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Title:	**Failure Handling for On Demand SI Acquisition Procedure**
Agenda Item:	**10.4.1.6.5**
Document for:	**Discussion and Decision**

1. Introduction

In the RAN2#97bis meeting, the following FFS has been identified：*FFS Error handing in case SI is not received*. In this paper, we discuss how to handle the on demand SI acquisition procedure failure and give our preference.

2. Discussion

2.1. Detection of SI acquisition procedure failure

It was agreed that the network broadcasts the requested SI messages after MSG1/3 based SI request is received. Hence one UE may receive the concerned SI messages even it fails to send the SI request, since the network may be triggered by other UEs to broadcast the SI messages. Therefore, the failure of RACH (e.g. the maximum number of preamble transmission is reached) during SI request transmission doesn't always lead to the SI acquisition procedure failure.

On the other hand, there is a certain probability that the UE fails to acquire the requested the SI messages, even after the reception of the SI request is acknowledged by the network, e.g. UE moves into a coverage hole while the network is broadcasting the requested SI messages. Hence,

Observation: For MSG1/3 based SI request methods, whether the SI acquisition procedure is successful can't be deduced from whether the SI request is acknowledged.

Therefore, we propose to use a straightforward way to detect the SI acquisition procedure failure in RRC, i.e. introduce a SI acquisition timer. The timer is started when RRC triggers MAC to initiate SI request transmission. If all the requested SI messages are received before the timer expires, the SI acquisition procedure is regarded as success. Otherwise, the SI acquisition procedure fails.

Proposal 1: For MSG1/MSG3 based SI request procedure, SI acquisition timer is introduced. If all the requested SI messages are received by UE RRC before the timer expires, the SI acquisition procedure is completed successfully; otherwise, the procedure fails.

Although the above discussion is based on MSG1/3 based SI request methods, we find no reason to prevent RRC_CONNECTED UE from applying the timer during on demand SI acquisition procedure. Given uniform operation between RRC_IDLE and RRC_CONNECTED UEs is also simplifying the protocol, we propose:

Proposal 2: The SI acquisition timer is also applied for on demand SI acquisition procedure initiated by RRC_CONNECTED UEs.

For the length of SI window and the repetition period of each SI message can be various from one cell to another, it may take one UE different time to acquire certain SI message in different cells. Hence it is reasonable to enable different cell to apply differnet length for the SI acquisition timer.

Clearly, the length of the timer should be signalled before one UE initiates SI request procedure, hence the length of the timer should be signalled in the minimum SI.

Proposal 3: The length of the SI acquisition timer is configurable and should be signalled in the minimum SI.

2.2. RRC re-initiate the SI request procedure

In the last RAN2 meeting, some papers proposed that the RRC can re-initiate the SI request procedure when the MSG1/MSG3 based SI request procedure is failure. The identified use cases and proposed solutions in the papers are following:

➢   Case1：After receiving the indication of RACH problem from UE MAC[1]

Proposed solution: Upon receiving the indication of RACH problem from UE MAC at a cell, UE RRC starts a prohibit timer. While the timer is running, UE RRC shall not trigger RACH procedure for SI request at the cell. After the timer is expired, if SI is still requested, UE RRC re-triggers RACH procedure for SI request at the cell. UE RRC is allowed to trigger RACH procedure at the cell up to N times. N is configured by the cell.

➢ Case2：UE fails to acquire the requested SI-Message, after receiving SI response[2]

Proposed solution: If a UE requesting on-demand SI receives Msg2, but still fails to acquire the requested SI-Message, the UE should re-initiate the request procedure (up to a maximum number of times) without applying power ramping to the Msg1 transmission.

The models of both the above solutions seem a little complex. Both solutions involves specify retransmission in two layers, i.e. MAC layer handles RACH MSG1/3 retransmission and RRC layer handles SI request procedure re-initiation. The maximum number of SI request procedure re-initiation times needs to be signaled to UE.
In our understanding, it takes a long time for the UE RRC to re-initiation the SI request procedure up to N times. In the duration, UE may want to give up the SI acquisition procedure if the SI requested is not needed any longer. Hence, it seems the UE rather than the network is more suitable to decide how many times the SI request procedure should be re-initiated. Hence, we propose when and how the SI request procedure is re-initiated is left to UE implementation.

Proposal 4: UE RRC can decide whether to re-initiate the SI request procedure after the SI acquisition procedure fails (i.e. the SI acquisition timer expires) by itself. How many times RRC can re-initiate the SI request procedure is left to UE implementation.

2.3. Handling of SI missing

For the SI which is provided on demand, the SI can be considered as missing if one UE fails to obtain the SI before the UE decides to not re-initiate SI acquisition procedure any more. Then, need we specify how to handle the missing of the SI which is provided on demand?
In LTE, how to handle the missing of essential SI is specified, while how to handle the missing of non-essential SI(equivalent to other SI in NR) is left to UE implementation. In another word, whether a specified solution to handle SI missing is need or not is mainly decided by how important the missing SI is. As the principle works well in LTE, we prefer to follow the same principle in NR. Hence, we propose.
Proposal 5: How to handle the missing of other SI for NR is left to UE implementation, no matter the related SI is provided via broadcasted periodically or on demand.

3. Conclusion

In this contribution, how to handle the on demand SI acquisition procedure failure is discussed and we propose:

Proposal 1: For MSG1/MSG3 based SI request procedure, SI acquisition timer is introduced. If all the requested SI messages are received by UE RRC before the timer expires, the SI acquisition procedure is completed successfully; otherwise, the procedure fails.

Proposal 2: The SI acquisition timer is also applied for on demand SI acquisition procedure initiated by RRC_CONNECTED UEs.

Proposal 3: The length of the SI acquisition timer is configurable and should be signalled in the minimum SI.

Proposal 4: UE RRC can decide whether to re-initiate the SI request procedure after the SI acquisition procedure fails (i.e. the SI acquisition timer expires) by itself. How many times RRC can re-initiate the SI request procedure is left to UE implementation.

Proposal 5: How to handle the missing of other SI for NR is left to UE implementation, no matter the related SI is provided via broadcasted periodically or on demand.

References

[1]   R2-1713697 Remaining issues on on-demand SI request procedure LG Electronics Inc.
[2]   R2-1712488 Open issues on On-demand SI   Ericsson