IEEE P802.11
Wireless LANs

|  |
| --- |
| 11bn PDT MAC Seamless Roaming |
| Date: January, 2025 |
| Author(s): |
| Name | Affiliation | Address | Phone | Email |
| Duncan Ho | Qualcomm Technologies, Inc | 5665 Morehouse Dr, San Diego CA 92131 USA | +1 (858) 845-3214 | dho@qti.qualcomm.com |
| Liwen Chu | NXP |  |  |  |
| Xiangxin Gu | Spreadtrum |  |  |  |
| Xiandong Dong | Xiaomi |  |  |  |
| Tuncer Baykas | Ofinno |  |  |  |
| Gaurav Patwardhan | HPE |  |  |  |
| Ning Gao | Oppo |  |  |  |
| Pei Zhou | TCL |  |  |  |
| Frank Hsu | Mediatek Inc. |  |  |  |
| Xuwen Zhao |  |  |  |  |
| Juseong Moon | KNUT |  |  |  |
| Ronny Yongho Kim | KNUT |  |  |  |
| John Wullert | Peraton Labs |  |  |  |
| Tuncer Baykas | Ofinno |  |  |  |
| Manasi Ekkundi | Samsung Electronics |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
| Insun Jang | LGE |  |  |  |
| Fangxin Xu | Shenzhen Longsailing Semiconductor |  |  |  |
| SunHee Baek | LG Electronics |  |  |  |
| Ryuichi Hirata | Sony |  |  |  |
| Thomas Handte | Sony |  |  |  |
| Liangxiao Xin | Oppo |  |  |  |
| Liuming Lu | Oppo |  |  |  |
| Yunpeng Yang | TP-link |  |  |  |
| Arik Klein | Huawei |  |  |  |
| Zisheng Wang | ZTE |  |  |  |
| Prabodh Varshney | Nokia |  |  |  |
| Liubogoshchev | Nokia |  |  |  |
| Yun Li | ZTE |  |  |  |
| Thomas Derham | Broadcom |  |  |  |
| Abhishek Chaturvedi | Samsung |  |  |  |
| Hang Yang | Ruijie Networks Co., Ltd. |  |  |  |
| Alfred Asterjadhi | Qualcomm Technologies, Inc. |  |  |  |
| Subir Das | Peraton Labs |  |  |  |
| Abhishek Patil | Qualcomm Technologies, Inc. |  |  |  |
| Peshal Nayak | Samsung |  |  |  |
| Zhenpeng Shi | Huawei |  |  |  |
| Massinissa Lalam | Sagemcom |  |  |  |
| Julien Sevin | Canon |  |  |  |
| Yuki Fujimori | Canon |  |  |  |
| Haorui Yang | China Mobile |  |  |  |
| Tomo Adachi | Toshiba |  |  |  |
| Kyosuke Inoue | Sharp Corporation |  |  |  |
| Stephane Baron | Canon |  |  |  |
| Brian Hart | Cisco |  |  |  |
| Yu Hsien Chang |  |  |  |  |
| Rubayet Shafin | Samsung Electronics |  |  |  |
| Lei Zhou | New H3C |  |  |  |
| Gabor Bajko | Mediatek |  |  |  |
| Shuang Fan | Sanechips |  |  |  |
| Lili Hervieu | CableLabs |  |  |  |
| Hanqing Lou | InterDigital |  |  |  |
| Jeongki Kim | Ofinno |  |  |  |
| Kosuke Aio | Sony Corporation |  |  |  |
| Giovanni Chisci | Qualcomm Incorporated |  |  |  |
| Binita Gupta | Cisco |  |  |  |
| Guogang Huang | Huawei |  |  |  |
| Po-Kai Huang | Intel |  |  |  |
| Mike Montemurro | Huawei |  |  |  |
| Peshal Nayak | Samsung |  |  |  |
| Jay Yang | ZTE |  |  |  |
| Yelin Yoon | LGE |  |  |  |
| Nima Namvar | Charter Communications |  |  |  |
| Ross Jian Yu | Huawei |  |  |  |
| Shawn Kim | Wilus Inc. |  |  |  |
| Yue Zhao | Huawei |  |  |  |
| Sungjin Park | LGE |  |  |  |
| Xiaofei Wang | InterDigital |  |  |  |

Abstract

This document contains Proposed Draft Text (PDT) for the Seamless Roaming feature of the proposed TGbn (UHR, Ultra High Reliability) amendment to the 802.11 standard.

**Revision information**

The following is a summary of the important changes that occurred within each revision of this document:

|  |  |
| --- | --- |
| **Revision** | **Major changes** |
| 0 | Initial revision |
| 1 | Adjusted the author list.Addressed the feedback received offline and from the reflector.Addressed the comments in 11-24-1881-00-00bn-pdt-mac-seamless-roaming-mgrAddressed the comments in 11-24-1881-00-00bn-pdt-mac-seamless-roaming\_bg\_JRW-mmAddressed the comments in 11-24-1881-00-00bn-pdt-mac-seamless-roaming-mgr+DH-mgrAddressed the comments in 11-24-1881-01-011bn-PDT-mac-seamless-roaming-v5-mgrAddressed the comments in 11-24-1881-00-00bn-pdt-mac-seamless-roaming-HGG |
| 2 | Addressed more comments from the reflector between 1/2 and 1/6/2025. |
| 3 | Addressed further comments on the reflector sent on 1/6/2025 |
| 4 | Addressed some comments discussed on the TGbn MAC 1/6/2025 and created a clean version |
| 5  | Addressed some other offline comments from some TTT members. Tracking changes are wrt to R4 of this document.Mainly moved the “DL data forwarding” out to the section 37.12.6 |
| 6 | A clean version of R5 |

**Introduction**

Interpretation of a Motion to Adopt.

A motion to approve this submission means that the editing instructions and any changed or added material are actioned in the TGbe Draft. The abstract, revision information, introduction, explanation of the proposed changes and references sections are not part of the adopted material.

***Editing instructions formatted like this are intended to be copied into the TGbe Draft (i.e. they are instructions to the 802.11 editor on how to merge the text with the baseline documents).***

**Explanation of the proposed changes:**

The proposed changes to the 802.11 TGbn draft within this document are based on the following motions adopted by the TGbn task group:

**Relevant passing motions:**

All the passing motions up to and including those in the 2024 November IEEE 802 Plenary Session (see [1]).

[Motion #2, [1]]

Move to add the following text to the TGbn SFD

* + 11bn defines a mechanism that enables a non-AP MLD to roam from one AP MLD to another AP MLD and the non-AP MLD remains in state 4 (see 11.3) during and after roaming to the other AP MLD

[Motion #26, [1]]

Move to add the following text to the TGbn SFD:

* Define in 11bn that when a non-AP MLD is in the process of roaming from the current AP MLD to a target AP MLD, the context related to the non-AP MLD is transferred to the target AP MLD such that it preserves the data exchange context for the non-AP MLD or the context can be renegotiated with the target AP MLD
	+ Details on what context can be transferred and what context can be renegotiated are TBD
	+ How to transfer the context is TBD.

[Motion #27, [1]]

Move to add the following text to the TGbn SFD:

* As part of the seamless roaming procedure, during roaming,
	+ after the request/response exchange that initiates notification of the DS mapping change from the current AP MLD to the target AP MLD,
		- The current AP MLD may deliver buffered DL data frames for a TBD period of time.
		- The non-AP MLD may retrieve buffered DL data frames from the current AP MLD
		- The non-AP MLD may send UL data to target AP MLD.
		- It is assumed that the target AP MLD is able to deliver data frames to non-AP MLD after the DS mapping change
	+ The current AP MLD may forward DL data to the target AP MLD.
		- When and how to initiate the forwarding of DL data is TBD

[Motion #44, [1]]

Move to add to the TGbn SFD the following:

* Define a request frame sent by a non-AP MLD in state 4 to initiate the roaming procedure
* The roaming procedure performs context transfer to the target AP MLD and perform the necessary changes of the DS mapping from the current AP MLD to the target AP MLD
* Define a response frame sent to the non-AP MLD to indicate readiness for the non-AP MLD to send class 3 frames to the target AP MLD
* TBD on data transmission from non-AP MLD to current AP MLD during the request/response frame exchange
* NOTE – What context is transferred is TBD.
* NOTE – TBD on which request/response frame to use

[Motion #162, [1]]

Move to add to the TGbn SFD the following:

* As part of seamless roaming procedure, before the request/response exchange requesting the roaming transition from a current AP MLD to a target AP MLD, a roaming preparation procedure can be performed that includes:
* Transfer or renegotiation of the context to a target AP MLD, and
* Setting up the link(s) with a target AP MLD.
* Details on what context can be transferred or renegotiated is TBD

**Text to be adopted begins here.**

***TGbn editor: Please add the following new subclause 37.12 Seamless Roaming to the 802.11bn draft D0.1:***

**37.12 Seamless Roaming**

[Editorial note: the following text assumes the TBD Request frame is sent to the serving AP MLD and the TBD Response frame is received from the serving AP MLD because that is the simplest interpretation of Motion #44. There have been some proposals/discussions the non-AP MLD may need to send the TBD Request frame to the target AP MLD directly. Will need to revise the following text if those turn into Motions].

[Editorial note: the term “Seamless Roaming” may need to be updated to be more aligned with 802.11 spec language (e.g., Seamless BSS transition)]

**37.12.1 General [M#2]**

Seamless roaming is a mechanism for a non-AP MLD to transition from its current AP MLD to a target AP MLD that minimizes the time during which connectivity between the non-AP MLD and the DS is lost. By using this mechanism, the non-AP MLD remains in State 4 of association during the transition while preserving the context for data transmission for a seamless experience. [Editorial note: need further clarification on which peer entity that State 4 is referring to since there are the current AP MLD and the target AP MLD]

[Editorial note: to be done - A description of the framework is required here (or in Clause 4).

[Editorial note: to be done - A definition of the components that take part in the transition process. Note that this may change the names of the components in the sections below.

**37.12.2 Roaming preparation procedure [M#162]**

When a non-AP MLD uses Seamless roaming to transition from the current AP MLD to a target AP MLD, roaming preparation procedure may be performed before performing the roaming execution procedure that is described in 37.12.3 (Roaming execution procedure). The roaming preparation procedure consists of:

* Transfer of the context (see 37.12.4 (Context)) related to the non-AP MLD from the current AP MLD to the target AP MLD or the renegotiation of the context with the target AP MLD (see 37.x.4 (Context)). The context that can be transferred or renegotiated in this procedure is defined in 37.12.4 (Context).
* Setting up the link(s) with the target AP MLD.
* Details on what context can be transferred or renegotiated is TBD

[Editorial note: how the renegotiation and link setup are done are TBD]

**37.12.3 Roaming execution procedure [M#27, 44]**

When a non-AP MLD uses Seamless roaming to transition from the current AP MLD to a target AP MLD, the non-AP MLD shall send a TBD Request frame to the current AP MLD. The current AP MLD may transmit individually addressed downlink Data frames to the non-AP MLD for a period of TBD time. The period of TBD time starts from the time the TBD Response frame is received. If the non-AP MLD chooses to receive the individually addressed buffered downlink Data frames from the current AP MLD, it may do so for a period of TBD time.

After receiving the TBD Request frame:

* The current AP MLD shall transfer the context (see 37.12.4 (Context)) that is required for enabling operations with the target AP MLD. The context that can be transferred or renegotiated in this procedure is defined in 37.12.4 (Context).
* The current AP MLD shall send a TBD Response frame to the non-AP MLD after the transfer or renegotiation of the context is completed.

The non-AP MLD shall not transmit Class 3 frames to the target AP MLD until it has received the TBD Response frame sent by the current AP MLD.

After the TBD Request and Response frame exchange, if necessary and if the DS is not already notified about the update of the destination mapping for the non-AP MLD, the DS is notified about the update of the destination mapping for the non-AP MLD[M#44].

**37.12.4 Context [M#26]**

[Content TBD: a place holder for what context can be transferred or renegotiated.]

**37.12.5 DL data transmission [M#27]**

[Content TBD: a place holder for details on DL data transmission.]

**37.12.6 Data forwarding [M#27]**

As part of Seamless roaming, the current AP MLD may forward DL data to the target AP MLD (when and how to initiate the forwarding of DL data is TBD).

**Text to be adopted ends here.**

**References:**

1. [11-24-0171r20](https://mentor.ieee.org/802.11/dcn/24/11-24-0171-20-00bn-tgbn-motions-list-part-1.pptx): 11-24-0171-20-00bn-tgbn-motions-list-part-1, Alfred Asterjadhi (Qualcomm Inc.)