IEEE P802.11  
Wireless LANs

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 802.11 HEW Draft PAR and 5C | | | | |
| Date: 2013-11-12 | | | | |
| Author(s): | | | | |
| Name | Affiliation | Address | Phone | email |
| Osama Aboul-Magd | Huawei Technologies | 303 Terry Fox Drive  Kanata, ONT, Canada | +1-613-287-1405 | [osama.aboulmagd@huawei.com](mailto:osama.aboulmagd@huawei.com) |
|  |  |  |  |  |

Abstract

This is a draft PAR and five criteria for IEEE 802.11 HEW Study Group consideration.

R0: document created.

R1: Dec 02/2013 🡪 added text to different sections of the PAR and the 5C.

# PAR

**P802.11**

**Submitter Email: osama53@rogers.com**  
**Type of Project:** Amendment to IEEE Standard 802.11-2012  
**PAR Request Date:** TBD  
**PAR Approval Date:  
PAR Expiration Date:  
Status:** Unapproved PAR, PAR for an Amendment to an existing IEEE Standard

**1.1 Project Number:** P802.11tbd  
**1.2 Type of Document:** Standard   
**1.3 Life Cycle:** Full Use

**2.1 Title:** 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: Enhancements for Highly Efficient Wireless LAN

**3.1 Working Group:** Wireless LAN Working Group (C/LM/WG802.11)   
**Contact Information for Working Group Chair**

**Name:** Bruce Kraemer  
**Email Address:** bkraemer@marvell.com   
**Phone:** 321-751-3988

**Contact Information for Working Group Vice-Chair Name:** Jon Rosdahl  
**Email Address:** jrosdahl@ieee.org  
**Phone:** 801-492-4023

**3.2 Sponsoring Society and Committee:** IEEE Computer Society/LAN/MAN Standards Committee (C/LM)   
**Contact Information for Sponsor Chair**

**Name:** Paul Nikolich  
**Email Address:** p.nikolich@ieee.org   
**Phone:** 857.205.0050

**Contact Information for Standards Representative Name:** James Gilb  
**Email Address:** gilb@ieee.org  
**Phone:** 858-229-4822

**4.1 Type of Ballot:** Individual  
**4.2 Expected Date of submission of draft to the IEEE-SA for Initial Sponsor Ballot:**2017-July  
**4.3 Projected Completion Date for Submittal to RevCom:**2018-July

**5.1 Approximate number of people expected to be actively involved in the development of this project:** 200

**5.2.a. Scope of the complete standard:** This amendment defines standardized modifications to both the 802.11 physical layers (PHY) and the 802.11 Medium Access Control Layer (MAC) that enable modes of operation capable of supporting TBD times improvements in the average throughput per station in indoor, outdoor, and dense deployment scenarios.

The new standard operates below 6 GHz carrier frequency while ensuring backward compatibility and coexistence with legacy IEEE802.11 devices in the 2.4 GHz and 5 GHz unlicensed bands.

**5.2.b. Scope of the project:** This amendment specifies protocols, procedures, and managed objects to enhance the ability of IEEE P802.11 to efficiently support dense deployment scenarios and to improve system level performance parameters.

**5.3 Is the completion of this standard dependent upon the completion of another standard: NO**

**5.4 Purpose:** The purpose of the amendment is to enhance the 802.11 wireless local area network (LAN) user quality of experience by improving average throughput per station in high density deployments, including office enterprise, residential, and hotspot. Deployments of interest also include operator deployments and outdoor environments.

**5.5 Need for the Project:**WLAN devices are currently been deployed in diverse scenarions. Previous amendments have focused on increasing peak rates and have shown modes of operation capable of supporting several Gbps rates. This project will focus on the need for efficiency improvements in high density deployments. In addition, improvements will be made to support environments such as wireless corporate office, outdoor hotspot, dense residential apartments, or stadiums. Improvements will target increasing the area throughput and/or average throughput per station. Quality of experience for the user will be addressed by improving the minimum average data rate, or maximum connection setup delay, or maximum packet transmission delay.  
 **5.6 Stakeholders for the Standard:**Manufacturers and users of semiconductors, personal computers, enterprise networking devices, consumer electronic devices, home networking equipment, mobile devices, and cellular operators who rely on IEEE 802.11 technology for data offloading.

**Intellectual Property:  
6.1.a. Is the Sponsor aware of any copyright permissions needed for this project?: No**

**6.1.b. Is the Sponsor aware of possible registration activity related to this project?:** No

**7.1 Are there other standards or projects with a similar scope?:**   
No

**7.2 Joint Development**  
**Is it the intent to develop this document jointly with another organization?:** No  
  
**8.1 Additional Explanatory Notes (Item Number and Explanation):**

Unlike previously developed IEEE 802.11 amendments, this amendment will focus on system-level metrics representative of the performance obtained by stations in typical deployment environments. Previous amendments focused on peak theoretical throughput achieved in ideal conditions.

Since the values of these metrics will depend on the scenario, the focus will be on the relative improvement of these metrics compared to previous 802.11 amendments (802.11n in 2.4GHz and 802.11ac in 5GHz).

The amendment will be evaluated with a set of typical deployment scenarios representative of the main expected usage models that are expected to suffer bottlenecks in the coming years: residential, enterprise, indoor and outdoor hotspots. HEW SG has initiated the creation of a high-level simulation scenario working document (ref: 13/0657r6) to model these scenarios

- These scenarios highlight three categories of objectives to improve WLAN efficiency in WLANs:

* Significantly increase airtime usage efficiency in scenarios with a high density of STAs per BSS.
* Significantly increase spectral reuse and manage interference between neighboring OBSS in scenarios with a high density of both STAs and BSSs, in cases where they may or may not share the same management entity
* Increase robustness to outdoor propagation characteristics and increase uplink transmission reliability

The metrics will directly correspond to the user experience in the identified scenarios, including overall throughputs, distribution of throughputs (e.g. 5th percentile of user throughput CDF), and satisfaction of the latency/jitter/packet loss constraints of applications.

This pooject may include the capability to handle multiple simultaneous communications in both the spatial and frequency domains, in both the UL and DL.

# Five Criteria

## Broad Market Potential

A standards project authorized by IEEE 802 LMSC shall have a broad market potential. Specifically, it shall have the potential for:

a) Broad sets of applicability.

Cisco’s VNI predicts that Internet traffic will reach Zettabytes by the end of 2016. 51% of the total traffic is expected to originate on WLAN connections.

Due to mobile operators deploying carrier Wi-Fi for data offloading and continuous deployment by other operators for broadband service, Infonetics Research predicts that the carrier Wi-Fi market to reach $2.8 B by year 2017, at a 5 year CAGR of 40%. Units will grow from 985K access points (AP) by year 2012 to 5.3M APs in year 2017, a 40% CAGR.

Forecasts from International Data Corporation (IDC) show that 87% of connexted devices sales by 2017 will be tablets and smartphones. Those devices are equipped with Wi-Fi interfaces that drive increased Wi-Fi traffic volume.

Traffic growth continues to be driven by significant growth in the video traffic. New uses such as multimedia, simultaneous transmission of multiple high rate video streams, audio, and on-line gaming, and cloud communication using virtual desktop infrastructure, will drive the need for improving system level performance and user experienceper in the home, enterprise and outdoor environments.

b) Multiple vendors and numerous users.

A wide variety of vendors currently build numerous products for the WLAN marketplace. According to Dell’Oro Group overall Wireless LAN market revenues are forecast to exceed $11 billion in 2017, nearly 50 percent greater than 2012 revenues. It is anticipated that the majority of those vendors, and others, will participate in the standards development process and subsequent commercialization activities.

Wi-Fi Alliance estimated that 25% of homes around the world use Wi-Fi.

c) Balanced costs (LAN versus attached stations).

1. WLAN equipment is accepted as having balanced costs. The development of Wireless capabilities to enhance the efficiency of WLAN network deployments will not disrupt the established balance.

## Compatibility

IEEE 802 LMSC defines a family of standards. All standards should be in conformance : IEEE Std 802, IEEE 802.1D, and IEEE 802.1Q. If any variances in conformance emerge, they shall be thoroughly disclosed and reviewed with IEEE 802.1 Working Group. In order to demonstrate compatibility with this criterion, the Five Criteria statement must answer the following questions.

a)Does the PAR mandate that the standard shall comply with IEEE Std 802, IEEE Std 802.1D and IEEE Std 802.1Q?

b)If not, how will the Working Group ensure that the resulting draft standard is compliant, or if not, receives appropriate review from the IEEE 802.1 Working Group?

Compatibility with IEEE 802 requirements will be accomplished by keeping the MAC SAP interface the same as the existing 802.11 standard. The proposed amendment shall introduce no 802.1 architectural changes. The MAC SAP definition shall not be altered, ensuring that all LLC and MAC interfaces are compatible to and in conformance with the IEEE 802.1 Architecture, Management and Internetworking standards. New managed objects shall be defined as necessary in a format and structure consistent with existing 802.11 managed objects. Backward compatibility and coexistence with legacy devices will be granted for the 2.4 GHz and 5GHz bands

## Distinct Identity

Each IEEE 802 LMSC standard shall have a distinct identity. To achieve this, each authorized project shall be:

a) Substantially different from other IEEE 802 LMSC standards.

Unlike previous amendments that focused on peak throughput, this project will result in a WLAN with that can efficiently support dense stations as well as access points deployments. This project will focus on system level performance and improving airtime usage as well as interference management between neighboring OBSS with high station and BSS density. OBSS may be managed by different entities.

b) One unique solution per problem (not two solutions to a problem).

There is no other wireless LAN standard focusing on significantly improving WLAN efficiency in dense deployment scenarios other than 802.11hew operating in bands below 6GHz.

c) Easy for the document reader to select the relevant specification.

The 802.11hew amendment will differentiate itself from other IEEE 802 wireless standards via the title which stresses the specification of highly efficient WLAN technology.

## Technical Feasibility

For a project to be authorized, it shall be able to show its technical feasibility. At a minimum, the proposed project shall show:

a) Demonstrated system feasibility.

Candidate technologies that may contribute to achieve the targeted efficiency encompass time/frequency/space multiplexing: OFDMA, SDMA, multiple simultaneous transmissions in the frequency and the spatial domain and Multi-User MIMO transmissions. These technologies have demonstrated feasibility in the cellular context. The following document includes an overview of candidate technologies discussed in the HEW SG:

<https://mentor.ieee.org/802.11/dcn/13/11-13-1375-01-0hew-summary-and-discussions-of-proposals-on-potential-phy-technologies-in-hew.pptx>

b) Proven technology, reasonable testing.

IEEE 802.11 is a mature technology which has a wide variety of legacy devices and a proven track record, with several billions of devices shipping each year and 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.

c) Confidence in reliability.

Current reliable WLAN solutions provide confidence in the reliability of the technology that will be developed by the project. This project will result in similar or improved reliability over current levels

d) Coexistence of IEEE 802 LMSC wireless standards specifying devices for unlicensed operation.

The working group will create a CA document as part of the WG balloting process

## Economic Feasibility

For a project to be authorized, it shall be able to show economic feasibility (so far as can reasonably be estimated) for its intended applications. At a minimum, the proposed project shall show:

a) Known cost factors, reliable data.

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 802.11b or 802.11g and 802.11n, or between 802.11a and 802.11n. The cost factors for these transitions are well known and the data for this is well understood.

b) Reasonable cost for performance.

The new standard will provide users with improved efficiency by focusing on system level performance metrics related to per area throughput, average throughput per STA, and frame delay and jitter. In general, the cost factor changes needed to implement the technology envisioned by the study group are well within the capabilities of existing technology. Competition between manufacturers will ensure that costs remain reasonable.

c) Consideration of installation costs

The proposed standard has no known impact on installation costs. **References:**