Project	**IEEE 802.16 Broadband Wireless Access Working Group <http://ieee802.org/16>**
Title	**Changes on 802.16e to support the flexible management of session information**
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Re:	This is a response to a Call for Comments IEEE 802.16e-04/xxx
Abstract	This document describes the limitation of the current 802.16e standard to manage flexibly session information (e.g., security information, session information, etc). This document shows as well what changes on the current text are required to support the flexible management of session information. By these changes, the 802.16e standard can achieve the performance improvement during the active handoff and can allow no limitation of BS type from product perspective.
Purpose	The document is submitted for review by 802.16e Working Group members.
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1. Introduction

This document describes the limitation of the current 802.16e standard to manage flexibly session information (e.g., security information, session information, etc).

Merits introduced by the centralized session management are described as followings:

- Low latency Handover: Since the session information is managed in the centralized manner, the delay required for re-initialization, re-association, re-authentication, and re-registration will not occurred when the SS moves across the boundary of BSs controlled and managed by the centralized session information.
- Performance improvement: Since the SS does not need to re-initialization, re-association, re-authentication and re-registration always, the overhead of MAC signaling is reduced much.
- Controlled Privacy and Security framework: Since security parameters are managed in the centralized manner, it is easy to manage these security parameters under the operator's consistent policy.

This document shows as well what changes on the current text are required to support the flexible management of session information. By these changes, the 802.16e standard can achieve the performance improvement during the active handoff and can allow no limitation of BS type from product perspective.

Simple changes first occur on the following standard texts:

- Definition enhancements of 'Basic connection' and 'Primary connection'
- Connection Type changes of ARQ-Feedback/Discard/Reset' from 'Basic' to "Primary'

2. Why session information needs to be managed/anchored?

2.1. Considerations to efficiently improved handover

2.1.1. Low latency Handover

Generally, if the SS moves the different BSs, the SS shall re-associate with new BS(target BS). At that time, there is some time for SS to be required to re-associate with new BS. In order to reduce this delay, there may be two ways; one is that the old BS transfers the session information to the new BS by inter-BS communication, the new BS use the old session information, and the other is that the old BS anchors his session information even if the SS moves to new BS.
Since the session information is managed in the centralized manner, the delay required for re-initialization, re-association, re-authentication, and re-registration will not occurred when the SS moves across the boundary of BSs controlled and managed by the centralized session information.
The process is well deployed and operated in 3G with BSC-BTS centralized architecture.

2.1.2. Performance Improvement

Since the SS does not need to re-initialization, re-association, re-authentication and re-registration always, the overhead of MAC signaling over the air is reduced much.

2.1.3. Controlled Privacy and Security framework

Since security parameters are managed in the centralized manner, it is easy to manage these security parameters under the operator's consistent policy.

2.2. Considerations for centralized BS architecture

The mechanism to anchor the session information may allow splitting MAC functions logically into two parts with a hierarchy; one is the real-time sensitive function (we called real time MAC) changes in real-time and the other is the real-time insensitive function (we called non real time MAC) does not change in real-time. This concept is similar to the IETF CAPWAP architecture to support the centralized architecture.

The non-real time MAC functions contain function for session setup or adjustment the function for SS's security like data encryption key and message authentication key, and the other function for maintain the seamless session information such as ARQ state information.
The real time MAC functions contain the function to handle most MAC messages requiring low latency and the functions for MAC PDU construction, scheduling and fragmentation.

From the control plane perspective, the non-real time MAC performs the session control and management. The real time MAC executes the link control to enable quick response to the requests from SS's. Since the most control messages are carried over the Basic CID, Primary CID and Secondary CID allocated to the SS after the successful ranging, the basic connection is terminated at the link control of the real time MAC, and the primary management connection is terminated at the session control block of the non-real time MAC.

The split of MAC enables the centralized network architecture like BSC-BTS of 3G cellular.

3. Suggested Change to the Standard

Change 1: Definition of Basic & Primary Management Connection

Definitions of basic & primary management connection in 3.6 and 3.42 should be changed as follows.

Basic connection

Old definition: "Basic Connection: Connection that is established during subscriber station (SS) initial ranging and used to transport delay-intolerant medium access control (MAC) management messages."

New definition: "Basic Connection: Connection that is established during subscriber station (SS) initial ranging and used to transport delay-tolerant medium access control (MAC) management messages and MAC management messages that might enable to maintain some session information depending on PHY."

Primary management connection

Old definition: "Primary Management Connection: A connection that is established during initial subscriber station (SS) ranging and used to transport delay-tolerant medium access control (MAC) management messages."

New definition: "Primary Management Connection: A connection that is established during initial subscriber station (SS) ranging and used to transport delay-intolerant medium access control (MAC) management messages and MAC management messages that might enable to maintain some session information not depending on PHY."

Change 2: Transport Connection for ARQ

6.4.2.3.30 ARQ Feedback message

A system supporting ARQ shall be able to receive and process the ARQ Feedback message. The ARQ Feedback message, as shown in Table 59, can be used to signal any combination of different ARQ ACKs (cumulative, selective, selective with cumulative). The message shall be sent on the appropriate primary~~basic~~ management connection.

6.4.2.3.31 ARQ Discard message

This message is applicable to ARQ-enabled connections only. The transmitter sends this message when it wants to skip a certain number of ARQ blocks. The ARQ Discard message shall be sent as a MAC management message on the primary~~basic~~ management connection of the appropriate direction.

6.4.2.3.32 ARQ Reset message

This message is applicable to ARQ-enabled connections only. The transmitter or the receiver may send this message. The message is used in a three-part dialog to reset the parent connection's ARQ transmitter and receiver state machines. The ARQ Reset messages shall be sent as a MAC management message on the primary~~basic~~ management connection of the appropriate direction. Table 61 shows the format of the Reset message.

6.4.4 ARQ mechanism

NOTE—ARQ shall not be used with the PHY specification defined in 8.1.
The ARQ mechanism is an optional part of the MAC and can be enabled on a per-connection basis. The perconnection ARQ and associated parameters shall be specified and negotiated during connection creation or change. A connection cannot have a mixture of ARQ and non-ARQ traffic. Similar to other properties of the MAC protocol the scope of a specific instance of ARQ is limited to one unidirectional connection. The ARQ feedback information can be sent as a standalone MAC management message on the appropriate primary management connection, or piggybacked on an existing connection. ARQ feedback cannot be fragmented. The implementation of ARQ is optional.

Table 14 should be replaced with:

Type	Message name	Message description	Connection
0	UCD	Uplink Channel Description	Broadcast
1	DCD	Downlink Channel Description	Broadcast
2	DL-MAP	Downlink Access Definition	Broadcast
3	UL-MAP	Uplink Access Definition	Broadcast
4	RNG-REQ	Ranging Request	Initial Ranging or Basic
5	RNG-RSP	Ranging Response	Initial Ranging or Basic
6	REG-REQ	Registration Request	Primary Management
7	REG-RSP	Registration Response	Primary Management
8	*reserved*		
9	PKM-REQ	Privacy Key Management Request	Primary Management
10	PKM-RSP	Privacy Key Management Response	Primary Management

Type	Message name	Message description	Connection
11	DSA-REQ	Dynamic Service Addition Request	Primary Management
12	DSA-RSP	Dynamic Service Addition Response	Primary Management
13	DSA-ACK	Dynamic Service Addition Acknowledge	Primary Management
14	DSC-REQ	Dynamic Service Change Request	
15	DSC-RSP	Dynamic Service Change Response	Primary Management
16	DSC-ACK	Dynamic Service Change Acknowledge	Primary Management
17	DSD-REQ	Dynamic Service Deletion Request	Primary Management
18	DSD-RSP	Dynamic Service Deletion Response	Primary Management
19		*Reserved for future use*	
20		*Reserved for future use*	
21	MCA-REQ	Multicast Assignment Request	Primary Management
22	MCA-RSP	Multicast Assignment Response	Primary Management
23	DBPC-REQ	Downlink Burst Profile Change Request	Basic
24	DBPC-RSP	Downlink Burst Profile Change Response	Basic
25	RES-CMD	Reset Command	Basic
26	SBC-REQ	SS Basic Capability Request	Basic
27	SBC-RSP	SS Basic Capability Response	Basic
28	CLK-CMD	SS network clock comparison	Broadcast
29	DREG-CMD	De/Re-register Control	Basic
30	DSX-RVD	DSx Received Message	Primary Management
31	TFTP-CPLT	Config File TFTP Complete Message	Primary Management
32	TFTP-RSP	Config File TFTP Complete Response	Primary Management
33	ARQ-Feedback	Standalone ARQ Feedback	~~Basic~~**Primary Management**
34	ARQ-Discard	ARQ Discard message	~~Basic~~ **Primary Management**
35	ARQ-Reset	ARQ Reset message	~~Basic~~ **Primary Management**
36	REP-REQ	Channel measurement Report Request	Basic
37	REP-RSP	Channel measurement Report Response	Basic
38 -255	Reserved		