Project	**IEEE 802.16 Broadband Wireless Access Working Group <http://ieee802.org/16>**
Title	**Coexistence of Fixed and Mobile Services**
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Re:	The document is submitted in response to “Call for Contributions on Project 802.16e: Mobility Enhancements to IEEE Standard 802.16/802.16a” (IEEE 802.16e-02/01)
Abstract	The document contains suggestions on additions to 802.16/802.16 OFDM/OFDMA MAC to implement the handover procedure
Purpose	The document is submitted for consideration in IEEE 802.16 WG
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Coexistence of Fixed and Mobile Services

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1. Acronyms

DL	Downlink
DL-MAP	Downlink MAP message
FDD	Frequency Division Duplex
IE	Information Element (e.g. of MAP message)
MS	Mobile Station ("mobile" SS)
OFDM	Orthogonal Frequency Division Multiplexing
OFDMA	Orthogonal Frequency Division Multiple Access
SS	Subscriber Station
TDD	Time Division Duplex
UL	Uplink
UL-MAP	Uplink MAP message

References

[1] IEEE P802.16/D5-2001 IEEE Draft Standard for Local and Metropolitan Area Networks – Part 16: Air Interface for Fixed Broadband Wireless Access Systems, 2001-10-18

[2] IEEE P802.16a/D7-2002 Draft Amendment to IEEE Standard for Local and Metropolitan Area Networks Part 16: Air Interface for Fixed Broadband Wireless Access Systems –Medium Access Control Modifications and Additional Physical Layer Specifications for 2-11 GHz, 2002-11-17

2. Document's Goal

The goal of this document is to suggest a method for radio channel sharing among transmissions performed using different PHY technologies: 1) 802.16a OFDM/OFDMA ("fixed" technology) and 2) future 802.16e (or "mobile" technology). Note that in the case "mobile" communications use not the same frequency channel(s) as "fixed" communications, the structure of the frame may be the same as the structure described in [1] [2] for the corresponding PHY options.

It is assumed that the same BS controller takes care of allocating both "fixed" and "mobile" resources. The idea is in time interleaving of "fixed" frames & "mobile" frames.

3. Frame Structure

3.1. TDD

This method is suitable for both OFDM and OFDMA (see Figure 1). The following are features suggested for implementation of time interleaving

- Time axis is divided into *superframes* of fixed length and within a superframe one or several frames of each type (fixed/mobile) appear
- Superframe starts from "fixed" preamble, DL frame prefix and a burst carrying DL-MAP and UL-MAP messages. The prefix and MAP messages have the same structure as specified in [1] , [2]
- "Fixed" transmissions leave gaps for embedding of "mobile" transmissions into the superframe
- Order of "fixed" and "mobile" DL and UL subframes can be either sequential as at Figure 1 or interlaced, for example: F-DL|M-DL|F-UL|M-UL. Note that the sequential mode provides more flexibility, for example superframes of the form F-DL|F-UL|M-DL|M-UL|M-DL|M-UL may appear that potentially decreases system latency. On the other hand, interlaced mode provides better support for synchronization of DL/UL subframes of base stations that is important for TDD.
- "Mobile" frame contains its own DL-MAP and UL-MAP that specify DL and UL allocations
- Partitioning of superframe period between "fixed" and "mobile" is flexible i.e. may change from one superframe to another. As a consequence, "mobile" frames are of variable size
- For the sake of initial synchronization, either "fixed" DL Frame Prefix or "fixed" DL-MAP may point to the start of nearest "mobile" frame.

The following picture describes an example of interleaving of "fixed" frames and "mobile" frames with one "mobile" frame contained by "fixed" frame. For each PHY type separated DL and UL subframes are allocated denoted as "F-DL", "F-UL" (fixed) and "M-DL", "M-UL" (mobile). "Fixed" versions of DL-MAP / UL-MAP messages are those described in [1] [2] . The same structure of named messaged may be suitable also for "mobile" (depends on pending PHY definition). Presence of "mobile" should be taken in account by the BS's scheduler that should implicitly allocate gaps in "fixed" frames for "mobile" activity.

Initial synchronization to downlink for MS ("mobile" SS) starts from the acquisition of DL preamble of the "mobile" frame; then the DL Frame prefix and then DL-MAP should be received and decoded. Additional gain can be reached using repetition of DL preamble of "fixed" part; then the MS synchronizes onto "fixed" portion of DL, receives from "fixed" Dl-MAP information on "mobile" frame offset and starts receiving "mobile" DL subframes.

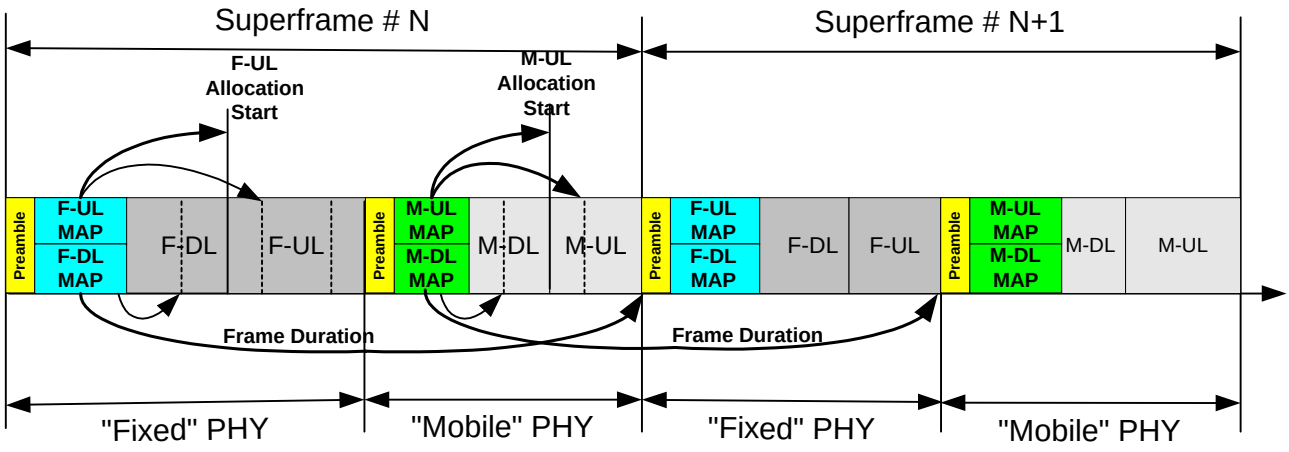

Figure 1. Coexistence of "Fixed" and "Mobile": Frame Structure for TDD

3.2. FDD

This method is suitable for both OFDM and OFDMA.

The following picture describes time interleaving of “fixed” frames & “mobile” frames. For each PHY type separated DL and UL subframes are allocated denoted as “F-DL”, “F-UL” (fixed) and “M-DL”, “M-UL” (mobile). No change in DL-MAP / UL-MAP messages is required for “fixed”. The same structure of named messaged may be suitable also for “mobile” (depends on pending PHY definition) Presence of “mobile” should be taken in account by the BS’s scheduler.

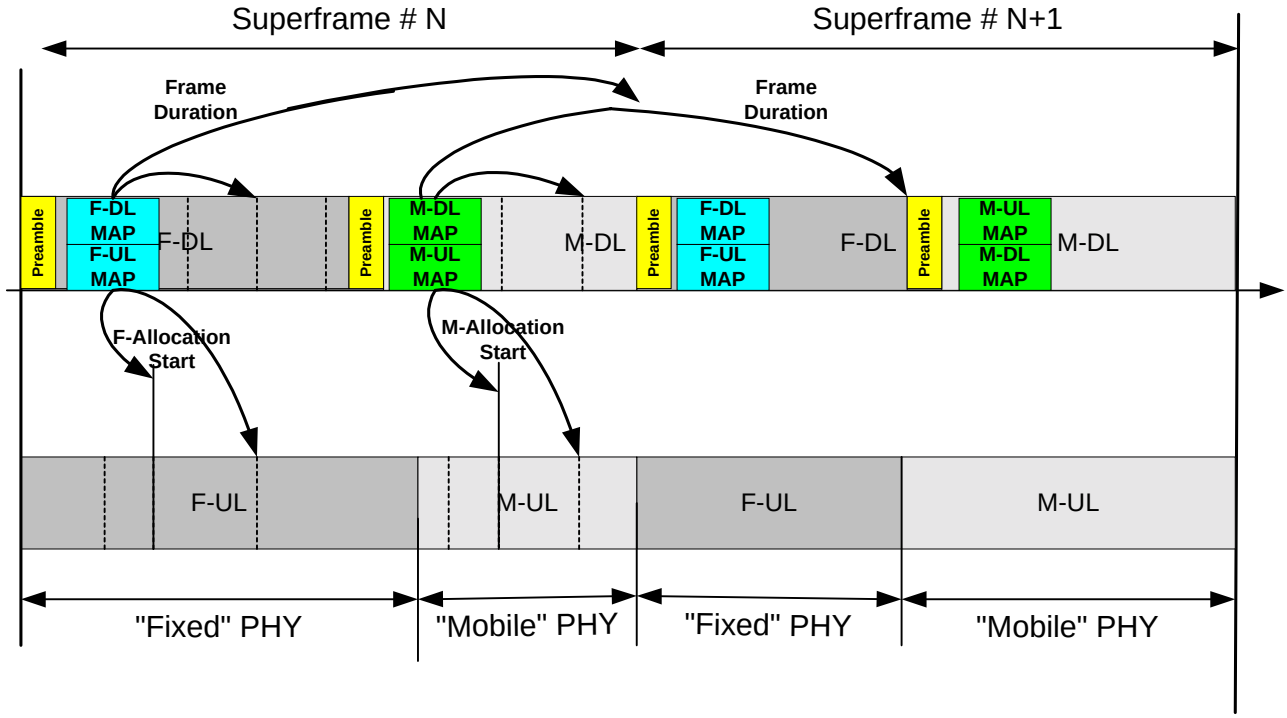

Figure 2. Coexistence of "Fixed" and "Mobile": Frame Structure for FDD

Note 1. As an option, UL transmissions may appear in another order: F-UL|M-UL that will provide better conditions for half duplex MSs.

Note 2. As opposite to Figure 2 allocation example, MAP messages may point not to the same frame where they are transmitted but to the start of the next frame or any other place using Allocation_Start_Time MAC function.