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Title:	**Remaining issues of on demand SI**
Agenda Item:	**10.4.1.6.6**
Document for:	**Discussion and Decision**

1. Introduction & Background

During the last few RAN2 meetings, details of on demand SI acquisition mechnism were discussed and some progress was made. However, there are still some remaining issues to be addressed.

In this paper, we fouce on the following issues:

- Need of additional SI transmission indication;

- Granularity of SI requested;

- Msg3/Msg4 contents for Msg3 based SI request approach.

2. Discussion

2.1. Need of additional SI transmission Indication

In the January 2017 RAN2 adhoc meeting, one issue of additional SI transmission Indication is identified as following:

> Agreements related to SI provided by broadcast
> **……**
> 3: The scheduling information for other SI includes SIB type, validity information, periodicity, and SI-window information in minimum SI irrespective of whether other SI is periodically broadcasted or provided on demand. FFS Whether there is an additional indication that an on demand SI is actually being broadcast at this instant in time.

The additional indicator intends to depress the redundant SI request from one UE if the broadcast of the concerned SI has already been triggered by another UE. Obviously, the indicator reduces the load of RACH and UE power consumption. However, it has the drawback that the UE is required to read the additional indicator before sending the SI request. But please note that doesn't mean UE always has to perform extra SI reading for the indicator before sending SI request. In most cases, UE attempts to obtain all the interested SI when it enters a new cell, i.e. UE obtains the scheduling information in RMSI first, and then decide whether to send SI request according to additional indicator in the scheduling information. Since UE anyway needs to obtain the RMSI while entering a new cell, the acquisition of the additional indicator leads almost no impact to UE.

Hence, we think the advantages of the additional indicator outweigh the disadvantages. We prefer to introduce the additional indication. Given the minimum granularity of SI broadcasting is one SI message, we propose:

Proposal 1: There is one additional indication per on demand SI message, which indicates whether the SI message is actually being broadcast at this instant in time or not, in the scheduling information.

Clearly, the change of the above additional indication doesn't mean the content of the corresponding SI message is modified. Therefore, the change of indication, which may be frequent, should not trigger UEs to re-acquire SI.

Proposal 2: The change of the additional indication should not trigger system information modification procedure, i.e. paging.

2.2. Granularity of SI requested

In RAN2#98 meeting, it was agreed that for MSG1 based SI request, the minimum granularity of requested SI is one SI message, since the minimum granularity of network broadcasting is one SI message. In our understanding, the minimum granularity of requested SI for MSG3 based SI request method can also be one SI message for the same reason.

Proposal 3: For MSG3 based SI request, the minimum granularity of requested SI is one SI message.

For RRC_CONNECTED UE, things are different. It was agreed that the requested SI is delivered to RRC_CONNECTED UE via dedicated signaling. This means it is possible for the network to deliver only the SIBs exactly needed by the UE. Obviously, delivering SIBs is more radio resource efficient than delivering the whole SI message if not all the SIBs in the SI message are requested. It makes sense to take one SIB as the minimum granularity of the requested SI for RRC_CONNECTED UE.

Proposal 4: For SI request sent from the RRC_CONNECTED UE, the minimum granularity of requested SI is one SIB.

2.3. Msg3/Msg4 contents for Msg3 based SI request approach

In the June 2017 RAN2 adhoc meeting, some agreements for Msg3 based SI request method were reached:

Agreements for Msg3 based SI request method:
1: UE determines successful Msg3 based on reception of Msg4
FFS Details of the Msg4 content used to confirm successful Msg3. To be discussed initially CP.
2: Preamble(s) for SI request using Msg3 based Method are not reserved.
3: RRC signalling is used for SI request in Msg3.
FFS: RRC signalling how to indicate the requested SI/SIB details left to ASN.1 work.
5: Temporary C-RNTI received in Msg2 is used for Msg4 reception

Even though the detailed format of MSG3 is left to ASN.1, the content in MSG3 still needs to be agreed first.

In our understanding, MSG3 based SI request procedure is contention tolerate and requires no full contention resolution. For example, two UEs send the same preamble on the same RACH occasion to initiate the MSG3 based SI request, and the same SI messages are requested. According to the traditional understanding, this is a typical RACH collision, and can be solved by including unique UE ID in MSG3, the ID of the UE which wins the contention resolution is sent back in MSG4 to enable UE to check whether it is the winner. But in MSG3 based SI request method, we have a better choice: make both UEs' SI request procedure success, since both UEs can obtain the requested SI messages which are broadcasted and the network doesn't need to know by which UE the SI request is sent. With this in mind, the unique UE ID needs not to be included in the MSG3. With no unique UE ID in MSG3, one UE cannot decide whether received MSG4 carrying part information from MSG3 is the response to its request or to the other UE's. But one UE can confirm the SI requested by it will be broadcasted if the received MSG4 matches the MSG3 sent. Hence, we say the contention is not fully resolved. Hence, we propose

Proposal 5: Only the list of requested SI messages is included in the SI request RRC message for msg3 based SI approach, i.e. unique UE id is not included.

In the previous email discussion [1], most companies prefer to apply bitmap to indicate the requested SI messages list, since the size of MSG3 is limited. The details of the bitmap, e.g. the mapping between bit position and SI message requested can be discussed later.

Proposal 6: A BITMAP where each bit indicates whether one SI message is requested or not is included in the MSG3, given the size limitation of MSG3. Details of the BITMAP are left to ASN.1 work.

In LTE, a common MAC CE(i.e. UE Contention Resolution Identity MAC CE carring the first 6 bytes of MAC SDU in MSG3) is included in RACH MSG4 if the UE has no valid C-RNIT, no matter which RRC message is carried in MSG3. This design enables the UE MAC to identify whether it is responded by the network without understanding the high layer message. In NR, we propose to reuse the design principle, i.e. a common MSG4 format is defined to response MSG3 for UEs with no valid C-RNIT, no matter which RRC message (RRC SI request message or RRCConnectionRequest etc.) is carried in MSG3. Therefore, the details of the Msg4 content for Msg3 based SI request approach can be decided in RACH procedure, and we think reuse the format of UE Contention Resolution Identity MAC CE is a possible way.

Proposal 7: A common MSG4 format is defined to response MSG3 for UEs with no valid C-RNIT, no matter which RRC message (RRC SI request message or RRCConnectionRequest etc.) is carried in MSG3. Details of the Msg4 content for Msg3 based SI request approach can be decided in RACH procedure.

3. Conclusion

In this contribution, we discuss the remaining issues of the on demand SI and propose:

Proposal 1: There is one additional indication per on demand SI message, which indicates whether the SI message is actually being broadcast at this instant in time or not, in the scheduling information.

Proposal 2: The change of the additional indication should not trigger system information modification procedure, i.e. paging.

Proposal 3: For MSG3 based SI request, the minimum granularity of requested SI is one SI message.

Proposal 4: For SI request sent from the RRC_CONNECTED UE, the minimum granularity of requested SI is one SIB.

Proposal 5: Only the list of requested SI messages is included in the SI request RRC message for msg3 based SI approach, i.e. unique UE id is not included.

Proposal 6: A BITMAP where each bit indicates whether one SI message is requested or not is included in the MSG3, given the size limitation of MSG3. Details of the BITMAP are left to ASN.1 work.

Proposal 7: A common MSG4 format is defined to response MSG3 for UEs with no valid C-RNIT, no matter which RRC message (RRC SI request message or RRCConnectionRequest etc.) is carried in MSG3. Details of the Msg4 content for Msg3 based SI request approach can be decided in RACH procedure.

References

[1]   R2-1707090 Summary of [98#34][NR] On demand SI (Lenovo)   Lenovo, Motorola Mobility

[2]   R2-1705511 SI Request and Delivery using Msg 3 Approach Nokia, Alcatel-Lucent Shanghai Bell