3GPP TSG-RAN WG1 Meeting #105-e R1-21xxxxx

e-Meeting, May 10th – 27th, 2021

Agenda Item: 8.5

Source: Qualcomm

Title: Email discussion/approval for the reply LS to R1-2102306

Document for: Discussion

# 1 Introduction

SA2 sent an LS (R1-2102306) to RAN1 about Scheduling Location in Advance to reduce Latency:

SA2 has technically endorsed the attached CR to TS 23.273 to support scheduling of location of a target UE in advance using a scheduled location time at which location measurements for the target UE would be obtained by the UE (in the case of DL measurements) and/or NG-RAN (in the case of UL measurements). The scheduled location time is provided by a requesting LCS Client, AF or the UE and transferred to the LMF, which then interacts with the NG-RAN and/or UE to schedule the location measurements at the scheduled location time. The resulting location (e.g. as calculated based on the location measurements by the UE or LMF) is then provided to a recipient LCS Client, AF or the target UE, depending on the type of location request. Use of a scheduled location time allows latency to be reduced since effective latency only commences at the scheduled location time and can exclude time spent prior to this for sending the location request and scheduling the location measurements.

SA2 believes that RAN1 and RAN2 may be planning to supporting a similar capability as documented in an LS sent by RAN2 to RAN1 in R2-2102125 (“LS to capture Text Proposal for TR 38.857”) which includes an attachment R2-2102124 (“Text Proposals of latency enhancements”) with the following bullet item:

- “Latency reduction related to the reporting and request of positioning assistance data (e.g., via location scheduling in advance of the time of when the location is needed)”

Accordingly, SA2 would like to **ask RAN1 and RAN2 whether support can be provided for a scheduled location time as part of Rel-17 and as defined in the attached CR to TS 23.273.** SA2 also invite RAN1 and RAN2 to provide any other comments on support of this feature which may be applicable to support in 5GC.

**To RAN1, RAN2**

**ACTION:** SA2 kindly asks RAN1 and RAN2 to provide a response to the question above once RAN1 and RAN2 are in a position to answer.

The following related contributions are related to the discussion of the LS above:

Related contributions:

1. [R1-2104643](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_105\Docs\R1-2104643.zip) Draft reply LS to SA2 on Scheduling Location in Advance Qualcomm Incorporated
2. [R1-2105937](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_105\Docs\R1-2105937.zip) Discussion on scheduling location in advance to reduce latency Huawei, HiSilicon
3. R1-2104362 Discussion on latency enhancement for NR positioning vivo
4. R1-2104674 Enhancements for Latency Improvements for Positioning Qualcomm Incorporated
5. R1-2104908 NR Positioning Latency Reduction Intel Corporation

During the preparation phase it was identified to perform an Email Discussion/Approval during this meeting.

# Background of the SA2 LS

In some scenarios, a UE, LCS Client or AF that is requesting the location of a target UE may know a time at which the location should be obtained. Some examples of this are as follows.

- Periodic Location: With a periodic deferred 5GC-MT-LR, the location of a UE is obtained at fixed periodic intervals. Clearly, the location time is then known in advance.

- IIot Location: In a factory or warehouse with moving tools, components, packages etc., there could be a precise expectation of when a moving tool, component or package etc. will reach a specific location or will have completed a specific movement or operation. It may then be useful or critical to locate the tool, component or package etc. to confirm the expectation and make any further adjustments.

- Scheduled Location: The location of UEs may sometimes be scheduled to occur at specific times in the future. For example, vehicles on a road may all be located at the same time to provide an indication of traffic congestion as well as to assist with V2X. People, containers, transportation systems etc., may also be located at certain common times.

In the scenarios above, the objective is to determine where the UE is located at the scheduled location time. The known time (referred to as a scheduled location time) can be provided in advance to reduce the effective latency in providing location results.



# Progress in RAN2 with regards to this issue

RAN2 discussed the LS from SA2 at RAN2#113bis and sent a reply LS in [6] asking a few questions for clarification to SA2:

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| RAN2 discussed the subject matter and have some questions for clarification to enable us to better understand the feature. Before RAN2 can decide on support of the feature as defined in the SA2 endorsed CR 0151r1 to TS 23.273 in S2-2102047, RAN2 would first like to understand what the CR describes. Please see below for RAN2 questions:  1. Definition of "scheduled location time":  The definition of scheduled location time is not fully clear to RAN2 since the SA2 endorsed CR describes the scheduled location time differently in different parts of the CR and there is a different description of scheduled location time in the SA2 LS itself. RAN2 would like to have a clear definition of scheduled location time first as this may impact what is signalled to UE and/or NG-RAN. Please see below for detailed comments:  In section 4.1c it says "The request includes the scheduled location time T" which is described as the start of location preparation phase. So, time T is the scheduled location time.  Section 4.1c also says "the scheduled location time allows an external LCS Client, AF or the UE to specify a time in the future at which a current location of the UE is to be obtained". However, in Figure 4.1c-1, the time when the LCS client, AF or UE obtains the location is T+t2. The time T in the figure is shown as the time at which the UE or NG-RAN obtains the location measurements.  The SA2 LS description also states "…support scheduling of location of a target UE in advance using a scheduled location time at which location measurements for the target UE would be obtained by the UE (in the case of DL measurements) and/or NG-RAN (in the case of UL measurements)". This seem to align with the time T in Figure 4.1c-1 which show it as a scheduled measurement time.  In section 6.3.1, step 25 describes the scheduled location time as the time at which the LMF must obtain the UE location, not the time at which the LCS client receives the location or the time at which the LMF schedules the measurement.  2. In section 6.1.2, there is the following editor’s note:  "Editor's note: Feedback from RAN is needed to verify whether location measurements can be scheduled to occur at a UE or NG-RAN at a specific scheduled location time."  Please clarify the requirement whether measurements in UE/NG-RAN need to be scheduled at the scheduled location time received from 5GC or at a time before the scheduled location time received from 5GC.  3. Can SA2 clarify the time format used for the scheduled location time T which is provided to an LMF (e.g., UTC, etc.)?  4. For a Deferred 5GC-MT-LR for periodic location events, RAN2's understanding is that a scheduled location time may apply for the first periodic location report only. For each succeeding periodic location report, the  "scheduled location time" is equivalent to the periodic reporting interval. Please confirm whether RAN2's understanding is correct, or whether different location times T can apply for succeeding periodic location reports.  5. Clause 4.1c says "A scheduled location time can be used with a 5GC-MT-LR, 5GC-MO-LR or deferred 5GC-MT-LR for periodic *or triggered* location events."  RAN2 would like to understand how a scheduled location time can be applicable to triggered location events given its sporadic nature. |

# Summary of views based on RAN1 t-doc submissions

The summary based on inputs from the contributions in RAN1 #105 is given below:

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| **Company** | **Proposals** |
| Qualcomm [1][4] | Proposal 1: Send a draft Reply LS:   * RAN1 thanks SA2 for their LS on Scheduling Location in Advance to reduce Latency. * RAN1 discussed the subject matter and agrees that scheduling location in advance is within the positioning enhancement work item objective, and RAN1 will target supporting this feature in Rel-17 positioning enhancement time frame in alignment with the CR received from SA2.   Proposal 2: For UE-based positioning, a UE is expected to report a location estimate which is valid for the requested “Location Time”.  Proposal 3: For UE-assisted/network-based Positioning, support LMF sending a “Time-domain Window” configuration(s) to both UE and gNBs that define the time at which the measurements are expected to be obtained.   * Each window is defined with a start/End configuration * If startTime is provided, the device (UE/gNB) is expected to perform measurements and reporting that start no earlier than the startTime. * If EndTime is provided, the device (UE/gNB) is expected to perform measurements no later than the EndTime.   Proposal 4: With regards to the requested Time-domain measurement Window:  Study further the UE behavior when a limited number (or none) of PRS instances appears within a configured time-domain window. |
| vivo [2] | Proposal 1:   * Physical layer latency reduction should be independent of scheduled location time. * The method with scheduled location time can be considered as a further optimization to be discussed in Rel-17 if scheduled location time is supported. |
| Huawei | *Observation 1: RAN1 understands that the feature developed by SA2 does not require additional normative work for UL methods, but may require normative work for DL and DL+UL methods, which is led by RAN WG2.*  *Observation 2: We cannot see the “latency reduction” of any kind provided by TS 22.261, TR 38.857, or S2-2102047, but consider it rather as an explicit location time decoupled from the arrival time of the LCS request message.*  *Observation 3: Tolerance of T is required considering the radio interface fluctuation.*  Based on the observations, we have the following proposal to reply to SA2.  *Proposal 1: Reply to SA with the following content:*   |  | | --- | | RAN1 assumes that scheduling location in advance is within the positioning enhancement work item objective, and RAN1 thinks that supporting this feature in Rel-17 positioning enhancement time frame is up to RAN2.  However, currently RAN1 does not see a clear definition of latency, which can be reduced from scheduling location in advance.  In addition, RAN1 believes that the tolerant of T is required considering the nature of radio interface. | |
| Intel [9] | Proposal 4:   * For NR positioning latency reduction,   + Continue discussion on scheduling location and DCI based signaling mechanism once more details are clarified by SA2 with respect to definition and potential pre-configuration of scheduling location information for NR positioning |

# Discussion Phase 1

Questions to attempt to reach a common understanding of the feature?

**Question 1:**

* Do you consider the scheduling location in advance feature one potential positioning enhancement that is within the scope of the WI objectives of Rel-17?

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| Company | Answer |
| Nokia/NSB | If the feature can really result in reduction in latency, then it is within the scope of the WI objectives of Rel-17. We do not see the scheduled location provides any latency gain in signalling on any interface between LCS client all the way up to UE. On the other hand it increases the signalling now due to additional LPP and NRPPa signalling of time T and it increases the processing in LMF, gNB and UE. So, we do not see a latency gain in the solution and so we do not see it being within the scope of the WI objectives of Rel-17. |

**Question 2:**

* Do you agree that, from RAN1 perspective, support can be provided for a scheduled location time as part of Rel-17 and as defined in the attached CR to TS 23.273? If not, please provide an explanation.

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| Company | Answer |
| Nokia/NSB | No. Please clarify first what the impact is to RAN1 specifications for the solution as defined in the attached CR to TS 23.273. The proposal overall needs clarification. On the other hand, if this solution impacts measurements we are wondering how it impacts the UE measurement performance defined by RAN4 and any RAN1 defined UE measurement behaviour (e.g., in 38.214). |

**Question 3:**

* Could there be potential impacts to RAN1 work and/or specifications to support or enable this feature?

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| Company | Answer |
| Nokia/NSB | Possibily, yes. UE measurement behavior may need to be defined. There are also on going discussions on configuratble time windows in RAN1 which appear may be related however those enhancements have initially been targeted for Rx/Tx timing error mitigation.  From the RAN2 reply LS it seems clear there is not common understanding among companies and WGs what is being proposed and what specification work is needed. |

**Question 4:**

* Any additional comments you would like to provide?

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| Company | Comments |
| Nokia/NSB | Perhaps the proponents could clarify the RAN1 expected impact and the gains that would be achieved. |

# Conclusions

TBD

# References

1. [R1-2104643](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_105\Docs\R1-2104643.zip) Draft reply LS to SA2 on Scheduling Location in Advance., Qualcomm
2. [R1-2105937](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_105\Docs\R1-2105937.zip) Discussion on scheduling location in advance to reduce latency Huawei, HiSilicon
3. R1-2104362 Discussion on latency enhancement for NR positioning vivo
4. R1-2104674 Enhancements for Latency Improvements for Positioning, Qualcomm
5. R1-2104908 NR Positioning Latency Reduction, Intel Corporation
6. R2-2104420 Response LS on Scheduling Location in Advance to reduce Latency, RAN2.
7. [S2-2102047](https://www.3gpp.org/ftp/tsg_sa/WG2_Arch/TSGS2_143e_Electronic/INBOX/S2-2102047.zip) Addition of a Scheduled Location Time, Qualcomm