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Re:	Call for inputs for commentary of p802.16e/D1
Abstract	This contribution describes handover in idle mode for IEEE P802.16e/D1-2004.
Purpose	Discuss and Adopt enhanced feature of p802.16e/D1
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Idle hand over & Location Update in 802.16e.

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Problem Statements

Absence of a light handover process

By adopting idle mode in the 802.16e standard, we can simplify the handover and location update procedures of a MSS in idle mode. While in performing the handover in idle mode, the MSS is only required to receive new configuration messages without transacting with the BS. In addition, the MSS may register the location information if needed. Comparing to handovers taken place in awake or sleep mode, the MSS and BS does not require exchanging handover related MAC messages. The BS can efficiently allocate CIDs because assigned CIDs to the MSS can be reused immediately as soon as the BS and MSS enter to idle mode.

In this document, we introduce an efficient idle handover in order to reduce the handover budget. This proposal shall also provide an idle handover determination algorithm. In addition, it also introduces location update procedures to support the mobility while the MSS stays in idle mode.

Overview of Proposed Solutions

The MSS in idle mode shall periodically search for the strongest cell on the corresponding frequency. An idle handover occurs when an MSS in idle mode moves from the coverage area of the current serving BS to the coverage area of another BS. The MSS scanning neighbor BSs according to neighbor BS information in MOB_NBR-ADV. During idle mode, the MSS shall update the neighbor set whenever it detects that the **MOB_NBR-ADV** message is changed.

After performing the idle handover, the MSS shall discard all unnecessary messages received in the broadcast CID of the old serving BS. The MSS shall start Normal Operation of idle mode with a new serving BS and perform the Location Registration if needed.

If the MSS discovers that a new serving BS doses not support idle mode, the MSS shall perform the network re-entry and initialization procedures to transit its mode to awake mode.

During the idle handover, the MSS shall perform location registration operation if the registration condition is met. Through the Location Registration, the MSS notifies the BS of its location, the paging parameters and other characteristics. The MSS informs the BS of its location so that the BS can efficiently page the MSS when the BS has a message to transmit to the MSS.

Here, we propose two location registration scheme, the zone-based registration and the timer-based registration.

Zone-based registration means that the MSS perform location registration either when it receives a paging message from the BS to perform the zone-based registration or when the packet zone is changed as a result of the idle handover. At this time, as the zone identifier, PZONE_ID in **MOB_NBR-ADV** message is used.

Timer-based registration means that the MSS perform location registration when a specified timer expired. That timer value is received from the BS and the BS can enable or disable timer-based registration

On both the zone-based registration and the timer-based registration, the MSS shall inform the BS of its previous packet zone ID using a PREV_PZONE_ID of the **MOB_LU-REQ** message.

Proposed Changes in Document

Accept following section as whole

6.4.18.4 Idle handover in idle mode

An idle handover occurs when an MSS in idle mode moves from the coverage area of the current serving BS to the coverage area of another BS. The MSS in idle mode shall periodically search for the strongest cell on the corresponding frequency. And while in idle mode, the MSS shall update the neighbor set whenever it detects that the **MOB_NBR-ADV** message is changed. If the MSS determine that one BS of the neighbor set is sufficiently stronger than a serving BS, the MSS shall perform the idle handover procedure. If the MSS performs the handover in idle mode, it is called the idle handover.

While performing the idle handover, the MSS shall monitor all frames temporarily in order to rec-eive **UCD, DCD,** and **MOB_NBR-ADV** messages on the broadcast CID transmitted by the neighbor BS. After receiving all these messages, the MSS shall resume the periodic monitoring operation.

During the idle handover procedure, the MSS shall receive **MOB_NBR-ADV** messages of a new serving BS and then the MSS shall update handover related parameters.

After performing the idle handover, the MSS shall discard all unnecessary messages received in the broadcast CID of the old serving BS. The MSS shall start Normal Operation of idle mode with a new serving BS and, if needed, it perform the Location Registration using MOB_LU-REQ/RSP messages.

The Figure shows the overview of performing the idle handover from BS1 to BS2.

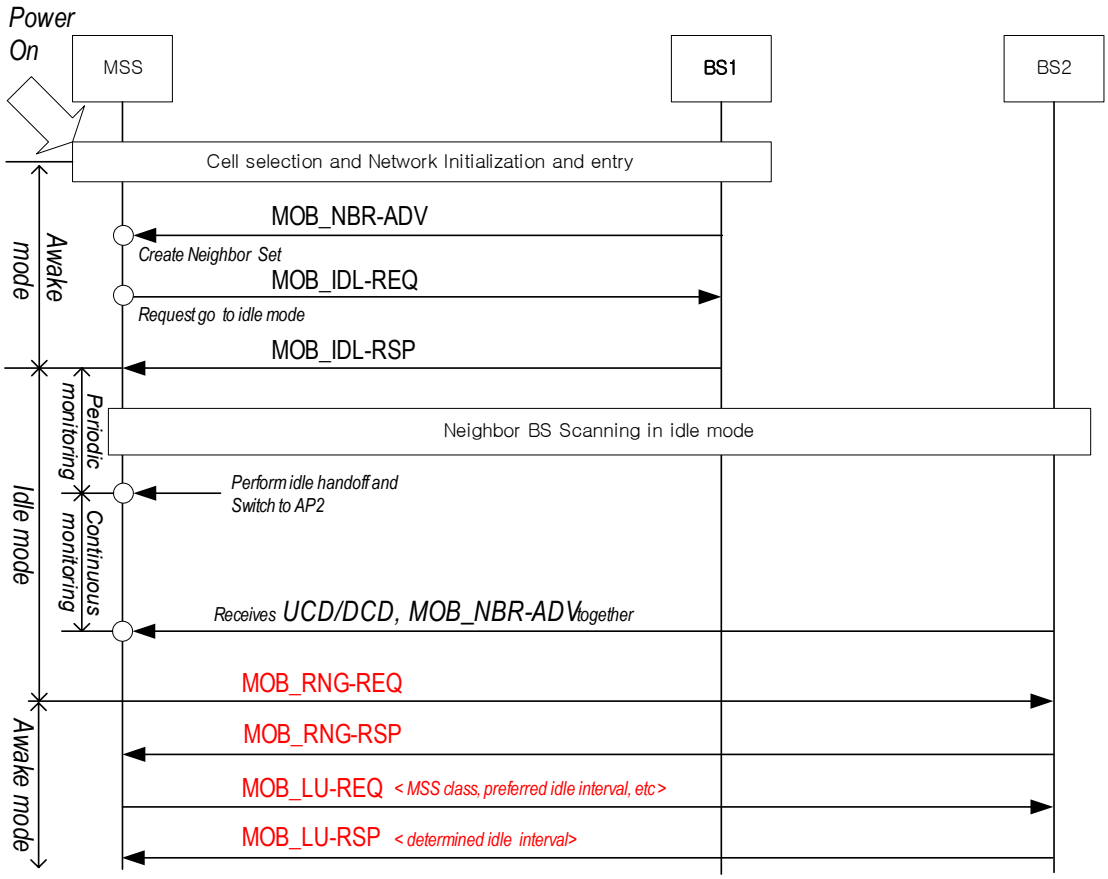

Figure XX. Idle Handover Procedure

If the MSS discovers that a new serving BS doses not support idle mode, the MSS shall perform t-he network re-entry and initialization procedures to transit its mode to awake mode.

If the MSS moves around the boundary of two or more cells frequently, multiple idle handovers should take place accordingly. To prevent such an undesirable side effects or to reduce the ping-pong effe-cts, the MSS is prohibited to perform successive idle handover within a specified time interval using an idle handover timer, called *a guard timer*. This timer can guarantee the MSS and the BS to perform only one idle handover within an appropriate time without any interruptions or ambiguity of handover destinations. If another idle handover is required before the timer is expired, the MSS ignores the newly generat-ed idle handover request. After a successful idle handover, the timer is reset. The BS broadcast the *guard timer* using IH_GUARD field of a **MOB_NBR-ADV** message

6.4.18.4.1 Location registration procedure in idle mode

During idle handover, if the MSS is triggered to operate for location update, before transmitting MOB_LU-REQ message, MSS start initial ranging procedure with new serving BS. And after obtain BCID, the MSS transmit MOB_LU-REQ message with BCID. After successful location update, the new serving BS may release BCID of the MSS and the MSS return to idle mode. Through the Location regist-ration, the MSS notifies the BS of its location, the paging parameters and other characteristics. The MSS informs the BS of its location so that the BS can efficiently page the MSS when the BS has a message to transmit to the MSS.

6.4.18.4.1.1 Zone-based registration

The MSS perform the zone-based registration either when it receives a paging message from the BS to perform the zone-based registration or when the packet zone is changed as a result of the idle han-dover. Each packet zone has its own zone identifier, PZONE_ID that is broadcasted in the **MOB_NBR-ADV** message. Geographically, a packet zone can consists of one or more cells.

The BS may update the location registration of the MSS either on the inside module or on the external Location server and the location information will be used to page MSS terminated message at a later time.

6.4.18.4.1.2 Timer-based registration

Upon entering idle mode, the BS can enable or disable the MSS to register the location when a sp-ecified timer expires. The BS shall inform the MSS of timer-based registration capability using the TB_REGI_REQUIRED field of the **MOB_IDL-RSP** message. A value of the timer is set to the TB_REGI_INDEX field of the **MOB_IDL-RSP** message. The MSS shall restart this timer when re-ent-ering idle mode if the timer-based registration is enabled.

The timer-based registration causes the MSS to register at regular intervals, TB_REGI_INT-ERVAL. If the MSS detects that it has to perform the zone-based registration and the timer-based registration simultaneously, the MSS shall perform the zone-based registration and ignore the timer-based registration.

The MSS shall compute the timer expiration count as

$$TB\_REGI\_INTEVAL = 2^{i} \times T$$

, where *i* is REST_INTERVAL_INDEX and T is the TB_REGI_INDEX.

The TB_REGI_INTERVAL is an integral multiple of the REST_INTERVAL and so the MSS can increment the timer-based registration counter every specified multiple of REST_INTERVAL frames. The counter is reset when the timer is restarted.

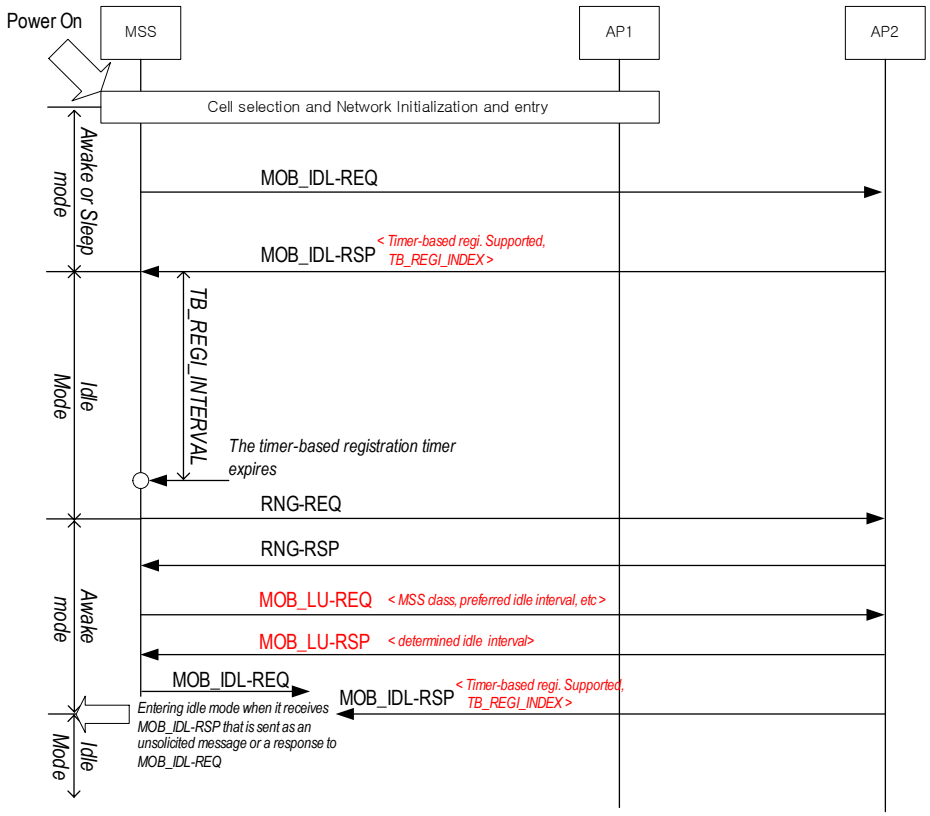

Figure XX. Timer Based Location Update Procedure

Modify following TLV elements

6.4.2.3 MAC Management Messages

Table 14b. MAC Management Messages

Type	Message Name	Message Description	Connection
??	MOB_IDL-REQ	Idle request message	Basic
??	MOB_IDL-RSP	Idle response message	Basic
??	MOB_LU-REQ	Location update request message	Primary
??	MOB_LU-RSP	Location update response message	Primary
38, 57-255		Reserved	

6.4.2.3.57 Location Update Request (MOB_LU-REQ) Message

MSS supporting idle-mode uses the **MOB_LU-REQ** message to request permission from the BS to update its location. The **MOB_LU-RSP** message is sent from the MSS to the BS on the MSS's primary CID.

Table XX.MOB_LU-REQ Message Format

Syntax	Size	Notes
MOB_LU-REQ_Message_Format() {		
Management message type = ??	8 bits	
MSS class	4bits	Refer to REG-REQ
PREF_REST_INTERVAL_INDEX	4 bits	
PREV_PZONE_ID		
}		

Parameters shall be as follows:

PREF_REST_INTERVAL_INDEX

MSS preferred rest interval index. the BS may accept it or propose a different value through a MOB_LU-RSP message

PREV_PZONE_ID

Previous packet zone ID. This is a packet zone ID of a previous serving cell as a result of the last idle handover.

6.4.2.3.58 Location Update Response (MOB_LU-RSP) Message

The MOB_LU-RSP message shall be sent form BS to a MSS on the MSS's primary CID in response to an MOB_LU-REQ message. The MSS shall enter idle-mode using the parameters in the message. In the case where idle is denied (After-REQ-action = 1), it is recommended that the BS provide unsolicited MOB_IDL-RSP message.

Table XX. LR-RSP Message Format

Syntax	Size	Notes
MOB_LU-RSP_Message_Format() {		
Management message type = ??	8 bits	
LU approved	1bits	0 : Location update failed 1 : Location update succeed
If(LU approved == 0){		
After-REQ-action	1 bit	0: The MSS may retransmit the MOB_LU-REQ after the time duration (REQ-duration) given by the BS in this message 1: The MSS shall not retransmit the MOB_LU-REQ and shall wait the MOB_LU-RSP from the BS.
REQ-duration	4 bits	Time duration for case where After-REQ-action value is 000.
Reserved	2 bits	
} else{		
SEL_REST_INTERVAL_INDEX	4 bits	
TB_REGI_REQUIRED	1 bits	Timer-base registration required 0 : non-required 1 : required
if(TB_REGI_REQUIRED)		
{		
TB_REGI_INDEX	8bits	0 : reserved 1~255
}		
Reserved	2 bits	
}		
}		

Parameters shall be as follows:

LU approved

The activation indicator of the MSS when the MSS receives this message from the BS.

After-REQ-action

On MSS request to update its location rejected by the BS, indicate recourse action.

REQ-duration

Waiting value for the MOB_LU-REQ message re-transmission (measured in frames)

SEL_REST_INTERVAL_INDEX

Final Rest interval index (measured in frames). The MSS can only accept or reject it.