IEEE P802.11  
Wireless LANs

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| Liaison response to 3GPP R2-141855 | | | | |
| Date: 2014-05-15 | | | | |
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Abstract

Reply to the liaison from 3GPP RAN R2-141855. Also see 11-14-0519r0.

The 3rd Generation Partnership Project (3GPP) submitted a letter to the IEEE 802.11 Working Group (WG). The letter is documented in 11-14-0519r0. This document contains recommended response text drafted by members of the IEEE 802.11 Task Group mc.

# Summary of the letter from 3GPP

The 3GPP TSG RAN Working Group (WG) 2 created a letter to the IEEE 802.11 WG during the 3GPP TSG-RAN2 Meeting #85bis. The letter reports that “3GPP TSG-RAN WG2 (RAN2) is developing a mechanism for inter-working between 3GPP RATs [Radio Access Technologies] (UMTS and LTE) and WLAN.” To allow for efficient inter-working of IEEE 802.11 WLAN and 3GPP’s radio technologies, the 3GPP RAN WG2 intends to develop mechanisms that provide access network selection and traffic routing. The proposed 3GPP mechanism allows a device to steer traffic from one radio technology to another. The letter highlights that this decision process considers several parameters. Among these parameters, 3GPP TSG RAN WG 2 identified RCPI and RSNI as candidates to observe: “If, for a WLAN AP, the RCPI measured by the terminal is above the RCPI-threshold and/or RSNI measured by the terminal is above the RSNI-threshold (***and other conditions are fulfilled***), the terminal should steer traffic to the WLAN AP.” 3GPP TSG RAN WG2 further emphasizes “[…] that ***other metrics than RSNI and RCPI are also considered in this mechanism*** […]” since the decision making process does not rely on PHY layer based measurements only. Consequently 3GPP TSG RAN WG2 asks the IEEE 802.11 WG about its opinion regarding the usefulness of the RCPI and RSNI values to represent PHY layer conditions.

In their letter, the 3GPP TSG RAN WG2 asks about the applicability of certain measurement functionality in the IEEE Std 802.11. The questions are as follows.

* Question 1: Does IEEE 802.11 WG consider WLAN RCPI a suitable metric of WLAN signal strength such that it can be compared to thresholds as in the above described mechanism?
* Question 2: Does IEEE 802.11 WG consider WLAN RSNI a suitable metric of WLAN signal quality such that it can be compared to thresholds as in the above described mechanism?
* Question 3: Does IEEE 802.11 WG consider any other WLAN signal metric more suitable for the above described mechanism?

# Summary of this reply letter

IEEE 802.11 Task Group mc developed this reply letter for approval by the IEEE 802.11 Working Group.

To: 3GPP TSG-RAN WG2 c/o Mattias.a.bergstrom@ericsson.com

Subject: Liaison on WLAN signal measurements for WLAN/3GPP Radio interworking

Date: 2014-05-12

Dear Mattias,

We would like to thank 3GPP TSG-RAN Working Group (WG) 2 for its letter that we received on 2014-04-14. In its letter 3GPP TSG-RAN WG2 asked the IEEE 802.11 WG the following three questions:

1. Does IEEE 802.11 WG consider WLAN RCPI a suitable metric of WLAN signal strength such that it can be compared to thresholds as in the above described mechanism?
2. Does IEEE 802.11 WG consider WLAN RSNI a suitable metric of WLAN signal quality such that it can be compared to thresholds as in the above described mechanism?
3. Does IEEE 802.11 WG consider any other WLAN signal metric more suitable for the above described mechanism?

We answer your questions as follows.

* Regarding Question 1: We consider the RCPI value as defined in IEEE 802.11™-2012 a metric for signal strength.
* Regarding Question 2: We consider the RSNI value as defined in IEEE 802.11™-2012 a metric for signal quality in downlink direction.
* Regarding Question 3: Understanding that the objective of the mechanism is to select the network that provides the best match to the QoS and/or throughput requirements of the system, the consideration of RNSI/RCPI is not sufficient on its own to efficiently estimate the available throughput and QoS that will be experienced in the IEEE 802.11 WLAN. Other metrics should be taken into account, especially channel bandwidth, operating band, number of spatial streams, BSS load, and WAN metrics, see also the attached Table 1. Comparing only the RSNI/RCPI, as is, to thresholds presents some risks of poor decisions. Ideally, a single parameter, such as estimated throughput, which combines all of the above parameters, would be determined inside of the wlan modem and then delivered to the upper layers.

Please note that there is no explicit accuracy requirement for RSNI, but RSNI is defined by the ratio of the received signal power (RCPI - ANPI) to the noise plus interference power (ANPI). Both, ANPI and RCPI, have accuracy requirements of ±5 dB.

Sincerely,

Adrian Stephens  
IEEE 802.11 Working Group Chair

**References:**

• Table 1: 802.11 metrics suitable for WLAN selection and reselection

• List of abbreviations

• 11-14-0679-00-000m-Considerations When Using 802.11 Metrics for Traffic Steering

Table 1: 802.11 Metrics Suitable for WLAN Selection and Reselection.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Metric Name | Available in Beacon or Probe Response | Available in Measu-rement | Available via ANQP | Note |
| RCPI | Y | Y See Note 1. |  | From STA channel scan. From Beacon Measurement by STA. Or from Link Measurement by STA or AP |
| RSNI | Y. | Y See Note 1. |  | From channel scan. From Beacon Measurement by STA. Or from Link Measurement by STA or AP. |
| ANPI |  | Y See Note 1. |  | From Noise Histogram Measurement by STA. |
| Channel Load |  | Y |  | From Channel Load Measurement by STA or AP. |
| SSID | Y |  |  | From channel scan. |
| BSS Load | Y |  |  | From channel scan. Measured at AP. |
| BSS Avg Access Delay | Y | Y |  | From channel scan. From STA Statistics Measurement by STA. Measured at AP for non-QOS STAs. |
| BSS AC Access Delay | Y | Y |  | From channel scan. From STA Statistics Measurement by STA. Measured at AP for QOS streams.. |
| BSS Available Admission Capacity | Y |  |  | From channel scan. When admission control is in use, this is estimated at AP. |
| Noise Histogram |  | Y |  | From Noise Histogram Measurement at AP or STA. |
| Tx/Rx Frame Count |  | Y |  | From STA Statistics Measurement by STA or AP. |
| QOS Tx/Rx Frame Count |  | Y |  | From STA Statistics Measurement by STA or AP. For QOS streams. |
| FCS Error Count |  | Y |  | From STA Statistics Measurement by STA or AP. |
| Retry Count |  | Y |  | From STA Statistics Measurement by STA or AP. |
| Retry AMSDU Count |  | Y |  | From STA Statistics Measurement by STA or AP. |
| Supported Operating Classes | Y |  |  | From channel scan. From AP for BSS. |
| BSS Description | Y |  |  | From channel scan. From AP for BSS. Includes parameters such as: operating channel width, number of spatial streams, LDPC, beamforming, aggregation, etc. |
| Roaming Consortium | Y |  | Y | From channel scan. From AP for BSS, or through AP in ANQP Query. |
| NAI Realm |  |  | Y | Through AP in ANQP Query. |
| 3GPP Cell Network |  |  | Y | Through AP in ANQP Query. |
| Capability Lists |  |  | Y | Through AP in ANQP Query. |
| WAN Metrics |  |  | Y | Through AP in ANQP Query. This is vendor specific metric used by Wi-Fi Alliance. |
| STA Capabilities |  |  |  | From STA; Includes parameters such as: operating channel width, number of spatial streams, LDPC, beamforming, aggregation, etc. |

NOTE1: RCPI has a specified accuracy requirement of ±5 dB (at 95% confidence level). There is no explicit accuracy requirement for RSNI, but RSNI is calculated as RCPI minus ANPI which both has accuracy requirements of ±5 dB, and hence RSNI has an implicit accuracy requirement of ±10 dB.



List of abbreviations

* RCPI: received channel power indicator
* RSNI: received signal to noise indicator
* RSSI: receive signal strength indicator
* ANQP: access network query protocol
* BSS: basic service set
* ANPI: average noise power indicator
* FCS: frame check sequence
* LDPC: low-density parity check
* WAN: wide area network
* NAI: network access identifier
* A-MSDU: aggregate MAC service data unit
* QoS: Quality of Service