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Re:	This contribution is response to call for contribution about IEEE 802.16e-D3
Abstract	This document proposes the scheme enhancing scanning and association operation with SCAN-REQ/RSP
Purpose	Discuss and adapt proposed text and message format.
Notice	
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Patent Policy and Procedures	

Enhancement of Scanning and Association using SCAN-REQ/RSP

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1. Problem Statement

Currently, in many ways, MSS can get information about neighbor BS and measure SINR value of neighbor BS. MSS can get informed of neighbor BS with NBR-ADV message or by scanning another frequency directly. And MSS can measure SINR during scan interval or sleep interval without interruption of service with serving BS. According to the measured SINR values, it can decide whether it handover another BS or not. Further, MSS can get advantage expediting handover process using association with neighbor BS. Association is the process of pre-calibrating parameters required for ranging with neighbor BS. When MSS decide to hand over, MSS can try association with neighbor BS before actual handoff. After association, MSS begin actual handoff process with transmitting MOB-MSSHO-REQ. Therefore we can regard association process as the pre-handoff procedure and fast association process shall effect fast handoff completion after deciding handoff.

However, at current draft 802.16e-D3, there is no specific procedure for association during Scan Interval. In addition, the MSS does not get assistance from serving BS and should access to target BS through random access during scan interval despite negotiation with serving BS for allocation of scan interval.

A MSS may try to make association with as many as candidate Target BSs during the short Scan Interval, it is crucial that the Target BS allows fast access to MSS in order to minimize delay time for association.

Our proposed solution can enhance the association process faster than previous algorithm using random access and we can get advantage that actual handoff time will be shortened after MSS's decision of handoff. And our solution can prevent MSS from trying association to inappropriate neighbor BS which cannot support continuous services as serving BS provides currently.

Since serving BS can negotiate with target BS for assigning fast_ranging_IE, we can get advantage using only redundant resource of target BS to make handoff procedure easy.

2. Proposed Remedy

2.1 Enhancement of Scanning

We propose to include Neighbor BS list in MOB_SCN-REQ message to indicate the target BSs that Serving BS recommend MSS to scan. Since the MSS should perform Scanning operation within a limited time, MOB_SCN-RSP message needs to include recommend neighbor BS list in order not to waste time for Scanning inappropriate neighbor BS.

2.2 Association Procedure during scanning interval

We propose fast access scheme for association operation in order to allow MSS to fast access to target BS during Scan Interval. Since a MSS in association procedure tries to access to target BS by initial ranging that takes unexpected time, it sometimes may fail to associate with target BS within a limited Scan Interval. Therefore, we need to allow MSS to use fast-ranging in order to finish association within a limited Scan Interval.

A modified MOB_SCN-REQ and MOB_SCN-RSP message are proposed to enhance MSS's operation of association for Scan Interval. ASC-Notification and ASC-Notification-RSP backbone messages are also proposed to inform target BSs of the information of MSS.

A MSS trying association can access to target BS through fast UL ranging IE provided by Target Neighbor BS. This case is the same as handoff case with above proposed messages and scenario.

- MOB_SCN-REQ

  This message includes Scan type field to indicate whether a MSS requests Scanning or Association. A serving BS may understand what operation the MSS requests and inform the target BSs of that the MSS is going to try association based on Scan Type field value. It also includes Target BS lists to report which BSs the MSS tries to associate with.

- MOB_SCN-RSP

  This message includes also Scan Type filed as MOB_SCN-REQ. This field may indicate which operation the Serving BS allows to the MSS. When a serving BS order a MSS to associate with target BSs, it is able to transmit unsolicited MOB_SCN-RSP message to a MSS. In this case, the BS can indicate whether the BS oders scanning or association. It also includes Target BS-ID that the Serving BS recommends a MSS for association.

- ASC-Notification

  ASC_Notification is used to inform Target BS of MSSs, which try to make association with Target BS, so that Target BS may assign fast UL ranging IE.. The goal of ASC-Notification is the same as HO_pre-notification message.

- ASC-Notification-RSP

Target BS may response to ASC-Notification with reserved BW and QoS resources of BS. The purpose of this message is the same as HO_Pre-Notification-RSP

3. Proposed Text Changes
6.3.2.3.51 Scanning Interval Allocation Request (MOB-SCN-REQ) message
[Modify Table 92e in Page 22, Line 1 – MOB-SCN-REQ Message format as follows]

A MOB-SCN-REQ message may be transmitted by an MSS to request a scanning interval for the purpose of seeking neighbor BS, and determining their suitability as targets for HO. An MSS may perform scanning with Scan_Type = 0, or association with Scan_Type = 1.
An MSS shall generate MOB-SCN-REQ messages in the format shown in Table 92e:

Table 92e --- MOB-SCN-REQ Message Format

Syntax	Size	Notes
MOB-SCN-REQ_Message_Format() {		
Management message type = 50		
Scan Duration	12 bits	Units are frame
Scan Type	1 bit	[0] Scanning [1] Association
Reserved	3 bits	
For(j=0; j<N_Recommended; j++) {		N_Recommended can be derived from the known length of the MAC message
Neighbor BS-ID	48 bits	Target BS-ID for association
}		
}		

The following parameters shall be included in the MOB-SCN-REQ message,
> **Scan Duration**
>> Duration (in units of frames) of the requested scanning period.
> **Scan Type**
>> Operation that a MSS intend to during Scanning Interval
> **Neighbor BS-ID**
>> Target BS list for Scanning if Scan_Type=0 or target BS list for association if Scan_Type=1.

6.3.2.3.51 Scanning Interval Allocation Response (MOB-SCN-RSP) message
[Modify Table 92e in Page 22, Line 1 – MOB-SCN-RSP Message format as follows]

A MOB-SCN-RSP message shall be transmitted by the BS in response to an MOB-SCN-REQ message sent by an MSS. In addition, BS may send an unsolicited MOB_SCN_RSP. If a BS transmits a unsolicited MOB_SCN_RSP, Scan_Type should set to '0' for scanning and '1' for association to indicate which operation the BS intends to. Neighbor BS Lists is also included in MOB_SCN-RSP message to indicate which Neighbor BS are recommended for MSS to scan. If the BS allow Association (Scan_Type=1), at most of the cases only one Target BS is recommended in the neighbor BS list. The message shall be transmitted on the basic CID.
The format of the MOB-SCN-RSP message is depicted in Table 92f[S1].

Table 92f --- MOB-SCN-RSP Message Format

Syntax	Size	Notes
MOB-SCN-REQ_Message_Format() {		
Management message type = 51	8 bits	
CID	16 bits	Basic CID of the MSS
Duration	12 bits	Units are frame
Start Frame	4 bits	
Scan_Type	1 bit	[0] Scanning [1] Association
Reserved	7 bits	
For(j=0; j<N_Recommended; j++) {		N_Recommended can be derived from the length field in the MAC header of the message
Neighbor BS-ID	48 bits	
}		
}		

The following parameters shall be included in the MOB-SCN-RSP message:

CID
Basic CID of the MSS that have sent MOB-SCN-REQ message.

Duration
Duration (in units of frames) where the MSS may scan for neighbor BS.

Start Frame
Measured from the frame in which this message was received. A value of zero means that it
will start in the next frame.

Scan Type
0 : The BS allows Scanning operation requested by MOB_SCN-REQ or lets an MSS perform scanning neighbor BS
1 : The BS allows Association operation requested by MOB_SCN-REQ or lets an MSS perform association with
Neighbor BS during Scanning Interval

Neighbor BS-ID
Recommended target BS list for Scanning if Scan_Type=0 and target BS-ID for association if Scan_Type=1.

Figure E.2—Example BS advertisement and scanning (with association) by MSS request
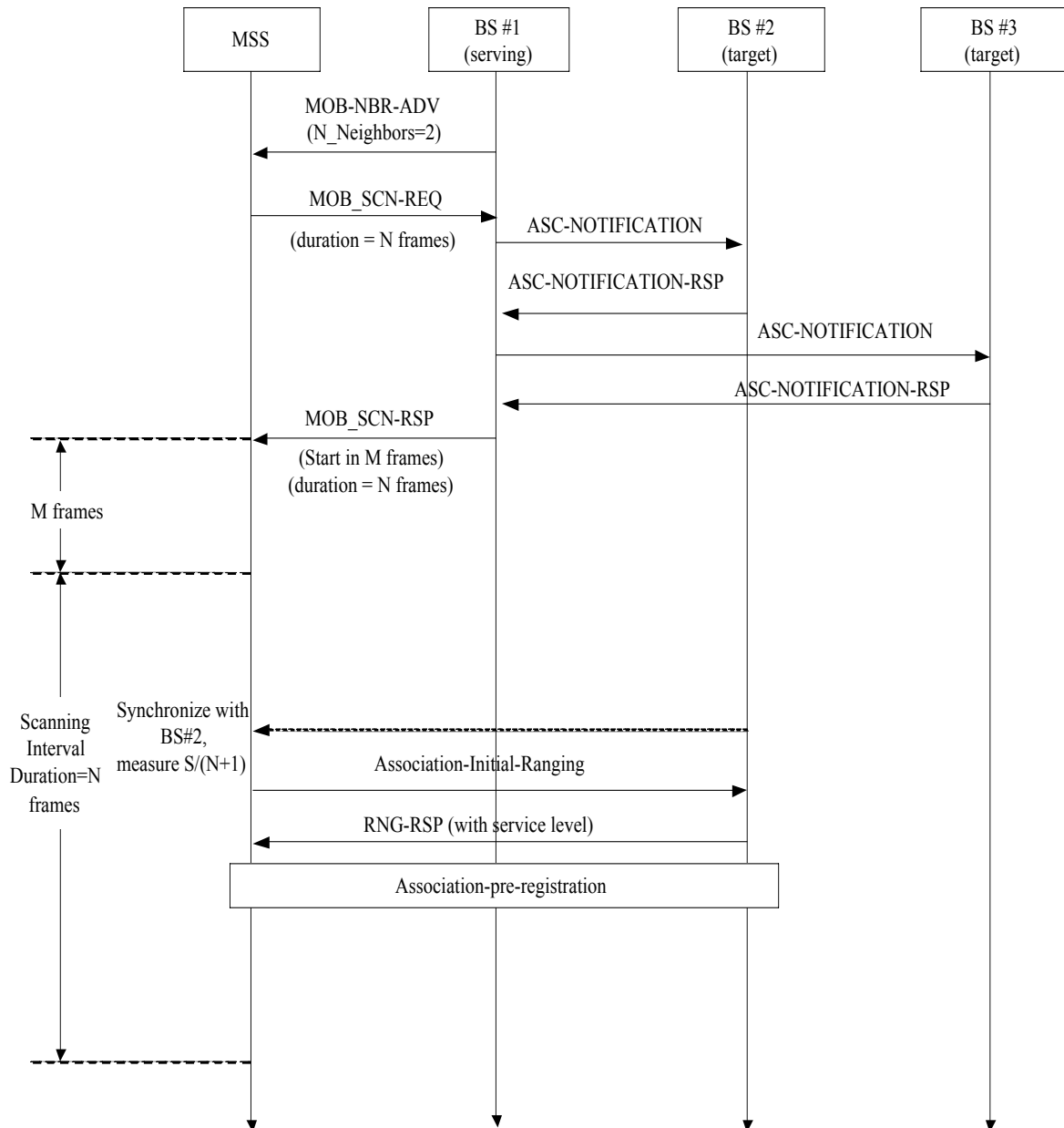
D.2.11 Association-notification (ASC-NOTIFICATION) message

This message is sent from one BS to another BS, typically to request information about a MSS. Typically the message will be sent as a reaction to reception of a MOB_SCN-REQ message with Scan_Type=1 or in cases where a BSS is trying to order a MSS to make association.

The message contains the following information

Field	Size	Notes
Global Header	152 bits	
For (j=0; j<Num_Records;j++){	8 bits	
MSS unique ID	16 bits	Basic CID of the MSS

Estimated time to start Association	12 bits	Units are frame
Required BW	4 bits	
For (i=0; i<Num_SFID_Records: i++){		Number of SFID records can be derived from the length field in MAC header of message
SFID	32 bits	
For(u=0;u<Num_QoS_Records;i++) {		
Required QoS	variable	
}		
}		
}		
Security Field	TBD	

D.2.11 Association-notification response (ASC-NOTIFICATION-RSP) message

This message is sent from one BS to another BS, typically in response to a SCN-NOTIFICATION message. It does inform the BS of the level of service the MSS could expect when it associate. The message contains the following information

Field	Size	Notes
Global Header	152 bits	
For (j=0; j<Num_Records;j++){	8 bits	Num Records can be derived from the length fields in the MAC header of the message
MSS unique ID	48bits	MAC Address of the MSS
BW estimated	8 bits	
QoS estimated	variable	
}		
Security Field	TBD	