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Re:	Task Group Review of Working Group Draft P802.16h/D2b
Abstract	There are many messages in current P802.16h/D2 which require SS send message to its neighbor BS. But BS may not correctly receive an uplink burst without performing ranging procedure. So we propose BS schedule Inter-system communication time slot for SS. Before send any message to neighbor BS, SS should perform ranging procedure using scheduled Inter-system communication time slot.
Purpose	To solve the problem that neighbor BS can't receive a burst from foreign SS without performing ranging procedure.
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A Method to Implement the Inter-system Communication over Air

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Introduction

To make the intersystem communication over the air work, SSs in the overlapped area of two BSs must be choose as relays or forwarders. These SSs can receive DL messages from source BS and destination BS and/or source BS and destination BS can receive UL messages from forward SSs. These SSs are in the interference area of two BSs.

One mechanism uses CXCC for intersystem communication over the air. In this mechanism, CXP messages are sent by serving BS to serving forward SS/SSs during normal operation period. Then forward SSs/SS forwards these messages to foreign BS during CXCC period. Or forward SS/SSs receives CXP messages from foreign BS during CXCC period, then forwards these messages to its/their serving BS. Using this mechanism, forward SS/SSs doesn't access to neighbor BS.

Since the forward SS/SSs doesn't access to neighbor BS. The UL transmission is scheduled by serving BS. The main problem is that neighbor BS doesn't know another BS's UL schedule and it doesn't know foreign SS basic CID which is allocated by foreign SS's serving BS.

So another mechanism is proposed by C802.16h-07/027 [5] during section #48 and during section #49, TG discussed this issues again which is proposed by C802.16h-07/054 [6] and accepted the idea. But the text proposed by C802.16h-07/027 is not included in the newest working document [1]. Because TG has accepted many comments and contributions since section #48, it is necessary to rewrite the text proposed in C802.16h-07/027 based on the latest LE TG working document [1]. This is the main purpose of this contribution. And anther purpose of this contribution is further discussing two intersystem communication mechanisms.

Comparisons of two intersystem communication mechanisms over the air

Following table gives the comparisons between two mechanisms.

Table 1 Comparisons of two intersystem communication mechanisms over the air

	Forward SS/SSs don't access foreign BS	**Forward SS/SSs access foreign BS as Fowarder or Relay**
Intersystem messages transmission period	Use CXCC DL: Once at least 64 frames UL: Once at least 64 frames	Using every BS's master subframes/frames DL: Once every 4 frames UL: Once every 4 frames
Backward compatibility	DL: Synchronize PHY and decode MAC messages in one frame -> higher requirement to SS	Back compatible except SS should maintenance the timing and context of both BSs.

	UL: additional PHY modification is requested for SS send UL messages to foreign BS.	And ranging with neighbor BS is OK since 16e[4] has accepted similar procedure- association procedure.
Performance	DL: synchronize PHY and decode MAC messages in one frame UL: without ranging Worse performance. (Forwarding SSs are always at the edge of BS)	DL: Can use periodic preamble to DL synchronization UL: ranging Better performance.
Complexity	Higher synchronization and decoding requirements. Additional UL PHY modification.	SS should maintenance the timing and context of both BSs.
Suitable to	Un-emergency, repeated messages, such as BSD BS sends message to foreign SS, and foreign SS forwards this messages to its serving BS.	Emergency, dedicated messages BS sends message to foreign SS, and foreign SS forwards this messages to its serving BS. And serving BS sends message to serving SS, and serving SS forwards this message to foreign BS.

Proposed Text

6.3.2.3 MAC management messages

[Insert the following rows into Table-14]

Table 14 MAC management message

Type	Message Name	Message Description	Connection
67	BSD	Base Station Descriptor	Broadcast
68	SSURF	SS Uplink RF Descriptor	Basic
~~69~~	~~ADPD~~	~~Advertisement Discovery Policy Descriptor~~	~~Multicast~~
~~70~~	~~ADV-REQ~~	~~Advertisement Request~~	~~Broadcast~~
~~71~~	~~Notification~~	~~Notify whether the relaying SS completes the CTCXP operations~~	~~Basic~~
~~72~~	~~ADV-RSP~~	~~Advertisement Response~~	~~Basic~~
~~73~~	~~RA-REQ~~	~~Resource Allocation Request~~	~~Basic~~
~~74~~	~~RA-RSP~~	~~Resource Allocation Response~~	~~Basic~~
~~75~~	~~ACK~~ ~~*[*Editor's notes: the*~~	~~The offeror BS acknowledges the correct reception of RA_RSP message~~	~~Basic~~

	~~*name of the CT message should be specific]*~~		
~~76~~69	BS_CCID_REQ	Base Station Co-Channel Interference Detection Indication	Basic
~~77~~70	BS_CCID_RSP	Base Station Co-Channel Interference Detection Response	Basic
~~78~~71	CXP-REQ-MAC	Coexistence Protocol Request MAC message	Broadcast or Basic or Multicast
~~79~~72	CXP-RSP-MAC	Coexistence Protocol Response MAC message	Broadcast or Basic
73	ACCESS-NBS-REQ	Access neighbor BS requirement message	Basic
74	ACCESS-NBS-RSP	Access neighbor BS response message	Basic
75	FORWARD-END-REQ	Forward end request message	Basic
~~82~~76-255	Reserved		

[Add a section 6.3.2.3.73 as indicate:]

6.3.2.3.73 Access Neighbor BS Request message (ACCESS-NBS-REQ)

This message is send by BS to its serving SS to request this SS to access neighbor BS during neighbor BS's master sub-frame as a forward SS. After receiving this message, SS tries to access neighbor BS as forward SS during the neighbor BS's master sub-frame.

ACCESS-NBR-REQ message may include the following parameters:

Neighbor BSID: The BSID of neighbor BS which serving BS request SS to access to.
Master sub-frame index of neighbor BS: The master sub-frame index of the requested neighbor BS.

Table 108al ACCESS-NBS-REQ message format

Syntax	**Size**	**Notes**
ACCESS-NBR-REQ_message_Format() {		
Management Message Type =73	8bits	
Neighbor BSID	48bits	The BSID of Neighbor BS which SS will access to.
Master sub-frame index of neighbor BSID	2bits	The master sub-frame index of neighbor BSID. The requested SS will try to access to neighbor BSID during this sub-frame.
Padding Nibble	6bits	Padding to reach byte boundary.
}		

[Add a section 6.3.2.3.74 as indicate:]

6.3.2.3.74 Access Neighbor BS Response message (ACCESS-NBS-RSP)

After receiving the ACCESS-NBR-REQ message from serving BS, SS tries to access neighbor BS as forward SS during the neighbor BS's master sub-frame. SS uses ACCESS-NBS-RSP to report the serving BS if it can access neighbor BS successfully.

ACCESS-NBR-RSP message may include the following parameters:

BSID of neighbor BS: The BSID of neighbor BS which the SS accesses to.
Result of access procedure: Indicate if SS has successfully access to requested neighbor BS.

Table 108am ACCESS-NBS-RSP message format

Syntax	**Size**	**Notes**
ACCESS-NBR-RSP_message_Format() {		
Management Message Type =74	8bits	
BSID of neighbor BS	48bits	The BSID of Neighbor BS which SS tries to access to.
Result of access procedure	8bits	0: SS has successfully access to the requested neighbor BS >1: SS fail to access the requested neighbor BS 1: SS can't get PHY synchronization with neighbor BS 2: SS can't get MAC synchronization with neighbor BS 3: Ranging procedure failed 4: other reason
Padding Nibble	6bits	Padding to reach byte boundary.
}		

11.5 RNG-REQ Message Encodings

[Insert the following rows into Table 364:]

Table 364 RNG-REQ message encodings

Name	Type(1 byte)	Length	Value(variable length)
SS attribute	13	1	0: normal SS 1: Forward SS

15.6 Inter-system communication over air

[Move section 15.6.1 to section 15.6.2 and Add a new section 15.6.1]

15.6.1 Procedure of Inter-system communication over air

When some messages need to send to its neighbor BS over air, serving BS may select one or more SSs as forwarder between two BSs. The forward SSs are always the SSs which in the overlapped area of two BSs, that is, the interference victim SSs by neighbor BS. These SSs communicate with serving BS during the serving BS's master sub-frame and are idle during the serving BS's slave sub-frame.

System may select the forward SS according to the RSSI of neighbor BS detected by the interference victim SSs. The SSs with the higher neighbor BS RSSI may be better.

After determining the forward SS, serving BS may request forward SS to access to neighbor BS as a forwarder via Access-NBS-REQ message. Upon receiving the access neighbor BS request, forward SS will try to access neighbor BS during the master sub-frame of neighbor BS. It will try to establish synchronization with neighbor BS, obtain transmission parameter, perform ranging, negotiate basic capabilities, be authorized and exchange key, perform registration. These procedures are performed during the neighbor BS's master sub-frame and just like a normal SS network entry procedure described in section 6.3.9 except that in the RNG-REQ message, forward SS should tell its neighbor BS it communicates with neighbor via parameter "SS attribute" just for Inter-system communication and the BSID of its serving BS via parameter "serving BSID". Neighbor BS may allocate Basic CID, primary management CID and secondary management CID to the forward SS.

If the forward SS fails to access neighbor BS, it shall responses with failing access to neighbor to BS its serving BS via Access-NBS-RSP message. Serving BS will select another SS as forward SS or terminate Inter-system communication procedure over air.

If the forward SS accesses neighbor BS successfully, it shall response with success to access to neighbor BS to its serving BS via Access-NBS-RSP message. Serving BS and its neighbor BS can communicate with each via the forward SS. Forward SS will communicate with serving BS during serving BS's master sub-frame and communicate with neighbor BS during neighbor BS's master sub-frame during the intersystem communication period. Forward SS shall maintained corresponding contexts for both serving BS and neighbor BS.

Forward message request (by CXP-REQ-MAC message) may be initiated by serving BS or neighbor BS.

If the forward massage is initiated by serving BS, serving BS will send forward request message to forward SS. After receiving forward request message from serving BS, forward SS may send a response signal to its serving BS. Forward SS should ask its neighbor BS for uplink transmission opportunity and transmit messages to neighbor BS during the allocated uplink transmission resource. After receiving forward request message (by CXP-REQ-MAC message) from the forward SS, neighbor may send a response (by CXP-RSP-MAC message) to forward SS. The forward procedure initiated by neighbor BS may follow similar procedure.

Serving BS and neighbor may request forward SS forward one or more messages to neighbor. During the Inter-system communication procedure, forward SS may perform necessary ranging procedure with serving BS during serving BS's master sub-frame and ranging procedure with neighbor BS's master sub-frame as described in section 6.3.10.

When Inter-system communication ends, serving BS or neighbor may send Inter-system communication end massage to forward SS. After receiving the Inter-system communication end message, forward SS and neighbor BS may release all contexts related to Inter-system communication.

Figure below gives an example of Inter-system communication procedure.

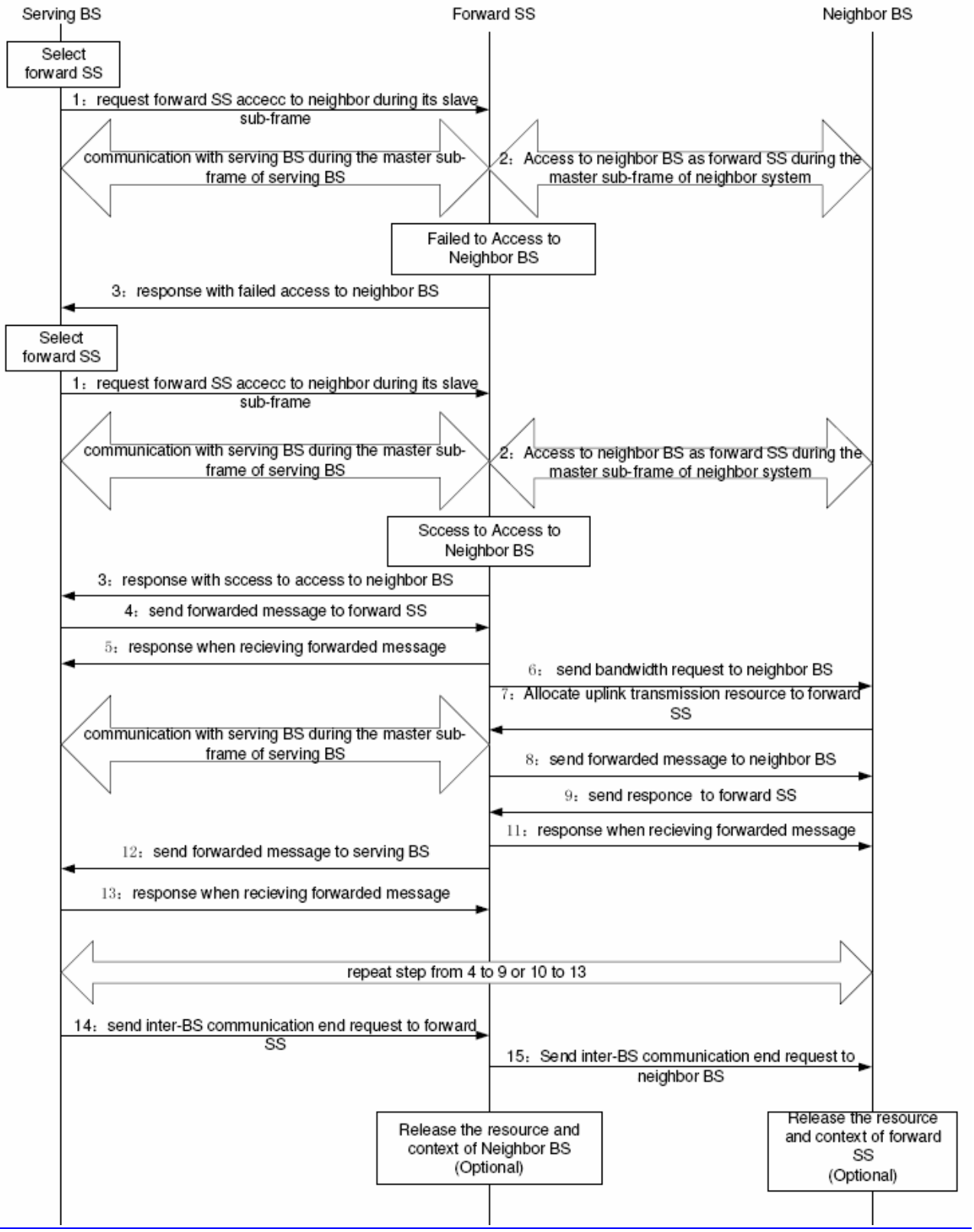

Figure hx procedure of Inter-system communication

15.6.~~1~~2 CT-CXP

Conclusion

Intersystem communication procedure over the air initial proposed by C802.16h-07/027 [5] during section #48 and was accepted by TG during section #49 by C802.16h-07/054 [6] and accepted the idea. But the text proposed by C802.16h-07/027 is not included in the newest working document [1]. This contribution proposes the text to support intersystem communication procedure over the air initial proposed by C802.16h-07/027 [5] based on the latest LE TG working document [1]. This contribution also further compares two intersystem communication mechanisms.

Reference

[1] IEEE 802.16h-D2b: Air Interface for Fixed and Mobile Broadband Wireless Access Systems: Amendment for Improved Coexistence Mechanisms for License-Exempt Operation
[2] C802.16h-07/006, Procedures for inter-system communication over the air
[3] IEEE 802.16-2004: Air Interface for Fixed Broadband Wireless Access Systems
[4] IEEE 802.16-2005: Air Interface for Fixed Broadband Wireless Access Systems: Amendment 2: Physical Media Access Control Layers for combined fixed and mobile operation in license band
[5] C802.16h-07/027, A method to implement Inter-system communication over air
[6] C802.16h-07/045, Scheduling master sub-frame/frame for coexistence messages transmission