3GPP TSG-RAN WG2 #110-e R2-20xxxxx

Electronic meeting, 1th - 12th June, 2020

Agenda Item: 6.7.2.1(NR\_IIOT-Core)

Source: NTTDOCOMO, INC.

Title: Report of email discussion [AT110-e][053][IIOT] Accurate Reference Time (NTT DOCOMO)

Document for: Discussion and Decision

# 1 Introduction

This document is to report the summary of the following email discussion:

* [AT110-e][053][IIOT] Accurate Reference Time (NTT DOCOMO)

Scope: Address the following FFSes: FFS 1 whether the UE is allowed to send the same interest message again. FFS 2 the need for a prohibit timer T346. Can also address other proposals provided in the documents under 6.7.2.1 if there is interest (proponents will need to push and explain).

 Intended outcome: Agreements

 Deadline: June 5, 0700 UTC

# 2 Issue summaries

## 2.1 Clock drift issue

In [1]-[10], most of the papers showed the reasoning of resending referenceTimeInfo interest message to the network is based on the concern of UE clock drift. Regarding this clock drifting issue, [8] point out UE can always calculate the reference timing based on DL timing information after receiving the reference time from gNB once. TS 38.331 already specified that“if the referenceTimeInfo field is received in DLInformationTransfer message, the time field indicates the time at the ending boundary of the system frame indicated by referenceSFN”, so the question is whether the time provided by gNB can be always computed/predicted if UE has received *referenceTimeInfo* from gNB once. In detail, whether gNB implementation always provide reference time in a predictable way, i.e. time2 - time1 = (referenceSFN2 - referenceSFN1) \* 10 ms, with the pairs (time1, referenceSFN1), (time2, referenceSFN2) corresponding to two reference time provisioning instances. If this is common understanding among companies, there is no need to resend referenceTimeInfo interest message to the network for resolving clock drift issue.



**Figure 1: Reference time provisioning at gNB side [8]**

**Question1. Whether gNB implementation always provide reference time in a predictable way, i.e. time2 - time1 = (referenceSFN2 - referenceSFN1) \* 10 ms, with the pairs (time1, referenceSFN1), (time2, referenceSFN2) corresponding to two reference time provisioning instances?**

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| **Company** | **Yes/No** | **Comment** |
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**Question2. Whether UE can always calculate the reference timing based on DL timing information after receiving the reference time from gNB once i.e the time provided by gNB can be always computed/predicted by UE if UE has received *referenceTimeInfo* from gNB once?**

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| **Company** | **Yes/No** | **Comment** |
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## 2.2 Whether UE resend the same interest message

Regarding whether UE is allowed to resend the same interest message, since it is related to Q1/2, so firstly it is necessary to confirm companies with the following understanding:

**Question 3. Do companies agree with the following understanding? If not, please explain the reasons.**

***If UE can always calculate the reference timing based on DL timing information after receiving the reference time from gNB once, then there is no necessity for UE to resend the same interest message to network.***

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| **Company** | **Yes/No** | **Comment** |
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If the answer for Q1/2 are negative (UE could not calculate the time information based on DL timing information), then it is necessary to discuss how to resolve the clock drift issue with the following candidate solutions proposed by companies.

* Option1. Once UE send the interest request, UE rely on periodic gNB broadcast to refresh its reference time and should no longer resend the request to the network as proposed in [2]. (No change is needed in current RRC CR);
* Option2. Once UE send the interest request, since UE cannot resend UEAssistanceInformation message with referenceTimeInfoInterest set to true, UE may toggle referenceTimeInfoInterest to false, and toggle referenceTimeInfoInterest to true again to request gNB to send the time information [5][8]. (No change is needed in current RRC CR);
* Option3. Adding a level 2 condition, once UE send the interest request, UE toggle referenceTimeInfoInterest to false as proposed in [7]. (change is needed in current RRC CR);
* Option4. Once UE send the interest request with referenceTimeInfoInterest set to true, UE is allowed to resend UEAssistanceInformation message with referenceTimeInfoInterest set to true again. (change is needed in current RRC CR) [6] [8].

**Question 4. If UE could not compute/predict the time information itself due to clock drift issue, which solution is preferred as mentioned above?**

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| **Company** | **Preferred Option** | **Comment** |
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Regarding resending the same interest message, another issue is pointed out in [6] that UE may frequently resend the referenceTimeInfo interest request during a short period of time if no reference time information is received i.e. network missed receiving the request from UE or UE missed receiving referenceTimeInfo from network. While in [10], it mentioned RRC message should not be lost, which is guaranteed by RLC AM.

**Question 5. Is there a possibility UE who is configured with referenceTimeInterestReporting-r16 send the referenceTimeInfo interest message to network but no reference time information is received from network?**

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| **Company** | **Yes/No** | **Comment** |
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## 2.3 Whether prohibit timer T346 is needed

Regarding whether the prohibit timer T346 is needed, since it is highly related to discussion result of previous Q1/2/3/4, so it is necessary to confirm companies with the following understandings 1~4 one by one:

**Question 6. Do companies agree with the following understanding? If not, please explain the reasons.**

1. ***If UE can always calculate the reference timing based on DL timing information after receiving the reference time from gNB once, then there is no necessity for UE to resend the interest message to network and prohibit timer T346 is not needed [8].***

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| **Company** | **Yes/No** | **Comment** |
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**Question 7. Do companies agree with the following understanding?**

1. ***Since current RRC CR allow UE to toggle referenceTimeInfoInterest to false, and toggle referenceTimeInfoInterest to true again to request gNB to send the time information (properly implemented UE may not toggle the field often or even if does toggle the field frequently), a prohibit timer T346 would be a safe approach to mitigate the UL signaling overhead [5].***

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| **Company** | **Yes/No** | **Comment** |
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**Question 8. Do companies agree with the following understanding?**

1. ***If UE is allowed to resend UEAssistanceInformation message with referenceTimeInfoInterest set to true again after it previously sending UEAssistanceInformation with referenceTimeInfoInterest also set to true, a prohibit timer T346 is needed to mitigate the UL signaling overhead [8].***

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| **Company** | **Yes/No** | **Comment** |
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**Question 9. Do companies agree with the following understanding?**

1. ***Even UE is allowed to resend reference time information request , considering the overload concern for UE signalling could be solved by gNB implementation, and the UE-frequently-requiring scenario wouldn’t be realistic, so prohibit timer T346 is not needed [7].***

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| **Company** | **Yes/No** | **Comment** |
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**Question 10. If there are other reasons showing T346 is necessary, please comment it bellow.**

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| **Company** | **Yes/No** | **Comment** |
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## 2.4 Further enhancement

In [9], it mentioned since the clock accuracy of each UE might be different, setting them with a common timer might result in a problem UE with a worse clock drift cannot send the RRC message with *referenceTimeInfo* if needed. So it proposed the configuration of timer should take the UE clock accuracy performance e.g. clock drift rate into account.

**Question 11. Do companies agree with the following enhancement in rel-16?**

***a prohibit timer configured according to the UE clock accuracy performance should be introduced to prevent the UE from sending the RRC message requesting for the referenceTimeInfo IE too frequently, which saves transmission resource over uu interface.***

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| **Company** | **Yes/No** | **Comment** |
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## 2.5 Other issues

**Question 12. If there are any issues which are not mentioned in section 2.1~2.4, please comment it bellow.**

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| **Company** | **Yes/No** | **Comment** |
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# 3. Conclusion

TBD

# 4 References

1. R2-2004830 Remaining issues on Accurate Reference timing NTT DOCOMO, INC.
2. R2-2004585 Open issues on Accurate Reference Timing CATT discussion
3. R2-2004676 Remaining issues for accurate reference time request Nokia, Nokia Shanghai Bell
4. R2-2004736 Remaining issues on the UE request of the reference time vivo discussion
5. R2-2004957 Remaining details on UE request of reference time Ericsson discussion
6. R2-2005040 FFS for UE request for accurate reference timing ZTE Corporation, Sanechips, China Southern Power Grid Co., Ltd discussion
7. R2-2005152 Request of accurate reference time delivery Huawei, HiSilicon discussion
8. R2-2005300 On UE request of reference time provisioning Intel Corporation discussion
9. R2-2005340 Discussion on the need of prohibit timer and retransmission of the same interest message OPPO discussion
10. R2-2005646 Confirmation of UE assistance with referenceTimeInfoInterest Samsung discussion