics, [https://www.strategyanalytics.com/access-services/devices/connected-home/consumer-electronics/market-data/report-detail/global-broadband-and-wlan-(wi-fi)-networked-households-forecast-2012-2021](https://www.strategyanalytics.com/access-services/devices/connected-home/consumer-electronics/market-data/report-detail/global-broadband-and-wlan-%28wi-fi%29-networked-households-forecast-2012-2021)