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Title	**Keep Alive Mechanism For Session Information Management**
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Re:	Response to IEEE 802.16-04/19 (Recirculation Ballot #14a Announcement)
Abstract	In order to minimize the session information which are inactive for long time, Keep Alive mechanism is introduced. After configured number of unresponsiveness to Keep Alive message, BS purges inactive session information to optimal utilize the session information storage.
Purpose	Discuss and Adopt as the session information management mechanism
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Keep Alive Mechanism for Session Information Management

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1. Problem Statements

Current IEEE 802.16d/e standard does not specify session information purge procedure. Previously, main target of 802.16 was fixed broadband wireless access and session purging procedure caused by mobility was not considered. During the traversal(or handoff), target BS may retrieves session information from source BS and may requests to source BS to purge all the session related information. But if the target BS somehow does not get source BS ID from MSS, or MSS does not request source BS to purge all the session information before traversal, then session information will not be purged by BS. Inactive session information grows over time and may cause system failure due to database drainage if appropriate measure is not taken.

2. Overview of Proposed Solution

To differentiate between connection and session, *session* is defined as below. Session is established when registration is complete, but to extensively define all the shared-information between MSS and BS, information obtained after registration procedure like Service Flow Parameters, IP Address are also included in Session Information.

connection: A unidirectional mapping between base station (BS) and subscriber station (SS) medium access control (MAC) peers for the purpose of transporting a service flow's traffic. Connections are identified by a connection identifier (CID). All traffic is carried on a connection, even for service flows that implement connectionless protocols, such as Internet Protocol (IP).

Session: A session refers to a shared state between the BS and MSS and it is established after registration is complete. Session information includes Basic CID, Primary Management CID, Secondary Management CID, Security Association, MSS capabilities, MAC Address. Transport CID, Service Flow Parameters, IP Address of SS, NAI etc also are included in session information.

The MSS and BS shall monitor the traffic flowing on the downlink connection and uplink connection, respectively, directed to-or-from the MSS. If either the MSS or the BS detects a period of inactivity of at least *Session Close Time/ Number of KeepAlive* minutes, it may send a KeepAliveRequest message. The recipient of the message shall respond by sending the KeepAliveResponse message. When a KeepAliveResponse message is received, the recipient shall not send another KeepAliveRequest message for at least *Session Close Time/Number of KeepAlive* minutes. If either the MSS or the BS does not detect any traffic from the other-side directed to it for a period of at least *Session Close Time* minutes, it shall purge the session information of that MSS and all the other information related with the MSS. If the value *of Session Close Time* is set to zero, the MSS and BS shall not send or expect keep-alive messages, and shall disable the transitions occurring as a consequence of not receiving these messages.

Name	Length	Description
Session Close Time	2 byte	Default is 2880, that is 48 hours. 0 means disable keepAlive messages; all other values are in minutes.
Number of KeepAlive	1 byte	Default is 3.

3. Proposed Changes to IEEE 802.16e/D2

3.1 Option 1-Addition of New messages *KeepAlive*

3.Definitions

[Add the following text to section 3:]

3.2 Session:

A session refers to a shared state between the BS and MSS and it is established after registration is complete. Session information includes Basic CID, Primary Management CID, Secondary Management CID, Security Association, MSS capabilities, MAC Address. Transport CID, Service Flow Parameters, IP Address of SS, NAI etc also are included in session information.

[Add the following after 6.3.21 MSS Idle Mode]

6.3.22 Session Information Management

A session is established when registration is complete, and session information includes Basic CID, Primary Management CID, Secondary Management CID, Security Association, MSS capabilities, MAC Address. But information obtained after registration procedure like Service Flow Parameters, IP Address are also referred to as session information.

The MSS and BS shall monitor the traffic flowing on the downlink connection and uplink connection, respectively, directed to-or-from the MSS. If either the MSS or the BS detects a period of inactivity of at least *Session Close Time/ Number of KeepAlive* minutes, it may send a KeepAliveRequest message. The recipient of the message shall respond by sending the KeepAliveResponse message. When a KeepAliveResponse message is received, the recipient shall not send another KeepAliveRequest message for at least *Session Close Time/Number of KeepAlive* minutes and extend the *Session Close Time* with *Session Close Time/Number of KeepAlive* minutes. If either the MSS or the BS does not detect any traffic from the other-side directed to it for a period of at least *Session Close Time* minutes, it shall purge the session information of that MSS and other information related with the MSS. If the value of *Session Close Time* is set to zero, the MSS and BS shall not send or expect keep-alive messages, and shall disable the transitions occurring as a consequence of not receiving these messages.

[in Section 6.3.2.3 MAC Management messages]

[Change Table 14a as shown]

Type	Message	Message Description	Connection
60	MOB-HO-IND	HO indication message	basic
61	KA-REQ	KeepAlive request message	primary
62	KA-RSP	KeepAlive response message	primary
~~61~~63-255	*reserved*		

[Add the following after 6.3.2.3.58 BS Broadcast Paging(MOB_PAG-ADV) message]

6.3.2.3.59 KeepAlive request(KA-REQ) message

This message is sent when either the MSS or the BS detects a period of inactivity of at least *Session Close Time/ Number of KeepAlive* minutes.

Table 1 KA-REQ message format

Syntax	Size	Notes
KeepAlive_Message_Format(){		
Management Message Type = 61	8 bits	
Transaction ID	16 bits	
TLV Encoded Attributes	Variable	TLV specific

}		

6.3.2.3.60 KeepAlive response(KA-RSP) message

This message is sent when either the MSS or the BS receives KeepAlive request message. When a KeepAliveResponse message is received, the recipient shall not send another KeepAliveRequest message for at least *Session Close Time/Number of KeepAlive* minutes.

Table 2 KA-RSP message format

Syntax	Size	Notes
KeepAlive_Message_Format(){		
Management Message Type = 62	8 bits	
Transaction ID	16 bits	
Confirmation Code	8 bits	
TLV Encoded Attributes	Variable	TLV specific
}		

11.7 **REG-REQ/RSP management message encodings**

[Insert immediately before the start of section 11.8]

11.7.11 Keep Alive parameters

11.7.11.1 Session Close Time

The value of this field specifies the inactivity period, in minutes, after which both the MSS and the BS purges the session information related with the MSS.

Type	Length	Value	Scope
20	2	Default is 2880, that is 48 hours. 0 means disable keepAlive messages; all other values are in minutes.	REG-RSP

11.7.11.2 Number of KeepAlive

The value of this field specifies the number of times KeepAlive messages shall be sent during Session Close Time.

Type	Length	Value	Scope
21	1	Default is 3.	REG-RSP

[Change 12.1.1.4.8 as shown]

12.1.1.4.8 REG-RSP

— Secondary Management CID
— Uplink CID Support
— Vendor ID Encoding (if present in REG-REQ)
— PKM Flow Control (if present in REG-REQ or changed from default)
— DSx Flow Control (if present in REG-REQ or changed from default)
— MCA Flow Control (if present in REG-REQ or changed from default)
— IP version (if present in REG-REQ or changed from default)
— MAC CRC support (if present in REG-REQ or changed from default)
— Multicast Polling Group CID support (if present in REG-REQ or changed from default)
— Vendor-specific information (Compound, only allowed if Vendor ID present in REG-REQ, and extensions provided)
— Vendor ID

— Vendor-specific extensions
— Session Close Time(default = 2880 min)
— Number of KeepAlive(default = 3)
— HMAC Tuple

3.2 Option 2-Using Exiting RNG-REQ/RSP messages for *Awake mode MSS*

6.3.22 Connection Information Management

If the T27 timer expires *Number of KeepAlive* times of successive grants without receiving RNG-REQ for awake mode MSS, it shall purge the connection information of that MSS and the connection information includes the whole information related with the MSS like security context, ARQ states, MAC address etc.

When the serving BS successfully transferred connection information to target BS and is notified the success of handoff, it may purge all the connection information of the MSS based on the local policy.

6.3.2.3.6 Ranging Response (RNG-RSP) message

[Add the following to section 6.4.2.4.6:]
When a BS sends a RNG-RSP message in response to a RNG-REQ message containing Serving BS ID, the BS may include the following TLV parameter in the RNG-RSP message:

Service Level Prediction — This value indicates the level of service the MSS can expect from this BS. The following encodings apply:

0 = No service possible for this MSS.
1 = Some service is available for one or several Service Flow authorized for the MSS.
2 = For each authorized Service Flow, a MAC connection can be established with QoS specified by the AuthorizedQoSParamSet.
3 = No service level prediction available.

Service Level prediction may be accompanied by a number of Service Flow Encodings as specified in 11.4.913 sufficient to uniquely identify the AuthorizedQoSParamSet associated with the predicting SLP. If Service Flow Encodings are included, then the SLP response is specific to the presented AuthorizedQoSParamSet defined by the associated encodings. Included Service Flow Encodings are restricted to the following parameters only:

— Global Service Class Name
— Service Flow QoS parameter set encodings as defined in 11.13 such that the combination of Global Service Class Name and any Service Flow modifying parameters fully defines an AuthorizedQoSParamSet profile being assessed
— Service Flow Identifier

If individual AuthorizedQoSParamSet profiles are provided for multiple Service Level Predictions, then each Service Level Prediction is specific to its associated AuthorizedQoSParamSet profile and shall include only response options ‘0’ or ‘2’.

Number of KeepAlive
When T27 timer expires *Number of KeepAlive* times of successive grants without receiving RNG-REQ, BS shall purge the connection information of that MSS.

11.5 RNG-RSP TLV for re-establishment of Service Flows

[Add the following rows to table 320:]

Table 318a-RNG-RSP Message Encodings

Name	Type(1 byte)	Length	Value
QoS Parameters	[145/146].Variable	Variable	Compound TLV incorporating one or more 11.13 QoS Paramater Set definition encodings
SFID	[145/146].1	4	
Resource Retain Flag	20		This value indicates whether the former Serving BS retains the connection information of the MSS. 0 = the connection information for the MSS is deleted 1 = the connection information fo the MSS is r
Number of KeepAlive	8	1	Number of T27 expiration of successive grants allowed until session information purge