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Re:	Re-circulation ballot of P802.16g/D7
Abstract	Improve the efficiency, flexibility, robustness and
Purpose	Adoption of the proposed text changes
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SII Broadcast Improvement

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Motivation

The current NSP request/response mechanism is unnecessary complex, badly documented and inefficient as it may generate unnecessary (partial) network entries by MS' looking for a network.

NSP TLVs should be communicated through DCD messages, rather than through the SII-ADV and SBC-REQ/RSP messages. That is much simpler for both the MS and the BS, it is more in line with the current network entry procedures and it is more flexible as it makes it possible for a BS to inform an MS of its' neighbours NSPs (through the MOB_NBR-ADV and the DCD settings TLV).

The next section elaborates on the problems with the current mechanism, followed by the proposed solution. The final section lists the proposed changes to the document.

Problems

1) There is no description of when an MS should or is allowed to request NSP information by means of an SBC-REQ message. Should it start this (partial) network entry immediately after it has received DCD and UCD messages or should it wait until an unspecified amount of time after the messages are available? Note that if an MS starts this procedure immediately after reception of DCD and UCD (which is optimal for the MS in terms of scanning/network entry delay) that this effectively makes it useless to have the SII-ADV broadcast period be any longer than the DCD and UCD transmission periods!

2) The draft does not state whether an MS that is in the process of requesting SII information (by performing a partial network entry) is allowed to continue this procedure upon reception of an (unsolicited) SII-ADV message. This may cause unnecessary network load. Especially when a BS or network goes down because of failure, all MSs that were attached to that BS/network (even those in Idle Mode!) will start looking for other networks. In case they do receive DCD and UCD messages but no SII-ADV information, they may all start network entry procedures at the same time, thus overloading their neighbor networks, even if none of the MSs is allowed to enter those networks.

3) The draft currently states in Section 6.3.2.3.24: "The following parameters shall be included when solicited in the SBC-REQ message, unless there are no NSP Ids to be included in the NSP List TLV, and unless the BS constructs and transmits an SII-ADV message including the NSP List TLV and NSP Change Count TLV contemporaneously with SBC-RSP:" Since there is no capability bit in any message that allows the MS and BS to communicate whether or not they support the SII functionality, if an MS sends a SBC-REQ and receives a SBC-RSP without SII TLVs, it cannot tell whether the BS does not support SII, whether it had no SII information or whether it has actually sent an SII-ADV message instead but the MS failed to receive it. An MS may decide to re-transmit the SBC-REQ multiple times in order to be sure that it didn't fail to receive such information in case it did not receive any SII information upon request. Obviously this causes a lot of unnecessary load.

4) The current mechanism is unnecessarily complex. The mechanism has significant state-machine impact on both the BS and the MS because of the coupling of scanning and basic capability negotiation. For the BS it means that it cannot safely use network entry optimizations such as providing unsolicited BW to an MS in the network entry phase as any MS may decide to abort the net entry based on reasons unknown to the BS. For the MS it means it has to keep (yet another) set of BS-specific information with its own change count value and the associated potential synchronization problems.

5) The mechanism may cause an MS to perform network entry procedures with numerous BS before finding its

preferred network. This increases the load on networks (that aren't even going to service the MS) and increases the network entry delay for the MS.

6) The current mechanism allows a BS to provide information about its NSPs, but it does not specify anything about the BS' neighbors. Do all BS from the same NAP serve the same NSPs? The draft does not provide any guidance, so an MS must assume they may serve different NSPs meaning it has to perform the same potentially lengthy SII procedure with all BSs, even when they use the same Operator ID!

7) Since the SBC-RSP is sent on the Basic Management CID it cannot be fragmented. Any increase of its size will therefore reduce robustness of this message.

Proposed solution

The proposed solution is to remove the SII-ADV message, and remove the SIQ and NSP List and NSP Change Count TLVs from the SBC-REQ and RSP messages and instead add the NSP List TLV to the DCD message. Obviously this increases the size of the DCD message, but the DCD message is already quite large so the additional overhead is relatively low, especially with a small number of NSPs. Furthermore, the DCD message can be fragmented so the robustness of the message can be guaranteed even if it is quite large.

An MS that is scanning for NAPIDs has to wait for DCD messages when a BS uses compressed MAPs. Adding the NSPs to the DCD therefore does increase network entry delay or add any complexity to BS or MS. Furthermore, since the MS needs the DCD in order to enter the network there is no need for capability negotiation of SII features: the DCD simply includes the NSP TLVs or it doesn't.

Finally, since the difference of neighbor BS' DCD TLVs can be indicated through MOB_NBR-ADV messages without additional complexity, this proposed solution makes it possible for an MS to know neighbor BS' information without waiting for NSP information.

The SII-ADV message has a fixed overhead of 10 bytes (GMH, Management Message Type and NSP count TLV). So if the periodicity of the SII-ADV message is the same as the DCD periodicity, the DCD version (as proposed in this document) is always more efficient.

The DCD and UCD intervals are primarily driven by the need to reduce overhead (larger interval is better) and the need to reduce network entry delay (smaller interval is better). The SII-ADV interval will be driven by the same needs. The only reason that the SII interval in the current draft can be larger than the DCD interval is that an MS may request the SII information by means of a (partial) network entry.

However, one single partial network entry by an MS costs (not counting CDMA code and DL/ULMAP IE overhead; also not counting possible retries due to reception errors), at least 87 additional bytes of overhead[1].

The following Tables show the amount of overhead for the DCD approach (as suggested in this document) compared to the SII-ADV approach (as suggested in the current draft), for periodicities of the SII-ADV messages that are three times (Table 1) and two times as large as that of the DCD message (and thus neglecting problems 1 and 3 from the previous section).

[1] CDMA code RNG-RSP = GMH+MMT+reserved field+status TLV+ranging code attributes TLV (not including any adjustments) = 17 bytes
RNG-REQ = GMH+MMT+reserved field+MAC version TLV+MAC Address TLV = 19 bytes
REQ reply RNG-RSP = GMH+MMT+reserved field+status TLV+Basic CID TLV+ Primary CID TLV+MAC Address TLV (not including any adjustments) = 25 bytes
SBC-REQ = GMH+MMT+SIQ TLV + param set TLV (absolute bare minimum!!!) = 13 bytes
SBC-RSP = GMH+MMT+NSP count TLV + param set TLV (absolute bare minimum, not counting NSP List TLV!!!) = 13 bytes

Table 1 Comparison of overhead caused by SII in case SII-ADV period is three times the DCD period for the following cases:
1)proposed DCD based solution,
2) current SII-ADV solution, no MS performing net entry
3) current SII-ADV solution with one MS performing network entry

Number of NSPs	0	1	2	3	4	5	6	7	8	9
1) DCD	0	15	24	33	42	51	60	69	78	87
2) SII-ADV	10[2]	15	18	21	24	27	30	33	36	39
3) SII-ADV + netentry	102+87	117	123	129	135	141	147	153	159	165

Table 2 Comparison of overhead caused by SII in case SII-ADV period is two times the DCD period for the following cases:
1)proposed DCD based solution,
2) current SII-ADV solution, no MS performing net entry
3) current SII-ADV solution with one MS performing network entry

Number of NSPs	0	1	2	3	4	5	6	7	8	9
1) DCD	0	10	16	22	28	34	40	46	52	58
2) SII-ADV	102	15	18	21	24	27	30	33	36	39
3) SII-ADV + netentry	102+87	117	123	129	135	141	147	153	159	165

As can be seen the additional overhead of the DCD approach as suggested in this document is limited, especially for smaller number of NSPs. In case problem 1 is taken into account and the SII-ADV interval is (almost) equal to the DCD interval itself, the DCD approach is more efficient in all cases. Furthermore, one single MS actively requesting NSP information offsets all potential gains of the SII-ADV mechanism.

When all the problems in the previous section are taken into account, it is obvious that the problems and risks of the SII-ADV mechanism do not justify its complexity.

Proposed changes

Remove Section 6.3.2.3.63 (SII-ADV message, page 17).

[2] SII-ADV would probably not be sent in this case, but this has unknown MS behavior as result, see problem 3.

Remove Section 11.1.8.2 (NSP Change Count TLV, page 27).

Remove Section 11.8.9 (SIQ TLV, page 32).

In Section 10.1, Table 342, page 24, remove the line containing “SII-ADV interval”.

Change scope of the NSP List TLV (11.1.8.1, page 27) to DCD only; change the section number of 11.1.8.1. to 11.4.3 and remove 11.1.8. Add the following note to that section: "In case NSP TLV is not present in DCD, the only NSPID that is available is equal to the NAPID (Operator ID)".

Remove the line “Service Information Query” from Section 6.3.2.3.23 (page 16).

Remove section 6.3.2.3.24 (page 16) from this draft (i.e. remove currently captured proposed changes).

Remove “SII-ADV” from the scope field of Section 11.1.9.1 (page 28).

Remove “SII-ADV” from the scope field of Section 11.1.9.2 (page 28).

Remove “SII-ADV” from the scope field of 11.1.9.5 (page 29).