3GPP TSG-RAN WG2 Meeting #126 R2-2405760

Fukuoka, Japan, 20th May – 24th May, 2024

**Agenda item: 7.6.3**

**Source: Samsung**

**Title: Summary of [AT126][302][IoT NTN Enh] T390 issues (Samsung)**

**WID/SID: IoT\_NTN\_enh-Core**

**Document for: Discussion and Decision**

# Introduction

This offline handles the following:

* [AT126][302][IoT NTN Enh] T390 issues (Samsung)

 Scope: discuss T390 issues (based on the proposals in R2-2405151, R2-2405499, R2-2405440, R2-2404157, R2-2404653, R2-2405526, R2-2404594)

 Intended outcome: report of offline discussion

 Deadline for companies' feedback: Wednesday 2024-05-22 20:00 (but F2F discussion is invited)

 Deadline for rapporteur's summary (in R2-2405760): Thursday 2024-05-23 08:00

# Discussion

How to handle the timer T390 during handovers was discussed in RAN2#125bis. It was originally proposed that T390 is stopped when the network triggers a handover. However it was realized that the issue is more about handling of connected mode mobility for a UE that is not synchronized.

## T390 and random access

A potentially more fundamental issue that was mentioned is whether a UE can perform connected mode random access to the serving cell (PCell) when T390 is running. According to current procedures, a UE is not prevented from triggering random access during T390, for instance due to no uplink resources, too many SR attempts or even for NB-IoT RACH-based SR.

In *R2-2404594 “Discussion on RACH triggering during T390 running”,* the following is proposed:

1. Upon RACH being triggered while T390 is running, UE considers T390 as expired.

### **Q1: Can a UE perform connected mode random access to PCell during T390? (non-handover case)**

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| **Company** | **Yes/No/See comment** | **Comment** |
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**Rapporteurs understanding:**

RAN1 likely did not consider the issue of performing connected mode random access during T390 and RAN2 has modelled the uplink transmissions extension as a period in which the UE may remain in connected mode with invalid GNSS, with no further limitations on UE action.

On one hand the network may be aware of the UE being configured with T390, and on the other hand the UE will be unsynchronized and the resources for random access will be shared with other UEs. There may be a need to consult with RAN1 regarding the issue.

Another interpretation may be that UE performing RACH with invalid GNSS is a consequence that network may have to live with when configuring uplink transmission extension.

#### **Offline F2F discussion:**

## T390 during (conditional) handover

As explained above, the question that S068 triggered in RAN2#125bis was whether a UE is allowed to perform a handover to a target cell or not when the UE does not have a valid GNSS position. In release 17, the UE is required to have

For performing a handover to a target cell, a number of solutions or resolutions have been suggested:

* UE does not perform handover to target cell if UE does not have valid GNSS position fix:
	+ - UE performs GNSS position fix before executing the handover if T390 is running [2]
		- Handovers while T390 are not allowed while T390 is running. Network ensures that T390 is not running while handover is being triggered for both HO and CHO [2].
		- Other?
* Allow a handover to execute to a target cell while UE does not have valid GNSS position fix:
	+ - For CHO, do not include gnss-ValidityDuration in RRCConnectionReconfigurationComplete to signal T390 is running [4].
		- Signal T390 value in RRCConnectionReconfigurationComplete [5].
		- Other?

A first important decision to be made is whether the system shall allow for a UE to execute a handover to target cell while UE does not have a valid GNSS position. A system may potentially ensure that no handovers are performed either via network implementation or via UE methods to perform GNSS position fix.

### **Q2: Shall the system allow for a UE to be able to execute handover to target cell while UE does not have valid GNSS position?**

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| **Company** | **Yes/No/See comment** | **Comment** |
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**Rapporteurs understanding**

Rapporteur notes that even though answer to Q1 may allow for connected mode random access for non-handovers, this may not mean that handovers are allowed for a UE that does not have valid GNSS position.

Rapporteur notes that during the online discussion there were clear issues raised on whether it can be assumed that the target cell may be able to handle a UE with T390 running. Furthermore, it was also raised that an unsynchronized UE will cause interference to other UEs that are synchronized, especially on common resources such as RACH. It breaks with basic release 17 principles.

Thus rapporteur’s preference is that the system shall not allow a UE to execute to target cell if the UE does not have a valid GNSS position.

#### **Offline F2F discussion:**

### **Q3a: If yes to Q2, how is target cell made aware of T390 running at the UE?**

**- Option 1: gnss-ValidityDuration is not included in RRCConnectionReconfigurationComplete**

**- Option 2: T390 value is signalled in RRCConnectionReconfigurationComplete**

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| **Company** | **Yes/No/See comment** | **Comment** |
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#### **Offline F2F discussion:**

### **Q3b: If no to Q2, how do we ensure that UE has valid GNSS position fix before execution of handover:**

**- Option 1: UE performs GNSS position fix before executing the handover if T390 is running.**

**- Option 2: Handovers are not allowed while T390 is running or GNSS position is invalid. Network ensures that T390 is not running while handover is being triggered.**

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| **Company** | **Yes/No/See comment** | **Comment** |
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#### **Offline F2F discussion:**

## Other T390 issues

**Handling of T390 and GNSS position fix during C-DRX inactive period.**

In [4] and [5], the issue of stopping T390 when a UE performs a GNSS position fix during C-DRX inactive period is mentioned. The issue is that currently there is no condition to stop T390 after has successfully

### **Q4: Shall T390 be stopped after successful GNSS position fix during C-DRX inactive period?**

- Option 1: Yes

- Option 2: Other option

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| **Company** | **Yes/No/See comment** | **Comment** |
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**Rapporteurs understanding.**

Currently, T390 is stopped for two cases: 1) an indication is received from lower layers to perform GNSS position fix (triggered GNSS position fix), and 2) RRC re-establishment is triggered.

Thus the T390 is never stopped when a UE successfully acquires GNSS position fix. Rapporteurs understanding is that this is needed.

#### **Offline F2F discussion:**

In [6] is proposed to unify the stopping procedures for GNSS measurement triggered by the network, for autonomous GNSS measurement and for performing GNSS measurement during C-DRX this is done by stopping T390 after a successful GNSS measurement.

**Proposal 1 UE stops T390 (if it is running) upon performing the GNSS measurement, no matter whether the GNSS measurement is triggered by the network, performed by the UE using an autonomous gap, or performed by the UE using available idle periods.**

**Proposal 2 Replace the changes relevant to the conditions for stopping T390 in R2-2403774 with the text proposal in Section 3.**

Part of the CR is the following:



### **Q5: Should the T390 be stopped upon GNSS measurement for all cases, i.e is the CR in R2-2405526 acceptable?**

- Option 1: Yes

- Option 2: No

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| **Company** | **Yes/No/See comment** | **Comment** |
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**Rapporteurs understanding.**

Rapporteurs understanding is that the CR can be pursued.

#### **Offline F2F discussion:**

**Further procedures for stopping T390**

In [3] it is proposed:

**Proposal 1: For RRC re-establishment procedure, T390 is stopped once GNSS acquisition is initiated.**

### **Q6: Does the T390 stopping condition during RRC re-establishment need to change?**

- Option 1: Yes

- Option 2: No

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| **Company** | **Yes/No/See comment** | **Comment** |
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**Rapporteurs understanding:**

In the contribution it stated that the current Rel-17 condition to have valid GNSS position fix before initiating RRC re-establishment means that the T390 may not be stopped before the GNSS position fix:

5.3.7.1a Condition for re-establishing RRC Connection in NTN

If s*ystemInformationBlockType31* (*systemInformationBlockType31-NB* in NB-IoT) is broadcast, a RRC connection re-establishment is initiated only if the UE has a valid GNSS position.

NOTE: The UE may need to re-acquire the GNSS position before re-establishing the connection to avoid interruption during the connection.

However, our interpretation is that the Rel-17 condition simply means that the UE shall have a valid GNSS position fix before RRCConnectionReestablishment is sent to the lower layers. With this interpretation, the T390 will always stop after for instance an RLF is triggered. Furthermore, our understanding is that the procedures for Rel-17 GNSS position requirements should not be mixed with Rel-18 GNSS position fix, because the Rel-17 GNSS position requirements does not specify when the GNSS position fixes should be performed.

Furthermore, section 5.5.9 that specify GNSS measurement triggering and reporting, clearly state that the section is for “*GNSS measurement can be triggered aperiodically by the GNSS Measurement Command MAC CE (see TS 36.321 [6]), or triggered by the UE autonomously if enabled by the network, or triggered by the UE using available idle periods.*”, so in order to bring in Rel-17 GNSS position fix for re-establishment, we have to bring it in here.

Rapporteurs understanding is that current stopping condition is sufficient, but a release 17 correction could be pursued to clarify that UE does not transmit *RRCConnectionReestablishmentRequest* before GNSS is invalid.

#### **Offline F2F discussion:**

# Conclusion

In this contribution we have the following observations and proposals:

**Proposal 1: ....**

**Proposal 2: ....**

# Reference

1. R2-2404594, Discussion on RACH triggering during T390 running, OPPO.
2. R2-2405151, [S068] Handling GNSS uplink transmission extension during handover, Samsung, ZTE and Google
3. R2-2404653, T390 handling during mobility [S067][S068], Apple
4. R2-2405499, [S068] UE behaviour on T390 upon handover or CHO, Huawei, HisSilicon
5. R2-2405440, On left open issues for T390 handling, Nokia, Nokia Shanghai bell
6. R2-2405526, Corrections on the conditions for stopping T390, Google